

6.4.5 Security mode set-up procedure

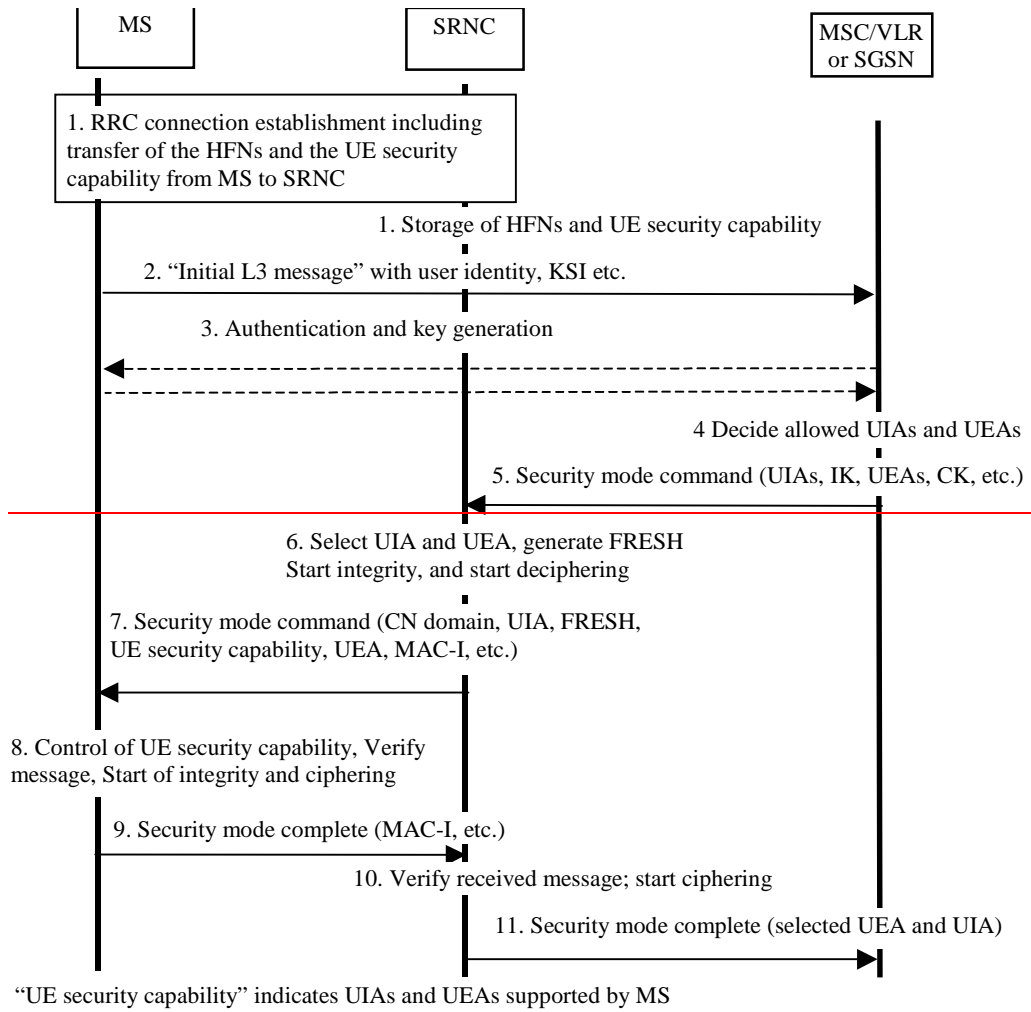
This section describes one common procedure for both ciphering and integrity protection set-up. It is mandatory to start integrity protection of signalling messages by use of this procedure at each new signalling connection establishment between MS and MSC/VLR respective SGSN. The three exceptions when it is not mandatory to start integrity protection are:

- If the only purpose with the signalling connection establishment and the only result is periodic location registration, i.e. no change of any registration information.
- If there is no MS-MSC/VLR (or MS-SGSN) signalling after the initial L3 signalling message sent from MS to MSC/VLR (or SGSN), i.e. in the case of deactivation indication sent from the MS followed by connection release.
- If the only MS-MSC/VLR (or MS-SGSN) signalling after the initial L3 signalling message sent from MS to MSC/VLR (or SGSN), and possible user identity request and authentication (see below), is a reject signalling message followed by a connection release.

When the integrity protection shall be started, the only procedures between MS and MSC/VLR respective SGSN that are allowed after the initial connection request (i.e. the initial Layer 3 message sent to MSC/VLR or SGSN) and before the security mode set-up procedure are the following:

- Identification by a permanent identity (i.e. request for IMSI), and
- Authentication and key agreement

The message sequence flow below describes the information transfer at initial connection establishment, possible authentication and start of integrity protection and possible ciphering.



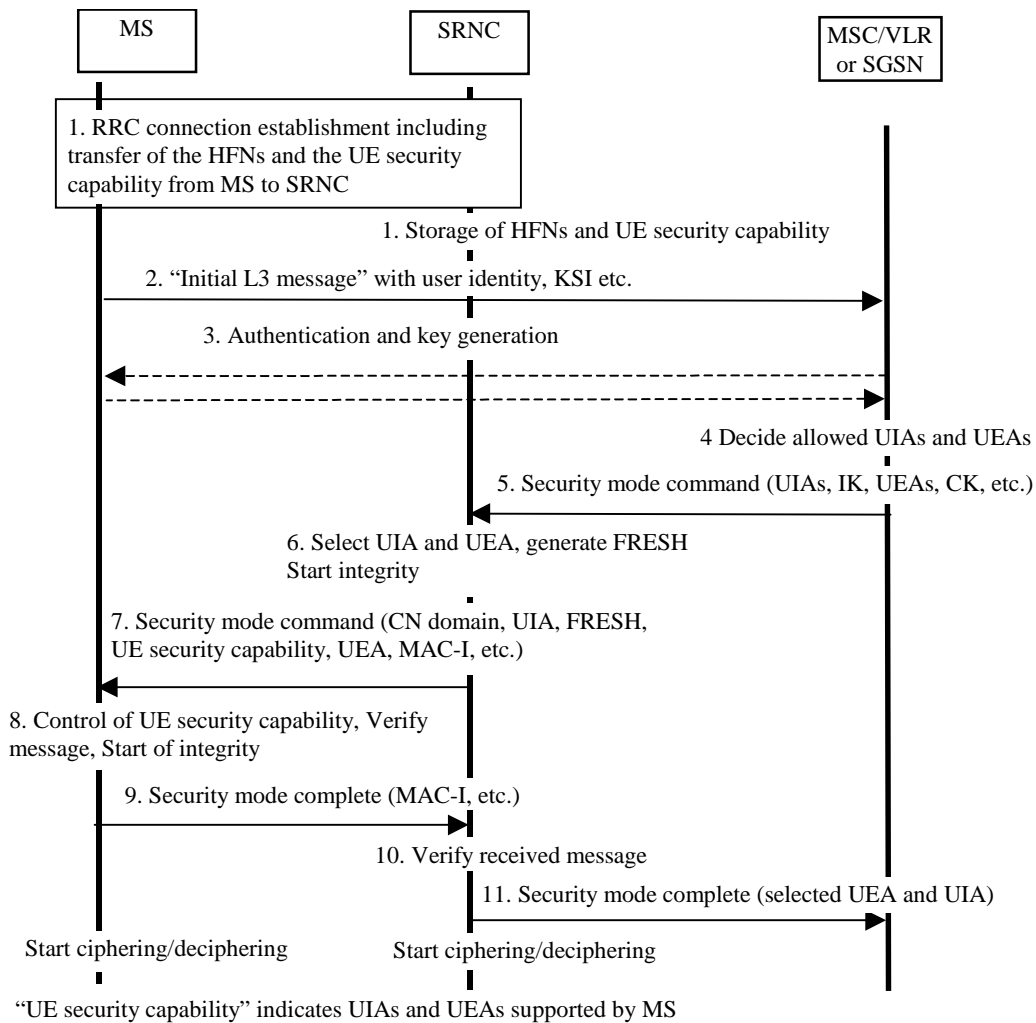


Figure 14: Local authentication and connection set-up

NOTE 1: The network must have the "ME security capability" information before the integrity protection can start, i.e. the "ME security capability" must be sent to the network in an unprotected message. Returning the "ME security capability" later on to the ME in a protected message will give ME the possibility to verify that it was the correct "ME security capability" that reached the network.

Detailed description of the flow above:

1. RRC connection establishment includes the transfer from MS to RNC of the ME security capability and the initial hyperframe numbers (HFN) for the CS service domain respective the PS service domain. The UE security capability information includes the ciphering capabilities (UEAs) and the integrity capabilities (UIAs) of the MS. The initial HFN is used to initialise the HFN to be used as part of one of the input parameters COUNT-I for the integrity algorithm and COUNT-C, for the ciphering algorithm. The initial HFNs and the UE security capability information are stored in the SRNC.
2. The MS sends the Initial L3 message (Location update request, CM service request, Routing area update request, attach request, paging response etc.) to the MSC/VLR or SGSN. This message contains e.g. the user identity and the KSI. The included KSI (Key Set Identifier) is the KSI allocated by the CS service domain or PS service domain at the last authentication for this CN domain.
3. User identity request may be performed (see 6.2). Authentication of the user and generation of new security keys (IK and CK) may be performed (see 6.3.3). A new KSI will then also be allocated.
4. The MSC/VLR or SGSN determines which UIAs and UEAs that are allowed to be used.
5. The MSC/VLR or SGSN initiates integrity and ciphering by sending the RANAP message Security Mode

Command to SRNC. This message contains a list of allowed UIAs and the IK to be used. If ciphering shall be started, it contains the allowed UEAs and the CK to be used. If a new authentication and security key generation has been performed (see 3 above), this shall be indicated in the message sent to the SRNC. The indication of new generated keys implies that the initial HFN to be used shall be reset (i.e. set to zero) at start use of the new keys. Otherwise, it is the HFN already available in the SRNC that shall be used (see 1. above).

6. The SRNC decides which algorithms to use by selecting from the list of allowed algorithms, and the list of algorithms supported by the MS (see 6.4.2). The SRNC generates a random value FRESH and initiates the downlink integrity protection. If the requirements received in the Security mode command can not be fulfilled, the SRNC sends a SECURITY MODE REJECT message to the requesting MSC/VLR or SGSN. The further actions are described in 6.4.2.
7. The SRNC generates the RRC message Security mode command. The message includes the ME security capability, the UIA and FRESH to be used and if ciphering shall be started also the UEA to be used. Additional information (start of ciphering) may also be included. Because of that the MS can have two ciphering and integrity key sets, the network must indicate which key set to use. This is obtained by including a CN type indicator information in the Security mode command message. Before sending this message to the MS, the SRNC generates the MAC-I (Message Authentication Code for Integrity) and attaches this information to the message.
8. At reception of the Security mode command message, the MS controls that the ME security capability received is equal to the ME security capability sent in the initial message. The MS computes XMAC-I on the message received by using the indicated UIA, the stored COUNT-I and the received FRESH parameter. The MS verifies the integrity of the message by comparing the received MAC-I with the generated XMAC-I.
9. If all controls are successful, the MS compiles the RRC message Security mode complete and generates the MAC-I for this message. If any control is not successful, the procedure ends in the MS.
10. At reception of the response message, the SRNC computes the XMAC-I on the message. The SRNC verifies the data integrity of the message by comparing the received MAC-I with the generated XMAC-I.
11. The transfer of the RANAP message Security Mode Complete response, including the selected algorithms, from SRNC to the MSC/VLR or SGSN ends the procedure.

The Security mode command to MS starts the downlink integrity protection, i.e. ~~also this and~~ all following downlink messages sent to the MS are integrity protected ~~and possibly ciphered using the new integrity configuration~~. The Security mode complete from MS starts the uplink integrity protection ~~and possible ciphering~~, i.e. ~~also this and~~ all following messages sent from the MS are integrity protected ~~and possibly ciphered using the new integrity configuration~~. When ciphering shall be started, the Ciphering Activation time information that is exchanged between SRNC and MS during the Security mode set-up procedure sets the RLC Sequence Number/Connection Frame Number when to start ciphering in DL respective UL using the new ciphering configuration.