**3GPP TSG-CT WG3 Meeting #128 *C3-232326***

**Bratislava, Slovakia, 22nd - 26th May, 2023**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **29.513** | **CR** | **0472** | **rev** | **-** | **Current version:** | **18.1.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **X** |

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|  |
| ***Title:***  |  Support of 3GPP extensions for DetNet |
|  |  |
| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | CT3 |
|  |  |
| ***Work item code:*** | DetNet |  | ***Date:*** | 2023-05-15 |
|  |  |  |  |  |
| ***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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | TS 23.503 requires in clause 6.1.3.23b the 3GPP extension to the IETF draft-ietf-detnet-yang, so that the DetNet controller can provide to the 5GS system the maximum latency and the maximum loss the 5GS system shall apply.TS 23.501 specifies in clause 5.28.5.2 the 3GPP extension to the IETF draft-ietf-detnet-yang to support the indication to the DetNet controller of a TSCTSF generated identifier of the 5GS node, and in clause 5.28.5.3 the extension of the IETF draft-ietf-detnet-yang returned status codes to complete them with details the 5GS may return. During CT3#127e it was agreed by CT3 WG that the 3GPP extensions to IETF draft-ietf-detnet-yang are documented in TS 29.565. The documentation proposal was covered in DP C3-231096 and C3-231097.The 3GPP extensions to IETF draft-ietf-detnet-yang documented in TS 29.565 is called 3gpp-5gs-detnet-node. |
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| ***Summary of change:*** | The Reference architecture and the 5GS DetNet node information reporting and 5GS DetNet node configuration clauses are updated to describe the support of the YANG module 3gpp-5gs-detnet-node. |
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| ***Consequences if not approved:*** | The DetNet Controller cannot provide the amximum latency and maximum loss requirements the 5GS system shall apply, the 5GS node Id and/or additional status codes in the response to the configuration request.  |
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| ***Clauses affected:*** | 4, 5.5.12.2, 5.5.12.3 |
|  |  |
|  | **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:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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

# 4 Reference architecture

The policy framework functionality in 5G is comprised of the functions of the Policy Control Function (PCF), the policy and charging enforcement functionality supported by the SMF and UPF, the access and mobility policy enforcement functionality supported by the AMF, the Network Data Analytics Function (NWDAF), the Network Exposure Function (NEF), the Charging Function (CHF), the Unified Data Repository (UDR), the Time Sensitive Communication and Time Synchronization Function (TSCTSF), the Application Function (AF) and the 5G Direct Discovery Name Management Function (5G DDNMF).

The policy framework functionality for multicast-broadcast services in 5G is comprised of the functions of the Policy Control Function (PCF), the Multicast/Broadcast Service Function (MBSF), the Multicast-Broadcast Session Management Function (MB-SMF), the Network Exposure Function (NEF), the Unified Data Repository (UDR) and the Application Function (AF).

For the roaming scenario, the Security Edge Protection Proxy (SEPP) is deployed between the V-PCF and H-PCF. 3GPP TS 23.503 [4] specifies the 5G policy framework stage 2 functionality.



Figure 4.1-1a: Overall non-roaming 5G Policy framework architecture (service based representation)



Figure 4.1-1b: Overall non-roaming 5G Policy framework architecture (reference point representation)

NOTE 1: The N4, N4mb, Nmb2, Nmb9 and N19mb interfaces are not part of the Policy Framework architecture but shown in the figures for completeness.

NOTE 2: If an SCP is deployed it can be used for indirect communication between NFs and NF services as described in Annex E of 3GPP TS 23.501 [2].

NOTE 3: MB-SMF, MBSTF, MB-UPF and MBSF apply only when the MBS PCC Architecture as described in 3GPP TS 23.247 [54] is deployed. In this case only the entities shown in that architecture are applicable.

The AF trusted by the operator interacts with the PCF via the N5 reference point. In the case of an untrusted AF, the AF interacts with the PCF via the NEF. The NEF interacts with the PCF via the N30 reference point in the same way that the AF interacts with the PCF via the N5 reference point.

The Nchf service for online and offline charging consumed by the SMF is defined in 3GPP TS 32.240 [28].

The Nchf service for Spending Limit Control consumed by the PCF is defined in 3GPP TS 29.594 [23].

The PCF providing session management policy control for a UE (i.e. PCF for the PDU Session) and the PCF providing non-session management policy control for that UE (i.e. PCF for the UE) may be different PCF instances and the communication between the PCF for the UE and the PCF for the PDU Session is performed over the N43 reference point.

NOTE 3: The roaming scenarios for SNPNs are not supported in this Release.



Figure 4.1-2a: Overall roaming policy framework architecture - LBO (service based representation)



Figure 4.1-2b: Overall roaming policy framework architecture - LBO (reference point representation)

NOTE 4: In the LBO scenario, the PCF in the VPLMN may interact with the AF in order to generate PCC rules for services delivered via the VPLMN. The PCF in the VPLMN uses locally configured policies according to the roaming agreement with the HPLMN operator as input for PCC rule generation. The PCF in VPLMN has no access to subscriber policy information from the HPLMN nor to session management policy data for the UE in the VPLMN to retrieve input for PCC Rule generation. The interactions between the PCF in the VPLMN and the PCF in the HPLMN through the Npcf service based interface enables the PCF in the HPLMN to provision UE policies to the PCF in the VPLMN, as described in 3GPP TS 23.503 [4] clause 5.2.5.

NOTE 5: In the LBO scenario, AF requests targeting a DNN (and slice) and / or a group of UEs are stored in the UDR by the NEF. The PCF in the VPLMN subscribes to and get notification from the UDR in the VPLMN for those AF requests. Details are defined in clause 5.6.7 of 3GPP TS 23.501 [2].

NOTE 6: For the sake of clarity, SEPPs are not depicted in the roaming reference point architecture figures.

NOTE 7: N4 and N32 are not service based interfaces.

NOTE 8: The Home Routed PDU sessions are not supported for TSC networks in this Release.



Figure 4.1-3a: Overall roaming policy framework architecture - home routed scenario (service based representation)



Figure 4.1-3b: Overall roaming policy framework architecture - home routed scenario (reference point representation)

NOTE 9: For the sake of clarity, SEPPs are not depicted in the roaming reference point architecture figures.

NOTE 10: N4 and N32 are not service based interfaces.

NOTE 11: An SCP can be used for indirect communication between NFs and NF services within the VPLMN, within the HPLMN, or in within both VPLMN and HPLMN. For simplicity, the SCP is not shown in the roaming architecture.

NOTE 12: Non-roaming architecture, local breakout roaming architecture and home-routed roaming architecture for interworking between 5GS and EPS are defined in 3GPP TS 23.501 [2]. The signalling flows described in clause 5 apply to this scenario by replacing SMF by the SMF+PGW-C and with the differences applicable to EPC as described in Annex B.3 of 3GPP TS 29.512 [9].

To allow the 5G system to interwork with AFs related to existing services, e.g. IMS based services, Mission Critical Push To Talk services, the PCF shall support the corresponding Rx procedures and requirements defined in 3GPP TS 29.214 [18]. This facilitates the migration from EPC to 5GC without requiring these AFs to upgrade to support the N5 interface.



Figure 4.1-4: Interworking between 5G Policy framework and AFs supporting Rx interface

To support Deterministic Networking, the TSCTSF offers RESTCONF (IETF RFC 8040 [66]) and/or NETCONF (IETF RFC 6241 [65]) interfaces to access to the schema defined by the 3GPP Extended Deterministic Networking (DetNet) YANG Model specified in 3GPP TS 29.565 [60] (extension of IETF draft-ietf-detnet-yang [64]), to enable the provisioning of configuration and operation data for DetNet flows. The 5G System is integrated with the Deterministic Network as defined in IETF RFC 8655[63] as a logical DetNet transit router (see 3GPP TS 23.501 [2], clause 4.4.8.4). The TSCTSF performs mapping in the control plane between the 5GS internal functions and the DetNet controller.



Figure 4.1-5: Interworking between TSCTSF and DetNet controller to support Deterministic Networking.

\* \* \* \* Second Change \* \* \* \*

#### 5.5.12.2 5GS DetNet node information reporting



Figure 5.5.12.2-1: 5GS DetNet node information reporting

1. During SM Policy Association establishment, the PCF based on local configuration determines that the SM Policy Association enables Deterministic Networking and provides to the SMF the "TSN\_BRIDGE\_INFO" policy control request trigger as described in figure 5.2.1-1, step 11.

 When the trigger is met, the PCF receives TSC User Plane information (for DetNet it represents 5GS Router information): port number, User Plane node ID and, if available, MTU size for IPv4 and MTU size for IPv6 as described in figure 5.2.2.3-1, step 2. The PCF may also receive NW-TT PMIC (with network side interface configuration information) The PCF invokes the Npcf\_PolicyAuthorization\_Notify service operation to notify to the TSCTSF the received TSC User Plane information, and if available, NW-TT PMIC, as described in figure 5.2.2.3-1, step 5 and includes the UE IP address to identify the PDU session.

2. The TSCTSF then invokes the Npcf\_PolicyAuthorization\_Create request message to the PCF as described in clause 5.2.2.2.2.1 to create an AF-session. The TSCTSF shall subscribe with the PCF to the "TSN\_BRIDGE\_INFO" event, to get notifications abut NW-TT PMIC/UMIC updates as specified in 3GPP TS 29.514 [10] and if the "AdditionalAddresses" feature is supported, to the "ADDITIONAL\_ADDR" event to receive information about the one or more Framed Routes available for the PDU session or about the IPv6 prefixes delegated to the UE by IPv6 Prefix Delegation.

3. If the information is available in the PCF, the PCF returns the event related information in the Npcf\_PolicyAuthorization\_Create response (e.g. TSC User Plane information (5GS Router information), additional addresses, if subscribed and available, and PMIC(s) if available).

 The TSCTSF stores the DNN, S-NSSAI and IP address(es) as received from PCF and associates them with the AF-session, as described in 3GPP TS 29.565 [60].

 If the TSCTSF determines the interface configuration information for the created AF-session is complete, the TSCTSF may report to the DetNet controller the collected interface(s) information as described in step 10.

4. The TSCTSF interacts with the PCF by triggering a Npcf\_PolicyAuthorization\_Update request message as specified in 3GPP TS 29.514 [10], to retrieve PMIC information, if not available in the TSCTSF, from the NW-TT to read network interface configuration, as specified in 3GPP TS 23.501 [2].

5. The PCF responds with a "200 OK" or "204 No Content" status code to the received PATCH request.

6. The PCF provides to the SMF the PMIC information received from the TSCTSF as described in clause 5.2.2.2.2.2, which sends the received PMIC to the NW-TT/UPF.

7. When the SMF detects PMIC changes for the NW-TT, the SMF provides the received PMIC information to the PCF as described in clause 5.2.2.3.

8. The TSCTSF receives the PMIC information from NW-TT ports from the PCF with the notification of BRIDGE\_INFO event, as specified in 3GPP TS 29.514 [10]. The PCF invokes the Npcf\_PolicyAuthorization\_Notify service operation by sending an HTTP POST request to the callback URI as specified in clause 5.2.2.3.

9. The TSCTSF responds to the PCF with a "204 No Content" status code.

10. The TSCTSF determines that the interface information for the AF session is complete and may provide the collected network and device side interface configuration to the DetNet controller as defined in 3GPP TS 23.501 [2].

 When both, the TSCTSF and the DetNet controller support the 3GPP Extension 3gpp-5gs-detnet-node as specified in 3GPP TS 29.565 [60], the TSCTSF may use the user-plane node ID received in step 1 to generate an identifier of the 5GS DetNet node and provide it to the DetNet controller.

NOTE: The 5GS node identification can be realized by providing an identifier of the 5GS DetNet node to the DetNet controller using the exposure of 5GS DetNet node identification specified in the 3GPP Extension 3gpp-5gs-detnet-node in 3GPP TS 29.565 [60], or the TSCTSF can provide different termination points (addresses) for the signalling between the DetNet controller and the TSCTSF, each one representing different 5GS nodes.

\* \* \* \* Third Change \* \* \* \*

#### 5.5.12.3 5GS DetNet node configuration

The DetNet controller triggers the 5GS DetNet node configuration procedure to provide Deterministic Networking specific parameters to 5GS as described in figure 5.5.12.2-1.



Figure 5.5.12.3-1: DetNet Node configuration

1. The DetNet controller provides YANG data model configuration to the TSCTSF. The TSCTSF uses the identifier of the incoming and outgoing interfaces, as provided in step 10 of figure 5.5.12.2-1, to determine the affected PDU Session(s) and flow direction, whether it is uplink or downlink. The TSCTSF also determines if the flow is UE to UE in which case two PDU sessions will be affected for the flow and the TSCTSF breaks up the requirements to individual requirements for the PDU Sessions.

2. The TSCTSF determines the 5GS requirements for the DetNet flow.

 When both, the TSCTSF and the DetNet controller support the 3GPP Extension 3gpp-5gs-detnet-node as specified in 3GPP TS 29.565 [60], the TSCTSF maps the received 5GS maximum latency and/or 5GS maximum loss to QoS parameters to PCF as specified in clause 5.5.12.4. When the TSCTSF and/or the DetNet controller do not support the 3GPP Extension 3gpp-5gs-detnet-node or the DetNet YANG configuration includes the E2E traffic requirements, the TSCTSF derives 5GS requirements based on pre-configured mapping as described in 3GPP TS 29.565 [60]. The TSCTSF also constructs a TSCAC for each flow description.

 The TSCTSF provides the mapped parameters and the flow description to the PCF(s) on a per AF Session basis for the given UE address.

3. The TSCTSF interacts with the PCF by triggering a Npcf\_PolicyAuthorization\_Update request message as specified in 3GPP TS 29.514 [10], to provide the required QoS for each flow description. The TSCTSF subscribes to the report of successfull/unsuccessful resource allocation outcome as specified in 3GPP TS 29.514 [10].

4. The PCF authorizes the request from TSCTSF and responds with a "200 OK" or "204 No Content" status code to the received PATCH request. If the PCF determines that the requirements can't be authorized, it rejects the request with the appropriate status code and error cause. In case the request is rejected, the TSCTSF informs the DetNet controller about the unsuccessful outcome as described in step 9.

5. Once the PCF authorizes the request, the PCF updates the SMF with corresponding new PCC rule(s) and policy control request triggers as specified in the PCF initiated SM Policy Association Modification procedure described in clause 5.2.2.2.2.2. The QoS flow is established according to the 5GS QoS requirements for the DetNet flow.

6. The SMF reports to the PCF the outcome about the successful/unsuccessful establishment of the QoS flow as specified in clause 5.2.2.3.

7. The PCF invokes the Npcf\_PolicyAuthorization\_Notify request service operation to provide to the TSCTSF the outcome of the QoS provisioning parameters by sending an HTTP POST request to the callback URI as specified in clause 5.2.2.3.

8. The TSCTSF responds to the PCF with a "204 No Content" status code.

9. The TSCTSF responds to the DetNet controller.

 When both, the TSCTSF and the DetNet controller support Extension 3gpp-5gs-detnet-node as specified in 3GPP TS 29.565 [60], the TSCTSF may provide 5GS specific status code information on the result of the configuration to the DetNet controller. If the status of the flow changes later for any reason (e.g., service data flow deactivation) or the PDU session is released, the TSCTSF notifies the DetNet controller on the status of the flow with 5GS specific information.

\* \* \* \* End of change \* \* \* \*