**3GPP TSG-SA5 Meeting #158S5-247195**

Orlando, FL, U.S.A., 18 - 22 November 2024

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **28.552** | **CR** | **0643** | **rev** | **1** | **Current version:** |  |  |
|  | | | | | | | | |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network | **X** |

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| ***Title:*** | Rel-19 CR TS 28.552 correction of GTP capacity performance measurements | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Ericsson LG Co, Orange | | | | | | | | | |
| ***Source to TSG:*** | S5 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** |  | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** | A |  | | | | | ***Release:*** | | |  |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | To support OAM input data for QoS Sustainability Analytics, SA5 added the new performance measurements and KPIs in TS 28.552 related to “DL capacity GTP” for gNB in clause 5.1 and “UL/DL capacity GTP” for UPF in clause 5.4.  In SA5 154 a LS (S5-241777) was sent to SA2, to explain that “available GTP capacity” could be simply obtained by substracting the actual value of network data transmission from the maximum value of the defined GTP capacity, and therefore not requiring any new performance measurement.  In SA5 155 meeting, CR(S5-243355) added the use case of GTP capacity performance measurements to better explain the purpose of related performance measurements.  Even though it is certainly more difficult to obtain the Available Capacity since it varies over time and depends on multiple factors including network congestion, we believe that such additional performance measurement could be beneficial to maintain. Furthemore, this information is not so straight forward as it might seem due to the fact to easily obtain the real usage value from all links of a given shared network.  wrong non-valid references exist in the document | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Correct the clause for GTP capacity performance measurements, Explain the necessity to keep the “Available GTP Capacity” performance measurement. Correct references. Add missing reference. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Wrong statement in the document. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2, 5.1.1.13.3.6, 5.1.1.6.1.4, 5.1.1.6.1.8, 5.1.1.6.1.9, 5.1.1.6.1.10, 5.1.1.6.1.11, 5.1.1.6.1.12, 5.1.1.6.1.13, 5.1.1.6.5.2, 5.1.1.6.5.4, 5.1.1.6.8.4, 5.1.1.6.8.8, 5.1.1.6.8.9, 5.1.1.10.11, 5.1.1.13.3.6, 5.1.1.31.2, 5.1.1.38, 5.1.1.40, 5.1.1.41, 5.1.3.1.2, 5.1.3.1.4, 5.1.3.1.5, 5.4.1.8, 5.4.3.1.2, 5.5.4.1.2, 5.14.2.1, 6.2, 110. A.117, A.124 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

***First 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] Void.

[3] 3GPP TS 32.404: "Performance Management (PM); Performance measurements - Definitions and template".

[4] 3GPP TS 23.501: "System Architecture for the 5G System".

[5] IETF RFC 5136: "Defining Network Capacity".

[6] 3GPP TS 38.473: "NG-RAN; F1 Application Protocol (F1AP)".

[7] 3GPP TS 23.502: "Procedures for the 5G System".

[8] 3GPP TS 28.554: "Management and orchestration; 5G end to end Key Performance Indicators (KPI)".

[9] 3GPP TS 32.425: "Performance Management (PM); Performance measurements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN)".

[10] 3GPP TS 32.451: "Key Performance Indicators (KPI) for Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Requirements".

[11] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

[12] Void.

[13] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[14] 3GPP TS 29.502: "5G System; Session Management Services; Stage 3".

[15] Void.

[16] 3GPP TS 29.244: "Technical Specification Group Core Network and Terminals; Interface between the Control Plane and the User Plane Nodes; Stage 3".

[17] ETSI GS NFV-IFA027 v2.4.1: "Network Functions Virtualisation (NFV); Management and Orchestration; Performance Measurements Specification".

[18] Void.

[19] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[20] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[21] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3".

[22] 3GPP TS 29.413: "Application of the NG Application Protocol (NGAP) to non-3GPP access".

[23] 3GPP TS 29.122: "Technical Specification Group Core Network and Terminals; T8 reference point for Northbound APIs".

[24] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[25] ETSI ES 202 336-12 V1.2.1: "Environmental Engineering (EE); Monitoring and control interface for infrastructure equipment (power, cooling and building environment systems used in telecommunication networks); Part 12: ICT equipment power, energy and environmental parameters monitoring information model".

[26] 3GPP TS 28.541: "Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3".

[27] 3GPP TS 29.274: "Evolved General Packet Radio Service (GPRS); Tunnelling Protocol for Control plane (GTPv2-C); Stage 3".

[28] 3GPP TS 29.510: "5G System; Network function repository services; Stage 3".

[29] 3GPP TS 38.314: "NR; layer 2 measurements".

[30] 3GPP TS 28.313: "Self-Organizing Networks (SON) for 5G networks".

[31] 3GPP TS 38.415: "NG-RAN; PDU session user plane protocol".

[32] 3GPP TS 38.321: "NR MAC protocol specification".

[33] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[34] 3GPP TS 38.215: "NR; Physical layer measurements".

[35] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".

[36] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

[37] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in Idle mode and RRC Inactive state".

[38] Void.

[39] 3GPP TS 29.507: "5G System; Access and Mobility Policy Control Service; Stage 3".

[40] 3GPP TS 29.512: "5G System; Session Management Policy Control Service; Stage 3".

[41] 3GPP TS 29.531: "5G System; Network Slice Selection Services".

[42] 3GPP TS 29.281: "General Packet Radio System (GPRS) Tunnelling Protocol User Plane (GTPv1-U)".

[43] 3GPP TS 29.540: "5G System; SMS Services; Stage 3".

[44] 3GPP TS 29.522: "5G System; Network Exposure Function Northbound APIs; Stage 3".

[45] 3GPP TS 29.541: "5G System; Network Exposure FunctionServices for Non-IP Data Delivery (NIDD); Stage 3".

[46] 3GPP TS 23.503: "Policy and charging control framework for the 5G System (5GS); Stage 2".

[47] 3GPP TS 29.504: "5G System; Unified Data Repository Services; Stage 3".

[48] 3GPP TS 29.554: "5G System; Background Data Transfer Policy Control Service; Stage 3".

[49] 3GPP TS 38.300: "NR and NG-RAN Overall description; Stage-2".

[50] Void.

[51] 3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".

[52] 3GPP TS 23.558: "Architecture for enabling Edge Applications".

[53] 3GPP TS 23.273: "5G System (5GS); Location Services (LCS); Stage 2".

[54] 3GPP TS 29.572: "5G System (5GS); Location Management Services; Stage 3".

[55] Void

[56] 3GPP TS 38.425: "NG-RAN; NR User plane protocol".

[57] 3GPP TS 36.425: "(E-UTRAN); X2 interface user plane protocol".

[58] 3GPP TS 29.520: "5G System; Network Data Analytics Services; Stage 3".

[59] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[60] 3GPP TS 37.340: "NR; Multi-connectivity; Overall description; Stage-2".

[61] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[62] 3GPP TS 28.532: "Management and orchestration; Generic management services".

[63] 3GPP TS 28.318: "Management and Orchestration; Network and Service Operations for Energy Utilities (NSOEU)".

[64] 3GPP TS 38.213: "NR;Physical layer procedures for control".

[65] 3GPP TS 28.622: "Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[x] 3GPP TS 23.527: "5G System; Restoration procedures ".

[y] 3GPP TS 32.426: " Telecommunication management; Performance Management (PM); Performance measurements Evolved Packet Core (EPC) network".

[z] ITU‑T Y.1540: "Internet protocol data communication service - IP packet transfer and availability performance parameters".

***Next change***

###### 5.1.1.6.1.4 Number of requested legacy handover resource allocations

a) This measurement provides the number of legacy handover resource allocation requests received by the target NR cell CU.

b) CC.

c) On receipt of HANDOVER REQUEST message (see TS 38.413 [11]) by the NR cell CU from the AMF, or receipt of HANDOVER REQUEST message (see TS 38.423 [13]) , where the message denotes a legacy handover, by the target NR cell CU from the source NR cell CU, for requesting the preparation of resources for handover.

d) A single integer value.

e) MM.HoResAlloInterReq.

f) NRCellCU.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurements is for performance assurance.

***Next change***

###### 5.1.1.6.1.8 Number of successful legacy handover executions

a) This inter gNB handover measurement provides the number of successful legacy handover executions received by the source gNB.

b) CC.

c) On receipt at the source gNB of UE CONTEXT RELEASE TS 38.423 [13] over Xn from the target gNB following a successful handover, where the message denotes a legacy handover, or, if handover is performed via NG, on receipt of UE CONTEXT RELEASE COMMAND TS 38.413 [11] from AMF following a successful inter gNB handover, where the message denotes a legacy handover, the counter is stepped by 1.

d) A single integer value.

e) MM.HoExeInterSucc.

f) NRCellCU;  
NRCellRelation.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

***Next change***

###### 5.1.1.6.1.9 Number of failed legacy handover executions

a) This inter gNB handover measurement provides the number of failed legacy handover executions for asource gNB.

b) CC.

c) This counter is incremented when handover execution failures occur. It is assumed that the UE context is available in the source gNB. The following events are counted:

1) On reception of NGAP UE CONTEXT RELEASE COMMAND TS 38.413 [11] from AMF indicating an unsuccessful inter gNB handover;

2) On reception of RrcReestablishmentRequest (see TS 38.331 [20]) where the reestablishmentCause is handoverFailure, from the UE in the source gNB, where the reestablishment occurred in the source gNB;

3) On expiry of a Handover Execution supervision timer in the source gNB;

4) On reception of XnAP RETRIEVE UE CONTEXT REQUEST TS 38.423 [13] in the source gNB, when the reestablishment occurred in another gNB.

The failure causes for UE CONTEXT RELEASE COMMAND are listed in TS 38.413 [11] clause 9.3.1.2. An event increments the relevant subcounter by 1. For MM.HoExeInterFail.UE\_CONTEXT\_RELEASE\_COMMAND, an event increments the relevant subcounter per failure cause by 1.

As one handover failure might cause more than one of the above events, duplicates need to be filtered out.

d) Each subcounter is an integer value.

e) MM.HoExeInterFail.UeCtxtRelCmd.*cause;*

*MM.HoExeInterFail.RrcReestabReq;*

*MM.HoExeInterFail.HoExeSupTimer;*

*MM.HoExeInterFail.RetrUeCtxtReq;*

Where *cause* identifies the failure cause of the UE CONTEXT RELEASE COMMAND message.

f) NRCellCU;  
NRCellRelation.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

***Next change***

###### 5.1.1.6.1.10 Mean Time of requested legacy handover executions

a) This measurement provides the mean time of inter gNB legacy handover executions during each granularity period. The measurement is split into subcounters per S-NSSAI.

b) DER(n=1).

c) This measurement is obtained by accumulating the time interval for every successful inter gNB handover executions procedure per S-NSSAI between the receipt by the source NG-RAN from the target NG-RAN of UE CONTEXT RELEASE TS 38.423 [13] over Xn, or, if handover is performed via NG, the receipt of UE CONTEXT RELEASE COMMAND TS 38.413 [11] from AMF and the sending of a RRCReconfiguration message triggering the Uu handover from the source NG-RAN to the UE over a granularity period using DER, for legacy handovers. The end value of this time will then be divided by the number of inter gNB legacy handovers observed in the granularity period to give the arithmetic mean, the accumulator shall be reinitialised at the beginning of each granularity period.

d) Each measurement is an integer value, in milliseconds.

e) MM.HoExeInterReq.TimeMean.*SNSSAI.*

f) NRCellCU.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this measurement is for monitoring the mean time of inter gNB handovers during the granularity period.

***Next change***

###### 5.1.1.6.1.11 Max Time of requested legacy handover executions

a) This measurement provides the max time of inter gNB legacy handover executions during each granularity period. The measurement is split into subcounters per S-NSSAI.

b) DER(n=1).

c) This measurement is obtained by measuring the time interval for every successful inter gNB handover executions procedure per S-NSSAI between the receipt by the source NG-RAN from the target NG-RAN of UE CONTEXT RELEASE TS 38.423 [13] over Xn, or, if handover is performed via NG, the receipt of UE CONTEXT RELEASE COMMAND TS 38.413 [11] from AMF and the sending of a RRCReconfiguration message triggering the Uu handover from the source NG-RAN to the UE over a granularity period using DER, for legacy handovers. The high tide mark of this time will be stored in a gauge, the gauge shall be reinitialised at the beginning of each granularity period.

d) Each measurement is an integer value, in milliseconds.

e) MM.HoExeInterReq.TimeMax.*SNSSAI.*

f) NRCellCU.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this measurement is for monitoring the max time of inter gNB handovers during the granularity period.

***Next change***

###### 5.1.1.6.1.12 Number of successful handover executions per beam pair

a) This inter gNB handover measurement provides the number of successful handover executions received by the source gNB per beam pair, i.e. beam in the source and beam in the target cell.

b) CC

c) On receipt at the source gNB of UE CONTEXT RELEASE TS 38.423 [13] over Xn from the target gNB following a successful handover, or, if handover is performed via NG, on receipt of UE CONTEXT RELEASE COMMAND TS 38.413 [11] from AMF following a successful inter gNB handover, the counter is stepped by 1.

d) A single integer value.

e) MM.HoExeInterSSBSucc

f) Beam.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

###### 5.1.1.6.1.13 Number of failed handover executions per beam pair

a) This inter gNB handover measurement provides the number of failed handover executions for source gNB per beam pair.

b) CC.

c) This counter is incremented when handover execution failures occur. It is assumed that the UE context is available in the source gNB. The following events are counted:

1) On reception at the source of NGAP UE CONTEXT RELEASE COMMAND TS 38.413 [11] from AMF indicating an unsuccessful inter gNB handover,

2) On reception of RrcReestablishmentRequest (see TS 38.331 [20]) where the reestablishmentCause is handoverFailure, from the UE in the source gNB, where the reestablishment occurred in the source gNB;

3) On expiry of a Handover Execution supervision timer in the source gNB;

4) On reception of XnAP RETRIEVE UE CONTEXT REQUEST TS 38.423 [13] in the source gNB, when the reestablishment occurred in another gNB.

The failure causes for NGAP UE CONTEXT RELEASE COMMAND are listed in TS 38.413 [11]. An event increments the relevant subcounter by 1. For MM.HoExeInterSSBFail.UeCtxtRelCmd, an event increments the relevant subcounter per failure cause by 1.

As one handover failure might cause more than one of the above events, duplicates need to be filtered out.

d) Each subcounter is an integer value.

e) MM.HoExeInterSSBFail.UeCtxtRelCmd.*cause*;

MM.HoExeInterSSBFail.RrcReestabReq;

MM.HoExeInterSSBFail.HoExeSupTimer;

MM.HoExeInterSSBFail.RetrUeCtxtReq;

Where *cause* identifies the failure cause of the NGAP UE CONTEXT RELEASE COMMAND message.

f) Beam.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

***Next change***

###### 5.1.1.6.5.2 Number of successful intra-frequency handover executions

a) This measurement provides the number of successful intra-frequency handover executions received by the source NRCellCU.

b) CC.

c) On reception of *RRCReconfigurationComplete* message from the UE to the target NRCellCU indicating a successful intra-frequency intra gNB handover (see TS 38.331 [20]), or, on reception of UE CONTEXT RELEASE TS 38.423 [13] over Xn from the target gNB following a successful intra-frequency inter gNB handover, or, if handover is performed via NG, on reception of UE CONTEXT RELEASE COMMAND TS 38.413 [11] from AMF following a successful intra-frequency inter gNB handover, the counter is stepped by 1.

d) A single integer value.

e) MM.HoExeIntraFreqSucc.

f) NRCellCU.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

***Next change***

###### 5.1.1.6.5.4 Number of successful inter-frequency handover executions

a) This measurement provides the number of successful inter-frequency handover executions received by the source NRCellCU.

b) CC.

c) On reception of *RRCReconfigurationComplete* message from the UE to the target NRCellCU indicating a successful inter-frequency intra gNB handover (see TS 38.331 [20]), or, on reception of UE CONTEXT RELEASE TS 38.423 [13] over Xn from the target gNB following a successful inter-frequency inter gNB handover, or, if handover is performed via NG, on reception of UE CONTEXT RELEASE COMMAND TS 38.413 [11] from AMF following a successful inter-frequency inter gNB handover, the counter is stepped by 1.

d) A single integer value.

e) MM.HoExeInterFreqSucc.

f) NRCellCU.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

***Next change***

###### 5.1.1.6.8.4 Number of requested DAPS handover resource allocations

a) This measurement provides the number of DAPS handover resource allocation requests received by the target NR cell CU.

b) 1CC

c) On receipt of HANDOVER REQUEST message (see TS 38.413 [11]) by the NR cell CU from the AMF, or receipt of HANDOVER REQUEST message (see TS 38.423 [13]) by the target NR cell CU], where the message denotes a DAPS handover, from the source NR cell CU, for requesting the preparation of resources for handover.

d) A single integer value.

e) MM.DapsHoResAlloInterReq.

f) NRCellCU.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurements is for performance assurance.

***Next change***

###### 5.1.1.6.8.8 Number of successful DAPS handover executions

a) This inter gNB handover measurement provides the number of successful DAPS handover executions received by the source gNB.

b) CC

c) On receipt at the source gNB of UE CONTEXT RELEASE TS 38.423 [13] over Xn from the target gNB following a successful DAPS handover, or, if handover is performed via NG, on receipt of UE CONTEXT RELEASE COMMAND TS 38.413 [11] from AMF following a successful inter gNB DAPS handover, the counter is stepped by 1.

d) A single integer value.

e) MM.DapsHoExeInterSucc.

f) NRCellCU,  
NRCellRelation.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

***Next change***

###### 5.1.1.6.8.9 Number of failed DAPS handover executions

a) This inter gNB handover measurement provides the number of failed DAPS handover executions.

b) CC.

c) This counter is incremented when handover execution failures occur. It is assumed that the UE context is available in the source gNB. The following events are counted:

1) On reception of NGAP UE CONTEXT RELEASE COMMAND TS 38.413 [11] from AMF indicating an unsuccessful inter gNB DAPS handover;

2) On reception of *RrcReestablishmentRequest* (see TS 38.331 [20]) where the reestablishmentCause is handoverFailure, from the UE in the source gNB, where the reestablishment occurred in the source gNB, for a DAPS handover;

3) On expiry of a Handover Execution supervision timer in the source gNB for a DAPS handover;

4) On reception of XnAP RETRIEVE UE CONTEXT REQUEST TS 38.423 [13] in the source gNB, for a DAPS handover, when the reestablishment occurred in another gNB;

5) On reception of *FailureInformation* (see TS 38.331 [20]) where *failureType-r16* is set to *daps-failure*.

The failure causes for UE CONTEXT RELEASE COMMAND are listed in TS 38.413 [11] clause 9.3.1.2. An event increments the relevant subcounter by 1. For MM.DapsHoExeInterFail.UE\_CONTEXT\_RELEASE\_COMMAND, an event increments the relevant subcounter per failure cause by 1.

As one handover failure might cause more than one of the above events, duplicates need to be filtered out.

d) Each subcounter is an integer value.

e) MM.DapsHoExeInterFail.UeCtxtRelCmd.*cause*;  
MM.DapsHoExeInterFail.RrcReestabReq;MM.DapsHoExeInterFail.HoExeSupTimer;MM.DapsHoExeInterFail.RetrUeCtxtReq;  
MM.DapsHoExeInterFail.FailInfo.

Where *cause* identifies the failure cause of the UE CONTEXT RELEASE COMMAND message.

f) NRCellCU,  
NRCellRelation.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurement is for performance assurance.

***Next change***

##### 5.1.1.10.11 Mean number of DRBs undergoing from User Plane Path Failures

a) This measurement provides the number of DRB’s prone to GTP-U Error Indication, the 5G CU-UP shall return a GTP-U Error Indication if it does not have a corresponding GTP-U context (see clause 5.2 of TS 23.527 [x]).

b) CC.

c) The 5G CU-UP should also notify the GTP-U user plane path failure via the Operation and Maintenance system. All DRB’s of this UE are counted for this measurement to the target 5GS cell. Each DRB attempted to establish is added to the relevant measurement per QCI, the possible QCIs are included in TS 23.501 [4]. The sum of all supported per QCI measurements shall equal the total number of DRB’s attempted to setup. In case only a subset of per QCI or per supported S-NSSAI measurements are supported, a sum subcounter will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the .sum suffix.

e) The measurement name has the form DRB.GTPUPathFailure.5QI, where 5QI identifies mapped 5QI and DRB.GTPUPathFailure.SNSSAI, where SNSSAI identifies the S-NSSAI.

f) NRCellCU.

g) Valid for packet switched traffic.

h) 5GS.

***Next change***

##### 5.1.1.13.3.6 Number of Initial QoS flow failed to setup

a) This measurement provides the number of Initial QoS flows failed to setup. The measurement is split into subcounters per failure cause.

b) CC.

c) On transmission by the NG-RAN of a INITIAL CONTEXT SETUP RESPONSE message, each QoS flow failed to establish is added to the relevant measurement per cause, the possible causes are included in TS 38.413 [11]. The sum of all supported per cause measurements shall equal the total number of Initial QoS flows failed to setup. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form QF. InitialEstabFailNbr.*Cause*  
where *Cause* identifies the cause resulting in the QoS flow setup failure.

f) NRCellCU.

g) Valid for packet switched traffic.

h) 5GS.

***Next change***

##### 5.1.1.31.2 SS-RSRQ distribution per SSB

a) This measurement provides the distribution of SS-RSRQ per SSB received by the gNB of a serving cell from UEs in the *measResults* IEs in *MeasurementReport* messages that is triggered by the gNB sending the *measConfig* messages to request UEs to send the UE measurement reports (see clause 5.5.2 in TS 38.331 [20]).

b) CC.

c) This measurement is obtained by incrementing the appropriate measurement bin identified by *rsrq* value in the *MeasQuantityResults* IE in *ssb-Results* IE for the SSB identified by *ssb-Index*, where the *rsrq* value for the SSB beam of the serving cell is reported by a UE to the gNB via the *measResultServingCell* in *MeasResultServMO* IE in the *measResults* message (see TS 38.331 [20]).

d) Each subcounter is an integer.

e) MR.SS-RSRQPerSSB.*Bin*

where *Bin* represents the range of reported SS-RSRQ value (0 .. 127) mapping to -43 dB to 20 dB with 0.5 dB resolution (See Table 10.1.11.1-1 in TS 38.133 [35]).

NOTE: Number of bins and the range for each bin is left to implementation.

f) Beam

g) Valid for packet switched traffic

h) 5GS

***Next change***

#### 5.1.1.38 Number of Successfully applied RRCReconfiguration for connected mode power saving Wake-Up Signal functionality.

a) Configuring the connected mode power saving WUS functionality is done through RRC signalling by including the dcp-Config-r16 IE (see TS 38.331 [20], clause 6.3.2- PhysicalCellGroupConfig) in RRCReconfiguration.

This measurement provides the number of such RRCReconfiguration messages that are successfully applied on UE side, for an RRC connection established within the existing NRCellCU.

b) CC

c) Two subcounters will be maintained. One for MCG and one for SCG. On reception of RRCReconfigurationComplete message from the UE, following a transmission of RRCReconfiguration message to that same UE, If the transmitted RRCReconfiguration message to the UE carries masterCellGroup or secondaryCellGroupConfiguration, and one or both of these containers contain setup of the dcp-Config-r16 IE, then the corresponding subcounters will be incremented accordingly.

d) Each measurement is an integer value.

e) The measurement name has the form RRC.WUS.DEPLOYMENT where DEPLOYMENT identifies whether WUS is configured over Master Cell Group, in which case DEPLOYMENT = MCG, or Secondary Cell Group, in which case DEPLOYMENT = SCG.

f) NRCellCU

g) Valid for packet switched traffic

h) 5GS

i) One usage of this performance measurement is to characterize the WUS enablement.

***Next change***

#### 5.1.1.40 Number of RRCReconfiguration for successfully configuring NR-NR Dual Connectivity (NR-NR-DC)

a) This measurement provides the number of UE side successfully applied RRCReconfiguration carrying the NR-NR-DC for an RRC connection established within the existing NRCellCU.

b) CC

c) On reception of RRCReconfigurationCompletemessage from the UE, following a transmission of RRCReconfiguration message to that same UE, if the transmitted RRCReconfiguration contains the setup of mrdc-SecondaryCellGroup-nr-SCG (see TS 38.331 [20], clause 6.2.2 - MRDC-SecondaryCellGroupConfig), the counter will be incremented.

d) Each measurement is an integer value.

e) The measurement name has the form RRC.RRCRECONF.Scg.Nr

f) NRCellCU

g) Valid for packet switched traffic

h) 5GS

i) One usage of this performance measurement is to characterize NR-NR-DC Configuration rate and enablement.

#### 5.1.1.41 Number of RRCResume for successfully configuring NR-NR Dual Connectivity (NR-NR-DC)

a) This measurement provides the number of UE side successfully applied RRCResume messages carrying the NR-NR-DC for an RRC connection established within the existing NRCellCU.

b) CC

c) On reception of RRCResumeComplete message from the UE, following a transmission of RRCResume message to that same UE, if the transmitted RRCResume contains the setup of mrdc-SecondaryCellGroup-r16-nr-SCG-r16 (see TS 38.331[20], 6.2.2 - mrdc-SecondaryCellGroup-r16-nr-SCG-r16) the counter will be incremented.

d) Each measurement is an integer value.

e) The measurement name has the form RRC.RRCRESUME.Scg.Nr

f) NRCellCU

g) Valid for packet switched traffic

h) 5GS

i) One usage of this performance measurement is to characterize NR-NR-DC Configuration rate and enablement.

***Next change***

##### 5.1.3.1.2 UL F1-U Packet Loss Rate

a) This measurement provides the fraction of PDCP SDU packets which are not successfully received at gNB-CU-UP. It is a measure of the UL packet loss on the F1-U interface. The measurement is optionally split into subcounters per QoS level (mapped 5QI or QCI in NR option 3) and subcounters per supported S-NSSAI.

b) SI

c) This measurement is obtained as: 1000000\* Number of missing UL GTP sequence numbers (TS 29.281 [42]), representing packets that are not delivered to higher layers, of a data radio bearer, divided by Total number of UL GTP sequence numbers (also including missing sequence numbers) of a bearer, starting from the GTP sequence number of the first packet delivered by gNB-DU to gNB-CU-UP until the GTP sequence number of the last packet. Separate counters are optionally maintained for mapped 5QI (or QCI for option 3) and per supported S-NSSAI.

d) Each measurement is an integer value representing the loss rate multiplied by 1E6. The number of measurements is equal to one. If the optional QoS and S-NSSAI level measurement are performed, the measurements are equal to the number of mapped 5QIs and the number of supported S-NSSAIs.

e) The measurement name has the form DRB.F1UpacketLossRateUl and optionally DRB.F1UPacketLossRateUl.*QOS* where *QOS* identifies the target quality of service class, and DRB.F1UPacketLossRateUl.S*NSSAI* where *SNSSAI* identifies the S-NSSAI.

f) GNBCUUPFunction

g) Valid for packet switched traffic

h) 5GS

i) One usage of this measurement is for performance assurance within integrity area (user plane connection quality).

##### 5.1.3.1.3 DL F1-U Packet Loss Rate

a) This measurement provides the fraction of PDCP SDU packets which are not successfully received at the gNB-DU). It is a measure of the DL packet loss on the F1-U interface. The measurement is optionally split into subcounters per QoS level (mapped 5QI or QCI in NR option 3), and subcounters per supported S-NSSAI.

b) SI

c) This measurement is obtained as: 1000000\* Number of missing DL GTP sequence numbers (TS 29.281 [42]), representing packets that are not delivered to lower layers, of a data radio bearer, divided by Total number of DL GTP sequence numbers (also including missing sequence numbers) of a bearer, starting from the sequence number of the first packet delivered by gNB-CU-UP to gNB-DU until the GTP sequence number of the last packet. Separate counters are optionally maintained for mapped 5QI (or QCI for NR option 3) and per supported S-NSSAI.

d) Each measurement is an integer value representing the loss rate multiplied by 1E6. The number of measurements is equal to one. If the optional QoS and S-NSSAI level measurement are performed, the measurements are equal to the number of mapped 5QIs and the number of supported S-NSSAIs.

e) The measurement name has the form DRB.F1UpacketLossRateDl .and optionally DRB.F1UPacketLossRateDl.*QOS* where *QOS* identifies the target quality of service class, and DRB.F1UPacketLossRateDl.*SNSSAI* where *SNSSAI* identifies the S-NSSAI.

f) NRCellDU

g) Valid for packet switched traffic

h) 5GS

i) One usage of this measurement is for performance assurance within integrity area (user plane connection quality).

***Next change***

##### 5.2.5.2.1 Number of 5G paging procedures

a) This measurement provides the number of 5G paging procedures initiated at the AMF. The initial paging procedures as well as the repeated paging procedures are counted.

b) CC.

c) Incremented when a 5G paging request is sent i.e. at the transmission of the first paging request (TS 23.502 [7] and TS 24.501 [24]).

d) A single integer value.

e) MM.Paging5GReq

f) AMFFunction

g) Valid for packet switching.

h) 5GS.

***Next change***

##### 5.3.2.1.1 Number of QoS flows requested to create

a) This measurement provides the number of QoS flows requested to create. This measurement is split into subcounters per S-NSSAI and subcounters per 5QI.

b) CC.

c) Receipt of Nsmf\_PDUSession\_UpdateSMContext Request which includes the N1 SM container IE containing the QoS flows requested to create (see TS 23.502 [7]) from AMF by the SMF; or transmission of Namf\_Communication\_N1N2MessageTransfer which includes N1 SM container IE containing the QoS flows requested to create to AMF by the SMF (see TS 23.502 [7]). Each QoS flow requested to create in the message triggers the relevant subcounter per S-NSSAI and the relevant subcounter per 5QI to increment by 1 respectively (the S-NSSAI is the S-NSSAI that the PDU session belongs to, or the new S-NSSAI if the S-NSSAI for the serving PLMN derived from the S-NSSAI of the home PLMN differs from the S-NSSAI provided in the Create SM Context Request, see clause 6.1.6.2.4 in TS 29.502 [14]).

d) Each measurement is an integer value.

e) SM.QoSflowCreateReq.*SNSSAI* andSM.QoSflowCreateReq.*5QI.*

Where the *SNSSAI* identifies theS-NSSAI, and the *5QI* identifies the5QI.

f) SMFFunction.

g) Valid for packet switched traffic.

h) 5GS.

##### 5.3.2.1.2 Number of QoS flows successfully created

a) This measurement provides the number of QoS flows successfully created. This measurement is split into subcounters per S-NSSAI and subcounters per 5QI.

b) CC.

c) Receipt of Nsmf\_PDUSession\_UpdateSMContext Request that includes the N2 SM information IE containing the successfully created (set up or added) QoS flows from AMF by the SMF (see TS 23.502 [7]). Each successfully created QoS flow triggers the relevant subcounter per S-NSSAI and the relevant subcounter per 5QI to increment by 1 respectively (the S-NSSAI is the S-NSSAI that the PDU session belongs to, or the new S-NSSAI if the S-NSSAI for the serving PLMN derived from the S-NSSAI of the home PLMN differs from the S-NSSAI provided in the Create SM Context Request, see clause 6.1.6.2.4 in TS 29.502 [14]).

d) Each measurement is an integer value.

e) SM.QoSflowCreateSucc.*SNSSAI* andSM.QoSflowCreateSucc.*5QI.*

Where the *SNSSAI* identifies theS-NSSAI, and the *5QI* identifies the5QI.

f) SMFFunction.

g) Valid for packet switched traffic.

h) 5GS.

***Next change***

##### 5.3.2.1.4 Number of QoS flows requested to modify

a) This measurement provides the number of QoS flows requested to modify. This measurement is split into subcounters per S-NSSAI and subcounters per 5QI.

b) CC.

c) Receipt of Nsmf\_PDUSession\_UpdateSMContext Request which includes the N1 SM container IE containing the QoS flows requested to modify (see TS 23.502 [7]) from AMF by the SMF; or transmission of Namf\_Communication\_N1N2MessageTransfer which includes N1 SM container IE containing the QoS flows requested to modify to AMF by the SMF (see TS 23.502 [7]). Each QoS flow requested to modify in the message triggers the relevant subcounter per S-NSSAI and the relevant subcounter per 5QI to increment by 1 respectively (the S-NSSAI is the S-NSSAI that the PDU session belongs to, or the new S-NSSAI if the S-NSSAI for the serving PLMN derived from the S-NSSAI of the home PLMN differs from the S-NSSAI provided in the Create SM Context Request, see clause 6.1.6.2.4 in TS 29.502 [14]).

d) Each measurement is an integer value.

e) SM.QoSflowModReq.*SNSSAI* andSM.QoSflowModReq.*5QI.*

Where the *SNSSAI* identifies theS-NSSAI, and the *5QI* identifies the5QI.

f) SMFFunction.

g) Valid for packet switched traffic.

h) 5GS.

##### 5.3.2.1.5 Number of QoS flows successfully modified

a) This measurement provides the number of QoS flows successfully modified. This measurement is split into subcounters per S-NSSAI and subcounters per 5QI.

b) CC.

c) Receipt of Nsmf\_PDUSession\_UpdateSMContext Request that includes the N2 SM information IE containing the successfully modified QoS flows from AMF by the SMF (see TS 23.502 [7]). Each successfully modified QoS flow triggers the relevant subcounter per S-NSSAI and the relevant subcounter per 5QI to increment by 1 respectively (the S-NSSAI is the S-NSSAI that the PDU session belongs to, or the new S-NSSAI if the S-NSSAI for the serving PLMN derived from the S-NSSAI of the home PLMN differs from the S-NSSAI provided in the Create SM Context Request, see clause 6.1.6.2.4 in TS 29.502 [14]).

d) Each measurement is an integer value.

e) SM.QoSflowModSucc.*SNSSAI* andSM.QoSflowModSucc.*5QI.*

Where the *SNSSAI* identifies theS-NSSAI, and the *5QI* identifies the5QI.

f) SMFFunction.

g) Valid for packet switched traffic.

h) 5GS.

***Next change***

#### 5.4.1.8 Outgoing GTP Data Packet Loss

a) This measurement provides the number of GTP data packets which are not successfully received at gNB over N3. It is a measure of the outgoing GTP data packet loss per N3 on an UPF interface. The measurement is split into subcounters per QoS level (5QI).

b) CC.

c) This measurement is obtained by a counter: Number of missing outgoing GTP sequence numbers (TS 29.281 [42]) among all GTP packets delivered by an UPF interface to a gNB. Separate counter is maintained for each 5QI.

d) Each measurement is an integer value representing the lost GTP packets.. If the QoS level measurement is performed, the measurements are equal to the number of 5QIs.

e) The measurement name has the form GTP.OutDataPktPacketLossN3UPF or GTP.OutDataPktPacketLossN3UPF.QoSwhere QoS identifies the target quality of service class.

f) EP\_N3.

g) Valid for packet switched traffic.

h) 5GS.

***Next change***

##### 5.4.3.1.2 Number of failed N4 session establishments

a) This measurement provides the number of failed N4 session establishments at the UPF. This measurement is split into subcounters per rejection cause.

b) CC.

c) On transmission of N4 session establishment response message that contains the cause indicating the rejection of N4 session establishment request (see TS 23.502 [7]) by the UPF to SMF. Each N4 session establishment response message indicating the rejection of N4 session establishment request triggers the relevant subcounter per rejection cause to increment by 1.

d) A single integer value.

e) SM.N4SessionEstabFail.*cause*where the cause identities the cause of the rejection of N4 session establishment request, per the encoding of the cause defined in clause 8.2.1 of TS 29.244 [16].

f) UPFFunction.

g) Valid for packet switched traffic.

h) 5GS.

***Next change***

##### 5.5.4.1.2 Number of successful background data transfer policy creations

a) This measurement provides the number of successful background data transfer policy creations at the PCF.

b) CC

c) Transmission of an Npcf\_BDTPolicyControl\_Create response by the PCF to an NEF indicating a successful background data transfer policy creation (see TS 29.554 [48]).

d) An integer value

e) BDTP.CreateSucc

f) PCFFunction

g) Valid for packet switched traffic

h) 5GS

##### 5.5.4.1.3 Number of failed background data transfer policy creations

a) This measurement provides the number of failed background data transfer policy creations at the PCF.

b) CC

c) Transmission of an Npcf\_BDTPolicyControl\_Create response by the PCF to an NEF indicating a failed background data transfer policy creation (see TS 29.554 [48]), each message increments the relevant subcounter per failure cause by 1.

d) Each subcounter is an integer value

e) BDTP.CreateFail.*cause*  
Where *cause* indicates the failure cause of background data transfer policy creation.

f) PCFFunction

g) Valid for packet switched traffic

h) 5GS

***Next change***

### 5.14.2 Service provisioning procedure related measurements

#### 5.14.2.1 Number of service provisionig requests

a) This measurement provides the number of Service provisioning requests (see clause 8.3.3 of TS 23.558 [52]) received by the ECS.

b) CC

c) On receipt by the ECS from the EEC of Service provisioning request. Each provisioning request is added.

d) Each subcounter is an integer value.

e) SP.SerProvReq.

f) ECSFunction.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurements is for ECS performance assurance.

#### 5.14.2.2 Number of successful discovery

a) This measurement provides the number of successful Service provisioning request at the ECS.

b) CC

c) On transmission of Service provisioning response (see clause 8.3.3 of TS 23.558 [52]) by the ECS to the EEC that sent the provisioning request. Each accepted request is added.

d) Each subcounter is an integer value.

e) SP.SerProvSucc.

f) ECSFunction.

g) Valid for packet switched traffic.

h) 5GS.

i) One usage of this performance measurements is for ECS performance assurance.

***Next change***

#### 5.18.2.5 Number of ML model training service subscription from FL Server NWDAF

a) This measurement provides the number of ML model training service subscription generated by the FL Server NWDAF.

b) CC

c) On sending the ML model training service subscription by the FL Server NWDAF to FL client NWDAFs to subscribe ML model training information for FL model aggregation (See TS 23.288 [59]), each subscription is added to the corresponding counter. The measurement can be split into subcounters per Analytics ID (see clause 5.1.6.2.42 and 5.1.6.3.4 in TS 29.520 [58]) and subcounters per S-NSSAI.

d) An integer value

e) The measurement name has the form DANS.TrainingSerSubGenerated, and

DANS.TrainingSerSubGenerated.*AnalyticsID*, where *AnalyticsID* identifies different analytics, and

DANS.TrainingSerSubGenerated.*SNSSAI*, where *SNSSAI* identifies the S-NSSAI.

f) NWDAFFunction

g) Valid for packet switched traffic

h) 5GS

#### 5.18.2.6 Number of ML model training service notifications received by the FL Server NWDAF

a) This measurement provides the number of ML model training service notifications received by the FL Server NWDAF.

b) CC

c) On receipt by the FL Server NWDAF of the notification corresponding to the ML model training service subscription from FL Server NWDAF (See TS 23.288 [59]), each transmitted notification is added to the corresponding counter. The measurement can be split into subcounters per Analytics ID (see clause 5.1.6.2.42 and 5.1.6.3.4 in TS 29.520 [58]) and subcounters per S-NSSAI.

d) An integer value

e) The measurement name has the form DANS.TrainingSerNotificationReceived, and

DANS.TrainingSerNotificationReceived.*AnalyticsID*, where *AnalyticsID* identifies different analytics, and

DANS.TrainingSerNotificationReceived.*SNSSAI*, where *SNSSAI* identifies the S-NSSAI.

f) NWDAFFunction

g) Valid for packet switched traffic

h) 5GS

***Next change***

## 6.2 Virtualised resource usage measurement

a) This measurement provides the mean usage of virtualised resource (e.g. processor, memory, disk) in single network slice instance during the granularity period.

b) OM

c) This measurement is generated with .sum suffix for the usage of each virtualised NF (see TS 32.426 [y]) related to single network slice instance by taking the weighted average. The algorithm of the weighted average is vendor specific.

d) Each measurement is an real value (Unit:%).

e) MeanProcessorUsage

MeanMemoryUsage

MeanDiskUsage

f) Performance measurement service.

g) Packet Switched.

h) 5GS

NOTE: The name of service in f) needs to align with the TS (e.g., 28.550) defining the management service.

***Next change***

# A.110 Monitoring of coordination between multiple NWDAFs

There are two cases where coordination between multiple NWDAFs are required: (i) when NWDAF is able to act as an Aggregator NWDAF (the NWDAF with analytics aggregation capability); and (ii) when NWDAF is able to act as FL Server NWDAF (the NWDAF with ML model aggregation capability).

In the case where an NWDAF analytics service consumer requests Analytics ID(s) that requires multiple NWDAFs to collectively serve the request, the Aggregator NWDAF may act as the analytics service consumer to request the analytics information from other NWDAFs. After collecting analytics information from other NWDAFs, the Aggregator NWDAF may act as the analytics service producer to provide the aggregated analytics information.

In the case where a NWDAF training service consumer requests ML model training that requires multiple NWDAFs to perform ML model training to collectively serve the request, the FL Server NWDAF may act as the ML training service consumer to request the ML model training information from other NWDAFs (acting as FL clients). After several such iterations of collecting ML model training information from other NWDAFs, the FL server NWDAF provides an aggregated trained ML model to the NWDAF training service consumer TS 23.288 [59].

The coordination between multiple NWDAFs may directly impact the performance of service provided by the Aggregator NWDAF or the FL Server NWDAF and resource management between multiple NWDAFs. Therefore, the measurements related to the coordination between multiple NWDAFs are needed to reflect the performance of NWDAF service. These measurements are important in decision-making for the management of NWDAF.

The number of SBA interaction activities needs to be monitored. It reflects how many NFs the Aggregator NWDAF or the FL Server NWDAF coordinates with and how busy the Aggregator NWDAF or the FL Server NWDAF is on aggregation operation. The SBA interaction activity may include the subscription, request, notification and response received and/or generated by the Aggregator NWDAF or the FL Server NWDAF (see TS 23.288 [59]). In order to know the performance of Aggregator NWDAF or FL Server NWDAF when providing different types of services to the consumers, the number of SBA interaction activities related to different types of analytics need to be monitored respectively. The analytics type is identified by Analytics ID (see TS 23.288 [59]).

The measurements described above are some of the basic statistic information to monitor the performance of Aggregator NWDAF or FL Server NWDAF on coordination with other NWDAFs. Operators can use this statistic information to analyse and evaluate the performance of multiple NWDAFs, and make configuration and resource allocation among multiple NWDAFs.

***Next change***

# A.117 Monitoring of ML models in NWDAF

NWDAF containing Model Training Logical Function (MTLF) can train ML models for a particular analytics ID (specified in TS 23.288 [59]) based on the request from multiple training consumers. NWDAF Analytics Logical Function (AnLF) can deploy trained ML models for generating analytics based on the request from multiple analytics consumers. Considering that the NWDAF AnLF may host several ML models for generating analytics for multiple analytics IDs at the same time, there is a need for monitoring the usage of ML models deployed in NWDAF AnLF as it reflects the service load of the NWDAF AnLF. The operators can use this information for resource optimization or load balancing of NWDAF AnLF.

***Next change***

# A.124 Use case for GTP capacity performance measurements

The performance measurements in clauses 5.1 (GTP capacity) and 5.4 (GTP capacity) are needed for the NWDAF to produce QoS sustainability analytics.

As described in TS 23.288 [59], the consumer of QoS Sustainability analytics may request NWDAF analytics information regarding the QoS change statistics for an Analytics target period in the past in a certain area or the likelihood of a QoS change for an Analytics target period in the future in a certain area. To improve QoS Sustainability analytics, NWDAF may additionally collect GTP metrics.

GTP capacity performance measurements are defined to support NWDAF to produce QoS sustainability analytics according to the IP-layer clause capacity and IP-layer available clause capacity definition from ITU-T Y.1540 [z] between UE, NG-RAN, and UPF at the GTP level. The definitions are harmonized with the ones proposed by IETF and described in IETF-RFC 5136 [5].

The available GTP capacity between UPF and UE is calculated by NWDAF by implementation, e.g. by subtracting the UL/DL traffic volume from the maximum value of the GTP capacity and no additional definition is needed in this TS.However, ITU-T Y.1540 [z] states that available capacity is not easily measureable, and ususually requires support from monitoring systems with access to utilization measurement for all links. Such access is normally limited to the corresponding network operators. Addidtionnaly RFC 5136 [5] specifies within the IP Link Usage definition that the information transmitted across the link can be generated by any source, including those sources that may not be directly attached to either side of the link.

According to ITU-T Y.1540 [z]: “knowing how much IP-layer capacity is available in real-time across an IP network (congested or not) is valuable information to the network operators and to the application users.” RFC 5136 [5] acknowledges also that determining how much capacity is available for use on a congested link is potentially much more useful. NOTE: “Available GTP Capacity” performance measurement is not defined in this version of the specification,

***End of changes***