AnyLogic – Tutorial 05

Optimization of traffic light phases

1. The street model

Before we start edit the scale of the model to 1 meter = 4 px. Click at the right end of the scale and drag it till the aimed scale is shown.

At first we need a model of our street network. There are a main street a two one way streets crossing the main street.

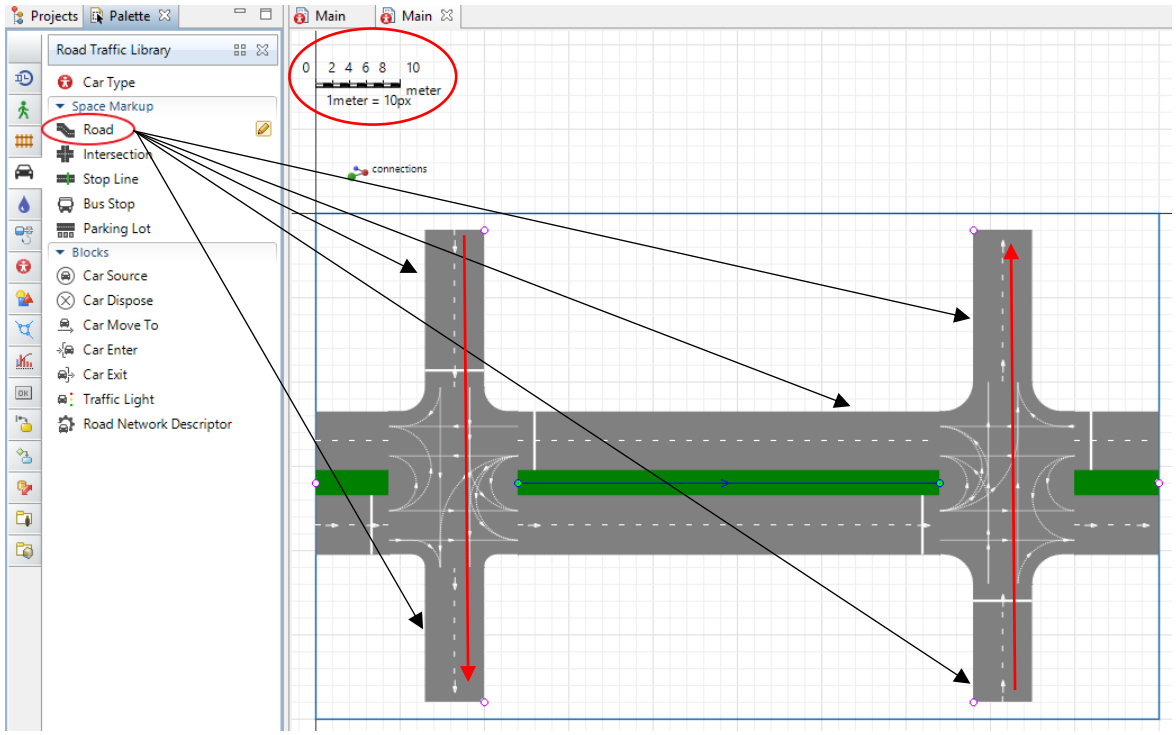


figure 1: Street plan

Start with the main street. Draw a single one horizontal. And edit the properties like in Figure 2.

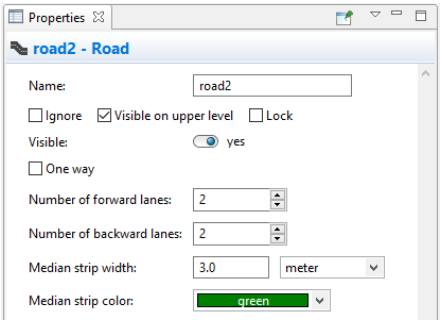


figure 2: Properties of the main street

Add the 4 one way streets by connecting them with the middle line of the main street. After that edit the properties as shown in figure 3.

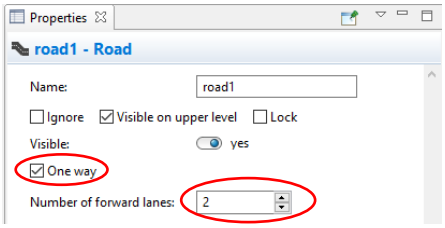


figure 3: Properties of the one way streets

On the right intersection we want to add a crossing line. For that click onto the intersection. After that click on the lower right blue rectangle and last on the line leading to the left traffic lane. After that the line is shown as white connection.

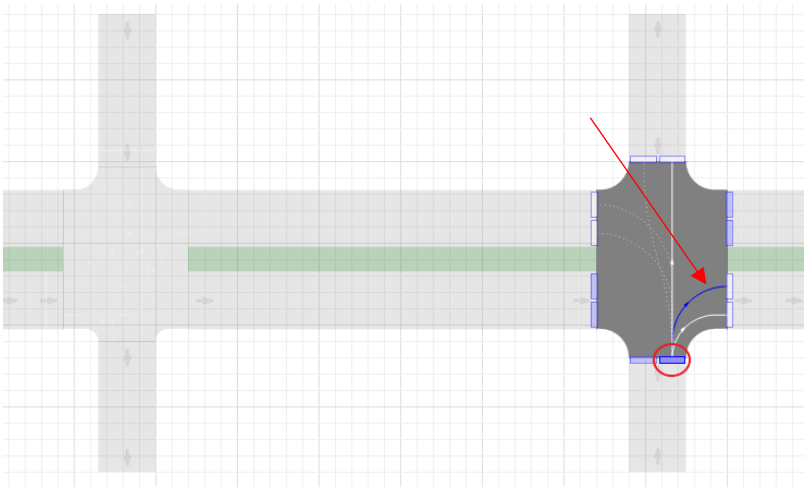
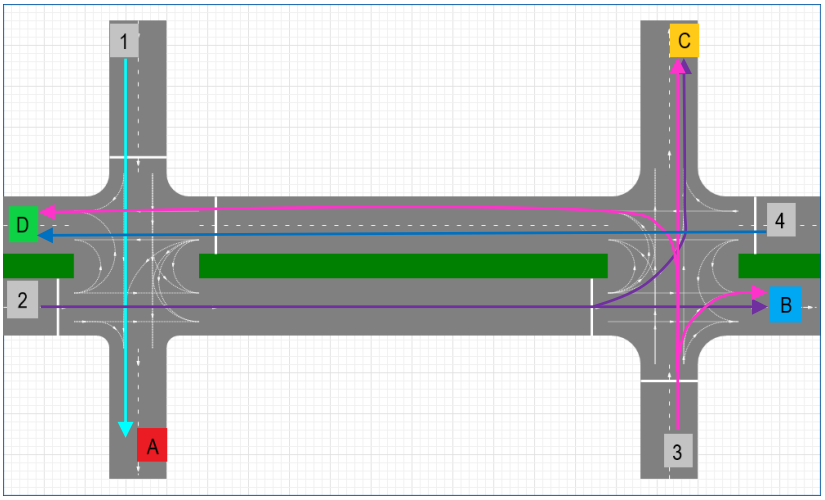


figure 4: Edit the traffic routing

2. The traffic flow

In the next step we need the logic for the traffic. First look at figure 5. It defines abbrevations for for the traffic points.



From	To
1	A
2	B,C
3	B,C,D
4	D

figure 5: Routing definitions

Let's start with the first rout: 1 → A. Drag a "Car Source", a "Car Move To" and a "Car Dispose from the palette to the canvas. Click on the small symbol, which is marked on the right in figure 6, than click on the road where cars come from respectively where they should move.

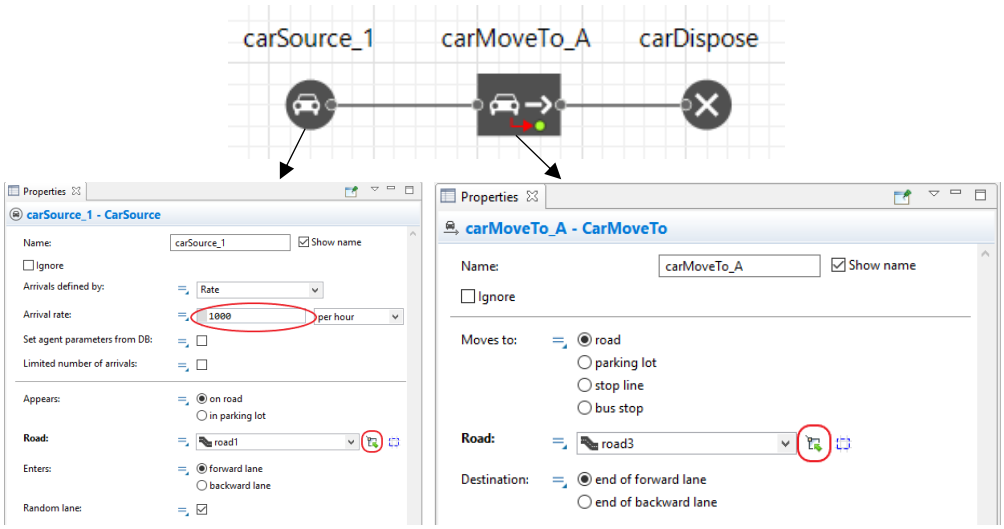


figure 6: Car Movement from 1 to A

The next line, 2 to B and 2 to C, will be added.

Set the car entry of source 2 in the same way as set for source 1.

The rate is 2000 per hour

The “Select Output” you find in the “Process Modeling Library”.

Set the probability of “selectOutput” to 0.8.

Set the destinations of “carMoveTo_B” and “carMoveTo_C” in the same way as “carMoveTo_A.”

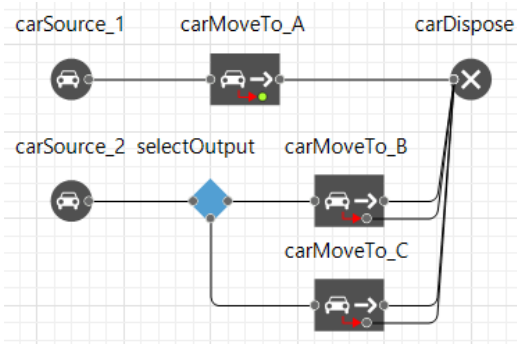


figure 7: The traffic flow with the second line of the table

After that line 3 of the table will be added the same way.

The rate of “carSource_3” is 1000.

The “Select Output5” you find in the “Process Modeling Library”, too.

The probability for moving to B is 0.3.

The probability for moving to C is 0.5.

The probability for moving to D is 0.2.

The rest is 0.

Set the Destination for “carMoveTo_D” as shown in figure 5.

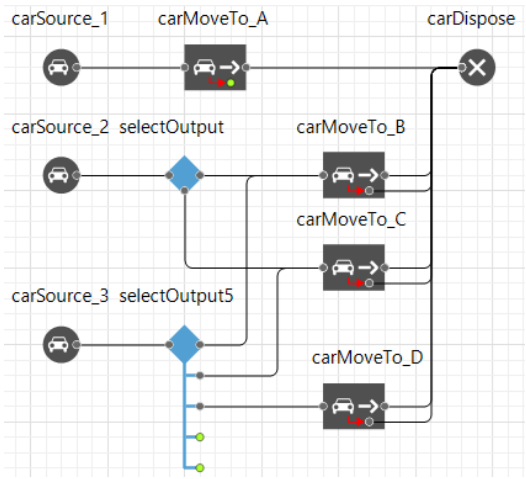


figure 8: Line 3 of 4 added

Add the last traffic flow: 4 to D.

The rate of “carSource_4” is 2000 per hour.

Set the value of “Enters” in “carSource_4” to “backward lane”.

Set the destination of “carMoveTo_D”.

Set the property “Destionation” of “carMoveTo_D” to “end of backward lane”

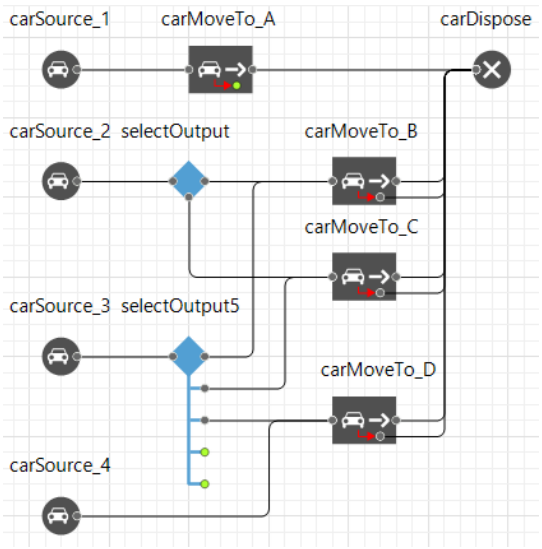


figure 9: Cars moving from 4 to D

3. The right of way

Lets add a priority-to-the-right rule. At the right intersection the cars moving to the right have to wait.

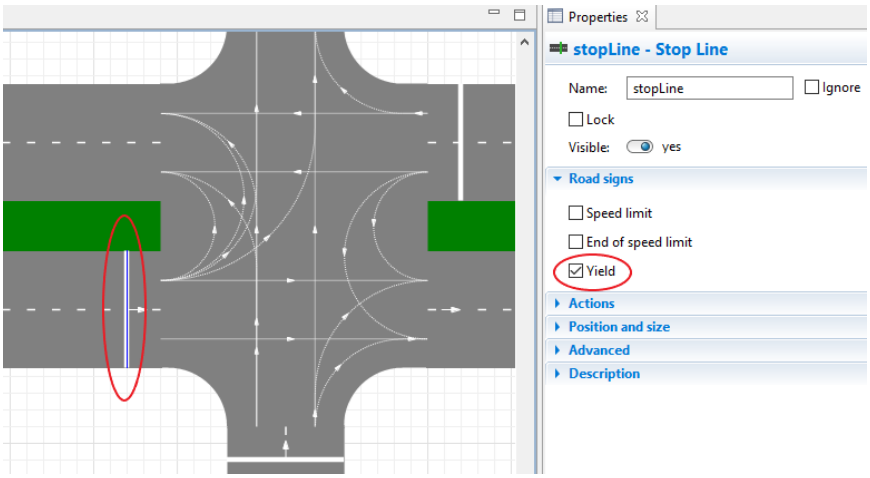


figure 10: Yield intersection

Start the simulation and enjoy the traffic.

You will see the traffic will stop after some time. We need some traffic lights to control the traffic flow.

4. Traffic lights

Add two traffic lights to the intersections. Drag the traffic lights from the palette to the canvas and select the intersection for them.

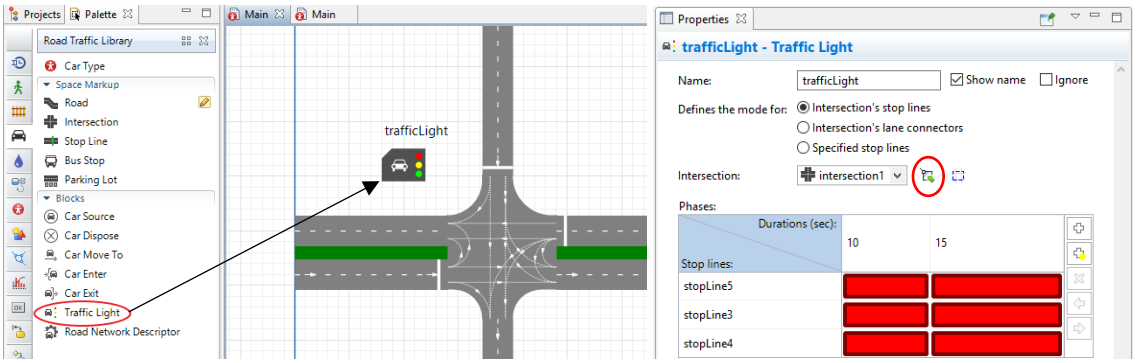


figure 11: Add a traffic light

Do this for both intersections.

Edit the traffic light for the left intersection. Set the property “Defines the mode for: “ to “Intersections stop lines” and add two yello phases. The red/green phases are 30 seconds long the yellow phases 5 seconds.

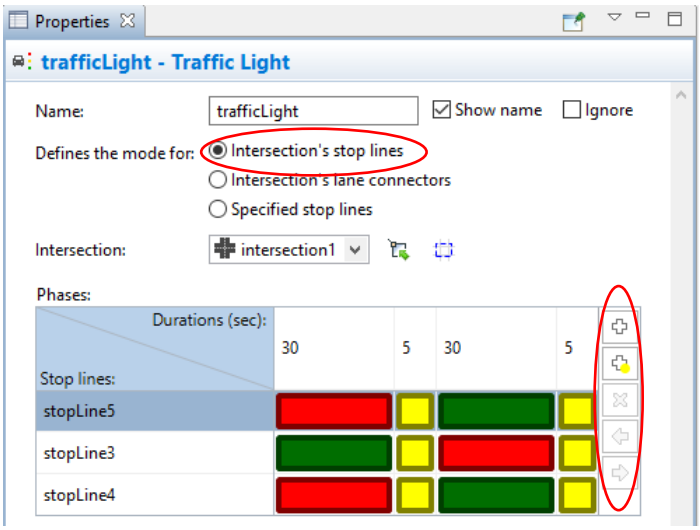


figure 12: Properties of the left traffic light

You can see the stop lines on the road change their color between gren and red.

The right traffic light ned to be edited like follows.

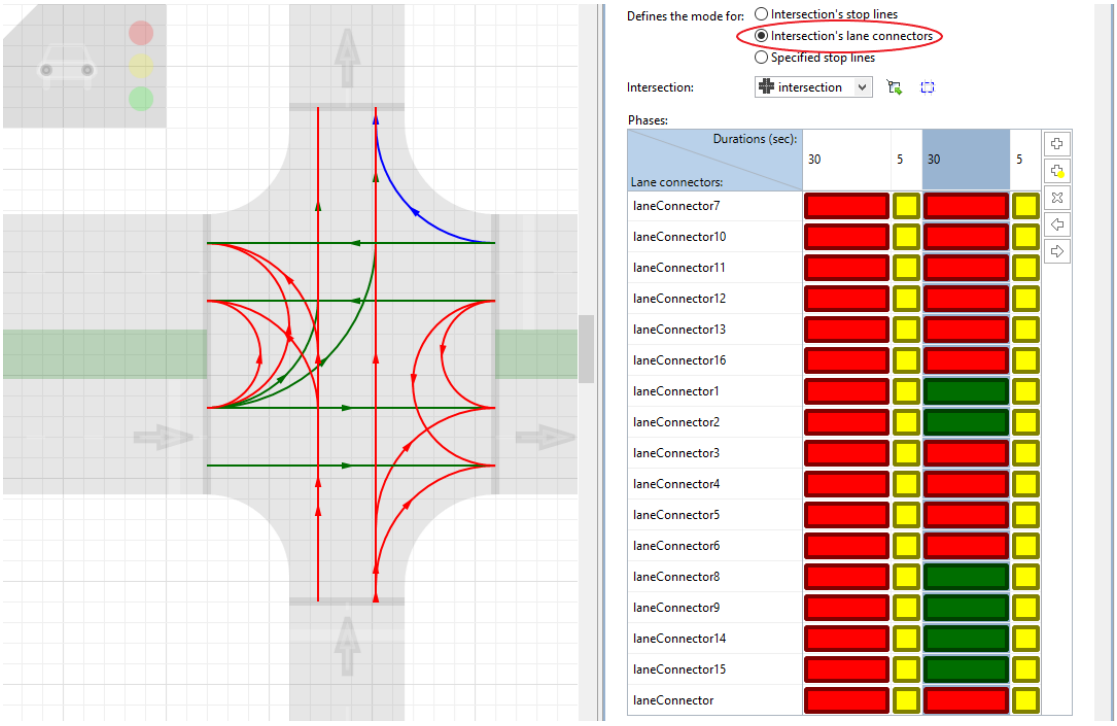


figure 13: The right traffic light 1/2

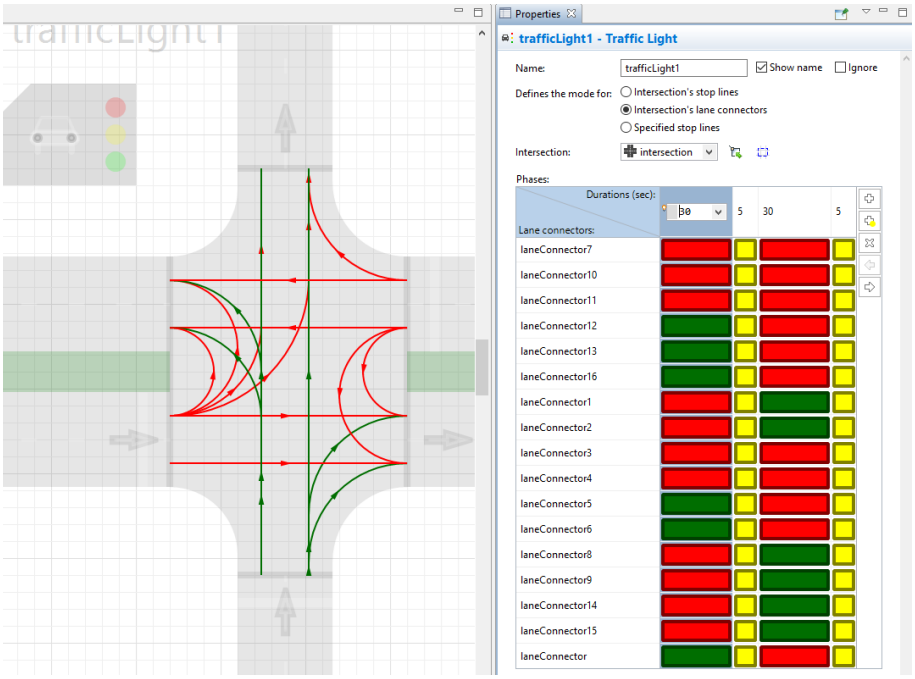
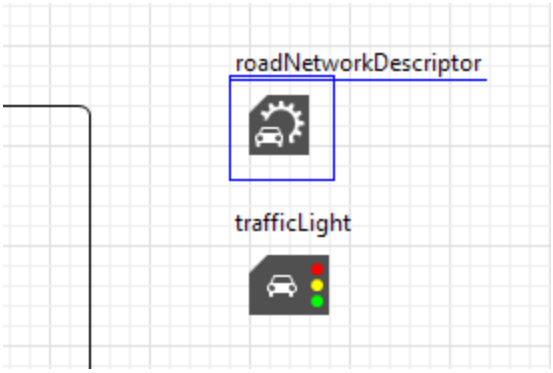


figure 14The right traffic light 2/2

Start the Simulation another time and watch it. If your cars don't stop at the lights, try to move the intersections away from the car entries towards the middle of the canvas.

5. Analyzation

1. Add the **RoadNetworkDescriptor** element onto the graphical diagram from the **Road Traffic Library** palette. There is also no need to connect this element to any other flowchart blocks.

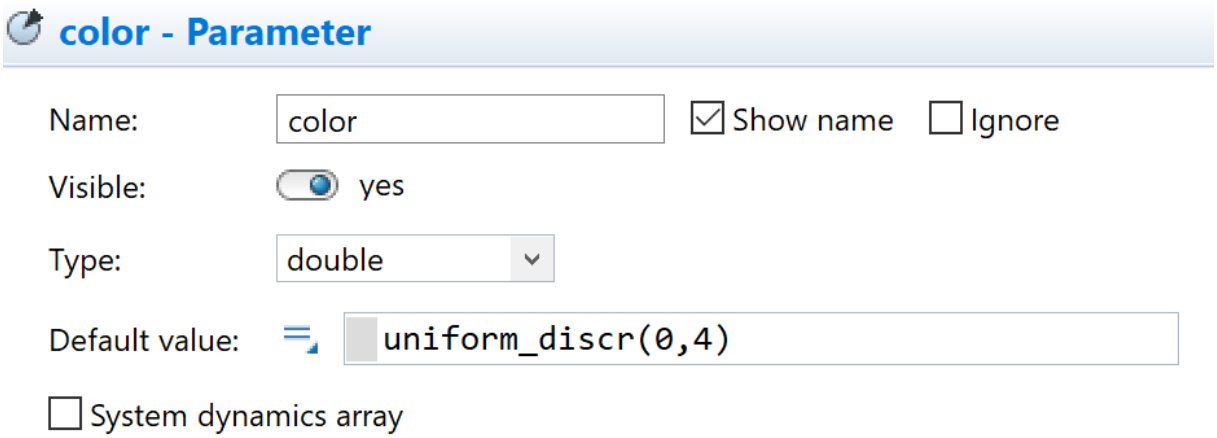


2. Modify the element's properties. Choose the name of the created road network (**roadNetwork**) from the **Road network** drop-down list.
3. Open the **Density map** section of **RoadNetworkDescriptor** properties and select the **Enable density map** checkbox.

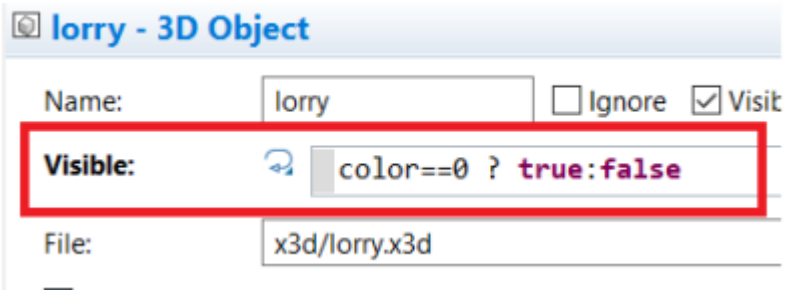
Run the model and examine the current traffic situation on the intersection.

Creating different vechiles type

- Draw a Car Type fron road traffic library palatte to the canvas
- Create the agent type from scratch and name it as Car
- Select Car as a 3D animation and click on finish
- Drag a parameter to the Car canvas and name it color and edit the following as indicated



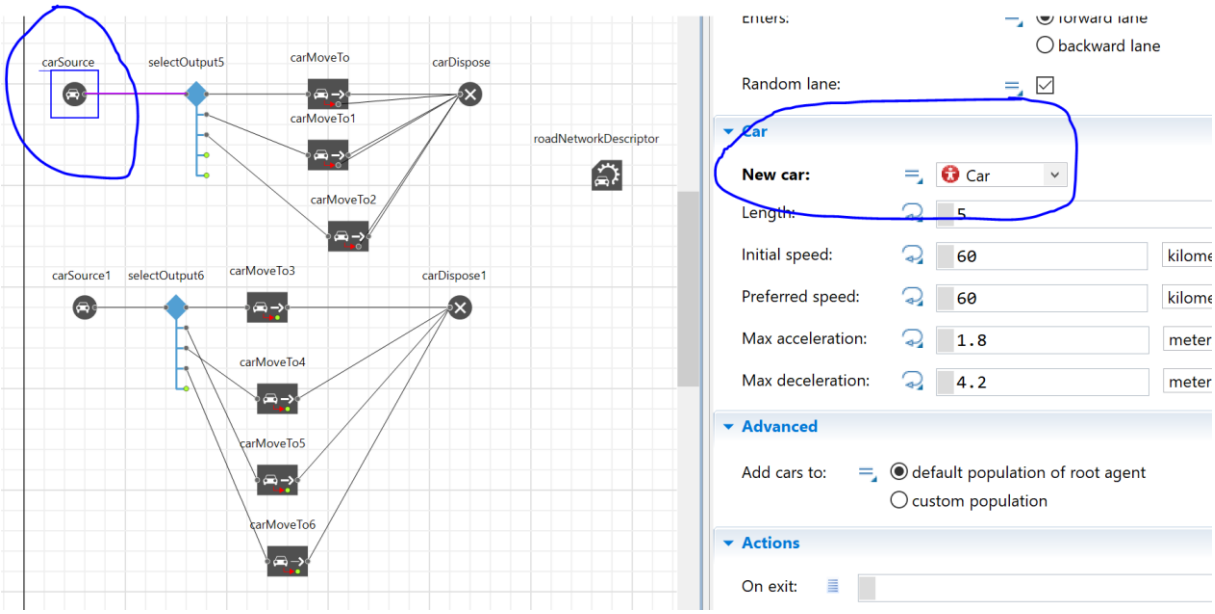
uniform_discr(0,4) this function creates an equal and probable number of outcomes for 5 numbers. After that, we dragged 5 different vehicles from 3D objects library into the car agent. And make changes on the visibility of the vehicles as indicated



The vehicles1 is visible in our system if the number generated by the color parameter is equal to 0, similarly, vehicles2 is visible in our system if the number generated by the color parameter is equal to 1 and so on.

After changing the visiblity of all the vechiles, place all the vechicles at the the orgin.

Go to main, select carsource and update the New car as indicated, do it for all the car source in your system



5. Analyzation

To visualize the time are car is in the model we take a “Histogram Data” element from the “Analysis” palette.

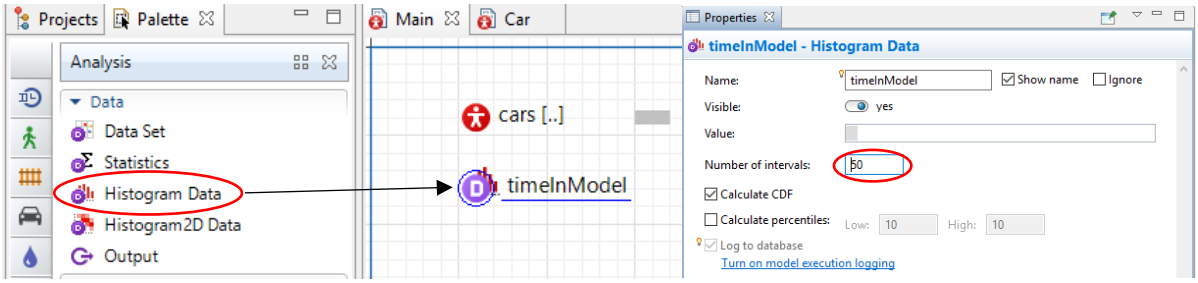


figure 15: Add a histogramm data and set the number of intervals to 50

To show the data stored in our histogram data, add a “Histogram” from the “Analysis” palette and configure it.

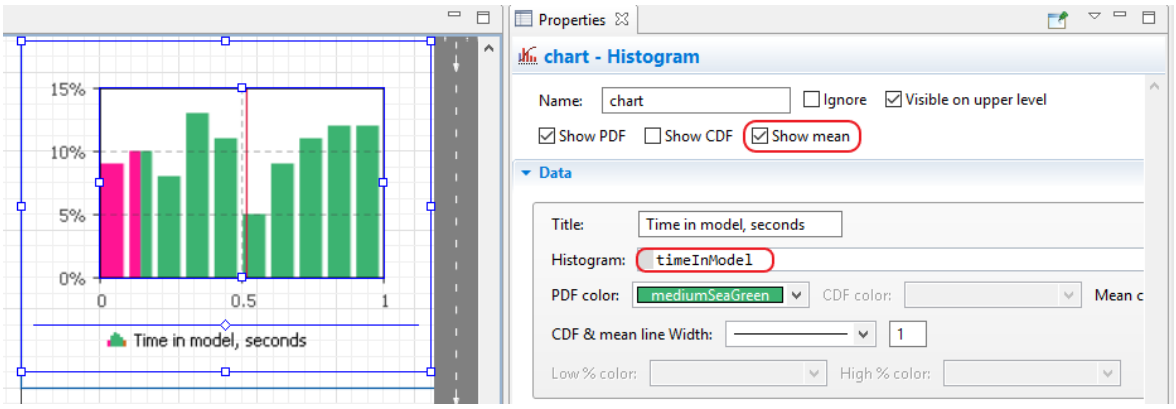
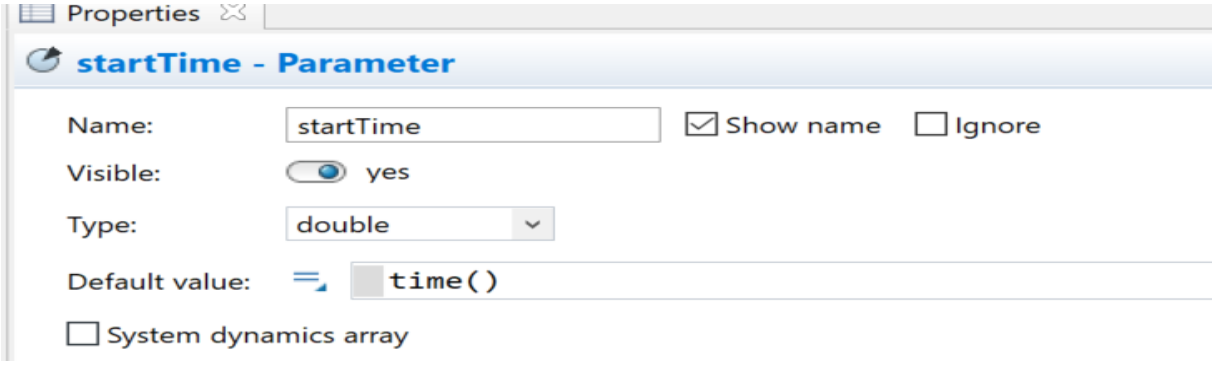


figure 16: The histogram chart

Now open Car agent type and create a parameter startTime, type double and default value: time() as indicated below



After that go back to “main” and an agent to the modell. It’s a population and is from the type we just created.

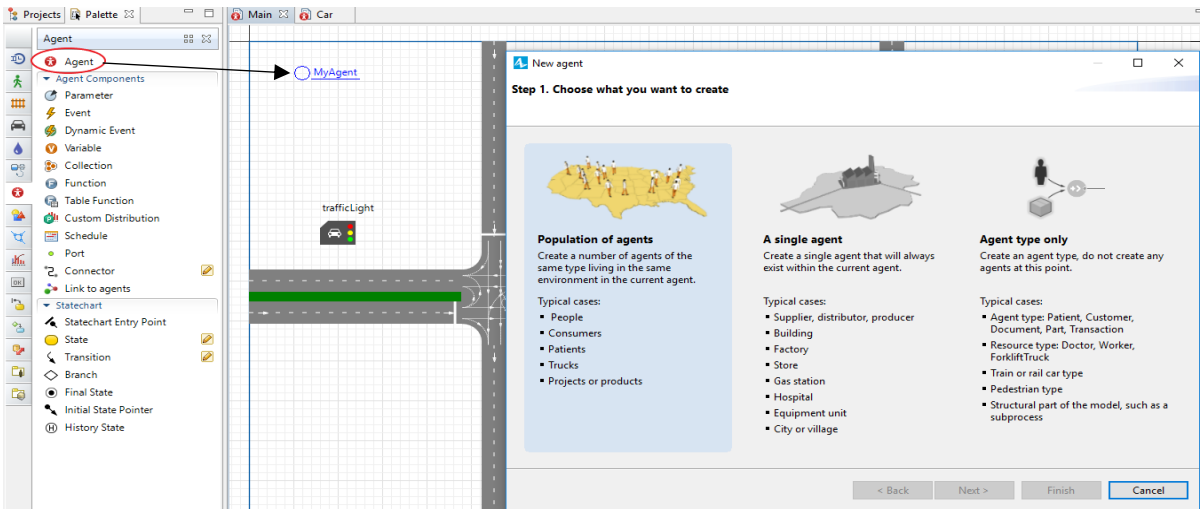


figure 17: Create the agent population

In the next window select “I want to use an existing agent type” before clicking “Next”.

Then you choose you type “Car” and name the population “cars”.

Click “Next until you are in step 6

Select “Create initially empty population …”.

Click “Finish”

After that you have the agent population. Set in all car sources the type and the population as shown in figure 21.

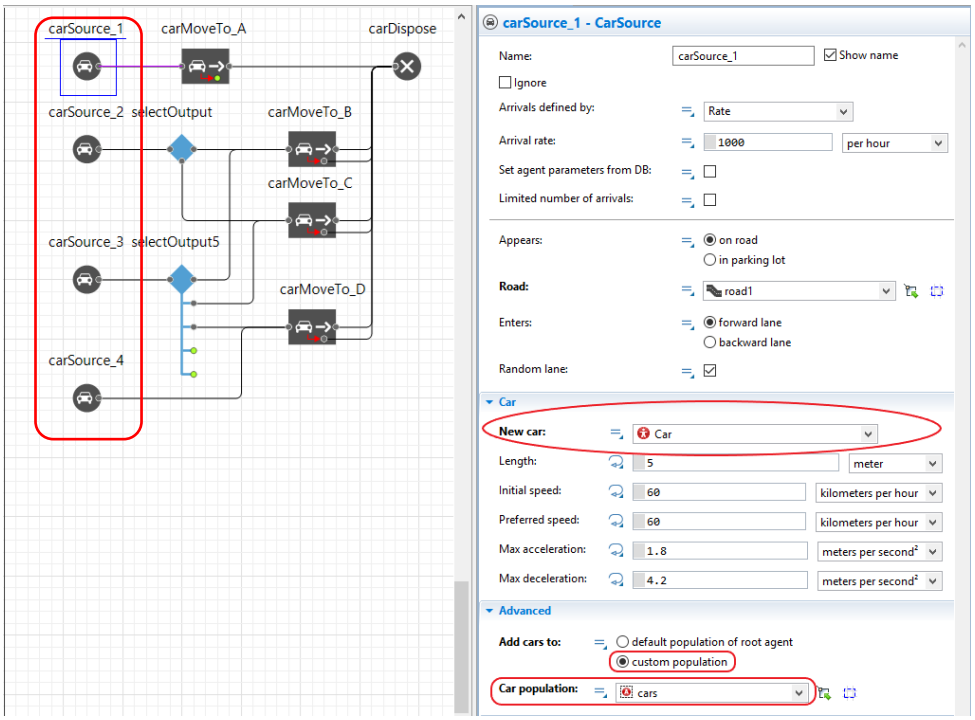
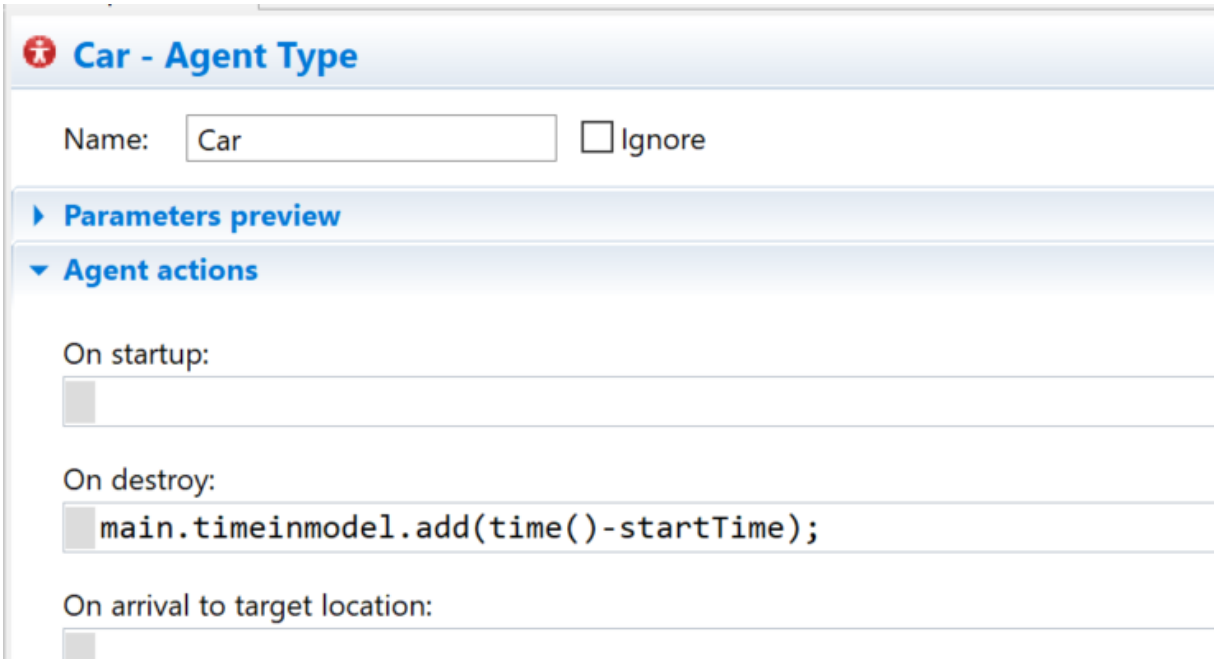


figure 18: Set type and population

Open Car agent type and change as indicated



Before you start the next time the simulation, make it stop after 600 seconds.

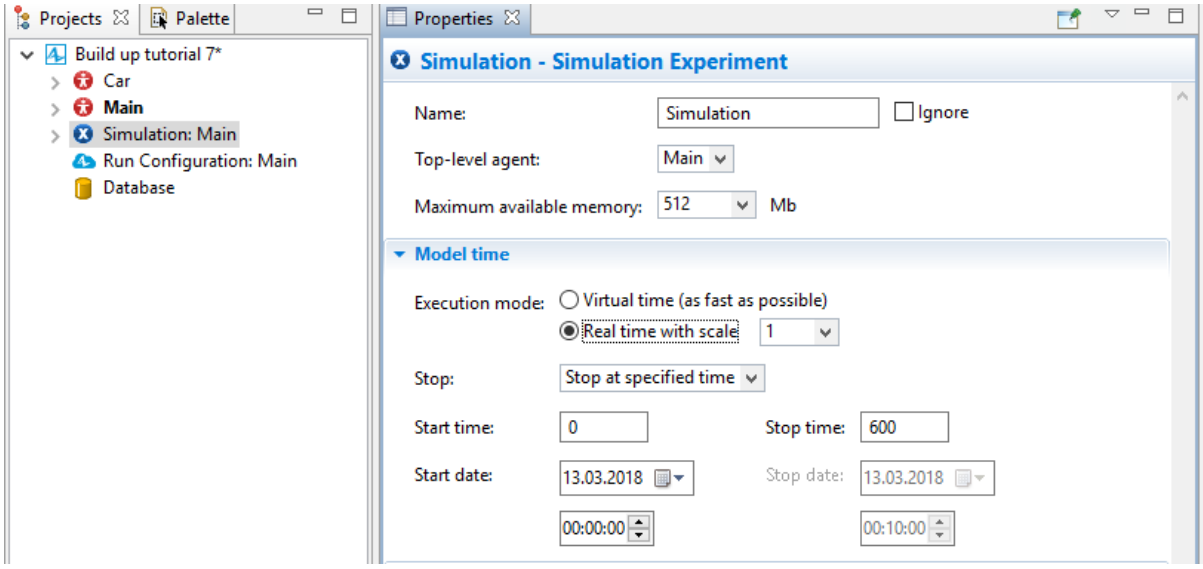


figure 19: Edit the simulation parameters

Start the simulation and take a look at the histogram. Memorize the mean value.

6. Optimization

In the last step we want to optimize the times of the traffic light phases. Add four double parameters, one for each red/green phase, to your model and set the phase lengths of the traffic lights to them.

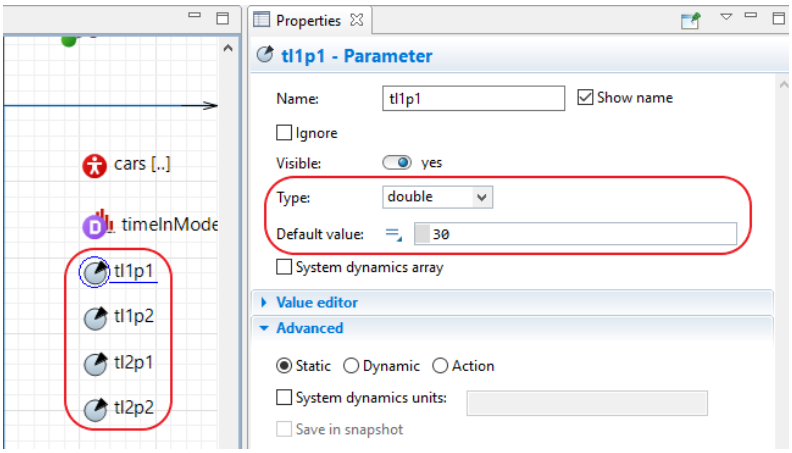


figure 20: Type and default value of the parameters

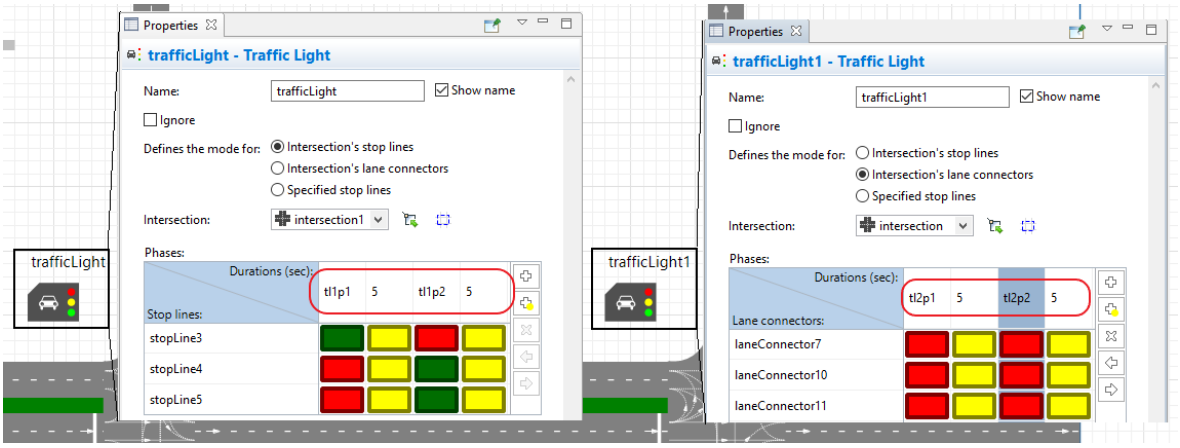


figure 21: Set the phase length of the traffic lights

For optimization it's necessary to add a new experiment. Click on "File/New/Experiment" and add an optimization

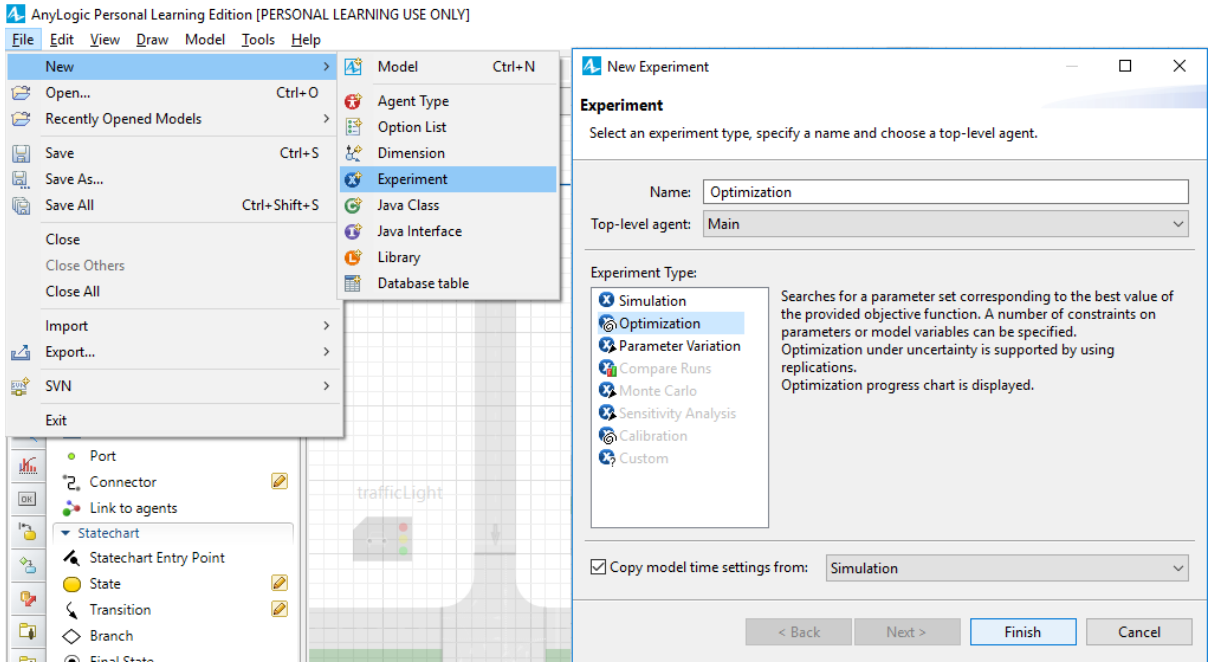


figure 22: Add a new optimization

The objective of our optimization is the mean value of the histogram data "timeInModel". The optimization parameters are the phase lengths of our two traffic lights. They are descrete and will be changed in five second steps.

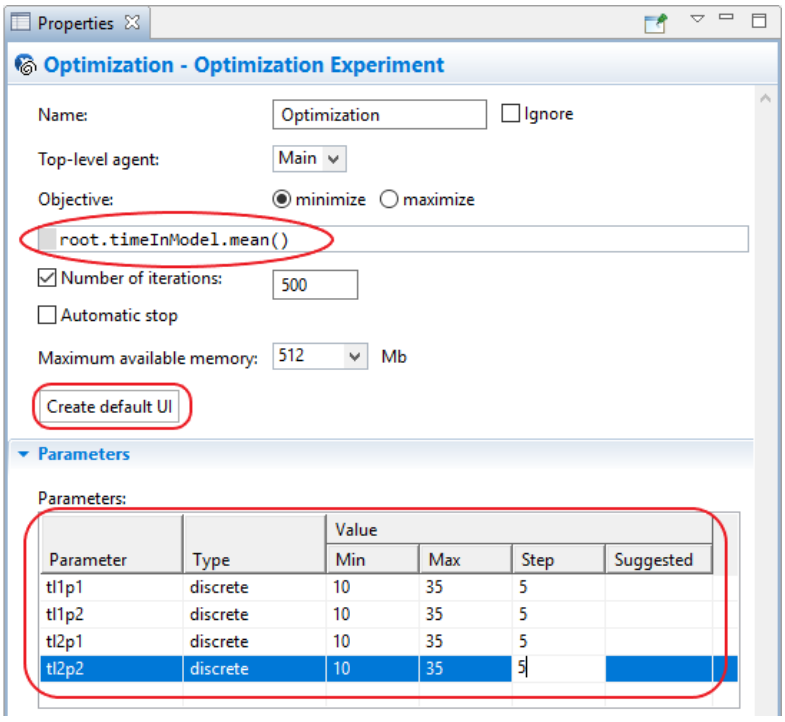


figure 23: the objective of optimization and parameters

After setting up the optimization we want to see the results of it. For this purpose click on the button “Create default UI”. Some UI elements appear on the canvas. Start the optimization by clicking on the down arrow in the right of the start button and select your optimization. Wait until its ready, this will take some time.

In the yellow box with the copy button in the default UI the results will be shown.

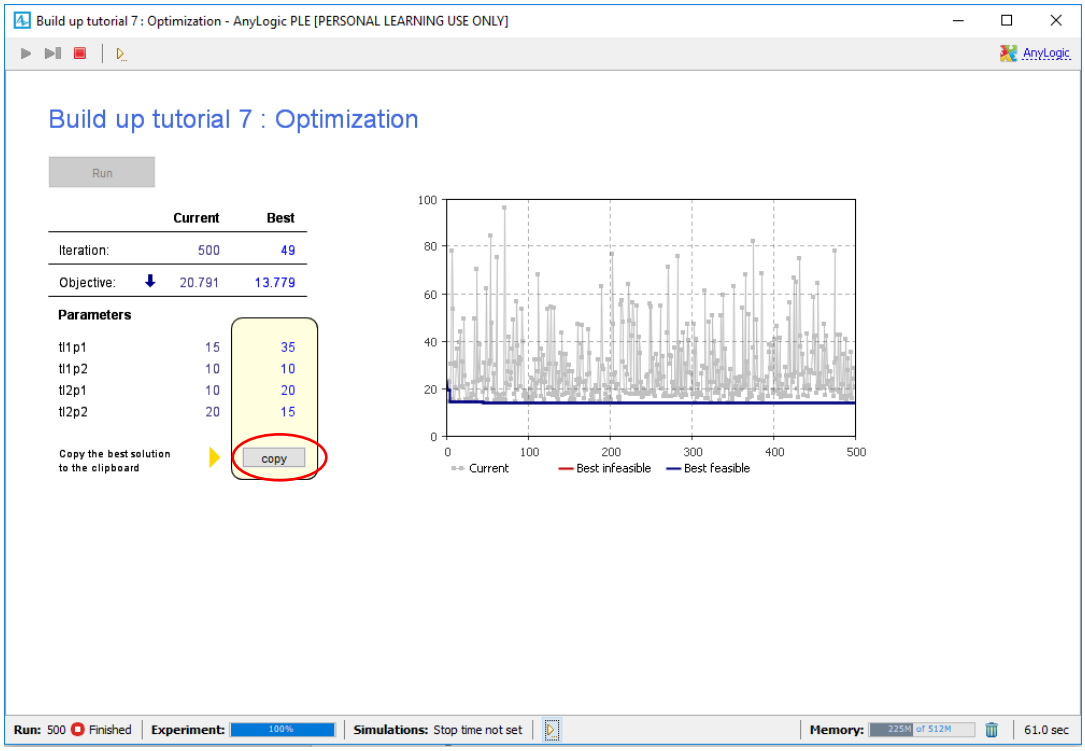


figure 24: Copy the results

After that click onto the simulation of your project and under the point parameters click onto “Paste from Clipboard”. Start again the simulation (not optimization) and have a look onto the mean value of the time in model. It should be smaller than before the optimization.

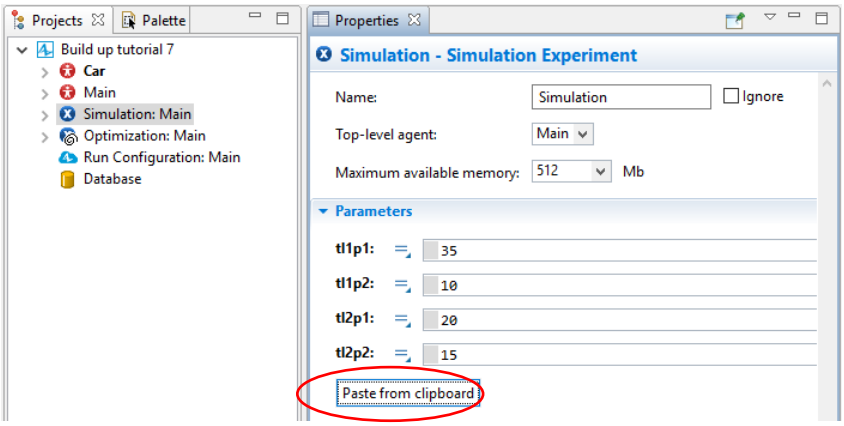


figure 25: Paste the optimization result

7. Extension Exercises

Complete this example

https://anylogic.help/tutorials/road-traffic/index.html