3GPP TSG-RAN WG3 #126 R3-24xxxx

**Orlando, USA, 18th – 22nd , November, 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

### Multi-hop prevention

**For multi-hop prevention, RAN3 to down select to following three solutions:**

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

**Solution 2: Use the slice dedicated for backhauling, i.e. use a list of S-NSSAIs in RRCsetupcomplete to do access control and/or use a list of S-NSSAIs in handover signalling. No CN upgrade is needed.**

**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.**

**Solution5: In case of handover for a WAB-node, the new WAB-node indication is included in the HO request, then the target BH-RAN node can perform access control for this WAB-node.**

**Proposal 1: RAN3 to only support solutions 1, 2 and 3, and to down select solution 4 and 5.**

**Further discuss the following solution in the online session:**

**For multi-hop prevention:**

* **For initial access, WAB-gNB may use dedicated frequencies and/or PCIs and potential other legacy OTA parameters(e.g. NR CGI) , to ensure that the WAB-MTs of other WAB-nodes avoid (re)selecting the WAB-gNB cells.**
* **For HO, the target WAB-gNB should reject HO preparation including the S-NSSAI used for Backhauling.**
* **For initial access, 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.**

### Avoiding Xn establishment between WAB-gNBs

**Proposal 2-1: Since the WAB-gNB supports the functionality of a legacy gNB, it can establish Xn connections with BH gNB’s and WAB-gNBs, and it can use the legacy procedures to discover neighbour gNBs and resolve their TNL addresses.**

**Proposal 2-2: The WAB-gNB can prevent Xn establishment with a peer WAB-gNB based on implementation.**

**Proposal 2-3: The WAB-gNB can discover that a peer RAN node is a WAB-gNB based on a WAB-specific frequency, a WAB-specific PCI value and/or a WAB-specific indicator provided for a served cell in the Xn Setup procedure.**

**Proposal 2-4: WAB-related enhancements to Xn are ignored by a BH RAN node that does not support WAB.**

### Additional ULI

**Proposal: Additional ULI for WAB consists of TAC and Cell ID, which are determined by the WAB-node based on WAB-node’s physical location. This solution allows Opton1 and Option3.**

**It is up to SA2 to support one of Opton1 and Option3 or both.**

- 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.

Samsung take the reply LS.

**NTN BH related issues to be continued…**

Additional ULI when WAB-MT accesses via NTN

**Observation 2: It needs to be discussed whether Uu cell ID of MT’s serving cell or mapped cell ID is included as additional ULI when WAB-MT accesses via NTN.**

**Observation 3: If Uu cell ID is used, it may won’t help since the Uu cell ID doesn’t really reflect the location of the WAB node.**

**Proposal 6: If mapped cell is used as additional ULI, it needs to be discussed how could the WAB-gNB obtain the mapped cell ID of BH-gNB.**

**Observation 4: Multiple TACs and UE Location Derived TAC is included as ULI in NR NTN if the UE is accessing via NTN.**

**Proposal 7: It needs to be discussed how to define the TAC format in the additional ULI when the WAB-MT accesses the network via NTN, inluding whether one TAC or multiple TACs are included, and whether the UE Location Derived TAC is included in the additional ULI.**

### Mobility

**Proposal 9: The two logical gNB solution can support UE’s AMF change during WAB-gNB mobility.**

**Capture this solution in 38.401 WAB baseline CR.**

**Further discuss the following in the online session.**

1. 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.

### Handling of WAB-gNB’s traffic during PDU session change

**Proposal 4-1: When the WAB-MT changes the WAB-MT’s PDU session, the following legacy procedures can be used to migrate the WAB-gNB’s interfaces to the new IP addresses:**

* **NG-C and Xn-C can be migrated via legacy procedures defined in TS 38.412 and TS 38.422, respectively.**
* **NG-U GTP-U tunnels can be migrated via the NGAP PDU session Resource Modify Indication procedure.**
* **Xn-U GTP-U tunnels used for DC can be migrated via the Xn S-NG-RAN NODE MODIFICATION PROCEDURES.**
* **Xn-U GTP-U tunnels used during UE handover do not need to be migrated since short-lived.**

**Proposal 4-2: When the WAB-MT changes the WAB-MT’s PDU session, the migration of OAM traffic to the new IP address(es) is out of scope.**

### NG connection management

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

### Xn connection management

**Proposal 2-1: WAB-gNB can reuse existing Xn-C TNL address discovery procedure to know the Xn-C TNL address of BH-gNB serving WAB-MT, then setup Xn with BH-gNB serving WAB-MT.**

**Proposal 2-2: BH-gNB can provide the Xn-C TNL address of neighboring gNB to WAB-gNB, so WAB-gNB can directly initiate Xn Setup with neighbour gNB.**

**Proposal 2-3: 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 2-4: If Xn is to be avoided among WAB-gNBs, TNL discovery procedure can be enhanced to avoid Xn establishment as early as possible among WAB-gNBs.**

**Proposal 2-5: RAN3 discuss the enhancement to avoid the UE context retrieval problems when Xn is removed between a WAB-gNB and a surrounding gNB.**

**Proposal 2-2: The WAB-gNB can prevent Xn establishment with a peer WAB-gNB based on implementation.**

**Proposal 2-3: The WAB-gNB can discover that a peer RAN node is a WAB-gNB based on a WAB-specific frequency, a WAB-specific PCI value and/or a WAB-specific indicator provided for a served cell in the Xn Setup procedure.**

**Proposal 2-4: WAB-related enhancements to Xn are ignored by a BH RAN node that does not support WAB.**

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

**Proposal 4-3: The WAB-gNB should be notified about the target BH-gNB for the WAB-MT HO.**

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

**Proposal 6: Discuss the introduction of WAB-specific cause values for XnAP and NGAP.**

**Proposal 1-1: WAB-gNB can recognize BH-RAN-node via SIB1 of the cell serving the WAB-MT.**

**Proposal 1-5: WAB cell specific info can be added to the serving cell information and the neighbour cell information in Xn messages.**

**Proposal 1-6: WAB-gNB considers the cell not included in the serving/neighbour cell information of current BH-RAN-node as no longer acting as the neighbour cell.**

**Proposal 1-7: WAB-gNB removes Xn with the with the NG-RAN nodes which do not serve any neighbour cell of the WAB-gNB.**

### WAB node authorization

**Proposal 1-1: In alignment with SA2, RAN3 confirms that the WAB-MT is authorized to support a PDU session for backhauling based on WAB-specific S-NSSAI and DNN, and that this authorization can be time- and location-dependent.**

**Proposal 1-2: In alignment with SA2, RAN3 confirms that the WAB-gNB’s service authorization is based on OAM configuration.**

**Proposal 1-3: In alignment with SA2, RAN3 confirms that when the WAB-gNB’s authorization status changes from “authorized” to “not authorized”, the UEs served by the WAB-gNB should be handed over to other RAN nodes or released, and then the WAB-gNB’s NG and Xn connection(s) should be removed.**

**Proposal 1-4: When the WAB-gNB’s authorization status changes from “not authorized” to “authorized”, the WAB-gNB can reestablish NG connection and potentially Xn connection(s) and start serving UEs.**

**Proposal 1-5: The WAB-MT should be authorized to support BH PDU sessions while the collocated WAB-gNB is serving UEs and has backhaul connections established. RAN3 assumes that this time alignment can be achieved based on configuration.**

**Proposal 2: When the authorization status of a WAB-gNB changes from “authorized” to “not authorized” (along with the authorization status of its co-located WAB-MT):**

* **The WAB-gNB node attempts to hand over and/or releases the UEs.**
* **The NG and Xn connections of the WAB-gNB are removed.**
* **Optionally, some or all PDU sessions of the WAB-MT may be released, and the WAB-MT may be de-registered from the network.**
1. The UP resources for the established BH PDU session(s) should be released if the WAB-MT/WAB-gNB is non-authorized.
2. The WAB-MT informs the 5GC serving the WAB-MT of the de-authorization status of the WAB-gNB in time.

### Topology discovery

**Proposal 17: WAB-gNB sends identity of its co-located WAB-MT (e.g., C-RNTI and cell ID) to the BH-gNB via Xn to enable topology discovery.**

- Option 1: WAB-gNB sends identity of its co-located WAB-MT to the BH-gNB via Xn.

- Option 2: WAB-MT sends identity of its co-located WAB-gNB to the BH-gNB via RRC.

### Change of backhaul resources during mobility

**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.**

### PCI configuration and collision avoidance

**Proposal 5: PCI configuration and PCI collision avoidance to follow the same procedure as defined for mobile IAB in TS 38.401, clause 7.8.**

**Proposal 6: The legacy mechanisms can be reused for PCI collision detection of WAB-gNB. The PCI space can be partitioned between WAB-gNB cells and stationary cells by implementation.**

**Proposal 13: The PCI of WAB-gNB’s cell is configured by the OAM, and it can be reconfigured during the mobility of WAB-node in case PCI collision is detected.**

**Proposal 14: RAN3 to discuss how to avoid PCI collision and re-configure PCI for WAB-gNB cell when there is no Xn interface between the WAB-gNB and neighboour gNBs.**

**Proposal 7: Due to CU-DU split is out-of-scope of R19 WAB, PCI reconfiguration via F1AP for mobile IAB-node is not appliable for WAB node.**

### Resource coordination

**Proposal 7-1: For in-band backhauling in non-roaming scenarios, introduce a new XnAP procedure for a WAB-gNB and its BH-gNB to coordinate the resources of this WAB-gNB and its co-located WAB-MT.**

**Proposal 7-2: 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.**

**Proposal 7-3: RAN3 assumes out-of-band backhauling when the WAB-gNB and the WAB-MT are served by different PLMNs.**

**Proposal 6-1: Xn signalling to exchange cell resource configurations specified for IAB can be made applicable to WAB. F1 enhancements and lower layer control is out of the WI scope.**

**Proposal 6-2: The BH-gNB detects the co-location of the WAB-gNB and WAB-MT during the Xn Setup procedure initiated by the WAB-gNB, via the WAB-MT’s ID (e.g. C-RNTI) received from the WAB-gNB in XN SETUP REQUEST message or Xn SETUP RESPONSE message.**

**Proposal 11: If the BH gNB uses CU-DU split architecture, the F1 signaling designed for IAB resource multiplexing is reused via the F1 signaling between the CU and DU parts of the BH-gNB.**

**Proposal 12: The BH-gNB configures WAB-gNB’s semi-static cell resource to the WAB-gNB via Xn signalling. And WAB-gNB sends its multiplexing capability to BH-gNB via Xn signalling.**

**Proposal 13: RAN3 to send an LS to RAN1 to check whether the attribute of soft and configuration of the availability of soft resources is supported in WAB.**

**Proposal 14: RAN3 to discuss whether BH-gNB considers cell specific signaling/channel resources as hard resources at the IAB-DU.**

**Proposal 15: WAB resource configuraiton of neighbour gNB is exchanged between WAB-gNB and BH-gNB, or between BH-gNBs via Xn signaling.**

**Proposal 16: BH-gNB sends its per-child MT link-NA resource configuration to the WAB-gNB via Xn.**

### Awareness of WAB at BH-RAN node

**Proposal 8: WAB-MT shall be able to access a legacy gNB without WAB specific enhancement**

**Proposal 9: An indication could be broadcasted by BH-RAN node so that WAB-MT could be aware of the capability of the gNB.**

**Proposal 10: RAN3 to send an LS to RAN2 to trigger the discussion if RAN3 assumes that it would be beneficial to broadcast an indication to indicate that the gNB supports WAB enhancement.**

### In-band or out-band deployments

Proposal 3: OAM configures the inband/outband mode to WAB-node.

**Proposal 4: To support the in-band WAB deployment, the BH-RAN must be upgraded to aware of WAB and can support the resource multiplexing. RAN3 to discuss how to ensure the in-band WAB selects a proper BH-gNB.**

### NTN backhaul

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

**Proposal 5: If the backhaul is NTN link, the UE’s CN should know the BH link type is NTN.**

### Others

**Proposal 4: To guarantee the QoS of NG-C/Xn-C and NG-U/Xn-U traffic over the BH link,**

* **For uplink, WAB-node maps the traffic to QoS flows of WAB-MT, and WAB-MT maps the QoS flows to DRBs.**
* **For downlink, BH-UPF maps the traffic to QoS flows of WAB-MT, and BH-gNB maps the QoS flows to DRBs.**

**Proposal 5: Coordination between WAB-MT and BH-gNB may be needed to mitigate the impact of degradation and congestion on the BH link.**

**Proposal 8: The access and the BH network can coordinate for mitigating BH link degradation.**

**Proposal 9: Calculation of the WAB-gNB PDB (i.e., the WAB counterpart of the 5G-AN PDB specified in TS 23.501) considers the PDB of the BH network.**

**Proposal 1: RAN3 to capture that a tunnel may be used to transfer the WAB-gNB’s traffic in TS 38.401.**

**Proposal 3: If RAN3 decides to specify the scenario where ng-eNB serves WAB-MT, an LS is sent to SA2 so that SA2 would update the specification accordingly.**

**Proposal 4: If RAN3 decides to specify the scenario where ng-eNB serves WAB-MT, it needs to be captured in TS 36.300 that WAB also applies for EUTRA connected to 5GC where ng-eNB shall be considered as the BH-RAN node instead of gNB.**

**Proposal 6: If RAN3 decides not to specify the scenario where ng-eNB serves WAB-MT, the definition of BH-RAN-node needs to be removed in TS 38.401, and “BH-RAN node” used in the text needs to replaced with “BH-gNB”.**

## 5G Femto

### General

**Proposal 5: Confirm the Working Assumption that an NR Femto may serve more than one cell.**

**Proposal2: Capture the following in section 4.x.3.1**

**NG-U is defined as specified in clause 4.3.1.1 regardless of whether it is concentrated in the NR Femto GW.**

**Add dot line box for GW (from L1 to IP layer) in the following figure.**



Fig 1. User plane protocol stack in NR Femto

**What would be roles of Femto GW for user plane?**

**Option1: GTP-U proxy**

**Option2: UDP proxy**

**Option3: routing at the IP (FFS whether NAT support)**

**GTP-U proxy and UDP proxy are ruled out.**

**Proposal 4: TS 38.300 captures reference for NG control plane for NR Femto without NR Femto GW.**



Figure 4.X.3.2-1: Control plane for NG Interface for NR Femto to AMF with the NR Femto GW

**Proposal 1: The NR Femto shall only connect to a single NR Femto GW at one time when the NR Femto connects via the NR Femto GW.**

**Proposal 2: The NR Femto GW supports NG-Flex configuration and can simultaneously connect to multiple AMFs.**

### Access control

**Proposal 6: Referencing existing definitions and specification is sufficient for access control with CAG – all functionality is already specified.**

**Proposal 7: The text in Sec. 5.3 of TR 38.799 should be adopted as a NOTE; there is no need to explicitly mention “open”, “closed”, and “hybrid” access mode in such NOTE and there is no need to introduce such definitions.**

### 4.x.4 Access Control

Cells served by an NR Femto node may be deployed as part of a PNI-NPN (see clause 4.8) in order to restrict access to UEs according to the respective subscription.

NOTE: The NR Femto node may use the CAG mechanism for PNI NPN (see clause 16.7.4) as follows:

- The NR Femto node may activate a PLMN cell, which can be accessed by legacy UE without access control of CAG.

- The NR Femto may activate a cell shared by both PLMN and CAG, through broadcasting both the *plmn-IdentityInfoList* and the *npn-IdentityInfoList-r16* in the SIB1, but without the *cellReservedForOtherUse*. Then, this cell is accessible to UEs which have the allowed CAG list including a CAG-ID broadcasted by the cell. For the legacy UE not supporting CAG, this cell is viewed as a normal PLMN cell.

- The NR Femto node may activate an NPN-only cell by broadcasting the *cellReservedForOtherUse IE* with value “true”, then this cell can only be accessed by the UEs whose allowed CAG list includes a CAG-ID broadcasted by the cell.

1. RAN3 to avoid defining access mode for the NR femto. No access mode indication is needed in UE associated NGAP messages for the access mode determination and verification.
2. NR Femto GW is not responsible for CAG access control. The CAG access control is implemented on the AMF.
3. RAN3 to further coordinate with SA2 and SA3 about whether the NR femto GW/AMF needs to determine/verify that the NR femto serves NPN-only cell(s) or cell(s) can shared by both PLMN and CAG.

**Proposal 6: Three kinds of access control is captured as a note without corresponding access modes being mentioned in spec.**

### NR Femto GW related issues

**Proposal 3**: send the LS in [4] to SA3 to check whether the verification aspects which applied to HeNB GW architecture apply to NR Femto GW architecture.

**Proposal 1: When the NR Femto GW is not present, the NG UP protocol stack for an NR Femto is the same as currently specified in Sec. 4.3.1.1 of TS 38.300, so a reference to that section is sufficient.**

**Proposal 2: There is no need to mention GTP-U level switching at the NR Femto GW, at least in normative text.**

**Proposal 3: Capture a single figure for NG UP for the case with the NR Femto GW, highlighting in the figure and in the description text that different possible switching at the NR Femto GW are possible (e.g. UDP level, IP level).**

**Proposal 4: When the NR Femto GW is not present, the NG CP protocol stack for an NR Femto is the same as currently specified in Sec. 4.3.1.2 of TS 38.300, so adding a reference to that section in the current text is sufficient; Fig. 4.X.3.2-1 is not needed.**

**Proposal 3: A NR Femto node shall only connect to a single NR Femto GW at one time, and will not simultaneously connect to another NR Femto GW or AMF.**

**Proposal 4: Not support Xn interface between NR Femto GW and other nodes.**

### Functional split

**Proposal 1**: discuss the functional aspects of NR Femto, NR Femto GW and AMF presented in the TP for TS 38.300 draft CR in [2] to provide equivalent support of functionalities as the HeNB subsystem.

**Proposal 2**: discuss the corresponding stage 3 aspects with the TS 38.413 CR proposed in [3].

1. The NR Femto node forwards the UE’s requested S-NSSAI to the NR Femto GW in INITIAL UE MESSAGE. The NR Femto GW selects proper AMF accordingly.
2. RAN3 to agree the TP for TS 38.300 and 38.413 to capture spec impact introduced by the functional split for NR Femto.
3. RAN3 assumes NR Femto GW verifies the Femto node ID in NG SETUP REQUEST, PWS RESTART INDICATION and PWS FAILURE INDICATION, and check with SA3 for confirmation.

### Local breakout

**Proposal 8: Take the appropriate text from Sec. 5.4 of TR 38.799 as baseline for a simple definition for local breakout.**

**Proposal 9: Agree the text proposal in [5] for inclusion in the BL CR for stage 2.**

### Proximity

**Proposal 4**: Initiate discussions with RAN2 on how proximity works with NR Femto in 5G and possible functional impacts for RAN3.

**Proposal 8: Not introduce the proximity indication for NR Femto.**

### Femto ID

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

**Proposal 2: The global gNB ID can be reused directly to identify the NR Femto node.**

### Issue of NG mobility impact

1. RAN3 to discuss how the AMF knows the association of the Femto GW and the Femto node, or to agree at most one Femto GW can be deployed in a TA.

### Others

**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 5: NNSF function is located at the NR Femto GW.**

**Proposal 6: Support following Xn-based handover scenarios for NR Femto.**

**- gNB or any NR Femto node -> open access NR Femto node**

**- gNB or any NR Femto node -> hybrid access NR Femto node**

**- Hybrid access NR Femto node or closed access NR Femto node -> closed access NR Femto node**

**- Any NR Femto node -> gNB**

**Proposal 7: For the UE handover of NR Femto, the handover cannot be supported if the target cell is a non-CAG cell.**

**Ericsson TP**

**Revision of 7454**

**Access control**

**Huawei TP**

**Protocol stack**

**Nokia TP**

**Functional split**

**ZTE TP**

**38.410**

**Revision of 7731**

When the NR Femto connects to a Femto GW, selection of an AMF at UE attachment is hosted by the NR Femto GW instead of the NR Femto.

**Hosted => performed**

**FFS on the wording of UE attachment**

**[R3-247486]**

### 4.X.2 Functional Split

An NR Femto hosts the same functions as a gNB as described in clause 4.1, with the following additional specifics in case of connection to the NR Femto GW:

- Discovery of a suitable Serving NR Femto GW;

- An NR Femto shall only connect to a single NR Femto GW at one time, namely no NG-C Flex function shall be used at the NR Femto:

- The NR Femto will not simultaneously connect to another NR Femto GW, or another AMF.

- The TAC and PLMN ID used by the NR Femto shall also be supported by the NR Femto GW;

- Selection of an AMF at UE attachment is hosted by the NR Femto GW instead of the NR Femto. Upon reception of the GUAMI from a UE, the NR Femto shall include it in the INITIAL UE MESSAGE message.

- NR Femtos may be deployed without network planning. An NR Femto may be moved from one geographical area to another and therefore it may need to connect to different NR Femto GWs depending on its location;

- Signalling the GUAMI of the Source AMF and the *Source AMF UE NGAP ID* to the NR Femto GW in the NGAP PATH SWITCH REQUEST message.

<<<<<<<<<<<<<<<<<<<< Unmodified Text Omitted >>>>>>>>>>>>>>>>>>>>

The NR Femto GW hosts the following functions:

- Relaying UE-associated NG application part messages between the AMF serving the UE and the NR Femto serving the UE, except the UE CONTEXT RELEASE REQUEST message received from the NR Femto with an explicit GW Context Release Indication. In that case, the NR Femto GW terminates the NGAP UE Context Release Request procedure and releases the UE context if it determines that the UE identified by the received UE NGAP IDs is no longer served by an NR Femto attached to it. Otherwise it ignores the message.

- In case of NGAP INITIAL CONTEXT SETUP REQUEST message and NGAP HANDOVER REQUEST message, informing the NR Femto about any GUAMI corresponding to the serving AMF, the AMF UE NGAP ID assigned by the AMF and the AMF UE NGAP ID assigned by the NR Femto GW for the UE. In case of NGAP PATH SWITCH REQUEST ACKNOWLEDGE message, informing the NR Femto about the AMF UE NGAP ID assigned by the AMF and the AMF UE NGAP ID assigned by the NR Femto GW for the UE.

NOTE: In case of NGAP INITIAL UE MESSAGE message, whether to verify, for a closed NR Femto, that the indicated cell access mode and CAG ID are valid for that NR Femto is pending SA3 study.

- Terminating non-UE associated NG application part procedures towards the NR Femto and towards the AMF. In case of NG PWS RESTART INDICATION message and PWS FAILURE INDICATION message, replacing the gNB ID of the NR Femto by the NR Femto GW ID before sending the PWS RESTART INDICATION message (respectively the PWS FAILURE INDICATION message) to the AMF.

NOTE: In case of NG SETUP REQUEST message, whether to verify that the identity used by the NR Femto is valid and determining whether the access mode of the NR Femto is closed or not is pending SA3 study.

NOTE: In case of NG PWS RESTART INDICATION message and PWS FAILURE INDICATION message, whether to verify that the indicated cell identity is valid is pending SA3 study.

- Upon receiving an OVERLOAD START/STOP message, the NR Femto GW should send the OVERLOAD START/STOP message towards the NR Femto(s) including in the message the identities of the affected AMF node(s). The NR Femto uses this information received from the OVERLOAD START message to identify to which traffic the above defined rejections shall be applied. The NR Femto shall apply the defined rejections until reception of an OVERLOAD STOP message applicable to this traffic, or until the NR Femto receives a further OVERLOAD START message applicable to the same traffic, in which case it shall replace the ongoing overload action with the newly requested one.

NOTE: If an NR Femto GW is deployed, non-UE associated procedures shall be run between NR Femtos and the NR Femto GW and between the NR Femto GW and the AMF.

- Supporting TAC and PLMN ID used by the NR Femto.

- Routing the NGAP PATH SWITCH REQUEST message towards the AMF based on the GUAMI of the source AMF received from the NR Femto.

A list of CAG IDs may be included in the NGAP PAGING message. If included, the NR Femto GW may use the list of CAG IDs for paging optimisation.

<<<<<<<<<<<<<<<<<<<< Unmodified Text Omitted >>>>>>>>>>>>>>>>>>>>

In addition to functions specified in clause 4.1, the AMF hosts the following functions:

- Access control for initial access of UEs that are members of Closed Access Groups (CAG):

NOTE: In case of an NR Femto directly connected, whether to verify that the identity used by the NR Femto is valid when receiving the NGAP SETUP REQUEST message and determining whether the access mode of the NR Femto is closed or not is pending SA3 study.

NOTE: In case of an NR Femto directly connected, whether to verify, for a closed NR Femto, that the indicated cell access mode and CAG ID are valid when receiving the NGAP INITIAL UE MESSAGE message is pending SA3 study.

NOTE: In case of an NR Femto directly connected, whether to verify that the indicated gNB identity of the NR Femto is valid when receiving the NGAP PWS RESTART INDICATION message and the NG PWS FAILURE INDICATION message is pending SA3 study.

- Routing of handover messages, Uplink RAN Configuration Transfer and Downlink RAN Configuration Transfer messages towards NR Femto GWs based on the Selected TAI contained in these messages.

NOTE: If routing ambiguities are to be avoided, a TAI used in an NR Femto GW should not be reused in another NR Femto GW.

NOTE: The AMF or NR Femto GW should not include the list of CAG IDs for paging when sending the paging message directly to an un-trusted NR Femto or gNB (to be checked by SA3).

<<<<<<<<<<<<<<<<<<<< End of Changes >>>>>>>>>>>>>>>>>>>>

**[R3-247488]**

**1. Overall Description:**

As previously indicated, RAN3 has agreed to have an NR Femto architecture in release 19 with an optional NR Femto GW for NG interface aligned with the 4g architecture deployment with HeNB GW.

RAN3 noticed that in 4g TS 36.300 specified multiple security verification checks to be performed by HeNB GW (respectively MME) to verify certain information sent by the HeNB. RAN3 would like SA3 to feedback on whether similar verification checks are needed in 5G to be performed by the NR Femto GW (respectively AMF).

The verification points to be checked by SA3 have been captured as NOTEs in the attached stage 2 RAN3 draft CR against TS 38.300.

**2. Actions:**

**To SA3 group:**

**ACTION:** RAN3 kindly ask SA3 to indicate whether the verification checks indicated in NOTEs pending SA3 in the attached CR for TS 38.300 are applicable in 5G for the NR femto GW (respectively AMF).

# Conclusion, Recommendations

## WAB

**Proposal: Additional ULI for WAB consists of TAC and Cell ID, which are determined by the WAB-node based on WAB-node’s physical location. This solution allows Opton1 and Option3.**

**It is up to SA2 to support one of Opton1 and Option3 or both.**

- 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.

Samsung take the reply LS.

**NTN BH related issues to be continued…**

**Proposal 9: The two logical gNB solution can support UE’s AMF change during WAB-gNB mobility.**

**Capture this solution in 38.401 WAB baseline CR.**

**Further discuss the following in the online session.**

1. 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.

**Further discuss the following solution in the online session:**

**For multi-hop prevention:**

* **For initial access, WAB-gNB may use dedicated frequencies and/or PCIs and potential other legacy OTA parameters(e.g. NR CGI) , to ensure that the WAB-MTs of other WAB-nodes avoid (re)selecting the WAB-gNB cells.**
* **For HO, the target WAB-gNB should reject HO preparation including the S-NSSAI used for Backhauling.**
* **For initial access, 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.**

## 5G Femto

**Proposal 5: Confirm the Working Assumption that an NR Femto may serve more than one cell.**

**Proposal2: Capture the following in section 4.x.3.1**

**NG-U is defined as specified in clause 4.3.1.1 regardless of whether it is concentrated in the NR Femto GW.**

**Add dot line box for GW (from L1 to IP layer) in the following figure.**



Fig 1. User plane protocol stack in NR Femto

**What would be roles of Femto GW for user plane?**

**Option1: GTP-U proxy**

**Option2: UDP proxy**

**Option3: routing at the IP (FFS whether NAT support)**

**GTP-U proxy and UDP proxy are ruled out.**

**Proposal 4: TS 38.300 captures reference for NG control plane for NR Femto without NR Femto GW.**



Figure 4.X.3.2-1: Control plane for NG Interface for NR Femto to AMF with the NR Femto GW

**Proposal 1: The NR Femto shall only connect to a single NR Femto GW at one time when the NR Femto connects via the NR Femto GW.**

**Proposal 2: The NR Femto GW supports NG-Flex configuration and can simultaneously connect to multiple AMFs.**

**Proposal 6: Referencing existing definitions and specification is sufficient for access control with CAG – all functionality is already specified.**

**Proposal 7: The text in Sec. 5.3 of TR 38.799 should be adopted as a NOTE; there is no need to explicitly mention “open”, “closed”, and “hybrid” access mode in such NOTE and there is no need to introduce such definitions.**

### 4.x.4 Access Control

Cells served by an NR Femto node may be deployed as part of a PNI-NPN (see clause 4.8) in order to restrict access to UEs according to the respective subscription.

NOTE: The NR Femto node may use the CAG mechanism for PNI NPN (see clause 16.7.4) as follows:

- The NR Femto node may activate a PLMN cell, which can be accessed by legacy UE without access control of CAG.

- The NR Femto may activate a cell shared by both PLMN and CAG, through broadcasting both the *plmn-IdentityInfoList* and the *npn-IdentityInfoList-r16* in the SIB1, but without the *cellReservedForOtherUse*. Then, this cell is accessible to UEs which have the allowed CAG list including a CAG-ID broadcasted by the cell. For the legacy UE not supporting CAG, this cell is viewed as a normal PLMN cell.

- The NR Femto node may activate an NPN-only cell by broadcasting the *cellReservedForOtherUse IE* with value “true”, then this cell can only be accessed by the UEs whose allowed CAG list includes a CAG-ID broadcasted by the cell.

**Ericsson 38.300 TP (R3-247809)**

**Revision of 7454**

**Access control**

**Huawei 38.300 TP (R3-247799)**

**Protocol stack**

**Nokia 38.300 TP (R3-247791)**

**Functional split**

**Huawei Nokia 38413 TP (R3-247800)**

**Functional split**

**ZTE 38.410 TP (R3-24xxxxx)**

**Revision of 7731**

When the NR Femto connects to a Femto GW, selection of an AMF at UE attachment is hosted by the NR Femto GW instead of the NR Femto.

**Hosted => performed**

**FFS on the wording of UE attachment**

# References

|  |  |  |
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| [R3-247110](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247110.zip) | Reply to SA2 Regarding UE Access Control and Additional ULI for WAB-Nodes (Ericsson) | discussion |
| [R3-247195](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247195.zip) | (TP to 38.401 36.300) Discussion on supporting WAB (ZTE Corporation) | other |
| [R3-247196](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247196.zip) | Discussion on other aspects for WAB and the reply LS to SA2 (ZTE Corporation) | other |
| [R3-247197](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247197.zip) | (TP to 38.305) Support of location service involving WAB-nodes (ZTE Corporation, Nokia, Nokia Shanghai Bell, Ericsson, Qualcomm, Lenovo, CATT) | other |
| [R3-247198](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247198.zip) | (TP to 38.455) Support of location service involving WAB-nodes (ZTE Corporation, Nokia, Nokia Shanghai Bell, Ericsson, Qualcomm, Lenovo, CATT) | other |
| [R3-247222](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247222.zip) | (TP to BL CR of 38.423 on WAB) Discussion on mobility and reliability for WAB (NEC) | other |
| [R3-247226](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247226.zip) |  Discussion on enhancements for WAB (CANON Research Centre France) | discussion |
| [R3-247227](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247227.zip) | (draft Reply LS to SA2 – TP to BL CR 38.401) Discussion on SA2 questions on multi-hop WAB and UE ULI (Qualcomm Inc.) | other |
| [R3-247228](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247228.zip) | (TP to BL CR 38.401) Discussion of aspects related to WAB (Qualcomm Inc.) | other |
| [R3-247229](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247229.zip) | BL draft CR to TS 38.300 on Support of WAB (Qualcomm, Ericsson, CATT, ZTE, Nokia, Nokia Shanghai Bell) | draftCR |
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| [R3-247279](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247279.zip) | Discussion on Wireless Access Backhaul (NTT DOCOMO INC.) | discussion |
| [R3-247342](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247342.zip) | (TP for TS 38.401) Discussion on NG management and Xn management for WAB (Nokia, Nokia Shanghai Bell) | other |
| [R3-247343](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247343.zip) | (TP for TS 38.423) Discussion on WAB mobility (Nokia, Nokia Shanghai Bell) | other |
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| [R3-247354](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247354.zip) | Discussion on other aspects for the support of WAB (Samsung) | discussion |
| [R3-247363](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247363.zip) | (TPs for TS 38.413) Architecture and Access control for WAB (Huawei) | other |
| [R3-247364](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247364.zip) | (TP for TS 38.401) Discussion on WAB related procedures (Huawei) | other |
| [R3-247428](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247428.zip) | Architecture and configuration for WAB-node (Lenovo) | discussion |
| [R3-247429](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247429.zip) | Discussion on WAB node migration (Lenovo) | discussion |
| [R3-247627](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247627.zip) | Discussion on RAN2 Impact and Functional Aspects of WAB (China Telecom) | discussion |
| [R3-247628](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247628.zip) | Discussion on Multi-hop Prevention and Authorization for WAB (China Telecom) | discussion |
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| [R3-247271](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247271.zip) | Impact to NGAP for NR Femto (CATT) | discussion |
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| [R3-247355](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247355.zip) | (TP to TS 38.300) Discussion on NR Femto architecture and functional split (Samsung) | discussion |
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| [R3-247648](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247648.zip) | Discussion on NR Femto Architecture and Functionality (Baicells) | discussion |
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| [R3-247730](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_126%5CDocs%5CR3-247730.zip) | TP for access control for NR Femto (ZTE corporation, Nokia) | discussion |
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