

May 14 – May 17, 2002

Victoria, Canada

Agenda Item: TBD
Source: Ericsson
Title: ISIM related issues
Document for: Discussion and decision

1. Scope and objectives

The current version 5.1.0 of TS33.203 states in chapter 8.1 that the following parameters are for FFS:

1. *[Editors Note: It is FFS if a KSI, data equivalent to the START parameter, AMF related data, storage for CK and IK is needed or not.]*

and

2. *[Editors Note: It is FFS if an IMS subscriber shall be de-registered at power off]*

This paper attempts to discuss the requirements for the need of KSI, START values, Threshold and HFN for IMS; and also whether there is a need to store the security keys for IMS on the ISIM application.

This paper proposes that at power off the existing SAs in the UE should be deleted and need not to be stored in the ISIM.

2 Introduction

After the joint meeting between SA3 and T3 in Sophia Antipolis 26 November 2001, SA3 sent out an LS in S3-010647 to a number of groups as T3, SA2, SA1, CN1 and T2.

It was stated in this LS that the SA3/T3 joint meeting concluded the following:

ISIM application SHALL include (at least) the following: IMPI; Home Network Domain Name; Support for SQNs used in the context of IMS domain; Algorithms and Authentication Key (K).

FOR FURTHER STUDY (Depends on the final decision on the mechanisms for protecting SIP signalling): Security Keys (CK, IK); data equivalent to the Key Set Identifier; data equivalent to the START parameter; AMF related data.

3 The need for START value, Threshold and HFN in IMS

In UMTS, the integrity method and confidentiality method used are dependent on two counters COUNT-I and COUNT-C i.e. the integrity and ciphering protection is driven by COUNT-I and COUNT-C respectively. This two values need to be initialised at connection establishment. The

START value, which is dependent on these two, counters then as defined in [TS33.102] needs to be stored in the USIM and in the ME. There is a START value defined for both the PS domain and the CS domain respectively. The 20 most significant bits of the RRC HFN, RLC HFN and MAC-d HFN are when utilised, initialising the START value. Also the COUNT-I and COUNT-C are dependent on the RRC HFN and MAC-d HFN, RLC HFN respectively. When START for either domain has reached a threshold i.e. the value THRESHOLD, the ME shall trigger a new authentication procedure in order to receive new security keys.

In IMS the authentication procedure is based on the SIP expiry timer in the UE and the S-CSCF, and the policy of the home network when to trigger a re-authentication procedure. Furthermore the security mechanism in IMS, i.e. IPSec ESP, does have its own mechanisms for replay protection and SA lifetime handling. Hence no START, HFN nor THRESHOLD values are required to be stored in the ISIM in IMS.

4 The need for storing the IPSec SA on the ISIM

There is currently no requirement in IMS for ISIM “plastic roaming”, i.e. when the user is able to change the UICC Card with an ISIM application from one terminal to another and is still able to re-use the same security association without requiring the network performing a new authentication of the subscriber.

In TS33.203 we have the requirement that the initial REGISTER message, which is always sent unprotected by the UE, mandates the network to perform a new authentication in order to establish a new security association between the UE and the P-CSCF.

When the UE is powered on or the UICC card is moved from one terminal to another terminal without powering off, the UE has to send an initial unprotected Register in order to establish a new security association. Therefore there is no need to define a requirement to store the security keys as integrity key and encryption key on the ISIM application in order for the SA to survive scenarios mentioned above in this chapter. Instead at power off the existing SAs in the UE shall be deleted.

In order to associate the security services and the session keys that shall be applied for an IP packet IPSec requires an SA (Security Association) and an SPI that identifies the SA. Since there is no need to store the session keys on the ISIM for plastic roaming there is no need to store the SPI and the SA itself on the ISIM. It should be noted that the UMTS KSI is not applicable for IMS since the IPSec SPI, which identifies the SA and session keys, is used instead.

Conclusions

Ericsson proposes that:

- No START, HFN and THRESHOLD values are required for IMS. Accordingly there is no requirement to support or store any of these parameters on the ISIM.
- There is no need to store the IPSec SA i.e. session keys as the integrity key and encryption key, SPI, sequence number etc on the ISIM in order to support plastic roaming as discussed above in this paper.

- No KSI value is required for IMS.
- The existing SAs in the UE are deleted at power off.
- It is not a security requirement that an IMS subscriber should be de-registered at power off or not but since the SAs are deleted Ericsson proposes that the corresponding Editors Note is removed (Bullet 2 in Section 1 in this paper).

It is proposed that TS 33.203 is updated according to the attached CR and T3 is informed by sending an LS with this information in order to be able to complete the ISIM application within the REL-5 timeframe.

References

[TS33203] 3G TS 33.203: "3rd Generation Partnership Project (3GPP); Technical Specification Group (TSG) SA3; Access Security for IP-based services".

CHANGE REQUEST

⌘ **33.203 CR** ⌘ rev ⌘ Current version: **5.1.0** ⌘

For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.

Proposed change affects: ⌘ (U)SIM ME/UE Radio Access Network Core Network

Title:	⌘ ISIM related parameters		
Source:	⌘ Ericsson		
Work item code:	⌘ IMS-ASEC	Date:	⌘ 06/05/2002
Category:	⌘ F	Release:	⌘ Rel-5
	Use <u>one</u> of the following categories: F (correction) A (corresponds to a correction in an earlier release) B (addition of feature), C (functional modification of feature) D (editorial modification) Detailed explanations of the above categories can be found in 3GPP TR 21.900 .		Use <u>one</u> of the following releases: 2 (GSM Phase 2) R96 (Release 1996) R97 (Release 1997) R98 (Release 1998) R99 (Release 1999) REL-4 (Release 4) REL-5 (Release 5)

Reason for change:	⌘ Remove some editors notes in TS33.203. Clarify how that the SAs shall be deleted at power off and no storage of SA is required in the ISIM.
Summary of change:	⌘ In IMS plastic roaming is not required and R'99 parameters like e.g. START, TRHESHOLD and HFN are not applicable in IMS
Consequences if not approved:	⌘ Open issues are kept in TS33.203 and other specifications cannot be progressed

Clauses affected:	⌘ 6.1.1, 8.1		
Other specs affected:	<input type="checkbox"/> Other core specifications <input type="checkbox"/> Test specifications <input type="checkbox"/> O&M Specifications	⌘	
Other comments:	⌘		

6.1.1 Authentication of an IM-subscriber

Before a user can get access to the IM services at least one IMPU needs to be registered and the IMPI authenticated in the IMS at application level. In order to get registered the UE sends a SIP REGISTER message towards the SIP registrar server i.e. the S-CSCF, cf. Figure 1, which will perform the authentication of the user.

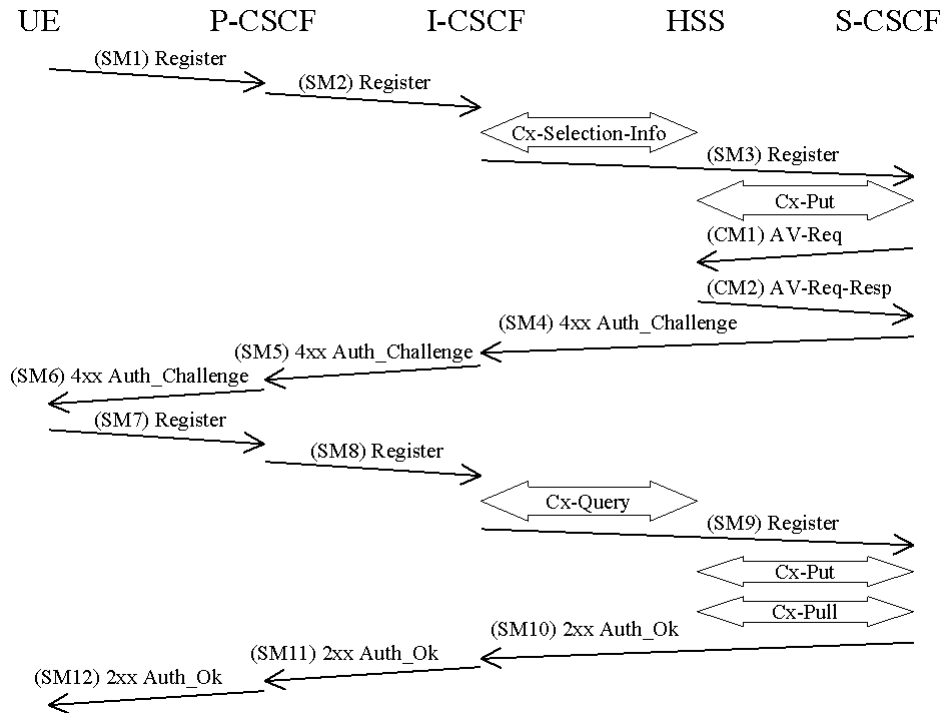


Figure 4: The IMS Authentication and Key Agreement for an unregistered IM subscriber and successful mutual authentication with no synchronization error

The detailed requirements and complete registration flows are defined in [8] and [11].

SMn stands for SIP Message n and CMm stands for Cx message m which has a relation to the authentication process:

SM1:
REGISTER(IMPI, IMPU)

In SM2 and SM3 the P-CSCF and the I-CSCF respectively forwards the SIP REGISTER towards the S-CSCF.

In order to handle mobile terminated calls while the initial registration is in progress and not successfully completed the S-CSCF shall send a registration flag to the HSS. The registration flag shall be stored in the HSS together with the S-CSCF name. The aim of the registration flag is to indicate whether a particular IMPU of the user is unregistered or registered at a particular S-CSCF or if the initial registration at a particular S-CSCF is pending. The HSS receives the information about this state (together with the S-CSCF name and the user identity) from the S-CSCF with which (re-) registration of the user is carried out only when a Cx-Put message is sent from the S-CSCF to the HSS. The registration flag shall be set to *initial registration pending* at the Cx-Put procedure after SM3 has been received by the S-CSCF.

Upon receiving the SIP REGISTER the S-CSCF shall use an Authentication Vector (AV) for authenticating and agreeing a key with the user. If the S-CSCF has no valid AV then the S-CSCF shall send a request for AV(s) to the HSS in CM1 together with the number n of AVs wanted where n is at least one but less than or equal to nmax.

[Editor's note: The maximum value of n i.e. nmax only if required by CN4.]

Upon receipt of a request from the S-CSCF, the HSS sends an ordered array of n authentication vectors to the S-CSCF. The authentication vectors are ordered based on sequence number. Each authentication vector consists of the following components: a random number RAND, an expected response XRES, a cipher key CK, an integrity key IK and an

authentication token AUTN. Each authentication vector is good for one authentication and key agreement between the S-CSCF and the IMS user.

When the S-CSCF needs to send an authentication challenge to the user, it selects the next authentication vector from the ordered array and sends the parameters RAND and AUTN to the user. Authentication vectors in a particular S-CSCF are used on a first-in / first-out basis.

At this stage the HSS has performed a check that the IMPI and the IMPU belong to the same user.

CM1:
Cx-AV-Req(IMPI, n)

If the HSS has no pre-computed AVs the HSS creates the needed AVs on demand for that user and sends it to the S-CSCF in CM2.

CM2:
Cx-AV-Req-Resp(IMPI, n, RAND₁||AUTN₁||XRES₁||CK₁||IK₁,..., RAND_n||AUTN_n||XRES_n||CK_n||IK_n)

The S-CSCF sends a SIP 4xx Auth_Challenge i.e. an authentication challenge towards the UE including the challenge RAND, the authentication token AUTN in SM4 and the integrity key IK and optionally the cipher key CK.

[Editor's note: It is FFS if re-use and re-transmission of RAND and AUTN is allowed. If allowed the mechanisms have to be defined.]

SM4:
4xx Auth_Challenge(IMPI, RAND, AUTN, IK, (CK))

[Editor's note: The use of KSI i.e. Key Set Identifier for IMS is FFS.]

When the P-CSCF receives SM5 it shall store the key(s) and remove that information and forward the rest of the message to the UE i.e.

SM6:
4xx Auth_Challenge(IMPI, RAND, AUTN)

Upon receiving the challenge, SM6, the UE takes the AUTN, which includes a MAC and the SQN. The UE calculates the XMAC and checks that XMAC=MAC and that the SQN is in the correct range as in [1]. If both these checks are successful the UE calculates the response, RES, puts it into the Authorization header and sends it back to the registrar in SM7. It should be noted that the UE at this stage also computes the session keys CK and IK.

SM7:
REGISTER(IMPI, RES)

The P-CSCF forwards the RES in SM8 to the I-CSCF, which queries the HSS to find the address of the S-CSCF. In SM9 the I-CSCF forwards the RES to the S-CSCF.

Upon receiving the response, RES, the S-CSCF retrieves the active XRES for that user and checks if XRES=RES. If the check is successful then the user has been authenticated and the IMPU is registered in the S-CSCF. To ensure that the S-CSCF is able to take the decision whether a subsequent registration shall trigger a new authentication and to be able to check that all INVITE messages will be sent to/from an authorized subscriber it shall be possible to implicitly register IMPU(s). The implicitly registered IMPU(s) all belong to the same Service Profile. All the IMPU(s) being implicitly registered shall be delivered by the HSS to the S-CSCF. The S-CSCF shall regard all implicitly registered IMPU(s) as registered IMPU(s).

At this stage the S-CSCF shall send in the Cx-Put after receiving SM9 an update of the registration-flag. If the authentication of the subscriber is successful the registration flag shall take the value *registered*. When the authentication is unsuccessful the registration flag shall be set to *unregistered*.

When a subscriber has been registered this registration will be valid for some period of time. Both the UE and the S-CSCF will keep track on a timer for this purpose but the expiration time in the UE is smaller than the one in the S-CSCF in order to make it possible for the UE to be registered and reachable without interruptions. The UE initiated re-registration opens up a potential denial-of-service attack in the sense that an attacker could re-register a subscriber in an unprotected message and respond with the wrong RES and the HN could then de-register the subscriber. It shall be defined by the policy of the operator when successfully registered IMPU(s) are to be de-registered.

The authenticated re-registration looks the same as the initial registration except that CM1 and CM2 can be omitted as long as the S-CSCF has valid AV(s). The P-CSCF shall forward the unprotected REGISTER to S-CSCF with an indication that the existing SA is not applied. As a consequence, the S-CSCF shall trigger a new authentication procedure. At a re-registration the registration flag has already the value *registered*. The policy of the home provider states whether the flag shall be changed at a re-registration based on two scenarios.

- If the re-registration is successful, the registration status keeps registered and timer for next registration is refreshed in the S-CSCF.
- The IMS subscriber remains registered after unsuccessful re-registration until timer set for next re-registration is expired. Before that the registration flag is kept in the HSS to the value *registered* even if the authentication was unsuccessful. The S-CSCF shall not remove the data about subscriber's registration and the P-CSCF shall keep the existing SA.

The lengths of the IMS AKA parameters are specified in chapter 6.3.7 in [1].

***** NEXT CHANGED SECTION *****

8.1 Requirements on the ISIM application

This section identifies requirements on the ISIM application to support IMS access security. It does not identify any data or functions that may be required on the ISIM application for non-security purposes.

The ISIM shall include:

- The IMPI
- At least one IMPU
- Home Network Domain Name
- Support for sequence number checking in the context of the IMS Domain
- The same framework for algorithms as specified for the USIM applies for the ISIM
- An authentication Key

The ISIM shall deliver the CK to the UE although it is not required that SIP signaling is confidentiality protected.

At UE power off the existing SAs in the MT shall be deleted. The session keys and related information in the SA shall never be stored on the ISIM.

~~{Editors Note: It is FFS if a KSI, data equivalent to the START parameter, AMF related data, storage for CK and IK is needed or not.}~~

~~{Editors Note: It is FFS if an IMS subscriber shall be de-registered at power off}~~