**3GPP TSG- Meeting #**

**, , - rev os S2-2411734**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** | **1** | **Current version:** |  |  |
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| *For* [***HELP***](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 |  |

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|  |
| ***Title:***  | Update on multihop ProSe U2N Relay Discovery with model B |
|  |  |
| ***Source to WG:*** | Interdigital, China Telecom(?) |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** | 2024-11-08 |
|  |  |  |  |  |
| ***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)* |
|  |  |
| ***Reason for change:*** | Rev: terminology is changed to “Accumulated QoS for PC5 link” to align with multihop U2N with model A.For both multihop 5G ProSe U2N Relay with model A and model B, IM Relay may select a discovery announcement message or solicitation message to be sent to the next hop based on criteria such as delay or Accumulated QoS for PC5 link in model A. But how to calculate the delay value is missing in model B discovery. |
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| ***Summary of change:*** | Clarifications on path selection with discovery with model B with accumulated delay. |
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| ***Consequences if not approved:*** | Model B discovery for U2N multihop relay feature will not work properly. |
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| ***Clauses affected:*** | 5.8.3.1, 6.3.2.5.3 |
|  |  |
|  | **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:*** |  |

\* \* \*Start of 1st Changes \* \* \*

#### 5.8.3.1 Common identifiers for 5G ProSe UE-to-Network Relay

The following parameters are used for the 5G ProSe UE-to-Network Relay Discovery Announcement message (Model A), where Source Layer-2 ID and Destination Layer-2 ID are used for sending and receiving the message and Announcer Info and Relay Service Code are contained in the message:

- Source Layer-2 ID: the 5G ProSe UE-to-Network Relay self-selects a Source Layer-2 ID for 5G ProSe UE-to-Network Relay Discovery.

- Destination Layer-2 ID: the Destination Layer-2 ID for 5G ProSe UE-to-Network Relay Discovery is selected based on the configuration as described in clause 5.1.4.1.

- Announcer Info: provides information (i.e. User Info ID) about the announcing user.

- Relay Service Code: parameter identifying a connectivity service the 5G ProSe UE-to-Network Relay provides to a 5G ProSe Remote UE. The Relay Service Codes are configured in a 5G ProSe UE-to-Network Relay for advertisement. Additionally, the Relay Service Code may also identifies authorized users the 5G ProSe UE-to-Network Relay would offer service to and may be used to select the related security policies or information e.g. necessary for authentication and authorization between the 5G ProSe Remote UE and the 5G ProSe UE-to-Network Relay (e.g. a Relay Service Code for relays for police members only would be different than a Relay Service Code for relays for Fire Fighters only, even though potentially they provided connectivity to same DN e.g. to support Internet Access).

The 5G ProSe UE-to-Network Relay Discovery Announcement message (Model A) is extended and modified as follows when used for 5G ProSe multi-hop UE-to-Network Relay discovery:

- Hop-Count: This value reflects the number of PC5 hops for the 5G ProSe Remote UE to reach the network. It is set to 1 by the 5G ProSe UE-to-Network Relay and shall be incremented by 1 every time the 5G ProSe UE-to-Network Relay Discovery Announcement message is forwarded by a 5G ProSe Intermediate UE-to-Network Relay.

 A 5G ProSe Intermediate UE-to-Network Relay shall only process the 5G ProSe UE-to-Network Relay Discovery Announcement if the Hop-Count is present and the value is less than the (pre-)configured maximum number of hops for the associated RSC and the optional Hop-Limit in the message.

- Source Layer-2 ID: the 5G ProSe UE-to-Network Relay or the 5G ProSe Intermediate UE-to-Network Relay self-selects a Source Layer-2 ID when sending the discovery message.

- Destination Layer-2 ID: the 5G ProSe Intermediate UE-to-Network Relay sets the Desination Layer-2 ID of the 5G ProSe UE-to-Network Relay Discovery Announcement message based on configuration described in clause 5.1.4.1.

- Announcer Info: identify information (i.e. User Info ID) of the announcing 5G ProSe UE-to-Network Relay or the 5G ProSe Intermediate UE-to-Network Relay.

- (optinal) Root Relay Info: this is the User Info ID of the 5G ProSe UE-to-Network Relay. A 5G ProSe Intermediate UE-to-Network Relay may stored it in the discovery entry and included it in the 5G ProSe UE-to-Network Relay Discovery Announcement message. This information can be used in the relay selection at the 5G ProSe Remote UE or other 5G ProSe Intermediate UE-to-Network Relays.

- (optional) Accumulated QoS for PC5 link: this reflects the QoS supported over all the PC5 links to the Root Relay, i.e. the 5G ProSe UE-to-Network Relay, for this RSC.

- (optional) Hop-Limit: this is the hop limit set by the announcing 5G ProSe UE-to-Network Relay to a value smaller than the configured maximum number of hops.

Editor's note: Whether the same 5G ProSe UE-to-Network Relay Discovery Announcement message is reused for multi-hop operation or a new message type is to be defined will be decided by Stage 3.

The following parameters are used for the 5G ProSe UE-to-Network Relay Discovery Solicitation message (Model B), where Source Layer-2 ID and Destination Layer-2 ID are used for sending and receiving the message and Discoverer Info and Relay Service Code are contained in the message:

- Source Layer-2 ID: the 5G ProSe Remote-UE self-selects a Source Layer-2 ID for 5G ProSe UE-to-Network Relay Discovery.

- Destination Layer-2 ID: the Destination Layer-2 ID for 5G ProSe UE-to-Network Relay Discovery is selected based on the configuration as described in clause 5.1.4.1.

- Discoverer Info: provides information (i.e. User Info ID) about the discoverer user.

- Target Info: provides information (i.e. User Info ID) about the targeted discoveree user.

- Relay Service Code: information about connectivity that the discoverer UE is interested in. The Relay Service Codes are configured in the 5G ProSe Remote UEs interested in related connectivity services.

To support Multi-hop 5G ProSe UE-to-Network Relay discovery the following parameters are added:

- (Optional) Hop count: indicates the number of hops that the message is already relayed. It is increased by 1 per hop.

- (Optional) Hop-Limit: a unmodified value that indicates the hop limit of the message. It is set, by the 5G ProSe Remote UE, to a value smaller than the (pre)configured maximum number of hops.

- Path information: an (ordered) list of User Info ID(s) of Intermediate UE-to-Network Relay(s) that indicates the transmitted path of the message.

- (optional) Accumulated QoS for PC5 link: this reflects the QoS supported over all the PC5 links starting from the PC5 link between the Remote UE and a Intermediate UE-to-Network Relay in the path information for this RSC.

The following parameters are used in the 5G ProSe UE-to-Network Relay Discovery Response message (Model B), where Source Layer-2 ID and Destination Layer-2 ID are used for sending and receiving the message and Discoveree Info and Relay Service Code are contained in the message:

- Source Layer-2 ID: the 5G ProSe UE-to-Network Relay self-selects a Source Layer-2 ID for 5G ProSe UE-to-Network Relay Discovery.

- Destination Layer-2 ID: set to the Source Layer-2 ID of the received 5G ProSe UE-to-Network Relay Discovery Solicitation message.

- Relay Service Code: identifies the connectivity service the 5G ProSe UE-to-Network Relay provides to 5G ProSe Remote UEs that matches the Relay Service Code from the corresponding Discovery Solicitation message.

- Discoveree Info: provides information (i.e. User Info ID) about the discoveree.

To support Multi-hop 5G ProSe UE-to-Network Relay discovery the following parameters are added:

- (Optional) Hop count: indicates the number of hops between the 5G ProSe Remote UE and the 5G ProSe UE-to-Network Relay on the path selected by the 5G ProSe UE-to-Network Relay.

- (Optional) Path information: an (ordered) list of User Info ID(s) of Intermediate UE-to-Network Relay(s) on the path selected by the 5G ProSe UE-to-Network Relay.

- (optional) Accumulated QoS for PC5 link: this reflects the QoS supported over all the PC5 links along the path from Remote UE to the 5G ProSe UE-to-Network Relay for this RSC.

The following parameters may be used in the Relay Discovery Additional Information message (using Model A) based on the procedure defined in clause 6.5.1.3 for 5G ProSe UE-to-Network Relay and clause 6.3.2.5.4 for 5G ProSe multi-hop UE-to-Network Relay where Source Layer-2 ID and Destination Layer-2 ID are used for sending and receiving the message and the other parameters are contained in the message:

- Source Layer-2 ID: the 5G ProSe UE-to-Network Relay or the 5G ProSe Intermediate UE-to-Network Relay self-selects a Source Layer-2 ID to send the Relay Discovery Additional Information message.

- Destination Layer-2 ID: the Destination Layer-2 ID to send the Relay Discovery Additional Information message is selected based on the configuration as described in clause 5.1.4.1.

- Relay Service Code: the Relay Service Code associated with the message. The Relay Service Code is used to identify the security parameters needed by the receiving UE to process the discovery message.

- Announcer Info: provides information about the announcing user (i.e. User Info ID of the 5G ProSe UE-to-Network Relay).

- Hop-Count: This value reflects the number of PC5 hops for the 5G ProSe Remote UE to reach the network. It is set to 1 by the 5G ProSe UE-to-Network Relay and shall be incremented by 1 every time the Relay Discovery Additional Information message is forwarded by a 5G ProSe Intermediate UE-to-Network Relay.

 A 5G ProSe Intermediate UE-to-Network Relay shall only process the Relay Discovery Additional Information message if the Hop-Count is present and the value is less than the (pre-)configured maximum number of hops for the associated RSC and the optional Hop-Limit in the message.

- Announcer Info of 5G ProSe Intermediate UE-to-Network Relay: identify information (i.e. User Info ID) of the 5G ProSe Intermediate UE-to-Network Relay connected to 5G ProSe UE-to-Network Relay. This parameter is only applicable to the additional parameter announcement procedure over 5G ProSe multi-hop UE-to-Network Relay specified in clause 6.3.2.5.4.

- (optional) Hop-Limit: this is the hop limit set by the announcing 5G ProSe UE-to-Network Relay to a value smaller than the configured maximum number of hops.

- Additional parameters: the additional parameters for 5G ProSe Layer-3 UE-to-Network Relay (when applicable) are defined in clause 5.8.3.2.

NOTE 1: The UE implementation needs to ensure that when the UE self-selects Source Layer-2 IDs, the self-selected Source Layer-2 IDs are different between 5G ProSe Direct Discovery (including 5G ProSe UE-to-Network Relay Discovery) in clause 6.3.2 and 5G ProSe Direct Communication (including 5G ProSe UE-to-Network Relay Communication) in clause 6.4 and are different from any other provisioned Destination Layer-2 IDs as described in clause 5.1 and any other self-selected Source Layer-2 IDs used in a simultaneous 5G ProSe Direct Discovery (including 5G ProSe UE-to-Network Relay Discovery) with a different discovery model.

NOTE 2: If a 5G ProSe UE-to-Network Relay and 5G ProSe Remote UE from different PLMNs discover each other, it means that the Relay Service Code is associated with the same connectivity service, and the same Relay Service Code is provisioned based on Service Level Agreement among PLMNs.

NOTE 3: The Hop count, Hop-Limit and Path information are used for multi-hop 5G ProSe UE-to-Network Relay Discovery with Model B. The multi-hop UE-to-Network Relay Discovery message has no impact on 5G ProSe UE-to-Network Relay or 5G ProSe Remote UE that only supports the single-hop UE-to-Network Relay. Single-hop and Multi-hop UE-to-Network Relays discoveries can be distinguished based on RSC.

\* \* \*Start of 2nd Changes \* \* \*

##### 6.3.2.5.3 Procedure for Multi-hop 5G ProSe UE-to-Network Relay Discovery with Model B



Figure 6.3.2.5.3-1: General Procedures for 5G ProSe Multi-hop UE-to-Network Relay Discovery with Model B

1. The 5G ProSe Remote UE determines the Hop-Limit for discovery based on policy configuration (i.e. a mapping between maximum number of hops and RSC) or QoS requirements.

 If the Hop-Limit is determined based on configuration associated with the RSC, the 5G ProSe Remote UE does not include the Hop-Limit in the Solicitation message. Otherwise, the 5G ProSe Remote UE includes the Hop-Limit in the Solicitation message.

2a. The 5G ProSe Remote UE sends a 5G ProSe UE-to-Network Relay Discovery Solicitation message. The 5G ProSe UE-to-Network Relay Discovery Solicitation message additionally contains following IEs compared with that in clause 6.3.2.3.3: an indication that multi-hop relay is supported, hop count and Hop-Limit.

 The Target Info may contain the User Info ID of the UE-to-Network Relay and Intermediate Relay(s).

3a. If an indication that multi-hop relay is supported is contained in the received Solicitation message, the RSC contained in the Solicitation message matches any of the (pre)configured RSC(s), as specified in clause 5.1.4.1a, of a 5G ProSe Intermediate Relay, and the Target Info matches the User Info ID of the 5G ProSe Intermediate Relay (if any), the 5G ProSe Intermediate Relay may decide to send a 5G ProSe UE-to-Network Relay Discovery Solicitation message.

 The 5G ProSe Intermediate Relay shall drop the received Solicitation message if the hop count (corresponding to the number of Relays included in the message) has reached the Hop-Limit of the received Solicitation message or the (pre)configured maximum number of hops associated with the RSC.

 The 5G ProSe Intermediate Relay may send a Response message when it has already found or established PC5 link with 5G ProSe UE-to-Network Relay(s), without sending Solicitation message. i.e., steps 4a-8a are skipped and step 9a is performed directly. The response message additionally contains the User Info ID of UE-to-Network Relay, path information to the UE-to-Network Relay which is an (ordered) list of User Info ID of intermediate Relay(s).

 If the same information on User Info IDs of Remote UE and UE-to-Network Relay is received from different ProSe UEs, the 5G ProSe Intermediate UE-to- Network Relay may select a Solicitation message to be sent to the next hop based on various criteria (e.g., hop count, delay, channel quality of received messages, etc.).

NOTE: If the 5G ProSe Remote UE does not receive any response after a pre-configured time, based on application requirement, it may increase the Hop-Limit and send the discovery message again.

4a. A 5G ProSe Intermediate Relay sends a Solicitation message, it additionally includes its own User Info ID in the message. i.e., the message contains the path information which is an (ordered) list of User Info ID of Relays in the path that has relayed the Solicitation message. The hop count is increased by 1. The solicitation message may include Accumulated QoS for PC5 link.

 The Accumulated QoS for PC5 link, if present in the received solicitation message, will be updated to include the QoS of the PC5 link between the 5G ProSe Intermediate Relay and its child UE (Intermediate Relay or Remote UE).

2b.-5b. The Solicitation message from the same Remote UE goes through a different ordered list of 5G ProSe Intermediate Relays.

6-7. If the RSC contained in the solicitation message matches any of the (pre)configured RSC(s), as specified in clause 5.1.4.1, of the 5G ProSe UE-to-Network Relay, and the Target Info matches the User Info ID of the 5G ProSe UE-to-Network Relay (if any), then the 5G ProSe UE-to-Network Relay responds to the 5G ProSe Intermediate Relay with a 5G ProSe UE-to-Network Relay Discovery Response message. The 5G ProSe UE-to- Network Relay Discovery Response message additionally contains the path information compared with that in clause 6.3.2.3.3. The response message may include the received Accumulated QoS for PC5 link.

 The 5G ProSe UE-to-Network Relay may choose the path based on e.g., the PC5 signal strength of each message received, hops to the Remote UE, the path information, Accumulated QoS for PC5 link, etc.

Editor's note: It is FFS how the 5G ProSe UE-to-Network Relay decides when to send the Relay Discovery Response message.

8-10. A 5G ProSe Intermediate Relay forwards a 5G ProSe UE-to-Network Relay Discovery Response message. The Response message additionally contains the path information. The response message may include the received Accumulated QoS for PC5 link.

Editor's note: It is FFS if and how the Relay Discovery Response message is forwarded along the path indicated in the path information.

11. The Remote UE may perform relay path selection based on e.g., the PC5 signal strength, Accumuled QoS for PC5 link, and the number of hops to the 5G ProSe UE-to-Network Relay.

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

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