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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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Introduction

This clause is optional. If it exists, it is always the third unnumbered clause.

1 Scope

The scope for this technical specification is to specify the security features and mechanisms for secure access to the IM CN subsystem for the 3G mobile telecommunication system.

The IM CN SS in UMTS will support IP Multimedia applications such as video, audio and multimedia conferences. 3GPP has chosen SIP, Session Initiation Protocol, as the signaling protocol for creating and terminating Multimedia sessions, cf. [6]. This specification only deals with how the SIP signaling is protected, how the subscriber is authenticated and how the subscriber authenticate the IM CN SS network.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

[1] 3G TS 33.102: "3rd Generation Partnership Project (3GPP); Technical Specification Group (TSG) SA; 3G Security; Security Architecture".

[2] 3G TS 22.228: "3rd Generation Partnership Project (3GPP); Technical Specification Group (TSG) SA; Service Requirements for the IP Multimedia Core Network".

[3] 3G TS 23.228: "3rd Generation Partnership Project (3GPP); Technical Specification Group (TSG) SA; IP Multimedia (IM) Subsystem".

[4] 3G TS 21.133: "3rd Generation Partnership Project (3GPP); Technical Specification Group (TSG) SA; Security Threats and Requirements ".

[5] 3G TS 33.210: "3rd Generation Partnership Project (3GPP); Technical Specification Group (TSG) SA; 3G Security; Network domain security; IP network layer security".

[6] IETF RFC 2543bis-03 (2001) “SIP: Session Initiation Protocol”

[7] IETF RFC 2284 (1998) “PPP Extensible Authentication Protocol (EAP)”

[8] IETF Draft (2001) “draft-arkko-pppext-eap-aka-00.txt”

[9] IETF Draft (2001) “draft-http-eap-basic-01.txt”

[10] IETF RFC 2716 (1999) “PPP EAP TLS Authentication Protocol”

[11] IETF Draft (2001) “draft-haverinen-pppext-eap-sim-01.txt”

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

Confidentiality: The property that information is not made available or disclosed to unauthorised individuals, entities or processes.

Data integrity: The property that data has not been altered in an unauthorised manner.

Data origin authentication: The corroboration that the source of data received is as claimed.

Entity authentication: The provision of assurance of the claimed identity of an entity.

Key freshness: A key is fresh if it can be guaranteed to be new, as opposed to an old key being reused through actions of either an adversary or authorised party.

USIM – User Services Identity Module. In a security context, this module is responsible for performing UMTS subscriber and network authentication and key agreement. It should also be capable of performing GSM authentication and key agreement to enable the subscriber to roam easily into a GSM Radio Access Network.

ISIM – IM Services Identity Module. In a security context, this module is responsible for performing subscriber and network authentication and key agreement in IM CN SS. The ISIM resides on the UICC.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AAA	Authentication Authorisation Accounting
AKA	Authentication and key agreement
CSCF	Call State Control Function
GGSN	Gateway GPRS Support Node
HN	Home Network
HSS	Home Subscriber Server
HTTP	Hypertext Transfer Protocol
IM	IP Multimedia
IMPI	IM Private Identity
IMPU	IM Public Identity
ISIM	IM Services Identity Module
MAC	Message Authentication Code
ME	Mobile Equipment
PPP	Poin to Point Protocol
PS	Packet Switched
SA	Security Association
SEG	Security Gateway
SDP	Session Description Protocol
SGSN	Serving GPRS Support Node
SIP	Session Initiation Protocol
UA	User Agent
UAC	UA Client
UAS	UA Server
UE	User Equipment
UICC	UMTS IC Card
USIM	User Services Identity Module
VN	Visited Network

4 Overview of the security architecture

[Editor's note This section shall have a figure of the overall architecture for the IM CN SS and explaining text on the trust relations, possible threats and a brief overview of the provided security features.]

In the PS domain, the service is not provided until a security association is established between the mobile equipment and the network. IM CN subsystem is essentially an overlay to the PS-Domain and is not embedded in the SGSN or GGSN nodes consequently a second security association is required between the multimedia client and IM CN subsystem before access is granted to multimedia services. The IM CN Subsystem Security Architecture is shown in the following figure. The ISIM is responsible for the handling of keys, SQN etc that are tailored to IM CN SS. The keys i.e. CK and IK, SQN etc handled by the ISIM are all independent of the similar parameters that exist in the USIM.

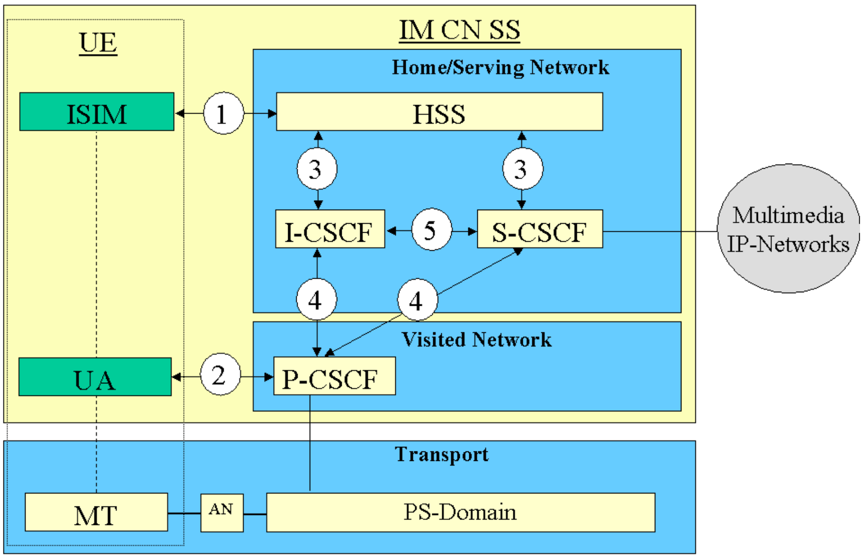


Figure 1. This is the security architecture for the IM CN Subsystem.

There are five different security associations and different needs for security protection for IM CN SS and they are numbered 1,2, 3, 4 and 5 in figure 1 where:

1. Provides mutual authentication. The HSS delegates the performance of subscriber authentication to the S-CSCF. However the HSS is responsible for generating keys and challenges. The long-term key in the ISIM and the HSS is associated with the IMPI.

2. Provides a secure link and a security association between the UE and a P-CSCF.

3. Provides security within the network domain internally for the Cx-interface. This part is not covered in this specification instead [5] specifies what security measures shall be defined in the internal network over the Cx-interface.

4. Provides security between different networks for SIP capable nodes. This part is not covered in this specification instead [5] specifies what security measures shall be defined for these type of interfaces.

5. Provides security within the network internally between SIP capable nodes. This part is not covered in this specification instead [5] specifies what security measures shall be defined for these types of interfaces.

[Editors Note: Security measures for application servers (OSA and SIP AS) and IM SSF is FFS but it seems that this is covered by NDS]

Mutual authentication is required between the UE and the HN.

The mechanisms specified in this technical specification are independent of the mechanisms defined for the CS- and PS-domain.

An independent IM CN Subsystem security mechanism provides additional protection against security breaches. For example, if the PS-Domain security is breached the IM CN Subsystem would continue to be protected by it's own security mechanism.

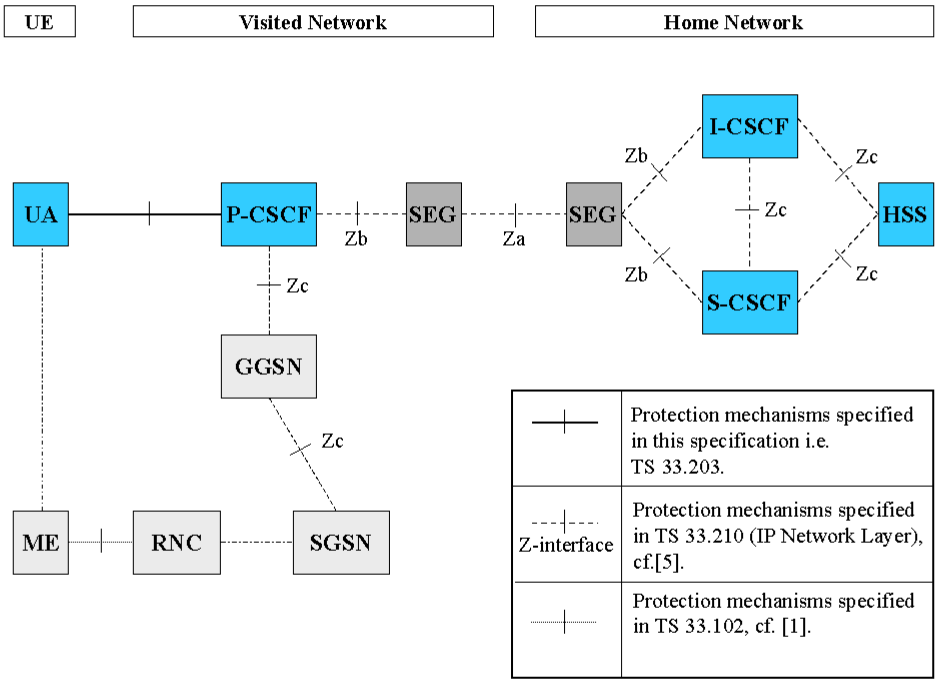

UE
Visited Network
Home Network
I-CSCF
Zb
Zc
UA
P-CSCF
Zb
SEG
Za
SEG
Zc
HSS
Zc
Zb
Zc
S-CSCF
GGSN
Zc
ME
RNC
SGSN
Protection mechanisms specified in this specification i.e. TS 33.203.
Z-interface
Protection mechanisms specified in TS 33.210 (IP Network Layer), cf.[5].
Protection mechanisms specified in TS 33.102, cf. [1].

Figure 2. This figure gives an overview of the security architecture for IM CN SS and the relation with Network Domain security, cf. [5].

The confidentiality and integrity protection for SIP-signaling is provided in a hop-by-hop fashion, cf. Figure 2. The first hop i.e. between the UE and the P-CSCF is specified in this technical specification. The other hops, inter-domain and intra-domain are specified in [5].

5 Security features

[Editor's note: This section shall explain the provided security features in detail]

5.1 Secure access to IM CN SS

5.1.1 Authentication of the subscriber and the network

[Editor's note: This section shall deal with subscriber identity and authentication of the subscriber and Home Network/Serving Network]

An IM-subscriber will have its subscriber profile located in the HSS in the Home Network. The exact details of the subscriber profile are FFS but it will contain information on the subscriber that may not be revealed to an external partner, cf. [3]. At registration an S-CSCF is assigned to the subscriber by the I-CSCF. The subscriber profile will be downloaded to the S-CSCF over the Cx-reference point from the HSS (Cx-Pull). When a subscriber requests an IM-service the S-CSCF will check, by matching the request with the subscriber profile, if the subscriber is allowed to continue with the request or not i.e. Home Control (Authorization of IM-services).

All SIP-signaling will take place over the PS-domain in the user plane i.e. IM-services are essentially an overlay to the PS-domain. Hence the Visited Network will have control of all the subscribers in the PS-domain i.e. Visited Control (Authorization of bearer resources) since the Visited Network provides with a transport service and QoS.

For IM-services a new security association is required between the mobile and the IM CN SS before access is granted to IM-services. The Home Network or a 3rd party even (which does not have to be an UMTS operator) provides the user with the IM-services.

The mechanism for mutual authentication in UMTS is called UMTS AKA. It is a challenge response protocol and the AuC in the Home Stratum derives the challenge. A Quintet containing the challenge is sent from the Home Stratum to the Serving Network. The Quintet contains the expected response XRES and also a message authentication code MAC. The Serving Network compares the response from the UE with the XRES and if they match the UE has been authenticated. The UE calculates an expected MAC, XMAC, and compares this with the received MAC and if they match the UE has authenticated the Serving Network.

The AKA-protocol is a secure protocol developed for UMTS and it will be reused for IM-services and then called IMS AKA.

The Home Network authenticates the subscriber at registrations or re-registrations only. In order to re-authenticate a subscriber the Home Network can force a re-registration by using e.g. a re-registration timer.

[Editors Note: Authentication shall according to the current requirements only take place at (Re-)Registrations.]

5.1.2 Confidentiality protection

~~*[Editor's note: This section shall deal with what confidentiality protection that is provided between different nodes both inter domain, intra domain and the UE]*~~

IP-based services will get protection by the confidentiality protection defined in R'99 at the bearer level. In R'99 confidentiality protection is provided for signaling data and user data between the UE and the serving RNC. The serving RNC retrieves the cipher key CK from the SN. The ciphering protection for UMTS is optional to use.

For UMTS access confidentiality protection for SIP signaling can either rely on the confidentiality mechanisms provided by UMTS and mechanisms provided by Network Domain Security, cf. [5] or as specified in section 6.2.

[Editor's note: At this stage both Annex B and Annex C provides with potential measures for confidentiality protection. One of these solutions will be the normative solution. Note that for R5 confidentiality measures are optional.] ~~*[Editor's note: It is optional to implement confidentiality protection and it should be applied at the same level as the integrity protection.]*~~

5.1.3 Integrity protection

~~*[Editor's note: This section shall deal with what integrity protection that is provided between different nodes both inter domain, intra domain and the UE]*~~

Integrity protection shall be used end-to-end between the UE and the P-CSCF for protecting the SIP signaling, as specified in section 6.3. The following mechanisms are provided.

1. The UE and the P-CSCF shall negotiate what integrity algorithm that shall be used for the session, specified in chapter 7.

2. The UE and the P-CSCF shall agree on an integrity key, ~~IK_{IM}~~IK that shall be used for the integrity protection~~when calculating a MAC~~. The mechanism is based on IMS AKA and specified in chapter 6.1.

3. The UE and the P-CSCF shall both make~~ a MAC check to~~ verify that the data received originates from a ~~node which~~node, which has the agreed session key, ~~IK_{IM}~~IK. This check is also used for detecting if the data has been tampered with by a man-in-the-middle.

[Editor's note: At this stage both Annex B and Annex C provides with potential measures for integrity protection. One of these solutions will be the normative solution.]~~*[Editor's note: It is FFS at what layer the SIP signaling shall be protected. It can be placed from the IP-Level up to the SIP-level.]*~~

5.2 Visibility and configurability

[Editor's note: This section shall contain what the subscriber shall be able to configure and what is visible for the subscriber regarding the actual protection the subscriber is provided with.]

The user shall be informed which level of protection that is in use.

5.3 Network topology hiding

The operational details of an operator's network are sensitive business information that operators are reluctant to share with their competitors. While there may be situations (partnerships or other business relations) where the sharing of such information is appropriate, the possibility should exist for an operator to determine whether or not the internals of its network need to be hidden.

It shall be possible to hide the network topology from other operators, which includes the hiding of the number of S-CSCFs, the capabilities of the S-CSCFs and the capability of the network.

[Editor's note: The hiding requirements for the P-CSCFs are FFS]

The I-CSCF shall have the capability to encrypt the address of an S-CSCF in SIP Via, Record-Route, Route and Path headers and then decrypt the address when handling the response to a request. The P-CSCF may receive routing information that is encrypted but the P-CSCF will not have the key to decrypt this information.

The mechanism shall support the scenario that different I-CSCFs in the HN may encrypt and decrypt the address of the S-CSCFs.

6 Security mechanisms

[Editor's note: This section shall describe the security mechanisms that are provided inter domain, intra domain and to the UE.]

6.1 Authentication and key agreement

[Editor's note: This section shall describe in detail how the authentication is performed and how the keys, IK and CK, are derived and delivered to the different nodes.]

The scheme for authentication and key agreement in the IM CN SS is called IMS AKA. The IMS AKA achieves mutual authentication between the ISIM and the HN, cf. Figure 3. Furthermore a security association is established between the UE and the P-CSCF. The ISIM and the HSS keeps track of the counters SQN$_{ISIM}$~~$_{UE}$~~ and SQN$_{HSS}$ for the IM-domain. The handling of the SQN can be as in [1]. IMS AKA is based on EAP, cf. [7], and the AKA extension to EAP and HTTP, cf. [8] and [9] respectively.

The HN shall choose the EAP AKA scheme for authenticating an IM subscriber accessing through UMTS. The security parameters e.g. keys generated by the AKA scheme are transported by SIP and embedded in EAP.

[Editors Note: Shall the HN choose EAP AKA for 3GPP-access or is it to be an option for the HN to choose either EAP AKA or perhaps any other mechanism e.g. HTTP digest depending on policy?]

The generation of the authentication vector AV that includes RAND, XRES, CK, IK and AUTN shall be done in the same way as specified in [1]. For each user it is the HSS that keeps track of the counter SQN$_{HSS}$. The requirements on the SQN handling both in the Home Network i.e. the HSS and the ISIM are specified in [1]. The AMF field can be used in the same way as in [1].

The identity used for authenticating a subscriber is the private identity, IMPI, which has the form of a NAI, cf. [3]. The HSS and the ISIM share a long-term key associated with the IMPI.

6.1.1 Registration of an IM-subscriber

Before a user can get access to the IM services he needs to be registered and authenticated in the IM CN SS 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 3, which will perform the authentication of the user.

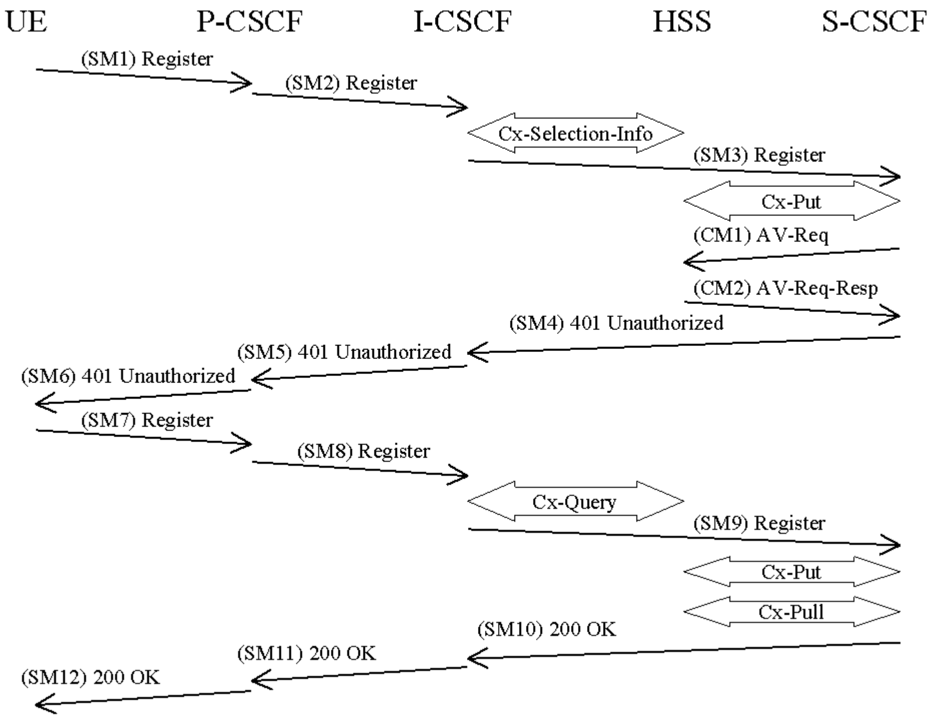


Figure 3: The IMS Authentication and Key Agreement for an unregistered IM subscriber and successful mutual authentication with no synchronization error.

<u>**The flows in more detail**</u>

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

SM1:

REGISTER sip: ----
Via: ----
From: IMPI
To: IMPU
Call-ID: ----
Cseq: 1 REGISTER
Content-Length: 0

[Editor's note: This example covers the case when only one public identity is registered. It is still FFS how to treat the case when the subscriber registers several public identities.]

The P-CSCF and the I-CSCF forwards the SIP REGISTER towards the S-CSCF and adds a Via header with their addresses included, i.e. SM2 and SM3. Upon receiving the SIP REGISTER the S-CSCF will need one AV which includes the challenge. As an option the S-CSCF can require more than one AVs. If the S-CSCF has no valid AV then the S-CSCF shall send a request for the 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.

CM1:

Cx-AV-Req(IMPI, IMPU, 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, IMPU,n,$RAND_1||AUTN_1||XRES_1||CK_1||IK_1$,….,$RAND_n||AUTN_n||XRES_n||CK_n||IK_n$)

The S-CSCF sends a SIP 401 Unauthorized to the UE including the challenge RAND, the authentication token AUTN in SM4 and the integrity key IK and optionally the cipher key CK.

SM4:

SIP/2.0 401 Unauthorized
Via: ----
From: IMPI
To: IMPU
Call-ID: ----
Cseq: 1 REGISTER
WWW-Authenticate: eap *paramaters:RAND||AUTN*
Key parameters: *IK(||CK)*
Content-Length: 0

[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:

SIP/2.0 401 Unauthorized
Via: ----
From: IMPI
To: IMPU
Call-ID: ----
Cseq: 1 REGISTER
WWW-Authenticate: eap *paramaters:RAND||AUTN*
Content-Length: 0

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.

SM7:

SIP/2.0 401 Unauthorized
Via: ----
From: IMPI
To: IMPU
Call-ID: ----

Cseq: 1 REGISTER

Authorization: eap *parameters: RES*

Content-Length: 0

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.

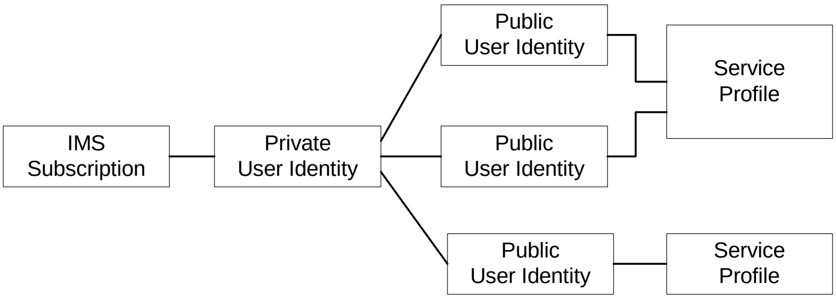
When a subscriber has been registered this registration will be valid for some period of time. Both the UE and the S-CSCF will keep track on a timer for this purpose but the expiration time in the UE is smaller than the one in the S-CSCF in order to make it possible for the UE to be registered and reachable without interruptions. This feature is FFS in [3]. The re-registration feature opens up a potential denial-of-service attack in the sense that an attacker could re-register a subscriber and respond with the wrong RES and the HN could then de-register the subscriber. This shall be avoided by letting the subscriber be registered with the old set of parameters until a re-registration is successfully authenticated.

[Editor's note: It is FFS if this way of protecting the user from DoS attack is feasible or not. The current assumption by SA3 is that DoS attacks are difficult to standardize against e.g. error messages shall not be integrity protected.]

The re-registration looks the same as the registration case except that CM1 and CM2 can be omitted as long as the S-CSCF has valid AV(s).

[Editor's note: Potential failure scenarios and potential extra requirements needed for the handling several AV(s) in the S-CSCF are left FFS.]

[Editor's note: The current assumption has been that all IMPUs will be registered in the same S-CSCF. This however is not the general scenario adopted by SA2. It is left FFS how the current solutions need to be adapted to the general scope as shown in the figure:



According to the SA1 requirement this is the scenario that should be supported by the IMS in Release 5. All public user identities that are associated with the same profile should have the same set of services. Public user identities that are associated with a different profile could have a different set of services.]

[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.]

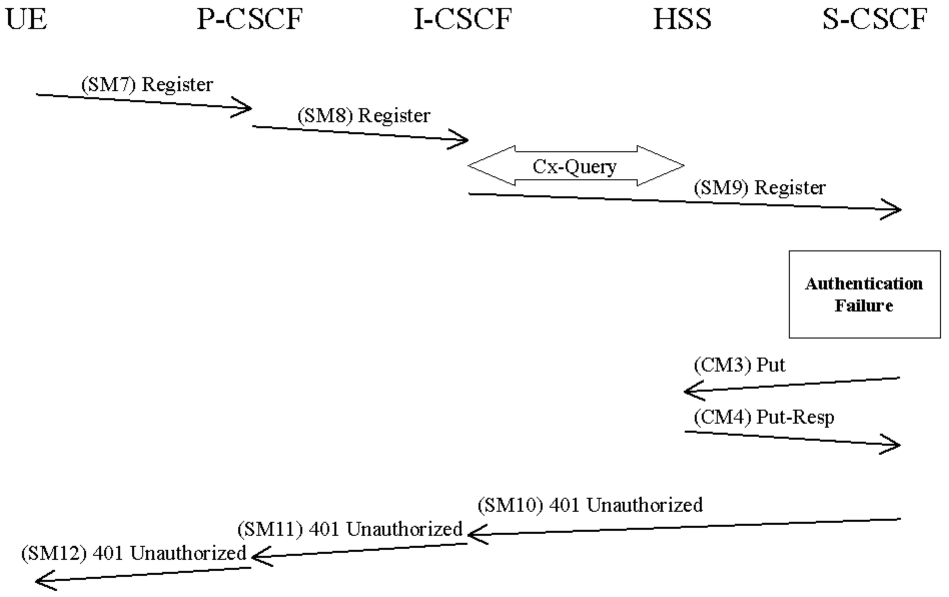
The lengths of the IMS AKA parameters are specified in chapter 6.3.7 in [1].

6.1.2 Authentication failures

[Editor's note: This subsection shall deal with the requirements for network and user authentication failures.]

6.1.2.1 User authentication failure

When the check of the RES in the S-CSCF fails the user can not be authenticated and hence registration fails. The flow is identical as for the successful registration in 6.1.1 up to SM9.



CM3:

Cx-AV-Req(IMPI, IMPU, Clear S-CSCF name)

The S-CSCF sends a Cx-Put (CM3) to the HSS, which indicates that authentication failed and that, the S-CSCF should be cleared for that particular IMPU. The HSS responds with a Cx-Put-Resp in CM4. In SM10 the S-CSCF sends a 401 unauthorized towards the UE, no security parameters shall be included in this message.

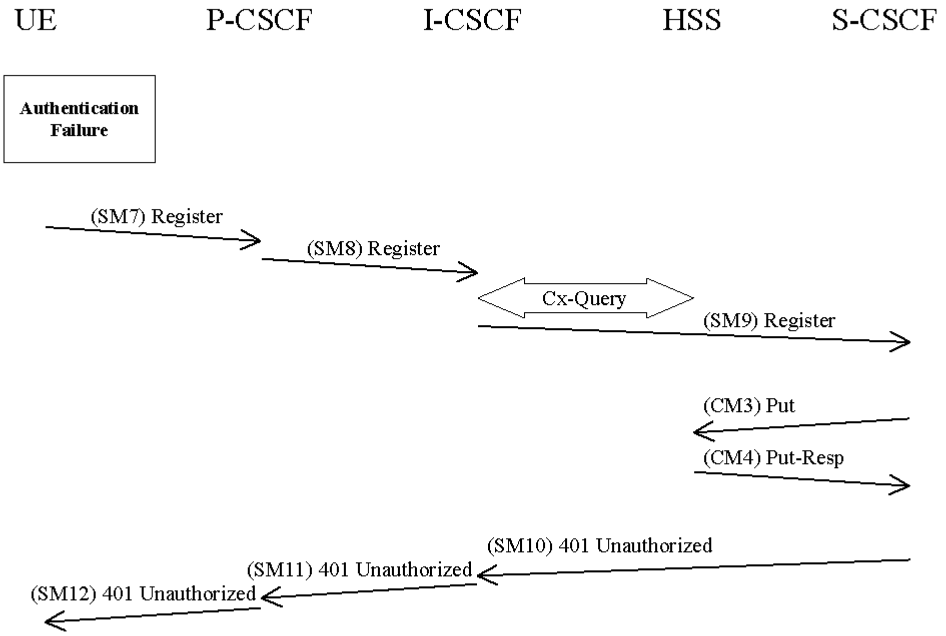
SM10:

SIP/2.0 401 Unauthorized
Via: ----
From: IMPI
To: IMPU
Call-ID: ----
Cseq: 1 REGISTER
Content-Length: 0

Upon receiving SM10 the I-CSCF shall clear any registration information related to the IMPU.

6.1.3.2 Network authentication failure

In this section the case when the authentication of the network is not successful is specified. When the check of the MAC in the UE fails the network can not be authenticated and hence registration fails. The flow is identical as for the successful registration in 6.1.1 up to SM6.



The UE shall send a Register message towards the HN including an indication of the cause of failure in SM7. The P-CSCF and the I-CSCF forward this message to the S-CSCF.

SM7:

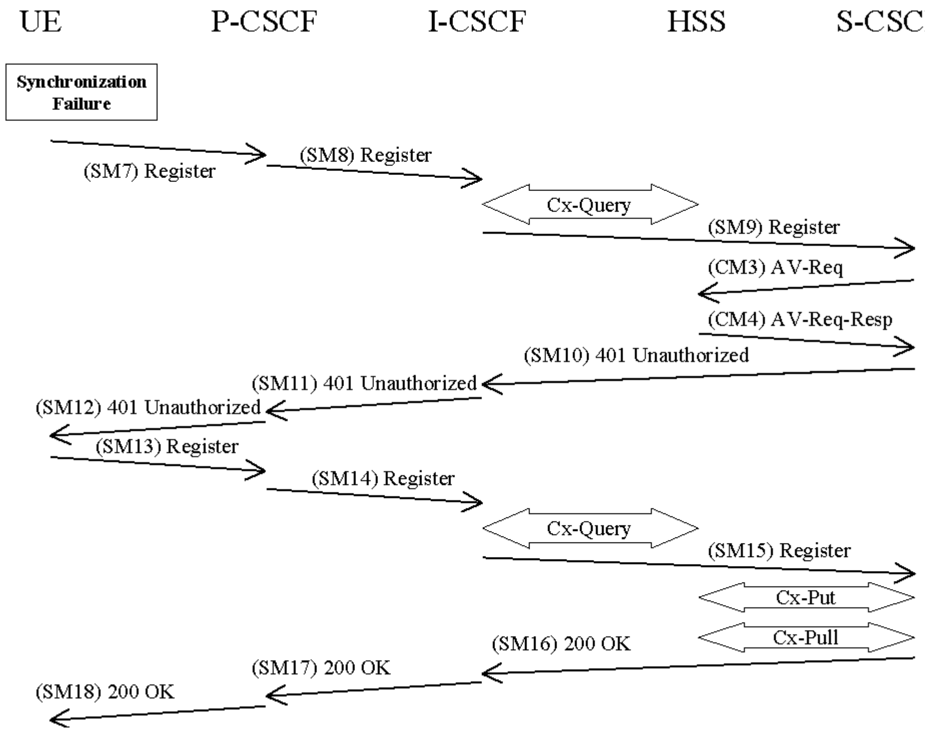
REGISTER sip: ----
Via: ----
From: IMPI
To: IMPU
Call-ID: ----
Cseq: 1 REGISTER
Failure: *AuthenticationFailure*
Content-Length: 0

Upon receiving SM9, which includes the cause of authentication failure, the S-CSCF sends a Cx-Put in CM3 and receives a Cx-Put-Resp in CM4. The S-CSCF sends a 401 Unauthorized towards the UE. The messages CM3, CM4 and SM10-SM12 shall be the same as in 6.1.2.1.

6.1.4 Synchronization failure

[Editor's note: This subsection shall deal with the requirements for the case when the SQNs in the ISIM and the HSS are not in synch.]

In this section the case of an authenticated registration with synchronization failure is described. After re-synchronization, authentication may be successfully completed, but it may also happen that in subsequent attempts other failure conditions (i.e. user authentication failure, network authentication failure) occur. In below only the case of synchronization failure with subsequent successful authentication is shown. The other cases can be derived by combination with the flows for the other failure conditions.



The flow equals the flow in 6.1.3.1 up to SM6. When the UE receives SM6 it detects that the SQN is out of range and sends a synchronization failure back to the S-CSCF in SM7.

SM7:

~~SIP/2.0 401 Unauthorized~~REGISTER sip: ----
Via: ----
From: IMPI
To: IMPU
Call-ID: ----
Cseq: 1 REGISTER

Failure: *SynchFailure||AUTS*

Content-Length: 0

Upon receiving the *Synchronization Failure* and the AUTS the S-CSCF sends an Av-Req to the HSS in CM3 including the required number of Avs, n.

CM3:

Cx-AV-Req(IMPI, IMPU, RAND,AUTS, n)

The HSS checks the AUTS as in section 6.3.5 in [1]. If the check is successful and potentially after updating the SQN the HSS creates and sends new AVs to the S-CSCF in CM4.

CM4:

Cx-AV-Req-Resp(IMPI, IMPU,n,$RAND_1$||$AUTN_1$||$XRES_1$||CK_1||IK_1,….,$RAND_n$||$AUTN_n$||$XRES_n$||CK_n||IK_n)

The rest of the messages i.e. SM10-SM18 including the Cx messages are exactly the same as SM4-SM12 and the corresponding Cx messages in 6.1.1.

6.2 Confidentiality mechanisms

[Editor's note: This section shall deal with cipher algorithms]

For access to IMS through UMTS no cipher algorithms are specified for IM CN SS other than those provided by UMTS R´99 i.e. [1] and Network Domain Security [5].

[Editor's note: No other accesses than UMTS are within the scope of R5. Since it is optional to implement the text above seems too stringent. Hence the editor believes that it would be good if also confidentiality mechanisms where defined.]

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[Editor's note: At this stage both Annex B and Annex C provides with potential measures for confidentiality protection. One of these solutions will be the normative solution. Note that for R5 confidentiality measures are optional.]

6.3 Integrity mechanisms

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[Editor's note: At this stage both Annex B and Annex C provides with potential measures for integrity protection. One of these solutions will be the normative solution.]~~[Editor's note: This section shall deal with integrity algorithms]~~

~~[Editor's note: the following mechanisms are FFS:~~

~~data integrity protection method~~

~~etc]~~

6.4 Hiding mechanisms

The Hiding Mechanism is optional for implementation. All I-CSCFs in the HN shall share the same encryption and decryption key Kv. If the mechanism is used and the operator policy states that the topology shall be hidden the I-CSCF shall encrypt the address of the S-CSCF. An IV of 128-bit is needed at the encryption and decryption phase and it shall be appended to the encrypted information. The information shall also be MAC protected with a block cipher in CBC-MAC mode.

When the I-CSCF decrypts the information it shall verify the integrity.

[Editor's note: The above text is very brief and the mechanisms have to be described in more detail.]

7 Security association set-up procedure~~mode set-up~~

~~[Editor's note: the following mechanisms are FFS:~~

~~Key settings~~

~~Mechanisms for ciphering and integrity mode negotiation~~

~~Key lifetime~~

~~Key identification~~

~~When to start encryption and integrity protection]~~

The security mode setup procedure is necessary in order to decide when and how the security services start. In the IM CN SS authentication of users is performed during registration as in Section 6.1. Subsequent signaling communications in this session will be integrity and option confidentiality protected based on the keys derived during the authentication process.

7.1 Security association parameters

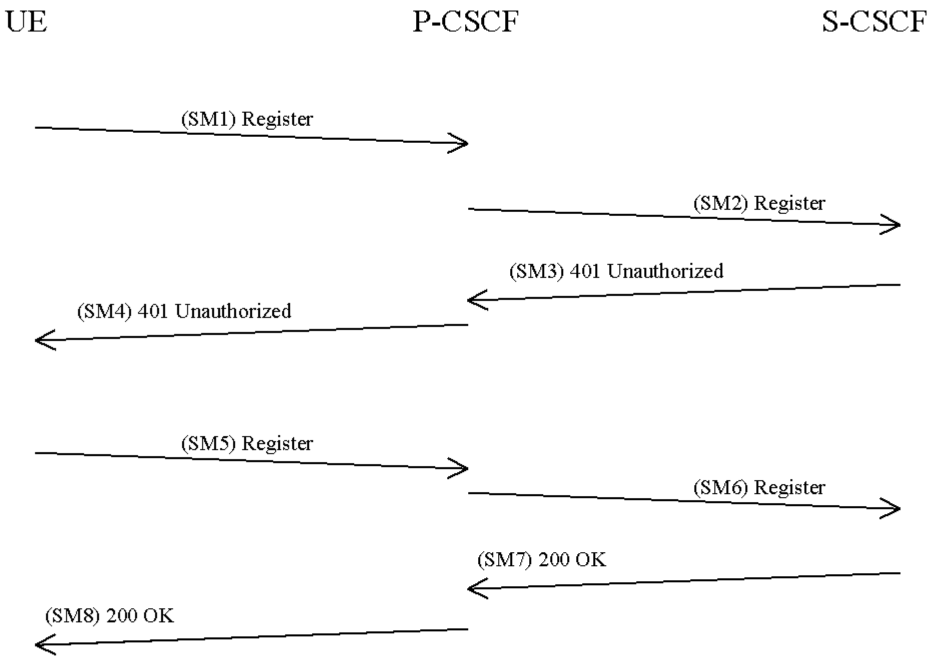
The SA parameters, identifiers and attributes that shall be negotiated between UE and P-CSCF, are

- Authentication (integrity) algorithm
- Life type: the life type is always seconds
- SA duration: the SA duration has a fixed length of 2^{32}-1.
- Key length: the length of encryption and authentication (integrity) keys is 128 bits.

[Editors Note: Parameters specifically related to IPSec are kept in Annex D and should be moved into this section if that solution is finally chosen.]

~~7.1 Set-up of security services~~7.2 Set-up of security associations (successful case)

In this section the normal case is specified i.e. when no failures occurs. Note that for simplicity some of the nodes and messages have been omitted.



The UE sends a Register message towards the S-CSCF for authentication purposes. This has been described in 6.1. In order to setup the security services the UE shall include a proposed set of security algorithms. In this case a list of n integrity algorithms and a list of m confidentiality algorithms are proposed.

The SPI_U shall be chosen in such a way that it uniquely identify the (unidirectional) inbound SA at the UE side, within the UE.

Elements in [...] are optional.

SM1:

REGISTER sip: ----
Via: ----
From: IMPI
To: IMPU
Call-ID: ----
Cseq: 1 REGISTER
...

Security-setup: *esp | integrity algorithms list | [confidentiality algorithms list]| SPI_U*

Content-Length: 0

~~SM1:~~

~~REGISTER sip: ----~~
~~Via: ----~~
~~From: IMPI~~
~~To: IMPU~~
~~Call-ID: ----~~
~~Cseq: 1 REGISTER~~

~~Security-setup: Integrity-Algorithm-1, Integrity-Algorithm-2, …, Integrity-Algorithm-n~~

~~Content-Length: 0~~

[Editors Note: The parameters esp and SPI_U are related to the IPSec protection mechanism and should be removed from this TS if SIP-level integrity protection is chosen. A similar parameter as the SIP_U should probably defined for the SIP-level protection solution]

The P-CSCF shall choose one of the proposed algorithms based on the policy that applies and send the selected algorithm to the UE in SM4.~~:~~

The SPI_P shall be chosen in such a way that it uniquely identifies the (unidirectional) inbound SA at the P-CSCF side, within the P-CSCF.

[Editors Note: The unprotected port specifies the port where the P-CSCF is willing to accept unprotected error messages sent by the UE.]

[Editors Note: It is FFS if the HN shall take part in the negotiation of algorithms.]

SM4:

SIP/2.0 401 Unauthorized
Via: ----
From: IMPI
To: IMPU
Call-ID: ----
Cseq: 1 REGISTER
...

Security-setup: esp | *integrity algorithm | [confidentiality algorithm] | SPI _P | unprotected_port*

Content-Length: 0

~~SM4:~~

~~SIP/2.0 401 Unauthorized~~
~~Via: ----~~
~~From: IMPI~~
~~To: IMPU~~
~~Call-ID: ----~~
~~Cseq: 1 REGISTER~~
~~Security-setup: Integrity-Algorithm-m~~

~~Content-Length: 0~~

[Editors Note: The parameters esp and SPI_P are related to the IPSec protection mechanism and should be removed from this TS if SIP-level integrity protection is chosen. A similar parameter as the SIP_P should probably defined for the SIP-level protection solution. The unprotected port is only valid for the IPSec solution and shall be removed if Sip-level protection is chosen. The unprotected port for IPSec specifes what port shall be used for error messages sent from the UE.]

The UE shall in SM5 start the integrity protection – and optionally the confidentiality protection -of the whole SIP-message by setting up security associations according to the parameters negotiated in SM1 and SM4, and applying the corresponding protection to the SIP-message~~using the Integrity-Algorithm-m and the IK and include a MAC~~. Furthermore the Security-setup line~~proposed set of algorithms that where~~ sent in SM1 shall be included:

SM5:

REGISTER sip: ----
Via: ----
From: IMPI
To: IMPU
Call-ID: ----
Cseq: 1 REGISTER
Security-setup: *esp | integrity algorithms list | [confidentiality algorithms list]| SPI_U*

...

Content-Length: 0

~~SM5:~~

~~REGISTER sip: ----~~
~~Via: ----~~
~~From: IMPI~~
~~To: IMPU~~
~~Call-ID: ----~~
~~Cseq: 1 REGISTER~~
~~Security-setup: Integrity-Algorithm-1, Integrity-Algorithm-2, …, Integrity-Algorithm-n~~
~~MAC~~
~~Content-Length: 0~~

[Editors Note: The parameters esp and SPI_U are related to the IPSec protection mechanism and should be removed from this TS if SIP-level integrity protection is chosen. A similar parameter as the SIP_U should probably defined for the SIP-level protection solution]

After receiving SM5 from the UE, the P-CSCF shall compare the Security-Setup line of this message with the Security-Setup line received in SM1.~~*[Editors Note: The security mode setup shall be generic such that for future needs confidentiality algorithms can be negotiated and applied. At this the NULL algorithm shall be assumed to be the confidentiality algorithm i.e. the system will rely on existing confidentiality mechanisms defined for UMTS and R'99.]*~~

[Editors Note: It is FFS if the HN shall take part in the negotiation process.]

7.3 Error cases in the set-up of security associations

Whenever an expected message is not received after a time-out the receiving entity considers the registration to have failed.

[Editor's note: Clarify, how SIP registration handles the inconsistent state that is created by a lost SM8 message]

7.3.1 Error cases related to IMS AKA

Errors related to IMS AKA failures are specified in section 6.1. However, this section additionally describes how these shall be treated, related to security setup.

[Editors Note: It is FFS if this is appropriate taking DoS attacks into account.]

7.3.1.1 User authentication failure

In this case the authentication of the user fails in the network due an incorrect RES. The S-CSCF will send a 401 Unauthorized message SM7, which will pass through the already established SA to the UE as SM8.

Note, that this failure will already occur in SM5, when the UE does not use the correct integrity key IK. In this situation, the P-CSCF will receive protected packets that cannot be verified and therefore will be discarded.

In order to handle this situation, the P-CSCF shall implement a timer for the authentication process. When a message is received that passes the integrity-check and successfully completes the authentication, it is immediately processed. However, if during the registration timer the P-CSCF receives packets that cannot be verified, it discards them. At the end of the registration timer, it reports an authentication failure back to the home network.

It may seem from the above discussion that there is no requirement to check the RES at the S-CSCF since a false RES sent by a UE will never reach the S-CSCF. However, it is still necessary to check RES at the S-CSCF since this prevents a P-CSCF from registering a UE without performing user authentication. It therefore reduces S-CSCF trust in the P-CSCF.

7.3.1.2 Network authentication failure

If the UE is not able to successfully authenticate the network, the UE is not able to create the key IK and therefore the SA with the P-CSCF, such that it is not possible to send SM5 in a protected way. Since the P-CSCF already expects SIP messages from the UE to be protected, and is not already aware of any errors, the P-CSCF shall accept such REGISTER messages indicating network authentication failure in the clear.

So the UE sends a new register message SM5, indicating a network authentication failure, to the P-CSCF, without protection. SM5 should not contain the security-setup line of the first message.

[Editors Note: For IPSec failure messages due to a network authentication failure shall be sent on a different port, the unprotected port. This text shall be moved into the main body if IPSec is finally chosen.]

7.3.1.3 Synchronisation failure

In this situation, the UE observes that the AUTN sent by the network in SM4 contains an out-of-range sequence number. The UE shall sends a new register message SM5 to the P-CSCF in the clear, indicating the synchronization failure. SM5 should not contain the Security-Setup line of the first message, and the P-CSCF shall keep the security-setup state created after receiving SM1 from the UE.

[Editors Note: For IPSec failure messages due to synchronization failures shall be sent on a different port. *This text shall be moved into the main body if IPSec is finally chosen.]*

7.3.2 Error cases related to the Security-Set-up

7.3.2.1 Unacceptable proposal set

In this case the P-CSCF cannot accept the proposal set sent by the UE in the Security-Set-up command of SM1. SM4 shall respond to SM1 with indicating a failure, by sending a 403 Forbidden error message.

The P-CSCF therefore shall modify the message SM2 such that the S-CSCF sends a 403 Forbidden error message back to the UE in SM3/4 and the registration process is finished.

SM2:

REGISTER sip: ----
Via: ----
From: IMPI
To: IMPU
Call-ID: ----
Cseq: 1 REGISTER
Security-setup: *esp | integrity algorithms list | [confidentiality algorithms list]| SPI_U*

Failure: *NoCommonIntegrityAlgorithm*

Content-Length: 0

[Editors Note: The parameters esp and SPI_U are related to the IPSec protection mechanism and should be removed from this TS if SIP-level integrity protection is chosen. A similar parameter as the SIP_U should probably defined for the SIP-level protection solution]

[Editors Note: It is FFS how the exact mechanism shall be for the Unacceptable proposal set case. The editor believes that the S-CSCF is the registrar and hence the P-CSCF should only be able to modify the headers and not send back responses. The failure response should be sent by the S-CSCF. This however has not been agreed.]

7.3.2.2 Unacceptable algorithm choice

If the P-CSCF sends in the security-setup line of SM4 an algorithm that is not acceptable for the UE (i.e. has not been proposed), the UE shall not continue to create a security association with the P-CSCF and shall terminate the registration procedure.

7.3.2.3 Failed consistency check of Security-Set-up lines

This is the case if the Security-Setup line in SM5 from the UE to the P-CSCF cannot be verified, so the Security-Setup line of the unprotected SM1 and the Security-Setup line of the protected SM5 do not match. The P-CSCF shall respond to the UE by sending a 403 Forbidden error message in SM8. The P-CSCF therefore shall modify the message SM6 such that the S-CSCF sends a 403 Forbidden error message back to the UE in SM7/8 and the registration process is finished.

SM6:

REGISTER sip: ----
Via: ----
From: IMPI
To: IMPU
Call-ID: ----
Cseq: 1 REGISTER
Security-setup: *esp | integrity algorithms list | [confidentiality algorithms list]| SPI_U*

Failure: *NoCommonIntegrityAlgorithm*

Content-Length: 0

[Editors Note: The parameters esp and SPI_U are related to the IPSec protection mechanism and should be removed from this TS if SIP-level integrity protection is chosen. A similar parameter as the SIP_U should probably defined for the SIP-level protection solution]

[Editors Note: It is FFS how the exact mechanism shall be for the Unacceptable proposal set case. The editor believes that the S-CSCF is the registrar and hence the P-CSCF should only be able to modify the headers and not send back responses. The failure response should be sent by the S-CSCF. This however has not been agreed.]

7.3.3 Authenticated re-registration

If the registration is a re-registration, a pair of security associations between UE and P-CSCF is already active.

[Editors Note: It is FFS if these SAs shall protect the first two messages of the authenticated re-registration, i.e. SM1 and SM4.

Before SM5 is sent by the UE, both peers shall replace the existing SA by the new SA negotiated during these first two messages.

7.3.3.1 Handling of security associations in authenticated re-registrations (successful case)

[Editors Note: The following part of the description is independent of the particular mechanism for integrity and confidentiality protection.]

Before re-registration begins the following SAs exist:

- SA1 from UE to P-CSCF
- SA2 from P-CSCF to UE

The re-registration then is as follows:

1) The UE sends SM1 to re-register with the IMS, using the existing SA1 to the P-CSCF. As in the case of a new registration, a list of parameters to be negotiated in a security association set-up is included.

[Editors Note: It is FFS if the SA1 shall be used for SM1 or not]

2) The P-CSCF waits for the response SM3 from the S-CSCF and then sends SM4 to the UE, using SA2. As in the case of a new registration, the parameters selected for the new security associations are included. The P-CSCF then creates two new security associations, in parallel to the existing ones, in its database:

- SA11 from UE to P-CSCF

- SA12 from P-CSCF to UE

3) If SM4 could be successfully processed by the UE, the UE also creates the new SAs SA11 and SA12 in its database. The UE then sends SM5 to the P-CSCF. As in the case of a new registration, the authentication response and the list of parameters repeated from message 1 are included. SM5 is protected with the new SA11.

4) The P-CSCF waits for the response SM7 from the S-CSCF and then sends SM8 to the UE, using the new SA 12.

5) After the reception of SM8 by the UE, the re-registration is complete.

The UE now uses the new SAs for all subsequent messages. The old (outbound) SA1 is deleted. The old (inbound) SA2 must be kept until a further SIP message protected with the new inbound SA12 is successfully received from the P-CSCF.

The P-CSCF keeps all four SAs with the UE active until a further SIP message protected with the new inbound SA11 is successfully received from the UE. In the meantime, the P-CSCF continues to use the old SA2 for outbound traffic to the UE.

Aspects specific to the use of IPsec/ESP:

The new security associations SA11 and SA12 shall be bound to a new port on the UE side. This new port shall be communicated by the UE in the first REGISTER message SM1 in the list of parameters to be negotiated in a security association set-up.

[Editor's note: If it is desired to use identical messages for new registrations and re-registrations then a new port can also be included in the first message for new registrations although it is not strictly needed there.]

7.3.3.2 Error cases related to authenticated re-registration

Whenever an expected message is not received after a time-out the receiving entity considers the registration to have failed. The receiving entity then deletes any new security associations it may have established and continues to use the old ones if they have not yet expired.

If the registration protocol goes well up to the last message SM8, and SM8 is sent by the P-CSCF, but not received by the UE , then the UE has only the olds SAs available (after the time-out), but the P-CSCF cannot know this. Therefore, the P-CSCF continues to use the old SA2 for outbound traffic to the UE, but keeps both, old and new SAs. The new SAs are deleted when a message is received from the UE which is protected with the old SA, or if a REGISTER message is received on the port where the P-CSCF accepts specific unprotected messages.

7.3.3.3 Error cases related to IMS AKA

User authentication failure

The S-CSCF will send a 401 Unauthorized message SM7, which will pass through the already established SA to the UE as SM8. Afterwards, both, the UE and the P-CSCF delete the new SAs.

Network authentication failure

If the UE is not able to successfully authenticate the network, it does not establish a new SA. The UE sends a REGISTER message SM5 indicating a network authentication failure to the P-CSCF, using the already established SA. The P-CSCF deletes the new SAs after receiving this message.

Synchronisation failure

If the UE notices a synchronisation failure it does not establish a new SA. The UE sends a message SM5, indicating the synchronisation failure, to the P-CSCF, using the already established SA. The P-CSCF deletes the new SA after receiving this message.

7.3.3.4 Error cases related to the Security-Setup

Unacceptable proposal set

The message SM4 shall respond to the first REGISTER message SM1 with a 403 Forbidden, using the already established SA. Neither side establishes a new SA.

The P-CSCF therefore shall modify the message SM2 such that the S-CSCF sends the 403 Forbidden error message back to the UE in SM3/4 and the registration process is finished.

SM2:

```
    REGISTER sip: ----
    Via: ----
    From:  IMPI
    To: IMPU
    Call-ID: ----
    Cseq: 1 REGISTER
    Security-setup:  esp | integrity algorithms list | [confidentiality algorithms list ]|
    SPI_U

    Failure: NoCommonIntegrityAlgorithm
Content-Length: 0
```

[Editors Note: It is FFS how the exact mechanism shall be for the Unacceptable proposal set case. The editor believes that the S-CSCF is the registrar and hence the P-CSCF should only be able to modify the headers and not send back responses. The failure response should be sent by the S-CSCF. This however has not been agreed.]

[Editors Note: The parameters esp and SPI_U are related to the IPSec protection mechanism and should be removed from this TS if SIP-level integrity protection is chosen. A similar parameter as the SIP_U should probably defined for the SIP-level protection solution]

Failed consistency check of Security-Set-up lines

This is the case if the Security-Setup line in SM5 from the UE to the P-CSCF cannot be verified, so the Security-Setup line of the unprotected SM1 and the Security-Setup line of the protected SM5 do not match. In this case the P-CSCF shall respond to the UE by sending a 403 Forbidden error message in SM8 using the already established SA. Both sides delete the new SAs.

The P-CSCF therefore shall modify the message SM6 such that the S-CSCF sends the 403 Forbidden error message back to the UE in SM7/8 and the registration process is finished.

SM6:

```
    REGISTER sip: ----
    Via: ----
    From:  IMPI
    To: IMPU
    Call-ID: ----
    Cseq: 1 REGISTER
    Security-setup:  esp | integrity algorithms list | [confidentiality algorithms list ]|
    SPI_U

    Failure: NoCommonIntegrityAlgorithm
Content-Length: 0
```

[Editors Note: It is FFS how the exact mechanism shall be for the Unacceptable proposal set case. The editor believes that the S-CSCF is the registrar and hence the P-CSCF should only be able to modify the headers and not send back responses. The failure response should be sent by the S-CSCF. This however has not been agreed.]

[Editors Note: The parameters esp and SPI_U are related to the IPSec protection mechanism and should be removed from this TS if SIP-level integrity protection is chosen. A similar parameter as the SIP_U should probably defined for the SIP-level protection solution]

~~7.2 Failures in the set-up process~~

~~Failures related to authentication failures and synchronization failures are specified in 6.1. However when a failure occurs the SIP failure messages shall not be integrity protected. The integrity algorithm shall only be applied in the successful cases.~~

~~[Editors Note: It is FFS if this is appropriate taking DoS attacks into account.]~~

~~7.2.1 Unacceptable proposal set~~

~~When the P-CSCF receives a proposal set in a SIP REGISTER message in SM1 that is not acceptable it shall modify the message such that the S-CSCF sends an error message back to the UE in SM3 and the registration process is finished.~~

~~SM2:~~

~~REGISTER sip: ----~~
~~Via: ----~~
~~From: IMPI~~
~~To: IMPU~~
~~Call-ID: ----~~
~~Cseq: 1 REGISTER~~
~~Security-setup: Integrity-Algorithm-1, Integrity-Algorithm-2, …, Integrity-Algorithm-n~~

~~Failure: *NoCommonIntegrityAlgorithm*~~

~~Content-Length: 0~~

~~[Editors Note: It is FFS how the exact mechanism shall be for the Unacceptable proposal set case. The editor believes that the S-CSCF is the registrar and hence the P-CSCF should only be able to modify the headers and not send back responses. The failure response should be sent by the S-CSCF. This however has not been agreed.]~~

~~7.2.2 Failure of integrity check~~

~~When the P-CSCF receives a SIP message, which is integrity, protected and the integrity check fails the P-CSCF shall silently discard that message.~~

~~[Editors Note: It is still FFS how failures related to MAC failures shall be handled in detail. This includes the behavior of both the P-CSCF and the UE.]~~

Annexes are only to be used where appropriate:

Annex <A> (normative): <Normative annex title>

Annex B (Informative): Mechanisms for IPSec based solution

[Editors Note: If the IPSec solution is finally chosen the chapters below shall be moved into the main body of this TS in the corresponding sections.]

B.1 6.2 Confidentiality mechanisms

[Editor's note: This section shall deal with cipher algorithms]

For access to IMS through UMTS no cipher algorithms are specified for IM CN SS other than those provided by UMTS R´99 i.e. [1] and Network Domain Security [5].

[Editor's note: No other accesses than UMTS are within the scope of R5. Since it is optional to implement the text above seems too stringent. Hence the editor believes that it would be good if also confidentiality mechanisms where defined.]

IPsec ESP may optionally be implemented for providing confidentiality of SIP signalling between the UE and the P-CSCF, protecting all SIP signalling messages at the IP level. If ESP confidentiality is used, it shall be applied in transport mode between UE and P-CSCF. If ESP confidentiality is provided, it is always provided in addition to ESP integrity protection.

The SAs that are required for ESP shall use the 128-bit integrity key CK generated through IMS AKA, as specified in chapter 6.1.

If confidentiality is required, for each direction, there is one ESP SA for both confidentiality and integrity that shall be used between the UE and the P-CSCF. The encryption transform is identical for the two SAs in either direction. The encryption key for the SA inbound from the P-CSCF is CK. The encryption key for the SA outbound from the P-CSCF is CK_{MOD}

[Note: CK_{MOD} is a suitable modification of CK. An example of a suitable modification is a rotation of the key bits by n bits, where n remains to be determined.]

The method to set up ESP security associations during the SIP registration procedure is specified in chapter 7.

B.2 6.3 Integrity mechanisms

IPsec ESP shall provide integrity protection of SIP signalling between the UE and the P-CSCF, protecting all SIP signalling messages at the IP level. ESP integrity shall be applied in transport mode between UE and P-CSCF.

The SAs that are required for ESP shall use the 128-bit integrity key IK generated through IMS AKA, as specified in chapter 6.1. The transform used for the ESP SA shall be negotiated as specified in chapter 7. ESP shall use two unidirectional SAs between the UE and the P-CSCF, one in each direction. The integrity algorithm is identical for both SAs. The integrity key for the SA inbound from the P-CSCF is IK. The integrity key for the SA outbound from the P-CSCF is IK_{MOD}

[Note: IK_{MOD} is a suitable modification of IK. An example of a suitable modification is a rotation of the key bits by n bits, where n remains to be determined.]

The method to set up ESP security associations during the SIP registration procedure is specified in chapter 7.

Annex C (Informative): Mechanisms for SIP-level solution

[Editors Note: If the SIP-level solution is finally chosen the chapters below shall be moved into the main body of this TS in the corresponding sections.]

C.1 6.2 Confidentiality mechanisms

[Editor's note: This section shall deal with cipher algorithms]

For access to IMS through UMTS no cipher algorithms are specified for IM CN SS other than those provided by UMTS R´99 i.e. [1] and Network Domain Security [5].

[Editor's note: No other accesses than UMTS are within the scope of R5. Since it is optional to implement the text above seems too stringent. Hence the editor believes that it would be good if also confidentiality mechanisms where defined.

C.2 6.3 Integrity mechanisms

Annex D (Informative): Set-up procedures for IPSec based solution

[Editors Note: If the IPSec solution is finally chosen the chapters below shall be moved into the main body of this TS in the corresponding sections.]

D.1 7.1 Security association parameters

The SA parameters, identifiers and attributes that shall be negotiated between UE and P-CSCF, are

- ESP transform identifier
- Authentication (integrity) algorithm
- SPI

Further parameters:

- Life type: the life type is always seconds
- SA duration: the SA duration has a fixed length of 2^{32}-1.
- Key length: the length of encryption and authentication (integrity) keys is 128 bits.

Selectors:

The security associations have to be bound to specific parameters (selectors) of the SIP flows between UE and P-CSCF, i.e. IP addresses and ports. Both sides have to use the same policy here, but since the required selectors will be known from the SIP messages, there is no need to negotiate them. The only parameter that shall be negotiated, is a port for specific unprotected SIP messages at the P-CSCF:

1. For the inbound SA at the P-CSCF (outbound for the UE) the P-CSCF shall use a fixed port. This may be port 5060 as the standard SIP port, or any other fixed port where the server accepts SIP messages from the UE. In addition, another port for specific unprotected SIP messages from the UE to the server is fixed.
   For the outbound SA at the P-CSCF (inbound for the UE) ANY port number shall be allowed at the P-CSCF.

2. On the UE side, the SIP UAs shall use the same port for both sending and receiving SIP signalling to the P-CSCF.

3. If there are multiple SIP UAs belonging to different ISIMs in one UE they shall use different SAs and bind them to different ports on the UE side.

4. The UE may send only the following messages to the fixed port for unprotected messages:
   - initial REGISTER message
   - REGISTER message with network authentication failure indication
   - REGISTER message with synchronization failure indication

   All other messages incoming on this port must be discarded by the SIP application on the P-CSCF.

[Note: It is ffs whether case 3 can actually occur.]

Annex E (Informative): Open issues in SA3 tailored to CN1

This annex contains issues that need discussion and resolution related to the work performed by SA3 and CN1. When the technical content is stable and the TS33.203 is going for approval to SA this Annex will be removed.

The issues in the issue column are questions defined by CN1 and sent to SA3 for clarification. In the Status/Answer column the status in SA3 or the answer to the question is given.

Issue ID	Issue description	Source	Date	Answer from SA3	Status
S3#19-1	Security work for the ISC interface	S3-010404	SA3#19/July	Work just started.	Open
S3#19-2	Security needed for OSA API interface between HN and 3rd party providers	S3-010404	SA3#19/July	Work just started.	Open
S3#19-3	Can a call be terminated towards an IMPU that has not been registered?	S3-010404	SA3#19/July	Current understanding of SA3 is no. However this requirement should be stated by SA2 not SA3.	Closed/SA3#20/October
S3#19-4	Is it necessary to transport the KSI or similar in SIP-register messages.	S3-010404	SA3#19/July	This is FFS.	Open
S3#19-5	What SIP messages shall be authenticated?	S3-010404	SA3#19/July	(Re-)Registrations.	Closed/SA3#20/October
S3#19-6	Network hiding performed by the I-CSCF.	S3-010404	SA3#19/July	Work started. See also S3#19-9	Open
S3#19-7	Questions related to session transfer.	S3-010404	SA3#19/July	SA3 has sent an LS to GSM association, S3-010383. Work has started.	Open
S3#19-8	Discrepancy in time plans between CN1 and SA3	S3-010404	SA3#19/July	TS33.203 shall be ready March 2002.	Closed/SA3#20/October
S3#19-9	What is the due date for the WI on hiding?	S3-010339	SA3#19/July	Included in TS33.203 section 6.4. The TS stage 2 will be ready March 2002.	Closed/SA3#20/October
S3#19-10	Should the system be able to authenticate e.g. INVITEs and not be bound to the Registration procedure?	S3-010339	SA3#19/July	Authentication shall only take place at (re-)registrations	Closed/SA3#20/October
S3#19-11	At what layer does encryption take place?	S3-010339	SA3#19/July	Encryption is optional to implement. If used it shall be at the same layer as integrity protection. It is still open if SIP-level or IP-level.	Closed/SA3#20/October
S3#19-12	Hiding the callers IP-address: anonymity	S3-010339	SA3#19/July	For further study	Open

Annex <X> (informative): Change history

It is usual to include an annex (usually the final annex of the document) for specifications under TSG change control which details the change history of the specification using a table as follows:

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2000-10	SA3#15bis	33.2xx		0.1.0	Initial version of the specification		
2000-11	SA3#16			0.1.1	Input from AdHoc meeting		
2001-03	SA3#17	33.203		0.2.0	Input from the SA3#17 meeting in Göteborg		
2001-04		33.203		0.2.1	Termination of confidentiality in the P-CSCF moved to an editors note. Kept the R'99 mechanism in the main document. Where to terminate is FFS.		
2001-05	SA3#17bis	33.203		0.3.0	Input from the SA3#17bis meeting in Madrid.		
2001-06	SA3#18	33.203		0.4.0	Input from the SA3#18 meeting in Phoenix.		
2001-08	SA3#19	33.203		0.5.0	Input from the SA3#19 meeting in Newbury.		
2001-09	SA3#19bis	33.203		0.6.0	Input from the SA3#19bis meeting in Nice		

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