**3GPP TSG-RAN WG3 Meeting #114bis-e *R3-220xxxx***

**E-meeting, 17 - 26 January 2022**

**Agenda item: 24.4**

**Source:** **Lenovo, Motorola Mobility**

**Title: (TP to 38.300 BL CR) DL non-SDT data and signalling arrival during SDT procedure**

**Document for: Discussion and Decision**

# **1 Introduction**

In RAN3#114e, an WA was made as:

**WA: when applying Way 2 for SDT without anchor relocation, RAN3 assumes the anchor could move the UE back to RRC Inactive by using RRCRelease message.**

This contribution further discusses the details of DL non-SDT data and signalling arrival during SDT procedure.

# **2 Discussion**

As specific in TS 38.300, RAN paging procedure is performed when DL data or signalling arrival for RRC\_INACTIVE state:

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| --- |
| 9.2.2.4.2 Network triggered transition from RRC\_INACTIVE to RRC\_CONNECTED The following figure describes the network triggered transition from RRC\_INACTIVE to RRC\_CONNECTED:    Figure 9.2.2.4.2-1: Network triggered transition from RRC\_INACTIVE to RRC\_CONNECTED  1. A RAN paging trigger event occurs (incoming DL user plane, DL signalling from 5GC, etc.).  2. RAN paging is triggered; either only in the cells controlled by the last serving gNB or also by means of Xn RAN Paging in cells controlled by other gNBs, configured to the UE in the RAN-based Notification Area (RNA).  3. The UE is paged with the I-RNTI.  4. If the UE has been successfully reached, it attempts to resume from RRC\_INACTIVE, as described in clause 9.2.2.4.1. |

Observation 1: In legacy, RAN paging procedure is performed when DL data or signalling arrival for RRC\_INACTIVE state.

**Case 1: receiving gNB receives DL non SDT data or signalling**

In the first case, the receiving gNB receives DL non SDT data or signalling from core network e.g. after anchor relocation. In this embodiment, before receiving downlink non-SDT data or signalling arrival, the anchor relocation procedure has been performed. Through the Retrieve UE Context procedure, the receiving gNB has fetched all UE context from the last serving gNB. And the receiving gNB also performs path switch procedure. After path switch procedure, the non-SDT data or signalling arrives at the receiving gNB directly. Instead performing RAN paging, upon receiving the DL non-SDT data or signalling from core network, the receiving gNB decides to resume the non SDT RBs and send the UE to RRC\_CONNECTED state with sending *RRCResume* message, if the small data transmission is on-going. Upon receiving the *RRCResume* message, the UE resumes all non-SDT RBs and enters RRC\_CONNECTED state.



Figure 1. receiving gNB receives DL non SDT data or signalling

1. When the receiving gNB receives DL non SDT data or signalling from core network during SDT procedure, the receiving gNB can send the UE to RRC\_CONNECTED state directly by sending *RRCResume* message. (stage 2 impact only).

Case 2: last serving gNB receives DL non SDT data/signalling during Retrieve UE Context procedure

In this case, the last serving gNB receives DL non-SDT data or signalling from CN during or before Retrieve UE Context Procedure (i.e. before anchor relocation).



Figure 2. last serving gNB receives DL non SDT data/signalling during Retrieve UE Context procedure

- when receiving the RETRIEVE UE CONTEXT REQUEST message from the receiving gNB, and the last serving gNB receives downlink data or signalling from core network, the last serving gNB decides anchor relocation is needed.

- The last serving gNB responds the RETRIEVE UE CONTEXT RESPONSE message to the receiving gNB, which includes the Non-SDT data/signalling arrival indication.

- The receiving gNB decides to resume the Non-SDT RBs and moves the UE to RRC\_CONNECTED state according to the non-SDT data/signalling arrival indication. The receiving gNB can send *RRCResume* message to the UE. If the UE is already sent to RRC\_INACTIVE, the receiving gNB can sends RAN paging message to the UE.

- with the non-SDT data/signalling idnciation, the receiving gNB can also allocate the data forwarding addresses for the non-SDT RBs.

1. When the last serving gNB receives DL non-SDT data or signalling from CN during or before Retrieve UE Context Procedure, the last serving gNB includes an ‘non-SDT data/signalling arrival indication’ in the RETRIEVE UE CONTEXT RESPONSE message, so that the receiving gNB can decide to resume the Non-SDT RBs and moves the UE to RRC\_CONNECTED state and allocate the data forwarding addresses for the non-SDT RBs.

Case 3: last serving gNB receives DL non SDT data/signalling during SDT without anchor relocation procedure

In one option, when the last serving gNB receives DL data from the UPF of non-SDT PDU session or non-SDT QoS flow, or DL UE-associated signalling from the AMF, the last serving gNB sends RAN PAGING message to the receiving gNB. When the receiving gNB receives the RAN PAGING message and there is SDT transmission for the same UE, the receiving gNB may send the *RRCRelease* message to UE. At meanwhile, the receiving gNB may send the RAN paging message to the UE. When UE receives the *RRCRelease* message, the UE enters into RRC\_INACTIVE. After that, the UE receives the RAN paging, and enters into RRC\_CONNECTED state in response to RAN paging message.



Figure 3. last serving gNB receives DL non SDT data/signalling during SDT without anchor relocation procedure (option 1)

In another option, when the last serving gNB receives DL data from the UPF of non-SDT PDU session or non-SDT QoS flow, or DL UE-associated signalling from the AMF, the last serving gNB ends the SDT procedure and sends a *RRCRelease* message to the serving gNB. And the serving gNB forwards the *RRCRelease* message to the UE. Along with the *RRCRelease* message, the last serving gNB provides the DL non-SDT data/signalling arrival indication to the serving gNB, so that the serving gNB is aware of the RRC Release is caused by the downlink non-SDT data/signalling arrival. A new indication could added in the *RRCRelease* message to inform the UE about the DL non-SDT data/signalling arrival, so that the UE can initialize another RRC resume procedure for the DL non-SDT data/signalling transmission.



Figure 4. last serving gNB receives DL non SDT data/signalling during SDT without anchor relocation procedure (option 2)

Since both option 1 and option 2 have impact on RAN2, it would be better to send an LS to RAN2.

1. RAN3 sends an LS to RAN2 to check how to handle the case that the last serving gNB receives DL non-SDT data or signalling from CN during SDT without anchor relocation procedure.

Case 4: CU-CP and CU-UP separation case.

When the gNB-CU-UP receives the downlink non-SDT data from the core network, the gNB-CU-UP sends non-SDT data arrival indication to the gNB-CU-CP. Upon receiving the data arrival indication, the gNB-CU-CP identifies that there is on-going SDT procedure and resumes the UE to RRC\_CONNECTED state. The gNB-CU-CP may also send the non-SDT data arrival indication to the gNB-DU.



Figure 5. Procedure for CU-CP and CU-UP separation case

1. When the gNB-CU-UP receives the downlink non-SDT data from the core network, the gNB-CU-UP sends non-SDT data arrival indication to the gNB-CU-CP.

# **3 Conclusion**

This contribution discusses how to handle DL non-SDT data and signalling arrival during SDT procedure.

Observation 1: In legacy, RAN paging procedure is performed when DL data or signalling arrival for RRC\_INACTIVE state.

1. When the receiving gNB receives DL non SDT data or signalling from core network during SDT procedure, the receiving gNB can send the UE to RRC\_CONNECTED state directly by sending *RRCResume* message. (stage 2 impact only)
2. When the last serving gNB receives DL non-SDT data or signalling from CN during or before Retrieve UE Context Procedure, the last serving gNB includes an ‘non-SDT data/signalling arrival indication’ in the RETRIEVE UE CONTEXT RESPONSE message, so that the receiving gNB can decide to resume the Non-SDT RBs and moves the UE to RRC\_CONNECTED state and allocate the data forwarding addresses for the non-SDT RBs.
3. RAN3 sends an LS to RAN2 to check how to handle the case that the last serving gNB receives DL non-SDT data or signalling from CN during SDT without anchor relocation procedure.
4. When the gNB-CU-UP receives the downlink non-SDT data from the core network, the gNB-CU-UP sends non-SDT data arrival indication to the gNB-CU-CP.

A corresponding TP to 38.300 BL CR is provided in the Annex and a draft LS is provided in [3].

# Reference

[1] RAN2 Chairman Notes on RAN2#113e.

[2] RAN2 Chairman Notes on RAN2#115e.

[3]

# Annex (TP to 38.300 BL CR)

## XX.1 Support of RACH based SDT

For RACH based SDT, the UE in RRC\_INACTIVE initiates RACH and requests RRC resume together with UL SDT data. If the UE accesses a gNB other than the last serving gNB, the UL SDT data is buffered at the receiving gNB before the receiving gNB triggers the XnAP Retrieve UE Context procedure. The receiving gNB indicates SDT to the last serving gNB and the last serving gNB decides whether to relocate the UE context or not. Other SDT assistance information may also be provided by the receiving gNB to help the decision.

Editor’s Note: Details of assistance information is pending to future discussion.

Editor’s Note: UL SDT data may also need to be buffered in other cases, details are pending to the discussion.

If the last serving gNB decides not to relocate the UE context, at least information necessary for the receiving gNB to handle SDT is retrieved to the receiving gNB.

Editor’s Note: FFS on details of the retrieved information and how in case of no relocation.

If the last serving gNB decides not to relocate the UE context, in case SDT is used for signalling, SRB PDCP PDUs (FFS on the first SDT payload) is transferred between the receiving gNB and the last serving gNB.

Editor’s Note: The signalling transmission over the Xn could either via extending the XnAP RRC TRANSFER message or via defining a new XnAP class-2 procedure, details are pending to the further discussion.

When the receiving gNB receives DL non SDT-data or DL non-SDT signalling from core network during RACH based SDT procedure, the receiving gNB may send the UE to RRC\_CONNECTED state directly by sending the RRC Resume message.

Editor’s Note: It is FFS how to handle the case that the last serving gNB receives DL non-SDT data or DL non-SDT signalling from CN during SDT without anchor relocation procedure.