3GPP TSG-RAN WG3 Meeting #125 R3-244716

**Maastricht, NL, 19 - 23 Aug, 2024**

Title: (TP for TR 38.769) RAN architecture aspects

Agenda Item: 16.2

Source: Huawei

Document for: other

# 1 Introduction

In [1], about the RAN architecture, the Logical System Architecture for AIoT was captured, this contribution tried to have further text proposals to topology 1 and topology, on the architecture and protocol stack.

# 2 Reference

1. R3-244030 (BL pCR to TR 38.769) Study on solutions for Ambient IoT in NR, Huawei, CMCC

# 3 Text Proposal to TR 38.769

***------------Start of the Change-------------***

# 3 Definitions of terms, symbols and abbreviations

This clause and its three (sub) clauses are mandatory. The contents shall be shown as "void" if the TS/TR does not define any terms, symbols, or abbreviations.

## 3.1 Terms

For the purposes of the present document, the terms given in TR 21.905 [1] 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].

**example:** text used to clarify abstract rules by applying them literally.

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

<symbol> <Explanation>

## 3.3 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].

AIoT Ambient IoT

AIoT RAS AIoT Radio Access System

DO-A Device-originated autonomous

DO-DTT Device-originated by device-terminated trigger

DT Device-terminated

FR Frequency Range

IoT Internet of Things

LPWA Low-power, wide-area

LTE-MTC Long Term Evolution – Machine Type Communication

NB-IoT Narrowband IoT

RFID Radio frequency identification

SFO Sampling frequency offset

***------------Start of the Next Change-------------***

## 6.2 Protocol stack and signalling procedures

Editor’s note: Corresponds to the RAN2 objective in the SID.

## 6.3 RAN architecture aspects

Editor’s note 1: Corresponds to the second RAN3 objective in the SID, to identify RAN architecture aspects, including whether support for split architecture is necessary.

This chapter attempts to identify and describe architectural elements necessary to define a RAN architecture for support of Ambient IoT embedded in the overall 5G system architecture in support of topology 1 and topology 2 (as defined in TR 38.848 [2]).

Editor’s Note 2: What functionalities are hosted by the 5GS for AIoT is TBD.

This chapter also attempts to identify a functional split between RAN and CN.

Figure 6.3-1 depicts the logical system architecture for AIoT.

It consists of the following architectural elements:

**AIoT device**: equipment with characteristics outlined e.g. in TS 22.369 [x] and TR 38.848 [2].

**AIoT RAN**: hosts certain functions for AIoT as part of the functional split between RAN and CN.

**AIoT radio**: radio interface between AIoT device and Common reader function.

**AIoT CN**: hosts certain functions for AIoT as of the functional split between RAN and CN

NOTE: the details of AIoT CN are subject to SA2.

**XX interface**: interface between the AIoT RAN and the AIoT CN on which certain AIoT specific functions are performed.

**Common reader function**: a function that communicates with the AIoT device by means of AIoT radio.

**AIoT RAN node function**: a function residing in AIoT RAS. It contains e.g. the control of the AIoT radio resources used towards the AIoT device.

NOTE: “control of AIoT radio resources” does not necessarily imply dynamic configuration of resources but could also rely on static assignment of resources by means of OAM. Aspects concerning coordination of the Upper Layer functions (e.g. Inventory, Command) e.g. in case these functions have to be performed over a multitude of instances of the Common Reader Function are FFS.

Figure 6.3-1: Logical System Architecture for AIoT

### 6.3.1 Support of Topology 1

Figure 6.3.1-1 depicts a deployment scenario for topology 1 based on Figture 6.3-1, where the the Common reader function and AIoT RAN node function are deployed within an AIoT RAN.



**Figure 6.3.1-1 Deployment scenario for topology 1**

In Topology 1, the XX interface represents a single interface instance, and it could be either a new logical interface or a NG interface.

Figure 6.3.1-2 shows the Protocol stack for Topology 1:

1. 
2. **Figure 6.3.1-2. Protocol Stack for Topology 1**

The XXAP is terminated in AIoT RAN node.

Upper layer information might be transported over XXAP, details are pending on SA2 agreements, e.g. the interaction between upper layer information exchange and XXAP in order to trigger the AIoT RAN node functions.

Editor’s Note: the signalling transport for XXAP is FFS.

### 6.3.2 Support of Topology 2

Figure 6.3.2-1 depicts a deployment scenario for topology 2 based on Figture 6.3-1, the Common reader function located at AIoT-enabled UE, and the AIoT RAN node function located at the AIoT-enabled gNB.

The definitions of the 2 additional entities are given below:

**AIoT-enabled gNB**: a gNB supporting AIoT RAN function, which is able to communicate with the AIoT enabled UE via NR Uu interface.

**AIoT-enabled UE**: a UE supporting Common reader function, which is able to communicate with the AIoT Device via the AIoT radio interface.



**Figure 6.3.2-1 Deployment scenario for topology 2**

NOTE: Figure 6.3.2-1 doesn’t illustrate the protocol between AIoT enabled UE and AIoT CN.

In Topology 2, the XX interface could be based on NG or a new interface carried over NG or a new interface, XX signaling could be transported via XX-C or XX-U.

In Topology 2, the the AIoT CN could include AMF and AIoT related network functions.

The AIoT-enabled gNB performs radio resource management for AIoT related radio resources, details are pending on RAN1 and RAN2 mechanisms.

#### 6.3.2.1 Solutions for Topology 2

To support Topology 2, the following solutions are to be studied for conveying AIoT upper layer contents:

* **RRC based solution.** With this solution, AIoT CN sends explicit XXAP signaling, and then forwards the related information explicitly to the AIoT-enabled UE via NR Uu RRC.
* **NAS based solution.** With this solution, there is no explicit termination of AIoT upper layer information at AIoT-enable gNB, AIoT upper layer information is transmitted over AIoT-enable UE's NAS.
* **UP based solution.** With this solution, there is no explicit termination of AIoT upper layer information at AIoT-enable gNB, AIoT upper layer information is transmitted as AIoT-enable UE's user plane data.

Editor’s note: how to enable radio resource control for above is FFS.

**Solution1: RRC based solution**

In this solution, upon receiving AIOT service related messages from AIoT CN via XXAP, the AIoT-enabled gNB forwards the corresponding information towards the AIoT-enabled UE via NR Uu RRC, and upon receiving AIOT service related messages from AIoT-enabled UE via NR Uu RRC, the AIoT-enabled gNB further transmits the response/reports towards AIoT CN via XXAP.



Figure 6.3.2.1-1: RRC based solution of Topology 2

**Solution 2: NAS based solution**

In this solution, the AIoT service related messages between the AIoT CN and the AIoT-enabled UE are carried via AIoT-enabled UE’s DL/UL NAS packets, the AIoT-enabled gNB handles the AIoT-enabled UE’s NAS packets as legacy, i.e., using DL NAS Transport and UL NAS Transport over NGAP.



Figure 6.3.2.1-2: NAS based solution of Topology 2

**Solution 3: UP based solution**

In this solution, the AIoT service related messages between the AIoT CN and the AIoT-enabled UE are carried via AIoT-enabled UE’s PDU Session, the AIoT-enabled gNB handles the AIoT-enabled UE’s user plane data as legacy, i.e., over NG-U GTP-U tunnels.



**Figure 6.3.2.1-3: UP Session based solution of Topology 2**

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