Status of standardization and regulation with regards to GNSS in ITS

High Quality Positioning: a Key to Success for Autonomous Driving

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Outline

- Context
- Gap analysis
  - Approach
  - Findings
- Summary

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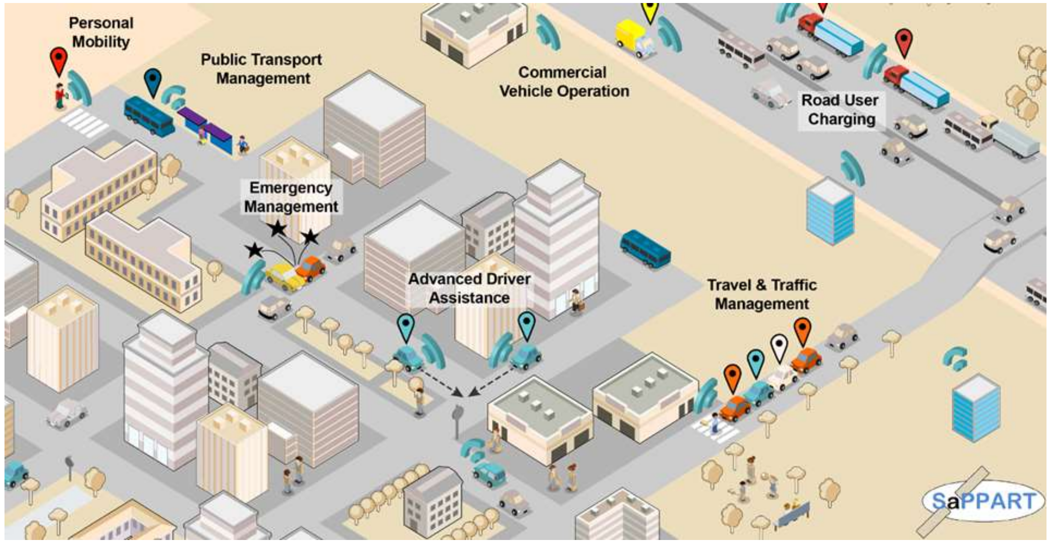
Context

GNSS users and integrators face 2 major challenges:

- estimate the expected performance of the service
- lack of common framework for defining and assessing GNSS-positioning performances



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Gap analysis

Approach

- Inventory of relevant documents
- Gap analysis of the positioning aspects
- Synthesis and actions

Scope: 75 standards and 25 regulations in ITS (taximeters, DGT, EFC, eCall, Smart tachograph, C-ITS, ADAS, autonomous driving)

A few use cases and findings are highlighted in the following slides

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Findings - Dangerous Goods Transport

Directive 2008/68/EC **on inland DGT**


ADR
European Agreement
Volume I

- Regulation barely addresses positioning aspects
- References the “provisions” in ADR re “tracking tracing” for high-consequence dangerous goods

Gaps

- Nothing about the positioning performance, not even for non-high consequence dangerous goods
- Nothing on geofencing of DGT on certain roads or areas
- Nothing on cross-border monitoring of DGT

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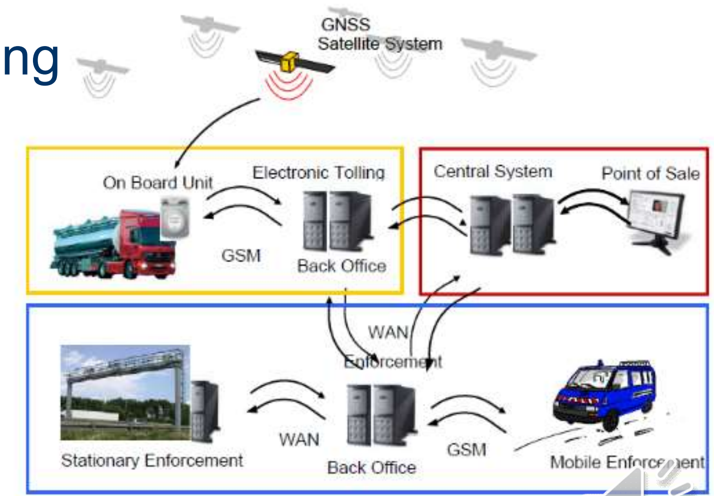
Findings - Electronic Fee Collection

- EFC used to achieve a variety of **transport pricing policies**
- Main **technologies** used in Europe
  - CEN dedicated short-range communication
  - Video-based charging
  - **Autonomous GNSS-based systems**
    - Section-/cordon-based charging
    - Area-based charging



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Findings - Electronic Fee Collection

- European electronic toll service (**EETS**) **legislation** in place
  - Separation of the Toll Charger and Service Provider (SP)
  - Positioning functionality and performance requirements (OBE + Proxy) responsibility of the SP
- **Standards and recent procurements mirror the EETS legislation**
  - E.g. ISO/TS 17444 on ‘Charging performance metrics and examination framework’
    - E2E and intermediate metrics (e.g. toll declaration) but **not the positioning performance**
    - In line with the EETS legislation and to avoid duplication with 16803

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Findings - Electronic Fee Collection

- **A proposal for a recast of the EETS Directive and Decision** launched in 2017-05
  - contain several significant changes but none regarding the handling of the positioning performance

- Gaps
  - no essential gap identified from the EETS-perspective
  - an open market for OBE requires that positioning performances are established; EN 16803 series is intended to bridge this gap

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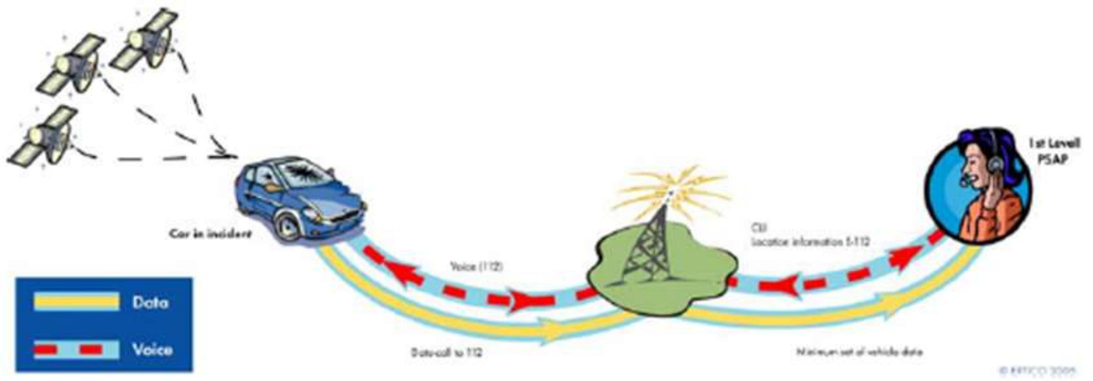
Findings - eCall



- The eCall system shall allow the “PSAP operator to identify the **position and heading of the vehicle to a minimum degree of accuracy as defined in EN 15722 for the Minimum Set of Data (MSD) coordinates**”
- “the receivers shall be **compatible with the positioning services** provided by satellite navigation systems including the **Galileo** and the EGNOS systems”

Findings - eCall

- 6 main eCall standards
- Only EN 15722 on eCall minimum set of data deals with positioning performance: **a flag in the MSD should be set to 'no confidence' when "there is less than 95% confidence that exact position is within a radius of ± 150 m of reported position"**

Gaps

- Regulation only referred to EN 15722
- EN 15722:
  - The meaning is not clear: the 95th percentile of the error distribution < 150 m?
  - No conformity assessment test case

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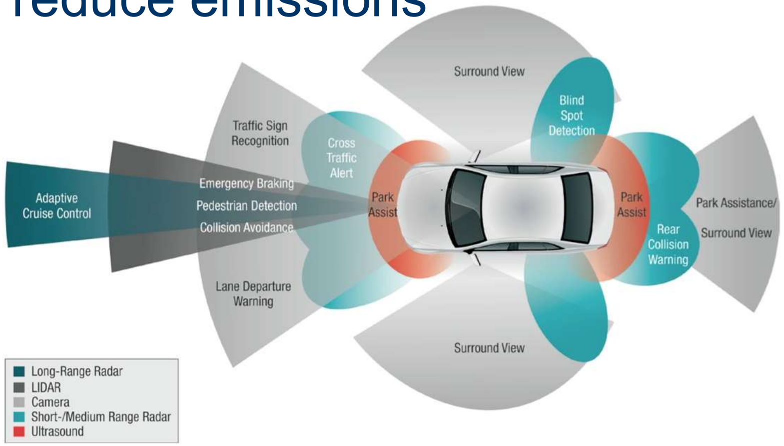
Findings - eCall

New EU regulation (2017/79) on EC type-approval procedures for eCall in-vehicles systems, technical units and components

- Test procedures defined in Annex VI
  - The tests are based on constellation simulators
  - Perhaps not the ultimate solution but a big step forward in anticipation of 16803-2
- applies from 2018-03-31

Findings - ADAS

- Increase safety and driving comfort, reduce emissions
- New services
  - Adaptive cruise control
  - Curve speeds assistance
  - Lane change assistance
  - Vision enhancements
  - Intersection collision avoidance …..
- New technologies – competing concepts
- Legislation and liability difficult issues



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Findings - ADAS

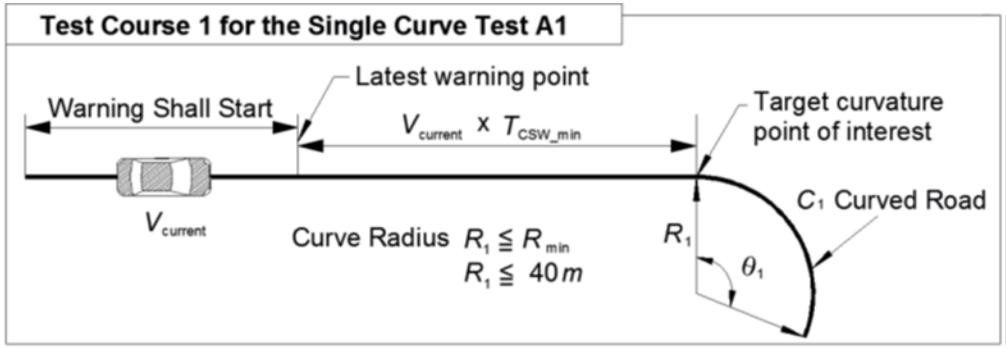
What about vehicle positioning?

- **vehicle positioning is not necessary for every service**
  - ABS, automatic lighting, rear view assistance…
  - depends on the vehicle design (e.g. collision avoidance based on radar measuring the distance between the vehicles)
- **but is part of the vehicle's system**
  - navigation based only on relative information is not sufficient to cover all the cases
- **necessity to have an absolute position**
  - calibration of sensors: odometer, accelerometer, gyros
  - image correlation
  - map matching (lidar)

Findings - ADAS

Example: Curve speed warning systems (CSWS)

- Performance requirements and test procedures (ISO 11067)
- **The test course shall be located in an open place so that the GNSS receiver of CSWS functions properly**



Gaps

- Positioning performance indicators are generally neglected or not verifiable
- Test procedures do not reflect the real operational environment

Findings - ADAS

Example B: Longitudinal Collision Risk Warning
(LCRW, ETSI TS 101 539-3:2013**)**

- "In case position is used for longitudinal alignment estimation, the vehicle **position accuracy shall be equal or less than one meter with a confidence level of 95 %**"

Gaps

- Metrics unit not exact / verifiable
- Test procedure not defined

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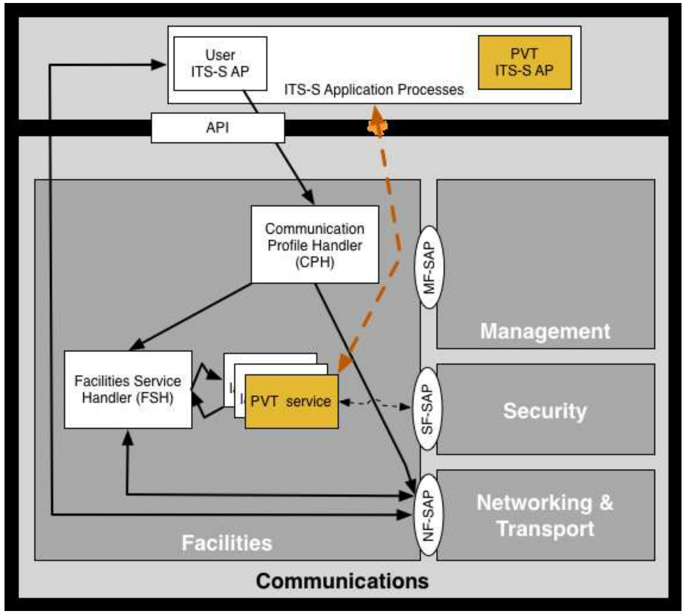
Findings - ADAS

- On-going work "ISO/TS 21176 "**PVT functionality in the ITS station**"
- Prepared in **cooperation** between the **ITS** and the **GNSS** standardisation communities
- The need for and expectation on this new facility is growing among ITS stakeholders (Autonomous Driving…)
- A first draft is expected in the next weeks



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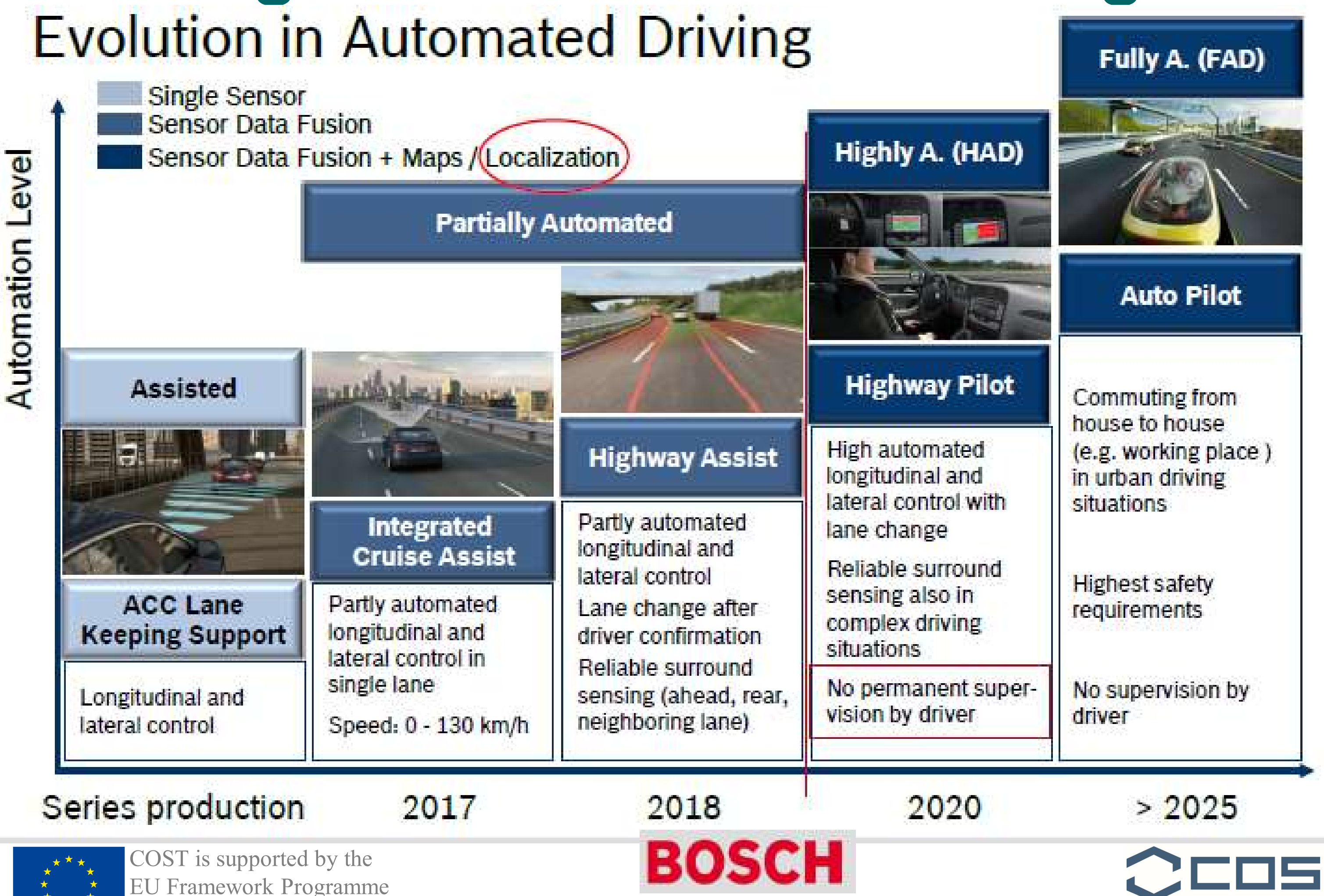
Findings - Autonomous Driving



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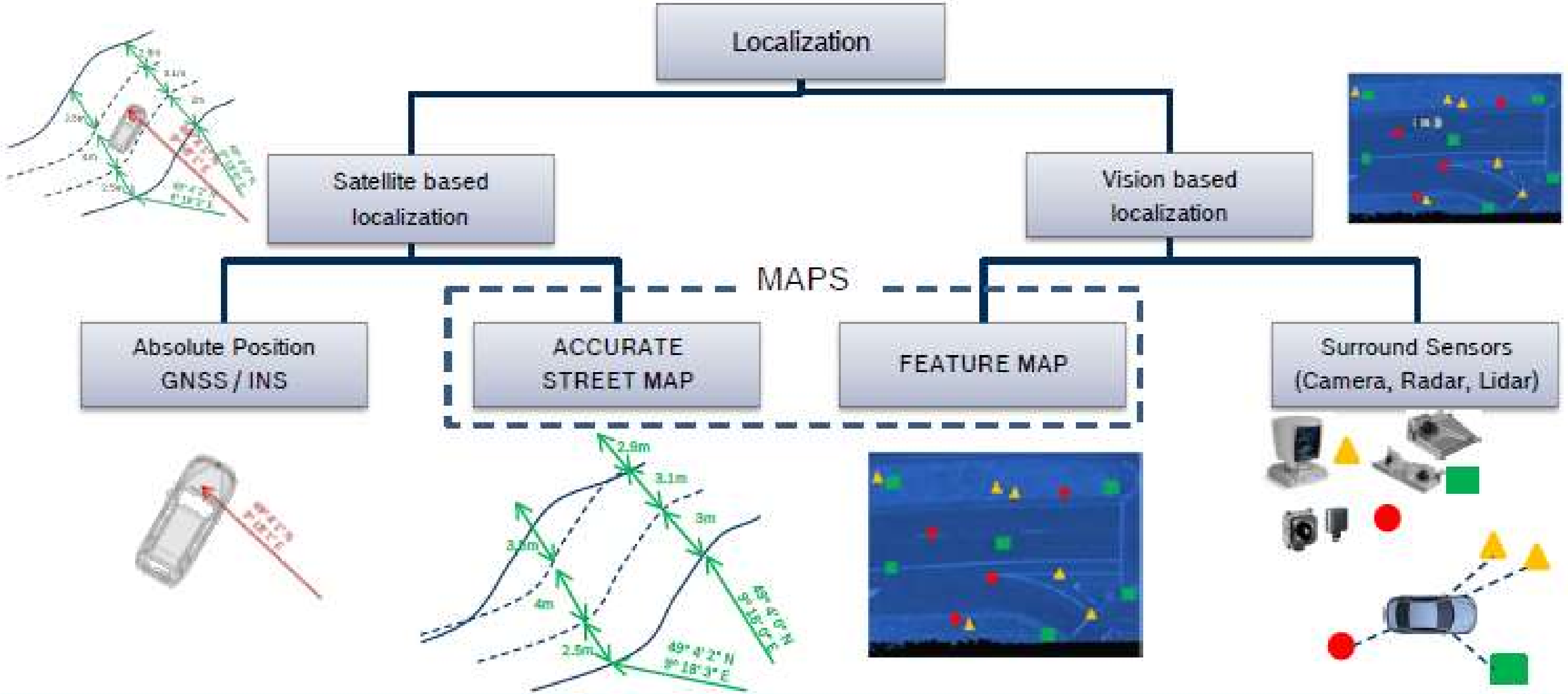
Finding - Autonomous Driving
Options for Absolute Localization



→ **Localization can be done with MAPS, surround sensors and GNSS systems. Benefits and drawbacks on all sides.**

Findings - Autonomous Driving

- From level 0 (no automation) to level 5 (fully autonomous)
- Levels 0, 1, and 2 corresponds to ADAS
- Levels 3 and 5 are what most people recognize as autonomous driving

- NHTSA does currently not recommend to establish safety standards for self-driving vehicle technologies

Gaps

- Legal, technological as well as human performance issues must be addressed in more depth before standards can be developed on a more solid basis

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Summary

- GNSS-based positioning performances in ITS depend on the environment and are often overestimated
- Critical ITS applications require positioning performance indicators and examination framework
- Positioning QoS requirements are often neglected or not verifiable in current ITS regulations and standards
- Privacy protection considerations in current European regulations limit the use and societal benefits of positioning services
- Linking of GNSS-positioning and ITS experts starts to bear fruits. Room for strengthening the exchanges with the automotive industry and ITS legislators
- Standards are under development that can be used to underpin agreements between ITS stakeholders and to support ITS legislations

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THANK YOU FOR YOUR ATTENTION !

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