**3GPP TSG-SA3 Meeting #108-Bis-e *S3-222927-r2***

**e-meeting, 10 - 14 October 2022** *revision of S3-222570*

**Source: Interdigital, Apple, AT&T, CableLabs, Convida Wireless, Deutsche Telekom, Ericsson, Intel, JHU, Google, Lenovo, Nokia, NCSC, NTT DOCOMO, Oppo, Philips International B.V., US NIST, US NSA, Verizon, Xiaomi, ZTE**

**Title: PCR for KI #1: Privacy aspects of variable length user identifiers**

**Document for: Approval**

**Agenda Item: 5.4**

# 1 Decision/action requested

***This document proposes cleanup to key issue #1: Privacy aspects of variable length user identifiers. SA3 is kindly requested to approve this document.***

# 2 References

[1] 3GPP TR 33.870 v0.1.0

# 3 Rationale

This PCR addresses three editor’s notes in KI #1.

Main reasons:

Backward Compatibility: Since Rel-16, subscriptions (e.g., NPN subscriptions) have already been assigned NAI SUPIs of variable and unequal length that reflect the names that the end-users of those NPN subscriptions are using. If we assume that operators will now move to a scheme where usernames are all of equal length, then this would require users to be assigned new SUPIs when they upgrade devices. The 3GPP will study and ultimately propose a solution that will allow to preserve already-assigned meaningful username IEs of SUPI in the NAI format.

Flexibility and preserving operators’ choice: Variable length username allows MNOs to take advantage of the flexibility of the NAI SUPI format. In many cases, MNOs use SUPIs that are provided by the NPN owners and would prefer to have variable-length usernames that won’t leak private information, i.e., a 3GPP-developed solution instead of managing the "username" field.

Editor’s Notes in clauses 5.1.2 and 5.1.3 are redundant. 3GPP is contribution-driven and new threats and requirements can be added upon contributing with or without having such Editor’s Notes.

Additional reasoning and information to support this proposal are in the accompanying discussion paper in S3-222580.

# 4 Detailed proposal

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

## 5.1 Key issue #1: Privacy aspects of variable length user identifiers

### 5.1.1 Key issue details

Some networks may decide to allow user identifiers with variable length, e.g. in case SUPI of type NAI. If an attacker can learn something about the length, this will reduce the size of the anonymity set.

The length can become visible to an attacker in case a length preserving encryption scheme is being used for identifier concealment.

3GPP authentication schemes referred to in TS33.501[xx] are: 5G-AKA, EAP-AKA', as well as other key generating EAP methods, e.g., EAP-TLS and EAP-TTLS. All of these methods identify the subscriber using SUPI. While SUPI of type IMSI is not variable in length, therefore this key issue is not applicable to SUPIs of type IMSI.

For NAI based SUPI types, the authentication method may leak the length of the SUPI even if identifier privacy mechanisms specified for the authentication methods are used.

These privacy mechanisms are:

- For 5G-AKA and EAP-AKA' the mechanisms are profile A, profile B, or proprietary SUCI calculation scheme.

- When some EAP based methods are used, e.g., EAP-TLS and EAP-TTLS, an anonymous SUCI can be used, and the actual SUPI is sent after an EAP inner method secure channel is established, e.g. the TLS tunnel.

### 5.1.2 Security threats

An attacker on the air interface can identify and track subscribers with unusual lengths of the username field of variable-length SUPI in NAI format even if it is confidentiality protected (e.g., relatively short or long SUPIs).

Note: NAIs can be used for any EAP method.

If such an unusual length of the username field is unique to a single subscriber, an adversary may be able to uniquely attribute it to that subscriber.

If there is a group of subscribers with unusual lengths of username fields in their SUPIs, the attacker may be able to infer the membership of those subscribers in such a group.

5.1.3 Potential security requirements

The 5G system should protect against anonymity set reduction based on identifier length.

Note: the following conditions are necessary for proper evaluation against potential security requirements:

* Every solution needs to indicate which authentication mechanisms it works with.
* Every solution has to be evaluated whether it is backwards compatible with e.g., already deployed SUPIs in NAI format used for NPN subscriptions.

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