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Intelligent transport systems — Cooperative systems — Application requirements and objectives

Systèmes de transport intelligents — Systèmes coopératifs — Exigences d'application et objectifs

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by ISO/TC 204, *Intelligent transport systems*.

This first edition cancels and replaces ISO/TS 17423:2014, which has been technically revised.

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 21217:2014.

Applications and communications are linked together using the concepts of flows and paths and communication profiles described in ISO 21217:2014 with related flow and path management procedures specified in ISO 24102-6[2)][11]. 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 ISO 24102-6[11]. There may be well-known registered Flow Types as specified in ISO 17419.

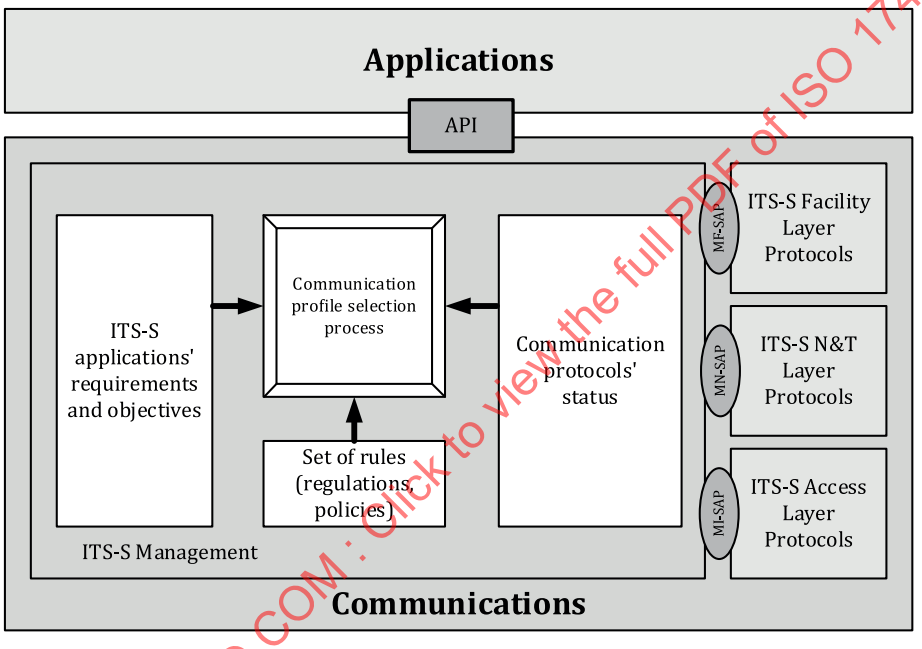

Figure 1 — ITS-S communication profile selection process

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 ISO 24102-6[11].

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

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.

1) The term “Cooperative ITS” (C-ITS) indicates specific features of ITS [4]. For the purpose of this document, no distinction between ITS and C-ITS is needed.

2) To be published.

Intelligent transport systems — Cooperative systems — Application requirements and objectives

1 Scope

This document

— 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 are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4217:2015, *Codes for the representation of currencies*

ISO/IEC 8824-1:2015, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation*

ISO 17419, *Intelligent transport systems — Identifiers — Globally unique identification*

ISO 21217:2014, *Intelligent transport systems — Communications access for land mobiles (CALM) — Architecture*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
authorization
prescription that a particular behaviour shall not be prevented

Note 1 to entry: Unlike a *permission* (3.10), an authorization is an empowerment.

Note 2 to entry: From ITU-T X.911[14].

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

Note 1 to entry: Examples of ITS-S application processes are ITS-S applications, ITS-S facility applications (e.g. for CAM), and ITS-S management applications (e.g. FSAP specified in ISO 22418[10]).

[SOURCE: ISO 21217:2014, 3.19, modified — Note 1 to entry has been added.]

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

[SOURCE: ISO 21217:2014, 3.9 — modified: Note 1 to entry was deleted.]

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

[SOURCE: ISO 21217:2014, 3.11]

3.5
ITS-S application
ITS-S application process residing in the ITS-S application entity

[SOURCE: ISO 21217:2014, 3.18]

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

[SOURCE: ISO 17419:2018, 3.14]

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

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

3.9
ITS-S application process RX/TX interface
sink or source of an ITS-S application process

3.10
permission
rule that a particular behaviour is allowed to occur

Note 1 to entry: From ITU-T X.911[14].

4 Symbols and 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_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”
CSP_SpecificCommsProts	Communication service parameter “Specific communications protocols”
ITS-S-FlowID	Flow Identifier, see ISO 24102-6[11]
IICP	ITS station-internal management communications protocol, see ISO 24102-4[9]
ITS-S	ITS station, see ISO 21217:2014
ITS-SCP	ITS station communication profile

ITS-SCPS	ITS station communication protocol stack
ITS-SCU	ITS station communication unit, see ISO 21217:2014
ITS-SU	ITS station unit, see ISO 21217:2014
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
ITS-S-FlowTypeID	ITS-S flow type identifier (from ISO 24102-6)

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 21217:2014 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 17419, is enabled by

— abstraction of ITS-S application processes (e.g. 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 21217:2014,

— procedures by which instances of ITS-S application processes running in an ITS station unit (ITS-SU) specified in ISO 21217:2014 can present requirements for communication services in an abstract and standardized way to the ITS station management as specified in this document,

— 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" (CSP) as identified in this document. 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. The cost function needs to be extremized (maximized or minimized) as discussed in Annex C.

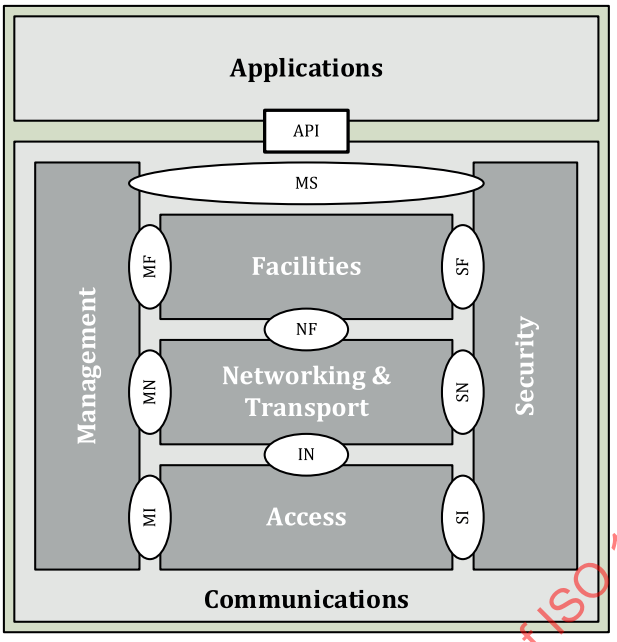

Figure 2 — ITS station architecture [ISO 21217:2014]

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, specified in ETSI EN 302 637-2[15]),

— ITS-S application processes located in the ITS-S management entity (e.g. SAM and SRM sources specified in ISO/TS 16460[1] and ISO 24418[10]),

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

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

There are also other application processes that can get access to the communication services 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 21217:2014 and ISO 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.

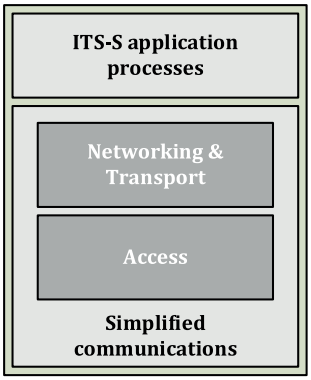

Figure 3 — Simplified architecture

Application processes are classified in ISO 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 ITU-T X.911[14].

CSPs for ITS-S application process sources are specified in 5.3, 5.4, 5.5, 5.6 and 5.7. An overview is presented in 5.9. An ITS-S application process shall present the mandatory CSPs, and may present those optional CSPs which are relevant for it. Mandatory CSPs shall be treated as optional in case CSP_FlowType is presented.

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 1 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 (/ sink)[3] (ITS-S application process RX/TX interface), 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 `ITSappProcSinkSourceNo` specified in ISO 17419 which is unique in the scope of that ITS-S application process. For each communication source an ITS-S application process presents a set of communication requirements to the ITS-S management as specified in this document. Such a set of communication requirements is linked to an ITS flow type identifier (ITS-S-FlowTypeID). ITS-S-FlowTypeIDs may be well-known registered identifiers pointing to pre-defined well-known sets of requirements or may be dynamically assigned in an ITS-SU.

Information contained in a registry for ITS flow types is given by the ASN.1 type `ITSflowTypeRegistry` specified in Annex A. This registry shall contain entries for ITS flow types given by the ASN.1 type `ITSflowType` specified in Annex A and listed in Table 1. A registration authority may add further information elements to properly identify and support management of ITS flow types. A registration authority shall clearly distinguish the range of well-known registered ITS-FlowTypeIDs and dynamically assigned ITS-FlowTypeIDs.

NOTE 2 A general introduction on registries for unique identifiers in ITS is provided in ISO 17419.

Table 1 — Registry components of ITSflowType

Component of `ITSflowType`	Semantics
`id`	`FlowTypeID`
`req`	List of applicable communication service parameters `ITSSappCPReqReg`. The communication service parameter CSP_FlowType presenting a value of ITS-FlowTypeID is prohibited in `req`. The `CostObjective` used in some communication service parameters is not part of a registered ITS flow type. Thus the value presented in the registry is not relevant. The convention shall be to use the value 255 (maximum relevance) in the registry, and to replace it by an applicable value upon usage.

CSPs 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.

3) An ITS-S application process might need to maintain flows for different communication sources, e.g. audio, video and messages.

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 refusal 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 ITS-S-FlowID has been assigned to an ITS-S application process, see ISO 24102-6[11], the ITS-S application process can

— present ADUs for transmission,

— publish data objects, and

— subscribe to reception of data objects,

e.g. using the procedures specified in ISO/TS 17429:2017, Clause 8[3].

Once a ITS-S-FlowID has been assigned to an ITS-S application process, see ISO 24102-6[11], the ITS-S application process cannot update CSPs associated with the flow.

An ITS-S application process may also present requirements on communication sinks (ITS-S application process RX/TX interface), e.g. to request opening a receive port identified by an ITS port number (ITS-PN). Similarly to the communication sources of an ITS-S application process these communication sinks are uniquely identified by a reference number of ASN.1 type `ITSappProcSinkSourceNo` specified in ISO 17419. CSPs for ITS-S application process sinks are specified in 5.8.

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[8]. Details of APIs depend on the operating system used to implement them.

ITS-S application processes may reside in the ITS-S application entity, 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 document.

Management procedures and service primitives related to these CSPs 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

CSPs are grouped into classes. The following communication service parameter classes are identified in this document:

— The class of operational CSPs is specified in 5.3.

— The class of destination CSPs is specified in 5.4.

— The class of performance CSPs is specified in 5.5.

— The class of security CSPs is specified in 5.6.

— The class of protocol CSPs is specified in 5.7.

— CSPs relevant for ITS-S application process sinks, specified in 5.8

— An overview of all CSPs identified in this document is presented in 5.9.

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

ASN.1 specifications of the CSPs are provided in Annex A.

5.3 Operational CSPs

5.3.1 List of CSPs

Operational CSPs specified in this document are:

— "Logical channel" communication service parameter CSP_LogicalChannelType (**mandatory**) as specified in 5.3.2;

— "Session continuity" communication service parameter CSP_SessionCont (optional) as specified in 5.3.3;

— "Average ADU generation rate" communication service parameter CSP_AvgADUrate (optional) as specified in 5.3.4;

— "FlowType" communication service parameter CSP_FlowType (optional) as specified in 5.3.5;

— "Maximum Priority" communication service parameter CSP_MaxPrio (optional) as specified in 5.3.6;

— "Port Number" communication service parameter CSP_PortNo (**mandatory**) as specified in 5.3.7;

— "Expected flow lifetime" communication service parameter CSP_ExpFlowLifetime (optional) as specified in 5.3.8.

5.3.2 Logical channel

CSP_LogicalChannelType indicates the logical channel to be used for communications. It shall always be presented by an ITS-S application process. CSP_LogicalChannelType shall be of ASN.1 type `LogicalChannelType` specified in ISO 17419.

Logical channels are subject to registration as specified in ISO 17419. Some examples of logical channels are presented in Table 2.

Table 2 — Examples of logical channels

Acronym	Name	Description
CCH	Control channel	For dissemination and exchange of basic channel control information, communication information, and application management information.
SaCH	Service advertisement channel	For advertising of applications and services e.g. using FSAP specified in ISO 22418[10].
SfCH	Safety of life and property channel	For dissemination and exchange of safety of life and property critical information.
SCH	Service channel	For exchange of peer to peer ITS-S application process data, and for general message dissemination.

5.3.3 Session continuity

CSP_SessionCont indicates that the flow is related to a session. CSP_SessionCont shall be of ASN.1 type `SessionCont` specified in Annex A.

`SessionCont` is a binary flag indicating whether a session may be interrupted or not. In case the binary flag is set to one, an active session should not be interrupted by the station management.

5.3.4 Average ADU generation rate

CSP_AvgADUrate indicates the repetition period (time) at which ADUs will be presented for transmission. It is applicable only for information dissemination. CSP_AvgADUrate shall be of ASN.1 type `AvgADUrate` specified in Annex A.

The value zero indicates an unknown average rate.

In case CSP_AvgADUrate is not presented, then the value of zero shall apply.

5.3.5 Flow type

CSP_FlowType presents a well-known registered flow type identifier FlowTypeID specified in ISO 17419 which uniquely points to a set of pre-defined CSPs. CSP_FlowType shall be of ASN.1 type `FlowTypeID` specified in Annex A.

When CSP_FlowType is presented, no other CSPs need to be presented including those indicated to be mandatory. CSP_FlowType shall overrule other CSPs that conflict with the implicit CSPs identified by CSP_FlowType.

5.3.6 Maximum priority

CSP_MaxPrio presents the maximum allowed priority for flows. In case CSP_MaxPrio is not present, lowest priority 0 is assumed. CSP_MaxPrio shall be of ASN.1 type `ITSapObPriority` specified in Annex A.

5.3.7 Port number

CSP_PortNo is a mandatory CSP that consists of two parts, a direction indicator of ASN.1 type `PortRxTx` and the port number mappings of ASN.1 type `PortNumberMappings`. CSP_PortNo is presented for communication sources and communication sinks to indicate a well-known port number to be associated with the interface. CSP_PortNo shall be of ASN.1 type `PortNoInfo` specified in Annex A.

In case the given interface is not associated with a well-known port, the port number PORT_UNK specified in ISO 17419 shall be presented.

5.3.8 Expected flow lifetime

CSP_ExpFlowLifetime indicates the expected lifetime of a flow. CSP_ExpFlowLifetime shall be of ASN.1 type `ExpFlowLifeTime` specified in Annex A.

`ExpFlowLifeTime` consists of a time information of ASN.1 type `TimeDurationValue`. `TimeDurationValue` indicates the expected time for a flow. A time value of zero indicates "time unknown".

In case CSP_ExpFlowLifetime is not presented, then the value of zero shall apply.

5.4 Destination CSPs

5.4.1 List of CSPs

Destination CSPs specified in this document are:

— "Destination type" communication service parameter CSP_DestinationType (**mandatory**) as specified in 5.4.2.

— "Destination domain" communication service parameter CSP_DestinationDomain (**mandatory**) as specified in 5.4.3.

— "Communication distance" communication service parameter CSP_CommDistance (optional) as specified in 5.4.4.

— "Directivity" communication service parameter CSP_Directivity (optional) as specified in 5.4.5.

NOTE Destination address information is provided by the ITS-S application process at time of ITS-S-FlowID allocation, see ISO 24102-6[11].

5.4.2 Destination type

CSP_DestinationType indicates the type of transmission. It shall always be presented by an ITS-S application process. CSP_DestinationType is of ASN.1 type `DestinationType` specified in Annex A.

DestinationType indicates the following different casting types:

— 1: broadcast transmission;

— 2: multicast transmission to a defined multicast group;

— 4: unicast transmission to a specific station;

— 8: anycast transmission to exactly one undefined station;

— 16: geocast transmission to an area given by geo-coordinates.

5.4.3 Destination domain

CSP_DestinationDomain indicates the domain of communications. It shall always be presented by an ITS-S application process. CSP_DestinationDomain is of ASN.1 type `DestDomain` specified in Annex A.

DestDomain supports selection of the following communication domains:

— 1: ITS station-internal domain;

— 2: local domain (including single-hop communications, e.g. performed with FNTP specified in ISO/TS 16460[1] and ISO 29281-1[13]);

— 4: site local domain;

— 8: ITS network local domain without Internet access;

— 16: global domain (=Internet).

5.4.4 Communication distance

CSP_CommDistance indicates the required minimum communication distance in metres to reach the next neighbour node (next node outside the ITS-SU), if applicable. CSP_CommDistance is of ASN.1 type `CommDistance` specified in Annex A. The value zero shall indicate a distance larger than the maximum possible value of 65 535 m.

5.4.5 Directivity

CSP_Directivity provides information on the required antenna aperture as specified in ISO 21218[5] and ISO 21214[12]. CSP_Directivity is of ASN.1 type Directivity specified in Annex A. This CSP is only applicable for some access technologies, e.g. CALM IR specified in ISO 21214[12].

5.5 Performance CSPs

5.5.1 List of CSPs

Performance CSPs specified in this document are:

— "Resilience" communication service parameter CSP_Resilience (optional) as specified in 5.5.2;

— "Minimum required throughput" communication service parameter CSP_MinThP (optional) as specified in 5.5.3;

— "Maximum allowed latency" communication service parameter CSP_MaxLat (optional) as specified in 5.5.4;

— "Maximum APDU size" communication service parameter CSP_MaxADU (**mandatory**) as specified in 5.5.5.

5.5.2 Resilience

CSP_Resilience requests provision of appropriate means to increase the likelihood of proper delivery of messages. CSP_Resilience is of ASN.1 type `Resilience` specified in Annex A.

Appropriate means to increase the likelihood of proper delivery of messages include:

— **Acknowledgement of messages**: Acknowledgements can be at the ITS-S access layer, at the ITS-S networking & transport layer, or at the ITS-S facilities layer. Acknowledgements can be from the destination node or from any interim node. Acknowledgment of messages should be selected only in case of unicast transmission.

— **Repeated transmission of the same message**: This should only be selected in case of information dissemination.

5.5.3 Minimum required throughput

CSP_MinThP indicates the required average data rate in integer multiples of 100 bit/s. CSP_MinThP is of ASN.1 type `MinThP` specified in Annex A.

The range is from zero to 429 496 729 500 bit/s in steps of 100 bit/s. The value zero should not be used, as it only indicates that no requirement for throughput is presented. This CSP is especially meaningful for flows of audio and video streams. It is less meaningful for transmission of single messages, e.g. DENM.

5.5.4 Maximum allowed latency

CSP_MaxLat indicates the maximum acceptable latency. CSP_MinThP is of ASN.1 type `MaxLat` specified in Annex A.

Possible value ranges that can be indicated by `MaxLat` are

— response within less than 10 ms,

— response within less than 100 ms,

— response within less than 1 s,

— response within less than 10 s,

— response within less than 1 min,

— response within less than 10 min, and

— response within less than 1 h.

This CSP may be meaningful for transmission of single messages, e.g. SPaT, CAM, DENM.

5.5.5 Maximum ADU size

CSP_MaxADU indicates the maximum size of protocol data units from an ITS-S application process flow. CSP_MaxADU shall be of ASN.1 type `MaxADU` specified in Annex A.

The maximum ADU size can be presented in steps of 100 bytes in the range from zero to 6 553 400 bytes. The value zero indicates an unknown APDU size. The value `MaxADU` = 65 535 indicates an ADU size in excess of 6 553 400 bytes.

This CSP is necessary in case of "large ADUs" where fragmentation is potentially needed due to frame size restrictions in the ITS-S access technologies. It shall always be presented by an ITS-S application process.

5.6 Security CSPs

5.6.1 List of CSPs

Security CSPs specified in this document are:

— "Need for data confidentiality" communication service parameter CSP_DataConfidentiality (optional) as specified in 5.6.2;

— "Need for data integrity" communication service parameter CSP_DataIntegrity (optional) as specified in 5.6.3;

— "Need for non-repudiation" communication service parameter CSP_NonRepudiation (optional) as specified in 5.6.4;

— "Need for data source authentication" communication service parameter CSP_SourceAuthentication (optional) specified in 5.6.5.

5.6.2 Need for data confidentiality

CSP_DataConfidentiality indicates that authentication is needed. CSP_DataConfidentiality is of ASN.1 type `DataConfidentiality` specified in Annex A. `DataConfidentiality` allows presentation of the cost factor, i.e. the relevance of this CSP.

5.6.3 Need for data integrity

CSP_DataIntegrity indicates that encryption of the ADUs of the ITS-S application process is needed. CSP_DataIntegrity is of ASN.1 type `DataIntegrity` specified in Annex A. `DataIntegrity` allows presentation of the cost factor, i.e. the relevance of this CSP.

5.6.4 Need for non-repudiation

CSP_NonRepudiation indicates that the ITS-S application process requires appropriate means to ensure non-repudiation. CSP_NonRepudiation is of ASN.1 type `ReqNonrepudiation` specified in Annex A. `ReqNonrepudiation` allows presentation of the cost factor, i.e. the relevance of this CSP.

5.6.5 Need for source ITS-S application process authentication

CSP_SourceAuthentication indicates that the ITS-S application process needs the source of the protocol data units which the ITS-S application process is producing to be authenticable at the receiver side. CSP_SourceAuthentication is of ASN.1 type `SourceAuthentication` specified in Annex A. `SourceAuthentication` allows presentation of the cost factor, i.e. the relevance of this CSP.

5.7 Protocol CSP

5.7.1 List of CSPs

Protocol CSPs specified in this document are:

— "Communication protocol stack" communication service parameter CSP_Protocol (optional) as specified in 5.7.2;

— "Specific communications protocols" communication service parameter CSP_SpecificCommsProts (optional) as specified in 5.7.3.

5.7.2 Communication protocol stack

The optional communication service parameter CSP_Protocol allows identification of a complete non-parameterized communication protocol stack needed for a specific flow. CSP_Protocol indicates a globally unique registered communication protocol stack identifier specified in ISO 17419.

CSP_Protocol is of ASN.1 type `ProtocolReq` specified in Annex A.

NOTE CSP_Protocol can also identify a set of communication protocol stacks, including partial communication protocol stacks, together with rules on how to apply them. An example is `itsProtStackID-eCall` = 1 identifying the eCall service; details are currently under development at CEN PT 1508.

5.7.3 Specific communications protocols

The optional "Specific communications protocols" communication service parameter CSP_SpecificCommsProts allows identification of selected non-parameterized communications protocols needed for a specific flow. CSP_SpecificCommsProts indicates globally unique registered protocol identifiers specified in ISO 17419.

NOTE Different to CSP_Protocol, CSP_SpecificCommsProts does not necessarily specify a complete communications protocol stack.

CSP_SpecificCommsProts is of ASN.1 type `SpecCommProts` specified in Annex A.

`SpecCommProts` distinguishes protocols in the

— ITS-S access layer,

— ITS-S networking & transport layer,

— ITS-S facilities layer,

— ITS-S management entity,

— ITS-S security entity, and

— other protocols.

Protocols are identified by a globally unique protocol identifier `ITSprotID` specified in ISO 17419.

5.8 CSPs for sinks

The following CSPs specified for ITS-S application process sources are also applicable for ITS-S application process sinks:

— CSP_LogicalChannelType, specified in 5.3.2;

— CSP_FlowType, specified in 5.3.5;

— CSP_MaxPrio, specified in 5.3.6;

— CSP_PortNo, specified in 5.3.7;

— CSP_ExpFlowLifetime, specified in 5.3.8;

— CSP_Directivity, specified in 5.4.5.

5.9 CSPs overview

Table 3 presents an overview of all CSPs specified in this document. Mandatory communication service parameters are presented in bold.

Table 3 — Communication service parameters overview

Communication service parameter	ASN.1 type	Comment
Operational communication service parameters		
CSP_LogicalChannelType	`LogicalChannelType`	**Mandatory** communication service parameter.
CSP_SessionCont	`SessionCont`	Applicable only for session based flows.
CSP_AvgADUrate	`AvgADUrate`	Applicable only for information dissemination flows.
CSP_FlowType	`FlowTypeID`	Identifier of a flow type.
CSP_MaxPrio	`ITSapObPriority`	Maximum allowed priority for flows
CSP_PortNo	`PortNoInfo`	**Mandatory** communication service parameter, applicable for communication sources and communication sinks.
CSP_ExpFlowLifetime	`ExpFlowLifeTime`	Expected lifetime of a flow; not necessarily a flow related to a session.
Destination communication service parameters		
CSP_DestinationType	`DestinationType`	**Mandatory** communication service parameter.
CSP_DestinationDomain	`DestDomain`	**Mandatory** communication service parameter.
CSP_CommDistance	`CommDistance`	Applicable only to indicate distance to next neighbour node (outside the ITS-SU).
CSP_Directivity	`Directivity`	Applicable only to indicate communication direction towards the next neighbour node (outside the ITS-SU).
Performance communication service parameters		
CSP_Resilience	`Resilience`	Any means suited to increase the likelihood of proper delivery of messages.
CSP_MinThP	`MinThP`	Especially meaningful for flows of audio and video streams. Less meaningful for transmission of single messages, e.g. DENM.
CSP_MaxLat	`MaxLat`	Especially meaningful for transmission of single messages, e.g. CAM, DENM, SPaT.
CSP_MaxADU	`MaxADU`	**Mandatory** communication service parameter. Necessary in case of "large ADUs" where due to frame size restrictions in the ITS-S access technologies potentially fragmentation is needed.
Security communication service parameters		
CSP_DataConfidentiality	`DataConfidentiality`	
CSP_DataIntegrity	`DataIntegrity`	
CSP_NonRepudiation	`ReqNonrepudiation`	
CSP_SourceAuthentication	`SourceAuthentication`	

Table 3 *(continued)*

Communication service parameter	ASN.1 type	Comment
Protocol communication service parameter		
CSP_Protocol	`ProtocolReq`	A complete registered non-parameterized protocol stack
CSP_SpecificCommsProts	`SpecCommProts`	List of specific non-parameterized communications protocols

The informative Annex B provides examples of value assignments for CSPs considering three different use cases.

6 Policies and regulations

In the context of this document, the terms "policy" and "regulation" are used to indicate rules used in the decision process to select a communication protocol stack (see Figure 1). Policies are not enforceable, and may be presented by the user of an ITS-SU, an organisation, or an authority. Regulations are enforceable, and may be presented only by an authority. How policies and regulations are made available in an ITS-SU is outside the scope of this document. Some information on policies and regulations is provided in ISO 17419. Policies and regulations may apply either for specific ITS-S application processes, or for specific communication protocols, e.g. frequency regulation. Policies and regulations typically are valid in a specific region. ISO 17419 distinguishes policy regions and regulatory regions.

Examples of policies set up by the user of an ITS-SU are identified in this document:

— Cost policy specified in 6.1;

— Station anonymity policy specified in 6.2;

— Station location privacy policy specified in 6.3;

— Station authentication policy specified in 6.4.

6.1 Cost policy

6.1.1 List of rules

Cost rules specified in this document are

— "Flat rate" rule specified in 6.1.2,

— "Maximum rate per data unit" rule specified in 6.1.3,

— "Maximum rate per connection time" rule specified in 6.1.4,

— "Maximum rate per connection" rule specified in 6.1.5.

All of these rules are based on the ASN.1 type `MediumCost` specified in ISO 17419.

6.1.2 Flat rate

The "Flat rate" rule R_FlatRate indicates that cost for communications shall be limited based on a flat rate price.

`MediumCost` shall be applied as specified in Table 4.

Table 4 — R_FlatRate

Component of `MediumCost`	Value	Semantics
`costClass`	1 or 2	Value 1 shall be selected for zero cost. Otherwise value 2 shall be selected.
`costAmount`	Currency unit	Present in case of `costClass` = 2. Indicating the flat rate price. Price information consists of a currency unit (three digit number code specified in ISO 4217:2015), the integer part of the value, and the fractional part of the value.
`timeUnit`	—	Optional component is not present for R_FlatRate.
`amountUnit`	—	Optional component is not present for R_FlatRate.

6.1.3 Maximum rate per data unit

The "Maximum rate per data unit" rule R_DataUnitRate indicates that cost for communications shall be limited based on a price per data unit.

`MediumCost` shall be applied as specified in Table 5

Table 5 — R_DataUnitRate

Component of `MediumCost`	Value	Semantics
`costClass`	4	Maximum rate per data unit.
`costAmount`	Currency unit	Price per data unit. Price information consists of a currency unit (three digit number code specified in ISO 4217:2015), the integer part of the value, and the fractional part of the value.
`timeUnit`	—	Optional component is not present for R_DataUnitRate.
`amountUnit`	Present	Possible data units to be selected: 1 kbyte, 10 kbyte, 100 kbyte, 1 Mbyte, 10 Mbyte, 100 Mbyte, 1 Gbyte, 10 Gbyte.

6.1.4 Maximum rate per connection time

The "Maximum rate per connection time" rule R_ConnectTimeRate indicates that cost for communications shall be limited based on a price per connection time.

`MediumCost` shall be applied as specified in Table 5.

Table 6 — R_ConnectTimeRate

Component of `MediumCost`	Value	Semantics
`costClass`	3	Maximum rate per connection time.
`costAmount`	Currency unit	Price per time unit. Price information consists of a currency unit (three digit number code specified in ISO 4217:2015), the integer part of the value, and the fractional part of the value.
`timeUnit`	Time unit	Possible time units to be selected: µs, ms, second, minute, hour, day, week, month, year; see ISO 21218[5].
`amountUnit`	—	Optional component is not present for R_ConnectTimeRate.

6.1.5 Maximum rate per connection

The "Maximum rate per connection" rule R_ConnectRate indicates that cost for communications shall be limited based on a price per connection.

`MediumCost` shall be applied as specified in Table 7.

Table 7 — R_ConnectRate

Component of `MediumCost`	Value	Semantics
`costClass`	5	Maximum rate per connection.
`costAmount`	Currency unit	Price per connection. Price information consists of a currency unit (three digit number code specified in ISO 4217:2015), the integer part of the value, and the fractional part of the value.
`timeUnit`	—	Optional component is not present for R_ConnectRate.
`amountUnit`	—	Optional component is not present for R_ConnectRate.

6.2 Need for station anonymity

The "Need for station anonymity" rule R_StationAnonymity indicates whether station anonymity is needed or not. R_StationAnonymity is of ASN.1 type `Anonymity` specified in Annex A. `Anonymity` allows presentation of the cost factor, i.e. the relevance of this rule. Default is the value zero, i.e. "not needed".

6.3 Need for station location privacy

The "Need for station location privacy" rule R_StationLocationPrivacy indicates whether station location privacy is needed or not. R_StationLocationPrivacy is of ASN.1 type `LocPrivacy` specified in Annex A. `LocPrivacy` allows presentation of the cost factor, i.e. the relevance of this rule. Default is the value zero, i.e. "not needed".

6.4 Support of station authentication

The "Support of station authentication" rule R_StationAuthentication whether support for authentication of the ITS-SU by a peer station is needed or not. R_StationAuthentication is of ASN.1 type `StationAuthentication` specified in Annex A. `StationAuthentication` allows presentation of the cost factor, i.e. the relevance of this rule. Default is the value zero, i.e. "not needed".

7 ITS-S procedures for ITS-S communication profile selection

7.1 Overview

The following procedures are identified:

— Presentation of CSPs by ITS-S application processes, specified in 7.2;

— Monitoring of capabilities of communications, specified in 7.3;

— Monitoring of change in regulations and policies, specified in 7.4;

— Selection of ITS-S communication profiles, specified in 7.5;

— Provision of additional rules and policies by user of ITS-SUs, specified in 7.6;

— ITS-S communication profile assignment for applications which are not certified to be installed in an ITS-SU, specified in 7.7.

As ITS-S application processes may reside e.g. in the ITS-S application entity, the ITS-S management entity, and the ITS-S facilities layer, the services REQUEST and COMMAND of the MA-SAP, the MS-SAP and the MF-SAP are used to exchange information and command between the ITS-S management entity and the ITS-S application entity, the ITS-S management entity, and the ITS-S facilities layer, respectively. These services and related .request and .confirm service primitives are specified in ISO 24102-3[8]. This document specifies functions carried in these service primitives. The ASN.1 definition of these functions is specified in Annex A.

These functions provide the mechanisms to present CSPs to the ITS-S management entity, and the mechanisms to present feedback to the ITS-S application processes on the selection of ITS-S communication profiles.

7.2 Presentation of CSPs

CSPs are presented by ITS-S application processes to the ITS-S management entity using the service primitives A-REQUEST(`ITS-S-Appl-Reg`), or MF-REQUEST(`ITS-S-Appl-Reg`), or MS-REQUEST(`ITS-S-Appl-Reg`), respectively. `ITS-S-Appl-Reg` consists of a sequence of elements of ASN.1 type `ITSSappCPReqReg` illustrated in Table 8. `ITS-S-Appl-Reg` and `ITSSappCPReqReg` are specified in Annex A.

Table 8 — CSPs per source / sink

Component of `ITSSappCPReqReg`	Value	Semantics
`reference`	`ITS-SapSsId`	Implementation specific identifier of an ITS-S application process in an ITS-SU, see ISO 17419.
`requirements`	`ITSSappReqs`	List of CSPs for reference.

The requests introduced directly above shall be acknowledged with MA-REQUEST(`ITS-S-Appl-RegConf`), or MF-REQUEST(`ITS-S-Appl-RegConf`), or MS-REQUEST(`ITS-S-Appl-RegConf`), respectively. `ITS-S-Appl-RegConf` consists of a sequence of elements of ASN.1 type `ITSSappCPReqConf` which are illustrated in Table 9. `ITS-S-Appl-RegConf` and `ITSSappCPReqConf` are specified in Annex A.

In the case that an appropriate ITS-S communication profile is not currently available, the request is confirmed with error/return code = 10 "VALUE NOT AVAILABLE" as specified in ISO 24102-3[8]. Otherwise, the request is confirmed with error / return code = 0 "SUCCESS" as specified in ISO 24102-3[8]. The confirmation `ITS-S-Appl-RegConf` consists of details as illustrated in Table 9.

Table 9 — Confirmation of CSPs per source / sink

Component of `ITSSappCPReqConf`	Value	Semantics
`Reference`	`ITS-SapSsId`	Implementation specific identifier of an ITS-S application process in an ITS-SU, see ISO 17419.
`confDetails`	`ITSSappReqConf`	List of information on success or failure for `reference`. This information is either presenting the BOOLEAN information TRUE = success or FALSE = failure, or it shows an achievable value which is outside of the required range, or it may be the ASN.1 `NULL` type.

7.3 Monitoring of capabilities of communications

Capabilities of communications are related to protocols contained in the ITS-S access layer, the ITS-S networking & transport layer, and the ITS-S facilities layer, and possibly also in the ITS-S security entity and the ITS-S management entity. Such capabilities depend on the installation and on the actual status of the implemented protocols.

Specification of functionality in support of monitoring of capabilities of communication interfaces is outside the scope of this document. This functionality is specified elsewhere, e.g. in ISO 21218[5] and ISO 24102-1[6] for capabilities of communication interfaces (ITS-S access layer), and in ISO 24102-6[11], ISO 29281-1[13] for capabilities of the ITS-S networking & transport layer.

7.4 Monitoring of regulations and policies

Regulations and policies are applicable in specific regions. ISO 17419 specifies how regulatory regions and policy regions are identified. Procedures to get updates of regulations and policies may use push or pull mechanisms.

Functionality in support of monitoring of radio regulations is specified in ISO 21218[5] and ISO 24102-1[6].

7.5 Selection of ITS-S communication profiles

Upon presentation of CSPs for each source of an ITS-S application process, the ITS-S management will try to identify applicable initial communication protocol stacks for each source, and will initialize the best suited communication protocol stack as specified in ISO 24102-6[11]. Success and failure to identify such protocol stacks will be reported as specified in 7.2. Resolution of conflicting rules (regulations and policies) is outside the scope of this document.

The cost value of ASN.1 type `CostObjective` indicates the relevance of a CSP and may have values in the range from zero to 255. A value of zero means that the related CSP is not at all relevant. A value of 255 indicates highest relevance. CSPs not presenting a cost value have an implicit cost value of 255. How a communication profile selection process uses the cost value is outside the scope of this document, allowing for different implementations.

In the case that no appropriate ITS-S communication profile could be selected, and all BOOLEAN information in Table 9 reports success, the ITS-S application process shall notify the ITS-S management whether it accepts to operate on available ITS-S communication profiles with the confirmed values, or whether it will stop operation. In the latter case, the user of the ITS-SU should be informed about a non-resolvable conflict. The notification shall use the A-REQUEST(`ITS-S-Appl-RegFinal`), or MF-REQUEST(`ITS-S-Appl-RegFinal`), or MS-REQUEST(`ITS-S-Appl-RegFinal`), respectively. `ITS-S-Appl-RegFinal` consists of a sequence of elements of ASN.1 type `ITSSappCPFinal` which are illustrated in Table 10. `ITS-S-Appl-RegFinal` is specified in Annex A.

Table 10 — Final confirmation of CSPs for all sources and sinks

Component of `ITSSappCPFinal`	Value	Semantics
`applicationID`	`ITSsapid`	Implementation specific identifier of an ITS-S application process in an ITS-SU, see ISO 17419.
`final`	`Logic`	TRUE: ITS-S application process can operate on available ITS-S communication profiles with the confirmed values. FALSE: ITS-S application process cannot operate at all.

Upon successful assignment of communication protocol stacks for each given source, an ITS-S application process can start requesting ITS-S-FlowIDs and producing related flows as specified in ISO 24102-6[11].

In the case of failure, ITS-S remote management specified in ISO 24102-2[7] can be used to download missing protocols from the ITS-SCU configuration management centre, if applicable. Further details are out of scope of this document.

7.6 Interaction with user of ITS-SU

Interaction with the ITS-SU user depends on implementation. Details are outside the scope of this document.

7.7 Support of other application processes

The ITS-S is specified in ISO 21217:2014 as a "Bounded Secured Managed Domain" which implies that any kind of software (ITS-S application processes, communication protocols, etc.) running in an ITS-SU must be certified. A large number of applications related to ITS already exists, e.g. as apps in smart phones, which are not certified to run in an ITS-SU. Nevertheless such applications should also get reasonable access to the communication tools available in an ITS-SU. In this document, the meaning of ITS-SU is generalized such that it may consist of two parts:

— the part operated as a BSMD;

— the part operated outside of the BSMD.

In support of such application processes operated outside of the BSMD in a generalized ITS-SU, ISO 21217:2014 defines the application adaptation interface providing ITS-S gateway functionality. Such an application adaptation interface interconnects an "external protocol stack" to the ITS-S management entity, to the ITS-S facilities layer, and to the ITS-S networking & transport layer, and thus supports also direct routing on a default path to the Internet which enables end to end communications.

Two main classes of application processes operated outside of the BSMD are identified:

a) Application processes which know how to present CSPs as specified in this document;

b) All other applications.

Class a) application processes may get a best effort ITS-S communication profile as decided by the ITS-S management.

Class b) application processes shall only get a default path to Internet as decided by the ITS-S management.

All application processes operated outside of the BSMD shall always only get lowest priority access to the communication tools (referred to as ITS-S services in ISO 21217:2014) compared to ITS-S application processes as specified in ISO 17419. When required, the ITS-S management entity may even block completely any data flow between the "other stations" and the ITS-S, or the data flow for selected "other applications", in order to ensure proper operation of the ITS-S application processes.

Annex A
(normative)

ASN.1 modules

A.1 Overview

The ASN.1 basic notation is specified in ISO/IEC 8824-1:2015. The following ASN.1 module is specified in this annex:

— CITSapplReq2 {iso(1) standard(0) cits-applReq (17423) asnm-1 (1) version2 (2)}

In case the ASN.1 specifications given in this Annex are not in accordance with illustrations or specifications provided elsewhere in this document, the specifications given in this Annex shall prevail.

Updates of this ASN.1 module will be published on http://standards.iso.org/iso/17423/ed-1/en.

Applicable encodings of the types and values defined in the ASN.1 module specified in A.2 depend on the usage. ASN.1 BASIC-PER, UNALIGNED, as specified in ISO/IEC 8825-2:2015[16], shall apply if no other explicit requirement on encoding is given.

A.2 Module CITSapplReq

```
CITSapplReq2 {iso(1) standard(0) cits-applReq (17423) asnm-1 (1) version2 (2)}

DEFINITIONS AUTOMATIC TAGS::=BEGIN

IMPORTS

-- C-ITS Data Dictionary (still in ISO 17419)
UserPriority,  TimeDurationValue, Logic, NullType, PortNumber, MediumCost FROM
CITSdataDictionary1 {iso(1) standard(0) cits-applMgmt (17419) dataDictionary (1) version1
(1)}

-- ISO 17419
ITSaid, FlowTypeID, ITSappProcSinkSourceNo, PortRxTx, ITSprotocolStackID,
LogicalChannelType, ITSprotID, ITSsapid, ITS-scuId, ITS-SapSsId, ITSprotocol FROM
CITSapplMgmtApplReg2 {iso(1) standard(0) cits-applMgmt (17419) applRegistry (2) version2
(2)}

-- ISO 21218
DataRate, Directivity FROM ITSllsap {iso(1) standard(0) calm-ll-sap(21218) asnm-1 (1)
version2 (2)}

;

-- End of IMPORTS

-- Types
-- General types
CostObjective::=INTEGER{
   notRelevant         (0),
   highestRelevance    (255)
   }(0..255)

-- SAP functions, 7.2
-- MA-SAP / MF-SAP / MS-SAP functions ISO 24102-3
-- Functions used in these three SAPs
ITS-S-Appl-Reg::= SEQUENCE OF ITSSappCPReqReg

ITS-S-Appl-RegConf::= SEQUENCE OF ITSSappCPReqConf
```

```
ITS-S-Appl-RegFinal::=ITSSappCPFinal

ITS-S-Appl-RegFinalConf::=NullType

-- Used in REQUEST.request service primitive
ITSSappCPReqReg::=SEQUENCE{
   Reference      ITS-SapSsId,
   Requirements   ITSSappReqs
   }

-- Used in REQUEST.confirm service primitive
ITSSappCPReqConf::=SEQUENCE{
   Reference       ITS-SapSsId,
   Confirmations   ITSSappReqConf
   }

-- Notification of final decision of ITS-S application process
-- Used in REQUEST.request service primitive
ITSSappCPFinal::=SEQUENCE{
   applicationID   ITSsapid, -- same as in .request
   final          Logic
   }

-- CSPs per communication source identified by ITSappProcSinkSourceNo, clause 5

-- CSP reference numbers
RefREQSCP::= INTEGER {
   c-logChannel          (0), -- 5.3.2
   c-sessionCont         (1), -- 5.3.3
   c-destType            (2), -- 5.4.2
   c-avgADUrate          (3), -- 5.3.4
   c-destDomain          (4), -- 5.4.3
   c-flowType            (5), -- 5.3.5
   c-maxAPDU             (6), -- 5.5.5
   c-commDistance        (7), -- 5.4.4
   c-portNo              (8), -- 5.3.7
   c-directivity         (9), -- 5.4.5
   c-resilience          (13), -- 5.5.2
   c-minThP              (15), -- 5.5.3
   c-maxLat              (17), -- 5.5.4
   c-protocolReq         (19), -- 5.7.2
   c-dataConfidentiality    (21), -- 5.6.2
   c-dataIntegrity          (23), -- 5.6.3
   c-nonReputability        (25), -- 5.6.4
   c-dataAuthentication     (27), -- 5.6.5
   c-maxPriorityFlow        (29), -- 5.3.6
   c-expFlowLifeTime        (31), -- 5.3.8
   c-specItsProts           (33) -- 5.7.3
   } (0..255)

-- CSP request CLASS
REQSCP::=CLASS {
   &ref   RefREQSCP,
   &ReqParam
   }

-- CSP Request
ITSSappReqs::=SEQUENCE OF ITSSappSingleReq

ITSSappSingleReq::=SEQUENCE{
   refNo   REQSCP.&ref({Req-SCP}),
   param   REQSCP.&ReqParam({Req-SCP}{@refNo})
   }

-- CSP confirm CLASS
REQSCPCONF::=CLASS {
   &ref   RefREQSCP,
   &ReqConfParam
   }
```

```
-- CSP Confirm
ITSSappReqConf::=SEQUENCE OF ITSSappReqSingleConf

ITSSappReqSingleConf::=SEQUENCE{
   refNo    REQSCPCONF.&ref({ReqConf-SCP}), -- same as in request
   param    REQSCPCONF.&ReqConfParam({ReqConf-SCP}{@refNo})
   }


-- Request CSPs (mandatory and optional)
Req-SCP REQSCP::={logChannel | destType | destDomain | maxAPDU | sessionCont | avgADUrate
| flowType | commDistance | directivity | resilience | minThP | maxLat | protocolReq |
dataConfidentiality | dataIntegrity | nonReputability | dataAuthentication |
maxPriorityFlow | portNo | expFlowLifeTime | specItsProts, ...}

-- Mandatory Request CSPs (only even ref numbers)
logChannel    REQSCP::={&ref c-logChannel, &ReqParam LogicalChannelType}
destType      REQSCP::={&ref c-destType, &ReqParam DestinationType}
destDomain    REQSCP::={&ref c-destDomain, &ReqParam DestDomain}
maxAPDU       REQSCP::={&ref c-maxAPDU, &ReqParam MaxADU}
portNo        REQSCP::={&ref c-portNo, &ReqParam PortNoInfo}


DestinationType::=INTEGER{
   broadcast    (1),
   multicast    (2),
   unicast      (4),
   anyCast      (8),
   geoCast      (16)
   }(0..255)

DestDomain::=INTEGER{
   stationInternal    (1),
   linkLocal          (2),
   siteLocal          (4),
   itsNWlocal         (8),
   global             (16)
   } (0..255)

MaxADU::=INTEGER(0..65535) -- multiples of 100 byte

PortNoInfo::=SEQUENCE{
   direction    PortRxTx,
   pnMapping    PortNumberMappings
   }

PortNumberMappings::=SEQUENCE OF PortNumberMapping

PortNumberMapping::=SEQUENCE{
   number       PortNumber,
   protType     ITSprotocol
   }

-- Optional Request CSPs (only odd ref numbers)
sessionCont          REQSCP::={&ref c-sessionCont, &ReqParam SessionCont}
avgADUrate           REQSCP::={&ref c-avgADUrate, &ReqParam AvgADUrate}
flowType             REQSCP::={&ref c-flowType, &ReqParam FlowTypeID}
commDistance         REQSCP::={&ref c-commDistance, &ReqParam CommDistance}
directivity          REQSCP::={&ref c-directivity, &ReqParam Directivity}
resilience           REQSCP::={&ref c-resilience, &ReqParam Resilience}
minThP               REQSCP::={&ref c-minThP, &ReqParam MinThP}
maxLat               REQSCP::={&ref c-maxLat, &ReqParam MaxLat}
protocolReq          REQSCP::={&ref c-protocolReq, &ReqParam ProtocolReq}
dataConfidentiality  REQSCP::={&ref c-dataConfidentiality, &ReqParam DataConfidentiality}
dataIntegrity        REQSCP::={&ref c-dataIntegrity, &ReqParam DataIntegrity}
nonReputability      REQSCP::={&ref c-nonReputability, &ReqParam ReqNonrepudiation}
dataAuthentication   REQSCP::={&ref c-dataAuthentication, &ReqParam SourceAuthentication}
maxPriorityFlow      REQSCP::={&ref c-maxPriorityFlow, &ReqParam ITSapObPriority}
expFlowLifeTime      REQSCP::={&ref c-expFlowLifeTime, &ReqParam ExpFlowLifeTime}
specItsProts         REQSCP::={&ref c-specItsProts, &ReqParam SpecCommProts}
```

```
SessionCont::=Logic -- false: session may be interrupted

AvgADUrate::=TimeDurationValue

CommDistance::=SEQUENCE{
   minDistance   MinCommDistance, -- meter
   cost          CostObjective
   }

MinCommDistance::= INTEGER(0..65535)

Resilience::=CostObjective -- if presented, resilience is requested

MinThP::=SEQUENCE{
   minThP   DataRate,
   cost     CostObjective
   }

MaxLat::=SEQUENCE{
   lat    MaxLatLevel,
   cost   CostObjective
   }

MaxLatLevel::=INTEGER{
   unknown    (0), -- unknown latency
   small      (1), -- response within less than 1 ms
   ms         (2), -- response within less than 10 ms
   ms10       (4), -- response within less than 100 ms
   ms100      (8), -- response within less than 1 second
   sec        (16), -- response within less than 10 seconds
   sec10      (32), -- response within less than 1 minute
   min        (64), -- response within less than 10 minutes
   min10      (128), -- response within less than 1 hour
   any        (255) -- any latency - not further specified
   } (0..255)

ProtocolReq::=ITSprotocolStackID

DataConfidentiality::=CostObjective

DataIntegrity::=CostObjective

ReqNonrepudiation::=CostObjective

SourceAuthentication::=CostObjective

ITSapObPriority::=UserPriority

ExpFlowLifeTime::=TimeDurationValue -- expected time of a flow

SpecCommProts::=SEQUENCE OF ITSprotID

-- Confirm CSPs (mandatory and optional)
ReqConf-SCP REQSCPCONF::={logChannelConf | destTypeConf | destDomainConf | maxAPDUConf |
sessionContConf | avgADUrateConf | flowTypeConf | commDistanceConf | directivityConf |
resilienceConf | minThPConf | maxLatConf | protocolReqConf | dataConfidentialityConf |
dataIntegrityConf | nonReputabilityConf | dataAuthenticationConf | maxPriorityFlowConf |
portNoConf | expFlowLifeTimeConf | specItsProtsConf, ...}

-- Mandatory Confirm CSPs(only odd ref numbers): ok (TRUE) / nok or possible values
logChannelConf    REQSCPCONF::={&ref c-logChannel, &ReqConfParam Logic}
destTypeConf      REQSCPCONF::={&ref c-destType, &ReqConfParam Logic}
destDomainConf    REQSCPCONF::={&ref c-destDomain, &ReqConfParam Logic}
maxAPDUConf       REQSCPCONF::={&ref c-maxAPDU, &ReqConfParam MaxADU}
portNoConf        REQSCPCONF::={&ref c-portNo, &ReqConfParam NullType}

-- Optional Confirm CSPs (only even ref numbers):
sessionContConf           REQSCPCONF::={&ref c-sessionCont, &ReqConfParam Logic}
avgADUrateConf            REQSCPCONF::={&ref c-avgADUrate, &ReqConfParam Logic}
flowTypeConf              REQSCPCONF::={&ref c-flowType, &ReqConfParam Logic}
commDistanceConf          REQSCPCONF::={&ref c-commDistance, &ReqConfParam CommDistance}
```

```
directivityConf          REQSCPCONF::={&ref c-directivity, &ReqConfParam Directivity}
resilienceConf           REQSCPCONF::={&ref c-resilience, &ReqConfParam Logic}
minThPConf               REQSCPCONF::={&ref c-minThP, &ReqConfParam MinThP}
maxLatConf               REQSCPCONF::={&ref c-maxLat, &ReqConfParam MaxLat}
protocolReqConf          REQSCPCONF::={&ref c-protocolReq, &ReqConfParam Logic}
dataConfidentialityConf  REQSCPCONF::={&ref c-dataConfidentiality, &ReqConfParam Logic}
dataIntegrityConf        REQSCPCONF::={&ref c-dataIntegrity, &ReqConfParam Logic}
nonReputabilityConf      REQSCPCONF::={&ref c-nonReputability, &ReqConfParam Logic}
dataAuthenticationConf   REQSCPCONF::={&ref c-dataAuthentication, &ReqConfParam Logic}
maxPriorityFlowConf      REQSCPCONF::={&ref c-maxPriorityFlow, &ReqConfParam NullType}
expFlowLifeTimeConf      REQSCPCONF::={&ref c-expFlowLifeTime, &ReqConfParam NullType}
specItsProtsConf         REQSCPCONF::={&ref c-specItsProts, &ReqConfParam SpecCommProts}

-- Policies and regulations (rules), clause 6
-- Policies reference number
RefPOLICY::= INTEGER {
   c-policyMediumCost              (0),
   c-policyLocPrivacy              (1),
   c-policyAnonymity               (2),
   c-policyStationAuthentication   (3)
   } (0..255)

-- Policies CLASS
POLICYC::=CLASS {
   &ref   RefPOLICY,
   &PolParam
   }

-- Policies
Policies::=SEQUENCE OF SinglePolicy

SinglePolicy::=SEQUENCE{
   refNo   POLICYC.&ref({Policy}),
   param   POLICYC.&PolParam({Policy}{@refNo})
   }

Policy POLICYC::={policyMediumCost | policyLocPrivacy | policyAnonymity |
policyStationAuthentication, ...}

policyMediumCost   POLICYC::={&ref c-policyMediumCost, &PolParam MediumCost}
policyLocPrivacy   POLICYC::={&ref c-policyLocPrivacy, &PolParam LocPrivacy}
policyAnonymity    POLICYC::={&ref c-policyAnonymity, &PolParam Anonymity}
policyStationAuthentication  POLICYC::={&ref c-policyStationAuthentication, &PolParam
StationAuthentication}


-- Financial policies, 6.1
-- MediumCost is specified in CITSdataDictionary1 (ISO 17419)

-- Station anonymity 6.2
Anonymity::=CostObjective

-- Location privacy, 6.3
LocPrivacy::=CostObjective

-- Station authentication, 6.4
StationAuthentication::=CostObjective

-- ITS Flow Type registry (see also ISO 17419)
-- whole set of registration information
ITSflowTypeRegistry::=SEQUENCE OF ITSflowType

-- a single record
ITSflowType::=SEQUENCE{
   Id    FlowTypeID, -- Flow type identifier (only well-known flow types; imported from
ISO 17419)
   Req   ITSSappReqs -- list of requirements
   }

-- values
```

```
version INTEGER(0..255)::=2 -- Version of this ASN.1 module

/*
   The ASN.1 specification has been checked for conformance to the ASN.1
   standards by OSS ASN.1 Syntax Checker, and by OSS ASN-1STEP
*/

END
```

A.3 Definitions to be added to ISO 24102-3

The following definitions are dynamic extensions of types defined in ISO 24102-3 with CLASS. An up-todate version of the ASN.1 module ITSmsap { iso (1) standard (0) calm-management (24102) msap (3) asnm-1 (1) version2(2)} including all dynamic updates is published on the ISO Standards Maintenance Portal at http://standards.iso.org/iso/24102/-3/ed-2/en.

IMPORT statement to be added:

```
ITS-S-Appl-Reg, ITS-S-Appl-RegConf, ITS-S-Appl-RegFinal, ITS-S-Appl-RegFinalConf FROM
CITSapplReq {iso(1) standard(0) cits-applReq (17423) asnm-1 (1) version2 (2)}
```

To be added to MF-Request:

```
iTS-S-Appl-RegMF            MFSAP-RR::={&mxref c-iTS-S-Appl-RegMF, &MXParam ITS-S-Appl-
Reg}
iTS-S-Appl-RegFinalMF       MFSAP-RR::={&mxref c-iTS-S-Appl-RegFinalMF, &MXParam ITS-S-
Appl-RegFinal}
```

To be added to MF-ReqConfirm:

```
iTS-S-Appl-RegConfMF        MFSAP-RC::={&mxref c-iTS-S-Appl-RegMF, &MXParam ITS-S-Appl-
RegConf}
iTS-S-Appl-RegFinalConfMF   MFSAP-RC::={&mxref c-iTS-S-Appl-RegFinalMF, &MXParam ITS-S-
Appl-RegFinalConf}
```

To be added to MS-Request:

```
iTS-S-Appl-RegMS            MSSAP-RR::={&mxref c-iTS-S-Appl-RegMS, &MXParam ITS-S-Appl-
Reg}
iTS-S-Appl-RegFinalMS       MSSAP-RR::={&mxref c-iTS-S-Appl-RegFinalMS, &MXParam ITS-S-
Appl-RegFinal}
```

To be added to MS-ReqConfirm:

```
iTS-S-Appl-RegConfMS        MSSAP-RC::={&mxref c-iTS-S-Appl-RegMS, &MXParam ITS-S-Appl-
RegConf}
iTS-S-Appl-RegFinalConfMS   MSSAP-RC::={&mxref c-iTS-S-Appl-RegFinalMS, &MXParam ITS-S-
Appl-RegFinalConf}
```

To be added to MA-Request:

```
iTS-S-Appl-Reg              MASAP-RR::={&mxref c-iTS-S-Appl-Reg, &MXParam ITS-S-Appl-Reg}
iTS-S-Appl-RegFinal         MASAP-RR::={&mxref c-iTS-S-Appl-RegFinal, &MXParam ITS-S-Appl-
RegFinal}
```

To be added to MA-ReqConfirm:

```
iTS-S-Appl-RegConf          MASAP-RC::={&mxref c-iTS-S-Appl-Reg, &MXParam ITS-S-Appl-
RegConf}
```

```
iTS-S-Appl-RegFinalConf     MASAP-RC::={&mxref c-iTS-S-Appl-RegFinal, &MXParam ITS-S-Appl-
RegFinalConf}
```

The following ASN.1 value definitions (values 'a' and 'b') will be completed by ISO TC204. The result will be published on the ISO Standards Maintenance Portal at http://standards.iso.org/iso/24102/-3/ed-2/en.

```
c-iTS-S-Appl-RegMF          RefMFSAP-R::= <'a' tbd>
c-iTS-S-Appl-RegFinalMF     RefMFSAP-R::= <'b' tbd>
c-iTS-S-Appl-RegMS          RefMSSAP-R::= <'a' tbd>
c-iTS-S-Appl-RegFinalMS     RefMSSAP-R::= <'b' tbd>
c-iTS-S-Appl-Reg            RefMASAP-R::= <'a' tbd>
c-iTS-S-Appl-RegFinal       RefMASAP-R::= <'b' tbd>
```