**3GPP TSG-WG SA2 Meeting #164S2-240xxxx**

**Maastricht, NL, 19th Aug – 23rd Aug, 2024 (revision of S2-240xxxx)**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  | **23.304** | **CR** | **XXXX** | **rev** | **X** | **Current version:** | **19.0.0** |  |
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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 |  |

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|  |
| ***Title:***  | Update on ProSe U2U Multihop Relay for non-IP PDU |
|  |  |
| ***Source to WG:*** | Huawei, HiSilicon, China Telecom |
| ***Source to TSG:*** | SA2 |
|  |  |
| ***Work item code:*** | 5G ProSe\_Ph3 |  | ***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 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:*** | Addition of features to support multi-hop Layer-3 UE-to-UE Relay for PDU type Ethernet and Unstructured based on the conclusions for KI#2 in TR 23.700-03. |
|  |  |
| ***Summary of change:*** | 1. Update the Policy/Parameter provisioning of maximum number of hops for 5G ProSe UE-to-UE Relay and End UE.
2. Update QoS handling for 5G ProSe Layer-3 UE-to-UE Relay in terms of multi-hop.
3. Update the identifiers for multi-hop U2U Discovery.
4. New clause for multi-hop UE-to-UE Relay discovery with Model A.
5. New clause for multi-hop UE-to-UE Relay discovery with Model B.
6. New clause for Layer-2 link management over PC5 reference point for multi-hop Layer-3 UE-to-UE Relay.
7. New clause for 5G ProSe Communication via Multi-hop 5G ProSe Layer-3 UE-to-UE Relay.
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|  |  |
| ***Consequences if not approved:*** | Multi-hop Layer-3 UE-to-UE Relay will not be fully supported. |
|  |  |
| ***Clauses affected:*** | 5.1.5.1, 5.6.3.1, 5.8.4.2, 6.3.2.4.1, 6.3.2.4.2a (new), 6.3.2.4.3a (new), 6.4.3.7.3a (new), 6.7.1a (new) |
|  |  |
|  | **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 \* \* \* \*

#### 5.1.5.1 Policy/Parameter provisioning for 5G ProSe UE-to-UE Relay

The following information is provisioned in the UE in support of the UE assuming the role of a 5G ProSe UE-to-UE Relay:

1) Authorisation policy for acting as a 5G ProSe Layer-3 and/or Layer-2 UE-to-UE Relay:

- when the UE is "served by NG-RAN":

- PLMNs in which the UE is authorized to relay traffic for 5G ProSe Layer-3 and/or Layer-2 End UEs accessing 5G ProSe UE-to-UE Relays over PC5 reference point.

- when the UE is not "served by NG-RAN":

- Indicates whether the UE is authorized to relay traffic for 5G ProSe Layer-3 and/or Layer-2 End UEs accessing 5G ProSe UE-to-UE Relays over PC5 reference point.

- The authorisation for a UE to act as a 5G ProSe UE-to-UE Relay also authorizes the use of 5G ProSe UE-to-UE Relay Discovery with Model A and Model B.

NOTE 1: It is up to UE and application implementation to select a discovery model, or whether to perform both models simultaneously.

2) ProSe Relay Discovery policy/parameters for 5G ProSe UE-to-UE Relay:

- Includes the parameters that enable the UE to perform 5G ProSe UE-to-UE Relay Discovery when provided by PCF or provisioned in the ME or configured in the UICC:

- 5G ProSe UE-to-UE Relay Discovery parameters (User Info ID, Relay Service Code(s), UE-to-UE Relay Layer indicator, Network Assistance Security Indicator, optional Maximum Number of Hops per RSC). The UE-to-UE Relay Layer indicator indicates whether the associated RSC is offering 5G ProSe Layer-2 or Layer-3 UE-to-UE Relay service. Network Assistance Security Indicator indicates whether the associated RSC is offering security procedures with or without network assistance when the 5G ProSe UE-to-UE Relay is served by NG-RAN. The Maximum Number of Hops indicates the default hop limit when using the associated RSC for discovery procedure.

- Default Destination Layer-2 ID(s) for sending Relay Discovery Announcement message and sending/receiving Relay Discovery Solicitation messages;

- Default Destination Layer-2 ID(s) for sending/receiving Direct Communication Request message for ProSe UE-to-UE Relay Communication with integrated Discovery;

- For 5G ProSe Layer-3 UE-to-UE Relay, the traffic type (IP, Ethernet, Unstructured) to be used for the relayed traffic for each Relay Service Code;

- Includes security related content for 5G ProSe UE-to-UE Relay, see TS 33.503 [29].

NOTE 2: The security mechanism selection according to Network Assistance Security Indicator is specified in TS 33.503 [29].

3) Validity time indicating the expiration time of the Policy/Parameter for 5G ProSe UE-to-UE Relay discovery and communication.

The following information is provisioned in the UE in support of the UE assuming the role of a 5G ProSe End UE and thereby enabling the use of a 5G ProSe UE-to-UE Relay:

1) Authorisation policy for using a 5G ProSe Layer-3 and/or Layer-2 UE-to-UE Relay:

- When the UE is "served by NG-RAN":

- PLMNs in which the UE is authorized to use a 5G ProSe Layer-3 and/or Layer-2 UE-to-UE Relay.

- When the UE is "not served by NG-RAN":

- Indicates whether the UE is authorised to use a 5G ProSe Layer-3 and/or Layer-2 UE-to-UE Relay.

 The authorisation for a UE to act as a 5G ProSe End UE also authorizes the use of 5G ProSe UE-to-UE Relay discovery with Model A and Model B.

NOTE 3: It is up to UE and application implementation to select a discovery model, or whether to perform both models simultaneously.

2) Policy/parameters for 5G ProSe UE-to-UE Relay Discovery:

- Includes the parameters for 5G ProSe UE-to-UE Relay Discovery as a 5G ProSe End UE and for enabling the UE to connect to the 5G ProSe UE-to-UE Relay after discovery when provided by PCF or provisioned in the ME or configured in the UICC:

- 5G ProSe UE-to-UE Relay Discovery parameters (Relay Service Code(s), UE-to-UE Relay Layer indicator, Network Assistance Security Indicator, optional Maximum Number of Hops per RSC). The UE-to-UE Relay Layer indicator indicates whether the associated RSC is offering 5G ProSe Layer-2 or Layer-3 UE-to-UE Relay service. Network Assistance Security Indicator indicates whether the associated RSC is offering security procedures with or without network assistance when the 5G ProSe UE-to-UE Relay is served by NG-RAN. The Maximum Number of Hops indicates the default hop limit when using the associated RSC for discovery procedure.

- Default Destination Layer-2 ID(s) for sending/receiving Relay Discovery Solicitation messages and receiving Relay Discovery Announcement message;

- Default Destination Layer-2 ID(s) for sending/receiving Direct Communication Request message for ProSe UE-to-UE Relay Communication with integrated Discovery;

- For 5G ProSe Layer-3 UE-to-UE Relay, the traffic type (IP, Ethernet, Unstructured) to be used for the relayed traffic for each Relay Service Code;

- Includes security related content for 5G ProSe UE-to-UE Relay, see TS 33.503 [29].

NOTE 4: The security mechanism selection according to Network Assistance Security Indicator is specified in TS 33.503 [29].

3) Validity time indicating the expiration time of the Policy/Parameter for 5G ProSe UE-to-UE Relay discovery and communication.

The following information is provisioned in the UE in support of the UE assuming the role of a 5G ProSe UE-to-UE Relay as well as in the UE in support of the UE assuming the role of a 5G ProSe End UE and thereby enabling the use of a 5G ProSe UE-to-UE Relay:

1) Radio parameters for 5G ProSe UE-to-UE Relay Discovery when the UE is not "served by NG-RAN":

- Includes the radio parameters NR PC5 with Geographical Area(s) and an indication of whether they are "operator managed" or "non-operator managed". The UE uses the radio parameters to perform 5G ProSe Direct Discovery over PC5 reference point when "not served by NG-RAN" only if the UE can reliably locate itself in the corresponding Geographical Area. Otherwise, the UE is not authorized to transmit.

- Default PC5 DRX configuration (see TS 38.331 [16]).

NOTE 5: Radio parameters for 5G ProSe UE-to-UE Relay Discovery when the UE is not "served by NG-RAN" and Radio parameters when the UE is "not served by NG-RAN" for 5G ProSe Direct Discovery in clause 5.1.2.1 are expected to be aligned for direct and relayed discovery for UE to UE communication.

2) Radio parameters for 5G ProSe UE-to-UE Relay communication when the UE is not "served by NG-RAN":

- Includes the radio parameters NR PC5 with Geographical Area(s) and an indication of whether they are "operator managed" or "non-operator managed". The UE uses the radio parameters to perform 5G ProSe Direct Communication over PC5 reference point when "not served by NG-RAN" only if the UE can reliably locate itself in the corresponding Geographical Area. Otherwise, the UE is not authorized to transmit.

NOTE 6: Radio parameters for 5G ProSe UE-to-UE Relay communication when the UE is not "served by NG-RAN" and Radio parameters when the UE is "not served by NG-RAN" for 5G ProSe Direct Communication in clause 5.1.3.1 are expected to be aligned for direct and relayed UE to UE communication.

\* \* \* \* Next change \* \* \* \*

#### 5.6.3.1 QoS handling for 5G ProSe Layer-3 UE-to-UE Relay

For a 5G ProSe Layer-3 End UE connecting with another 5G ProSe Layer-3 End UE(s) via 5G ProSe Layer-3 UE-to-UE Relay, the QoS requirement of the relay traffic between the peer 5G ProSe Layer-3 End UE(s) can be satisfied by the corresponding QoS control for the PC5 link between source 5G ProSe Layer-3 End UE and 5G ProSe Layer-3 UE-to-UE Relay (i.e. first hop PC5 QoS control) and the QoS control for the PC5 link between 5G ProSe Layer-3 UE-to-UE Relay and target 5G ProSe Layer-3 End UE (i.e. second hop PC5 QoS control). The first hop PC5 QoS and second hop PC5 QoS is controlled with PC5 QoS rules and PC5 QoS parameters (e.g. PQI, GFBR, MFBR, PC5 LINK-AMBR) as specified in clause 5.6.1.

As shown in figure 5.6.3.1-1 below, the end-to-end QoS is met only when the QoS requirements are properly satisfied over the two legs respectively.



Figure 5.6.3.1-1: End-to-End QoS for 5G ProSe Layer-3 UE-to-UE Relay operation

To achieve this, the source 5G ProSe Layer-3 End UE initiates PC5 QoS Flows setup or modification during the Layer-2 link establishment or modification procedure, the source 5G ProSe Layer-3 End UE provides the QoS Info as described in clause 6.4.3.7.3 to the 5G ProSe Layer-3 UE-to-UE Relay. The received PC5 QoS parameters of the QoS Info (i.e. PQI and conditionally other parameters such as MFBR/GFBR, etc.) are interpreted as the end-to-end QoS requirements by the 5G ProSe Layer-3 UE-to-UE Relay for the traffic transmission between source 5G ProSe Layer-3 End UE and target 5G ProSe Layer-3 End UE. The source 5G ProSe Layer-3 End UE derives the end-to-end QoS parameters as defined in clause 5.6.1. The 5G ProSe Layer-3 UE-to-UE Relay, based on its implementation, decides the PQI for the first hop PC5 QoS control and the PQI for the second hop PC5 QoS control, by considering the received PC5 QoS parameters from the source 5G ProSe Layer-3 End UE. The 5G ProSe Layer-3 UE-to-UE Relay provides the QoS Info (including PQI value chosen by the 5G ProSe Layer-3 UE-to-UE Relay for the second hop) to the target 5G ProSe Layer-3 End UE. After accepted QoS Info of the second hop QoS from the target 5G ProSe Layer-3 End UE is received, 5G ProSe Layer-3 UE-to-UE Relay provides the QoS Info (including PQI value chosen by the 5G ProSe Layer-3 UE-to-UE Relay for the first hop) to the source 5G ProSe Layer-3 End UE with considering the received second hop QoS. If the source 5G ProSe Layer-3 End UE performs the Layer-2 link modification procedure to add new PC5 QoS Flow(s) or modify the existing PC5 QoS Flow(s) for IP traffic or Ethernet traffic over PC5 reference point, the source 5G ProSe Layer-3 End UE may also provide the PC5 QoS Rule(s) for the PC5 QoS Flow(s) to be added or modified to the 5G ProSe Layer-3 UE-to-UE Relay. The 5G ProSe Layer-3 UE-to-UE Relay may generate the Packet Filters used over the second hop based on the received PC5 QoS Rule(s).

For multi-hop 5G ProSe Layer-3 UE-to-UE Relay, each 5G ProSe Layer-3 UE-to-UE Relays split the QoS parameters, according to the received QoS Info, into two parts: one part is the QoS parameters of the previous hop, the other part is the QoS parameters from the 5G ProSe Layer-3 UE-to-UE Relay to the target End UE (the rest QoS parameters). The 5G ProSe Layer-3 UE-to-UE Relay sends the rest QoS parameters to the next hop.

As shown in figure 5.6.3.1-2 below, the end-to-end QoS is met only when the QoS requirements are properly satisfied over the multiple legs respectively.

 Figure 5.6.3.1-2: End-to-End QoS for Multi-hop 5G ProSe Layer-3 UE-to-UE Relay operation

Source End UE1

UE-to-UE

Relay1

Target End UE2

UE-to-UE

Relay(s)

PC5

PC5

PC5

1st hop PC5 QoS (PQI)

E2E QoS for a relay service

PC5 QoS (PQI)

PC5 QoS (PQI)

To achieve this, when the source End UE sets up a PC5 QoS Flow, it provides the End-to-End QoS parameters to a 5G ProSe Layer-3 UE-to-UE Relay. Each 5G ProSe Layer-3 UE-to-UE Relay splits the QoS parameters, according to the received QoS Info, into the QoS parameters of the previous hop and the QoS parameters from itself to the target End UE. The 5G ProSe Layer-3 UE-to-UE Relay sends the rest PC5 QoS parameters to the next hop.

The target End UE and each 5G ProSe Layer-3 UE-to-UE Relay send the accepted PC5 QoS parameters and the accumulated QoS parameters to the previous hop. The accepted PC5 QoS parameters can be determined based on the QoS parameters of the previous hop as mentioned above, with considering the received accumulated QoS from next hop.

The accumulated QoS parameter is interpreted as the sum of accepted QoS parameters of the PC5 links from the receiver to the target End UE.

\* \* \* \* Next change \* \* \* \*

#### 5.8.4.2 Common identifiers for 5G ProSe UE-to-UE Relay Discovery

The following parameters are used as UE-to-UE Relay Discovery set of identifiers for the 5G ProSe UE-to-UE 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 User Info ID and Relay Service Code are contained in the message:

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

- Destination Layer-2 ID: the Destination Layer-2 ID for 5G ProSe UE-to-UE Relay Discovery Announcement message is selected based on the configuration as described in clause 5.1.5.1.

- User Info ID of 5G ProSe UE-to-UE Relay: provides information about the 5G ProSe UE-to-UE Relay.

- Relay Service Code: information to indicate the connectivity service the 5G ProSe UE-to-UE Relay provides to 5G ProSe End UEs.

- (Optional) Hop count: indicates the number of hops that per Direct Discovery set is already relayed. It will be increased by 1 per hop.

- (Optional) Maximum number of hops: a const value that indicates the hop limit per Direct Discovery set.

- (Optional) Path information: an (ordered) list of User Info of UE-to-UE Relays that indicates the transmitted path per Direct Discovery set.

The following parameters are used as UE-to-UE Relay Discovery set of identifiers for the 5G ProSe UE-to-UE Relay Discovery Solicitation message (Model B) between discoverer 5G ProSe End UE and 5G ProSe UE-to-UE Relay, where Source Layer-2 ID and Destination Layer-2 ID are used for sending and receiving the message and User Info ID and Relay Service Code are contained in the message:

- Source Layer-2 ID: the discoverer 5G ProSe End UE self-selects a Source Layer-2 ID for 5G ProSe UE-to-UE Relay Discovery Solicitation message.

- Destination Layer-2 ID: the Destination Layer-2 ID for 5G ProSe UE-to-UE Relay Discovery Solicitation message is selected based on the configuration as described in clause 5.1.5.1.

- Relay Service Code: information about connectivity service that the discoverer 5G ProSe End UE is interested in.

- (Optional) Hop count: indicates the number of hops that the Direct Discovery set is already relayed. It will be increased by 1 per hop.

- (Optional) Maximum number of hops: a const value that indicates the hop limit of the Direct Discovery set. The following parameters are used as UE-to-UE Relay Discovery set of identifiers in the 5G ProSe UE-to-UE Relay Discovery Response message (Model B) between discoverer 5G ProSe End UE and 5G ProSe UE-to-UE Relay or between 5G ProSe UE-to-UE Relays for multi-hop discovery, where Source Layer-2 ID and Destination Layer-2 ID are used for sending and receiving the message and User Info ID and Relay Service Code are contained in the message:

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

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

- User Info ID of 5G ProSe UE-to-UE Relay: provides information about the 5G ProSe UE-to-UE Relay.

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

- (Optional) Hop count: a const value that indicates the number of hops between the source and target 5G ProSe End UE.

- (Optional) Path information: an (ordered) list of User Info of UE-to-UE Relays that indicates the transmitted path of the Direct Discovery set.

The following parameters are used as UE-to-UE Relay Discovery set of identifiers for the 5G ProSe UE-to-UE Relay Discovery Solicitation message (Model B) between 5G ProSe UE-to-UE Relay and discoveree 5G ProSe End UE or between 5G ProSe UE-to-UE Relays for multi-hop discovery, where Source Layer-2 ID and Destination Layer-2 ID are used for sending and receiving the message and User Info ID and Relay Service Code are contained in the message:

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

 When a 5G ProSe UE-to-UE Relay self-selects a Source Layer-2 ID for a received 5G ProSe UE-to-UE Relay Discovery Solicitation message, it selects a different Source Layer-2 ID values for each 5G ProSe UE-to-UE Relay Discovery Solicitation message, so that the 5G ProSe UE-to-UE Relay can correlate the 5G ProSe UE-to-UE Relay Discovery Response message with the 5G ProSe UE-to-UE Relay Discovery Solicitation message. The 5G ProSe UE-to-UE Relay can determine the discoverer 5G ProSe End UE that triggered the 5G ProSe UE-to-UE Relay Discovery Solicitation based on the destination Layer-2 ID of the received 5G ProSe UE-to-UE Relay Discovery Response message.

- Destination Layer-2 ID: the Destination Layer-2 ID for 5G ProSe UE-to-UE Relay Discovery Solicitation message is selected based on the configuration as described in clause 5.1.5.1.

- User Info ID of 5G ProSe UE-to-UE Relay: provides information about the 5G ProSe UE-to-UE Relay.

- Relay Service Code: identifies the connectivity service the 5G ProSe UE-to-UE Relay provides to 5G ProSe End UEs.

- (Optional) Hop count: indicates the number of hops that the Direct Discovery set is already relayed. It will be increased by 1 per hop.

- (Optional) Maximum number of hops: a const value that indicates the hop limit of the Direct Discovery set.

- (Optional) Path information: an (ordered) list of User Info of UE-to-UE Relays that indicates the transmitted path of the Direct Discovery set.

The following parameters are used as UE-to-UE Relay Discovery set of identifiers in the 5G ProSe UE-to-UE Relay Discovery Response message (Model B) between 5G ProSe UE-to-UE Relay and discoveree 5G ProSe End UE, where Source Layer-2 ID and Destination Layer-2 ID are used for sending and receiving the message and User Info ID and Relay Service Code are contained in the message:

- Source Layer-2 ID: the discoveree 5G ProSe End UE self-selects a Source Layer-2 ID for 5G ProSe UE-to-UE Relay Discovery Response message.

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

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

- (Optional) Hop count: a const value that indicates the number of hops of between the source and target 5G ProSe End UE.

- (Optional) Path information: an (ordered) list of User Info of UE-to-UE Relays that indicates the transmitted path of the Direct Discovery set.

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 and 5G ProSe UE-to-UE Relay Discovery) in clause 6.3.2 and 5G ProSe Direct Communication (including 5G ProSe UE-to-Network Relay Communication and 5G ProSe UE-to-UE Relay Communication) in clause 6.4, 6.5 and 6.7 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 and 5G ProSe UE-to-UE Relay Discovery) with a different discovery model.

NOTE 2: If a 5G ProSe UE-to-UE Relay and 5G ProSe End UEs 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, Maximum number of hops and Path information are used for multi-hop 5G ProSe UE-to-UE Relay Discovery. The multi-hop UE-to-UE Discovery message has no impact on 5G ProSe UE-to-UE Relay or 5G ProSe End UE that only supports single-hop UE-to-UE Relay as, e.g., single-hop and multi-hop UE-to-UE Relay may be distinguished based on RSC.

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

#### 6.3.2.4 5G ProSe UE-to-UE Relay Discovery

##### 6.3.2.4.1 General

5G ProSe UE-to-UE Relay Discovery is applicable to both 5G ProSe Layer-3 and Layer-2 UE-to-UE Relay Discovery for public safety use and commercial services. To perform 5G ProSe UE-to-UE Relay Discovery, the 5G ProSe End UE and the 5G ProSe UE-to-UE Relay are pre-configured or provisioned with the related information as described in clause 5.1.

A Relay Service Code (RSC) is used in the 5G ProSe UE-to-UE Relay Discovery, to indicate the connectivity service the 5G ProSe UE-to-UE Relay provides to 5G ProSe End UEs. The RSCs are pre-configured or provisioned on the 5G ProSe UE-to-UE Relay and the 5G ProSe End UE as defined in clause 5.1. The 5G ProSe UE-to-UE Relay and the 5G ProSe End UE are aware of whether a RSC is offering 5G ProSe Layer-2 or Layer-3 UE-to-UE Relay service based on the UE-to-UE Relay Layer indicator as specified in clause 5.1. A 5G ProSe UE-to-UE Relay supporting multiple RSCs advertises the RSCs using multiple discovery messages, with one RSC per discovery message.

To support multi-hop 5G ProSe UE-to-UE Relay Discovery, a maximum number of hops is used in the 5G ProSe UE-to-UE Relay Discovery, which could be decided per RSC or by End UE based on QoS requirements. Hop count, maximum number of hops may be included in the discovery message. When relaying the discovery message, the 5G ProSe UE-to-UE Relay includes in the message its own User Info.

##### 6.3.2.4.2 Procedure for 5G ProSe UE-to-UE Relay Discovery with Model A

Depicted in Figure 6.3.2.4.2-1 is the procedure for 5G ProSe UE-to-UE Discovery with Model A.



Figure 6.3.2.4.2-1: 5G ProSe UE-to-UE Relay Discovery with Model A

1. The 5G ProSe UE-to-UE Relay has discovered other UEs in proximity and obtains the Direct discovery set from other UEs in proximity per RSC. (e.g. via a previous 5G ProSe UE-to-UE Relay Discovery or via secure PC5 connection between 5G ProSe U2U Relay and 5G ProSe End UE (refer to TS 33.503 [29])).

2. The 5G ProSe UE-to-UE Relay sends a UE-to-UE Relay Discovery Announcement message. The UE-to-UE Relay Discovery Announcement message contains the Type of Discovery Message, User Info ID of the 5G ProSe UE-to-UE Relay, RSC and Direct discovery set including list of protected user info (i.e. Application Layer ID) received from the 5G ProSe End UEs supporting the RSC. The UE-to-UE Relay Discovery Announcement message is sent using the Source Layer-2 ID and Destination Layer-2 ID as described in clause 5.8.4.

 The 5G ProSe UE-to-UE Relay shall only announce user info (i.e. Application Layer ID) of other UEs in proximity that did not include an Announce Prohibited Indication when they were previously discovered.

NOTE: 5G ProSe UE-to-UE Relay announces Direct discovery set from other UEs in proximity only if their PC5 signal strength measured by the 5G ProSe UE-to-UE Relay is above configured signal strength threshold as specified in TS 38.331 [16].

 A 5G ProSe End UE monitors announcement messages from a 5G ProSe UE-to-UE Relay. The 5G ProSe End UEs determine the Destination Layer-2 ID for signalling reception as specified in clause 5.1.

##### 6.3.2.4.2a Procedure for Multi-hop 5G ProSe UE-to-UE Relay Discovery with Model A

Depicted in Figure 6.3.2.4.2a-1 is the procedure for Multi-hop 5G ProSe UE-to-UE Relay Discovery with Model A.

UE-to-UERelay1

Relay1

UE-to-UE

Relay2

End UE1

1. obtains Direct Discovery set

2. 5G ProSe UE-to-UE Relay Discovery Announcement message

4. 5G ProSe UE-to-UE Relay Discovery Announcement message

3. decides to relay Direct Discovery set(s)

Figure 6.3.2.4.2a-1: 5G ProSe multi-hop UE-to-UE Relay Discovery with Model A

1. When a 5G ProSe UE-to-UE Relay has received discovery message(s) from other UEs (e.g., via a previous 5G ProSe UE-to-UE Relay Discovery). The discovery message(s) may include Direct Discovery set(s) and the corresponding path information indicated by an (ordered) list of User Info ID of Relays, RSC, hop count and optionally the maximum number of hops of the Direct Discovery set.

2. The 5G ProSe UE-to-UE Relay sends a UE-to-UE Relay Discovery Announcement message. The UE-to-UE Relay Discovery Announcement message contains the User Info ID of itself, Direct Discovery set including list of protected user info of End UEs, a list of paths indicated by an (ordered) list of User Info ID of Relays, hop count corresponding to each user info in the Direct Discovery set and optionally maximum number of hops corresponding to each user info in the Direct Discovery set. Each path corresponds to a user info in the Direct Discovery set.

The UE-to-UE Relay Discovery Announcement message is sent using the Source Layer-2 ID and Destination Layer-2 ID as described in clause 5.8.4.

3. After receiving UE-to-UE Relay Discovery Announcement message(s), a 5G ProSe UE-to-UE Relay may send a UE-to-UE Relay Discovery Announcement message including a list of Direct Discovery sets. A Direct Discovery set is dropped if the User Info of the 5G ProSe UE-to-UE Relay is already included in the path information of the Direct Discovery set. For each Direct Discovery set, if its hop count (i.e. the number of User Info of Relays in the path information) has reached the maximum number of hops, the Relay should drop the Direct Discovery set, i.e., not including it in the Announcement message to be sent.

NOTE: Based on implementation, Relay UEs can decide to forward the discovery message with the same direct discovery set at most once in order to control the total number of discovery messages transferred among relays. To determine the identical direct discovery set, the relay UE can compare the direct discovery set bit by bit if it is encrypted, or check the source End UE and target End UE User info if the direct discovery set is not encrypted.

4. A 5G ProSe End UE or a 5G ProSe UE-to-UE Relay monitors Announcement message from a 5G ProSe UE-to-UE Relay. The 5G ProSe End UEs and 5G ProSe UE-to-UE Relays determine the Destination Layer-2 ID for signalling reception as specified in clause 5.1.

##### 6.3.2.4.3 Procedure for 5G ProSe UE-to-UE Relay Discovery with Model B

Depicted in Figure 6.3.2.4.3-1 is the procedure for 5G ProSe UE-to-UE Relay Discovery with Model B.



Figure 6.3.2.4.3-1: 5G ProSe UE-to-UE Relay Discovery with Model B

1. The discoverer 5G ProSe End UE (UE-1) sends a 5G ProSe UE-to-UE Relay Discovery Solicitation message. The 5G ProSe UE-to-UE Relay Discovery Solicitation message contains the Type of Discovery Message, RSC and the Direct Discovery set which includes the protected user info (i.e. Application Layer ID) of the discoverer 5G ProSe End UE (UE-1) and the discoveree 5G ProSe End UE (UE-2). The 5G ProSe UE-to-UE Relay Discovery Solicitation message is sent using the Source Layer-2 ID and Destination Layer-2 ID as described in clause 5.8.4.

 A 5G ProSe UE-to-UE Relay determines the Destination Layer-2 ID for signalling reception as specified in clause 5.1.

 The discoverer 5G ProSe End UE may include an Announce Prohibited Indication in the UE-to-UE Relay Discovery Solicitation message. If a 5G ProSe UE-to-UE Relay receives a Relay Discovery Solicitation message with an Announce Prohibited Indication it does not consider the 5G ProSe End UE as discovered during this procedure for inclusion in 5G ProSe UE-to-UE Relay Discovery with Model A, see clause 6.3.2.4.2, step 1.

2. If the RSC contained in the solicitation message matches any of the (pre)configured RSC(s), as specified in clause 5.1.5.1, of a 5G ProSe UE-to-UE Relay, the 5G ProSe UE-to-UE Relay sends a 5G ProSe UE-to-UE Relay Discovery Solicitation message. The 5G ProSe UE-to-UE Relay Discovery Solicitation message contains the Type of Discovery Message, the Direct Discovery set which includes the list of protected user info (i.e. Application Layer ID) of the discoverer 5G ProSe End UE (UE-1) and the discoveree 5G ProSe End UE (UE-2), User Info ID of UE-to-UE Relay, RSC. 5G ProSe UE-to-UE Relay Discovery Solicitation message is sent using the Source Layer-2 ID and Destination Layer-2 ID as described in clause 5.8.4.

 A 5G ProSe End UE determines the Destination Layer-2 ID for signalling reception as specified in clause 5.1.

 The 5G ProSe UE-to-UE Relay self-selects the Source Layer-2 ID as specified in clause 5.8.4.2.

3. If the RSC contained in the solicitation message matches any of the (pre)configured RSC(s), as specified in clause 5.1.5.1, of the discoveree 5G ProSe End UE (UE-2), and the discoveree 5G ProSe End UE (UE-2) matches the user info (i.e. Application Layer ID) of the discoveree 5G ProSe End UE (UE-2) contained in the solicitation message, then the discoveree 5G ProSe End UE (UE-2) responds to the 5G ProSe UE-to-UE Relay with a 5G ProSe UE-to-UE Relay Discovery Response message. The 5G ProSe UE-to-UE Relay Discovery Response message contains the Type of Discovery Message, RSC, the Direct Discovery set which includes the protected user info (i.e. Application Layer ID) of the discoverer 5G ProSe End UE (UE-1) and the discoveree 5G ProSe End UE (UE-2). The 5G ProSe UE-to-UE Relay Discovery Response message is sent using the Source Layer-2 ID and Destination Layer-2 ID as described in clause 5.8.4. If the discoveree 5G ProSe End UE (UE-2) receives multiple UE-to-UE Relay Discovery Solicitation messages from different 5G ProSe UE-to-UE Relays with the same RSC and the user info (i.e. Application Layer ID) of the discoveree 5G ProSe End UE (UE-2), it may choose to respond or not to a 5G ProSe UE-to-UE Relay (e.g. based on the PC5 signal strength of each message received).

 The discoveree 5G ProSe End UE may include an Announce Prohibited Indication in the UE-to-UE Relay Discovery Response message. If a 5G ProSe UE-to-UE Relay receives a Relay Discovery Response message with an Announce Prohibited Indication it does not consider the 5G ProSe End UE as discovered during this procedure for inclusion in 5G ProSe UE-to-UE Relay Discovery with Model A, see clause 6.3.2.4.2, step 1.

4. The 5G ProSe UE-to-UE Relay sends a 5G ProSe UE-to-UE Relay Discovery Response message. The 5G ProSe UE-to-UE Relay Discovery Response message contains the Type of Discovery Message, User Info ID of UE-to-UE Relay, RSC, the Direct Discovery set which includes the list of protected user info (i.e. Application Layer ID of the discoverer 5G ProSe End UE (UE-1) and the discoveree 5G ProSe End UE (UE-2). The 5G ProSe UE-to-UE Relay Discovery Response message is sent using the Source Layer-2 ID and Destination Layer-2 ID as described in clause 5.8.4.

##### 6.3.2.4.3a Procedure for Multi-hop 5G ProSe UE-to-UE Relay Discovery with Model B

Depicted in Figure 6.3.2.4.3a-1 is the procedure for Multi-hop 5G ProSe UE-to-UE Relay Discovery with Model B.



Figure 6.3.2.4.3a-1: Multi-hop 5G ProSe UE-to-UE Relay Discovery with Model B1. The Source End UE decides the maximum number of hops for discovery based on policy configuration (i.e. a mapping between maximum number of hops and RSC) or QoS parameters.

If the maximum number of hops is decided based on RSC or is decided as the same value as that based on RSC, the Source End UE may not include the maximum number of hops in the Solicitation message. Otherwise the Source End UE includes the maximum number of hops in the Solicitation message.

2a. The Source End UE sends a 5G ProSe UE-to-UE Relay Discovery Solicitation message. The 5G ProSe UE-to-UE Relay Discovery Solicitation message additionally contains following information compared with that defined in clause 6.3.2.4.3: hop count which will be increased by 1 per hop, a const value of maximum number of hops.

3a. If the RSC contained in the solicitation message matches any of the (pre)configured RSC(s), as specified in clause 5.1.5.1, of a 5G ProSe UE-to-UE Relay, the 5G ProSe UE-to-UE Relay may decide to send a 5G ProSe UE-to-UE Relay Discovery Solicitation message.

The 5G ProSe UE-to-UE Relay should drop the received Solicitation message when its own User Info ID is contained in the received Solicitation message, or if the hop count (i.e. the number of Relays included in the message) has reached the maximum number of hops of the received Solicitation message. The maximum number of hops may be obtained from the Solicitation message or may be decided based on RSC if it is not obtained from the message.

If the same Direct Discovery Set is received from different 5G ProSe-enabled UEs, the 5G ProSe UE-to-UE 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 1: If the Source End UE does not receive any response after a timeout, based on application requirement, it may increase the maximum number of hops and send the discovery message again.

NOTE 2: Based on implementation, Relay UEs can decide to send the discovery message with the same direct discovery set at most once in order to control the total number of discovery messages transferred among Relays. To determine the identical direct discovery set, the Relay UE can compare the direct discovery set bit by bit if it is encrypted, or check the source End UE and target End UE User info if the direct discovery set is not encrypted.

4a. A 5G ProSe UE-to-UE 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 sent the Solicitation message. The hop count is increased by 1.

 The 5G ProSe UE-to-UE Relay may assign unique Layer-2 ID for sending Solicitation message as described in clause 6.3.2.4.3.

2b.-6b. Another transmission path of the Solicitation message.

7-8. If the RSC contained in the solicitation message matches any of the (pre)configured RSC(s), as specified in clause 5.1.5.1, of the Target 5G ProSe End UE, and the Target 5G ProSe End UE matches the user info (i.e. Application Layer ID) of the discoveree 5G ProSe End UE contained in the solicitation message, then the Target 5G ProSe End UE responds to the 5G ProSe UE-to-UE Relay with a 5G ProSe UE-to-UE Relay Discovery Response message. The 5G ProSe UE-to-UE Relay Discovery Response message additionally contains the path information compared with that defined in clause 6.3.2.4.3.

 The Target 5G ProSe End UE may choose a path and sends Response message to 5G ProSe UE-to-UE Relay(s) based on e.g. the PC5 signal strength of each message received, hops to the Source End UE, the path information, etc.

9-10. A 5G ProSe UE-to-UE Relay sends a 5G ProSe UE-to-UE Relay Discovery Response message. A 5G ProSe UE-to-UE Relay can associate the User Info ID and Layer-2 ID of neighbour UE-to-UE Relays according to the Response message. The association can be used in the subsequent Link Management procedures.

11. The Source End UE may perform the UE-to-UE Relay(s)/path selection for subsequent Link Management procedures based on e.g. the PC5 signal strength of the received Response messages, the number of hops to Target 5G ProSe End UE.

##### 6.3.2.4.4 Candidate 5G ProSe UE-to-UE Relay Discovery

This procedure for candidate 5G ProSe UE-to-UE Relay Discovery to support the negotiated Relay reselection as described in clause 6.7.4 when the discoverer End UE discovers a candidate 5G ProSe UE-to-UE Relay.

The procedure for 5G ProSe UE-to-UE Relay Discovery with Model B (see clause 6.3.2.4.3) is used with the following differences:

- Step 1: In the 5G ProSe UE-to-UE Relay Discovery Solicitation message the RSC and the User Info ID of a candidate 5G ProSe UE-to-UE Relay are included in the UE-to-UE Relay Discovery set and the Direct Discovery set is not included. If the 5G ProSe End UE receives the Layer-2 ID of the candidate 5G ProSe UE-to-UE Relay in a Link Modification Request message, it may set the Layer-2 ID of the candidate 5G ProSe UE-to-UE Relay as the Destination Layer-2 ID.

NOTE: The User Info ID of the candidate 5G ProSe UE-to-UE Relay and the user info (i.e. Application Layer ID) of the discoveree 5G ProSe End UE can be distinguished by the 5G ProSe UE-to-UE Relay as different IEs in the message.

- Step 2 and step 3 are skipped because Direct Discovery set is absent, and the User Info ID of the candidate 5G ProSe UE-to-UE Relay in the received 5G ProSe UE-to-UE Relay Discovery Solicitation message matches that of the 5G ProSe UE-to-UE Relay.

- Step 4: If a 5G ProSe UE-to-UE Relay matches the User Info ID of a candidate 5G ProSe UE-to-UE Relay received in the 5G ProSe UE-to-UE Relay Discovery Solicitation then it sends the 5G ProSe UE-to-UE Relay Discovery Response (with the RSC received in step 1) and does not include the Direct Discovery set.

##### 6.3.2.4.5 Acquiring Direct discovery set by model A discovery

The 5G ProSe UE-to-UE Relay may monitor Announcement messages from the 5G ProSe End UEs.

When receiving an Announcement message from a 5G ProSe End UE, the 5G ProSe UE-to-UE Relay may include the received protected user info (i.e. Application Layer ID) in the UE-to-UE Relay Discovery Announcement message as specified in clause 6.3.2.4.2.

\* \* \* \* Next change \* \* \* \*

##### 6.4.3.7.3a Layer-2 link management over PC5 reference point for Multi-hop 5G ProSe Layer-3 UE-to-UE Relay

For the 5G ProSe Communication via Multi-hop 5G ProSe Layer-3 UE-to-UE Relay as described in clause 6.7.1a, the description in clause 6.4.3.7.1 applies with following differences and clarifications:

The Direct Communication Request message over the PC5 reference point between source End UE and the first hop UE-to-UE Relay additionally includes:- Path Information: an (ordered) list of User Info ID of 5G ProSe UE-to-UE Relays selected by the source 5G ProSe End UE based on the path information provided to the source 5G ProSe End UE during 5G ProSe UE-to-UE Relay Discovery procedure.

- QoS Info: indicates the End to End QoS Info from the source End UE to the target End UE.

The Direct Communication Request message over the PC5 reference point between two UE-to-UE Relays includes:

- User Info of source 5G ProSe End UE.

- User Info of target 5G ProSe End UE.

- Path information.

- ProSe Service Info: the information about the ProSe identifier(s).

- RSC: the connectivity service provided by the 5G ProSe UE-to-UE Relay as requested by the source 5G ProSe End UE.

- Security Information: the information for the establishment of security for the PC5 link establishment between two UE-to-UE Relays or between target End UE and UE-to-UE Relay (see TS 33.503 [29]).

- QoS Info: indicates the rest QoS Info from the UE-to-UE Relay to the target End UE.

- The Direct Communication Request message over the PC5 reference point between between the target End UE and UE-to-UE Relay additionally includes:

- Path information.

- QoS Info: indicates the rest QoS Info from the UE-to-UE Relay to the target End UE.

- The Direct Communication Accept message over the PC5 reference point between target End UE and UE-to-UE Relay additionally includes:

- QoS Info which is the accepted QoS Info of the hop between target End UE and the last UE-to-UE Relay.

- The Direct Communication Accept message over the PC5 reference point between two UE-to-UE Relays includes:

- User Info of target 5G ProSe End UE.

- Path information.

- QoS Info which is the accepted QoS Info of the hop between two UE-to-UE Relays and the accumulated QoS Info of hops from the receiver UE-to-UE Relay to the target End UE.

- The Direct Communication Accept message over the PC5 reference point between the source End UE and UE-to-UE Relay additionally includes:

- Path information.

- QoS Info which is the accepted QoS Info of the hop between two UE-to-UE Relays and the accumulated QoS Info of hops from the source End UE to the target End UE.

- The Link Modification Request message over the PC5 reference point between source End UE and the first hop UE-to-UE Relay additionally includes:

- Path Information: an (ordered) list of User Info ID of 5G ProSe UE-to-UE Relays provided to the source 5G ProSe End UE during 5G ProSe UE-to-UE Relay Discovery procedure.

 - QoS Info: indicates the End-to-End QoS Info from the source End UE to the target End UE.

- The Link Modification Request message over the PC5 reference point between two UE-to-UE Relays includes:

- User Info of source 5G ProSe End UE.

- Path Information.

- User Info of target 5G ProSe End UE.

- QoS Info: indicates the rest QoS Info from the UE-to-UE Relay to the target End UE.

- The Link Modification Request message over the PC5 reference point between the target End UE and UE-to-UE Relay additionally includes:

- Path Information.

- QoS Info: indicates the rest QoS Info from the UE-to-UE Relay to the target End UE.

- The Link Modification Accept message over the PC5 reference point between the target End UE and UE-to-UE Relay additionally includes:

- Path information.

- QoS Info which is the accepted QoS Info of the hop between target End UE and UE-to-UE Relay.

- The Link Modification Accept message over the PC5 reference point between two UE-to-UE Relays includes:

- Path information.

- QoS Info which is the accepted QoS Info of the hop between two UE-to-UE Relays and the accumulated QoS Info of hops from the UE-to-UE Relay to the target End UE.

- The Link Modification Accept message over the PC5 reference point between source End UE and the first UE-to-UE Relay additionally includes:

- Path information.

 - QoS Info which is the accepted QoS Info of the hop between source End UE and the first UE-to-UE Relay and the accumulated QoS Info of hops from the UE-to-UE Relay to the target End UE.

NOTE: The path information in DCR/LMR/DCA/LMA message is used for multi-hop 5G ProSe UE-to-UE Relay Discovery only. A 5G ProSe UE-to-UE Relay Discovery that only supports single-hop UE-to-UE Relay will ignore the messages that contains path information.

- In the Security Procedure of the PC5 reference point between source End UE and UE-to-UE Relay, the source 5G ProSe Layer-3 End UE provides the QoS Info of the end-to-end QoS to the 5G ProSe Layer-3 UE-to-UE Relay. If the PC5 link is used for transferring Ethernet traffic, the source 5G ProSe Layer-3 End UE provides its Ethernet MAC address.

- In the Security Procedure of the PC5 reference point between two UE-to-UE Relays, a 5G ProSe Layer-3 UE-to-UE Relay provides the QoS Info from itself to the target 5G ProSe Layer-3 UE-to-UE Relay. If the PC5 link is used for transferring Ethernet traffic, the 5G ProSe Layer-3 UE-to-UE Relay provides the Ethernet MAC address of the source 5G ProSe Layer-3 End UE.

- In the Security Procedure of the PC5 reference point between target End UE and a UE-to-UE Relay, the 5G ProSe Layer-3 UE-to-UE Relay provides the QoS Info of the last hop QoS to the target 5G ProSe End UE. If the PC5 link is used for transferring Ethernet traffic, the 5G ProSe Layer-3 UE-to-UE Relay provides the Ethernet MAC address of the source 5G ProSe Layer-3 End UE.

- The 5G ProSe Layer-3 UE-to-UE Relay decides the QoS Info of the next hop to source End UE with considering the accumulated QoS Info of the hop(s) to the target End UE which is received in the Direct Communication Accept message.

- For adding new end-to-end QoS flow or modifying existing end-to-end QoS flow, the Link Modification Accept message over each PC5 reference point additionally includes QoS Info of that hop. If the PC5 link is used for transferring Ethernet traffic, the target 5G ProSe Layer-3 End UE may provide its Ethernet MAC address.For a path between a specific pair of End UEs, if at least one of the PC5 link is released, the 5G ProSe Layer-3 UE-to-UE Relay(s) in the path may release other PC5 link(s) in the path.

\* \* \* \* Next change \* \* \* \*

### 6.7.1a 5G ProSe Communication via Multi-hop 5G ProSe Layer-3 UE-to-UE Relay for Non-IP Type PDU

1a. Authorization and Provisioning

2. Discovery Procedure

3. DCR or LMR

5. DCR or LMR

7. DCR or LMR

4. Security Establishment

6. Security Establishment

8. Security Establishment

9. DCA or LMA

10. DCA or LMA

11. DCA or LMA

U2U Relay1

U2U Relay2

Source End UE1

Target End UE2

1a. Authorization and Provisioning

1b. Authorization and Provisioning

Figure 6.7.1a-1: Layer-2 link establishment via 5G ProSe Layer-3 UE-to-UE Relay for Non-IP Type PDU

1. 5G ProSe Layer-3 End UE1 and 5G ProSe Layer-3 End UE2 are authorized for multi-hop UE-to-UE Relay service as End UE and are provisioned with parameters for discovery and connection setup with other UEs via multi-hop UE-to-UE Relay services.

5G ProSe Layer-3 UE-to-UE Relays are authorized for multi-hop UE-to-UE Relay service as Relay UE and are provisioned with parameters for discovery and connection setup with other UEs and relay UEs via multi-hop UE-to-UE Relay services (as described in clause 5.1.5.1). The provisioned parameter may include parameters such as RSC (Relay service Code)(s), list of PLMN, user info of UE for application which are allowed at multi-hop relay connection.

2. It is assumed that the source 5G ProSe Layer-3 End UE1 selectes a relay path to the Target End UE2 from the discovery procedure which is captured in clause 6.3.2.4.

3. The source 5G ProSe Layer-3 End UE1 initiates the unicast Layer-2 link establishment procedure with the 5G ProSe Layer-3 UE-to-UE Relays by sending a Direct Communication Request message to the UE-to-UE Relay. The parameters included in the Direct Communication Request message are described in clause 6.4.3.7.3a.

If there is already a PC5 link with the same RSC been established between the End UE and the UE-to-UE Relay or between UE-to-UE Relays, a Link Modification Request message is sent instead of Direct Communication Request message. The parameters included in the LMR message are described in clause 6.4.3.7.3a.

4. (Optional) When the security protection is enabled, the source 5G ProSe Layer-3 End UE sends the parameters as described in clause 6.4.3.7.3a to the 5G ProSe Layer-3 UE-to-UE Relay.

5. A UE-to-UE Relay sends a Direct Communication Request or Link Modification Request message to the next UE-to-UE Relay according to the path information in the received Direct Communication Request or Link Modification Request message.

The Source Layer-2 ID of the Direct Communication Request message is self-assigned by the UE-to-UE Relay and the Destination Layer-2 ID is the unicast Layer-2 ID associated with the User Info ID of the next hop UE-to-UE Relay.

7. A UE-to-UE Relay may know it is the last Relay in the path (e.g., according to the User Info ID of Relays in the received Direct Communication Request/Link Modification Request message). The UE-to-UE Relay sends a Direct Communication Request/Link Modification Request message to the target 5G ProSe Layer-3 End UE.

The Destination Layer-2 ID is the unicast Layer-2 ID of target End UE or a broadcast Layer-2 ID. Unicast Layer-2 ID is used if the Layer-2 ID of the Target End UE is known to the UE-to-UE Relay.

9. The target End UE sends a Direct Communication Accept message to the UE-to-UE Relay it has successfully established security with. The DCA message may include the path information.

10-11. After receiving a DCA message, the UE-to-UE Relay (e.g. Relay2) sends a DCA message to the next UE-to-UE Relay (e.g. Relay1) or Source End UE it has successfully established security with. The UE-to-UE Relay may decide the next UE-to-UE Relay (e.g. Relay1) according to the received DCA message or from which it previously received a corresponding DCR message.

For Ethernet communication, the 5G ProSe Layer-3 UE-to-UE Relay maintains the association between PC5 links and Ethernet MAC addresses received from the 5G ProSe Layer-3 End UE.

For Unstructured traffic communication, for each pair of source and target 5G ProSe Layer-3 End UEs, the 5G ProSe Layer-3 UE-to-UE Relay maintains the 1:1 mapping between two PC5 links to the (next hop to) source 5G ProSe Layer-3 End UE and the (next hop to) target 5G ProSe Layer-3 End UE.

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