3GPP TSG-RAN WG3 #115-e R3-222481

21th Feb – 3rd Mar 2022

Online

Agenda Item: 24.2

Source: ZTE (moderator)

Title: Summary of Offline Discussion on CB: # SDT2\_CGbased

Document for: Approval

# Introduction

**CB: # SDT3\_CGbased**

**- How to indicate CG-SDT configuration kept in the gNB-DU?**

**- Whether and when gNB-DU shall be aware of the bearer type of SDT Bearer?**

**- How to handle fallback to RA-SDT or to normal Resume?**

**- E1AP impact only for CG-SDT?**

**- Capture agreements, clean up and provide TPs if agreeable**

(ZTE - moderator)

Summary of offline disc [R3-222481](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\Drafts\CB%20%23%20SDT3_CGbased\Inbox\R3-222481.zip)

# For the Chairman’s Notes

<TBD>

# Discussion- Third round

<TBD>

# Discussion- Second round

**Please answer the following two questions, which is neccsary to have decision before the online discussion.**

**Question 9: In case that gNB-CU sends UE to RRC\_inactive, does gNB-DU keep non-SDT context? If yes, what is the beneif to keep it?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| ZTE | No | For RA-SDT without anchor relocation case, we only transfer SDT related RLC configuration, we shall use the same method with CG-SDT. If kept non-SDT context in gNB-DU, we do not see much benefit and usage, but occupy much gNB-DU resource. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Question 10: Wether the gNB-CU-UP could buffer the data from gNB-DU before the resume indication received from CU-CP?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| ZTE | Not sure | If gNB-CU-UP can buffer data, then solution 2 is simpler than solution 1, because solution 1 needs to initiate UE context modification procedure to inform verification pass to the gNB-DU. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Please confirm/mdofiy the following proposals to be agreed**

1. The gNB-CU configure "SDT" as one type of DRB configuration in the DU context, and add an optional "SDT" indicator per DRB in the DRB To Be Setup/Modified List in F1AP **UE Context Setup/Modification Request** messages to indicate whether a DRB is SDT capable or not
2. The gNB-CU sends **UE context modification request** message including a new IE (e.g., *CG-SDT query information*)
3. When UE into RRC\_inactive, it shall additionally add a new IE (e.g., *CG-SDT configuration indicator, CG-SDT Kept Indicator*) to gNB-DU via **UE context release command** message.
4. In case that UE and gNB has configured CG-SDT but the UE decides to initiate RA-SDT or non-SDT procedure.
   1. gNB-DU sends INITIAL UL RRC MESSAGE TRANSFER message to gNB-CU
   2. gNB-CU sends UE CONTEXT SETUP REQUEST message to gNB-DU including ***old gNB-DU UE F1AP ID***
   3. gNB-DU find the stored CG-SDT configuration via ***old gNB-DU UE F1AP ID***
   4. gNB-DU sends UE CONTEXT SETUP RESPONSE message to gNB-CU for confirmation

Note: In the next round or next meeting, whether *old gNB-CU F1AP UE ID* is included in the UE CONTEXT SETUP REQUEST message.

1. When the TAT-SDT expires, the gNB-DU initiates the UE Context Release Request procedure, including a new Cause value, as below

|  |  |
| --- | --- |
| TAT-SDT Expiry | The gNB-DU triggers UE Context Release Request to due TAT-SDT timer expiries. |

1. In the second round, for CG SDT procedure, fix 38.401 BLCR including
   1. Before triggering step 4 towards the gNB-DU, the gNB-CU-CP should trigger Bearer Context Modification Request with suspend indication towards the gNB-CU-UP.
   2. After step 10, fix UL NAS PDU green arrow so that it is forwarded to 5GC directly from CU-CP (not through CU-UP).
   3. After step 8, add the optional UL RRC MESSAGE TRANSFER procedure to carry an RRC message if multiplexed together with RRCResumeRequest.
   4. Merge [3], [8] and [11]
2. In the second round, for CG SDT procedure, fix 38.473 BLCR including
   1. The gNB-DU shall store the CS-RNTI for CG-SDT.
   2. Remove the editor’s note “FFS on the details of CG-SDT resource configuration”.
   3. Remove the editor’s note “Whether CG-SDT Query Indication IE is per DRB basis or not is FFS” in CG-SDT BL CR to TS 38.473. CG-SDT Query Indication IE is per UE but not per DRB basis.
3. **UE context release procedure is used to send the RRC release message to the UE (7:1:4), final decision after question 9.**

# Discussion-First round

## Progress in the last meeting

Lower layer configuration for SDT DRBs, F1AP association, and F1 tunnel information are kept in gNB-DU when gNB-CU sends the UE to RRC\_INACTIVE.

Once the UE initiates RRC Resume procedure from another cell, the gNB-CU shall indicate to the gNB-DU to release the assigned CG-SDT resource.

When the gNB-DU receives the query indication, it should transfer the CG-SDT related resources within the DU to CU RRC Information IE. Introduce an SDT-MACPHY-Config IE to DU to CU RRC Information IE for the gNB-CU to generate the RRC Release message with CG-SDT config;

The gNB-CU notifies the gNB-DU to keep SDT RLC config and store CG resource for SDT when UE entering RRC inactive; *FFS on other parts of UE context info to be stored. FFS on signalling design*

gNB-DU shall store which bearers are CG-SDT bearers and the C-RNTI.

*The gNB-DU should be aware the bearer type of SDT Bearer, FFS on any enhancements are needed*

When the TAT-SDT expires, the gNB-DU initiates the UE Context Release Request procedure (details to be checked, FFS on new cause).

Proposal to add a new codepoint for SDT resume in the Bearer Context Status Change IE. Addition to be considered in the E1 output TP of “# SDT4\_Others”

When CG-SDT is configured but the UE selects RA-SDT or non-SDT procedure, the gNB-CU provides the old gNB-DU F1AP UE ID to the gNB-DU. The gNB-DU retrieves the old CG-SDT resource configuration and old UE context based on the old gNB-DU F1AP UE ID. *FFS on new F1AP UE association or old UE F1AP UE association.*

*To be continued…*

## How to indicate that CG-SDT configuration should be kept in the DU

There is currently an FFS on which F1AP message is used to send the UE to RRC\_INACTIVE while preserving part of the UE context in the gNB-DU due to CG-SDT configuration:

*Editor’s note: In the step 4/5, which F1AP procedure used to send the RRC release message to the UE is FFS.*

When network decides to stop SDT procedure, the gNB-CU shall send RRCRelease message to UE, change UE into RRC\_inactive mode. There are several candidate solutions on the table, to send the RRC release message to the UE.

1. UE context modification procedure
2. UE context release procedure
3. DL RRC Message Transfer

For RA-SDT, gNB-DU does not need to store SDT related information nor F1 tunnels. So, for RA-SDT and CG-SDT, it is proposed to use the same F1AP: UE context release procedure to send the RRC release message to the UE.

**Question 1: Which F1AP procedure to send the RRC release message to the UE?**

* Solution 1: UE context modification procedure
* Solution 2: UE context release procedure
* Solution 3: DL RRC Message Transfer
* Solution 4: Other, if any

|  |  |  |
| --- | --- | --- |
| **Company** | **sol-1, sol-2, sol-3** | **Comment** |
| ZTE | Sol 2 | Both solutions are workable, but since UE context release procedure shall be used for RA-SDT, we suggest to use the same procedure. |
| Intel Corporation | Sol 3 | For CG-SDT, unlike RA\_SDT, we agreed that SDT related context remains in the last serving DU:  **Lower layer configuration for SDT DRBs, F1AP association, and F1 tunnel information are kept in gNB-DU when gNB-CU sends the UE to RRC\_INACTIVE.**  **The gNB-CU notifies the gNB-DU to keep SDT RLC config and store CG resource for SDT when UE entering RRC inactive;** **FFS on other parts of UE context info to be stored. FFS on signalling design”**  So, we don't prefer Solution 2.  And regarding "non-SDT" related context, we really believe it is beneficial to keep and make it suspended/resumed. As discussed in Section 2.3 of [11], forcing DU to keep SDT related context only and let it delete other non-SDT related context can create more signaling and redundancy. **In CG-SDT, three entities (DU, CU-UP, CU-UP) do not get changed unless the UE fallback to RA-SDT and requests resume on another DU.** It is much better to maintain full UE context in the last serving DU, and then make non-SDT related context "suspended" when released to INACTIVE with CG SDT configuration and "resumed" when DL non-SDT data arrives and sent to CONNECTED via *RRCResume*.  From this sense and together with per-DRB "SDT indicator" in the *DRB To Be Setup/Modified List* over F1AP, we prefer Solution 3 than Solution 1. |
| Samsung | Sol 2 | From functionality point of view, the above three options are workable. However, this procedure is used to send UE to INACTIVE status, which is originally achieved via UE context release procedure. We think it is better to follow this legacy design. On top of this, we can figure out some enhancements w.r.t. SDT. For sol1 or sol2, we need spend more spec. effort to indicate the usage of the used messages. |
| Huawei | Sol 1 | For CG-SDT, sol-1 is more reasonable since gNB-DU preserves the UE context concering CG-SDT, the F1AP UE association is kept, which are quite different from the legacy handling when moving the UE to inactive mode by using UE context release procedure, i.e. the UE context at DU and the F1AP association will be released.  In case of solution2, the UE Context release procedure will be needed to be enhanced to not release UE context/association…. |
| Google | Sol 3 | All three solution can work for CG-SDT as long as the related context is kept. But we see some benefits for keeping also non-SDT context. |
| CATT | Sol 2 or sol 3 | All the solutions are feasible.  If we decide to keep all the UE context in gNB-DU, it seems solution 3 is better. Or else, solution 2 is preferred. |
| Ericsson | Sol 2 | UE Context Release procedure. The only new thing is to clarify that the procedure will be triggered for this CG-SDT case.  We are also open to consider Sol 3 in light of Intel’s comments. But we note that some topics such as Positioning AI 19.2.2. are dependent of this outcome, so we strive for simplication… |
| Lenovo | Solution 2 |  |
| China Telecom | Solution 2 | We prefer to extend the legacy procedure to support this feature. |
| Nokia | Solution 2 |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Smmary:**

Solution 1: 1 (HW)

Solution 2: 7 (ZTE, SS, CATT, E///, Leno, CTC, Nokia)

Solution 3: 4 (Intel, Google, CATT, E///)

Solution 1/2/3, majority companies prefer solution 2 (7:1:4). However, we shall decide whether non-SDT context shall be stored at gNB-DU.

**Lower layer configuration for SDT DRBs, F1AP association, and F1 tunnel information are kept in gNB-DU when gNB-CU sends the UE to RRC\_INACTIVE. The gNB-CU notifies the gNB-DU to keep SDT RLC config and store CG resource for SDT when UE entering RRC inactive.** **FFS on other parts of UE context info to be stored. FFS on signalling design”**

**Moderator’s proposal:**

UE context release procedure is used to send the RRC release message to the UE.

Question xx: In case that gNB-CU sends UE to RRC\_inactive, does gNB-DU keep non-SDT context? If yes, what is the beneif to keep it?

## Whether gNB-DU shall buffer UL SDT data

In the baseline CR, there is an editor note, as below.

*Editor’s note: Before step 8, it is FFS whether the UL small data/UL NAS PDU shall be buffered at gNB-DU until gNB-CU-CP verifies successfully via UE’s I-RNTI.*

There are two candidate solutions on the table.

1. The gNB-DU buffers UL SDT data
2. The gNB-CU-UP buffers UL SDT data

For RA-SDT procedure, the gNB-DU has to buffer UL SDT data before F1 tunnel establishment. But, for CG-SDT procedure, the gNB-DU already stores CG-SDT resources and F1 tunnels. It seems feasible to directly forward UL SDT data without buffering.

In case of the candidate solution 1, after the verification, the gNB-CU can send the UE CONTEXT MODIFICATION REQUEST message to the gNB-DU to indicate the successful verification of UE sending the buffered UL SDT data. Meanwhile, shall initiate E1AP procedure (e.g., Bearer context modification) to inform the gNB-CU-UP to resume SDT DRB and send the UL SDT data.

In case of the candidate solution 2, after the gNB-CU-UP verifies UE, it shall initiate E1AP procedure (e.g., Bearer context modification) to inform the gNB-CU-UP to resume SDT DRB and send the buffered UL SDT data.

**Solution 1 needs to use additional F1AP procedure than solution 2 which is not needed. Solution 1 is similar to RA-SDT method. Solution 2 needs the gNB-CU-UP to buffer UL SDT data.**

**Question 2: Whether the UL small data/UL NAS PDU shall be buffered at gNB-DU until gNB-CU-CP verifies successfully via UE’s I-RNTI?**

* Solution 1: The gNB-DU buffers UL SDT data
* Solution 2: The gNB-CU-UP buffers UL SDT data
* Solution 3: Other, if any

|  |  |  |
| --- | --- | --- |
| **Company** | **sol-1, sol-2, sol-3** | **Comment** |
| ZTE | Prefer sol 1 (sol 2 is also fine if feasible) | We wonder if gNB-CU-UP can buffer the receiving UL data or has to discard the receiving UL data before the gNB-CU-CP indicates SDT bearer status changed to “ResumeforSDT”. If it can, then solution 2 is also fine to us.  Solution 1 is same as the RA-SDT procedure, but is needs additional F1AP message. |
| Intel Corporation | Solution 2 | CU-UP will buffer the receiving UL data (i.e. PDCP PDU) as the bearer context has been suspended. If verification is successful at CU-CP, SDT bearers in CU-UP would be resumed. If verification is not successful (BTW, this case would be very rare as CG-SDT works only in the same cell), the UE will be fallback to RRC setup. The bearer context will be re-established in CU-UP and UL data would be discarded. |
| Samsung | Sol-1 | In legacy system, the F1-U transmission occurs only if the UE is verified and authorized. We think it is better to follow the same principle, which is aligned with sol-1.  For sol-2, indeed, it can cause less signalling than sol-1. However, this means that a possible risk that the packet of not-verified UE can be reached to the CU-UP side, which holds security functionality of the UEs. We should avoid this kind of design. |
| Huawei | Sol-1 | Sol-1 is more reliable and safe since it avoids to deliver data of unverified UEs. |
| Google | Solution 2 | Since F1 tunnel information is kept at the DU (unlike RA-SDT), the DU should be able to forward the identified SDT data to the CU-UP. Additional Class 1 procedure (i.e., UE CONTEXT MODIFICATION REQUEST message and UE CONTEXT MODIFICATION RESPONSE message) is required for solution 1. |
| CATT | Solution 2 | For solution 1, as gNB-DU does not know when the SDT DRB is resumed in gNB-CU-UP, some indication from gNB-CU-CP seems needed, or else the gNB-DU does not know when to send the buffered data to gNB-CU-UP. |
| Ericsson | Sol-1 | Agree with Samsung and Huawei |
| Lenovo | Soution 2 | Solution 2 can work well without any extra standard impact |
| China Telecom | Solution 1 | For solution2, in case of the PDCP entity in CU-UP is in suspend state, we are not sure that CU-UP could buffer the data from gNB-DU before the resume indication received from CU-CP. And if the solution 2 is finally agreed in RAN3, a LS to RAN2 is needed because it has some impact on PDCP. |
| Nokia | Solution 2 | We can take a WA on solution 2 while checking if any issue. |
|  |  |  |
|  |  |  |

**Smmary:**

Solution 1: 5 (ZTE, SS, HW, E///, CTC)

Solution 2: 6 (ZTE, Intel, Google, CATT, Leno, Nokia)

**Moderator’s proposal:**

**Solution 1 vs Soluton 2, slighter majority companies (6:5) prefer solution 2. However, if the gNB-CU-UP cannot buffer the data from gNB-DU before the resume indication received from CU-CP, solution 2 is not workable.**

**Question: Wether the gNB-CU-UP could buffer the data from gNB-DU before the resume indication received from CU-CP?**

## When gNB-DU shall be aware of the bearer type of SDT Bearer

This issue is based on the following progress in the last meeting.

*The gNB-DU should be aware the bearer type of SDT Bearer, FFS on any enhancements are needed*

In [6], it observes that if the full UE context is kept in gNB-DU, DU does not necessarily to be aware of the SDT bearer type, and if only the SDT related UE context is kept in gNB-DU, gNB-DU should be aware of the SDT bearer type.

For a FFS on whether to keep other UE context at the gNB-DU, we think that based on to current RAN3 agreement, the gNB-DU has the sufficient information to support the CG-SDT when the UE in RRC\_INACTIVE initiates the CG-SDT. It seems that there is no requirement to keep other UE context at gNB-DU. For a FFS on whether to maintain a full UE context in gNB-DU, the gNB-DU does not need to store the information related to the non-SDT bearer since this information is not used by the UE and gNB-DU during the CG-SDT. For the case where the CG-SDT resource is configured but the UE selects the RA-SDT procedure, the information related to the non-SDT bearer is not used. When the CG-SDT resource is configured but the UE initiates the non-SDT procedure, the gNB-CU initiates the UE Context Setup procedure. Therefore, the gNB-CU can provide the information of all RBs including SDT bearers and non-SDT bearers to the gNB-DU when sending the UE to RRC\_CONNECTED state.

**The gNB-DU only needs to keep SDT related UE context and SDT related F1 connection.**

Then, we shall confirm that which node to decide bearer type of SDT bearer (both CG-SDT and RA-SDT)

**It is the gNB-CU to decide bearer type of both RA-SDT bearer and CG-SDT bearer.**

Based on the above proposal, when network will configure RA-SDT bearer, because the new receiving gNB-DU can be different from the old anchor gNB when UE initiates a SDT procedure, the gNB-DU does not need to be aware of bearer type of RA-SDT bearer.

**The gNB-DU does not need to be aware of bearer type of RA-SDT bearer.**

When gNB-CU configures CG-SDT, it shall inform the gNB-DU by F1AP message. Based on e.g., [1] [4] and [14], there several candidate solutions.

1. If CG-SDT to be configured, the gNB-CU sends UE context modification request message including the list of SDT bearers (DRB and SRB), as well as CG-SDT query information.
2. If CG-SDT to be configured, the gNB-CU sends UE context set up request message including the list of SDT bearers (DRB and SRB), as well as CG-SDT query information.
3. If CG-SDT to be configured, the gNB-CU sends F1AP message (e.g., UE context release command message) including the list of SDT bearers (DRB and SRB), as well as RRCRelease message when UE into RRC\_inactive mode.
4. Considering that that this is not a dynamic characteristics, have an indication in the UE Context Setup Request.
5. If the full UE context is kept in gNB-DU, gNB-DU does not necessarily to be aware of the SDT bearer type

For solution 1/2, it is benefit for gNB-DU to configure CG-SDT resources for this UE, because the gNB-DU can configure suitable CG-SDT resources based on the quantity and quality (e.g., QoS) of the CG-SDT bearers to be configured. However, the gNB-CU shall additionally add a new IE (e.g., CG-SDT configuration indicator) to gNB-DU via UE context release command message when UE into RRC\_Inactive.

For solution 3, it is benefit for gNB-CU to inform this message directly then the additional IE used in method 1 is not needed. However, the gNB-DU has to blindly configure CG-SDT resources when receiving “CG-SDT query indicator” from gNB-CU.

**The gNB-DU should be aware the bearer type of SDT Bearer which includes SDT DRB identity list and/or SRB**

**Question 3: Do companies agree with the following proposals?**

**Proposal 1: It is the gNB-CU to decide bearer type of both RA-SDT bearer and CG-SDT bearer.**

**Proposal 2: The gNB-DU only needs to keep SDT related UE context and SDT related F1 connection.**

**Proposal 3: The gNB-DU does not need to be aware of bearer type of RA-SDT bearer.**

**Proposal 4: The gNB-DU needs to be aware of bearer type of CG-SDT bearer**

**Proposal 5: CG-SDT bearer includes SDT DRB identity list and/or SRB**

**Proposal 6: If CG-SDT bearer to be configured, the gNB-DU should be aware the bearer type of SDT Bearer which includes SDT DRB identity list and SRB if any**

|  |  |  |
| --- | --- | --- |
| **Company** | **P1, P2, …** | **Comment** |
| ZTE | Yes for all Proposals |  |
| Intel Corporation | Yes except P3, P4, P5, P6 | P3: Not sure whether we should distinguish RA-SDT type or CG-SDT type for a DRB, but P4 is true.  For P5/P6, why are considering only the "list"?  We really prefer to configure "SDT" as one type of DRB configuration in the DU context, and add an optional "SDT" indicator per DRB in the *DRB To Be Setup/Modified List* in F1AP UE Context Setup/Modification Request messages to indicate whether a DRB is SDT capable or not. |
| Samsung |  | P1~P2: Agree  P3~P4: according to RAN2 discussion, there are only SDT bearer and non-SDT bearer. In this sense, we do not need to mention RA-SDT bearer and CG-SDT bearer here. For P3, I assume it is referring to gNB-DU of serving gNB side, while P4 is referring to anchor gNB side. In this sense, we suggest the following proposal:  P3: The gNB-DU of anchor gNB side needs to be aware of SDT bearer, while the gNB-DU of serving gNB side needn’t.  P5: some rewording, e.g., “P5: SDT bearer includes SDT DRB and SDT SRB”, which is intuitive. Or, we can delete this proposal.  P6: is this related to RAN2 discussion, i.e., whether CG-SDT resource configuration is generated based on the knowledge of SDT bearers or not? If my understanding is correct, RAN2 didn’t consider the knowledge of SDT bearers when generating CG-SDT resource configuration. In this sense, P6 is not needed or we can change P6 as:  P6: gNB-DU needn’t know the SDT bearers when configuring CG-SDT resource. |
| Huawei | Yes for all Proposals |  |
| Google | Yes for all proposals generally | But for P2 it seems related to answer in Q1 and it may be beneficial to keep also non-SDT context in case CG-SDT is configured. |
| CATT | Yes,but | It seems we should decide firstly whether to keep also the non-SDT context in case CG-SDT. |
| Ericsson | Yes for all |  |
| Lenovo | Yes for all | If p2 is agreed, it would be better to use UE context release procedure to release the non-SDT related UE context in Q1. |
| China Telecom | Yes for all |  |
| Nokia | Yes for all |  |
|  |  |  |
|  |  |  |

**Question 4: If CG-SDT bearer to be configured, when gNB-DU shall be aware of the bearer type SDT Bearer (SDT DRB identity list and SRB)?**

* Solution 1: The gNB-CU sends **UE context modification request** message including SDT Bearers (as well as CG-SDT query information). When UE into RRC\_inactive, it shall additionally add a new IE (e.g., *CG-SDT configuration indicator, CG-SDT Kept Indicator*) to gNB-DU via **UE context release command** message.
* Solution 2: The gNB-CU sends **UE context set up request** message including SDT Bearers, as well as CG-SDT query information
* Solution 3: The gNB-CU sends F1AP message (e.g., **UE context release command message**) including SDT Bearers, as well as RRCRelease message when UE into RRC\_inactive mode.
* Solution 4: Considering that that this is not a dynamic characteristics, the gNB-CU configure "SDT" as one type of DRB configuration in the DU context, and add an optional "SDT" indicator per DRB in the *DRB To Be Setup/Modified List* in F1AP UE Context Setup/Modification Request messages to indicate whether a DRB is SDT capable or not.
* Solution 5: If the full UE context is kept in gNB-DU, DU does not necessarily to be aware of the SDT bearer type
* Solution 6: Other, if any

|  |  |  |
| --- | --- | --- |
| **Company** | **Sol-1, 2, ...** | **Comment** |
| ZTE | Sol 1 | In our view, the gNB-DU shall be aware of CG-SDT bearer list when it is asked to configure suitable CG-SDT resource. On the contrary, without CG-SDT bearer list, it cannot configure suitable CG-SDT when receiving “CG-SDT qurery information” |
| Intel Corporation | Sol 4 |  |
| Samsung | Sol-3 | As mentioned in Q3, RAN2 didn’t assume the knowledge of SDT bearers when configuring CG-SDT resource. So, it may be unnecessary to use sol1 and sol2. |
| Huawei | Sol-1 | It is benefit for gNB-DU to be aware of the SDT bearer list when configuring CG-SDT resources. |
| Google | Sol 3 |  |
| CATT | Sol 1 | gNB-DU has to be aware of the SDT bearers for CG-SDT case, as it need to assign related resources for CG-SDT related bearers. So, just forget the solution 5.  We understand solution 3 here is not a full solution, as it not mentioned how to query and allocate the CG-SDT resources. |
| Ericsson | Sol 1 |  |
| Lenovo | Solution 1 |  |
| China Telecom | Solution 1 |  |
| Nokia | Solution 1 | As per tdoc 1819. |

**Smmary:**

Solution 1: 7 (ZTE, HW, CATT, E///, Leno, CTC, Nokia)

Solution 2: 0

Solution 3: 2 (SS, Google)

Solution 4: 1 (Intel)

**Moderator’s proposal:**

**Majoriry companies think the gNB-DU shall know the SDT bearer information before CG-SDT configuration.**

The gNB-CU configure "SDT" as one type of DRB configuration in the DU context, and add an optional "SDT" indicator per DRB in the DRB To Be Setup/Modified List in F1AP **UE Context Setup/Modification Request** messages to indicate whether a DRB is SDT capable or not

The gNB-CU sends **UE context modification request** message including a new IE (e.g., *CG-SDT query information*)

When UE into RRC\_inactive, it shall additionally add a new IE (e.g., *CG-SDT configuration indicator, CG-SDT Kept Indicator*) to gNB-DU via **UE context release command** message.

## Fallback to RA-SDT or to normal Resume

When CG-SDT is configured but the UE selects RA-SDT or non-SDT procedure, the gNB-CU provides the old gNB-DU F1AP UE ID to the gNB-DU. The gNB-DU retrieves the old CG-SDT resource configuration and old UE context based on the old gNB-DU F1AP UE ID. *FFS on new F1AP UE association or old UE F1AP UE association.*



Figure 1

**Step 2:** The UE will reconnect and the gNB-DU will use a new F1 signaling connection by Initial UL RRC Message Transfer message towards the gNB-CU CP.

**Step 3:** The gNB-CUfind this UE is “old” UE via I-RNTI

**Step 4:** The gNB-CU sends F1AP request message including ***old gNB-DU F1AP UE ID***, by e.g., UE context set up request message.

**Step 5:** The gNB-DU sends F1AP response message.

In Step 4, some papers suggest to reuse the maintained F1-C/F1-U tunnel in case of CG-SDT fall back to RA-SDT or non-SDT at the same gNB. More, [10][11] suggest that the gNB-CU sends the UE CONTEXT MODIFICATION REQUEST message to the gNB-DU using the old F1AP association and provide the newly revived new UE DU F1AP ID as a new optional IE. The gNB-DU associates the new C-RNTI to the UE context, discards the new UE DU F1AP ID and the old C-RNTI.

In Step 5, [4] thinks that it is the gNB-DU to find the old context and the gNB-DU can then report back in the UE Context Setup Response message the stored CG-SDT configuration.

**Question 5: Companies are kindly invited to answar the following questions (options, IEs and solutions)**

Step 4: gNB-CU sends F1AP request message

* Option 1: UE context set up request message

(Note: new F1AP association, then old F1AP association shall be released by CU initiated UE context release command message)

* Option 2: UE context modification request message

(Note: old F1AP association, then no need to set up a new F1 tunnel and release the old F1 tunnel. However, it is new usage of *UE context modification request* after *Initial UL RRC message Transfer*)

* Option 3: Add the CG-SDT configuration into the F1 Initial UL RRC Message Transfer (seen in [4])

This request message shall includes ***old gNB-DU F1AP UE ID.***

* Candidate IE 1: old gNB-DU F1AP UE ID only
* Candidate IE 2: old gNB-CU F1AP UE ID and old gNB-DU F1AP UE ID pair

Step 5: The gNB-DU sends F1AP response message

* Solution 1: The gNB-CU finds the UE context, then gNB-DU does not include CG-SDT resource to gNB-CU via F1AP response message.
* Solution 2: The gNB-DU finds the UE context, then gNB-DU shall include CG-SDT resource to gNB-CU via F1AP response message

|  |  |  |
| --- | --- | --- |
| **Company** | **Option 1/2/3**  **Candidate IE 1/2**  **Solution 1/2** | **Comment** |
| ZTE | Both option 1 and 2  IE 2  Solution 1 | As legacy, after receiving Initial UL RRC Message Transfer message, the CU shall trigger UE context set up procedure. But for this SDT case, it can be enhanced to use UE context modification procedure by using the old F1AP association.  IE2 can provide more information then IE 1  It is gNB-CU to find the UE context, so solution 1 is reasonable. |
| Intel Corporation | Option 2 and see comments | For Option 2, what the UE CTXT MOD REQ should include is the "gNB-DU F1AP UE ID" that was tossed to CU over new F1 due to fallback or non-SDT.  For Step 5, not sure about the intention. As long as the *CG-SDT Query Indication* is included in the UE CTXT MOD REQ msg, the DU will supply CG-SDT configuration. |
| Samsung | Option 1  Candidate IE 1  Solution 1 | In TS38.473, the initial UL RRC message transfer procedure has the following text  “The establishment of the UE-associated logical F1-connection shall be initiated as part of the procedure”  This means that when receiving INITIAL UL RRC MESSAGE TRANSFER message, the new UE-associated logical F1-connection is established. Thus, the new F1-connection should be used for UE, and the old one can be released. In this sense, Option 1 is more aligned with the current design.  For Step 5, we are unclear of the intention to include CG-SDT configuration. |
| Huawei | Option 2  Candidate IE2  For step 5, up to whether CG SDT Query indication is included in step 4. | The maintained F1-C/F1-U tunnel can be reused.  Old gNB-CU F1AP UE ID is mandatory in UE CONTEXT MODIFICATION REQUEST message |
| Google | Option 1  Candidate IE 1  Solution 1 | New F1-connection should be used to follow current design. |
| CATT | Option 1  Candidate IE 1  Solution 1 | Share the view with SS. |
| Ericsson | Option 1&2  Candidate IE 2  Solution 1 | IE2 helps the gNB-CU to successfully retrieve and verify the UE context. |
| Lenovo | Option 1  Candidate IE 1  Solution 1 |  |
| China Telecom | Option 1&2  Candidate IE 2  Solution 1 |  |
| Nokia | Option 1  Candidate IE1  Solution 2 | Please note that we support option 1 in 1819. Option 3 is proposed as an optimization on top: we would have expected a separate question for it. |
|  |  |  |
|  |  |  |

**Smmary:**

* Option 1: 7 (ZTE, SS, Google, CATT, E///, CTC, Nokia)
* Option 2: 5 (ZTE, Intel, HW, E///, CTC)

**Option1 vs Option 2, a slighter majority companies (7:5) prefer to follow legacy design (i.e., option 1) for the initial access.**

* IE1: 5 (SS, Google, CATT, Leno, Nokia)
* IE2: 4 (ZTE, HW, E///, CTC)

**IE1 vs IE2, a slighter majority companies (5:4) prefer to include *old gNB-DU UE F1AP ID***

* Solution 1: 7 (ZTE, SS, Google, CATT, E///, Leno, CTC)
* Solution 2: 1 (Nokia)

**Solution 1 vs Solution 2, majority companies (7:1) prefer to not include CG-SDT configuration in the response message.**

**Moderator’s proposal:**

In case that UE and gNB has configured CG-SDT but the UE decides to initiate RA-SDT or non-SDT procedure.

gNB-DU sends INITIAL UL RRC MESSAGE TRANSFER message to gNB-CU

gNB-CU sends UE CONTEXT SETUP REQUEST message to gNB-DU including ***old gNB-DU UE F1AP ID***

gNB-DU find the stored CG-SDT configuration via ***old gNB-DU UE F1AP ID***

gNB-DU sends UE CONTEXT SETUP RESPONSE message to gNB-CU for confirmation

In the next round or next meeting, whether *old gNB-CU F1AP UE ID* is included in the UE CONTEXT SETUP REQUEST message.

## Whether it is needed to introduce a new Caus value

When the TAT-SDT expires, the gNB-DU initiates the UE Context Release Request procedure (details to be checked, FFS on new cause)

In the current F1AP specification, the appropriate cause value shall be indicated for the UE context release request message, as below.

|  |
| --- |
| *The gNB-DU controlling a UE-associated logical F1-connection initiates the procedure by generating a* ***UE CONTEXT RELEASE REQUEST*** *message towards the affected gNB-CU node.*  *The UE CONTEXT RELEASE REQUEST message shall indicate* ***the appropriate cause value****.* |

In some papers, it states that in order to increase KPI, it is proposed to add a new cause value.

But, in [8], it states that the TAT-SDT is separately maintained by the gNB-DU and the UE. Upon the timer expires, they both release the CG-SDT resource by themselves. No F1 impact is identified and gNB-CU does not have any new actions. Hence, it is unnecessary to introduce a new cause.

**Question 6: Whether it is needed to introduce a new Caus value?**

* Yes. The new Cause value shall be defined as e.g., in [7]

|  |  |
| --- | --- |
| TAT-SDT Expiry | The gNB-DU triggers UE Context Release Request to due TAT-SDT timer expiries. |

* No. No need to introduce a new Cause value

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| ZTE | Yes | New cause value is benefit |
| Intel Corporation | Yes | Cause value is free. |
| Samsung | Yes |  |
| Huawei | No? | New cause is unnecessary since gNB-CU does not have any new actions.  But we are fine with the new cause if majority want it. |
| Google | Yes/No | No strong view |
| CATT | Better to have | With it, it could make the CU knows the detail reason for release. |
| Ericsson |  | No strong view. We should verify first that this is not a corner-case scenario. |
| Lenovo | Yes | There is no other cause value can be used. |
| China teleocm | yes |  |
| Nokia | Yes |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Smmary:**

Yes: 7 (ZTE, Intel, SS, Leno, CTC, Nokia)

Netural: (HW, Google, E///)

No：0

**Moderator’s proposal:**

When the TAT-SDT expires, the gNB-DU initiates the UE Context Release Request procedure, including a new Cause value, as below

|  |  |
| --- | --- |
| TAT-SDT Expiry | The gNB-DU triggers UE Context Release Request to due TAT-SDT timer expiries. |

## Fix current BLCR

**TS 38.401 BLCR**

In [8][11][3], it states that as defined in TS 38.401 section 8.9.6.1, during the RRC Connected to RRC Inactive state transition, the gNB-CU-CP should trigger Bearer Context Modification Request with suspend indication towards the gNB-CU-UP.

**In CG-SDT TS 38.401 BL CR, before triggering step 4 towards the gNB-DU, the gNB-CU-CP should trigger Bearer Context Modification Request with suspend indication towards the gNB-CU-UP.**

In [11], it states that after step 10, the green arrow for UL NAS PDU was drawn to be delivered to 5GC via CU-UP, which is not correct. UL NAS PDU is delivered to AMF directly from CU-CP.

**For CG SDT procedure in 38.401 BLCR, after step 10, fix UL NAS PDU green arrow so that it is forwarded to 5GC directly from CU-CP (not through CU-UP).**

As a result, if an RRC message carrying UL NAS PDU was multiplexed together with RRCResumeRequst, the receiving DU just needs to forward that RRC message to CU-CP via UL RRC MESSAGE TRANSFER, like RRCResumeRequest being forwarded via UL RRC MESSAGE TRANSFER in step 8.

**For CG SDT procedure in 38.401 BLCR, after step 8, add the optional UL RRC MESSAGE TRANSFER procedure to carry an RRC message if multiplexed together with RRCResumeRequest.**

**Question 7: Do companies agree with the following proposals to fix TS38.401 BLCR?**

**Proposal 7: In CG-SDT TS 38.401 BL CR, before triggering step 4 towards the gNB-DU, the gNB-CU-CP should trigger Bearer Context Modification Request with suspend indication towards the gNB-CU-UP.**

**Proposal 8: For CG SDT procedure in 38.401 BLCR, after step 10, fix UL NAS PDU green arrow so that it is forwarded to 5GC directly from CU-CP (not through CU-UP).**

**Proposal 9: For CG SDT procedure in 38.401 BLCR, after step 8, add the optional UL RRC MESSAGE TRANSFER procedure to carry an RRC message if multiplexed together with RRCResumeRequest.**

|  |  |  |
| --- | --- | --- |
| **Company** | **P7, P8, P9** | **Comment** |
| ZTE | Agree with all proposals |  |
| Intel Corporation | All agree | Yes, let's please fix and make the figure pretty. The complete suggestion is described in Section 2.4 of [11]. |
| Samsung | Agree |  |
| Huawei | Agree for P7,8 | For P9, the NAS message should be forwarded to the last serving gNB in case the UE is verified, right? |
| Google | Agree |  |
| CATT | Agree |  |
| Ericsson | Agree, but | Suggest merging also with [3] |
| Lenovo |  | Prefer to check TPs in the second round. |
| China Telecom | agree |  |
| Nokia | Agree all |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Smmary:**

Yes: 7 (ZTE, Intel, SS, Leno, CTC, Nokia)

Netural: (HW, Google, E///)

No：0

**Moderator’s proposal:**

In the second round, for CG SDT procedure, fix 38.401 BLCR including

Before triggering step 4 towards the gNB-DU, the gNB-CU-CP should trigger Bearer Context Modification Request with suspend indication towards the gNB-CU-UP.

After step 10, fix UL NAS PDU green arrow so that it is forwarded to 5GC directly from CU-CP (not through CU-UP).

After step 8, add the optional UL RRC MESSAGE TRANSFER procedure to carry an RRC message if multiplexed together with RRCResumeRequest.

Merge [3], [8] and [11]

**TS 38.473 BLCR**

In some contributions, e.g. [8], it suggest to introduce the new IE.

|  |
| --- |
| **RAN2#115e agreement:**  42. CS-RNTI based dynamic retransmission mechanism can be reused for CG-SDT. FFS whether CS-RNTI is the same one as the one previously configured in RRC\_CONNECTED or a new CS-RNTI one is provided to the UE  **RAN2#116bis-e agreement:**  9. CS-RNTI for CG-SDT is provided to the UE in *RRCRelease* message. |

According to RAN2 agreement, the CS-RNTI is provided to the UE in *RRCRelease* message. If the UE initiates the CG-SDT, the UE needs to monitor PDCCH with CS-RNTI for scheduling the retransmission. Therefore, the gNB-DU needs to store the CS-RNTI for the timely scheduling operation.

**If gNB-CU decides to configure CG-SDT bearer, the gNB-DU shall store the CS-RNTI for CG-SDT.**

In [9], it states that first editor’s note can be resolved based on the agreement “Introduce an *SDT-MACPHY-Config* IE to *DU to CU RRC Information* IE for the gNB-CU to generate the RRC Release message with CG-SDT config” in RAN3 #114bis-e meeting. This agreement is already reflected into the current CG-SDT BLCR to TS 38.473. Therefore, this editor’s note can be removed.

**Remove the editor’s note “FFS on the details of CG-SDT resource configuration” in CG-SDT BL CR to TS 38.473.**

Second editor’s note is related to the gNB-DU awareness of CG-SDT bearers. Based on RAN2 progress and running TS38.331CR, this editor’s note can be also removed, and the CG-SDT configuration shall not be per DRB basis

**Remove the editor’s note “Whether CG-SDT Query Indication IE is per DRB basis or not is FFS” in CG-SDT BL CR to TS 38.473. CG-SDT Query Indication IE is not per DRB basis.**

**Question 8: Do companies agree with the following proposals to fix TS38.473 BLCR?**

**Proposal 10: If gNB-CU decides to configure CG-SDT bearer, the gNB-DU shall store the CS-RNTI for CG-SDT.**

**Proposal 11: Remove the editor’s note “FFS on the details of CG-SDT resource configuration” in CG-SDT BL CR to TS 38.473.**

**Proposal 12: Remove the editor’s note “Whether CG-SDT Query Indication IE is per DRB basis or not is FFS” in CG-SDT BL CR to TS 38.473. CG-SDT Query Indication IE is not per DRB basis.**

|  |  |  |
| --- | --- | --- |
| **Company** | **P10, P11, P12** | **Comment** |
| ZTE | Agree with all proposals | For the proposal 12, this is decided by RAN2. When we check RAN2 38331 running CR, it is per UE not per DRB. |
| Intel Corporation | Seems OK with all. |  |
| Samsung | Agree |  |
| Huawei | Agree with all proposals |  |
| Google | Agree |  |
| CATT | Agree | For P12, just to clarify:  The CG-SDT Query Indication IE is per UE not per DRB. Then to make gNB-DU aware of SDT DRBs to allocate the related CG resources upon receiving of the Query Indication, a separate SDT DRB list will be provided to gNB DU together with the CG-SDT Query Indication IE. Right? |
| Ericsson | OK for all |  |
| China teleocm | Ok for all |  |
| Nokia | Agree all |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Smmary:**

Yes: all companies

No：0

**Moderator’s proposal:**

In the second round, for CG SDT procedure, fix 38.473 BLCR including

The gNB-DU shall store the CS-RNTI for CG-SDT.

Remove the editor’s note “FFS on the details of CG-SDT resource configuration”.

Remove the editor’s note “Whether CG-SDT Query Indication IE is per DRB basis or not is FFS” in CG-SDT BL CR to TS 38.473. CG-SDT Query Indication IE is per UE but not per DRB basis.

# Conclusion, Recommendations [if needed]

# References

1. [R3-221794](C:\\3GPP\\RAN2-117\\TSGR3_115-e\\Inbox\\会议硬盘\\TSGR3_115-e\\Docs\\R3-221794.zip) Discussion on left issues for CG-SDT (ZTE, China Telecom, Ericsson)
2. [R3-221795](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\会议硬盘\TSGR3_115-e\Docs\R3-221795.zip) (TP for CG-SDT BLCR to TS 38.473) Left issue for CG-SDT (ZTE, China Telecom, Ericsson)
3. [R3-221801](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\会议硬盘\TSGR3_115-e\Docs\R3-221801.zip) (TP for CG-SDT BL CR to TS 38.401) Procedures for F1 CG-SDT procedures(Ericsson, ZTE, China Telecom)
4. [R3-221818](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\会议硬盘\TSGR3_115-e\Docs\R3-221818.zip) (TP for TS 38.401) Conclusions on CG-based SDT (Nokia, Nokia Shanghai Bell)
5. [R3-221819](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\会议硬盘\TSGR3_115-e\Docs\R3-221819.zip) (TP for TS 38.473) Conclusions on CG-based SDT (Nokia, Nokia Shanghai Bell)
6. [R3-221897](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\会议硬盘\TSGR3_115-e\Docs\R3-221897.zip) (TP for SDT BL CRs) On CG based SDT (CATT)
7. [R3-221996](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\会议硬盘\TSGR3_115-e\Docs\R3-221996.zip) (TP to CG-SDT TS 38.473 BL CR) New Cause in the UE Context Release Request message (Lenovo, Motorola Mobility)
8. [R3-222172](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\会议硬盘\TSGR3_115-e\Docs\R3-222172.zip) (TP to CG-SDT BL CR of TS 38.401) Leftover issues on CG-SDT (Huawei)
9. [R3-222239](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\会议硬盘\TSGR3_115-e\Docs\R3-222239.zip) (TP for CG-SDT BL CR to TS 38.473) Support of CG-SDT in F1 (LG Electronics)
10. [R3-222318](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\会议硬盘\TSGR3_115-e\Docs\R3-222318.zip) (TP to CG-SDT BL CR of TS38.473) Discussion on CG-based small data transmission (Samsung)
11. [R3-222354](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\会议硬盘\TSGR3_115-e\Docs\R3-222354.zip) (TP for CG-SDT BL CR for TS 38.401/473/470) Toward the completion of CG-SDT (Intel Corporation)

Note: The following three papers are moved into 24.4, to discuss E1AP issue.

1. [R3-222050](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\会议硬盘\TSGR3_115-e\Docs\R3-222050.zip) Discussion on remaining issues on E1 impact on SDT (China Telecom Corporation Ltd.)
2. [R3-222051](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\会议硬盘\TSGR3_115-e\Docs\R3-222051.zip) TP to TS38.463 on the support of SDT in E1 interface (China Telecom Corporation Ltd.)
3. [R3-222240](file:///C:\3GPP\RAN2-117\TSGR3_115-e\Inbox\会议硬盘\TSGR3_115-e\Docs\R3-222240.zip) (TP for RA-SDT BL CR to TS 38.463) Support of SDT in E1 (LG Electronics)