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Using TimescaleDB and Apache Superset to support Co-Simulation Data Exploration

Co-Simulation is a technique commonly used in research to analyse complex systems that are hard to simulated by monolithic simulation models. In co-simulation, different models are used simultaneously to represent a system. Especially in the energy sector, where the systems often have many components, co-simulation is a standard solution. Mosaik is an open source co-simulation tool developed for the energy domain. It allows to couple multiple models very flexibly, wherefore simulations with complex dependencies can be set up. When running a simulation through mosaik, a multitude of data is generated through the connected models. The analysis of this data is difficult to do and requires knowledge about programming libraries such as pandas and Matplotlib. The goal of this work is to introduce software tools and proper documentation to simplify the process of analysing and visualising simulation data for researchers.

This abstract introduces a Timescale database adapter for mosaik, which allows for a more seamless collection of simulation data. This adapter, in conjunction with Apache Superset, allows for analysis and interpretation of co-simulation data from mosaik. The visualisation through Superset allows researchers to easily demonstrate their findings visually and share them with others. This improves the data analysis process and increases the explainability of research findings.

The presented software is developed as a specialized SQL adapter for the Timescale database. TimescaleDB is chosen, as most generated simulation data is timeseries data, where TimescaleDB offers sophisticated support for.

While the adapter is written with TimescaleDB in mind, it also supports generic Postgres databases. The user can choose between multiple table layouts for storing the data. The adapter is open source under the MIT license and thus accessible for anyone to use or modify for their use case.

Additionally, Apache Superset is chosen as the visualisation tool. Superset is an open source data visualisation tool with an interactive web interface. The usage of the visualization component of this work depends on the actual simulation setup. Nevertheless, due to similarities between simulations in the energy domain, helpful defaults and explanations are given in our tutorial for users to have a quick and seamless experience when first using it in conjunction with mosaik.

To conclude, a TimescaleDB adapter was developed for the mosaik co-simulation tool and a tutorial to visualize the data in Apache Superset was written and published. The adapter is easy to use and, through Superset, enables researchers to make their data explainable and accessible with little programming knowledge needed. In future work, the adapter can be expanded by saving simulation metadata to tables in the database. This allows the researchers to gain insights about the simulation itself, such as simulation time, and enables a better understanding and analysis of the results. Furthermore, more tutorials for using the adapter with different visualisation tools such as Grafana can be added.
Sourcecode: https://gitlab.com/mosaik/components/data/mosaik-timescaledb
Tutorial: https://mosaik.readthedocs.io/en/latest/tutorials/apache-superset.html

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