**3GPP TSG-SA WG2 Meeting #170 S2-2507748**

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**Title: KI#2 interim agreements**

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**Agenda Item: 20.4.1**

**Work Item / Release: FS\_EnergySys\_Ph2 / Rel-20**

*Abstract of the contribution: The contribution proposes interim agreements for KI#2.*

**1. Introduction**

For KI#2 “Support of service adjustments for the UE”, 12 solutions have been included in the TR, which are summarized and analysed in the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sol.** | **High-level solution principles** | **Whether and how to support taking the energy related information (e.g. energy related characteristics, renewable energy information) into account to determine traffic handling for the UE (e.g. QoS adjustment)** | **Whether and how to support policy control based on interaction with EIF** | **Identify charging impacts caused by service adjustment (in cooperation with SA WG5)** |
| 2 | - Existing 5G MM, SM and BDT procedure can be enhanced for energy saving based on coarse-grained energy consumption (EnC) information.  - Slice EnC can be used to trigger service adjustments on all or some slice users. | The PCF takes Slice energy consumption (EnC) information into account to adjust AM/SM/BDT policy. | The PCF retrieves the slice level EnC from the OAM (not EIF) system and compares the current consumption with slice level EnC thresholds defined in the slice control policy data. Once EnC exceeds the thresholds, the PCF performs AM policy, SM policy adjustment (e.g. applying lower UE-AMBR or Session-AMBR) or BDT policy (re-)selection. |  |
| 3 | AF, in addition to the desired QoS requirement, includes QoS Requirement Adaptability that indicates how much AF can tolerate to different QoS requirements than the desired.  Upon the request from the AF, the PCF, based on the energy information from OAM and operator's policy, identifies the energy-optimized candidate time slots for data transfer and, similar to the PDTQ, predicts the QoS level in each slot; then if the predicted QoS level is in the range of AF QoS Adaptability, the PCF includes the time slot to the list to be negotiated with AF. | PCF negotiates PDTQ policy with the AF considering energy related information | The PCF retrieves energy-related information from the OAM (not EIF), and decides energy-optimized candidate time slots for data transfer in the PDTQ policy. |  |
| 4 | - to update the value of QoS rules, QoS profile and Alternative QoS profile by re-using the existing parameters. No new parameters are added based on the energy related information.  - to enhance the SMF to be aware of the energy status of NG-RAN (e.g. whether the NG-RAN is using renewable energy or not) and then decide whether to update Alternative QoS profile or not  - to allow SMF to update the QoS configuration based on the PCC rules from PCF which has interacted with EIF  NOTE 2: The usage of QoS rules to UE and QoS profiles to NG-RAN are the same as specified in TS 23.501 [2], i.e. UE and NG-RAN are not required to take the energy criteria/attributes/characteristics into account to determine how to use QoS rules and QoS profile. | The PCF decides energy related QoS profile, QoS rules and optionally the energy related Alternative QoS profiles based on notifications from the EIF.  The SMF decides energy related QoS profile, QoS rules and optionally the energy related Alternative QoS profiles based on PCC rules, local configuration, and energy attributes of NG-RAN (e.g. whether the NG-RAN is using renewable energy or not). | The PCF decides energy related QoS profile, QoS rules and optionally the energy related Alternative QoS profiles based on notifications from the EIF. |  |
| 5 | The network energy saving behaviours are provided by the network based on the operators' decisions and may be configured in the PCFs of the PLMN.  The AF may indicate to the network the preferred or expected network energy saving behaviours for its applications or its UEs. So the network energy saving behaviours, e.g. QoS adjustment, are negotiated between the application providers and operators. Then the PCF makes the policy decisions taking into consideration the AF request and the energy related information. | AF provides the network energy saving behaviours (e.g. QoS adjustment) and the PCF makes the policy decisions taking into consideration the AF request and the energy related information. | The PCF makes policy decisions for the network energy saving behaviours (e.g. QoS adjustment) based on the AF request and notifications from EIF. |  |
| 6 | The PCF takes the energy related information in the notifications from the EIF into account for policy control. | The PCF takes energy consumption of the UE or PDU Session (over 5G access or 3GPP access) into account to adjust AM/SM policies. | The PCF determines and updates AM and SM policies (e.g. UE-AMBR, RFSP Index, Session-AMBR, MA PDU Session Control information) based on notifications from the EIF and operator policy. |  |
| 7 | - AF provides Energy Saving Service Requirements along with legacy QoS requirements to PCF, the Energy Saving Service Requirements which indicates the service requirement(s) for the AF session if energy saving is applied by the 5GS.  - PCF generates the Energy Saving QoS profile(s) and the priority list for the QoS flow based on AF's request and operator policy. The Energy Saving QoS profile(s) can be applied to both GBR and Non-GBR QoS flow.  - PCF sends the Energy Saving QoS profile(s) and the priority list to SMF and then to NG-RAN along with the legacy QoS profile.  - NG-RAN selects the Energy Saving QoS profile only if NG-RAN decides to downgrade the QoS parameters due to energy saving.  - NG-RAN notifies the selected Energy Saving QoS profile to SMF, SMF will further inform the selected Energy Saving QoS profile to PCF and to UPF for charging purpose. | The PCF decides Energy Saving QoS profile. The SMF sends Energy Saving QoS profile to NG-RAN. The NG-RAN decides to use Energy Saving QoS Profile for energy efficiency. | PCF generates the Energy Saving QoS profile(s) and the priority list for the QoS flow based on AF's request and operator policy. No interaction with EIF. | NG-RAN notifies the selected Energy Saving QoS profile to SMF, SMF will further inform the selected Energy Saving QoS profile to PCF and to UPF for charging purpose. |
| 13 | The PCF can control the energy consumption of the UEs using the network slice by monitoring the energy consumption of per UE and per slice for the UEs using the network slice via interactions with the EIF.  The solution assumes that the PCF aggregates the energy consumption information per UE per slice for the UEs using the network slice.  The PCF adjust the AM policy (e.g., network slice replacement) based on the aggregated energy consumption information for the UE and the network slice for all the UEs using the network slice. | The PCF monitors the energy consumption of the network slice that is subject to the energy control. If the threshold is reached, the PCF adjust the AM policies for the UEs to reduce the energy consumption of the network slice. | The PCF adjust the AM policy (e.g., network slice replacement, RFSP index) based on notifications of energy consumption information from the EIF. |  |
| 14 | - The PCF subscribes the energy related information of target UE, PDU session or QoS flow from EIF.  - If the EIF notifies to PCF that the energy consumption information including renewable energy or the ratio of renewable energy exceed the renewable energy ratio threshold, the PCF may decide to adjust the policy information.  - The PCF initiates the SM Policy Association Modification to increase the QoS of target UE, PDU session or QoS flow, e.g., increase the UL/DL maximum/guaranteed bitrate.  - Finally, the UEs which are served with more renewable energy can enjoy better QoS guarantees in 5GS. | The PCF subscribes the energy related information (incl. renewable energy ratio) of target UE, PDU session or QoS flow from EIF, and modifies SM policy to provide better QoS to UE, PDU session or QoS flow served with renewable energy. | The PCF subscribes the energy related information (incl. renewable energy ratio) of target UE, PDU session or QoS flow from EIF, and modifies SM policy (e.g., increase the UL/DL maximum/guaranteed bitrate) target UE, PDU session or QoS flow served with renewable energy. |  |
| 15 | - It is assumed that a user is subscribed to one of the available UE energy saving services via the service provider AF or alternatively by the operator, based on the SLA agreement between the operator and the service provider.  - It is assumed that the PCF holds energy saving policy, for example operator defined, per each available UE energy saving service. Two UE energy saving services, UE energy saving service A and UE energy saving service B, are defined by this solution.  - It is also assumed that the AF can monitor on the application level the communication with the UE. Based on certain criteria within the AF, the AF may request activation for the UE subscribed UE energy saving service.  NOTE: UE energy saving service is an Energy Saving Subscription as specified in clause 6.15.1 that can be subscribed by the user. | The PCF activates UE energy saving policy based on UE energy saving service parameter (UE energy saving service level A or B) provided by the AF (via the UDR). | The PCF activates UE energy saving policy based on UE energy saving service parameter. No interactions with EIF. | Charging based on UE energy saving service level, i.e. level A (high price subscription) and level B (low price subscription). |
| 16 | The PCF takes the energy related information into account for URSP generation. The energy related information in this solution can be from the OAM. | The PCF takes the energy related information (slice level EnC/EnE, renewable energy information for each slice) into account for URSP generation. | The PCF generates URSP based on the energy related information (slice level EnC/EnE, renewable energy information for each slice) from OAM. No interactions with EIF. |  |
| 17 | - PCF adds an IE of "reason for a policy change" in charging info of the associated PCC rule when service adjustment is applied for an SDF.  - SMF sends the reason for a policy change together with existing charging info to CHF.  Although currently described for Session Policies, the solution can also be applied for AM policies and incorporate a "reason for change" for AM policy updates via the AMF to the CHF. | PCF is triggered to apply some policy decisions (e.g. to change QoS) e.g. to reduce the energy consumption of the UE and/or NW slice. | PCF is triggered to apply some policy decisions (e.g. to change QoS) e.g. to reduce the energy consumption of the UE and/or NW slice.  How the PCF is triggered is unclear. | - PCF adds an IE of "reason for a policy change" in charging info of the associated PCC rule when service adjustment is applied for an SDF.  - SMF sends the reason for a policy change together with existing charging info to CHF. |
| 18 | There is an Energy Saving indication in the Session Management Subscription data per DNN/S-NSSAI. The SMF retrieves the Session Management Subscription data using Nudm\_SDM\_Get. The SMF provides Energy Saving indication to PCF in the SM policy association establishment.  Later on, when the PCF make the policy decision, it can take this Energy Saving indication into consideration. | Define the Energy Saving indication in Session Management Subscription data per DNN/S-NSSAI, and the PCF performs SM policy control taking this indication and Energy consumption information into account. | The PCF performs SM policy control taking into account the Energy Saving indication for SM and notifications of Energy consumption information from the EIF. |  |

Based on the above summary and analysis, KI#2 interim agreements are proposed.

**2. Proposal**

It is proposed to agree the following changes to 3GPP TR 23.700-67.

\* \* \* Start of Change \* \* \* \*

### 7.1.2 Agreed Principles for KI#2

Editor's note: This clause will include the principles that are agreed as work progresses for the specific KI#2. This may be populated directly or e.g. also when a topic in clause 7.2.2 gets resolved and a principle is agreed.

The interim agreements on principles for KI#2 are as follows:

- The PCF may make the following policy control decisions for network energy saving based on subscription information, AF request and/or operator policy:

- SM policy control.

- PDTQ policy negotiation with the AF, e.g. adjusting the time window and/or QoS for data transfer.

\* \* \* Next Change \* \* \* \*

### 7.2.2 Topics for further consideration for KI#2

Editor's note: This clause will include the topics for further consideration as work progresses for the specific KI#2. Eventually this clause should only contain topics for further consideration that did not result in agreements (i.e. in agreed principle(s) in a clause 7.1.2) and can either be then marked as not pursued or postponed to a future Release.

The following topics/principles are for further consideration:

- The PCF may subscribe to notifications of the following energy related information from the EIF:

- Energy Consumption information at UE, S-NSSAI (e.g. per UE per Network Slice), PDU Session and Service Data Flow (e.g. per UE per application) granularity.

- renewable energy consumption ratio at UE, S-NSSAI (e.g. per UE per Network Slice), PDU Session and Service Data Flow (e.g. per UE per application) granularity.

- The PCF may obtain the following energy related information from the OAM:

- Energy Consumption information at Network Slice granularity.

- renewable energy consumption ratio at Network Slice granularity.

Editor’s note: Whether and how the renewable energy related information can be collected relies on SA WG5, so feedback from SA WG5 is needed to conclude renewable energy aspect.

- The PCF may perform policy control taking into account energy related information from the EIF and/or OAM.

- The PCF may generate PCC rules with energy related QoS parameters sets. The SMF may generate energy related QoS profile based on PCC rules with energy related QoS parameters sets or based on local policy, and provide the energy related QoS profile to the NG-RAN. NG-RAN selects the energy related QoS profile only if NG-RAN decides to downgrade the QoS due to energy saving. NG-RAN notifies the selected energy related QoS profile to SMF, SMF will further inform the selected energy related QoS profile to PCF and to UPF for charging purpose.

NOTE: One or more energy related QoS Parameter Sets can be provided in a prioritized order.

Editor’s note: Whether and how the energy related QoS profile can be used by NG-RAN for energy saving needs feedback from RAN WGs.

- The PCF may make the following policy control decisions for network energy saving:

- UE policy control, e.g. generating and updating URSP rules.

- The PCF add "reason for a policy change" in charging info of the associated PCC rule when service adjustment is applied for an SDF. SMF sends the reason for a policy change together with existing charging info to CHF.

- The AF may indicate to the network the preferred or expected network energy saving behaviors per application. The PCF may perform energy saving SM policy control based on the AF provided service parameters (e.g. activate different UE subscribed energy saving service levels which lead to different service experiences).

\* \* \* End of Change \* \* \* \*