

DIN EN ISO 22418

ICS 03.220.01; 35.240.60

Einsprüche bis 2019-02-07

Entwurf

**Intelligente Verkehrssysteme –
Protokoll zur schnellen Bekanntgabe von Diensten (FSAP)
(ISO 22418:2018);
Englische Fassung prEN ISO 22418:2018**

Intelligent transport systems –
Fast service announcement protocol (FSAP) (ISO 22418:2018);
English version prEN ISO 22418:2018

Systèmes de transport intelligents –
Protocole d'annonce de service rapide (FSAP) (ISO 22418:2018);
Version anglaise prEN ISO 22418:2018

Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2018-12-07 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.

Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses Entwurfs besonders zu vereinbaren.

Stellungnahmen werden erbeten

- vorzugsweise online im Norm-Entwurfs-Portal von DIN unter www.din.de/go/entwuerfe bzw. für Norm-Entwürfe der DKE auch im Norm-Entwurfs-Portal der DKE unter www.entwuerfe.normenbibliothek.de, sofern dort wiedergegeben;
- oder als Datei per E-Mail an naautomobil@din.de möglichst in Form einer Tabelle. Die Vorlage dieser Tabelle kann im Internet unter www.din.de/go/stellungnahmen-norm-entwuerfe oder für Stellungnahmen zu Norm-Entwürfen der DKE unter www.dke.de/stellungnahme abgerufen werden;
- oder in Papierform an den DIN-Normenausschuss Automobiltechnik (NAAutomobil), 10004 Berlin, Postfach 8 04 62, Behrenstr. 35, 10117 Berlin.

Die Empfänger dieses Norm-Entwurfs werden gebeten, mit ihren Kommentaren jegliche relevanten Patentrechte, die sie kennen, mitzuteilen und unterstützende Dokumentationen zur Verfügung zu stellen.

Gesamtumfang 61 Seiten

DIN-Normenausschuss Automobiltechnik (NAAutomobil)

Nationales Vorwort

Dieses Dokument (prEN ISO 22418:2018) wurde vom Technischen Komitee ISO/TC 204 „Intelligent Transport Systems“ in Zusammenarbeit mit dem Technischen Komitee CEN/TC 278 „Intelligente Verkehrssysteme“, dessen Sekretariat von NEN (Niederlande) gehalten wird, erarbeitet.

Das zuständige deutsche Normungsgremium ist der Gemeinschaftsarbeitsausschuss NA 052-00-71 GA „Gemeinschaftsarbeitsausschuss NAAutomobil/DKE: Intelligente Verkehrssysteme“ des DIN-Normenausschusses Automobiltechnik (NAAutomobil).

Das Präsidium des DIN hat mit seinem Beschluss 1/2004 festgelegt, dass von dem in den Regeln der europäischen Normungsarbeit von CEN/CENELEC verankerten Grundsatz, wonach Europäische Normen in den drei offiziellen Sprachen Deutsch, Englisch und Französisch veröffentlicht werden, in begründeten Ausnahmefällen abgewichen und auf die deutsche Sprachfassung verzichtet werden kann.

Die Genehmigung dafür hat die DIN-Geschäftsleitung entsprechend ihren in Anlage 1 zu dem DIN-Rundschreiben A 5/2004 festgelegten Kriterien für die vorliegende Norm auf Antrag des NA 052 NAAutomobil als Ergebnis einer Einzelfallentscheidung erteilt, zumal bereits dieser Norm zugrunde liegende Papiere überwiegend in englischer Sprache auch von den deutschen Marktteilnehmern angewendet werden.

Die Vorhaltung von ITS-Diensten an bestimmten Orten entlang einer Straße verlangt, dass die Verfügbarkeit und der Zweck solche Dienste bekannt sind damit ein Straßennutzer entscheiden kann, den angebotenen Dienst auch zu nutzen. Die Bekanntheit solcher Dienste kann über sogenannte Pull- oder Push-Mechanismen erreicht werden. Auch wenn Pull-Mechanismen bereits für zeitunkritische Verwendung allgemein bekannt und verstanden sind, basieren viele Anwendungsfälle auf Push-Mechanismen. Push-Mechanismen unterstützen „obligatorische Dienste“, die lokal und dynamisch verfügbar sein können, beruhen in den meisten Fällen auf lokalen Richtlinien und nicht auf globaler Gesetzgebung.

Dieses Dokument legt in anschaulicher Art und Weise die Eigenschaften des kooperativen Push-Mechanismus „Dienstanzeige“, basierend auf dem in ISO/TS 16460 international harmonisierten Botschaftsformat fest, welches oberhalb lokaler Kommunikationsprotokolle angeordnet ist.

Nationaler Anhang NA (informativ)

Begriffe

Für die Anwendung dieses Dokuments gelten die Begriffe der ISO 21217:2014.

SO und IEC stellen terminologische Datenbanken für die Verwendung in der Normung unter den folgenden Adressen bereit:

- IEC Electropedia: unter <http://www.electropedia.org/>
- ISO Online Browsing Platform: unter <http://www.iso.org/obp>

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols and abbreviated terms	2
5 General requirements	2
6 Architecture	4
6.1 ITS communications architecture	4
6.2 Implementation architecture	4
6.3 Communication roles and entities	4
6.4 Communication phases	5
6.4.1 Overview	5
6.4.2 Service initialization phase	5
6.4.3 Service operation phase	8
6.5 Advertised services	8
6.6 FSAP reference architecture	9
7 Protocol elements	10
7.1 Management service access points	10
7.2 Protocol data units	10
7.2.1 General	10
7.2.2 Fast service advertisement message	11
7.2.3 Fast service response message	11
7.2.4 Secured messages	11
7.2.5 Request and response messages	12
7.3 Port numbers	12
7.4 ITS application object identifier	12
8 Protocol procedures	12
8.1 General	12
8.1.1 FSAP communication handler procedures	12
8.1.2 FSAP manager procedures	13
8.1.3 Extension elements	13
8.2 Service provider	14
8.2.1 FSAP registration	14
8.2.2 FSAP registration update	15
8.2.3 FSAP deregistration	17
8.2.4 FSAP communication management	18
8.2.5 Transmission of FSAM	21
8.2.6 Reception of FSRM	21
8.3 Service user	24
8.3.1 FSAP registration	24
8.3.2 FSAP registration update	25
8.3.3 FSAP deregistration	25
8.3.4 Reception of FSAM	26
8.4 Service operation phase	30
8.5 ITS station-internal management communications	31
8.6 Duplicate service detection	31
8.7 System Service	31
8.7.1 General	31
8.7.2 Mandatory applications	31
9 Optionally supported features	32

10	Conformance	32
11	Test methods	32
Annex A (normative)	ASN.1 modules	33
Annex B (normative)	Support of application requirements for communications	41
Annex C (normative)	Support of path and flow management	43
Annex D (normative)	Implementation conformance statement	44
Bibliography		55

Foreword

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

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

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

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

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

This first edition cancels and replaces ISO 24102-5:2013 which has been technically revised.

Introduction

Provisioning of ITS services at specific locations on the road network requires awareness of the availability and the purpose of such services in order to allow a road network user deciding on the potential consumption of such a service. Awareness of services can be achieved by pull and push mechanisms. Whilst pull mechanisms are well understood and deployed for non-time-critical usage, several use cases depend on a push mechanism. Whilst pull mechanisms require a-priori knowledge of an intended service, push mechanisms support also "mandatory services" that may be locally and dynamically applicable and defined by local policies rather than global regulations.

This document illustrates and specifies the features of the cooperative push mechanism "Service Advertisement" based on the internationally harmonized message format specified in ISO/TS 16460:2016, and builds on top of any localized communications protocol stack.

WAVE service advertisement (WSA) specified in IEEE 1609.3^[3] is interoperable with the service advertisement specified in this document. However this document supports more features from ISO/TS 16460:2016 than WSA does.

Understanding service advertisement and the related protocol specified in this document requires understanding of ISO/TS 16460:2016.

Requirements are specified in the following clauses of this document.

- Clause 5 specifies general requirements.
- Clause 6 presents a tutorial on architectural issues related to FSAP.
- Clause 7 specifies protocol elements of FSAP.
- Clause 8 specifies protocol procedures of FSAP.
- Clause 9 specifies conformance declaration.
- Clause 10 specifies test methods.
- Annex A specifies the ASN.1 module for FSAP.
- Annex B specifies details of the optional support of presenting communication requirements of FSAP to the ITS station management compliant with ISO 17423:2018.
- Annex C specifies details of the optional support of path and flow management for FSAP compliant with ISO 24102-6:2018.
- Annex D presents the implementation conformance statement proforma.

Intelligent transport systems — Fast service announcement protocol (FSAP)

1 Scope

This document specifies the "Fast Service Announcement Protocol" (FSAP).

FSAP is in support of locally advertised ITS services uniquely identified by an ITS application identifier (ITS-AID).

This document specifies message formats and related basic protocol procedures by reference to ISO/TS 16460:2016, and further related protocol requirements for operation of FSAP in the context of an ITS station specified in ISO 21217:2014.

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

ISO/IEC 8825-7, *Information technology — ASN.1 encoding rules — Part 7: Specification of Octet Encoding Rules (OER)*

ISO/TS 16460:2016, *Intelligent transport systems — Communications access for land mobiles (CALM) — Communication protocol messages for global usage*

ISO 17419, *Intelligent Transport Systems — Cooperative ITS — Globally unique identification*

ISO 17423:2018, *Intelligent Transport Systems — Cooperative ITS — Application requirements for selection of communication profiles*

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

ISO 21218, *Intelligent Transport Systems — Hybrid communications — Access technology support*

ISO 24102-3, *Intelligent Transport Systems — ITS station management — Part 3: Service access points*

ISO 24102-4, *Intelligent Transport Systems — ITS station management — Part 4: Station-internal management communications*

ISO 24102-6:2018, *Intelligent Transport Systems — ITS station management — Part 6: Path and flow management*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21217:2014 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>

4 Symbols and abbreviated terms

FSAM	Fast service advertisement message
FSAP	Fast service announcement protocol
FSRM	Fast service response message
REQN	Request message PDU, no response message PDU expected
REQRES	Request or response message PDU out of the set REQW, REQN, RES
REQW	Request message PDU, response message PDU expected
RES	Response message PDU, acknowledging a REQW
S-FSAM	Secured FSAM
S-FSRM	Secured FSRM
SrvIniP	Service initialization phase
SrvOpP	Service operation phase

5 General requirements

The normative part of the specification of the "Service Advertisement messages" in ISO/TS 16460:2016 is a normative part of this document.

The "Fast Service Announcement Protocol" (FSAP) specified in this document shall be identified in FSAP application protocol data units (APDUs) by the version number three.

APDUs specified in this document are the "Fast Service Advertisement Message" (FSAM) and the "Fast Service Response Message" (FSRM).

The messages FSAM and FSRM shall be encapsulated by a security frame, resulting in a Secured FSAM (S-FSAM) and a Secured FSRM (S-FSRM).

Fragmented transmission of FSRMs and FSAMs is prohibited, thus the maximum size of S-FSAMs and S-FSRMs is limited by the capabilities of the protocol stack used for transmission.

FSAP is identified at the ITS-S networking & transport layer by

- the well-known registered ITS port number (ITS-PN) PORT_SAM = 1 = 0x00.01 published on [10], identifying the FSAP port that is receiving groupcasted S-FSAMs, and
- dynamically assigned ITS-PNs:
 - PORT_DYN_FSAM identifying the FSAP port that is receiving unicast S-FSAMs. The dynamic assignment is done in the ITS-SU that is transmitting S-FSRMs;
 - PORT_DYN_FSRM identifying the FSAP port that is receiving unicast S-FSRMs. The dynamic assignment is done in the ITS-SU that is transmitting S-FSAMs;

as illustrated in Table 1; see also 7.3 on ITS port numbers.

Table 1 — FSAP ITS port numbers

Direction	Source ITS-PN	Destination ITS-PN	MAC mode
From service advertiser to service user	PORT_DYN_FSRM	PORT_SAM	Groupcast (broadcast or multicast)
		PORT_DYN_FSAM	Unicast
From service user to service advertiser	PORT_SAM	PORT_DYN_FSRM	Unicast
	PORT_DYN_FSAM		

NOTE Procedures on how to perform multicast transmission of S-FSAs are not specified in this document.

Unicast transmissions of S-FSRMs and S-FSAs may be repeated, e.g. after timeout for a respective acknowledgement, as defined by implementation.

Further on the FSAP is identified by

- the ITS application identifier (ITS-AID) 2.113.664 published on [10]; see also 7.4. The p-encoded (ASN.1 unaligned packed encoding rules) presentation of this number of ASN.1 type `ITSaid` specified in ISO 17419 is 0pE0.00.00.00, i.e. fits into a four octet field.

An implementation supporting path and flow management shall be compliant with ISO 24102-6:2018.

An implementation for a distributed ITS-SU, i.e. an ITS-SU consisting of several ITS-SCUs interconnected with an ITS station-internal network, shall be compliant with ISO 24102-4.

As

- identical message formats for service advertisement are used in IEEE 1609.3^[2] (WAVE SAM) and ETSI TS 102 890^[16] (ESAM), and
- the features specifications in IEEE 1609.3^[2] and ETSI TS 102 890^[16] are sub-sets of the specification in this document,

an implementation of FSAP optionally may support the service advertisement from IEEE WAVE devices and the service announcement from ETSI ITS stations by considering the following:

- WAVE SAM support
 - 1) The only supported access technology is IEEE 802.11 OCB mode specified in IEEE 802.11^[4] (ISO 21215^[6] with US frequency allocation and WAVE-specific details).
 - 2) The only networking & transport layer protocol supported is the WAVE Short Message protocol (WSMP) specified in IEEE 1609.3^[2], which uses the same message format as FNTF with TPID-FS zero^[8].
 - 3) Port numbers are not used. Instead, the service advertisement message SAM is identified by the value 135 of ITS-AID, used as a transport layer destination address in WSMP (i.e. in FNTF with TPID-FS zero^[8]).
 - 4) The WAVE SAM is identical to FSAM.
 - 5) S-FSAM (Security encapsulated FSAM) uses the same format and encoding as WAVE does. WAVE security is specified in IEEE 1609.2^[3].
 - 6) FSRM and other features, e.g. mandatory applications and private service channels, are not supported.
- ESAM support
 - 1) The only supported access technology is IEEE 802.11 OCB mode (ISO 21215^[6] with EU frequency allocation and ETSI-specific details).

- 2) The only networking & transport layer protocol currently supported is ETSI GeoNetworking/ETSI Basic Transport Protocol.
- 3) The ESAM is identified by the BTP port number for SAM specified in ETSI TS 103 248.
- 4) The ESAM is identical to FSAM except that ESAM is preceded by the ETSI common message header.
- 5) Security encapsulation is not specified.
- 6) FSRM and other features, e.g. mandatory applications and private service channels, are not supported.

6 Architecture

6.1 ITS communications architecture

The "FAST Service Announcement Protocol" (FSAP) is designed as a functionality of the ITS station and communication architecture specified in ISO 21217:2014.

6.2 Implementation architecture

The "Fast Service Announcement Protocol" (FSAP) specified in this document supports the implementation architectures introduced in ISO 21217:2014.

6.3 Communication roles and entities

The "FAST Service Announcement Protocol" (FSAP) distinguishes the following roles identified in ISO/TS 16460:2016:

- a) Service Advertiser:
 - Management of advertisement requests from Service Providers
 - Transmission of FSAMs and reception of FSRMs
- b) Service Provider:
 - Provision of ITS services
- c) Service User:
 - Reception of FSAMs and transmission of FSRMs
 - Consumption of ITS services

An ITS-SU may simultaneously or sequentially act as a service advertiser, service provider, and service user.

This document does not explicitly consider the distinction of service advertiser ITS-SUs and service provider ITS-SUs; for the purpose here the two roles are assumed to be located in the same ITS-SU.

An instance of any kind of ITS station identified in ISO 21217:2014 (roadside, vehicle, portable, centre) may implement the FSAP.

6.4 Communication phases

6.4.1 Overview

In order to allow an ITS-SU to offer an ITS service to another ITS-SU by means of an application session, a service initialization phase (SrvIniP) is performed by the FSAP, where the SrvIniP is based on localized communication, e.g. applying the FNTTP networking & transport layer protocol specified in ISO 29281-1^[8].

After initialization, the application session is performed during the service operation phase (SrvOpP), where the SrvOpP may be based on either localized communication or networking, e.g. IPv6 communication, over any kind of access technology.

During SrvIniP, handover to another protocol stack, e.g. another access technology and IPv6, may be demanded.

The real-time SrvIniP procedures preferably are implemented in an ITS-S router.

NOTE The specification of SrvOpP is outside the scope of this document.

6.4.2 Service initialization phase

The purpose of SrvIniP is to invite a peer ITS-SU by means of a "Fast Service Announcement Message" (FSAM) to use an ITS service which is uniquely identified by an ITS application identifier (ITS-AID) specified in ISO 17419; ITS-AID points to an ITS application object.

NOTE 1 Usage of some allocated ITS-AID values may not be meaningful in FSAM.

Acceptance of such an invitation typically results in a session, where the two peer ITS-S applications exchange data. However, a session is not necessarily needed, i.e. the service may be provided completely by the FSAM. Thus FSAM provides also the means to periodically broadcast information from ITS broadcast services.

Three operational options of SrvIniP are specified. The distinction originally was motivated by the two ITS application objects

- 1) ITS application class^[1] and
 - 2) ITS application,
- and was extended
- 3) to allocate private communication channels to individual ITS station units (ITS-SUs).

Option one, originally designed for ITS application classes (DSRC-like SrvIniP)^[1], is illustrated in Figure 1. FSAM is sent by a service advertiser ITS station to invite for a service initialization phase. FSRM is sent by a service user ITS station to acknowledge FSAM. Successful SrvIniP is given by the first successful REQW or REQN of the service provider.

NOTE 2 In [1], BST corresponds functionally to FSAM, and VST corresponds functionally to FSRM.

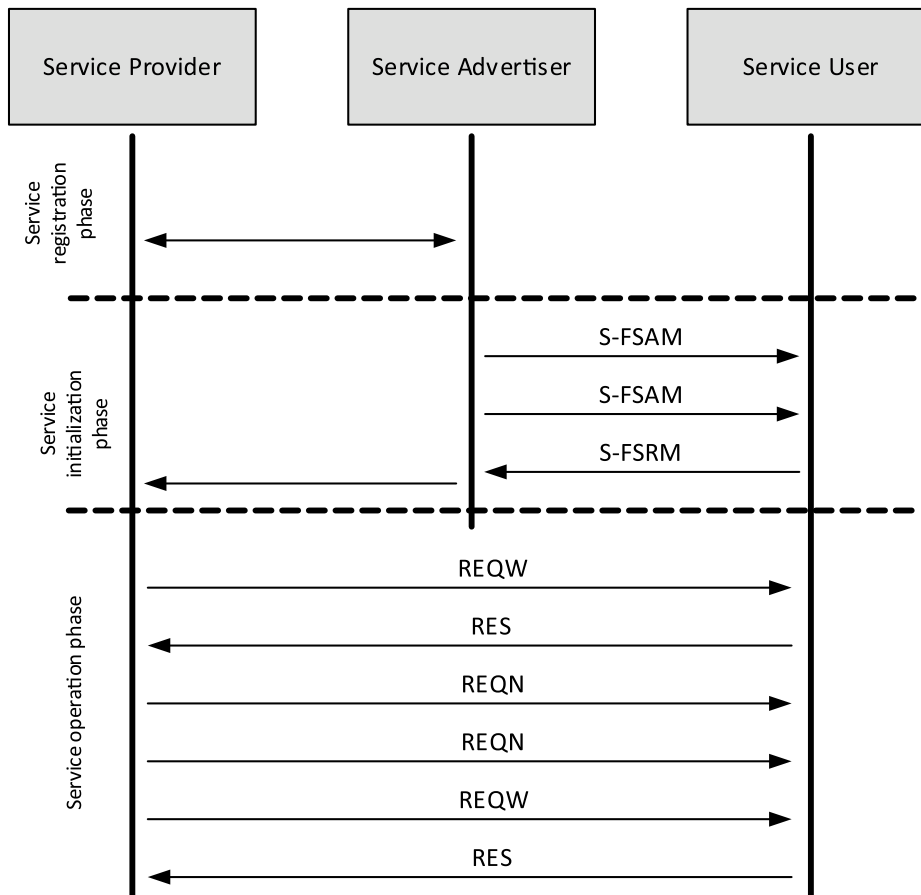


Figure 1 — ITS application session with FSRM

NOTE 3 The concept of application classes was introduced in [1]. Distinction of classes was done with an identifier of ASN.1 type `DSRCApplicationEntityID`. The difference between an ITS application class and an ITS application is, that for an ITS application class several contexts exist. Each context itself can be referred to as an ITS application.

During a `SrvOpP`

- requests, either with or without an expected response, typically are sent by the service provider, but may also be sent by the service user, and
- responses typically are sent by the service user, but may also be sent by the service provider, dependent on the specification of the ITS application.

NOTE 4 Rules on which data are sent by a service provider or by a service user apply strictly for [1]. In general, for ITS there are no such rules.

NOTE 5 As specified in ISO 21217:2014, the service user and service client instances of an ITS application are referred to as ITS-S application processes; ITS-S application processes residing in the "Applications" entity are referred to as ITS-S applications.

Option two, originally designed for ITS applications (WAVE-like `SrvIniP`)[2], is illustrated in Figure 2. FSAM is sent by a service advertiser to perform service service initialization. Successful `SrvIniP` is given by the first successful REQW or REQN of the service user.

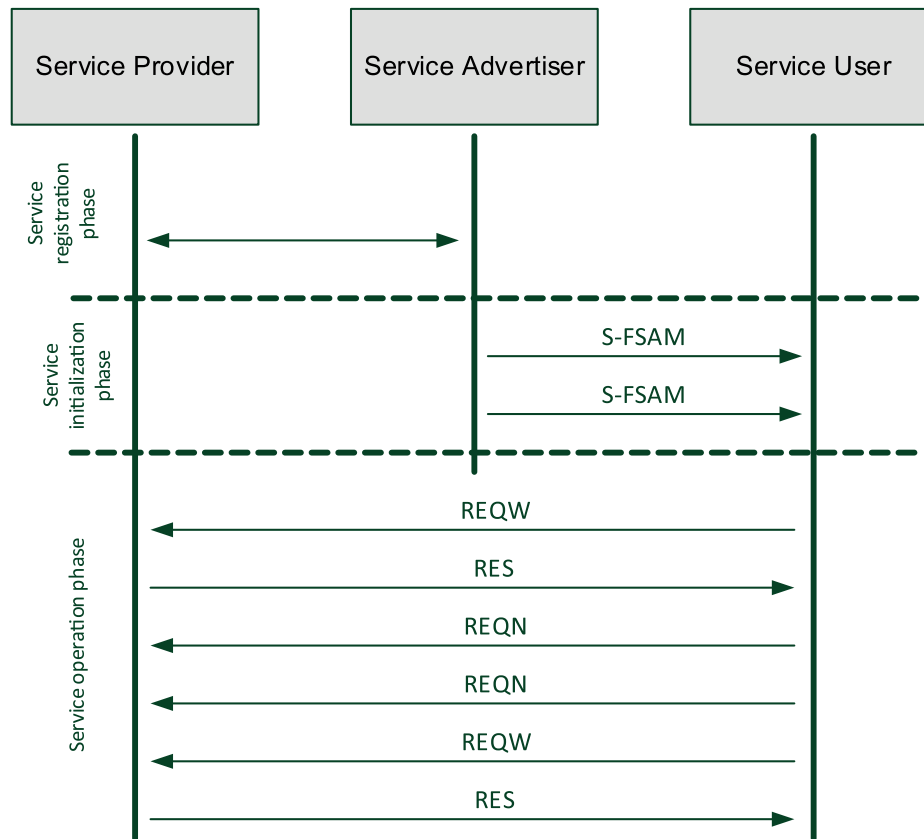


Figure 2 — ITS application session without FSRM

During a SrvOpP

- requests, either with or without an expected response, typically are sent by the service user, but may also be sent by the service provider, and
- responses typically are sent by the service provider, but may also be sent by the service user, dependent on the specification of the ITS application.

NOTE 6 In general for ITS there is no such strict rule which station type is sending which type of message.

Option three presents the situation when a service advertiser wants to allocate private communication channels to service users. In this option an additional handshake between the service advertiser and the service user is needed prior to start of the SrvOpP. The option three is applicable for ITS applications and ITS application classes.

NOTE 7 "Private communication channel" does not necessarily mean that only a single service user station operates on it. It is up to the service advertiser station to allocate a private communication channel to one or several service user stations.

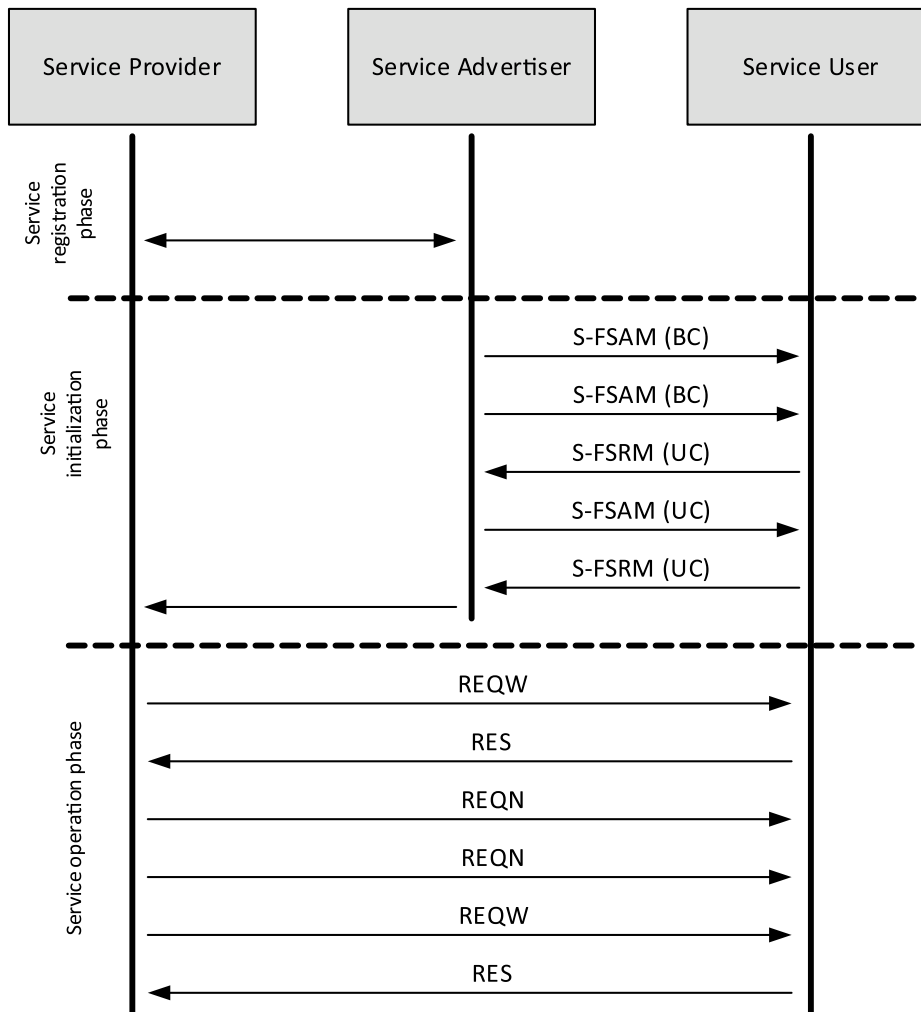


Figure 3 — ITS application session with privately allocated communication channel

6.4.3 Service operation phase

Management of reception and transmission of session messages, e.g.

- "Request with No response expected" (REQN),
- "Request With response expected" (REQW),
- "Response to a request" (RES)

as illustrated in Figures 1, 2, and 3 is outside the scope of this document.

6.5 Advertised services

ITS services being advertised with FSAP are provided by ITS applications which typically are specified with two complementary ITS-S application processes, e.g. one implementing the provider part, the other implementing the user part; see ISO 21217:2014.

An ITS application is uniquely identified by an ITS-AID specified in ISO 17419. The one or several ITS-S application processes of such a single ITS application are distinguished by means of the ITS-S application process identifier (ITS-SAPID) specified in ISO 17419. Thus a specific ITS-S application process is uniquely identified by the tuple {ITS-AID, ITS-SAPID}.

ITS-SAPIDs can also be used to distinguish different versions of the ITS-S application process

In order to identify and execute the proper ITS-S application processes during the SrvOpP, two approaches are identified:

- a) management by FSAP;
- b) management by the ITS application not using specific features of FSAP.

The approach a) defines in general an ITS application as an ITS application class, i.e. an ITS application with different contexts; see ISO 17419. Thus upon reception of an FSAM advertising such an ITS application class, the service user station first will reply with an FSRM presenting the supported ITS-SAPID values. Based on this information, the service provider will select a suited ITS-S application process identified by the ITS-SAPID, if possible, or will not be able to provide the service.

A possible procedure b) would be to use version numbers in the APDUs of the ITS-S application processes, allowing a receiving entity to select the appropriate protocol.

6.6 FSAP reference architecture

The FSAP reference architecture is illustrated in Figure 4.

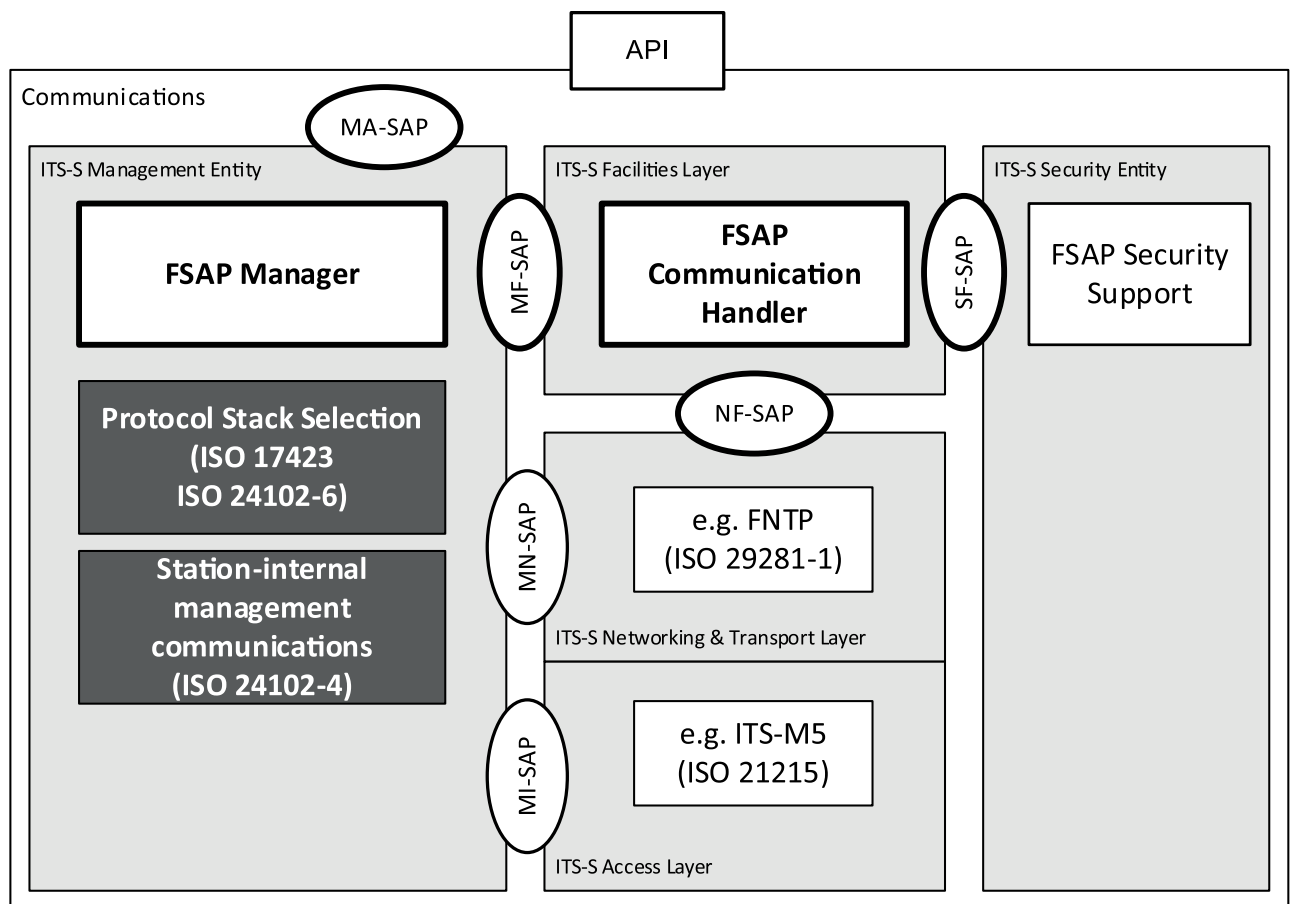


Figure 4 — FSAP reference architecture

The FSAP is specified by means of two functional entities located in the ITS station, see ISO 21217:2014, i.e.

- "FSAP communication handler" located in the ITS-S facilities layer;
- "FSAP manager" located in the ITS-S management entity.

Security services in support of FSAP are located in the ITS-S security entity shown in Figure 4. Related specifications, except very general ones in 7.2.4, are out of scope of this document.

Further support functionalities are

- protocol stack selection, e.g. as specified in ISO 17423:2018 and ISO 24102-6:2018;
- station-internal management communications, e.g. as specified in ISO 24102-4.

NOTE There are initial investigations in ISO TC204 to provide the functionality of the FSAP Communication Handler as part of an ITS station capability defined in ISO TS 17429[9].

7 Protocol elements

7.1 Management service access points

NOTE SAPs are functional descriptions which in many cases are not implemented as observable interfaces. Thus in general SAPs are not testable. The requirements set up in this document with respect of SAPs thus just mean the functional behaviour rather than a specific implementation. As far as related ASN.1 definitions are given, these become mandatory as soon as the defined elements become observable, e.g. within PDUs for ITS station-internal management communications specified in ISO 24102-4.

FSAP uses functionality of the MA-SAP, MF-SAP, and SF-SAP. This functionality is provided by means of procedures with parameters presented in Tables. Appropriate ASN.1 type definitions implementing this functionality are specified.

7.2 Protocol data units

7.2.1 General

The format of FSAM shall be identical to the format of SAM specified in ISO/TS 16460:2016; it is presented in Figure 5.

FSAM							
Header					Body		
4 bits	4 bits	4 bits	4 bits	Optional Variable	Optional Variable	Optional Variable	Optional Variable
Version	Option Selector	FSAM-ID	FSAM-Count	FSAM Extensions	Service Info Segment	Channel Info Segment	IPv6 Routing Advertisement

Figure 5 — General format of FSAM

The format of FSRM shall be identical to the format of SRM specified in ISO/TS 16460:2016; it is presented in Figure 6.

FSRM					
Header			Body		
4 bits	4 bits	Optional Variable	Optional Variable	Optional Variable	Optional Variable
Version	Option Selector	FSRM Extensions	Private Channel Allocation Request	Context Information	Private Channel Allocation Confirm

Figure 6 — General format of FSRM

None of the features specified in ISO/TS 16460:2016 are prohibited for FSAM and FSRM.

7.2.2 Fast service advertisement message

The "Fast Service Advertisement Message" (FSAM) is of ASN.1 type *F_{sam}* specified in A.2. It is identical to the service advertisement message SAM of ASN.1 type *S_{am}* specified in ISO/TS 16460:2016.

7.2.3 Fast service response message

The "Fast Service Response Message" (FSRM) is of ASN.1 type *F_{srm}* specified in A.2. It is identical to the service response message SRM of ASN.1 type *S_{srm}* specified in ISO/TS 16460:2016.

7.2.4 Secured messages

The messages FSAM and FSRM shall be encapsulated by a security frame, resulting in a Secured FSAM (S-FSAM) and a Secured FSRM (S-FSRM) as presented in Figure 7.

Secured message				
Header			Body	Trailer
4 bit	4 bit	Optional Variable	Variable	Optional Variable
Version	Security Option Selector	Security Header	Original or processed FSAM / FSRM	Security Trailer

Figure 7 — Encapsulated FSAM and FSRM

Basic requirements are specified in ISO/TS 16460:2016.

The "Secured message" in Figure 7 is specified with the following ASN.1 code, applying octet encoding rules (OER) specified in ISO/IEC 8825-7:

```
Smessage ::= SEQUENCE {
    protocolVersion    INTEGER (0..255), -- actual version value is three
    content            SmessageContent
}

SmessageContent ::= CHOICE {
    unsecuredData      OCTET STRING, -- contains unmodified FSAM or FSRM
    signedData         SignedData,
    encryptedData      EncryptedData,
    ...
}
```

Currently identified values of the "Security Option Selector" are:

- 0x80: Unsecured message.

The optional security header and security trailer are not present. The body contains the unmodified FSAM or FSRM preceded by a length field indicating the number of octets contained in FSAM and FSRM, respectively.

- 0x81: Signed message.

The optional security header and trailer are present. The body contains the unmodified FSAM or FSRM preceded by a length field indicating the number of octets contained in FSAM and FSRM, respectively.

— 0x82: Encrypted message.

The optional security header and trailer are present. The body contains encrypted data.

Different methods to sign or encrypt messages are possible. One approach is specified in IEEE 1609.2[3] with `Smessage ::= Ieee1609Dot2Data`.

FSAP uses the services of the ITS-S Security Entity for signing and encrypting messages.

Further security details are out of scope of this document.

7.2.5 Request and response messages

Request and response messages may be exchanged between peer ITS-S units within SrvOpP.

NOTE Details are outside the scope of this document.

7.3 Port numbers

FSAP uses an ITS-S network & transport layer protocol, where ITS port numbers (ITS-PNs) are used to identify source and destination endpoints in an ITS station. ITS-PNs are of ASN.1 type `PortNumber` specified in ISO f.

Source and destination endpoints of ITS-S applications, i.e. peer instances of ITS applications, advertised with FSAP are accessible either with static (well-known) port numbers, or with dynamically assigned port numbers according to the rules of the ITS-S networking & transport layer protocol and the protocol procedures specified in this document. The number range of dynamically assigned port numbers `PORT_DYN`, and assigned values of static port numbers `PORT_REG` are identified in ISO 17419 and published on the ISO Standards Maintenance Portal^[10].

7.4 ITS application object identifier

ITS application objects are identified by means of an "ITS Application object Identifier" (ITS-AID) specified in ISO 17419. ITS-AID is of ASN.1 type `ITSaid`. Assigned numbers are published on the ISO Standards Maintenance Portal^[10].

8 Protocol procedures

8.1 General

8.1.1 FSAP communication handler procedures

The FSAP communication handler located in the ITS-S facilities layer shown in Figure 4 performs the following tasks:

- Cooperate with the FSAP manager located in the ITS-S management entity via the MF-SAP as illustrated in Figure 1, using MF-Commands and MF-Requests specified in ISO 24102-3 with details specified in this document. The purposes are:
 - Receive registering, updating and deregistering requests from the FSAP manager for FSAM real-time groupcasting;
 - Receive requests from the FSAP manager for sending FSAMs and FSRMs in unicast mode to identified peer stations;
 - Forward received FSAMs and FSRMs from peer stations to the FSAP manager, and perform appropriate procedures.
- Prepare necessary ITS-S networking & transport layer protocols for communication.

- Assemble and maintain FSAM PDUs and FSRM PDUs.
- Involve the FSAP security support located in the ITS-S security entity via the SF-SAP illustrated in Figure 1, using SF-Commands and SF-Requests specified in ISO 24102-3 with details specified in other standards or specification documents, for:
 - converting FSAM PDUs into S-FSAM PDUs, and FSRM PDUs into S-FSRM PDUs;
 - converting S-FSAM PDUs into FSAM PDUs, and S-FSRM PDUs into FSRM PDUs.
- Request transmission of S-FSAM PDUs and S-FSRM PDUs via the proper lower communications protocol stack accessible via the NF-SAP.
- Receive S-FSAM PDUs and S-FSRM PDUs from the proper lower communications protocol stack via the NF-SAP.

Details are given by dedicated procedures specified in this document.

8.1.2 FSAP manager procedures

The FSAP manager located in the ITS-S management entity shown in Figure 4 performs the following tasks:

- Cooperate with ITS-S application objects via the MA-SAP as illustrated in Figure 1, using MA-Commands and MA-Requests specified in ISO 24102-3.
 - Register and deregister ITS-S application processes as service providers or service users, and maintain such registrations.
 - Notify registered ITS-S application processes about events of the FSAP. Details depend on the role as service provider or service user.
- Cooperate with the FSAP communication handler, see 8.1.1.
- Manage forwarding of FSAP related information between ITS-SCUs of the same ITS station applying ITS station-internal management communications specified in ISO 24102-4, if applicable.
- Contribute to the management of selecting communication protocol stacks for ITS-S applications, e.g. specified in ISO 24102-1^[7], ISO 17423:2018, ISO 24102-6:2018.

Details are given by dedicated procedures specified in this document.

8.1.3 Extension elements

Processing of extension elements contained in FSAMs and FSRMs, if applicable, shall be as specified in ISO/TS 16460:2016 and in this document. Details of management of some "Extension elements" specified in ISO/TS 16460 may depend on implementations.

Applicable extension elements identified so far are:

- a) SAM extensions listed in ISO/TS 16460:2016, Table 5;
 - The extended channel info segment extension shall be supported by FSAP for implementations (ITS-SUs) supporting hybrid communications.
- NOTE The extended channel info segment extension is not supported in IEEE 1609.3^[2].
- b) Service info extensions listed in ISO/TS 16460:2016, Table 7;
 - The SAM application data extension shall be supported by FSAP.
 - The SrvOpP Protocol Stack extension of ASN.1 type `SrvOpP-ProtocolStack` specified in A.4 shall be supported by FSAP for implementations (ITS-SUs) supporting hybrid communications.