

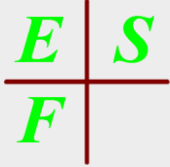


IEEE / ISO Harmonization Workshop

Fast Service Advertisement

WSA (IEEE 1609.3) – FSAP (ISO 24102-5)





Harmonization WAVE / FAST

Feedback to ITS Standards Development Organizations – Communications

Document HTG3-3

Version: 2012-11-12

EU-US ITS Task Force

Standards Harmonization Working Group

Harmonization Task Group 3

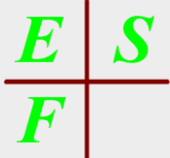
[*Feedback documents on EC web*](#)

Most of the feedback is related to FSAP/WSA, and to FNTF/WSMP



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Harmonization WAVE / FAST

Feedback to ITS Standards Development Organizations – Security

Document HTG1-3

Version: 2012-11-12

EU-US ITS Task Force

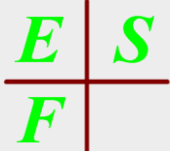
Standards Harmonization Working Group

Harmonization Task Group 3



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Harmonization WAVE / FAST

HTG3-NT-02: Transport protocols

WSMP, FNTP, BTP

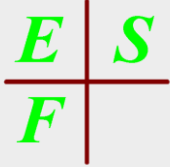
Action-HTG3-23. ETSI consider replacement of BTP [24] with FNTP [16]. IEEE consider incorporation of a port mapper function for WSMP [52] to provide consistent capability with FNTP. SDOs continue to coordinate for ongoing harmonization of features, formats, and protocols toward eventual common protocol.

BTP is designed to work only with GeoNetworking



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HTG3-ME-01: Service advertisement

FSAP, WSA

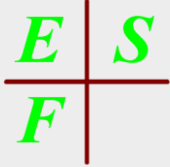
Action-HTG3-32. In general, SDOs coordinate on standards for a single, generalized service advertisement protocol to accommodate (as options) the requirements from each SDO domain. Specifically, ISO provide IEEE 1609 working group rationale for a CTX protocol and IEEE consider incorporating the CTX feature [14] in a suitable way in the WSA protocol [52].

Action-HTG3-33. SDOs continue to coordinate on consolidated minimal requirements for service delivery mechanisms. Specifically, ETSI/ISO consider whether the SAM-over-802.11 data frames option is essential to service advertisement in [14], and if so, propose a similar feature to the IEEE 1609 working group for incorporation in [52].



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Harmonization WAVE / FAST

HTG3-ME-01: Service advertisement

FSAP, WSA

Action-HTG3-34. ISO consider updating the SAM format [14] to include information comparable to the WSA Country String [52] (whose format details are specified in IEEE Std 802.11 [49]).

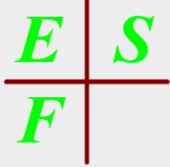
Action-HTG3-36. ISO consider adopting IEEE 1609 [52] router advertisement approach for FSAP [14].

Action-HTG3-37. IEEE consider whether the session support feature of FSAP is beneficial to service advertisement in [52] and if so, consider incorporating the mechanism specified in [14].



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Harmonization WAVE / FAST

HTG3-ME-01: Service advertisement

FSAP, WSA

Action-HTG3-38. ISO evaluate the compatibility of this feature (TX power indication) with the station reference architecture, and its optional inclusion in the FSAP [14] for specific access technologies.

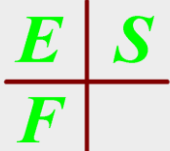
Action-HTG3-39. ISO consider inclusion of this feature (SAM/WSA repetition rate) in the FSAP [14], e.g., as an optional feature for specific access technologies.

Action-HTG3-40. ISO consider inclusion of this feature (Location of service provider antenna) in the FSAP [14], e.g., as an optional feature for specific access technologies.



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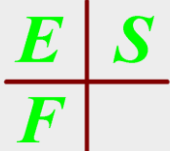
Harmonization WAVE / FAST

- [5] ISO 21215:2010, Intelligent transport systems—Communications access for land mobiles (CALM)—M5
- [14] DIS 24102-5:2012, Intelligent transport systems—Communications access for land mobiles (CALM)—Station management—Part 5: Fast service advertisement protocol (FSAP)
- [16] DIS 29281-1:2012, Intelligent transport systems—Communications access for land mobiles (CALM)—Non-IP networking—Part 1: Fast networking & transport layer protocol (FNTP)
- [46] ISO/IEC 8802-2:1998, ANSI/IEEE Std 802.2TM :1998, IEEE Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements Part 2: Logical Link Control



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Harmonization WAVE / FAST

- [49] IEEE Std 802.11TM :2012, IEEE Standard for Information technology— Telecommunications and information exchange between systems - Local and metropolitan area networks—Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications
- [51] IEEE P1609.2TM D15, Draft Standard for Wireless Access in Vehicular Environments (WAVE)—Security Services for Applications and Management Messages
- [52] IEEE Std 1609.3TM :2010, IEEE Standard for Wireless Access in Vehicular Environments (WAVE)—Networking Services



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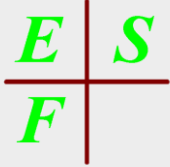


Harmonized standards

Standards aim on enabling global markets. Consequently duplicate or even competing standards are not supporting the goal of standardization, but create silo-like niche-markets and increased cost of products.

The harmonization effort for WAVE / FAST aims on

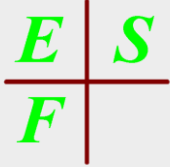
- increased market acceptance (requirements from vendors and users)
- increased technical stability by improved and harmonized globally applicable specifications
- increased trust in SDOs by not maintaining "last centuries' visions" and by not accepting specification proposals from single companies, but applying the consensus process
- increased efficiency, reliability, scalability of standardized services
- doing the step from field trial equipment to mass production for global usage, and by this saving investment in the future (no need for costly updates) – which might break backward compatibility of mass products with trial equipment
- timely delivery of standards for day-1 mass production



Harmonization WAVE / FAST

Harmonization Paradigm

- IEEE designed an optimized single access technology system: **WAVE device**.
 - ISO designed a general multi access technology system: **ITS station unit**.
1. Harmonization in no way must affect the "internal" design of these two different systems.
 2. Harmonization shall be restricted to preferably full interoperability of the messaging (WSMP/FNTP) and service advertisement protocols (WSA/FSAP) related to the WAVE radio technology (IEEE 802.11), i.e. the interoperability of an ITS station meeting a WAVE station.
 3. Station internal interfaces and management procedures need not to be harmonized.
 4. Functional backward compatibility is highly recommended (validation of functionality is where the money was invested), whilst binary backward compatibility is not necessarily needed at this stage.



Harmonization WAVE / FAST

Practical approach in standardization

Common protocol specifications are to be presented in a common document. For this purpose, ISO already prepared for a work item in TC204 WG16. The work item is to produce an International Standard ISO 16460.

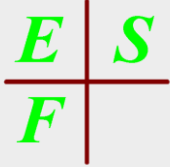
ISO 16460 is to be referenced in modified versions of the related

- ISO standards (ISO 24102-5, ISO 29281-1), and
- IEEE standards (IEEE 1609.3)

Security specifications are already existent in a separate IEEE standard IEEE 1609.2.

IEEE 1609.2 is to be referenced in modified versions of the related

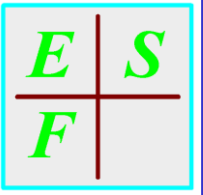
- ISO standards (ISO 24102-5, ISO 29281-1).



Harmonization WAVE / FAST

Conformance testing

- Conformance testing is a pre-requisite for large-scale deployment
- ETSI STF 455 validated the test suites for FNTP and FSAP
- These test suites use TTCN-3 (C-like language for testing) and ASN.1 import. ASN.1 formal description language is essential to ensure high quality of test suites.
- These test suites can quickly be updated to support the harmonized solution in case ASN.1 is used to specify the protocol messages. Conformance tests of the harmonized solution can be run earliest in Q3/2014, assuming consensus on the harmonized solution in February 2014.



Approach towards a harmonized Service Advertisement Protocol



Terms and Definitions

ITS service

ISO 21217: functionality provided to users of intelligent transport systems designed e.g. to increase safety, sustainability, efficiency, or comfort

EN 302 665: service provided by an ITS application to the user of ITS

ITS application

ISO 21217: instantiation of an ITS service that involves an association of two or more complementary ITS-S application processes

EN 302 665: association of two or more complementary ITS-S applications

ITS-S application process

ISO 21217: element in an ITS station that performs information processing for a particular application, and uses ITS-S services to transmit and receive information

ITS-S application

ISO 21217: ITS-S application process residing in the ITS-S application entity

EN 302 665: fragment of an ITS application available at an ITS station that uses ITS-S services to connect to one or more other fragments of the same ITS application

ITS-S service

ISO 21217: communication functionality of an ITS-S that provides the capability to connect to other nodes

EN 302 665: communication functionality offered by an ITS-S to an ITS-S application



Terms and Definitions (FSAP)

SAM

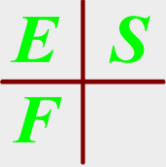
ISO 24102-4: Service Advertisement Message.

SAMs are sent from port PORT_SAM to port PORT_SAM; PORT_SAM is the value of a well-known ITS port specified in CEN/ISO 17419.

CTX

ISO 24102-4: Service context message, containing information on service contexts. Used in advertisements of ITS application classes. Content is specific to the related ITS application class.

CTXs are sent from PORT_SAM to port PORT_SAM.



Terms and Definitions (1609)

provider: Advertiser of a Wireless Access in Vehicular Environments (WAVE) service. See also: user; Wireless Access in Vehicular Environments (WAVE) Service Advertisement.

user: One that acts on receipt of a WAVE Service Advertisement. See also: provider; Wireless Access in Vehicular Environments (WAVE) Service Advertisement.

WAVE Service Advertisement monitoring

The WME monitors and verifies services advertised by other WAVE devices for use by higher layers and management functions.

Provider Service Context (PSC): A field associated with a Provider Service Identifier (PSID) containing supplementary information related to the service. The internal format of the PSC is PSID dependent. *Octet string of size 1 .. 31.*



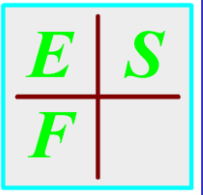
Purpose of Service Advertisement

- Service advertisement is a "**push**" information service used over single-hop communication links without networking capabilities. Typically the service advertiser ITS station unit is a roadside unit.
- The purpose is informing ITS station units about availability of an ITS service. Such an ITS service may be **mandatory** (to be used in a "vicinity" around the advertiser station) or voluntarily (optional) to be consumed.
- Such an ITS service typically is provided in a session, but may be given also with a single broadcast message (as part of the service advertisement).
- An advertised service may be offered in the **service advertiser** ITS station unit or in an **service provider** ITS station unit.
- A service provider ITS station unit may be a central ITS station unit located somewhere in a network, e.g. in the Internet.



Purpose of Service Advertisement

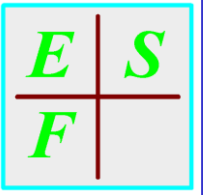
- An advertised service may be reachable via
 - the same or a similar single-hop communication link as used for SAM / CTX, or
 - another link.
 - Fast Service Advertisement is an ITS application with its own ITS-AID = 2.113.664 (PSID field value = 0xe0.00.00.00); allocated for ISO 24102-5.
- Thus
- ✓ change of communication channel, and
 - ✓ change of access technology, and
 - ✓ change of ITS-S networking & transport layer protocol may be applicable to run a service session.



General requirements

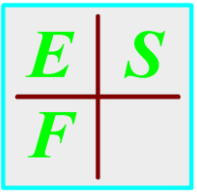
- Support of different access technologies
 - Access technologies may only support **data frames**. Usage of MAC management frames should be omitted to enable an efficient general approach.

NOTE: MAC management frame was selected in WAVE to enable WAVE devices without WSMP to receive SAMs and use IP based services. ISO 24102-5 already now supports MAC management frames.



General requirements

- Support of several instantiations of the same ITS-S application process in an ITS station unit, i.e. the usage of port numbers allowing for well-known port numbers and dynamically assigned port numbers.
- Efficient (slim) packet format to enable sessions between vehicle ITS station units and roadside ITS station units at typical speed of highways over narrowband channels.



ITS station units involved

- The overall process of advertising ITS services and consume them may involve different roles, which partly may be implemented in the same ITS station unit. Roles are:
 - Service advertiser
 - Service provider
 - Service user
 - Access to service provider (*is such a role necessary?*)
- In a simple scenario, the service advertiser and the service provider are located in the same ITS station unit.
- The service advertiser and the service user must be in ITS station units which support single-hop communications. The service provider may or may not support single-hop communications, dependent on the services provided.

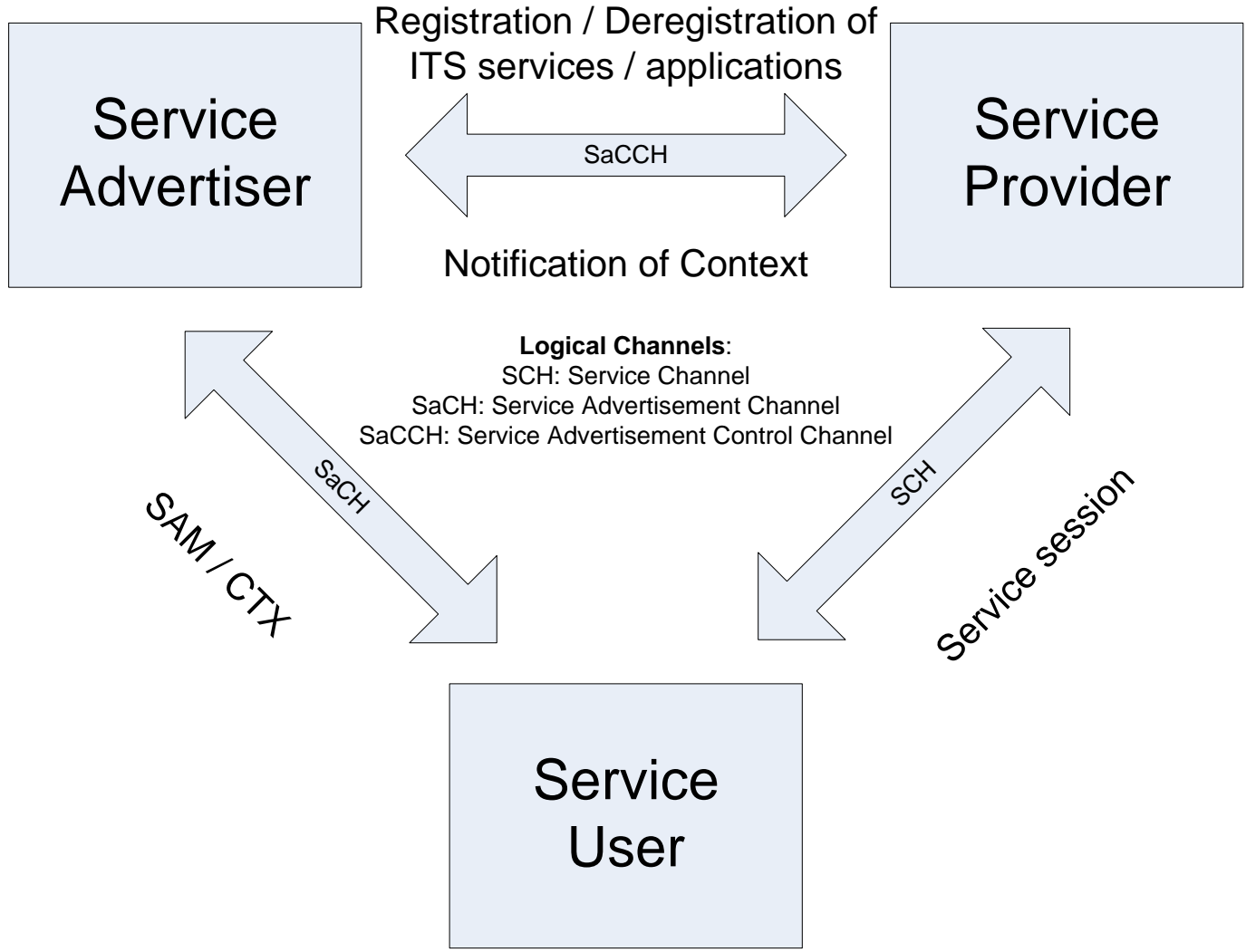


Basic procedures

- **Service advertisement management protocol** between service advertiser and service provider.
- **Service advertisement protocol** between service advertiser and service user.
- *(Session protocols between service provider and service user.)*
- Advertisement of an ITS application class
 - *Choice of instance of class by user:* Context information to be provided by user to the provider in order to uniquely identify the instance of the class. (*FSAP*)
 - *Selection of instance of class by provider:* Context information provided together with the service advertisement. (*WSA-PSC*)
- Advertisement of a unique ITS application (*FSAP, WSA*)

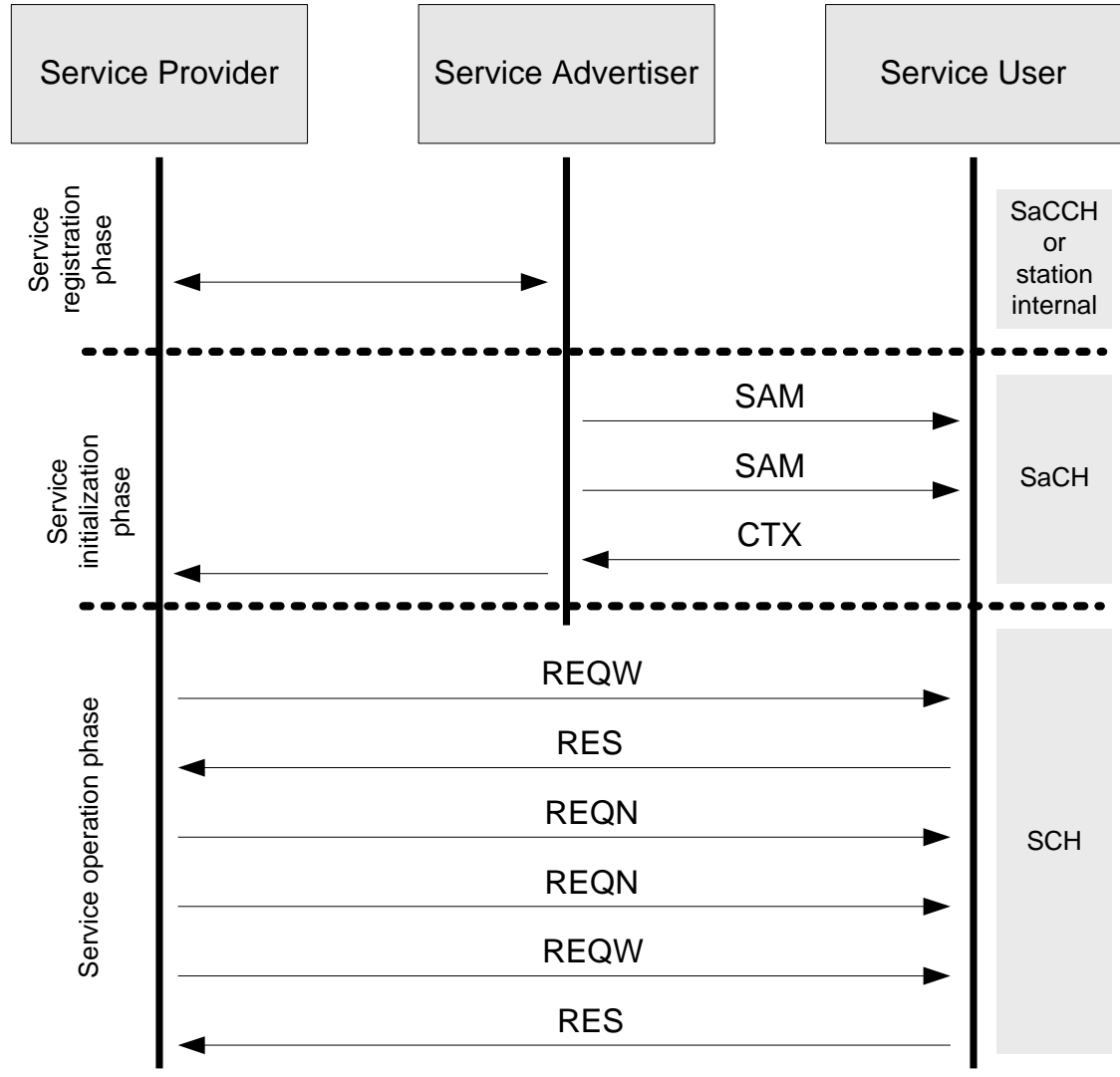


Basic procedures



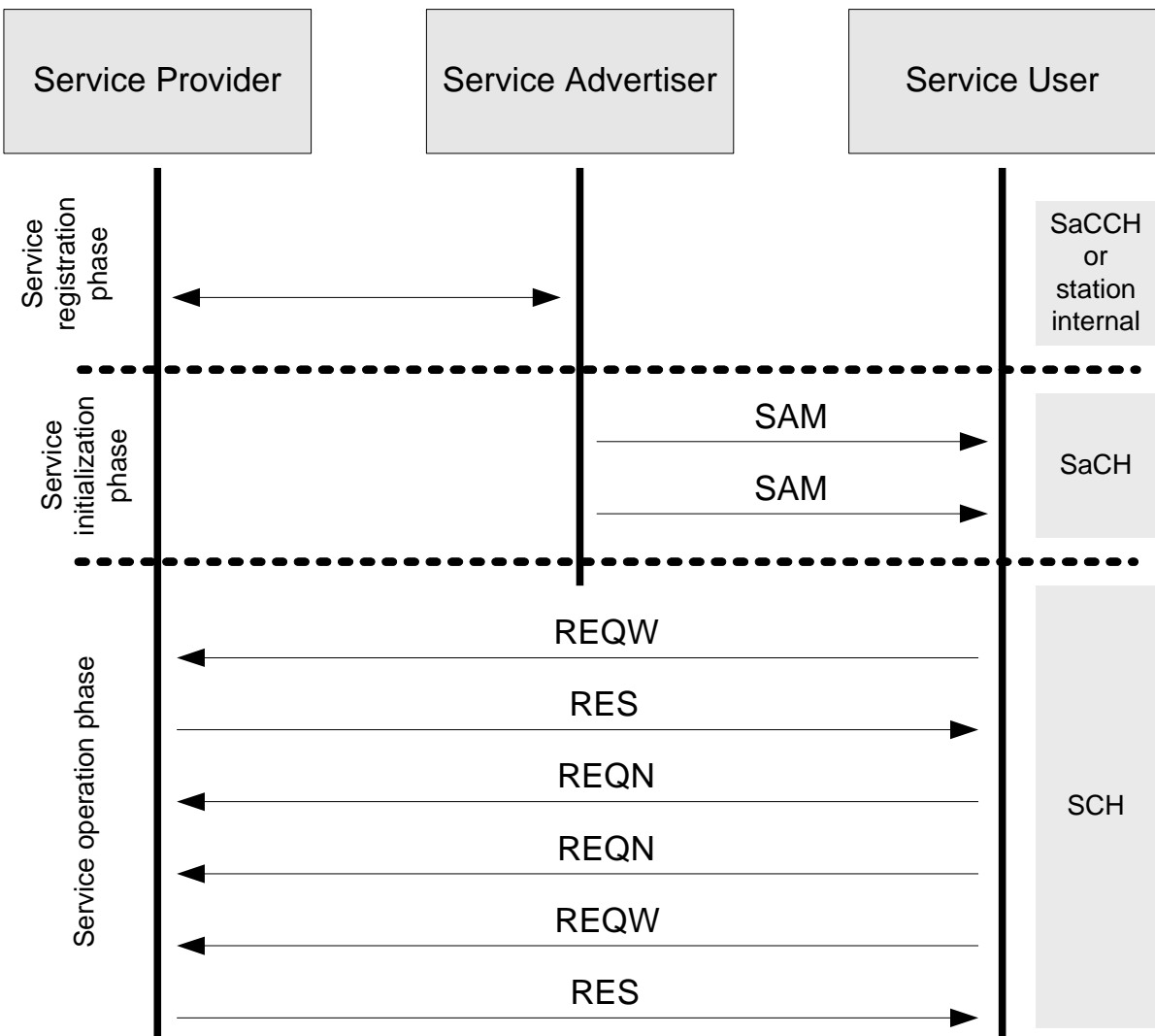


Operational Mode 1





Operational Mode 2





Security

- Security is build on top of the concept of a trusted device (*ISO: Bounded Secured Managed Entity*)
- Security may involve
 - Authentication of service advertiser (includes authorized ITS-AIDs)
 - *(Authentication of service provider*
 - *Authentication of service user*
 - *Encryption of messages)*
- Security
 - may be provided by generic ITS-S facility layer / security entity services (*CEN/ISO 17423*), or
 - may be an integral part of the service advertisement protocol using services of the ITS-S security entity (*IEEE 1609.2*)



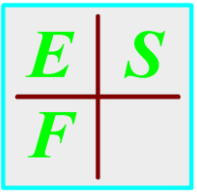
Mandatory features

- WSA/FSAP protocol version number
 - Behavior in case of mismatch is not specified.
- Change count (*IEEE 1609.3 – value range 0 .. 7*)
 - Changes value when content of SAM changes.
 - Mandatory feature in the message.
 - Usage in the receiver is optional. Allows to avoid parsing a SAM that was already received previously.



Additional features

- Feature how a service provided through an application given by an ITS-AID can be reached:
 - ✓ Usage of a URL, e.g. (examples from CVIS):
 - `http://server.com:987/yyy`
 - `tcp://[1.2.3.4.5.6.7.8]:887`
 - *intensively discussed – needs more discussion*
- Multiple router advertisements
 - Seems to be that the functionality for more than a single router advertisement is reasonable.



Start of harmonization

Some facts:

- None of the two standardized service advertisement protocols (WSA / FSAP) provides all of the functionality required.
- WSA and FSAP were tested in several research projects.
- FSAP (and FNTTP) are used in the GreenFlow product line (see presentation from Imtech).
- CVIS contributed to the protocol development at ISO.
- Validated TTCN-3 test suite for FSAP exists at ETSI ([STF 455](#)).
Using ASN.1 for the protocol specification, the test suite can be updated quickly to support the harmonized solution.
- In ISO communication protocols are specified using ASN.1.
 - ✓ *Design of a common solution should be easily possible.*
 - ✓ *Usage of ASN.1 should be easily possible.*



Harmonized FWSAP

Secure FWSAP			
1 octet	variable	variable	variable
Security Selector _{0/1}	Security Header	FWSAP (SAM / CTX)	Security Trailer

Security Selector = 1 indicates that the Security header and trailer are present.

FWSAP (SAM)					
1 octet	1 octet	variable	variable	variable	variable
Message-ID = '0'b Version (0 .. 15) ChnCnt (0 .. 7)	Number N of extensions	N extensions	Service Info List	Channel Info List	Router Advertisement

Optional Extension		
1 octet	1 .. 2 octet	Var.
Element ID (WSMP WAVE element ID)	Length	Extension data

Proposal (IEEE 1609 meeting in Austin / Texas)



Harmonized FWSAP

This proposal complies with all requirements and offers:

- ✓ *The flexibility of extensions as used in IEEE 1609.3, which can be defined in ASN.1 using the type CLASS.*
- ✓ *The efficiency of ISO 24102-5 by not using Type ID fields to identify instantiations of Service Info, Channel Info, and Routing Advertisement. Note that this approach from IEEE 1609.3 cannot be defined with ASN.1.*
- ✓ *The advantages of using ASN.1 to specify messages – reliability, flexibility, efficient testing.*
- ✓ *The experience on security specified in IEEE 1609.2.*
- ✓ *Optional features specific to the ISO requirements.*
- ✓ *Efficient message structure.*
- ✓ *Support of any kind of networking & transport layer protocol, and also usage of MAC management frames for service advertisement protocol messages (SAM, CTX).*



Harmonized FWSAP

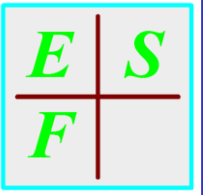
FWSAP Service Info List	
1 octet	variable
Number S Service Infos	S Service Infos

Proposal (IEEE 1609 meeting in Austin / Texas)

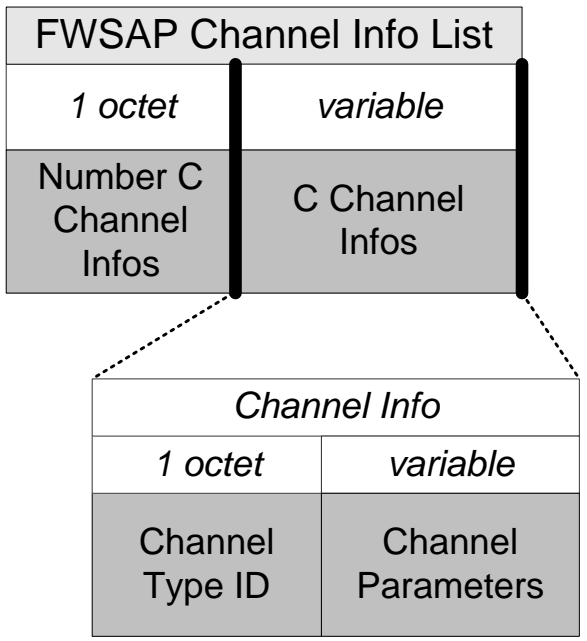
ServerPort is not contained in an extension, as it is always needed.

Service Info				
Var.	1 .. 2 octet	1 octet	1 octet	variable
ITS-AID / PSID	ServerPort	Channel Info Index	Number N of Extensions	N Extensions

- Channel Info Index points to an entry in Channel Info List.



Harmonized FWSAP



Channel Info index in Service Info List points to an entry in Channel Info List:
 0: no channel info applicable
 1: first entry
 n: nth entry

Channel Type ID is specified in ISO 21218 in parameter MedType.

Channel Info for 802.11							
1 octet	1 octet	1 octet	1 octet	1 octet	1 octet	1 octet	variable
Channel Type ID = 5	Operating Class	802.11 channel No	Adaptable	Data Rate	TX Power	Number N of Extensions	N Extensions

Proposal (IEEE 1609 meeting in Austin / Texas)



Harmonized FWSAP

FWSAP Router Advertisement	
<i>1 octet</i>	<i>variable</i>
Number R Routing Advertisements	R Routing Advertisements

<i>Routing Advertisement</i>						
<i>2 octets</i>	<i>8 octets</i>	<i>1 octet</i>	<i>8 octets</i>	<i>8 octets</i>	<i>1 octet</i>	<i>variable</i>
Router Lifetime	IP Prefix	Prefix Length	Default Gateway	Primary DNS	Number N of Extensions	N Extensions

Proposal (IEEE 1609 meeting in Austin / Texas)



Harmonized FWSAP

FWSAP (CTX)			
<i>1 octet</i>	<i>1 octet</i>	<i>variable</i>	<i>variable</i>
Message-ID = '1'b Version (4 bit) reserved (3 bit)	Number N of extensions	N extensions	Service Context List

<i>Optional Extension</i>		
<i>1 octet</i>	<i>1 .. 2 octet</i>	<i>Var.</i>
Element ID (WSMP WAVE element ID)	Length	Extension data

Proposal (IEEE 1609 meeting in Austin / Texas)

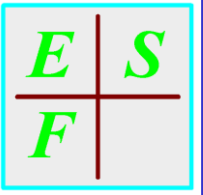


Harmonized FWSAP

FWSAP Service Context List	
<i>1 octet</i>	<i>variable</i>
Number C Service Contexts	S Service Contexts

<i>Service Context</i>				
<i>Var.</i>	<i>variable</i>	<i>1 .. 2 octet</i>	<i>1 octet</i>	<i>variable</i>
ITS-AID / PSID	Context Data	UserPort	Number N of Extensions	N Extensions

Proposal (IEEE 1609 meeting in Austin / Texas)



WFSAP Extensions

Mutually exclusive usage only:

- c-2Dlocation (5) Antenna of service advertiser
- c-3DlocAndConf (6) Antenna of service advertiser

Identifiers or role holders

- c-advertiserID (7) ID of advertiser

Communication management

- c-repeatRate (17) Number of SAMs per second!?
- c-countryString (18) Indicates a regulatory domain!?

Note: "*c-name* (*m*)" indicates an Integer constant with name *c-name* and with value *m*. The value *m* is defined in 1609.3 as the WAVE extension element number.



WFSAP extension

- Location of antenna of service advertiser (*IEEE 1609.3*)
 - Optional feature in the message used to select the advertiser with best location.
 - *New proposal presented by Kapsch at the Austin meeting to have a location info containing also the velocity vector (advertiser on a mobile platform – used for platooning)*
 - *New proposal presented at the Austin meeting to indicate the type of antenna, i.e. directional*
- needs detailed investigations*



WFSAP extension

- SAM/WSA repetition rate (*IEEE 1609.3*)
 - Optional feature in the message.
 - Allows to detect lost SAMs.
 - Value selected by service advertisement manager based on requirements from applications. Rules are not standardized.
 - Knowledge about given road traffic scenario beneficial.



WFSAP extension

- Country String (*IEEE 1609.3; 6.2.2.1.2; used for CCH purposes*)
 - Indicates regulatory domain of service advertiser.
 - Intended for radio regulation. ISO 3166 country numbering plus 802.11 specific part. Specified in 802.11
 - It is needed to consider also other access technologies than 802.11.
 - Should indicate what is needed to run the session.
 - *What about service provider – is provider always located in the same regulatory domain?*



Service Info Extensions

- c-psc (8) ServiceData in ISO
- c-ipAddress (9) Router Advertisement needed
- c-providerMAC (11) If different to advertiser MAC

802.11 specific

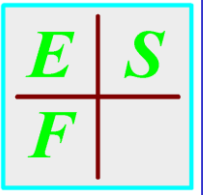
- c-rcpiThreshold (19)

To be discontinued!??

- ~~e-wsaCountThreshold (20)~~ requires to receive the same SAM several times before it may be used??!
- ~~e-wsaCountThresInterval (22)~~ depends on (20)

Implemented differently

- ~~e-providerPort (10)~~ Now always contained in main field



Service Info Extensions

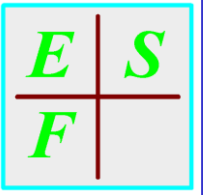
Newly to be defined:

- | | |
|-------------------|--|
| c-servicePriority | (23), One octet INTEGER (0..255) such as UserPriority from ISO 21218 |
| c-url | (24), Text string containing a URL |



Service info extension

- Service Priority (*IEEE 1609.3*)
 - Presented by an application to the service advertisement manager to allow queuing requests to include service infos in a SAM.
 - May be added as an Extension to inform a potential service user to learn about necessary prioritization at the advertiser / provider station
 - *Requires further discussions to clarify usefulness of informing a user about these priority values.*



Channel Info Extensions

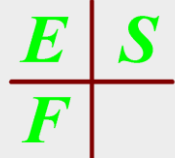
802.11 specific

c-EDCAparamSet (12) see 802.11

To be discontinued!??

~~e-channelAccess (21)~~ only applicable for SCH/CCH switching

→ *requires intensive clarification to understand usage*



Router Advertisement Extensions

- c-secondaryDNS (13) adds another 16 octets, likely not very useful in the given context
- c-gatewayMAC (14)



Approach towards a harmonized Messaging Protocol



Harmonized messaging protocol

Jointly developed proposal (IEEE 1609 meeting in Los Angeles and ISO TC204 WG16 meeting in San Diego).

FWNTP General Header			FWNTP Type Header	FWNTP Body
<i>4 bits</i>	<i>4 bits</i>	<i>1 octet</i>	<i>dependent on type</i>	<i>dependent on type</i>
Res.	Version	PDU Type choice	Ports and options	Payload

Currently six different PDU types are identified:

1. Information dissemination (BSM, CAM, ...) – only destination port field
2. Safety type. Same as 1. plus Safety Control Field (*under discussion*)
- 3. General purpose – source and destination port field plus options**
4. Station-internal forwarding
5. LPP (Japanese usage of FNTTP from ISO)
6. *General type allowing for "networking and general options" followed by a universal Transport Protocol selector*

N-hop BC is deprecated due to missing details making it feasible.

... see the following five slides



Harmonized messaging protocol

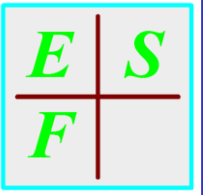
- 1. Information dissemination (BSM, CAM, ...) – only destination port field

FWNTP Type 0 Header	FWNTP Body	
<i>1 .. 2 (3, 4) octets</i>	<i>1 - 2 octets</i>	<i>0, 1 .. octets (variable)</i>
PSID / destination port	Length	Payload

It is required to use well-known destination port number values identical to already assigned PSID (ITS-AID) values. However there will be two distinct registries, one for ITS-AID / PSID, and one for ITS port numbers.

Although the format of the destination port field (same format as for ITS-AID specified in CEN/ISO 17419) allows for any size, it is recommended to use only port numbers for field sizes 1 and 2 octets.

It would be better to have a port number field of size 2 or variable size (1-2)!



Harmonized messaging protocol

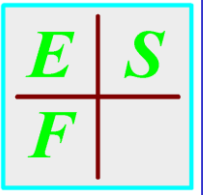
3. General purpose – source and destination port field plus extensions

FWNTP Type 2 Header				FWNTP Body	
1 .. 2 (3, 4) octets	1 .. 2 (3, 4) octets	1 octet	variable	1 - 2 octets	0, 1 .. octets (variable)
source port	PSID / destination port	No. N of extensions	N extensions	Length	Payload

Optional Element		
1 octet	1 .. 2 octet	Var.
Element ID (WSMP WAVE element ID)	Length	Extension data

Source port field may contain the value "not known / don't care" (PORT_UNK) if no reply is needed.

Extensions are specified in IEEE 1609.3 and in ISO (shared Element ID space).



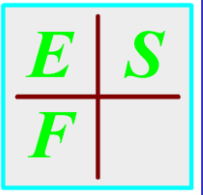
Harmonized messaging protocol

4. Station-internal forwarding

FWNTP Type 3 Header				
<i>2 octets</i>	<i>2 octets</i>	<i>2 octets</i>	<i>8 octets</i>	<i>1 octet</i>
source port <small>(PORT_HST or PORT_RTR)</small>	destination port <small>(PORT_RTR or PORT_HST)</small>	ITS-SCU-ID ITS-S host	Link-ID VCI in ITS-S router	Counter

FWNTP Body				
FWNTP General Header			FWNTP Type Header	FWNTP Body
<i>4 bits</i>	<i>4 bits</i>	<i>1 octet</i>	<i>dependent on type</i>	<i>dependent on type</i>
Res.	Version	PDU Type choice Type 3 prohibited	Ports and options	Payload

FWNTP Body of the ITS station-internal forwarding PDU contains a complete FWNTP PDU as used in the link between peer ITS station units.



Harmonized messaging protocol

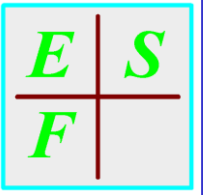
5. LPP

FWNTP Type 4 Header				
1 .. 2 (3, 4) octets	1 .. 2 (3, 4) octets	1 octet	variable	variable
source port	PSID / destination port	No. N of extensions	N extensions	LPP extension <small>ARIB STD-T88:2004, DSRC application sub-layer</small>

Optional Element		
1 octet	1 .. 2 octet	Var.
Element ID (WSMP WAVE element ID)	Length	Extension data

FWNTP Body	
1 - 2 octets	0, 1 .. octets (variable)
Length	Payload

Do we need the Optional Elements?



Harmonized messaging protocol

6. ... General types allowing for "networking and general options" followed by a universal Transport Protocol selector

FWNTP Type 5 Header					FWNTP Body	
1 octet	variable	1 .. 2 (3, 4) octets	1 .. 2 (3, 4) octets	variable	1 - 2 octets	0, 1 .. octets (variable)
No. N of extensions	N extensions	source port	PSID / destination port	T-Protocol fields	Length	Payload

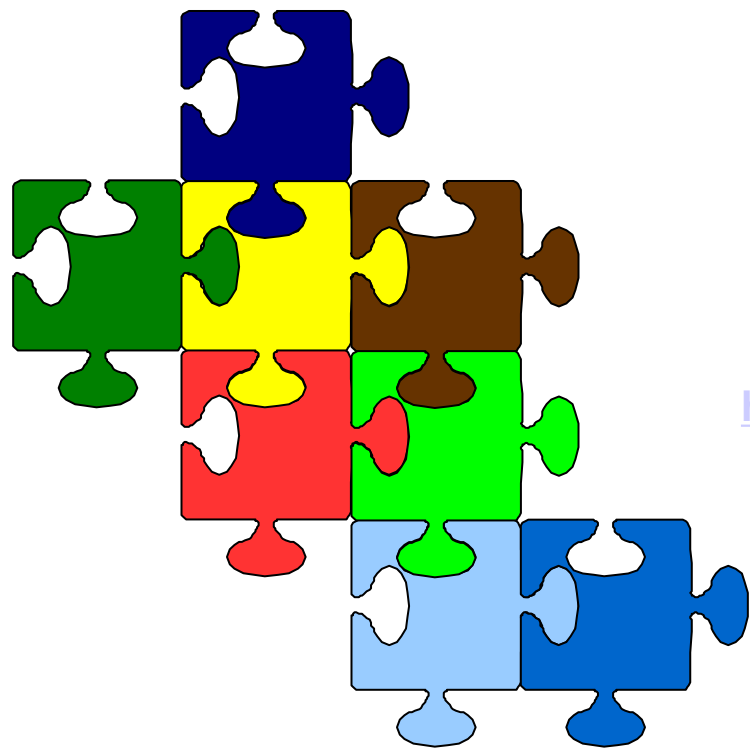
Optional Element		
1 octet	1 .. 2 octet	Var.
Element ID (WSMP WAVE element ID)	Length	Extension data

Details of T-Protocol fields depend on PDU type choice.

In case such a feature is needed, it would be better to follow a straight-forward hierarchical approach for the common FWNTP message format as proposed by Dr. Richard Roy / USA!



Elektrische Signalverarbeitung Dr. Fischer GmbH



ESF GmbH
Hans-Joachim Fischer
Fichtenweg 9
D-89143 Blaubeuren
Germany
HJFischer@fischer-tech.eu
<http://www.fischer-tech.eu>
<http://release1.its-standards.eu>
phone: +49 7344 175 340