3GPP TSG SA WG5 Meeting 135-e TDoc S5-211146rev1

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**Source: Huawei**

**Title: Update on MDA assisted energy saving**

**Document for: Approval**

**Agenda Item: 6.5.4**

# 1 Decision/action requested

***Discuss and approve on the proposal.***

# 2 References

[1] TR 28.809 Study on enhancement of management data analytics v1.1.0

# 3 Rationale

It is proposed to update the potential requirements and potential information carried in the analytics report of MDA assist energy saving according to the use case and solution on MDA assisted energy saving in draft TR 28.809 [1]. The evaluation clause is also proposed.

# 4 Detailed proposal

This document proposes the following changes in TR 28.809 [1].

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| **1st Change** |

### 6.6.1 MDA assisted energy saving

#### 6.6.1.1 Use case

Energy saving is a critical issue for the 5G operators. Energy saving is achieved by activating the energy saving mode of the NR capacity booster cell or 5GC NF (e.g. UPF etc.), and the energy saving activation decision making may be based on the various information such as load information of the related cells/UPFs, the energy saving policies set by operators as specified in TS 28.310 [14] and the energy saving instructions provided by MDAS producer as described in TR 28.813 [23].

As the conclusion from clause 7.2 of the TR 21.866 [15], "The EE Control and Coordination Function: a self-managed automated process to control and coordinate system wide power saving operations including the access networks, core network, backhaul/fronthaul transmission networks, backbone networks and other subsystems", the management system has the overall view of network load information and it could also take the inputs from the control plane analysis (e.g. the analytics provided by NWDAF). The management system may provide the network wide analytics and cooperate with Core and RAN domains and decide on which cell/UPF should move into energy saving mode in a coordinated manner.

There are various performance measurements could be used as inputs by MDA for energy saving analysis, for example, the EE related performance measurements, (e.g. PDCP data volume of cells, PNF temperature, and PNF power consumption etc.) for the gNBs, and the data volume, number of PDU sessions with SSC mode 1 (see TS 23.501 [13]), delay related measurements, and VR usage for UPFs.

The composition of the traffic load could be also considered as inputs for energy saving analysis. (e.g., the percentage of high-value traffic in the traffic load). The variation of traffic load may be related to the network data (e.g., historical handover information of the UEs or network congestion status). Collecting and analysing the network data with machine learning tools may provide predictions related to the trends of traffic load. The composition and the trend of the traffic load may be used as references for making decision on energy saving.

MDAS may also obtain NF location or other inventory information such as energy efficiency and the energy cost of the data centers, while analysing historical network information. Based on the collected information, MDAS producer makes analysis and gives suggestions to network management in optimization suggestion for 5G Core NF deployment options in high-value traffic region (e.g. location of VNF in context of energy saving). The information from control plane data analysis from NWDAF, such as UE Communication analytics (see TS 23.288 [18]), may also be used as input for energy saving analysis and instruction.

The decision of core NF and RAN node energy saving should be coordinated by management system to guarantee the overall network and service performance are not affected as much as possible.

To achieve an optimized balance between the energy consumed and the performance provided by the network, MDAS can be used to provide an analytics report by analysing the above information comprehensively to assist the energy saving.

#### 6.6.1.2 Potential requirements

**REQ-MDA\_ES-CON-1** The MDAS producer should have a capability to provide the analytics report describing the energy saving instruction.

**REQ-MDA\_ES-CON-2** The analytics report describing the energy saving instruction should contain the following information:

- The identifier of the energy saving instruction described in the analytics report;

- Location of geographical area where the unreasonable energy consumption exists or optimization recommended;

- Root cause of the energy consumption issue;

- Recommended NR Cells (ES-Cell) to enter energySaving state;

- Recommended candidate cells with precedence for taking over the traffic of each ES-Cell.

- Recommended UPFs (ES-UPF) to enter energySaving state;

- Recommended candidate UPFs with precedence for taking over the traffic of each ES-UPF.

- Predictions related to the trends of traffic load which could be used as references for making decision on energy saving.

- Recommended 5GC NF deployment options in high-value traffic region (e.g. location of VNF in context of energy saving).

**REQ-MDA\_ES-CON-X** The MDAS producer should have a capability to update the recommended decisions and fine-tune the accuracy of the analytics result after being informed of the service experience changes and traffic load changes since the recommended decisions have been are taken to make energy saving decisions.

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| **Next change** |

##### 6.6.1.3.2 Data required for MDA assisted energy saving

The following table shows the potential data required to analyse the energy saving issue.

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| Data Category | Required Data |
| Performance Measurements | PNF Power Consumption: Power consumed over the measurement period, see clause 5.1.1.19.2 of TS 28.552 [8]; PNF Energy consumption: The energy consumed, see clause 5.1.1.19.3 of TS 28.552 [8];PNF Energy Temperature: The temperature over the measurement period, see clause 5.1.1.19.4 of TS 28.552 [8];PNF Voltage: The voltage, see clause 5.1.1.19.5 of TS 28.552 [8];PNF Current: The current, see clause 5.1.1.19.6 of TS 28.552 [8];PNF humidity consumption: The percentage of humidity during the measurement period, see clause 5.1.1.19.7 of TS 28.552 [8];PDCP Data Volume of NR cells: The transmitted PDCP data volume, see clause 5.1.2.1 and 5.1.3.6 of TS 28.552 [8];Virtual resource usage of NF: The resource usage of virtual network functions, see clause 5.7.1 of TS 28.552 [8].Data volume of UPF: see clause 5.4 of TS 28.552 [8].Delay related measurements of UPF: see clause 5.4 of TS 28.552 [8].Number of PDU sessions with SSC mode 1 on UPF. |
| QoE Data | The measurements that are collected are DASH (see TS 26.247 [16]) and MTSI (see TS 26.114 [17]) measurements (see TS 28.406 [24]).  |
| NRM | MOIs of the cells, UPFs and SMFs, see TS 28.541 [20]. |
| Alarm information | The alarm information of the cells, UPFs and SMFs. |
| Network analytics data | The control plane analysis result from the NWDAF defined in TS 23.288 [18], e.g., observed service experience related network data analytics.  |
| Pre-trained Prediction Models | The pre-trained models, which may be based on ML algorithms and trained to be able to produce the expected training output for consumers, e.g., pre-trained base station energy-saving scenarios prediction models, pre-trained traffic load prediction models. |

##### 6.6.1.3.3 Analytics report for MDA assist energy saving

The following table shows the potential information carried in the analytics report of MDA assist energy saving.

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| Analytics Report of MDA assisted energy saving | Attribute Name | Description |
| Energy saving analytics identifier | The identifier of the MDA assisted energy saving  |
| Location | The geographical area, UPFs or the cells where the unreasonable energy consumption exists or recommended 5GC NF deployment options or NR cells in high-value traffic geographical area. |
| Root cause | The root cause of the part of the energy consumption that may be conserved, e.g., ultra-low traffic load area with energy consumption, excessive energy consumption |
| Recommended prediction models | The optimal prediction models which can provide more accurate information prediction results to assist the energy saving related decision making. |
| Energy saving recommendations | For ES on NR cells. It may contain a set of- recommended NR Cell (ES-Cell) to enter energySaving state.- recommended candidate cells with precedence for taking over the traffic of the ES-Cell.- a time period, during which energy saving is or not allowed;- predictions related to the trends of traffic load which could be used as references for making decision on energy saving of NR cells.For ES on UPFs. It may contain a set of- recommended UPF (ES-UPF) to conduct energy saving;- recommended candidate UPFs with precedence for taking over the traffic of the ES-UPF.- a time period, during which energy saving is or not allowed;- predictions related to the trends of traffic load which could be used as references for making decision on energy saving of UPFs. |

#### 6.6.1.4 Evaluation

Based on the potential solutions, the required inputs are listed in clause 6.6.1.3.2, where:

- The performance measurements and KPIs is defined in TS 28.552 [8].

- QoE data as defined in TS 26.247 [29] and TS 26.114 [30] can be acquired through the procedures defined in TS 28.405 [31].

- NRM is defined in TS 28.541 [20].

- Alarm information of the cells, UPFs and SMFs are defined in TS28.545 [22].

- Network analytics data is defined in TS 23.288 [18].

- The Pre-trained Prediction Models can be obtained from the ML model training for MDA.

Therefore, MDA is feasible to support the analyses and predictions of MDA assisted energy saving.

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| **End of change** |