

# Smart Mobility

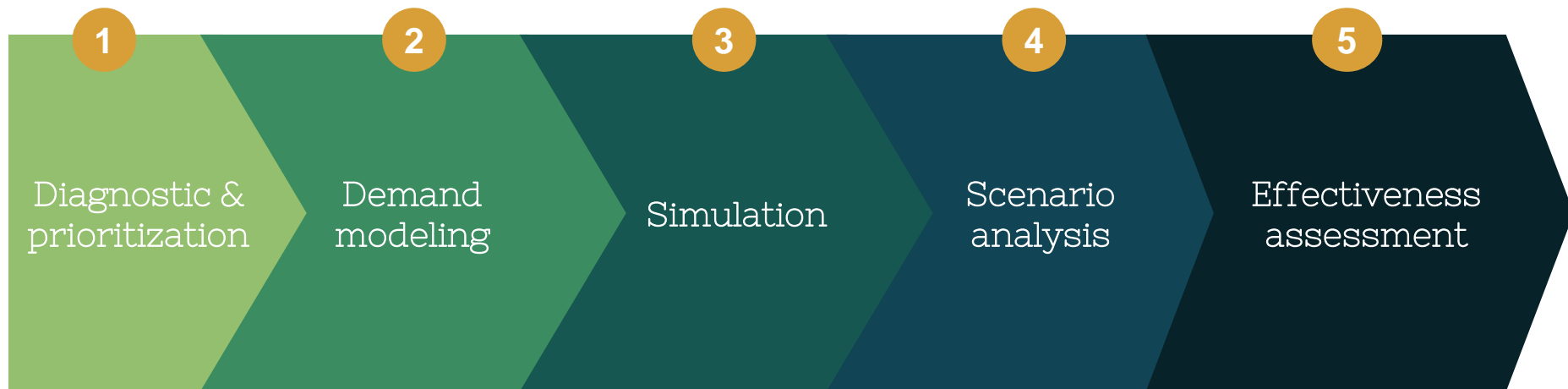
Technology applied to urban mobility management

Gabriel Francisco Medeiros Bogo

Division of Urban Planning and Sustainable Development

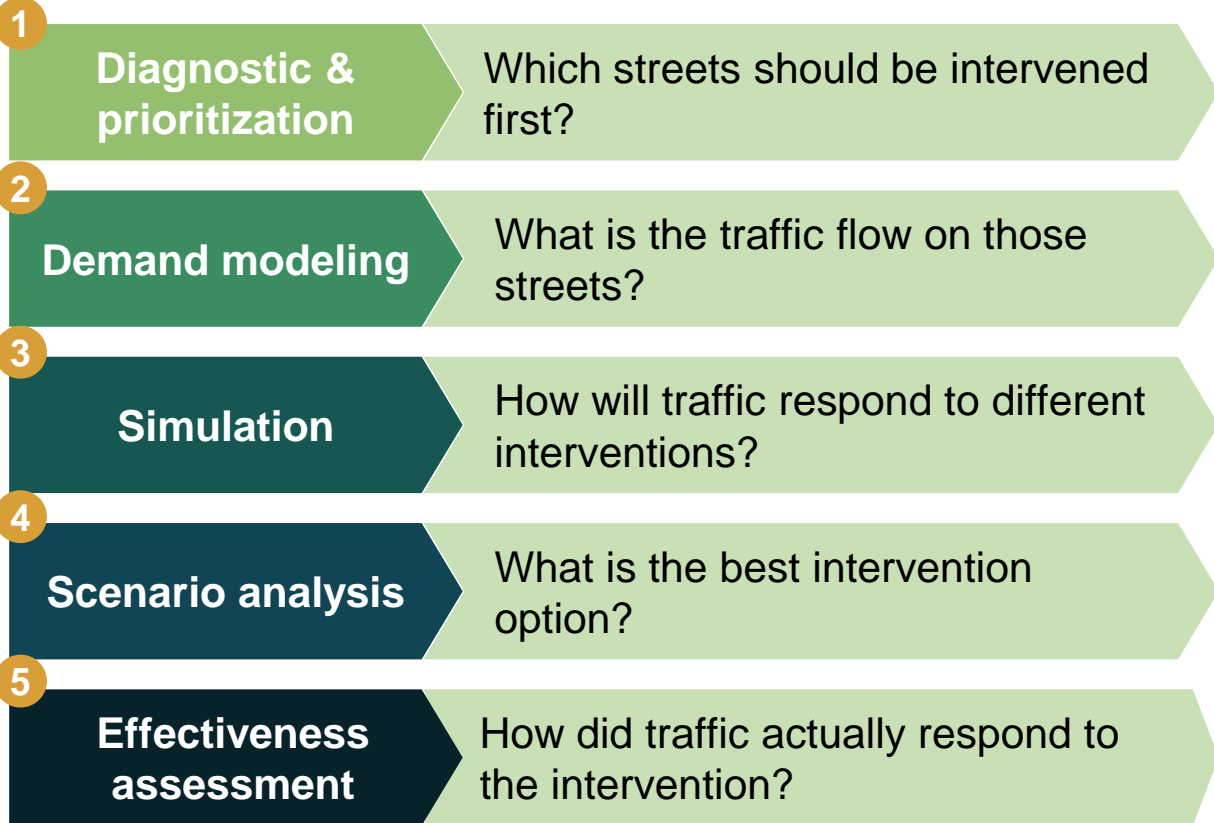


## Methodology





# Methodology



## Data



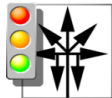
**waze**



Prefeitura de  
**Joinville**



## Tools



**SUMO**



**python**



**ArcGIS**



**amazon**  
web services™



Postgre**SQL**



# CONNECTED CITIZENS

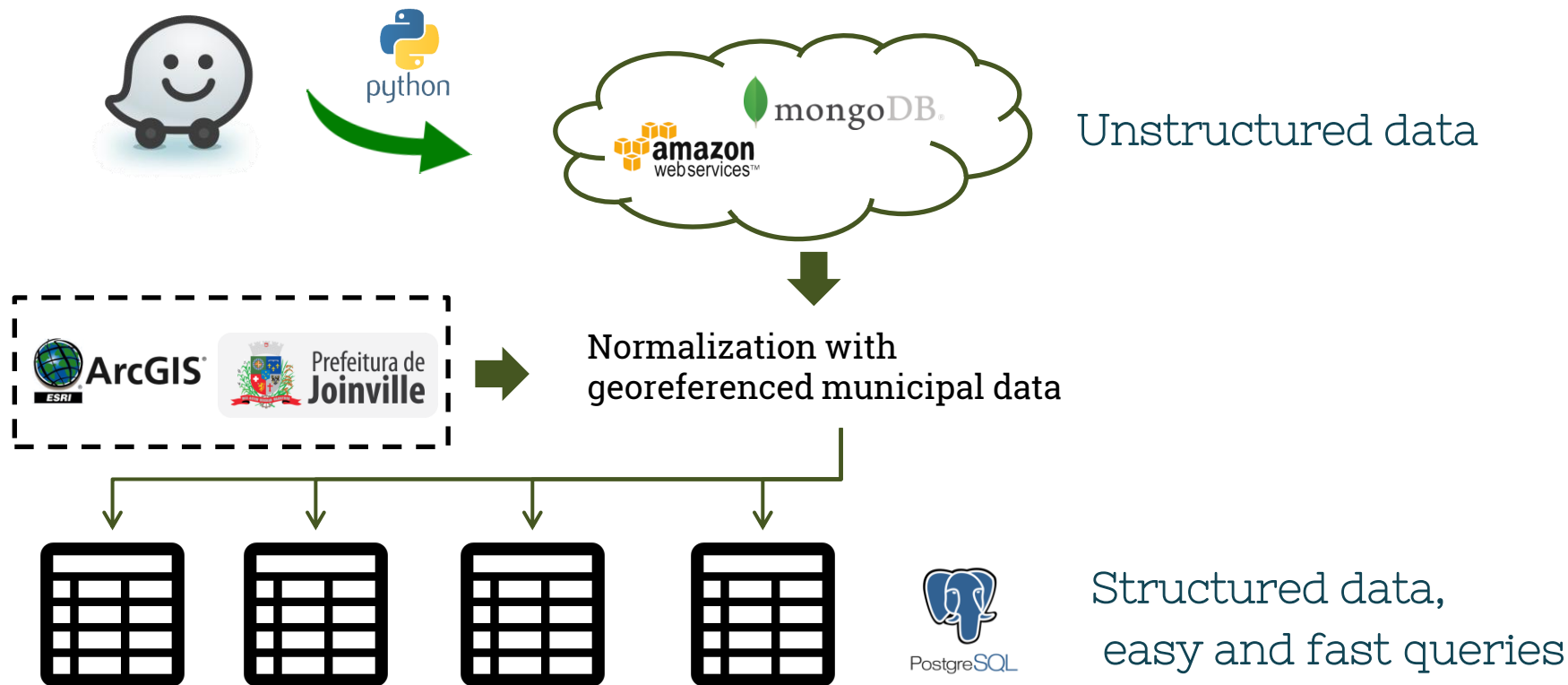
by waze



- Real time data
- Partners across the globe (500+)
- Global forum for discussion of data applications
- Program started on October/2014 (we're all learning together!)

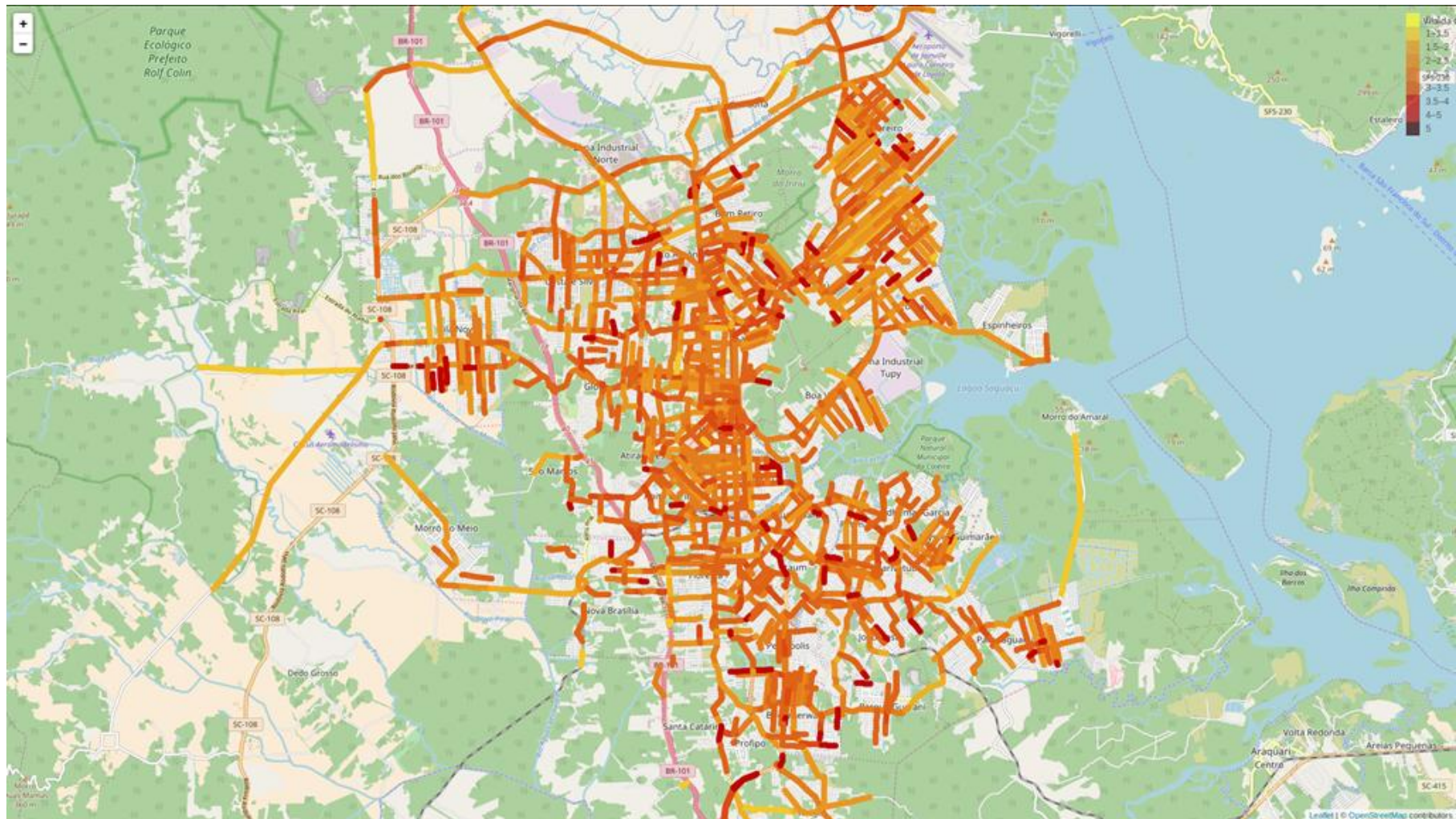


## Architecture in Joinville



# +510,000

Jam minutes stored since September/2017





# +370,000 km

Of jams stored in database



# 1,616 streets

Covered by the data



# Every 2 min

New data is cleaned and stored





How are we using  
the data?

# 1

## Diagnostic & prioritization

Which streets should be intervened first?

Diagnostic &  
prioritization

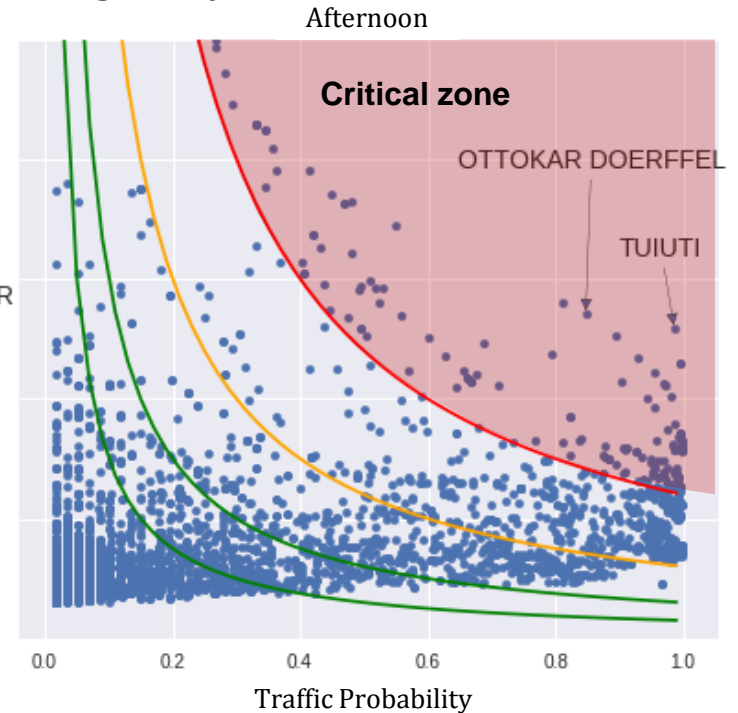
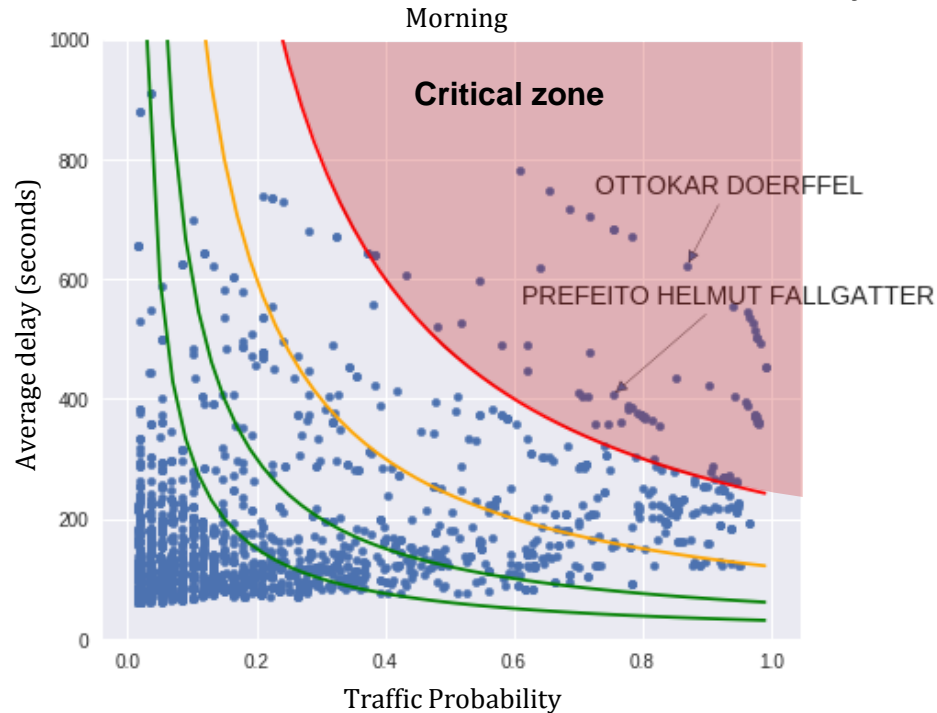
Demand  
modeling

Simulation

Scenario  
analysis

Effectiveness  
assessment

## Traffic Probability vs Average Delay



Diagnostic &  
prioritization

Demand  
modeling

Simulation

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Effectiveness  
assessment



waze



Prefeitura de  
Joinville



Currently  
receiving  
intervention

Section	Street	Direction N/S	Direction E/W	Period	Traffic Probability	Average Speed (km/h)	Average length (m)	Average delay (s)	Number of accidents	Function
8839	TUIUTI	South	East	pm	100%	5.99	709	459	9	ARTERIAL
4919	FLORIANOPOLIS	South	East	pm	98%	15.90	1,612	251	7	ARTERIAL
4920	FLORIANOPOLIS	South	East	pm	98%	15.81	1,633	256	8	ARTERIAL
2909	GUANABARA	South	West	am	91%	11.16	967	277	8	ARTERIAL
7919	OTTOKAR DOERFFEL	South	West	pm	100%	9.98	1,158	330	5	ARTERIAL
8002	ANITA GARIBALDI	North	East	pm	99%	12.44	1,343	259	6	ARTERIAL
14195	DONA FRANCISCA	North	West	am	97%	9.87	1,129	373	6	ARTERIAL
843	GETULIO VARGAS	South	East	pm	94%	10.36	1,083	266	6	ARTERIAL
3740	MONSENHOR GERCINO	South	East	pm	88%	11.57	1,223	276	5	ARTERIAL

# 2

## Demand modeling

What is the traffic flow on those streets?

Diagnostic & prioritization

Demand modeling

Simulation

Scenario analysis

Effectiveness assessment

Exploratory



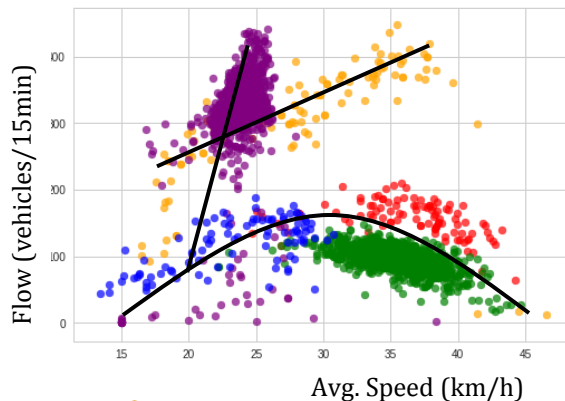
Waze CCP Data

+



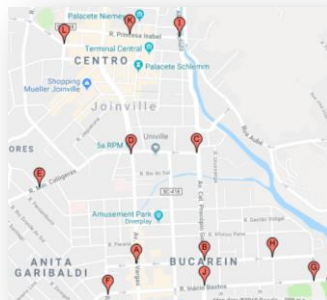
Speed radars'  
traffic count

Statistical model for  
traffic flow



*Investigation being carried out with  
involvement of local university*

Cloud of traffic flow  
points



Input for traffic  
simulator



SUMO

+

DFROUTER

# 3

## Simulation

How will traffic respond to different interventions?

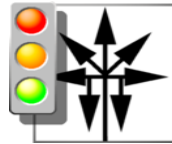
Diagnostic &  
prioritization

Demand  
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Simulation

Scenario  
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Effectiveness  
assessment



**SUMO**  
Simulation of  
Urban Mobility



Usage of drones for precise counting  
and refinement of route definition



# 4

## Scenario analysis

What is the best intervention option?

Diagnostic &  
prioritization

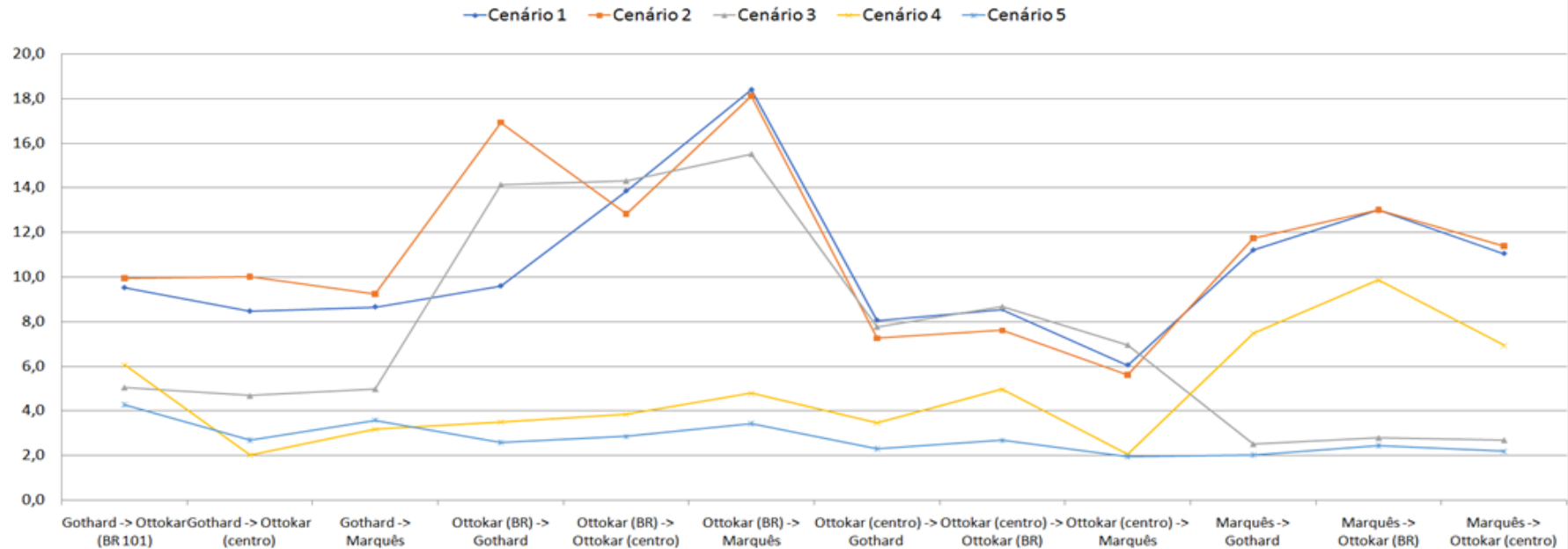
Demand  
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## Average travel time (from simulation)



Diagnostic &  
prioritization

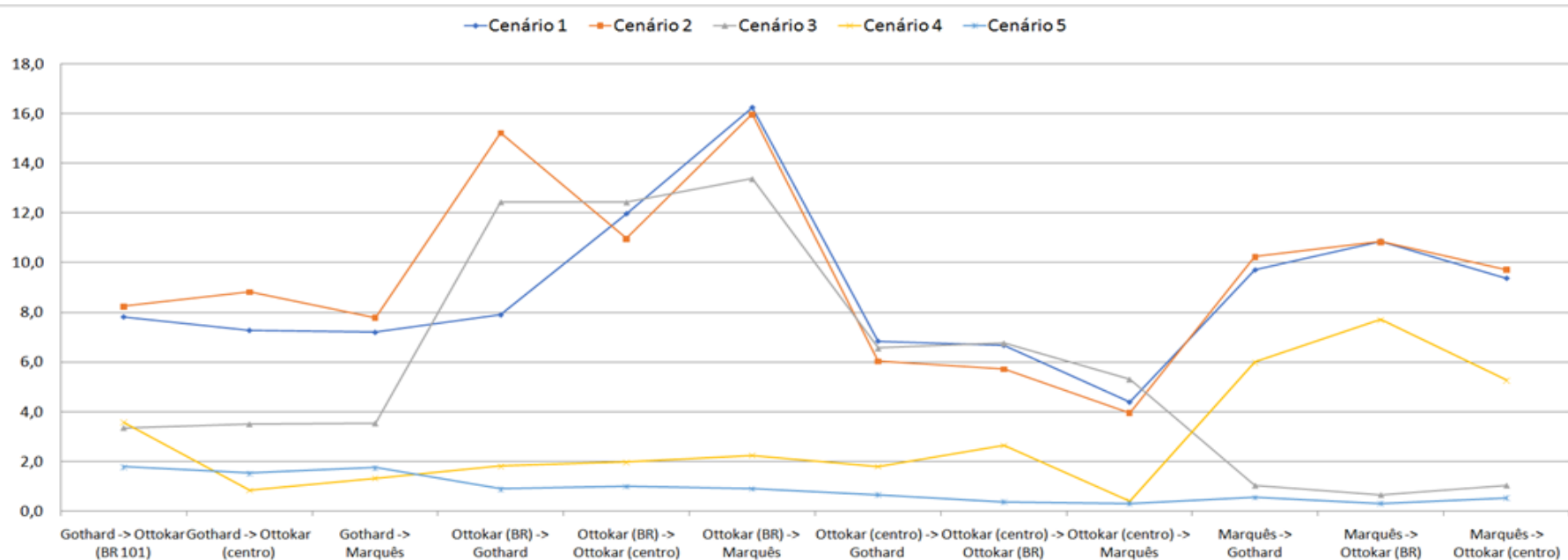
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## Average wasted time (minutes) (from simulation)



Diagnostic &  
prioritization

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	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Gain
Avg travel time (min)	11.6	11.4	8.4	5.4	2.8	-8.7
Avg wasted time (min)	9.8	9.6	6.6	3.4	0.8	-9.0
Max travel time (min)	38.6	36.8	23.7	21.2	5.8	-32.8

# 5

## Effectiveness assessment

How did traffic actually respond to the intervention?

Diagnostic &  
prioritization

Demand  
modeling

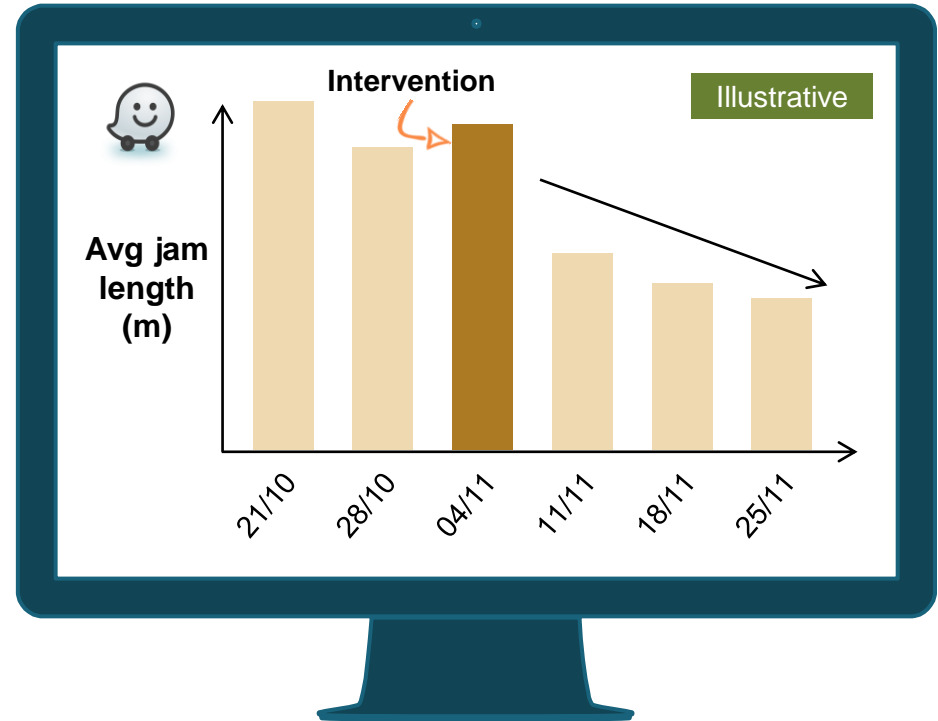
Simulation

Scenario  
analysis

Effectiveness  
assessment



Street: Ottokar Doerffel  
Section: 7919





# Challenges





Highly specialized HR

SOFTWARE  
ENGINEERING

DATA ANALYSIS  
AND  
STATISTICS

TRAFFIC  
ENGINEERING



**Not the core of Municipalities**





How to grow, perpetuate and disseminate Smart Mobility ?

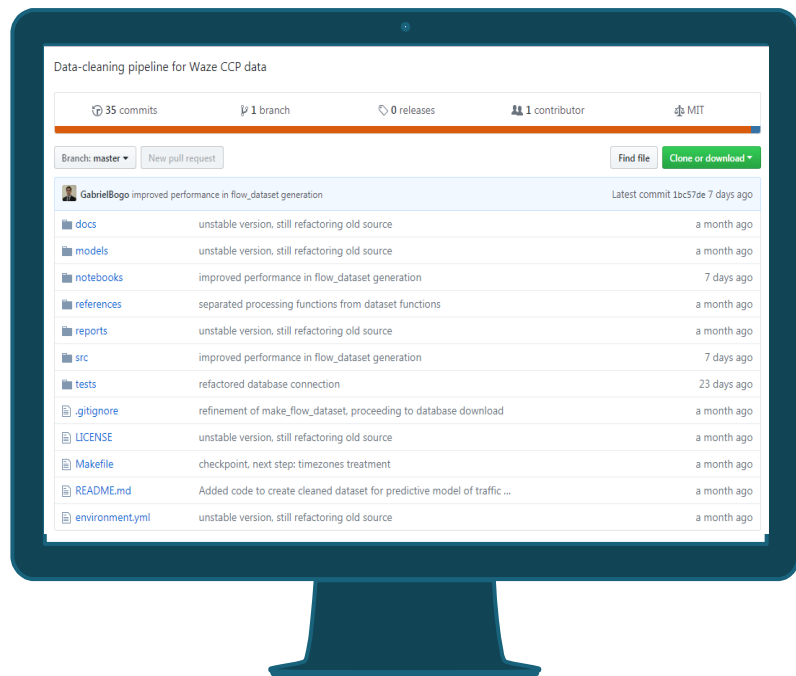




## Proposals

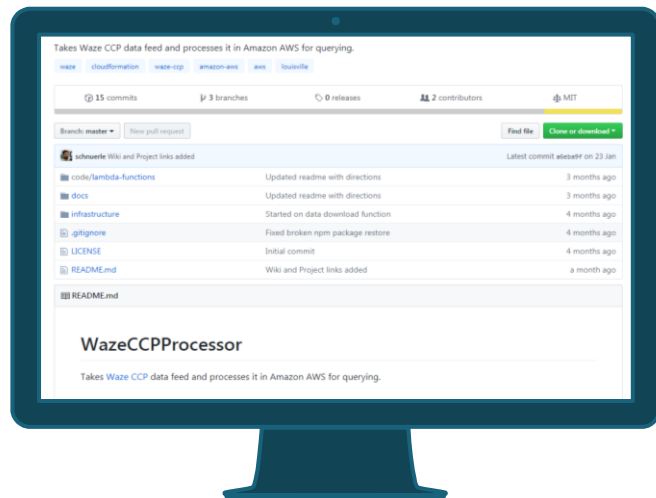
- Open-source e Hackatons
- Collaboration between Municipalities
- Articulation of Triple Helix

# Open-source & Hackatons

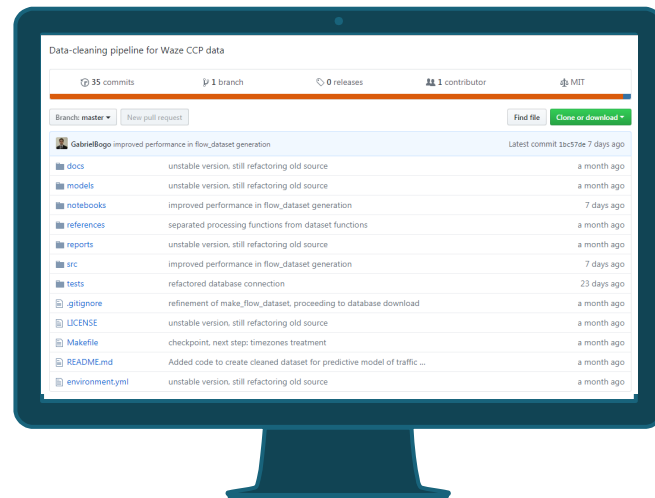


- All code (not data) is shared in GitHub ([github.com/GabrielBogo/Joinville-Smart-Mobility](https://github.com/GabrielBogo/Joinville-Smart-Mobility))
- All studies are verifiable and replicable
- Studies can be further advanced through Data Science Hackatons

# Collaboration



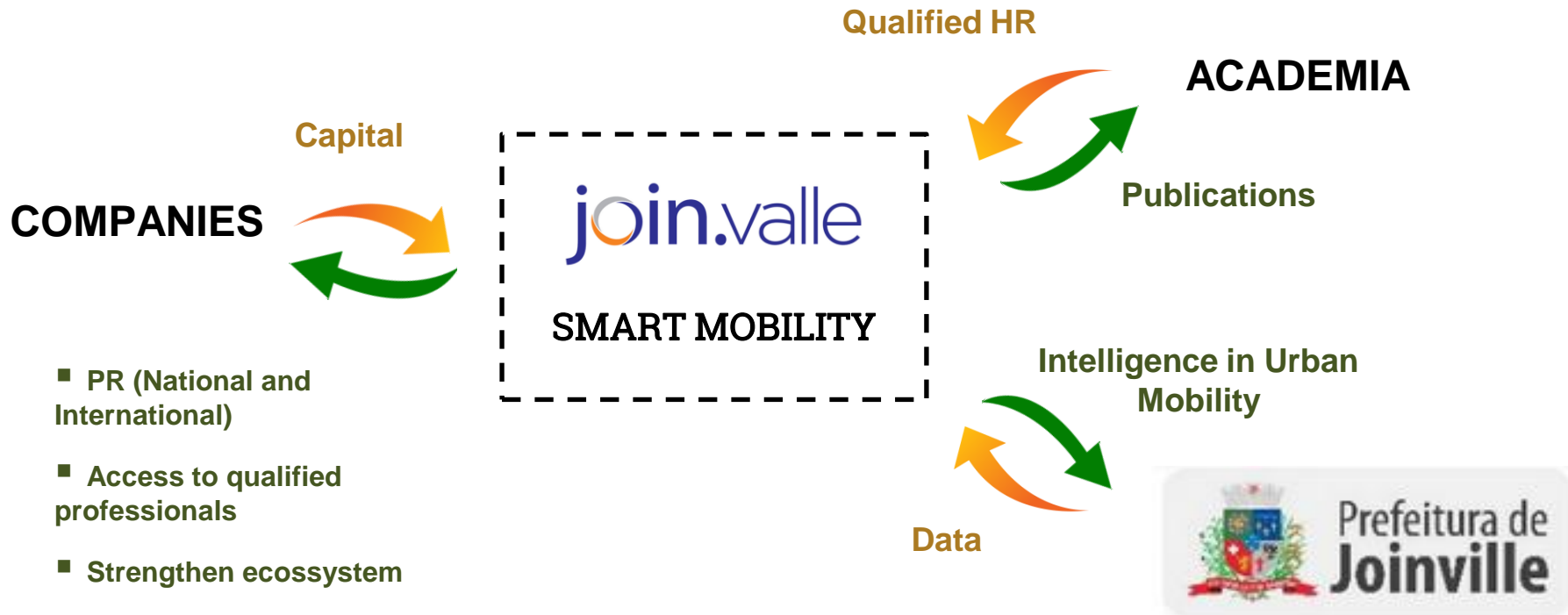
GitHub from Louisville, USA



GitHub from Joinville, Brasil

**Collaboration can unify and potentialize work!**

# Articulation of Triple Helix



# Thank you

Gabriel Francisco Medeiros Bogo

Division of Urban Planning and Sustainable Development