

Intelligent Transport Systems (ITS); Classification and management of ITS application objects



Reference

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Foreword

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

Introduction

The present document presents the results of a joint approach of CEN, ETSI, IEEE and ISO towards classification and management of ITS application objects, i.e.:

- ITS message sets;
- ITS applications; and
- ITS application classes.

An essential element to manage ITS application objects is an ITS application (object) identifier (ITS-AID).

In Europe, standardization of ITS at CEN started in 1991 in the Technical Committee TC 278 "Road Transport and Traffic Telematics". In 2002, EN 12834 [4] produced by TC 278 WG9 "Dedicated Short Range Communication (DSRC)" was published. EN 12834 [4] contains the specification of a DSRC application class identifier of ASN.1 type DSRCApplicationEntityID. Numbers of DSRCApplicationEntityID for 16 classes of DSRC applications were allocated. The most prominent used on the market are (0) for "System" and (1) for "Electronic Fee Collection" (EFC).

In 1992, ISO TC204 "Intelligent Transport Systems" was founded. ISO TC 204 and CEN TC278 work jointly together. ISO TC204 WG15, the mirror group of CEN TC278 WG9, published ISO 15628 [5], i.e. the international version of EN 12834 [4]. ISO allocated numbers of DSRCApplicationEntityID for further three ITS DSRC application classes. ISO TC204 WG16 developed a basic set of communication standards for cooperative systems in ITS - CALM (Communications Access for Land Mobiles). In ISO 24102 [7], FAST ITS service advertisement is specified. Identification of ITS application classes and ITS applications was achieved by means of the ITS application identifier of ASN.1 type ServiceID specified in ISO 29281 [8]. ServiceID recognizes the work done so far at CEN TC278 WG9 and ISO TC204 WG15, adopting the already allocated numbers for DSRCApplicationEntityID.

IEEE developed the set of WAVE (Wireless Access in Vehicular Environment) standards 1609 - first version published in 2006. This work maintained and continued DSRCApplicationEntityID of ISO TC204 WG15. IEEE 1609.3 [i.11] specifies WAVE service advertisement. Identification of what [8] refers to as ITS application classes and ITS applications is achieved by means of a "Provider Service Identifier" (PSID).

End 2007, ETSI TC ITS was founded. ETSI and CEN work jointly together towards cooperative ITS under the EC mandate M/453 [i.3]. CEN TC278 WG16 and its international mirror committee ISO TC204 WG18 focus on cooperative applications in ITS, whereas ETSI TC ITS and ISO TC204 WG16 focus on communications for ITS. These bodies share the opinion that there is a need for a globally unique identifier of ITS application objects. EU and U.S. declared the intent to jointly develop cooperative systems for ITS [i.4]. This includes harmonization of standards. The globally unique approach to identify and manage ITS application objects is in line with [i.4].

In 2010, the original definition of PSID was revised by IEEE 1609 WG in cooperation with ETSI TC ITS STF 404 such that the PSID field contains the ITS Application Identifier (ITS-AID) applying unaligned PER as specified in the present document.

The present document provides mandatory specifications of technical elements for ITS application object management, and recommendations for management procedures with a major focus on the needs for communications.

CEN TC 278 WG16 and ISO TC 204 WG18 are complementing the present document with specifications of global management procedures, taking into account the recommendations of the present document. Further on, they are specifying further technical details related to classification and management of ITS application objects.

Experts from CEN, ISO TC204 WG16 and WG18, and IEEE 1609 indicated mutual interest to consider the specification of the ITS application identifier (ITS-AID) given in the present document for finalization or next revisions of their standards on cooperative systems and communications for ITS.

The purpose of global registration of ITS-AID is to identify uniquely ITS application objects which are defined by standards or by private specifications. Whether private specifications, in order to ensure proper operation in an ITS station with respect of overall system security and reliability, need to be publicly available is outside the scope of the present document. The operational purposes of ITS-AID and the related framework are:

- to identify endpoints in the ITS station for proper evaluation of protocol data units;
- to support secure installation and maintenance of ITS application objects in instances of ITS stations.

1 Scope

The present document provides:

- the technical specification of the globally applicable identifier of ITS application objects, referred to as "ITS Application ID" (ITS-AID);
- requirements and specifications related to operational needs of ITS stations applying ITS-AID in protocol data units;
- specification of technical elements used for registration of ITS application objects;
- recommendations for the procedural framework for registration and certification of ITS application objects;
- recommendations for the procedural framework and operational needs related to installation and maintenance of ITS application objects in instances of ITS stations.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

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

- [1] ISO/IEC 8825-2: "Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)".
- [2] ISO 21217: "Intelligent transport systems - Communications access for land mobiles (CALM) - Architecture".
- [3] ETSI EN 302 665: "Intelligent Transport Systems (ITS); Communications Architecture".
- [4] CEN EN 12834: "Road transport and traffic telematics - Dedicated Short Range Communication (DSRC) - DSRC application layer".
- [5] ISO 15628: "Road transport and traffic telematics - Dedicated short range communication (DSRC) - DSRC application layer".
- [6] ISO 21218: "Intelligent transport systems - Communications access for land mobiles (CALM) - Medium service access points".
- [7] ISO 24102: "Intelligent transport systems - Communications access for land mobiles (CALM) - Management".
- [8] ISO 29281: "Intelligent transport systems - Communications access for land mobiles (CALM) - Non-IP networking".
- [9] ISO 15662: "Intelligent transport systems - Wide area communication - Protocol management information".

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI TR 102 707: "Intelligent Transport Systems (ITS); ETSI object identifier tree; ITS domain".
- [i.2] ETSI ES 202 663: " Intelligent Transport Systems (ITS); European profile standard for the physical and medium access control layer of Intelligent Transport Systems operating in the 5 GHz frequency band".
- [i.3] M/453 EN:2009: "Standardisation Mandate addressed to CEN, CENELEC and ETSI in the field of information and communication technologies to support the interoperability of co-operative systems for intelligent transport in the European Community".
- [i.4] EC/DGINFSO-USDOT/RITA:2009: "EU-U.S. Joint Declaration of Intent on Research Cooperation in Cooperative Systems".
- [i.5] ISO 21212: "Intelligent Transport Systems - Communications access for land mobiles (CALM) - 2G cellular systems".
- [i.6] ISO 21213: "Intelligent Transport Systems - Communications access for land mobiles (CALM) - 3G cellular systems".
- [i.7] ISO 21214: "Intelligent Transport Systems - Communications access for land mobiles (CALM) - Using infra-red systems".
- [i.8] ISO 21215: "Intelligent Transport Systems - Communications access for land mobiles (CALM) - M5".
- [i.9] ISO 21216: "Intelligent Transport Systems - Communications access for land mobiles (CALM) - Millimetre communications".
- [i.10] ISO 21210: "Intelligent Transport Systems - Communications access for land mobiles (CALM) - IPv6 networking".
- [i.11] IEEE 1609.3™-2010: "Standard for Wireless Access in Vehicular Environments (WAVE) -Networking Services".
- [i.12] ISO 17274: "Intelligent Transport Systems - Co-operative Systems - Classification and management of ITS applications in a global context".
- [i.13] ISO 17275: "Intelligent Transport Systems - Co-operative Systems - ITS application requirements for selection of communication profiles".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in [2], [3], [5], [6], [7], [8] and the following apply:

ITS application class: class of ITS applications with a procedural framework as specified in [5], [7], uniquely identified by the globally applicable ITS application identifier ITS-AID

ITS application object: generic term for either ITS application class, or ITS application, or ITS message set

ITS message set: set of messages for a specific purpose in ITS, uniquely identified by the globally applicable ITS application identifier ITS-AID

ITS registration authority: authorised entity responsible for registration of ITS application objects

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in [2], [3], [5], [6], [7], [8], [i.11] and the following apply:

cam	Endpoint where processing of received CAMs starts
ctx	Endpoint where processing of received CTXs starts
CTX	ITS service context message
FMT-ID	Facility Message Type Identifier
ITS-AID	ITS Application object Identifier
ITS-APDU	Protocol Data unit exchanged between peer entities of ITS access layer
ITS-ASDU	Service Data Unit exchanged between ITS access layer and ITS networking & transport layer
ITS-FPDU	Protocol Data Unit exchanged between peer entities of ITS facilities layer
ITS-FSDU	Service Data Unit exchanged between ITS facilities layer and ITS-S applications
ITS-NPDU	Protocol Data Unit exchanged between peer entities of ITS networking & transport layer
ITS-NSDU	Service Data Unit exchanged between ITS networking & transport layer and ITS facilities layer
ITS-RA	ITS Registration Authority
msg	Endpoint where processing of received MSGs starts
MSG	General ITS message, different to CAM
sam	Endpoint where processing of received SAMs starts

4 Global ITS application object management

4.1 Classification

Management of ITS application objects first of all requires classification of them. A top level classification distinguishes:

- ITS message sets;
- ITS applications;
- ITS application classes.

A sub-classification according to the relevance for cooperative ITS can be identified and expressed e.g. by means of communication priorities. Such sub-classification is based on societal requirements on usage of cooperative ITS, e.g. distinction between road safety applications and "just for fun Internet surfing". Consequently the sub-classification is mainly a non-technical process, which needs technical support to be provided by standards. Details related to the non-technical process will be presented in [i.12].

Relevance aspects lead to rules on access rights of ITS application objects to use functionalities of an ITS station or an ITS sub-system. These access rights need technical elements in order to enable real-time management of ITS application objects in ITS sub-systems. The same technical elements may be subject of registration of ITS application objects.

The following two clauses provide a tutorial-like introduction to:

- normative requirements on technical operations specified in annex A; and to
- informative recommendations on procedures for management presented in annex B.

4.2 Technical operation

4.2.1 Modes of communication

An ITS station may support the following modes of communication:

- Transmission of messages to unknown recipients (broadcast or multicast communications).
- Requests and responses in a session between two ITS peer station entities (single-hop unicast communications).
- ITS-specific multi-hop communications.
- Communication with legacy systems, e.g. those based on ISO 15628 [5] or any kind of existing Internet service, which are not aware of ITS.

The first and second mode are dedicated to ad-hoc communications, i.e. primarily single-hop communications [8] using access technologies such as ITS-G5 [i.2] / CALM M5 [i.8], CALM IR [i.7], 63 GHz [i.9]. The third and fourth mode typically use the Internet protocol IPv6 [i.10] via any kind of access technology, including the above mentioned ad-hoc access technologies, cellular network technologies [i.5], [i.6] and others.

The first mode is used to transmit messages from ITS message sets, such as CAM and DENM. It is also needed to transmit service advertisement messages [7], [i.11], which enables subsequent sessions between peer stations.

NOTE: "Service announcement" and "service advertisement" are synonyms.

The second mode requires a service advertisement message [7], [i.11] as a prerequisite to initialize the relation between the ITS-S applications residing in the two peer stations.

4.2.2 Addressing in an ITS station

Address information has to go with every frame in order to select the proper instance of an ITS station or protocol inside an instance of an ITS station. Addressing basically is needed for every one of the three ITS layers (access layer, networking & transport layer, facilities layer) [2], [3]. It is contained in protocol data units (PDUs) exchanged between instances of ITS stations. Address information is forwarded between the layers as parameters in service data units (SDUs). Data flow (SDUs and PDUs) is illustrated in figure 1 for the generic OSI model and in figure 2 for the ITS station architecture [2], [3].

NOTE: There could be system designs which deviate from this architecture such that the networking & transport layer or the facilities layer is empty. Nevertheless a proper addressing scheme is needed.

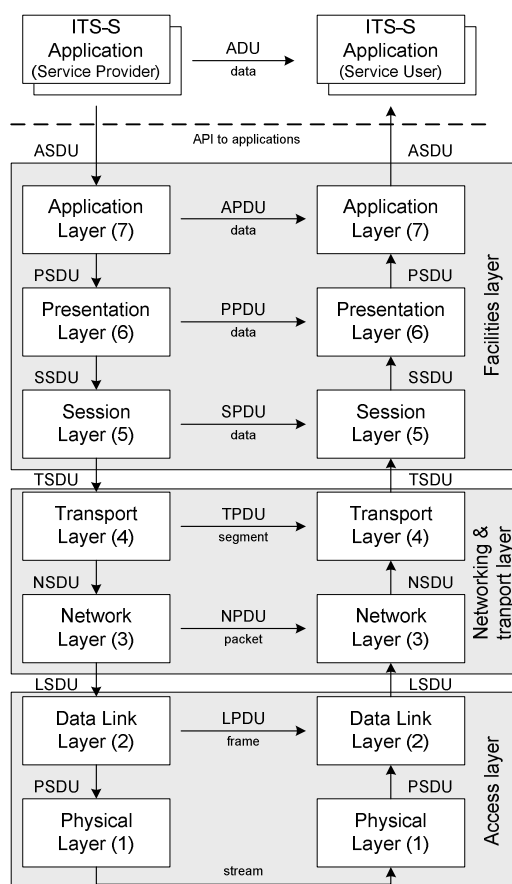


Figure 1: Data flow in the OSI model

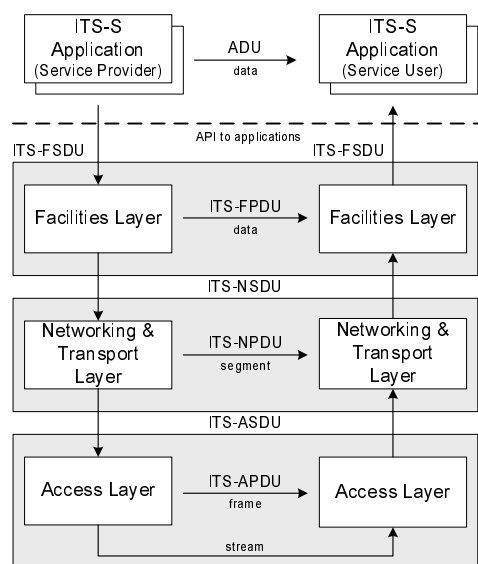


Figure 2: Data flow in the ITS station

The purpose of addressing in the access layer is:

- to identify at the MAC sub-layer of the data link layer, whether a received frame shall be forwarded to the upper layers or not (MAC address);
- to identify the proper protocol (LLC control field) in the LLC sub-layer of the data link layer;
- to identify the proper endpoint in the next higher layer, usually the networking protocol (DSAP and SSAP, or Ether-Type, or IEEE 802.11 ACTION frame type used for WAVE service advertisement).

The purpose of addressing in the networking & transport layer is:

- to identify the proper node in a network (e.g. IP address);
- to identify the proper transport protocol (transport header);
- to identify the proper endpoint in the next higher layer, usually a facility in the facilities layer, or in the management, e.g. for service announcement and service advertisement (port number).

Details of addressing in the facilities layer are illustrated in figure 3. The purpose of addressing in the facilities layer is:

- to identify an ITS application object by means of the ITS application identifier (ITS-AID);
- to identify a "Facility Message Type" (FMT) by means of an FMT identifier (FMT-ID), e.g. of ASN.1 type MessageType [7].

In receive mode, each lower layer has to inspect the proper header in order to identify address information to be used as meta address data in an SDU for selection of the next higher target-point (usually address elements in a service primitive of a service access point).

In transmit mode, each higher layer has to provide meta address data in an SDU to be inserted in a header in the next lower layer.

Each layer, see figures 1 and 2, only inspects or creates those headers in a frame (LLC sub-layer), a packet (networking sub-layer), a segment (transport sub-layer), data (facility layer, ITS-S applications), which are necessary for next step addressing. Note that a next target-point in receive mode may also be the management entity (see e.g. ISO 24102 [7] groupcasting and service advertisement) and IEEE 1609 WSA [i.11].

Figure 3 illustrates where in the ITS station architecture the ITS-AID is being used.

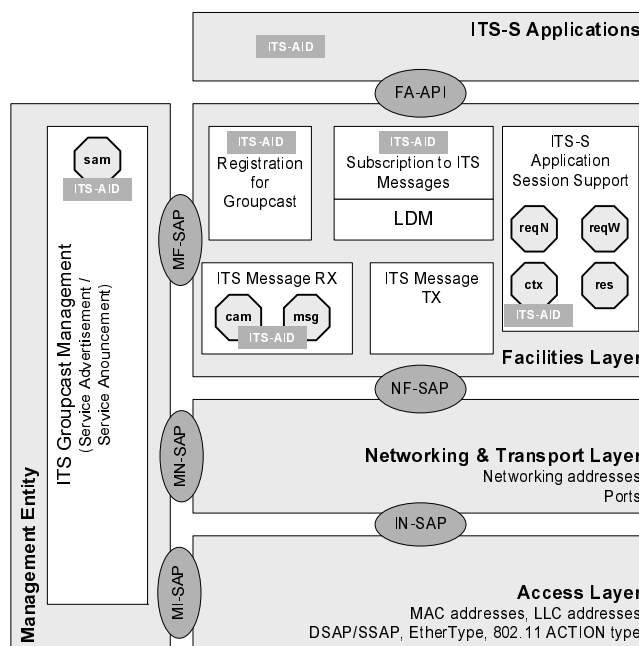


Figure 3: Addressing architecture ITS-S.

The octagons indicate target-points of PDUs; these target points are also referred to as endpoints. The access to these endpoints in receive mode is given by port numbers of the protocol used in the networking & transport layer. The access to sam may also be via MI-SAP in case MAC management frames are used to carry the "Service Advertisement Message" (SAM) [7].

Registered globally valid port numbers are needed to identify at least the endpoints:

- sam: service advertisement message;
- cam: cooperative awareness message;
- msg: general message;
- ctx: context message as acknowledgement of service announcement message for ITS application classes.

Preferably these registered globally valid port numbers are used in all kinds of transport protocols designed to connect to these endpoints. However it would be sufficient that port number allocation is done specifically per transport layer protocol.

Registration of port numbers also has to provide a large range of numbers to be dynamically assigned by transport protocols.

The address data element ITS-AID is evaluated at the locations indicated with the label "ITS-AID". This shows, that the data element ITS-AID is contained in:

- "Service Advertisement Messages" (SAM) [7], evaluated in sam;
- "Service Context" (CTX) messages [7], which constitute an acknowledgement of an ITS application class offered in a SAM, evaluated in ctx;
- "Cooperative Awareness Messages" (CAM), evaluated in cam;
- other ITS messages, e.g. "Decentralized Environmental Notification Messages" (DENM), evaluated in msg;
- subscriptions to ITS messages;
- requests to register for groupcasting (service advertisement).

4.2.3 ITS-AID and related data elements

The ITS application identifier ITS-AID is encoded in an address data element of ASN.1 type `ITSaid` with variable length as specified in clause A.2.

Assignment of values of ITS-AID to a specific ITS application object will consider the number allocation and number reservation of `DSRCApplicationEntityID` [4], [5]. Thus for new assignments, these values in the range of 0 to 31 already assigned by CEN and ISO are no more available.

NOTE: `DSRCApplicationEntityID` [4], [5] is specified as a data type with variable length. However the optional extension mechanism is not used as specified in CEN profile standards. Most of the numbers already assigned were never used in products, thus could be re-assigned to new ITS application objects by CEN TC278 / ISO TC204.

The ITS application identifier ITS-AID is used to identify uniquely the specification of a specific ITS application object together with some essential properties of it. Essential properties of an ITS application object are e.g.:

- **Name**
Human readable name of the ITS application object.
- **Type**
 - ITS application.
 - ITS application class, e.g. those identified by means of the `DSRCApplicationEntityID` [4], [5].
 - ITS message set.
- **Context**
Application class context, e.g. as specified in [4], [5]. Applicable for ITS application classes.

- **Owner**

- Standard.
- Private specification.

A universal object identifier (OID) is helpful to identify the owner uniquely.

- **Priority**

Maximum allowed user priority [6] to be used in protocol data units (messages) generated by the ITS application object.

- **Certificate**

Information on the status of the certificate needed to install an ITS application object in an ITS sub-system.

- **Messages**

Allowed messages defined for this ITS object. A message may be identified by:

- Name
Human readable name of this message.
- Number
Sequential number unique for this ITS application.
- Type
Either detailed specification of ADU presented in figure 1 or "any/not specified" indication.
- Message priority
Maximum allowed priority of a message.
- Logical channels
List of logical channels which may be used to carry this message. Logical channels are characterized by a sequential number, and a name unique within ITS, and a user priority value indicating the minimum required priority of a message for transmission.

NOTE: As congestion control may lower the actual value of priorities, only the originally assigned message priority value is used to identify allowed or prohibited access to a logical channel.

- Communication profiles required or allowed for this message
Indication of allowed or required communication profiles for communication. A communication profile may indicate functionality of the ITS-S access layer, the ITS-S networking & transport layer, the ITS-S facilities layer and functionality of the ITS-S management entity and ITS-S security entity.

- **General requirements**

Indication of general requirements of ITS application objects not directly related to elements of the ITS station reference architecture [3], [7], [i.13]. An example of such requirements is the cost of communications to be paid by the end-user.

The mandatory technical specification is provided in the normative annex A.

Recommendations for further specifications are provided in the informative annex B.

4.3 Management procedures

4.3.1 Overview

The management procedures are divided into two parts:

- "off-line" procedures, to be performed by e.g. registration and certification authorities;
- "on-line" procedures, to be performed in an ITS sub-system, especially in an ITS station.

The purpose of these management procedures is to ensure proper, secure operation of ITS application objects implemented in instances of ITS stations, and to avoid or at least reduce the probability of unauthorized use of ITS sub-system functionalities by ITS application objects.

ITS application objects may be developed by many different organisations, beyond others road authorities, city authorities and car makers.

The "off-line" procedures constitute the global management framework and include technical specifications needed to perform the "on-line" procedures.

4.3.2 Off-line procedures

ITS application objects are uniquely identified by an ITS application identifier (ITS-AID), see also clauses 4.2.2 and 4.2.3. The registration of ITS application objects is performed by an ITS registration authority. The format of the globally unique ITS-AID is specified in annex A and illustrated in figure A.1.

NOTE: Until a suitable registration authority is identified and in operation, each SDO may maintain a list of assigned ITS-AID values for ITS application objects being developed in the SDO including the unique link to the standard where the ITS application object is specified. This procedure requires harmonization with the other SDOs in order to produce globally unique assigned values.

Rules on who can install ITS application objects in an instance of an ITS station, and how this is done need to be set up e.g. by the registration authority and / or ITS security authorities with technical support from standards organizations.

Technical elements of the "off-line" procedures are specified in the normative annex A and will be given in [i.12].

Elements of the "off-line" procedures are recommended in more detail in annex B. Others will be under the responsibility of authorities, or will be standardized in [i.12].

4.3.3 On-line procedures

"On-line" management covers the following tasks for proper real-time operation of ITS sub-systems. These procedures are given by standardized protocols which run in ITS sub-systems, especially in ITS stations.

- Installation, update and de-installation of ITS application objects in a protected environment, e.g. by an accredited laboratory or service station.
- Installation, update and de-installation of ITS application objects via ITS communication links (e.g. ITS application store).
- Registration / de-registration of ITS application objects [2], [3], [7] in an ITS station for on-line usage.
- Activation / de-activation of ITS application objects in an ITS station for on-line usage.

NOTE: Installation and update of an ITS application object not necessarily registers or activates it for on-line usage.

- Access of one ITS application object to another ITS application object, e.g. an ITS-S application launches another ITS-S application, or an ITS-S application registers for reception of ITS messages.

- Proper access of ITS application objects to the functionalities of an ITS protocol stack [2], [3], [6], [7], [8], e.g. mandatory or optional or prohibited functionalities of the ITS facilities layer, the ITS networking & transport layer and the ITS access layer by means of communication profiles, logical channels, priorities, message types.

Access rights may cover the following functional aspects:

- usage of protocols in general;
- load of a communication channel, influenced e.g. by repetition rate of messages, data size, message priority.
- Proper access of ITS application objects to the functionalities of the ITS security entity and the ITS management entity.
- Proper access of ITS application objects to functionalities of an ITS sub-system outside an ITS station:
 - read access via the proprietary network (in-vehicle or roadside) to instantaneous information, e.g. GPS, sensors;
 - write access via the proprietary network (in-vehicle or roadside) to actors, e.g. driver interface.

Technical elements of the "on-line" procedures are specified in the normative annex A and will be specified in [i.13]. Further elements and procedures will be specified in [i.12].

Informative recommendations on how to manage ITS application objects are provided in the informative annex B. These informative recommendations will be further developed in [i.12] towards mandatory requirements.

Annex A (normative): ITS application object identification and management

A.1 Requirements

Every ITS application object shall be uniquely identified by a value of the "ITS application identifier" (ITS-AID). ITS-AID shall be of ASN.1 type `ITSaid` specified in clause A.2.2. Figure A.1 illustrates the format of ITS-AID for ASN.1 unaligned PER. The bits "Length Control" are CHOICE and EXTENSION bits which define the size of the data type. The element "Length indicator N" identifies the number N of octets following this element and containing the value of ITS-AID.

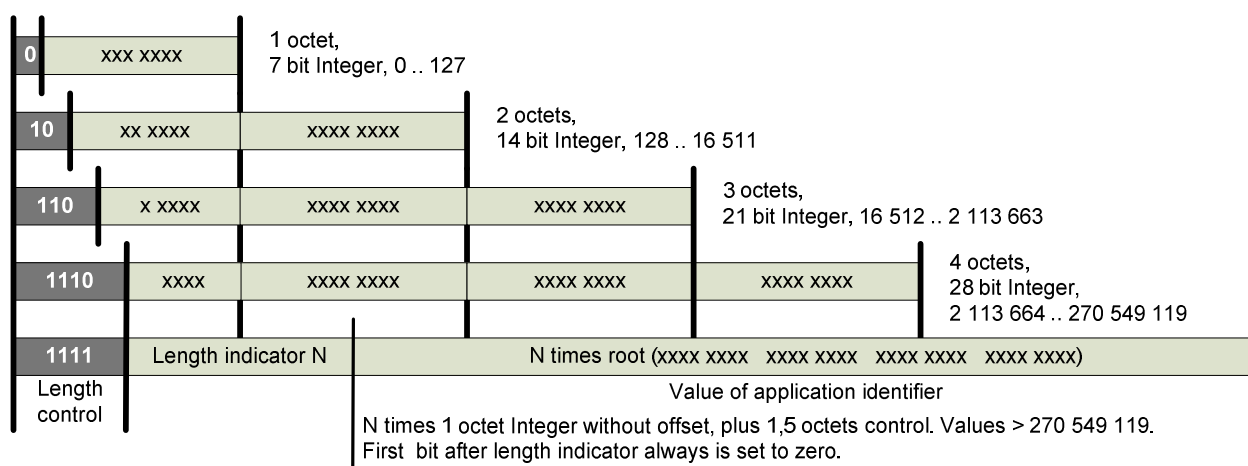


Figure A.1: Structure of ITS-AID field

On-line operation of ITS application objects installed in an instance of an ITS station shall be controlled by means of technical parameters and related procedures. These procedures shall manage the access of ITS application objects to functionality of the ITS station and the ITS sub-system. The technical parameters used in the procedures, e.g. minimum and / or maximum values of priorities, shall be covered by the registration parameters.

The registry for ITS application objects shall be given by the ASN.1 type `ITSapObSet` specified in clause A.2.3. This registry shall contain entries for ITS application objects given by the ASN.1 type `ITSapOb` specified in clause A.2.3. An ITS application object shall be characterized by elements with ASN.1 types presented in table A.1. A registration authority may use further information to properly identify an ITS application object, and to properly support off-line and on-line management of ITS application objects. Examples of such further information are presented in clauses B.5 and B.6.

NOTE: Further mandatory requirements are under development [i.12].

Installation and maintenance of ITS objects in instances of ITS stations shall be performed in a secure way. Suitable technical means to ensure secure operation will be specified in other standards. Secure operation might need the involvement of "ITS Security Authorities". An ITS station shall allow installation of application objects only in case it accepts the certificate of the application object.

ITS-S applications, which start a session by transmitting a SAM, shall register themselves on-line in an instance of an ITS station prior to operation. This on-line registration may apply information contained in the ITS application registry. There shall be means to deregister ITS-S applications in instances of ITS stations, once these are no more actively needed. On-line de-registration is different from de-installation. Registration of ITS-S applications requires further data elements as specified in [2], [3], [7] and in clause B.5.

Table A.1: Characteristics of ITS application objects

Name of element	ASN.1 type	Description
ITSapOb. iTSaid	ITSaid	This shall be the ITS application identifier (ITS-AID). The format shall be as given in the ASN.1 specification in clause A.2.2, which is illustrated in figure A.1.
ITSapOb. iTSapObName	ITSapObName	This element shall contain the human-readable name of the ITS application object. The format shall be as given in the ASN.1 specification in clause A.2.3.
ITSapOb. iTSapObType	ITSapObType	This shall indicate, whether ITS-AID refers to an ITS application or to an ITS application class or to an ITS message set. The format shall be as given in the ASN.1 specification in clause A.2.3.
ITSapOb. iTSapObOwner	ITSapObOwner	This shall indicate whether the specification of the ITS application object is given by a standard or by a private specification. The owner shall be identified by a human readable name and by a universal object identifier. The format shall be as given in the ASN.1 specification in clause A.2.3.
ITSapOb. iTSapObPrio	ITSapObPriority	This priority shall indicate the maximum allowed priority of messages produced by the ITS application object. The format shall be as given in the ASN.1 specification in clause A.2.3.
ITSapOb. iTSapObCert	ITSapObCertificate	This element shall uniquely identify whether the registered ITS application object is certified or not, which is the issuing ITS security authority, and when the certificate will expire. The format shall be as given in the ASN.1 specification in clause A.2.3.

NOTE: The precise definition of "ITS security authority" is outside the scope of the present document.

Universal object identifiers to identify the standards organizations CEN, ETSI, IEEE and ISO shall be as specified in clause A.2.3.

Further details of the technical elements shall be as specified in the ASN.1 module presented in clause A.2.

A.2 ASN.1 modules

A.2.1 Overview

The following two ASN.1 modules are specified in this annex:

- **ITSaid0v0** { itu-t(0) identified-organization(4) etsi(0) itsDomain(5) wg2(2) itsaid(2860) operation(0) version(0)}
- **ITSaid1v0** { itu-t(0) identified-organization(4) etsi(0) itsDomain(5) wg2(2) itsaid(2860) management(1) version(0)}

These modules import ASN.1 definitions from [i.1] on OIDs used for identification of ASN.1 modules in standards from ETSI TC ITS.

A.2.2 Module ITSaid0v0

This module specifies the ASN.1 type definition of the data element ITS-AID illustrated in figure A.1 together with useful ASN.1 value definitions.

Unaligned packed encoding rules (PER) as specified in [1] shall be applied for the ASN.1 module ITSaid0v0 in case the data elements and value elements are used in an ITS communication link. Encoding rules for usage in a registration authority are outside the scope of the present document.

This module imports ASN.1 definitions from ASN.1 modules specified in [i.1].

```
ITSaid0v0 { itu-t(0) identified-organization(4) etsi(0) itsDomain(5) wg2(2) itsaid(2860)
operation(0) version0(0) } DEFINITIONS AUTOMATIC TAGS ::= BEGIN
```

```
IMPORTS
```

```

oidITSwg2 FROM ITSreg { itu-t(0) identified-organization(4) etsi(0) itsDomain(5) wg2(2)
version1(1)};

-- End of IMPORTS

-- Types

-- ITS-AID
ITSaid::=VarLengthNumber

VarLengthNumber::=CHOICE{
    content      [0]  INTEGER(0..127), -- one octet length
    extension    [1]  Ext1
}

Ext1::=CHOICE{
    content      [0]  INTEGER(128..16511), -- two octets length
    extension    [1]  Ext2
}

Ext2::=CHOICE{
    content3     [0]  INTEGER(16512..2113663), -- three octets length
    extension    [1]  Ext3
}

Ext3::=INTEGER(211664..270549119,...) -- four and more octets length

-- Values

oidITSaid OBJECT IDENTIFIER::={ oidITSwg2 itsaid(2860) }
oidITSaid0 OBJECT IDENTIFIER::={ oidITSaid operation(0) }
oidITSaid0v0 OBJECT IDENTIFIER::={ oidITSaid0 version(0) }

version INTEGER(0..255)::=0 -- version of this module

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

END

```

A.2.3 Module ITSaid1v0

This module specifies ASN.1 type definitions of the minimum set of elements presented in table A.1 to be contained in the registry for ITS application objects together with useful ASN.1 value definitions.

Unaligned packed encoding rules (PER) as specified in [1] shall be applied for the ASN.1 module ITSaid1v0 in case the data elements and value elements are used in an ITS communication link. Encoding rules for usage in a registration authority are outside the scope of the present document.

This module imports ASN.1 definitions from ASN.1 modules specified in [5], [6], [7], [i.1] and the present document.

```

ITSaid1v0 { itu-t(0) identified-organization(4) etsi(0) itsDomain(5) wg2(2) itsaid(2860) registry(1)
version0(0) } DEFINITIONS AUTOMATIC TAGS::=BEGIN

IMPORTS
oidITSwg2 FROM ITSreg { itu-t(0) identified-organization(4) etsi(0) itsDomain(5) wg2(2) version1(1) }

ITSaid FROM ITSaid0v0 { itu-t(0) identified-organization(4) etsi(0) itsDomain(5) wg2(2) itsaid(2860)
operation(0) version0(0) }

ITS-S-Appl-Reg FROM CALMmanagement { iso(1) standard(0) calm-management(24102) version1(1) }

CIclass, CIaClass, DataRate, MediumCost, UserPriority FROM CALMllsap { iso(1) standard(0) calm-ll-
sap(21218) version1(1) }

DSRCApplicationEntityID, ApplicationContextMark FROM DSRCData { iso(1) standard(0) dsrc(15628)
dsrcData(0) version(1) };

-- End of IMPORTS

-- Types

```

```

-- registration information records for several ITS application objects
ITSapObSet ::= SEQUENCE OF ITSapOb

-- extendable record for the whole set of registration information
-- for a single ITS application object (ITSapOb)
ITSapOb ::= SEQUENCE {
    iTSAid                iTSAid,                -- ITS-AID
    iTSApObName           iTSApObName,           -- human-readable name of ITSapOb
    iTSApObType           iTSApObType,           -- class or application or message set
    iTSApObOwner          iTSApObOwner,         -- owner of the ITS application
    iTSApObPrio           iTSApObPriority,       -- maximum allowed priority of messages
    iTSApObCert           iTSApObCertificate    -- information on certificate
}

ITSapObName ::= PrintableString

ITSapObType ::= ENUMERATED {
    appClass              (0),
    application           (1),
    messageSet            (2)
}

ITSapObOwner ::= SEQUENCE {
    ownerName             iTSApObOwnerName,
    ownerType             iTSApObOwnerType,
    ownerOID              OBJECT IDENTIFIER
}

ITSapObOwnerName ::= PrintableString

ITSapObOwnerType ::= ENUMERATED {
    standard              (0),
    private                (1)
}

ITSapObPriority ::= UserPriority                -- Definition of priority classes
-- (e.g. highest, high, medium, low, lowest) is to be done by the registration
-- authority.

ITSapObCertificate ::= SEQUENCE {
    issuingSA             IssuingSA,
    startDate             CertStartDate,
    endDate               CertEndDate,
    status                CertStatus
}

IssuingSA ::= SEQUENCE {
    name                  SAname,
    saOID                 OBJECT IDENTIFIER
}

SAname ::= PrintableString

CertStartDate ::= CHOICE {
    inactive              [0] NULL, -- indicates that certificate is not issued
    date                  [1] NumericString (SIZE(8)) -- yyyyymmdd
}

CertEndDate ::= CHOICE {
    inactive              [0] NULL, -- this shall apply if StartDate is set to [0]
    date                  [1] NumericString (SIZE(8)), -- yyyyymmdd
    never                  [2] NULL -- indicates that there is no end date
}

CertStatus ::= CHOICE {
    active                [0] NULL, -- indicates the certificate is issued
    inactive              [1] NULL, -- indicates that certificate is not issued
    testActiv             [2] NULL, -- indicates that ITS application object is in test phase
    blocked               [3] CertBlocked
    -- indicates that issued certificate is blocked.
}

CertBlocked ::= SEQUENCE {
    date                  [0] NumericString (SIZE(8)), -- yyyyymmdd
    issuingSA             [1] IssuingSA -- SA who performed black-listing of an ITS-AID
}

-- Values

```

```
-- OIDs of standards organizations
oidISO OBJECT IDENTIFIER ::= { iso(1) standard(0) }
oidETSI OBJECT IDENTIFIER ::= { itu-t(0) identified-organization(4) etsi(0) }
oidIEEE OBJECT IDENTIFIER ::= { iso(1) identified-organization(3) ieee(3) }
oidCEN OBJECT IDENTIFIER ::= { iso(1) identified-organization(3) cen(162) }

-- OIDs for this module
oidITSaid OBJECT IDENTIFIER ::= { oidITSwg2 itsaid(2860) }
oidITSaid1 OBJECT IDENTIFIER ::= { oidITSaid registry(1) }
oidITSaid1v0 OBJECT IDENTIFIER ::= { oidITSaid1 version(0) }

-- version of this module
version INTEGER(0..255) ::= 0

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

END
```

Annex B (informative): ITS application management framework

B.1 ITS registration authority

B.1.1 Organization

The recommended "ITS Registration Authorities" (ITS-RAs) for registration of ITS application objects are:

- Standardization Organisations;
- "United Nations Economic Commission for Europe" (UN-ECE) WP 29 "Vehicle Regulations and Technical Innovations".

Preferably there is only one global ITS-RA. However one or more regional ITS-RAs may operate together on the one global registry, applying jointly agreed management procedures.

B.1.2 Tasks and procedures

It is recommended that the registration authority only may register ITS application objects which are already certified by an ITS security authority. Nevertheless, as a preparatory step, the registration authority may assign ITS-AID values to an organization, which actually does not finalize registration as long as the certificate is missing.

There may also be non-registered ITS application objects. However during run-time, these ITS application objects will get only very restricted access to the functionalities of the ITS sub-system [i.12]. To apply such restrictions during run-time is a security feature required for ITS stations.

It is recommended to request fees for registration of an ITS application object in order to achieve fair usage of numbers over a long period of time.

NOTE: For ITS applications of public interest, the fee may be very low or even zero.

It is recommended that the registration authority fulfils the task to define in detail and implement the procedures recommended below.

- Initial registration of a new ITS application object without certificate being presented. The registry is based on the ASN.1 element `ITSapObSet` specified in annex A. Process and grant requests for registration of ITS application objects to private/legal persons developing ITS application object specifications/operating private ITS application objects.
- Add a certificate, which was assigned by a security authority to an ITS application object, to the registry record of this ITS application object.
- Black-listing of a registered ITS application object, i.e. mark certificate to be invalid.
- De-black-listing of a black-listed ITS application object.
- Change of ownership of an ITS application object.
- Inactivation of an ITS application object, i.e. invalidation of the certificate. The registered ITS-AID is maintained.
- Deregistration of an ITS application object. ITS-AID may be reused after a guard time.
- Maintain a repository of the registry accessible by an authorized audience or by everybody.

B.2 ITS security authorities

B.2.1 Organization

It is recommended to have regional and national "ITS Security Authorities".

B.2.2 Tasks and procedures

It is recommended that ITS security authorities s are in charge of the following tasks.

- Create the procedural security framework for ITS.
- Evaluate requests for registration of ITS application objects in close cooperation with standards organizations, providing the technical expertise needed to evaluate requests for ITS application objects, and define access rights for the evaluated ITS application object:
 - Check e.g. the description of the ITS application object, i.e. which use cases are supported, which security mechanisms are implemented, which permissions to use specific functionalities of an ITS sub-system are requested or prohibited.
- Assign certificates (signatures) to ITS application objects presented for registration:
 - The certificate should be calculated from a security key and the ITS application object software code together with information on rights and restrictions how to use the functionalities of an ITS sub-system. This information needs to contain the full registration record including the certification status.
 - In case of testing a new ITS application object, given by the certification status CertStatus = testActive specified in clause A.2.3, the certificate should be calculated without using the ITS application object software code.
- Interact with ITS registration authorities with respect of certificates.
- Operate security frameworks by ITS security authorities.

B.3 ITS application object developers

ITS application objects may be developed by any organization which is capable to develop software.

B.4 ITS application object installers and operators

It is recommended that only registered and certified ITS application objects can be installed in an instance of an ITS station! Consequently there is no need to define restrictions on who may install an ITS application object in an instance of an ITS station.

NOTE: For development of ITS application objects a test installation procedure using a special certificate is supported by the present document. See certification status CertStatus = testActive specified in clause A.2.3. This beneficially should require an instance of an ITS station specifically prepared to support testing in order to avoid unauthorized usage of ITS application objects certified for testing in instances of ITS stations used for ordinary operation.

The following options for installation of ITS application objects in instances of ITS stations are identified:

- By certified organisations, e.g. car makers, car service stations, road authorities.
- Automatically, e.g. by roadside installations (ITS application store).

- By other organisations, e.g. service providers, who present ITS application objects which are registered and certified.
- By end users.

Typical operators of ITS application objects are:

- Authorities, e.g. city, road, police, emergency, military.
- Car makers.
- Commercial organizations.

Authorized certified organizations, e.g. city authorities, road authorities, may operate ITS application stores, offering registered and certified ITS application objects for dynamic automatic upload from ITS roadside sub-systems into vehicle ITS sub-systems and personal ITS sub-systems.

B.5 Technical management elements

Essential properties of ITS application objects, mandatory for registration purposes, are presented in clause 4.2.3. The following bullet list presents recommendations for further data elements useful to describe an ITS application object, especially with respect of on-line management in an ITS station:

- **Messages**

Allowed messages defined for this ITS application object. The set of information on messages is of ASN.1 type `ITSapObMMsgs` specified in clause B.6. A single message may be identified by:

- Name
Human readable name of this message.
- Number
Sequential number unique for this ITS application object.
- Maximum message priority
Maximum allowed priority of a message. The maximum possible value of this priority is given by the value of the ITS application object priority presented in table A.1.
- Logical channels [2], [3], [6]
List of logical channels of ASN.1 type `ITSlogChannels` which may be used to carry this message. Logical channels are identified by a sequential number and a name, unique within ITS. Every logical channel is associated with a user priority value. Messages with an associated message priority equal to or larger than this user priority value are allowed to access the logical channel.
- Communication profiles required or allowed for this message
Indication of allowed or required communication profiles for communication. A communication profile may indicate functionality of the ITS-S access layer, the ITS-S networking & transport layer, the ITS-S facilities layer and functionality of the ITS-S management entity and ITS-S security entity. The list of the communication profiles is of ASN.1 type `ITScommProfiles`.

- **General requirements**

Indication of general requirements of ITS application objects not directly related to elements of the ITS station reference architecture. General requirements are identified by the ASN.1 type `ITSapplRq` specified in clause B.6. An example of such requirements is the cost of communications to be paid by the end-user. See also [i.13].

Elements of messages of an ITS application object are presented in table B.1.

Table B.1: Elements of ITSapObMsgs

Name of element	ASN.1 type	Description
ITSapObMsgs . msgName	ITSapObMsgName	This element contains the human-readable name of the message
ITSapObMsgs . msgNo	ITSapObMsgNo	This element identifies a message.
ITSapObMsgs . msgPort	ITSapObMsgPort	This element indicates the destination port as either a predefined port with globally valid static value, or as a dynamic port.
ITSapObMsgs . msgMaxPriority	ITSapObMsgMaxPriority	Maximum allowed priority of the message. This value is in the range of 0 up to the value in ITSapObPriority. This value is used to control the on-line access to a logical channel.
ITSapObMsgs . msgLCHs	ITSlogChannels	This element lists all logical channels which are allowed to be used for transmission of this message. Logical channels are as specified in table B.2.
ITSapObMsgs . msgCommProfiles	ITScommProfiles	This element contains a single one or a list of communication profiles. A single communication profile <i>ITScommProfile</i> is as specified in table B.3.

Table B.2: Logical channels

Channel name	ASN.1 type ITSlogChannel Reference number	Description
lch0	0	Control channel (CCH) [3], [i.2]
lch1	1	Service channel (SCH) 1 [3], [i.2]
lch2	2	SCH 2 [3], [i.2]
lch3	3	SCH 3 [3], [i.2]
lch4	4	reserved for future use
lch5	5	reserved for future use
lch6	6	reserved for future use
lch7	7	reserved for future use
lch8	8	reserved for future use
lch9	9	Secondary CCH
lch10	10	SCH 4
lch11	11	SCH 5
lch12	12	SCH 6
lch13	13	Auxiliary channel (ACH) 1
lch14	14	ACH 2
lch15	15	ACH 3
lch16 .. lch254	16 .. 254	These reference numbers shall be reserved for application specific logical channels.
lch255	255	This shall be an indicator for "unspecified logical channel".

Every logical channel is associated with a priority value. This value indicates the minimum message priority required in order to allow this message to access the logical channel. Such a message priority is in the range of zero (lowest priority) up to the value given in *ITSapObPriority*. The actually used priority value in a transmission request service primitive may be lower than the message priority. The value may be modified e.g. by the congestion control algorithm, which does not affect the right to access a specific logical channel. The final on-line decision on selection of a logical channel is done at the networking & transport layer. Mapping of logical channels onto physical channels is as specified in the related standards on access technologies. Different logical channels may be mapped on the same physical channel even in case the minimum required message priority of these logical channels is different. Concurrent transmission requests are managed at least in the access layer based on the priority of the pending messages.

EXAMPLE: The logical channels lch0 and lch9 are mapped on the G5CC of ITS5 [i.2].

NOTE: The mapping of logical channels onto physical channels may depend on the region where the ITS station is operated.

Table B.3: Communication profile ITScommProfile

Name of element	ASN.1 type	Description
ntlayer	NtlayerFunc	This element contains information on functionality required from the networking & transport layer in order to process properly the message.
alayer	AlayerFunc	This element contains information on functionality required from the access layer in order to process properly the message.
mentity	MentityFunc	This element contains information on functionality required from the management entity in order to process properly the message.

General requirements on ITS application objects are presented in table B.1.

Table B.4: General requirements on ITS application objects ITSapplRq

Name of requirement	ASN.1 type	Description
mediumCost	MediumCost	This element contains allowed cost values for communication as specified in [6].
connectionCost	ConnectionCost	This element contains allowed cost values for communication as specified in [9].
internet	BOOLEAN	This element identifies whether access to Internet is needed (TRUE) or not (FALSE).
adhoc	BOOLEAN	This element identifies whether ad-hoc communication is needed (TRUE) or not (FALSE).
latency	ITSlatency	This element identifies the maximum allowed latency, i.e. time delay between generation of a message in the facilities layer or in an ITS-S application, and the transmission in the access layer at the antenna [6].
responsiveness	Responsiveness	This element defines the maximum allowed time delay between a requested ITS service and the performance of the requested service [9].
directionality	Directionality	This element defines coarsely the radiation pattern of an access technology [9].
directivity	Directivity	This element defines precisely the radiation pattern of an access technology [6].
serviceArea	ServiceArea	This element defines whether communication is required to be continuously possible during a service session, or whether it may be interrupted, together with a size value [9].
commRange	CommRange	Required communication range in multiples of 1/10 m. See CommRangeRef in [6].
bandwidth	Bandwidth	This elements defines the required transmission ability in terms of the transmission capacity and format (text, audio, simple graphic, still image, video) [9].
dataRateNWreq	DataRate	This element defines the average effective minimum data rate required at the IN-SAP [6].
targetArea	TargetArea	This element defines the shape of a required communication zone together with a size value [9].
accessTech	MedType	This element defines the required access technology.

B.6 ASN.1 module ITSaid2v0

This module specifies ASN.1 type definitions of data elements proposed for management of ITS application objects together with useful ASN.1 value definitions.

Unaligned packed encoding rules (PER) as specified in [1] shall be applied for the ASN.1 module ITSaid2v0 in case the data elements and value elements are used in an ITS communication link. Encoding rules for usage in a registration authority are outside the scope of the present document.

This module imports ASN.1 definitions from ASN.1 modules specified in [6], [9] and [i.1].

```
ITSaid2v0 { itu-t(0) identified-organization(4) etsi(0) itsDomain(5) wg2(2) itsaid(2860)
management(2) version0(0) } DEFINITIONS AUTOMATIC TAGS ::= BEGIN
```

```

IMPORTS
oidITSwg2 FROM ITSreg { itu-t(0) identified-organization(4) etsi(0) itsDomain(5) wg2(2) version1(1) }

VarLengthNumber FROM ITSaid0v0 { itu-t(0) identified-organization(4) etsi(0) itsDomain(5) wg2(2)
itsaid(2860) operation(0) version0(0) }

Directionality, ServiceArea, Bandwidth, ConnectionCost, TargetArea, Responsiveness FROM
ProtocolManagementInformation { iso(1) standard(0) iso15662(15662) protocolManagementInformation(1) }

CiaClass, Ciclass, DataRate, DataRate, Directivity, MediumCost, UserPriority FROM CALMllsap { iso(1)
standard(0) calm-ll-sap(21218) version1(1) };

-- End of IMPORTS

-- Types
ITSapObMsgs ::= SEQUENCE OF ITSapObMsg

ITSapObMsg ::= SEQUENCE {
    msgName           ITSapObMsgName,
    msgNo             ITSapObMsgNo,
    msgPort           ITSapObMsgPort,           -- destination port
    msgMaxPriority    ITSapObMsgMaxPriority,
    msgLCHs           ITSlogChannels,         -- allowed logical channel types
    msgCommProfiles  ITScommProfiles
}

ITSapObMsgName ::= PrintableString

ITSapObMsgNo ::= CHOICE {
    appSpecMsg      [0] MsgNo,
    msgSet          [255] MsgSetID
}

MsgNo ::= VarLengthNumber

MsgSetID ::= VarLengthNumber

ITSapObMsgPort ::= CHOICE {
    static          [0] PortNumber,
    dynamic         [255] NULL
}

PortNumber ::= INTEGER (0..65535)

ITSstaticPorts ::= INTEGER {
    sam             (0),           -- same as NWref=0 in ISO 29281-2010
    ctx             (1),
    cam             (2),
    msg             (3),
    -- reserved for future use: (4-31)
    -- reserved for dynamic assignment (32-65503)
    -- reserved for future use: (65504-65531)
    feh             (65532), -- same as NWref=252 in ISO 29281-2010
    ffwR            (65533), -- same as NWref=253 in ISO 29281-2010
    ffwH            (65534), -- same as NWref=254 in ISO 29281-2010
    unknown         (65535)      -- same as NWref=255 in ISO 29281-2010
} (0..65535)

ITSapObMsgMaxPriority ::= UserPriority

ITSlogChannels ::= SEQUENCE OF ITSlogChannel

ITSlogChannel ::= SEQUENCE {
    type             LogicalChannelType,
    priority         UserPriority           -- minimum required priority of message
    -- the actually used priority may be lower (set e.g. by congestion control,
    -- which does not affect the right to access a specific logical channel
    -- decision on selection of a logical channel (mapped to a physical channel) is
    -- done at the networking & transport layer.
}

LogicalChannelType ::= INTEGER {
    -- generic logical channel types
    lch0             (0), -- CCH
    lch1             (1), -- SCH1
    lch2             (2), -- SCH2
    lch3             (3), -- SCH3

```

```

    lch4          (4),
    lch5          (5),
    lch6          (6),
    lch7          (7),
    lch8          (8),
    lch9          (9), -- Secondary CCH
    lch10         (10), -- SCH4
    lch11         (11), -- SCH5
    lch12         (12), -- SCH6
    lch13         (13), -- ACH1
    lch14         (14), -- ACH2
    lch15         (15), -- ACH3
-- lch16 ... lch 254 reserved for application specific channel types
    lch255        (255) -- unspecified channel type
  } (0..255)

-- Mapping of logical channels on physical channels as specified in access tech
-- standards, see ETSI architecture standard.

ITSCommProfiles ::= SEQUENCE OF ITSCommProfile

ITSCommProfile ::= SEQUENCE {
    nlayer        NLayerFunc,
    alayer        ALayerFunc,
    mentity       MentityFunc
}

NLayerFunc ::= SEQUENCE OF NLayerFunctionalities

ALayerFunc ::= SEQUENCE OF ALayerFunctionalities

MentityFunc ::= SEQUENCE OF MentityFunctionalities

NLayerFunctionalities ::= CHOICE {
    protocolN     [0]      NWprotocolType, -- network layer protocol
    protocolT     [1]      TprotocolType, -- transport protocol type
    any           [255]    NULL -- no special request
}

ALayerFunctionalities ::= CHOICE {
    ciClass       [0]      Ciclass, -- from ISO 21218 [6]
    ciAccessClass [1]      Ciaclass, -- from ISO 21218 [6]
    ciMedType     [2]      MedType, -- from ISO 21218 [6]
    dataRate      [3]      DataRate, -- from ISO 21218 [6]
    any           [255]    NULL -- no special request
}

MentityFunctionalities ::= CHOICE {
    protocolM     [0]      MprotocolType,
    any           [255]    NULL -- no special request
}

--

NWprotocolType ::= INTEGER {
    unknown       (0), -- unknown networking protocol
    any           (1), -- any networking protocol - not further specified
-- ISO networking technologies
    fast          (2), -- CALM FAST [8]
    geoRouting    (3), -- CALM GeoRouting
    ipv6          (4), -- CALM IPv6 [i.10]
    wave          (5), -- IEEE 1609 [i.11]
-- ETSI networking technologies
    geoNetworking (64) -- GeoNetworking
} (0..255)

TprotocolType ::= INTEGER {
    unknown       (0), -- unknown networking protocol
    any           (1), -- any networking protocol - not further specified
-- ISO transport layer technologies
-- IETF transport layer technologies
    tcp          (2), -- TCP
    udp          (3), -- UDP
-- ETSI transport layer technologies
    btp          (64) -- Basic transport protocol
} (0..255)

```

```

MedType::=INTEGER {
    unknown          (0), -- unknown technology
    any              (1), -- any access technology - not further specified
-- ISO access technologies
    calm21212       (2), -- 2G technology
    calm21213       (3), -- 3G technology
    calm21214       (4), -- Infrared
    calm21215       (5), -- Microwaves based on IEEE 802.11. Includes (64)
    calm21216       (6), -- Millimeterwaves
    calm25112       (7), --
    calm25113       (8), --
    calm29283       (9), --
-- ETSI access technologies
    itsg5a          (64), -- Microwaves at 5,9 GHz based on 802.11
-- DSRC access technologies
    iso15628        (128), -- DSRC [4], [5]
-- LAN access technologies
    lanFast         (254), -- several, may be CAN, FAST over Ethernet
    lanIP           (255) -- several, may be IPv6 over Ethernet
} (0..255) -- Redefinition to be adopted in next version of [6]
MprotocolType::=INTEGER{
    unknown          (0), -- unknown networking protocol
    any              (1), -- any networking protocol - not further specified
-- ISO networking technologies
    iumc            (2) -- Inter Unit Management Communication
                  -- Inter-ITS-SCU communication [7]
-- ETSI networking technologies
} (0..255)

ITSapplRq::= SEQUENCE OF ITSapplRequirements

ITSapplRequirements::=CHOICE{
    mediumCost      [0]      MediumCost, -- [6]
    connectionCost [1]      ConnectionCost, -- [9]
    internet        [2]      BOOLEAN, -- TRUE, if Internet Access is needed
    adhoc           [3]      BOOLEAN, -- TRUE if ad-hoc access is needed
    latency         [4]      ITSlatency, -- Time allowed for a reply
    responsiveness [5]      Responsiveness, -- [9]
    directionality [6]      Directionality, -- [9]
    directivity     [7]      Directivity, -- [6]
    serviceArea     [8]      ServiceArea, -- [9]
    commRange       [9]      CommRange, -- same as CommRangeRef in [6]
    bandwidth       [10]     Bandwidth, -- [9]
    dataRateWreq    [11]     DataRate, -- [6]
    targetArea      [12]     TargetArea, -- [9]
    accessTech      [13]     MedType,
    noReq           [255]    NULL -- no special requirements
}

CommRange::=INTEGER(0..65535) -- in 1/10 m.

ITSlatency::=ENUMERATED{
    unknown          (0), -- unknown latency
    any              (1), -- any latency - not further specified
    ms               (2), -- response within milliseconds
    ms10             (3), -- response within 10s of ms
    ms100            (4), -- response within 100s of ms
    sec              (5), -- response within seconds
    sec10            (6), -- response within 10s of seconds
    min              (7), -- response within minutes
    min10            (8) -- response within 10s of minutes
}

--

-- Values

oidITSaid OBJECT IDENTIFIER::={ oidITSwg2 itsaid(2860) }
oidITSaid2 OBJECT IDENTIFIER::={ oidITSaid management(2) }
oidITSaid2v0 OBJECT IDENTIFIER::={ oidITSaid2 version(0) }

```

```
version INTEGER(0..255)::=0 -- version of this module

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

END
```

History

Document history		
V1.1.1	May 2011	Publication