**3GPP TSG-SA2 # 146E (e-meeting)S2-21xxxxx**

**August 16 – August 27, 2021**

**Source: Orange**

**Title: Discussion on CN procedures involving NWDAF**

**Document for: Discussion**

**Agenda Item: 9.1.3**

**Work Item / Release: Rel-18**

***Abstract of the contribution:*** *This paper discusses on the possibility to improve the quality of specifications concerning CN procedures involving NWDAF and proposes an objective to be added to the Rel-18 eNA study.*

# Discussion

The key to the performance improvements brought about by the NWDAF lies in its effective and relevant use by other CN and OSS entities. For CN, use cases describing the consumption of NWDAF services are defined in NF procedures. The procedures currently only mention the possibility of NWDAF requests, with little details.

For instance, for the decisions related to SMF selection, the current text can be found in TS 23.501 6.3.2:

*The following factors may be considered during the SMF selection:* (…)

*i) Load conditions of the candidate SMFs.*

*j) Analytics (i.e. statistics or predictions) for candidate SMFs' load as received from NWDAF (see TS 23.288 [86]), if NWDAF is deployed.* (...)

Several risks can be identified in this example:

1. Systematic use of NWDAF services leading to overloading of the NWDAF.
To avoid such situations, the solicitation of the NWDAF might be rather reserved to situations of highest objectives, for instance depending on the load conditions of candidate SMFs (i.e. above a certain threshold), or on specific services (e.g., URLCC, emBB), user profiles (e.g. NPN) or DNNs. The NWDAF query parameters (prediction period, accuracy) should also be studied, as they have a direct impact on the NWDAF load
2. Systematic use of data collection leading to overloading of provider NFs.
To avoid such situations, the data collection policies should also be studied, as they have a direct impact on the NF load.
3. Indiscriminate use of the analytics returned by the NWDAF, with the risk of overly sensitive or even conflictual control loops.
To avoid such situations, each consumer NF can voluntarily integrate the NWDAF estimates in a general decision-making process, with several options (e.g. hierarchical decisions, fuzzy logic, random selection of the SMF if the evaluated SMFs have similar estimated loads over the prediction period, or low confidence).

The human network operator should be able to govern the eNA network policies, in order to be able to define the goals and setting modes of each use case. Such governance should allow the human operator to control the use of NWDAF analytics and configure them to operate either in "open-loop" or "closed-loop" mode.

In a more general way:

* Each procedure including eNA analytics should be validated to trust the performance of recommendation. Human could be able to validate the loop to test and trust recommendation before the control loop could be closed.
* Each recommendation should be governed by administrator by prescribing which key objectives the control loop should manage.
* Each control loop should manage their assigned associated managed entities to avoid multiple control loop managing the same managed entities (parameters).
* The number of control loops within the network should be limited, with a provided governance interface to manage hierarchical control loop.
* Conflict resolution should be managed with the following properties:

Activation of a control loop should be added with no conflicted decisions with existing control loop.

A control loop should be managed and controlled as any other managed entities (e.g. ability to started or stopped).

# Conclusion and Proposal

There is a need to define more precisely the governance modes of the eNA control loops.

For such purpose, it is proposed to study to what extent the network procedures involving the NWDAF could be specified more precisely:

- studying, per use case, under which conditions the consuming NF should request NWDAF services (e.g. customer profile, type of application / DNN, network load) and which parameters should be used (e.g., prediction period, accuracy).

- studying, per use case, the data collection policies (e.g. permanent data collection, on-demand)

- studying, per use case, the choices that result from the analytics received from NWDAF, i.e. identify the criteria that will contribute to the decision of the consumer NF (e.g. results, confidence), and the possible alternatives of actions (e.g. ignore, take into account, use fuzzy logic, do random choice).

Eventually, it would be left to the implementations to choose among these triggers and parameters, feedback criteria and actions. As a complement, the study should identify which API/parameters/rules/criteria should be available for operator configuration (e.g. per DNN, slice, per NF).

Lastly, it should be investigated whether other use cases (e.g. identified in TR 23.791 or TR 23.700-91) can benefit from the existing statistics (e.g. SMF selection could also be based on UE location predictions, PCF selection could use various analytics as well).

We propose to add this as an objective to the Rel-18 Study Item following up on eNA\_ph2.

# Annex: NWDAF R16 use cases

| NF | Use case an related procedure |
| --- | --- |
| AF/ NEF 1 | AF derivation of UE expected behaviour as stated in TS 23.502 clause 4.15.6.2 “NEF service operations information flow”, [Conditional, on using NWDAF-assisted values] for a UE or group of UEs. |
| AF/ NEF 2 | “NEF derivation of network status information” based on user data congestion analytics, as stated in TS 23.502 clause 4.15.7 “network Status Reporting” |
| AMF / SCP 1 | “AMF and SCP selection of SMF” based on SMF load analytics as stated in TS 23.501 clause 6.3.2 “SMF discovery and selection” |
| AMF 1 | “AMF decision on MICO mode” based on UE mobility or UE communication analytics as stated in 23.501 clause 5.4.1.3 |
| AMF 2 | “AMF update of Mobility Pattern” based on UE mobility analytics as stated in TS 23.501 clause 5.3.4.2 “Mobility Pattern” |
| AMF 3 | “AMF decision on paging” based on UE mobility analytics as stated in 23.501 clause 5.4.3 “Paging strategy handling” |
| NSSF 1 | “NSSF selection of network slice ”based on Slice load analytics as stated in TS23501 clause 5.15.5.2.1 “Registration to a set of Network Slices” or “Network update of network slice” based on Slice load analytics as stated in TS 23.501 clause 5.15.5.2.2 “Modification of the Set of Network Slice(s) for a UE” |
| PCF 1 | “PCF collection of abnormal behaviour” as stated in TS 23.503 per clause 5.3.11 “Interactions between NWDAF and PCF” and 6.1.1.3 “Policy decisions based on network analytics” using Exception IDs specified in TS 23.288]  |
| PCF 2 | “PCF collection of slice specify information” e.g., slice load as stated in TS 23.503 clause 4.2.3 “Network status analytics information requirements” and clause 6.1.1.3 where the PCF is notified when the load level of the Network Slice Instance reaches the threshold, and then the PCF may verify if the RFSP index value needs to be modified for a SUPI for which an AM Policy Association is created; this is based on operator policies in the PCF, as defined in clause 6.1.2.1.  |
| PCF 3 | “PCF collection of observed service experience” as stated in TS 23.503 per clause 5.3.11 “Interactions between NWDAF and PCF” and 6.1.1.3. “Policy decisions based on network analytics”, The PCF may check the 5QI values assigned to the Application, the number of UEs affected and may use this as input to calculate and update the authorized QoS for a service data flow template. |
| PCF 4 | Session management by PCF using information from AF, SMF and NWDAF (Service Experience) as stated in clause 6.2.1.1.1 of TS 23.503 |
| PCF 5 | “PCF derivation of transfer policies for BDT” based on Network Performance analytics (number of UEs and load in the area of interest), as stated in TS 23.502 clause 4.16.7.2 “Procedures for future background data transfer” and clause 4.16.7.3 “Procedure for BDT warning notification”. Also specified in 23.503 6.1.1.3. Also renegotiation of BDT policies (23.503 6.1.2.4). |
| SMF 1 |  “SMF selection and reselection of UPF” based on UPF load analytics as stated in TS 23.501 clause 6.3.3.3 “Selection of an UPF for a particular PDU Session” |