**3GPP TSG-RAN WG3 #112-e R3-212631**

**Online, 17th – 27th May 2021**

Title: Summary of offline discussion on Small Data Transmission

Source: Ericsson

Agenda Item: 30

Document for: Approval

# Introduction

**CB: # 34\_SDT\_[LOW-PRIO]**

**- (E///) Without anchor relocation during SDT can be considered as a corner case; Before figuring out any solution to support without anchor relocation, the benefits of scenario vs. network complexity should be analyzed; If the scenario is clearly identified, then RAN3 needs to down-select the solutions considering the simplicity; For CG-based SDT, F1 impact is not seen at this stage; initially discuss possible specification impacts for the SDT workplan**

**- (ZTE) In case of SDT with anchor relocation, the legacy procedure can be reused and no new procedure will be needed; RLC configuration and RLC tunnel for the SDT shall be established at receiving gNB; introduce new Xn signaling for support of SDT RLC context transfer**

**- (NEC) introduce Opt1 to support SDT without UE context relocation by forwarding at least the RLC configuration to the new gNB in order to handle the SDT message; introduce assistance info in the RETRIEVE UE CONTEXT REQUEST message to indicate to the last serving gNB the type of transmission (e.g. SDT, not-SDT, other) and whether the SDT is only one-shot or potentially multiple transmissions; in case of multiple SDT transmissions, it would be beneficial for the last serving gNB to relocate the UE context to the new gNB.**

**- (CATT) Confirm that RLC handling should be processed in the receiving gNB for SDT data transmission; RETRIEVE UE CONTEXT RESPONSE could be reused to transfer the full UE context to the receiving gNB, an indication may need to be introduced in this message to indicate whether the anchor is kept or not; RRC Release message may need to be included in the XnAP UE Context Release Command message if the anchor gNB is kept and anchor want to indicate the receiving node to release the UE context transferred before; Retrieve UE Context Failure message or a new defined class 2 message could be used to provide the partial UE Context from the anchor gNB to the receiving gNB; discuss how to assign UL/DL GTP-U tunnels between anchor gNB and the receiving gNB for SDT data transmission; discuss partial or full UE context should be provided from anchor gNB to the receiving gNB firstly, then go to the details of the solution.**

**- (HW) The RLC handling node for the small data DRB is the new gNB after the RACH SDT based anchor relocation by Retrieve UE context procedure successful operation; The RLC handling node for the small data DRB is the new gNB after the RLC configuration is provided from the last serving gNB by the enhanced Retrieve UE context procedure successful operation; Support RACH based SDT without anchor relocation by forwarding PDCP PDU via DRB level data forwarding tunnel; Support RACH based SDT without anchor relocation by providing the RLC configuration, DRB Level data forwarding UL TNL Information and RRC Release from the last serving gNB to the new gNB, the enhanced RETRIEVE UE CONTEXT RESPONSE message should be used; Support DL data forwarding in case of RACH based SDT without anchor relocation, by reusing XN-U ADDRESS INDICATION message to provide the DRB Level data forwarding DL TNL Information.**

**- (LG) confirm that the RLC PDU is processed in the receiving gNB; In case of SDT procedure without anchor relocation, the anchor gNB should provide the stored RLC configuration and PDCP TNL information to the receiving gNB instead of full UE context**

**- (CT) RLC PDU will be processed in the receiving gNB**

**- (QC) Acknowledge the need to support low latency operation particularly for the single UL packet case and take the flow in this document as a baseline for further study**

**- Chair: this discussion should be treated with low priority; suggest to start evaluating the scenario and settling a few basic principles on which there is consensus (e.g. if agreeable, RLC PDU will be processed in the receiving gNB?)**

(E/// - moderator)

Summary of offline disc [R3-212631](file:///D:\3GPPmeeting\202105%20RAN3%20112e\TSGR3_112-e\Inbox\Drafts\CB%20%23%2034_SDT_%5bLOW-PRIO%5d\Inbox\R3-212631.zip)

# For the Chairman’s Notes

Propose the following:

R3-20xxxa, R3-20xxxc merged

R3-20xxxc rev [in xxxg] – agreed

R3-20xxxd rev [in xxxh] – agreed

R3-20xxxe rev [in xxxi] – agreed

R3-20xxxf rev [in xxxj] – endorsed

Propose to capture the following:

**Agreement text…**

**Agreement text…**

**WA: carefully crafted text…**

Issue 1: no consensus

**Issue 2: issue is acknowledged; need to further check the impact on xxx. May be possible to address with a pure st2 change. To be continued…**

# Discussion

## Issue 1

Although various proposals were given on how to support both anchor and without anchor relocation cases, there is no detailed discussion of the specific scenarios yet. The scenario of anchor relocation for SDT is widely acknowledged. The main focus stays on the without anchor relocation case, which is applied during periodic RNA update. Does company agree that such scenario happens often with UE in the INACTIVE state sending UL small data?

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| Company | Comment |
| ZTE | No need to reconsider this scenario.  Since this issue has already been captured in the WID scope as “*Context fetch and data forwarding (with and without anchor relocation) in INACTIVE state for RACH-based solutions [RAN2, RAN3]*”, and RAN2 also agreed to support this, so RAN3 also needs to design signalling to support it, other than re-considering scenario. |
| Lenovo, Motorola Mobility | Same view with ZTE. RAN3 needs to specify the without anchor relocation case according to the WID. |
| China Telecom | Agree. This scenario was approved in WID. There is no need to question the rationality in this phase. |
| Huawei | Support to specify without anchor relocation case. |
| InterDigital | Agree with ZTE |
| CMCC | The objective has been in the WID, it should not be discussed in WG. |
| Google | Agree with ZTE |
| E/// | It is reasonable to discuss the scenario and then the solution. Based on the comments above, can we say companies agree that SDT would happen during periodic RNA update? |
| Samsung | Agree with ZTE |
| Qualcomm | Generally we should follow the WID – unless we hit some kind of wall of course. This does not seem to be the case. |

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| LGE | Agree with ZTE |

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| Nokia | Agree with ZTE |
| NEC | Agree with ZTE, surely we need to support and specify the scenario without anchor relocation. |
| CATT | Agree with ZTE, we do not need to re-discuss the SDT scenario, we just need to discuss the solutions to support SDT data transmission. We assume both anchor relocation and non-anchor relocation should be supported for SDT transmission, anchor could make the decision on whether to relocate, some assistance info may be needed. |



## Issue 2

If the group agrees the above scenario thus to support without anchor relocation for SDT, three options have been proposed as followings. This question is also related to RAN2’s assumption on which node to process RLC and they would leave final decision to RAN3 in [1]. A swift reply is required to RAN2 if another alternative is shortlisted.

**Option 1**: Full context fetch, i.e., retrieve all the UE context from the anchor gNB, and process data in the receiving gNB.

**Option 2**: Partial context fetch, i.e., retrieve RLC Config from the anchor gNB, and then forward the PDCP SDUs.

**Option 3**: No context fetch, i.e., forward the MAC PDUs to the anchor gNB without processing in the receiving gNB.

To down-select the candidates, companies need to take several factors into account, e.g., signaling exchange between the nodes, possible latency especially for single data, CU-DU split architecture, and etc. Please give your preference by providing reasons based on the criteria among these or any additional ones.

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| Company | Comment |
| ZTE | Option 2.  In my understanding, option 2 is the only method to support SDT without anchor relocation. Option 1 is used for SDT with anchor relocation, and option 3 is excluded by RAN2.  For option 2, in CU-DU split architecture, new-gNB-DU handles the MAC/RLC/PHY packet and old-gNB-CU handles the PDCP packet. |
| Lenovo, Motorola Mobility | Option 1 or Option 2 but too early to decide.  We confirm the receiving gNB should handle RLC-PDU.  However, it is FFS on the signalling exchange between receiving gNB and last serving gNB.  We need further analysis the detailed IEs in RLC-Config. There are several Ies in the RLC-Config as specified in TS 38.331, e.g. which Ies are needed. Whether the RLC-Config should be carried in RRC Container.  RAN3 don’t need to down-select in this meeting since there is no TU allocated. |
| China Telecom | Option 2  Option 1: As the SDAP/PDCP/RLC configuration are fetched from the anchor node in this case, the uplink data can be processed in the serving gNB and directly send to 5GC rather than forwarded to the anchor node.  Option 3: RAN2 ruled out this option. |
| Huawei | Select option 2.  Option 1 should be rule out as well. |
| InterDigital | Option 2 (but we can wait…) |
| CMCC | Option 2 and 3. Is that Option 1 for the scenario of with anchor relocation? |
| Google | Option 1 or 2. |
| E/// | Reply to CMCC: Option 1 is similar as anchor relocation procedure. One additional step after context fetch is to forward the processed data to the anchor gNB for without anchor relocation case, which is yes an inefficient way.  Reply to CTC: RAN2 made an assumption and would leave final decision to RAN3. RAN3 needs to let RAN2 know if a different solution is considered. |
| Samsung | Option 2  In addition to RLC-config, the logical channel related configurations may also need. |
| Qualcomm | Our document (R3-211708) proposes a flow that enables BOTH options 2 and 3 (the latter only for the first UL message).  Since the moderator decides to ignore it and does not even include a list of documents that it is referring to, the validity of this offline discussion is t open to challenge. I believe it is also not strictly true (as stated by ZTE) that RAN2 has excluded option 2 (why else state that it is RAN3’s decision).  So let’s rewind a little and slow down. In any case there is no rush to make this decision in this meeting. |

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| LGE | Option 2  At least, RAN3 needs to confirm that the RLC PDU is processed in the receiving gNB. |

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| Nokia | The only question to answer is where RLC PDU is processed. Therefore, to select between (option 1, option 2) or (option 3).  In our view we should follow RAN2 assumption and select RLC PDU processed in receiving (serving) gNB. This means exclude option 3. |
| NEC | more on option 2. |
| CATT | Following the decision of RAN2 that the RLC proceeding should be done in the receiving node, we assume the Option 1 and 2 are feasible.  For option 1, it’s almost same as the existing context fetch procedure as defined for Inactive. Maybe minor change is needed, e.g. the assistance info provided by the receiving gNB, anchor kept indicator provided by the anchor gNB.  For option 2, new signalling for partial UE context retrieve may need to be defined.  Which one to be selected is related to the detail design, could be further discussed. |



## Issue 3

If the group tends to adopt Option 2 for the without anchor relocation case, i.e., RLC handling in the receiving gNB, which procedures should be used?

This can be a question when WI starts. Considering companies brought detailed analysis this meeting, we may try to see if any quick and straight-forward conclusion would be made. Take XnAP as an example, the possibilities include (1) reusing RETRIEVE UE CONTEXT FAILURE message, (2) using RETRIEVE UE CONTEXT RESPONSE message, or (3) introducing a new procedure.

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| Company | Comment |
| ZTE | (3) a new procedure.  RAN2 is discussing how to terminate ongoing SDT procedure when e.g., non-SDT type DL user data coming, in principle, RAN2 agreed that in this case, the UE context shall be relocated and path switch procedure will be triggered. So that, in my view, method (1) is not suitable to support latter UE context relocation. (2) is used to transfer full UE context so that it is also not suitable to support non UE context relocation case  However, we are fine to postpone the detail discussion and to discuss it when TU is allocated.  In this CB, we wish to achieve consensus that RLC handling is within the receiving gNB (i.e., its gNB-DU), and give RAN3’s feedback to RAN2, because RAN2 needs our result to continue their work. |
| Lenovo, Motorola Mobility | too early to decide.  We don’t see any urgent to discuss this since there is no TU allocated in this meeting. |
| China Telecom | No strong views.  Option1/2: the subsequent XnAP message, i.e, Xn-U address message, also need to introduce new IEs for data forwarding if Option1/2 are supported |
| Huawei | Prefer (2)  For (1) normally after the failure case the XnAP associated is terminated, but in SDT without anchor relocation case, after the UE context retrieve procedure, the Xn-U address Indication procedure will be triggered to enable data forwarding, use the same XnAP UE association.  For (3), in case (2) can work, seems no need to choose (3). |
| InterDigital | Prefer (2) |
| CMCC | Too early to decide |
| Google | (1) or (3) as the RRC Release message should be sent by the last serving base station in case of without context relocation. |
| E/// | (1) or (2). Enhancements to the existing procedures should do the job. |
| Samsung | We prefer (2).  As (1) includes “CONTEXT FAILURE” in the name of the message, it is not easy to imagine this is for the “no anchor relocation” case which UE context transferring is still required.  For (3), we don’t need to design a new procedure as (2) can cover both of the case i.e., w/ and w/o anchor relocation by adding an indicator IE. |
| Qualcomm | It’s too early to go randomly into this specific stage 3 decision. There are no Tus, and the discussion is only here because of an LS on the type of relocation.  Our flow in R3-211708 uses the legacy procedure mainly, but this is something that can be discussed. |

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| LGE | Prefer (2), but we need to further discuss this |

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| Nokia | This issue 3 is not part of the LS scope.  There is no TU allocated for SDT at this meeting. Please follow 3GPP rules, otherwise don’t complain of the overload! |
| NEC | Prefer (1) as today the failure message has been used for the “Periodic RNA update procedure without UE context relocation”, we can reuse that. However, certainly the signalling message need to enhance to support the SDT. |
| CATT | 1. Or (3) seems better than (2). Maybe (3) is better.   It's too early to decide. |



## Issue 4

Whether to separate the processing of single and multiple SDT is worth a thought. This is also related to WA from last meeting about assistance information, which can be used to aid the last serving gNB to decide relocation/non-relocation. The content of IE is FFS yet. We need to clarify the behaviour of network node on how to treat differently for handling of single and multiple small data? As an illustration, one proposal says once the last serving gNB is aware of multiple small data, anchor relocation should be performed. The question will be does company agree to let the last serving gNB decide to relocate the anchor always if subsequent data is foreseen?

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| Company | Comment |
| ZTE | The last serving gNB is a smart gNB, when detecting one or multiple SDT data, either relocate or not relocate UE context, leave it to network implementation. |
| Lenovo, Motorola Mobility | Good starting point to discuss.  There are two issues are not clear so far:  - how the last serving gNB to decide whether anchor relocation is needed?  - how the last serving gNB to decide whether the UE should enter RRC\_CONNECTED. |
| China Telecom | The last serving gNB determines whether to relocate the anchor regardless of single or multiple SDT. And RAN2/3 can discuss which information can be used as assistance information to indicate multiple SDT. |
| Huawei | It was agreed by RAN2 to support subsequent data transmission, not only one shot, it is better to have a unified solution to support both one shot and multiple packets transmission.  The last serving gNB makes the decision based on the received information in the RETRIEVE UE CONTEXT REQUEST, FFS on the assistance information (e.g. indication of multiple packets). |
| InterDigital | Agree with Huawei, based on assistance information FFS |
| CMCC | Assistance information from access gNB to anchor gNB is needed to help the anchor gNB to make de decision, FFS on assistance information |
| Google | No strong view. Either the ZTE proposal or the FFS Assistance Information can work. |
| E/// | We foresee some benefits of this proposal to simplify the decision of last serving gNB. For example, if only single UL data in the RRCResumeRequest message arrives, then we need to consider whether it is worth to execute context fetch which would bring extra latency just for one-shot data. |
| Samsung | Agree with Huawei |
| Qualcomm | Huawei’s statement is a good summary for now. |

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| LGE | Agree with Huawei, FFS on assistance information |

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| Nokia | This issue 4 is not part of the LS scope.  There is no TU allocated for SDT at this meeting. Please follow 3GPP rules, otherwise don’t complain of the overload! |
| NEC | Agree with CMCC that Assistance information from access gNB to anchor gNB is needed to help the anchor gNB to make de decision. We can discuss and check further detail how does the anchor gNB decide whether to relocate or not. |
| CATT | Share the view with HW  it is better to have a unified solution for one shot and multiple shots SDT transmission.  The decision of anchor relocation should be done in the anchor, and we assume some assistance info is needed to be provided from receiving node to the anchor. |



## Issue 5

Does the group agree that currently no impact in RAN3 is seen with the support of CG-SDT as stated in WI objectives?

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| Company | Comment |
| ZTE | In aggregate gNB deployment, no impact in RAN3 is foreseen. But in disaggregate gNB deployment, it has some RAN3 impact.  For instance, in legacy RRC inactive mode, gNB-DU resource will be released and F1 connection is removed, but in case of CG-SDT, gNB-DU resource (at least CG resources) shall be stored and F1 connection shall be kept. |
| Lenovo, Motorola Mobility | Same view with ZTE. In this of CG based SDT, the gNB-DU needs to store and keep (some) UE context. |
| China Telecom | It is need to study how to support CG-SDT in CU/DU split scenario.  In order to support CG-SDT, the DU shall keep the RLC configuration and CG configuration of the inactive UE. However, the existing F1 message UE CONTEXT RELEASE will release all related signalling and user data transport resources in DU. |
| Huawei | We provided analyses about the RAN3 impact of the CG based SDT in R3-210140 last meeting with the following proposals:  Proposal 1: the gNB-CU gets the CG configuration from gNB-DU before configuring the UE to INACTIVE state.  Proposal 2: the gNB-DU maintains the CG configuration for the inactive mode UEs configured with SDT CG resources.  Proposal 3: the gNB-DU maintains the UE Context (including RLC configuration and F1-U tunnels) for the inactive mode UEs configured with SDT CG resources. |
| CMCC | Impacts on CU-DU split architecture |
| Google | Share the same view with ZTE. |
| E/// | We don’t see the need to transfer info over F1 since the DU is the one who generates lower layer configuration to be used by CU to configure the UE as part of RRC information. But tend to agree with ZTE’s point on how to store the CG resources needs further discussion. |
| Samsung | Agree with ZTE. Issues may exist with the split gNB. |
| LGE | Agree with ZTE |
| Nokia | This issue 5 is not part of the LS scope.  There is no TU allocated for SDT at this meeting. Please follow 3GPP rules, otherwise don’t complain of the overload! |
| NEC | Agree that we need to discuss further the impact on CU-DU split architecture. |
| CATT | Share the view with ZTE, F1 should be impacted to support CG-based SDT for CU-DU split architecture. |
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## Issue 6

Do we need to send an LS to RAN2 in this meeting or later provided that any collaboration work is identified?

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| Company | Comment |
| ZTE | Yes. It is RAN3’s scope to decide which node to handle RLC. Currently, RAN2 assumes but does not decide that the receiving gNB handles RLC, and RAN2 is waiting for RAN3’s final decision.  In the LS, “*It is RAN2 understanding that it is up to RAN3 to make the final decision, however if RAN3 needs another solution to handle the RLC PDU, RAN3 should let RAN2 know before making the final decision.*”  So, RAN3 shall send an LS to RAN2 including our decision in this meeting, which is benefit for RAN2 to continue their normative work. |
| Lenovo, Motorola Mobility | we can confirm RAN2 that the receiving gNB handles RLC.  However, the details of signalling (full context v.s. partial context) should be FFS. RAN3 can continue to discuss the details of signalling. |
| China Telecom | Yes. We need a LS to inform RAN2 about our decision. |
| Huawei | Maybe no need, if we get agreement that receiving gNB handles RLC, it is aligned with RAN2 assumption, it means RAN3 do not need “another solution to handle the RLC PDU”. |
| InterDigital | Probably not necessary but not against doing so |
| CMCC | No strong view |
| Google | Agree with Lenovo. |
| E/// | No need for this meeting.  In RAN2’s reply LS they said, if RAN3’s understanding is aligned with them, then no feedback is required. |
| Samsung | Agree with ZTE and Lenovo. We should send LS to RAN2 that receiving gNB handles RLC. |
| Qualcomm | Not really, and there is no need either. See also the comments made for issue 2. |

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| LGE | No strong view |

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| Nokia | We can confirm RAN2 that RLC PDU will be processed in the receiving gNB.  The rest is to be started only when TU is allocated to RAN3. |
| NEC | If a LS can help RAN2 to progress their work, can send, otherwise no need. |
| CATT | We agree to tell RAN2 we confirmed their WA on RLC proceeding. |



# Conclusion, Recommendations

If needed

# References

1. R3-211514, Reply LS on small data transmission (TSG RAN WG2)