MATSim in a corporate environment: Simulating MOIA on AWS

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MOIA is an on-demand ride-pooling operator with two services in Hamburg and Hanover[1] and operates with up to 300 special-purpose vehicles in Hamburg, which is the largest comprehensive ride-pooling fleet in Europe.
MOIA uses transport simulations for multiple use cases, and they include the following:

- Understand the implication the ride-pooling system has on the mobility system.

- Test and evaluate algorithmic changes before bringing them to production.

- Analyze changing external circumstances and their effects on the ride-pooling system.

For the transport simulations, MOIA relies on the simulation environment MATSim [Horni et al., 2016], among others, as its agent-based structure and the DRT extension are very well suitable for the simulation of ride-pooling systems. Some of MOIA's employees are actively contributing to MATSim's open-source community, regularly publishing scientific articles using MATSim [Hörl and Zwick, 2021, Kuehnel et al., 2021, Zwick et al., 2021, Zwick and Axhausen, 2020] and support bachelor and master theses.
An extensive tech stack is used to offer MOIA's digital product and allow a data-driven product development with state-of-the-art tools. This tech stack is also available to be used for the MATSim simulations, which allows further automation and analyses of the simulations.
We want to present how MOIA's mobility analytics team uses MATSim in combination with the extensive tech stack of MOIA. Besides inspiring others to improve their pipeline of using MATSim, we hope to receive valuable feedback of other groups dealing with MATSim and other tech environments.
Figure 1 shows the pipeline of regularly triggered simulations of MOIA's historical service. The simulations are used to validate and monitor the simulations' capability to replicate MOIA's real-world service. The simulations are run on the Amazon Web Services (AWS)[2] platform. The input, which is either manually generated or automatically retrieved from MOIA's historical demand and supply data, the MATSim code and an R script for additional analyses is containerized and submitted to an elastic container on AWS. On this container, a simulation job can be run manually for customized simulations or triggered automatically for our regular weekly simulations. The simulation is run on the Elastic Compute Cloud (EC2), which is automatically selected, started and shut-down after the job is finished. When the MATSim simulation is completed, all usual MATSim output files and the R-report are written to the Simple Storage Service (S3) of AWS, from where it can be downloaded or directly analyzed. Additionally, certain output parameters are written to a database in AWS Athena, which allows quick analyses across multiple scenarios. At completion of a job, a Slack[3] notification is triggered to inform all stakeholders that all output files are available.

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[1]https://www.moia.io/en, last accessed: 28/02/2022
[2]https://aws.amazon.com/, last accessed: 28/02/2022
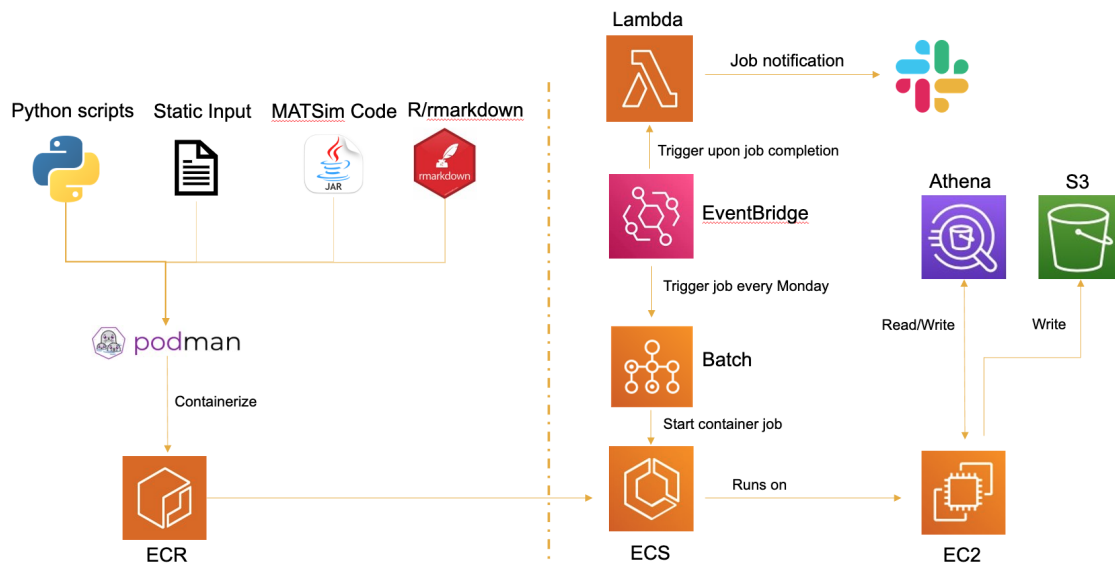[3]https://slack.com/, last accessed 28/02/2022

Figure 1: Structure of used (AWS) services for MOIA's weekly service simulation.

Keywords: AWS; ride-pooling; shared mobility; tech stack; automation

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