**3GPP TSG- Meeting #**

**, , –** (revision of S2-2409972)

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** | **5044** | **rev** |  | **Current version:** |  |  |
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| *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 |  | Core Network | **X** |

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| ***Title:***  |  |
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| ***Source to WG:*** |  |
| ***Source to TSG:*** |  |
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| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***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 canbe 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)* |
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| ***Reason for change:*** | The following principle is concluded for KI#3 in the TR 23.700-66:*2) For enhancements on existing operations and procedures for energy saving and energy efficiency:**- UP path of PDU session may be adjusted.**NOTE 3: The energy related decision will also consider operator’s policy.*This CR proposes a procedure to implement this principle, where SMF may adjust the UP path of PDU sessions based on energy-related information. |
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| ***Summary of change:*** | Adding a new procedure for adjustment of UP path of PDU session |
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| ***Consequences if not approved:*** | The concluded principle is not implemented in the specification. |
|  |  |
| ***Clauses affected:*** | 2, 4.3.X (new) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **N** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **N** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **N** |  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] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[3] IETF RFC 7296: "Internet Key Exchange Protocol Version 2 (IKEv2)".

[4] Void.

[5] Void.

[6] IETF RFC 4861: "Neighbor Discovery for IP version 6 (IPv6)".

[7] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS)".

[8] IETF RFC 4862: "IPv6 Stateless Address Autoconfiguration".

[9] 3GPP TS 38.300: "NR and NG-RAN Overall Description; Stage 2".

[10] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

[11] Void.

[12] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol Specification".

[13] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[14] Void.

[15] 3GPP TS 33.501: "Security Architecture and Procedures for 5G System".

[16] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

[17] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[18] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3".

[19] Void.

[20] 3GPP TS 23.503: "Policy and Charging Control Framework for the 5G System ".

[21] IETF RFC 4191: "Default Router Preferences and More-Specific Routes".

[22] 3GPP TS 23.122: "Non-Access-Stratum (NAS) functions related to Mobile Station in idle mode".

[23] 3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".

[24] 3GPP TS 23.203: "Policy and charging control architecture".

[25] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[26] 3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".

[27] Void.

[28] 3GPP TS 23.167: "IP Multimedia Subsystem (IMS) emergency sessions".

[29] Void.

[30] Void.

[31] Void.

[32] 3GPP TS 29.507: "Access and Mobility Policy Control Service; Stage 3".

[33] 3GPP TS 23.003: "Numbering, Addressing and Identification".

[34] Void.

[35] 3GPP TS 23.251: "Network sharing; Architecture and functional description".

[36] 3GPP TS 29.502: "5G System; Session Management Services; Stage 3".

[37] 3GPP TS 29.510: "5G System; Network function repository services; Stage 3".

[38] 3GPP TS 23.380: "IMS Restoration Procedures".

[39] 3GPP TS 32.421: "Telecommunication management; Subscriber and equipment trace; Trace concepts and requirements".

[40] IETF RFC 4555: "IKEv2 Mobility and Multihoming Protocol (MOBIKE)".

[41] 3GPP TS 24.502: "Access to the 3GPP 5G Core Network (5GCN) via Non-3GPP Access Networks (N3AN); Stage 3".

[42] 3GPP TS 32.290: "Services, operations and procedures of charging using Service Based Interface (SBI)".

[43] 3GPP TS 36.304: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode".

[44] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in idle mode".

[45] 3GPP TS 32.255: "5G system; 5G data connectivity domain charging; Stage 2".

[46] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

[47] 3GPP TS 29.513: "5G System; Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3".

[48] IEEE Std 802.11-2016 (Revision of IEEE Std 802.11-2012): "IEEE Standard for Information technology - Telecommunications and information exchange between systems Local and metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

[49] IETF RFC 2410: "The NULL Encryption Algorithm and its use with IPsec".

[50] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services; Stage 2".

[51] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS); Stage 2".

[52] 3GPP TS 29.503: "5G System; Unified Data Management Services; Stage 3".

[53] 3GPP TS 23.316: "Wireless and wireline convergence access support for the 5G System (5GS)".

[54] 3GPP TS 23.222: "Functional architecture and information flows to support Common API Framework for 3GPP Northbound APIs; Stage 2".

[55] 3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".

[56] 3GPP TS 36.321: "Evolved Universal Terrestrial Radio Access (E-UTRA); Medium Access Control (MAC) protocol specification".

[57] 3GPP TS 29.512: "5G System; Session Management Policy Control Service; Stage 3".

[58] 3GPP TS 29.525: "5G System; UE Policy Control Service; Stage 3".

[59] IETF RFC 6696: "EAP Extensions for the EAP Re-authentication Protocol (ERP)", July 2012.

[60] IETF RFC 5295: "Specification for the Derivation of Root Keys from an Extended Master Session Key (EMSK)", Aug. 2008.

[61] 3GPP TS 23.272: "Circuit Switched (CS) fallback in Evolved Packet System (EPS); Stage 2".

[62] 3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

[63] 3GPP TS 29.561: "5G System; Interworking between 5G Network and external Data Networks; Stage 3".

[64] 3GPP TS 29.413: "Application of the NG Application Protocol (NGAP) to non-3GPP access".

[65] Void.

[66] IEEE Std 802.1Q-2022: "IEEE Standard for Local and Metropolitan Area Networks-Bridges and Bridged Networks".

[67] Void.

[68] 3GPP TS 23.632: "User Data Interworking, Coexistence and Migration".

[69] 3GPP TS 29.244: "Interface between the Control Plane and the User Plane nodes".

[70] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[71] 3GPP TS 32.256: "Charging Management; 5G connection and mobility domain charging; Stage 2".

[72] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[73] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".

[74] 3GPP TS 23.548: "5G System Enhancements for Edge Computing; Stage 2".

[75] IEEE Std 802.1AS-2020: "IEEE Standard for Local and metropolitan area networks--Timing and Synchronization for Time-Sensitive Applications".

[76] IEEE Std 1588-2019: "IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control".

[77] 3GPP TS 23.304: "Proximity based Services (ProSe) in the 5G System (5GS)".

[78] 3GPP TS 23.247: "Architectural enhancements for 5G multicast-broadcast services".

[79] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[80] 3GPP TS 23.256: "Support of Uncrewed Aerial Systems (UAS) connectivity, identification and tracking; Stage 2".

[81] 3GPP TS 23.216: "Single Radio Voice Call Continuity (SRVCC); Stage 2".

[82] 3GPP TS 29.519: "5G System; Usage of the Unified Data Repository service for Policy Data, Application Data and Structure Data for Exposure; Stage 3".

[83] 3GPP TS 23.558: "Architecture for enabling Edge Applications".

[84] 3GPP TS 23.540: "Technical realization of Service Based Short Message Service; Stage 2".

[85] 3GPP TS 29.598: "Unstructured data storage services".

[86] 3GPP TS 23.041: "Technical realization of Cell Broadcast Service (CBS)".

[87] 3GPP TS 29.522: "5G System; Network Exposure Function Northbound APIs; Stage 3".

[88] 3GPP TS 23.586: "Architectural Enhancements to support Ranging based services and Sidelink Positioning".

[89] 3GPP TS 29.214: "Policy and Charging Control over Rx reference point".

[90] 3GPP TS 23.015: "Technical realization of Operator Determined Barring (ODB)".

[91] 3GPP TS 29.505: "5G System; Usage of the Unified Data Repository service for Subscription Data".

[92] 3GPP TS 28.405: "Quality of Experience (QoE) measurement collection; Control and configuration".

[93] 3GPP TS 29.564: "User Plane Function Services; Stage 3".

[94] 3GPP TS 33.533: "Security aspects of ranging based services and sidelink positioning".

[95] 3GPP TS 33.122: "Security aspects of Common API Framework (CAPIF) for 3GPP northbound APIs".

[X] 3GPP TS 28.552: "Management and orchestration; 5G end to end Key Performance Indicators (KPI)".

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

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

\*\*\*\*\*\*\*\*\*\* Next Change (All New Text) \*\*\*\*\*\*\*\*\*\*

### 4.3.X Energy-aware Adjustment of PDU UP Path

Energy consumption (and consequently other energy-related aspects such as carbon emission) of user plane of 5GC is determined by UP path of PDU sessions. SMF may take the energy-related information provided by OAM and/or EIF into account and based on the operator’s policy, it may adjust the UP path of (a subset of) established PDU sessions.

Editor's note: The name of the NF to provide energy-related information and the corresponding service operations are FFS.

NOTE X: In this release of specification, only the energy consumption is considered for adjustment of UP paths of PDU session.

Figure 6.3.X-1 shows the procedure wherein SMF may adjust the UP path of (some) PDU sessions based on energy-related information.



Figure 6.3.X-1: Procedure for Energy-Aware adjustment of PDU UP path

1. In deriving PCC rules, based on operator's policy, the PCF may include information about PDU path adjustment (e.g., UEs subject to path adjustment, or thresholds to trigger path adjustment process) in the rules and inform the SMF via Npcf\_SMPolicyControl\_UpdateNotify.

2. The SMF subscribes to energy-related information of UPFs defined in clause 6.7.3.1 of TS 28.554 [X] either

a) by creating an instance of a performance metric production job (i.e. an instance of the PerfMetricJob information object class defined in clause 4.3.31 of TS 28.622 [X]) by invoking the createMOI operation of the Provisioning Management Service (MnS) (see TS 28.532 clause 11.1.1.1); or

b) by creating an instance of a management data collection (i.e. an instance of the ManagementDataCollection information object class defined in clause 4.3.47 of TS 28.622 [X]) by invoking the createMOI operation of the Provisioning MnS (see TS 28.532 clause 11.1.1.1).

3. The SMF subscribes to energy-related information at the PDU session level to EIF by invoking Neif\_EventExposure\_Subscribe; and gets the information by Neif\_EventExposure\_Notify.

4. [Optional] The SMF may subscribe to NWDAF for some Analytics IDs (e.g. NF Load Analytics ID) by invoking Nnwdaf\_AnalyticsSubscription\_Subscribe.

5. The SMF initiates the process of adjustment of UP paths of PDU sessions based on some triggers which are locally configured based on operator's policy and/or PCC rules received from the PCF; for example, if the energy consumption of some PDU sessions is above a threshold, or starting a time period.

6. Based on the operator's energy objective (e.g., minimizing energy consumption) configured in the SMF, and considering the SSC mode of PDU sessions, the SMF identifies a number of PDU sessions that adjusting the UP paths of the PDU sessions improves the objective; for example, by consolidating traffic on a limited number of PSA UPFs or replacing/removing UL CL UPFs. In this process, the SMF may take the load and energy-related information of the UPFs into account.

7. Based on the outcome of the optimization process, the SMF may configure the newly adjusted paths using the existing procedures, e.g.,

 - The SMF may remove additional PDU Session Anchor and Branching Point or UL CL using procedure defined in clause 4.3.5.5.

 - In case of SSC mode 2, the SMF may change the PSA UPF using the procedure defined in clause 4.3.5.1.

 - In case of SSC mode 2, the SMF may change the PSA UPF using the procedures defined in clause 4.3.5.2 or 4.3.5.3.

 - The SMF may change the additional PSA UPF, BP UPF, or UL CL UPF using the procedures defined in clauses 4.3.5.6 or 4.3.5.7.

\*\*\*\*\*\*\*\*\*\* End of Changes \*\*\*\*\*\*\*\*\*\*