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Part 8: Interface between security entity and network and transport layer

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Intelligent Transport Systems (ITS).

The present document is part 8 of a multi-part deliverable. Full details of the entire series can be found in part 1 [i.1].

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

ITS stations are complex systems that may be implemented in different ways. The reference architecture is described in the communications architecture standard ETSI EN 302 665 [1], clause 4.4. The present document aims to address the security interface from a functional point of view. Access control to the Service Access Point and further definitions of station internals are out of scope of the present document.

The SAP specification is specific to the ITS architecture but generic to the concrete technologies used.

Therefore, the present document is structured in the following way:

First, the architecture integration is outlined. Secondly, functionalities are collected from related standards and mapped to service primitives. Finally, the use of service primitives in procedures is described.

1 Scope

The present document specifies interfaces between the ITS security entity and the ITS network and transport layers including interface services and service primitives which are extensible in order to achieve general applicability. Additionally, it specifies related procedures and common parameters.

The SN-SAP description in the present document is functional as according to the ISO model as modified by ETSI EN 302 665 [1].

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI EN 302 665: "Intelligent Transport Systems (ITS); Communications Architecture".

[2] ETSI TS 102 940: "Intelligent Transport Systems (ITS); Security; ITS communications security architecture and security management".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI TS 102 723-1: "Intelligent Transport Systems (ITS); OSI cross-layer topics; Part 1: Architecture and addressing schemes".

[i.2] ETSI TS 101 539-2: "Intelligent Transport System (ITS); V2X Applications; Intersection Collision Risk Warning (ICRW) application requirements specification".

[i.3] ETSI TS 101 539-3: "Intelligent Transport Systems (ITS); V2X Applications; Part 3: Longitudinal Collision Risk Warning (LCRW) application requirements specification".

[i.4] PRE-DRIVE C2X Deliverable D1.3: "Security Architecture".

[i.5] EVITA Deliverable D3.2: "Secure On-board Architecture Specification".

[i.6] ETSI TS 102 637-1: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 1: Functional Requirements".

[i.7] ETSI TS 102 637-2: "Intelligent Transport Systems (ITS);Vehicular Communications; Basic Set of Applications; Part 2: Specification of Cooperative Awareness Basic Service".

[i.8] ETSI ES 202 663: "Intelligent Transport Systems (ITS); European profile standard for the physical and medium access control layer of Intelligent Transport Systems operating in the 5 GHz frequency band".

[i.9] ISO 24102-3: "Intelligent transport systems -- Communications access for land mobiles (CALM) -- ITS station management -- Part 3: Service access points".

[i.10] ETSI TS 103 097: "Intelligent Transport Systems (ITS); Security; Security header and certificate formats".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI EN 302 665 [1], ETSI TS 102 940 [2] and the following apply:

security association: addressing information and 'security material' for connecting to the 'security management entity'

NOTE: This corresponds to 'enrolment authorities' and 'authorization authorities'.

security entity: functional entity inside an ITS station which offers 'security mechanisms'

security protocol: protocol used to encode and decode 'security material' and messages between ITS Stations

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 302 665 [1], ETSI TS 102 940 [2] and the following apply:

ASN	Abstract Syntax Notation
CAM	Cooperative Awareness Message
DENM	Decentralized Environmental Notification Message
ICRW	Intersection Collision Risk Warning
ID	'pseudonym' identity
IN-SAP	access layer - networking & transport layer SAP
ISO	International Organization for Standardization
ITS-S	ITS-Station
LCRW	Longitudinal Collision Risk Warning
NF-SAP	Networking & transport layer - Facilities layer SAP
RX	Receiver
SA	Security Association

NOTE: SA is contextual dependent either "name of interface between security entity and ITS-S applications" as given in ETSI EN 302 665 [1] or "Security Association".

SAP	Service Access Point
SF-SAP	Security entity - Facilities layer SAP
SN-SAP	Security entity - Networking & transport layer SAP
TX	Transmitter

4 Architecture integration

4.1 General

4.1.1 Introduction

Figure 1 shows the ITS station reference architecture, as defined in ETSI EN 302 665 [1]. The present document contains the specification of the Service Access Points (SAP), connecting the security entity and the networking and transport layers, i.e. SN-SAP.

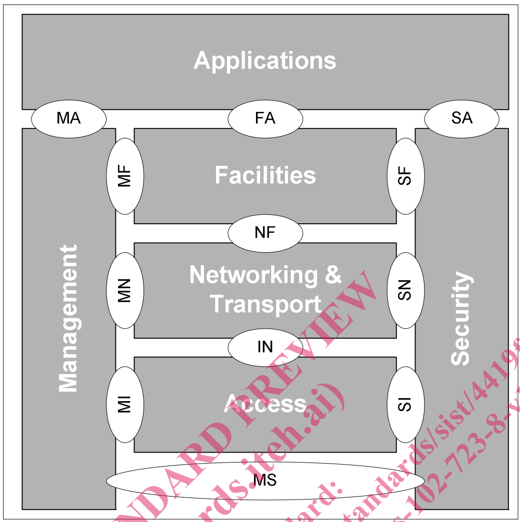

Figure 1: ITS station reference architecture

Interaction between the security entity and the layers may follow two principles. First, the vertical message flow through the layers from top to bottom or vice versa. Secondly, the horizontal control communication from the security entity towards the corresponding layer. Both are described in clauses 4.1.2 and 4.1.3.

4.1.2 Vertical message flow

Figure 2 extends the ITS station reference architecture by illustrating the overall information flow through the layers, from originating application on the left hand side, to the receiving application on the right hand side.

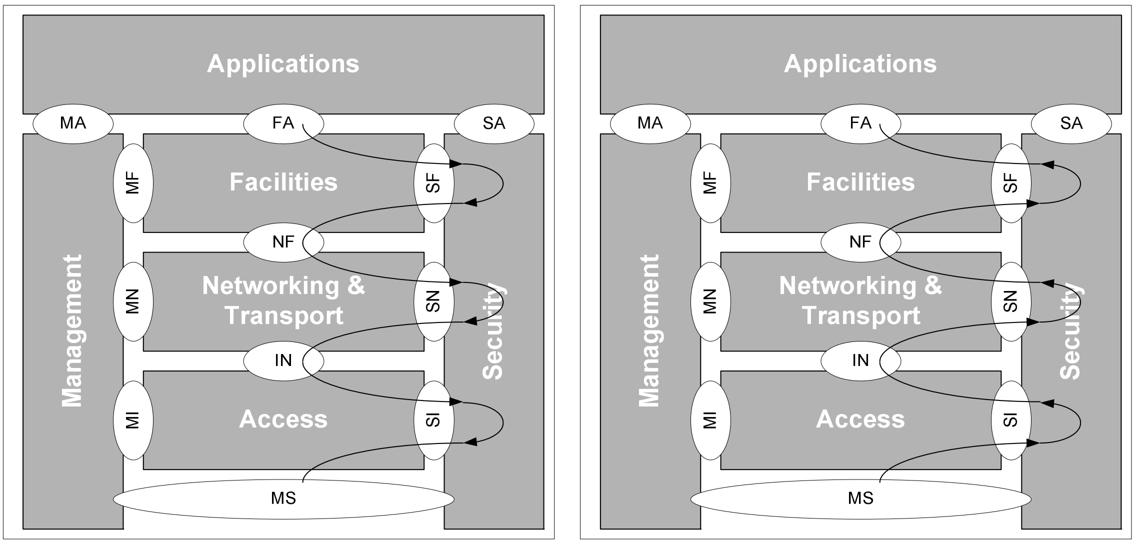

Figure 2: TX (left) and RX (right) information flow through the ITS station

The present document specifies only the SN-SAP, therefore only a subset of the ITS station reference architecture has to be taken into account. Figure 3 shows the typical information flow between any sending (TX) and receiving (RX) party, with regard to the SN-SAP only. The security entity acts like a layer inside the networking and transport layers, i.e. it is called during the processing of messages traversing the networking and transport layers. The security entity will however not act as a layer above or below the networking and transport layers. This means that interactions with Facilities and Access layers are achieved via other means, i.e. the NF-SAP is used for the interaction between the networking and transport layers and Facilities layers, whereas the IN-SAP is used for the interaction between the access layer and networking and transport layers.

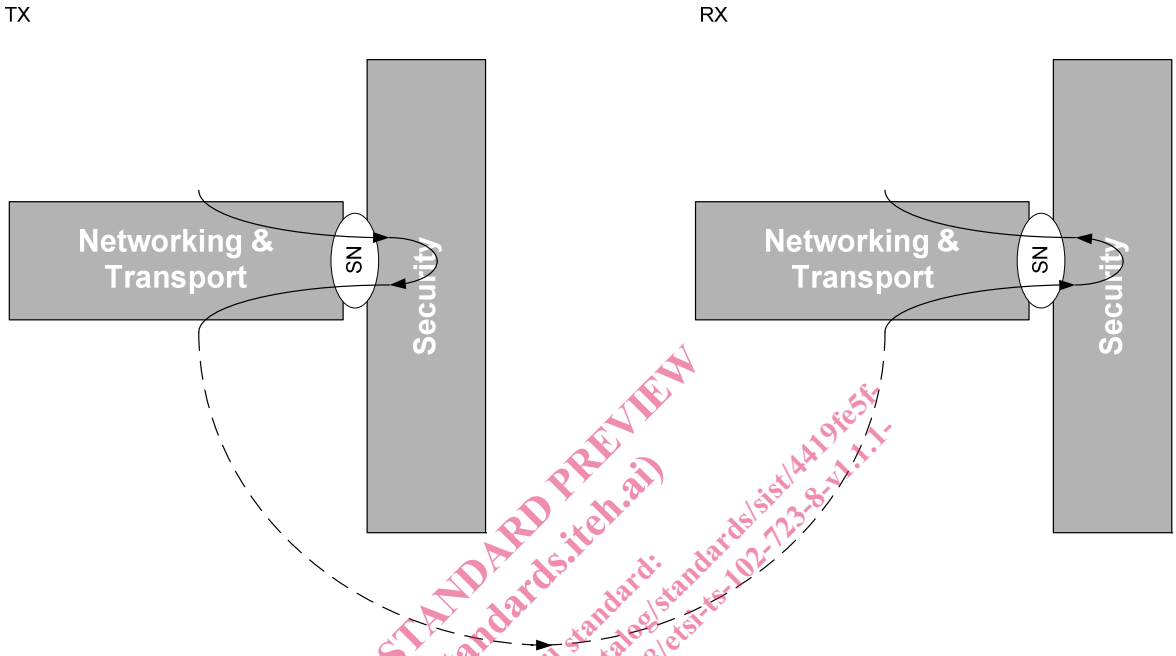

Figure 3: SN-SAP centric Information flow

4.1.3 Horizontal control communication

Figure 4 outlines the second communication principle. There is a horizontal control communication between the security entity and the corresponding communications layer, networking and transport in this case. This is needed for the ID change functionality introduced later. In general, the security entity will be able to indicate an ID change to the corresponding layer and some additional ID change related calls.

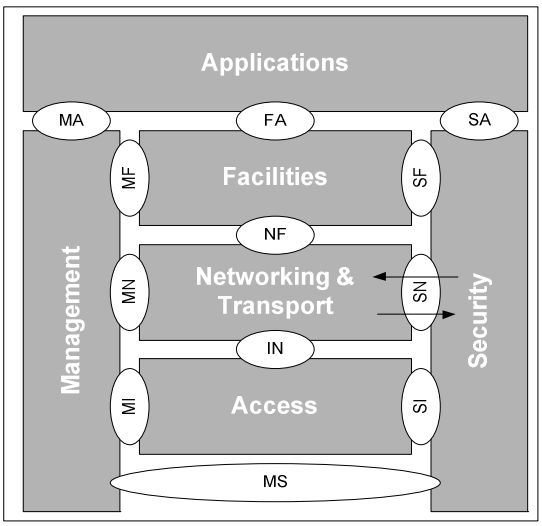

Figure 4: Horizontal Control Communication

4.1.4 Protocol work split

The SN-SAP provides a set of primitive security functions to the networking and transport layer.

Figure 5 shows how a protocol entity within the networking and transport layer handles the sending and receiving of information but uses some security extensions to invoke the primitive functions of the Security layer in order to meet the security requirements of this layer. They are supported by the Identity Management Capabilities, specified in ETSI TS 102 940 [2], clause 6, necessary to apply the Atomic Security Capabilities.

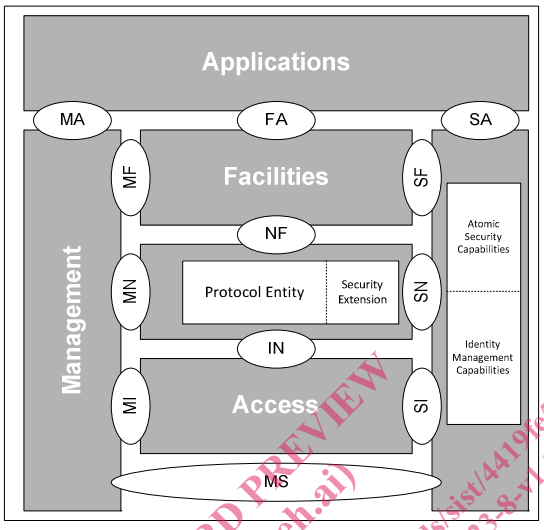

Figure 5: Protocol work split

4.1.5 Multiple instances

The present document does not discuss architecture. However, the SAP shall support different permissions. The management of different credential sets at the same time can be implemented by using multiple instances of the security entity at the same time. Different or same components in the networking and transport layers might use multiple instances of the security entity using the service primitives described in clause 5. Handling and access control of those is out of scope of the present document.

4.1.6 Error handling

The present document does not make assumptions on implementation specific error handling for using the described services. I.e. if a call of any of the described services fails for some reason, the present document does not specify if this should be handled using exceptions or any other error handling technique.

However, the present document does specify the behaviour of services that can have a positive or negative result. E.g. a SN-VERIFY can be SUCCESSFUL if the verification was successful or it can be unsuccessful, if the signature was invalid (FALSE_SIGNATURE). This is considered to be within normal operation conditions, and therefore not an error.

4.2 Security services

The required ITS security services are identified as the first level security services in ETSI TS 102 940 [2], clause 5.2. In addition to those, security services used in the research projects PRE-DRIVE C2X and EVITA where adopted and fitted to the existing services. See PRE-DRIVE C2X Deliverable D1.3 [i.4] and EVITA Deliverable D3.2 [i.5] for documentation on the research project services.

Table 1 summarizes the security services to be specified in the present document, clause 5. Those security services are invoked directly by applications or other components and layers according to ETSI TS 102 940 [2]. A "security service group" is introduced to ease the readability of the table.

Table 1: Security Service to Service Implementation Assignment

Security Service Group	Security Service Name	Type/Direction	Implemented by (clause 5)
Confidentiality	Encrypt Single Message	Request	SN-ENCRYPT
	Decrypt Single Message	Request	SN-DECRYPT
Authentication and Integrity	Authorize Single Message	Request	SN-SIGN
	Validate Authorization on Single Message	Request	SN-VERIFY
Identity Management	Lock ID Change	Request	SN-ID-LOCK
	Unlock ID Change	Request	SN-ID-UNLOCK
	Subscribe to ID Change Notification	Request	SN-IDCHANGE-SUBSCRIBE
	Unsubscribe from ID Change Notification	Request	SN-IDCHANGE-UNSUBSCRIBE
	Change ID	Indication send to subscribed entities	SN-IDCHANGE-EVENT
	Trigger ID Change	Request	SN-IDCHANGE-TRIGGER
Extras	Log Security Event	Request	SN-LOG-SECURITY-EVENT
	Extract Permissions	Request	SN-EXTRACT-PERMISSIONS
	Encapsulate Message	Request	SN-ENCAP
	Decapsulate Message	Request	SN-DECAP

5 Interfaces between the security entity and the networking and transport layers

5.1 Interface services

The following services for the SN-SAP are defined in the present document:

- SN-SIGN
  Create authentication information for outgoing ITS messages
- SN-VERIFY
  Validate authentication information from incoming ITS messages
- SN-ENCRYPT
  Encrypt outgoing ITS single messages
- SN-DECRYPT
  Decrypt incoming ITS single messages
- SN-IDCHANGE-SUBSCRIBE
  Subscribe for notifications on SN-IDCHANGE-EVENT, used for concurrent identifiers exchange across the ITS-S
- SN-IDCHANGE-EVENT
  The indication sent to subscribers on IDCHANGE
- SN-IDCHANGE-UNSUBSCRIBE
  Unsubscribe for IDCHANGE notifications, cf. SN-IDCHANGE-EVENT
- SN-IDCHANGE-TRIGGER
  Ask security entity to trigger IDCHANGE procedure
- SN-ID-LOCK
  Ask security entity to avoid IDCHANGEs
- SN-ID-UNLOCK
  Release SN-ID-LOCK