**SA WG2 Meeting #162 S2-2405136**

**15 - 19 April, 2024, Changsha, China (revision of S2-2404066)**

**Title: KI#3, New Sol: Enhancement for AF influence on traffic routing with Energy related analytics**

**Source: KDDI, TOYOTA MOTOR CORPORATION, CATT**

**Document for: Approval**

**Agenda Item: 19.4**

**Work Item / Release: FS\_EnergySys / Rel-19**

*Abstract of the contribution: It is proposed a new Solution for KI#3.*

# 1 Discussion

According to the FS\_EnergySys (SP-231391), the following Key Issue #3 need to be studied:

*‐ Whether and how to enhance the existing operations and procedures to satisfy the energy saving and energy efficiency requirements.*

*‐ Whether and how to enhance the NF selection/re-selection related functionalities considering energy saving and energy efficiency based on e.g., NF energy states, analytics, and energy related information.*

*‐ Whether and how to enhance network analytics for network energy saving and network energy efficiency.*

*‐ What, if any, energy related information (e.g., per QoS flow/PDU session/UE/NF) is required and how it is collected to support 5GS enhancement.*

The solution for NWDAF-based Energy Analytics (Solution #12) was implemented in TR 23.700-66. This contribution proposes how to enhance the AF influence on traffic routing considering the Energy related analytics.

# 2. Proposal

It is proposed to add the following new solution to TR 23.700-66 " Study on Energy Efficiency and Energy Saving".

\*\*\* 1st Changes \*\*\*

## 6.0 Mapping of Solutions to Key Issues

Editor's note: This clause describes the mapping between solutions and key issues.

Table 6.0-1: Mapping of Solutions to Key Issues

|  |  |
| --- | --- |
| Solutions | Key Issues |
|  | 1 | 2 | 3 |
| 1 | x |  |  |
| 2 | x |  |  |
| 3 | x |  | x |
| 4 | x |  |  |
| 5 | x |  | x |
| 6 | x |  |  |
| 7 |  | x |  |
| 8 |  | x |  |
| 9 |  | x |  |
| 10 |  | x |  |
| 11 |  | x | x |
| 12 |  |  | x |
| 13 |  |  | x |
| 14 |  |  | x |
| 15 |  | x | x |
| 16 | x |  |  |
| 17 | x |  |  |
| 18 | x |  |  |
| 19 | x |  |  |
| 20 | x | x | x(analytics input) |
| 21 |  | x |  |
| 22 |  | x |  |
| 23 |  | x |  |
| 24 |  | x |  |
| 25 |  | x |  |
| 26 |  | x |  |
| 27 |  | x |  |
| 28 |  | x |  |
| 29 |  |  | x |
| 30 |  |  | x |
| 31 |  | x |  |
| 32 |  |  | x |
| X |  |  | X |

\*\*\* 2nd Change (all new text)\*\*\*

## 6.x Solution #X: Enhancement for AF influence on traffic routing with Energy related analytics

### 6.x.1 Key Issue mapping

This solution maps to KI#3.

### 6.x.2 Functional Description

This solution is proposed to address Key Issue #3: 5GS enhancements for network energy saving and efficiency.

Transmitting data of the same application(s) via different paths may cause different energy consumptions in the network, as different traffic routing paths involves different 5GC NFs (e.g. PSA UPF, UL CL/BP UPF). So network energy related information can be used as one of the criteria for configuring/reconfiguring the User Plane of the PDU session (including selecting/reselecting the target DNAI, PSA UPF, and/or UL CL/BP UPF(s), etc.) to save network energy and improve energy efficiency.

As specified in clause 5.6.7 of TS 23.501 [2] and clause 4.3.6 of TS 23.502 [3], the AF may influence the traffic routing of the application by providing the list of DNAI(s), or the NEF can provide the mapping between the AF-Service-Identifier and a list of DNAI(s) based on local configuration when the DNAI(s) being used by the applications are statically defined. The list of DNAI(s) is then provided to the PCF (except in the case of HR SBO where Traffic Influence information is provided directly from V-NEF to V-SMF bypassing the PCF), and the PCF may update the list of DNAI(s), e.g. based on service experience analytics per UP path as defined in TS 23.288 [14]. Finally the PCF provides the list of DNAI(s) to the SMF, and the SMF may take appropriate actions to reconfigure the User plane of the PDU Session, such as determining the target DNAI and adding, replacing or removing UPF(s) (acting as UL CL/BP or PSA) in the data path, e.g. based on service experience analytics and/or DN Performance analytics per UP path as defined in TS 23.288 [14].

It mainly proposes how to enhance the AF influence on traffic routing considering Energy related analytics (e.g. EE (Energy efficiency), EC (Energy Consumption) and Renewable energy ratio).

### 6.x.3 Procedure

A detailed procedure is provided below:



Figure 6.x.3-1: Procedure for U-Plane path relocation with Energy related analytics

The procedure described in this clause is based on the U-Plane path relocation as defined in clause 4.3.6.2, clause 4.3.6.3 and clause 4.3.6.4 of TS 23.502[3].

1. The AF invokes a Nnef\_TrafficInfluence\_Create service operation as defined in clause 4.3.6.2 and clause 4.3.6.4 of TS 23.502[3]. The request may contain the list of DNAI(s) and one of following Energy related requirements based on e.g. the SLA between an application provider represented by the AF and the 5GC operator:

‐ Energy related KPIs (e.g. Maximum allowed EC Required minimum EE or Renewable energy ratio for the application).

1. The AF request is forwarded to the PCF by the NEF as described in clause 4.3.6.2 and clause 4.3.6.4 of TS 23.502 [3].

3a. When the AF request is received, the PCF may request the Energy related analytics from the NWDAF as follows:

- If the AF request contains the Energy related KPIs, the PCF sends to the NWDAF a request or subscription for the Energy related analytics per U-Plane path (DNAI, the Energy related KPIs requested by the AF).

NOTE 1: Other parameters in the analytics request / subscription can refer to TS 23.288 [14] and e.g. Solution #12.

 In addition, the PCF may request other network analytics per U-Plane path (e.g., Analytics ID = "Service Experience"), to decide the list of DNAI(s) in the PCC rule to provide to the SMF.

3b. The NWDAF sends the response or notification(s) with Energy related analytics to the PCF.

3c. The PCF may update the DNAI(s) in the PCC rule taking into account of Energy related analytics, i.e. selecting the DNAI(s) which fulfills the Energy related KPIs. Then, the PCF may update the SMF with the corresponding new policy information about the PDU Session by invoking Npcf\_SMPolicyControl\_UpdateNotify service operation as described in clause 4.3.6.2 and clause 4.3.6.4 of TS 23.502 [3]. The updated policy information may contain the Energy related KPIs.

Editor's note: Whether and how to measure/calculate Energy related information (e.g. EC, EE) of DNAI is FFS.

4a. When the updated policy information about the PDU Session is received from the PCF, the SMF may request the Energy related analytics from the NWDAF as follows:

- If the updated policy information contains the Energy related KPIs, the SMF interacts with the NWDAF and sends a request or subscription for the Energy related analytics per U-Plane path (DNAI, the Energy related KPIs received in the updated policy information).

NOTE 2: Other parameters in the analytics request / subscription can refer to TS 23.288 [14] and e.g. Solution #12.

 In addition, the SMF may request other network analytics per U-Plane path (e.g., Analytics ID = "Service Experience" and/or "DN Performance"), to decide the target DNAI and whether or not to reconfigure the U-Plane of the PDU Session.

4b. The NWDAF sends a response or notify with Energy related analytics to the SMF, if the requested Energy related KPIs are met.

5-8. Based on the Energy related analytics from the NWDAF, the SMF may take appropriate actions to reconfigure the User Plane of the PDU Session as defined in clause 4.3.6.2 and clause 4.3.6.4 of TS 23.502 [3], such as determining the target DNAI and adding, replacing or removing UPF(s) acting as UL CL/BP or PSA, to ensure that the Energy related KPIs are fulfilled.

NOTE 3: How the NWDAF generates the Energy related analytics is not addressed in the proposed solution but uses other solutions (e.g. Solution #12).

### 6.x.4 Impacts on existing services, entities and interfaces

NWDAF:

- Support for the Energy related analytics.

NEF:

- Nnef\_TrafficInfluence service is extended to support the Energy related KPIs.

UDR:

- Nudr\_DM\_Notify service is extended to support the Energy related KPIs.

PCF:

- Npcf\_SMPolicyControl\_UpdateNotify service and Npcf\_PolicyAuthorization service are extended to support the Energy related KPIs.

- Request/Subscribe to the Energy related analytics, and update the list of DNAI(s) taking into account of the Energy related analytics.

SMF:

- Request/Subscribe to the Energy related analytics, and reconfigure the User Plane of the PDU Session (such as determining the target DNAI and adding, replacing or removing UPF(s) acting as UL CL/BP or PSA) based on Energy related analytics.

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