

SWP 3.1 – Central ITS Station

Interface IF3: C-ITS-S <-> R-ITS-S

R-ITS-S Communication Data

WP3 - Functional specifications &
development

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Overview of changes

No.	Version	Status	Date	Type of Change
3	03.00	Released	2015-07-15	Third Release
4	03.10	Released	2015-10-28	Third Release – Update
5	03.50	Released	2016-04-29	Third Release – Second Update
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Table 1: Document History

Reference to the status- and version administration:

Status:

In progress the document is currently in editing mode

Released the document has been checked and released by quality assurance, it can only be modified if the version number is updated.

Versions:

Takes place in two stages. Released documents receive the next higher integral version number.

00.01, 00.02 etc. Not released versions, with the status in progress

01, 02, etc. Released version with the status released

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1 Document Information

1.1 Purpose of this document

This document specifies the interface and describes the data objects used for communication operations between C-ITS-S and R-ITS-S.

1.2 Definitions, Terms and Abbreviations

Abbreviation	Comment
ASN.1	Abstract syntax notation one
Base64	Is a group of similar binary-to-text encoding schemes
Bootstrapping	basic initialization and configuration of a device for being able to communication the managing server
CAM	Cooperative awareness message
C-ITS	Cooperative ITS
C-ITS-S	C-ITS Station
Data model	A hierarchical set of Parameters that define the Configuration accessible via OCIT-C DM for a particular Device.
DEN	Decentralized environmental notification
DENM	DEN message
DM	Device management
ETSI	European Telecommunications Standards Institute
HTTP	Hypertext transfer protocol - protocol for distributed, collaborative, hypermedia information systems
HTTPS	HTTP secure
IP	Internet protocol - a set of rules for sending data across a network
ISO	International standardization organization
ITS	intelligent transportation system – enables 'smarter' use of traffic transport networks
IVI	In vehicle information
LAN	Local area network
NAT	Network address translation – maps private IP-Addresses into external public IP addresses
OCIT-C	open communication interface for road traffic control systems – center to center

Abbreviation	Comment
Parameter	A name-value pair that represents part of a Device's configuration or status. A Parameter name is a Path Name.
PVD	Probe vehicle data (single vehicle data)
R-ITS-S	Roadside ITS Station (Roadside Unit)
SSL	Secure socket layer - protocol for communication security via the Internet.
TLS	transport layer Security – Follower of the SSL protocol
UMTS	Universal mobile telecommunication system
URL	uniform resource locator – (web address)
V2X	vehicle to Infrastructure / infrastructure to vehicle communication used in ITS systems
V-ITS-S	Vehicle ITS Station
VPN	virtual private network - extends a private network across a public network
XSD	XML schema definition
XML	Extensible markup language

Table 2: Definitions, Terms and Abbreviations

1.3 References

All references in this document can be found in the master table of references available in the "Eco-AT_SWP2.3_MasterTableOfReferences_v03.60.pdf" document.

2 Introduction

2.1 Requirements

In the direction C-ITS-S to R-ITS-S (“downstream”) the following data is sent:

- Event / traffic information (i.e. DENM message)
- In vehicle information (i.e. IVI message)
- Protected zones information

In the direction R-ITS-S to C-ITS-S (“upstream”) the following data is sent:

- Traffic Information (based on aggregation of received CAM messages over the air)
- Probe vehicle Data (PVD) data for travel time estimation (based on single CAM).
- DENMs received from other ITS-G5 communication.
- DENM data generated in the R-ITS-S.
- Trailer status information.

2.2 System overview

Figure 1 gives an ECo-AT System overview and the OCIT-C communication roles of R-ITS-S and C-ITS-S.

The communication paths are as follows:

- R-ITS-S with Cellular connection to C-ITS-S
- R-ITS-S with LAN connection to C-ITS-S

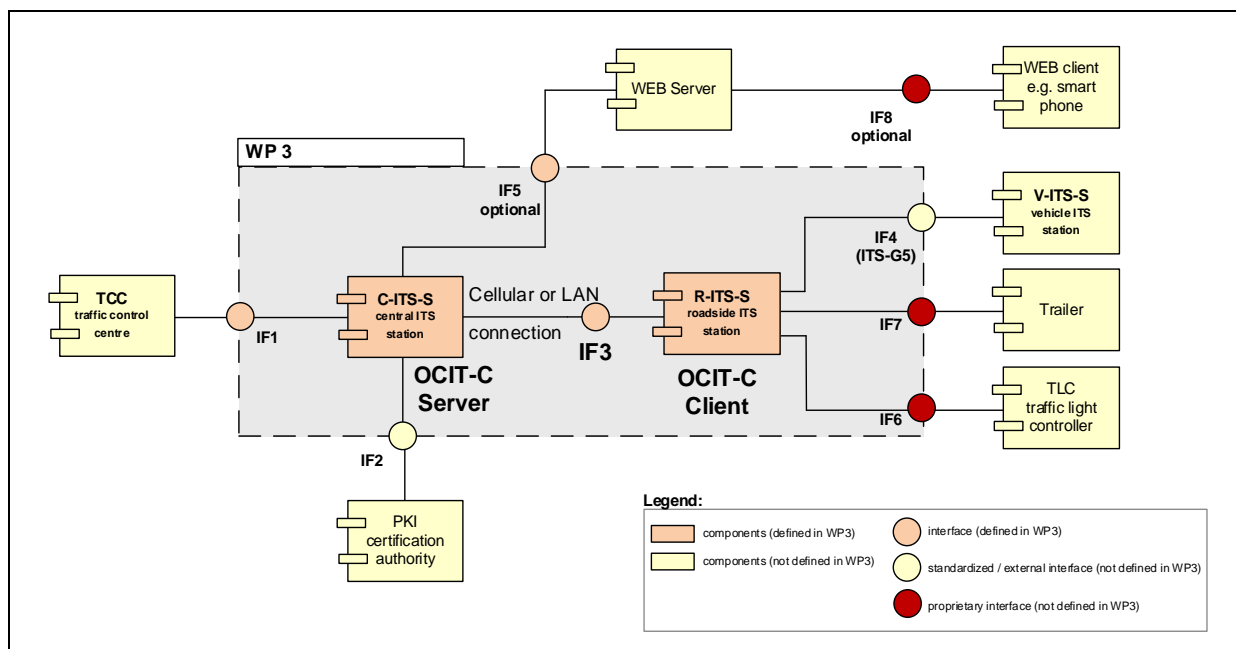


Figure 1: Communication scenarios

The Communication between the R-ITS-S and the C-ITS-S is done via an IP based connection initiated by the R-ITS-S. This means the C-ITS-S is always the OCIT-C Server and the R-ITS-S will always be the OCIT-C Client. Since all communication is initiated by the R-ITS-S also deployment scenarios which include a NAT on the network link between C-ITS-S to R-ITS-S (e.g. UMTS uplink) can be handled.

Security considerations:

For security reasons it is recommended to use a VPN tunnel for the communication link over a public network (e.g. UMTS). The C-ITS-S server may be the VPN Server and the R-ITS-S the VPN Client. If HTTPS is used, SSL server authentication and OCIT-C "in-protocol" or http basic- / digest authentication may be a solution.

If a public network is used for communication (e.g. UMTS) the initial connect shall be encrypted using HTTPS and authenticated (by http-digest Access Authentication or in-protocol credentials) with a factory defined initial password.

2.3 Sample Sequence diagrams

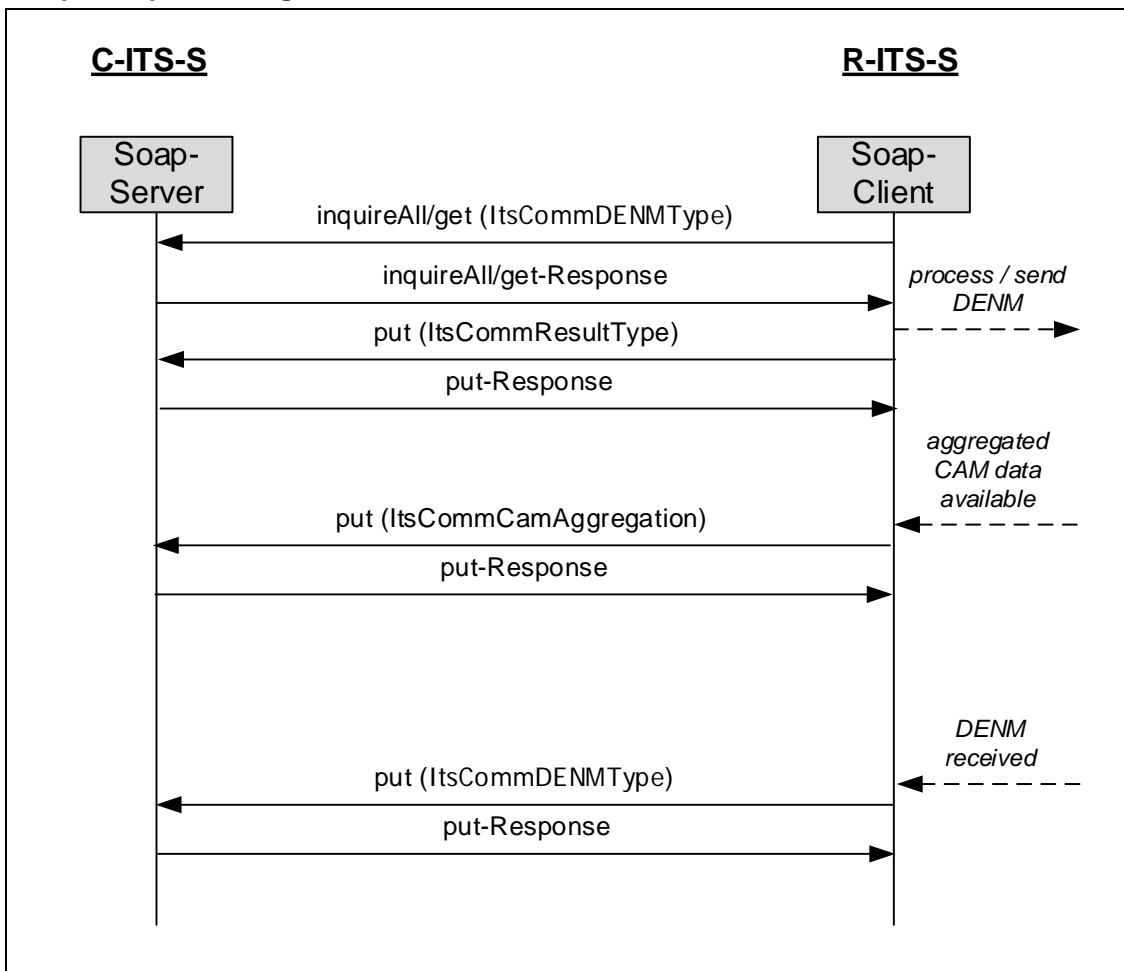


Figure 2: OCIT-C sample Sequence diagram

Remarks: The client polls the server for new data objects using "InquireAll" [OCIT-C transport] after reboot or whenever the "position counter" [OCIT-C transport] is not known. In all other situations "get"/"wait4Get" [OCIT-C transport] is used.

The objects may contain an optional "key" value for transaction control. In case of successful operation (due to the polled object) the R-ITS-S will acknowledge the successful processing (e.g. DEN/IVI information) if the optional "key" object-field was present.

To improve efficiency the new "wait4Get" protocol shall be used to bundle multiple "get" call in one operation.

2.4 Bidirectional communication between C-ITS-S and R-ITS-S

Using the "wait4get" [OCIT-C transport] command the client and the server are able to communicate in both directions. The client sends a "wait4get" request to the server including a timeout for the response. The answer

from the server is delayed until either the timeout takes place or data become available on the server to transmit to the client. After a complete "wait4Get" session the client starts the next "wait4get" request to keep the communication channel from server to the client open. If the client wants to transmit data to the server, it uses the "put" command [OCIT-C transport] to transmit data. The "put" command is executed in parallel to the open "wait4get" channel. This allows a bidirectional communication between the client and the server. See an example in the following Figure 3.

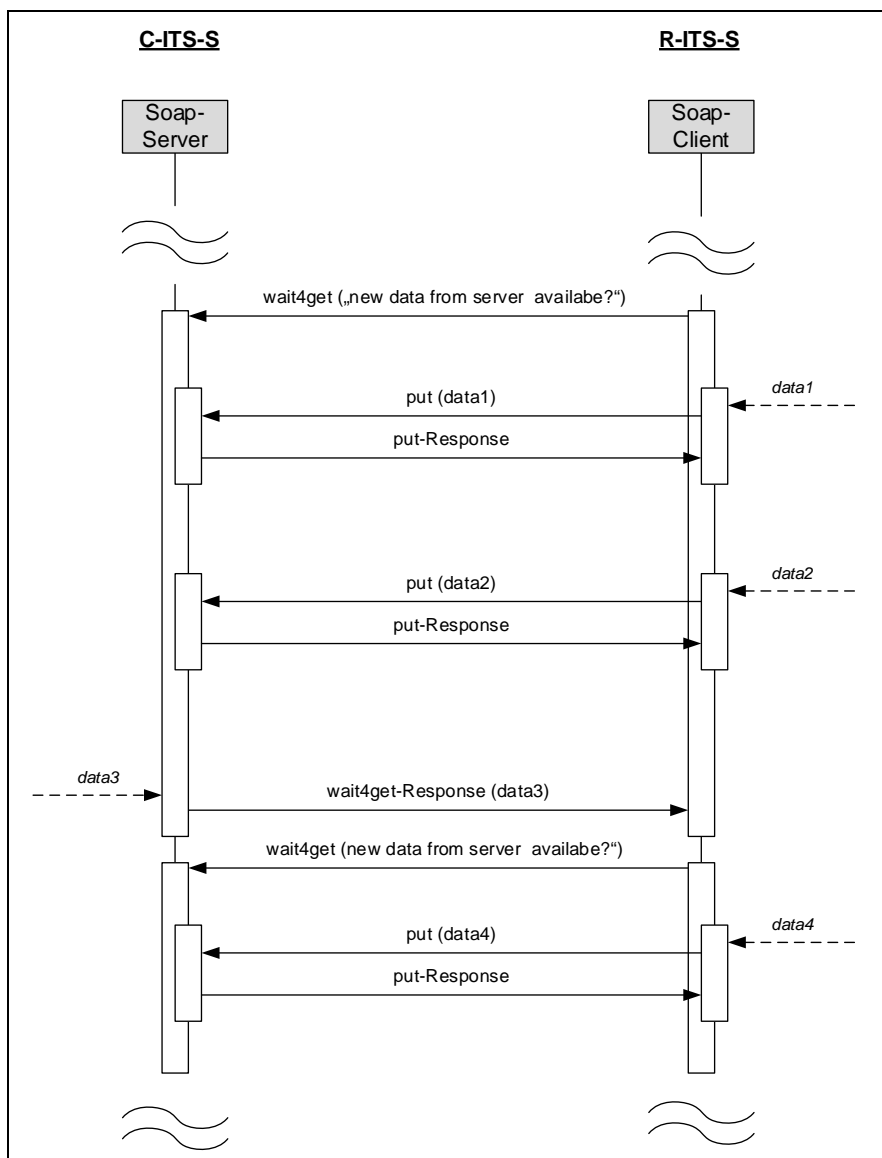


Figure 3: Bidirectional data communication sequence using wait4get

2.5 Protocol encoding

The IF3 protocol defines data communication and management data elements which are encoded in the XML format which uses a XSD-Schema for validation. For the data communication part as described in this document the XSD-Schema [ECo-AT SWP3.1 IF3 XSD] is used. It defines the ECo-AT specific data and foresees the transport of ITS data payload (see clause 2.5.1) defined by ETSI and ISO.

2.5.1 ITS Payload data encoding between C-ITS-S and R-ITS-S

The ITS payload data encoding/decoding format (e.g. DEN, IVI, etc.) for traffic between the C-ITS-S and the R-ITS-S is configurable using the R-ITS-S Device Management interface [ECo-AT SWP3.1 IF3 management]). During first connection setup, the R-ITS-S informs the C-ITS-S (see "DeviceInform" [OCIT-C transport]) about the default rule for ITS payload encoding (manufacturer specific). There are three possible encoding rules for implementation:

- Unaligned Packed Encoding Rules (UPER)
- XML Encoding Rules (XER)
- XML Encoding Rules with gzip compression (XER)

The C-ITS-S may request the R-ITS-S to change the encoding rule. The R-ITS-S confirms or rejects the request based on manufacturer implementation. The C-ITS-S must support all three encoding rules. The R-ITS-S must support at least one out of the three encoding rules.

XML- Encoding:

ITS Payload encoded using XML coding rules, shall use the corresponding XSD-Schema for validation. The definition of the ITS payload used in ECo-AT is written in ASN.1 and published by ETSI and ISO. The data protocol definition for ECo-AT interface 3 (defined in this document), foresees a container (see clause 4.1.8) for embedding the ITS payload defined by ETSI (e.g. DENM) and ISO (e.g. IVI). To avoid legal implications the ITS payload has not been directly included in the IF3 protocol definition. This gives also an additional benefit for maintenance: If the ITS payload will be changed by ETSI or ISO there is no need to adapt the IF3 definition of this document.

3 Scenarios

3.1 C-ITS-S sending ITS data payload

The C-ITS-S will create the ITS data payload (e.g. DEN, IVI, etc.; see clause 4.1.2, 4.1.10) and send it to the R-ITS-S for transmission over the air. If necessary the R-ITS-S may decode/encode the ITS data payload (e.g. DEN, IVI) received from the C-ITS-S for the purpose of filling in missing values. Usually the values are provided by the C-ITS-S. For specific dissemination requirements (e.g. change of identity, change of position, etc.) the C-ITS-S may request that the R-ITS-S provides specific data elements based on its current configuration. In this case the C-ITS-S sets the value to "0" with the expectation that the R-ITS-S fills in the value. The configuration data, e.g. of the station ID is set using the OCIT-C Device Management primitives [ECo-AT SWP3.1 IF3 management]. The following data element of the payload allows a value of "0":

- Station ID
- Position
- Time

The C-ITS-S provides additionally to the ITS data payload also meta-data, like Geo-Network information (see clause 4.1.8) to include the e.g. destination area, the repetition interval, the validity period and a unique identifier to discriminate amongst different DENM messages.

Based on the meta-data, the R-ITS-S can autonomously send a message periodically, and the C-ITS-S may at any time either update or cancel the ongoing repeat.

3.2 R-ITS-S forwarding of received ITS data payload

In this scenario the R-ITS-S will forward the payload from the ITS messages (e.g. DENM, see clause 4.1.2) received from V-ITS-S stations to the C-ITS-S. The forwarding is configurable via the Device management interface [ECo-AT SWP3.1 IF3 management] .

3.3 R-ITS-S sending Traffic Information (aggregated CAMs)

The R-ITS-S shall be able, if configured [ECo-AT SWP3.1 IF3 management], to aggregate received CAM messages from V-ITS-S and to send the aggregation result (see clause 4.1.1) on a periodic basis to the C-ITS-S [ECo-AT SWP3.1 IF3 management]. Aggregation parameters and interval settings are defined by the R-ITS-S Device Management specification [ECo-AT SWP3.1 IF3 management] .

3.4 R-ITS-S sending probe vehicle data - PVD (single vehicle data)

The R-ITS-S sends probe vehicle (single vehicle) data derived from received CAMs from V-ITS-S to the C-ITS-S. Each time the R-ITS-S detects a new V-ITS-S (identified by the CAM stationID) it computes the PVD data (see clause 4.1.17) and sends the corresponding V-ITS-S travel data to the C-ITS-S.

3.5 R-ITS-S sending traffic warning trailer data

The R-ITS-S sends, if connected to the trailer controller, trailer status messages to the C-ITS-S. Based on the trailer manufacturer, different trailer status data may be available. The trailer data defined in this specification (see clause 4.1.20) is the minimum trailer status data, which should be provided by a trailer manufacturer.

3.6 R-ITS-S sending “basic RWW from R-ITS-S” DENM to C-ITS-S

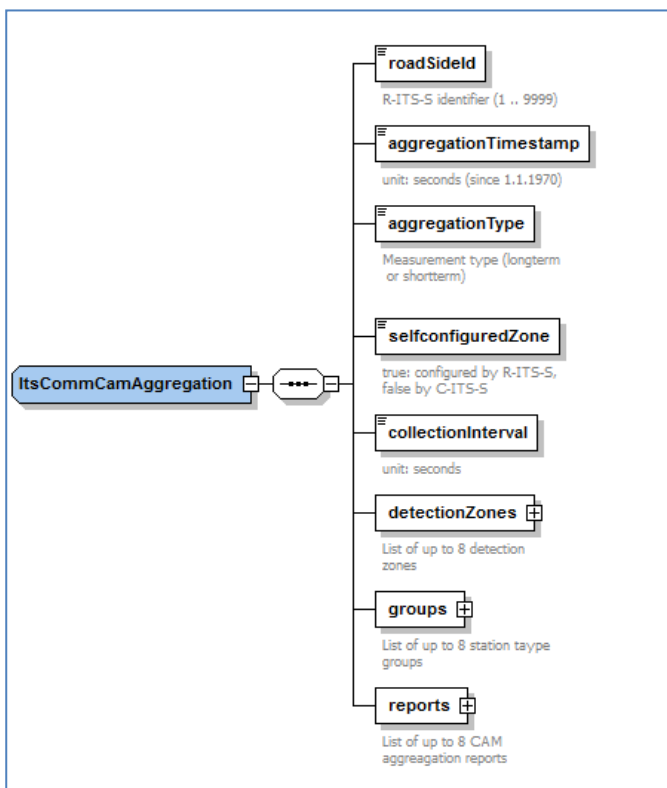
In this scenario the R-ITS-S generates a DENM for ITS-G5 broadcast and for transmission to the C-ITS-S. The basic RWW information sent to the C-ITS-S will be augmentation with RWW data from the TCC and rebroadcasted via R-ITS-S (see 4.1.2).

4 Data Objects

4.1 Complex data types

4.1.1 ItsCommCamAggregation

This type represents the aggregated CAM data sent from R-ITS-S to C-ITS-S (“upstream”).



Name	Type	Usage	Description
roadSideld	"xs:unsignedInt"	M	R-ITS-S identifier Value (1 .. 9999)
aggregationTimeStamp	"xs:unsignedInt"	M	Time Stamp of the acquired data. (Seconds since the 1.1.1970). Unit : sec.
aggregationType	"ItsCommAggregationType"	M	Long or short term aggregation.
selfconfiguredZone	"xs:boolean"	M	true => self configured by R-ITS-S false => configured by C-ITS-S

Name	Type	Usage	Description
collectionInterval	"xs:unsignedInt"	M	Unit: seconds
detectionZones	"ItsCommDetectionZone"	M	List of up to 8 detection zones
groups	"ItsCommStationTypeGroup"	M	List of up to 8 station type group
report	"ItsCommZoneReport"	M	List of up to 8 CAM aggregation report
M = mandatory O = optional			

Table 3: data elements of "ItsCommCamAggregation"

The configuration parameters for aggregation are defined in the IF3 R-ITS-S Device Management specification [ECo-AT SWP3.1 IF3 management]. For more information concerning the CAM aggregation see the ECo-AT CAM Aggregation document [ECo-AT SWP2.1 UC CAM aggr].

4.1.2 ItsCommDENMType

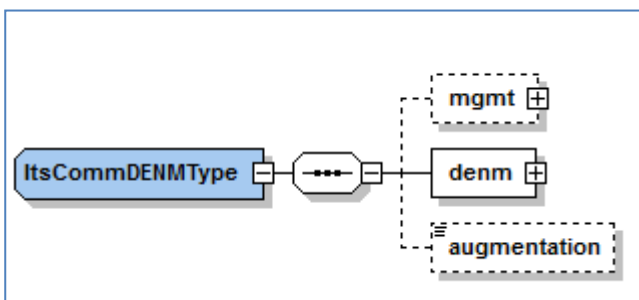
This type represents a DEN message. It will be used by R-ITS-S and C-ITS-S.

R-ITS-S:

- Forward received DENMs from R-ITS-S to the C-ITS-S
- Send "basic RWW" from R-ITS-S DENM to the C-ITS-S for augmentation

C-ITS-S:

- Initiate, update or cancel DENM repetition at R-ITS-S
- Send augmented DENM from C-ITS-S to R-ITS-S for transmission

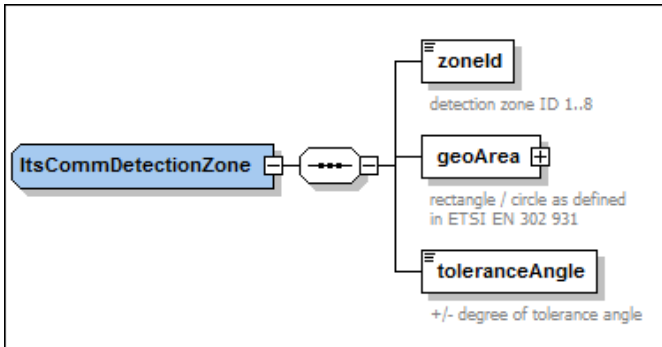


Name	Type	Usage	Description
mgmt	"ItsCommValidity"	O	Interval for automatic message repetition (see clause 4.1.21). If missing the DENM will be sent once.
denm	"ItsCommItsMessage"	M	The "denm" payload is defined in [ETSI 302 637-3]
augmentation	"xs:boolean"	O	<p><u>R-ITS-S -> C-ITS</u></p> <p>true:</p> <p>The "denm" payload is generated by the R-ITS-S and sent to the C-ITS-S for RWW "augmentation".</p> <p>false:</p> <p>The "denm" payload has been received by the R-ITS-S and forwarded to the C-ITS-S.</p> <p><u>C-ITS-S -> R-ITS-S</u></p> <p>true:</p> <p>The augmented RWW "denm" payload is sent to the R-ITS-S</p> <p>false:</p> <p>The "denm" payload has been generated by the C-ITS-S (e.g. triggered by the TCC) and sent to the R-ITS-S</p> <p>Note:</p> <p>If there is no augmentation flag set the DENM is not augmented mode.</p>
<p>M = mandatory O = optional</p>			

Table 4: data elements of "ItsCommDENMType"

4.1.3 ItsCommDetectionZone

This type represents the detection zone for the CAM aggregation as defined in [ECo-AT SWP2.1 UC CAM aggr].

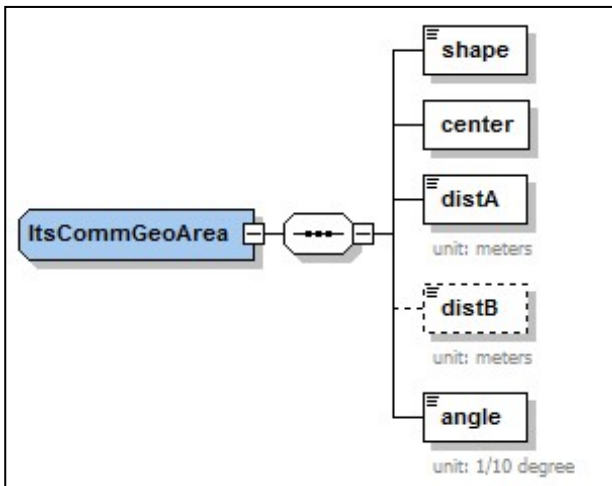


Name	Type	Usage	Description
zoneld	"xs:unsignedInt"	M	Detection Zone ID (8 zones max) Value: 1..8
geoArea	"ItsCommGeoArea"	M	Rectangle / circle. The heading of the detection zone is defined by the "angle" of the data type "ItsCommGeoArea"
toleranceAngle	"xs:int"	M	Tolerance angle as offset (+/-) in relation to the angle (heading) of the "geoArea". The vehicles within the tolerance area are considered for the detection.
M = mandatory O = optional			

Table 5: data elements of "ItsCommDetectionZone"

4.1.4 ItsCommGeoArea

This type is used to represent a geographical area shape. The shapes are defined conform to ETSI EN 302 931 [ETSI 302 931]. Three shapes are defined: circular, rectangular and elliptical area.

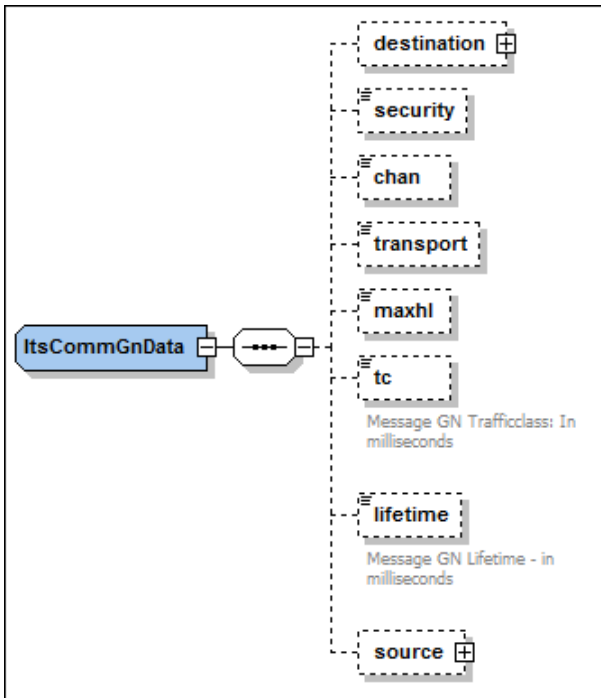


Name	Type	Usage	Description
shape	"ItsCommAreaShape"	M	Shape
center	"ItsCommPosition"	M	Center Position
distA	"xs:unsignedInt"	M	Unit: meters
distB	"xs:unsignedInt"	O	Unit: meters Not needed for Circle shape
angle	"xs:unsignedInt"	M	Unit: 1/10 th degree from North. Value: 0..3601: North(0), East(900), South(1800), West(2700), unavailable(3601)
M = mandatory O = optional			

Table 6 data elements of "ItsCommGeoArea"

4.1.5 ItsCommGnData

This type is used to represent the information from ITS G5 Geo Network header.



Name	Type	Usage	Description
destination	"ItsCommGnDestination"	O	Destination
security	"ItsCommSecurityData"	O	Security Info
chan	"ItsCommGnChannel"	O	Communication Channel
transport	"ItsCommTransportType"	O	GN Transport type
maxhl	"xs:unsignedInt"	O	Maximum Hop Limit 0..10 [ETSI 302 636-4-1]
tc	"xs:unsignedInt"	O	Traffic class [ETSI 302 636-4-1]
lifetime	"xs:unsignedInt"	O	Lifetime in milliseconds [ETSI 302 636-4-1]
source	"ItsCommGnSource"	O	GN Source metadata
M = mandatory O = optional			

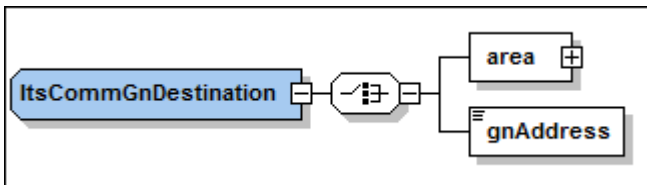
Table 7 data elements of "ItsCommonGnData"

If any or all of the optional fields is missing the following defaults apply:

- Destination Area: Circle, 1000m
- Security: DENM: "sec-denm", IVI: "sec-general"
- Channel: CCH: "chan-cch"
- Transport Type: DENM: "gn-gbc", IVI uses "gn-tsb"
- Max. Hop Limit, Traffic class, Lifetime: Defaults as specified in [ETSI 302 636-4-1].
- Source: current GN source address of R-ITS-S

4.1.6 ItsCommGnDestination

This type is used to represent a Geo Destination (needed for GBC and GUC) as defined in [ETSI 302 636-4-1].

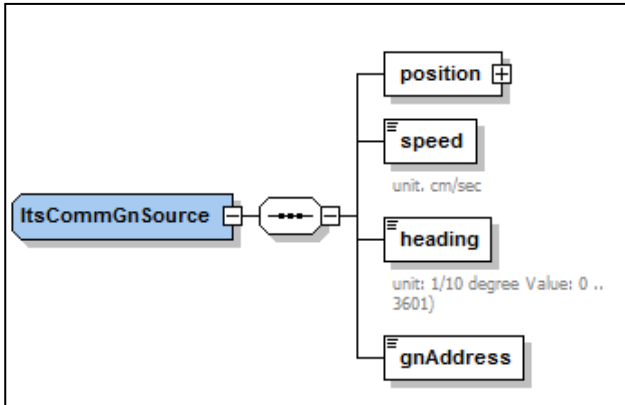


Name		Type	Usage	Description
choice:	area	"ItsCommGeoArea"	M	Destination Area for GBC
	gnAddress	"xs:base64Binary"(8)	M	GN Address for GUC
M = mandatory O = optional				

Table 8 data elements of "ItsCommonGnDestination"

4.1.7 ItsCommGnSource

This type is used to represent a Geo Network Source Address.



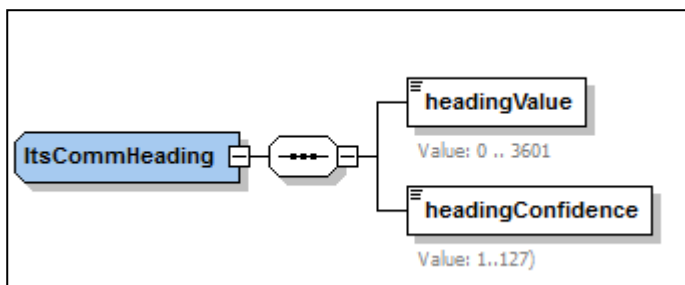
Name	Type	Usage	Description
position	"ItsCommPosition"	M	Geographic Position of Sender
speed	"xs:unsignedInt"	M	Current Speed (cm/sec) [ETSI 302 636-4-1]
heading	"xs: unsignedInt"	M	Current Heading [ETSI 302 636-4-1] Value: (0..3601) wgs84North(0), wgs84East(900), wgs84South(1800), wgs84West(2700), unavailable(3601)}
gnAddress	"xs:base64Binary" (8)	M	GN Address of Sender

M = mandatory
O = optional

Table 9 data elements of " ItsCommGnSource"

4.1.8 ItsCommHeading

This type represents the information for the heading direction of a vehicle as defined by Heading as defined defined by [ETSI 102 894-2]



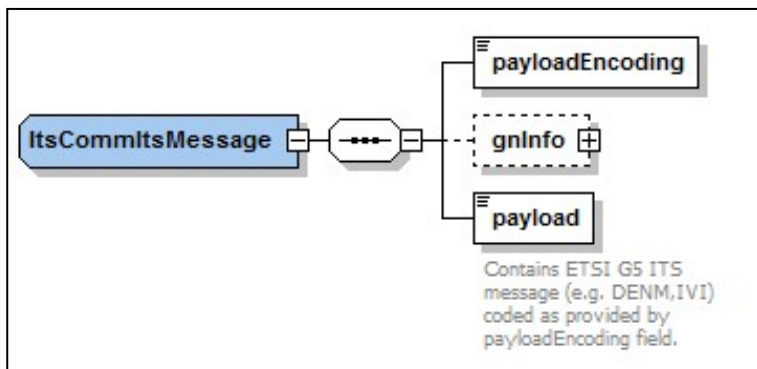
Name	Type	Usage	Description
headingValue	"xs:int"	M	Heading value as defined by ETSI (DE_HeadingValue) [ETSI 102 894-2] Values for heading : 0..3601: North(0), East(900), South(1800), West(2700), unavailable(3601)
headingConfidence	"xs:int"	M	Heading Confidence value as defined by ETSI (DE_HeadingConfidence) [ETSI 102 894-2] Values for Confidence: 1..127
M = mandatory O = optional			

Table 10: data elements of " ItsCommHeading"

4.1.9 ItsCommItsMessage

This type represents all information of a received or sent ITS message over the IF3 interface.

The "gnInfo" element shall be provided by the C-ITS-S ("downstream"), and is optional for any "upstream" message.



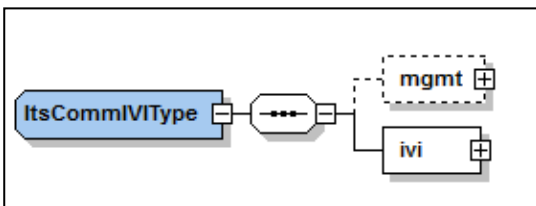
Name	Type	Usage	Description
payloadEncoding	"ItsCommContentEncoding"	M	Payload (e.g. DEN, IVI) encoding rules
gnInfo	"ItsCommGnData"	O	GN information for / from GN header
payload	"xs:base64Binary"	M	<p>The encoding of the payload is defined by the "content" data element.</p> <p>For XML-encoding the corresponding XSD-Schema, which are derived from the ETSI ASN.1 specification shall be used. Within ECo-AT the XSD for the DENM and IVI payload are used (see clause 2.5).</p> <p>Note: 32 kByte is the largest amount of data possible in the payload data element. This is applicable to XML encoded messages by the C-ITS-S, which are finally encoded into UPER by the R-ITS-S for over the air transmission. If the C-ITS-S encodes the payload using UPER the size will be much smaller. In both cases the payload has to fit into the message size defined by ITS-G5 [ETSI 302 663] Be aware to include the Geo-Network layer, MAC layer, signature and certificate in the message size calculation.</p>

Name	Type	Usage	Description
M = mandatory O = optional			

Table 11: data elements of "ItsCommItsMessage"

4.1.10 ItsCommIVIType

This type represents an IVI message. It will be used by the C-ITS-S to initiate, update or cancel an IVI message including the repetition condition ("downstream").

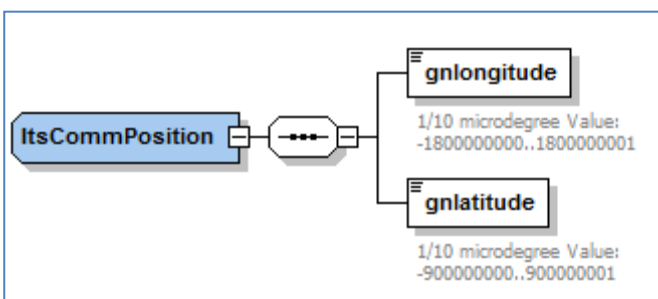


Name	Type	Usage	Description
mgmt	"ItsCommValidity"	O	Interval for automatic message repetition (see clause 4.1.21). If missing the IVI message will be sent once.
ivi	"ItsCommItsMessage"	M	The "IVI" payload is defined in [ISO 19321].
M = mandatory O = optional			

Table 12: data elements of "ItsCommIVIType"

4.1.11 ItsCommPosition

This type is used to represent the Possible Geo Position. Values are in 1/10 Micro Degree.



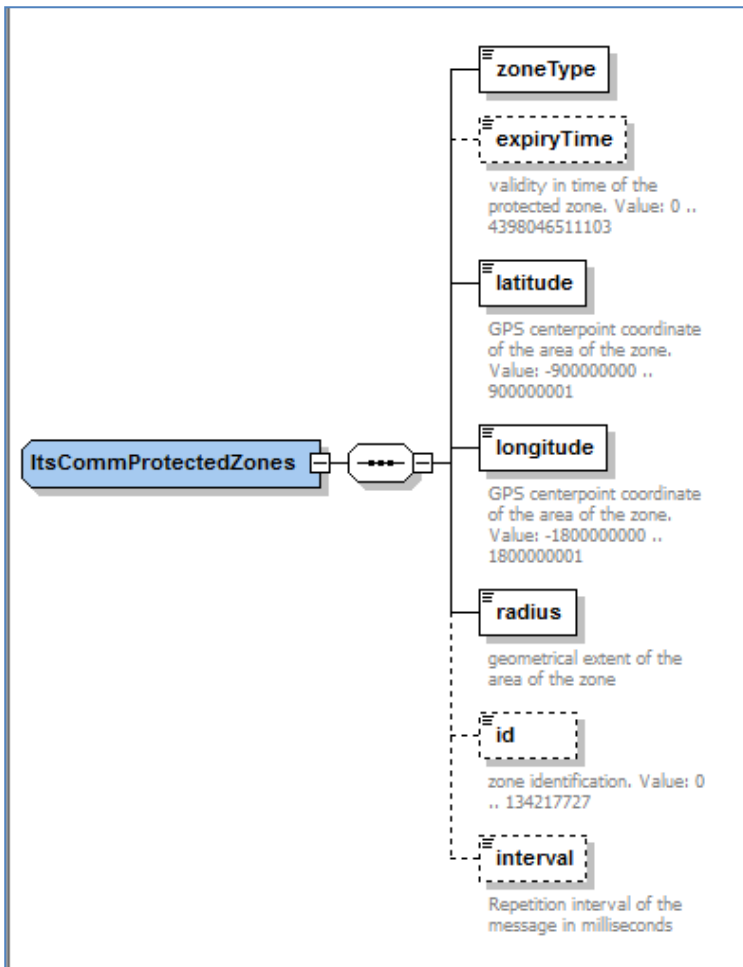
Name	Type	Usage	Description
gnlongitude	"xs:int"	M	Longitude unit: 1/10 micro degree as defined in [ETSI TS 102894-2] Value: -1800000000 .. 1800000001
gnlatitude	"xs:int"	M	Latitude unit: 1/10 micro degree as defined in [ETSI TS 102894-2] Value: -900000000 .. 900000001
M = mandatory O = optional			

Table 13 data elements of "ITSCommPosition"

4.1.12 ItsCommProtectedZones

This type represents the protected communication zones data. In the context of the ECo-AT, a protected zone corresponds to a tolling zone, which shall be protected from ITS 5.9 GHz communication interference. The protected zones data will be transmitted from the C-ITS-S to the R-ITS-S, which builds a CAM message and includes the protected zone data into the CAM container: "RSUContainerHighFrequency". The CAM message will be transmitted periodically according to the "interval" value. The reception of a new set of

protected zone data stops the current (if any) transmission of CAM, builds a new CAM with the new protected zone data and retransmits the new CAM periodically.



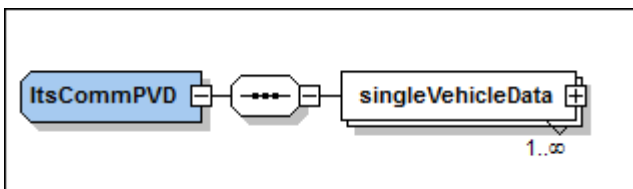
Name	Type	Usage	Description
zoneType	"xs:unsignedInt"	M	Type of protected zones as defined by ETSI (enumeration in "DE_ProtectedZoneType") [ETSI 102 894-2]
expiryTime	"xs:long"	O	Actually only value "0" for tolling zones is defined as defined by ETSI ("DE_TimestampIts") [ETSI 102 894-2]

Name	Type	Usage	Description
latitude	"xs:int"	M	as defined by ETSI ("DE_Latitude") [ETSI 102 894-2]
longitude	"xs:int"	M	as defined by ETSI ("DE_Longitude") [ETSI 102 894-2]
radius	"xs:int"	M	as defined by ETSI ("DE_ProtectedZoneRadius") [ETSI 102 894-2]
id	"xs:int"	O	as defined by ETSI ("DE_ProtectedZoneID") [ETSI 102 894-2]
interval	"xs:unsignedInt"	O	Repetition interval of the message in milliseconds (use 0 to cancel information). Note: If the "interval" data element is not present the default "interval" is set to 1 second.
M = mandatory O = optional			

Table 14 data elements of "ItsCommProtectedZones"

4.1.13 ItsCommPVD

This type represents the probe vehicle data. It is used by the C-ITS-S to calculate the travel time between two or more R-ITS-S. For keeping the channel load small the probe from different vehicles may be bundled in one message.

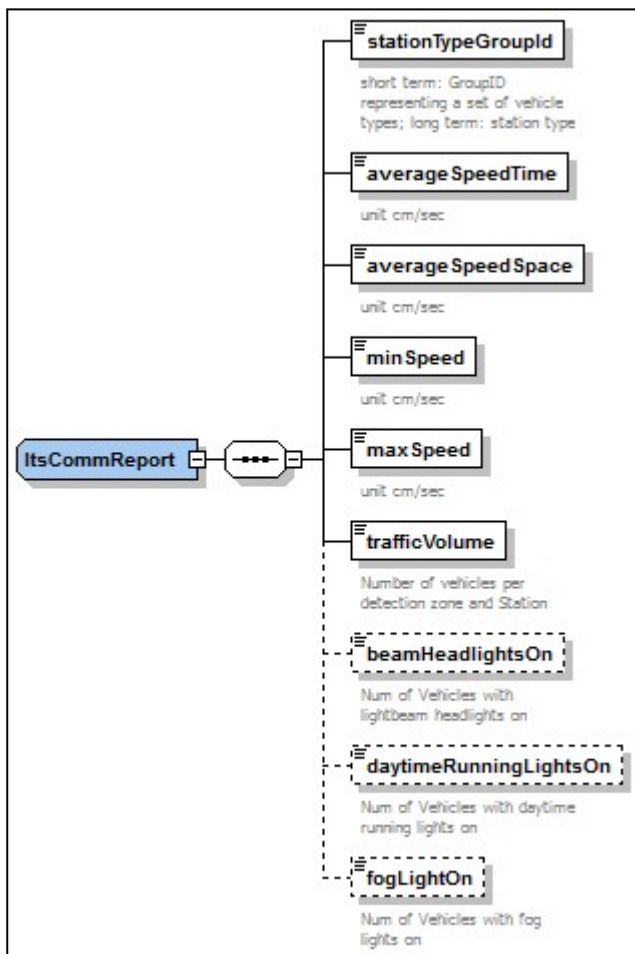


Name	Type	Usage	Description
singlevehicleData	"ItsCommSingleVehicleData"	M	Single vehicle data used for travel time estimation.
M = mandatory O = optional			

Table 15 data elements of "ItsCommPVD"

4.1.14 ItsCommReport

This type represents the report for the CAM aggregation as defined in [ECo-AT SWP2.1 UC CAM agr].

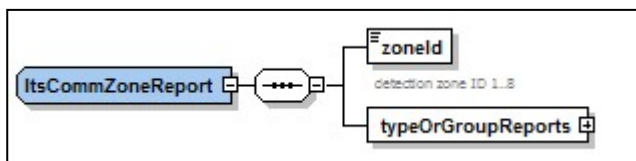


Name	Type	Usage	Description
stationTypeGroupId	"xs:unsignedInt"	M	Short term: Station type group Long term: Station type.
averageSpeedTime	"xs:unsignedInt"	M	Unit: centimeter/second
averageSpeedSpace	"xs:unsignedInt"	M	Unit: centimeter/second
minSpeed	"xs:unsignedInt"	M	Unit: centimeter/second
maxSpeed	"xs:unsignedInt"	M	Unit: centimeter/second
trafficVolume	"xs:unsignedInt"	M	Number of vehicles
beamHeadlightsOn	"xs:unsignedInt"	O	Number of vehicles
dayTimeRunningLightsOn	"xs:unsignedInt"	O	Number of vehicles
fogLightOn	"xs:unsignedInt"	O	Number of vehicles
M = mandatory O = optional			

Table 16 data elements of "ItsCommReport"

4.1.15 ItsCommZoneReport

This type represents the zone report for the CAM aggregation as defined in [ECo-AT SWP2.1 UC CAM aggr].

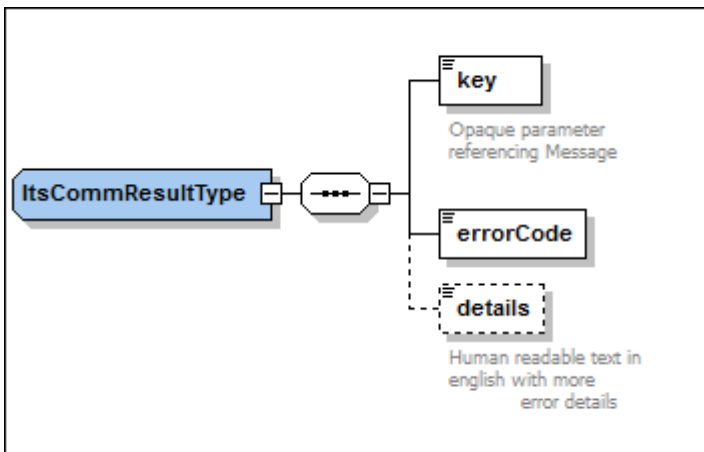


Name	Type	Usage	Description
zonelId	"xs:unsignedInt"	M	Identification of a zone for CAM aggregation.
typeOrGroupReports	"ItsCommReport"	M	1..8 reports including aggregated CAM data.
M = mandatory O = optional			

Table 17: data elements of "ItsCommZoneReport"

4.1.16 ItsCommResultType

This type represents the Acknowledgment sent from R-ITS-S to C-ITS-S (“upstream”).

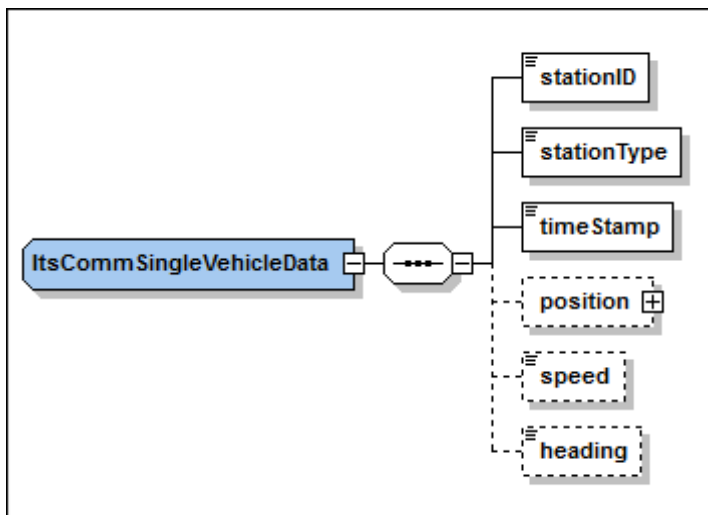


Name	Type	Usage	Description
key	"xs:string"	M	Opaque identifier from C-ITS-S
errorCode	"ItsCommErrorCode"	M	Result of operation
details	"xs:string"	O	Human readable text giving details on error cause.(English)
M = mandatory O = optional			

Table 18: data elements of "ItsCommResultType"

4.1.17 ItsCommSingleVehicleData

This type represents the probe vehicle data of a single vehicle. It is used by the C-ITS-S to calculate the travel time between two or more R-ITS-S.

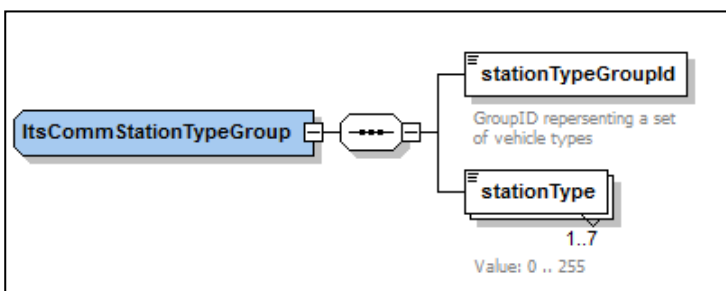


Name	Type	Usage	Description
stationID	"xs:unsignedLong"	M	Station Identifier as defined by ETSI ("DE_StationID") [ETSI 102 894-2] Value: 0..4398046511103
stationType	"xs:int"	M	Station type Identifier as defined by ETSI ("DE_StationType") [ETSI 102 894-2] Values used within ECo-AT: unknown(0), motorcycle(4), passengerCar(5), bus(6), lightTruck(7), heavyTruck(8), trailer(9), specialVehicles(10).
timeStamp	"xs:unsignedInt"	M	Time Stamp of the acquired data. (Seconds since the 1.1.1970). Unit : sec.
position	"ItsCommPosition"	O	PVD data: Geographical position of the vehicle.
speed	"xs:int"	O	PVD data: Speed of the vehicle as defined by ETSI (DE_SpeedValue) [ETSI 102 894-2]. Unit: cm/sec
heading	"ItsCommHeading"	O	Heading direction (angle) value for vehicle
M = mandatory O = optional			

Table 19: data elements of "ItsCommSingleVehicleData"

4.1.18 ItsCommStationTypeGroup

This type represents the station group definition for the CAM aggregation as defined by [ECo-AT SWP2.1 UC CAM aggr].

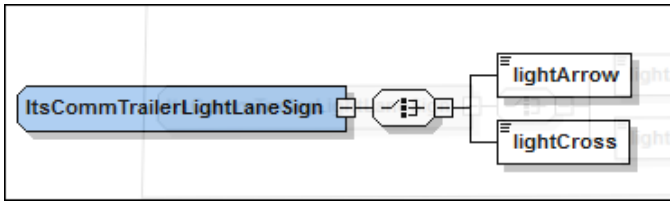


Name	Type	Usage	Description
stationTypeGroupId	"xs:unsignedInt"	M	Identification of a group of station types
stationType	"xs:Int"	M	Station type Identifier as defined by ETSI ("DE_StationType") [ETSI 102 894-2] Value: (0 .. 255) unknown(0), motorcycle(4), passengerCar(5), bus(6), lightTruck(7), heavyTruck(8), trailer(9), specialVehicles(10).
M = mandatory O = optional			

Table 20: data elements of "ItsCommStationTypeGroup"

4.1.19 ItsCommTrailerLightLaneSign

This type represents the status of the lighting lane signs. They indicate to drive on left, or right. A cross indicates a closed lane. See mark 2 in Figure 4.



Name	Type	Usage	Description	
choice	lightArrow	"xs: unsignedInt "	C ₁	Visible illumination of the light left or right lane arrow. Values: 0 = lights are turned off 1 = illuminating lights are displaying a left arrow 2 = illuminating lights are displaying a right arrow
	lightCross	"xs:boolean"	C ₂	Visible illumination of the light cross, signalling a closed lane. Values: false = lights are turned off true = illuminating lights are displaying a cross.
M = mandatory O = optional C<n> = choice. One of C<n> is mandatory				

Table 21: data elements of "ItsCommTrailerLightLaneSign"

4.1.20 ItsCommTrailerStatus

This type represents the traffic warning trailer data sent to the R-ITS-S. General data like position, speed and heading are notified by the R-ITS-S device management interface.

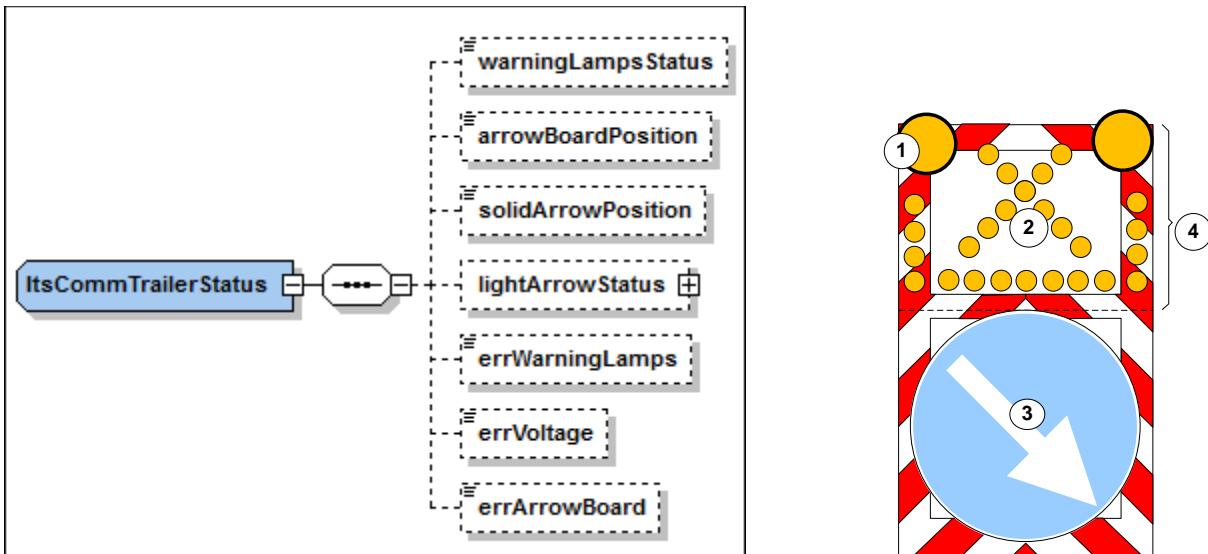


Figure 4 warning trailer with arrow board

Name	Type	Usage	Description
warningLampsStatus	"xs: boolean"	O	Warning blinking lamps positioned on top of the signal board. (see mark 1 in Figure 4.). Values: false = warning lamps off, true = warning lamps on
arrowBoardPosition	"xs: unsignedInt"	O	Position of the arrow board (see mark 4 in Figure 4). The board may be unfold and therefore visible to traffic or fold back, down into the trailer. Values: 0=unknown; 1= down; 2 = up

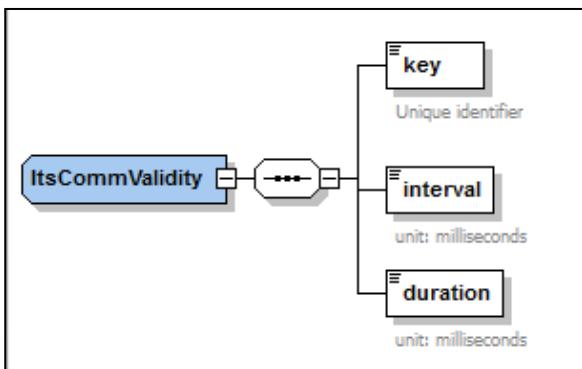
Name	Type	Usage	Description
arrowPosition	"ItsCommArrowPosition"	O	Position of the arrow, showing the direction of driving - left or right (see mark 3 in Figure 4).
lightArrowStatus	"ItsCommTrailerLightLaneSign"	O	Light arrow status of the trailer sign board (see mark 2 in Figure 4).
errWarningLamps	"xs:boolean"	O	Warning lamps error condition: false = no error true = warning lamps error
errVoltage	"xs:boolean"	O	Battery voltage error condition: false = no error true = under voltage of battery
errArrowBoard	"xs:boolean"	O	Arrow Board lifting/lowering error condition: false = no error true = arrow board lifting/lowering error
M = mandatory O = optional			

Table 22 data elements of "ItsCommTrailerStatus"

4.1.21 ItsCommValidity

This type represents the desired repetition rate and validity period of the message.

The validity element is used for the C-ITS-S to send DEN and IVI information (“downstream”). The data elements "interval" and duration are not part of the message itself but are included in the metadata which is sent together with the ITS payload to the R-ITS-S (see clause 4.1.10.).



Name	Type	Usage	Description
key	"xs:string"	M	Key used for identifying the request for payload (e.g. IVI, DENM) transmission by the C-ITS-S. The key shall be used by the C-ITS-S for identification of the payload transmission operation (starting, stopping or prolongation). See also the clause “messageTraceability in [ECo-AT SWP3.1 IF1 data].
interval	"xs:unsignedInt"	M	Repetition interval of the message in milliseconds (use 0 to cancel information).
duration	"xs:unsignedInt"	M	Time interval in milliseconds, defining how long in time the message will be repeated.
M = mandatory O = optional			

Table 23: data elements of "ItsCommValidity"

4.2 Simple data types

4.2.1 ItsCommAggregationType

This simple type is used to represent the aggregation type

Enumeration value	Description
"Longterm"	Long term aggregation
"Shortterm"	Short term aggregation

Table 24: enumeration values for data type "ItsCommAggtype"

4.2.2 ItsCommAreaShape

This simple type is used to represent the geo area geometry.

Enumeration value	Description
"circle"	Opaque identifier when sent by C-ITS-S
"rectangle"	Opaque identifier when sent by C-ITS-S
"ellipsis"	Opaque identifier when sent by C-ITS-S

Table 25: enumeration values for data type "ItsCommAreaShape"

4.2.3 ItsCommArrowPosition

This simple type is used to represent the geo area geometry.

Enumeration value	Description
"left"	Arrow position showing to left
"right"	Arrow position showing to right

Table 26: enumeration values for data type "ItsCommArrowPosition"

4.2.4 ItsCommContentEncoding

This type is used to represent the possible content encodings of the data payload.

Enumeration value	Description
"uper"	ASN.1 Unaligned Packet Encoding Rules

Enumeration value	Description
"xer-compressed"	ASN.1 XML Encoding Rules compressed with gzip
"xer-plain"	ASN.1 XML Encoding Rules in plain ASCII

Table 27: enumeration values for data type "ItsCommContentEncoding"

For detailed information on the related ASN.1 syntax see the CAM, DENM, IVI Specification and their Version noted in the references section.

4.2.5 ItsCommErrorCode

This type is used to represent the Possible Error code.

Enumeration value
"success"
"invalidEncoding"
"invalidData"
"commError"

Table 28: enumeration values for data type "ItsCommErrorCode"

4.2.6 ItsCommGnChannel

This type is used to represent the Possible Radio channels as defined in [ETSI 302 663].

Enumeration value	Description
"chan-cch"	Control channel
"chan-sch1"	Service Channel 1
"chan-sch2"	Service Channel 2
"chan-sch3"	Service Channel 3
"chan-sch4"	Service Channel 4
"chan-sch5"	Service Channel 5
"chan-sch6"	Service Channel 6

Table 29: enumeration values for data type "ItsCommGnChannel"

Within the ECo-AT project only the radio Channel CCH is used.

4.2.7 ItsCommSecurityData

The security profiles contain the security parameters for the message as defined in [ETSI 103 097]. The security profile "sec-denm", is used for DENM and "sec-general" for IVI messages.

Enumeration value	Description
"sec-none"	No security used on ITS G5
"sec-denm"	Security profile for DENM
"sec-general"	Security profile for generic messages (e.g. IVI)

Table 30: enumeration values for data type "ItsCommSecurityData"

4.2.8 ItsCommTransportType

This type is used to represent the Possible GN Transport Types as defined in [ETSI 302 636-4-1].

Enumeration value	Description
"gn-shb"	Single Hop Broadcast
"gn-tsb"	Topological Scoped Broadcast
"gn-gbc"	Geo Broadcast
"gn-gac"	Geo Anycast
"gn-guc"	Geo Unicast

Table 31: enumeration values for data type "ItsCommTransportType"

(End of Document)