3GPP TSG CN Plenary
Meeting #11, Palm Springs, U.S.A
14th - 16th March 2001

Tdoc NP-010073

Source:	**TSG CN WG4**
Title:	**CRs to R99 on Work Item GTP Enhancement**
Agenda item:	**7.14**
Document for:	**APPROVAL**

Introduction:

This document contains **13** CRs on **R99** Work Item **"GTP Enhancement"**, that have been agreed by **TSG CN WG4**, and are forwarded to TSG CN Plenary meeting #11 for approval.

Spec	CR	Rev	Doc-2nd-Level	Phase	Subject	Cat	Ver_C
29.060	163		N4-010016	R99	Re-configure the IEs in the PDU Notification Request to make it in ascending order	F	3.7.0
29.060	166		N4-010019	R99	Corrections to editorwork of 29.060 v 3.7.0	F	3.7.0
29.060	162		N4-010139	R99	Handling of sequence numbers for reliable transmission of control plane messages	F	3.7.0
29.060	178		N4-010181	R99	Re-configure the IEs in the Send Routeing Information for GPRS Response message to make it in ascending order	F	3.7.0
29.060	174	1	N4-010182	R99	Essential Correction of the delete PDP context procedure	F	3.7.0
29.060	173	3	N4-010183	R99	Clarifications to the GTP-U protocol	F	3.7.0
29.060	187		N4-010404	R99	Clarification on the handling of sequence numbers in the GTP user plane	F	3.7.0
29.060	188		N4-010405	R99	Clarifications and clean up of the error handling section	F	3.7.0
29.060	155	4	N4-010452	R99	Adding Uplink TEID Data I and user plane GGSN address to PDP Context IE	F	3.7.0
29.060	191	1	N4-010455	R99	Clarification on the use of the term G-PDU	F	3.7.0
29.060	170	2	N4-010456	R99	Clarification on the TEID value of the signalling messages	F	3.7.0
29.060	182	2	N4-010458	R99	GSN address in Error Indication	F	3.7.0
29.060	186	1	N4-010460	R99	Clarification of Error Indication	F	3.7.0

CR-Form-v3

CHANGE REQUEST

| ⌘ | **29.060** CR **155** | ⌘ rev **4** ⌘ | Current version: | **3.7.0** ⌘ |

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘   (U)SIM ☐   ME/UE ☐   Radio Access Network ☐   Core Network ☒

Title: ⌘	Adding Uplink TEID Data I and user plane GGSN address to PDP Context IE	
Source: ⌘	CN4	
Work item code: ⌘	GTP enhancement	***Date:*** ⌘ 27 February 2001
Category: ⌘	**F** (Essential correction)	***Release:*** ⌘ R99

Use one of the following categories:	*Use one of the following releases:*
F *(essential correction)*	*2* *(GSM Phase 2)*
A *(corresponds to a correction in an earlier release)*	*R96* *(Release 1996)*
B *(Addition of feature),*	*R97* *(Release 1997)*
C *(Functional modification of feature)*	*R98* *(Release 1998)*
D *(Editorial modification)*	*R99* *(Release 1999)*
Detailed explanations of the above categories can	*REL-4* *(Release 4)*
be found in 3GPP TR 21.900.	*REL-5* *(Release 5)*

Reason for change: ⌘	CN plenary meeting # 10 has taken Nokia, Alcatel, Siemens and Ericsson's view on loss-less SRNS relocation as the working assumption. Adding new IEs to PDP Context IE has been agreed. Nortel would withdraw their objection to this solution, if ambiguity on GTP-U sequence numbering would be resolved. 29.060 has several ambiguities. The first sentence in sub-clause 9.3.1.1 reads: " The sending GSN shall use 0 for the value of the Sequence Number of the first T-PDU in a tunnel ". An undefined term 'dialog' is used in sub-clause 9.3.1.1. It is prohibited for two different remote GTP-U endpoints to send traffic to a GTP-U protocol entity using the same TEID value (sub clause 9.1).
	The latter contradicts to the SRNS Relocation procedure as it is defined in 23.060 (e.g. sub clause 6.9.2.2.1 step 4), and therefore the restriction should be removed for the SRNS Relocation and Intersystem Change procedures.
	Following quote of sub clause 12.7.2.1.1 'Consistent Sequence Numbering of PDUs on Iu and Gn Interfaces' in 23.060 resolves the ambiguity provoked by usage of undefined term 'dialogue':
	"The GTP-U PDU sequence numbers allocated by the GGSN (down-link) and SRNS (up-link) are kept unchanged irrespective of the number of GTP tunnels the PDU is transferred over. Therefore, SGSN shall use on the Iu interface for down-link PDUs the GTP-U sequence number received from the GGSN, and shall use on the Gn interface for up-link PDUs the GTP-U sequence number received from the SRNS. **In case of SRNS relocation and intersystem change, the SRNS and SGSN shall tunnel PDUs without changing the GTP-U sequence numbers.**"
	The last sentence above makes clear that the fist sentence in 9.3.1.1 is not correct and needs to be changed.
	23.121 requires that 3G-SGSN shall not buffer packets at all. Hence, in order to

		support loss-less relocation the new SGSN should receive Up-link TEID for Data I and GGSN user plane address with the Forward Relocation Request message. That requires adding this information elements to the PDP Context IE. The proposed CR aligns 29.060 with stage 2 specifications: 23.121 and 23.060. Last week the S2 has accepted related Tdoc S2-010380 by the email approval.
Summary of change: ⌘		The proposed CR clarifies ambiguous issues in 29.060 and provides for loss-less relocation in a way that makes 29.060 conform to the requirements defined in 23.121 and 23.060.
Consequences if not approved: ⌘		If this CR is not approved 29.060 shall continue to contradict 23.121 and 23.060 on the matter of the loss-less relocation. Besides, vendors which disagree on the issue might produce GTP-U entities that shall not inter-operate.

Clauses affected:	⌘	7.7.29; 9.1; 9.3.1.1		
Other specs affected:	⌘	**X** Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	23.060
Other comments:	⌘	Usage of terms 'G-PDU' and 'T-PDU' has been aligned with N4-010455.		

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at:
http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

7.7.29   PDP Context

The PDP Context information element contains the Session Management parameters, defined for an external packet data network address, that are necessary to transfer between SGSNs at the Inter SGSN Routeing Area Update procedure.

NSAPI is an integer value in the range [0; 15].

The NSAPI points out the affected PDP context.

The SAPI indicates the LLC SAPI that is associated with the NSAPI.

The Transaction Identifier is the 4 or 12 bit Transaction Identifier used in the 3G TS 24.008 Session Management messages which control this PDP Context. If the length of the Transaction Identifier is 4 bit, the second octet shall be set to all zeros. The encoding is defined in 3G TS 24.007. The latest Transaction Identifier sent from SGSN to MS is stored in the PDP context IE.

Reordering Required (Order) indicates whether the SGSN shall reorder T-PDUs before delivering the T-PDUs to the MS. When the Quality of Service Negotiated (QoS Neg) is Release 99, the Reordering Required (Order) shall be ignored by receiving entity.

The VPLMN Address Allowed (VAA) indicates whether the MS is allowed to use the APN in the domain of the HPLMN only or additionally the APN in the domain of the VPLMN.

The QoS Sub Length, QoS Req Length and QoS Neg Length represent respectively the lengths of the QoS Sub, QoS Req and QoS Neg fields, excluding the QoS Length octet.

The Quality of Service Subscribed (QoS Sub), Quality of Service Requested (QoS Req) and Quality of Service Negotiated (QoS Neg) are encoded as described in section 'Quality of Service (QoS) Profile'. Their minimum length is 4 octets; their maximum length may be 255 octets.

The Sequence Number Down is the number of the next T-PDU that shall be sent from the new SGSN to the MS. The number is associated to the Sequence Number from the GTP Header of an encapsulated T-PDU.

The Sequence Number Up is the number that new SGSN shall use as the Sequence Number in the GTP Header for the next encapsulated T-PDU from the MS to the GGSN.

The Send N-PDU Number is used only when acknowledged peer-to-peer LLC operation is used for the PDP context. Send N-PDU Number is the N-PDU number to be assigned by SNDCP to the next down link N-PDU received from the GGSN. It shall be set to 255 if unacknowledged peer-to-peer LLC operation is used for the PDP context.

The Receive N-PDU Number is used only when acknowledged peer-to-peer LLC operation is used for the PDP context. The Receive N-PDU Number is the N-PDU number expected by SNDCP from the next up link N-PDU to be received from the MS. It shall be set to 255 if unacknowledged peer-to-peer LLC operation is used for the PDP context.

The Up-link Tunnel Endpoint Identifier Control Plane is the Tunnel Endpoint Identifier used between the old SGSN and the GGSN in up link direction for control plane purpose. It shall be used by the new SGSN within the GTP header of the Update PDP Context Request message.

The GGSN Address for User Traffic and the Up-linkTunnel Endpoint Identifier Data I are the GGSN address and the Tunnel Endpoint Identifier used between the old SGSN and the GGSN in up-link direction for user plane traffic on a PDP context. They shall be used by the new SGSN to send up-link user plane PDU to the GGSN.

The PDP Context Identifier is used to identify a PDP context for the subscriber.

The PDP Type Organisation and PDP Type Number are encoded as in the End User Address information element.

The PDP Address Length represents the length of the PDP Address field, excluding the PDP Address Length octet.

The PDP Address is an octet array with a format dependent on the PDP Type. The PDP Address is encoded as in the End User Address information element if the PDP Type is IPv4 or IPv6.

The GGSN Address Length represents the length of the GGSN Address field, excluding the GGSN Address Length octet.

The old SGSN includes the GGSN Address for control plane that it has received from GGSN at PDP context activation or update.

The APN is the Access Point Name in use in the old SGSN. I.e. the APN sent in the Create PDP Context request message.

The spare bits x indicate unused bits that shall be set to 0 by the sending side and which shall not be evaluated by the receiving side.

Octet	Field				
1	Type = 130 (Decimal)				
2-3	Length				
4	Res-erved	VAA	Res-erved	Order	NSAPI
5	X	X	X	X	SAPI
6	QoS Sub Length				
7 - (q+6)	QoS Sub [4..255]				
q+7	QoS Req Length				
(q+8)-(2q+7)	QoS Req [4..255]				
2q+8	QoS Neg. Length				
(2q+9)-(3q+8)	QoS Neg [4..255]				
(3q+9)-(3q+10)	Sequence Number Down (SND) [1]				
(3q+11)-(3q+12)	Sequence Number Up (SNU) [1]				
3q+13	Send N-PDU Number [1]				
3q+14	Receive N-PDU Number [1]				
(3q+15)-(3q+18)	Up-link Tunnel Endpoint Identifier Control Plane				
(3q+19)-(3q+22)	Up-linkTunnel Endpoint Identifier Data I				
3q+23<s>19</s>	PDP Context Identifier				
3q+24<s>0</s>	Spare 1 1 1 1			PDP Type Organisation	
3q+25<s>1</s>	PDP Type Number				
3q+26<s>2</s>	PDP Address Length				
(3q+27<s>3</s>)-m	PDP Address [1..63]				
m+1	GGSN Address for control plane Length				
(m+2)-n	GGSN Address for control plane [4..16]				
n+1	GGSN Address for User Traffic Length				
(n+2)-o	GGSN Address for User Traffic [4..16]				
<s>n</s>o+1	APN length				
(<s>n</s>o+2)-p<s>o</s>	APN				
o<s>p</s>+1	Spare (sent as 0 0 0 0)			Transaction Identifier	
<s>O</s>p+2	Transaction Identifier				

Figure 43: PDP Context Information Element

1)   This field shall not be evaluated when the PDP context is received during UMTS intra system handover/relocation.

Table 48: Reordering Required Values

Reordering Required	Value (Decimal)
No	0
Yes	1

Table 49: VPLMN Address Allowed Values

VPLMN Address Allowed	Value (Decimal)
No	0
Yes	1

*** *Next Modification* ***

9   GTP-U

GTP-U Tunnels are used to carry encapsulated T-PDUs between a given pair of GTP-U Tunnel Endpoints. The Tunnel Endpoint ID (TEID) which is present in the GTP header shall indicate which tunnel a particular T-PDU belongs to. In this manner, packets are multiplexed and de-multiplexed by GTP-U between a given pair of Tunnel Endpoints. The TEID value to be used in the TEID field shall be negotiated for instance during the GTP-C Create PDP Context and the RAB assignment procedures that take place on the control plane.

The maximum size of a T-PDU that may be transmitted without fragmentation by GGSN or the MS is defined in UMTS 23.060. The GGSN shall fragment, reject or discard T-PDUs, depending on the PDP type and implementation decisions, directed to the MS if the T-PDU size exceeds the maximum size. The decision if the T-PDUs shall be fragmented or discarded is dependent on the external packet data network protocol.

9.1   GTP-U Protocol Entity

The GTP-U protocol entity provides packet transmission and reception services to user plane entities in the GGSN, in the SGSN and, in UMTS systems, in the RNC. The GTP-U protocol entity receives traffic from a number of GTP-U tunnel endpoints and transmits traffic to a number of GTP-U tunnel endpoints. There is a GTP-U protocol entity per IP address.

The TEID in the GTP-U header is used to de-multiplex traffic incoming from remote tunnel endpoints so that it is delivered to the User plane entities in a way that allows multiplexing of different users, different packet protocols and different QoS levels. Therefore no two remote GTP-U endpoints shall send traffic to a GTP-U protocol entity using the same TEID value except for data forwarding as part of the SRNS relocation or Intersystem Change procedures.

9.3.1.1   Usage of Sequence Number

~~Only during the PDP context activation~~Tthe ~~~~sending GGSN and SRNC shall use 0 for the value of the Sequence Number of the first G̶T-PDU in a tunnel, only during the PDP context activation, and increment the Sequence Number for each following G̶T-PDU. The value shall wrap to zero after 65535.

~~When a dialogue is opened between GSNs, t~~The receiving GGSN and SRNC shall set the content of a counter to zero, only during the PDP context activation. When the receiving GGSN and SRNC receives a valid G̶T-PDU, it shall increment this counter by one. This counter shall wrap to zero after 65535. It defines the 'Expected Sequence Number'.

Based on the received and Expected Sequence Number values, the receiving GGSN and SRNC may decide whether or not to discard the received G̶T-PDU. Annex B (Informative) describes a method to determine whether a received G̶T-PDU is valid.

The receiving GGSN and SRNC shall reorder the incoming T-PDUs in sequence if the Reordering Required flag in the PDP context is set. In this case, if needed, the receiving GGSN and SRNC shall take into account a maximum number of valid received frames and a maximum elapsed time to assume that a G̶T-PDU was lost.

The G̶T-PDU sequence numbers allocated by the GGSN (down-link) and SRNC (up-link) are kept unchanged irrespective of the number of GTP tunnels the PDU is transferred over. Therefore, SGSN shall use on the Iu interface for down-link PDUs the G̶T-PDU sequence number received from the GGSN, and shall use on the Gn interface for up-link PDUs the G̶TP-PDU sequence number received from the SRNC. In case of SRNS relocation and intersystem change, the SRNC and SGSN shall tunnel PDUs without changing the G̶T-PDU sequence numbers.

3GPP TSG-CN4 Meeting #5   *Tdoc N4-001067*
Paris, France, 13-17 November 2000

	CR-Form-v3
CHANGE REQUEST	

⌘	**29.060** CR **162**	⌘	rev	**-**	⌘	Current version:	**3.7.0**	⌘

For **HELP** *on using this form, see bottom of this page or look at the pop-up text over the* ⌘ *symbols.*

Proposed change affects: ⌘   (U)SIM ☐   ME/UE ☐   Radio Access Network ☐   Core Network ☒

Title:	⌘	Handling of sequence numbers for reliable transmission of control plane messages
Source:	⌘	CN4
Work item code:	⌘ GTP enhancements	***Date:*** ⌘ Jan 2001
Category:	⌘ **F** (Critical Correction)	***Release:*** ⌘ R99

Use one of the following categories:	*Use one of the following releases:*
F *(essential correction)*	*2* *(GSM Phase 2)*
A *(corresponds to a correction in an earlier release)*	*R96* *(Release 1996)*
B *(Addition of feature),*	*R97* *(Release 1997)*
C *(Functional modification of feature)*	*R98* *(Release 1998)*
D *(Editorial modification)*	*R99* *(Release 1999)*
Detailed explanations of the above categories can	*REL-4* *(Release 4)*
be found in 3GPP TR 21.900.	*REL-5* *(Release 5)*

Reason for change:	⌘	since the response to a gtp message can potentially be sent from an ip interface different from the one that received the request message, this cr defines the usage of the sequence numbers for control plane messages that allow for such a behaviour.
Summary of change:	⌘	see the reson for change
Consequences if not approved:	⌘	there could be conflicting sequence numbers if the sequence number is defined to be unique only for the path, as currently specified.

Clauses affected:	⌘	7.6		
Other specs affected:	⌘ ☐	Other core specifications	⌘	
	☐	Test specifications		
	☐	O&M Specifications		
Other comments:	⌘	This CR is subcategory "essential"		

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

7.6 Reliable Delivery of Signalling Messages

Each path maintains a queue with signalling messages to be sent to the peer. The message at the front of the queue, if it is a request for which a response has been defined, shall be sent with a Sequence Number, and shall be held in a path list until a response is received. Each path has its own list. The Sequence Number shall be unique for each outstanding request message sourced from the same IP/UDP endpoint in a single path list. A GSN or RNC may have several outstanding requests while waiting for responses.

The T3-RESPONSE timer shall be started when a signalling request message (for which a response has been defined) is sent. A signalling message request or response has probably been lost if a response has not been received before the T3-RESPONSE timer expires. The request is then retransmitted if the total number of request attempts is less than N3-REQUESTS times. The timer shall be implemented in the control plane application. The wait time for a response (T3-RESPONSE timer value) and the number of retries (N3-REQUESTS) shall be configurable per procedure. The total wait time shall be shorter than the MS wait time between retries of Attach and RA Update messages.

All received request messages shall be responded to and all response messages associated with a certain request shall always include the same information. Duplicated response messages shall be discarded, and, for the SGSN Context Response case, the SGSN Context Acknowledge message shall be sent depending on the content of the received response message. A response message without a matching outstanding request should be considered as a duplicate.

The Forward Relocation Complete and Forward SRNS Context messages shall be treated as signalling request messages. The Forward Relocation Complete Acknowledge and Forward SRNS Context Acknowledge messages shall be treated as response messages.

The SGSN Context Response message needs special treatment by the old SGSN and New SGSN:

The New SGSN must consider this as a regular response to the outstanding SGSN Context Request message, but also copy the sequence number in the header of the SGSN Context Acknowledge it shall send back to the old SGSN depending on the content of the received response message.The Old SGSN, when it expects the new SGSN to send back a SGSN Context Acknowledge in response to a SGSN Context Response, shall keep track of the SGSN Context Response message sequence number and apply to this message the rules valid for a Request message too.If a GSN or RNC is not successful with the transfer of a signalling message, e.g. a Create PDP Context Request message, it shall inform the upper layer of the unsuccessful transfer so that the controlling upper entity may take the necessary measures.

CR-Form-v3

CHANGE REQUEST

⌘ **29.060** CR **163** ⌘ rev ⌘ Current version: **3.7.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title: ⌘	Re-configure the IEs in the PDU Notification Request to make it in ascending order	

Source: ⌘	CN4	

Work item code: ⌘	GTP Enhancements	***Date:*** ⌘	5th January 2001

Category: ⌘	**F** (Agreed by consensus)	***Release:*** ⌘	R99

Use <u>one</u> of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use <u>one</u> of the following releases:
2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
REL-4 *(Release 4)*
REL-5 *(Release 5)*

Reason for change: ⌘	According to the TS 29.060 section 7.7, The information elements shall be sorted, with the Type fields in ascending order, in the control plane messages. Currently, the IEs defined for the PDU Notification Request message does not follow the above rule. (I.e. This message has wrong IE order.)
Summary of change: ⌘	This CR reconfigures the IEs in the PDU Notification Request message in order to make it in ascending order.
Consequences if not approved: ⌘	Since the PDU Notification Request message does not follow the very fundamental rule in GTP, some of GTP node may encounter the serious problem in GTP message handling.

Clauses affected: ⌘	7.3.8

Other specs Affected: ⌘	☐ Other core specifications ⌘		
	☐ Test specifications		
	☐ O&M Specifications		

Other comments: ⌘	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at:
http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

7.3.8 PDU Notification Request

When receiving a T-PDU the GGSN checks if a PDP context is established for that PDP address. If no PDP context has been previously established, the GGSN may try to deliver the T-PDU by initiating the Network-Requested PDP Context Activation procedure. The criteria, used by the GGSN to determine whether trying to deliver the T-PDU to the MS or not, may be based on subscription information in the GGSN and are outside the scope of GPRS standardisation.

As part of the Network-Requested PDP Context Activation procedure the GGSN sends a PDU Notification Request message to the SGSN indicated by the HLR. If the GGSN has an active PDP context with different SGSN from the one indicated by the HLR, then the SGSN information shall be obtained from an active PDP context. When receiving this message, the SGSN shall be responsible for requesting the MS to activate the indicated PDP Context.

The IMSI is inserted in the IMSI information element in the PDU Notification Request message.

The End User Address information element contains the PDP type and PDP address that the SGSN shall request the MS to activate.

The Access Point Name information element identifies the access point of packet data network that wishes to connect to the MS.

The GGSN shall include a GGSN Address for control plane. The SGSN shall store this GGSN Address and use it when sending control plane messages to the GGSN.

The Tunnel Endpoint Identifier Control Plane information element shall be a tunnel endpoint identifier Control Plane selected by the GGSN and shall be used by the SGSN in the GTP header of the corresponding PDU Notification Response or PDU Notification Request Reject message.

If the GGSN receives a Create PDP Context Request before the PDU Notification Response, the GGSN shall handle the Create PDP Context Request as normal context activation and ignore the following PDU Notification Response.

If the SGSN receives a PDU Notification Request after a Create PDP Context Request has been sent but before a Create PDP Context Response has been received, the SGSN shall:

1. send a PDU Notification Response with Cause 'Request accepted' without any further processing and then

2. wait for the Create PDP Context Response.

The optional Private Extension contains vendor or operator specific information.

Table 14: Information Elements in a PDU Notification Request

Information element	Presence requirement	Reference
IMSI	Mandatory	7.7.2
~~GGSN Address for Control Plane~~	~~Mandatory~~	~~7.7.32~~
Tunnel Endpoint Identifier Control Plane	Mandatory	7.7.14
End User Address	Mandatory	7.7.27
Access Point Name	Mandatory	7.7.30
GGSN Address for Control Plane	Mandatory	7.7.32
Private Extension	Optional	7.7.44

CR-Form-v3

CHANGE REQUEST

⌘ **29.060 CR 166** ⌘ rev **-** ⌘ Current version: **3.7.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network [x]

Title:	⌘	Corrections to editorwork of 29.060 v 3.7.0
Source:	⌘	CN4
Work item code:	⌘	GTP enhancements
	Date: ⌘	4.12.2000
Category:	⌘ **F**	(Correction to wrongly implemented CR)
	Release: ⌘	R99

Use one of the following categories:
 F *(essential correction)*
 A *(corresponds to a correction in an earlier release)*
 B *(Addition of feature),*
 C *(Functional modification of feature)*
 D *(Editorial modification)*
Detailed explanations of the above categories can
be found in 3GPP TR 21.900.

Use one of the following releases:
 2   (GSM Phase 2)
 R96   (Release 1996)
 R97   (Release 1997)
 R98   (Release 1998)
 R99   (Release 1999)
 REL-4 (Release 4)
 REL-5 (Release 5)

Reason for change:	⌘	According to approved CR 141 (against 3.5.0) the Error Indication message does not include 'GSN address' IE. However, the IE is there in version 3.7.0 The header field visible in Page View mode indicates wrong version and date for the specification.
Summary of change:	⌘	See above
Consequences if not approved:	⌘	

Clauses affected:	⌘	Header line on top of every page, 7.3.7
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm.
Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

7.3.7 Error Indication

A GSN/RNC shall send an Error Indication to the other GSN or RNC if no active PDP context exists for a received G-PDU.

The GSN shall delete its PDP context and the GSN/RNC may notify the Operation and Maintenance network element when an Error Indication is received.

The SGSN shall indicate to the MS when a PDP context has been deleted due to the reception of an Error Indication message. The MS may then request the re-establishment of the PDP context.

The information elements Tunnel Endpoint Identifier Data I shall be the TEID fetched from the G-PDU that triggered this procedure.

The optional Private Extension contains vendor or operator specific information.

Table 13: Information Elements in an Error Indication

Information element	Presence requirement	Reference
Tunnel Endpoint Identifier Data I	Mandatory	7.7.13
~~GSN Address~~	~~Mandatory~~	~~7.7.13~~
Private Extension	Optional	7.7.44

CR-Form-v3

CHANGE REQUEST

| ✂ | **29.060** CR **170** | ✂ | rev | **2** | ✂ | Current version: | **3.7.0** | ✂ |

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ✂ symbols.*

Proposed change affects: ✂ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	✂	Clarification on the TEID value of the signalling messages
Source:	✂	CN4
Work item code:	✂ GTP enhancements	*Date:* ✂ 19/02/2001
Category:	✂ **F** (Agreed by Consensus)	*Release:* ✂ R99

Use one of the following categories:
F (essential correction)
A (corresponds to a correction in an earlier release)
B (Addition of feature),
C (Functional modification of feature)
D (Editorial modification)
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	✂	According to the current 29.060, a 'GSN address for Control Plane' IE of the request messge could be different from the interface the message is sent from.
		In such a case, the value to be set to the TEID in the GTP header of the response message is ambiguous since the 'TEID-C' IE received in the request message is only unique within the 'GSN address for Control Plane' IE conveyed in the same message and the response message must be sent back toward the IP Source Address of the request message.
		However above behaviour in the sending entity is an implementation option and the receiving entity should be able to always use the notified TEID for the corresponding response message.
Summary of change:	✂	It was clarified that the TEID notified in the request message is always used for the corresponding response message.
Consequences if not approved:	✂	If this CR is not approved, the value to be set to the TEID in the GTP header of the response message is ambiguous and therefore interwoking problem may occur.

Clauses affected:	✂	8.2
Other specs affected:	✂ ☐ Other core specifications ✂	
	☐ Test specifications	
	☐ O&M Specifications	
Other comments:	✂	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

8.2   Usage of the GTP-C Header

For control plane messages the GTP header shall be used as follows:

- Version shall be set to decimal 1 ('001').

- Protocol Type (PT) shall be set to '1'.

- (S) shall be set to '1'.

- PN shall be set to '0'. A GTP-C receiver shall ignore this flag.

- Message Type shall be set to the unique value that is used for each type of control plane message. Valid message types are marked with an x in the GTP-C column in Table 1.

- Length shall be the length, in octets, of the control plane message excluding the GTP header.

- The Tunnel Endpoint Identifier is set by the sending entity to the value requested by the corresponding entity (SGSN or GGSN); it identifies all the PDP Contexts with the same PDP address and APN (for Tunnel Management messages) or it identifies each MS and its associated context data(for messages not related to Tunnel Management), except for the following cases:

  • The Create PDP Context Request message for a given MS sent to a specific GGSN shall have the Tunnel Endpoint Identifier set to all zeros, if the SGSN has not been assigned a Tunnel Endpoint Identifier Control Plane by the GGSN.

  • The Update PDP Context Request message for a given MS sent to a specific GGSN shall have the Tunnel Endpoint Identifier set to all zeros, if it is used to switch the GTP version of the tunnel to the GGSN from GTP v0 to GTP v1.

  • The Identification Request/Response messages, where the Tunnel Endpoint Identifier shall be set to all zeros.

  • The SGSN Context Request message, where the Tunnel Endpoint Identifier shall be set to all zeros.

  • The Echo Request/Response, Supported Extension Headers notification and the Version Not Supported messages, where the Tunnel Endpoint Identifier shall be set to all zeros.

  • The Forward Relocation Request message, where the Tunnel Endpoint Identifier shall be set to all zeros.

  • The PDU Notification Request message, where the Tunnel Endpoint Identifier shall be set to all zeros.

  •

  • The Relocation Cancel Request message where the Tunnel Endpoint Identifier shall be set to all zeros, except for the case where the old SGSN has already been assigned the Tunnel Endpoint Identifier Control Plane of the new SGSN.

  • All Location Management messages, where the Tunnel Endpoint Identifier shall be set to all zeros.

  The GSN Address for Control Plane set in the request message could be different from the IP Source address of the message. The Tunnel Endpoint Identifier notified in the request message is also used in this case for sending the corresponding response message.

- Sequence Number shall be a message number valid for a path. Within a given set of contiguous Sequence Numbers from 0 to 65535, a given Sequence Number shall, if used, unambiguously define a GTP control plane request message sent on the path (see section Reliable delivery of control plane messages). The Sequence Number in a control plane response message shall be copied from the control plane request message that the GSN is replying to. For GTP-C messages not having a defined response message for a request message, i.e. for messages Version Not Supported, Supported Extension Headers Notification and Error Indication, the Sequence Number shall be ignored by the receiver.

- N-PDU Number shall not be interpreted.

The GTP-C header may be followed by subsequent information elements dependent on the type of control plane message. Only one information element of each type is allowed in a single control plane message, except for the Authentication Triplet, the PDP Context and the Tunnel Endpoint Identifier Data II information element where several occurrences of each type are allowed.

	Bits							
Octets	8	7	6	5	4	3	2	1
1 – m	GTP header							
m - n	Information Element(s)							

Figure 61: GTP Header followed by subsequent Information Elements

CR-Form-v3

CHANGE REQUEST

⌘ **29.060** CR **173** ⌘ rev **3** ⌘ Current version: **3.7.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network X

Title: ⌘	Clarifications to the GTP-U protocol	
Source: ⌘	CN4	
Work item code: ⌘	GTP enhancements	***Date:*** ⌘ 15 January 2001
Category: ⌘ **F**	(Agreed by Consensus)	***Release:*** ⌘ R99

Use one of the following categories:	*Use one of the following releases:*
F *(essential correction)*	*2 (GSM Phase 2)*
A *(corresponds to a correction in an earlier release)*	*R96 (Release 1996)*
B *(Addition of feature),*	*R97 (Release 1997)*
C *(Functional modification of feature)*	*R98 (Release 1998)*
D *(Editorial modification)*	*R99 (Release 1999)*
Detailed explanations of the above categories can	*REL-4 (Release 4)*
be found in 3GPP TR 21.900.	*REL-5 (Release 5)*

Reason for change: ⌘	Both the user plane and the control plane interface between SGSN and RNC is the Iu interface. User plane data over Iu interface is handled by GTP-U (transferred by G-PDUs). G-PDUs make use of UDP/IP services. Control plane data over Iu interface is handled by RANAP. However GTP-U messages does not contain only User Data messages but also Path Management messages and the Error Indication message. Ambiguity on these matters in 29.060 cause the confusion. To be clear, GTP-U messages other than a User Data message can be collectively called GTP-U Signaling Message. GTP Signaling message contains both GTP-C message and GTP-U Signaling message. Besides this, proposed CR corrects number of other errors in 29.060 version 3.7.0.
Summary of change: ⌘	Issues related to GTP signalling messages exchanged between SGSN and RNC over the Iu interface are clarified. The proposed changes align 29.060 with 23.060.
Consequences if not approved: ⌘	29.060 would not provide for the reliable delivery of GTP-U signaling messages.

Clauses affected: ⌘	3.1: 4; 6; 7.3.7; 7.5.4; 7.6; 7.7; 7.7.44; 8.2; 9; 9.1.1; 9.3.1; 11.1; 11.1.1; 11.1.3; 11.1.4; 11.1.5; 11.1.6; 11.1.7; 11.1.8; 11.1.11; 11.1.12; 11.3

Other specs affected: ⌘	☐	Other core specifications	⌘	
	☐	Test specifications		
	☐	O&M Specifications		

Other comments: ⌘	

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

3.1   Definitions

For the purposes of the present document, the following terms and definitions apply.

Conditional: When the presence requirement for the information element is conditional, the receiving protocol level can check the presence or absence of an IE based on the received information.

G-PDU: T-PDU plus a GTP header. A G-PDU is sent in a path.

GTP Tunnel: A GTP tunnel in the GTP-U plane is defined for each PDP Context in the GSNs and/or each RAB in the RNC. A GTP tunnel in the GTP-C plane is defined for all PDP Contexts with the same PDP address and APN (for Tunnel Management messages) or for each MS (for messages not related to Tunnel Management). A GTP tunnel is identified in each node with a TEID, an IP address and a UDP port number. A GTP tunnel is necessary to forward packets between an external packet data network and an MS user.

MM Context: Information sets held in MS and GSNs for a GPRS subscriber related to mobility management (MM) (please refer to the MM Context Information Element).

NSAPI: Network Service Access Point Identifier. An integer value in the range [0; 15], identifying a certain PDP Context. It identifies a PDP context belonging to a specific MM Context ID.

Path: UDP/IP path is used to multiplex GTP tunnels.

Path Protocol: Path Protocol is the protocol used as a bearer of GTP between GSNs or between a GSN and a RNC.

PDP: Packet Data Protocol (PDP) is a network protocol used by an external packet data network interfacing to GPRS.

PDP Context: Information sets held in MS and GSNs for a PDP address (please refer to the PDP Context Information Element).

Quality of Service: Quality of Service may be applicable for the GPRS backbone and the Iu interface if the path media supports it. Separate paths with different priorities may be defined between a GSN pair or between a GSN and an RNC.

GTP-C Message: GTP-C or control plane messages are exchanged between GSN/RNC pairs in a path. The control plane messages are used to transfer GSN capability information between GSN pairs, to create, update and delete GTP tunnels and for path management. Note that only the T-PDU message is a non-signalling message.

GTP-U Message: GTP-U or user plane messages are exchanged between GSN pairs or GSN/RNC pairs in a path. The user plane messages are used to carry user data packets, and signalling messages for path management and error indication.

T-PDU: Original packet, for example an IP datagram, from an MS or a network node in an external packet data network. A T-PDU is the payload that is tunnelled in the GTP tunnel.

Traffic Flow Template: TFTs are used by GGSN to distinguish between different user payload packets and transmit packets with different QoS requirements via different PDP context but to the same PDP address.

Tunnel Endpoint IDentifier (TEID): The TEID unambiguously identifies a tunnel endpoint in the receiving GTP-U or GTP-C protocol entity. The receiving end side of a GTP tunnel locally assigns the TEID value the transmitting side has to use. The TEID values are exchanged between tunnel endpoints using GTP-C (or RANAP, over the Iu) messages.

UDP/IP Path: UDP/IP path is a connection-less unidirectional or bidirectional path defined by two end-points. and aAn IP address and a UDP port number define an end-point. A UDP/IP path carries G-PDUsGTP messages between GSN nodes, and between GSN and RNC nodes related to one or more GTP tunnels.

*** *Next Modification* ***

4   General

The present document defines the GPRS Tunnelling Protocol (GTP), i.e. the protocol between GPRS Support Nodes (GSNs) in the UMTS/GPRS backbone network. It includes both the GTP control plane (GTP-C) and data transfer (GTP-U) procedures. ItGTP also lists the messages and information elements used by the GTP based charging protocol GTP', which is described in GSM 12.15.

GTP (GTP-C and GTP-U) is defined for the Gn interface, i.e. the interface between GSNs within a PLMN, and for the Gp interface between GSNs in different PLMNs. Only GTP-U is defined for the Iu interface between Serving GPRS Support Node (SGSN) and the UMTS Terrestrial Radio Access Network (UTRAN).

On the Iu interface, the Radio Access Network Application Part (RANAP) protocol and signalling part of GTP-U isare performing the control function for user plane (GTP-U).

GTP' is defined for the interface between CDR generating functional network elements and Charging Gateway(s) within a PLMN. Charging Gateway(s) and GTP' protocol are optional, as the Charging Gateway Functionality may either be located in separate network elements (Charging Gateways), or alternatively be embedded into the CDR generating network elements (GSNs) when the GSN-CGF interface is not necessarily visible outside the network element. These interfaces relevant to GTP are between the grey boxes shown in Figure 1.

Figure 1: GPRS Logical Architecture with interface name denotations

GTP allows multi-protocol packets to be tunnelled through the UMTS/GPRS Backbone between GSNs and between SGSN and UTRAN.

In the control plane, GTP specifies a tunnel control and management protocol (GTP-C) which allows the SGSN to provide packet data network access for an MS. Control Plane signalling is used to create, modify and delete tunnels.

In the user plane, GTP uses a tunnelling mechanism (GTP-U) to provide a service for carrying user data packets.

The GTP-U protocol is implemented by SGSNs and GGSNs in the UMTS/GPRS Backbone and by Radio Network Controllers (RNCs) in the UTRAN. SGSNs and GGSNs in the UMTS/GPRS Backbone implement the GTP-C protocol. No other systems need to be aware of GTP. UMTS/GPRS MSs are connected to an SGSN without being aware of GTP.

It is assumed that there will be a many-to-many relationship between SGSNs and GGSNs. A SGSN may provide service to many GGSNs. A single GGSN may associate with many SGSNs to deliver traffic to a large number of geographically diverse mobile stations.

SGSN and GGSN implementing GTP protocol version 1 should be able to fallback to GTP protocol version 0. All GSNs should be able to support all earlier GTP versions.

*** *Next Modification* ***

---

6   GTP Header

The GTP header is a variable length header used for both the GTP-C and the GTP-U protocols. The minimum length of the GTP header is 8 bytes. There are three flags that are used to signal the presence of additional optional fields: the PN flag, the S flag and the E flag. The PN flag is used to signal the presence of N-PDU Numbers. The S flag is used to signal the presence of the GTP Sequence Number field. The E flag is used to signal the presence of the Extension Header field, used to enable future extensions of the GTP header defined in this document, without the need to use another version number. If any of these three flags are set, the length of the header is at least 12 octets and the fields corresponding to the flags that are set shall be evaluated by the receiver. The sender shall set all the bits of the unused fields to zero. The receiver shall not evaluate the unused fields.

The GTP-C and the GTP-U use some of the fields in the GTP header differently. The different use of such fields is described in the sections related to GTP-C and to GTP-U.

Always present fields:

- Version field: This field is used to determine the version of the GTP protocol. For the treatment of other versions, see subclause 11.1.1, "Different GTP versions". The version number shall be set to '1'.

- Protocol Type (PT): This bit is used as a protocol discriminator between GTP (when PT is '1') and GTP' (when PT is '0'). GTP is described in this document and the GTP' protocol in GSM 12.15. Note that the interpretation of the header fields may be different in GTP' than in GTP.

- Extension Header flag (E): This flag indicates the presence of the Next Extension Header field when it is set to '1'. When it is set to' 0', the Next Extension Header field either is not present or, if present, must not be interpreted.

- Sequence number flag (S): This flag indicates the presence of the Sequence Number field when it is set to '1'. When it is set to '0', the Sequence Number field either is not present or, if present, must not be interpreted. The S flag shall be set to '1' in GTP-C messages and in GTP-U/GTP' signalling type of messages.

- N-PDU Number flag (PN): This flag indicates the presence of the N-PDU Number field when it is set to '1'. When it is set to '0', the N-PDU Number field either is not present, or, if present, must not be interpreted. This flag is significant only for GTP-U. As such, this flag is unused by GTP-C and it shall be ignored by a GTP-C receiving entity.

- Message Type: This field indicates the type of GTP message. The valid values of the message type are defined in subclause 7.1 for both GTP-C and GTP-U.

- Length: This field indicates the length in octets of the payload, i.e. the rest of the packet following the mandatory part of the GTP header (that is the first 8 octets). The Sequence Number, the N-PDU Number or any Extension headers shall be considered to be part of the payload, i.e. included in the length count.

- Tunnel Endpoint Identifier (TEID): This field unambiguously identifies a tunnel endpoint in the receiving GTP-U or GTP-C protocol entity. The receiving end side of a GTP tunnel locally assigns the TEID value the transmitting side has to use. The TEID values are exchanged between tunnel endpoints using GTP-C (or RANAP, over the Iu) messages.

Optional fields:

- Sequence Number: This field is an optional field in GTP-U T-PDUs. It is used as a transaction identity for signalling messages having a response message defined for a request message, that is the Sequence Number value is copied from the request to the response message header. and asIn the user plane, an increasing sequence number for T-PDUs, is transmitted via GTP-U tunnels, when transmission order must be preserved.

- N-PDU Number: This field is used at the Inter SGSN Routeing Area Update procedure and some inter-system handover procedures (e.g. between 2G and 3G radio access networks). This field is used to co-ordinate the data transmission for acknowledged mode of communication between the MS and the SGSN. The exact meaning of this field depends upon the scenario. (For example, for GSM/GPRS to GSM/GPRS, the SNDCP N-PDU number is present in this field).

- Next Extension Header Type: This field defines the type of Extension Header that follows this field in the G-PDU.

Bits

Octets	8	7	6	5	4	3	2	1
1	Version			PT	(*)	E	S	PN
2	Message Type							
3	Length (1st Octet)							
4	Length (2nd Octet)							
5	Tunnel Endpoint Identifier (1st Octet)							
6	Tunnel Endpoint Identifier (2nd Octet)							
7	Tunnel Endpoint Identifier (3rd Octet)							
8	Tunnel Endpoint Identifier (4th Octet)							
9	Sequence Number (1st Octet)$^{1) 4)}$							
10	Sequence Number (2nd Octet)$^{1) 4)}$							
11	N-PDU Number$^{2) 4)}$							
12	Next Extension Header Type$^{3) 4)}$							

(*) This bit is a spare bit. It shall be sent as '0'. The receiver shall not evaluate this bit.
1) This field shall only be evaluated when indicated by the S flag.
2) This field shall only be evaluated when indicated by the PN flag.
3) This field shall only be evaluated when indicated by the E flag.
4) This field shall be present when any one or more of the S, PN and E flags are set.

Figure 2: Outline of the GTP Header

The format of GTP Extension Headers is depicted in Figure 2. The Extension Header Length field specifies the length of the particular Extension header in 4 octets units. The Next Extension Header Type field specifies the type of any Extension Header that may follow a particular Extension Header. If no such Header follows, then the value of the Next Extension Header Type shall be 0.

Octets	
1	Extension Header Length
2 - m	Extension Header Content
m+1	Next Extension Header Type (*)

(*) The value of this field is 0 if no other Extension header follows.

Figure 3: Outline of the Extension Header Format

The length of the Extension header shall be defined in a variable length of 4 octets, i.e. m+1 = n*4 octets, where n is a positive integer.

Bits 7 and 8 of the Next Extension Header Type define how the recipient shall handle unknown Extension Types. The recipient of an extension header of unknown type but marked as 'comprehension not required' for that recipient shall read the 'Next Extension Header Type' field (using the Extension Header Length field to identify its location in the G-PDU).

The recipient of an extension header of unknown type but marked as 'comprehension required' for that recipient shall:

- If the message with the unknown extension header was a request, send a response message back with CAUSE set to "unknown mandatory extension header".

- Send a Supported Extension Headers Notification to the originator of the GTP PDU.

- Log an error.

Bits 7 and 8 of the Next Extension Header Type have the following meaning:

Bits 8	7	Meaning
0	0	Comprehension of this extension header is not required. An Intermediate Node shall forward it to any Receiver Endpoint
0	1	Comprehension of this extension header is not required. An Intermediate Node shall discard the Extension Header Content and not forward it to any Receiver Endpoint. Other extension headers shall be treated independently of this extension header.
1	0	Comprehension of this extension header is required by the Endpoint Receiver but not by an Intermediate Node. An Intermediate Node shall forward the whole field to the Endpoint Receiver.
1	1	Comprehension of this header type is required by recipient (either Endpoint Receiver or Intermediate Node)

Figure 4: Definition of bits 7 and 8 of the Extension Header Type

An Endpoint Receiver is the ultimate receiver of the GTP-PDU (e.g. an RNC or the GGSN for the GTP-U plane). An Intermediate Node is a node that handles GTP but is not the ultimate endpoint (e.g. an SGSN for the GTP-U plane traffic between GGSN and RNC).

Next Extension Header Field Value	Type of Extension Header
0000 0000	No more extension headers
1100 0000	PDCP PDU number

Figure 5: Definition of Extension Header Type

*** *Next Modification* ***

7.3.7   Error Indication

A GSN/RNC shall send an Error Indication to the other GSN or RNC if no active PDP context exists for a received G-PDU.

The GSN shall delete its PDP context and the GSN/RNC may notify the Operation and Maintenance network element when an Error Indication is received.

The SGSN shall indicate to the MS when a PDP context has been deleted due to the reception of an Error Indication message. The MS may then request the re-establishment of the PDP context.

The information elements Tunnel Endpoint Identifier Data I shall be the TEID fetched from the G-PDU that triggered this procedure.

The optional Private Extension contains vendor or operator specific information.

Table 13: Information Elements in an Error Indication

Information element	Presence requirement	Reference
Tunnel Endpoint Identifier Data I	Mandatory	7.7.13
GSN Address	Mandatory	7.7.4~~3~~2
Private Extension	Optional	7.7.44

7.5.4   SGSN Context Response

The old SGSN shall send an SGSN Context Response to the new SGSN as a response to a previous SGSN Context Request.

Possible Cause values are:

- - 'Request Accepted'.

- - 'IMSI not known'.

- - 'System failure'.

- - 'Mandatory IE incorrect'.

- - 'Mandatory IE missing'.

- - 'Optional IE incorrect'.

- - 'Invalid message format'.

- - 'Version not supported'.

- - 'P-TMSI Signature mismatch'.

If the Cause contains the value 'Request accepted', all information elements are mandatory, except PDP Context and Private Extension.

If the Cause contains the value 'P-TMSI Signature mismatch' the IMSI information element shall be included in the response, otherwise only the Cause information element shall be included in the response.

The old SGSN shall include a SGSN Address for control plane. The new SGSN shall store this SGSN Address and use it when sending control plane messages for the MS to the old SGSN in the SGSN context transfer procedure.

The Tunnel Endpoint Identifier Control Plane field specifies a Tunnel Endpoint Identifier, which is chosen by the old SGSN. The new SGSN shall include this Tunnel Endpoint Identifier in the GTP header of all subsequent control plane messages, which are sent from the new SGSN to the old SGSN and related to the PDP context(s) requested.

The IMSI information element contains the IMSI matching the TLLI or P-TMSI (for GSM or UMTS respectively) and RAI in the SGSN Context Request.

One or several Receive State Variable information elements may be included in the message.

The MM Context contains necessary mobility management and security parameters.

All active PDP contexts in the old SGSN shall be included as PDP Context information elements.

If there is at least one active PDP context, the old SGSN shall start the T3-TUNNEL timer and store the address of the new SGSN in the "New SGSN Address" field of the MM context. The old SGSN shall wait for SGSN Context Acknowledge before sending T-PDUs to the new SGSN. If the old SGSN has one or more active PDP contexts for the subscriber and an SGSN Context Acknowledge message is not received within a time defined by T3-RESPONSE, the old SGSN shall retransmit the SGSN Context Response to the new SGSN as long as the total number of attempts is less than N3-REQUESTS. After N3-REQUESTS unsuccessfully attempts, the old SGSN shall proceed as described in section 'Reliable delivery of ~~control plane~~ signalling messages' in case the transmission of a control plane message fails N3-REQUESTS times.

Radio Priority SMS contains the radio priority level for MO SMS transmission, and shall be included if a valid Radio Priority SMS value exists for the MS in the old SGSN.

Radio Priority is the radio priority level that the MS uses when accessing the network for the transmission of uplink user data for a particular PDP context. One Radio Priority IE shall be included per PDP context that has a valid radio priority value assigned to it in the old SGSN.

Packet Flow Id is the packet flow identifier assigned to the PDP context. One Packet Flow Id IE shall be included per PDP context that has a valid packet flow identifier value assigned to it in the old SGSN.

The optional Private Extension contains vendor or operator specific information.

Table 27: Information Elements in a SGSN Context Response

Information element	Presence requirement	Reference
Cause	Mandatory	7.7.1
IMSI	Conditional	7.7.2
Tunnel Endpoint Identifier Control Plane	Conditional	7.7.14
Radio Priority SMS	Optional	7.7.20
Radio Priority	Optional	7.7.21
Packet Flow Id	Optional	7.7.22
MM Context	Conditional	7.7.28
PDP Context	Conditional	7.7.29
SGSN Address for Control Plane	Conditional	7.7.32
Private Extension	Optional	7.7.44

*** *Next Modification* ***

7.6　　Reliable Delivery of Signalling Messages

Each path maintains a queue with signalling messages to be sent to the peer. The message at the front of the queue, if it is a request for which a response has been defined, shall be sent with a Sequence Number, and shall be held in a path list until a response is received. Each path has its own list. The Sequence Number shall be unique for each outstanding request message in a single path list. A GSN or RNC may have several outstanding requests while waiting for responses.

The T3-RESPONSE timer shall be started when a signalling request message (for which a response has been defined) is sent. A signalling message request or response has probably been lost if a response has not been received before the T3-RESPONSE timer expires. The request is then retransmitted if the total number of request attempts is less than N3-REQUESTS times. The timer shall be implemented in the control plane application as well as user plane application for Echo Request / Echo Response. The wait time for a response (T3-RESPONSE timer value) and the number of retries (N3-REQUESTS) shall be configurable per procedure. The total wait time shall be shorter than the MS wait time between retries of Attach and RA Update messages.

All received request messages shall be responded to and all response messages associated with a certain request shall always include the same information. Duplicated response messages shall be discarded, and, for the SGSN Context Response case, the SGSN Context Acknowledge message shall be sent depending on the content of the received response message. A response message without a matching outstanding request should be considered as a duplicate.

The Forward Relocation Complete and Forward SRNS Context messages shall be treated as signalling request messages. The Forward Relocation Complete Acknowledge and Forward SRNS Context Acknowledge messages shall be treated as response messages.

The SGSN Context Response message needs special treatment by the old SGSN and New SGSN:

The New SGSN must consider this as a regular response to the outstanding SGSN Context Request message, but also copy the sequence number in the header of the SGSN Context Acknowledge it shall send back to the old SGSN depending on the content of the received response message.The Old SGSN, when it expects the new SGSN to send back a SGSN Context Acknowledge in response to a SGSN Context Response, shall keep track of the SGSN Context Response message sequence number and apply to this message the rules valid for a Request message too.If a GSN or RNC is not successful with the transfer of a signalling message, e.g. a Create PDP Context Request message, it shall inform the upper layer of the unsuccessful transfer so that the controlling upper entity may take the necessary measures.

7.7   Information Elements

A ~~control plane~~ GTP Signalling message may contain several information elements. The TLV (Type, Length, Value) or TV (Type, Value) encoding format shall be used for the GTP information elements. The information elements shall be sorted, with the Type fields in ascending order, in the ~~control plane~~ signalling messages. The Length field contains the length of the information element excluding the Type and Length field.

For all the length fields, bit 8 of the lowest numbered octet is the most significant bit and bit 1 of the highest numbered octet is the least significant bit.

Within information elements, certain fields may be described as spare. These bits shall be transmitted with the value defined for them. To allow for future features, the receiver shall not evaluate these bits.

The most significant bit in the Type field is set to 0 when the TV format is used and set to 1 for the TLV format.
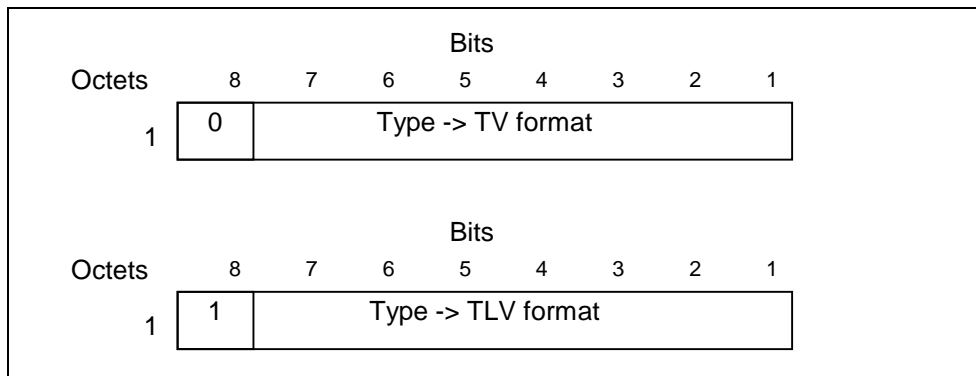

Figure 8: Type field for TV and TLV format

Table 37: Information Elements

IE Type Value	Format	Information Element	Reference
1	TV	Cause	7.7.1
2	"	International Mobile Subscriber Identity (IMSI)	7.7.2
3	"	Routeing Area Identity (RAI)	7.7.3
4	"	Temporary Logical Link Identity (TLLI)	7.7.4
5	"	Packet TMSI (P-TMSI)	7.7.5
6-7	Spare		
8	"	Reordering Required	7.7.6
9	"	Authentication Triplet	7.7.7
10	Spare		
11	"	MAP Cause	7.7.8
12	"	P-TMSI Signature	7.7.9
13	"	MS Validated	7.7.10
14	"	Recovery	7.7.11
15	"	Selection Mode	7.7.12
16	"	Tunnel Endpoint Identifier Data I	7.7.13
17	"	Tunnel Endpoint Identifier Control Plane	7.7.14
18	"	Tunnel Endpoint Identifier Data II	7.7.15
19	"	Teardown Ind	7.7.16
20	"	NSAPI	7.7.17
21	"	RANAP Cause	7.7.18
22	"	RAB Context	7.7.19
23	"	Radio Priority SMS	7.7.20
24	"	Radio Priority	7.7.21
25	"	Packet Flow Id	7.7.22
26	"	Charging Characteristics	7.7.23
27	"	Trace Reference	7.7.24
28	"	Trace Type	7.7.25
29	"	MS Not Reachable Reason	7.7.25A
117-126	Reserved for the GPRS charging protocol (see GTP' in GSM 12.15)		
127	"	Charging ID	7.7.26
128	TLV	End User Address	7.7.27
129	"	MM Context	7.7.28
130	"	PDP Context	7.7.29
131	"	Access Point Name	7.7.30
132	"	Protocol Configuration Options	7.7.31
133	"	GSN Address	7.7.32
134	"	MS International PSTN/ISDN Number (MSISDN)	7.7.33
135	"	Quality of Service Profile	7.7.34
136	"	Authentication Quintuplet	7.7.35
137	"	Traffic Flow Template	7.7.36
138	"	Target Identification	7.7.37
139	"	UTRAN Transparent Container	7.7.38
140	"	Target RNC Information	7.7.39
141	"	Extension Header Type List	7.7.40
142	"	Trigger Id	7.7.41
143	"	OMC Identity	7.7.42
239-250	Reserved for the GPRS charging protocol (see GTP' in GSM 12.15)		
251	"	Charging Gateway Address	7.7.43
252-254	Reserved for the GPRS charging protocol (see GTP' in GSM 12.15)		
255	"	Private Extension	7.7.44

*** *Next Modification* ***

7.7.44   Private Extension

The Private Extension information element contains vendor specific information. The Extension Identifier is a value defined in the Private Enterprise number list in the most recent "Assigned Numbers" RFC (RFC 1700 or later).

This is an optional information element that may be included in any ~~control plane~~ GTP Signalling message. A ~~control plane~~ signalling message may include more than one information element of the Private Extension type.
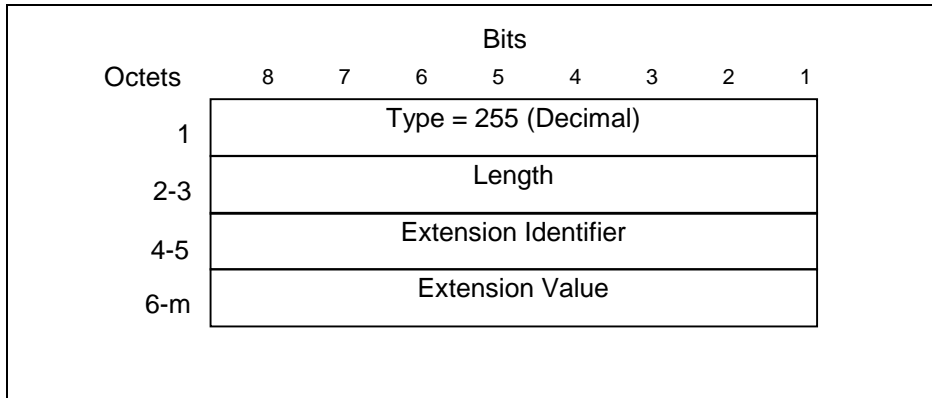
```
                              Bits
          Octets    8    7    6    5    4    3    2    1
            1              Type = 255 (Decimal)
            2-3                    Length
            4-5               Extension Identifier
            6-m                 Extension Value
```

Figure 59: Private Extension Information Element

*** *Next Modification* ***

8.2   Usage of the GTP-C Header

For control plane messages the GTP header shall be used as follows:

-    Version shall be set to decimal 1 ('001').

-    Protocol Type (PT) shall be set to '1'.

-    (S) shall be set to '1'.

-    PN shall be set to '0'. A GTP-C receiver shall ignore this flag.

-    Message Type shall be set to the unique value that is used for each type of control plane message. Valid message types are marked with an x in the GTP-C column in Table 1.

-    ~~Length shall be the length, in octets, of the control plane message excluding the GTP header.~~Length shall be the length in octets of the payload, i.e. the rest of the packet following the mandatory part of the GTP header (that is the first 8 octets). The Sequence Number, the N-PDU Number or any Extension headers shall be considered to be part of the payload, i.e. included in the length count.

-    The Tunnel Endpoint Identifier is set by the sending entity to the value requested by the corresponding entity (SGSN or GGSN); it identifies all the PDP Contexts with the same PDP address and APN (for Tunnel Management messages) or it identifies each MS and its associated context data(for messages not related to Tunnel Management), except for the following cases:

•   The Create PDP Context Request message for a given MS sent to a specific GGSN shall have the Tunnel Endpoint Identifier set to all zeros, if the SGSN has not been assigned a Tunnel Endpoint Identifier Control Plane by the GGSN.

- The Update PDP Context Request message for a given MS sent to a specific GGSN shall have the Tunnel Endpoint Identifier set to all zeros, if it is used to switch the GTP version of the tunnel to the GGSN from GTP v0 to GTP v1.

- The Identification Request/Response messages, where the Tunnel Endpoint Identifier shall be set to all zeros.

- The SGSN Context Request message, where the Tunnel Endpoint Identifier shall be set to all zeros.

- The Echo Request/Response, Supported Extension Headers notification and the Version Not Supported messages, where the Tunnel Endpoint Identifier shall be set to all zeros.

- The Forward Relocation Request message, where the Tunnel Endpoint Identifier shall be set to all zeros.

- The PDU Notification Request message, where the Tunnel Endpoint Identifier shall be set to all zeros.

-

- The Relocation Cancel Request message where the Tunnel Endpoint Identifier shall be set to all zeros, except for the case where the old SGSN has already been assigned the Tunnel Endpoint Identifier Control Plane of the new SGSN.

- All Location Management messages, where the Tunnel Endpoint Identifier shall be set to all zeros.

  - Sequence Number shall be a message number valid for a path. Within a given set of contiguous Sequence Numbers from 0 to 65535, a given Sequence Number shall, if used, unambiguously define a GTP control plane request message sent on the path (see section Reliable delivery of ~~control plane~~ signalling messages). The Sequence Number in a control plane response message shall be copied from the control plane request message that the GSN is replying to. For GTP-C messages not having a defined response message for a request message, i.e. for messages Version Not Supported, and Supported Extension Headers Notification ~~and Error Indication~~, the Sequence Number shall be ignored by the receiver.

  - N-PDU Number shall not be interpreted.

The GTP-C header may be followed by subsequent information elements dependent on the type of control plane message. Only one information element of each type is allowed in a single control plane message, except for the Authentication Triplet, the PDP Context and the Tunnel Endpoint Identifier Data II information element where several occurrences of each type are allowed.
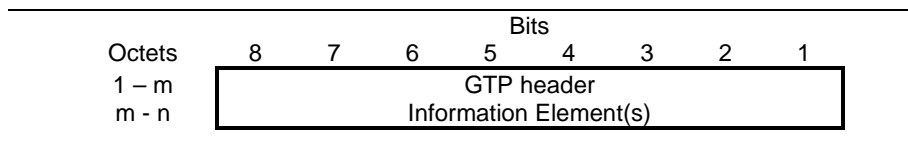
	Bits							
Octets	8	7	6	5	4	3	2	1
1 – m	GTP header							
m - n	Information Element(s)							

Figure 61: GTP Header followed by subsequent Information Elements

*** *Next Modification* ***

9   GTP-U

GTP-U Tunnels are used to carry encapsulated T-PDUs and signalling messages between a given pair of GTP-U Tunnel Endpoints. The Tunnel Endpoint ID (TEID) which is present in the GTP header shall indicate which tunnel a particular T-PDU belongs to. In this manner, packets are multiplexed and de-multiplexed by GTP-U between a given pair of Tunnel Endpoints. The TEID value to be used in the TEID field shall be negotiated for instance during the GTP-C Create PDP Context and the RAB assignment procedures that take place on the control plane.

The maximum size of a T-PDU that may be transmitted without fragmentation by GGSN or the MS is defined in UMTS 23.060. The GGSN shall fragment, reject or discard T-PDUs, depending on the PDP type and implementation decisions,

directed to the MS if the T-PDU size exceeds the maximum size. The decision if the T-PDUs shall be fragmented or discarded is dependent on the external packet data network protocol

---

*** *Next Modification* ***

9.1.1 Handling of Sequence Numbers

This functionality is provided only when the S bit is set to 1 in the GTP-U header.

The GTP-U protocol entity must reorder out of sequence T-PDUs when in sequence delivery is required. This is optional at the SGSN in UMTS. The GTP-U protocol entity shall deliver to the user plane entity only in sequence T-PDUs and notify the sequence number associated to each of them. The notification of the sequence number is not necessary at the GGSN, but it is mandatory at the SGSN and RNC. The user plane entity shall provide a sequence number to the GTP-U layer together with T-PDUs to be transmitted in sequence. GTP-U protocol entities at the GGSN may optionally generate autonomously the sequence number, but should be able to use sequence numbers provided by the user plane entity.

When the sequence number is included in the GTP-U header, a user plane entity acting as a relay of T-PDUs between GTP-U protocol entities, or between PDCP (or SNDCP) protocol entities and GTP-U protocol entities, shall relay the sequence numbers between those entities as well. In this way it is possible to keep consistent values of sequence numbers from the GGSN to the UE (MS in GPRS) by relaying the sequence number across the CN GTP-U bearer, the Iu GTP-U bearer and the Radio bearer (via PDCP or SNDCP N-PDU numbers). This functionality is beneficial during SRNS relocation.

For GTP-U signalling messages having a response message defined for a request message, Sequence Number shall be a message number valid for a path. Within a given set of continuous Sequence Numbers from 0 to 65535, a given Sequence Number shall, if used, unambiguously define a GTP-U signalling request message sent on the path (see section Reliable delivery of signalling messages). The Sequence Number in a signalling response message shall be copied from the signalling request message that the GSN or RNC is replying to. For GTP-U messages not having a defined response message for a request message, i.e. for messages Supported Extension Headers Notification and Error Indication, the Sequence Number shall be ignored by the receiver.

*** *Next Modification* ***

9.3.1 Usage of the GTP-U Header

The GTP-U header shall be used as follows:

- Version shall be set to decimal 1 ('001').

- Protocol Type (PT) shall be set to '1'.

- If the S field is set to '1' the sequence number field is present otherwise it is set to '0'.For GTP-U messages Echo Request, Echo Response and Supported Extension Headers Notification, the S field shall be set to '1'.-PN flag: the GTP-U header includes the N-PDU Number field if the PN flag is set to 1.

- Message Type shall be set according to Table 1. The value 255 is used when T-PDUs are transmitted. The value 1 and 2 are used for "Echo" messages. The value 26 is used for "Error Indication" message. The value 31 is used for "Supported Extension Headers Notification" message.

- ~~Length: Size of the T-PDU excluding the GTP-U header size.~~Length: This field indicates the length in octets of the payload, i.e. the rest of the packet following the mandatory part of the GTP header (that is the first 8 octets). The Sequence Number, the N-PDU Number or any Extension headers shall be considered to be part of the payload, i.e. included in the length count.

- Sequence Number: This field is present only if the S field is set to 1. The handling of this field is specified in subclause 9.1.1. It shall be used in order to decide whether or not to discard a received T-PDU, as specified in sub-clause 9.3.1.1 Usage of the Sequence Number or as a transaction identity for GTP-U signalling messages having a response message defined for a request message. For GTP-U messages ~~Version Not Supported and~~ Supported Extension Headers Notification, and Error Indication the Sequence Number shall be ignored by the receiver.

- N-PDU Number: This field shall be included if and only if the PN flag is set to 1. In this case, the old SGSN (or RNC) uses it, at the Inter SGSN Routeing Area Update procedure (or SRNS relocation), to inform the new SGSN (or RNC) of the N-PDU number assigned to T-PDU. If an N-PDU number was not assigned to the T-PDU by PDCP, or if the T-PDU is to be transferred using unacknowledged peer-to-peer LLC operation, then PN shall be set to 0.

- TEID: Contains the Tunnel Endpoint Identifier for the tunnel to which this T-PDU belongs. The TEID shall be used by the receiving entity to find the PDP context, except for the following cases:

- The Echo Request/Response, and Supported Extension Headers notification ~~and the Version Not Supported~~ messages, where the Tunnel Endpoint Identifier shall be set to all zeroes.

- The Error Indication message where the Tunnel Endpoint Identifier shall be set to all zeros.

*** *Next Modification* ***

10.1.1   UDP Header

10.1.1.1   Request Messages

The UDP Destination Port number for GTP-C request messages is 2123. It is the registered port number for GTP-C.

The UDP Destination Port number for GTP-U request messages is 2152. It is the registered port number for GTP-U.

The UDP Source Port is a locally allocated port number at the sending GSN/RNC.

10.1.1.2   Response Messages

The UDP Destination Port value shall be the value of the UDP Source Port of the corresponding request message.

The UDP Source Port shall be the value from the UDP Destination Port of the corresponding request message.

10.1.1.3   Encapsulated T-PDUs

The UDP Destination Port number shall be 2152. It is the registered port number for GTP-U. The UDP Source Port is a locally allocated port number at the sending GSN/RNC.

10.1.2   IP Header

An Internet Protocol (IP) compliant with STD 0005 shall be used.

10.1.2.1   Request Messages and Encapsulated T-PDUs

The IP Source Address shall be an IP address of the source GSN/RNC from which the message is originating.

The IP Destination Address in a GTP request message shall be an IP address of the destination GSN/RNC. The IP Destination Address in an encapsulated T-PDU GTP shall be an IP address of the destination GSN/RNC.

10.1.2.2   Response Messages

The IP Source Address shall be an IP address of the source GSN/RNC from which the message is originating.

The IP Destination Address shall be copied from the IP Source Address of the GTP request message to which this GSN/RNC is replying.

*** Next Modification ***

11.1   Protocol Errors

A protocol error is defined as a message with unknown, unforeseen or erroneous content. The term silently discarded used in the following sub clauses means that the implementation shall discard the message without further processing and should log the event including the erroneous message and should include the error in a statistical counter.

An information element with 'Mandatory' in the 'Presence requirement' column of a message definition shall always be present in that message.

The conditions for a conditional information element define whether the information element is semantically:

- mandatorily present;

- optionally present;

- mandatorily absent.

An information element, which is semantically mandatorily present but is omitted from the message, is treated as missing data.

An information element, which is semantically mandatorily absent but is present in the message, is treated as unexpected data.

A GTP Request is distinguished from a GTP Response by the message names (sub-clause 7.1, Message Formats). The Error Indication, the Version Not Supported, Supported Extension Headers Notification and the SGSN Context Acknowledge messages shall be considered as Responses for the purpose of this Section.

The sub clauses 11.1.1 to 11.1.13 shall be applied in decreasing priorities.

11.1.1   Different GTP Versions

If a receiving node receives a GTP control plane message of an unsupported version, that node shall return a GTP Version Not Supported message indicating in the Version field of the GTP header the latest GTP version that that node supports. The received G-PDU shall then be discarded.

A GTP version '0' only GSN may not be listening on port 2123 and as such it will not be able to send back a Version Not Supported message to a peer trying to establish a dialogue with it using GTP-C. As such, a GSN supporting both version '1' and version '0' shall fall back to version '0' if the attempt to contact a peer using version '1' fails.

It is an implementation option keeping a shortlist of recently contacted version '0' only GSNs, as well of the version supported by those nodes sending back a Version Not Supported message.

*** Next Modification ***

11.1.3   Unknown GTP ~~Control Plane~~ Signalling Message

When a message using a Message Type value defining an Unknown GTP signalling message is received, it shall be silently discarded.

11.1.4   Unexpected GTP ~~Control Plane~~ Signalling Message

When an unexpected GTP control plane message is received, e.g. a Response message for which there is no corresponding outstanding Request, or a GTP control plane message sent in the wrong direction, it shall be silently discarded.

11.1.5   Missing Mandatorily Present Information Element

The receiver of a GTP ~~control plane~~ signalling Request message with a missing mandatorily present information element shall discard the request, should log the error, and shall send a Response with Cause set to 'Mandatory IE missing'. The receiver of a Response with a missing mandatory information element shall notify the upper layer and should log the error.

11.1.6   Invalid Length

In a received GTP ~~control plane~~ signalling message Request, a mandatory TLV format information element may have a Length different from the Length defined in the version that this message claims to use. In this case, this information element shall be discarded, the error should be logged, and a Response shall be sent with Cause set to 'Mandatory IE incorrect'.

In a received GTP ~~control plane~~ signalling message Response, if a mandatory TLV format information element has a Length different from the Length defined in the version that this message claims to use, then the requesting entity shall treat the GTP ~~control plane~~ signalling procedure as having failed.

11.1.7   Invalid Mandatory Information Element

The receiver of a GTP ~~control plane~~ signalling message Request including a mandatory information element with a Value that is not in the range defined for this information element value shall discard the request, should log the error, and shall send a response with Cause set to 'Mandatory IE incorrect'.

The receiver of a GTP ~~control plane~~ signalling message Response including a mandatory information element with a Value that is not in the range defined for this information element shall notify the upper layer that a message with this sequence number has been received and should log the error.

If a GSN receives an information element with a value which is shown as reserved, it shall treat that information element as not being in the range defined for the information element.

   NOTE: The receiver does not check the content of an information element field that is defined as 'spare'.

11.1.8   Invalid Optional Information Element

The receiver of a GTP ~~control plane~~ signalling message including an optional information element with a Value that is not in the range defined for this information element value shall discard this IE, should log the error, and shall treat the rest of the message as if this IE was absent.

If a GSN receives an information element with a value which is shown as reserved, it shall treat that information element as not being in the range defined for the information element.

   NOTE: The receiver does not check the content of an information element field that is defined as 'spare'.

*** *Next Modification* ***

11.1.11 Unexpected Information Element

An information element with a Type value which is defined in GTP but is not expected in the received GTP ~~control plane~~ signalling message shall be ignored (skipped) and the rest of the message processed as if this information element was not present.

11.1.12 Repeated Information Elements

If an information element is repeated in a GTP ~~control plane~~ signalling message in which repetition of the information element is not specified, only the contents of the information element appearing first shall be handled and all subsequent repetitions of the information element shall be ignored. When repetition of information elements is specified, only the contents of specified repeated information elements shall be handled.

**** Next modified section ****

11.3 MS Detach

When an MS detaches, all ongoing GTP control plane procedures related to th~~e~~is MS ~~being attached~~ shall be aborted. The SGSN shall send Delete PDP Context Request messages for all active PDP contexts to the peer GGSNs.

CHANGE REQUEST

CR-Form-v3

29.060 CR 174   rev **1**   Current version: **3.7.0**

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the symbols.*

Proposed change affects: (U)SIM ☐   ME/UE ☐   Radio Access Network ☐   Core Network ☒

Title:	Essential Correction of the delete PDP context procedure
Source:	CN4
Work item code:	GTP enhancements ***Date:*** 15/01/20001
Category:	**F** (Essential correction) ***Release:*** R99

Use one of the following categories:
  F *(essential correction)*
  A *(corresponds to a correction in an earlier release)*
  B *(Addition of feature),*
  C *(Functional modification of feature)*
  D *(Editorial modification)*
Detailed explanations of the above categories can
be found in 3GPP TR 21.900.

Use one of the following releases:
  2   *(GSM Phase 2)*
  R96   *(Release 1996)*
  R97   *(Release 1997)*
  R98   *(Release 1998)*
  R99   *(Release 1999)*
  REL-4 *(Release 4)*
  REL-5 *(Release 5)*

Reason for change:	The delete PDP context procedure may happen to generate this undesirable situation: 1) SGSN sends a delete PDP context for a given TEID and NSAPI with the Teardown indicator set. 2)the GGSN receives the message, sends the Delete PDP context reply and removes the PDP context(s) data. 3) the response gets lost 4) the SGSN retransmits the Delete PDP context req. 5) the GGSN cannot respond since the TEID to be used is unknown 6) the SGSN eventually times out, but the outcome is ambiguos, since it is impossible to determine whether the context was actually deleted or not at the SGSN. Similar situations occur for GGSN initiated procedures (not described for sake of simplicity).
Summary of change:	The proposed solution to the problem is the following: The GGSN returns in step 5 above a delete PDP context response with Cause value "Non existing PDP context". The TEID in this message shall be '0'. Thus step 6 will not occur (unless loss is very high) and the SGSN will have consistent information about the peer.

Consequences if not approved:	The Delete PDP context procedure could fail with no certainty that the status at the GGSN is consistent (it is not known whether the procedure has failed because all of the Requests were not received or because the context has been torn down but all the response messages were lost). The result may eventually be a number of "orphaned" sessions on the GGSN and undesirable effects in time based charging if the application at the SGSN incorrectly determines that the PDP context is torn down at the GGSN when instead all the delete PDP context requests were lost.

Clauses affected:	7.3.5; 7.3.6	
Other specs affected:	☐ Other core specifications	
	☐ Test specifications	
	☐ O&M Specifications	
Other comments:	This is essential CR	

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

7.3.5   Delete PDP Context Request

A Delete PDP Context Request shall be sent from a SGSN node to a GGSN node as part of the GPRS Detach procedure or the GPRS PDP Context Deactivation procedure or from a GGSN node to a SGSN node as part of the PDP Context Deactivation Initiated by GGSN procedure. A request shall be used to deactivate an activated PDP Context or an activated set of PDP contexts associated to a PDP address assigned to a single MS.

A GSN shall be prepared to receive a Delete PDP Context Request at any time and shall always reply regardless if the PDP context exists or not (as per the Delete PDP Context Response message description section), except in cases described below.

If any collision occurs, the Delete PDP Context Request takes precedence over any other Tunnel Management message.

The Teardown Ind is used to indicate that all PDP contexts that share the PDP address with the PDP context identified in the request should also be deactivated. This may trigger the deletion of all the information kept for a MS at a GSN, if no other PDP contexts associated to other PDP addresses are active on the GSN. This information element shall always be included by the sending GSN when the last PDP context associated to a PDP address is torn down and there are no outstanding Create PDP context requests for other PDP context different from the one being torn down for that PDP address.

If a GSN receives a Delete PDP context without a Teardown Indicator and only that PDP context is active for a PDP address, then the GSN shall ignore the message. (Note: This is symptom of a race condition. The reliable delivery of signalling messages will eventually lead to a consistent situation, allowing the teardown of the PDP context.)The optional Private Extension contains vendor or operator specific information.

Table 11: Information Elements in a Delete PDP Context Request

Information element	Presence requirement	Reference
Teardown Ind	Conditional	7.7.16
NSAPI	Mandatory	7.7.17
Private Extension	Optional	7.7.44

7.3.6   Delete PDP Context Response

The message shall be sent as a response of a Delete PDP Context Request.

A GSN shall ignore a Delete PDP Context Response for a non-existing PDP context.

If a GSN receives a Delete PDP Context Request message for a non existing PDP context, it will send back to the source of the message a Delete PDP Context Response message with cause value "Non existent". The TEID value used in the response message shall be zero.

Possible Cause values are:

-    'Request Accepted'

-    'Mandatory IE incorrect'

-    'Mandatory IE missing'

-    'Optional IE Incorrect'

-    'Invalid message format'

-    'Non existent'.

If the received Delete PDP Context Response contains a cause value other than 'Request accepted' and 'Non Existent', the PDP context shall be kept active.

The optional Private Extension contains vendor or operator specific information.

Table 12: Information Elements in a Delete PDP Context Response

Information element	Presence requirement	Reference
Cause	Mandatory	7.7.1
Private Extension	Optional	7.7.44

CR-Form-v3

CHANGE REQUEST

| ⌘ | **29.060** CR **178** | ⌘ rev | ⌘ Current version: | **3.7.0** | ⌘ |

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Re-configure the IEs in the Send Routeing Information for GPRS Response message to make it in ascending order
Source:	⌘	CN4
Work item code: ⌘	GTP Enhancements	**Date:** ⌘ 16th January 2001
Category:	⌘ **F** (Agreed by consensus)	**Release:** ⌘ R99

Use one of the following categories:
F (essential correction)
A (corresponds to a correction in an earlier release)
B (Addition of feature),
C (Functional modification of feature)
D (Editorial modification)
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	According to the TS 29.060 section 7.7, The information elements shall be sorted, with the Type fields in ascending order, in the control plane messages.
		Currently, the IEs defined for the Send Routeing Information for GPRS Response message does not follow the above rule. (I.e. This message has wrong IE order.)
Summary of change: ⌘		This CR reconfigures the IEs in the Send Routeing Information for GPRS Response message in order to make it in ascending order.
Consequences if not approved:	⌘	Since the Send Routeing Information for GPRS Response message does not follow the very fundamental rule in GTP, some of GTP node may encounter the serious problem in GTP message handling.

Clauses affected:	⌘	7.4.2

Other specs Affected:	⌘	☐ Other core specifications	⌘
		☐ Test specifications	
		☐ O&M Specifications	

Other comments:	⌘	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at:
http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

7.4.2   Send Routeing Information for GPRS Response

The GTP-MAP protocol-converting GSN sends a Send Routeing Information for GPRS Response message as a response to the Send Routeing Information for GPRS Request message to the GGSN that sent the request.

The Cause value indicates if the GTP-MAP protocol-converting GSN accepted the request or not.

Possible Cause values are:

- 'Request Accepted'.

- 'No resources available'.

- 'Service not supported'.

- 'System failure'.

- 'Mandatory IE incorrect'.

- 'Mandatory IE missing'.

- 'Optional IE incorrect'.

- 'Invalid message format'.

- 'Version not supported'.

The MAP Cause information element contains the MAP error code received from the HLR and shall not be included if the Cause contains another value than 'Request accepted'.

The GSN Address information element contains the IP address of the SGSN and shall not be included if the Cause contains another value than 'Request accepted'.

It is an implementation issue what to do if the Cause or MAP Cause indicates that no location information is available. The MS not Reachable Reason information element indicates the reason for the setting of the Mobile station Not Reachable for GPRS (MNRG) flag and shall not be included if the Cause contains another value than 'Request accepted'.

The optional Private Extension contains vendor or operator specific information.

Table 19: Information Elements in a Send Routeing Information for GPRS Response

Information element	Presence requirement	Reference
Cause	Mandatory	7.7.1
IMSI	Mandatory	7.7.2
MAP Cause	Optional	7.7.8
~~GSN Address~~	~~Optional~~	~~7.7.32~~
MS not Reachable Reason	Optional	7.7.25A
GSN Address	Optional	7.7.32
Private Extension	Optional	7.7.44

CR-Form-v3

CHANGE REQUEST

⌘	**29.060** CR **182**	⌘ rev	**2**	⌘ Current version:	**3.7.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

Title:	⌘	GSN address in Error Indication
Source:	⌘	CN4
Work item code: ⌘	GTP Enhancements	***Date:*** ⌘ 27 February, 2001
Category: ⌘	F (Agreed by Consensus)	***Release:*** ⌘ R99

Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.	*Use one of the following releases:* 2 *(GSM Phase 2)* R96 *(Release 1996)* R97 *(Release 1997)* R98 *(Release 1998)* R99 *(Release 1999)* REL-4 *(Release 4)* REL-5 *(Release 5)*

Reason for change:	⌘	The Error Indication was categorised as GTP-U message in CR 141r2. In the same CR the GSN address IE was removed from the Error Indication message. The removal of GSN address IE was argumented by stating that the same information can be obtained from the IP header that carries the Error Indication message. The necessary information for the receiver of the Error Indication is the destination IP address of the original data packet along with the TEID since the TEID is unique *within* the IP address. Thus, with the current 29.060 specification, the destination IP address of the original data packet should always be copied to the source IP address field of the Error Indication message. However, mandating this kind of functionality restricts implementations, since it would require that the Error Indication message is sent from the same IP interface as where the data packet was received.
Summary of change: ⌘		This CR proposes to reintroduce the GSN address IE in Error Indication message
Consequences if not approved:	⌘	If the CR is not approved, implementations will be restricted and Error Indication message may lead to releasing incorrect context.

Clauses affected:	⌘	7.3.7
Other specs affected:	⌘ ☐ ☐ ☐	Other core specifications ⌘ Test specifications O&M Specifications
Other comments:	⌘	

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at:
http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

7.3.7 Error Indication

A GSN/RNC shall send an Error Indication to the other GSN or RNC if no active PDP context exists for a received G-PDU.

The GSN shall delete its PDP context and the GSN/RNC may notify the Operation and Maintenance network element when an Error Indication is received.

The SGSN shall indicate to the MS when a PDP context has been deleted due to the reception of an Error Indication message. The MS may then request the re-establishment of the PDP context.

The information elements Tunnel Endpoint Identifier Data I shall be the TEID fetched from the G-PDU that triggered this procedure.

The information element GSN Address shall be the destination address (e.g. destination IP address) fetched from the original user data message that triggered this procedure. A GSN Address can be a GGSN, SGSN or RNC address. The TEID and GSN Address together uniquely identify the related PDP context or RAB in the receiving node. The format of the RNC IP address is the same as the GSN address as defined in 3GPP TS 23.003.

The optional Private Extension contains vendor or operator specific information.

Table 13: Information Elements in an Error Indication

Information element	Presence requirement	Reference
Tunnel Endpoint Identifier Data I	Mandatory	7.7.13
GSN Address	Mandatory	7.7.132
Private Extension	Optional	7.7.44

<div style="text-align:right">*CR-Form-v3*</div>

CHANGE REQUEST

⌘	**29.060** CR **186**	⌘ rev	**1**	⌘ Current version:	**3.7.0**	⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘   (U)SIM ☐   ME/UE ☐   Radio Access Network **X**   Core Network **X**

Title:	⌘	Clarification of Error Indication
Source:	⌘	CN4
Work item code: ⌘	GTP Enhancements	***Date:*** ⌘ 28 February, 2001
Category: ⌘	**F** (Agreed by consensus)	***Release:*** ⌘ R99

Use *one* of the following categories:	Use *one* of the following releases:
F *(essential correction)*	2 *(GSM Phase 2)*
A *(corresponds to a correction in an earlier release)*	R96 *(Release 1996)*
B *(Addition of feature),*	R97 *(Release 1997)*
C *(Functional modification of feature)*	R98 *(Release 1998)*
D *(Editorial modification)*	R99 *(Release 1999)*
Detailed explanations of the above categories can	REL-4 *(Release 4)*
be found in 3GPP TR 21.900.	REL-5 *(Release 5)*

Reason for change:	⌘	A GTP-U TEID identifies a GTP-U tunnel endpoint on Iu and Gn interfaces. In addition to this, it has somewhat different meaning on these interfaces. On Gn interface the GTP-U TEID identifies a PDP context, while on Iu the GTP-U TEID identifies a RAB. Since a RAB can be released, e.g. due to low activity, and at the same time the associated PDP context can be preserved in the SGSN, it is important to state clearly how the Error Indication message is used on Iu. In the current 29.060 the use of Error Indication has not been specified properly and it may give the understanding that the SGSN shall delete the PDP context on reception of Error Indication on Iu although the Error Indication actually points out a RAB on Iu and it is not necessary to delete the PDP context. Thus on reception of Error Indication, the associated RAB should be released while the associated PDP context should be preserved.
Summary of change: ⌘		It is clarified how to handle the Error Indication when used on Iu.
Consequences if not approved:	⌘	If this CR is not approved, PDP context will be deleted incorrectly, when an Error Indication is used on Iu.

Clauses affected:	⌘	7.3.7
Other specs	⌘ **X**	Other core specifications ⌘ A related CR (Tdoc S2-010682, revised to S2-010721) against 23.060 has been submitted to SA2.
affected:	☐	Test specifications
	☐	O&M Specifications

Other comments: ⌘

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at:
http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

7.3.7 Error Indication

A GSN/RNC shall send an Error Indication to the other GSN or RNC if no active PDP context or RAB exists for a received G-PDU.

When an Error Indication is received from a GSN, Tthe receiving GSN shall delete its PDP context and the GSN/RNC may notify the Operation and Maintenance network element. when an Error Indication is received.

The SGSN shall indicate to the MS when a PDP context has been deleted due to the reception of an Error Indication message from the GGSN. The MS may then request the re-establishment of the PDP context.

When an SGSN receives an Error Indication from an RNC, the SGSN shall locally release the RAB. The SGSN should preserve the associated PDP context. The SGSN may then request re-establishment of the RAB.

When an RNC receives an Error Indication from an SGSN, the RNC shall locally release the RAB

The behaviour of the SGSN when it receives an Error Indication from an RNC is specified in TS 23.060.

The behaviour of the RNC when it receives an Error Indication from a SGSN is specified in TS 23.060..

The information elements Tunnel Endpoint Identifier Data I shall be the TEID fetched from the G-PDU that triggered this procedure.

The optional Private Extension contains vendor or operator specific information.

Table 13: Information Elements in an Error Indication

Information element	Presence requirement	Reference
Tunnel Endpoint Identifier Data I	Mandatory	7.7.13
GSN Address	Mandatory	7.7.13
Private Extension	Optional	7.7.44

CR-Form-v3

CHANGE REQUEST

| ⌘ | **29.060** CR **187** | ⌘ rev | **-** | ⌘ | Current version: | **3.7.0** | ⌘ |

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☒**X** Core Network ☒**X**

Title: ⌘	Clarification on the handling of sequence numbers in the GTP user plane
Source: ⌘	CN4
Work item code: ⌘	GTP enhancements ***Date:*** ⌘ 26/02/2001
Category: ⌘	**F** (agreed by consensus) ***Release:*** ⌘ R99

Use one of the following categories:	*Use one of the following releases:*
F *(essential correction)*	*2 (GSM Phase 2)*
A *(corresponds to a correction in an earlier release)*	*R96 (Release 1996)*
B *(Addition of feature),*	*R97 (Release 1997)*
C *(Functional modification of feature)*	*R98 (Release 1998)*
D *(Editorial modification)*	*R99 (Release 1999)*
Detailed explanations of the above categories can	*REL-4 (Release 4)*
be found in 3GPP TR 21.900.	*REL-5 (Release 5)*

Reason for change: ⌘	Essential clarification of the usage of sequence numbers
Summary of change: ⌘	The CR clarifies the handling of sequence number is on a per TEID basis
Consequences if not approved: ⌘	The spec would have ambiguity

Clauses affected: ⌘	9.1.1
Other specs affected: ⌘	☐ Other core specifications ⌘
	☐ Test specifications
	☐ O&M Specifications
Other comments: ⌘	

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

9.1.1   Handling of Sequence Numbers

This functionality is provided only when the S bit is set to 1 in the GTP-U header.

The GTP-U protocol entity must reorder out of sequence T-PDUs when in sequence delivery is required. This is optional at the SGSN in UMTS. The GTP-U protocol entity shall deliver to the user plane entity only in sequence T-PDUs and notify the sequence number associated to each of them. The notification of the sequence number is not necessary at the GGSN, but it is mandatory at the SGSN and RNC. The user plane entity shall provide a sequence number to the GTP-U layer together with T-PDUs to be transmitted in sequence. GTP-U protocol entities at the GGSN may optionally generate autonomously the sequence number, but should be able to use sequence numbers provided by the user plane entity. The sequence number is handled on a per GTP-U Tunnel (that is TEID) basis.

CR-Form-v3

CHANGE REQUEST

| ✿ | **29.060** CR **188** | ✿ rev | **-** | ✿ | Current version: | **3.7.0** | ✿ |

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ✿ symbols.*

Proposed change affects: ✿   (U)SIM ☐   ME/UE ☐   Radio Access Network ☐   Core Network ☒

Title: ✿	Clarifications and clean up of the error handling section	
Source: ✿	CN4	
Work item code: ✿	GTP enhancements	***Date:*** ✿ 26/02/2001
Category: ✿ **F** (agreed by consensus)		***Release:*** ✿ R99

Use <u>one</u> of the following categories:
  F *(essential correction)*
  A *(corresponds to a correction in an earlier release)*
  B *(Addition of feature),*
  C *(Functional modification of feature)*
  D *(Editorial modification)*
Detailed explanations of the above categories can
be found in 3GPP TR 21.900.

Use <u>one</u> of the following releases:
  2   (GSM Phase 2)
  R96   (Release 1996)
  R97   (Release 1997)
  R98   (Release 1998)
  R99   (Release 1999)
  REL-4 (Release 4)
  REL-5 (Release 5)

Reason for change: ✿	The current text is ambiguos
Summary of change: ✿	The text is clarified by better definint the meaning of "message sent in the wrong direction"
Consequences if not approved: ✿	The text in the spec looks not sufficiently accurate and somewhat not acceptable in a specification

Clauses affected: ✿	11.1
Other specs affected: ✿	☐ Other core specifications ✿ ☐ Test specifications ☐ O&M Specifications
Other comments: ✿	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ✿ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

11   Error Handling

11.1   Protocol Errors

A protocol error is defined as a message with unknown, unforeseen or erroneous content. The term silently discarded used in the following subclauses means that the implementation shall discard the message without further processing and should log the event including the erroneous message and should include the error in a statistical counter.

An information element with 'Mandatory' in the 'Presence requirement' column of a message definition shall always be present in that message.

The conditions for a conditional information element define whether the information element is semantically:

- mandatorily present;

- optionally present;

- mandatorily absent.

An information element, which is semantically mandatorily present but is omitted from the message, is treated as missing data.

An information element, which is semantically mandatorily absent but is present in the message, is treated as unexpected data.

A GTP Request is distinguished from a GTP Response by the message names (sub-clause 7.1, Message Formats). The Error Indication, the Version Not Supported and the SGSN Context Acknowledge messages shall be considered as Responses for the purpose of this Section.

The subclauses 11.1.1 to 11.1.13 shall be applied in decreasing priorities.

11.1.1   Different GTP Versions

If a receiving node receives a GTP control plane message of an unsupported version, that node shall return a GTP Version Not Supported message indicating in the Version field of the GTP header the latest GTP version that that node supports. The received G-PDU shall then be discarded.

A GTP version '0' only GSN may not be listening on port 2123 and as such it will not be able to send back a Version Not Supported message to a peer trying to establish a dialogue with it using GTP-C. As such, a GSN supporting both version '1' and version '0' shall fall back to version '0' if the attempt to contact a peer using version '1' fails.

It is an implementation option keeping a shortlist of recently contacted version '0' only GSNs, as well of the version supported by those nodes sending back a Version Not Supported message.

11.1.2   GTP Message Too Short

When a GTP message is received, and is too short to contain the GTP header for the GTP version that the sender claims to use, the G-PDU message shall be silently discarded.

11.1.3   Unknown GTP Control Plane Message

When a message using a Message Type value defining an Unknown GTP signalling message is received, it shall be silently discarded.

11.1.4   Unexpected GTP Control Plane Message

When an unexpected GTP control plane message is received, e.g. a Response message for which there is no corresponding outstanding Request, or a GTP control plane message sent in the wrong direction, or a GTP control plane

message a GSN is not expected to handle (such as a PDU Notification Request received by a GGSN), it shall be silently discarded.

CR-Form-v3

CHANGE REQUEST

| ⌘ | **29.060** CR | **191** ⌘ rev | **1** | ⌘ | Current version: | **3.7.0** | ⌘ |

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network **X**

Title:	⌘	Clarification on the use of the term G-PDU
Source:	⌘	CN4
Work item code: ⌘	GTP Enhancements	***Date:*** ⌘ 27/02/2001
Category: ⌘	F (Agreed by consensus)	***Release:*** ⌘ R99

Use *one* of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature)*,
C *(Functional modification of feature)*
D *(Editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use *one* of the following releases:
2   *(GSM Phase 2)*
R96   *(Release 1996)*
R97   *(Release 1997)*
R98   *(Release 1998)*
R99   *(Release 1999)*
REL-4 *(Release 4)*
REL-5 *(Release 5)*

Reason for change:	⌘	The term G-PDU is not used consistenly throughout the 29-060
Summary of change: ⌘	The term G-PDU is in some places substituted with the term GTP-PDU	
	In 7.5.4 a sentence from a wrognly implemented CR is removed.	
Consequences if not approved:	⌘	It is unclear wheather the extension header applies to both GTP-C and GTP-U messages.

Clauses affected:	⌘	3.1 6 7.1 7.5.4 11.1.1 11.1.2
Other specs affected:	⌘ ☐	Other core specifications ⌘
	☐	Test specifications
	☐	O&M Specifications
Other comments:	⌘	

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

Conditional: When the presence requirement for the information element is conditional, the receiving protocol level can check the presence or absence of an IE based on the received information.

G-PDU: A G-PDU is a user data message. It consists of a T-PDU plus a GTP header. ~~A G-PDU is sent in a path.~~

GTP Tunnel: A GTP tunnel in the GTP-U plane is defined for each PDP Context in the GSNs and/or each RAB in the RNC. A GTP tunnel in the GTP-C plane is defined for all PDP Contexts with the same PDP address and APN (for Tunnel Management messages) or for each MS (for messages not related to Tunnel Management). A GTP tunnel is identified in each node with a TEID, an IP address and a UDP port number. A GTP tunnel is necessary to forward packets between an external packet data network and an MS user.

MM Context: Information sets held in MS and GSNs for a GPRS subscriber related to mobility management (MM) (please refer to the MM Context Information Element).

NSAPI: Network Service Access Point Identifier. An integer value in the range [0; 15], identifying a certain PDP Context. It identifies a PDP context belonging to a specific MM Context ID.

Path: UDP/IP path is used to multiplex GTP tunnels.

Path Protocol: Path Protocol is the protocol used as a bearer of GTP between GSNs or between a GSN and a RNC.

PDP: Packet Data Protocol (PDP) is a network protocol used by an external packet data network interfacing to GPRS.

PDP Context: Information sets held in MS and GSNs for a PDP address (please refer to the PDP Context Information Element).

Quality of Service: Quality of Service may be applicable for the GPRS backbone and the Iu interface if the path media supports it. Separate paths with different priorities may be defined between a GSN pair or between a GSN and an RNC.

GTP-C Message: GTP-C or control plane messages are exchanged between GSN/RNC pairs in a path. The control plane messages are used to transfer GSN capability information between GSN pairs, to create, update and delete GTP tunnels and for path management. ~~Note that only the T-PDU message is a non-signalling message.~~

GTP-U Message: GTP-U or user plane messages are exchanged between GSN pairs or GSN/RNC pairs in a path. The user plane messages are used to carry user data packets and for path management.

GTP-PDU: A GTP Protocol Data Unit is either a GTP-C message or a GTP-U message.

Signalling Message: Any GTP-PDU except the G-PDU.

T-PDU: Original packet, for example an IP datagram, from an MS or a network node in an external packet data network. A T-PDU is the payload that is tunnelled in the GTP-U tunnel.

Traffic Flow Template: TFTs are used by GGSN to distinguish between different user payload packets and transmit packets with different QoS requirements via different PDP context but to the same PDP address.

Tunnel Endpoint IDentifier (TEID): The TEID unambiguously identifies a tunnel endpoint in the receiving GTP-U or GTP-C protocol entity. The receiving end side of a GTP tunnel locally assigns the TEID value the transmitting side has to use. The TEID values are exchanged between tunnel endpoints using GTP-C (or RANAP, over the Iu) messages.

UDP/IP Path: UDP/IP path is a connection-less path defined by two end-points and an IP address and a UDP port number define an end-point. A UDP/IP path carries G-PDUs between GSN nodes related to one or more GTP tunnels.

6 GTP Header

Optional fields:

- Sequence Number: This field is an optional field in ~~GTP-U-T~~-PDUs. It is used as a transaction identity for signalling messages having a response message defined for a request message and as an increasing sequence number for T-PDUs, transmitted via GTP-U tunnels, when transmission order must be preserved.

- N-PDU Number: This field is used at the Inter SGSN Routeing Area Update procedure and some inter-system handover procedures (e.g. between 2G and 3G radio access networks). This field is used to co-ordinate the data transmission for acknowledged mode of communication between the MS and the SGSN. The exact meaning of this field depends upon the scenario. (For example, for GSM/GPRS to GSM/GPRS, the SNDCP N-PDU number is present in this field).

- Next Extension Header Type: This field defines the type of Extension Header that follows this field in the G~~T~~P-PDU.

Bits

Octets	8	7	6	5	4	3	2	1
1		Version		PT	(*)	E	S	PN
2	Message Type							
3	Length (1st Octet)							
4	Length (2nd Octet)							
5	Tunnel Endpoint Identifier (1st Octet)							
6	Tunnel Endpoint Identifier (2nd Octet)							
7	Tunnel Endpoint Identifier (3rd Octet)							
8	Tunnel Endpoint Identifier (4th Octet)							
9	Sequence Number (1st Octet)$^{1) 4)}$							
10	Sequence Number (2nd Octet)$^{1) 4)}$							
11	N-PDU Number$^{2) 4)}$							
12	Next Extension Header Type$^{3) 4)}$							

(*) This bit is a spare bit. It shall be sent as '0'. The receiver shall not evaluate this bit.
1) This field shall only be evaluated when indicated by the S flag.
2) This field shall only be evaluated when indicated by the PN flag.
3) This field shall only be evaluated when indicated by the E flag.
4) This field shall be present when any one or more of the S, PN and E flags are set.

Figure 2: Outline of the GTP Header

The format of GTP Extension Headers is depicted in Figure 2. The Extension Header Length field specifies the length of the particular Extension header in 4 octets units. The Next Extension Header Type field specifies the type of any Extension Header that may follow a particular Extension Header. If no such Header follows, then the value of the Next Extension Header Type shall be 0.

Octets	
1	Extension Header Length
2 - m	Extension Header Content
m+1	Next Extension Header Type (*)

(*) The value of this field is 0 if no other Extension header follows.

Figure 3: Outline of the Extension Header Format

The length of the Extension header shall be defined in a variable length of 4 octets, i.e. m+1 = n*4 octets, where n is a positive integer.

Bits 7 and 8 of the Next Extension Header Type define how the recipient shall handle unknown Extension Types. The recipient of an extension header of unknown type but marked as 'comprehension not required' for that recipient shall read the 'Next Extension Header Type' field (using the Extension Header Length field to identify its location in the G~~T~~P-PDU).

Table 1: ~~Signalling~~ Messages in GTP

Message Type value (Decimal)	Message	Reference	GTP-C	GTP-U	GTP'
0	For future use. Shall not be sent. If received, shall be treated as an Unknown message.				
1	Echo Request	7.2.1	X	X	x
2	Echo Response	7.2.2	X	X	x
3	Version Not Supported	7.2.3	X		x
4	Node Alive Request	GSM 12.15			X
5	Node Alive Response	GSM 12.15			X
6	Redirection Request	GSM 12.15			X
7	Redirection Response	GSM 12.15			X
8-15	For future use. Shall not be sent. If received, shall be treated as an Unknown message.				
16	Create PDP Context Request	7.3.1	X		
17	Create PDP Context Response	7.3.2	X		
18	Update PDP Context Request	7.3.3	X		
19	Update PDP Context Response	7.3.4	X		
20	Delete PDP Context Request	7.3.5	X		
21	Delete PDP Context Response	7.3.6	X		
22-25	For future use. Shall not be sent. If received, shall be treated as an Unknown message.				
26	Error Indication	7.3.7		X	
27	PDU Notification Request	7.3.8	X		
28	PDU Notification Response	7.3.9	X		
29	PDU Notification Reject Request	7.3.10	X		
30	PDU Notification Reject Response	7.3.11	X		
31	Supported Extension Headers Notification	7.2.4	X	X	
32	Send Routeing Information for GPRS Request	7.4.1	X		
33	Send Routeing Information for GPRS Response	7.4.2	X		
34	Failure Report Request	7.4.3	X		
35	Failure Report Response	7.4.4	X		
36	Note MS GPRS Present Request	7.4.5	X		
37	Note MS GPRS Present Response	7.4.6	X		
38-47	For future use. Shall not be sent. If received, shall be treated as an Unknown message.				
48	Identification Request	7.5.1	X		
49	Identification Response	7.5.2	X		
50	SGSN Context Request	7.5.3	X		
51	SGSN Context Response	7.5.4	X		
52	SGSN Context Acknowledge	7.5.5	X		
53	Forward Relocation Request	7.5.6	X		
54	Forward Relocation Response	7.5.7	X		
55	Forward Relocation Complete	7.5.8	X		
56	Relocation Cancel Request	7.5.9	X		
57	Relocation Cancel Response	7.5.10	X		
58	Forward SRNS Context	7.5.11	X		
59	Forward Relocation Complete Acknowledge	7.5.x	X		
60	Forward SRNS Context Acknowledge	7.5.x	X		
61-239	For future use. Shall not be sent. If received, shall be treated as an Unknown message.				
240	Data Record Transfer Request	GSM 12.15			X
241	Data Record Transfer Response	GSM 12.15			X
242-254	For future use. Shall not be sent. If received, shall be treated as an Unknown message.				
255	G~~T~~-PDU	9.3.1		X	

7.5.4   SGSN Context Response

The old SGSN shall send an SGSN Context Response to the new SGSN as a response to a previous SGSN Context Request.

Possible Cause values are:

- 'Request Accepted'.

- 'IMSI not known'.

- 'System failure'.

- 'Mandatory IE incorrect'.

- 'Mandatory IE missing'.

- 'Optional IE incorrect'.

- 'Invalid message format'.

- 'Version not supported'.

- 'P-TMSI Signature mismatch'.

If the Cause contains the value 'Request accepted', all information elements are mandatory, except PDP Context and Private Extension.

If the Cause contains the value 'P-TMSI Signature mismatch' the IMSI information element shall be included in the response, otherwise only the Cause information element shall be included in the response.

The old SGSN shall include a SGSN Address for control plane. The new SGSN shall store this SGSN Address and use it when sending control plane messages for the MS to the old SGSN in the SGSN context transfer procedure.

The Tunnel Endpoint Identifier Control Plane field specifies a Tunnel Endpoint Identifier, which is chosen by the old SGSN. The new SGSN shall include this Tunnel Endpoint Identifier in the GTP header of all subsequent control plane messages, which are sent from the new SGSN to the old SGSN and related to the PDP context(s) requested.

The IMSI information element contains the IMSI matching the TLLI or P-TMSI (for GSM or UMTS respectively) and RAI in the SGSN Context Request.

~~One or several Receive State Variable information elements may be included in the message.~~

11.1.1   Different GTP Versions

If a receiving node receives a GTP control plane message of an unsupported version, that node shall return a GTP Version Not Supported message indicating in the Version field of the GTP header the latest GTP version that that node supports. The received GTP-PDU shall then be discarded.

A GTP version '0' only GSN may not be listening on port 2123 and as such it will not be able to send back a Version Not Supported message to a peer trying to establish a dialogue with it using GTP-C. As such, a GSN supporting both version '1' and version '0' shall fall back to version '0' if the attempt to contact a peer using version '1' fails.

It is an implementation option keeping a shortlist of recently contacted version '0' only GSNs, as well of the version supported by those nodes sending back a Version Not Supported message.

11.1.2   GTP Message Too Short

When a GTP message is received, and is too short to contain the GTP header for the GTP version that the sender claims to use, the GTP-PDU message shall be silently discarded.