BUDAPESTI UNIVERSITY OF TECHNOLOGY AND ECONOMICS
FACULTY OF TRANSPORTATION ENGINEERING AND VEHICLE ENGINEERING
DEPARTMENT OF CONTROL FOR TRANSPORTATION AND VEHICLE SYSTEMS

Co-simulation design lab

Task description

You will work in groups of three. You are given a scenario (see below) that tests various components of an EGO vehicle (or something related). Design (do not implement!) a co-simulation framework (of at least two software) that can realize the scenario accurately and efficiently.

1. Search the internet for suitable simulator software tools and methods.
2. Explain how the selected simulators can be coupled (what type of interfaces are available, whether the implementation of middleware is necessary, and what data is communicated between the software).
3. Collect the inputs for the scenario and describe the logged outputs.
4. Create a block diagram of the co-simulation architecture.
5. List some arguments for why those programs were selected. What are the benefits and limitations?
6. Create a short presentation (approx. 5 slides) explaining the points above.

Schedule:

5 min: Form groups of three people and select from the topics below.

55 min: Design the simulation framework using the internet (lab PCs or your laptop)

30 min: In a short presentation (you can use PowerPoint or/and the blackboard), briefly explain the co-simulation framework you propose to realize the scenario (approx. 5 min/group).

Scenarios:

1. An EGO vehicle is equipped with a blind-spot detection radar. In this scenario, the EGO vehicle shall travel at high speed on a long highway stretch with moderate traffic. The scenario shall test the accuracy of the blind-spot detection algorithm.
2. This scenario shall test a camera-based lane-keeping function of an EGO vehicle. The function uses image processing to detect puddles (potholes of unknown depth filled with water) and outputs a vehicle trajectory. In the scenario, puddles shall be randomly placed on the road, and the simulated EGO vehicle shall avoid them.
3. In this scenario, the EGO vehicle is simulated on a racetrack. Simulate the evolution of the sound level at different points of the tribune.
4. In this scenario, the reliability of the communication between an EGO vehicle and a downstream vehicle shall be simulated. The EGO vehicle receives a message from the

downstream vehicle that it is emergency braking on a slippery road. The goal of the simulation is to evaluate the braking distance at different communication noise levels.

5. This scenario tests a fuel-efficient routing algorithm for an ICE EGO vehicle. The scenario shall take place in a large urban network with dense traffic. In the scenario, the EGO vehicle shall travel along the route defined by the algorithm. The fuel consumption shall be modeled with high fidelity.
6. In this scenario, a hybrid electric EGO vehicle's emission must be modeled dynamically. To this end, simulate the evolution of the emissions (main pollutants) and their route in a traffic network, fulfilling the requirements of the RDE (Real Driving Emissions) cycle.
7. Test a vehicle platoon (around 5-10 vehicles at the same time) in a freeway context. The freeway scenario must include Variable Message Signs with dynamic speed limits and other vehicles. Adaptive Cruise Control (ACC) is assumed to be applied by all vehicles.
8. Simulate a centralized, autonomous intersection. Assume all vehicles are equipped with V2X devices communicating with an RSU. The goal is to evaluate the throughput of the intersection at different traffic volumes.