Submitted by the expert from Germany

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Federal Ministry
for Digital
and Transport

Vehicular Communications

ITS Task Force on Vehicular Communications (2nd session)
June 23rd 2023

Content

- Background
- Current situation
- Communication technologies
- Stakeholder
- Infrastructure
- Use cases
- Accidentology
- Challenges
- Need for regulation

Background

- Research started roughly 30 years ago, political discussion 20 years ago
  - Enough scientific evidence to ensure the positive impact on vehicle safety

- The goal was indicated to achieve harmonization and area-wide deployment in order to realize the positive impacts on vehicle safety and traffic flow

- Deployment takes place only at a slow pace
  - Fragmented solutions have established
  - Lack of planning certainty

Current situation

- Why now?
  - With UN R155, cybersecurity can be ensured in the vehicle, being a prerequisite for secure communication

- Current market is fragmented and no overarching solutions are available (e.g. communication technology)

- Different standards exist or are in development (e.g. ETSI, ISO, SAE)

- The technical maturity is given by the fact that the implementation is present in some vehicles

Communication technologies

- Different technologies might be fit for purpose
  - Long-range via existing 3G / 4G / 5G mobile networks
  - Short-range via ETSI ITS-G5 / WAVE (WIFI-based, 802,11p) or Sidelink / PC5
  - Combination of both – „hybrid communication“

- Different requirements for different services / use cases
  - No hard latency requirements, e.g. comfort and navigation
  - Latency critical, i.e. immediate crash avoidance

Communication technologies

- Many potential criteria to be considered

- For each individual technology
  - Availability on the market
  - Coverage / range
  - Performance (Latency, throughput…)
  - …

- Across different technology
  - Compatibility (technology-wise)
  - Interoperability (content-wise)
  - Interference / congestion on the radio channel – spectrum use
  - …

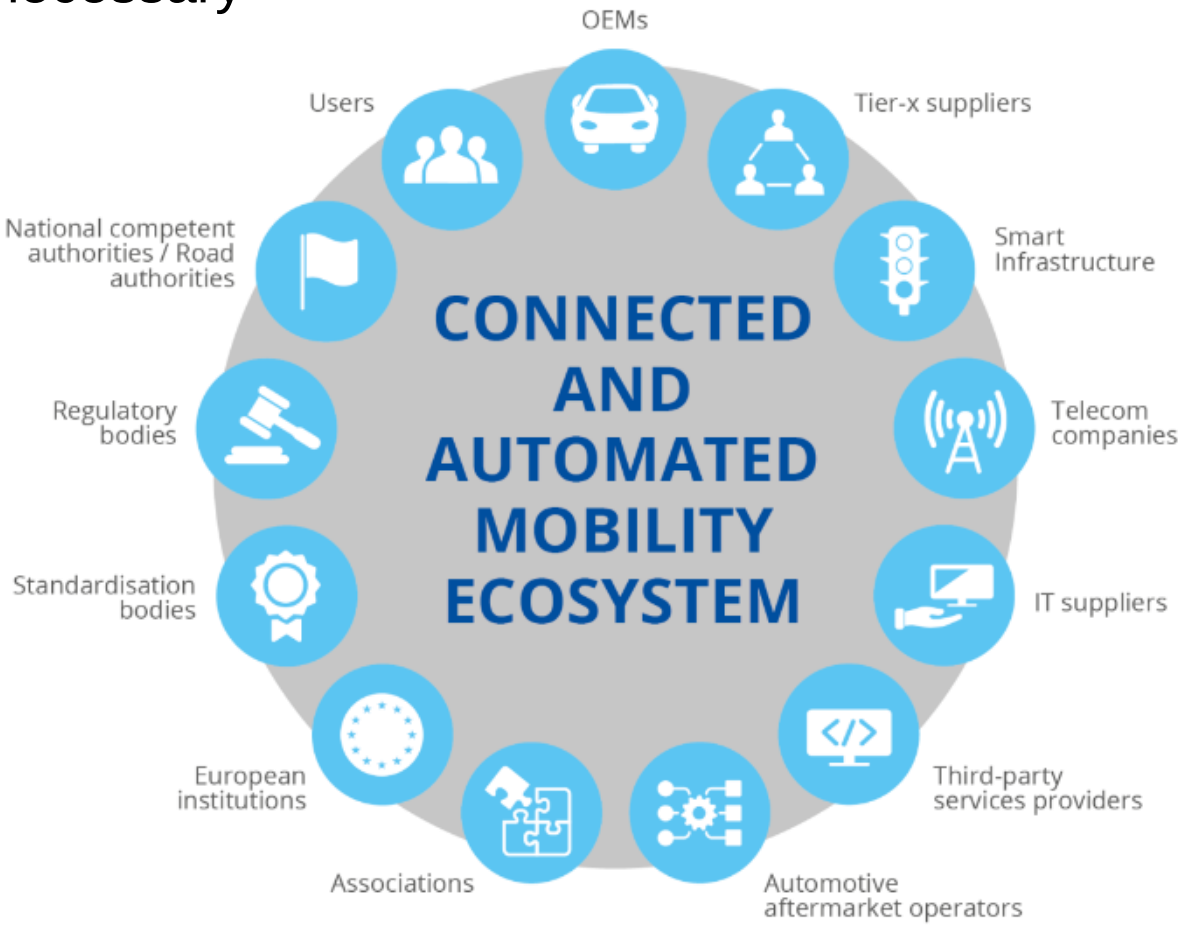
	ETSI ITS-G5 (802.11p)	3GPP R14 PC5	3GPP R16/R17 PC5	3GPP LTE Uu	3GPP 5G Uu	Bluetooth 5.0 (LE)
EU-Deployments		Not existent	Not existent	Proprietary, not applicable to SECUR	Deployment has started Proprietary, not applicable to SECUR	Not existent
V2X-Profile Standardization for cross OEM interoperability:		Not tested	Not existent	Not existent	Not existent	Not existent
V2X-Message Standardization for cross OEM communication:				Not existent	Not existent	Not existent
Radio Access Technology:			Not tested, Hardware not available			
Regulatory & Deployment aspects:		CEPT/ECC regulation • Coexistence with existing deployments • Tolling Coexistence	CEPT/ECC regulation • Coexistence with existing deployments • Tolling Coexistence	GDPR- / CPOC- / Policy-Compliance	GDPR- / CPOC- / Policy-Compliance	GDPR- / CPOC- / Policy-Compliance

: No issues
: Known issues, currently not resolved
: Not existent

Source: SECUR Project, UTAC
https://www.utac.com/wp-content/uploads/2023/04/SECUR-D2.2-Suitability-of-the-different-technologies-for-the-selected-use-cases-v1.4.pdf

Stakeholder

- System are not owned/run by one single actor/group
- Alignment within and across stakeholder groups is necessary
- Different roles/sectors
  - Regulators
  - Road operators & authorities
  - Automotive industry
  - Telecommunication
  - Service providers
  - …



Source: ENISA
https://www.enisa.europa.eu/publications/cybersecurity-stocktaking-in-the-cam/@@download/fullReport

Stakeholder

- Numerous public and private actors
- OEM, aftermarket, national, international
- Might be sender / receiver or “enabler”

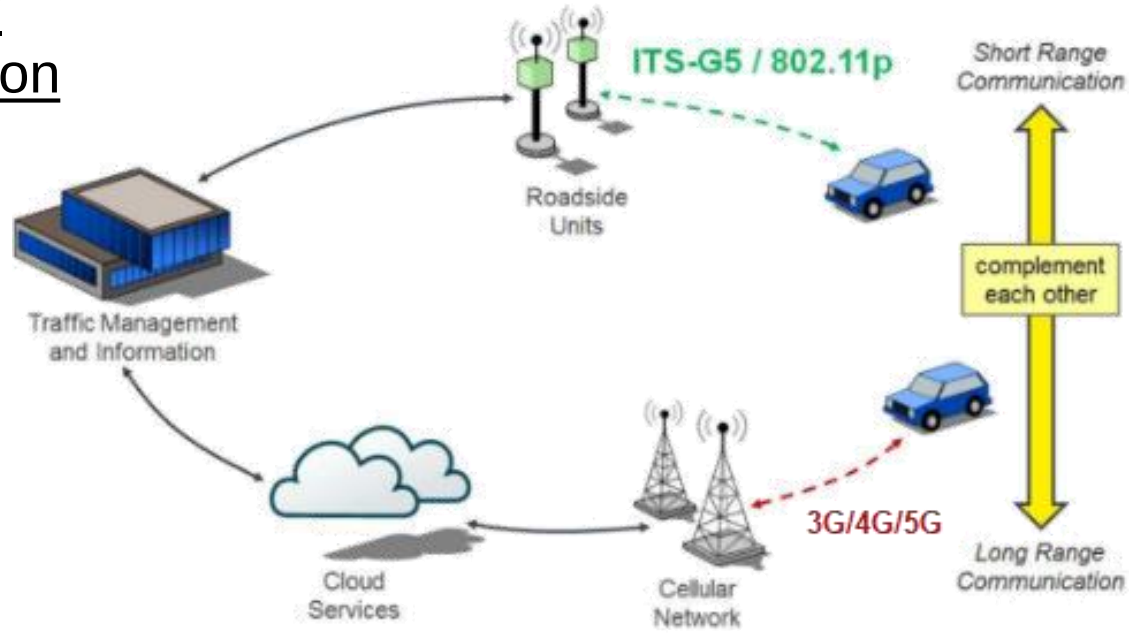
Europäische Kommission

Federal Ministry for Digital and Transport

Infrastructure

- C-Roads / Cooperative ITS Corridor

- Construction site warning system / *„Baustellenwarner“*
  - 1500 devices are being rolled out and will be active on the highways
  - But the messages <u>can only be received by few vehicles via short-range communication</u>



- It is becoming noticeable that the infrastructure is implementing more and more systems that have integrated communication technologies

Use cases

- Agreed list of so-called „Day One“ Services
- Different benefits to be realized
- Combination of safety, comfort, traffic flow / reduced emissions

❑ ***List of Day1 services***

Hazardous location notifications:

- *Slow or stationary vehicle(s) & Traffic ahead warning*
- *Road works warning*
- *Weather conditions*
- *Emergency brake light*
- *Emergency vehicle approaching*
- *Other hazardous notifications*

Signage applications:

- *In-vehicle signage*
- *In-vehicle speed limits*
- *Signal violation / Intersection Safety*
- *Traffic signal priority request by designated vehicles*
- *Green Light Optimal Speed Advisory (GLOSA)*
- *Probe vehicle data*
- *Shockwave Damping (falls under ETSI Category “local hazard warning”)*

❑ ***List of Day 1’5 services***

- *Information on fuelling & charging stations for alternative fuel vehicles*
- *Vulnerable Road user protection*
- *On street parking management & information*
- *Off street parking information*
- *Park & Ride information*
- *Connected & Cooperative navigation into and out of the city (1st and last mile, parking, route advice, coordinated traffic lights)*
- *Traffic information & Smart routing*

Source: EU COM, C-ITS Platform Report, 2016
https://transport.ec.europa.eu/system/files/2016-09/c-its-platform-final-report-january-2016.pdf

Use cases

- More services and use cases exist (e.g. collective perception)
- ADAS & on-board sensors won‘t solve everything (e.g. non-line-of-sight)
- Connectivity & cooperation address additional areas of interest, thereby helping to close the gap

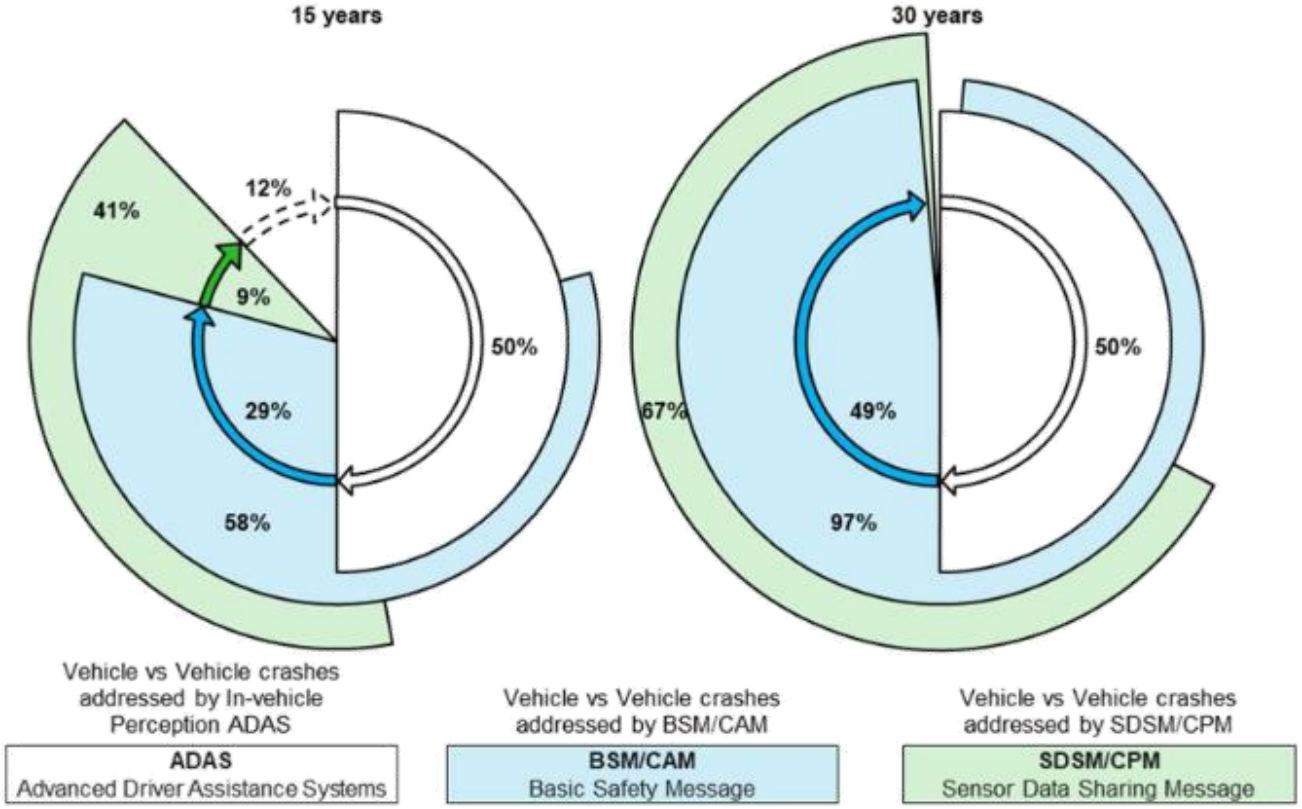


Figure 11: Fields-of-action of V2X-enhanced ADAS addressing vehicle vs vehicle crashes. At year 15 and year 30 of introduction.

Source: Feifel, Erdem, Menzel, Gee - 27th ESV Conference, Proceedings https://www-esv.nhtsa.dot.gov/Proceedings/27/27ESV-000082.pdf

Accidentology

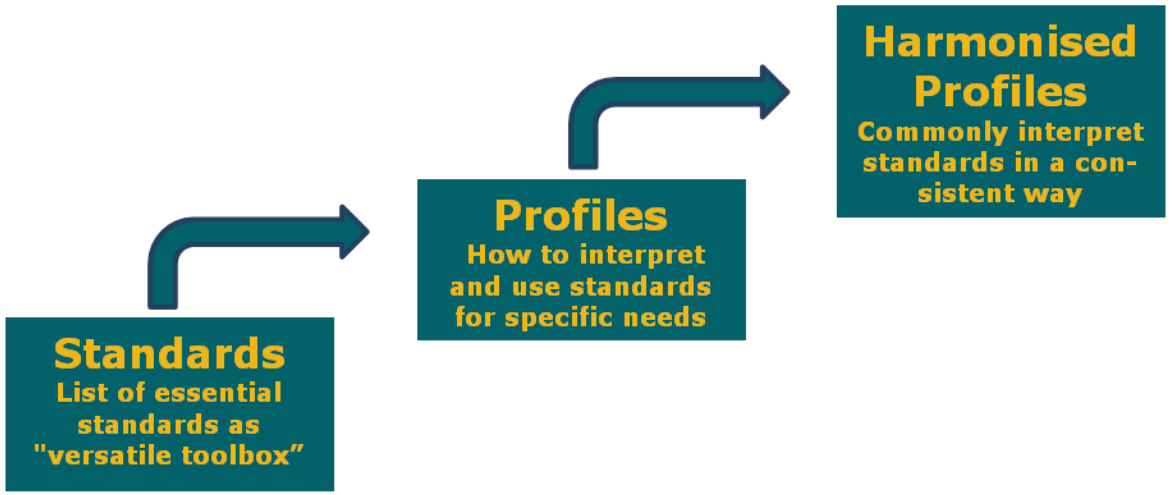
- Enough scientific evidence to ensure the positive impact on vehicle safety

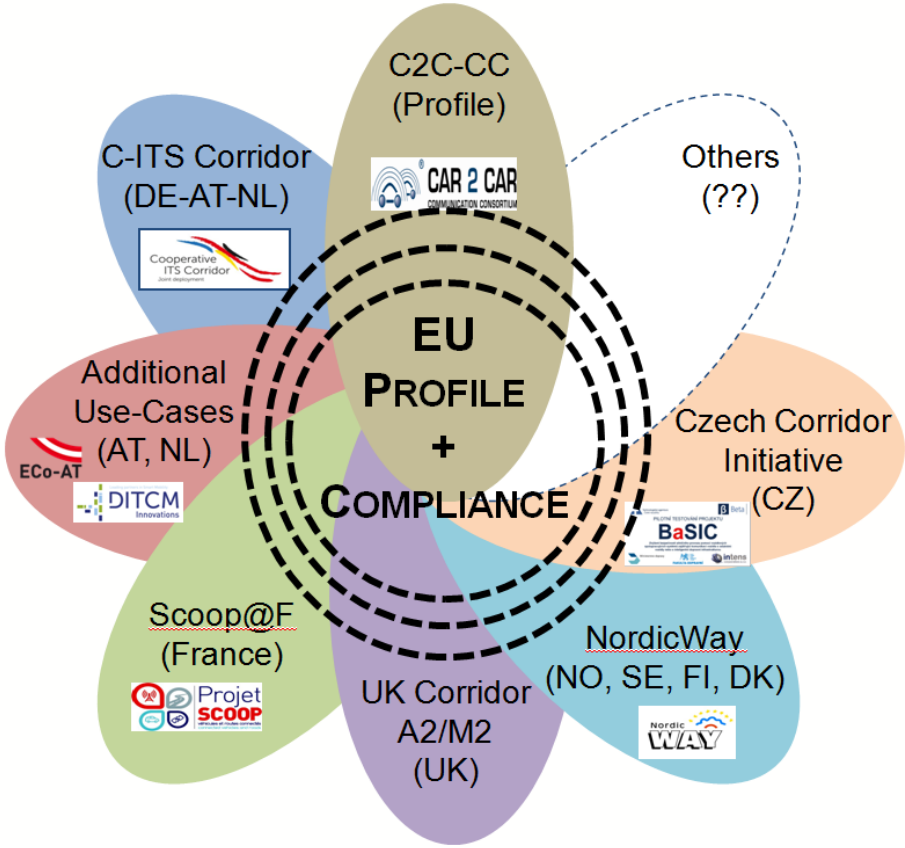
- Direct communication among vehicles, or V2V, has the potential to address approximately **80 percent** of unimpaired multi-vehicle crashes and if collective perception service is included in combined V2V and V2I technologies the potential to address vehicles versus VRU crashes is also around **80 percent** to protect VRU (based on crash data: in Japan 76%, in Germany 83% and in US 84%)

Source: Working document towards a preliminary draft new Report ITU-R M.[CAV] - Connected Automated Vehicles (CAV) https://www.itu.int/dms_pub/itu-r/md/19/wp5a/c/R19-WP5A-C-0708!N16!MSW-E.docx

Challenges

- Communication standards provide a huge toolbox as framework
- A detailed manual is needed how to use the tools properly
  - ➢ Profiles
- Communication requires sender & receiver to use harmonized profiles
- At least an agreed common core is required





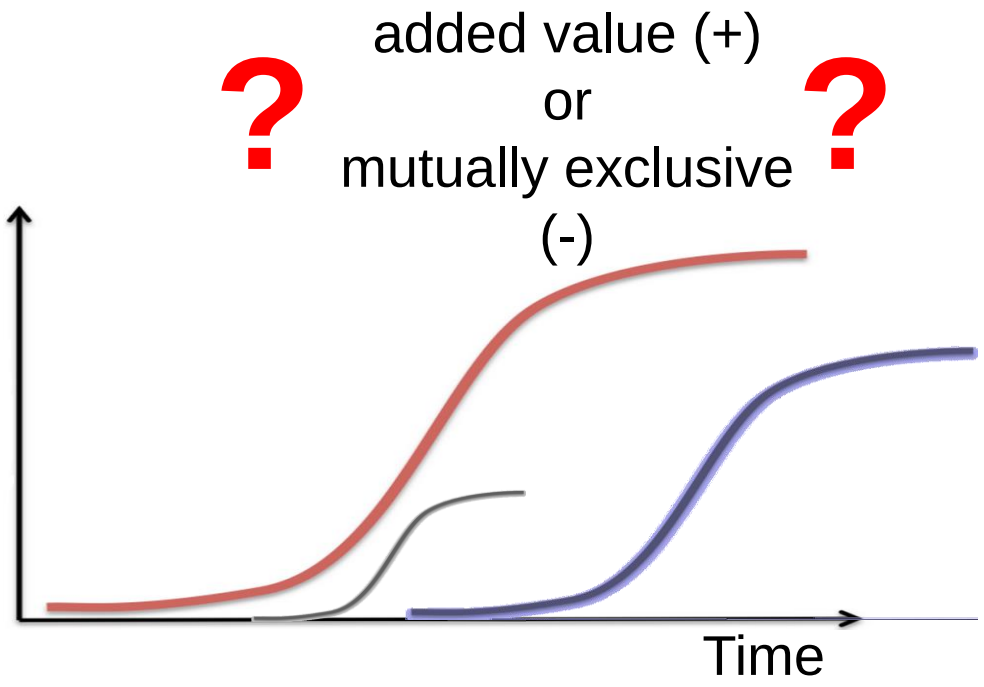
Source: BASt, CODECS project

Challenges

- Ramp up of penetration rate takes time
  - Highest benefits when each vehicle/actor can communicate with every other
  - Non-interoperable solutions problematic

- Consider transition from older to newer generations
  - Avoid starting from scratch again
  - Capabilities/functionalities might be added removed

- Stability and flexibility required
  - Backward-compatibility across versions of standards
  - Need to adopt new use cases / developments



Challenges

- Vehicle manufacturers interested, but mostly cautious/hesitant
  - The first frontrunner needs to consider „the chance to explore new markets“ versus „the burden to solve all problems for followers“?
  - Keep data in silos and under control or open up for an increased benefit?
  - Which technology to use – and on which market?

- Infrastructure operators willing to modernize, but resources are limited
  - Infrastructure has long life cycles (20, 30, 40 years), technology might become outdated

Challenges

- Vehicle Challenges in many areas
  - Organizational (governance, roles and responsibilities, resources)
  - Technical (interoperability, specification details)
  - Functional (selection of services, interpretation of use cases)
  - Legal (compliance, liability)

- Majority not solvable on an individual basis
  - Changes on the sender side impact receiver
  - Certainty needs to be established along value chains and in value networks
  - Aspects like acceptance are rather social considerations

Need for regulation

- Harmonized approach for vehicle technology
- Enable vehicles to receive messages (e.g. hazard warnings)
- In the area of direct communication, commitment to one technology or enabling coexistence
- Hybrid communication offers the possibility, through the dual approach, that information can be passed on to the relevant vehicles via several channels in a way that promotes safety
- Counteracting fragmentation and increasing planning security

Federal Ministry for Digital and Transport

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