**3GPP TSG- Meeting # *S2-2409060***

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** | **3** | **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 | **X** | Radio Access Network |  | Core Network |  |

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| ***Title:***  |  |
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| ***Source to WG:*** |  |
| ***Source to TSG:*** | SA2 |
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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:*** | 1. In TS 23.304, there is a single signalling diagram with details on the setup of new end-to-end PC5 link via L2 UE-to-UE relay in clause 6.7.2In this procedure, the addition of a new end-to-end PC5 link may be treated as a modification of an exsitng Layer-2 PC5 direct link between End UE and U2U relay UE. This modification has been implemented in ProSe Direct Link Modification procedure (as specified in TS 24.554). With the same design logic, when the end-to-end PC5 link between two End-UEs is released, the link shall also be modified with a similar PC5-S link modification procedure to synchronize the PC5 link context among the End UE and Relay UE. It is not suitable to let lower layer (PC5-RRC) to exchange this e2e link release informaiton because the lower layer does not know the full context of the released PC5 link as “User info ID” are never exposed to lower layers, the only identifier known by the lower layer is just Layer-2 address. As a result, the upper layer of ProSe Relay UE may continue regard itself serving an outdated “User Info ID”of a ProSe End UE and may also include it in its Model-A discovery message falsely.It is proposed to capture the above procedure in the TS 23.304 with a concise description in 6.4.3.7.22. TS 23.304, clause 6.4.3.7.2 provides a blanket statement that end-to-end PC5-S messages are exactly as the same as what has been specified as clause 6.4.3.1 to 6.4.3.5. However, for UE-to-UE relay case, there are some problems to reuse the direct PC5 link procedures in 6.4.3.1~6.4.3.5. One problem is that the Layer-2 ID which are supposed to encapsulated in the lower layer headers are no longer available end-to-end. To make the above statement work, RAN2 has made the agreement that lower layer of End UE provides the per-hop Layer-2 ID of peer UE to ProSe Layer after receiving any PC5-S signalling (RAN2 LS S2-2403891/R2-2401918). This requires the Layer-2 ID of the end-to-end PC5 link and per-hop link are the same. This has to be updated in Stage 2  |
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| ***Summary of change:*** | 1. Added the desciption text to explain that for L2 U2U relay, End UE releasing the e2e link can trigger the Layer-2 link release/modificaiton procedure towards the relay UE.2. Description added in 6.4.3.7.2 on how the Layer-2 ID for the end-to-end PC5 connection is set .  |
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| ***Consequences if not approved:*** |  1.The L2 U2U relay UE will not be able to cleanly remove the end-to-end link context between a pair of User Info IDs of End UEs.2. Ambiguity about the Layer-2 ID relations between end-to-end link and per-hop link remain. |
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| ***Clauses affected:*** |  6.4.3.7.2 |
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|  | **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:*** |  |

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|  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* First Change \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

##### 6.4.3.7.2 Layer-2 link management over PC5 reference point for 5G ProSe Layer-2 UE-to-UE Relay

For the 5G ProSe Communication via 5G ProSe Layer-2 UE-to-UE Relay as described in clause 6.7.2, the description in clause 6.4.3.7.1 applies. In case of ProSe communication via 5G ProSe Layer-2 UE-to-UE Relay, an end-to-end Direct Communication Request message between the source 5G ProSe End UE and the target 5G ProSe End UE is transmitted after the per-hop connections have been established. The information from end-to-end unicast link profile in clause 6.4.3.7.1 is used for mapping of the destination Layer-2 ID as specified in TS 38.300 [12] and TS 38.331 [16].

The message contents over PC5 reference point for unicast mode 5G ProSe Direct Communication as depicted from clause 6.4.3.1 to clause 6.4.3.5 are same for the end-to-end connection between peer 5G ProSe End UEs.

When the 5G ProSe End UEs initiate End-to-End PC5-S signalling to release an end-to-end ProSe link via 5G ProSe Layer 2 UE-to-UE relay, the 5G ProSe End UE which has initiated the PC5-S release procedure triggers Layer-2 link modification or a Layer-2 link release procedure as described in clause 6.4.3.7 towards 5G ProSe Layer-2 UE-to-UE relay.

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#### 6.4.3.2 Link identifier update for a unicast link

Figure 6.4.3.2-1 shows the link identifier update procedure for a unicast link. When privacy requirements are configured for a ProSe Identifier associated with the unicast link, identifiers used for the unicast mode of 5G ProSe communication over PC5 reference point (e.g. Application Layer ID, Source Layer-2 ID and IP address/prefix) shall be changed over time as specified in clauses 5.8.2.1 and 5.8.2.4. A UE may decide to change the identifiers for other reasons, e.g. application layer requirement. This procedure is used to update and exchange new identifiers between the source and the peer UEs for a unicast link before using the new identifiers, to prevent service interruptions. When there are privacy requirements as indicated above, this procedure is executed over a security protected unicast link.

If a UE has multiple unicast links using the same Application Layer IDs or Layer-2 IDs, the UE needs to perform the link identifier update procedure over each of the unicast links.



Figure 6.4.3.2-1: Link identifier update procedure

0. UE-1 and UE-2 have a unicast link established as described in clause 6.4.3.1.

1. UE-1 decides to change its identifier(s), e.g. due to the Application Layer ID change or upon expiry of a timer. UE-1 generates its new Layer-2 ID and sends a Link Identifier Update Request message to UE-2 using the old identifiers.

 The Link Identifier Update Request message includes the new identifier(s) to use (including the new Layer-2 ID, Security Information, optionally the new Application Layer ID and optionally new IP address/prefix if IP communication is used). The new identifier(s) shall be cyphered to protect privacy if security is configured for the unicast link. After sending the Link Identifier Update Request message, if the UE-1 has data to send, UE-1 keeps sending data traffic to UE-2 with the old identifiers until UE-1 sends the Link Identifier Update Ack message to UE-2.

NOTE 1: The timer is running on per Source Layer-2 ID.

NOTE 2: When one of the two UEs acts as IPv6 router as described in clause 5.5.1.1 and the IP address/prefix also needs to be changed, the corresponding address configuration procedure would be carried out after the Link Identifier update procedure.

2. Upon reception of the Link Identifier Update Request message, UE-2 changes its identifier(s). UE-2 responds with a Link Identifier Update Response message which includes the new identifier(s) to use (including the new Layer-2 ID, Security Information, optionally the new Application Layer ID and optionally a new IP address/prefix if IP communication is used). The new identifier(s) shall be cyphered to protect privacy if security is configured for the unicast link. The Link Identifier Update Response message is sent using the old identifiers. UE-2 continues to receive traffic with the old Layer-2 ID from UE-1 until UE-2 receives traffic with the new Layer-2 ID from UE-1. After sending the Link Identifier Update Response message, UE-2 keeps sending data traffic to UE-1 with the old identifier, if UE-2 has data to send, until UE-2 receives the Link Identifier Update Ack message from UE-1.

3. Upon reception of the Link Identifier Update Response message, UE-1 responds with a Link Identifier Update Ack message. The Link Identifier Update Ack message includes the new identifier(s) from UE-2, as received on the Link Identifier Update Response message. The Link Identifier Update Ack message is sent using the old identifiers. UE-1 continues to receive traffic with the old Layer-2 ID from UE-2 until UE-1 receives traffic with the new Layer-2 ID from UE‑2.

4. The ProSe layer of UE-1 passes the PC5 Link Identifier for the unicast link and the updated Layer-2 IDs (i.e. new Layer-2 ID for UE-1 for the source and new Layer-2 ID of UE-2 for the destination) down to the AS layer. This enables the AS layer to update the provided Layer-2 IDs for the unicast link.

 UE-1 starts using its new identifiers and UE-2's new identifiers for this unicast link.

5. Upon reception of the Link Identifier Update Ack message, the ProSe layer of UE-2 passes the PC5 Link Identifier for the unicast link and the updated Layer-2 IDs (i.e. new Layer-2 ID of UE-2 for the source and new Layer-2 ID for UE-1 for the destination) down to the AS layer. This enables the AS layer to update the provided Layer-2 IDs for the unicast link.

 UE-2 starts using its new identifiers and UE-1's new identifiers for this unicast link.

NOTE 3: The Security Information in the above messages also needs to be updated at the same time as the Layer-2 IDs. This is defined in TS 33.503 [29].

#### 6.4.3.3 Layer-2 link release over PC5 reference point

Figure 6.4.3.3-1 shows the layer-2 link release procedure over PC5 reference point.



Figure 6.4.3.3-1: Layer-2 link release procedure

0. UE-1 and UE-2 have a unicast link established as described in clause 6.4.3.1.

1. UE-1 sends a Disconnect Request message to UE-2 in order to release the layer-2 link and deletes all context data associated with the layer-2 link. The Disconnect Request message includes Security Information.

2. Upon reception of the Disconnect Request message, UE-2 shall respond with a Disconnect Response message and deletes all context data associated with the layer-2 link. The Disconnect Response message includes Security Information.

 The ProSe layer of each UE informs the AS layer that the unicast link has been released. The ProSe layer uses PC5 Link Identifier to indicate the released unicast link. This enables the AS layer to delete the context related to the released unicast link.

NOTE: The Security Information in the above messages is defined in TS 33.503 [29].

#### 6.4.3.4 Layer-2 link modification for a unicast link

Figure 6.4.3.4-1 shows the layer-2 link modification procedure for a unicast link. This procedure is used to:

- add new PC5 QoS Flow(s) in the existing PC5 unicast link.

- This covers the case for adding new PC5 QoS Flow(s) to the existing ProSe service(s) as well as the case for adding new PC5 QoS Flow(s) to new ProSe service(s).

- modify existing PC5 QoS Flow(s) in the existing PC5 unicast link.

- This covers the case for modifying the PC5 QoS parameters for existing PC5 QoS Flow(s).

- This also covers the case for removing the associated ProSe service(s) from existing PC5 QoS Flow(s) as well as the case for associating new ProSe service(s) with existing PC5 QoS Flow(s).

- remove existing PC5 QoS Flow(s) in the existing PC5 unicast link.



Figure 6.4.3.4-1: Layer-2 link modification procedure

0. UE-1 and UE-2 have a unicast link established as described in clause 6.4.3.1.

1. The ProSe application layer in UE-1 provides application information for PC5 unicast communication. The application information includes the ProSe Service Info and the initiating UE's Application Layer ID. The target UE's Application Layer ID may be included in the application information. If UE-1 decides to reuse the existing PC5 unicast link as specified in clause 5.3.4, so decides to modify the unicast link established with UE-2, UE-1 sends a Link Modification Request to UE-2.

 The Link Modification Request message includes:

a) To add new PC5 QoS Flow(s) in the existing PC5 unicast link:

- QoS Info: the information about PC5 QoS Flow(s) to be added. For each PC5 QoS Flow, the PFI, the corresponding PC5 QoS parameters (i.e. PQI and conditionally other parameters such as MFBR/GFBR, etc.) and optionally the associated ProSe identifier(s).

- Optional PC5 QoS Rule(s).

b) To modify PC5 QoS Flow(s) in the existing PC5 unicast link:

- QoS Info: the information about PC5 QoS Flow(s) to be modified. For each PC5 QoS Flow, the PFI, the corresponding PC5 QoS parameters (i.e. PQI and conditionally other parameters such as MFBR/GFBR, etc.) and optionally the associated ProSe identifier(s).

- Optional PC5 QoS Rule(s).

c) To remove PC5 QoS Flow(s) in the existing PC5 unicast link:

- PFIs.

2. UE-2 responds with a Link Modification Accept message.

 The Link Modification Accept message includes:

- For case a) and case b) described in step 1:

- QoS Info: the information about PC5 QoS Flow(s) requested by UE-1. For each PC5 QoS Flow, the PFI, the corresponding PC5 QoS parameters (i.e. PQI and conditionally other parameters such as MFBR/GFBR, etc.) and optionally the associated ProSe identifier(s).

- Optional PC5 QoS Rule(s).

 The ProSe layer of each UE provides information about the unicast link modification to the AS layer. This enables the AS layer to update the context related to the modified unicast link.

#### 6.4.3.5 Layer-2 link maintenance over PC5 reference point

The PC5 Signalling Protocol shall support keep-alive functionality that is used to detect if a particular PC5 unicast link is still valid. Either side of the PC5 unicast link can initiate the layer-2 link maintenance procedure (i.e. keep-alive procedure), based on for example triggers from the AS layer or internal timers. The UEs shall minimize the keep-alive signalling, e.g. cancel the procedure if data are successfully received over the PC5 unicast link.



Figure 6.4.3.5-1: Layer-2 link maintenance procedure

0. UE-1 and UE-2 have a unicast link established as described in clause 6.4.3.1.

1. Based on trigger conditions, UE-1 sends a Keep-alive message to UE-2 in order to determine the status of the PC5 unicast link.

NOTE 1: It is left to Stage 3 to determine the exact triggers for the keep-alive messages. For example, the trigger can be based on a timer associated with the Layer-2 link. The timer can be reset with a successful reception event defined by TS 38.300 [12].

2. Upon reception of the Keep-alive message, UE-2 responds with a Keep-alive Ack message.

The UE initiating the keep-alive procedure shall determine the follow-up actions based on the result of the signalling, e.g. proceed with implicit layer-2 link release.

NOTE 2: It is left to Stage 3 to determine the follow-up actions. For example, a successful reception event can also cancel the layer-2 link release if received in time.