cosima: Integrating OMNeT++ into the co-simulation framework mosaik

Frauke Oest[1,2], Malin Radtke[1,2], and Emilie Frost[1,2]

[1] OFFIS – Institute for Information Technology, Oldenburg, Germany
firstname.surname@offis.de
[2] University of Oldenburg, Oldenburg, Germany
firstname.surname@uol.de

1 Abstract for OMNeT++ Community Summit

In the domain of smart energy systems, co-simulation is used to connect heterogeneous simulators representing e.g., power plants, analysis or control strategies (for example multi-agent systems). The python-based co-simulation framework mosaik is able to orchestrate the data exchange and time synchronization between individual simulators and simulates in discrete time and in discrete events. The latter functionality enables the efficient coupling of communication simulators, where events are happening sporadically and a fine-grained time resolution is needed, whereas other simulators are operating in a different, less detailed time resolution.

The project cosima (**co**mmunication **sim**ulation with **a**gents) integrates OMNeT++ as a communication simulator for mosaik in order to simulate the data exchange between mosaik simulators more realistically. Therefore, mosaik messages are simulated through a OMNeT- and INET-based network, so that the dynamic behaviour of the communication is regarded and made available for mosaik simulators. This includes for example the integration of end-2-end delay information from OMNeT++ into the scheduling of messages in mosaik.

In the current implementation, we consider multi-agent systems where each agent is implemented as a mosaik simulator. Their message exchange is simulated in OMNeT++.

The current implementation provides several features. These can be easily set or customized in an included configuration file, allowing for easy execution of many different scenarios. This includes for example infrastructure changes. The changes are given dynamically to OMNeT++ by the mosaik simulators during runtime and include the disconnect or reconnect of clients, routers or switches. This allows the consideration of dynamic changes in the infrastructure and communication disruptions.

Our project includes many networks implemented in OMNeT++, which allows the simulation of different situations, for example with different numbers of hosts or different locations. So far, cosima has been tested with up to 50 agents.

Moreover, the connection of the given mosaik simulators with plant simulators is provided. Each agent simulator can be connected to a photovoltaik (PV) plant and thus control it. The simulated PV plant stores power values for a given time and forwards those to the agent, which can then make adjustments or take control actions. Due to the generalized interface of cosima, it is easy to integrate further simulators to enable more scenarios.

In addition, collected information (e.g., the number of simulation steps or messages exchanged) provides a comprehensive overview of the simulations performed. This can also be used to create evaluation graphs that help to analyze the simulation.

Availability of data and materials

The code can be found at: https://gitlab.com/mosaik/examples/cosima
For further information, have a look at our website: https://cosima.offis.de/
Preprint of our paper in which we present cosima: https://arxiv.org/abs/2209.12550