Innovation transfer in smart mobility
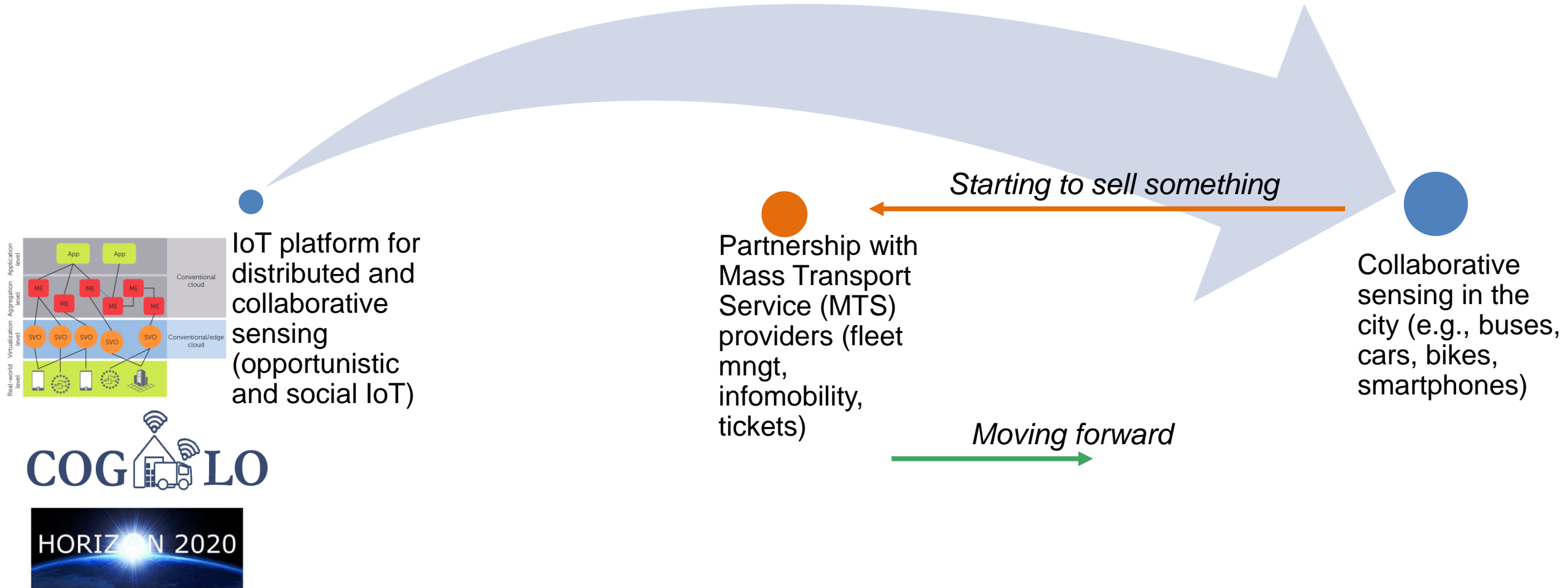
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CIO, GreenShare Srl, Cagliari, Italy

From research prototype to the field

IoT platform for distributed and collaborative sensing (opportunistic and social IoT)

Partnership with Mass Transport Service (MTS) providers (fleet mngt, infomobility, tickets)

Starting to sell something

Collaborative sensing in the city (e.g., buses, cars, bikes, smartphones)

Moving forward

What GreenShare offers

- We provide public transport operators with technologies for/to

AVM (automatic vehicle monitoring)

Infomobile app
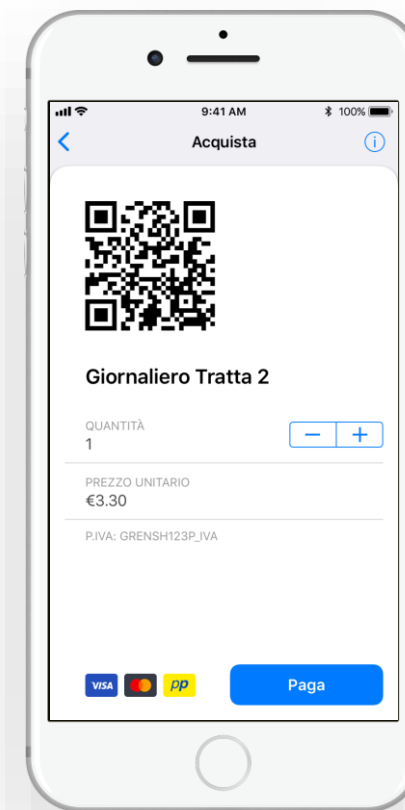
Sell tickets

Arianna
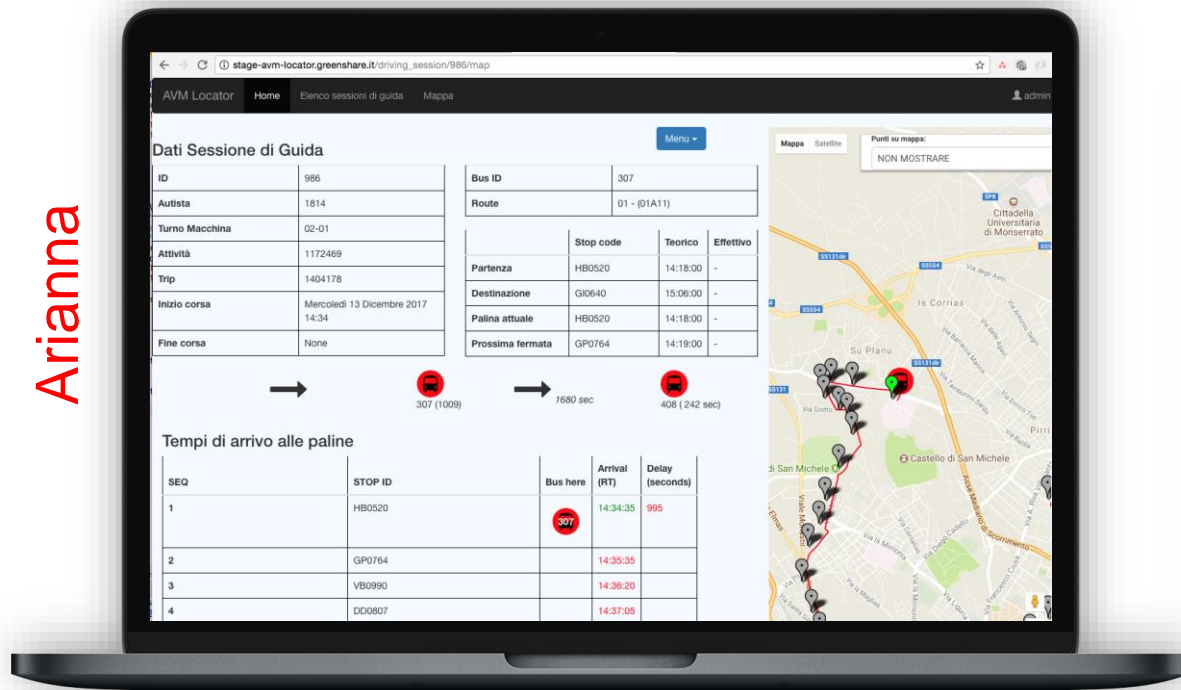
TeseoApp
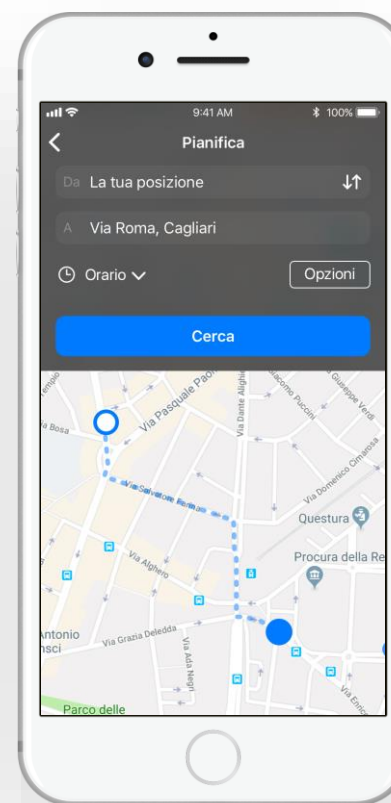
SmarTicket

The approach that we use

- **Our applications are released in while label**
- We are the technological partner for the Mass Transit Service (MTS) providers to improve their relationship with the users
- Numbers
  - We sell 2M tickets per year
  - We have 10 big customers
  - Total income: almost 1MEuros

Where the innovation is needed

- Market lately dominated by Mobility as a Service (MaaS) providers
  - Acting as the interface in-between MTS and customers
    - MTS loses the relationship with users (and the data)
  - open call for tenders required by EU regulations (not direct commitment)
- Similarly to what is happening in our telecom market
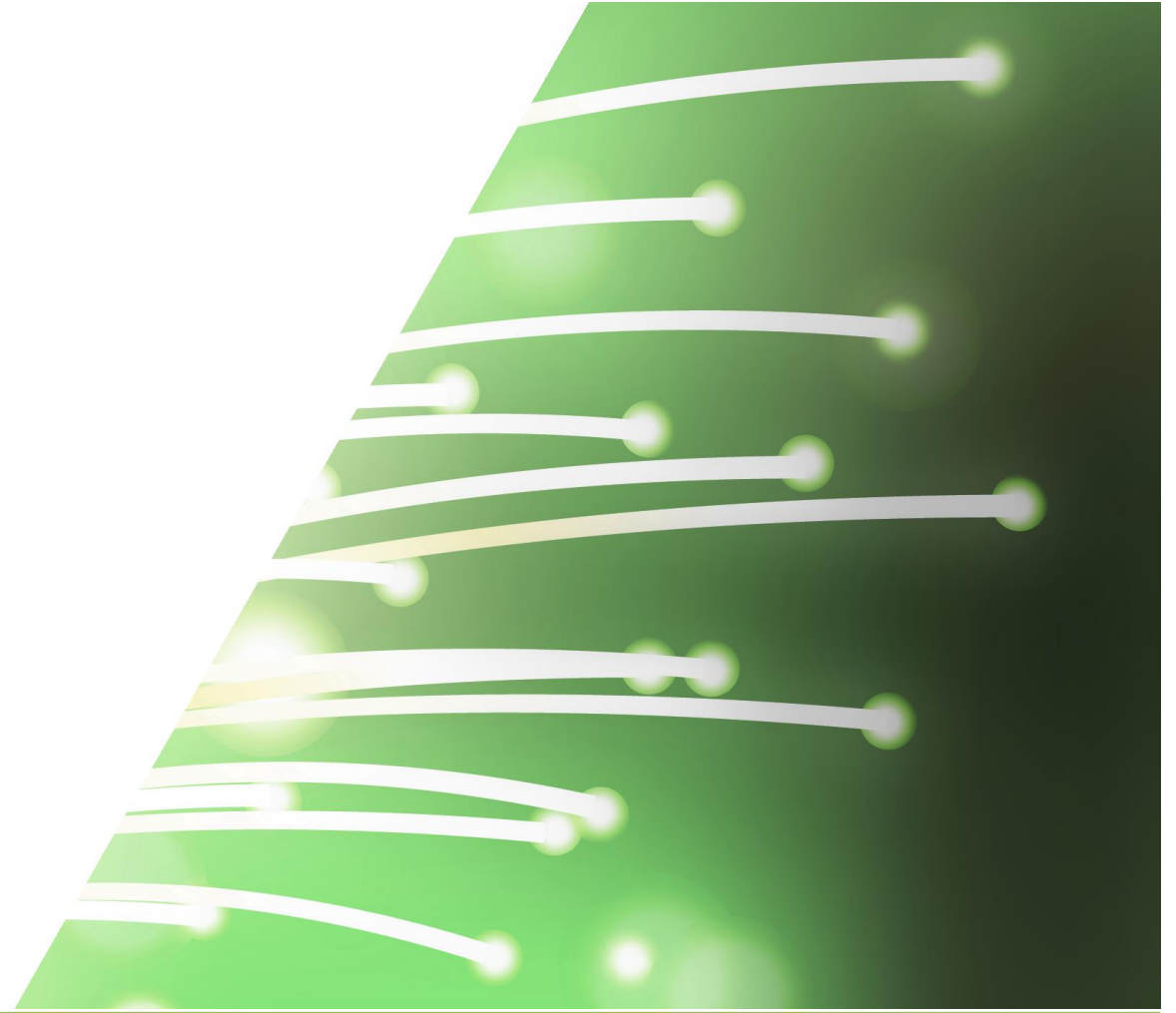 - OTTs - ISPs

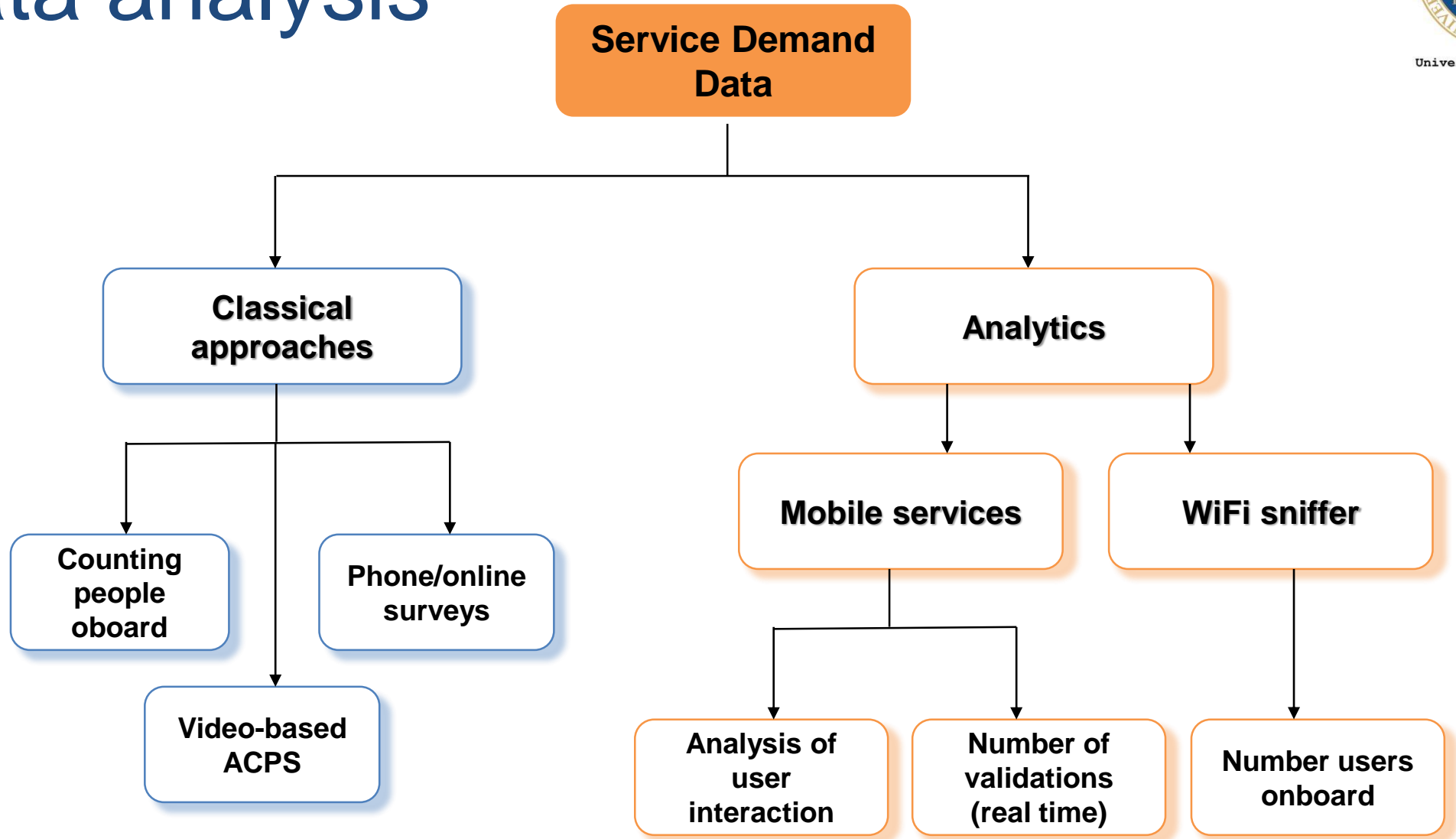**MOBILITY AS A SERVICE**

Public Transport Service

… and what has been (is being) transferred (as innovation)

1. Collection and analysis of data
   – TeseoApp data
   – WiFi sniffing based APCS
2. BT technologies for automatic bus check-in / check-out

Data analysis

Service Demand Data

Classical approaches
- Counting people oboard
- Phone/online surveys
- Video-based ACPS

Analytics
- Mobile services
  - Analysis of user interaction
  - Number of validations (real time)
- WiFi sniffer
  - Number users onboard
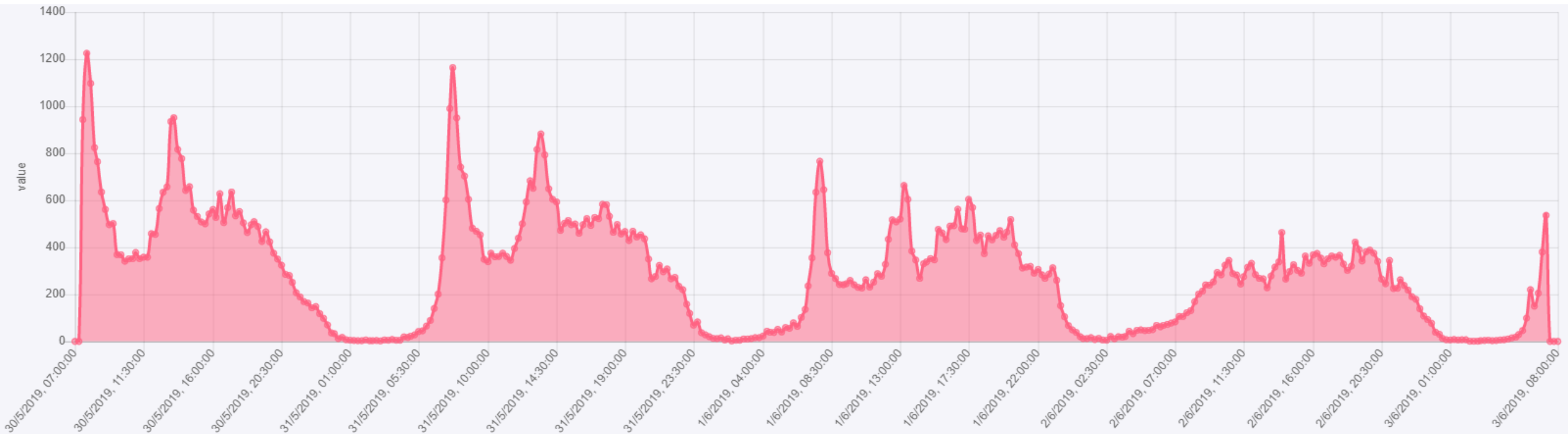
Data collected from TeseoApp

- Requests for next transits per line and per stop

- Tickets validation data
  - Check-in: where, how often, and delays in the performed operations
  - Checkout

- Journey planning requests

- Journey assistance requests

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Request of next transit times from the TeseoApp

Number of enquires for next bus transits
Every 15 mins from unique users in total

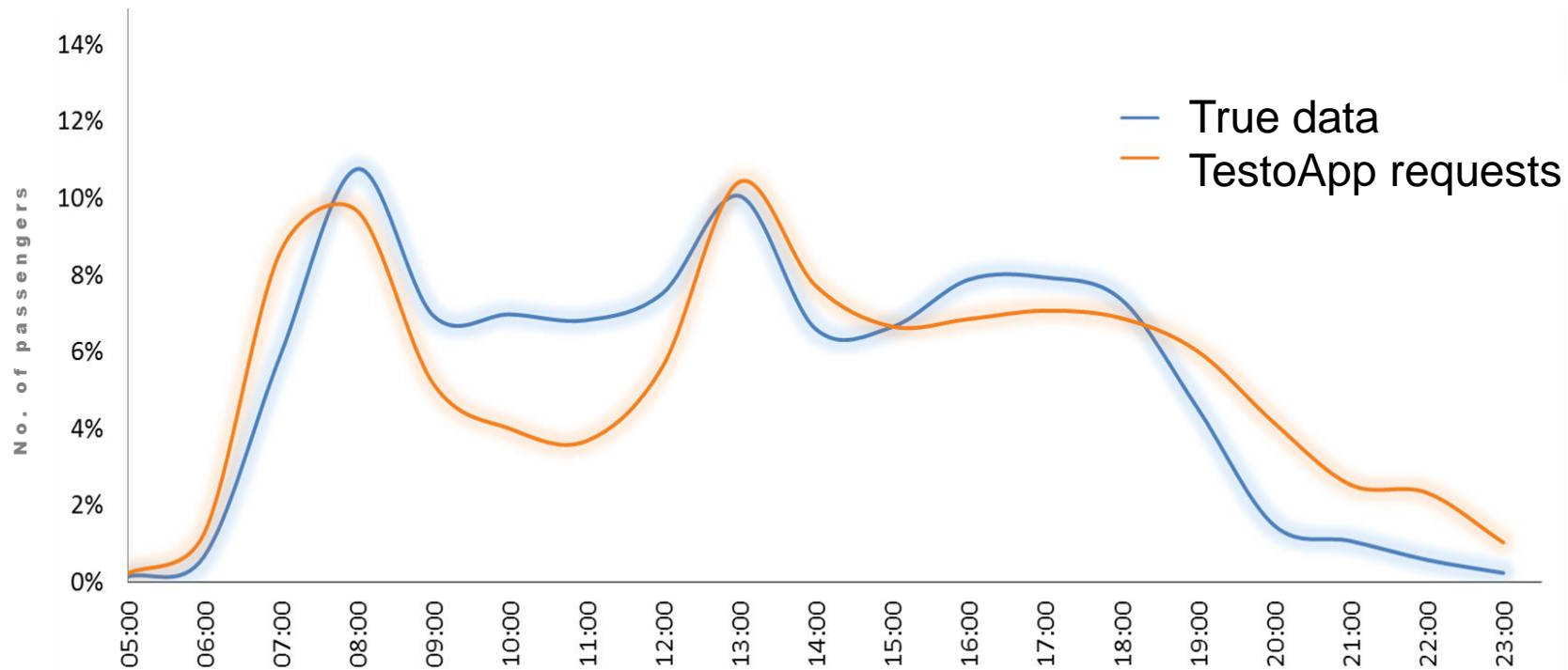# Request of next transit times from the TeseoApp

Number of enquires for next bus transits
Every 15 mins from unique users for a single stop
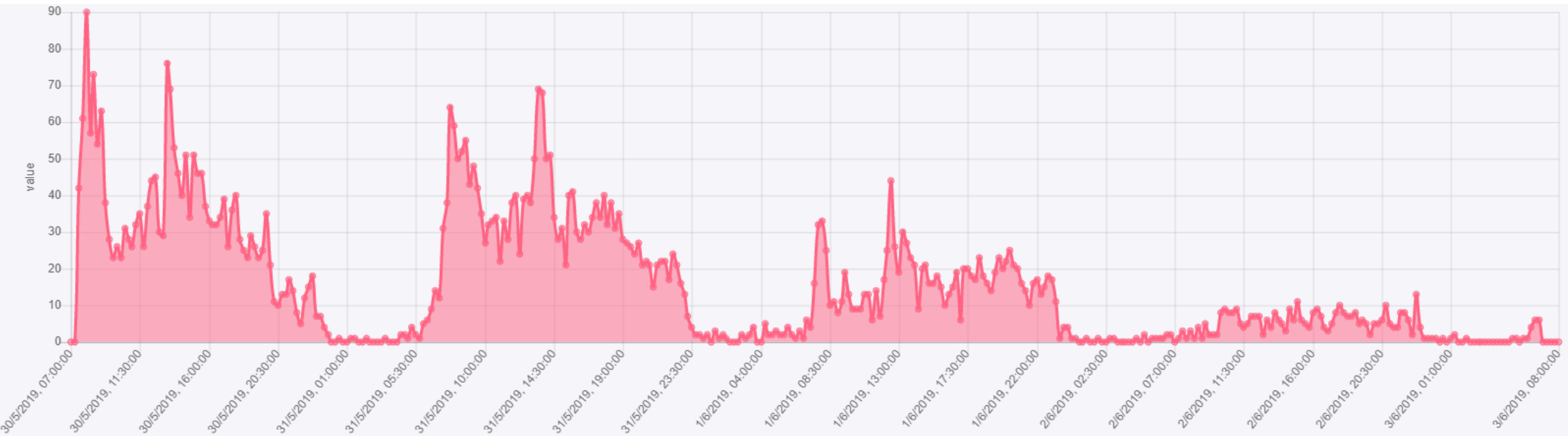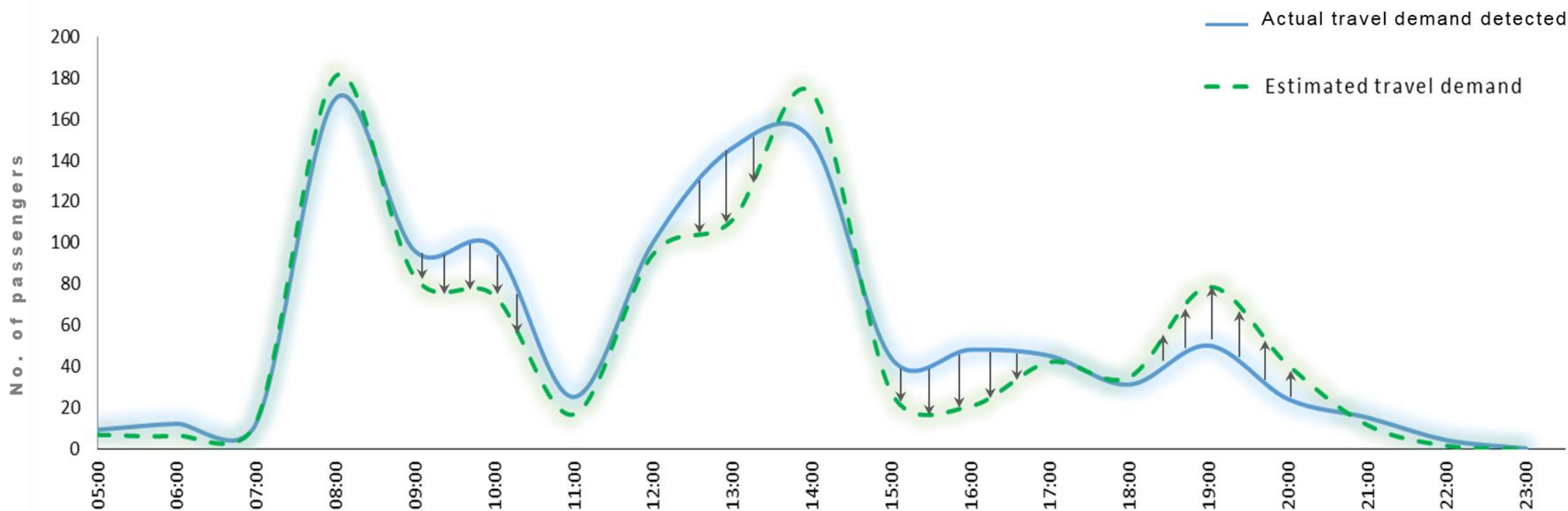
Processing of collected data

Differences between the true data and the TeseoApp requests
(numbers nomalized by the total number of users)

Processing of collected data

Corrections introduced in the TeseoApp requests data

7:04 in the morning

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12:23 in the morning same day

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Analysis of sequences of requests

- Analysis of requests coming from the same users over the same day
  - This is used to estimate the O/D matrixes

| CODICE UTENTE	CODICE PALINA	CODICE LINEA	GIORNO	ORA INTERROGAZIONE
0057F009-044B-4315-A364-F206EF05858B	BA0014	M	06/05/2019	15:45:26
0057F009-044B-4315-A364-F206EF05858B	RE0538	M	06/05/2019	17:20:17
0057F009-044B-4315-A364-F206EF05858B	RE0821	M	06/05/2019	17:20:27
0057F009-044B-4315-A364-F206EF05858B	PA0205	1	06/05/2019	17:57:27
0057F009-044B-4315-A364-F206EF05858B	PA0205	1	06/05/2019	18:01:27
0066835F-2413-4275-AF6A-9738F9F35616	PM0029	M	07/05/2019	08:21:54
0068E251-A8CF-4587-A455-2B2769523BA1	AB0109	1	06/05/2019	13:13:56
0068E251-A8CF-4587-A455-2B2769523BA1	PF0626	20	06/05/2019	13:01:46
0068E251-A8CF-4587-A455-2B2769523BA1	AB0109	1	06/05/2019	13:51:56
0068E251-A8CF-4587-A455-2B2769523BA1	DD0807	20	06/05/2019	14:00:06
0068E251-A8CF-4587-A455-2B2769523BA1	PF0626	20	06/05/2019	13:51:56
0068E251-A8CF-4587-A455-2B2769523BA1	DD0807	20	06/05/2019	14:02:26
0068E251-A8CF-4587-A455-2B2769523BA1	LI0738	3	06/05/2019	19:46:37
0068E251-A8CF-4587-A455-2B2769523BA1	AB0109	1	06/05/2019	20:55:08
007E4C15-8069-4637-8CFC-C8D814D37669	CU2093	U_EX	06/05/2019	15:08:57
007E4C15-8069-4637-8CFC-C8D814D37669	CU2094	U_EX	06/05/2019	15:08:47

Estimation of O/D matrixes
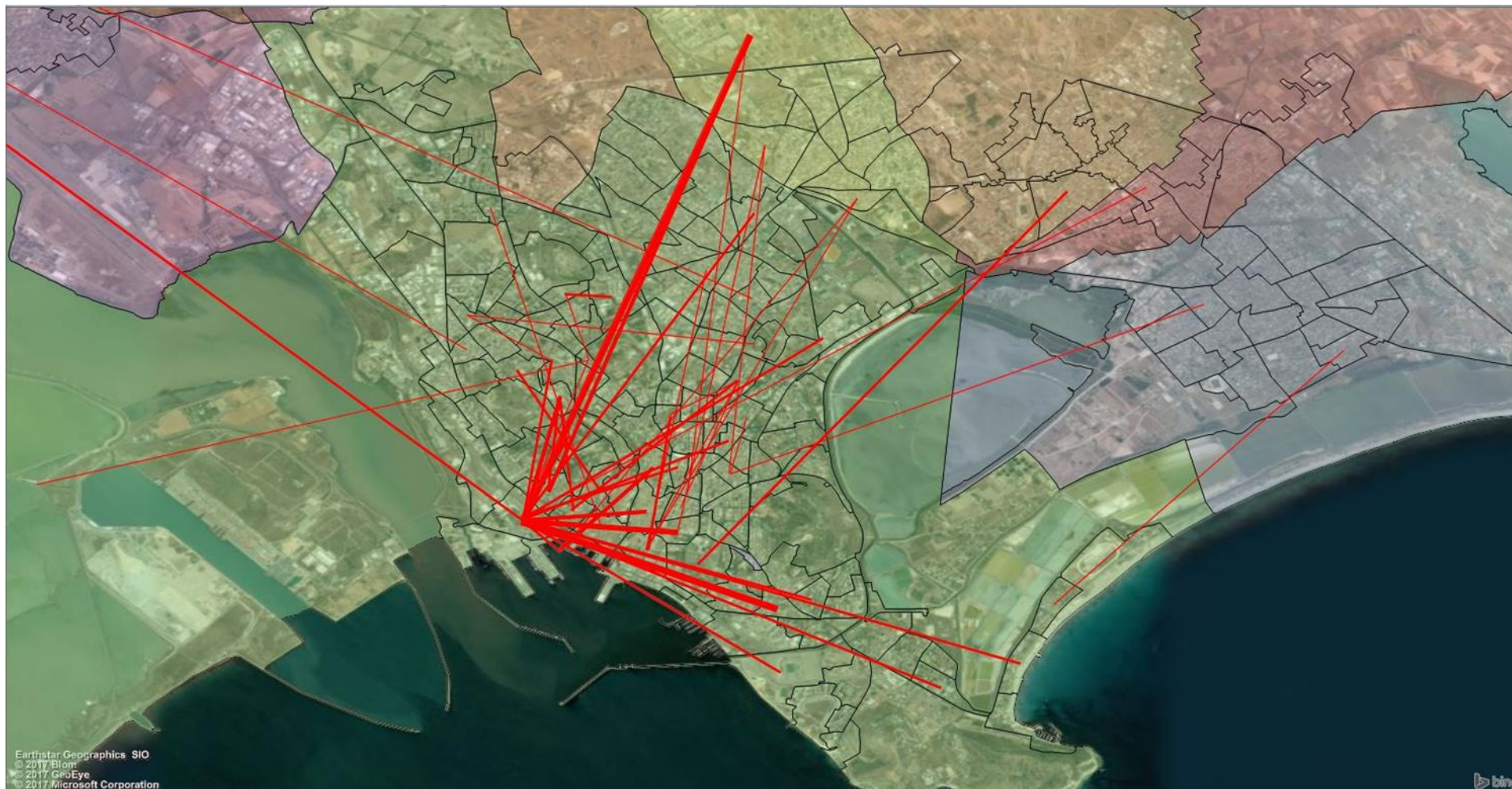
TeseoApp data is not enough … the WiFi sniffer based APCS
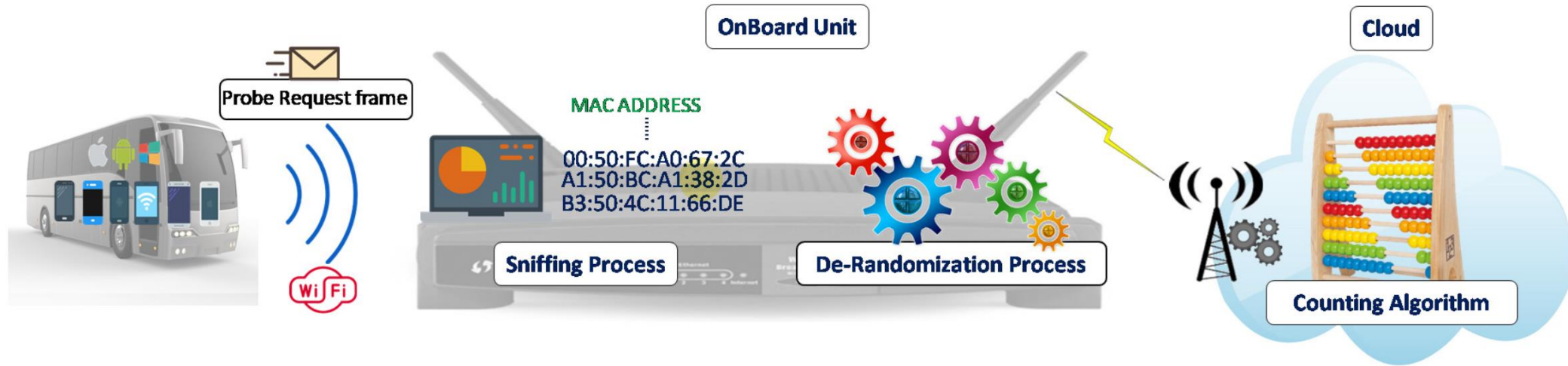
- The OnBoard unit sniffs the sent *probes request frames*
  - It performs de-randomization (tags and time intervals)
  - It counts the number of devices in the bus
  - It provides an estimation of people in/out at each stop
  - It estimates the O/D matrix

The WiFi based APCS
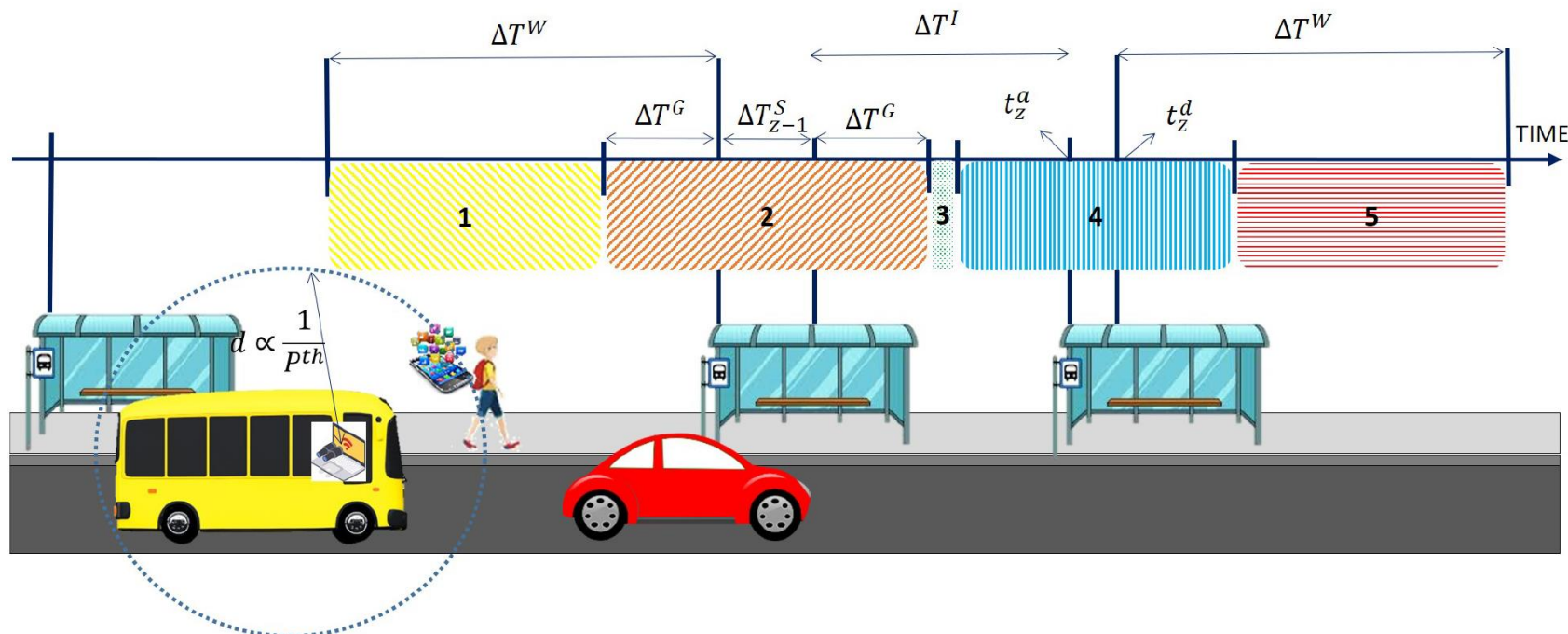
- Counting people onboad
  - Issues with people at the bus stop
  - People in nearby vehicles
  - Probes requests are not sent regularly
  - The distance between bus stops is not constant

Approprite tuning needed

	Test 1	Test 2	Test 3
ΔT^W (minutes)	2	4	4
N^{frame}	5	3	1
P^{th} (dBm)	-55	-65	-65
ΔT^P (minutes)	1	1	1
ΔT^G_z (seconds)	10	20	20

|	Planned Experiment		First Test		Second Test		Third Test	
Device	O	D	O	D	O	D	O	D
A	1	2	NA	NA	1	2	1	2
B	1	6	1	6	1	6	1	6
C	1	9	1	8	1 5	3 9	1	9
D	2	12	4	12	2	12	3	12
E	6	8	6	8	6	8	6	8
F	6	9	6	9	6	9	6	9
G	8	13	8	13	8	13	8	13
H	9	10	NA	NA	9	10	9	10
X			3	5				

Incentive the check-in and check-out operations

- 5% of the users use the mobile ticketing system
  - We can track when they check-out (however, this requires the user to acquire a QR code)
  - We automatized the check-out (also) with the usage of BT beacons in the bus

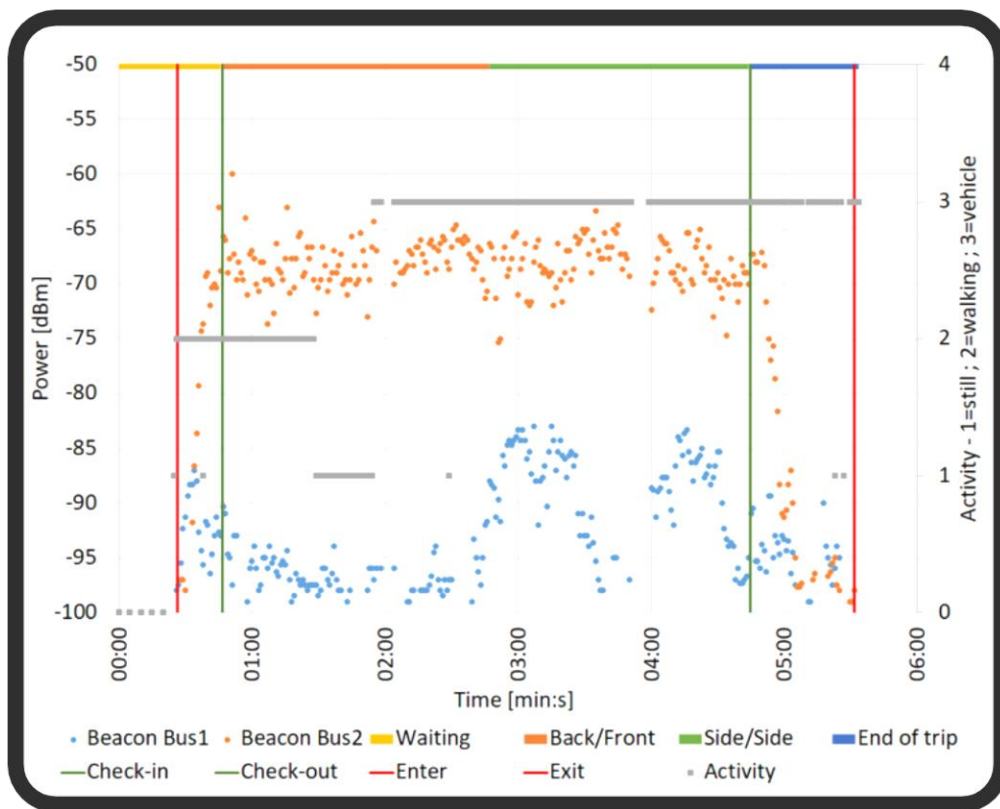https://www.blueupbeacons.com
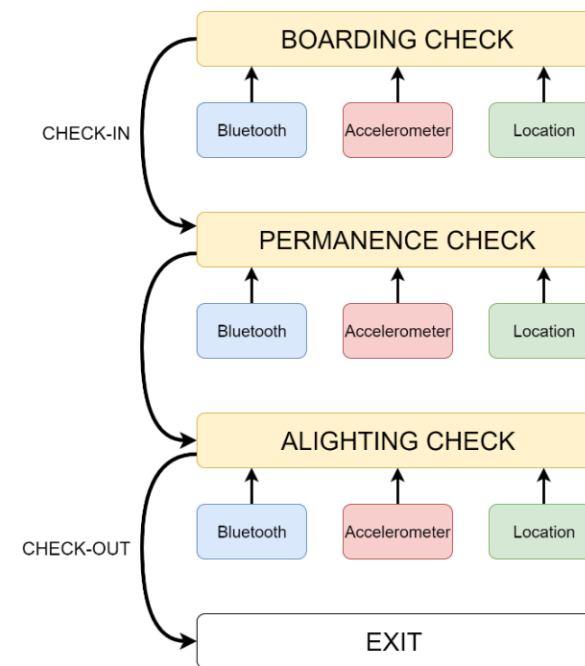
Experiments still going on

Two nearby buses

Idle bus at the stop

Concluding: coming from academia has some

Flexibility

Collection of real scenario data for exper.

Advantages

Knowl. of the needed technol.

Eager to test our knowl. in real settings

Interdisci-plinarity needed

Need to exit from our comfort zone

Disadvantages

The life in the wild is different from the life in the lab

Too fervid on technolog.

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