Co-simulation of vehicles and crowds for rescue trials

Yun-Pang Flötteröd1\*, Michael Behrisch1, Martijn Hendriks2, Jean-Benoit Bonne3, Erik Vullings4, Rinze Bruining4

1 German Aerospace Center (DLR), Institute of Transportation Systems, Germany

2 XVR Simulation, The Netherlands

3 Thales SIX GTS France, ThereSIS – AS&BSim, France

4 The Netherlands Organisation for applied scientific research (TNO), The Netherlands

\*yun-pang.floetteroed@dlr.de

Abstract

Crisis management (CM) is getting more and more attention worldwide. Different tools and solutions have been developed. The interoperability between these tools and solutions is however still questionable and needed to be enhanced in order to handle crisis situations with various aspects (e.g. rescue procedure, vehicle routing, crowd evacuation, flood prediction) in a complete manner. To facilitate efficient and effective CM-trainings, trials and tests the EU-funded project Driver+ has developed an open source cloud-based test-bed, based on the distributed messaging platform Apache Kafka. This test-bed has linked up different solutions and simulators for being able to meet the needs of proposed trainings and experiments. Several trials have been executed and experiences have been gained for further test-bed enhancement. In this paper, the main focus is put on the integration of XVR, SE-Star and SUMO simulators in the Driver+ test-bed, where XVR provides different learning environments for all levels of incident command, SE-Star handles crowd simulation and SUMO focuses on vehicular simulation and routing. With the cloud-based test-bed and the provided time management service these simulation tools can synchronically exchange information with each other in the connected systems. A simulation scenario around the world forum in The Hague, Nederland is established for demonstration of the connected systems.

1. Introduction [DLR]

* The importance of the crisis management/ needs for tools for practical trainings
* Briefly introduce Driver+ project and its progress and the executed/planned trials

1. Test-bed and simulators
   1. Driver+ Test-bed [TNO]

• framework, current development and functions, format…

* 1. SE-STAR [Thales]
* Brief introduction about SE-STAR
* Connectors built for coupling with the test-bed/XVR
* functions
  1. XVR and XVR RM [XVR]
* Brief introduction about XVR and XVR RM
* Connectors built for coupling with the test-bed/SE-STAR
* functions
  1. SUMO-Connector [DLR]
* Connectors built for coupling with the test-bed
* functions
  1. Coupling concept [DLR,XVR, Thales]
* XVR with SE-STAR [XVR,Thales]
* XVR.RM with SUMO [DLR,XVR]
* Message sending between XVR, SE-STAR and SUMO [DLR, XVR, Thales]

1. Scenario
   1. Description and setup [DLR, XVR, Thales]

• scenario description [DLR]

• setup and applied models:

* XVR [XVR]
* SE-STAR [Thales]
* SUMO [DLR]
  1. Action plan [DLR]

• Sequence diagram

1. Conclusion [DLR, XVR, Thales, TNO]

* Limitations of the coupling
* Future Work

1. Acknowledgements

The authors gratefully acknowledge the funding of the DRIVER+ project received from the European Union’s 7th Framework Programme for research, technological development and demonstration under Grant Agreement no. 607798.

References

Vullings, Erik, van Campen, S., Hameete, P., Hendriks, M. (2019). Cloud-based M&S for Trails and Exercises. In *2019 30th International Forum for the Military and Civil Simulation, Training and Education Community (ITEC)*, May 14-16, Stockholm. (accepted)

Lopez, P. A., Behrisch, M., Bieker-Walz, L., Erdmann, J., Flötteröd, Y.-P., Hilbrich, R., … Wießner, E. (2018). Microscopic Traffic Simulation using SUMO. In *2018 21st International Conference on Intelligent Transportation Systems (ITSC)* (pp. 2575–2582). IEEE.