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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies end-to-end Key Performance Indicators (KPIs) for the 5G network and network slicing.

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] Void.

[3] ITU-T Recommendation E.800: "Definitions of terms related to quality of service".

[4] 3GPP TS 24.501: " Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

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

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

kbit kilobit (1000 bits)
RTT Round Trip Time

4 End to end KPI concept and overview

The following KPI categories are included in the present document:

- Accessibility (see the definition in [3]).
- Integrity (see the definition in [3]).
- Utilization

For future update of the document it will also include:

- Retainability (see the definition in [3]).
- Availability.
- Mobility.

5 KPI definitions template

a) Long name (Mandatory): This field shall contain the long and descriptive name of the KPI.

b) Description (Mandatory): This field shall contain the description of the KPI.
Within this field it should be given if the KPI is focusing on network or user view.

c) Logical formula definition (Mandatory):
The logical formula should describe what the KPI formula is in logical way. The description of the formula is given in a written textual format without any measurement or counter names. E.g. a success rate KPI's logical formula is the successful event divided by all event.

d) Physical formula definition (Optional):
This field should contain the KPI formula description using the 3GPP defined counter names.
This field can be used only if the counters needed for the KPI formula is defined in any of the 3GPP TS for performance measurements (TS 28.552 [5]).

e) Measurement names used for the KPI (Optional):
This clause should list the measurement names used for the KPI.
This clause can be filled out only when the underlying measurements for the KPI formula can be defined, i.e. physical formula definition is available.

f) KPI Object (mandatory)
This clause shall describe the object of the KPI. The object of the KPI is one or some of the following:

- NR and NG-RAN;
- 5GC
- 5GS

g) KPI category (mandatory)
This clause contains the classification of the KPI into one of the KPI categories listed in clause 4.

h) Unit of the KPI (mandatory)
This clause describes the unit of the KPI. The unit can be one of the following:

- percentage;
- time interval (second or millisecond or microsecond);
- Erlang;
- kbit/s.

i) Type of the KPI (Mandatory)
This clause describes the type of the KPI. The KPI type can be one of the following:

- MEAN: This KPI is produced to reflect a mean measurement value based on a number of sample results.
- RATIO: KPI is produced to reflect the percentage of a specific case occurrence to all the cases.
- CUM: This KPI is produced to reflect a cumulative measurement which is always increasing.

j) Remark: (Optional)
This field is for any further information that is needed for the KPI definition.

Here it is proposed to define any additional information that would be needed for the KPI definition; e.g. the definition of a call in UTRAN.

6 End to end KPI definitions

6.1 KPI Overview

The KPI categories defined in [2] will be reused by the present document.

6.2 Accessibility KPI

6.2.1 Registered Subscribers of Network and Network Slice Instance through AMF

a) Registered Subscribers of Single Network Slice Instance through AMF.

b) This KPI describe the total number of subscribers that are registered to a network slice instance.

c) This KPI is obtained by counting the subscribers in AMF that are registered to a network slice instance.

d) $RSSNSI = \sum_{AMF} RegisteredSubNbrMean$

e) RegisteredAMFSubNbrMean

f) 5GS

g) Accessibility

h) Interger

i) CUM

6.2.2 Registered Subscribers of Network through UDM

a) Registered Subscribers of Network through UDM

b) This KPI describes the total number of subscribers that are registered to a network through UDM.

c) This KPI is corresponding to the measurement RM.RegisteredSubUDMNbrMean that counts subscribers registered in UDM..

d) $RSSNSI = \mathrm{Re}\, gisteredSubUDMNbrMean$

e) RegisteredSubUDMNbrMean

f) 5GS

g) Accessibility

h) Integer

i) CUM

6.2.3 Registration success rate of one single network slice instance

a) Registration success rate of one single network slice instance.

b) This KPI describes the ratio of the number of successfully performed registration procedures to the number of attempted registration procedures for the AMF set which related to one single network slice instance and is used to evaluate accessibility provided by the end-to-end network slice instance and network performance.

c) This KPI is obtained by successful registration procedures divided by attempted registration procedures.

d)

$$RSR = \frac{\sum_{Type} AMF.5GSRegisSucc.Type}{\sum_{Type} AMF.5GSRegisAtt.Type} * 100\%$$

e) AMF.5GSRegisAtt.*Type*
AMF.5GSRegisAttachSucc.*Type*

NOTE: Above measurements with subcounter .*Type* should be defined in 3GPP TS 24.501 [4].

f) 5GS

g) Accessibility

h) Percentage

i) RATIO

6.3 Integrity KPI

6.3.1 Latency of 5G Network

6.3.1.0 KPI categories

a) End-to-end latency of 5G network.

b) This KPI describes the end to end packet transmission latency through the RAN, CN, and TN part of 5G network and is used to evaluate utilization performance of the end-to-end network.

c) This KPI is the RTT end to end latency of UE IP packets transmitted from UE to the N6 interface in the 5G network. The N6 interface is the reference point between UPF and DN.

d) E2ELatency

e) End-to-end latency

f) 5GS

g) Integrity

h) Time interval (millisecond)

i) MEAN

6.3.1.1 Downlink latency in gNB-DU

a) Downlink latency for IP packets through gNB in split scenario.

b) This KPI describes the gNB-DU part of the packet transmission latency experienced by an end-user. It is used to evaluate the gNB latency contribution to the total packet latency.

c) This KPI is the average (arithmetic mean) of the time from reception of IP packet to gNB-DU until transmission of first part of that packet over the air interface, for a packet arriving when there is no previous data in queue for transmission to the UE.

d) DownlinkLat = DRB.RlcSduLatencyDl or optionally DownlinkLat.QoSx = DRB.RlcSduLatencyDl.QoSx where QOS identifies the target quality of service class.

e) DRB.RlcSduLatencyDl, DRB.RlcSduLatencyDl.QoS,

f) NG-RAN

g) Integrity

h) Time interval (microsecond)

i) MEAN

6.3.2 Upstream throughput for network and Network Slice Instance

a) Upstream throughput for network and network slice instance.

b) This KPI describes the upstream throughput of one single network slice instance by computing the packet size for each successfully transmitted UL IP packet through the network slice instance during each observing granularity period and is used to evaluate integrity performance of the end-to-end network slice instance.

c) This KPI is obtained by measuring the total number of upstream octets provided by N3 interface from NG-RAN to all UPFs, related to the single network slice instance, divided by the granularity period (in milliseconds).

d) $$UTSNSI = \frac{\sum_{UPF} GTP.InDataOctN3UPF.SNSSAI}{GranularityPeriod} \times 8$$

e) GTP.InDataOctN3UPF.

f) 5GS.

g) Integrity.

h) kbit/s.

i) MEAN.

6.3.3 Downstream Throughput for Single Network Slice Instance

a) Downstream throughput for network and network slice instance.

b) This KPI describes the downstream throughput of one single network slice instance by computing the packet size for each successfully transmitted DL IP packet through the network slice instance during each observing granularity period and is used to evaluate integrity performance of the end-to-end network slice instance.

c) This KPI is obtained by downstream throughput provided by N3 interface from all UPFs to NG-RAN which are related to the single network slice instance.

d) $$UTSNSI = \sum_{UPF} GTP.OutDataOctN3UPF$$

e) GTP.OutDataOctN3UPF.

f) 5GS.

g) Integrity.

h) kbit/s.