

ETSI TS 129 244 V17.10.0 (2024-04)



**LTE;
5G;**

**Interface between the Control Plane and the User Plane nodes
(3GPP TS 29.244 version 17.10.0 Release 17)**

[ETSI TS 129 244 V17.10.0 \(2024-04\)](https://standards.iteh.ai/catalog/standards/etsi/18a08889-90ed-4f09-8139-1082e14c12d8/etsi-ts-129-244-v17-10-0-2024-04)

<https://standards.iteh.ai/catalog/standards/etsi/18a08889-90ed-4f09-8139-1082e14c12d8/etsi-ts-129-244-v17-10-0-2024-04>



Reference

RTS/TSGC-0429244vha0

Keywords

5G,LTE

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from:

<https://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

If you find a security vulnerability in the present document, please report it through our

Coordinated Vulnerability Disclosure Program:

<https://www.etsi.org/standards/coordinated-vulnerability-disclosure>

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2024.
All rights reserved.

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

Legal Notice

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

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables. (2024-04)

The cross reference between 3GPP and ETSI identities can be found under <https://webapp.etsi.org/key/queryform.asp>.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Intellectual Property Rights	2
Legal Notice	2
Modal verbs terminology.....	2
Foreword.....	15
1 Scope	17
2 References	17
3 Definitions, symbols and abbreviations	20
3.1 Definitions	20
3.2 Abbreviations	20
4 Protocol Stack	22
4.1 Introduction	22
4.2 UDP Header and Port Numbers	23
4.2.1 General.....	23
4.2.2 Request Message	23
4.2.3 Response Message	23
4.3 IP Header and IP Addresses	23
4.3.1 General.....	23
4.3.2 Request Message	23
4.3.3 Response Message.....	24
4.4 Layer 2	24
4.5 Layer 1	24
5 General description.....	24
5.1 Introduction	24
5.2 Packet Forwarding Model	24
5.2.1 General.....	24
5.2.1A Packet Detection Rule Handling	27
5.2.1A.1 General	27
5.2.1A.2 PDI Optimization	28
5.2.1A.2A Provisioning of SDF filters	28
5.2.1A.3 Bidirectional SDF Filters	29
5.2.1A.4 Application detection with PFD.....	29
5.2.2 Usage Reporting Rule Handling	29
5.2.2.1 General	29
5.2.2.2 Provisioning of Usage Reporting Rule in the UP function	30
5.2.2.2.1 General	30
5.2.2.2.2 Credit pooling (for EPC)	34
5.2.2.2.3 Reporting of Usage Report to the CP function.....	35
5.2.2.3.1 General	35
5.2.2.3.2 Credit pooling.....	39
5.2.2.3.3 Traffic Usage Reporting with Redundant Transmission	40
5.2.2.4 Reporting of Linked Usage Reports to the CP function.....	40
5.2.2.5 End Marker Reception Reporting	40
5.2.3 Forwarding Action Rule Handling.....	41
5.2.3.1 General	41
5.2.4 Buffering Action Rule Handling.....	43
5.2.4.1 General	43
5.2.4.2 Provisioning of Buffering Action Rule in the UP function	43
5.2.5 QoS Enforcement Rule Handling	44
5.2.5.1 General	44
5.2.5.2 Provisioning of QoS Enforcement Rule in the UP function.....	44
5.2.5.3 Reflective QoS (for 5GC)	44
5.2.6 Combined SGW/PGW Architecture	44
5.2.7 Multi-Access Rule Handling (for 5GC).....	45

5.2.7.1	General	45
5.2.8	Session Reporting Rule Handling	46
5.2.8.1	General	46
5.2.8.2	Provisioning of Session Reporting Rule in the UP function	46
5.2.8.2.1	General	46
5.2.8.3	Reporting of Session Report to the CP function	46
5.2.8.3.1	General	46
5.2.9	Handling of Rules that cannot be activated	46
5.3	Data Forwarding between the CP and UP Functions	47
5.3.1	General.....	47
5.3.2	Sending of End Marker Packets.....	48
5.3.3	Forwarding of Packets Subject to Buffering in the CP Function.....	48
5.3.3.1	General.....	48
5.3.3.2	Forwarding of Packets from the UP Function to the CP Function.....	49
5.3.3.3	Forwarding of Packets from the CP Function to the UP Function.....	49
5.3.4	Data Forwarding between the CP and UP Functions with one PFCP-u Tunnel per UP Function or PDN.....	50
5.3.4.1	General.....	50
5.3.4.2	Forwarding of Packets from the UP Function to the CP Function.....	50
5.3.4.3	Forwarding of Packets from the CP Function to the UP Function.....	50
5.3.5	Forwarding of user data using Control Plane Clot 5GS Optimisation (for 5GC).....	51
5.3.5.1	General.....	51
5.3.5.2	Forwarding of Packets from the UP Function to the CP Function.....	51
5.3.5.3	Forwarding of Packets from the CP Function to the UP Function.....	51
5.4	Policy and Charging Control.....	51
5.4.1	General.....	51
5.4.2	Service Detection and Bearer/QoS Flow Binding	52
5.4.3	Gating Control	52
5.4.4	QoS Control.....	53
5.4.5	DL Flow Level Marking for Application Detection	54
5.4.6	Usage Monitoring	54
5.4.7	Traffic Redirection.....	54
5.4.8	Traffic Steering.....	55
5.4.9	Provisioning of Predefined PCC/ADC Rules	56
5.4.10	Charging	57
5.4.11	(Un)solicited Application Reporting.....	58
5.4.12	Service Identification for Improved Radio Utilisation for GERAN	59
5.4.13	Transport Level Marking	59
5.4.14	Deferred PDR activation and deactivation.....	59
5.4.15	Packet Rate enforcement	60
5.4.15.1	General.....	60
5.4.15.2	Packet rate enforcement over Sxb and N4 interfaces.....	60
5.4.15.3	PGW and SMF behaviour	61
5.4.16	QoS differentiation for Stand-alone Non-Public Network (SNPN).....	62
5.4.16.1	General.....	62
5.4.16.2	Access to PLMN services via SNPN	62
5.4.16.3	Access to SNPN services via PLMN	62
5.5	F-TEID Allocation and Release	63
5.5.1	General.....	63
5.5.2	Void.....	63
5.5.3	F-TEID allocation in the UP function.....	63
5.6	PFCP Session Handling.....	64
5.6.1	General.....	64
5.6.2	Session Endpoint Identifier Handling.....	64
5.6.3	Modifying the Rules of an Existing PFCP Session.....	64
5.7	Support of Lawful Interception	64
5.7.1	General.....	64
5.7.2	Lawful Interception in EPC	64
5.7.3	Lawful Interception in 5GC.....	65
5.8	PFCP Association.....	65
5.8.1	General.....	65
5.8.2	Behaviour with an Established PFCP Association.....	66

5.8.3	Behaviour without an Established PFCP Association	66
5.9	Usage of Vendor-specific IE	67
5.10	Error Indication Handling	67
5.11	User plane inactivity detection and reporting	67
5.11.1	General.....	67
5.11.2	User plane inactivity detection and reporting per PDN connection or PDU session	67
5.11.3	User plane inactivity detection and reporting per PDR	68
5.12	Suspend and Resume Notification procedures	68
5.13	Ethernet traffic (for 5GC).....	68
5.13.1	General.....	68
5.13.2	Address Resolution Protocol or IPv6 Neighbour Solicitation Response by SMF	69
5.13.3	Address Resolution Protocol or IPv6 Neighbour Solicitation Response by UPF	70
5.13.3A	Provisioning of MAC addresses and SDF filters in Ethernet Packet Filters	70
5.13.4	Bidirectional Ethernet Filters	70
5.13.5	Reporting of UE MAC addresses to the SMF.....	71
5.13.6	Ethernet PDU session anchor relocation.....	71
5.14	Support IPv6 Prefix Delegation.....	72
5.15	Signalling based Trace (De)Activation	72
5.16	Framed Routing.....	72
5.17	5G UPF (for 5GC).....	73
5.17.1	Introduction.....	73
5.17.2	Uplink Classifier and Branching Point	73
5.17.3	Data forwarding during handovers between 5GS and EPS.....	73
5.18	Enhanced PFCP Association Release.....	74
5.18.1	General.....	74
5.18.2	UP Function Initiated PFCP Session Release	75
5.19	Activation and Deactivation of Pre-defined PDRs.....	75
5.20	Support of Access Traffic Steering, Switching and Splitting for 5GC.....	76
5.20.1	General.....	76
5.20.2	MPTCP functionality.....	77
5.20.2.1	General	77
5.20.2.2	Activate MPTCP functionality and Exchange MPTCP Parameters.....	77
5.20.2.3	Control of Multipath TCP Connection Establishment by MPTCP Proxy	77
5.20.2.4	Traffic Steering and IP Translation by MPTCP Proxy	78
5.20.3	ATSSS-LL functionality.....	78
5.20.3.1	Activate ATSSS-LL functionality and Exchange ATSSS-LL Parameters.....	78
5.20.4	Handling of GBR traffic of a MA PDU session	79
5.20.4.1	General	79
5.20.4.2	Access Availability Reporting	79
5.20.5	Access type of an MA PDU session becoming (un)available.....	79
5.20.6	PMFP message handling in UPF	79
5.21	UE IP address/prefix Allocation and Release.....	80
5.21.1	General.....	80
5.21.2	UE IP address/prefix allocation in the CP function	81
5.21.2.1	General	81
5.21.2.2	UE IP Address/prefix allocation using DHCP or AAA server.....	81
5.21.3	UE IP address/prefix allocation in the UP function	81
5.21.3.1	General	81
5.21.3.2	Reporting UE IP Address Usage to the CP function.....	82
5.22	PFCP sessions successively controlled by different SMFs of an SMF set (for 5GC)	83
5.22.1	General.....	83
5.22.2	With one PFCP association per SMF Set and UPF.....	83
5.22.3	With one PFCP association per SMF and UPF.....	84
5.22.4	Restoration of PFCP Sessions associated with an FQ-CSID, Group ID or PGW-C/SMF IP Address	86
5.23	5G VN Group Communication (for 5GC).....	86
5.24	Support of Ultra Reliable Low Latency Communication for 5GC.....	87
5.24.1	General.....	87
5.24.2	Redundant Transmission on N3/N9 interfaces	88
5.24.2.1	General	88
5.24.2.2	GTP-U tunnel setup for redundant transmission	88
5.24.2.3	Duplicating downlink packets for redundant transmission	89
5.24.2.4	Eliminating duplicated uplink packets	89

5.24.3	Redundant Transmission at transport layer.....	89
5.24.4	Per QoS Flow Per UE QoS Monitoring.....	89
5.24.4.1	General.....	89
5.24.4.2	QoS Monitoring Control.....	90
5.24.4.3	QoS Monitoring Reporting.....	90
5.24.5	Per GTP-U Path QoS Monitoring.....	91
5.24.5.1	General.....	91
5.24.5.2	GTP-U path monitoring.....	91
5.24.5.3	QoS monitoring of a PDU session based on GTP-U path monitoring.....	92
5.24.5.4	QoS Monitoring Reporting.....	92
5.25	Support of IPTV (for 5GC).....	92
5.26	Support of Time Sensitive Communication, Time Synchronization and 5GS integration with TSN (for 5GC).....	94
5.26.1	General.....	94
5.26.2	5GS Bridge management.....	94
5.26.3	Transfer of 5GS bridge and port management information.....	94
5.26.4	Reporting clock drift between External and 5GS times from UPF to SMF.....	95
5.27	Inter-PLMN User Plane Security.....	95
5.28	Downlink data delivery status with UPF buffering (for 5GC).....	96
5.28.1	General.....	96
5.29	Support Reliable Data Service.....	96
5.30	Notifying Start Pause of Charging.....	97
5.31	Support of L2TP.....	98
5.31.1	General.....	98
5.31.2	L2TP Tunnel and L2TP Session Setup.....	98
5.31.3	L2TP Session and L2TP Tunnel Release.....	99
5.32	Support of Uplink packets buffering.....	100
5.32.1	General.....	100
5.32.2	Uplink packets buffering for on-line charging.....	100
5.32.3	Uplink packets buffering during EAS relocation.....	100
5.33	Support of enhancement of Edge Computing (for 5GC).....	100
5.33.1	General.....	100
5.33.2	Uplink packet buffering for low packet loss during EAS relocation.....	100
5.33.3	Edge Relocation using EAS IP address and Port number Replacement.....	100
5.33.4	EAS Discovery procedure with Local DNS Server/Resolver.....	101
5.33.5	Direct Reporting of QoS monitoring events to Local NEF or AF.....	101
5.34	Support of 5G Multicast and Broadcast Service.....	101
5.34.1	General.....	101
5.34.2	N4mb requirements.....	102
5.34.2.1	General.....	102
5.34.2.2	Instructing the MB-UPF to forward MBS data using multicast and/or unicast transport.....	102
5.34.2.3	Detecting and reporting user plane (in)activity of an MBS session.....	103
5.34.2.4	Activation and Deactivation of a Multicast MBS session.....	103
5.34.3	N4 requirements.....	104
5.34.3.1	General.....	104
5.34.3.2	Instructing the UPF to forward (or stop forwarding) multicast MBS data to associated PDU sessions.....	104
5.34.3.3	Instructing a combined UPF/MBS-UPF to forward multicast MBS data to associated PDU sessions.....	106
5.35	Support of Per Slice UP Resource Allocation and Usage Reporting by the UP Function.....	107
5.35.1	General.....	107
5.36	Paging Policy Indicator Provisioning.....	108
5.36.1	General.....	108
5.36.2	Enhanced Paging Policy Indicator Provisioning.....	108
6	Procedures.....	109
6.1	Introduction.....	109
6.2	PFCP Node Related Procedures.....	109
6.2.1	General.....	109
6.2.2	Heartbeat Procedure.....	109
6.2.2.1	General.....	109
6.2.2.2	Heartbeat Request.....	109

6.2.2.3	Heartbeat Response	109
6.2.3	Load Control Procedure	109
6.2.3.1	General	109
6.2.3.2	Principles.....	110
6.2.3.3	Load Control Information	110
6.2.3.3.1	General Description.....	110
6.2.3.3.2	Parameters	111
6.2.3.3.3	Frequency of Inclusion	111
6.2.4	Overload Control Procedure	112
6.2.4.1	General	112
6.2.4.2	Principles.....	112
6.2.4.3	Overload Control Information.....	113
6.2.4.3.1	General Description.....	113
6.2.4.3.2	Parameters	113
6.2.4.3.3	Frequency of Inclusion	115
6.2.4.4	Message Throttling.....	115
6.2.4.4.1	General	115
6.2.4.4.2	Throttling algorithm – "Loss".....	116
6.2.4.5	Message Prioritization.....	116
6.2.4.5.1	Description	116
6.2.4.5.2	Based on the Message Priority Signalled in the PFCP Message	117
6.2.5	PFCP PFD Management Procedure.....	117
6.2.5.1	General	117
6.2.5.2	CP Function Behaviour	117
6.2.5.3	UP Function Behaviour.....	117
6.2.6	PFCP Association Setup Procedure	118
6.2.6.1	General	118
6.2.6.2	PFCP Association Setup Initiated by the CP Function	118
6.2.6.2.1	CP Function Behaviour	118
6.2.6.2.2	UP Function behaviour.....	119
6.2.6.3	PFCP Association Setup Initiated by the UP Function	119
6.2.6.3.1	UP Function Behaviour	119
6.2.6.3.2	CP Function Behaviour	120
6.2.7	PFCP Association Update Procedure.....	120
6.2.7.1	General	120
6.2.7.2	PFCP Association Update Procedure Initiated by the CP Function	120
6.2.7.2.1	CP Function Behaviour	120
6.2.7.2.2	UP Function Behaviour	120
6.2.7.3	PFCP Association Update Procedure Initiated by UP Function.....	121
6.2.7.3.1	UP Function Behaviour	121
6.2.7.3.2	CP Function Behaviour	121
6.2.8	PFCP Association Release Procedure.....	122
6.2.8.1	General	122
6.2.8.2	CP Function Behaviour	122
6.2.8.3	UP Function behaviour	122
6.2.9	PFCP Node Report Procedure	122
6.2.9.1	General	122
6.2.9.2	UP Function Behaviour.....	122
6.2.9.3	CP Function behaviour.....	122
6.3	PFCP Session Related Procedures.....	123
6.3.1	General.....	123
6.3.2	PFCP Session Establishment Procedure	123
6.3.2.1	General	123
6.3.2.2	CP Function Behaviour	123
6.3.2.3	UP Function Behaviour.....	123
6.3.3	PFCP Session Modification Procedure	123
6.3.3.1	General	123
6.3.3.2	CP Function behaviour.....	124
6.3.3.3	UP Function Behaviour.....	124
6.3.4	PFCP Session Deletion Procedure	124
6.3.4.1	General	124
6.3.4.2	CP Function Behaviour	124

6.3.4.3	UP Function Behaviour.....	125
6.3.5	PFCP Session Report Procedure.....	125
6.3.5.1	General.....	125
6.3.5.2	UP Function Behaviour.....	125
6.3.5.3	CP Function Behaviour.....	125
6.4	Reliable Delivery of PFCP Messages.....	125
6.5	PFCP messages bundling.....	126
7	Messages and Message Formats.....	127
7.1	Transmission Order and Bit Definitions.....	127
7.2	Message Format.....	127
7.2.1	General.....	127
7.2.1A	PFCP messages bundled in one UDP/IP packet.....	127
7.2.2	Message Header.....	128
7.2.2.1	General Format.....	128
7.2.2.2	PFCP Header for Node Related Messages.....	128
7.2.2.3	PFCP Header for Session Related Messages.....	129
7.2.2.4	Usage of the PFCP Header.....	129
7.2.2.4.1	General.....	129
7.2.2.4.2	Conditions for Sending SEID=0 in PFCP Header.....	130
7.2.3	Information Elements.....	130
7.2.3.1	General.....	130
7.2.3.2	Presence Requirements of Information Elements.....	130
7.2.3.3	Grouped Information Elements.....	131
7.2.3.4	Information Element Type.....	132
7.3	Message Types.....	132
7.4	PFCP Node Related Messages.....	133
7.4.1	General.....	133
7.4.2	Heartbeat Messages.....	133
7.4.2.1	Heartbeat Request.....	133
7.4.2.2	Heartbeat Response.....	134
7.4.3	PFCP PFD Management.....	134
7.4.3.1	PFCP PFD Management Request.....	134
7.4.3.2	PFCP PFD Management Response.....	135
7.4.4	PFCP Association messages.....	136
7.4.4.1	PFCP Association Setup Request.....	136
7.4.4.1.1	General.....	136
7.4.4.1.2	Clock Drift Control Information IE within PFCP Association Setup Request.....	138
7.4.4.1.3	GTP-U Path QoS Control Information IE within PFCP Association Setup Request.....	139
7.4.4.2	PFCP Association Setup Response.....	141
7.4.4.3	PFCP Association Update Request.....	144
7.4.4.3.1	UE IP Address Usage Information IE within PFCP Association Update Request.....	146
7.4.4.4	PFCP Association Update Response.....	148
7.4.4.5	PFCP Association Release Request.....	148
7.4.4.6	PFCP Association Release Response.....	148
7.4.4.7	PFCP Version Not Supported Response.....	148
7.4.5	PFCP Node Report Procedure.....	149
7.4.5.1	PFCP Node Report Request.....	149
7.4.5.1.1	General.....	149
7.4.5.1.2	User Plane Path Failure Report IE within PFCP Node Report Request.....	149
7.4.5.1.3	User Plane Path Recovery Report IE within PFCP Node Report Request.....	150
7.4.5.1.4	Clock Drift Report IE within PFCP Node Report Request.....	150
7.4.5.1.5	GTP-U Path QoS Report IE within PFCP Node Report Request.....	150
7.4.5.1.6	QoS Information in GTP-U Path QoS Report IE.....	151
7.4.5.1.7	Peer UP Restart Report IE within PFCP Node Report Request.....	151
7.4.5.1.7	Peer UP Restart Report IE within PFCP Node Report Request.....	151
7.4.5.2	PFCP Node Report Response.....	152
7.4.5.2.1	General.....	152
7.4.6	PFCP Session Set Deletion.....	152
7.4.6.1	PFCP Session Set Deletion Request.....	152
7.4.6.2	PFCP Session Set Deletion Response.....	152
7.4.7	PFCP Session Set Modification.....	153

7.4.7.1	PFCP Session Set Modification Request.....	153
7.4.7.2	PFCP Session Set Modification Response	154
7.5	PFCP Session Related Messages.....	155
7.5.1	General.....	155
7.5.2	PFCP Session Establishment Request.....	155
7.5.2.1	General	155
7.5.2.2	Create PDR IE within PFCP Session Establishment Request	161
7.5.2.3	Create FAR IE within PFCP Session Establishment Request	168
7.5.2.4	Create URR IE within PFCP Session Establishment Request	174
7.5.2.5	Create QER IE within PFCP Session Establishment Request	179
7.5.2.6	Create BAR IE within PFCP Session Establishment Request	183
7.5.2.7	Create Traffic Endpoint IE within PFCP Session Establishment Request	184
7.5.2.8	Create MAR IE within PFCP Session Establishment Request.....	187
7.5.2.9	Create SRR IE within PFCP Session Establishment Request	188
7.5.2.10	Provide ATSSS Control Information IE within PFCP Session Establishment Request.....	191
7.5.2.11	Provide RDS Configuration Information IE within PFCP Session Establishment Request.....	191
7.5.3	PFCP Session Establishment Response	191
7.5.3.1	General	191
7.5.3.2	Created PDR IE within PFCP Session Establishment Response	194
7.5.3.3	Load Control Information IE within PFCP Session Establishment Response	195
7.5.3.4	Overload Control Information IE within PFCP Session Establishment Response	195
7.5.3.5	Created Traffic Endpoint IE within PFCP Session Establishment Response.....	195
7.5.3.6	Created Bridge Info for TSC IE within PFCP Session Establishment Response	196
7.5.3.7	ATSSS Control Parameters IE within PFCP Session Establishment Response	196
7.5.3.8	Void.....	197
7.5.4	PFCP Session Modification Request	198
7.5.4.1	General	198
7.5.4.2	Update PDR IE within PFCP Session Modification Request.....	203
7.5.4.3	Update FAR IE within PFCP Session Modification Request.....	204
7.5.4.4	Update URR IE within PFCP Session Modification Request	207
7.5.4.5	Update QER IE within PFCP Session Modification Request	211
7.5.4.6	Remove PDR IE within PFCP Session Modification Request.....	214
7.5.4.7	Remove FAR IE within PFCP Session Modification Request.....	214
7.5.4.8	Remove URR IE within PFCP Session Modification Request	214
7.5.4.9	Remove QER IE PFCP Session Modification Request.....	214
7.5.4.11	Update BAR IE within PFCP Session Modification Request	215
7.5.4.12	Remove BAR IE within PFCP Session Modification Request	216
7.5.4.13	Update Traffic Endpoint IE within PFCP Session Modification Request.....	216
7.5.4.14	Remove Traffic Endpoint IE within PFCP Session Modification Request	218
7.5.4.15	Remove MAR IE within PFCP Session Modification Request	218
7.5.4.16	Update MAR IE within PFCP Session Modification Request	218
7.5.4.17	Create PDR/FAR/URR/QER/BAR/MAR IEs within PFCP Session Modification Request.....	220
7.5.4.18	TSC Management Information IE within PFCP Session Modification Request.....	220
7.5.4.19	Remove SRR IE within PFCP Session Modification Request	220
7.5.4.20	Update SRR IE within PFCP Session Modification Request.....	220
7.5.4.21	Ethernet Context Information within PFCP Session Modification Request.....	221
7.5.4.22	Query Packet Rate Status IE within PFCP Session Modification Request	221
7.5.5	PFCP Session Modification Response.....	222
7.5.5.1	General	222
7.5.5.2	Usage Report IE within PFCP Session Modification Response.....	225
7.5.5.3	TSC Management Information IE within PFCP Session Modification Response	225
7.5.5.4	Packet Rate Status Report IE within PFCP Session Modification Response	226
7.5.5.5	Updated PDR IE within PFCP Session Modification Response	226
7.5.6	PFCP Session Deletion Request	227
7.5.7	PFCP Session Deletion Response.....	227
7.5.7.1	General	227
7.5.7.2	Usage Report IE within PFCP Session Deletion Response.....	229
7.5.8	PFCP Session Report Request	229
7.5.8.1	General	229
7.5.8.2	Downlink Data Report IE within PFCP Session Report Request.....	231
7.5.8.3	Usage Report IE within PFCP Session Report Request.....	232
7.5.8.4	Error Indication Report IE within PFCP Session Report Request	235

7.5.8.5	TSC Management Information IE within PFCP Session Report Request.....	235
7.5.8.6	Session Report IE within PFCP Session Report Request.....	236
7.5.9	PFCP Session Report Response.....	237
7.5.9.1	General.....	237
7.5.9.2	Update BAR IE within PFCP Session Report Response.....	239
7.6	Error Handling.....	239
7.6.1	Protocol Errors.....	239
7.6.2	Different PFCP Versions.....	240
7.6.3	PFCP Message of Invalid Length.....	240
7.6.4	Unknown PFCP Message.....	240
7.6.5	Unexpected PFCP Message.....	240
7.6.6	Missing Information Elements.....	240
7.6.7	Invalid Length Information Element.....	241
7.6.8	Semantically incorrect Information Element.....	241
7.6.9	Unknown or unexpected Information Element.....	241
7.6.10	Repeated Information Elements.....	242
8	Information Elements.....	242
8.1	Information Elements Format.....	242
8.1.1	Information Element Format.....	242
8.1.2	Information Element Types.....	243
8.2	Information Elements.....	250
8.2.1	Cause.....	250
8.2.2	Source Interface.....	253
8.2.3	F-TEID.....	253
8.2.4	Network Instance.....	254
8.2.5	SDF Filter.....	254
8.2.6	Application ID.....	256
8.2.7	Gate Status.....	256
8.2.8	MBR.....	257
8.2.9	GBR.....	257
8.2.10	QER Correlation ID.....	257
8.2.11	Precedence.....	258
8.2.12	Transport Level Marking.....	258
8.2.13	Volume Threshold.....	258
8.2.14	Time Threshold.....	259
8.2.15	Monitoring Time.....	259
8.2.16	Subsequent Volume Threshold.....	260
8.2.17	Subsequent Time Threshold.....	260
8.2.18	Inactivity Detection Time.....	261
8.2.19	Reporting Triggers.....	261
8.2.20	Redirect Information.....	262
8.2.21	Report Type.....	263
8.2.22	Offending IE.....	264
8.2.23	Forwarding Policy.....	264
8.2.24	Destination Interface.....	264
8.2.25	UP Function Features.....	265
8.2.26	Apply Action.....	269
8.2.27	Downlink Data Service Information.....	270
8.2.28	Downlink Data Notification Delay.....	271
8.2.29	DL Buffering Duration.....	271
8.2.30	DL Buffering Suggested Packet Count.....	272
8.2.31	PFCPSMReq-Flags.....	272
8.2.32	PFCPSRRsp-Flags.....	273
8.2.33	Sequence Number.....	273
8.2.34	Metric.....	273
8.2.35	Timer.....	274
8.2.36	Packet Detection Rule ID (PDR ID).....	274
8.2.37	F-SEID.....	275
8.2.38	Node ID.....	275
8.2.39	PFD Contents.....	276
8.2.40	Measurement Method.....	278

8.2.41	Usage Report Trigger.....	278
8.2.42	Measurement Period	280
8.2.43	Fully qualified PDN Connection Set Identifier (FQ-CSID).....	280
8.2.44	Volume Measurement.....	282
8.2.45	Duration Measurement	282
8.2.46	Time of First Packet.....	283
8.2.47	Time of Last Packet	283
8.2.48	Quota Holding Time	283
8.2.49	Dropped DL Traffic Threshold.....	283
8.2.50	Volume Quota.....	284
8.2.51	Time Quota	285
8.2.52	Start Time	285
8.2.53	End Time	285
8.2.54	URR ID.....	285
8.2.55	Linked URR ID IE.....	286
8.2.56	Outer Header Creation	286
8.2.57	BAR ID.....	288
8.2.58	CP Function Features.....	288
8.2.59	Usage Information	289
8.2.60	Application Instance ID	290
8.2.61	Flow Information	290
8.2.62	UE IP Address	290
8.2.63	Packet Rate	291
8.2.64	Outer Header Removal	293
8.2.65	Recovery Time Stamp	294
8.2.66	DL Flow Level Marking	295
8.2.67	Header Enrichment	295
8.2.68	Measurement Information.....	296
8.2.69	Node Report Type.....	297
8.2.70	Remote GTP-U Peer	297
8.2.71	UR-SEQN.....	298
8.2.72	Activate Predefined Rules	298
8.2.73	Deactivate Predefined Rules.....	299
8.2.74	FAR ID	299
8.2.75	QER ID	299
8.2.76	OCI Flags.....	299
8.2.77	PFCP Association Release Request.....	300
8.2.78	Graceful Release Period.....	300
8.2.79	PDN Type	301
8.2.80	Failed Rule ID.....	301
8.2.81	Time Quota Mechanism.....	302
8.2.82	Void	303
8.2.83	User Plane Inactivity Timer	303
8.2.84	Multiplier	303
8.2.85	Aggregated URR ID IE.....	303
8.2.86	Subsequent Volume Quota	303
8.2.87	Subsequent Time Quota.....	304
8.2.88	RQI	304
8.2.89	QFI.....	305
8.2.90	Query URR Reference	305
8.2.91	Additional Usage Reports Information.....	305
8.2.92	Traffic Endpoint ID	306
8.2.93	MAC address	306
8.2.94	C-TAG (Customer-VLAN tag).....	306
8.2.95	S-TAG (Service-VLAN tag).....	307
8.2.96	Ethertype.....	308
8.2.97	Proxying.....	308
8.2.98	Ethernet Filter ID.....	308
8.2.99	Ethernet Filter Properties	309
8.2.100	Suggested Buffering Packets Count.....	309
8.2.101	User ID	309
8.2.102	Ethernet PDU Session Information.....	311

8.2.103	MAC Addresses Detected.....	311
8.2.104	MAC Addresses Removed.....	312
8.2.105	Ethernet Inactivity Timer.....	312
8.2.106	Subsequent Event Quota.....	313
8.2.107	Subsequent Event Threshold.....	313
8.2.108	Trace Information.....	313
8.2.109	Framed-Route.....	314
8.2.110	Framed-Routing.....	314
8.2.111	Framed-IPv6-Route.....	314
8.2.112	Event Quota.....	314
8.2.113	Event Threshold.....	315
8.2.114	Time Stamp.....	315
8.2.115	Averaging Window.....	315
8.2.116	Paging Policy Indicator (PPI).....	316
8.2.117	APN/DNN.....	316
8.2.118	3GPP Interface Type.....	316
8.2.119	PFCPSRReq-Flags.....	317
8.2.120	PFCPAUReq-Flags.....	318
8.2.121	Activation Time.....	318
8.2.122	Deactivation Time.....	319
8.2.123	MAR ID.....	319
8.2.124	Steering Functionality.....	319
8.2.125	Steering Mode.....	320
8.2.126	Weight.....	320
8.2.127	Priority.....	320
8.2.128	UE IP address Pool Identity.....	321
8.2.129	Alternative SMF IP Address.....	321
8.2.130	Packet Replication and Detection Carry-On Information.....	322
8.2.131	SMF Set ID.....	322
8.2.132	Quota Validity Time.....	323
8.2.133	Number of Reports.....	323
8.2.134	PFCPASRsp-Flags.....	323
8.2.135	CP PFCP Entity IP Address.....	324
8.2.136	PFCPSEReq-Flags.....	324
8.2.137	IP Multicast Address.....	324
8.2.138	Source IP Address.....	325
8.2.139	Packet Rate Status.....	326
8.2.140	Create Bridge Info for TSC IE.....	327
8.2.141	DS-TT Port Number.....	327
8.2.142	NW-TT Port Number.....	327
8.2.143	5GS User Plane Node.....	328
8.2.144	Port Management Information Container.....	328
8.2.145	Requested Clock Drift Information.....	328
8.2.146	Time Domain Number.....	329
8.2.147	Time Offset Threshold.....	329
8.2.148	Cumulative rateRatio Threshold.....	329
8.2.149	Time Offset Measurement.....	330
8.2.150	Cumulative rateRatio Measurement.....	330
8.2.151	SRR ID.....	330
8.2.152	Requested Access Availability Information.....	331
8.2.153	Access Availability Information.....	331
8.2.154	MPTCP Control Information.....	332
8.2.155	ATSSS-LL Control Information.....	332
8.2.156	PMF Control Information.....	332
8.2.157	MPTCP Address Information.....	333
8.2.158	UE Link-Specific IP Address.....	333
8.2.159	PMF Address Information.....	334
8.2.160	ATSSS-LL Information.....	335
8.2.161	Data Network Access Identifier.....	335
8.2.162	Average Packet Delay.....	335
8.2.163	Minimum Packet Delay.....	336
8.2.164	Maximum Packet Delay.....	336

8.2.165	QoS Report Trigger	336
8.2.166	GTP-U Path Interface Type	337
8.2.167	Requested QoS Monitoring	337
8.2.168	Reporting Frequency.....	338
8.2.169	Packet Delay Thresholds	338
8.2.170	Minimum Wait Time	339
8.2.171	QoS Monitoring Measurement	339
8.2.172	MT-EDT Control Information	340
8.2.173	DL Data Packets Size	340
8.2.174	QER Control Indications	340
8.2.175	NF Instance ID.....	341
8.2.176	S-NSSAI	341
8.2.177	IP version.....	341
8.2.178	PFCPASReq-Flags	342
8.2.179	Data Status.....	342
8.2.180	RDS Configuration Information	342
8.2.181	MPTCP Applicable Indication.....	343
8.2.182	User Plane Node Management Information Container	343
8.2.183	Number of UE IP Addresses.....	343
8.2.184	Validity Timer	344
8.2.185	Offending IE Information	344
8.2.186	RAT Type	344
8.2.187	L2TP User Authentication.....	345
8.2.188	LNS Address.....	346
8.2.189	Tunnel Preference	346
8.2.190	Calling Number	346
8.2.191	Called Number.....	347
8.2.192	L2TP Session Indications	347
8.2.193	DNS Server Address	347
8.2.194	NBNS Server Address	348
8.2.195	Maximum Receive Unit.....	348
8.2.196	Thresholds.....	348
8.2.197	Steering Mode Indicator	349
8.2.198	Group Id.....	349
8.2.199	CP IP Address.....	349
8.2.200	IP Address and Port Number Replacement.....	350
8.2.201	DNS Query Filter.....	351
8.2.202	Event Notification URI.....	351
8.2.203	Notification Correlation ID.....	351
8.2.204	Reporting Flags.....	352
8.2.205	Predefined Rules Name	352
8.2.206	MBS Session Identifier.....	352
8.2.207	Multicast Transport Information.....	353
8.2.208	MBSN4mbReq-Flags.....	354
8.2.209	Local Ingress Tunnel	354
8.2.210	MBS Unicast Parameters ID	355
8.2.211	MBSN4Resp-Flags	355
8.2.212	Tunnel Password.....	356
8.2.213	Area Session ID	356
8.2.214	DSCP to PPI Mapping Information	356
8.2.215	PFCPSDRsp-Flags.....	357
8.2.216	QER Indications.....	357
8.2.217	Vendor-Specific Node Report Type	357
8.2.218	Configured Time Domain.....	358

Annex A (Informative): PFCP Load and Overload Control Mechanism.....359

A.1	Throttling Algorithms.....	359
A.1.1	"Loss" Throttling Algorithm	359
A.1.1.1	Example of Possible Implementation	359