ETSI
The Standards People

Security Conference

# Road-Map Towards  Dynamic Trust Assurances for Safety and Security Convergence in Safety-Critical Systems


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# CONNECT

- Continuous and Efficient Cooperative Trust Management for Resilient CCAM
- Cooperative, Connected and Autonomous Mobility

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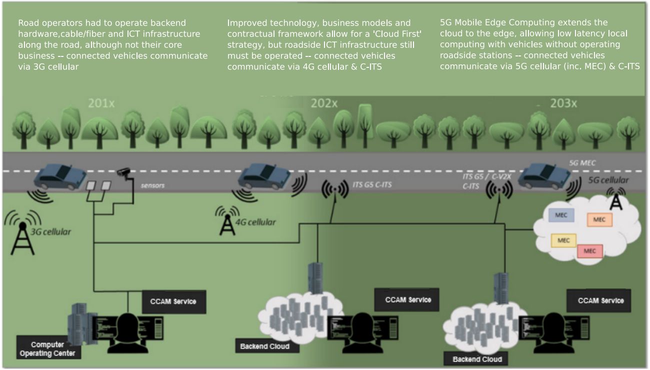
# MEC support for CCAM services




Source: based on Ertico

## 5G & Mobile Edge Computing

- 5G provides URLL communications
- MEC close to the service user
- → Low latency local computing
- → Support for safety-critical CCAM services

## Service example: platooning

- Automated highway corridors
- Platoon remotely managed by the MEC

# MEC support for CCAM services: challenges

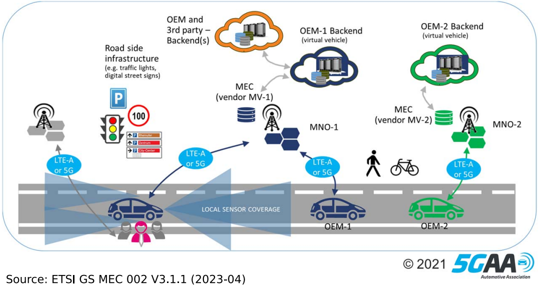


Complex system

- Multi OEMs
- Multi MNOs
- Multi service suppliers

→ Heterogeneous data sources, distinct security domains

→ Impact on the system's security




Source: ETSI GS MEC 002 V3.1.1 (2023-04)

# MEC support for CCAM services: challenges

## Complex system

- Multi OEMs
- Multi MNOs
- Multi service suppliers

→ Heterogeneous data sources, distinct security domains

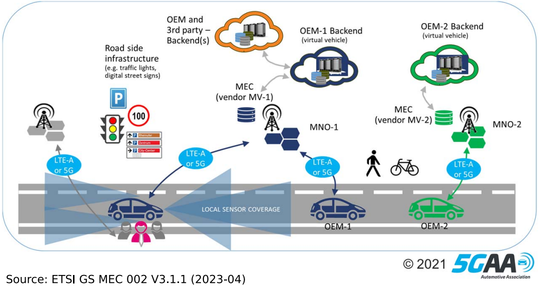
→ Impact on the system's security

## Challenge

- Collaborative data sharing between security domains
- Functional safety assurance

→ Need to dynamically assess trust to achieve resilience

→ Zero-trust principle



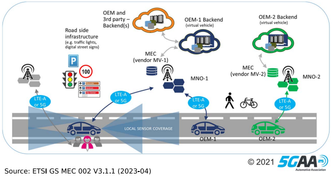

Source: ETSI GS MEC 002 V3.1.1 (2023-04)

## Platooning example

- Discovery of the MEC service (no shared trust domain)
- Handover between different MNOs / different vendors

# Trust in CCAM applications

## Trust across the system

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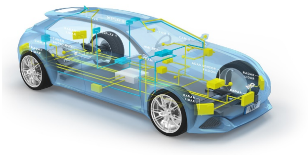
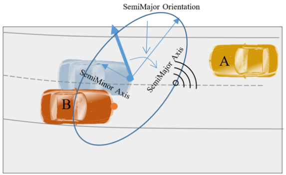
## Trust within the vehicle

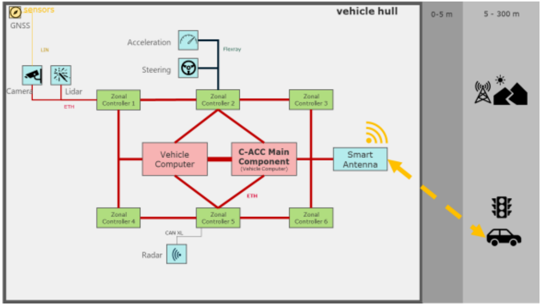


## Trust in the data




Dynamically assess trust between interacting components to achieve resilience

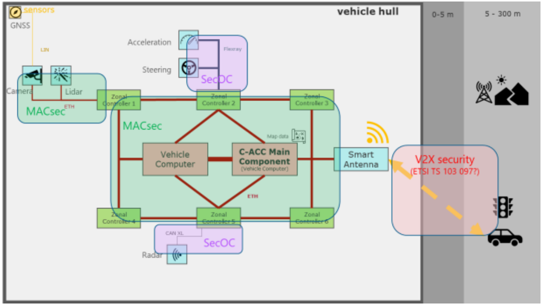
# Use case: trust needs in C-ACC




## C-ACC

- Cooperative - Adaptive Cruise Control

# Use case: trust needs in C-ACC




## C-ACC

- Cooperative - Adaptive Cruise Control

## Security features

- Bus between GNSS and camera unsecured
- Integrity protection on sub-networks only
- Integrity on dataflow through ZC1 non guaranteed

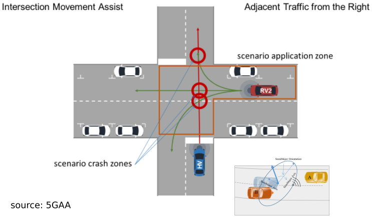
## Trust need example

- C-ACC component → camera
- Trust defined w.r.t. end-to-end data integrity

# Use case: trust needs in IMA

## Intersection Movement Assist

- Alert of collisions danger in the intersection
- Based on C-ITS messages (CAM and CPM)




source: 5GAA

kinematic data

# Use case: trust needs in IMA

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- Alert of collisions danger in the intersection
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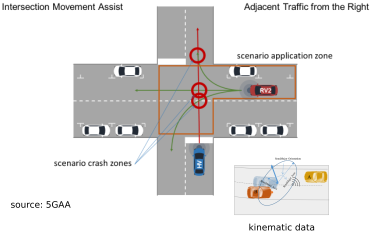


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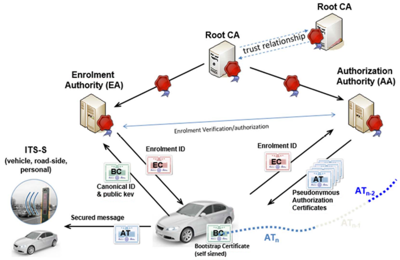
## ETSI C-ITS PKI




- Acces control & privacy
- Message: sender autenthication & integrity
- Misbehaviour: incorrect kinematic content in the message (intentional or not)

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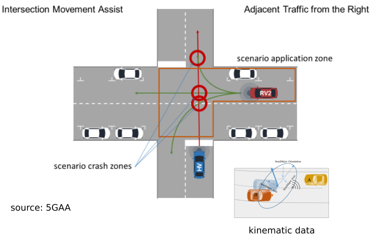


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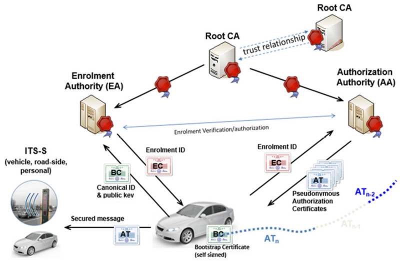
## Trust needs

- IMA application → kinematic datapoint
- Trust defined w.r.t. datapoint correctness

## ETSI C-ITS PKI

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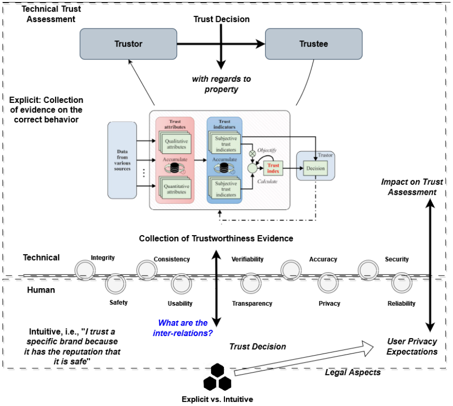
# CONNECT: Trust modeling and assessment




## Trust relationship

- Between a trustor and a trustee, w.r.t. a property or task
- Allows to take a trust-related decision w.r.t. task

→ Expected behaviour of the trustee

## Trustworthiness

- Measure of the ability / compliance of the trustee

→ Technical assessment: based on the collection of trustworthiness evidence

→ User privacy expectations influence allowed evidence

## CONNECT's Trust Assessment Framework (TAF)

- Framework to continuously assess the collection of trust relatioships relative to a function (trust model)

horizon-connect.eu

# CONNECT: Trust enablers

## Zero-trust paradigm

- Never trust, always verify

## Trustworthiness evidence

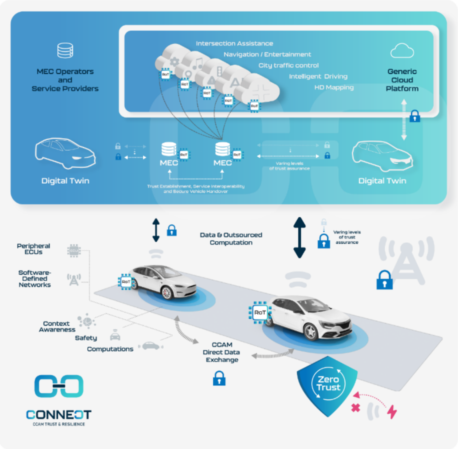
- Trustworthiness evidence collected by verifiable means
- Continuous verification of the configuration integrity of the underlying hw and instantiated sw stack
- Continuous verification of the of the execution state of the target system during runtime

→ Design a distributed Root of Trust supporting both the vehicle and the MEC for enabling trust

→ Leverage trustworthiness claims (as defined by IETF) for disclosing the attestation results as a trust source

## Do not breach privacy

- Collecting evidence shall not break privacy profiles



# Exemple: IMA use case

## Trust needs

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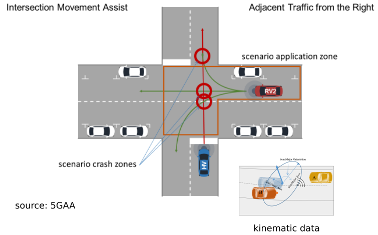


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## What verifiable evidence?

# Exemple: IMA use case

## Trust needs

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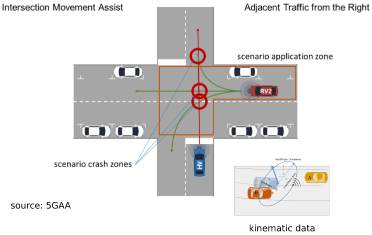



## What verifiable evidence?

## Misbehaviour detection and reporting

- Local Misbehaviour Detection: detect incoherence in C-ITS messages (based on kinematic model)
- Misbehaviour Reporting: report misbehaviour detectors to backend

## Harmonised attributes (TCs)

- The vehicle verifies attestation evidence of integrity of internal components
- Trustworthiness claims (TCs) to the outside do not expose internal evidence
- Harmonized attributes are signed with anonymous credentials leveraging zero knowledge signatures

# Exemple: IMA use case (cont.)

## At the MEC

- TAF uses vehicle TCs and Misbehaviour Reports (MRs) as evidence for assessing trust in V2X-nodes
- The MEC provides trust levels of V2X-nodes as a service (V2X-Node Trustworthiness Message)

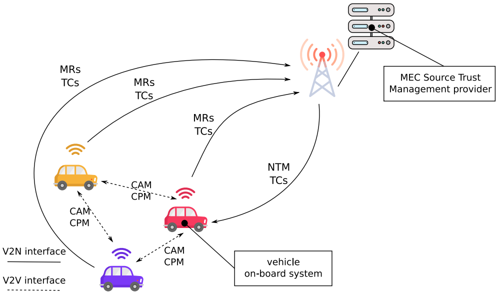
## At the vehicle

- TAF uses local misbehaviour detectors as evidence for assessing trust in data from V2X node
- TAF also uses trust level on the emitter V2X-node as evidence

## IMA application

- The IMA consumes only trusted kinematic data

→ It can rely on a more accurate view of the scene



# Conclusions



## Challenges in complex, multi-entity systems

- Increasing complexity has impact on the security of services

## Dynamic trust assurance

- Zero-trust principle
- Perform trust-based decisions grounded on verifiable evidence

→ Trust model: definition and assessment framework

→ Trustworthiness evidence: open questions

- What could be a base for mutual trust (e.g., quality of data, development process data, etc)?
- Which data is evidence, and on which basis (per function, per function class, per component?)
- Who are the stakeholders and what role do they have (e.g., standardization, regulation)?
- What is needed for acceptance and homologation?

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If you need further information, please contact the coordinator:

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