

Requirements

Based on the interview and conducted research the following use-cases were derived in order to get a good understanding of the requirements of the traffic simulator.

Simulation: to be able to run **simulations** for the entire city of Wonderland, Mr. Dalpiaz and his team have invested in extra **sensors** in the city. When the system is asked to **run** a simulation, it is able to **retrieve** enough reliable data from the entire city to run a simulation and recommend the users of the system with four different **options**. The four suggestions are based on the **environmental effect**, the **noise effect**, how **effective** it is, and **how fair it is**. The simulation should not favor any of the neighborhoods of Wonderland, they all should be treated equally.

Event: an **event** is taking place in the stadium of Wonderland. As the head of urban planning, Mr. Dalpiaz wants to provide the traffic simulation system with the origin of the **extra flow** of incoming road users. The system will run a simulation based on the parameters provided by Mr. Dalpiaz. After the simulation is completed, it will provide Mr. Dalpiaz with four **suggestions** on how the traffic in the entire city should be arranged. Based on those suggestions Mr. Dalpiaz decides to go for the most environmentally friendly option since it is only slightly less effective but improves the pollution rates a lot than the other three options.

Emergency: the temperatures at the city's nuclear power plant have risen a few degrees in the last couple of hours. The **police** contact the **urban planning department** since they want to redirect the traffic within a radius of 3 kilometers around the power plant. They want to **close** the **roads** very close to the power plant. Mr. Dalpiaz and his colleagues run the simulation and instruct the police where they have to **redirect** the **citizens** of Wonderland and where they should **road blockages**. A **snapshot** is made for future reference so that employees, who do not have access to the advanced version of the traffic simulation software, know what to advise the police. The next day everything has returned to normal in the nuclear power plant and the traffic situation will be recovered as well.

Complaints: the employees at the urban planning department of the municipality of Wonderland receive various complaints from their citizens. A few of them complain about noise disturbance in the eastern part of Wonderland. Some others complain about the trouble getting to work every morning. They have to wait a very long time before they can enter the city's ring. When they return home, they have trouble exiting the ring. This is due to the long waiting lines before the traffic lights. One of the newer employees of the urban planning department, who is working today decides to take a snapshot of the situation. The snapshot shows the situation for the whole day. In the traffic simulation software, he is able to use this snapshot and see what happens when he changes various **parameters**. Since he just started working there, he is not allowed to change all the parameters. He is able to add **obstacles** to

the road so that a road is closed and he can change the **speed limit** for the entire municipality. His boss does not want to change the speed limits every day, but only wants to change things when they will improve the long-term traffic situation in Wonderland. So, before really applying the speed limit change, he contacts his boss. His boss has access to the more advanced view of the traffic simulation software and he can see if this was a problem for a longer period of time, based on data of three months. He can also use more and different parameters to run a simulation, which makes predictions for longer periods of time. The speed limit changes the employee wanted to apply were indeed correct and they contacted the police in order to implement it. `

Traffic lights: in case of an emergency or to control the in- and outflow of drivers in the city of Wonderland, the traffic lights should be able to respond to the changes the urban planning department wants to apply. This means all the traffic lights should be intelligent traffic lights.

Cost reduction: the major of Wonderland, the boss of Mr. Dalpiaz wants to keep the costs for the project as low as possible. Since a fair amount of money has to be spent on new traffic lights and new sensors, there will be less money available for the development of the traffic simulator. In order to keep the costs low, we as developers, will use the already existing software SUMO. SUMO is an open source platform, which means anybody can contribute or add new things to the software. The SUMO software as it is, is already quite extensive and they also did projects with the modeling of emission and noise¹.

Access to the system: in order to not harm the privacy laws in Wonderland, the system needs to run on-premise. All the employees of the urban planning department should be able access the system, but there will be an extinction between the more experienced and technical employees and those who do not have this knowledge. The more experienced employees will have access to all the data and can change more parameters. The less experienced employees can only change a few parameters, such as adding an obstacle and change the speed limit for the entire city, instead of changing the speed limit for one particular street.

¹ Behrisch, M., Bieker, L., Erdmann, J., & Krajzewicz, D. (2011). SUMO—simulation of urban mobility: an overview. In *Proceedings of SIMUL 2011, The Third International Conference on Advances in System Simulation*. ThinkMind.