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DI TRENTO

SimuTorino

Simulating 5G-enabled
vehicular networks in a
Turin urban context

Brando Chiminelli, Alessio Juan De Paoli,
Davide Parpinello, Davide Zordan

01

The project

Introduction to
the project
SimuTorino

02

SUMO

Simulation of
Urban MObility

03

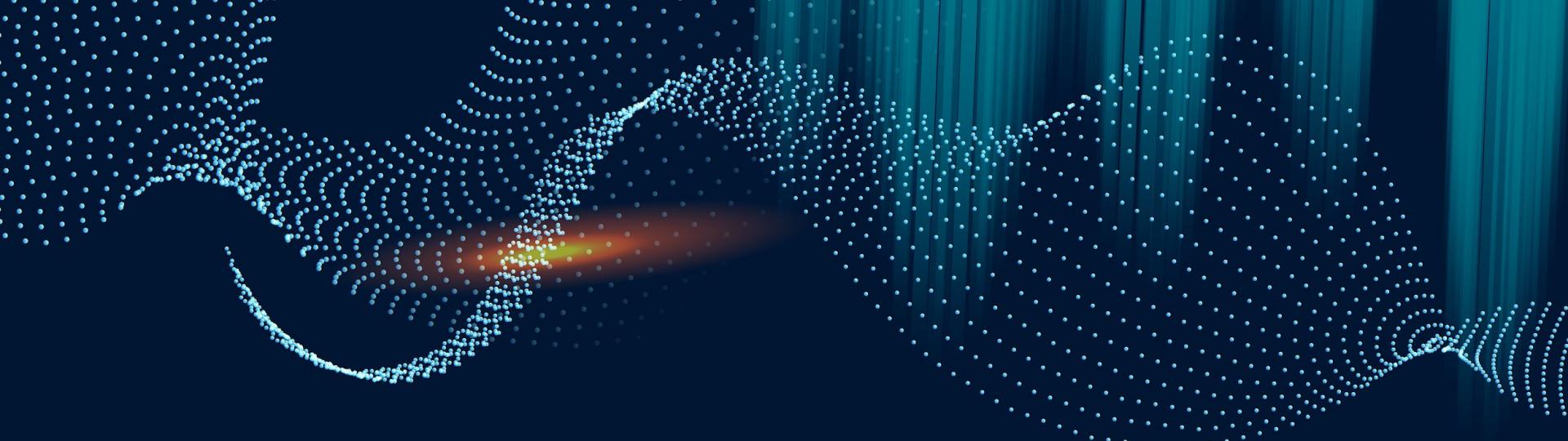
Simu5G

Simulate 5G
architecture

04

Automation

Automate the
execution and
update of the
project



01 | The project

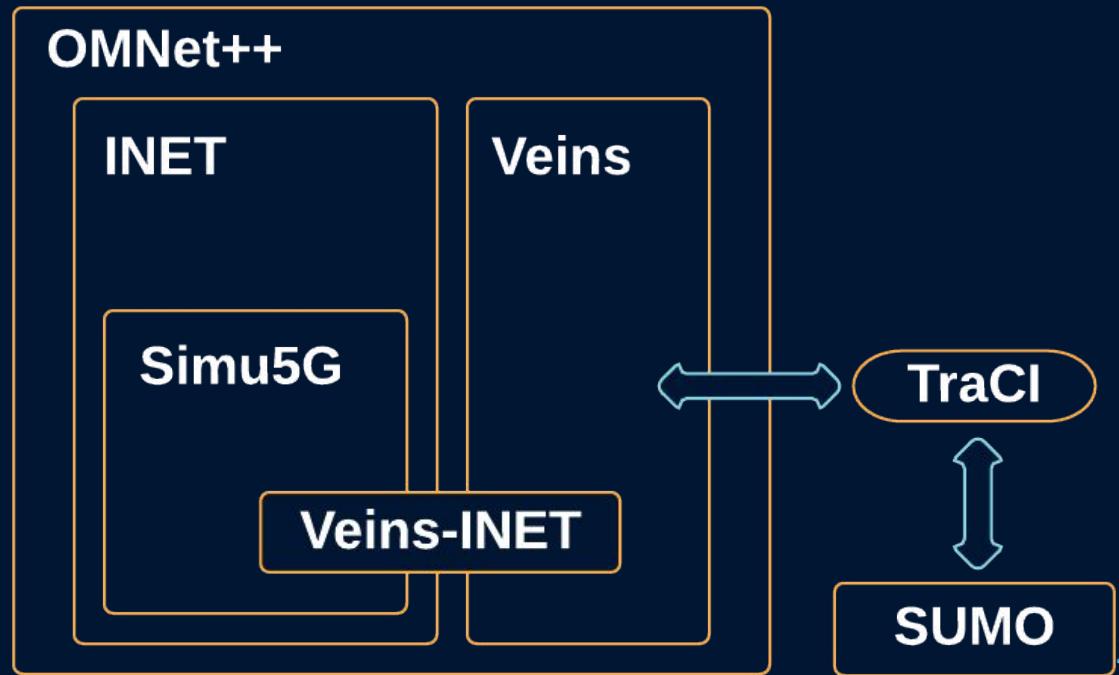
A little introduction about SimuTorino

Project goal



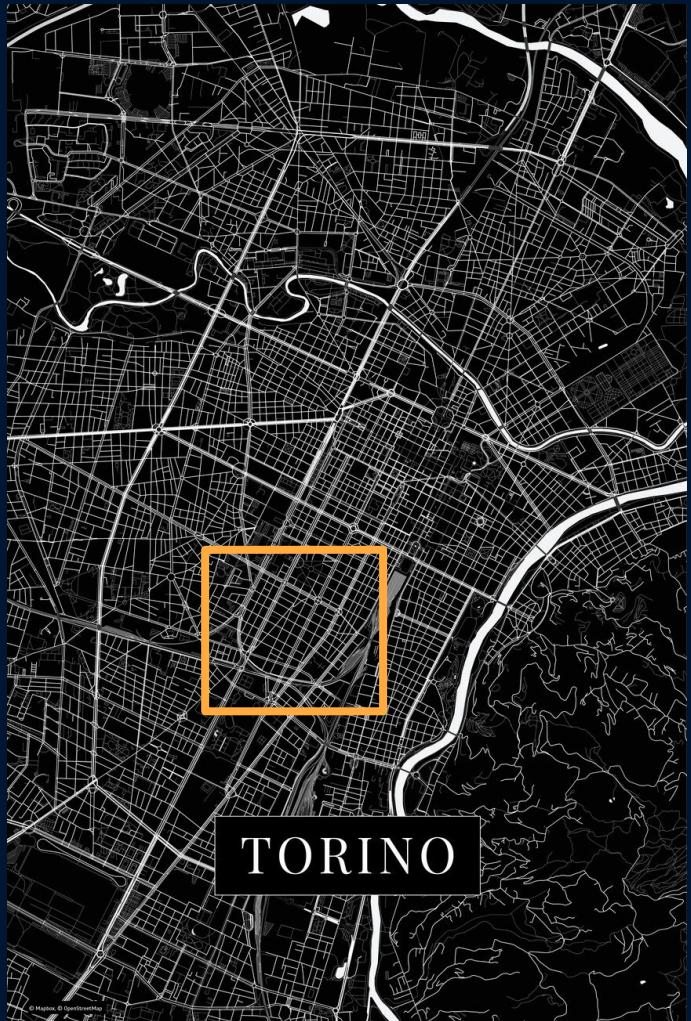
The goal of the project is to simulate the traffic in an urban context and implement a 5G network that enables vehicular communications

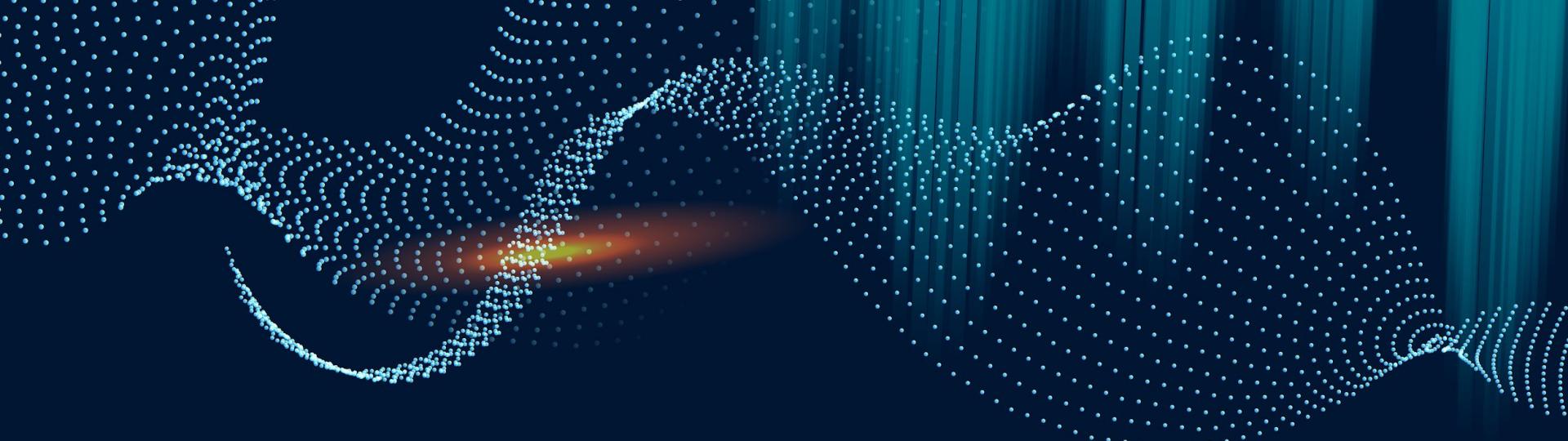
System architecture



Why Turin?

- Turin is a smart city with an important already active open data environment
- “Crocetta” district, 10 traffic sensors and 17 antennas

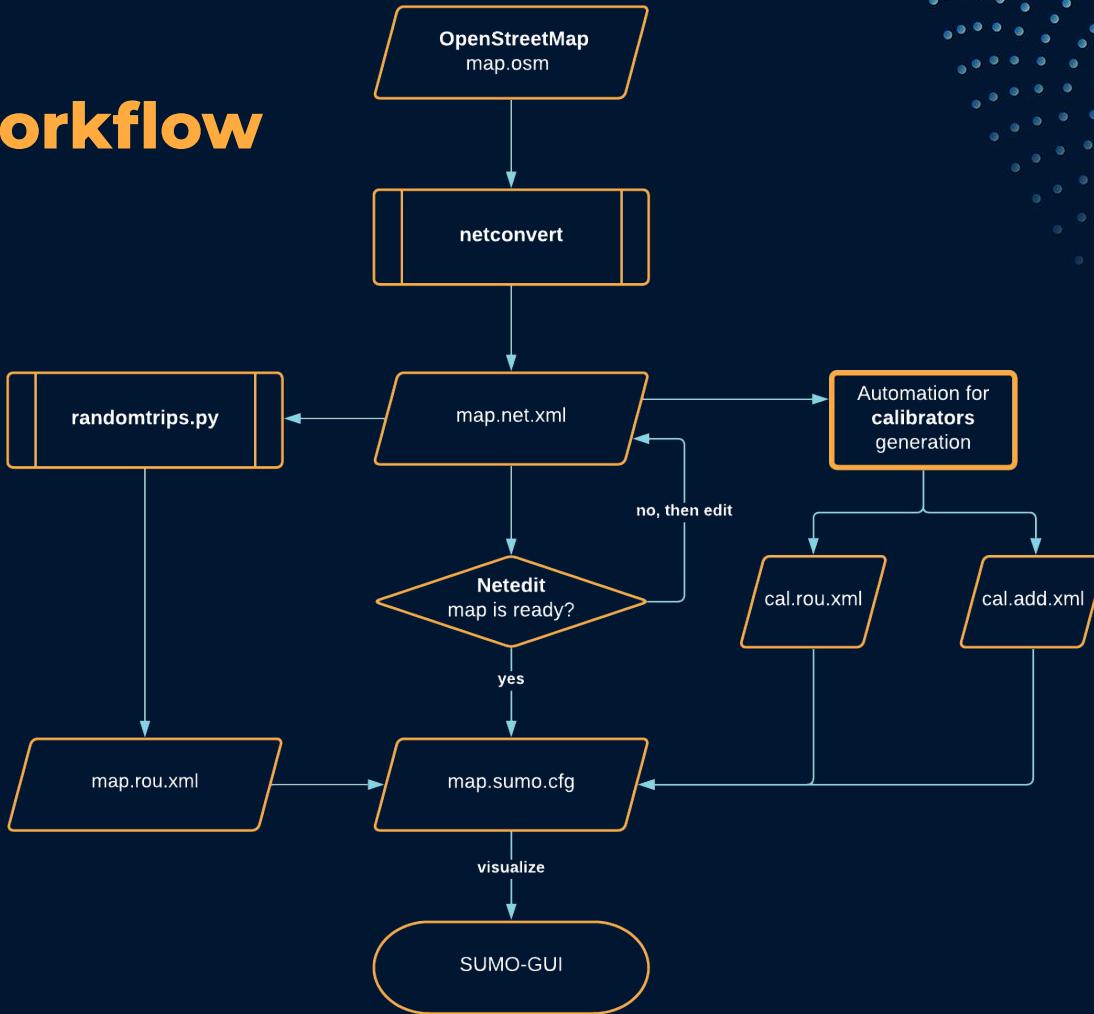




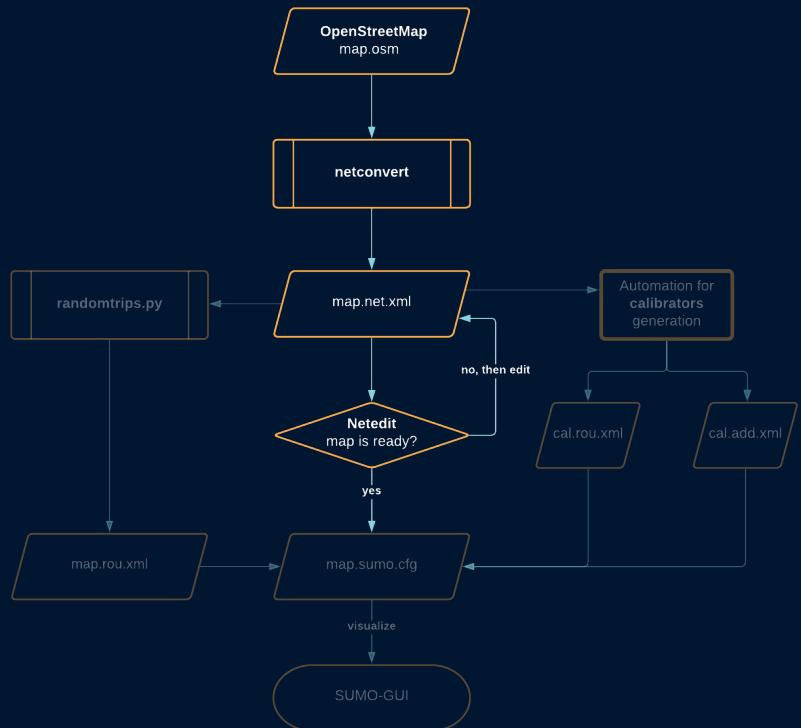
02 | SUMO

A traffic simulator

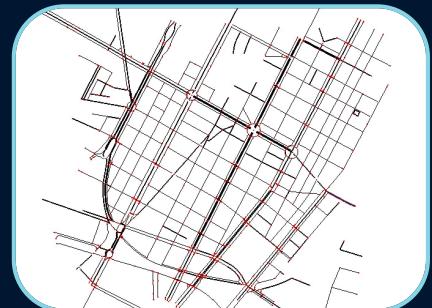
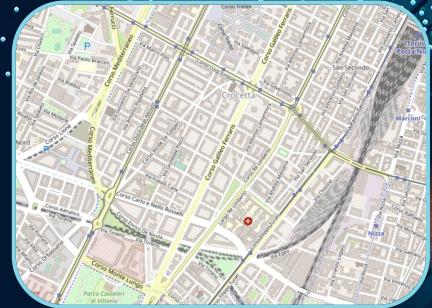
SUMO workflow



OpenStreetMap and Netedit



- Selection of an area in OpenStreetMap and export as .osm file
- **netconvert** command converts .osm to .net.xml file
- net.xml refinement using the **Netedit** tool



randomtrips.py

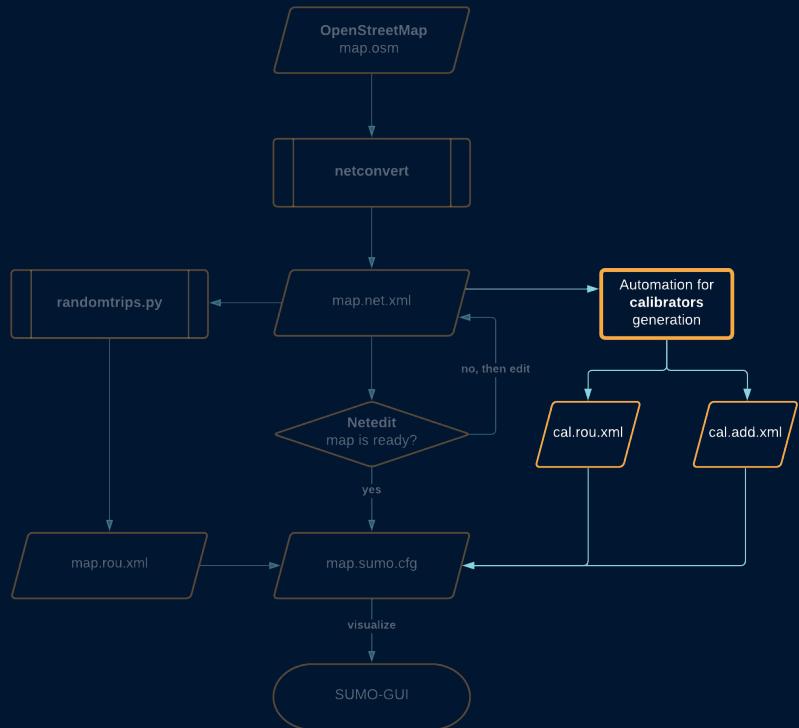


randomtrips.py is a predefined function that generates a set of random trips for a given network (map.net.xml).

Useful arguments:

- e (to specify end time, e.g. 3600)
- p (to specify interval of generation, e.g. "-p 2" means 1 car every 2 seconds)
- random to enable seed randomization

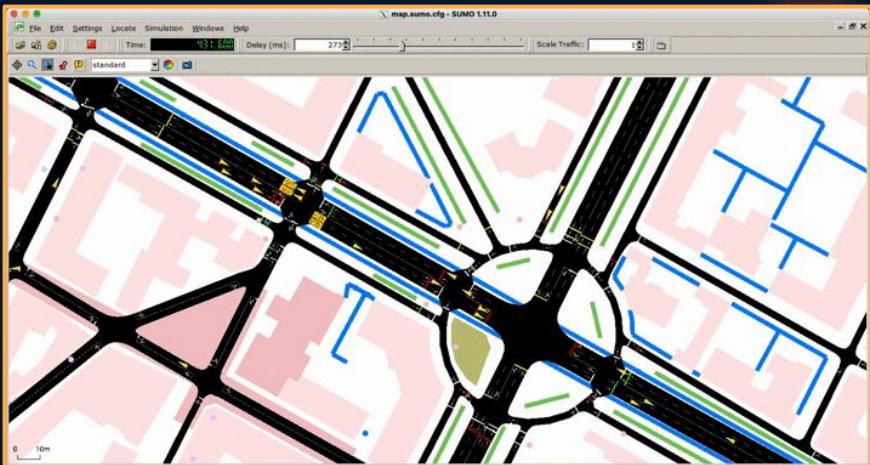
Calibrators

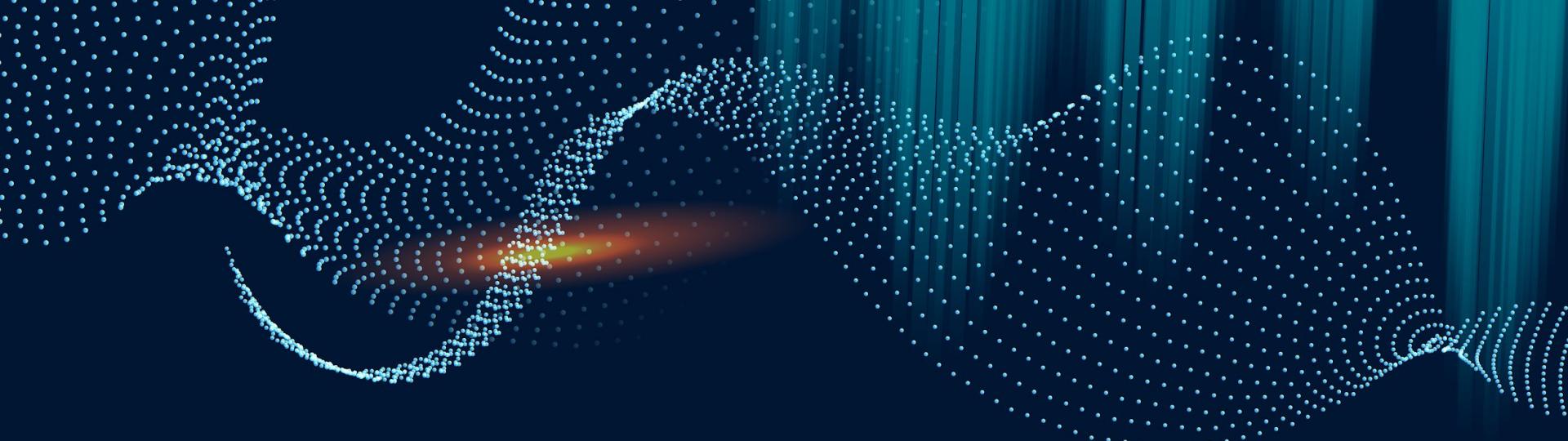


A **calibrator** will remove vehicles in excess of the specified flow and it will insert new vehicles if the normal traffic demand of the simulation does not meet the specified number of `vehsPerHour`.

A route is sampled from the route distribution (with 100 possible routes starting from each calibrator) that is generated by the script `generate_cal_routes.py`

SUMO-GUI





03

Simu5G

An OMNeT++ library to simulate
5G architecture

OMNeT++

Discrete Event Simulator



OMNeT++ is component-based C++ simulation library and framework, primarily for building network simulators.

Libraries for building network simulation



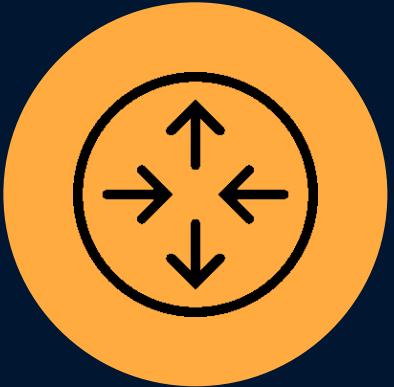
INET



Veins



Simu5G



INET

INET contains models for the Internet stack, wired and wireless link layer protocols and support for mobility.



Veins

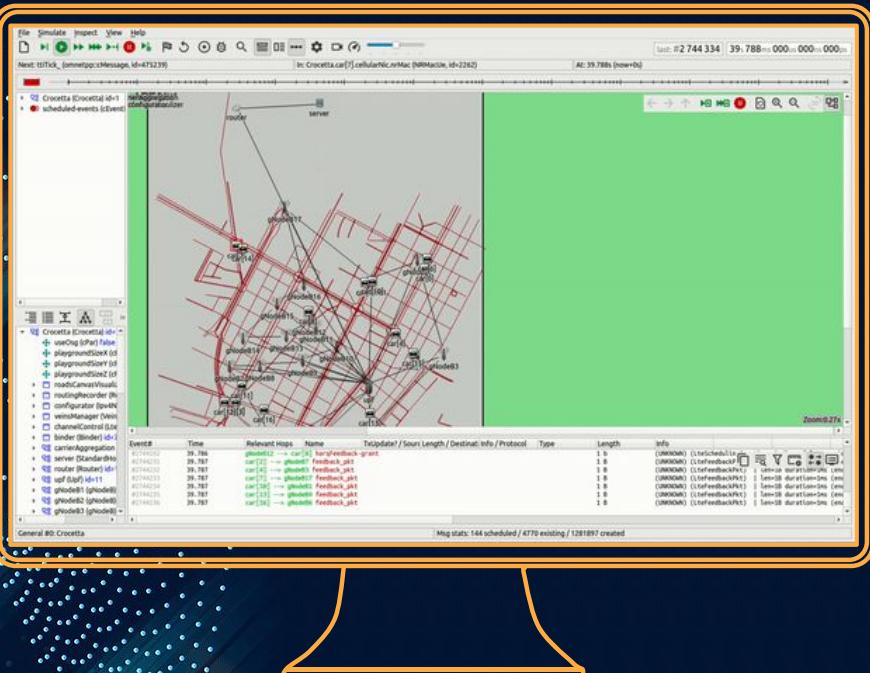
Veins is an open source framework for running vehicular network simulations



Simu5G

Simu5G is a extension of INET that allows to simulate 5G networks

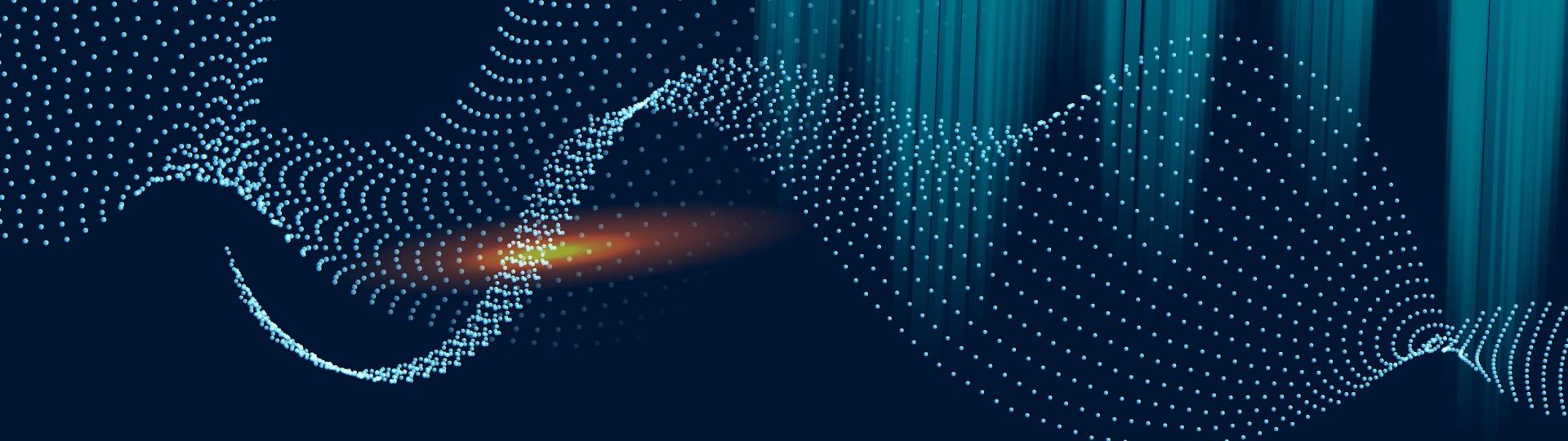
Demo example - Uplink process



Type of packages exchanged:

- LteAirFrame
- Feedback_pkt
- HarqFeedback-grant

The association of UEs to gNodeBs is done according to the criterion of the best SINR.



04

Automation

A way to keep the project up to date

Vagrant



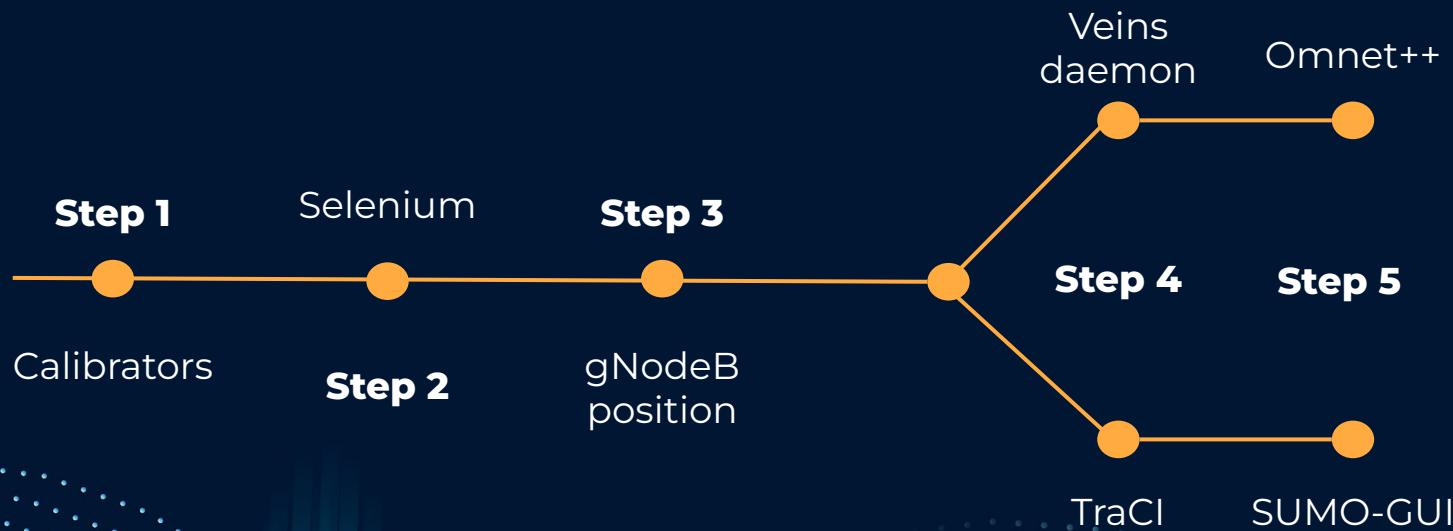
Vagrant File



- "ubuntu/focal64"
- Base libraries
- Packages:
 - GChrome and Selenium driver
 - OMNet
 - Sumo
 - INET
 - Veins
 - Simu5g

`launch_simu.py`

Steps of automation





SIMUTORINO

An automated real-time vehicular network simulation



GitHub

<https://github.com/davideparpinello/SimuTorino>

THANKS!

Do you have any questions?

- brando.chiminelli@studenti.unitn.it
 - alessiojuan.depaoli@studenti.unitn.it
 - davide.parpinello@studenti.unitn.it
 - davide.zordan@studenti.unitn.it
-

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Thanks to:

