|  |  |
| --- | --- |
| 3GPP TR 23.700-06 V0.2.0 (2024-03) | |
| Technical Report | |
| 3rd Generation Partnership Project;  Technical Specification Group Services and System Aspects;  Study on architecture enhancements for  vehicle-mounted relays - Phase 2  (Release 19) | |
|  | |
|  |  |
|  | |
| The present document has been developed within the 3rd Generation Partnership Project (3GPP TM) and may be further elaborated for the purposes of 3GPP. The present document has not been subject to any approval process by the 3GPPOrganizational Partners and shall not be implemented. This Specification is provided for future development work within 3GPPonly. The Organizational Partners accept no liability for any use of this Specification. Specifications and Reports for implementation of the 3GPP TM system should be obtained via the 3GPP Organizational Partners' Publications Offices. | |

|  |
| --- |
|  |
| ***3GPP***  Postal address  3GPP support office address  650 Route des Lucioles - Sophia Antipolis  Valbonne - FRANCE  Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16  Internet  http://www.3gpp.org |
| ***Copyright Notification***  No part may be reproduced except as authorized by written permission. The copyright and the foregoing restriction extend to reproduction in all media.  © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).  All rights reserved.  UMTS™ is a Trade Mark of ETSI registered for the benefit of its members  3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners LTE™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners  GSM® and the GSM logo are registered and owned by the GSM Association |

Contents

Foreword 5

1 Scope 7

2 References 7

3 Definitions of terms and abbreviations 8

3.1 Terms 8

3.2 Abbreviations 8

4 Architecture assumptions and requirements 8

4.1 Architecture assumptions 8

4.2 Architecture requirements 9

5 Key Issues 10

5.1 Key Issue #1: Architectural enhancements for the support of a MWAB 10

5.2 Key Issue #2: Authorization of a MWAB and configuration of MWAB 10

5.3 Key Issue #3: Control of UE's access to 5GS via a wireless access backhaul 10

5.4 Key Issue #4: Efficient mobility and service continuity when served by MWAB 11

5.4.1 General description 11

5.5 Key Issue #5: Support of location services for UEs when MWAB(s) is involved 12

5.6 Key Issue #6: Support of Emergency services for UEs via a MWAB 12

6 Solutions 12

6.0 Mapping of solutions to key issues 12

6.1 Solution #1: Architecture enhancements to support MWAB operations 12

6.1.1 General 12

6.1.2 Functional descriptions 15

6.1.3 Procedures 16

6.1.3.1 MWAB-UE registration and authorization 16

6.1.3.2 Control of UE's access to MWAB 16

6.1.3.3 Support of Location Service for UEs when MWAB(s) is involved 16

6.1.3.4 UE mobility to and from a MWAB cell 16

6.1.4 Impacts on services, entities, and interfaces 17

6.2 Solution #2: MWAB architecture and procedures 17

6.2.1 General 17

6.2.2 Functional descriptions 17

6.2.2.1 Connection with OAM server over PDU session 17

6.2.2.2 N2 connection over BH PDU session 17

6.2.2.3 N3 over BH PDU session 18

6.2.2.4 Xn over BH PDU session 18

6.2.2.5 Handling of NG establishment with respect to the topic of multi-hop handling 18

6.2.3 Procedures 19

6.2.3.1 Connection with OAM server over PDU session 19

6.2.3.2 N2 connection over BH PDU session 19

6.2.3.3 N3 connection over BH PDU session 20

6.2.3.4 Xn connection over BH PDU session 20

6.2.3.5 Alternative handling of N2 transmission by using dedicated IP address for MWAB-gNB 20

6.2.3.6 MWAB NG-establishment 20

6.2.3.7 MWAB-UE registration over other MWAB-gNB 20

6.2.3.8 MWAB-UE N2 handover and multi-hop handling 21

6.2.3.9 MWAB-UE Xn handover and multi-hop handling 22

6.2.4 Impacts on services, entities, and interfaces 22

6.3 Solution #3: N3 backhaul PDU session management 23

6.3.1 General 23

6.3.2 Functional descriptions 23

6.3.3 Procedures 24

6.3.3.1 Handling of a UE PDU session establishment or modification 24

6.3.4 Impacts on services, entities, and interfaces 25

6.4 Solution #4: MWAB authorization handling 25

6.4.1 Introduction 25

6.4.2 Functional Description 25

6.4.3 Procedures 26

6.4.3.1 MWAB node authorization and operation initiation 26

6.4.3.2 MWAB authorization status change for Registered MWAB 27

6.4.4 Impacts on services, entities, and interfaces 29

6.5 Solution #5: Authorization and Change of Authorization of a MWAB and configuration of a MWAB 29

6.5.1 General 29

6.5.2 Functional descriptions 29

6.5.3 Procedures 30

6.5.3.1 MWAB service authorization and MWAB gNB configuration 30

6.5.3.2 MWAB change of service authorization 31

6.5.4 Impacts on services, entities, and interfaces 32

7 Evaluation 32

8 Conclusions 32

# Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

**shall** indicates a mandatory requirement to do something

**shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

**should** indicates a recommendation to do something

**should not** indicates a recommendation not to do something

**may** indicates permission to do something

**need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

**can** indicates that something is possible

**cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

**will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

**might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

**might not** indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

**is** (or any other verb in the indicative mood) indicates a statement of fact

**is not** (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

# 1 Scope

The scope of this Technical Report is to study and identify potential architecture and system level enhancements for the 5G system to support the operation of a mobile gNB mounted on vehicles, using NR for wireless access toward the UE and for wireless backhaul access toward the 5GC. The study addresses the service requirements documented in TS 22.261 [3] for the mobile base station relays, and focuses on the following aspects:

- architecture enhancements for the support of the wireless backhauling of the mobile gNB and its CN/OAM (e.g. N2/N3) interfaces, including e.g. UE access control, mobility aspects;

- the architecture to enable authorization and configuration of the mobile gNB;

- support of UE location services and emergency services via the mobile gNB.

The wireless backhauling of mobile gNB and CN/OAM (e.g. N2/N3) interfaces may use the existing TN or NTN technology.

NOTE 1: The mobile gNB configuration aspect needs synchronization with RAN working group.

NOTE 2: No enhancement is aimed to the existing QoS mechanisms for the wireless backhaul.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[3] 3GPP TS 22.261: "Service requirements for the 5G system; Stage 1".

[4] 3GPP TS 38.300: "NR; NR and NG-RAN Overall Description".

[5] 3GPP TS 38.401: "NG-RAN Architecture description".

[6] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS); Stage 2".

[7] 3GPP TS 23.502: "Procedures for the 5G System (5GS); Stage 2"

[8] 3GPP TS 38.413: “NG-RAN; NG Application Protocol (NGAP)”.

[9] 3GPP TS 23.122: “Non-Access-Stratum (NAS) functions related to Mobile Station (MS) in idle mode”.

[10] 3GPP TS 23.503: " Policy and charging control framework for the 5G System (5GS); Stage 2".

# 3 Definitions of terms and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in TR 21.905 [1], TS 23.501 [2] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**mobile gNB with wireless access backhaul:** A mobile base station acts as a gNB for other UEs and provide access to the 5G networks, i.e., providing a NR access link to UEs and connected wirelessly to the 5GC (using NR) through an IP connectivity provided by a PDU sessions established via a NG-RAN cell that the mobile gNB can camp on. The PDU session is provided either by a Terrestrial Network or by a Non-Terrestrial Network. Such mobile gNB may be mounted on a moving vehicle and serve UEs that can be located inside or outside the vehicle (or entering/leaving the vehicle).

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1] and TS 23.501 [2].

MWAB Mobile gNB with wireless access backhauling

MWAB-gNB gNB component of the MWAB

MWAB-UE UE component of the MWAB

NTN Non-Terrestrial Network

TN Terrestrial Network

# 4 Architecture assumptions and requirements

## 4.1 Architecture assumptions

The study should be based on the following architecture assumptions:

- the MWAB consists of a gNB component (MWAB-gNB) and a UE component (MWAB-UE);

- the MWAB-gNB is based on the gNB functionality specified in TS 38.300 [4] and TS 38.401 [5];

NOTE 1: Architecture impact on MWAB-gNB may depend on the RAN study output and needs to be coordinated with RAN WGs.

NOTE 2: In this release CU/DU split of the MWAB-gNB is not supported.

- the MWAB-gNB's N2/N3 and OAM access are over the IP connectivity provided by the PDU sessions(s) of the MWAB-UE;

- the interface between MWAB-UE and MWAB-gNB is not in scope of SA WG2 if it needs to be standardized;

- the MWAB-UE has a single NR Uu hop to the NG-RAN (i.e., MWAB-UE access a gNB via NR Uu interface which may use either TN or NTN technology);

- the MWAB may serve UEs located inside or outside the vehicle mounted with the relay;

- NR Uu is used for the radio link between a MWAB-gNB and served UEs. The NR Uu radio link between the MWAB-gNB and served UE does not use NTN technology;

- LCS framework as defined in TS 23.273 [6] is used for providing the location service to the served UEs;

- the MWAB may connect to an NG-RAN of a PLMN or an SNPN;

- the MWAB-gNB may broadcast a PLMN ID that is different to the PLMN ID of the PLMN that the MWAB-UE is connected to;

- the UE’s serving PLMN is the one broadcast by the MWAB-gNB it is camped on/connected to. This may be a different PLMN ID to that of the PLMN serving the MWAB-UE;

- the MWAB-UE supports emergency services.

Figure 4.1-1 illustrates an example architecture for non-roaming scenarios.

MWAB operation can also support roaming scenario.



Figure 4.1-1: Non-Roaming MWAB architecture for 5GS

## 4.2 Architecture requirements

Solutions of the study should provide architecture and system level enhancements to the 5G system to support the operation of MWAB to satisfy the normative requirements of a mobile base station relay specified in TS 22.261 [3]. Specifically:

- a MWAB shall be capable to serve legacy UE(s) to connect via MWAB;

- support end-to-end service continuity for the UEs served by a MWAB upon MWAB mobility should be specified;

- support the mobile network operator to configure, provision and control the operation of a MWAB;

NOTE 1: Configuration of the MWAB needs to be coordinated with RAN WGs.

NOTE 2: Charging support will be coordinated with SA5 if there is such need.

- support of regulatory requirements (e.g. for support of emergency services, priority services) when UEs access 5GS via a MWAB;

- support roaming of the MWAB-UE from its HPLMN into a VPLMN.

# 5 Key Issues

## 5.1 Key Issue #1: Architectural enhancements for the support of a MWAB

This Key issue addresses architectural enhancements required to support the MWAB connects to the 5GC with the use of wireless backhauling (for the N2/N3 interfaces) via IP connectivity provided by a PDU session.

This will include:

- Whether and how the MWAB provides service for UEs from the HPLMN and UEs from other PLMN when the MWAB roaming nationally/internationally to another PLMN.

- How to provide the backhaul link using a PDU sessions for a MWAB, to support the N2/N3 interfaces and connectivity to an OAM server.

- How to discover and determine the AMF for the MWAB-gNB to connect to.

NOTE: The AMF discovery and determination need to be coordinated with RAN WGs.

## 5.2 Key Issue #2: Authorization of a MWAB and configuration of MWAB

A MWAB that operates in a PLMN by using the wireless access backhaul and serving UEs in proximity, is subject to authorization, with the additional support of the HPLMN of the MWAB in case of roaming. In addition, configuration of the MWAB (both the MWAB-gNB and MWAB-UE) for the MWAB operation needs to be studied.

This Key issue will study:

- How to authorize a MWAB to serve UEs and how to update and handle the MWAB authorization status (including de-authorize or authorize a previously not authorized MWAB and RAN-CN interface handling).

- How to support the configuration and update of the configuration of the MWAB with information related to MWAB operation, including the RAN-CN interface handling.

NOTE: Coordination with RAN WGs is needed due to the dependency on RAN.

## 5.3 Key Issue #3: Control of UE's access to 5GS via a wireless access backhaul

This key issue is to investigate efficient control of UE access to MWAB. In particular, the following aspects should be addressed:

- Whether and how to enhance the existing CAG mechanism to control and manage the access of a UE via MWAB.

NOTE 1: Support of legacy UE(s) shall be considered.

NOTE 2: Aspects related to RAN need to be coordinated with RAN WGs.

## 5.4 Key Issue #4: Efficient mobility and service continuity when served by MWAB

### 5.4.1 General description

When the moving vehicles are equipped with MWAB, the MWAB-gNB can provide 5G coverage and communication to UEs (inside the vehicle and/or in its vicinity), and connected wirelessly to the 5G network via a macro NG-RAN node. When one or a group of UEs are already served by the MWAB, there are two mobility scenarios to be studied as the following:

- Scenario A (mobility within the same 5GC node): When the UEs are continuously served by a MWAB (e.g. inside the vehicle and/or in its vicinity), and this MWAB-gNB is moving around within a limited geographical area while keeping connecting with the same 5GC nodes (e.g. AMF and UPF). In this case, the UE keeps the connection with the MWAB, and there is no change of the connections as in figure 5.4.1-1. However, the change of the NG-RAN nodes serving the MWAB-UE and the MWAB location may have impact on the mobility or service restrictions to the UE served by the MWAB.

- Scenario B (mobility between different 5GC nodes): When the UEs are continuously served by a MWAB (e.g. inside the vehicle and/or in its vicinity), and this MWAB is moving around over a long distance. To continue to provide services to the UEs, the MWAB needs to change the 5GC nodes it connects to. In this case, the UE keeps the connection with the MWAB-gNB, but there is a possible change of the AMF and UPF.

NOTE 1: For the above scenarios, whether the cell information in the System Information Broadcast (e.g. Cell ID, TAC) changes has RAN dependency.



Figure 5.4.1-1: Scenarios for efficient mobility and service continuity

The following aspects need to be studied for UEs served by the MWAB in the case of mobility in the scenarios A and B:

- Whether and how to enhance current procedures of mobility and service continuity for a UE. The following aspects need to be considered in potential solutions:

- how to reflect the change of MWAB serving cell or location in the mobility management of the UEs served by the MWAB.

- how to efficiently manage the mobility of the UEs served by the MWAB, when 5GC node change is necessary.

- how to manage the RAN-CN interfaces.

NOTE 2: Mechanisms related to mobility management and service continuity have RAN dependency and should align with the progress of RAN WGs.

## 5.5 Key Issue #5: Support of location services for UEs when MWAB(s) is involved

Based on the requirements of TS 22.261 [3], the 5G system shall be able to support location services for the UEs accessing 5GS via a mobile base station relay. When a UE is served by a MWAB, the MWAB’s movement may affect not only positioning procedures but also regulatory services needing UE location. MWAB(s) not serving a UE may also be involved to determine the location of the UE. Therefore, this key issue needs to address:

- How to support location services for the UEs served by a MWAB that moves, including the cases when the MWAB roams to a VPLMN.

- Whether and how to support the involvement of other MWAB(s) not serving the UE in the location measurement.

NOTE: For this key issue, this study should as a baseline attempt to reuse the functionality supporting location service involving MBSR as specified in TS 23.273 [6].

## 5.6 Key Issue #6: Support of Emergency services for UEs via a MWAB

Based on the requirements of TS 22.261 [3], the 5G system shall be able to support emergency service for the UEs accessing 5GS via a mobile base station relay. Therefore, this key issue needs to address:

- Whether any enhancements are needed to support emergency service (including graceful release) for the UEs accessing 5GS via a MWAB. MWAB mobility and roaming scenarios shall be considered.

- Whether and how to handle the case when MWAB-UE initiates or has an ongoing emergency session already.

# 6 Solutions

## 6.0 Mapping of solutions to key issues

Editor's note: This clause describes the mapping between solutions and key issues.

Table 6.0-1: Mapping of solutions to key issues

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Key Issues | | | | | |
| Solutions | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | x | x | x |  | x | x |
| 2 | x |  |  |  |  |  |
| 3 | x |  |  |  |  |  |
| 4 |  | x |  |  |  |  |
| 5 |  | x |  |  |  |  |

## 6.1 Solution #1: Architecture enhancements to support MWAB operations

### 6.1.1 General

Figure 6.1.1-1 presents an example architecture for the MWAB operation when no roaming was involved for the MWAB-UE. In this case, there may be two PLMNs involved, i.e., the PLMN 1 that serves the MWAB-UE, and the PLMN 2 that serves the UE connected to the MWAB.

In this case, the MWAB-gNB logically belongs to PLMN 2, and establishes N2 and N3 connection with the UE AMF and UE UPF via the PDU session of the MWAB-UE established with PLMN 1. MWAB-gNB announces PLMN IDs of PLMN 2.

If the UE served by the MWAB is roaming, there is another PLMN (not shown in the figure), i.e., the HPLMN of the UE served by the MWAB, involved. The interactions of the HPLMN of the UE and PLMN 2 are the same as that described in TS 23.501 [2] clause 4.2.4 for the roaming case.

The MWAB UPF in PLMN 1 serves the MWAB-UE and provides the connection via a N6 interface towards PLMN 2, to carry the N2 and N3 traffic from MWAB-gNB. The MWAB-UPF also supports the access to the OAM system in PLMN 2 by the MWAB-gNB.

NOTE: Depending on deployment requirement, a security gateway may be required between the MWAB-UPF and the PLMN 2 core network. In that case, the MWAB-gNB need to connect to the security gateway based on pre-configured security credentials. In that case, the traffic between MWAB-gNB and the PLMN 2 goes inside the security tunnel established via the security gateway.

Editor's Note: Details of such operation with the security gateway will be coordinated with RAN3 and SA3.

UE connected to the MWAB-gNB can access the 5GS services offered by PLMN 2 as normal. No enhancement to the UE is required. The UE connected to the MWAB-gNB is not aware of PLMN 1, and thus does not need any roaming agreement between its HPLMN and the PLMN 1.

In some cases, the PLMN 1 and PLMN 2 can be the same PLMN.



Figure 6.1.1-1 Architecture for MWAB operation support – non-roaming

Figure 6.1.1-2 presents an example architecture for the MWAB operation when MWAB-UE is roaming with a Local Breakout PDU session for its operation. In this case, there may be three PLMNs involved, i.e., the PLMN 1 that serves the MWAB-UE, and the PLMN 2 that serves the UE connected to the MWAB, and the HPLMN of the MWAB-UE. The use of the Local Breakout PDU session by the MWAB can be configured by the HPLMN, e.g. with some VPLMN specific URSP rules.

In this case, the PLMN-1 may access the MWAB's HPLMN UDM for the subscription information. The rest of the operation are similar to that shown in Figure 6.1.1-1.

If the UE served by the MWAB is roaming, there is another PLMN (not shown in the figure), i.e., the HPLMN of the UE served by the MWAB, involved. In that case, the interaction of the HPLMN of the UE and PLMN 2 is the same as that described in TS 23.501 [2] for the roaming case.

The UE served by the MWAB-gNB is not aware of PLMN 1, and thus does not need any roaming agreement between its HPLMN and the PLMN 1.



Figure 6.1.1-2 Architecture for MWAB operation support – roaming with Local Breakout

Figure 6.1.1-3 presents an example architecture for the MWAB operation when MWAB-UE is roaming with a Home Routed PDU session for its operation. In this case, PDU session of the MWAB-UE is routed by PLMN 1 to the HPLMN of the MWAB.

In this case, the PLMN-1 may access the MWAB's HPLMN UDM for the subscription information. The rest of the operation are similar to that shown in Figure 6.1.1-1.

If the UE served by the MWAB is roaming, there is another PLMN (not shown in the figure), i.e., the HPLMN of the UE served by the MWAB, involved. In that case, the interaction of the HPLMN of the UE and PLMN 2 is the same as that described in TS 23.501 [2] for the roaming case.

The UE served by the MWAB-gNB (of PLMN-2) is not aware of PLMN 1, and thus does not need any roaming agreement between its HPLMN and the PLMN 1.

Editor's Note: It is FFS how to ensure that the S-NSSAI used by MWAB-UE allows access to PLMN 2's slice serving the UE.



Figure 6.1.1-3 Architecture for MWAB operation support – roaming with Home Routed

### 6.1.2 Functional descriptions

The MWAB operates as follows to provide service to a UE:

1. To operate as a MWAB, the MWAB-UE needs to first register to a serving network that is allowed by its subscription, and that is PLMN 1 in the architecture shown in clause 6.1.1. The serving PLMN authorizes the MWAB based on its subscription and provides the authorization result indication to the MWAB-UE.

2. MWAB-UE provides the authorization result indication to the MWAB-gNB, which may trigger the MWAB-gNB to attempt the connection with the PLMN it serves, i.e., PLMN 2 in the architectures shown in clause 6.1.1.

3. The attempt from the MWAB-gNB triggers the MWAB-UE to establishes a PDU session(s) for the MWAB operation, based on the configuration of the MWAB-UE, e.g. with the proper DNN, S-NSSAI, and the SSC Mode. Only IP based of PDU sessions are used for the MWAB operations support. The configuration of the MWAB-UE can be Local Configuration, or URSP rules.

4. The serving PLMN of MWAB-UE selects the proper MWAB UPF according to the DNN and S-NSSAI for the PDU session and ensures that the selected MWAB UPF provides the connection to the PLMN 2's AMF and UPF.

5. The MWAB-gNB establishes the connection to the OAM system of the PLMN 2 and obtains the corresponding configurations to operate as a gNB for PLMN 2. This includes for example the configuration on the AS layer operation, and also the information to be sent in the SIB, e.g. PLMN ID(s). Details of the configuration information are out of scope of SA2.

6. The MWAB starts to operate based on the OAM control as a gNB for PLMN 2, and serves the UE in proximity for PLMN 2. The MWAB-gNB may also instructed by the OAM system to establish N2 interface using the NG setup procedure defined in TS 38.413 [8] with some AMFs in PLMN 2 over the PDU session provided by MWAB-UE.

Editor's Note: It is FFS how to support MOCN RAN sharing.

7. When a UE camps on the MWAB-gNB starts requests a connection, e.g. initiates a registration or service request procedure, the MWAB-gNB performs usual operation as specified in TS 23.501 [2] and route the message to a suitable UE AMF in PLMN 2. The AMF may be aware of that the UE is served by a MWAB based on the ULI information.

8. When the UE establishes a PDU session, the UE SMF selects a proper UE UPF. The MWAG-gNB may establish the N3 interface with the UPF over the PDU session of the MWAB-UE, if it is not yet established.

9. The UE served by the MWAB-gNB (of PLMN-2) is not aware of the serving PLMN of the MWAB-UE, and thus does not need a roaming agreement with the serving PLMN of the MWAB-UE.

The efficient mobility and service continuity support for UE when the serving MWAB moves (KI#4) will be addressed in a separate solution compatible with this solution.

### 6.1.3 Procedures

#### 6.1.3.1 MWAB-UE registration and authorization

The MWAB-UE performs PLMN selection based on existing procedures in TS 23.122 [9].

MWAB-UE also follows existing procedures in TS 23.501 [2], for network slice configuration. The serving PLMN access the HPLMN of the MWAB-UE for the subscription data.

The MWAB-UE may be triggered by the MWAB-gNB to establish the PDU session(s) for MWAB operation. This can be based on an interface out of scope of SA2.

The MWAB-UE uses Local Configuration or the URSP to identify the PDU session parameters to use, e.g. the S-NSSAI, DNN, and SSC modes derived from the Route Selection Descriptor.

There may be VPLMN specific URSP rules configured on the MWAB-UE, and in that case the PDU session parameters may be different in different VPLMNs.

The requested S-NSSAI and DNN will be authorized based on the subscription of the MWAB based on existing procedures in TS 23.501 [2] and TS 23.502 [7].

No procedure enhancement to those defined in TS 23.501[2] and TS 23.502 [7] is necessary.

#### 6.1.3.2 Control of UE's access to MWAB

Legacy UE can access the MWAB-gNB as a normal gNB.

For CAG capable UEs, the enhancement as described in TS 23.501 [2] clause 5.35A.7 can be reused for control the access to the MWAB, if the MWAB is configured by OAM of PLMN 2 to broadcast CAGs.

Editor's Note: It is FFS whether enhancements is needed to prevent the MWAB-UE from selecting the MWAB-gNB cell (including the case of MWAB-UE and MWAB-gNB belonging to same MWAB).

#### 6.1.3.3 Support of Location Service for UEs when MWAB(s) is involved

A separate solution compatible with the architecture introduced in this solution will be used to support the Location Service, based on the principles defined in TS 23.501 [2] clause 5.35A.5.

Editor's Note: It is FFS if further enhancements is needed to use the NRPPa procedures with MWAB in the roaming cases.

#### 6.1.3.4 UE mobility to and from a MWAB cell

Existing UE mobility procedure can be reused. No enhancement is required, based on the same considerations as described in TS 23.501 [2] clause 5.35A.3.1 and 5.35A.3.2.

### 6.1.4 Impacts on services, entities, and interfaces

None.

Editor's Note: Related procedures can be eventually documented in informative annex in TS 23.501[2].

## 6.2 Solution #2: MWAB architecture and procedures

### 6.2.1 General

The solution provides methods for architectural enhancements for the support of a MWAB, which is based on the support of MWAB architecture as specified in clause 4.1 with the following high-level descriptions according to the different usages of PDU sessions(s) of the MWAB-UE:

- Connection with OAM server over IP connectivity provided by the PDU session of MWAB-UE.

- N2 interface with AMF over the IP connectivity provided by the PDU session of MWAB-UE.

- N3 interface with UPF over the IP connectivity provided by the PDU session of MWAB-UE.

### 6.2.2 Functional descriptions

#### 6.2.2.1 Connection with OAM server over PDU session

When a PDU session is used for the MWAB to access the OAM server, the MWAB-UE establishes a dedicated PDU session for the OAM traffic. Additionally, the OAM server address can be configured per PLMN ID, the MWAB selects the OAM server address of the respective PLMN ID for which it wants to act as NG-RAN.

The MWAB-UE is configured dedicated DNN/S-NSSAI for the PDU session for backhaul link to the OAM server, or the AMF provides it when the MWAB-UE attempts to establish the PDU session in the slice where the OAM service is (e.g a default DNN/S-NSSAI can be used).

The MWAB-gNB accesses the OAM server and the OAM server can then configure the MWAB-gNB additional information for N2 or N3 connectivity. The MWAB-gNB requests the establishment of the N2 or N3 based on the configuration, which may trigger establishment of additional BH PDU sessions by the MWAB-UE, e.g. based on Local Configuration or URSP rules. The N2 connection is established on a BH PDU sessions as per the received configuration.

#### 6.2.2.2 N2 connection over BH PDU session

The N2 connection with AMF for the MWAB-gNB:

- The BH PDU session’s PSA routes the N2 message between the MWAB-gNB and AMF based on the IP address.

- The N2 connection with AMF set over BH PDU session is described in the Figure 6.2.2.2-1.

- The MWAB-UE is configured with dedicated DNN/S-NSSAI for the PDU session for backhaul link to be used by the MWAB-gNB. When MWAB-UE establishes the PDU session to access the OAM server, the address of the AMF(s) for the MWAB-gNB to connect to can be configured by the OAM based on MWAB’s location.

NOTE: Considering the mobility of MWAB-gNB, the AMF change may happen because of the regional deployment of AMF. the N2 connection change during MWAB-gNB mobility will be co-ordinated with the mobility aspects of key issue#4.

UE#1

UE#2

MWAB

gNB

UE

**AMF set**

**BH PDU Session**

AMF

AMF

AMF

AMF

BH-gNB

BH-UPF

N2 of UE

Figure 6.2.2.2-1: N2 connection over BH PDU session

#### 6.2.2.3 N3 over BH PDU session

Editor’s Note: Detailed description is FFS.

#### 6.2.2.4 Xn over BH PDU session

The MWAB-gNB's Xn, if enabled based on configuration by OAM, may share the same PDU session of N2/N3 or different PDU session. When the respective PDU session providing IP connectivity is established, IP connectivity is also used to connect with another NG-RAN (using the Xn interface).

Editor’s Note: It is FFS whether or not to support Xn connection over BH PDU Session and need the coordination with RAN WG3.

#### 6.2.2.5 Handling of NG establishment with respect to the topic of multi-hop handling

Editor’s Note: Whether and how to avoid multi-hop handing needs to coordination with RAN WG3.

The MWAB need to avoid multi-hop (until RAN WGs agree otherwise). A solution is provided to ensure this is possible without requiring new impacts on MWAB-UE and the deployed NG-RAN (except in the event of Xn handover)

The MWAB-gNB includes in the NG SETUP REQUEST message to the AMFs that it is configured to establish NG with an indication that it is a MWAB-gNB. The AMF stores this information.

If a MWAB-UE attempts to register at another MWAB cell, the AMFs that receives the registration request from the MWAB-UE can based on the received information and not accept the registration.

Editor’s Note: It is FFS how to avoid the multi-hop during the N2 and Xn handover.

When there is a N2 handover of a MWAB-UE, the AMF can indicate in the Handover Request that it is handing over a MWAB-UE. If the target gNB is a MWAB-gNB, the MWAB-gNB can reject the handover based on its policy and the information received.

Editor’s Note: The feasibility of this N2 handover solution will be evaluated later in the evaluation phase.

When there is a Xn handover of a MWAB-UE, the Source RAN node can indicate in the handover required MWAB-UE. If the target gNB is an MWAB-gNB the MWAB-gNB can reject the handover based on its policy and the information received.

NOTE: It is assumed that the support of this in Xn case, will require the AMF to provide this information to NG-RAN in the MWAB-UE context and also a new Xn IE to be included by a gNB. Hence, for example, in a PLMN where no NG-RAN upgrade is desired to support MWABs, the MWABs can be configured to not establish Xn to other gNBs.

Editor’s Note: The feasibility of this Xn handover solution will be evaluated later in the evaluation phase.

### 6.2.3 Procedures

#### 6.2.3.1 Connection with OAM server over PDU session

The MWAB-UE may be configured dedicated DNN/S-NSSAI for the PDU session for backhaul link to the OAM server (e.g. Local Configuration or URSP rules) or network serving the MWAB-UE may determine a default DNN/S-NSSAI for it based on subscription.

#### 6.2.3.2 N2 connection over BH PDU session

The N2 message routing over BH PDU session is described in the Figure 6.2.3.2-1.

gNB

UE

**MWAB**

BH gNB

MWAB-UE AMF

MWAB-UE SMF

MWAB-UE UPF

**BH 5GC**

AMF

OAM

1. a dedicated PDU session for the OAM traffic

2. BH PDU session for N2 connection

3. Generates the UL N2 message (Source IP: MWAB-UE IP address, Destination IP: AMF address)

4. UL data via BH PDU session (payload (N2 message))

IP routing based on the destination IP address

5. payload (N2 message)

6. Generates the DL N2 message (Source IP: AMF address, Destination IP: MWAB-UE IP address)

7. payload (N2 message)

8. DL data via BH PDU session (payload (N2 message))

Figure 6.2.3.2-1: N2 message routing over BH PDU session

1 When MWAB-UE establishes the PDU session to access the OAM server, the address(es) of the AMF(s) for the MWAB-gNB to connect to can be configured by the OAM based on MWAB’s location.

Editor's Note: Details of the OAM configuration, e.g., whether one configuring the operation as a gNB in the BH-PLMN and one for getting configuration for N2/N3, is FFS.

2 The MWAB-gNB requests the connection towards the AMF(s) for N2 backhaul link via the interface with the MWAB-UE, and this triggers the establishment of a PDU session with a dedicated DNN/S-NSSAI based on Local Configuration or URSP rules of the MWAB-UE.

3 The MWAB generates the UL N2 message (e.g. NG SETUP REQUEST message) whose source IP address is the IP address associated with the N2 connection provided by the of MWAB-UE and destination IP address is the AMF address.

4 The UL N2 message as the UL traffic is routed to the PSA of the BH PDU session.

5 The PSA of the BH PDU session routes the N2 message to the AMF.

6 The AMF generates the DL N2 message (e.g. NG SETUP RESPONSE message) whose source IP address is the AMF address and destination IP address is the IP address of MWAB-UE.

7 The DL N2 message is routed to the PSA of the BH PDU session.

8 The PSA of the BH PDU session routes the DL N2 message to the MWAB.

#### 6.2.3.3 N3 connection over BH PDU session

Editor’s Note: Detailed description is FFS.

#### 6.2.3.4 Xn connection over BH PDU session

Similar to the N3 connection over BH PDU session, the Xn connection is the user plane which routes the traffic from MWAB-gNB to another NG-RAN. The Xn message routing over BH PDU session is similar as the Figure 6.2.3.2-1.

#### 6.2.3.5 Alternative handling of N2 transmission by using dedicated IP address for MWAB-gNB

Editor's Note: The additions proposed by this clause need further discussion.

There might be following additional treatment for MWAB-gNB IP address on top of the procedure in clause 6.2.3.2:

- Step 1: OAM may also configure MWAB with MWAB-gNB IP address, which is used to establish N2 interface with the AMF. MWAB-gNB may use the configured IP address to interact with AMF regarding N2.

Editor's Note: The IP packet routing used in this procedure is FFS.

#### 6.2.3.6 MWAB NG-establishment

Editor's Note: The procedure is only for information, and details need to be further coordinated with RAN WGs.



Figure 6.2.3.6-1: MWAB NG connection establishment including additional information for MWAB

The MWAB NG establishment is augmented with additional information the AMF stores to later decide what to do for MWAB UEs that attempt to register.

#### 6.2.3.7 MWAB-UE registration over other MWAB-gNB



Figure 6.2.3.7-1: MWAB-UE registration and multi-hop handling.

The MWAB-UE of MWAB 2 attempts to register over a MWAB-gNB of MWAB 1. The AMF rejects the Registration or accepts the registration without authorizing the MWAB-UE to operate as MWAB.

#### 6.2.3.8 MWAB-UE N2 handover and multi-hop handling

Editor’s Note: The detailed procedures of N2 handover is FFS.

Editor's Note: The procedure is only for information, and details need to be further coordinated with RAN WGs.



Figure 6.2.3.8-1: MWAB-UE N2 handover successful

In figure 6.2.3.8-1 the AMF indicates that the UE being handed over is a MWAB UE. The target RAN node is not a MWAB so it does not interpret any of this information, so the handover is successful (there is no multi-hop).



Figure 6.2.3.8-2: MWAB-UE N2 handover successful

In figure 6.2.3.8-2 the AMF indicates that the UE being handed over is a MWAB UE. The target RAN node is a MWAB and rejects the handover.

#### 6.2.3.9 MWAB-UE Xn handover and multi-hop handling

Editor’s Note: The detailed procedures of Xn handover is FFS.

Editor's Note: The procedure is only for information, and details need to be further coordinated with RAN WGs.



Figure 6.2.3.9-1: MWAB-UE N2 handover successful

In figure 6.2.3.9-1 the source NG-RAN node indicates that the UE being handed over is a MWAB UE. The target RAN node is not a MWAB, so it does not interpret any of this information, so the handover is successful (there is no multi-hop).



Figure 6.2.3.9-2: MWAB-UE Xn handover successful

In figure 6.2.3.9-2 the source NG-RAN node indicates that the UE being handed over is a MWAB UE. The target RAN node is an MWAB and rejects the handover. Note there is impact on the source NG-RAN. If a PLMN does not desire to upgrade the NG-RAN, it can e.g., disable the Xn establishment for MWABs to prevent Xn handovers to an MWAB.

### 6.2.4 Impacts on services, entities, and interfaces

MWAB:

- may be configured with dedicated DNN/S-NSSAI for the PDU session for backhaul link.

- OAM configures MWAB-gNB with the PDUs session information to be used for the N2/N3

- MWAB-gNB triggers PDU sessions establishment for the BH link based on obtained configuration and uses related address(es) for N2/N3, OAM interactions

- the address of the AMF for the MWAB-gNB to connect to can be configured by the OAM based on MWAB’s location.

- Support Multi-hop prevention feature as detailed above.

AMF:

* support identification of an NG connection as related to a MWAB and the multi-hop prevention procedures as outlined above.

OAM:

- Configuration of MWAB with BH PDU sessions information and AMF address information (and other information related to MWAB-gNB operation

## 6.3 Solution #3: N3 backhaul PDU session management

### 6.3.1 General

This solution is to address KI#1 about how to provide the backhaul link using a PDU sessions for a MWAB to support the N3 interfaces.

MWAB provides wireless connection to the 5GC through an IP connectivity provided by a PDU session; hence, both N2 interface and N3 interface are carried over the PDU session(s) between NWAB-UE and 5GC.

At least one PDU session is established between NWAB-UE and 5GC for both N2 interface and N3 interface depending on the configuration of the MWAB:

- Single BH PDU session for both N2 and N3.

- Multiple BH PDU session(s) for N2 and PDU session(s) for N3.

The PDU sessions of the UEs served by a MWAB are carried over BH PDU session(s) for N3 backhaul.

### 6.3.2 Functional descriptions

This solution assumes that:

- BH PDU session for N2 backhaul is already established.

- One or multiple BH PDU session(s) for N3 backhaul is already established or has not been established. Each BH PDU session is associated with the default 5QI and ARP of the QoS Flow associated with the default QoS rule as defined in clause 6.4 of TS 23.503[10].

For the UL/DL UE traffic, the UE PDU session QoS received at MWAB-gNB (i.e., the UE QoS flow) is bound to the BH QoS flow (and/or BH PDU session). The MWAB binds the UE QoS flow to BH PDU session based on the UE requested PDU session and the QoS flow characteristics:

- If there is an existing BH PDU session which is suitable to support the UE PDU session and its QoS flows characteristics, this BH PDU session is selected, and the UE PDU session is bound to this BH PDU session.

- If no existing BH PDU session suitable, a new PDU session is established based on the UE PDU session and its QoS flow characteristics. Alternatively, an existing BH PDU session is modified to accommodate the new PDU session or QoS flow.

NOTE: It is the MWAB-gNB to trigger MWAB-UE to establish/modify the BH PDU session as defined in clause 4.3 of TS 23.502[7].



Figure 6.3.2-1: Mapping of QoS flows at MWAB and at BH UPF

Figure 6.3.2-1 shows that the UE traffic for a specific QoS flow of a UE PDU sessions is carried in GTP-U tunnels for UL and DL that are associated with DSCP values and IP@ of theUPF(for UL) of the UE and IP address of MWAB-gNB (for DL). The DSCP value can be identified at the MWAB-gNB based on policy related to information the MWAB-gNB has in the SM context for the PDU session. The MWAB gNB then requests the MWAB-UE to perform a modification of the BH PDU session with a specific 5QI/ARP and other QoS parameters that are suitable to handle the new DL QoS flow of the UE served by the MWAB. The SDF included in the PDU session modification is identified by the IP@ of the MWAB-gNB and the DSCP value. This provides the BH UPF with the packet classification rules it needs to map the DL traffic from the UE UPF to the right QoS flow on the BH PDU session.

### 6.3.3 Procedures

#### 6.3.3.1 Handling of a UE PDU session establishment or modification



Figure 6.3.3.1-1: Handling of a UE PDU session establishment or modification

1. A PDU session is established or modified for a UE as defined in clause 4.3 of TS 23.502 [X], and this causes the MWAB-gNB to receive from SMF a new SM context for a PDU session including at least a QoS flow.

2. For each QoS flow the MWAB-gNB determines the required 5QI/ARP and other QoS parameters in the BH PDU session and TNL to be used to signal to the BH SMF the SDF for the QoS rules related to this SDF for DL. For UL the QoS rules are also determined by MWAB and the TNL information determined at the MWAB-gNB is used to classify in UL.

3. The MWAB-UE modifies the BH PDU session as instructed.

4. The UPF of the BH PDU session is now ready to correctly process DL traffic from the UE UPF.

5. The MWAB-UE acks the correct modification of the BH PDU session.

6. The MWAB-gNB can complete the establishment of the PDU session.

7. The data for the UE PDU session can be sent/received with the right QoS.

### 6.3.4 Impacts on services, entities, and interfaces

MWAB:

- The MWAB binds the UE QoS flow to a BH PDU session based on the UE requested PDU session and the QoS flow characteristics

## 6.4 Solution #4: MWAB authorization handling

### 6.4.1 Introduction

This solution addresses issues related to KI#2. It provides methods to support MWAB operation authorization in different roaming scenarios. It also provides means to handle authorization status change handling for both MWAB-gNB logic and MWAB-UE logic.

### 6.4.2 Functional Description

When MWAB node includes MWAB-gNB function and MWAB-UE function as described in clause 4, the authorization of the MWAB operation is based on subscription information linked to the MWAB-UE and the authorization status can depend on the location and/or time.

The MWAB-gNB and MWAB-UE may be connected to the same network/5GC, or they may be connected to different network/5GC. The UDM which holds the subscription information for MWAB-UE can be in the BH-5GC (i.e. where the MWAB-UE is registered) or in a different 5GC (which has roaming agreement with the network serving the MWAB-UE).



Figure 6.4.2-1: MWAB-gNB and MWAB-UE connect to the same 5GC



Figure 6.4.2-2: MWAB-gNB and MWAB-UE connect to different 5GCs

The BH-AMF, where the MWAB-UE is registered, is responsible for the authorization of the MWAB operation during the NAS registration procedure in all scenarios (i.e. non-roaming as well as roaming) based on the subscription information linked to the MWAB-UE.

The BH-AMF provides the MWAB node authorization information to the MWAB-UE via NAS registration related message and to the BH-gNB via NGAP message.

The MWAB-UE provides the authorization information to MWAB-gNB. The communication between MWAB-UE and MWAB-gNB is based on implementation.

The MWAB-gNB initiates the gNB operations (e.g. it requests MWAB-UE to setup IP connections for needed backhaul communication and sets up the RAN-CN connection towards AMF), if authorization information indicates that the MWAB is allowed to operate as MWAB node.

### 6.4.3 Procedures

#### 6.4.3.1 MWAB node authorization and operation initiation

This procedure describes the MWAB node authorization steps and the operations with focus on the 5GC aspects.



Figure 6.4.3.1-1: MWAB node authorization and operation initiation

MWAB-UE registration and authorization phase:

1. The MWAB-UE triggers registration towards the selected PLMN in NR cell. The MWAB-UE provides the MWAB Indication via RRC and NGAP message to BH-AMF.

2. The BH-AMF retrieves MWAB-UE subscription data from UDM and authorizes the MWAB operation.

3. The BH-AMF accepts the MWAB-UE registration request and provides the MWAB authorization status to MWAB-UE and BH-gNB.

Editor’s Note: The need of the indications on RRC and NGAP is FFS.

MWAB-gNB operation initiation:

4. Based on authorization allowed information provided, the MWAB establishes the IP connectivity for backhaul usage. Or the MWAB-UE may establish PDU Session to provide the IP connectivity for backhaul usage based on the MWAB authorization status (i.e. authorized) provided by the AMF.

NOTE 2: The detailed communication between MWAB-gNB and MWAB-UE is implementation based and not in SA2 scope.

5. The MWAB-gNB connects to the AMF via the backhaul IP connectivity provided by the MWAB-UE.

6. The MWAB-gNB initiates the service towards UE.

NOTE 3: how the MWAB-gNB receives the parameters needed for operation (e.g. PLMN ID, TAC, Cell information with CAG IDs, AMF information for connection) is addressed by other solutions.

UE registration via MWAB-gNB cell:

7. The UEs allowed to access the MWAB cell selects the cell and trigger Registration Request.

#### 6.4.3.2 MWAB authorization status change for Registered MWAB

This procedure is used when MWAB authorization status changes for a registered MWAB-UE .



Figure 6.4.3.2-1: MWAB authorization status change handling

Registered MWAB-UE authorization status change:

1. BH-AMF triggers NAS UE configuration update procedure to inform the MWAB-UE with the MWAB authorization status change.

When MWAB-UE authorization status is changed from allowed to not-allowed, the BH-AMF may provide one of the following additional information in the UE Configuration Update Command message:

a) Indication that the MWAB-UE needs to be deregistered.

b) Indication that the BH PDU Session(s) need to be released.

NOTE 1: The triggering for this may be different (e.g., subscription data change, location restriction, time restriction, local policy in BH-AMF).

MWAB-UE authorization status change from allowed to not-allowed:

2. Based on authorization allowed information provided by the MWAB-UE, the MWAB-gNB triggers the move of connected UEs to other cells.

3. After all the UEs are moved, the MWAB-gNB may remove the TNLA and NGAP connection towards the AMF.

4. The MWAB releases the IP connectivity or the MWAB-UE may release the BH PDU Session(s) based on the additional information received in step 1.

The MWAB-UE may deregister based on the additional information received in step 1. Or the BH-AMF may deregister the MWAB-gNB from the network based on local policy, after the BH PDU Sessions(s) have been released or a timer that started at step 1 expires.

Editor’s Note: The needs and usage of the additional indications from step 1 is FFS.

The MWAB-gNB shuts down the air interface.

NOTE 2: Deregistration of MWAB-UE can be performed without performing BH PDU Session(s) release separately.

NOTE 3: The detailed communication between MWAB-gNB and MWAB-UE is implementation based and not in SA2 scope.

MWAB-UE authorization status change from not-allowed to allowed:

5-8. Same to steps 4-7 in Figure 6.4.3.1-1.

### 6.4.4 Impacts on services, entities, and interfaces

AMF:

- Support MWAB authorization handling based on subscription data and local policy.

- Support NGAP removal procedure.

MWAB-UE:

- Support Authorization status handling.

- Support the IP connectivity establishment for the backhaul usage request from MWAB-gNB.

MWAB-gNB:

- Support NGAP removal procedure.

- Support the handling of UE move to other cells when authorization status changes.

## 6.5 Solution #5: Authorization and Change of Authorization of a MWAB and configuration of a MWAB

### 6.5.1 General

This is a Solution addressing Key Issue #2: Authorization of a MWAB and configuration of MWAB

### 6.5.2 Functional descriptions

The solution is based on this outline:

- The MWAB-UE optionally includes a MWAB indication in the Registration request, in the UE MM Core Network Capability defined in clause 5.3.4 of TS 23.501 [2]. Alternatively, or in addition, the MWAB-UE may be configured by the HPLMN a specific (set of) S-NSSAI(s) associated with the MWAB operation, and the MWAB-UE includes the S-NSSAI in the Registration Request.

- During registration, the AMF retrieves subscription data and the UDM provides to the AMF in subscription data, the MWAB authorized indication with optional location and time availability if the SUPI is authorized for MWAB operation.

- The MWAB-UE is either accepted or rejected, if it is rejected it shall only register if the cause code and received information from AMF allows. If it is accepted, then if establishes a PDU session to obtain connectivity to an OAM server.

- At any time the AMF can change authorization status for the MWAB by means of UE configuration update. If a MWAB is changing to not authorized from authorized the MWAB-gNB triggers handover of the UEs it serves to other cells of other gNBs. Then MWAB-UE may release the NG related PDU sessions. The AMF may also release the PDU sessions of the MWAB-UE if it is configured to do so after a certain amount of time. The MWAB then stops service (which may cause any remaining UEs that could not be handed over to experience RLF, unless the MWAB had released their RRC connection before going out of service).

### 6.5.3 Procedures

#### 6.5.3.1 MWAB service authorization and MWAB gNB configuration



Figure 6.5.3.1-1: MWAB service authorization and initial MWAB-gNB configuration

1. The MWAB-UE registers and optionally includes in the UE MM Core network capability defined in clause 5.3.4 of TS 23.501[2] an indication it is intending to act as MWAB, optionally also indicate the PLMN(s) for which it may want to act as MWAB-gNB to network. It is assumed the MWAB-UE is configured with a list of PLMNs it is not allowed to register with and any Preferred PLMNs list as usual for a UE. Alternatively, or in addition, the MWAB-UE may be configured by the HPLMN with a (set of) S-NSSAI(s) associated with the MWAB operation and requests it in the registration procedure.

Editor's note: whether the MWAB-UE optionally also indicates the PLMN(s) for which it may want to act as MWAB-gNB to the network is FFS

Editor’s Note: The need of the indication on NAS MM capability is FFS.

2. The AMF retrieves the subscription data and checks whether the UE is authorized to act as MWAB by checking presence of MWAB Operation Allowed and any related location and time information. The AMF provides a default S-NSSAI for MWAB-UE if no S-NSSAI was requested by the MWAB-UE. The MWAB-UE also obtains any Configured NSSAI as applicable.

3. If the MWAB-UE subscription allows, the MWAB-UE is accepted and an indication that MWAB operation is allowed along with MWAB information is sent to the MWAB-UE, and the Allowed NSSAI including the S-NSSAI(s) for MWAB operation as applicable. The MWAB information includes:

a) MWAB-Authorized. Additionally, the area and time the UE is authorized optionally for per PLMN; or

b) MWAB-Unauthorized, additionally the area and time the UE is not authorized optionally per PLMN for.

The AMF may also send registration reject (if the UE is not allowed to remain registered in PLMN) to the MWAB-UE and indicate the MWAB information as MWAB-Unauthorized, additionally the area and time the UE is not authorized optionally for the PLMN.

Editor's Note: Whether per PLMN MWAB information has to be provided to UE is FFS.

4. If UE is authorized for MWAB, then it can start MWAB operations as MWAB in the area or time the UE is authorized to act as MWAB. If the UE enters a location or time the UE is not authorized to act as MWAB it will stop operating as MWAB. To start MWAB operation, the MWAB- UE establishes a PDU session to get initial configuration information for the MWAB-gNB from the OAM server. The PDU session establishment Request may include S-NSSAI and DNN depending on the MWAB-UE configuration. If no DNN is included, the AMF determines the correct one to use for the MWAB.

5. The MWAB-UE provides to the MWAB gNB the IP address it can use to contact the OAM server.

6. The MWAB-gNB contact the OAM server and obtains configuration

7. The MWAB-gNB establishes, based on how it has been configured by the OAM server, any additional PDU sessions to then use the for N2 and N3 connections as necessary.

8. If UE is not authorized for MWAB in the area or time (indicated by network) the UE will not start the MWAB operations. The UE can again attempt to act as MWAB i.e. execute from step 1 in the area or time where the UE is allowed to act as MWAB.

The MWAB-UE may maintain a list of authorized area and time per PLMN.

#### 6.5.3.2 MWAB change of service authorization



Figure 6.5.3.2-1: MWAB change of service authorization

1. The UDM may provide updated subscription data changing the MWAB authorization status to (not) authorized.

2. The AMF determines whether the MWAB authorization status has changed to Allowed or Not Allowed, and if so, the AMF updates the MWAB-UE with the new MWAB authorization status by a UE configuration update procedure. Additionally AMF may indicate below MWAB information:

a) MWAB-Authorization status, additionally the area and time the UE is (not) authorized for;

3. The MWAB-UE acknowledges the reception of the message.

4a. If the authorization state was changed to MWAB Operation Allowed, the MWAB continues from step 4 of figure Figure 6.5.3.1-1. And all other steps are skipped.

4b. If the authorization state was changed to MWAB Operation Not Allowed, then the MWAB-gNB hands over to other gNBs the UEs it serves.

5. The MWAB-gNB stops serving any UE and informs OAM it is out of service. The MWAB-gNB also releases all the NG connections to the AMFs if is connected to over the B/H PDU sessions.

6. The MWAB-gNB informs the MWAB-UE it has to release the b/h sessions it had requested earlier to establish.

7. The MWAB-UE releases all the b/h PDU sessions.

8. The AMF of the MWAB-UE or tthe MWAB-UE may initiate deregistration procedure when there are no more b/h PDU sessions based on policy. If so, the AMF may provide a suitable cause code and location/time information to the UE.

Editor's note: whether and how the acknowledgement from the MWAB-UE after the graceful release will be provided to the network is FFS.

### 6.5.4 Impacts on services, entities, and interfaces

AMF:

* ability to authorize and update authorization state and support MWABs as per message flows above.

MWAB (new):

* support the interactions with the OAM and 5GS as outlined above for authorization and change of authorization state.

OAM:

- configuration of MWAB.

# 7 Evaluation

Editor's note: This clause provides the evaluations of the solutions of clause 6.

# 8 Conclusions

Editor's note: This clause provides the conclusions for the study.

Annex A:  
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Change history | | | | | | | |
| Date | Meeting | TDoc | CR | Rev | Cat | Subject/Comment | New version |
| 2024-01 | SA2#160-Ad Hoc-e | S2-2400128 | - | - | - | TR skeleton agreed in SA2#160-Ad Hoc-e | 0.0.0 |
| 2024-01 | SA2#160-Ad Hoc-e | S2-2401701 | - | - | - | Scope for TR 23.700-06 on VMR\_Ph2. | 0.1.0 |
| 2024-01 | SA2#160-Ad Hoc-e | S2-2401702 | - | - | - | Definitions and terminologies for TR 23.700-06 on VMR\_Ph2. | 0.1.0 |
| 2024-01 | SA2#160-Ad Hoc-e | S2-2401703 | - | - | - | Architecture assumptions and requirements for TR 23.700-06 on VMR\_Ph2. | 0.1.0 |
| 2024-01 | SA2#160-Ad Hoc-e | S2-2401704 | - | - | - | Architecture assumptions for FS\_VMR\_Ph2. | 0.1.0 |
| 2024-01 | SA2#160-Ad Hoc-e | S2-2401705 | - | - | - | New KI: Authorization of a MWAB and Configuration of a MWAB-UE | 0.1.0 |
| 2024-01 | SA2#160-Ad Hoc-e | S2-2401706 | - | - | - | New KI: MWAB Architecture and procedures | 0.1.0 |
| 2024-01 | SA2#160-Ad Hoc-e | S2-2401707 | - | - | - | New KI: Control of UE's access to 5GS via a wireless access backhaul. | 0.1.0 |
| 2024-01 | SA2#160-Ad Hoc-e | S2-2401708 | - | - | - | New key issue for VMR\_Ph2 on mobility support. | 0.1.0 |
| 2024-01 | SA2#160-Ad Hoc-e | S2-2401709 | - | - | - | New KI: Support of location services. | 0.1.0 |
| 2024-01 | SA2#160-Ad Hoc-e | S2-2401710 | - | - | - | New KI: Support of emergency services. | 0.1.0 |
| 2024-03 | SA2#161 | S2-2403279 | - | - | - | KI #2, 4 – Update with clarification on the RAN-CN connection aspects. | 0.2.0 |
| 2024-03 | SA2#161 | S2-2403713 | - | - | - | New solution proposal: Architecture enhancements for the support of MWAB | 0.2.0 |
| 2024-03 | SA2#161 | S2-2403845 | - | - | - | Key Issue #1: New solution for MWAB architecture and procedures | 0.2.0 |
| 2024-03 | SA2#161 | S2-2403834 | - | - | - | KI#1, New solution: N3 backhaul PDU session management | 0.2.0 |
| 2024-03 | SA2#161 | S2-2403716 | - | - | - | KI#2, New solution, MWAB authorization handling | 0.2.0 |
| 2024-03 | SA2#161 | S2-2403717 | - | - | - | KI#2: New solution on MWAB authentication and authorization | 0.2.0 |