3GPP TSG-RAN WG3 #125bis R3-24xxxxx

Hefei, China, 15th – 19th October, 2024

Agenda Item: 12.2

Source: NTTDOCOMO (moderator)

Title: Summary of Offline Discussion on additional topological enhancement

Document for: Approval

# Introduction

This document provides a summary of the offline discussion on additional topological enhancements.

# Discussion

## WAB

### General

**Proposal 1.1: In compliance with the WID and TR 38.799, WAB to meet the following assumptions:**

**- The WAB-gNB is based on the gNB functionality specified in TS 38.300 [4] and TS 38.401 [3].**

**- The WAB-MT supports at least a subset of UE functionalities.**

**- The NR Uu is used for the radio link between WAB-gNB and the served UEs.**

**- The NR Uu radio link between the WAB-gNB and the served UEs does not use NTN.**

**- WAB does not support the scenario where the access and the backhaul are in-band while the backhaul uses NTN.**

**- A WAB-gNB should not serve WAB-MT(s).**

**- The WAB-gNB and the WAB-MT may connect to the same PLMN or to different PLMNs.**

**- The WAB-MT may connect to a public PLMN or an SNPN.**

**- The WAB-gNB may connect to a public PLMN or an SNPN.**

**- split gNB functionality for WAB gNB is out of scope.**

**Proposal 1.2: The above assumptions for WAB to be captured on stage-2 spec. FFS on which spec.**

**Proposal 1: RAN3 to capture the following in the stage2 spec based on TR 38.799. FFS on which spec.**

**- The definitions and terminology**

**- architecture and protocol stack for WAB.**

**- WAB-node integration procedure.**

**- Configuration of WAB-gNB**

### Multiple hop prevention

**FFS on the following RAN-based solutions can avoid multi-hop WAB and address SA2’s issues:**

**Solution 1: The WAB-gNB uses dedicated frequencies and/or PCIs. FFS on any other legacy OTA parameters.**

**Solution 2: Use the slice for backhauling i.e. use the S-NSSAIs in RRCsetupcomplete to do access control.**

**Solution 3: WAB-gNB-cells broadcast a new indicator in SIB to bar WAB-MT, and the WAB-MT avoids (re)selection of cells broadcasting this indicator.**

**Solution4: BH-gNB broadcast a new indicator “WAB allowed”in SIB. WAB-gNB does not broadcast “WAB allowed”.**

### Additional ULI

The MWAB-gNB provides to the AMF an Additional ULI. The Additional ULI is:

- TAC/Cell ID of the cell serving the MWAB-UE if the PLMN serving the MWAB-UE and the PLMN broadcasted by the MWAB-gNB are the same PLMN.

- If the PLMN serving the MWAB-UE and the PLMN broadcasted by the MWAB-gNB are not the same PLMN, which below option used for the Additional ULI will be determined in normative phase.

- option 1: mapped TAC/Cell ID based on geo-location of the MWAB based on input from OAM.

- option 2: geo-location of the MWAB.

- option 3: TAC/Cell ID of the cell serving the MWAB-UE in other PLMN.

- The AMF may provide the received Additional ULI to LMF in LCS request.

**RAN3 needs to understand that sending Additional ULI is used for other purposes other than positioning.**

**For inter PLMN positioning, sending additional ULI does not make sense.**

**Ask SA2 to clarify the usage of sending additional ULI.**

**Send reply LS to SA2 on issue2.**

### Access control during HO

**Option 1: via explicit indication.**

**Option 2: via UE capability. (RAN2 impact)**

**Proposal 9: In case of handover for a WAB-node, the WAB-node indication is included in the HO request, then the target BH-RAN node can perform access control for this WAB-node. RAN3 to discuss whether to introduce a new explicit indicator or use a special S-NSSAI value as the indicator.**

**Proposal 5-3: Target WAB-gNB of a handover sees slices deployed for WAB-MTs in the WAB-MT’s handover request, and rejects the handover to avoid multi-hop in Xn/NG handovers.**

### NG interface

**Proposal 1-1: The NG connection(s) of a WAB-gNB can be removed upon WAB-node mobility, or when the authorization status of the WAB-gNB becomes “not authorized”.**

**Proposal 1-2: The NG connection(s) of a WAB-gNB can be suspended.**

**Proposal 1-3: Introduce a “WAB-gNB” indication in the NG SETUP REQUEST message.**

**Proposal 1-4: Introduce a cause value indicating the reason for NG connection removal.**

**Proposal 8-1: Whether to introduce NG suspension procedure can wait for NTN's conclusion.**

**Proposal 6: If the backhaul is NTN link, the UE’s CN should know the BH link type is NTN.**

### WAB authorization

**Proposal 3.1: RAN3 to wait for SA2 on the definition for the WAB-node authorization procedure.**

**Proposal 2: When the authorization status of a WAB-gNB changes from “authorized” to “not authorized”:**

* **The WAB-gNB node attempts to hand over and/or release the UEs.**
* **The NG and Xn connections of the WAB-gNB are removed or suspended.**
* **Optionally, some or all PDU sessions of the WAB-MT may be released, and the WAB-MT may be de-registered from the network.**

**Proposal 3.3: In case the WAB-gNB authorization status changes from “not authorized” to “authorized”, the WAB-gNB to reinstate NG and the operation of the WAB-gNB’s air interface.**

**Proposal 3.4: The above agreements to be captured on stage 2.**

### Mobility

**Proposal 3: Support only the two-logical-gNB solution for UE’s AMF change.**

1. RAN3 send LS to SA2 to confirm the feasibility of the option B1, i.e., Single WAB-gNB with a single cell using mobility registration update due to TAC change.

**Proposal 7: Capture the two logical gNB solution and Option 2 for single gNB solution in stage-2 spec.**

Option 1: Single WAB-gNB with a single cell using mobility registration update due to TAC change.

Option 2: Single WAB-gNB with two cells with different TACs, using NG-based HO.

Option 3: Single WAB-gNB single cell without TAC change.

### Xn interface

**Proposal 4-1: The WAB-gNB includes an ID of the co-located WAB-MT in the XN SETUP REQUEST or in the NG-RAN CONFIGURATION UPDATE message sent to the BH-gNB.**

**Proposal 4-2: The WAB-gNB should be aware of whether the BH link for the WAB-MT is TN or NTN.**

**Proposal 4-3: Xn connection between WAB-gNBs can be established.**

**Proposal 4-4: Specify a cause value to be used in the XN SETUP FAILURE message, for the case when the sending node does not allow setting up Xn with other WAB-gNBs.**

**Proposal 4-5: The WAB-gNB should be notified about the target BH-gNB for the WAB-MT HO.**

**Proposal 4-6: Introduce a cause value indicating the reason for Xn removal.**

**Proposal 4-7: Specify a cause value indicating that the cause of Xn removal failure is WAB-MT HO failure or HO cancellation.**

**Proposal 2: The BH-gNB can provides the TNL information of neighbour gNBs to the WAB node.**

**Proposal 5-3: WAB-gNB can also use the neighboring cell information received from the BH-gNB to update its NCRT or initiate the Xn-C TNL address discovery procedure towards the neighboring gNB for further TNL/Xn Setup with the neighboring gNB, without waiting for the measurement report from UE (or WAB-MT).**

**Proposal 5.1: For avoiding Xn establishment between WAB-gNBs, the following two options to be considered:**

**Option 1: The WAB-gNB rejects Xn Setup Requests based on WAB-specific frequency or PCI range in the served cell information.**

**Option 2: The WAB-gNB rejects Xn Setup Request based on a “WAB” indicator in the served cell information.**

**Proposal 5.2: In case RAN3 agrees to PCI partitioning as the solution to PCI collision avoidance, the same solution to be used for avoidance of Xn establishment between WAB-gNBs.**

### PCI configuration and collision avoidance

**Proposal 4: PCI configuration and PCI collision avoidance to follow the same procedure as defined for mobile IAB in TS 38.401, clause 7.8.**

### Resource coordination

**Proposal 5-1: For in-band backhauling in non-roaming scenarios, introduce a new XnAP procedure for the WAB-gNB and the BH-gNB to coordinate the resources of a WAB-gNB and its co-located WAB-MT.**

**Proposal 5-2: RAN3 assumes out-of-band backhauling when the WAB-gNB and the WAB-MT are served by different PLMNs.**

**Proposal 5-3: For in-band backhauling, discuss which parts of XnAP IEs defined in clauses 9.2.2.94-97 of TS 38.423 should be used in the procedure for WAB resource coordination.**

### Handling of WAB-gNB’s traffic during WAB-node mobility

During the mobility of WAB node, there is no impact on the the WAB-gNB’s traffic during WAB-node mobility if a tunnel carried via BH PDU session is used to protect the WAB-gNB’s traffic.

If the WAB-gNB’s traffic reuse the WAB-MT’s IP address, the WAB-gNB’s traffic should be redirected to the new IP address using legacy procedures when the WAB-MT’s IP address is updated during mobility.

### Others

**Proposal 3-1: BH-gNB can indicate to the WAB-gNB that specific BH resources cannot be maintained.**

**Proposal 3-2: BH-gNB is aware which slices/PDU sessions are associated with specific resources at the WAB-gNB and may use this information to determine whether a target BH-gNB is able to maintain BH resources for the WAB-gNB.**

**Proposal 1: it is concluded that WAB-MT need to support all RRC States and all SRBs.**

**Proposal 2: the behaviour of WAB-gNB in Idle and inactive state of WAB-MT need to be discussed in RAN2.**

## 5G Femto

### General

To have NG-U concentrator optionally.

ForR3-245324, the following change are agreed.

Add note that security GW and NR femto management system are out of RAN3 scope.

Remove “The NR Femto GW shall connect to the 5GC in a way that inbound and outbound mobility to cells served by the NR Femto GW shall not necessarily require inter AMF handovers.”

replace “based on implementation, transport of NG-U between NR Femto and 5GC may be optionally concentrated in NR Femto GW” “.The NG-U interface from the NR Femto may be terminated at the NR Femto GW, or a direct logical U-Plane connection between NR Femto and UPF may be used (as shown in Figure 4.x.1-1).”

remove “Figure 4.X.1-2: Overall NG-RAN Architecture with deployed NR Femto GW.”

Remove Figure 4.x.3.1-1: User plane for NG-U interface for NR Femto without NR Femto GW

Remove Figure 4.x.3.1-2: User plane for NG-U interface for NR Femto with NR Femto GW

Modify “access layer” in Figure 4.X.3.2-1: Control plane for NG-C Interface for NR Femto to AMF without the NR Femto GW

For protocol stack, control plane is ok. For user plane, add editorial note: description FFS.

Remove “When present (Fig. 4.X.3.1-2), the NR Femto GW shall terminate the non-UE-dedicated procedures – both with the NR Femto, and with the AMF. The NR Femto GW relays Control Plane data between the NR Femto and the AMF. The scope of any protocol function associated to a non-UE-dedicated procedure shall be between NR Femto and NR Femto GW and/or between NR Femto GW and AMF.”

Modify as follows:

The NR Femto may directly connect to 5GC. The NG-RAN architecture may also deploy an NR Femto Gateway (NR Femto GW) to allow the concentration of NG-C interface between the NR Femto and the 5GC. Based on implementation, transport of NG-U between NR Femto and 5GC may be optionally concentrated in NR Femto GW.

For NR Femto, the NG interface is defined as the interface:

- Between the NR Femto GW and the Core Network;

- Between the NR Femto and the NR Femto GW;

- Between the NR Femto and the Core Network;

The NR Femto GW appears to the AMF as a gNB. The NR Femto GW appears to the NR Femto as an AMF. The NG interface between the NR Femto and the 5GC is the same, regardless whether the NR Femto is connected to the 5GC via an NR Femto GW or not.

FFS how to modify Figure 4.X.1-1: NR Femto Logical Architecture

**Proposal 3**: agree the stage 2 CR in R3-245325 for the functional aspects including NOTEs for the security aspects which are still pending SA3.

**Proposal 4:** agree the stage 3 CR for TS 38.413 in [4].

**Proposal 5**: send the LS in R3-245327 to SA3 to check whether the verification aspects which applied to HeNB GW architecture apply to NR Femto GW architecture.

### Others

**Decide whether an NR Femto may have more than one cell**

1. RAN3 to investigate how to design the ID for NR femto node, i.e., whether to introduce dedicated NR Femto Node ID, or reuse the Global gNB ID.

**Proposal 1: 5G-S-TMSI IE sent from the Femto node in NGAP messages can be used to select AMF for UE.**

**Proposal 2: The new IE AMF UE NGAP ID 2 is introduced to the INITIAL CONTEXT SETUP REQUEST message, HANDOVER REQUEST message and PATH SWITCH REQUEST ACKNOWLEDGE message to indicate the AMF UE NGAP ID assigned by the AMF.**

**Proposal 3: The NR Femto GW supports NG-Flex configuration and can simultaneously connect to multiple AMFs.**

**Proposal 4: The NR Femto GW shall host the NNSF function instead of the NR Femto nodes.**

**Proposal 5: The assistance information for NNSF if present should be transferred over NG interface from NR Femto node to NR Femto GW.**

**Proposal 2: A NR Femto GW should have the ability to verify the validity of the indicated cell access mode and CAG ID for a closed HeNB during the PATH SWITCH procedure.**

# Conclusion, Recommendations

# BLCR assignments

* WAB
  + 38.413 Huawei
  + 38.423 Nokia
  + 38.401 E///
  + 38.300 ZTE
  + 38.410 Samsung
  + 38.420 CATT

* 5G Femto
  + 38.300 E///
  + 38.413 Nokia
  + 38.410 ZTE

# References

|  |  |  |
| --- | --- | --- |
| [R3-245402](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245402.zip) | Functional Aspects of WAB-Nodes (Ericsson) | discussion |
| [R3-245391](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245391.zip) | (TPs for TS 38.300/38.413) Architecture and Access control for WAB (Huawei) | other |
| [R3-245247](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245247.zip) | (draft Reply LS to SA2) Discussion on SA2 questions on multi-hop WAB and UE ULI (Qualcomm Inc.) | other |
| [R3-245175](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245175.zip) | (TP for TS 38.401) Discussion on high level aspects for WAB (Nokia, Nokia Shanghai Bell) | other |
| [R3-245176](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245176.zip) | (TP for TS 38.423) Discussion on WAB mobility (Nokia, Nokia Shanghai Bell) | other |
| [R3-245248](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245248.zip) | Discussion on assumptions and architecture for WAB (Qualcomm Inc.) | other |
| [R3-245252](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245252.zip) | Discussion on stage-2 aspects for WAB (CATT) | discussion |
| [R3-245253](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245253.zip) | Other issues for WAB (CATT) | discussion |
| [R3-245286](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245286.zip) | (TP to BL CR of 38.423 on WAB) Discussion on the reliability and mobility for WAB (NEC) | other |
| [R3-245381](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245381.zip) | Discussion on Wireless Access Backhaul (NTTDOCOMO, INC.) | discussion |
| [R3-245383](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245383.zip) | Discussion on enhancements for WAB (CANON Research Centre France) | discussion |
| [R3-245392](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245392.zip) | (TP for TS 38.300) Discussion on WAB related procedures (Huawei) | other |
| [R3-245155](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245155.zip) | Discussion on WAB mobility (Samsung) | discussion |
| [R3-245156](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245156.zip) | Discussion on other aspects for the support of WAB (Samsung) | discussion |
| [R3-245403](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245403.zip) | Reply to SA2 Regarding WAB-MT Access Control and Additional ULI for WAB-Nodes (Ericsson) | discussion |
| [R3-245446](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245446.zip) | Architecture and configuration for WAB-node (Lenovo) | discussion |
| [R3-245447](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245447.zip) | Integration and migration for WAB node (Lenovo) | discussion |
| [R3-245637](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245637.zip) | Access control and location information in WAB (LG Electronics) | discussion |
| [R3-245640](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245640.zip) | Discussion on RAN2 impact of WAB (China Telecom) | discussion |
| [R3-245641](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245641.zip) | On Xn and NG interface management (China Telecom) | discussion |
| [R3-245655](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245655.zip) | (TP to 38.300) Discussion on supporting WAB and the reply LS to SA2 (ZTE Corporation) | other |
| [R3-245656](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245656.zip) | (TP to 38.305 38.455) Support of location service involving WAB (ZTE Corporation) | other |

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| [R3-245018](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245018.zip) | LS on Clarification regarding definition of 5G NR femto ownership (SA3(Nokia)) | LS in |
| **Architecture, Functional Aspects** | | |
| [R3-245151](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245151.zip) | On NR Femto Architecture and functional split (China Telecom) | discussion |
| [R3-245157](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245157.zip) | Discussion on NR Femto architecture (Samsung) | discussion |
| [R3-245254](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245254.zip) | Discussion on 5G Femto in stage 2 (CATT) | discussion |
| [R3-245255](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245255.zip) | Impact to NG interface for 5G Femto (CATT) | discussion |
| [R3-245298](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245298.zip) | (TP to TS38.300) NR Femto (NEC) | other |
| [R3-245305](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245305.zip) | Discussion on NR Femto Architecture and Functionality (Baicells) | discussion |
| [R3-245306](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245306.zip) | TP to 38.300 for NR Femto (Baicells) | discussion |
| [R3-245323](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245323.zip) | Completion of Protocol and Functional aspects of NR Femto Architecture (Nokia ) | discussion |
| [R3-245324](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245324.zip) | Introduction of NR Femto Architecture and protocol aspects (Nokia, TMO US, AT&T, Verizon Wireless, BT, Charter) | draftCR |
| [R3-245325](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245325.zip) | Introduction of Functional aspects of NR Femto architecture (Nokia, TMO US, AT&T, Verizon Wireless, BT, Charter) | draftCR |
| [R3-245327](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245327.zip) | LS on Security Verifications related to NR Femtos (Nokia) | LS out To: SA3 CC: |
| [R3-245639](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245639.zip) | Discussion on 5G femto (NTTDOCOMO, INC.) | discussion |
| [R3-245393](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245393.zip) | (TP for TS 38.300) Discussion on the architecture for NR Femto (Huawei) | other |
| [R3-245486](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245486.zip) | NR Femto - Stage 2 Aspects (Ericsson) | discussion |
| [R3-245487](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245487.zip) | NR Femto - Stage 2 TP (Ericsson) | other |
| [R3-245448](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245448.zip) | Architecture and access control for NR Femto (Lenovo) | discussion |
| [R3-245449](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245449.zip) | (TP to 38.300) On NR Femto (Lenovo) | other |
| [R3-245535](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245535.zip) | Discussion on architecture and access control for NR Femto (ZTE corporation) | discussion |
| [R3-245536](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245536.zip) | (TP for BLCR 38.300&38.410)NR Femto (ZTE corporation) | discussion |
| [R3-245636](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245636.zip) | (TP for TS 38.300) Support of 5G Femto (LG Electronics) | other |
| **Access Control** | | |
| [R3-245152](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245152.zip) | On access control for NR Femtos (China Telecom) | discussion |
| [R3-245158](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245158.zip) | Discussion on access control for NR Femto (Samsung) | discussion |
| [R3-245394](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245394.zip) | (TP for TS 38.300) Access control for NR Femto (Huawei) | other |
| **NGAP Impacts** | | |
| [R3-245326](file:///D:\会议硬盘\TSGR3_125-bis\Docs\R3-245326.zip) | Introduction of NR Femto architecture with optional NR Femto Gateway (Nokia, TMO US, AT&T, Verizon Wireless, BT, Charter) | CR1194r, TS 38.413 v18.3.0, Rel-19, Cat. B |