



Technical Document - Confidential

GSM GENERAL PACKET RADIO SERVICES
MESSAGE SEQUENCE CHARTS
SM

| | |
|---------------------|--------------------------|
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3. Added param 'apn' to REQ_PDP_ACT_REJ
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5. Add reaction to SMREG_PDP_ACTIVATE_REJ_RES.
6. Review , skip AA.

Table of Contents

| | | |
|-----|---|-------------------------------------|
| 1.1 | References | 6 |
| 1.2 | Abbreviations | 8 |
| 1.3 | Terms | 11 |
| | GRR (RLC/MAC) – Radio Link Control/Medium Access Control | 12 |
| | LLC – Logical Link Control | 12 |
| | GMM – GPRS Mobility Management | 13 |
| | SM – Session Management | 13 |
| | SNDCP - Subnetwork Dependant Convergence Protocol | 13 |
| | GACI – GPRS Application Control Interface | 13 |
| | USART - Universal Synchronous Asynchronous Receiver Transmitter Driver | 13 |
| | TOM – Tunnelling of Messages | 13 |
| | Flow Control | 14 |
| | Identified PDP context activation | 15 |
| | PDP context activation, MS initiated, requested NSAPI not yet used | 15 |
| | PDP context activation, MS initiated, requested NSAPI already used | 15 |
| | PDP context activation, MS initiated, new attach accepted by the network or MS already attached | 16 |
| | PDP context activation, receiving ACTIVATE_PDP_CONTEXT_ACCEPT | 17 |
| | PDP context activation, NSAPI now in use | 17 |
| | Unsuccessful PDP context activation, MS initiated | 18 |
| | PDP context activation, network initiated | 18 |
| | PDP context activation, network initiated, ACI accepts | 18 |
| | PDP context activation, timer expiring up to four times | 19 |
| | PDP context activation, timer expiring for the fifth time | 19 |
| | Collision of MS initiated and network requested PDP context activation, comparable | 19 |
| | Receiving activation reject messages in state PDP_ACTIVE_PENDING | 20 |
| | Receiving activation reject messages in state other than PDP_ACTIVE_PENDING | 20 |
| | PDP context activation, network initiated, ACI does not accept | 20 |
| | Collision of MS initiated and network requested PDP context activation, not comparable | 21 |
| | Anonymous PDP context activation | Error! Bookmark not defined. |
| | PDP context deactivation | 21 |
| | PDP context deactivation, MS initiated | 22 |
| | PDP context deactivation, MS initiated, network accepts | 23 |
| | PDP context deactivation, MS initiated, NSAPI released | 23 |
| | PDP context deactivation, network initiated | 23 |
| | PDP context deactivation, network initiated, NSAPI released | 24 |
| | PDP context deactivation, timer expiring up to four times | 24 |
| | PDP context deactivation, timer expiring for the fifth time | 24 |
| | PDP context deactivation, collision of deactivation requests | 25 |
| | Anonymous PDP context deactivation | Error! Bookmark not defined. |
| | PDP context modification | 25 |
| | PDP context modification initiated by the network, MS accepts QoS and SAPI | 25 |
| | PDP context modification initiated by the network, MS does not accept QoS and SAPI | 26 |
| | PDP context modification, network initiated, SNDCP finished requested changes | 26 |
| | Handling of unknown, unforeseen and erroneous protocol data | 27 |
| | Message too short | 27 |
| | Message other than SM_STATUS with TI value “111” | 27 |
| | Invalid transaction identifier value | 27 |
| | REQUEST_PDP_CONTEXT_ACTIVATION message with TI flag set to “1” | 28 |
| | Unknown message type | 28 |

| | |
|--|----|
| Unforeseen message type | 28 |
| Non-semantic mandatory information element errors, not in list 4.08, 8.5 | 29 |
| Non-semantic mandatory information element errors, DEACTIVATE_PDP_CONTEXT_REQUEST | 29 |
| Non-semantic mandatory information element errors, REQUEST PDP CONTEXT ACTIVATION | 30 |
| Non-semantic mandatory information element errors, ACTIVATE PDP CONTEXT REQUEST | 30 |
| Detach | 31 |
| MS initiated detach, GPRS only | 31 |
| Network initiated detach, GPRS only | 31 |
| A. Acronyms | 32 |
| B. Glossary | 32 |

List of Figures and Tables

List of References

[ISO 9000:2000]

International Organization for Standardization. Quality management systems - Fundamentals and vocabulary. December 2000

1.1 References

- [1] GSM 05.02 version 8.0.0 Release 1999
Digital cellular telecommunications system (Phase 2+);
Multiplexing and multiple access on the radio path
- [2] GSM 04.60 version 6.3.0 Release 1997
Digital cellular telecommunications system (Phase 2+);
General Packet Radio Service (GPRS);
Mobile Station (MS) - Base Station System (BSS) interface;
Radio Link Control/ Medium Access Control (RLC/MAC) protocol
- [3] GSM 04.08 version 6.3.0 Release 1997
Digital cellular telecommunications system (Phase 2+);
Mobile radio interface layer 3 specification
- [4] GSM 03.64 version 6.1.0 Release 1997
Digital cellular telecommunications system (Phase 2+);
General Packet Radio Service (GPRS);
Overall description of the GPRS radio interface; Stage 2
- [5] GSM 03.60 version 6.3.1 Release 1997
Digital cellular telecommunications system (Phase 2+);
General Packet Radio Service (GPRS);
Service description; Stage 2
- [6] GSM 04.07 version 6.3.0 Release 1997
Digital cellular telecommunications system (Phase 2+);
Mobile radio interface signalling layer 3; General aspects
- [7] GSM 04.64 version 6.3.0 Release 1997
Digital cellular telecommunications system (Phase 2+);
General Packet Radio Service (GPRS);
Mobile Station - Serving GPRS Support Node (MS-SGSN)
Logical Link Control (LLC) layer specification
- [8] GSM 05.08 version 6.4.0 Release 1997
Digital cellular telecommunications system (Phase 2+);
Radio subsystem link control
- [9] GSM 05.10 version 6.3.0 Release 1997
Digital cellular telecommunications system (Phase 2+);
Radio subsystem synchronization
- [10] GSM 03.20 TS 100 929: July 1998 (GSM 03.20 version 6.0.1)
Security related network functions, ETSI
- [11] Draft GSM 03.22: August 1998 (GSM 03.22 version 6.1.0)
Functions related to Mobile Station (MS) in idle mode and group receive mode, ETSI
- [12] GSM 04.65 V6.3.0: Subnetwork Dependant Convergence Protocol
ETSI, March 1999
- [13] ITU-T V42bis ITU-T, Recommendation V.42 bis 1990
- [14] GSM 09.60 GPRS Tunneling Protocol (GTP) across the Gn and Gp Interface

- [15] RFC 1661 IETF STD 51 July 1994
The Point-to-Point Protocol (PPP)
- [16] RFC 1662 IETF STD 51 July 1994
PPP in HDLC-like Framing
- [17] RFC 1570 January 1994
PPP LCP Extensions
- [18] RFC 1989 August 1996
PPP Link Quality Monitoring
- [19] RFC 1332 May 1992
The PPP Internet Protocol Control Protocol (IPCP)
- [20] RFC 1877 December 1995
PPP IPCP Extensions for Name Server Addresses
- [21] RFC 2153 May 1997
PPP Vendor Extensions
- [22] RFC 1334 October 1992
PPP Authentication Protocols (for Password Authentication Protocol only)
- [23] RFC 1994 August 1996
PPP Challenge Handshake Authentication Protocol (CHAP)
- [24] TIA/EIA-136-370
Packet-Data Services – Enhanced General Packet Radio for TIA/EIA-136 (EGPRS-136) - Overview,
Telecommunications Industry Association
- [25] TIA/EIA-136-376
Packet-Data Services – EGPRS-136 Mobility Management, Telecommunications Industry Association
- [26] TIA/EIA-136-972
Packet-Data Services – Stage 2 Description, Telecommunications Industry Association

1.2 Abbreviations

| | |
|-------|--|
| ACI | Application Control Interface |
| AGCH | Access Grant Channel |
| AT | Attention sequence "AT" to indicate valid commands of the ACI |
| BCCH | Broadcast Control Channel |
| BS | Base Station |
| BSIC | Base Station Identification Code |
| C/R | Command/Response |
| C1 | Path Loss Criterion |
| C2 | Reselection Criterion |
| CBCH | Cell Broadcast Channel |
| CBQ | Cell Bar Qualify |
| CC | Call Control |
| CCCH | Common Control Channel |
| CCD | Condat Coder Decoder |
| CCI | Compression and Ciphering Interface |
| CHAP | Challenge Handshake Authentication Protocol |
| CKSN | Ciphering Key Sequence Number |
| CRC | Cyclic Redundancy Check |
| DCCH | Dedicated Control Channel |
| DCOMP | Identifier of the user data compression algorithm used for the N-DPU |
| DISC | Disconnect Frame |
| DL | Data Link Layer |
| DM | Disconnected Mode Frame |
| DTX | Discontinuous Transmission |
| E | Extension bit |
| EA | Extension Bit Address Field |
| EL | Extension Bit Length Field |
| EMMI | Electrical Man Machine Interface |
| F | Final Bit |
| FACCH | Fast Associated Control Channel |
| FHO | Forced Handover |
| GACI | GPRS Application Control Interface |
| GMM | GPRS Mobility Management |
| GP | Guard Period |
| GRR | GPRS RR |
| GSM | Global System for Mobile Communication |
| HDLC | High-level Data Link Control |
| HISR | High level Interrupt Service Routine |
| HPLMN | Home Public Land Mobile Network |
| I | Information Frame |
| IMEI | International Mobile Equipment Identity |
| IMSI | International Mobile Subscriber Identity |
| IP | Internet Protocol |
| IPCP | Internet Protocol Control Protocol |
| ITU | International Telecommunication Union |
| IWF | Interworking Function |
| Kc | Ciphering Key |
| L | Length Indicator |
| LAI | Location Area Information |
| LCP | Link Control Protocol |
| LISR | Low level Interrupt Service Routine |

| | |
|-------|---|
| LLC | Logical Link Control |
| LPD | Link Protocol Discriminator |
| LQM | Link Quality Monitoring |
| M | More bit used to indicate the last segment of N-DPU |
| MAC | Medium Access Control |
| MCC | Mobile Country Code |
| MM | Mobility Management |
| MMI | Man Machine Interface |
| MNC | Mobile Network Code |
| MS | Mobile Station |
| MT | Mobile Termination |
| N(R) | Receive Number |
| N(S) | Send Number |
| NC | Network Control |
| NCC | National Colour Code |
| NCP | Network Control Protocol |
| NECI | New Establishment Causes included |
| N-PDU | Network Protocol Data Unit |
| NSAPI | Network Layer Service Access Point Identifier |
| OTD | Observed Time Difference |
| P | Poll Bit |
| P/F | Poll/Final Bit |
| PACCH | Packet Associated Control Channel |
| PAP | Password Authentication Protocol |
| PBCCH | Packet BCCH |
| PCCCH | Packet CCCH |
| PCOMP | Identifier of the protocol control information compression algorithm used for the N-DPU |
| PDCH | Packet Data Channel |
| PDP | Packet Data Protocol e.g. IP or X.25 |
| PDTCH | Packet Data Traffic Channel |
| PRACH | Packet RACH |
| PSI | Packet System Information |
| PCH | Paging Channel |
| PCO | Point of Control and Observation |
| PDU | Protocol Data Unit |
| PL | Physical Layer |
| PLMN | Public Land Mobile Network |
| PPC | Packet Physical Convergence |
| PPP | Point-to-Point Protocol |
| PTP | Point to Point |
| QoS | Quality of Service |
| RACH | Random Access Channel |
| REJ | Reject Frame |
| RLC | Radio Link Control |
| RNR | Receive Not Ready Frame |
| RR | Radio Resource Management |
| RR | Receive Ready Frame |
| RTD | Real Time Difference |
| RTOS | Real Time Operating System |
| SABM | Set Asynchronous Balanced Mode |
| SACCH | Slow Associated Control Channel |
| SAP | Service Access Point |
| SAPI | Service Access Point Identifier |
| SDCCH | Stand alone Dedicated Control Channel |
| SDU | Service Data Unit |
| SGSN | Serving GPRS Support Node |

| | |
|-------|---|
| SIM | Subscriber Identity Module |
| SM | Session Management |
| SMS | Short Message Service |
| SMSCB | Short Message Service Cell Broadcast |
| SNDCP | Subnetwork Dependant Convergence Protocol |
| SNSM | SNDCP-SM |
| SS | Supplementary Services |
| TAP | Test Application Program |
| TBF | Temporary Block Flow |
| TCH | Traffic Channel |
| TCH/F | Traffic Channel Full Rate |
| TCH/H | Traffic Channel Half Rate |
| TCP | Transmission Control Protocol |
| TDMA | Time Division Multiple Access |
| TE | Terminal Equipment - e. g. a PC |
| TFI | Temporary Flow Identifier |
| TLLI | Temporary Logical Link Identifier |
| TMSI | Temporary Mobile Subscriber Identity |
| TOM | Tunnelling of Messages |
| TQI | Temporary Queuing Identifier |
| UA | Unnumbered Acknowledgement Frame |
| UART | Universal Asynchronous Receiver Transmitter |
| UI | Unnumbered Information Frame |
| USF | Uplink State Flag |
| V(A) | Acknowledgement State Variable |
| V(R) | Receive State Variable |
| V(S) | Send State Variable |
| VPLMN | Visited Public Land Mobile Network |

1.3 Terms

| | |
|-----------------------|--|
| Entity: | Program which executes the functions of a layer |
| Message: | A message is a data unit which is transferred between the entities of the same layer (peer-to-peer) of the mobile and infrastructure side. Message is used as a synonym to protocol data unit (PDU). A message may contain several information elements. |
| Primitive: | A primitive is a data unit which is transferred between layers on one component (mobile station or infrastructure). The primitive has an operation code which identifies the primitive and its parameters. |
| Service Access Point: | A Service Access Point is a data interface between two layers on one component (mobile station or infrastructure). |

Overview

The Protocol Stacks are used to define the functionality of the GSM protocols for interfaces. The GSM specifications are normative when used to describe the functionality of interfaces, but the stacks and the subdivision of protocol layers does not imply or restrict any implementation.

The protocol stack for fax and data transmission consists of several entities. Each entity has one or more service access points, over which the entity provides a service for the upper entity. The entity, which is described in this document, is coloured grey in the following figure :

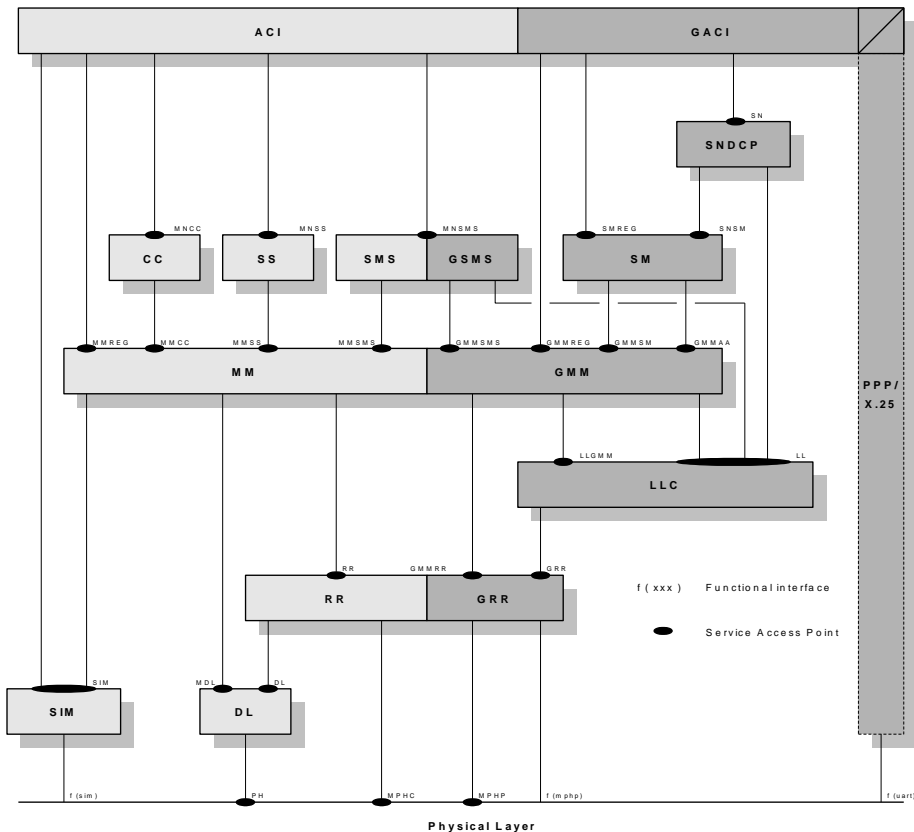


Figure 0-1: Architecture of the GSM/GPRS protocol stack

The information units passed via the SAPs are called primitives and consists of an operation code and several parameters. See the Users Guide for details.

The entities of the GPRS protocol stack are:

GRR (RLC/MAC) – Radio Link Control/Medium Access Control

This layer contains two functions: The Radio Link Control function provides a radio-solution-dependent reliable link. The Medium Access Control function controls the access signalling (request and grant) procedures for the radio channel, and the mapping of LLC frames onto the GSM physical channel.

LLC – Logical Link Control

The LLC entity provides multiple highly reliable logical links for asynchronous data transfer between the MS and the network. It supports variable-length information frames, acknowledged and unacknowledged data transfer, flow and sequence control, error detection and recovery, notification of unrecoverable errors, user identity confidentiality, and ciphering of user and signaling data.

GMM – GPRS Mobility Management

The GMM entity provides procedures for the mobility of the MS, such as informing the network of its present location, and user identity confidentiality. It manages the GMM context (attach, detach, routing area updating), supports security functions such as authentication of user and MS, controls ciphering of data, and initiates the response to paging messages.

SM – Session Management

The main function of the session management (SM) is to support PDP context handling of the user terminal. Session Management activates, modifies and deletes the contexts for packet data protocols (PDP). Session Management services are provided at the SMREG-SAP and the SNSM-SAP for anonymous and non-anonymous access. The non-anonymous and anonymous access procedures for PDP context activation and PDP context deactivation are available at the SMREG-SAP. In addition there exists a PDP context modification for non-anonymous PDP contexts.

SNDCP - Subnetwork Dependant Convergence Protocol

SNDCP carries out all functions related to transfer of Network layer Protocol Data Units (N-PDUs) over GPRS in a transparent way. SNDCP helps to improve channel efficiency by means of compression techniques. The set of protocol entities above SNDCP consists of commonly used network protocols. They all use the same SNDCP entity, which then performs multiplexing of data coming from different sources to be sent using the service provided by the LLC layer.

GACI – GPRS Application Control Interface

The GACI is the GPRS extension of the ACI. It is specified in GSM 07.07 and 07.60. It is responsible for processing of the GPRS related AT Commands to setup, activate and deactivate the PDP context parameter. It also provides functionality for the interworking between GMM/SM/SNDCP and a packet oriented protocol like PPP.

USART - Universal Synchronous Asynchronous Receiver Transmitter Driver

The USART is a hardware component that facilitates a connection between the mobile station and terminal equipment (e.g. a PC). This interface uses some of the circuits described in V.24.

The data exchange provided by this unit is serial and asynchronous (synchronous communication is not in the scope of this document). A driver that uses interrupts to manage a circular buffer for the sending and receiving direction is necessary in order to use this component in the GPRS. The driver has to be able to perform flow control.

TOM – Tunnelling of Messages

The TOM entity is present if and only if HS136 is supported (the feature flag FF_HS136 is enabled).

The main function of TOM is to tunnel non-GSM signalling messages between the MS and the SGSN. The only non-GSM signalling which is currently supported by TOM is for the EGPRS-136 system (according to TIA/EIA-136-376). Data transfer in both uplink and downlink direction is possible. Two different priorities (high, low) of signalling data transfer are supported. TOM uses the unacknowledged mode of LLC and the acknowledged mode of GRR (RLC/MAC).

Introduction

[GSM 04.65, 7]

Flow Control

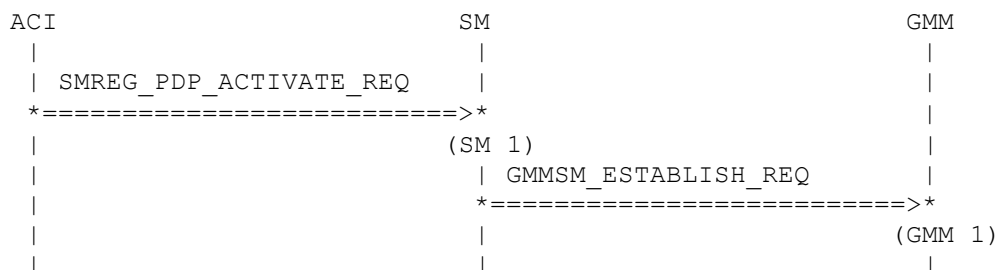
Between SM and GMM no flow control has been established.

Protocol

Identified PDP context activation

<R.SM.SERVICES.A.001>

PDP context activation, MS initiated, requested NSAPI not yet used



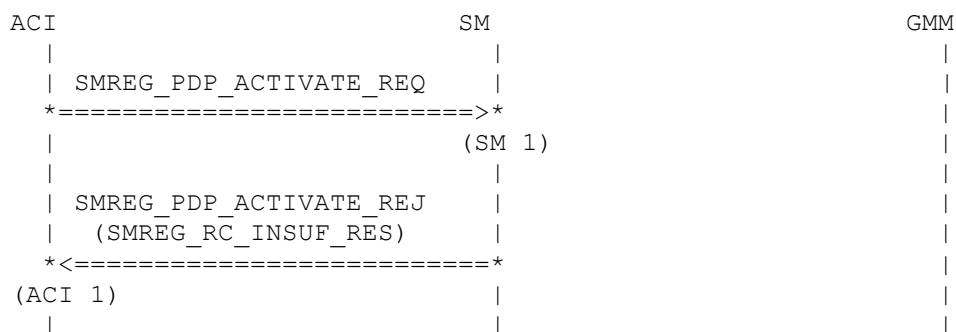
(SM 1)

SM is in state PDP_INACTIVE <R.SM.PDP_INAC.M.001>, <R.SM.MS_CONT.M.001>. The requested NSAPI is not yet used <R.SM.MS_ACT_S.M.005>. ACI sends an SMREG_PDP_ACTIVATE_REQ to initiate a PDP context activation.

(GMM 1)

SM starts timer T3380 <R.SM.MS_ACT_S.M.003>. SM sends a GMMSM_ESTABLISH_REQ to force a setup of GMM connection <R.SM.MS_CONT.M.002> and enters the state AWAIT_GMMSM_ESTABLISH_CNF. (If the MS has already been attached GMM will just send back a confirmation.)

PDP context activation, MS initiated, All the transaction identifiers are in use



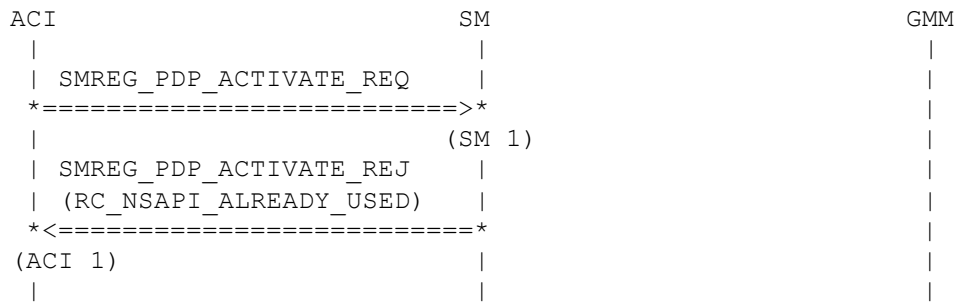
(SM 1)

SM is in state PDP_INACTIVE <R.SM.PDP_INAC.M.001>, <R.SM.MS_CONT.M.001>. The requested NSAPI is not yet used <R.SM.MS_ACT_S.M.005>. ACI sends an SMREG_PDP_ACTIVATE_REQ to initiate a PDP context activation.

(ACI 1)

SM sends SMREG_PDP_ACTIVATE_REJ primitive with the cause RC_INSUF_RES to the ACI informing that all the TI's are in use.

PDP context activation, MS initiated, requested NSAPI already used



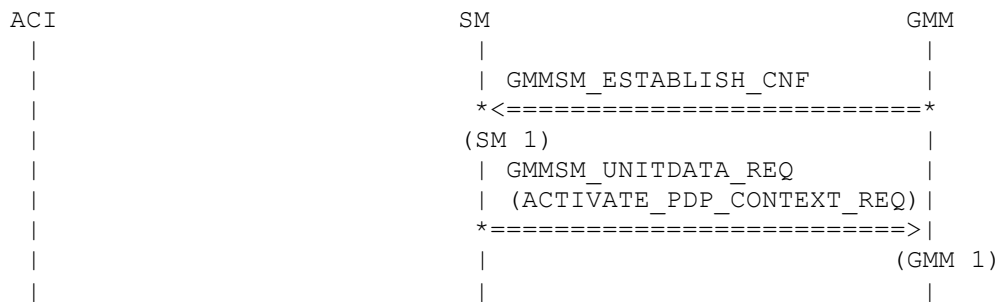
(SM 1)

SM receives an SMREG_PDP_ACTIVATE_REQ. The requested NSAPI is already in use.

(ACI 1)

SM sends an SMREG_PDP_ACTIVATE_REJ to GMM with cause RC_NSAPI_ALREADY_USED <R.SM.MS_ACT_S.M.005>.

PDP context activation, MS initiated, new attach accepted by the network or MS already attached



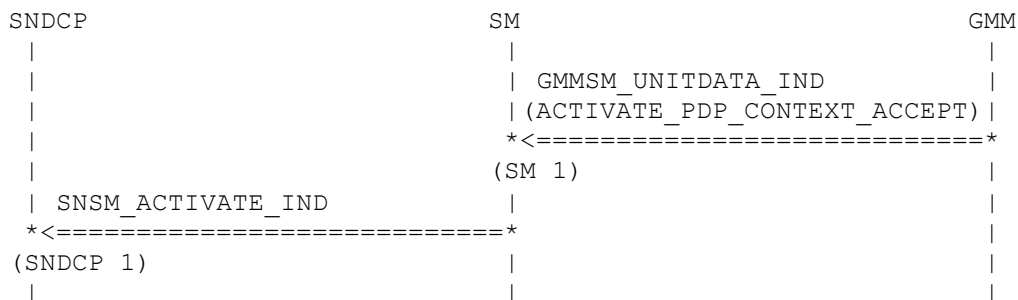
(SM 1)

SM is in state AWAIT_GMMSM_ESTABLISH_CNF, but has sent a GMMSM_ESTABLISH_REQ to initiate a new GMM connection. The MS has already been attached or the network has sent the ATTACH ACCEPT message to the MS, the indirect attach was successful. GMM sends a GMMSM_ESTABLISH_CNF <R.SM.MS_CONT.M.003>. Now session management can proceed with PDP context activation.

(GMM 1)

SM sends an ACTIVATE_PDP_CONTEXT_REQ message to activate the requested PDP context <R.SM.MS_ACT_S.M.001>, <R.SM.MS_CONT.M.004> and changes to state PDP_ACTIVE_PENDING <R.SM.PDP_A_P.M.001>, <R.SM.MS_ACT_S.M.002>. The message contains the selected NSAPI, PDP type and, if the MS requests a static address, the PDP address <R.SM.MS_ACT_S.M.004>.

PDP context activation, receiving ACTIVATE_PDP_CONTEXT_ACCEPT



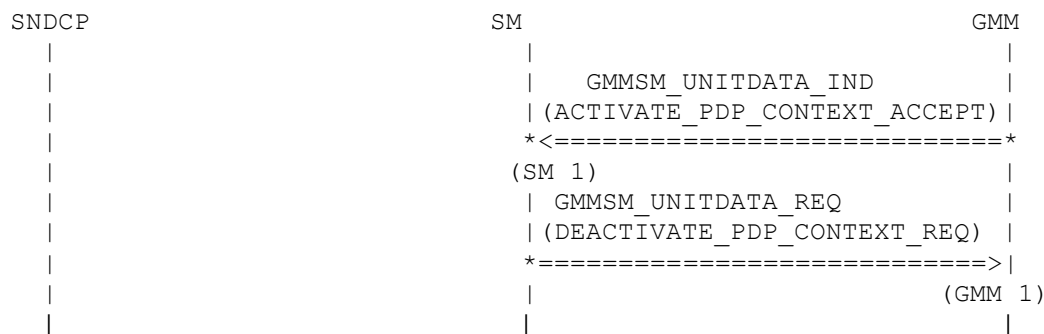
(SM 1)

SM is in state PDP_ACTIVE_PENDING <R.SM.PDP_A_P.M.001>. SM receives an ACTIVATE_PDP_CONTEXT_ACCEPT message indicating that the MS indicated PDP context activation succeeded <R.SM.MS_ACT_S.M.009>, <R.SM.MS_CONT.M.009>.

(SND CP 1)

SM stops timer T3380 <R.SM.MS_ACT_S.M.010>, <R.SM.MS_CONT.M.010>. SM changes to state PDP_ACTIVE_AWAIT_SND CP. SM sends an SNSM_ACTIVATE_IND to SND CP if the QOS are acceptable <R.SM.MS_CONT.M.011>.

PDP context activation, If QOS is not acceptable



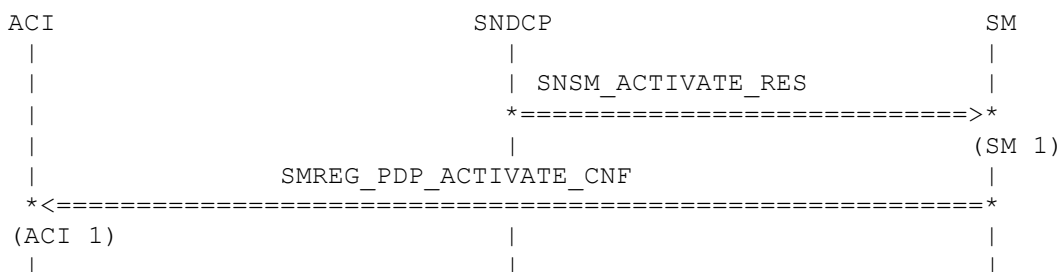
(SM1)

SM is in state PDP_ACTIVE_PENDING <R.SM.PDP_A_P.M.001>. SM receives an ACTIVATE_PDP_CONTEXT_ACCEPT message indicating that the MS indicated PDP context activation succeeded <R.SM.MS_ACT_S.M.009>, <R.SM.MS_CONT.M.009>.

(GMM 1)

SM Rejects the PDP context when QOS is not acceptable and sends DEACTIVATE_PDP_CONTEXT_REQ to inform GMM of the deactivation stops the Timer 3380 and starts Timer 3390 and enters into state PDP_INACTIVE_PENDING.

PDP context activation, NSAPI now in use



(SM 1)

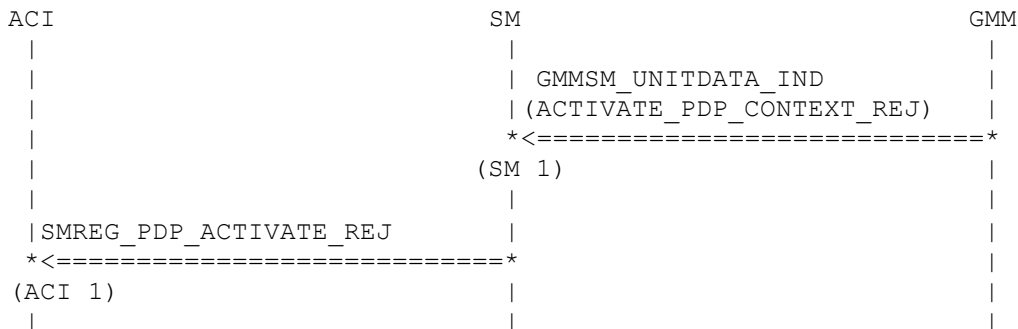
SM is in state PDP_ACTIVE_AWAIT_SND CP and SND CP has sent an SNSM_ACTIVATE_RES to inform the SM entity that the indicated NSAPI is now in use and that the acknowledged peer-to-peer LLC operation for the indicated SAPI is established, if necessary <R.SM.MS_CONT.M.012>.

(ACI 1)

SM sends an SMREG_PDP_ACTIVATE_CNF to ACI to confirm that the PDP context is active <R.SM.MS_CONT.M.013>.

Unsuccessful PDP context activation, MS initiated

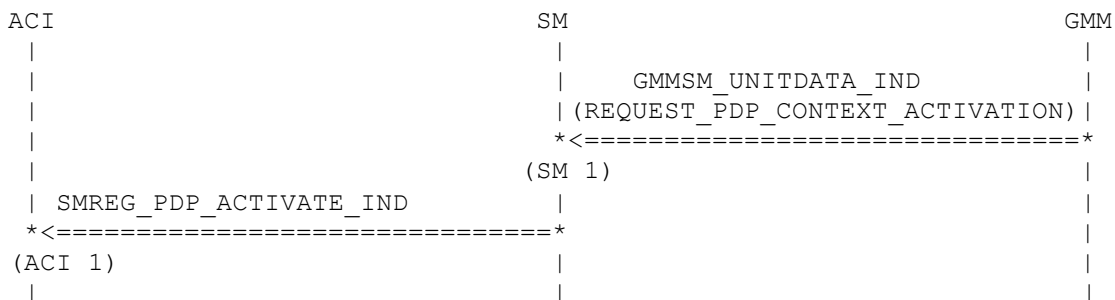
<R.SM.MS_ACT_U.M.004>



(SM 1)

SM is in state PDP_ACTIVE_PENDING <R.SM.PDP_A_P.M.001> and waiting for an ACTIVATE_PDP_CONTEXT_ACC message, but receives an ACTIVATE_PDP_CONTEXT_REJ instead <R.SM.N_ACT_U.M.004>.. It shall stop timer T3380 <R.SM.N_ACT_U.M.005> in turn informs ACI about the Deactivation by SMREG_PDP_ACTIVATE_REJ Message and enter state PDP_INACTIVE <R.SM.N_ACT_U.M.006>.

PDP context activation, network initiated



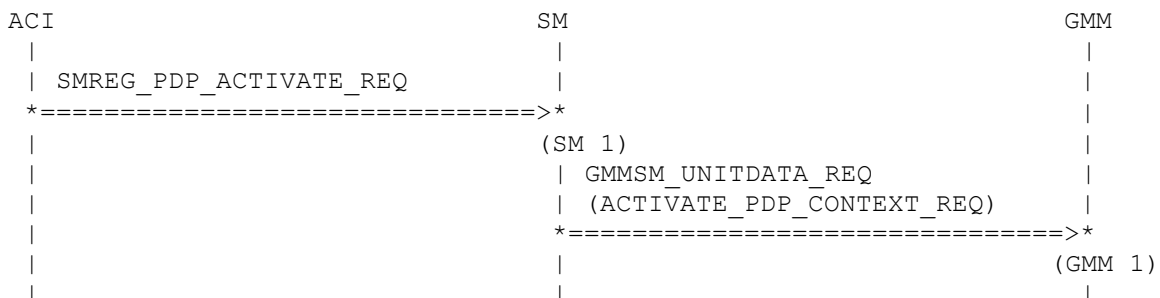
(SM 1)

SM is in state PDP_INACTIVE <R.SM.PDP_INAC.M.001>. SM receives a REQUEST_PDP_CONTEXT_ACTIVATION message to be informed about a network initiated PDP context activation <R.SM.N_ACT_S.M.003>, <R.SM.NET_CONT.M.004>.

(ACI 1)

SM sends an SMREG_PDP_ACTIVATE_IND to inform ACI about the requested connection. <R.SM.NET_CONT.M.005>.

PDP context activation, network initiated, ACI accepts



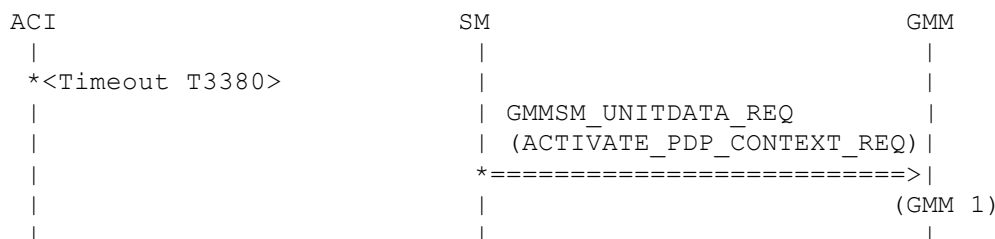
(SM 1)

SM has sent an SMREG_PDP_ACTIVATE_IND to ACI and receives an SMREG_PDP_ACTIVATE_REQ <R.SM.NET_CONT.M.006>.

(GMM 1)

SM starts timer T3380 <R.SM.NET_CONT.M.007>. SM sends an ACTIVATE_PDP_CONTEXT_REQ message and changes to state PDP_ACTIVE_PENDING <R.SM.PDP_A_P.M.001>, <R.SM.NET_CONT.M.008>. The ACTIVATE_PDP_CONTEXT_REQ message sent by the MS in order to initiate the PDP context activation shall contain the PDP address requested by the network in the REQUEST_PDP_CONTEXT_ACTIVATION message <R.SM.N_ACT_S.M.007>. The rest of the activation procedure is the same for MS initiated and network initiated context activation. <R.SM.N_ACT_S.A.009>

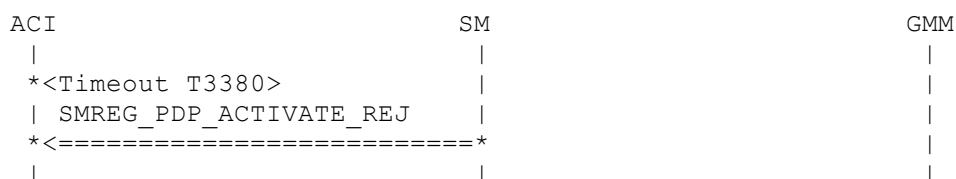
PDP context activation, timer expiring up to four times



(GMM 1)

SM is in state PDP_ACTIVE_PENDING. Instead of receiving the expected ACTIVATE_PDP_CONTEXT_ACCEPT message the timer T3380 expires (for a first, second, third or fourth time) <R.SM.ACT_ABNO.M.001>. Then the MS resends the ACTIVATE_PDP_CONTEXT_REQ message <R.SM.ACT_ABNO.M.002> and resets and restarts T3380 <R.SM.ACT_ABNO.M.003>.

PDP context activation, timer expiring for the fifth time



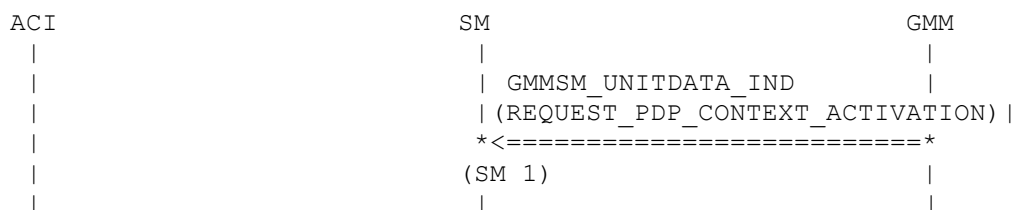
(GMM 1)

SM is in state PDP_ACTIVE_PENDING. Instead of receiving the expected ACTIVATE_PDP_CONTEXT_ACCEPT message the timer T3380 expires for the fifth time <R.SM.ACT_ABNO.M.004>. Then the MS releases all resources possibly allocated for this invocation <R.SM.ACT_ABNO.M.005> and aborts the procedure without re-attempting to activate the context <R.SM.ACT_ABNO.M.006>.

(ACI 1)

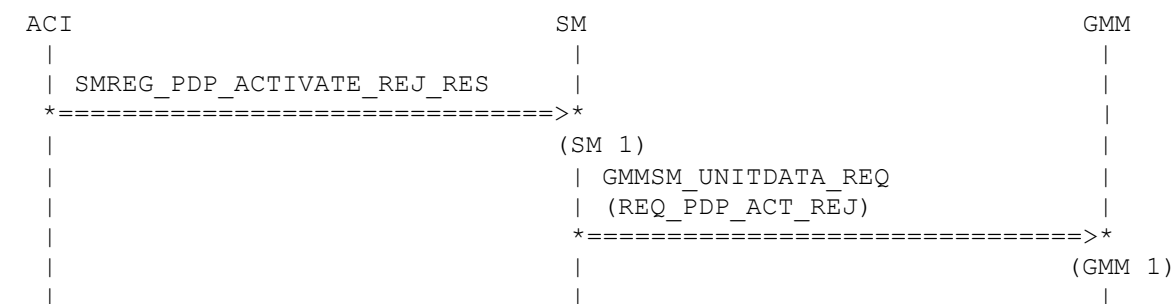
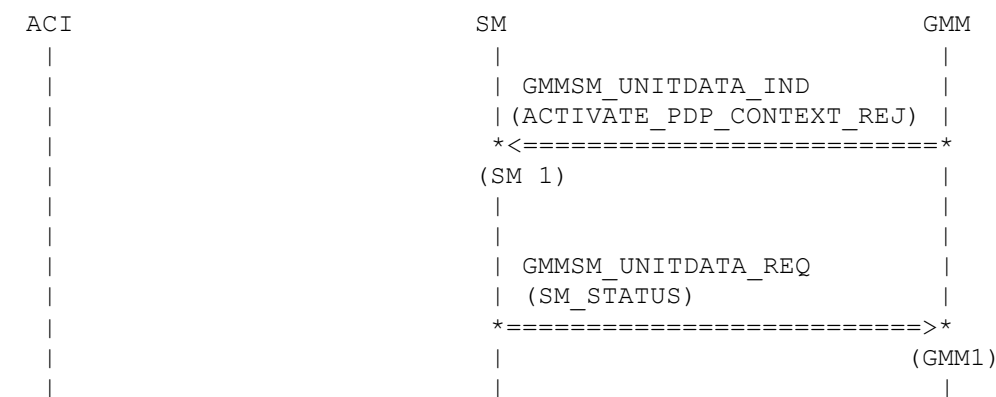
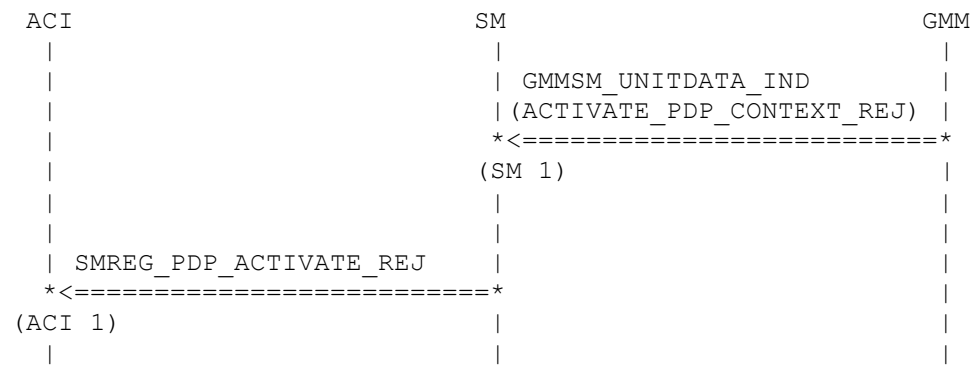
SM sends an SMREG_PDP_ACTIVATE_REJ with cause "Network failure". [HK: primitive not explicitly mentioned in GSM 4.08, 6.1.3.1.5, cause "Network failure" is just assumed here!!!].

Collision of MS initiated and network requested PDP context activation, comparable



(SM 1)

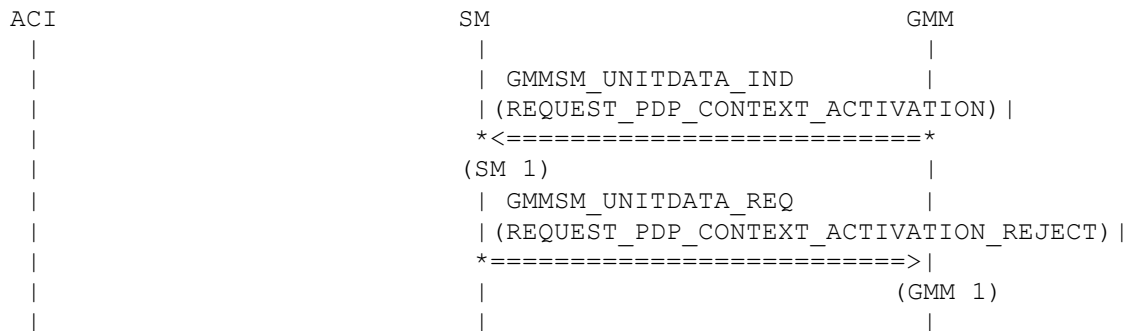
SM is in state PDP_ACTIVE_PENDING after having sent an ACTIVATE_PDP_CONTEXT_REQ message, receives a REQUEST_PDP_CONTEXT_ACTIVATION message, both messages contain the same PDP address and the request from the MS has neither been accepted nor rejected. <R.SM.ACT_ABNO.M.013>. The MS initiated PDP context activation shall take precedence over the network requested PDP context activation <R.SM.ACT_ABNO.A.014>, i.e. the MS discards the received REQUEST_PDP_CONTEXT_ACTIVATION message <R.SM.ACT_ABNO.M.017> and waits for an ACTIVATE_PDP_CONTEXT_ACCEPT message <R.SM.ACT_ABNO.M.018>.



(GMM 1)

SM sends a REQ_PDP_ACT_REJ message to reject the MT activation.

Collision of MS initiated and network requested PDP context activation, not comparable



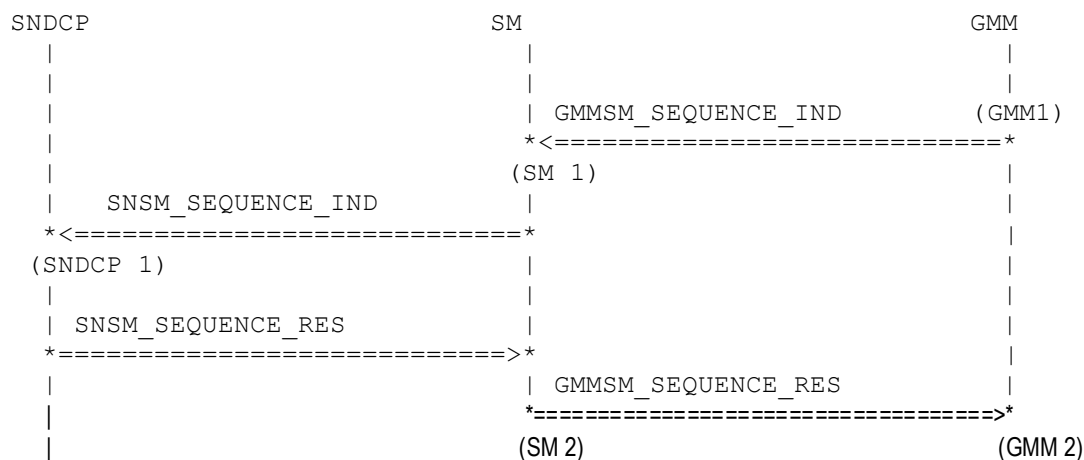
(SM 1)

SM is in state PDP_ACTIVE_PENDING after having sent an ACTIVATE_PDP_CONTEXT_REQ message, receives a REQUEST_PDP_CONTEXT_ACTIVATION message, the request from the MS has neither been accepted nor rejected. <R.SM.ACT_ABNO.M.013>. The address and APN in the REQ_PDP_ACT and ACTIVATE_PDP_REQ message are not comparable.

(GMM 1)

SM rejects with cause "Insufficient Resources".

GMM Sends Receive N-PDU number in the form of SEQUENCE primitive



(GMM 1)

Network sends the Receive N-PDU number in the form of GMMSM_SEQUENCE_IND to SM.

(SM 1)

SM will forward this message in a primitive to SNDCP.

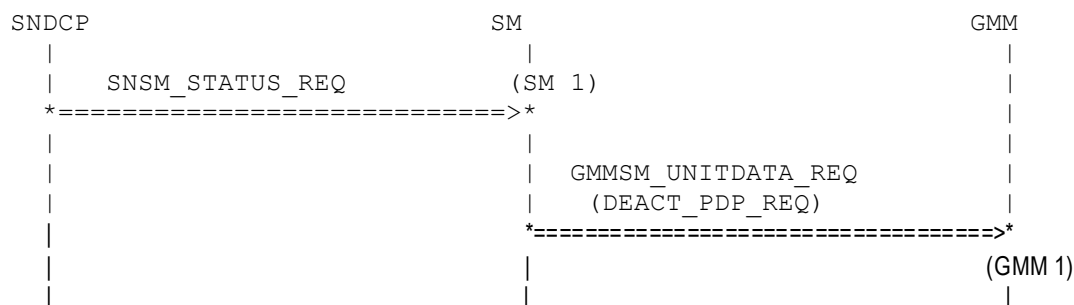
(SNDCP 1)

SNDCP after receiving the Receive N-PDU number from N/w puts the current N-PDU number of MS SNDCP's in SNSM_SEQUENCE_RES primitive to SM.

(SM 2)

SM will in turn sends Receive N-PDU number of SNDCP to GMM through GMMSM_SEQUENCE_RES.

SNDCCP sends STATUS primitive to SM to Deactivate particular PDP Context



(SM 1)

SM is in PDP_ACTIVE state and SNDCCP sends SNSM_STATUS_REQ primitive to SM to Deactivate particular PDP Context

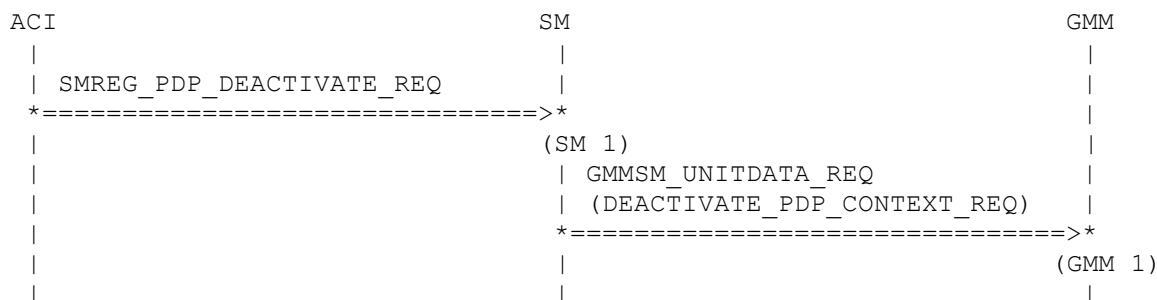
(GMM 1)

SM deactivates particular contexts using the affected nsapi for both Acknowledge and Unacknowledged mode, Starts Timer 3390 and enters into the State PDP_INACTIVE_PENDING.

PDP context deactivation

<R.SM.SERVICES.A.001>

PDP context deactivation, MS initiated



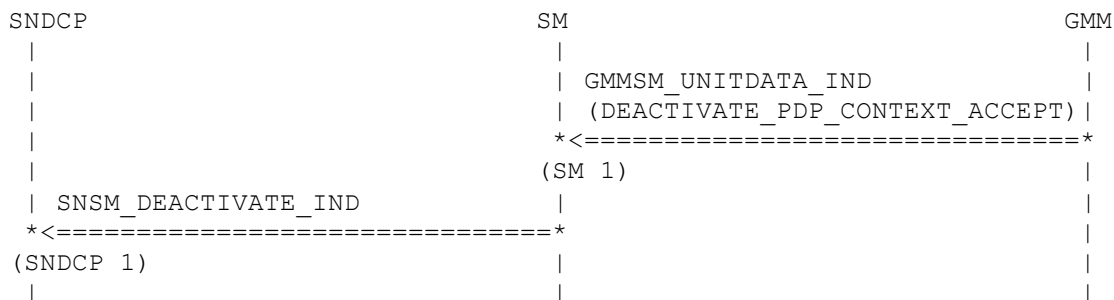
(SM 1)

SM is in state PDP_ACTIVE <R.SM.PDP_ACT.M.001>. ACI sends an SMREG_PDP_DEACTIVATE_REQ to initiate the anonymous PDP context deactivation <R.SM.PDP_DE_M.M.001>.

(GMM 1)

SM starts timer T3390 <R.SM.MS_DEACT.M.003>, <R.SM.PDP_DE_M.M.002>. SM enters state PDP_INACTIVE_PENDING <R.SM.PDP_I_P.M.001><R.SM.MS_DEACT.M.002> and sends a DEACTIVATE_PDP_CONTEXT_REQ message <R.SM.MS_DEACT.M.001>, <R.SM.PDP_DE_M.M.003> containing the transaction identifier in use for the PDP context to be deactivated and a cause code that typically indicates one of the following causes: #26 insufficient resources, #36 regular PDP context deactivation or #37 QoS not accepted.

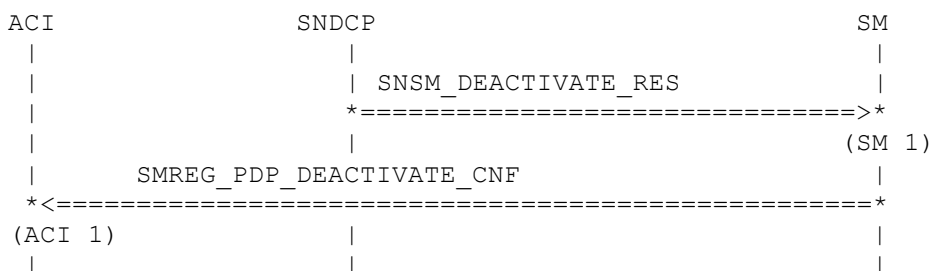
PDP context deactivation, MS initiated, network accepts



(SM 1)
SM is in state PDP_INACTIVE_PENDING <R.SM.PDP_I.P.M.001>. The network sends a DEACTIVATE_PDP_CONTEXT_ACCEPT message to inform the MS that the deactivation request is accepted <R.SM.MS_DEACT.M.007>, <R.SM.PDP_DE_M.M.007>.

(SND CP 1)
SM stops timer T3390 <R.SM.MS_DEACT.M.008>, <R.SM.PDP_DE_M.M.008>. SM enters state PDP_INACTIVE_WAIT_SND CP. SM sends an SNSM_DEACTIVATE_IND to inform SND CP that the NSAPI in question can be de-allocated <R.SM.PDP_DE_M.M.009>. (SND CP will do so only if the LLC link in question is not used by any other PDP context using acknowledged mode <R.SM.MS_DEACT.M.009>.

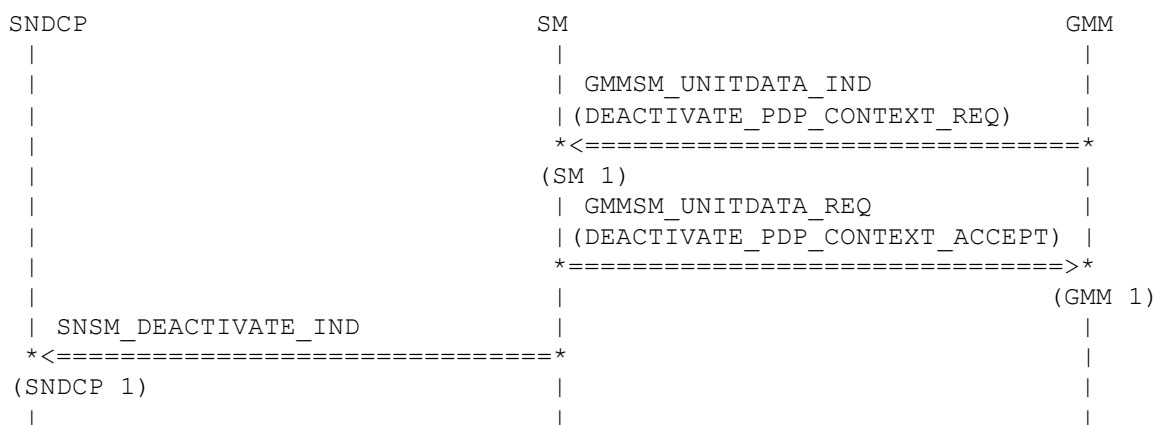
PDP context deactivation, MS initiated, NSAPI released



(SM 1)
SM is in state PDP_INACTIVE_WAIT_SND CP. SND CP sends an SNSM_DEACTIVATE_RES to inform SM that the NSAPI in question has been released <R.SM.PDP_DE_M.M.012>.

(ACI 1)
SM sends an SMREG_PDP_DEACTIVATE_CNF to ACI to confirm that the PDP context has been deactivated <R.SM.PDP_DE_M.M.013>.

PDP context deactivation, network initiated



(SM 1)
SM is in state PDP_ACTIVE <R.SM.PDP_ACT.M.001>. The network sends a DEACTIVATE_PDP_CONTEXT_REQ message to initiate a PDP context deactivation <R.SM.N_DEACT.I.001>, <R.SM.N_DEACT.M.004>.

<R.SM.PDP_DE_N.M.004>. The message contains the transaction identifier in use for the PDP context to be deactivated and a cause code that typically indicates one of the following causes: #36 regular PDP context deactivation, #38 network failure or #39 reactivation requested. .

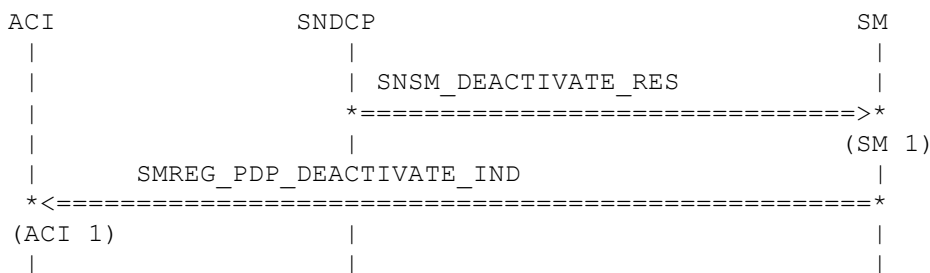
(GMM 1)

SM enters state PDP_INACTIVE_WAIT_SNDPCT_MT. SM answers with a DEACTIVATE_PDP_CONTEXT_ACCEPT message <R.SM.N_DEACT.M.005>, <R.SM.PDP_DE_N.M.005>.

(SNDPCT 1)

SM sends an SNSM_DEACTIVATE_IND to SNDPCT to inform the SNDPCT entity that an NSAPI has been deallocated and cannot be used by the SNDPCT entity anymore <R.SM.PDP_DE_N.M.006>. All buffered N-PDUs corresponding to this NSAPI are deleted. SNDPCT will release the affected LLC link if it is not used by any other PDP context using acknowledged mode.

PDP context deactivation, network initiated, NSAPI released



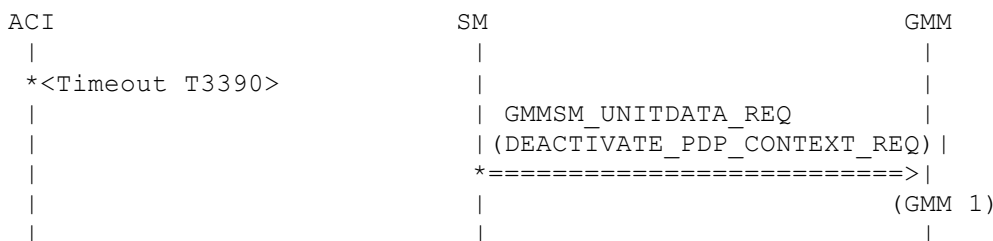
(SM 1)

SM is in state PDP_INACTIVE_WAIT_SNDPCT_MT. SNDPCT sends an SNSM_DEACTIVATE_RES to inform SM that the NSAPI in question has been released <R.SM.PDP_DE_N.M.010>.

(ACI 1)

SM sends an SMREG_PDP_DEACTIVATE_IND to ACI to confirm that the PDP context has been deactivated <R.SM.PDP_DE_N.M.011> and enters the state PDP_INACTIVE.

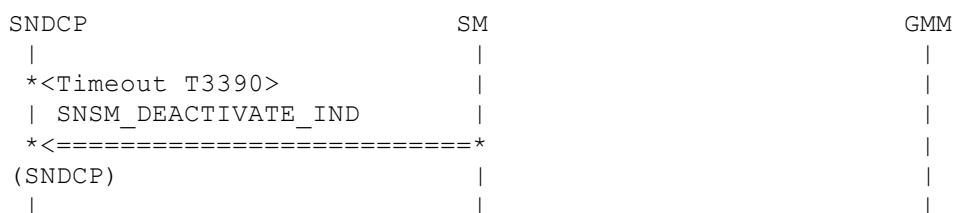
PDP context deactivation, timer expiring up to four times



(GMM 1)

SM is in state PDP_INACTIVE_PENDING. Instead of receiving the expected DEACTIVATE_PDP_CONTEXT_ACCEPT message the timer T3390 expires (for a first, second, third or fourth time) <R.SM.DE_ABNO.M.001>. Then the MS resends the DEACTIVATE_PDP_CONTEXT_REQ message <R.SM.DE_ABNO.M.002> and resets and restarts T3390 <R.SM.DE_ABNO.M.003>.

PDP context deactivation, timer expiring for the fifth time



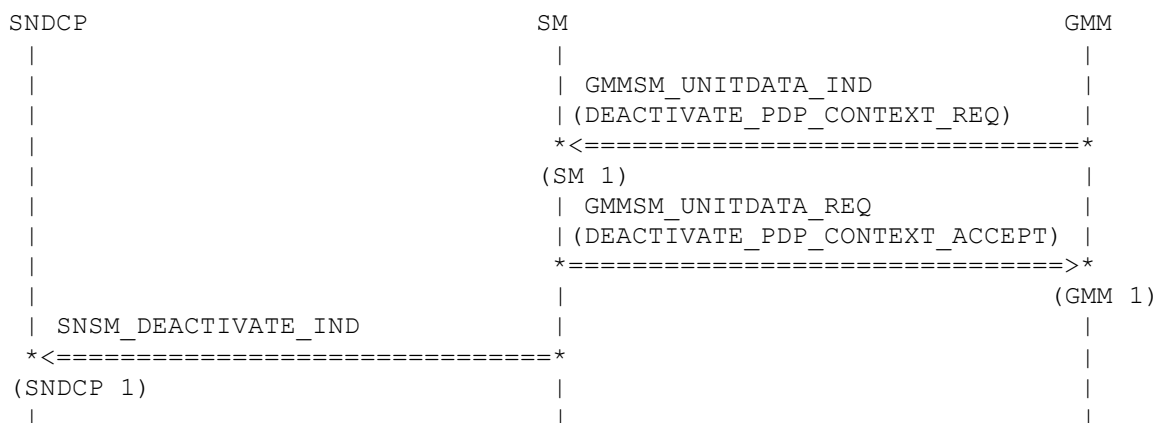
(GMM 1)

SM is in state PDP_INACTIVE_PENDING. Instead of receiving the expected DEACTIVATE_PDP_CONTEXT_ACCEPT message the timer T3390 expires for the fifth time <R.SM.DE_ABNO.M.004>.

(SND CP 1)

Then the MS releases all resources possibly allocated for this invocation <R.SM.DE_ABNO.M.005> and erases the PDP context related data <R.SM.DE_ABNO.M.006>. This is initiated by sending an SNSM_DEACTIVATE_IND and enters the state PDP_INACTIVE_WAIT_SND CP.

PDP context deactivation, collision of deactivation requests



(SM 1)

SM is in state PDP_INACTIVE_PENDING after having sent a DEACTIVATE_PDP_CONTEXT_REQ message. Instead of the expected DEACTIVATE_PDP_CONTEXT_ACCEPT a DEACTIVATE_PDP_CONTEXT_REQ is received (collision) <R.SM.DE_ABNO.A.012>.

(GMM 1)

SM replies with the message DECATIVATE_PDP_CONTEXT_ACCEPT <R.SM.DE_ABNO.M.013>. SM stops timer T3390 <R.SM.DE_ABNO.M.014>.

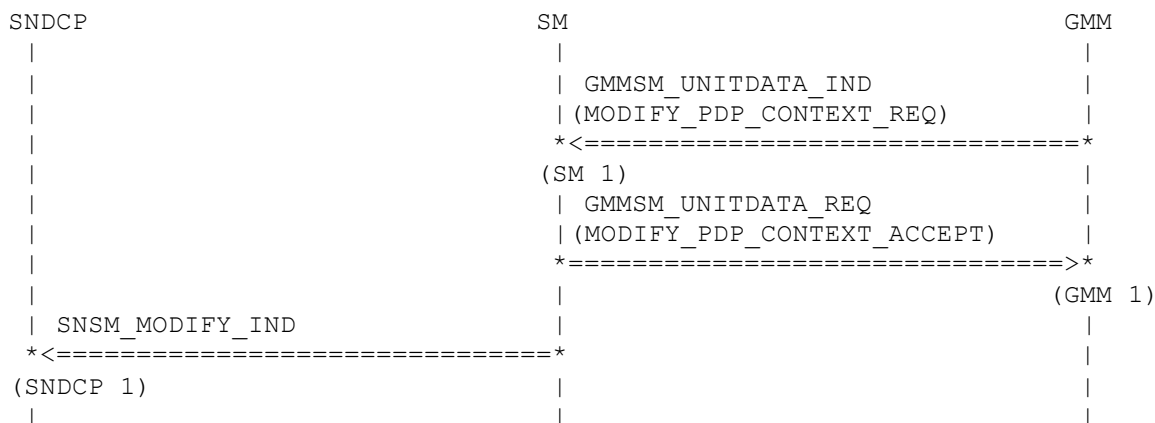
(SND CP 1)

SM sends an SNSM_DEACTIVATE_IND to SND CP to inform the SND CP entity that an NSAPI has been deallocated and cannot be used by the SND CP entity anymore. All buffered N-PDUs corresponding to this NSAPI are deleted.

PDP context modification

<R.SM.SERVICES.A.001>

PDP context modification initiated by the network, MS accepts QoS and SAPI



(SM 1)

SM is in state PDP_ACTIVE <R.SM.PDP_ACT.M.001>. The network sends a MODIFY_PDP_CONTEXT_REQ message to initiate a PDP context modification <R.SM.CONT_MOD.M.005>, <R.SM.CO_MOD.M.004>, <R.SM.RAU_INTE.M.006>.

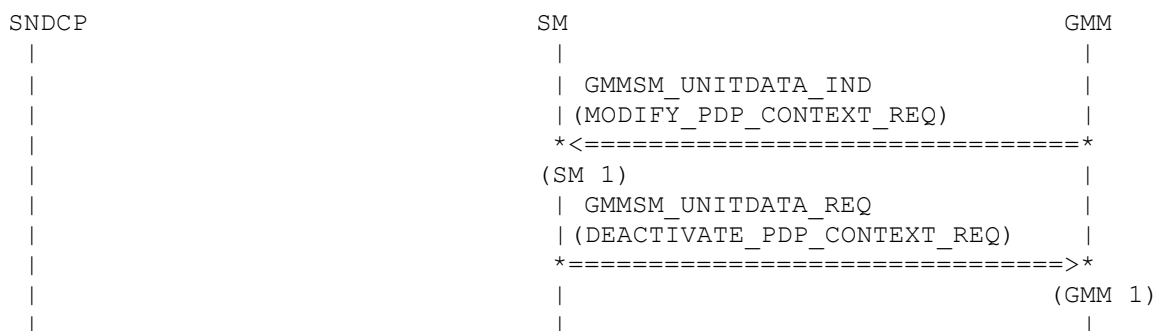
(GMM 1)

The MS accepts the proposed new QoS and the indicated LLC SAPI <R.SM.CONT_MOD.M.006> (That means the requested new QoS corresponds with the "minimum QoS given by GACI during activation). SM answers with a MODIFY_PDP_CONTEXT_ACCEPT message <R.SM.CONT_MOD.M.006>, <R.SM.CONT_MOD.M.007>, <R.SM.CO_MOD.M.005>, <R.SM.RAU_INTE.M.007>.

(SND CP 1)

SM sends an SNSM_MODIFY_IND to SND CP to trigger change of the QoS profile (see GSM 04.08) for an NSAPI and indication of the SAPI to be used <R.SM.CO_MOD.M.006>, <R.SM.RAU_INTE.M.008>. It is also used by the SM entity in the SGSN to inform the SND CP entity that an NSAPI shall be created, together with the (re-)negotiated QoS profile, the SAPI assigned, and, in the MS, the radio priority level to be used by RLC/MAC.

PDP context modification initiated by the network, MS does not accept QoS and SAPI



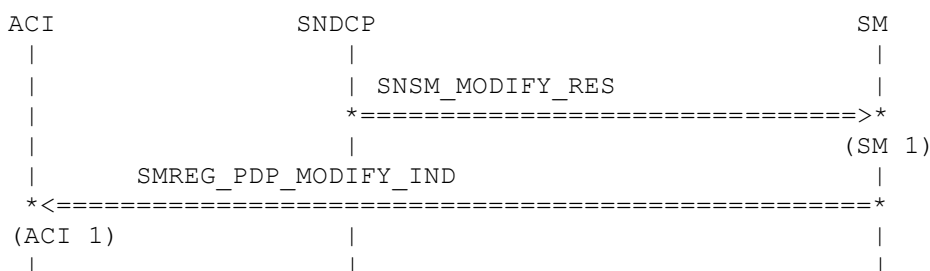
(SM 1)

SM is in state PDP_ACTIVE <R.SM.PDP_ACT.M.001>. The network sends a MODIFY_PDP_CONTEXT_REQ message to initiate a PDP context modification <R.SM.CONT_MOD.M.005>.

(GMM 1)

The MS does not accept the new QoS and the indicated LLC SAPI <R.SM.CONT_MOD.M.008> and initiates the PDP context deactivation procedure by sending a DEACTIVATE_PDP_CONTEXT_REQ message <R.SM.CONT_MOD.M.009> and starts the Timer 3390 and enters into PDP_INACTIVE_PENDING state.

PDP context modification, network initiated, SND CP finished requested changes



(SM 1)

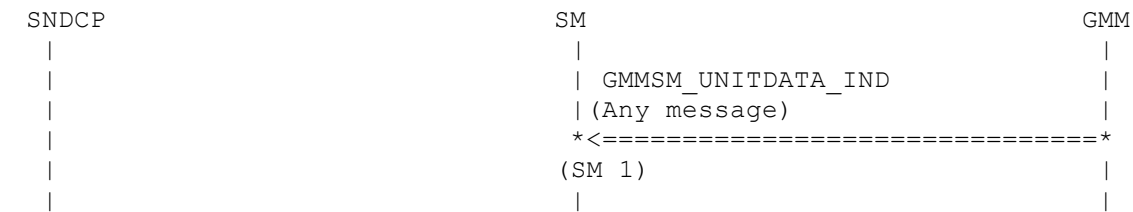
SM is in state PDP_ACTIVE <R.SM.PDP_INAC.M.001>. SND CP sends an SNSM_DEACTIVATE_RES to inform SM that the NSAPI in question has been released <R.SM.CO_MOD.M.010>.

(ACI 1)

SM sends an SMREG_PDP_MODIFY_IND to ACI to confirm that the PDP context has been deactivated <R.SM.CO_MOD.M.011>.

Handling of unknown, unforeseen and erroneous protocol data

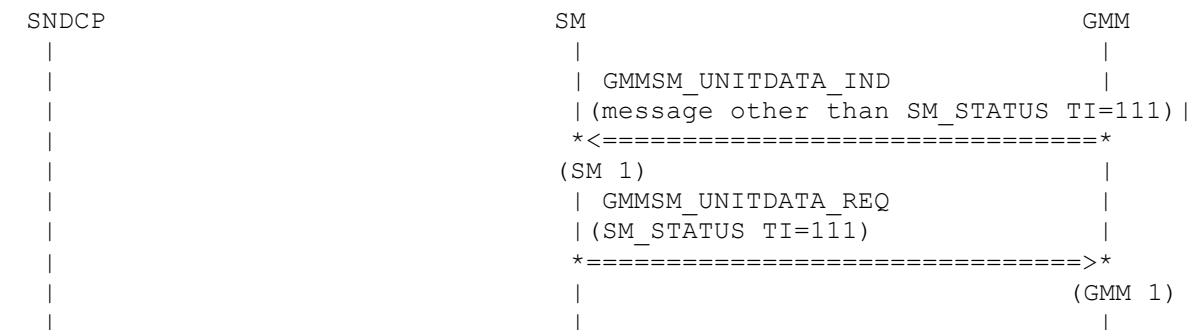
Message too short



(SM 1)

SM is in any state. It receives a message too short to contain a complete message type IE. <R.SM.MSG.A.001>. That message is ignored <R.SM.MSG.A.002>.

Message other than SM_STATUS with TI value "111"



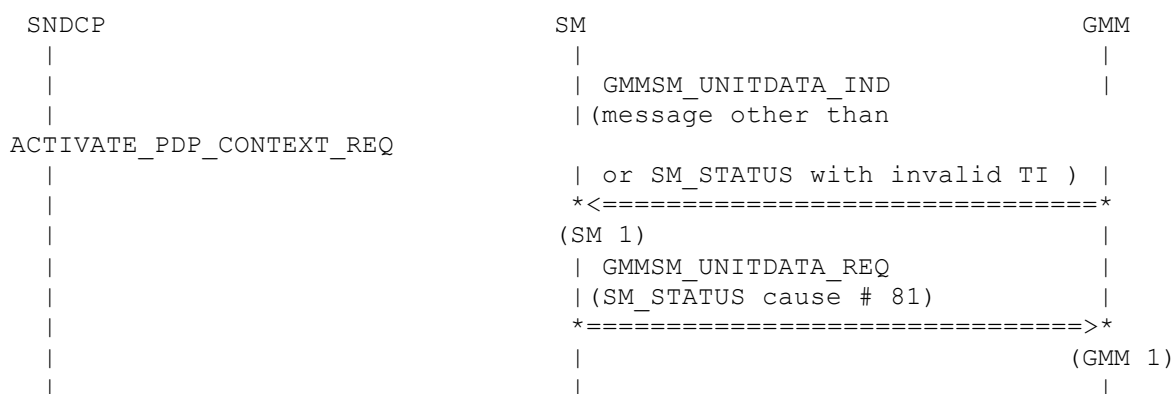
(SM 1)

SM is in any state. It receives a message other than SM_STATUS and having a TI value "111" <R.SM.UN_TI.A.001>.

(GMM 1)

SM shall immediately send an SM_STATUS message with TI value "111".

Invalid transaction identifier value



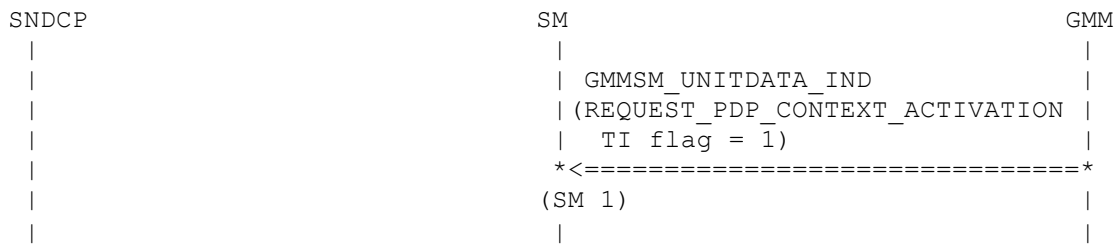
(SM 1)

A session management message except REQUEST_PDP_CONTEXT_ACTIVATION or SM_STATUS is received by the MS specifying a transaction identifier which is not recognized as relating to an active context or to a context that is in the process of activation or deactivation or has been [recently] deactivated <R.SM.UN_TI.M.006>.

(GMM 1)

SM sends an SM_STATUS message with cause #81 "Invalid transaction identifier value" using the received transaction identifier value <R.SM.UN_TI.M.007>.

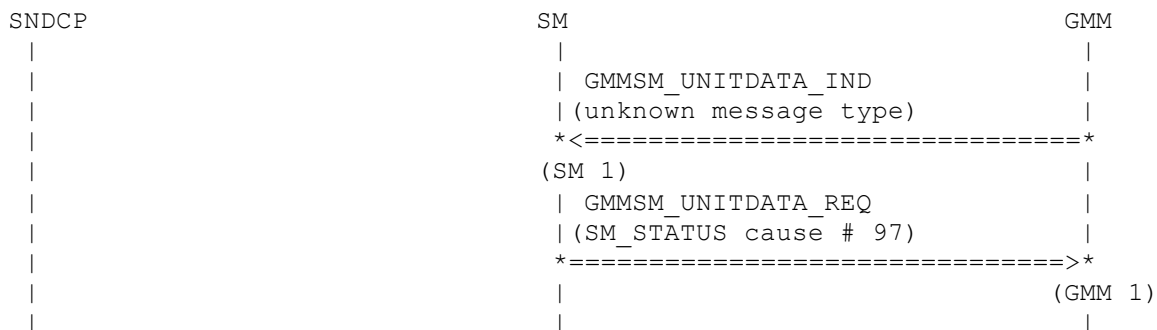
REQUEST_PDP_CONTEXT_ACTIVATION message with TI flag set to "1"



(SM 1)

a REQUEST_PDP_CONTEXT_ACTIVATION is received with transaction identifier set to "1" <R.SM.UN_TI.M.009>. This message is ignored <R.SM.UN_TI.M.010>.

Unknown message type



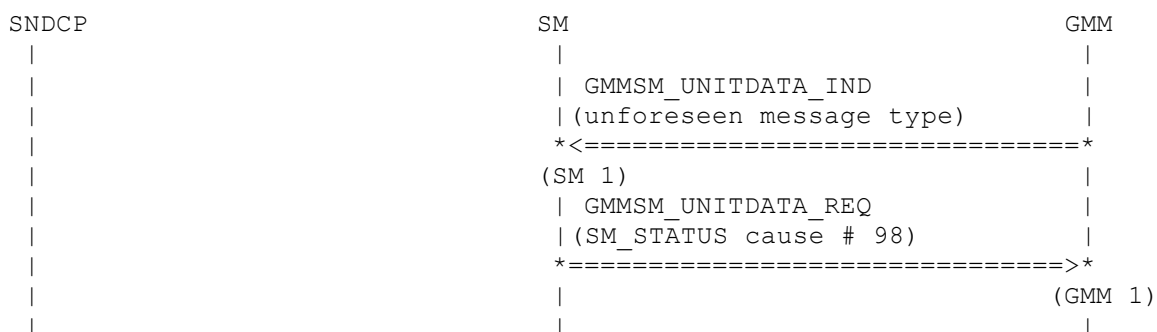
(SM 1)

If a mobile station receives an SM message with message type not defined for the PD or not implemented by the receiver <R.SM.UN_MSG_T.M.001>, then

(GMM 1)

it shall return a status message (SM STATUS) with cause # 97 "message type non-existent or not implemented" <R.SM.UN_MSG_T.M.002>.

Unforeseen message type



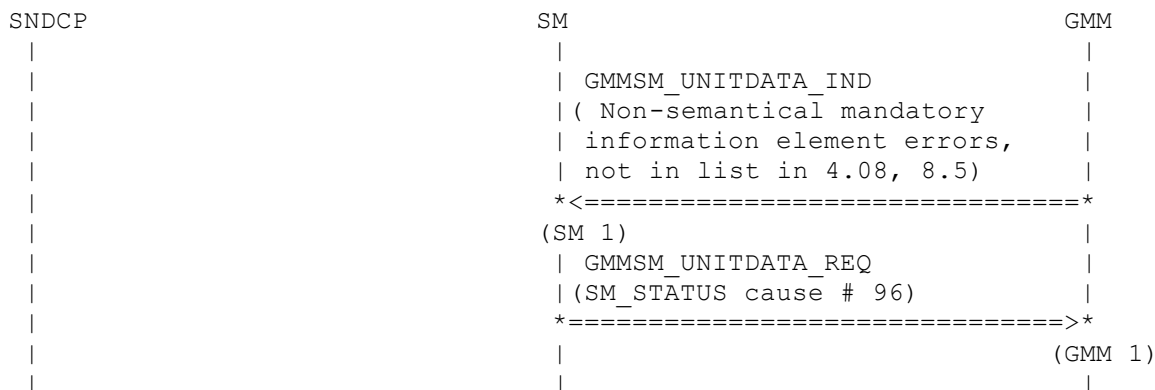
(SM 1)

If a mobile station receives an SM message with message type not compatible with the protocol state <R.SM.UN_MSG_T.M.006> and an RR connection exists <R.SM.UN_MSG_T.M.007>, then

(GMM 1)

it shall return a status message (SM STATUS) with cause # 98 "Message type not compatible with protocol state" <R.SM.UN_MSG_T.M.008>.

Non-semantic mandatory information element errors, not in list 4.08, 8.5



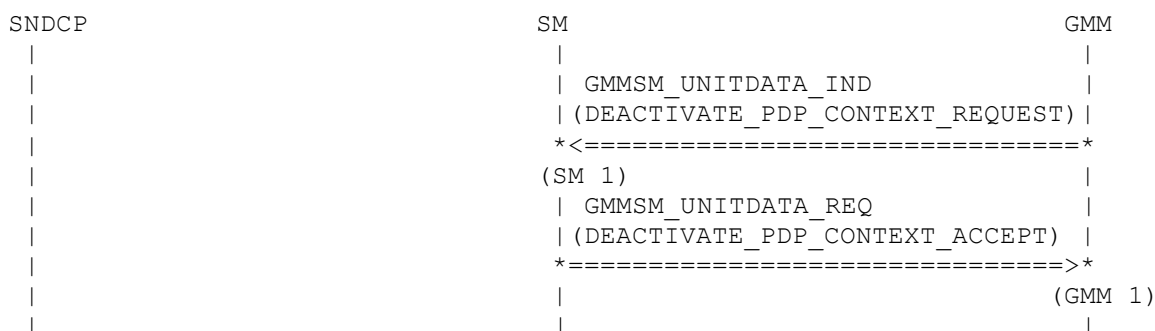
(SM 1)

The mobile station receives an SM message with Non-semantic mandatory information element errors and the message is not in the list in [GSM 04.65, 8.5] <R.SM.MAND_ERR.M.005> and an RR connection exists <R.SM.MAND_ERR.M.002>

(GMM 1)

The MS shall return a status message (SM-STATUS) with cause # 96 "invalid mandatory information" <R.SM.MAND_ERR.M.003>. If no RR connection exists the message is just ignored <R.SM.MAND_ERR.M.004>.

Non-semantic mandatory information element errors, DEACTIVATE_PDP_CONTEXT_REQUEST



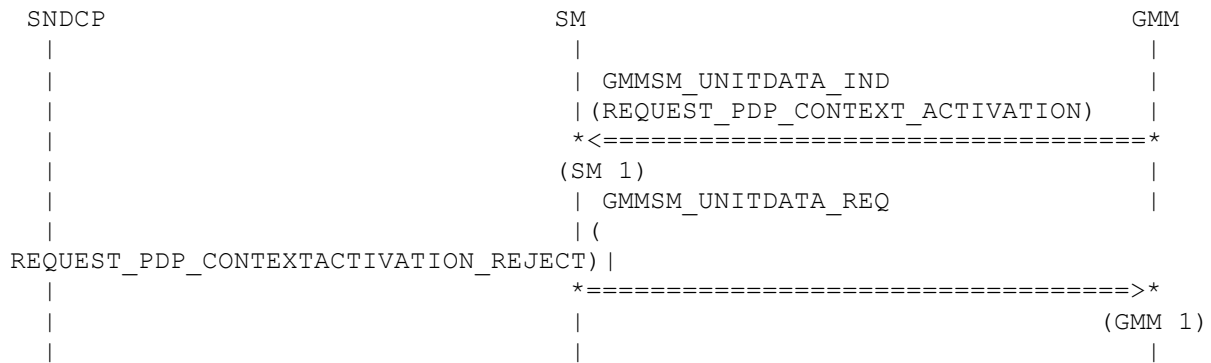
(SM 1)

The mobile station receives an SM message with Non-semantic mandatory information element errors and the message is DEACTIVATE PDP CONTEXT REQUEST <R.SM.MAND_ERR.M.006>.

(GMM 1)

The MS shall return a DEACTIVATE PDP CONTEXT ACCEPT message. All resources allocated for that context shall be released.

Non-semantic mandatory information element errors, REQUEST PDP CONTEXT ACTIVATION



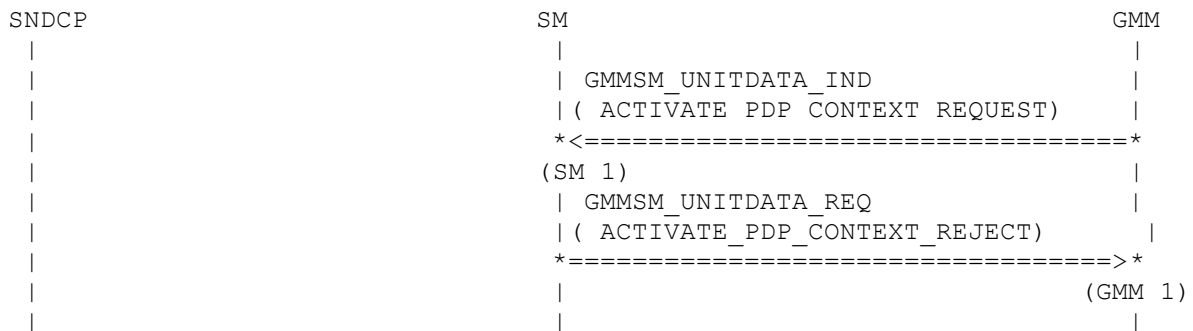
(SM 1)

The mobile station receives an SM message with Non-semantic mandatory information element errors and the message is REQUEST_PDP_CONTEXT_ACTIVATION <R.SM.MAND_ERR.M.008>.

(GMM 1)

The MS shall return a REQUEST_PDP_CONTEXT_ACTIVATION_REJECT message with cause # 96 "Invalid mandatory information".

Non-semantic mandatory information element errors, ACTIVATE PDP CONTEXT REQUEST



(SM 1)

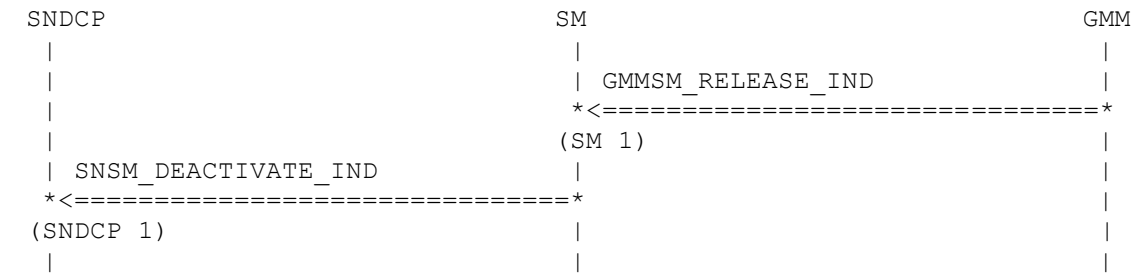
The mobile station receives an SM message with Non-semantic mandatory information element errors and the message is REQUEST_PDP_CONTEXT_ACTIVATION <R.SM.MAND_ERR.M.008>.

(GMM 1)

The MS shall return a REQUEST_PDP_CONTEXT_ACTIVATION_REJECT message with cause # 96 "Invalid mandatory information".

Detach

MS initiated detach, GPRS only



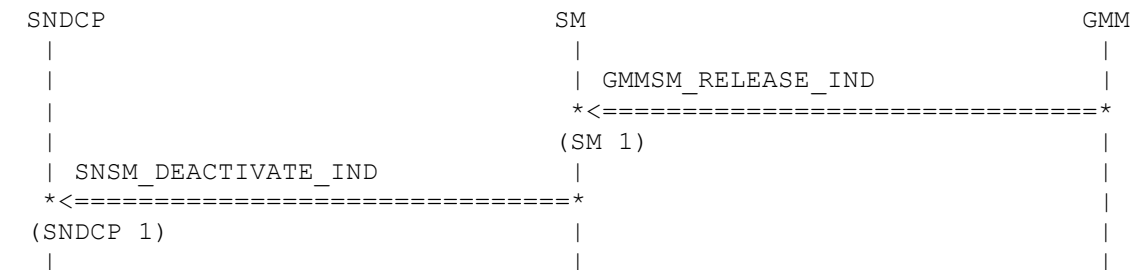
(SM 1)

SM receives a GMM SM_RELEASE_IND from GMM <R.SM.MS_DET.A.001>.

(SND CP 1)

SM initiates the release of the logical link by sending an SNSM_DEACTIVATE_IND <R.SM.MS_DET.A.002>.

Network initiated detach, GPRS only



(SM 1)

SM receives a GMM SM_RELEASE_IND from GMM <R.SM.NET_DET.A.001>.

(SND CP 1)

SM initiates the release of the logical link by sending an SNSM_DEACTIVATE_IND <R.SM.NET_DET.A.002>.

Appendices

A. Acronyms

DS-WCDMA Direct Sequence/Spread Wideband Code Division Multiple Access

B. Glossary

International Mobile Telecommunication 2000 (IMT-2000/ITU-2000) Formerly referred to as FPLMTS (Future Public Land-Mobile Telephone System), this is the ITU's specification/family of standards for 3G. This initiative provides a global infrastructure through both satellite and terrestrial systems, for fixed and mobile phone users. The family of standards is a framework comprising a mix/blend of systems providing global roaming. <URL: <http://www.imt-2000.org/>>