**3GPP TSG-SA5 Meeting #133e S5-205112rev03**

**12 Oct to 21 Oct 2020, E-meeting**

**Source: China Telecom**

**Title:** **Solutions on EE KPI for 5GC**

**Document for: Approval**

**Agenda Item: 6.5.2**

# 1 Decision/action requested

***The group is asked to discuss and agree on the proposal.***

# 2 References

[1] 3GPP TS 28.554: Management and orchestration; 5G end to end Key Performance Indicators (KPI)

[2] S5-204554: Discussion paper on 5GC EE KPI

[3] TR 28.813 0.2.0: Study on new aspects of Energy Efficiency (EE) for 5G

# 3 Rationale

TS 28.554 [1] – clause 6.7 (Energy Efficiency (EE) KPI) contains so far one single KPI definition: NG-RAN data Energy Efficiency (EE) (cf. clause 6.7.1). A corresponding EE KPI is missing for 5GC.

In SA5#132e, the following way forwards proposed in [2] were endorsed:

* *The energy efficiency of VNF may be evaluated according to the hardware energy consumption and the resource utilization made by VNF and this may be considered in 5GC EE KPI definition.*
* *Based on the resource utilization of VNF and the equation of VNF\_RERi provided in ES 203 539, the VNF resource efficiency ratio may be considered as a building block for the energy efficiency metric for 5GC NF.*
* *The energy efficiency metric for 5GC NF based on resource efficiency ratio of VNF(s) composing the 5GC NF may be used in 5GC EE KPI definition.*

Based on this way forward, in this contribution, we proposed a solution to address the Key Issue #2: EE KPI for 5GC.

# 4 Detailed proposal

This document proposes the following changes in TR 28.813 [3].

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| **1st Change** |

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.501: "5G; System Architecture for the 5G System".

[3] 3GPP TS 32.130: "Telecommunication management; Network sharing; Concepts and requirements".

[4] 3GPP TS 28.552: "Management and orchestration; 5G performance measurements".

[5] 3GPP TS 28.554: "Management and orchestration; 5G end to end Key Performance Indicators (KPI)".

[6] ETSI ES 203 228 v1.2.1: "Environmental Engineering (EE);Assessment of mobile network energy efficiency".

[7] S5-201169/S2-1912770: LS on analytics support for energy saving

[8] 3GPP TS 28.622: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[9] Draft ETSI GR NFV-IFA 015 V3.4.1 (2020-05): "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Report on NFV Information Model".

[10] ETSI GR NFV 003 V1.5.1 (2020-01): "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".[11] 3GPP TS 28.809: "Management and orchestration; Study on enhancement of Management Data Analytics (MDA)".

[12] 3GPP TS 28.310: "Management and orchestration; Energy efficiency of 5G".

[x] ETSI GS NFV-TST 008 V3.3.1: "Network Functions Virtualisation (NFV) Release 3; Testing; NFVI Compute and Network Metrics Specification"

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| **2nd Change** |

## 4.2 Key Issue #2: EE KPI for 5GC

### 4.2.1 Description

TS 28.554 [5] – clause 6.7 (Energy Efficiency (EE) KPI) contains so far one single KPI definition: NG-RAN data Energy Efficiency (EE) (cf. clause 6.7.1). A corresponding EE KPI is missing for 5GC.

Multiple potential solutions are proposed for this KI:

1. Potential solution applying the generic EE KPI.

This potential solution proposes to apply the generic EE KPI (see clause 5.3 of ETSI ES 203 228 [6]):



to the 5GC, leading to the definition of a new EE KPI:



1. Potential solution based on the VNF resource efficiency ratio.

With Network Functions Virtualisation (NFV), physical equipment in the telecom network architecture can be replaced by virtual network functions running on standard server platform. Since the 5GC can be fully virtualized, and the 5GC NF can be composed of VNF(s), in this potential solution, the 5GC EE KPI based on Resource Efficiency Ratio (RER) is introduced as:



Depending on the solution, new measurements may have to be defined in TS 28.552 [4].

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| **3rd Change** |

4.2.2.X Potential solution #X for UsefulOutput5GC

4.2.2.X.1 Introduction

This potential solution focuses on the definition of UsefulOuput5GC appeared in:



For this proposed solution, it can be applied to both User Plane Function(UPF) and Control Plane network functions that constitute the 5GC. And it is assumed that the definition of the useful output for UPF and control plane network function are different.

4.2.2.X.2 Description

The useful output of a 5GC NF is defined as the capacity of the 5GC NF, and depending on the different type of 5GC NFs, it may be:

* throughput (e.g. bps, pps) for data plane 5GC NF
* capacity (e.g. subscribers, sessions) for control plan 5GC NF.

The UsefulOuput5GC is composed of the useful output of all the 5GC NF. Therefore, the UsefulOuput5GC can be divided into:

* UsefulOuput5GC, throughput, which can be further devided into:
	+ UsefulOuput5GC, bps
	+ UsefulOuput5GC, pps
* UsefulOutput5GC, capacity, which can be further divided into
	+ UsefulOutput5GC, subscribers
	+ UsefulOutput5GC, sessions

NOTE: Since each type of the useful output is one dimension used to describe the UsefulOuput5GC, when one or multiple types of useful output are used for calculation, such as the calculation of resource efficiency ratio, the calculation is made with respect to each type of useful output, i.e. the useful output of the same kind can be added together, while the useful output of different kinds cannot be added together.

In this proposed solution, the following network functions may be considered (see clause 4.2.2 of TS 23.501 [2]):

- Authentication Server Function (AUSF):

- Access and Mobility Management Function (AMF)

- Unstructured Data Storage Function (UDSF)

- Network Exposure Function (NEF)

- Intermediate NEF (I-NEF)

- Network Repository Function (NRF)

- Network Slice Selection Function (NSSF)

- Policy Control Function (PCF)

- Session Management Function (SMF)

- Unified Data Management (UDM)

- Unified Data Repository (UDR)

- User Plane Function (UPF)

- UE radio Capability Management Function (UCMF)

- Application Function (AF)

- 5G-Equipment Identity Register (5G-EIR)

- Network Data Analytics Function (NWDAF)

- CHarging Function (CHF).

Editor's Note: The measurement of the useful output for the 5GC NF is FFS.

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| **4th Change** |

4.2.2.Y Potential solution #Y for ResourceConsumption5GC Estimation

4.2.2.Y.1 Introduction

This potential solution focuses on the definition of ResourceConsumption5GC appeared in:



4.2.2.Y.2 Description

The ResourceConsumption5GC (which is also denoted as R5GC) is defined as the resource allocated to all 5GC NF.



where RNF represents the resource allocated to a 5GC NF.

Since the 5GC NF is composed of 1 to many VNFs, the resource allocated to 5GC NF is the sum of the resource allocated to the VNFs composing the 5GC NF.



where RVNF represents ResourceConsumption.

The resource considered are Virtualization Container (VC) resources and Virtual Network resources. Therefore, ***R5GC*** can be further denoted as { ***RNF, cpu, RNF, memory***, ***RNF, storage***}. Moreover, as 5GC NF is composed of 1 to many VNFs, we have the following definitions:

* ***RNF, cpu*** is CPU resource consumption, defined as the sum of the used CPU capacity of the underlying VCs allocated to each of the VNFs composing the 5GC NF.
* ***RNF, memory*** is memory resource consumption, defined as the sum of the total memory used of the underlying VCs allocated to each of the VNFs composing the 5GC NF.
* ***RNF, storage*** is storage resource consumption, defined as the sum of the total storage used of the underlying VCs allocated to each of the VNFs composing the 5GC NF.

NOTE1: NF is composed of VNF(s). VNFs are composed of VNFC(s). VNFC is deployed on Virtualization Container(s). Therefore, the summation of the resource used by the VNFs composing the 5GC NF is based on the measurement of the corresponding VNFCs' resource consumption on the VCs. And this can be expressed as the following:



NOTE2: The consumption of the resource of different kinds may not be able to be added together. But the consumption of the resource of the same kind will be added together. Therefore, for each VNF, there will be a summation of resource consumption for each kind of resource, e.g. the total CPU resource consumption, the total memory resource consumption, etc. And they will be used or considered separately. And similarly, for each NF, there will be a summation of resource consumption for each kind of resource, based on the resource consumption of the VNFs. And they also will be used or considered separately. And so is for the 5GC.

Since each of the VNFs composing the 5GC NF may not be the only VNF running on a NFVI, the virtual resource consumption of the each VNF needs to be measured separately.

Resource consumption can be measured through performance monitoring, which could be external monitoring tools or monitoring functions provided by NFV infrastructure.

The ***RNF, cpu*** can be calculated as average CPU utilization (as clause 6.6 in [x]) multiplied by clock speed in megahertz (MHz) of CPU and number of cores.

The measurement of the ***RNF, memory*** can be derived from other memory metrics (as clause 8.6 in [x])

As the methods of measurement for storage systems vary widely and depend on the implementation, the measurement of the ***RNF, storage*** may not be defined separately.

Editor's Note: It is FFS whether the measurement of the storage resource consumption should be defined.

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| **End of change** |