



Be smart in a SNAP!

LIVING LAB

X Roma

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES

SNAP4 Appliances and Dockers Installations



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FIRENZE

**DINFO**  
DIPARTIMENTO DI  
INGEGNERIA  
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**DISIT**  
DISTRIBUTED SYSTEMS  
AND INTERNET  
TECHNOLOGIES LAB



# SNAP4CITY



Powered by

## *scalable Smart aNalytic APplication builder for sentient Cities: for Living Lab and co-working with Stakeholders*

<https://www.Snap4City.org>



Paolo Nesi, [paolo.nesi@unifi.it](mailto:paolo.nesi@unifi.it)  
<https://www.Km4City.org>  
<https://www.disit.org>









# Snap4City: Builder of Sentient Cities Solutions

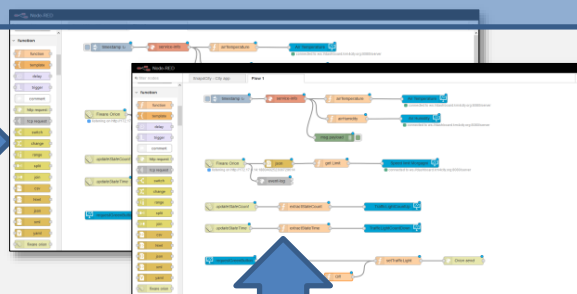
Dashboards with data driven IOT Applications enforcing intelligence

IOT and data World



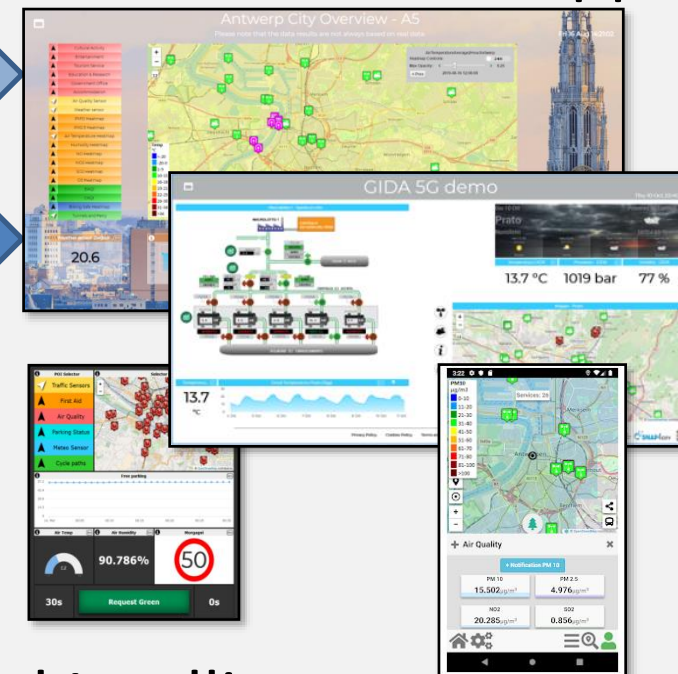
My IOT Devices

IOT Applications



Big Data Analytics, Artificial Intelligence

Dashboards and Apps







## APPLIANCES CONTAINERS



- LOCAL GOVERN
- STAKEHOLDERS
- CITY USERS
- IN-HOUSE
- ENERGY OPERATORS
- MOBILITY OPERATORS
- COMMERCIAL OPERATORS
- SECURITY OPERATORS
- INDUSTRIES
- RESEARCHERS
- START-UPS
- ASSOCIATIONS

- GDPR
- SECURITY
- PRIVACY
- ASSESSMENT
- AUDITING
- PENTESTED

- OPEN IOT DEVICES
- IOT EDGE
- IOT GATEWAY
- PAX COUNTERS
- IOT BUTTONS

- TEST CASES, SCENARIOUS, VIDEOS, HACKATHONS
- OPEN SOURCES, COMMUNITY OF CITIES
- TRAINING TUTORIALS, COMMUNITY MANAGEMENT

### IOT APPLICATIONS - INSTANT APPS



DATA DRIVEN APPLICATIONS • REAL TIME PROCESSING • BATCH PROCESSING • ANY PROTOCOL & FORMAT

### DASHBOARDS & APPLICATIONS



CONTROL ROOM • SITUATION ROOM • OPERATOR DASHBORDS • BUSINESS INTELLIGENCE • WHAT-IF ANALYSIS • DECISION SUPPORT • SIMULATIONS • RISK ANALYSIS • RESILIENCE ANALYSIS

### MOBILE & WEB APPLICATIONS



DEVELOPMENT KIT • SUGGESTIONS • MOBILE APPS • MONITORING PANELS • PLATFORM UTILITIES • READY TO USE SMART APPLICATIONS

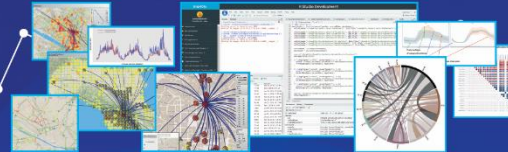
## MICROSERVICES & ADVANCED SMART CITY API

### LIVING LAB - DEV TOOLS - COWORKING



IOT DIRECTORY • SERVICE MAP • RESOURCE MANAGER • DATA GATE • R STUDIO • ETL

### BIG DATA - DATA ANALYTICS



PREDICTIONS • ANOMALY DETECTION • WHAT-IF ANALYSIS • TRAFFIC FLOW RECONSTRUCTION • ORIGIN-DESTINATION MATRICES • SOCIAL MEDIA ANALYSIS • OFFER VS DEMAND ANALYSIS • ENVIRONMENTAL DATA ANALYSIS AND PREDICTIONS • REAL TIME HEATMAPS • ROUTING • ALERTING • EARLY WARNING • PERSONAL AND VIRTUAL ASSISSTANTS • SMART SOLUTIONS • SMART SHARING • PARTECIPATORY

### DATA ANALYTICS TOOLS - MICRO-APPLICATIONS



## KM4CITY DATA AGGREGAT KNOWLEDGE BASE - EXPERT SYSTEM OF THE CITY - BIG DATA STORE

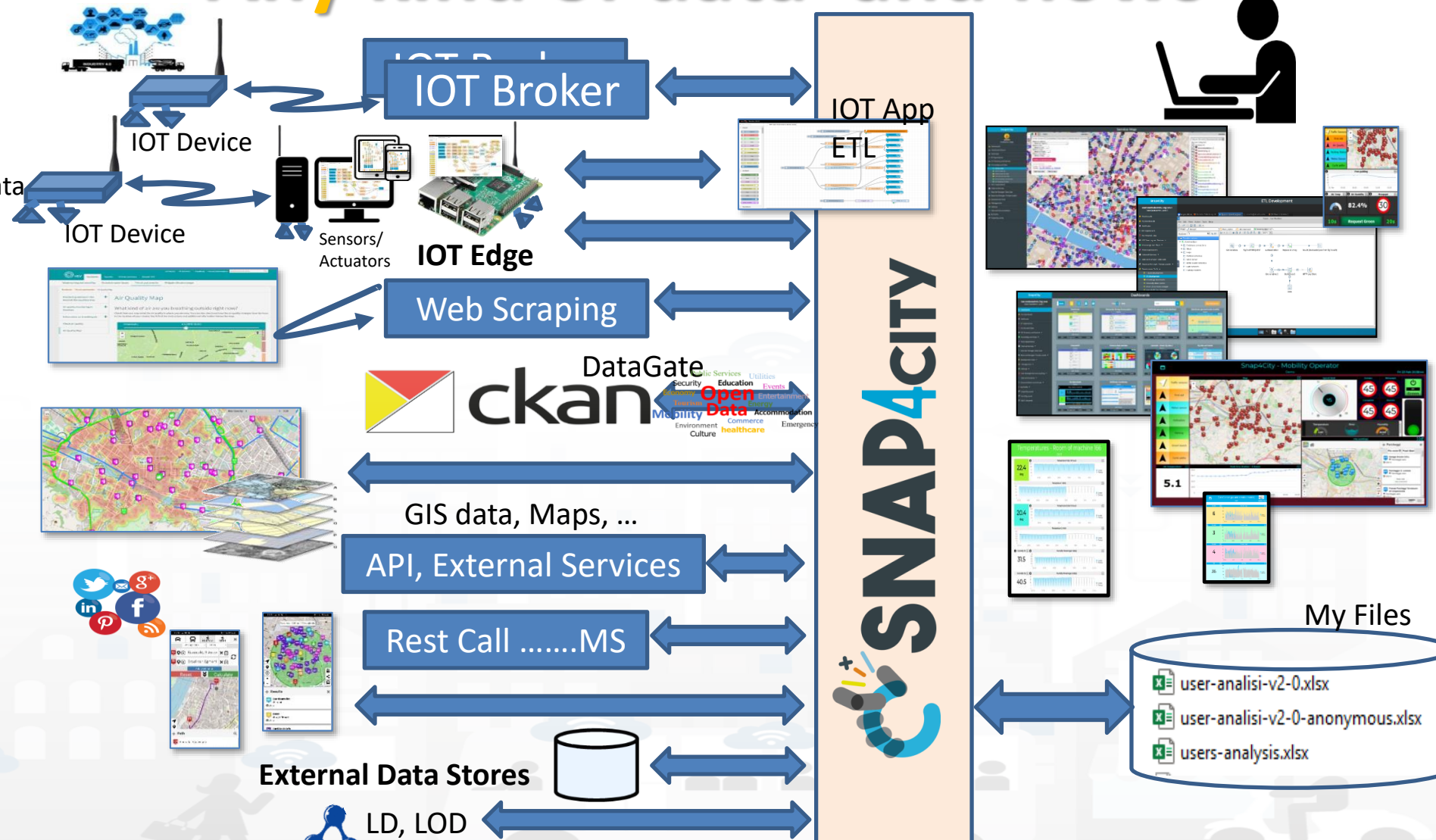
## IOT MNG - DATA MNG - DATA INSPECTOR - PROCESS MNG - USER ENGAGEMENT - GDPR MNG ...

- GIS
- CITY UTILITIES
- OPEN DATA
- LEGACY & EXTERNAL SERVICES
- PERSONAL DATA
- IOT / IOE
- BROKERS
- KPI
- INDUSTRY 4.0
- SOCIAL MEDIA





# Any kind of data and flows



- **Open Data:**
  - Data gate, federation of Open Data Portals
  - ETL processes (PULL)
  - IOT Application processes
- **IOT Networks:**
  - IOT Application processes, data driven or PULL
  - IOT Brokers (Push) → IOT Shadow
- **Web Pages:**
  - Web scraping, crawling processes
- **Social media: Twitter, Facebook,...**
  - Twitter Vigilance, IOT App
- **Mobile Apps**
  - Smart City API
- **Files upload: CSV, Excel, etc.**
  - IOT Applications, ETL
- **REST API, WS, FTP, LD, LOD, etc.**
  - IOT Applications, ETL
- **Data base accesses**
  - GIS: WFS, WMS
  - ETL, IOT Application

# Standards and Interoperability

**Compliant with:** AMQP, COAP, MQTT, OneM2M, HTTP, HTTPS, TLS, Rest Call, SMTP, TCP, UDP, NGSI, LoRa, LoRaWan, TheThingsNetwork, SigFOX, DATEX II, SOAP, WSDL, Twitter, FaceBook, Telegram, SMS, OLAP, MySQL, Mongo, HBASE, SOLR, SPARQL, EMAIL, FTP, FTPS, WebSocket, WebSocket Secure, ModBUS, OPC, GML, RS485, WFS, WMS, ODBC, JDBC, Elastic Search, Phoenix, XML, JSON, CSV, db, GeoJSON, Enfuser FMI, Android, Raspberry Pi, Local File System, ESP32, Libelium, IBIMET, OBD2, SVG, XLS, XLSX, TXT, HTML, CSS, etc.







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# SMARTCITY EXPO WORLD CONGRESS












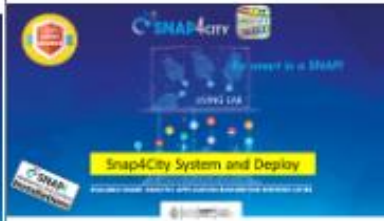
19-21 November 2019 - Barcelona

*See you at Snap4City Stand A118*








## November 2019 Training for Barcelona Smart City World Expo Congress

	1st day	2nd day	3rd day	4th day	5th day	6th day
what	General	Dashboards	IOT App, App, Network	Data Analytics	DataWareHouse Data Ingestion	System and Installation
PDF						
Inter active						

The updated Snap4City mobile development App Kit as open source for developing mobile and web App using Cordoba Apache is accessible on GitHub from:

<https://github.com/disit/snap4cityAppKit>

Swagger documentation of Smart City API is on: <https://www.km4city.org/swagger/external/index.html>

7th day, the Mobile App Development exploiting the Smart city API					
Slides ENG in PDF about the structure of the kit and main tools		interactive SLIDES ENG about the structure of the kit and main tools		video ENG on HOW to use the Dev Kit from zero	



# Florence









# Firenze Oggi

# 2019



Fri 25 Oct 23:29:38

## 43666

Totale utenti WIFI

COLONNINE RICARICA

176 INSTALLATE

71 % ATTIVE

5.1 % IN USO

**GENERAL METEO**

MINIMO BASSO MEDIO ALTO

**RISCHIO IDRAULICO**

**RISCHIO TEMPORALI**

**RISCHIO IDROGEOLOGICO**

**RISCHIO NEVE**

**RISCHIO GHIACCIO**

**RISCHIO VENTO**

**SITUAZIONE VIABILITA**

**0 INCIDENTI**

0 CHIUSURE AL TRAFFICO (TOT)

0 CHIUSURE PER CANTIERI

0 PROGR. 0 NON PROG.

0 LIMITAZIONI AL TRAFFICO (TOT)

0 LIMITAZIONI PER CANTIERI

0 NON PROG. 0 PROGR.

**0 TOT. EVENTI SULLA RETE**

<b>SMN</b> 28.7 % occupati su 607 posti	<b>BINARIO16</b> 55.2 % occupati su 165 posti	<b>FORTEZZA</b> 27.8 % occupati su 521 posti
<b>LEOPOLDA</b> 36 % occupati su 300 posti	<b>CALZA</b> 70.3 % occupati su 148	<b>S.AMBROGIO</b> 99.7 % occupati su 379 posti
<b>PARTERRE</b> 34 % occupati su 656 posti	<b>CAREGGI</b> 24.9 % occupati su 406 posti	<b>BECCARIA</b> 98.1 % occupati su 210 posti

## ANALYSIS

Energy Environment

Mobility Social

Resilience

## Attesa media alla fermata

<b>Linea 6</b> 3 min	<b>Linea 13</b> 13 min
<b>Linea 17</b> 4 min	<b>Linea 23</b> 5 min
<b>Linea 31</b> 19 min	<b>Linea 36</b> 2 min

**FLUSSI INGRESSO CITTA**

TOTALE  
**284094**  
VEICOLI

**FLUSSI INGRESSO ZTL**

TOTALE ZTL  
**57499**  
VEICOLI

<b>Nati Italiani</b> 163 ultimo mese consolidato	<b>Nati stranieri</b> 49 ultimo mese	<b>Deceduti</b> 395 ultimo mese	<b>Matrimoni</b> 19 ultimi 7 giorni	<b>Unioni Civili</b> 0 ultimi 7 giorni
<b>Segnalazioni ricevute in attesa</b> 1116 ultimo mese	<b>In Lavorazione</b> 524	<b>Risolte</b> 305	<b>Chiuse senza risoluzione...</b> 285	
<b>Manutenzioni Stradali</b> 54 oggi	<b>Verde Pubbli...</b> 4	<b>Decoro Urbano</b> 6	<b>Relitti</b> 3	

<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTQzOA==>





# Smart City Control Room

## a set of dashboards and tools



This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement N° 691735



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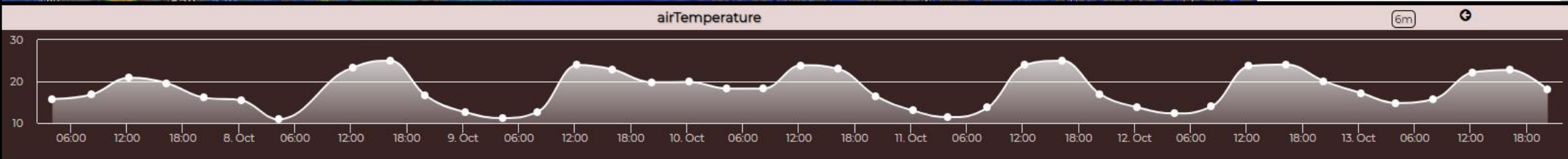
# Mobility and Environment What-IF Analysis

This dashboard contains data derived from actual sensors and predictive values under validation

- Air Quality Sensors
- Weather Sensors
- PM10 Heatmap
- PM25 Heatmap
- CO Heatmap
- CO2 Heatmap
- O3 Heatmap
- NO2 Heatmap
- Europ. AQI Heatmap
- Air Humidity Heatmap
- Air Temp. Heatmap
- Wind Speed Heatmap
- Gral Pred. HM NOX (3m)
- Gral Pred. HM NOX (6m)
- Traffic Sensors
- Traffic Flow
- Cycling Paths
- Accident Heatmap
- Only HRes Anym. Gral
- Scenarios
- What-if analysis

Firenze Oggi

Air Temperat... (6m)



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjE5MA==>

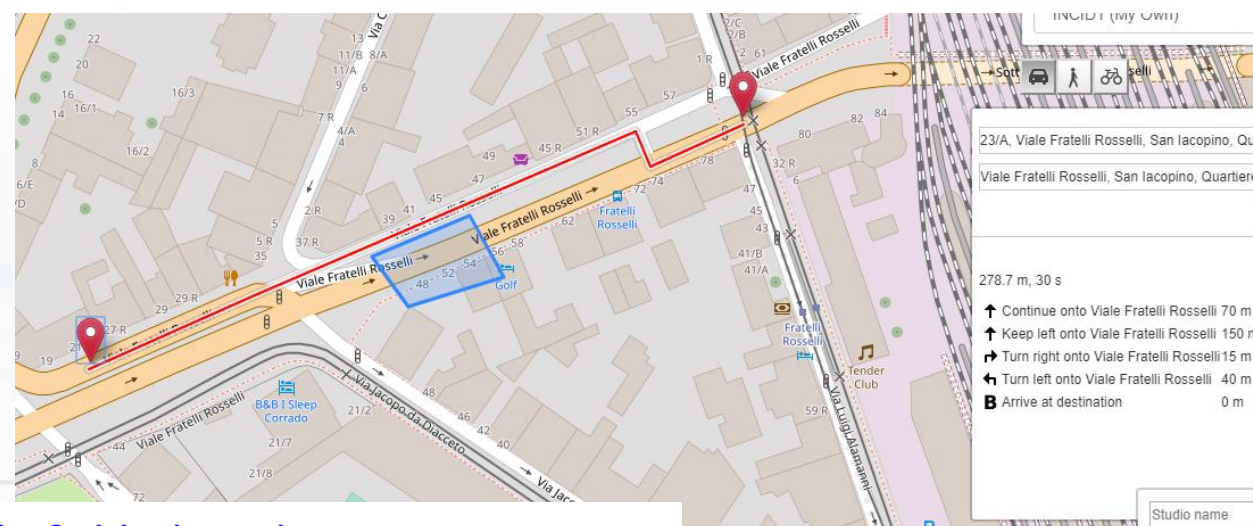
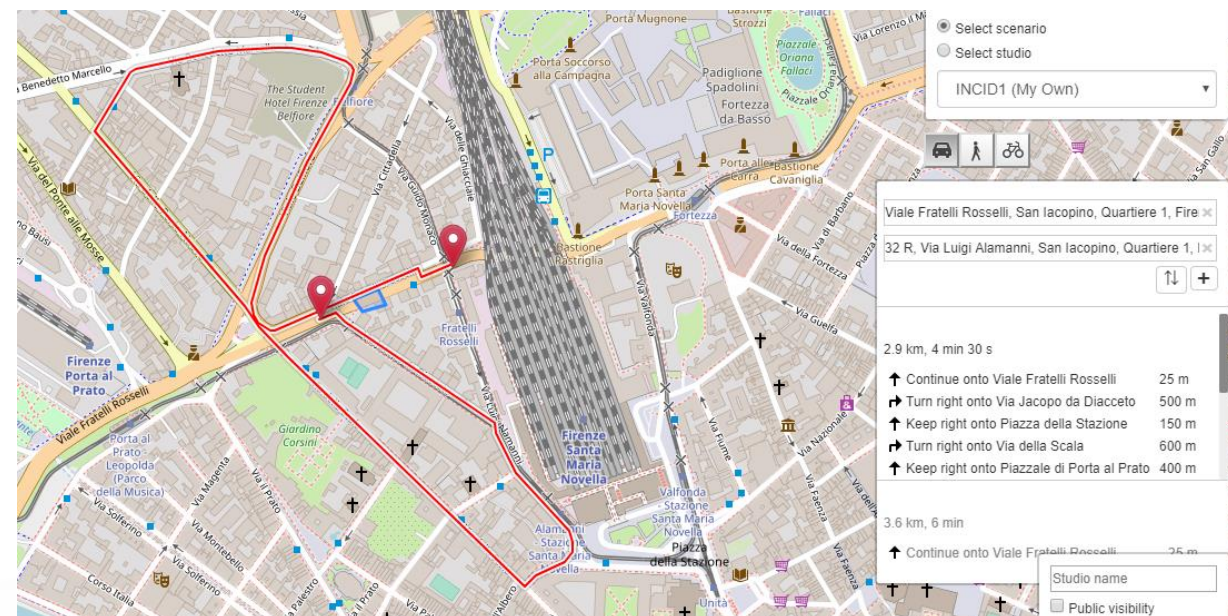


Accidents and elements blocking Points and Shapes taken into account for:

- Routing
- Traffic Flow reconstruction
- Evacuation paths
- Rescue team paths

Assessment on the basis of changes:

- Mobility demand assessment
- Mobility Offer assessment



# Smart City Control Room (Data View)



This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement N° 691735



- **Mobility:**
  - **quality of public transportation service (mean delay on bus-stops)**
  - public transport operators schedule and paths, routing, multimodal routing
  - traffic flow reconstruction (Sii-Mobility)
  - Smart parking: predictions
  - Accidents and events, Log, heatmaps
- **Environment:**
  - **irrigators**
  - **smart waste (are coming)**
  - Sensors: PM10, PM2.5,.....
  - Pollination
  - Heatmaps: PM10, PM2.5, ...
  - NOX predictions (TRAFAIR CEF)
- **Energy:**
  - **recharging stations (fast and reg.)**
  - **consumption meters (smart info)**
  - **smart light, street lights**



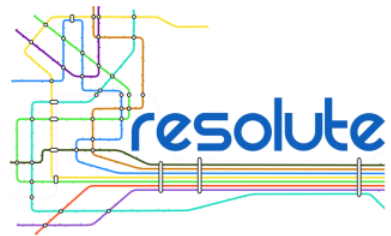
- **Weather**
  - Forecast and actual
- **Social:**
  - **smart benches**
  - Entertainment events
  - Twitter monitoring, Sentiment analysis, NLP text
  - TV camera streams
  - Triage status of some Hospital
- **People Flows:**
  - **Wi-Fi status**
  - Origin destination matrices, people flow (RESOLUTE)
- **Governmental and Communications:**
  - **KPI of the City**
  - **Digital Signage**
  - Civil protection, Resilience (Resolute)
- **Tourism and Culture:**
  - POI, etc.

## Analysis:

- what-if routing, scenarios,
- traffic flow, environmental predictions

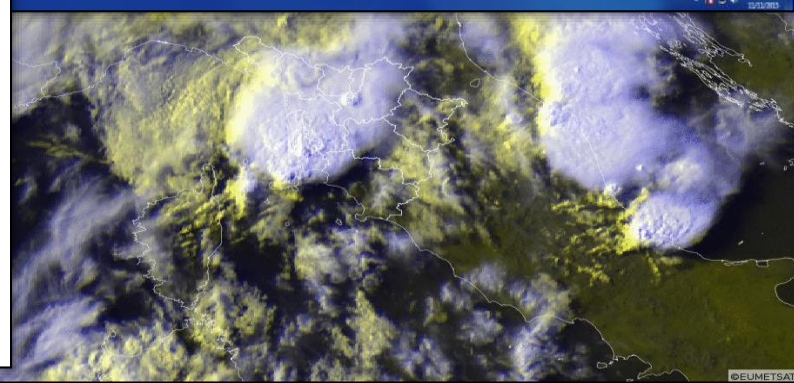
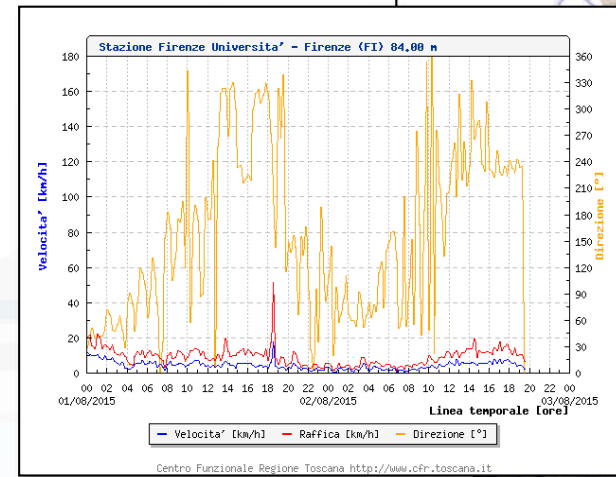
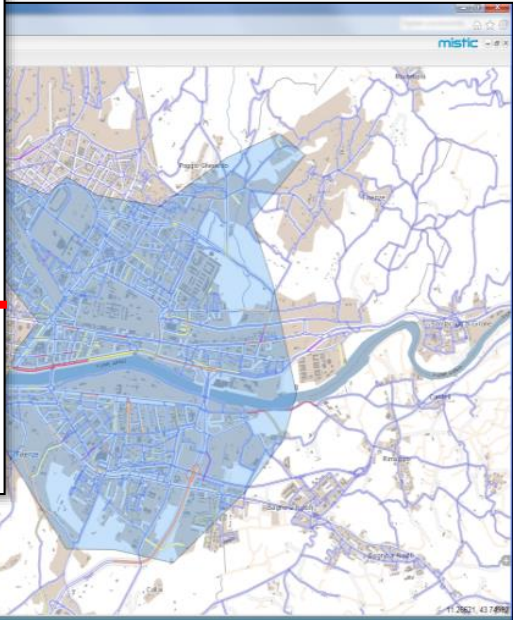
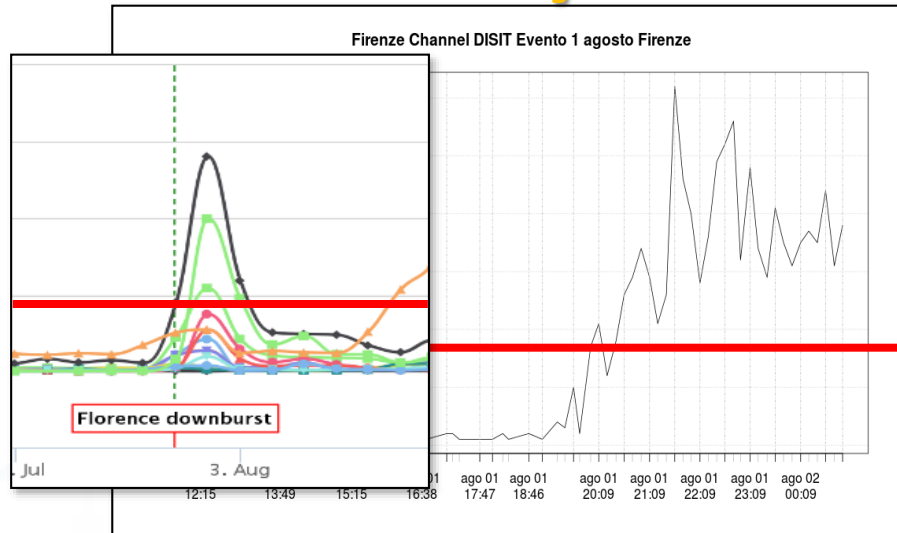




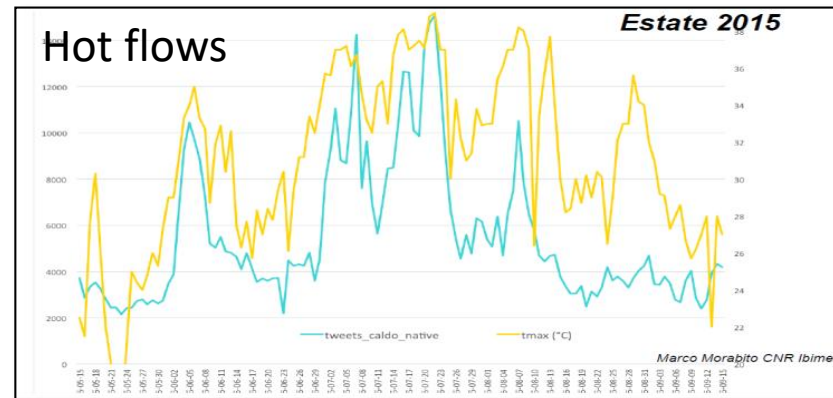


# Twitter Vigilance

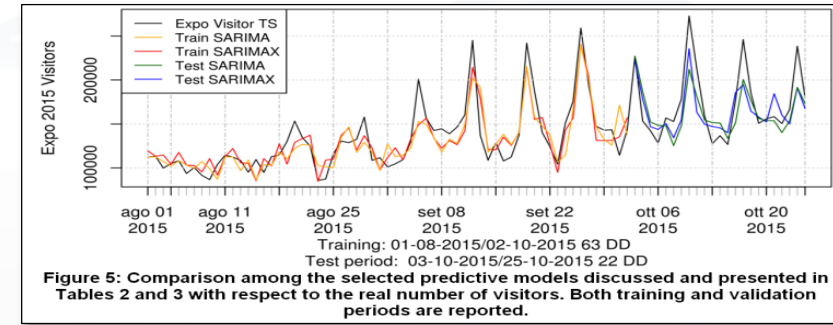
## Early Warning



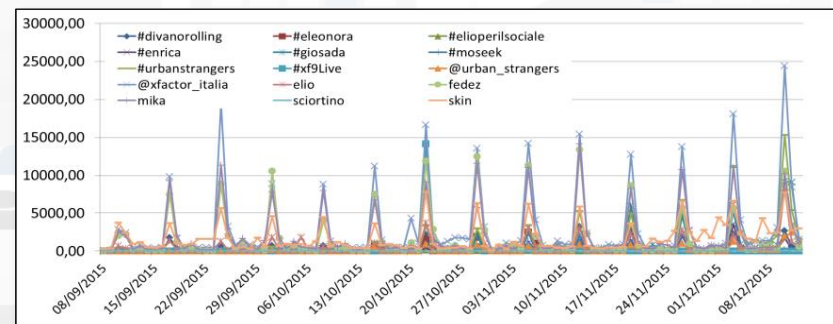
## Predictive models



## Attendance at long lasting events: EXPO2015



## Attendance at recurrent events: TV, football

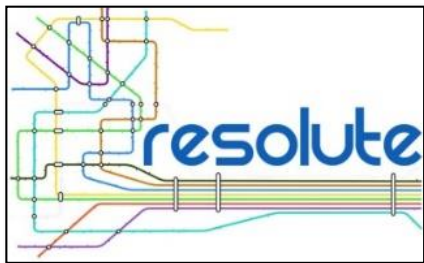








# ERMG: European Resilience Management Guide



## ANTICIPATING



- European Resilience Management Guidelines
- Game Based Training

## MONITORING



- Big Data Platform
- IoT/IoE/Open Data
- Real Time Dashboard
- Resilience Control Room
- Data Analytics
- Early Warnings
- Urban Traffic Manager Data Exchange

## RESPONDING



- Smart Decision Support Systems (DSS)
- Evacuation Decision Support
- Smart Intelligent Transport Systems
- Emergency Support Smart App
- Resilience DSS

## LEARNING



- Human Behavior Analysis
- Predictive Analytics
- Urban Transport System Dynamic Analysis
- Resilience Quantification
- Network Analysis





# Tuscany Region

Firenze, Pisa, Livorno, Prato, etc.





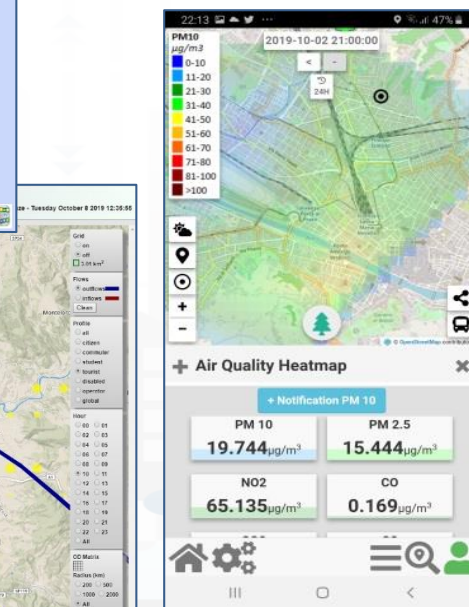
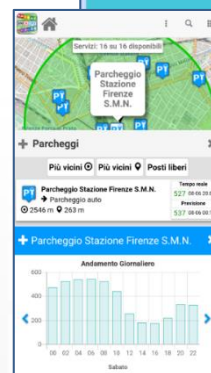
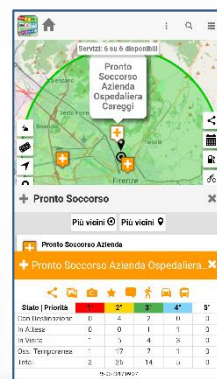
## • Dashboards & Services:

- **Mobility:** public transport operators schedule and paths, traffic Fi-Pi-Li main road, parking status and predictions, traffic sensors, Origin Destination matrix, routing, multimodal routing, etc.
- **Social:** Hospitals and triage, etc.
- **Environment:** sensors, heatmaps, alerting,
  - **Pollution Forecast**
  - **Weather Forecast**
- **Culture and Tourisms**
- Etc.

## • Mobile App and MicroApplications:

- Tuscany in a Snap (all stores)
- Tuscany where what... km4city (all stores)

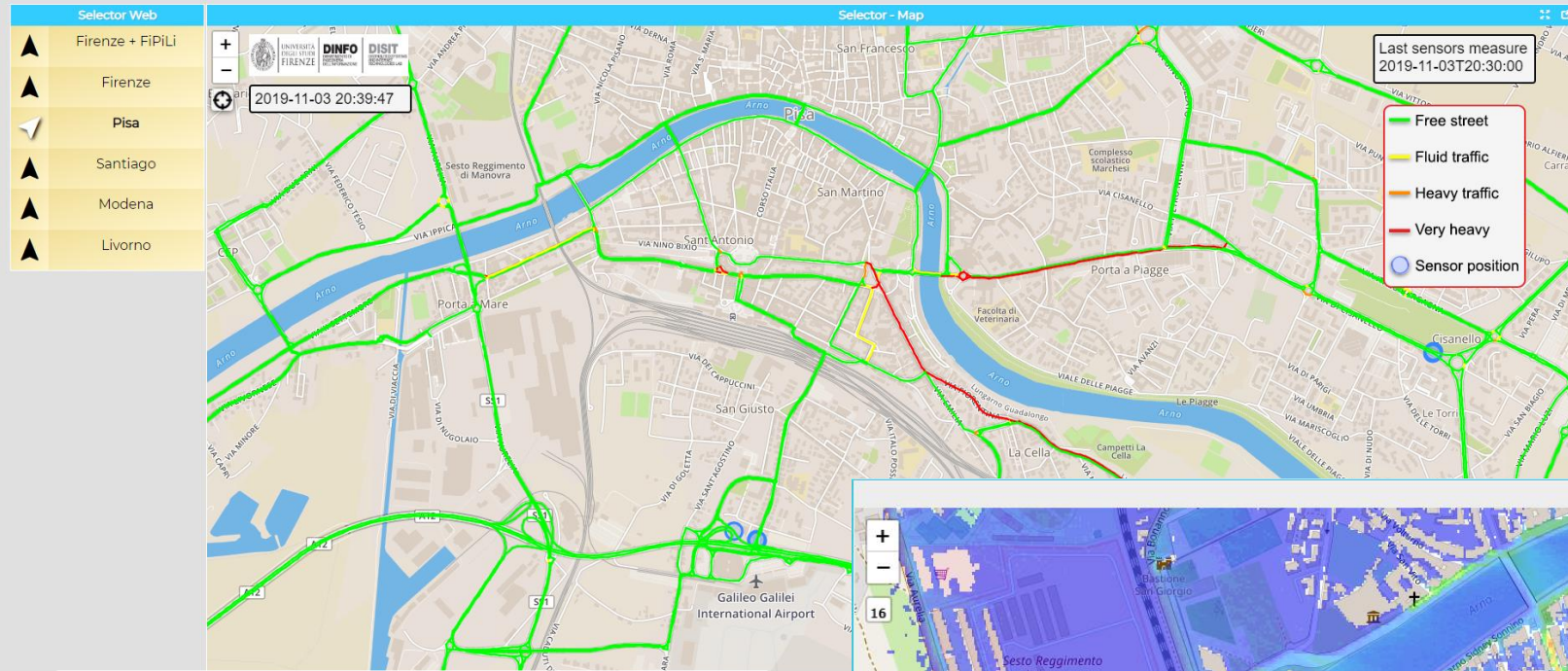
## • Numbers: 1.5 M complex events per day





# Traffic Flow Reconstruction for the cities

Sun 3 Nov 20:39:47



# Pisa







# *Helsinki*









- **Dashboards & Services:**

- **Environment & Weather**, PM10, PM2.5, NO, SO2, CO, noise, etc.

- Sensors values, Heatmap & Alerts on critical
- FMI Enfuser prediction: PM10, PM2.5, ..
- GRAL predictions PM10, validations
- Private sensors in Jätkäsaari area (personal dashboards)

- **Mobility:** Traffic Sensors, Operators, routing, multimodal routing, whatif

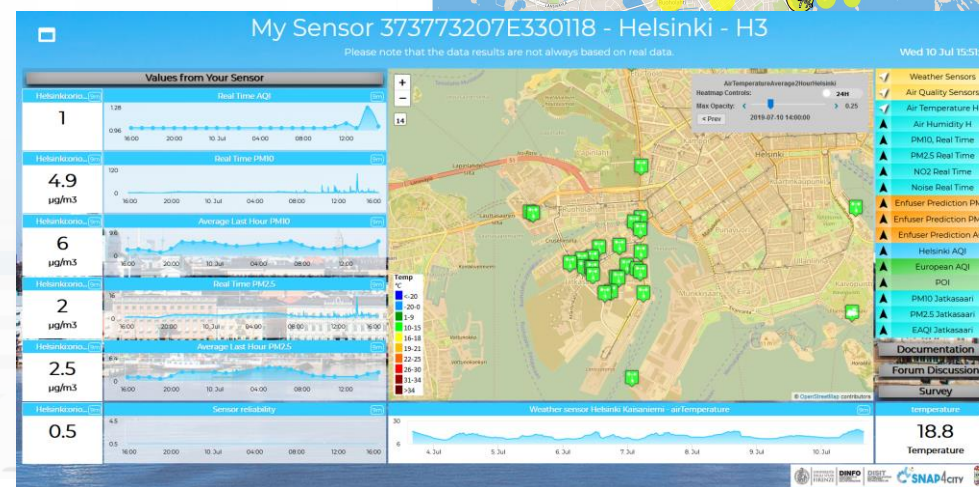
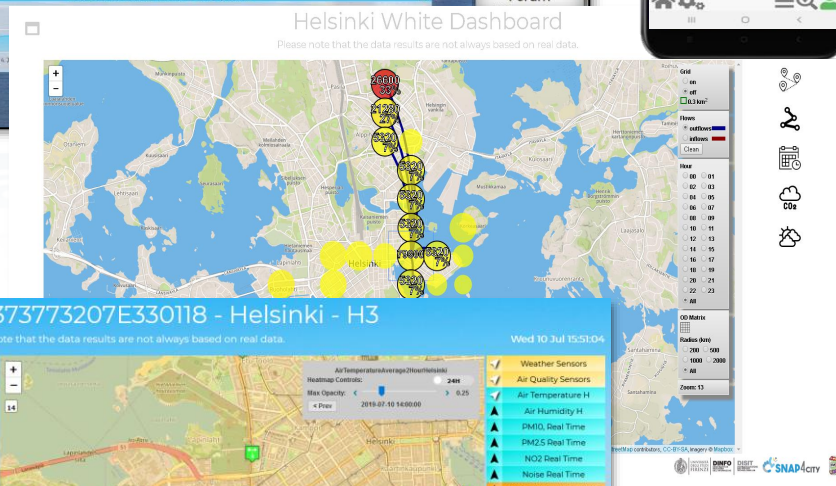
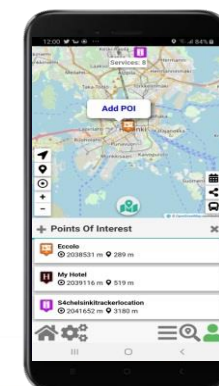
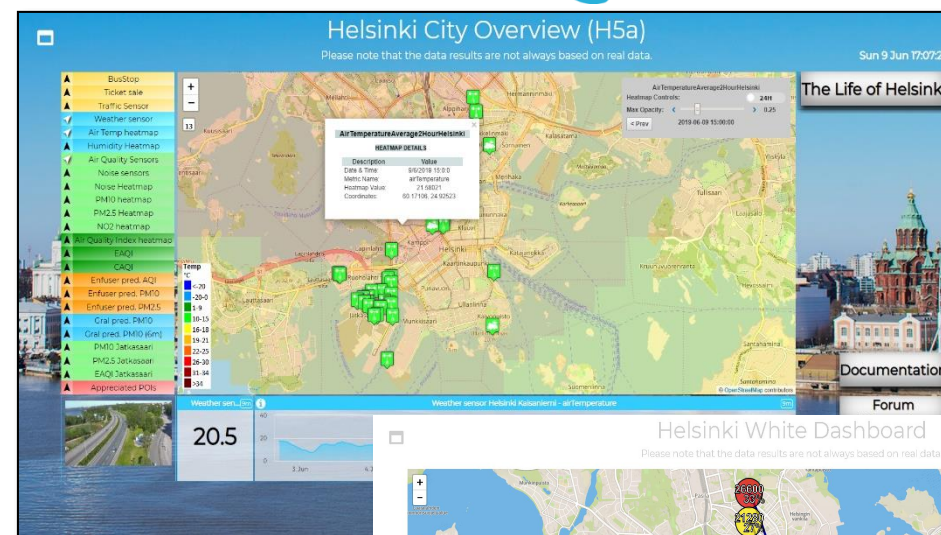
- **Social:** Twitter Vigilance, early warning

- **Life in Helsinki:** OD matrix people flow, Twitter Vigilance SA, hot places, etc.

- **Tourism and Culture**

- **Mobile App and MicroApplications:**

- Helsinki in a Snap (all stores)



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTQwNg==>

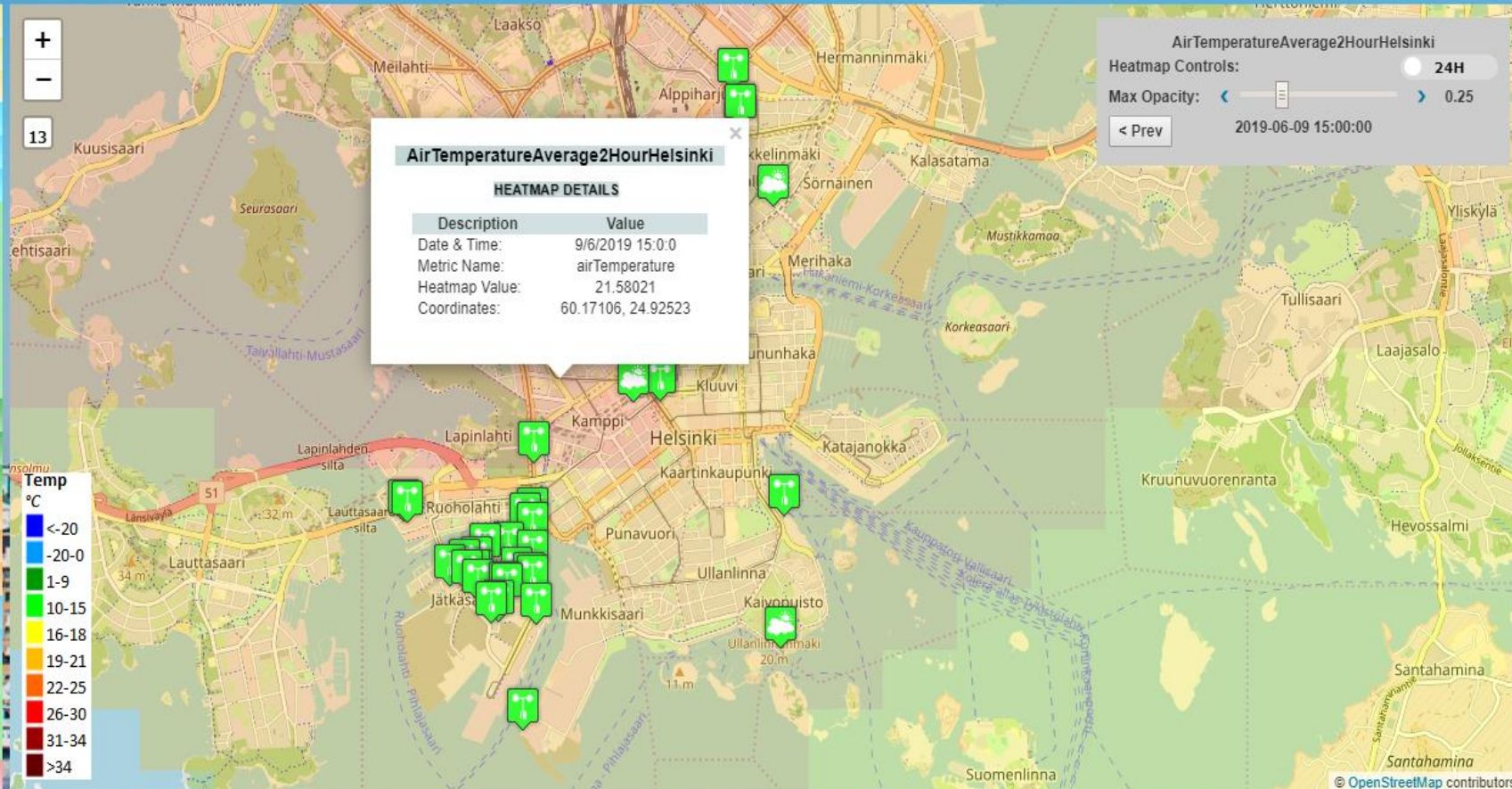


# Helsinki City Overview (H5a)

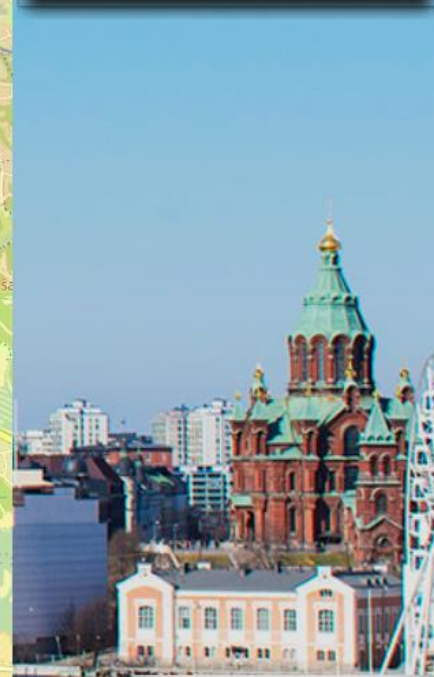
Please note that the data results are not always based on real data.

Sun 9 Jun 17:07:25

- ▲ BusStop
- ▲ Ticket sale
- ▲ Traffic Sensor
- ▼ Weather sensor
- ▼ Air Temp heatmap
- ▲ Humidity Heatmap
- ▼ Air Quality Sensors
- ▲ Noise sensors
- ▲ Noise Heatmap
- ▲ PM10 heatmap
- ▲ PM2.5 Heatmap
- ▲ NO2 heatmap
- ▲ Air Quality Index heatmap
- ▲ EAQI
- ▲ CAQI
- ▲ Enfuser pred. AQI
- ▲ Enfuser pred. PM10
- ▲ Enfuser pred. PM2.5
- ▲ Gral pred. PM10
- ▲ Gral pred. PM10 (6m)
- ▲ PM10 Jatkasaari
- ▲ PM2.5 Jatkasaari
- ▲ EAQI Jatkasaari
- ▲ Appreciated POIs



The Life of Helsinki



Documentation

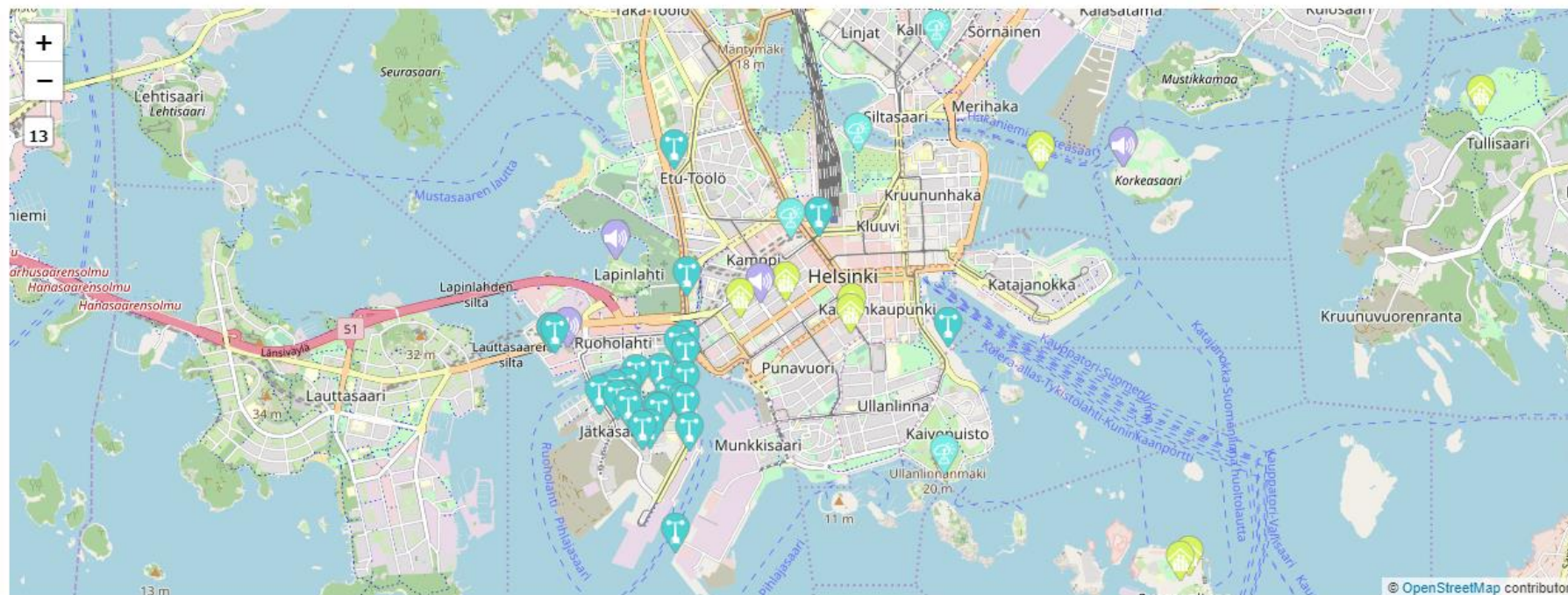
Forum Discussion

Survey



# Helsinki icon

Wed 13 Nov 16:47:53



Air Quality Monitoring Station Helsinki Mannerheimintie - airQualityPM10

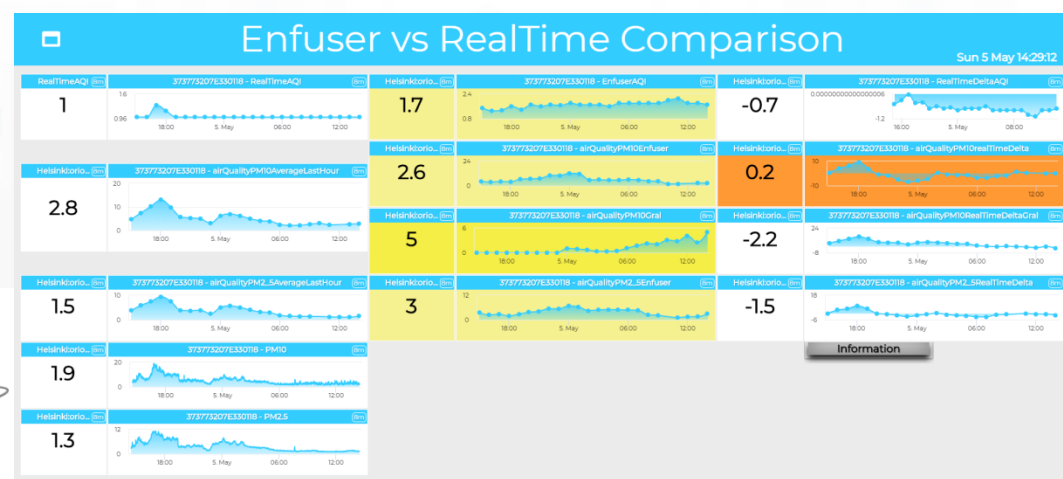
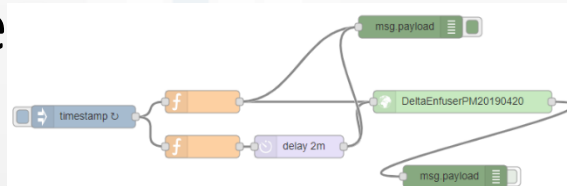
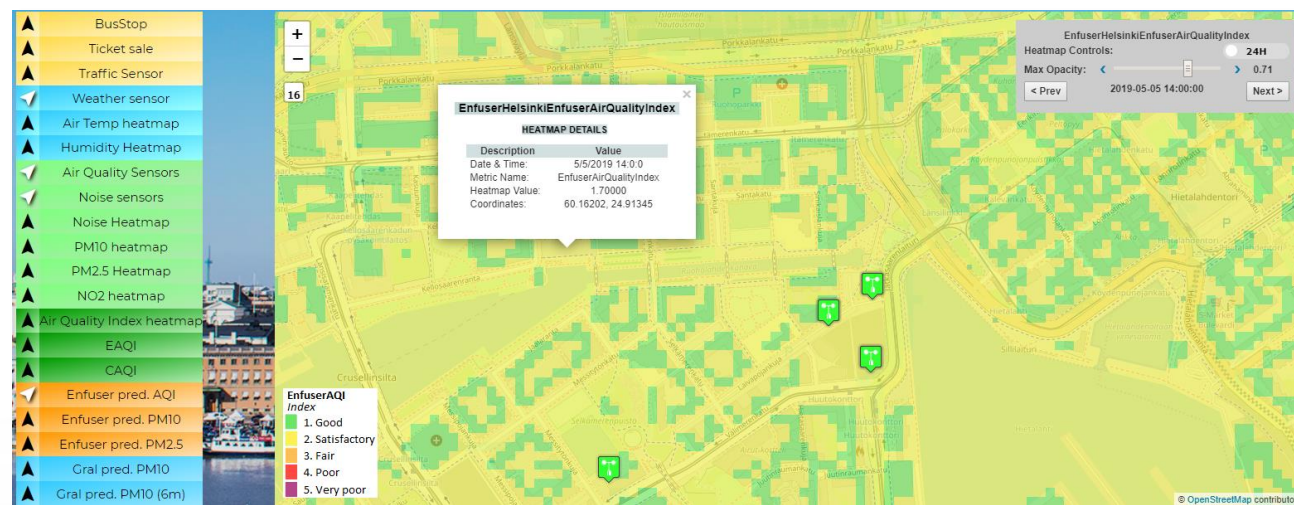




# Helsinki

## Data Analytics: Enfuser predictions

- **Enfuser predictions: AQI, PM10, PM2.5**
  - Data gathering, data processing for Piking
  - Delta Estimation Predictions vs Actual: on 12 points/sensors via R-Studio and IOT App
  - API for accessing data of Heatmaps in real time









## Environmental Data Predictions: GRAL

- GRAL predictions: PM10, NOX, ....
  - Comparison wrt real time values in actual value of Sensors
  - Graz Lagrangian Model.
- GRAL model takes into account:
  - pollution sources (for example the vehicles, their distribution on the streets, the about of pollution they produce according to their distribution over time and space, etc.),
  - structure of the city (streets and shape 3D of the buildings),
  - weather forecast (wind intensity and direction), etc.
- GRAL can be applied on NOX, PM10, PM2.5, ... or any other particles





## Environmental Devices hosted by Citizens



My Sensor 373773207E330118 - Helsinki - H3

Please note that the data results are not always based on real data.

Sun 3 Nov 23:39:19

**Values from Your Sensor**

Helsinki:orio... (8m)	Real Time AQI	1.044
Helsinki:orio... (8m)	Real Time PM10	1.5 $\mu\text{g}/\text{m}^3$
Helsinki:orio... (8m)	Average Last Hour PM10	4.5 $\mu\text{g}/\text{m}^3$
Helsinki:orio... (8m)	Real Time PM2.5	1 $\mu\text{g}/\text{m}^3$
Helsinki:orio... (8m)	Average Last Hour PM2.5	0.9 $\mu\text{g}/\text{m}^3$
Helsinki:orio... (8m)	Sensor reliability	0.5

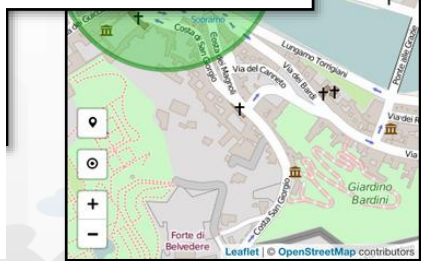
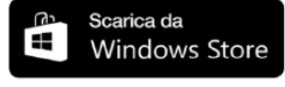
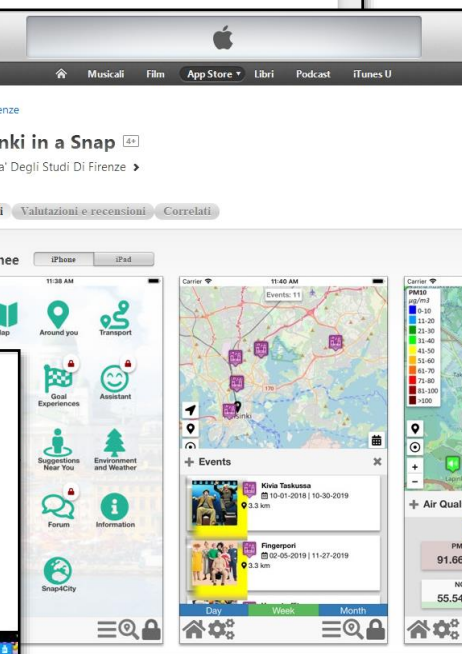
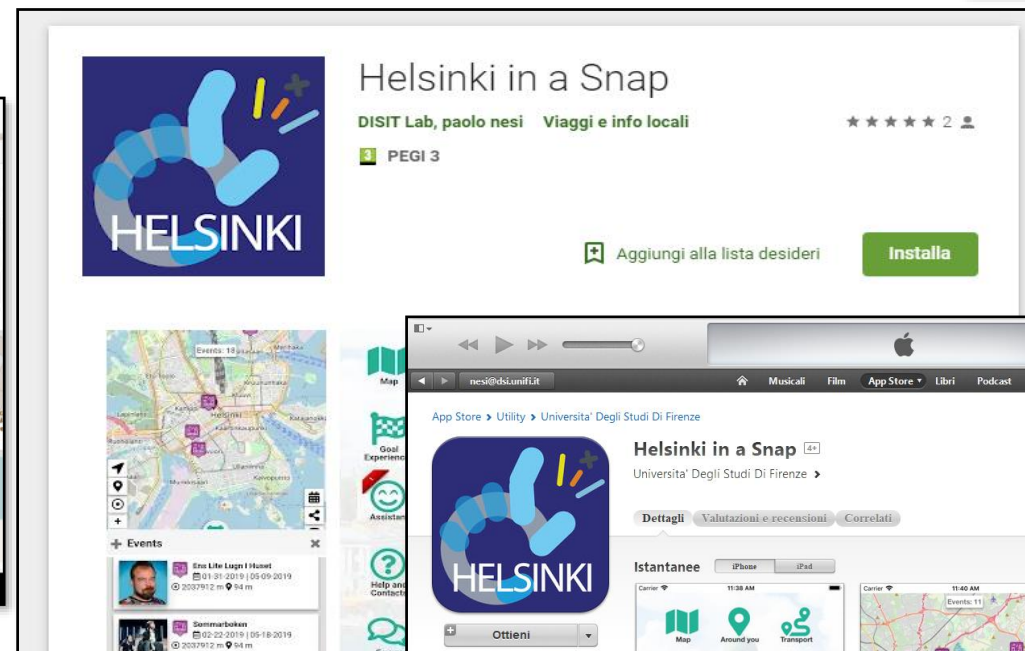
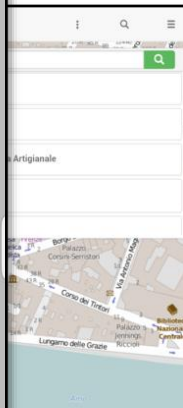
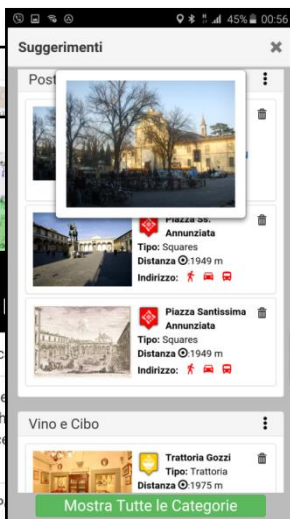
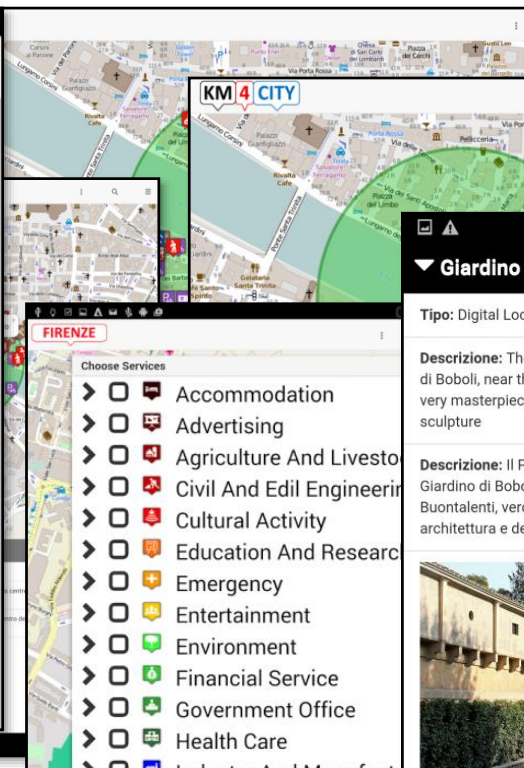
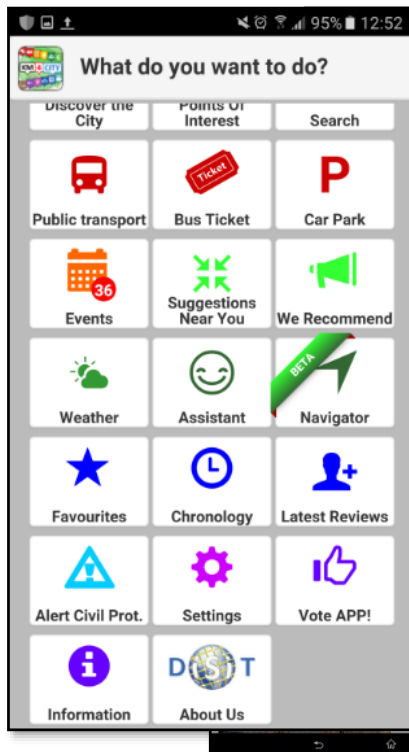
**Weather sensor Helsinki Kaisaniemi - air temperature**

0.4 Temperature

- Weather Sensors
- Air Quality Sensors
- Air Temperature H
- Air Humidity H
- PM10, Real Time
- PM2.5 Real Time
- NO2 Real Time
- Noise Real Time
- Enfuser Prediction PM10
- Enfuser Prediction PM2.5
- Enfuser Prediction AQI
- Helsinki AQI
- European AQI
- POI
- PM10 Jätkäsaari
- PM2.5 Jätkäsaari
- EAQI Jätkäsaari
- Documentation
- Forum Discussion
- Survey



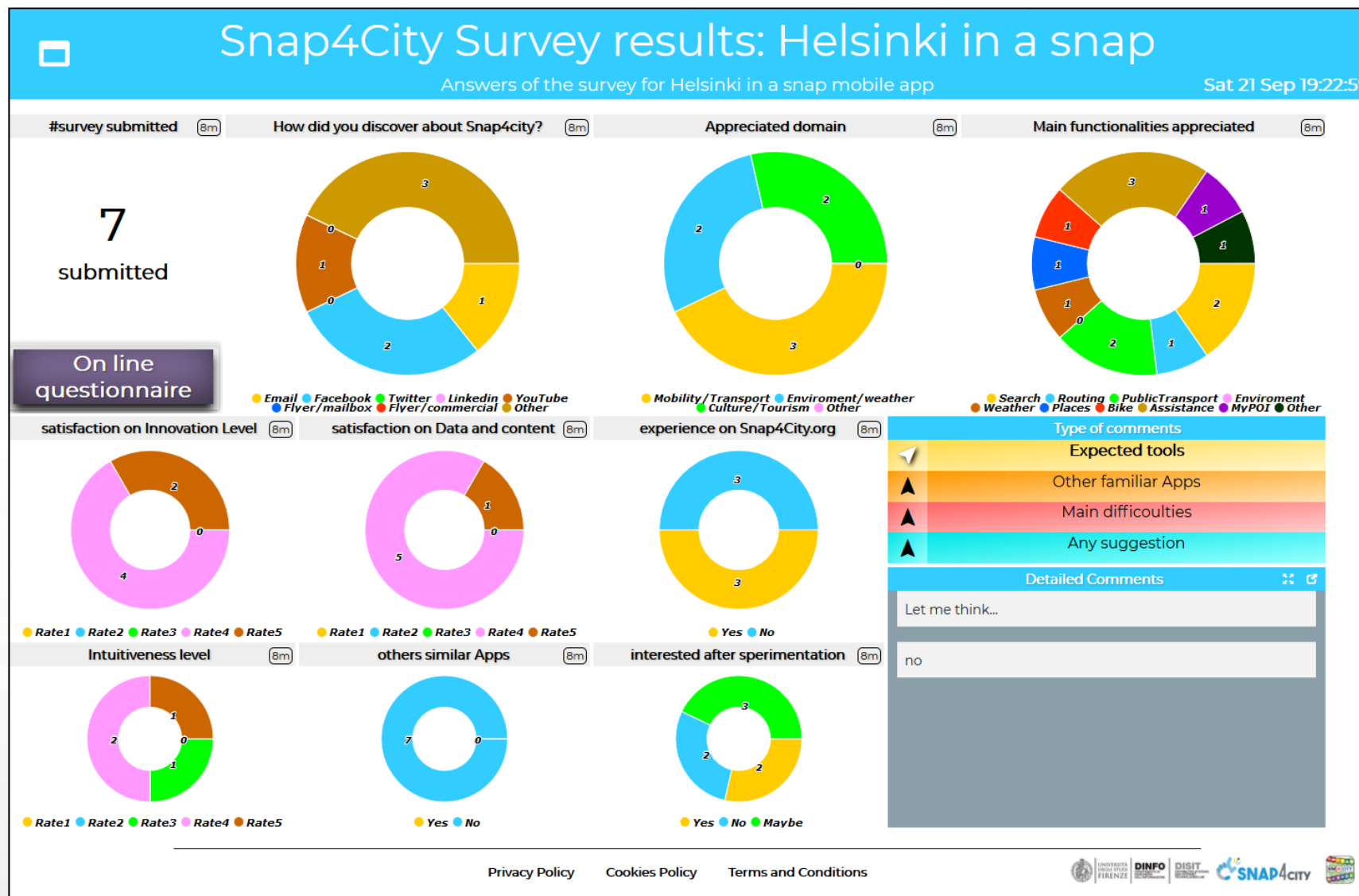
# Mobile Apps





<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc2OA==>

Dashboard  
created to monitor  
in real time the  
answers to the  
survey provided  
on the Mobile  
App directly by the  
Engagement tool

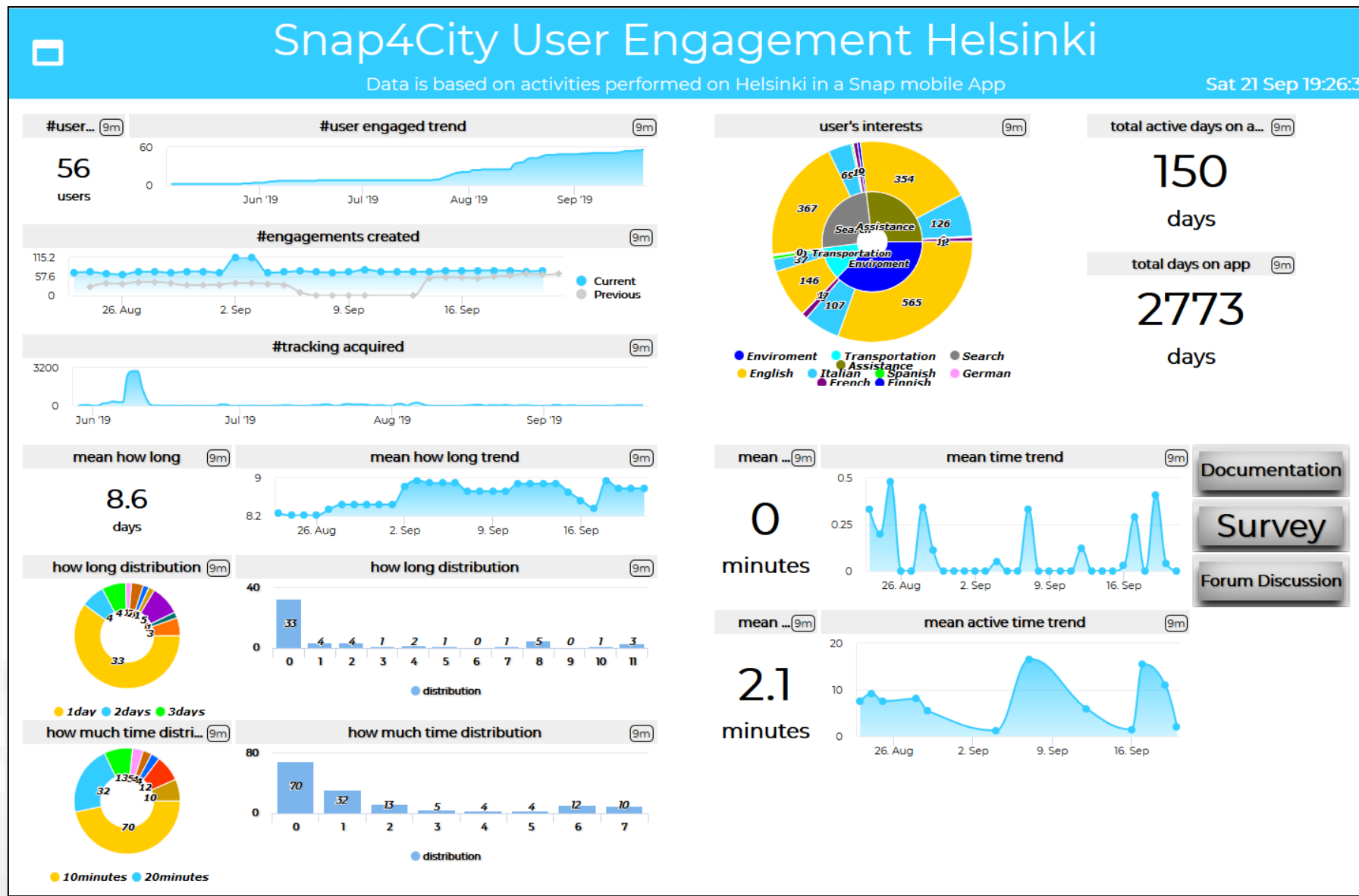




<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc1OA==>

## Dashboard monitoring the Mobile App:

- Collecting the clicks
- Describing the community of users in terms of the profile aspects
- Measuring the time spend, and topics of interest of the users, etc.

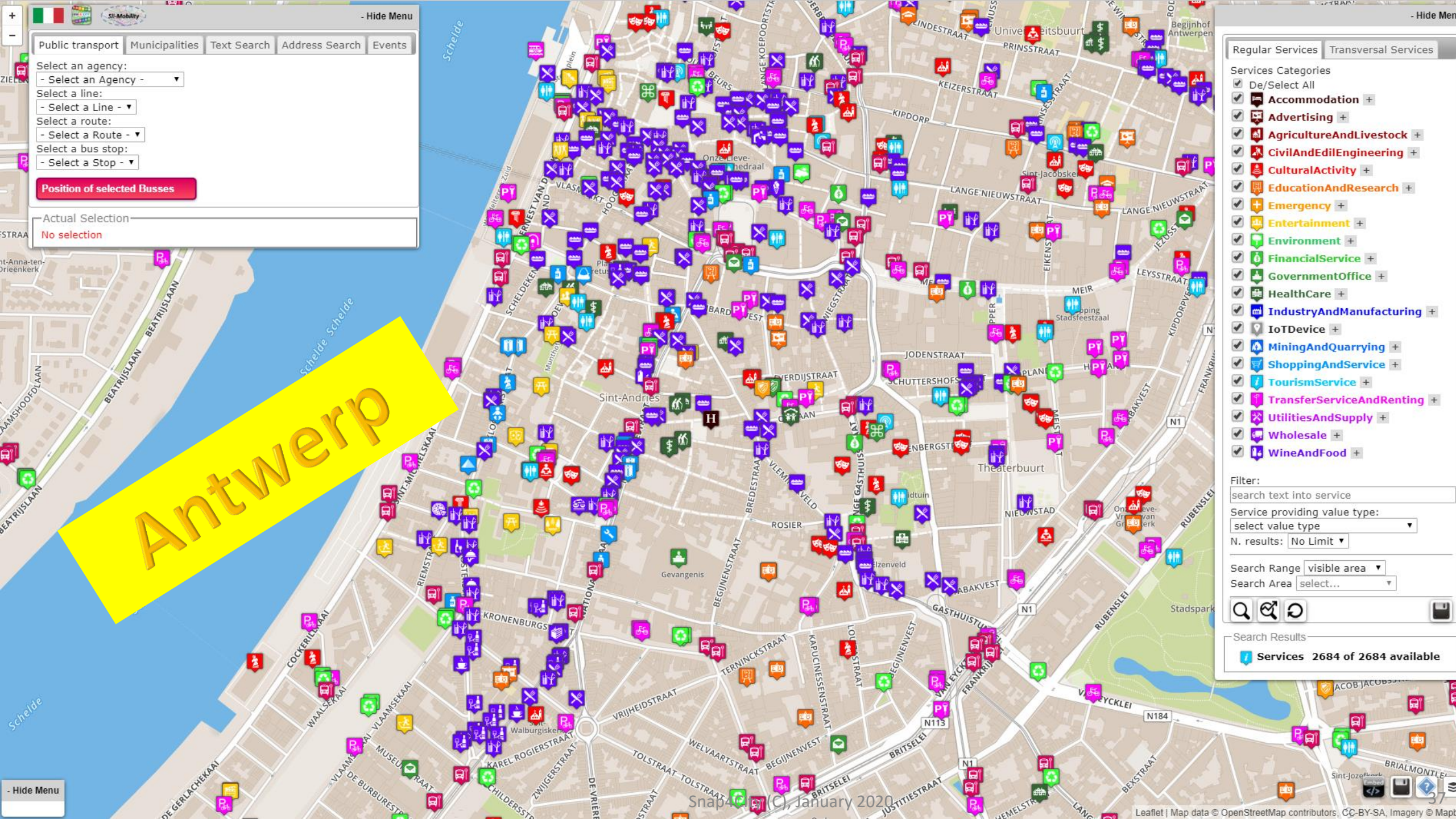




# *Antwerp*







Public transport Municipalities Text Search Address Search Events

Select an agency:

- Select an Agency -

Select a line:

- Select a Line -

Select a route:

- Select a Route -

Select a bus stop:

- Select a Stop -

Position of selected Busses

Actual Selection

No selection

Regular Services Transversal Services

Services Categories

De/Select All

Accommodation +

Advertising +

AgricultureAndLivestock +

CivilAndEdilEngineering +

CulturalActivity +

EducationAndResearch +

Emergency +

Entertainment +

Environment +

FinancialService +

GovernmentOffice +

HealthCare +

IndustryAndManufacturing +

IoTDevice +

MiningAndQuarrying +

ShoppingAndService +

TourismService +

TransferServiceAndRenting +

UtilitiesAndSupply +

Wholesale +

WineAndFood +

Filter:

search text into service

Service providing value type:

select value type

N. results: No Limit

Search Range visible area

Search Area select...



Search Results

Services 2684 of 2684 available

Antwerp



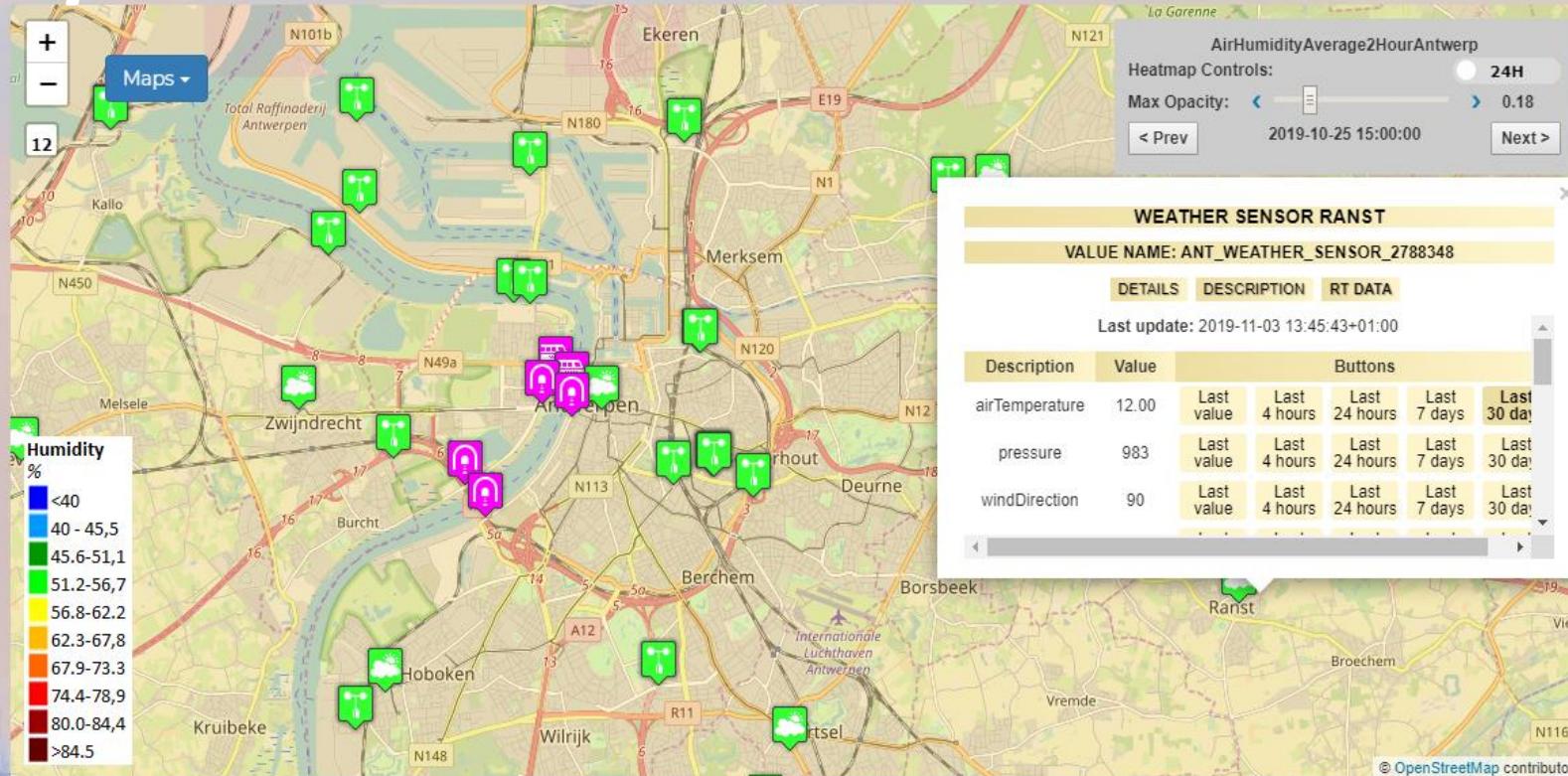
# Antwerp

## Antwerp City Overview - A5

Please note that the data results are not always based on real data.

Sun 3 Nov 14:09:43

- ▲ Cultural Activity
- ▲ Entertainment
- ▲ Tourism Service
- ▲ Education & Research
- ▲ Government Office
- ▲ Accommodation
- ▼ Air Quality Sensor
- ▼ Weather sensor
- ▲ PM10 Heatmap
- ▲ PM2.5 Heatmap
- ▲ Air Temperature Heatmap
- ▼ Humidity Heatmap
- ▲ NO Heatmap
- ▲ NO2 Heatmap
- ▲ SO2 Heatmap
- ▲ O3 Heatmap
- ▲ EAQI
- ▲ CAQI
- ▲ Biking Safe Heatmap
- ▼ Tunnels and Ferry
- ▲ Routing Scenario
- ▲ What-IF Routing



- Forum Discussion
- Documentation
- Survey
- The Life of Antwerp

<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTQwNw==>



## Unique Dashboard builder Multiple Styles

Antwerp Overview AS

AirTemperatureAverage2HourAntwerp

Heatmap Controls: 24H

Max Opacity: 0.18

2019-10-26 10:00:00

**AIR QUALITY MONITORING STATION 42R804 - ANTWERPEN (RING)**

VALUE NAME: ANTWERP\_AIR\_QUALITY\_BETR804

DETAILS DESCRIPTION RT DATA

Last update: 2019-11-03 09:00:00+01:00

Description	Value	Buttons				
airQualityPM10	8	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 days
airQualityNO2	21	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 days
airQualitySO2	null	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 days
airQualityPM2_5	3	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 days

Temp °C

- <-20
- 20-0
- 1-9
- 10-15
- 16-18
- 19-21
- 22-25
- 26-30
- 31-34
- >34

ant\_weather\_sensor\_28... 7m

10.2

airQualityPM10 - 30 days

03/11/2019 10:52:16







# Technical Selector: TECH MultiDataMap

## Antwerp Selector Tech

Sun 10 Nov 00:25:02

Heatmap

- MyPOI
  - Stripmuur Nero
  - Charif
  - Mile bvba
  - An Sibhin
  - Avini
  - BAZAR BIZAR by
  - My POI
  - WASBAR
  - bike sharing
  - The Zeeuwse
  - The School of Life Antwerpen
  - Vers Zuid
  - The Fish Market Cafe
  - Copyright
- Sensor
  - ant\_weather\_sensor\_2786229
  - ant\_weather\_sensor\_2786694
  - ant\_weather\_sensor\_2802031
  - ant\_weather\_sensor\_2803138
  - AirQualityObserved:VMM:42R801
  - AirQualityObserved:VMM:40HB23
  - AirQualityObserved:VMM:40AL01
  - AirQualityObserved:VMM:42M802
  - AirQualityObserved:VMM:42R803
  - AirQualityObserved:VMM:42R802
  - DISIT:orionUNIFI:GreenB-5k9y9
  - Weather sensor Antwerpen
  - Weather sensor Beveren
  - Weather sensor Sint-Gillis-Waas

AirQualitySO2Average2HourAntwerp

Heatmap Controls:  24H

Max Opacity:

< Prev 2019-11-10 00:00:00

WEATHER SENSOR ANTWERPEN						
VALUE NAME: ANT_WEATHER_SENSOR_2803138						
	DETAILS	DESCRIPTION	RT DATA			
windDirection	150		Last value	Last 4 hours	Last 24 hours	Last 7 d
windSpeed	1.5		Last value	Last 4 hours	Last 24 hours	Last 7 d
airHumidity	100		Last value	Last 4 hours	Last 24 hours	Last 7 d
visibility	5000		Last value	Last 4 hours	Last 24 hours	Last 7 d
cloudCoverOkta	0		Last value	Last 4 hours	Last 24 hours	Last 7 d

SO2  $\mu\text{g}/\text{m}^3$

- 0-50
- 50-100
- 100-200
- 200-275
- 275-350
- 350-425
- 425-500
- >500

Weather sensor Zwijndrecht - min... (8m)

0.6

airHumidity - 7 days (9m)



- **Dashboards & Services:**
  - **Environment & Weather:** PM10, PM2.5, NO, SO2, CO, etc.
    - Heatmap & Alerts on critical
  - **Mobility:** public transport Operators schedule and path, monitoring of river crossing, routing, what-if
  - **PAX Counters:** museum and public services, mobile PAX Counter for events
  - **Social:** Twitter Vigilance, early warning
  - **Life in Antwerp:** OD matrix people flow, Twitter Vigilance SA, hot places, ...
  - **Tourism and Culture**
- **Mobile App and MicroApplications:**
  - Antwerp in a Snap (all stores)

<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTQwNw==>



# PaxCounter devices



- Fixed PaxCounter LoraWan
  - Based on Wi-Fi- Bluetooth
- Mobile PaxCounter LoraWan
  - Based on Wi-Fi- Bluetooth
- Fixed PaxCounter(LoraWan+Wifi out)
  - Based on Wi-Fi- Bluetooth



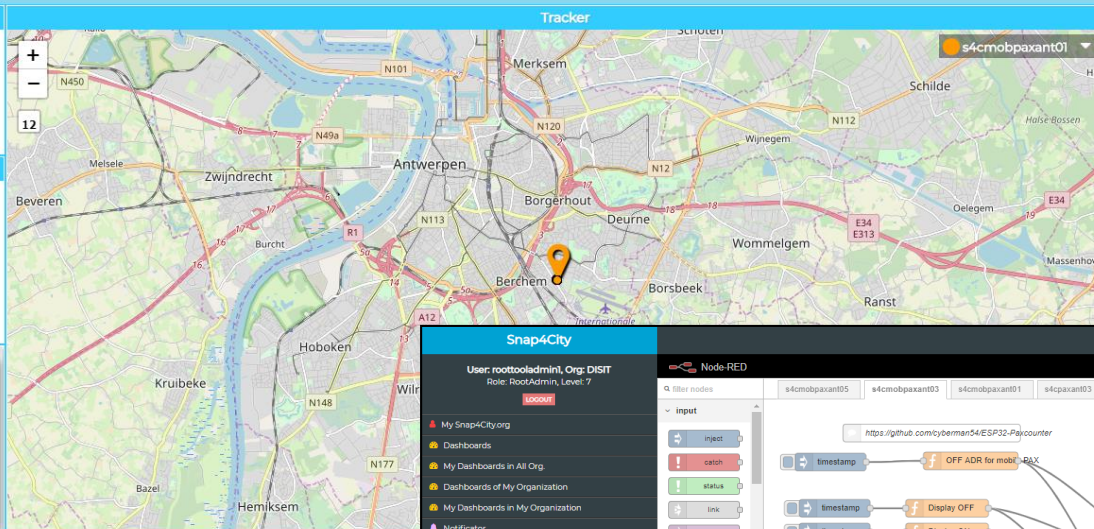
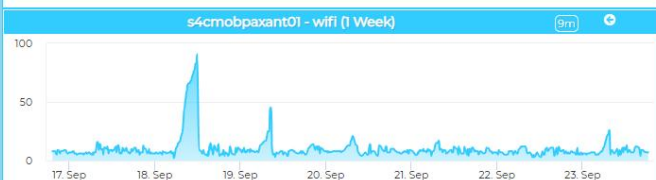
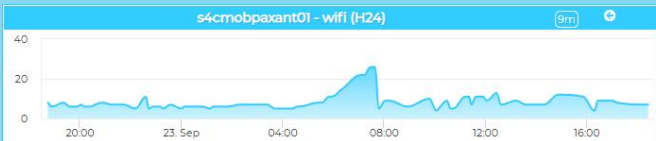
<https://www.snap4city.org/drupal/node/456>



# Programmable PAX counting

## Mobile PAXCounter 01 in Antwerp

Mon 23 Sep 18:39:46



Begin

Finish

Status

CUMULATIVE MODE OFF

Cumulative Mode Active from 2019-09-23T03:00:00.000Z and 2019-09-23T05:30:00.000Z

Device in Cumulative Mode OFF



**Snap4City**

User: rootooladmin@, Org: DISIT  
Role: RootAdmin, Level: 7

**Node-RED**

**PAXCounter Antwerp Control**

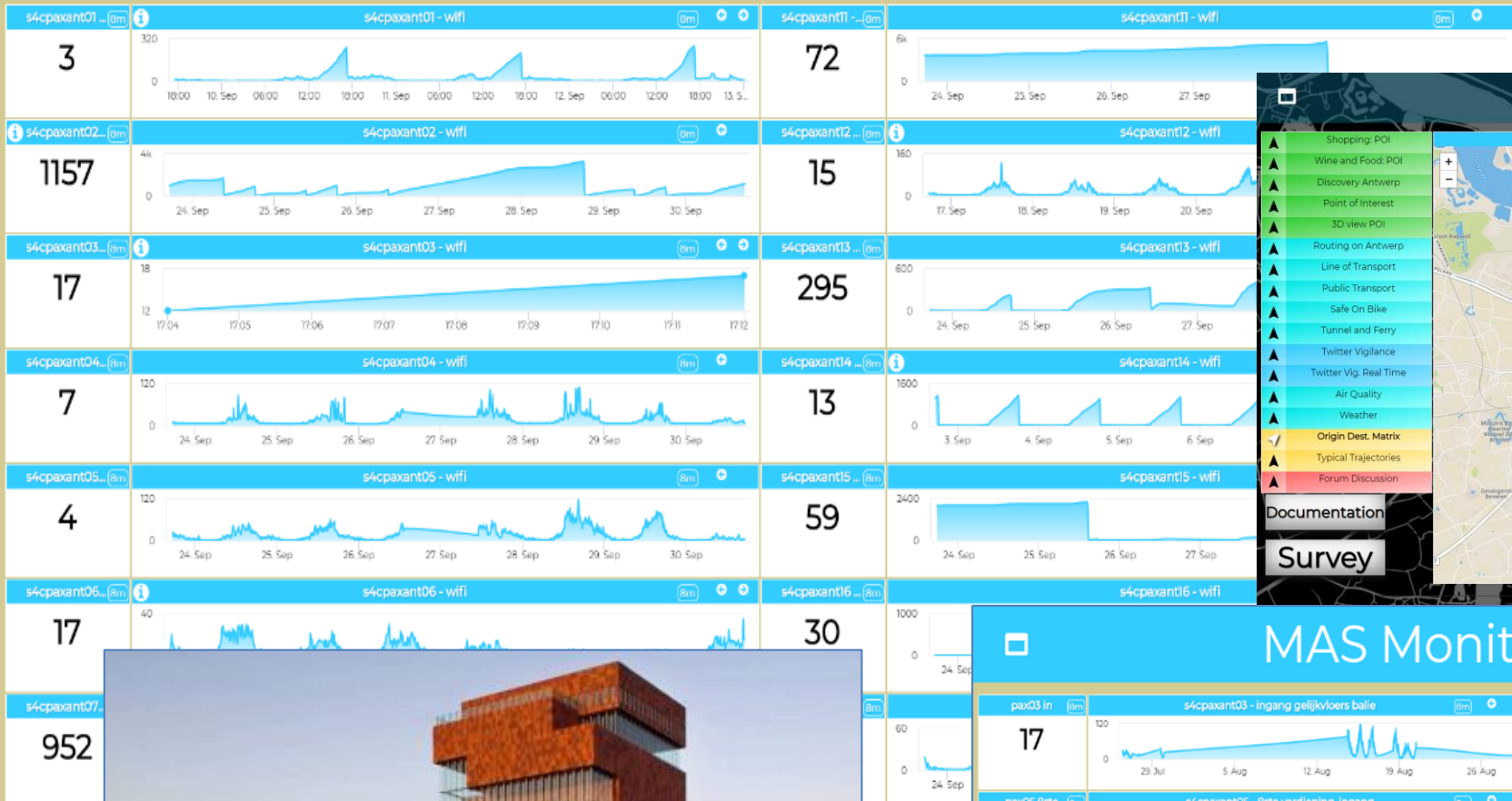
Dashboard showing a Node-RED workflow for controlling the PAX counter. The workflow includes triggers like 'timestamp' and 'request config from server', and actions like 'OFF ADR for mobile PAX', 'Display OFF', 'Display ON', 'Short range', 'MID range', 'Long range', 'WIFI Scan for 500m', and 'WIFI Scan for 100m'. The output is sent to 'msg.payload' and then to a 'Pax Counter Status' widget.

# Antwerp



# PAXCounter real time and trend

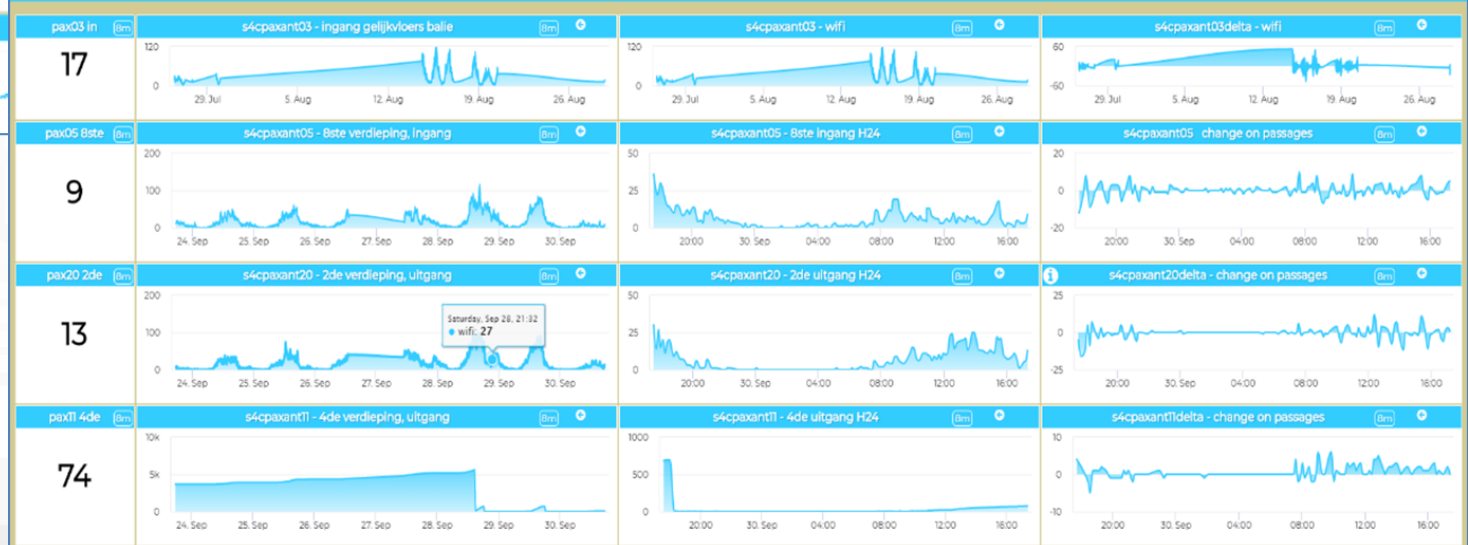
Mon 30 Sep 17:18:48



# Antwerp

## MAS Monitoring via PAXCounter

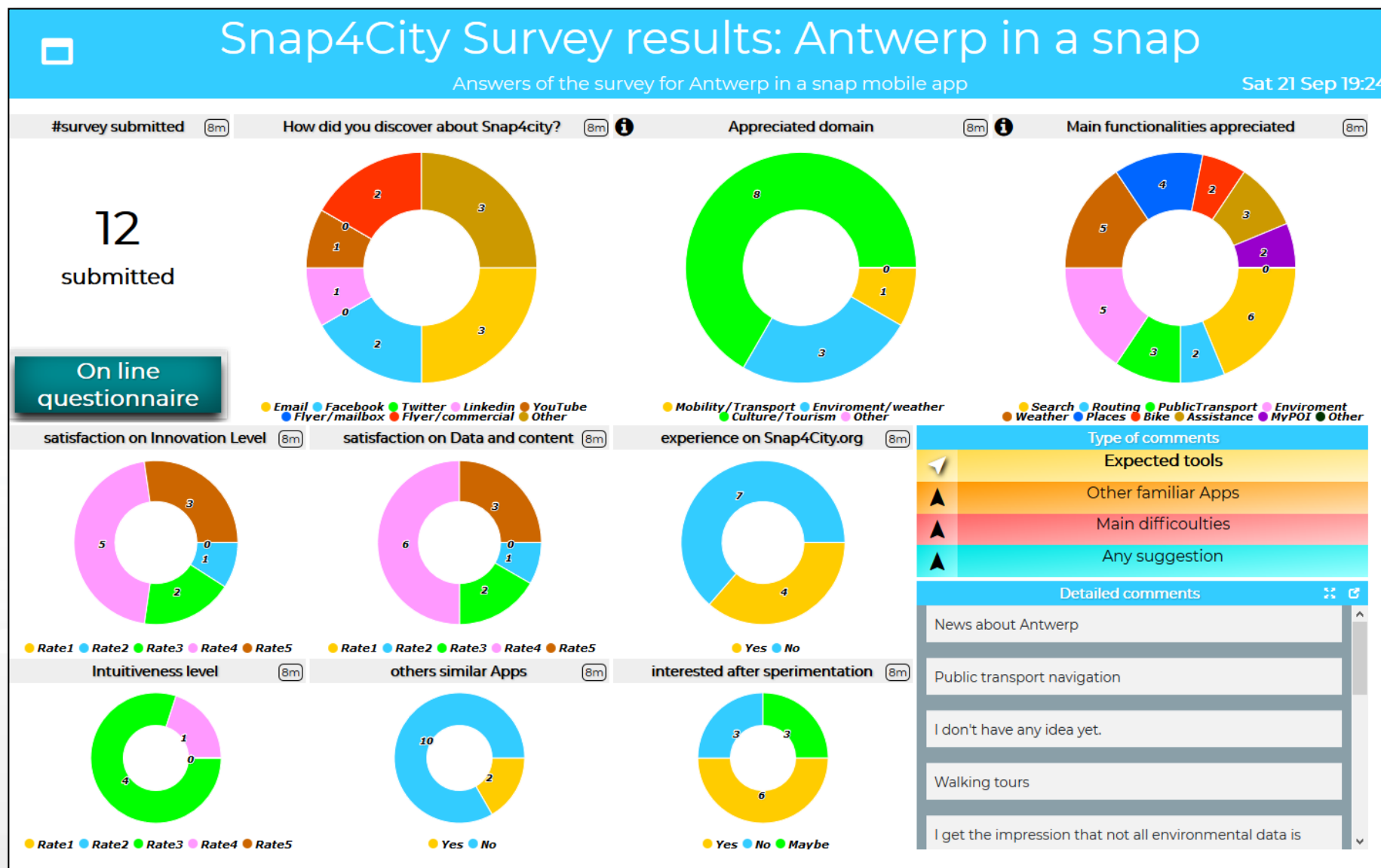
Mon 30 Sep 17:31:32





<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc20Q==>

Dashboard  
created to monitor  
in real time the  
answers to the  
survey provided  
on the Mobile  
App directly by the  
Engagement tool



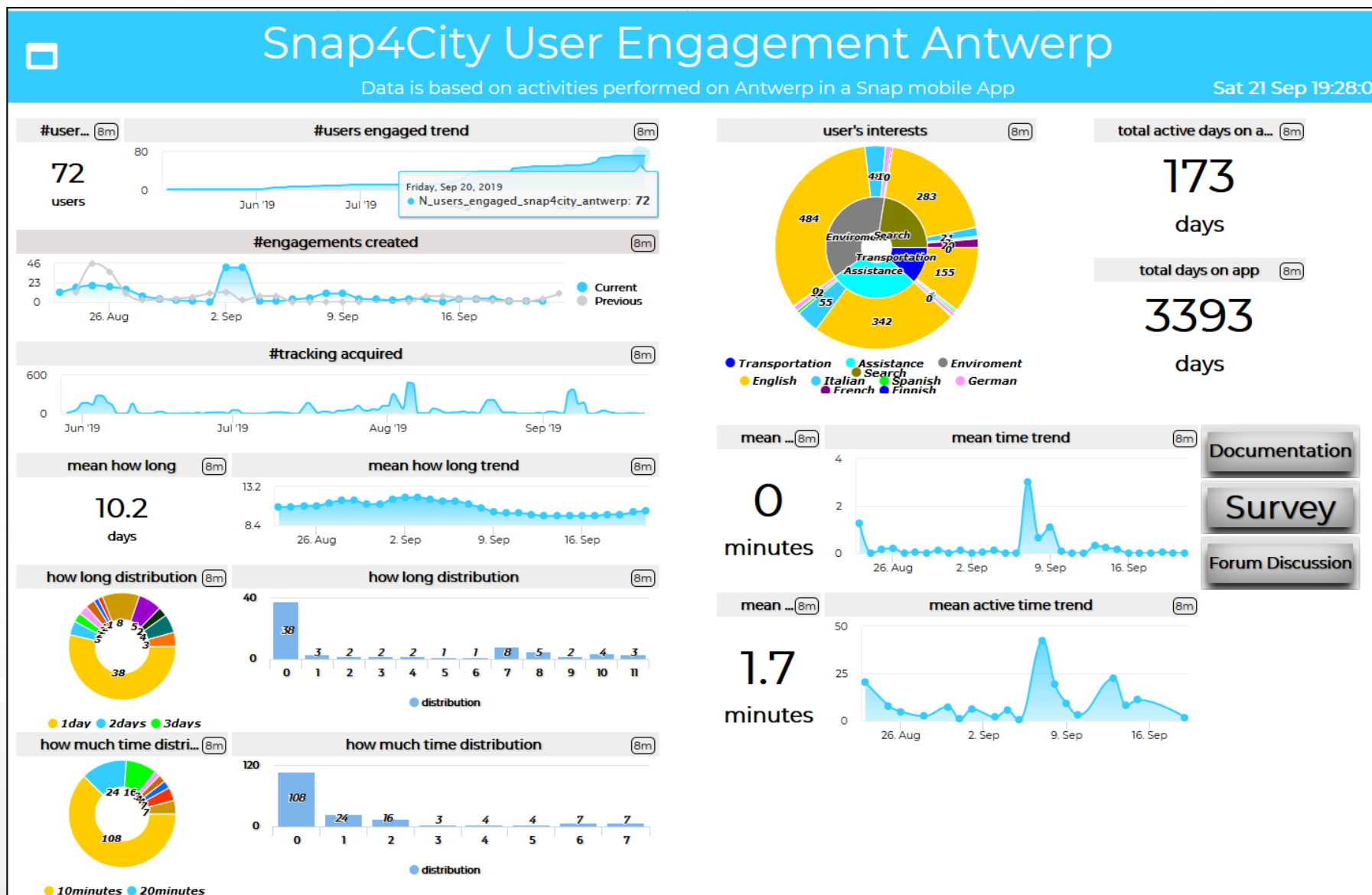
Antwerp



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc1OQ==>

## Dashboard monitoring the Mobile App:

- Collecting the clicks
- Describing the community of users in terms of the profile aspects
- Measuring the time spend, and topics of interest of the users, etc.



Antwerp

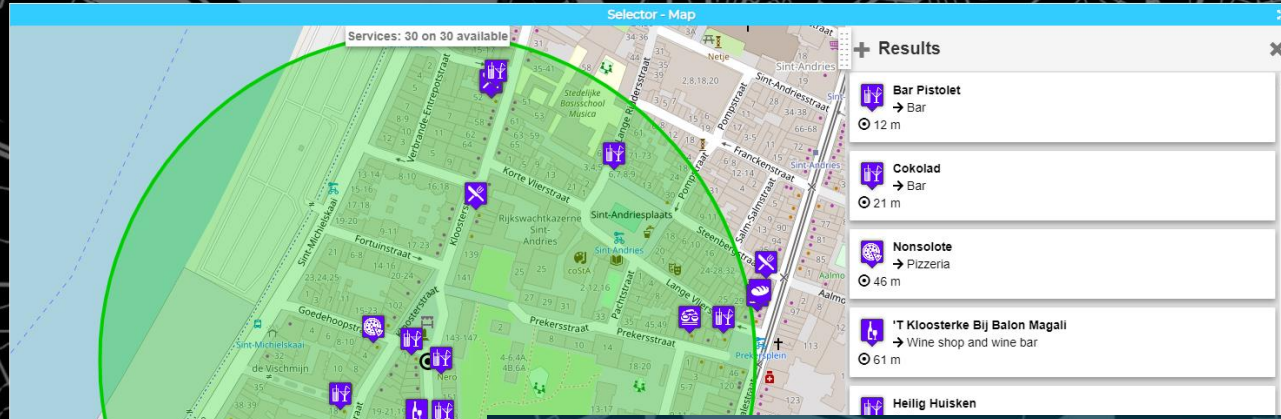


# The Life of Antwerp

Please note that the data results are not always based on real data.

Wed 13 Nov 16:51:16

- ▲ Shopping: POI
- ▲ Wine and Food: POI
- ▲ Discovery Antwerp
- ▲ Point of Interest
- ▲ 3D view POI
- ▲ Routing on Antwerp
- ▲ Line of Transport
- ▲ Public Transport
- ▲ Safe On Bike
- ▲ Tunnel and Ferry
- ▲ Twitter Vigilance
- ▲ Twitter Vig. Real Time
- ▲ Air Quality
- ▲ Weather
- ▲ Origin Dest. Matrix
- ▲ Typical Trajectories
- ▲ Forum Discussion
- Documentation
- Survey



# Antwerp

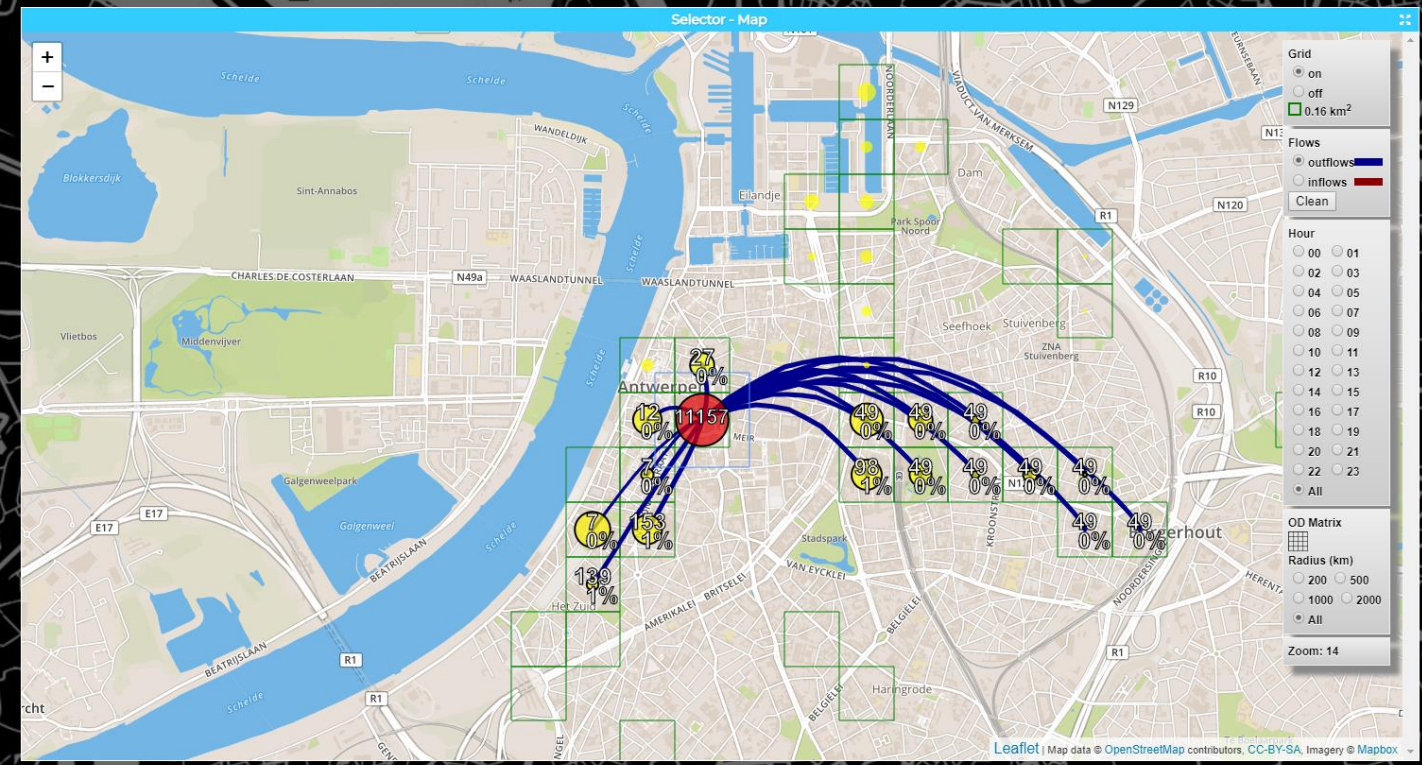
## The Life of Antwerp

Please note that the data results are not always based on real data.

Wed 13 Nov 16:51:45

<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTcwNg==>

- ▲ Shopping: POI
- ▲ Wine and Food: POI
- ▲ Discovery Antwerp
- ▲ Point of Interest
- ▲ 3D view POI
- ▲ Routing on Antwerp
- ▲ Line of Transport
- ▲ Public Transport
- ▲ Safe On Bike
- ▲ Tunnel and Ferry
- ▲ Twitter Vigilance
- ▲ Twitter Vig. Real Time
- ▲ Air Quality
- ▲ Weather
- ▼ Origin Dest. Matrix
- ▲ Typical Trajectories
- ▲ Forum Discussion
- Documentation
- Survey







*Prato  
Smart City vs Industry 4.0*



# GIDA set up



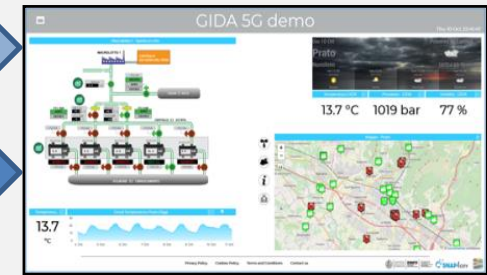
GESTIONE IMPIANTI DEPURAZIONE ACQUE S.p.A.

Smart City data from many sources



IOT Applications

Dashboards and Apps



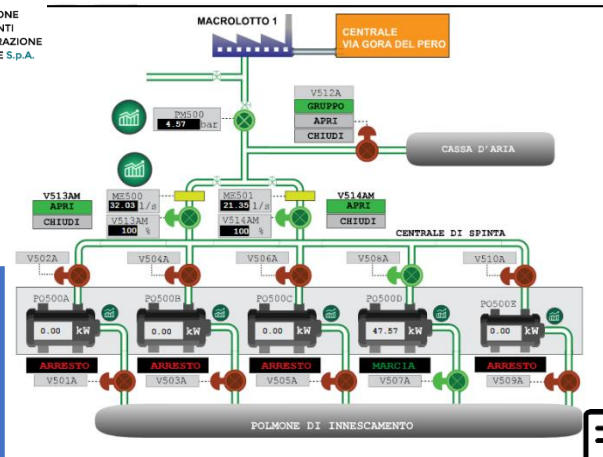
IOT Data Shadow Snap4City

Big Data Analytics, Artificial Intelligence



# Telemonitoring Telecontrol

5G



ModBus to Snap4City Gateway Edge

5G network devices





# Dashboards & Services:



GESTIONE  
IMPIANTI  
DEPURAZIONE  
ACQUE S.p.A.



## GIDA 5G demo

Wed 16 Oct 23:01:00

Details Absorption

Full Screen

Mer 16 Ott Powered by LaMMA

### Prato

Nuvoloso 16°C / 21°C

Gio 17 Ott 12° / 21° Nuvoloso	Ven 18 Ott 11° / 22° Nuvoloso	Sab 19 Ott Temp N/A Coperto	Dom 20 Ott Temp N/A Pioggia moderata o forte
-------------------------------------	-------------------------------------	-----------------------------------	--

tusc\_weather\_sensor\_o... [8m] Pressione - GIDA [8m] Umidità - GIDA [8m]

13.4°C    1020 bar    87 %

Temperatura... [8m]

13.6

°C

Trend Temperatura Prato (7gg) [8m]

Privacy Policy    Cookies Policy    Terms and Conditions    Contact us

# 5G







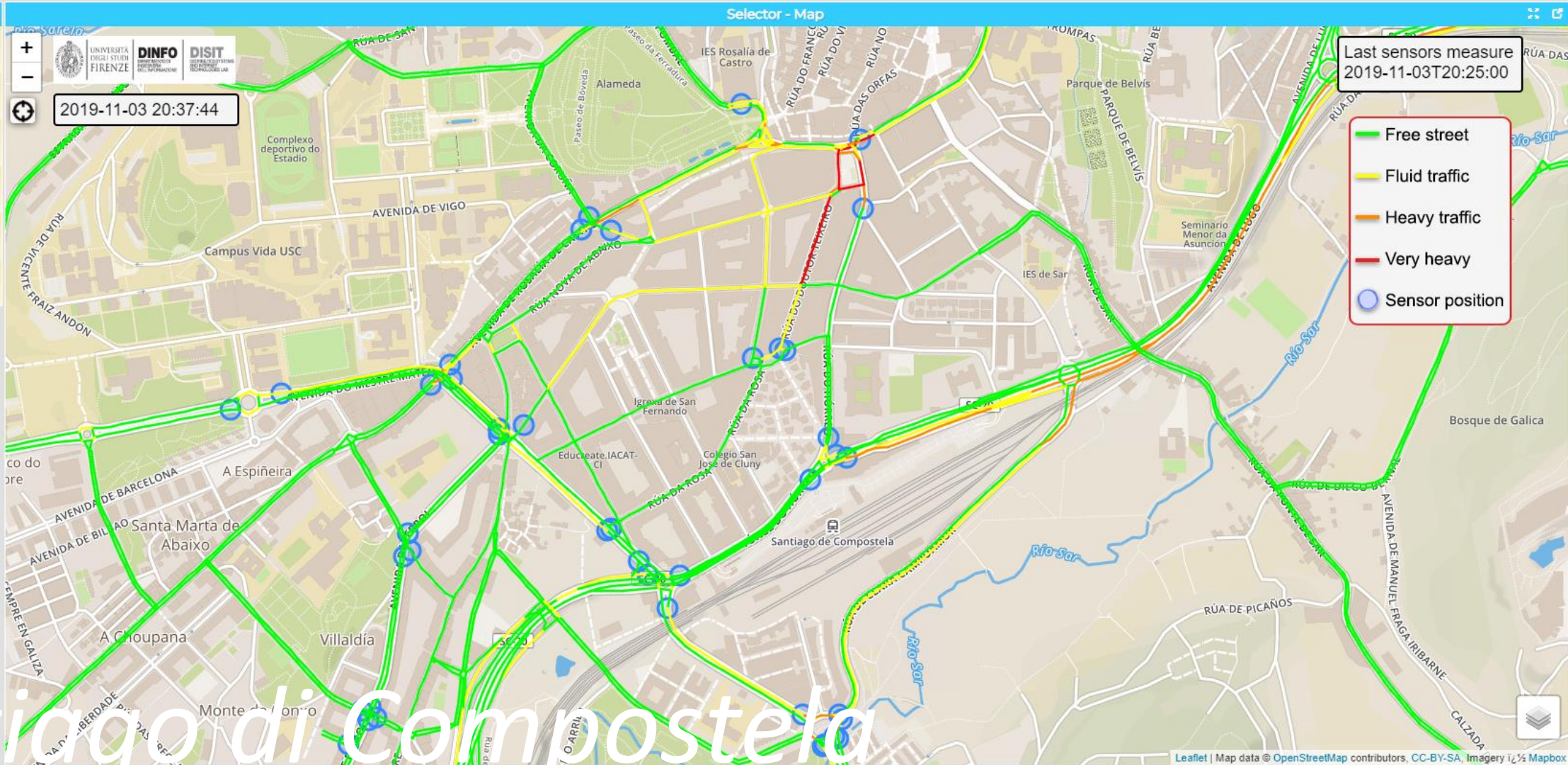
# *Santiago di Compostela*



# Traffic Flow Reconstruction for the cities

Sun 3 Nov 20:37:43

- Selector Web
- ▲ Firenze + FiPiLi
  - ▲ Firenze
  - ▲ Pisa
  - ▲ Santiago
  - ▲ Modena
  - ▲ Livorno



Santiago de Compostela





*Lonato del Garda*



# Smart Lonato del Garda

Sat 9 Nov 17:20:59



- Slot 1
- Slot 2
- Slot 3
- Slot 4
- Slot 5
- Slot 6
- Slot 7
- Slot 8
- Slot 9
- Slot 10
- Slot 11
- Slot 12
- Slot 13
- Slot 14
- Slot 15
- Slot 16
- Slot 17
- Slot 18
- Slot 19
- Slot 20
- Slot 21
- Slot 22
- Environment
- other

Selector - Map

TEST1\_AIRSENSEUR\_RVB01

VALUE NAME: TEST1\_AIRSENSEUR\_RVB01

DETAILS	DESCRIPTION	RT DATA
dateObserved	Last value	Last 4 hours, Last 24 hours, Last 7 days, Last 30 day
humidity	Last value	Last 4 hours, Last 24 hours, Last 7 days, Last 30 day
pressure	Last value	Last 4 hours, Last 24 hours, Last 7 days, Last 30 day
temperature	Last value	Last 4 hours, Last 24 hours, Last 7 days, Last 30 day



22

NumFreeSlots - Slots

20

SmartParkingLonato\_1

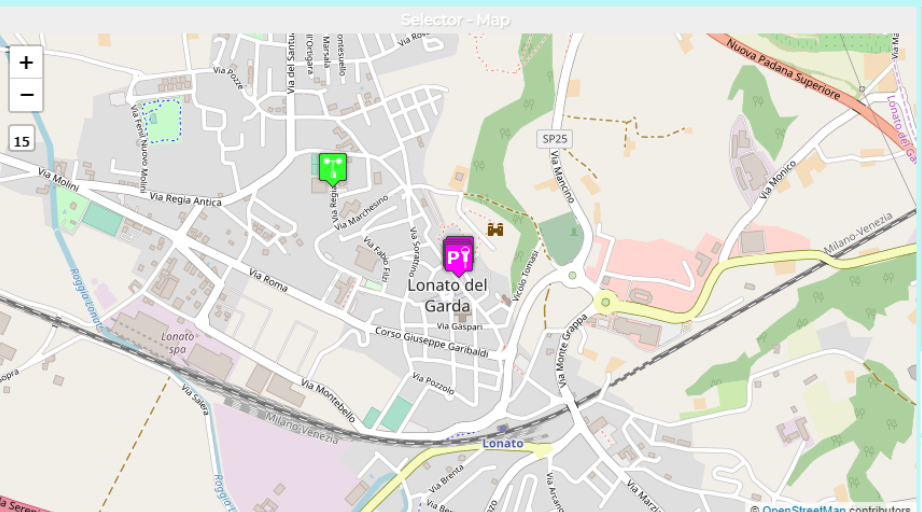
0 status

pressure 987.1 mm, humidity 66.3 %, temperature 14.1 C

# Smart Lonato del Garda

Tue 12 Nov 19:33:05

- Slot 1
- Slot 2
- Slot 3
- Slot 4
- Slot 5
- Slot 6
- Slot 7
- Slot 8
- Slot 9
- Slot 10
- Slot 11
- Slot 12
- Slot 13
- Slot 14
- Slot 15
- Slot 16
- Slot 17
- Slot 18
- Slot 19
- Slot 20
- Slot 21
- Slot 22
- Environment
- other



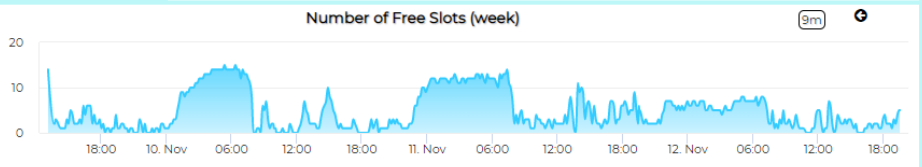
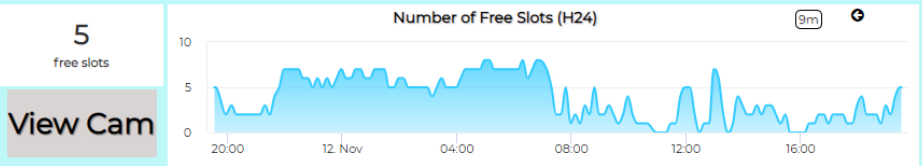
22

3 slot ID

Max Present Duration: 53 ore e 00 minuti

Median of Busy Slots: 1 ora e 24 minuti

AVG time of free slot: 9 minuti



Slot 1 - Status

0 status

Slot 15 - Seconds of Occupancy

pressure 976.2 mbar, humidity 82.7 %, temperature 10.7 C

AirSensEUR\_RVB01 - temperature (week)





# Smart Lonato del Garda - cam

Tue 12 Nov 19:31:54

Selector - Map

Slot 1  
Slot 2  
Slot 3  
Slot 4  
Slot 5  
Slot 6  
Slot 7  
Slot 8  
Slot 9  
Slot 10  
Slot 11  
Slot 12  
Slot 13  
Slot 14  
Slot 15  
Slot 16  
Slot 17  
Slot 18  
Slot 19  
Slot 20  
Slot 21  
Slot 22  
Environment  
other

1	2	3	4	5	6	7	8	9	10	11	12
22											
21	20	19	18	17	16	15	14	13			

view cam

AVG time of free slot 9m  
08 minuti

5  
free slots

Median of Busy Slots 9m  
1 ora e 23 minuti

Max Present Duration 9m  
53 ore e 01 minuto

[View main](#)

Slot 1 - Status 9m **0**  
status

Slot 15 - Seconds of Occupancy 9m

pressure 9m **976.2**  
mbar

humidity % 9m **82.7**  
%

temperature 9m **10.7**  
°C

AirSensEUR\_RVB01 - temperature (week) 9m







# <https://www.snap4city.org/4>

- [Scenario: Energy Monitoring](#)
- [Scenario: Multipurpose User Engagement Tools](#)
- [Scenario: 5G Enabled Water Cleaning Control \(smart city, industry 4.0\)](#)
- [Scenario: High Level Control of Industrial Plant \(industry 4.0\)](#)
- [Scenario: Vehicle Monitoring via OBD2](#)
- [Scenario: Events and Museums Monitoring in Antwerp](#)
- [Scenario: High Resolution Prediction of Environmental Data](#)
- [Scenario: Mobility and Transport Analyses in multiple cities](#)
- [Scenario: People Flow Analysis via Wi-Fi](#)
- [Scenario: Antwerp Pilot on Environmental Data](#)
- [Scenario: Helsinki Pilot on Environmental Data](#)
- [Scenario: Firenze Smart City Control Room](#)
- [Scenario: Mobile & Web App: Toscana Where What ... Km4City, Toscana in a Snap](#)
- [Scenario: Helsinki Pilot on User Behaviour](#)
- [Scenario: Antwerp Pilot on User Behaviour](#)



## Scenarios

- [Data Analytic: Origin Destination Matrices, Algorithms and tools](#)
- [Data Analytic: Traffic Flow Reconstruction](#)
- [Data Analytic: in general, and the cases of Antwerp and Helsinki](#)
- [Data Analytic: Predicting Air Quality](#)
- [Data Analytic: Analyzing Public Transportation Offer wrt Mobility Demand](#)



# MORE data in other locations that we manage

- **Mobility:**
    - Underpasses (real time)
    - Ferry and railways (real time)
    - tracking of busses (real time)
    - Delay at bus-stops (real time)
    - ODB2 monitoring vehicles data and trajectories (real time)
    - Mobile trajectories (real time)
    - Bike sharing (real time)
    - Connected Driving (real time)
    - Fuel station prices (real time)
  - **Environment:**
    - Sensors: Noise, distance, water flow, gas, ...
    - Heatmaps: Noise, ....
    - Mobile sensors: PAX, environment
    - FMI predictions: PM10, PM2.5, EAQI
    - Quality index: AQI, EAQI, CAQI, ..
  - **Energy:**
    - .....
  - **Weather**
    - Forecast and actual, several sources
  - **Social:**
    - PAX Counters, Mobile PAX Counters
    - Engagement data collected from mobile Apps
    - Clicks on Mobile Applications
    - Ranking, comments and images, from Apps (web and mob)
    - Entertainment events: different kinds
  - **People and People Flows:**
    - Mobile Applications
    - Origin destination matrices, people flow
  - **Governmental and Communications:**
    - Emergency, risk analysis and resilience
    - Notification of events, CAP, ..
  - **Tourism and Culture:**
    - POI, many many kinds
- Many data analytics, for example:**
- what-if routing, scenarios,
  - traffic flow, environmental predictions





## APPLIANCES CONTAINERS



- LOCAL GOVERN
- STAKEHOLDERS
- CITY USERS
- IN-HOUSE
- ENERGY OPERATORS
- MOBILITY OPERATORS
- COMMERCIAL OPERATORS
- SECURITY OPERATORS
- INDUSTRIES
- RESEARCHERS
- START-UPS
- ASSOCIATIONS

- GDPR
- SECURITY
- PRIVACY
- ASSESSMENT
- AUDITING
- PENTESTED

- OPEN IOT DEVICES
- IOT EDGE
- IOT GATEWAY
- PAX COUNTERS
- IOT BUTTONS

- TEST CASES, SCENARIOS, VIDEOS, HACKATHONS
- OPEN SOURCES, COMMUNITY OF CITIES
- TRAINING TUTORIALS, COMMUNITY MANAGEMENT

### IOT APPLICATIONS - INSTANT APPS



DATA DRIVEN APPLICATIONS • REAL TIME PROCESSING • BATCH PROCESSING • ANY PROTOCOL & FORMAT

### DASHBOARDS & APPLICATIONS



CONTROL ROOM • SITUATION ROOM • OPERATOR DASHBORDS • BUSINESS INTELLIGENCE • WHAT-IF ANALYSIS • DECISION SUPPORT • SIMULATIONS • RISK ANALYSIS • RESILIENCE ANALYSIS

### MOBILE & WEB APPLICATIONS



DEVELOPMENT KIT • SUGGESTIONS • MOBILE APPS • MONITORING PANELS • PLATFORM UTILITIES • READY TO USE SMART APPLICATIONS

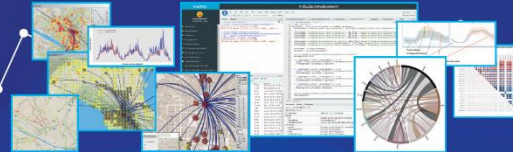
## MICROSERVICES & ADVANCED SMART CITY API

### LIVING LAB - DEV TOOLS - COWORKING



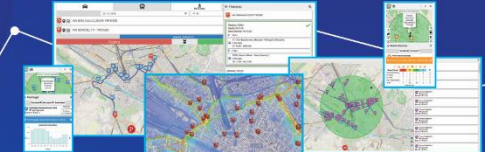
IOT DIRECTORY • SERVICE MAP • RESOURCE MANAGER • DATA GATE • R STUDIO • ETL

### BIG DATA - DATA ANALYTICS



PREDICTIONS • ANOMALY DETECTION • WHAT-IF ANALYSIS • TRAFFIC FLOW RECONSTRUCTION • ORIGIN-DESTINATION MATRICES • SOCIAL MEDIA ANALYSIS • OFFER VS DEMAND ANALYSIS • ENVIRONMENTAL DATA ANALYSIS AND PREDICTIONS • REAL TIME HEATMAPS • ROUTING • ALERTING • EARLY WARNING • PERSONAL AND VIRTUAL ASSISTANTS • SMART SOLUTIONS • SMART SHARING • PARTECIPATORY

### DATA ANALYTICS TOOLS - MICRO-APPLICATIONS



## KM4CITY DATA AGGREGAT KNOWLEDGE BASE - EXPERT SYSTEM OF THE CITY - BIG DATA STORE

## IOT MNG - DATA MNG - DATA INSPECTOR - PROCESS MNG - USER ENGAGEMENT - GDPR MNG ...

- GIS
- CITY UTILITIES
- OPEN DATA
- LEGACY & EXTERNAL SERVICES
- PERSONAL DATA
- IOT / IOE
- BROKERS
- KPI
- INDUSTRY 4.0
- SOCIAL MEDIA





# Smart City Functional Architecture

Transport systems  
Mobility, parking



Public Services,  
Govern, events, ...



Sensors, IOT Cameras,  
Wi-Fi



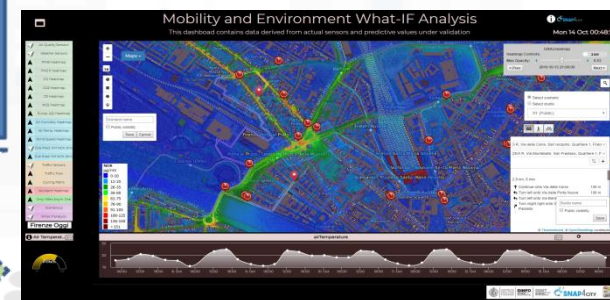
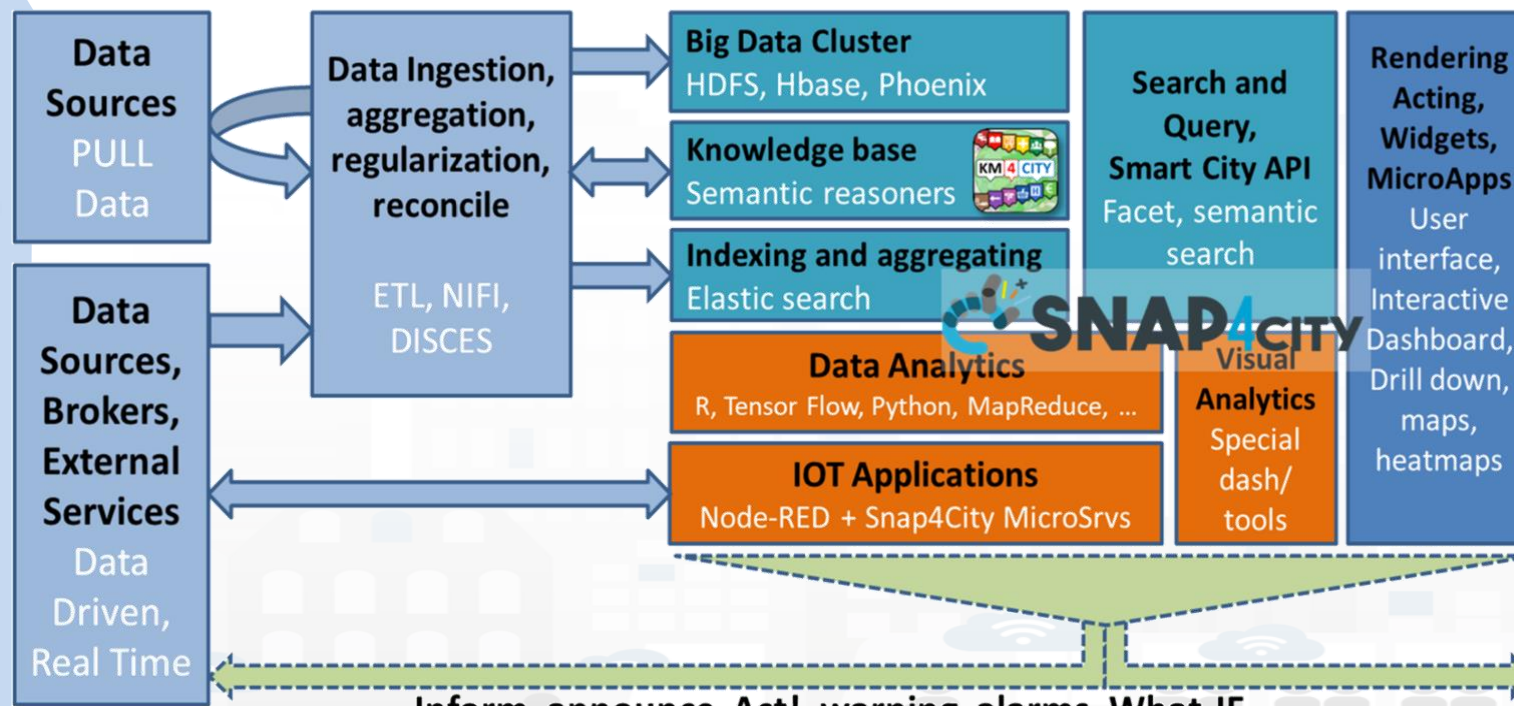
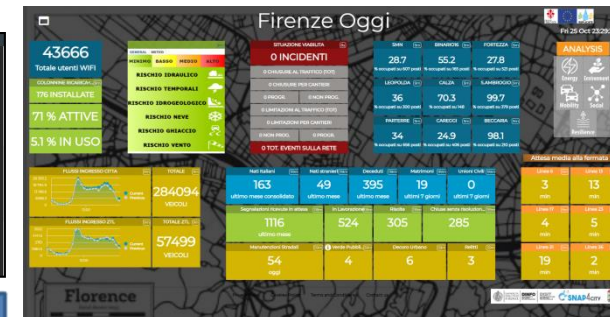
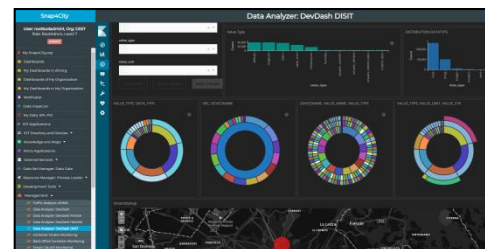
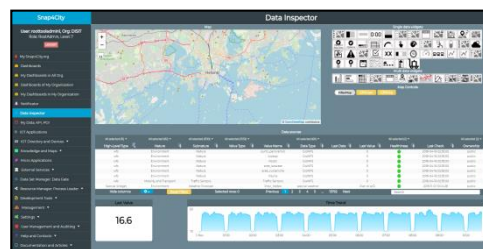
Environment, Water,  
energy



Shops, services,  
operators



Social Media



Inform, announce, Act!, warning, alarms, What-IF, ...



# Snap4City: Builder of Sentient Cities Solutions

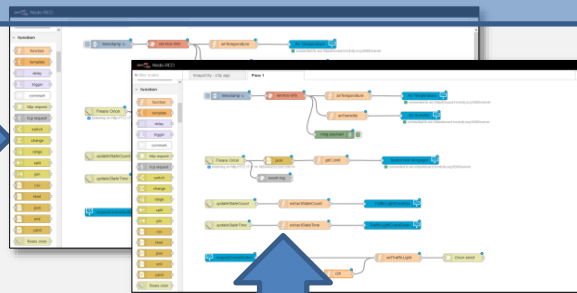
Dashboards with data driven IOT Applications enforcing intelligence

IOT and data World



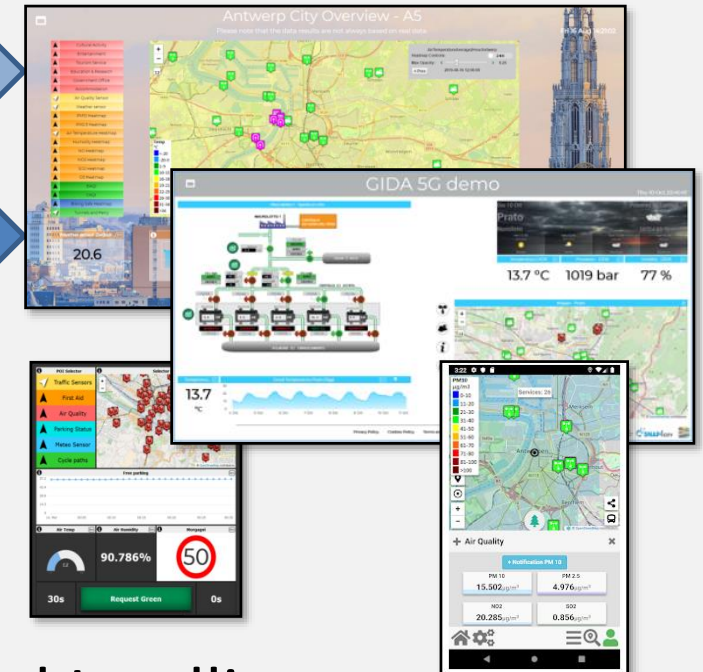
My IOT Devices

IOT Applications

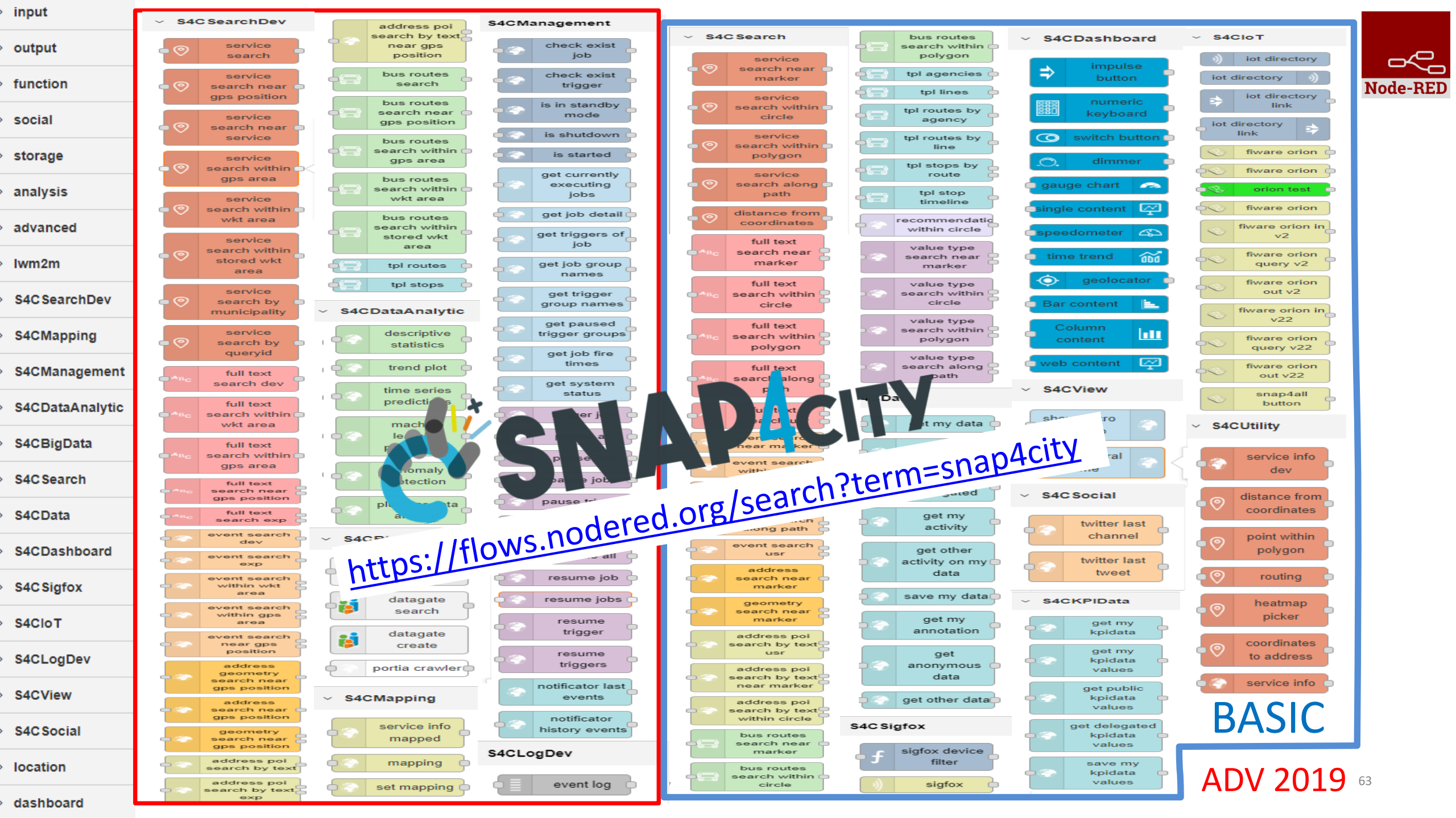


Big Data Analytics, Artificial Intelligence

Dashboards and Apps







The image displays a Node-RED interface with a sidebar on the left containing various function blocks. The main workspace is divided into several panels, each representing a different category of blocks:

- S4C SearchDev:** Includes blocks for service search, address poi search, bus routes search, and full text search.
- S4CManagement:** Includes blocks for checking job status, getting job details, and managing triggers.
- S4CSearch:** Includes blocks for service search near markers, polygons, and paths, as well as full text searches.
- S4CDashboard:** Includes blocks for impulse buttons, numeric keyboards, gauges, and content displays.
- S4CIoT:** Includes blocks for IoT directory, fiware orion, and snap4all buttons.
- S4CDataAnalytic:** Includes blocks for descriptive statistics, trend plots, and time series predictions.
- S4CView:** Includes blocks for showing data and activity.
- S4CSocial:** Includes blocks for fetching Twitter data.
- S4CKPIData:** Includes blocks for fetching kpidata values.
- S4CSigfox:** Includes blocks for sigfox device filtering.
- S4CMapping:** Includes blocks for service info mapping and mapping functions.
- S4CLogDev:** Includes an event log block.

**SNAP4CITY**  
<https://flows.nodered.org/search?term=snap4city>

BASIC





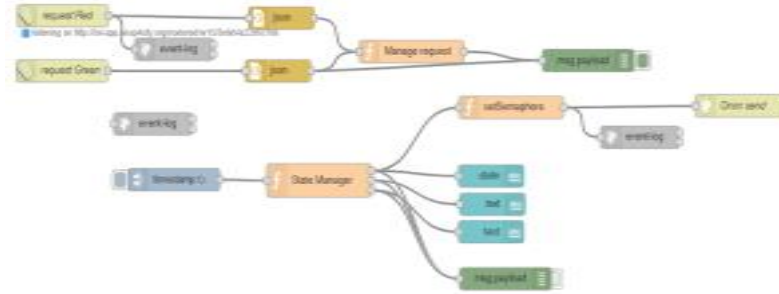


Traffic Sensors  
 First Aid  
 Air Quality  
 Parking Status  
 Meteo Sensor  
 Cycle paths

Free parking

Air Temp: 8.8°C  
 Air Humidity: 82.4%  
 Morgagni: 30

10s Request Green 20s



Snap4City - Mobility Operator

Speed limit: 45

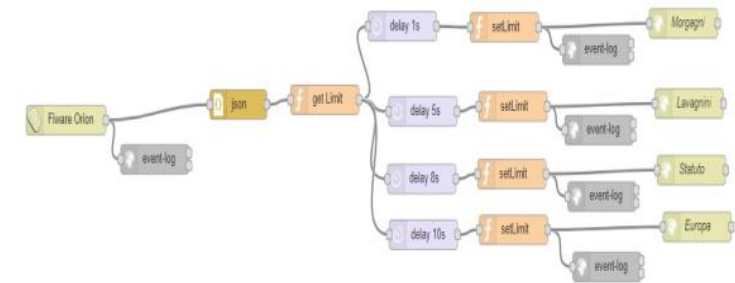
Temperature: 5.057°C  
 Humidity: 80.02%

City parkings: 22 su 22 disponibili

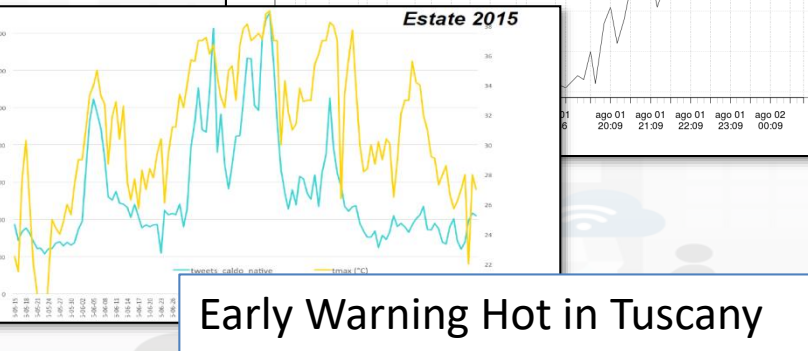
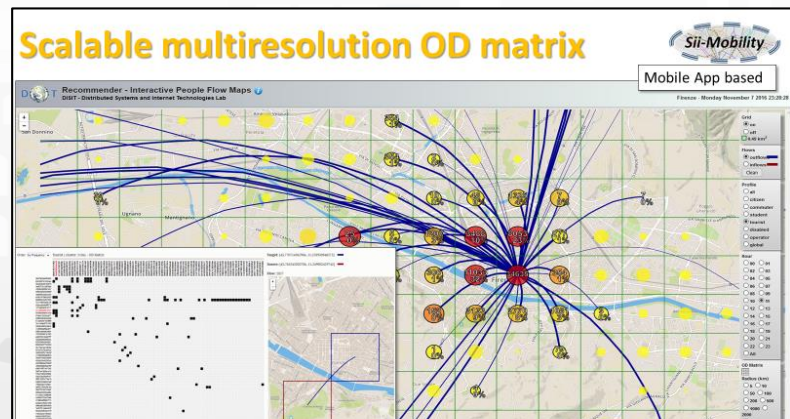
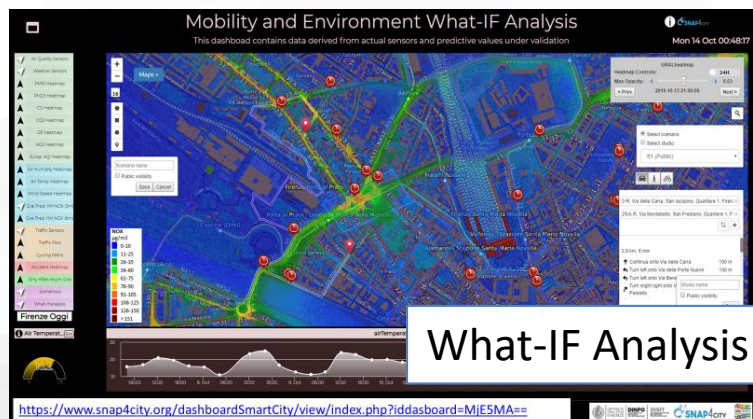
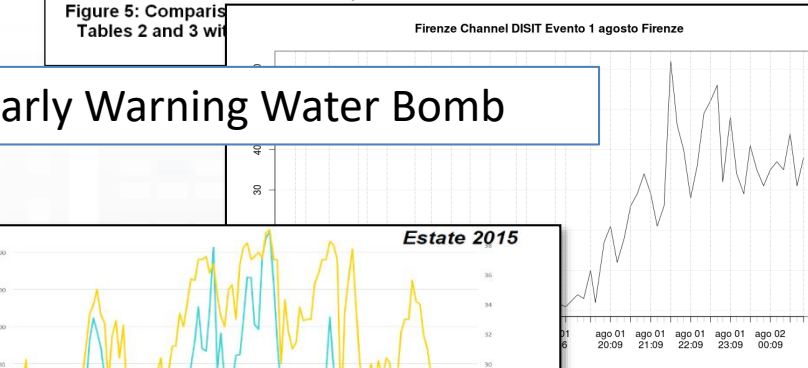
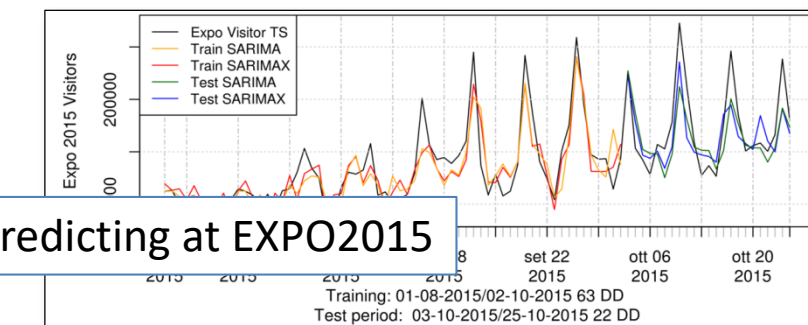
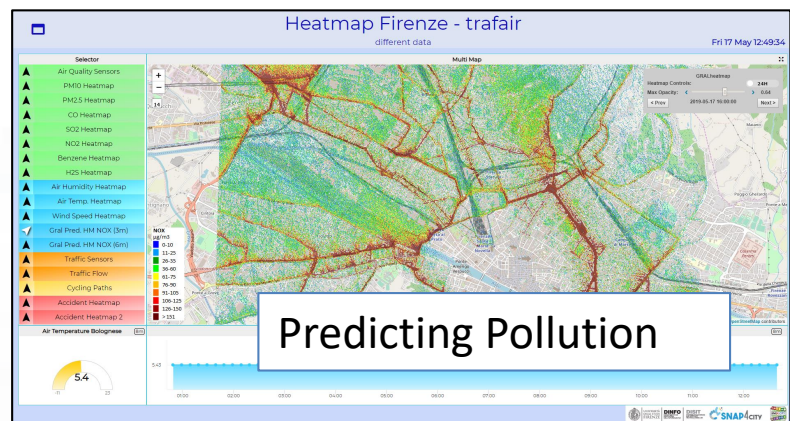
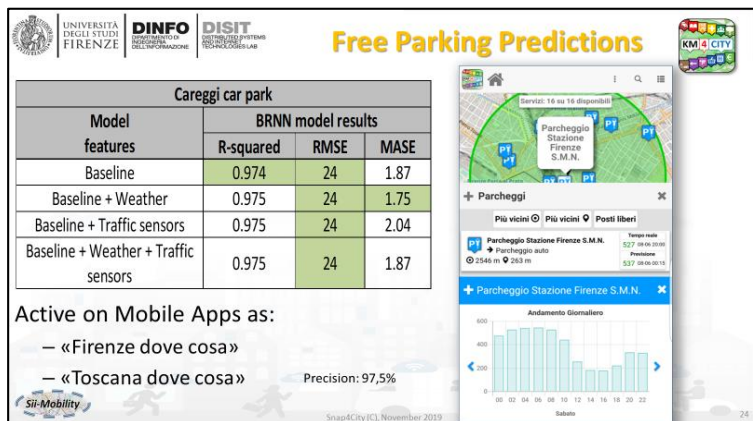
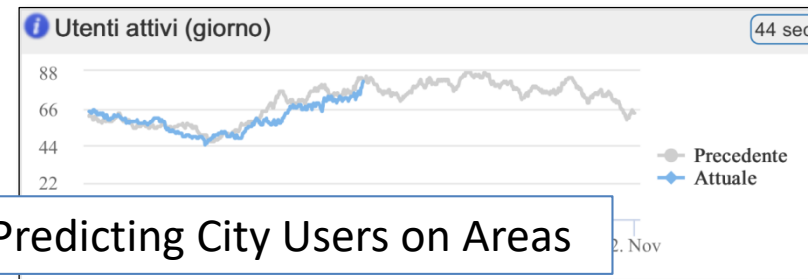
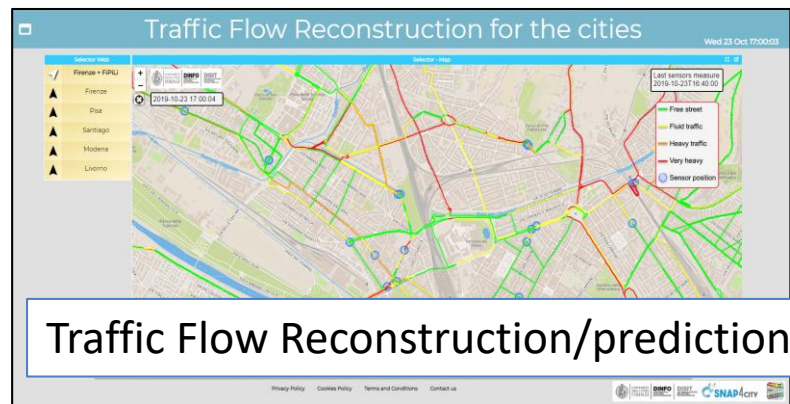
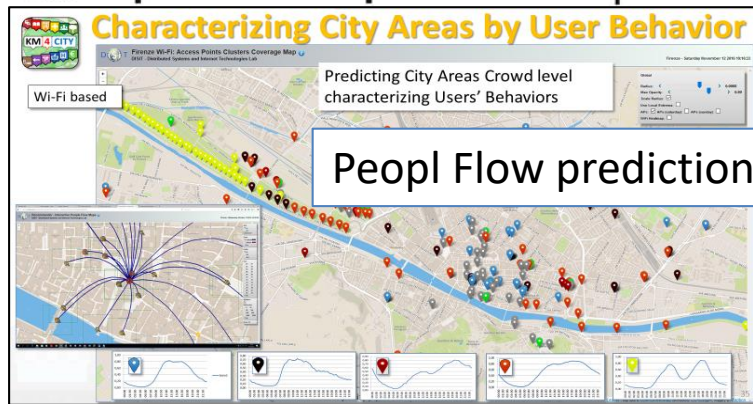
Parcheggi: Più vicini Posti liberi

- Garage Oriuolo S.R.L. (340 m)
- Parcheggio S. Lorenzo (459 m)
- Firenze Parcheggi Tornabuoni (811 m)

Air temperature: 5.1

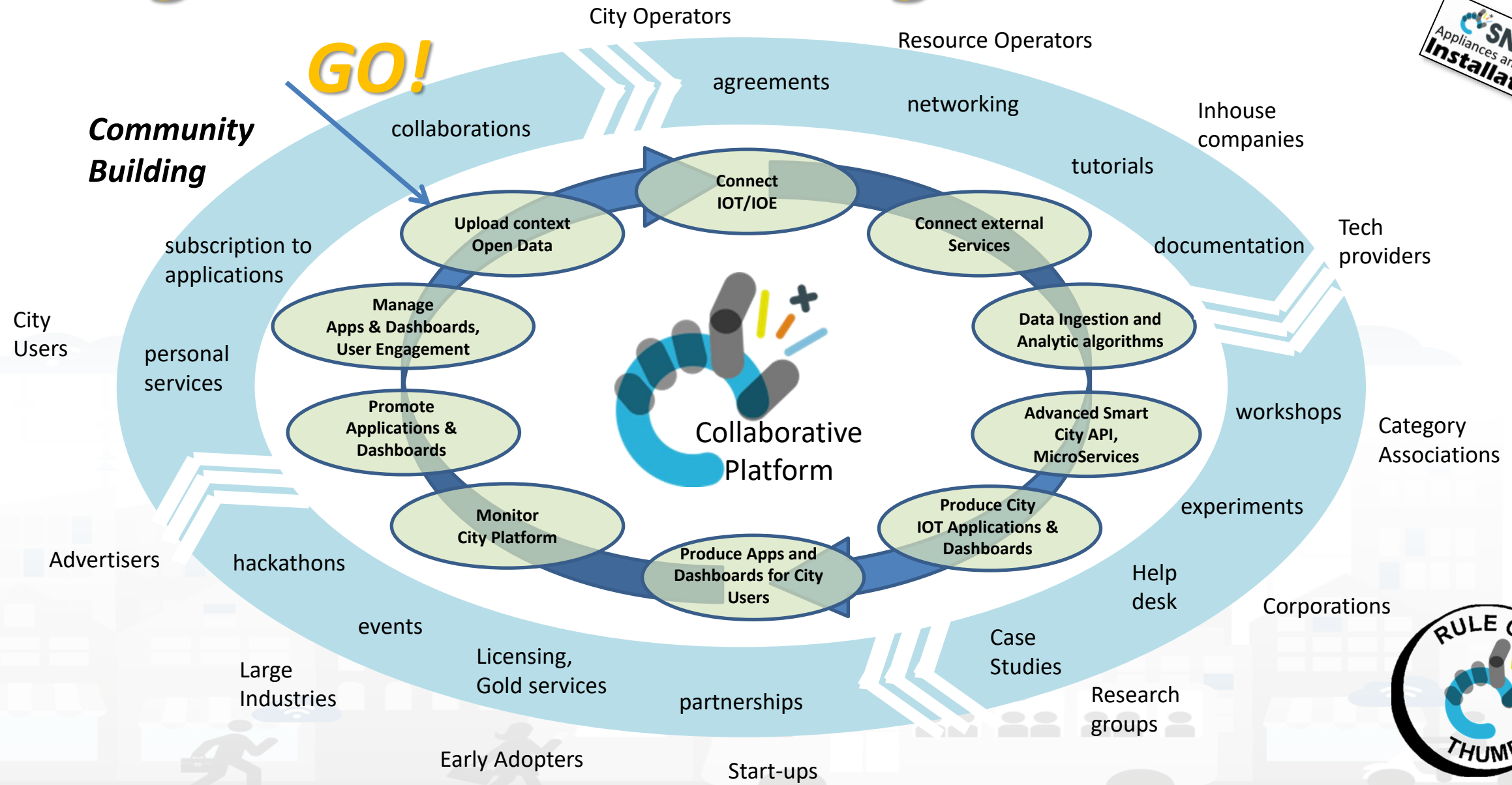








# Living Lab Accelerating





LOGIN

Dashboards (Public)

Knowledge and Maps

- Service Map (Toscana)
- Service Map 3D (Firenze)
- Helsinki Service Map
- Garda Lake Service Map
- Cagliari Service Map
- Service Map 3D (Helsinki)

Micro Applications

External Services

Data Set Manager: Data Gate

Resource Manager

Development Tools

Management

Help and Contacts

Documentation and Articles

Km4City portal

DISIT Lab portal



Home / Snap4City - scalable Smart aNalytic APplication builder for sentient Cities

# Snap4City - scalable Smart aNalytic APplication builder for sentient Cities



Tutorials



Scenarios



Innovations



Interoperability



Installations



What People say



Mobile Apps



IOT Devices



IOT Applications



Data Analytics



Dashboards



Living Lab



Smart City API

Smart City  
Ontology

Articles



See you at Stand A118

EUROPEAN OPEN  
SCIENCE CLOUD  
MARKETPLACE

BUILD YOUR APP FOR A CONNECTED CITY

Smart Cities need to set up a flexible Living Lab to cope with the city evolution in terms of services and city users' needs and sustainability. Snap4City solution (<https://www.snap4city.org>) provides a flexible method and solution to quickly create a large range of smart city applications exploiting heterogeneous data and enabling services for stakeholders by IOT/IOE, data analytics and big data technologies. Snap4City applications may exploit multiple paradigms as data driven, stream and batch processing, putting co-creation tools in the hands of: (i) Smart Living Lab users and developers a plethora of solutions to develop applications without vendor lock-in nor technology lock-in, (ii) final users customizable / flexible mobile Apps and tools, (iii) city operators and decision makers specialized / sophisticated city dashboards and IOT/IOE applications for city status monitoring, control and decision support. Snap4City satisfies all the expected requirements of Select4Cities challenge PCP and much more, and it is 100% open source, scalable, robust, respects user needs and privacy; provides MicroServices and easily replaceable tools; compliant with GDPR; provides a set of tools for knowledge and living lab management, and it is compliant with more than 60 protocols including and its end user oriented communication. Snap4City is an official platform of FiWare, an official library of 3C Foundation, Node-RED, certified on

Login

## Registration

- [New Registration](#)
- Request a new password

## Search

Search

-Any-

Powered by  
[www.km4city.org](http://www.km4city.org)

FI-WARE

Virtual  
Assistant





SNAP4city  
Be smart in a SNAP!  
LIVING LAB  
9 July 2015, 2nd Training day of 3, Florence  
www.snapp4city.org

THE CIVIL SOCIETY LEADIN PLATFORM: SMART CITY AND LIVING LAB  
www.snapp4city.org

Coll@bora  
Assessorato Urbanistica Pianificazione per  
Sviluppo e Qualità di Vita  
Città di Firenze  
Sviluppo per il territorio  
Sviluppo per il territorio  
Sviluppo per il territorio

Welcome: how to start using Snap4City for beginners  
We suggest you  
Search  
Organization  
Help

Welcome: how to st  
We suggest you  
Organization  
Help



...2022

2020



bee smart city

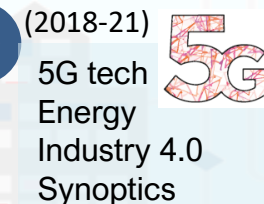


- User engagement
- Bike Sharing
- Data Analytics ++
- Social Predictions
- OBD2

2018



- Mobility Demand / Offer Analytics and Strategy



- Traffic and Mobility Impact on Pollution
- NOX predictions

2019



- Industry 4.0
- Critical Plant
- Monitoring

2017



- Smart Waste



- IOT/IOE, IOT App
- Living Lab
- Maker Support
- IOT Edge
- Smart City IOT
- GDPR
- Privacy & Security

Km4City 1.6.6 IOT/IOE



Km4City 1.6.4



- Origin-Destination and trajectories
- Traffic Reconstruction
- Offer Analysis
- OBU, smart devices



GHOST SIR

Km4City 1.6.2

- Smart Energy
- Sustainable Mobility
- Control Room Dashboard



REPLICATE

2016

Km4City 1.5



H2020

- Resilience Decision Support
- Smart First Aid
- User Behaviour Analysis, predictions
- Risk Analysis

2015

- Sardinia Region Smart City Strategies and plan



SII-MOBILITY SCN

- Infomobility
- Mobile App
- Routing
- Multimodality

2013 Km4City Ontology 1.1

- Tuscany Road Graph
- Mobility
- culture, tourism
- Events
- Parking
- Services
- Linked open graph

2014

- Weather Forecast
- Real Time Wi-Fi
- Entertainment
- Events
- LOD



- Twitter Vigilance
- Social Media Analytics, Sentiment Analysis

Km4City 1.4



DISIT lab roadmap vs model and tools' usage



TOP

# Urban Platform





# Snap4City has been Created to satisfy requirements of:



- **ENOLL:** <https://www.openlivinglabs.eu/>
  - [European Network of Living Labs](https://www.openlivinglabs.eu/)



- **EIP-SCC:** European Innovation Partnership on Smart Cities and Communities
  - <https://eu-smartcities.eu/>



- **Select4Cities:** Pre-Commercial Procurement Project to develop a data-driven, Internet-of-Everything (IoE) platform for large-scale urban co-creation
  - <https://www.select4cities.eu/>



# SELECT

for Cities

## CERTIFICATE OF ACHIEVEMENT

1° place award to

**UNIVERSITY OF FLORENCE -  
DEPARTMENT OF  
INFORMATION ENGINEERING**

for



# SNAP4CITY

for successfully completing the  
SELECT for Cities PCP competition  
19.11.2019



This project has received funding from the European  
Union's Horizon 2020 research and innovation  
programme under grant agreement No 688196

Snap4City (C), January 2020

**DIGIPOLIS  
FORUM VIRIUM HELSINKI  
CITY OF COPENHAGEN**

**Buyers Group**



TOP

# DASHBOARDS: FROM CITY DASHBOARD TO APPLICATIONS

FROM CITY DASHBOARD TO APPLICATIONS

DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT

FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS

IOT APPLICATIONS VS IOT EDGE DEVICES

QUALITY FOR BUSINESS

SNAP4CITY ARCHITECTURE AND ECOSYSTEM. OPENED TO DEVELOPERS AND STAKEHOLDERS

TWITTER VIGILANCE SOCIAL MEDIA ANALYSIS

SNAP4CITY AND KM4CITY PROJECTS

HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP

DECISION SUPPORT SYSTEM AND CITY RESILIENCE

SNAP4CITY THE VIEW OF THE ADMINISTRATORS

DATA ANALYTICS BUSINESS INTELLIGENCE, WHAT-IF AND SIMULATION

ADVANCED SMART CITY, MICROSERVICES, SNAP4CITY PARTNERSHIP

SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK









# Firenze Oggi

43666

Totale utenti WIFI

COLONNINE RICARICA <...9m

176 INSTALLATE

71 % ATTIVE

5.1 % IN USO

GENERAL METEO 9m

MINIMO BASSO MEDIO ALTO

**RISCHIO IDRAULICO**

**RISCHIO TEMPORALI**

**RISCHIO IDROGEOLOGICO**

**RISCHIO NEVE**

**RISCHIO GHIACCIO**

**RISCHIO VENTO**

SITUAZIONE VIABILITA 8s

**0 INCIDENTI**

0 CHIUSURE AL TRAFFICO (TOT)

0 CHIUSURE PER CANTIERI

0 PROGR. 0 NON PROG.

0 LIMITAZIONI AL TRAFFICO (TOT)

0 LIMITAZIONI PER CANTIERI

0 NON PROG. 0 PROGR.

**0 TOT. EVENTI SULLA RETE**

SMN 9m <b>28.7</b> % occupati su 607 posti	BINARIO16 9m <b>55.2</b> % occupati su 165 posti	FORTEZZA 9m <b>27.8</b> % occupati su 521 posti
LEOPOLDA 9m <b>36</b> % occupati su 300 posti	CALZA 9m <b>70.3</b> % occupati su 148	S.AMBROGIO 9m <b>99.7</b> % occupati su 379 posti
PARTERRE 9m <b>34</b> % occupati su 656 posti	CAREGGI 9m <b>24.9</b> % occupati su 406 posti	BECCARIA 9m <b>98.1</b> % occupati su 210 posti

## ANALYSIS

Energy

Environment

Mobility

Social

Resilience

## Attesa media alla fermata

Linea 6 9m <b>3</b> min	Linea 13 9m <b>13</b> min
Linea 17 9m <b>4</b> min	Linea 23 9m <b>5</b> min
Linea 31 9m <b>19</b> min	Linea 36 9m <b>2</b> min

FLUSSI INGRESSO CITTA 9m

TOTALE 9m  
**284094**  
VEICOLI

FLUSSI INGRESSO ZTL 9m

TOTALE ZTL 9m  
**57499**  
VEICOLI

Nati Italiani 119m <b>163</b> ultimo mese consolidato	Nati stranieri 119m <b>49</b> ultimo mese	Deceduti 119m <b>395</b> ultimo mese	Matrimoni 119m <b>19</b> ultimi 7 giorni	Unioni Civili 119m <b>0</b> ultimi 7 giorni
Segnalazioni ricevute in attesa 119m <b>1116</b> ultimo mese	In Lavorazione 119m <b>524</b>	Risolte 119m <b>305</b>	Chiuse senza risoluzione... 119m <b>285</b>	
Manutenzioni Stradali 59m <b>54</b> oggi	Verde Pubbli... 59m <b>4</b>	Decoro Urbano 59m <b>6</b>	Relitti 59m <b>3</b>	



# Smart City Control Room

## a set of dashboards and tools



This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement N° 691735



UNIVERSITÀ DEGLI STUDI FIRENZE

DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB







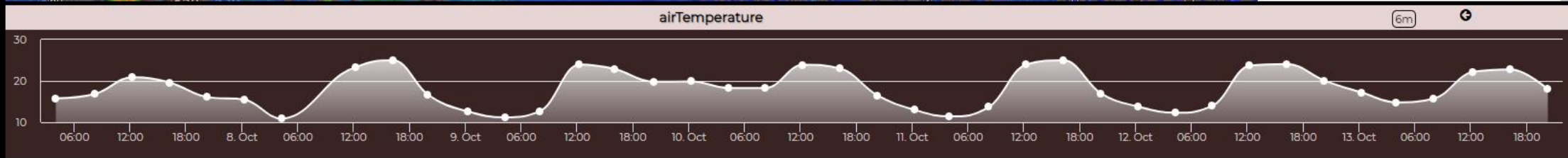
# Mobility and Environment What-IF Analysis

This dashboard contains data derived from actual sensors and predictive values under validation

- Air Quality Sensors
- Weather Sensors
- PM10 Heatmap
- PM25 Heatmap
- CO Heatmap
- CO2 Heatmap
- O3 Heatmap
- NO2 Heatmap
- Europ. AQI Heatmap
- Air Humidity Heatmap
- Air Temp. Heatmap
- Wind Speed Heatmap
- Gral Pred. HM NOX (3m)
- Gral Pred. HM NOX (6m)
- Traffic Sensors
- Traffic Flow
- Cycling Paths
- Accident Heatmap
- Only HRes Anym. Gral
- Scenarios
- What-if analysis

Firenze Oggi

Air Temperat... (6m)



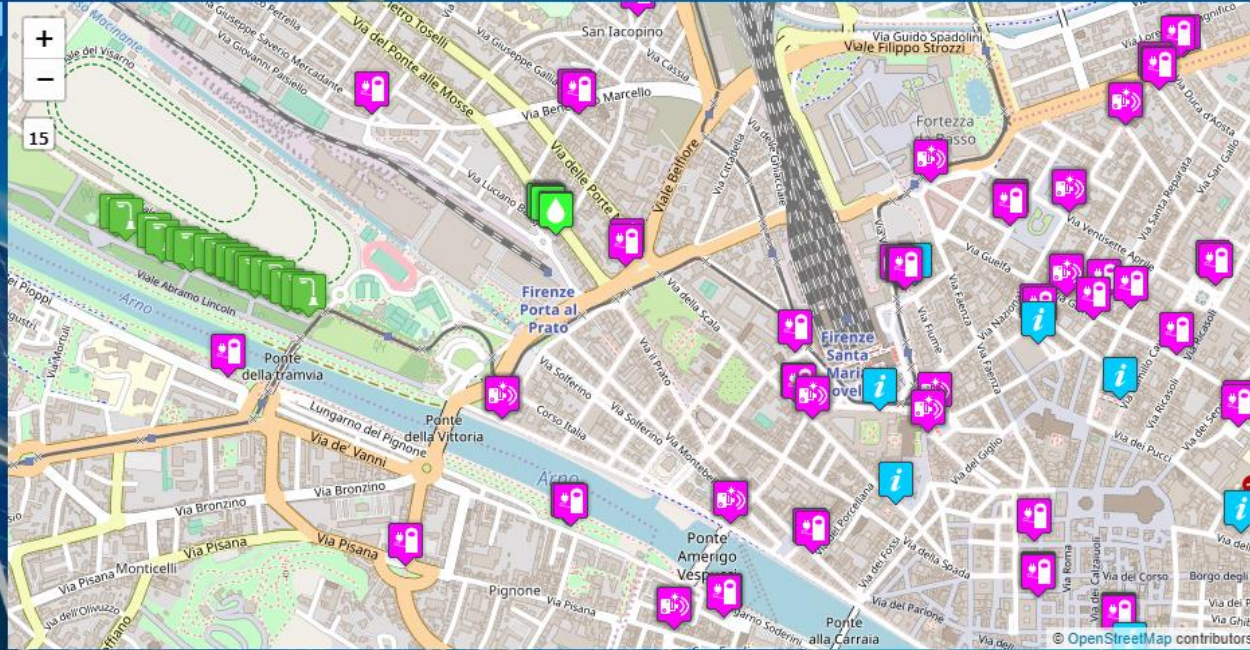






# - Energy -

- Selector - Click the icon
- Fast recharging stations
  - Normal recharging stations
  - ZTL gate
  - Smart waste
  - Florence WiFi POI
  - Digital Signage
  - Smart Irrigator
  - Smart Light
  - Smart Bench



- Environment
- Mobility
- Social
- Resilience
- Main

Real time ac... 89.6%

Accumulator... 100%

Accumulator... 67.7%

N&period; of App Users 12 users

Energy consumption vi... 278821 kWh

Smart Info consumption for 30 PODs

Monthly cumulative consumption 258.8 Kw/h

PODs Percentage 100 %



Fast Recharging Stations - Average Weekly consumption

Piazza Giorgini	Via Venosta	Via del Cavallaccio
21.1 Kw/h	32.6 Kw/h	16.8 Kw/h
Viale Guidoni	Piazza Donatello	Piazza Francia
17 Kw/h	25.4Kw/h	25.4 Kw/h



# - Mobility -

Tue 5 Nov 17:47:56

**Traffic Events in Firenze** 9m

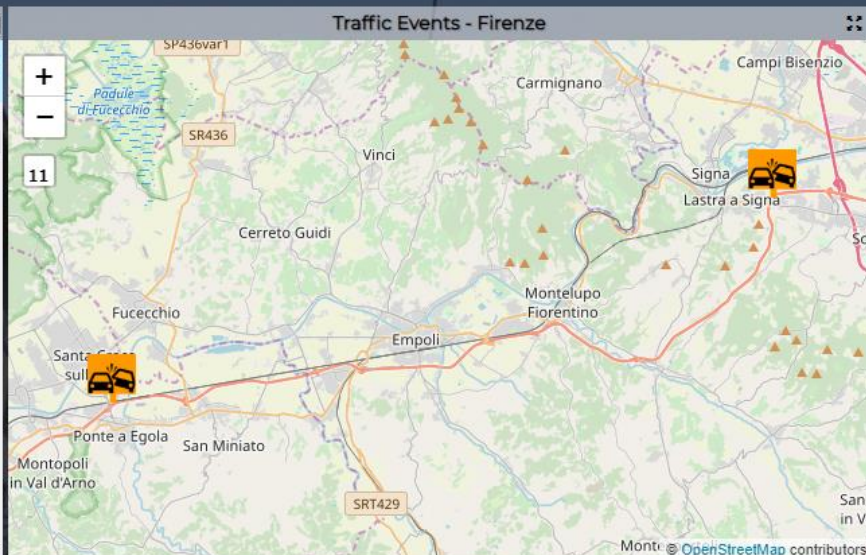
05/11/2019 16:00:45 5 MAP

**05-11-2019 17:13 VEICOLO FERMO O AVARIA**  
BROKEN DOWN VEHICLE(S)  
05/11/2019 17:13:07 5

**05-11-2019 16:55 VEICOLO FERMO O AVARIA**  
BROKEN DOWN VEHICLE(S)  
05/11/2019 16:55:45 5

**05-11-2019 17:12 TRAFFICO RALLENTATO**  
SLOW TRAFFIC  
05/11/2019 17:12:17 5

**05-11-2019 16:40 CODA IN USCITA A LA STRA**  
QUEUING TRAFFIC  
05/11/2019 16:40:32 5



**SMN** 9m

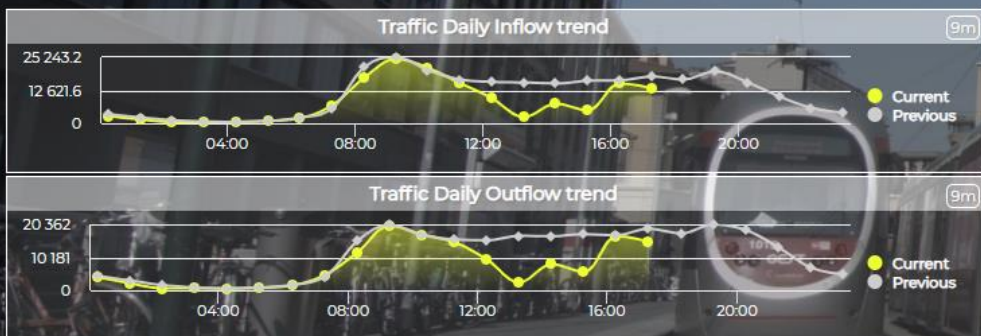
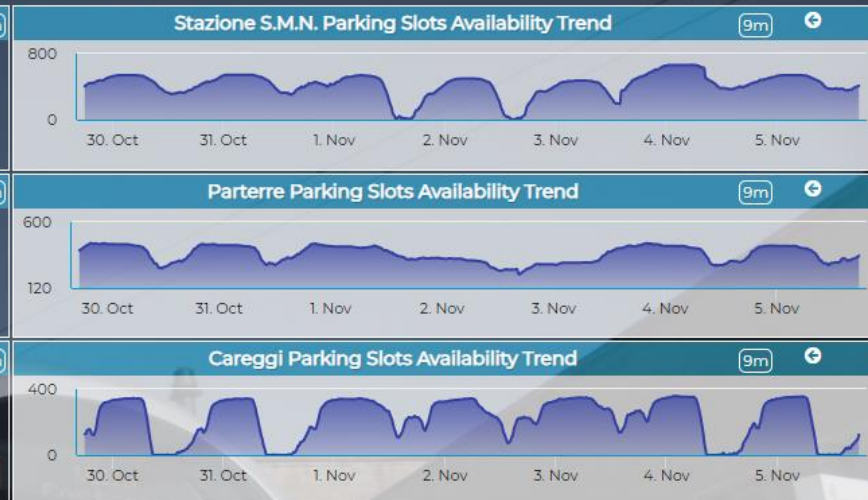
**411**  
free

**Parterre** 9m

**355**  
free

**Careggi** 9m

**123**  
free



**N. veicoli totali Inflow** 9m

**144137**  
n.

**N. veicoli totali Outflow** 9m

**132220**  
n.

**Public Transport Search**

Services: 7 on 7 available

**Public Transport**

All Favorites

**Condotta**  
→ BusStop  
C2 -  
62 m

C2	C2
17:51:00	18:00:00

Energy Environment Social Resilience Main

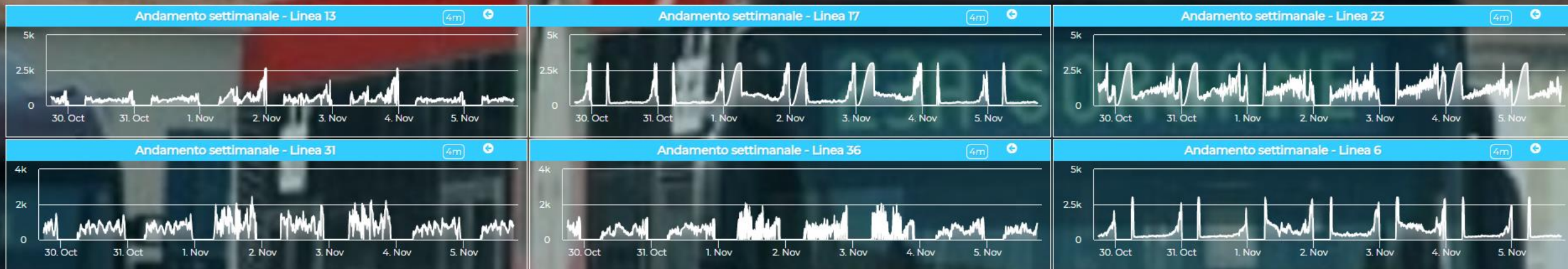




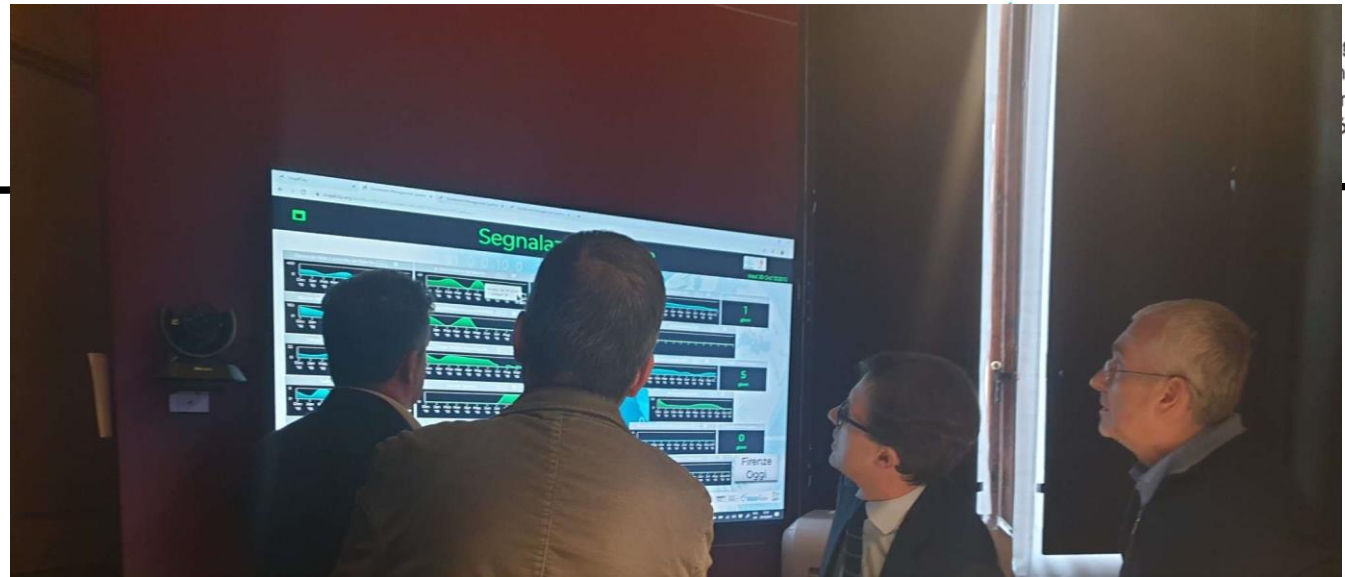
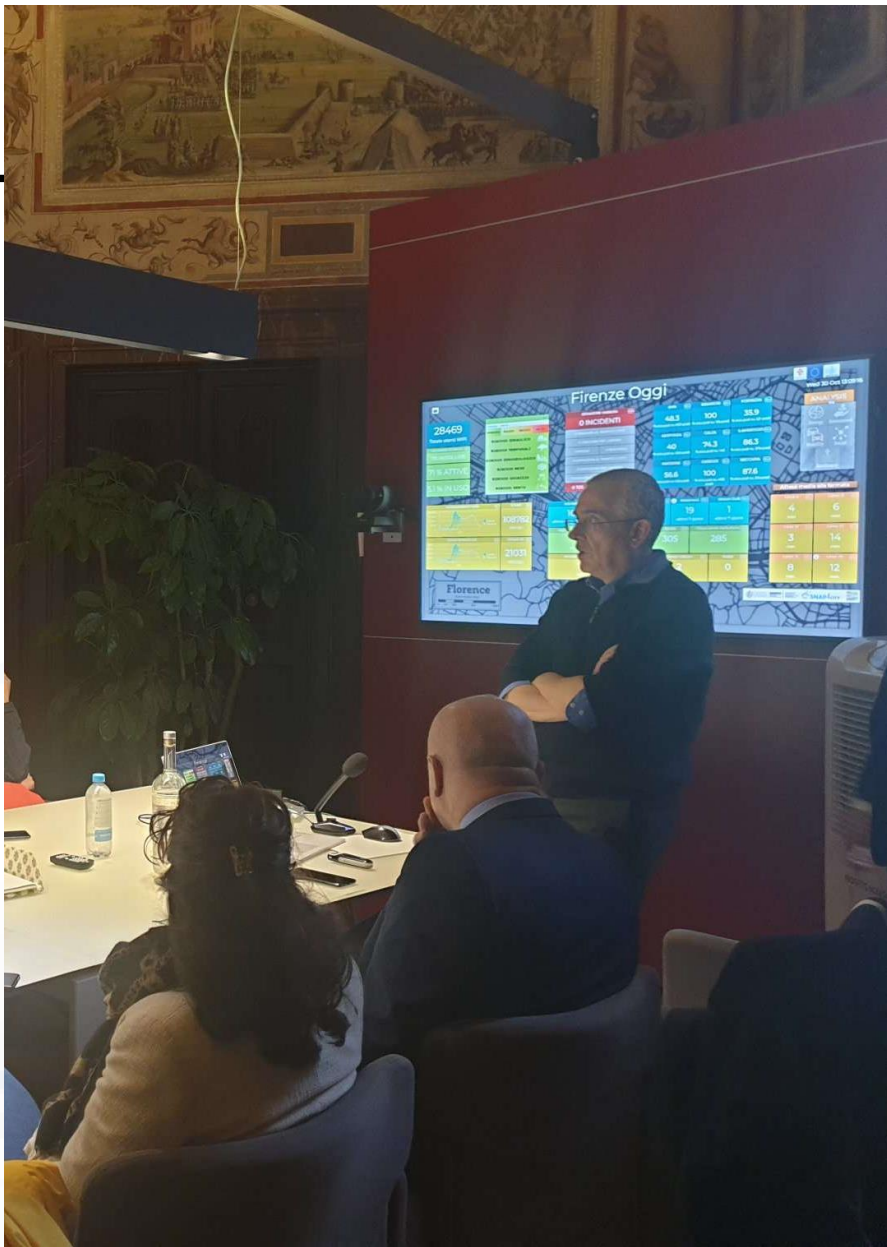
# Valutazione Trasporto Pubblico

Firenze - 6 linee

Tue 5 Nov 17:49:00







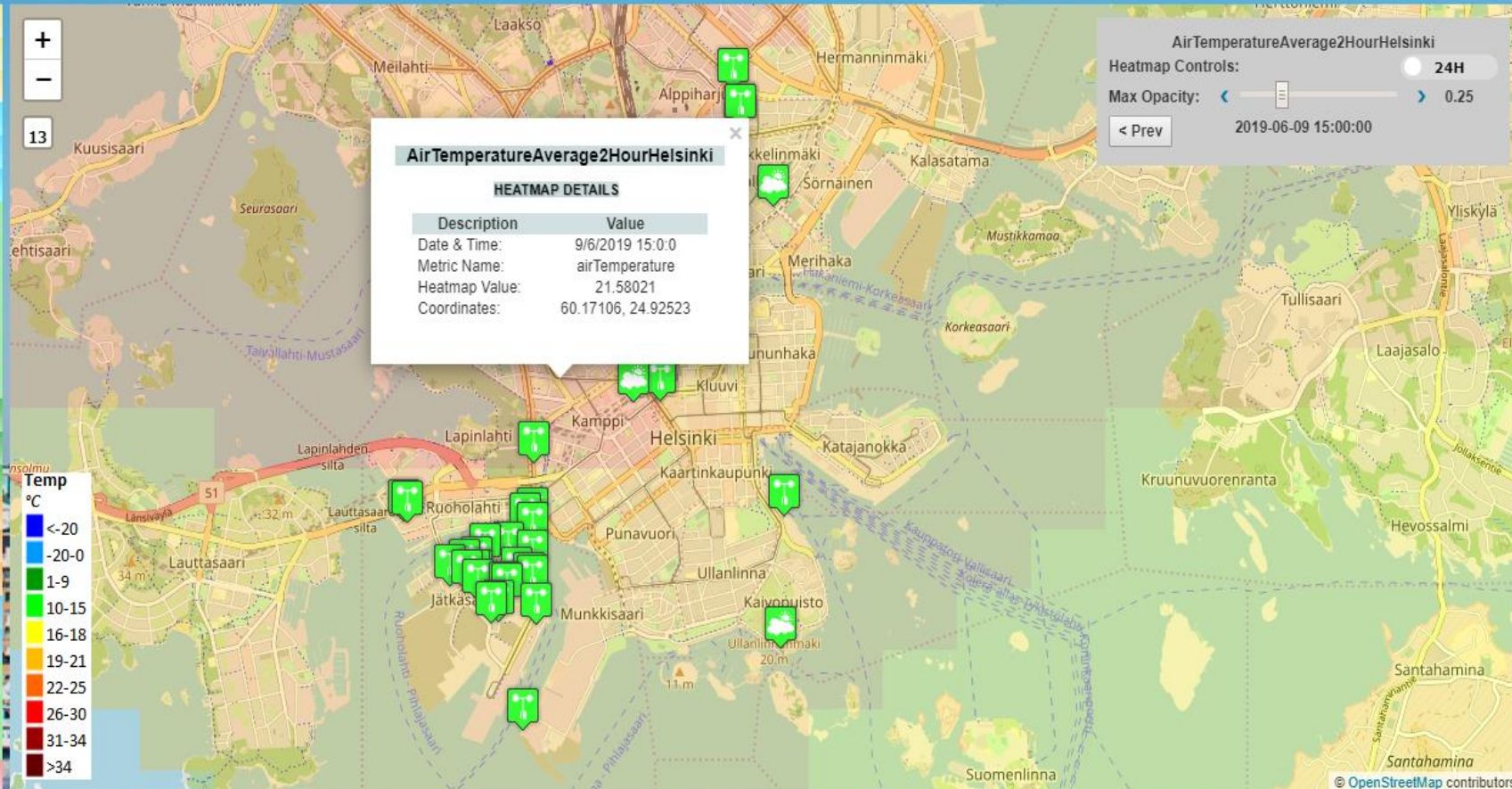


# Helsinki City Overview (H5a)

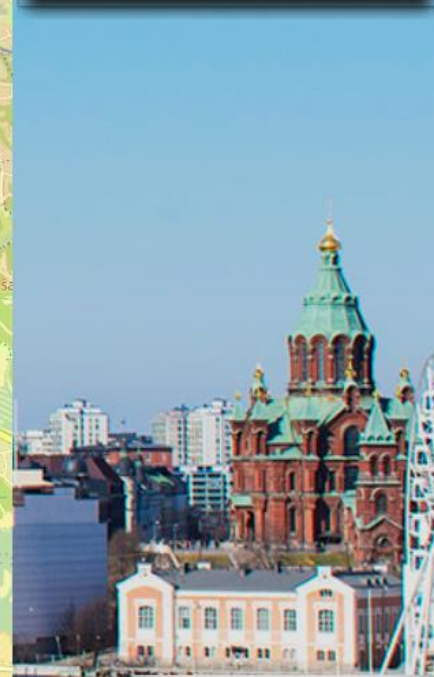
Please note that the data results are not always based on real data.

Sun 9 Jun 17:07:25

- ▲ BusStop
- ▲ Ticket sale
- ▲ Traffic Sensor
- ▼ Weather sensor
- ▼ Air Temp heatmap
- ▲ Humidity Heatmap
- ▼ Air Quality Sensors
- ▲ Noise sensors
- ▲ Noise Heatmap
- ▲ PM10 heatmap
- ▲ PM2.5 Heatmap
- ▲ NO2 heatmap
- ▲ Air Quality Index heatmap
- ▲ EAQI
- ▲ CAQI
- ▲ Enfuser pred. AQI
- ▲ Enfuser pred. PM10
- ▲ Enfuser pred. PM2.5
- ▲ Gral pred. PM10
- ▲ Gral pred. PM10 (6m)
- ▲ PM10 Jatkasaari
- ▲ PM2.5 Jatkasaari
- ▲ EAQI Jatkasaari
- ▲ Appreciated POIs



The Life of Helsinki



Documentation

Forum Discussion

Survey

<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTQwNg==>

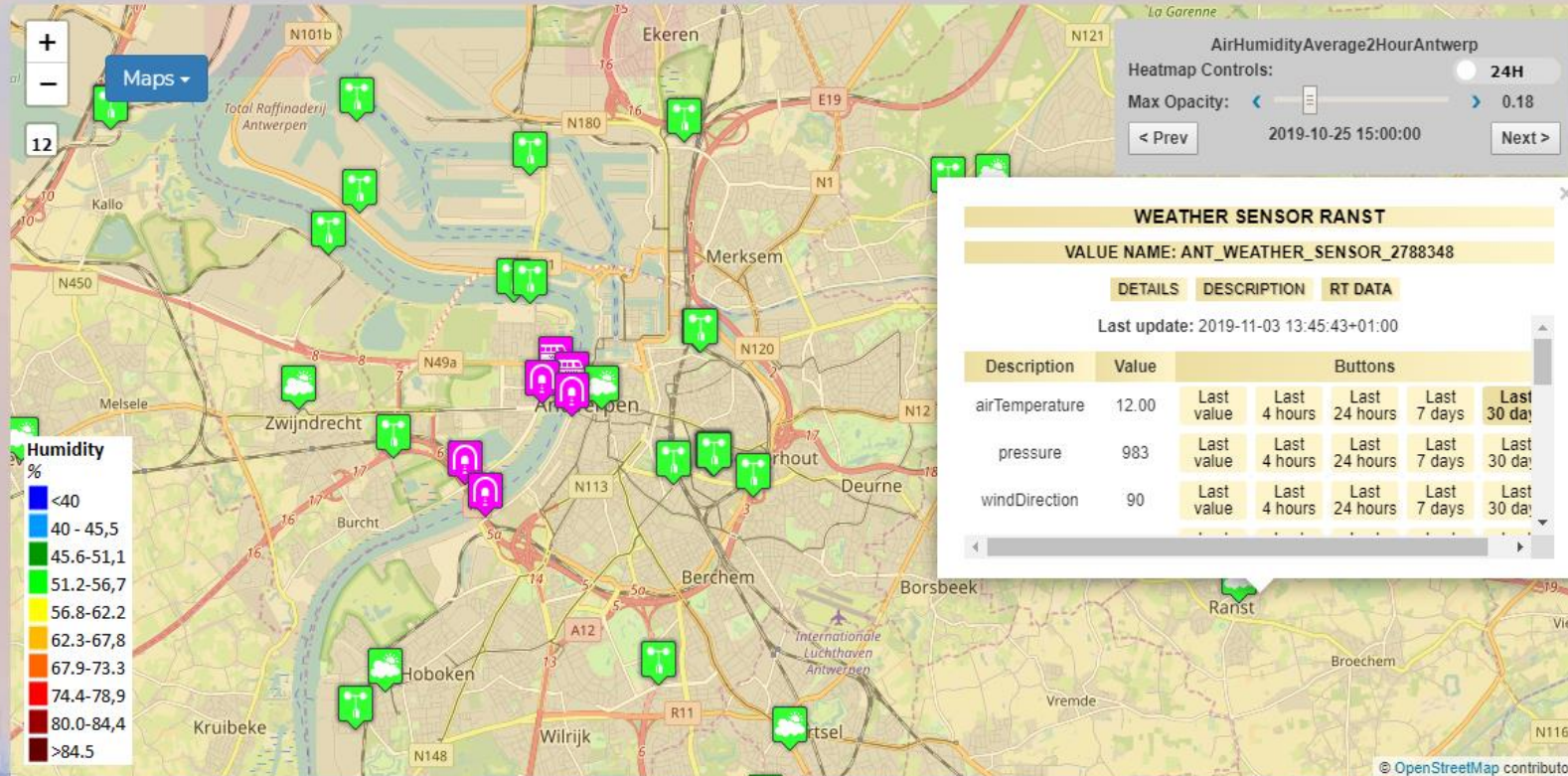


# Antwerp City Overview - A5

Please note that the data results are not always based on real data.

Sun 3 Nov 14:09:43

- ▲ Cultural Activity
- ▲ Entertainment
- ▲ Tourism Service
- ▲ Education & Research
- ▲ Government Office
- ▲ Accommodation
- ▼ Air Quality Sensor
- ▼ Weather sensor
- ▲ PM10 Heatmap
- ▲ PM2.5 Heatmap
- ▲ Air Temperature Heatmap
- ▼ Humidity Heatmap
- ▲ NO Heatmap
- ▲ NO2 Heatmap
- ▲ SO2 Heatmap
- ▲ O3 Heatmap
- ▲ EAQI
- ▲ CAQI
- ▲ Biking Safe Heatmap
- ▼ Tunnels and Ferry
- ▲ Routing Scenario
- ▲ What-IF Routing



- Forum Discussion
- Documentation
- Survey
- The Life of Antwerp

<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTQwNw==>



# Unique Dashboard builder Multiple Styles

**Antwerp Overview AS**

Temp °C

- <-20
- 20-0
- 1-9
- 10-15
- 16-18
- 19-21
- 22-25
- 26-30
- 31-34
- >34

**AIR QUALITY MONITORING STATION 42R804 - ANTWERPEN (RING)**

VALUE NAME: ANTWERP\_AIR\_QUALITY\_BETR804

DETAILS DESCRIPTION RT DATA

Last update: 2019-11-03 09:00:00+01:00

Description	Value	Buttons				
airQualityPM10	8	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 days
airQualityNO2	21	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 days
airQualitySO2	null	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 days
airQualityPM2_5	3	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 days

ant\_weather\_sensor\_28... 10.2

airQualityPM10 - 30 days

03/11/2019 10:52:16

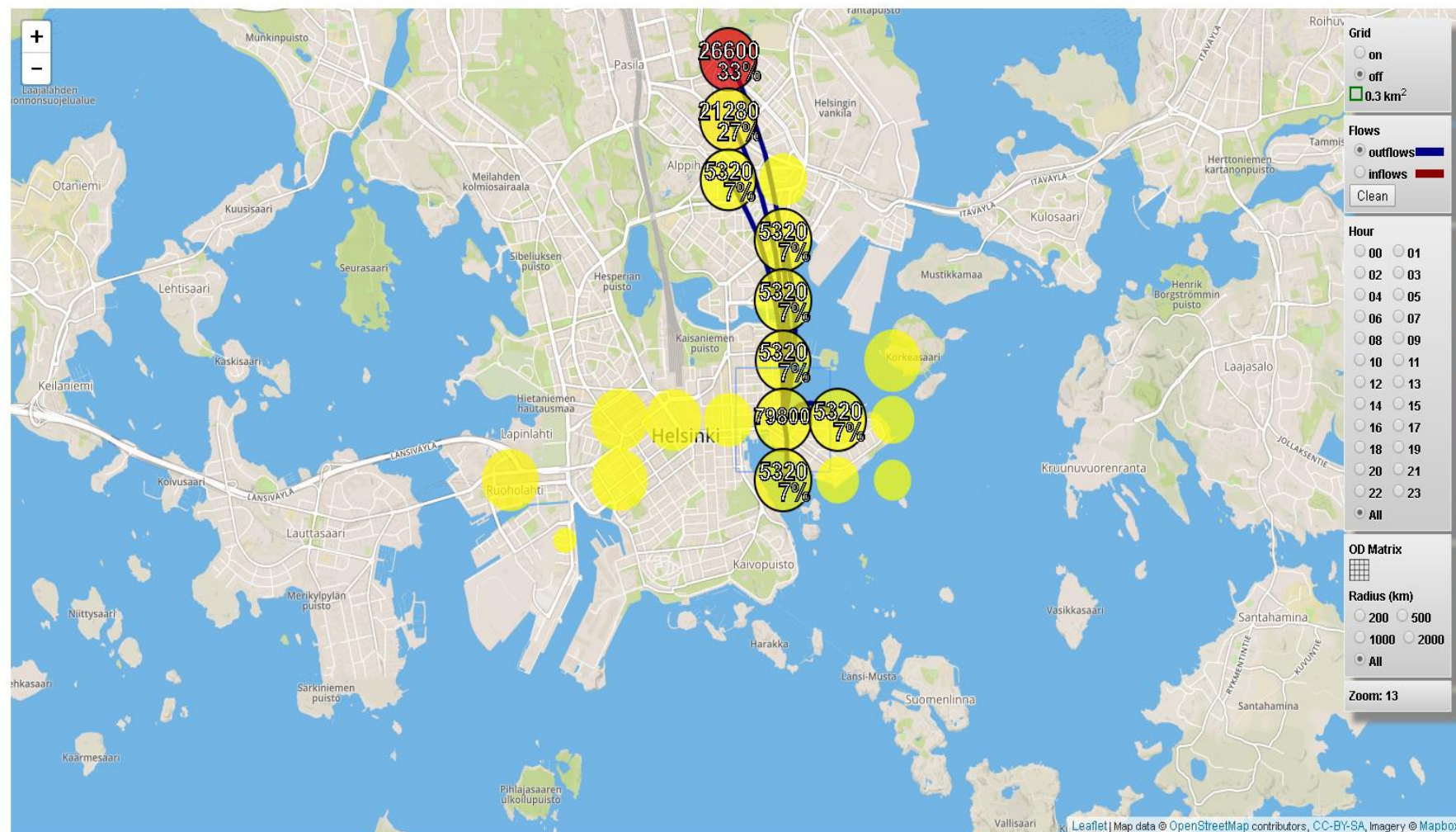
Privacy Policy Cookies Policy Terms and Conditions Contact us



# Helsinki White Dashboard

Please note that the data results are not always based on real data.

Thu 13 Jun 23:37:56



**Grid**  
 on  
 off  
0.3 km<sup>2</sup>

**Flows**  
 outflows  
 inflows  
Clean

**Hour**  
 00  01  
 02  03  
 04  05  
 06  07  
 08  09  
 10  11  
 12  13  
 14  15  
 16  17  
 18  19  
 20  21  
 22  23  
 All

**OD Matrix**

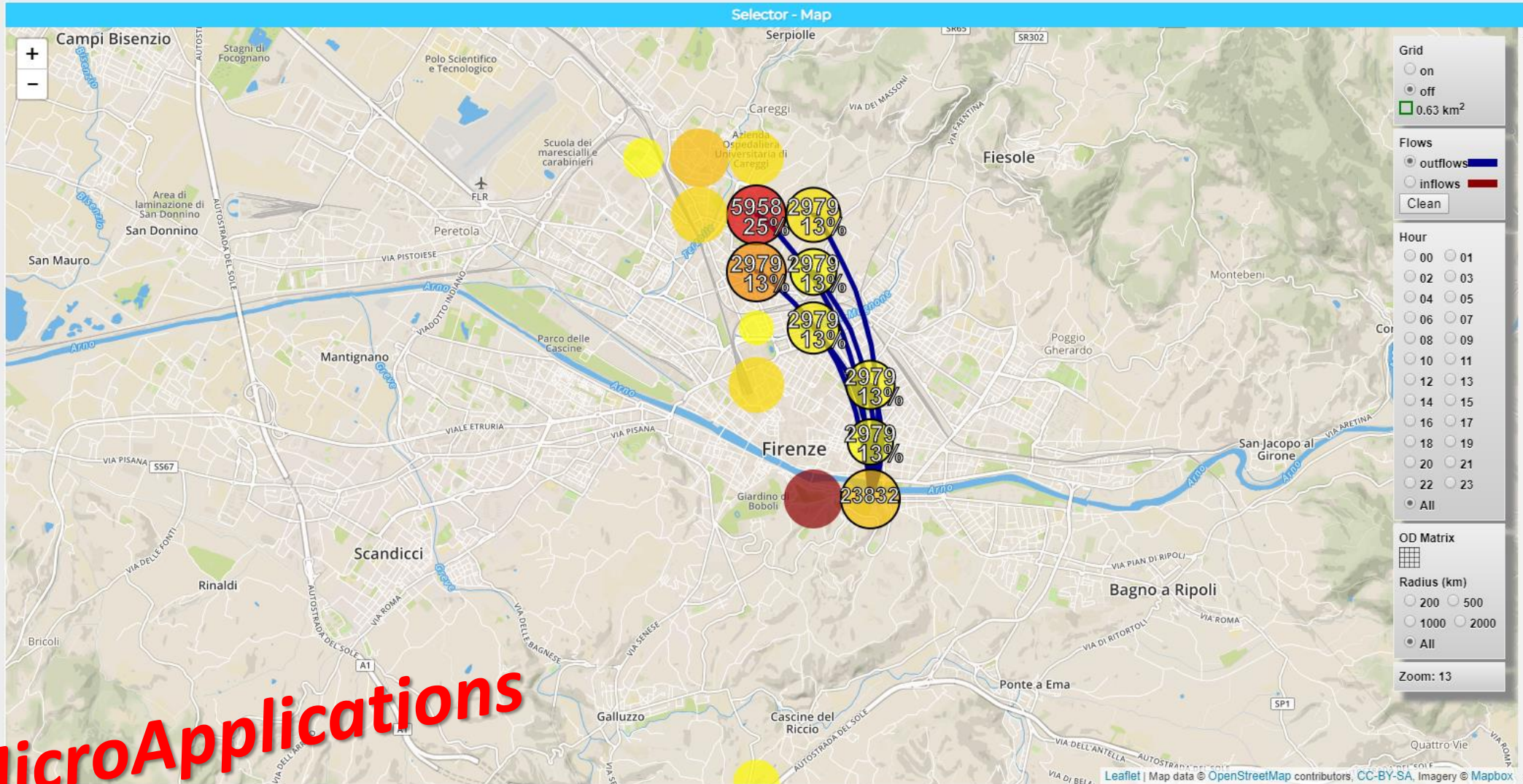
**Radius (km)**  
 200  500  
 1000  2000  
 All

**Zoom: 13**



# Life in Toscana: Dashboard

Mon 24 Jun 09:19:20



- Line of Transport
- Public Transport
- Travel Plan
- Air Quality
- Weather
- Origin Dest. Matrix
- Typical
- Trajectories
- Cultural Activities
- Forum
- Discussion

**MicroApplications**



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc3NA==>

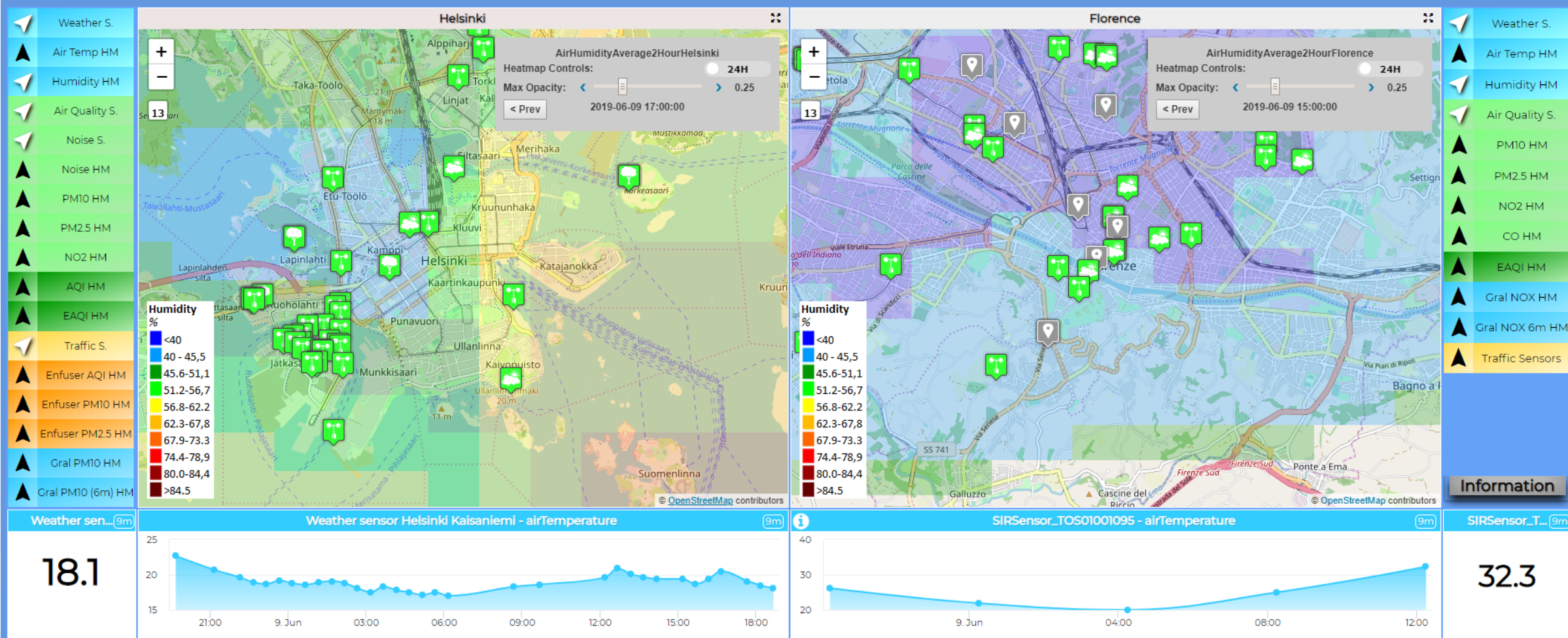


# Helsinki vs Florence comparison

## Helsinki vs Florence comparison

Please note that the data results are not always based on real data.

Sun 9 Jun 19:18:35





# 3D Map beta Testing

Fri 31 Jan 00:37:59



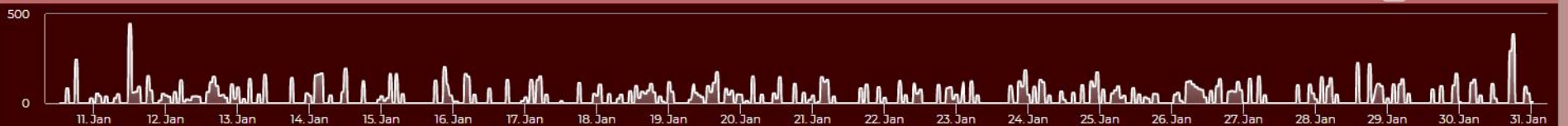
METRO487 - vehicleFlow 7m

METRO487 - vehicleFlow

7m



**6.6**  
num of vehicles





# Real Time Sensors via ServiceMap3D

3D data rendering



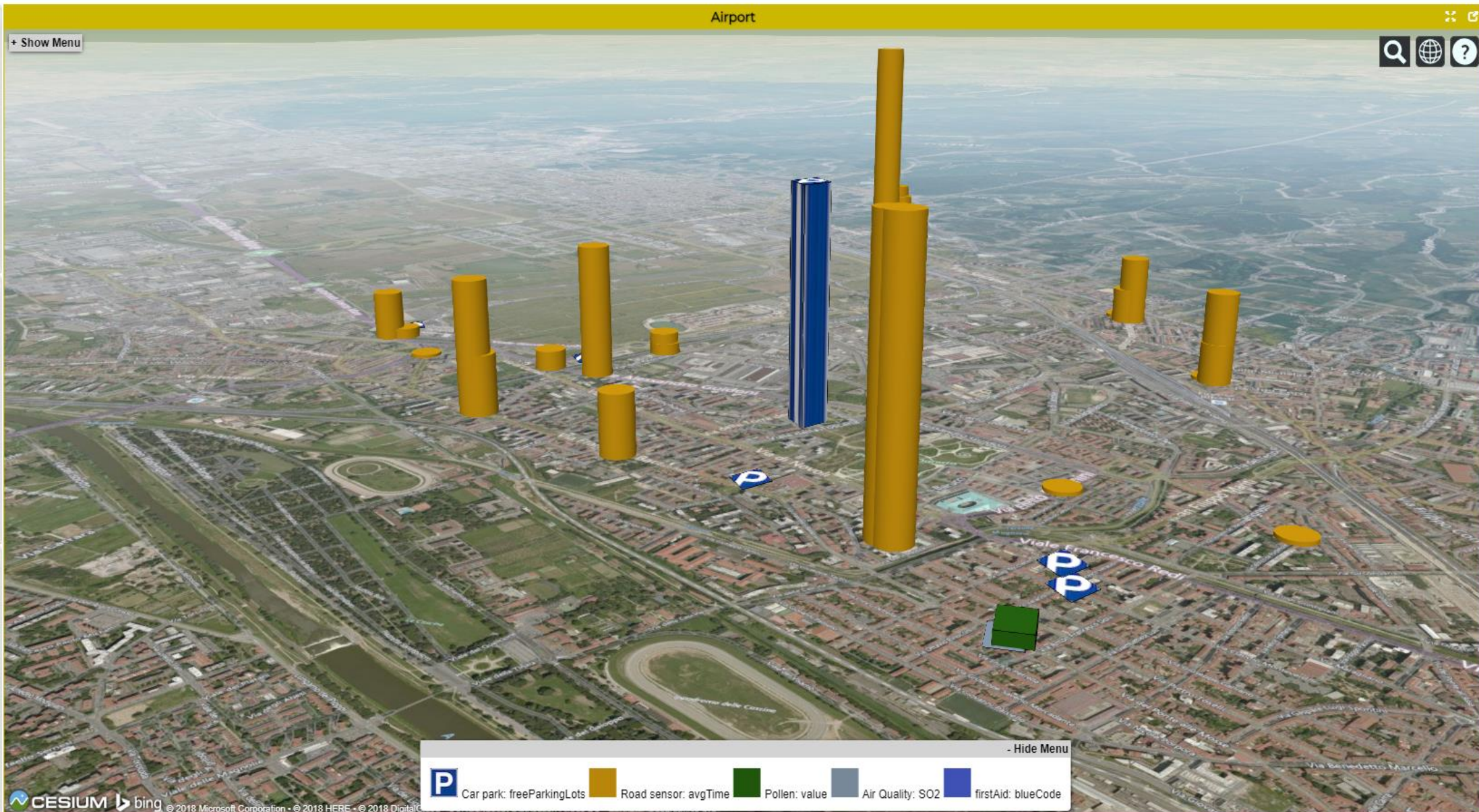
Firenze



Airport



Empoli





# Parking Monitoring Firenze

Tue 21 May 15:23:09

**Santa Maria Novella**

**Parcheggio Stazione Firenze S.m.n.**

Real time	05-21-2019 15:26
314	

Predictions	05-21-2019 15:30	05-21-2019 15:45	05-21-2019 16:00	05-21-2019 16:15
273				
445				
280				
475				

**Binario 16**

**Parcheggio Stazione Binario 16**

Real time	05-21-2019 15:26
1	

Predictions	05-21-2019 15:30	05-21-2019 15:45	05-21-2019 16:00	05-21-2019 16:15
96				
93				
92				
84				

**Fortezza**

**Parcheggio Stazione Fortezza Fiera**

Real time	05-21-2019 15:26
364	

Predictions	05-21-2019 15:45	05-21-2019 16:00	05-21-2019 16:15	05-21-2019 16:30
314				
198				
242				
45				

**Leopolda**

**Parcheggio Porta Al Prato**

Real time	05-21-2019 15:26
147	

Predictions	05-21-2019 15:30	05-21-2019 15:45	05-21-2019 16:00	05-21-2019 16:15
147				
155				
147				
154				

MicroApplications

**MAIN**

CALZA 9m  
97.3  
% posti occupati

S.AMBROGIO 9m  
75.7  
% posti occupati

CAREGGI 9m  
98.8  
% posti occupati

PARTERRE 9m  
51.4  
% posti occupati

BECCARIA 9m  
80  
% posti occupati

<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTE3MA==>



TOP

# *Operator Dashboards at different levels*







Fri 19 Oct 17:24:39

# MAPPA FIRENZE

**METRICHE**  
Last update: 2016-10-19 17:24:02:00

Descrizione	Valore	Last value	Last 24 hours	Last 7 days	Last 30 days
Avg Time	53.26	Last value	Last 24 hours	Last 7 days	Last 30 days
Concentration	74.4	Last value	Last 24 hours	Last 7 days	Last 30 days
Vehicle flow	317.0	Last value	Last 24 hours	Last 7 days	Last 30 days
Average Speed	5.0	Last value	Last 24 hours	Last 7 days	Last 30 days

Concentration - 7 days





# Chemical Plant Dashboard Green Impact Capacity (GIC) Altair Control room



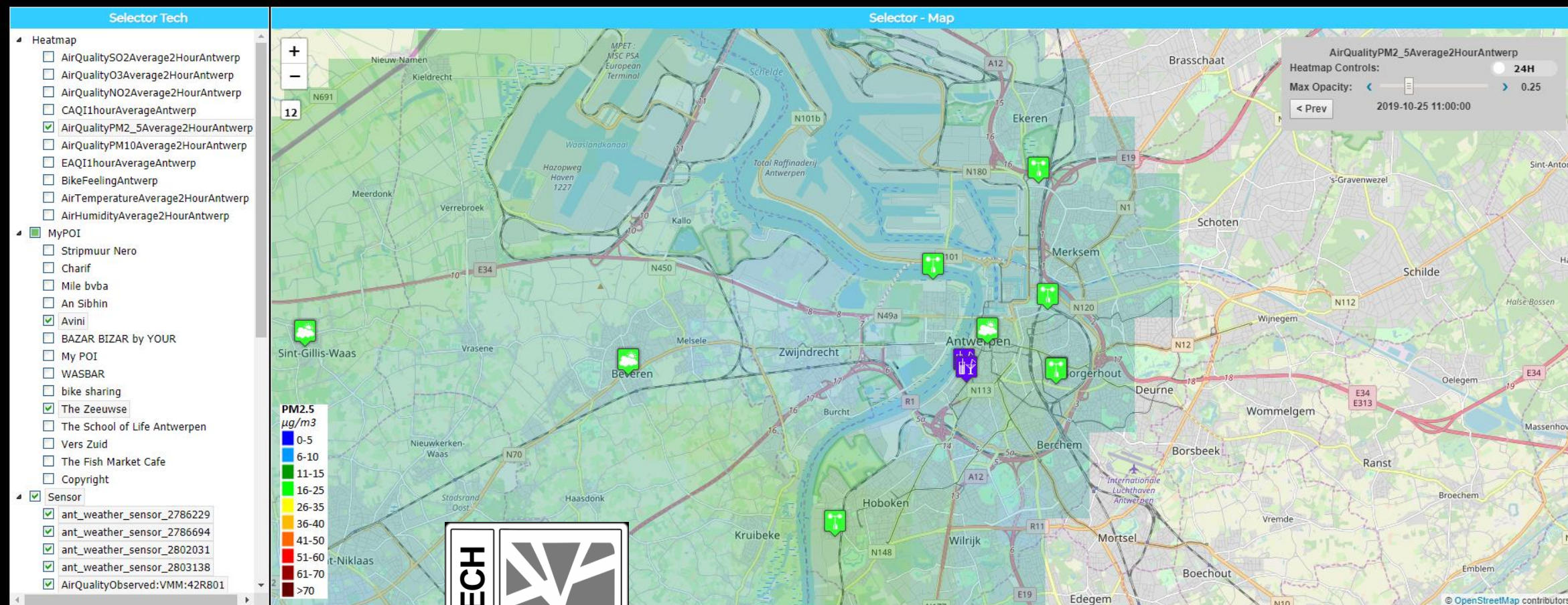


# Technical Selector: TECH MultiDataMap



## Antwerp Selector Tech

Fri 1 Nov 14:17:43





# Multi-Widget Map

Thu 13 Sep 13:07:01

SLOW TRAFFIC		
13/09/2018	10:30:42	5
13-09-2018 10:17 MATERIALI DISPERSI TRA CINESTRA FIORENTINA E CINESTRA A SINISTRA		
SHED LOAD(S)		
13/09/2018	10:17:22	5
INCIDENTI CON FERITI		
ACCIDENT(S)		
13/09/2018	09:41:48	1
13-09-2018 09:16 MATERIALI DISPERSI TRA CINESTRA EST E CINESTRA OVEST CINESTRA		
SHED LOAD(S)		
13/09/2018	09:16:05	5
13-09-2018 09:10 MATERIALI DISPERSI TRA CINESTRA OVEST E CINESTRA EST CINESTRA		
SHED LOAD(S)		
13/09/2018	09:10:49	5
13-09-2018 09:08 VEICOLO FERMO O AVARIA TRA CINESTRA A SINISTRA E CINESTRA FIORENTINA		
BROKEN DOWN VEHICLE(S)		
13/09/2018	08:32:54	5
13-09-2018 08:32 VEICOLO FERMO O AVARIA		
BROKEN DOWN VEHICLE(S)		
13/09/2018	08:32:54	5
MATERIALE IN CARREGGIATA		
Operator Event		
06/07/2018	18:07:34	
PEOPLE	OPERATOR	
0		
06/07/2018	18:07:14	
PEOPLE	OPERATOR	
0		
26/06/2018	18:38:51	
PEOPLE	OPERATOR	
0		
26/06/2018	18:18:14	



STORIE DI FATICA E DI RABBIA

€ ▲

"TENOR'S NIGHT"

€ ▲

LA TRAVIATA

€ ▲

"CELEBRAZIONI 1000 ANNI ABBAZIA DI SAN MINIATO"

Selector

- Air Quality
- Bus Stops
- Cycle Paths Geometry
- Cycle Paths Pins
- Heatmap
- Meteo Stations
- Recharging Stations - Normal
- Recharging Stations - Fast
- Traffic Flow Density

<https://main.snap4city.org/view/index.php?iddashboard=OTc2>







# First aids overview - Tuscany



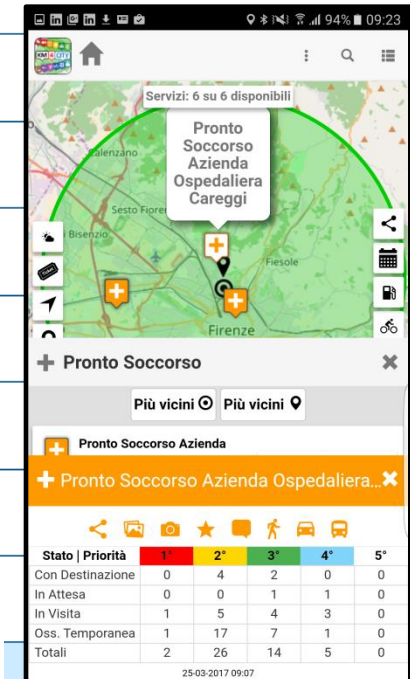
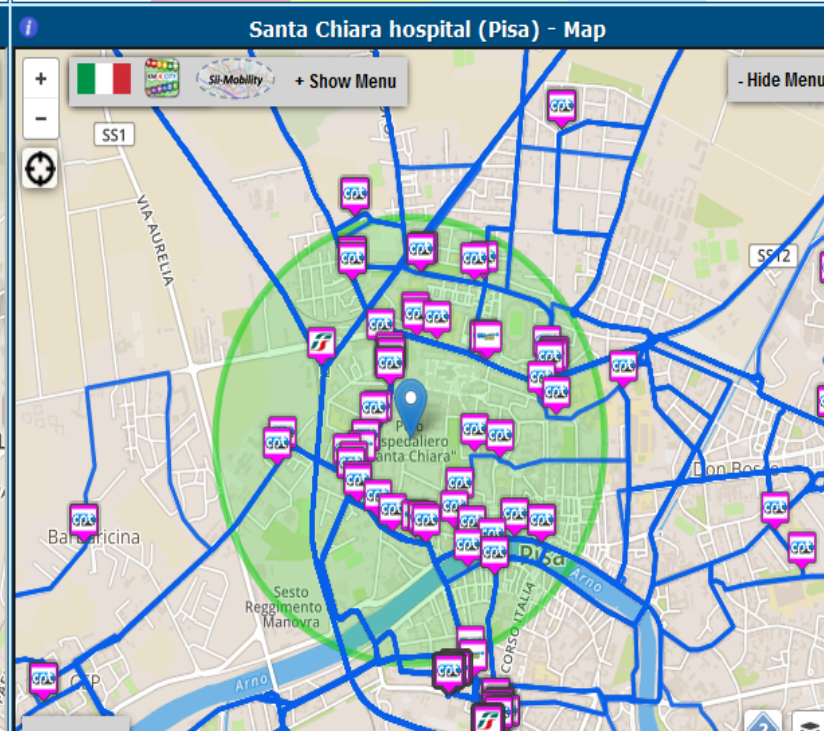
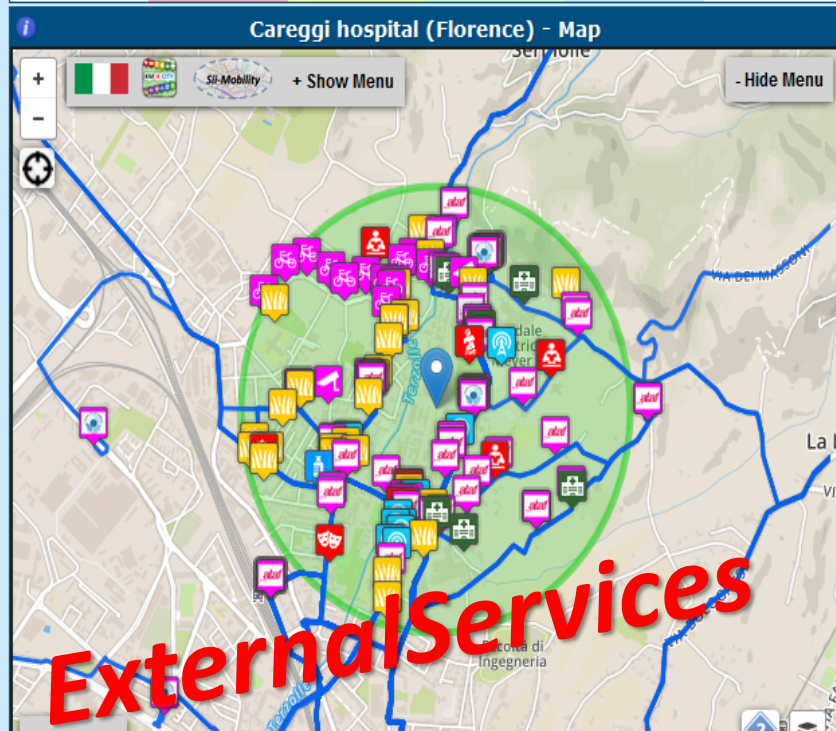
Service status of main first aids

Thu 25 May @ 11:00:34

Careggi hospital (Florence) - Details <span>9m</span>					
Priority\Status	Red code	Yellow code	Green code	Blue code	White code
Addressed	1	4	3	0	0
Waiting	0	2	9	2	0
In visit	1	9	18	3	0
In observation	4	19	2	0	0
<b>Totals</b>	<b>6</b>	<b>34</b>	<b>32</b>	<b>5</b>	<b>0</b>

Santa Chiara hospital (Pisa) - Details <span>9m</span>					
Priority\Status	Red code	Yellow code	Green code	Blue code	White code
Waiting	0	1	7	9	3
In visit	0	7	1	1	6
<b>Totals</b>	<b>0</b>	<b>8</b>	<b>8</b>	<b>10</b>	<b>9</b>

Other hospitals - Summary <span>9m</span>					
Priority\Hospitals	Red code	Yellow code	Green code	Blue code	White code
PS SAN GIOVANNI DI DIO TORREGALLI	1	16	20	1	0
PS SANTA MARIA NUOVA	1	14	12	3	0
PS AO CAREGGI	6	34	32	5	0
PS SANTA MARIA ANNUNZIATA	1	8	11	1	0
PS BORGO SAN LORENZO	0				0
PS OSPEDALI RIUNITI	3				1
PS CASENTINO					
PS SANTA CROCE					
PI PO CORTONA					
PS CIVILE PIOMBINO					



<https://main.snap4city.org/view/index.php?iddashboard=MTly>



External Services



TRENDS	QUOTES
#FIRENZE	
#FIORENTINA	
#UFFIZI	
#PONTEVECCHIO	
#ACCADEMIA	
#OPENDATA FIRENZE	
#BARGELLO	
#AEROPORTO #FIRENZE	
#FOOD	

TRENDS	QUOTES
@PITTI_IMMAGINE	
@PROV_FI_PC	
@MUSEONOVECENTO	
@SANTAGROCEOPERA	
@FIRENZEDIGITALE	
@BIBLIO_COMUNEFI	
@DISCOVERTUSCANY	
@STORIANATURALE	
@BNCFIRENZE	
@BANDIERAUFFIZI	

Events in Florence today

LOVE DUETS

€ ▲

ATTIVITÀ NEI MUSEI DI PALAZZO DIMINZATI E CASA MARTELLI

free ▲

SEONG-JIN CHO

€ ▲

"TESSUTO E RICCHEZZA A FIRENZE NEL '300. LANA, SETA E PITTURA" - LABORATORI PER FAMIGLIE

free free ▲

Cam Duomo

Cam PVecchio

Cam Piazzale

Cam S.Croce

Cam Segrone

Cam Repubblica

Cam Trinita

Cam V.le Tornabuoni





# (Cross widget interaction 2

E Experimental



Mon 15 Jan 15:16:37

PARKING

Station

PARKING

Parterre

PARKING

M. Centrale

PARKING

Fortezza

Duomo

Michelangelo

P. Signoria

Pollution

Rivers

Polls

Any data  
 Real time updated  
 Flexible design  
 Easy to produce  
 Highly interactive

### Park free - Speedometer

40

### Park free - Gauge

Low < 30  
30 <= Mid < 60  
High >= 60

40 %

### City webcams

### Traffic events

12-01-2018 18:43 CODA IN USCITA A

QUEUING TRAFFIC

12/01/2018 18:43:02 5

INCIDENTI SOLO DANNI

ACCIDENT(S)

12/01/2018 19:09:39 1

INCIDENTI SOLO DANNI

ACCIDENT(S)

12/01/2018 20:23:01 1

### Urban faults - Bars

Status	Dirty road	Road surface hole	Illumination KO	Sewer problem	Bumpy road
Reported	15	8	26	97	122
Taken over	5	12	22	4	53
Work in progress	1	17	45	41	144
Resolved	24	24	56	11	83

### Park free - 24 hours

Previous Current

### Traffic events - Map

### Urban faults - Stacked areas

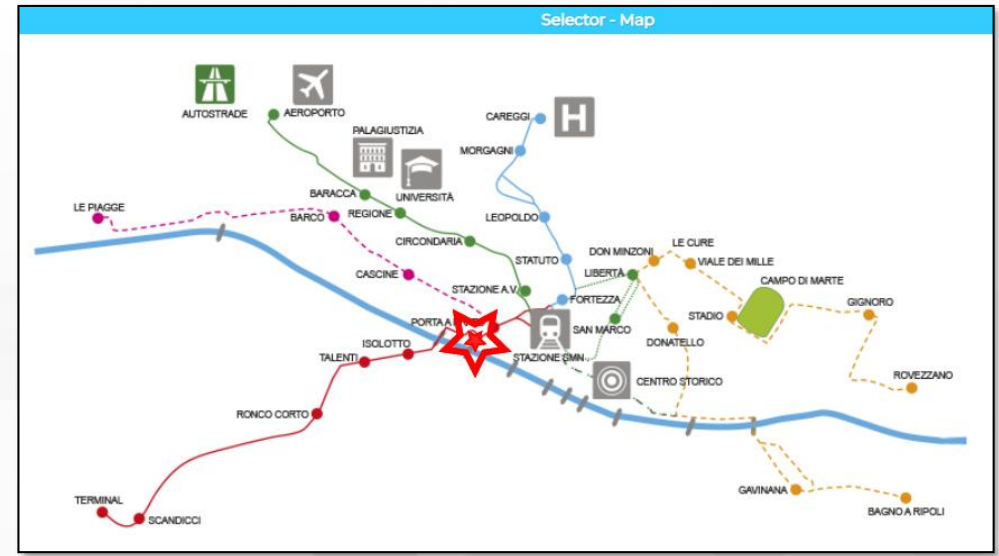
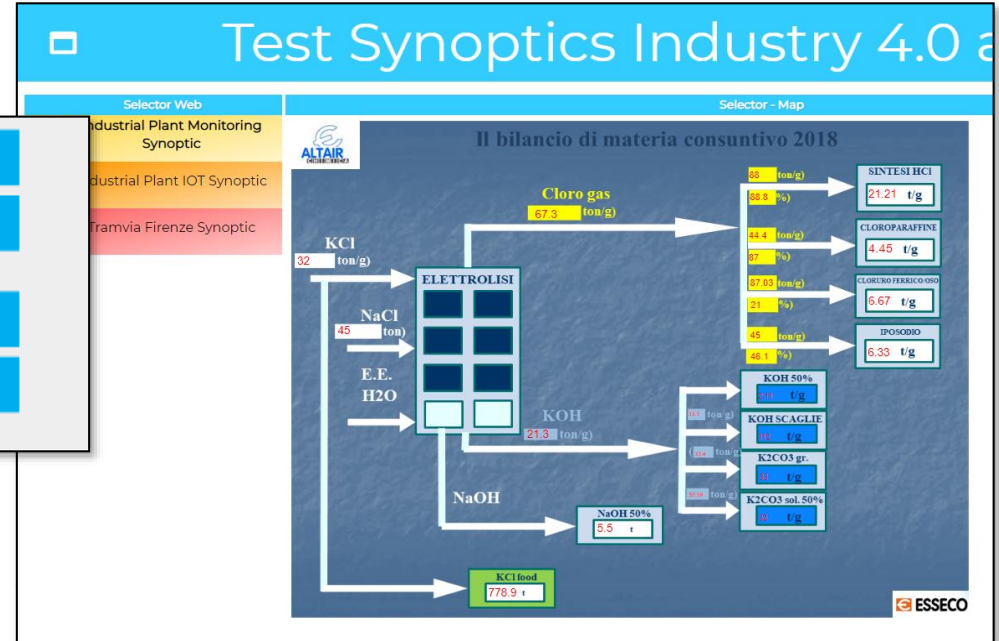
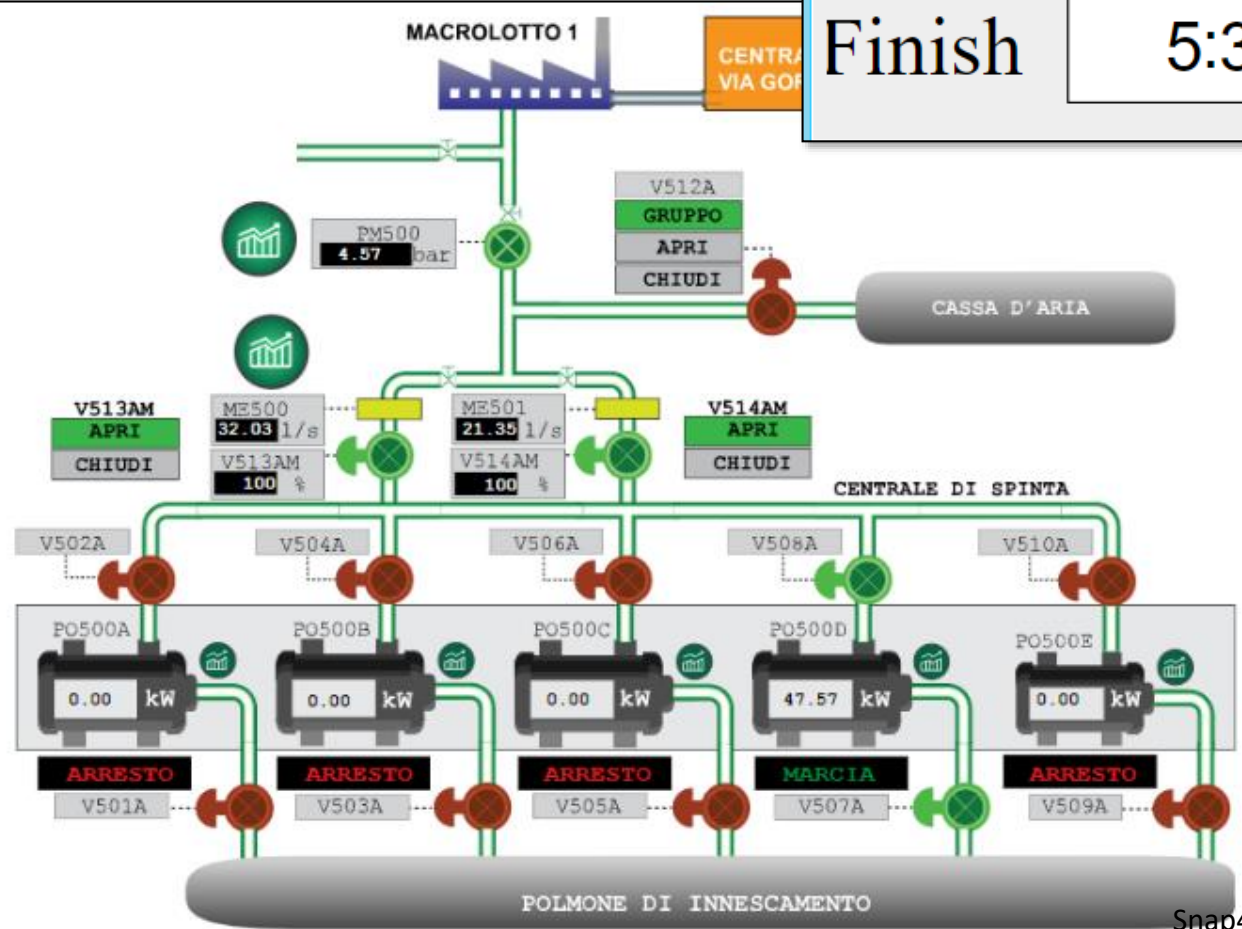
Status	Dirty road	Road surface hole	Illumination KO	Sewer problem	Bumpy road
Reported	15	97	26	122	8
Taken over	5	12	22	4	53
Work in progress	1	17	45	41	144
Resolved	24	24	56	11	83



## Custom Dashboards and Widgets (interactive, Animations, etc.)

- SVG for graphic design
- MyKPI for collecting data

Begin	3:00	+ -
Finish	5:30	+ -







## GIDA 5G demo

Wed 16 Oct 23:01:00

Details Absorption

Full Screen

Mer 16 Ott Powered by LaMMA

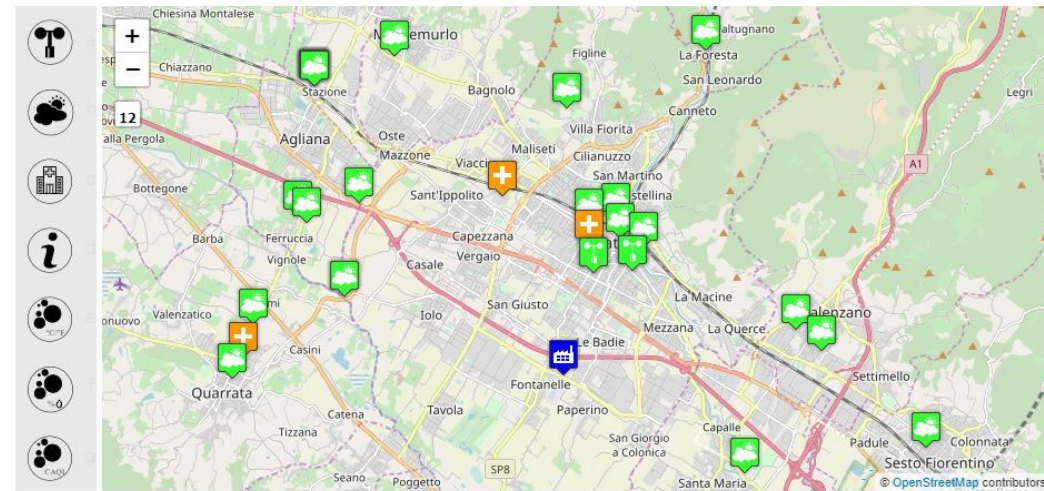
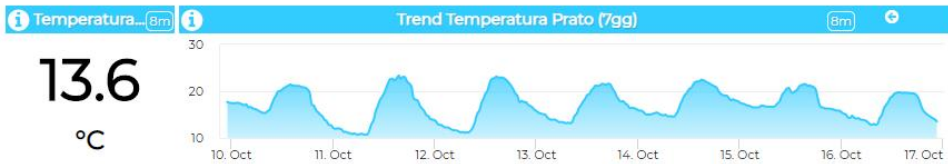
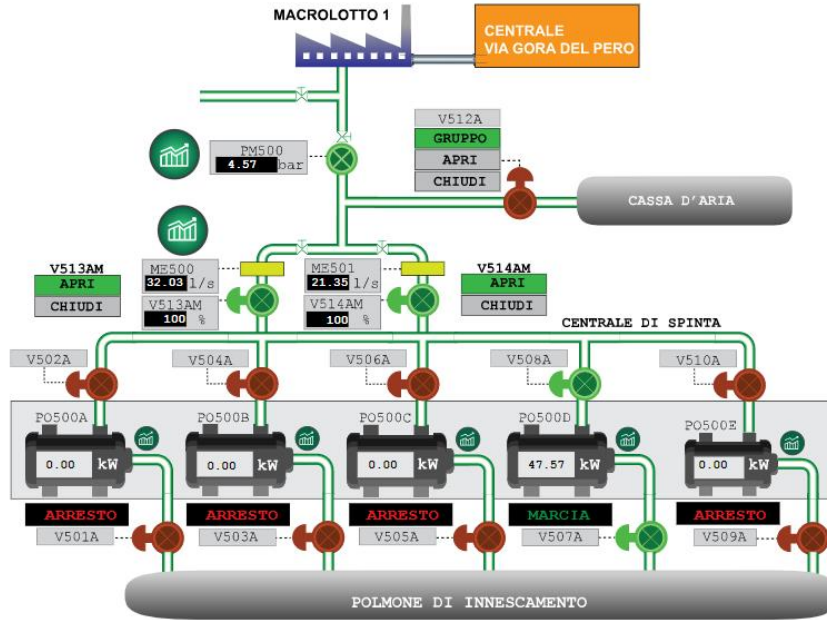
### Prato

Nuvoloso 16°C / 21°C

Gio 17 Ott 12°C / 21°C Nuvoloso	Ven 18 Ott 11°C / 22°C Nuvoloso	Sab 19 Ott Temp N/A Coperto	Dom 20 Ott Temp N/A Pioggia moderata o forte
---------------------------------------	---------------------------------------	-----------------------------------	--

tusc\_weather\_sensor\_o... [8m] Pressione - GIDA [8m] Umidità - GIDA [8m]

# 13.4°C 1020 bar 87%



# 5G





# Smart Lonato del Garda

Sat 9 Nov 17:20:59

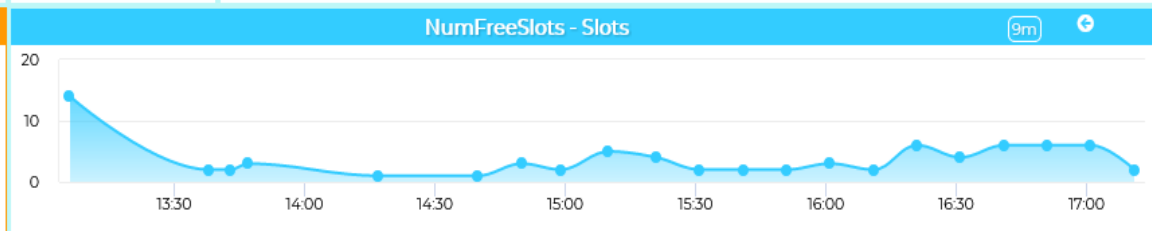
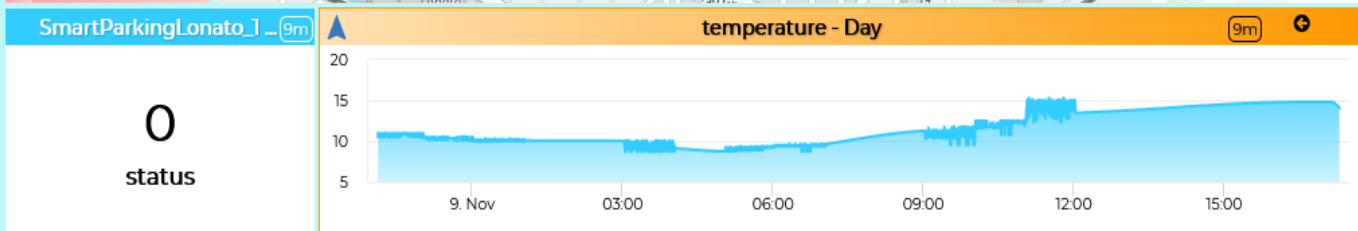
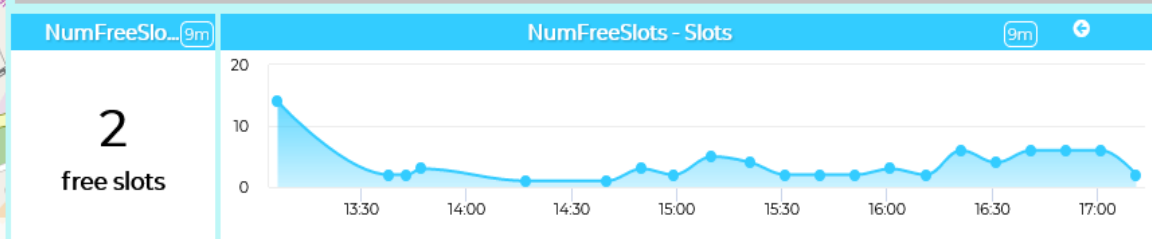
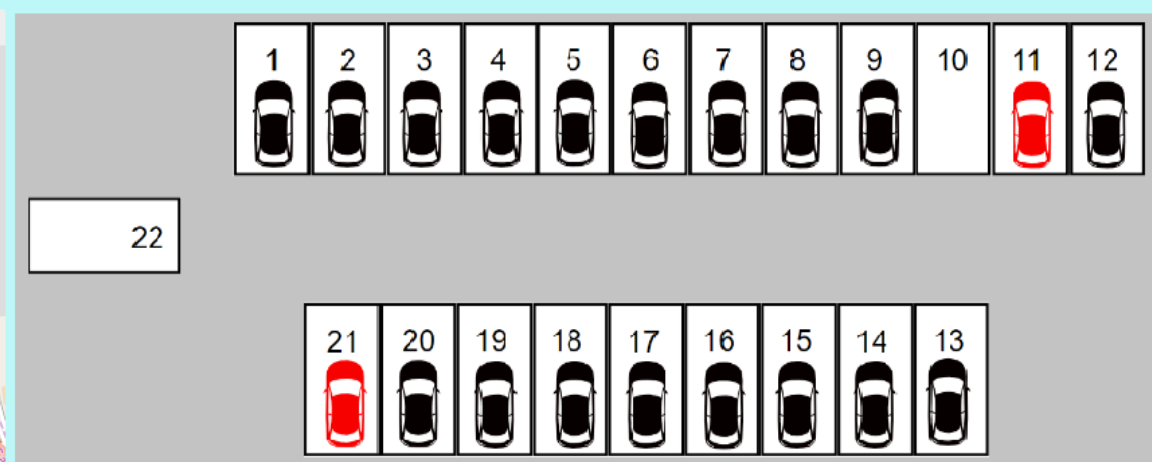
- ▲ Slot 1
- ▲ Slot 2
- ▲ Slot 3
- ▲ Slot 4
- ▲ Slot 5
- ▲ Slot 6
- ▲ Slot 7
- ▲ Slot 8
- ▲ Slot 9
- ▲ Slot 10
- ▲ Slot 11
- ▲ Slot 12
- ▲ Slot 13
- ▲ Slot 14
- ▲ Slot 15
- ▲ Slot 16
- ▲ Slot 17
- ▲ Slot 18
- ▲ Slot 19
- ▲ Slot 20
- ▲ Slot 21
- ▲ Slot 22
- ▼ Environment
- ▲ other

Selector - Map

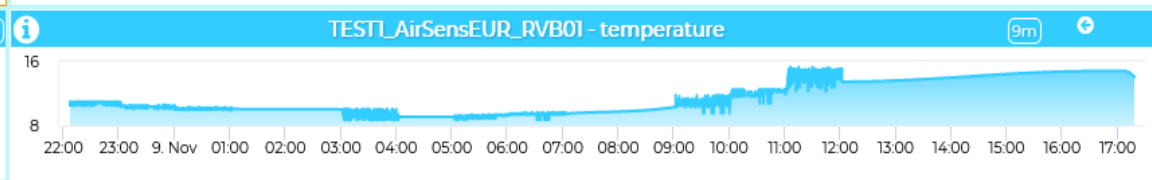
TEST1\_AIRSENSEUR\_RVB01

VALUE NAME: TEST1\_AIRSENSEUR\_RVB01

	DETAILS	DESCRIPTION	RT DATA			
dateObserved	4:18:33 PM	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 day
humidity	66.347755	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 day
pressure	987.0833	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 day
temperature	14.078355	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 day



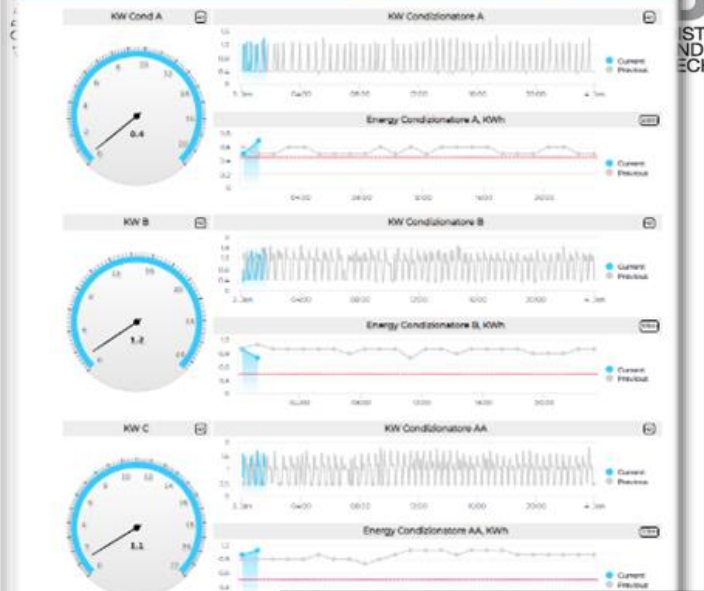
<p>pressure (9m)</p> <p style="font-size: 2em; font-weight: bold;">987.1</p> <p>mm</p>	<p>humidity % (9m)</p> <p style="font-size: 2em; font-weight: bold;">66.3</p> <p>%</p>	<p>temperature (9m)</p> <p style="font-size: 2em; font-weight: bold;">14.1</p> <p>C</p>
--	--	---



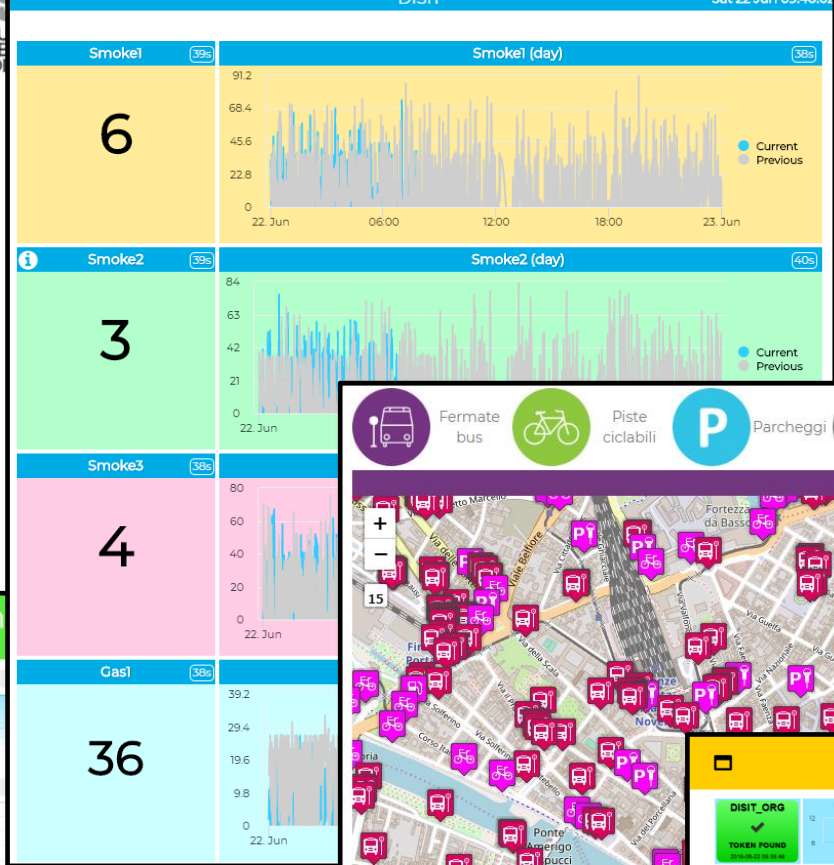
<p>Slot ID (9m)</p> <p style="font-size: 2em; font-weight: bold;">14</p> <p>slot ID</p>	<p>Max Present Duration (9m)</p> <p style="font-size: 1.5em; font-weight: bold;">19 ore e 11 minuti</p>
---	---



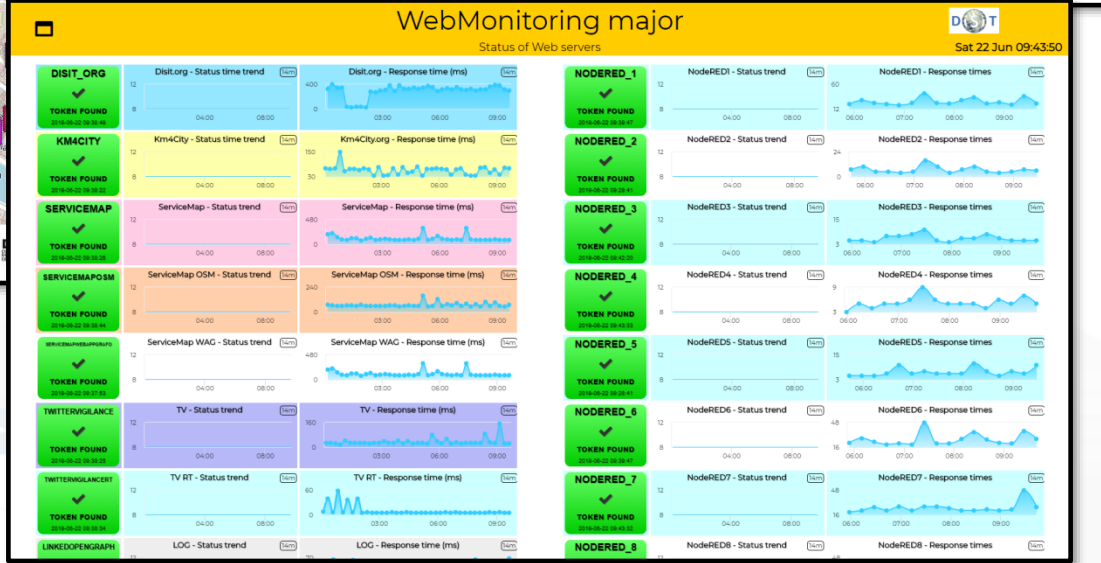
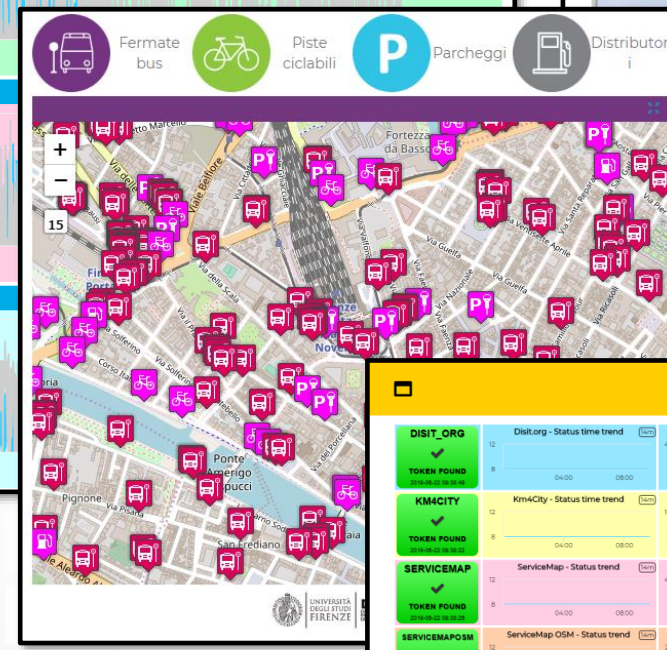
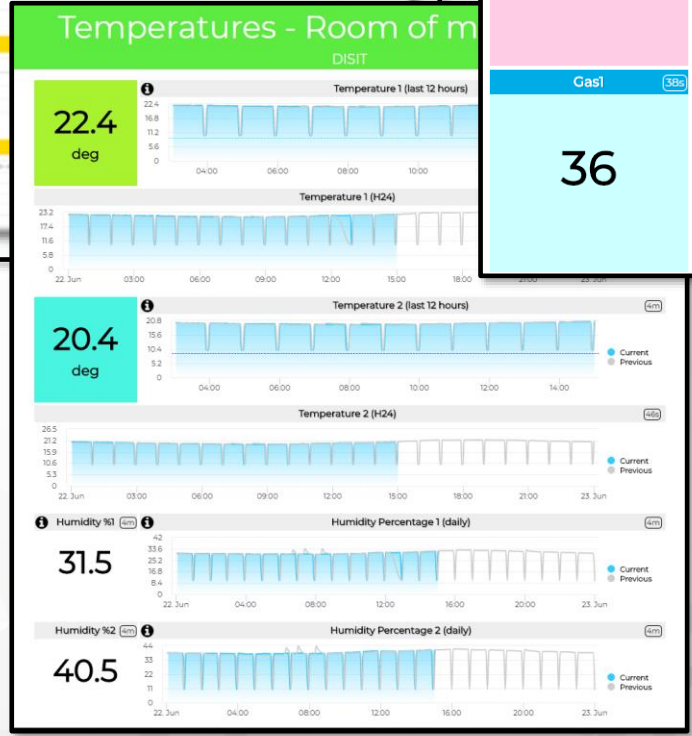
# Datacenter Energy Consumption



# DataCenter gas and smoke (mobile)



# Snap4City - Buttons with images

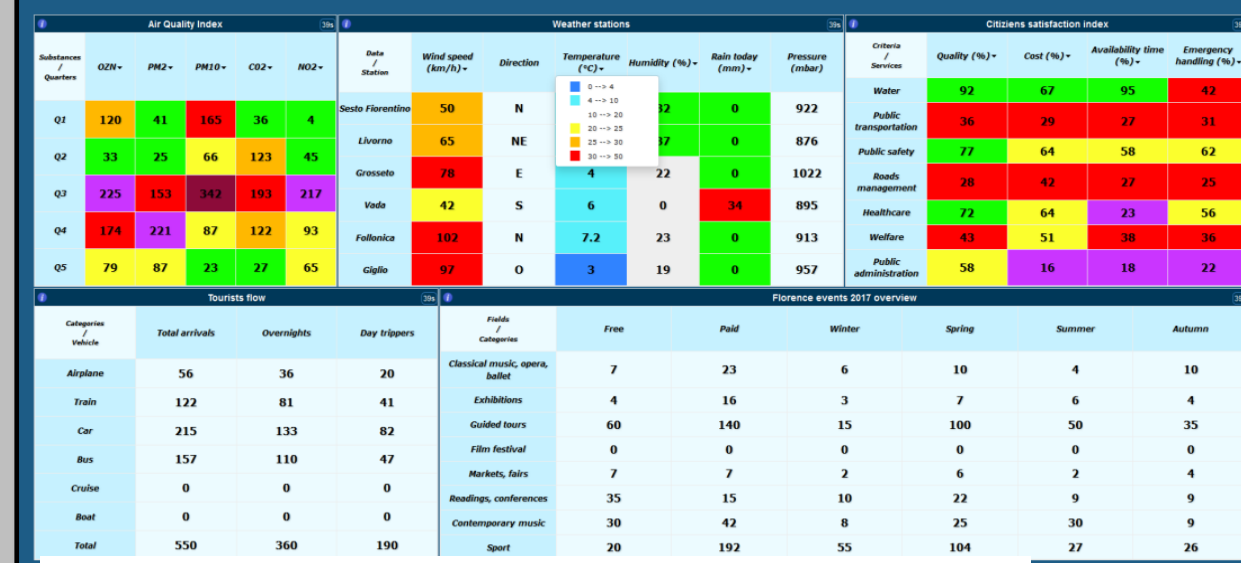




# Florence data overview

A table based overview over city main data

Wed 18 Jan @ 19:19:10

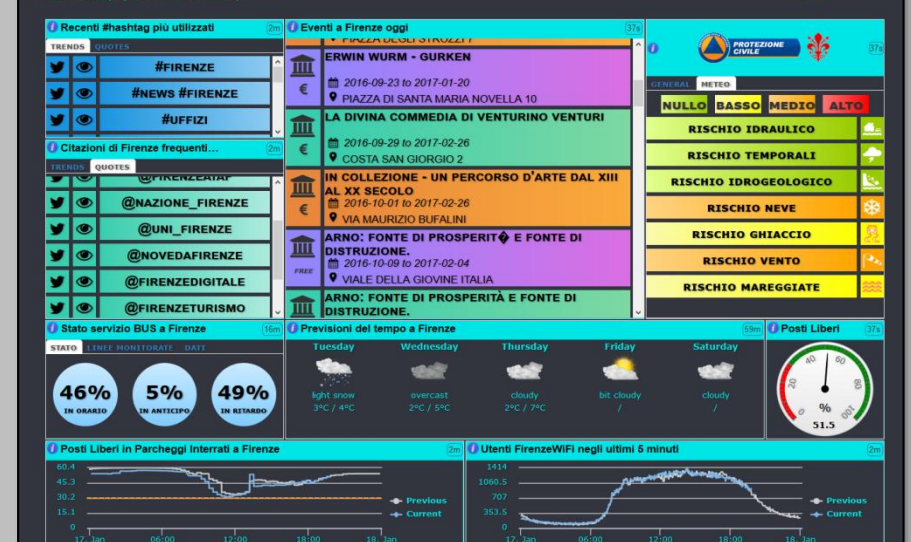


<https://main.snap4city.org/view/index.php?iddashboard=Nzc=>

# Servizi agli Utenti

Firenze (sperimentale)

Tue 17 Jan @ 19:52:49

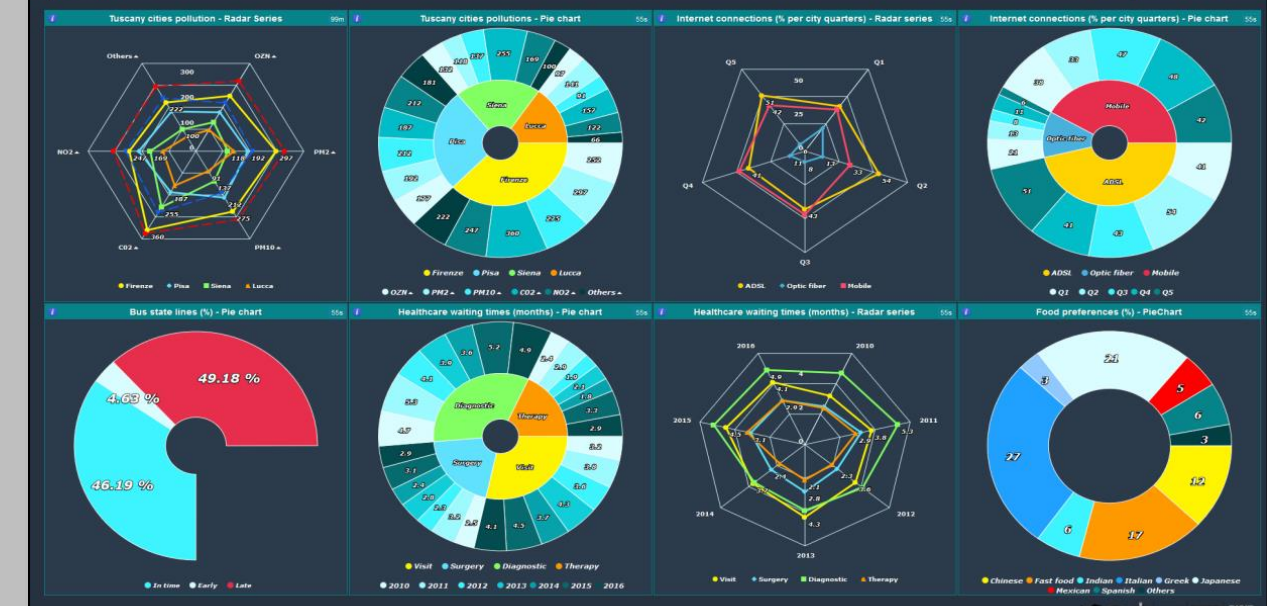


<https://main.snap4city.org/view/index.php?iddashboard=NjQ=>

# Smart City Data Overview 2

Sperimentale

Thu 16 Mar @ 02:24:52



<https://main.snap4city.org/view/index.php?iddashboard=MTAw>

# Smart City Data Overview

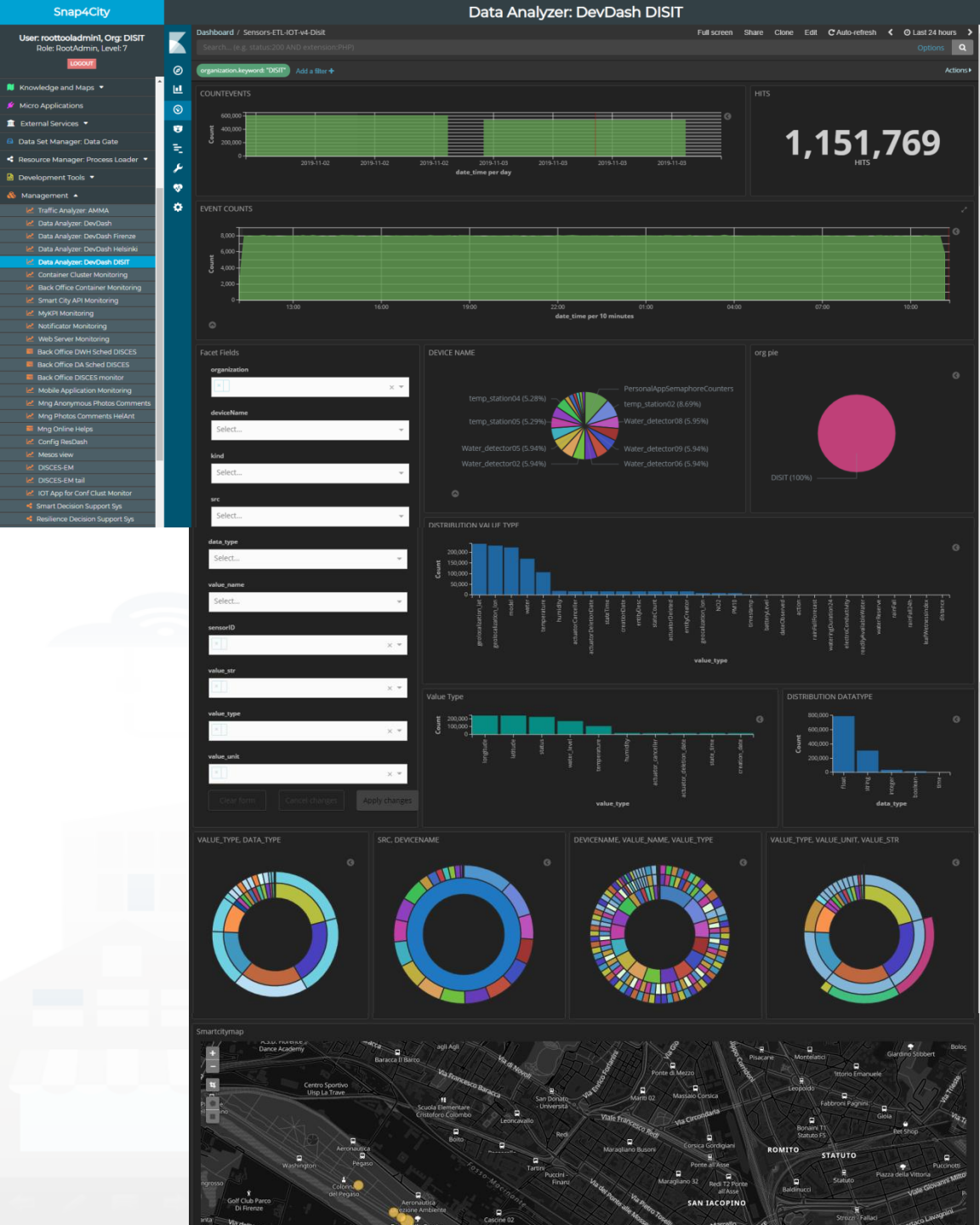
Sperimentale

Thu 16 Mar @ 02:23:38



<https://main.snap4city.org/view/index.php?iddashboard=ODM=>





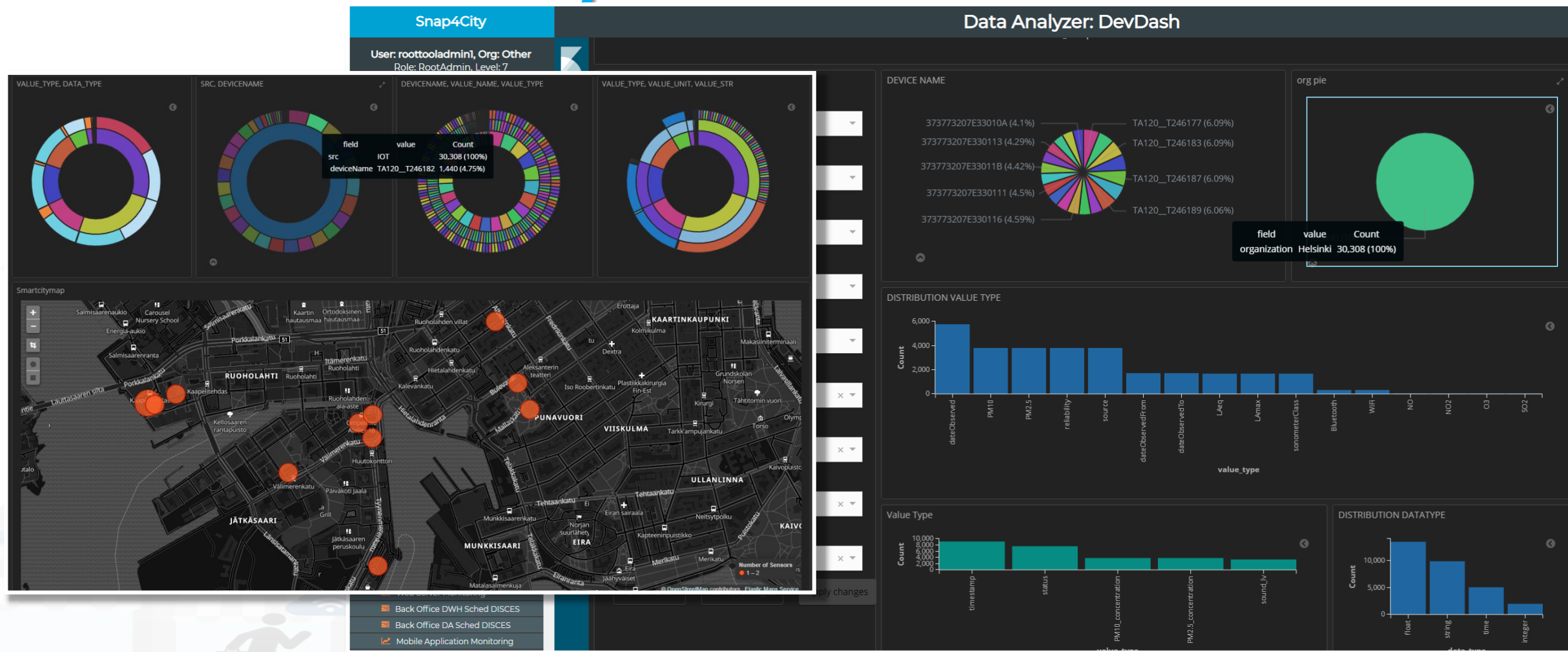
# Operator Business Analysis Dashboards: DevDash, AMMA

- Dynamic Filtering, Adaptable, ...
- Full data details, drill down,...
- Synergic with **Data Inspector** which addresses data relationships, processing and information



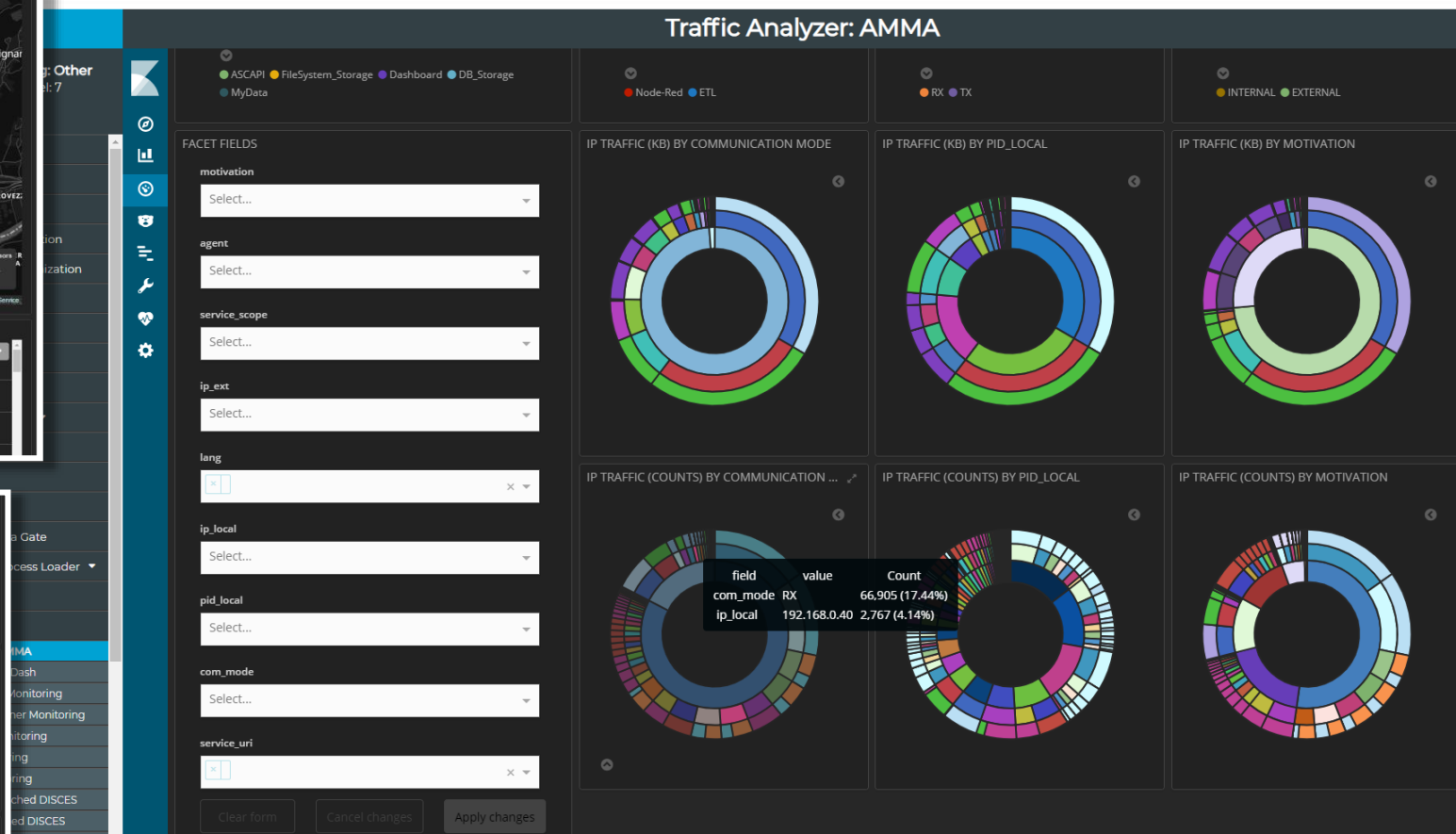
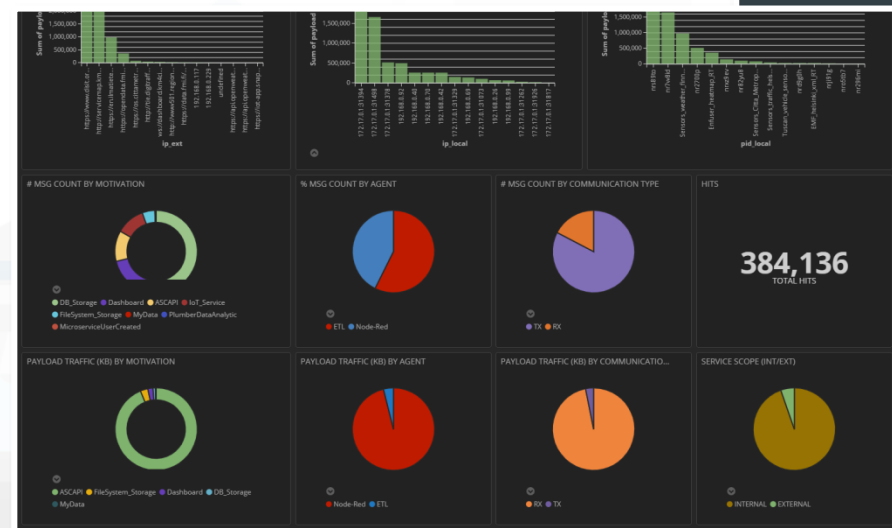
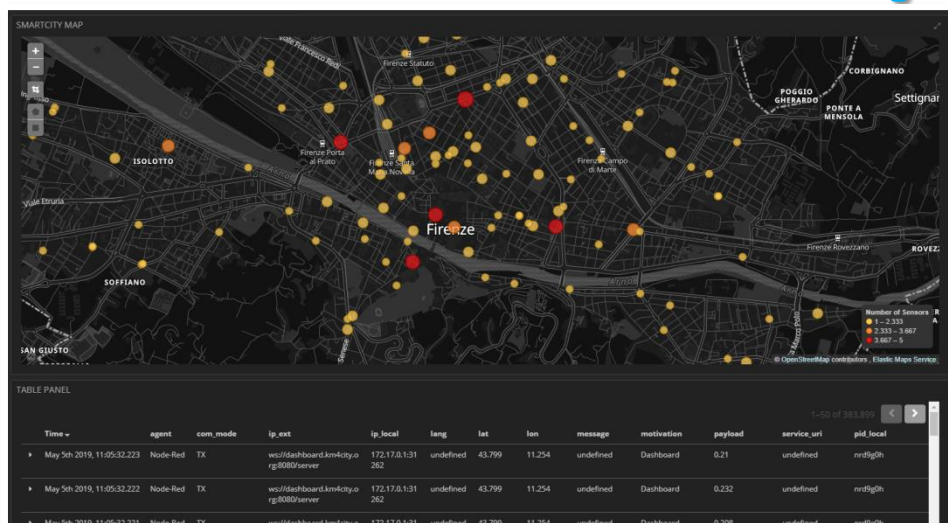


# DevDash by Elastic Search + Kibana





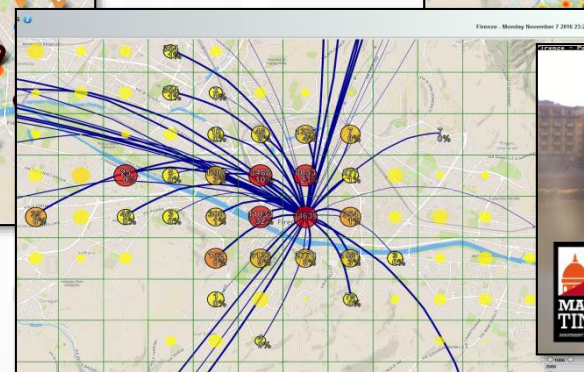
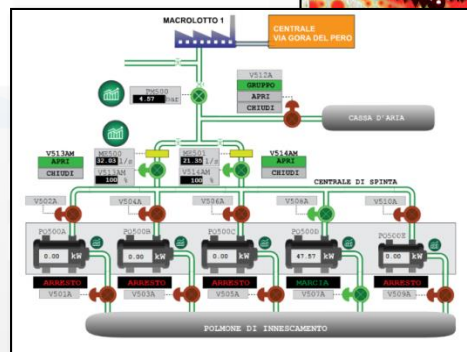
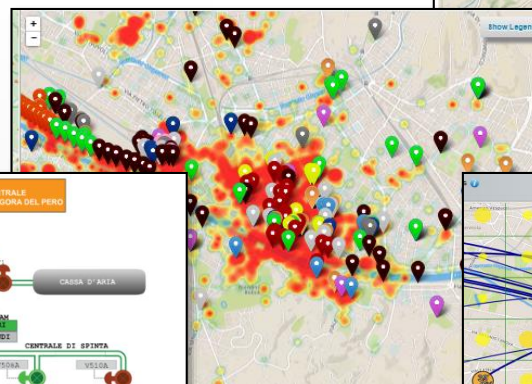
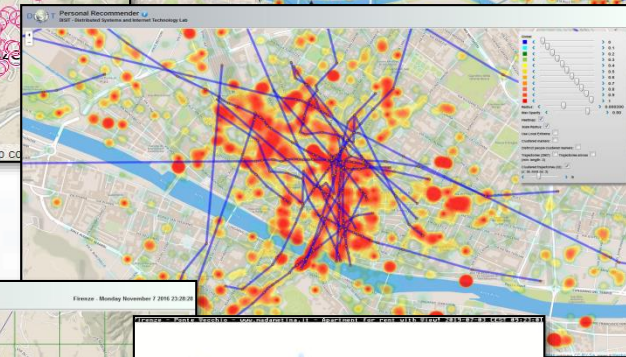
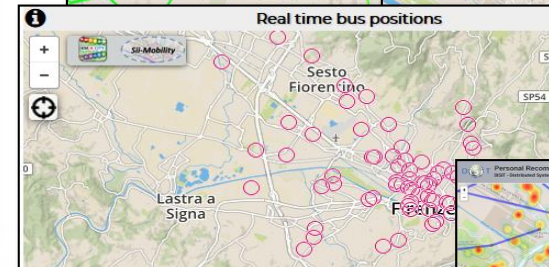
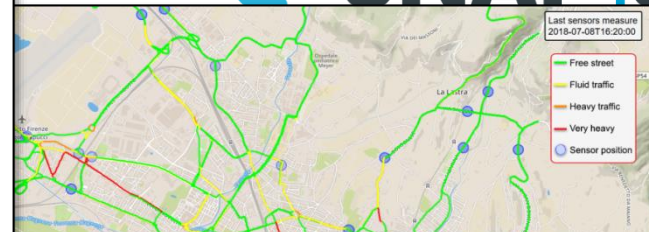
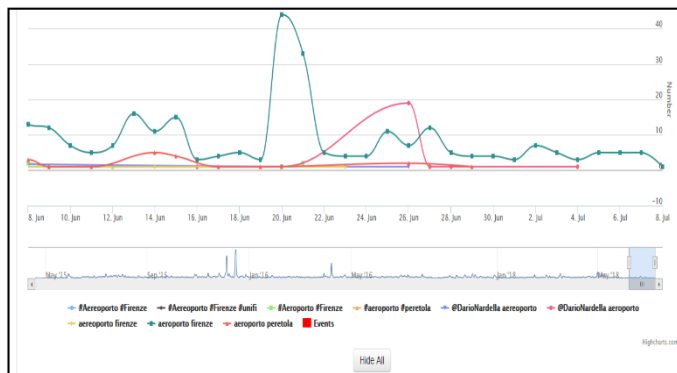
# AMMA by Elastic Search + Kibana





# External Services

- Twitter Vigilance:
  - Daily and real time
  - Volume and sentiment analysis
- Services on Maps, GIS, ArcGIS
- Real time sensors on 3D
- Web HTML5 Applications
- Origin Destination Matrix
- Real Time fleets
- Routing, Multimodal tools
- IPCAM connector
- Synoptics
- **Third party tools!**
- .....
- **Other tools also internal**
  - Traffic Flow Reconstruction
  - User behaviour monitoring
  - Tracking tools
  - Heatmaps tools
  - Trajectories tools





TOP

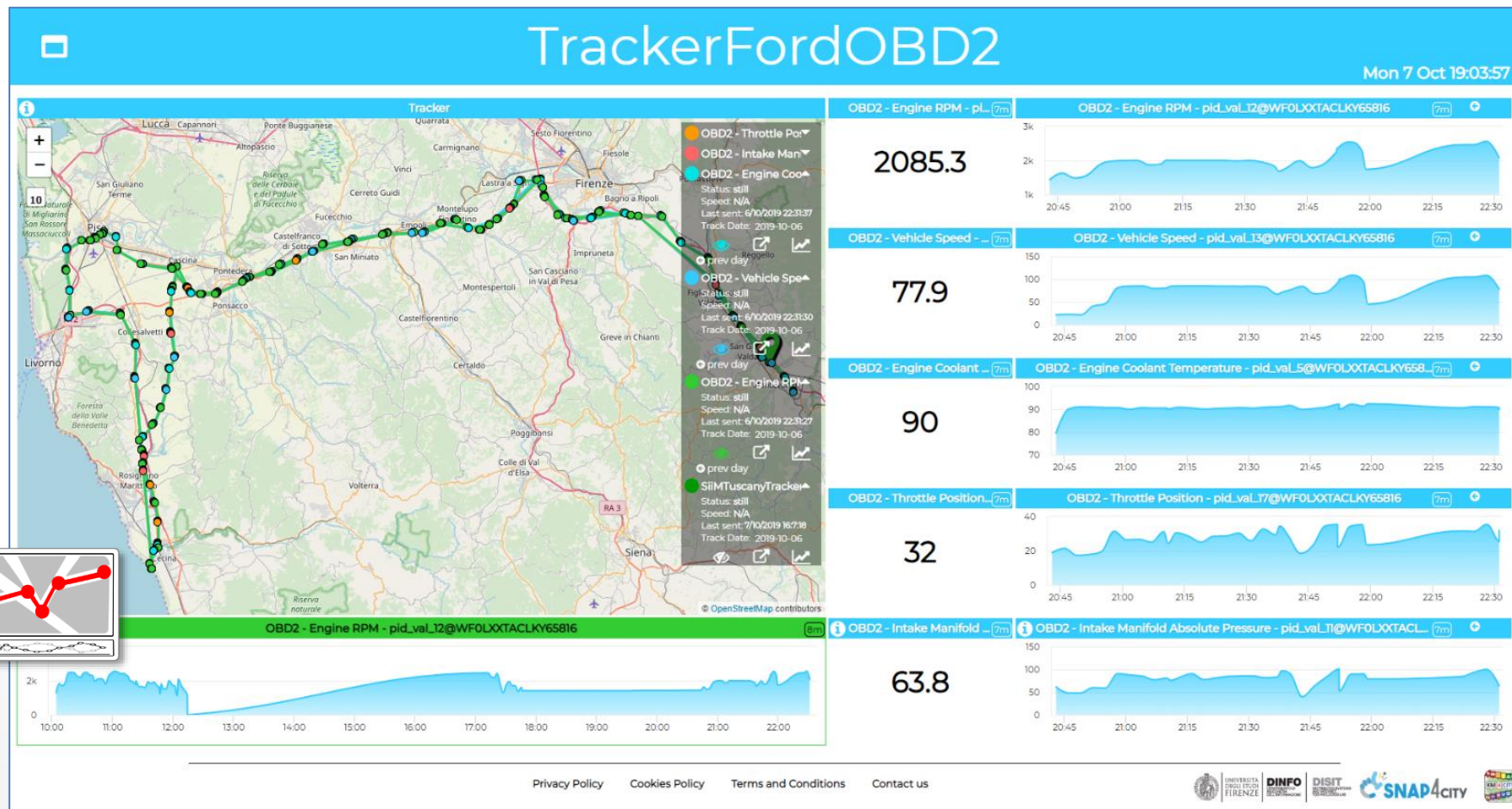
# Trajectories and Real Time Tracking



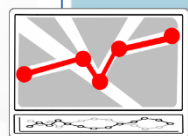


# MyKPI: Tracking of Devices and Mobiles

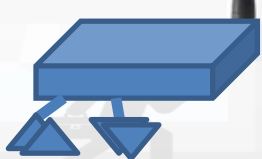
- Real Time Trajectories for
  - Mobile Phone
  - Moving IOT Devices
  - OBU, Vehicular Kits
  - Multiple tracks
  - Day by day
- Micro Application



Apps



OBU



Mobile  
PAX Counter



OBD2



# Real Time Tracking

## From mobile app:

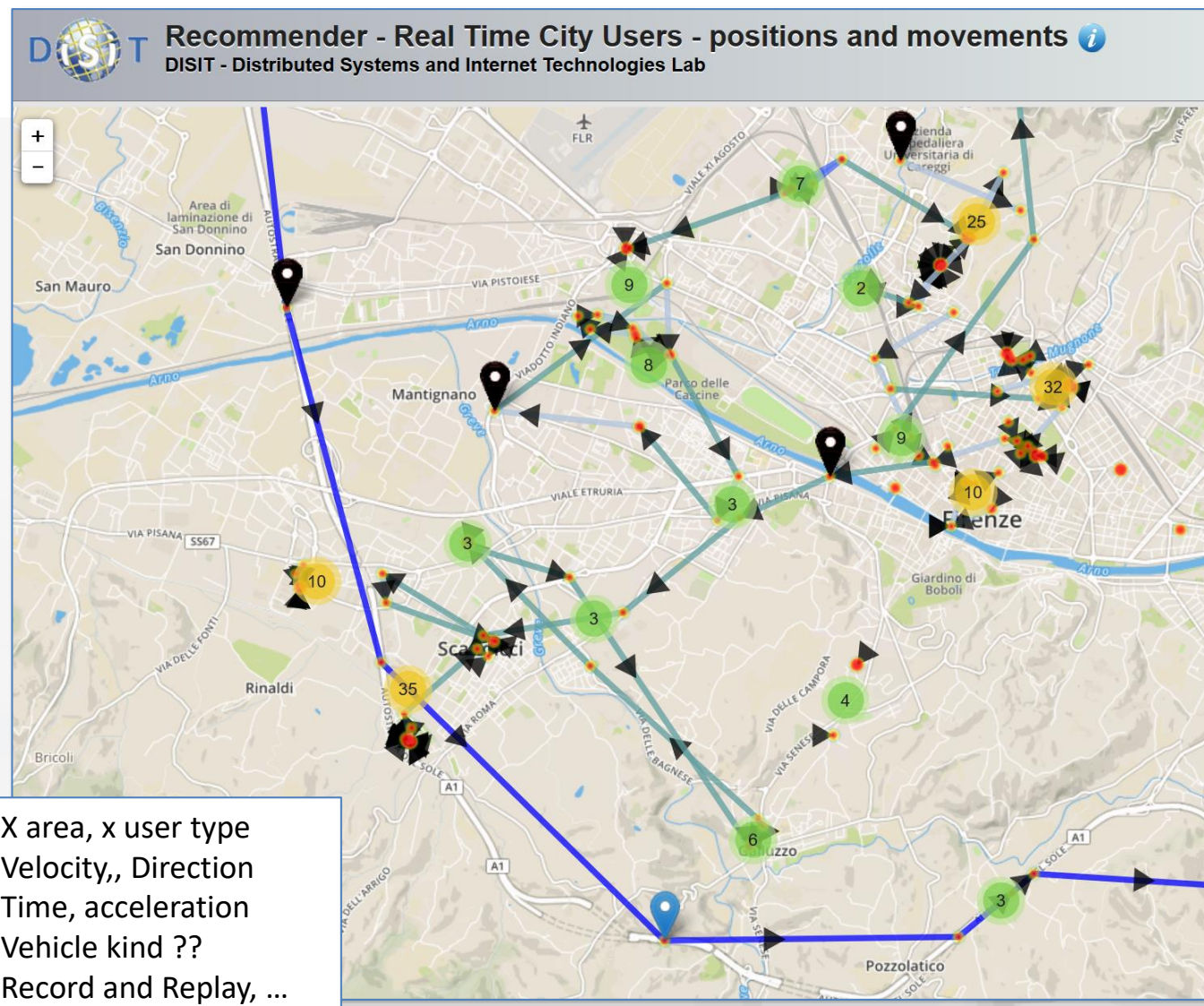
- Resolving GPS location: GPS, cells, wifi-network, ... mixt
- Noisy, different kind of devices, ...
- Smart algorithm on devices for location acquisition
- Anonymized data, terms of use on mobile

## Filtering:

- GPS Accuracy, kind of measure (GPS, mixt)
- Jump in time, space, velocity
- General noise (diff. devices)
- Knowledge of precision map

## Clustering:

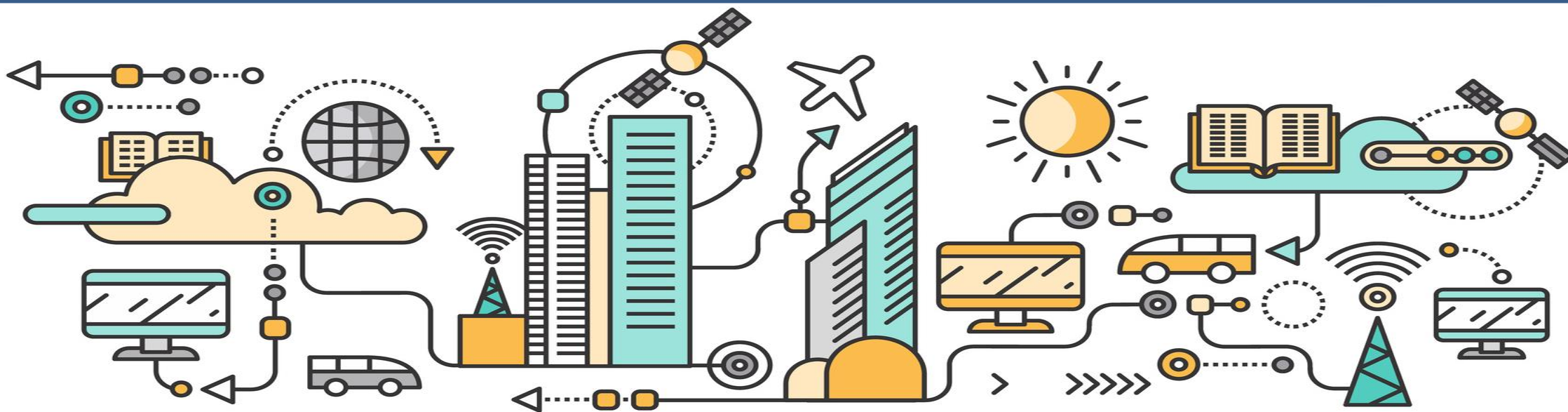
- time, space, user kind, etc.





TOP

# *Dashboards' Intelligence on Web and Mobile Devices*





# Snap4City: Builder of Sentient Cities Solutions

Dashboards with data driven IOT Applications enforcing intelligence

IOT and data World



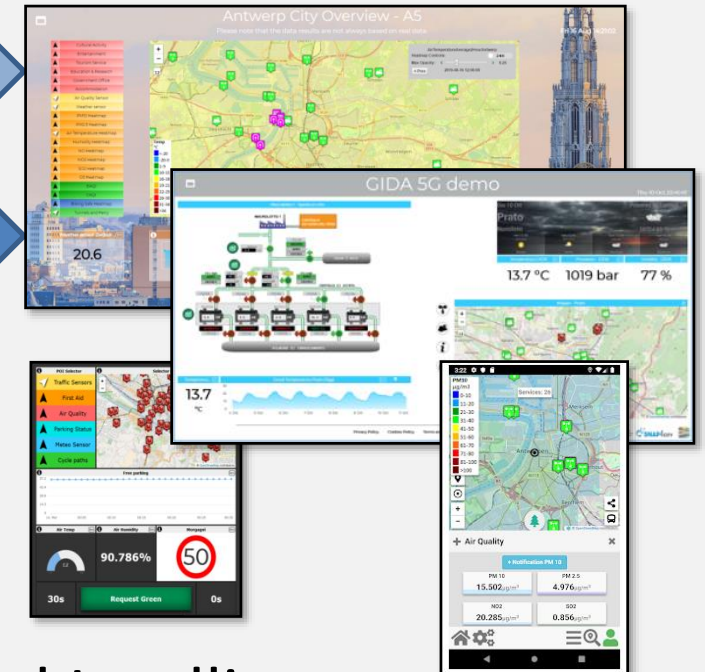
My IOT Devices

IOT Applications



Big Data Analytics, Artificial Intelligence

Dashboards and Apps

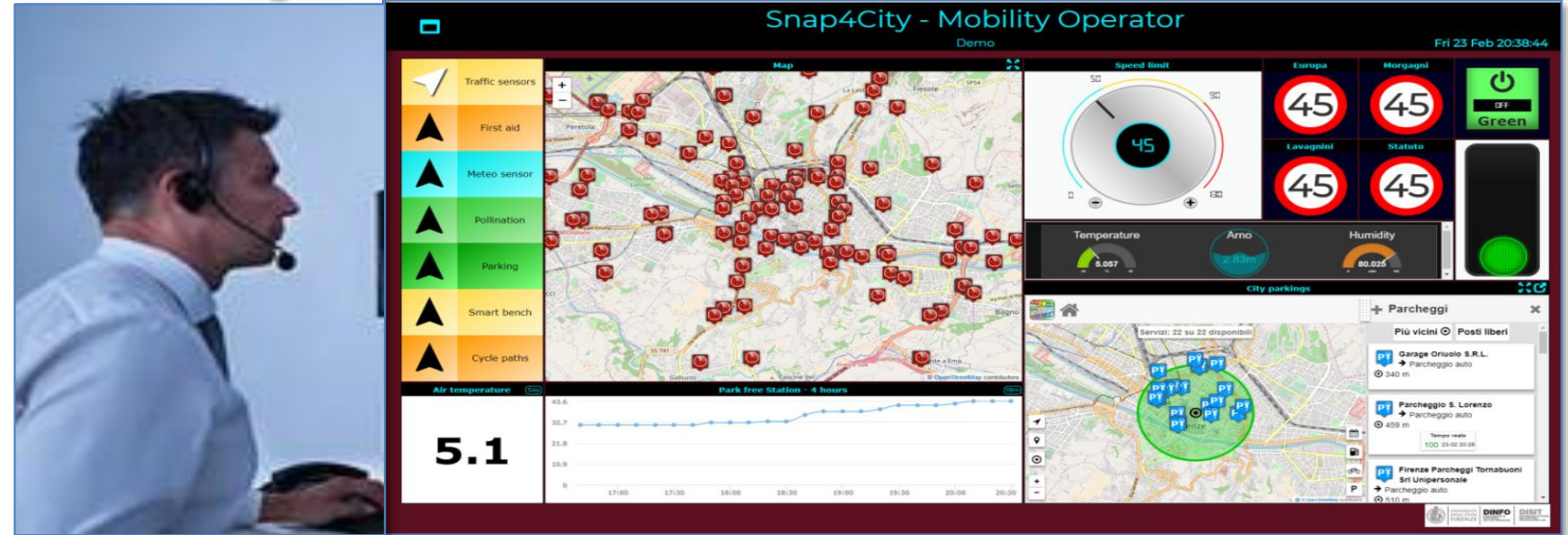




## Control Room Operator

Would like to:

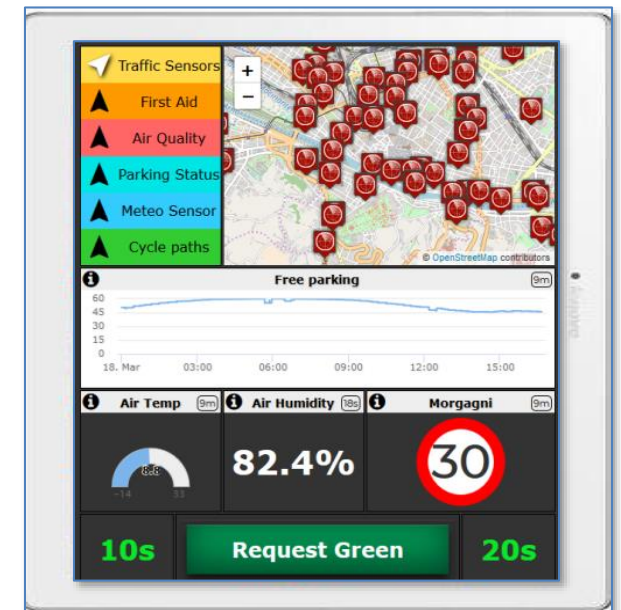
- **Monitor** traffic flow, Environment, Car parking, Cycling, First aid, temp., ...
- **Act and monitor** Dynamic Plates
- **Act and monitor** red lights



## Driver, Policeman

Would like to:

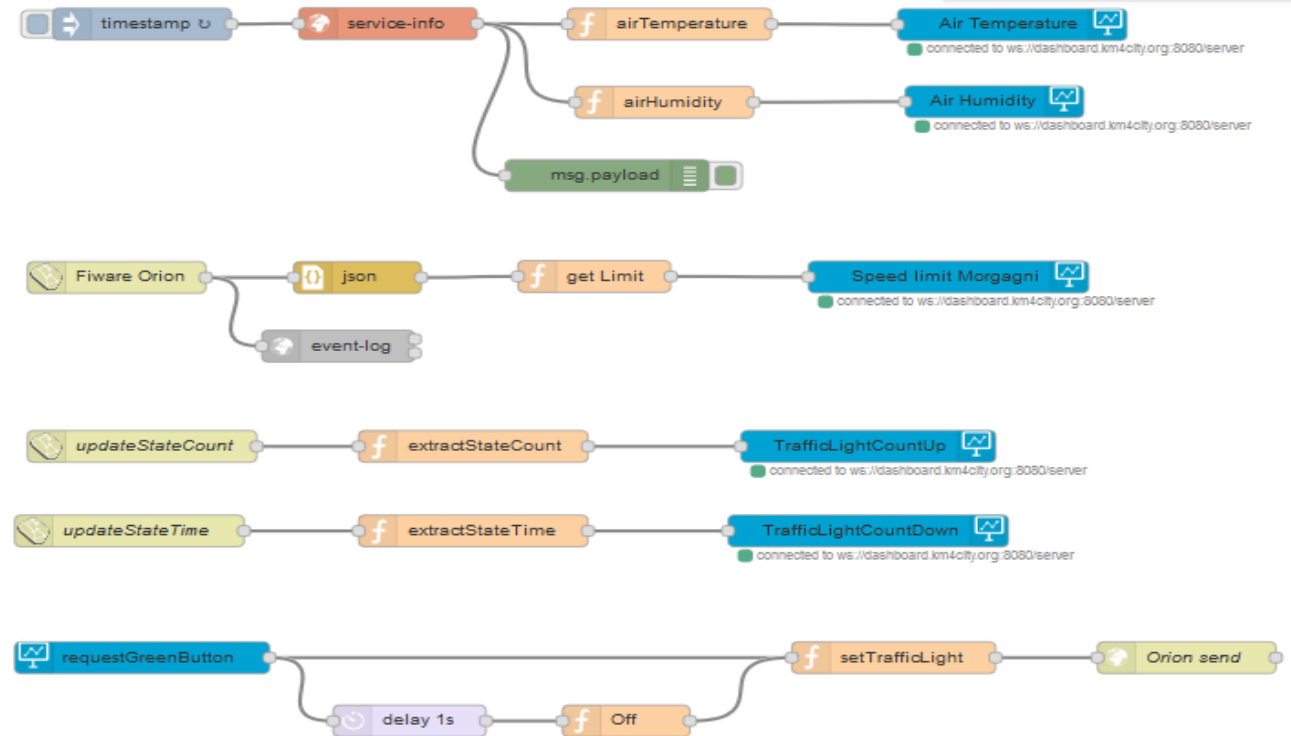
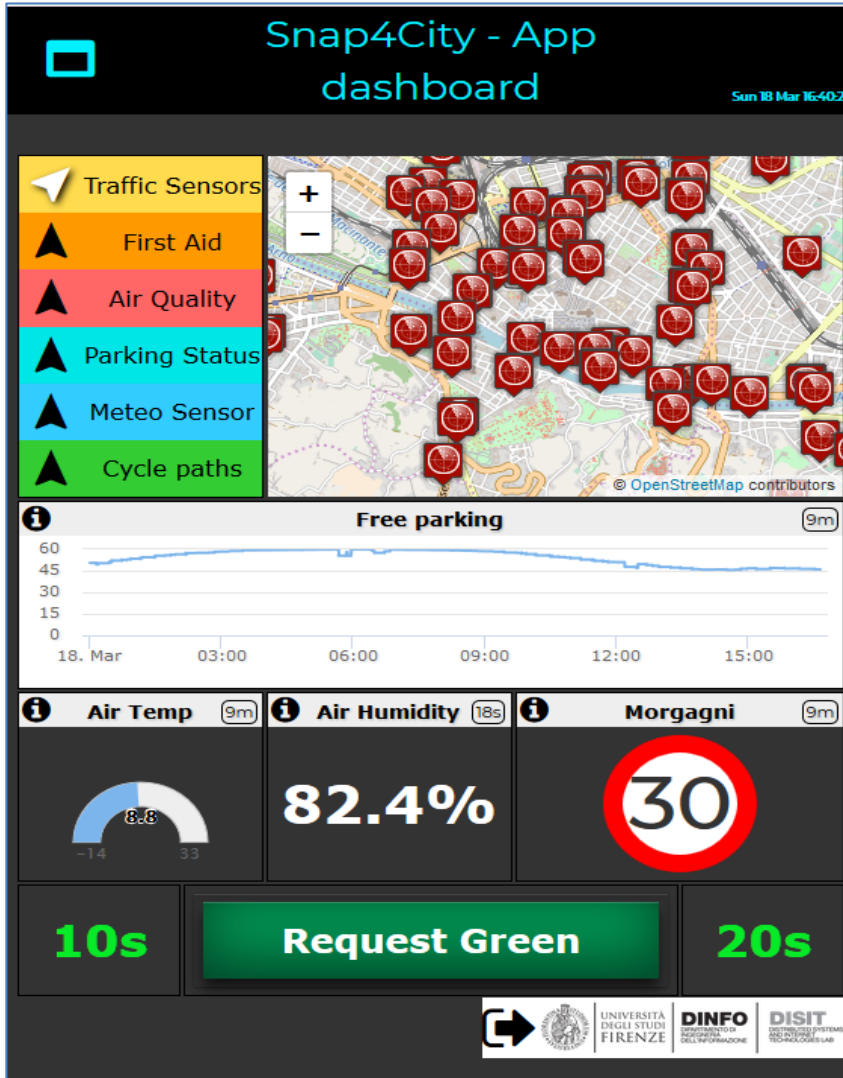
- **Monitor** traffic, Parking, env., speed limit, ...
- **Act and monitor** red lights





# IOT Application with City Dashboard

## Simple development



- Virtual Sensors and Virtual Actuators
- From Dashboard to IOT App and viceversa
- From Dashboard to IOT Brokers/Devices and viceversa

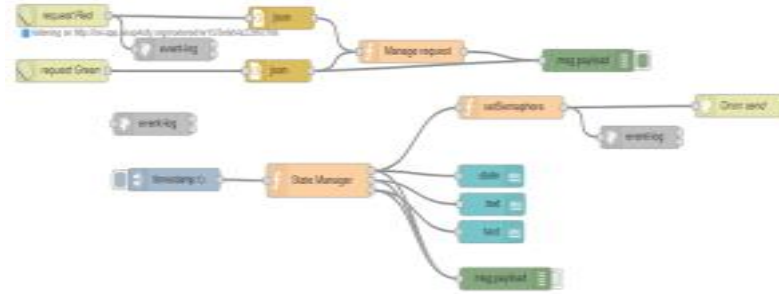


Traffic Sensors  
 First Aid  
 Air Quality  
 Parking Status  
 Meteo Sensor  
 Cycle paths

Free parking

Air Temp: 8.8°C  
 Air Humidity: 82.4%  
 Morgagni: 30

10s Request Green 20s



Snap4City - Mobility Operator

Speed limit: 45

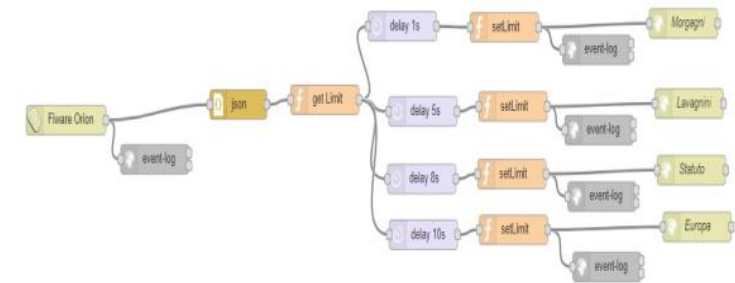
Temperature: 5.057°C  
 Humidity: 80.02%

City parkings: 22 su 22 disponibili

Parcheggi: Più vicini Posti liberi

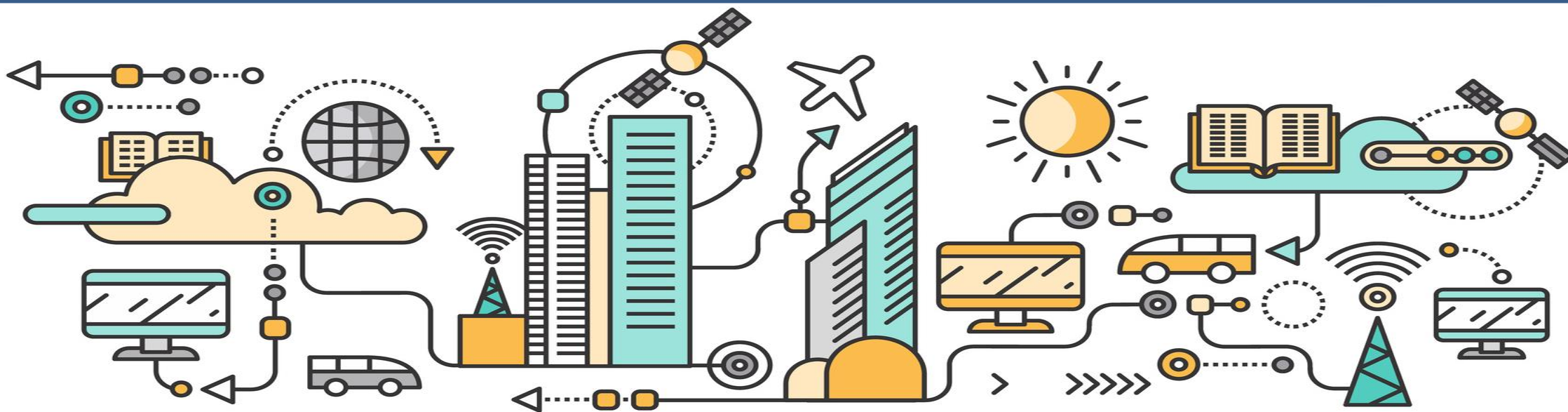
- Garage Oriuolo S.R.L. - Parcheggio auto - 340 m
- Parcheggio S. Lorenzo - Parcheggio auto - 459 m
- Firenze Parcheggi Tornabuoni Srl Impersonale - Parcheggio auto - 510 m

Air temperature: 5.1





# Smart City Control Room





# Citizens Engagement

Fri 6 Sep 16:58:10



- 
- Twitter Hashtags
- #FIORENTINA
  - #FIRENZE
  - #UFFIZI
  - #PONTEVECCHIO
  - #ACCADEMIA
  - #BARGELLO
  - #AEROPORTO #FIRENZE
  - #AEREOPORTO #FIRENZE

- 
- Twitter Chatrooms
- @NAZIONE\_FIRENZE
  - @DISCOVERTUSCANY
  - @UNI\_FIRENZE
  - @NOVEDAFIRENZE
  - @PROTCIVCOMUNEFI
  - @BNCFIRENZE
  - @MUSEONOVECENTO
  - @FIRENZEDIGITALE
  - @PITTI\_IMMAGINE

Civil Protection Alerts - Protezione Civile

NULLO BASSO MEDIO ALTO

- RISCHIO IDRAULICO
- RISCHIO TEMPORALI
- RISCHIO IDROGEOLOGICO
- RISCHIO NEVE
- RISCHIO GHIACCIO
- RISCHIO VENTO
- RISCHIO MAREGGIATE

First Aid - Careggi

Red code	Yellow code	Green code	Blue code	White code
7	7	57	23	9

First Aid - Torregalli

Red code	Yellow code	Green code	Blue code	White code
0	0	0	0	0

- Emergency
- Information
- Help
- Home

<https://www.snap4city.org/511>





# MAPPA FIRENZE

Fri 19 Oct 17:24:39

**DETAILED METRICS**  
Last update: 2016-10-19 17:24:02:00

Description	Last value	Last 24 hours	Last 7 days	Last 30 days
Avg Time	53.26	Last 24 hours	Last 7 days	Last 30 days
Concentration	74.4	Last 24 hours	Last 7 days	Last 30 days
Vehicle flow	317.0	Last 24 hours	Last 7 days	Last 30 days
Average Rainfall	5.0	Last 24 hours	Last 7 days	Last 30 days

Concentration - 7 days

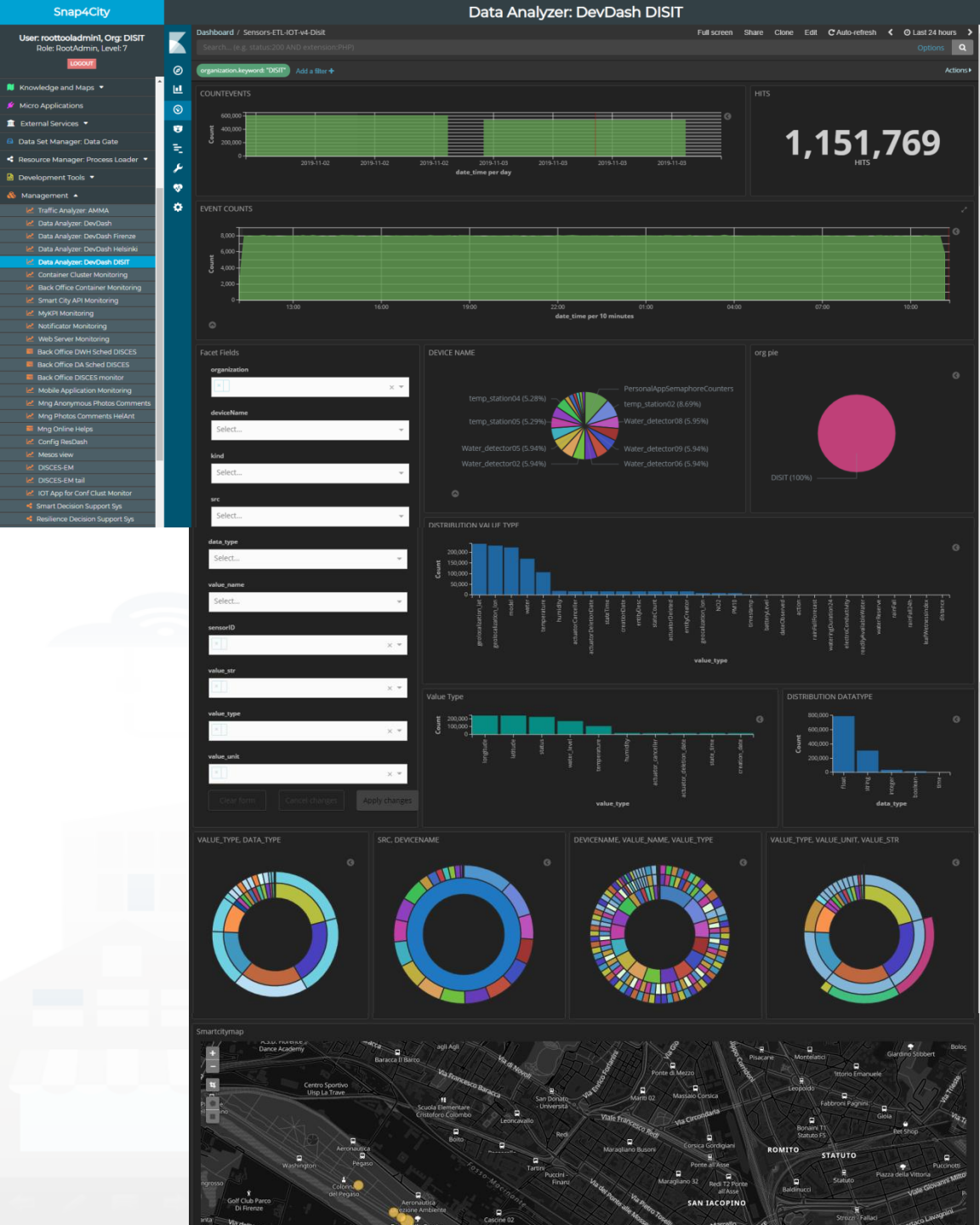




# Chemical Plant Dashboard Green Impact Capacity (GIC) Altair Control room







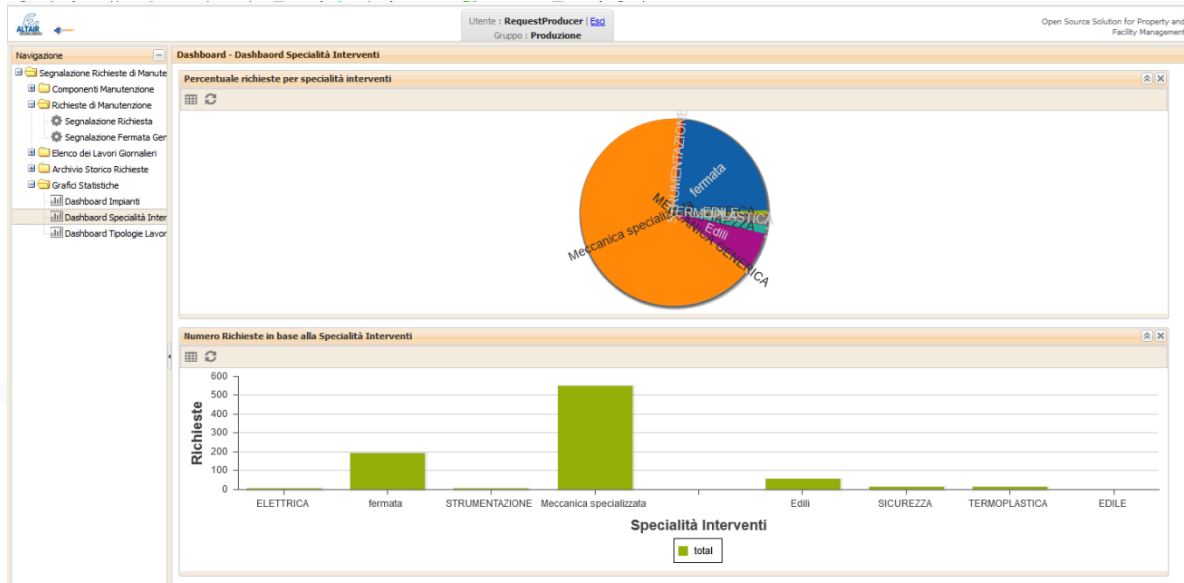
# Operator Business Analysis Dashboards: DevDash, AMMA

- Dynamic Filtering, Adaptable, ...
- Full data details, drill down,...
- Synergic with **Data Inspector** which addresses data relationships, processing and information

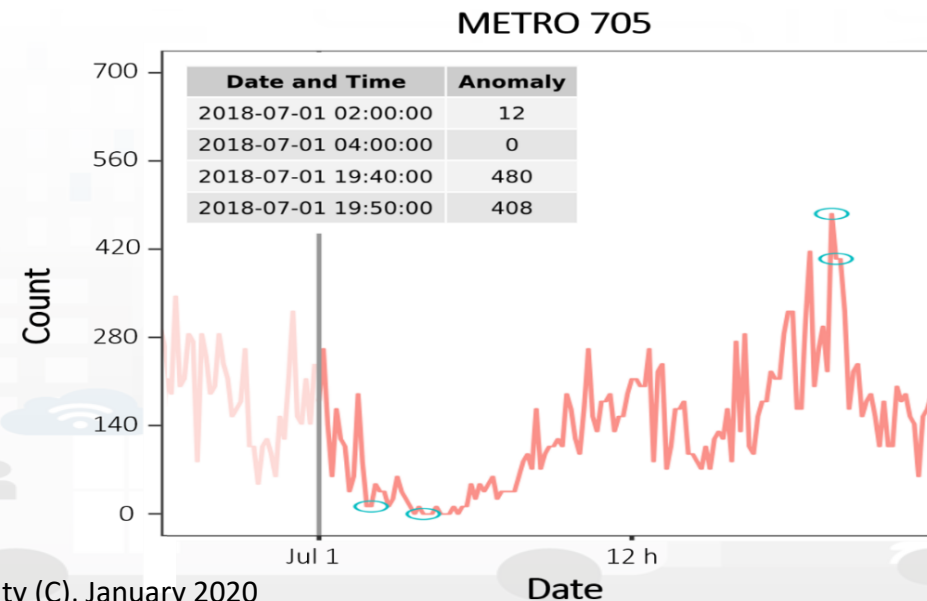




# Reports and Dashboards



# Anomaly detection Early Warning

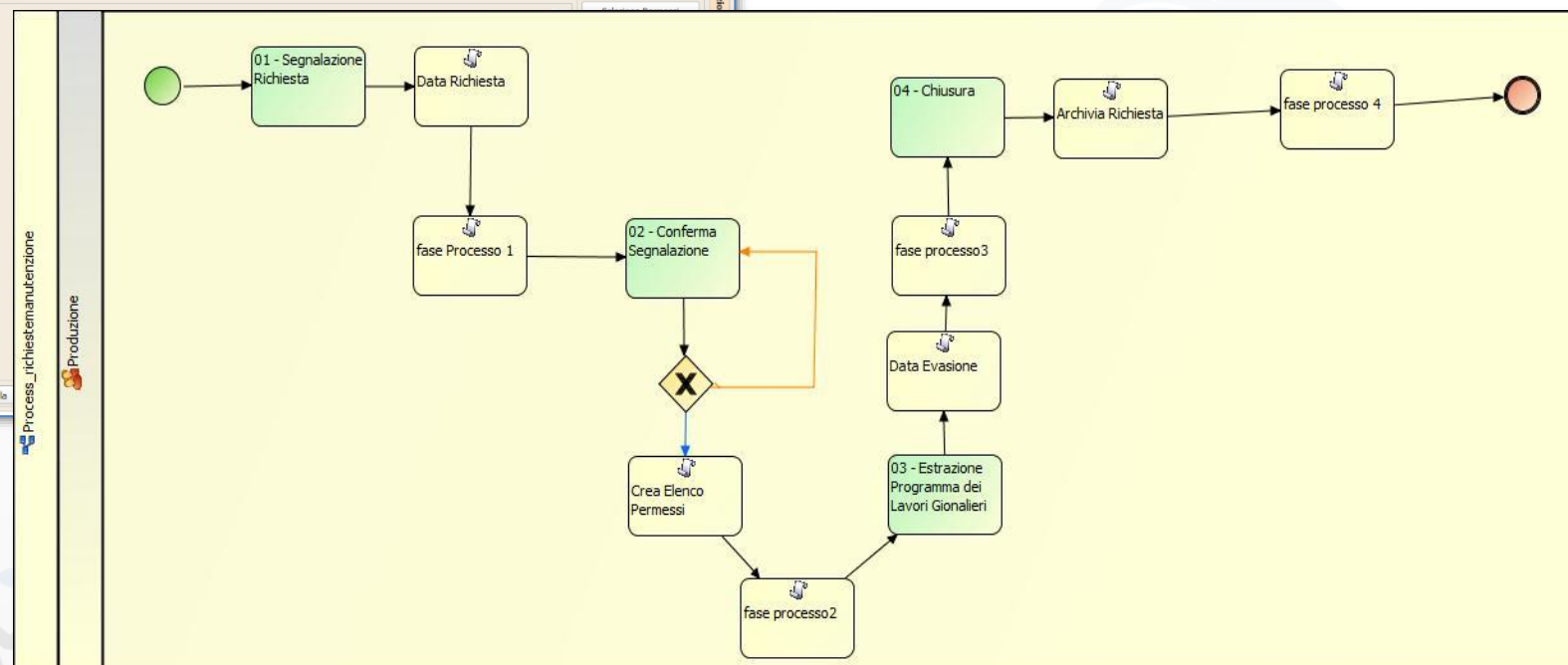




# Critical Events: ticket management

The screenshot shows the SNAP4CITY software interface. At the top, it displays the user 'RequestProducer' and the group 'Produzione'. The main area is a table titled 'Elenco - Segnalazione Richiesta' with columns for Id, Note, Apparecchiature, Impianti, Permessi di Lavoro, Specialità, priorità Intervento, Data Richiesta, Data Evazione, and Fase processo. Below the table, there is a detailed view of a request with fields for Impianti (ACIDO CLORIDRICO), Tipologia di Lavoro (ORDINARIO), and various filters and search options.

## Personalised Workflows





+ Add filter

- ABBATTIMENTO CLORO
- ACIDO CLORIDRICO
- ACQUA INDUSTRIALE
- ARIA SERVIZI E STRUMENTI
- CARBONATO DI POTASSIO
- CARICO PRODOTTI
- CICLO POTASSA CAUSTICA

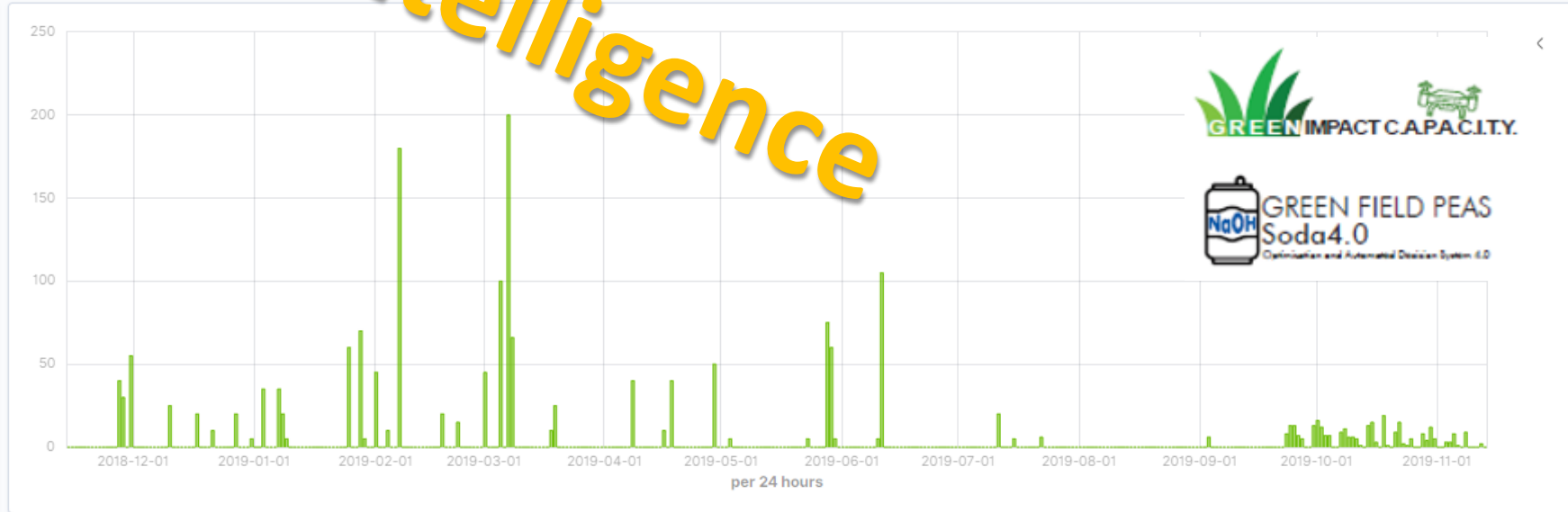
Impianto:  Specialità:  Tipologia Lavoro:  Siglatura:

**1,865** Numero di eventi nel periodo  
**264.491** 50th percentile of ore tra inizio e fine lavoro  
**673.151** Media ore passate tra inizio e fine lavoro

**CLORURO FERRICO STANDARD**  
**CARBONATO DI POTASSIO**  
 CICLO SALAMOIA IPOSODIO  
 IMPIANTO 3FC CARICO PRODOTTI



- CARBONATO DI P...
- CLORURO FERRIC...
- CICLO SALAMOIA
- ACIDO CLORIDRICO
- IPOSODIO
- IMPIANTO 3FC
- CARICO PRODOTTI
- POTASSA A SCAG...
- CLORURO FERRO...
- TAS
- CLORO PARAFFINA
- PRODUZIONE VA...
- SERVIZI
- CICLO POTASSA ...
- CICLO SALAMOIA...
- COCCINAZIONE



Maintenance Intelligence



TOP

# Web and Mobile App with Open Development Kit

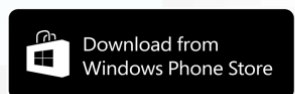
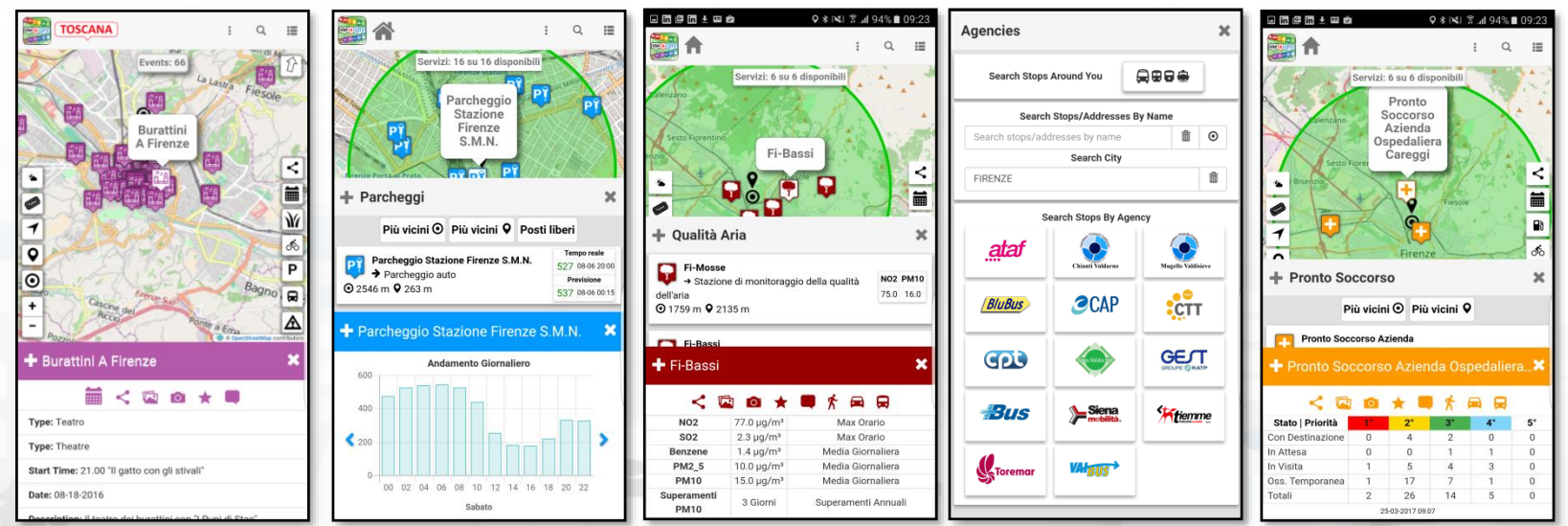
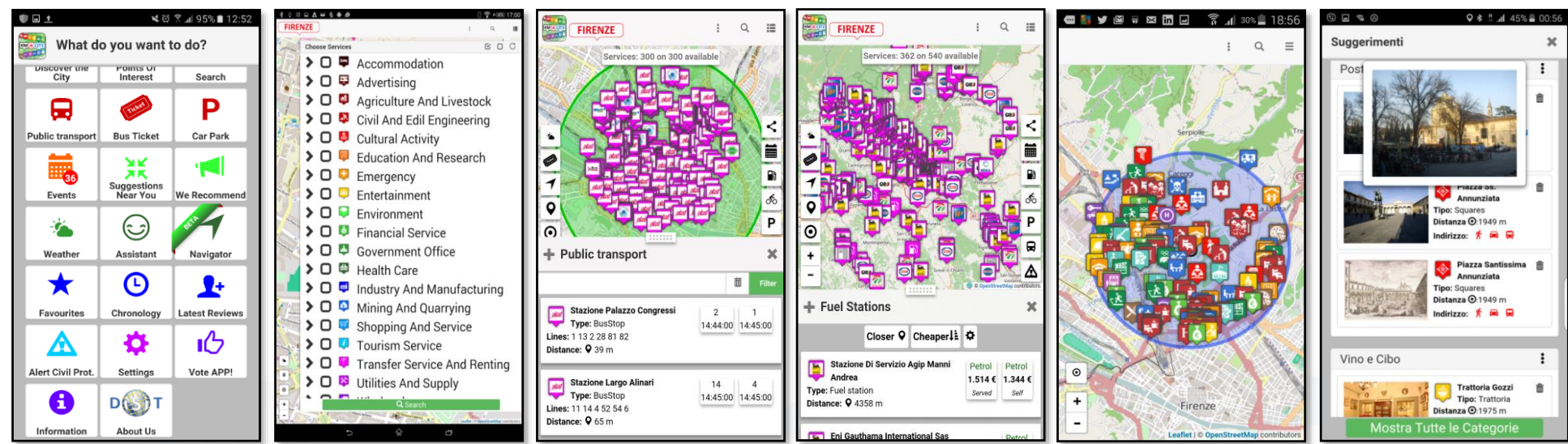




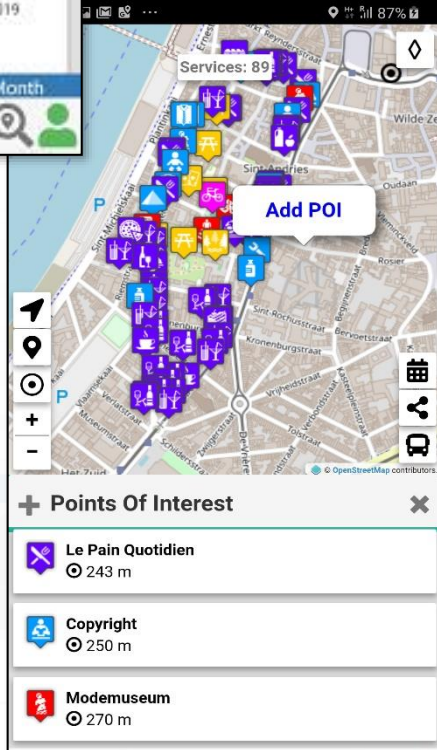
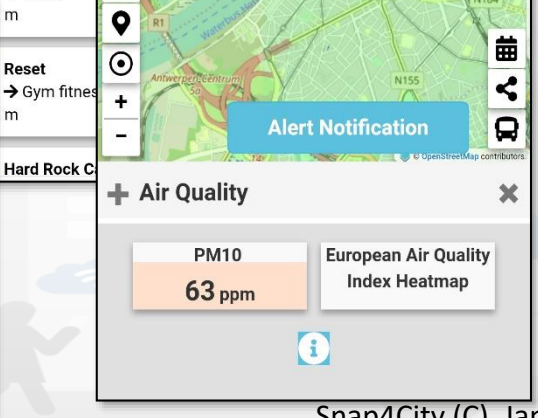
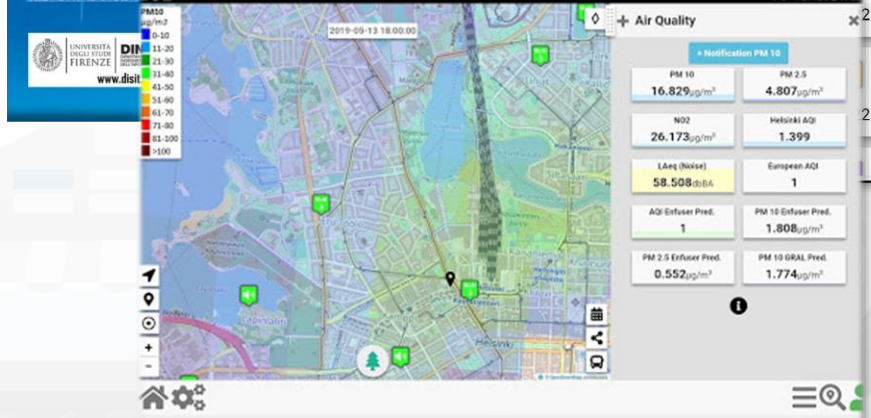
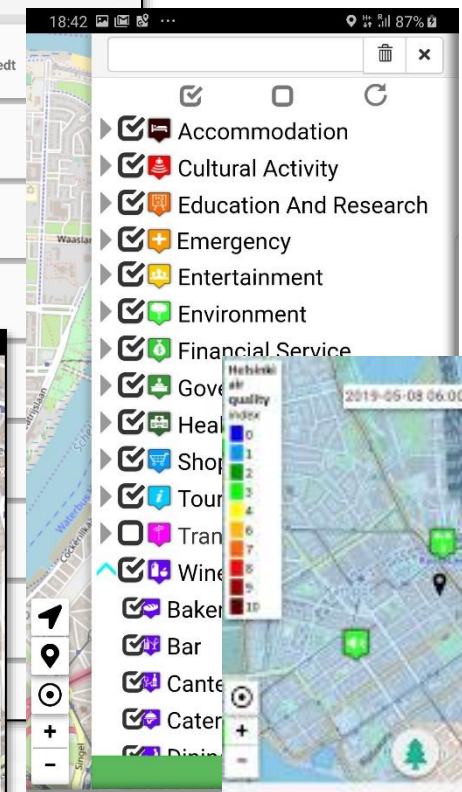
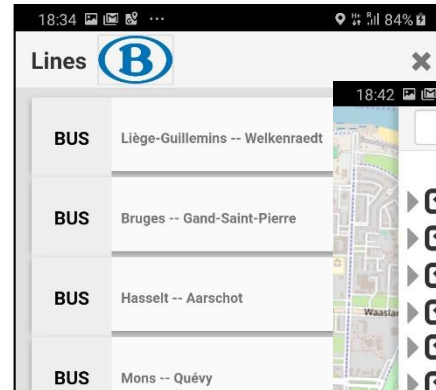
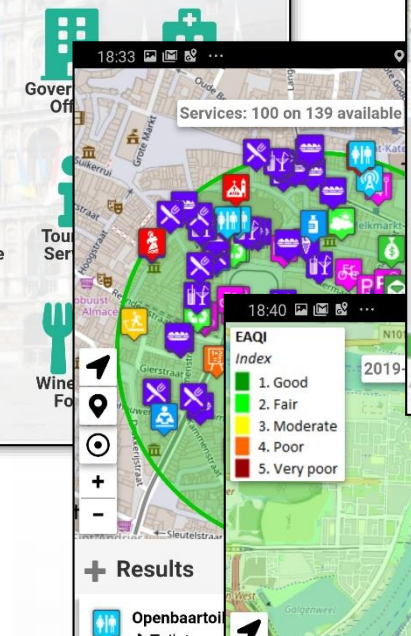
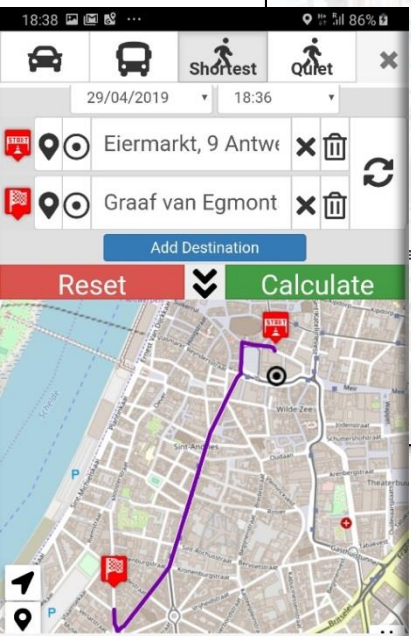
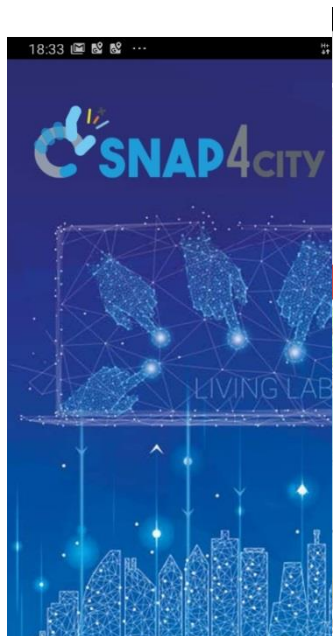
# Km4City APP



- Smart Parking, in Tuscany
- Smart First Aid in Tuscany
- Smart Public Transportation in Tuscany
- Smart Fuel pricing in Tuscany
- Bike Sharing in Pisa
- Weather condition in Tuscany
- Environmental data
- Pollution and Pollination in Tuscany
- Traffic Sensors in Tuscany
- Smart Routing in Tuscany
- Smart Transportation in Florence
  - Events, traffic, ...
- Entertainment Events in Florence







Snap4City (C), January 2020



TOP

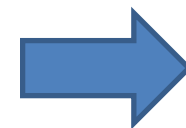
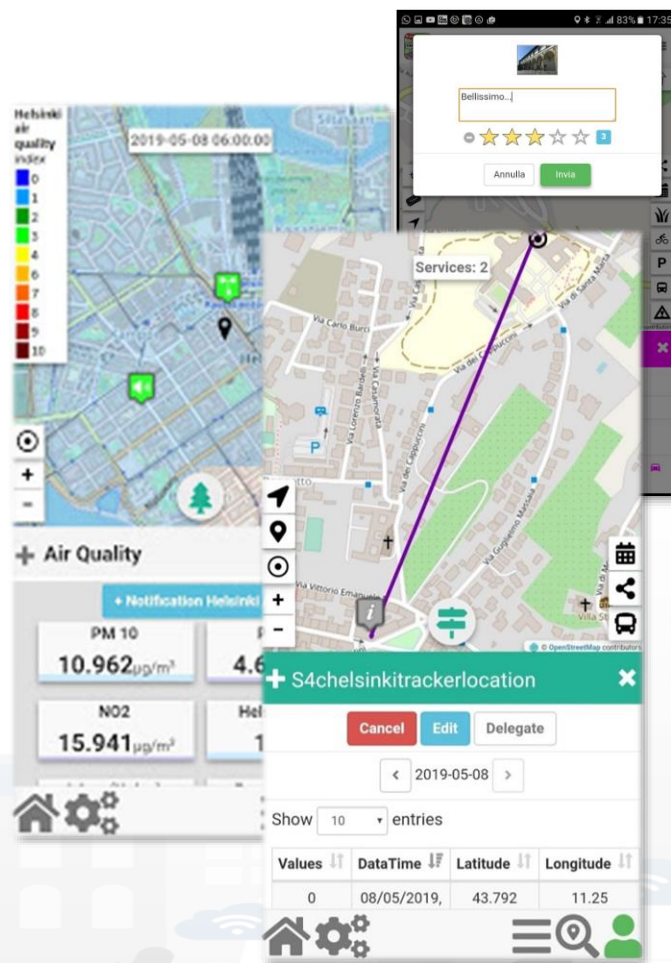
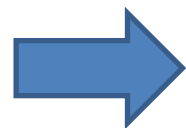
# *Understanding how City Users are using the City Services*





# The App is a Bidirectional Device

- GPS Positions
- Selections on menus
- Views of POI
- Access to Dashboards
- searched information
- Routing
- Ranks, votes
- Comments
- Images
- Subscriptions to notifications
- ....

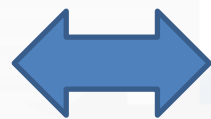


## Derived information

- Trajectories
- Hot Places by click and by move
- Origin destination matrices
- Most interested topics
- Most interested POI
- Delegation and relationships
- Accesses to Dashboards
- Requested information
- Routing performed
- .....

## Produced information

- Accepted ?
- Performed ?
- ...



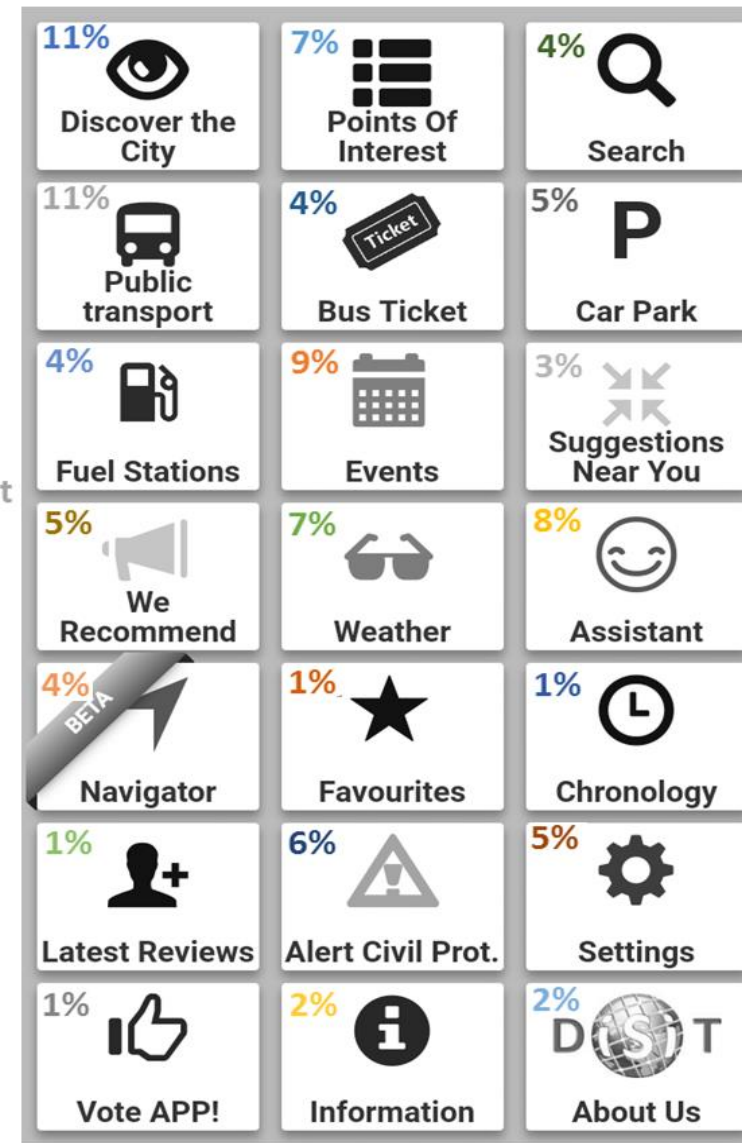
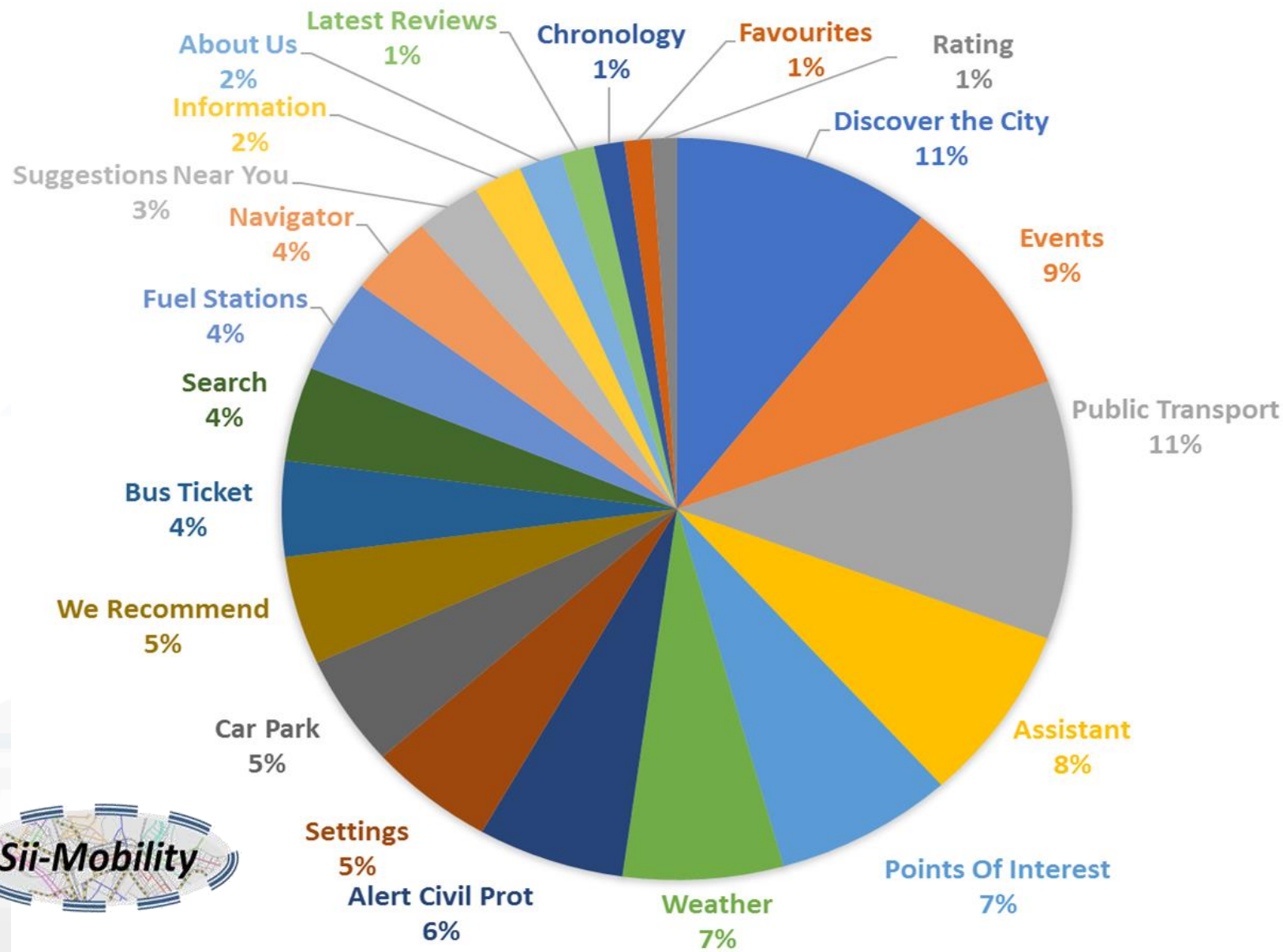
## Produced information

- Suggestions
- Engagements
- Notifications
- ...



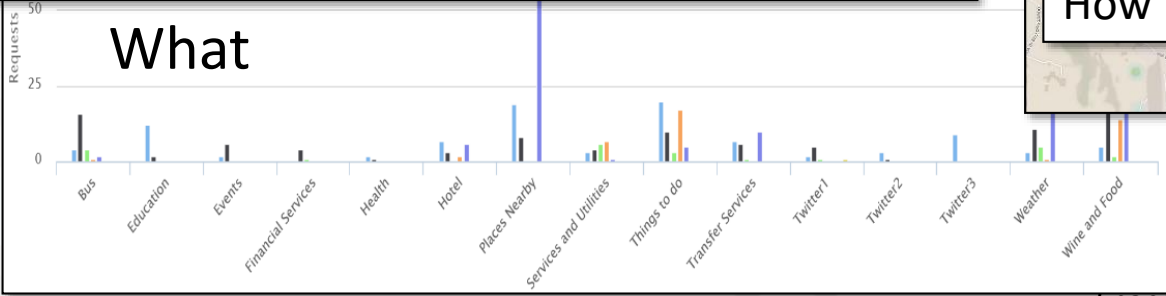
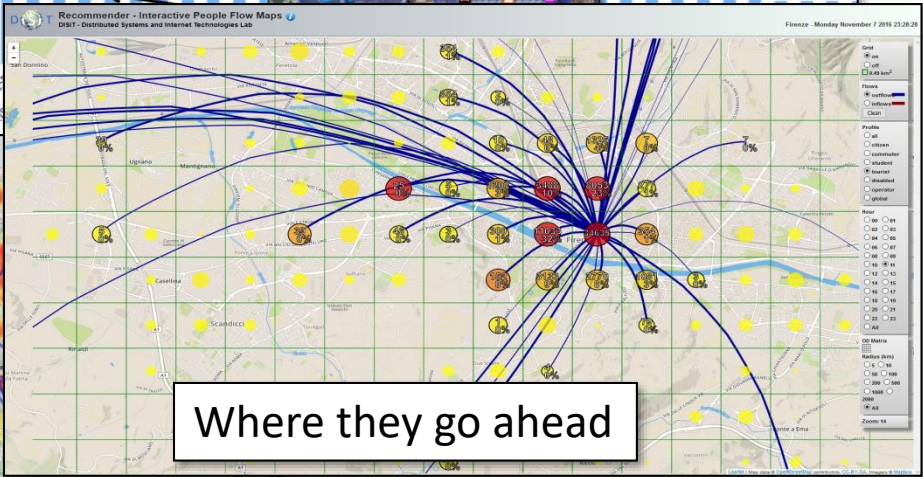
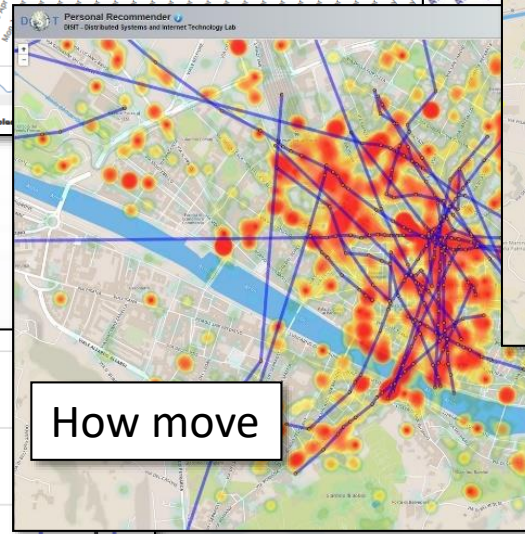
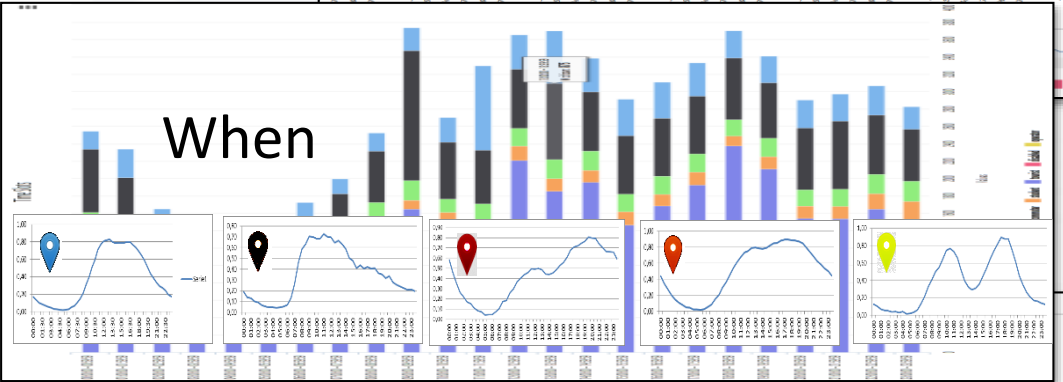
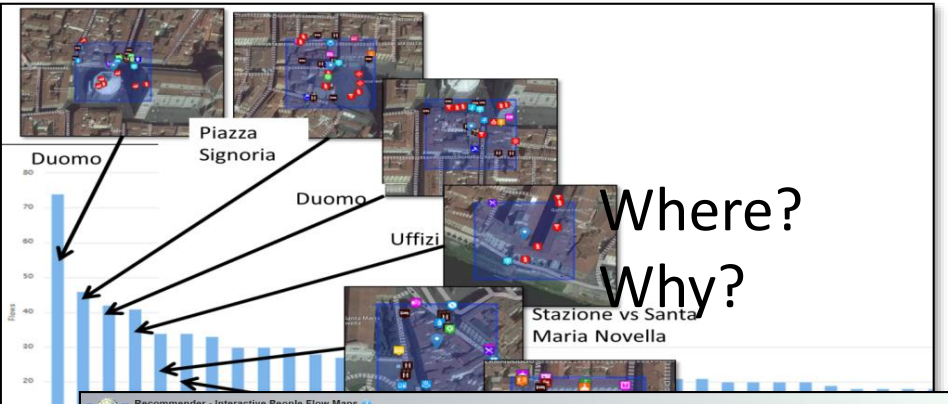
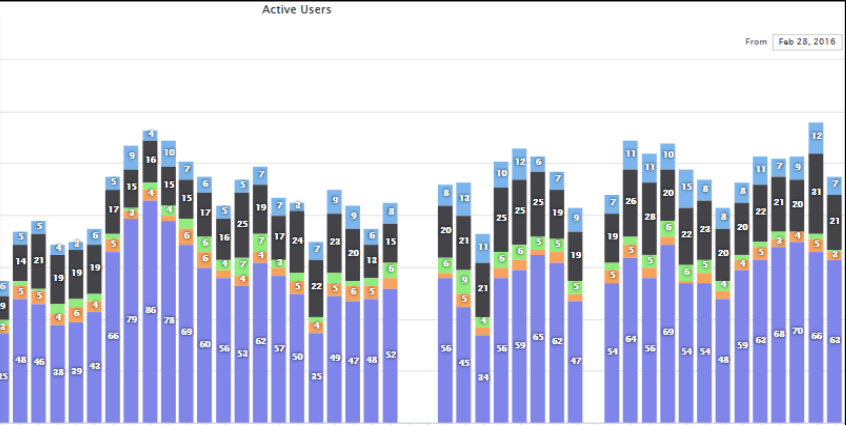
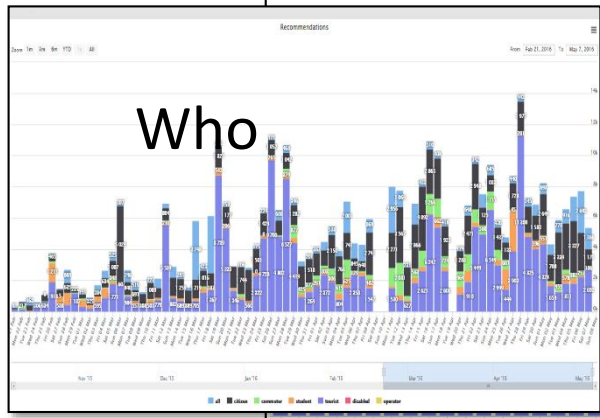


# Users' preferences





# User Behavior Analyser for Collective Profiling





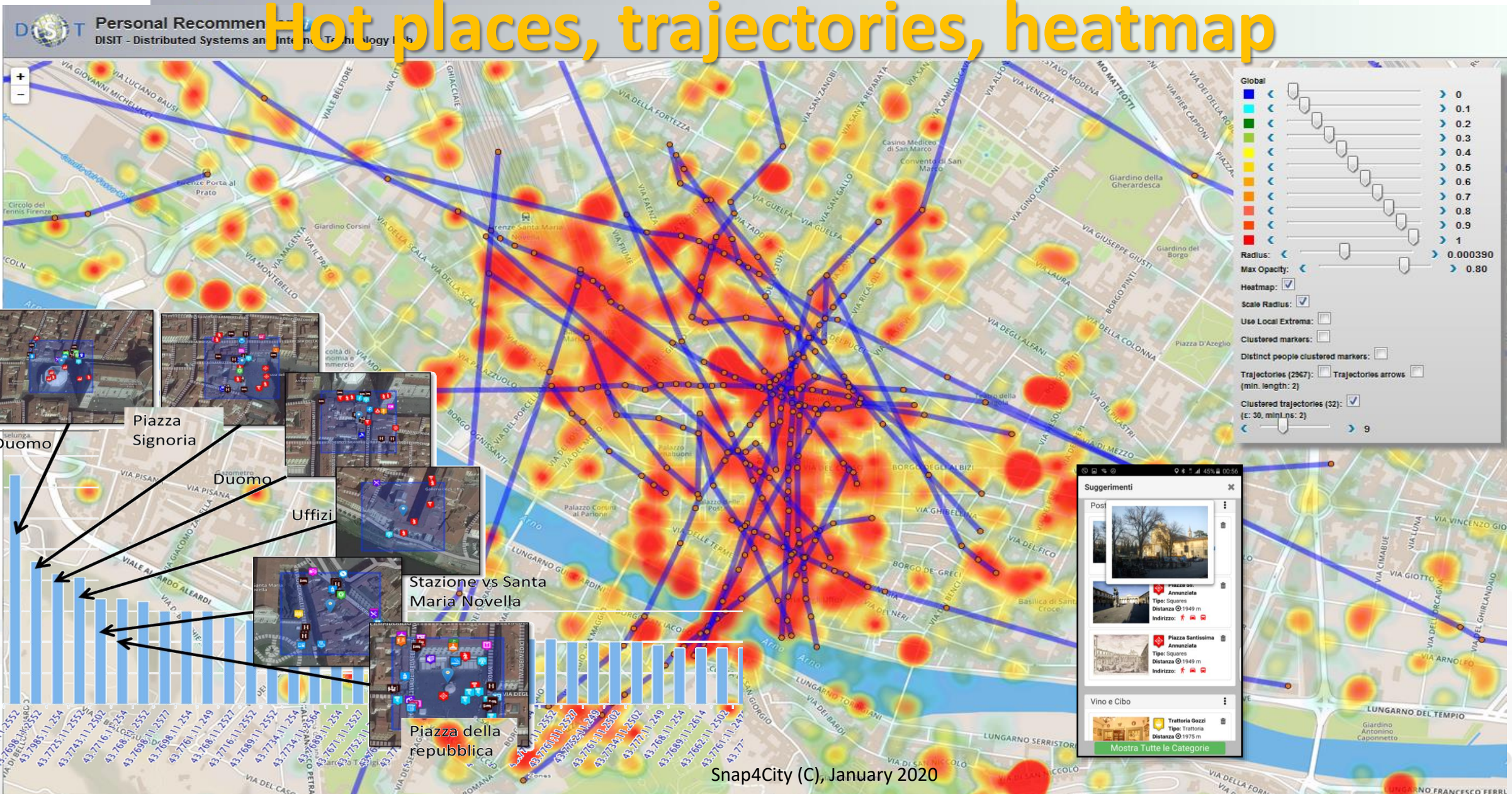




# User Behaviour Analyser



## Hot places, trajectories, heatmap





TOP

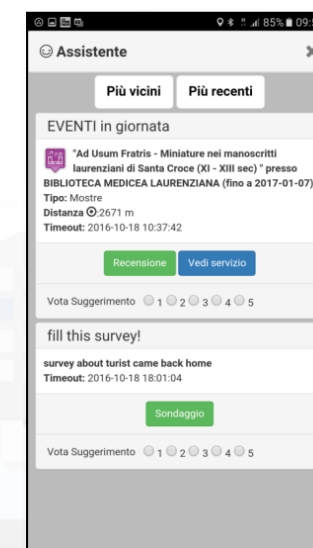
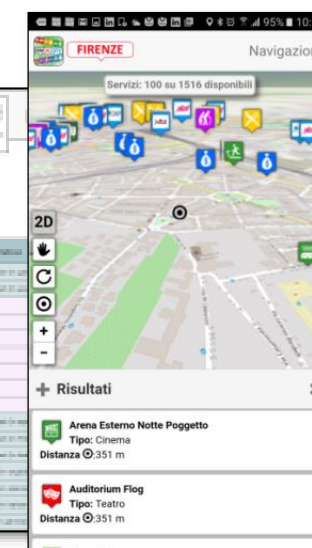
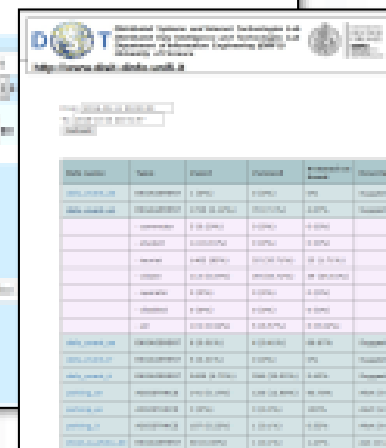
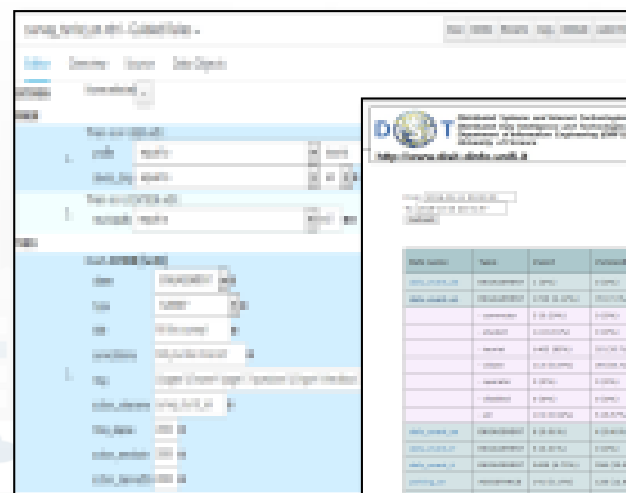
# *Engaging City Users Towards Virtuous Behaviours (real time)*





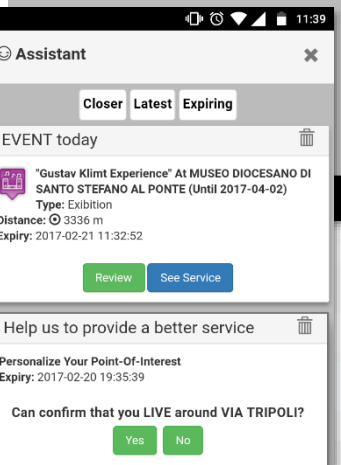
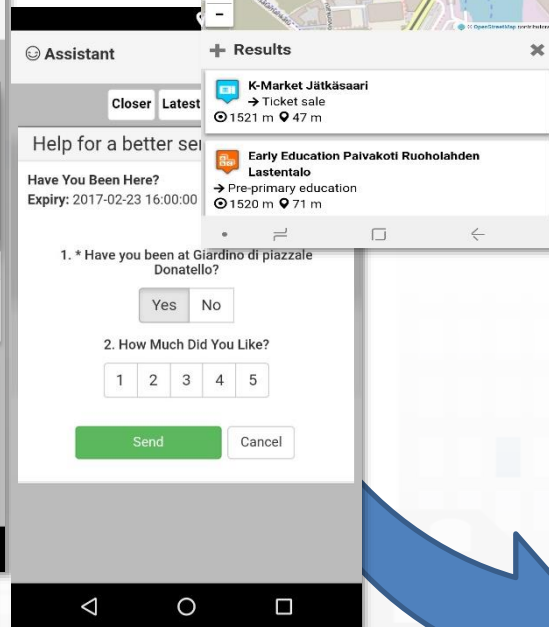
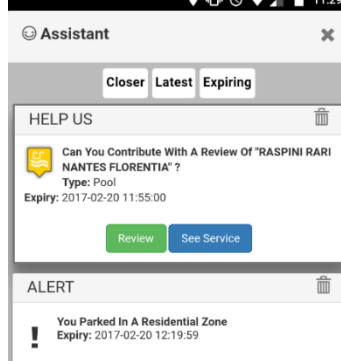
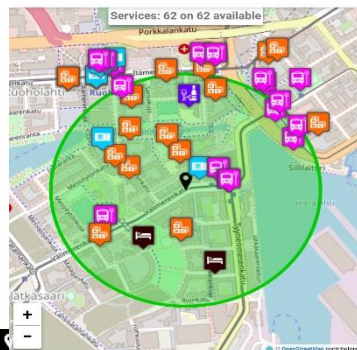
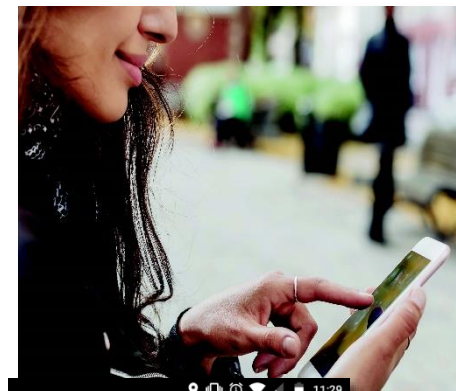
# Profiled Engagements to City Users

- The users are profiled to learn habits:
  - Personal POI, paths, Mobility habits
- Information and engagements sent to the users are programmed according to the context and user behavior to:
  - Stimulate virtuous habits
  - More sustainable habits
  - More healthy habits, etc.
  - Get feedbacks
  - Provide bonus and prices, .....
  - Send alerts, ....

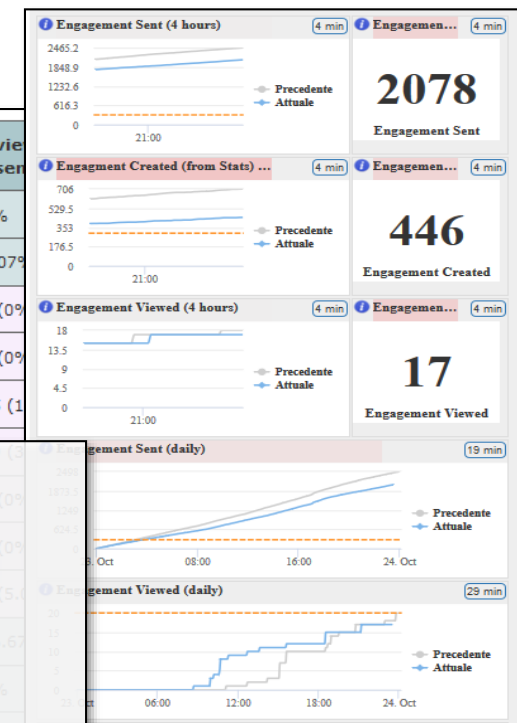




# Users' Engagement



Rule name	Type	#sent	#viewed	#viewed / #sent
daily_event_de	ENGAGEMENT	1 (0%)	0 (0%)	0%
daily_event_en	ENGAGEMENT	1720 (2.12%)	70 (7.1%)	4.07%
- commuter		5 (0.29%)	0 (0%)	0 (0%)
- student		14 (0.81%)	0 (0%)	0 (0%)
- tourist		1462 (85%)	25 (35.71%)	25 (17.1%)



## Inform

- Air Quality forecast is not very nice
- You have parked out of your residential parking zone
- The Road cleaning is this night
- The waste in S.Andreas Road is full

## Engage

Provide a comment, a score, etc.

## Stimulate / recommend

Events in the city, services you may be interested, etc..

## Provide Bonus, rewards if needed

you get a bonus since you parked here  
We suggest: leave the car out of the city, this bonus can be used to buy a bus ticket

Rules

User context

City context



# Sii smart. Sii-Mobility!

Scarica

Dal 15 aprile al 15 luglio scegliere il trasporto pubblico ti premia! Scarica l'app "Toscana dove, cosa", guadagna punti viaggiando in autobus e vinci tanti fantastici premi! Per maggiori informazioni visita il sito [info.sii-mobility.org](http://info.sii-mobility.org)

In palio per te  
Carnet multicorsa Cap e  
voucher per:

# Sii smart. Sii-Mobility!

Scarica, viaggia, vinci!

Dal 15 aprile al 15 luglio scegliere il trasporto pubblico ti premia! Scarica l'app "Toscana dove, cosa", guadagna punti viaggiando in autobus e vinci tanti fantastici premi! Per maggiori informazioni visita il sito [info.sii-mobility.org](http://info.sii-mobility.org)



In palio per te  
Carnet multicorsa Cpt e  
voucher per:



Ci Prendiamo cura del tuo benessere



# Sii smart. Sii-Mobility!

Scarica, viaggia, vinci!



Dal 15 aprile al 15 luglio scegliere il trasporto pubblico ti premia! Scarica l'app "Toscana dove, cosa", guadagna punti viaggiando in autobus e vinci tanti fantastici premi. Per maggiori informazioni visita il sito [info.sii-mobility.org](http://info.sii-mobility.org)



# Campaing on Sustainable Mobility

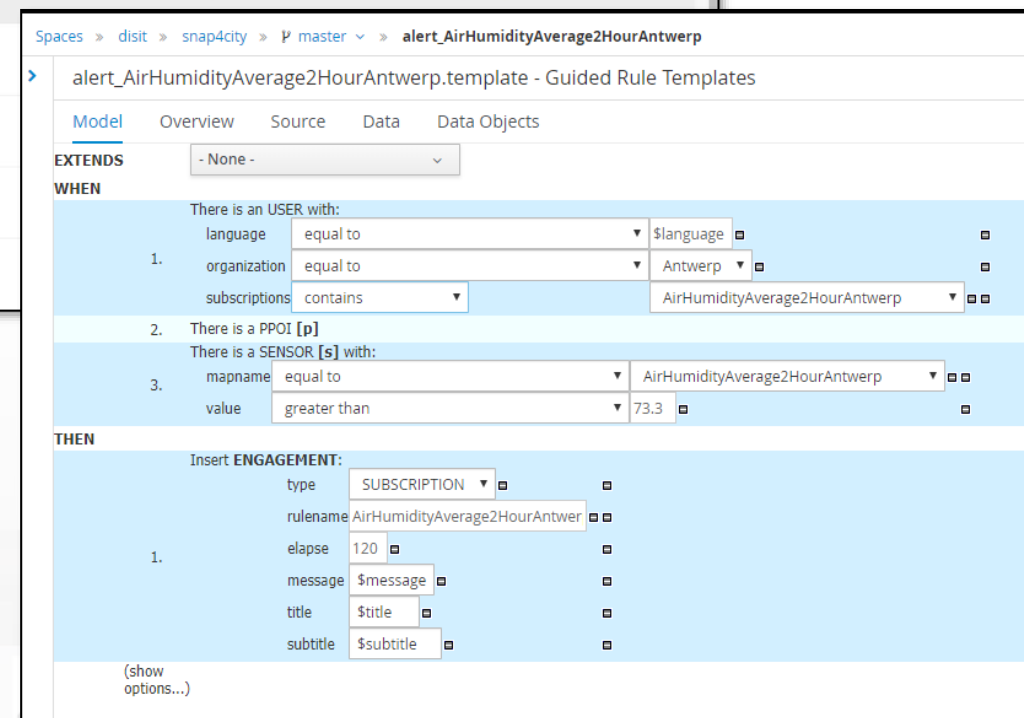
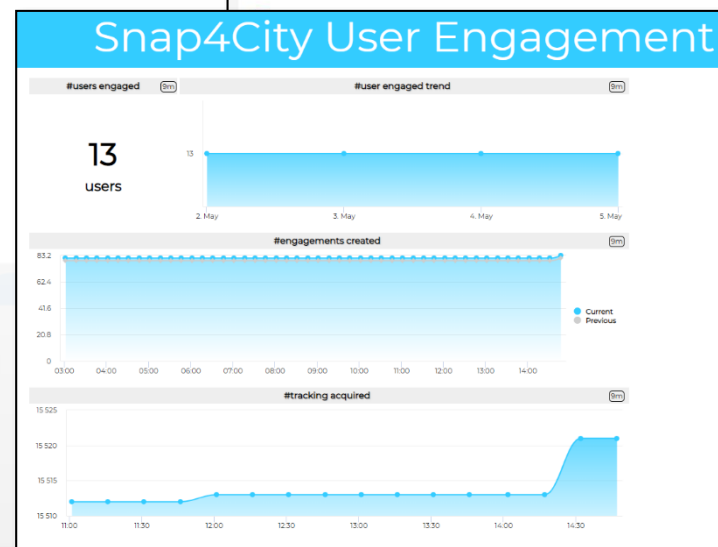
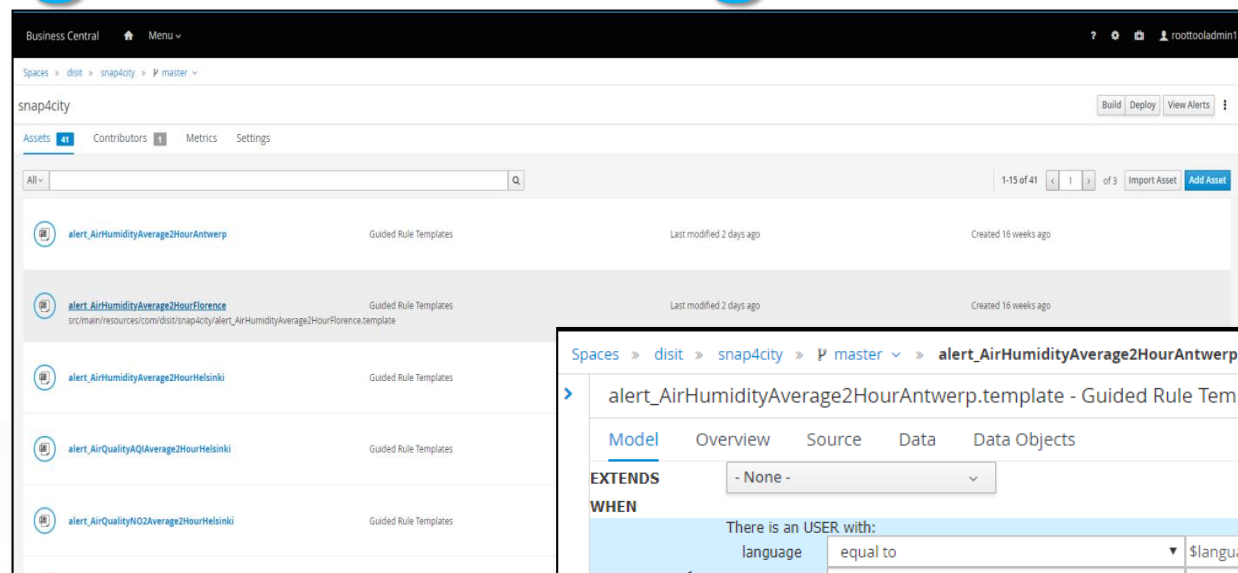
Snap4City (C), Janua





# Engagement Manager

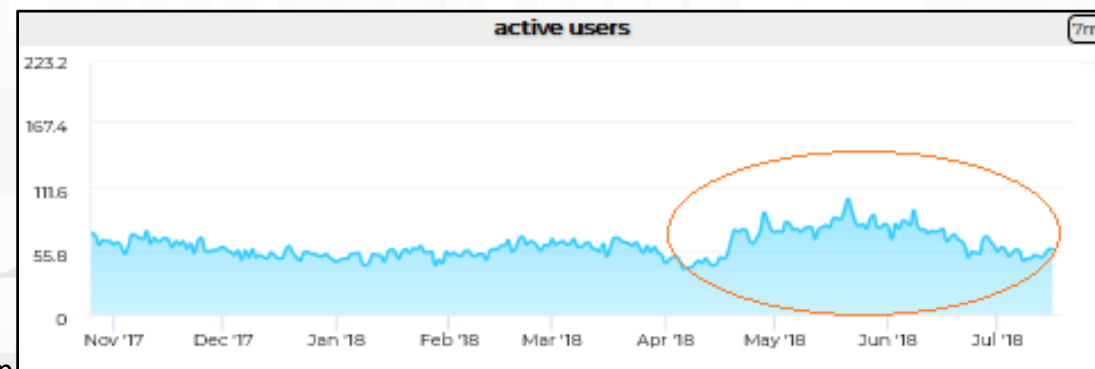
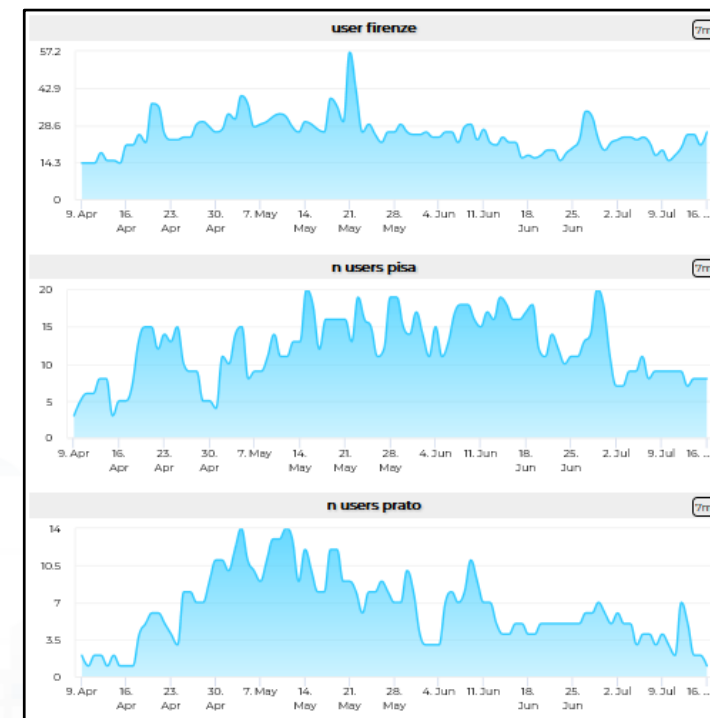
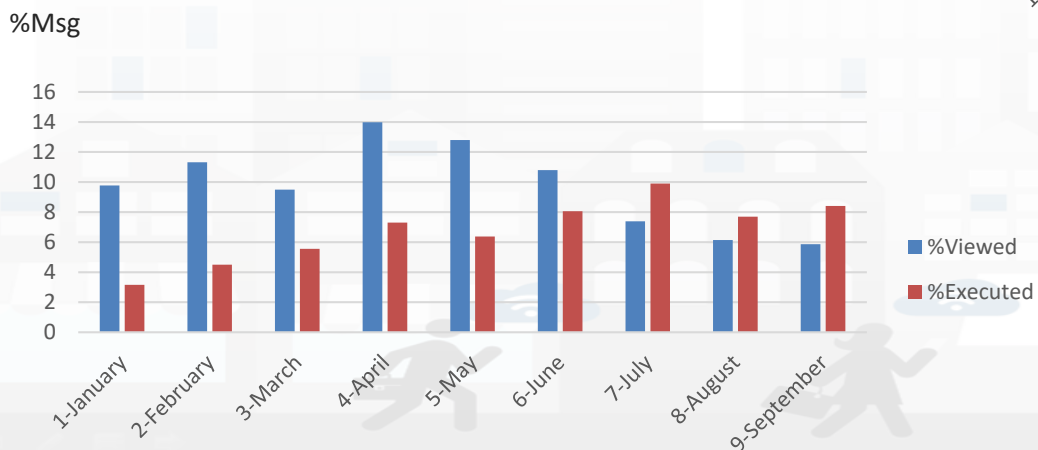
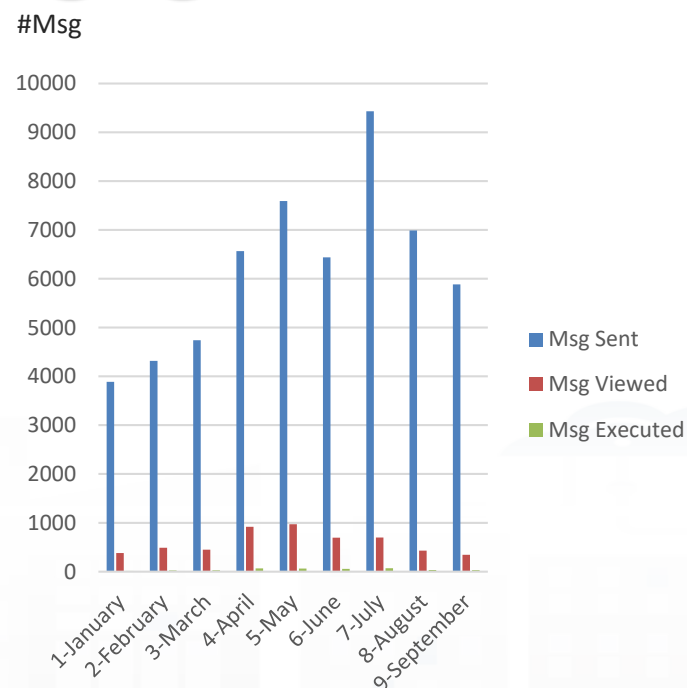
- Definition of Rules for campaigns
- Monitoring and follow-up for each City
- Segmented for user kind and interest





# Validation of user Engagement

Months	Msg Sent	Msg Viewed	Msg Executed
1-January	3888	380	12
2-February	4319	489	22
3-March	4739	450	25
4-April	6567	918	67
5-May	7594	972	61
6-June	6437	695	55
7-July	9432	697	69
8-August	6988	429	73
9-September	5885	345	49
Total	55849	5375	433





TOP

# DATA ANALYTICS, Big Data Science

FROM CITY DASHBOARD TO APPLICATIONS

DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT

FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS

IOT/IOE DEVICES AND NETWORKS

INTEGRATIONS, THE LOGIC AND THE SMARTNESS

API AND SMART CITY API, MICROSERVICES, SNAP4CITY API

SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK

SNAP4CITY FOR BEGINNERS

DATA ANALYTICS, BUSINESS INTELLIGENCE, WHAT-IF AND DATA VISUALIZATION

SNAP4CITY ARCHITECTURE AND ECOSYSTEM. OPENED TO DEVELOPERS AND STAKEHOLDERS

DECISION SUPPORT SYSTEM AND CITY RESILIENCE

TWITTER VIGILANCE, SOCIAL MEDIA ANALYSIS

HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP

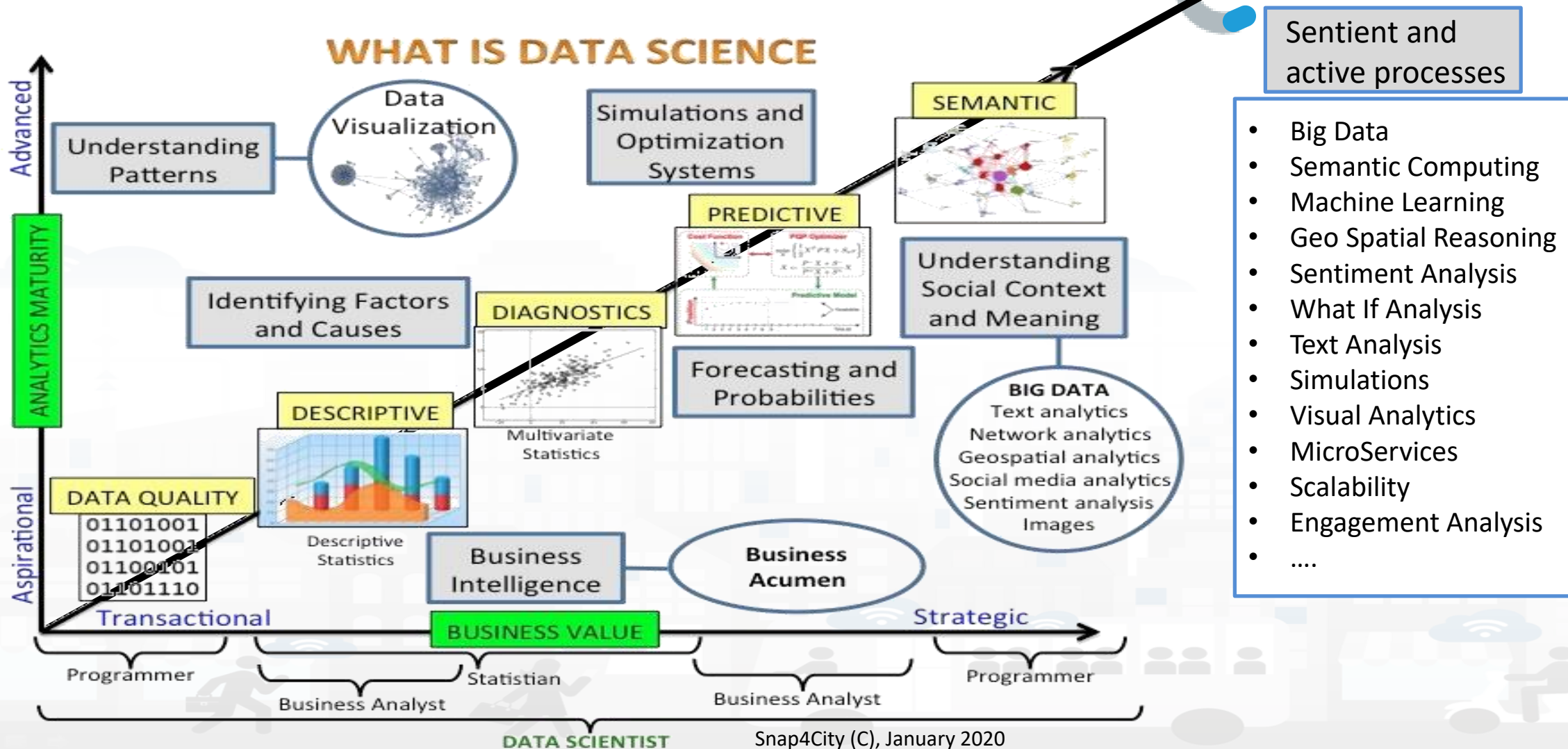
SNAP4CITY AND KM4CITY PROJECTS

SNAP4CITY THE VIEW OF THE ADMINISTRATORS





## WHAT IS DATA SCIENCE





# DATA ANALYTICS

- Traffic flow reconstruction from sensors and other sources: parking predictions: wi-fi people flow prediction and reconstruction
- What-if analysis, dynamic routing, origin destination matrices production from a large range of sources
- Analysis of the demand vs offer of mobility according to public transportation and multiple data sources
- Resilience and risk analysis
- Early warning computation
- Accidents heatmaps
- Traffic flow predictions
- NOX pollution prediction on the basis of traffic flow, 48 hours see
- Pollution prediction at 48 hours, every hour
- User engagement for sustainable mobility
- User's behaviour analysis, data reconstruction and calibration
- Tracking fleets, people, devices OBD2 support
- People flow analysis from PAX Counters
- Social media analysis on specific channel, specific keywords: see Twitter Vigilance, for NLP and Sentiment Analysis, SA
- Data quality assessment, prediction, anomaly detection
- Maintenance prediction and costs predictions
- ReTweet proneness, retweet-ability of tweets
- Audience prediction to TV channels and physical events





UNIVERSITÀ  
DEGLI STUDI  
FIRENZE

**DINFO**  
DIPARTIMENTO DI  
INGEGNERIA  
DELL'INFORMAZIONE

**DISIT**  
DISTRIBUTED SYSTEMS  
AND INTERNET  
TECHNOLOGIES LAB

# Disappearing Data Analytics



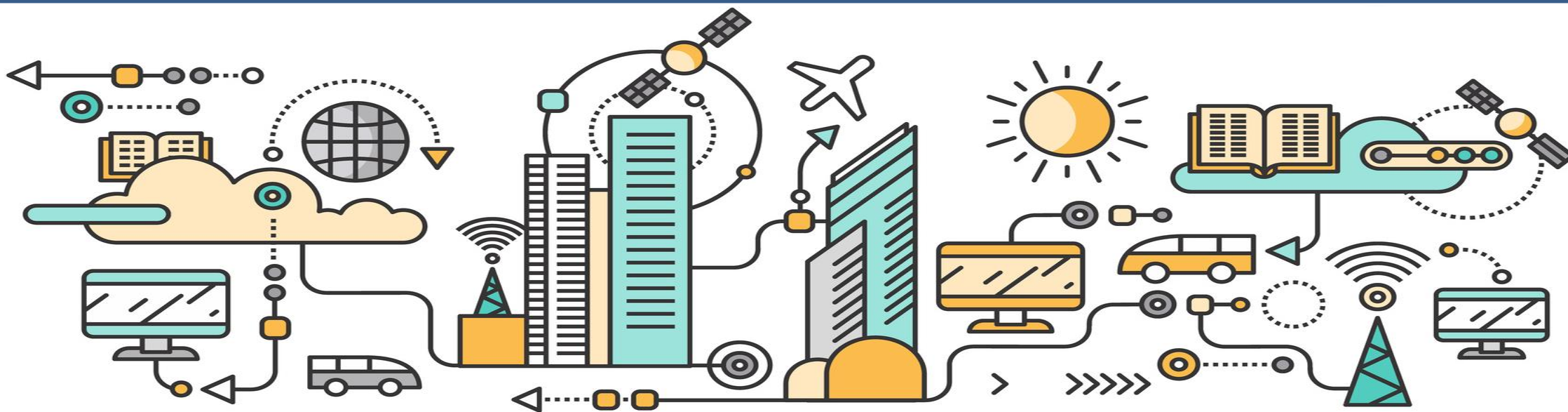
	Antwerp					Helsinki								Where				Main Data Sources
	City official	ICT official	Developer	Citizen, tourist, visitor	Business owner	City officials	City officials Domain experts	City officials City developers	Third party developers	Citizen	Citizens with respiratory problems	Tourists	Business owners	Mobile	MicroApplication	Tool, via Portal (ICT Developers)	Dashboards	
Discovery near to me	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			POI, OSM
Discovery along a path	X	X	X	X		X		X	X	X	X	X		X	X			POI, OSM
Discovery in an area, shape	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		POI, OSM
browsing Public Transport	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			OSM, GTFS
Full Text search	X	X	X	X	X	X		X	X	X	X	X	X	X		X		POI, OSM
Routing: pedestrian				X	X			X	X	X	X	X	X	X	X			OSM
Routing: pedestrian quite				X	X			X	X	X	X	X	X	X	X			OSM
Routing: private vehicles	X		X	X		X		X	X	X	X	X		X	X			OSM
Routing: Multimodal Public Transport				X					X	X	X	X		X	X	X		OSM, GTFS
heatmaps: weather (Temp, Humidity)	X	X		X	X	X	X		X	X	X	X	X	X			X	Sensors data, OSM
heatmaps: environmental variables, PM10, PM2.5, NO2, EAQI	X	X		X	X	X	X		X	X	X	X	X	X			X	Sensors data, OSM
heatmaps: environmental variables, Noise						X	X		X	X	X	X	X	X			X	Sensors data, OSM
heatmaps: safe on bike (Antwerp)	X	X		X	X									X			X	Spec. Portal
heatmaps: Enfuser prediction, PM10, PM2.5, AQI						X	X		X	X	X	X	X	X			X	Enfuser data
heatmaps piking values any place	X	X			X	X	X	X	X			X					X	Computed Heatmps
heatmaps: GRAL prediction, PM10						X	X		X	X	X	X	X	X			X	OSM, Traffic, Weather
Comparsion: Enfuser, Gral, Real Time						X	X										X	Enfuser, Sensors, GRAL
Sensors Data Time Trends, & drill down	X	X	X		X	X	X	X				X				X	X	Sensors data, OSM
Weather Forecast	X	X		X	X	X	X		X	X	X	X	X	X			X	Forecast Service
Origin Destination Matrices	X	X	X		X	X	X	X	X			X					X	Snap4City Mobile App
Typical trajectories	X	X	X	X	X	X	X	X	X			X				X	X	Snap4City Mobile App
Hot Area in the city	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	Snap4City Mobile App
Hot Places in Smart Zone	X	X	X	X	X									X		X	X	Snap4City PAXcounters
Services Suggestions on mobiles				X						X	X	X		X	X			Snap4City Mobile App
Alerts on critical cases: several variables	X			X	X	X	X			X	X	X		X				Sensors data, OSM
The most used services		X		X	X		X			X	X	X					X	Snap4City Mobile App
Twitter Trends Daily	X	X	X		X	X	X	X	X			X				X	X	Twitter Vigilance
The auditing of user and living lab		X				X		X								X		Snap4City Portal
Self assessment	X	X	X	X	X	X	X	X	X	X	X	X				X		Snap4City Portal
Trajectories reg from mobile PAX Counters	X	X	X			X	X	X							X		X	PAX Counters





TOP

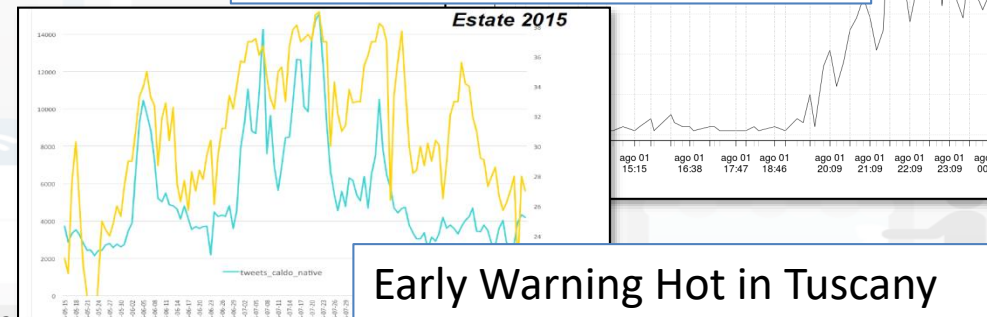
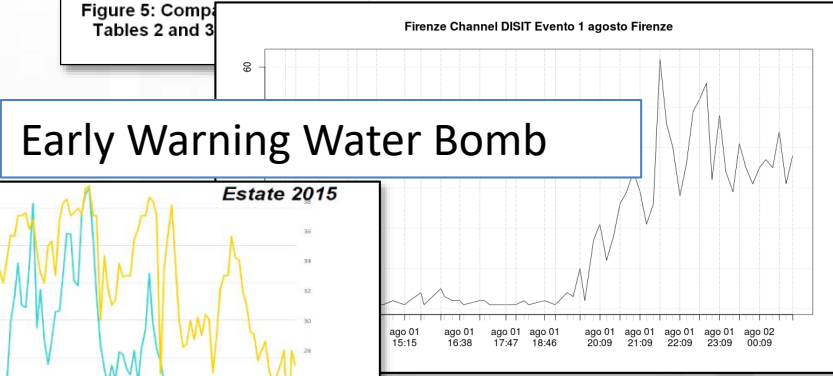
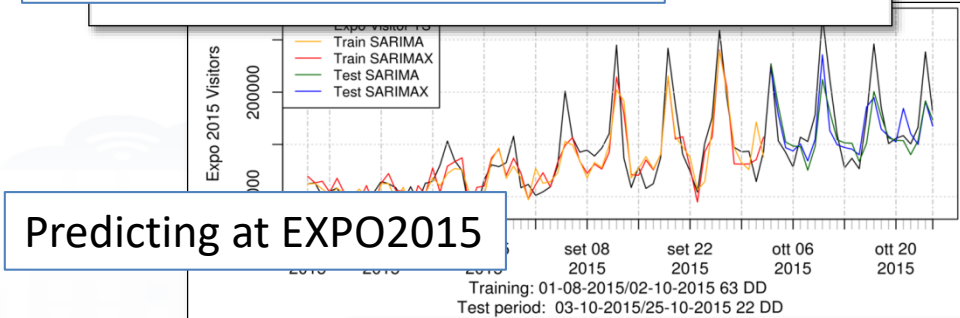
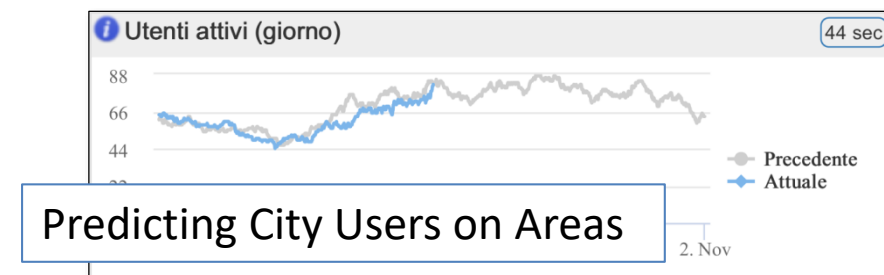
# Data Analytics: Predictions





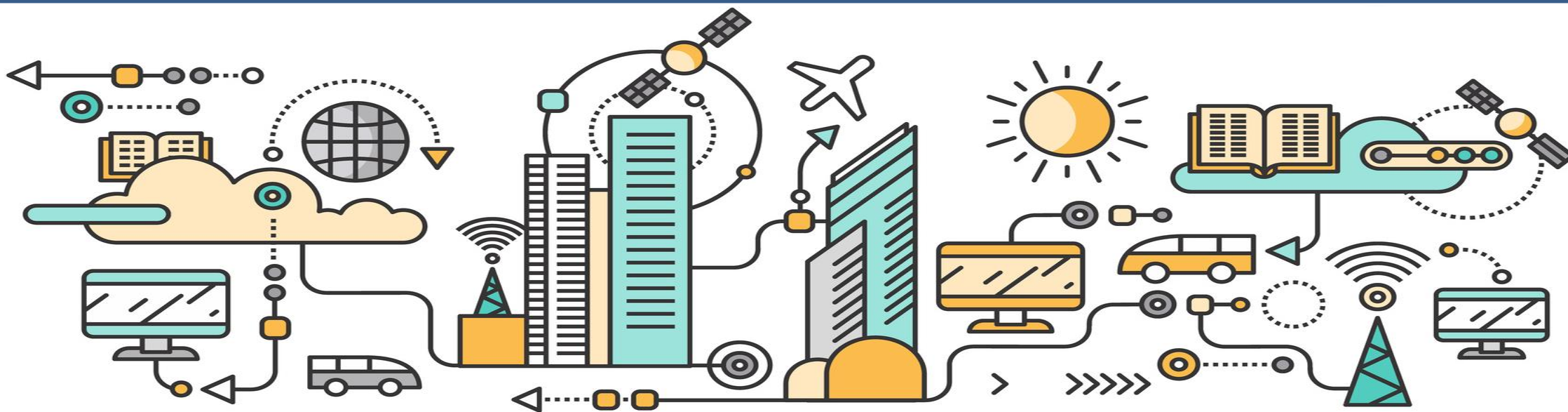
# Predicting Models for Administrators & City Users

- **Aiming at improving**
  - quality of service, distributing workload
  - early warning
- **Predictions: Short (15 min, 30 Min) and mid Term (1 week)**
- **Data Analytics: ML, NLP/SA, Clust., ...**
  - Traffic Flows → multi-flow reconstruction
  - Parking Status → free slots
  - Environmental Alarms
  - Air Quality parameters and indexes
  - People Flows (Wi-Fi, Twitter) → crowd, #number of people





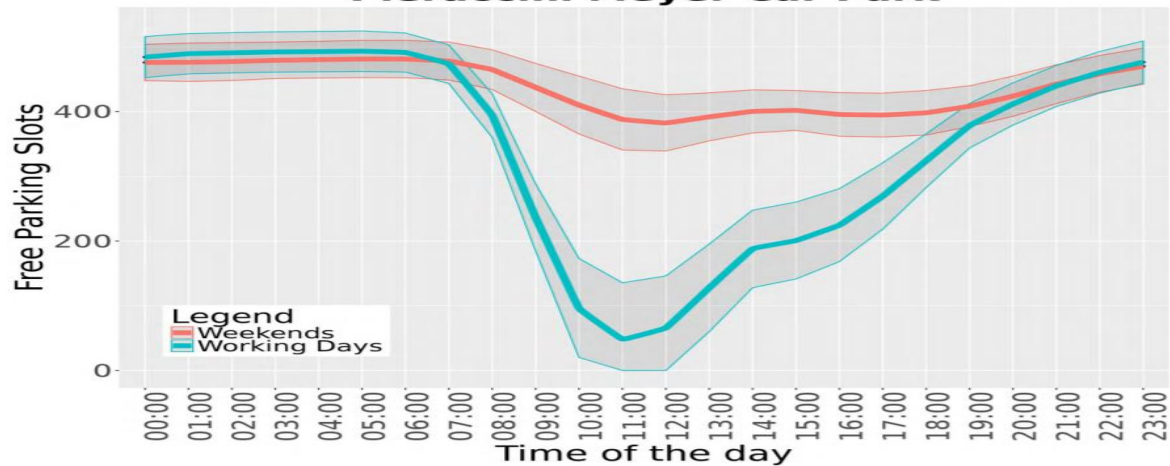
# Smart Parking: predictions





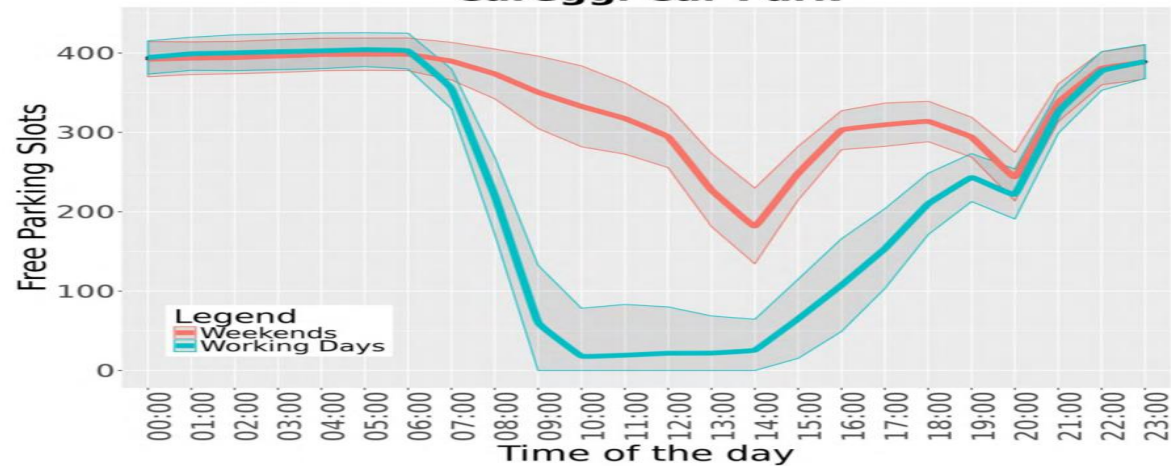
# Free Parking space trends

### Pieraccini Meyer Car Park



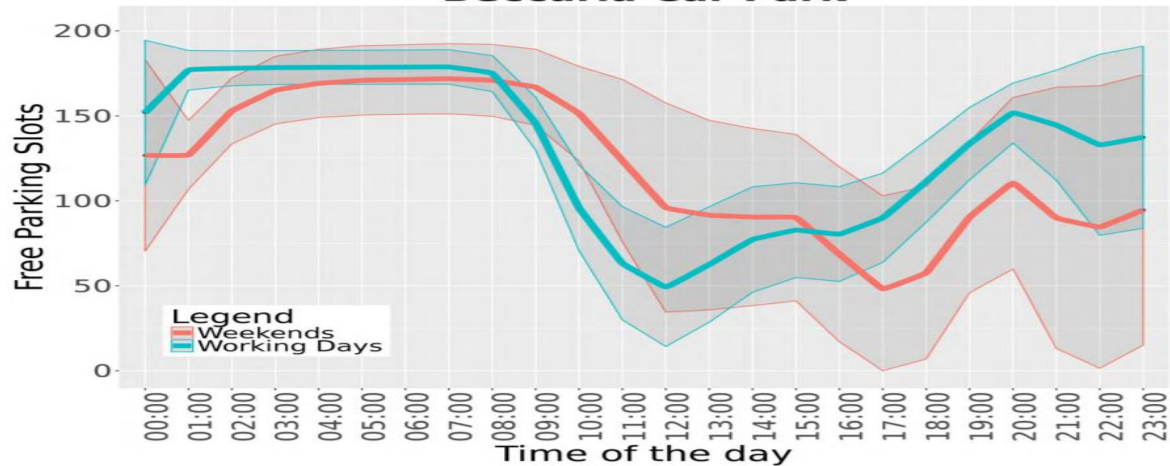
(a)

### Careggi Car Park



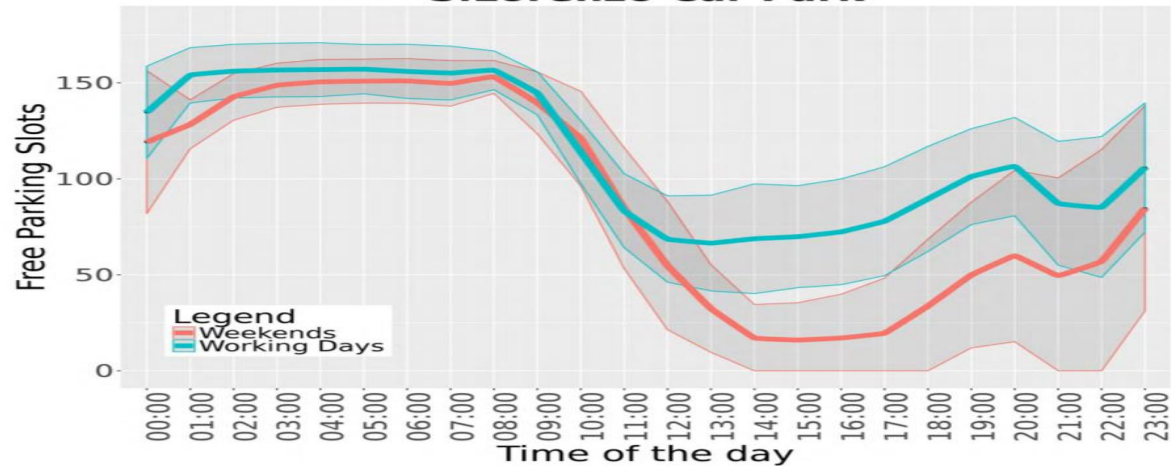
(b)

### Beccaria Car Park



(c)

### S.Lorenzo Car Park



(d)



# Free Parking Predictions

## Careggi car park

Model features	BRNN model results		
	R-squared	RMSE	MASE
Baseline	0.974	24	1.87
Baseline + Weather	0.975	24	1.75
Baseline + Traffic sensors	0.975	24	2.04
Baseline + Weather + Traffic sensors	0.975	24	1.87

Active on Mobile Apps as:

- «Firenze dove cosa»
- «Toscana dove cosa»

Precision: 97,5%





TOP

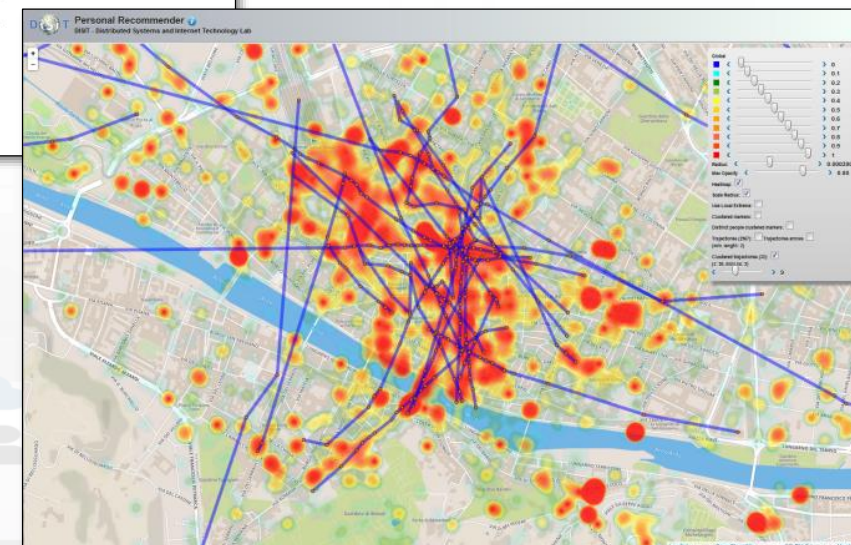
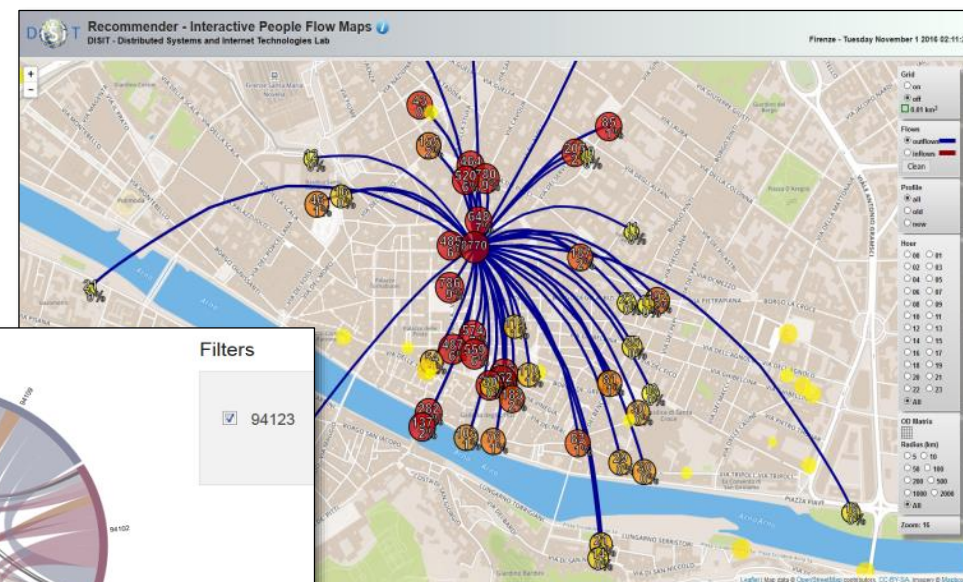
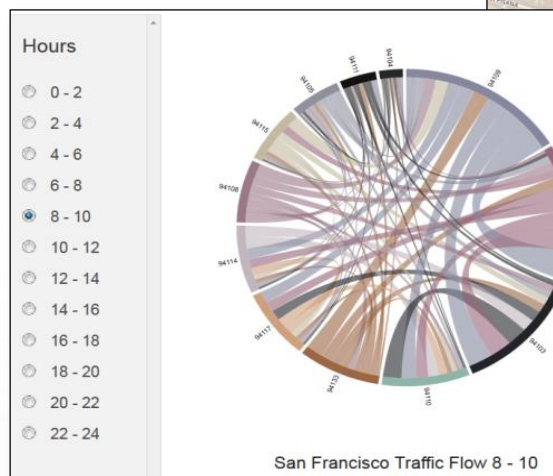
# *User Behaviour Analysis via Wi-Fi, OD Matrices, Trajectories*





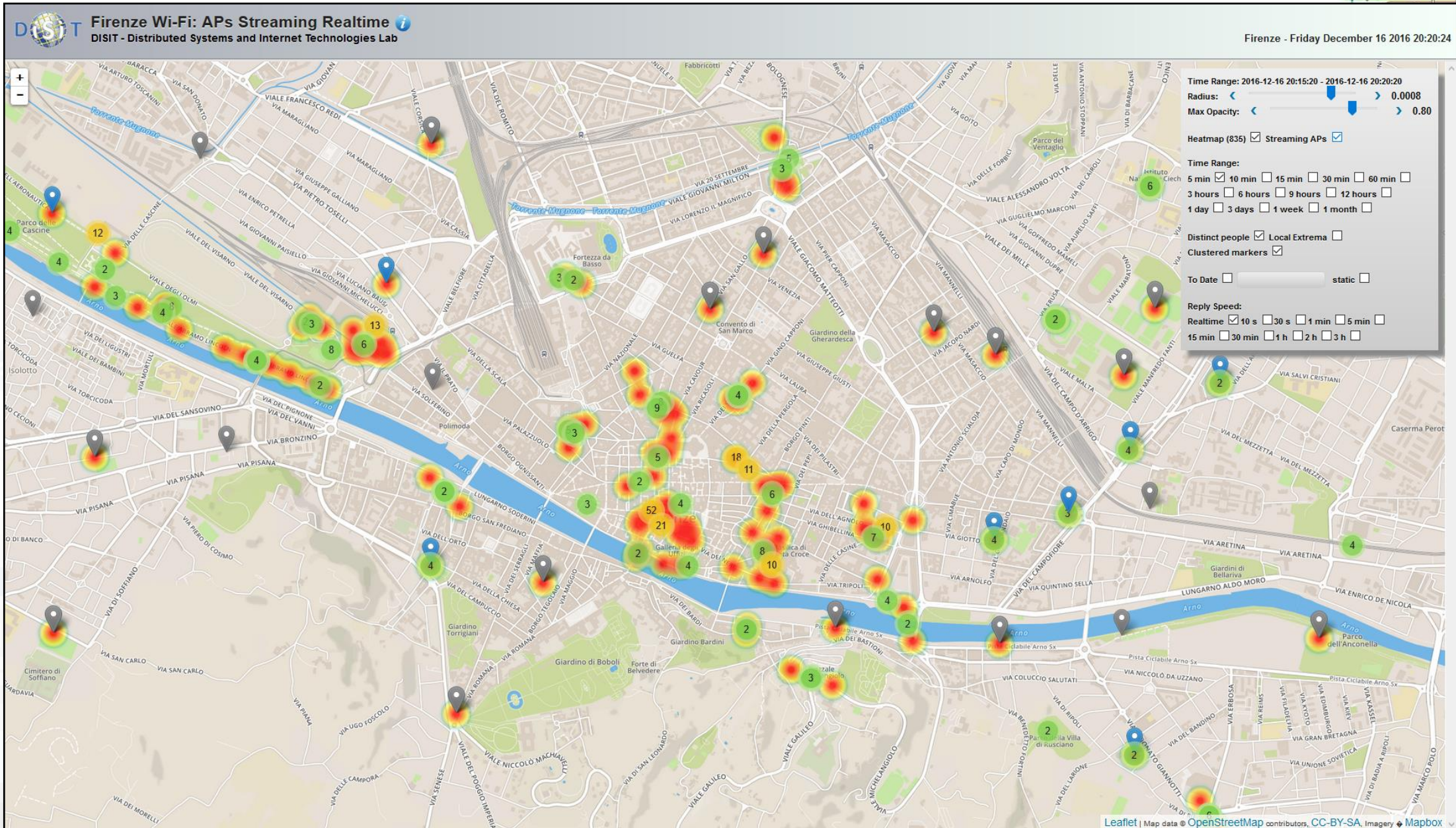
# User Behaviour Analysis

- **Monitoring movements by traffic flow sensors**
  - Spires and virtual spires
- **Monitoring movements from Mobile Cells**
  - Unsuitable for precise tracking and OD production
- **Monitoring movements from Wi-Fi**
- **Monitoring movements and much more from mobile Apps**





# Real Time Monitoring of Wi-Fi network





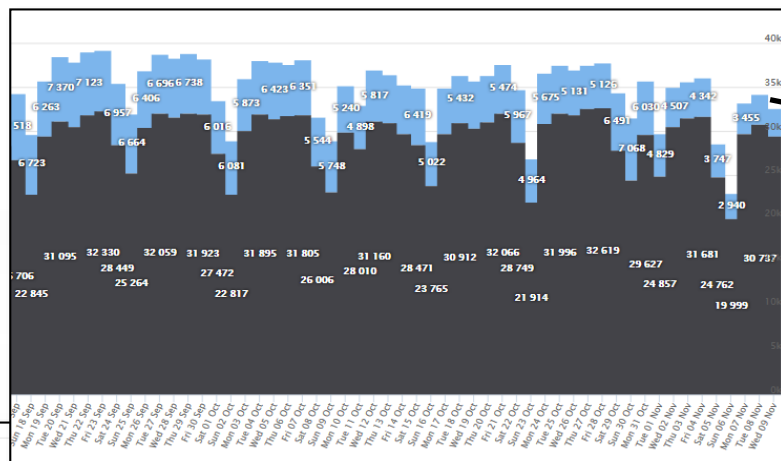
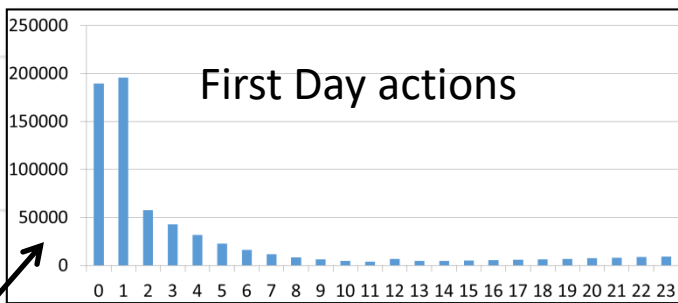
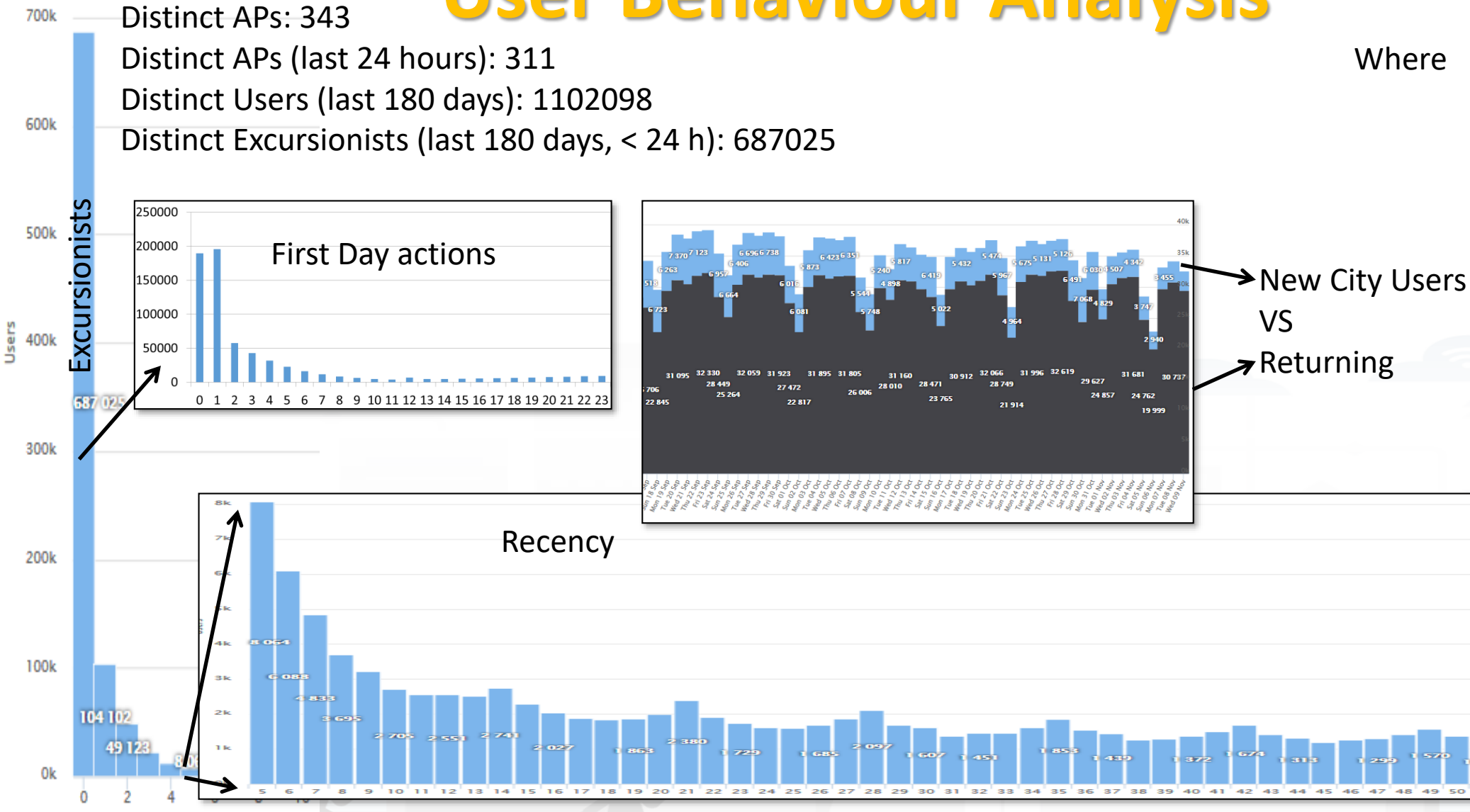




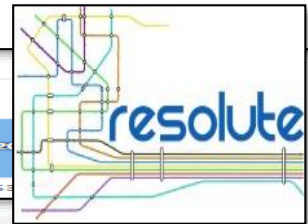
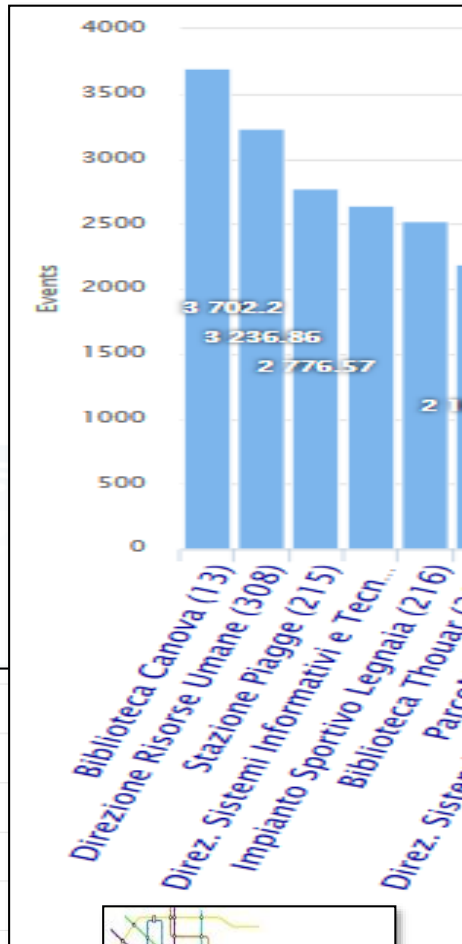
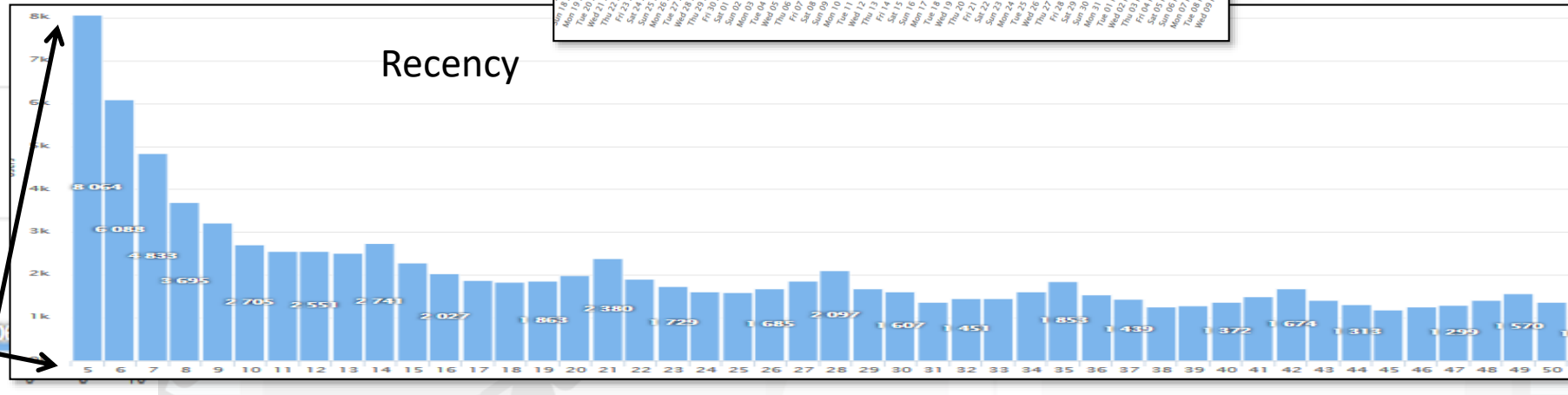
# User Behaviour Analysis

Distinct APs: 343  
 Distinct APs (last 24 hours): 311  
 Distinct Users (last 180 days): 1102098  
 Distinct Excursionists (last 180 days, < 24 h): 687025

Where



New City Users  
VS  
Returning





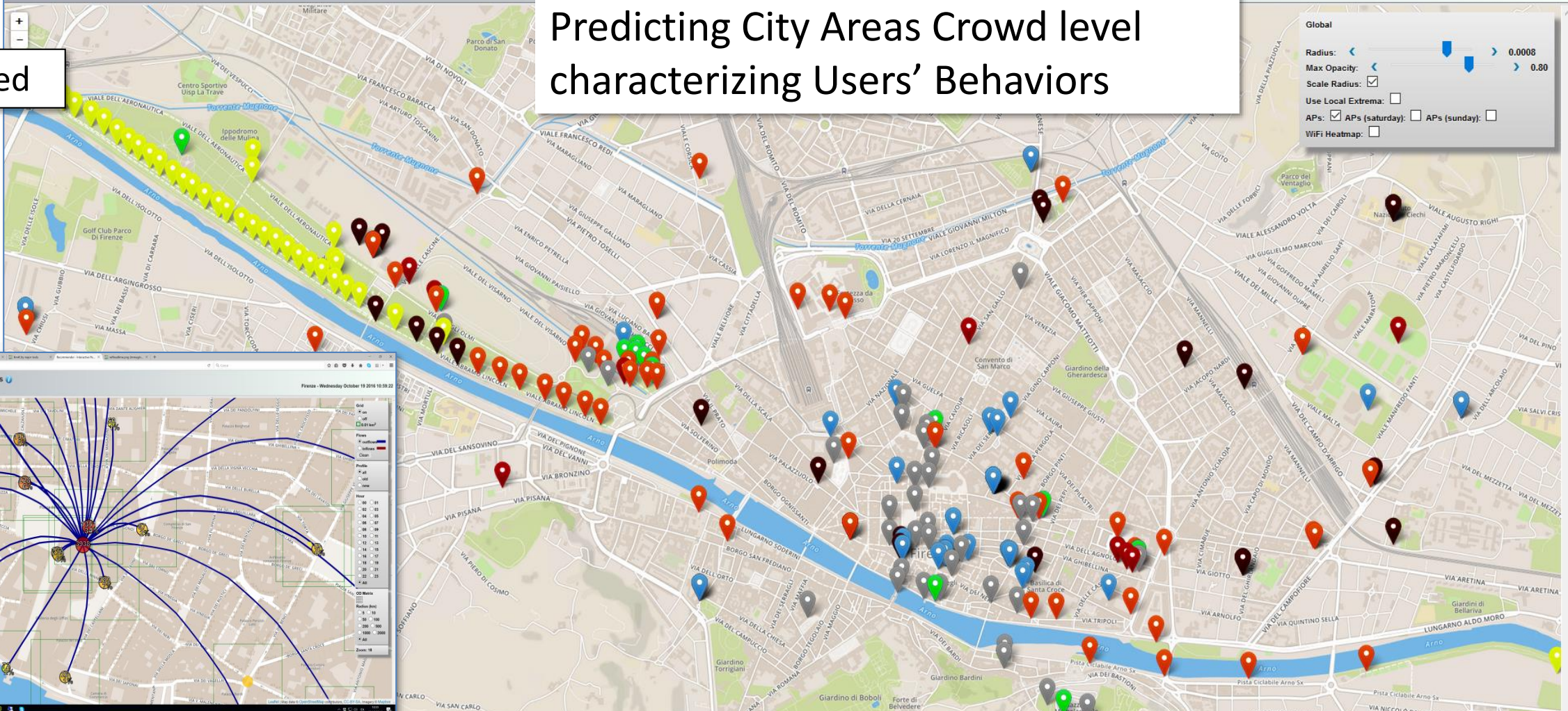
# Characterizing City Areas

DISIT Firenze Wi-Fi: Access Points Clusters Coverage Map  
DISIT - Distributed Systems and Internet Technologies Lab

Firenze - Saturday November 12 2016 19:16:33

Wi-Fi based

Predicting City Areas Crowd level characterizing Users' Behaviors



Global

Radius: < 0.0008 >

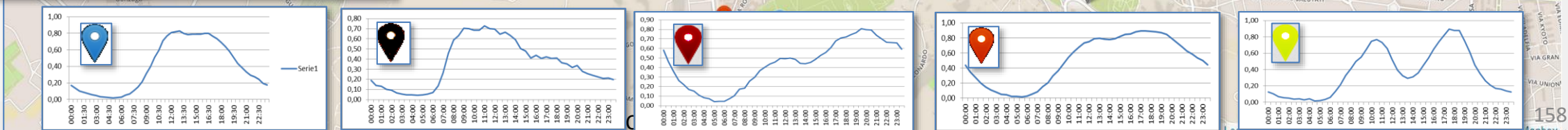
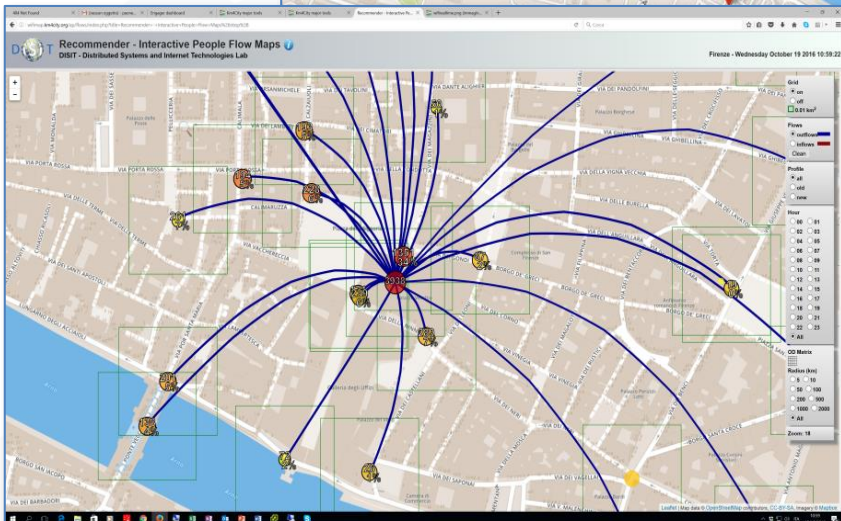
Max Opacity: < 0.80 >

Scale Radius:

Use Local Extrema:

APs:  APs (saturday)  APs (sunday)

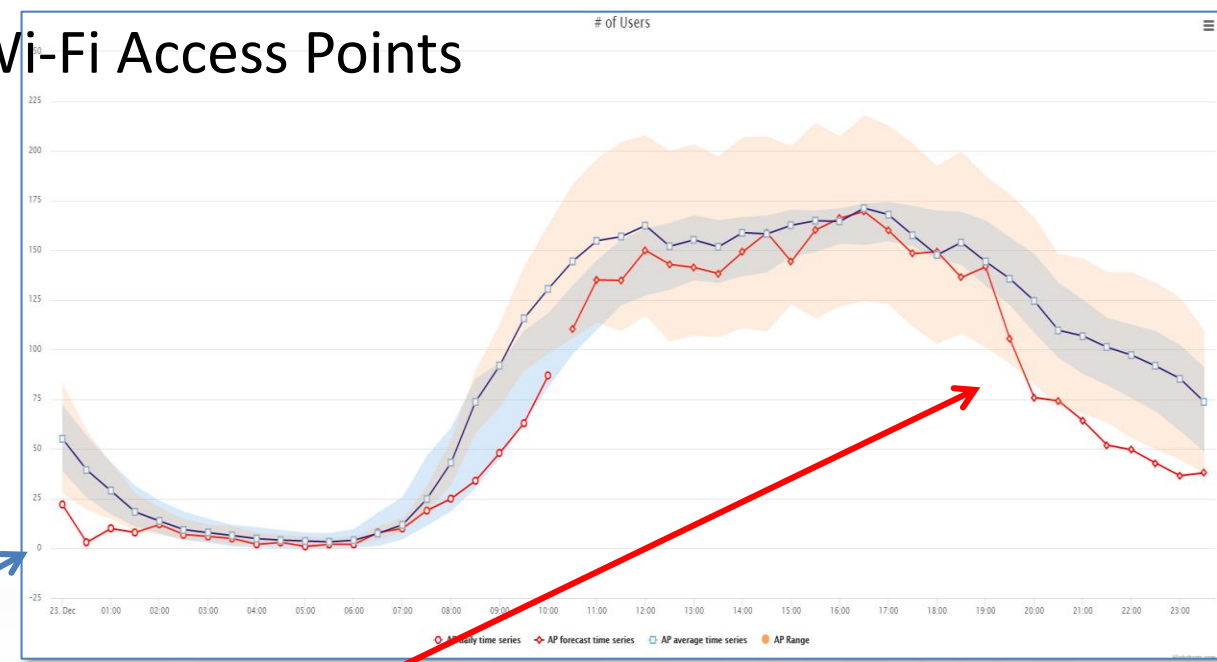
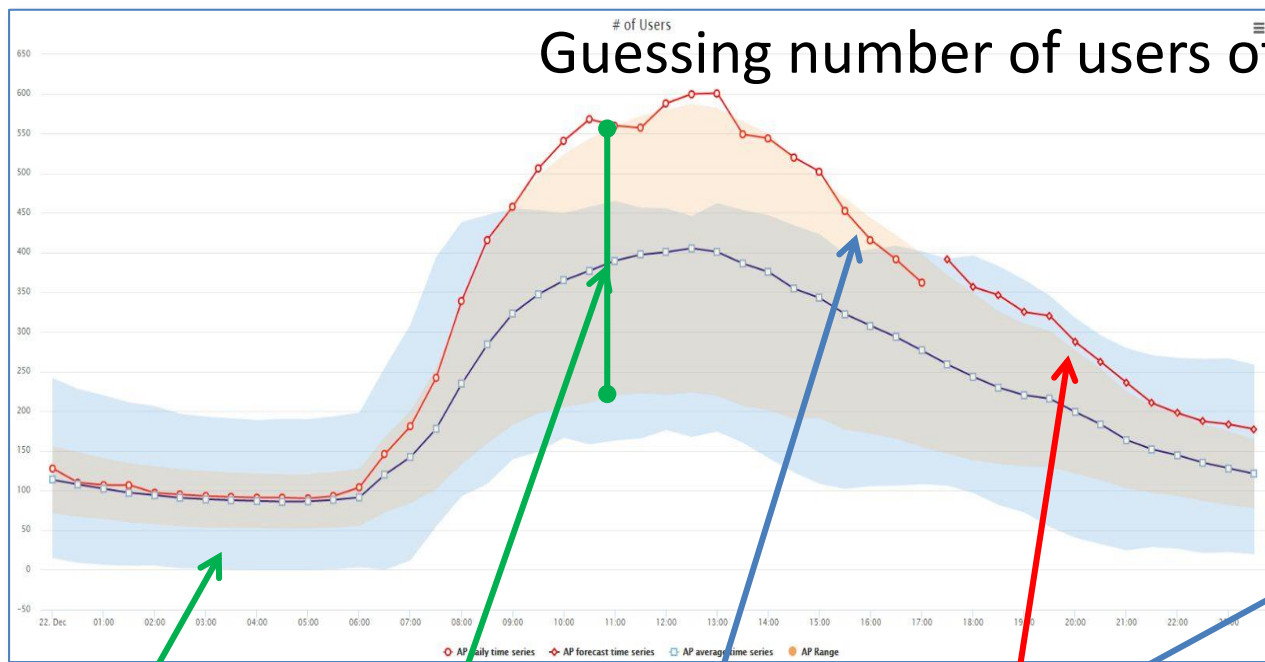
WiFi Heatmap:





# Prediction and Identification of Anomalies

## Guessing number of users of Wi-Fi Access Points



Cluster confidence

AP average and confidence

Actual AP trend for today

AP prediction for the next time slot in the day on the basis of past weeks

Predictive precision of the 95%



# Recognition of Used Transportation means

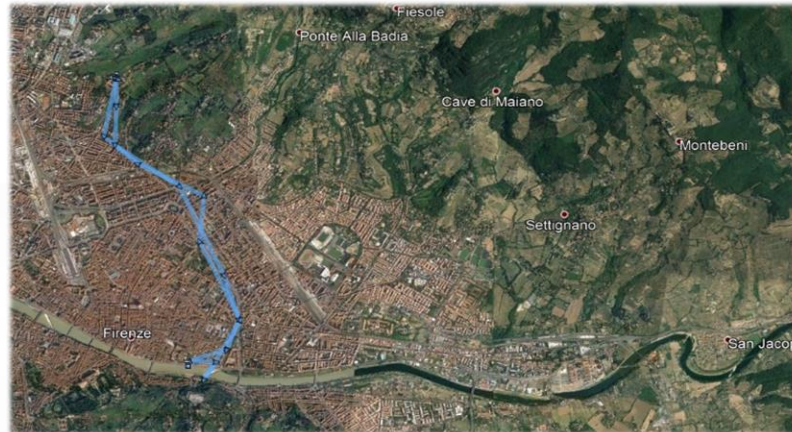




# Automated Classification of Users' Transportation Modality in Real Conditions

## Variables taken into account:

- **Day/Time Baseline and GPS:**
- **Accelerometer**
- **Proximity**
- **Temporal window**



## Four combinations of the different categories of data:

1. Baseline features and distance feature
2. Baseline, distance feature and accelerometer features
3. Baseline, distance feature and temporal window features
4. Baseline, distance, accelerometer, temporal features together

## Dataset:

- 30K observations
- 25 variables
- 38 different users
- 30 different kinds of devices
- 4 classes (Stationary, Walking, Private Transport, Public Transport)

Note that, *each user have used the mean of transport of his/her own preference.*

When the mode of transport is changed, the user was asked to notify the change to the App for creating the learning set and for validation.





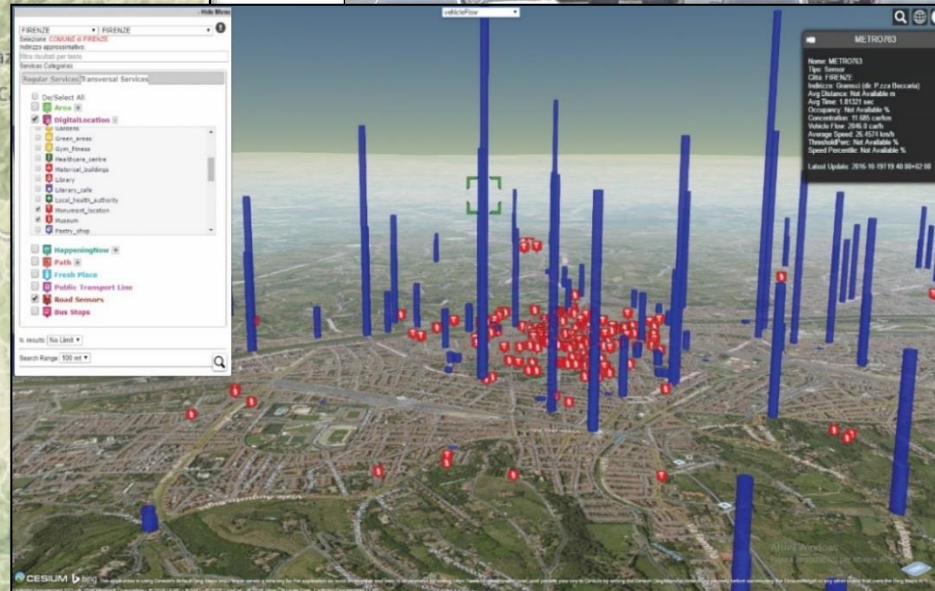
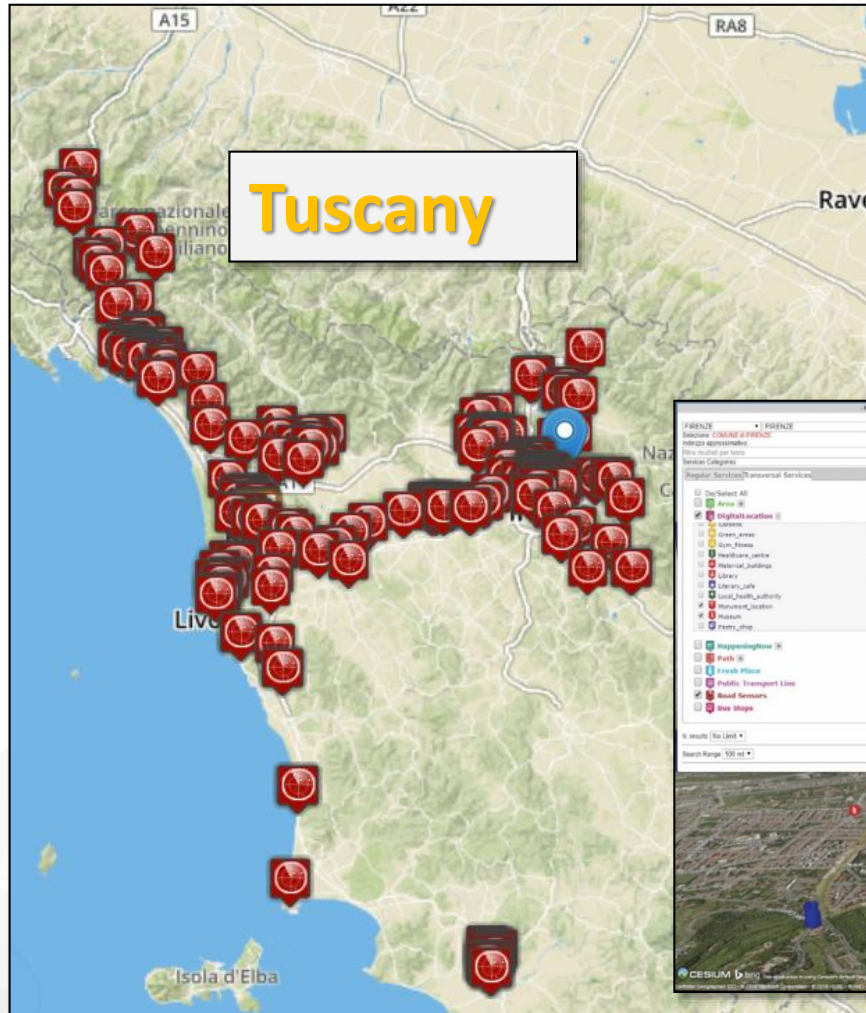


# Traffic Flow Tools



Spire and Virtual Spires (cameras), Bluetooth, ...

Specifically located: along, around, on gates, on x...





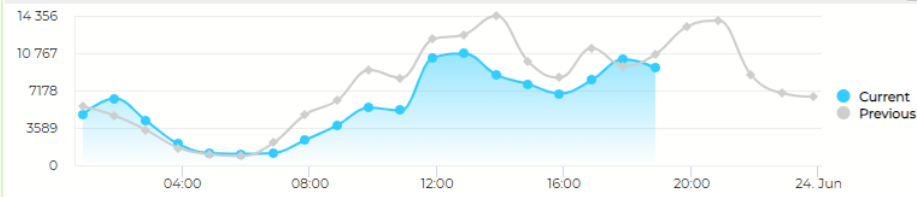
# Traffic Flow Monitoring - Firenze - Cloned

Sun 23 Jun 19:38:15

# IN FLOW 9m

9350

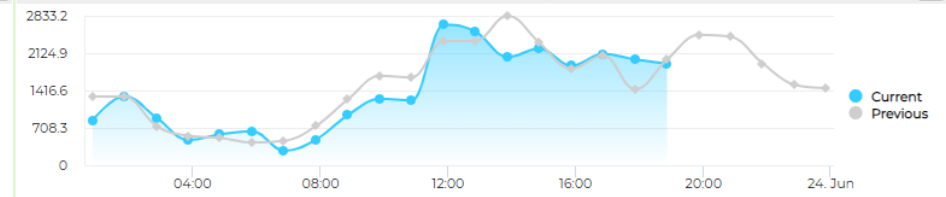
Firenze IN Traffic Flow (number of vehicles) 9m



ZTL in 9m

1925

ZTL in Traffic Flow daily trend 9m



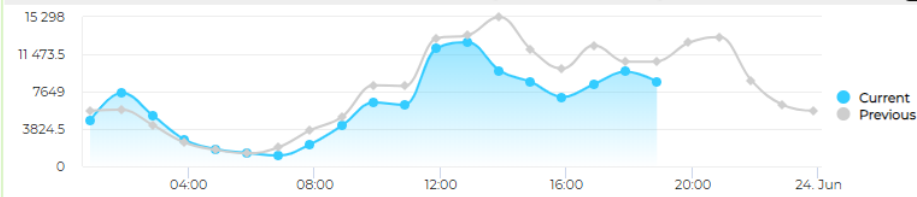
status comments 4m

All OK

# OUT FLOW 9m

8684

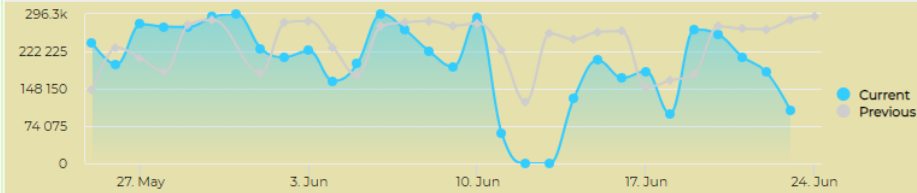
Firenze OUT Traffic Flow (number of vehicles) 9m



Inc Daily Inp... 9m

105354

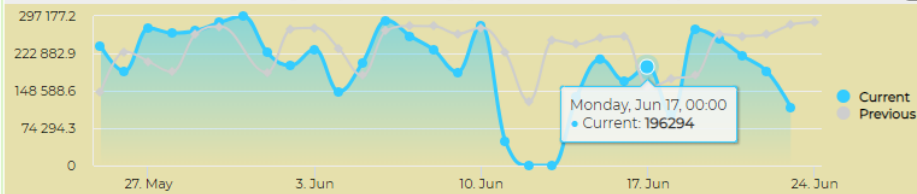
Daily Inputs (monthly) (last value is incremental) 9m



Inc Daily Out... 9m

116029

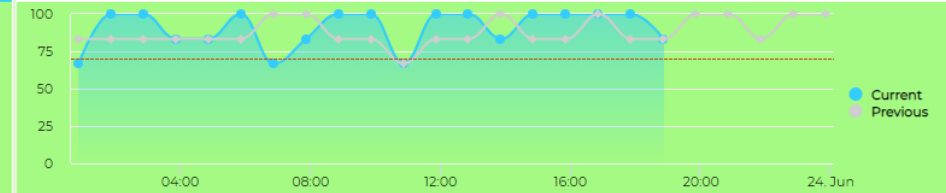
Daily Outputs (monthly) (last value is incremental) 9m



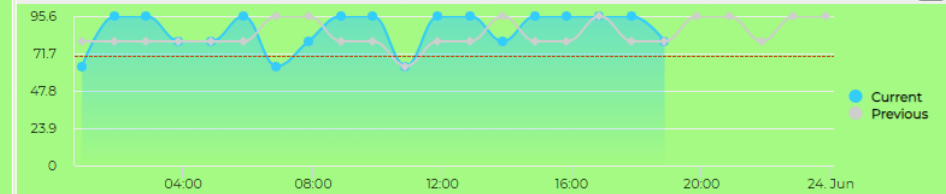
Current Time - C...

23/06/2019  
19:38:15

Quality of Measure in terms of percentage of expected measures considered 9m



Quality of Measure in percentage - ZTL in time trend compare 9m







# Toscana Traffico

Thu 1 Nov 14:15:47

**Traffic Events** 9m

**TEMPORARY TRAFFIC LIGHTS**  
 05/11/2018 00:00:00 5

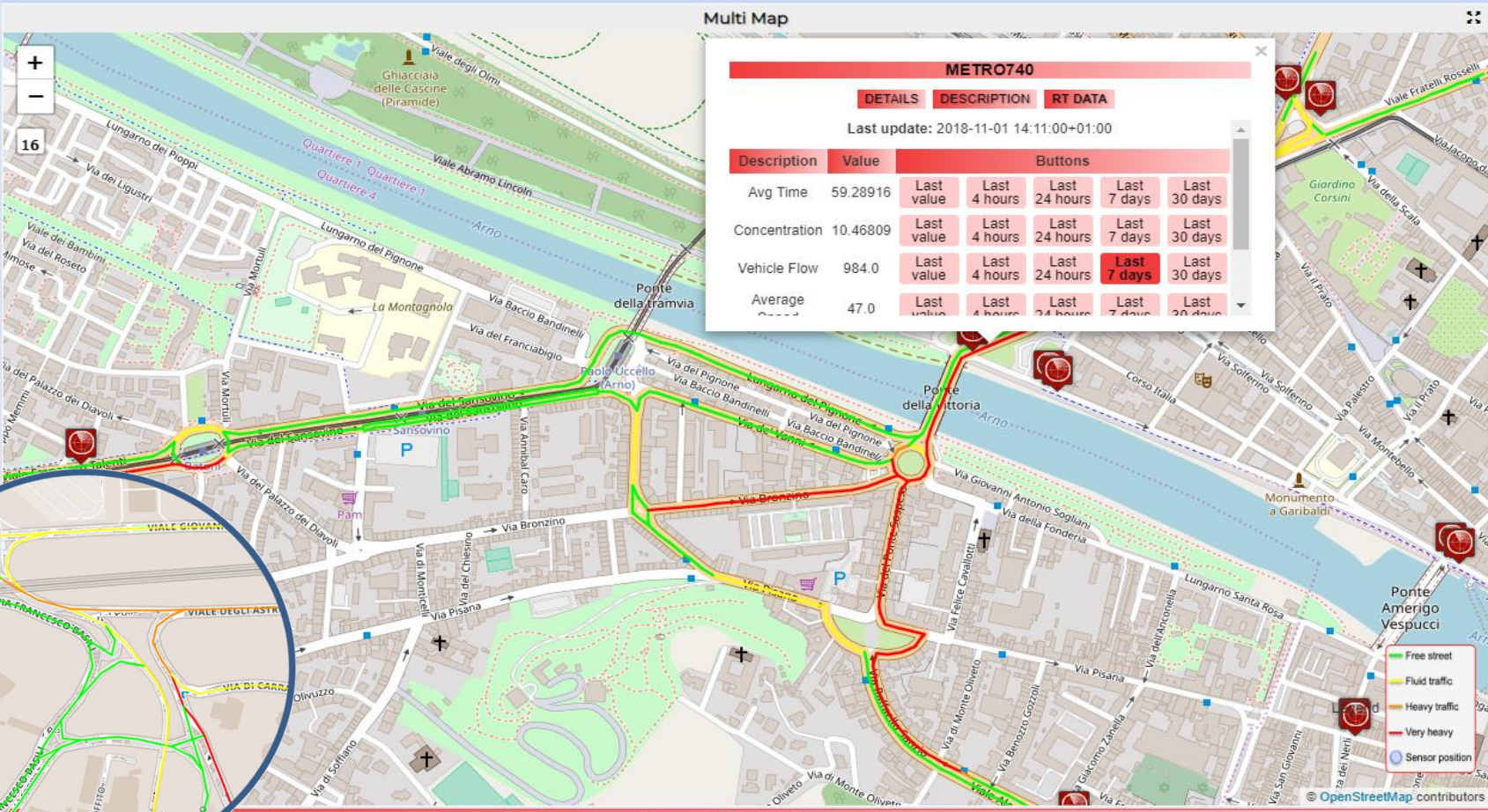
ORD. 2018-002375 - ISTITUZIONE DI SENSO UNICO ALTERNATO REGOLATO DA IMPIANTO SEMAFORICO MOBILE E/O MOVIERI, OLTRE ALLA LOCALIZZATA LIMITAZIONE DI VELOCITA' A 30 KM/H IN PROSSIMITA' DEL CANTIERE, PER IL RESTRINGIMENTO DELLA CARREGGIATA, SULLA S.P. N.56 'DEL BROLLO E POGGIO ALLA CROCE' AL KM 16+600 CIRCA, IN LOCALITA' CAPANNUCCIA E SULLA S.P. N.34 'DI ROSANO', PER INTERVENTI PUNTUALI, DAL KM 3+440 AL KM 5+500 CIRCA, IN LOCALITA' VALLINA, NEL COMUNE DI BAGNO A RIPOLI (FI), DAL GIORNO 05/11/2018 AL GIORNO 16/11/2018 CON ORARIO 08:00/17:00.

**TEMPORARY TRAFFIC LIGHTS**  
 05/11/2018 00:00:00 5

ORD. 2018-002375 - ISTITUZIONE DI SENSO UNICO ALTERNATO REGOLATO DA IMPIANTO SEMAFORICO MOBILE E/O MOVIERI, OLTRE ALLA LOCALIZZATA LIMITAZIONE DI VELOCITA' A 30 KM/H IN PROSSIMITA' DEL CANTIERE, PER IL RESTRINGIMENTO DELLA CARREGGIATA, SULLA S.P. N.56 'DEL BROLLO E POGGIO ALLA CROCE' AL KM 16+600 CIRCA, IN LOCALITA' CAPANNUCCIA E SULLA S.P. N.34 'DI ROSANO', PER INTERVENTI PUNTUALI, DAL KM 3+440 AL KM 5+500 CIRCA, IN LOCALITA' VALLINA, NEL COMUNE DI BAGNO A RIPOLI (FI), DAL GIORNO 05/11/2018 AL GIORNO 16/11/2018 CON ORARIO 08:00/17:00.

**TEMPORARY TRAFFIC LIGHTS**  
 05/11/2018 00:00:00 5

ORD. 2018-002375 - ISTITUZIONE DI SENSO UNICO ALTERNATO REGOLATO DA IMPIANTO SEMAFORICO MOBILE E/O MOVIERI, OLTRE ALLA LOCALIZZATA LIMITAZIONE DI VELOCITA' A 30 KM/H IN PROSSIMITA' DEL CANTIERE, PER IL RESTRINGIMENTO DELLA CARREGGIATA, SULLA S.P. N.56 'DEL BROLLO E POGGIO ALLA CROCE' AL KM 16+600 CIRCA, IN LOCALITA' CAPANNUCCIA E SULLA S.P. N.34 'DI ROSANO', PER INTERVENTI PUNTUALI, DAL KM 3+440 AL KM 5+500 CIRCA, IN LOCALITA' VALLINA, NEL COMUNE DI BAGNO A RIPOLI (FI), DAL GIORNO 05/11/2018 AL GIORNO 16/11/2018 CON ORARIO 08:00/17:00.



**METRO740**

DETAILS DESCRIPTION RT DATA

Last update: 2018-11-01 14:11:00+01:00

Description	Value	Buttons				
Avg Time	59.28916	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 days
Concentration	10.46809	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 days
Vehicle Flow	984.0	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 days
Average Speed	47.0	Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 days



**Selector**

- Air Quality
- Bus Stops
- Cycle Paths Geometry
- Cycle Paths Pins
- Hot places heatmap
- Meteo Stations
- Parkings
- Recharging Stations - Normal
- Recharging Stations - Fast
- Traffic Sensors
- Traffic Flow Density

**Florence Events** 9m

- CAMBIO DELLA GUARDIA A PALAZZO VECCHIO
- PER GRANDI E PUCCINI
- QUANTUOR EBENE, ALEXANDER LONGUICH
- "GLI STRUMENTI DI GALILEO" - A TUTTA SCIENZA!

<https://main.snap4city.org/view/index.php?iddashboard=MTE5MQ==>

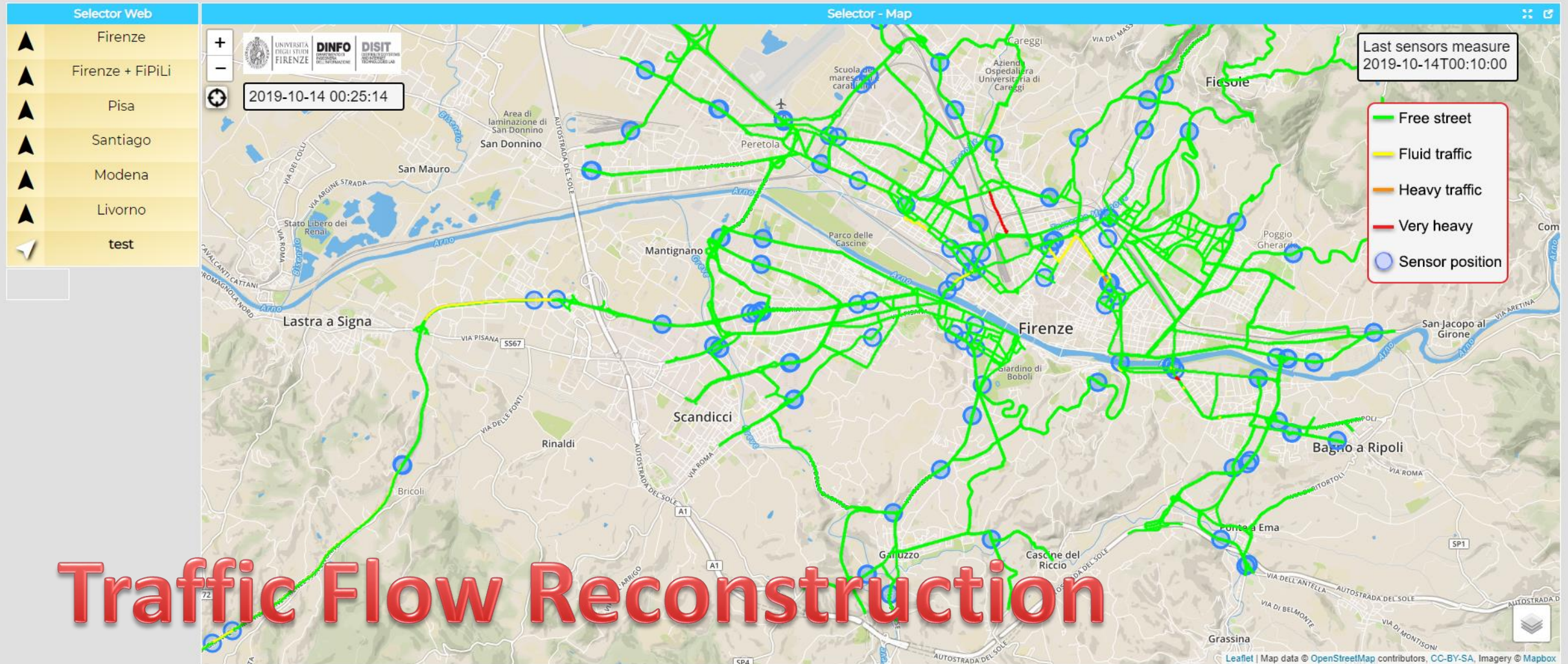






# Traffic Flow Reconstruction for the cities

Mon 14 Oct 00:25:15





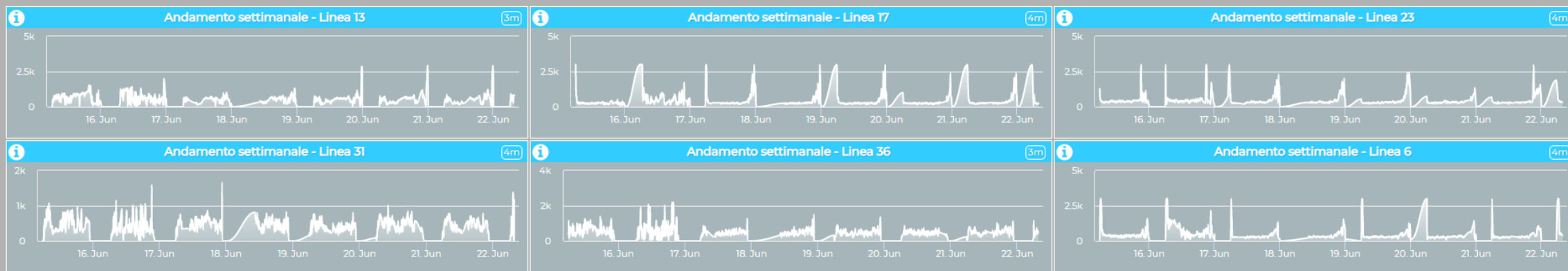
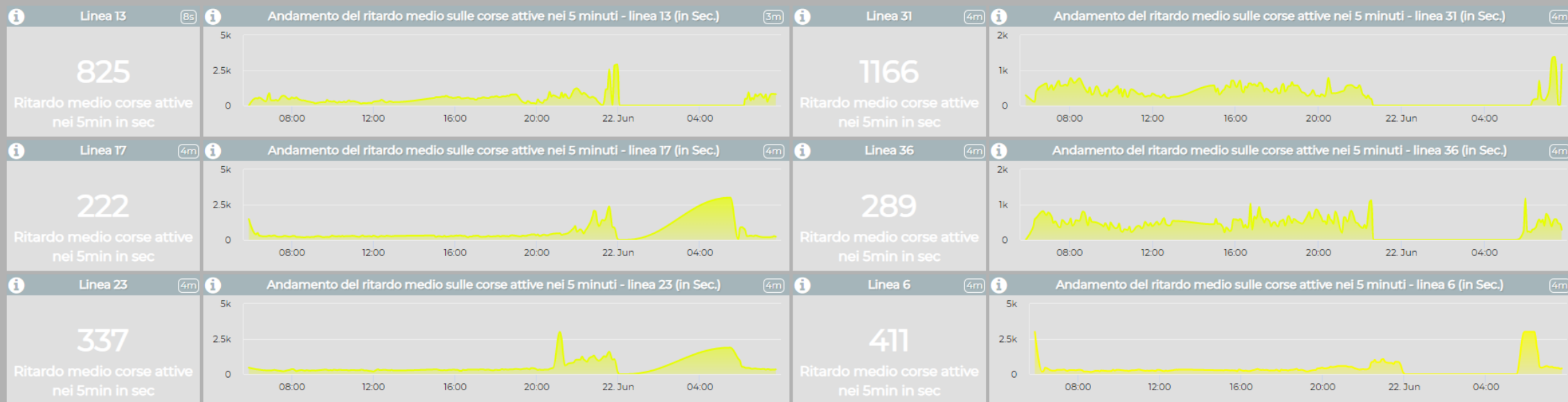




# Qualità Trasporto Pubblico - Cloned

Firenze - 6 linee

Sat 22 Jun 07:45:48





# Origin Destination Matrices





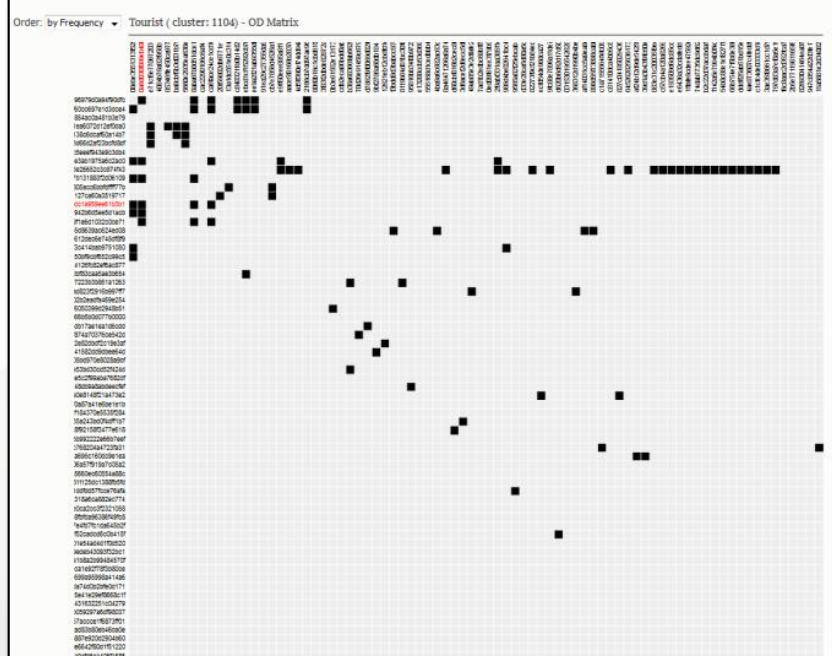
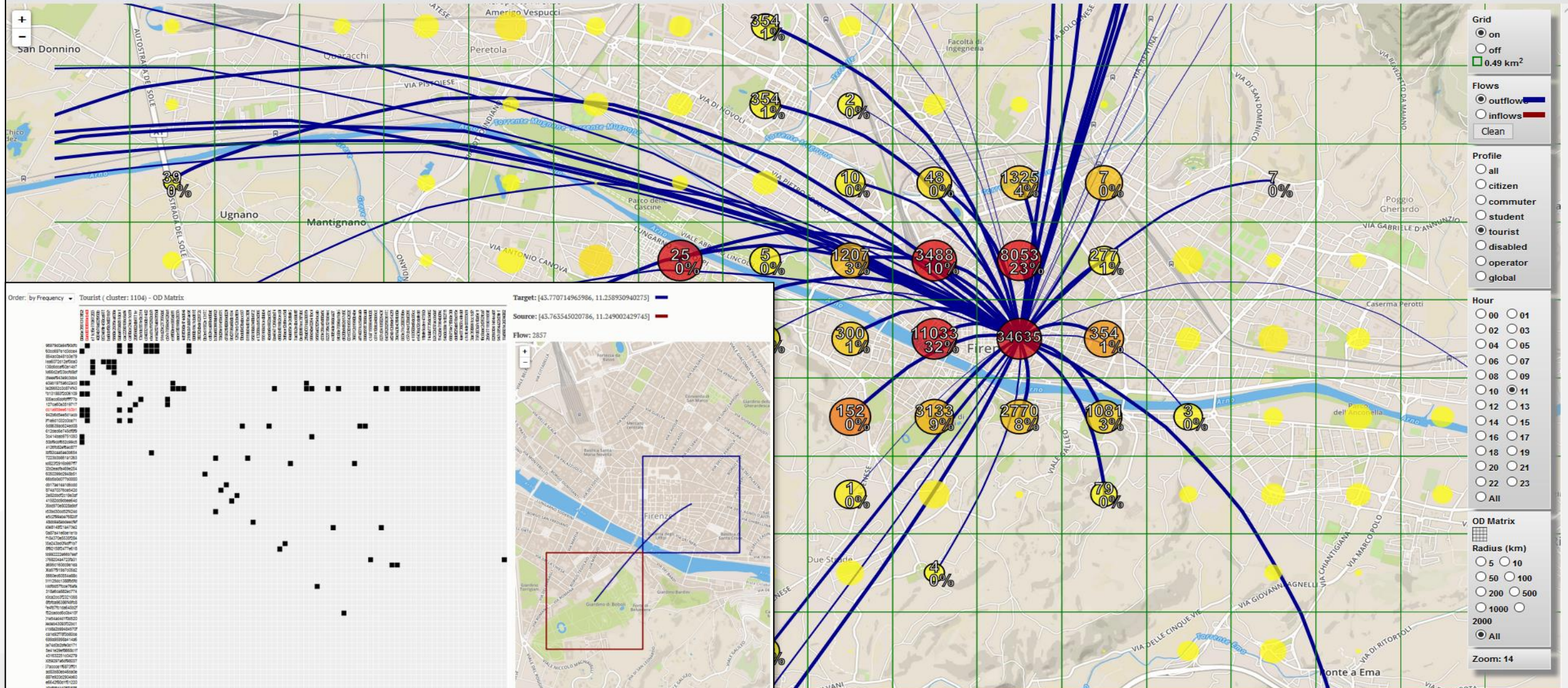
# Scalable multiresolution OD matrix



Mobile App based

Firenze - Monday November 7 2016 23:28:28

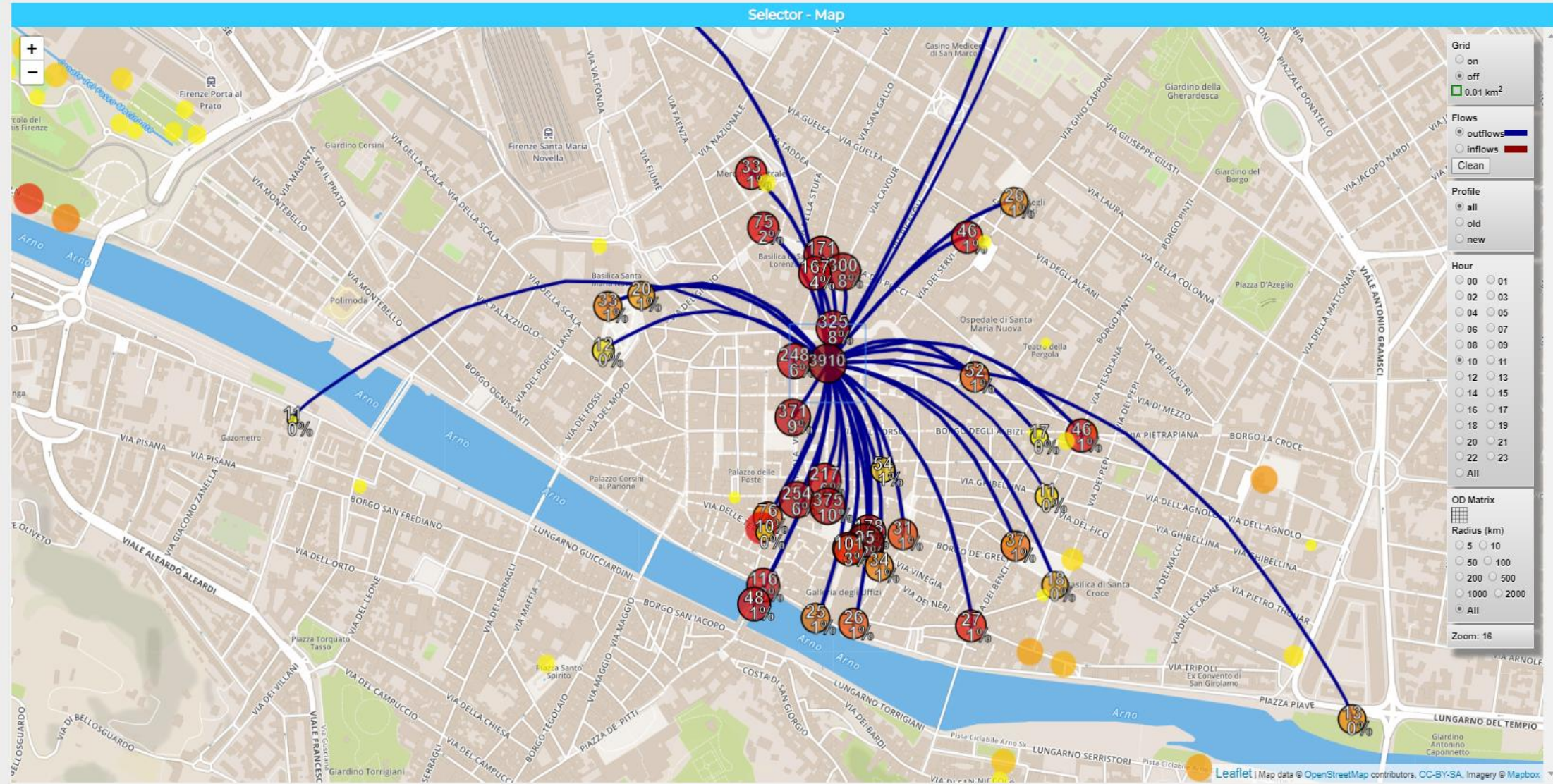
Recommender - Interactive People Flow Maps  
DISIT - Distributed Systems and Internet Technologies Lab





# Life in Toscana: Dashboard

Sun 20 Oct 23:44:05

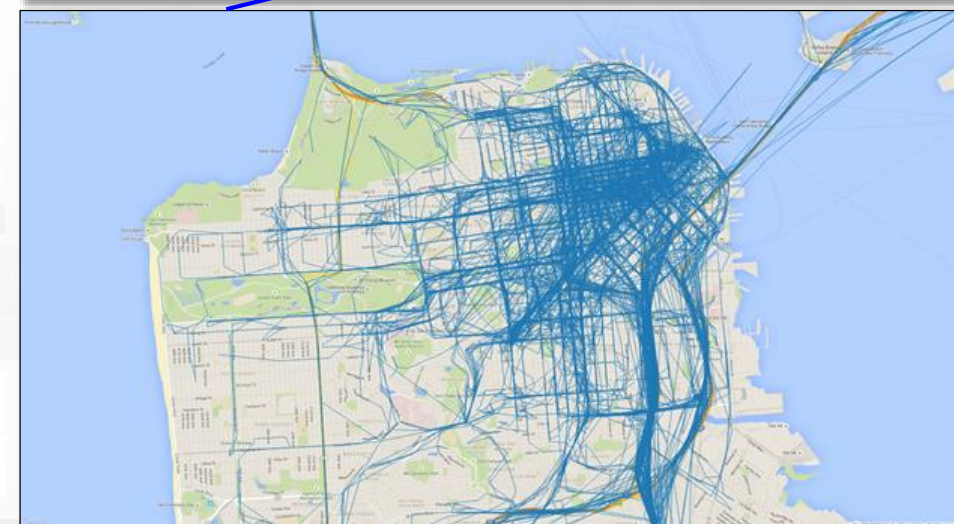
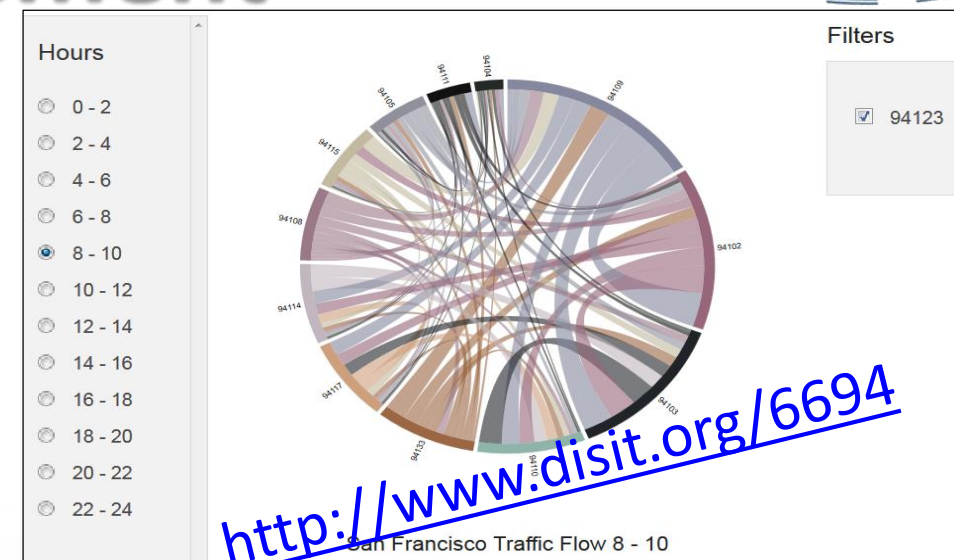


- ▲ Line of Transport
  - ▲ Public Transport
  - ▲ Travel Plan
  - ▲ Traffic Flow FIPILI
  - ▲ Air Quality
  - ▲ Weather
  - ▲ Origin Dest. Matrix
  - ▲ Typical Trajectories
  - ▲ People Flow WIFI
  - ▲ People Flow KM App
  - ▲ Cultural Activities
  - ▲ Forum Discussion
  - ▲ CAM
  - ▲ Ponte Vecchio
  - ▲ Real Time Busses
- Main



# Traffic and People Flow Assessment

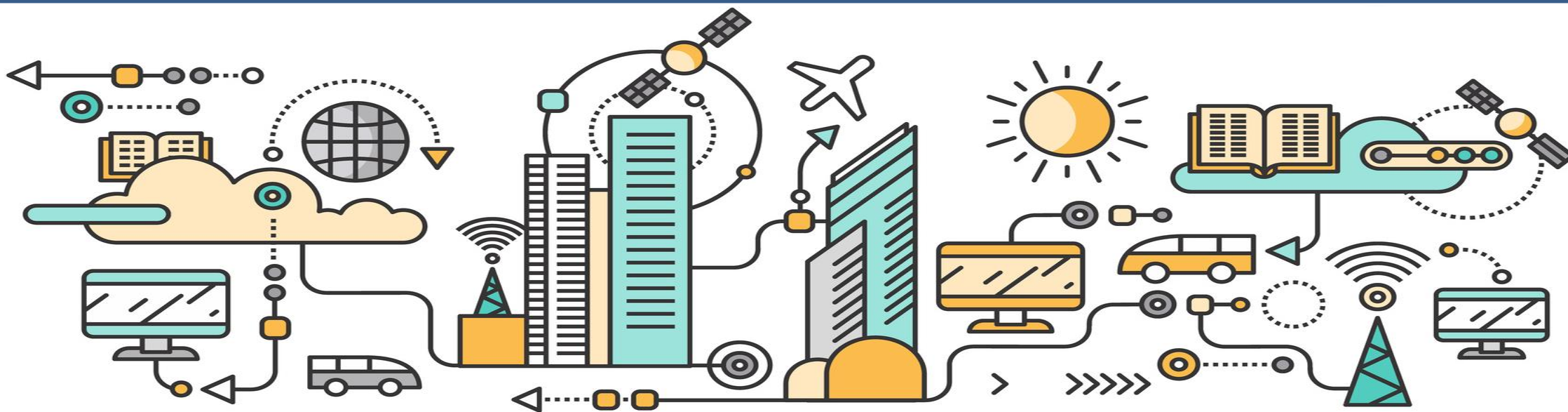
- **Origin Destination Matrix**
  - Specific Sensors, vehicle Kits, mobile App, Wi-Fi Access Points, etc.
  - Data from Taxi in San Francisco
- **Assess people and traffic flows to**
  - improve services
  - predict critical conditions on Crit. Infra.
  - take real time decisions and sending messages in push to population
  - Increase city resilience
  - optimize traffic flow
  - take decision of routing





TOP

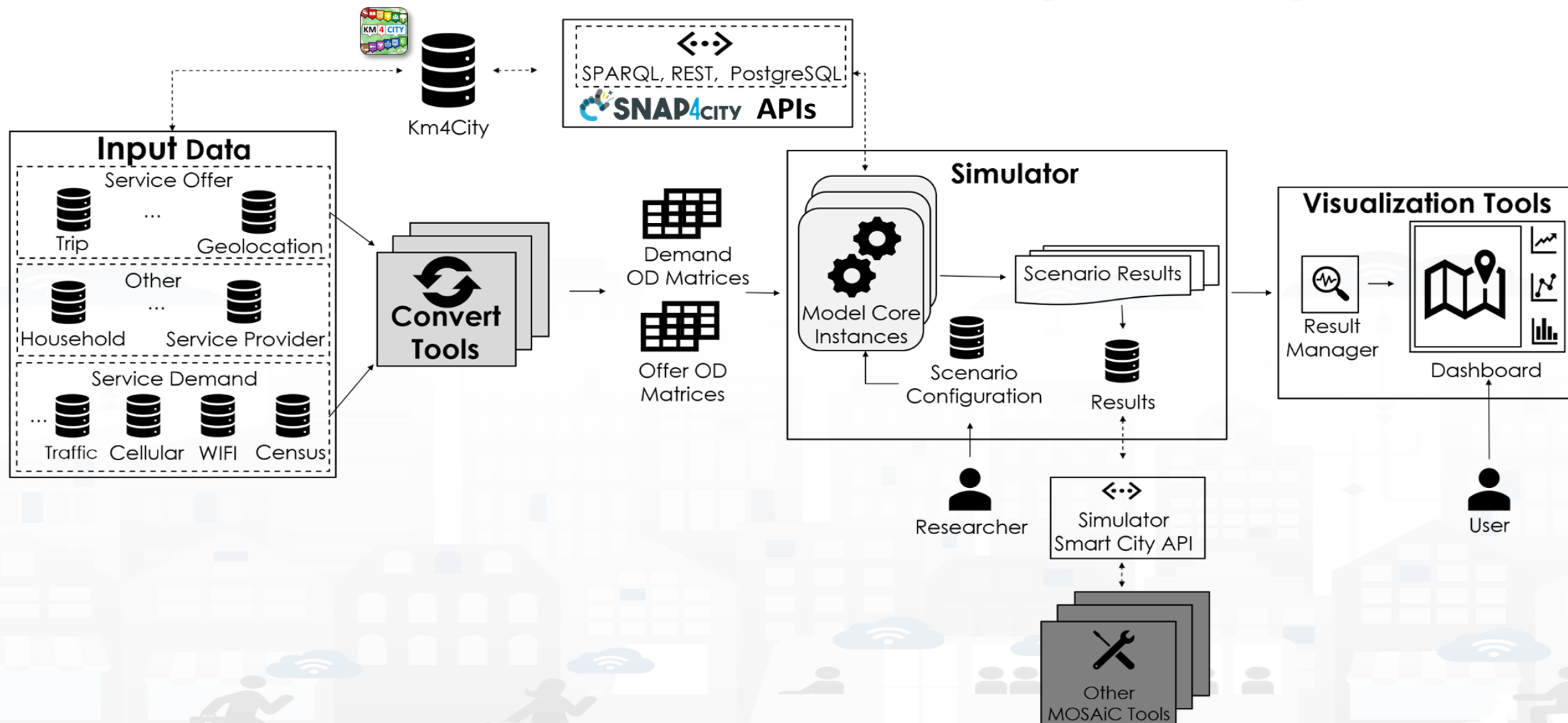
# *Demand of Mobility vs Offer of Transportation*







# Demand vs Offer of Mobility Analysis

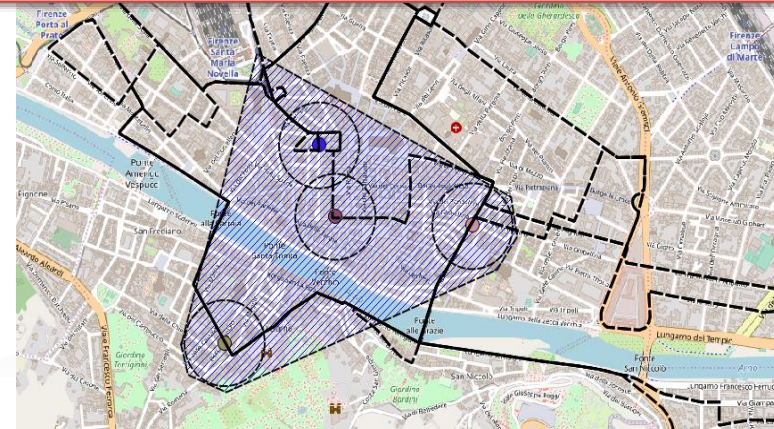




# What the Analysis tool produces

- Identification of critical Bus Stops over time
- Identification of critical courses of bus lines, over day and week
- Effects of changing the position of Bus Stops, courses and line schedules, bus size, etc.
- Effects of changing the contextual conditions:
  - The opening of shopping centers, cinemas, schools, etc..
  - Size of the buses
  - Etc.

Area and Bus stops considered for the Validation

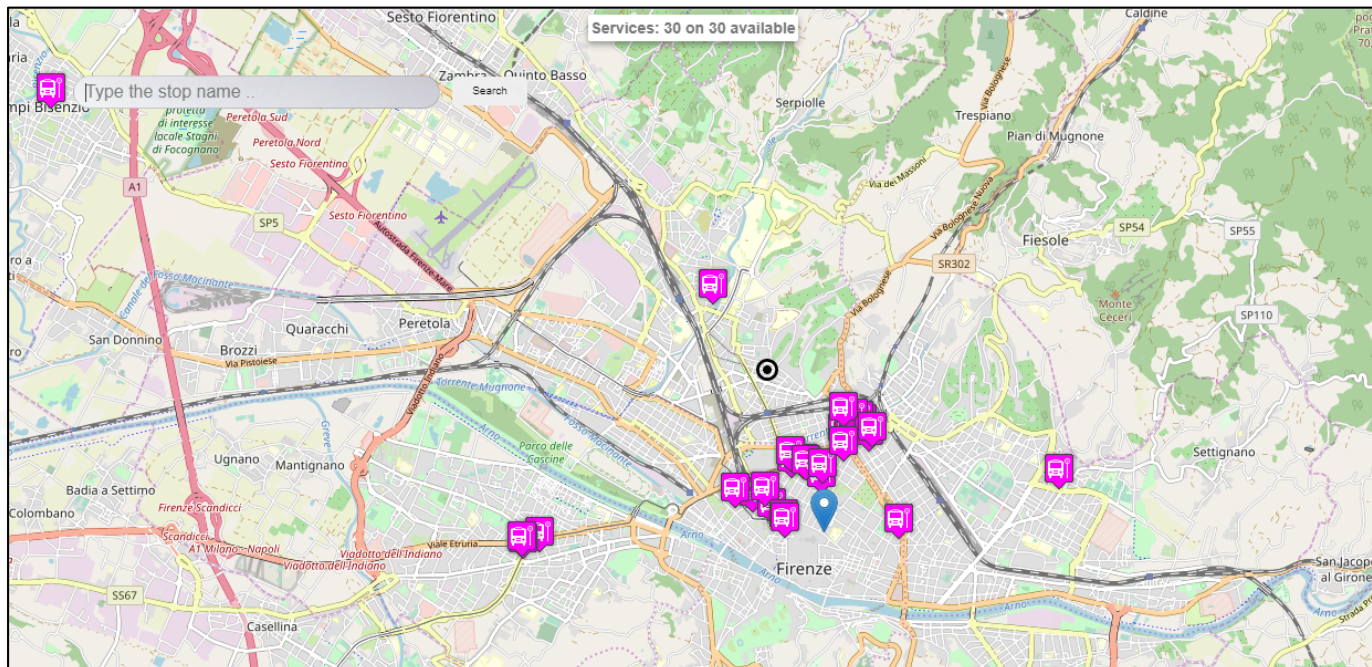


Parameters	Value
Morning interval	05:00 – 13:59
Afternoon interval	14:00 – 23:59
Time interval size	60 (min)
Morning outbound trips ( $\bar{O}ut_{mng}$ )	42393
Afternoon outbound trips ( $\bar{O}ut_{aft}$ )	52798
Radius ( $r$ ) of circle $c(s, r)$ around each stop $s$	250 (m)

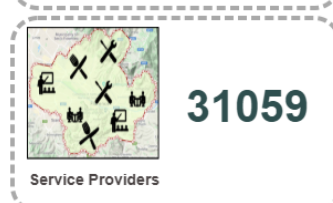
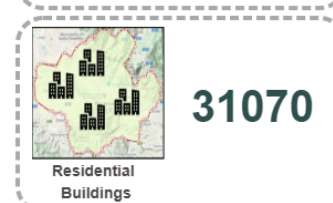
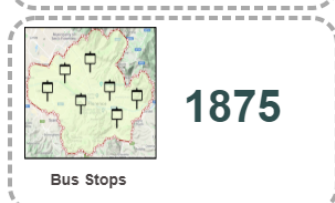
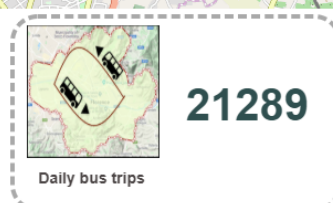
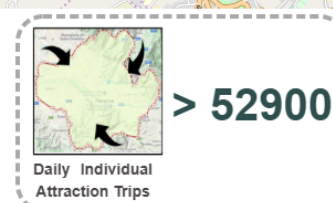
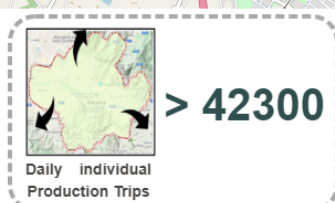
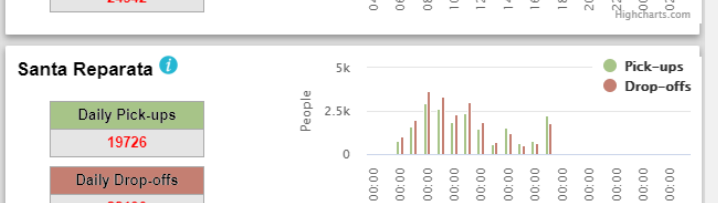
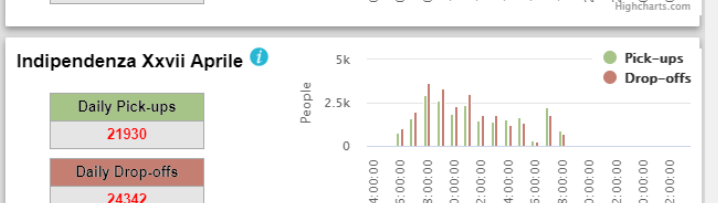
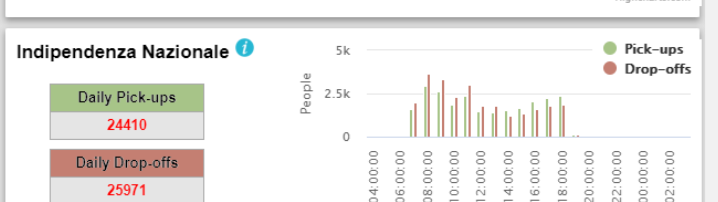
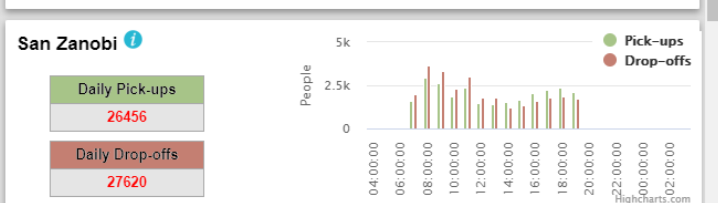
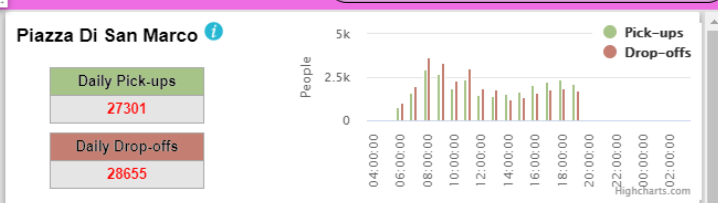




# Bus Stop Analysis: identification of criticalities



**The Most Crowded Stops** Select a time slot: 04:00 to 04:59 Search





TOP

# *Modal & Multimodal Routing for Navigation and Travel Planning*





User: roottooladmin1, Org: DISIT  
Role: RootAdmin, Level: 7

- 🏠 Dashboards
- 🏠 My Dashboards
- 🔔 Notificator
- 🔗 IOT Applications
- 👤 My Personal Data
- 🔗 IOT Directory and Devices
- 📄 Knowledge and Maps
- 🗺️ Service Map
- 📄 Loading WKT on Service Map
- 📄 Creating WKT
- 📄 Service Map 3D
- 📄 Helsinki Service Map
- 📄 Antwerp Service Map
- 📄 My Annotation on Services/Data
- 📄 Mapping Services Data
- 📄 ArcGIS DISIT Service
- 🔗 Micro Applications
- 🔗 External Services
- 📄 Data Set Manager: Data Gate
- 🔗 Resource Manager: Process Loader
- 🔗 Development Tools
- 🔗 Management
- ⚙️ Settings
- 👤 User Management and Auditing
- 👤 Help and Contacts
- 📄 Documentation and Articles
- 👤 My Profile
- 🔗 Snap4City portal
- 🔗 Km4City portal
- 🔗 DISIT Lab portal

🇮🇹
SI-Mobility
- Hide Menu

Public transport
Municipalities
Text Search
Address Search
Events

Select an agency:  
- Select an Agency -

Select a line:  
- Select a Line -

Select a route:  
- Select a Route -

Select a bus stop:  
- Select a Stop -

Position of selected Busses

Actual Selection

Coord: 43.7130, 10.9272

Address: [VIA DI PRATOVECCHIO, 58, EMPOLI](#)

Path from here
Path to here
Search geometry

Path

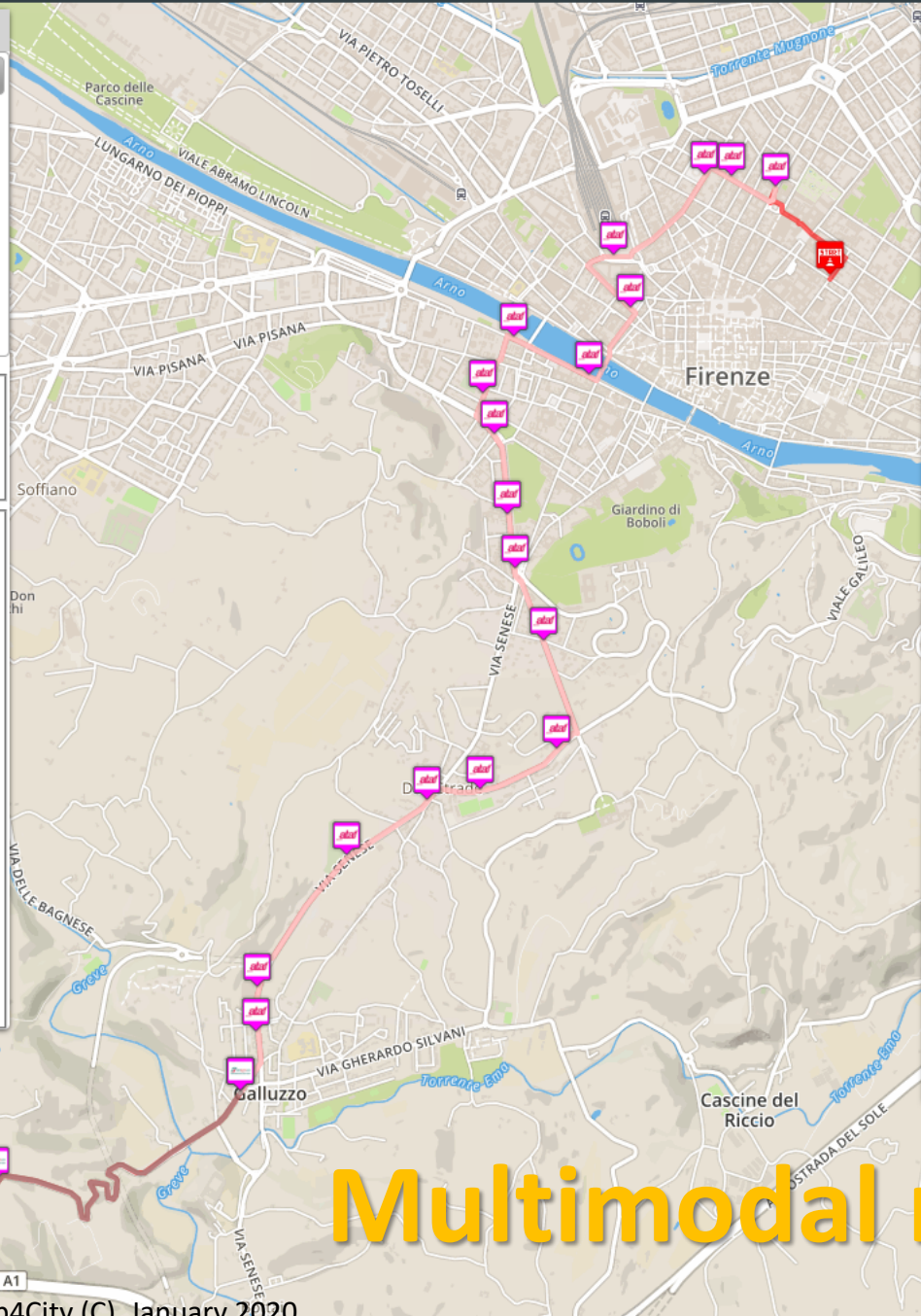
From: VIA DELLA PERGOLA, 39, FIRENZE  
To: VIA DI PRATOVECCHIO, 58, EMPOLI

Route via: public\_transport

Start date&time: today now

Search Path

3. Piazza della Santissima Annunziata 49m (14:40:13)
4. Via Cesare Battisti 148m (14:40:52)
5. Piazza San Marco 126m (14:42:47)
6. Via Camillo Cavour 1m (14:44:17)
7. 11 : Arazzieri - Volterra 7800m (15:06:00)
8. 37 : Galluzzo Via Volterra - Montespertoli (V. Risorgimento) Sn 26620m (18:52:00)
9. Viale Risorgimento 207m (19:45:00)
10. 32 : Montespertoli (V. Risorgimento) Sn - Viasanzio Fr.157 Sn 17534m (07:16:00)
11. 1 : Via Sanzio Fr.157 - Via Sanzio Fr. Coop Sn 1002m (08:08:00)
12. Via Raffaello Sanzio 45m (08:10:00)
13. nd 33m (08:10:35)



Regular Services
Transversal Services

Services Categories

- De/Select All
- Accommodation +
- Advertising +
- AgricultureAndLivestock +
- CivilAndEdilEngineering +
- CulturalActivity +
- EducationAndResearch +
- Emergency +
- Entertainment +
- Environment +
- FinancialService +
- GovernmentOffice +
- HealthCare +
- IndustryAndManufacturing +
- IoTDevice +
- MiningAndQuarrying +
- ShoppingAndService +
- TourismService +
- TransferServiceAndRenting +
- UtilitiesAndSupply +
- Wholesale +
- WineAndFood +

Filter:

search text into service

Service providing value type:  
select value type

N. results: 100

Search Range 100 mt

Search Area  
select...

🔍
🔄
📄

# Multimodal routing



# Routing and Multimodal Routing

## Modes:

- Pedonal, Vehicles
- Public Multimodal
- Multi Point for Delivering
- Constrained: quite, blocked, etc.

## Test it on our:

- Mobile Apps
- MicroApplication
- Dashboard
- ServiceMap service on Tuscany in Snap4City

The screenshot displays the Snap4City routing interface. On the left, a sidebar contains search and selection options: 'Public transport', 'Municipalities', 'Text Search', 'Address Search', and 'Events'. Below these are dropdown menus for 'Select an agency', 'Select a line', 'Select a route', and 'Select a bus stop'. A 'Position of selected Buses' button is also present. The 'Actual Selection' section shows coordinates (43.7600, 11.2420) and the address 'VIA SENESE, 1, FIRENZE'. The 'Path' section shows the route from 'VIA SAN GALLO, 203, FIRENZE' to 'VIA SENESE, 1, FIRENZE' via 'public\_transport'. A search path button is located below. The main map area shows a route through Florence, with various bus stops marked by icons. On the right, a summary panel shows the route details: 'Azzera' and 'Calcola' buttons, a map view, and a 'Percorso' section listing stops and distances. The 'Percorso' section includes a red-bordered box around the first stop: '20 : Romito Richa - Beslan T1 Fortezza' with 3 fermate and a duration of 22:28:00 - 22:33:00. Other stops listed include '13 : Beslan T1 Fortezza - Il David' (18 fermate, 22:34:00 - 22:53:00) and '13 : Il David - Erta Canina' (2 fermate).



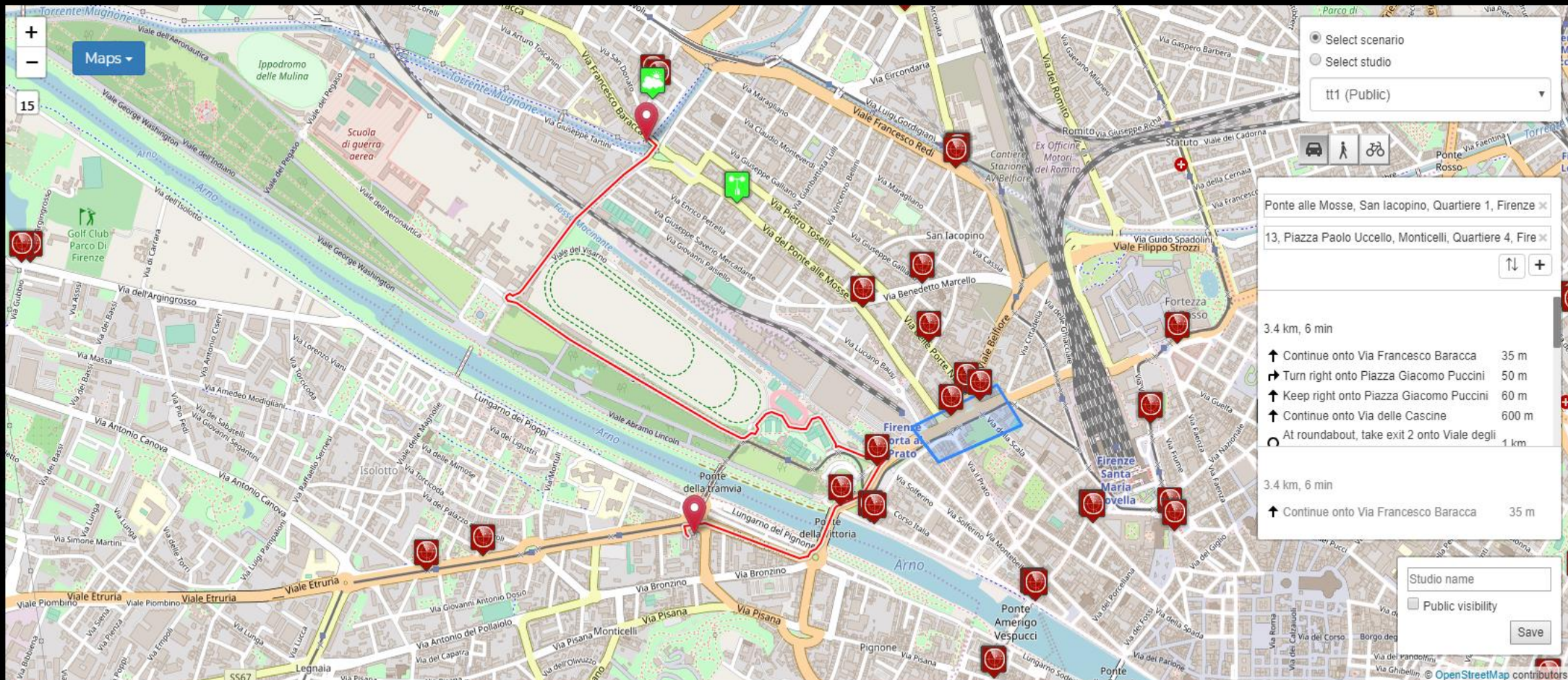
# Mobility and Environment What-IF Analysis

This dashboard contains data derived from actual sensors and predictive values under validation

- Air Quality Sensors
- Weather Sensors
- PM10 Heatmap
- PM2.5 Heatmap
- CO Heatmap
- CO2 Heatmap
- O3 Heatmap
- NO2 Heatmap
- Europ. AQI Heatmap
- Air Humidity Heatmap
- Air Temp. Heatmap
- Wind Speed Heatmap
- Gral Pred. HM NOX (3m)
- Gral Pred. HM NOX (6m)
- Traffic Sensors
- Traffic Flow
- Cycling Paths
- Accident Heatmap
- Only HRes Anym. Gral
- Scenarios
- What-if analysis

Firenze Oggi

Air Temperat... 9m



Select scenario  
Select studio  
tt1 (Public)

Ponte alle Mosse, San Iacopino, Quartiere 1, Firenze x  
13, Piazza Paolo Uccello, Monticelli, Quartiere 4, Fire x

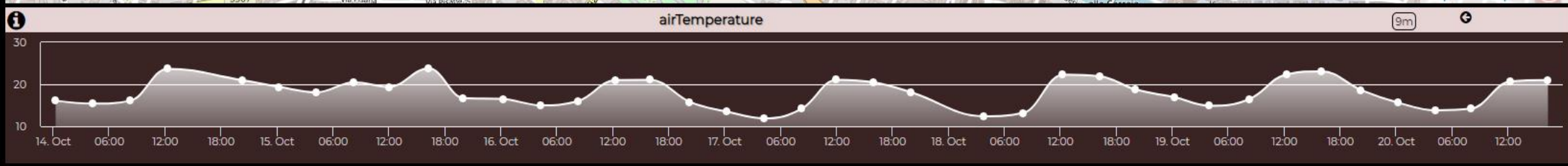
3.4 km, 6 min

- Continue onto Via Francesco Baracca 35 m
- Turn right onto Piazza Giacomo Puccini 50 m
- Keep right onto Piazza Giacomo Puccini 60 m
- Continue onto Via delle Cascine 600 m
- At roundabout, take exit 2 onto Viale degli 1 km

3.4 km, 6 min

- Continue onto Via Francesco Baracca 35 m

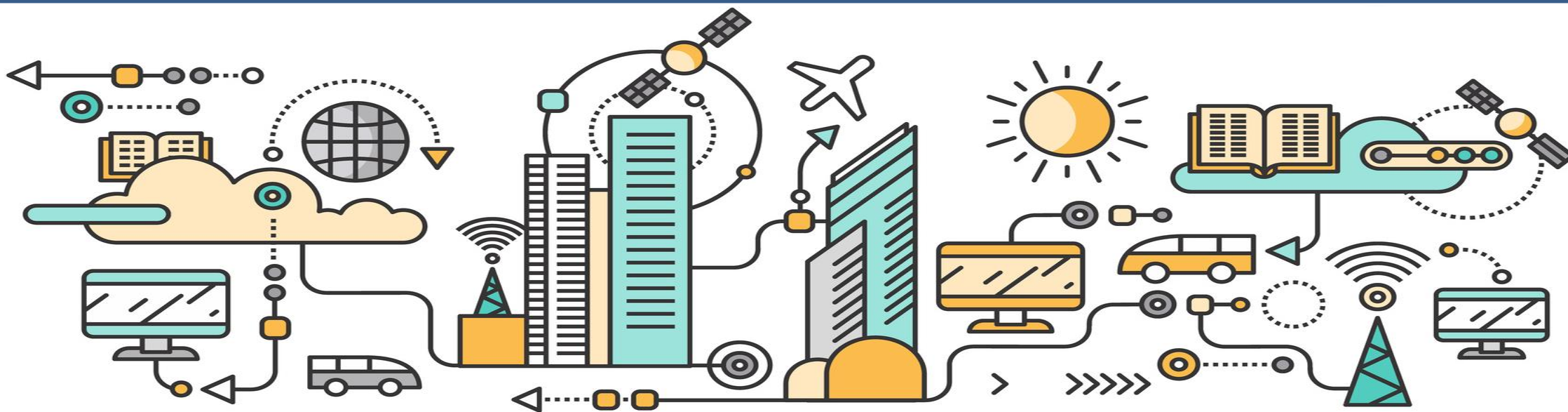
Studio name  
 Public visibility  
Save





TOP

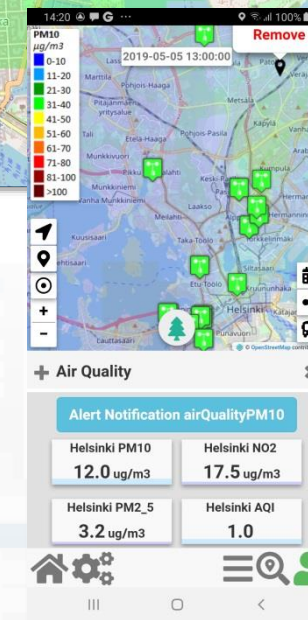
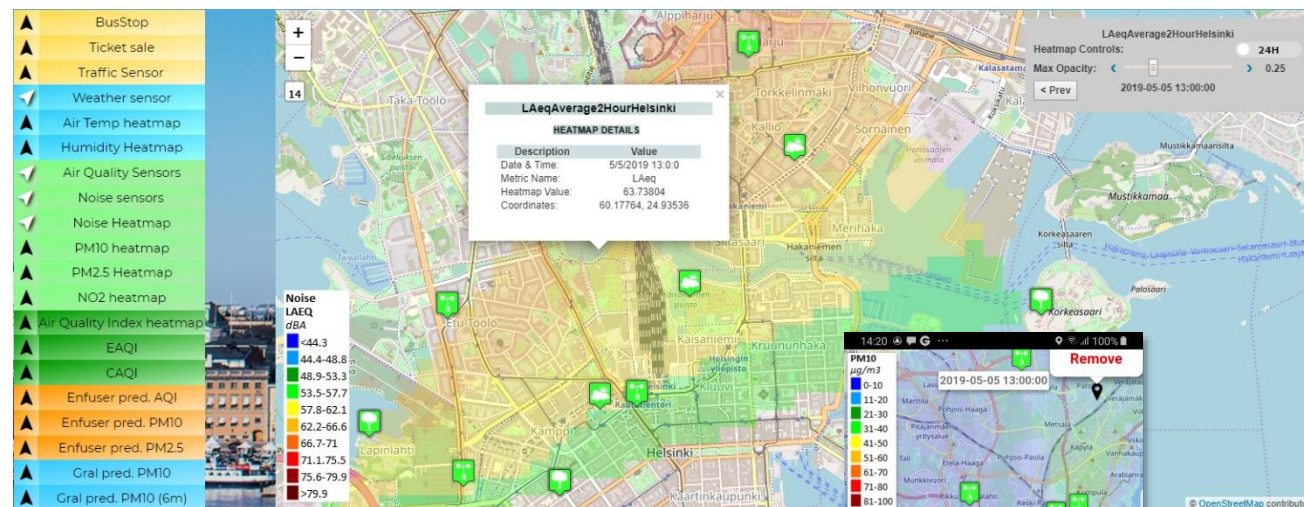
# *Environmental Data Predictions*





## Data Analytics: Heatmaps

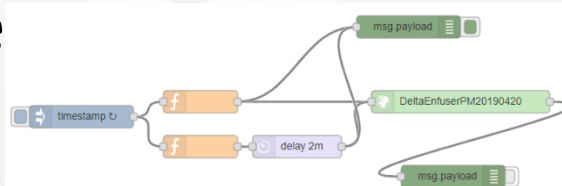
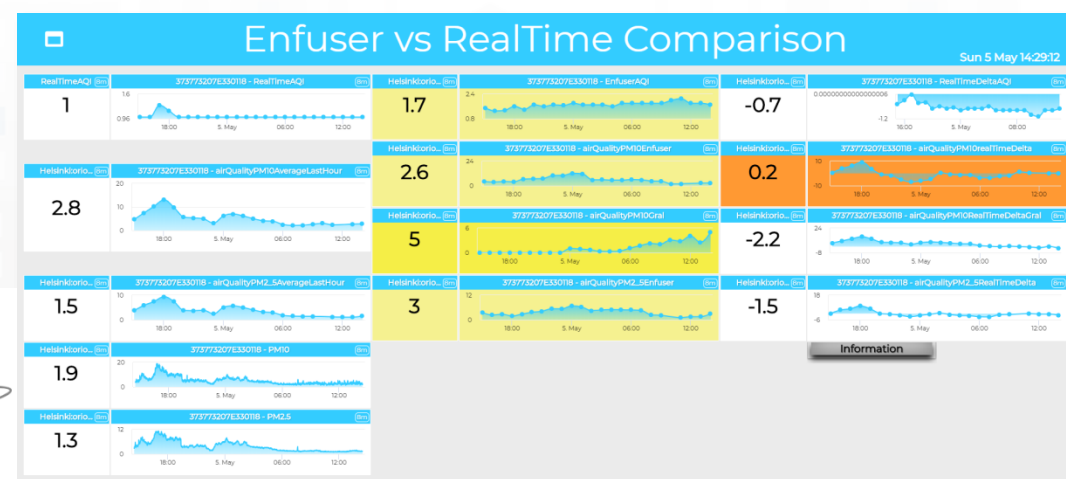
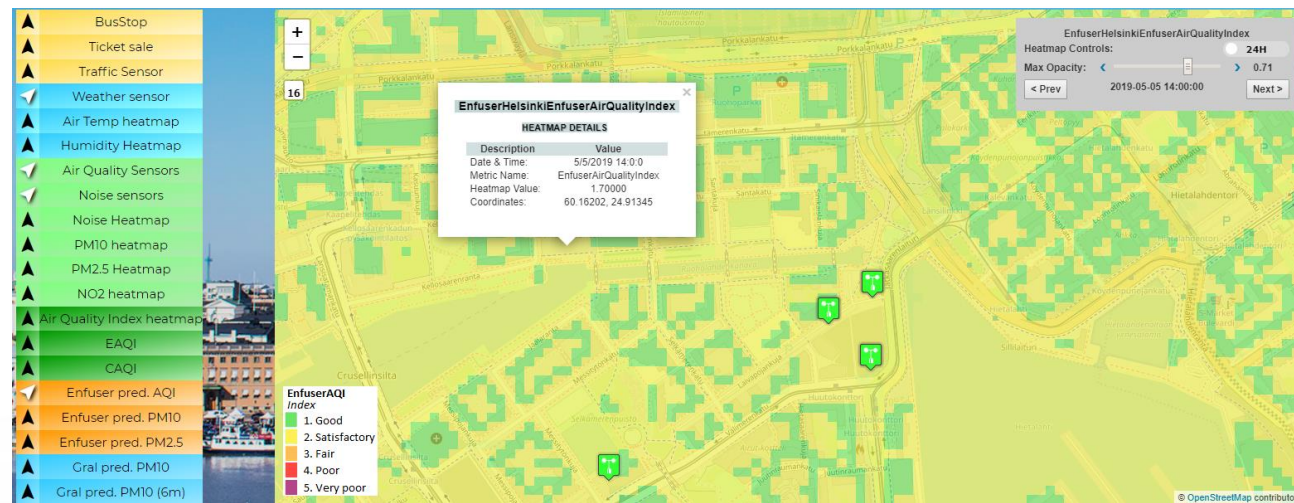
- Over the Gaussian Heatmaps
- Calibrated heatmaps on the basis of Interpolated data for:
  - From 200x200 to 4x4 mt
  - PM10, PM2.5, SO2, NO2, Noise, NO, O3, Enfuser, GRAL,....
  - Any programmed Color map
  - Animations over H24
  - Picking values in any place, values on their position.
  - On Web and Mobile App





## Data Analytics: Enfuser predictions

- **Enfuser predictions: AQI, PM10, PM2.5**
  - Data gathering, data processing for Piking
  - Delta Estimation Predictions vs Actual: on 12 points/sensors via R-Studio and IOT App
  - API for accessing data of Heatmaps in real time





# Data Analytics: AQI estimations

- **Legenda of Environmental data:**
  - <https://www.snap4city.org/drupal/node/435>
- **AQI estimation via Rstudio and IOT App:**
  - EAQI, European Air Quality Index
  - Enfuser AQI for Delta,
  - CAQI
  - Their corresponding Heatmaps

✓	Air Quality Sensors
✓	Noise sensors
✓	Noise Heatmap
▲	PM10 heatmap
▲	PM2.5 Heatmap
▲	NO2 heatmap
▲	Air Quality Index heatmap
▲	EAQI
▲	CAQI
▲	Enfuser pred. AQI
▲	Enfuser pred. PM10
▲	Enfuser pred. PM2.5
▲	Gral pred. PM10
▲	Gral pred. PM10 (6m)



## Environmental Data Predictions: GRAL

- GRAL predictions: PM10, NOX, ....
  - Comparison wrt real time values in actual value of Sensors
  - Graz Lagrangian Model.
- GRAL model takes into account:
  - pollution sources (for example the vehicles, their distribution on the streets, the about of pollution they produce according to their distribution over time and space, etc.),
  - structure of the city (streets and shape 3D of the buildings),
  - weather forecast (wind intensity and direction), etc.
- GRAL can be applied on NOX, PM10, PM2.5, ... or any other particles

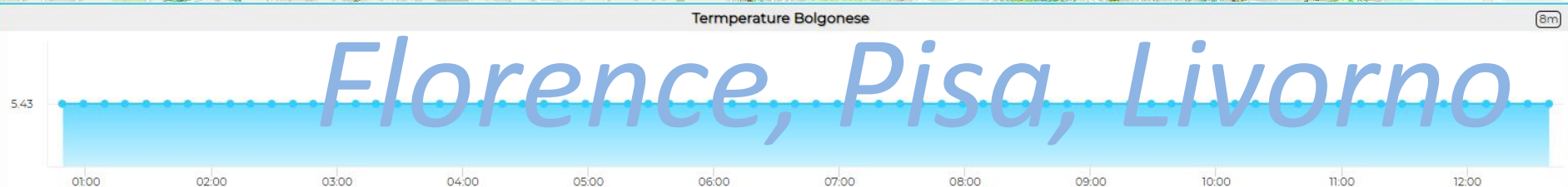
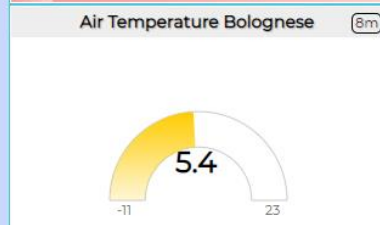
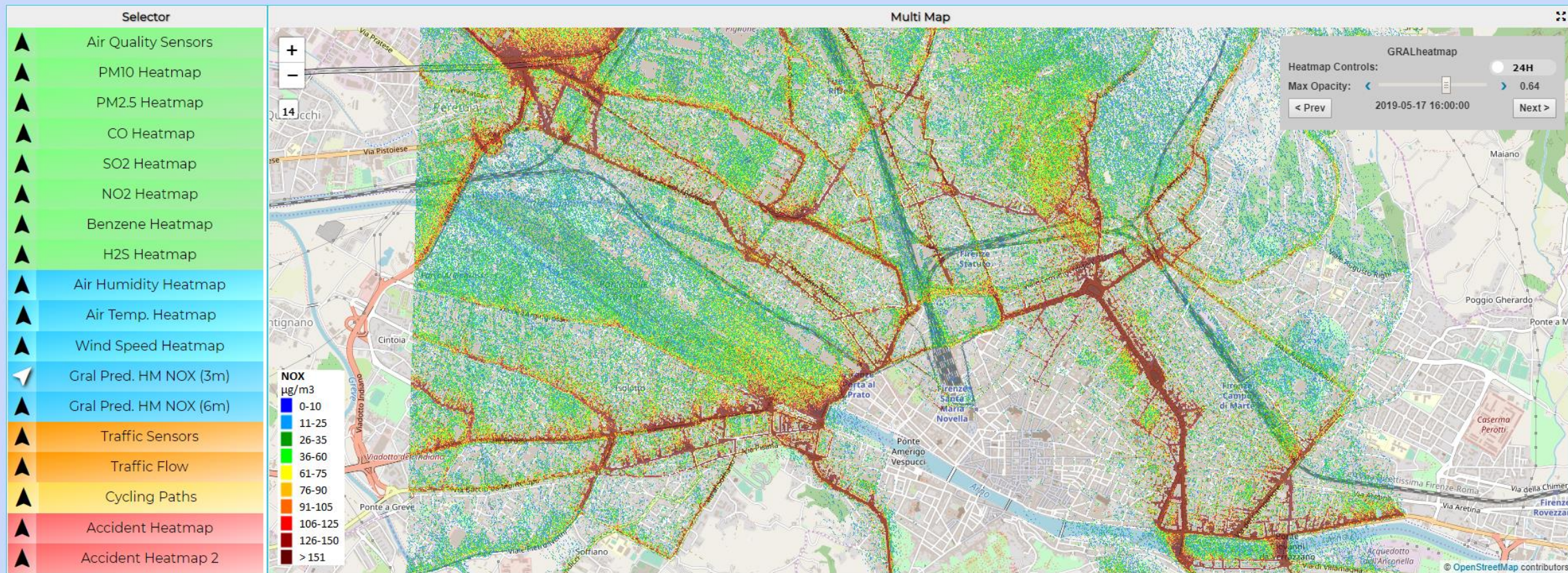




# Heatmap Firenze - trafair

different data

Fri 17 May 12:49:34



# Florence, Pisa, Livorno



# Prediction of Air Quality

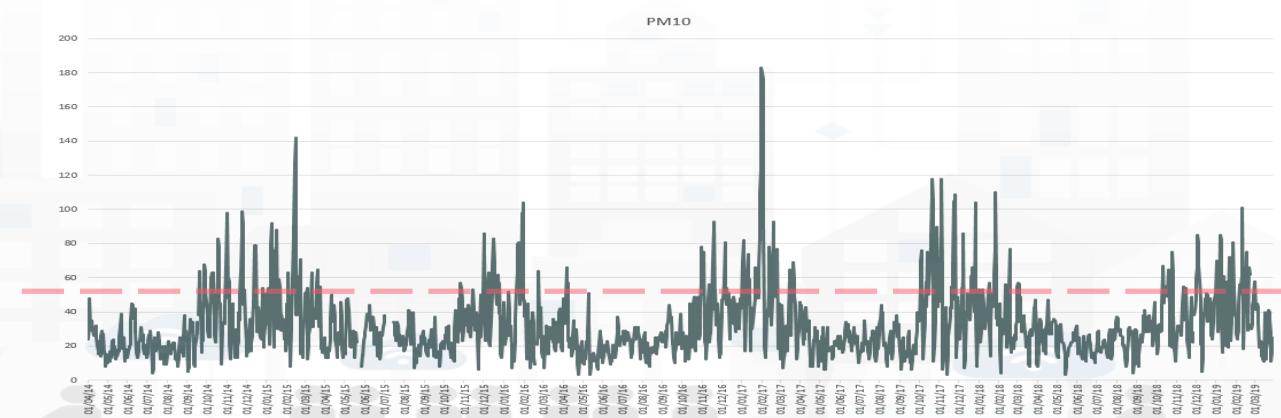




# Predicting Air Quality

- European Air Quality Directive
- Predicting critical days
  - PM10 with an accuracy of more than 90% and precision of 85%;
  - PM2.5 with an accuracy of 90% and precision greater than the 95%.
- Simulating Long terms values
  - For long terms predictions

Air Quality Directive				WHOguidelines	
Pollutant	Averaging period	Objective and legal nature and concentration	Comments	Concentration	Comments
PM <sub>2.5</sub>	One day			25 µg/m <sup>3</sup> (*)	99 <sup>th</sup> percentile (3 days/year)
PM <sub>2.5</sub>	Calendar year	Target value, 25 µg/m <sup>3</sup>	The target value has become a limit value since 1 January 2015	10 µg/m <sup>3</sup>	
PM <sub>10</sub>	One day	Limit value, 50 µg/m <sup>3</sup>	Not to be exceeded on more than 35 days per year.	50 µg/m <sup>3</sup> (*)	99 <sup>th</sup> percentile (3 days/year)
PM <sub>10</sub>	Calendar year	Limit value, 40 µg/m <sup>3</sup> (*)		20 µg/m <sup>3</sup>	
O <sub>3</sub>	Maximum daily 8-hour mean	Target value, 120 µg/m <sup>3</sup>	Not to be exceeded on more than 25 days per year, averaged over three years	100 µg/m <sup>3</sup>	
NO <sub>2</sub>	One hour	Limit value, 200 µg/m <sup>3</sup> (*)	Not to be exceeded more than 18 times a calendar year	200 µg/m <sup>3</sup> (*)	
NO <sub>2</sub>	Calendar year	Limit value, 40 µg/m <sup>3</sup>		40 µg/m <sup>3</sup>	





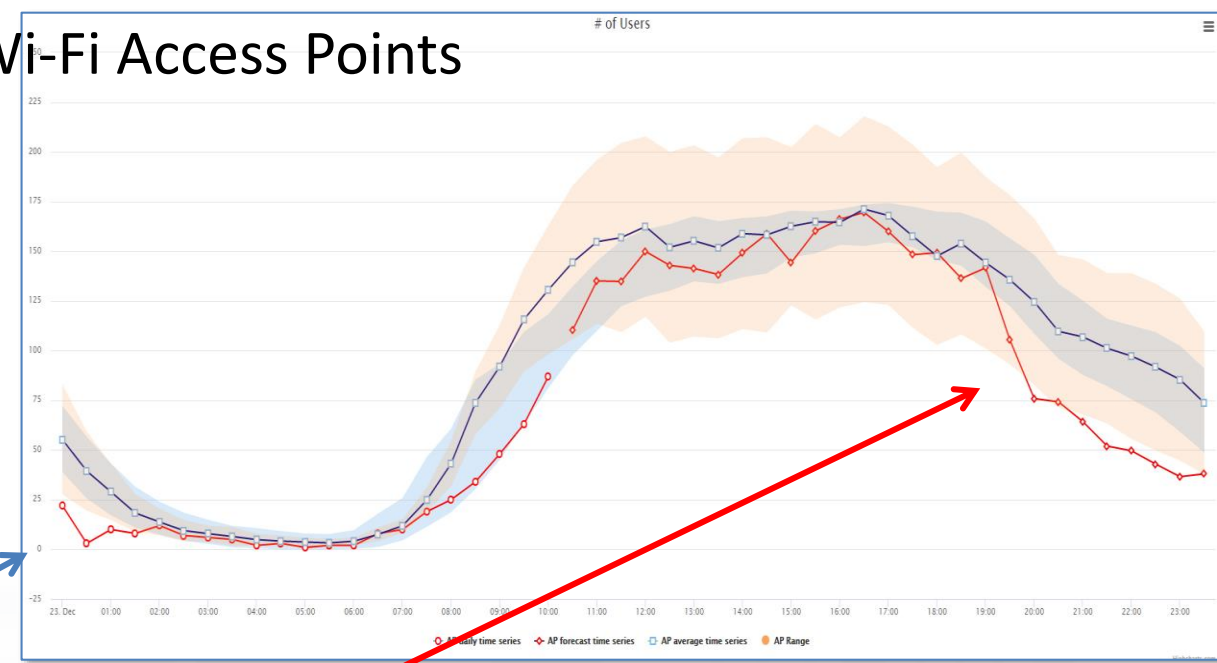
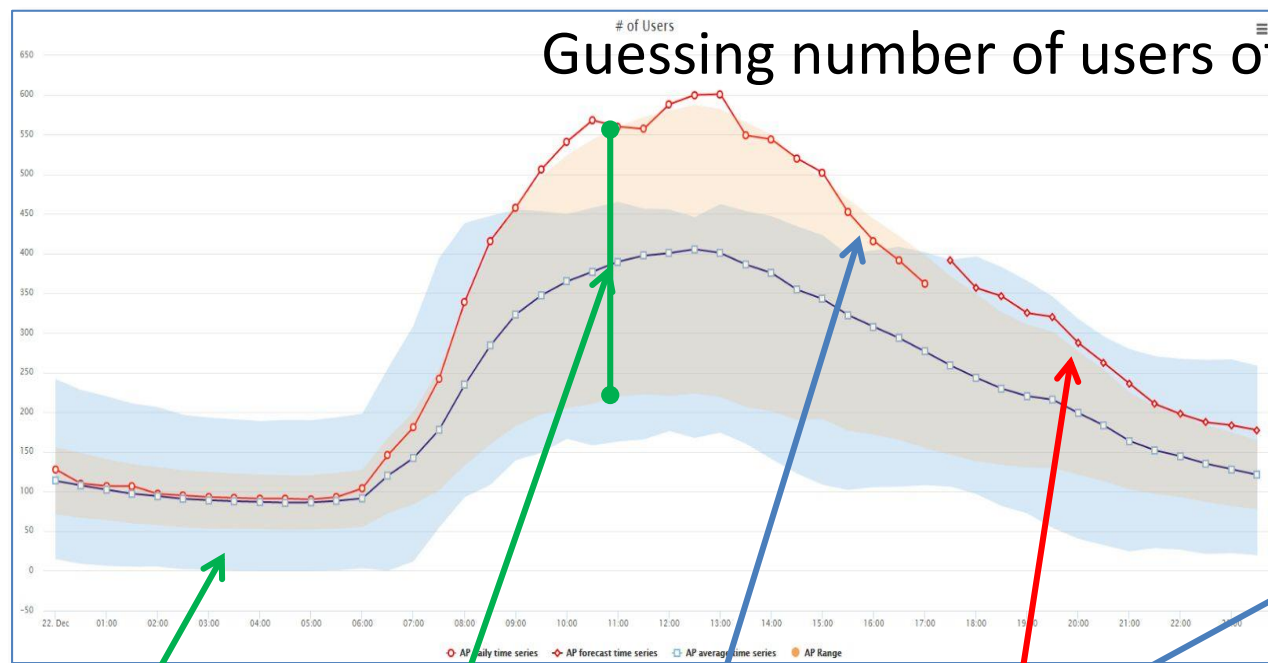
# Anomaly Detection





# Prediction and Identification of Anomalies

## Guessing number of users of Wi-Fi Access Points



Cluster confidence

AP average and confidence

Actual AP trend for today

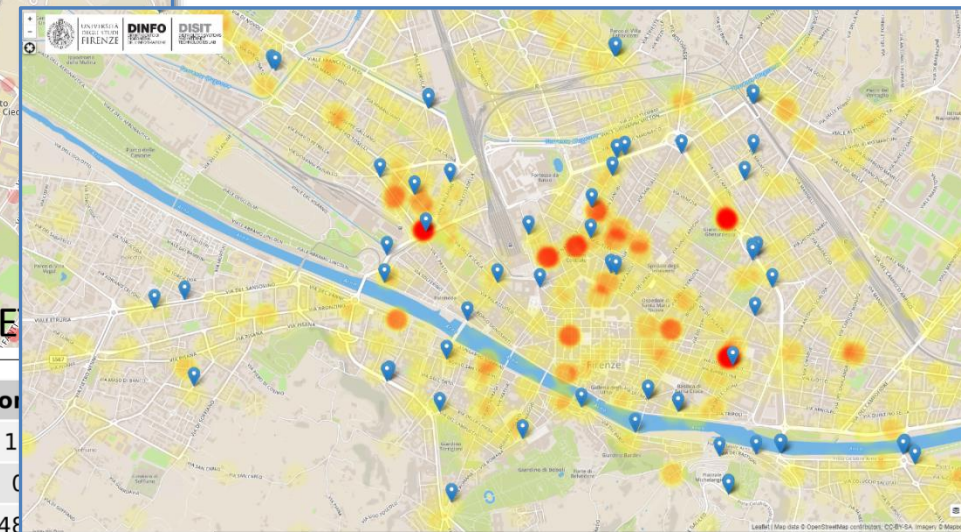
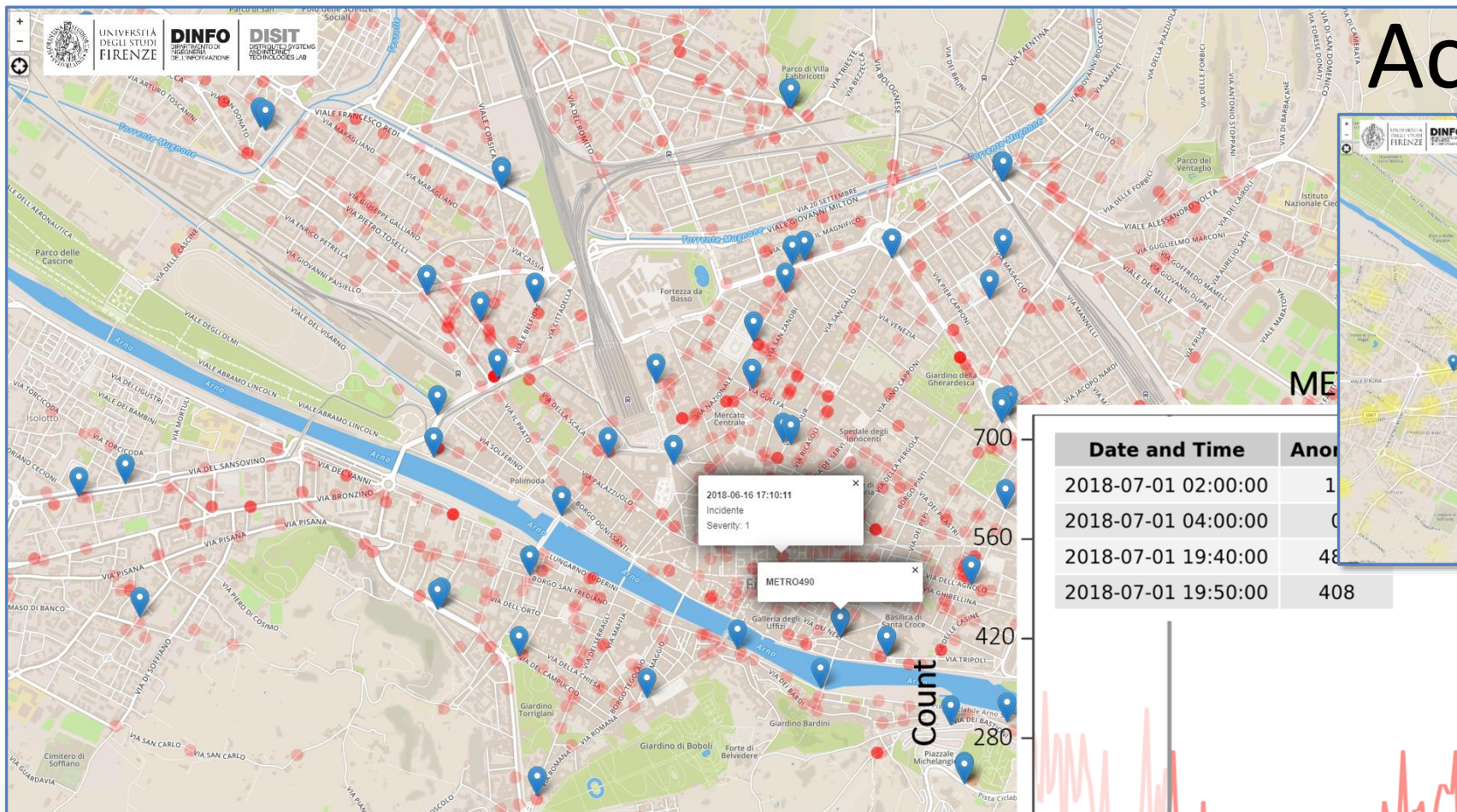
AP prediction for the next time slot in the day on the basis of past weeks

Predictive precision of the 95%

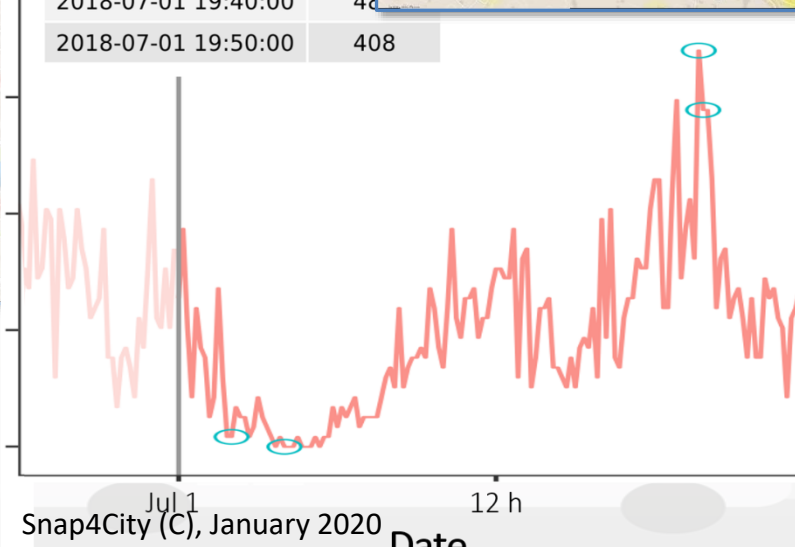


# Anomaly Detection

## Accidents Density



Date and Time	Anom
2018-07-01 02:00:00	1
2018-07-01 04:00:00	0
2018-07-01 19:40:00	48
2018-07-01 19:50:00	408



## Accidents vs Traffic



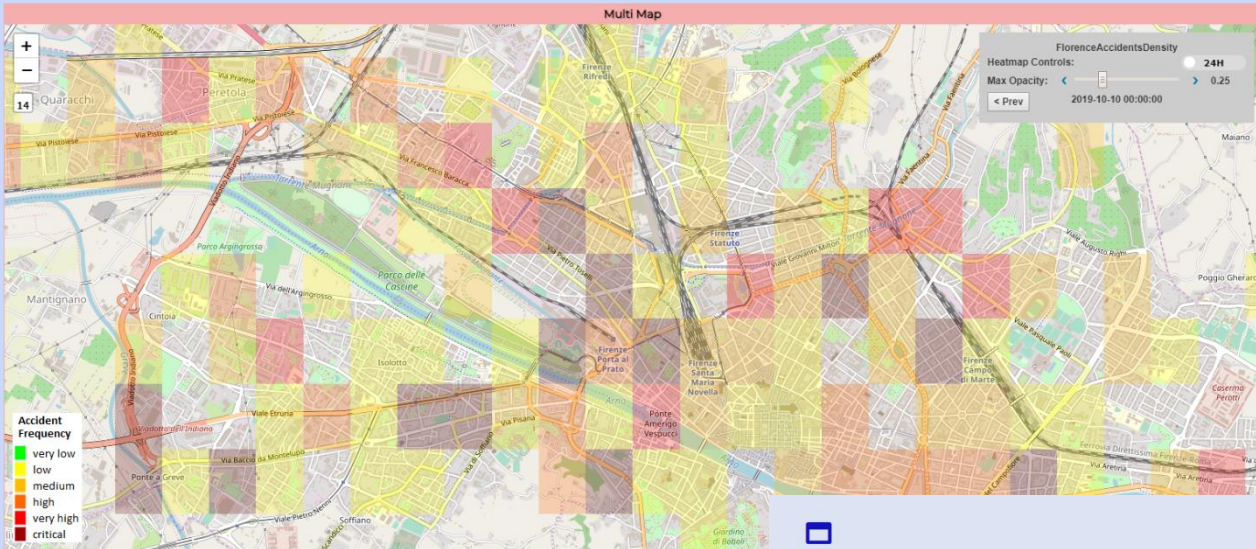
# What-IF analysis test

This dashboard contains data derived from actual sensors and predictive values under validation



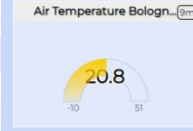
# Florence Accidents Density

- ▲ Air Quality Sensors
- ▲ Weather Sensors
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- ▲ PM2.5 Heatmap
- ▲ CO Heatmap
- ▲ CO2 Heatmap
- ▲ O3 Heatmap
- ▲ NO2 Heatmap
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- ▲ Air Temp. Heatmap
- ▲ Wind Speed Heatmap
- ▲ Gral Pred. HM NOX (3m)
- ▲ Gral Pred. HM NOX (6m)
- ▲ Traffic Sensors
- ▲ Traffic Flow
- ▲ Cycling Paths
- ▲ Accident Heatmap
- ▲ Accident Heatmap 2
- ▲ Only HRes Anym. Gral
- ▲ Scenario
- ▲ What-IF



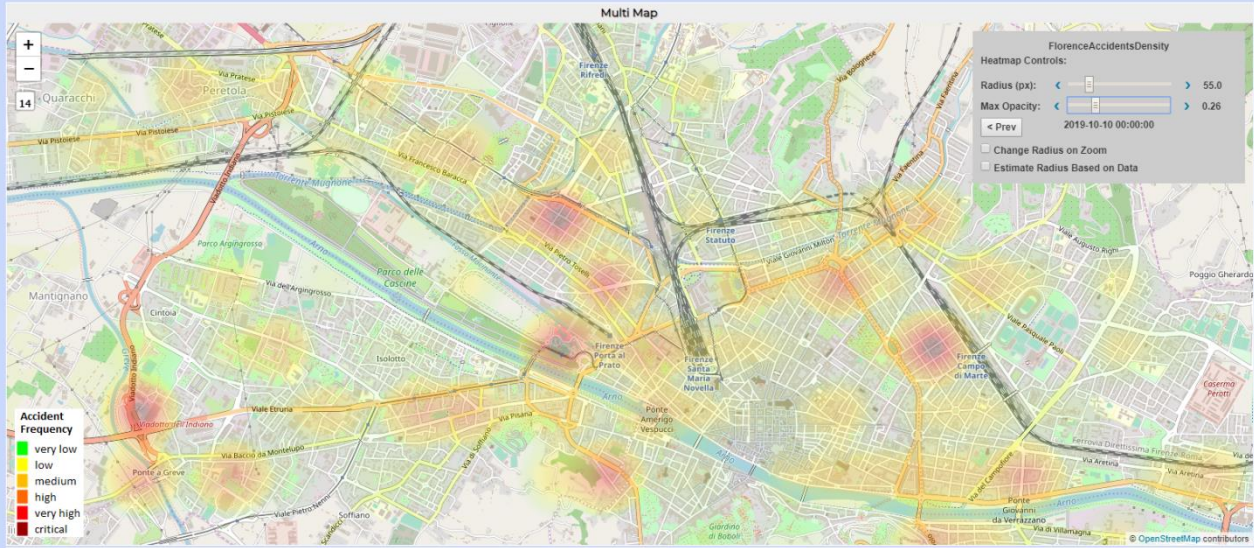
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- ▲ Scenario
- ▲ What-IF



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<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MjE4Nw==>





# WHAT-IF Analysis



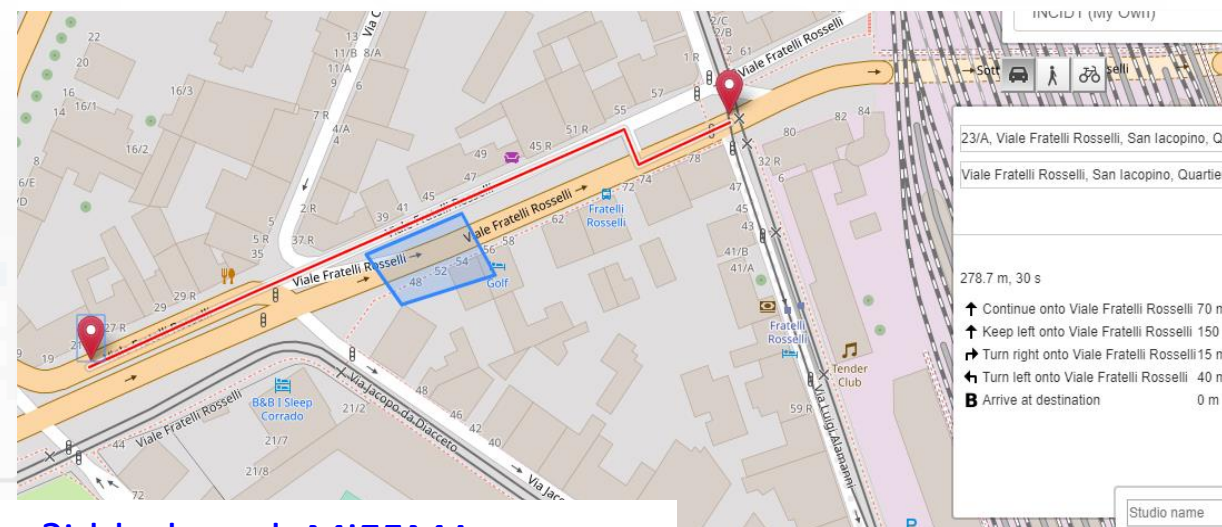
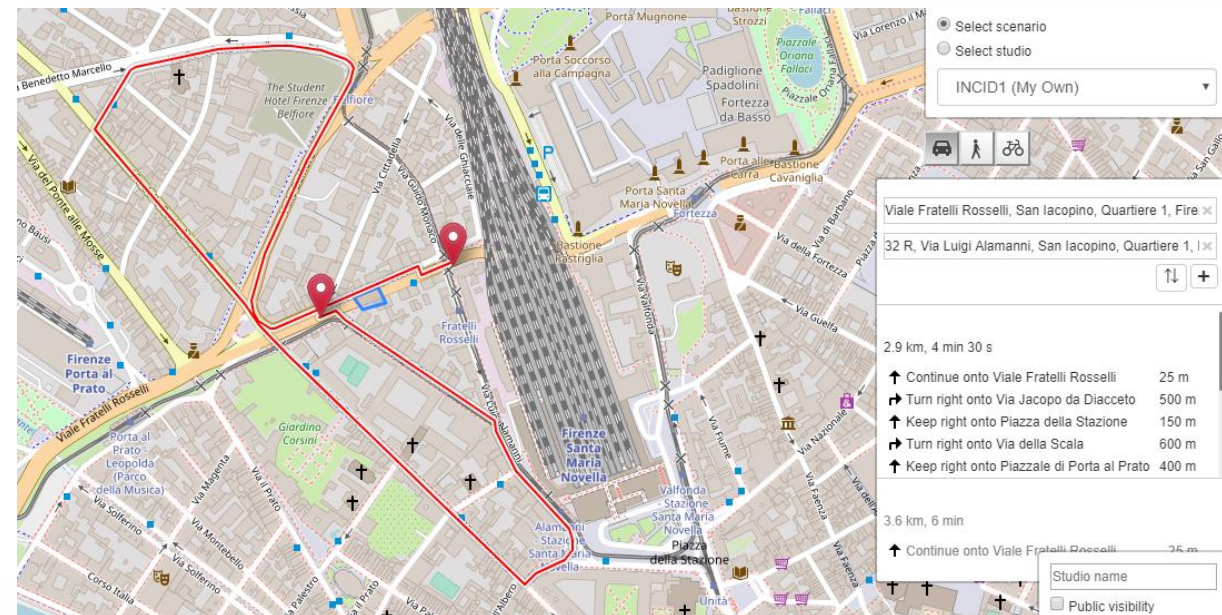


Accidents and elements blocking Points and Shapes taken into account for:

- Routing
- Traffic Flow reconstruction
- Evacuation paths
- Rescue team paths

Assessment on the basis of changes:

- Mobility demand assessment
- Mobility Offer assessment







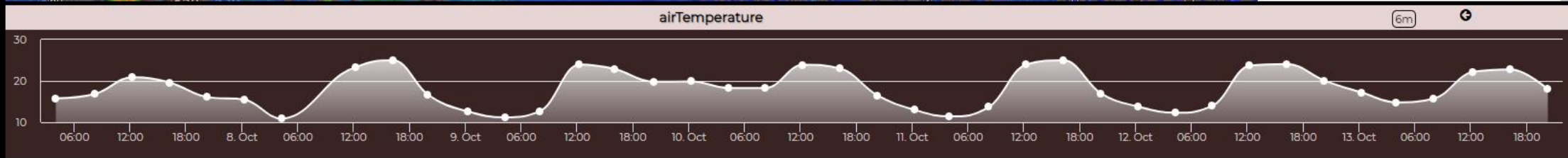
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- Only HRes Anym. Gral
- Scenarios
- What-if analysis

Firenze Oggi

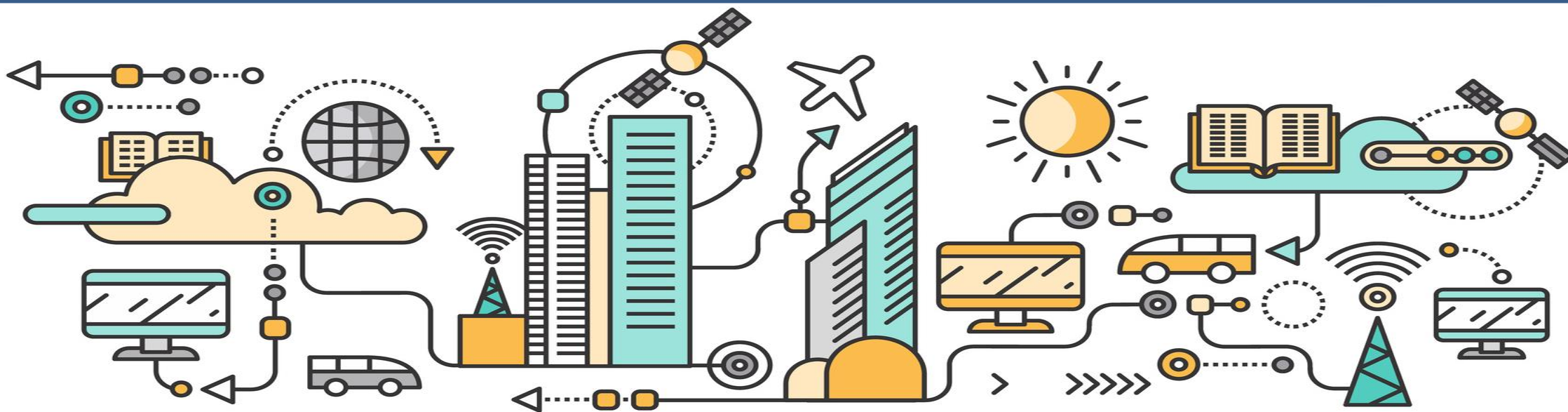
Air Temperat... (6m)



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjE5MA==>

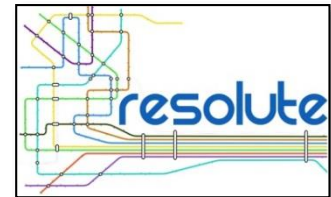


# Social Media Analysis





# Twitter Vigilance



## Prediction/Assessment

- Football game results as related to the volume of Tweets
- Number of votes on political elections, via sentiment analysis, SA
- Size and inception of contagious diseases
- marketability of consumer goods
- public health seasonal flu
- box-office revenues for movies
- places to be visited, most visited
- number of people in locations like airports
- audience of TV programmes, political TV shows
- weather forecast information
- Appreciation of services

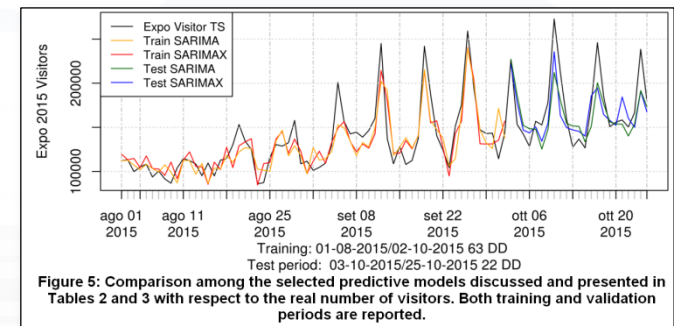
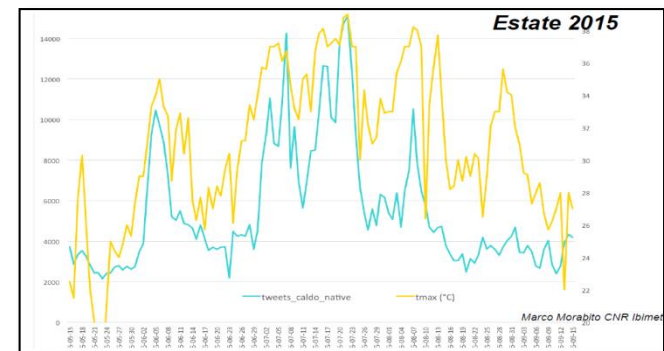
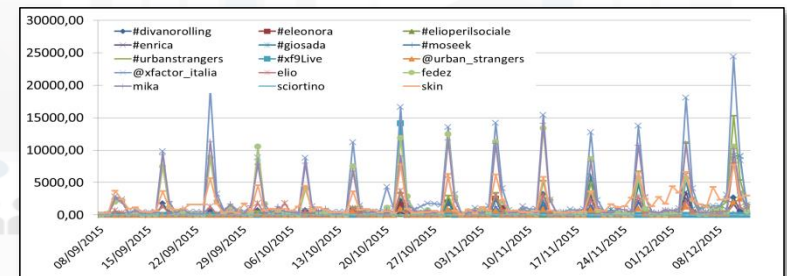
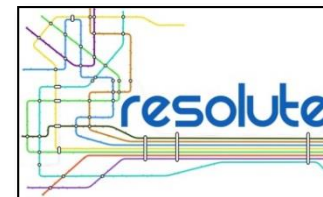


Figure 5: Comparison among the selected predictive models discussed and presented in Tables 2 and 3 with respect to the real number of visitors. Both training and validation periods are reported.

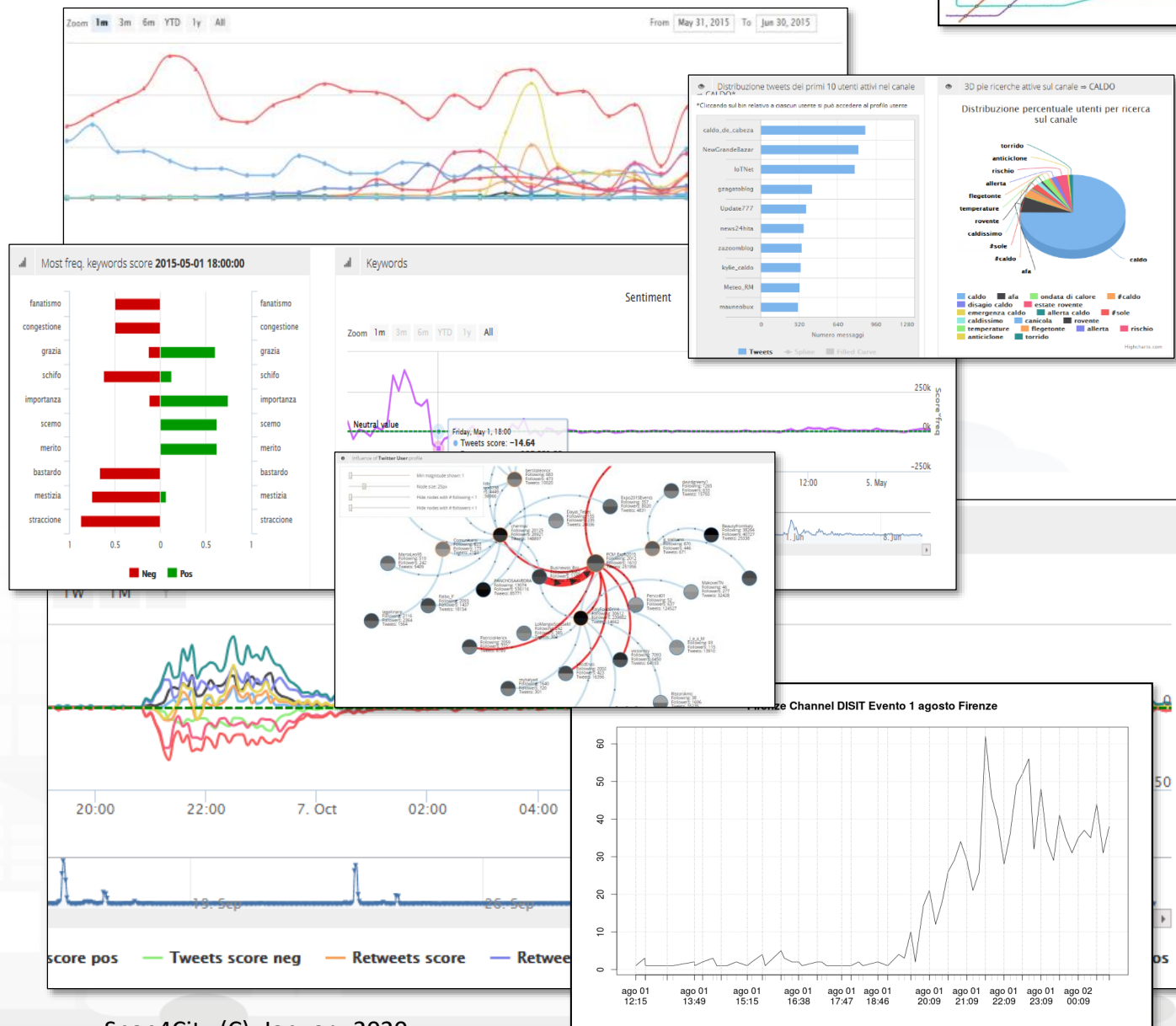




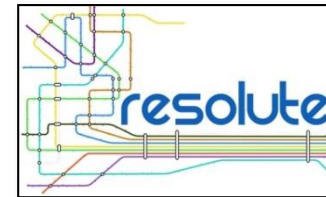
# Twitter Vigilance



- <http://www.disit.org/tv>
- <http://www.disit.org/rttv>
- Citizens as sensors to
  - Assess sentiment on services, events, ...
  - Response of consumers wrt, ...
  - Early detection of critical conditions
  - Information channel
  - Opinion leaders
  - Communities
  - Formation
  - Predicting volume of visitors for tuning the services







# Twitter Vigilance RT: sentiment analysis

Twitter Vigilance Real Time Dashboard  
Last crawling: 2016-11-05 18:34:25

Channel active from 2016-06-27 to 2016-11-05 18:30:00 | Data processed from 2016-06-28 08:10:00 to 2016-11-05 18:20:00 | NLP SA

Sentiment trends in channel Firenze

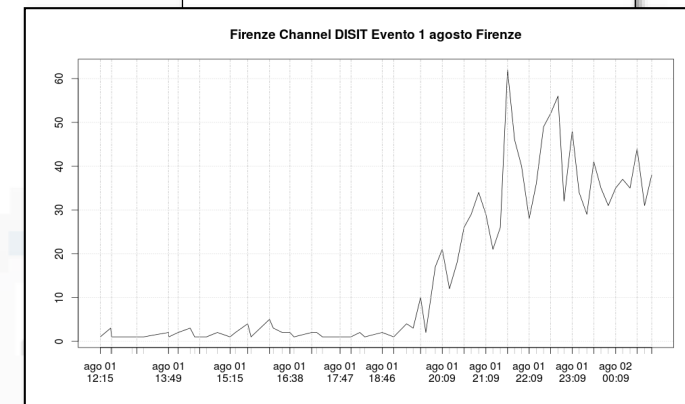
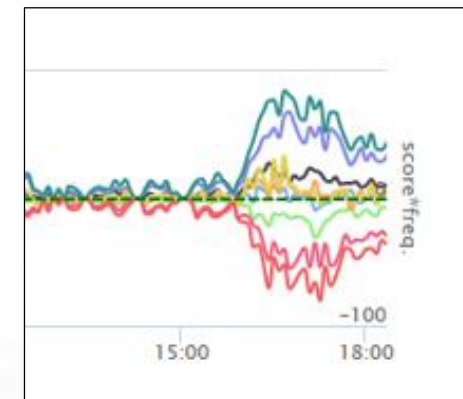
Most Significant Tweets for Sentiment in the period

- @Mario34mg - 2016-11-05 18:20:10  
@alessiarotta FIRENZE Lancio di bottiglie e pietre, cariche della polizia, transenne che volano, fumogeni e petardi...  
https://t.co/S53jRty7aX  
0 Retweets 0 Likes Sent. Score: 0.0625
- @ReTwtStorm\_jta - 2016-11-05 18:20:10  
RT @marcotravaglio: #Leopolda2016. Stasera alle 21.00 sono all'Obihall di Firenze con "Perché No". Vi aspetto  
PARTECIPA: https://t.co/M3Ffn...  
37 Retweets 0 Likes Sent. Score: 0.0113636
- @repubblicait - 2016-11-05 18:20:12  
Firenze, scontri e contusi al corteo anti Renzi: cariche e lancio di bottiglie https://t.co/R4lCjOUJO  
1 Retweet 0 Likes Sent. Score: 0

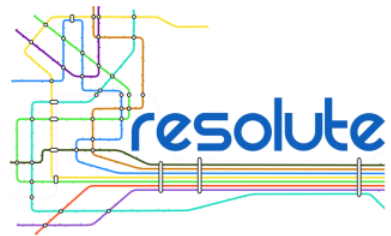
Last tweets per channel Firenze

- @BettoGigliola - 2016-11-05 18:35:05  
RT @augustoulli: Firenze, scontri e feriti al corteo dei manifestanti per il No: cariche e lancio di bottiglie https://t.co/Bcz5tjME9l via...  
7 Retweets 0 Likes
- @Awlceccchini - 2016-11-05 18:35:04  
Prato, inchiesta sul pellet: forniture pagate e mai consegnate, pronto maxi esposto dell'Aduc https://t.co/pa4FTjBWa7 via @repubblicait  
0 Retweets 0 Likes
- @Allen1it - 2016-11-05 18:35:04  
#Leopolda RIOTS. Scontri #Firenze, manifestante colpisce poliziotti con un segnale stradale https://t.co/OeFELg3arG via @repubblicait

## Real time Early Warning

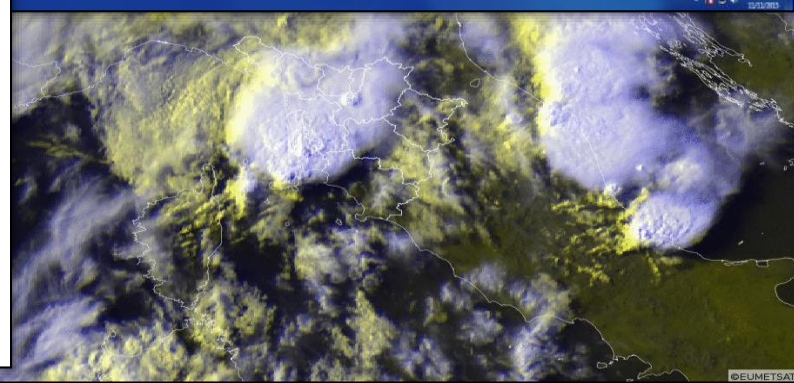
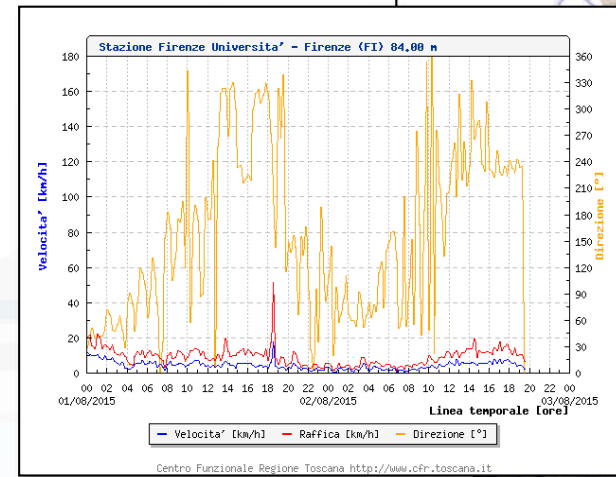
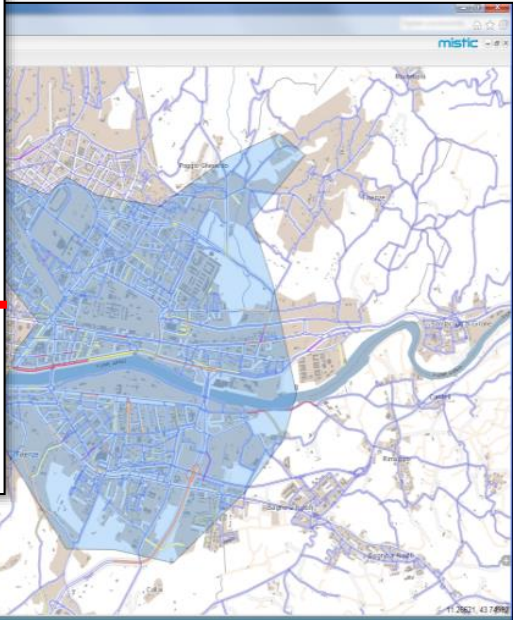
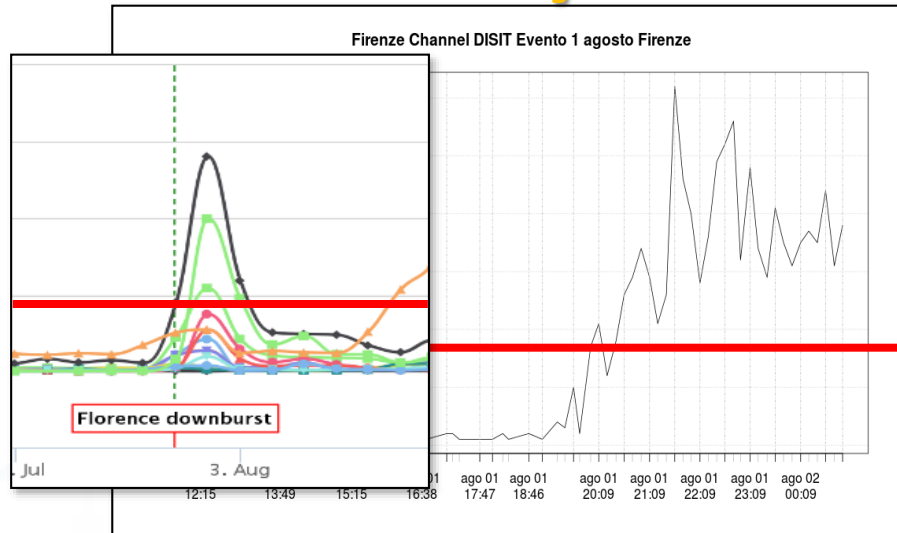




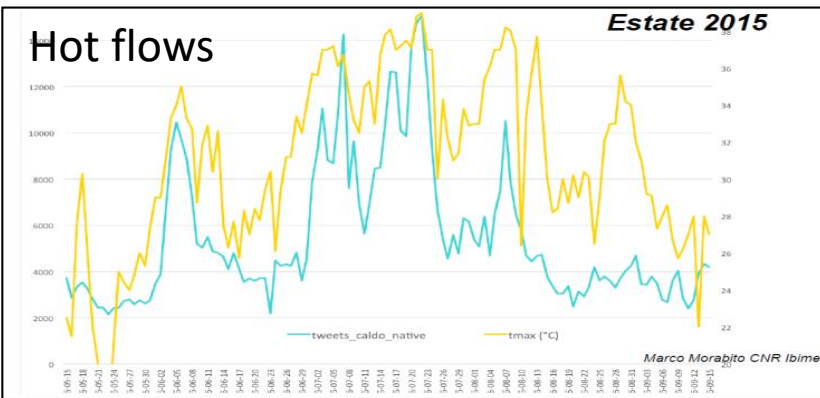


# Twitter Vigilance

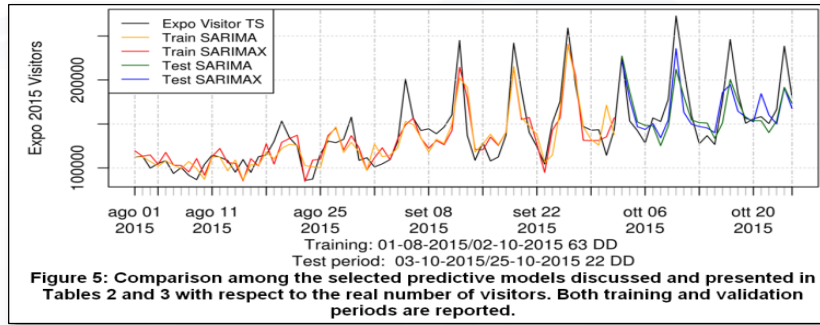
## Early Warning



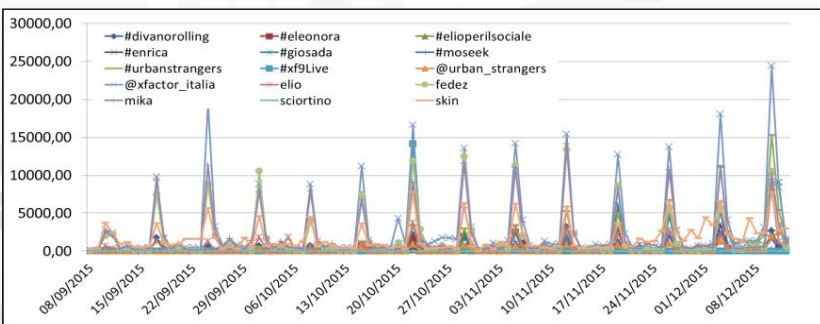
## Predictive models



## Attendance at long lasting events: EXPO2015



## Attendance at recurrent events: TV, football





TOP

FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS

FROM CITY DASHBOARD TO APPLICATIONS

DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT

# SNAP4CITY AND

# KM4CITY PROJECTS

IOT/IOE DEVICES AND NETWORKS

IOT APPLICATIONS, THE LOGIC AND THE SMARTNESS

ADVANCED SMART CITY API, MICROSERVICES, SNAP4CITY API

SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK

SNAP4CITY FOR BEGINNERS

SNAP4CITY ARCHITECTURE AND ECOSYSTEM. OPENED TO DEVELOPERS AND STAKEHOLDERS

DATA ANALYTICS, BUSINESS INTELLIGENCE, WHAT-IF ANALYTICS

TWITTER VIGILANCE, SOCIAL MEDIA ANALYSIS

DECISION SUPPORT SYSTEM AND CITY INTELLIGENCE

HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP

SNAP4CITY AND KM4CITY PROJECTS

SNAP4CITY THE VIEW OF THE ADMINISTRATORS





...2022

2020

**SELECT for Cities**  
 CERTIFICATE OF MERIT AWARDS  
 1<sup>st</sup> place award to  
 UNIVERSITY OF FRIULI - UNIVERSITY OF ENGINEERING  
 and **SNAP4CITY**  
 RESEARCH GROUP FOR THE CITY OF SUSTAINABLE DEVELOPMENT

**Reverberi Enetec**  
 Gruppo MPES

bee smart city

**GREEN FIELD PEAS Soda4.0**  
 Optimization and Automated Decision System 4.0

**SIRIUS**

**LAI Smart Bed**

- User engagement
- Bike Sharing
- Data Analytics ++
- Social Predictions
- OBD2

2018

**MOSAIC**  
 Mobility 4.0 for Smart (I) City  
 (2018-20)

- Mobility Demand / Offer
- Analytics and Strategy

(2018-21)  
 5G tech  
 Energy Industry 4.0  
 Synoptics

- Traffic and Mobility Impact on Pollution
- NOX predictions

2019

**EUROPEAN OPEN SCIENCE CLOUD**

- GREEN IMPACT**  
 POR FESR 2014-2020
- Industry 4.0
  - Critical Plant
  - Monitoring

2017

**TRAFAIR CEF**  
 (2018-21)

**life weee** (2017-20)  
 - Smart Waste

- IOT/IOE, IOT App
- Living Lab
- Maker Support
- IOT Edge
- Smart City IOT
- GDPR
- Privacy & Security

**SELECT H2020 for Cities** (2017-19)

**SNAP4CITY**

**Node-RED**

Km4City 1.6.6 IOT/IOE

Km4City 1.6.2

- Smart Energy
- Sustainable Mobility
- Control Room Dashboard

**REPLICATE**  
 (2016-21)  
 H2020

Km4City 1.6.4

- Origin-Destination and trajectories
- Traffic Reconstruction
- Offer Analysis
- OBU, smart devices

**GHOST SIR**  
 (2016-19)  
 H2020

**SII-MOBILITY SCN**  
 (2016-19)  
 Sii-Mobility

- Infomobility
- Mobile App
- Routing
- Multimodality

2016

Km4City 1.5

**resolute**  
 (2015-18)  
 H2020

- Resilience Decision Support
- Smart First Aid
- User Behaviour Analysis, predictions
- Risk Analysis

2015

- Sardinia Region Smart City Strategies and plan

**FIWARE**

**GREEN IMPACT CAPACITY**

2013 Km4City Ontology 1.1

- Tuscany Road Graph
- Mobility
- culture, tourism
- Events
- Parking
- Services
- Linked open graph

2014

- Weather Forecast
- Real Time Wi-Fi
- Entertainment
- Events
- LOD

**ckan**

- Twitter Vigilance
- Social Media Analytics, Sentiment Analysis

Km4City 1.4

DISIT lab roadmap vs model and tools' usage



# Main running projects

## Projects




- Sii-Mobility → mobility and transport, sustainability
- REPLICATE → ICT, smart City Control room, Energy, IOT
- RESOLUTE → Resilience, ICT, Big Data
- GHOST → Strategies, smart city
- TRAFair → Environment & transport
- MOSAIC → mobility and transport
- WEEE Life → Smart waste, environment
- Smart Garda Lake → Castelnuovo del Garda
- 5G → Industry 4.0 vs SmartCity
- Green Impact → Industry 4.0, Chemical Plant
- SmartBed (laid → smart health
- Green Field Peas (soda) → Industry 4.0, Chemical plant
- PISA Agreement → data aggregation
- Lonato del Garda → smart parking, environment





UNIVERSITÀ  
DEGLI STUDI  
FIRENZE

**DINFO**  
DIPARTIMENTO DI  
INGEGNERIA  
DELL'INFORMAZIONE

**DISIT**  
DISTRIBUTED SYSTEMS  
AND INTERNET  
TECHNOLOGIES LAB  
<http://www.disit.org>

# DISIT thanks to

Snap4City: IOT/IOE smart city [www.snap4city.org](http://www.snap4city.org)

Trafair: CEF project con varie Città

Mosaic: Mobility and transport model

Km4City: <http://www.km4city.org>

REPLICATE H2020, SCC1, EC flagship

<http://replicate-project.eu/>

Sii-Mobility SCN MIUR: <http://www.sii-mobility.org>

Feedback: reail and GDO Big Data analytics

5G with 3-Wind Open Fiber Estra

Coll@bora Social Innovation, MIUR:

<http://www.disit.org/5479>

RESOLUTE H2020, EC:

<http://www.resolute-eu.org>

TRACE-IT, RAISSS, TESYSRAIL, ...

Mobile Emergency:

<http://www.disit.org/5404>



TESYS RAIL



**RAISSS**





# Acknowledgements

- Thanks to the European Commission for founding. All slides reporting logo of **Snap4City** <https://www.snap4city.org> of **Select4Cities H2020** are representing tools and research founded by European Commission for the **Select4Cities** project. **Select4Cities** has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation Programme (grant agreement n° 688196)
- **TRAFAIR** is a CEF project. All slides reporting logo of TRAFAIR project are representing tools and research founded by the EC on CEF programme <http://trafair.eu/>
- Thanks to the European Commission for founding. All slides reporting logo of **REPLICATE H2020** are representing tools and research founded by European Commission for the REPLICATE project. **REPLICATE** has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation Programme (grant agreement n° 691735).
- Thanks to the European Commission for founding. All slides reporting logo of **RESOLUTE H2020** are representing tools and research founded by European Commission for the RESOLUTE project. **RESOLUTE** has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation Programme (grant agreement n° 653460).
- Thanks to the MIUR for co-founding and to the University of Florence and companies involved. All slides reporting logo of **Sii-Mobility** are representing tools and research founded by MIUR for the Sii-Mobility SCN MIUR project.
- **Km4City** is an open technology and research line of DISIT Lab exploited by a number of projects. Some of the innovative solutions and research issues developed into projects are also compliant and contributing to the Km4City approach and thus are released as open sources and are interoperable, scalable, modular, standard compliant, etc.

