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12 MAY 22

FINAL EVENT



IMAGinE



Comparing Cooperative Approaches in Simulation

OUTLINE

Simulation Setup at BMW

Existing Driving Functions

Architecture: Integration in Spider

Possibilities enabled by the integration

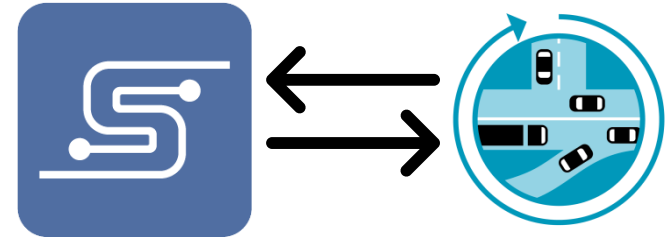
Results

Demo Video

Simulation Setup at BMW



- Goals:
 - Integrate with existing driving functions
 - Compare different cooperation approaches
 - Allow long-term usage and integration
- Use BMW Spider as simulation framework
- Connect Imagine maneuver planner to Spider



Existing Driving Functions

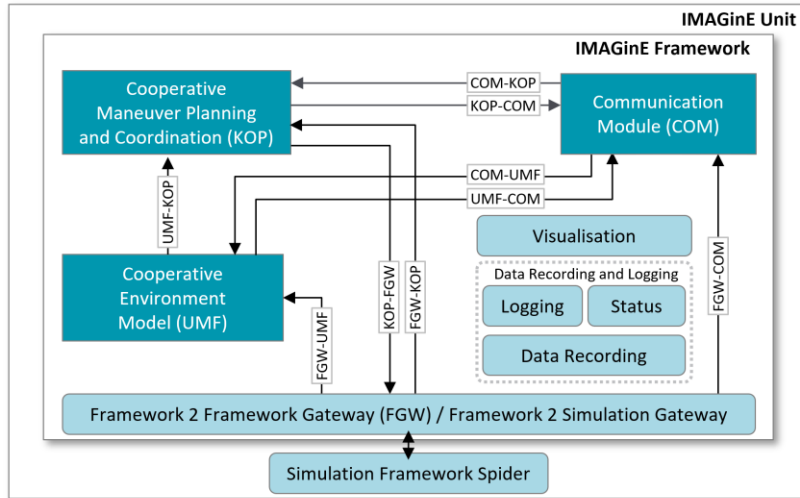


In addition to Imagine maneuver planner, both TRM and AD are already connected to Spider for offline & online simulation.

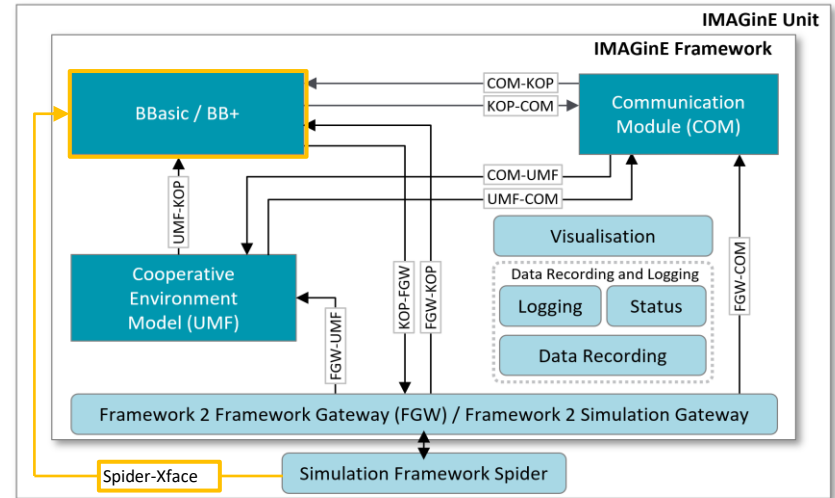
- TRM, extended with cooperation mechanism BBasic
 - Extensive driver model for simulating human driving behavior
 - Cooperation with other vehicles using indicator & prediction
 - Includes various reaction time models
- AD, extended with cooperation mechanism BB+
 - State of the art autonomous driving function developed at BMW

TRM: **T**raffic **m**odel, AD: **A**utonomous **d**riving

Architecture: Integration in Spider



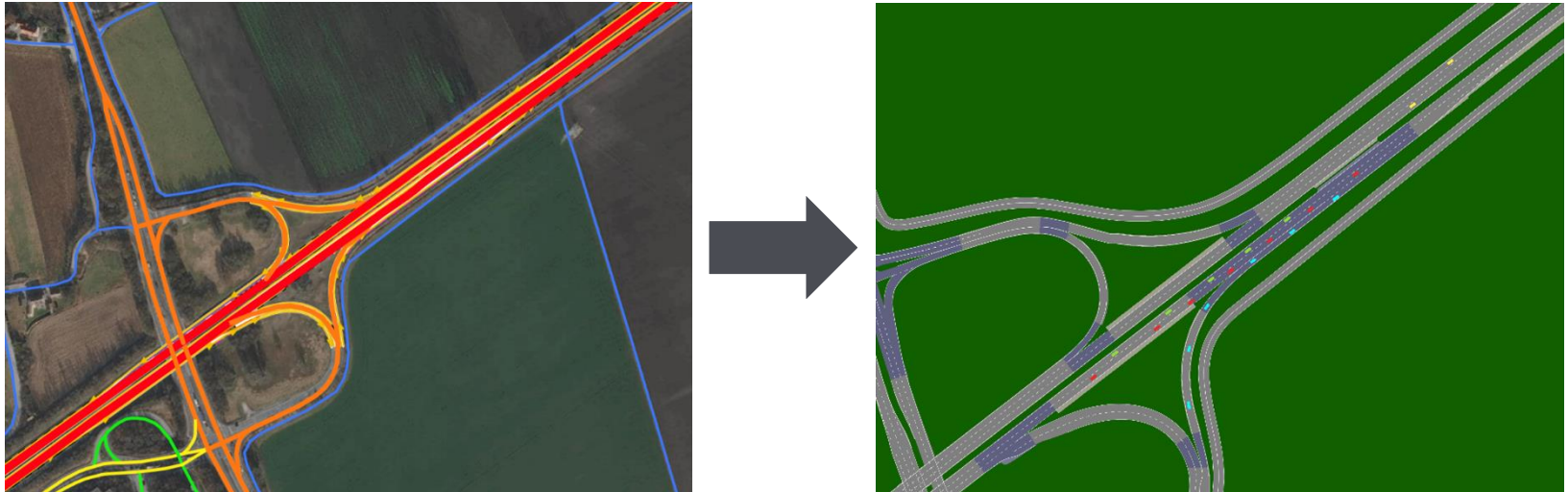
Integration of Imagine maneuver planner in Spider: Identical to CarMaker integration



Integration of BBasic and BB+ in Spider: Xface in addition to IMAGinE data

Possibilities enabled by the integration Map

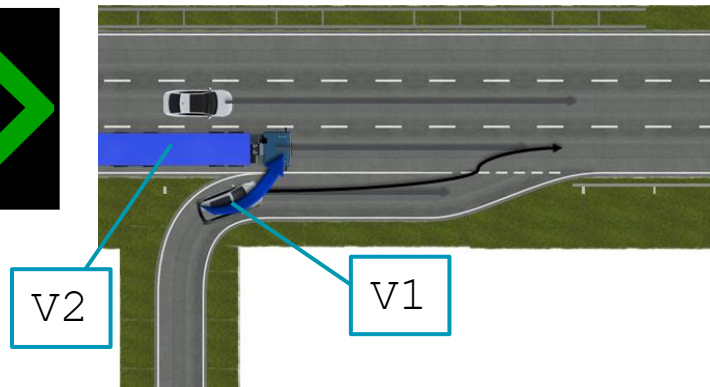
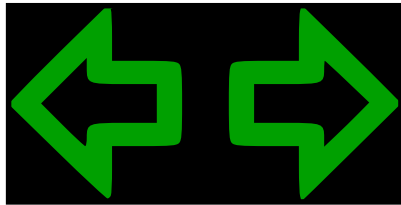
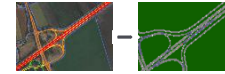
- Complex scenarios on real-world maps



Possibilities enabled by the integration

Communication options

- Complex scenarios on real-world maps
- Comparing communication options

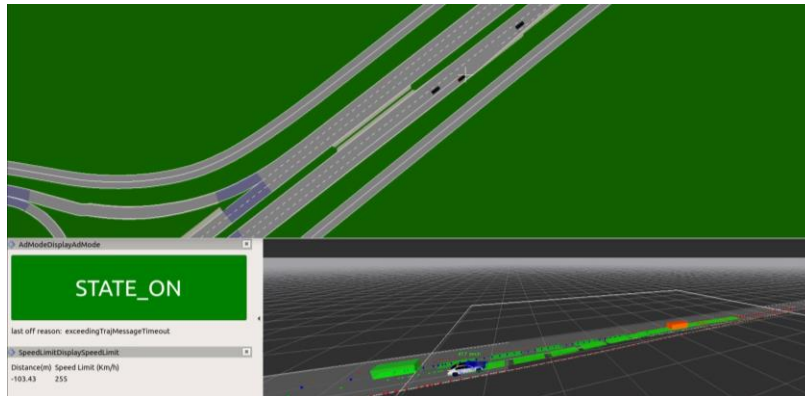
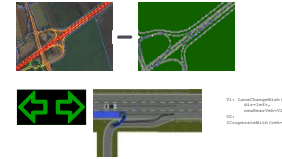


Communication messages:
V1:
„LaneChangeWish(dir=left,
newRearVeh=V2)“
V2:
„ICooperateWith(veh=V1)“

By the example of F1: Cooperative merging on highways

Possibilities enabled by the integration Model interaction

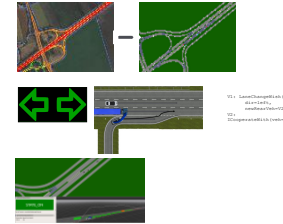
- Complex scenarios on real-world maps
- Comparing communication options
- Testing interaction between different models



Possibilities enabled by the integration

Human interaction

- Complex scenarios on real-world maps
- Comparing communication options
- Testing interaction between different models
- Comparing to human-like behavior

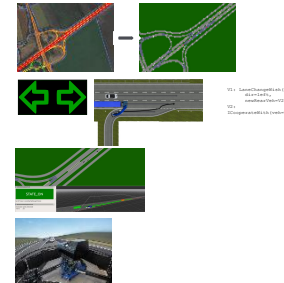


Possibilities enabled by the integration

Summary



- Complex scenarios on real-world maps
- Comparing communication options
- Testing interaction between different models
- Comparing to human-like behavior

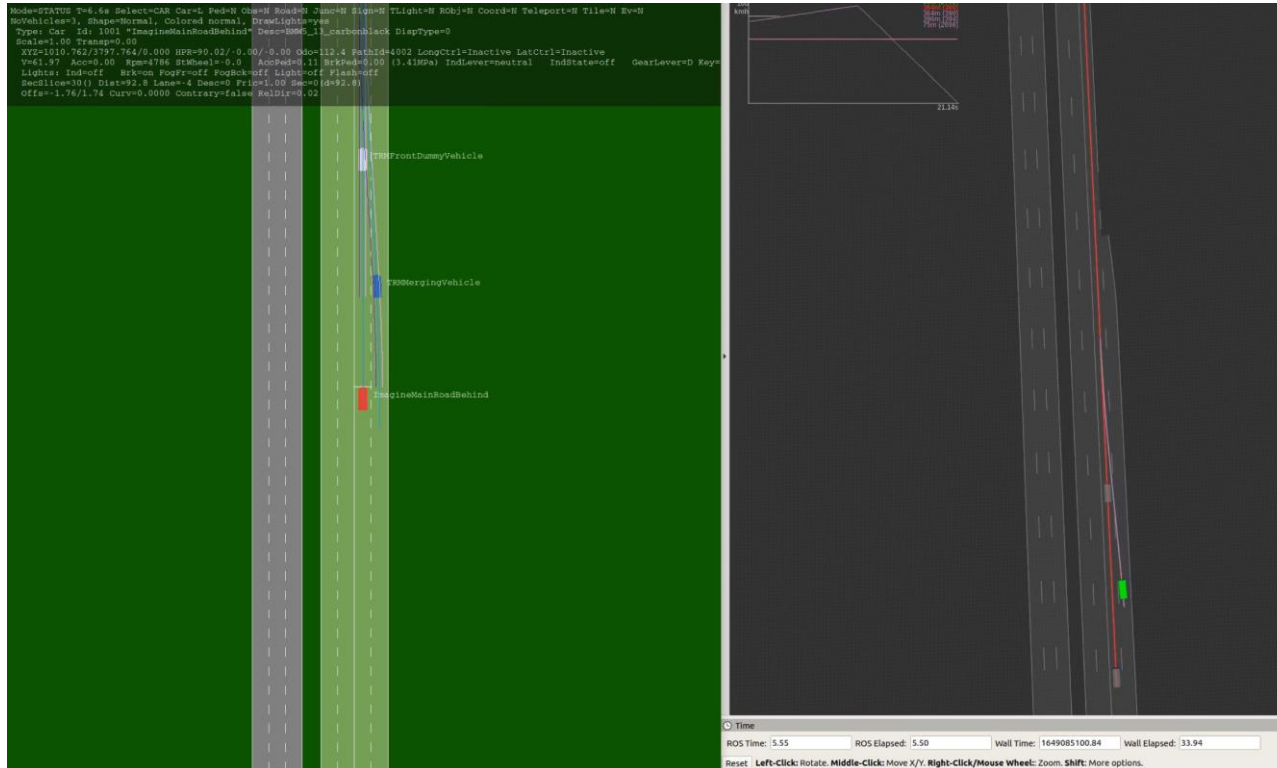


Results



- Cooperation via intention (“Bbasic”) and cooperation via trajectories (“Continuous Cooperation Concept”) led to comparable results in the simulations we did.
- Explicit cooperation confirmation (GRANT) improves cooperation.
- Similar gap sizes very helpful for cooperation between different systems.

Demo Video: IMAGinE maneuver planner & TRM



THANK YOU

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Images: IMAGinE, Unsplash

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