Tutorial 1: Introduction to the Simulation Setup
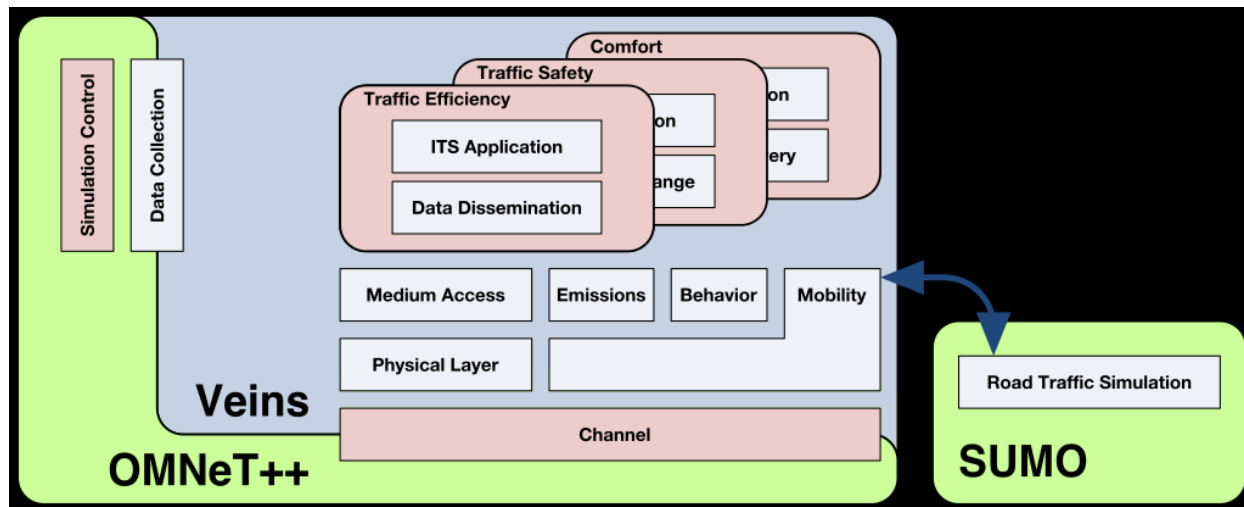
Introduction to the Simulation Setup

Prof. Sangyoung Park

Module "Vehicle-2-X: Communication and Control"

Tutorial Setup

- **Veins simulator**
  - Traffic simulator + network simulator
  - SUMO: Simulation of urban mobility
  - OMNet++
    - Discrete event simulator for networks

- **What can we test?**
  - To be elaborated at Tutorial parts

Source: Veins simulator website

SUMO – **S**imulation of **U**rban **Mo**bility

- Microscopic transport simulation

- DLR's open source microscopic transport system simulation software

- Under development since 2001 with the explicit goal to simulate large cities in real-time

- TraCI (Traffic Control Interface) allows access to a running road traffic simulation

  - It allows to retrieve values of simulated objects and to manipulate their behavior „on-line"

 - In our case „Veins simulator" connects to SUMO via TraCI!
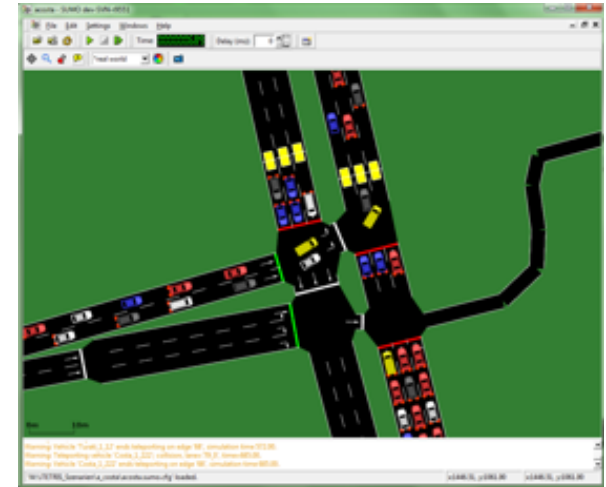
SUMO – What can be Run?

- Cars

- Busses

- Passengers

- Bicycles

- Pedestrians

- Ships

- Goods traffic

SUMO – What can be done?
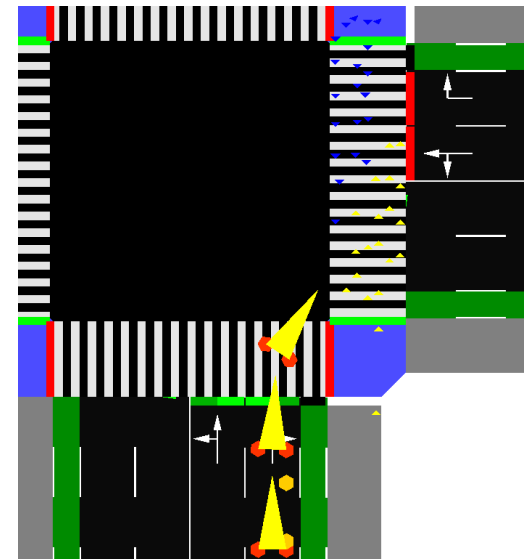
- Planning and evaluation/assessment
    - Traffic management
    - Infrastructure changes (traffic lights?)
    - Public transport
    - New technologies
        - Vehicular communication
        - Automated transport systems
    - Optimization
        - Traffic lights
        - Routing
    - Data fusion for traffic surveillance

OMNet++

- **O**bjective **M**odular **Net**work Testbed in C**++**

- Discrete event simulator

- Provides generalized framework for network simulation

- Written in C++
    - Source code publicly available

- Simulation model for Internet, IPv6, Mobility, etc.

Veins Simulator
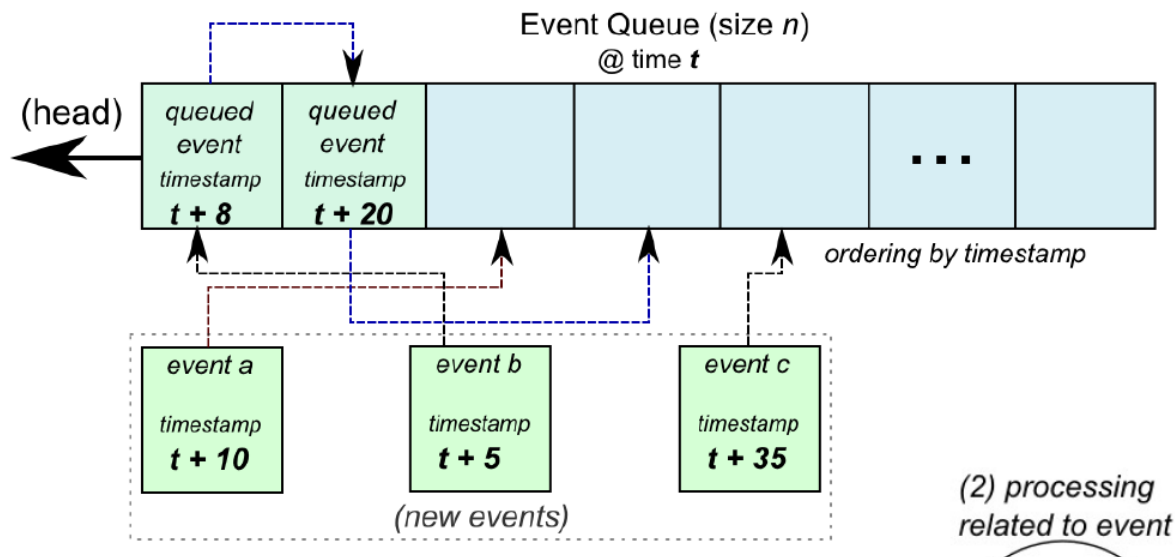
- Open source framework for running vehicular network simulations

- Based on two well-established simulators
  - OMNeT++: network simulator
  - SUMO: traffic simulator

- Allows online re-configuration and re-routing of vehicles in reaction to network packets

- Relies on IEEE 802.11p and IEEE 16094 DSRC/WAVE network layers

- Cellular networking: LTE

- Can perform city-block level simulations in real-time

- Suits our purpose! – I'm sold, let's use this
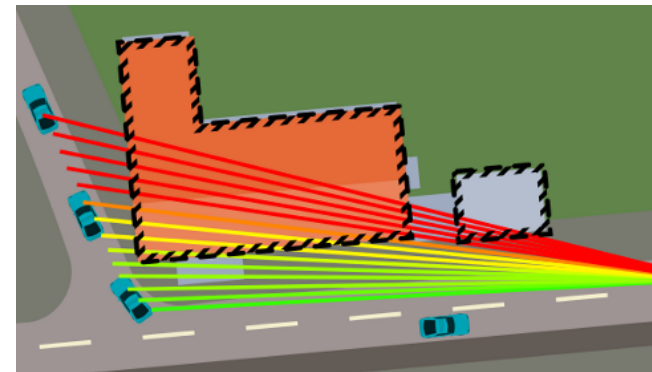
But You Need Some Skills

- Some software skills required

- Open source programs are usually developed on Linux/Unix platforms

- We have Windows machines

- **MinGW** is a free and open source software development environment to create MS Windows applications

  - Includes a port of the GCC (compiler), GNU Binutils, Window specific header files and import libraries

But You Need Some Skills

- MinGW commands
    - ls: display files and folders
    - cd: change directory (e.g., cd .. Changes directory up!)
    - *./file_name*: Execute an executable
    - echo $PATH: displays environment variable PATH
    - export PATH=PATH:/User/user/src/
        - Adds a path to the PATH variable so that the system could find the location of the libraries and binaries

- Now I want you to start with Veins Tutorial
    - https://veins.car2x.org/tutorial/

Things to be careful

- Do not install the newest version of the softwares

- If you scroll down on the SUMO release page, you will find „older releases" please install the version indicated in the Veins tutorial (0.32.0)

- You will find that the simulation is really slow

- This is due to the animation effects of the packets

- If you run at **fast** or **express** speed you will see that simulation is orders of magnitude faster

  - There are buttons on the top of the OMNet++ GUI when you launch the simulation