**3GPP TSG-WG2 Meeting #164 *S2-2408971***

**Maastricht, Netherlands, August 19 – 23, 2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **23.316** | **CR** |  | **rev** | **1** | **Current version:** | **18.5.0** |  |
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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 | **X** | Radio Access Network |  | Core Network | **x** |

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| ***Title:*** | Identifying devices behind RG | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Ericsson | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | UIA\_ARC | | | | |  | ***Date:*** | | | 2024-08-09 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***Release:*** | | | Rel-19 |
|  | *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:*** | | Conclusions for work item FS\_UIA\_ARC Rel 19 has been made in 3GPP meeting#163 and been added to TR 23.700-32 and this CR is part of normative work to include agreed features regarding 5G-RG and DHCPv6 in the specifications. | | | | | | | | |
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| ***Summary of change:*** | | The following changes has been made regarding identifying devices behind an RG via DHCPv6 messaging:  - A general term RG is used instead of 5G-RG since the solution can also be used by the FN-RGs   * general overview is provided in a new section 4.10x * Complementry explanation is added to the IP address allocation section * The procedure is clarified in a new section 7.3.8.x | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Incomplete specifications not aligned with study conclusions | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 2, 4.6.2.2, 4.6.2.3, 4.10x (new), 7.3.8.x (new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **x** |  | Other core specifications | | | | TS 23.501 CR#5503, TS 23.503 CR#1344 | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | The referenced clause 5.x and 5.9x of 23.501 being added by 23.501 CR5503  The referenced clause 6.1.3.x of TS 23.503 being added by 23.503 CR1344 | | | | | | | | |
|  | |  | | | | | | | | |
| ***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] 3GPP TS 23.502: "Procedures for the 5G system, Stage 2".

[4] 3GPP TS 23.503: "Policy and Charging Control Framework for the 5G System".

[5] BBF TR-124 issue 5: "Functional Requirements for Broadband Residential Gateway Devices".

[6] BBF TR-101 issue 2: "Migration to Ethernet-Based Broadband Aggregation".

[7] BBF TR-178 issue 1: "Multi-service Broadband Network Architecture and Nodal Requirements".

[8] CableLabs DOCSIS MULPI: "Data-Over-Cable Service Interface Specifications DOCSIS 3.1, MAC and Upper Layer Protocols Interface Specification".

[9] BBF TR-456 issue 2: "AGF Functional Requirements".

[10] BBF WT-457: "FMIF Functional Requirements".

NOTE: Technical Report of BBF WT-457 will be TR-457 which will be available when finalized by BBF.

[11] 3GPP TS 33.501: "Security architecture and procedures for 5G System".

[12] BBF TR-177 Issue 1 Corrigendum 1: "IPv6 in the context of TR-101".

[13] IETF RFC 6788: "The Line-Identification Option".

[14] 3GPP TS 23.003: "Numbering, Addressing and Identification".

[15] Void.

[16] IETF RFC 6603: "Prefix Exclude Option for DHCPv6-based Prefix Delegation".

[17] Void.

[18] BBF TR-069: "CPE WAN Management Protocol".

[19] BBF TR-369: "User Services Platform (USP)".

[20] IETF RFC 3046: "DHCP Relay Agent Information Option".

[21] IETF RFC 4604: "Using Internet Group Management Protocol Version 3 (IGMPv3) and Multicast Listener Discovery Protocol Version 2 (MLDv2) for Source-Specific Multicast".

[22] 3GPP TR 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[23] 3GPP TS 38.413: "NG RAN; NG Application Protocol (NGAP)".

[24] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[25] 3GPP TS 22.011: "Service accessibility".

[26] 3GPP TS 23.122: "Non-Access-Stratum (NAS) functions related to Mobile Station (MS) in idle mode".

[27] CableLabs WR-TR-5WWC-ARCH: "5G Wireless Wireline Converged Core Architecture".

[28] IETF RFC 3376: "Internet Group Management Protocol, Version 3".

[29] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS)".

[30] BBF TR-198: "DQS:DQM systems functional architecture and requirements".

[31] 3GPP TS 23.203: "Policy and charging control architecture".

[32] 3GPP TS 33.126: "Lawful Interception Requirements".

[33] IETF RFC 2236: "Internet Group Management Protocol, Version 2".

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

[35] IETF RFC 1112: "Internet Group Management Protocol".

[36] IETF RFC 2710: "Multicast Listener Discovery Version for IPv6".

[37] IETF RFC 2010: "Operational Criteria for Root Name Servers".

[38] BBF TR-470: "5G FMC architecture".

[39] 3GPP TS 29.519: "Policy Data, Application Data and Structured Data for exposure".

[40] 3GPP TS 23.041: "Public Warning System".

[41] IEEE Publication (2017): "Guidelines for Use of Extended Unique Identifier (EUI), Organizationally Unique Identifier (OUI), and Company ID (CID)". https://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/tutorials/eui.pdf.

[42] 3GPP TS 29.413: "Application of the NG Application Protocol (NGAP) to non-3GPP access".

[43] Void.

[44] 3GPP TS 24.502: "Access to the 3GPP 5G Core Network (5GCN) via non-3GPP access networks".

[45] 3GPP TS 23.402: " Architecture enhancements for non-3GPP accesses".

[46] BBF TR-181: "Device Data Model for TR-069".

[47] IETF RFC 8415: "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)".

[XX] IETF RFC 4649: "Dynamic Host Configuration Protocol for IPv6 (DHCPv6) Relay Agent Remote-ID Option".

\* \* \* \* Second change \* \* \* \*

### 4.6.2 IP address allocation

#### 4.6.2.1 General

IP address allocation is performed as described in TS 23.501 [2] clause 5.8.2.2, with the differences and additions described in this clause.

Stateless IPv6 Address Autoconfiguration applies with the differences described in clause 4.6.2.4.

In addition to the IP address management features described in TS 23.501 [2] clause 5.8.2.2 the 5GC network functions and RG support the following mechanisms:

a. IPv6 address allocation using DHCPv6 may be supported for allocating individual /128 IPv6 address(es) for a PDU Session. The details of IPv6 address allocation using DHCPv6 are described in clause 4.6.2.2.

b. IPv6 Prefix Delegation using DHCPv6 may be supported for allocating additional IPv6 prefixes for a PDU Session. The details of Prefix Delegation are described in clause 4.6.2.3.

The mechanisms in a. and b. above are only applicable for IPv6 and IPv4v6 PDU Session types.

The requested IPv6 address or set of IPv6 Prefixes may be (as defined in TS 23.501 [2] clause 5.8.2.2.1):

- allocated from a local pool in the SMF or

- obtained from the UPF. In that case the SMF shall interact with the UPF via N4 procedures to obtain a suitable IP address/Prefix, or

- obtained from an external server.

When obtaining the IP address from the UPF, the SMF provides the UPF with the necessary information allowing the UPF to derive the proper IP address (e.g. the network instance, IP version, size of the IP address or Prefix the UPF is to allocate).

The SMF may also provide IP configuration parameters (e.g. MTU value) to the 5G-RG, as described in clause 5.6.10 of TS 23.501 [2].

NOTE: In order to provide an IP MTU value that is specifically suitable for W-5GAN without considering N3 in case of combined W-AGF/UPF, the SMF can e.g. be configured with such MTU for a given DNN and/or for a given slice whether the DNN and/or the slice only serves wireline access and a UPF combined with the W-AGF has been selected for the PDU Session.

In this clause, unless specified otherwise, the RG may correspond either to a 5G RG or to a FN RG.

#### 4.6.2.2 IPv6 Address Allocation using DHCPv6

Optionally, and instead of using Stateless IPv6 Address Autoconfiguration, individual 128-bit IPv6 address(es) may be assigned to a PDU Session.

In this case, after PDU Session Establishment, the SMF sends a Router Advertisement message (solicited or unsolicited) towards the RG. The SMF shall set the Managed Address Configuration Flag (M-flag) in the Router Advertisement messages to indicate towards the RG that IPv6 Address allocation using DHCPv6 is available, as described in RFC 4861 [34]. In that case the IPv6 address of the RG is allocated using DHCPv6 Identity Association for Non-temporary Addresses (IA\_NA) and mechanisms defined in RFC 8415 [47].

The SMF may receive a Router Solicitation message, soliciting a Router Advertisement message.

When using DHCPv6 address allocation, a prefix (e.g. /64) may be allocated for the PDU Session at PDU Session Establishment from which the /128 addresses are selected. The SMF determines the size of the prefix for a PDU Session to a specific DNN and S-NSSAI based on subscription data and local configuration. The individual /128 address(es) allocated to the RG as part of DHCP IA\_NA procedure are then selected from the prefix allocated to the PDU Session. For statically assigned prefix, the subscription data in UDM for a DNN and S-NSSAI includes the prefix. Alternatively, individual 128-bit address(es) are allocated for the PDU Session without allocating a prefix to the PDU Session and provided to the RG as part of DHCP IA\_NA procedure.

When a prefix is allocated to the PDU Session, the SMF provides the prefix to the PCF instead of each /128 address. When individual /128 address(es) are allocated without allocating a prefix to the PDU Session, the SMF provides the /128 bits address(es) to PCF. Whether the SMF allocates a prefix for the PDU Session or individual 128-bit addresses is transparent to the RG and W-5GAN.

If Prefix Delegation (as described in clause 4.6.2.3) is also supported, a SMF may receive both DHCP options for IA\_NA and IA\_PD together in a single DHCPv6 message. An SMF may provide a reply to both IA\_NA and IA\_PD in the same message or alternatively process the DHCPv6 IA\_NA before the DHCPv6 IA\_PD.

The SMF may receive multiple different IA\_NA related DHCP requests within the same PDU Session.

NOTE: This is applicable if the RG acts as a DHCP relay for devices behind the RG. The 5G-RG can include the Device ID in the DHCPv6 relayed message via the INTERFACE-ID option as described in RFC 8415 [47] or REMOTE\_ID option as described in RFC 4649 [XX]. This information can be used by the SMF/PCF to identify the device behind the 5G-RG as described in clause 4.10x.

When IPv6 Address Allocation using DHCPv6 is used, 5GC does not support IPv6 multi-homing for enabling SSC mode 3 and PDU Sessions with multiple PDU Session Anchors.

#### 4.6.2.3 IPv6 Prefix Delegation via DHCPv6

In addition to what is the specified in clause 5.8.2.2.4 of TS 23.501 [2], there is following difference:

- UE is replaced by 5G-RG and FN-RG.

- For IPv6 stateless IPv6 address autoconfiguration or IPv6 address allocation using DHCPv6, the SMF determines the maximum size of the prefix that may be allocated for the PDU Session based on subscription data and local configuration.

- If IPv6 address allocation using DHCPv6 is used, the DHCPv6 message may include a request for a delegated prefix (IA\_PD) together with a request for an IPv6 address (IA\_NA). Alternatively, a delegated prefix may be requested after an IPv6 address has been assigned using IA\_NA.

- If the DHCPv6 request indicates support for prefix exclusion via the OPTION\_PD\_EXCLUDE option code in an OPTION\_ORO option and if the SMF accepts this option, the SMF delegates a prefix excluding the default prefix with help of OPTION\_PD\_EXCLUDE. Prefix exclusion procedures shall follow IETF RFC 6603 [16].

- The 5G-RG can act as DHCPv6 relay agent for non-3GPP devices connected to it and it can include the Device ID in the DHCPv6 relayed message via the INTERFACE-ID option as described in RFC 8415 [47] or REMOTE\_ID option as described in RFC 4649 [XX]. This information can be used by the SMF/PCF to identify the device behind the 5G-RG as described in clause 4.10x.

#### 4.6.2.4 The procedure of Stateless IPv6 Address Autoconfiguration

Stateless IPv6 Address Autoconfiguration applies as described in clause 5.8.2.2.3 of TS 23.501 [2] with the differences described below.

When the W-AGF is serving an FN-RG, the W-AGF may include in the PDU Session Establishment Request an interface identifier of the FN-RG IPv6 link-local address associated with the PDU Session. If the SMF receives an interface identifier in the PDU Session Establishment Request message, the SMF provides this interface identifier value as the UE interface identifier in the PDU Session Establishment Accept message. To ensure that the link-local address used by the FN-RG does not collide with the link-local address of the SMF in this case, the SMF selectes a different link-local address for use as the SMF link local address for the PDU Session. If the PDU Session Establishment Request message does not contain an interface identifier, the SMF selects interface identifier for the UE, and SMF link-local address, as described in clause 5.8.2.2.3 of TS 23.501 [2].

NOTE 1: An FN-RGs is configuring its IPv6 link local address based on its MAC address and is not able to use an interface identifier selected by SMF as described in clause 5.8.2.2.3 of TS 23.501 [2].

In case of wireline access, independent of whether SMF received an interface identifier in the PDU Session Establishment Request message or not, the SMF includes the SMF link local address in the PDU Session Establishment Accept message.

NOTE 2: The SMF link local address is needed by the W-AGF to support procedures towards the FN-RG defined in BBF TR-456 [9].

\* \* \* \* Third change \* \* \* \*

## 4.10x Identification of Non-3GPP Devices Behind 5G-RG using DHCPv6

To identify non-3GPP devices behind the 5G-RG in the 5GC, the 5G-RG can (create and) relay a DHCPv6 request and include the Non-3GPP Device Identifier (see clause 5.9.x of TS 23.501 [2]) in a DHCPv6 message via the INTERFACE-ID option as described in RFC 8415 [47] or REMOTE\_ID option as described in RFC 4649 [XX].

The SMF allocates the device IPv6 address/prefix based on the DHCPv6 request as described in clause 4.6.2 and creates Non-3GPP Device information (see clause 5.x of TS 23.501 [2]), which contains the Non -3GPP Device address and the Non-3GPP Device Identifier. The SMF forwards the Non-3GPP Device information to PCF, which may use this information for policy and charging decisions as described in clause 6.1.3.x of TS 23.503 [4]. The procedure for identifying non-3GPP devices behind the 5G-RG is described in clause 7.3.8.x.

NOTE 1: In addition to what is presented in this clause, the mechanisms described in clause 5.x of TS 23.501 [1] can be used to identify a non-3GPP devices behind the 5G-RG in the 5GC.

\* \* \* \* Fourth change \* \* \* \*

### 7.3.8.x IPv6 Session Management Procedures for Identifying Non-3GPP Devices Behind 5G-RG using DHCPv6

This clause describes the procedure to enable 5GC to identify the non-3GPP devices behind an 5G-RG using DHCPv6.



Figure 7.3.8-1: Identifying device behind RG.

0. The non-3GPP device QoS information is provided in the UDR by an AF.

1. The device is connected to the 5G-RG.

2. To provide connectivity for the device, the 5G-RG either establishes a new IPv6 PDU session or use an existing one. The RG decides on this either based on configuration or the URSP rules with Device Descriptor.

3. The connected Non-3GPP device may create a DHCPv6 Request to obtain IPv6 Address/Prefix or uses other access dependent methods. The 5G-RG determines whether the Non-3GPP device requires QoS differentiation and if required the 5G-RG creates a DHCPv6 Request and if no QoS differentiation is required and an existing address can be used for the Non-3GPP device then the 5G-RG may re-use the existing address for the Non-3GPP device and the rest of the steps are skipped.

4. If step 3 created a DHCPv6 request, the 5G-RG acts as a DHCPv6 relay agent and creates a DHCP relayed message and if QoS differentiation is to be requested includes the Non-3GPP Device Identifier via INTERFACE-ID option as described in RFC 8415 [47] or REMOTE\_ID option as described in RFC 4649 [XX].

5. The 5G-RG sends the DHCPv6 request to SMF via the user plane.

6. The SMF obtains the Non-3GPP Device Identifier from the DHCPv6 request and allocates the IPv6 Address/Prefix.

7. The SMF sends the DHCPv6 response with the allocated IPv6 Address/Prefix

8. The SMF initiates SM policy association modification request and includes Non-3GPP Device Information containing the Non-3GPP Device Identifier and the IPv6 Address/Prefix allocated to the Non-3GPP Device. The PCF uses Non-3GPP Device Identifier to obtain device QoS parameters and updates the PCC rules to provide the QoS/charging differentiation for the Non-3GPP Device.

9. PCF initiates the PDU session modification procedure.

10. Differentiated QoS is provisioned for the Non-3GPP Device in the user plane.

\* \* \* \* End of changes \* \* \* \*