



ENSEMBLE

Technical Implementation & Achievements

Dehlia Willemsen (TNO), September 23, 2021

Table of Content



Technical implementation

- Objectives
- Approach



Achievements

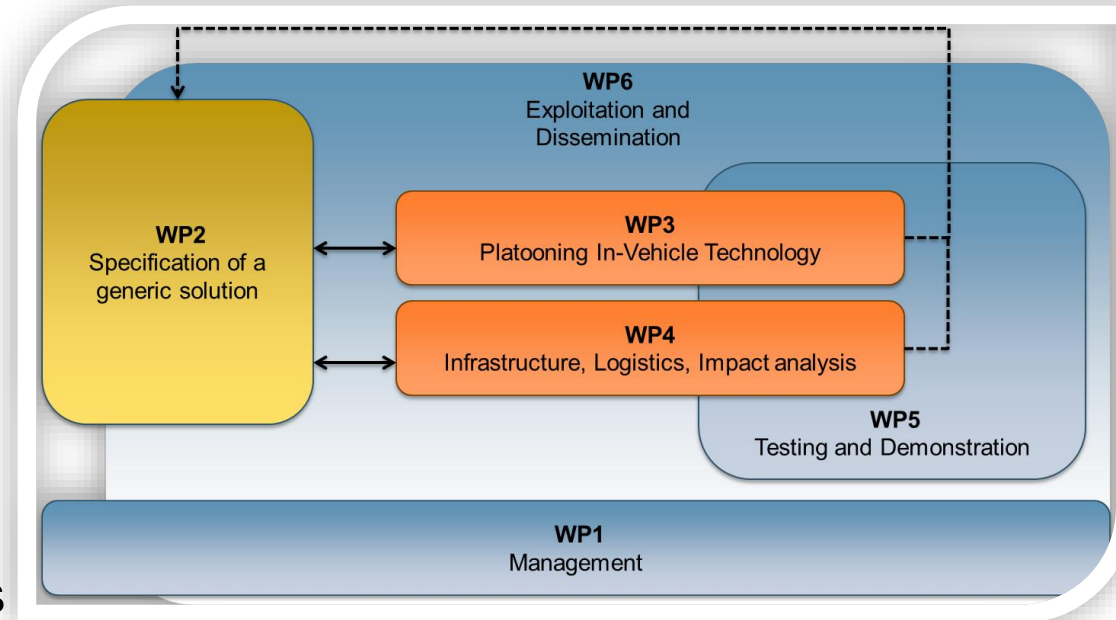
- Development
- Testing
- Feedback on Specifications and Requirements
- Technical Evaluation

Technical Implementation



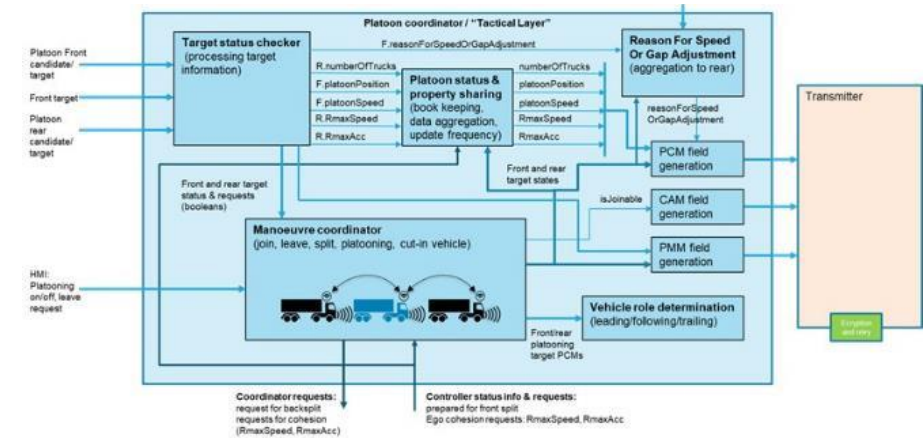
Objectives

- Design and implementation of a platooning system according to the specifications
- The Platooning Support Function is implemented
- Technical evaluation of the generic multi-brand platooning solution
- Validation of the implementations via physical tests on test track
- Multi-brand platooning testing on public roads
- Demonstration of the multi-brand platoon solution on public roads



Approach (1)

- Reference implementation
 - Common functionality only
 - Tactical Layer: available to the partners
 - Real-time implementation in HIL simulator
 - Verify Specifications and Requirements
 - Review
 - Issue list for details of implementation
 - Change request list for Specs and Reqs
 - WP2 feedback



Approach (2)

- OEM specific implementations
 - Equipping the trucks
 - Design the functionality
 - Mono-brand testing
- Dual/triple/quadruple-brand testing
- Multi-brand testing



Achievements



- Each OEM had a specific task in the project
- A common communication device was provided
 - reference implementation of communication messages
 - basic protocol in a test tool
- Examples of items we discussed about:
 - Join at large distances
 - Leave by braking
 - What to put in 'PlatoonID' field?
 - Join timeout: how long to wait for the join response and starting receiving the PCM message?



Dual / Triple / Quadruple testing



9-12 March 2020	AstaZero, Sweden	Volvo group, Scania, MAN
14-16 September, 2020	Helmond, Netherlands	DAF, Daimler, ZF/Wabco
23-25 March, 2021	Aldenhoven, Germany	DAF, IVECO, MAN (comm. only)
14 – 18 June, 2021	AstaZero, Sweden	Scania, Volvo group
21-25 June, 2021	Papenburg, Germany	DAF, Daimler, IVECO, MAN
20 – 22 July, 2021	Helmond, Netherlands	DAF, Daimler
16 – 20 August, 2021	AstaZero, Sweden	Scania, Volvo group
23 – 27 August, 2021	Jeversen, Germany	Daimler, IVECO
06-23 September 2021	IDIADA, Spain	DAF, Daimler, IVECO, MAN, Scania, Volvo Group

done in COVID
times!



Testing

- Functionality first
- Signing & Verification and Encryption ‘optional’/’later’
- Tests performed
 - Join from behind and leave: different combinations
 - Steady state platooning with speed variations
 - Emergency braking
 - Cut in
 - Receiving I2V message
- Some of the issues encountered:
 - Alignment of time and matching platooning partner
 - Load of communication box with Signing & Verification and logging ‘on’



Early feedback on Specs & Reqs



- This was actually an ongoing process during the development and testing of the platooning systems
- Examples:
 - KeyUpdate sequences: key management function necessary
 - When to stop sending PCM in leave sequence: after receiving ‘preparing’ or ‘prepared’?
 - When to update certain data fields during joining / platoon merge



Technical Evaluation

- Next months
- Gather all the experiences from 2.5 weeks of testing
- Gather data
- Evaluate data and conclude on the results

- To be presented at the final event next year





Thank you for your attention



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