

13 September, 2001, Sophia Antipolis, France

CR-Form-v4

## CHANGE REQUEST

⌘ **33.200 CR** ⌘ ev **-** ⌘ Current version: **4.0.0** ⌘

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

<b>Title:</b>	⌘ MAPsec Message Flows		
<b>Source:</b>	⌘ Siemens Atea, Ericsson		
<b>Work item code:</b>	⌘ MAPsec	<b>Date:</b>	⌘ 4-09-2001
<b>Category:</b>	⌘ <b>F</b>	<b>Release:</b>	⌘ Rel-4
	Use <u>one</u> of the following categories: <b>F</b> (correction) <b>A</b> (corresponds to a correction in an earlier release) <b>B</b> (addition of feature), <b>C</b> (functional modification of feature) <b>D</b> (editorial modification) Detailed explanations of the above categories can be found in 3GPP <a href="#">TR 21.900</a> .		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)

<b>Reason for change:</b>	⌘ A) To remove the editors note in clause 5.2 ⌘ B) Including message flows in the specification
<b>Summary of change:</b>	⌘ Add message flows to the specification
<b>Consequences if not approved:</b>	⌘

<b>Clauses affected:</b>	⌘ 4, 5.2, New annex B	
<b>Other specs affected:</b>	<input type="checkbox"/> Other core specifications <input type="checkbox"/> Test specifications <input type="checkbox"/> O&M Specifications	⌘
<b>Other comments:</b>	⌘	

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## 4 Principles of MAP application layer security

This technical specification defines mechanisms for protecting the MAP protocol at the application layer. The MAP protocol may also be protected at the network layer when IP is used as the transport protocol. However, whenever inter-working with networks using SS7-based transport is necessary, protection at the application layer shall be used.

Before protection can be applied, Security Associations (SA) needs to be established between the respective MAP network elements. Security associations define, among other things, which keys, algorithms, and protection profiles to use to protect MAP signalling. The necessary MAP-SAs between networks are negotiated between the respective network operators. The negotiated SA will be effective PLMN-wide and distributed to all network elements which implement MAP application layer security within the PLMN. Signalling traffic protected at the application layer will, for routing purposes, be indistinguishable from unprotected traffic to all parties except for the sending and receiving entities.

Protection at the application layer implies changes to the application protocol itself to allow for the necessary security functionality to be added.

The MAP application layer security interface between MAP-NEs engaged in security protected signalling is referred to in this specification as the Zf interface. The interface applies to all MAPsec transactions, intra- or inter-PLMN.

Annex B includes detailed procedures on how secure MAP signalling is performed between two MAP-NEs.

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## 5 MAP security (MAPsec)

### 5.1 Security services provided by MAPsec

The security services provided by MAPsec are:

- data integrity;
- data origin authentication;
- anti-replay protection;
- confidentiality (optional).

### 5.2 Properties and tasks of MAPsec enabled network elements

MAPsec MAP-NEs shall maintain the following databases:

- NE-SPD-MAP: A database in an NE containing MAP security policy information (see clause 5.3);
- NE-SADB-MAP: A database in an NE containing MAP-SA information. MAP-NEs shall monitor the SA lifetime and expired SAs shall be deleted from the database (see clause 5.4).

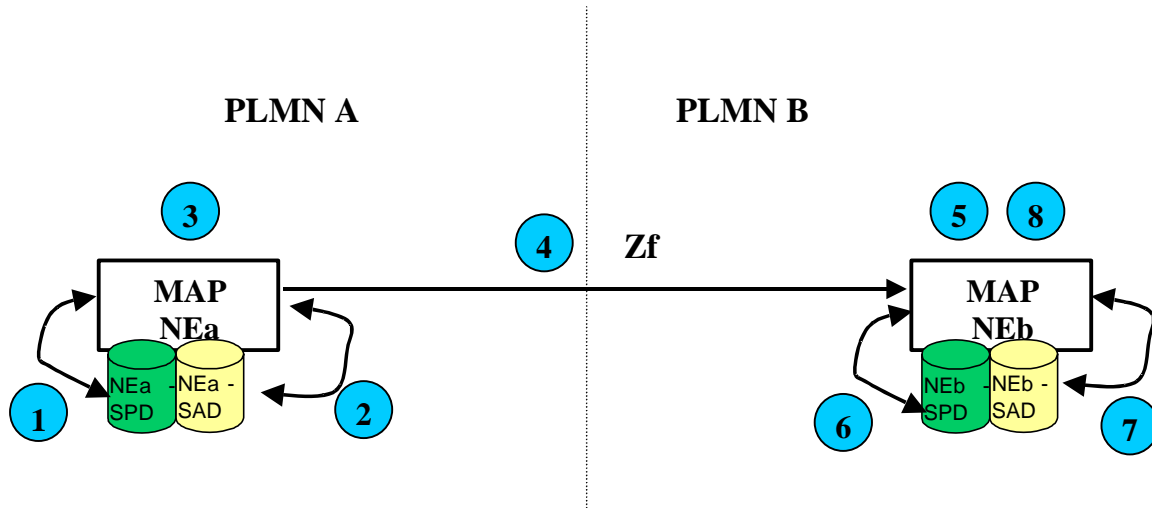
MAPsec MAP-NEs shall be able to perform the following operations:

- Secure MAP signalling (i.e. send/receive protected or unprotected messages) according to information in NE-SPD-MAP and NE-SADB-MAP. The structure of protected messages is defined in clause 5.5 and the protection algorithms are defined in clause 5.6.

Editor's note: Message flows to illustrate the in/out processing sequences are under development.

## Annex B (Normative): MAPsec message flows

Imagine a network scenario with two MAP-NEs at different PLMNs (NEa and NEb) willing to communicate using MAPsec. Figure 1 presents the message flow.



**Figure 1. MAPsec Message Flow**

According to Figure 1, when MAP-NEa (NEa) from PLMN A wishes to communicate with a MAP-NEb (NEb) of PLMN B using MAP protocol, the process is the following:

As the Sending Entity, NEa performs the following actions during the outbound processing of every MAP message:

1. NEa checks its Security Policy Database (SPD) to check if MAP security mechanisms shall be applied towards PLMN B:

- a) If the SPD does not mandate the use of MAPsec towards PLMN B, then normal MAP communication procedures will be used and the process continues in Step 4.b.
- b) If the SPD mandates the use of MAPsec towards PLMN B, then the process continues at step 2.
- c) If no valid entry in the SPD is found for PLMN B, then the communication is aborted and an error is returned to higher protocol layers.

2. NEa checks its Security Association Database (SAD) for a valid Security Association (SA) to be used towards PLMN B.

- a) In case protection of MAP messages towards PLMN B is not possible (e.g. no SA available, invalid SA...), then the communication is aborted and an error is returned to higher protocol layers.
- b) If a valid SA exists but the MAP dialogue being handled does not require protection (Protection Mode 0 applies to all the components of the dialogue), then the original MAP message in cleartext can be sent in step 4.b.
- c) If a valid SA exists and the MAP dialogue being handled requires protection, then the process continues at step 3. In the case where more than one valid SA is available at the SAD, NEa shall choose the one expiring the sooner.

3. NEa constructs the MAPsec message towards NEb using the parameters (keys, algorithms and protection profiles) found in the SA.
4. NEa generates either:
  - a) MAPsec traffic towards NEb.
  - b) An unprotected MAP message in the event that the SPD towards NEb or protection profiles for that specific MAP dialogue so allows it (1.a. or 2.b.).

At the Receiving Entity, NEb performs the following actions during the inbound processing of every MAP message it received:

5. If an unprotected MAP message is received, the process continues with step 6.

Otherwise, NEb decomposes the received MAPsec message and retrieves basic information to apply security measures ('SPI', 'sending PLMN-ID', 'TVP', 'IV' and 'Original Component Identifier').

Freshness of the protected message is checked at this time. If the Time Variant Parameter (TVP) received in the protected message is out of the acceptable window then the message shall be discarded.

6. NEb checks the SPD:

- a) If an unprotected MAP message is received and the SPD does not mandate the use of protected MAP messages, then the unprotected MAP message is simply processed.

*Editors Note: If an unprotected message is received, NEb can not properly address the SPD (policy check during 6.a. and 6.b.) and the SAD (profile check during 7.a. and 7.b.) since SendingPLMNid and SPI are missing! This issue must be investigated further.*

- b) If an unprotected MAP message is received but the SPD mandates the use of MAPsec messages, then the process continues in step 7.

*Note: SA needs to be checked in case Protection Profile might allow that this specific message is unprotected.*

- c) If a MAPsec message is received, but the SPD indicates that MAPsec is NOT to be used, then the message is discarded and an error is reported to higher protocol layers.

If the MAP dialogue is still open and it is waiting for an answer, NEb also reports this error condition back to NEa.

- d) If a MAPsec message is received and the SPD indicates that MAPsec is required, then the process continues at step 7.

- e) If no valid entry in the SPD is found for PLMN A, then the message is discarded and an error is reported to higher protocol layers.

If the MAP dialogue is still open and it is waiting for an answer, NEb also reports this error condition back to NEa.

7. NEb checks its SAD:

- a) If an unprotected MAP message is received, SPD mandated protection BUT SA indicates that the MAP dialogue being handled does not require protection (Protection Mode 0 applies to all the components of the dialogue), then the unprotected MAP message is simply processed.

- b) If an unprotected MAP message is received, SPD mandated protection and SA indicates that the MAP dialogue being handled requires protection, then NEb checks whether "Fallback to Unprotected Mode" is allowed:

- If NOT allowed, then the message is discarded and the corresponding error is reported to higher protocol layers. If the MAP dialogue is still open and it is waiting for an answer, NEb also reports this error condition back to NEa.
- If allowed, then the unprotected MAP message is simply processed.

c) If a MAPsec message is received, SPD mandated protection and the received SPI points to a valid SA, then the process continues at step 8.

d) If the received SPI does not point to a valid SA, the message is discarded and an error is reported to higher protocol layers. If the MAP dialogue is still open and it is waiting for an answer, NEb also reports this error condition back to NEa.

8. Integrity and encryption mechanisms are applied on the message as per the information in the SA (Keys, algorithms, protection profiles).

a) If the result after applying such procedures is NOT successful then the message is discarded and an error is reported to higher protocol layers. If the MAP dialogue is still open and it is waiting for an answer, NEb also reports this error condition back to NEa.

b) If the result after applying such procedures is successful, then NEb has the cleartext message NEa originally wanted to send NEb. After this, the MAP communications found inside the MAPsec headers are processed normally.

In the event the received message at NEb requires an answer to NEa (Return Result/Error), NEb will perform the process in steps 1 to 4 acting as the Sender and NEa will perform the process in steps 5 to 8 acting as the Receiver.

In the event a MAPsec enabled NE initiated a secured MAP communication towards a non-MAPsec enabled NE and the MAPsec enabled NE received an error indication of such circumstance (i.e. "OperationNotSupported"). The MAPsec enabled NE shall check whether "Fallback to Unprotected Mode" is allowed:

- If NOT allowed, then the communication is aborted.
- If allowed, then the MAPsec enabled NE could send an unprotected MAP message instead.

NOTE: The same procedures shall apply to secure MAP communications between MAP-NEs in the same PLMN.