SUBPART NINE

Visualizers

CHAPTER 33

Senozon Via

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33.1 Basic Information

Entry point to documentation:

`http://matsim.org/extensions` → Via

Invoking the module:

Standalone GUI, double-clickable jar file

Selected publications:

`http://via.senozon.com` → Download → manual

33.2 Introduction

Via is an application to visualize and analyze MATSim simulation results. Unlike MATSim, *Via* is not open source; it is developed as a proprietary commercial software by Senozon AG, an ETH Spin-off company founded by two former PhD students involved in MATSim development. Shortly after the company was founded, first (potential) client presentations began; the lack of visual material was an obvious handicap. Explaining to customers that all answers to their questions were contained in a huge events file was not satisfactory; pictures or even animations made it much easier for them to understand. Thus, work on a visualization tool started as soon as the company was set up. Initially planed as a purely internal tool, it quickly became clear that a graphical visualization and analysis tool would also benefit other users of MATSim. After a beta test phase with selected MATSim users in Spring 2011, the first version of *Via* was released in July 2011. Since then, the list of features provided by the application has grown continuously.

Via is written in Java and thus works on any platform able to run MATSim. For easier deployment, the application comes as double-clickable, native executable on Windows and Mac OS X,

partially hiding its Java nature. A limited version is available for free and can be downloaded from the product website (senozon AG, 2015). Different licenses are available for commercial usage or for research or educational purposes to serve different user group needs.

Via includes some general functionality that most people will use in the core application, like visualizing networks, facilities, vehicles and activities. Optionally available plugins provide additional features often relevant only to specialized user groups. This includes functionality related to public transport, comparison with car counts, using web maps like Google Maps or OSM as background, aggregation analyses, or movie recording.

Via allows customization of its window. The following descriptions refer to elements as they are placed in the default layout. The default configuration can be re-created by choosing Reset Window State from the Window menu in *Via*.

33.3   Simple Usage

Via differentiates between data sets, and how the data is visualized. It does so by managing data sources (typically MATSim files like network.xml or events.xml), and layers (e.g., displaying the network, vehicles, activity locations). A layer can use more than one data source for its visualization purposes (e.g., a network and some data from the events), and a data source can be used by multiple layers (e.g., events can be used by many different layers to visualize different things like vehicles, activities, link volumes, etc).

By default, *Via*'s window looks similar to the one shown in Figure 33.1. To add a file as a data source, the file can either be drag-and-dropped onto the layers list left of the black visualization area, or by choosing Add Data... from the File menu. To add a layer, the little plus icon in the lower left of the window can be pressed, or by choosing Add Layer... from the File menu. To get started, it's usually best to add a network and (small) events file from MATSim to Via, and create a Network layer and a Vehicles layer.

Elements shown in the visualization area like the network or vehicles can be queried. Queries are usually provided by layers, made available with buttons with question-mark icons. Clicking
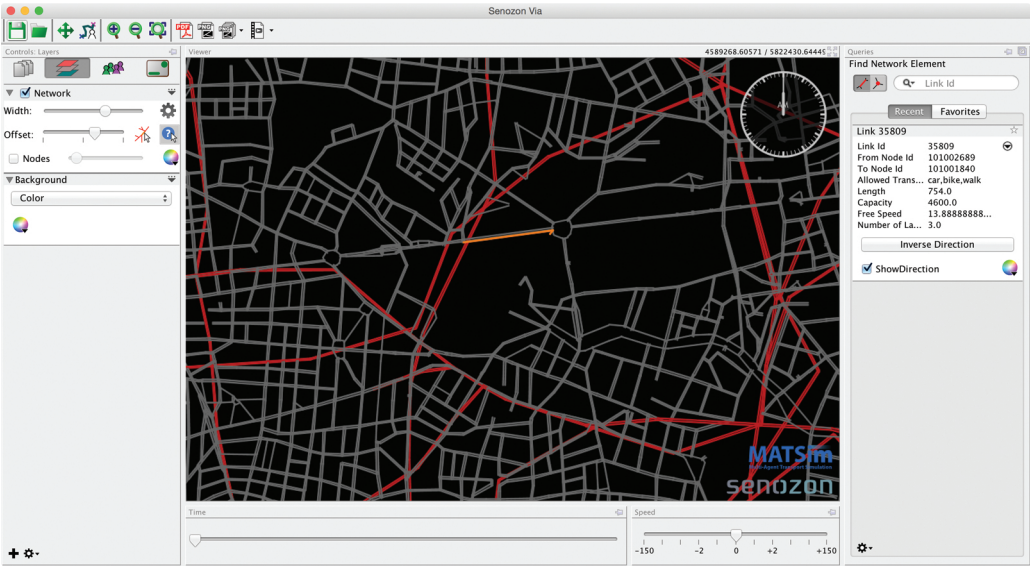

Figure 33.1: Via's window with default layout and a network query being shown.

such an icon activates the corresponding query mode, and any subsequent click on the visualization area will run the query. Query results are shown on the right side of the visualization area. Figure 33.1 shows a network query for links. One query is special, globally available, and not linked to a layer: querying an agent plan. This query is available from the toolbar, next to the icon, to shift the visualization view around.

Once a query has been made, *Via* often allows another query based on the current query results. By right-clicking in the visualization area, a pop up menu appears with more options regarding the last query, as well as additional possible queries. Examples are: `Select Link Analysis` given a link, `Select Facility Analysis` given a facility, `List Transit Lines` that use a given link, or `List Passengers` if a transit vehicles was queried in the first place.

33.4   Use Cases and Examples

33.4.1   Agent Visualization

The animated visualization of agents moving around in the modeled area was one of the main features in *Via*'s original development. To do this, *Via* needs only the `network.xml` and `events.xml` files from a MATSim run as data sources. For the visualization, a `Network` layer, `Vehicles` layer and activities layer must be created. With this setup, vehicles will move around in the visualization area as time progresses, and agents performing activities will be represented as colored dots.

The visualization can be further customized; with the addition of a `population.xml` file, more detailed activity coordinates can be loaded to obtain a better distribution of activity locations (MATSim's events file does not contain coordinates for activities, only the assigned link ID. So by default, all activities taking place on a link are first shown at the location of the link's to-node). Vehicles and groups of vehicles can also be styled differently; it is possible to visualize transit vehicles with a square shape with colors representing the occupancy of the vehicles, pedestrians or cyclists in a multi-modal simulation can be shown as circles and private cars can be displayed with a triangular shape with colors representing their absolute speed or their speed relative to the allowed maximum speed on their current link (see Figure 33.2). As mentioned above, arbitrary groups of vehicles can be styled differently, which is useful to highlight special agents, e.g., when simulating a fleet of electric vehicles, a car sharing fleet, or agents simulated with special routing guidance.

It is also possible to load arbitrary attributes for agents and then use those attributes for visualization purposes, e.g., having different colors for vehicles driven by agents who are employees, have a high income or are within a certain age range.

33.4.2   Facility Analysis

Activity facilities allow for very detailed modeling in MATSim, especially considering the functionality provided by the destination innovation module (Chapter 27). *Via* provides several unique ways to analyze the mobility effects to and from facilities.

For each facility, a detailed analysis can be performed showing the number of agents arriving at, departing from, or staying at a facility over the simulated time. The numbers can be differentiated by the type of activity the agents perform at the facility, by the transport mode they arrive or depart with, or by other arbitrary agent attributes loaded by users.

An alternative analysis is similar to the—for transport planners—well known `Select Link Analysis`, but designed for facilities: the `Select Facility Analysis`. This analysis shows the combined link loads produced by agents arriving or departing at a facility, showing the starting location for agents visiting a specific facility and what routes they use. Figure 33.3 shows such an example.
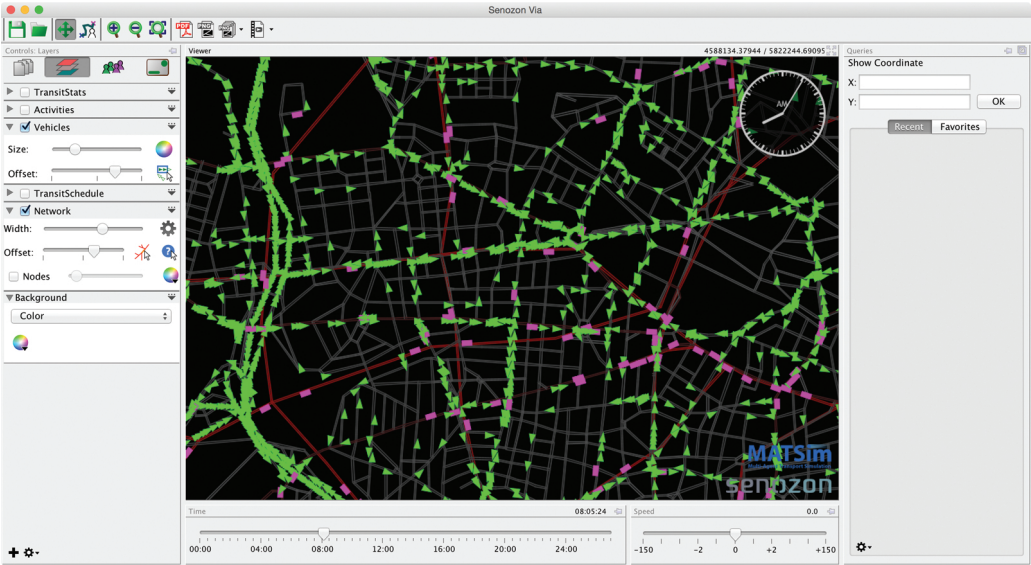
Figure 33.2: Vehicles in Via: Green triangular symbols represent private cars, pink rectangular symbols public transport vehicles.
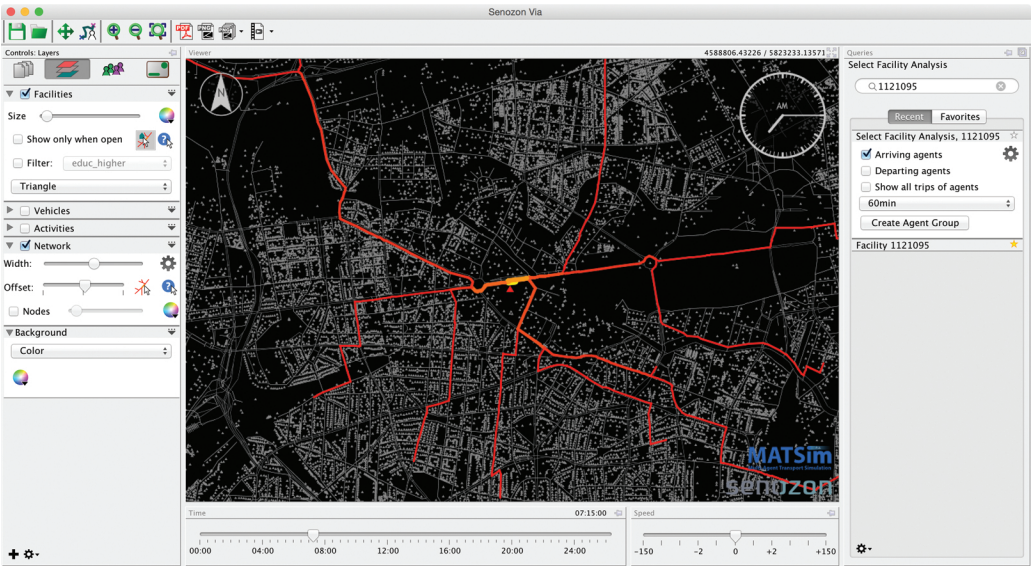

Figure 33.3: Select facility analysis: Links used to travel to and from a facility are highlighted.

33.4.3   *Public Transport Analysis*

The public transport plugin provides many different functions for analyzing public transport simulations. It starts with providing the specified vehicle types as agent attributes, so the vehicles can be differently visualized, based on the vehicle type they represent. Also, the absolute or relative occupancy of a transit vehicle is provided as attribute, allowing transit vehicles to be visualized accordingly. For stop locations, the number of passengers waiting for a bus or train can be plotted over the time of day, and the occupancy along a bus or train route can be visualized.
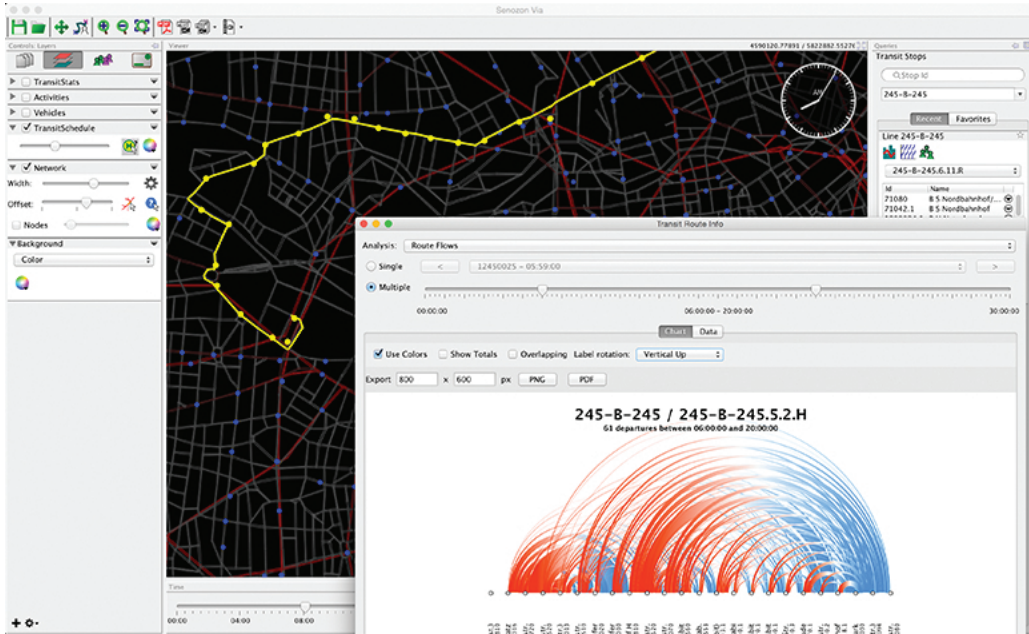
Figure 33.4: Passenger flows on a transit line.

A special, but very useful visualization is the `Route Flow` analysis. This shows, in a visually appealing way, the number of passengers traveling between two stops along a route—for all possible stop combinations. Figure 33.4 shows an example of such a route flow with the route of the transit line shown in the background. It is clear that the demand on the bus route is more or less split in two; a first travel demand up to about the first third of the route, and then it again collects passengers all wishing to go to one of the last stops along the route. This could indicate that it might make sense to split the line in two.

33.4.4   Scenario Comparisons

A typical use of MATSim is simulating a base case and then one or more case studies. Comparing scenarios then becomes an important step in the analysis of the different case studies. *Via* allows comparison of the link volumes of two scenarios visually by coloring the network with the absolute or relative difference of the link volumes between two models. In the future, other differences like average speeds will supported too. The differences are time-dependent, aggregated over time intervals as small as 15 minutes.

33.4.5   Aggregating Data

While MATSim requires and produces a lot of disaggregated data, it is still often necessary to aggregate data to make statements or predictions about a simulated scenario. *Via* provides a powerful mechanism to easily build arbitrary aggregations of available data. Such data can be either point data (like activity locations, trip start locations, GPS points or any other spatial point data) or origin-destination data (like trips with a start and end location, or the relation of an activity location to the home location of the agent performing the activity). While *Via* provides: activity locations, trip start and trip end locations, facility locations (automatically) as point data sources
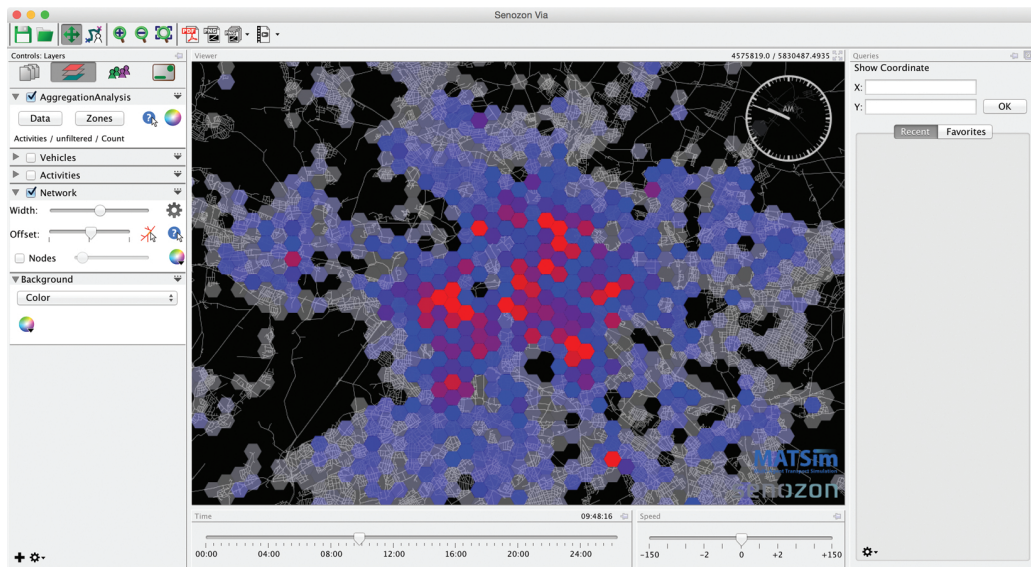
Figure 33.5: Aggregation analysis: Number of performed activities during the whole day.

for aggregation, and the trips performed by agents as O-D data sources, any tabular custom data with coordinate attributes can also be used for this.

Data can be aggregated into a rectangular or hexagonal grid, where the cell-size can be specified by the user, or into arbitrary zones provided as ESRI (Environmental Systems Research Institute) shape file by the user. The data points can be filtered by any of the available attributes, and the aggregation can either just count the data points in each region, or build the sum, the minimum or maximum or average of a data points attribute.

With the activity locations provided by an Activities Layer, the following (and more) aggregations are possible:

- show number of performed activities per region,
- show number of performed work activities per region,
- show number of work activities starting after 10 am per region, and
- show average duration of work activities starting after 10 am per region.

Similarly, with trip data provided by a Vehicles layer, the following exemplary aggregations are possible:

- show number of trip starts per region,
- show number of trip starts with mode "car" per region,
- show percentage share of trips starting with mode "car" in a region, compared to all trips starting in that region, and
- show average duration of trips starting with mode "pt" in a region after 11 am.

By using custom data tables, e.g., containing more information about trips, i.e., the 'from and to' activity types they connect, the number of line switches if it is a public transport trip (this requires the aggregation of MATSim's legs to trips for analysis purposes), many more complex analyses are just a few clicks away in *Via*, like showing the average duration of car-trips starting between 6 am and 8 am, going from "home" to "work".