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TECHNICAL SPECIFICATION

**Intelligent Transport Systems (ITS);  
Facilities Layer;  
Infrastructure Services;  
Release 2**

Sample Document

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# Foreword

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

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# Modal verbs terminology

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

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# Introduction

The infrastructure services are application support facilities provided by the Facilities layer that construct, manage and process messages distributed from infrastructure to end-users or vice-versa based on payload received from the application. The infrastructure services specified in the present document support infrastructure-based applications in order to achieve communication interoperability, and may be implemented in parallel to other services in an ITS-S.

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# 1 Scope

The present document provides specifications of infrastructure related ITS services to support communication between infrastructure ITS equipment and traffic participants using ITS equipment (e.g. vehicles, pedestrians). It defines services in the facilities layer for communication between the infrastructure and traffic participants. The specifications cover the protocol handling for infrastructure-related messages as well as requirements related to the security entity.

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## 2 References

### 2.1 Normative references

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

- [1] Void.
- [2] [ETSI TS 102 894-2](#): "Intelligent Transport Systems (ITS);Facilities Layer; Part 2: Common data dictionary (CDD); Release 2".
- [3] Void.
- [4] Void.
- [5] Void.
- [6] [ETSI TS 103 097](#): "Intelligent Transport Systems (ITS); Security; Security header and certificate formats; Release 2".
- [7] [CEN ISO/TS 19321](#): "Intelligent transport systems - Cooperative ITS - Dictionary of in-vehicle information (IVI) data structures".
- [8] [ETSI TS 103 899](#): "Intelligent Transport Systems (ITS); Vehicular Communications; Geographical Area Definition; Release 2".
- [9] [Recommendation ITU-T X.691](#) / [ISO/IEC 8825-2](#): "Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)".

### 2.2 Informative references

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- [i.1] Void.

- [i.2] ISO/TS 17423: "Intelligent transport systems — Application requirements and objectives".
- [i.3] ISO/TS 14823-1: "Intelligent transport systems — Graphic data dictionary — Part 1: Specification".
- [i.4] Void.
- [i.5] Void.
- [i.6] Void.
- [i.7] Void.
- [i.8] Void.
- [i.9] Void.
- [i.10] SAE J2945/5-202002: "Service Specific Permissions and Security Guidelines for Connected Vehicle Applications".
- [i.11] CEN ISO/TS 19091: "Intelligent transport systems - Cooperative ITS - Using V2I and I2V communications for applications related to signalized intersections".
- [i.12] Void.
- [i.13] ISO/TS 17427-1: " Intelligent transport systems — Cooperative ITS — Part 1: Roles and responsibilities in the context of co-operative ITS architecture(s)".
- [i.14] [ETSI TS 103 836-4-1](#): "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality; Release 2".
- [i.15] Void.
- [i.16] ETSI TS 103 900: "Intelligent Transport Systems (ITS); Facilities Layer; Cooperative Awareness Service; Release 2".
- [i.17] ETSI TS 103 831: "Intelligent Transport Systems (ITS); Facilities Layer; Decentralized Environmental Notification Service; Release 2".
- [i.18] ETSI TS 102 965: "Intelligent Transport Systems (ITS); Application Object Identifier (ITS-AID); Registration; Release 2".
- [i.19] ETSI TR 103 902: "Intelligent Transport Systems (ITS); ITS Framework; Terms, Symbols and Abbreviations; Release 2".
- [i.20] ISO 3166-1: "Codes for the representation of names of countries and their subdivisions — Part 1: Country code".
- [i.21] [Recommendation ITU-T S.1](#): "International Telegraph Alphabet No. 2".

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## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

For the purposes of the present document, the terms given in ETSI TR 103 902 [i.19] apply.

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

IS_Control	Interface required by the IS to management plane entity(ies)
IS_DataIn	Interface required by the IS to gather IS PDUs and other data
IS_DataOut	Interface required by the IS to pass IS PDUs to other entities
IS_DataProviding	Interface provided by the IS for making collected IS PDUs available
IS_Security	Interface required by the IS to security plane entity(ies)
IS_Triggering	Interface provided by the IS for controlling IS PDU dissemination

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TR 103 902 [i.19] and the following apply:

GPCH	General Purpose Channel
SFCH	SaFety Channel

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# 4 Infrastructure services introduction

## 4.1 Naming convention

Within the scope of the present document, the term "message" refers to the Facilities layer PDU; the term "payload" refers to the applications layer ADU. The payload is generated by the application and provided to the corresponding service of the Facilities layer. The Facilities service merges the *ItsPduHeader* with the payload, in order to construct a message. The message is then delivered to the ITS Networking & Transport Layer (NTL) with a set of communication parameters.

NOTE: In other specifications referred by the present document, the term message, payload, data structure may have different meanings e.g. in CEN ISO/TS 19091 [i.11] and in CEN ISO/TS 19321 [7]. Therefore, the current convention is defined for clarification purposes.

## 4.2 Services provided by IS

The infrastructure services refer to Facilities layer entities that manage the generation, transmission and reception of infrastructure-related messages from the infrastructure to Vehicle or Personal ITS-S or vice-versa. Figure 1 illustrates a high level functional architecture of the infrastructure services within the ITS communication architecture. The messages are Facilities layer PDUs that are exchanged among ITS-Ss. The payload is generated by ITS applications in the transmitting ITS-S. At the transmitting ITS-S, the transmission of a message is triggered by applications or by forwarding mechanisms. For this purpose, the applications may connect to other entities of the Facilities layer or to external entities, in order to collect relevant information for the generation of the payload. Once the message is generated, the services may repeat the transmission, until the applications requests the termination of the transmission, or trigger another request to generate updated messages. At the receiving ITS-S, the messages are processed by the services and the content of the message is delivered to applications or to other Facilities layer entity. In one typical application, the message is transmitted by a Roadside ITS-S and disseminated to a Vehicle ITS-S within a target destination area, in which the information included in the message is considered as relevant to traffic participants.

In the scope of the present document, the infrastructure services supports the management of the following message types. As result, the infrastructure services include a set of service entities as listed below:

- SPATEM as defined in Annex A. The corresponding service entity is referred as "Traffic Light Manoeuvre" - TLM service in the present document. TLM service is specified in clause 5 of the present document.
- MAPEM as defined in Annex A. The corresponding service entity is referred as "Road and Lane Topology" - RLT service in the present document. RLT service is specified in clause 6 of the present document.

- IVIM as defined in Annex A. The corresponding service entity is referred as "Infrastructure to Vehicle Information" - IVI service in the present document. IVI service is specified in clause 7 of the present document.
- SREM as specified in Annex A. The corresponding service entity is referred as "Traffic Light Control" - TLC service in the present document. TLC service is specified in clause 8 of the present document.
- SSEM as specified in Annex A. The corresponding service is referred as "Traffic Light Control" - TLC service in the present document. TLC service is specified in clause 8 of the present document.

NOTE: Other messages may be supported by infrastructure services in the future.

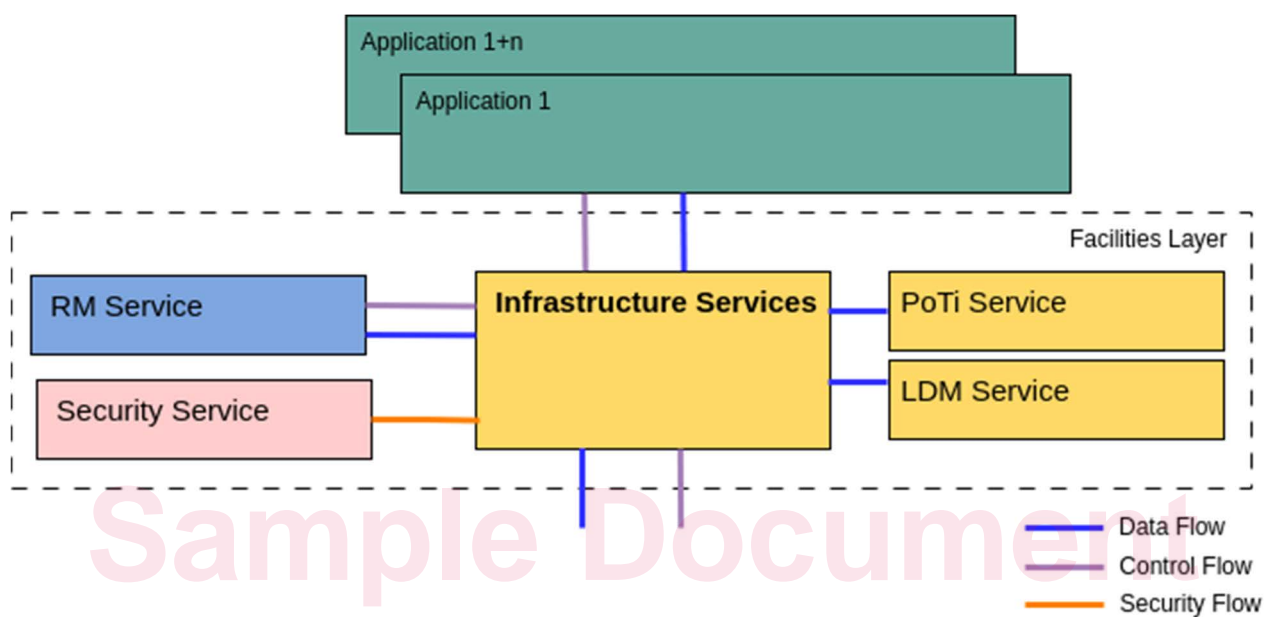


Figure 1: Infrastructure services and logical interfaces

The infrastructure services shall provide at least the following functions.

For the transmission service:

- Message encoding.
- Dissemination management.

For the reception service:

- Message decoding.
- Collection management.

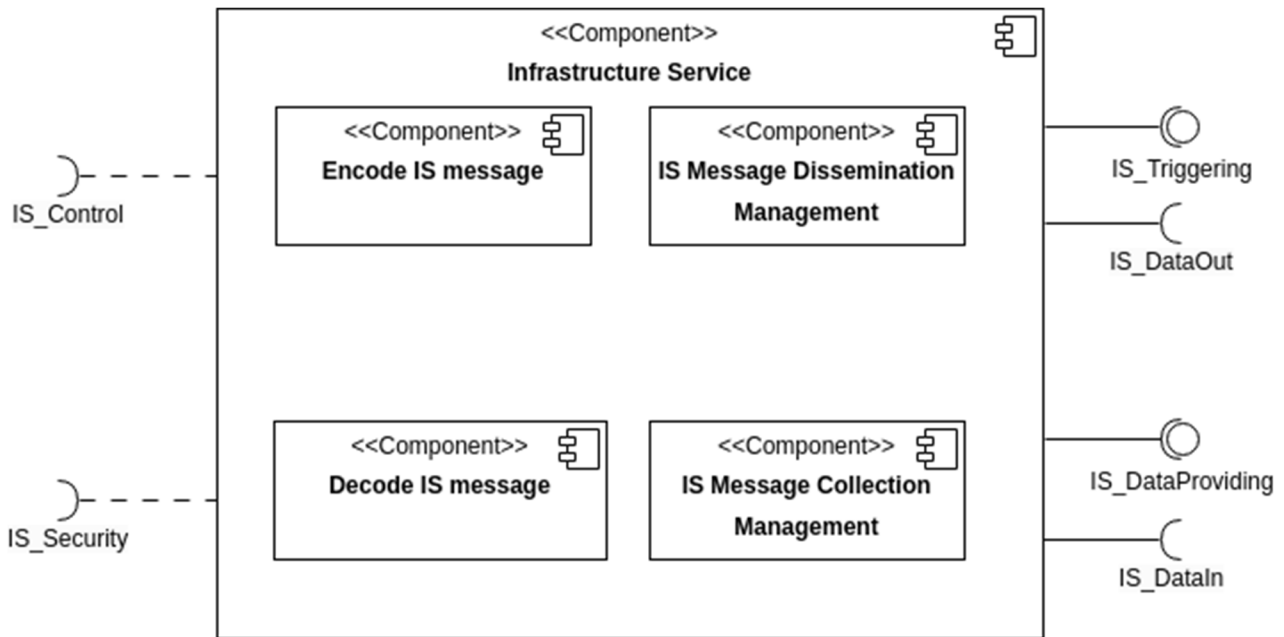


Figure 2: Infrastructure service component diagram

### 4.3 Infrastructure services in the ITS organizational architecture

Within the role "System Operation" as defined in ISO/TS 17427-1 [i.13], the following sub roles are relevant for the infrastructure services:

- "Content Provision" is responsible for generating the information that is conveyed in the message. This task is included in any application providing information to the application which generates the payload.
- "Service Provision" is responsible for the generation of the payload and the transmission of the message using an ITS-S. This task is managed by the application making use of the infrastructure services.
- "Service Presentation" is responsible for the reception of the messages and its processing and presentation. This task is managed by the infrastructure services and the application.

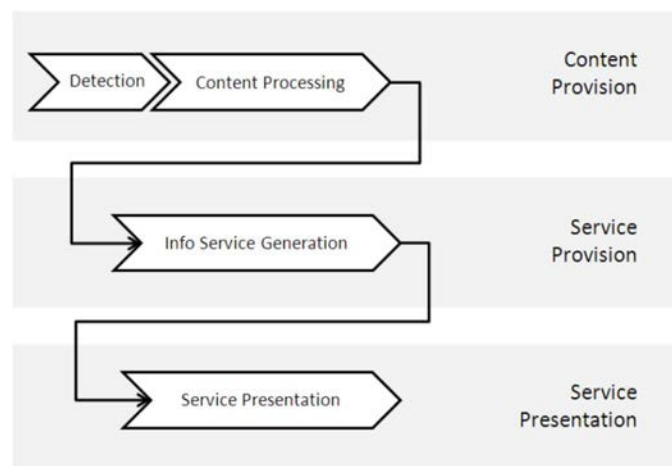


Figure 3: Identification of sub-roles of the role system (lifecycle) operation in the ITS organizational architecture

## 4.4 Interfaces of the infrastructure services

### 4.4.1 Interface to the ITS-S applications

The infrastructure services within the Facilities layer provide APIs to applications for the processing of the payload at the transmitting ITS-S and the receiving ITS-S. An application may execute requests to the infrastructure services in the Facilities layer to trigger, update or terminate transmission of a message. In addition, a set of Facilities control information is passed as specified in Table 1.

Table 1 presents the data contained in an application request.

**Table 1: Interfaces to ITS-S applications**

Category	Data	Definition
Data passed from application to infrastructure services (IS_Triggering)	Infrastructure message identification	Identification of the message
	Request type	Trigger, update or ending of transmission
	Dissemination parameter	Conditional PCI and SCI data for IS_DataOut (see Table 2) like e.g. GN traffic class as defined in ETSI TS 103 836-4-1[i.14], if GeoNetworking/BTP is used For more details, see the dissemination profile for each service in clauses 5 to 8
	Payload	Information contained in payload
Data returned from infrastructure services to the requesting application (IS_Triggering)	Infrastructure message identification or Another applicable identifier	The Infrastructure service returns the message identification or other applicable identifier created by the infrastructure service to the requesting application
	Failure notification	The infrastructure service returns a failure notification to the requesting application
Data provided from infrastructure services to application (IS_DataProviding)	Infrastructure message identification	Identification of the message
	Payload	Information contained in message as payload
	Collection parameter	Conditional PCI and SCI data from IS_DataIn (see Table 2)

### 4.4.2 Interface to management plan entities

The infrastructure services may exchange information with the entity(ies) in the ITS management plane via the interface IS\_Control.

NOTE: The specifications of the interface between the infrastructure services and the management entity is out of scope of the present document.

### 4.4.3 Interface to security plan entities

In case ETSI ITS security at the facilities layer is used, the infrastructure services exchange information directly with the entity(ies) in the security plane via the interface IS\_Security.

NOTE: The specifications of the interface between the infrastructure services and the security entity is out of scope of the present document.

### 4.4.4 Interfaces IS\_DataIn and IS\_DataOut

The infrastructure services shall pass the message for dissemination via the IS\_DataOut to either another facilities layer entity such as Resource Management or a lower layer functionality such as the NTL.

The infrastructure service shall gather messages via the IS\_DataIn from either another facility layer entity such as Resource Management or a lower layer functionality such as the NTL.

**Table 2: Messages exchanged over Interfaces IS\_DataIn and IS\_DataOut**

Category	Data	Data requirement	M/O/C (see note)	Remark/Condition
Data provided by the infrastructure services via IS_DataOut	PDU	{message} as specified in Annex A,	M	
	SCI	Additional control information related to security such as ITS-AID and SSP which shall be listed in the Authorization Ticket associated to the private key used to sign the message at the NTL.	C	if a security scheme at the NTL (e.g. ETSI Security [6]) requiring SCI is used.
	PCI	Additional control Information depending on the protocol stack applied in the NTL.	C	If a NTL protocol requiring PCI is used.
	RMI	Additional control information related to Resource management.	C	If RM is available.
Data gathered by the infrastructure services via IS_DataIn	Received PDU	{message} as specified in Annex A.	M	
	SCI	Additional control information related to security such as ITS-AID and SSP that are listed in the Authorization Ticket attached to the message and the result of the security check at the NTL.	C	if a security scheme at the NTL (e.g. ETSI Security [6]) requiring SCI is used.
	PCI	Additional control Information depending on the protocol stack applied in the NTL.	C	If a NTL protocol requiring PCI is used.
NOTE: M/O/C are as follows: "M" indicates that the Data element shall always be included. "O" indicates that the Data element may or may not be included. "C" indicates that the Data element shall be included only if the condition is satisfied.				

The infrastructure services may request data from the PoTi service using IS\_DataIn.

NOTE 1: The specifications of the interface between the infrastructure services and the PoTi service is out of scope of the present document.

The infrastructure services may provide messages to the LDM service using IS\_DataOut.

NOTE 2: The specifications of the interface between the infrastructure services and the LDM service is out of scope of the present document.

## 4.5 Common protocol requirements for infrastructure services

### 4.5.1 Security for messages used by infrastructure

The security mechanisms for messages used by the infrastructure service as specified in the present document shall use the message authentication with signatures to be verified at the receiving ITS-S with public keys contained in certificates. A certificate indicates its holder's permissions, i.e. what statements the holder is allowed to make or privileges it is allowed to assert in a message signed by that certificate. The format for the certificates shall be as specified in ETSI TS 103 097 [6].

All defined messages in the present document shall be signed using private keys associated to Authorization Tickets that contain the appPermissions item with the ITS-AID of the Service and corresponding SSPs of type BitmapSsp as specified in ETSI TS 103 097 [6].

Service permissions are indicated by a pair of identifiers within a certificate, the ITS-AID and the SSP. The ITS-Application Identifier (ITS-AID) as given in ETSI TS 102 965 [i.18] indicates the overall type of permissions being granted.