kennisplatform CROW

SSM Data

Dutch Profile version 2.1

Over deze publicatie

De internationale ontwikkeling van Smart Mobility zorgt voor flinke vernieuwingen in verkeer, vervoer en mobiliteit. Dit raakt direct ook de verkeersregelinstallaties in de Nederlandse steden en provincies en op rijkswegen. Als verkeersregelinstallaties kunnen communiceren met voertuigen en weggebruikers kunnen weggebruikers worden geïnformeerd over actuele fasewisselingen van verkeersregelinstallaties en hierop hun rijgedrag vroegtijdig aanpassen, kunnen doelgroepen als openbaar vervoer, nood- en hulpdiensten en vrachtwagens conform beleidswensen van overheden worden geprioriteerd en kan data van voertuigen zelf worden gebruikt voor betere netwerkregelingen. Dit bevordert doorstroming, bereikbaarheid, verkeersveiligheid en duurzaamheid, legt de basis voor connected en automated driving en speelt in op een digitale samenleving waarin data en connectiviteit bijdragen aan economisch aantrekkelijke en duurzame steden.

Voor het effectief, veilig en leveranciers- en overheidsonafhankelijk communiceren van intelligente verkeersregelinstallaties (iVRI's) met voertuigen en weggebruikers hebben bedrijven en overheden in het Innovatiepartnership Talking Traffic binnen internationale standaarden gezamenlijk specificaties en koppelvlakken voor iVRI's vastgelegd. Eenduidig gebruik door alle overheden en betrokken bedrijven van deze uniforme afspraken binnen internationale standaarden is noodzakelijk voor interoperabiliteit en een goede en betrouwbare werking. Deze standaarden zijn daarom vastgesteld door de landelijke publiek private Strategic Committee 'Borgen en beheren iVRI standaarden en producten'. Na vaststelling gelden deze standaarden voor alle bedrijven en overheden die in Nederland (willen gaan) werken aan iVRI's t.b.v. intelligente mobiliteit. Vanuit de rol van onafhankelijk en landelijk kennisinstituut verzamelt CROW deze landelijk vastgestelde standaarden en stelt deze transparant ter beschikking aan overheden, adviesbureaus en leveranciers.

About this publication

The international developments in Smart Mobility technology are boosting innovations for traffic, transportation and mobility. This has a direct effect on traffic control systems in Dutch cities and provinces, as well as national highways. When traffic controllers are able to communicate with vehicles and road users, the latter can be informed about real-time phase changes in traffic lights, enabling them to anticipate and adjust driving behaviour accordingly. Also, special interest groups, such as emergency services, public transport and freight carriers, can be prioritized in line with public policy guidelines. The data provided by vehicles themselves can be utilised to improve network-based traffic control programmes. This has a positive effect on flow, accessibility, traffic safety and sustainability, laying out the fundamentals for connected and automated driving and preparing for a digital society in which data and connectivity contribute to economically viable and sustainable cities.

In order to let intelligent traffic controllers (iVRI) communicate with vehicles and road users in an effective, safe and platform independent way, businesses and governments have created and recorded common specifications and interfaces for iVRI technology. These are compliant to international standards and developed within the framework of the Talking Traffic Innovation partnership. The unambiguous use of these uniform agreements, within international standards, by all governmental bodies and businesses is necessary for interoperability and a good and reliable operation. These standards are adopted by the national public-private Strategic Committee 'Ensuring and maintaining iVRI standards and products'. After adoption, these standards apply to all businesses and governmental bodies in the Netherlands that work, or plan to work, on iVRI technology for intelligent mobility purposes. Being an independent national knowledge institute, CROW collects these national standards and provides them to governments, consultants and suppliers in a transparent way.

SSM Data

Contents

1 Introduction

1.1 Purpose of this Document

This document provides the Dutch Profile for the SSM message. It offers an interpretation of data elements and describes the use of them as extension to the standards.

1.2 SSM Message

The Signal Status Message (SSM) is a message sent by a RoadSide Unit (RSU) in a signalized intersection. It is used to relate the current status of the signal and the collection of pending or active preemption or priority requests acknowledged by the controller. It is also used to send information about preemption or priority requests which were denied. This in turn allows a dialog acknowledgment mechanism between any requester and the signal controller. The data contained in this message allows other users to determine their "ranking" for any request they have made as well as to see the currently active events. When there have been no recently received requests for service messages, this message may not be sent. While the outcome of all pending requests to a signal can be found in the Signal Status Message, the current active event (if any) will be reflected in the SignalPhaseAndTiming (SPAT) message contents.

1.3 Assumptions

The following standards have been used to prepare this profile.

- SAE J2735, Dedicated Short Range Communications (DSRC) Message Set Dictionary, March 2016
- ISO TS19091, Intelligent transport systems — Cooperative ITS — Using V2I and I2V communications for applications related to signalized intersections, 2016(E)
- ETSI 103 301, Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Facilities layer protocols and communication requirements for infrastructure services, V1.1.1 (2016-11)
- ETSI TS102 894-2, Intelligent Transport Systems (ITS); Users and applications requirements; Part 2: Applications and facilities layer common data dictionary, V1.2.1 (2014-09)

1.4 Legend

Chapter 2 contains the actual profile describing how the data frames (DFs) and data elements (DEs) shall be used for the implementation of the SSM message.

The description of the DFs and DEs can be found in aforementioned standards. The description of the DEs and DFs in this document build upon the descriptions in these standards.

The font style of the name of DEs and DFs indicates the status as defined in the standards:

- **Bold**: required by the standard;
- *Italic*: these are optional in the standard;
- Underlined: one of these can be chosen (OR);

The status in the profile is indicated in a separate column by means of one of the following labels:

- Mandatory. This DF or DE is mandatory in the standard and is thus always provided.
- Profiled. This DF or DE is mandatory in the profile although optional in the standard. It is therefore assumed that this DF or DE will always be provided.
- Conditional. This DF or DE is mandatory in specific conditions and not used in other conditions. The conditions are provided in the profile.
- Optional. This DF or DE is optional in the standard as well as in the profile.
- Used. This DF or DE is a choice in the standard and used in the profile. It is therefore assumed that this DF or DE can be provided.
- Not used. This DF or DE is optional or a choice in the standard but not used in the profile. A response to the use of this DF or DE is therefore not guaranteed, but as the message is compliant with the SN.1 specification, the message is valid.
- Future use. This DF or DE is not relevant for use cases currently in scope and therefore not profiled in the current version of the profile.

- Bold. Applies to attributes in an enumeration or bitstring and indicates the attribute shall be assigned if applicable. All non-bold attributes are optional.

1.5 Document history

Version	Date	Changes
0.1	12-04-2017	First draft version
0.2	12-05-2017	Version with new comments for subWG meeting 12th of May
1.0	02-06-2017	Final draft for approval
1.1	15-06-2017	Minor revisions which are tracked in Annex B + summary of SSM profile added in Annex A.
1.2	29-06-2017	Final revised version for approval
2.1	08-02-2018	v1.8 revisions categorised into v2.1 and v3.0 changes. Added: corrections, clarifications and interpretation.

2 Signal Status Message Profile

Standard				Profile		
Level	Field	Meaning		Status	Content	Value
Header container (ItsPduHeader - ETSI TS 102 894-2 V1.4.1)						
h.1	**protocolVersion**	Version of the protocol.		Fixed	Current version is 1.	Set to 1
h.2	**messageID**	Indicates the type of message.		Fixed	Examples are denm(1), cam(2), spat(4) etc. SSM messageID is 10.	10
h.3	**stationID**	This is the ID of the station broadcasting the message.		Mandatory	The numerical presentation of the combination of the hexadecimal representation of the RoadRegulatorID and the IntersectionID (which is a multiple of ten).	Set by application.
Level 0: SSM						
0.1	*timeStamp [MinuteOfTheYear]*	The MinuteOfTheYear data element expresses the number of elapsed minutes of the current year in the time system being used (typically UTC time).		Profiled	Mandatory in profile as opposed to standard. To be used in combination with the following data element second.	Set by application
0.2	**second [Dsecond]**	The DSRC second expressed in this data element represents the milliseconds within the current UTC minute.		Mandatory	-	Set by application
0.3	*sequenceNumber [MsgCount]*	The MsgCount data element is used to provide a sequence number within a stream of messages with the same DSRCmsgID and from the same sender. Depending on the application the sequence number may change with every message or may remain fixed during a stream of messages when the content within each message has not changed from the prior message sent.		Profiled	Mandatory in profile as opposed to standard. The sequence number will be increased by one when the content of the message has changed from the prior message. The value of the MsgCount data element is limited to 127. Therefore, MsgCounts must be numbered continuously starting at 1.	Set by application Start at 1
0.4	**status [SignalStatus-List] (1..32)**	The SignalStatusList data frame consists of a list of SignalStatus entries.	SignalStatus The SignalStatus data frame is used to provide the status of a single intersection to others, including any active preemption or priority state in effect.	Mandatory	The SignalStatusList entries shall include one SignalStatus for each Intersection.	See level 1
0.5	*regional [REGION.Reg-SignalStatus-Message]*	The element is used for additional "regional information", as defined in ISO/PDTS 19091.		Not used	-	-

Standard				Profile		
Level	Field	Meaning		Status	Content	Value
Level 1: SignalStatusList → SignalStatus						
1.1	**sequence-Number [MsgCount]**	The MsgCount data element is used to provide a sequence number within a stream of messages with the same DSRCmsgID and from the same sender. Depending on the application the sequence number may change with every message or may remain fixed during a stream of messages when the content within each message has not changed from the prior message sent.		Mandatory	The sequence number will be increased by one when the content the SignalStatus has changed from the prior message. The value of the MsgCount data element is limited to 127. Therefore, MsgCounts must be numbered continuously starting at 1.	Set by application Start at 1
1.2	**id [IntersectionReferenceID]**	The IntersectionReference-ID is a globally unique value set, consisting of an optional RoadRegulatorID and a required IntersectionID assignment, providing an unique mapping to the intersection MAP.		Mandatory	The IntersectionReferenceID should reflect the IntersectionReferenceID defined in the SRM message.	Set by application
			region [RoadRegulatorID] The RoadRegulatorID data element is a globally unique identifier assigned to a regional authority.	Profiled	Mandatory in Dutch profile as opposed to standard. For each road operator a RoadRegulatorID is provided in the document 'Addendum VRA en geregeld Kruisingsvlak Identificatie 20170728'.	Set by application
			id [IntersectionID The IntersectionID is used within a region to uniquely define an intersection within that country or region.	Mandatory	The identifier shall be defined by the road operator.	Set by application
1.3	**sigStatus [SignalStatus-PackageList]**	The SignalStatusPackageList data frame consists of a list of SignalStatusPackage entries.	SignalStatusPackage The SignalStatusPackage data frame contains all the data needed to describe the preemption or priority state of the signal controller with respect to a given request and to uniquely identify the party who requested that state to occur.	Mandatory	-	See level 2
1.4	*regional [REGION.Reg-SignalStatus]*	The element is used for additional "regional information", as defined in ISO/PDTS 19091.		Not used	-	-

Standard				Profile		
Level	Field	Meaning		Status	Content	Value
Level 2: SignalStatusPackageList → SignalStatusPackage						
2.1	*Requestor [SignalRequester-Info]*	The SignalRequesterInfo data frame is used to contain information regarding the entity that requested a given signal behaviour. In addition to the VehicleID, the data frame also contains a request reference number used to uniquely refer to the request and some basic type information about the request maker which may be used by other parties. -- The party that made the initial SRM request		Profiled	Mandatory in profile as opposed to standard.	Set by application
			id [VehicleID] The VehicleID is used to uniquely identify a vehicle or other object.	Mandatory	The VehicleID should reflect the VehicleID defined in the SRM message. The data element StationID will be used, see level 3.	See level 3
			request [RequestID] The RequestID data element is used to provide a unique ID between two parties for various dialog exchanges. Combined with the sender's VehicleID, this provides a unique string for some mutually defined period of time.	Mandatory	The RequestID should reflect the RequestID defined in the SRM message.	Set by application
			sequenceNumber [MsgCount] The MsgCount data element is used to provide a sequence number within a stream of messages with the same DSRCmsgID and from the same sender. Depending on the application the sequence number may change with every message or may remain fixed during a stream of messages when the content within each message has not changed from the prior message sent.	Mandatory	The MsgCount should reflect the MsgCount defined in the SRM message.	Set by application

Standard				Profile		
Level	Field	Meaning		Status	Content	Value
			role *[BasicVehicleRole]* The BasicVehicleRole data element provides a means to indicate the current role that a DSRC device is playing.	Not used	-	-
			typeData *[RequestorType]* The RequestorType data frame is ssed when addition data besides the role is needed, at which point the role entry above is not sent. It holds information regarding all type and class data about the requesting vehicle.	Mandatory	Mandatory in profile as opposed to standard. The RequestorType should reflect the RequestorType defined in the SRM message.	See level 4
2.2	**inboundOn [Intersection-AccessPoint]**	The IntersectionAccess-Point data frame is used to specify the index of either a single approach or a single lane at which a service is needed. This is used to indicate the inbound points by which the requestor can traverse an intersection.		Mandatory	The IntersectionAccessPoint data frame should reflect the IntersectionAccessPoint data frame defined in the SRM message.	Set by application
			lane [LaneID] The LaneID data element conveys an assigned index that is unique within an intersection. It is used to refer to that lane by other objects in the intersection map data structure. Lanes may be ingress (inbound traffic) or egress (outbound traffic) in nature, as well as barriers and other types of specialty lanes.	Not used	-	-
			approach [ApproachID]	Choice	The ApproachID should reflect the ApproachID defined in the SRM message (if provided).	Set by application

Standard				Profile		
Level	Field	Meaning		Status	Content	Value
			The ApproachID data element is used to relate the index of an approach, either ingress or egress within the subject lane.			
			connection [LaneConnectionID] The LaneConnectionID data entry is used to state a connection index for a lane to lane connection. It is used to relate this connection and any dynamic clearance data sent in the SPAT.	Choice	The LaneConnectionID should reflect the LaneConnectionID defined in the SRM message (if provided).	Set by application
2.3	*outboundOn [Intersection-AccessPoint]*	The IntersectionAccess-Point data frame is used to specify the index of either a single approach or a single lane at which a service is needed. This is used to indicate the outbound points by which the requestor can traverse an intersection.		Not used	LaneConnectionID implies the outbound. Moreover, outBoundOn is not used in the SRM profile.	-
			Lane [LaneID]	Not used	-	-
			approach [ApproachID]	Not used	-	-
			connection [LaneConnectionID]	Not used	-	-
2.4	*minute [MinuteOfTheYear]*	The MinuteOfTheYear data element expresses the number of elapsed minutes of the current year in the time system being used (typically UTC time).		Mandatory	Mandatory in profile as opposed to standard.	-
2.5	*second [Dsecond]*	The DSRC second expressed in this data element represents the milliseconds within the current UTC minute.		Mandatory	Mandatory in profile as opposed to standard.	-
2.6	*duration [Dsecond]*	The duration value is used to provide a short interval that extends the ETA so that the requesting vehicle can arrive at the point of service with uncertainty or with some desired duration of service. This concept can be used to avoid needing to frequently update the request. The requester		Mandatory	Mandatory in profile as opposed to standard.	-

Standard			Profile		
Level	Field	Meaning	Status	Content	Value
		must update the ETA and duration values if the period of services extends beyond the duration time. It should be assumed that if the vehicle does not clear the intersection when the duration is reached, the request will be cancelled and the intersection will revert to normal operation.			
2.7	**status [Prioritization-ResponseStatus]**	The PrioritizationResponseStatus data element is used to indicate the general status of a prior prioritization request.	Mandatory	Output from the ITS application. Types (see SAE J2735 for details): • unknown (0) -- not used • requested (1) -- e.g. request was detected, awaiting map-matching data • processing (2) -- e.g. request is technically approved, request is in queue • watchOtherTraffic (3) -- for emergency vehicles this value implies 'all red' priority. • granted (4) -- prioritization is active, timing data to be derived from SPAT. • rejected (5) -- request was rejected • maxPresence (6) -- maximum presence time exceeded • reserviceLocked (7) -- maximum number of requests for manoeuvre within time frame exceeded For each SRM priorityRequest or priorityRequestUpdate, the RIS will return a SSM within one second. As a priorityCancellation	Set by application

Standard			Profile		
Level	Field	Meaning	Status	Content	Value
				terminates the priority handling, no SSM will be send in response to a SRM priorityCancellation.	
2.8	*Regional [REGION.Reg-SignalStatus-Package]*	The element is used for additional "regional information", as defined in ISO/PDTS 19091.	Not used	-	-

Level 3: VehicleID					
3.1	entityID [TemporaryID]	This is the random device identifier, called the TemporaryID. When used for a mobile OBU device, this value will change periodically to ensure the overall anonymity of the vehicle. Other devices, such as infrastructure (RSUs), may have a fixed value for the temporary ID value.	Not used	The data element StationID will be used instead.	-
3.2	stationID [StationID]	This is the ID of the station broadcasting the message.	Mandatory	The StationID should reflect the StationID defined in the SRM message.	Set by application

Level 4: RequestorType					
4.1	**role [BasicVehicle-Role]**	The BasicVehicleRole data element provides a means to indicate the current role that a DSRC device is playing.	Mandatory	EU Types: • basicVehicle (0), • publicTransport (1), • specialTransport (2), • dangerousGoods (3), • roadWork (4), • roadRescue (5), • emergency (6), • safetyCar (7),	Set by application
4.2	*subrole [RequestSubRole]*	The RequestSubRole data element is used to further define the details of the role which any DSRC device might play when making a request to a signal controller. Meanings based on regional needs to refine and expand the basic roles which are defined elsewhere.	Profiled	Mandatory in profile as opposed to standard, if provided in SRM. To be used to enrich information provided by the BasicVehicleRole data element. Types: • requestSubRoleUnKnown (0), • requestSubRole1 (1), -- bus • requestSubRole2 (2), -- tram • requestSubRole3 (3), -- metro • requestSubRole4 (4), -- train	Set by application

Standard			Profile		
Level	Field	Meaning	Status	Content	Value
				• requestSubRole5 (5), -- blue light and sirene • requestSubRole6 (6), -- 'glijdend transport' • requestSubRole7 (7), -- 'dienstregelingsrit' • requestSubRole8 (8), -- 'regelmaatdienstrit' • requestSubRole9 (9), -- 'HOV-lijn' • requestSubRole10 (10), -- 'materiaalrit' • requestSubRole11 (11), • requestSubRole12 (12), • requestSubRole13 (13), • requestSubRole14 (14), • requestSubRoleReserved (15)	
4.3	*request [Request-ImportanceLevel]*	The RequestImportance-Level data element is used to state what type of signal request is being made to a signal controller by a DSRC device in a defined role. The levels of the request typically convey a sense of urgency or importance with respect to other demands to allow the controller to use predefined business rules to determine how to respond.	Not used	-	-
4.4	*Iso3833 [Iso3833Vehicle-Type]*	The Iso3833VehicleType data element represents the value domain provided by ISO 3833 for general vehicle types. It is a European list similar to the list used for the Highway Performance Monitoring System (HPMS) in the US region. In this standard, the HPMS list is used in the data concept named VehicleType.	Not used	-	-
4.5	*hpmsType [VehicleType]*	The VehicleType data element is a type list (i.e., a classification list) of the vehicle in terms of overall size	Not used	-	-
4.6	*regional [REGION.Reg-RequestorType]*	The element is used for additional "regional information", as defined in ISO/PDTS 19091.	Not used	-	-

Annex A: Summary of SSM profile

bold = mandatory/used

bold-italic = conditional

italic = optional

~~strikethrough~~ = not used

red = extensions

timestamp [MinuteOfTheYear]

second [Dsecond]

sequenceNumber [MsgCount]

status [SignalStatusList]

SignalStatus

sequenceNumber [MsgCount]

id [IntersectionReferenceID]

region [RoadRegulatorID]

Id [IntersectionID]

sigStatus [SignalStatusPackageList]

SignalStatusPackage

Requestor [SignalRequesterInfo]

Id [VehicleID]

~~entityID [TemporaryID]~~

stationID [StationID]

Request [RequestID]

sequenceNumber [MsgCount]

~~role [BasicVehicleRole]~~

typeData [RequestorType]

role [BasicVehicleRole]

subrole [RequestSub-Role]

~~request [RequestImportanceLevel]~~

~~Iso3833 [Iso3833VehicleType]~~

~~hpmsType [VehicleType]~~

~~regional [REGION.Reg-RequestorType]~~

inboundOn [IntersectionAccessPoint]

~~lane [LaneID]~~

approach [ApproachID]

connection [LaneConnectionID]

~~outboundOn [IntersectionAccessPoint]~~

~~lane [LaneID]~~

~~approach [ApproachID]~~

~~connection [LaneConnectionID]~~

minute [MinuteOfTheYear]

second [Dsecond]

duration [Dsecond]

status [PrioritizationResponseStatus]

~~regional [REGION.Reg-SignalStatusPackage]~~

~~addGrpC [SignalStatus-addGrpC]~~

~~regional [REGION.Reg-SignalStatus]~~

~~regional [REGION.Reg-SignalStatusMessage]~~

Annex B: Planned v3.0 revisions

Planned changes are marked in red.

2.2	**inboundOn** **[Intersection-AccessPoint]**	The IntersectionAccess-Point data frame is used to specify the index of either a single approach or a single lane at which a service is needed. This is used to indicate the inbound points by which the requestor can traverse an intersection.	Mandatory	The IntersectionAccessPoint data frame should reflect the IntersectionAccessPoint data frame defined in the SRM message. In special cases, e.g. emergency vehicles, this DF can be used to indicate which lanes are cleared. Hence, the returned inboundOn may differ from or be more specific than the requested one. In this case, outboundOn shall be used.	Set by application
2.3	*outboundOn* *[Intersection-AccessPoint]*	The IntersectionAccess-Point data frame is used to specify the index of either a single approach or a single lane at which a service is needed. This is used to indicate the outbound points by which the requestor can traverse an intersection.	Conditional	Only used when the returned inboundOn differs from the requested one. For example in the case of emergency vehicles.	
2.8	*Regional* *[REGION.Reg-SignalStatus-Package]*	The element is used for additional "regional information", as defined in ISO/PDTS 19091.	Optional	One extension for this data frame. Only used when applicable. rejectedReason [rejectedReason] – enumeration with types: • unknown (0) • exceptionalCondition (1) -- e.g. bridge open, railway crossing • maxWaitingTimeExceeded (2) -- of conflicting signal groups, traffic safety measure • priorityDisabled (3) -- e.g. policy • higherPriorityGranted (4) -- e.g. emergency vehicle • vehicleTrackingUnknown (5)	Set by application

Annex C: Bit string example

A bit string is an arbitrarily long array of bits. Specific bits can be identified by parenthesized integers and assigned names. As an example, the bit string for the data element LaneSharing is shown in Figure 1.

Figure 1 Bit string example

The example shows the 10 bit sting '0001000100', where BIT3and BIT7 are set from left to right. This indicates that user types individualMotorizedVehicleTraffic and cyclistVehicleTraffic can access and use the respective lane.

Annex D: Members subWG NL profile

Jaap Vreeswijk – MAPtm

Martijn Harmenzon – MAPtm

Martin Barto – Vialis

Eric Koenders – Dynniq

Peter Luns – Siemens

Eddy Verhoeven – Siemens

Peter Smit – Swarco

Jaap Zee – Swarco

Kartik Mundaragi Shivakumar – RHDHV

Klaas-Jan op den Kelder – RHDHV

Wannes de Smet – BeMobile

Arie Schreuders – Sweco

Bram Schiltmans – RWS

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