
**Intelligent transport systems — ITS
station management —**

**Part 1:
Local management**

*Systèmes intelligents de transport — Gestion des stations ITS —
Partie 1: Gestion locale*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 24102-1:2013) which has been technically revised. It also incorporates the Amendment ISO 24102-1:2013/Amd1:2017.

A list of all parts in the ISO 24102 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

NOTE The former ISO 24102-5 has been converted into a separate standard ISO 22418, as it is not a station management standard.

Introduction

This document is part of a series of International Standards for communications in Intelligent Transport Systems (ITS) based on the ITS station and communications architecture specified in ISO 21217:2014 and illustrated in [Figure 1](#).

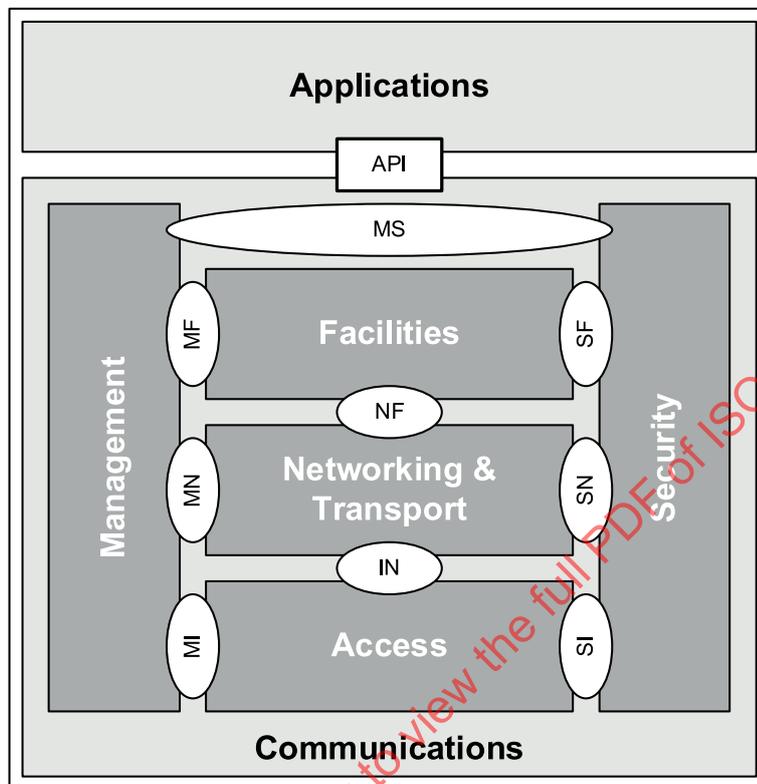


Figure 1 — ITS station reference architecture with named interfaces

This document is part 1 of a multi-part document which determines the intelligent transport systems (ITS) local station management that is architecturally located in the ITS station management entity.

The ITS station management entity provides functionality related to the management of communication protocol layers (Access, Networking & Transport, Facilities), the Security entity, and the ITS Applications entity introduced in ISO 21217:2014 and presented in [Figure 1](#).

ITS station management is specified as a distributed process, where no supervisory entity is employed.

Intelligent transport systems — ITS station management —

Part 1: Local management

1 Scope

This document provides specifications for intelligent transport systems (ITS) station management to be in conformance with the ITS station reference architecture.

Local ITS station management protocols are specified by means of management processes, and data that are exchanged between the station management entity and

- the ITS Applications entity above the API,
- the Security entity, and
- the various communication protocol layers:
 - access;
 - networking & transport;
 - facilities.

of the ITS station architecture specified in ISO 21217:2014 and illustrated in [Figure 1](#).

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 17419:2018, *Intelligent transport systems — Identifiers — Part 1: Globally unique identification*

ISO 17423:2018, *Intelligent transport systems — Cooperative systems — Application requirements and objectives*

ISO/TS 17429:2017, *Intelligent transport systems — Cooperative ITS — ITS station facilities for the transfer of information between ITS stations*

ISO 18750:2018, *Intelligent transport systems — Cooperative systems — Local dynamic map*

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

ISO 21218:2018, *Intelligent transport systems — Hybrid communications — Access technology support*

ISO 22418, *Intelligent transport systems — Fast service announcement protocol (FSAP)*

ISO 24102-2:2018, *Intelligent transport systems — ITS station management — Part 2: Remote management of ITS-SCUs*

ISO 24102-3:2018, *Intelligent transport systems — ITS station management — Part 3: Service access points*

ISO 24102-1:2018(E)

ISO 24102-4:2018, *Intelligent transport systems — ITS station management — Part 4: Station-internal management communications*

ISO 24102-6:2018, *Intelligent transport systems — Communications access for land mobiles (CALM) — ITS station management — Part 6: Path and flow management*

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

ISO/IEC 8825-2:2015, *Information technology — ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)*

ETSI TS 102 792 V1.2.1 (2015-06), *Intelligent Transport Systems (ITS); Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (CEN DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17419:2018, ISO 17423:2018, ISO 18750:2018, ISO 21217:2014, ISO 21218:2018, ISO 22418, ISO 24102-2, ISO 24102-3, ISO 24102-4, ISO 24102-6:2018 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 regulatory information

set of regulatory requirements for radio wave emission

3.2 ITS-S communication unit

addressable instance of the ITS station reference architecture comprising as a minimum the ITS-S router functionality

3.3 ITS-S path

part of a communication path between a source node and an anchor node being uniquely identified by a LinkID (identifying a CI in the source node and the next hop node) and by the anchor node

4 Symbols and abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO 17419:2018, ISO 17423:2018, ISO 18750:2018, ISO 21217:2014, ISO 21218:2018, ISO 22418, ISO 24102-2:2018, ISO 24102-3:2018, ISO 24102-4:2018, ISO 24102-6 and the following apply.

ITS-SCU	ITS Station Communication Unit
ITS-SSI	ITS Station State Information
LDM	Local Dynamic Map
n.a.	not applicable

PDU	Protocol Data Units
QoS	Quality of Service
RI	Regulatory Information

5 Introduction

The ITS station management entity provides functionality specified in the various parts of this multi-part document:

- 1) The functionality of local ITS station management specified in this document (ISO 24102-1).
- 2) The functionality of remote ITS station management is specified in ISO 24102-2.
- 3) The functionality of management service access points specified in ISO 24102-3.
- 4) The functionality of ITS station-internal management communications specified in ISO 24102-4.
- 5) The functionality of the "path and flow management specified in ISO 24102-6.

Detailed mandatory requirements are specified in the following clauses of this document.

- [Clause 6](#) provides general requirements.
- [Clause 7](#) specifies basic management procedures related to communication interfaces.
- [Clause 8](#) specifies interference protection mechanisms.
- [Clause 9](#) specifies regulatory information management issues.
- [Clause 10](#) introduces issues of congestion control.
- [Clause 11](#) specifies management of networking & transport layer forwarding information.
- [Clause 12](#) describes the concept of flow and path management.
- [Clause 13](#) specifies management of "Legacy CIs".
- [Clause 14](#) introduces neighbour lists.
- [Clause 15](#) specifies management data elements.
- [Clause 16](#) presents dynamic data issues.
- [Clause 17](#) specifies conformance declaration.
- [Clause 18](#) specifies test methods.
- The normative [Annex A](#) provides ASN.1 specifications.
- The normative [Annex B](#) specifies management parameters.

6 General requirements

6.1 Basics

Functionality of local ITS station management specified in this document builds on the ITS station and communication architecture specified in ISO 21217:2014, and uses the management service access points:

- MI-SAP: ITS-S management entity ↔ ITS-S access layer;
- MN-SAP: ITS-S management entity ↔ ITS-S networking & transport layer;
- MF-SAP: ITS-S management entity ↔ ITS-S facilities layer;
- MA-SAP: ITS-S management entity ↔ ITS-S applications entity;
- MS-SAP: ITS-S management entity ↔ ITS-S security entity;

specified in ISO 24102-3, see [Figure 1](#). The MA-SAP is part of the API presented in [Figure 1](#).

NOTE Although SAPs and the related service primitives specified in ISO 24102-3 cannot be tested and are not mandatory, in the context of this document, the elements of the service primitives can be an integral part of PDUs exchanged between physical entities (ITS-SCUs) in an ITS station using "ITS station-internal management communications" specified in ISO 24102-4. As PDUs are testable, those elements of service primitives that are part of a PDU become testable.

Functionality of local ITS station management is specified by means of procedures architecturally allocated in the ITS-S management entity, and by data and commands exchanged via the management service access points.

In implementations of ITS station units (ITS-SUs) consisting of several ITS station communication units (ITS-SCUs), exchange of management information (data and commands) between different ITS-SCUs via the ITS station-internal network may be needed. Such ITS station-internal management communications allows remote access to management SAPs. ITS station-internal management communication is specified in ISO 24102-4.

Means to secure the access to management functionality shall be specified within the global context of the ITS station unit as a Bounded Secured Managed Entity (BSME) specified in ISO 21217:2014. Security details are outside the scope of this document.

Management task in general may involve several ITS-S layers and ITS-S entities.

6.2 Security management

Security management covers procedures and data to manage security protocols architecturally allocated in the ITS-S security entity.

So far no procedures for security management are identified.

6.3 Privacy management

Privacy regulations may require unlinking private data from traceable address elements and identifiers contained in wireless messages sent by an ITS-SU. Such unlinking can be done by means of pseudonyms. In order to properly unlink private data from all such address elements and identifiers, simultaneous change of all of these address elements and identifiers is needed. Dependent on applicable regulations and intended usage of an ITS-SCU, the ITS station management shall provide an "ID Change Service" that

performs such simultaneous changes upon request to change pseudonym. Examples of such address elements and identifiers are

- addresses in the ITS-S access layer such as well-known registered MAC address,
- addresses in the ITS-S networking & transport layer such as well-known registered IP address,
- addresses in the ITS-S facilities layer such as "ITS Station Unit Identifier", and
- identifiers in the ITS-S application entity.

Requirements on how often or when to change pseudonyms are out of scope of this document. The ID Change Service may be a non-standardized service.

6.4 Application management

Application management covers procedures and data to manage ITS-S applications, i.e. ITS-S application processes architecturally allocated in the ITS-S applications entity. ITS-S application processes are introduced in ISO 21217:2014 and specified further in ISO 17419:2018.

Management of ITS-S applications includes the following tasks:

- Registration of ITS-S application processes and collection of their functional requirements for communications (exchange of APDUs with peer entities) shall be as specified in ISO 17423:2018.
- Support of registration of ITS-S application processes at a local dynamic map (storage for time-referenced and location referenced information) shall be as specified in ISO 18750:2018.
- Remote secure installation, update, and removal of ITS application processes by an ITS-SCU Configuration Management Centre (ITS-SCU-CMC) shall be as specified in ISO 24102-2.
- Management of flow identifiers and flows shall be as specified in ISO 24102-6.
- Registration of ITS-S application processes for service advertisement shall be as specified in ISO 22418.

This list may be extended by further application management tasks specified in other standards.

6.5 Facilities management

Facilities management covers procedures and data to manage ITS-S facilities architecturally allocated in the ITS-S facilities layer.

Management of ITS-S facilities includes the following tasks:

- Registration of local dynamic maps (storage for time-referenced and location referenced information) at the ITS station management shall be as specified in ISO 18750:2018.
- Remote secure installation, update, and removal of ITS facilities by an ITS-SCU Configuration Management Centre (ITS-SCU-CMC) shall be as specified in ISO 24102-2.
- Management of flow identifiers, paths and flows shall be as specified in ISO 24102-6.
- Support of identifying applicable regulations and policies shall be as specified in [Clause 9](#).
- Support of congestion control management shall be as specified in [Clause 10](#).
- Registration for message and data support shall be as specified in ISO TS 17429:2017.
- Support of identifying applicable regulations and policies shall be as specified in [Clause 9](#).

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- Provision of kinematics information on the ITS-SCU by means of a position, time, and velocity service, e.g. ISO 21176¹⁾[4].

This list may be extended by further application management tasks specified in other standards.

6.6 Networking & transport management

Networking & transport management covers procedures and data to manage protocols architecturally allocated in the ITS-S networking & transport layer.

Management of ITS-S networking & transport layer protocols includes the following tasks:

- Management of flow identifiers, paths and flows shall be as specified in ISO 24102-6.
- Support of management of forwarding tables of networking & transport protocols shall be as specified in [Clause 11](#).
- Support of identifying applicable regulations and policies shall be as specified in [Clause 9](#).
- Support of congestion control management shall be as specified in [Clause 10](#).

This list may be extended by further application management tasks specified in other standards.

6.7 Access technology management

Access technology management covers procedures and data to manage communication interfaces (CIs) and their virtual instantiations (VCIs) architecturally allocated in the ITS-S access layer.

Management of CIs and VCIs includes the following tasks:

- Management of flow identifiers, paths and flows shall be as specified in ISO 24102-6.
- Support in identifying applicable regulations and policies shall be as specified in [Clause 9](#).
- Station-internal self-interference management shall be as specified in [Clause 8](#).
- Interference mitigation management shall be as specified in [Clause 8](#).
- Congestion control management shall be as specified in [Clause 10](#).

This list may be extended by further application management tasks specified in other standards.

7 CI basic management

7.1 General

CI basic management shall be as specified in ISO 21218:2018.

Change of statuses of a CI/VCI shall be reported to all ITS-SCUs with the ITS-SCU Management command "Mcmd.VCI-update" specified in ISO 24102-4, if applicable for a given implementation. Reception of such a notification shall not be acknowledged.

Management communications with CIs/VCIs in other ITS-SCUs are with the ITS station-internal management communication PDUs "MI-rcmd", "MI-rreq", "MI-rget" and "MI-rset" specified in ISO 24102-4.

The ITS station management maintains information on the status of all CIs and VCIs, e.g. in a VCI list.

1) Currently at step 20.00: New project proposed

7.2 CI status

7.2.1 CI state machine

Figure 2 shows the CI state machine specified in ISO 21218:2018.

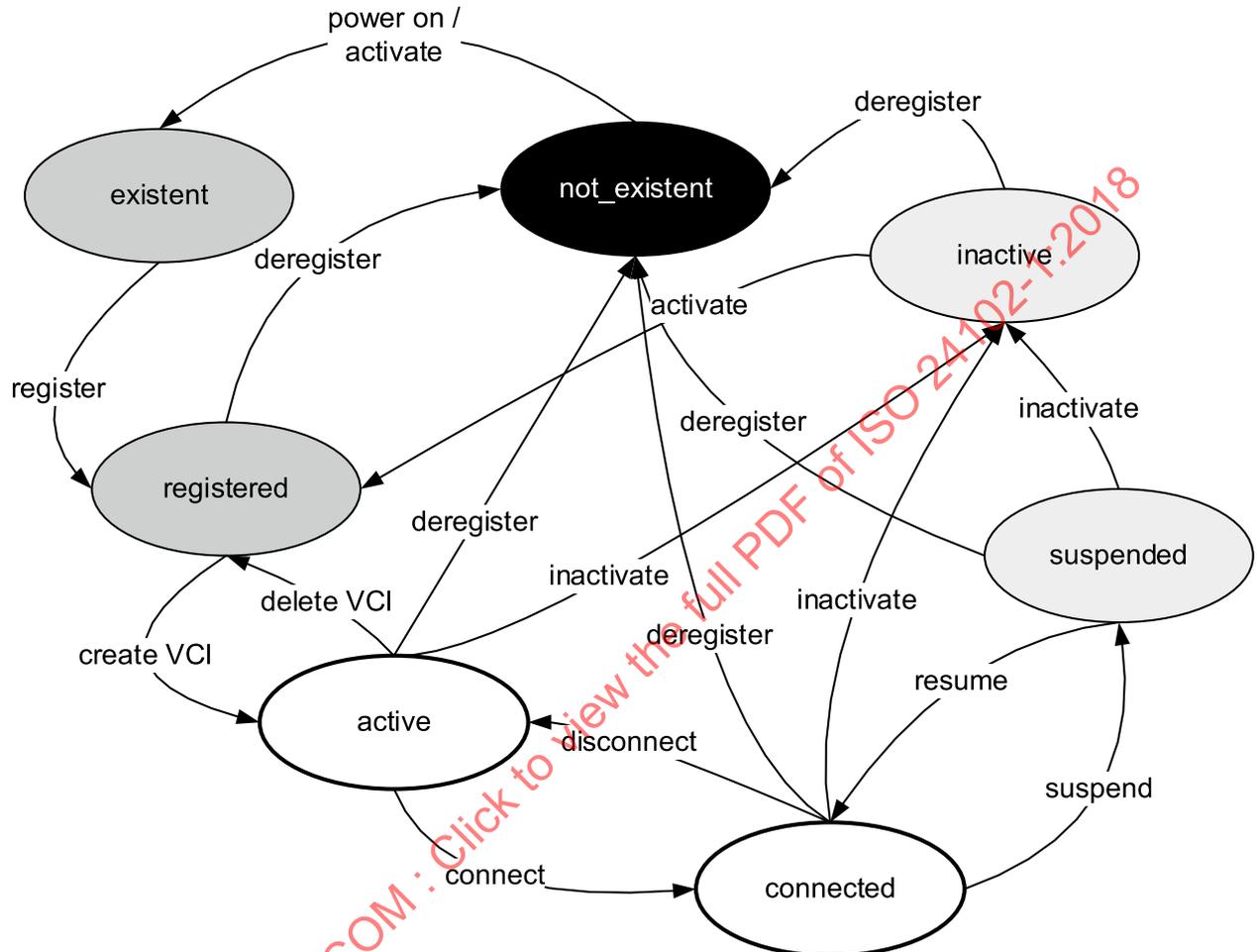


Figure 2 — CI state machine specified in ISO 21218

7.2.2 Registration

Registration of a CI at the ITS station management is the process to make the CI known to the ITS station management, and to make it addressable via a unique Link-ID. Registration of a CI shall be done as specified in ISO 21218.

Upon successful registration of a CI, the ITS station management shall create an entry in the VCI list with the values specified in Table 1.

Table 1 — Entry in VCI list upon registration of CI

Link-ID		Medium	CI Status	ConnectMode
LocalCIID	RemoteCIID			
Identifying the CI as specified in ISO 21218	Not applicable. Value identifying a specific destination as specified in ISO 21218	I-Parameter "MedType" as specified in ISO 21218	I-Parameter CIstatus equal to "registered", see ISO 21218.	I-parameter "Connect".

7.2.3 VCI creation

Creation of a VCI may be done

- upon request of the ITS station management, or
- by the CI on its own.

Creation of a VCI shall be done as specified in ISO 21218.

Upon successful creation of a VCI the ITS station management shall create an entry in the VCI list with the values specified in [Tables 2, 3](#) and [4](#), as applicable.

Table 2 — Entry in VCI list indicating an active CI (not yet connected)

Link-ID		Medium	CI Status	ConnectMode
LocalCIID	RemoteCIID			
Identifying the CI as specified in ISO 21218	Not applicable. Value identifying a specific destination as specified in ISO 21218	Set equal to I-parameter "Medium". See ISO 21218.	"Active"; see ISO 21218.	Set equal to I-parameter "Connect". See ISO 21218.

Table 3 — Entry in VCI List upon creation of a broadcast VCI

Link-ID		Medium	CI Status	ConnectMode
LocalCIID	RemoteCIID			
Identifying the CI as specified in ISO 21218	Value identifying broadcast communication as specified in ISO 21218	Set equal to I-parameter "Medium". See ISO 21218.	"Active"; see ISO 21218.	Set equal to I-parameter "Connect". See ISO 21218.

Table 4 — Entry in VCI List upon creation of a multicast VCI

Link-ID		Medium	CI Status	ConnectMode
LocalCIID	RemoteCIID			
Identifying the CI as specified in ISO 21218	Value identifying a multicast group as specified in ISO 21218	Set equal to I-parameter "Medium". See ISO 21218.	"Active"; see ISO 21218.	Set equal to I-parameter "Connect". See ISO 21218.

7.2.4 Deregistration

Deregistration of a CI at the ITS station management is the process reversal to the registration process. Successful deregistration is a prerequisite to remove a CI from the system during operation.

Deregistration of a CI may be done

- by the CI on its own,
- upon request of the ITS station management as specified in this document.

Deregistration of a CI shall be done as specified in ISO 21218.

Upon successful deregistration, the ITS station management shall delete all entries of this CI and the related VCIs in the VCI list.

7.2.5 Inactivation

Inactivation of a CI is the process to reset the CI and to block all subsequent communications.

Inactivation of a CI may be done upon request of the ITS station management.

Inactivation shall be done upon detected malfunctioning of the CI. There may be further reasons for inactivating a CI.

Inactivation of a CI shall be done as specified in ISO 21218.

Upon successful inactivation, the ITS station management shall change the status element of this CI in the VCI list to "inactive", and shall delete the entries of all related VCIs in the VCI list,

7.2.6 Activation

Activation of a CI is the process to enable communications in an inactive CI.

Activation of a CI may be done upon request of the ITS station management as specified in this document.

NOTE Requirements on events upon which a CI is activated are not specified in this document.

Activation of a CI shall be done as specified in ISO 21218.

Upon successful activation, the ITS station management shall change the status element of this CI in the VCI list to the value "registered".

7.2.7 Suspension of a CI

Suspension of a CI is the process to put all communications of a CI temporarily on hold, without deleting any packets or state variables.

Suspension of a CI may be done upon request of the ITS station management as specified in this document.

NOTE Conditions when a CI is inactivated are not specified in this document.

Suspension may be done as part of the ITS station self-interference management; details are out of scope of this document. There may be further reasons for suspending a CI.

Suspension of a CI shall be done as specified in ISO 21218.

Upon successful suspension, the ITS station management shall change the status element of this CI and the related VCIs in the VCI list to "suspended", and

7.2.8 Resuming

Resuming of a CI is the process to enable communications in a suspended CI.

Resuming of a CI may be done upon request of the ITS station management.

Resuming may be done as part of the ITS station self-interference management; details are out of scope of this document. There may be further reasons for resuming a CI.

Resuming of a CI shall be done as specified in ISO 21218.

Upon successful resuming, the ITS station management shall change the status element of this CI in the VCI list to "active", and the status of the related VCIs in the VCI list to "connected".

NOTE 2 This VCI state might have become wrong in the meanwhile. However this will be resolved automatically by an automatic status update of the CI.

7.2.9 Connection

Connection establishment of a CI is the process to initiate and maintain a relation to a specific peer station. Distinction is made according to the CI access class.

Connection of a VCI may be done

- by the CI on its own,
- upon request of the ITS station management as specified in this document.

Connection of a VCI shall be done as specified in ISO 21218.

Upon successful connection to a peer station, the ITS station management shall create an entry in the VCI list with the values specified in [Table 5](#).

Table 5 — Entry in VCI list upon successful connection of a unicast VCI

Link-ID		Medium	CI Status	ConnectMode
LocalCIID	RemoteCIID			
Identifying the CI as specified in ISO 21218	Value identifying the peer station as specified in ISO 21218	Set equal to I-parameter "Medium". See ISO 21218.	"Connected", see ISO 21218.	Set equal to I-parameter "Connect". See ISO 21218.

7.2.10 Disconnection

Disconnection of a VCI is the process to close relations to a peer station. Distinction is made according to the CI access class as specified in ISO 21218.

Disconnection of a VCI may be done

- by the CI on its own,
- upon request of the ITS station management as specified in this document.

Disconnection of a VCI shall be done as specified in ISO 21218. Upon successful disconnection of a VCI by the ITS station management or by the CI, the ITS station management shall update the entry of the VCI in the VCI list.

7.2.11 Deletion of a VCI

Deletion of a VCI may be done

- by the CI on its own,
- upon request of the ITS station management as specified in this document.

Deletion of a VCI shall be done as specified in ISO 21218.

Upon successful deletion of a VCI the ITS station management shall delete the entry in the VCI list.

7.3 I-Parameters

7.3.1 General

Upon registration of a CI, its RX-VCI and TX-VCI, if applicable, shall operate on the default settings of I-Parameters.

NOTE The default settings of the access technologies are specified in the media standards.

7.3.2 Setting of parameter values

Setting of I-Parameter values shall be done as specified in ISO 21218.

I-Parameter settings of a VCI may be changed

- by the ITS station management according to rules specified in this document,
- by the VCI on its own according to rules specified in the related medium standard.

I-Parameter values shall be set in accordance with regulatory requirements, if applicable.

Transmit parameters of a VCI may be changed temporarily on a packet by packet basis applying CIP-management as specified in ISO 21218 and in [6]. This shall not affect VCI I-Parameter-settings.

7.3.3 Retrieval of parameter values

Retrieval of I-Parameter values - either of a single parameter, or of multiple parameters, or of the complete set - of a VCI shall be done as specified in ISO 21218.

Retrieval of I-Parameter values may be done by the ITS station management according to rules specified in this document.

7.3.4 Monitoring of parameters

CIs/VCIs shall notify the ITS station management of changes of the following parameters:

- those that are required to be reported, i.e. mandatory change notification according to [Table 6](#),
- those requested by the ITS station management by means of the MI-COMMAND "MonitorIparameters" specified in ISO 21218.

[Table 6](#) shows a current snap-shot of those I-Parameters for which automatic monitoring shall apply disregard of the type of access technology, and the related mandatory behaviour of the ITS station management upon notification of a new value.

Table 6 — List of CI parameters subject to automatic notification

I-Parameter Name	Behaviour
LocalCIID	The LocalCIID may be changed in order to comply with privacy regulations.
RegulatoryInformation	Upon notification of change of regulatory information, the ITS station management shall accept the new limits for subsequent operations until a new update of RI will be available.
LLaddrTemp	A locally administered data link layer address, e.g. a MAC address, may be used to comply with privacy regulations. Change of such a data link layer address not necessarily changes the LocalCIID.
CIstatus	Status of a CI/VCI
Cost	Price information. Cost of communication in terms of money.

A specific access technology may not support all parameters listed in [Table 6](#), e.g. MACaddrTemp. Consequently, non-supported parameters will never change value, thus a notification will never happen.

Further parameters may be subject to automatic notification of value-changes as defined by implementation or according to other specifications.

7.3.5 Access to other ITS-SCUs

Direct access of the ITS station management in an ITS-SCU to parameters of other ITS-SCUs shall be prohibited, except for the following cases:

- read only access;
- manufacturer access.

Access to I-Parameters of another ITS-SCU shall be achieved by means of the ITS station-internal management communication PDUs "MI-rget" and "MI-rset" specified in ISO 24102-4.

7.4 Manufacturer access

A manufacturer of a CI may access its CI via the MI-SAP as specified in ISO 21218:2018.

Access security is outside the scope of the set of ISO International Standards on ITS, i.e. the manufacturer shall implement its own security scheme.

8 Interference management

8.1 General

Interference may be grouped into three groups:

- a) Interference from TX-VCI of an ITS-SU on external communication systems (may be other ITS-SUs or non-ITS systems);
- b) Self-interference of TX-VCI of the same ITS-SU;
- c) Interference from external non-ITS systems on RX-VCI of an ITS-SU.

Examples of interference for the above cases are:

- a) IEEE 802.11 OCB at 5,9 GHz standardized for ITS-SUs in ISO 21215^[5] onto the European road tolling systems based on the DSRC backscatter technology at 5,8 GHz standardized by CEN^[8] and ETSI^[10];
- b) LTE-V2X standardized for ITS-SUs in ISO 17515-3²⁾^[3] onto IEEE 802.11 OCB at 5,9 GHz standardized for ITS-SUs in ISO 21215^[5], and vice-versa;
- c) WiFi services and Cellular Network services operating on frequencies close to 5,9 GHz, i.e. the frequency band allocated for C-ITS road safety applications.

Various interference mitigation techniques are standardized or under development.

The design and integration goal is to avoid such interference as far as possible. A possible means to achieve this is proper assignment of orthogonal wireless communication channels.

2) To be published: Current stage 40.20

8.2 DSRC mitigation techniques

Mitigation techniques for protecting the European Electronic Toll Service based on DSRC^{[8][10]} operated at 5,8 GHz are specified in ETSI TS 102 792 V1.2.1 (2015-06) and shall be applied for ITS-SUs operated in Europe.

A further method to protect DSRC is referred to as "CI protection" and uses the cross-CI prioritization procedure specified in [8.3](#).

8.3 Cross-CI prioritization (self-interference)

8.3.1 General

Wireless TX-VCIs in an ITS station might suffer from cross-interference. This clause considers the case that at least two local TX-VCIs, e.g. using the same medium, need to be synchronized in order to avoid cross-interference. The procedure to synchronize transmission of multiple CIs based on user priority is called "Cross-CI prioritization".

Priority management across CIs is a somewhat slow process which requires involvement of the ITS station management for every packet to be prioritized.

The procedure of cross-CI prioritization is an optional procedure. The part related to the CI is specified in ISO 21218:2018.

NOTE An implicit option of cross-CI prioritization is CI protection. A CI to be protected is a device for radio communications such as passive transponder systems based on [1] and [2] which cannot harm other CIs. In CI protection mode, the CI to be protected does not need to await the positive acknowledgement of a prioritization request, but can try to perform communication at any time.

Cross-CI prioritization distinguishes three processes illustrated in [Figure 3](#):

- a) Registration of a victim CI for prioritization specified in [8.3.2](#);
- b) Presentation of a prioritization request by a victim CI specified in [8.3.3](#);
- c) Presentation of a prioritization release by a victim CI specified in [8.3.4](#).

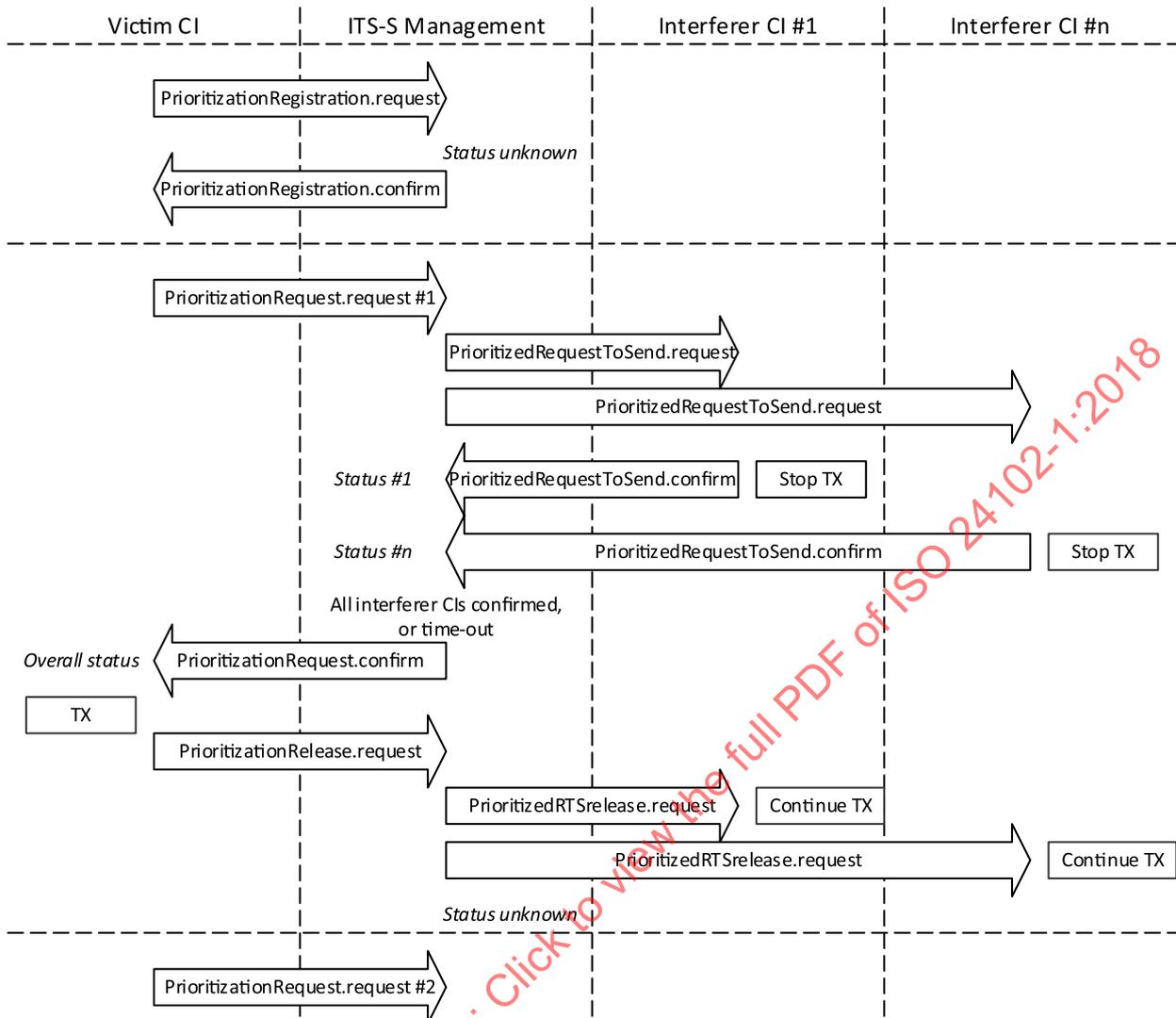


Figure 3 — Cross-CI prioritization processes

8.3.2 Registration of CI for prioritization request

Upon request of a CI to register for the cross-CI prioritization procedure, e.g. by means of the MI-REQUEST.request {PrioritizationRegistration} service primitive specified in ISO 21218:2018, the ITS station management shall perform the following steps:

- Create the header of the prioritization table for this CI, see [Table 10](#), containing the Link-ID, LocalCIID of the CI and the timeout information.
- Evaluate the list of information on potentially interfering access technologies contained in "PrioritizationRegistration" optionally complemented by the ITS station management with new potential interferers in order to identify the LocalCIID of all possible interferers in the ITS station by cross-checking in the VCI list.
- Create an entry in the prioritization table for each identified interferer with the interferer LocalCIID, and with "Status Interferer" set to "released".

8.3.3 Prioritization request

As specified in ISO 21218:2018, a CI may request cross-CI prioritization by means of the MI-REQUEST.request {PrioritizationRequest} service primitive.

Upon reception of such a request, the ITS station management shall compare the presented priority with the minimum priority required for cross-CI prioritization given in parameter "MinPrioCrossCI" specified in ISO 21218:2018. If the presented priority is less than the minimum priority required, then the ITS station management shall notify unsuccessful prioritization request to the requesting CI by means of the MI-REQUEST.confirm {PrioritizationRequest} service primitive, specified in ISO 21218:2018, with priority set equal to parameter "MinPrioCrossCI" and with status set to "ignored". Otherwise continue with the following steps.

The ITS station management shall

- a) either create or update the cross-CI prioritization table entries "Status", "Priority" and "Request number" as given in the request;
- b) start a prioritization timer T_prioritization for this request;
- c) forward the prioritization request to all known potential interferers by means of the MI-COMMAND.request {PrioritizedRequestToSend}" service primitive specified in ISO 21218:2018, and shall update the status interferer entries in [Table 10](#) to the value "requested";
- d) await until end of the prioritization period, i.e. the timer T_prioritization expired according to the timeout value given in [Table 10](#)
 - acknowledgement messages from all interferers;
 - a release of the actual prioritization request by means of the MI-REQUEST.request {PrioritizationRequest} service primitive specified in ISO 21218:2018 with "status" set to "release";
 - acknowledgements from interferers by means of the MI-COMMAND.confirm {PrioritizedRequestToSend}" service primitive specified in ISO 21218:2018 (the acknowledgements are used to update [Table 10](#));
- e) either
 - notify unsuccessful prioritization to the requesting CI by means of the MI-REQUEST.confirm {PrioritizationRequest} service primitive specified in ISO 21218:2018 with "priority" set equal to parameter "MinPrioCrossCI" specified in ISO 21218:2018 and with "status" set to "ignored" if not all of the potential interferences granted prioritization, or
 - notify successful prioritization to the requesting CI by means of the MI-REQUEST.confirm {PrioritizationRequest} service primitive with "priority" set equal to parameter "MinPrioCrossCI" and with status set to "granted" once all interferers granted prioritization, or
 - acknowledge the release of the actual prioritization request by means of the MI-REQUEST.confirm {PrioritizationRequest} service primitive specified in ISO 21218:2018.

The ITS station management shall apply "ITS station-internal management communications" specified in ISO 24102-4 in case other ITS-SCUs need to be addressed.

8.3.4 Prioritization release

Upon the end of the prioritization period, the ITS station management shall

- send the prioritization release MI-COMMAND.request {PrioritizedRTSrelease}" service primitive specified in ISO 21218:2018 to all known potential interferers, and shall update [Table 10](#) for this request, and
- stop the timer T_prioritization, if applicable.

This release command may be acknowledged with the empty MI-COMMAND.confirm {PrioritizedRTSrelease}" service primitive status set to "noted".

The ITS station management shall apply "ITS station-internal management communications" specified in ISO 24102-4 in case other ITS-SCUs need to be addressed.

9 Regulatory information management

All ITS stations shall comply with regional regulations and policies.

Management of regulatory information (RI) may include the following issues:

- Means to identify the location of the ITS-SU shall be based on a station-internal position, velocity and time service, e.g. as currently specified in ISO 21176^[4];
- CI-specific mechanisms specified in ISO 21218:2018;
- Remote station management specified in ISO 24102-2 shall be used to download applicable regulations and policies.

10 Congestion control

In some radio communication systems, congestion control is managed only at the MAC sub-layer. For many envisaged ITS applications, this approach is not sufficient. Thus congestion control needs to be extended to involve other layers of the OSI protocol stack including the ITS-S management, taking into consideration all available information on potential traffic in all communication channels.

Congestion control is a set of functions implemented in one or more ITS stations that is used to address congestion in the various ITS communication links. Congestion control is decentralized in the sense that ITS stations exchange as little information as possible in the ITS communication links, and control decisions are preferably taken locally inside each ITS station.

[Figure 4](#) shows the basic architecture of congestion control.

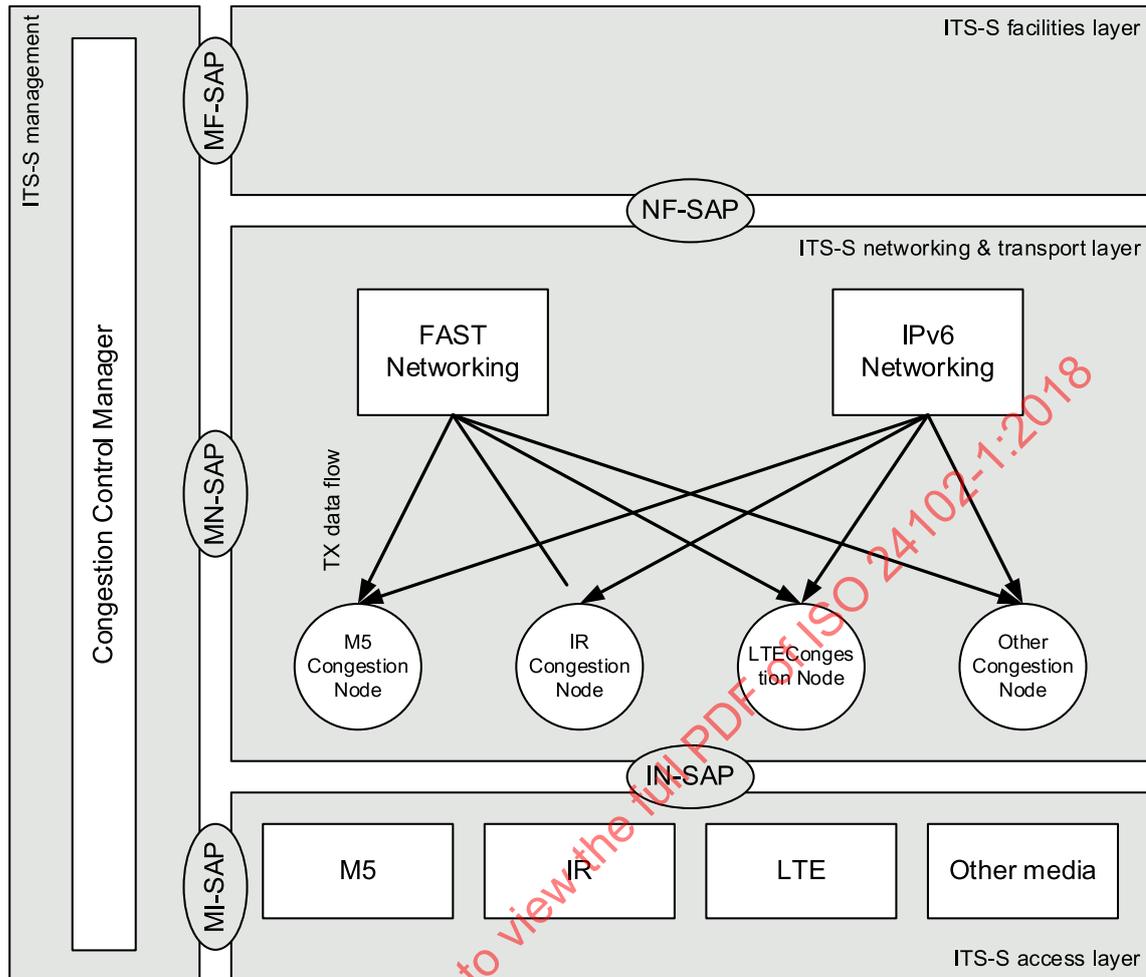


Figure 4 — Congestion control architecture

There are internal congestion nodes in the transmit path of each CI, e.g. M5 and IR ad-hoc access technologies, and LTE cellular network technology, and others presented in [Figure 4](#). External congestion nodes are the physically available channels.

NOTE 1 Congestion in the receive path of a CI is not considered in this document.

A wireless medium shared by neighbouring ITS stations constitutes the essential congestion node. Thus congestion control shall take care of the actual communication channel load observed at the external congestion node and at the internal congestion node.

Whereas the external congestion load cannot be influenced directly, the internal congestion load can be adjusted. This adjustment also has impact on the external congestion load.

Congestion control management may be based on

- QoS management based on user priority as specified in ISO 21218:2018,
- I-Parameters accessible via MI-SAP as specified in ISO 24102-3,
- CIP management via IN-SAP on a packet per packet basis as specified in [6],
- networking information accessible via MN-SAP, e.g. contained in the neighbour list, and
- application information accessible via MF-SAP, e.g. provided at time of registration at the ITS station management for the purpose of CI selection.

The part of the congestion control algorithm running autonomously in a station is a pure performance matter and may be subject to continuous improvements.

ETSI TC ITS is working on standards for congestion control algorithms with a focus on the ITS-M5 localized communications access technology. A congestion control algorithm allocated in the access layer is specified in [9].

11 Networking & transport layer forwarding information management

11.1 General

Management of applicable protocols in the network & transport layer can be done in a simple way on the basis of forwarding information, or applying path and flow management introduced in [Clause 12](#).

The ITS station management maintains networking & transport layer forwarding tables as required by networking & transport layer protocols, e.g. the Fast Networking & Transport layer Protocol (FNTP) specified in ISO 29281-1[6].

11.2 Maintenance commands

Maintenance of such forwarding tables includes creation, maintenance, and deletion of entries applying the MN-COMMAND.request "FWTCommand" of ASN.1 type `FWTcommand` specified in [Annex A](#). The Fast Networking & Transport layer Protocol (FNTP) specified in ISO 29281-1[6] uses the `FWTCommand` with the following instantiations of `FWTcommand`:

- Create a new entry: `FWTcommand.fwt = SetFNTP;`
- Update an entry: `FWTcommand.fwt = DeleteFNTP;`
- Delete an entry: `FWTcommand.fwt = UpdateFNTP.`

The MN-COMMAND.request "FWTCommand" is acknowledged by the MN-COMMAND.confirm "FWTCommand" of ASN.1 type `FWTcommandConf` specified in [Annex A](#); details depend on the networking & transport protocol.

11.3 Procedures

Using the MN-COMMAND.request "FWTCommand" introduced in [11.2](#), the ITS station management,

- upon successful creation of a VCI (see [7.2.3](#)) shall create initial entries in the forwarding tables of all supported networking protocols, if applicable;
- upon successful deregistration (see [7.2.4](#)) shall delete all entries of this CI and the related VCIs in the forwarding tables, if applicable;
- upon successful inactivation (see [7.2.5](#)) shall change the CI state of this CI in the forwarding tables to "inactive", and shall delete the entries of all related VCIs in the forwarding tables;
- upon successful suspension (see [7.2.7](#)) shall change the CI state of this CI and the related VCIs in the forwarding tables to "suspended", if applicable;
- upon successful resuming (see [7.2.8](#)) shall change the CI state of this CI and the related VCIs in the forwarding tables to "connected", if applicable;
- upon successful connection (see [7.2.9](#)) shall change the CI state of this VCI in the forwarding tables to "connected", if applicable.
- upon successful disconnection of a VCI (see [7.2.10](#)) shall change the CI state of this VCI in the forwarding tables to "active", if applicable;

- upon successful deletion of a VCI (see [7.2.11](#)) shall delete the entries of this VCI in the forwarding tables, if applicable.

12 Paths and flows

The general concept of paths and flows in ITS communications is based on similar concepts in IPv6 networking. This concept of paths and flows is essential in describing the abstraction of ITS-S applications from the communications services available in an ITS station (see ISO 21217:2014). This clause provides definitions for path and flow in the context of the ITS station reference architecture specified in ISO 21217. Identification of paths and flows is unique within an ITS station.

A communication path is defined as a sequence of nodes connected by links, starting at a source node and ending at one or more destination nodes. All communication paths have at least one fixed node between the source and the destination node that is referred to as an anchor node. The anchor node divides the communication path into two parts, one part from the source node to the anchor node, and the second from the anchor node to the destination node. The anchor node and the destination node may be one and the same node. The part of the communication path between the source node and the anchor node is referred to as an "ITS-S Path". An "ITS-S Path" is uniquely identified by a LinkID (identifying a CI in the source node and the next hop node) and by the anchor node. The next hop node and the anchor node may be one and the same node.

A flow type is a set of communication requirements/characteristics associated with a specific flow.

NOTE Categories of communication requirements/characteristics include QoS, security, priority, communication type (unicast, broadcast, multicast, bicast, anycast, geocast).

A flow is an identifiable sequence of packets of a given flow type to be transmitted to one or more entities. Each flow is identified by a FlowID which is unique in an ITS station and is mapped to a given path or a set of available paths.

Procedures for ascertaining available ITS-S paths, and for mapping flows to those paths are divided into distinct functions within the ITS-S management.

- Path management is a process for obtaining information about the anchor nodes, next hop nodes and available CIs. This process results in a local list of currently available paths and potentially available paths to be used in the future. The ITS-S management entity exchanges path management information with various communication protocol layers using well defined service primitives specified in ISO 24102-6.
- Flow management is a process of keeping track of the requirements of all flows, and collecting flow statistics. The ITS-S management entity exchanges flow management information with various communication protocol layers using well defined service primitives specified in ISO 24102-6.
- Path selection is a process of determining the most appropriate path(s) from available paths for a given flow or set of flows of the same characteristics. The ITS-S management entity commands the decisions using well defined service primitives specified in ISO 24102-6.

[Figure 5](#) illustrates the building blocks and data flows in the ITS station management entity involved in the path selection process.

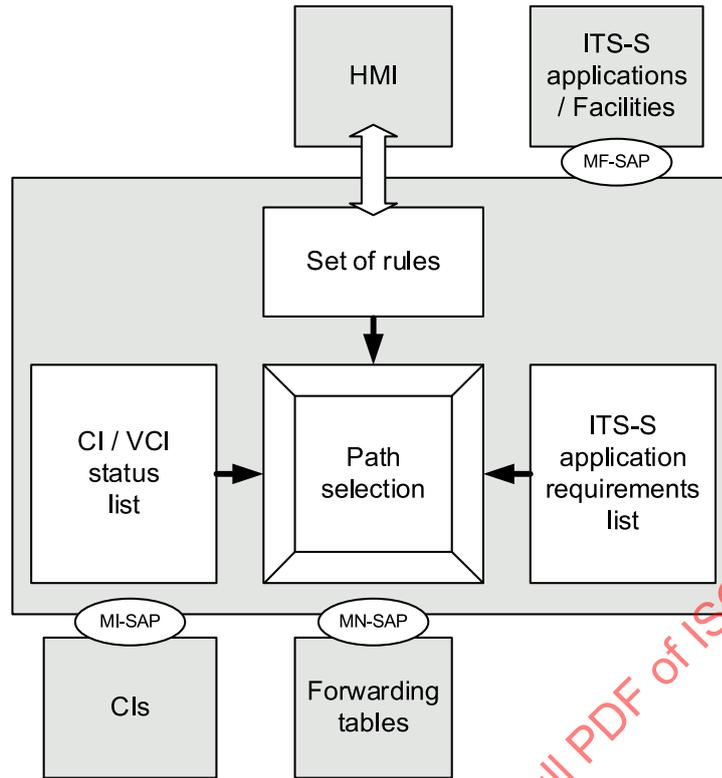


Figure 5 — Path selection

The CI/VCI status list, i.e. as a minimum the VCI list presented in [Table 8](#), extended by the VCI property list presented in [Table 9](#), contains properties, statuses and performance parameters of all CIs and virtual communication interfaces (VCI) in an ITS station. The CI/VCI status list is frequently updated via MI-SAP. An ITS-S router may advertise its properties to all ITS-S hosts, or an ITS-S host may perform a scan of all CIs attached to the local network.

Requirements obtained via MF-SAP using MF-REQUEST "ITS-S-Appl-Reg" specified in ISO 24102-3 is stored in an ITS-S application requirements list.

For the purpose of the above listed management procedures, further tables not illustrated in [Figure 5](#) are maintained:

- Local ITS station information table
Records the status of the local ITS station
- Neighbour ITS station information table
Maintains the status of the other ITS stations that are involved in the path determination. This latter- table will thus not record information about all ITS stations in the neighborhood of the ITS station.
- Path information table
Records various information about all existing or possible paths.
- Flow requirement table
Records performance requirements to be applied to each application flow.
- Flow information table
Contains networking parameters used to identify each flow.

- Flow statistics table
Contains various statistics about each flow and how flows are classified and routed.
- Flow policy table
Contains policies generated by the ITS station management. Allows flows to link to paths.

Further details are specified in ISO 24102-6.

13 Legacy CI

Management of legacy CIs is specified in ISO 29281-2[7].

14 Neighbour list

The ITS station management may maintain a neighbour list, i.e. a list of all known neighbouring stations. This list may contain forwarding table information of networking protocols received via MN-SAP with MN-REQUEST "FWTcommand" specified in [Clause 11](#).

15 Management data elements

15.1 ITS-SCU list

The ITS station management shall maintain information on all ITS-SCUs of its station with details as shown in [Table 7](#). The ITS-SCU list shall be represented in parameter "ITS-scuList" of ASN.1 type `ITS-scuList` specified in [Annex B](#).

Table 7 — Local ITS-SCU-list entry

ITS-SCU-ID	ITS-SCU type	Time of last update of this information	Unique-ID
Identifier of an ITS-SCU unique in an ITS station unit.	"unknown" "ITS-S Host" "ITS-S Router" "ITS-S Host and ITS-S Router" "any"	Usage may depend on implementation.	Text string to be defined by manufacturer of ITS-SCU, indicating type and serial number of hardware, and version of firmware/software.

15.2 VCI list

The ITS station management shall maintain information on the status of media with a minimum of details as shown in [Table 8](#). The VCI list shall be represented in parameter "VciList" of ASN.1 type `VciList` specified in [Annex B](#).

Table 8 — VCI List (medium status list) entry

Link-ID		Medium	CI Status	ConnectMode
LocalCIID	RemoteCIID			
Identifying the CI as specified in ISO 21218.	Value identifying the peer station as specified in ISO 21218.	Set equal to I-parameter "Medium". See ISO 21218.	Set equal to I-Parameter CListatus. See ISO 21218.	Set equal to I-parameter "Connect". See ISO 21218.
...				

There shall be one entry in the VCI list for every existent CI/VCI in the whole ITS station, i.e. having a CI state different to "not_existent" (see ISO 21218).

15.3 VCI performance parameter list

The ITS station management shall maintain information on the actual values of performance parameters of VCIs as presented in [Table 9](#) for every active VCI identified by the LINK-ID. The VCI performance parameter list for all VCIs shall be represented in parameter "VCIperformanceList" of ASN.1 type VCIperformanceList specified in [Annex B](#).

Table 9 — VCI performance parameter list entry

I-Parameter	Comment
Link-ID	Link-ID of VCI
Identified performance parameters; may depend on access technology.	

15.4 Cross-CI prioritization list

If cross-CI prioritization is supported by the ITS station management, the ITS station management in an ITS-SCU shall maintain information for every requesting CI of the same ITS-SCU and for every related request with details as specified in [Table 10](#). The cross-CI prioritization list shall be presented in parameter "CrossCiPrioList" of ASN.1 type CrCiPrioList specified in [Annex B](#).

Table 10 — Cross-CI prioritization table

LINK-ID	Timeout		
Link-ID specified in ISO 21218 of CI requesting cross-CI prioritization.	Maximum prioritization time in a given time unit. Used in interferer to set T_DummyAckGrant. The value is given by PrioritizationRegistration.timeout of the related CI, see ISO 21218.		
Request number	Priority	Status of prioritization request	Timer
Reference number of this request from MI-REQUEST Prioritization Request.seqNo	User priority of packet to be prioritized. Provided in MI-REQUEST Prioritization Request.priority, see ISO 21218	TX status of CI requesting cross-CI prioritization. 0: unknown 1: ignored by all potential interferers 16: requested 32: all potential interferers released 128: granted by all potential interferers See ISO 21218.	T_prioritization
Interferer ID	Status interferer		
Unique reference number of interferer #1 (Link-ID). Derived from MedTyp as provided in Prioritization Registration.interferers, see ISO 21218 by checking the VCI list.	0: unknown 1: request ignored Set upon reception of acknowledgement from this interferer. 16: requested (set upon prioritization request being sent) 32: released (set upon prioritization release being sent) 128: prioritization granted Set upon reception of acknowledgement from this interferer		
Unique reference number of interferer #2			
...			
Request number	Priority	Status	Timer
... further request			

15.5 Application requirements list

The ITS station management shall maintain information for every ITS-S application process being registered at the CI selection manager. The application requirements list shall be represented in parameter "ApplicationRequirementsList" of ASN.1 type `ApplicationRequirementsList` specified in [Annex B](#). Further details are specified in ISO 17423.

This list is also used for path and flow management introduced in [Clause 12](#).

16 Dynamic data

Dynamic data are data being registered at the ISO standards maintenance portal <http://standards.iso.org/iso/24102/-1/ed-2/en>. New details of dynamic data may be specified in other standards based on the generic definitions in this document, and will become part of this document once the other standard applies for a registration of these dynamic data details.

Dynamic data are:

- Management parameters, see [Annex B](#);
- Instantiations of the MN-COMAMND "FWTcommand", see [Clause 11](#);
- ITS-SCU types, see [B.2.7](#).

17 Conformance

An "Implementation Conformance Statements" (ICS) proforma used to declare elements of an implementation conforming to this document is provided in [Annex C](#).

In order to declare conformance with further features specified in this document, ICS/PICS proforma specified in referenced standards are applicable also.

18 Test methods

A "Test Suite Structure & Test Purposes" (TSS&TP) specification for conformance testing is not yet specified.

An "Abstract Test Suite" (ATS) for conformance testing is not yet specified.

Annex A (normative)

ASN.1 modules

A.1 Overview

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

— ITSmanagement { iso (1) standard (0) calm-management (24102) local (1) asnm-1 (1) version2 (2)}

In case the ASN.1 specifications given in this Annex do not conform 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 the ISO standards maintenance portal at <http://standards.iso.org/iso/24102/-1/ed-2/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 shall apply if no other explicit requirement on encoding is given.

A.2 Module CALMmanagement

```
ITSmanagement { iso (1) standard (0) calm-management (24102) local (1)
asnm-1 (1) version2 (2)}

DEFINITIONS AUTOMATIC TAGS ::= BEGIN

IMPORTS

-- C-ITS Data Dictionary (still in ISO 17419)
UserPriority, TimeDurationValue, Time48IAT, NullType FROM
CITSdataDictionary1 {iso(1) standard(0) cits-applMgmt (17419)
dataDictionary (1) version1 (1)}

-- ISO 17419
ITSsaid, ITSscuId, ITSatt, ITSsuID, ITSscuID FROM CITSapplMgmtApplReg
{iso(1) standard(0) cits-applMgmt (17419) applRegistry (2) version2 (2)}

-- ISO 17423
ITSSappCPReqReg, MediumCost FROM CITSapplReq {iso(1) standard(0)
cits-applReq (17423) asnm-1 (1) version2 (2)}

-- ISO 21218
CISTatus, Connect, DataRate, DataRatesNetwork, Directivity,
ITSscuKinematicState, Link-ID, MACaddress, RTSseqNo, RTSstatus,
LogicalChannels, I-Param, CommuniationRangeReference FROM ITSllsap
{iso(1) standard(0) calm-ll-sap(21218) asnm-1 (1) version2 (2)}

RSMPTimeout FROM ITSSremoteMgmt2 { iso (1) standard (0) calm-management
(24102) remote (2) asnm-1 (1) version2 (2)}

SetFNTTP, UpdateFNTTP, DeleteFNTTP, SetConfFNTTP, UpdateConfFNTTP,
DeleteConfFNTTP, SetNotFNTTP, UpdateNotFNTTP, DeleteNotFNTTP FROM ITSfntp
{ iso (1) standard (0) calm-nonip(29281) fntp(1) asnm-1 (1) version2 (2)}

;

-- End of IMPORTS
```

-- Types

ApplicationRequirementsList ::= ITSSappCPReqReg -- from TS 17423

-- Cross-CI Prioritization support

CrCiPrioList ::= SEQUENCE OF CrCiPrioReq

```
CrCiPrioReq ::= SEQUENCE {
    linkId      Link-ID, -- requesting CI
    timeout     TimeDurationValue,
    request     CCPrequest,
    interferer  CCPpotentialInterferers
}
```

CCPrequest ::= SEQUENCE OF CCPsingleRequest

```
CCPsingleRequest ::= SEQUENCE {
    seqNo      RTSseqNo,
    priority   UserPriority,
    status     RTSstatus -- allowed: unknown, requested, granted,
                released
}
```

CCPpotentialInterferers ::= SEQUENCE OF CCPpotInt -- potential interferers

```
CCPpotInt ::= SEQUENCE {
    linkID     Link-ID, -- interferer
    status     RTSstatus -- allowed: unknown, requested, released,
                granted
}
```

-- ITS-SU configuration

-- List of info on all VCIs of the whole ITS-SU

ITS-scuList ::= SEQUENCE OF ITS-scuListEntry

```
ITS-scuListEntry ::= SEQUENCE {
    its-scuId   ITS-scuId,
    its-scuType ITS-scuType,
    time        Time48IAT,
    uniqueID    UTF8String
}
```

VciList ::= SEQUENCE OF VciListEntry

```
VciListEntry ::= SEQUENCE {
    linkId      Link-ID,
    medType     ITSsatt,
    status      Cstatus,
    connect     Connect
}
```

VCiperformanceList ::= SEQUENCE OF VCiperformance

```
VCiperformance ::= SEQUENCE {
    linkId      Link-ID,
    performanceParams PerformanceParameters
}
```

PerformanceParameters ::= SEQUENCE OF I-Param

```
/* Included in PerformanceParameters
channelType LogicalChannels
minUserPrio UserPriority
dataRateNW  DataRate
dataRatesNW DataRatesNetwork
directivity Directivity
minUserPrio UserPriority
commRangeRef CommuniationRangeReference
cost        MediumCost
```

```
reliability Reliability
... may be changed or extended
*/
```

-- Management parameters (dynamic data)

```
RefMPARAM ::= INTEGER {
  c-stationID (0), -- globally unique ID of ITS-SU
  c-minPrioCrossCI (1),
  c-stationKinematicVector (2),
  c-iTS-scuId (3), -- address of ITS-SCU used by IICP
  c-vciList (4),
  c-crCiPrioList (5),
  c-stationUnitID (6), -- globally unique ID of the ITS-SCU
  c-applReqList (7),
  c-vCIperformList (8),
  c-talive (9),
  c-iTS-scuList (10),
  c-RSMPTimeout (11)
}
```

```
MPARAM ::= CLASS {
  &paramRef RefMPARAM UNIQUE,
  &Parameter
}
```

```
Param24102 ::= SEQUENCE{
  paramNo MPARAM.&paramRef({M-Params}),
  parameter MPARAM.&Parameter({M-Params}{@paramNo})
}
```

```
M-Params MPARAM::={stationID | minPrioCrossCI | itsScuKinematicState |
iTS-scuId | vciList | crCiPrioList | stationUnitID | applReqList |
vCIperformList | talive | iTS-scuList | rsmpTimeout, ...}
```

```
stationID MPARAM::={&paramRef c-stationID, &Parameter StationID}
minPrioCrossCI MPARAM::={&paramRef c-minPrioCrossCI, &Parameter
MinPrioCrossCI}
itsScuKinematicState MPARAM::={&paramRef c-stationKinematicVector,
&Parameter ItsScuKinematicState}
iTS-scuId MPARAM::={&paramRef c-iTS-scuId, &Parameter ITS-scuId}
vciList MPARAM::={&paramRef c-vciList, &Parameter VciList}
crCiPrioList MPARAM::={&paramRef c-crCiPrioList, &Parameter
CrCiPrioList}
stationUnitID MPARAM::={&paramRef c-stationUnitID, &Parameter
StationUnitID}
applReqList MPARAM::={&paramRef c-applReqList, &Parameter
ApplicationRequirementsList}
vCIperformList MPARAM::={&paramRef c-vCIperformList, &Parameter
VCIperformanceList}
talive MPARAM::={&paramRef c-talive, &Parameter Talive}
iTS-scuList MPARAM::={&paramRef c-iTS-scuList, &Parameter
ITS-scuList}
rsmpTimeout MPARAM::={&paramRef c-RSMPTimeout, &Parameter
RSMPTimeout}
```

```
StationID::=ITSsuID
```

```
MinPrioCrossCI::=UserPriority
```

```
StationUnitID::=ITSsuID
```

```
Talive::=TimeDurationValue -- time in ms
```

```
ITS-scuType ::= INTEGER{
  unknown (0),
  host (1),
  router (2),
  testSystem (3), -- conformance testing, see CEN/ISO TS 20026
  testCiUnit (4), -- conformance testing, see CEN/ISO TS 20026
}
```

```

hostAndRouter (5),
any (255)
} (0..255)

-- N&T layer forwarding tables

-- Actions for specific N&T protocol
RefFWT ::= INTEGER {
  c-fntpSet      (0), -- in support of FNTF
  c-fntpUpdate  (1),
  c-fntpDelete  (2)
}

FWT ::= CLASS {
  &fwtRef RefFWT UNIQUE,
  &Fwt
}

-- MN-COMMAND.request

FWTcommand ::= SEQUENCE {
  fwtNo          FWT.&fwtRef ({FwtCommands}),
  fwt            FWT.&Fwt ({FwtCommands}){@fwtNo}
}

-- in support of ISO 29281-1 FNTF
FwtCommands FWT ::= {fntpset | fntpupdate | fntpdelete, ...}

fntpsetFWT ::= {&fwtRef c-fntpSet, &Fwt SetFNTF}
fntpupdate  FWT ::= {&fwtRef c-fntpUpdate, &Fwt UpdateFNTF}
fntpdelete  FWT ::= {&fwtRef c-fntpDelete, &Fwt DeleteFNTF}

-- MN-COMMAND.confirm
FWTcommandConf ::= SEQUENCE {
  fwtNo          FWT.&fwtRef ({FwtCommandsConf}),
  fwt            FWT.&Fwt ({FwtCommandsConf}){@fwtNo}
}

-- in support of ISO 29281-1 FNTF
FwtCommandsConf FWT ::= {fntpsetConf | fntpupdateConf | fntpdeleteConf, ...}

fntpsetConf  FWT ::= {&fwtRef c-fntpSet, &Fwt SetConfFNTF}
fntpupdateConf FWT ::= {&fwtRef c-fntpUpdate, &Fwt UpdateConfFNTF}
fntpdeleteConf FWT ::= {&fwtRef c-fntpDelete, &Fwt DeleteConfFNTF}

-- MN-REQUEST.request
FWTnotify ::= SEQUENCE {
  fwtNo          FWT.&fwtRef ({FwtNotifys}),
  fwt            FWT.&Fwt ({FwtNotifys}){@fwtNo}
}

-- in support of ISO 29281-1 FNTF
FwtNotifys FWT ::= {fntpsetNotify | fntpupdateNotify | fntpdeleteNotify, ...}

fntpsetNotify  FWT ::= {&fwtRef c-fntpSet, &Fwt SetNotFNTF}
fntpupdateNotify FWT ::= {&fwtRef c-fntpUpdate, &Fwt UpdateNotFNTF}
fntpdeleteNotify FWT ::= {&fwtRef c-fntpDelete, &Fwt DeleteNotFNTF}

FWTnotifyConf ::= NullType

-- Value definitions

version INTEGER(0..255) ::= 2

/*
The ASN.1 specification has been checked for conformance to the ASN.1
standards with the OSS ASN-1STEP tool
*/

```

END

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

The following definitions are dynamic extensions of types defined in ISO 24102-3 with CLASS. An up-to-date version of the ASN.1 module

— ITSSapCmdMn { iso (1) standard (0) calm-management (24102) msap (3) commands (3) mn (3) version0 (0)}

including all dynamic updates is published on the ISO standards maintenance portal at <http://standards.iso.org/iso/24102/-1/ed-2/en>.

IMPORT statement to be added:

```
/* MN-COMMAND */
```

```
RefFWT, FWT, FWTcommand, FwtCommands, FWTcommandConf, FwtCommandsConf  
FROM ITSmanagement { iso (1) standard (0) calm-management (24102)  
local (1) asnm-1 (1) version2 (2)}
```

```
/* MN-COMMAND */
```

```
RefFWT, FWT, FWTnotify, FwtNotifys, FWTnotifyConf FROM ITSmanagement  
{ iso (1) standard (0) calm-management (24102) local (1) asnm-1 (1)  
version2 (2)}
```

To be added to MN-Command:

```
c-fWTcommand RefMNSAP-C::=<value 'a'>
```

```
MN-Command MNSAP-CR::={fWTcommand, ...}  
fWTcommand MNSAP-CR::={&mxref c-fWTcommand, &MXParam FWTcommand}
```

```
MN-CmdConfirm MNSAP-CC::={fWTcommandConf, ...}  
fWTcommandConf MNSAP-CC::={&mxref c-fWTcommand, &MXParam FWTcommandConf}
```

To be added to MN-Request:

```
c-fWTnotify RefMNSAP-C::=<value 'a'>
```

```
MN-RequestMNSAP-RR::={fWTnotify, ...}  
fWTnotify MNSAP-RR::={&mxref c-fWTnotify, &MXParam FWTnotify}
```

```
MN-CmdConfirm MNSAP-RC::={fWTnotifyConf, ...}  
fWTnotifyConf MNSAP-RC::={&mxref c-fWTnotify, &MXParam FWTnotifyConf}
```

Annex B (normative)

Management parameters

B.1 Overview

[Table B.1](#) presents an overview of management parameters with short descriptions.

The following clause in this annex presents details of the parameters.

The ASN.1 coding of the parameters is presented in [Annex A](#).

Table B.1 — Management parameters

Parameter name/ ASN.1 type	Description
StationID/StationID	Globally unique identifier of the ITS station unit specified in ISO 17419 with the acronym ITS-SUID. See B.2.1 .
MinPrioCrossCI/MinPrioCrossCI	Minimum user priority required for cross-CI prioritization. See B.2.2 .
ItsScuKinematicState/ ItsScuKinematicState	Actual kinematics state of station. Timestamp, latitude, longitude, altitude, speed, heading. See B.2.3 .
ITS-SCU-ID/ITS-scuId	Actually valid ITS-SCU-ID. See B.2.4 .
VciList/VciList	List containing information on all CIs and VCIs. Specified in Table 8 . See B.2.5 .
CrossCiPrioList/CrCiPrioList	Cross-CI prioritization list specified in Table 10 . See B.2.6 .
StationUnitID/StationUnitID	Globally unique identifier of the ITS-SCU specified in ISO 17419 with the acronym ITS-SCUID. See
ITS-scuList/ITS-scuList	ITS-SCU list specified in Table 7 . See B.2.7
ApplicationRequirementsList/ ApplicationRequirementsList	Application requirements list; see 15.5 . Sequence of ITSSappCPReqReg specified in ISO 17423.
VCIperformanceList/ VCIperformanceList	VCI performance parameter list specified in Table 9 . See B.2.9 .
Talive/Talive	Period of transmission of the "alive-signal" of an ITS-SCU. See B.2.10 .
RSMPtimeout/RSMPtimeout	Timeout used by the Remote Station Management Protocol specified in ISO 24102-2.

B.2 Description

B.2.1 StationID (ITS-SUID)

[Table B.2](#) specifies details of parameter "StationID".

Table B.2 — StationID

Param24102 type	ASN.1 type	Description
.stationID	ITSsuID	Globally unique identifier of an ITS station unit.

Due to privacy requirements, a unique station/server ID could be prohibited. In this case, the StationID shall be generated randomly. It is expected that roadside installations will be allowed to use a globally unique number.

B.2.2 MinPrioCrossCI

[Table B.3](#) specifies details of parameter "MinPrioCrossCI".

Table B.3 — Parameter MinPrioCrossCI

Param24102 type	ASN.1 type	Description
.minPrioCrossCI	UserPriority	Minimum user priority needed to request cross-CI protection.

B.2.3 ItsScuKinematicState

[Table B.4](#) specifies details of parameter "StationKinematicVector".

Table B.4 — Parameter ItsScuKinematicState

Param24102 type	ASN.1 type	Description
.itsScuKinematicState	ItsScuKinematicState	Specified in ISO 21218.

NOTE A facility service for position, velocity and time is being standardized in ISO 21176^[4].

B.2.4 ITS-SCU-ID

[Table B.5](#) specifies details of parameter "ITS-SCU-ID".

Table B.5 — Parameter ITS-SCU-ID

Param24102 type	ASN.1 type	Description
.its-scuId	ITS-scuId	ITS-SCU-ID uniquely identifying an ITS-SCU in an ITS station.

NOTE This parameter originally was specified in ISO 24102-4 and used for ITS station-internal management communications. There is also another ITS-SCU identifier specified in ISO 17419.

B.2.5 VciList

[Table B.6](#) specifies details of parameter "VCIlist".

Table B.6 — Parameter VCIIlist

Param24102 type	ASN.1 type	Description
.vciList	VciList	Information for every CI/VCI.
VciList. vciListEntry	VciListEntry	Contains a sequence of the following attributes of a CI/VCI.
VciListEntry. linkId	Link-ID	Link-ID of VCI/CI. See ISO 21218.
VciListEntry. medType	ITSatt	Medium type of CI/VCI. Set equal to I-Parameter "MedType". See ISO 21218.
VciListEntry. status	CIstatus	Status of the CI. Set equal to I-Parameter "CIstatus". See ISO 21218.
VciListEntry. connect	Connect	Connect mode of CI. Set equal to I-Parameter "Connect". See ISO 21218.

B.2.6 CrossCiPrioList

Table B.7 specifies details of parameter "CrossCiPrioList".

Table B.7 — Parameter CrossCiPrioList

Param24102 type	ASN.1 type	Description
.crCiPrioList	SEQUENCE	See Table 10.
CrCiPrioReq	SEQUENCE	
CrCiPrioReq. linkId	See ISO 21218.	Link-ID of requesting CI.
CrCiPrioReq. timeout	TimeDurationValue	Maximum prioritization time. Used with timer T_prioritization.
CrCiPrioReq. request	CCPrequest	Sequence of requests.
CCPsingleRequest. seqNo	RTSseqNo	Unique reference number of this request. See ISO 21218.
CCPsingleRequest. priority	UserPriority	User priority of packet for which prioritization is requested. See ISO 21218.
CCPsingleRequest. status	RTSstatus	Request status. See Table 10.
CrCiPrioReq. interferer	CCPpotentiInterferers	Sequence of interferers.
CCPpotInt. linkId	Link-ID	CIID of interferer. See ISO 21218.
CCPpotInt. status	RTSstatus	Status of interferer. See Table 10.

B.2.7 StationUnitID

Table B.8 specifies details of parameter "StatioUnitID".

Table B.8 — Parameter StationUnitID

Param24102 type	ASN.1 type	Description
.talive	Talive	Period of transmission of "alive-signal" of an ITS-SCU.

B.2.8 ApplicationRequirementsList

Table B.9 specifies details of parameter "ApplicationRequirementsList".

Table B.9 — Parameter ApplicationRequirementsList

Param24102 type	ASN.1 type	Description
.applReqList	ITSSappCPReqReg	Application requirements list used by CI selection manager. Specified in ISO 17423.

B.2.9 VCPerformanceList

[Table B.10](#) specifies details of parameter "VCPerformanceList".

Table B.10 — Parameter VCPerformanceList

Param24102 type	ASN.1 type	Description
.vCPerformanceList	VCPerformanceList	VCI performance parameter list.
VCPerformanceList	VCPerformance	Sequence of performance infos
VCPerformance. linkId	Link-ID	Link-ID of VCI, specified in ISO 21218, characterized by the following performance parameters.
VCPerformance. performanceParameters	PerformanceParameters	Sequence of applicable I-Parameters specified in ISO 21218.

B.2.10 Talive

[Table B.11](#) specifies details of parameter "Talive".

Table B.11 — Parameter Talive

Param24102 type	ASN.1 type	Description
.talive	Talive	Period of transmission of "alive-signal" of an ITS-SCU.

B.2.11 ITS-scuList

[Table B.12](#) specifies details of parameter "ITS-scuList".

Table B.12 — Parameter ITS-scuList

Param24102 type	ASN.1 type	Description
.iITS-scuList	ITS-scuList	Local ITS-SCU list.
ITS-scuListEntry. iITS-scuId	ITS-scuId	Unique identifier of an ITS-SCU of the same ITS station.
ITS-scuListEntry. its-scuType	ITS-scuType	Type of ITS-SCU: 0: "unknown" 1: "Host" 2: "Router" 3: "Test System" 4: "Test CI Unit" 5: "Host and Router" 255: "any"
ITS-scuListEntry. time	Time48IAT	Time of last update of this information.
ITS-scuListEntry. uniqueID	UTF8String	Text string to be defined by manufacturer of ITS-SCU, indicating e.g. type and serial number of hardware, and version of firmware/software.

B.2.12 RSMPTimeout

[Table B.11](#) specifies details of parameter "RSMPTimeout".

Table B.13 — Parameter Talive

Param24102 type	ASN.1 type	Description
.rsmpTimeout	RSMPTIMEOUT	Timeout used by the Remote Station Management Protocol specified in ISO 24102-2.

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Annex C (normative)

Implementation conformance statement (ICS) proforma

Users of this document may

- freely reproduce the ICS proforma in this annex so that it can be used for its intended purposes, and
- may further publish the completed ICS.

C.1 Guidance for completing the ICS proforma

C.1.1 Purposes and structure

The purpose of this Implementation Conformance Statement (ICS) proforma is to provide a mechanism whereby a supplier of an implementation of the requirements defined in this document may provide information about the implementation in a standardized manner.

The ICS proforma is subdivided into clauses for the following categories of information:

- guidance for completing the ICS proforma;
- identification of the implementation;
- identification of the implementation;
- global statement of conformance.

C.1.2 Abbreviated terms and conventions

The ICS proforma contained in this annex is comprised of information in tabular form in accordance with the guidelines presented in ISO/IEC 9646-7[11].

Item column	The item column contains a number which identifies the item in the table.
Item description column	The item description column describes in free text each respective item (e.g. parameters).
Status column	<p>The notations defined in ISO/IEC 9646-7[11] are used for the status column:</p> <p>m mandatory – the capability is required to be supported.</p> <p>o optional – the capability may be supported or not.</p> <p>n/a not applicable – in the given context, it is impossible to use the capability.</p> <p>x prohibited (excluded) – there is a requirement not to use this capability in the given context.</p> <p>o.i qualified optional – for mutually exclusive or selectable options from a set. "i" is an integer which identifies an unique group of related optional items and the logic of their selection which is defined immediately following the table.</p>

	<p>ci conditional – the requirement on the capability ("m", "o", "x" or "n/a") depends on the support of other optional or conditional items. "i" is a string containing the respective Table number, followed by a dash, followed by a sequential number identifying a unique conditional status expression which is defined immediately following the respective Table.</p> <p>r as specified in the related referenced standard of the CI access technology.</p>
Reference column	The reference column makes reference to this document, except where explicitly stated otherwise.
Support column	<p>The support column shall be filled in by the supplier of the implementation. The following common notations, defined in ISO/IEC 9646-7[1], are used for the support column:</p> <p>Y or y supported by the implementation.</p> <p>N or n not supported by the implementation.</p> <p>N/A, n/a, or no answer required (allowed only if the status is n/a, directly or after evaluation of a conditional status).</p>
Values allowed column	<p>The values allowed column contains the type, the list, the range, or the length of values allowed. The following notations are used:</p> <ul style="list-style-type: none"> — range of values: <min value> .. <max value> — list of values: <value1>, <value2>, ..., <valueN> — list of named values: <name1>(<val1>), <name2>(<val2>), ..., <nameN>(<valN>) — length: size (<min size> .. <max size>)
Values supported column	The values supported column shall be filled in by the supplier of the implementation. In this column, the values or the ranges of values supported by the implementation shall be indicated.
References to items	For each possible item answer (answer in the support column) within the ICS proforma a unique reference exists, used, for example, in the conditional expressions. It is defined as the table identifier, followed by a solidus character "/", followed by the item number in the table. If there is more than one support column in a table, the columns are discriminated by letters (a, b, etc.), respectively.
Prerequisite line	<p>A prerequisite line takes the form: Prerequisite: <predicate>.</p> <p>A prerequisite line after a clause or table title indicates that the whole clause or the whole table is not required to be completed if the predicate is FALSE.</p>

C.1.3 Instructions for completing the ICS proforma

The supplier of the implementation shall complete the ICS proforma. In particular, an explicit answer shall be entered using the notation described in [C.1.2](#).

C.2 Identification of the Implementation

Identification of the Implementation Under Test (IUT) and the system in which it resides, i.e. the System Under Test (SUT), shall be filled in so as to provide as much detail as possible regarding version numbers and configuration options.

The product supplier information and client information shall both be filled in if they are different.