**3GPP TSG-WG SA2 Meeting #154  *S2-2210849***

**Toulouse, France, Nov 14 – 18, 2022**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.503** | **CR** | **0791** | **rev** | **-** | **Current version:** | **17.6.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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| ***Title:*** | QoS Monitoring for dynamic satellite backhaul delay control | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Samsung, CATT | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5GSATB | | | | |  | ***Date:*** | | | 2022-11-14 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | It is concluded in clause 8.1 of TS 23.700-27 on PCC/QoS control enhancement considering dynamic satellite backhaul. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * Introduce policy control request triggers to detect in PCF that dynamic satellite backhaul is used to serve the PDU session. * Policy control and PCC decision by considering the dynamic satellite backhaul delay measured in GTP-U path. * PCC rule information for QoS Monitoring for dynamic satellite backhaul control. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | QoS monitoring to measure the packet delivery latency on N3 interface for a PDU session which is carried over satellite backhaul with dynamic delay is not supported. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.1.3.5, 6.1.3.6, 6.2.1.2, 6.3.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **x** |  | Other core specifications | | | | TS 23.501 CR 3816  TS 23.502 CR 3653 | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

\* \* \* \* First change \* \* \* \*

#### 6.1.3.5 Policy Control Request Triggers relevant for SMF

The Policy Control Request Triggers relevant for SMF define the conditions when the SMF shall interact again with PCF after a PDU Session establishment as defined in the Session Management Policy Establishment and Session Management Policy Modification procedure as defined in TS 23.502 [3].

The PCR triggers are not applicable any longer at termination of the SM Policy Association.

The access independent Policy Control Request Triggers relevant for SMF are listed in table 6.1.3.5-1.

The differences with table 6.2 and table A.4.3-2 in TS 23.203 [4] are shown, either "none" means that the parameter applies in 5GS or "removed" meaning that the parameter does not apply in 5GS, this is due to the lack of support in the 5GS for this feature or "modified" meaning that the parameter applies with some modifications defined in the parameter.

Table 6.1.3.5-1: Access independent Policy Control Request Triggers relevant for SMF

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Policy Control Request Trigger | Description | Difference compared with table 6.2 and table A.4.3-2 in TS 23.203 [4] | Conditions for reporting | Motivation |
| PLMN change | The UE has moved to another operators' domain. | None | PCF |  |
| QoS change | The QoS parameters of the QoS Flow has changed. | Removed |  | Only applicable when binding of bearers was done in PCRF. |
| QoS change exceeding authorization | The QoS parameters of the QoS Flow has changed and exceeds the authorized QoS. | Removed |  | Only applicable when binding of bearers was done in PCRF. |
| Traffic mapping information change | The traffic mapping information of the QoS profile has changed. | Removed |  | Only applicable when binding of bearers was done in PCRF. |
| Resource modification request | A request for resource modification has been received by the SMF. | None | SMF always reports to PCF |  |
| Routing information change | The IP flow mobility routing information has changed (when IP flow mobility as specified in TS 23.261 [11] applies) or the PCEF has received Routing Rules from the UE (when NBIFOM as specified in TS 23.161 [10] applies). | Removed |  | Not in 5GS yet. |
| Change in Access Type  (NOTE 8) | The Access Type and, if applicable, the RAT Type of the PDU Session has changed. | None | PCF |  |
| EPS Fallback | EPS fallback is initiated | Added | PCF |  |
| Loss/recovery of transmission resources | The Access type transmission resources are no longer usable/again usable. | Removed |  | Not in 5GS yet. |
| Location change (serving cell)  (NOTE 6) | The serving cell of the UE has changed. | None | PCF |  |
| Location change (serving area)  (NOTE 2) | The serving area of the UE has changed. | None | PCF |  |
| Location change  (serving CN node)  (NOTE 3) | The serving core network node of the UE has changed. | None | PCF |  |
| Change of UE presence in Presence Reporting Area (see NOTE 1) | The UE is entering/leaving a Presence Reporting Area. | None | PCF | Only applicable to PCF |
| Out of credit | Credit is no longer available. | None | PCF |  |
| Reallocation of credit | Credit has been reallocated after the former Out of credit indication. | Added | PCF |  |
| Enforced PCC rule request | SMF is performing a PCC rules request as instructed by the PCF. | None | PCF |  |
| Enforced ADC rule request | TDF is performing an ADC rules request as instructed by the PCRF. | Removed |  | ADC Rules are not applicable. |
| UE IP address change | A UE IP address has been allocated/released. | None | SMF always reports allocated or released UE IP addresses |  |
| UE MAC address change | A new UE MAC address is detected or a used UE MAC address is inactive for a specific period. | New | PCF |  |
| Access Network Charging Correlation Information | Access Network Charging Correlation Information has been assigned. | None | PCF |  |
| Usage report  (NOTE 4) | The PDU Session or the Monitoring key specific resources consumed by a UE either reached the threshold or needs to be reported for other reasons. | None | PCF |  |
| Start of application traffic detection and  Stop of application traffic detection  (NOTE 5) | The start or the stop of application traffic has been detected. | None | PCF |  |
| SRVCC CS to PS handover | A CS to PS handover has been detected. | Removed |  | No support in 5GS yet |
| Access Network Information report | Access information as specified in the Access Network Information Reporting part of a PCC rule. | None | PCF |  |
| Credit management session failure | Transient/Permanent failure as specified by the CHF. | None | PCF |  |
| Addition / removal of an access to an IP-CAN session | The PCEF reports when an access is added or removed. | Removed |  | No support in 5GS yet |
| Change of usability of an access | The PCEF reports that an access becomes unusable or usable again. | Removed |  | No support in 5GS yet |
| 3GPP PS Data Off status change | The SMF reports when the 3GPP PS Data Off status changes. | None | SMF always reports to PCF |  |
| Session AMBR change | The Session-AMBR has changed. | Added | SMF always reports to PCF |  |
| Default QoS change | The subscribed QoS has changed. | Added | SMF always reports to PCF |  |
| Removal of PCC rule | The SMF reports when the PCC rule is removed. | Added | SMF always reports to PCF |  |
| Successful resource allocation | The SMF reports to the PCF that the resources for a PCC rule have been successfully allocated. | Added | PCF |  |
| GFBR of the QoS Flow can no longer (or can again) be guaranteed | The SMF notifies the PCF when receiving notifications from RAN that GFBR of the QoS Flow can no longer (or can again) be guaranteed. | Added |  |  |
| UE resumed from suspend state | The SMF reports to the PCF when it detects that the UE is resumed from suspend state. | None | PCF | Only applicable to EPC IWK |
| Change of DN Authorization Profile Index | The DN Authorization Profile Index received from DN-AAA has changed. | Added | SMF always reports to PCF |  |
| 5GS Bridge information available | SMF has detected new 5GS Bridge information, which may contain, user-plane Node ID, UE-DS-TT residence time and Ethernet port (port number and MAC address) or IP address for the PDU Session and/or PMIC and/or UMIC. | Added | PCF |  |
| QoS Monitoring for URLLC | The SMF notifies the PCF of the QoS Monitoring information (e.g. UL packet delay, DL packet delay or round trip packet delay). | Added | PCF |  |
| DDN Failure event Subscription with Traffic Descriptor | The SMF requests PCF to provide or remove policies if it received an event subscription or cancellation for DDN Failure event including traffic descriptors. The SMF provides the traffic descriptors to the PCF for policy evaluation. | Added | PCF |  |
| DDD Status event Subscription with Traffic Descriptor | The SMF requests PCF to provide or remove policies if it received an event subscription or cancellation for DDD Status event including traffic descriptors. The SMF provides the traffic descriptors and the requested type(s) of notifications (notifications about downlink packets being buffered, and/or discarded) to the PCF for policy evaluation. | Added | PCF |  |
| QoS constraints change | The QoS constraints in the VPLMN have been provided or changed. | Added | SMF always reports to PCF |  |
| Satellite backhaul category change | The backhaul is changed between different satellite backhaul categories, or between satellite backhaul and non-satellite backhaul. | Added | PCF |  |
| NWDAF info change | The NWDAF instance IDs used for the PDU session or associated Analytics IDs used for the PDU session and available in the SMF have changed. | Added | PCF |  |
| Request for notification on SM Policy Association establishment or termination  (NOTE 9) | The SMF reports to the PCF the request to notify on the established or terminated SM Policy Association, | Added | PCF |  |
| Dynamic satellite backhaul in UP detected | The SMF reports to the PCF when the dynamical satellite backhaul is detected based on the satellite backhaul network delay measurement results of GTP-U path monitoring. | Added | PCF |  |
| QoS Monitoring for dynamic satellite backhaul delay control | The SMF notifies the PCF of the QoS Monitoring information (e.g. UL packet delay, DL packet delay, round trip packet delay). | Added | PCF |  |
| NOTE 1: The maximum number of PRA(s) per UE per PDU Session is configured in the PCF. The PCF may have independent configuration of the maximum number for Core Network pre-configured PRAs and UE-dedicated PRAs. The exact number(s) should be determined by operator in deployment.  NOTE 2: This trigger reports change of Tracking Area in both 5GS and EPC interworking, or reports change of Routing Area for GERAN/UTRAN access (see Annex G of TS 23.502 [3]).  NOTE 3: This trigger reports change of AMF in 5GC, change between ePDG and Serving GW in EPC, change between Serving GWs in EPC, change between EPC and 5GC, change between Serving Gateway and SGSN in GERAN/UTRAN from/to E-UTRAN mobility, or change between SGSNs in the case of GERAN/UTRAN access. In HR roaming case, if the AMF change is unknown by the H-SMF, then the AMF change is not reported.  NOTE 4: Usage is defined as either volume or time of user plane traffic.  NOTE 5: The start and stop of application traffic detection are separate event triggers, but received under the same subscription from the PCF.  NOTE 6: Location change of serving cell can increase signalling load on multiple interfaces. Hence it is recommended that any such serving cell changes only applied for a limited number of subscribers avoiding extra signalling load. It also is applicable for GERAN/UTRAN access.  NOTE 7: Void.  NOTE 8: For 3GPP access the RAT type may refer to NR, E-UTRAN, and, when the SMF+PGW-C enhancements to support GERAN/UTRAN access via Gn/Gp interface as specified in Annex L of TS 23.501 [2] apply, to UTRAN or GERAN. For MA PDU Session this trigger reports the current used Access Type(s) and RAT type(s) upon any change of Access Type and RAT type.  NOTE 9: The PCF for the PDU Session knows the change of the PCF for the UE by this Policy Control Request Trigger based on the associated binding information of and notifies the PCF for the UE as described in clause 6.1.3.18. | | | | |

NOTE 1: In the following description of the access independent Policy Control Request Triggers relevant for SMF, the term trigger is used instead of Policy Control Request Trigger where appropriate.

When the EPS Fallback trigger is armed by the PCF, the SMF shall report the event to the PCF when a QoS Flow with 5QI=1 is rejected due to EPS Fallback.

When the Location change trigger is armed, the SMF shall subscribe to the AMF for reports on changes in location to the level indicated by the trigger. If credit-authorization triggers and Policy Control Request Triggers require different levels of reporting of location change for a single UE, the location to be reported should be changed to the highest level of detail required. However, there should be no request being triggered for PCC rules update to the PCF if the report received is more detailed than requested by the PCF.

NOTE 2: The access network may be configured to report location changes only when transmission resources are established in the radio access network.

The Resource modification request trigger shall trigger the PCF interaction for all resource modification requests not tied to a specific QoS Flow received by SMF. The resource modification request received by SMF may include request for guaranteed bit rate changes for a traffic aggregate and/or the association/disassociation of the traffic aggregate with a 5QI and/or a modification of the traffic aggregate.

The enforced PCC rule request trigger shall trigger a SMF interaction to request PCC rules from the PCF for an established PDU Session. This SMF interaction shall take place within the Revalidation time limit set by the PCF in the PDU Session related policy information. The SMF reports that the enforced PCC rule request trigger was met and the enforced PCC Rules.

NOTE 3: The enforced PCC rule request trigger can be used to avoid signalling overload situations e.g. due to time of day based PCC rule changes.

The UE IP address change trigger shall trigger a SMF interaction with the PCF if a UE IP address is allocated or released during the lifetime of the PDU Session. The SMF reports that the UE IP address change trigger was met and the new or released UE IP address.

The UE MAC address change trigger shall trigger a SMF interaction with the PCF if a new UE MAC address is detected or a used UE MAC address is inactive for a specific period during the lifetime of the Ethernet type PDU Session. The SMF reports that the UE MAC address change trigger was met and the new or released UE MAC address.

NOTE 4: The SMF instructs the UPF to detect new UE MAC addresses or used UE MAC address is inactive for a specific period as described in TS 23.501 [2].

The Access Network Charging Correlation Information trigger shall trigger the SMF to report the assigned access network charging identifier for the PCC rules that are accompanied with a request for this trigger at activation. The SMF reports that the Access Network Charging Correlation Information trigger was met and the Access Network Charging Correlation Information.

If the Usage report trigger is set and the volume or the time thresholds, earlier provided by the PCF, are reached, the SMF shall report this situation to the PCF. If both volume and time thresholds were provided and the thresholds, for one of the measurements, are reached, the SMF shall report this situation to the PCF and the accumulated usage since last report shall be reported for both measurements.

The management of the Presence Reporting Area (PRA) functionality enables the PCF to subscribe to reporting change of UE presence in a particular Presence Reporting Area.

NOTE 5: PCF decides whether to subscribe to AMF or to SMF for those triggers that are present in both tables 6.1.2.5-2 and 6.1.3.5-1. If the Change of UE presence in Presence Reporting Area trigger is available on both AMF and SMF, PCF should not subscribe to both AMF and SMF simultaneously.

Upon every interaction with the SMF, the PCF may activate / deactivate reporting changes of UE presence in Presence Reporting Area by setting / unsetting the corresponding trigger by providing the PRA Identifier(s) and additionally the list(s) of elements comprising the Presence Reporting Area for UE-dedicated Presence Reporting Area(s).

The SMF shall subscribe to the UE Location Change notification from the AMF by providing an area of interest containing the PRA Identifier(s) and additionally the list(s) of elements provided by the PCF as specified in clause 5.6.11 of TS 23.501 [2] and in clause 5.2.2.3.1 of TS 23.502 [3].

When the Change of UE presence in Presence Reporting Area trigger is armed, i.e. when the PCF subscribes to reporting change of UE presence in a particular Presence Reporting Area and the reporting change of UE presence in this Presence Reporting Area was not activated before, the SMF subscribes to the UE mobility event notification service provided by the AMF for reporting of UE presence in Area of Interest which reports when the UE enters or leaves a Presence Reporting Area (an initial report is received when the PDU Session specific procedure is activated). The SMF reports the PRA Identifier(s) and indication(s) whether the UE is inside or outside the Presence Reporting Area(s), and indication(s) if the corresponding Presence Reporting Area(s) is set to inactive by the AMF to the PCF.

NOTE 6: The serving node (i.e. AMF in 5GC or MME in EPC/EUTRAN) can activate the reporting for the PRAs which are inactive as described in the TS 23.501 [2].

When PCF modifies the list of PRA id(s) to change of UE presence in Presence Reporting Area for a particular Presence Reporting Area(s), the SMF removes or adds the PRA id(s) provided in the UE mobility event notification service provided by AMF for reporting of UE presence in Area Of Interest. When the PCF unsubscribes to reporting change of UE presence in Presence reporting Area, the SMF unsubscribes to the UE mobility event notification service provided by AMF for reporting of UE presence in Area Of Interest, unless subscriptions to AMF remains due to other triggers.

The SMF stores PCF subscription to reporting for changes of UE presence in Presence Reporting Area and notifies the PCF with the PRA Identifier(s) and indication(s) whether the UE is inside or outside the Presence Reporting Area(s) based on UE location change notification in area of interest received from the serving node according to the corresponding subscription.

NOTE 7: The SMF can also be triggered by the CHF to subscribe to notification of UE presence in PRA from the AMF, and notifies the CHF when receiving reporting of UE presence in PRA from the AMF, referring to TS 32.291 [20].

If PCF is configured with a PRA identifier referring to the list of PRA Identifier(s) within a Set of Core Network predefined Presence Reporting Areas as defined in TS 23.501 [2], it activates the reporting of UE entering/leaving each individual PRA in the Set of Core Network predefined Presence Reporting Areas, without providing the complete set of individual PRAs.

When a PRA set identified by a PRA Identifier was subscribed to report changes of UE presence in Presence Reporting Area by the PCF, the SMF additionally receives the PRA Identifier of the PRA set from the AMF, along with the individual PRA Identifier(s) belonging to the PRA set and indication(s) of whether the UE is inside or outside the individual Presence Reporting Area(s), as described in TS 23.501 [2].

When the Out of credit detection trigger is set, the SMF shall inform the PCF about the PCC rules for which credit is no longer available together with the applied termination action.

When the Reallocation of credit detection trigger is set, the SMF shall inform the PCF about the PCC rules for which credit has been reallocated after credit was no longer available and the termination action was applied.

The Start of application traffic detection and Stop of application traffic detection triggers shall trigger an interaction with PCF once the requested application traffic is detected (i.e. Start of application traffic detection) or the end of the requested application traffic is detected (i.e. Stop of application traffic detection) unless it is requested within a specific PCC Rule to mute such interaction for solicited application reporting or unconditionally in the case of unsolicited application reporting. The application identifier and service data flow descriptions, if deducible, shall also be included in the report. An application instance identifier shall be included in the report both for Start and for Stop of application traffic detection when service data flow descriptions are deducible. This is done to unambiguously match the Start and the Stop events.

At PCC rule activation, modification and deactivation the SMF shall send, as specified in the PCC rule, the User Location Report and/or UE Timezone Report to the PCF.

NOTE 8: At PCC rule deactivation the User Location Report includes information on when the UE was last known to be in that location.

If the trigger for Access Network Information reporting is set, the SMF shall check the need for access network information reporting after successful installation/modification or removal of a PCC rule or upon termination of the PDU Session. The SMF shall check the Access Network Information report parameters (User Location Report, UE Timezone Report) of the PCC rules and report the access network information to the PCF. The SMF shall not report any subsequent access network information updates received from the PDU Session without any previous updates of related PCC rule unless the associated QoS Flow or PDU Session has been released.

If the SMF receives a request to install/modify or remove a PCC rule with Access Network Information report parameters (User Location Report, UE Timezone Report) set the SMF shall initiate a PDU Session modification to retrieve the current access network information of the UE and forward it to the PCF afterwards.

If the Access Network Information report parameter for the User Location Report is set and the user location (e.g. cell) is not available to the SMF, the SMF shall provide the serving PLMN identifier to the PCF.

The Credit management session failure trigger shall trigger a SMF interaction with the PCF to inform about a credit management session failure and to indicate the failure reason, and the affected PCC rules.

NOTE 9: As a result, the PCF may decide about e.g. PDU Session termination, perform gating of services, switch to offline charging, change rating group, etc.

NOTE 10: The Credit management session failure trigger applies to situations wherein the PDU Session is not terminated by the SMF due to the credit management session failure.

The default QoS change triggers shall trigger the PCF interaction for all changes in the default QoS data received in SMF from the UDM.

The Session AMBR change trigger shall trigger the SMF to provide the Session-AMBR to the PCF containing the DN authorised Session AMBR if received from the DN-AAA, or the Subscribed Session-AMBR received from the UDM as described in clause 5.6.6 of TS 23.501 [2].

The default QoS change trigger reports a change in the default 5QI/ARP retrieved by SMF from UDM, as explained in clause 5.7.2.7 of TS 23.501 [2].

If the PCC Rules bound to a QoS Flow are removed when the corresponding QoS Flow is removed or the PCC rules are failed to be enforced, the SMF shall report this situation to the PCF. The PCF may then provide the same or updated PCC rules for the established PDU Session.

If the trigger for successful resource allocation is set and the PCF has also provided an indication that a specific PCC rule is subject to this trigger, the SMF shall report to the PCF when the resources associated to this PCC rule have been successfully allocated. The SMF shall report resource allocation failure always to the PCF, independently of this trigger.

If the GFBR of the QoS Flow can no longer (or can again) be guaranteed trigger is armed, the SMF shall check the need for reporting to the PCF when the SMF receives an explicit notification from (R)AN indicating that GFBR of the QoS Flow can no longer (or can again) be guaranteed or when the condition described in clause 5.7.2.4 of TS 23.501 [2] is met during the handover. The SMF shall report that GFBR of the QoS Flow can no longer (or can again) be guaranteed accordingly to the PCF for those PCC rules which are bound to the affected QoS Flow and have the QoS Notification Control (QNC) parameter set. If additional information is received with the notification from NG-RAN (see clause 5.7.2.4 of TS 23.501 [2]), the SMF shall also provide to the PCF the reference to the Alternative QoS parameter set corresponding to the Alternative QoS Profile referenced by NG-RAN. If NG-RAN has indicated that the lowest priority Alternative QoS Profile cannot be fulfilled, the SMF shall indicate to the PCF that the lowest priority Alternative QoS parameter set cannot be fulfilled.

In an interworking scenario between 5GS and EPC/E-UTRAN, as explained in clause 4.3 of TS 23.501 [2], the PCF may subscribe via the SMF also to the Policy Control Request Triggers described in clause 6.1.2.5 when the UE is served by the EPC/E-UTRAN.

The change of DN Authorization Profile Index shall trigger a SMF interaction to send DN Authorization Profile Index to retrieve a list of PCC Rules (as defined in clause 6.3) and/or PDU Session related policy (as defined in clause 6.4) for an established PDU Session.

If the trigger for 5GS Bridge information available is armed, the SMF shall report the 5GS Bridge information when the SMF has determined or updated the 5GS Bridge information, e.g. when SMF has detected an Ethernet port which supports exchange of Ethernet Port Management Information Containers or received User plane node Management Information Container or Port Management Information Container. If a new manageable Ethernet DS-TT port is detected, the SMF provides User plane node ID, the port number and optionally MAC address of the related port of the related PDU Session to the PCF. If the SMF has received UE-DS-TT Residence Time then the SMF also provides UE-DS-TT Residence Time to the PCF. If the SMF has received the User plane node Management Information Container from NW-TT or Port Management Information Container from NW-TT or DS-TT, the SMF also provides User plane node Management Information Container or Port Management Information Container and related port number to the PCF.

When the QoS Monitoring for URLLC trigger is set, the SMF shall indicate the RAN and the UPF to perform the measurement of the QoS parameters based on the PCC rule information for QoS Monitoring as defined in clause 4.3.3.2 of TS 23.502 [3]. Upon receiving the QoS Monitoring report from the UPF, the SMF sends the measurement report to the PCF.

When the QoS Monitoring for dynamic satellite backhaul delay control trigger is set, the SMF shall indicate the UPF to perform the measurement of the QoS parameters on GTP-U path based on the PCC rule information for QoS Monitoring. Upon receiving the QoS Monitoring report from the UPF, the SMF sends the measurement report to the PCF.

If the Policy Control Request Trigger "DDN Failure event subscription with Traffic Descriptor" or "DDD Status event subscription with Traffic Descriptor" is set, the SMF shall request policies if it received a subscription or cancellation of notifications for availability after DDN Failure event with traffic descriptor or DDD Status event with traffic descriptor, respectively. The SMF indicates whether it is a subscription or cancellation event and provides the received Traffic Descriptor as well as the requested type(s) of notifications (notifications about downlink packets being buffered, and/or discarded) to the PCF. When the SMF indicates a subscription event, the PCF checks whether an installed PCC rule exists for the received Traffic Descriptor and if so, the PCF sets the Downlink Data Notification Control information of that PCC rule according to the requested type(s) of notifications. Otherwise, the PCF provides a new PCC Rule with the received Traffic Descriptor in the SDF Template, the Downlink Data Notification Control information set according to the requested type(s) of notifications and other PCC Rule information set to the same values as in the existing PCC rule that previously matched the traffic. When the new PCC has to be bound to the QoS Flow associated with the default QoS rules, the PCF sets the "Bind to QoS Flow associated with the default QoS rule" parameter. From now on, the PCF needs to keep the PCC rule for the DDD event detection fully synchronized with the existing PCC rule that previously matched the traffic for all other policy and charging control settings to ensure the same user experience and traffic treatment according to the operator policy. When the SMF indicates a cancellation event, the PCF removes the Downlink Data Notification Control information in the installed PCC Rule or removes the PCC Rule if a new PCC rule has been provided during the subscription event and this PCC rule is no longer necessary for any other policy enforcement.

NOTE 11: Downlink Data Delivery (DDD) status event and DDN Failure event are specified in clause 4.15.3 of TS 23.502 [3].

The QoS constraints change trigger shall trigger a SMF interaction with the PCF if QoS constraints are received by the SMF during the lifetime of the PDU Session. The SMF reports that the QoS constraints change trigger was met and the new QoS constraints.

When the Satellite backhaul category change trigger is armed, the SMF reports to the PCF that the Satellite backhaul category change was met and the new satellite backhaul category (or that satellite backhaul is no longer used) when it becomes aware that there is a change of the backhaul which is used for the PDU Session between satellite backhaul categories, or between satellite backhaul and a non-satellite backhaul. The SMF determines whether or not a satellite backhaul is used and whether there is a change of backhaul based on signalling from the AMF as specified in TS 23.501 [2].

NOTE 12: As specified in clause 5.8.2.15 in TS 23.501 [2], satellite backhaul category refers to the type (i.e. GEO, MEO, LEO or OTHERSAT) of the satellite used in the backhaul. Only a single backhaul category can be indicated.

The NWDAF info change trigger shall trigger the SMF to interact with the PCF when the list of NWDAF Instance IDs used for the PDU Session or associated Analytics IDs used for the PDU Session are changed in the SMF.

The Request for notification on SM Policy Association establishment or termination indicates to the SMF that the request from the AMF to notify on the established or terminated SM Policy Association should be sent to the PCF together with the received PCF binding information.

When the Dynamic satellite backhaul in UP detected is armed, the SMF reports to the PCF that the UP connection of the PDU session is over dynamical satellite backhaul when the SMF detects that based on the satellite backhaul network delay measurement results of the GTP-U path for the PDU session.

\* \* \* \* Next change \* \* \* \*

#### 6.1.3.6 Policy control

QoS control refers to the authorization and enforcement of the maximum QoS that is authorized for a service data flow, for a QoS Flow or for the PDU Session. A service data flow may be either of IP type or of Ethernet type. PDU Sessions may be of IP type or Ethernet type or unstructured.

The PCF, in a dynamic PCC Rule, associates a service data flow template to an authorized QoS that is provided in a PCC Rule to the SMF. The PCF may also activate a pre-defined PCC Rule that contains that association.

The authorized QoS for a service data flow template shall include a 5QI and the ARP. For a 5QI of GBR or Delay-critical GBR resource type, the authorized QoS shall also include the MBR, GBR and may include the QoS Notification Control parameter (for notifications when authorized GFBR can no longer ( or can again) be fulfilled). For 5QI of Non-GBR resource type, the authorized QoS may include the MBR and the Reflective QoS Control parameter. The 5QI value can be standardized (i.e. referring to QoS characteristics as defined in clause 5.7.3 of TS 23.501 [2]), pre-configured (i.e. referring to QoS characteristics configured in the RAN) or dynamically assigned (i.e. referring to QoS characteristics provided by the PCF as Explicitly signalled QoS Characteristics in the PDU Session related policy information described in clause 6.4).

NOTE 1: Further details, special cases and additional parameters are described in clause 6.3.1.

QoS control also refers to the authorization and enforcement of the Session-AMBR and default 5QI/ARP combination. The PCF may provide the Authorized Session-AMBR and the Authorized default 5QI and ARP combination as part of the PDU Session information for the PDU Session to the SMF. The Authorized Session-AMBR and Authorized default 5QI/ARP values takes precedence over other values locally configured or received at the SMF.

In home routed roaming, the H-SMF may provide the QoS constraints received from the VPLMN (defined in clause 4.3.2.2.2 of TS 23.502 [3]) to the H-PCF. The H-PCF ensures that the Authorized Session-AMBR value does not exceed the Session-AMBR value provided by the VPLMN and the Authorized default 5QI/ARP contains a 5QI and ARP value supported by the VPLMN. If no QoS constraints are provided the H-PCF considers that no QoS constraints apply unless operator policies define any. The PCF shall also consider the QoS constraints for the setting of the Subsequent Authorized default 5QI/ARP and Subsequent Authorized Session-AMBR.

For policy control, the AF interacts with the PCF and the PCF interacts with the SMF as instructed by the AF. For certain events related to policy control, the AF shall be able to give instructions to the PCF to act on its own, i.e. based on the service information currently available. The following events are subject to instructions from the AF:

- The authorization of the service based on incomplete service information;

NOTE 2: The QoS authorization based on incomplete service information is required for e.g. IMS session setup scenarios with available resources on originating side and a need for resource reservation on terminating side.

- The immediate authorization of the service;

- The gate control (i.e. whether there is a common gate handling per AF session or an individual gate handling per AF session component required);

- The forwarding of QoS Flow level information or events (see clause 6.1.3.18).

The UE and the AF shall provide all available flow description information (e.g. source and destination IP address and port numbers and the protocol information) to enable the binding functionality and the generation or selection of the service data flow filter(s) in the PCC rules. The AF may also provide a ToS (IPv4) or TC (IPv6) value that is set by the application as part of the flow description information. The PCF generates a PCC Rule with service data flow filter(s) (either as IP Packet Filter set as defined in clause 5.7.6.2 of TS 23.501 [2] or as Ethernet Packet Filter set as defined in clause 5.7.6.3 of TS 23.501 [2]) derived from the flow description information.

NOTE 3: A ToS/TC value can be useful when another packet filter attribute is needed to differentiate between packet flows. For example, packet flows encapsulated and encrypted by a tunnelling protocol can be differentiated by the ToS/TC value of the outer header if appropriately set by the application. To use ToS/TC for service data flow detection, network configuration needs to ensure there is no ToS/TC re-marking applied along the path from the application to the PSA UPF and the specific ToS/TC values are managed properly to avoid potential collision with other usage (e.g., paging policy differentiation).

If SMF indicates that a PDU session is carried over NR satellite access or satellite backhaul, the PCF may take this information into account for the policy decision, e.g. together with any delay requirements provided by the AF.

If SMF indicates that the dynamic satellite backhaul is used to serve the PDU session, the PCF may request the SMF to report the packet delay on N3 interface and take the packet delay into account for the policy decision. The PCF may generate QoS monitoring rule for the packet delay measurement.

Based on the satellite backhaul indication, the PCF generates PCC rules suitable for satellite backhaul, where the PCC rules indicate the SMF to activate QoS monitoring. Based on the received PCC rules, the SMF requests to activate QoS monitoring to measure the packet delivery latency on N3 interface via N4 Association Update Procedure as specified in clause 4.4.3 of TS 23.502 [3]. The measured delay can be used by PCF for policy control.

\* \* \* \* Next change \* \* \* \*

#### 6.2.1.2 Input for PCC decisions

The PCF shall accept input for PCC decision-making from the SMF, the AMF, the CHF, the NWDAF if present, the UDR and if the AF is involved, from the AF, as well as the PCF may use its own predefined information. These different nodes should provide as much information as possible to the PCF. At the same time, the listed information below describes only examples of the information provided by the respective node and is not intended to be complete. Depending on the particular scenario all the information may not be available or is already provided to the PCF.

The AMF may provide information related to the UE as defined in clause 5.2.5.2 of TS 23.502 [3], for example:

- SUPI;

- PEI of the UE;

- Location of the subscriber;

- Service Area Restrictions;

- RFSP Index;

- RAT Type;

- GPSI;

- Access Type;

- Serving Network identifier (PLMN ID or PLMN ID and NID, see clause 5.34 of TS 23.501 [2]);

- Allowed NSSAI;

- UE time zone;

- Subscribed UE-AMBR;

- Mapping Of Allowed NSSAI;

- S-NSSAI for the PDU Session;

- Requested DNN.

NOTE 1: The Access Type and RAT Type parameters should allow extension to include new types of accesses.

The UE may provide information such as:

- OSId;

- List of PSIs;

- Indication of UE support for ANDSP.

The SMF may provide information related to the PDU Session as defined in clause 5.2.5.4 of TS 23.502 [3], for example:

- SUPI;

- PEI of the UE;

- IPv4 address of the UE;

- IPv6 network prefix assigned to the UE;

- Default 5QI and default ARP;

- Request type (initial, modification, etc.);

- Type of PDU Session (IPv4, IPv6, IPv4v6, Ethernet, Unstructured);

- Access Type;

- RAT Type;

- GPSI;

- Internal-Group Identifier;

- Location of the subscriber;

- S-NSSAI;

- DNN;

- Serving Network identifier (PLMN ID or PLMN ID and NID, see clause 5.34 of TS 23.501 [2]);

- Application Identifier;

- Allocated application instance identifier;

- Detected service data flow descriptions;

- UE support of reflective QoS (as defined in clause 5.7.5.1 of TS 23.501 [2]);

- Number of supported packet filters for signalled QoS rules for the PDU Session (indicated by the UE as defined in clause 5.7.1.4 of TS 23.501 [2]);

- 3GPP PS Data Off status;

- DN Authorization Profile Index (see clause 5.6.6 of TS 23.501 [2]);

- DN authorized Session AMBR (see clause 5.6.6 of TS 23.501 [2]);

- Satellite backhaul category information;

- Dynamic satellite backhaul delay measured in GTP-U path;- Provisioning Server address(es) (see clause 5.30 of TS 23.501 [2]).

The UDR may provide the information for a subscriber connecting to a specific DNN and S-NSSAI, as described in the clause 6.2.1.3.

The UDR may provide policy information related to an ASP as defined in clause 5.2.12.2 of TS 23.502 [3], for example:

- The ASP identifier;

- A transfer policy together with a Background Data Transfer Reference ID, the volume of data to be transferred per UE, the expected amount of UEs.

NOTE 2: The information related with AF influence on traffic routing may be provided by UDR when the UDR serving the NEF is deployed and stores the application request.

The UDR may provide the service specific information as defined in clause 4.15.6.7 of TS 23.502 [3].

The AF, if involved, may provide application session related information as defined in clause 5.2.5.3 of TS 23.502 [3] directly or via NEF, e.g. based on SIP and SDP, for example:

- Subscriber Identifier;

- IP address of the UE;

- Media Type;

- Media Format, e.g. media format sub-field of the media announcement and all other parameter information (a= lines) associated with the media format;

- Bandwidth;

- Sponsored data connectivity information;

- Flow description, e.g. source and destination IP address and port numbers and the protocol;

- AF application identifier, i.e. an identifier that refers to the application the AF session belongs to, containing either an AF identifier, an external application identifier (if the NEF is involved and performs the mapping to the application identifier) or an application identifier (if the AF is configured accordingly);

NOTE 3: Either Flow description or (external) application identifier for application detection control can be provided.

- DNN and possibly S-NSSAI;

- AF Communication Service Identifier (e.g. IMS Communication Service Identifier), UE provided via AF;

- AF Application Event Identifier;

- AF Record Information;

- Flow status (for gating decision);

- Priority indicator, which may be used by the PCF to guarantee service for an application session of a higher relative priority;

NOTE 4: The AF Priority information represents session/application priority and is separate from the MPS 5GS Priority indicator.

- Emergency indicator;

- Application service provider;

- DNAI;

- Information about the N6 traffic routing requirements;

- GPSI;

- Internal-Group Identifier;

- Temporal validity condition;

- Spatial validity condition;

- AF subscription for early and/or late notifications about UP management events;

- AF transaction identifier;

- TSC individual QoS information as described in clause 6.1.3.22;

- QoS information to be monitored;

- Service area coverage;

- Indication that high throughput is desired;

- Reporting frequency;

- User Plane Latency Requirement.

The AF may provide BDT related information as defined in clause 5.2.5.5 of TS 23.502 [3] via NEF, for example:

- Background Data Transfer Reference ID;

- BDT Policy;

- Volume per UE;

- Number of UEs;

- Desired time window;

- Network Area Information.

The CHF, if involved, may provide the following information for a subscriber as defined in clause 5.2.5.17 of TS 23.502 [3], for example:

- Policy counter status for each relevant policy counter.

The NWDAF, if involved, may provide analytics information as described in clause 6.1.1.3.

In addition, the predefined information in the PCF may contain additional rules based on charging policies in the network, whether the subscriber is in its home network or roaming, depending on the QoS Flow attributes.

The 5QIs (see clause 5.7.4 of TS 23.501 [2]) in the PCC rule is derived by the PCF from AF or UDR interaction if available. The input can be SDP information or other available application information, in line with operator policy.

The Allocation and Retention Priority in the PCC Rule is derived by the PCF from AF or UDR interaction if available, in line with operator policy.

\* \* \* \* Next change \* \* \* \*

### 6.3.1 General

The Policy and charging control rule (PCC rule) comprises the information that is required to enable the user plane detection of, the policy control and proper charging for a service data flow. The packets detected by applying the service data flow template of a PCC rule form a service data flow.

Two different types of PCC rules exist: Dynamic rules and predefined rules. The dynamic PCC rules are provisioned by the PCF to the SMF, while the predefined PCC rules are configured into the SMF, as described in TS 23.501 [2], and only referenced by the PCF.

NOTE 1: The procedure for provisioning predefined PCC rules is out of scope for this specification.

The operator defines the PCC rules.

Table 6.3.1 lists the information contained in a PCC rule, including the information name, the description and whether the PCF may modify this information in a dynamic PCC rule which is active in the SMF. The Category field indicates if a certain piece of information is mandatory or not for the construction of a PCC rule, i.e. if it is possible to construct a PCC rule without it.

The differences with table 6.3 in TS 23.203 [4] are shown, either "none" means that the IE applies in 5GS or "removed" meaning that the IE does not apply in 5GS, this is due to the lack of support in the 5GS for this feature or "modified" meaning that the IE applies with some modifications defined in the IE.

Table 6.3.1: The PCC rule information in 5GC

| Information name | Description | Category | PCF permitted to modify for a dynamic PCC rule in the SMF | Differences compared with table 6.3. in TS 23.203 [4] |
| --- | --- | --- | --- | --- |
| Rule identifier | Uniquely identifies the PCC rule, within a PDU Session.  It is used between PCF and SMF for referencing PCC rules. | Mandatory | No | None |
| **Service data flow detection** | *This part defines the method for detecting packets belonging to a service data flow.* |  |  |  |
| Precedence | Determines the order, in which the service data flow templates are applied at service data flow detection, enforcement and charging. (NOTE 1). | Conditional (NOTE 2) | Yes | None |
| Service data flow template | For IP PDU traffic: Either a list of service data flow filters or an application identifier that references the corresponding application detection filter for the detection of the service data flow.  For Ethernet PDU traffic: Combination of traffic patterns of the Ethernet PDU traffic.  It is defined in clause 5.7.6.3 of TS 23.501 [2]. | Mandatory (NOTE 3) | Conditional  (NOTE 4) | Modified  (packet filters for Ethernet PDU traffic added) |
| Mute for notification | Defines whether application's start or stop notification is to be muted. | Conditional (NOTE 5) | No | None |
| **Charging** | *This part defines identities and instructions for charging and accounting that is required for an access point where flow based charging is configured* |  |  |  |
| Charging key  (NOTE 22) | The charging system (CHF) uses the charging key to determine the tariff to apply to the service data flow. |  | Yes | None |
| Service identifier | The identity of the service or service component the service data flow in a rule relates to. |  | Yes | None |
| Sponsor Identifier | An identifier, provided from the AF which identifies the Sponsor, used for sponsored flows to correlate measurements from different users for accounting purposes. | Conditional  (NOTE 6) | Yes | None |
| Application Service Provider Identifier | An identifier, provided from the AF which identifies the Application Service Provider, used for sponsored flows to correlate measurements from different users for accounting purposes. | Conditional  (NOTE 6) | Yes | None |
| Charging method | Indicates the required charging method for the PCC rule.  Values: online or offline or neither. | Conditional (NOTE 7) | No | None |
| Service Data flow handling while requesting credit | Indicates whether the service data flow is allowed to start while the SMF is waiting for the response to the credit request.  Only applicable for charging method online.  Values: blocking or non-blocking |  | No | New |
| Measurement method | Indicates whether the service data flow data volume, duration, combined volume/duration or event shall be measured.  This is applicable to reporting, if the charging method is online or offline.  Note: Event based charging is only applicable to predefined PCC rules and PCC rules used for application detection filter (i.e. with an application identifier). |  | Yes | None |
| Application Function Record Information | An identifier, provided from the AF, correlating the measurement for the Charging key/Service identifier values in this PCC rule with application level reports. |  | No | None |
| Service Identifier Level Reporting | Indicates that separate usage reports shall be generated for this Service Identifier.  Values: mandated or not required |  | Yes | None |
| **Policy control** | *This part defines how to apply policy control for the service data flow.* |  |  |  |
| Gate status | The gate status indicates whether the service data flow, detected by the service data flow template, may pass (Gate is open) or shall be discarded (Gate is closed). |  | Yes | None |
| 5G QoS Identifier (5QI) | The 5QI authorized for the service data flow. | Conditional (NOTE 10) | Yes | Modified  (corresponds to QCI in TS 23.203 [4]) |
| QoS Notification Control (QNC) | Indicates whether notifications are requested from 3GPP RAN when the GFBR can no longer (or can again) be guaranteed for a QoS Flow during the lifetime of the QoS Flow. | Conditional (NOTE 15) | Yes | Added |
| Reflective QoS Control | Indicates to apply reflective QoS for the SDF. |  | Yes | Added |
| UL-maximum bitrate | The uplink maximum bitrate authorized for the service data flow |  | Yes | None |
| DL-maximum bitrate | The downlink maximum bitrate authorized for the service data flow |  | Yes | None |
| UL-guaranteed bitrate | The uplink guaranteed bitrate authorized for the service data flow |  | Yes | None |
| DL-guaranteed bitrate | The downlink guaranteed bitrate authorized for the service data flow |  | Yes | None |
| UL sharing indication | Indicates resource sharing in uplink direction with service data flows having the same value in their PCC rule |  | No | None |
| DL sharing indication | Indicates resource sharing in downlink direction with service data flows having the same value in their PCC rule |  | No | None |
| Redirect | Redirect state of the service data flow (enabled/disabled) | Conditional (NOTE 8) | Yes | None |
| Redirect Destination | Controlled Address to which the service data flow is redirected when redirect is enabled | Conditional  (NOTE 9) | Yes | None |
| ARP | The Allocation and Retention Priority for the service data flow consisting of the priority level, the pre-emption capability and the pre-emption vulnerability | Conditional (NOTE 10) | Yes | None |
| Bind to QoS Flow associated with the default QoS rule | Indicates that the dynamic PCC rule shall always have its binding with the QoS Flow associated with the default QoS rule (NOTE 11). |  | Yes | Modified (corresponds to bind to the default bearer in TS 23.203 [4]) |
| Bind to QoS Flow associated with the default QoS rule and apply PCC rule parameters | Indicates that the dynamic PCC rule shall always have its binding with the QoS Flow associated with the default QoS rule.  It also indicates that the that the QoS related attributes of the PCC rule shall be applied to derive the QoS parameters of the QoS Flow associated with the default QoS rule instead of the PDU Session related parameters Authorized default 5QI/ARP. | Conditional (NOTE 17) | Yes | Added |
| PS to CS session continuity | Indicates whether the service data flow is a candidate for vSRVCC. |  |  | Removed |
| Priority Level | Indicates a priority in scheduling resources among QoS Flows (NOTE 14). |  | Yes | Added |
| Averaging Window | Represents the duration over which the guaranteed and maximum bitrate shall be calculated (NOTE 14). |  | Yes | Added |
| Maximum Data Burst Volume | Denotes the largest amount of data that is required to be transferred within a period of 5G-AN PDB (NOTE 14). |  | Yes | Added |
| Disable UE notifications at changes related to Alternative QoS Profiles | Indicates to disable QoS Flow parameters signalling to the UE when the SMF is notified by the NG-RAN of changes in the fulfilled QoS situation. The fulfilled situation is either the QoS profile or an Alternative QoS Profile. | Conditional  (NOTE 25) | Yes | Added |
| Precedence for TFT packet filter allocation | Determines the order of TFT packet filter allocation for PCC rules | Conditional (NOTE 28) | Yes | Added |
| **Access Network Information Reporting** | *This part describes access network information to be reported for the PCC rule when the corresponding QoS Flow is established, modified or terminated.* |  |  |  |
| User Location Report | The serving cell of the UE is to be reported. When the corresponding QoS Flow is deactivated, and if available, information on when the UE was last known to be in that location is also to be reported. |  | Yes | None |
| UE Timezone Report | The time zone of the UE is to be reported. |  | Yes | None |
| **Usage Monitoring Control** | *This part describes identities required for Usage Monitoring Control.* |  |  | None |
| Monitoring key  (NOTE 23) | The PCF uses the monitoring key to group services that share a common allowed usage. |  | Yes | None |
| Indication of exclusion from session level monitoring | Indicates that the service data flow shall be excluded from PDU Session usage monitoring |  | Yes | None |
| **N6-LAN Traffic Steering Enforcement Control (NOTE 18)** | *This part describes information required for N6-LAN Traffic Steering.* |  |  |  |
| Traffic steering policy identifier(s) | Reference to a pre-configured traffic steering policy at the SMF  (NOTE 12). |  | Yes | None |
| **AF influenced Traffic Steering Enforcement Control (NOTE 18)** | *This part describes information required for AF influenced Traffic Steering.* |  |  |  |
| Data Network Access Identifier | Identifier(s) of the target Data Network Access (DNAI). It is defined in clause 5.6.7 of TS 23.501 [2]. |  | Yes | Added |
| Per DNAI: Traffic steering policy identifier | Reference to a pre-configured traffic steering policy at the SMF  (NOTE 19). |  | Yes | Added |
| Per DNAI: N6 traffic routing information | Describes the information necessary for traffic steering to the DNAI. It is described in clause 5.6.7 of TS 23.501 [2] (NOTE 19). |  | Yes | Added |
| Information on AF subscription to UP change events | Indicates whether notifications in the case of change of UP path are requested and optionally indicates whether acknowledgment to the notifications shall be expected (as defined in clause 5.6.7 of TS 23.501 [2]). |  | Yes | Added |
| Indication of UE IP address preservation | Indicates UE IP address should be preserved. It is defined in clause 5.6.7 of TS 23.501 [2]. |  | Yes | Added |
| Indication of traffic correlation | Indicates that the target PDU Sessions should be correlated via a common DNAI in the user plane. It is described in clause 5.6.7 of TS 23.501 [2]. |  | Yes | Added |
| Information on User Plane Latency requirements | Indicates the user plane latency requirements. It is defined in clause 6.3.6 of TS 23.548 [33]. |  | Yes | Added |
| Indication for Simultaneous Connectivity at Edge Relocation | Indicates request for simultaneous connectivity over source and target PSA from the AF (see clause 5.6.7 of TS 23.501 [2]). |  | Yes | Added |
| Information for EAS IP Replacement in 5GC | Indicates the Source EAS identifier and Target EAS identifier, (i.e. IP addresses and port numbers of the source and target EAS). (see clause 5.6.7 of TS 23.501 [2]). |  | Yes | Added |
| **NBIFOM related control Information** | *This part describes PCC rule information related with NBIFOM.* |  |  |  |
| Allowed Access Type | The access to be used for traffic identified by the PCC rule. |  |  | Removed |
| **RAN support information** | *This part defines information supporting the RAN for e.g. handover threshold decision.* |  |  |  |
| UL Maximum Packet Loss Rate | The maximum rate for lost packets that can be tolerated in the uplink direction for the service data flow. It is defined in clause 5.7.2.8 of TS 23.501 [2]. | Conditional (NOTE 13) | Yes | None |
| DL Maximum Packet Loss Rate | The maximum rate for lost packets that can be tolerated in the downlink direction for the service data flow. It is defined in clause 5.7.2.8 of TS 23.501 [2]. | Conditional (NOTE 13) | Yes | None |
| **MA PDU Session Control**  **(NOTE 20)** | *This part defines information supporting control of MA PDU Sessions* |  | Yes | New |
| Application descriptors | Identifies the application traffic for which MA PDU Session control is required based on the Steering Functionality, the Steering Mode, Steering Mode Indicator and Threshold Values. It is described in clause 5.32.8 of TS 23.501 [2]. | Conditional (NOTE 27) | Yes | New |
| Steering Functionality | Indicates the applicable traffic steering functionality. | Conditional (NOTE 21) | Yes | New |
| Steering Mode | Indicates the rule for distributing traffic between accesses together with associated steering parameters (if any). | Conditional (NOTE 21) | Yes | New |
| Steering Mode Indicator | Indicates either autonomous load-balance operation or UE-assistance operation, if the Steering Mode is set to "Load Balancing", as defined in TS 23.501 [2]. |  | Yes | New |
| Threshold Values | A Maximum RTT or a Maximum Packet Loss Rate or both. |  | Yes | New |
| Charging key for Non-3GPP access  (NOTE 22) | Indicates the Charging key used for charging packets carried via Non-3GPP access for a MA PDU Session. |  | Yes | New |
| Monitoring key for Non-3GPP access  (NOTE 23) | Indicates the Monitoring key used to monitor usage of the packets carried via Non-3GPP access for a MA PDU Session. |  | Yes | New |
| **QoS Monitoring for URLLC** | *This part describes PCC rule information related with QoS Monitoring for URLLC.* |  |  |  |
| QoS parameter(s) to be measured | UL packet delay, DL packet delay or round trip packet delay. |  | Yes | Added |
| Reporting frequency | Defines the frequency for the reporting, such as event triggered, periodic, when no packet delay measurement result is received for a delay exceeding a threshold, or when the PDU Session is released. |  | Yes | Added |
| Target of reporting | Defines the target of the QoS Monitoring reports, it can be the PCF or the AF or the Local NEF, decided by the PCF. |  | Yes | Added |
| Indication of direct event notification | Indicates that the QoS Monitoring event shall be reported by the UPF directly to the NF indicated by the Target of reporting. |  | Yes | Added |
| **Alternative QoS Parameter Sets**  **(NOTE 24)**  **(NOTE 26)** | *This part defines Alternative QoS Parameter Sets for the service data flow.* |  |  |  |
| Packet Delay Budget | The Packet Delay Budget in this Alternative QoS Parameter Set. |  | Yes | Added |
| Packet Error Rate | The Packet Error Rate in this Alternative QoS Parameter Set. |  | Yes | Added |
| UL-guaranteed bitrate | The uplink guaranteed bitrate in this Alternative QoS Parameter Set. |  | Yes | Added |
| DL-guaranteed bitrate | The downlink guaranteed bitrate in this Alternative QoS Parameter Set. |  | Yes | Added |
| **TSC Assistance Container** | *This part defines parameters provided by TSN AF or TSCTSF. The parameters are defined in clause 5.27.2 of TS 23.501 [2].* |  | No | Added |
| **Downlink Data Notification Control** | *This part describes information required for controlling the sending of Downlink data delivery status event and DDN Failure event notifications as specified in clause 4.15.3 of TS 23.502 [3].* |  |  |  |
| Notification control for DDD status | Indicates that notifications of downlink data delivery status are required and the requested type of such notifications. |  | Yes | Added |
| Notification Control for DDN Failure | Indicates that notifications of DDN Failure are required. |  | Yes | Added |
| **QoS Monitoring for dynamic satellite backhaul delay control** | *This part describes PCC rule information related with QoS Monitoring for dynamic satellite backhaul delay control.* |  |  |  |
| QoS parameter(s) to be measured | UL packet delay, DL packet delay or round trip packet delay. |  | Yes | Added |
| Reporting frequency | Defines the frequency for the reporting, such as event triggered, periodic, or when the PDU Session is released. |  | Yes | Added |
| Threshold Values | A Maximum UL packet delay, or a Maximum DL packet delay, or a Maximum round trip packet delay, or all. |  |  |  |
| Target of reporting | Defines the target of the QoS Monitoring reports, it can be the PCF or the AF or the Local NEF, decided by the PCF. |  | Yes | Added |
| Indication of direct event notification | Indicates that the QoS Monitoring event shall be reported by the UPF directly to the NF indicated by the Target of reporting. |  | Yes | Added |
| NOTE 1: For PCC rules based on an application detection filter, the precedence is only relevant for the enforcement, i.e. when multiple PCC rules overlap, only the enforcement, reporting of application starts and stops, monitoring, and charging actions of the PCC rule with the highest precedence shall be applied.  NOTE 2: The Precedence is mandatory for PCC rules with SDF template containing SDF filter(s). For dynamic PCC rules with SDF template containing an application identifier, the precedence is either preconfigured in SMF or provided in the PCC rule from PCF.  NOTE 3: Either service data flow filter(s) or application identifier shall be defined per each rule.  NOTE 4: YES, if the service data flow template consists of a set of service data flow filters. NO if the service data flow template consists of an application identifier  NOTE 5: Optional and applicable only if application identifier exists within the rule.  NOTE 6: Applicable to sponsored data connectivity.  NOTE 7: Mandatory if there is no default charging method for the PDU Session.  NOTE 8: Optional and applicable only if application identifier exists within the rule.  NOTE 9: If Redirect is enabled.  NOTE 10: Mandatory when Bind to QoS Flow associated with the default QoS rule is not present.  NOTE 11: The presence of this attribute causes the 5QI/ARP/QNC/Priority Level/Averaging Window/Maximum Data Burst Volume of the rule to be ignored for the QoS Flow binding.  NOTE 12: The Traffic steering policy identifier can be different for uplink and downlink direction. If two Traffic steering policy identifiers are provided, then one is for uplink direction, while the other one is for downlink direction.  NOTE 13: Optional and applicable only for voice service data flow in this release.  NOTE 14: Optional and applicable only when a value different from the standardized value for this 5QI in Table 5.7.4-1 TS 23.501 [2] is required.  NOTE 15: Optional and applicable only for GBR service data flow.  NOTE 16: Usage of the charging information in described in TS 32.255 [21].  NOTE 17: Only one PCC rule can contain this attribute and this PCC rule shall not contain the attribute Bind to QoS Flow associated with the default QoS rule.  NOTE 18: Only one of the two shall be present in a PCC rule.  NOTE 19: Per DNAI, a Traffic steering policy identifier and/or N6 traffic routing information can be provided. If the pre-configured traffic steering policy (that is referenced by the Traffic steering policy identifier) contains information that is overlapping with the N6 traffic routing information, the N6 traffic routing information shall take precedence.  NOTE 20: Only applicable to a PCC Rules provided to a MA PDU Session.  NOTE 21: Mandatory when MA PDU Session Control information is provided.  NOTE 22: When a Charging key for Non-3GPP access is provided, the parameters in the Charging Section (other than the Charging key) apply to both accesses and the Charging key (in the Charging Section) shall be used for charging packets carried via the 3GPP access.  NOTE 23: When a Monitoring key for Non-3GPP access is provided, the Monitoring key (in the Usage Monitoring Control Section) shall be used to monitor usage of the packets carried via the 3GPP access.  NOTE 24: Optional and applicable only for GBR service data flow with QoS Notification Control enabled.  NOTE 25: Optional and applicable only for GBR service data flow for which Alternative QoS Parameter Set(s) are provided.  NOTE 26: One or more Alternative QoS Parameter Sets can be provided in a prioritized order starting with the Alternative QoS Parameter Set that has the highest priority.  NOTE 27: Mandatory in MA PDU Session Control information only when there is application identifier in the service data flow template.  NOTE 28: If this parameter is used, it has to be present in every PCC rule of the PDU Session. | | | | |

The Rule identifier shall be unique for a PCC rule within a PDU Session. A dynamically provided PCC rule that has the same Rule identifier value as a predefined PCC rule shall replace the predefined rule within the same PDU Session.

The Precedence defines in what order the activated PCC rules within the same PDU Session shall be applied at the UPF for service data flow detection. When a dynamic PCC rule and a predefined PCC rule have the same precedence, the dynamic PCC rule takes precedence.

NOTE 2: The operator shall ensure that overlap between the predefined PCC rules can be resolved based on precedence of each predefined PCC rule in the SMF. The PCF shall ensure that overlap between the dynamically allocated PCC rules can be resolved based on precedence of each dynamically allocated PCC rule.

For downlink packets all the service data flow templates, activated for the PDU Session shall be applied for service data flow detection and for the mapping to the correct QoS Flow. For uplink packets the service data flow templates activated on their QoS Flow shall be applied for service data flow detection (further details are provided in clause 6.2.2.2).

The *Service data flow template* may comprise any number of *Service data flow filters* or an *application identifier* as is defined in table 6.3.1.

NOTE 3: Predefined PCC rules may include service data flow templates, which support extended capabilities, including enhanced capabilities to identify events associated with application protocols.

A Service data flow filter contains information for matching user plane packets for IP PDU traffic or Ethernet PDU traffic. All Service data flow filters of a Service data flow template shall be of the same type, i.e. either Packet Filters for IP or Ethernet PDU traffic (defined in clause 5.7.6 of TS 23.501 [2]). The Service data flow template information within an activated PCC rule is applied by the SMF to instruct the UPF to identify the packets belonging to a particular service data flow.

For the IP PDU Session type only, the Service data flow template may consist of an application identifier that references an application detection filter that is used for matching user plane packets. The application identifier is also identifying the application, for which the rule applies. The same application identifier value can occur in a dynamic PCC rule and one or multiple predefined PCC rules. If so, the PCF shall ensure that there is at most one PCC rule active per application identifier value at any time.

The *Mute for notification* defines whether notification to the PCF of application's starts or stops shall be muted. Absence of this parameter means that start/stop notifications shall be sent.

The *Charging key* is the reference to the tariff for the service data flow. Any number of PCC Rules may share the same charging key value. The Charging key values for each service shall be operator configurable.

NOTE 4: Assigning the same Charging key for several service data flows implies that the charging does not require the credit management to be handled separately.

The *Service identifier* identifies the service. PCC Rules may share the same service identifier value. The service identifier provides the most detailed identification, specified for flow-based charging, of a service data flow.

NOTE 5: The PCC rule service identifier need not have any relationship to service identifiers used on the AF level, i.e. is an operator policy option.

The *Sponsor Identifier* indicates the (3rd) party organization willing to pay for the operator's charge for connectivity required to deliver a service to the end user.

The *Application Service Provider Identifier* indicates the (3rd) party organization delivering a service to the end user.

The *Charging method* indicates whether online charging or offline charging is required, or the service data flow is not subject to any end user charging. If the charging method identifies that the service data flow is not subject to any end user charging, a Charging key shall not be included in the PCC rule for that service data flow, along with other charging related parameters. If the charging method is omitted the SMF shall apply the default charging method provided within the PDU Session related policy information (see clause 6.4). The Charging method is mandatory if there is no default charging method for the PDU Session.

NOTE 6: With converged charging architecture for 5GC, online charging method also includes usage reporting from the SMF to the CHF. Hence, setting the charging method to online will also result in usage reports and thus allow for offline charging being performed by the CHF.

The *Service Data Flow handling while requesting credit* indicates either "blocking" if a credit for the Charging Key needs to be granted as a condition for the PCC Rule to be active or "non-blocking" if a credit for the Charging Key has been requested as a condition for the PCC Rule to be active.

The *Measurement method* indicates what measurements apply to charging for a PCC rule.

The *Service Identifier Level Reporting* indicates whether the SMF shall generate reports per Service Identifier. The SMF shall accumulate the measurements from all PCC rules with the same combination of Charging key/Service Identifier values in a single report.

The *Application Function Record Information* identifies an instance of service usage. A subsequently generated usage report (i.e. CDR), generated as a result of the PCC rule by the SMF, may include the Application Function Record Information, if available. The Application Function Record Information may contain the AF Charging Identifier and/or the Flow identifiers. If exclusive charging information related to the Application function record information is required, the PCF shall provide a service identifier, not used by any other PCC rule of the PDU Session at this point in time, for the AF session.

NOTE 7: For example, the PCF may be configured to maintain a range of service identifier values for each service which require exclusive per instance charging information. Whenever a separate counting or credit management for an AF session is required, the PCF shall select a value, which is not used at this point in time, within that range. The uniqueness of the service identifier in the SMF ensures a separate accounting/credit management while the AF record information identifies the instance of the service.

The *Gate* indicates whether the SMF shall instruct the UPF to let a packet identified by the PCC rule pass through (gate is open) to discard the packet (gate is closed).

NOTE 8: A packet, matching a PCC Rule with an open gate, may be discarded due to credit management reasons.

The *5G QoS Identifier*, 5QI, represents the QoS parameters for the service data flow. The 5G QoS identifier is scalar and accommodates the need for differentiating QoS in both 3GPP and non-3GPP access type.

The bitrates indicate the authorized bitrates at the IP packet level of the SDF, i.e. the bitrates of the IP packets before any access specific compression or encapsulation.

The *UL maximum-bitrate* indicates the authorized maximum bitrate for the uplink component of the service data flow.

The *DL maximum-bitrate* indicates the authorized maximum bitrate for the downlink component of the service data flow.

The *UL guaranteed-bitrate* indicates the authorized guaranteed bitrate for the uplink component of the service data flow.

The *DL guaranteed-bitrate* indicates the authorized guaranteed bitrate for the downlink component of the service data flow.

The 'Maximum bitrate' is used for enforcement of the maximum bit rate that the SDF may consume, while the 'Guaranteed bitrate' is used by the SMF to determine resource allocation demands.

The *UL sharing indication* indicates that resource sharing in uplink direction for service data flows with the same value in their PCC rule shall be applied by the SMF as described in clause 6.2.2.4.

The *DL sharing indication* indicates that resource sharing in downlink direction for service data flows with the same value in their PCC rule shall be applied by the SMF as described in clause 6.2.2.4.

The *Allocation and Retention Priority* indicates the allocation, retention and priority of the service data flow. The ARP contains information about the priority level, the pre-emption capability and the pre-emption vulnerability. The Allocation and Retention Priority resolves conflicts of demands for network resources.

The *Priority Level* is signalled together with the 5QI to the (R)AN and UPF, only when a value different from the standardized value in the QoS characteristics Table 5.7.4-1 in TS 23.501 [2] is required.

The *Averaging Window* is signalled together with the 5QI to the (R)AN and UPF, only when a value different from the standardized value in the QoS characteristics Table 5.7.4-1 in TS 23.501 [2] is required.

The *Maximum Data Burst Volume* is signalled together with the 5QI to the (R)AN, only when a value different from the standardized value in the QoS characteristics Table 5.7.4-1 in TS 23.501 [2] is required.

The *Bind to QoS Flow associated with the default QoS rule* indicates that the SDF shall be bound to the QoS Flow associated with the default QoS rule. The presence of this parameter attribute causes the 5QI/ARP of the rule to be ignored by the SMF during the QoS Flow binding.

The *Bind to QoS Flow associated with the default QoS rule and apply PCC rule parameters* indicates that the SDF shall be bound to the QoS Flow associated with the default QoS rule and that the QoS related attributes of the PCC rule shall be applied by the SMF to derive the QoS parameters of the QoS Flow associated with the default QoS rule instead of the PDU Session related information Authorized default 5QI/ARP.

NOTE 9: The Bind to QoS Flow associated with the default QoS rule and apply PCC rule parameters Indication has to be used whenever the PDU Session related information Authorized default 5QI/ARP (as described in clause 6.3.1) cannot be directly used as the QoS parameters of the QoS Flow associated with the default QoS rule, for example when a GBR 5QI is used or the 5QI priority level has to be changed.

The *QoS Notification Control,* QNC*,* indicates whether notifications are requested from the access network (i.e. 3GPP RAN) when the GFBR can no longer (or can again) be guaranteed for a QoS Flow during the lifetime of the QoS Flow. If it is set and the GFBR can no longer (or can again) be guaranteed, the access network (i.e. 3GPP RAN) sends a notification towards the SMF, which then notifies the PCF.

The *Disable UE notifications at changes related to Alternative QoS Profiles* parameter indicates to disable QoS Flow parameters signalling to the UE when the SMF is notified by the NG-RAN of changes in the fulfilled QoS situation. The fulfilled situation is either the QoS profile or an Alternative QoS Profile.

The *Precedence for TFT packet filter allocation* parameter determines the order in which TFT packet filters are allocated for PCC rules. The PCF may include this parameter if there is a possibility to run into a restriction regarding the number of TFT packet filters that can be allocated for the PDU Session and interworking with EPS with N26 deployment is supported (see also clause 4.11.1 of TS 23.502 [3]).

NOTE 9a: PCF can know that interworking with EPS with N26 is supported based on DNN and S-NSSAI of the PDU Session.

The *Reflective QoS Control* indicates to apply reflective QoS for the service data flow. The indication is used to control the RQI marking in the DL packets of the service data flow and may trigger the sending of the RQA parameter for the QoS Flow the service data flow is bound to. Reflective QoS is defined in clause 5.7.5 of TS 23.501 [2].

NOTE 10: While the UE applies a standardized value for the precedence of all UE derived QoS rules, PCC rules require different precedence values and PCF configuration has to ensure that there is a large enough value range for the precedence of PCC rules corresponding to UE derived QoS rules. To avoid that the precedence of network provided QoS rules need to be changed when Reflective QoS is activated and filters are overlapping, the PCF will take the standardized value for the precedence of UE derived QoS rules into account when setting the precedence value of PCC rules subject to Reflective QoS.

The *Reflective QoS Control* parameter shall not be used for the PCC rule with match-all SDF template. If PCC rule with match-all SDF template is present, the *Reflective QoS Control* parameter shall not be used for PCC rules which contain the *Bind to QoS Flow of the default QoS rule* parameter, either.

The *N6-LAN Traffic Steering Enforcement Control* contains *Traffic steering policy identifier(s)* for steering traffic onto N6-LAN to the appropriate N6 service functions deployed by the operator.

The access network information reporting parameters (*User Location Report*, *UE Timezone Report*) instruct the SMF about what information to forward to the PCF when the PCC rule is activated, modified or removed.

The *Monitoring Key* is the reference to a resource threshold. Any number of PCC Rules may share the same monitoring key value. The monitoring key values for each service shall be operator configurable.

The *Indication of exclusion from session level monitoring* indicates that the service data flow shall be excluded from the PDU Session usage monitoring.

The *AF influenced Traffic Steering Enforcement Control* may contain:

*- a set of DNAI(s)* (i.e. a reference to the DNAI(s) the SMF needs to consider for UPF selection/reselection), an optional Indication of traffic correlation and, per DNAI, a corresponding Traffic steering policy identifier (i.e. a reference to a pre-configured traffic steering policy at the SMF), and/or a corresponding N6 traffic routing information (when the N6 traffic routing information is provided explicitly as part of the AF influence request, as described in clause 5.6.7 of TS 23.501 [2]), or;

- an *AF subscription to UP change events* parameter which contains subscription information defined in clause 5.2.8.3 of TS 23.502 [3] for the change of UP path Event Id i.e. an *Indication of early and/or late notification* and information on where to provide the corresponding notifications (Notification Target Address + Notification Correlation ID as specified in clause 4.15.1 of TS 23.502 [3]) and optionally an indication of "AF acknowledgment to be expected" to the corresponding notifications as described in clause 5.6.7 of TS 23.501 [2].

- a *user plane latency requirements* parameter which contains AF requested information on the requirements for user plane latency defined in TS 23.548 [33].

- an *indication for Simultaneous Connectivity at Edge Relocation*, which includes *Keep existing PSA* indication to provide guidance to the network on whether to provide simultaneous connectivity over source and target PSA at edge relocation; also, optionally a related *Keep existing PSA timer* that indicates the minimum time interval to be considered for inactivity for the traffic described before the connectivity over the source PSA may be removed, as defined in TS 23.548 [33].

The *Traffic Steering Enforcement Control* may contain Indication of UE IP address preservation. The SMF takes this indication into account when determining whether to reselect PSA UPF, as specified in clause 5.6.7 of TS 23.501 [2].

The *Redirect* indicates whether the uplink part of the service data flow should be redirected to a controlled address.

The *Redirect Destination* indicates the target redirect address when *Redirect* is enabled.

The *UL Maximum Packet Loss Rate* indicates the maximum rate for lost packets that can be tolerated in the uplink direction.

The *DL Maximum Packet Loss Rate* indicates the maximum rate for lost packets that can be tolerated in the downlink direction.

The *Application descriptors* provides one or several instances of the OSId and OSAppId combination. It is used by the UE to identify the application traffic for which steering is required based on the Steering Functionality, the Steering Mode, the Steering Mode Indicator and the Threshold Values.

The *Steering Functionality* indicates the method for how traffic matching the SDF template in the UPF or a Traffic descriptor in the UE is sent over the MA PDU Session. The method ATSSS\_LL indicates that the traffic matching the SDF template is sent over the MA PDU Session without additional tunnelling, e.g. with IP flow switching. The method MPTCP indicates that the traffic matching the SDF template is sent over the MA PDU Session using MPTCP.

The *Steering Mode* indicates the rule for distributing downlink SDFs in the UPF or uplink traffic in the UE between accesses, together with the associated steering parameters. The PCF may indicate separate values for uplink and downlink directions. The available Steering Modes are defined in TS 23.501 [2].

The *Steering Mode Indicator* indicates that the UE or the UPF or both may change the steering parameters provided in the Steering Mode and may adjust the traffic steering based on their own decisions, as further defined in TS 23.501 [2]. When the PCF selects the Load-Balancing Steering Mode for both the uplink and the downlink, and the PCF provides a *Steering Mode Indicator* for the uplink equal to UE-assistance operation, then the PCF shall provide the same *Steering Mode Indicator* for the downlink.

The *Threshold Values* indicate the authorized RTT or Packet Loss Rate for a SDF. The PCF may include one threshold value for RTT and one threshold value for Packet Loss Rate per SDF. The PCF may indicate separate values for uplink and downlink directions. The Steering Modes that may use the threshold values and how the UE and UPF enforces them are defined in TS 23.501 [2].

The *Charging key for Non-3GPP access* indicates the Charging key that shall be used for charging the detected service data flow traffic carried via Non-3GPP access. The other charging related parameters apply for both accesses.

The *Monitoring key for Non-3GPP access* indicates the Monitoring key that shall be used for monitoring the usage of the detected service data flow traffic carried via Non-3GPP access.

The *QoS parameter(s) to be measured* indicates the UL packet delay, DL packet delay or round trip packet delay between the UE and the UPF is to be monitored when the QoS Monitoring for URLLC or QoS Monitoring for dynamic satellite backhaul delay control is enabled for the service data flow.

The *Reporting frequency* indicates the frequency for the reporting, such as event triggered, periodic, when no packet delay measurement result is received for a delay exceeding a threshold, or when the PDU Session is released. The following applies:

- If the *Reporting frequency* indicates "periodic", the reporting time period shall also be included in the PCC rule. The reporting time period may also be used as the threshold for reporting packet delay measurement failure: if no measurement result is received for a delay exceeding this threshold, the UPF shall report to the SMF and the SMF shall report to the PCF or to the AF indicating a packet delay measurement failure.

- If the *Reporting frequency* indicates "event triggered", the *Reporting threshold(s)* and the *minimum waiting time* shall also be included in the PCC rule. The *Reporting threshold(s)* indicates the measurement threshold for each of the included *QoS parameter(s)* to be measured, i.e. the UL packet delay, DL packet delay or round trip packet delay. When *Reporting threshold(s)* is exceeded, the UPF shall report to the SMF and the SMF shall report to the PCF or to the AF. If more than one value is received at one given point of time for UL packet delay, DL packet delay or round trip packet delay respectively, the SMF reports the minimum and maximum packet delays to the PCF or the AF. The SMF sends the first report when the *Reporting threshold* is exceeded and the minimum waiting time is applied for the subsequent report (if the threshold is exceeded after the waiting time). The Reporting threshold(s) may also be used as the threshold for reporting packet delay measurement failure: if no measurement result is received for a delay exceeding this threshold, the UPF shall report to the SMF and the SMF shall report to the PCF or to the AF indicating a packet delay measurement failure.

The *Target of reporting* indicates the target for the QoS Monitoring reports sent as notifications. It can be either the PCF or the AF (the NEF may be on the path between SMF and AF). The PCF shall include Notification Target Address + Notification Correlation ID as specified in clause 4.15.1 of TS 23.502 [3].

The *Indication of direct event notification* indicates that the QoS Monitoring reports shall be sent by the UPF directly to the Local NEF or the AF (as indicated by the Target of reporting) as described in clause 6.4 of TS 23.548 [33] instead of sending the reports to the SMF.

The *Alternative QoS Parameter Set(s)* define alternative set(s) of QoS parameters for the service data flow. Every set consists of a PER, a PDB, as well as an UL and a DL guaranteed bitrate QoS parameter.

The content of the *TSC Assistance Container* is defined in clause 5.27.2 of TS 23.501 [2].

The *Downlink Data Notification Control* applies to the control of subscription to Downlink Data Delivery status event notifications and DDN Failure event notifications as specified in clause 4.15.3 of TS 23.502 [3]. The following parameters are included:

- The *Notification control for DDD status* applies as described in clause 4.15.3.2.8 of TS 23.502 [3] and contains the following parameters:

- indication that notifications of Downlink Data Delivery status are required; and

- the requested type of such notifications (notifications about downlink packets being buffered, and/or discarded).

- The *Notification Control for DDN Failure* applies as described in clause 4.15.3.2.9 of TS 23.502 [3] and contains the following parameters:

- indication that notifications of DDN Failure are required.

NOTE 11: Downlink Data Notification Control information is provided to assist the SMF in the generation/update of N4 information. The PCF will not be notified about the Downlink data delivery status events or the DDN Failure events.

\* \* \* \* End of changes \* \* \* \*