**Stor-Göteborg, , -**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
|  |
| *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:***  |  |
|  |  |
| ***Source to WG:*** |  |
| ***Source to TSG:*** | S2 |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** |  |
|  | *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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | TS 23.502 contains the following:5.2.5.7 Npcf\_EventExposure service*5.2.5.7.1 General****Service description:*** *This service enables an NF to subscribe and get notified about PCF events for a group of UE(s) or any UE accessing a combination of (DNN, S-NSSAI).**The events can be subscribed by a NF consumer are described in clause 6.1.3.18 of TS 23.503 [20].**When the consumer NF is the NWDAF, the event ID “Signalling Storm” including Request type and number of requests corresponding to the request type from NF, Unexpected operational status indicator, etc. is used to collect data for NF related information from PCF for Signalling Storm Analytics as specified in clause 6.x.2 of TS 23.288 [50].**..*Related stage 3 TS 29.523 contains:**Table 5.6.2.8-1: Definition of type PcEventNotification**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| sigInfos | array(NfSignallingInfo) | C | 1..N | Contains signalling information. It shall be included when the reported event is "SIGNALLING\_INFO". | SignallingInfo |

And TS 29.571 defines:5.2.4.29 Type NfSignallingInfoTable 5.2.4.29-1: Definition of type NfSignallingInfo

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute name** | **Data type** | **P** | **Cardinality** | **Description** |
| nfSigInfoPerWndw | array(NfSignallingInfoPerTimeWindow) | O | 1..N | Contains NF signalling information per time window. |
| avgReqProcTime | Uinteger | O | 0..1 | The average processing time (in milliseconds) of each request, i.e. the time duration between receiving the request from an NF and sending the response to the NF. |
| nfHeartbeatInfo | NfHeartbeatInfo | O | 0..1 | Contains NF heartbeat-related information. |
| unexpStatusInd | boolean | O | 0..1 | Indicates whether the NF is at an unexpected status (i.e. deviates from the normal operations, based on thresholds or rules configured by operator).- "true": the NF is at an unexpected status.- "false": the NF is not at an unexpected status.The default value is "false" if omitted. |

5.2.4.30 Type NfSignallingInfoPerTimeWindowTable 5.2.4.30-1: Definition of type NfSignallingInfoPerTimeWindow

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute name** | **Data type** | **P** | **Cardinality** | **Description** |
| tw | TimeWindow | M | 1 | The time window in which the provided signalling information occurred. |
| nfSigInfoPerService | map(NfSignallingInfoPerService) | M | 1..N | Each entry of the map contains NF signalling information for a specific service. The key of the map is the "serviceName" attribute of the NfSignallingInfoPerService data type. |

5.2.4.31 Type NfSignallingInfoPerServiceTable 5.2.4.31-1: Definition of type NfSignallingInfoPerService

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute name** | **Data type** | **P** | **Cardinality** | **Description** |
| serviceName | ServiceName | M | 1 | The name of the service as specified in clause 6.1.6.3.11 of 3GPP TS 29.510 [29] to which the provided signalling information refers. |
| numOfReq | Uinteger | O | 0..1 | The number of requests received for this service. (NOTE) |
| numOfReqUnresp | Uinteger | O | 0..1 | The number of requests received for this service which were not responded. (NOTE) |
| numOfReqReject | Uinteger | O | 0..1 | The number of requests received for this service which were rejected. (NOTE) |
| numOfRedMessages | Uinteger | O | 0..1 | The number of redundant received messages, i.e. messages which were transmitted multiple times. |
| numOfPosteriorReq | Uinteger | O | 0..1 | The number of posterior requests, i.e. requests that were triggered by a previous request received by the same NF. |

Editor's Note: It is FFS, whether the above measurements should be reported per service name or per service instance. 5.2.4.32 Type NfHeartbeatInfoTable 5.2.4.32-1: Definition of type NfHeartbeatInfo

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute name** | **Data type** | **P** | **Cardinality** | **Description** |
| numOfRetrans | Uinteger | O | 0..1 | Number of retransmissions performed. |
| hbIntvl | Uinteger | O | 0..1 | NF heartbeat interval in milliseconds. |

TS 23.503 Clause 6.1.3.18 is supposed to describe all parameters for PCF event reporting, but is lacking such information. |
|  |  |
| ***Summary of change:*** | Summary of change: Align with TS 23.288, TS 23.502 and stage 3 TS 23.523 by adding event exposure parameters required as input to related to signalling load analytics to Clause 6.1.3.18 |
|  |  |
| ***Consequences if not approved:*** | Misallignment with TS 23.288, TS 23.502 and stage 3 TS 23.523 |
|  |  |
| ***Clauses affected:*** | 6.1.3.18 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | An alternative proposal to document the new event in TS 23.502 is in S2-2506207. |
|  |  |
| ***This CR's revision history:*** |  |

#### 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. Other NFs may subscribe/unsubscribe to notifications of events from the PCF for the PDU Session or from the PCF for the 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) | Availability for N24 per UE(NOTE 6) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| PLMN Identifier Notification(NOTE 5) | The PLMN identifier or SNPN identifier where the UE is currently located. | AF, PCF | Yes | Yes | Yes | No | No | Yes |
| 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 | No |
| EPS fallback | EPS fallback is initiated | AF | Yes | Yes | No | 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 | 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 | No |
| Access Network Information Notification | The user location and/or timezone and/or identifier of the serving satellite of the UE when the PDU Session has changed in relation to the AF session. | AF | Yes | Yes | No | 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 | No |
| Service Data Flow deactivation | The resources related to the AF session are released. | AF, TSCTSF | Yes | Yes | No | No | No | No |
| Resource allocation outcome | The outcome of the resource allocation related to the AF session. | AF, TSCTSF | Yes | Yes | No | 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 | No |
| QoS Monitoring parameters | The QoS Monitoring parameter(s) (as defined in clause 5.45 of TS 23.501 [2]) are reported to the AF according to the subscription based on QoS Monitoring reports received from the SMF. | AF | No | Yes | No | No | No | No |
| Network support for QoS Monitoring | The QoS Monitoring can no longer (or can again) be performed by the network for the service data flow. | AF | No | Yes | No | No | No | No |
| Packet Delay Variation | Monitoring and reporting of 5GS Packet Delay Variation based on packet delay measured between UE and PSA UPF. | AF | No | Yes | No | No | No | No |
| Round-trip delay measurement over two service data flows | Measurements of round-trip delay considering the UL direction of a service data flow and the DL direction of another service data flow. It is derived from measurements of packet delay between UE and PSA UPF. | AF | No | Yes | No | No | No | No |
| Network support for ECN marking for L4S(NOTE 8) | The ECN marking for L4S can no longer (or can again) be performed by the network for the service data flow. | AF | No | Yes | No | No | No | No |
| Out of credit | Credit is no longer available. | AF | Yes | Yes | No | No | No | No |
| Reallocation of credit | Credit has been reallocated after the former Out of credit indication. | AF | Yes | Yes | No | No | No | No |
| 5GS Bridge/Router information Notification(NOTE 3) | 5GS Bridge/Router information that the PCF has received from the SMF. | TSN AF, TSCTSF | No | Yes | No | 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 | No |
| 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 | Yes |
| Start of application traffic detection andStop of application traffic detection | The start or the stop of application traffic has been detected. | PCF, AF | No | No | Yes | Yes(NOTE 4) | No | No |
| UE reporting Connection Capabilities from associated URSP rule | The Connection Capability received from the UE during PDU Session Establishment or Modification, see clause 6.6.2.4. | PCF | No | No | No | Yes | No | Yes |
| Satellite backhaul category change | The backhaul has changed between different types of satellite backhaul, or the backhaul has changed between satellite backhaul and non-satellite backhaul. | AF | No | Yes | Yes | No | No | No |
| Change of PDUID | The PDUID assigned to a UE has changed. | 5G DDNMF | No | No | No | No | Yes | No |
| 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 | No |
| Reporting of extra UE addresses | Reporting of the extra IP addresses or address ranges allocated for the given PDU Session resulting from framed routes or IPv6 prefix delegation. | TSCTSF | No | Yes | No | No | No |  |
| Notification on BAT offset | The PCF reports the BAT offset and optionally the adjusted periodicity that has been received from the SMF. | TSCTSF | No | Yes | No | No | No |  |
| UE reachability status change | The PCF reports when it receives an indication of a change of the UE reachability status. | AF | No | Yes | No | No | No | No |
| Result of UE Policy Container delivery via EPS | The PCF reports the result of UE policies delivery via EPS. | PCF | No | No | No | Yes(NOTE 9) | No | No |
| Notification on outcome Network Slice Replacement | The PCF reports the outcome of Network Slice Replacement. | AF | No | No | No | No | Yes | No |
| Data Rate Limitation Information for the Non-GBR service data flow | The PCF reports the uplink and downlink maximum bitrate authorized for the Non-GBR service data flow and any change of it. | AF | No | Yes | No | No | No | No |
| Data Rate Limitation Information for the PDU Session | The PCF reports the uplink and downlink Authorized Session-AMBR of the PDU Session and any change of it. | AF | No | No | Yes | No | No | No |
| Signalling Information | The PCF reports information about signalling interactions with peer NF instsnces. | NWDAF | No | No | Yes | Yes | 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: The PCF for the UE subscribes to this Event indirectly via AMF and SMF.NOTE 8: Subscription to this event is performed implicitly when AF provides the ECN marking for L4S support indication.NOTE 9: The PCF for the UE subscribes to this Event to PCF for the PDU Session. |

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 the H-PCF requests to report the PLMN identifier where the UE is currently located, the V-PCF provisions the PCRT on "PLMN change" to the AMF as described in clause 6.1.2.5 and then forwards the PLMN ID received from the AMF to the H-PCF.

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 and/or the Satellite Identifier 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 or TSCTSF 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 or TSCTSF 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 or TSCTSF 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 the SMF has notified the PCF about resource allocation failure together with an Access Type (as described in clause 6.1.3.5), the PCF shall only notify the AF when the PCC rule is removed and without forwarding any Access Type information. If the SMF has notified the PCF about resource allocation failure due to UE temporary unreachable together with a maximum waiting time, if available, (as described in clause 6.1.3.5), the PCF shall notify the AF on resource allocation failure and provide the UE temporary unreachable and the maximum waiting time, if available.

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 the PCF receives a direction information together with the notification from the SMF, the PCF shall also forward the direction information to the AF. If other information is received together 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 Policy Control Request Trigger accordingly, as described in clause 6.1.3.21. The PCF sends the QoS Monitoring reports to AF based on the QoS Monitoring reports that it receives from the SMF, according to AF subscription and PCF selected notification path e.g. PCF does not report to AF if AF will receive the QoS Monitoring reports directly from the UPF.

NOTE 2: The QoS Monitoring report received by the PCF and the information sent to the AF can be different. The QoS Monitoring report (e.g. packer delay) may be used by PCF to calculate the requested QoS parameter (e.g. packet delay variation).

NOTE 3: This event can only be subscribed as part of an AF session with required QoS (described in clause 6.1.3.22) and as part of AF requested QoS for a UE or group of UEs not identified by a UE address (described in clause 6.1.3.28).

NOTE 4: If the service data flow is mapped to two QoS Flows (i.e. the UL traffic and DL traffic of the service data flow are separated into two QoS Flows respectively) in the same PDU Session, the PCF triggers QoS Monitoring for each direction packet delay of the individual QoS Flows respectively and generates the QoS Monitoring reports for the AF based on the packet delay monitored on the QoS Flow for each direction (as described in clause 5.37.4 of TS 23.501 [2]).

If the AF subscribes to be notified of Packet Delay Variation reports (the variation of UL/DL packet delay between UE and PSA UPF), the PCF triggers the QoS monitoring procedure, derives the 5GS Packet Delay Variation and reports the value to the AF, as described in clause 6.1.3.26.

NOTE 5: This event can only be subscribed as part of an AF session with required QoS (described in clause 6.1.3.22).

If the AF subscribes to Round-trip delay measurement over two service data flows considering the UL direction of a service data flows and the DL direction of another service data flow, PCF triggers the QoS monitoring procedure to derive the Round-Trip delay measurement for delay measurements on the individual QoS Flows respectively (as described in clause 6.1.3.27.1 and in clause 5.37.4 of TS 23.501 [2]. The PCF derives the Round-Trip delay based on the packet delay measurement reports of the QoS Flows of each direction and reports the results to the AF. PCF sets QoS Monitoring Policies for each of the individual service data flows and QoS Monitoring Policy Control Request Trigger as described in clause 6.1.3.21.

NOTE 6: This event can only be subscribed as part of an AF session with required QoS (described in clause 6.1.3.22).

If the AF subscribes to the event Network support for QoS Monitoring, the PCF sets the QoS Monitoring can no longer (or can again) be performed Policy Control Request Trigger in the SMF, if not done before. The PCF shall notify the AF that QoS Monitoring can no longer (or can again) be performed by the network based on the last notification from the SMF that QoS Monitoring can no longer (or can again) be performed but only if the QoS monitoring parameter for which the AF subscription relates to is affected.

NOTE 7: AF QoS monitoring subscription can require implicit support of QoS monitoring parameters not directly associated with the functionality requested by the AF, e.g. PDV monitoring requires the support of packet delay monitoring. In that case the PCF will also report whether QoS monitoring can no longer (or can again) be performed.

If the AF indicates ECN marking for L4S support by the application, PCF authorizes the request and sets the ECN marking for L4S can no longer (or can again) be performed trigger accordingly. PCF shall further send the notification it receives from the SMF to AF on whether the network can not (or can again) perform ECN marking for L4S, for example, if due to user mobility neither target 5G-AN nor UPF PSA support ECN marking for L4S.

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 (H-)PCF, via V-PCF when roaming, to report on the outcome of the UE Policies delivery due to service specific parameter provisioning procedure, the (H-)PCF reports the outcome of the related UE Policies provisioning procedure for the related traffic descriptor for the UE to the AF, via V-PCF when roaming. The outcome of the UE Policies provisioning procedure includes the success, the failure with an appropriate cause, including failure reported by the UE as described in TS 24.501 [22] or failure detected by the network e.g. service parameters provided by the AF are not authorized for a SUPI, or the interim status report such as the UE is temporarily unreachable or that URSP Rules have not yet been delivered by the H-PCF (see clauses 4.15.6.7 and 5.2.5.7 of TS 23.502 [3]). The PCF reports the outcome of the UE Policy provisioning procedure for each of the UEs that were included as Target UEs in the service specific information Data Subset in UDR. When the AF requested the PCF for the UE to report on the outcome of the UE Policies delivery due to service specific parameter provisioning procedure targeting a single UE, the Result of UE Policy Container delivery via EPS event trigger shall be subscribed.

NOTE 8: An example reason for sending an interim status report that indicates that "URSP Rules have not yet been delivered by the H-PCF" may be that the UE does not support the VPLMN Specific URSP Rules feature and is not registered in the PLMN where the service parameters apply.

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.

A request to forward UE reporting Connection Capabilities from an associated URSP rule triggers the reporting when the PCF receives UE reporting of URSP rule enforcement information from the SMF matching specific Connection Capabilities (see clause 6.6.2.4). The request may include SUPI(s), DNN(s) and/or S-NSSAI(s) to which the request applies. The PCF reports the received Connection Capabilities and PDU Session information including the SUPI, UE requested DNN, Selected DNN, S-NSSAI, SSC Mode, PDU Session Type.

If an AF requests the PCF to report Start of application traffic detection and Stop of application traffic detection via bulk subscription, the AF shall provide the application identifier together with the S-NSSAI and DNN. The PCF provides a PCC rule for the application identifier together with the corresponding Policy Control Request Trigger to the SMF for every PDU Session to this S-NSSAI and DNN. When the PCF receives start of application traffic detection event or stop of application traffic detection event for the PCC rule in a PDU Session, the PCF forwards the event to the AF together with the UE identifier and optionally the IP address of the PDU Session corresponding to this PCC rule. When the AF removes bulk subscription for this application identifier, then the PCF removes the Policy Control Request Trigger from the SMF for every PDU Session to this S-NSSAN and DNN, if it is not used for other purpose.

NOTE 9: The restriction of the bulk subscription to a specific combination of S-NSSAI and DNN avoids excessive signalling load.

If an AF requests the PCF to report on the change between different types of satellite backhaul or the change between satellite backhaul and non-satellite backhaul (as specified in clause 5.43.4 of TS 23.501 [2]), 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 of Satellite backhaul category, notify the AF on the Satellite backhaul category change event was met and forward the current Satellite backhaul category received from the SMF to the AF. When the satellite backhaul is no longer used, the Satellite backhaul category indicates that a non-satellite backhaul is 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 an implicit subscription and the reporting to the PCF for the UE when the PCF for the PDU Session receives PCF binding information together with Request for notification of SM Policy Association establishment and termination from the SMF. The PCF for the PDU Session derives the PCF for the UE from the PCF binding information and then notifies the PCF for the UE on this event, including the PCF binding information of the PCF for the PDU Session.

If the TSCTSF requests the PCF notifications for reporting of extra UE addresses, the PCF shall provide the extra UE addresses allocated to the PDU Session due to Framed Routes or IPv6 prefix delegation. The report shall include the actual list of IPv4 address masks or a list of IPv6 prefixes as currently allocated.

If the AF provides the Capability for BAT adaptation or BAT Window and subscribes to PCF for Notification on BAT offset, the PCF will trigger the subscription to SMF for Notification on BAT offset defined in clause 6.1.3.5. When the Notification on BAT offset trigger is set and the PCF receives a BAT offset and optionally an adjusted periodicity from the SMF, the PCF identifies the affected AF session (based on the PCC rule indicated by the SMF) and forwards the BAT offset and optionally the adjusted periodicity for this AF session to the TSCTSF.

A request to report Result of UE Policy Container delivery via EPS triggers the reporting when the PCF for the PDU Session receives the UE Policy Container from the UE during UE Policy Container delivery via EPS, or a delivery failure result for UE Policy Container delivery via EPS with appropriate reason from the 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 UE reachability status change, the PCF shall provide the corresponding Policy Control Request Trigger to the SMF to enable the report of the UE reachability status change to the PCF, if not already subscribed. The PCF shall, upon indication of change of reachability status, notify the AF and forward the information received from the SMF to the AF.

If an AF requests the PCF to report on the change between S-NSSAI and Alternative S-NSSAI, the PCF reports the outcome of the network slice replacement to the AF.

If an AF requests the PCF to report the Data Rate Limitation Information for the Non-GBR service data flow, the PCF reports the uplink and downlink maximum bitrate authorized for the service data flow to the AF and any change of it. Further details are described in clause 6.1.3.27.1.

If an AF requests the PCF to report the Data Rate Limitation Information report for the PDU Session, the PCF reports the uplink and downlink Authorized Session-AMBR for the PDU Session to the AF and any change of it. Further details are described in clause 6.1.3.27.1.

If an NWDAF requests the PCF to report signalling information, the PCF reports information related the amount of successful and failed signalling interactions with peer NF service instances, as detailed in Clause 6.22.2 of TS 23.288 [24].