**3GPP TSG-WG SA2 Meeting #161 *S2-240xxxx***

**Athens, Feb 26 – Mar 01, 2024 (revision of S2-2402615)**

**Source: Nokia, Nokia Shanghai Bell**

**Title: New solution:** **Ambient IoT data retrieval**

**Document for: Approval**

**Agenda Item: 19.14**

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

*Abstract: a new solution to support information transfer from the Ambient IoT devices*

# 1. Introduction/Discussion

A new solution is proposed to enable 5GC support for AF to retrieve data from the target AIoT devices.

# 2. Text Proposal

It is proposed to approve the following changes in TR 23.700-13 v0.1.0.

*FIRST CHANGE*

## 6.X Solution #X: 5GC support for AF to retrieve data from AIoT devices

6.X.1 Description

This solution address aspects of key issue #3 on Support of Ambient IoT Services.

This solution enables the AF to retrieve data from the target AIoT devices via 5GC, using Topology 2.

Editor's note: it is FFS whether the proposed solution can be applied for Topology 1.

This solution considers scenarios in which an application service provider has prior information about intermediate nodes (abbreviated as I-node) expected to be located in specific places (e.g., intermediate nodes being used only in particular warehouses). Additionally, scenarios where the provider knows candidate locations for the target AIoT devices (e.g., the AIoT devices attached to goods are expected to be in particular warehouses or retail markets) are also considered.

The assumption and high-level procedures of this solution are as follows:

* The AIoT device ID is defined by the external application and provided by the AF to the 5GC when requesting the AIoT-related services. The uniqueness of the AIoT device ID per application is assumed to be guaranteed by the application itself, while achieving the uniqueness of the AIoT device ID in the 5G domain could be accomplished, for example, by prefixing the unique owner ID (e.g., unique company prefixes assigned by EPCglobal).
* AIoT devices are not registered with the 5GC.
* A legacy UE, additionally capable of directly communicating with the AIoT devices through backscattering, is acting as the intermediate node, serving as both activator and reader.
* A UE acting as an intermediate node is registered with 5GC using the existing mechanism, with some enhancements to indicate its capability of acting as an intermediate node.
* The AF possesses information about the candidate location(s) of the target AIoT devices or about the preferred intermediate node (i.e., external UE ID) and provides them when requesting the AIoT related services to 5GC.
* When information about the preferred intermediate node is provided while it is not operational, or when the location(s) of the target AIoT devices are given, the 5GC selects the intermediate node based on the network information. The process of selecting such an intermediate node is not within the scope of this solution. This means that this solution supports both static and dynamic binding with the intermediate node.
* How to support security between each entity (e.g., between AIoT device and I-node, and AIoT device and CN) involved in the procedures (e.g., relying on application security or providing network security based on the information provided by the application) is assumed to be addressed by SA3.
* The Uu interface between the intermediate node and the gNB is assumed to be used, while a new protocol stack, defined by RAN, is assumed to be used between the AIoT device and the intermediate node.

6.X.2 Procedures

The procedure for data retrieval from AIoT devices based on AF request is depicted in figure 6.x.2-1.



Figure 6.x.3.2-1: Information Flow for AIoT data retrieval

To facilitate communication between an external AF with AIoT devices for data retrieval, this solution proposes certain measures to be taken:

1. It is assumed that the AF requesting 5GC to retrieve data from specific AIoT devices possesses their AIoT device IDs, either defined by the device manufacturer or the AF itself, along with candidate locations of the AIoT devices or information (e.g., external ID) of the intermediate node covering the target AIoT devices.
2. The intermediate node, acting as both Activator and the Reader is an ordinary UE with the capability to send activating signals to AIoT devices and receive backscattered signals from AIoT devices. The intermediate node is registered with the 5GC. They may indicate support of the capability to act as an intermediate node.
3. The AF sends a request to 5GC, utilizing an API called AIOT\_Read, to activate the target AIoT devices for the purpose of data reading. The AF’s request includes following parameters: the target AIoT device IDs defined by the external application and installed in the AIoT devices, the candidate locations of the target AIoT devices or the external ID (i.e., external UE ID) of the intermediate node that can directly communicate with the target AIoT devices, optionally specific target data to be read by the AF.
4. Upon receiving the AF request, the NEF authorizes the AF request based on SLA.
5. The NEF translates the external ID (e.g., GPSI) of the intermediate node, if provided, to the SUPI via UDM and verifies whether the UE possessing the translated SUPIs is authorized to function as intermediate node through UDM. The NEF translates the location, if provided by the AF, into 3GPP based location information (Tracking areas TA(s), cell ID(s), etc). The NEF identifies the serving AMF(s) via UDM by utilizing the SUPI of the intermediate node, if applicable, or by considering the candidate locations of the AIoT devices. The NEF selects AIoTF that can be a standalone NF or collocated with the NEF.
6. An AIOT\_Read request message is sent to the AIoTF, including the following parameters: the target AIoT devices, candidate locations or the SUPI of the intermediate node, Serving AMF(s) as derived in step 4, optional Requested target data.
7. The AIoTF may select the intermediate node based on the information provided in step 5 to communicate with the target AIoT devices.
8. The AIoTF requests the serving AMF to initiate the communication, which includes the target AIoT device IDs, candidate locations or SUPI of the selected intermediate node, and optional Requested target data.
9. The AMF identifies the serving gNB by utilizing the SUPI of the intermediate node, if applicable, or by considering the candidate locations of the AIoT devices.
10. The gNB may select the intermediate node, if not provided in step 8, based on the local RAN conditions to communicate with the target AIoT devices, which is beyond the scope of this solution.
11. The gNB sends an Activating request message to the selected intermediate node, specifying the target AIoT devices to wake up and the Requested target data (if applicable).
12. The selected intermediate node broadcasts the activating signal which includes the target AIoT device IDs and the Requested target data (if applicable).
13. The AIoT devices receive the activating signal from the Activator. The AIoT devices check whether their device IDs match any of the target AIoT device IDs included in the activation signal. If there's no match, the AIoT devices do not react.
14. The AIoT devices check whether their device IDs match any of the target AIoT device IDs included in the activation signal. If there’s a match, the AIoT devices check the presence of Requested target data within the activating signal. If it is absent, the AIoT devices send a backscattering message incorporating only their device IDs. If the Requested target data is present, the AIoT devices send a backscattering message including their device IDs and only the data requested to the intermediate node.
15. The intermediate node monitors the channel through which AIoT devices transmit their messages. If the AIoT device ID within the received message corresponds to any of the target AIoT device IDs obtained in step 6, the intermediate node assesses which AIoT devices, from the list of expected AIoT devices, have provided a response. The intermediate node then forwards this information, encompassing AIoT device data (if applicable) and the AIoT device ID, to the AF possibly via gNB, AMF, AIoTF and NEF. How exactly the intermediate node forwards the received information is beyond the scope of this solution.
16. The intermediate node may wait for the expected AIoT devices to reply until the timer, which is set locally, runs out. If some of the expected AIoT devices do not reply before the timer ends, they are considered missing.
17. The intermediate node informs the AF through the gNB and the 5GC about these devices that are missing.

6.X.3 Impacts on services, entities and interfaces

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

*END OF CHANGES*