Towards ITS deployment

November 6, 2015

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Smart mobility, TU/e wide

Cooperative Driving (platooning), A270: Helmond-Eindhoven, 2011
(Mechanical Engineering/TNO)

Full electric: Lupo (ME)

Full Solar: Stella 1

Strategic Area Smart Mobility
And of course, Stella LUX
Smart mobility, TU/e wide

- 4X Local controllers for steering, braking, suspension;
- Front and rear IVDC;
- 1X Global IVDC state estimation and supervisory control.

(Semi-)independent developed components by various partners!

Hybrid Innovations for Trucks (HIT) project

Safety-Critical Domain Certification

InMotion, Solar Team, “Cars in Context” TU/e projects

Functional safety methodology (PDEng projects)
Agenda

• Towards ITS deployment
  – ‘roadblocks’ for progress
  – elements of forthcoming projects
  – CONVERGE solutions

• Ongoing, and new projects
What are we talking about?

C2C-CC (Car2Car Communication Consortium initiated by six European car manufacturers) architecture (~2010)
Towards deployment

• Many pilots ongoing
  – e.g. A67, A58 in the Netherlands
  – VIBe consortium
  – won’t try to list them all

• Do they form a path towards deployment?

• Can we have access to large numbers of vehicles and large test sites?
Privacy, Safety, and Security

• **Privacy**: control over personal information

• **Safety**: freedom from danger or risk on injury resulting from recognized but potentially hazardous events

• **Security**: regulating access to (electronic) assets according to some policy
  – *policy*: allowed and disallowed actions
  – *security mechanisms*: can be regarded as enforcing the policy

• Privacy and safety restrictions result in *security policies*
  – security for privacy and security for safety
Deployment: security

• Security for safety is a must?
  – perhaps trust-based solutions work

• Privacy is a big concern, but
  – what is the threat model precisely?
  – and is this threat worse than what can be tracked anyway?
  – can we work with trust?

• Installing PKI infra should not be a problem
  – but who is the authority?
  – CONVERGE has a solution to this

• CONVERGE has solutions. Is this solved now?
Certification

• Third party ITS application development
  – on top of an (open) stack inside vehicles
  – on top of collected data in the cloud

• Development process of safety critical systems
  – ISO 26262

• See previous slide: trust anchors

• CONVERGE has solutions for this, and a programming concept
  – services, compliance, certification
  – layered service discovery
  – proxy-based forwarding
Next Generation Vehicle OS...
VIBe consortium: cloud based apps
ISO 26262: functional safety

- Safety under performing normal functions
  - avoid excessive risk of normal functions
  - examine and deal with common failures [fault → error → failure]
- Explicit ‘safety life cycle’ for automotive products
- ‘Safety goals’ classified in risk classes, are determined for each ‘hazardous event’
  - risk class: ASIL, Automotive Safety Integrity Class
    - QM, ASIL A-D, order of magnitude of risk
    - combination of severity, exposure, controllability
      - e.g S3, E4, C3: life threatening, highly probable, difficult to control (ASIL D)
- Adherence to ISO 26262 expected to increase
Deployment: scalability

- Message loss in 802.11p as function of number of vehicles in neighborhood
  - interference
  - hidden nodes

Model, analysis, and improvements for V2V communication based on 802.11p, Batsuuri, Bril, Lukkien
Deployment: scalability

VD = 48

SMR ~ 78%

CDF of vehicles

SMR (%)
Evolutionary introduction

• Requirement: adding technology / applications that can only make things (some metrics) better
  – implies a restriction in introduced applications
  – Question: considering that technology can fail: can we ever accept a situation where failure of this new technology would break safety?
    • compare to flat tires or failure of power steering

• For legacy: develop equipment that can have a basic functionality satisfying the above requirement
Stakeholder inclusion

• Different governmental bodies

• Manufacturers

• Application developers

• CONVERGE has proposals for this
Communication

• Is there IPv6 bandwidth in 802.11p?

• Will RSUs be there or will it be 5G?

• Do we need QoS management?
  – CONVERGE has solutions for this
  – also for combining 5G and G5
Science or Engineering

• Is research needed?
  – some at least to examine emergent effects

• Or just engineering?
  – yes, a lot
  – needs planning instead of bottom up growth

• Or legal matters? Laws?
  – yes

• Getting the right partners to team up?
  – yes, stakeholders must be included, and facilitated
Ongoing

• Cooperative driving (iGame)
• Autonomous driving (iCave)
• Applications, application development
  – trust and security
  – application stack inside vehicles
  – applications on top of cloud collected data (VIBe)
• Functional safety
Project opportunities

• Horizon 2020, testbeds
• ITEA? (software intensive systems)
• other programs?
• With who?
Discussion