TECHNICAL SPECIFICATION

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Intelligent transport systems — Cooperative systems — ITS application requirements and objectives for selection of communication profiles

Systèmes intelligents de transport — Systèmes coopératifs — Exigences d'application d'ITS pour sélection d'interfaces de communication

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Foreword

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ISO/TS 17423 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 278, *Intelligent transport systems*, in collaboration with ISO Technical Committee ISO/TC 204, *Intelligent transport systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Introduction

Abstracting applications from communications is a useful basic architectural principle of Intelligent Transport Systems [1)] (ITS) embodied in the ITS station and communication architecture presented in ISO 21217.

Applications and communications are linked together using the concepts of flows and paths and communication profiles described in ISO 21217 with related flow and path management procedures specified in Reference [6]. The ITS station management uses communication requirements and objectives of applications together with the capabilities of the ITS station (status of available communication protocol stacks) and sets of decision rules (regulations and policies) to select suitable parameterized ITS-S communication protocol stacks, also referred to as "ITS-S Communication Profiles" (ITS-SCP), for each source of a potential flow as illustrated in Figure 1. A set of communication requirements is referred to as a Flow Type in Reference [6]. There may be well-known registered Flow Types as specified in ISO/TS 17419.

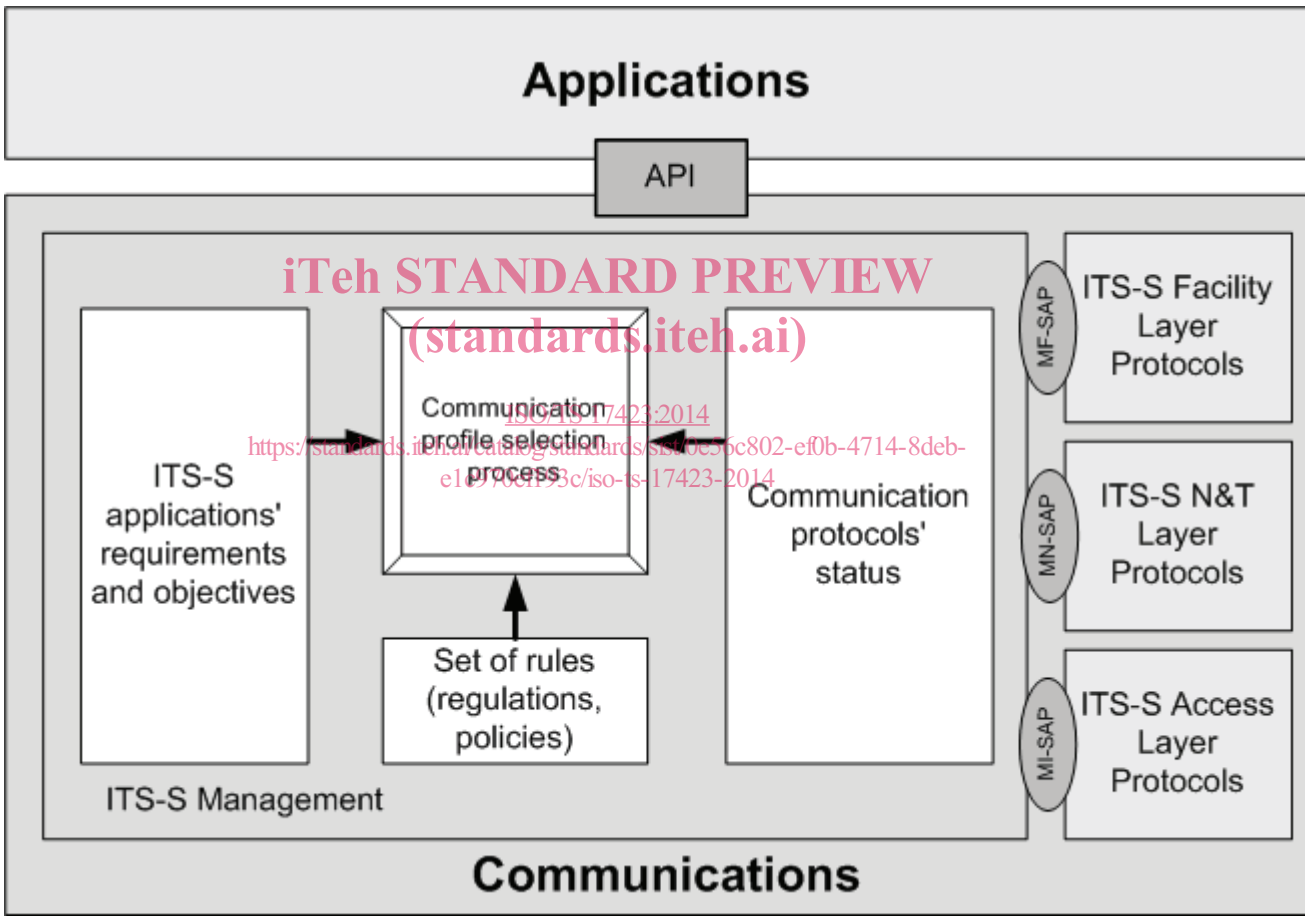

Figure 1 — ITS-S communication profile selection process

An ITS-S communication profile is independent of any destination address. However an instantiation of a communication profile includes the address of the next hop recipient, and a path includes address information of the next hop recipient, the anchor and the destination as specified in Reference [6].

A user of an ITS station unit may be able to influence the selection of ITS-S communication profiles by providing his own policies.

1) The term "Cooperative ITS" (C-ITS) indicates specific features of ITS[1]. For the purpose of this Technical Specification, no distinction between ITS and C-ITS is needed.

Information from a Local Dynamic Map (LDM) on neighbouring stations offering certain communication capabilities may also be useful for the ITS-S communication profile selection process, although not indispensable.

Intelligent transport systems — Cooperative systems — ITS application requirements and objectives for selection of communication profiles

1 Scope

This Technical Specification

— specifies communication service parameters presented by ITS station (ITS-S) application processes to the ITS-S management in support of automatic selection of ITS-S communication profiles in an ITS station unit (ITS-SU),

— specifies related procedures for the static and dynamic ITS-S communication profile selection processes at a high functional level,

— provides an illustration of objectives used to estimate an optimum ITS-S communication profile.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 21217, *Intelligent transport systems — Communications access for land mobiles (CALM) — Architecture*

ISO 21218, *Intelligent transport systems — Communications access for land mobiles (CALM) — Access technology support*

ISO/TS 17419, *Intelligent transport systems — Cooperative systems — Classification and management of ITS applications in a global context*

ISO 24102-3, *Intelligent transport systems — Communications access for land mobiles (CALM) — ITS station management — Part 3: Service access points*

ISO/IEC 8825-2, *Information technology — ASN.1 encoding rules: Specification of Packed Encoding Rules (PER) — Part 2*

ISO 4217:2008, *Codes for the representation of currencies and funds*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TS 17419, ISO 21217, ISO 21218 and the following apply.

3.1
authorization
prescription that a particular behaviour shall not be prevented

Note 1 to entry: Unlike a permission, an authorization is an empowerment.

3.2
ITS-S application process
element in an ITS station that performs information processing for a particular application, and uses ITS-S services to transmit and receive information

EXAMPLE ITS-S applications, ITS-S facility applications (e.g. for CAM), ITS-S management applications (e.g. FSAP[5]).

3.3
ITS application
instantiation of an ITS service that involves an association of two or more complementary *ITS-S application processes* (3.2)

3.4
ITS service
functionality provided to users of intelligent transport systems designed e.g. to increase safety, sustainability, efficiency, or comfort

3.5
ITS-S application
ITS-S application process (3.2) residing in the *ITS-S application* (3.3) entity

3.6
ITS-S application process provisioner
functionality in an ITS-SU offering *ITS-S application processes* (3.2) for download to other ITS-SUs

3.7
ITS-S communication profile
parameterized ITS-S communication protocol stack

3.8
ITS-S communication protocol stack
set of ITS-S communication protocols, which may be identified by a registered globally unique reference number, enabling communications between an ITS-SCU and other nodes

3.9
ITS-S RX/TX interface
sink or source of an *ITS-S application process* (3.2)

3.10
permission
rule that a particular behaviour is allowed to occur

4 Abbreviated terms

BSME	Bounded Secured Managed Entity, see ISO 21217
CPSP	Communication Profile Selection Process
CRO	Communication Requirements and Objectives
CSP	Communication Service Parameter
CSP_AvgADUrate	Communication service parameter "Average ADU generation rate"
CSP_CommDistance	Communication service parameter "Communication distance"
CSP_DataConfidentiality	Communication service parameter "Need for data confidentiality"
CSP_DataIntegrity	Communication service parameter "Need for data integrity"

CSP_DestinationDomain	Communication service parameter “Destination domain”
CSP_DestinationType	Communication service parameter “Destination type”
CSP_Directivity	Communication service parameter “Directivity”
CSP_ExpFlowLifetime	Communication service parameter “Expected flow lifetime”
CSP_FlowType	Communication service parameter “Flow type”
CSP_LogicalChannelType	Communication service parameter “Logical channel”
CSP_MaxADU	Communication service parameter “Maximum ADU size”
CSP_MaxLat	Communication service parameter “Maximum allowed latency”
CSP_MaxPrio	Communication service parameter “Maximum priority”
CSP_MinThP	Communication service parameter “Minimum throughput”
CSP_NonRepudiation	Communication service parameter “Need for non-repudiation”
CSP_NxRepeat	Communication service parameter “N-times ADU repetition”
CSP_PortNo	Communication service parameter “Port Number”
CSP_Protocol	Communication service parameter “Protocol requirements”
CSP_Resilience	Communication service parameter “Resilience”
CSP_SessionCont	Communication service parameter “Session continuity”
CSP_SourceAuthentication	Communication service parameter “Source authentication”
FlowID	Flow Identifier[6]
IICP	ITS station-internal management communications protocol[4]
ITS-S	ITS station, see ISO 21217
ITS-SCP	ITS station communication profile
ITS-SCPS	ITS station communication protocol stack
ITS-SCU	ITS station communication unit, see ISO 21217
ITS-SU	ITS station unit, see ISO 21217
R_ConnectRate	“Maximum rate per connection” rule
R_ConnectTimeRate	“Maximum rate per connection time” rule
R_DataUnitRate	“Maximum rate per data unit” rule
R_FlatRate	“Flat Rate” rule
R_StationAnonymity	“Need for station anonymity” rule
R_StationAuthentication	“Support of station authentication” rule
R_StationLocationPrivacy	“Need for station location privacy” rule

5 Communication service parameters

5.1 Abstraction of application processes from communications

The ITS station (ITS-S) reference architecture presented in Figure 2 and specified in ISO 21217 distinguishes two main blocks, i.e. “Applications” and “Communications”. ITS-S application processes in “Applications” access communication services in “Communications” through an API. Portability of ITS-S application processes, which leads to the creation of ITS application process repositories as described in ISO/TS 17419, is enabled by

— abstraction of ITS-S application processes (in “Applications”) from communication protocols (in “Facilities”, “Networking & Transport”, “Access”) and supporting management and security functionality (in “Management”, “Security”) introduced as an essential basics of an ITS station in ISO 21217, and

— procedures by which instances of ITS-S application processes running in an ITS station unit (ITS-SU) specified in ISO 21217 can present requirements for communication services in an abstract and standardized way to the ITS station management as specified in this Technical Specification, and

— procedures for automatic selection of optimum communication profiles by the ITS station management for each set of required communication services.

Communication service requirements are presented by means of communication service parameters as identified in this Technical Specification. These parameters are used to identify sets of possible choices of ITS-S communication profiles as well as selecting the “optimal” ITS-S communication profile out of each set. The selection of the “optimal” ITS-S communication profile is implementation dependent and generally involves the formulation of a cost function based on objectives that needs to be extremized (maximized or minimized) as discussed in Annex C.

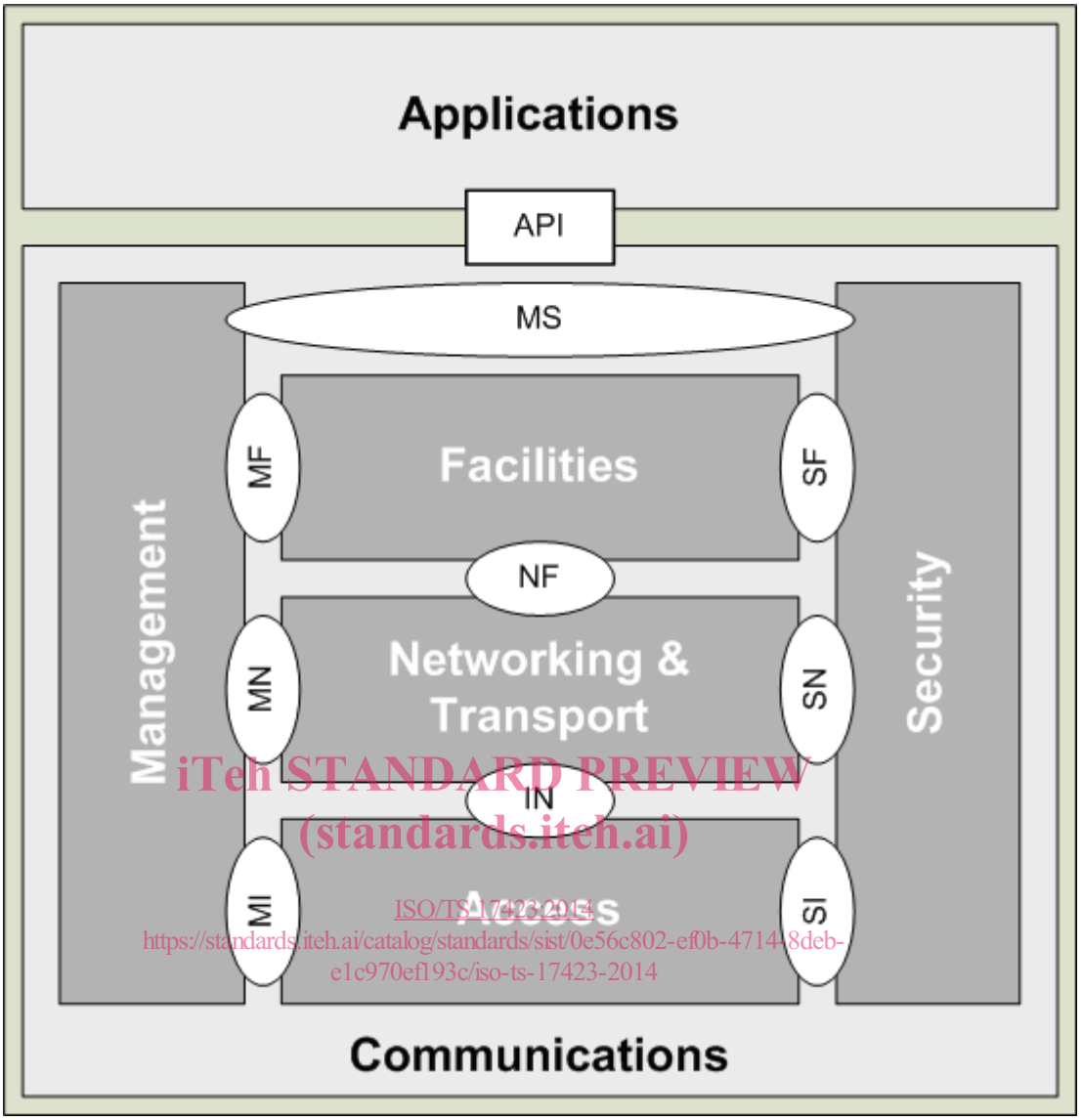

Figure 2 — ITS station architecture [from **ISO 21217**]

The same approach to present communication requirements and objectives also applies to:

— ITS-S application processes located in the ITS-S facilities layer (e.g. CAM source),

— ITS-S application processes located in the ITS-S management entity (e.g. SAM and CTX sources [5]),

— ITS-S application processes located in the ITS-S security entity, and

— ITS-S application processes located somewhere else in an ITS station.

There are also other application processes that can get access to the communication tools of an ITS-SU. Such other application processes are not certified to be installed in an ITS-SU implemented as a BSME as described in ISO 21217 and ISO/TS 17419, but may use selected functionality from it, especially communication functionality.

Figure 3 illustrates a simplified version of Figure 2 to be applied to the process illustrated in Figure 1 considering ITS-S application processes in general.

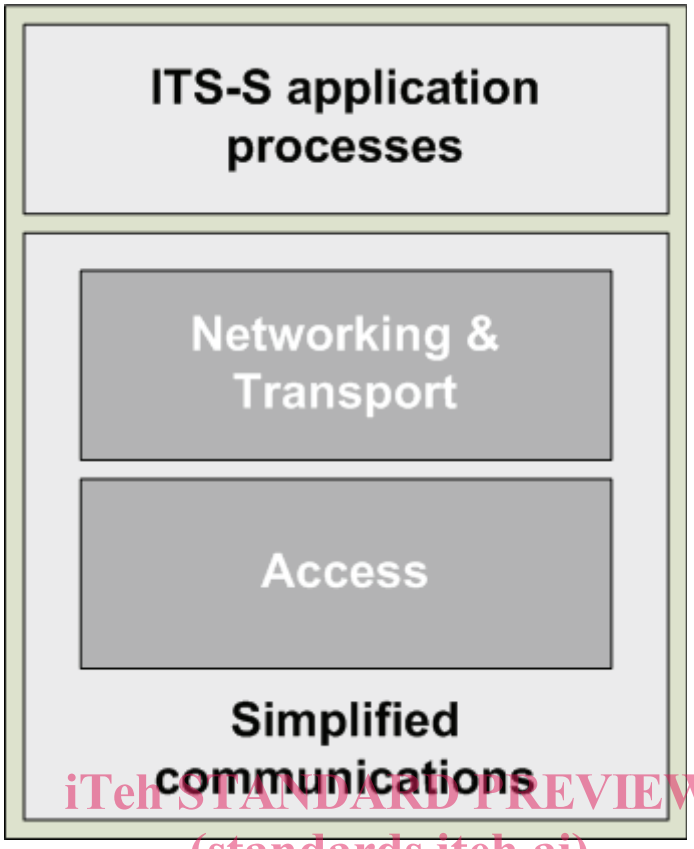

Figure 3 — Simplified architecture

Application processes are classified in ISO/TS 17419 as:

— ITS-S application processes certified for a BSME and identified by an ITS-AID (ITS-S facilities applications, ITS-S management applications, ITS-S security applications and ITS-S applications):

  — authorized ITS-S applications

  — permitted ITS-S applications

— application processes not certified for a BSME and without ITS-AID:

The definitions of "authorized" and "permitted" are given in Reference [12].

Communication service parameters are specified in 5.3, 5.4, 5.5, 5.6 and 5.7. An overview is presented in 5.8. An ITS-S application process shall present the mandatory communication service parameters, and may present those optional communication service parameters which are relevant for it.

Users of ITS-SUs may present rules, see Figure 1, by means of user policies, e.g. for cases where the ITS-S application process did not specify a specific value (example: financial requirements). Requirements may also be given by authorities in terms of regulations and policies, or by other entities in terms of policies, see Figure 1.

NOTE Regulations are enforceable rules. Policies are rules or guidelines which cannot be enforced.

An ITS-S application process may have more than one communication source[2)], and these communication sources may have different communication requirements. Each communication source (and sink) of an ITS-S application process is identified by a reference number of ASN.1 type InterfaceNo specified in ISO/TS 17419 which is unique in the scope of that ITS-S application process. For each communication

2) An ITS-S application process might need to maintain flows for different communication sources, e.g. audio, video and messages (e.g. SPaT, IVI, CAM, DENM, ...).

source an ITS-S application process presents a set of communication requirements to the ITS-S management as specified in this Technical Specification. Such a set of communication requirements is linked to an ITS flow type identifier (ITS-FlowTypeID). ITS-FlowTypeIDs may be well-known registered identifiers pointing to pre-defined well-known sets of requirements as specified in ISO/TS 17419, or may be dynamically assigned in an ITS-SU.

Communication service parameters presented by ITS-S application processes for each communication source are used by the ITS station management to select the best suited ITS-S communication profile per communication source. It might be that an ITS-S management is not able to provide a communication protocol stack which fully complies with the requirements, i.e. fails to identify and select an appropriate ITS-S communication profile. In this failure situation either a best effort approach to enable communications or a refuse to support this particular communication source applies. In any case the ITS-S management reports the status of the ITS-S communication profile selection procedure to the ITS-S application process.

Once a FlowID has been assigned to an ITS-S application process, the ITS-S application process cannot update communication service parameters associated with the flow.[6]

The interface between “Applications” and “Communications” illustrated in Figure 1 is an “Application Programming Interface” (API). An API provides the functionality described in the service access points MA-SAP, SA-SAP and FA-SAP specified in ISO 24102-3. Details of APIs depend on the operating system used to implement them.

ITS-S application processes may reside in the ITS-S application entity, in the ITS-S facilities layer, in the ITS-S security entity, and in the ITS-S management entity. The interaction between ITS-S application processes and the ITS-S management entity is specified in terms of functions in the service primitives of the MA-SAP, the MF-SAP, and the MS-SAP illustrated in Figure 2.

The specification of APIs for ITS is outside the scope of this Technical Specification.

Management procedures and service primitives related to these communication service parameters are specified in Clause 7.

The normative Annex A provides an ASN.1 module with specifications of types and values used to present the communication requirements and objectives.

5.2 Communication service parameter classes

Communication service parameters are grouped into classes. The following communication service parameter classes are identified in this Technical Specification:

— The class of operational parameters is specified in 5.3.

— The class of destination parameters is specified in 5.4.

— The class of performance parameters is specified in 5.5.

— The class of security parameters is specified in 5.6.

— The class of protocol parameters is specified in 5.7.

— An overview of all parameters identified in this Technical Specification is presented in 5.8.

Some communication service parameters are mandatory, i.e. shall be presented by all ITS-S application processes as specified in 7.2.

ASN.1 specifications of the communication service parameters are provided in Annex A.