3GPP TSG-RAN WG3 #117-e R3-225031

Online, 15th -24th August, 2022

Agenda Item: 13.3

Source: Huawei (moderator)

Title: Summary of CB: # IAB3\_MobEnh

Document for: Approval

# Introduction

This paper is for the following offline discussion:

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| **CB: # IAB3\_MobEnh****- Discussions on support for legacy UEs****- Discussion on procedures for group mobility****- Discussion on RACH-less access for UEs served by the mobile IAB** **- Discussion on mobile IAB node capabilities exchange with other nodes****- Discussion on pre-storing F1AP and BAPAP configurations to facilitate mobility****- Discussion on user location information reported while a UE is connected to a mobile IAB node**(HW - moderator)Summary of offline disc [R3-225031](file:///C%3A%5CUsers%5Cs00539476%5CAppData%5CLocal%5CTemp%5CRar%24DIa11268.17365%5CInbox%5CR3-225031.zip) |

The following papers will be covered as assigned by the chair:

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| [R3-224233](file:///D%3A%5CRAN3%5CRAN3-117e%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224233.zip) | Handling legacy UE in UAM using Mobile-IAB (KT Corp., LG Uplus, SK Telecom, ETRI) | discussion |
| [R3-224355](file:///D%3A%5CRAN3%5CRAN3-117e%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224355.zip) | Discussion on group mobility for mobile IAB and Ues (Huawei) | discussion |
| [R3-224356](file:///D%3A%5CRAN3%5CRAN3-117e%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224356.zip) | Discussion on RACH optimization for connected UE of mobile IAB (Huawei) | discussion |
| [R3-224378](file:///D%3A%5CRAN3%5CRAN3-117e%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224378.zip) | Discussion on mobility enhancements (Nokia, Nokia Shanghai Bell) | discussion |
| [R3-224430](file:///D%3A%5CRAN3%5CRAN3-117e%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224430.zip) | Mobility enhancements for mobile IAB-node and its served UE (Lenovo) | discussion |
| [R3-224431](file:///D%3A%5CRAN3%5CRAN3-117e%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224431.zip) | (TP to TS 38.401) Support for group mobility of mobile IAB-node. (Lenovo) | other |
| [R3-224497](file:///D%3A%5CRAN3%5CRAN3-117e%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224497.zip) | Enhancements for IAB-Node Mobility IAB (Ericsson) | discussion |
| [R3-224505](file:///D%3A%5CRAN3%5CRAN3-117e%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224505.zip) | Enhancements for mobility of IAB-node and its served UEs (Qualcomm Inc.) | discussion |
| [R3-224706](file:///D%3A%5CRAN3%5CRAN3-117e%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224706.zip) | Update of location information for cells of mobile IAB (Fujitsu) | discussion |
| [R3-224712](file:///D%3A%5CRAN3%5CRAN3-117e%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224712.zip) | Reduction of UE migration in mobile IAB scenario (ZTE) | discussion |
| [R3-224713](file:///D%3A%5CRAN3%5CRAN3-117e%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224713.zip) | Discussion on location update of UEs served by mobile IAB (ZTE) | discussion |
| [R3-224768](file:///D%3A%5CRAN3%5CRAN3-117e%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224768.zip) | Discussion on group mobility (Xiaomi) | discussion |
| [R3-224827](file:///D%3A%5CRAN3%5CRAN3-117e%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224827.zip) | Discussion on mobility enhancements (samsung) | discussion |

Please give your feedback before Thursday, 18 August, 2022, 23:59 UTC. This is to allow we can discuss the summary for this CB in the mobile IAB online session in Monday 22 August, 2022.

# For the Chairman’s Notes

To capture the following proposal as agreements

[To be added]

# Discussion

## Enhancement for Signaling reduction and service reduction

The contributions belong to this CB has raised various aspects for signaling reduction, based on the moderator’s understanding, the different solutions are grouped into four categories: group handover, context sharing between logical DUs, skip RACH for UEs, pre-storing configuration for mobile IAB.

### Group handover.

Considering that the target CU should consider the traffic load of the migrating IAB-DU’s served UEs to make the admission control decision. Moreover, when the target CU performs F1AP configuration in the target path, and it will be beneficial if the target CU has knowledge of all the UE’s traffic to be switched to its topology, otherwise, multiple F1AP signallings should be used if the target CU only configure target path for one UE’s traffic at one time. In [[R3-224355](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224355.zip) HW], it is proposed to support the group/combined HO at least for all connected UEs of a mobile IAB, and discuss whether to support the combined HO for mobile IAB-MT and the connected UEs.

Similarly, [[R3-224430](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224430.zip) Len] propose to define a group-based Handover Request and Handover Request Acknowledge in Xn interface for IAB-MT and all related served UEs, as well as a new non-UE associated F1AP procedure for group-based UE context setup of all served UE of mobile IAB-node.

From the aspect of signaling reduction and admission control at the target donor CU, [R3-224497 E///] also propose to discuss signalling for group handover of UEs served by an mIAB-node, where handover information pertaining to multiple UEs may be included in one message.

[R3-224768 Xiaomi] also propose some phases for group mobility, includes: group handover preparation phase, group handover execution phase, group path switch phase, and group context release.

[R3-224505 QC] mentions that group mobility enhancements refer to the bundling of UE-specific information for a group of UEs into a common message, and propose that group mobility enhancements should be considered after progress has been made with the baseline procedures.

Based on the common part of these papers, the moderator tries to give the following proposal,

**Proposal 1: For group mobility enhancement, RAN3 discuss how to support the bundling of UE information for UEs connected to the mobile IAB.**

Companies are invited to provide feedback on the following questions.

**Q1-1: Do you agree the proposal 1?**

**Q1-2: Do you think the combined HO for mobile IAB-MT and the connected UEs is necessary for the group mobility enhancement?**

**Q1-3: If you agree P1, do you think the following phases should be considered when design group based signaling: group handover preparation phase, group handover execution phase, group path switch phase, and group context release.**

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| **Company** | **Yes/No** | **Reasons/Comments** |
| LG Uplus | Q1-1) Yes | We think group mobility feature is essential part. Handling the information of UEs between IAB-MT and donor-CU seems most critical to us. |
| Q1-2) No | If combined HO means simultaneous IAB-MT and UEs HO, it seems too risky to us. |
| Q1-3) Yes | 4-step phase would be fine as a baseline. Group handover execution phase might need to be refined. |
| **Ericsson** | **Q1-1) Yes, but see comment****Q1-2) No****Q1-3) Yes** | **Q1-1)** Provided that “bundling” means sending, within one message, information pertaining to multiple UEs.**Q1-2)** The **mDU and mMT handovers should be decoupled,** as we explained in R3-224496. |
| **Huawei** | Q1-1 YesQ1-2 Yes for full migrationQ1-3 Yes | Q1-2: If full migration is performed, we see the benefits of the combined handover for the IAB-MT and UEs, for the admission control in target donor CU, and the signalling reduction for configuring the target path. |
| **Qualcomm** | Q1-1 YesQ1-2 NoQ1-3: Yes to HO prep, path switch, context release.  | Q1-2: We already discussed full migration in Rel-17. In this discussion, we assumed that DU change was preceded by MT migration. Q1-3: Group handover for RRC-related signaling is in RAN2 scope. |
| Lenovo | Q1-1: YesQ1-2: YesQ1-3: see comments | For Q1-3, for handover execution phase and context release phase, separate procedures are needed for MT and UEs. |
| **Nokia** | Q1-1: NoQ1-2: NoQ1-3: No | **Please clarify what can be saved by bundling of UE information. This is different to the “group” signaling introduced in previous release that other information for the UEs are not changed, and only need to change the TNL address that is common for UEs. In this case, there are “Many” context are specific for each UE, e.g. handover request message. What can be saved by the bundling?** |
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###  Context sharing between two logical DUs .

[[R3-224378](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_117-e%5CDocs%5CR3-224378.zip) Nok] mentioned that the co-located source DU and target DU can share the UE context/configuration considering they are co-located, and this can reduce signaling.

[R3-224827 SS] also propose: In order to decrease signaling overhead caused by UE context migration, some low layer configurations can be shared between two logical DUs which are in the same entity.

We can see the common part for the two papers is that some configuration/UE context can be shared between two logical DUs inside a same mobile IAB-node, and this is beneficial for signaling reduction. And the moderator try to give the following proposal:

**Proposal 2: In case of full migration, RAN3 discuss the optimization for signaling reduction that allow some configuration/UE context be shared between two logical DUs in the mobile IAB-node**

Companies are invited to provide feedback on the following question:

**Q2: Do you agree Proposal 2?**

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| **Company** | **Agree/Disagree** | **Reasons/Comments** |
| LG Uplus | Neutral | Not so critical to us |
| **Ericsson** | **Not sure** | Shouldn’t the donor CUs always be involved in the coordination? |
| Huawei | Agree | If some context/configuration can be shared between the two logical DUs, it will be beneficial for less signalling overhead and service interruption reduction. |
| Qualcomm | Yes | RAN3 may consider optimizations along these lines. The proposal is sufficiently high level. Discussion on this topic should certainly be allowed. |
| Lenovo | Yes | Because the air interface between UEs and mobile IAB-node doesn’t change during the full migration, the lower layer configuration can be shared between two logical IAB-DUs. |
| Nokia | Yes | Agree with QC |
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###  Skip RACH for served UEs

[R3-224430 Len] indicates that the timing advance for the served UEs of the mobile IAB-node can be shared between the two logical DUs which are co-located at the same mobile IAB-node, so the served UEs of the mobile IAB-node can perform HO without RACH, during full migration. [R3-224356 HW] just gives similar proposal. The HO without RACH can reduce signaling and avoid RACH collision among UEs connected to the mobile IAB-node. The moderator would like to propose the following:

**Proposal 3:** **The served UE of mobile IAB-node may perform handover without RACH during inter-donor full migration together with the mobile IAB-node. More details about how to skip RACH for these UEs should involve RAN2.**

 Companies are invited to provide feedback on the following question:

**Q3: Do you agree Proposal 3?**

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| **Company** | **Agree/Disagree** | **Reasons/Comments** |
| LG Uplus | Neutral | Not so critical to us |
| **Ericsson** | **This is entirely a RAN2 issue** |  |
| Huawei | Agree | The UE HO skip RACH should be discussed in RAN2.  |
| Qualcomm | Disagree | We are not principally opposed but this topic is in RAN2 scope.In this context, RAN3 should agree that UE needs to perform security change during full migration. This needs to be taken into account by RAN2 when discussing the RACH-less HO issue. We therefore propose:**Proposal 3:** **The served UEs of the mobile IAB-node to perform security change as part of the HO between logical DUs.** |
| Lenovo | Yes | Served UEs can perform HO with RACH as baseline, and HO without RACH can be studied as an enhancement. |
| Nokia | No | This should be discussed in RAN2. |
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###  pre-storing the F1 and BAP configurations at the mobile IAB-node

[R3-224497 E///] pointed out that in some typical scenarios that the mIAB-nodes mounted onboard public transport vehicles, such as city buses and trains, the routes of public transport vehicles are usually predetermined and known in advance. For such scenario, the paper propose to consider the pre-storing the F1 and BAP configurations at the mIAB-node before the mIAB-node reaches connects to the area where these settings are to be applied. These configurations can be activated once the mIAB-MT connects to the corresponding cell.

The moderator try to give the following proposal based on the paper:

**Proposal 4: RAN3 investigate whether to allow pre-storing the F1 and BAP configurations at the mobile IAB-node.**

Companies are invited to provide feedback on the following question:

**Q3: Do you agree Proposal 4?**

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| **Company** | **Agree/Disagree** | **Reasons/Comments** |
| LG Uplus | Agree | As the first step, public transport usage scenario is preferred and route information seems useful for mobility parameter optimization. |
| **Ericsson** | **Agree** | Although we only discussed the scenario with known trajectory in the paper, in fact, **the pre-storing is needed even in random trajectory scenarios**, where multiple candidate configurations can be stored, and the one to be activated depends on where the mIAB moves. |
| Huawei | Agree but with some comments | 1) It is more applicable to the scenario that the trajectory is predetermined for the mobile IAB-node. 2) BAP configuration should be RAN2 scope. 3) Which configurations are suitable to be pre-stored? This needs further discussion. |
| Qualcomm | Agree | This is a good idea and needs further discussion. RAN3 should take the lead on this discussion, and if anything can be identified related to BAP, they should liaise RAN2. Agree with Huawei’s point 3): Identify which configurations are suitable to be pre-stored. |
| Lenovo | Agree, but | Pre-storing F1 and BAP configuration is beneficial especially for the scenario with known trajectory. This can be discussed after design for full migration procedure. In case of the second logical DU setups F1 with target CU in advance, the mobile IAB-node can also obtain the F1 and BAP configuration before MT migration. |
| Nokia | Agree with comments | Agree with HW. It is better to first discuss what the “configuration” is. |
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## Mobile IAB indication

[R3-224430 Len] has the two following proposals on introducing mobile attribute in air interface, and Xn interface:

* *Mobile IAB-node informs IAB-donor-CU with its mobile attribute during integration or after integration.*
* *Mobile attribute of mobile IAB-node needs to be exchanged between source IAB-donor and target IAB-donor via XnAP during inter-donor migration procedure.*
* *Mobile IAB-node broadcasts its mobile attribute to UEs, e.g., via SIB1.*

Besides, this paper also proposes RAN3/2 to discuss whether to differentiate onboard UEs and surrounding UEs for mobile IAB-node.

[R3-224505] proposes that to allow for mobile-IAB-specific optimizations, the IAB-DU to indicate if a cell aims to cover onboard users. This is similar to the [4430 Len]’s third proposal as pasted above.

Based on the moderator’s view, we may need to clarify the motivation before determine to introduce the mobile attribute informed from mobile IAB-node to the IAB-donor-CU, and in Xn interface during inter-donor migration. Moreover, the broadcast of mobile attributes to UEs aims at optimization for the on-board UEs, but it is RAN2 territory. In RAN3, we can first clarify that whether and how to differentiate the on-board UEs and surrounding UEs, if this is not possible, the broadcast of mobile attribute in the air interface seems not necessary.

Companies are invited to provide feedback on the following questions.

**Q5-1: Do you think the mobile IAB-node indication need to be send from the mobile IAB node to the IAB-donor CU during the integration or after integration?**

**Q5-2: Do you think the mobile IAB-node indication need to be exchanged between source IAB-donor and target IAB-donor via XnAP during inter-donor migration procedure.**

**Q5-3: Do you think the network and/or the UE itself needs to know whether the UE is an on-board UE or a surrounding UE?**

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| **Company** | **Answer** | **Reasons/Comments** |
| LG Uplus | Q5-1) Yes | Mobile IAB should be distinguished from Fixed IAB since lots of mobility features are different. Seems essential. |
| Q5-2) Yes | Similar reasoning as the response of Q5-1) |
| Q5-3) Yes (only for network) | It could be useful for preventing cell reselection of normal cell (which means non-mobile-IAB cell) by on-board UE. However, we prefer transparent solution to UE since we consider legacy UE service (legacy UE means Rel-15/16/17 UE) |
| **Ericsson** | **Q5-1) Yes, during the integration****Q5-2) Yes****Q5-3) No** | **Q5-3)** The motivation for the proposal is to prevent surrounding UEs to migrate together with the mIAB. This is an enhancement targeting surrounding UEs, which has be precluded in the WID. |
| Huawei | Q5-1) not sureQ5-2) not sureQ5-3) No | For Q5-1 and Q5-2, More clarification about the motivation for introducing the mobile IAB-node indication to the IAB-donor during the integration procedure, and the Xn handover preparation procedure are expected. Proponents please explain why the current IAB-node indication in message 5 and the Xn HO REQUEST message is not enough.For Q5-3: Agree with Ericsson. |
| Qualcomm | Q5-1) YesQ5-2) YesQ5-3) Yes (only for network and only if info is available) | Motivation for 5-1 and 5-2: The CU needs to have this information so that it won’t use the mobile IAB-node as a parent node during IAB-node migration. It may also use it for smart UE HO decisions.5-3: If the mobile IAB-node has information related to onboard coverage, e.g., cell X targets onboard UEs while cell Y doesn’t, it should disclose this information with the CU. This allows the CU to make smarter HO decisions.  |
| Lenovo | Q5-1: YesQ5-2: YesQ5-3: Yes | For 5-1 and 5-2, mobile IAB-node can support full migration while fixed IAB-node doesn’t support full migration, it’s necessary for the serving donor and target to be aware of the mobile attribute. And we also agree with QC’s motivation.For 5-3: Agree with LGU and QC. In addition, it’s not an optimal choice for the surrounding UEs to migrate together with the mobile IAB-node. It’s necessary to differentiate onboard UE and surrounding UE at least for the network. |
| Nokia | Q5-1) not sureQ5-2) not sureQ5-3) yes with comments | Q5-1: if it is via RRC, it should be discussed in RAN2.Q5-2: If it is a mobile IAB authorized indication, then it should be transferred to target. Otherwise, why is it needed?Q5-3: this is beneficial, but should this be discussed in other WGs? For example, it may be in RAN2 (UE send an indication to CU?), or SA2 (CN/application server for train/ticket know when a UE board/leave the train, then send it to CU?) |
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## UE location related issue

### TAC/NCGI/RANAC

[R3-224505 QC], [R3-224706 Fujitsu], [R3-224713 ZTE] and [R3-224357 HW] discuss the location information for mobile IAB cells.

[R3-224706 Fujitsu] proposes that the TAC/NCGI broadcasted in the system information of the mobile IAB cell should be changed based on the location of the mobile IAB-MT.

[R3-224505 QC] proposes 3 options for the UE location reported to the AMF. [R3-224713 ZTE] also provides several solutions for the TAC and RANAC configured for the mobile IAB cell. Generally, the solutions can be categorized into two sets:

Set 1: Dynamic TAC/RANAC/NCGI for the mobile IAB cell to indicate physical location when it moves.

Set 2: Dedicated TAC/RANAC/NCGI for the mobile IAB cell.

Considering that the ongoing VMR SI in SA2 also includes the TAC/NCGI issue, [R3-224357 HW] suggest the TAC issue should wait SA2 progress and discuss RAN impact if necessary.

Companies are invited to provide feedback on the following question about the location information.

**Q6: Which option do you prefer for the issue of location information of the mobile IAB?**

* **Option 1: Dynamic TAC/RANAC/NCGI for the mobile IAB cell to indicate physical location** **when it moves.**
* **Option 2: Dedicated TAC/RANAC/NCGI for the mobile IAB cell, not change when it moves.**
* **Option 3: RAN wait for SA2 progress**

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| **Company** | **Answer** | **Reasons/Comments** |
| LG Uplus | Option 3 | We slightly prefer option 1 in order to diminish complexity. However, SA2’s checking is required. |
| **Ericsson** | **Option 3** |  |
| Huawei | Option 3 | Generally, we think the location information should link to the physical location. but suggest to wait for SA2’s output since this has big impact on CN. |
| **Qualcomm** | All options | Option 1 should be supported as the baseline. SA2 currently discusses Option 2 and will bring it to RAN, which ends up being Option 3.In any case, RAN3 needs to address this issue even if SA2 did not bring it to RAN3’s attention. For these reasons, RAN3 should start the discussion to make best use of the TUs available. |
| Lenovo | Option 3 |  |
| **Nokia** | **Option 3** |  |
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## WID modification for support UAM use cases with mobile IAB

[R3-224233 KT, LG U+ etc.] proposes to revise Mobile-IAB WID to support UAV features for UAM services, considering some legacy UEs may connect to the mobile IAB-node deployed in the UAV, the following two bullets are proposed to be added in the objective of the mobile-IAB WID:

*• The MT of IAB-node equipped with UAV features [RAN2]*

*• As for UAM use case, define procedures for the DU of IAB-node to provide flying state information of a UE riding the aerial vehicle. [RAN3]*

Companies are invited to provide your view on the above modification to WID

**Q7: Do you agree to add the following two bullets in the objective of the mobile IAB WID to support UAV** **features for UAM services?**

*• The MT of IAB-node equipped with UAV features [RAN2]*

*• As for UAM use case, define procedures for the DU of IAB-node to provide flying state information of a UE riding the aerial vehicle. [RAN3]*

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| **Company** | **Answer** | **Reasons/Comments** |
| LG Uplus | Yes | In Korea, UAM service is launched in the 2nd half of 24, which is aligned with Rel-18 commercialization timeline. As mentioned in our contribution, mobile IAB is essential to support Rel-15/16/17 UEs riding in aerial vehicle.For this, we expect that the work load is very light but should be in scope. |
| **Ericsson** | **Should this be handled at RAN Plenary level?** |  |
| Huawei | See comment | We understand the motivation, but the change of WID thing should be discussed in RAN plenary.  |
| Qualcomm | See comment | This needs to be discussed in RAN Plenary. Proponents should submit contributions on this topic to TSG RAN#97. It would be helpful if these contributions would also discuss the implications, i.e., which additional functionality would have to be supported by mIAB. The better the understanding on the scope of this functionality the more likely it will be adopted. |
| Lenovo |  | It can be discussed in RAN plenary firstly. |
| Nokia |  | Agree with the motivation, but modifying WID should be discussed in RAN plenary. |
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