ECo-AT

Publication Event of Release 1 Documents

Vienna, 15/01/2015

Agenda

		Responsible	Time Schedule
1.	Welcome	Harrer	10:00 - 10:10
2.	C-ITS Corridor & ECo-AT	Harrer / Jandrisits	10:10 - 10:30
3.	Use Case Overview	Jandrisits	10:30 - 10:50
4.	Road Works Warning	Kaltwasser	10:50 - 11:45
5.	In-Vehicle Information	Meckel	11:45 - 12:30
	Lunch		12:30 - 13:15
6.	System Overview	Kaltwasser	13:15 - 14:00
7.	Intersection Safety	Meckel	14:00 - 14:45
	Networking Break		14:45 - 15:00
8.	CAM Aggregation	Kaltwasser	15:00 - 15:45
9.	DENM Applications	Meckel	15:45 - 16:30
10.	Next steps	Jandrisits	16:30 - 16:45
11.	AOB	all	16:45 - 17:00

Cooperative ITS Corridor – Joint Deployment NL/DE/AT

Manfred Harrer

The Official Start

On 10 June 2013 ministers representing Germany, Austria and the Netherlands, the countries initiating the corridor, signed the Memorandum of Understanding.

The C-ITS Corridor NL-DE-AT

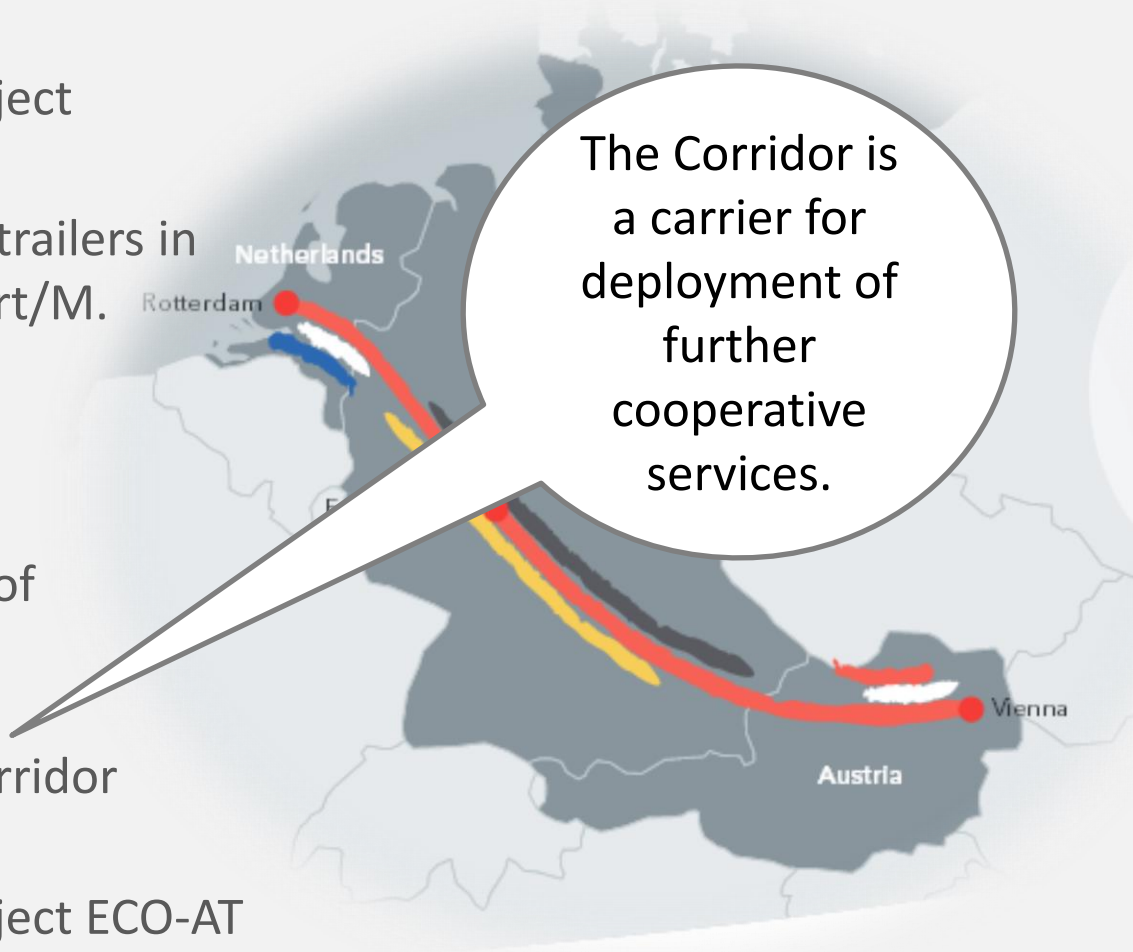
Providing a basis for standardized, international, future-oriented cooperative ITS services

- A joint road map for the introduction of the initial cooperative ITS services
- Common functional descriptions of the initial cooperative ITS services and technical specifications
- Start of the actual implementation of the initial cooperative ITS services

The Phases

1. Pre-development and proof-of-concept
   - within the Austrian project ECO-AT,
   - with road works safety trailers in Hessen around Frankfurt/M.
   - by extension of Dutch Test-site DITCM

2. Nationwide Deployment of Road Works Warning and Probe Vehicle Data in the Cooperative ITS Corridor (NL – DE – AT)
   - within the Austrian project ECO-AT



The Use Cases in the Corridor

At least two use cases will be implemented jointly along the whole corridor

- **Road Works Warning**
  Vehicles approaching a road works site will be warned and informed directly in the vehicle in addition to the conventional signage means. The exact location, start and end time and site-phases will be provided.
- **Improved Traffic Management by using Vehicular Data**
  In the future the roadside C-ITS infrastructure can detect vehicular road traffic and event data (security relevant as well as road availability data) and will provide it to the traffic control centers (TCC).

ECo-AT is working on the definition of additional use cases.

Strategic Goals
Road Works Warning

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- Increase the safety of road works personnel by the warning of approaching vehicles in the vicinity of the construction site
- Increase road safety by early indication of road works on the motorway network
- Knowledge of the current location of road works and the current phase of long-term construction sites on the motorway network in the traffic control center to improve road works management and road network management
- Dissemination of more accurate information for traffic information services
- Supporting the distribution of C-ITS technology in the vehicle to bring the road works information timely, accurate and on the relevant road section directly in the vehicle
- As road operator to exploit the technology later for other applications in the vehicle.

Strategic Goals

Improved Traffic Management by using Vehicular Data

- Improve the road section and network management - and thus avoid congestions - with more comprehensive data on the availability of the road (e.g. travel times and impacts influencing the availability)
- Improve the incident management through the timely availability of accurate information about disturbances / events on the road network
- Creation of an provider independent access to vehicle data by direct road-side detection and thus introducing a new "core technology" in traffic management
- Supporting the distribution of C-ITS technology in the vehicle in order to make this technology usable for further applications for road operators

The ECo-AT project

Jandrisits Marko

European Corridor – Austrian Testbed for Cooperative Systems

ECo-AT

- is the Austrian project to create harmonised and standardised cooperative ITS applications jointly with partners in Germany and the Netherlands
- The project is led by the Austrian motorway operator ASFINAG
- Project partners are:

Project Objectives for ECo-AT

- To close the gap between R&D and implementation for a harmonised role out of C-ITS in the corridor
    - by defining in cooperation with industry partners all elements in the value chain for C-ITS,
    - by adapting industry partners products and internal ASFINAG procedures,
    - By testing the overall system in a living lab environment and finally
    - by procuring and implementing the Day One services on a corridor in Austria

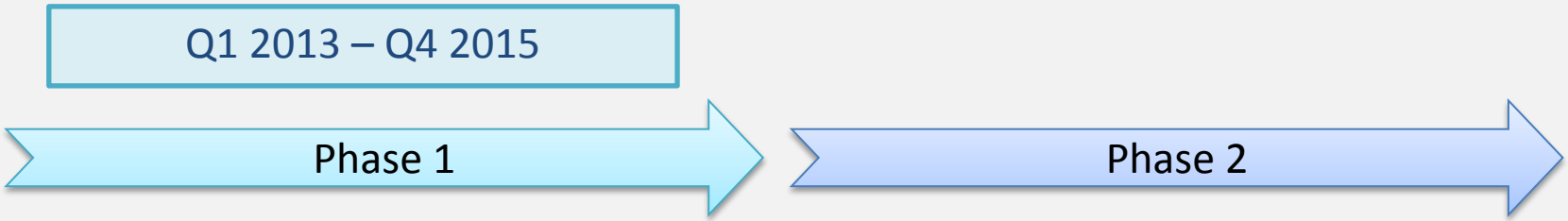
Major Topics for ECo-AT

- Use Cases
- Roles & Responsibilities
- System architecture for whole value chain
- Traffic Control Centre (TCC)
- Road Side Units (RSU)
- Co-Existence (5,8 / 5,9 GHz)
- Convergence (5,9 GHz with cellular systems)
- Upwards Compatibility
- Conformance Testing
- Definition and Implementation of a Living Lab
- Tender procedure – procurement
- Conformance Testing
- Roll Out and Operation

Phase 1 ECo-AT

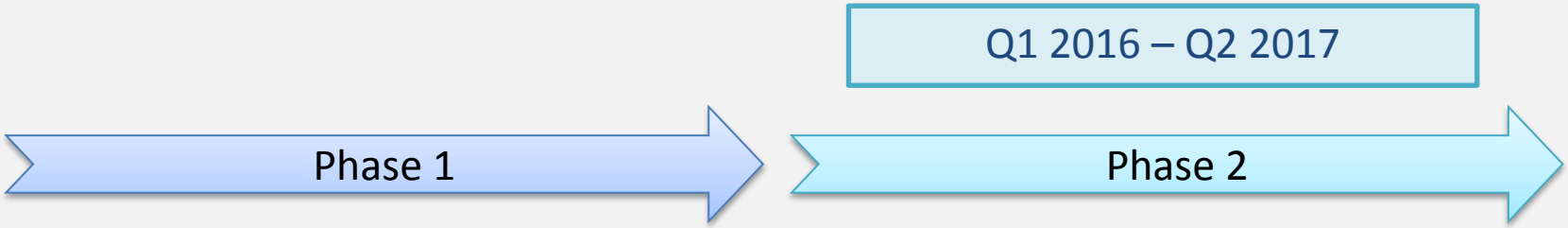
- Finalise together with industry the necessary functional specifications for all components of cooperative systems, harmonise it in the corridor DE / NL / AT
- Support the adaptation of the components and products of industry partners
- Test the components in a Living Laboratory

The result of Phase 1 will be a full systems specification for C-ITS which has been tested and verified by the ECo-AT industry partners and by 3rd parties.



Phase 2 ECo-AT

- In Phase 2, the systems are procured and the living lab is used to verify the functional specifications in phase 1



ECo-AT

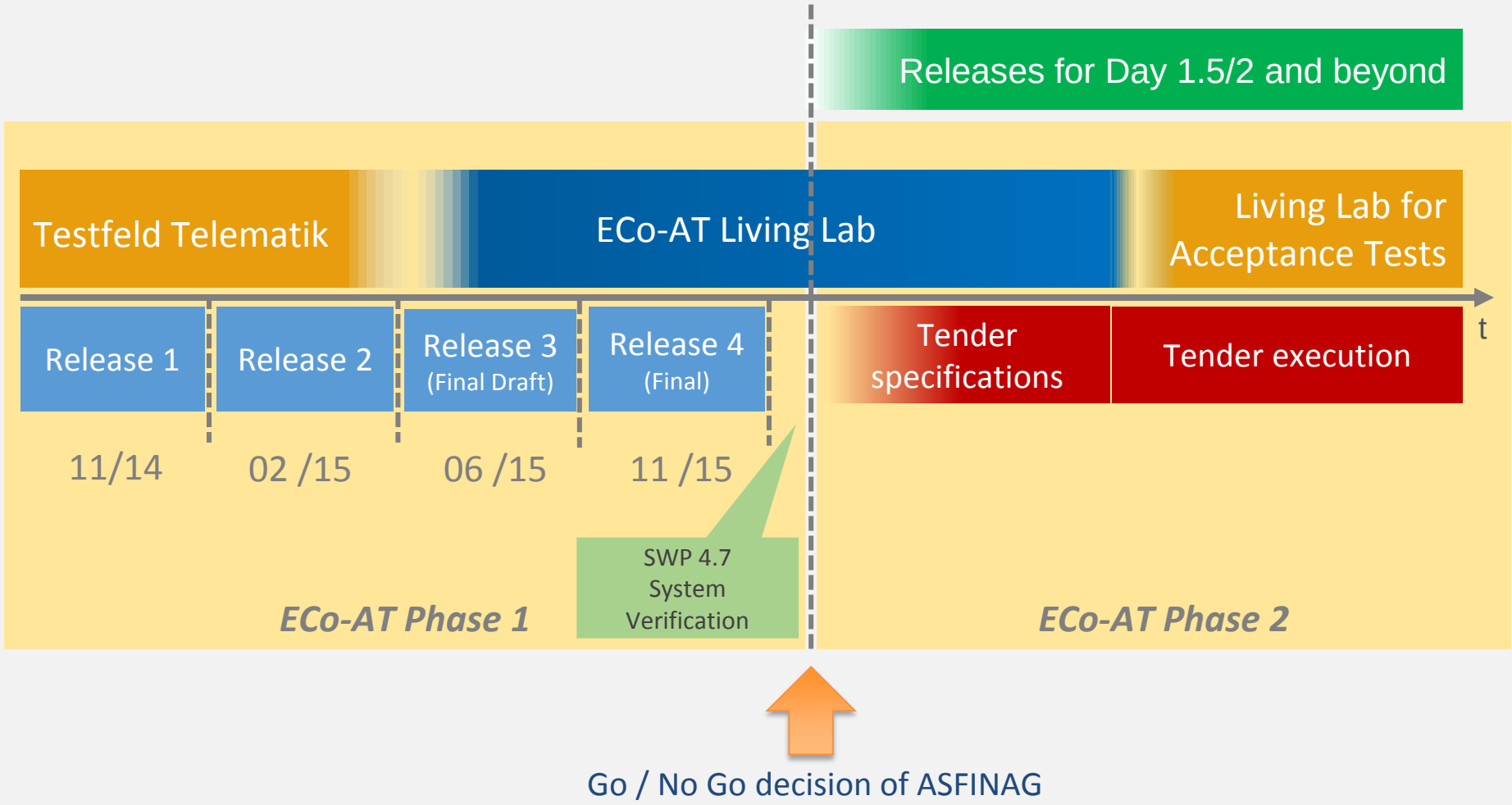
Use Case Overview

Jandrisits Marko

Document Reference:
"ECo-AT_SWP2.1_OverviewOnUseCases_v01.00.docx"

ASFINAG ITS Vienna Region VOLVO IPTE ftw Creating Communication Technologies
kapsch HiTec marketing SIEMENS swarco bast
powered by klima+ energie fonds

Project Schedule



Go / No Go decision of ASFINAG

Releases in ECo-AT

In ECo-AT Phase 1 all project partners will cooperate on the development of system architecture specifications. These system architecture specifications will be developed in 4 releases and each release will be published for public consultation:

- Release 1 in 11/2014
- Release 2 in 02/2015
- Release 3 (Final Draft) in 06/2015
- Release 4 (Final) in 11/2015

3rd parties & Living Lab

- 3rd parties (companies not being project partners of ECo-AT) will have access to the system specifications as they are published.
- Project partners as well as 3rd parties are invited to test against the system specification in the ECo-AT Living Lab on a voluntary basis.
- Access to the Living Lab and test tools will be granted under specific terms, which for still have to be defined. This is planned to happen with Release 2 in 02/2015
- The Living Lab phase will start at the same time for 3rd parties and project partners.

3rd parties & Living Lab

- ASFINAG will develop the tender specifications and start the tendering procedures for the procurement of the C-ITS system in Phase 2. This work will be based on the published final Phase 1 system specification.

- ASFINAG will use the Living Lab for acceptance tests of C-ITS systems and components for operational use, based on test procedures and tools agreed and developed in Phase 1.

- All use cases deployed in the scope of ECo-AT Phase 2 are called “Day 1 use cases”, all others “Day 2 use cases”.

Use Cases Day 1

	Day 1			Day 2
Use Case	Release 1	Release 2	Release 3/4	
Road works warning (RWW) • Emergency, Short Term • Mobile RW • Long Term RW	X	X	X	
In-vehicle-information (IVI) • Dynamic signs • Static Signs	Draft	X	X	
Probe vehicle data (PVD) • aggregation of CAM • PVD including PDM	Draft	X		X
Intersection Safety (ISS)	Draft	X		
Other DENM based applications • Processing of DENM from the vehicles • TCC initiated DENMs based on traffic information content	Draft	X	X	
Multimodal information (MIF)	Feasibility Study			

Release 1 Documents

Overview

- **Release 1 of ECo-AT consists of 9 documents**

Explanatory Release Note	“ECo-AT_SWP2.3_ExplanatoryReleaseNote_v01.00.docx”
Use case Overview	“ECo-AT_SWP2.1_OverviewOnUseCases_v01.00.docx”
Use case Road Works Warning (RWW)	“ECo-AT_SWP2.1_RoadWorksWarning_v01.00.docx”
Use case In-Vehicle Information (IVI)	“ECo-AT_SWP2.1_InVehicleInformation_v01.00.docx”
Use case CAM Aggregation	“ECo-AT_SWP2.1_CAM_Aggregation_v01.00.docx”
Use case Intersection Safety (ISS)	“ECo-AT_SWP2.1_IntersectionSafety_v01.00.docx”
Use case Other DENM Applications	“ECo-AT_SWP2.1_DENM_Applications_v01.00.docx”
System overview	“ECo-AT_SWP2.3_SystemOverview_v01.00.docx”

› *Feedback Document*

Release 1 Documents

Explanatory Note and Use Case Overview

- **Explanatory Note Release 1**
  - Introduction for C-ITS / V2X, ITS Corridor, ECo-AT
  - ECo-AT Phases and Releases
  - Overview on Documents in Release 1

- **Overview on Use Cases**
  - Overview on ECo-AT Use Cases
  - Definition of Terms (day 1, day 2, release 1, release 2, …)
  - Assignment of Use Cases to day 1 / day 2 and releases
  - Definition of Living Lab

Release 1 Documents

System Overview

- **System Overview**
  - Current status of ECo-AT
  - First description of the ECo-AT System
  - Early specification and common understanding for all partners regarding
    - system architecture
    - system components
    - interfaces
    - communication model
    - usage of data elements
    - security architecture
    - message management
  - Basis for development of system requirements and functional requirements in later releases
  - Basis for harmonization with Corridor partners

Release 1 Documents

Use Cases RWW and IVI

- **Use Case *Road Works Warning***
  - Deployment scenarios for Road Works Warnings
  - System setup and (preliminary) triggering conditions
  - Data and message content for mapping Road Works layouts to DENM
    - Emergency/ad hoc RW – Sofortmaßnahme – Regelplan „S“
    - Short term RW – Arbeitsstellen kürzerer Dauer – Regelplan „K“
- **Use Case *In-Vehicle Information***
  - Distinction between IVI and IVS and plans in ECo-AT
  - Status for IVI / IVS in Austria – Legal environment and existing signage
  - IVI / IVS Standardization (ISO/TS 19321)
  - Data availability for the IVI / IVS use case
  - Profile of IVI ISO/TS 19321 for the use in ECo-AT including coding examples for all sign types

Release 1 Documents

Use Cases ISS and CAM Aggregation

- **Use Case *Intersection Safety***
  - Deployment scenarios / use cases for ECo-AT
    - Vehicle Speed optimisation approaching an intersection, based on signal status
    - Fast pre-emption of traffic due to traffic light signal change (red to green)
    - Red light violation
  - Message overview (SPaT / MAP)
    - Traffic-light status (SPaT – Signal Phase and Timing)
    - Geographical representation of the vicinity of the traffic light (MAP)
  - Relevant data elements in SPaT / MAP

- **Use Case *CAM Aggregation***
  - Purpose of CAM Aggregation, differentiation from PVD
  - Comparison with TLS traffic data
  - Functional description of CAM Aggregation for release 1 of ECo-AT

Release 1 Documents

Use Case Other DENM applications

- **Use Case *Other DENM Applications – Hazardous Location Warnings / Events***
  - Introducing the ASFINAG event management system
  - Procedures for matching events to ETSI use cases and DENMs
  - Examples for event matching
  - Relation to ITS Directive / priority action „c“

Questions and Feedback

- For any further feedback please use the Feedback form
- For any further information visit:

www.eco-at.info

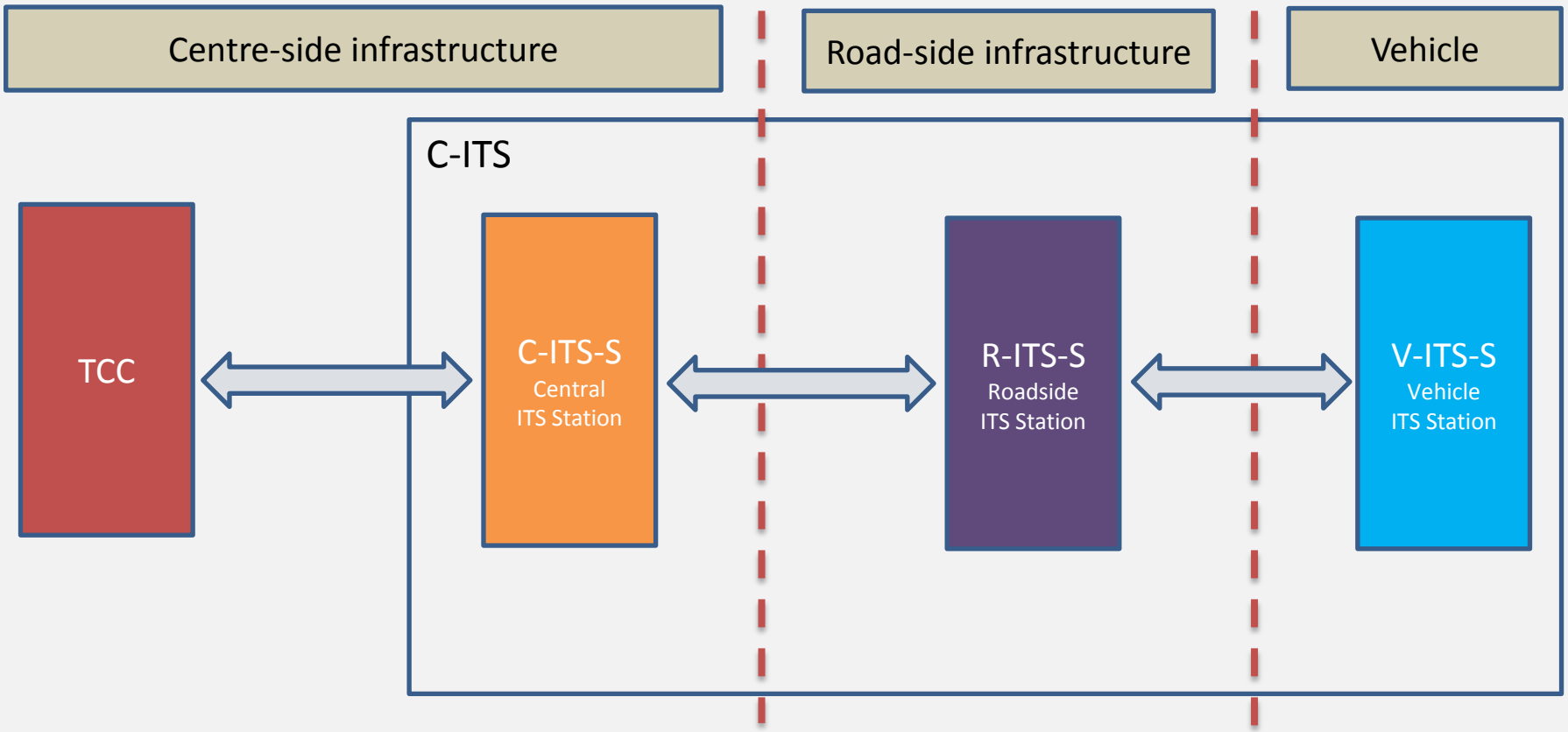
ECo-AT

Road Works Warning

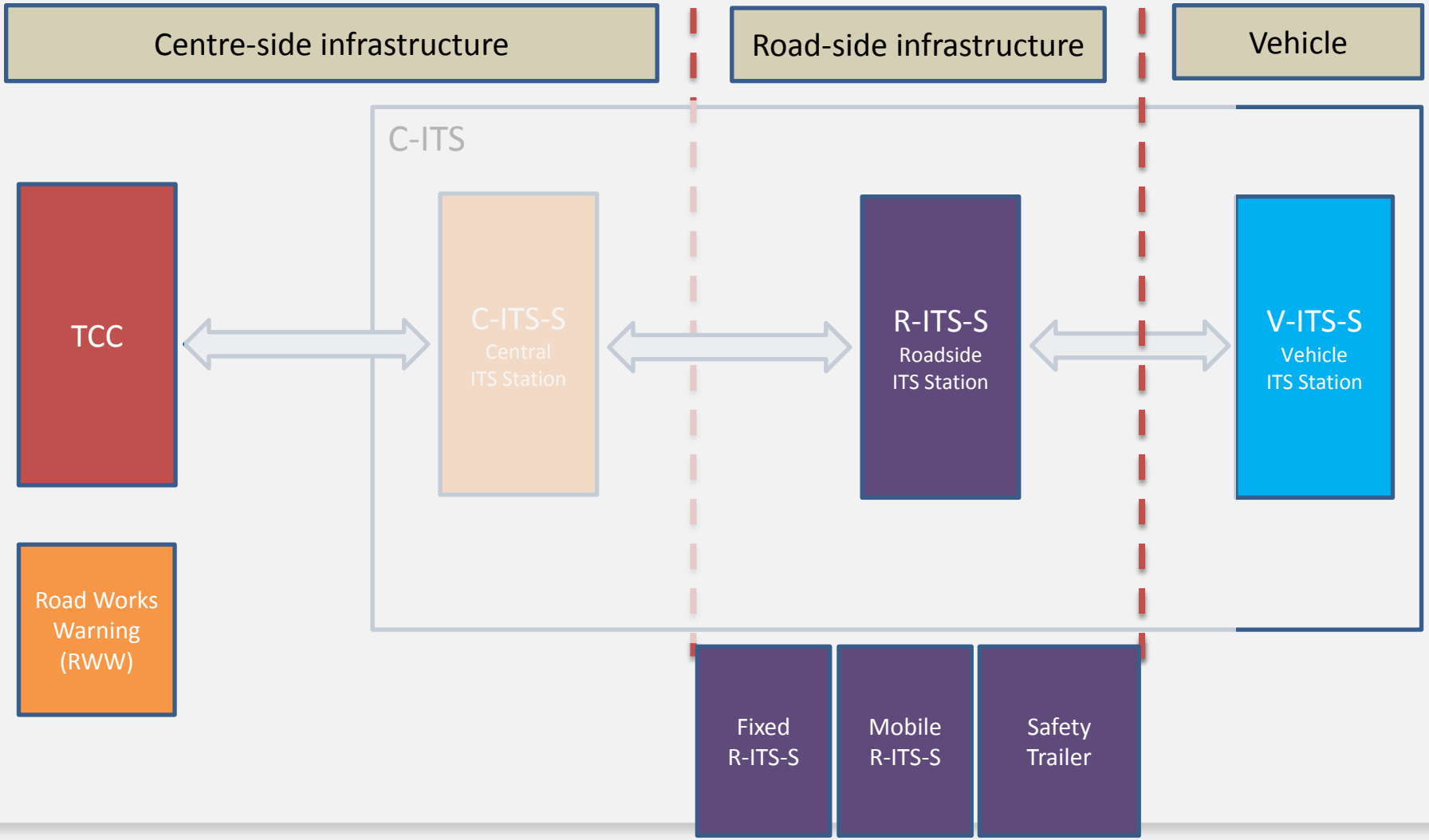
Kaltwasser Josef

Document Reference:
“ECo-AT_SWP2.1_RoadWorksWarning_v01.00.docx”

Overview System Architecture

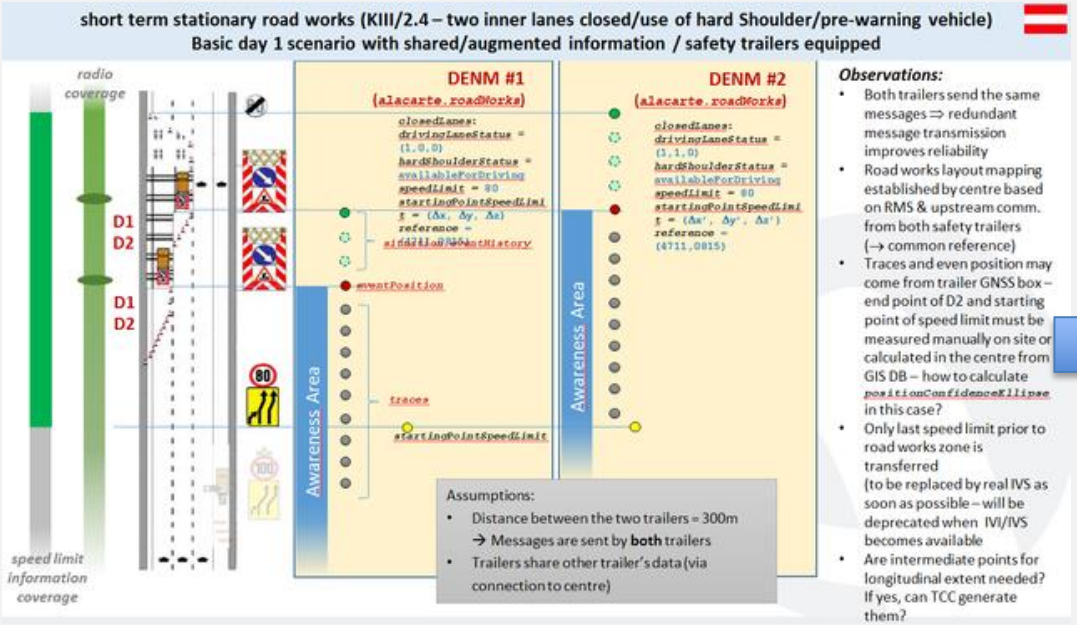


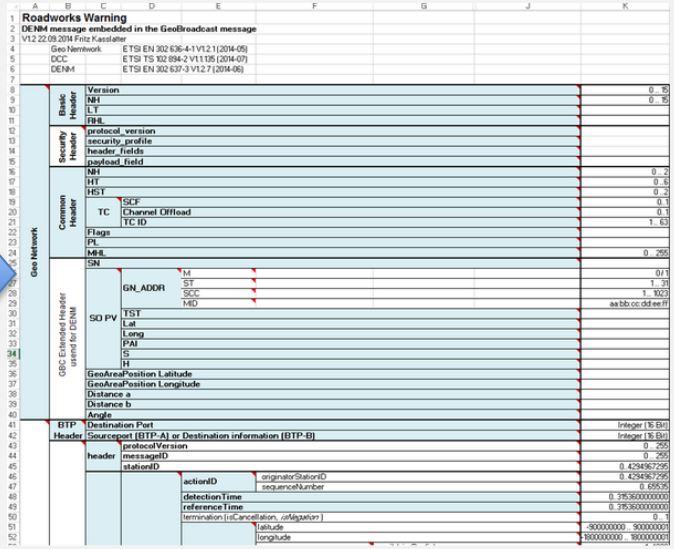
Road Works Warning - RWW



Road Works Warning in Release 1

- Concrete Mapping of different road works layouts to DENM (layouts according to Austrian regulation RVS)
- Validation with operational units of ASFiNAG (MSG SE, SG VM & BE)
- Reference to new road works management system BMS 2012





Different scenarios of R-ITS-S

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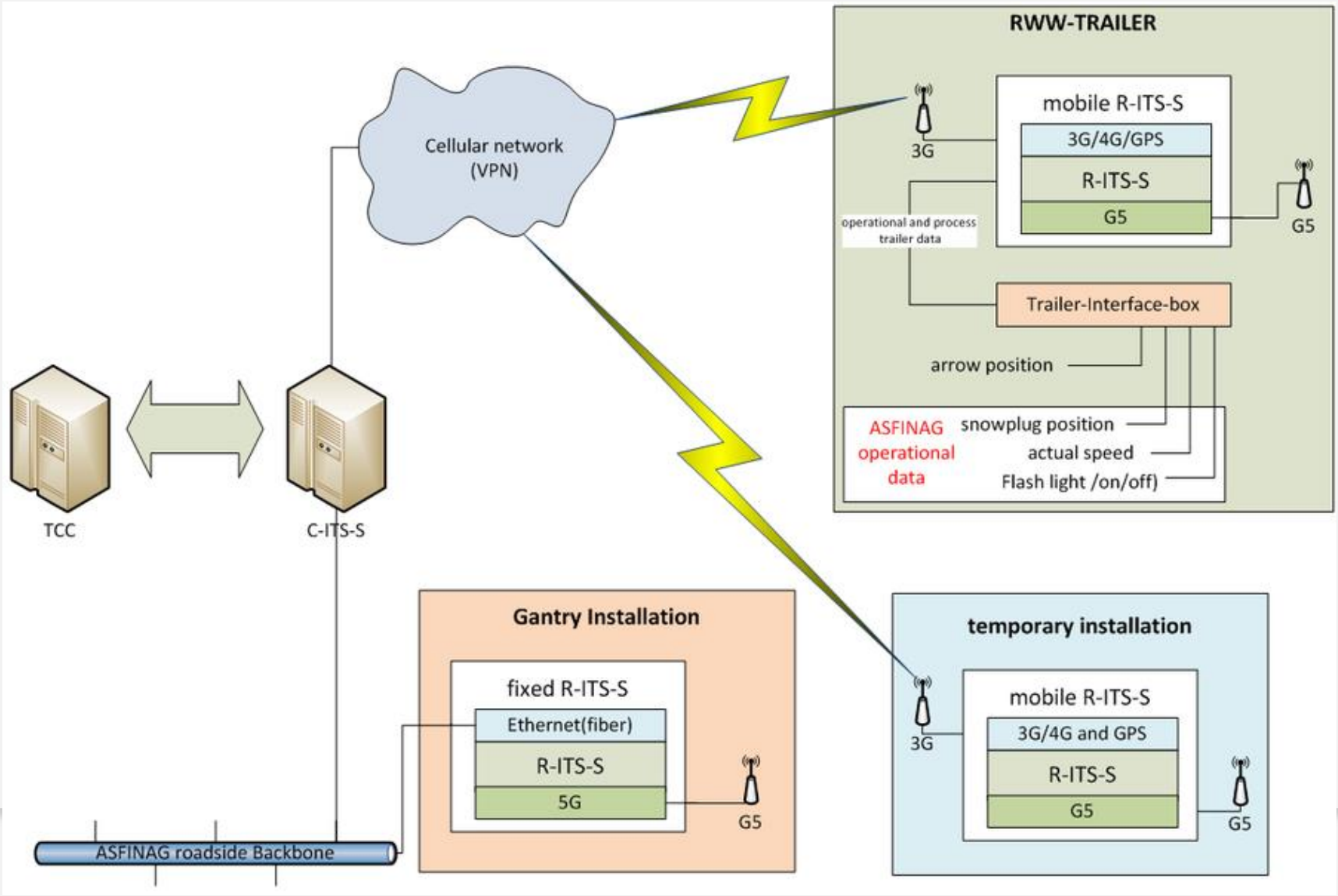
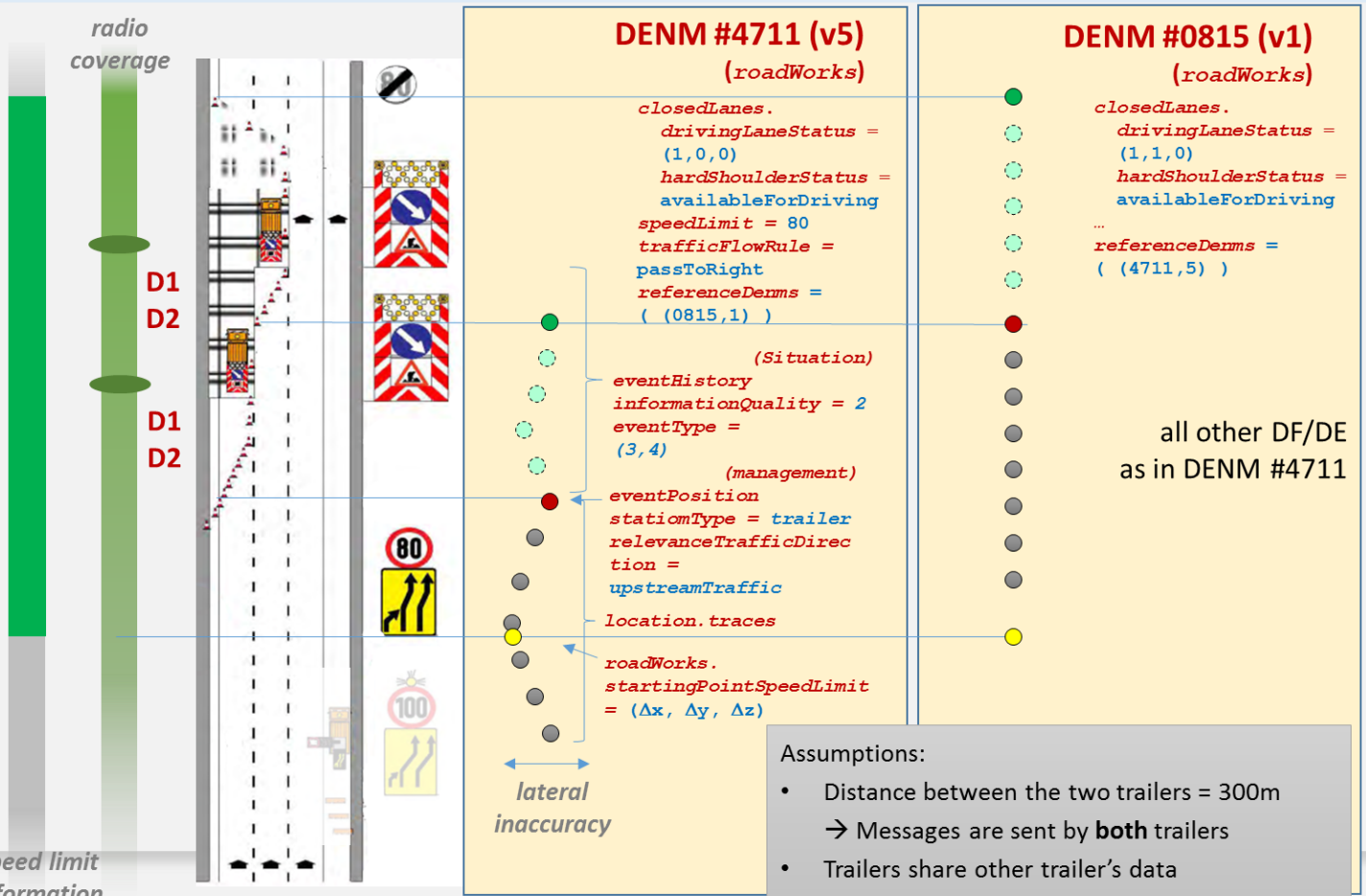


The layout template

two inner lanes closed

short term stationary road works (KIII/2.4 – two inner lanes closed/use of hard Shoulder/pre-warning vehicle)
Basic day 1 scenario with shared/augmented information / safety trailers equipped



Assumptions:

- Distance between the two trailers = 300m
  → Messages are sent by **both** trailers
- Trailers share other trailer's data
  (via connection to centre)

Observations:

- Both trailers send the same messages ⇒ redundant message transmission improves reliability
- Road works layout mapping established by centre based on RMS & upstream comm. from both safety trailers (→ common reference)
- Traces may come from trailer GNSS box – event positions and end point of DENM#0815 and starting point of speed limit must be measured automatically or manually on site or calculated in the centre from GIS DB (with potential error!)
- Only last speed limit prior to road works zone is transferred (will be sent by IVI/IVS when available)
- Are intermediate points for longitudinal extent needed? If yes, can TCC generate them?

Short term stationary road works

Related layouts with minor coding deviations

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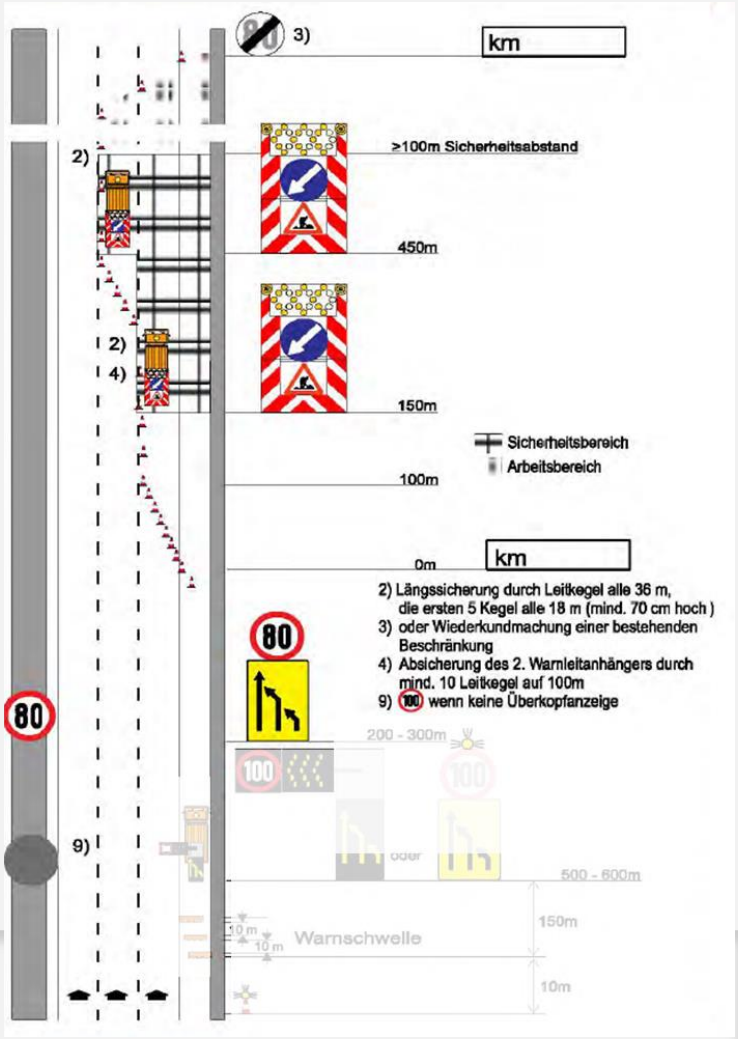
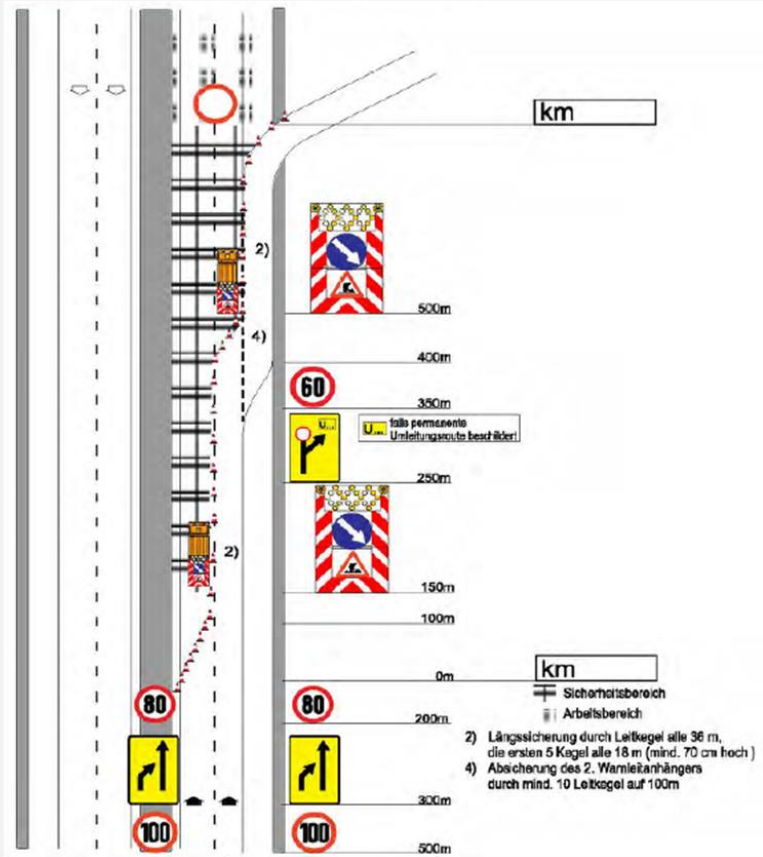
- RVS 05.05.42
  - **KIII/2.3** – two outer lanes closed/pre-warning vehicle
    - ***drivingLaneStatus*** = `(0,0,1)` resp. `(0,1,1)`
    - ***hardShoulderStatus*** = `closed`
    - ***trafficFlowRule*** = `passToLeft`
  - **KIII/2.2** – inner lane closed/pre-warning vehicle
    - Only one DENM
    - ***drivingLaneStatus*** = `(1,0,0)`
  - **KIII/2.1** - outer lane closed/pre-warning vehicle
    - Only one DENM
    - ***drivingLaneStatus*** = `(0,0,1)`
    - ***hardShoulderStatus*** = `closed`
    - ***trafficFlowRule*** = `passToLeft`
  - **KII/2.1 – KII/2.3**
    same coding except for one lane less:
    drivingLaneStatus = `(0,1)` or `(1,0)`
  - **KII/1.1** same coding except for all lanes available
  - **KII/3.1 – KII/3.3 & KIII/3.1 & KIII/3.2** same coding (only difference: fixed sign pre-warner)



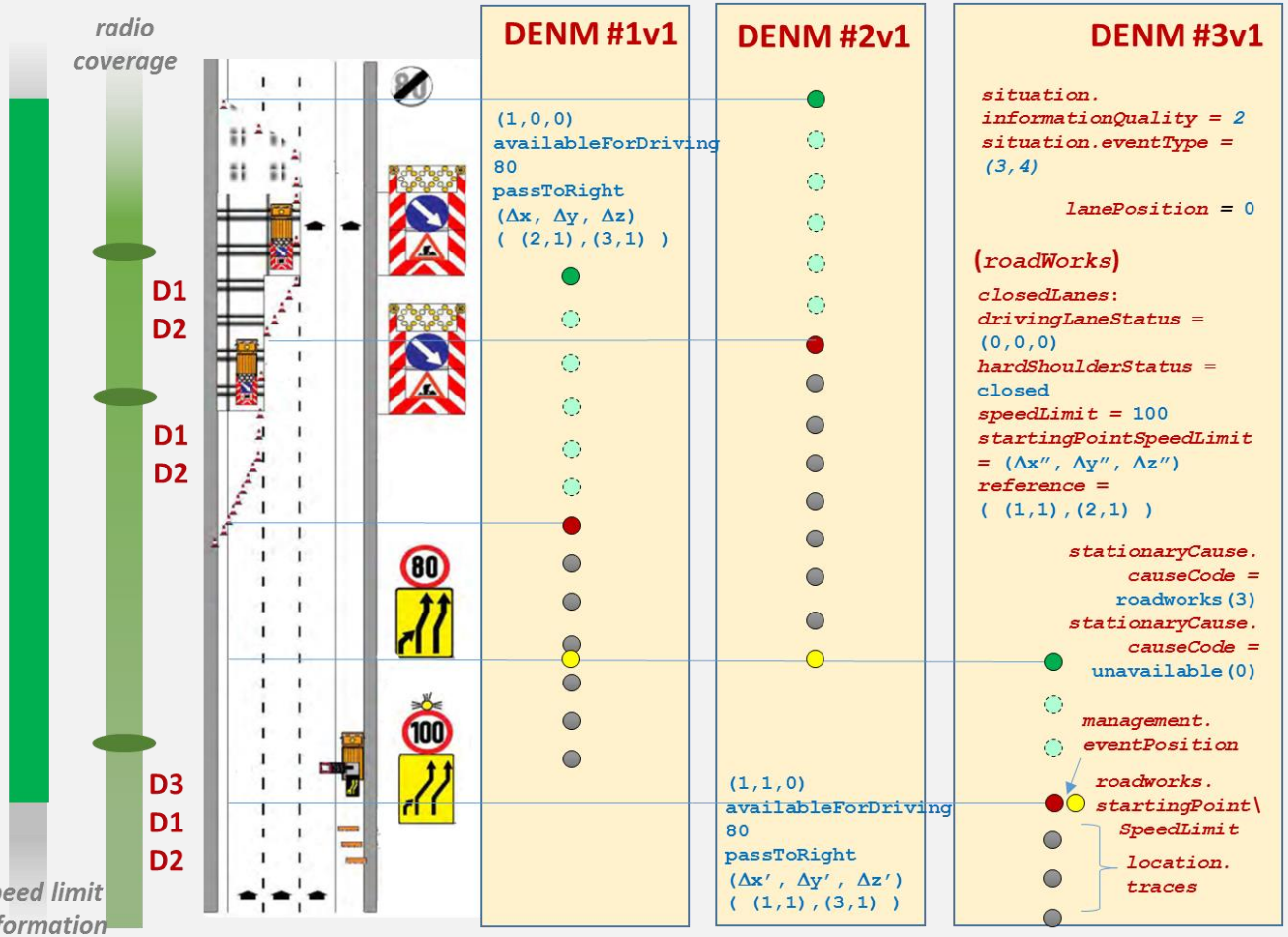
KII/3.4 – full closure of both lanes/deviation via exit

Short term road works layouts with difficult coding

- RVS 05.05.42
  - **KII/3.4**
    - ***drivingLaneStatus*** = `(1,1)`
    - ***hardShoulderStatus*** = `closed`
  - We could use in principle the same coding as before, just that a third DENM with event position at the point of the full closure (*eventPosition* and traces have to come from the centre database) indicates all lanes closed and hard shoulder is closed as well.
  - This coding would NOT be explicitly convey that the traffic is forced to leave at the respective exit – the applications would have to deduce that themselves from the fact that all lanes plus the hard shoulder are closed.



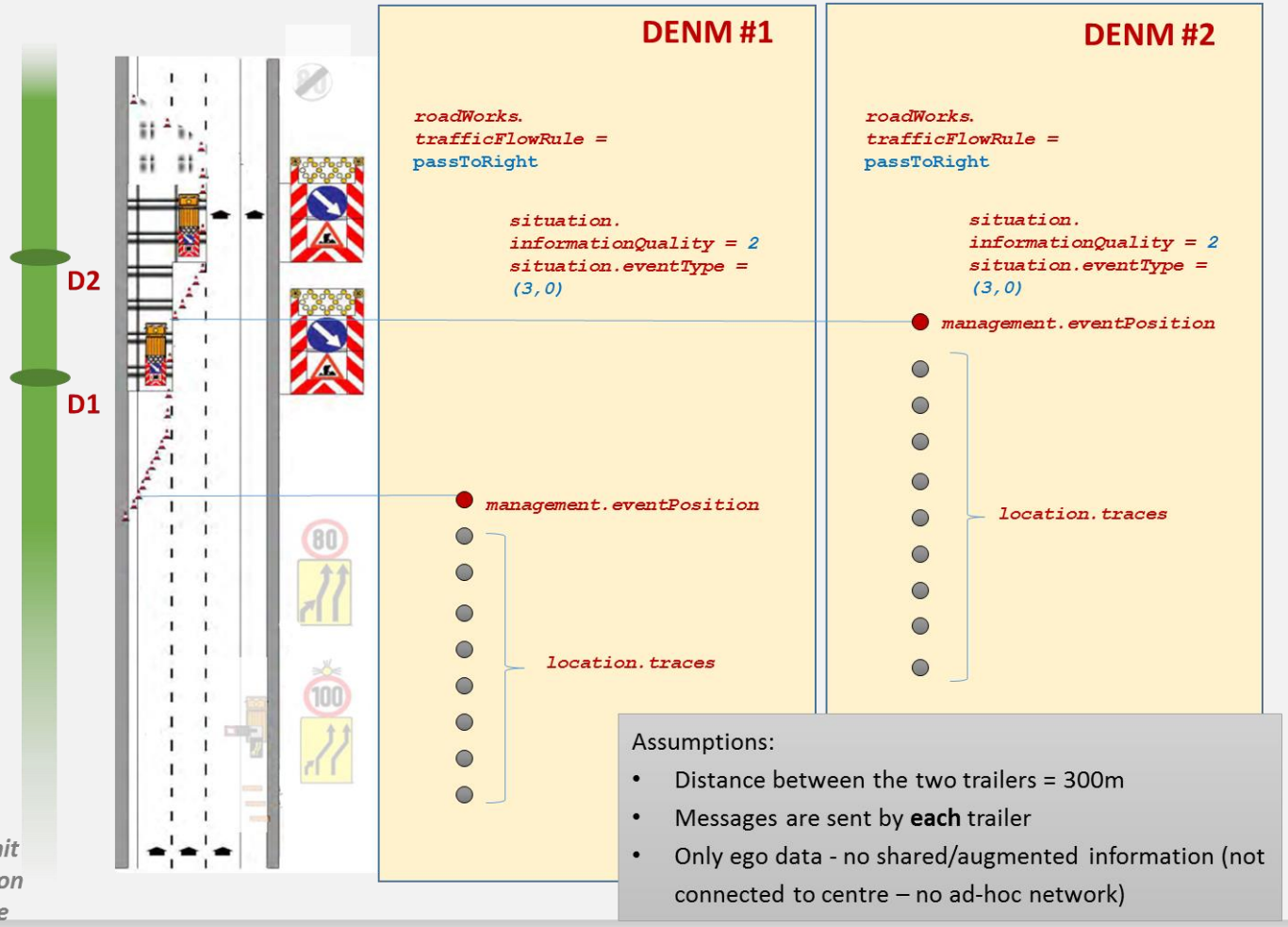
Further option – equipped pre-warner



Observations:

- Combined use of alacarte lanePosition, stationaryVehicle & roadWorks containers
- If the pre-warner is also equipped with a R-ITS-S it can send out all DENMs → information can be received earlier by the vehicle
- Complete speed limit information available inside the road works area
- The principle of adding a stationary vehicle container could also be applied to the safety trailers
- Unclear how to set stationType for the pre-warner: lightTruck(7), trailer(9), specialVehicles(10) or roadSideUnit(15)?

Autonomous mode without connection to centre



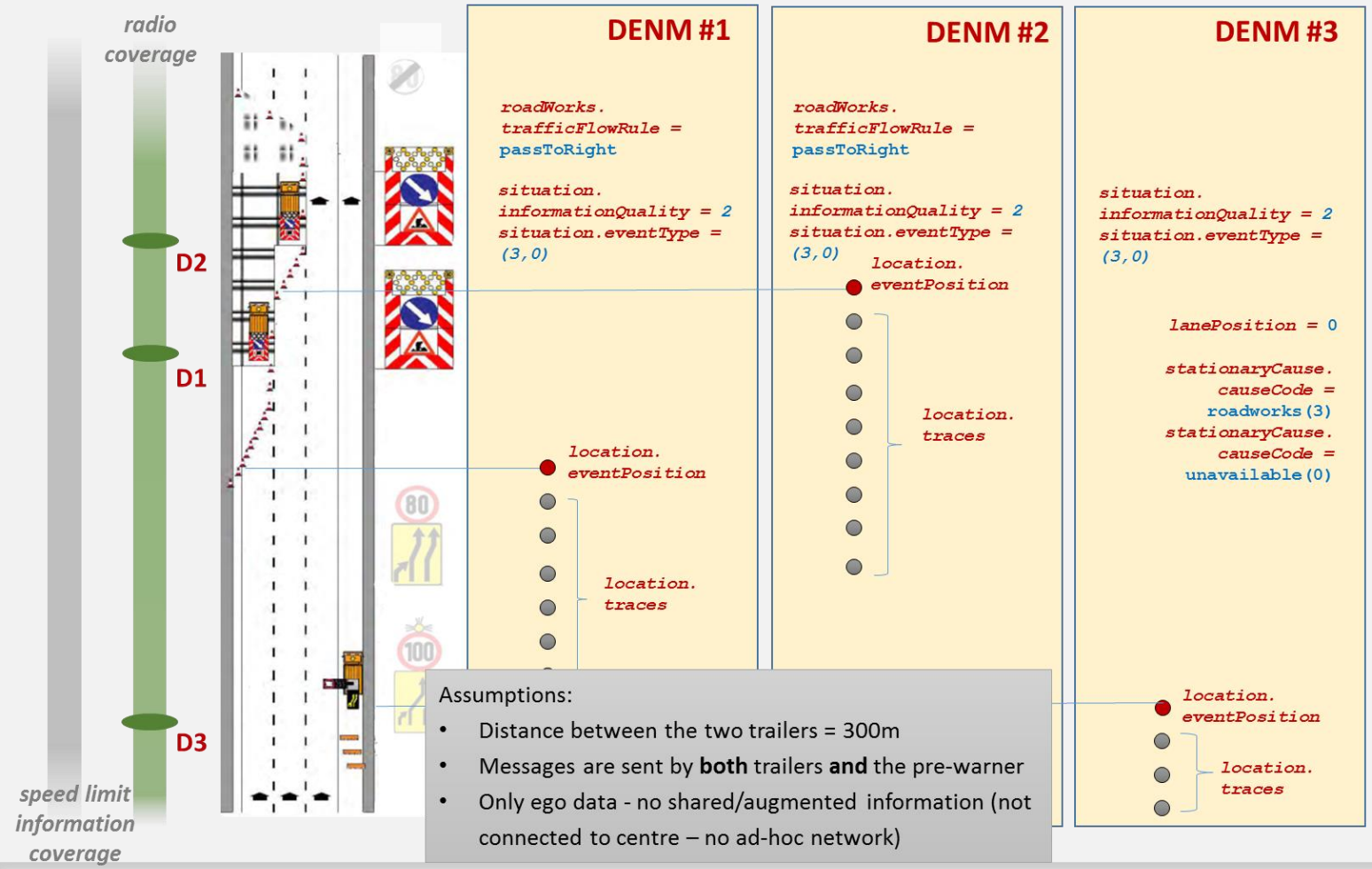
Assumptions:

- Distance between the two trailers = 300m
- Messages are sent by **each** trailer
- Only ego data - no shared/augmented information (not connected to centre – no ad-hoc network)

Observations:

- Each R-ITS-S can only transmit ego information!
- Traces created from trailer's GNSS unit – it is not clear yet how the actual event position can be derived locally from the trailer's GNSS position data
- Arrow position conveyed by passing rule attribute
- No speed information
- Each trailer sends its own DENM (different action IDs, no common reference)
- No information on longitudinal extent
- IVS information on arrow sign to be replaced by proper IVS messages as soon as possible
- The cone offset to determine the eventPosition from the current position of the trailer has to be determined on-site!

Autonomous mode without equipped pre-warner



Assumptions:

- Distance between the two trailers = 300m
- Messages are sent by **both** trailers **and** the pre-warner
- Only ego data - no shared/augmented information (not connected to centre – no ad-hoc network)

Observations:

- Traces and event position created from trailer's / pre-warner's GNSS unit
- Arrow position of trailer conveyed by passing rule attribute
- No speed limit information
- All IVS information (arrows) to be replaced by proper IVS as soon as possible
- Each trailer and the pre-warner send their own DENM (different action IDs, no common reference)
- No information on longitudinal extent
- Pre-warner just sends stationary vehicle warning for hard shoulder
- Unclear how to set stationType for the pre-warner

Short term stationary/mobile road works

S & A – Road work layouts

- RVS 05.05.42
  - **SII/1 & SII/2** – immediate action
    equivalent to fall-back KII/2.1 & KII/2.2 without pre-warner
  - **AII/2.1 & AII/2.2** and **AIII/2.1** – tbd Release 2
    - Include speed of moving road works: *eventSpeed* and *eventPositionHeading*

Features of Release 1

Short term road works only – S & K layouts

- Safety trailer stand-alone / fall-back / moving road works scenario
  - Position of trailer with traces
  - Position of arrow (= passing rule)
  - Optional: equipped pre-warners send warning messages for blocked hard shoulder
- Basic scenario – safety trailers equipped
  - Start of road works with traces
  - Longitudinal extension of road works area
  - Speed limit value for inner road works area
  - Availability of lanes & allowed use of hard shoulder
  - Common reference supports receiver processing
- Optional: Basic scenario – safety trailers and pre-warner equipped
  - Full coverage of speed limits (inner road works area & approach)
  - Blocking of hard shoulder by pre-warner is transmitted

Limitations of Release 1

- No mapping of A types yet (= moving road works)
  - › Requires further clarification with practitioners
- No mapping of long term road works yet

Pending issues RWW

- Validation of concepts with application designers
  (Are the designed messages useful to create an application?)
- Validation of concepts with road works practitioners
  (Is the described approach feasible in practice?)
- Validation of data fusion concepts
  (Is the augmented information sufficiently accurate?)
- Specification & validation of triggering conditions
  (Against day-to-day practice in the field)
- Pending decisions:
  - How to determine required geographical positions on-site?
    (C-ITS enabled Equipment? Hand-held devices? …)
  - How to validate generated messages?
    (Always on-site? Extensive test phase? …)
- Which scenarios to support on Day 1?
- Which types of R-ITS-S?

Questions and Feedback

- Open discussion and Questions
- For any further feedback please use the Feedback form
- Please visit our homepage, to find:
    - project description
    - information concerning
    - objectives and facts
    - phases and releases
    - system specifications
    - project partners
    - contact
    - And further information

www.eco-at.info

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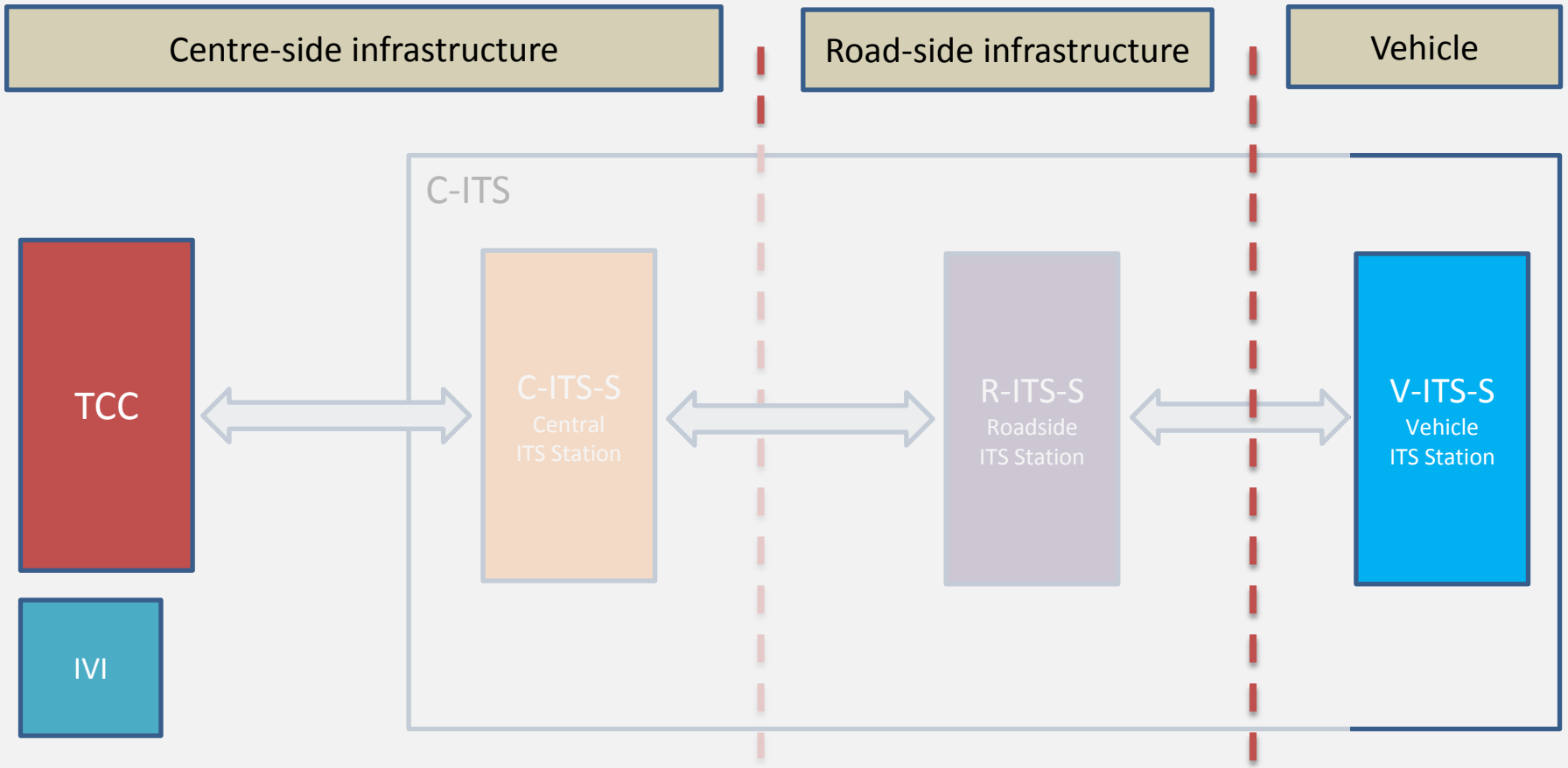
In-Vehicle Information

Meckel Peter

Document Reference:
“ECo-AT_SWP2.1_InVehicleInformation_v01.00.docx”

ASFINAG ITS Vienna Region VOLVO IPTE ftw Creating Communication Technologies
kapsch HiTec marketing SIEMENS swarco bast
powered by klima+ energie fonds

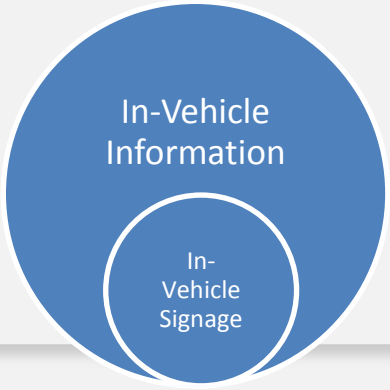
Use Case In-Vehicle Information – IVI



In-Vehicle Signage

Scope

- Release 1 of ECo-AT contains a Draft Document on the Use Case “In-Vehicle Information”
- Distinction between IVI / IVS
  - *In-Vehicle Information* (IVI) denotes a data structure that is required by different ITS services to convey information into the vehicle
  - One of these services is *In-Vehicle Signage* (IVS) which provides static as well as dynamic road sign information
- Scope of ECo-AT
  - To provide an In-Vehicle Signage (IVS) subset of IVI in a highway / interurban scenario (in several releases)

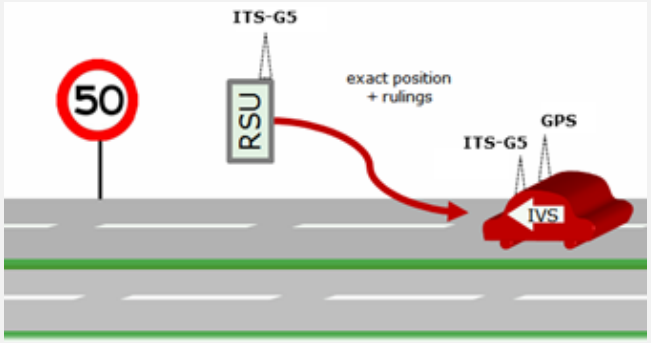


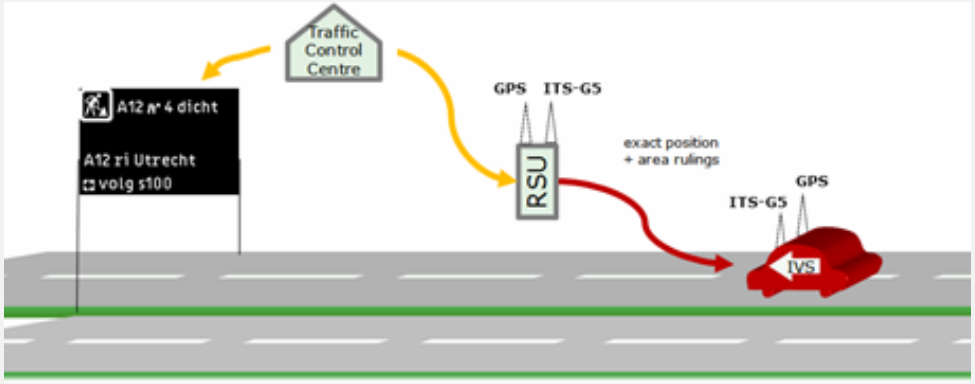
ECo-AT IVI / IVS	Static Signs	Dynamic Signs
Release 1	(Draft)	(Draft)
Release 2	(Draft)	Electronic road signs (highway / inter-urban)
Release 3/4	Static road signs (highway / inter-urban)	Electronic road signs (highway / inter-urban)

In-Vehicle Signage

Scope II

- Information presented by means of In-Vehicle Information (IVI) …
  - … is not legally binding (at least in Day 1 / ECo-AT)
  - … provides *information* only, the decision on how this information is processed is the choice of the application designer (car **manufacturers**, OEMs or service providers) and may differ from one application/device/vehicle to the other
- Roadside ITS Stations (R-ITS-S) – connected to a TCC – shall broadcast IVI information to passing vehicles
  - No standalone / unconnected R-ITS-S in ECo-AT





In-Vehicle Signage

Scope III

- The In-Vehicle Information service should at least provide the following data and information
  - › Signage
    - Type of signage (danger, priority, prohibitory, mandatory etc.)
    - Identification of signage (e.g. against a catalogue)
    - Content (e.g. max. 100 km/h)
    - Time validity
    - Message type (informative or mandatory)
    - Vehicle classification
  - › Coverage
    - Road and direction of relevance, at least the exact position of the signs
    - Minimum area and direction of awareness expressed as waypoints on the approach to which the vehicle can match its own trajectory (traces)

In-Vehicle Signage

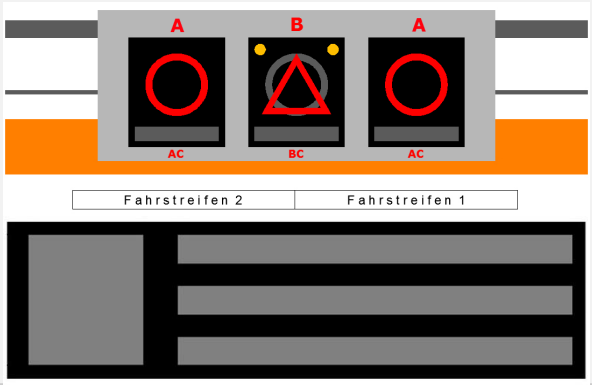
Legal Environment

- Legislation: Straßenverkehrsordnung (StVO)
  - Road signs in Austria are regulated by law in the “Straßenverkehrsordnung (StVO)”. The current edition of this law is published by the Legal Information System of the Republic of Austria via https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10011336.
- Guidelines and Regulations: RVS
  - › The RVS (“Richtlinien und Vorschriften für das Straßenwesen”) stipulates guidelines and regulations for sign posting and road signs on streets with public traffic in Austria. There a different guidelines / regulations for highway / inter-urban and rural / urban area
    - RVS 05.02.13 Beschilderung und Wegweisung auf Autobahnen
    - RVS 05.02.12 Beschilderung und Wegweisung im untergeordneten Straßennetz
- Vienna Convention
  - most European countries refer to the Vienna Convention on Road Signs and Signals (http://www.unece.org/fileadmin/DAM/trans/conventn/signalse.pdf)

In-Vehicle Signage

Existing Signage

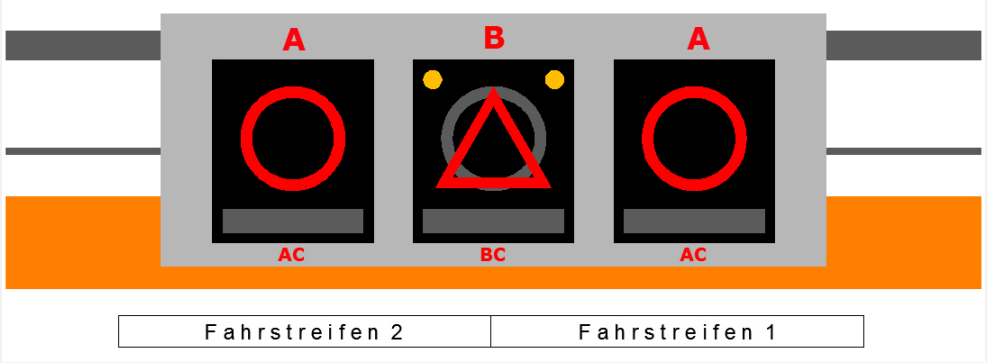
- The focus of ECo-AT on Day 1 will be on electronic and static signage in highway / inter-urban areas
- ASFINAG currently operates approx. 800 locations of dynamic signage with approximately 6000 display options.
  - Variable Message Signs (VMS)
  - Variable Text Panels (VTP)
  - Variable Direction Signs (VDS)
- Data about static signage is collected in a central database for static road signs

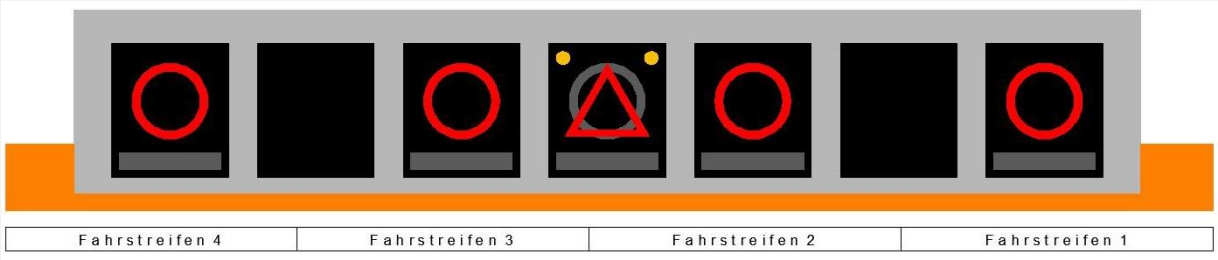


In-Vehicle Signage

Existing Signage II

- Variable Message Signs (VMS)
  - The cross-section signage mounted centrally overhead consists of centre-lane mounted VMS signs (A) with an additional information sign below (AC) and an intermediate VMS (B), also with an additional sign below (BC).





In-Vehicle Signage

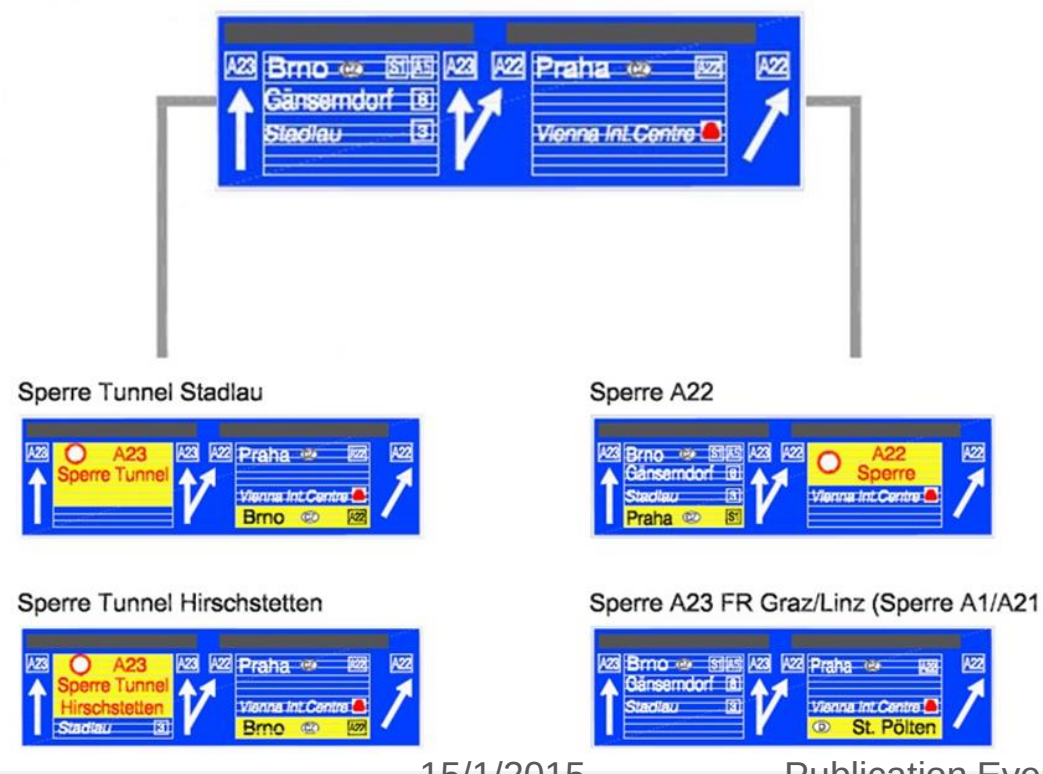
Existing Signage III

- Variable Text Panels (VTP)
  - › Variable Text Panels are changeable signs based on LED technology on which information about particular events can be presented for road users in the form of free text, accompanied by at least one pictogram.
  - › There are two forms of VTPs on the ASFINAG network
    - Variable Text Panel (Wechseltextanzeige - WTA)
      - WTAs consist of three lines of (free) text and one VMS to display a road sign or a pictogram
    - Fully graphical Variable Text Panel (Wechseltextanzeige - WTA-V)
      - WTA-Vs are freely programmable information panels with individually addressable pixels. Any form of text and/or pictures can be presented.

In-Vehicle Signage

Existing Signage IV

- Variable Direction Signs (VDS)
  - › Variable direction signs are signs that can display pre-defined scenarios on otherwise conventional road sign plates by rotation of three or four prism bars. The movement of the prism is controlled by a motor.



In-Vehicle Signage

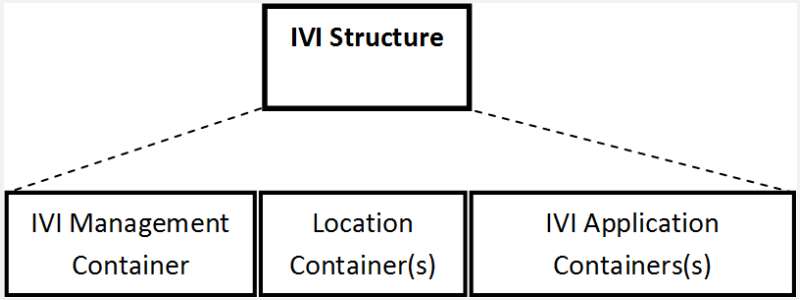
Standardization

- In-Vehicle Information (IVI) cannot be adequately conveyed with currently published C-ITS message standards like DENM.
- Although DENM has been used successfully as a temporary workaround for IVI in some demonstrations in the past, the operational roll-out of IVI requires a new standard
- ECo-AT has settled on ISO/TS 19321 – *Dictionary of in-vehicle information (IVI) data structures* because it provides all the required functionality and is available in the necessary timeframe.
- ISO/TS 17425 – *Data exchange specification for in-vehicle presentation of external road and traffic related data* would have been another option, but is further behind in its development and currently not stable enough for ECo-AT

In-Vehicle Signage

ISO/TS 19321

- ISO/TS 19321 defines the IVI Structure and provides a toolbox of information elements for IVI. Usage of these elements depends on the specific context and application of IVI for a specific service. It supports both mandatory and advisory road signage
- The IVI Structure is
  - intended to be profiled to fulfil the requirements of a specific service
  - is specified as a general, extensible data structure, split into several containers
  - is intended to be encapsulated in a message with the appropriate ITS Common Header, similar to a DENM message



In-Vehicle Signage

Sign Catalogue

- For the presentation of IVI / IVS, a corresponding common catalogue of road and information signs to refer to is needed
  - Otherwise each application and/or country would need its own national / proprietary catalogue
- ISO/TS 19321 refers to the sign catalogue established by “ISO/TS 14823 - *Graphic data dictionary for pre-trip and in-trip information dissemination systems*”
  - This standard presents a system of standardized codes for existing signs and pictograms used to deliver traffic and traveler information
  - The current version of the standard is mainly focused on static road signs and is missing signs relevant for dynamic signage (VMS).
  - ISO/TS 14832 is therefore insufficient for IVI / IVS at the moment, but is planned to be the definitive reference in the future. Additional signs from all countries will be added, as agreed by between the committees in charge of ISO/TS 19321 and ISO TS/14823

In-Vehicle Signage

ECo-AT Profile of ISO/TS 19321

- Release 1 of ECo-AT contains a profile of ISO/TS 19321 for the use as IVI / IVS Service in ECo-AT
- This includes specific “Mandatory / Optional / Absent” (M/O/A) requirements for all components

Component	Data Element	Nr	M/O/A[a]	Additional requirements
serviceProviderId	Provider	1	M	
iviIdentificationNumber	IviIdentificationNumber	1	M	
timestamp	TimestampIts	1	M	
validFrom	TimestampIts	1	O	Present if known by the service
validTo	TimestampIts	1	O	Present if known by the service
connectedIviStructures	IviIdentificationNumber	1..8	A	
iviStatus	IviStatus	1	M	

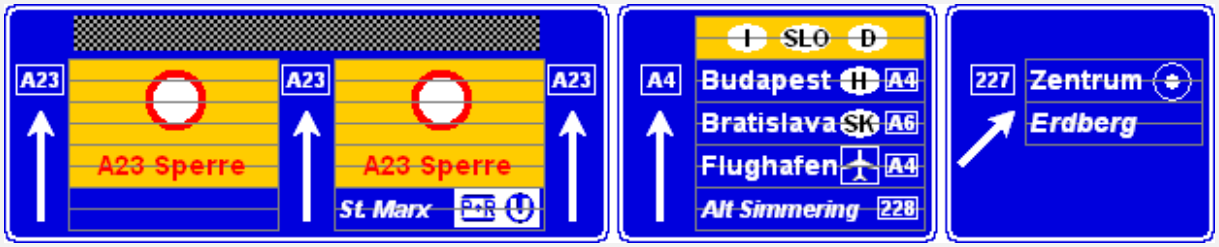
Component	Data Element	Nr	M/O/A[a]	Additional requirements
referencePosition	ReferencePosition	1	M	Position of the start of the Relevance Zone, measured at the transversal centre of the carriageway
referencePositionTime	TimestampIts	1	A	
referencePositionHeading	Heading	1	A	
referencePositionSpeed	Speed	1	A	

Component	Data Element	Nr	M/O/A[a]	Additional requirements
zoneId	Zid	1	M	Value 1 for Detection Zone, Value 2…n for Relevance Zone(s)
laneNumber	LanePosition	1	O	Mandatory if single lanes are described.
zoneExtension	INTEGER (0..255)	1	A	
zoneHeading	HeadingValue	1	A	
zone	Zone		M	
Zone	Segment	1	M	
line	PolygonalLine	1	M	
PolygonalLine	DeltaPosition	1..32	M	Measured at the transversal centre of the carriageway or of the lane
laneWidth	LaneWidth	1	O	Mandatory if single lanes are described.

In-Vehicle Signage

ISO/TS 19321 Coding Examples

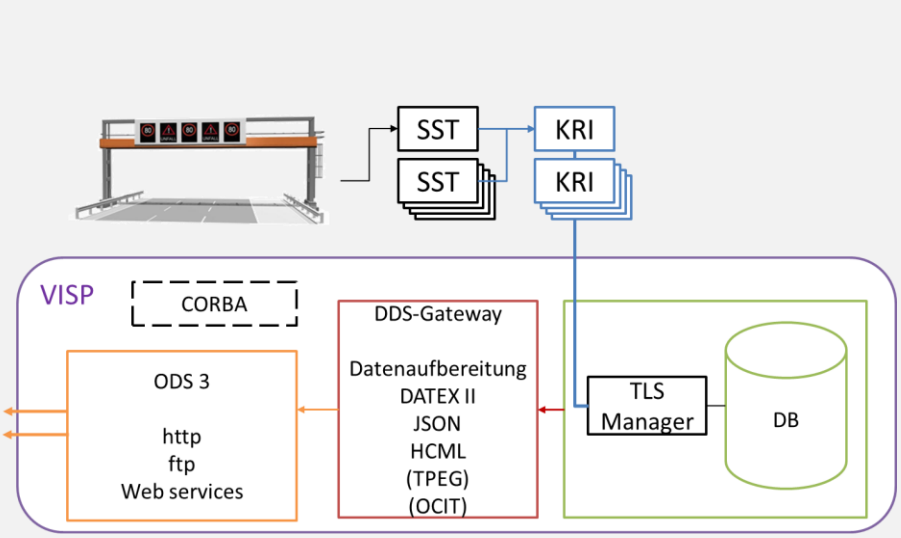
- Release 1 of ECo-AT also contains coding examples for all types of electronic signage on the ASFINAG network

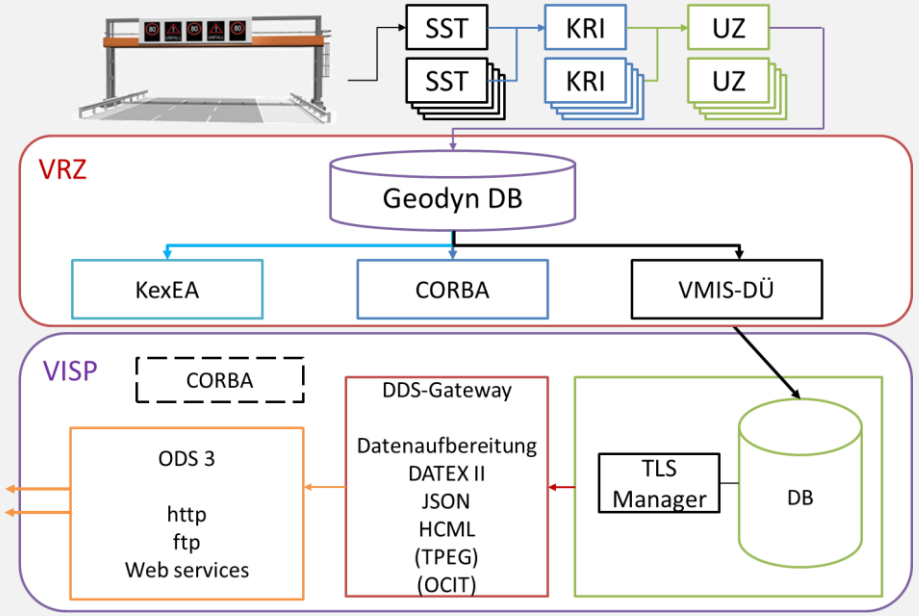


In-Vehicle Signage

Data Availability

- Real-time data for IVI / IVS is basically available from the electronic signage (via TLS), but there is no standard interface or format to provide it for time-critical, external applications like IVI / IVS
- Parameters like latency have to be checked and all existing interfaces have to be reviewed for suitability regarding use case. This will be part of the next releases





In-Vehicle Signage

Open Issues / Further Releases

- Data Availability / Source
- IVI Location
  - How IVI messages are geographically positioned and encoded, which kind of location reference system is used at the source, how to map all location information reasonably into the destination IVI message
- IVI Timing
  - relevant timing parameters for the IVI messages (in regard to creation, duration, update, cancellation …) and roles and responsibilities for these parameters
- Gather OEM support for IVI messages

Questions and Feedback

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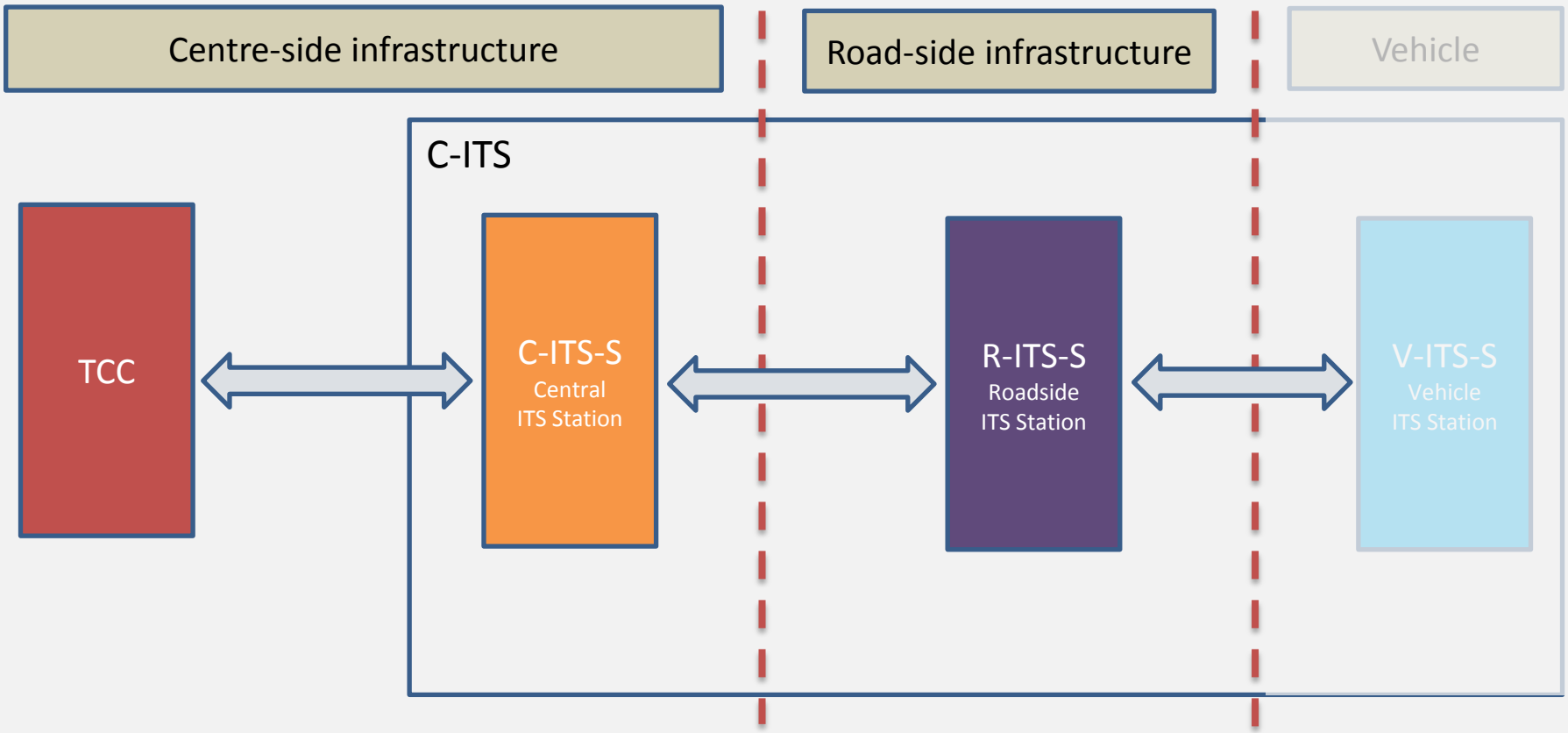
System Overview

Kaltwasser Josef

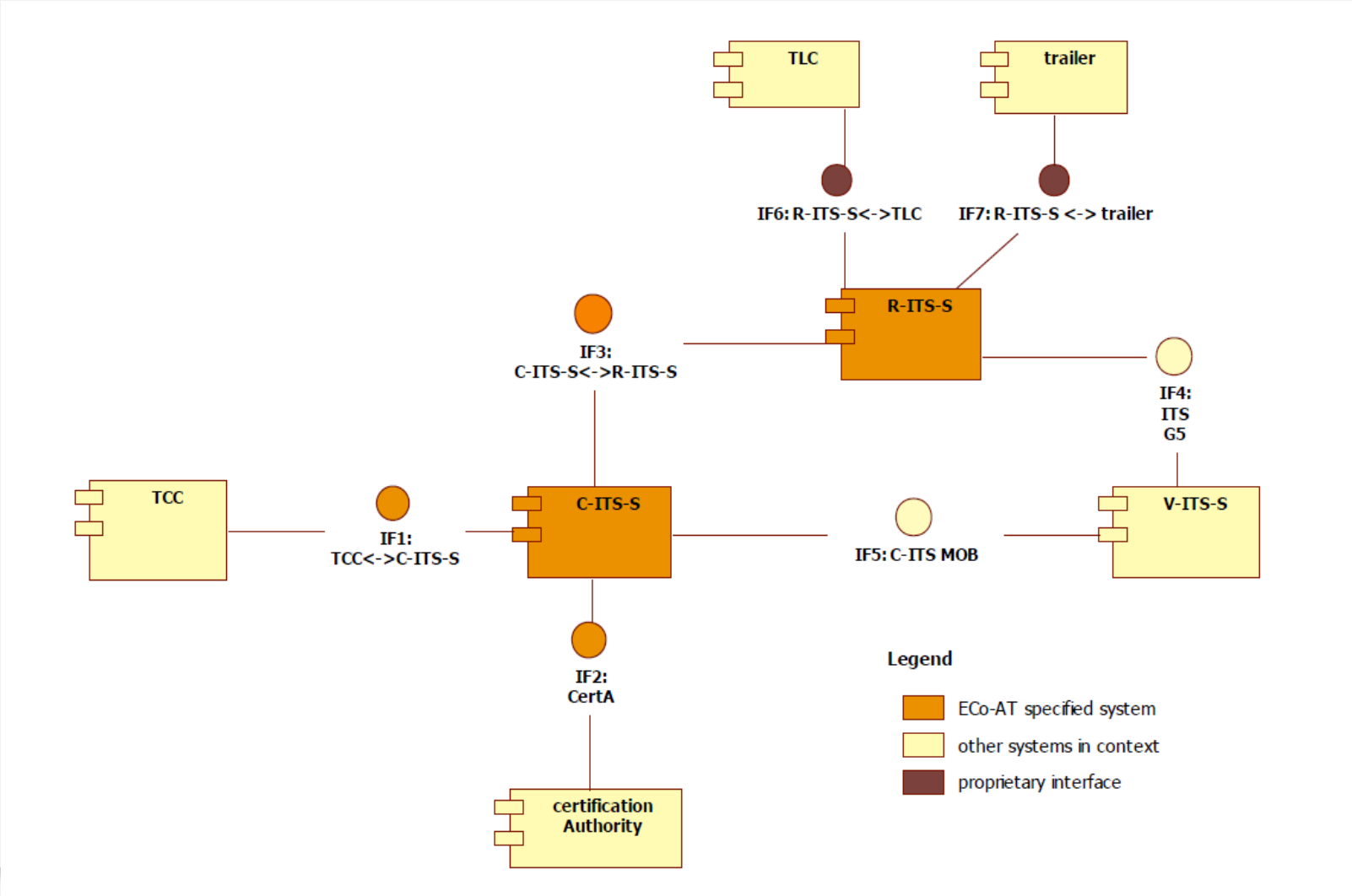
Document Reference:
"ECo-AT_SWP2.3_SystemOverview_v01.00.docx"

ASFINAG ITS Vienna Region VOLVO IPTE ftw Creating Communication Technologies
kapsch HiTec marketing SIEMENS swarco bast
powered by klima+ energie fonds

Overview System Architecture

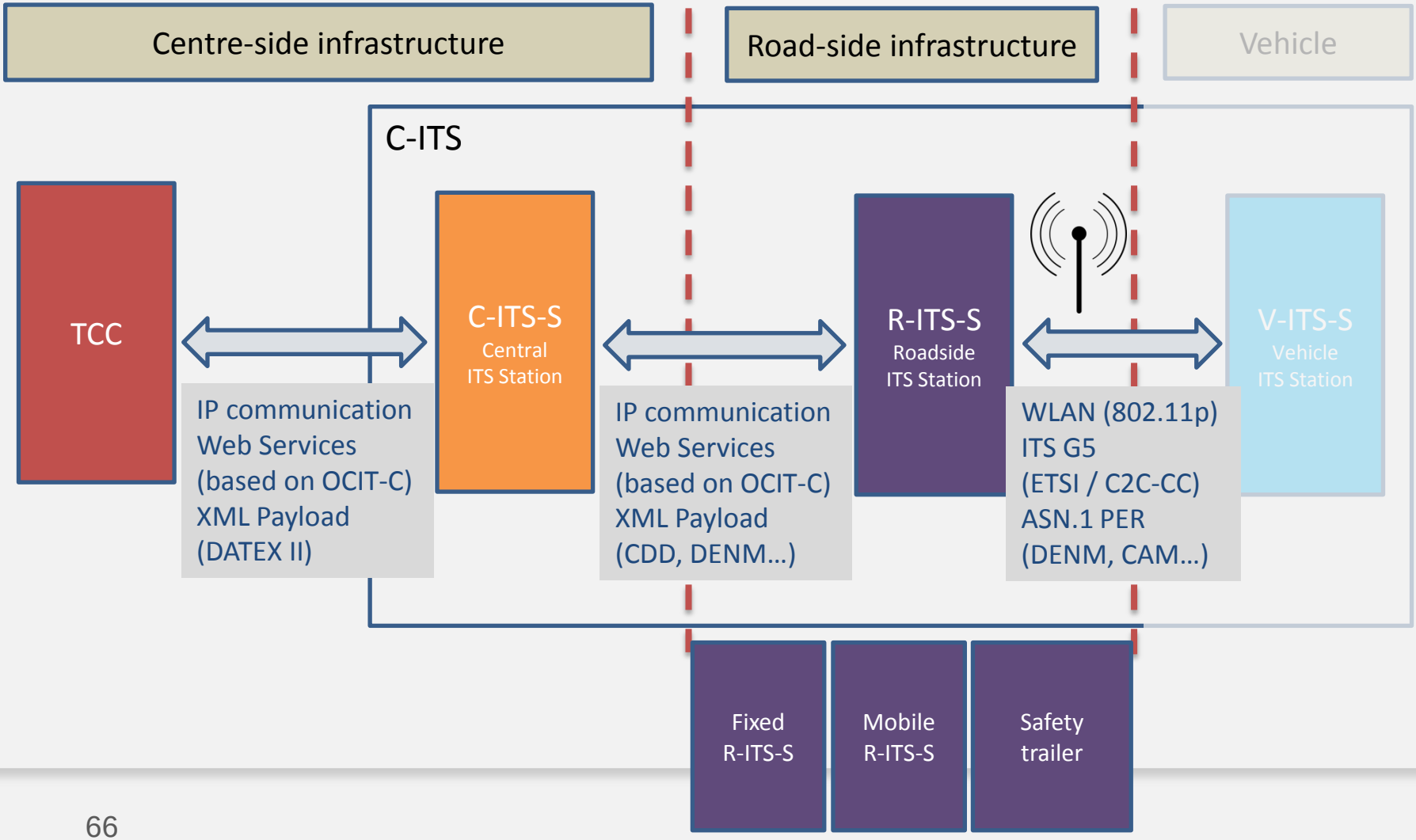


Overview System Architecture



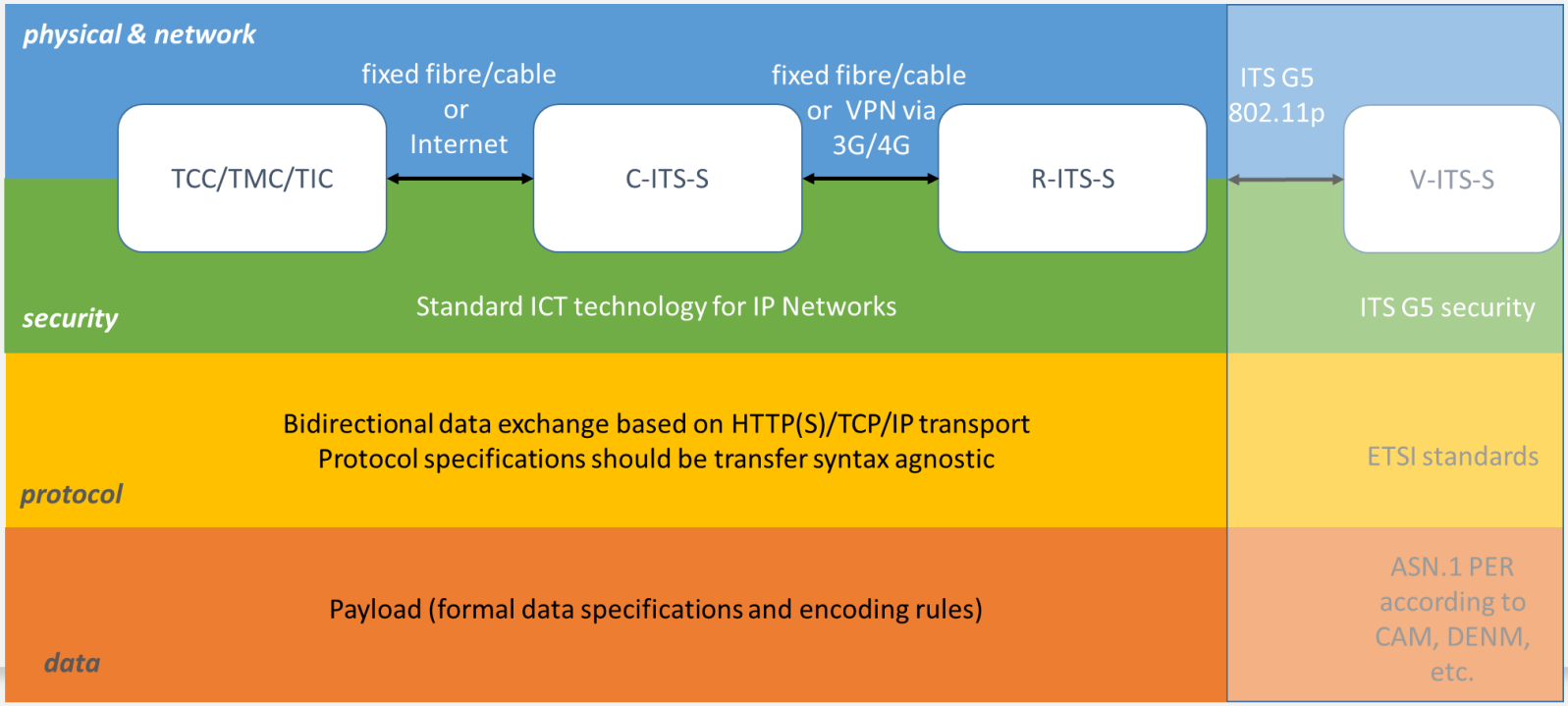
Overview System Architecture

ECo-AT



Communication model in ECo-AT

- Layered model along the line of OSI
- IP based communication using IP Security standards
- Interfaces specified as Web Services (SOAP over HTTP(S), Extensions for bidirectional communication („longPolling“), based on OCIT-C protocol spec.)
- Data coding in XML (based on DATEX II or ASN.1 specs. from ETSI, SAE…)
- Standardisation at CEN / ISO proposed



ECo-AT

Physical & Network Layer

- Use of standard ICT technologies, in particular IP networking (Note: IPv4 and IPv6)
- Bearer agnostic (only QoS dependent)
- Broadband / low latency required
- This basic analysis seems to be shared by the other C-ITS corridor partners

ECo-AT

Security Layer

- Security in IP Networks is standardised & proven and requires no ITS specific Extensions
- Standard ICT security mechanisms (incl. standard PKI) for IP connections (SSL, IPsec)
- Note: The connection TCC ↔ C-ITS-S ↔ R-ITS-S does not use the ITS G5 security systems (C-ITS PKI)
- To be considered: what is the best scope for a PKI? (maybe National, due to national regulations)

ECo-AT

Protocol Layer

- Various standard technologies & tools available for this layer from ICT
- But: No European ITS Standard for this Layer (incl. DATEX)
- Protocol shall be agnostic to payload content
- ECo-AT proposal: SOAP/WSDL und HTTP(S) based on OCIT-C protocol spec.
    - Functions: Application data, System Management, Notification
    - Extensions needed for bidirectional, asynchronous communication („longPolling“) – to be standardised at ISO/CEN
- Concerns have been expressed regarding SOAP in the discussion with C-ITS Corridor partners ⇒ new technology based on social media proposed: BOSH (Bidirectional-streams Over Synchronous HTTP)

Data Layer

Interface: TCC ↔ C-ITS-S

- CEN/TS 16157 (DATEX II) is a widely accepted standard in Europe, which contains many data concepts already and that allows backwards compatible extension with new data elements.
  - › DATEX II is the preferred standard for implementing the IST Directive and the subsequent delegated regulations of the European Commission
  - › Some Industry partners already use other data formats in their products (e.g. OCIT)
  - › Neither DATEX II nor these industry standards do currently include a comprehensive
    C-ITS data model that also covers the infrastructure requirements
    → Such a model has to be specified in the corridor project!
- Specification of payload in UML (using the DATEX II methodology) is also promoted by the
  C-ITS Corridor partners and would support the solution to be put forward for standardisation at CEN
- The option of client/server negotiations of alternative transfer syntax is considered in ECo-AT

Data Layer

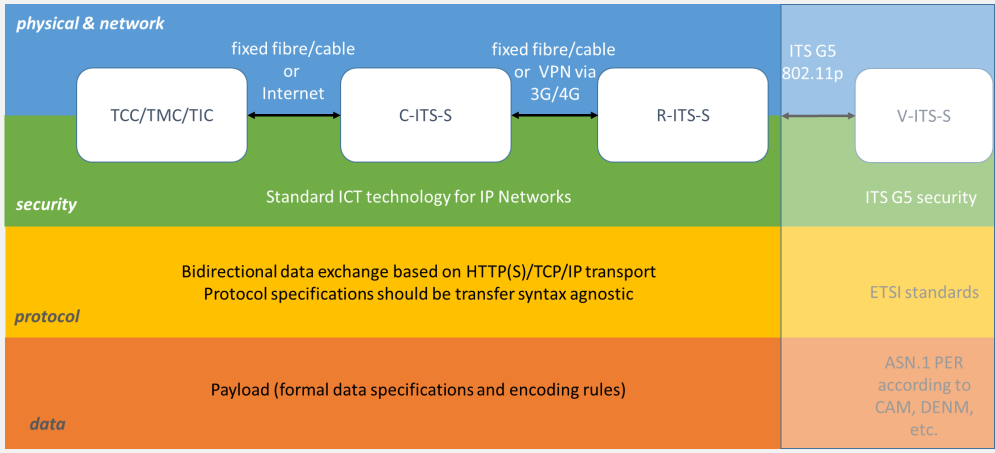
Interface: C-ITS-S ↔ R-ITS-S

- ECo-AT considerations:
  - › Data specifications should by based on /and re-use) the CDD (plus SAE, etc.) but need to be extended with infrastructure related data elements/frames
  - › Data specifications should be provided using ASN.1 (as for the C-ITS standards)
  - › An XML based transfer syntax is needed for Web Service / SOAP transmission – options to be considered:
    - XML Encoding Rules
    - direct mapping from ASN.1 to XSD
    - binary coding UPER (Base64)
- Further discussion with C-ITS Corridor partners required

System Architecture

Conclusion

- System architecture and communication model specify framework conditions and interfaces that allow a vendor mixed system environment
- ECo-AT strives to harmonise system architecture, communication protocols and interfaces – as much as possible – with the corridor partners and on European level
- While there is in general much consensus, the corridor partners have expressed some different points of view and requirements for some aspects of the system architecture and interfaces – common working groups are trying to harmonise these aspects
- System architecture and interfaces will be fully specified and published as part of the ECo-AT system specification releases



Further content of the System Overeview document

- Message Management
  → initial concept of where and how to create the C-ITS messages
- Security
  → initial considerations, as far as possible; still waiting for pending clarifications regarding security and privacy aspects
- Appendix: use of DENM parameters in ECo-AT
  → Clarification regarding the use of specific DENM parameters inside the different Eco-AT Use Cases and scenarios

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ECo-AT

Intersection Safety

Meckel Peter

Document Reference:
“ECo-AT_SWP2.1_IntersectionSafety_v01.00.docx”

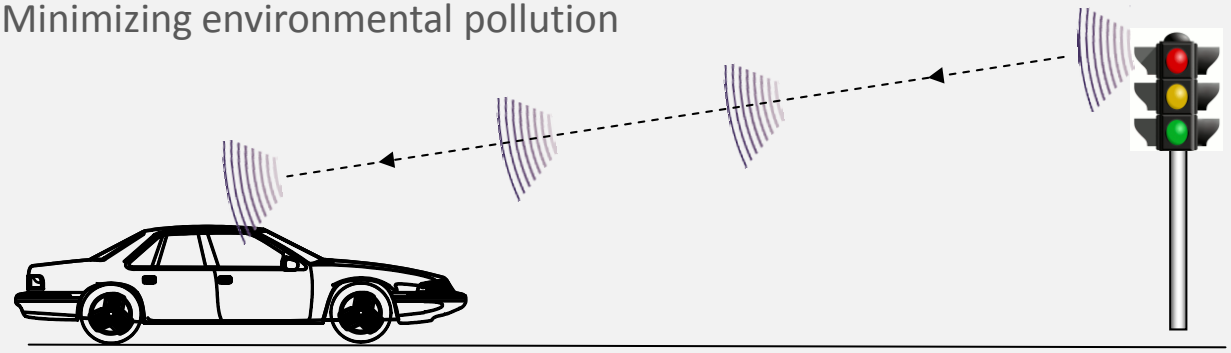
Intersection Safety ISS

Motivation for Cooperative Systems within intersection

The Intersection safety use cases are good examples of Day One Infrastructure-to-Vehicle (I2V) use cases, because equipped vehicles have immediate benefit from day 1 on, independent of the rate of Cooperative-ITS (C-ITS) equipped vehicles.

The use cases are defined as an extension to existing traffic light controlled intersections, with the following focus:

- Optimization of traffic flow
- Increasing traffic safety
- Minimizing environmental pollution



Intersection Safety ISS

Use Case Overview

ECo-AT will introduce the following basic intersection safety uses cases for day one dissemination:

- UC1 - Vehicle Speed optimization approaching an intersection based on signal status.
- UC2 - Fast clearing of intersection due to traffic light signal change
- UC3 - Red light violation

These use cases are good examples for the usage of Day One SPAT/MAP protocols broadcasted in an intersection environment. Additional use cases like "V2X based Start-Stop" are out of scope and in the responsibility of car manufacturers.

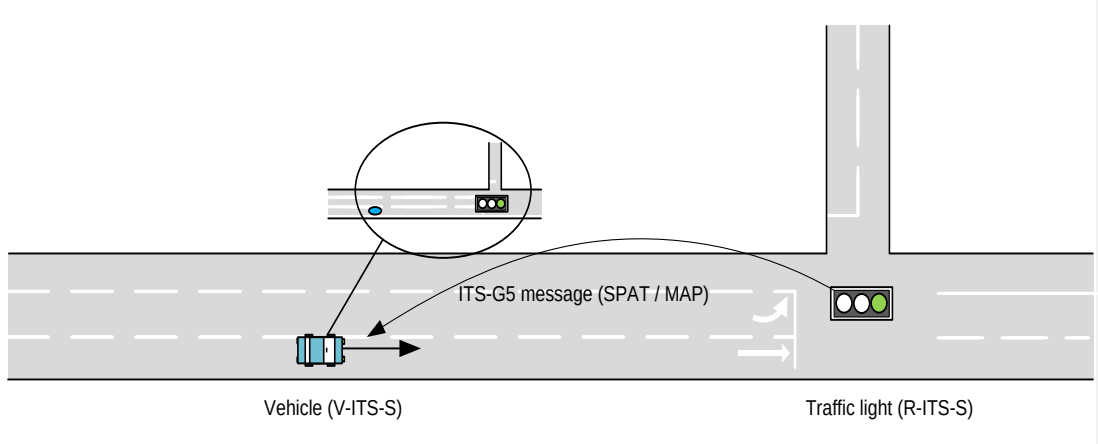
Intersection Safety ISS

UC1 Vehicle Speed optimization

Vehicles approaching a traffic light will inform the driver in advance about the traffic signal status for crossing the conflict area of an intersection.

The vehicle (V-ITS-S), based on the SPAT/MAP information received from the infrastructure (R-ITS-S) may advice an optimal speed to the driver for smoothly approaching the intersection (in case of red) or for passing safely the conflict area of the intersection.

The SPAT / MAP information broadcasted from the R-ITS-S reflects the real-time signal phase & timing status for each lane. Therefore a vehicle may be able to predict the optimal speed advice on each lane.



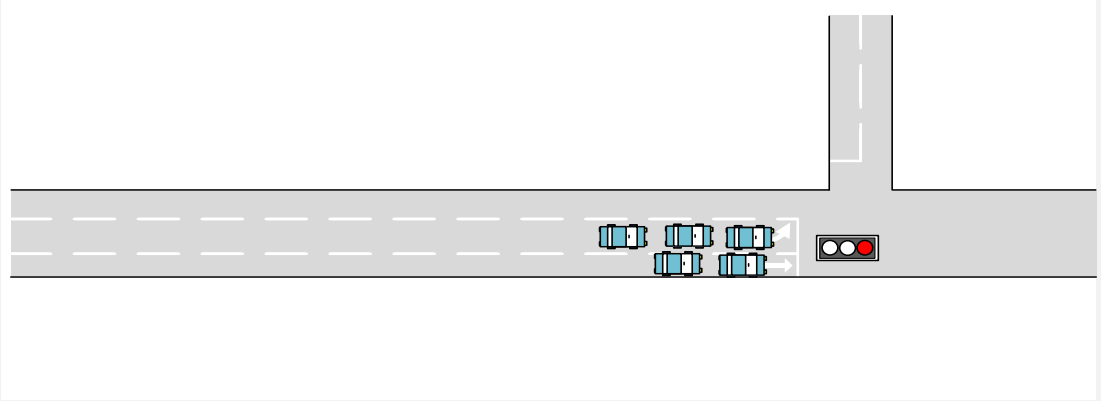
Intersection Safety ISS

UC2 Fast clearing of intersection

Vehicles waiting because of a “red” traffic light will inform the driver about the traffic light status in travelling direction.

If the traffic light is attempting to change to green within the next five seconds, the driver will be informed to prepare for efficient crossing/clearing the intersection.

This will allow a fast preemption, optimizing the vehicle throughput for a signal cycle and reducing potential traffic queues.



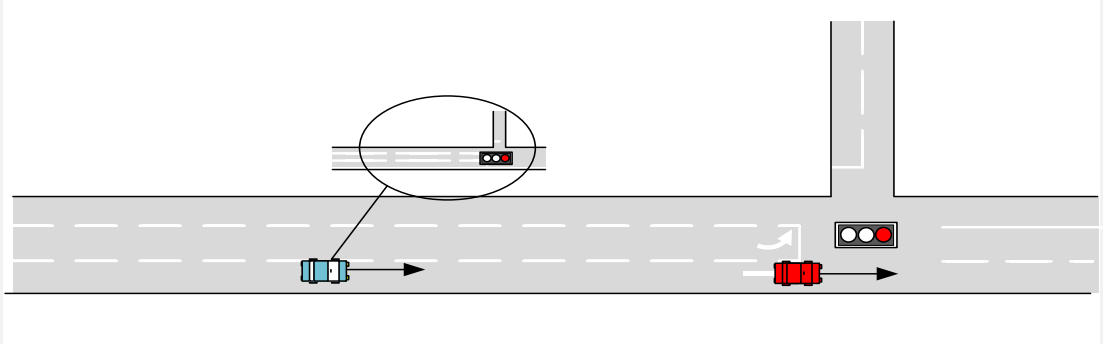
Intersection Safety ISS

UC3 Red light violation

Vehicles approaching a traffic light will inform the driver in advance about the traffic signal status for crossing the conflict area of an intersection.

As described in use case UC1 the vehicle / driver is aware of traffic light signal status and changes in real-time.

If the driver is distracted he/she may not recognize a pending change from green to red. Due to the SPAT / MAP information broadcasted from the infrastructure (R-ITS-S), the vehicle is able to detect a potential red light violation and alert the driver.



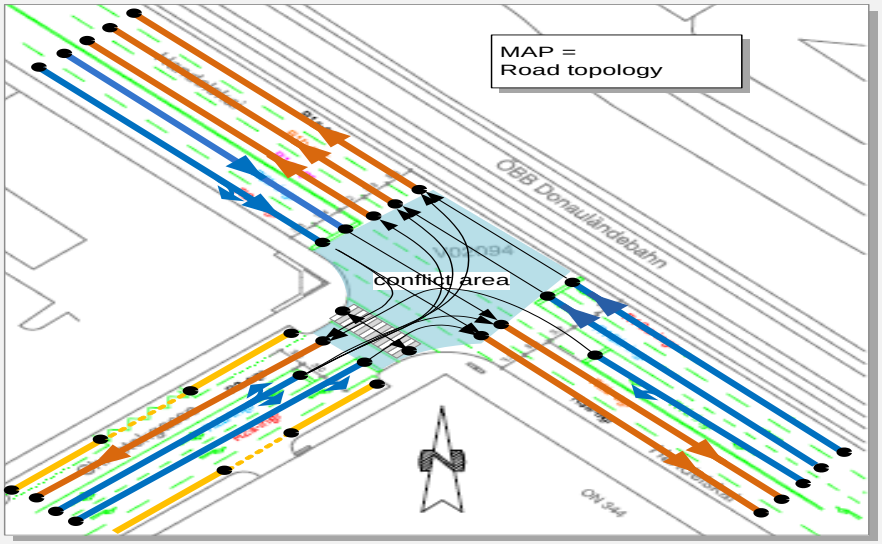
Intersection Safety ISS

ISS Protocols: intersection Topology (MAP)

The MAP message defines the topology of an infrastructure area. It includes

- all the roads for vehicles, public transportation and the paths for pedestrian crossings.
- The topology for an intersection and the topology for a road segment
- (in future enhancements) additional topology-descriptions like roundabouts intersections.

The area of an intersection described in the MAP is suggested to cover about 200 m of the approaches, starting from the position of the stop line.

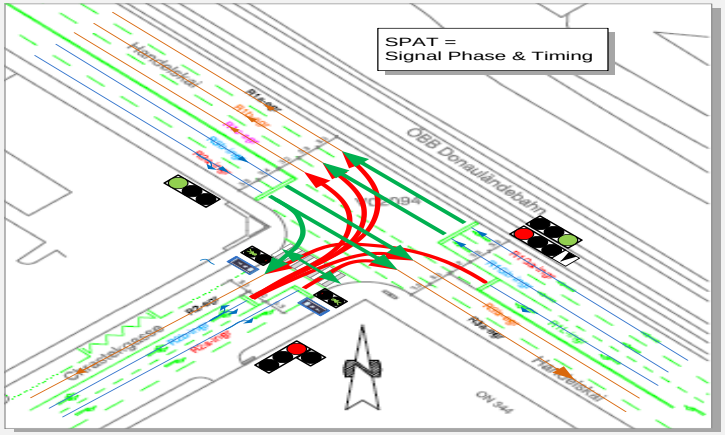


Intersection Safety ISS

ISS Protocols: Signal Phase & Timing (SPAT)

The SPAT message provides the status of the signals in an intersection. The status information includes

- general operational states of the traffic light controller
- the current signal state
- the residual time of the state before changing in to the next state
- the right of way for each allowed maneuver (connection between lanes)
- assistance for crossing the conflict area
- (may also include) detailed green way advisory information and the status for public transport prioritization.



Intersection Safety ISS

Current Status and Open Issues

- Current Status of the Release 1 Draft Document on the „Intersection Safety“ Use Case
    - Three SPAT / MAP based use cases
    - SPAT / MAP Message overview and transmission parameters
    - Description of data elements
        - MAP: MapData / IntersectionGeometry / Generic Lane
        - SPAT: SPAT / IntersectionState / MovementState / Movemen

- Open Issues
    - Rather stable situation / use cases in Release 1
    - Further Enhancements of the Standards / Use Cases
        - Green Wave / GLOSA
        - Emergency Priorization
        - Public Transport

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ECo-AT

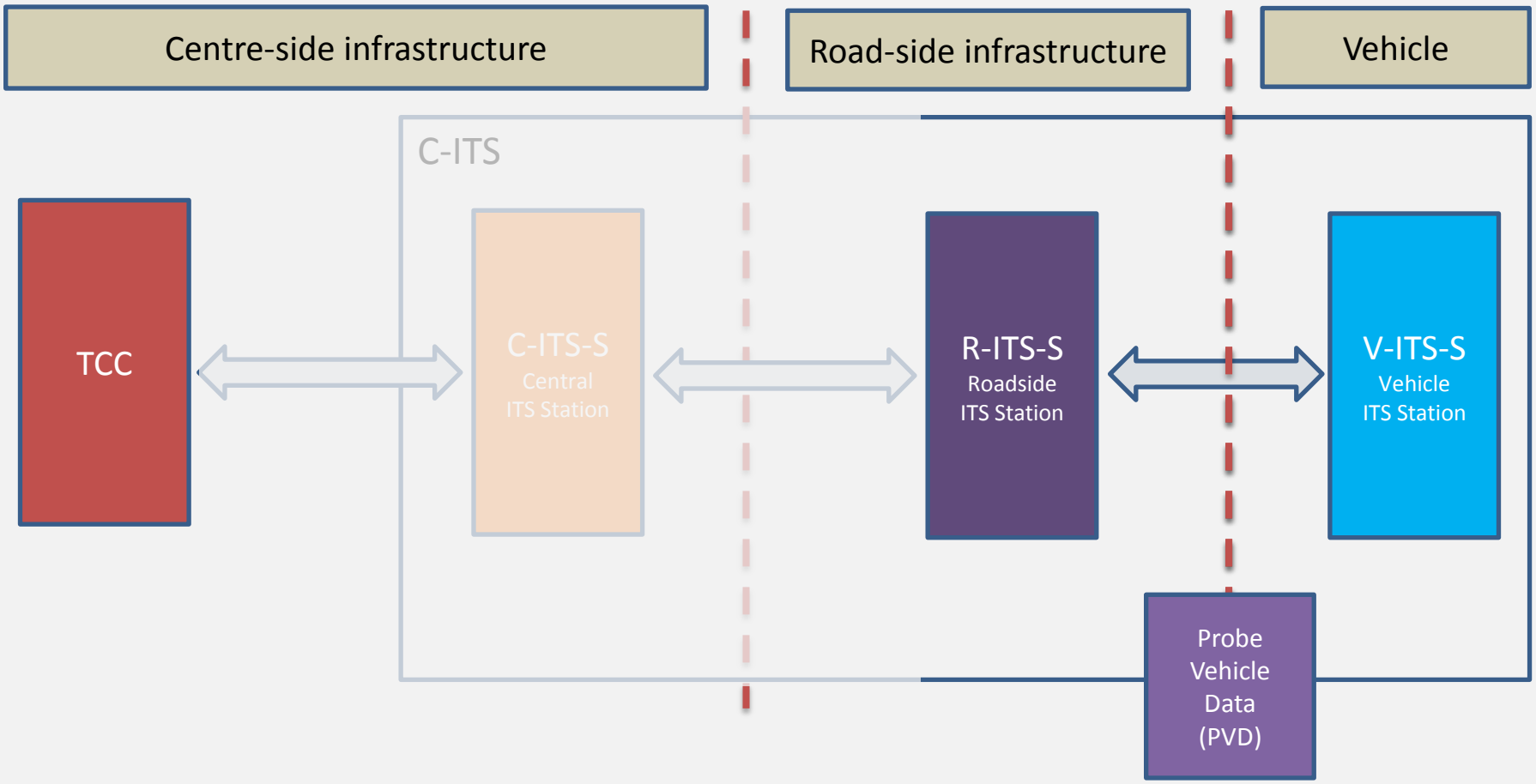
CAM Aggregation

Kaltwasser Josef

Document Reference:
“ECo-AT_SWP2.1_CAM_Aggregation_v01.00.docx”

ASFINAG ITS Vienna Region VOLVO IPTE ftw Creating Communication Technologies
kapsch HiTec marketing SIEMENS swarco bast
powered by klima+ energie fonds

Use Case Probe Vehicle Data – PVD



Probe Vehicle Data - PVD

- Day 1
  - Due to various (technical and non-technical) reasons, the envisaged full probe vehicle data transmission by vehicles will not be possible on Day 1.
  - To make a start, average vehicle speed values will be calculated by R-ITS-S from CAM reception for detection zones inside the radio range of the R-ITS-S and will be transmitted in a TLS-like format to the TCC ⇒ “CAM aggregation”
- Day 2 (Objective)
  - Minimum: CAM aggregation across multiple R-ITS-S
  - Expected: ‘Real’ PVD transmission by vehicles using a dedicated message (not CAM / DENM) and controlled via Probe Data Management (PDM)

NOTE: this use case addresses only the reception of CAM messages from vehicles – the reception and processing of DENM messages will be specified in the “DENM Applications” use case (in Release 2)

CAM aggregation – release planning

- Release 1: CAM aggregation similar to TLS – first draft
  - Which data from TLS can be supported by CAM aggregation?
  - Proposal for a general CAM aggregation concept
- Release 2: final CAM aggregation document
  - Final use case (UC) description following the requirements from road operators for traffic data
  - Possibly going beyond general TLS data
  - Mobile R-ITS-S (standalone case, without connection to the C-ITS-S)
- Day2 (not part of ECo-AT): data aggregation from PVD

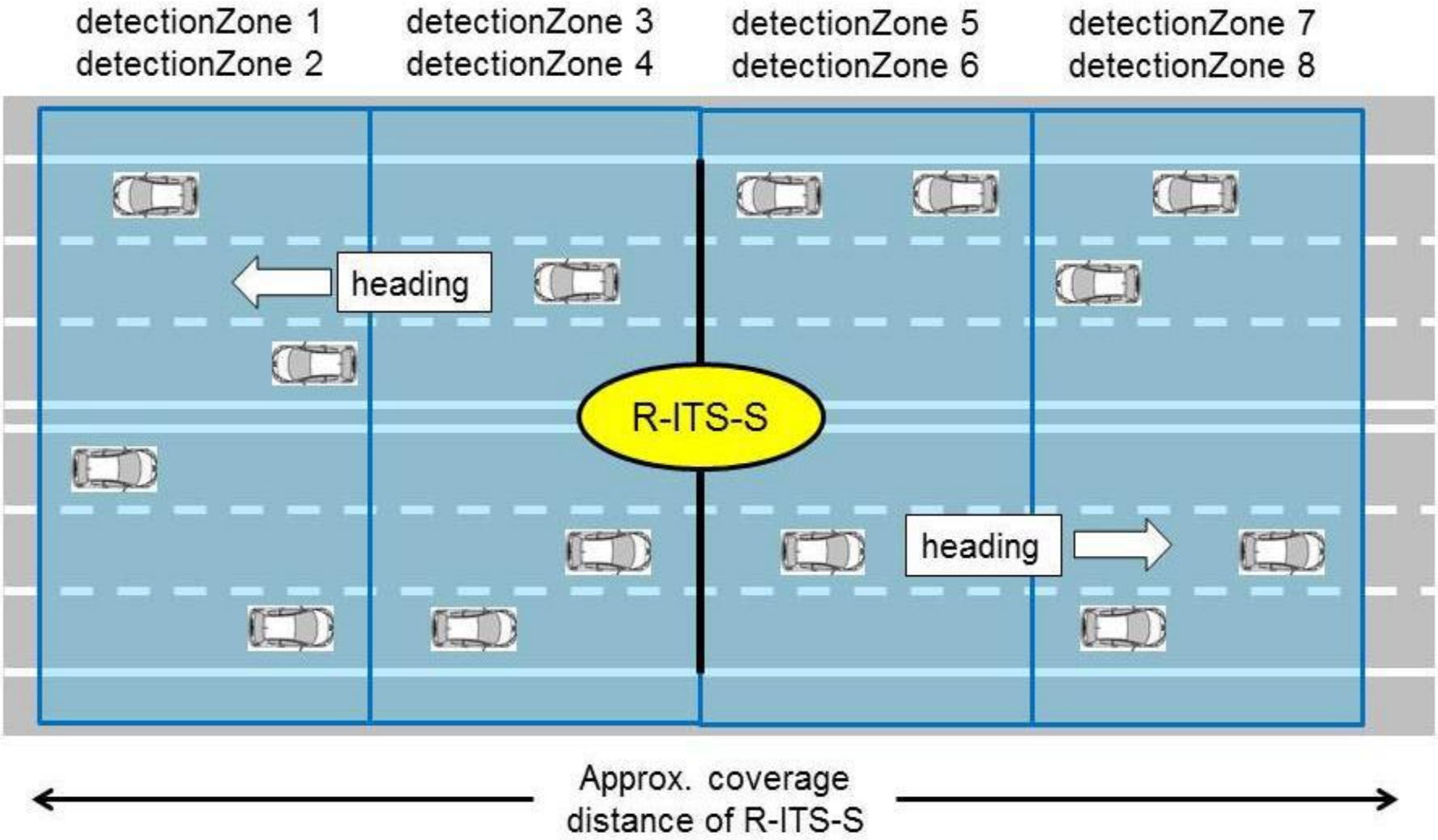
Considerations for CAM Aggregation

- Traffic data shall be estimated from CAMs received by an R-ITS-S (inside the radio coverage area of the R-ITS-S)
- Stationary R-ITS-S
  - The parameters (road topology, aggregation areas, heading, blocking of roads adjacent/parallel to highway, …) shall be configured manually at the centre
- Mobile R-ITS-S (with connection to the central ITS station (C-ITS-S))
  - The parameters (road topology, aggregation areas, heading, blocking of roads adjacent/parallel to highway, …) shall be configured in the centre. Compared to the stationary R-ITS-S these are more dynamic.
- Mobile R-ITS-S (standalone case, without connection to the C-ITS-S)
  - The R-ITS-S has to set the parameters by itself (→ self-configuration mode. The R-ITS-S has to “learn” the road topology)

Comparison TLS vs. CAM

- General difference
  - TLS data is gathered on a by-lane basis, for all vehicles
  - CAM data is gathered on a by-detection zone basis, only for ITS-G5-equipped vehicles
- Different vehicle classification schemes (based on ***stationType*** DE in CAM)
- Different values possible (gap & occupancy not for C-ITS)
- Volume values related only to ITS G5 equipped vehicles

Detection Zones



CAM Speed Aggregation

- Configurable speedCollectionInterval
- Mandatory data from V-ITS-S
  - a ***StationType*** in (4..10)
  - a distinct ***StationID*** for this ***speedCollectionInterval***
  - a heading that matches the azimuth of the ***speedDetectionZone***, +/- 2.5 degrees
  - a ***referencePosition*** that is within the ***speedDetectionZone***, if the speed detection zone is defined as a rectangle
- Data to C-ITS-S
  - the timestamp of the end of the ***CollectionInterval***
  - the setting of the ***CollectionInterval***
  - per detection zone:
    - the detection zone ID
    - per ***stationType*** (or groups of ***stationTypes***):
      - average speed
      - traffic volume (number of vehicles)
      - standard deviation of speed

Questions and Feedback

- Open discussion and Questions
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DENM Applications

Meckel Peter

Document Reference:
“ECo-AT_SWP2.1_DENM_Applications_v01.00.docx”

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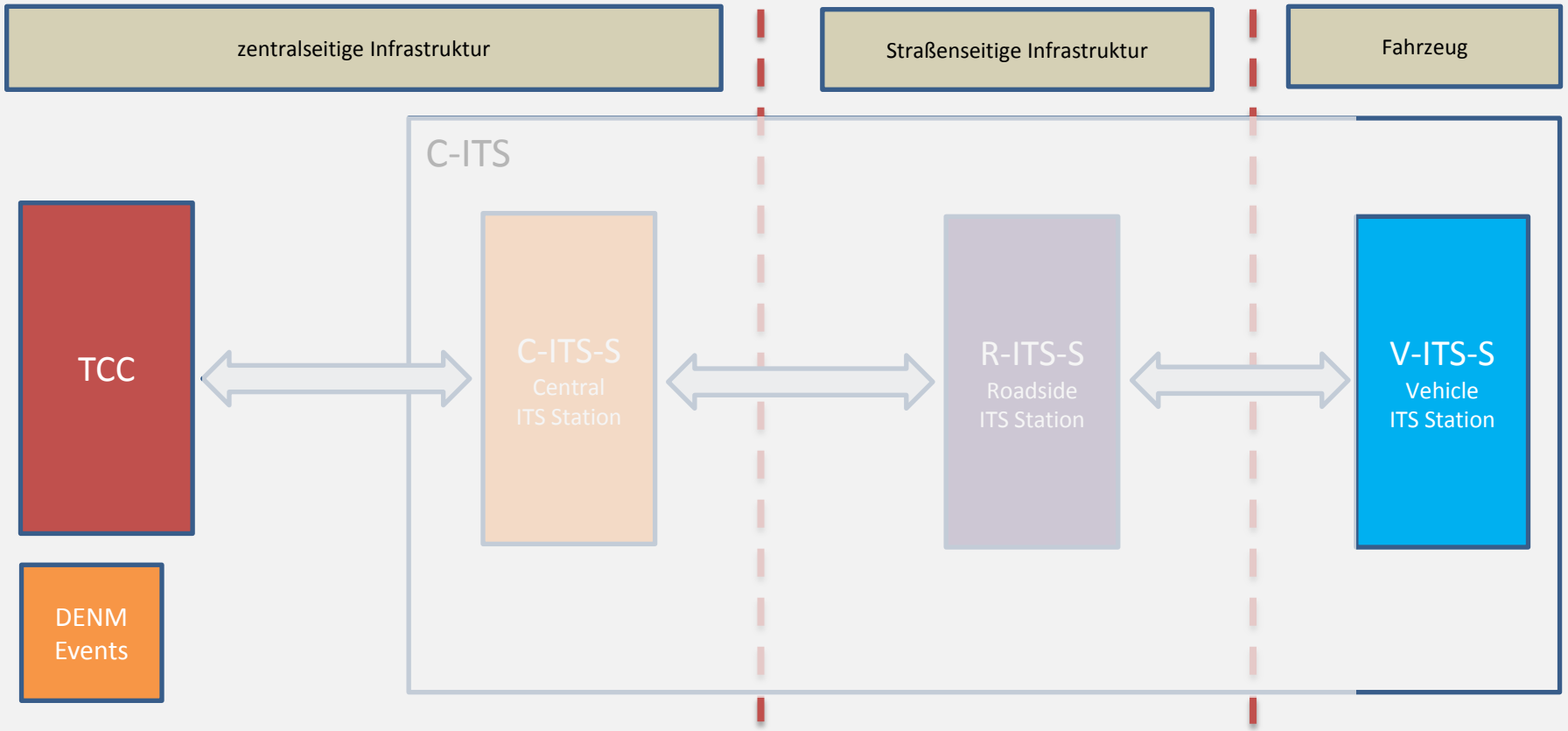
Use Case
Other DENM Applications / Events



DENM Events

Scope

- Release 1 of ECo-AT contains an early Draft Document on the Use Case “Other DENM Applications / Hazardous Location Warnings / Events”
  - The document gives an overview on how to create other DENM applications in ECo-AT – beside the RWW application – by using currently available infrastructure based content
  - It focuses on Hazardous Location Warnings / Events and describes, how relevant traffic events, which are available at ASFINAGs TCC, can be mapped into adequate DEN messages. The overall emphasis will be on TCC initiated events only
  - These messages could also be a way to comply with the demands of the ITS Directive (2010/40/EU) to provide safety related messages free of charge to users

DENM Events

Road Operator‘s Perspective

- ASFINAG operates and maintains the entire Austrian motorway and expressway network comprising 2.183km of roads.
- Roadside events on this network can be detected by
  - a sensor based traffic data collection and classification system implemented on most motorways
  - an efficient traffic management system which uses sensors and measuring instruments along the route, responding to sudden events and regulating the flow of traffic via display gantries
  - a digital multicast video system, providing live streams from approximately 5900 cameras on the whole network
- This data – augmented with data from other traffic service providers – is the basis for the RDS-TMC broadcasting service in Austria
- **C-ITS and the DENM message provide a further communication channel to directly alert road users about ongoing events**

DENM Events

Event Management System

ASFINAG is currently deploying an internal Event Management System which initially covers the following events for Release 1:

id	Event description (ASF-EMS)	Event description (CEN english [ALERT-C])	Alert-C code
1	Höhenkontrolle	overheight warning system triggered	11
2	Tunnelsperre	tunnel closed	25
3	Verkehrsüberlastung	stationary traffic	101
4	Unfall	accident	201
5	Ladegutverlust	shed load	210
6	Panne	broken down vehicle	211
7	Totalsperre	closed	401
8	Erhaltungsmaßnahme	maintenance work	703
9	Brand	closed due serious fire	965
10	gefährliche Fahrbahnverhältnisse	hazardous driving conditions	1001
11	Geisterfahrer	vehicle on wrong carriageway	1701
12	Sondertransport	abnormal load	1751

Impo nd subject to frequent change. The data presented is therefore an example based on the available data while preparing Release 1. It will be updated to a much larger, stable categorization in a later releases.

DENM Events

Mapping to ETSI BSA

These events can be mapped to the applications defined in ETSI's Basic Set of Applications

- application class "Active road safety"
- the application "Driving assistance – Road Hazard Warning RHW"

UseCases from [ETSI-BSA] clause 4.1	ASF-EMS events
UC006 Wrong way driving warning	vehicle on wrong carriageway
UC008 Stationary vehicle - vehicle problem	broken down vehicle
UC009 Traffic condition warning	stationary traffic
	closed
	tunnel closed
	accident
	shed load
	hazardous driving conditions
	abnormal load
	overheight warning system triggered
	closed due serious fire
~~UC011 Roadwork warning~~	~~maintenance work~~

DENM Events

ITS Directive

DENM based events could also be seen as C-ITS's way to comply with Priority action "c" of the ITS Directive (2010/40/EU)

- Priority action "c" prompts operators to provide a minimum set of safety related messages free of charge to users
- DENM based events would provide the necessary road safety-related information content and also satisfy further requirements

DENM Events

Event Mapping

- In order to use TCC based event information for sending out infrastructure based DENMs, there is a need for an event code-mapping from ALERT-C to DENM and the ETSI CDD
- Starting with the ALERT-C code, a corresponding equivalent has to be found in the in DENM and ETSI CDD, in context with TPEG-TEC
- Process and Principles
  1. Take ALERT-C code and find matching cause code according to DENM specification
  2. Determine sub cause code according to DENM specification and / or (if possible) according to TPEG-TEC specification
  3. If the description of the event is not sufficiently specific to allocate a proper sub-cause code, the mapping is done to the cause code with the sub-cause code “unavailable”
  4. If there is no correspondent cause found, no matching is done

DENM Events

Event Mapping II

The result of this mapping is the following table:

ASF-EMS		DENM Codes					
Event description (ALERT-C)	**Alert-C Code**	**Cause Code**	**Description**	**mapping with TPEG-TEC**	**Sub Cause Code**	**Description**	**comment**
vehicle on wrong carriageway	1701	14	Wrong way driving	Specified as vehicle on wrong carriageway in tec002 of clause 9.2 in TISA TAWG11071 [i.10]	2	vehicle in wrong direction	In case that cars are driving against the one way direction of the carriage way, also known as ghost-driver. (i.e. not parked)
broken down vehicle	211	91	Vehicle breakdown	Values are assigned referring to ETSI TS 101 539-1 [i.4], clause 5.3.3	0	unavailable	the reason is still not relevant
stationary traffic	101	1	Traffic condition	Specified as traffic congestion in tec002 of clause 9.2 in TISA TAWG11071 [i.10]	5	stationary traffic	
					6	queuing traffic	could be also possible
accident	201	2	Accident	Specified as accidents in tec002 of clause 9.2 in TISA TAWG11071 [i.10]	0	unavailable	
					1	traffic congestion	In case that the capacity limitation of the street is causing the message.
shed load	210	10	Hazardous location - Obstacle on the road	Specified as objects on the road in tec002 of clause 9.2 in TISA TAWG11071 [i.10]	1	shed load	In case that the objects are parts of the load of a lorry.
hazardous driving conditions	1001	9	Hazardous location - Surface condition	Specified as hazardous driving conditions in tec002 of clause 9.2 in TISA TAWG11071 [i.10]	0	unavailable	the reason is still not relevant

DENM Events

Open Issues / Further Releases

- Finalize Event Categorization for ASFINAG Event Management System
- Update Event Mapping
- Event Location
  - How events are geographically positioned and encoded, which kind of location reference system is used at the source, how to map all location information reasonably into the destination DENM
- Event Timing
  - relevant timing parameters for the DENM based events (in regard to creation, duration, update, cancellation …) and roles and responsibilities for these parameters.
- Gather OEM support for infrastructure based DENMs
- Processing of DENMs from Vehicles

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Next Steps

Jandrisits Marko

Next Steps

Please use the Feedback form to give further feedback

Next releases

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