**3GPP TSG-RAN WG3 Meeting #129R3-255763**

**Bengaluru, India, 25 – 29 August 2025**

**Agenda item: 22.2**

**Source: Nokia, Nokia Shanghai Bell**

**Title: (TP to BL CR for TS 38.401) Support of service continuity in Multi-hop U2N relay**

**Document for: Discussion and Decision**

# 1 Introduction

This contribution proposes Stage-2 TP for following:

* Capture the following agreement based on the corresponding TP proposed in R3-255158
  + RAN3 supports that the Remote UE local ID uniquely identifies a multi-hop Remote UE within the Last Relay UE.
* Add some descriptions that the existing procedures in Clauses 8.19.4.1 and 8.19.4.2 can be used for Scenarios C and D.

# TP to BL CR for TS 38.401

***-----------------Start of Change-------------------***

### 8.19.4 Service Continuity for L2 U2N relay

#### 8.19.4.1 Inter-gNB-DU switch from direct to indirect path

The signalling flow for U2N Remote UE switch from direct to indirect path with gNB-DU change is shown in Figure 8.19.4.1-1. If the target path is multi-hop, it is assumed that all L2 U2N Relay UEs along the target path are in the RRC\_CONNECTED. However, if the target path is a single-hop, the target U2N Relay UE can be in any RRC state.



Figure 8.19.4.1-1: U2N Remote UE Direct-to-indirect Path Switch with gNB-DU change procedure

1. The Uu measurement configuration and measurement report signalling is performed between U2N Remote UE and gNB-CU to evaluate both relay link measurement and Uu link measurement. The U2N Remote UE may report one or multiple candidate U2N Relay UE(s) and Uu measurement results after it measures/discovers the candidate U2N Relay UE(s).

2. The gNB-CU decides to switch the U2N Remote UE to a target U2N Relay UE under a different gNB-DU (i.e., target gNB-DU).

3. The reconfiguration to target U2N Relay UE is performed among U2N Relay UE, the target gNB-DU and gNB-CU, if the U2N Relay UE is in RRC\_CONNECTED state. The gNB-CU sends an *RRCReconfiguration* message to the target U2N Relay UE. If the target Relay UE is in RRC\_IDLE/INACTIVE state, this step is skipped and the configuration to the target U2N Relay UE is performed in Step 10.

4. gNB-CU sends the UE CONTEXT SETUP REQUEST message for the U2N Remote UE to the target gNB-DU, which contains the path switch configuration at least.

5. gNB-DU responds with the UE CONTEXT SETUP RESPONSE message to gNB-CU.

6. gNB-CU sends the UE CONTEXT MODIFICATION REQUEST message by including the *RRCReconfiguration* message to the source gNB-DU. The contents in the *RRCReconfiguration* message may include at least path switch configuration, PC5 Relay RLC channel configuration for relaying traffic, bearer mapping configuration and the associated radio bearer(s).

7. The source gNB-DU sends the *RRCReconfiguration* message to the U2N Remote UE. The U2N Remote UE stops UP and CP transmission over Uu after reception of *RRCReconfiguration* message from the gNB.

8. The source gNB-DU sends the UE CONTEXT MODIFICATION RESPONSE message to the gNB-CU.

9. The U2N Remote UE establishes PC5 connection with target U2N Relay UE.

10. The U2N Remote UE completes the path switch procedure by sending the *RRCReconfigurationComplete* message to the target gNB-DU via the target U2N Relay UE. In case the U2N relay UE is in RRC\_IDLE/ INACTIVE state, when the U2N relay UE receives the *RRCReconfigurationComplete* message, the reception of the *RRCReconfigurationComplete* message will first trigger RRC setup/resume procedure for the U2N relay UE to enter RRC\_CONNECTED state.

11. The target gNB-DU sends the UL RRC MESSAGE TRANSFER message to gNB-CU by including the *RRCReconfigurationComplete* message.

12. The gNB-CU sends an UE CONTEXT RELEASE COMMAND message to the source gNB-DU.

13. The source gNB-DU releases the UE context and responds the gNB-CU with an UE CONTEXT RELEASE COMPLETE message.

#### 8.19.4.2 Intra-gNB-DU switch from direct to indirect path

The signalling flow for U2N Remote UE switch from direct to indirect path without gNB-DU change is shown in Figure 8.19.4.2-1. If the target path is multi-hop, it is assumed that all L2 U2N Relay UEs along the target path are in the RRC\_CONNECTED. However, if the target path is a single-hop, the target U2N Relay UE can be in any RRC state.



Figure 8.19.4.2-1: U2N Remote UE Direct-to-indirect Path Switch without gNB-DU change procedure

1. The Uu measurement configuration and measurement report signalling is performed between U2N Remote UE and gNB-CU to evaluate both relay link measurement and Uu link measurement. The U2N Remote UE may report one or multiple candidate U2N Relay UE(s) and Uu measurement results after it measures/discovers the candidate U2N Relay UE(s).

2. The gNB-CU decides to switch the U2N Remote UE to a target U2N Relay UE under the same gNB-DU.

3. The reconfiguration to target U2N Relay UE is performed among U2N Relay UE, gNB-DU and gNB-CU if U2N Relay UE is in RRC\_CONNECTED state. The gNB-CU sends an *RRCReconfiguration* message to the target U2N Relay UE. If the target Relay UE is in RRC\_IDLE/INACTIVE state, this step is skipped and the configuration to the target U2N Relay UE is performed in Step 9.

4. gNB-CU sends the UE CONTEXT MODIFICATION REQUEST message for the U2N Remote UE to gNB-DU, which contains the path switch configuration at least. The F1-U packets of the U2N Remote UE can be continuously transmitted via previous tunnels if there is no tunnel update in this step.

5. gNB-DU responds with the UE CONTEXT MODIFICATION RESPONSE message to gNB-CU.

6. gNB-CU sends the DL RRC MESSAGE TRANSFER message by including the *RRCReconfiguration* message to gNB-DU. The contents in the *RRCReconfiguration* message may include at least path switch configuration, PC5 Relay RLC channel configuration for relaying traffic, bearer mapping configuration and the associated radio bearer(s).

7. gNB-DU sends the *RRCReconfiguration* message to the U2N Remote UE. The U2N Remote UE stops UP and CP transmission over Uu after reception of *RRCReconfiguration* message from the gNB.

8. The U2N Remote UE establishes PC5 connection with target U2N Relay UE.

9. The U2N Remote UE completes the path switch procedure by sending the *RRCReconfigurationComplete* message to the gNB-DU via the target U2N Relay UE. In case the U2N Relay UE is in RRC\_IDLE/INACTIVE state when receiving the *RRCReconfigurationComplete* message, the reception of the *RRCReconfigurationComplete* message will first trigger RRC setup/resume procedure for the U2N relay UE to enter RRC\_CONNECTED state.

10. The gNB-DU sends the UL RRC MESSAGE TRANSFER message to gNB-CU by including the *RRCReconfigurationComplete* message.

***-----------------Next Change-------------------***

8.19.xx Remote UE initial access for Multi-hop Layer-2 UE-to-Network Relay

The signalling flow for Remote UE Initial access is shown in Figure 8.19.xx-1.



**Figure 8.19.xx-1: Overall procedure for Remote UE’s initial access via multi-hop relay**

1. The U2N Remote UE, the First U2N Relay UE, the Intermediate U2N Relay UE, and the Last U2N Relay UE perform discovery procedure, and establish PC5 connection using NR ProSe procedure.

2. The U2N Remote UE sends an *RRCSetupRequest* message to the First U2N Relay UE via PC5 Relay RLC channel.

3. The First U2N Relay UE withholds the received RRC message. If the First U2N Relay UE is in RRC\_IDLE/RRC\_INACTIVE state, it should send its own *RRCSetupRequest* message to the Intermediate U2N Relay UE via PC5 Relay RLC channel in order to trigger the RRC establishment/resume procedure to enter RRC\_CONNECTED state upon reception of the RRC message from the U2N Remote UE. If the Intermediate U2N Relay UE is in RRC\_IDLE/RRC\_INACTIVE state, it should trigger the RRC establishment/resume procedure in clause 8.19.1 to enter RRC\_CONNECTED state upon reception of the RRC message from the First U2N Relay UE. If all Relay UEs are in RRC\_CONNECTED state, this step could be skipped.

4. The First U2N Relay UE in RRC\_CONNECTED state sends the *SidelinkUEInformationNR* message to the gNB-DU via the Intermediate U2N Relay UE and Last U2N Relay UE.

5. The gNB-DU sends the UL RRC MESSAGE TRANSFER message of the First U2N Relay UE by encapsulating the *SidelinkUEInformationNR* message to gNB-CU, and gNB-CU allocates the local ID of U2N Remote UE to uniquely identify the U2N Remote UE within the Last U2N Relay UE.

6. The gNB-CU sends the UE CONTEXT MODIFICATION REQUEST message of the Last U2N Relay UE to gNB-DU. Such message may request the establishment of Uu Relay RLC channel(s) and PC5 Relay RLC channel(s) for the transmission of U2N Remote UE’s SRB0.

7. The gNB-DU sends the UE CONTEXT MODIFICATION RESPONSE message of the Last U2N Relay UE to gNB-CU.

8. The gNB-CU sends the DL RRC MESSAGE TRANSFER message of the Last U2N Relay UE to gNB-DU by encapsulating the *RRCReconfiguration* message, which contains the local ID allocated to the U2N Remote UE. The *RRCReconfiguration* message shall also contain the Uu Relay RLC channel(s) configuration and PC5 Relay RLC channel(s) configuration if not configured and bearer mapping for relaying of U2N Remote UE’s SRB0.

9. The gNB-DU sends the *RRCReconfiguration* message to the Last U2N Relay UE to configure the local ID of the U2N Remote UE, the Uu Relay RLC channel(s) configuration, PC5 Relay RLC channel(s) configuration and bearer mapping for relaying of U2N Remote UE’s SRB0.

10. The Last U2N Relay UE sends the *RRCReconfigurationComplete* message to gNB-DU.

11. The gNB-DU sends the UL RRC MESSAGE TRANSFER message of the Last U2N Relay UE by encapsulating the *RRCReconfigurationComplete* message to gNB-CU.

12. The gNB-CU configures the Intermediate U2N Relay UE with the local ID allocated to the U2N Remote UE, PC5 Relay RLC channel and bearer mapping for relaying of U2N Remote UE’s SRB0. According to the configuration from gNB-CU, the Intermediate U2N Relay UE may establish a PC5 Relay RLC channel for relaying of U2N Remote UE’s SRB0 over PC5. This step follows the same signaling flow as described in steps 6-11.

13. The gNB-CU configures the First U2N Relay UE with the local ID allocated to the U2N Remote UE, PC5 Relay RLC channel and bearer mapping for relaying of U2N Remote UE’s SRB0. According to the configuration from gNB-CU, the First U2N Relay UE may establish a PC5 Relay RLC channel for relaying of U2N Remote UE’s SRB0 over PC5. This step follows the same signaling flow as described in steps 6-11.

14. After receiving the local ID of the U2N Remote UE and the PC5 Relay RLC channel(s) configuration and bearer mapping for relaying of U2N Remote UE’s SRB0, the First U2N Relay UE sends the *RRCSetupRequest* message of the U2N Remote UE to gNB-DU via the Intermediate U2N Relay UE and the Last U2N Relay UE. The local ID of the U2N Remote UE and RB ID for SRB0 are conveyed in the SRAP header.

15. The gNB-DU allocates a C-RNTI and a gNB-DU UE F1AP ID for the U2N Remote UE and sends the INITIAL UL RRC MESSAGE TRANSFER message to gNB-CU by encapsulating the *RRCSetupRequest* message of the U2N Remote UE. In addition, the local ID of the U2N Remote UE, the gNB-DU UE F1AP ID of the Last U2N Relay UE and the sidelink configuration container for the PC5 Relay RLC channel configuration for relaying of U2N Remote UE’s SRB1 are included in the INITIAL UL RRC MESSAGE TRANSFER message.

16. The gNB-CU allocates a gNB-CU UE F1AP ID for the U2N Remote UE and generates a *RRCSetup* message towards the U2N Remote UE. The RRC message is encapsulated in the DL RRC MESSAGE TRANSFER message, and includes the configurations of PC5 Relay RLC channel and bearer mapping at least for the transmission of U2N Remote UE’s SRB1.

17. The gNB-DU sends the *RRCSetup* message to the U2N Remote UE via the First U2N Relay UE, the Intermediate U2N Relay UE and Last U2N Relay UE.

18. The gNB-CU configures the Last U2N Relay UE with PC5 Relay RLC channel, Uu Relay RLC channel and bearer mapping for relaying of U2N Remote UE’s SRB1. According to the configuration from gNB-CU, the Last U2N Relay UE establishes a PC5 Relay RLC channel for relaying of U2N Remote UE’s SRB1 over PC5 and establishes a Uu Relay RLC channel for relaying of U2N Remote UE’s SRB1 towards gNB-DU if not configured yet.

The gNB-CU configures the First U2N Relay UE and the Intermediate U2N Relay UE with PC5 Relay RLC channel and bearer mapping for relaying of U2N Remote UE’s SRB1. According to the configuration from gNB-CU, the First U2N Relay UE and the Intermediate U2N Relay UE establish the PC5 Relay RLC channels for relaying of U2N Remote UE’s SRB1 over PC5 if not configured yet.

NOTE 1: Step 18 can be performed earlier, e.g., via Steps 6-13.

19. The U2N Remote UE sends the *RRCSetupComplete* message to the gNB-DU via the First U2N Relay UE, the Intermediate U2N Relay UE and Last U2N Relay UE.

20. The gNB-DU encapsulates the RRC message in the UL RRC MESSAGE TRANSFER message and sends it to the gNB-CU.

21. Upon receiving the *RRCSetupComplete* message of U2N Remote UE, the gNB-CU sends the INITIAL UE MESSAGE message to the AMF.

22. The AMF sends the INITIAL CONTEXT SETUP REQUEST message to the gNB-CU.

23. The gNB-CU sends the UE CONTEXT SETUP REQUEST message to establish the U2N Remote UE context in the gNB-DU. Such message may request the configuration of PC5 Relay RLC channels for the transmission of U2N Remote UE’s SRB2 and DRBs, and may also encapsulate the *SecurityModeCommand* message.

24. The gNB-DU sends the *SecurityModeCommand* message to the U2N Remote UE via the First U2N Relay UE, the Intermediate U2N Relay UE and Last U2N Relay UE.

25. The gNB-DU sends the UE CONTEXT SETUP RESPONSE message of the U2N Remote UE to the gNB-CU, which contains the configuration of PC5 Relay RLC channels for the transmission of U2N Remote UE’s SRB2 and DRBs.

26. The U2N Remote UE responds with the *SecurityModeComplete* message.

27. The gNB-DU encapsulates the RRC message in the UL RRC MESSAGE TRANSFER message and sends it to the gNB-CU.

28. The gNB-CU generates the *RRCReconfiguration* message for U2N Remote UE and encapsulates it in the DL RRC MESSAGE TRANSFER message. The *RRCReconfiguration* message contains the configuration of PC5 Relay RLC channels and bearer mapping for the transmission of U2N Remote UE’s SRB2 and DRBs.

29. The gNB-DU sends *RRCReconfiguration* message to the U2N Remote UE via the First U2N Relay UE, the Intermediate U2N Relay UE and Last U2N Relay UE.

30. The U2N Remote UE sends *RRCReconfigurationComplete* message to the gNB-DU via the First U2N Relay UE, the Intermediate U2N Relay UE and Last U2N Relay UE.

31. The gNB-DU encapsulates the RRC message in the UL RRC MESSAGE TRANSFER message and send it to the gNB-CU.

32. The gNB-CU sends the INITIAL CONTEXT SETUP RESPONSE message to the AMF.

33. The gNB-CU configures additional Uu Relay RLC channels between the gNB-DU and the Last U2N Relay UE, and additional PC5 Relay RLC channels for the First U2N Relay UE, the Intermediate U2N Relay UE, and the Last U2N Relay UE for relaying of U2N Remote UE’s DRBs and SRBs. Also, such step may configure the bearer mapping between U2N Remote UE’s DRB/SRB and PC5/Uu Relay RLC channel at the First U2N Relay UE, the Intermediate U2N Relay UE, and the Last U2N Relay UE.

NOTE 2: This step can be performed earlier.

***-----------------End of Change-------------------***