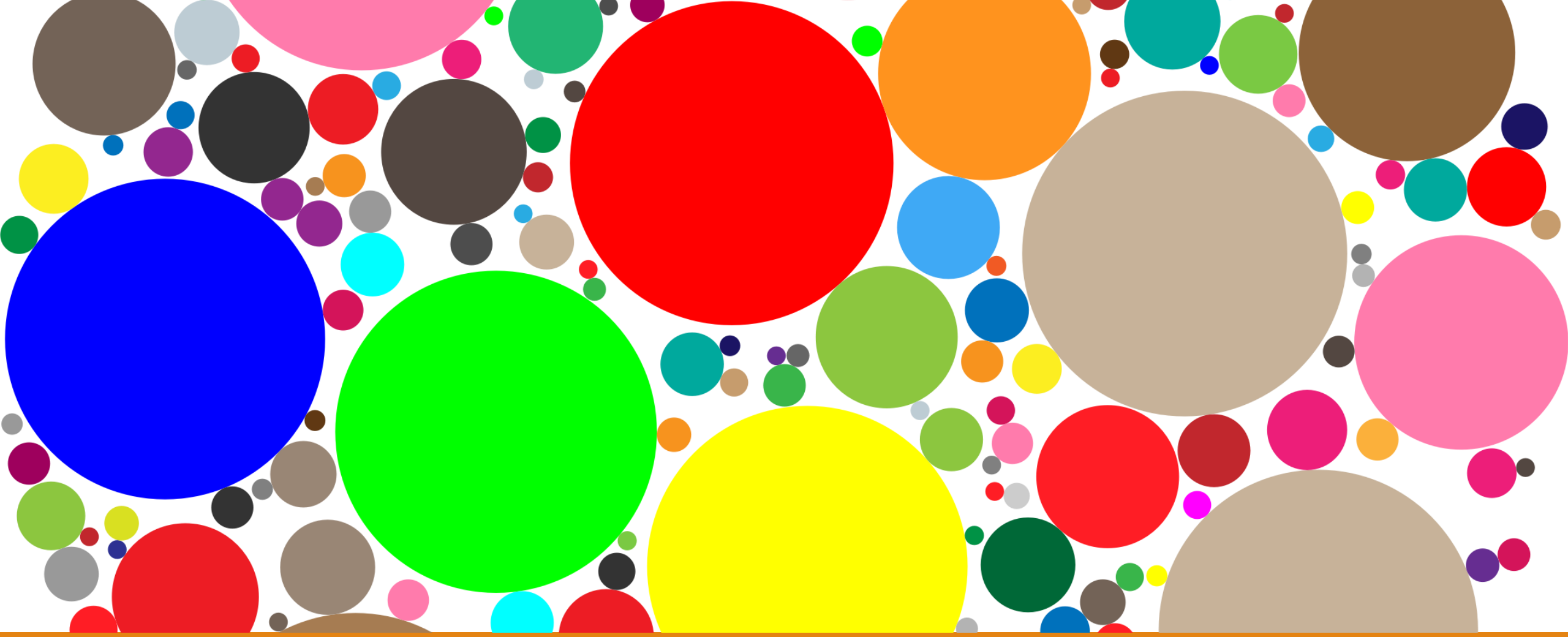


Minimal Transportation Simulation

Minimal Transportation Simulation

ALEXIS PIBRAC

INTERNSHIP FEB-MAY 2016

上海交通大學

SHANGHAI JIAO TONG UNIVERSITY

POLYTECHNIQUE MONTRÉAL

PR. CHEN JIANGHANG

PR. WANG XIAOLEI

PR. BILAL FAROOQ

ALEXIS PIBRAC

Plan

1. Presentation of the study
2. The simulation tool
3. Some results
4. What’s next

Plan

1. Presentation of the study
2. The simulation tool
3. Some results
4. What’s next

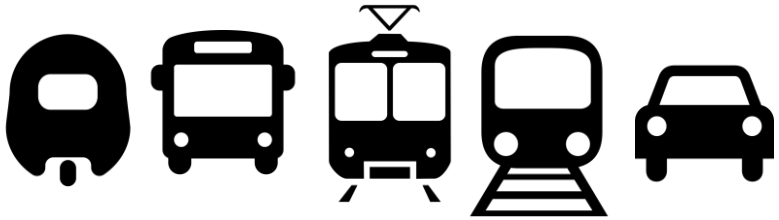
The dynamic transportation systems

STATIC

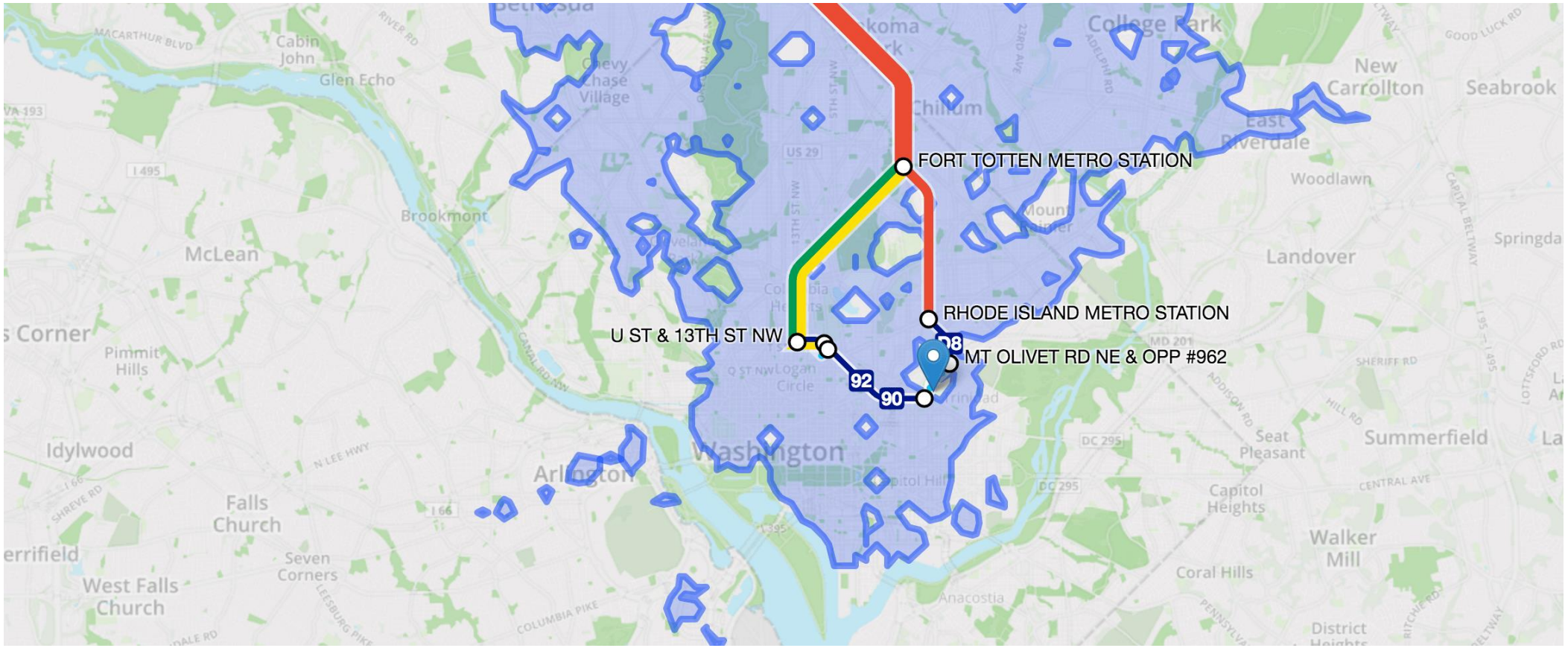
- Personal cars
- Metro/subways/bus/train
- Walk/bike

DYNAMIC

- Taxi
- Uber style
- Ridesharing
- Carsharing
- Driverless car float?



Transportation simulations

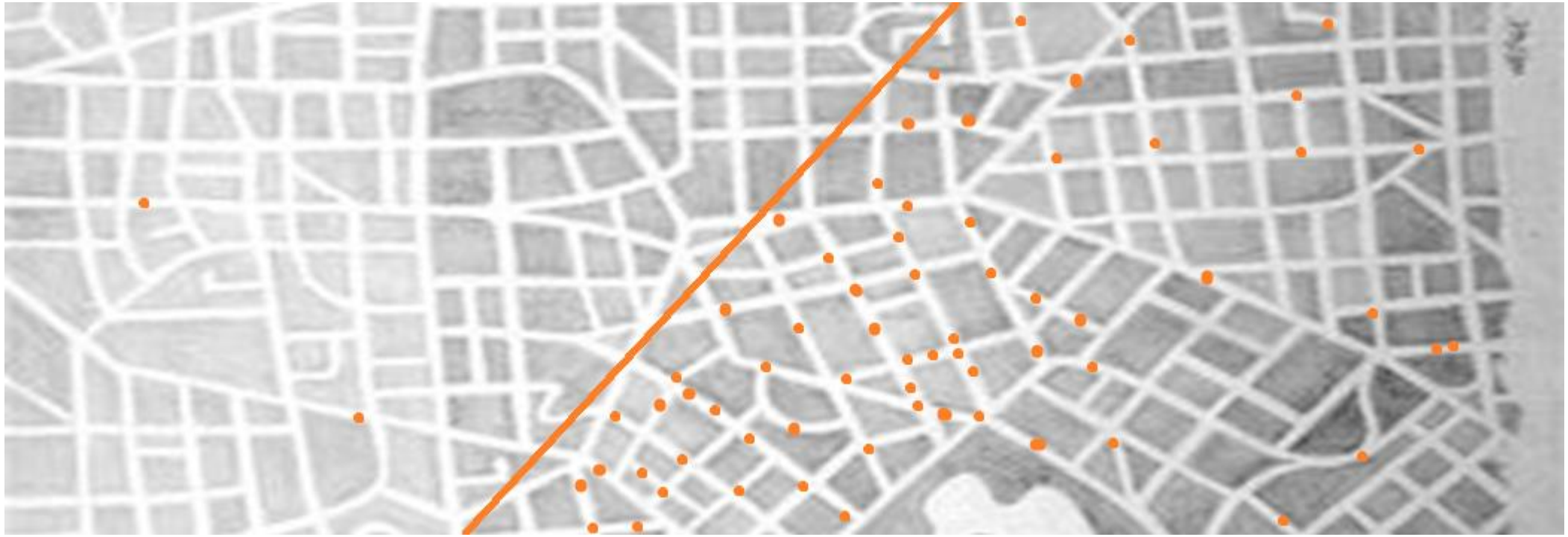


Transportation simulations

- Number of users
- Efficiency
- Price
- Side effects
- Vehicule kilometers travelled saving
- …

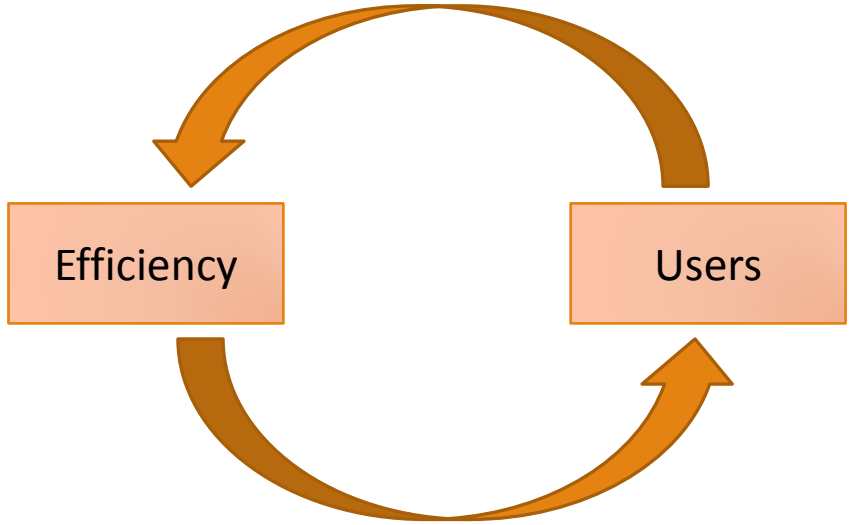
Dynamic transportation systems

The efficiency depends on the number of users.



Dynamic transportation systems

The installation and efficiency are dynamic.



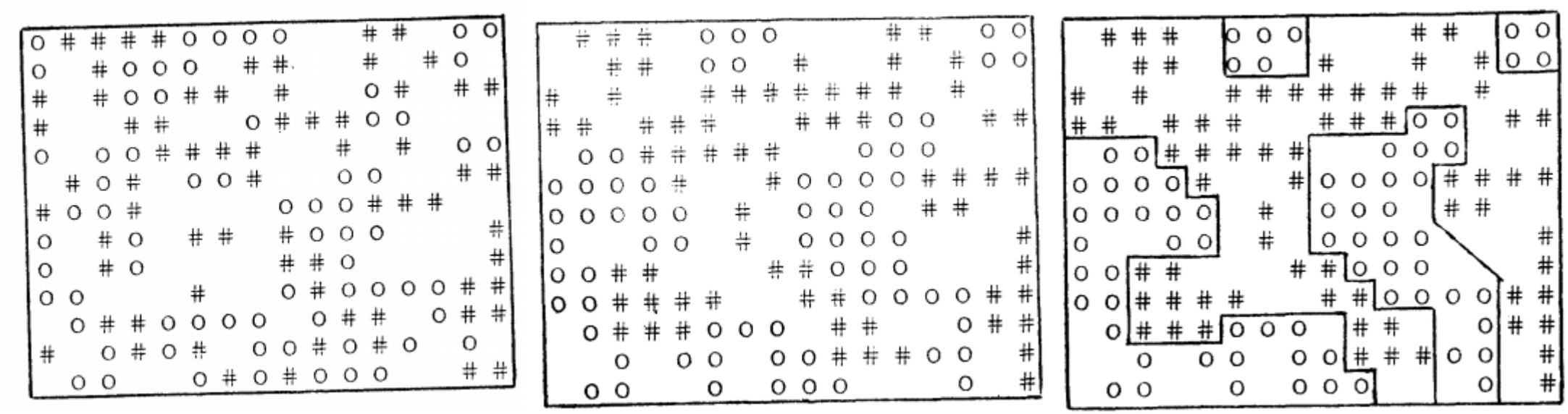
Transportation simulations

…already exist

But designed for STATIC modes, can’t accept DYNAMIC ones.

The Schelling approach

« Dynamic models of segregation », 1971



The Schelling approach

SEGREGATION IS

Analysed at a macroscopic level

Dependant on the network

Dependant on individual behaviors

The Schelling approach

SEGREGATION IS

Analysed at a macroscopic level

Dependant on the network

Dependant on individual behaviors

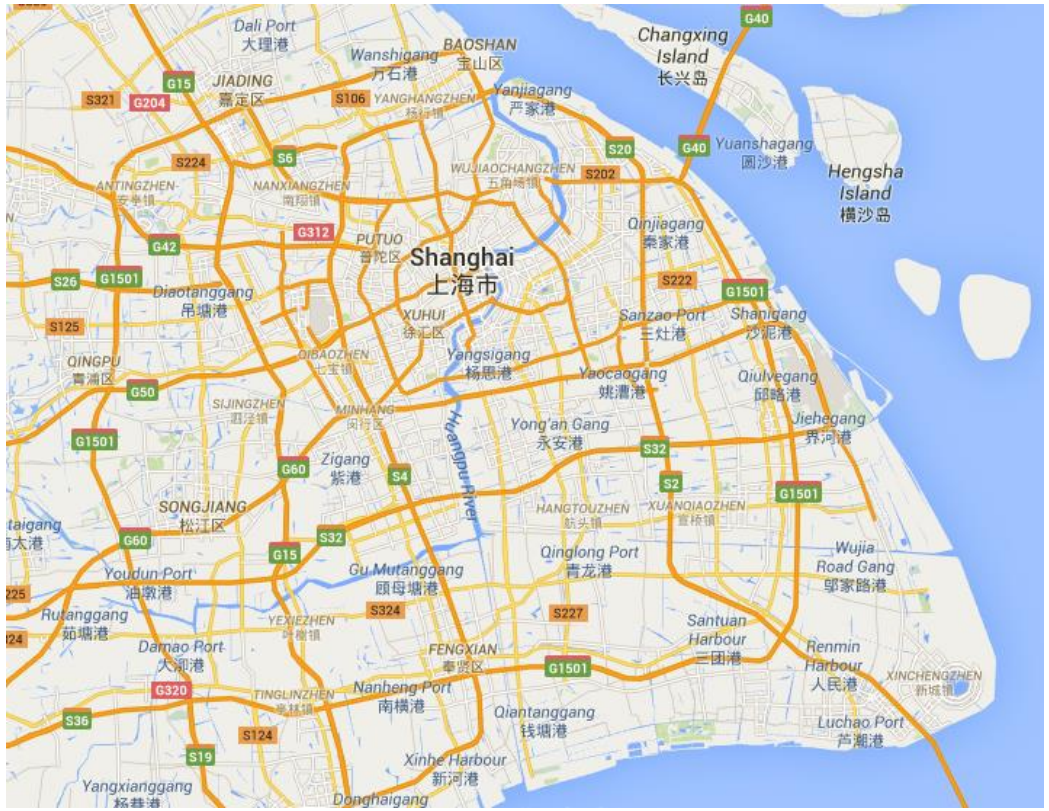
DYNAMIC TRANSPORTATION SYSTEM EFFICIENCY IS

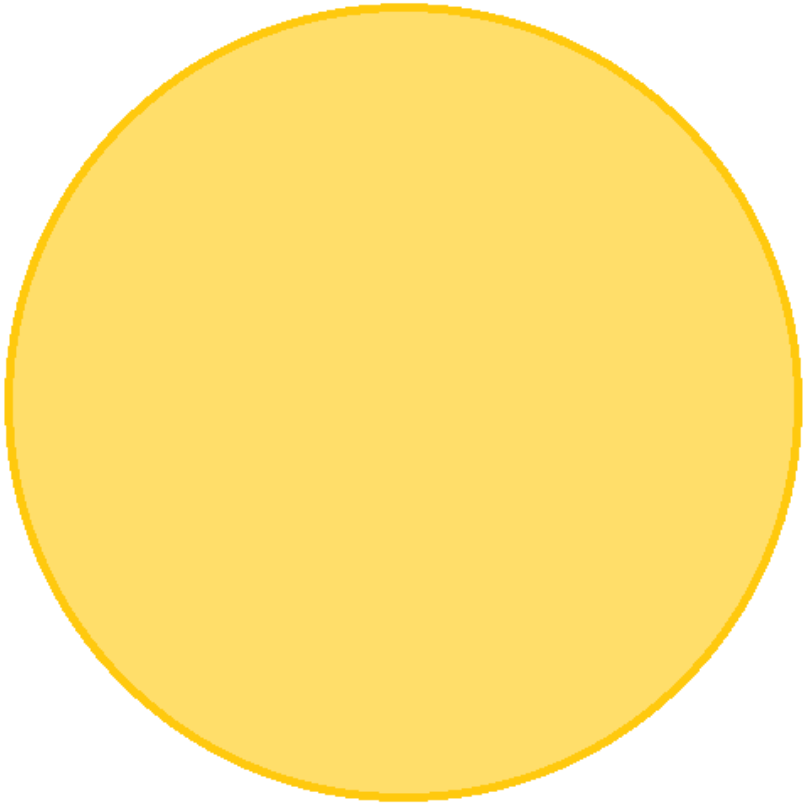
Analysed at a macroscopic level

Dependant on the network

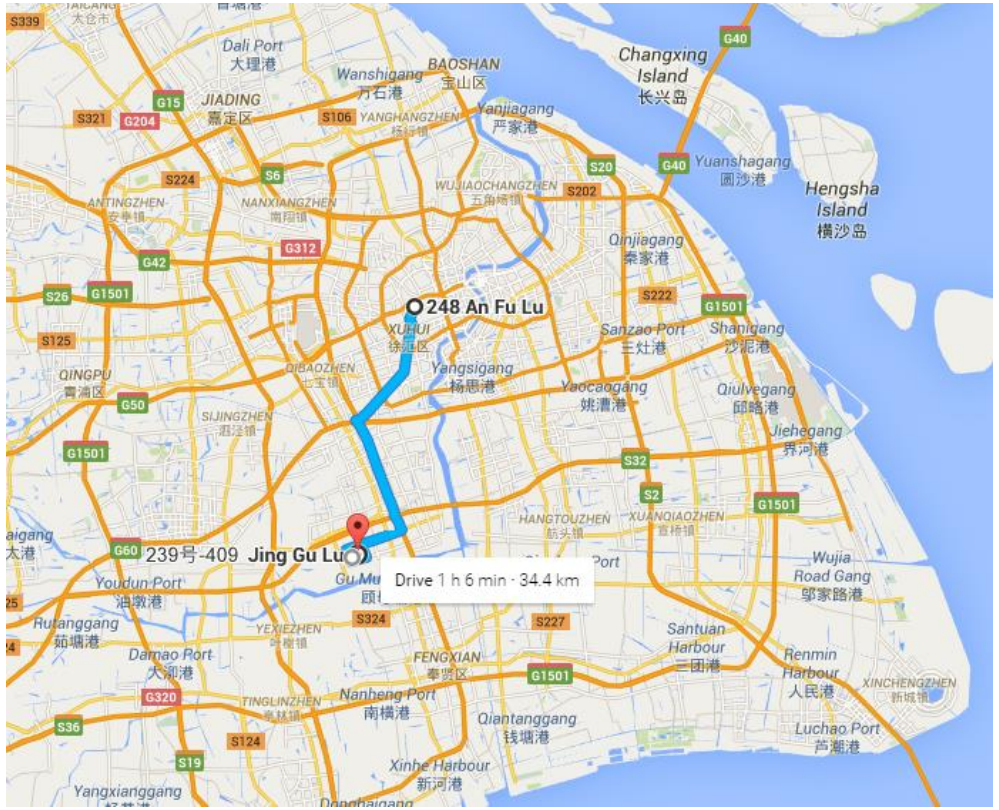
Dependant on individual behaviors

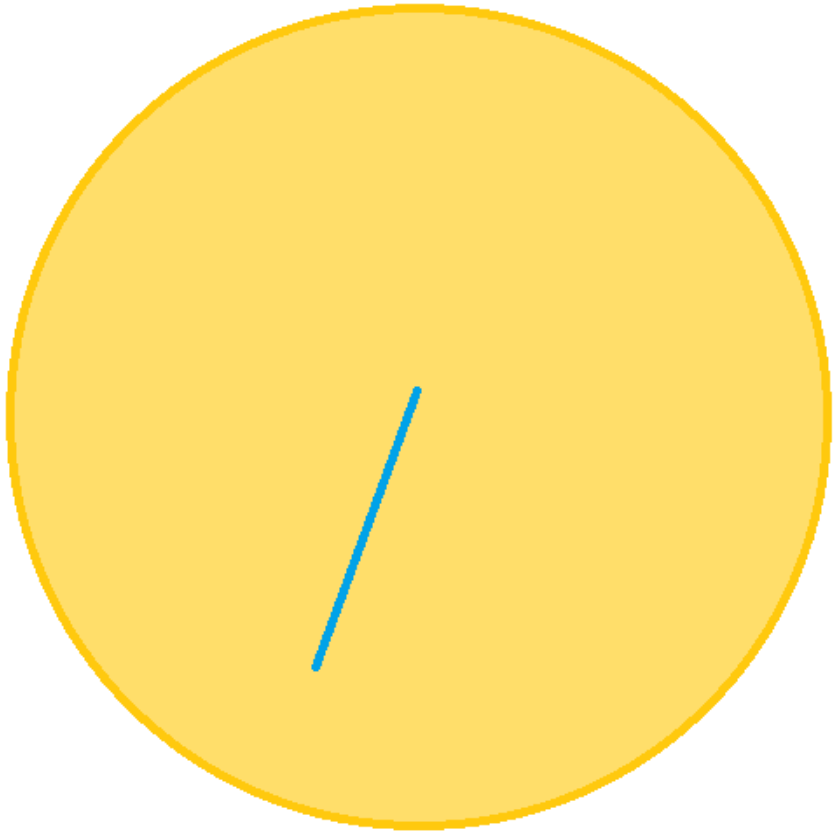
Our approach



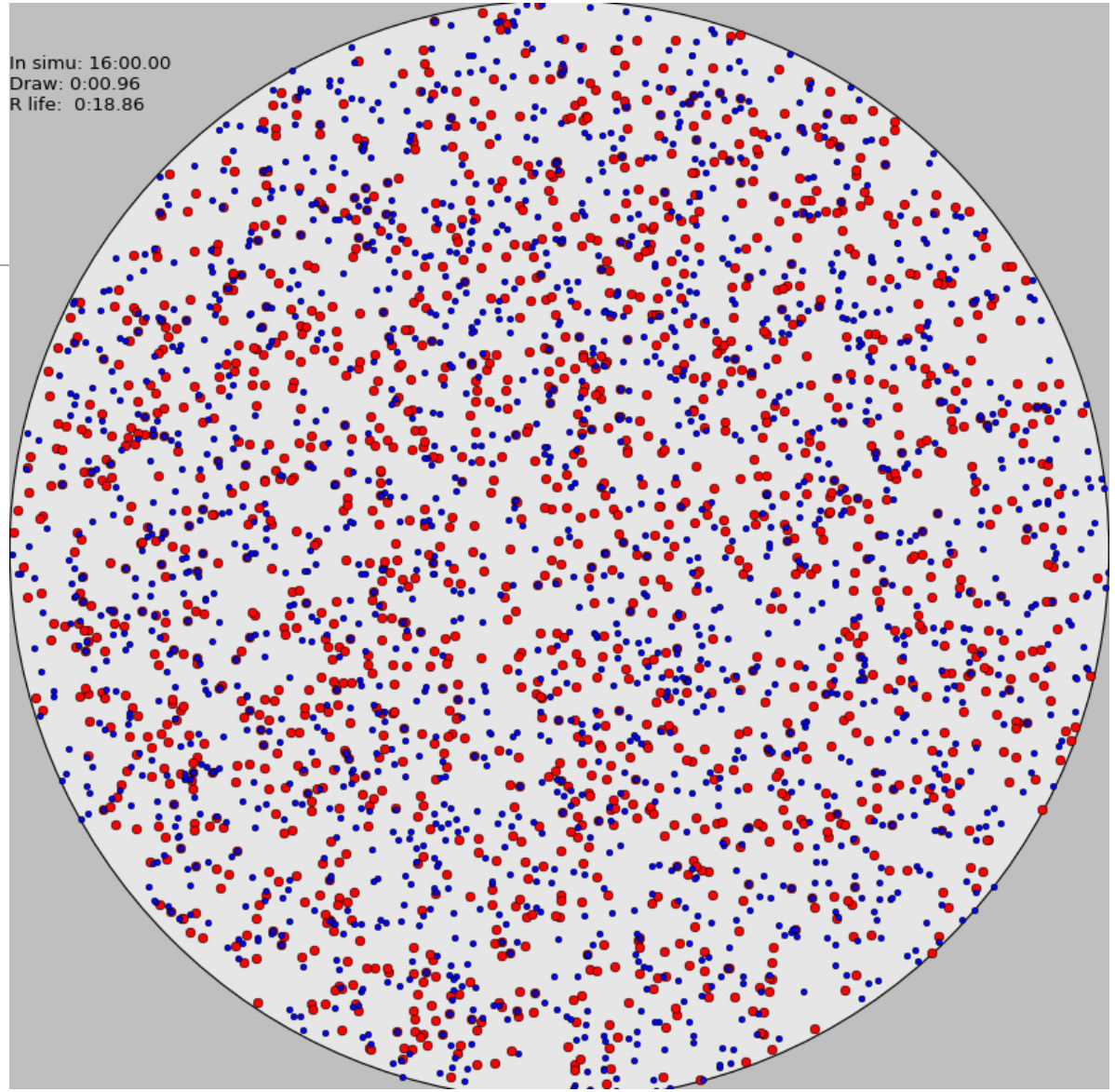


Our approach

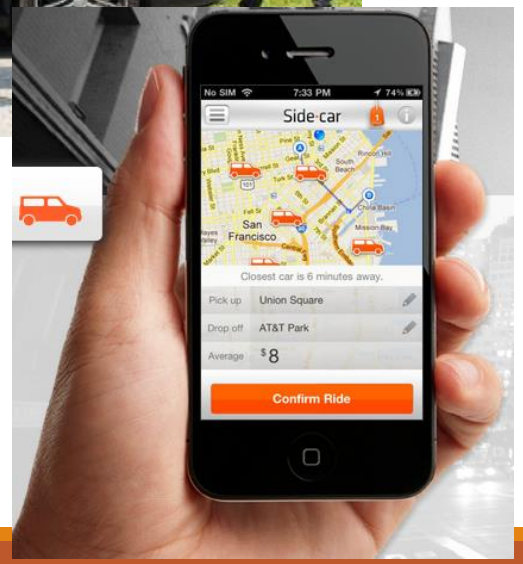




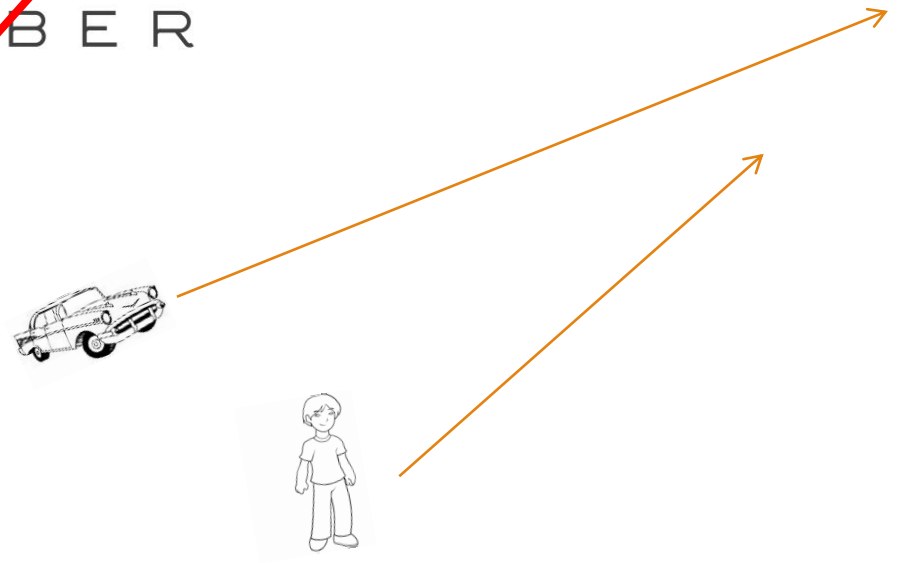
Our simulation



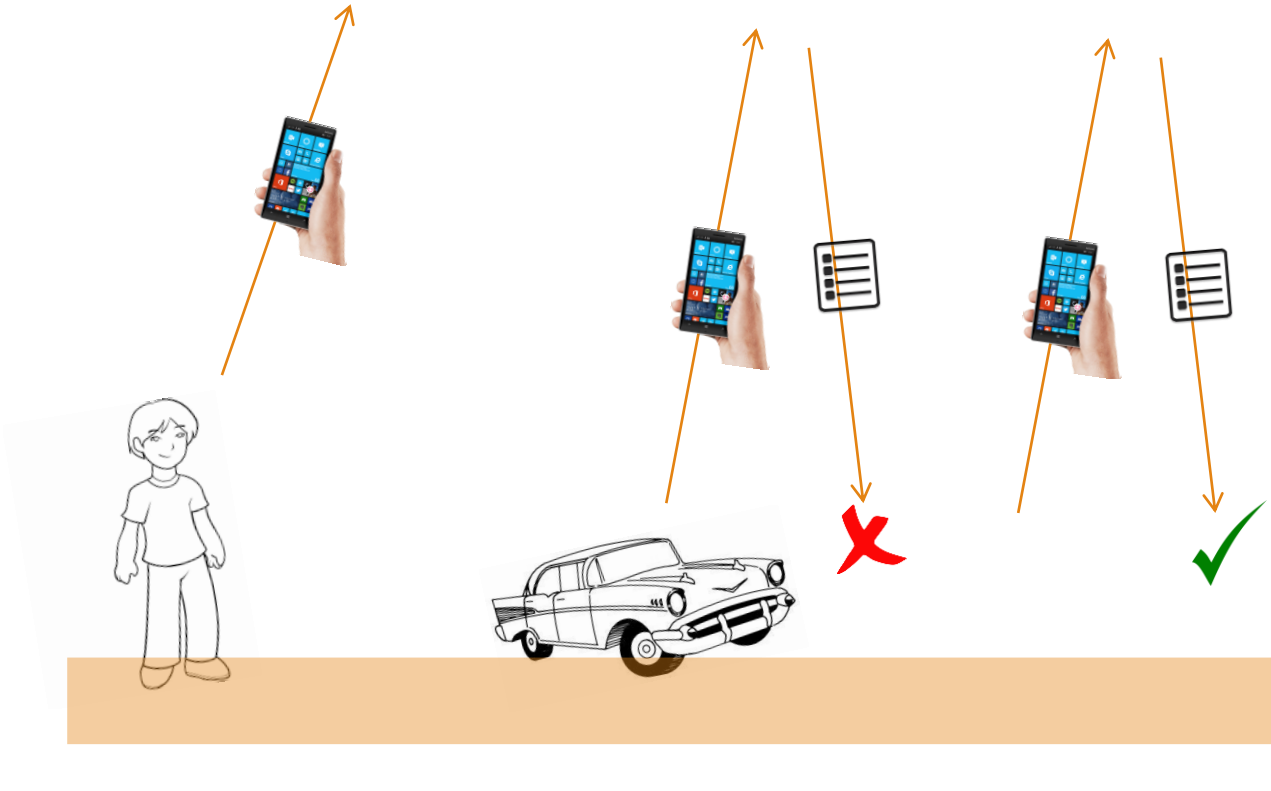
Chosen transportation system: Dynamic Ride-Sharing



UBER



Chosen transportation system: « Shanghai platform »



Plan

1. Presentation of the study
2. The simulation tool
3. Some results
4. What’s next

The tool

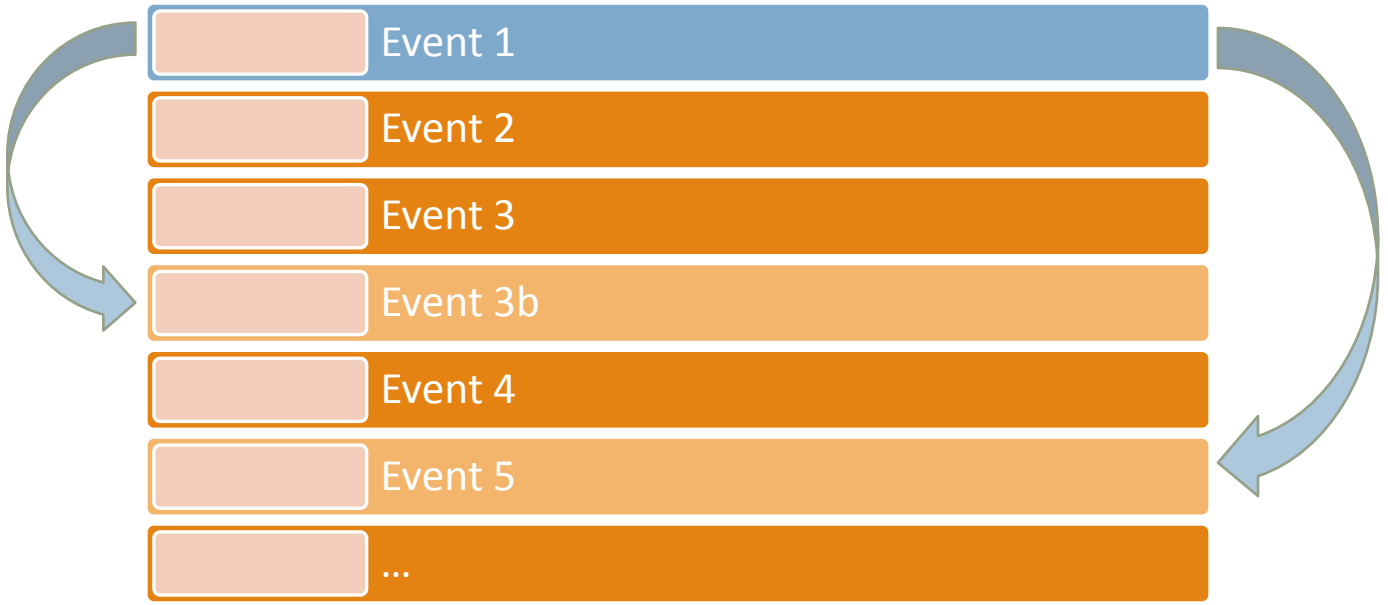
- In Python
- Agent based
- Discrete event simulation

The tool

- In Python
- Agent based
- Discrete event simulation

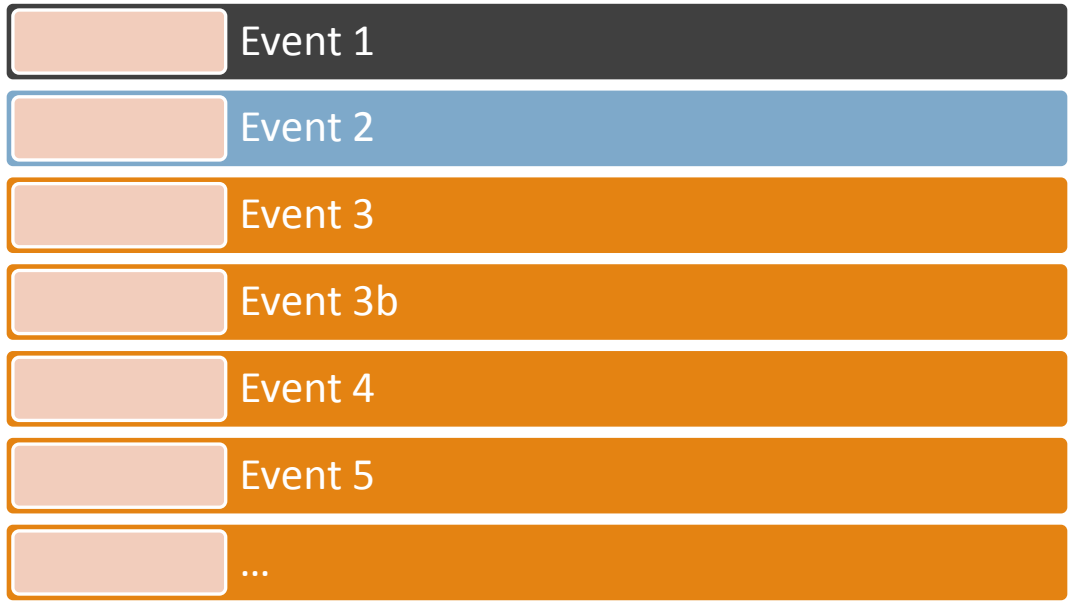
The tool

- In Python
- Agent based
- Discrete event simulation



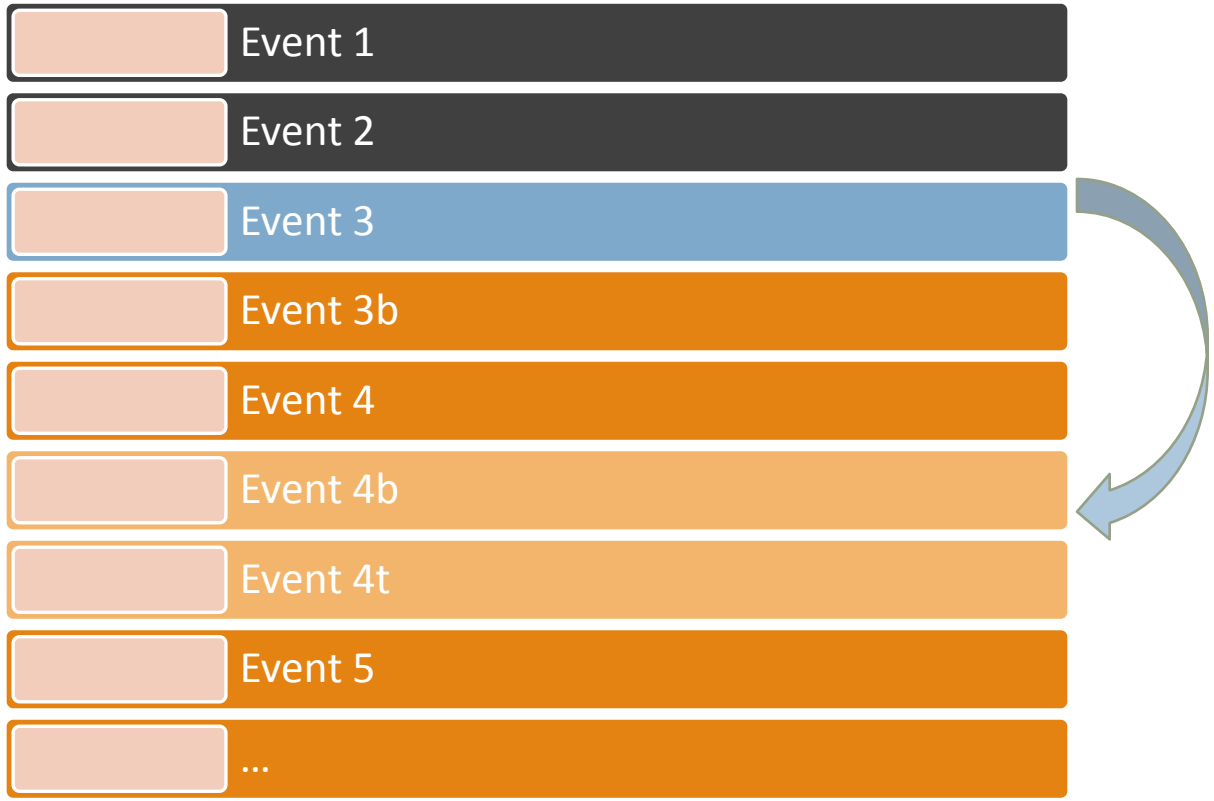
The tool

- In Python
- Agent based
- Discrete event simulation



The tool

- In Python
- Agent based
- Discrete event simulation



The tool

Core

- System’s functions
- Graphs and display tools

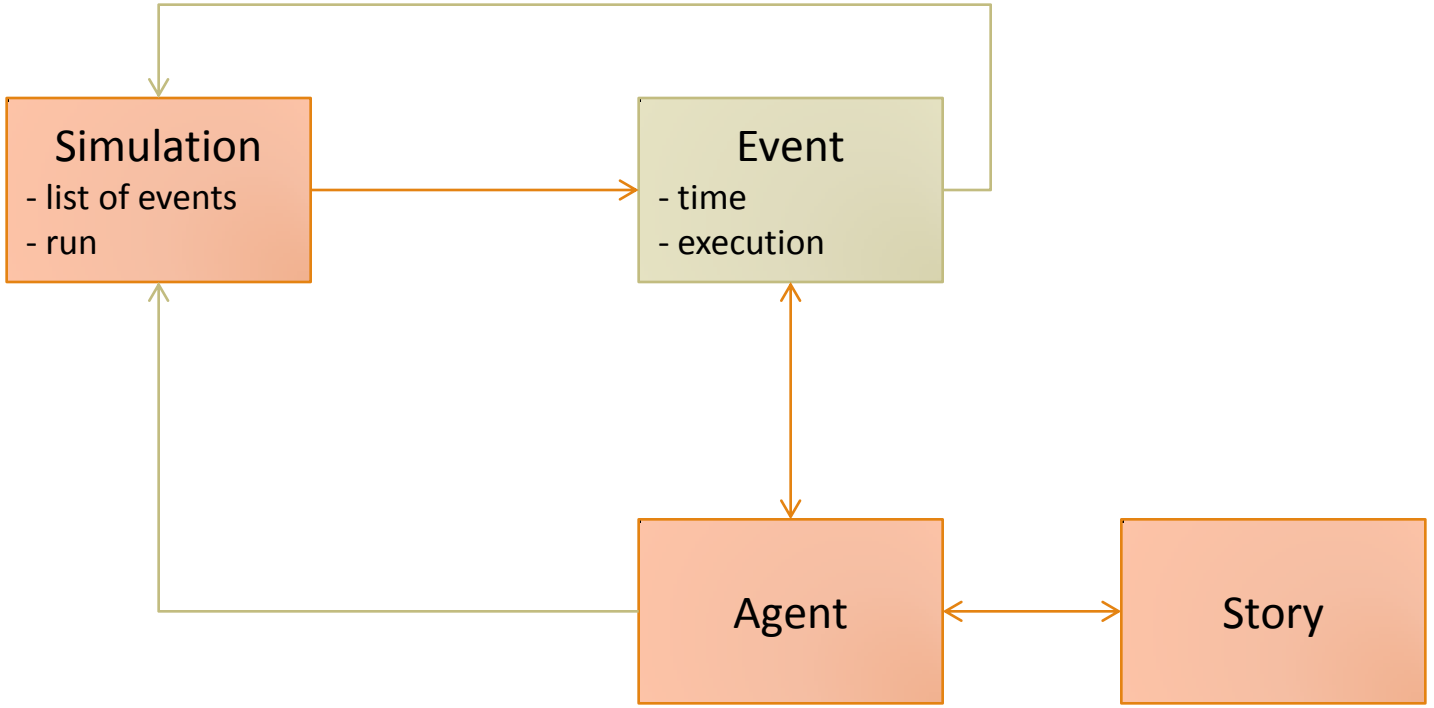
Matching Platform

- One kind of dynamic system + description of agents
- Particular functions to prepare the simulation

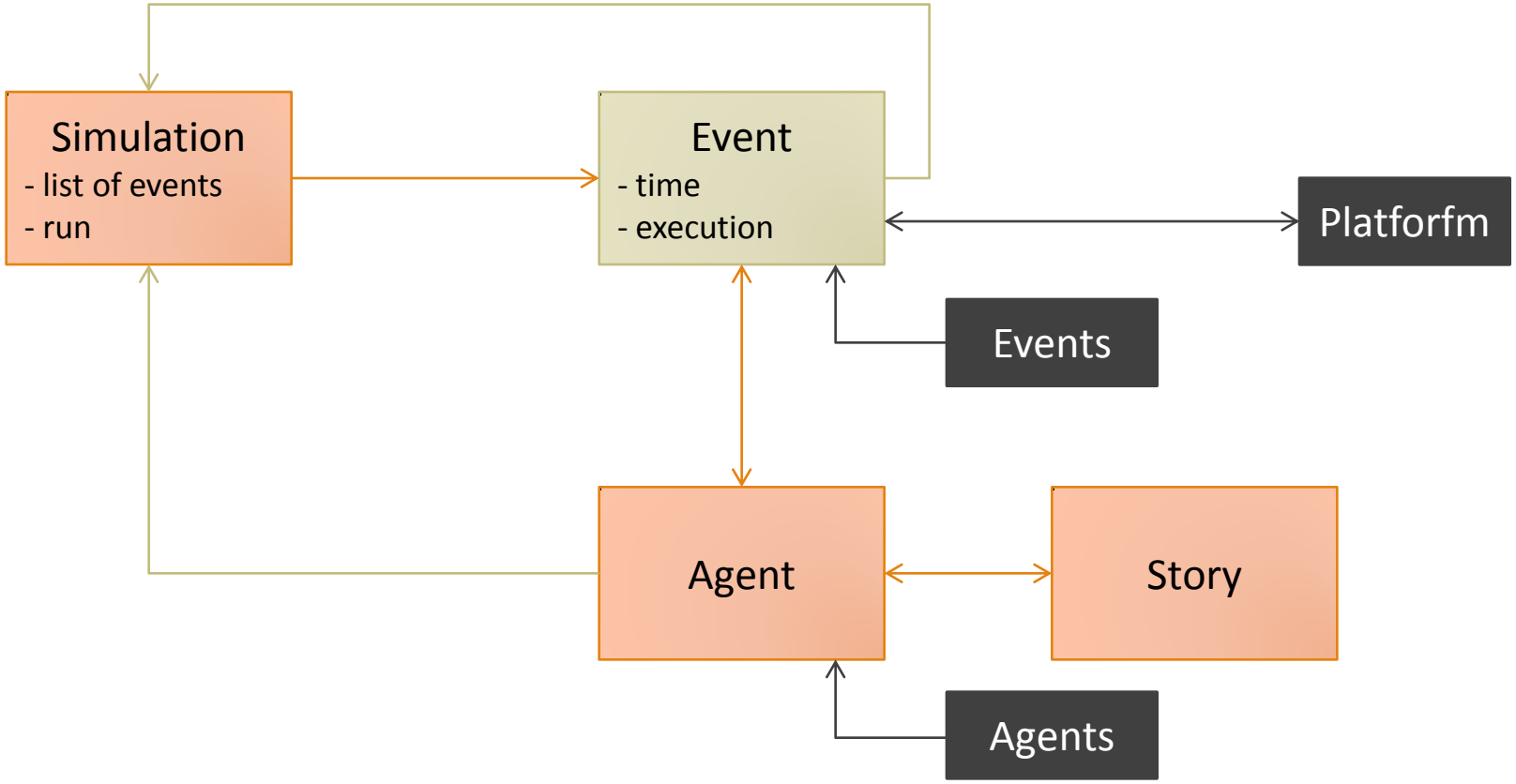
Execution of Simulations

- Config.py (parameters)
- Execution

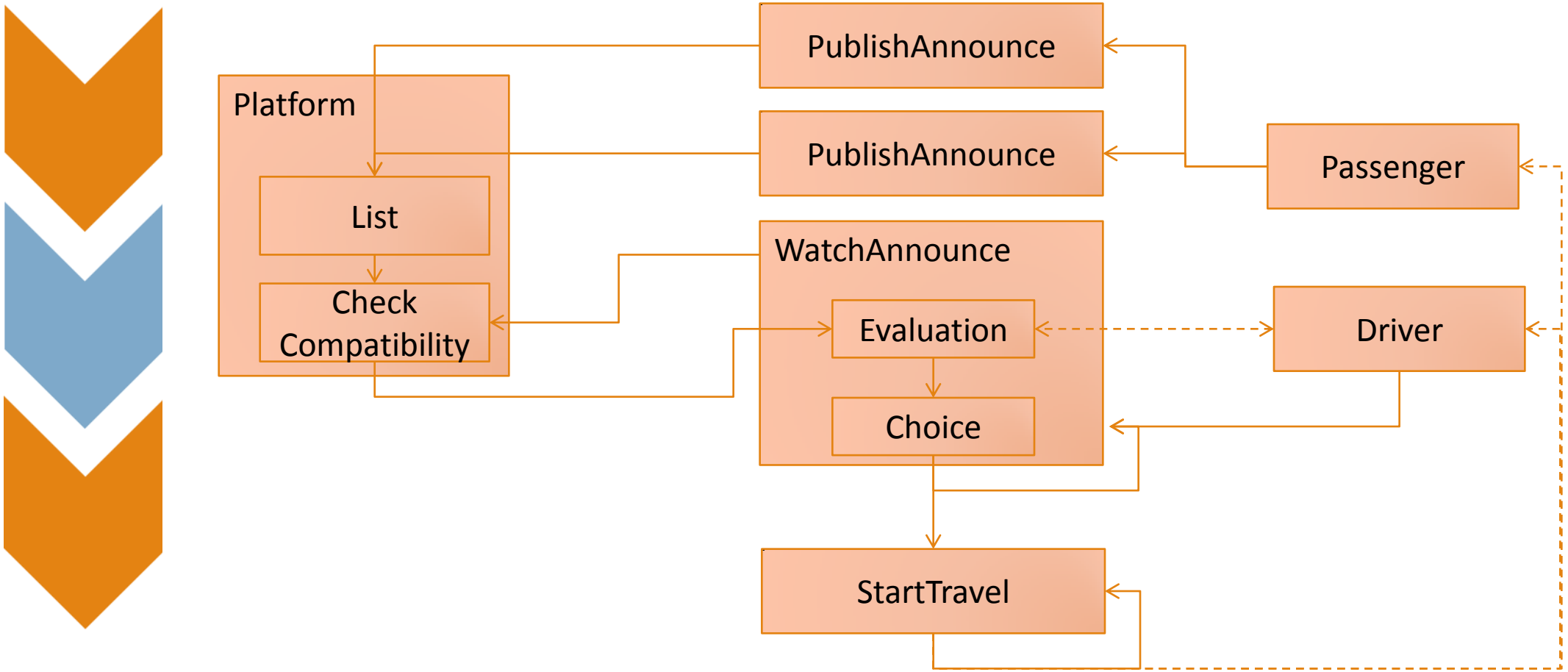
The tool: Core



The tool: Core



The tool: matching platform



The tool: Parameters

Config.py

```
12 #DIMENSION OF THE NETWORK
13 speed = 25 / 3.6 # 25 km/h
14 radius = 25 * 1000 #  25km
15 end = 3 * 3600 #  3h
16
17 #GENERAL VALUES
18 N_driver=2000# [100000]# [2000,4000,5000]#,6000,7000,8000,9000,10000,20000,30000,50000]
19 N_passenger=2000#[100000]# [2000,4000,5000]#,6000,7000,8000,9000,10000,20000,30000,50000]
20
21 #DRIVERS CARACTERISTICS
22 first_watching_before_first_departure = 5 * 60
23 window_size_of_departure = 15 * 60
24 time_elasticity = 5 * 60
25 fuel_cost = 0.6/1000#0.5RMB per kilometer
26 watching_repetition_average = 60 # -> random
27 watching_repetition_variance = 10
28 time_perception_average = 5/60 # = 24 * 50/100 / 3600 #50% of average income, in second   -> random
29 time_perception_variance = 3/60 #10% percent
30
31 #PASSENGERS CARACTERISTICS
32 publishing_advance = 20 * 60
33
34 #PLATFORM CARACTERISTICS
35 def benefits(origin,destination,network):
36     """Shanghai pricing"""
37     distance=network.travel_distance(origin,destination) / 1000 # in meter
38     if distance < 3: #3 first km fixprice
39         return 11#in RMB
40     if distance < 20:#until 20km at 1.5RMB / km
41         return 6.5 + distance * 1.5 # 11 + (distance - 3) * 1.5
42     return 16.5 + distance # 28.5 + (distance - 20) *1   # 28.5 = 3 + (20 - 3) * 1.5
```

Plan

1. Presentation of the study
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Basic simulations

Time = 3h

Radius = 25km

Perceived speed = 25km/h

20 000 drivers

20 000 passengers

Shanghai’s fuel cost and ride price

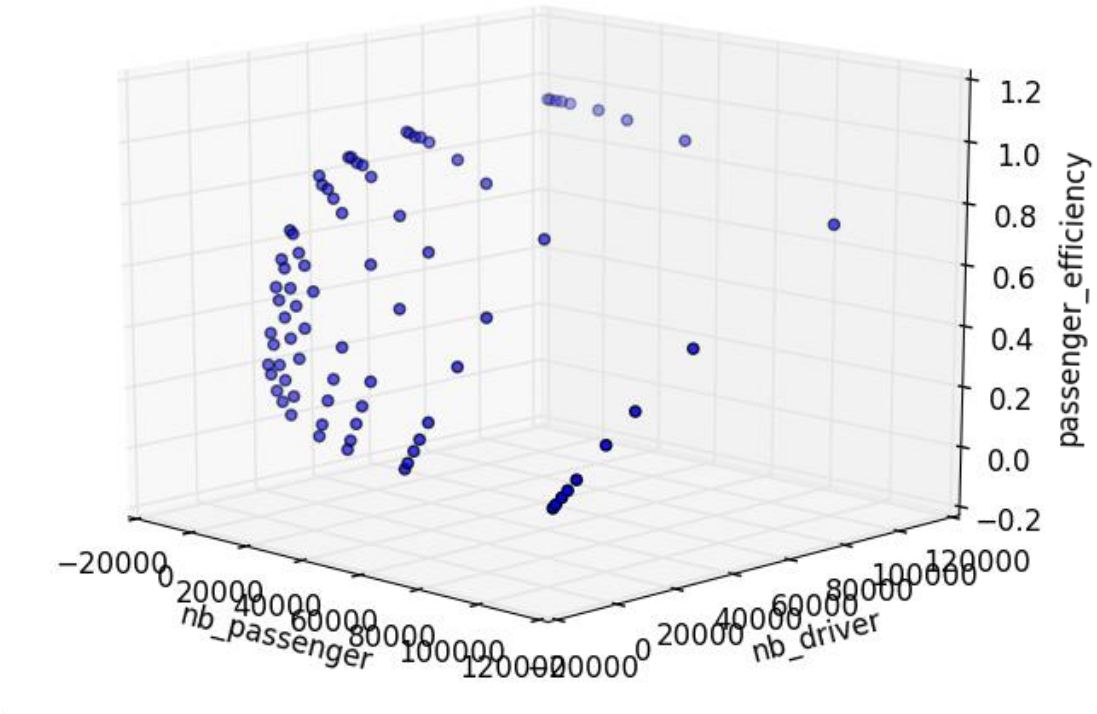
Platform reliability and efficiency

Several simulations launched with different parameters

Reliability

against

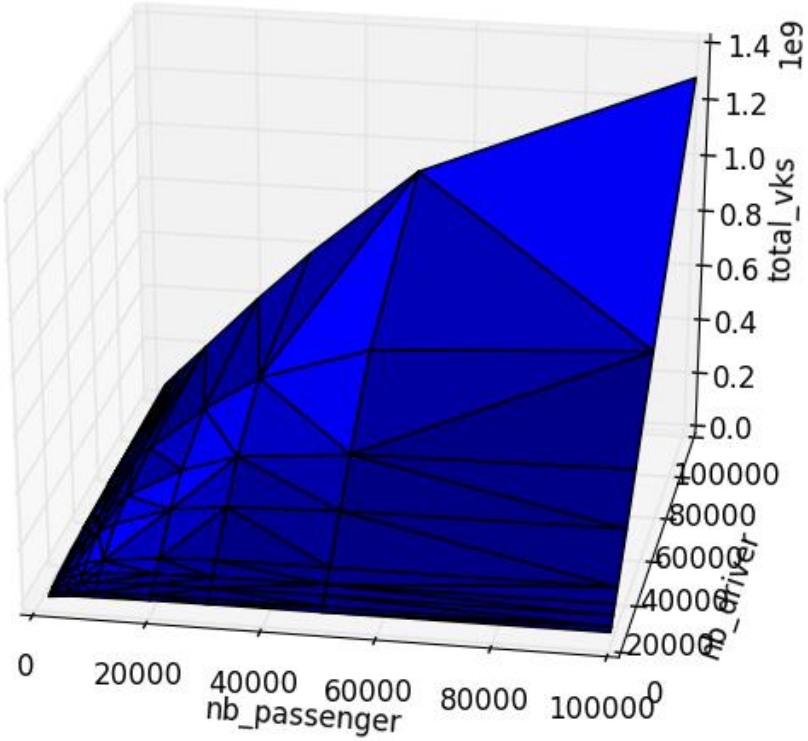
Number of users



Vehicule kilometers traveled saving

against

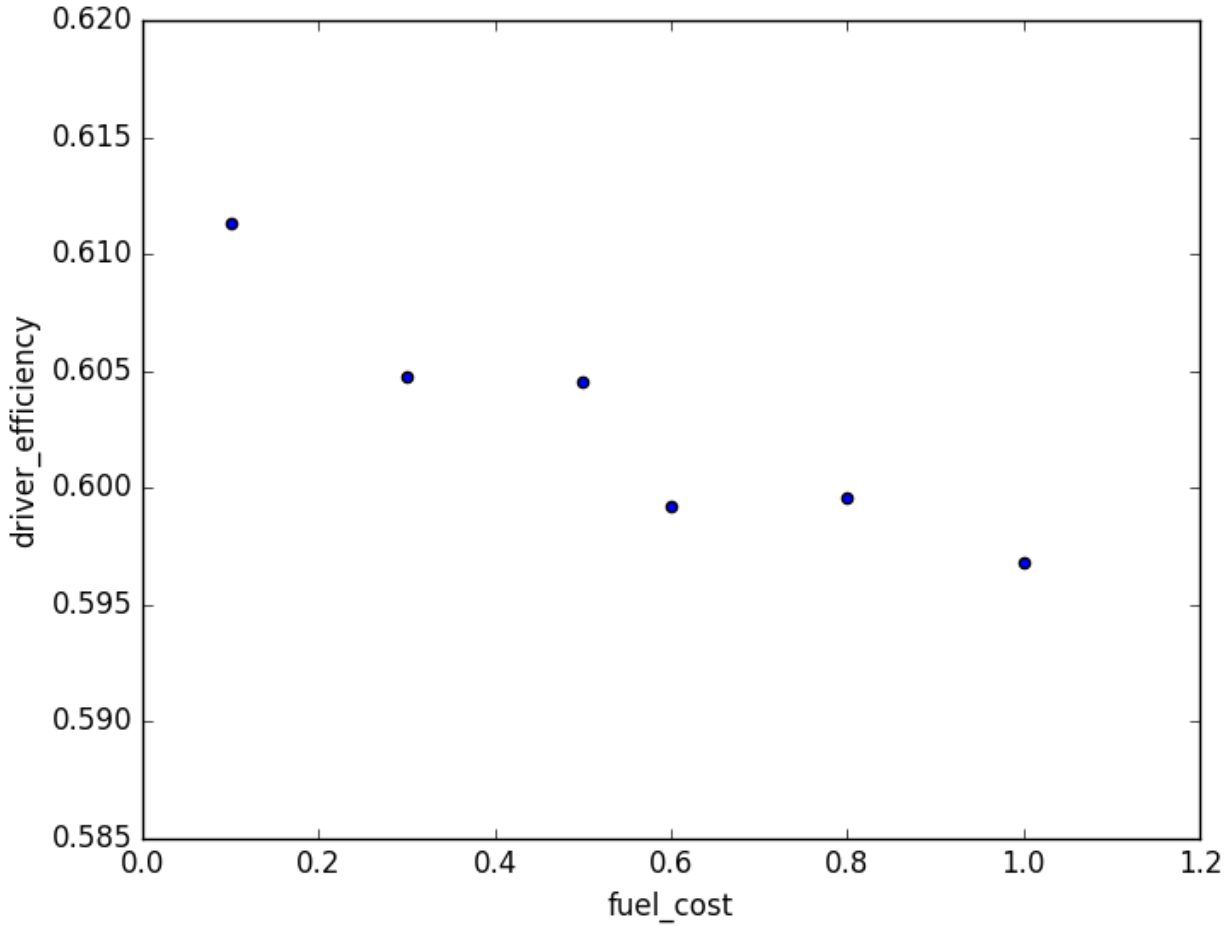
Number of users



Reliability

against

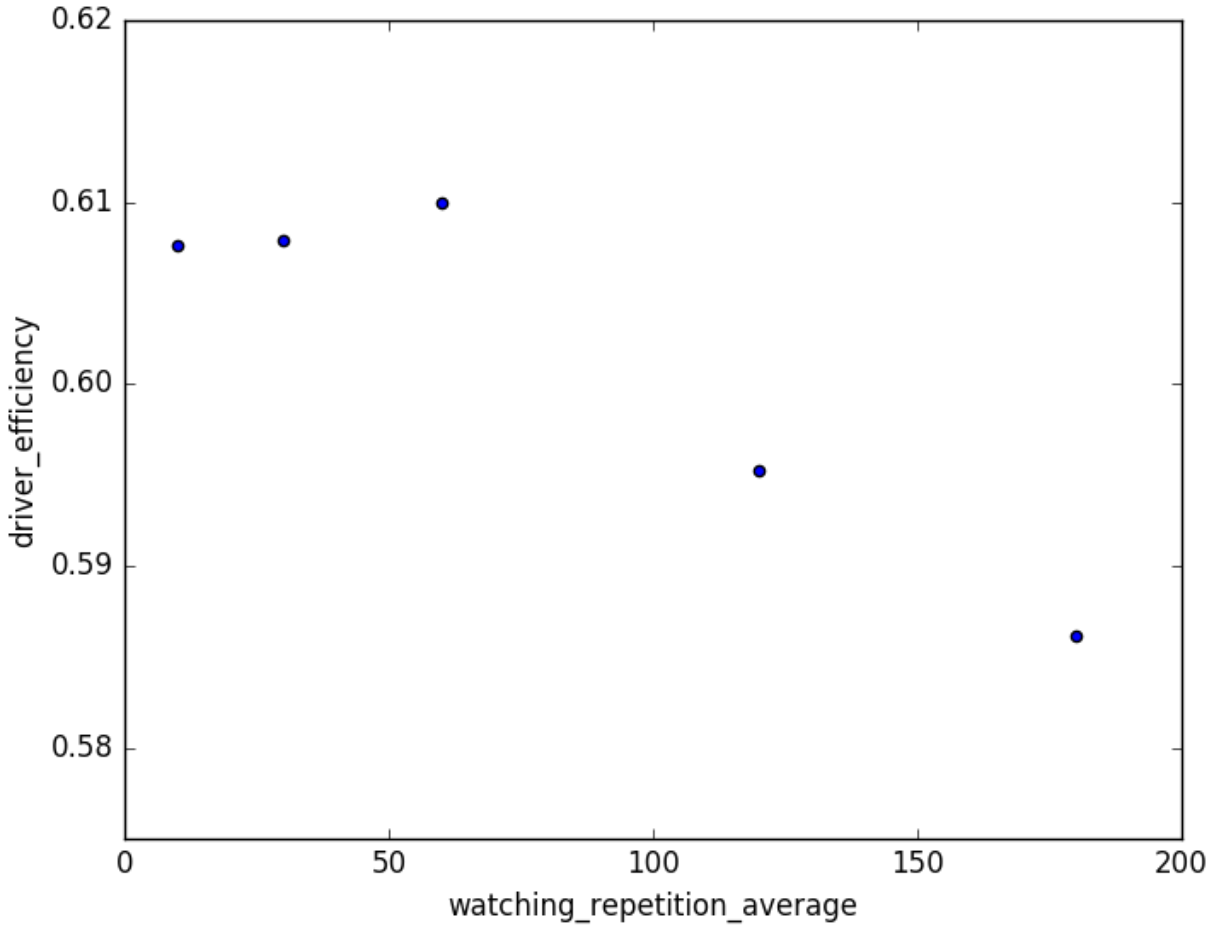
Fuel cost



Reliability

against

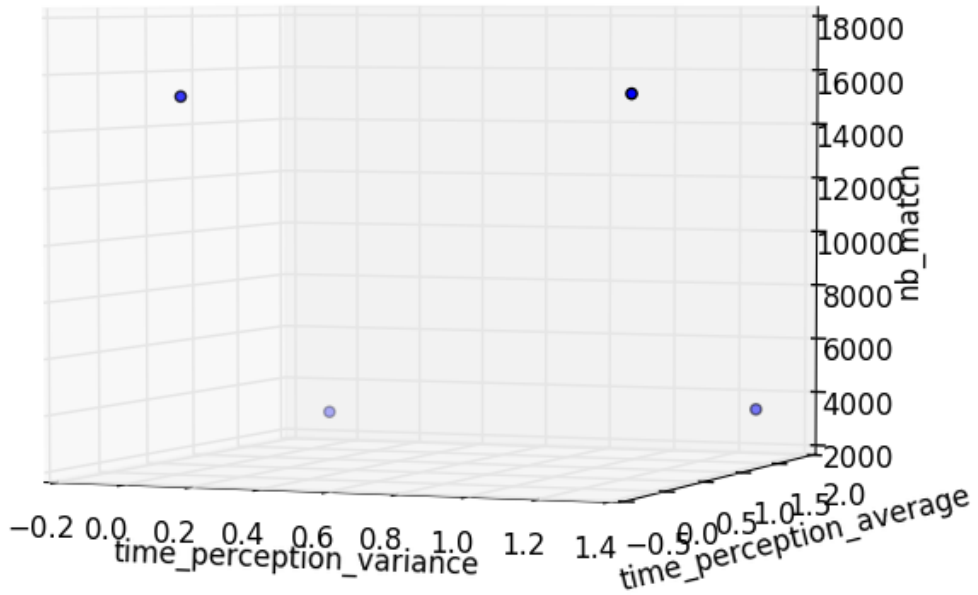
Average watching tempo



Number of matches

against

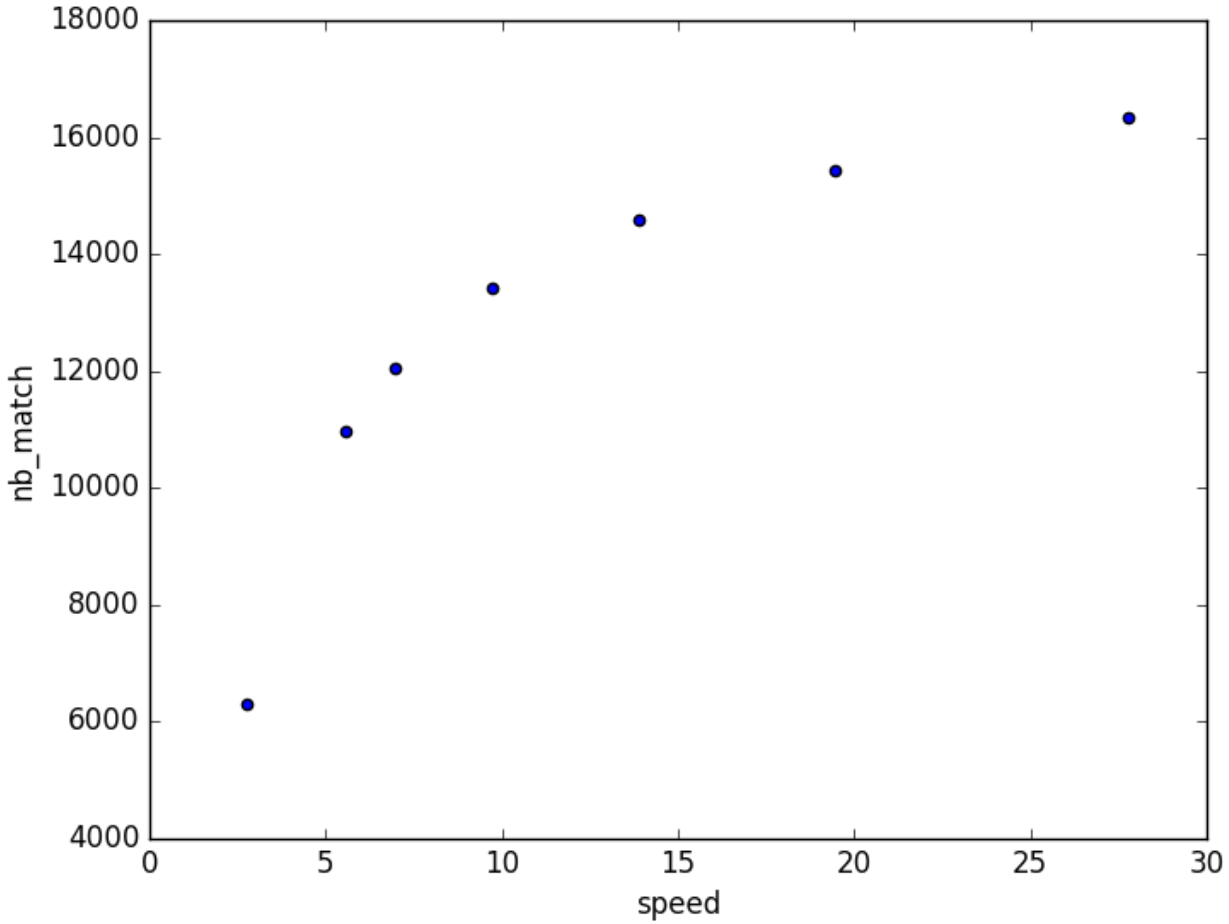
Driver's value of time



Number of match

against

Average speed



Customer analysis

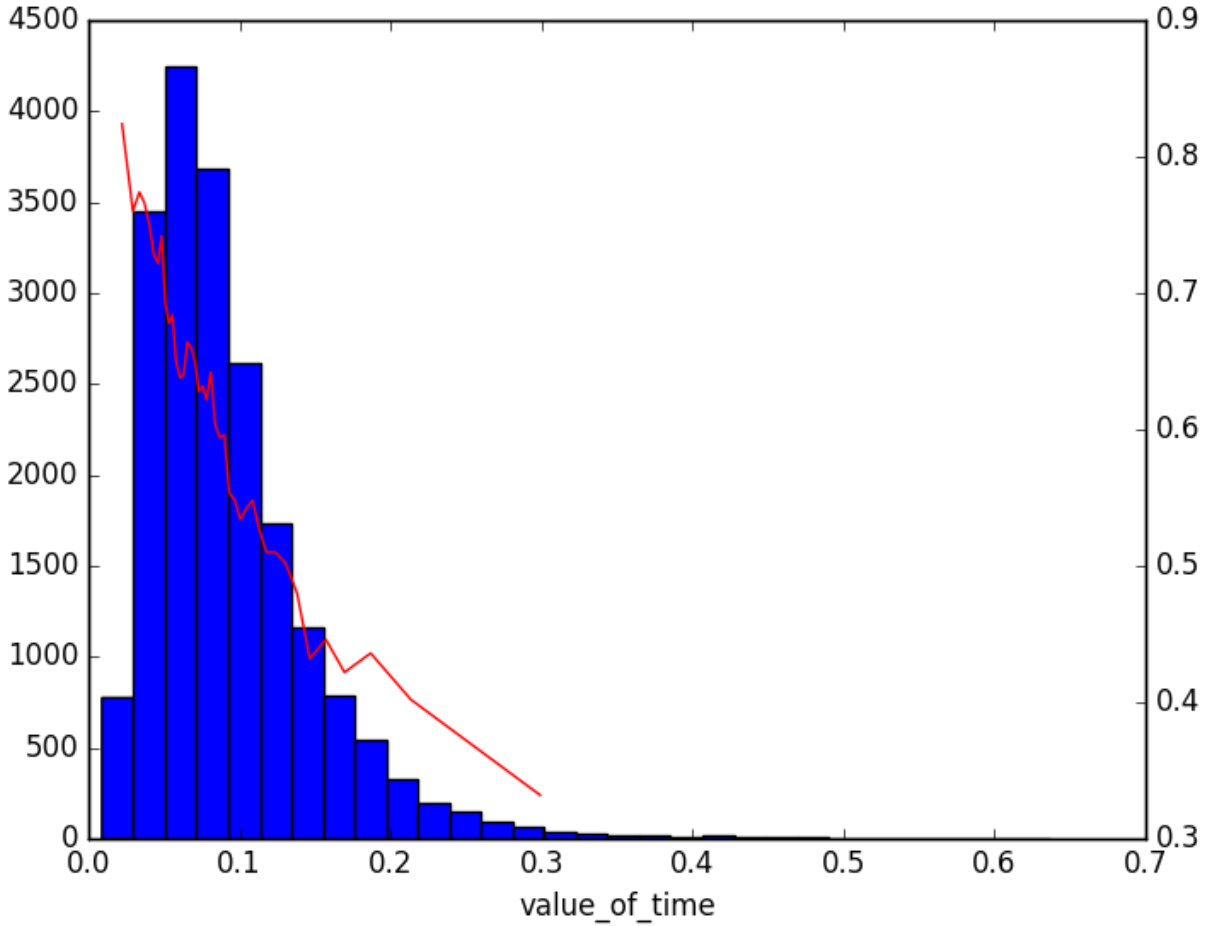
One simulation analysed

Different customers are compared

Reliability for a driver

against

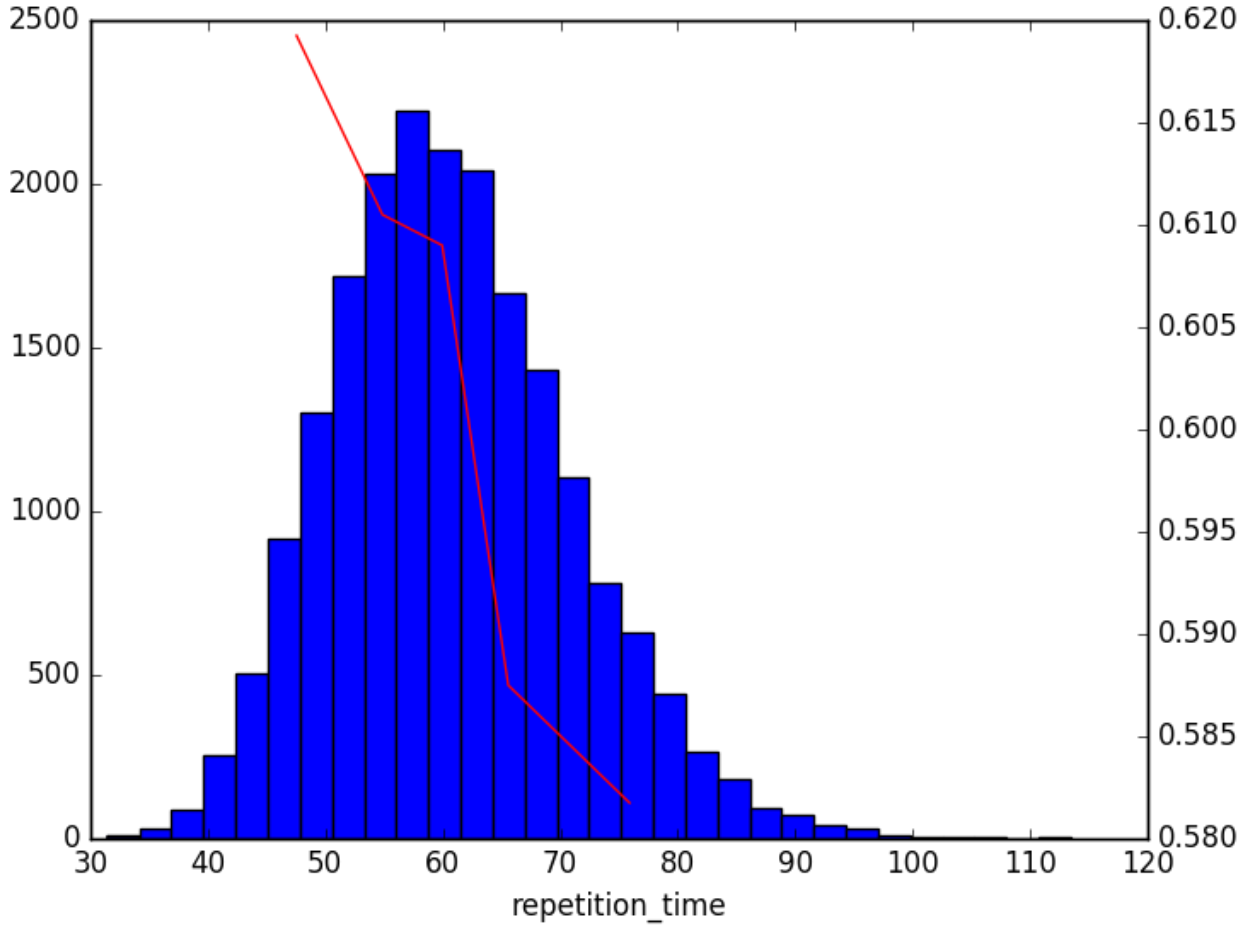
Driver's value of time



Reliability for a driver

against

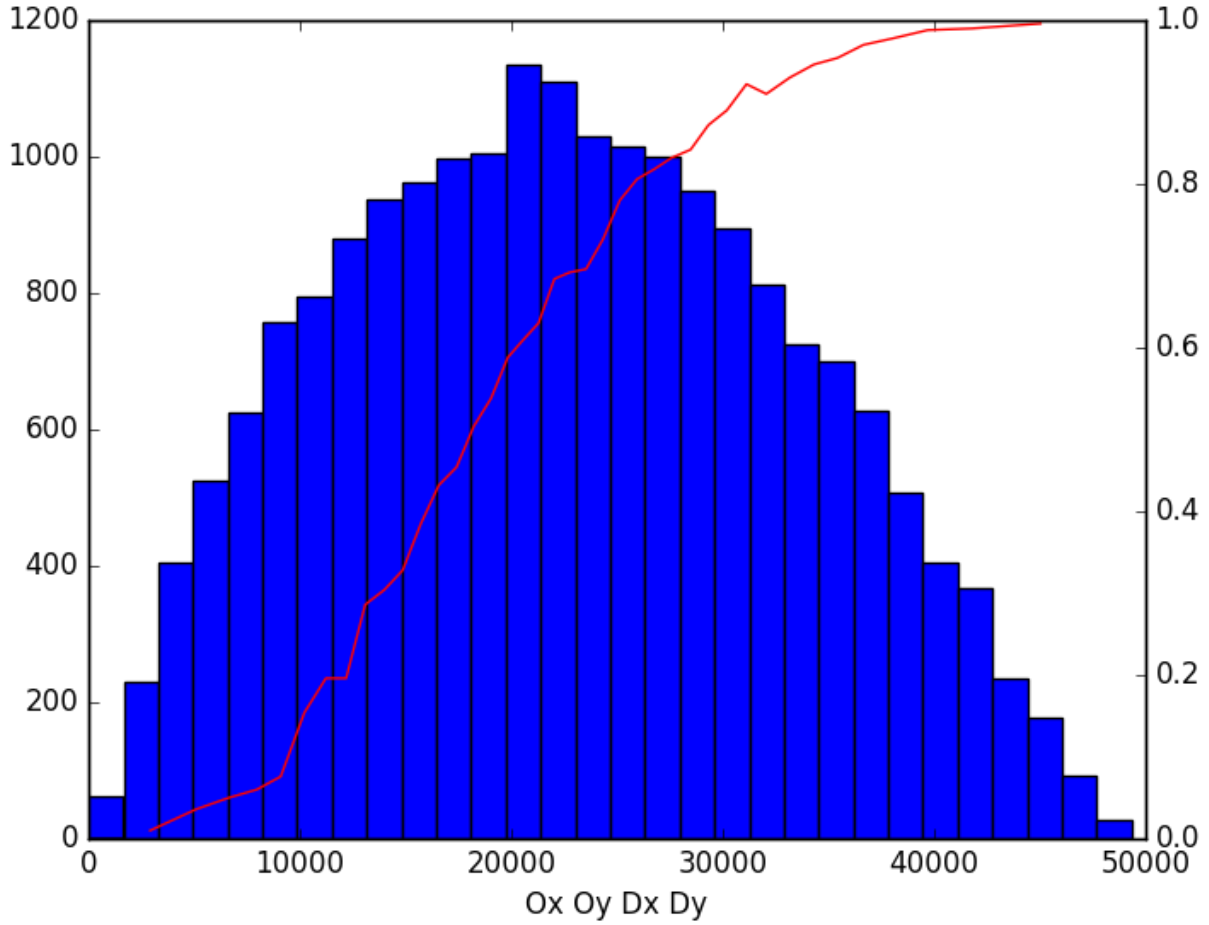
Driver's watching tempo



Reliability for a driver

against

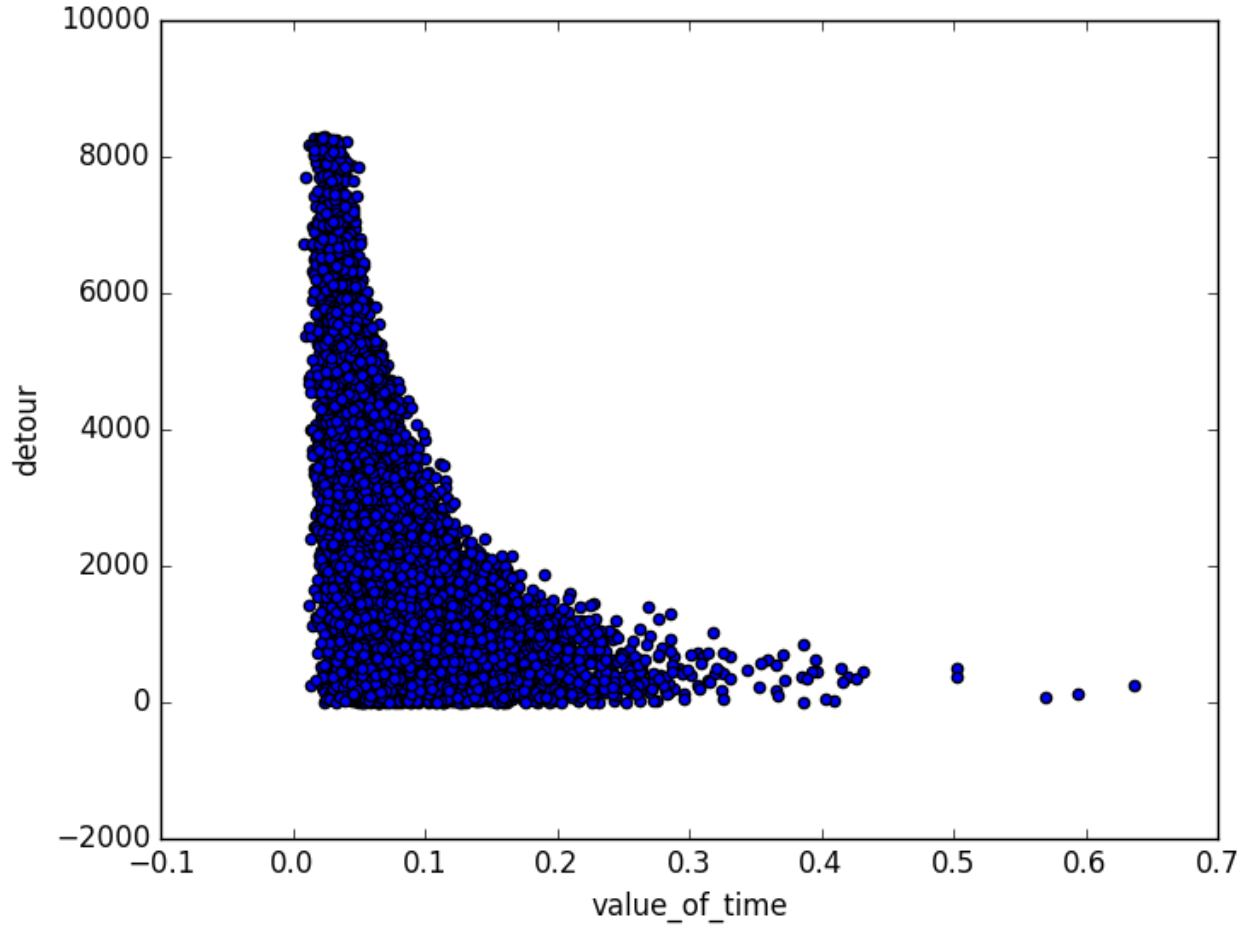
Driver's trip length



Detour

against

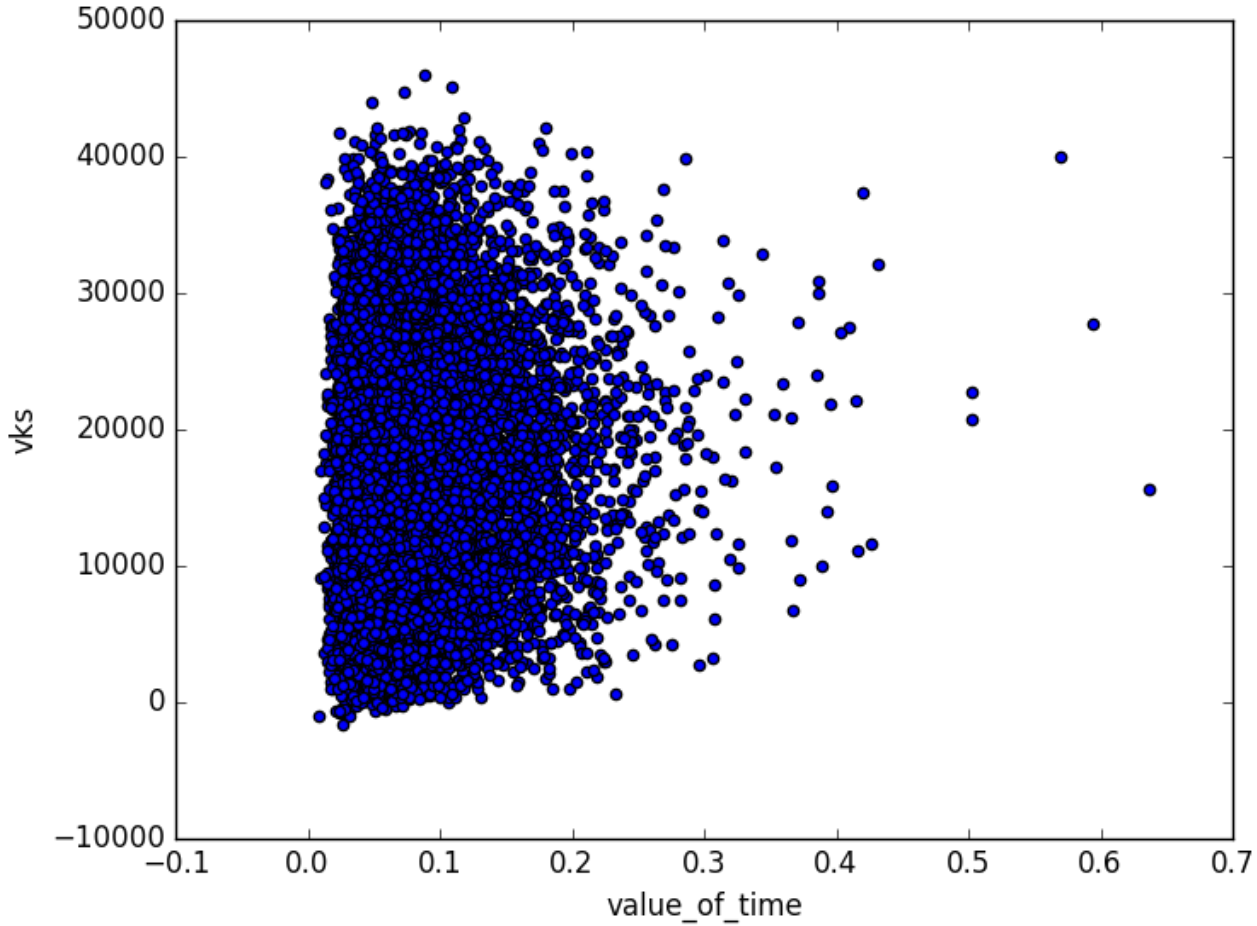
Driver's value of time



Vehicule kilometer traveled saving

against

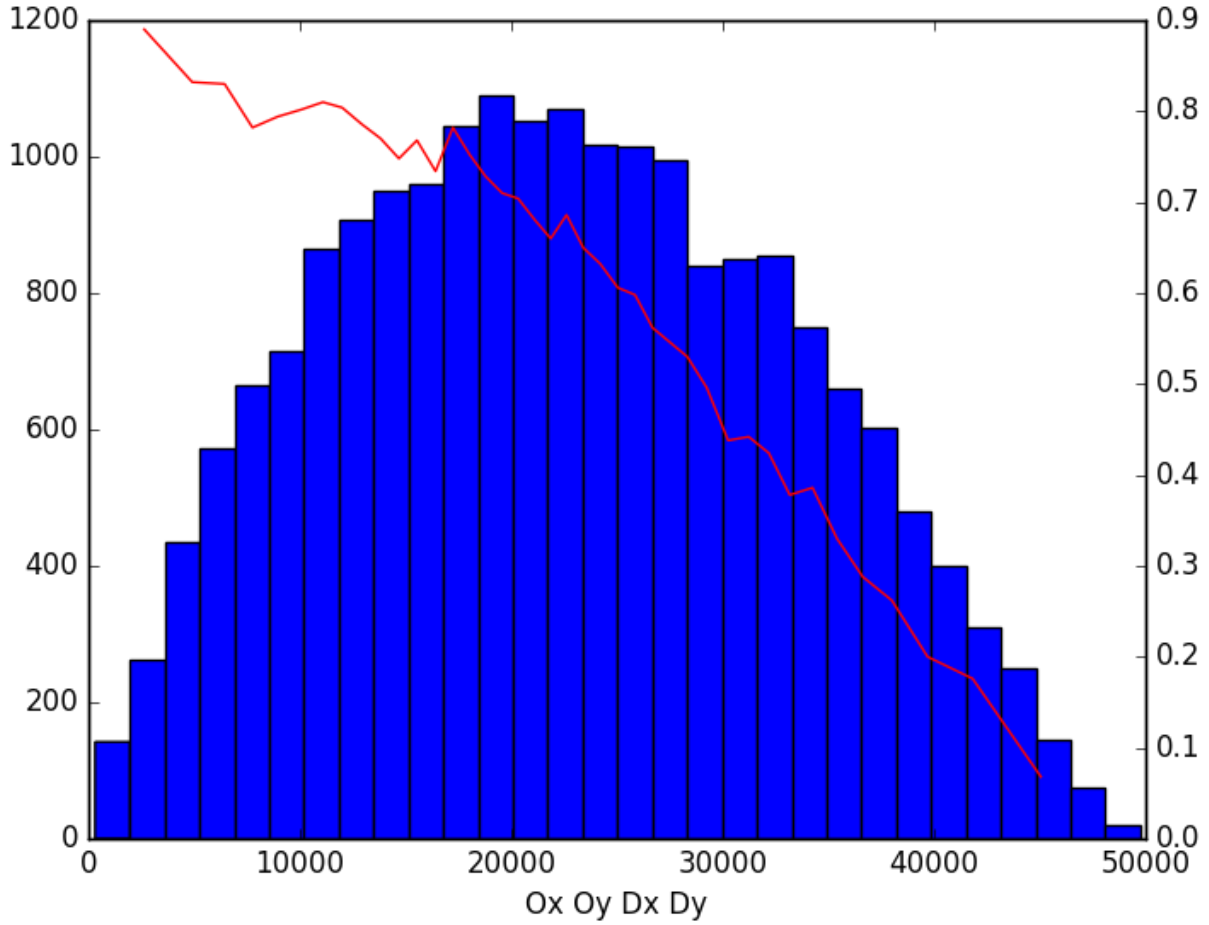
Driver's value of time



Reliability for a passenger

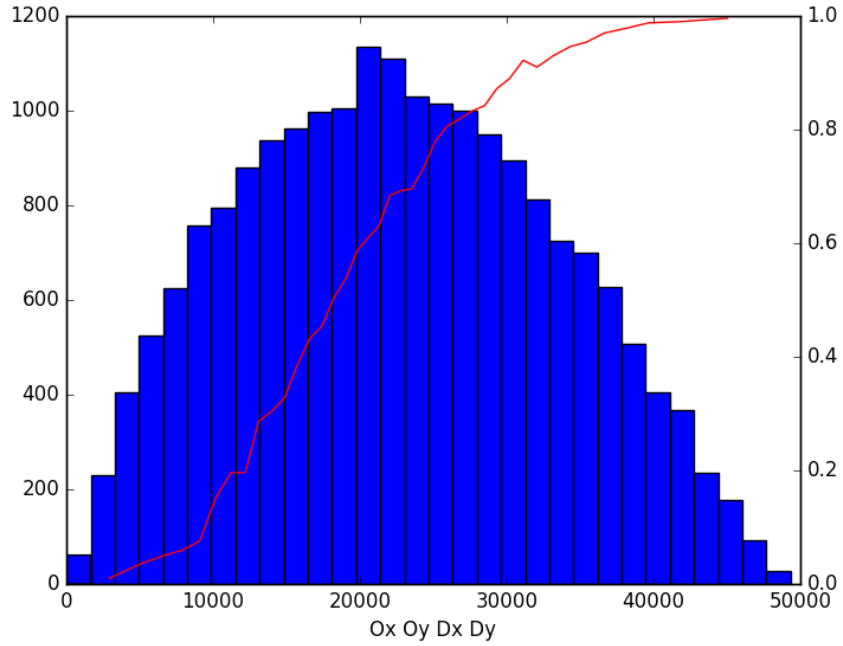
against

Passenger’s trip length

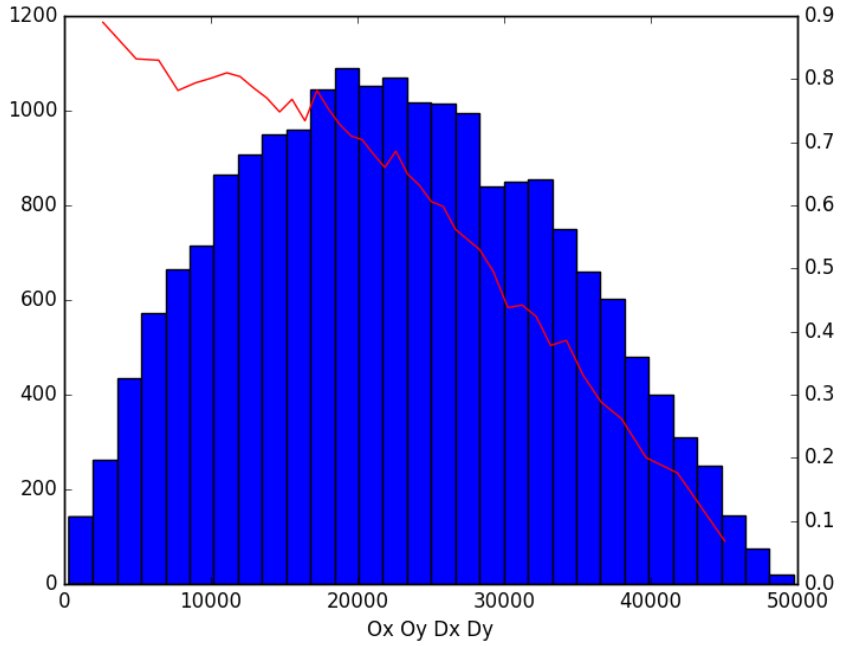


Reliability against trip length

DRIVERS



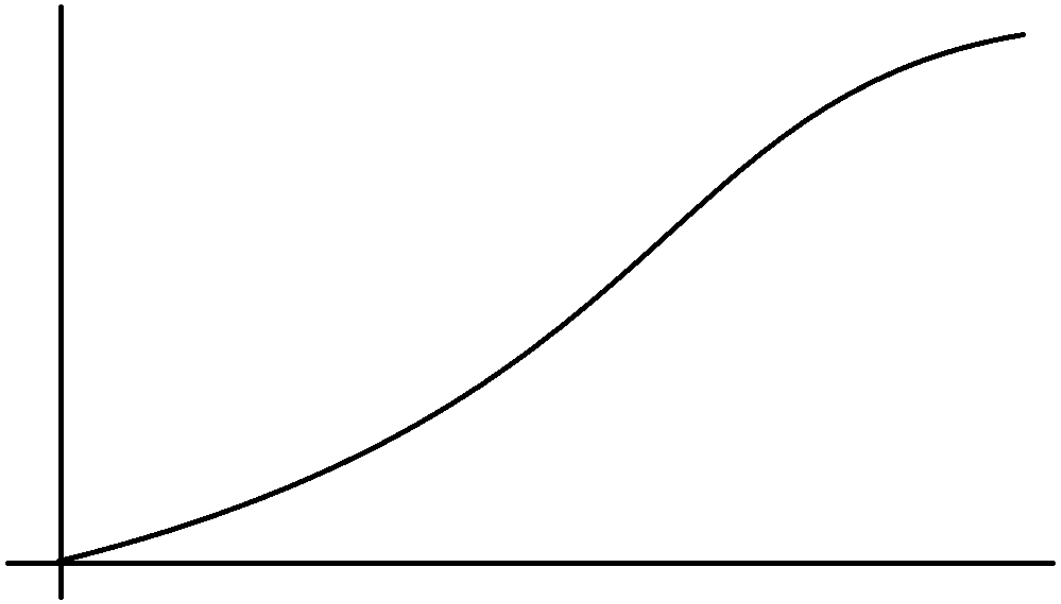
PASSENGERS



Interpretation

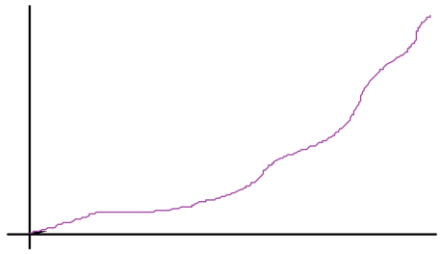
Goal:

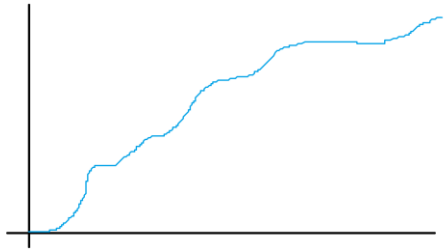
- Efficiency VS number of users
- Efficiency VS incentives
- …

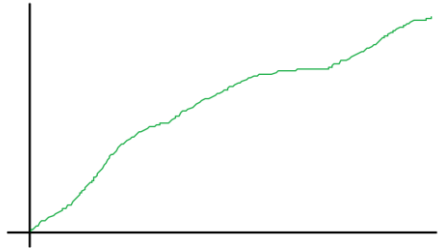


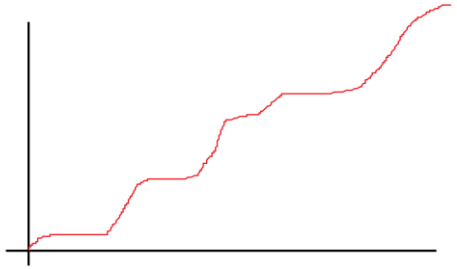
Interpretation

Relation depends on (System + network)



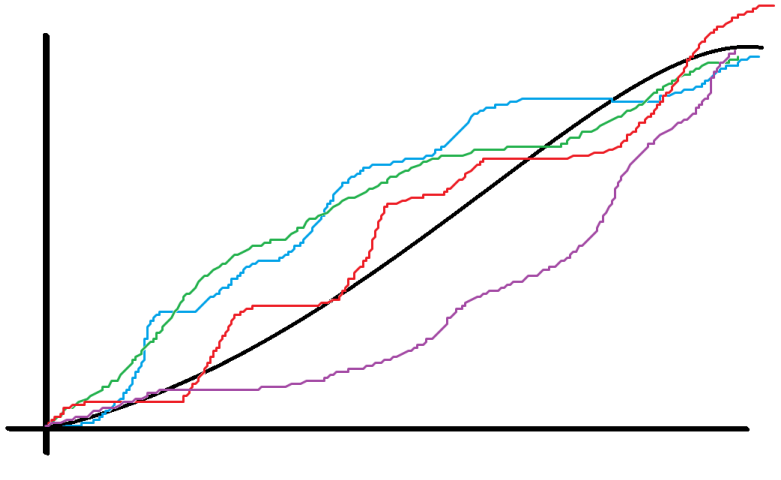






Interpretation

There is a particular law for the system (using only some average network particularities).



Plan

1. Presentation of the study
2. The simulation tool
3. Some results
4. What’s next

With the « Shanghai platform »

- More simulations – more different scenarios – more analysis
- Fit the curves
- Spot and analyse unexpected effects

New platforms

- Implement and test new platforms
- Improve the realism and utility of the tool

Thank you for your attention

Thank you for your attention

ALEXIS.PIBRAC@GMAIL.COM