BS ISO 24102-6:2018

BSI Standards Publication

Intelligent transport systems — Communications access for land mobiles (CALM) — ITS station management

Part 6: Path and flow management

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National foreword

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INTERNATIONAL STANDARD

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Intelligent transport systems — Communications access for land mobiles (CALM) — ITS station management —

Part 6:
Path and flow management

Systèmes intelligents de transport — Accès aux communications des services mobiles terrestres (CALM) — Gestion des stations ITS —

Partie 6: Titre manque

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Contents

Page

Foreword ..... **v**
Introduction ..... **vi**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Symbols and abbreviated terms **3**
5 Overview **4**
5.1 Relation with the ITS station reference architecture 4
5.2 ITS-S flows 4
5.3 ITS-S communication profiles 4
5.4 ITS-S paths 4
5.5 ITS-S capabilities 6
5.6 Path and flow management 6
5.7 ITS station management functionalities 8
5.8 ITS station management information tables 9
5.9 Interaction with ITS station layers 9
6 Requirements for flow management and communication profile selection **11**
6.1 ITS-S flow type parameters 11
6.2 ITS-S flow parameters 13
6.3 ITS-S flow monitoring 14
6.4 Notification of a communication profile determination 15
6.5 Processing request to provide communication profiles 15
6.6 Processing flow statistic reports 15
7 Requirements for flow registration **16**
7.1 Processing ITS-S flow type registration from ITS-S-AP 16
7.2 Processing RegisterFlow from ITS-S-AP 16
7.3 Processing ReleaseFlow request from ITS-S-AP 17
7.4 Checking ITS-S-AP credentials 17
7.5 Checking communication requirements 17
7.6 Checking ITS-S path availability 18
7.7 Communication profile determination 18
8 Requirements for path management **19**
8.1 ITS-S path parameters 19
8.2 Topological and geographic position parameters 19
8.3 Collecting topological and geographical information 20
8.4 Path management 21
8.5 ITS-S path monitoring 21
8.6 Interface management 22
9 Requirements for path selection **22**
9.1 General requirements for path selection 22
9.2 Routing policies parameters 22
9.3 Notifying path selection 22
9.4 Notifying routing policies 23
10 Requirements for ITS-S capabilities management **23**
10.1 Maintenance of ITS-S capabilities information 23
10.2 Determination of internal ITS-S capabilities 24
10.3 Determination of neighbour ITS-S capabilities 24
10.4 Activating ITS-S capabilities in the ITS-S Managed Service Entity 24
10.5 Suspending ITS-S capabilities in the ITS-S Managed Service Entity 24
10.6 Resuming ITS-S capabilities in the ITS-S Managed Service Entity 25

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10.7 Reporting about ITS-S capabilities in the ITS-S Managed Service Entity 25
Annex A (normative) **M*-COMMANDs from SME** **26**
Annex B (normative) **M*-REQUESTs to the SME** **37**
Annex C (normative) **PFM error codes** **45**
Annex D (normative) **ASN-1 modules** **46**
Bibliography **64**

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

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

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Introduction

This document is part of a series of International Standards for communications access for land mobiles (CALM). An introduction to this series of International Standards is provided in ISO 21217:2014.

This document is Part 6 of a series of International Standards that specifies path and flow management as part of the local ITS station management.

The ITS station management entity provides functionalities related to the management of communication protocol layers and the security entity presented in the ITS station reference architecture specified in ISO 21217:2014 and presented in Figure 1 — ITS station reference architecture.

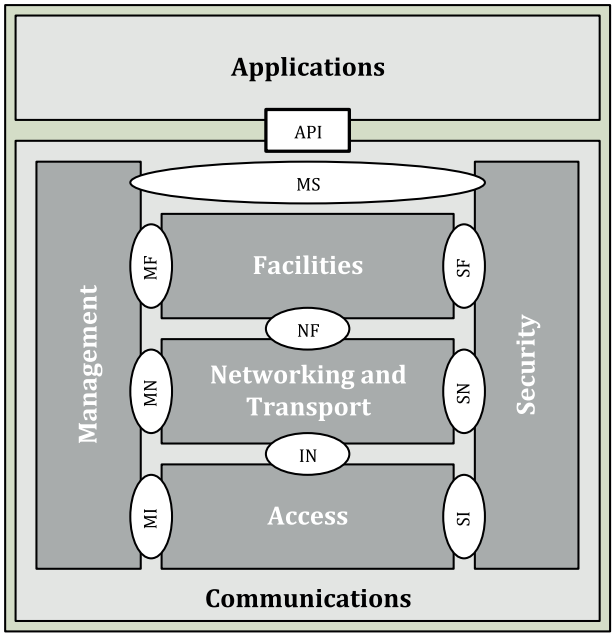

Figure 1 — ITS station reference architecture

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

This document defines the functionalities of the ITS station that are used to collect the information necessary for path and flow management:

— the capabilities of all layers of the ITS station (functionalities, technologies and protocols) supported by the ITS station;

— the capabilities of neighbour ITS stations (functionalities, technologies and protocols) supported by the neighbour ITS stations;

— the current network conditions (availability and characteristics of a communication interface, availability of Internet access, etc.);

— the existing data flows and their communication requirements (identity of the destination node, security procedures applied to the data flow, end-to-end delay, packet size, etc);

— the available routing paths to a destination node;

— how a data flow is mapped to the selected routing path.

The information collected by the ITS station management entity is used to determine the most appropriate communication profile (facilities protocols, transport protocols, network protocols, access technologies and communication channels) and routing path indicating where to route packets of each

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data flow, according to the communication requirements provided by the application and depending on the current network conditions. The method to perform this determination has competitive value and is out of scope of this document.

This document provides a detailed specification of the concept of paths and flows introduced in ISO 21217:2014. It complements ISO 17423:2018, ISO/TS 17429:2017, and ISO 24102-3[17]. The concept of paths and flows is essential for abstracting ITS station applications from the communications services available in the ITS station and for selecting the most appropriate communication profile (i.e. protocol stack).

The functionalities specified in this document apply to all types of ITS stations without distinction. They are useful for ITS stations equipped with various access technologies and/or various protocol stacks.

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INTERNATIONAL STANDARD **ISO 24102-6:2018**

Intelligent transport systems — Communications access for land mobiles (CALM) — ITS station management —

Part 6: Path and flow management

1 Scope

This document specifies parameters and procedures for the ITS station management entity to manage data flows and routing paths associated with available communication resources in an ITS station, and to map data flows to routing paths.

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 17423:2018, *Intelligent transport systems — Cooperative systems — ITS application requirements and objectives for selection of communication profiles*

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

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 http://www.electropedia.org/

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

3.1
anchor node
logical node contained in an ITS-S path which, when instantiated, has a locator known by the source node

3.2
destination node
communication end point of an ITS-S path

Note 1 to entry: In multicast operation, there can be many distinct destination nodes.

3.3
ITS-S egress anchor node
second (last) anchor node contained in an ITS-S path

3.4
ITS-S ingress anchor node
first anchor node contained in an ITS-S path

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3.5
ITS-S anchor segment
segment of an ITS-S path that starts at an ITS-S ingress anchor node and ends up at an ITS-S egress anchor node

3.6
ITS-S capability
uniquely addressable protocol or functionality that is part of an ITS-S Managed Service Entity

Note 1 to entry: Examples of ITS-S capabilities in the ITS station facilities layer are generic ITS-S facilities layer services specified in ISO/TS 17429 (Communication Profile Handler, Facilities Services Handler, Content Subscription Handler), the position and time service defined in ISO/TS 21176[1)], the security service defined in ISO/TS 21177[2)]; examples of ITS-S capabilities in the ITS-S networking and transport layer are IPv6 functionalities defined in ISO 21210 (IPv6 neighbour discovery, IPv6 forwarding, IPv6 mobility support, ...), the fast service announcement protocol defined in ISO 22418[3)], etc.

3.7
ITS-S communication profile
ITS-SCP
parameterized ITS-S communication protocol stack (set of protocols composing all the ITS station layers) that allows communication end points to communicate with one another

3.8
ITS-S flow
identifiable sequence of packets of a given ITS-S flow type transmitted between a source node and a destination node

3.9
ITS-S flow identifier
FlowID
identifier, being unique within an ITS station unit, that identifies an ITS-S flow

3.10
ITS-S flow type
set of characteristics describing a data flow

Note 1 to entry: Flow types could be pre-assigned, well known and recorded with some authority registry or defined by the applications following a number of conventions

3.11
ITS-S flow type identifier
FlowTypeID
identifier being unique within the ITS station that identifies an ITS-S flow type

3.12
ITS-S path
directed sequence of nodes connected by links starting at a source node, traversing a communication interface of the source ITS-S, an ITS-S ingress anchor node and an ITS-S egress anchor node, ending at a destination node

Note 1 to entry: In some circumstances, the ITS-S ingress anchor node and the ITS-S egress anchor nodes might be collapsed with the destination node (i.e. the roles of the ITS-S ingress anchor node and the ITS-S egress anchor node are played by the destination node).

Note 2 to entry: For bidirectional communications, two such ITS-S paths exist, i.e. one starting at each communication end point. Note further that there could be multiple ITS-S paths between a source and its destination.

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1) Under development.

2) Under development.

3) To be published.

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3.13
ITS-S path identifier
PathID
identifier of a given ITS-S path being unique within an ITS station

3.14
ITS-S managed service entity
MSE
uniquely addressable entity in an ITS-S layer comprised of a set of related ITS-S capabilities

Note 1 to entry: Examples of ITS-S managed service entities are: a communication module in the ITS-S access technologies layer (M5, cellular, etc.), a protocol suite in the ITS-S networking and transport layer (IPv6, FNTP, GeoNetworking, 6LoWPAN, etc.), the generic facilities MSE at the ITS-S facilities layer.

3.15
locator
identifier of the topological location of a node in a communication network

Note 1 to entry: A locator of an ITS station is the identifier of an ITS-S ingress anchor node (an ITS station has as many locators as there are ITS-S ingress anchor nodes to which it is attached).

3.16
registered ITS-S flow
ITS-S flow that has been allocated an ITS-S FlowID

3.17
source node
communication end point that creates packets for transmission to peer entities

4 Symbols and abbreviated terms

CI	Communication Interface, see ISO 21218[14]
ITS-S-FlowID	ITS Station Flow Identifier
ITS-S-FlowTypeID	ITS Flow Type Identifier
ITS-S	ITS station, see ISO 21217:2014
ITS-S-AP	ITS Station Application Process
ITS-S-APID	ITS Station Application Process Identifier
ITS-SCP	ITS station communication profile
ITS-SCU-CMC	ITS-SCU Communication Management Centre, see ISO 24102-2[16]
MSE	ITS station Managed Service Entity
PathID	ITS station Path Identifier
PFM, pfm	Path and Flow Management
SAL	ITS Station Access Layer
SFL	ITS Station Facilities Layer
SME	ITS Station Management Entity
SNTL	ITS Station Networking and Transport Layer

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VCI Virtual Communication Interface, see ISO 21218[14]

5 Overview

5.1 Relation with the ITS station reference architecture

This document specifies functionalities of the ITS "Station Management Entity" (SME) of the communication architecture specified in ISO 21217:2014. The layered ITS station communication architecture is illustrated in Figure 1 — ITS station reference architecture. The ITS "Station Facilities Layer" (SFL), the ITS "Station Networking & Transport Layer" (SNTL), and the ITS "Station Access Layer" (SAL) are each capable of containing multiple managed service entities (ITS-S Managed Service Entity) running simultaneously as detailed in ISO 21217:2014.

5.2 ITS-S flows

In general, an ITS station supports multiple ITS-S applications of different types such as applications for road safety, traffic efficiency, value added services and infotainment. Each application that needs to send and receive data is most often either engaged in a bidirectional exchange with known communication peers, or is repetitively broadcasting data to unidentified receivers. The nature of the transmitted information is known and communication requirements are typically specific to the type of data flow (road safety, traffic efficiency, infotainment). These communication requirements can be expressed in terms of bandwidth, end-to-end delay, security, packet size, etc. for each type of data flow. A list of requirements is provided in ISO 17423:2018.

The ITS-S flow type allows the classification of data flows with the same characteristics, transmitted from distinct ITS stations or to distinct destination nodes. However, in the common situation in which several applications are installed in a given ITS station unit, these applications are typically engaged in several data exchanges of distinct nature (different flow types). There could consequently exist multiple ongoing data flows of different natures, competing for the same ITS station resources.

5.3 ITS-S communication profiles

In general, an ITS station supports multiple protocols and functionalities (ITS-S capabilities) within each of the ITS station layers: in the ITS-S facilities layer (e.g. the communication handler specified in ISO 17423:2018, ITS-S application processes for CAM[24] and DENM[25],...), various types of ITS-S networking and transport layer protocols (IPv6[8], FNTP[21], GeoNetworking[26],...) and various types and instances of access technologies (communication interfaces[14]).

Available protocols and access technologies can be combined in various ways to transfer data to the destination. A collection of protocols used to transfer data to a destination is referred to as the communication profile (ITS-SCP).

The communication profile indicates the protocol stack, i.e. the protocols at the ITS station facilities layer, the ITS station networking and transport layer, and ITS station access technologies layer that are used for a given data flow.

Several communication profiles could exist to reach a given destination. Some communication profiles may not be appropriate to reach a given destination if the communication end points do not support a compatible set of protocols.

5.4 ITS-S paths

An ITS-S path as defined in ISO 21217:2014 starts at its source node and ends up at a destination node. There may be zero or more intermediate nodes in the ITS-S path between the source node and the destination node.

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However, the ITS-S path towards a destination node goes through "selectable communication nodes" that are pre-determined according to the peer nodes engaged in the communication. These "selectable communication nodes" are referred to as the 'ITS-S anchor nodes' (respectively the 'ITS-S ingress anchor node' and the 'ITS-S egress anchor node') and form the entry and exit end points of a controllable path segment ('ITS-S anchor segment'). This is illustrated in Figure 2.

NOTE 1 The CI, the ITS-S ingress anchor node and the ITS-S egress anchor node are the selectable parts of the path. The CI is the starting point of the ITS-S path. The ITS-S ingress anchor node is the first selectable communication node on the path to which the packets are forwarded, whereas the egress ITS-S anchor is the last selectable communication node.

NOTE 2 For groupcast communication, there are multiple destinations but the packets transmitted to a group are not duplicated before reaching the ITS-S egress anchor node, hence all destination nodes are said to be reachable over the same path. The ITS-S egress anchor node can play the role of a rendez-vous point for IP-based multicast communications.

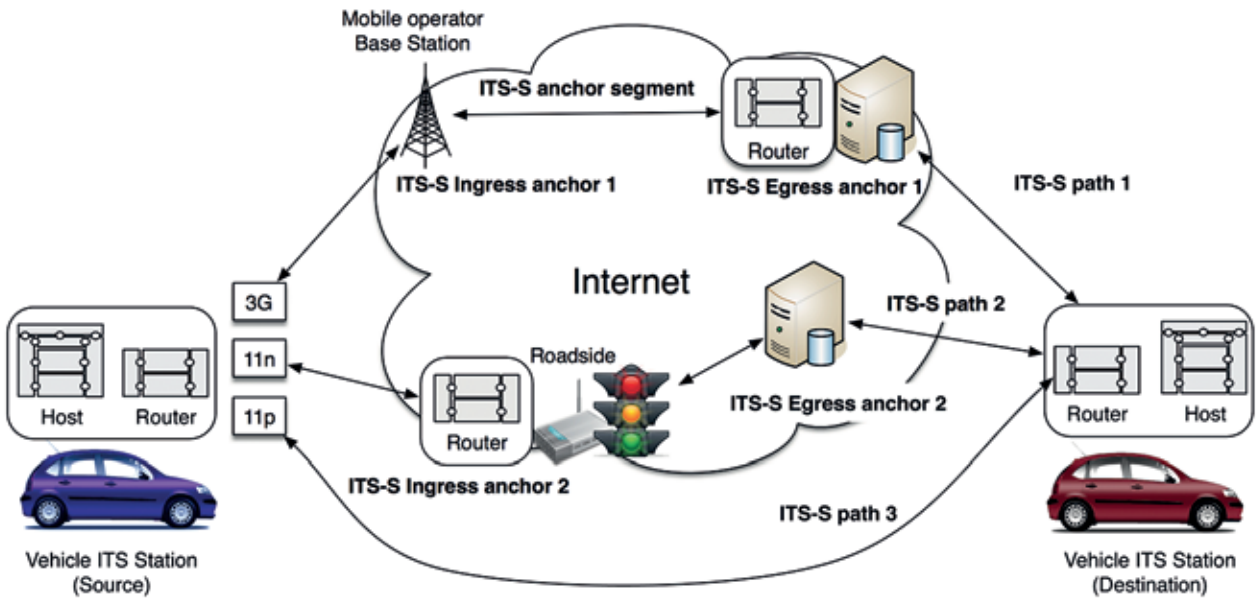

Figure 2 — Overview of the concept of ITS-S path and ITS-S anchor segment

In some circumstances, for example when the source node and the destination node are both located in the same local network (see ITS-S path 3 in Figure 2), the ingress and ITS-S egress anchor nodes are collapsed with the destination node.

— For Internet-based communications (see ITS-S path 1 and 2 in Figure 2), an ITS-S path goes through a communication interface (CI) of the source ITS-S. The ITS-S ingress anchor node is a node in the access network to which the ITS station is locally attached, and the ITS-S egress anchor node is a node in the Internet to which the ITS station is remotely attached. It finally reaches its destination node.

— For local ad hoc communications (see ITS-S path 3 in Figure 2), an ITS-S path goes through a CI of the source ITS-S. The ingress anchor, egress anchor and the destination node are identical.

The diversity of communication interfaces and ITS-S anchor nodes imply a multiplicity of ITS-S paths may be available to reach a given destination node. This happens:

— When multiple ITS-S ingress anchor nodes are reachable through the same communication interface, each of them typically located in the access network of distinct operators or located in different parts of the network when communication traffic is discriminated between road safety, traffic efficiency and infotainment types of services, or when multiple ITS-S ingress anchor nodes are reachable through distinct communication interfaces. Note that ITS-S ingress anchor nodes could be significantly distant in the topology of the communication network (e.g. the ITS-S ingress

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anchor node on an ITS-S path going through an 11p communication interface of a vehicle ITS station is likely on the roadside infrastructure whereas the ITS-S ingress anchor node on an ITS-S path going through the 3G communication interface is in the network of a cellular operator thus much further away).

— When a diversity of ITS-S egress anchor nodes from the same service operator are deployed in distinct geographic areas or when a diversity of ITS-S egress anchor nodes from distinct service operators provide similar or complementary services.

These ITS-S paths can take very different routes.

5.5 ITS-S capabilities

ITS-S capabilities are used to indicate protocols and functionalities that can be provided by a given ITS-S managed service entity. Each ITS-S capability provides a well-identified function, with some specific characteristics. Each ITS-S capabilitiy has a unique identifier. Well-known ITS-S capabilities may be recorded in a global registry. An ITS-S capability can be provided by several protocols or methods.

At the ITS-S networking and transport layer, examples of ITS-S capabilities in the IPv6 Networking ITS-S managed service entity (`mse-IPv6suite`) are the protocols providing network addressing (IPv6 Stateless Address AutoConfiguration), the protocol providing session continuity (IPv6 mobility support), the protocol providing encryption (IPsec). These ITS-S capabilities of the IPv6 Networking MSE are defined in ISO 21210.

ITS-S capabilities of the generic ITS-S managed service entity in the ITS-S facilities layer (`mse-GISFsuite`) are specified in ISO 17423:2018 (facilities service handler, content subscription handler, communication profile handler), in ISO/TS 21177 [21177] (security service) and ISO/TS 21176[7] (position and time functionality).

5.6 Path and flow management

When there are multiple ITS-S flows and a diversity of communication profiles and ITS-S paths, it is useful to determine for each ITS-S flow:

— The most suitable ITS-S communication profile to transfer data to the destination. This determination is not only necessary for the appropriate use of resources at the sending ITS station, but is also necessary to ensure both communication end points use a compatible set of protocols.

— The most suitable ITS-S path for routing a given ITS-S flow. This determination is not only necessary to route the packets but also to map ITS-S flows to the ITS-S path that best meets the communication requirements of the ITS-S application processes installed on the ITS station.

The determination of the ITS-S path implies the selection of the communication interface, the ITS-S ingress anchor node and ITS-S egress anchor node as shown in Figure 2.

Such determination is made by the ITS station management entity once it has gathered sufficient information on the following categories of information:

— Communication requirements of the applications installed on the ITS station that require communication resources of the ITS station (classified in operational, destination type, performance, monetary cost, energy cost, security, and protocol requirements as specified in ISO 17423:2018).

— Capabilities of all layers of the ITS station (functionalities, technologies and protocols supported by the ITS station, characteristics of available communication interfaces, etc.):

  — Supported ITS station facilities layer protocols (CAM[24], DENM[25], SPaT, MAP, CoAP[6], communication handler, service announcement, generic message handling, local dynamic map[3],…) and their parameters;

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  - Supported ITS station network & transport layer protocols (UDP, TCP, FNTP[21], IPv6[8], 6LowPAN[5], GeoNetworking/BTP[26], etc.), the functionalities they provide (broadcasting, multicasting, geocasting, mobility management, multihoming, etc.) and their parameters;
  - Supported ITS station access technologies layer protocols (IEEE 802.11(p)[13][27][28], infrared[12], satellite[23], 2G[10]/3G[11], LTE[2], IEEE 802.15.4[29],...), the functionalities they provide (short range communication, medium range communication, long range communication, ...) and their parameters;
- Capabilities of the access networks to which the ITS station is attached:
  - Network services provided by surrounding neighbour nodes (e.g. vehicle ITS station able to relay information to other vehicles, roadside ITS station providing Internet connectivity, etc.). The ITS station detects neighbour ITS stations and other legacy nodes through network services (neighbour discovery and other mechanisms including signalling protocols) and facilities services (CAM, DENM, SPaT, MAP, SAM, ...). For instance, among the services of neighbour ITS stations detected from network layer signalling protocols, a neighbour ITS station may provide a network access service allowing the ITS station to access the Internet while another may provide an anchor service;
  - Current network conditions: various metrics of an access technology (bandwidth, packet loss), status of link (set up, in use, ...), network load, reachability over that link (availability of Internet access);
- Capabilities of the peer communication end points as they must be able to support the same communication profiles;
- Capabilities of the ITS-S anchor nodes along the ITS-S path;
- Regulations and policies including local, national and regional rules (e.g. allowed access technologies and their transmission power; location privacy) and stakeholder rules (e.g. always prefer one access technology over another).

Figure 3 illustrates the architectural components (building blocks and management data flows) of the ITS station management entity which are involved in the ITS-S path selection process. The same architecture applies to the communication profile selection process introduced in ISO 17423:2018.

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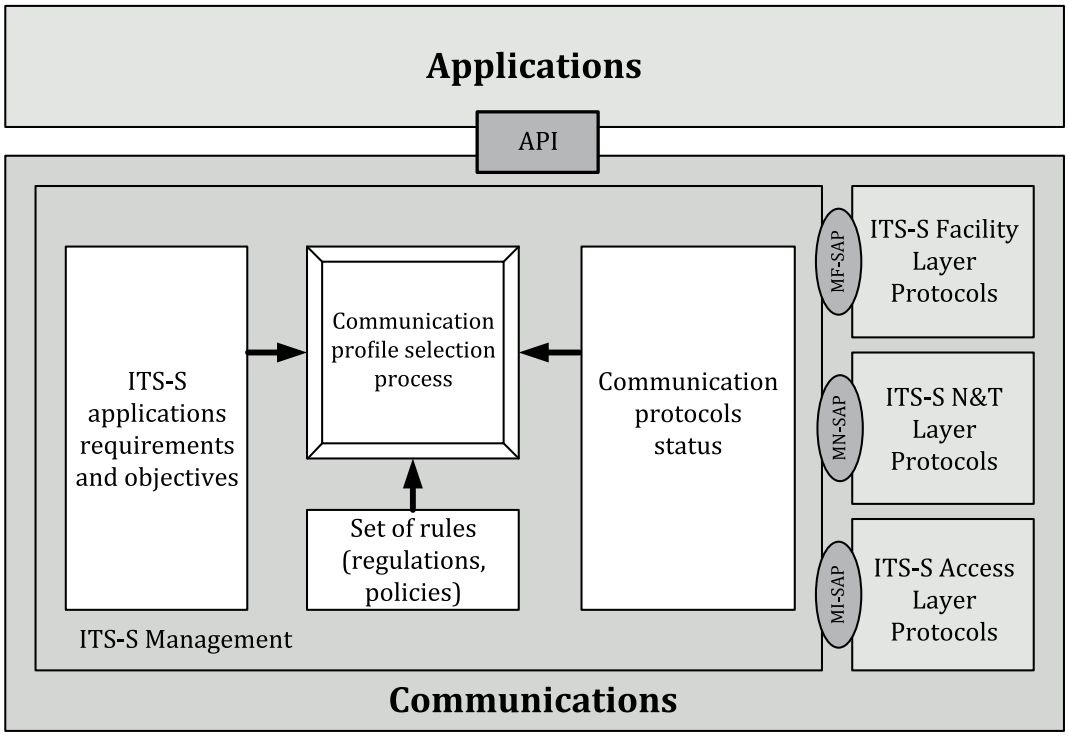

Figure 3 — Architecture of the communication profile and path selection [ISO 21217:2014]

NOTE In general, it cannot be ensured that the communication requirements will be met all along a particular ITS-S path as there can be no knowledge of the capabilities of all the nodes along the ITS-S path.

5.7 ITS station management functionalities

This document defines the following functionalities of the ITS "Station Management Entity" (SME) to determine available ITS-S paths and select the most appropriate one for each ITS-S flow.

— ***ITS station capabilities management*** is the process of ascertaining the capabilities of the ITS station (supported protocols or services and their functions, available communication interfaces and their characteristics) and which of them can be used at a given time.

— ***Path management*** is the process of determining ITS-S paths where packets can be routed. To do so, the SME must collect information from the ITS-S layers. In particular, it must determine the neighbour network nodes that could act as ITS-S ingress anchor nodes, their capabilities and the network services they provide (e.g. Internet access).

— ***Flow management*** is the process of keeping track of the ITS-S flows in the ITS station, including assigning and releasing the ITS-S flow identifiers.

— ***Path selection*** is the process of determining the most appropriate ITS-S path(s) from all the ITS-S paths available for a given ITS-S flow or a set of ITS-S flows of the same characteristics.

— ***Communication profile selection*** is the process of determining the most appropriate protocol stack for an ITS-S flow.

In order to determine the most appropriate ITS-S path for a given ITS-S flow, the SME must first have the most up-to-date view of all the available ITS-S paths and for how long they are able to survive. Keeping track of the available ITS-S paths requires gathering information from all ITS-S layers and maintaining accurate information.

The SME thus collects information from all the ITS-S layers and monitors the current state of the network (via the MN-SAP), the characteristics of the access technologies (via the MI-SAP), flow

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requirements expressed by applications (via the MA-SAP) or the facilities (via the MF-SAP), and other information maintained locally in order to determine routing policies to be applied to ITS-S flows, given the flow requirements, the current status of the network and access technologies characteristics.

Once the determination is realized, the SME provides to all ITS-S layers the communication profile(s) (ITS-SCP) and the rules to be applied to a given ITS-S flow or set of ITS-S flows. This information can be updated dynamically.

NOTE The rationale for those functionalities is detailed in the deliverable D2.4 *Final System Specification* of the ITSSv6 project[30] from which this document is largely derived.

5.8 ITS station management information tables

The SME collects and maintains information about ITS-S flows, ITS-S paths and ITS-S capabilities. This information can be maintained in the form of tables as illustrated on Figure 4.

Parameters obtained through the M*-SAP are expressed to the SME in a protocol agnostic fashion so that mechanisms for path and flow management are performed identically and independently of the type of ITS station (vehicle, roadside, personal or central ITS stations), its capabilities (protocols and functionalities) and the type of implementation (distributed in several ITS-SCU or not).

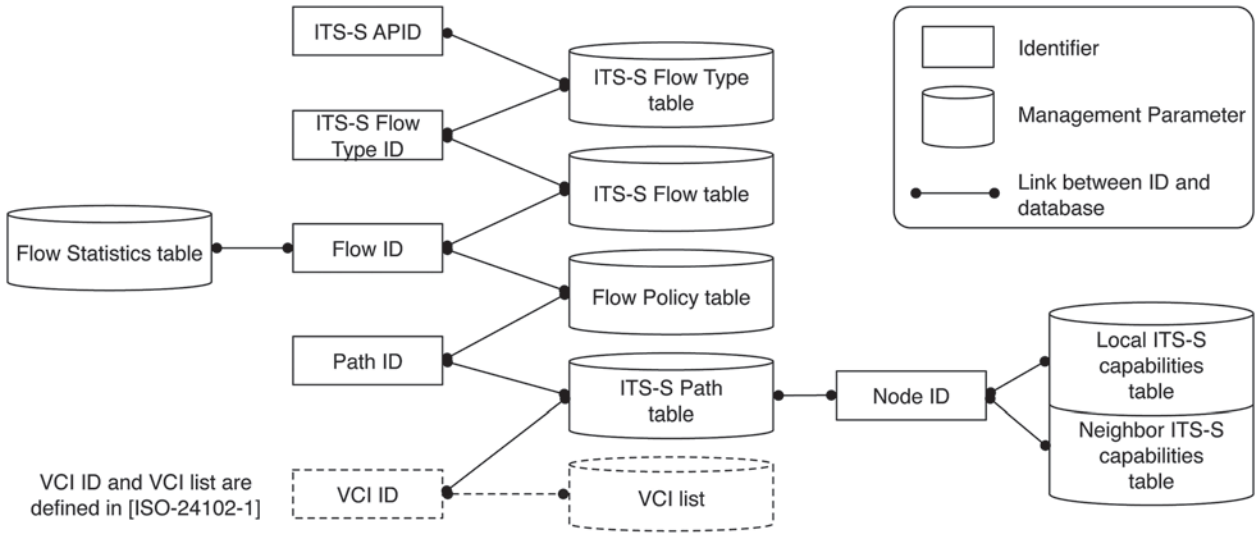

Figure 4 — Information maintained within the ITS station management entity

5.9 Interaction with ITS station layers

The interaction between the ITS "Station Management Entity" (SME) and the layers of the ITS station architecture, the ITS station application entity and the ITS station security entity is made through the management Service Access Points (SAP) of the ITS station (MI-SAP, MN-SAP, MF-SAP, MA-SAP, MS-SAP) specified in ISO 21217:2014 and in ISO 24102-3[17] as follows.

— The interactions between the SME and ITS station application processes (ITS-S-APs) are realized through the MA-SAP using the MA-REQUEST service initiated by the ITS-S-APs, and the MA-COMMAND service initiated by the SME. These service primitives are specified in ISO 24102-3[17]. ISO 17423:2018 and ISO/TS 17429:2017 specify how related service primitive functions are handled by the ITS-S-APs.

— The interactions between the SME and the ITS "Station Facilities Layer" (SFL) are realized through the MF-SAP using the MF-REQUEST service initiated by the SFL to the SME and the MF-COMMAND service initiated by the SME. The request and confirm service primitives are specified

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in ISO 24102-3[17]. ISO/TS 17429:2017 specifies how related service primitive functions are handled by the generic ITS-S managed service entity (`mse-GISFsuite`) of the SFL.

— The interactions between the SME and the ITS "Station Networking & Transport Layer" (SNTL) are realized through the MN-SAP using the MN-REQUEST service initiated by the SNTL, and the MN-COMMAND service initiated by the SME. The request and confirm service primitives are specified in ISO 24102-3[17]. ISO 21210[8] specifies how related service primitive functions are handled by the IPv6 Networking ITS-S Managed Service Entity of the SNTL (`mse-IPv6suite`) whereas ISO 29281-1[22] specifies how related service primitive functions are handled by the FNTP ITS-S Managed Service Entity of the SNTL (`mse-FNTPsuite`).

NOTE ISO 21210[8] is intended to be revised as Part 1[9] of a multi-part standard on IPv6.

— The interactions between the SME and the ITS "Station Access Layer" (SAL) are realized via the MI-SAP using the MI-REQUEST service initiated by the SAL, and the MI-COMMAND service initiated by the SME. The request and confirm service primitives are specified in ISO 24102-3[17]. ISO 21218[14] and ISO 24102-1[15] specify how related service primitives are handled by Communication Interface ITS-S Managed Service Entity of the SAL (`mse-CIsuite`).

Figure 5 shows the information flow between the SME and the ITS station layers.

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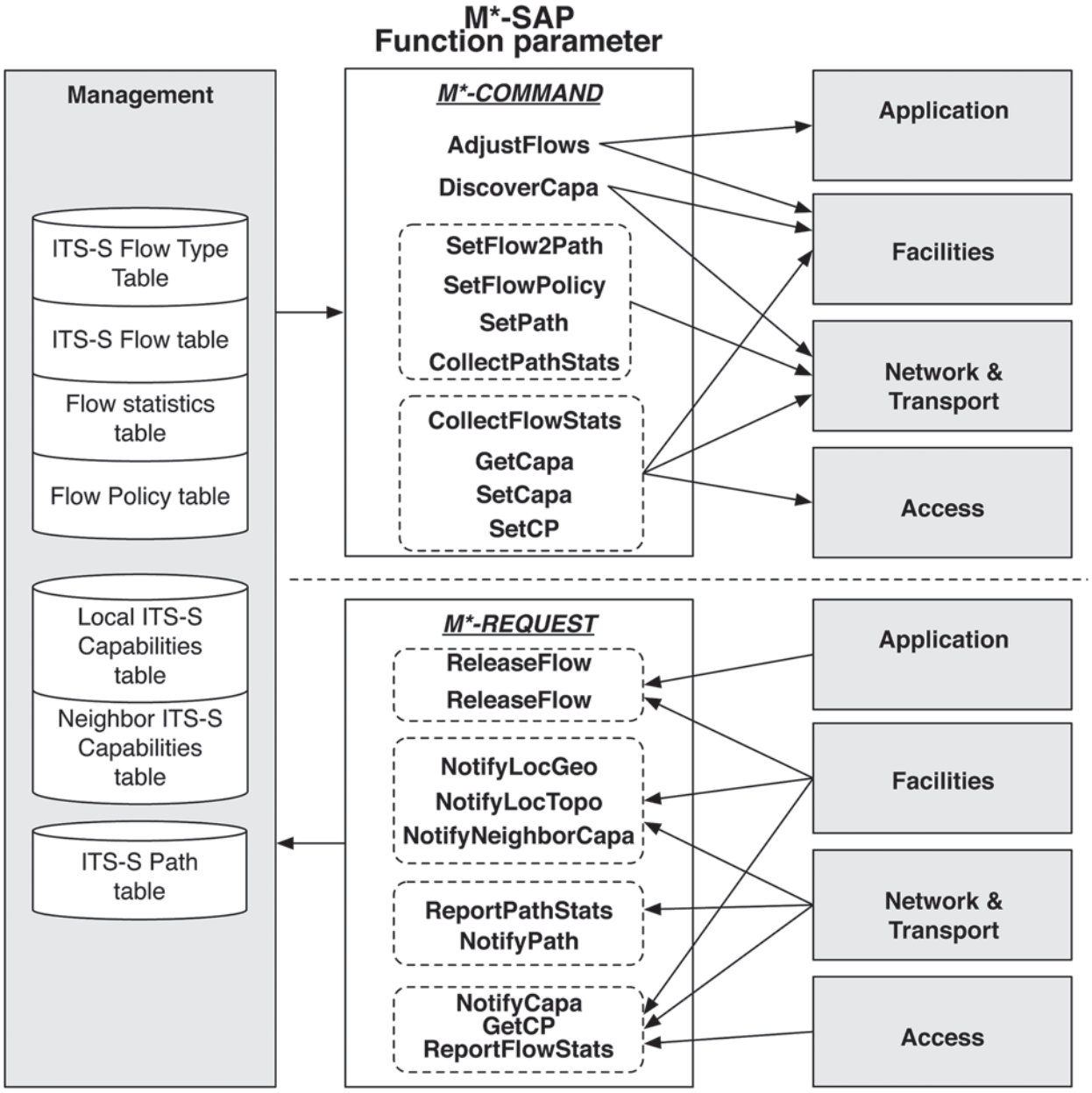

Figure 5 — Cross-layer information flow for path and flow management

6 Requirements for flow management and communication profile selection

6.1 ITS-S flow type parameters

Table 1 presents the list of parameters that are maintained by the SME for each ITS-S flow type known within the ITS-S. The method used to record ITS-S flow type information is implementation specific and is out of scope of this document. The parameters presented in Table 1 shall be of ASN.1 types specified in the normative Annex D.

Each ITS-S flow type is identified by an ITS-S flow type identifier (ITS-FlowTypeID) which shall be unique in the ITS station. Well-known flow types may be identified by a globally unique ITS-FlowTypeID assigned by a registry.

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Table 1 — ITS-S flow type parameters maintained by the SME

ITS-S flow type parameters	ASN.1 type	Description
IITS-S-APID (key)	`ITSsapiid`	Identifier of an ITS-S application process (exactly one of possibly several instances of it in an ITS-SU). Originally specified in ISO 24102-1[15] with name `ApplicationID`; now specified in ISO 17419[1].
ITS-S RX/TX interface (key)	`ITS-SapSsId`	Sink or source of an ITS-S-AP. Specified in ISO 17419[1].
ITS-FlowTypeID	`FlowTypeID`	Identifier of the ITS-S flow type (if larger than 0, corresponds to a well-known ITS-S flow type which parameters are recorded in a registry). Specified in ISO 17419[1].
Priority	`UserPriority`	Requested priority to be applied to this ITS-S flow type. Specified in ISO 17419[1].
ServSecu	`CapaInfos`	List of security services (ITS-S capabilities) to be applied to packets of this ITS-S flow type. Necessary atomic operations are performed by the ITS station security entity (DataConfidentiality, DataIntegrity, NonRepudiation, SourceAuthentication, LocationPrivacy).
ServFac	`CapaInfos`	List of ITS station facilities layer services (ITS-S capabilities) to be applied to packets of this ITS-S flow type once or on a per packet basis.
ServCom	`CapaInfos`	List of ITS communication services (ITS-S capabilities) to be applied to packet of this ITS-S flow type once or on a per packet basis. (ContConnect, NxRepeat, etc.).
RcvPort	`PortNumber`	Specific port requested by the ITS-S-AP to receive
DstType/ CommunicationMode	`DestinationType`	Type of transmission (single receiver, group of receivers (multicast, broadcast), geographic area, etc.)
DstDomain	`DestDomain`	Domain of communication (ITS-S internal, local, Internet)
CommDistRequested	`MinCommDistance`	Minimum distance in meter to reach the next neighbour node. Specified in ISO 17423:2018.
Directivity	`Directivity`	Information about the required antenna aperture. Specified in ISO 21218[14].
Resilience	`Resilience`	Request to provide the appropriate means to increase the likelihood of proper delivery of messages. Specified in ISO 17423:2018 as CostObjective.
MinThroughput	`DataRate`	The required minimum average data rate. Specified in ISO 17423:2018 with reference to ISO 21218[14].
MinLatency	`MaxLat`	Maximum acceptable latency. Specified in ISO 17423:2018.
Duration	`ExpFlowLifeTime`	Expected duration of ITS-S flow. Specified in ISO 17423:2018.
CostMonetary	`MediumCost`	Maximum accepted monetary cost. Specified in ISO 17419.
MaxADU	`MaxADU`	The maximum ADU size requested by ITS-S-AP. Specified in ISO 17423:2018.
MaxFPDU	`MaxFPDUnoFragmentation`	The maximum FPDU size calculated by the SME on the basis of MaxADU.
PortNo	`PortNumber`	Port number provided by the ITS-S-AP

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ITS-S flow type parameters	ASN.1 type	Description
ProtoTrans	`CapaInfos`	Identifier and associated parameters of the transport protocol (ITS-S capability), if requested by the ITS-S-AP
ProtoNet	`CapaInfos`	Identifier and associated parameters of the network protocol (ITS-S capability), if requested by the ITS-S-AP
ProtoAccessIDProtoNetInfo	`CapaInfoIDCapaInfo`	Identifier of the access technology (ITS-S capability), if requested by the ITS-S-APAssociated set of parameters specific to the requested network protocol
ProtoLogicalChannelType-ProtoAccessID	`LogicalChannelTypeCapa-InfoID`	Identifier of the requested logical channel (CCH, SaCH, SCH, SfCH – see ISO 21217:2014 Section 8.2.3). Specified in ISO 17419[1].Identifier of the access technology (ITS-S capability), if requested by the ITS-S-AP
ProtoLogicalChannelType	`LogicalChannelType`	Identifier of the requested logical channel (CCH, SaCH, SCH, SfCH – see ISO 21217:2014 Section 8.2.3). Specified in ISO 17419[1].

6.2 ITS-S flow parameters

Table 2 presents the list of parameters that are maintained by the SME for each ITS-S flow known within the ITS-S. The method used to record ITS-S flow information is implementation specific and is out of scope of this document. The parameters presented in Table 2 shall be of ASN.1 types specified in the normative Annex D.

Each ITS-S flow is identified by an ITS-S flow identifier (ITS-S-FlowID) which shall be unique in the ITS station.

Each entry shall contain an ITS-FlowTypeID allowing the retrieval of the list of communication requirements detailed in 6.1.

The destination fields are necessary to determine ITS-S paths allowing to reach a given destination.

Table 2 — ITS-S flow parameters maintained by the SME

Flow parameters	ASN.1 type	Description
ITS-S-FlowID (key)	`FlowID`	Identifier of the ITS-S flow
RegisStatus	`FlowRegistrationStatus`	Current status of this ITS-S flow (FLOW_REGISTERED, FLOW_ONGOING, FLOW_SUSPENDED)
RegisTime	`FlowRegistrationTime`	Time at which this flow was registered
ITS-FlowTypeID	`FlowTypeID`	Identifier of the corresponding ITS-S flow type (point to the list of communication requirements).
Priority	`UserPriority`	Priority of the ITS-S flow determined by the SME
DstType/CommunicationMode	`DestinationType`	Type of transmission (single receiver, group of receivers (multicast, broadcast), geographic area, etc.)

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