**3GPP TSG-SA3 Meeting #119 draft\_S3-244669-r1**

Orlando, US, 11 -15 November 2024

**Source: KPN**

**Title: New solution on combined authentication and data protection for Ambient IoT services**

**Document for: Approval**

**Agenda Item: 5.9**

# 1 Decision/action requested

***This contribution proposes a new solution in TR 33.713.***

# 2 References

[1] 3GPP TR 33.713 Study on security aspects of Ambient Internet of Things (AIoT) services in 5G

# 3 Rationale

This contribution proposes a new solution to combine authentication and data transmission into a single message for Ambient IoT devices. Such a procedure helps even low complexity Ambient IoT devices to communicate with the network.

# 4 Detailed proposal

It is proposed that SA3 approve the below pCR for inclusion in the TR [1].

**\*\*\*\*\* START OF 1st CHANGE \*\*\*\*\***

## 6.Y Solution #Y: Combined authentication and data protection for Ambient IoT services

### 6.Y.1 Introduction

This solution addresses key issue #5 on authentication and key issue #4 on protection of information during AIoT service communication. It combines authentication and data transmission into a single message so that low complexity/ low energy devices are not required to perform multiple exchange of messages in order to first authenticate and then to send a message securely. A successful decryption of the message is an indication of authentication of the device.

### 6.Y.2 Solution details



Figure 6.Y.2-1 Procedure for combined authentication and data protection

0. The device is pre-provisioned with a device ID, shared symmetric key K\_AIoT and a set of nonces. For each device, Authentication Server stores its device ID and the associated key K\_AIoT and set of nonces.

1. AF to NEF: Request data (device information, [type of data])

Device information contains the information about the devices that needs to provide data to the AF, this could be for instance a device ID or a set of device IDs or a group ID. Optionally, type of data expected from the devices can be part of this request.

The NEF selects an appropriate AIoT function.

2. NEF to AIoT function: Request data (device information, [type of data]).

The AIoT function selects a Reader capable of interacting with the required device(s).

3. AIoT function to Reader: Request data (device information, [type of data]).

4. Reader to AIoT device: Paging ([device information]).

The paging message optionally contains device information indicatng the devices that need to be paged.

5a. AIoT device selects a nonce randomly from the set of provisioned nonces (Nonce1) and derives a symmetric key K\_d using K\_AIoT and Nonce1 as inputs.

5b. AIoT device encrypts data that needs to be sent to the AF along with device ID using K\_d as the encryption key or compute keyed hash of device ID using K\_d, resulting in Enc\_K\_d (data) and Enc\_K\_d (device ID), respectively.

6. AIoT device to Reader: Send\_data (device ID, Enc\_K\_d(data), Enc\_K\_d(device ID), Nonce1)

7. Reader to AIoT function: Send\_data (device ID, Enc\_K\_d(data), Enc\_K\_d(device ID), Nonce1)

AIoT function selects AIoT specific Authentication Server holding the K\_AIoT associated with the device ID.

8. AIoT function to Authentication Server: Decrypt\_data\_request (device ID, Enc\_K\_d(data), Enc\_K\_d(device ID), Nonce1)

9a. Authentication Server obtains K\_AIoT based on received device ID.

9b. Authentication Server derives K\_d using K\_AIoT and Nonce1 as inputs.

NOTE 1: The algorithm used by the Authentication Server to derive K\_d is the same as the one used by the AIoT device to derive K\_d.

9c. Authentication Server decrypts the Enc\_K\_d(device ID), using K\_d, and checks if the decrypted device ID matches the unencrypted device ID received or computes the keyed hash of device ID using K\_d and checks if the resulting hash matches the unencrypted device ID received.

If the decrypted device ID matches the received unencrypted device ID or if the match on hashed ID is successful, the AIoT device is considered to be authenticated.

If the decrypted device ID doesn’t match the received unencrypted device ID or if the match on hashed ID is unsuccessful, the AIoT device is considered to be not authenticated. An appropriated error response is provided to the AIoT function.

NOTE 2: The error case where the decrypted device ID doesn’t match the received unencrypted device ID or if the match on hashed ID is unsuccessful is not specified in detail in this solution.

9d. Authentication Server decrypts Enc\_K\_d(data), using K\_d, resulting in an (unencrypted) data.

10. Authentication Server to AIoT function: Decrypt\_data\_response (authentication\_result, data)

Authentication result is Successful if the match in step 9c is successful, else it is Failed.

Data contains the decrypted data obtained in step 9d.

11. AIoT function to NEF: Send data (data).

Message containing data is sent from AIoT function to NEF, if authentication result is Successful. If authentication result is Failed, an appropriate response is sent to the NEF.

12. NEF to AF: Send data (data).

Message containing data is sent from NEF to AF, if authentication result is Successful. If authentication result is Failed, an appropriate response is sent to the AF.

Editor’s Note: Procedure to update set of nonces is FFS

Editor’s Note: Procedure to prevent replay attack is FFS

Editor’s Note: Procedure to perform integrity protection of messages in this solution is FFS

### 6.Y.3 Evaluation

This solution addresses key issue #5 on authentication and key issue #4 on information protection. The solution is applicable when the amount of data that needs to be sent from device to network/application function is small enough to be embedded in a single message.

The solution does not involve a handshake to perform the authentication, instead it is based on implicit authentication. In this case, only the authenticated device can successfully encrypt the data and the device ID. Similarly, only the authenticated network can decrypt the message and device ID and verify it. Replay protection is achieved with the help of nonce.

The solution remains valid even if the paging message does not contain any device specific information and provides one way authentication.

Editor’s Note: Further evaluation is FFS

**\*\*\*\*\* END OF 1st CHANGE \*\*\*\*\***