**3GPP TSG-SA2 # 143E (e-meeting) *S2-2100092***

**Febuarary.24 – March 1, 2021**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.503** | **CR** | **0505** | **rev** | **0** | **Current version:** | **16.6.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network | **x** |

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| ***Title:*** | PCF Management Considering Various NWDAF Analytics Output | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | China Telecom, Spirent, Ericsson, CATT, Huawei | | | | | | | | | |
| ***Source to TSG:*** | SA2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | eNA\_Ph2 | | | | |  | ***Date:*** | | | 2021-1-11 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-11 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
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| ***Reason for change:*** | | According to the conclusion of TR23.700-91 of FS\_eNA\_Ph2, the Analytic IDs for “User Data congestion”, “Data Dispersion”, “Service in use” and “Observed Service Experience” are proposed for the normative work for the KI#12, NWDAF-assisted RFSP policy.  The PCF may subscribe to the above analytics as consideration for RFSP index management. Thus corresponding description needs update in clause 6.1.1.3, policy decisions based on network analytics, and clause 6.1.2.1 access and mobility related policy control. In addition, clause 5.3.11 is further updated to include all the other potential NWDAF analytics inputs into the PCF, which are not presently captured. | | | | | | | | |
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| ***Summary of change:*** | | This CR:  [Change -1] clause 5.3.11  Updated to include all the potential NWDAF analytics inputs into the PCF.  [Change-2] clause 6.1.1.3  Adding descriptions on PCF usage of NWDAF Analytics Id “User Data Congestion”, “Data Dispersion”, “Observed Service” and “UE Communicaiton” realated to RFSP index management.  Re-organize the structure of this clause. For PCF may use more than 1 analytics result to make one policy decision, while same analytics can be use for different policy decision under different circumstances, it is better to separate the part of PCF’S subcription to NWDAF from the part of PCF’s usage of the analytics.  [Change-3] clause 6.1.2.1  Extend PCF’s consideration when selecting RFSP index with conclusions from KI#12, e.g., the service(s) UE consuming and the congestion situation in the network. | | | | | | | | |
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| ***Consequences if not approved:*** | | The PCF may have insuffient information for RFSP selection to ensure UEs’ service experience or mitigate network congestion. | | | | | | | | |
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| ***Clauses affected:*** | | 6.1.1.3, 6.1.2.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS23.288 | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

\* \* \* First Change \* \* \*

### 5.3.11 Interactions between NWDAF and PCF

The Nnwdaf enables the PCF to subscribe to and be notified on the following analytics:

- Slice Load Level

- Service Experience

- Network Performance

- Abnormal Behaviour

- UE Mobility

- UE Communication

- User Data Congestion

- Data Dispersion

The Nnwdaf enables the PCF to request or subscribe to and be notified on a “Slice Load Level” analytics including a slice instance load level. This is described in clause 6.3 of TS 23.288 [24].

The Nnwdaf enables the PCF to request or subscribe to and be notified on ”Observed Service Experience” analytics (i.e. the average observed Service MoS) as described in clause 6.4 of TS 23.288 [24].

The Nnwdaf enables the PCF to request or subscribe to and be notified on “Network Performance analytics” as described in clause 6.6 of TS 23.288 [24].

The Nnwdaf enables the PCF to request or subscribe to and be notified on an “Abnormal Behaviour” analytics. This is described in clause 6.7.5 of TS 23.288 [24].

The Nnwdaf enables the PCF to request or subscribe to and be notified on a “UE Mobility” analytics. This is described in clause 6.7.2 of TS 23.288 [24].

The Nnwdaf enables the PCF to request or subscribe to and be notified on a “UE Communication analytics”. This is described in clause 6.7.3 of TS 23.288 [24].

The Nnwdaf enables the PCF to request or subscribe to and be notified on a “User Data Congestion” analytics in an area of interest. This is described in clause 6.8 of TS 23.288 [24].

The Nnwdaf enables the PCF to request or subscribe to “Dispersion Analytics”. This is described in clause 6.x of TS 23.288 [24].

NOTE: How this information may be used by the PCF is described in clause 6.1.1.3

The N23 reference point is defined for the interactions between NWDAF and PCF in the reference point representation.

\* \* \* \* 2nd Change \* \* \* \*

#### 6.1.1.3 Policy decisions based on network analytics

Policy decisions based on network analytics allow PCF to perform policy decisions taking into account the analytics information provided by the NWDAF. The PCF subscribes/unsubscribes to Analytics information as defined in TS 23.288 [24].The following Analytics IDs are relevant for Policy decisions: "Load level information", "Service Experience", "Network Performance", "Abnormal behaviour", "UE Mobility", "UE Communication", "User Data Congestion" and "Data Dispersion":

* The PCF may subscribe to notifications of network analytics related to "Load Level Information" using the Nnwdaf\_AnalyticsSubscription\_Subscribe service operation including the Analytics ID "Load level information", the Analytics Filter "S-NSSAI and NSI ID" and the Analytics Reporting Information set to a load level threshold value. The PCF is notified when the load level of the Network Slice Instance reaches the threshold.

The NWDAF service to retrieve the Load Level Information is described in clause 6.3 of TS 23.288 [24].

* The PCF may subscribe to notifications of network analytics related to "Service Experience" using the Nnwdaf\_AnalyticsSubscription\_Subscribe service operation including the Analytics ID "Service Experience", the Target of Analytics Reporting "SUPI", "Internal Group Id" or "any UE" and the Analytics Filter including one or more "Application ID(s)". The PCF is notified on the Service Experience statistics or predictions including, for each Application Id, the list of SUPIs for which Service Experience is provided. In addition, both spatial and time validity may be provided as well as the confidence of the prediction.

The NWDAF service to retrieve the service experience (i.e. the average observed Service MoS) is described in clause 6.4 of TS 23.288 [24].

* The PCF may subscribe to notifications of network analytics related to "Network Performance" using the Nnwdaf\_AnalyticsSubscription\_Subscribe service operation including the Analytics ID "Network Performance", the Target of Analytics Reporting "Internal Group Id" and the Analytics Filter including the Area of Interest. The PCF is notified on the Network Performance statistics or predictions including the Area of Interest. In addition, the confidence of the prediction may be provided.

The NWDAF services to retrieve "Network Performance" as described in clause 6.6 of TS 23.288 [24].

* The PCF may subscribe to notifications of network analytics related to "Abnormal behaviour" using the Nnwdaf\_AnalyticsSubscription\_Subscribe service operation including the Analytics ID "Abnormal behaviour", the Target of Analytics Reporting "SUPI", "Internal Group Id" or "any UE" and the Analytics Filter including the expected analytics type or the list of Exceptions IDs and per each Exception Id a possible threshold and other Analytics Filter Information if needed. The list of Exception IDs is specified in TS 23.288 [24].

The NWDAF services to retrieve "Abnormal behaviour" analytics are described in clause 6.7.5 of TS 23.288 [24].

* The PCF may subscribe to notifications of network analytics related to "UE Mobility" using NWDAF\_AnalyticsSubscription\_Subscribe service operation including the Analytics ID "UE Mobility", the Target of Analytics Reporting "SUPI", "Internal Group Id" or "Any UE", and the Analytics Filter may include an "Area(s) of Interest". The PCF is notified on the UE Mobility statistics or predictions.

The NWDAF services to retrieve "UE Mobility" analytics are described in clause 6.7.2 of TS 23.288 [24].

* The PCF may subscribe to notifications of network analytics related to "UE Communication" using NWDAF\_AnalyticsSubscription\_Subscribe service operation including the Analytics ID "UE communication", the Target of Analytics Reporting "SUPI", "Internal Group Id" or "Any UE" and the Analytics Filter may include one or more "Application ID(s)". The PCF is notified on the UE communication statistics or predictions including list of application(s) in use and corresponding characteristics, e.g. start time and duration time. In addition, the confidence of the prediction may be provided.

The NWDAF services to retrieve "UE Communication" analytics are described in clause 6.7.3 of TS 23.288 [24].

* The PCF may subscribe to notifications of network analytics related to "User Data Congestion" using NWDAF\_AnalyticsSubscription\_Subscribe service operation including the Analytics ID "User Data Congestion", the Target of Analytics Reporting containing either a SUPI or "any UE", and the Analytics Filter may include Area of Interest and reporting threshold. The PCF is notified when the congestion level reaches the threshold.

The NWDAF services to retrieve "User Data Congestion" analytics are described in clause 6.8 of TS 23.288 [24].

* The PCF may subscribe to notifications of network analytics related to "Data Dispersion" using NWDAF\_AnalyticsSubscription\_Subscribe service operation including the Analytics ID "UE Dispersion Analytics" and the dispersion analytic (DA) type, Data or Transactions., The Target of Analytics Reporting containing "SUPI", "Internal Group Id" or "any UE", and the Analytics Filter may optional list of TA(s), Area(s) of Interest, Cells, or S-NSSAI.

The NWDAF services to retrieve "Data Dispersion" analytics are described in clause 6.X of TS 23.288 [24].

The PCF may use the network analytics information from NWDAF as input to its policy decision to apply operator defined actions for session and non-session management related policy control as described in sections 6.1.2 and 6.1.3.

Operator defined actions may include the subscription to notifications to other analytics in NWDAF. In addition the reception of a notification about a previously subscribed network analytics may trigger the evaluation of policy decisions in PCF e.g. based on the notification of "User Data Congestion", the PCF may further requests the NWDAF to report the data dispersion analytics of either any user or just the heavy users located at the congested area of interest.

Examples of operator policies including network analytics information from NWDAF as inputs for policy decisions included below:

* Based on the notification of "Load Level Information" of the Network Slice Instance
* Based on the Service Experience statistics or predictions, t
* the network analytics related to "Network Performance"
* Based on the UE mobility statistics or predictions, the PCF may adjust Service Area Restriction as defined in clause 6.1.2.1.
* the network analytics related to

The PCF may make policy decisions based on combination of following network analytics provided by NWDAF: Examples of operator policies including combination of multiple network analytics from NWDAF as inputs for policy decisitions are included below:

* Based on the notification of service in use, either from NWDAF provided by "UE Communication" analytics or from other NFs depending on the method to be used, the PCF may request the "Service Experience" analytics for each application in use of the RAT/Frequecy (i.e. RFSP index) where the UE is located, as determined by the PCF operator policies or by the RFSP subscribed value. Then the PCF may use this information to check and change the RFSP index value.
* Based on the notification of "User Data Congestion", the PCF may further request the NWDAF to report the “Data Dispersion Analytics” of either a UE or just the heavy UEs located at the congested area of interest. To mitigate the reported or predicted congestion at the area of interest, the PCF may perform AM or SM policy modification to the UE under their controlas decribd in TS 23.502 [3] clause 4.16.2.2 step 3 for the case of AMF and clause 4.16.5.2 steps 4 and 5 for the case of SMF. A policy modification of UE-AMBR, which is the aggregated bit rate across all non-GBR flows of the PDU session, update to RFSP value for a change of RAT or a frequency band and/or service area restriction. For example, in order to mitigate the user plane data congestion, the PCF may use the data dispersion for an application to update the policy of the QoS flows for the application (e.g. reduce GFBR or MFBR).

\* \* \* 3rdChange \* \* \*

#### 6.1.2.1 Access and mobility related policy control

The access and mobility policy control encompasses the management of service area restrictions, the management of the RFSP functionalities and UE-AMBR, and the management of the SMF selection. This clause defines the management of service area restrictions and RFSP Index for a UE registered over 3GPP access. The management of service area restrictions for a 5G-RG or a FN-CRG using W-5GAN are specified in TS 23.316 [27].

The management of service area restrictions enables the PCF of the serving PLMN (e.g. V-PCF in roaming case) to modify the service area restrictions used by AMF as described in TS 23.501 [2] clause 5.3.4.

A UE's subscription may contain service area restrictions, which may be further modified by PCF based on operator defined policies at any time, either by expanding a list of allowed TAIs or by reducing a non-allowed TAIs or by increasing the maximum number of allowed TAIs. Operator defined policies in the PCF may depend on input data such as UE location, time of day, information provided by other NFs, network analytics from NWDAF, etc.

The AMF may report the subscribed service area restrictions received from UDM during Registration procedure or when the AMF changed, the conditions for reporting are that local policies in the AMF indicate that Access and Mobility Control is enable. The AMF reports the subscribed service area restrictions to the PCF also when the policy control request trigger for service area restrictions change, as described in clause 6.1.2.5, is met. The AMF receives the modified service area restrictions from the PCF. The AMF stores them then use it to determine mobility restriction for a UE. The PCF may indicate the AMF that there is an unlimited service area.

The service area restrictions consist of a list of allowed TAI(s) or a list of non-allowed TAI(s) and optionally the maximum number of allowed TAIs.

NOTE 1: The enforcement of the service area restrictions is performed by the UE, when the UE is in CM-IDLE state or in CM-CONNECTED state when in RRC Inactive, and in the RAN/AMF when the UE is in CM-CONNECTED state.

The management of the RFSP Index enables the PCF to modify the RFSP Index used by the AMF to perform radio resource management functionality as described in TS 23.501 [2] clause 5.3.4. PCF modifies the RFSP Index based on operator policies that take into consideration e.g. accumulated usage, load level information per network slice instance, the service(s) UE consuming, the congestion situation in the network, the UE data dispersion, etc. The subscribed RFSP Index may be further adjusted by the PCF based on operator policies at any time.

For radio resource management, the AMF may report the subscribed RFSP Index received from UDM during the Registration procedure or when the AMF changed. The conditions for reporting are that local policies in the AMF indicate that Access and Mobility Control is enable. The AMF reports the subscribed RFSP Index to the PCF when the subscription to RFSP Index change to the PCF is met. The AMF receives the modified RFSP Index from the PCF.

NOTE 2: The enforcement of the RFSP Index is performed in the RAN.

Upon change of AMF, the source AMF informs the PCF that the UE context was removed in the AMF in the case of inter-PLMN mobility.

The management of UE-AMBR enables the PCF to provide the UE-AMBR information to AMF based on serving network policy. The AMF may report the subscribed UE-AMBR received from UDM. The conditions for reporting are that the PCF provided Policy Control Request Triggers to the AMF to report subscriber UE-AMBR change. The AMF receives the modified UE-AMBR from the PCF. The AMF provides a UE-AMBR value of the serving network to RAN as specified in TS 23.501 [2], clause 5.7.2.6.

The management of the SMF selection enables the PCF to instruct the AMF to contact the PCF during the PDU Session Establishment procedure to perform a DNN replacement, as specified in TS 23.501 [2], clause 5.6.1. To indicate the conditions to check whether to contact the PCF at PDU Session establishment (as specified in clause 6.1.2.5), the PCF provides the Policy Control Request Triggers SMF selection management and, if necessary Change of the Allowed NSSAI, together with SMF selection management related policy control information (see clause 6.5) during UE Registration procedure and at establishment of the AM Policy Association.

The PCF may update SMF selection management information based on PCF local decision or upon being informed about a new Allowed NSSAI. The AMF applies the updated SMF selection management information to new PDU Sessions only, i.e. already established PDU Sessions are not affected.

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