Tramola: Improved Editing and Visualizations in Simunto's Modelling Suite for MATSim

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Introduction

The Multi-Agent Transport Simulation MATSim provides a framework for highly-efficient, large-scale mobility simulations. Its focus is on implementing various algorithms and functionality to simulate the travel behavior of large populations, combined with the simulation of public transport vehicles, freight, demand-responsive transit (DRT) and other mobility participants.

Input data for simulations is typically expected in XML files, and output is similarly provided in XML or CSV files. While both file formats are theoretically human readable, the sheer size of the files in realistic scenarios prevents users from making direct modifications to such data. To create case studies, users often write Java code that reads in data, makes the required changes using MATSim's JAVA API, and then writes out a new set of data to be used to simulate the case study. Even simple changes like closing a bridge or changing the allowed free speed for a few selected links become very tedious and time-consuming.

Tramola is a web-application that provides a graphical user interface to manage and edit MATSim scenarios, perform simulation runs and analyze and visualize results. Since its first presentation at the MATSim User Meeting 2021, Tramola has evolved in various important ways.

Improved scenario editing

The existing simple network editing task like changing link properties and adding or deleting links got expanded with more batch-edit functionality. This allows to select multiple links, and change attributes for all selected links in a simple bulk operation.

When editing public transport data, it is now possible to explicitly set the network route of transit lines. This allows to map bus routes to actual links of the road network, or train routes to actual links representing rails. Especially for important client-specific visualizations, the fact that transit vehicles will no longer travel in straight lines through buildings or across natural barriers but follow the actual routes is a major improvement. In addition, it also enables more realistic behavior as transit vehicles might have to share road space and interact with private car traffic.

In the last few years, demand-responsive transit (DRT) has become one of the most-used additional features in MATSim. Case studies often vary the service area, stop locations or the number and initial positioning of the DRT fleet. Tramola now supports editing all these elements and will also support hubs and charger locations for edrt very soon in its easy to use visual scenario editor.

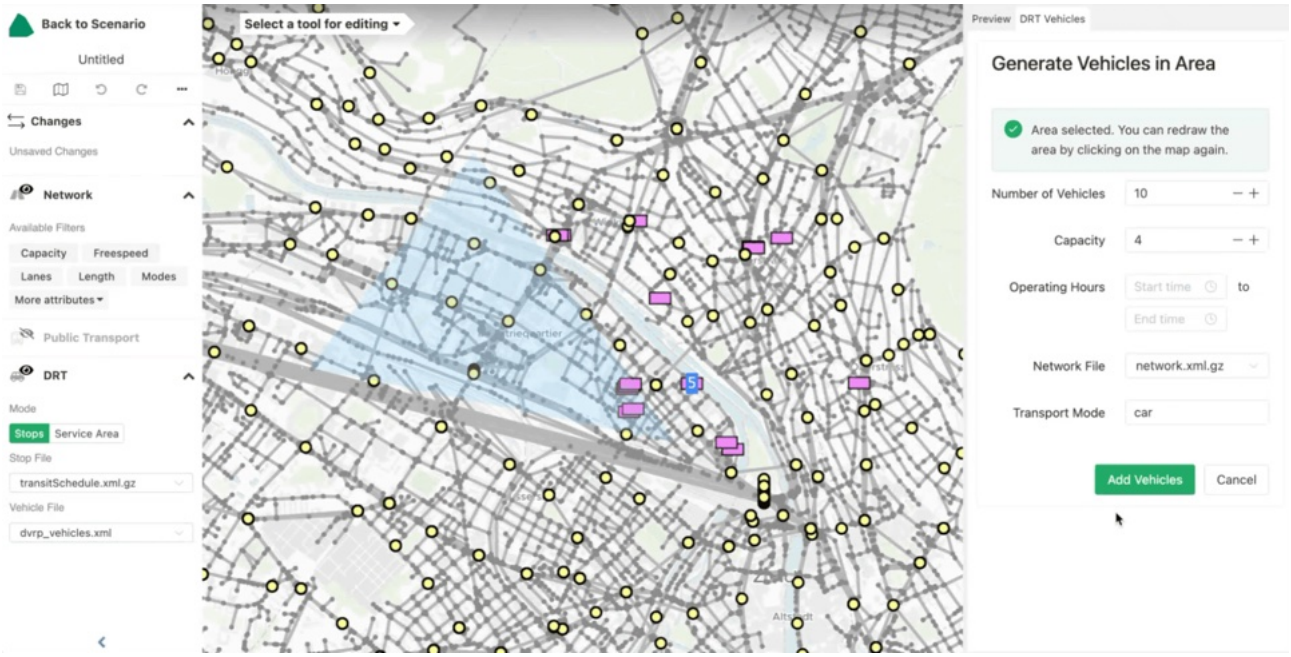

Figure 1: DRT editor

Revamped scenario visualizations and analysis

For visualizing and analyzing MATSim scenarios, a small number of tools exist: OTFVis for basic vehicle visualizations, SimWrapper with numerous dashboards containing statistics for many aspects of MATSim simulation, and Via for powerful, extensive and interactive visualization and analysis functionality even for larger MATSim scenarios. Having all scenario data and run results in Tramola makes it an obvious choice to also offer some visualization and analysis capabilities, instead of forcing users to export the data and use additional tools. For this reason, Tramola has now a few of the most used analysis features built-in.

Visualization of link-volumes, filterable by a number of attributes such as network mode of vehicles, departure or arrival times of the trips leading to the link-volumes, even activity-types before or after the trip, or even person attributes such as age can be used to create specific results.

Figure 2: Link Volumes in the Open Berlin v6.3 10pct scenario for the time between 8am and 8:30am from agents older 20, traveling at least 5 km.

Flow-Bundles (sometimes also called select-link-analysis) aggregate the volumes of all trips leading along a specific road segment. They are an important tool for transport planners to figure out who might be affected from a road closure, or what the catchment area for a specific link is. Tramola now supports this analysis out of the box.

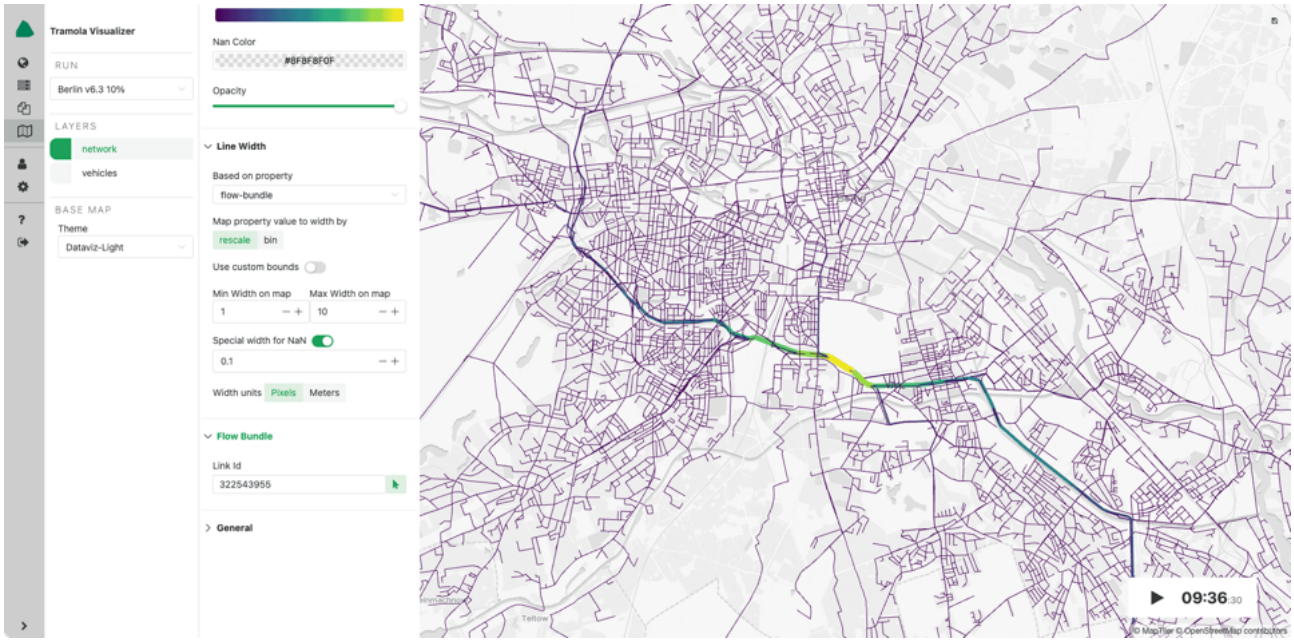

Figure 3: Flow-bundle analysis on the highway south of Tempelhof, in the Open Berlin v6.3 10pct scenario.

When case studies are simulated, the comparison to a base case is an important feature to analyze the actual differences resulting from the measures. Tramola now includes functionality to visualize differences on the network, e.g. to see where the amount of traffic has increased or decreased.

Last but not least, the vehicle visualization that highlights MATSim's fully dynamic capabilities now support various visual representations for the vehicles, including a 3D mode, and coloring based on speed or other attributes. In addition, the visualization has been optimized to support even simulations with multiple millions of agents.

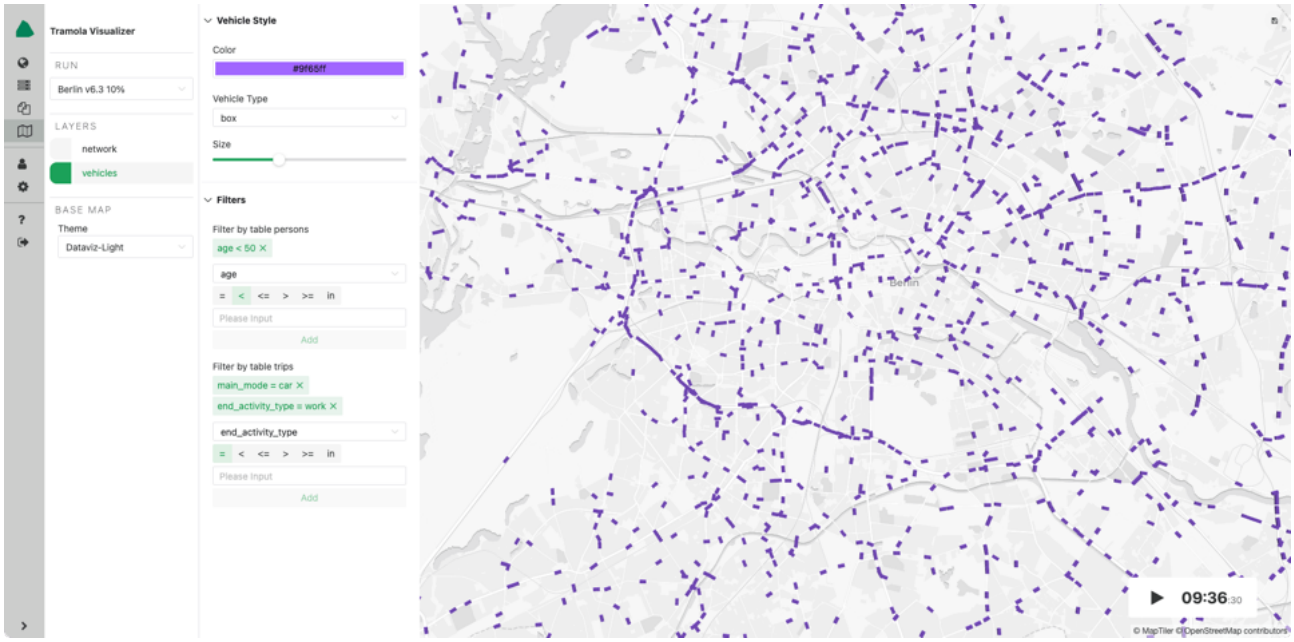

Figure 4: Vehicles driven by agents younger than 50 years on their way to work, in the Open Berlin v6.3 10pct scenario.

Conclusions

Tramola has come a long way since its introduction, providing a powerful environment where MATSim scenarios can be managed and edited, simulations can be configured and run, and results can be analyzed and visualized.