**SA WG2 Meeting # S2-20xxxxx**

**Source: Apple**

**Title: Solution for Key Issue #12: NWDAF-assisted RFSP Policy**

**Document for: Approval**

**Agenda Item: x.x**

**Work Item / Release: FS\_eNA\_ph2 / Rel-17**

*Abstract of the contribution: This contribution proposes a solution for Key Issue #12: NWDAF-assisted RFSP Policy*

# 1. Introduction

UE capabilities report includes critical information such as RAT support, band support, feature support, etc. In this proposal, the method and procedures are defined to derive one or more target UEs data analytics related to UE capabilities. This UE capability data analytics from NWDAF may assist network functions (AMF/PCF) in creating RFSP policy.

The NWDAF may generate statistical or predictive analytic information based on the received UE capabilities.

Statistical analytics may include target UEs feature support, band support, RAT support, device type and other statistical configuration.

Predictive analytics may include suggested frequency band priorities, suggested System Information Block (SIB) priorities, suggested DRX cycle configurations, and other predicted configurations.

# 2. Discussion

To support radio resource management in RAN, the AMF/PCF provides the RFSP policy. The RFSP policy is mapped by the RAN to locally defined configuration in order to apply specific RRM strategies, taking into account any available information in RAN. The RFSP policy is UE specific and applies to all the Radio Bearers.

The following are some example use case of NWDAF provided UE capabilities analytic data assisting NF (AMF/PCF) to create RFSP policy.

As a first example, the UE capability analytic information may specify that in a certain registration area, target group of UEs does not support Voice over NR but support Voice over LTE. In this instance, the NF may use this UE capability analytic information to create a RFSP policy to cause selection of E-UTRAN for the UE in idle mode.

As a second example, the UE capability analytic information may specify information regarding supported frequency bands. In this instance, the NF may use this UE capability analytic information to create RFSP policy to prioritize certain bands for idle mode re-selection or connected mode re-direction. It may also achieve sub-optimal carrier aggregation (CA) or E-UTRAN new radio dual connectivity (EN-DC) combination in connected mode.

As a third example, the analytic information may specify information regarding a type of service support for a UE, e.g., whether the service support type is voice-centric (e.g. phones), data centric (dongles, routers, etc.) or Machine Type Communication (MTC) devices. Here the analytic information may be used to establish a RFSP policy based on the type of service support.

# 3. Proposal

The following changes are proposed for TR 23.700-91.

**\* \* \* \* First Change (All new text) \* \* \* \***

## 6.X Solution #X: UE Capability Analytics assisting in creating RFSP policy

### 6.X.1 Functional Description

#### 6.X.1.1 General

This solution is proposed to address Key Issue #12: NWDAF-assisted RFSP Policy.

NWDAF supporting UE capability analytics shall be able to collect UE capability information from NF (AMF, PCF, UCMF, etc.) and perform data analytics to provide UE capability statistics and prediction to assist NF in creating the RFSP policy.

The consumer of these analytics may indicate in the request:

- The Target of Analytics Reporting which is a single UE or a group of UEs.

- Group of UEs with same radio capabilities that can be identified by UE Radio Capability ID as defined in TS 23.501 [2] clause 5.9.10 or Type Allocation Code.

- Analytics Filter Information containing optional list of feature support (e.g.VoLTE / VoNR), band support (e.g. B28, B7), RAT support (e.g NR,LTE) , device type (Voice Centric, data centric) or optional maximum number of results.

- An Analytics target period indicates the time period over which the statistics are requested.

- Preferred level of accuracy of the analytics (low/high).

#### 6.X.1.2 Input data

The NWDAF supporting data analytics on UE Capability shall be able to collect UE radio capability information on a group of UEs with same radio capabilities from UCMF/AMF.

The information collected by the NWDAF is defined is defined in Table 6.x.1.2-1.

Table 6.X.1.2-1 - UE Radio Capability information collected from NF

|  |  |  |
| --- | --- | --- |
| Information | Source | Descriptions |
| UE Radio Capability ID | AMF, UCMF | UE Radio Capability ID |
| UE radio capabilities | AMF, UCMF | UE radio capabilities available in UCMF, AMF |
| UE ID | AMF | SUPI, TAC |
| UE Locations (1…Max) | AMF | UE positions |
| > UE Location |  | TA or cells that the UE enters |
| > Time Stamp |  | A timestamp when the AMF detects the UE enters this location |

#### 6.X.1.3 Output Analytics

The NWDAF supporting data analytics on UE Capability shall be able to provide UE capability analytics to consumer NFs or AFs.

The analytics results provided by the NWDAF may be UE capability statistics as defined in table 6.x.1.3-1.

The analytics results provided by the NWDAF may be UE capability prediction as defined in table 6.x.1.3-2.

The analytics assist AMF/PCF to decide the RFSP Policy index for a UE or group of UEs in a registration area.

Table 6.X.1.3-1: UE Radio Capability information analytics statistics

|  |  |
| --- | --- |
| Information | Description |
| UE Radio Capability ID | UE Radio Capability ID |
| Feature Support | List of features supported by group of UEs such as VoLTE, VoNR, MIMO, etc. |
| Band Support | List of Bands supported by group of UEs such as B1, B28, etc. |
| RAT Support | List of RATs supported by group of UEs such as NR, LTE, etc. |
| Device Type | Device type category such as Voice Centric, Data Centric, MTC. |
| Time slot entry (1..max) | List of time slots during the analytics target period |
| > Time slot start | Time slot start within the analytics target period |
| > Duration | Duration of the time slot (average and variance) |
| > UE location (1..max) | Observed location statistics |

Table 6.X.1.3-2: UE Radio Capability information analytics prediction

|  |  |
| --- | --- |
| Information | Description |
| Frequency Band Priority for acquisition | Which frequency band to set as highest priority in System Selection |
| Frequency Band Priority for reselection | Which frequency band to set as highest priority for reselection |
| SIB Priorities | Which geographic location should the SIB priorities be updated |
| DRX Cycle | What DRX cycle could be set for better network utilisation |
| SIB Broadcast on Demand | Which locations to have SIBs broadcasted or on-demand |
| SIB Broadcast Timing | What timings could SIBs be broadcasted or on-demand |
| > UE location (1..max) | Observed location statistics |
| >> UE location | TA or cells which the UE stays |
| >> Ratio | Percentage of UEs in the group (in case of UE group) |

### 6.X.2 Procedures

#### 6.X.2.1 UE capability analytics based on AMF input



Figure 6.X.2.1-1: UE capability analytics based on AMF input

1. Consumer Network Function (NF) is subscribed to Network Data Analytics Function (NWDAF). When new UE radio capability information is received by AMF, corresponding UE capability is sent to NWDAF.

2. The consumer NF sends a request to the NWDAF for analytics on a specific UE or a group of UEs, using Nnwdaf\_AnalyticsInfo\_Request or Nnwdaf\_AnalyticsSubscription\_Subscribe. The consumer NF may request NWDAF statistics and/or predictions. The type of analytics is set to "UE Capability information". The NF provides the UE or group of UE ID(s) in the Target of Analytics Reporting.

3. If the request is authorized, the NWDAF may subscribe to events with all the serving AMFs for notification of location changes. This step may be skipped when e.g. the NWDAF already has the requested analytics available.

4. The NWDAF derives requested analytics.

5. The NWDAF provides requested UE Capability analytics to the consumer NF, using either the Nnwdaf\_AnalyticsInfo\_Response or Nnwdaf\_AnalyticsSubscription\_Notify.

6-7. If at step 1, the NF has subscribed to receive notifications for UE Capability analytics, after receiving event notification from the AMF subscribed by NWDAF, the NWDAF may generate new analytics and provide them to the NF.

#### 6.X.2.2 UE capability analytics based on UCMF input (based on subscription)



Figure 6.X.2.2-1: UE capability analytics based on UCMF input (based on subscription)

#### Precondition: RACS is supported by network.

1. Consumer Network Function (NF) is subscribed to Network Data Analytics Function (NWDAF).
2. NWDAF is subscribed to UE Capability Management Function (UCMF).
3. When a new UE Radio Capability ID is created in UCMF, corresponding UE radio capability information and UE Radio Capability ID is sent to NWDAF.
4. The consumer NF sends a request to the NWDAF for analytics on a specific UE or a group of UEs, using Nnwdaf\_AnalyticsInfo\_Request or Nnwdaf\_AnalyticsSubscription\_Subscribe. The consumer NF may request NWDAF statistics and/or predictions. The type of analytics is set to "UE Capability information". The NF provides the UE Radio Capability ID or the UE ID(s) in the Target of Analytics Reporting.
5. If the request is authorized, the NWDAF may subscribe to events with all the serving AMFs for notification of location changes. This step may be skipped when e.g. the NWDAF already has the requested analytics available.
6. The NWDAF derives requested analytics.
7. The NWDAF provides requested UE Capability analytics to the consumer NF, using either the Nnwdaf\_AnalyticsInfo\_Response or Nnwdaf\_AnalyticsSubscription\_Notify.

8-9. If at step 1, the NF has subscribed to receive notifications for UE Capability analytics, after receiving event notification from the AMFs subscribed by NWDAF, the NWDAF may generate new analytics and provide them to the NF.

#### 6.X.2.3 UE capability analytics based on UCMF input (on-demand)



Figure 6.X.2.3-1: UE capability analytics based on UCMF input (on-demand)

#### This procedure may be used for on-demand critical situation such as outage of section of the network.

#### NF (AMF/PCF) may request on demand UE Capability analytics of group of UEs served by the AMF. The serving AMF is offline due to outage. NWDAF may extract capabilities of all target UEs using TAC from UCMF and perform big data analytics.

#### Precondition: RACS is supported by network.

1. The NF sends a request to the NWDAF for analytics on a specific UE or a group of UEs, using either the Nnwdaf\_AnalyticsInfoRequest or Nnwdaf\_AnalyticsSubscription. The NF can request statistics or predictions or both. The type of analytics is set to "UE Capability information". The NF provides the list of UE Radio Capability IDs in the Target of Analytics Reporting.

2. NWDAF send Nucmf\_UECapabilityManagement\_Resolve\_Request (UE Capability ID) to resolve all UE capability IDs from UCMF.

3. UCMF sends all the requested UE Radio Capability IDs to NWDAF using Nucmf\_UECapabilityManagement\_Resolve\_Response. NWDAF acquires UE radio capabilities of all target UEs from UCMF.

4. If the request is authorized, NWDAF may subscribe to events with all the serving AMFs for notification of location changes. This step may be skipped when e.g. the NWDAF already has the requested analytics available.

5. The NWDAF derives requested analytics.

6. The NWDAF provide requested UE Capability analytics to the NF, using either the Nnwdaf\_AnalyticsInfo\_Response or Nnwdaf\_AnalyticsSubscription\_Notify.

7-8. If at step 1, the NF has subscribed to receive notifications for UE Capability analytics, after receiving event notification from the AMFs subscribed by NWDAF, the NWDAF may generate new analytics and provide them to the NF.

#### 6.X.2.4 Procedures for NWDAF providing UE capability analytics output to Consumer NF



Figure 6.X.2.4-1: Procedures for NWDAF providing UE capability analytics output to Consumer NF

1. The consumer NF sends a request to the NWDAF for analytics on a specific UE using Nnwdaf\_AnalyticsSubscription\_Subscribe. The type of analytics is set to "UE Capability information". The NF provides the UE or group of UE ID(s) in the Target of Analytics Reporting.

2. The NWDAF subscribes the network data from 5GC NF by invoking Nnf\_EventExposure\_Subscribe/Notify service operation.

3. The NWDAF derives the subscribed UE capability analytics.

4. The NWDAF provides the data analytics, i.e. UE capability analytics to the consumer NF by means of Nnwdaf\_AnalyticsSubscription\_Notify.

NOTE : The signalling flow only shows a subscription-notify model for the interaction of NWDAF and consumer NF for simplicity instead of both request-response model and subscription-notification model as defined in clause 6.1 of TS 23.288 [5].

### 6.X.3 Impacts

Editor's note: TBD.

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