**3GPP TSG-SA2 Meeting #155 *S2-230xxxx***

**Athens, Greece, 20-24 February 2023 (revision of S2-2301628)**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **23.503** | **CR** | **806** | **rev** | **XXX** | **Current version:** | **18.0.0** |  |
|  |
| *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:***  | Support of integration with IETF Deterministic Networking |
|  |  |
| ***Source to WG:*** | Ericsson, [Nokia, Nokia Shanghai Bell, Huawei, ZTE, Samsung] |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | DetNet |  | ***Date:*** | 2023-01-05 |
|  |  |  |  |  |
| ***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 canbe 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)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | Document DetNet interworking in the specifications per TR 23.700-46 conclusions. |
|  |  |
| ***Summary of change:*** | Include DetNet interworking functionality in the specification.Additional changes in Rev 2:- Clarify MTU size parameter is optional, and separately provided for v4 and v6.- Clarification on the reference to IETF draft.  |
|  |  |
| ***Consequences if not approved:*** | Conclusions of the DetNet study are not documented. |
|  |  |
| ***Clauses affected:*** | 2, 5.3.1, 5.3.13, 6.1.3.5, 6.1.3.18, 6.1.3.23a, 6.1.3.23b (new) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **x** |  |  Other core specifications  | TS 23.501 CR 3844, TS 23.502 CR 3683 |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ... |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ... |
|  |  |
| ***Other comments:*** | New clause 5.28.X of 23.501 is associated with CR#3844 |
|  |  |
| ***This CR's revision history:*** |  |

\* \* \* Start of Changes \* \* \*

# 2 References

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

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

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

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

…

[xx] IETF draft-ietf-detnet-yang: "Deterministic Networking (DetNet) YANG Model".

Editor's note:    The reference to draft-ietf-detnet-yang will be revised to RFC when finalized by IETF.

\* \* \* Next Change \* \* \*

5.3.1 Interactions between PCF and AF

Npcf and Naf enable transport of application level session information and Ethernet/IP port management information from AF to PCF. Such information includes, but is not limited to:

- IP filter information or Ethernet packet filter information to identify the service data flow for policy control and/or differentiated charging;

- media/application bandwidth requirements for QoS control;

- In addition, for sponsored data connectivity:

- the sponsor's identification;

- optionally, a usage threshold and whether the PCF reports these events to the AF;

- information identifying the application service provider and application (e.g. SDFs, application identifier, etc.);

- information required to enable Application Function influence on traffic routing as defined in clause 5.6.7 of TS 23.501 [2];

- information required to enable setting up an AF session with required QoS as defined in clause 6.1.3.22;

- information required to enable setting up an AF session with support for Time Sensitive Networking (TSN) as defined in clause 6.1.3.23.

- information required to enable setting up an AF session with support for Time Sensitive Communication as defined in clause 6.1.3.23a.

- information required to enable setting up an AF session with support for Deterministic Networking (DetNet) as defined in clause 6.1.3.23b.

Npcf also enables the AF to request to influence Access and Mobility related policies for a UE and enables the AF to provide guidance for UE URSP rule determination. Npcf and Naf enable the AF subscription to notifications on PDU Session events, i.e. the events requested by the AF as described in clause 6.1.3.18 and the change of DNAI as defined in clause 5.6.7 of TS 23.501 [2].

The N5 reference point is defined for the interactions between PCF and AF in the reference point representation.

\* \* \* Next Change \* \* \*

### 5.3.13 Interactions between PCF and TSCTSF

Npcf enables transport of application level session information from TSCTSF to PCF and Ethernet or IP port management information between PCF and TSCTSF. Such information includes, but is not limited to:

- information required to enable setting up an AF session with support for Time Sensitive Communication and Time Synchronization as defined in clause 6.1.3.23a.

- information required to enable setting up an AF session with support for Deterministic Networking as defined in clause 6.1.3.23b.

Npcf enables the TSCTSF subscription to notifications on PDU Session events, i.e. the events requested by the TSCTSF as described in clause 6.1.3.18.

The N84 reference point is defined for the interactions between PCF and TSCTSF in the reference point representation.

\* \* \* Next 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 andStop 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/Router information available | SMF has detected new 5GS Bridge/Router 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, MTU size for IPv4, MTU size for IPv6, and/or PMIC and/or UMIC. | Added | PCF |  |
| QoS Monitoring for URLLC | The SMF notifies the PCF of the QoS Monitoring reports (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 |  |
| 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/Router information available is armed, the SMF shall report the 5GS Bridge/Router information when the SMF has determined or updated the 5GS Bridge/Router 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 or determined based on local configuration for the given DNN, S-NSSAI that a new device side port has been established or modified in case of Deterministic Networking. 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. In case of Deterministic Networking, the SMF may also provide the MTU size for IPv4 and the MTU size for IPv6.

When the QoS Monitoring for URLLC trigger is set, the SMF shall, upon receiving the QoS Monitoring report from the UPF, send 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.

\* \* \* Next Change \* \* \*

#### 6.1.3.18 Event reporting from the PCF

The AF may subscribe/unsubscribe to notifications of events from the PCF for the PDU Session to which the AF session is bound. The AF can either subscribe/unsubscribe directly at the PCF or indirectly via an NEF or a TSCTSF.

The PCF for the UE may subscribe/unsubscribe to notifications of events from the PCF for the PDU Session of a UE. Other NFs may subscribe/unsubscribe to notifications of events from the PCF for a PDU Session or for a UE.

The events that can be subscribed by the AF and by other NFs are listed in Table 6.1.3.18-1.

Table 6.1.3.18-1: Events relevant for reporting from the PCF

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Event | Description | NF that can subscribe for reporting | Availability for Rx PDU Session (NOTE 2) | Availability for N5 per PDU Session  | Availability for Bulk Subscription(NOTE 1) | Availability for N43 per SUPI, DNN, S-NSSAI | Availability for N5 per UE(NOTE 6) |
| PLMN Identifier Notification(NOTE 5) | The PLMN identifier or SNPN identifier where the UE is currently located. | AF | Yes | Yes | Yes | No | No |
| Change of Access Type | The Access Type and, if applicable, the RAT Type of the PDU Session has changed. | AF | Yes | Yes | Yes | No | No |
| EPS fallback | EPS fallback is initiated | AF | Yes | Yes | No | No | No |
| Signalling path status | The status of the resources related to the signalling traffic of the AF session. | AF | Yes | Yes | No | No | No |
| Access Network Charging Correlation Information | The Access Network Charging Correlation Information of the resources allocated for the AF session. | AF | Yes | Yes | No | No | No |
| Access Network Information Notification | The user location and/or timezone when the PDU Session has changed in relation to the AF session. | AF | Yes | Yes | No | No | No |
| Reporting Usage for Sponsored Data Connectivity | The usage threshold provided by the AF has been reached; or the AF session is terminated. | AF | Yes | Yes | No | No | No |
| Service Data Flow deactivation | The resources related to the AF session are released. | AF | Yes | Yes | No | No | No |
| Resource allocation outcome | The outcome of the resource allocation related to the AF session. | AF | Yes | Yes | No | No | No |
| QoS targets can no longer (or can again) be fulfilled | The QoS targets can no longer (or can again) be fulfilled by the network for (a part of) the AF session. | AF | No | Yes | No | No | No |
| QoS Monitoring parameters | The QoS Monitoring parameter(s) (e.g. UL packet delay, DL packet delay or round trip packet delay) are reported to the AF according to the QoS Monitoring reports received from the SMF. | AF | No | Yes | No | No | No |
| Out of credit | Credit is no longer available. | AF | Yes | Yes | No | No | No |
| Reallocation of credit | Credit has been reallocated after the former Out of credit indication. | AF | Yes | Yes | No | No | No |
| 5GS Bridge/Router information Notification(NOTE 3) | 5GS Bridge/Router information that PCF has received from SMF. | TSN AF, TSCTSF | No | Yes | No | No | No |
| Notification on outcome of service area coverage change | The outcome of the request of service area coverage change. | AF | No | No | Yes | No | Yes |
| Notification on outcome of UE Policies delivery | The outcome of the request for UE policies delivery due to service specific parameter provisioning procedure. | AF | No | No | No | No | No |
| Start of application traffic detection andStop of application traffic detection | The start or the stop of application traffic has been detected. | PCF | No | No | No | Yes(NOTE 4) | No |
| Satellite backhaul category change | The backhaul has changed between different satellite backhaul categories (i.e. GEO, MEO, LEO, OTHERSAT), or the backhaul has changed between satellite backhaul and non-satellite backhaul. | AF | No | Yes | Yes | No | No |
| Change of PDUID | The PDUID assigned to a UE has changed. | 5G DDNMF | No | No | No | No | Yes |
| SM Policy Association established or terminated | The establishment or termination of a SM Policy Association is reported | PCF | No | No | No | Yes(NOTE 7) | No |
| Additional addresses | Additional IP addresses or address ranges allocated for the given PDU Session. | TSCTSF | No | Yes | No | No | No |
| NOTE 1: Additional parameters for the subscription as well as reporting related to these events are described in TS 23.502 [3].NOTE 2: Applicability of Rx is described in Annex C.NOTE 3: 5GS Bridge/Router information is described in clause 6.1.3.5.NOTE 4: Bulk subscription is implicit. NOTE 1 does not apply.NOTE 5: For a PDU Session established over a SNPN, the combination of the PLMN id and the NID identifies the SNPN.NOTE 6: This column contains also UE context related events that are reported to other consumers such as 5G DDNMF via other reference points than N5. The Conditions for reporting column indicates the respective consumer.NOTE 7: This PCF for the UE subscribes to this Event via AMF and SMF. |

If an AF requests the PCF to report the PLMN identifier where the UE is currently located, then the PCF shall provide the PLMN identifier or the SNPN identifier to the AF if available. Otherwise, the PCF shall provision the corresponding PCC rules, and the Policy Control Request Trigger to report PLMN change to the SMF. The PCF shall, upon receiving the PLMN identifier or the SNPN identifier from the SMF forward this information to the AF, including the PLMN Id and if available the NID.

If an AF requests the PCF to report on the change of Access Type, the PCF shall provide the corresponding Policy Control Request Trigger to the SMF to enable the report of the Change in Access Type to the PCF. The PCF shall, upon reception of information about the Access Type the user is currently using and upon indication of change of Access Type, notify the AF on changes of the Access Type and forward the information received from the SMF to the AF. The change of the RAT Type shall also be reported to the AF, even if the Access Type is unchanged. For MA PDU Session the Access Type information may include two Access Type information that the user is currently using.

If an AF requests the PCF to report on the signalling path status, for the AF session, the PCF shall, upon indication of removal of PCC Rules identifying signalling traffic from the SMF report it to the AF.

If an AF requests the PCF to report Access Network Charging Correlation Information, the PCF shall provide to the AF the Access Network Charging Correlation Information, which allows to identify the usage reports that include measurements for the Service Data Flow(s), once the Access Network Charging Correlation Information is known at the PCF.

If an AF requests the PCF to report Access Network Information (i.e. the User Location Report and/or the UE Timezone Report) at AF session establishment, modification or termination, the PCF shall set the Access Network Information report parameters in the corresponding PCC rule(s) and provision them together with the corresponding Policy Control Request Trigger to the SMF. For those PCC rule(s) based on preliminary service information the PCF may assign the 5QI and ARP of the QoS Flow associated with the default QoS rule to avoid signalling to the UE.

NOTE 1: The PCF can also use the dynamic or pre-defined PCC Rules related to the IMS signalling to request Access Network Information reporting. This can be used to support e.g., regulatory requirements for SMS over IP, where the IMS network (i.e. P‑CSCF) needs to retrieve the user location and/or UE Time Zone information. Note that due to regulatory requirements, the Access Network Information can be requested for SMS over IP, impacting a large number of PDU Sessions, that can lead to significant increase in signalling load when the Access Network Information is requested from AMF.

The PCF shall, upon receiving an Access Network Information report corresponding to the AF session from the SMF, forward the Access Network Information as requested by the AF (if the SMF only reported the serving PLMN identifier or the SNPN identifier to the PCF, as described in clause 6.1.3.5, the PCF shall forward it to the AF). For AF session termination the communication between the AF and the PCF shall be kept alive until the PCF report is received.

If an AF requests the PCF to report the Usage for Sponsored Data Connectivity, the PCF shall provision the corresponding PCC rules, and the Policy Control Request Trigger to the SMF. If the usage threshold provided by the AF has been reached or the AF session is terminated, the PCF forwards such information to the AF.

If an AF requests the PCF to report the Service Data Flow deactivation, the PCF shall report the release of resources corresponding to the AF session. The PCF shall, upon being notified of the removal of PCC Rules corresponding to the AF session from the SMF, forward this information to the AF. The PCF shall also forward, if available, the reason why the resources are released, the user location information and the UE Timezone.

If an AF requests the PCF to report the Resource allocation outcome, the PCF shall report the outcome of the resource allocation of the Service Data Flow(s) related to the AF session. The AF may request to be notified about successful or failed resource allocation. In this case, the PCF shall instruct the SMF to report the successful resource allocation trigger (see clause 6.1.3.5). If the SMF has notified the PCF that the resource allocation of a Service Data Flow is successful and the currently fulfilled QoS matches an Alternative QoS parameter set (as described in clause 6.2.2.1), the PCF shall also provide to the AF the QoS Reference parameter or the Requested Alternative QoS Parameter Set which corresponds to the Alternative QoS parameter set referenced by the SMF.

If an AF requests the PCF to report when the QoS targets can no longer (or can again) be fulfilled for a particular media flow, the PCF shall set the QNC indication in the corresponding PCC rule(s) that includes a GBR or delay critical GBR 5QI value and provision them together with the corresponding Policy Control Request Trigger to the SMF. At the time, the SMF notifies that GFBR can no longer (or can again) be guaranteed for a QoS Flow to which those PCC Rule(s) are bound, the PCF shall report to the AF the affected media flow and provides the indication that QoS targets can no longer (or can again) be fulfilled. If additional information is received with the notification from SMF (see clause 5.7.2.4 of TS 23.501 [2]), the PCF shall also provide to the AF the QoS Reference parameter or the Requested Alternative QoS Parameter Set which corresponds to the Alternative QoS parameter set referenced by the SMF. If the SMF has indicated that the lowest priority Alternative QoS parameter set cannot be fulfilled, the PCF shall indicate to the AF that the lowest priority QoS Reference or the lowest priority set of Requested Alternative QoS Parameters of the Alternative Service Requirements cannot be fulfilled.

If the AF subscribes to be notified of the QoS Monitoring reports, the PCF decides about the path for the QoS Monitoring reports and sets the QoS Monitoring for URLLC Policy Control Request Trigger accordingly, as described in clause 6.1.3.21. The PCF shall further send the QoS Monitoring reports it receives from the SMF to the AF, unless the AF has provided an indication of direct event notification (i.e. in this case, the AF will receive the QoS Monitoring reports directly from the UPF).

NOTE 2: This event can only be subscribed as part of an AF session with required QoS (described in clause 6.1.3.22).

If an AF requests the PCF to report on the Out of credit event for the associated service data flow(s), the PCF shall inform the AF (when it gets informed by the SMF) that credit is no longer available for the services data flow(s) related to the AF session together with the applied termination action.

If an AF requests the PCF to report on the Reallocation of credit event for the associated service data flow(s), the PCF shall inform the AF (when it gets informed by the SMF) that credit has been reallocated after credit was no longer available and the termination action was applied for the service data flow(s) related to the AF session.

The PCF can arm the trigger of 5GS Bridge/Router information available to SMF based on local policy (i.e. without an AF request) or based on subscription request from TSCTSF. The PCF shall, upon reception of the 5GS Bridge/Router information (refer to clauses 6.1.3.23, 6.1.3.23a, 6.1.3.23b) from the SMF, forward this information to the TSN AF or the TSCTSF. When the PCF has received the User plane node Management Information Container or Port Management Information Container and related port number from SMF, the PCF also provides User plane node Management Information Container or Port Management Information Container and related port number to the TSN AF or TSCTSF. When SMF has reported the 5GS Bridge/Router information and no AF session exists, the PCF forward this information to a pre-configured TSN AF, or to a pre-configured TSCTSF or a TSCTSF discovered and selected via NRF. In the case of private IPv4 address being used for IP type PDU Session, the PCF shall additionally report DNN and S-NSSAI of the PDU Session to TSCTSF.

If the AF requests the PCF to report on the outcome of the service area coverage change, the PCF reports the outcome of the service area coverage change to the AF and notifies the current service area coverage to the AF. The outcome is the result of the execution of the request of service coverage change at the PCF; the outcome is successful if the request was executed, and includes the current service area coverage that may be the same or different from the service area coverage provided by the AF. The subscription may also be implicit. In this case there may be bulk subscription, either for an Internal-Group-Id or for any UE. In order to prevent massive notifications to the AF, the request for any UE is associated to a specific Application Identifier or DNN, S-NSSAI. For bulk subscription, when the AF request includes an expiration time, the PCF stops reporting to the AF when the expiration time is reached.

If the AF requests the PCF to report on the outcome of the UE Policies delivery due to service specific parameter provisioning procedure targeting a single UE, the PCF reports the outcome of the related UE Policies provisioning procedure for the related traffic descriptor for the UE. The outcome of the UE Policies provisioning procedure includes the success, the failure with an appropriate cause or the interim status report such as UE is temporarily unreachable. (See clauses 4.15.6.7 and 5.2.5.7 of TS 23.502 [3])

A request to report Start of application traffic detection and Stop of application traffic detection triggers the reporting when the PCF receives start of application traffic detection event or stop of application traffic detection event from SMF. The reception of a subscription to this event triggers the setting of the corresponding Policy Control Request Trigger to SMF, if not already subscribed.

If an AF requests the PCF to report on the change between different satellite backhaul categories (i.e. GEO, MEO, LEO, OTHERSAT) or the change between satellite backhaul and non-satellite backhaul, the PCF shall provide the corresponding Policy Control Request Trigger to the SMF to enable the report of satellite backhaul category change (see clause 6.1.3.5) to the PCF. The PCF shall, upon reception of information about the change between satellite backhaul categories or change between satellite backhaul and non-satellite backhaul, notify the AF on the satellite backhaul category change event was met and forward the current satellite backhaul category information received from the SMF to the AF, or indicate that a satellite backhaul is no longer used.

If 5G DDNMF requests the PCF to report on the Change of PDUID, the PCF shall notify whenever a new PDUID is allocated. Further details on how the 5G DDNMF retrieves and subscribes to notifications on Change of PDUID are defined in TS 23.304 [34].

A request to report SM Policy Association established or terminated triggers the reporting when the PCF receives the request for notification on the SM Policy Association from SMF. The PCF notifies on the EventID "SM Policy Association established/terminated", includes the PCF binding information of the PCF for the PDU Session of the UE, as described in clause 6.1.1.2.2.

If the TSCTSF requests the PCF to report additional addresses, the PCF shall report additional addresses allocated to the PDU Session due to Framed Routes or IPv6 prefix delegation. The report shall include a list of IPv4 address masks or a list of IPv6 prefixes.

\* \* \* Next Change \* \* \*

#### 6.1.3.23a Support of Time Sensitive Communication and Time Synchronization

Enablers for Time Sensitive Communication and Time Synchronization are defined in TS 23.501 [2] clause 5.27.

In the case of integration with IEEE TSN network, the TSN AF interacts with the PCF as described in clause 6.1.3.23. In the case of integration with DetNet network, the TSCTSF interacts with the PCF as described in clause 6.1.3.23b.

When the PCF has the 5GS Bridge/Router information for the PDU Session received from SMF and has a subscription for the 5GS Bridge/Router information Notification from the TSCTSF or the PCF determines that the PDU Session is potentially impacted by (g)PTP based time synchronization service based on a local policy, if integration with IEEE TSN does not apply, the PCF provides the following parameters to the TSCTSF:

- 5GS user-plane Node information:

- User-plane Node ID;

- UE-DS-TT Residence time;

- port number of the DS-TT;

- MAC address of the Ethernet port of DS-TT (i.e. DS-TT port MAC address) (for Ethernet type PDU Session), or IP address of the UE (for IP type PDU Session, additionally DNN and S-NSSAI of IP type PDU Session in the case of private IPv4 address being used for the PDU Session);

- Port Management Information Container and the related port number;

- User plane node Management Information Container.

Upon reception of the above information, if the TSCTSF does not have a corresponding AF session, the TSCTSF shall create an AF session with the PCF.

The TSCTSF may receive a request from an AF that a data session to a UE is to be set up for Time Sensitive Communication with a specific QoS and parameters that describe the traffic characteristics. If so, the TSCTSF provides the Flow Descriptions, the TSC Assistance Container (as described in clause 5.27.2.3 of TS 23.501 [2]), and the related QoS information to the PCF by setting up an AF session with required QoS as described in clause 6.1.3.22. In addition, the TSCTSF may provide the following parameters to the PCF:

- Port Management Information Container and related Port number as applicable.

- User plane node Management Information Container.

The TSCTSF may use the PTP Port state of NW-TT and DS-TT in the Port/User plane node Management Information Container to determine the Port Pairs that will be used for (g)PTP delivery. Based on this the TSCTSF may request appropriate QoS treatment for the (g)PTP flows from PCF.

The AF may include the Capability for BAT adaptation or a BAT Window in the request (as described in clause 5.27.2.3 of TS 23.501 [2]).The PCF sends the BAT offset received from the SMF to the AF and the AF adjusts the burst sending time according to the indicated BAT offset.

\* \* \* Next Change \* \* \*

#### 6.1.3.23b Support of IETF Deterministic Networking

Enablers for the support of IETF Deterministic Networking are defined in TS 23.501 [2] clauses 4.4.8.4 and 5.28.X.

When the PCF has received the 5GS Bridge/Router information for the PDU Session from SMF and has a subscription for the 5GS Bridge/Router information Notification from the TSCTSF or based on a local policy, if integration with IETF Deterministic Networking applies, the PCF provides the following information to the TSCTSF:

- User-plane node ID;

- port number;

- For device side port:

- IP address or IPv6 prefix allocated to the PDU Session;

- MTU size for IPv4, MTU size for IPv6 (both optional);

- For network side port:

- Port Management Information Container (see Information for deterministic networking in Table 5.28.3.1.1 of TS 23.501 [2]).

Upon reception of the above information, if the TSCTSF does not have a corresponding AF session, the TSCTSF shall create an AF session with the PCF.

The TSCTSF shall subscribe for notifications from the PCF for Additional addresses for the same PDU Session. As a result, the TSCTSF shall be notified of any additional address or address range that is allocated for the given PDU Session as a result of Framed Routes or IPv6 Prefix delegation.

The TSCTSF may receive DetNet YANG configuration as described in IETF draft-ietf-detnet-yang [xx] from a DetNet Controller that describe the traffic characteristics and requirements. If so, the TSCTSF provides the Flow Descriptions, the TSC Assistance Container (as described in clause 5.27.2.3 of TS 23.501 [2]), and the related QoS information to the PCF as specified in the AF session with required QoS procedure for the signalling between the TSCTSF and the PCF described in clause 4.15.6.6 of TS 23.502 [3]. The TSCTSF may receive DetNet YANG configuration from the DetNet controller as described in IETF draft-ietf-detnet-yang [xx]. The TSCTSF maps the DetNet configuration as follows.

- Max-latency to Requested 5GS Delay.

- Min-bandwidth to Requested Guaranteed Bitrate.

- Max-loss to Requested Packet Error Rate.

- Max-consecutive-loss-tolerance to Survival time - when such mapping is possible, such as when there is only a single packet per interval.

- Interval to Periodicity.

- max-pkts-per-interval \* (max-payload-size + protocol header size) to Maximum Burst Size.

- max-pkts-per-interval \* (max-payload-size + protocol header size)/ Interval to Requested Maximum Bitrate.

DetNet flow specification is mapped to the Flow Description information.

In case the DetNet YANG configuration includes the Max-latency and Max-loss only for the end-to-end flow, the TSCTSF determines the requirements applicable to 5GS based on a pre-configured mapping for the given deployment.

Based on the mapping, the TSCTSF provides the Flow Descriptions, the TSC Assistance Container (as described in clause 5.27.2.3 of TS 23.501 [2]), and the related QoS information to the PCF by setting up an AF session with required QoS as described in clause 6.1.3.22.

\* \* \* End of Changes \* \* \*