

SUMO: Heterogeneous Traffic Simulation

Iftekharul Islam

Files for Today's Session

- Download and extract the zip file:



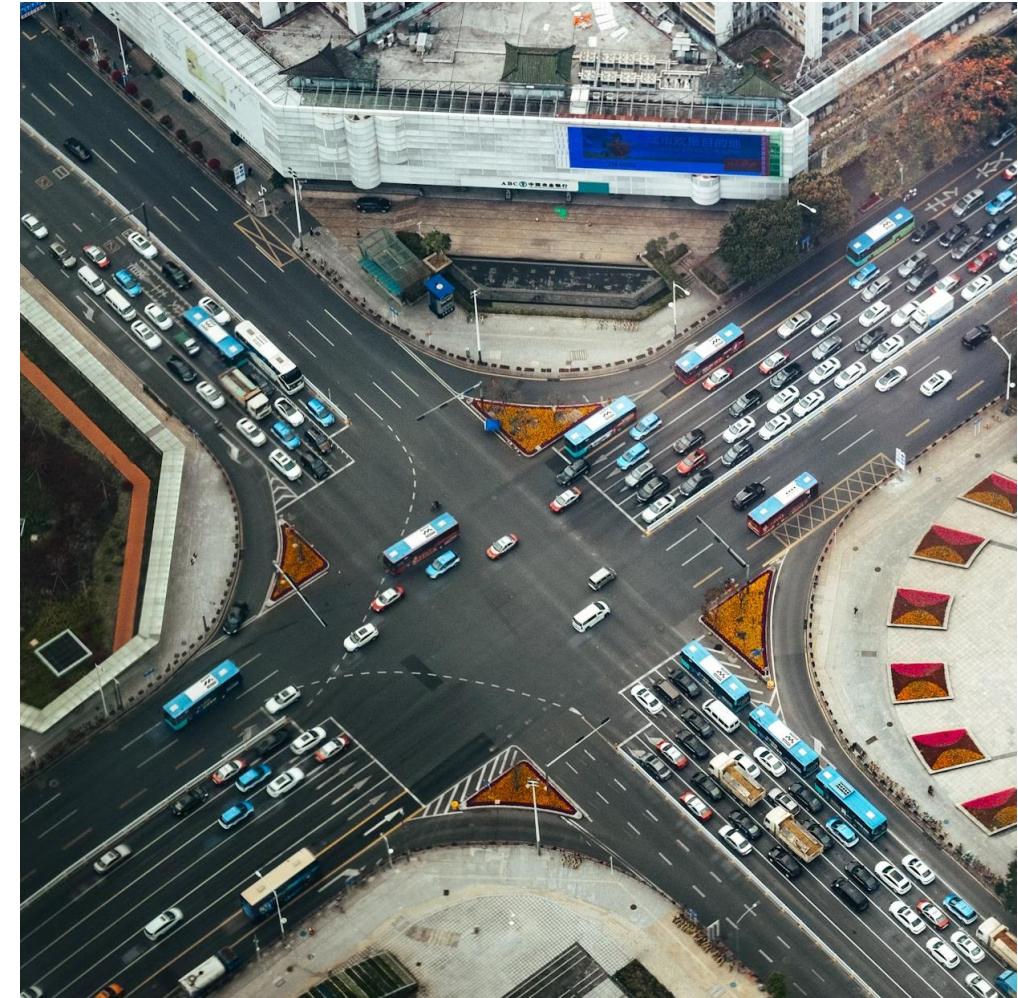
<https://tinyurl.com/cs690-lab1>

Agenda

- Introduction to Heterogeneous Traffic
- Vehicle Type Definitions
- Creating Heterogeneous Scenarios
 - Defining flows
 - Defining distributions

Heterogeneous Traffic

- Traffic composed of various vehicle types with different characteristics
- Reflects real-world complexity



Characteristics of Heterogeneous Traffic

- Varied vehicle attributes
 - Size
 - Speed
 - Acceleration/deceleration
 - Minimum gap etc.

Defining Vehicle Types & Routes

```
<!-- Basic passenger car -->
<vType id="car" vClass="passenger" length="5.0" minGap="2.5"
maxSpeed="50.0" accel="2.6" decel="4.5"/>
```

```
<!-- Simple route definition -->
<route id="north_left" edges="-E0 E3"/>
```

```
<!-- Individual vehicles -->
<vehicle id="car_1" type="car" route="north_left" depart="20"/>
```

Defining Vehicle Types & Routes

- SUMO has various classes of vehicles available:
 - passenger, taxi, bus, motorcycle, truck,...
 - [https://sumo.dlr.de/docs/Vehicle Type Parameter Defaults.html](https://sumo.dlr.de/docs/Vehicle_Type_Parameter_Defaults.html)

Mini Challenge: 6 Minutes

- Add two more vehicles of the following types and attributes.
- The truck should start from the south and take a left turn, departing before the car.
- The bus should start from the south and go straight, departing after the car.

[Note: The vehicles need to be listed according to the depart time to be properly generated.]

	Truck	Bus
ID	<i>truck</i>	<i>bus</i>
Vehicle Class	<i>truck</i>	<i>bus</i>
Length	<i>8 m</i>	<i>12 m</i>
Min Gap	<i>3 m</i>	<i>3 m</i>
Max Speed	<i>22 m/s</i>	<i>25 m/s</i>
Acceleration	<i>1.3 m/s²</i>	<i>1.2 m/s²</i>
Deceleration	<i>4 m/s²</i>	<i>4 m/s²</i>

Creating Heterogeneous Traffic Flow

- Define flow explicitly for each type
- Define flow using type distribution for each route

Creating Heterogeneous Traffic Flow

- **Define flow explicitly for each type**

```
<!-- Flow definitions -->
<flow id="carflow_1" type="car" route="north_left" begin="0"
end="900" vehsPerHour="120"/>
```

Mini Challenge: 4 Minutes

- Add flow definition for truck and bus similarly for the same route.
- Cars, trucks, and busses should constitute roughly 60%, 30%, and 10% of the overall traffic, respectively.

Creating Heterogeneous Traffic Flow

- **Define flow using type distribution for each route**

```
<!-- Vehicle type distribution -->
<vTypeDistribution id="fleet1" vTypes="car truck bus"
probabilities="0.6 0.3 0.1"/>

<!-- Flow using distribution -->
<flow id="mixed_flow_1" type="fleet1" route="north_left"
begin="0" end="900" vehsPerHour="200"/>
```

Mini Challenge: 5 Minutes

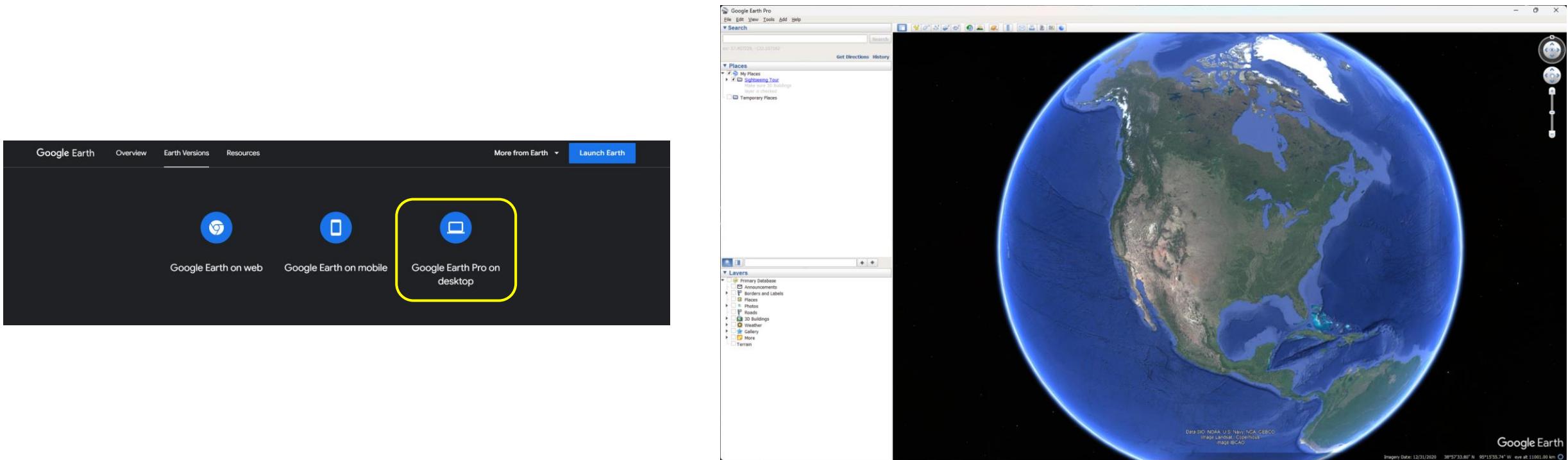
- Add one more vehicle type (such as taxi or delivery). Use your best estimates for the attribute values.
- Add another vehicle distribution with the four vehicle types.
- Add two more mixed flows for south_left and south_straight directions with your vehicle distribution.

Heterogeneity from a different Angle: Driving Behavior

```
<vType id="regular" vClass="passenger" speedFactor="1.0" sigma="0.5" tau="2.0"/>  
<vType id="aggressive" vClass="passenger" speedFactor="1.2" sigma="0.7" tau="1.0"/>  
<vType id="cautious" vClass="passenger" speedFactor="0.8" sigma="0.4" tau="3.0"/>
```

Next Lab: Background Image in SUMO

- Download and install **Google Earth Pro** on desktop
 - <https://www.google.com/earth/about/versions/>



References

- [https://sumo.dlr.de/docs/Vehicle Type Parameter Defaults.html](https://sumo.dlr.de/docs/Vehicle_Type_Parameter_Defaults.html)
- [https://sumo.dlr.de/docs/Definition of Vehicles%2C Vehicle Types%2C and Routes.html](https://sumo.dlr.de/docs/Definition_of_Vehicles%2C_Vehicle_Types%2C_and_Routes.html)