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Technical Specification

**3rd Generation Partnership Project;
Technical Specification Group Core Network and Terminals;
3GPP Evolved Packet System (EPS);
Evolved General Packet Radio Service (GPRS)
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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x   the first digit:

1   presented to TSG for information;

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3   or greater indicates TSG approved document under change control.

y   the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z   the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies the stage 3 of the control plane of the GPRS Tunnelling Protocol, Version 2 for Evolved Packet System interfaces (GTPv2-C).

In this document, unless otherwise specified the S5 interface refers always to "GTP-based S5" and S8 interface refers always to "GTP-based S8" interface.

GTPv2-C shall be used across the following EPC signalling interfaces: S3, S4, S5, S8, S10, S11 and S16.

GTPv2-C based protocols shall also be used across Sv (3GPP TS 29.280 [15]) and S101 (3GPP TS 29.276 [14]) interfaces.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1]   3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2]   3GPP TS 23.003: "Numbering, addressing and identification".

[3]   3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[4]   3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp interface".

[5]   3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".

[6]   IETF RFC 791 (STD 0005): "Internet Protocol", J. Postel.

[7]   IETF RFC 768 (STD 0006): "User Datagram Protocol", J. Postel.

[8]   3GPP TS 32.251: "Telecommunication Management; Charging Management; Packet Switched (PS) domain charging.

[9]   3GPP TS 32.298: "Telecommunication Management; Charging Management; Charging Data Record (CDR) parameter classification.

[10]   3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)".

[11]   3GPP TS 33.102: "3G security; Security architecture".

[12]   3GPP TS 33.401: "3GPP System Architecture Evolution (SAE); Security architecture".

[13]   3GPP TS 29.281: "GPRS Tunnelling Protocol User Plane (GTPv1-U)".

[14]   3GPP TS 29.276: "Optimized Handover Procedures and Protocols between E-UTRAN Access and cdma2000 HRPD Access – Stage 3".

[15]   3GPP TS 29.280: "3GPP EPS Sv interface (MME to MSC) for SRVCC".

[16] IETF RFC 2460: "Internet Protocol, Version 6 (IPv6) Specification".

[17] 3GPP TS 23.007: "Restoration procedures".

[18] 3GPP TS 32.422: "Telecommunication management; Subscriber and equipment trace; Trace control and configuration management ".

[19] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

[20] 3GPP TS 36.414: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 data transport".

[21] 3GPP TS 23.272: "Circuit switched fallback in Evolved Packet System; Stage 2".

[22] 3GPP TS 29.118: "Mobility Management Entity (MME) - Visitor Location Register (VLR) SGs interface specification ".

[23] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

GTP-PDU: GTP Protocol Data Unit is either a GTP-C Message or a GTP-U Message. GTP-U Message may be either a signalling message across the user plane tunnel, or a G-PDU (see clause 6).

- **Signalling Message**: any GTP-PDU (GTP-C or GTP-U) except the G-PDU.

- **G-PDU:** GTP user plane message, which carries the original packet (payload). G-PDU consists of GTP-U header and a T-PDU.

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

- **GTP-C Message:** GTP control plane message type of a GTP-PDU. GTP-C message consists of GTP-C header, which is followed by zero or more information elements.

- **GTP-U Message:** GTP user plane message. The user plane messages are used to carry user data packets, and also signalling messages e.g. for path management and error indication. Therefore, GTP-U message consists of GTP-U header, which is followed by either a T-PDU, or zero or more information elements.

GTP Tunnel: FFS (see also subclause 4.2 "GTP Tunnel").

Path: A pair of UDP/IP endpoints identify GTP path (see subclause 4.1 "GTP Path").

Tunnel Endpoint: A tunnel endpoint is identified with a TEID, an IP address and a UDP port number (see subclause 4.2 "GTP Tunnel").

Tunnel Endpoint Identifier (TEID): unambiguously identifies a tunnel endpoint in scope of a path (see subclause 4.2 "GTP Tunnel").

3.2 Symbols

For the purposes of the present document, the following symbols apply:

S1-U Interface between SGW and eNB
X2 Interface between eNBs

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

AMBR	Aggregate Maximum Bit Rate
APN	Access Point Name
APN-NI	Access Point Name Network Identifier
APN-OI	Access Point Name Operator Identifier
CR	Comprehension Required
EBI	EPS Bearer ID
eBN	Evolved Node B
EPC	Evolved Packet Core
EPS	Evolved Packet System
F-TEID	Fully Qualified Tunnel Endpoint Identifier
G-PDU	GTP-U non-signalling PDU
GPRS	General Packet Radio Service
GTP	GPRS Tunnelling Protocol
GTP-PDU	GTP-C PDU or GTP-U PDU
GTPv2-C	GTP version 2, control plane
GTPv2-U	GTP version 2, user plane
IMSI	International Mobile Subscriber Identity
IP	Internet Protocol
LBI	Linked Bearer identity
L1	Layer 1
L2	Layer 2
MEI	Mobile Equipment Identity
MSISDN	Mobile Subscriber ISDN Number
PAA	PDN Address Allocation
PCO	Protocol Configuration Options
PDU	Protocol Data Unit
PDN	Packet Data Network or Public Data Network
PGW	PDN Gateway
PTI	Procedure Transaction Id
QoS	Quality of Service
RAT	Radio Access Type
SGW	Serving Gateway
TEID	Tunnel Endpoint Identifier
TEID-C	Tunnel Endpoint Identifier, control plane
TEID-U	Tunnel Endpoint Identifier, user plane
TFT	Traffic Flow Template
TLIV	Type Length Instance Value
UDP	User Datagram Protocol
ULI	User Location Info

4 General

4.1 GTP Path

A path is identified in each node with an IP address and a UDP port number. A path may be used to multiplex GTP tunnels.

4.2 GTP Tunnel

GTP tunnels are used between two nodes communicating over a GTP based interface, to separate traffic into different communication flows.

A GTP tunnel is identified in each node with a TEID, an IP address and a UDP port number. 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 S1-MME messages.

The criteria defining when the same or different GTP tunnels shall be used between to nodes differs between the control and the user plane, and also between interfaces.

For the control plane, for each end-point of a GTP-C tunnel:

- The TEID-C is unique per PDN-Connection on GTP based S5 and S8. The same tunnel is shared for the control messages related to all bearers associated to the PDN-Connection. A TEID-C on S5/S8 interface is released after all its associated EPS bearers are deleted.

- There is only one pair of TEID-Cs per UE on each of the S3 and the S10 interfaces. The same tunnel is shared for the control messages related to the same UE operation. A TEID-C on S3/S10 interface is released after its associated UE context is removed or the UE is detached.

- There is only one pair of TEID-C per UE over the S11 and the S4 interface. The same tunnel is shared for the control messages related to the same UE operation. A TEID-C on S11/S4 interface is released after all its associated EPS bearers are deleted.

For GTP-U, a TEID-U is used according to 3GPP TS 29.281 [13].

NOTE: GTP-U is based on GTP version 1 (GTPv1).

4.3 Protocol stack

Protocol stack for GTPv2 is depicted in Figure 4.3-1.
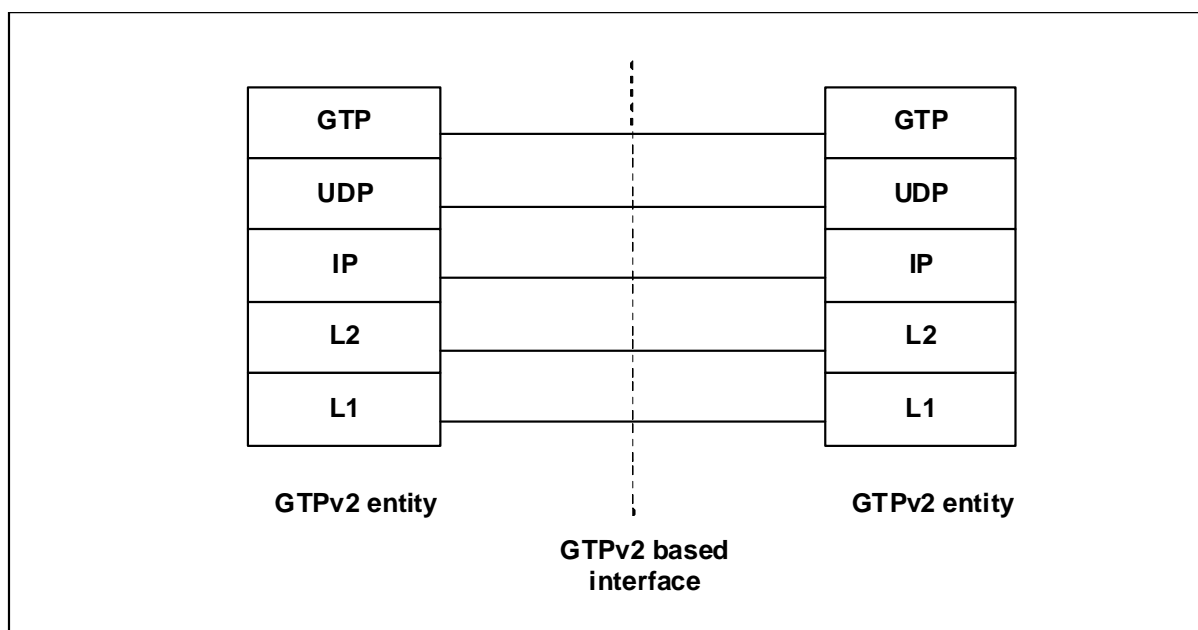
Figure 4.3-1: GTPv2 stack

GTPv2 headers are specified in respective clauses of this specification.

4.3.1 UDP header and port numbers

A User Datagram Protocol (UDP) compliant with IETF RFC 768 [7] shall be used.

4.3.1.1 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 Source Port is a locally allocated port number at the sending GTP entity.

4.3.1.2 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.

4.3.1.3 Version Not Supported Indication

The UDP Destination Port number for the Version Not Supported Indication shall be the UDP source port of the GTP packet that triggered the GTPv2 entity to send this message.

The UDP Source Port number for the Version Not Supported Indication shall be the UDP destination port of the GTP packet that triggered the GTPv2 entity to send this message.

4.3.2 IP header and IP addresses

4.3.2.1 Request Messages

The IP Source Address shall be an IP address of the source GTPv2 entity from which the message is originating.

The IP Destination Address in a GTP request message shall be an IP address of the destination GTPv2 entity.

4.3.2.2 Response Messages

The IP Source Address shall be copied from the IP destination address of the GTP request message to which this GTPv2 entity is replying.

The IP Destination Address shall be copied from the IP Source Address of the GTP request message to which this GTPv2 entity is replying.

4.3.2.3 Version Not Supported Indication

The IP Source Address for the Version Not Supported Indication shall be set to the IP destination address of the GTP message that triggered the GTPv2 entity to send this message.

The IP Destination Address for the Version Not Supported Indication shall be set to the IP source address of the GTP message that triggered the GTPv2 entity to send this message.

4.3.3 Layer 2

Typically Ethernet will be used as a Layer 2 protocol, but operators may use any other technology.

4.3.4 Layer 1

Operators may use any Layer 1 technology.

4.4 Transmission Order and Bit Definitions

The messages in this document shall be transmitted in network octet order starting with octet 1.

The most significant bit of an octet in a GTP message is bit 8. If a value in a GTP message spans several octets and nothing else is stated, the most significant bit is bit 8 of the octet with the lowest number.

5 GTP Header for Control Plane

5.1 General format

Control Plane GTP uses a variable length header. Control Plane GTP header length shall be a multiple of 4 octets. Figure 5.1-1 illustrates the format of the GTPv2-C Header.

Octets	**Bits**							
	8	7	6	5	4	3	2	1
1	Version			Spare	T	Spare	Spare	Spare
2	Message Type							
3	Message Length (1st Octet)							
4	Message Length (2nd Octet)							
m–k(m+3)	If T flag is set to 1, then TEID shall be placed into octets 5-8. Otherwise, TEID field is not present at all.							
n-(n+1)	Sequence Number							
(n+2)-(n+3)	Spare							
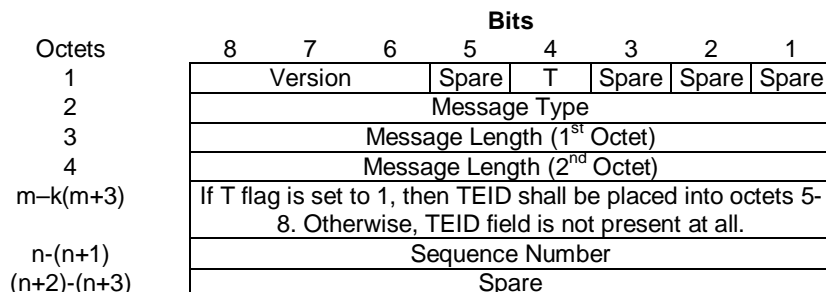
Figure 5.1-1: General format of GTPv2 Header for Control Plane

Where:

- if T = 0, TEID field is not present, k = 0, m = 0 and n = 5.

- if T = 1, TEID field is present, k = 1, m = 5 and n = 9.

The usage of GTPv2-C header across EPC specific interfaces is defined in the subclause 5.5 "Usage of the GTPv2-C Header". Octet 1 bits shall be coded as follows:

- Bits 6-8 represent the Version field.

- Bit 5 is spare, the sender shall set it to zero and the receiver shall ignore it.

- Bit 4 represents the TEID flag (T).

- Bits 3-1 are spare, the sender shall set it to zero and the receiver shall ignore it.

5.2 Control Plane GTP Extension Header

The legacy Extension Header mechanism is not used in GTP version 2 control plane. Future extensions will be implemented by adding Information Elements in the message body if new parameters are needed.

5.3 GTP-C header for Echo and Version Not Supported messages

GTPv2-C message header for Echo Request, Echo Response and Version Not Supported Indication messages shall not contain TEID field, but the Sequence Number fields, followed by two spare octets as depicted in figure 5.3-1. The spare bits shall be set to zero by the sender and ignored by the receiver.

Bits

Octets	8	7	6	5	4	3	2	1
1	Version			Spare	T=0	Spare	Spare	Spare
2	Message Type							
3	Message Length (1st Octet)							
4	Message Length (2nd Octet)							
5	Sequence Number (1st Octet)							
6	Sequence Number (2nd Octet)							
7	Spare							
8	Spare							

Figure 5.3-1: The format of Echo and Version Not Supported message Header

5.4   EPC specific GTP-C header

Apart from Echo Request, Echo Response and Version Not Supported Indication messages the GTP-C message header shall contain TEID and Sequence Number fields, followed by two spare octets. Typical GTP-C header is depicted in figure 5.4-1. The spare bits shall be set to zero by the sender and ignored by the receiver.

Bits

Octets	8	7	6	5	4	3	2	1
1	Version			Spare	T=1	Spare	Spare	Spare
2	Message Type							
3	Message Length (1st Octet)							
4	Message 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)							
10	Sequence Number (2nd Octet)							
11	Spare							
12	Spare							

Figure 5.4-1: The format of EPC specific GTPv2 Control Plane message Header

5.5   Usage of the GTPv2-C Header

The format of the GTPv2-C header is specified in subclause 5.1 "General format". The usage of the GTP-C header across e.g. S101 ([14]) and Sv ([15]) interfaces are defined in the respective specifications.

The usage of the GTPv2-C header for EPC specific interfaces is defined below.

The first octet of the header shall be used is the following way:

- Bits 8-6, which represent GTP-C version shall be set to decimal 2 ('010').

- Bit 5 is a spare bit. Sending entity shall set it to '0' and the receiving entity shall ignore it.

- Bit 4 represents a 'T' flag, which indicates if TEID field is present in the GTP-C header or not. If 'T' flag is set to 0, then the TEID field is not present in the GTP-C header at all. If 'T' flag is set to 1, then the TEID field immediately follows the Length field in octets 5 – 8. Apart fro Echo Request and Echo Response messages, in all EPC specific messages the value of the 'T' flag shall be set to '1'.

- Bit 3 is a spare bit. Sending entity shall set it to '0' and the receiving entity shall ignore it.

- Bit 2 is a spare bit. Sending entity shall set it to '0' and the receiving entity shall ignore it.

- Bit 1 is a spare bit. Sending entity shall set it to '0' and the receiving entity shall ignore it.

The usage of the fields in octets 2- n of the header is specified below.

- Octet 2 represents the Message type field, which shall be set to the unique value for each type of control plane message. Message type values are specified in Table 6.1-1 "Message types for GTPv2".

- Octets 2-3 represent the Length field. This field shall indicate the length of the message in octets excluding the mandatory part of the GTP-C header (the first 4 octets). The TEID (if present) andSequence Number (if present) shall be included in the length count. The format of the Length field is specified in subclause 8.2 "Information Element Format".

- For EPC specific interfaces T=1 and therefore octets 5-8 represent Tunnel Endpoint Identifier (TEID) field. This field shall unambiguously identifies a tunnel endpoint in the receiving GTP-C entity. In the following cases the TEID field shall be present in a GTPv2-C header, but its value shall be set to '0':

Editor's note: a list of the relevant cases should be added here.

- Octets 9-10 represent GTP Sequence Number field.

The GTP-C header may be followed by subsequent information elements dependent on the type of control plane message.

		Bits						
Octets	8	7	6	5	4	3	2	1
1 – m	GTP-C header							
m - n	Information Element(s)							
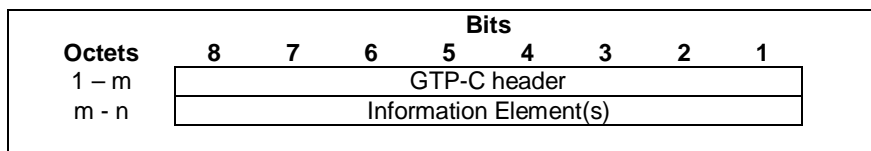
Figure 5.5-1: GTP-C Header followed by subsequent Information Elements

6 GTP-C Message Types and Message Formats

GTP-C message is sent across GTP control plane tunnel. In a message, GTP-C header is followed by zero or more information elements. GTP-C messages are used for the control plane path management, for the control plane tunnel management and for mobility management.

T-PDU is an original packet, for example an IP datagram, from an UE, or from a network node in an external packet data network.

6.1 Message Format and Type values

GTP defines a set of messages between two associated EPC network elements. The messages to be used are defined in the Table 6.1-1.

Table 6.1-1: Message types for GTPv2

Message Type value (Decimal)	Message	Reference	GTP-C	GTP-U
0	Reserved			
1	Echo Request		X	X
2	Echo Response		X	X
3	Version Not Supported Indication		X	
4-24	Reserved for S101 interface	TS 29.276 [14]		
25-31	Reserved for Sv interface	TS 29.280 [15]		
	SGSN/MME to PDN-GW (S4/S11, S5/S8)			
32	Create Session Request		X	
33	Create Session Response		X	
34	Update User Plane Request		X	
35	Update User Plane Response		X	
36	Modify Bearer Request		X	
37	Modify Bearer Response		X	
38	Delete Session Request		X	
39	Delete Session Response		X	
40	Change Notification Request		X	
41	Change Notification Response		X	
42-63	For future use			
	Messages without explicit response			
64	Modify Bearer Command (MME/SGSN to PGW –S11/S4, S5/S8)		X	
65	Modify Bearer Failure Indication (PGW to MME/SGSN –S5/S8, S11/S4)		X	
66	Delete Bearer Command (MME to PGW –S11, S5/S8)		X	
67	Delete Bearer Failure Indication (PGW to MME –S5/S8, S11)		X	
68	Bearer Resource Command (MME/SGSN to PGW –S11/S4, S5/S8)		X	
69	Bearer Resource Failure Indication (PGW to MME/SGSN –S5/S8, S11/S4)		X	
70	Downlink Data Notification Failure Indication (**SGSN/**MME to SGW –S4/S11)		X	
71-94	For future use			
	PDN-GW to SGSN/MME (S5/S8, S4/S11)			
95	Create Bearer Request		X	
96	Create Bearer Response		X	
97	Update Bearer Request		X	
98	Update Bearer Response		X	
99	Delete Bearer Request		X	
100	Delete Bearer Response		X	
101-127	For future use			
	MME to MME, SGSN to MME, MME to SGSN, SGSN to SGSN (S3/10/S16)			
128	Identification Request		X	
129	Identification Response		X	
130	Context Request		X	
131	Context Response		X	
132	Context Acknowledge		X	
133	Forward Relocation Request		X	
134	Forward Relocation Response		X	
135	Forward Relocation Complete Notification		X	
136	Forward Relocation Complete Acknowledge		X	
137	Forward SRNS Context Notification		X	
138	Forward SRNS Context Acknowledge		X	
139	Relocation Cancel Request		X	
140	Relocation Cancel Response		X	
141-148	For future use			
	SGSN to MME, MME to SGSN (S3)			
149	Detach Notification		X	
150	Detach Acknowledge		X	
151	CS Paging Indication		X	
152-159	For future use			

Message Type value (Decimal)	Message	Reference	GTP-C	GTP-U
	MME to SGW (S11)			
160	Create Forwarding Tunnel Request		X	
161	Create Forwarding Tunnel Response		X	
162	Suspend Notification		X	
163	Suspend Acknowledge		X	
164	Resume Notification		X	
165	Resume Acknowledge		X	
166	Create Indirect Data Forwarding Tunnel Request		X	
167	Create Indirect Data Forwarding Tunnel Response		X	
168-175	For future use			
	SGW to SGSN/MME (S4/S11)			
176	Downlink Data Notification		X	
177	Downlink Data Notification Acknowledgement		X	
178	Update Bearer Complete		X	
179-191	For future use			
	Other			
192-244	For future use			
245-255	Reserved for GTP-U	TS 29.281 [13]		X

6.1.1 Presence requirements of Information Elements

There are three different presence requirements (Mandatory, Conditional, or Optional) for an IE within a given GTP-PDU:

- Mandatory means that the IE shall be included by the sending side, and that the receiver diagnoses a "Mandatory IE missing" error when detecting that the IE is not present. A response including a "Mandatory IE missing" cause, shall include the type of the missing IE.

- Conditional means:

  • that inclusion of the IE by the sender depends on conditions specified in the relevant protocol specification;

Editor's Note: the receiver shall check the conditions as specified in the corresponding message type description, based on the parameter combination in the message and/or on the state of the receiving node, to infer if a conditional IE shall be expected. Only if a conditional IE, which is absolutely necessary for the receiving entity to complete the procedure, is missing, then the receiver shall abort the procedure.

- Optional means that the IE shall be included as a service option. Therefore, the IE may be included or not in a message.

For conditional IEs, the clause describing the GTP-PDU explicitly defines the conditions under which each IE becomes mandatory or optional for that particular GTP-PDU. These conditions shall be defined so that the presence of a conditional IE only becomes mandatory if it is critical for the receiving entity. The definition might reference other protocol specifications for final terms used as part of the condition.

Editor's Note: This definition of conditions shall be done per conditional IE in a dedicated column of the table listing the IEs for that GTP-PDU.

6.1.2 Comprehension requirements for Information Elements

For future extensibility of the GTP-C protocol, it shall be possible to add new mandatory and conditional Information Element (IE) types to the existing messages.

Editor's note: It is FFS if these requirements would apply also to GTP-U.

For the legacy GTPv2 entity such IEs will be unexpected, but will be treated as optional IEs. That is, the IEs of known type will be processed and the IEs of unknown or unexpected type will be silently discarded.

In future updates to the existing procedures it may become required that the sending entity is aware if the new mandatory or conditional IE was comprehended by the receiver, or not.

In order to support future types, a field "Comprehension Required" (CR) shall be included as part of the common header of each IE (see subclause 8.2).

An Endpoint Receiver is the ultimate receiver of the specific GTP-C message (e.g. a P-GW for a Create Session Request message, or a MME or a S4-SGSN for a Create Session Response message, or a S-GW for a Update User Plane Request message).

An Intermediate Node is a node that handles GTP-C but is not the ultimate endpoint of the specific GTP-C message (e.g. an S-GW for a Create Session Request message).

A CR field is defined as part of the Information element header as a 3 bits decimal scalar field which shall have the following values. This field shall be set by the sending node as follows:

CR	Defined Behaviour Behaviour of the Receiving Node
0	No comprehension shall be required of the receiving node and therefore no explicit behaviour is required for the understanding of the IE.
1	This Information Element shall be comprehended by the receiving node. For a Request message: if the receiving GTP entity cannot comprehend the IE while the comprehension is required by the CR flag, then the receiver shall discard the request, should log the error, and shall send a response with an appropriate Cause value. For a Response message: if the receiving GTP entity cannot comprehend the IE while the comprehension is required by the CR flag, then the receiver shall notify the upper layer that a message with this unknown or unexpected IE has been received and should log the error.
2-7	Reserved

Figure 6.1.2-1: Definition of Comprehension Required Flag of thefor Information Elements

Editor's note: it is FFS if Cause should be amended by complete IE or only its Type.

Editor's Note: It is for further study if a rejected Response message shall lead to an error notification back to the sender. Rejected Request messages shall always include an appropriate rejection cause value in the corresponding Response, but this can be added to the normative text, here or in clause 9.1, once the handling of Response messages is decided.

6.1.3 Grouped Information Elements

Information elements can contain other IEs. This type of IE is called "Grouped IEs".

Grouped IEs have a length value in the TLIV encoding, which includes the added length of all the embedded IEs plus the length of any other, non-TLIV-encoded, value fields. Example:
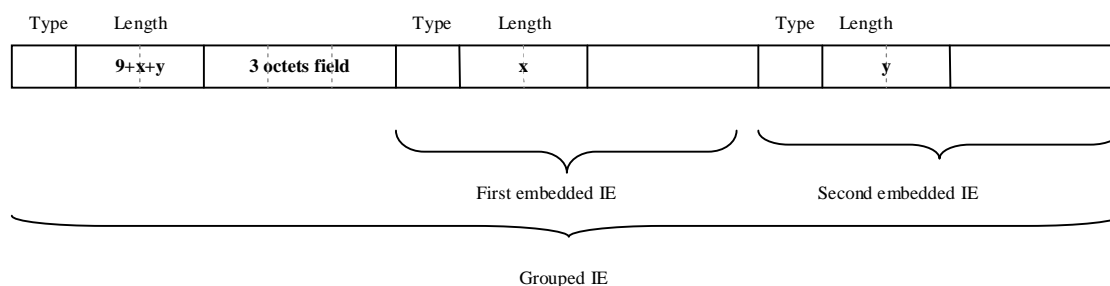
Figure 6.1.3-1: Grouped IE format

In this example, the first value field, marked as "3 octets field", represents a field which is not a TLIV encoded GTP IE.

In order to provide the flexibility of having optional or conditional embedded IEs, as well as a variable number of them, it is required that all non-TLIV-encoded fields are the beginning of the grouped IE. After the last defined non-TLIV-encoded field, only embedded TLIV-encoded IEs might follow.

The flexibility of having optional, conditional or a variable number of embedded fields within an IE is not provided by non-grouped IEs and it is due to the usage of TLIV encoded fields. This flexibility also allows using one and the same

type of grouped IEs for different messages and slightly different purposes, as long as the main purpose of the IE type is the same. It is encouraged to define grouped IEs in a flexible way to minimize the number of types needed.

Grouped IEs are not marked by any flag or limited to a specific range of IE type values. The clause describing an IE in this specification shall explicitly state if it is grouped.

NOTE: Each entry into each Grouped IE creates a new scope level. Exit from the grouped IE closes the scope level. The GTPv2 message level is the top most scope. This is analogous to the local scope of a subroutine/function.

6.1.4 Information Element instance

Every GTPv2 message and grouped IE within a message in this specification has a column documenting the instance value of each IE.

When a GTPv2 message is encoded for use the instance value of each included IE is encoded in the Instance field of the IE for the message scope. See clause 7 and subclause 8.2 for details of that encoding.

An Information Element in an encoded GTPv2 message or encoded grouped IE is identified by the pair of IE Type and Instance values and described by a specific row in the corresponding tables in subclauses of 7 in the present document.

If several Information Elements with the same Type and Instance values are included in an encoded GTPv2 message, they represent a list for the corresponding IE name and row identified in the message grammar in subclauses of clause 7.

If several Information Elements with the same Type and Instance values are included in an encoded grouped IE, they represent a list for the corresponding IE name and row identified in the grouped IE grammar in subclauses of clause 7.

In tables in this document the instance value for "Private Extension" is marked as VS (Vendor Specific). While an instance value must be encoded by the sender the value can be Vendor and even Private Extension specific.

The same IE name might be used in different messages (on the top level or within grouped IEs) in this specification. The instance value and name of an IE is only meaningful within the scope of the message definition . The combination of Type value and Instance value uniquely identifies a specific row in a message description table.

6.4 Message Granularity

The GTPv2-C messages shall be sent per UE on the S3, S10 and S16 interfaces.

The GTPv2-C messages shall be sent per PDN-Connection on the S4 and S11 interfaces apart from the following exclusion.

The following GTPv2-C messages are sent per UE on the S4 and S11 interfaces:

- Downlink Data Notification/Acknowledgement

- Stop Paging

7   GTP-C messages

7.1   Path Management Messages

Three path management messages are specified for GTP-C: Echo Request, Echo Response and Version Not Supported Indication.

7.1.1   Echo Request

3GPP TS 23.007 [17] specifies that a GTP-C entity may send an Echo Request to find out if the peer entity is alive. When and how often an Echo Request message may be sent is implementation specific but an Echo Request shall not be sent more often than every 60 s on each path. This does not prevent resending an Echo Request with the same sequence number according to the T3-RESPONSE timer.

As an implementation option, it is recommended that Echo Request should be sent only when a GTP-C entity has not received any GTP response message for a previously sent request message on the GTP-C path for the above specified, implementation dependent period of time.

Table 7.1.1-1 specifies the information elements included in the Echo Request message.

The optional Private Extension contains vendor or operator specific information.

Table 7.1.1-1: Information Element in Echo Request

Information elements	P	Condition / Comment	CR	IE Type
Recovery	M	None	1	Recovery
Private Extension	O	None	0	Private Extension

7.1.2   Echo Response

3GPP TS 23.007 [17] specifies that a GTP-C entity shall be prepared to receive an Echo Request at any time and it shall reply with an Echo Response.

Table 7.1.2-1 specifies the information elements included in the Echo Response message.

The Recovery information element contains the local Restart Counter, which is specified in 3GPP TS 23.007 [17])

The optional Private Extension contains vendor or operator specific information.

Table 7.1.2-1: Information Element in Echo Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Recovery	M	None	1		0
Private Extension	O	None	0	Private Extension	VS

7.1.3   Version Not Supported Indication

This message contains only the GTPv2 header and indicates the latest GTP version that the sending entity supports.

7.2   Tunnel Management Messages

A node shall include the Recovery information element if it is in contact with the peer for the first time or the node has restarted recently and the new Restart Counter value has not yet been indicated to the peer. The peer receiving the

Recovery information element shall handle it as when an Echo Response message is received but shall consider the rest of the message in accordance with the message semantics and parameters.

> Editor's Note: The CSID Information Element for partial failure handling is specified for some of the messages. The rest of the messages that may need to carry the CSID IE are FFS.

7.2.1 Create Session Request

The Create Session Request message shall be sent on the S11 interface by the MME to the SGW, and on the S5/S8 interface by the SGW to the PGW as part of the procedures:

- E-UTRAN Initial Attach

- UE requested PDN connectivity

The message shall also be sent on the S11 interface by the MME to the SGW as part of the procedures:

- Tracking Area Update procedure with Serving GW change

- S1/X2-based handover with SGW change

- UTRAN Iu mode to E-UTRAN Inter RAT handover with SGW change

- GERAN A/Gb mode to E-UTRAN Inter RAT handover with SGW change

and on the S4 interface by the SGSN to the SGW as part of the procedures:

- Routing Area Update with MME interaction and with SGW change

- E-UTRAN to UTRAN Iu mode Inter RAT handover with SGW change

- E-UTRAN to GERAN A/Gb mode Inter RAT handover with SGW change

- Serving RNS relocation

- Combined hard handover and SRNS relocation

- Combined Cell / URA update and SRNS relocation

- Enhanced serving RNS relocation with SGW relocation

- PDP Context activation

Table 7.2.1-1: Information Elements in a Create Session Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
IMSI	M	None	1	IMSI	0
MSISDN	C	In case of E-UTRAN Initial Attach it shall be included on S11 if provided in the subscription data from the HSS and it shall be included on S5/S8 if provided by the MME In case of UE Requested PDN Connectivity it shall be included if the MME has it stored for that UE	1	MSISDN	0
ME Identity (MEI)	C	The MME shall include ME Identity (MEI) IE, if available.	1	MEI	0
User Location Info (ULI)	C	Shall be included for E-UTRAN initial attach and UE requested PDN connectivity.	1	ULI	0
Serving Network	C	Shall be included for E-UTRAN initial attach and UE requested PDN connectivity.	1	Serving Network	0
RAT Type	M	None	1	RAT Type	0
Indication Flags	M	Applicable flags: S5/S8 Protocol Indicator: shall be used on S11/S4 and set according to the protocol chosen to be used on S5/S8 Dual Address Bearer Flag: shall be set to 1 when the UE requests PDN type IPv4v6 and all SGSNs which the UE may be handed over to support dual addressing, which is determined based on node pre-configuration by the operator Handover Indication: shall be set in E-UTRAN Initial Attach or in UE Requested PDN Connectivity if the UE comes from non-3GPP access Operation Indication: shall be set in TAU/RAU	1	Indication	0
Sender F-TEID for Control Plane	M	None	1	F-TEID	0
PGW S5/S8 Address for Control Plane or PMIP	C	Shall be sent on S11 / S4. TEID or GRE Key is set to "0" in the E-UTRAN initial attach and UE requested PDN connectivity procedures.	1	F-TEID	1
Access Point Name (APN)	C	Shall be included for E-UTRAN initial attach and UE requested PDN connectivity.	1	APN	0
Selection Mode	C	Shall be included for E-UTRAN initial attach and UE requested PDN connectivity. It indicates whether a subscribed APN or a non subscribed APN chosen by the MME was selected.	1	Selection Mode	0
PDN Type	M	Shall be set to IPv4, IPv6 or IPv4v6, This is based on the subscription record retrieved from the HSS.	1	PDN Type	0
PDN Address Allocation (PAA)	C	Included for E-UTRAN initial attach and UE requested PDN connectivity. The PDN type field in the PAA is set based on the UE request. In case of static IP address assignment, the MME shall set the IPv4 address and/or IPv6 prefix length and IPv6 address if available. If static IP address assignment is not used, the the IPv4 address shall be set to 0.0.0.0, and IPv6 Prefix Length and IPv6 address shall all be set to zero.	1	PAA	0
Maximum APN Restriction	M	Denotes the most stringent restriction as required by any already active bearer context. If there are no already active bearer contexts, this value is set to the least restrictive type	1	APN Restriction	0
Aggregate Maximum Bit Rate (APN-AMBR)	C	This IE represents the APN-AMBR. It shall be included for E-UTRAN initial attach and UE requested PDN connectivity.	1	AMBR	0
Protocol Configuration Options (PCO)	O	Not applicable to TAU/RAU/Handover	1	PCO	0
Bearer Contexts	M	Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers. One bearer shall be included for "eUTRAN Initial Attach" or "UE requested PDN Connectivity"; One or more bearers shall be included for Handover/TAU with SGW change	1	Bearer Context	0
Bearer Contexts to be removed	C	Shall be included on S4/S11 in mobility cases where any of the bearers existing before the mobility procedure will be deactivated as consequence of the mobility procedure. For each of those bearers an IE with this type and instance values shall be included.	1	Bearer Context	1
Trace Information	C	This IE includes Trace Reference, Trace Type, Trigger Id, OMC Identity. Shall be included if SGW and/or PGW is activated [18].	1	Trace Information	0
Recovery	C	Included if contacting the peer for the first time	1	Recovery	0
MME-CSID	O	Optionally included by MME on S11. Shall be forwarded by SGW on S5/S8. Only one value may be present per PDN connection	1	CSID	0
SGW-CSID	O	Optionally included by SGW on S5/S8. Only one value may be present per PDN connection.	1	CSID	1
Private Extension	O	None	0	Private Extension	VS

Table 7.2.1-2: Bearer Context to be createdwithin Create Session Request

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
UL TFT	O	None	1	Bearer TFT	0
DL TFT	O	None	1	Bearer TFT	1
S1-U eNodeB F-TEID	C	Shall be included on S11 at eUTRAN handover/TAU	1	F-TEID	0
S4-U SGSN F-TEID	C	Shall be included on S4	1	F-TEID	1
S5/8-U SGW F-TEID	C	Included on S5/S8 at "eUTRAN Initial Attach" or "UE Requested PDN Connectivity"	1	F-TEID	2
Bearer Level QoS	M	None	1	Bearer QoS	0
Charging Characteristics	C	Shall be included according to 3GPP TS 32.251 [8]	1	Charging Characteristics	0
Bearer Flags	O	Applicable flags: • PPC (Prohibit Payload Compression)	1	Bearer Flags	0

Table 7.2.1-3: Bearer Context to be removed within Create Session Request

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
S4-U SGSN F-TEID	C	Shall be sent on S4	1	F-TEID	1

7.2.2 Create Session Response

The Create Session Response message shall be sent on the S11 interface by the SGW to the MME, and on the S5/S8 interface by the PGW to the SGW as part of the procedures:

- E-UTRAN Initial Attach

- UE requested PDN connectivity

The message shall also be sent on the S11 interface by the SGW to the MME as part of the procedures:

- Tracking Area Update procedure with Serving GW change

- S1/X2-based handover with SGW change

- UTRAN Iu mode to E-UTRAN Inter RAT handover with SGW change

- GERAN A/Gb mode to E-UTRAN Inter RAT handover with SGW change

and on the S4 interface by the SGW to the SGSN as part of the procedures:

- Routing Area Update with MME interaction and with SGW change

- E-UTRAN to UTRAN Iu mode Inter RAT handover with SGW change

- E-UTRAN to GERAN A/Gb mode Inter RAT handover with SGW change

- Serving RNS relocation

- Combined hard handover and SRNS relocation

- Combined Cell / URA update and SRNS relocation

- Enhanced serving RNS relocation with SGW relocation

- PDP Context activation

Table 7.2.2-1: Information Elements in a Create Session Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
BCM	C	Shall be included if this message is part of the procedure PDP Context Activation using S4	1	Bearer Control Mode	0
Change Reporting Action	C	Shall be sent on S4 if the MS Info Change Reporting mechanism is to be used for this subscriber in the SGSN	1	Change Reporting Action	0
Sender F-TEID for Control Plane	C	Shall be sent on S11. On S5/S8 it is not needed because its content would be identical to the IE PGW S5/S8 Address for Control Plane or PMIP	1	F-TEID	0
PGW S5/S8 Address for Control Plane or PMIP	M	Shall include the TEID in the GTP based S5/S8 case and the GRE key in the PMIP based S5/S8 case.	1	F-TEID	1
PDN Address Allocation (PAA)	C	Shall be included for E-UTRAN initial attach and UE requested PDN connectivity.	1	PAA	0
APN Restriction	M	Denotes the restriction on the combination of types of APN for the APN associated with this EPS bearer Context.	1	APN Restriction	0
Aggregate Maximum Bit Rate (APN-AMBR)	C	This IE represents the APN-AMBR. Shall be included if the received APN-AMBR has been modified by the PCRF	1	AMBR	0
Protocol Configuration Options (PCO)	O	Not applicable to TAU/RAU	1	PCO	0
Bearer Contexts created	M	Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers. One bearer shall be included for "eUTRAN Initial Attach" or "UE Requested PDN Connectivity" One or more created bearers shall be included for Handover/TAU with SGW change	1	Bearer Context	0
Bearer Contexts marked for removal	C	Shall be included on S4/S11 in mobility cases where any of the bearers existing before the mobility procedure will be deactivated as consequence of the mobility procedure. For each of those bearers an IE with this type and instance values shall be included.	1	Bearer Context	1
Trace Information	C	This IE includes Trace Reference, Trace Type, Trigger Id, OMC Identity. Shall be included if SGW and/or PGW is activated [18]..	1	Trace Information	0
Recovery	C	Shall be included If contacting the peer for the first time	1	Recovery	0
PGW-CSID	O	Optionally included by PGW on S5/S8. Shall be forwarded by SGW on S11. Only one value may be present per PDN connection	1	CSID	2
SGW-CSID	O	Optionally included by SGW on S11. Only one value may be present per PDN connection.	1	CSID	1
Private Extension	O	None	0	Private Extension	VS

Table 7.2.2-2: Bearer Context Createdwithin Create Session Response

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	**P**	**Condition / Comment**	**CR**	**IE Type**	**Ins.**
EPS Bearer ID	M	None	1	EBI	0
Cause	M	Indicates if the bearer handling was successful, and if not, gives information on the reason.	1	Cause	0
UL TFT	O	None	1	Bearer TFT	0
DL TFT	O	None	1	Bearer TFT	1
S1-U SGW F-TEID	C	Shall be included on S11 if S1 is used	1	F-TEID	0
S4-U SGW F-TEID	C	Shall be included on S11 if S4 is used	1	F-TEID	1
S5/8-U PGW F-TEID	C	Included in "eUTRAN Initial Attach" or "UE Requested PDN Connectivity	1	F-TEID	2
S12 SGW F-TEID	C	Shall be included on S11 if S12 is used	1	F-TEID	3
Bearer Level QoS	C	Shall be included if the received QoS parameters have been modified	1	Bearer QoS	0
Charging Id	M	None	1	Charging Id	0
Bearer Flags	O	Applicable flags: • PPC (Prohibit Payload Compression)	1	Bearer Flags	0

Table 7.2.2-3: Bearer Context marked to be removed within Create Session Response

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	**P**	**Condition / Comment**	**CR**	**IE Type**	**Ins.**
EPS Bearer ID	M	None	1	EBI	0
Cause	M	Indicates if the bearer handling was successful, and if not, gives information on the reason.	1	Cause	0

7.2.3   Create Bearer Request

The Create Bearer Request message shall be sent on the S5/S8 interface by the PGW to the SGW and on the S11 interface by the SGW to the MME as part of the Dedicated Bearer Activation procedure.

The message shall also be sent on the S5/S8 interface by the PGW to the SGW and on the S4 interface by the SGW to the SGSN as part of the Secondary PDP Context Activation procedure or the Network Requested Secondary PDP Context Activation procedure.

Table 7.2.3-1: Information Elements in a Create Bearer Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Procedure Transaction Id (PTI)	C	Shall besent when the procedure was initiated by a UE Requested Bearer Resource Modification Procedure. PTI shall be the same as the one used in the corresponding Bearer Resource Command	1	RAT Type	0
Linked Bearer Identity (LBI)	M	Used to identify the PDN connection	1	EBI	0
APN Aggregate Maximum Bit Rate (APN-AMBR)	C	This IE shall be included when the P-GW initiates a create bearer procedure in case of policy updates due to the creation of non GBR flows	1	AMBR	0
Protocol Configuration Options (PCO)	O	None	1	PCO	0
Bearer Contexts	M	Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers.	1	Bearer Context	0
PGW-CSID	O	Optionally included by PGW on S5/S8. Shall be forwarded by SGW on S11. Only one value may be present per PDN connection	1	CSID	2
SGW-CSID	O	Optionally included by SGW on S11. Only one value may be present per PDN connection.	1	CSID	1
Private Extension	O	None	0	Private Extension	VS

Table 7.2.3-2: Bearer Context within Create Bearer Request

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	Shall be set to 0	1	EBI	0
UL TFT	M	None	1	Bearer TFT	0
DL TFT	C	Shall be sent for PMIP based S5/S8	1	Bearer TFT	1
S1-U SGW F-TEID	C	Shall be sent on S11 if the S1-U interface is used	1	F-TEID	0
S5/8-U PGW F-TEID	C	Shall be sent on S5/S8	1	F-TEID	1
S12 SGW F-TEID	C	Shall be sent on S4 if the S12 interface is used	1	F-TEID	2
Bearer Level QoS	M	None	1	Bearer QoS	0
Charging Characteristics	C	Shall be included according to 3GPP TS 32.251 [8]	1	Charging Characteristics	0
Charging Id	M	None	1	Charging Id	0
Bearer Flags	O	Applicable flags: • PPC (Prohibit Payload Compression)	1	Bearer Flags	0

7.2.4 Create Bearer Response

The Create Bearer Response message shall be sent on the S5/S8 interface by the SGW to the PGW, and on the S11 interface by the MME to the SGW as part of the Dedicated Bearer Activation procedure.

The message shall also be sent on the S5/S8 interface by the SGW to the PGW and on the S4 interface by the SGSN to the SGW as part of Secondary PDP Context Activation procedure or the Network Requested Secondary PDP Context Activation procedure.

Table 7.2.4-1: Information Elements in a Create Bearer Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Bearer Contexts	M	Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers.	1	Bearer Context	0
MME-CSID	O	Optionally included by MME on S11. Shall be forwarded by SGW on S5/S8. Only one value may be present per PDN connection	1	CSID	0
SGW-CSID	O	Optionally included by SGW on S5/S8. Only one value may be present per PDN connection.	1	CSID	1
Private Extension	O	None	0	Private Extension	VS

Table 7.2.4-2: Bearer Context within Create Bearer Response

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
Cause	M	Indicates if the bearer handling was successful, and if not, gives information on the reason.	1	Cause	0
S1 eNodeB F-TEID	C	Shall be sent on S11 if the S1-U interface is used	1	F-TEID	0
S1 SGW F-TEID	C	Shall be sent on S11. It may be used to correlate the bearers with those in the Create Bearer Request	1	F-TEID	1
S5/8-U SGW F-TEID	C	Shall be sent on S5/S8	1	F-TEID	2
S5/8-U PGW F-TEID	C	Shall be sent on S5/S8. It may be used to correlate the bearers with those in the Create Bearer Request	1	F-TEID	3
S12 RNC F-TEID	C	Shall be sent on S4 if the S12 interface is used	1	F-TEID	4

7.2.5   Bearer Resource Command

A Bearer Resource Command message shall be sent from a MME to a SGW and forwarded to PGW as a part of the UE requested bearer resource modification procedure.

The message shall also be sent on S4 interface by a SGSN to a SGW and on S5/S8 interface by a SGW to a PGW as part of MS initiated modification procedure, secondary PDP context activation procedure.

Table 7.2.5--1 specifies the presence of the IEs in the message.

Table 7.2.5-1: Information Elements in a Bearer Resource Command

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Linked EPS Bearer ID (LBI)	M	None	1	LBI	0
Procedure Transaction Id (PTI)	M	None	1	PTI	0
Flow Quality of Service (Flow QoS)	C	Not included for Bearer resource release.	1	Flow QoS	0
Traffic Aggregate Description (TAD)	M	The TAD consists of the description of the packet filter(s) for traffic flow aggregate.	1	TAD	0
Private Extension	O	None	0	Private Extension	VS

7.2.6   Bearer Resource Failure Indication

A Bearer Resource Failure Indication shall be sent by PGW to SGW and forwarded to MME to indicate failure of UE requested bearer resource modification procedure.

The message shall also be sent by a PGW to a SGW and forwarded to a SGSN as part of failure of MS initiated modification procedure, secondary PDP context activation procedure.

Table 7.2.6-1 specifies the presence of the IEs in the message.

Possible Cause values are:

-    "No resources available".

-    "No memory is available".

-    "Missing or unknown APN".

-    "User authentication failed".

-    "System failure".

-    "Semantic error in the TAD operation".

-    "Syntactic error in the TAD operation".

-    "Semantic errors in packet filter(s)".

-    "Syntactic errors in packet filters(s)".

-    "Mandatory IE incorrect".

-    "Mandatory IE missing".

-    "Optional IE incorrect".

-    "Invalid message format".

-    "APN access denied – no subscription".

Table 7.2.6-1: Information Elements in a Bearer Resource Failure Indication

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Linked EPS Bearer ID	M	None	1	EBI	0
Procedure Transaction ID (PTI)	M	None	1	PTI	0
Recovery	O	None	1	Recovery	0
Private Extension	O	None	0	Private Extension	VS

7.2.7   Modify Bearer Request

The Modify Bearer Request message is sent on S11 by the MME to the SGW and on S5/S8 by the SGW to the PGW as part of the procedures:

-    E-UTRAN Tracking Area Update without SGW Change

-    UE triggered Service Request

-    Inter eNodeB handover with MME relocation

-    UTRAN Iu mode to E-UTRAN Inter RAT handover

-    GERAN A/Gb mode to E-UTRAN Inter RAT handover

-    UE requested PDN connectivity

-    3G SGSN to MME combined hard handover and SRNS relocation procedure

It is also sent on S4 by the SGSN to the SGW and on S5/S8 by the SGW to the PGW as part of the procedures:

- Routeing Area Update with MME interaction and without SGW change

- Routeing Area Update with MME interaction and with SGW change

- Inter SGSN Routeing Area Update Procedure and Combined Inter SGSN RA / LA Update to S4 SGSNs

- Combined RA / LA Update in the Case of Inter SGSN RA Update Procedure

- Iu mode RA Update Procedure

- Serving RNS Relocation Procedure

- Combined Hard Handover and SRNS Relocation Procedure

- Combined Cell / URA Update and SRNS Relocation Procedure

- Enhanced Serving RNS Relocation without SGW relocation

- UE Initiated Service Request Procedure

- Iu mode to A/Gb mode Intra SGSN Change

- A/Gb mode to Iu mode Intra SGSN Change

- Iu mode to A/Gb mode Inter-SGSN Change

- A/Gb mode to Iu mode Inter-SGSN Change

- Paging Response with no established user plane on S4

- PDP Context Activation Procedure

on S4 by the SGSN to the SGW as part of:

- READY to STANDBY transition within the network

- RAB Release Procedure

- Iu Release Procedure

- RAB Assignment Procedure

on S11 by the MME to the SGW as part of:

- E-UTRAN Initial Attach

- S1 release procedure

and on S5/S8 by the SGW to the PGW as part of:

- Tracking Area Update procedure with Serving GW change

- Inter eNodeB handover without MME relocation, with Serving GW relocation

- E-UTRAN to UTRAN Iu mode Inter RAT handover

- E-UTRAN to GERAN A/Gb mode Inter RAT handover

- Gn/Gp SGSN to MME Tracking Area Update

- Enhanced Serving RNS Relocation with SGW relocation

Table 7.2.7-1: Information Elements in a Modify Bearer Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
ME Identity (MEI)	C	Shall be sent on S5/S8 in case of Gn/Gp SGSN to MME TAU	1	MEI	0
User Location Info (ULI)	O	None	1	ULI	0
Serving Network	C	Shall be sent in case of TAU with MME change Sent in case of RAU with MME interaction	1	Serving Network	0
RAT Type	C	Shall be sent on S11 in case of TAU with MME change, UE triggered Service Request and I-RAT Handover. Shall be sent on S5/S8 in case of RAT type change. Shall be sent on S4 in case of RAU with MME interaction	1	RAT Type	0
Indication Flags	M	Applicable flags: • ISRAI: Shall be used on S11 in case of TAU without MME change and in case of IRAT handover. Shall be used on S4 in case of RAU with MME interaction • Handover Indication: Shall be set in E-UTRAN Initial Attach or in UE Requested PDN Connectivity if the UE comes from non-3GPP access • Scope Indication: Shall be used on S11 in case of S1 release procedure to release all S1-U bearers for the UE	1	Indication	0
Sender F-TEID for Control Plane	C	Shall be sent on S11	1	F-TEID	0
PGW S5/S8 Address for Control Plane or PMIP	C	Shall be sent on S11 in case of Handover or TAU	1	F-TEID	1
Aggregate Maximum Bit Rate (APN-AMBR)	C	APN-AMBR shall be sent in case of 3G SGSN to MME combined hard handover and SRNS relocation procedure	1	AMBR	0
Delay Downlink Packet Notification Request	C	Shall be sent on S11 in case of UE triggered Service Request	1	Delay Value	0
Bearer Contexts to be modified	C	Shall be sent if the indication flag "Scope Indication" Is not set. Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers to be modified	1	Bearer Context	0
Bearer Contexts to be removed	C	Shall be included on S4/S11 in mobility cases where any of the bearers existing before the mobility procedure will be deactivated as consequence of the mobility procedure. For each of those bearers an IE with this type and instance values shall be included.	1	Bearer Context	1
Recovery	C	Included if contacting the peer for the first time	1	Recovery	0
Private Extension	O	None	0	Private Extension	VS

Table 7.2.7-2: Bearer Context to be modified within Modify Bearer Request

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
NSAPI	C	Sent in case of 3G SGSN to MME combined hard handover and SRNS relocation procedure	1	NSAPI	0
S1 eNodeB F-TEID	C	Sent on S11 if S1-U is being used: • at eUTRAN initial attach • at UE triggered Service Request • in all handover cases	1	F-TEID	0
S5/8-U SGW F-TEID	C	Sent on S5/S8 at Handover or TAU	1	F-TEID	1
S5/8-U PGW F-TEID	C	Handover/TAU (S11) in case of GTP based S5/S8 IRAT-Handover (S11) in case of GTP based S5/S8	1	F-TEID	2
S12 RNC F-TEID	C	Sent on S11 if S12 is being used	1	F-TEID	3
Bearer Level QoS	C	Sent on S11 at TAU without SGW change	1	Bearer QoS	0
Charging Characteristics	C	To be included according to 3GPP TS 32.251 [8]	1	Charging Characteristics	0
Charging Id	C	Sent on S11 in case of SGW change	1	Charging Id	0

Table 7.2.7-3: Bearer Context to be removed within Modify Bearer Request

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0

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7.2.8 Modify Bearer Response

The Modify Bearer Request message is sent on S11 by the SGW to the MME and on S5/S8 by the PGW to the SGW as part of the procedures:

- E-UTRAN Tracking Area Update without SGW Change

- UE triggered Service Request

- Inter eNodeB handover with MME relocation

- UTRAN Iu mode to E-UTRAN Inter RAT handover

- GERAN A/Gb mode to E-UTRAN Inter RAT handover

- UE requested PDN connectivity

- 3G SGSN to MME combined hard handover and SRNS relocation procedure

It is also sent on S4 by the SGW to the SGSN and on S5/S8 by the PGW to the SGW as part of the procedures:

- Routeing Area Update with MME interaction and without SGW change

- Routeing Area Update with MME interaction and with SGW change

- Inter SGSN Routeing Area Update Procedure and Combined Inter SGSN RA / LA Update to S4 SGSNs

- Combined RA / LA Update in the Case of Inter SGSN RA Update Procedure

- Iu mode RA Update Procedure

- Serving RNS Relocation Procedure

- Combined Hard Handover and SRNS Relocation Procedure

- Combined Cell / URA Update and SRNS Relocation Procedure

- Enhanced Serving RNS Relocation without SGW relocation

- UE Initiated Service Request Procedure

- Iu mode to A/Gb mode Intra SGSN Change

- A/Gb mode to Iu mode Intra SGSN Change

- Iu mode to A/Gb mode Inter-SGSN Change

- A/Gb mode to Iu mode Inter-SGSN Change

- Paging Response with no established user plane on S4

- PDP Context Activation Procedure

on S11 by the SGW to the MME as part of:

- E-UTRAN Initial Attach

- S1 release procedure

on S4 by the SGSN to the SGW as part of:

- READY to STANDBY transition within the network

- RAB Release Procedure

- Iu Release Procedure

- RAB Assignment Procedure

and on S5/S8 by the PGW to the SGW as part of:

- Tracking Area Update procedure with Serving GW change

- Inter eNodeB handover without MME relocation, with Serving GW relocation

- E-UTRAN to UTRAN Iu mode Inter RAT handover

- E-UTRAN to GERAN A/Gb mode Inter RAT handover

- Gn/Gp SGSN to MME Tracking Area Update

- Enhanced Serving RNS Relocation with SGW relocation

Table 7.2.8-1: Information Elements in a Modify Bearer Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
MSISDN	C	Shall be included by the PGW if it is stored in its UE context	1	MSISDN	0
Sender F-TEID for Control Plane	C	Shall be sent on S11. On S5/S8 it is not needed because its content would be identical to the IE PGW S5/S8 Address for Control Plane or PMIP	1	F-TEID	0
PGW S5/S8 Address for Control Plane or PMIP	M	Shall include the TEID in the GTP based S5/S8 case and the GRE key in the PMIP based S5/S8 case	1	F-TEID	1
Protocol Configuration Options (PCO)	C	Used in Inter RAT handover from UTRAN or GERAN to E-UTRAN	1	PCO	0
Bearer Contexts modified	M	Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers modified	1	Bearer Context	0
Bearer Contexts marked for removal	C	Shall be included on S4/S11 in mobility cases where any of the bearers existing before the mobility procedure will be deactivated as consequence of the mobility procedure. For each of those bearers an IE with this type and instance values shall be included.	1	Bearer Context	1
Recovery	C	Included if contacting the peer for the first time	1	Recovery	0
Private Extension	O	None	0	Private Extension	VS

Table 7.2.8-2: Bearer Context modified within Modify Bearer Response

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
Cause	M	Indicates if the bearer handling was successful, and if not, gives information on the reason.	1	Cause	0
NSAPI		Not used in response messages	1	NSAPI	1
S1 SGW F-TEID	C	Used on S11 if S12 is used	1	F-TEID	0
S12 SGW F-TEID	C	Used on S11 if S12 is used	1	F-TEID	1
Bearer Level QoS		Not used in response messages	1	Bearer QoS	0

Table 7.2.8-3: Bearer Context marked for removal within Modify Bearer Response

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
Cause	M	Indicates if the bearer handling was successful, and if not, gives information on the reason.	1	Cause	0

7.2.9 Delete Session Request and Delete Bearer Request

7.2.9.1 Delete Session Request

A Delete Session Request message is sent on S11 by the MME to the SGW and on S5/S8 by the SGW to the PGW as part of the procedures:

- EUTRAN Initial Attach

- Inter MME Tracking Area Update with SGW Change

- UE Initiated Detach

- HSS Initiated Detach

- MME Initiated Detach

- Intra MME S1 Based Handover

- Inter MME S1 Based Handover without SGW Change

- Inter MME S1 Based Handover with SGW Change

- X2 Based handover with SGW Relocation

- UE Requested PDN Disconnection

It is also sent on S4 by the SGSN to the SGW, and on S5/S8 by the SGW to the PGW as part of

- MS, HLR or SGSN initiated detach procedure

- Combined GPRS/IMSI Attach

- MS and SGSN Initiated Bearer Deactivation Procedure using S4

and on S4 by the SGSN to the SGW as part of

- Enhanced Serving RNS Relocation without Serving GW relocation using S4Table 7.2.9.1-1 specifies the presence of the IEs in the message.

A Delete Session Request message may include an Indication IE, with Operation Indication (OI) bit set to 1, which is used to inform SGW whether the SGW should continue forwarding the message to the PGW or not when it receives this message.

Table 7.2.9.1-1: Information Elements in a Delete Session Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Linked EPS Bearer ID (LBI)	M	This IE shall be included to indicate the default bearer associated with the PDN being disconnected	1	EBI	0
Indication Flags	M	Applicable flags: • Tear down Indicator: all bearers associated with the PDN connection are torn down used on S11/S5/S8 • Operation Indication: always set, used on S11/S5/S8 • Scope Indication: if request corresponds to S1 based handover procedures, then this bit is set	1	Indication	0
Protocol Configuration Options (PCO)	C	If the UE includes the PCO IE, then the MME shall copy the content of this IE transparently from the PCO IE included by the UE.	1	PCO	0
Private Extension	O	None	0	Private Extension	VS

7.2.9.2 Delete Bearer Request

A Delete Bearer Request is shall be sent as part of PGW or MME initiated bearer deactivation procedures, execution part of MS initiated EPS bearer modification procedure using S4 or PGW initiated bearer deactivation procedure using S4.. This Request is sent by the PGW to the SGW and may be forwarded to the MME or S4-SGSN. Table 7.2.9.2-1 specifies the presence of IEs in this message.

Table 7.2.9.2-1: Information Elements in a Delete Bearer Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Linked EPS Bearer ID (LBI)	C	If the request corresponds to P-GW initiated detach procedure to deactivate all bearers belonging to a PDN connection, then this IE shall be included to indicate the default bearer associated with the PDN being disconnected. This IE shall be included only when the EPS Bearer ID List is not present in the message.	1	EBI	0
Bearer Contexts	C	It shall be used for bearers different from the default one. In this case at least one bearer shall be included. Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers. Used for dedicated bearers. When used, at least one dedicated bearer shall be present	1	Bearer Context	0
Procedure Transaction Id (PTI)	C	If the request corresponds to UE requested bearer resource modification procedure for an E-UTRAN or MS initiated EPS bearer modification procedure using S4,, this IE shall be included.	1	PTI	0
APN Aggregate Maximum Bit Rate (APN-AMBR)	C	This IE shall be included when the P-GW initiates a delete procedure in case of policy updates due to the deletion of non GBR flows	1	AMBR	0
Protocol Configuration Options (PCO)	C	The MME shall copy the content of this IE transparently from the PCO IE included by the UE if the PGW wishes to provide the UE with application specific parameters	1	PCO	0
PGW-CSID	O	Optionally included by PGW on S5/S8. Shall be forwarded by SGW on S11. Only one value may be present per PDN connection	1	CSID	2
SGW-CSID	O	Optionally included by SGW on S11. Only one value may be present per PDN connection.	1	CSID	1
Private Extension	O	None	0	Private Extension	VS

Table 7.2.9.2-2: Bearer Context within Delete Bearer Request

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M		1	EBI	0

7.2.10   Delete Session Response and Delete Bearer Response

7.2.10.1   Delete Session Response

A Delete Session Response message shall be sent as a response to a Delete Session Request message from the SGW to the MME as part of the following procedures:

- EUTRAN Initial Attach

- Inter MME Tracking Area Update with SGW Change

- UE Initiated Detach

- HSS Initiated Detach

- MME Initiated Detach

- Intra MME S1 Based Handover

- Inter MME S1 Based Handover with SGW Change

- Inter MME S1 Based Handover without SGW Change

- X2 Based Handover with SGW Relocation

- UE Requested PDN Disconnection

Possible Cause values are:

- "Request accepted".

- "Request accepted".

- "Request accepted partially"

- "Request rejected"

- "Context not found"

- "Mandatory IE incorrect".

- "Mandatory IE missing".

- "Missing or unknown APN".

- "User authentication failed".

- "System failure".

- "Semantic error in the TAD operation".

- "Syntactic error in the TADoperation".

- "Semantic errors in packet filter(s)".

- "Syntactic errors in packet filters(s)".

- "Optional IE incorrect".

- "Invalid message format".

- "APN access denied – no subscription".

- "All dynamic addresses are occupied"

- "Unexpected repeated IE"

Table 7.2.10.1-1 specifies the presence of the IEs in the message.

The sending entity shall include Cause IE in the Delete Session Response message. The IE indicates if the peer has deleted the bearer, or not.

Table 7.2.10.1-1: Information Elements in a Delete Session Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Recovery	C	If contacting the peer for the first time	1	Recovery	0
Protocol Configuration Options (PCO)	C	The MME shall copy the content of this IE transparently from the PCO IE included by the UE if the PGW wishes to provide the UE with application specific parameters	1	PCO	0
Private Extension	O	None	0	Private Extension	VS

7.2.10.2 Delete Bearer Response

The Delete Bearer Response shall be sent as a response of Delete Bearer Request.

Possible Cause values are:

- "Request accepted".

- "Request accepted partially"

- "Request rejected"

- "Context not found"

- "Mandatory IE incorrect".

- "Mandatory IE missing".

- "Missing or unknown APN".

- "User authentication failed".

- "System failure".

- "Semantic error in the TAD operation".

- "Syntactic error in the TAD operation".

- "Semantic errors in packet filter(s)".

- "Syntactic errors in packet filters(s)".

- "Optional IE incorrect".

- "Invalid message format".

- "APN access denied – no subscription".

- "All dynamic addresses are occupied"

- "Unexpected repeated IE"

Table 7.2.10.2-1: Information Elements in Delete Bearer Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
LBI	C	If the request corresponds to P-GW initiated detach procedure, this IE shall be included to deactivate all the bearers associated with the default bearer of a PDN connection.	1	EBI	0
Bearer Contexts	C	It shall be used for bearers different from default one. In this case at least one bearer shall be included. Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers. Used for dedicated bearers. When used, at least one dedicated bearer shall be present.	1	Bearer Context	0
Recovery	C	Used if contacting the peer for the first time	1	Recovery	0
MME-CSID	O	Optionally included by MME on S11. Shall be forwarded by SGW on S5/S8. Only one value may be present per PDN connection	1	CSID	0
SGW-CSID	O	Optionally included by SGW on S5/S8. Only one value may be present per PDN connection.	1	CSID	1
Private Extension	O	None	0	Private Extension	VS

Table 7.2.10.2-2: Bearer Context within Delete Bearer Response

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
Cause	M	This IE shall indicate if the bearer handling was successful, and if not, gives information on the reason.	1	Cause	0

7.2.11 Downlink Data Notification messages

7.2.11.1 Downlink Data Notification

A Downlink Data Notification message shall be sent on S11 interface by a SGW from a SGW to a MME as a part of the network triggered service request procedure.

The message shall also be sent on S4 interface by a SGW from a SGW to a SGSN as part of Paging with no established user plane on S4, SGW triggered paging with S4.

Table 7.2.11.1-1 specifies the presence of the IEs in the message.

Table 7.2.11.1-1: Information Elements in a Downlink Data Notification

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Private Extension	O	None	1	Private Extension	VS

7.2.11.2 Downlink Data Notification Acknowledgement

A Downlink Data Notification Acknowledgement shall be sent from a MME/SGSN to a SGW in response to Downlink Data Notification with an indication of success, or failure when MME/SGSN has reachability or abnormal conditions.

Table 7.2.11.2-1 specifies the presence of the IEs in the message.

Table 7.2.11.2-1: Information Elements in a Downlink Data Notification Acknowledgement

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Data Notification Delay	C	The MME/SGSN shall include an adaptive delay indication to the SGW to delay the number of Data Notification indications, if the rate of Downlink Data Notification event occurance in the MME/SGSN becomes significant (as configured by the operator) and the MME/SGSN's load exceeds an operator configured value.	1	Delay Value	0
Recovery	O	None	1	Recovery	0
Private Extension	O	None	1	Private Extension	VS

Possible Cause values are:

- "Request accepted",

- "Unable to page UE".

7.2.11.3 Downlink Data Notification Failure Indication

A Downlink Data Notification Failure indication shall be sent from an MME/SGSN to a SGW indicating that the UE did not respond to paging. It shall also be sent in the case that the UE responded to the page with a Service Request but

that the MME has rejected the request by sending a Service Reject to the UE because the requested service is not supported.

Table 7.2.11.3-1 specifies the presence of the IEs in the message.

Table 7.2.11.3-1: Information Elements in a Downlink Data Notification Failure Indication

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Private Extension	O	None	1	Private Extension	VS

Possible Cause values are:

- "UE not responding"

- "Service denied".

  Editor's note: Other potential Cause values are FFS.

7.2.12 Update User Plane Request

The Update User Plane Request message is sent on S11 by the MME to the SGW as part of the Inter eNodeB handover without MME relocation, with Serving GW relocation procedure. Table 7.2.12-1 specifies the presence of the IEs in the message.

Table 7.2.12-1: Information Elements in an Update User Plane Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Bearer Contexts to be updated	M	None	1	Bearer Context	0
Bearer Contexts to be removed	C		1	Bearer Context	1
Recovery	C	If contacting the peer for the first time	1	Recovery	0
Private Extension	O	None	1	Private Extension	VS

Table 7.2.12-2: Bearer Context to be updated within Update User Plane Request

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
S1 eNodeB F-TEID	M	None	1	F-TEID	0

Table 7.2.12-3: Bearer Context to be removed within Update User Plane Request

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0

7.2.13 Update User Plane Response

The Update User Plane Response message is sent on S11 by the SGW to the MME as part of the Inter eNodeB handover without MME relocation, with Serving GW relocation procedure.

Table 7.2.13-1 specifies the presence of the IEs in the message.

Table 7.2.13-1: Information Elements in a Update User Plane Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Bearer Contexts updated	O	None	1	Bearer Contexts	0
Bearer Contexts marked for removal	O	None	1	Bearer Contexts	1
Private Extension	O	None	1	Private Extension	VS

Table 7.2.13-2: Bearer Context updated within Update User Plane Response

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
Cause	M	Indicates if the bearer handling was successful, and if not, gives information on the reason.	1	Cause	0
S1 SGW F-TEID	C	Used on S11	1	F-TEID	0

Table 7.2.13-3: Bearer Context marked for removal within Update User Plane Response

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
Cause	M	Indicates if the bearer handling was successful, and if not, gives information on the reason.	1	Cause	0

7.2.14 Modify Bearer Command and Failure Indication

7.2.14.1 Modify Bearer Command

The Modify Bearer Command is sent on S11 by the MME to the SGW and on S5/S8 by the SGW to the PGW as part of the HSS Initiated Subscribed QoS Modification procedure.

Table 7.2.14.1-1: Information Elements in a Modify Bearer Command

Information elements	P	Condition / Comment	CR	IE Type	Ins.
APN-Aggregate Maximum Bit Rate (APN-AMBR)	M	This IE shall contain the modified APN-AMBR value received by the MME from the HSS.	1	AMBR	0
Bearer Contexts	M	Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers	1	Bearer Context	0
Private Extension	O	None	0	Private Extension	VS

Table 7.2.14.1-2: Bearer Context within Modify Bearer Command

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	**P**	**Condition / Comment**	**CR**	**IE Type**	**Ins.**
EPS Bearer ID	M	This IE shall contain the bearer that has been modified.	1	EBI	0
Bearer Level QoS	C	Mandatory if other parameters than the APN-AMBR have changed	1	Bearer QoS	0

7.2.14.2 Modify Bearer Failure Indication

The Modify Bearer Failure Indication is sent on S5/S8 by the PGW to the SGW and on S11 by the SGW to the MME as part of failure of HSS Initiated Subscribed QoS Modification procedure.

Cause IE indicates that an EPS bearer has not been updated in the PGW.

Possible Cause values are:

- "Context not found"

- "No resources available".

- "No memory is available".

- "Missing or unknown APN".

- "User authentication failed".

- "System failure".

- "Semantic error in the TADoperation".

- "Syntactic error in the TADoperation".

- "Semantic errors in packet filter(s)".

- "Syntactic errors in packet filters(s)".

- "Mandatory IE incorrect".

- "Mandatory IE missing".

- "Optional IE incorrect".

- "Invalid message format".

- "APN access denied – no subscription".

- "All dynamic addresses are occupied"

- "Unexpected repeated IE"

Table 7.2.14.2-1: Information Elements in a Modify Bearer Failure Indication

Information elements	**P**	**Condition / Comment**	**CR**	**IE Type**	**Ins.**
Cause	M	None	1	Cause	0
Bearer Context	M	Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers		Bearer Context	0
Recovery	C	Only included if contacting the peer for the first time	1	Recovery	0
Private Extension	O	None	1	Private Extension	VS

Table 7.2.14.2-2: Bearer Context within Modify Bearer Failure Indication

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	This IE shall contain the bearers that have failed.	1	EBI	0
Cause	M	Indicates if the bearer handling was successful, and if not, gives information on the reason.	1	Cause	0

7.2.15   Update Bearer Request

For GTP based S5/S8, the Update Bearer Request shall be sent by the P-GW to the S-GW and forwarded to the MME as part of the following procedures:

- PDN GW Initiated Bearer Modification with Bearer QoS Update

- HSS Initiated Subscribed QoS Modification

- PGW Initiated Bearer Modification without Bearer QoS Update

- UE Request Bearer Resource Modification procedure

The message shall also be sent on S5/S8 interface by the PGW to the SGW and on S4 interface by the SGW to the SGSN as part of the following procedures:

- PGW Initiated EPS Bearer Modification

- Execution part of MS-Initiated EPS Bearer Modification

For PMIP based S5/S8, the Update Bearer Request is sent from the SGW to the MME over S11.

Table 7.2.15-1 specifies the presence requirements and the conditions of the IEs in the message.

Table 7.2.15-1: Information Elements in a Update Bearer Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
IMSI	M	None	1	IMSI	0
Bearer Contexts	M	This IE shall contain contexts related to bearers that need QoS/TFT modification. Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers.	1	Bearer Context	0
Procedure Transaction Id (PTI)	C	If the request corresponds to UE requested bearer resource modification procedure for an E-UTRAN or MS initiated EPS bearer modification procedure, this IE shall be included. PTI shall be the same as the one used in the corresponding Bearer Resource Command or Modify Bearer Command	1	PTI	0
Protocol Configuration Options (PCO)	C	PGW shall include Protocol Configuration Options (PCO) IE, if available.	1	PCO	0
GRE Key	C	The SGW shall include the GRE Key IE for uplink traffic if PMIP-based S5/S8 is used	1	GRE Key	0
Aggregate Maximum Bit Rate (APN-AMBR)	M	APN-AMBR	1	AMBR	0
Trace Information	C	Trace Reference, Trace Type, Trigger Id, OMC Identitiy. Included if SGW and/or PGW is activated.	1	Trace Information	0
Private Extension	O	None	0	Private Extension	VS

Table 7.2.15-2: Bearer Context within Update Bearer Request

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
UL TFT	O	This IE shall be included if message relates to Bearer Modification and TFT change or if PMIP based S5/S8	1	Bearer TFT	0
DL TFT	O	PMIP based S5/S8 only	1	Bearer TFT	1
Bearer Level QoS	C	This IE shall be included if QoS modification is requested and no TFT change	1	Bearer QoS	0
Legacy QoS	C	This IE shall be included if QoS modification is requested and no TFT change	1	Legacy QoS	0
Charging Characteristics	C	To be included according to TS 32.251. To be included according to TS 32.251	1	Charging Characteristics	0
Charging Id	C	None	1	Charging Id	0
Prohibit Payload Compression	O	None	1	Prohibit Payload Compression	0

7.2.16 Update Bearer Response

An Update Bearer Response shall be sent from a MME/SGSN to a SGW and forwarded to the PGW as a response to an Update Bearer Request message.

Table 7.2.16-1 specifies the presence requirements and the conditions of the IEs in the message.

Cause IE indicates if an EPS bearer has been modifed in the MME/SGSN or not. The EPS Bearer has not been modified in the MME if the Cause IE value differs from "Request accepted" or "Request accepted partially". Possible Cause values are:

- "Request accepted".

- "Request accepted partially"

- "Request accepted partially"

- "Request rejected"

- "Context not found"

- "Mandatory IE incorrect".

- "Mandatory IE missing".

- "Missing or unknown APN".

- "User authentication failed".

- "System failure".

- "Semantic error in the TFT operation".

- "Syntactic error in the TFT operation".

- "Semantic errors in packet filter(s)".

- "Syntactic errors in packet filters(s)".

- "Optional IE incorrect".

- "Invalid message format".

- "APN access denied – no subscription".

- "All dynamic addresses are occupied"

- "Unexpected repeated IE"

Table 7.2.16-1: Information Elements in an Update Bearer Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Bearer Contexts	M	This IE shall contain contexts related to bearers for which QoS/TFT modification was requested. Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers	1	Bearer Context	0
Protocol Configuration Options (PCO)	C	MME/SGSN shall include PCO IE if such information was received from the PGW. This IE shall be included if the Cause IE contains the value "Request accepted".	1	PCO	0
Recovery	C	If contacting the peer for the first time	1	Recovery	0
Private Extension	O	None	1	Private Extension	VS

Table 7.2.16-2: Bearer Context within Update Bearer Response

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
Cause	M	Indicates if the bearer handling was successful, and if not, gives information on the reason.	1	Cause	0

7.2.17   Delete Bearer Command and Failure Indication

7.2.17.1   Delete Bearer Command

A Delete Bearer Command message shall be sent from a MME to a SGW on S11 and forwarded to PGW on S5/S8 as a part of the eNodeB requested bearer modification or MME-Initiated Dedicated Bearer Deactivation procedure.

Table 7.2.17.1-1: Information Elements in Deactivate Bearer Command

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Bearer Contexts	M	This IE shall be used to indicate dedicated bearers. When used, at least one dedicated bearer shall be present. Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers	1	Bearer Context	0
Private Extension	O	None	0	Private Extension	VS

Table 7.2.17.1-2: Bearer Context within Deactivate Bearer Command

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0

7.2.17.2   Delete Bearer Failure Indication

A Delete Bearer Failure Indication is sent on S5/S8 by the PGW to the SGW and on S11 by the SGW to the MME as part of failure of MME Initiated Dedicated Bearer Deactivation procedure.

Cause IE indicates that an EPS bearer has not been deleted in the PGW.

Possible Cause values are:

- "Context not found"

- "Mandatory IE incorrect".

- "Mandatory IE missing".

- "Missing or unknown APN".

- "User authentication failed".

- "System failure".

- "Semantic error in the TAD operation".

- "Syntactic error in the TAD operation".

- "Semantic errors in packet filter(s)".

- "Syntactic errors in packet filters(s)".

- "Optional IE incorrect".

- "Invalid message format".

- "APN access denied – no subscription".

- "All dynamic addresses are occupied"

- "Unexpected repeated IE"

Editor's Note: Additional cause values are FFS.

Table 7.2.17.2-1: Information Elements in a Deactivate Bearer Failure Indication

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Bearer Context	M	This IE shall contain the list of failed bearers.	1	Bearer Context	0
Recovery	C	Used If contacting the peer for the first time	1	Recovery	0
Private Extension	O	None	1	Private Extension	VS

Table 7.2.17.2-2: Bearer Context within Deactivate Bearer Failure Indication

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
Cause	M	This IE shall indicate if the bearer handling was successful, and if not, gives information on the reason.	1	Cause	0

7.2.18   Create Indirect Data Forwarding Tunnel Request

The Create Indirect Data Forwarding Tunnel Request message is sent on S11/S4 by the MME/SGSN to the SGW as part of the Handover procedures.

Table 7.2.18-1 specifies the presence requirements and the conditions of the IEs in the message.

Table 7.2.18-1: Information Elements in a Create Indirect Data Forwarding Tunnel Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Bearer Contexts	M	Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers	1	Bearer Context	0
Private Extension	O	None	0	Private Extension	VS

Table 7.2.18-2: Bearer Context within Create Indirect Data Forwarding Tunnel Request

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
S1 eNodeB F-TEID	C	Target eNodeB F-TEID. This IE shall be present in the message sent from the target MME to the target SGW	1	F-TEID	0
S1-U SGW F-TEID	C	Target SGW F-TEID This IE shall be present in the message sent from the source MME to the source SGW	1	F-TEID	1
S4-U SGSN F-TEID	C	Target SGSN F-TEID This IE shall be present in the message sent from the target SGSN to the target SGW when direct tunnel is not used	1	F-TEID	2
S12 RNC F-TEID	C	Target RNC F-TEID This IE shall be present in the message sent from the target SGSN to the target SGW when direct tunnel is used	1	F-TEID	3

7.2.19   Create Indirect Data Forwarding Tunnel Response

A Create Indirect Data Forwarding Tunnel Response message shall be sent by a Serving GW to an MME/SGSN as a response to a Create Indirect Data Forwarding Tunnel Request message.

Table 7.2.19-1 specifies the presence requirements and the conditions of the IEs in the message.

The Cause value indicates if the Indirect Data Forwarding Tunnels has been created in the Serving GW or not. Indirect Data Forwarding Tunnels have not been created in the Serving GW if the Cause differs from 'Request accepted'. Possible Cause values are:

- "Request Accepted".

- "No resources available".

- "System failure".

- "Mandatory IE incorrect".

- "Mandatory IE missing".

- "Optional IE incorrect".

- "Invalid message format".

Only the Cause IE shall be included in the response if the Cause IE contains another value than 'Request accepted'.

Table 7.2.19-1: Information Elements in a Create Indirect Data Forwarding Tunnel Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Bearer Contexts	M	Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers	1	Bearer Context	0
Private Extension	O	None	0	Private Extension	VS

Table 7.2.19-2: Bearer Context within Create Indirect Data Forwarding Tunnel Response

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
Cause	M	Indicates if the tunnel setup was successful, and if not, gives information on the reason.	1	Cause	0
S1-U SGW F-TEID	C	It is the target SGW F-TEID when present in the response sent from the target SGW to the target MME. Or It is the source SGW F-TEID when present in the response sent from the source SGW to the source MME.	1	F-TEID	0
S12 SGW F-TEID	C	S12 usage only. It is the target SGW F-TEID when present in the response sent from the target SGW to the target SGSN. Or It is the source SGW F-TEID when present in the response sent from the source SGW to the source SGSN.	1	F-TEID	1
S4-U SGW F-TEID	C	S4-U usage only. It is the target SGW F-TEID when present in the response sent from the target SGW to the target SGSN. Or It is the source SGW F-TEID when present in the response sent from the source SGW to the source SGSN.	1	F-TEID	2

7.2.20 Update Bearer Complete

The Update Bearer Complete message is sent on S4 by the SGW to the SGSN as part of the MS or SGSN initiated modification procedure.

Table 7.2.20-1 specifies the presence of the IEs in the message.

Table 7.2.20-1: Information Elements in an Update Bearer Complete

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Bearer Contexts	M	Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers	1	Bearer Context	0
Private Extension	O	None	1	Private Extension	VS

Table 7.2.20-2: Bearer Context within Update Bearer Complete

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	P	Condition / Comment	CR	IE Type	Ins.
EPS Bearer ID	M	None	1	EBI	0
Cause	M	Indicates if the bearer handling was successful, and if not, gives information on the reason.	1	Cause	0

7.3 Mobility Management Messages

7.3.1 Forward Relocation Request

A Forward Relocation Request message shall be sent from the source MME to the target MME over S10 interface as part of S1-based handover relocation procedure from the source MME to the target SGSN, or from the source SGSN to the target MME over S3 interface as part of Inter RAT handover and combined hard handover and SRNS relocation procedures, or from source SGSN to the target SGSN over S16 interface as part of SRNS Relocation and PS handover procedures.

Table 7.3.1-1 specifies the presence requirements and conditions of the IEs in the message.

Table 7.3.1-1: Information Elements in a Forward Relocation Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
IMSI	M	None	1	IMSI	0
Sender's F-TEID for Control Plane	M	This IE specifies the address and the tunnel for control plane message which is chosen by the source MME/SGSN.	1	F-TEID	0
MME/SGSN UE EPS Bearer Contexts	M	Several IEs with this type and instance values shall be included as necessary to represent a list of PDN Connections	1	PDN Connection	0
MME/SGSN UE MM Context	M	None	1	MM Context	0
Indication	C	This IE shall be included if either one of the DFI flag and ISRSI flag is set. DFI flag is set if direct forwarding is supported. DFI flag shall not be set if the message is used for SRNS relocation procedure. ISRSI flag is set if the source MME/SGSN is capable to establish ISR for the UE or if the ISR is activated, the source MME/SGSN then indicate the target SGSN/MME to maintain ISR for the UE in the inter RAT handover procedures.	1	Indication	0
E-UTRAN Transparent Container	C	This IE shall be included if the message is used for UTRAN/GERAN to E-UTRAN inter RAT handover procedure, intra RAT handover procedure and 3G SGSN to MME combined hard handover and SRNS relocation procedure.	1	F-Container	0
UTRAN Transparent Container	C	This IE shall be included if the message is used for PS handover to UTRAN Iu mode procedures, SRNS relocation procedure and E-TURAN to UTRAN inter RAT handover procedure.	1	F-Container	1
Target Identification	C	This IE shall be included if the message is used for SRNS relocation procedure and handover to UTRAN/E-UTRAN procedures.	1	Target Identification	0
HRPD access node S101 IP address	C	This IE shall be included only if the HRPD pre registration was performed at the source MME	1	S101-IP-Address	0
1xIWS S102 IP address	C	This IE shall be included only if the 1xRTT CS fallback pre registration was performed at the source MME	1	S102-IP-Address	0
RAN Cause	C	This IE is the information from the source eNodeB, the source MME shall include this IE in the message.	1	F-Cause	0
RANAP Cause	C	This IE is the information from the source RNC, the source SGSN shall include this IE in the message.	1	F-Cause	1
BSS Container	C	This IE shall be included if the message is used for PS handover to GERAN A/Gb mode and E-UTRAN to GERAN A/Gb mode inter RAT handover procedure.	1	F-Container	0
Cell Identification	C	This IE shall be included if the message is used for PS handover to GERAN A/Gb mode and E-UTRAN to GERAN A/Gb mode inter RAT handover procedure.	1	Cell Identification	0
BSSGP Cause	C	This IE is the information from source BSS, the source SGSN shall include this IE in the message.	1	F-Cause	2
Selected PLMN ID	O	The Selected PLMN ID IE indicates the core network operator selected for the UE in a shared network. The old SGSN shall include this IE if the selected PLMN identity is available.	1	Selected PLMN ID	0
EPS Bearer Contexts Prioritization	O	When the EPS Bearer Context Prioritization IE is included, it informs the target MME/SGSN that the EPS bearer Contexts are sent prioritized.	1	Contexts Prioritization	0
Recovery	C	If contacting the peer for the first time	1	Recovery	0
Private Extension	O	None	1	Private Extension	VS

7.3.2   Forward Relocation Response

A Forward Relocation Response message shall be sent as a response to Forward Relocation Request during S1-based handover procedure, Inter RAT handover procedures, SRNS Relocation procedure and PS handover procedures.

Table 7.3.2-1 specifies the presence requirements and conditions of the IEs in the message.

Cause IE indicates if the relocation has been accepted, or not. The relocation has not been accepted by the target MME/SGSN if the Cause IE value differs from "Request accepted". Possible Cause values are:

- "Request accepted".

- 'System failure'.

- 'Mandatory IE incorrect'.

- 'Mandatory IE missing'.

- 'Optional IE incorrect'.

- 'No resources available'.

- 'Invalid message format'.

- 'Relocation failure'.

Table 7.3.2-1: Information Elements in a Forward Relocation Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M		1	Cause	0
Sender's F-TEID for Control Plane	C	If the Cause IE contains the value"" Request accepted"", the target MME/SGSN shall include this IE in Forward Relocation Response message.	1	F-TEID	0
Indication	C	This IE shall be included if the target MME/SGSN has selected a new SGW. This IE shall not be included if the message is used for SRNS relocation procedure. SGWCI flag is set to indicate Serving GW change.	1	Indication	0
List of Set-up Bearers	C	The list of set-up Bearers IE contains the EPS bearer Identifiers of the Bearers that were successfully allocated in the target system during a handover procedure. This IE shall be included if the Cause IE contains the value "Request accepted". Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers.	1	Bearer Context	0
List of Set-up RABs	C	The list of set-up RABs IE contains the RAB Identifiers of the RABs that were successfully allocated in the target system. This IE shall be included if the Cause IE contains the value "Request accepted". Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers.	1	Bearer Context	1
eNodeB Cause	C	If the Cause IE contains the value "Request accepted", this IE is mandatory if cause value is contained in S1-AP message.	1	F-Cause	0
RANAP Cause	C	If the Cause IE contains the value "Request accepted", this IE is mandatory if cause value is contained in RANAP message.	1	F-Cause	1
E-UTRAN Transparent Container	O	This IE contains the radio-related and core network information for handover to E-UTRAN. If the Cause IE contains the value "Request accepted", this IE is included.	1	F-Container	0
UTRAN Transparent Container	O	This IE contains the radio-related and core network information for handover to UTRAN. If the Cause IE contains the value "Request accepted", this IE is included.	1	F-Container	1
BSS Container	O	This IE contains the radio-related and core network information for handover to GERAN. If the Cause IE contains the value "Request accepted", this IE is included.	1	F-Container	2
List of Set-up PFCs	O	The list of set-up PFCs IE contains the Packet Flow Identifies of the PFCs that were successfully allocated in the target system during a PS handover to/from GERAN or inter RAT handover to/from GERAN. If the Cause IE contains the value "Request accepted", this IE is included.	1	Bearer Context List	0
BSSGP Cause	O	For handover to GERAN, if a cause value is received from the Target BSC, the BSSGP Cause IE shall be included and shall be sent to the cause value received from the target BSC.	1	F-Cause	2
Private Extension	O	None	1	Private Extension	VS

Bearer Context IE in this message is specified in Table 7.3.2-2, the source system shall use this IE for data forwarding in handover.

Table 7.3.2-2: Bearer Context

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
EPS Bearer ID	C	This IE shall be included if the message is used for S1-Based handover procedure.	1	EBI	0
NSAPI	C	This IE shall be included if the message is used for SRNS relocation procedure and Inter RAT handover to/from Iu mode procedures.	1	NSAPI	0
Packet Flow ID	C	This IE shall be included if the message is used for PS handover and Inter RAT handover to/from A/Gb mode procedures.	1	Packet Flow ID	0
eNB F-TEID for data forwarding	C	This eNB F-TEID shall be included for direct data forwarding.	1	F-TEID	0
SGW F-TEID for data forwarding	C	This SGW F-TEID shall be included for indirect data forwarding.	1	F-TEID	1

7.3.3   Forward Relocation Complete Notification

A Forward Relocation Complete Notification message shall be sent to the source MME/SGSN to indicate the handover has been successfully finished.

Table 7.3.3-1 specifies the presence requirements and conditions of the IEs in the message.

Table 7.3.3-1: Information Elements in a Forward Relocation Complete Notification

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Indication	C	This IE shall be included if the message is used for inter RAT handover, and the UE has ISR capability. Available flags: ISRAI flag is set to indicate to the source MME/SGSN whether it shall maintain the UE's context and whether it shall activate ISR.	1	Indication	0
Private Extension	O	None	1	Private Extension	VS

7.3.4   Forward Relocation Complete Acknowledge

A Forward Relocation Complete Acknowledge message shall be sent as a response to Forward Relocation Complete Notification during inter eNodeB handover with MME relocation procedure.

Table 7.3.4-1 specifies the presence requirements and conditions of the IEs in the message.

Table 7.3.4-1: Information Elements in a Forward Relocation Complete Acknowledge

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Recovery	O	None	1	Recovery	0
Private Extension	O	None	1	Private Extension	VS

7.3.5   Context Request

The new MME/SGSN shall send the Context Request message to the old MME/SGSN on S3/S16/S10 interface as a part of TAU/RAU procedure to get the MM and EPS bearer Contexts for the UE.

If the sending node is a MME, it shall include in the Context Request message:

- the GUTI IE and Complete TAU Request Message IE if the GUTI received from UE indicates the old node is a MME.

- the RAI IE, P-TMSI IE and P-TMSI Signature IE if the GUTI received from UE indicates the old node is an SGSN.

Editor's note: It is FFS if other means than GUTI could be needed to identify the old nodes.

If the sending node is an SGSN, it shall include RAI IE, P-TMSI IE and P-TMSI Signature IE in the Context Request message.

The new MME differentiates the type of the old node from the most significant bit of the MME group id in GUTI. The value 0 indicates that the old node is an SGSN, the GUTI shall be mapped to RAI and P-TMSI by the new MME; and the value 1 indicates the old node is a MME, the new MME include GUTI IE and Complete TAU Request Message IE in the Context Request message. The Mapping between temporary and area identities is defined in 3GPP TS 23.003 [2].

The GUTI IE shall not coexist with any of the RAI IE, P-TMSI IE and P-TMSI Signature IE in a Context Request message. If this occurs, the receiving node shall return a corresponding cause value in the response message.

Table 7.3.5-1 specifies the presence requirements and conditions of the IEs in the message.

Table 7.3.5-1: Information Elements in a Context Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
IMSI	C	IMSI shall be included if the MS Validated value indicates 'YES'.	1	IMSI	0
GUTI	C	The New MME shall include this IE over S10 interface.	1	GUTI	0
Routeing Area Identity(RAI)	C	This IE shall be included over S3/S16 interface, if the GUTI indicates the old node is an SGSN, the new MME maps this IE from GUTI.	1	ULI for RAI	0
Packet TMSI(P-TMSI)	C	This IE shall be included over S3/S16 interface, if the GUTI indicates the old node is an SGSN, the new MME maps this IE from GUTI.	1	P-TMSI	0
P-TMSI Signature	C	This IE shall be included over S3/S16 interface, if the GUTI indicates the old node is an SGSN, the new MME maps this IE from GUTI.	1	P-TMSI Signature	0
Complete TAU request message	C	The new MME shall include this IE, and the old MME may use this IE for integrity check.	1	Complete Request Message	0
S3/S16/S10 Address and TEID for Control Plane	C	This IE specifies the address and the tunnel for control plane message which is chosen by the new MME/SGSN.	1	F-TEID	0
UDP Source Port Number	C	If an SGSN within the same SGSN pool as the old SGSN receives this message, the SGSN shall include the UDP Source Port number of the received message in this optional parameter if this IE is not present and relay the message to the old SGSN. The old SGSN shall use this UDP port as the UDP destination port of the Context Response message.	1	Port Number	0
RAT Type	C	The RAT Type indicates the Radio Access Technology which is used in the new system.	1	RAT Type	0
HRPD access node S101 IP address	C	This IE shall be included only if the HRPD pre registration was performed at the old MME	1	S101-IP-Address	0
1xIWS S102 IP address	C	This IE shall be included only if the 1xRTT CS fallback pre registration was performed at the old MME	1	S102-IP-Address	0
MS Validated	O	The MS Validated indicates that the new system has successfully authenticated the UE, IMSI shall be included if the MS Validated value indicates 'YES'.	1	MS Validated	0
Hop Counter	O	If an SGSN within the same SGSN pool with the old SGSN receives this message, the SGSN shall decrement the Hop Counter if this IE is present in the received message; otherwise may include a Hop Counter with a value of max-1, and relay the message to the old SGSN.	1	Hop Counter	0
Private Extension	O	None	1	Private Extension	VS

Editor's note: It is FFS whether there is more Information Element for this message.

7.3.6 Context Response

A Context Response message shall be sent as a response to a previous Context Request message during TAU/RAU procedure.

Possible Cause values are:

- 'Request Accepted'.

- 'IMSI not known'.

- 'System failure'.

- 'Mandatory IE incorrect'.

- 'Mandatory IE missing'.

- 'Optional IE incorrect'.

- 'Invalid message format'.

- 'P-TMSI Signature mismatch'.

    Editor's note: Other potential Cause values are FFS.

Table 7.3.6-1 specifies the presence requirements and conditions of the IEs in the message.

Table 7.3.6-1: Information Elements in a Context Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
IMSI	C	None	1	IMSI	0
MME/SGSN UE MM Context	C	None	1	MM Context	0
MME/SGSN UE ESP bearer Contexts	C	This IE shall be included if there is at least a PDN connection for this UE on the sending MME/SGSN. Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers.	1	PDN Connection	0
S3/S16/S10 Address and TEID for Control Plane	C	This IE specifies the address and the tunnel for control plane message which is chosen by the old MME/SGSN.	1	F-TEID	0
ISRSI	C	This IE shall be included if the Cause IE value indicates "Request accepted" and the old system has the ISR capability.	1	Indication	0
EPS Bearer Contexts Prioritization	O	When the EPS Bearer Context Prioritization IE is included, it informs the new MME/SGSN that the EPS bearer Contexts are sent prioritized.	1	Contexts Prioritization	0
Private Extension	O	None	1	Private Extension	VS

Editor's note: It is FFS whether there is more Information Element for this message.

7.3.7 Context Acknowledge

A Context Acknowledge message shall be sent as a response to a previous Context Response message.

Possible cause values are:

- 'Request accepted'.

- 'System failure'.

- 'Mandatory IE incorrect'.

- 'Mandatory IE missing'.

- 'Optional IE incorrect'.

- 'No resources available'.

- 'Invalid message format'.

- 'Authentication failure'.

    Editor's note: Other potential Cause values are FFS.

Table 7.3.7-1 specifies the presence requirements and conditions of the IEs in the message.

Table 7.3.7-1: Information Elements in a Context Acknowledge

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
SGW Change Indication	C	SGW change indication indicates a new Serving GW has been selected. The old MME/old SGSN marks in its context that the information in the GWs and the HSS are invalid.	1	Indication	0
ISRAI	C	ISR indicates to the old system that it shall maintain the UE's contexts. This IE shall be included if the Cause IE value indicates "Request accepted".	1	Indication	1
Private Extension	O	None	1	Private Extension	VS

Editor's note: It is FFS whether there is more Information Element for this message.

7.3.8 Identification Request

If the UE identifies itself with temporary identity and it has changed SGSN/MME since detach in Attach procedure, the new MME/SGSN shall send an Identification Request message to the old SGSN/MME over S3, S16 or S10 interface to request IMSI.

Table 7.3.8-1 specifies the presence requirements and conditions of the IEs in the message.

If the sending node is a MME, it shall include in the Identification Request message:

- the GUTI IE and Complete Attach Request Message IE if the GUTI received from UE indicates the old node is a MME.

- the RAI IE, P-TMSI IE and P-TMSI Signature IE if the GUTI received from UE indicates the old node is an SGSN.

Editor's note: It is FFS if other means than GUTI could be needed to identify the old nodes.

If the sending node is an SGSN, it shall include RAI IE, P-TMSI IE and P-TMSI Signature IE in the Identification Request message.

The new MME differentiates the type of the old node from the most significant bit of the MME group id in GUTI. The value 0 indicates that the old node is an SGSN, the GUTI shall be mapped to RAI and P-TMSI by the new MME; and the value 1 indicates the old node is a MME, the new MME include GUTI IE and Complete Attach Request Message IE in the Identification Request message. The Mapping between temporary and area identities is defined in 3GPP TS 23.003 [2].

The GUTI IE shall not coexist with any of the RAI IE, P-TMSI IE and P-TMSI Signature IE in an Identification Request message. If this occurs, the receiving node shall return a corresponding cause value in the response message.

Table 7.3.8-1: Information Elements in an Identification Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
GUTI	C	The new MME shall include this IE over S10 interface.	1	GUTI	0
Routeing Area Identity(RAI)	C	This IE shall be included over S3/S16 interface, if the GUTI received from the UE indicates the old node is an SGSN, the new MME maps this IE from GUTI.	1	ULI for RAI	0
Packet TMSI(P-TMSI)	C	This IE shall be included over S3/S16 interface, if the GUTI received from the UE indicates the old node is an SGSN, the new MME maps this IE from GUTI.	1	P-TMSI	0
P-TMSI Signature	C	This IE shall be included over S3/S16 interface, if the GUTI received from the UE indicates the old node is an SGSN, the new MME maps this IE from GUTI.	1	P-TMSI Signature	0
Complete Attach Request Message	C	The new MME shall include this IE over S10 interface, and the old MME may use this IE for integrity check.	1	Complete Request Message	0
Address for Control Plane	O	If an SGSN within the same SGSN pool with the old SGSN receives this message, the SGSN shall include the old IP address of the received message in this optional parameter if this IE is not present and relay the message to the old SGSN.	1	IP Address	0
UDP Source Port Number	C	If an SGSN within the same SGSN pool as the old SGSN receives this message, the SGSN shall include the UDP Source Port number of the received message in this optional parameter if this IE is not present and relay the message to the old SGSN. The old SGSN shall use this UDP port as the UDP destination port of the Identification Response message.	1	Port Number	0
Hop Counter	O	If an SGSN within the same SGSN pool with the old SGSN receives this message, the SGSN shall decrement the Hop Counter if this IE is present in the received message; otherwise may include a Hop Counter with a value of max-1, and relay the message to the old SGSN.	1	Hop Counter	0
Private Extension	O	None	1	Private Extension	VS

Editor's note: It is FFS whether there is more Information Element for this message.

7.3.9 Identification Response

The old SGSN/MME shall send an Identification Response message to the new MME/SGSN as a response to a previous Identification Request message over S3/S10/S16 interface.

Table 7.3.9-1 specifies the presence requirements and conditions of the IEs in the message.

For Intra Domain Connection of RAN Nodes to Multiple CN Nodes, if an old SGSN within an SGSN pool receives an Identification Request message that contains the optional parameter Address for Control Plane, the old SGSN shall use this address as destination IP address of the Identification Response message.

Possible Cause values are:

- 'Request accepted'.

- 'IMSI not known'.

- 'System failure'.

- 'Mandatory IE incorrect'.

- 'Mandatory IE missing'.

- 'Optional IE incorrect'.

- 'Invalid Message format'

- 'P-TMSI Signature mismatch'.

Editor's note: Other potential Cause values are FFS.

Only the Cause information element shall be included in the response if the Cause contains another value than 'Request accepted'.

One or several Authentication Quadruplet information elements, Authentication Quintuplet information elements may be included in the message if the Cause contains the value 'Request accepted'.

Table 7.3.9-1: Information Elements in an Identification Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
IMSI	C	This IE is mandatory if the Cause contains the value 'Request accepted'.	1	IMSI	0
Authentication Quadruplet	O	If the Cause contains the value 'Request accepted', the old node may include one or several Authentication Quadruplet in the Identification Response message.	1	Authentication Quadruplet	0
Authentication Quintuplet	O	If the Cause contains the value 'Request accepted', the old node may include one or several Authentication Quintuplet in the Identification Response message.	1	Authentication Quintuplet	1
Private Extension	O	None	1	Private Extension	VS

Editor's note: It is FFS whether there is more Information Element for this message.

7.3.10   Forward SRNS Context Notification

A Forward SRNS Context Notification message shall be sent from the Old SGSN to the New SGSN over S16 interface to forward the RNC contexts to the target system.

When the old SGSN receives the RANAP message Forward SRNS Context, the old SGSN shall send a Forward SRNS Context Notification message to the new SGSN. The new SGSN shall forward the message to the target RNC using the corresponding RANAP message.

When the old SGSN receives a BSSGP message PS handover Required and the acknowledged peer-to-peer LLC operation is used for the Bearer Context or when "delivery order" is set in the Bearer Context QoS profile, the old SGSN shall send a Forward SRNS Context Notification message with the PDU Number IE to the new SGSN. The new SGSN shall forward the message to the target RNC/ target BSS using the corresponding RANAP message only for PS handover to Iu mode.

When the old SGSN receives a BSSGP message PS handover Required from source BSS/RNC for PS handover to A/Gb mode, the value part of RAB Context IE shall be empty according to its defined minimum length.

Table 7.3.10-1 specifics the presence requirements and conditions of the IEs in the message.

Table 7.3.10-1: Information Elements in a Forward SRNS Context Notification

Information elements	P	Condition / Comment	CR	IE Type	Ins.
RAB Contexts	M	Several IEs with this type and instance values shall be included as necessary to represent a list of Bearers. For each RAB context in the received RANAP message, the old SGSN shall include this IE in the message.	1	RAB Context	0
Source RNC PDCP context Info	O	If available, the old SGSN shall include an Source RNC PDCP context info in the message.	1	Source RNC PDCP context Info	0
PDU Numbers	O	The old SGSN shall include this IE in the message if the acknowledged peer-to-peer LLC operation is used for the Bearer Context or when "delivery order" is set in the Bearer Context QoS profile in A/Gb mode to Iu/A/Gb mode PS handover.	1	PDU Numbers	0
Private Extension	O	None	1	Private Extension	VS

Editor's note: It is FFS whether there is more Information Element for this message.

7.3.11   Forward SRNS Context Acknowledge

A Forward SRNS Context Acknowledge message shall be sent to the old SGSN as a response to Forward SRNS Context Notification.

Possible Cause values are:

- 'Request Accepted'.

- 'Mandatory IE incorrect'.

- 'Mandatory IE missing'.

- 'Optional IE incorrect'.

- 'Invalid message format'.

Editor's note: Other potential Cause values are FFS.

Table 7.3.11-1 specifics the presence requirements and conditions of the IEs in the message.

Table 7.3.11-1: Information Elements in a Forward SRNS Context Acknowledge

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Private Extension	O	None	1	Private Extension	VS

Editor's note: It is FFS whether there is more Information Element for this message.

7.3.12   Detach Notification

A Detach Notification message shall be sent from an MME to the associated SGSN, or from an SGSN to the associated MME as a part of Detach procedure if the ISR is activated between the MME and SGSN for the UE.

Possible Cause values are:

- "Local Detach".

- "Complete Detach".

'Local Detach' indicates that this detach is local to the MME/SGSN and so the associated SGSN/MME registration where the ISR is activated shall not be detached. The MME/SGSN that receives this message including this Cause value of 'Local Detach' only deactivates the ISR. This Cause value shall be included in the procedures:

- MME/SGSN-initiated Detach Procedure in case of implicit detach.

- HSS-initiated Detach Procedure.

'Complete Detach' indicates both the MME registration and the SGSN registration that the ISR is activated for, shall be detached. This 'Complete Detach' Cause value shall be included in the procedures:

- UE-initiated Detach Procedure.

- MME/SGSN-initiated Detach Procedure in case of explicit detach.

Table 7.3.12-1 specifics the presence of the IEs in the message.

Table 7.3.12-1: Information Elements in a Detach Notification

Information elements	P	Condition / Comment	CR	IE Type	Ins.
IMSI	M	None	1	IMSI	0
Cause	M	None	1	Cause	0
Private Extension	O	None	0	Private Extension	VS

Editor's notes: It is FFS whether there is more Information Element for this message.

7.3.13   Detach Acknowledge

A Detach Acknowledge message shall be sent as a response to a Detach Notification message during Detach procedure.

Possible Cause values are:

- 'Request accepted'.

- 'IMSI not known'.

- 'System failure'.

- 'Mandatory IE incorrect'.

- 'Mandatory IE missing'.

- 'Optional IE incorrect'.

- 'Invalid Message format'

Editor's note: Other potential Cause values are FFS.

Table 7.3.13-1 specifics the presence of the IEs in the message.

Table 7.3.13-1: Information Elements in a Detach Acknowledge

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Recovery	O	None	1	Recovery	0
Private Extension	O	None	0	Private Extension	VS

Editor's notes: It is FFS whether there is more Information Element for this message.

7.3.14   Change Notification Request

The Change Notification Request message is sent on the S4 interface by the SGSN to the SGW and on the S5/S8 interface by the SGW to the PGW as part of location dependent charging related procedures.

The TEID value used in this message shall be zero.

Table 7.3.14-1: Information Element in Change Notification Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
IMSI	M	None	1	IMSI	0
RAT Type	M	None	1	RAT Type	0
User Location Information (ULI)	C	The SGSN shall include the User Location Information IE if the MS is located in a RAT Type of GERAN, UTRAN or GAN and shall include the CGI, SAI or RAI in the 'Geographic Location' field depending on whether the MS is in a cell, a service or a routing area respectively.	1	ULI	0
Private Extension	O	Vendor or operator specific information	0	Private Extension	VS

7.3.15 Change Notification Response

The Change Notification Request message is sent on the S4 interface by the SGW to the SGSN and on the S5/S8 interface by the PGW to the SGW as part of location dependent charging related procedures to acknowledge the receipt of a Change Notification Request.

The TEID value used in this message shall be zero.

If the IMSI is unknown for the receiving GTP-C entity, then the message shall be silently discarded and no further processing of the IEs shall continue.

Editor's Note: It is FFS if GGSN shall be replaced by PGW in the following text.

If the received Change Notification Response contains a Cause value of 'IMSI not known', then the Change Reporting mechanism shall be stopped in the receiving SGSN for all PDP Contexts or Bearers associated with the IMSI received and the GGSN from which the response was received. The SGSN shall then initiate an Update PDP Context for all of these PDP Contexts associated with the GGSN.

If the MS Info Change Reporting mechanism is to be stopped for this subscriber in the SGSN, then the GGSN shall include the MS Info Change Reporting Action IE in the message and shall set the value of the Action field appropriately.

Table 7.3.15-1: Information Element in Change Notification Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
IMSI	M	None	1	IMSI	0
Cause	M	None	1	Cause	0
Change Reporting Action	O	If the MS Info Change Reporting mechanism is to be stopped for this subscriber in the SGSN, then the GGSN shall include the MS Info Change Reporting Action IE with the appropriate Action field	1	Change Reporting Action	0
Private Extension	O	Vendor or operator specific information	0	Private Extension	VS

7.3.16 Relocation Cancel Request

A Relocation Cancel Request message shall be sent from the source MME/SGSN to the target MME/SGSN on S3/S10/S16 interface as part of handover Cancel procedure.

Table 7.3.16-1 specifics the presence of the IEs in the message.

Table 7.3.16-1: Information Elements in Relocation Cancel Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
IMSI	M	None	1	IMSI	0
Private Extension	O	None	1	Private Extension	VS

7.3.17 Relocation Cancel Response

A Relocation Cancel Response message shall be sent as a response to a previous Relocation Cancel Request message during handover Cancel procedure.

Possible Cause values are:

- 'Request Accepted'.

- 'IMSI not known'.

- 'System failure'.

- 'Mandatory IE incorrect'.

- 'Mandatory IE missing'.

- 'Optional IE incorrect'.

- 'Invalid message format'.

Table 7.3.17-1 specifics the presence of the IEs in the message.

Table 7.3.17-1: Information Elements in Relocation Cancel Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
Private Extension	O	None	1	Private Extension	VS

7.4 CS Fallback related messages

7.4.1 Suspend Notification

The Suspend Notification message is sent on S11 by the MME to the SGW as part of the CS fallback from E-UTRAN access to UTRAN/GERAN CS domain access related procedures.

Table 7.4.1-1: Information Element in Suspend Notification

Information elements	P	Condition / Comment	CR	IE Type	Ins.
IMSI	M		1	IMSI	0
Private Extension	O	Vendor or operator specific information	0	Private Extension	VS

7.4.2 Suspend Acknowledge

The Suspend Acknowledge message is sent on S11 by the SGW to the MME as part of the CS fallback from E-UTRAN access to UTRAN/GERAN CS domain access related procedures.

Table 7.4.2-1: Information Element in Suspend Acknowledge

Information elements	P	Condition / Comment	CR	IE Type	Ins.
IMSI	M		1	IMSI	0
Private Extension	O	Vendor or operator specific information	0	Private Extension	VS

7.4.3 Resume Notification

The Resume Notification message is sent on S11 by the MME to the SGW as part of the resume procedure returning from CS fallback to E-UTRAN.

Table 7.4.3-1: Information Element in Resume Notification

Information elements	P	Condition / Comment	CR	IE Type	Ins.
IMSI	M		1	IMSI	0
Private Extension	O	Vendor or operator specific information	0	Private Extension	VS

7.4.4 Resume Acknowledge

The Resume Acknowledge message is sent on S11 by the SGW to the MME as part of the resume procedure returning from CS fallback to E-UTRAN.

Table 7.4.4-1: Information Element in Resume Acknowledge

Information elements	P	Condition / Comment	CR	IE Type	Ins.
IMSI	M		1	IMSI	0
Private Extension	O	Vendor or operator specific information	0	Private Extension	VS

7.4.5 CS Paging Indication

The CS Paging Indication shall be sent on the S3 interface by the MME to the associated SGSN when ISR is activated as part of mobile terminated CS services. The MME gets the related information from SGsAP-PAGING-REQUEST message as specified in 3GPP TS29.118 [21].Table 7.4.5-1 specifies the presence requirements and the conditions of the IEs in the message.

Table 7.4.5-1: Information Element in CS Paging Indication

Information elements	P	Condition / Comment	CR	IE Type	Ins.
IMSI	M	None	1	IMSI	0
VLR Number	M	None	1	FFS	0
TMSI	O		1	TMSI	0
Location area identifier	O		1	ULI	0
Global CN-Id	O		1	Global CN-Id	0

Editor's notes: the IEs in this table needs to be examined once the CSFB stage 2 will be stabilized.

7.5 Non-3GPP access related messages

7.5.1 Create Forwarding Tunnel Request

Editor's Note: It is FFS if this request message and corresponding response message will be sent per PDN connection basis.

 A Create Forwarding Tunnel Request message shall be sent by a MME to a Serving GW as a part of the MME configures resources for indirect data forwarding during active handover procedure from E-UTRAN to CDMA 2000 HRPD access.

Table 7.5.1-1 specifies the presence requirements and the conditions of the IEs in the message.

Table 7.5.1-1: Information Elements in a Create Forwarding Tunnel Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
S103 PDN Data Forwarding Info	M	The MME shall include the forwarding Infomation for all PDN connections of the UE requesting data forwarding towards the PDSN in the message as S103 PDN Data Forwarding Info information elements. The Serving GW shall forward downlink data to the PDSN via the GRE tunnel identified by the PDSN Address and PDSN GRE Key included in this information element when it receives downlink data forwarded from the eNodeB belonging to the corresponding EPS bearers of the PDN connection.	1	S103PDF	0

7.5.2 Create Forwarding Tunnel Response

A Create Forwarding Tunnel Response message shall be sent by a Serving GW to a MME as a response to a Create Forwarding Tunnel Request message.

Table 7.5.2-1 specifies the presence requirements and the conditions of the IEs in the message.

The Cause value indicates if Data Forwarding Resources has been created in the Serving GW or not. Data Forwarding Resources have not been created in the Serving GW if the Cause differs from 'Request accepted'. Possible Cause values are:

- "Request Accepted".

- "No resources available".

- "System failure".

- "Mandatory IE incorrect".

- "Mandatory IE missing".

- "Optional IE incorrect".

- "Invalid message format".

Only the Cause IE shall be included in the response if the Cause IE contains another value than 'Request accepted'.

Table 7.5.2-1: Information Elements in a Create Forwarding Tunnel Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	None	1	Cause	0
S1-U Data Forwarding Info	C	S1-U Data Forwarding Info shall be included in the message if the Cause contains the value 'Request accepted'. For each EPS bearer requesting data forwarding which is included in the S103 PDN Data Forwarding Info fields of corresponding Create Forwarding Tunnel Request message, the Serving GW shall assign a Serving GW S1-U Address and Serving GW S1-U TEID pair and included it in the response message as S1-U Data Forwarding Info information element. The eNodeB shall forward downlink data of the EPS bearer to the Serving GW via the GTP-U tunnel identified by the Serving GW S1-U Address and Serving GW S1-U TEID.	1	S1UDF	0

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. The same provision is applicable to notification messages with an associated acknowledge message. Each path has its own list. The Sequence Number shall be unique for each outstanding request message sourced from the same IP/UDP endpoint. A node running GTP may have several outstanding requests while waiting for responses. A single request shall be answered with a single response, regardless whether it is per UE, per APN, or per bearer. A request / response pair of messages shall have the same sequence number.

The Sequence Number shall be unique for each outstanding notification message sourced from the same IP/UDP endpoint. A node running GTP may have several outstanding notifications while waiting for acknowledge messages. A single notification shall be answered with a single acknowledge, regardless whether it is per UE, per APN, or per bearer. A notification / acknowledge pair of messages shall have the same sequence number.

In the specific case of GTP Command Messages which do not have an explicit response, but which trigger a Request Message, the sequence number used by Command Message shall be the same for all three messages: the Command, the triggered Request and the corresponding Response messages.

A sequence number used for a Command Message and its associated messages shall have the most significant bit set to 1. A sequence number used for a Request Message not triggered by a Command Message shall have the most significant bit set to 0.

This setting of the most significant bit of the sequence number is done to avoid potential clashes between the sequence number selected for a Command Message, and the sequence number selected by a GTP peer for a Request Message which was not triggered by a Command Message.

A 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 timer expires.

A timer shall be started when a notification message (for which an acknowledge messages has been defined) is sent. A notification or acknowledge message has probably been lost if a response has not been received before the timer expires.

A timer shall be started when a command message is sent. A command or request message has probably been lost if a request has not been received before the timer expires.

Editor's Note: it is FFS how many response timers are needed and how the timers shall be handled.

Once a 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 timers and the number of retries (N3-REQUESTS) shall be configurable per procedure.

Editor's Note: In case of a node shall send a response message based on the response of another GTP message, the total waiting time of the inner loop response should be smaller than the waiting time of the outer loop response.

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. A response message without a matching outstanding request should be considered as a duplicate.

If a GTPv2 node is not successful with the transfer of a signalling message, e.g. a Create Bearer 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 Error Handling

7.7.1 Protocol Errors

A protocol error is defined as a message or Information Element received from a peer entity with unknown, unforeseen or erroneous content. The term silently discarded is used in the following subclauses to mean that the receiving GTP entity's implementation shall discard the message without further processing, or if possible discard the optional IE and continue processing. The receiving entity should however log the event including the erroneous message and should include the error in a statistical counter. Silently Discarding a message or IE(s) within a message should only be used for messages or IE(s) that can be safely ignored. IE(s) that can safely be ignored by a receiver are ones with the CR bit set to 0.

Editor's Note: It is FFS how a conditional IE should be treated by a receiving entity. A receiving node may deviate from the required error handling requirements, in the case of sending back messages with cause values, in order to limit traffic load or mitigate against a denial-of-service attack.

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

An information element with 'Conditional' in the 'Presence requirement' column of a message definition shall be sent when the conditions detailed in the 'Presence requirement' are met.

The Version Not Supported Indication message shall be considered as Response for the purpose of this subclause. The subclauses 7.7.2 to 7.7.14 shall be applied in decreasing priority.

Generally, in subclauses 7.7.2 to 7.7.14 when an error in an incoming GTP message is detected the GTP entity should log the error even if the IE or message fault is ignored or discarded. If the received message is a GTP response for a pending GTP request the GTP transaction layer shall stop retransmission of the matching request and notify the GTP application layer of the error even if the response is itself discarded.

7.7.2 Different GTP Versions

If a receiving peer node receives a GTP message of an unsupported version, that node shall return a GTP Version Not Supported Indication 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.

7.7.3 GTP Message Too Short

When a GTP message is received, and it 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.

7.7.4 Unknown GTP Signalling Message

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

7.7.5 Unexpected GTP Signalling Message

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

7.7.6 Missing Mandatory or Conditional Information Elements

The receiver of a GTP signalling Request message with a missing mandatory information element shall discard the request and shall send a Response with Cause set to 'Mandatory IE missing' together with a value of the missing mandatory IE.

The receiver of a Response with a missing mandatory information element shall notify the upper layer.

Editor's note: A missing Conditional Information Element in a GTPv2 message (grouped IE) whose condition is true may or may not be treated the same way as an Invalid Mandatory IE. If it is treated as mandatory IE however, the Cause 'Mandatory IE missing' is replaced with 'Conditional IE missing'.

7.7.7 Invalid Length

TLIV format information element shall have a variable length. In a received GTP signalling message Request, a mandatory TLIV 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' together with a copy of the offending mandatory IE.

In a received GTP signalling Response message, if a mandatory TLIV 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 signalling procedure as having failed. A message shall be sent with Cause set to 'Mandatory IE incorrect' together with a copy of the offending mandatory IE.

7.7.8 Invalid Mandatory or Conditional Information Element

The receiver of a GTP 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' together with a copy of the offending mandatory IE.

The receiver of a GTP 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. It shall send a response with Cause set to 'Mandatory IE incorrect' together with a copy of the offending mandatory IE.

If a GSN receives an information element with a value which is shown as reserved, it shall treat that information element as invalid and should log the error. It shall send a response with Cause set to 'Reserved Message Value Received' together with a copy of the offending message.

The principle is: the use of reserved values invokes error handling; the use of spare values can be silently discarded and so in the case of IEs with spare values used, processing shall be continued ignoring the spare values.

Editor's note: A missing Conditional Information Element in a GTPv2 message (grouped IE) whose condition is true may or may not be treated the same way as an Invalid Mandatory IE. If it is treated as mandatory IE however, the Cause 'Mandatory IE missing' is replaced with 'Conditional IE missing'.

7.7.9 Invalid Optional Information Element

The receiver of a GTP 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, but shall treat the rest of the message as if this IE was absent and continue processing.

If a GTP entity 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.

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

7.7.10 Unknown Information Element

An information element with an unknown Type value and CR=0 shall be ignored by the receiver of the message. This information element shall be skipped using its Length value.

The receiver of a GTP signalling message Request including an information element with an unknown Type value and CR=1 shall discard the request, and shall send a response with Cause set to 'Unknown CR IE' together with a copy of the offending unknown IE.

Editor's note: if is FFS if the receiver of a GTP signalling message Response including an information element with an unknown Type value and CR=1 shall discard the Response.

7.7.11 Out of Sequence Information Elements

Editor's Note: Since all IE are TLIV encoded the IE order is not needed to parse a GTPv2-C encoded message so no error occurs in this version of GTP. It is FFS however if a ordering on sending side may still be required by GTPv2 to allow GTPv2 parsers to be more efficient but it should not invoke a functional fault on reception.

7.7.12 Unexpected Information Element

An information element with a Type value which is defined in section 8.1 of the present specification but whose Instance Value is not expected in the received GTP signalling message according to the grammar defined in section 7.1 to 7.5 of the present specification shall be ignored (skipped) and the rest of the message processed as if this information element was not present.

NOTE: An Information Element in an encoded GTPv2 message or grouped IE is identified by the pair of IE Type and Instance value.

Editor's note: It is FFS how type value, instance value and CR field relate to each other

7.7.13 Repeated Information Elements

An Information Element is repeated if there is more than one IE with the same IE Type and Instance in the scope of the GTP message (scope of the grouped IE). Such an IE is a member in a list.

If an information element is repeated in a GTP 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 and all subsequent repetitions of the information element shall be ignored.

7.7.14 Incorrect Optional Information Elements

All optional information elements that are incorrect in a GTP signalling message shall be treated as not present in the message. However, if the receiving node cannot handle the message correctly because of the incorrect information element, the receiving node should log the error and shall return a response with Cause set to 'Optional IE incorrect' together with the offending IE.

7.8 Path Failure

Restoration and Recovery procedures, including path failure, are specified in 3GPP TS 23.007 [17].

7.9 Restoration and Recovery

Restoration and Recovery procedures are specified in 3GPP TS 23.007 [17].

7.9.X Delete PDN Connection Set Request

This message is sent on S5, S8, or S11 interfaces. The message sent by MME shall be forwarded by the SGW to PGW. The message sent by the PGW shall be forwarded by SGW to MME.

A node sends this message when a partial failure affects a set of its PDN connections for which CSID has been previously assigned. The receiving node identifies the set of PDN connections associated with the CSID from its PDN connection table, and marks them for deletion.

Table 7.9.X: Information Elements in a Delete PDN Connection Set Request

Information elements	P	Condition / Comment	CR	IE Type	Ins.
CSID	M	More than one CSID may appear	1	CSID	0
Cause	O		1	Cause	0
Private Extension	O	None	1	Private Extension	VS

7.9.Y Delete PDN Connection Set Response

This message is sent as a response to the Delete PDN Connection Set Request.

Table 7.9.Y: Information Elements in a Delete PDN Connection Set Response

Information elements	P	Condition / Comment	CR	IE Type	Ins.
Cause	M	"Success" indicates that the peer node successfully deleted the PDN connection set	1	Cause	0
Private Extension	O	None	1	Private Extension	VS

7.10 Fallback to GTPv1 mechanism

An EPC entity shall assume that each GTP processing node that it is about to communicate with is GTPv2 capable, i.e. before the first GTP tunnel is setup for a given UE/node, the EPC node shall always send a version 2 (GTPv2) message to a peer node.

A GTPv2 entity shall fallback to GTPv1 only if:

- a "Version Not Supported" message in GTPv1 format as specified in 3GPP TS 29.060 [4] is received from the peer node;

- Fallback to GTPv1 shall not occur on already established GTP tunnels without change of the peer nodes of the communication bearer.

7.11 Fallback to GTPv0

Fallback from GTPv2 to GTPv0 shall not be supported. Therefore, GTPv2 entity should not listen to the well-known GTPv0 port 3386. If GTPv2 entity listens to the GTPv0 port, the entity shall silently discard any received GTPv0 message.

8 GTP-C Information Elements

8.1 Information Element Types

A GTP control plane (signalling) message may contain several information elements. In order to have forward compatible type definitions for the GTPv2 information elements, all of them shall be TLV coded. GTPv2 information element type values are specified in the Table 8.1-1. In order to improve the efficiency of troubleshooting, it is recommended that the information elements should be arranged in the signalling messages as well as in the grouped IEs, according to the order the information elements are listed in the message definition table or grouped IE definition table in section 7. However the receiving entity shall be prepared to handle the messages with information elements in any order.

Within information elements, certain fields may be described as spare. These bits shall be transmitted with the value set to 0. To allow for future features, the receiver shall not evaluate these bits.

Table 8.1-1: Information Element types for GTPv2

IE Type value (Decimal)	Information elements	Comment / Reference
0	Reserved	
1	International Mobile Subscriber Identity (IMSI)	Extendable / 8.3
2	Cause (without embedded offending IE)	Extendable / 8.4
3	Recovery (Restart Counter)	Extendable / 8.5
4-50	Reserved for S101 interface	Extendable / See 3GPP TS 29.276 [14]
51-70	Reserved for Sv interface	Extendable / See 3GPP TS 29.280 [15]
71	Access Point Name (APN)	Extendable / 8.6
72	Aggregate Maximum Bit Rate (AMBR)	Extendable / 8.7
73	EPS Bearer ID (EBI)	Extendable / 8.8
74	IP Address	Extendable / 8.9
75	Mobile Equipment Identity (MEI)	Extendable / 8.10
76	MSISDN	Extendable / 8.11
77	Indication	Extendable / 8.12
78	Protocol Configuration Options (PCO)	Extendable / 8.13
79	PDN Address Allocation (PAA)	Extendable / 8.14
80	Bearer Level Quality of Service (Bearer QoS)	Extendable / 8.15
81	Flow Quality of Service (Flow QoS)	Extendable / 8.16
82	RAT Type	Extendable / 8.17
83	Serving Network	Extendable / 8.18
84	TEID-C	Extendable / 8.19
	TEID-U	Extendable / 8.19a
	TEID-U with EPS Bearer ID	Extendable / 8.19b
85	EPS Bearer Level Traffic Flow Template (Bearer TFT)	Extendable / 8.20
86	Traffic Aggregation Description (TAD)	Extendable / 8.21
87	User Location Info (ULI)	Extendable / 8.22
88	Fully Qualified Tunnel Endpoint Identifier (F-TEID)	Extendable / 8.23
89	TMSI	Extendable / 8.24
90	Global CN-Id	Extendable / 8.25
91	Legacy Quality of Service (Legacy QoS)	Extendable / 8.26
92	S103 PDN Data Forwarding Info (S103PDF)	Extendable / 8.27
93	S1-U Data Forwarding Info (S1UDF)	Extendable / 8.28
94	Delay Value	Extendable / 8.29
95	Bearer ID List	Extendable / 8.30
96	Bearer Context	Extendable / 8.31
97	S101-IP-Address	Extendable / 8.32
98	S102-IP-Address	Extendable / 8.33
99	Charging ID	Extendable / 8.34
100	Charging Characteristics	Extendable / 8.35
101	Trace Information	Extendable / 8.36
102	Bearer Flags	Extendable / 8.37
103	Paging Cause	Extendable / 8.38
104	PDN Type	Extendable / 8.39
105	Procedure Transaction ID	Extendable / 8.40
106	DRX Parameter	Extendable / 8.41
107	UE Network Capability	Extendable / 8.42
108	PDU Numbers	Extendable / 8.46
109	MM Context (GSM Key and Triplets)	Extendable / 8.43
110	MM Context (UMTS Key, Used Cipher and Quintuplets)	Extendable / 8.43
111	MM Context (GSM Key, Used Cipher and Quintuplets)	Extendable / 8.43
112	MM Context (UMTS Key and Quintuplets)	Extendable / 8.43
113	MM Context (EPS Security Context, Quadruplets and Quintuplets)	Extendable / 8.43
114	MM Context (UMTS Key, Quadruplets and Quintuplets)	Extendable / 8.43
115	PDN Connection	Extendable / 8.44
116	GRE Key	Extendable / 8.45
117	Bearer Control Mode	Extendable / 8.68
118	EPS Bearer Contexts Prioritization (Contexts Prioritization)	Extendable / 8.47
119	LMA IP Address	Extendable / 8.48
120	P-TMSI	Extendable / 8.49
121	P-TMSI Signature	Extendable / 8.50
122	Hop Counter	Extendable / 8.51
123	Authentication Quintuplet	Extendable / 8.52
124	Authentication Quadruplet	Extendable / 8.53
125	Complete Request Message	Extendable / 8.54
126	GUTI	Extendable / 8.55
127	F-Container	Extendable / 8.56
128	F-Cause	Extendable / 8.57
129	Selected PLMN ID	Extendable / 8.58
130	Target Identification	Extendable / 8.59
131	Cell Identification	Extendable / 8.67

IE Type value (Decimal)	Information elements	Comment / Reference
132	NSAPI	Extendable / 8.60
133	Packet Flow ID	Extendable / 8.61
134	RAB Context	Extendable / 8.62
135	Source RNC PDCP Context Info	Extendable / 8.63
136	UDP Source Port Number	Extendable / 8.64
137	APN Restriction	Extendable / 8.65
138	Selection Mode	Extendable / 8.66
139	Change Reporting Action	Extendable / 8.69
140	Cause including an embedded offending IE	Extendable / 8.4
141	PDN Connection Set Identifier (CSID)	Extendable / 8.70
142-254	Spare. For future use.	FFS
255	Private Extension	Extendable / 8.71

8.2 Information Element Format

Figure 8.2-1 depicts the format of an information element, which has the following mandatory fields:

- Type field: This field indicates the type of Information Element. The valid values of the IE type are defined in clause 8.1.

- Comprehension Required (CR) flag: If CR flag is set to 1, the comprehension of the IE is required. This flag may have variable values (0 or 1) only within optional IEs, and shall be set to 1 for all mandatory or conditional IEs.

Editor's note: Currently it is assumed that CR = 0 for GTP-U.

- Length: This field contains the length of the information element excluding the first four octets, which are common for all information elements (Type, Length and the octet 4) and is denoted "n" in Figure 8.2-1. 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.

					Bits				
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
1	Type								
2-3	Length = n								
4	CR		Spare		Instance				
5-(n+4)	IE specific data								
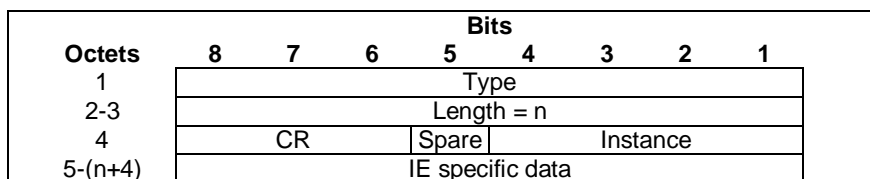
Figure 8.2-1: Information Element Format The Comprehension Required (CR) flag shall be used in the following way:

- CR flag is set to 1 in a Request message: if the receiving GTP entity cannot comprehend the IE, then the receiver shall discard the request, should log the error, and shall send a response with an appropriate Cause value.

Editor's note: it is FFS if Cause should be amended by complete IE or only its Type.

- CR flag is set to 1 in a Response message: if the receiving GTP entity cannot comprehend the IE, then the receiver shall notify the upper layer that a message with this unknown IE has been received and should log the error.

Editor's note: it is FFS if an error notification should be sent.

- Instance is documented in section 6.1.

An IE is said to be TLIV (Type, Length, Instance, Value) encoded.

8.3 International Mobile Subscriber Identity (IMSI)

International Mobile Subscriber Identity (IMSI) is transferred via GTP tunnels. The sending entity copies the value part of the IMSI into the Value field of the IMSI IE. IMSI is defined in 3GPP TS 23.003 [2].

Editor's note: IMSI coding will be defined in 3GPP TS 24.301 [3].

Editor's note: In the first release of GTPv2 spec (TS 29.274v8.0.0) n = 8. That is, the overall length of the IE is 11 octets. In future releases of the spec additional octets may be specified. The legacy receiving entity simply ignores the unknown octets.

	Bits							
Octets	8	7	6	5	4	3	2	1
1	Type = 1 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5-(n+4)	International Mobile Subscriber Identity (IMSI)							

Figure 8.3-1: IMSI

8.4 Cause

Cause IE is coded as this is depicted in Figure 8.4-1.

.	Bits							
Octets	8	7	6	5	4	3	2	1
1	Type = 2 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5	Cause value							
6-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.4-1: Cause

The Cause value shall be included in the response message. In a response message, the Cause value indicates the acceptance or the rejection of the corresponding request message. The Cause value shall indicate the explicit reason for the rejection.

If the rejection is due to a faulty IE, the offending IE shall be included as embedded IE within the cause "IE". In this case, the Cause IE becomes a grouped IE. The IE would be coded as depicted if Figure 8.4-2.

.	Bits							
Octets	8	7	6	5	4	3	2	1
1	Type = 140 (decimal)							
2-3	Length = n + 5							
4	CR		Spare		Instance			
5	Cause value							
6	Type = <type of the offending IE>							
7-8	Length = n (decimal)							
9	CR		Spare		Instance			
9-(n+9)	Value of the offending IE							

Figure 8.4-2: Cause including an embedded "offending IE"

The Cause may also be included in the request message. In a request message, the Cause value indicates the reason for the request.

"Request accepted" is returned when the GTPv2 entity has accepted a control plane request.

Table 8.4-1: Cause values

Message Type	Cause value (decimal)	Meaning
	0	Reserved. Shall not be sent and if received the Cause shall be treated as an invalid IE
Request	1	Paging Cause
	2	Local Detach
	3	Complete Detach
	4-15	Spare. This value range is reserved for Cause values in a request message
Acceptance Response	16	Request accepted
	17	Request accepted partially
	18	New PDN type due to subscription limitation
	19	New PDN type due to network preference
	20	New PDN type due to single address bearer only
	21-63	Spare. This value range is reserved for Cause values in acceptance response message
Rejection Response	64	Context Non Existent/Found
	65	Invalid Message Format
	66	Version not supported by next peer
	67	Invalid length
	68	Service not supported
	69	Mandatory IE incorrect
	70	Mandatory IE missing
	71	Optional IE incorrect
	72	System failure
	73	No resources available
	74	Semantic error in the TFT operation
	75	Syntactic error in the TFT operation
	76	Semantic errors in packet filter(s)
	77	Syntactic errors in packet filter(s)
	78	Missing or unknown APN
	79	Unexpected repeated IE
	80	GRE key not found
	81	Reallocation failure
	82	Denied in RAT
	83	Preferred PDN type not supported
	84	All dynamic addresses are occupied
	85	UE context without TFT already activated
	86	Protocol type not supported
	87	UE not responding
	88	UE refuses
	89	Service denied
	90	Unable to page UE
	91	No memory available
	92	User authentication failed
	93	APN access denied – no subscription
	94-255	Spare. This value range is reserved for Cause values in rejection response message

8.5 Recovery (Restart Counter)

Recovery IE is coded as this is depicted in Figure 8.5-1.

Editor's note: In the first release of GTPv2 spec (TS 29.274v8.0.0) n = 1. That is, the overall length of the IE is 4 octets. In future releases of the spec additional octets may be specified. The legacy receiving entity simply ignores the unknown octets.

.	**Bits**							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 3 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5-(n+4)	Recovery (Restart Counter)							

Figure 8.5-1: Recovery (Restart Counter)

8.6 Access Point Name (APN)

Access Point Name (APN) is transferred via GTP tunnels. The sending entity copies the value part of the APN into the Value field of the APN IE.

Editor's note: APN will be defined in 3GPP TS 23.003 [2].

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 71 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5-(n+4)	Access Point Name (APN)							

Figure 8.6-1: Access Point Name (APN)

8.7 Aggregate Maximum Bit Rate (AMBR)

Aggregate Maximum Bit Rate (AMBR) is transferred via GTP tunnels. The sending entity copies the value part of the AMBR into the Value field of the AMBR (APN-AMBR) IE.

Editor's note: AMBR will be defined in 3GPP TS 23.003 and its coding in TS 24.301.

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 72 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5-(n+4)	Aggregate Maximum Bit Rate (AMBR)							

Figure 8.7-1: Aggregate Maximum Bit Rate (AMBR)

8.8 EPS Bearer ID (EBI)

EPS Bearer ID (EBI) is coded as this is depicted in Figure 8.8-1.

Editor's note: In the first release of GTPv2 spec (TS 29.274v8.0.0) n = 1 and all spare bits in Octet 4 are set to 0. That is, the overall length of the IE is 4 octets. In future releases of the spec additional octets may be specified and new semantic for the spare bits may be defined. The legacy receiving entity simply ignores the unknown octets and values in the spare bits.

				Bits				
Octets	8	7	6	5	4	3	2	1
1	Type = 73 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5	Spare (all bits set to 0)				EPS Bearer ID (EBI)			
6-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.8-1: EPS Bearer ID (EBI)

8.9 IP Address

IP Address is coded as this is depicted in Figure 8.9-1. The Length field may have only two values (4 or 16) that determine if the Value field contains IPv4 or IPv6 address.

				Bits				
Octets	8	7	6	5	4	3	2	1
1	Type = 74 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5-(n+4)	IPv4 or IPv6 Address							

Figure 8.9-1: IP address

8.10 Mobile Equipment Identity (MEI)

Mobile Equipment Identity (MEI) is transferred via GTP tunnels. The sending entity copies the value part of the MEI into the Value field of the MEI IE. MEI is defined in 3GPP TS 23.003 [2].

Editor's note: MEI coding will be defined in TS 24.301.

				Bits				
Octets	8	7	6	5	4	3	2	1
1	Type = 75 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5-(n+4)	Mobile Equipment (ME) Identity							

Figure 8.10-1: Mobile Equipment (ME) Identity (MEI)

8.11   MSISDN

MSISDN is transferred via GTP tunnels. The sending entity copies the value part of the MSISDN into the Value field of the MSISDN IE. MSISDN is defined in 3GPP TS 23.003 [2].

Editor's note: MSISDN coding will be defined in TS 24.301.

	Bits							
Octets	8	7	6	5	4	3	2	1
1	Type = 76 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5-(n+4)	MSISDN							

Figure 8.11-1: MSISDN

8.12   Indication

Indication is coded as this is depicted in Figure 8.12-1.

	Bits							
Octets	8	7	6	5	4	3	2	1
1	Type = 77 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5	DAF	DTF	HI	DFI	OI	ISRSI	ISRAI	SGW CI
6	Reserved				PT	TDI	SI	MSV
7-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.12-1: Indication

The following bits within Octet 5 indicate:

- Bit 8 – DAF (Dual Address Bearer Flag): This bit shall be set when the UE requests PDN type IPv4/v6 and all SGSNs which the UE may be handed over to are Release 8 or above supporting dual addressing, which is determined based on node pre-configuration by the operator..

- Bit 7 – DTF (Direct Tunnel Flag): This bit shall be set when the UE is in UTRAN/GERAN network and Direct Tunnel is selected - Bit 6 – HI (Handover Indication): If this bit is set to 1, it indicates that UE handover from non-3GPP access to 3GPP access system during attach procedure or UE requested PDN connectivity procedure.

- Bit 5 – DFI (Direct Forwarding Indication): If this bit is set to 1, it indicates that the direct forwarding between source eNodeB/RNC and target eNodeB/RNC during the handover procedure is applied.

- Bit 4 – OI (Operation Indication): If this bit is set to 1, it denotes that the receiving entity shall continue forwarding this message to the next GTP node or the SGW shall send the Modify Bearer Request to the PGW during TAU/RAU with a SGW Change procedure.

- Bit 3 – ISRSI (Idle mode Signalling Reduction Supported Indication): If this is set to 1, it indicates that the old/source SGSN/MME is capable to activate ISR.

- Bit 2 – ISRAI (Idle mode Signalling Reduction Activation Indication): If this bit is set to 1, it indicates that the ISR is established between MME and S4 SGSN during TAU/RAU without a SGW change procedure or during Inter RAT handover without SGW change procedure. The SGW shall retain the resources for other CN node that has bearer resources on the SGW reserved and the old/source SGSN/MME shall maintain the UE's contexts and activate ISR.

- Bit 1 – SGWCI (SGW Change Indication): If this bit is set to 1, it indicates that the target MME/SGSN has selected a new SGW during TAU/RAU or handover with a SGW change procedure.

The following bits within Octet 6 indicate:

- Bit 8 to 5 – Reserved for future use and set to zero.

- Bit 4 - PT (Protocol Type) If this bit set to 1, it indicates that the protocol type for S5/S8 interface is PMIP; this bit is set to 0 to indicate the protocol type for S5/S8 interface is GTP.

- Bit 3 – TDI (Teardown Indication): If this bit is set to 1, it indicates that all bearers of the PDN connection shall be torn down.

- Bit 2 – SI (Scope Indication): If this bit is set to 1, it indicates that all GTP-U tunnels of the PDN connection over S1 interface should be released. This flag is set for messages during S1 release procedure.

- Bit 1 – MSV (MS Validated): If this bit is set to 1, it indicates that the new MME/SGSN has successfully authenticated the UE.

8.13 Protocol Configuration Options (PCO)

Protocol Configuration Options (PCO) is transferred via GTP tunnels. The sending entity copies the value part of the PCO into the Value field of the PCO IE.

Editor's note: PCO will be defined in 3GPP TS 23.003 and its coding in TS 24.301.

Octets	**Bits**							
	8	7	6	5	4	3	2	1
1	Type = 78 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare	Instance				
5-(n+4)	Protocol Configuration Options (PCO)							

Figure 8.13-1: Protocol Configuration Options (PCO)

8.14 PDN Address Allocation (PAA)

The PDN Address Allocation is coded as depicted in Figure 8.14-1.

NOTE: In Rel 8, Prefix length has a fixed value of /64.

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 79 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5	Spare				PDN Type			
6-(n+4)	PDN Address and Prefix							

Figure 8.14-1: PDN Address Allocation (PAA)

Table 8.14-1: PDN Address Allocation

PDN type value (octet 4)
Bits
3 2 1
0 0 1   IPv4
0 1 0   IPv6
0 1 1   IPv4/IPv6

Bits 8-4 of octet 5 are spare and shall be coded as zero.

PDN Address and Prefix (octet 6 to n+4)

If PDN type value indicates IPv4, an IPv4 address is present in the PDN Address and Prefix from octet 6 to octet 9. Bit 8 of octet 6 represents the most significant bit of the IPv4 address and bit 1 of octet 9 the least significant bit.

If PDN type value indicates IPv6, octet 6 contains the IPv6 Prefix Length. Octets 7 through 22 contain an IPv6 address. Bit 8 of octet 7 represents the most significant bit of the IPv6 address and bit 1 of octet 22 the least significant bit.

If PDN type value indicates IPv4/IPv6, octet 6 contains the IPv6 Prefix Length. Octets 7 through 22 contain an IPv6 address. Bit 8 of octet 7 represents the most significant bit of the IPv6 address and bit 1 of octet 22 the least significant bit. Octets 23 through 26 contain an IPv4 address. Bit 8 of octet 23 represents the most significant bit of the IPv4 address and bit 1 of octet 26 the least significant bit.

8.15 Bearer Quality of Service (Bearer QoS)

Editor's not: Bearer Quality of Service (Bearer QoS) is transferred via GTP tunnels. The sending entity copies the value part of the Bearer l QoS into the Value field of the Bearer QoS IE.

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 80 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5	ARP							
6-(n+4)	Flow Quality of Service Flow (Flow QoS)							

Figure 8.15-1: Bearer Level Quality of Service (Bearer QoS)

ARP shall be specified in 3GPP TS 36.413 [10]

8.16 Flow Quality of Service (Flow QoS)

Flow Quality of Service (Flow QoS) is transferred via GTP tunnels. The sending entity copies the value part of the Flow QoS into the Value field of the Flow QoS IE.

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 81 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5	Label (QCI)							
6-10	Maximum bit rate for uplink							
11-15	Maximum bit rate for downlink							
16-20	Guaranteed bit rate for uplink							
21-25	Guaranteed bit rate for downlink							
26-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.16-1: Flow Quality of Service (Flow QoS)

QCI, Maximum bit rate for uplink, Maximum bit rate for downlink, Guaranteed bit rate for uplink and Guaranteed bit rate for downlink shall be specified in 3GPP TS 36.413 [10].

Note: The encoding in 3GPP TS 24.301 is different from the encoding here.

8.17 RAT Type

RAT Type is coded as this is depicted in Figure 8.17-1.

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 82 (decimal)							
2-3	Length = 1 (decimal)							
4	CR		Spare		Instance			
5	RAT Type							
6-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.17-1: RAT Type

Editor's note: RAT Type value range 1-255 is sufficient and extensions are not necessary.

Table 8.17-1: RAT Type values

RAT Types	Values (Decimal)
<reserved>	0
UTRAN	1
GERAN	2
WLAN	3
GAN	4
HSPA Evolution	5
EUTRAN	6
<spare>	7-255

Editor's note: Spare values 7-255 will be used for other RAT Type definitions (e.g. other non-3GPP accesses).

8.18 Serving Network

Serving Network is coded as this is depicted in Figure 8.18-1. If MNC is 2 digits long, MNC digit 1 shall be set to 0.

Editor's note: In the first release of GTPv2 spec (TS 29.274v8.0.0) n = 3. That is, the overall length of the IE is 6 octets. In future releases of the spec additional octets may be specified. The legacy receiving entity simply ignores the unknown octets.

					Bits				
Octets	8	7	6	5	4	3	2	1	
1	Type = 83 (decimal)								
2-3	Length = n (decimal)								
4	CR			Spare	Instance				
5	MCC digit 1				MCC digit 2				
6	MCC digit 3				MNC digit 1				
7	MNC digit 2				MNC digit 3				
8-(n+4)	These octet(s) is/are present only if explicitly specified								

Figure 8.18-1: Serving Network

8.19 Tunnel Endpoint Identifier for Control Plane (TEID-C)

Tunnel Endpoint Identifier for Control Plane (TEID-C) is coded as this is depicted in Figure 8.19-1.

					Bits				
Octets	8	7	6	5	4	3	2	1	
1	Type = 84 (decimal)								
2-3	Length = 4 (decimal)								
4	CR			Spare	Instance				
5-8	Tunnel Endpoint Identifier for Control Plane (TEID-C)								
9-(n+4)	These octet(s) is/are present only if explicitly specified								

Figure 8.19-1: Tunnel Endpoint Identifier for Control Plane (TEID-C)

8.19a Tunnel Endpoint Identifier for User Plane (TEID-U)

Tunnel Endpoint Identifier for User Plane (TEID-U) is coded as this is depicted in Figure 8.19a.

					Bits				
Octets	8	7	6	5	4	3	2	1	
1	Type = (decimal)								
2-3	Length = 4 (decimal)								
4	CR			Spare	Instance				
5-8	Tunnel Endpoint Identifier for User Plane (TEID-U)								

Figure 8.19a: Tunnel Endpoint Identifier for User Plane (TEID-U)

8.19b Tunnel Endpoint Identifier for User Plane with EBI (TEID-U EBI)

Tunnel Endpoint Identifier for User Plane with EBI (TEID-U EBI) is coded as this is depicted in Figure 8.19b.

					Bits				
Octets	8	7	6	5	4	3	2	1	
1	Type = (decimal)								
2-3	Length = n (decimal)								
4	CR			Spare	Instance				
5-(n+4)	Tunnel Endpoint Identifier for User Plane with EBI								

Figure 8.19b: Tunnel Endpoint Identifier for User Plane with EBI (TEID-U EBI)

8.20   EPS Bearer Level Traffic Flow Template (Bearer TFT)

EPS Bearer Level Traffic Flow Template (Bearer TFT) is transferred via GTP tunnels. The sending entity copies the value part of the EPS Bearer Level TFT into the Value field of the EPS Bearer Level TFT IE.

Editor's note: EPS Bearer Level TFT will be defined in 3GPP TS 23.003 and its coding in TS 24.301.

Editor's note: It is FFS whether it needs two separate IE types for EPS Bearer Level TFT and SDF Level TFT.

| Octets | Bits |
	8	7	6	5	4	3	2	1
1	Type = 85 (decimal)
2-3	Length = n (decimal)
4	\multicolumn{3}{c}{CR}	Spare	\multicolumn{4}{c}{Instance}
5-(n+4)	EPS Bearer Level Traffic Flow Template (TFT)

Figure 8.20-1: EPS Bearer Level Traffic Flow Template (Bearer TFT)

8.21   Traffic Aggregate Description (TAD)

The Traffic Aggregate Description IE is coded as depicted in figure 8.21-1. The Traffic Aggregate Description is defined in 3GPP TS 24.008 [5].

| Octets | Bits |
	8	7	6	5	4	3	2	1
1	Type = 86 (Decimal)
2-3	Length = n (decimal)
4	\multicolumn{3}{c}{CR}	Spare	\multicolumn{4}{c}{Instance}
5-(n+4)	Traffic Aggregate Description

Figure 8.21-1 Traffic Aggregate Description

8.22   User Location Info (ULI)

User Location Info (ULI) is coded as this is depicted in Figure 8.22-1.

| Octets | Bits |
	8	7	6	5	4	3	2	1
1	Type = 87 (decimal)
2-3	Length = n (decimal)
4	\multicolumn{3}{c}{CR}	Spare	\multicolumn{4}{c}{Instance}
5	Spare	Spare	Spare	ECGI	TAI	RAI	SAI	CGI
	CGI
	SAI
	RAI
	TAI
x-(n+4)	ECGI

Figure 8.22-1: User Location Info

The flags ECGI, TAI, RAI, SAI and CGI in octed 5 indicate if the corresponding fields are present in the IE or not. If one of these flags is set to "0", the corresponding field is not present at all. The respective identities are defined in 3GPP TS 23.003 [2].

Editor's Note: The definition of ECGI is missing in 3GPP TS 23.003 v8.1.0. It can be found in 3GPP TS 36.413 v8.3.0, but it is expected that it will be moved to 23.003 in a future version.

The following subclauses specify the coding of the different identities.

8.22.1   CGI field

The coding of CGI (Cell Global Identifier) is depicted in Figure 8.22.1-1. If MNC is 2 digits long, MNC digit 1 shall be set to 0.

Octets	**Bits**							
	8	7	6	5	4	3	2	1
6	MCC digit 1				MCC digit 2			
7	MCC digit 3				MNC digit 1			
8	MNC digit 2				MNC digit 3			
9-10	Location Area Code (LAC)							
11-12	Cell Identity (CI)							

Figure 8.22.1-1: CGI

The Location Area Code (LAC) consists of 2 octets. Bit 8 of Octet 4 is the most significant bit and bit 1 of Octet 5 the least significant bit. The coding of the location area code is the responsibility of each administration. Coding using full hexadecimal representation shall be used.

The Cell Identity (CI) consists of 2 octets. Bit 8 of Octet 6 is the most significant bit and bit 1 of Octet 7 the least significant bit. The coding of the cell identity is the responsibility of each administration. Coding using full hexadecimal representation shall be used.

8.22.2   SAI field

The coding of SAI (Service Area Identifier) is depicted in Figure 8.22.2-1. If MNC is 2 digits long, MNC digit 1 shall be set to 0.

Octets	**Bits**							
	8	7	6	5	4	3	2	1
6	MCC digit 1				MCC digit 2			
7	MCC digit 3				MNC digit 1			
8	MNC digit 2				MNC digit 3			
9-10	Location Area Code (LAC)							
11-12	Service Area Code (SAC)							

Figure 8.22.2-1: SAI

The Location Area Code (LAC) consists of 2 octets. Bit 8 of Octet 4 is the most significant bit and bit 1 of Octet 5 the least significant bit. The coding of the location area code is the responsibility of each administration. Coding using full hexadecimal representation shall be used.

The Service Area Code (SAC) consists of 2 octets. Bit 8 of Octet 6 is the most significant bit and bit 1 of Octet 7 the least significant bit. The SAC is defined by the operator. See 3GPP TS 23.003 [2] section 12.5 for more information.

8.22.3   RAI field

The coding of RAI (Routing Area Identity) is depicted in Figure 8.22.3-1. If MNC is 2 digits long, MNC digit 1 shall be set to 0.

Octets	**Bits**							
	8	7	6	5	4	3	2	1
6	MCC digit 1				MCC digit 2			
7	MCC digit 3				MNC digit 1			
8	MNC digit 2				MNC digit 3			
9-10	Location Area Code (LAC)							
11-12	Routing Area Code (RAC)							

Figure 8.22.3-1: RAI

The Location Area Code (LAC) consists of 2 octets. Bit 8 of Octet 4 is the most significant bit and bit 1 of Octet 5 the least significant bit. The coding of the location area code is the responsibility of each administration. Coding using full hexadecimal representation shall be used.

The Routing Area Code (RAC) consists of 2 octets. Only Octet 6 contains the RAC. Octet 7 is coded as all 1's (11111111). The RAC is defined by the operator.

8.22.4 TAI field

The coding of TAI (Tracking Area Identity) is depicted in Figure 8.22.4-1. If MNC is 2 digits long, MNC digit 1 shall be set to 0.

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
6	MCC digit 1				MCC digit 2			
7	MCC digit 3				MNC digit 1			
8	MNC digit 2				MNC digit 3			
9-10	Tracking Area Code (TAC)							

Figure 8.22.4-1: TAI

The Tracking Area Code (TAC) consists of 2 octets. Bit 8 of Octet 4 is the most significant bit and bit 1 of Octet 5 the least significant bit. The coding of the tracking area code is the responsibility of each administration. Coding using full hexadecimal representation shall be used.

8.22.5 ECGI field

The coding of ECGI (E-UTRAN Cell Global Identifier) is depicted in Figure 8.22.5-1. If MNC is 2 digits long, MNC digit 1 shall be set to 0.

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
6	MCC digit 1				MCC digit 2			
7	MCC digit 3				MNC digit 1			
8	MNC digit 2				MNC digit 3			
9	Spare				ECI			
10-11	ECI (E-UTRAN Cell Identifier)							

Figure 8.22.5-1: ECGI

The E-UTRAN Cell Identifier (ECI) consists of 28 bits. Bit 4 of octet 4 is the most significant bit and bit 1 of Octet 7 the least significant bit. The coding of the E-UTRAN cell identifier is the responsibility of each administration. Coding using full hexadecimal representation shall be used.

8.23 Fully Qualified TEID (F-TEID)

Fully Qualified Tunnel Endpoint Identifier (F-TEID) is coded as this is depicted in Figure 8.23-1.

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 88 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
4	V4	V6	EBIF	Interface type				
5-8	TEID / GRE Key							
9 -(8+m)	IPv4 address							
(9+m) - (8+p)	IPv6 address							
(9+p)- (8+q)-	Spare				EPS Bearer ID (EBI)			
(9+q) - (n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.23-1: Fully Qualified Tunnel Endpoint Identifier (F-TEID)

where m=4*v4 , p=4*v4+16*v6 and q=4*v4+16*v6+EBIF.

The following flags are coded within Octet 4:

-   Bit 8 – V4: If this bit is set to 1, then IPv4 address field exists in the F-TEID otherwise the IPv4 address field is not present at all. .

-   Bit 7 – V6: If this bit is set to 1, then IPv6 address field exists in the F-TEID otherwise the IPv6 address field is not present at all.

-   Bit 6 – EBIF: If this bit is set to 1, then EPS Bearer ID field and Spare exist in the F-TEID otherwise Spare and EPS Bearer ID field are not present at all.

-   Bit 5 to Bit 1 – Interface Type: This 5 bit wide integer can take the following values representing interface type and endpoint:.

    0   S1-U eNB GTP-U interface

    1   S1-U SGW GTP-U interface

    2   S12 RNC GTP-U interface

    3   S12 SGW GTP-U interface

    4   S5/S8 SGW GTP-U interface

    5   S5/S8 PGW GTP-U interface

    6   S5/S8 SGW GTP-C interface

    7   S5/S8 PGW GTP-C interface

    8   S5/S8 SGW PMIPv6 interface (the 32 bit GRE key is encoded in 32 bit TEID field and since alternate CoA is not used the control plane and user plane addresses are the same for PMIPv6)

    9   S5/S8 PGW PMIPv6 interface (the 32 bit GRE key is encoded in 32 bit TEID field and the control plane and user plane addresses are the same for PMIPv6)

    10 S11 MME GTP-C interface

    11 S11/S4 SGW GTP-C interface

    12 S10 MME GTP-C interface

    13 S3 MME GTP-C interface

    14 S3 SGSN GTP-C interface

    15 S4 SGSN GTP-U interface

    16 S4 SGW GTP-U interface

    17 S4 SGSN GTP-C interface

    18 S16 SGSN GTP-C interface

Other values of "Interface Type" are reserved for future use

Editor's note: If S4 is decided to be GTPv2, then another bit is needed to indicate that the F-TEID belongs to Rel8 SGSN. In such case one more octet may be added to the IE.

8.24 TMSI

The TMSI, unambiguously associated with a given UE and Location area, is given by:

Octets	Bits 8	7	6	5	4	3	2	1
1	Type = 89 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5-(n+4)	TMSI							
	The TMSI is defined in 3GPP TS 23.003 [2].							

Figure 8.xx-1: TMSI

8.25 Global CN-Id

The Global CN-Id is coded as this is depicted in Figure 8.25-1.

Octets	Bits 8	7	6	5	4	3	2	1
1	Type = 90 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5	MCC digit 2				MCC digit 1			
6	MNC digit 3				MCC digit 3			
7	MNC digit 2				MNC digit 1			
8-(n+4)	CN-Id							
	The CN-Id is defined in 3GPP TS 23.003 [2].							

Figure 8.25-1: Global CN-Id

If an Administration decides to include only two digits in the MNC, then bits 5 to 8 of octet 6 are coded as "1111".

8.26 Legacy Quality of Service (QoS)

Legacy Quality of Service (QoS) is transferred via GTP tunnels. The sending entity copies the value part of the Legacy QoS into the Value field of the Legacy QoS IE.

Legacy Quality of Service (QoS) in the Figure 8.26-1 is coded according to 3GPP TS 24.008 [5].

Octets	Bits 8	7	6	5	4	3	2	1
1	Type = 91 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5-(n+4)	Legacy Quality of Service (QoS)							

Figure 8.26-1: Legacy Quality of Service (QoS)

8.27 S103 PDN Data Forwarding Info (S103PDF)

The PDSN Address and GRE Key identify a GRE Tunnel towards a PDSN over S103 interface for a specific PDN connection of the UE. The EPS Bearer IDs specify the EPS Bearers which require data forwarding that belonging to this PDN connection. The number of EPS bearer Ids included is specified by the value of EPS Bearer ID Number.

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

Octets	Bits

	**Bits**

Figure table:

Octets	8	7	6	5	4	3	2	1
1	Type = 92 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5	PDSN Address for forwarding Length							
6-(m+5)	PDSN Address for forwarding [4..16]							
(m+6)-(m+9)	GRE Key							
(m+10)	EPS Bearer ID Number = n							
(m+11)-(m+10+n)	Spare	Spare	Spare	Spare	EPS Bearer ID			

Figure 8.27-1: S103 PDN Data Forwarding Info

Editor's Notes: It is FFS whether it is needed to include PDN Identifer in this IE

8.28 S1-U Data Forwarding (S1UDF)

The Serving GW Address and Serving GW S1-U TEID consisit the S1-U Tunnel information allocated by the Serving GW for an EPS Bearer identified by the EPS Bearer ID which requires data forwarding during active handover from E-UTRAN Access to cdma2000 HRPD Access.

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

Octets	8	7	6	5	4	3	2	1
1	Type = 93 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5	Spare	Spare	Spare	Spare	EPS Bearer ID			
6	Serving GW Address Length							
7-(m+6)	Serving GW Address [4..16]							
(m+7)-(m+10)	Serving GW S1-U TEID							

Figure 8.28-1: S1-U Data Forwarding Info

8.29 Delay Value

Delay Value is coded as this is depicted in Figure 8.29-1.

					Bits				
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
1	Type = 94 (decimal)								
2-3	Length = n (decimal)								
4	CR			Spare	Instance				
5	Delay Value in integer multiples of 50 millisecs, or zero								
6-(n+4)	These octet(s) is/are present only if explicitly specified								

Figure 8.29-1: Delay Value

Delay Value is set to zero in order to clear a previously set delay condition.

8.30 Bearer ID List

Bearer ID List is coded as this is depicted in Figure 9.30-1.

					Bits				
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
1	Type = 95 (decimal)								
2-3	Length = n (decimal)								
4	CR			Spare	Instance				
5	m= number of bearer ID								
6	Spare				first Bearer ID				
7	Spare				second Bearer ID				
	...				...				
5+m	Spare				m'th Bearer ID				
6+m-(n+4)	These octet(s) is/are present only if explicitly specified								

Figure 8.30-1: Bearer ID List

8.31   Bearer Context

Bearer Context is a grouped IE containing a number of other IEs. Which of those IEs are mandatory, optional or conditional and the conditions that apply are GTP message specific, and described in the corresponding subclause under clause 7.

Bearer Context is normally repeated within a message with exactly the same Type and Instance values to represent a list of Bearer Contexts.

Bearer Context is coded as this is depicted in Table 8.31-1.

Table 8.31-1: Bearer Context

Bearer Context IE Type = 96 (decimal)					
Length = n (decimal)					
Information elements	**P**	**Condition / Comment**	**CR**	**IE Type**	**Instance**
EPS Bearer ID			1	EBI	
Cause		Used only in response messages Indicates if the bearer handling was successful, and if not, gives information on the reason.	1	Cause	
NSAPI		Sent in case of 3G SGSN to MME combined hard handover and SRNS relocation procedure	1	NSAPI	
UL TFT		Used only on request messages Used only for PMIP	1	Bearer TFT	
DL TFT		Used only on request messages	1	Bearer TFT	
S1 eNodeB F-TEID			1	F-TEID	
S1 SGW F-TEID			1	F-TEID	
S4-U SGSN F-TEID		Only applicable if S4 is used	1	F-TEID	
S4-U SGW F-TEID		Only applicable if S4 is used	1	F-TEID	
S5/8-U SGW F-TEID			1	F-TEID	
S5/8-U PGW F-TEID			1	F-TEID	
S12 RNC F-TEID		Only applicable if S12 is used	1	F-TEID	
S12 SGW F-TEID		Only applicable if S12 is used	1	F-TEID	
Bearer Level QoS			1	Bearer QoS	
Legacy QoS			1	Legacy QoS	
Charging Characteristics		Used only in direction MME -> SGW -> PGW	1	Charging Characteristics	
Charging Id		Used only in direction PGW -> SGW -> MME	1	Charging Id	
Prohibit Payload Compression		Used only in direction PGW -> SGW -> MME	1		

8.32   S101 IP Address

S101 IP address shall be coded as depicted in Figure 8.32-1. It contains the HRPD access node IP address. The Length field may have only two values (4 or 16) that determine if the Value field contains IPv4 or IPv6 address.

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 97 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5-(n+4)	IPv4 or IPv6 Address							
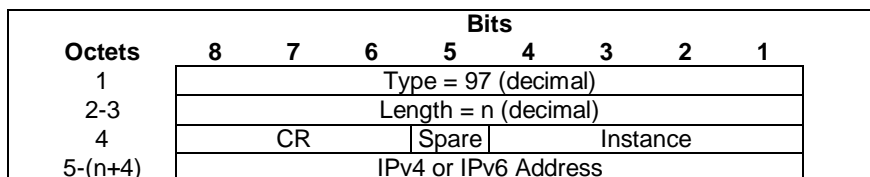
Figure 8.32-1: S101 IP address

8.33 S102 IP Address

S102 IP address shall be coded as depicted in Figure 8.33-1. It contains the 1xCS IWS IP address. The Length field may have only two values (4 or 16) that determine if the Value field contains IPv4 or IPv6 address.

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 98 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5-(n+4)	IPv4 or IPv6 Address							

Figure 8.33-1: S102 IP address

8.34 Charging ID

The Charging ID is a unique four-octet value generated by the PDN GW when a dedicated bearer is activated. A Charging ID is generated for each dedicated bearer. The Charging ID value 0 is reserved and shall not be assigned by the PDN GW.

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 99 (decimal)							
2-3	Length = 4 (decimal)							
4	CR		Spare		Instance			
5-8	Charging ID value							
9-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.34-1: Charging ID

8.35 Charging Characteristics

The charging characteristics information element is defined in 3GPP TS 32.251 [8] and is a way of informing both the SGW and PGW of the rules for producing charging information based on operator configured triggers. For the encoding of this information element see 3GPP TS 32.298 [9].

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 100 (decimal)							
2-3	Length = 2 (decimal)							
4	CR		Spare		Instance			
5-6	Charging Characteristics value							
7-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.35-1: Charging Characteristics

8.36   Trace Information

Trace Information is coded as this is depicted in Figure 8.36-1. See [18] for details on trace related information.

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 101 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5	Trace Reference Length							
6-v	Trace Reference Value							
v+1	Trace Id Length							
(v+2) – x	Trace Id Value							
x+1	Trigger Id Length							
(x+2) – y	Trigger Id Value							
y+1	OMC Identity Length							
(y+2) – z	OMC Identity Value							
(z+1) – (n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.36-1: Trace Information

8.37   Bearer Flags

Bearer Flags is coded as this is depicted in Figure 8.37-1.

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 102 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5	Spare	Spare	Spare	Spare	Spare	Spare	Spare	PPC
6-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.37-1: Bearer Flags

The following bits within Octet 5 indicate:

-    Bit 1 – PPC (Prohibit Payload Compression): This flag is used to determine whether an SGSN should attempt to compress the payload of user data when the users asks for it to be compressed (PPC = 0), or not (PPC = 1).

8.38   Paging Cause

Paging Cause is transferred from the SGW to MME across S11 so it can then be passed to the eNodeB over S1AP in the Paging message as specified in 3GPP TS 36.413 [10].

The Paging Cause is coded as shown in Figure 8.38-1.

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 103 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5-(n+4)	Paging Cause value							

Figure 8.38-1: Paging Cause

8.39 PDN Type

The PDN Type is coded as depicted in Figure 8.39-1.

Octets	Bits 8	7	6	5	4	3	2	1
1	Type = 104 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare		Instance		
5	Spare					PDN Type		
6-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.39-1: PDN Type

Table 8.39-1: PDN Type

PDN type value (octet 4)   Bits   **3 2 1**   0 0 1   IPv4   0 1 0   IPv6   0 1 1   IPv4/IPv6   Bits 8-4 of octet 4 are spare and shall be coded as zero.

8.40 Procedure Transaction ID (PTI)

Procedure Transaction Id is coded as this is depicted in Figure 8.40-1.

Octets	Bits 8	7	6	5	4	3	2	1
1	Type = 105 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare		Instance		
5	Procedure Transaction ID							
6-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.40-1: Procedure Transaction ID

8.41 DRX Parameter

DRX Parameter indicates whether the UE use DRX mode or not, this parameter is coded as this is depicted in Figure 8.41-1.

Octets	Bits 8	7	6	5	4	3	2	1
1	Type = 106 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare		Instance		
5-(n+4)	DRX Parameter							

Figure 8.41-1: DRX Parameter

8.42   UE Network Capability

UE Network Capability is coded as this is depicted in Figure 8.42-1.

Octets	**Bits**

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 107 (decimal)
2-3	Length = n (decimal)
4	\multicolumn{3}{c}{CR}	Spare	\multicolumn{4}{c}{Instance}
5-(n+4)	UE Network Capability

Figure 8.42-1: UE Network Capability

8.43   MM Context

The MM Context information element contains the Mobility Management, UE security parameters that are necessary to transfer over S3/S16/S10 interface.

Security Mode indicates the type of security keys (GSM/UMTS/EPS) and Authentication Vectors (quadruplets /quintuplets/triplets) that are passed to the new MME/SGSN.

Used Cipher indicates the GSM ciphering algorithm that is in use.

Used NAS Cipher indicates the EPS ciphering algorithm that is in use.

As depict in Figure 8.43-1, the GSM Key, Used Cipher and Authentication Triplets that are unused in the old SGSN shall be transmitted to the new SGSN for the GSM subscribers.

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type
2-3	Length = n (decimal)
4	\multicolumn{3}{c}{CR}	Spare	\multicolumn{4}{c}{Instance}
5-(n+4)	These octet(s) is/are present only if explicitly specified

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 109 (decimal)
2-3	Length = n (decimal)
4	\multicolumn{3}{c}{CR}	Spare	\multicolumn{4}{c}{Instance}
5	\multicolumn{3}{c}{Security Mode}	\multicolumn{2}{c}{Spare 11}	\multicolumn{3}{c}{CKSN}
6	\multicolumn{3}{c}{Number of Triplet}	\multicolumn{5}{c}{Spare11111}
7	\multicolumn{5}{c}{Spare11111}	\multicolumn{3}{c}{Used Cipher}
8-15	Kc
16-h	Authentication Triplet [0..4]
(h+1)-(h+5)	DRX parameter
(h+6)-m	UE Network Capability
(m+1)-(n+4)	ME Identity

Figure 8.43-1: GSM Key and Triplets

As depict in Figure 8.43-2, the UMTS Key, Used Cipher and Authentication Quintuplets that are unused in the old SGSN shall be transmitted to the new SGSN when the UMTS subscriber is attached to a GSM BSS in the old system, in case the user has a ME capable of UMTS AKA.

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 110 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5	Security Mode		Spare 11		CKSN/KSI			
6	Number of Quintuplets		Spare 11111					
7	Spare 11111				Used Cipher			
8-23	CK							
24-39	IK							
40-h	Authentication Quintuplet [0..4]							
(h+1)-(h+5)	DRX parameter							
(h+6)-m	UE Network Capability							
(m+1)-(n+4)	ME Identity							

Figure 8.43-2: UMTS Key, Used Cipher and Quintuplets

As depict in Figure 8.43-3, the GSM Key, Used Cipher and Authentication Quintuplets that are unused in the old SGSN shall be transmitted to the new SGSN when the UMTS subscriber is attached to a GSM BSS in the old system, in case the user has a ME no capable of UMTS AKA.

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 111 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5	Security Mode		Spare 11		CKSN/KSI			
6	Number of Quintuplets		Spare 11111					
7	Spare 11111				Used Cipher			
8-15	Kc							
16-h	Authentication Quintuplets [0..4]							
(h+1)-(h+5)	DRX parameter							
(h+6)-m	UE Network Capability							
(m+1)-(n+4)	ME Identity							

Figure 8.43-3: GSM Key, Used Cipher and Quintuplets

As depict in Figure 8.43-4, the UMTS Key, KSI and unused Authentication Quintuplets in the old SGSN shall be transmitted to the new SGSN/MME when the UMTS subscriber is attached to UTRAN in the old system.

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 112 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5	Security Mode		Spare 11		KSI			
6	Number of Quintuplets		Spare 11111					
7	Spare 11111							
8-23	CK							
24-39	IK							
40-h	Authentication Quintuplet [0..4]							
(h+1)-(h+5)	DRX parameter							
(h+6)-m	UE Network Capability							
(m+1)-(n+4)	ME Identity							

Figure 8.43-4: UMTS Key and Quintuplets

As depict in Figure 8.43-5, the EPS Security Context, unused Authentication Quadruplets in the old MME shall be transmitted to the new MME. And the Authentication Quintuplets may also be transmitted to the new MME if the old MME has the Authentication Quintuplets for this UE.

Octets	| Bits | | | | | | |						
	8	7	6	5	4	3	2	1
1	Type = 113 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5	Security Mode		Spare 11		KSI$_{ASME}$			
6	Number of Quintuplets		Number of Quadruplet		Spare 11			
7	Spare 1	Used NAS integrity protection algorithm		Used NAS Cipher				
8-10	NAS Downlink Count							
11-13	NAS Uplink Count							
14-45	K$_{ASME}$							
46-g	Authentication Quadruplet[0..4]							
(g+1)-h	Authentication Quintuplet [0..4]							
(h+1)-(h+5)	DRX parameter							
(h+6)-m	UE Network Capability							
(m+1)-(n+4)	ME Identity							

Figure 8.43-5: EPS Security Context, Quadruplets and Quintuplets

NAS integrity protection algorithm shall be specified in 3GPP TS 24.301 [23].

As depict in Figure 8.43-6, if the old MME has Authentication Quintuplets for this UE, the old MME will derive CK' and IK' from K$_{ASME}$ and transmit the CK', IK', KSI$_{ASME}$ and Authentication Quintuplets to the new SGSN, the Authentication Quadruplets may also be transmitted to the new SGSN.

Editor's Notes: the old SGSN/MME may delivery both Authentication Quadruplets and Authentication Quintuplets it holds to the peer combo node to optimize the procedure, the details need more clarification

Octets	| Bits | | | | | | |						
	8	7	6	5	4	3	2	1
1	Type = 114 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5	Security Mode		Spare 11		KSI$_{ASME}$			
6	Number of Quintuplets		Number of Quadruplet		Spare 11			
7	Spare							
8-23	CK							
24-39	IK							
40-g	Authentication Quadruplet[0..4]							
(g+1)-h	Authentication Quintuplet [0..4]							
(h+1)-(h+5)	DRX parameter							
(h+6)-m	UE Network Capability							
(m+1)-(n+4)	ME Identity							

Figure 8.43-6: UMTS Key, Quadruplets and Quintuplets

Table 8.43-1: Security Mode Values

Security Type	Value (Decimal)
GSM Key and Triplets	0
UMTS Key, Used Cipher and Quintuplets	1
GSM Key, Used Cipher and Quintuplets	2
UMTS Key and Quintuplets	3
EPS Security Context, Quadruplets and Quintuplets	4
UMTS Key, Quadruplets and Quintuplets	5

Table 8.43-2: Used NAS Cipher Values

Cipher Algorithm	Value (Decimal)
No ciphering	0
128-EEA1	1
128-EEA2	2

Table 8.43-3: Used Cipher Values

Cipher Algorithm	Value (Decimal)
No ciphering	0
GEA/1	1
GEA/2	2
GEA/3	3
GEA/4	4
GEA/5	5
GEA/6	6
GEA/7	7

8.44 PDN Connection

The PDN connection is coded as this is depicted in Table 8.47-1.

Table 8.44-1: PDN Connection

Information elements	P	Condition / Comment	CR	IE Type	Instance
		PDN Connection IE Type = 115 (decimal)			
		Length = n (decimal)			
APN	M	None	1	APN	
IPv4 Address	C	None if no IPv4 Address assigned	1	IP Address	
IPv6 Address	C	None if no IPv6 Address assigned	1	IP Address	
SGW S11/S4 IP Address and TEID for Control Plane	M		1	F-TEID	
PGW S5/S8 IP Address and TEID for Control Plane	C	Only Included for GTP based S5/S8	1	F-TEID	
LMA Address	C	Only included for PMIP based S5/S8	1	LMA Address	
GRE Key	C	Only included for PMIP based S5/S8	1	GRE Key	
Bearer Contexts	C	Several IEs with this type and instance values may be included as necessary to represent a list of Bearers.	1	Bearer Context	

The PDN Connection IE is a grouped IE. The PDN Connection IE is normally repeated within a message with exactly the same Type and Instance values to represent a list.

The Bearer Context is coded as this is depicted in Table 8.44-2.

Table 8.44-2: Bearer Context in PDN Connection

Information elements	P	Condition / Comment	CR	IE Type	Instance
		Bearer Context IE Type = 96 (decimal)			
		Length = n (decimal)			
EPS Bearer ID	M		1	EBI	
UL TFT	O		1	Bearer TFT	
DL TFT	O		1	Bearer TFT	
SGW S1/S4/S12 IP Address and TEID for user plane	C		1	F-TEID	
PGW S5/S8 IP Address and TEID for user plane	C	Only included for GTP based S5/S8	1	F-TEID	
Bearer Level QoS	M		1	Bearer QoS	
Transaction Identifier	M		1	TI	
Charging characteristics	O		1	Charging characteristics	
Container	O	Packet Flow ID , Radio Priority, SAPI, PS Handover XID Parameters may be included	1	Container	

8.45   GRE Key

The GRE Key is coded as this is depicted in Figure 8.45-1.

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 116 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5-(n+4)	GRE Key							

Figure 8.45-1: GRE Key

8.46   PDU Numbers

The PDU Numbers information element contains the sequence number status corresponding to a Bearer context in the old SGSN. This information element shall be sent only when acknowledged peer-to-peer LLC operation is used for the Bearer context or when the "delivery order" QoS attribute is set in the Bearer context QoS profile.

NSAPI identifies the Bearer context for which the PDU Number IE is intended.

DL GTP-U Sequence Number is the number for the next downlink GTP-U T-PDU to be sent to the UE when "delivery order" is set.

UL GTP-U Sequence Number is the number for the next uplink GTP-U T-PDU to be tunnelled to the S-GW when "delivery order" is set.

The Send N-PDU Number is used only when acknowledged peer-to-peer LLC operation is used for the Bearer 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 S-GW.

The Receive N-PDU Number is used only when acknowledged peer-to-peer LLC operation is used for the Bearer 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 UE.

The PDU Number IE will be repeated for each Bearer Context for which this IE is required.

PDU Numbers IE is coded as this is depicted in Figure 8.46-1.

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 108 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5	Spare(0 0 0 0)				NSAPI			
6-7	DL GTP-U Sequence Number							
8-9	UL GTP-U Sequence Number							
10-11	Send N-PDU Number							
12-13	Receive N-PDU Number							
14-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.46-1: PDU Numbers

8.47 EPS Bearer Contexts Prioritization (Contexts Prioritization)

The EPS Bearer Contexts Prioritization information element is used by the old SGSN/MME to inform the new SGSN/MME that prioritization of the EPS Bearer Contexts has been applied. When the information element is included, the length is set to zero.

					Bits				
Octets	8	7	6	5	4	3	2	1
1				Type = 118 (decimal)				
2-3				Length = n (decimal)				
4		CR		Spare		Instance		
5-(n+4)								

Figure 8.47-1: EPS Bearer Contexts Prioritization (Contexts Prioritization)

8.48 LMA IP Address

LMA IP address shall be coded as depicted in Figure 8.48-1. It contains the PDN GW IP address for PMIP-based S5/S8 interface. The Length field may have only two values (4 or 16) that determine if the Value field contains IPv4 or IPv6 address.

					Bits				
Octets	8	7	6	5	4	3	2	1
1				Type = 119 (decimal)				
2-3				Length = n (decimal)				
4		CR		Spare		Instance		
5-(n+4)				IPv4 or IPv6 Address				

Figure 8.48-1: LMA IP Address

8.49 Packet TMSI (P-TMSI)

The P-TMSI, unambiguously associated with a given UE and routeing area, is given by:

					Bits				
Octets	8	7	6	5	4	3	2	1
1				Type = 120 (decimal)				
2-3				Length = n (decimal)				
4		CR		Spare		Instance		
5-(n+4)				Packet TMSI (P-TMSI)				
				The P-TMSI is defined in 3GPP TS 23.003 [2].				

Figure 8.49-1: Packet TMSI (P-TMSI)

8.50 P-TMSI Signature

The P-TMSI Signature information element is provided by the UE in the Routeing Area Update Request and Attach Request messages to the SGSN, or is provided by the MME that is mapped from GUTI in the Identification Request and Context Request messages to the old SGSN for identification checking purposes. The content and the coding of the P-TMSI Signature information element are defined in 3GPP TS 24.008 [5].

					Bits				
Octets	8	7	6	5	4	3	2	1
1				Type = 121 (decimal)				
2-3				Length = n (decimal)				
4		CR		Spare		Instance		
5-(n+4)				P-TMSI Signature				

Figure 8.50-1: P-TMSI Signature

8.51 Hop Counter

Where Intra Domain Connection of RAN Nodes to Multiple CN Node is applied, the Hop Counter may be used to prevent endless loops when relaying Identification Request messages and Context Request messages. The maximum value is operator specific and shall not be lower than 1.

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 122 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
4	Hop Counter							
5-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.51-1: Hop Counter

8.52 Authentication Quintuplet

An Authentication Quintuplet consists of a Random string (RAND), an Expected user response (XRES), a Cipher key (CK), an Integrity key (IK), an Authentication token (AUTN) (see 3GPP TS 33.102 [11]).

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 123 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5-20	RAND							
21	XRES Length							
22-m	XRES							
(m+1)-(m+16)	CK							
(m+17)-(m+32)	IK							
m+33	AUTN Length							
(m+34)-(n+4)	AUTN							

Figure 8.52-1: Authentication Quintuplet

8.53 Authentication Quadruplet

An Authentication Quadruplet consists of a Random string (RAND), an Expected user response (XRES), an Authentication token (AUTN), a Key of Access Security Management Entity (K_{ASME}) (see 3GPP TS 33.102 [11] and TS 33.401 [12]).

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 124 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5-20	RAND							
21	XRES Length							
22-m	XRES							
m+1	AUTN Length							
(m+1)-(n-29)	AUTN							
(n-28)-(n+4)	K_{ASME}							

Figure 8.53-1: Authentication Quadruplet

8.54 Complete Request Message

The Complete Request Message is coded as this is depicted in Figure 8.54-1.

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 125 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5	Complete Request Message Type							
6-(n+4)	Complete Request Message							
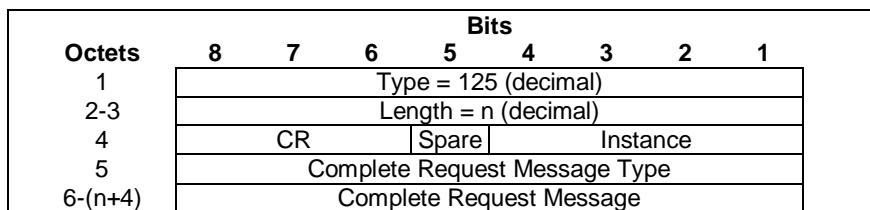
Figure 8.54-1: Complete Request Message

Complete Request Message type values are specified in Table 8.54-1.

Table 8.54-1: Complete Request Message type values and their meanings

Location Types	Values (Decimal)
Complete Attach Request Message	0
Complete TAU Request Message	1
<spare>	2-255

8.55 GUTI

The GUTI is coded as this is depicted in Figure 8.55-1.

	Bits							
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 126 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5	MCC digit 2				MCC digit1			
6	MNC digit3				MCC digit3			
7	MNC digit2				MNC digit1			
8-9	MME Group ID							
10	MME Code							
11-(n+4)	M-TMSI							

Figure 8.55-1: GUTI

If an Administration decides to include only two digits in the MNC, then bits 5 to 8 of octet 3 are coded as "1111".

8.56 Fully Qualified Container (F-Container)

Fully Qualified Container (F-TEID) is coded as this is depicted in Figure 8.56-1.

				Bits				
Octets	8	7	6	5	4	3	2	1
1	Type = 127 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5	Spare1111				Container Type			
6-(n+4)	F-Container field							

Figure 8.56-1: Full Qualified Container(F-Container)

The Container Type is coded as below :
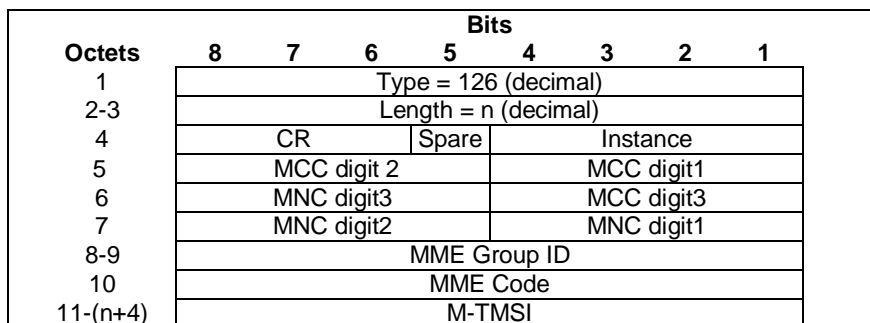
- If this field is set to 1, then the F-Container field present the UTRAN transparent container.

- If this field is set to 2, then the F-Container field present the BSS container.

- If this field is set to 3, then the F-Container field present the E-UTRAN transparent container.

8.57 Fully Qualified Cause (F-Cause)

Fully Qualified Cause (F- Cause) is coded as this is depicted in Figure 8.57-1.

				Bits				
Octets	8	7	6	5	4	3	2	1
1	Type = 128 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5-(n+4)	F-Cause field							

Figure 8.57-1: Full Qualified Cause (F-Cause)

8.58 Selected PLMN ID

The Selected PLMN ID IE contains the core network operator selected for tne UE in a shared network. Octets 4-6 shall be encoded as the content part of the 'Selected PLMN Identity' parameter in 3GPP TS 36.413 [10].

				Bits				
Octets	8	7	6	5	4	3	2	1
1	Type = 129 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5-(n+4)	Selected PLMN ID							

Figure 8.58-1: Selected PLMN ID

8.59 Target Identification

The Target Identification information element contains the identification of a target RNC or a target eNodeB.

Octets	\[8\]	\[7\]	\[6\]	Bits \[5\]	\[4\]	\[3\]	\[2\]	\[1\]
1	Type = 130 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5	Target Type							
6-(n+4)	Target ID							

Figure 8.59-1: Target Identification

Target type values are specified in Table 8.59-1.

Table 8.59-1: Target type values and their meanings

Location Types	Values (Decimal)
RNC ID	0
eNodeB ID	1
<spare>	2-255

8.60 NSAPI

The NSAPI information element contains an NSAPI identifying a PDP Context.

The spare bits x indicate unused bits, which shall be set to 0 by the sending side, and the sending side shall not evaluate them.

Octets	\[8\]	\[7\]	\[6\]	Bits \[5\]	\[4\]	\[3\]	\[2\]	\[1\]
1	Type = 132 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5	Spare1111				NSAPI			
6-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.60-1: NSAPI

8.61 Packet Flow ID

The Packet Flow Id information element contains the packet flow identifier assigned to a PDP context as identified by NSAPI.

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

Octets	\[8\]	\[7\]	\[6\]	Bits \[5\]	\[4\]	\[3\]	\[2\]	\[1\]
1	Type = 133 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare	Instance			
5	Spare1111				NSAPI			
6-(n+4)	Packet Flow ID							

Figure 8.61-1: Packet Flow ID

8.62 RAB Context

The RAB context information element contains sequence number status for one RAB in RNC, which corresponds to one PDP context. The RAB contexts are transferred between the RNCs via the SGSNs at inter SGSN hard handover.

NSAPI identifies the PDP context and the associated RAB for which the RAB context IE is intended.

DL GTP-U Sequence Number is the number for the next downlink GTP-U T-PDU to be sent to the UE.

UL GTP-U Sequence Number is the number for the next uplink GTP-U T-PDU to be tunnelled to the SGW.

DL PDCP Sequence Number is the number for the next downlink PDCP-PDU to be sent to the UE.

UL PDCP Sequence Number is the number for the next uplink PDCP-PDU to be received from the UE.

Table 8.62-1: RAB Context

		RAB ContextIE Type = 134 (decimal)			
		Length = n (decimal)			
Information elements	**P**	**Condition / Comment**	**CR**	**IE Type**	**Instance**
NSAPI	C	Shall be included if the source node is a RNC	1		
DL GTP-U Sequence Number	C	None	1		
UL GTP-U Sequence Number	C	None	1		
DL PDCP Sequence Number	C	None	1		
UL PDCP Sequence Number	C	None	1		

The RAB Context is a Grouped IE. The RAB Context IE is normally repeated within a message with exactly the same Type and Instance to represent a list.

8.63 Source RNC PDCP context info

The purpose of the Source RNC PDCP context info IE is to transfer RNC PDCP context information from a source RNC to a target RNC during an SRNS relocation.
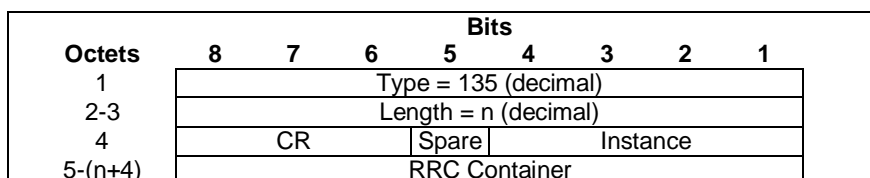

Figure 8.63-1: Source RNC PDCP context info

8.64 UDP Source Port Number

UDP Source Port Number is coded as this is depicted in Figure 8.64-1.
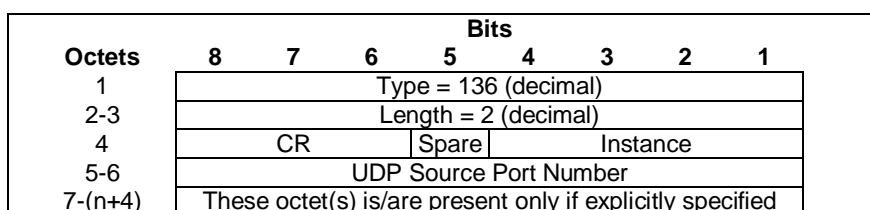

Figure 8.64-1: UDP Source Port Number

8.65   APN Restriction

The APN Restriction information element contains an unsigned integer value indicating the level of restriction imposed on EPS Bearer Contexts created to the associated APN.

The APN Restriction IE is coded as depicted in Figure 8.65-1:

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 137 (Decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
	Restriction Type value							
6-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.65-1: APN Restriction Type Information Element

An APN Restriction value may be configured for each APN in the PGW. It is used to determine, on a per UE basis, whether it is allowed to establish EPS bearers to other APNs.

Table 8.65-1: Valid Combinations of APN Restriction

Maximum APN Restriction Value	Type of APN	Application Example	APN Restriction Value allowed to be established
0	No Existing Contexts or Restriction		All
1	Public-1	MMS	1, 2, 3
2	Public-2	Internet	1, 2
3	Private-1	Corporate (e.g. who use MMS)	1
4	Private-2	Corporate (e.g. who do not use MMS)	None

Editor's Note: The actual application examples and combination of APN Restriction for EPS is FFS.

8.66   Selection Mode

The Selection mode information element indicates the origin of the APN in the message.

Octets	Bits							
	8	7	6	5	4	3	2	1
1	Type = 138 (Decimal)							
2-3	Length = n (decimal)							
4	CR		Spare		Instance			
5	1	1	1	1	1	1	1	Selec. Mode
6-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.66-1: Selection Mode Information Element

Table 8.66-1: Selection Mode Values

Selection mode value	Value (Decimal)
MS or network provided APN, subscribed verified	0
MS provided APN, subscription not verified	1
Network provided APN, subscription not verified	2
For future use. Shall not be sent. If received, shall be interpreted as the value '2'.	3

8.67   Cell Identification

The Cell Identification information element is coded as this is depicted in Figure 8.67-1.

				Bits				
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 131 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare		Instance		
5-12	Target Cell ID							
13	Source Type							
14-(n+4)	Source ID							

Figure 8.67-1: Target Identification

Source type values are specified in Table 8.67-1.

Table 8.67-1: Target type values and their meanings

Location Types	Values (Decimal)
Cell ID	0
RNC ID	1
eNodeB ID	2
<spare>	3-255

Editor's Note: The discrepancy between this definition of Target Identification IE (which appears as though it should be re-titled as Cell Identification according to 3GPP TS 29.060) and the one in clause 8.59 needs to be resolved.

8.68   Bearer Control Mode

Bearer Control Mode is coded as this is depicted in Figure 8.68-1.

				Bits				
Octets	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
1	Type = 117 (decimal)							
2-3	Length = n (decimal)							
4	CR			Spare		Instance		
5	Bearer Control Mode							
6-(n+4)	These octet(s) is/are present only if explicitly specified							

Figure 8.68-1: Bearer Flags

Valid codes for the Bearer Control Mode octet are:

- 0 (Selected Bearer Control Mode – 'MS_only');

- 1 (Selected Bearer Control Mode – 'Network_only');

- 2 (Selected Bearer Control Mode – 'MS/NW').

All other values are reserved.

8.69   Change Reporting Action

Change Reporting Action IE is coded as this is depicted in Figure 8.69-1.

Octets	**Bits**							
	8	7	6	5	4	3	2	1
1	Type = 139 (decimal)							
2-3	Length = n (decimal)							
4	CR	Spare	Spare	Instance				
5-(n+4)	Action							

Figure 8.69-1: Change Reporting Action

Table 8.69-1: Action values

Action	Value (Decimal)
Stop Reporting	0
Start Reporting CGI/SAI	1
Start Reporting RAI	2
<spare>	3-255

8.70   PDN Connection Set Identifier (CSID)

A PDN Connection Set Identifier (CSID) identifies a set of PDN connections belonging to an arbitrary number of UEs. The CSID is used on S5, S8 and S11 interfaces.

The size of CSID is two octets. It is coded as follows:

Editor's Note: The CSID may contain an identifier for the nodes. Such a node identifier (Node-ID) is necessary when MME CSID is provided to a PGW since a PGW has no reliable means of determining the identity of the MME that signals the partial failure messages. During other times, such a node identifier may be included. The exact usage and format of such a node identifier is FFS.

Octets	**Bits**							
	8	7	6	5	4	3	2	1
1	Type = TBD (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare	Instance				
5-m	Node-ID							
(m+1)-(n+4)	PDN Connection Set Identifier (CSID)							

Figure 8.x: CSID

8.71   Private Extension

Private Extension is coded as this is depicted in Figure 8.Figure 8.71-1.

Enterprise ID can be found at IANA web site (http://www.iana.org/assignments/enterprise-numbers).

Octets	**Bits**							
	8	7	6	5	4	3	2	1
1	Type = 255 (decimal)							
2-3	Length = n (decimal)							
4	CR		Spare	Instance				
5-6	Enterprise ID							
7-(n+4)	Proprietary value							

Figure 8.71-1. Private Extension

9 Security

To be edited

10 IP - The Networking Technology used by GTP

10.1 IP Version

GTPv2 entities shall support both versions of the Internet Protocol, version 4 as defined by IETF RFC 791 [6], and version 6 as defined by IETF RFC 2460 [16].

10.2 IP Fragmentation

It is specified here how the fragmentation mechanism shall work with GTP-C.

Fragmentation should be avoided if possible. Examples of fragmentation drawbacks are:

- Fragmentation is inefficient, since the complete IP header is duplicated in each fragment.

- If one fragment is lost, the complete packet has to be discarded. The reason is that no selective retransmission of fragments is possible.

By using Path MTU discovery the application may find out the MTU, and thereby utilise more efficient segmentation mechanisms.

Annex A (informative):
Change History

Date	TSG #	TSG Doc	CT4 Doc	CR	Rev	Cat	Subject/Comment	Old	New
2008-12	CT#42	CP-080717					V2.0.0 approved in CT#42	2.0.0	8.0.0