EasyWay

DATEX II & Cooperatives systems

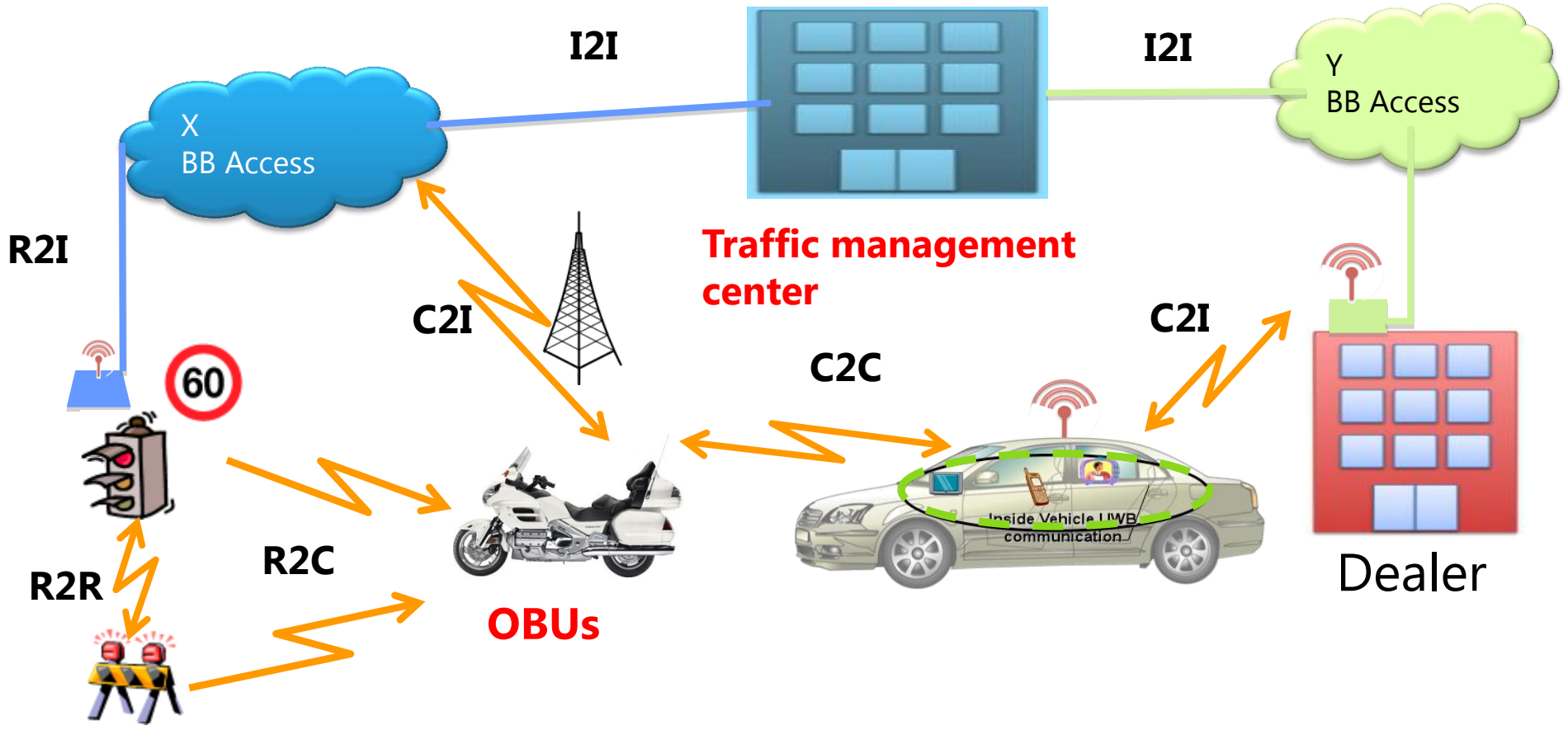
Lan Lin

Hitachi Europe SAS

ETSI TC ITS WG1 Co-chair

Table of content

Cooperative system: high level picture



(X-to-X communications)

: Wireless link (WAVE, 3G, Wi-Fi, WiMax ...)

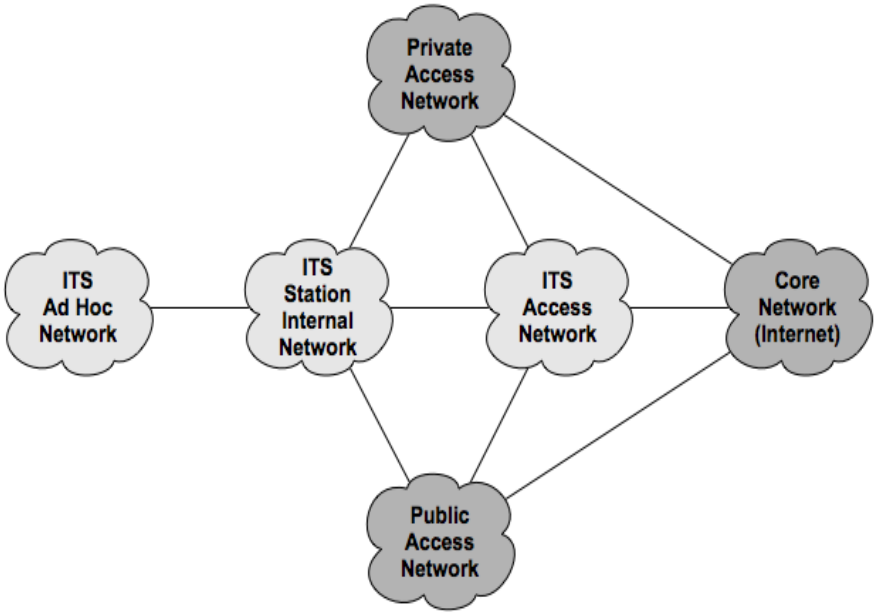
: Wireless LAN (UWB, Wi-Fi, ZigBee ...)

C2V, C2R-R2C, R2R, C2I-I2C and I2I:
C for Car (vehicle), R for Roadside, I for Infrastructure

ITS (Intelligent Transport Systems) communication

- **Radio spectrum 5,795 – 5,825 (30MHz) GHz has been allocated by EC for safety and traffic efficiency applications.**
  - Vehicles and road side units can form an ad hoc wireless network for direct communications (IEEE 802.11p)
  - Dissemination of application data based on geographic positions
- **ITS cooperative systems covers the usage of other communication technologies/networks for different ITS applications.**
  - Access networks and other infrastructure supporting networks will enable the communication of road users with infrastructure
  - IPv6 based networking and data dissemination

Source: ETSI



ITS network architecture overview

Hitachi Prototypes

RENESAS

❖Hitachi V2X Platform has been integrated into Renesas communication unit prototypes (WAVE-Box v1/v2)

RSU

- Hitachi V2X Platform
- Waterproof/Lightning-protection
- Communication Unit from Renesas
- Communication Interfaces:
  - ❖11p radio
  - ❖UMTS
  - ❖Ethernet
  - ❖RS-232

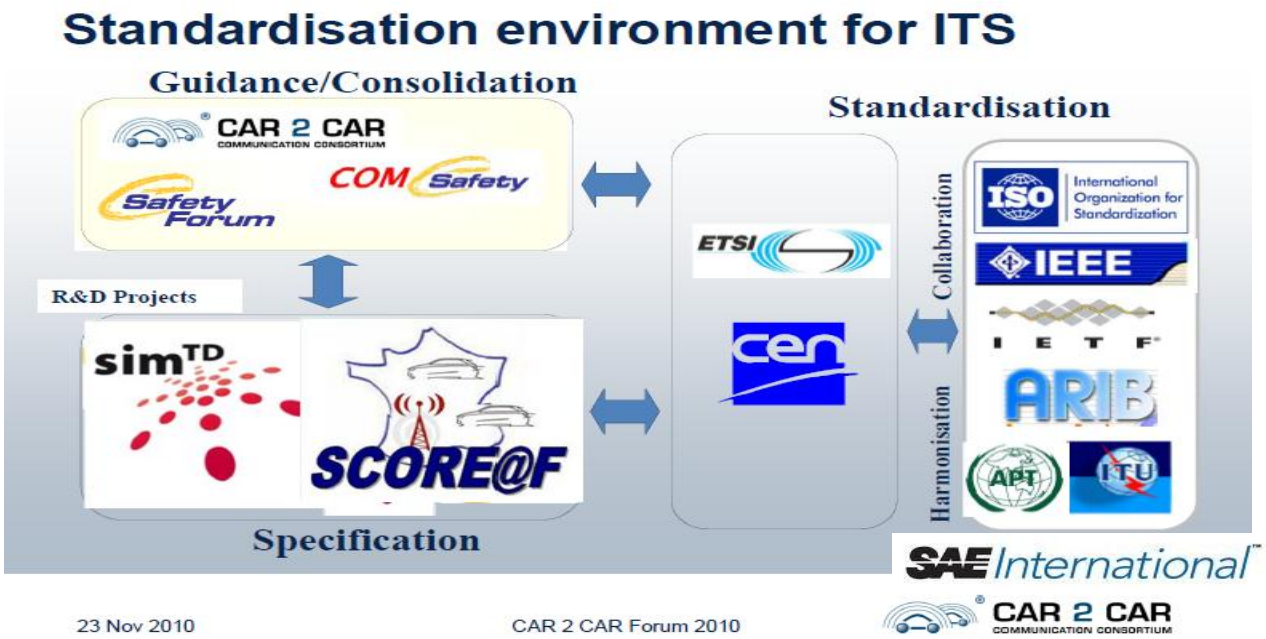
HITACHI
Inspire the Next

OBU

EU mandate 453

- **European Commission delivered a Standard Mandate (Mandate 453)**
  - To develop standards for Cooperative systems that enable ***interoperability*** and deployment of the system
  - Within a time frame of 30 months (Jan 2010- June 2012)
  - In line with EU ITS action plan and ITS directive for ITS deployment in pan European countries
  - ETSI and CEN accepted the mandate and established specific Technical committees (ETSI TC ITS, CEN TC278 WG16)
- **ETSI and CEN delivered a first joint response in March 2010 to**
  - Identify the list of ***minimum set of standards***
  - Define a general work program to develop the standards
  - Agree at high level on the work split between ETSI and CEN with a common collaboration scheme
  - High level needs for international standard harmonization

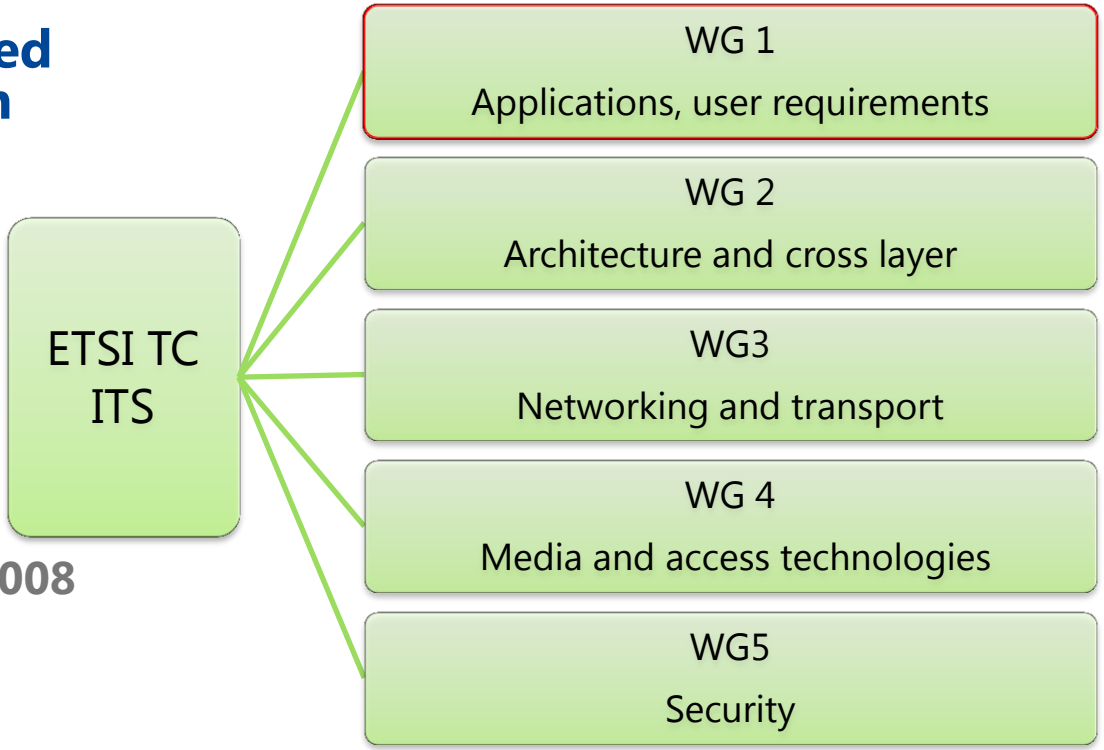
Standardization environment



- **EU :**
  - ETSI TC ITS, CEN TC278 collaboration in the framework of M/453
  - Collaboration with industry/public consortium: Car 2 car communication consortium, EASYWAY, eSafety , COMeSafety etc.
  - Inputs and feedbacks from R&D, FoT projects: DRIVE C2X, simTD, SCOREF etc.
- **International:**
  - Standardization collaboration: ISO, SAE International, IEEE, ISO, IETF
  - Strategy and deployment joint discussion: EU – US – JP

ETSI organization and work method overview

- **ETSI is an industry member based standardization organization on ICT/telecom field**
- **Stakeholders:**
  - Telecom operators
  - System provider
  - Auto makers
  - Institutes etc…
- **ETSI TC ITS:**
  - Technical committee on ITS since 2008
  - 5 working groups
  - Management team (chairs and co-chair participation)
  - Work method:
    - TC meeting (2 per year) for document and Work item approval
    - WG meetings (4 per year)
    - Ad hoc work meeting, Mail discussions
    - Approval by correspondence (ABC), distant approval procedure (30 days)



ETSI organization overview

CEN TC 278/ISO TC 204

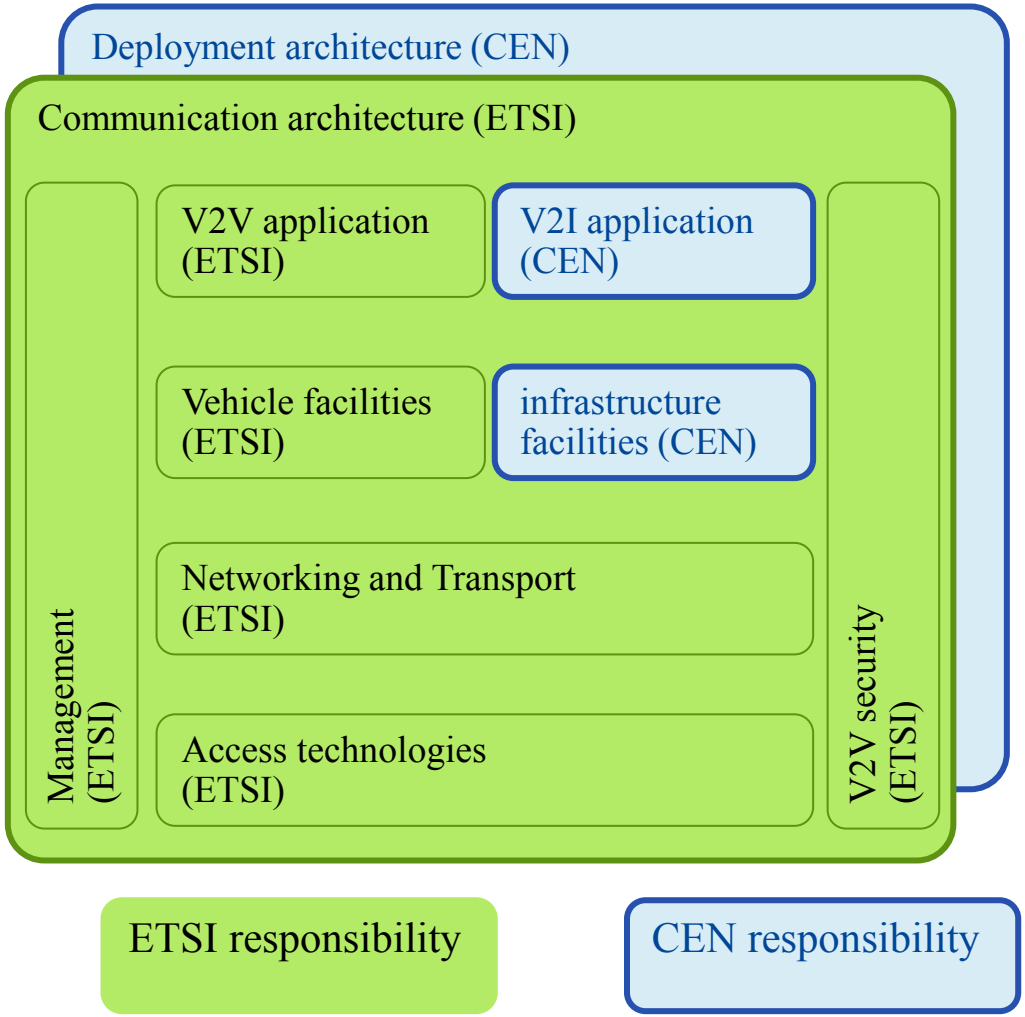
CEN TC278	ISO TC 204
WG13: Architecture	WG1: Architecture
	WG3: Database technology
WG1: ETC	WG5: Fee and tool collection
	WG7: Fleet management and freight operations
WG8: Road Data	WG9: Info management and control
WG4: TTI	WG10: Traveller Info management
	WG14: Vehicle warning and control
	WG16: CALM
WG16: Cooperative System	WG18: Cooperative System

Source: Mr. Shade, 4th ETSI ITS Workshop

ETSI CEN collaboration for M/453

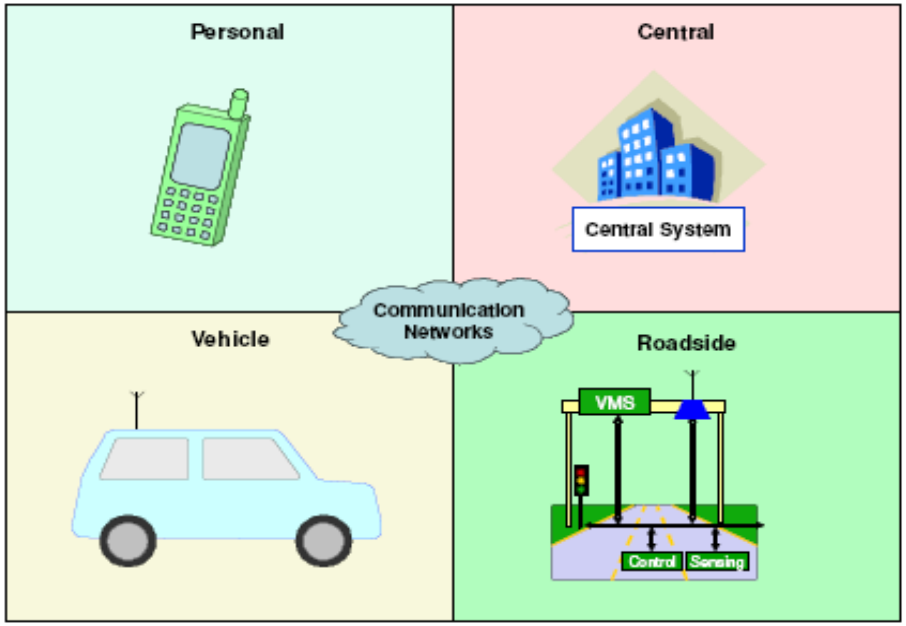
- **ETSI and CEN agreed at high level a work split in the joint report to M/453**
  - see figure on the right
- **Information exchanges between ETSI and CEN:**
  - Offline discussions
  - Common member participations
  - Invited expert participation to meetings

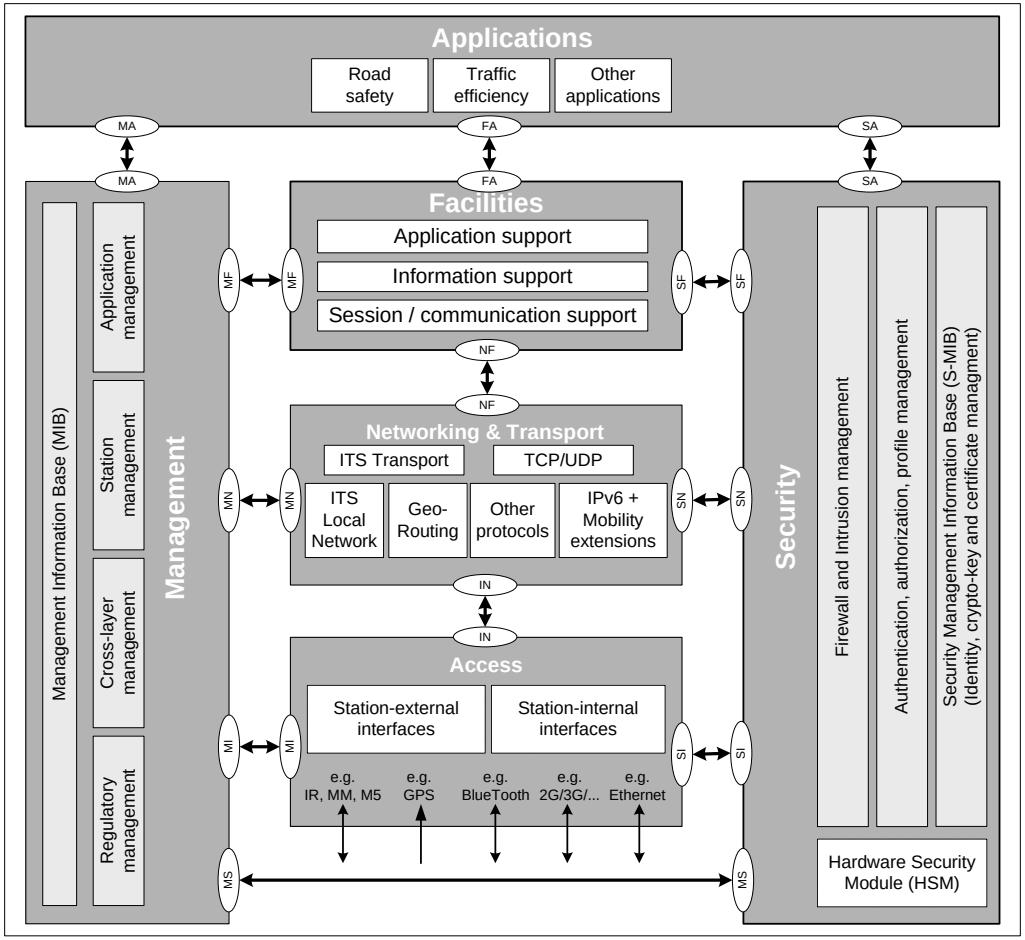
ETSI/CEN high level work split



ITS communication architecture: overview

- Derived from OSI reference architecture
- Harmonized with ISO/CEN architecture
- ITS station (ITS-S): communication/application entities embedded in systems participating to the ITS Cooperative systems.
- Four categories of ITS-S:
  - Vehicle ITS – S (OBU)
  - Road side ITS –S (RSU)
  - Central ITS-S (TMC, service providers)
  - Personal ITS-S (PND)





ITS station reference architecture
Source: ETSI TC ITS

Application standardization activities: Overview

Road safety

ETSI

- Cooperative Awareness
- Longitudinal collision risk
- Intersection collision risk

...

Traffic Efficiency

CEN

- Signal phase and timing
- In vehicle signage
- Contextual speed limit
- Vehicle data collection/ processing
- Recommended itinerary

...

Others

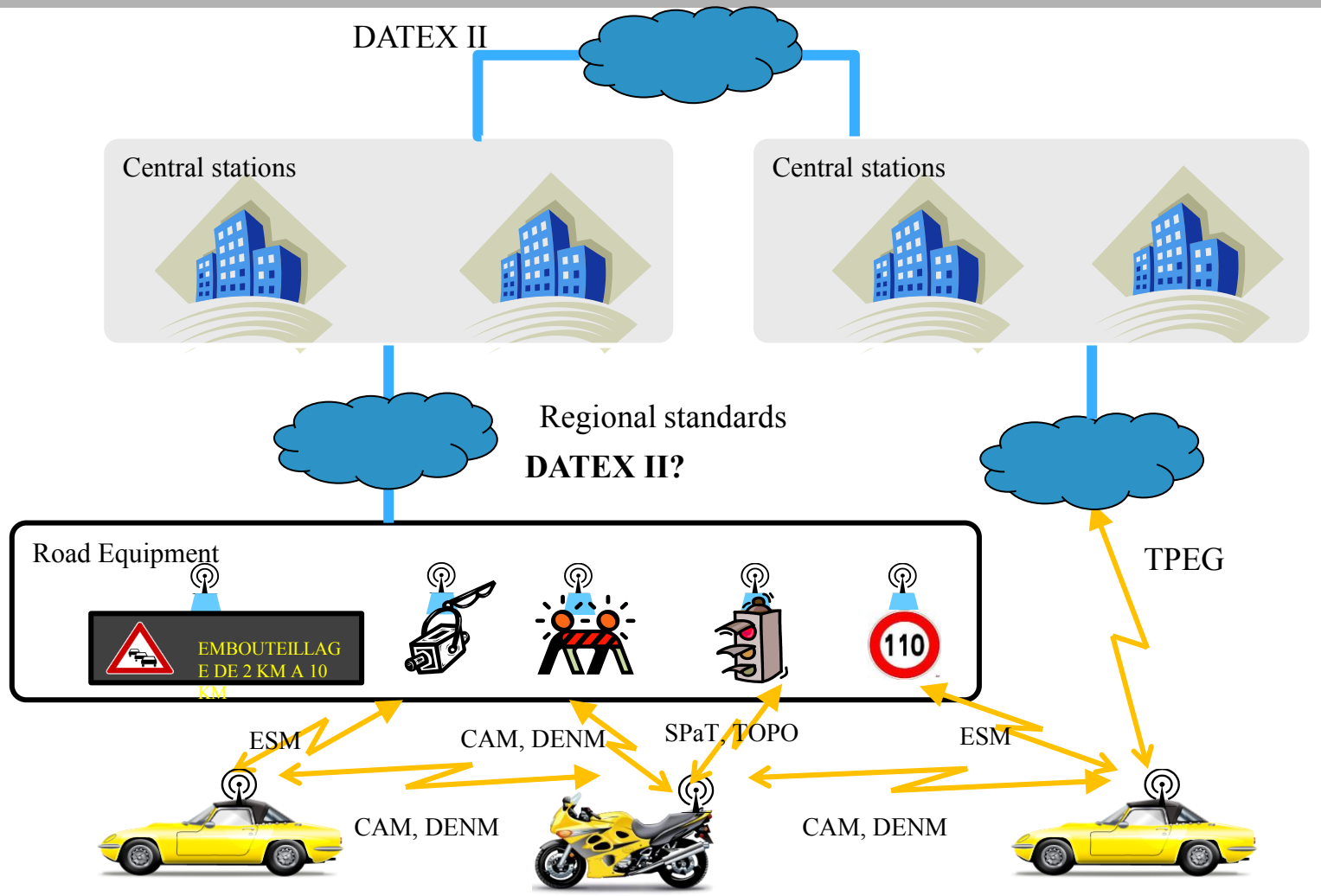
ETSI CEN

- POI: Electric vehicle charging spot notification
- POI: Tire pressure management system
- Probe system
- TPEG

...

Source: ETSI TC ITS

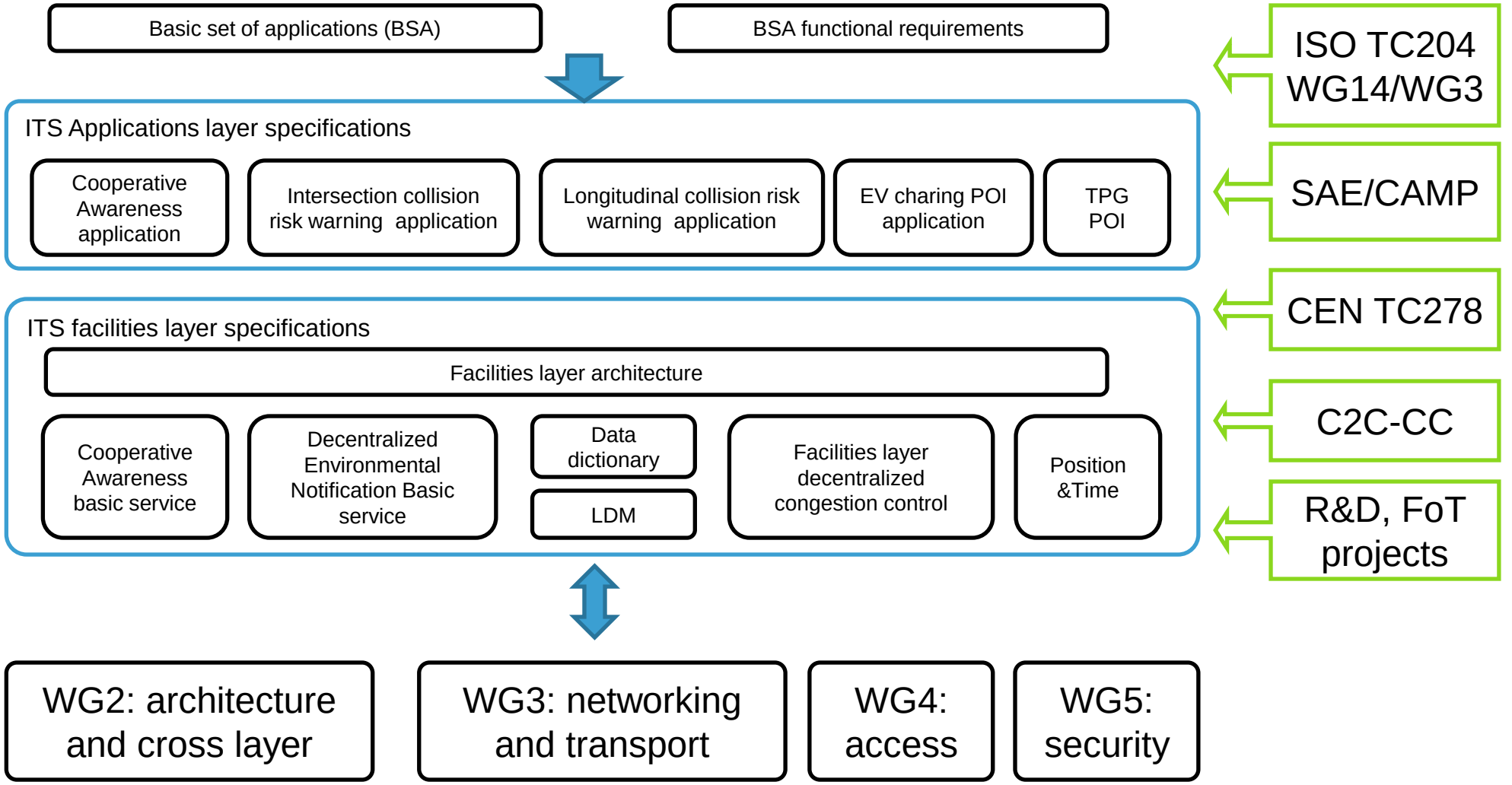
Data exchanges protocols: overview



CAM: Cooperative Awareness
DENM: Decentralized Environmental Notification Message

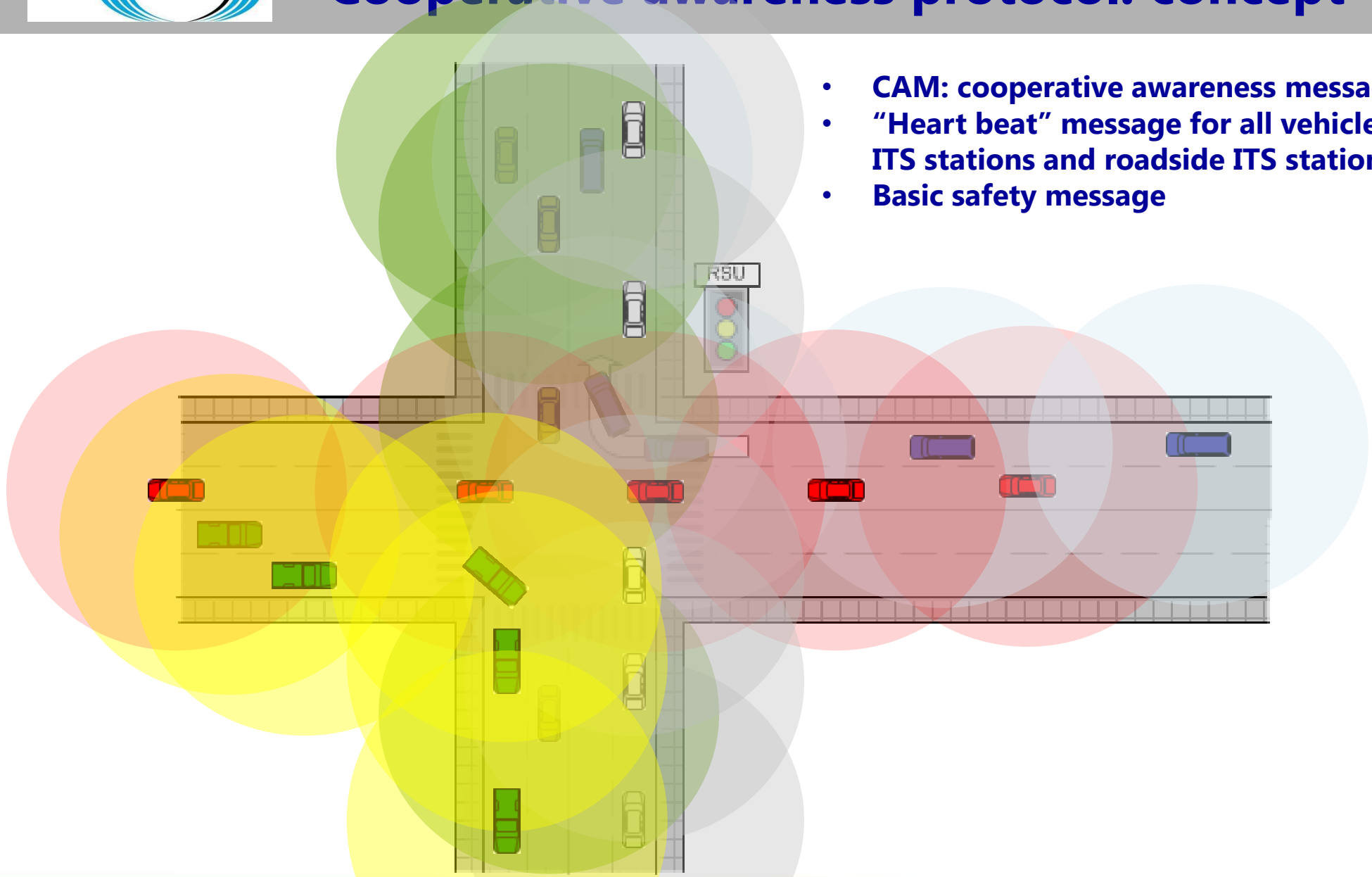
SPaT: Signal Phase and Timing
TOPO: Topology
ESM: Embedded Signage Message (including speed limit)

TC ITS WG1 work overview & M/453



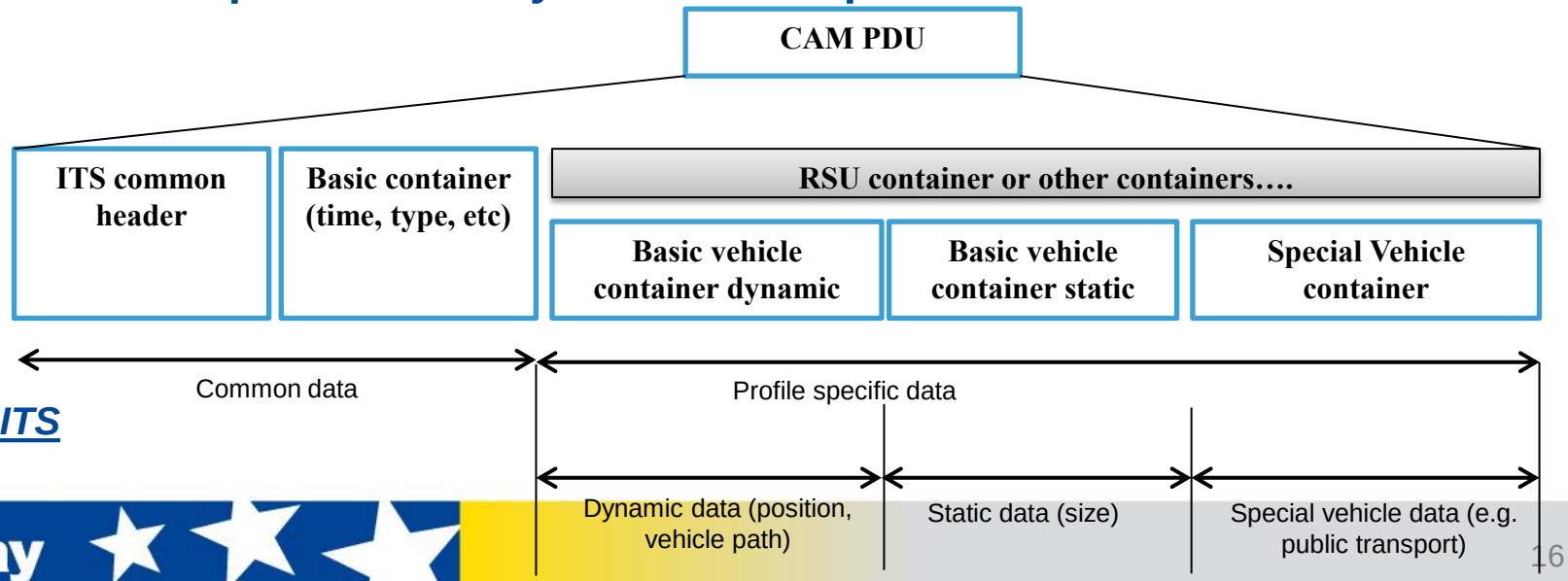
Cooperative awareness protocol: concept

- CAM: cooperative awareness message
- "Heart beat" message for all vehicle ITS stations and roadside ITS stations
- Basic safety message



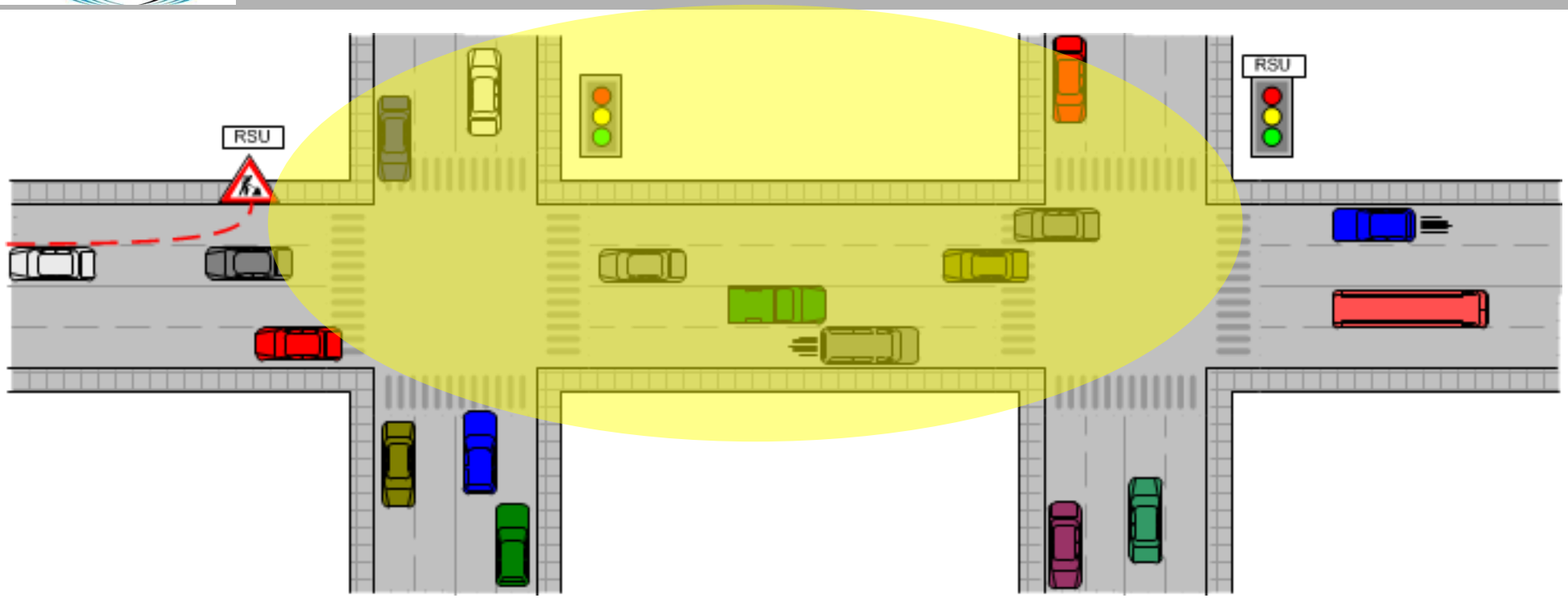
Message: Cooperative Awareness Message

- **CAM (Heartbeat message)**
  - **Vehicle position, vehicle basic data (acceleration, path history, curvature, vehicle size etc.)**
  - **Optimization of message structure**
    - Dynamic data with high frequency , static data with lower frequency
    - Extensibility of message with other profile e.g. road side ITS station, public transport vehicle etc. for future standards
- **Protocol operations: periodical one hop broadcasting up to 10Hz.**
- **Approximate communication range: 300 – 600m**
- **Strong collaboration with SAE, CAMP (USA) and Harmonization with US BSM (basic safety message)**
- **Document planned on April 2012 ready to starts EN process**



Source: ETSI 4th ITS workshop

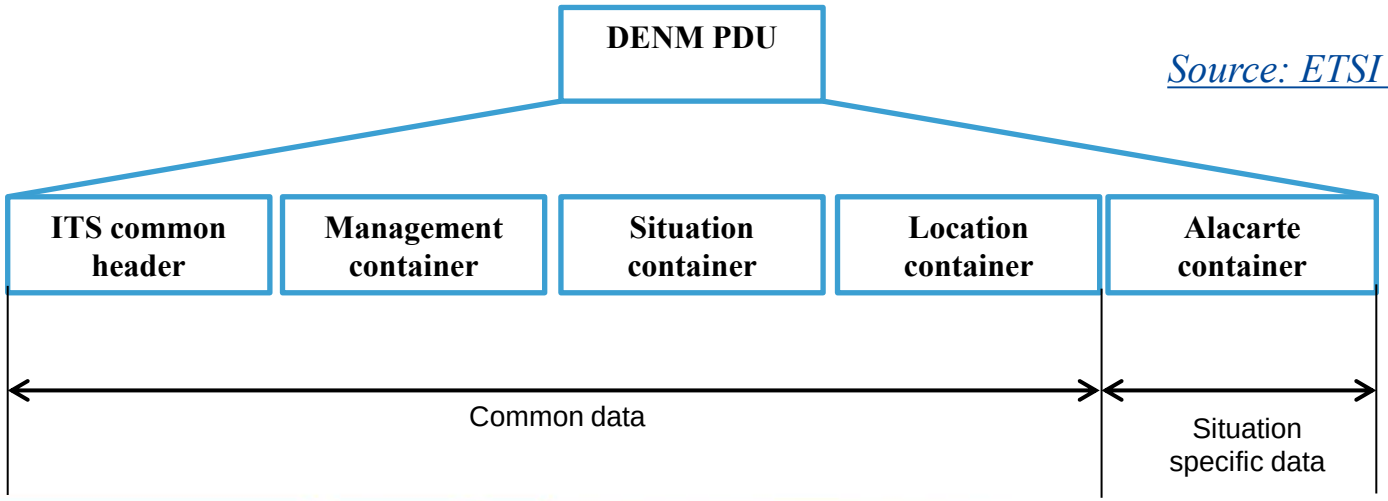
DENM protocol: concept



- **DENM: Decentralized Environmental Notification Message**
- **Events trigged message:**
  - **Road safety event: stationary vehicle, wrong way driving etc.**
  - **Road hazard information: black ice, obstacles, people on the road, low adhesion etc.**
  - **Traffic information: weather conditions, roadworks etc.**

Message set: DENM

- **DENM (Event driven message)**
  - Management container: life cycle management, generation, updates, cancel, validation etc.
  - Situation container: situation type (cause code), harmonized with TPEG-TEC
  - Location container: event location, relevance area.
  - Alacarte container for situation specific data (extensible with future new applications)
- **Protocol operation: event based transmission triggered by the application, periodical repetition with life cycle management**
- **Dissemination range: variable from several hundreds to several kms.**
- **Support of geographic location based dissemination protocol (geoNetworking)**
- **Document planned on April 2012 ready to starts EN process**



Source: ETSI 4th ITS workshop

CEN: work items established

- Extension of map database specifications for advanced driver assistance systems (ADAS) and cooperative systems (NP 14296 - April 2013)
- Interface Protocol and Message Set Definition between Traffic Signal Controllers and Detectors (ISO DIS 10711 – mid 2013)
- Forward Vehicle Collision Warning Systems (revised) (CD 15623 – mid 2013)
- Intersection Signal Information and Violation Warning Systems (NP 26684 – end 2013)
- Classification and management of ITS applications in a global context (TS17419 – November 2012)
- ITS application requirements for selection of communication profiles (TS17423 – November 2012)
- Data exchange specification for in-vehicle presentation of external road and traffic related data (TS 17425 – November 2012)
- Profiles for processing and transfer of information between ITS stations for applications related to transport infrastructure management, control and guidance (TS 17429 – November 2012)
- Contextual speeds - TS 17426 – November 2012

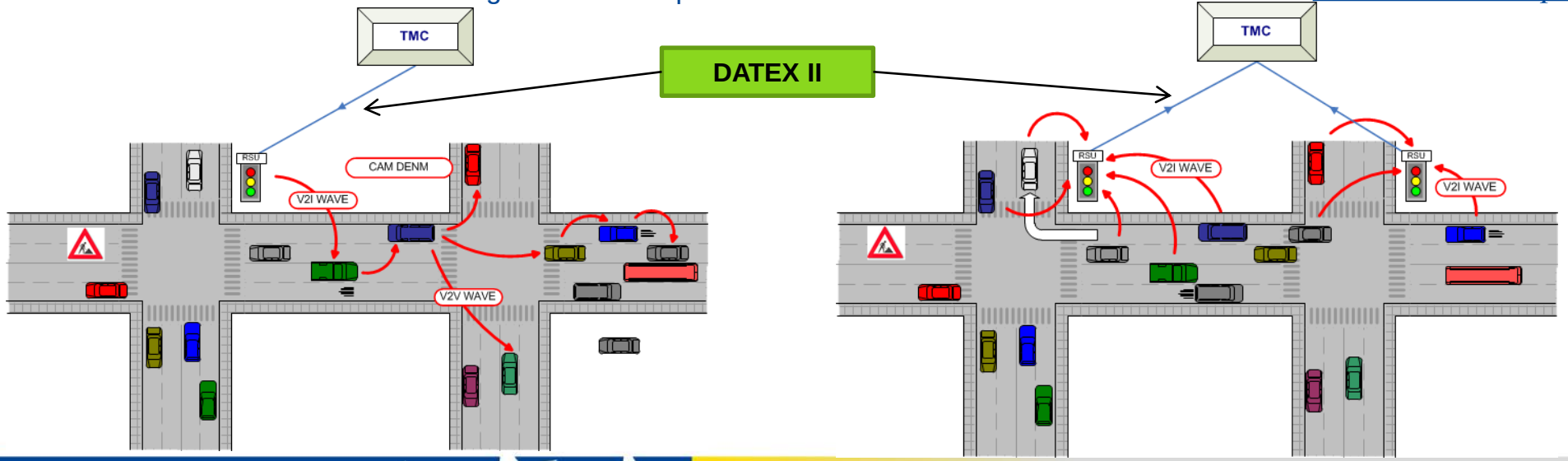
Source: Mr. Shade, 4th ETSI ITS Workshop

DATEX II & Cooperative system: potentials

- **CAM/DENM and DATEX II are specified for different purposes and with different constraints:**
  - ***Time constraint***: short latency (e.g. 300ms) and high dynamic information (e.g. CAM/DENM transmission and vehicle position updates at 10Hz) for road safety application VS latency tolerant, lower update rate for traffic information collection
  - ***Radio communication constraints***: Network congestion with scaling up vehicle number (message size, encoding rules) VS large bandwidth communication (e.g. optic fiber)
  - ***Scalability***: micro-driving environment, local road hazard VS large scale road network management;
- **Standard harmonization needs**
  - ***Vehicle/infrastructure integration***
    - Traffic information dissemination from TMC to final road users
    - CAM/DENM as enriched traffic "probe" data for traffic management center
  - ***Operational requirements:***
    - Information quality and liability
    - Harmonized traffic management and impact on traffic flow

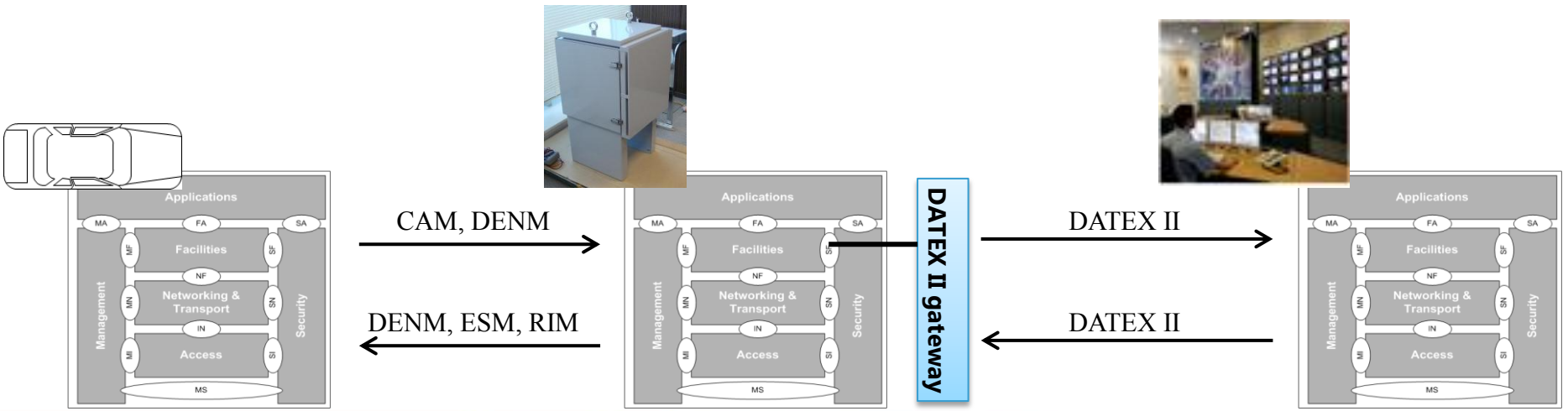
Interoperability

Source: iTETRIS project



Ongoing research work

- **National Field Operation Test project: simTD (Germany), *SCORE@F (France)***
- **DATEX II gateway**
  - **Uplink (from vehicle to TMC) :**
    - RSU aggregation of received CAM/DENM data
      - *Vehicle position*
      - *Local road hazard e.g. stationary vehicle, obstacle, accident etc.*
    - RSU provides aggregated data to TMC via DATEX II
      - *event information*
      - *traffic aggregation data e.g. average speed, travel time etc.)*
  - **Downlink (from TMC to vehicle):**
    - TMC provides traffic management information to RSU via DATEX II
      - *Traffic management: roadwork, recommended itinerary*
      - *Traffic regulation: contextual speed limit, VMS message etc.*
    - RSU "translate" the DATEX II to V2X messages



Standardization and future work

- **Ongoing CEN WI on the infrastructure processing and transfer of ITS station information to infrastructure**
  - ***DATEX II is proposed to be the protocol being used for TMC-RSU communication***
  - **Proof of concept in FoT projects → inputs and feedbacks to the WI**
- **Potential extension of DATEX II protocol?**

Message DATEX	Application	Messages V2I associés
DX_A	Road hazard	DENM
DX_A	Driving conditions	CAM, DENM
DX_A	Traffic counting	CAM
DX_B	Roadwork	DENM
DX_B	VITESSES	ESM
DX_B	Travel time	CAM
DX_B	ITINERAIRE_BIS	RIM
DX_C	POI	PoI
DX_C	RSU maintenance information	NA
DX_C	In vehicle signage	ESM

CAM: Cooperative Awareness
DENM: Decentralized Environmental Notification Message

ESM: Embedded Signage Message (including speed limit)
RIM: Recommended Itinerary Message

Thank you

Lan LIN

Lan.lin@hitachi-eu.com