**3GPP TSG-WG SA2 Meeting #163 *S2-******2406704***

**Jeju, KR, May 27th – 31st, 2024 (revision of S2-2404925, merging 2405961)**

**Source: Huawei, HiSilicon, vivo**

**Title: Sol#2 Update: AIoT Device ID** **for accessing remote subscription-like data**

**Document for: Approval**

**Agenda Item: 19.1**

**Work Item / Release: FS\_AmbientIoT / Rel-19**

*Abstract: Solution 2 updates to add information on how to use different elements of the AIoT Device ID to access subscription-like information in different scenarios.*

# 1. Introduction

There are two ENs in the solution, which are:

Editor’s Note: The use of the Owner Identifier is FFS and may depend on the solution for Inventory, etc.

Editor’s Note: It is FFS whether it can be assumed that the device and the CN can be pre-provisioned with Ambient IoT Device ID and the optional 3rd Party-defined identifier.

The first EN can be addressed based on the text explanation of this solution and the solution#17specified in TR 23.700-13. The second EN is solved by adding a new option for the Ambient IoT Device ID, which is fully controlled by the 3rd-Party. In this scenario, the Credentials Holder can be the entity deployed outside the PLMN. In other words, the Ambient IoT Device can be either configured with 3GPP-defined Identifier or Application-defined Identifier which depends on operator policy and implementation.

In the solution update, additional descriptions for two options of Ambient IoT Device ID are also provided to further explain how the Ambient IoT Device ID can be used in different scenarios and cases.

# 2. Text Proposal

It is proposed to capture the following changes vs. TR 23.700-13.

\* \* \* \* First change \* \* \* \*

## 6.2 Solution #2: AIoT Device ID with home network, owner and instance identification

### 6.2.1 Description

This solution addresses the KI#2 and the aspect about how to identify and format the identifier of Ambient IoT Device in order to identify specific Ambient IoT Device or a group of Ambient IoT Devices.

In this solution, the Ambient IoT Device is configured with 3GPP-defined identifier and optionally an Application-defined identifier.

According to TS 22.369 [2], the 5G system shall provide suitable mechanisms to support communication between an authorized 3rd party and an Ambient IoT device or group of Ambient devices. In addition, subject to user consent, operator's policy and 3rd party request, the 5G system shall provide information about an Ambient IoT device or a group of Ambient IoT devices (e.g. position) to the 3rd party via the 5G network. Based on these service requirements, the relationship among the Ambient IoT Device, Mobile Network Operator and the 3rd party is illustrated below.



Figure 6.2.1-1: Relationship Among Ambient IoT Device, Mobile Network Operator and 3rd Party

It is assumed an Ambient IoT Device is operated by a third party who has a service agreement with a Mobile Network Operator to enable Ambient IoT service in 3GPP system. The PLMN manages the Ambient IoT Device (e.g. holds the credentials of Ambient IoT Device, etc) and enables the communication between the 3rd party and the Ambient IoT Device via the 5G network. Based on this model, in the 3GPP system, different PLMNs may manage Ambient IoT Devices owned and operated by different third parties. If uniqueness of a Device ID cannot be guaranteed, the management of Ambient IoT devices and services provided by the 3GPP system may be impacted.

#### 6.2.1.1 Compatible format of AIoT Device ID Alternative 1

In this alternative, the structure of an AIoT Device ID contains:

- a **3GPP-defined Identifier**, and

- an **Application-defined Identifier**.

The 3GPP-defined identifier has the following components:

- **Home Network Identifier:** An identifier to indicate the AIoT network operator (e.g. MCC+MNC) who allocated the 3GPP-defined identifier. If the 3GPP-defined Identifier is not allocated by a PLMN AIoT network operator the Home Network Identifier is set to a pre-defined value e.g. 999 to indicate this.;

- **Enterprise Identifier:** an identifier used to identify an entity that owns the AIoT Device. It is unique within the Home Network Identifier domain.;

- **Instance Identifier:** an identifier used to identify a specific Ambient IoT device owned by the 3rd party/Enterprise.

NOTE 2: The Instance Identifier is allocated by the home MNO which may coordinate with the 3rd party/Enterprise.

The Application-defined identifier contents is application dependent and is assumed to be assigned by the 3rd party. The Application identifier can be used by the 3rd party to e.g. group Ambient IoT Devices together. As this identifier will not be used by the 3GPP system to uniquely identify the Ambient IoT Device, its allocation can be fully under the 3rd party’s control and the PLMN can retain control of the allocation and management of the Device ID used to locate the subscription-like data for an Ambient IoT Device.



Figure 6.2.1-2: Structure of Ambient IoT Device ID

The device can be configured with either:

- Only the 3GPP-defined identifier; or

- Only the Application-defined identifier; or

- Both a 3GPP-defined identifier and an Application-defined identifier.

The 3GPP-defined identifier is a permanent identifier used by the MNO to derive/locate subscription-like data related to Ambient IoT Devices. In terms of each component of the 3GPP defined identifier, the Enterprise Identifier has to be unique within the MNO identified by the Home Network Identifier. The Instance Identifier has to be unique within the Enterprise Identifier (which in turn is unique within a Home Network Identifier). The means that the 3GPP-defined identifier is unique globally. In this way, the length of the 3GPP-defined identifier can be shortened.

In the case of only a 3GPP-defined identifier, the 3rd party relies on the 3GPP-defined identifier allocated by the operator to perform Ambient IoT services.

An AF can use the either identifier request Ambient IoT services on specific Ambient IoT devices.

For example, when a 3rd party (e.g. AF) sends a service request (e.g. inventory or command) to 5GC, the 5GC can trigger the reader(s) to inventory a group of Ambient IoT Device by broadcasting a partial/full 3GPP-defined identifier or partial/full Application-defined Identifier or both. The Ambient IoT Devices matching the broadcasted message will perform random access responding to the broadcast message. For example, when the partial value is the Home Network Identifier, Enterprise Identifier, the Ambient IoT Devices matching that partial value (i.e. belonging to a specific enterprise), or if the partial value is (part of) the Application-defined Identifier (i.e. matching the Application-defined identifier), will respond to the broadcast message to perform random access and report to the network.

With such format, the network can enable different group of Ambient IoT Device to respond the broadcast message for inventory.

**Scenario 1: Ambient IoT Device is configured with 3GPP-defined identifier with optionally an application-defined identifier.**

In this scenario the Ambient IoT Device ID is a permanent, globally unique identifier which can be used by the PLMN to derive subscription-like data related to Ambient IoT Devices.

**Scenario 2: Ambient IoT Device is configured with** **special Home Network Identifier and an application-defined identifier**

In this scenario, Home Network Identifier of the Ambient IoT Device ID is assigned a reserved value indicating that the Ambient IoT Device ID is defined by a 3rd Party. The rest part of Ambient IoT Device ID is an application-defined identifier.

NOTE X: care should be taken by the 3rd party to ensure that each Ambient IoT Device ID is globally unique since it may occur that two different 3rd parties allocate exactly the same Ambient IoT Device ID to two devices.

Depending on the agreement between PLMN and the AF, it may allow the 3rd Party (i.e. the owner of the device) to re-home the management to different PLMNs as the Ambient IoT device travels through the supply chain. Hence, any target mobile network can locally take the control of the AIoT service without interaction with other networks, e.g., when performing 1) Authorization of the AF request; 2) Device ID validation; 3) Charging data collection: collect the charging data, etc.

NOTE Y: The enterprise may coordinate with other entities, e.g., device manufacturers, network operators, credentials holders or other enterprises etc. before this assignment.

A 3rd Party AF may provision the Ambient IoT Device profile to the PLMN via OAM mechanism or NEF provisioning service if allowed by the PLMN.As part of the provisioning process for Ambient IoT Device, the 3rd party AF transfers the Ambient IoT Device profile e.g. Application-defined Identifier and subscription like information to the (new)PLMN to manage the AIoT device, and additionally request the (current/previous) PLMN managing the device to remove the subscription-like information for the Ambient IoT Device which has been transferred (to new PLMN). Therefore, when the 3rd Party AF requests a new PLMN to perform Ambient IoT service operation, the Ambient IoT service operation is performed same as in the in current/previous PLMN.

Alternatively, the 3rd Party may delegate the Ambient IoT Device profile to the credential holders that has service agreement with the 3rd party and the PLMN. Therefore, when the 3rd Party requests the PLMN to perform Ambient IoT service operation, the PLMN contacts the external credential holders to perform the control of the AIoT service.

#### 6.2.1.2 Compatible format of AIoT Device ID Alternative 2

In RFID domain, EPC has been well used. In AIoT scenario, the AIoT device may be owned by the 3rd party but can be operated by an operator network. So it is possible for a AIoT device without operator allocated device ID before it being operated by any reader in the operator network. Upon reception of inventory signalling, the AIoT device may provide EPC to the reader as the response.

In order to construct an open and wide-applicable business for AIoT service, the AIoT network should be compatible to the AIoT devices with either 3GPP defined ID or EPC. However, EPC format is not suitable to be used in the 3GPP interfaces and among NFs directly and it should be translated into 3GPP defined device ID format, i.e. the 3GPP defined device ID format should be compatible to EPC.

Hence, apart from using the value of Home Network Identifier to differentiate whether the Ambient IoT Device ID is allocated by either MNO or 3rd Party, another compatible format of AIoT device ID can be proposed to cover these two scenarios.

In this alternative, the AIoT device ID still reuse NAI, i.e. the form of username@realm.

For the realm part, it contains the following information:

* The Scheme present the scheme of the AIoT device ID:
	+ If the AIoT device ID is mapped by EPC, it is the EPC scheme.
	+ If the AIoT device ID is 3GPP self-defined, it is 3GPP.
* The Assignment Mode present whether the Operating Entity ID is global unique assigned:
	+ Option 1: the Operating Entity ID assigned as globally unique.
	+ Option 2: the Operating Entity ID assigned as the combination of the Operating Entity ID and the Scheme is globally unique.
	+ Option 3: the Operating Entity ID assigned as the combination of the Operating Entity ID and the PLMN ID is globally unique.
* The Operating Entity presents the owner/manager/company/credential holder of the AIoT device:
	+ If the AIoT device ID is mapped by EPC, the value is company prefix in EPC.
	+ If the AIoT device ID is 3GPP self-defined, e.g. the value is the 3GPP allocated company value.

NOTE: If the AIoT device is owned by a network operator, the value could be the PLMN ID, since a network operator is also a company.

* Optional MCC+MNC, it is only needed when Operating Entity assigned such that the combination of the Operating Entity ID and the PLMN ID is globally unique.



Figure 6.2.1-3: Format of AIoT device ID

For the username part, it contains the following information:

* It is EPC, if the AIoT device ID is mapped by EPC.
* it is 3GPP defined username part, if the AIoT device ID is 3GPP self-defined.

The format of the EPC can be referred to GS1 TDS Release 2.1: "EPC Tag Data Standard"[10]. The structure of the EPC guarantees worldwide uniqueness of the EPC across all types of 920 physical objects and applications. The EPC URI is a string having the following form which is referred to section 6 of GS1 TDS Release 2.1: "EPC Tag Data Standard"[10]:

urn:epc:id:scheme:component1.component2.…

An example of a specific EPC URI is the following, where the scheme is *sgtin*:

urn:epc:id:sgtin:9521141.012345.4711

Where *Scheme* names an EPC scheme. The components (i.e. component1, component2, and following parts are the 911 remainder) and the precise form of the EPC depends on which EPC scheme is used.

Table 1.2-1: Example of EPC Schemes defined in Figure 6.1 of GS1 TDS Release 2.1: “EPC Tag Data Standard”[10]

|  |  |  |
| --- | --- | --- |
| EPC Scheme | Corresponding GS1 Key | Typical use |
| sgtin | GTIN (with added serial number) | Trade item |
| sscc | SSCC | Logistics unit |
| sgln | GLN (with or without additional extension) | Location |
| grai | GRAI (serial number mandatory) | Returnable asset |
| giai | GIAI | Fixed asset |
| … | … | … |

* It is observed that according EPC Scheme, the EPC format is determined.

And always, in the EPC URI, the component1 part is *CompanyPrefix*. The GS1 Company Prefix, assigned by GS1 to a managing entity or its delegates.

- It is observed that a CompanyPrefix is common for EPC.

### 6.2.1a How to locate the subscription-like data based on the Ambient IoT Device ID

#### 6.2.1a.1 AIoT Device ID Alternative 1

When a PLMN is interacting with a specific device (e.g. sending commands/data) it can use the 3GPP-defined identifier to locate subscription-like data for the device. How an AF requests an operation that results in interaction with the device will depend on other solutions (e.g. it may be directly request to the PLMN interacting with the device, via a partner PLMN, etc is not assumed by this Device ID solution).

The following is possible, based on whether the 3GPP-defined identifier is present and the value of the Home Network identifier subscription-like data maybe located as following, as shown in Figure 6.2.1-4:

- If Home network identifier matches the PLMN making the request, then the PLMN interacting with the device itself holds the subscription-like information.

- If the Home network identifier is another PLMN then the another PLMN holds the subscription like information and the PLMN interacting with the device can contact the other PLMN.

- If the Home network identifier is set the reserved value indicating it is a 3rd party defined AIoT Device ID, then the Enterprise Identifier can be used to locate subscription-like data stored by a 3rd party/enterprise and the PLMN interacting with the device can contact the enterprise. Optionally PLMNs may be provisioned with subscription-like data for an AIoT device, and in this case the PLMN would first check whether it holds the subscription-like data for the AIoT device before attempting to retrieve it from the enterprise represented by the Enterprise Identifier.



Figure 6.2.1-4: Locations for Subscription-like data

An agreement between the PLMN interacting with the device and other PLMNs/enterprise to allow access to the subscription-like data is expected to be required.

If the Home network identifier is unknown/uncontactable, the enterprise is unknown/uncontactable or the 3GPP-defined Identifier is absent then the PLMN will not be able to retrieve the subscription-like data and any services that require that data will not be able to be completed.

#### 6.2.1a.1 AIoT Device ID Alternative 2

The owner/manager/company/credential holder or the subscription-like data can be identified according to the Operating Entity which presents the owner/manager/company/credential holder of AIoT Device ID Alternative 2, the value of Operating Entity is e.g., the following:

* the Operating Entity can be PLMN ID, if the AIoT device is owned by a network operator, since a network operator is also a company.
* the Operating Entity can be Company prefix, if the AIoT device is mapped by the EPC.

### 6.2.2 Procedures

How to utilize such format of Ambient IoT Device ID when network performs service operations will be specified in the call flows in other solutions.

### 6.2.3 Impacts on services, entities and interfaces

Editor's note: This clause captures impacts on existing services, entities and interfaces.

\* \* \* \* End of changes \* \* \* \*