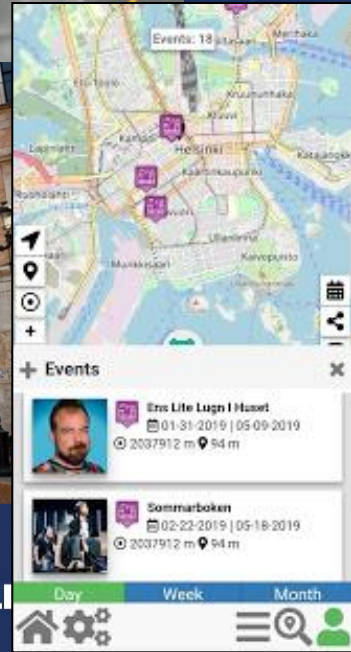




[www.snap4city.org](http://www.snap4city.org)  
[www.snap4solutions.org](http://www.snap4solutions.org)



# City Users' Services, Tourism Management and Safety, Digital Twin



DIGITAL TWIN SOLUTIONS TO SETUP SUSTAINABLE DECISION SUPPORT SYSTEMS AND BUSINESS INTELLIGENCE



UNIVERSITÀ  
DEGLI STUDI  
FIRENZE

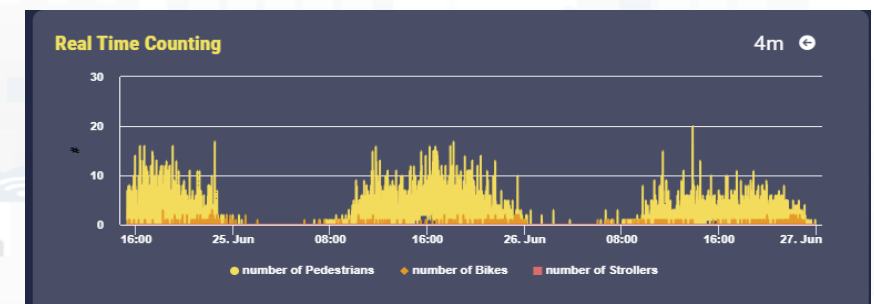
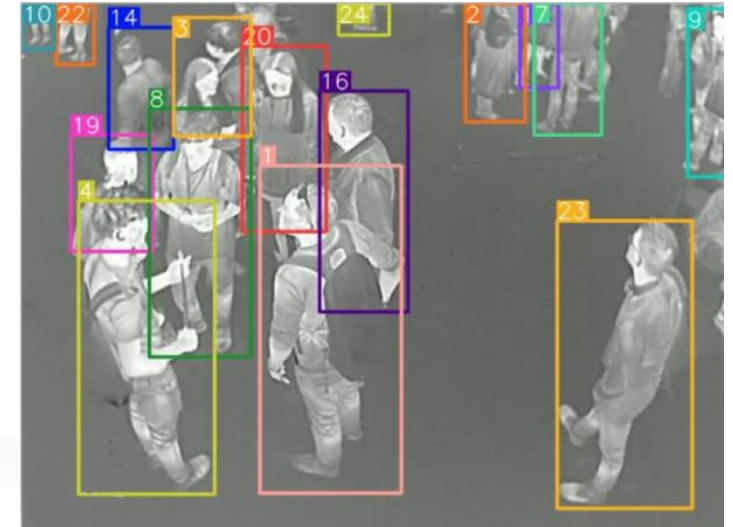
DINFO  
DIPARTIMENTO DI  
INGEGNERIA  
DELL'INFORMAZIONE

DISIT  
DISTRIBUTED SYSTEMS  
AND INTERNET  
TECHNOLOGIES LAB



# City User Behaviour/services, Tourism and Safety

- **Goals:**
  - Improve Quality of Life and quality of services for city users,
  - **Overtourism** mitigation, sustainability
  - Costs reduction of services
  - Improve accessibility to services: citizens, Tourists, commuters, etc.
  - Improve Security/Safety of city users
- **People Flow Analysis / Management:** in/out-door, retail, attractions
  - Counting, tracking, Flows, ODM, sentiment, etc.,
  - multiple sources: thermal & TV cameras, radar sensors, PAX sniffers, mobile data, ...
  - Data and/or OD matrices from: Wi-Fi, traffic data, mobile phone data
  - **Suggestions:** info Tourism, digital signages, engagement, .., via email, mobile apps, etc.
- **Tourists Flows & Retail Management:** predictions of presences, services' reputations, suggestions on second offer, over-tourism, notifications, early warning,
- **KPI:** 15 MinCityIndex, energy vs people, over-tourism, accepted suggestions, precision
- **Mobile App:** final users services/informing and operators
  - Info Tourism, people flows, info mobility, sharing, ...
  - Participation, engagement, ..
- **Participatory:** problem reporting, ticketing, etc.
- **Integration of any kind:** env/weather, mobility, ticketing, presences, POI, ..

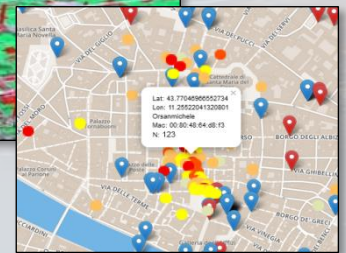
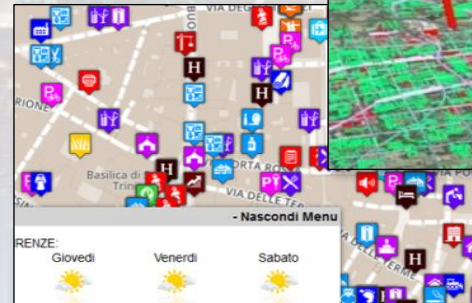
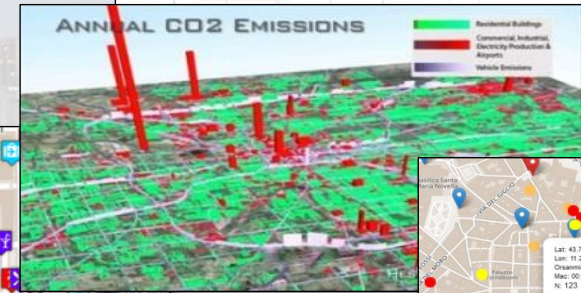
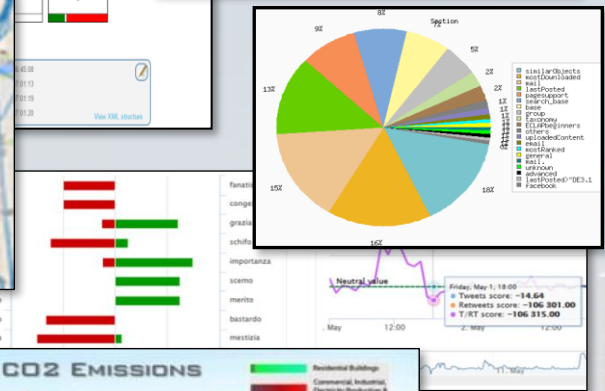
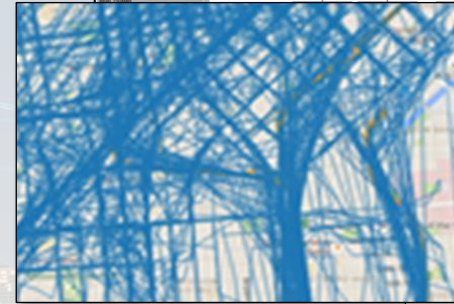
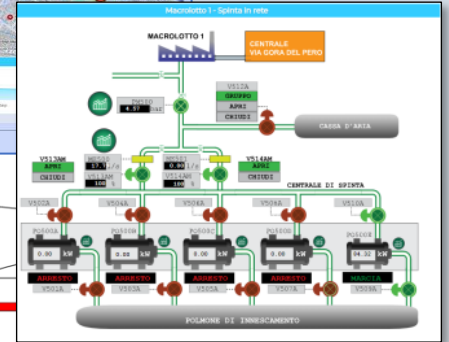
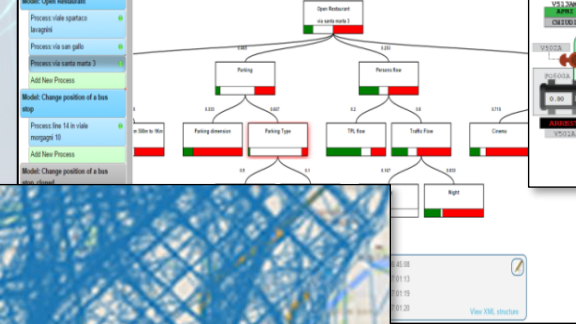
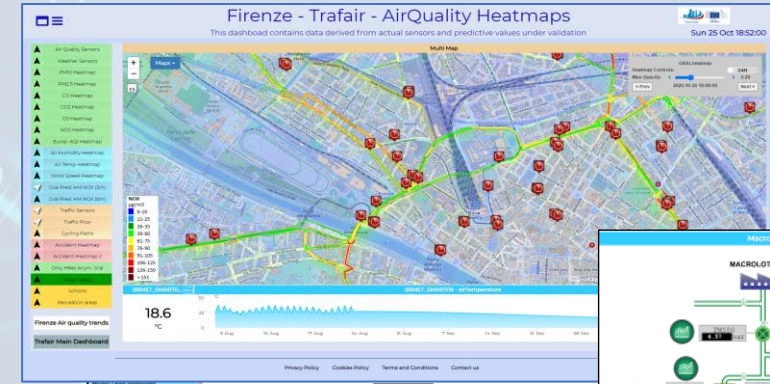




# Data Driven Decision Support



- Decision Support system
- Assessment / Strategies
- Data Rendering,
  - visual analytics, business intel..
- Data Analytics, ML, AI
- Data aggregation, Storage, indexing
- Data Ingestion







# Digital Twin Solutions for Sustainability

OPERATION AND PLAN - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - OPTIMIZATION - APPLICATIONS

### HORIZONTAL AI PLATFORM

### MOBILITY AND TRANSPORT

### SMART ENERGY AND SMART BUILDING

### ENVIRONMENT AND WASTE MANAGEMENT

### CITY USER'S SERVICES AND TOURISM MANAGEMENT

- DEVELOPMENT ENVIRONMENT AND METHODOLOGY
- VISUAL PROGRAMMING, ML, AI, HPC
- TRAINING COURSES
- LIVING LABS
- GUI CUSTOM STYLES
- FULL APPLICATIONS, DASHBOARDS AND VIEWS
- MOBILE APPS



### VISUAL ANALYTICS - SYNOPTICS - GRAPHICAL WIDGETS - ANALYTICS - BUSINESS INTELLIGENCE - SIMULATIONS

DASHBOARDS, WIDGETS TEMPLATES

PREDICTION - ANOMALY DETECTION - CLUSTERING - ROUTING - SENTIMENT NLP - TRAFFIC FLOW - PEOPLE FLOWS - SDG

15 MIN CITY INDEX - KPI - HEATMAPS - ORIGIN DESTINATION - ETC...

API - MICROSERVICES - GIS - BPM

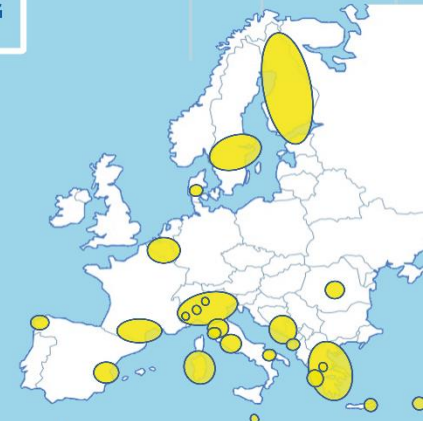
VIDEO - REPORTS - MAPS - 3D ...

EXPERT SYSTEM, KNOWLEDGE BASE SEMANTIC REASONING SMART DATA MODEL IOT DEVICE MODELS, STORAGE

BIG DATA ANALYTICS, ARTIFICIAL INTELLIGENCE EXPLAINABLE AI, MACHINE LEARNING, GENERATIVE AI OPERATIVE RESEARCH, STATISTICS

VISUAL PROGRAMMING, ADAPTERS DATA FLOWS, WORKFLOWS PARALLEL DISTRIBUTED PROCESSING DATA DRIVEN

FULL INTEROPERABILITY, ANY: DATA, BROKERS, NETWORKS AND VERTICALS



Powered by FIWARE

FREE TRIAL

PEN Test Passed

EU GDPR COMPLIANT

SNAP4 Appliances and Dockers Installations

EUROPEAN OPEN SCIENCE CLOUD

Node-RED

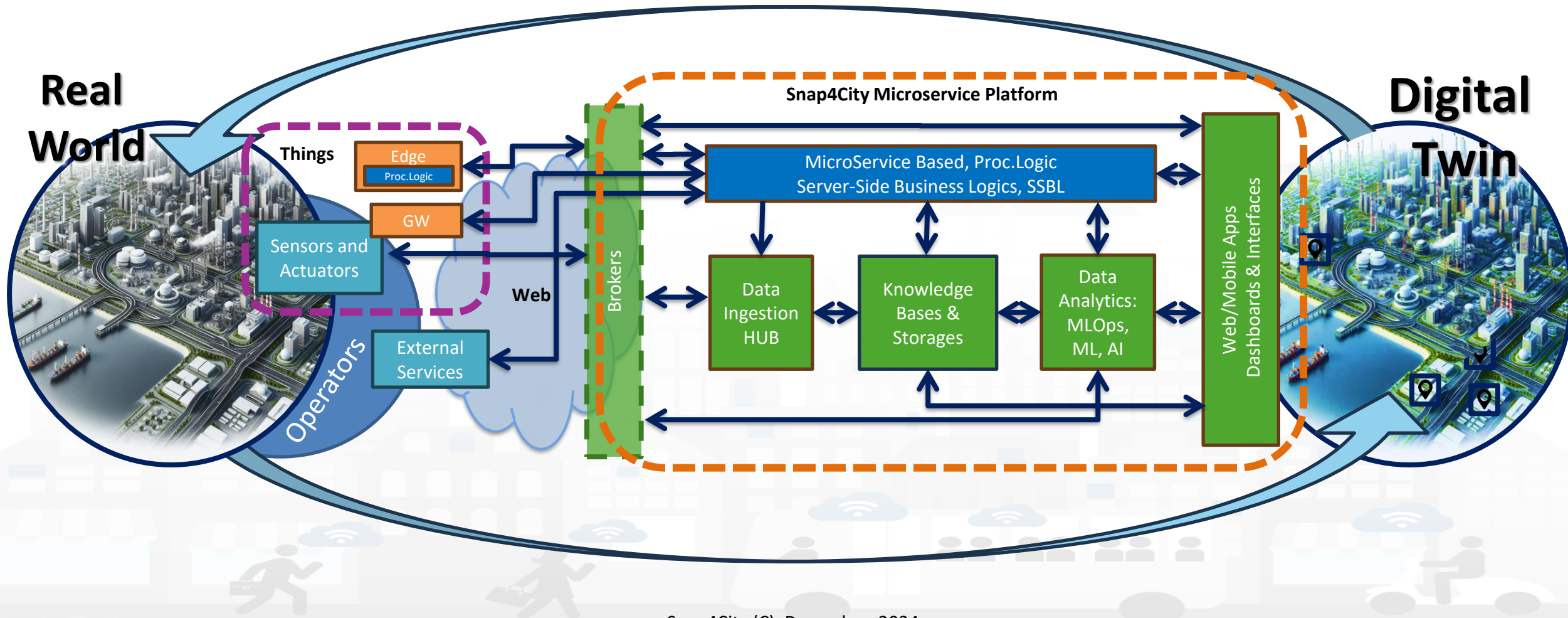
JS Foundation

E015 digital ecosystem

NVIDIA



# Digital Twin Development Platform

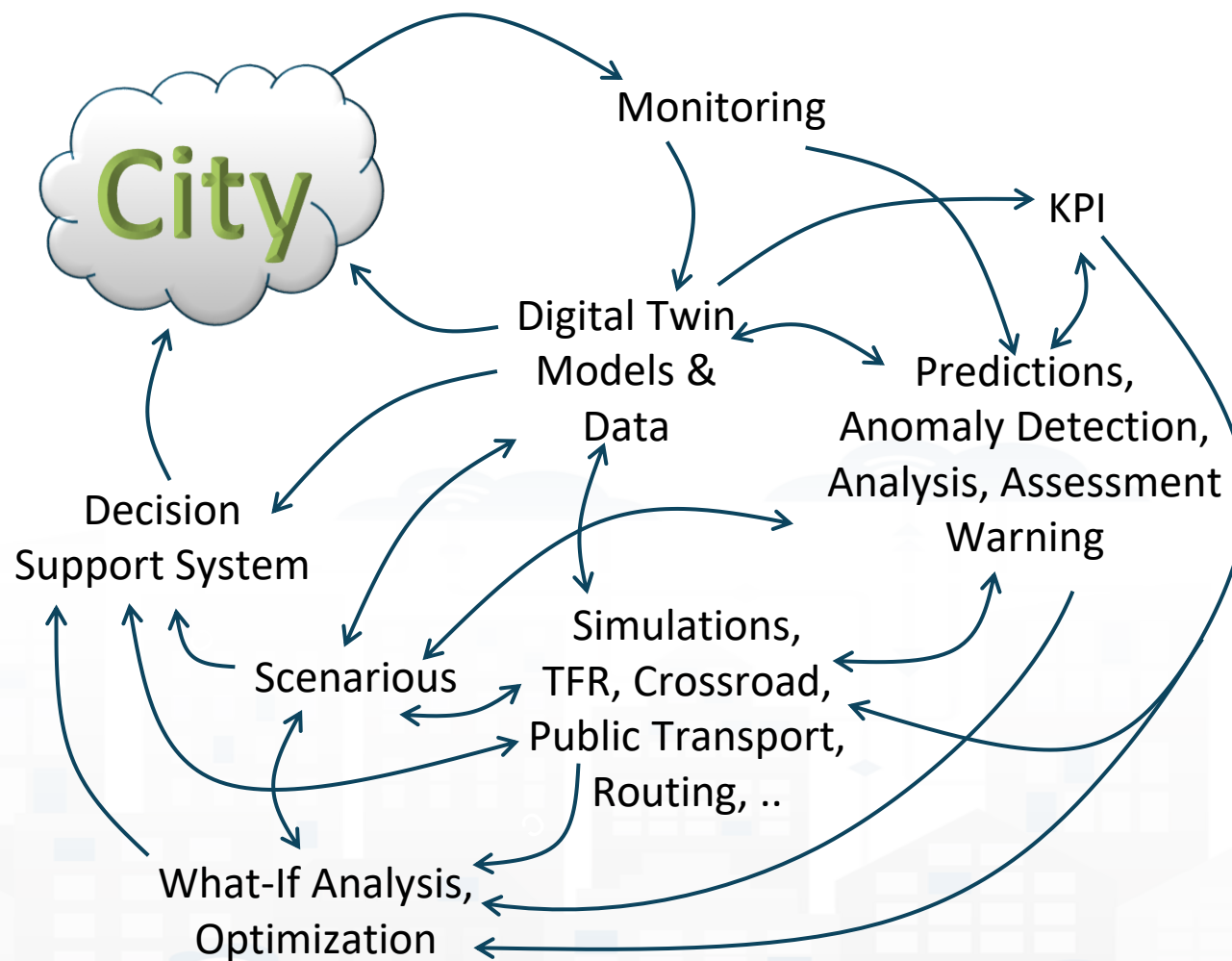


- **Controlling Status: management, and operational**

- Monitoring via KPI
- Predictions vs KPI
- Anomaly detection
- Neuro-Symbolic analysis
- Risk assessment
- Early warning on critical conditions
- Fast What-if analysis

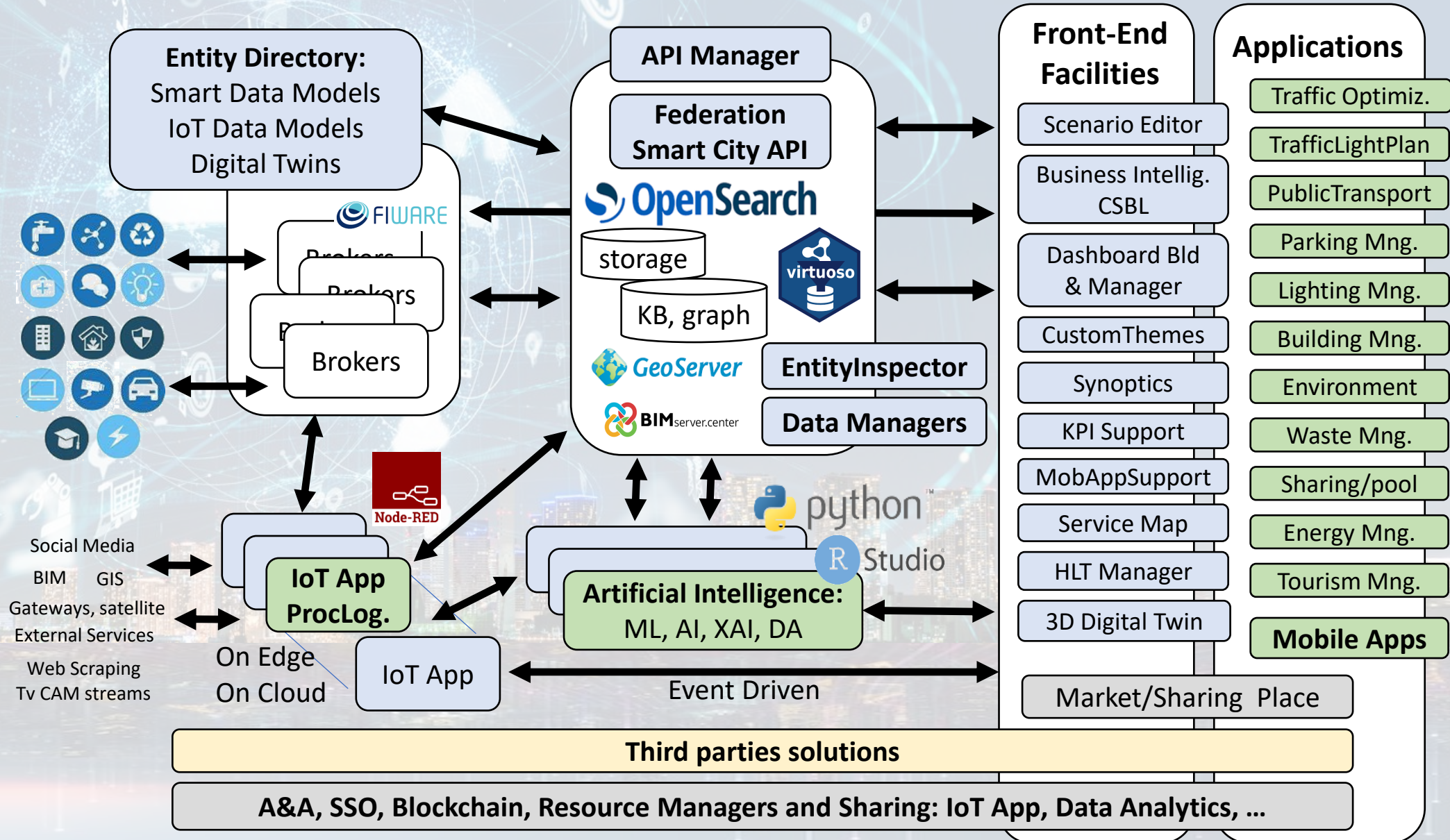
- **Making plan: tactic and strategic, medium and long range, micro/macro**

- Simulation & optimization
- Generative AI Prescriptions, scenarios
- Resilience to Unexpected unknowns
- What-if analysis wrt scenarios
- Collaboration with stakeholders





# Technical Architecture





# Monitoring and control

FROM CITY DASHBOARD TO APPLICATIONS

DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT

FORGING & MANAGING OPEN AND FRIENDLY WITH INDUSTRY MAP

IOT APPLICATIONS VS IOT EDGE DEVICES

SNAP4CITY BEGINS

SNAP4CITY ARCHITECTURE AND SYSTEM. OPEN TO DEVELOPERS AND STAKEHOLDERS

TWITTER VIGILANCE SOCIAL MEDIA ANALYSIS

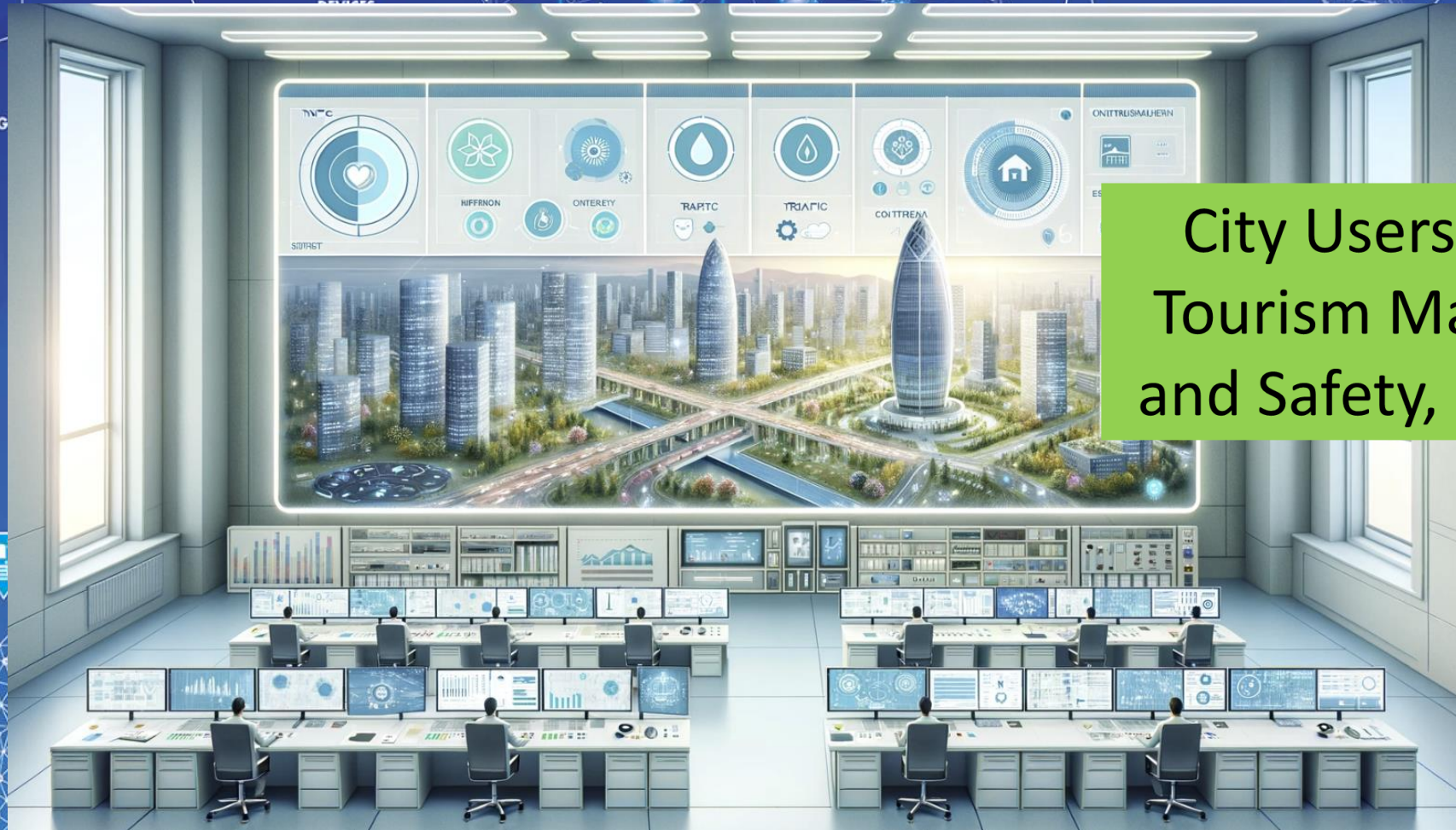
SNAP4CITY AND KM4CITY PROJECTS

HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP

PORT CITY

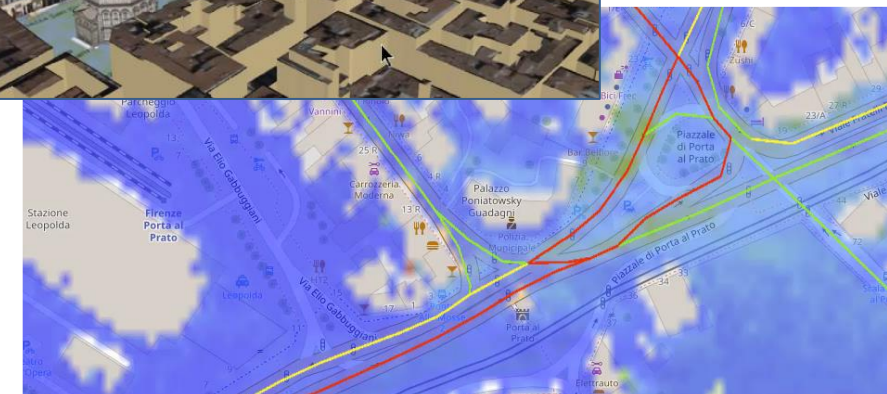
City Users' Services, Tourism Management and Safety, Digital Twin

100% OPEN SOURCE

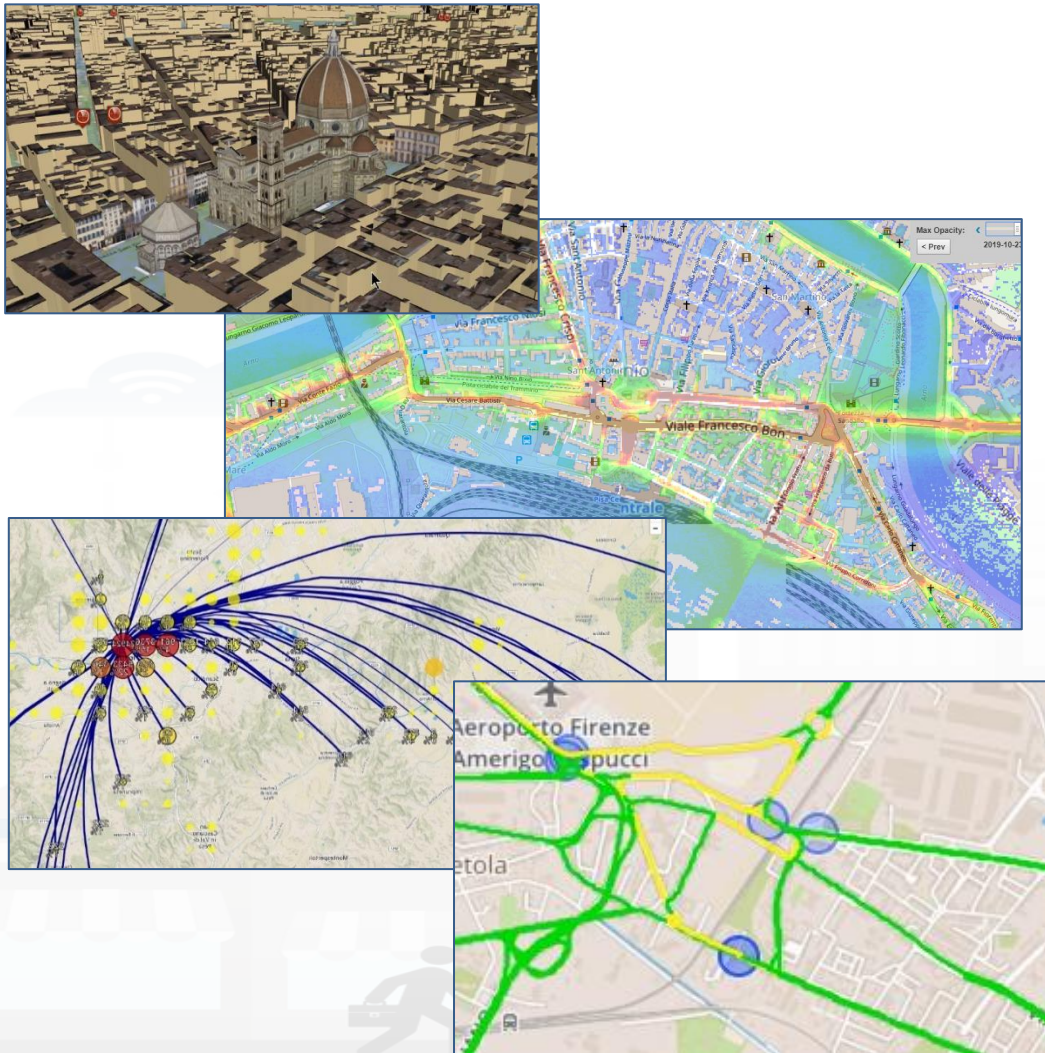




- **Controlling Status: management, and operational**
  - Monitoring via KPI
  - Computing predictions and KPI
  - Anomaly detection, Early warning
  - Control Rooms, situation rooms
- **Reacting: Computing in real time**
  - Changing semaphore maps
  - Changing Dynamic signage
  - Real time Info Mobility
  - User engagement via Mobile Apps
  - What-if analysis
  - etc.,



# Smart City Digital Twin City Digital Model with...



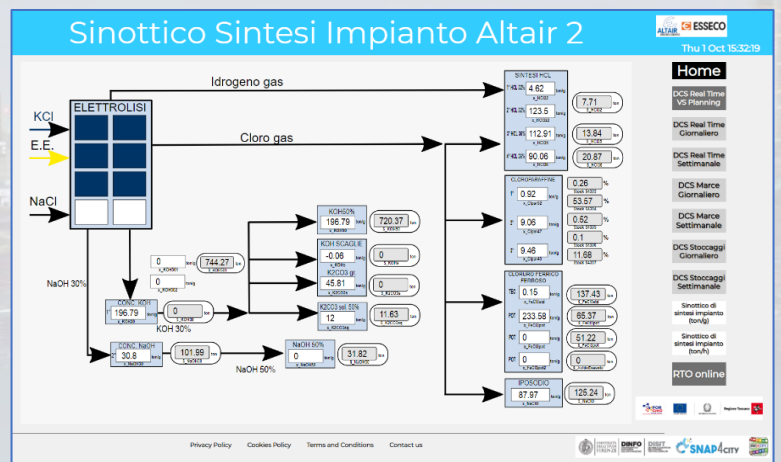
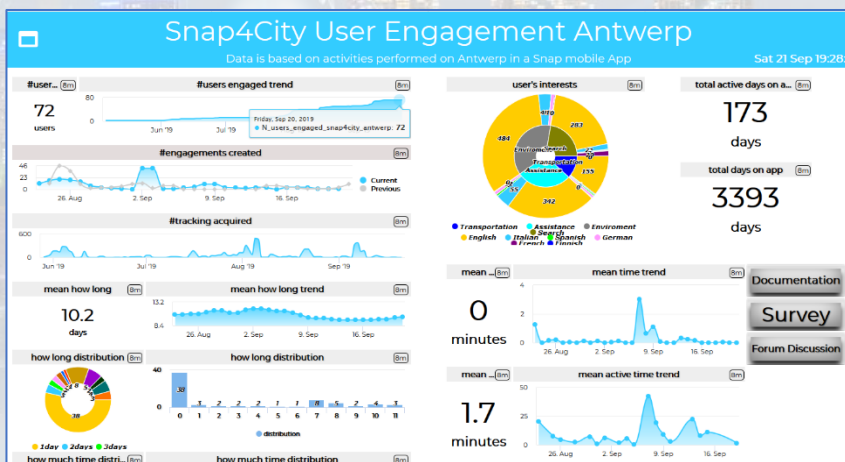
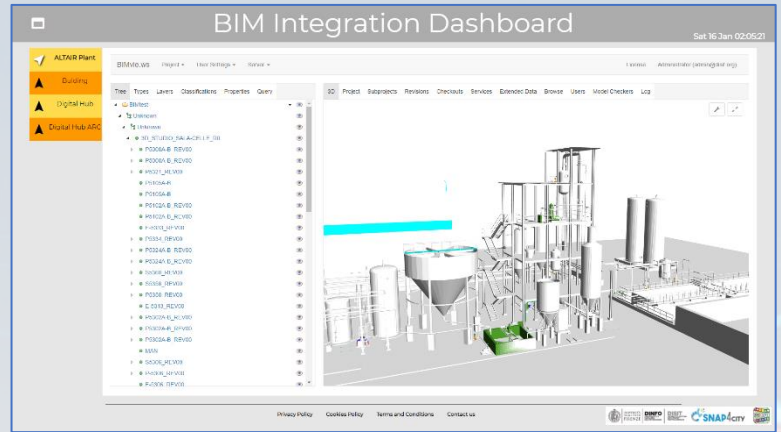
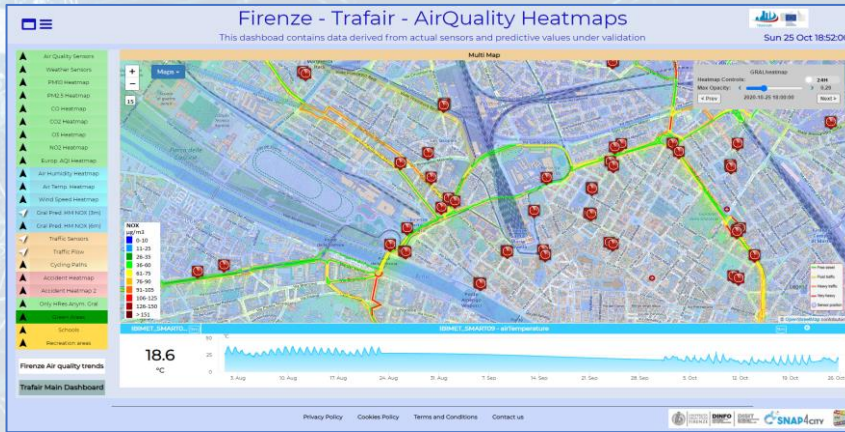
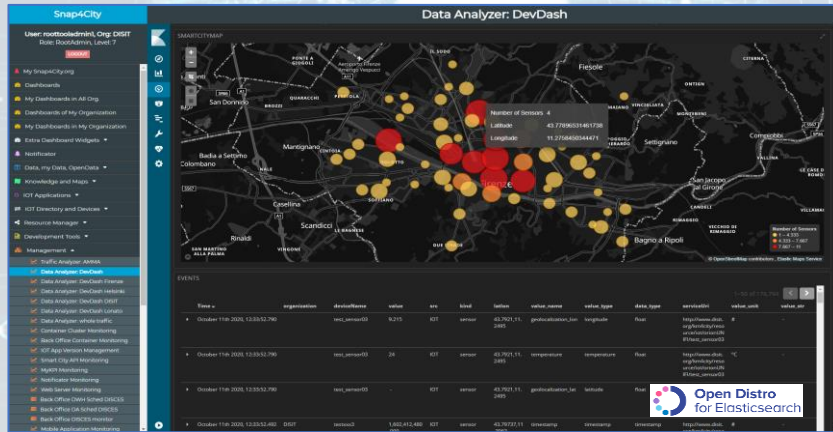
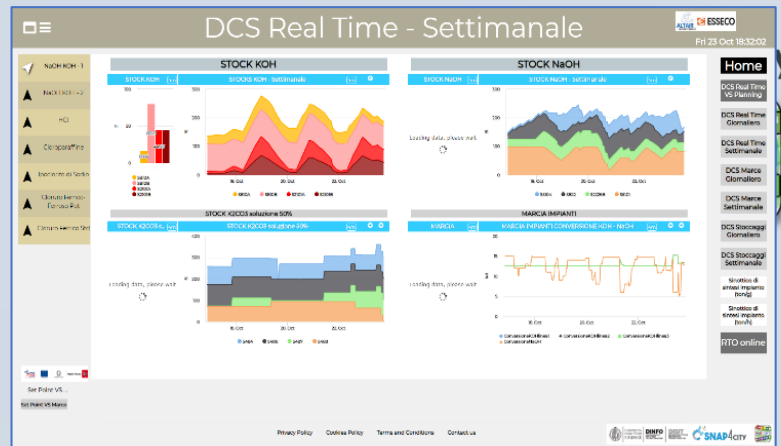
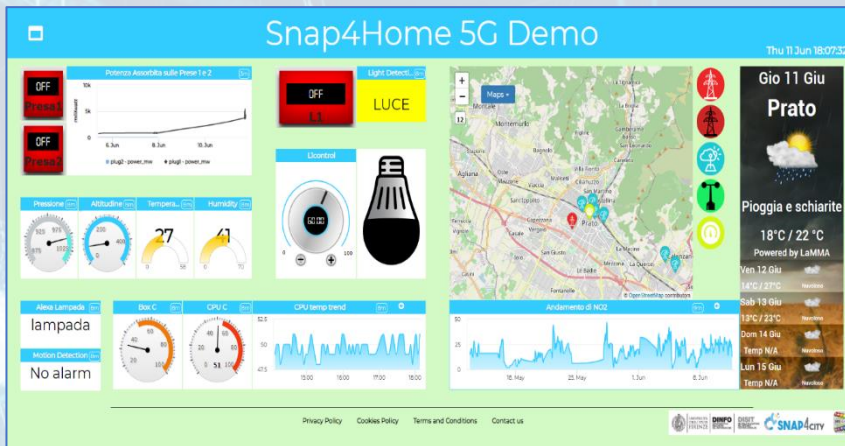
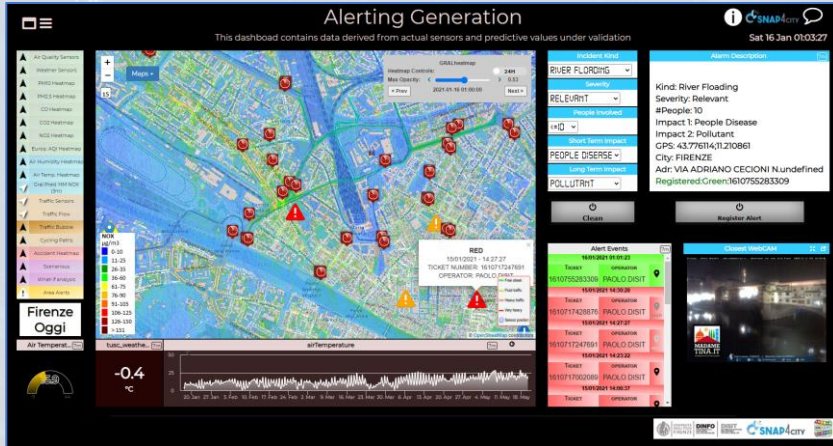
- Intuitive platform
- Any Data TYPE, any data source, any protocol
- Data storage seamless
- Data analytics → artificial intelligence, AI/XAI
- Data Ethics, AI Ethics, GDPR
- Interactive Data Representation, any kind
- Key Performance Indicators, any kind
- What-IF analysis – Simulation, prediction, 2D/3D
- Micro, Meso e macro scales
- Operation, planning tactic and strategic / optimization
- Collaborative and shared representation
- Sustainable, shared, open source 100%



## Complex and heterogeneous information, interoperability

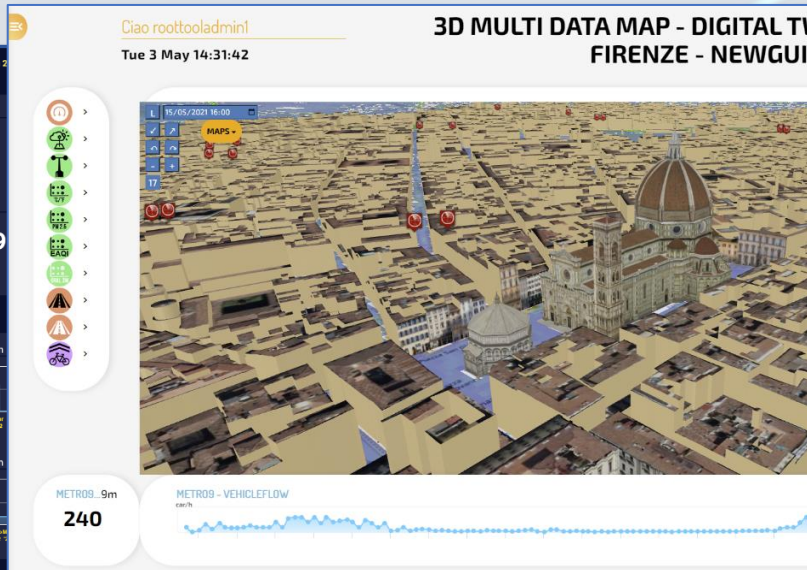
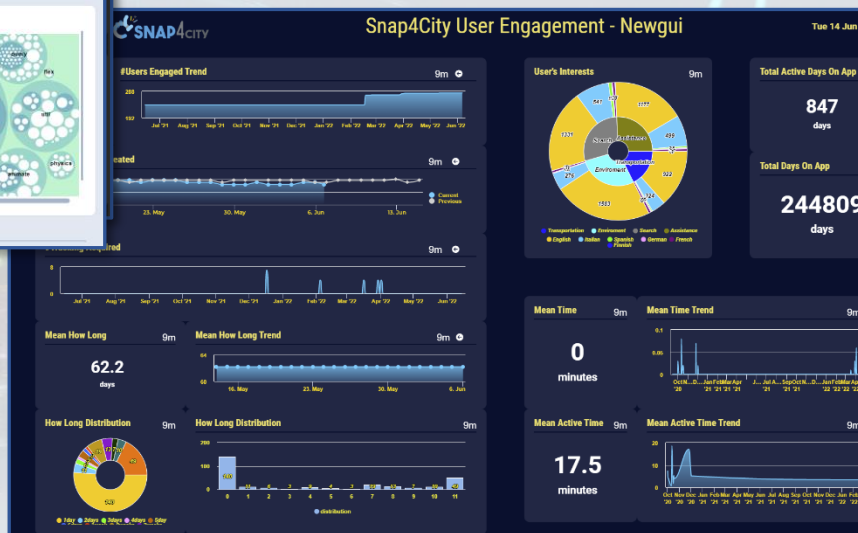
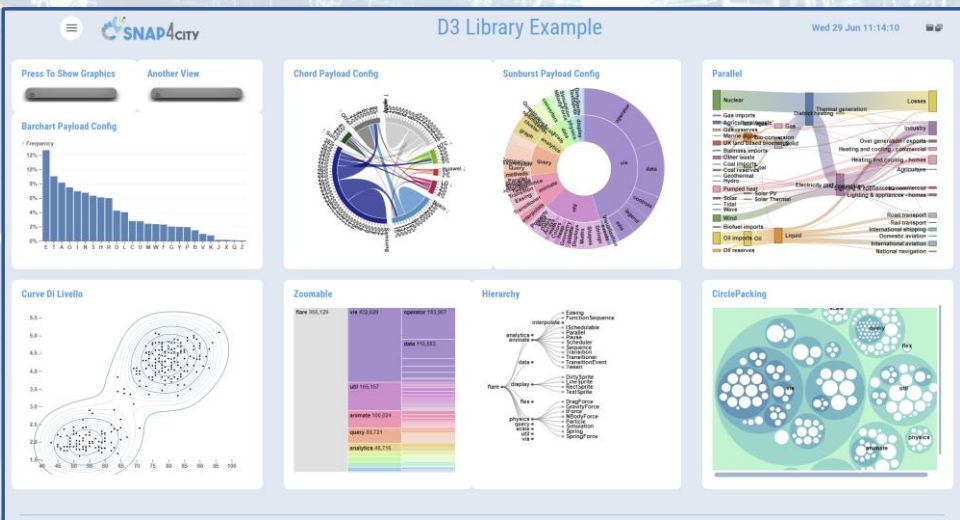
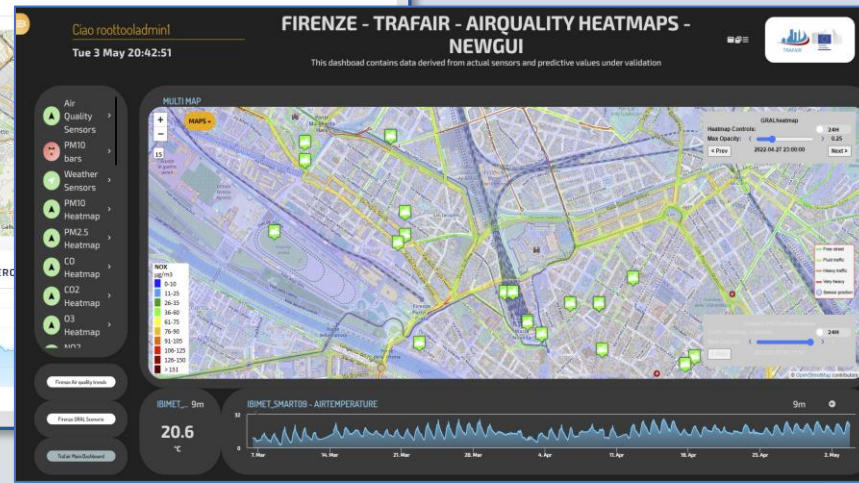
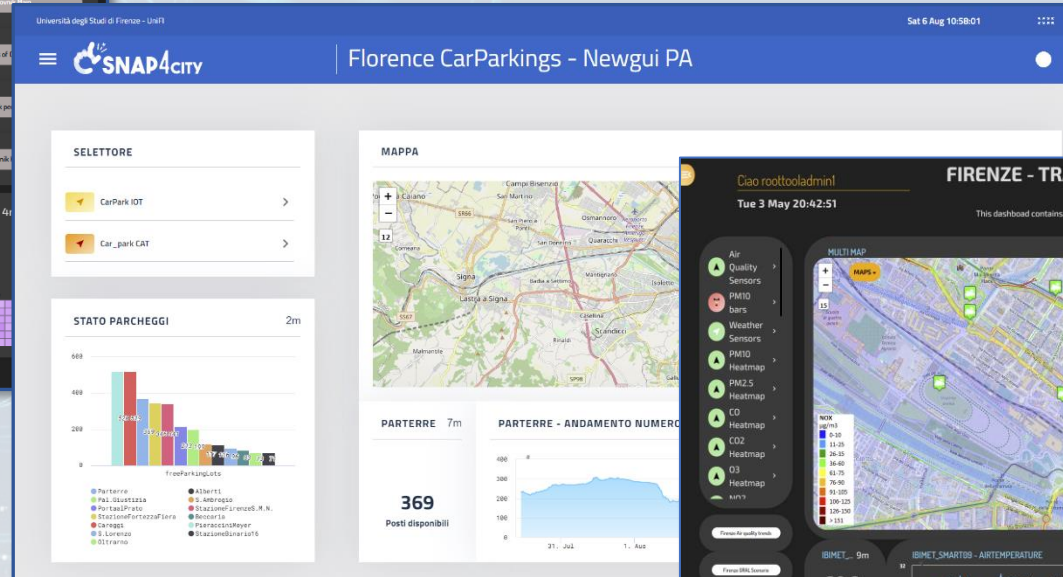
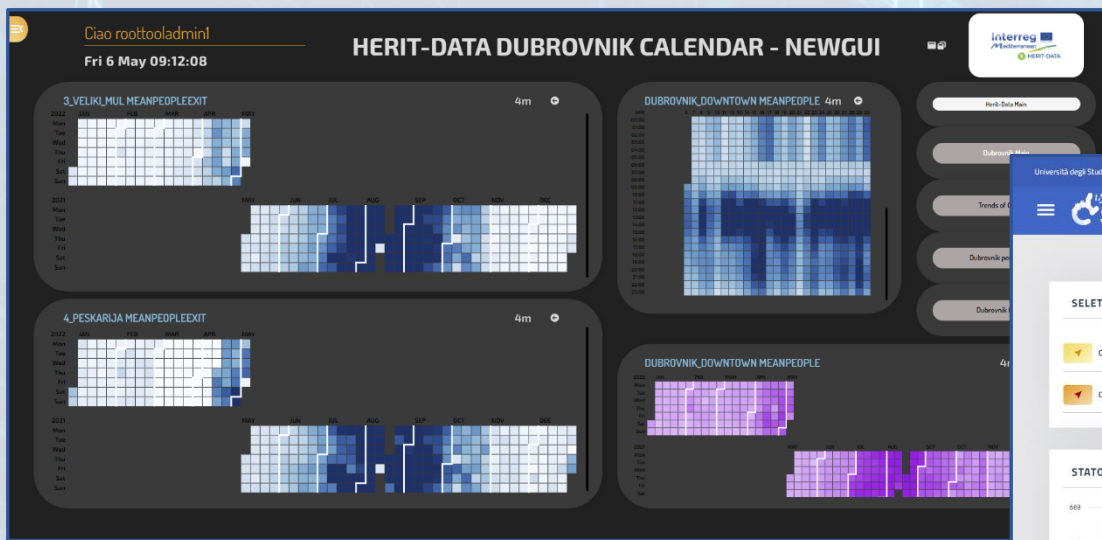
- GIS, ITS, AVM, IoT, BIM, CKAN, etc.
- Satellite services
- MaaS, last-mile delivery HUBs
- etc.







# Different Themes



New styles/themes can be developed by specializing a few files from open source

<https://www.snap4city.org/793>



# Control Room





# Key Performance Indicators, KPI



- **United Nations Sustainable Development Goals, SDGs** (for which cities can do more to achieve some of the 17 SDGs, <https://sdgs.un.org/goals>);
- **15 minutes cities** (where primary services must be accessible within 15 minutes on foot);
- **objectives of the European Commission** in terms of pollutant emissions for: NO2, PM10, PM2.5 ([https://environment.ec.europa.eu/topics/air\\_en](https://environment.ec.europa.eu/topics/air_en));
- **SUMI: mobility and transport vs env**
  - <https://www.snap4city.org/951>
- **SUMP/PUMS: mobility and transport vs env.**
- **ISO indicators:** city smartness, digitization, tech level.
- **Low Level/Real Time:** global traffic, quality of service, betweenness, centrality, queue, time to travel, etc.

Global  
&  
Local  
  
Periodic  
&  
Realtime

| Air Quality Directive |                           |  |   | WHO guidelines            |   |
|-----------------------|---------------------------|--|---|---------------------------|---|
| 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>      |   |



# 15MinCityIndex

**What would support my neighborhood to become a 15-Minute City?**

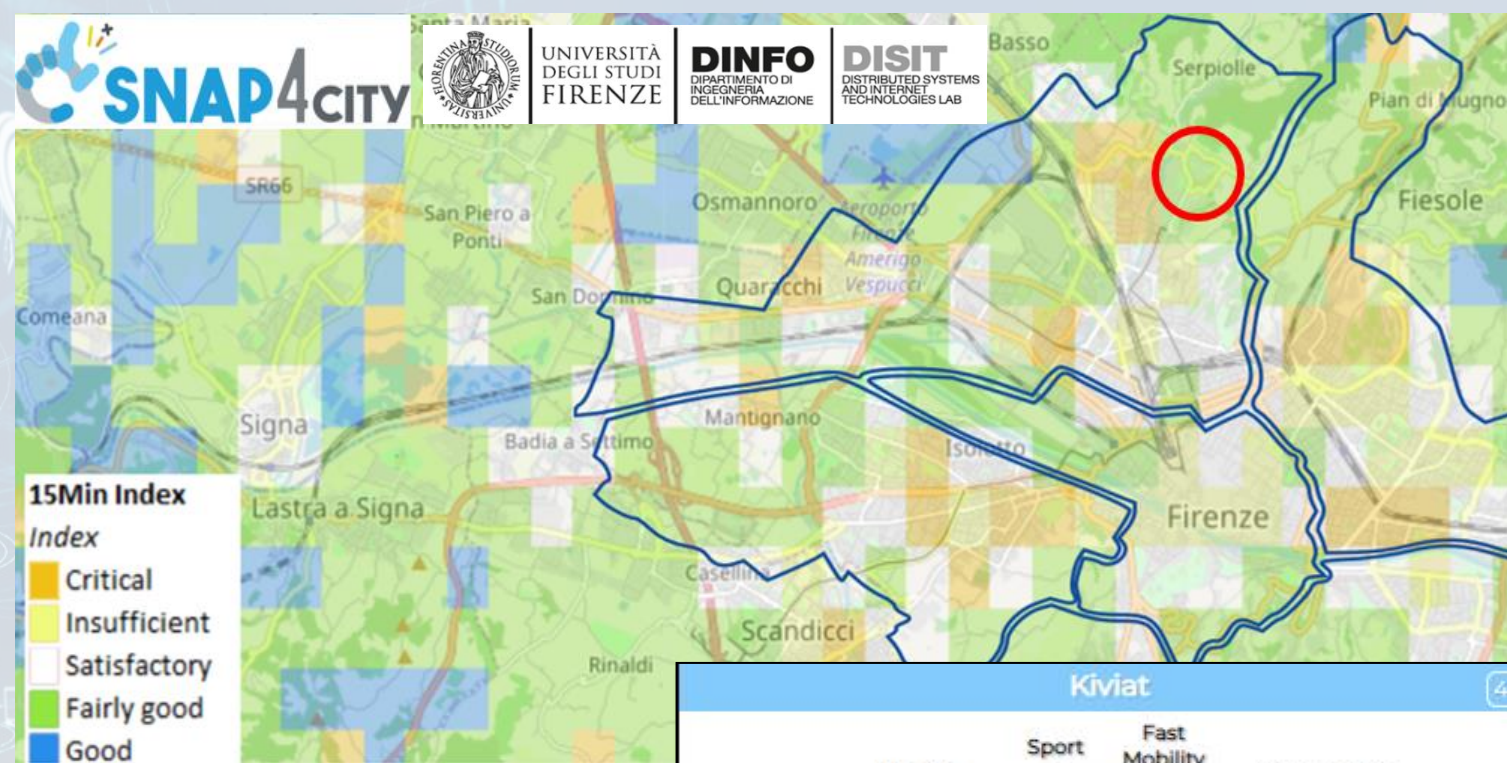
## Using the Open Data:

We developed a data analytic tool based on municipal and national open data to assess services adequacy for people living in each 15 minutes areas of the city.

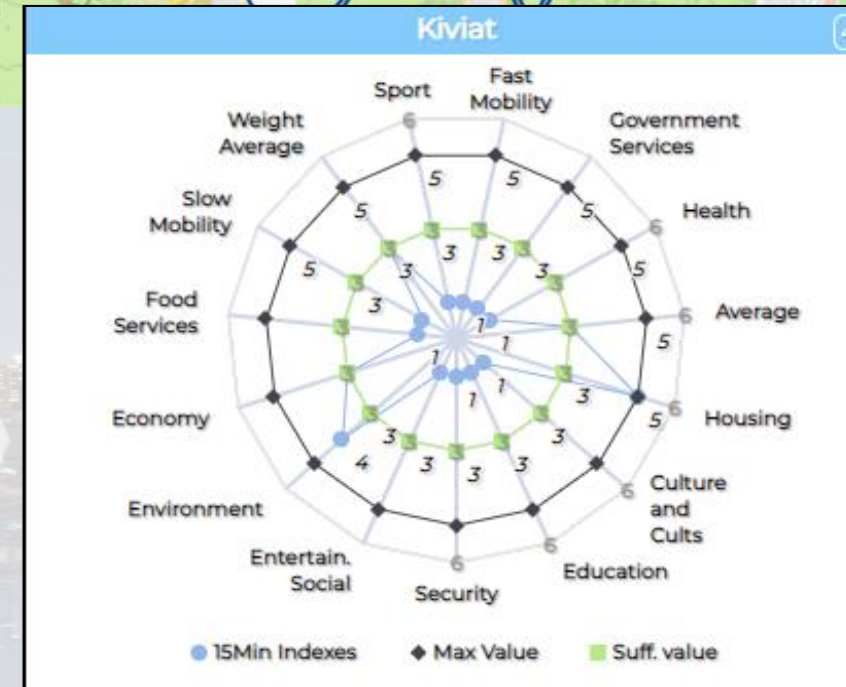
Good public transport services: bus, new tram line, train stations, cycle paths.



Careggi/Rifredi is a relevant district in Florence because of hosting the main Florence/Tuscany hospitals Careggi and Meyer, but also university headquarters and many other workplaces.



The tool supports the becoming of a 15-Minute city evaluating the service level in various domains.



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



# 15MinCityIndex on Bologna

Ciao roottooladmin!

Tue 3 May 20:14:59

## 15 MINUTI INDEX BOLOGNA CITTÀ METROPOLITANA - NEWGUI

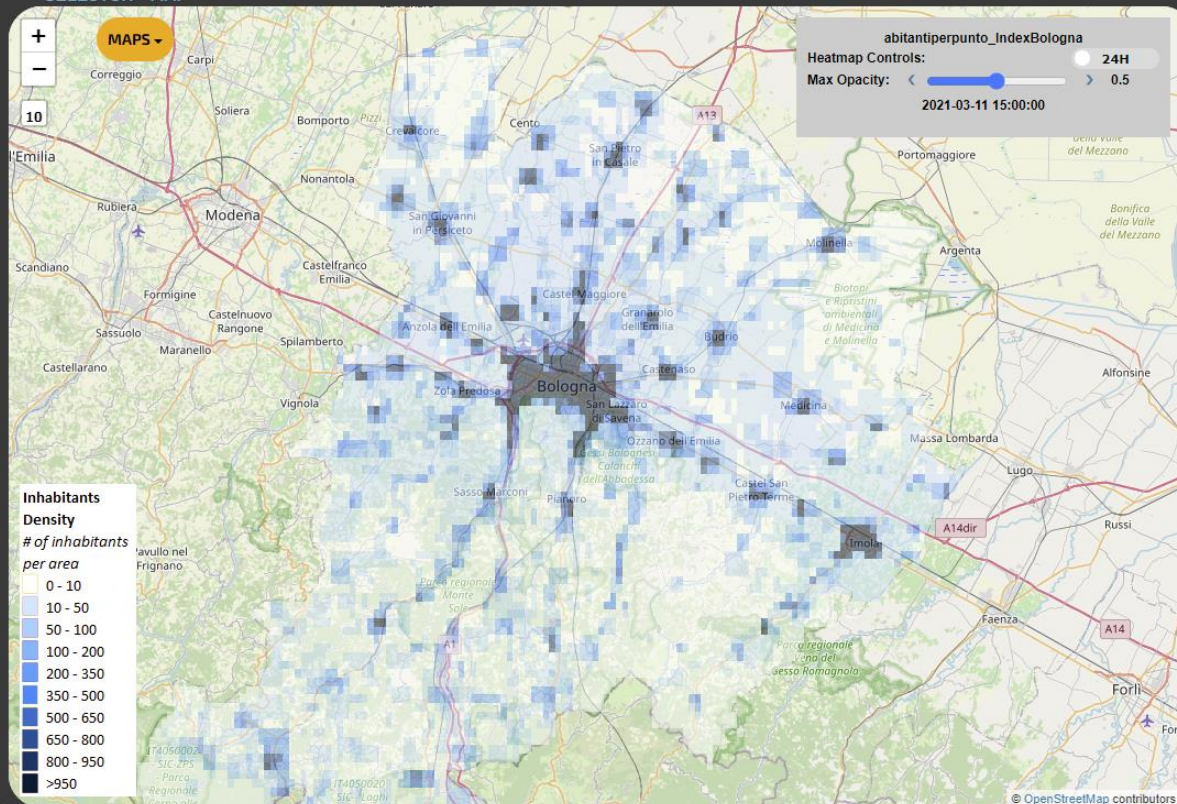
- # of Inhabitants >
- Green factor >
- Civil factor >
- Industrialization factor >
- Environment Index >
- 15Min Economy Index >
- 15Min Housing Index >
- 15Min Health Index >
- 15Min Food Index >
- 15Min Education Index >
- 15Min Slow Mob Index >

### THE PICKED POINT

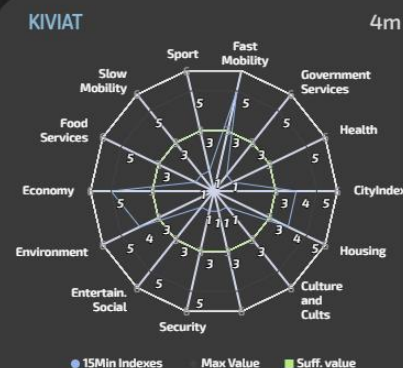
9m

City: Argelato  
Address: Via Casadio N. 1  
lat,lon: 44.61882,11.35437

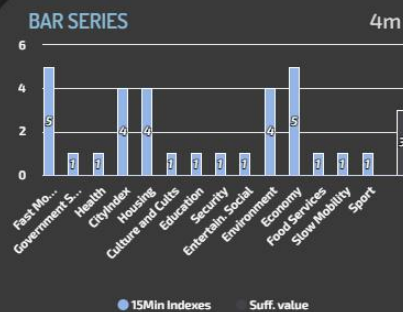
### SELECTOR - MAP



### KIVIAT



### BAR SERIES



- 1 NO POVERTY**
- 2 ZERO HUNGER**
- 3 GOOD HEALTH AND WELL-BEING**
- 4 QUALITY EDUCATION**
- 7 AFFORDABLE AND CLEAN ENERGY**
- 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE**
- 11 SUSTAINABLE CITIES AND COMMUNITIES**
- 12 RESPONSIBLE CONSUMPTION AND PRODUCTION**
- 13 CLIMATE ACTION**
- 15 LIFE ON LAND**





- **15 Minute City Index:**
  - 13 subindexes: energy, slow mobility, fast mobility, housing, economy education, culture and cults, health, entertainment, gov, food, security...



- Optimization of car sharing/pooling
- Monitoring and Prediction of energy consumption
- Stimulating: Bike sharing, e-bikes, car charge, etc.
- Sizing energy plants



- Predictive maintenance
- Decisions Support Systems
- Process optimization, control
- Industry 4.0 integrated solutions



- Reduction of emission, reduction of congestion
- Smart City infrastructure: monitoring and resilience, long terms predictions
- Effective and Low cost smart solutions
- What-if analysis, Simulations
- Origin Destination matrices computation



- Optimization of Waste Collection
- business intelligence tools for decision makers
- Reduction production costs
- Monitoring resource consumption



- Reduction of emission, reduction of congestion
- Monitoring and Predicting: NO2, NOX, CO2, Traffic flow, pollutant, landslide, waste, etc.
- Traffic flow reconstruction
- Demand vs Offer of Mobility analysis



- Shortening justice time
- Prediction of mediation proneness
- Assisting institution is taking legal decisions
- Anonymization and indexing legal docs.
- Ethical Explainable Artificial Intelligence



# Decision Support System: Immediate response and Tactical and Strategic Plans, via What-if Analysis

FROM CITY  
DASHBOARD TO  
APPLICATIONS

FORGING &  
MANAGING OPEN  
ARCHITECTURE  
AND ECOSYSTEMS

IOT APPLICATIONS  
AND DEVICES

SNAP4CITY  
FORUMS

SNAP4CITY  
ARCHITECTURE AND  
ECOSYSTEM, OPENED  
TO DEVELOPERS  
AND STAKEHOLDERS

TWITTER  
VIGILANCE SOCIAL  
MEDIA ANALYSIS

SNAP4CITY  
AND KM4CITY  
PROJECTS



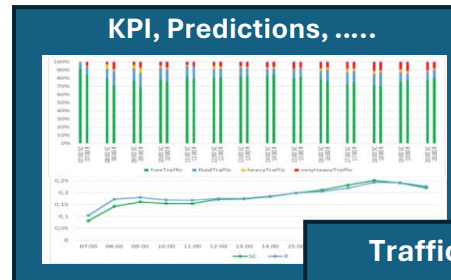
City Users' Services,  
Tourism Management  
and Safety, Digital Twin

NAP4CITY THE  
VIEW OF THE  
ADMINISTRATORS





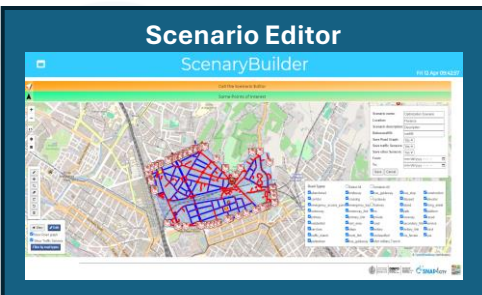
Monitoring



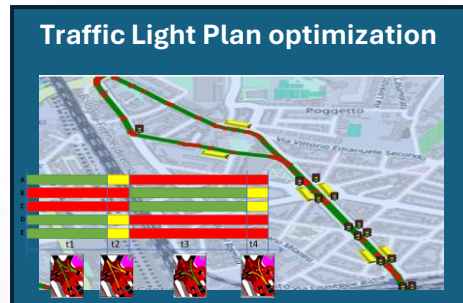
Digital Twin  
Models &  
Data

Predictions,  
Anomaly Detection,  
Analysis, Assessment  
Warning

Decision  
Support System

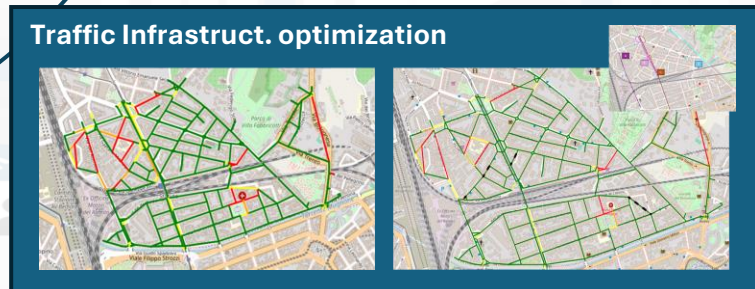
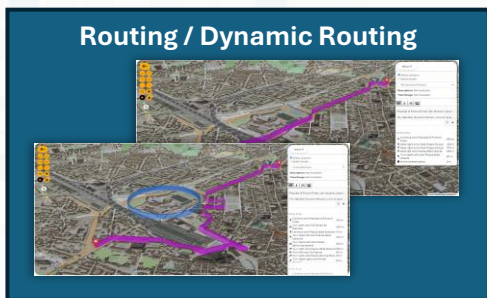


Simulations,  
TFR, Crossroad,  
Public Transport,  
Routing, ..



Scenarios

What-If Analysis,  
Optimization





Ciao

Fri 13 Oct 18:29:18

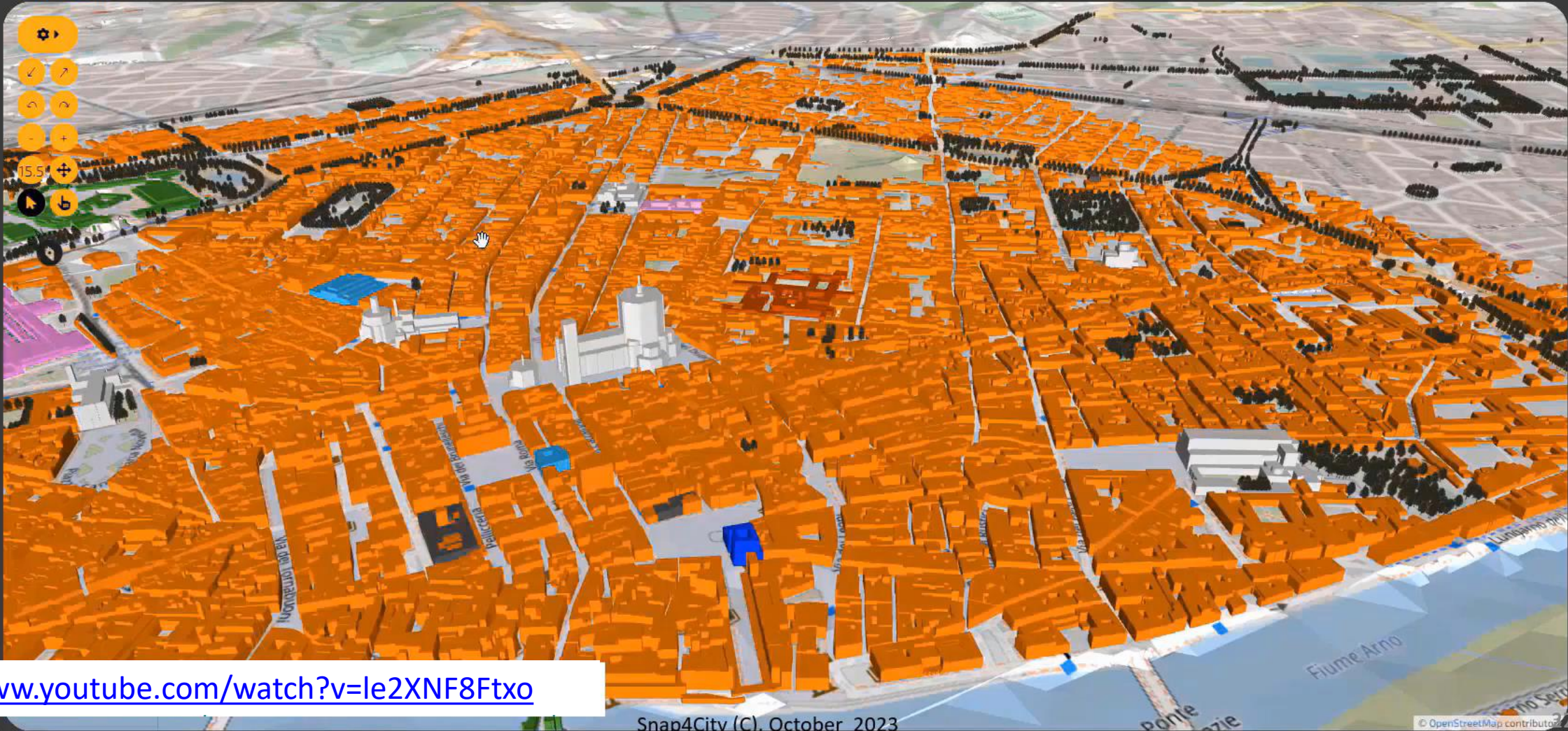
# FLORENCE SCDT

SELECT...

- GRAL HD
- NO 2
- Mobile
- Bar chart
- Highway
- Highway
- Bus
- WHAT-IF
- Car
- Person
- Bicycle

DOUBLE MAP

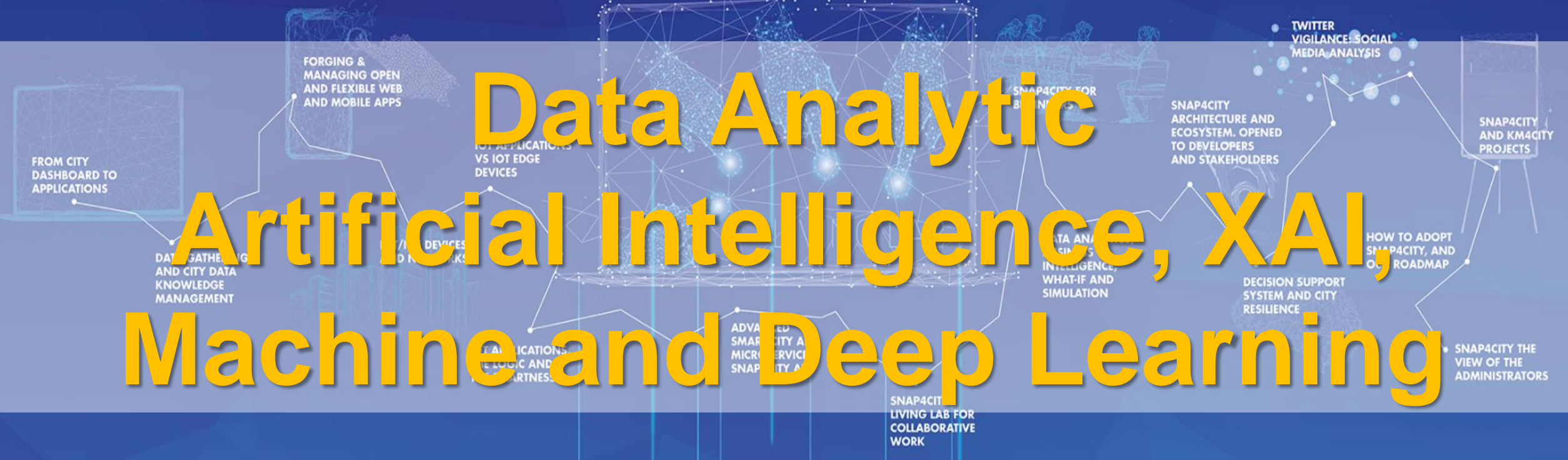
- Settings
- Home
- Previous
- Next
- 15.5
- Zoom in
- Zoom out



<https://www.youtube.com/watch?v=le2XNF8Ftxo>



# Data Analytic Artificial Intelligence, XAI, Machine and Deep Learning



City Users' Services,  
Tourism Management  
and Safety, Digital Twin







# Available AI Solutions on Snap4City

<https://www.snap4city.org/997>

**More than 80 Available Solutions & 300 AI applic.**

- **Mobility and Transport**
- **Environment, Weather, Waste, Water**
- **City Users Behaviour and Social analysis**
- **Energy and Control**
- **Tourism and People**
- **Security and Safety**
- **High Level Decision Support Solutions**
  - **Asset management**
  - **Resilience and Risks Analysis**
- **Low level Techniques**



[https://www.snap4city.org/download/video/DPL\\_SNAP4SOLU.pdf](https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf)

<https://www.snap4city.org/download/video/course/p4/>



# City User Behaviour/services, Tourism and Safety (2024/8)

- **Goals:**
  - Quality of Life, quality of services, over tourism mitigation, sustainability
  - Costs reduction of services
  - Accessibility to services: citizens, Tourists, commuters, etc.
  - Security/Safety of city users
- **Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)**
  - Monitoring services: tickets, reputation, usages, areas, etc.
  - Monitoring user behaviour (counting, trajectories): indoor/outdoor, hot places/services, ports, beaches,
  - Computing: origin destination, trajectories, travel means, etc.
  - Early detection/warning of critical conditions, connection with Video Management Systems
  - Managing entrances in city areas: restricted areas, touristic busses, etc.
  - Production of info-tourism, recommendations, nudging to city users and operators, second offer promotion
  - Providing Virtual Assistants for City Services, Tourist Offices, etc.
  - Monitoring reputation of services via: social media, blogs, etc.
  - Collecting complains, requests, participations from City users via mobile apps
  - Computing predictions of any kind
- **Solutions for Planning (optimization and what-if analysis)**
  - Reduction of Pollutant Emissions, via optimization
  - Optimization plan to distribution of workload on multiple touristic offers/services, area cleaning, etc.
  - Predicting reputation of services, touristic and operative
- **Algorithms and computational solutions, see next slide**





# City Users Behaviour, Safety, Security and Social Analysis (2024/8)

- **People detection and classification:** persona, strollers, bikes, etc. (ML, DL)
- **people counting and tracking,** head counting, people trajectories (via thermal cameras, ML, DL)
- **People flows prediction and reconstruction,** (ML, DL)
  - Wi-Fi data, mobile apps data, Mobile Data, etc.
- **User's behaviour analysis, People flow analysis** from PAX Counters and heterogenous data sources (ML, AI)
  - origin destination matrices, hot places, time schedule,
  - Recency and frequency, permanence, typical trajectory, etc.
- **Computing User engagement and suggestions** for sustainable mobility (Rule Based, ML)
- **Social media analysis** on specific channel, specific keywords: see Twitter Vigilance,
  - Reputation, service assessment: MultiLingual NLP and Sentiment Analysis, SA
  - Tweet proneness, retweet-ability of tweets, impact guessing
  - Audience predictions on TV channels and physical events, locations
  - Prediction of attendance of events and on attractions
- **Virtual Assistant construction,** LLM, NLP, Sentiment Analysis (DL, NLP)
- **Video management System integration for security**
- **15 Minute City Index ,** etc. (modeling and computability)
- Computing **SDG,** etc., (DP)
- Etc





# City Users' Behaviour Analysis





| Goals  | How to  | technicalities  |
|--|---|---|
| <b>Keep under control reputation</b>                     | Measuring and predicting  | Multichannel collections of appreciations, AI/LLM, sentiment analysis |
| <b>Predicting number of presences in advances</b>        | Measuring and predicting  | Counting, tracking and computing Orig. Dest. Matrices                 |
| <b>Controlling the overtourism</b>                       | Measuring, predicting, suggesting, producing tactics and strategies | Production of suggestions, serious games, engagements, ..             |
| <b>Stimulating actions, stimulating the second offer</b> | Suggesting, engaging, producing tactics and strategies              | Production of suggestions, and engagements                            |
| <b>Identification of critical conditions</b>             | Short and long terms Measuring                                      | In deep data analysis, AI for anomaly detections                      |
| <b>Increasing resilience</b>                             | Monitoring and early warning  | Strategies, dynamic routing, real time information to city users      |



# City User behavior analysis multiple data sources

- **Main Data Sources on the market**
  - Mobile Cell data from telecom operators, macro areas
  - Mobile App data from their operators, micro areas
  - OBU from Insurance operators, only private vehicles
  - Social media: limited information and quality
  - Local Operators of: museum, ticket office, restaurants, etc.
  - Data integrators: a mixt of the above, not clear methods
- **Sensor Data:**
  - PAX Counters, Sniffer, Wi-Fi sniffers, Radar, laser, etc.
  - TV Camera color, Thermal Cameras, radar track
- ***Snap4City: integration and computing tools for deductions***

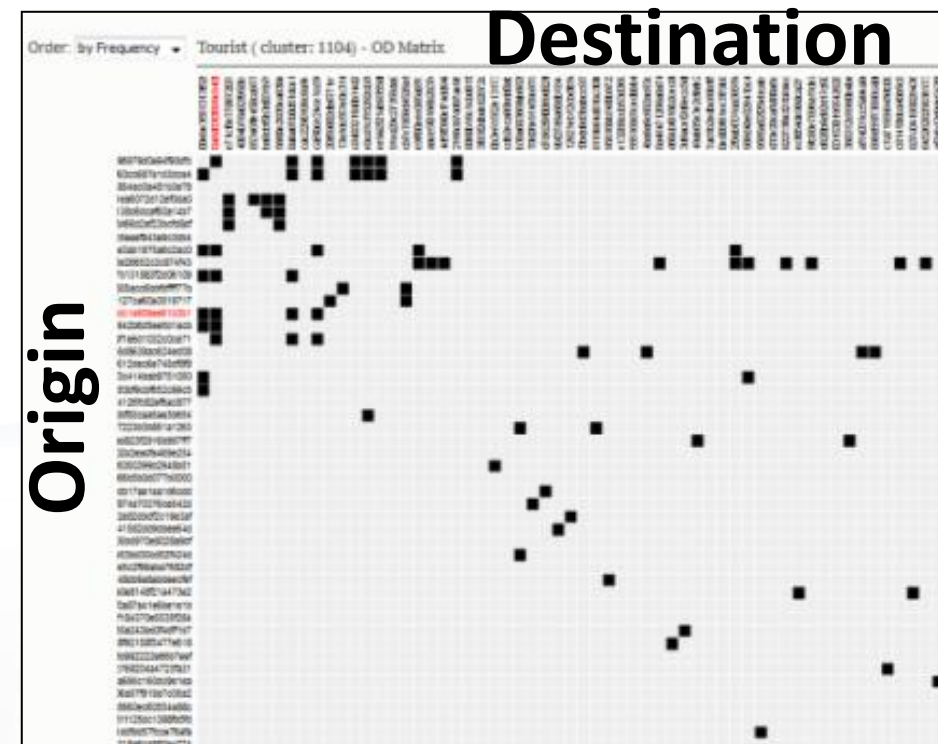






# Origin Destination Matrices

- **computed** from several kinds of data
  - Census Data
  - Cellular Mobile Data
  - Mobile App Data **trajectories**
  - OBU from vehicles **trajectories**
  - Composition of multiple sources: ODM + Trj
- **may represent:**
  - Demand of mobility
  - Offer of transportation
- **refer** to different area kinds for Origin and of Destination
  - Different kinds of OD areas
  - Different kinds of temporal resolutions → animations
    - Hourly, daily, weekly, monthly, etc...





# ODM, Traffic Flow

## ODM Origin Destination Matrices

Wed 1 Nov 10:47:28

**Selectornew**

- ▶ Admin Areas
- ▶ Areas or grids
- ▶ Traffic Sensors
- ▶ Traffic Flow
- ▶ Traffic Flow Manager New

**Map**

10 Seravezza

10-100%

**Origin-Destination Map**

Controls:

Show all polygons:  ON

Time period: week

Precision: municipality

Flow: outflow

Max Opacity:

2022-07-07 00:00:00

week

**FirenzeFIPITrafficRealtime**

Traffic Heatmap Controls: 24H

Max Opacity:  1

2023-11-01 03:00:00

<https://www.snap4city.org/dashboardSmartCity/view/Gea-Night.php?iddashboard=Mzk3Nw==>



## ODM Origin Destination Matrices

Wed 1 Nov 10:50:01

**Select or new**

- ▶ Admin Areas >
- ▶ Areas or grids >
- ▶ Traffic Sensors >
- ▶ Traffic Flow >
- ▶ Traffic Flow Manager New >

**Map**

13

Origin-Destination Map

**Controls:**

Show all polygons:  ON

Time period: week

Precision: municipality

Flow: outflow

Max Opacity:  0.32

2022-07-07 00:00:00

week

Area id: Bagno a Ripoli

Rate: 7.309%

**FirenzeFIPILITrafficRealtime**

Traffic Heatmap Controls:

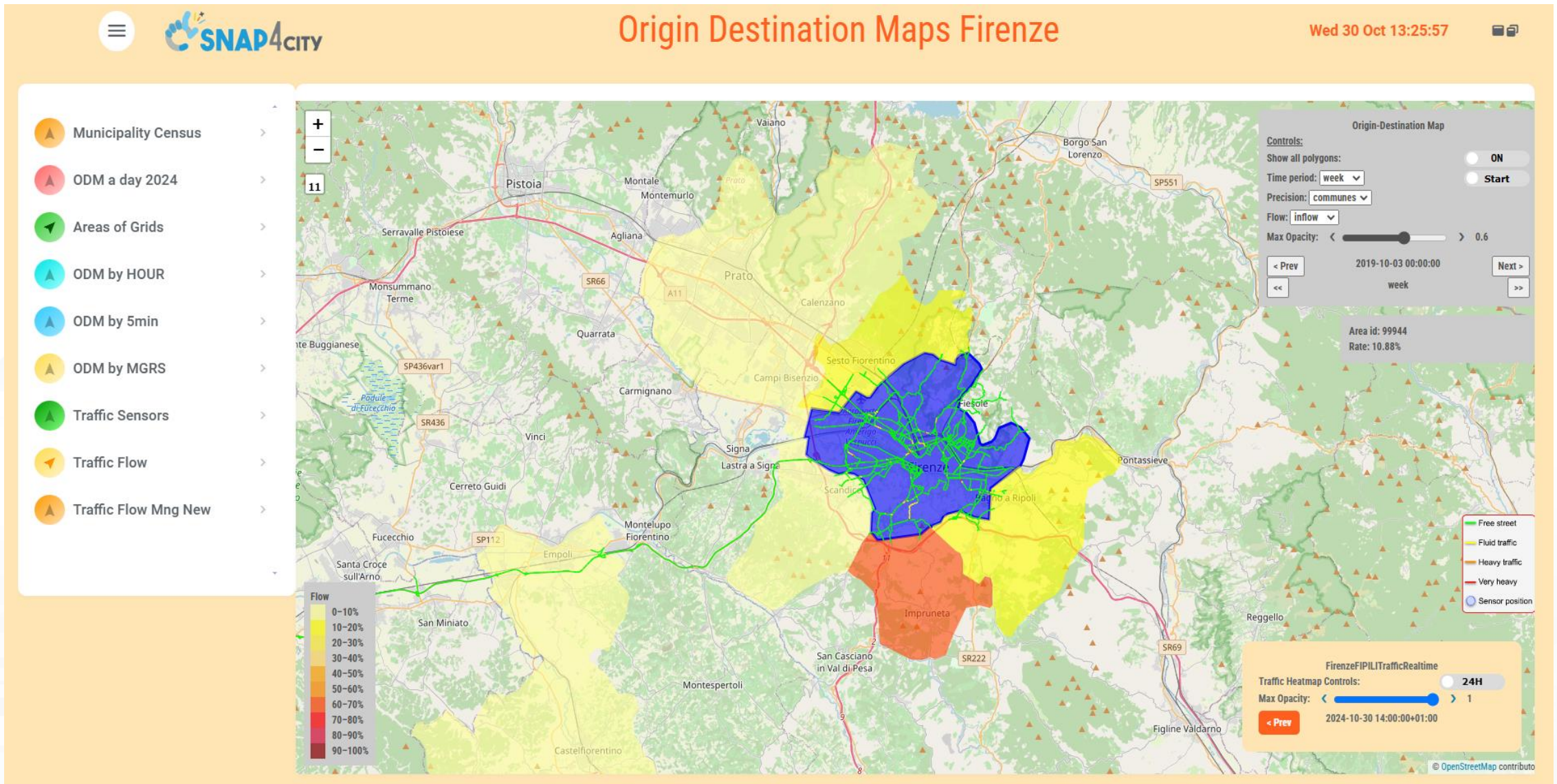
Max Opacity:  1

2023-11-01 03:00:00

[My Profile](#)

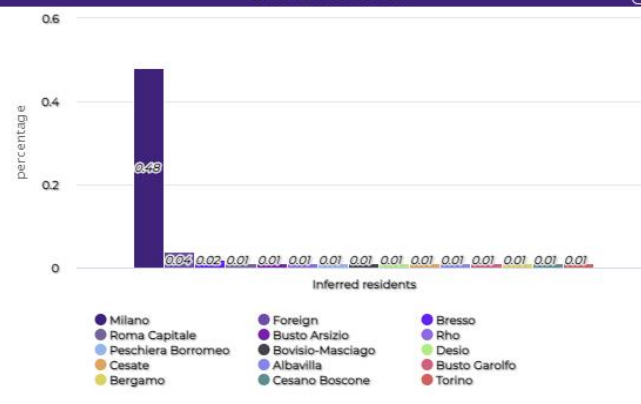
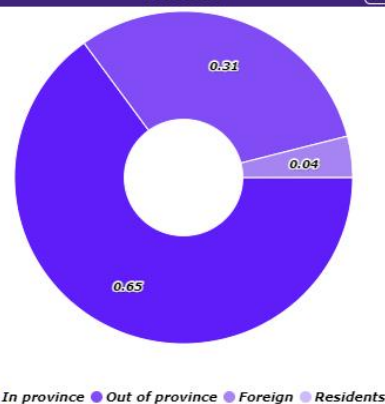
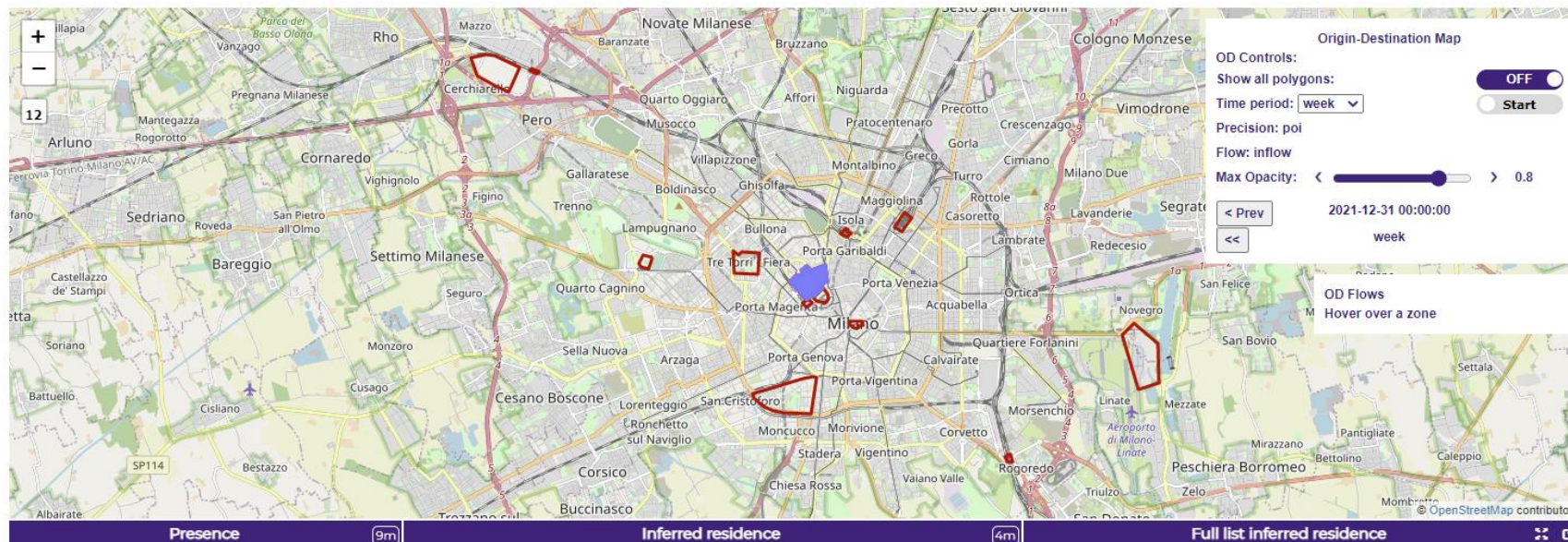
[Privacy Policy](#) [Cookies Policy](#) [Terms and Conditions](#) [Contact us](#)







# ODM Visual Analytic on Milan Area



## Parco Sempione

Region Province Municipality Census block

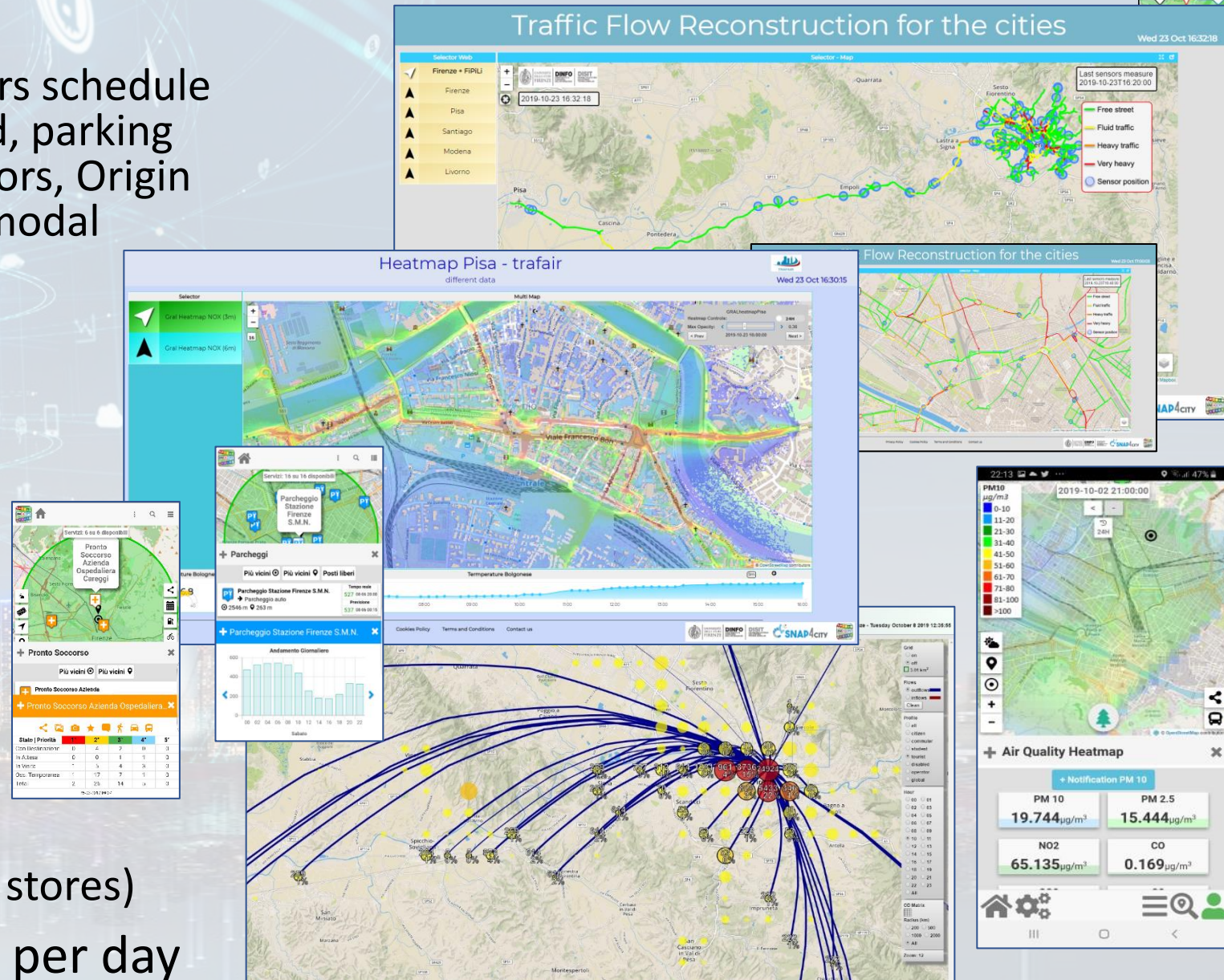
|                    |         |
|--------------------|---------|
| Milano             | 48.078% |
| Foreign            | 4.229%  |
| Bresso             | 1.741%  |
| Roma Capitale      | 1.392%  |
| Busto Arsizio      | 1.044%  |
| Rho                | 1.044%  |
| Peschiera Borromeo | 1.044%  |
| Bovisio-Masciago   | 1.044%  |
| Desio              | 1.044%  |
| Cesate             | 0.696%  |
| Albavilla          | 0.696%  |
| Busto Garolfo      | 0.696%  |



# Tuscany Region

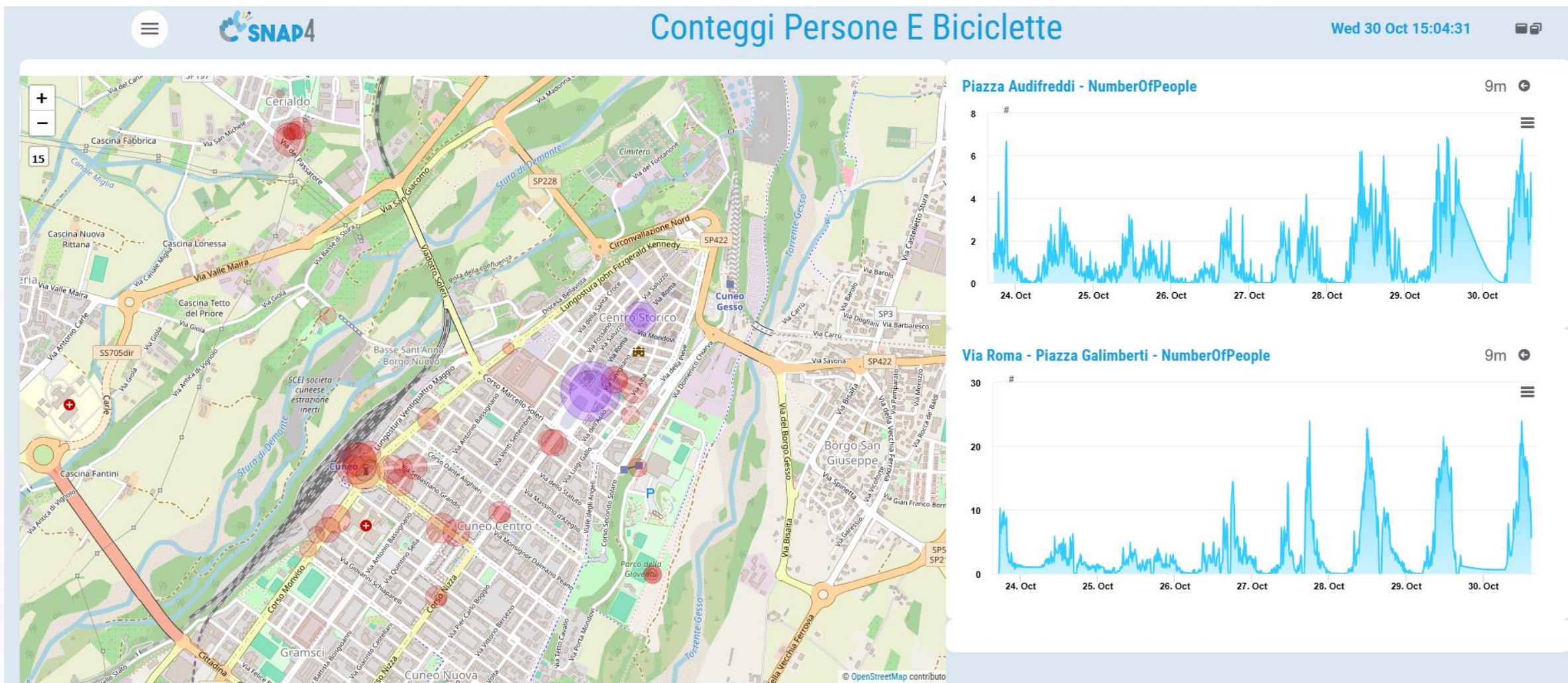
## • Dashboards & Services:

- **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:** NOX, NO2
  - **Weather Forecast,**
- **Culture and Tourism**
- 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





# Cuneo Counting People and Bikes





# Pont du Gard

- **Tourism Domain**

- KPIs
- Social Media
- People Flows
- Bike Flows

- **Dashboards**

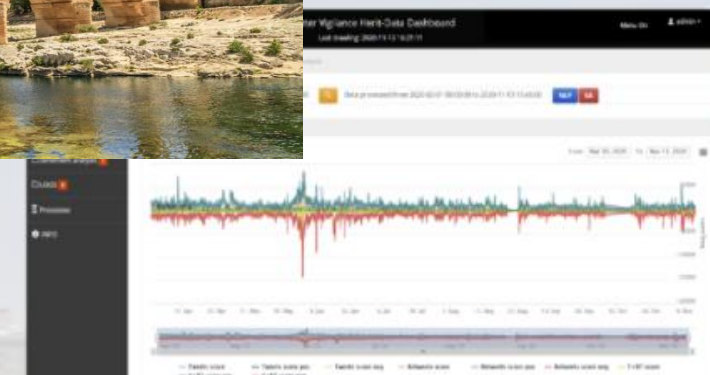
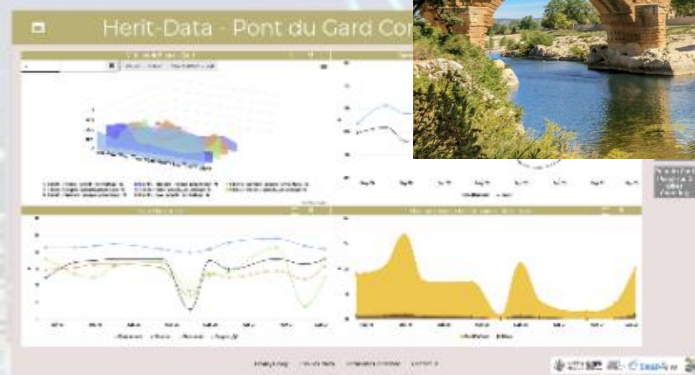
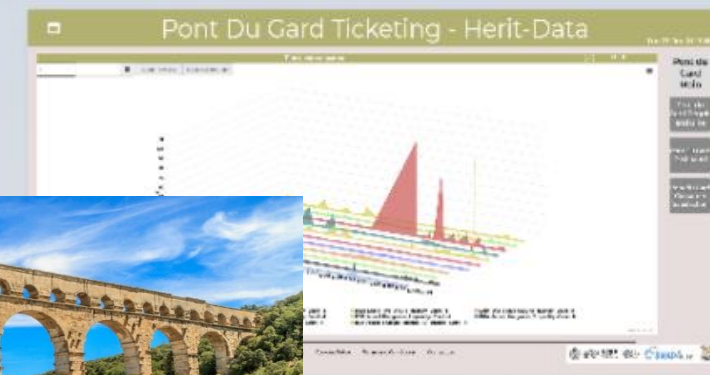
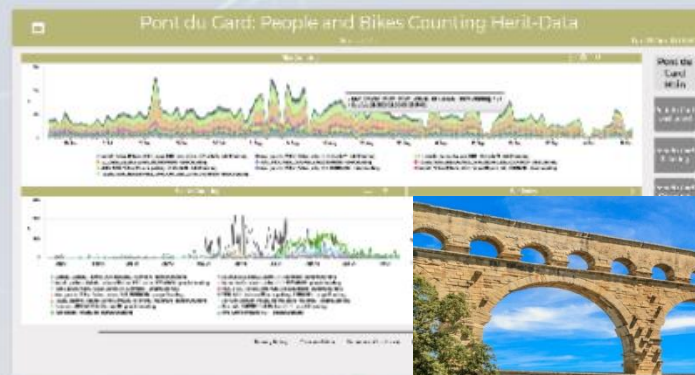
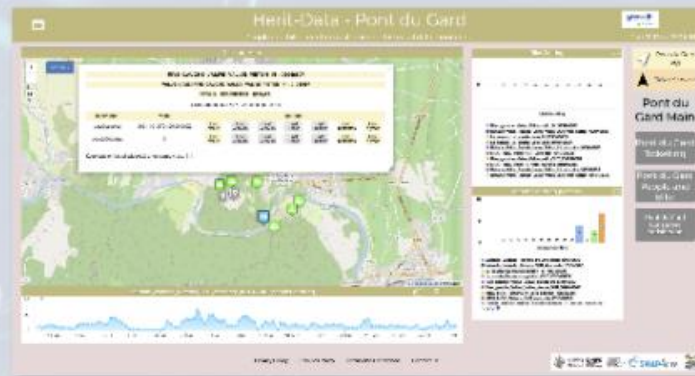
- Monitoring KPI
- People and bikes flows
- Twitter Vigilance

- **Historical and updated data**

- **Services Exploited on:**

- Dashboard

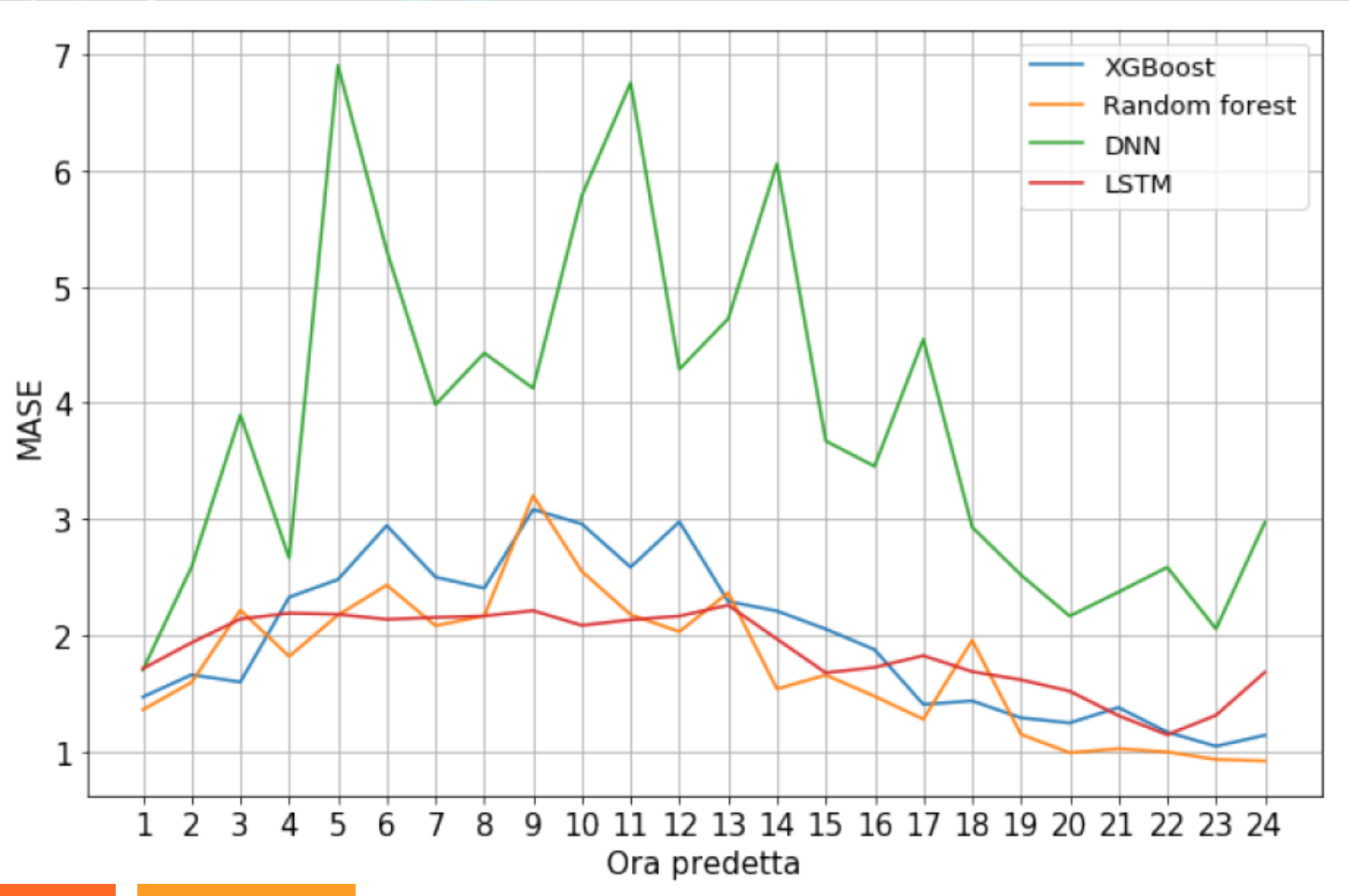
- **Since 2020**





# Pont du Gard: data analytics

- Prediction of the number of sold tickets 24 hours in advance
- Using:
  - Historical data
  - Weather conditions
  - Social Media



**Twitter Vigilance**

9 INDUSTRY, INNOVATION  
AND INFRASTRUCTURE



11 SUSTAINABLE CITIES  
AND COMMUNITIES





# Dubrovnik

- **Tourism Domain**

- Counting People
- TV Cameras and WiFi
- Social Media

- **Dashboards**

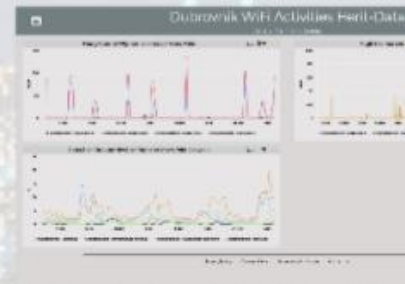
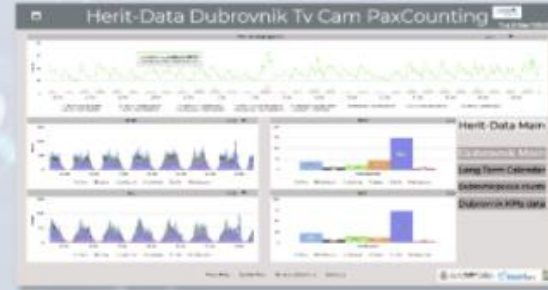
- Monitoring and real time control
- People flow
- Twitter Vigilance

- **Historical and Real Time data**

- **Services Exploited on:**

- Dashboard

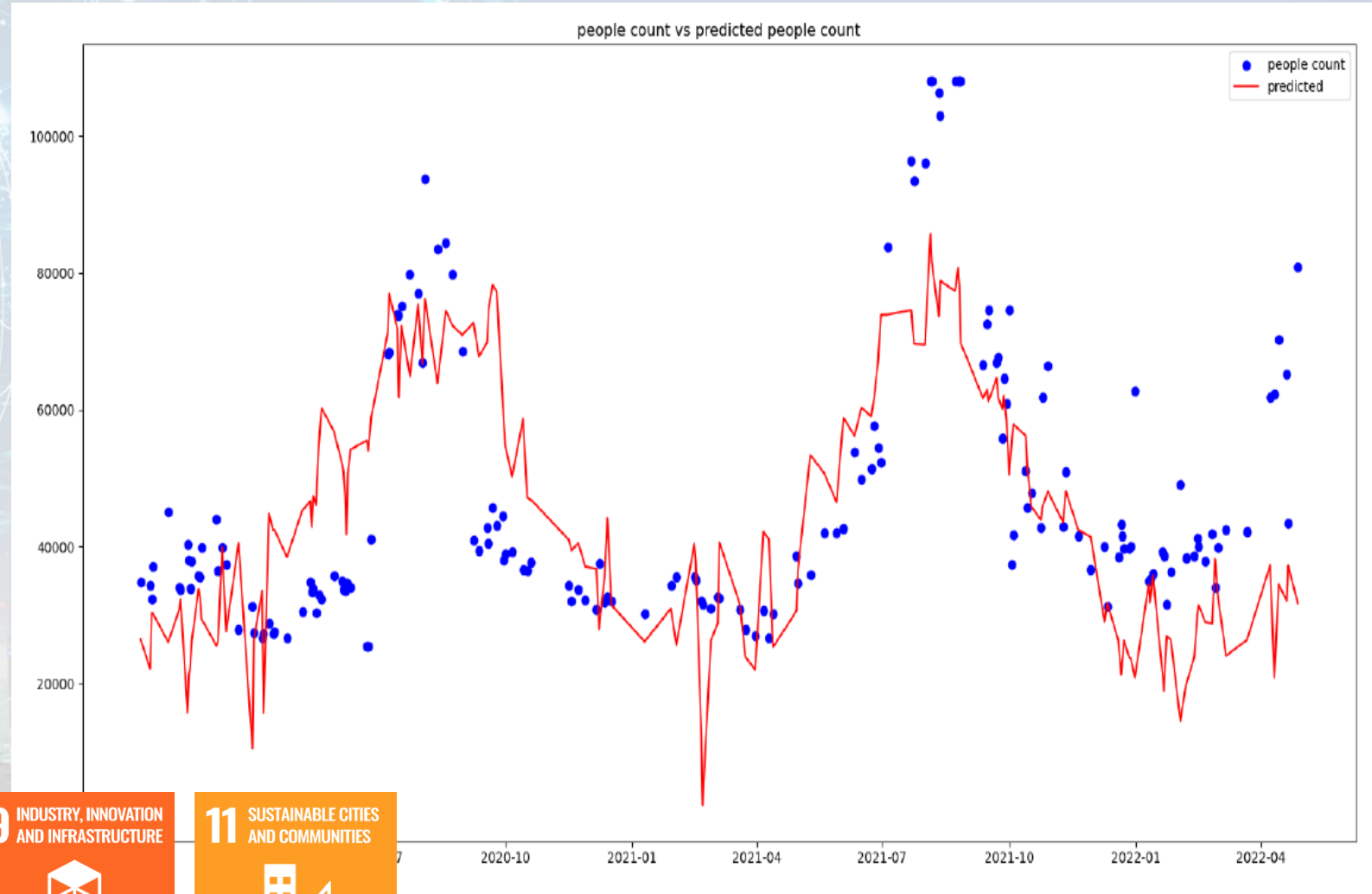
- **Since 2020**





# Dubrovnik: Data Analytics

- Assessing impact of advertising
- Prediction of presences on the basis of
  - Social Media Twitter Vigilance
  - weather conditions
  - Historical data



**Twitter Vigilance**





# Valencia, FSMLR

- **Tourism Domain**

- Counting People
- Environmental data
- Social Media

- **Dashboards**

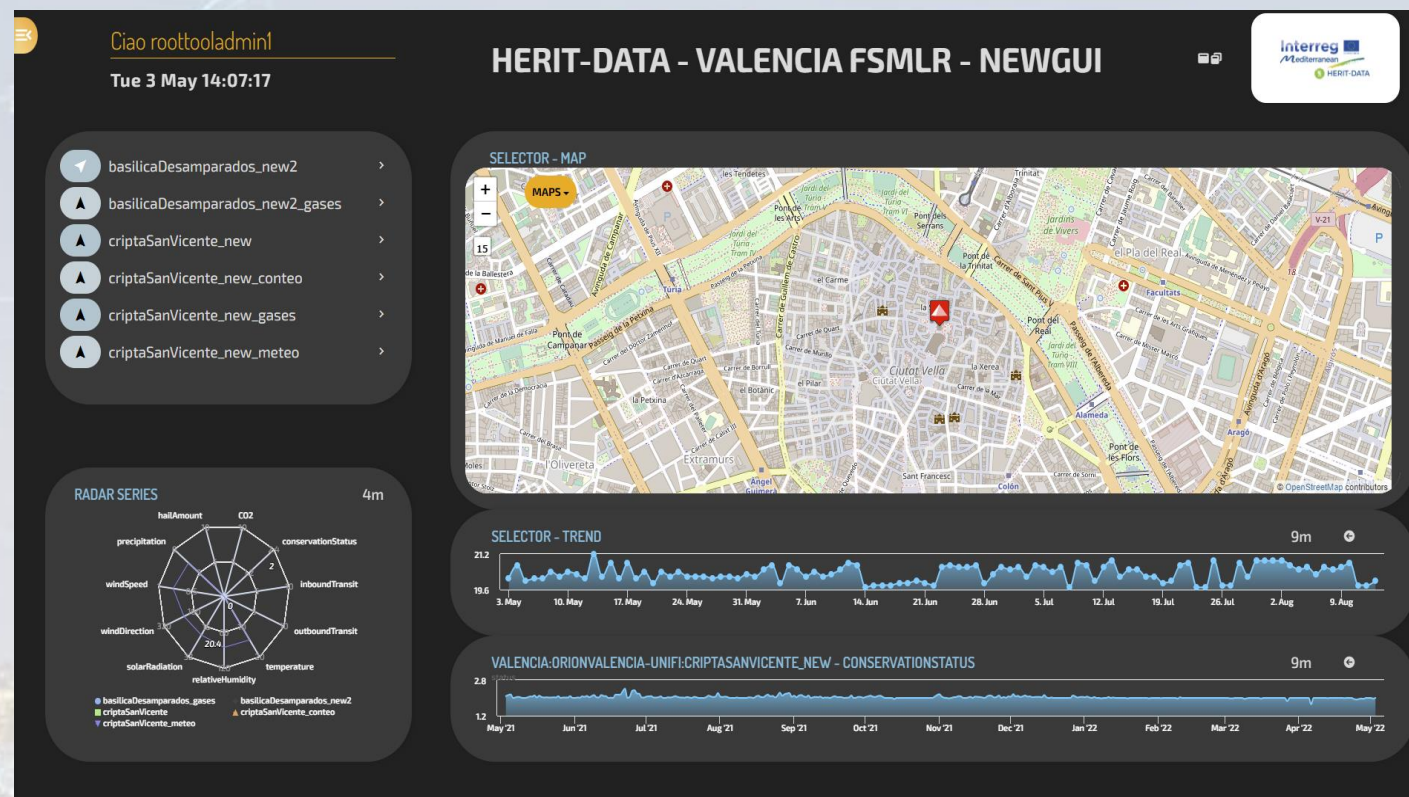
- Monitoring and real time control
- People flow
- Twitter Vigilance

- **Historical and Real Time data**

- **Services Exploited on:**

- Dashboard

- **Since 2020**

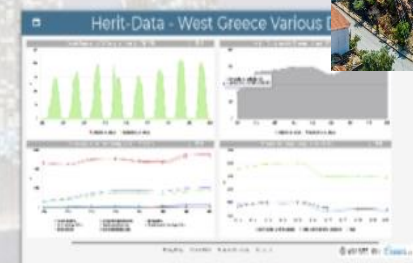
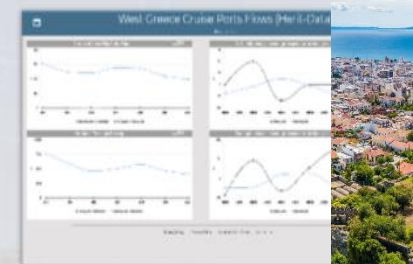
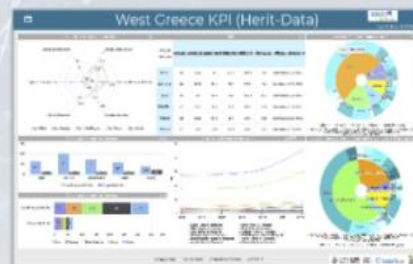
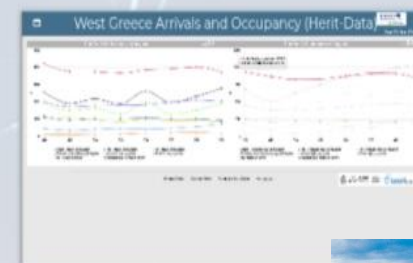
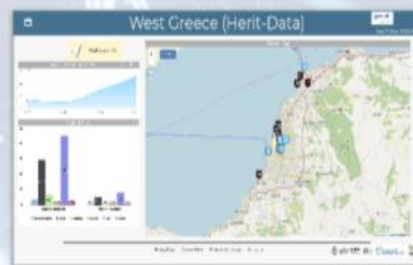


<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MzE1MA==>



# West Greece

- **Tourism Domain**
  - KPIs: ODM, Flows, ...
  - Social Media
  - People Flows
- **Dashboards**
  - Monitoring KPI
  - People flows
  - Twitter Vigilance
- **Historical and updated data**
- **Services Exploited on:**
  - Dashboard
- **Since 2020**

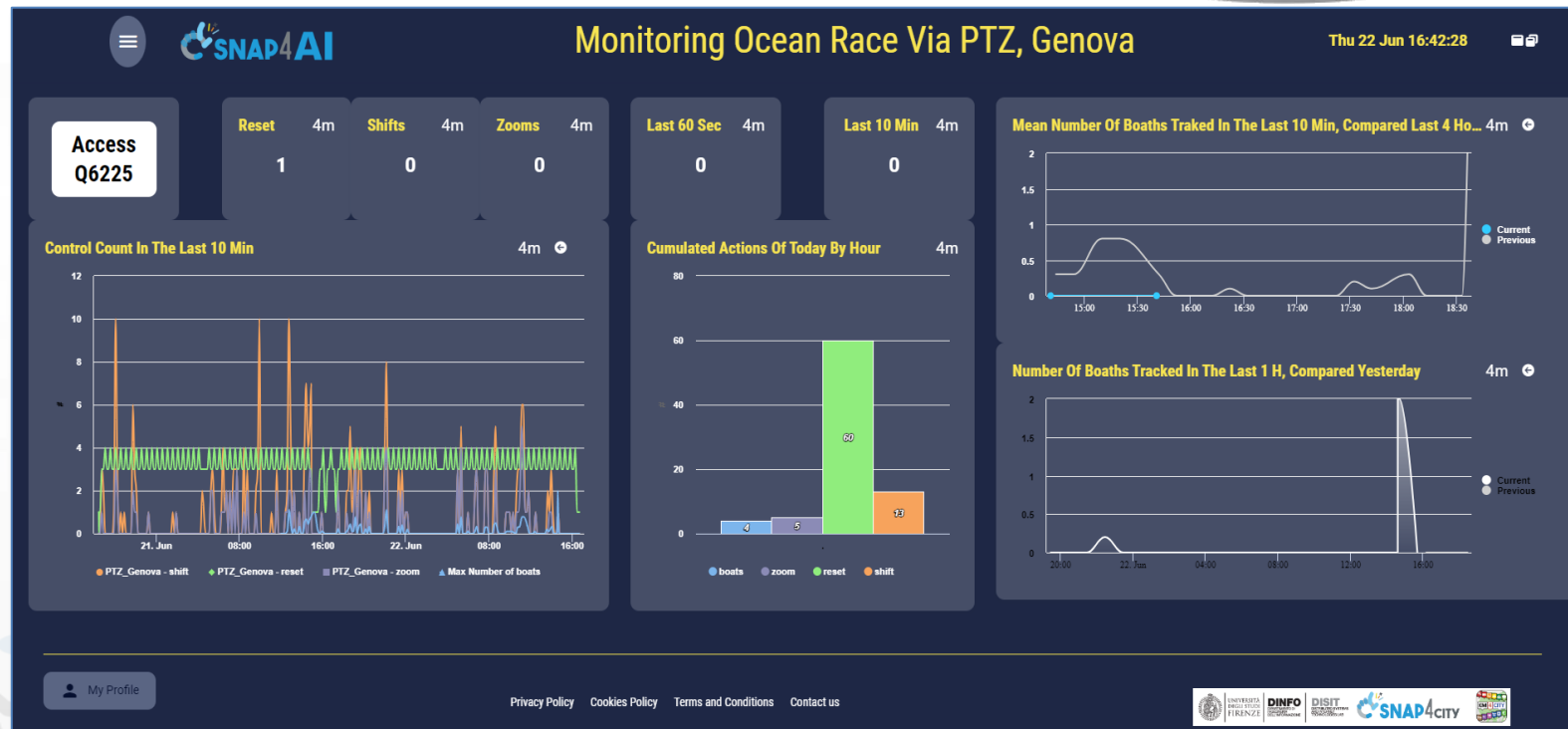




# Monitoring Boats AXIS Q6225



- Genova: Ocean Race, 2023



11 SUSTAINABLE CITIES AND COMMUNITIES







# Monitoring Ocean Race Via PTZ, Genova

Mon 26 Jun 23:57:01



Access  
Q6225

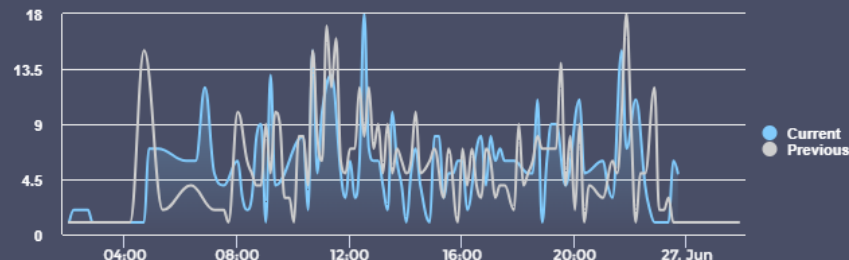
Reset 9m Shifts 9m Zooms 9m

2 0 0

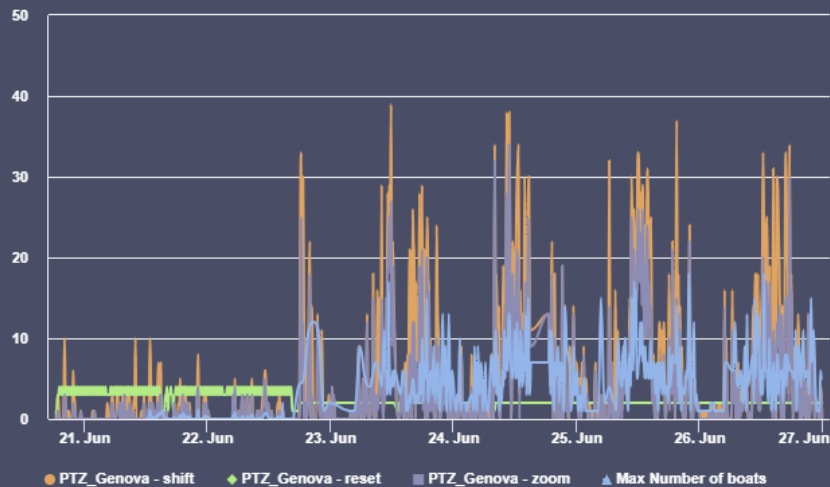
Last 60 Sec 9m Last 10 Min 9m

2 5

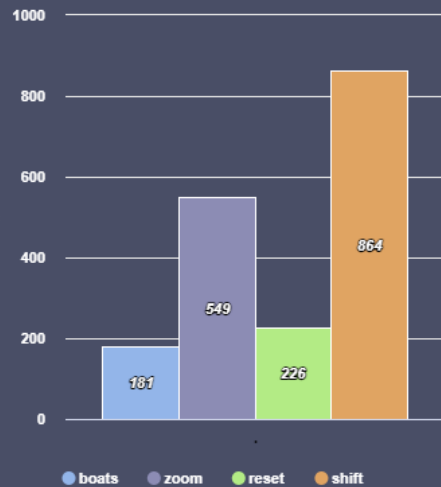
Mean Number Of Boats Traked In The Last 10 Min, Compared Last 24 H... 9m



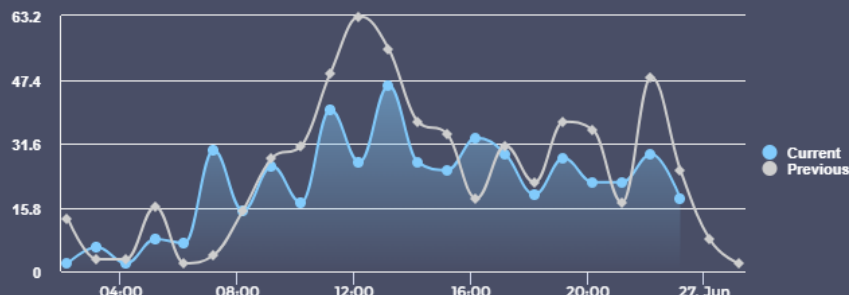
Control Count In The Last 10 Min 4m



Cumulated Actions Of Today By Hour 4m



Number Of Boats Tracked In The Last 1 H, Compared Last 24 Hours 9m





# Predicting Service's Load via NLP on Social Media





# Dubrovnik

- **Tourism Domain**

- Counting People
- TV Cameras and WiFi
- Social Media

- **Dashboards**

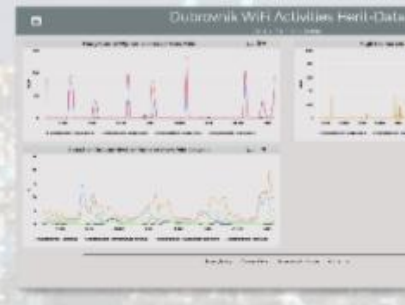
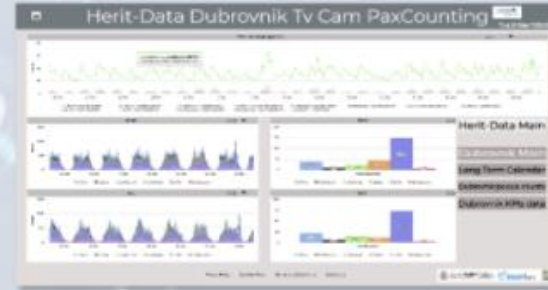
- Monitoring and real time control
- People flow
- Twitter Vigilance

- **Historical and Real Time data**

- **Services Exploited on:**

- Dashboard

- **Since 2020**





# Pont du Gard

- **Tourism Domain**

- KPIs
- Social Media
- People Flows
- Bike Flows

- **Dashboards**

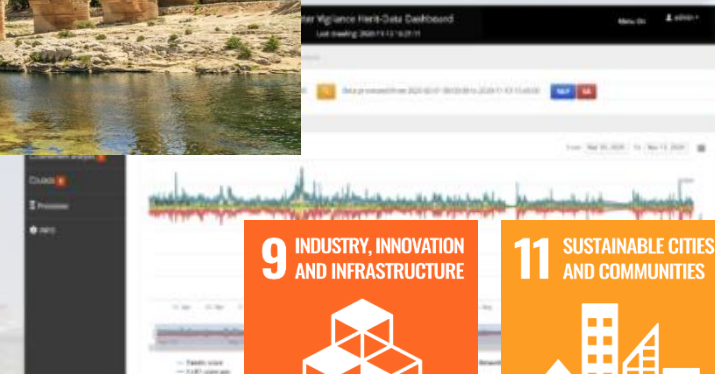
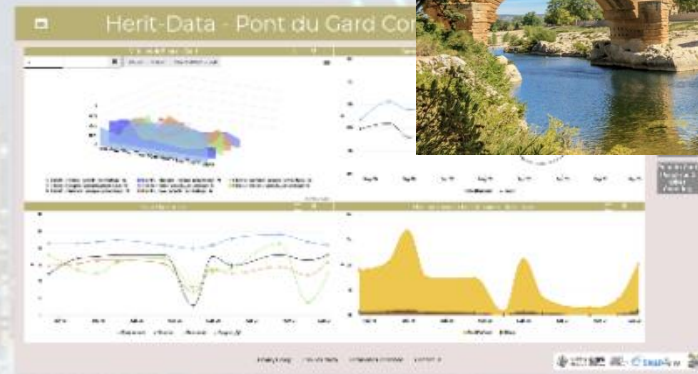
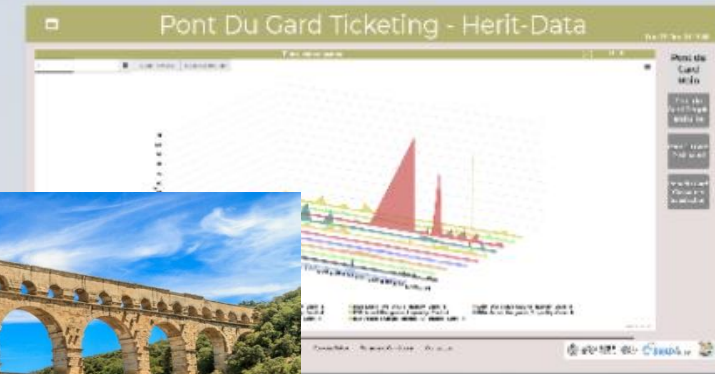
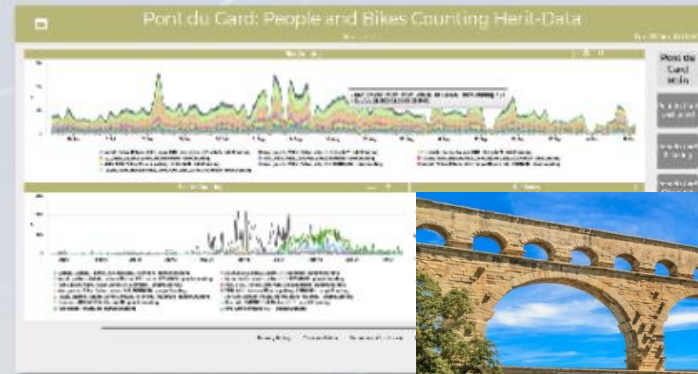
- Monitoring KPI
- People and bikes flows
- Twitter Vigilance

- **Historical and updated data**

- **Services Exploited on:**

- Dashboard

- **Since 2020**





# Correlating presences with energy, behavior, etc.







# Ispra Site, Buildings And Services

Mon 23 Oct 12:42:28



Building / Floor / Parking:

Building

All / Single Building:

All

Variable:

occupancy

Popup on Shape Click



Add To Map



Ispra - Occupancy 8m

883

Ispra - Occupancy

8m



## ISPRA Site



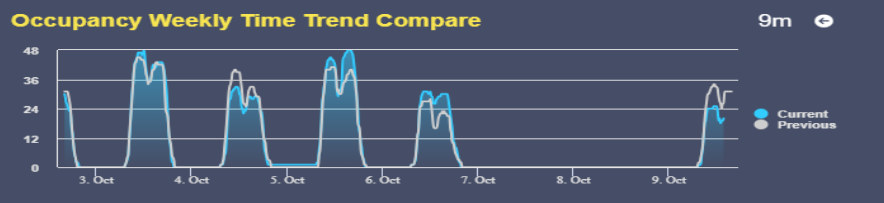
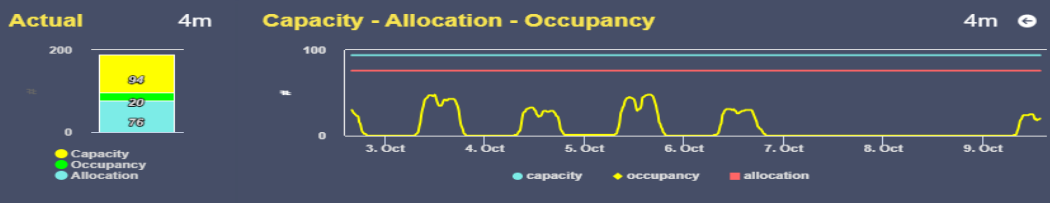
- Date Observed: 10/23/2023, 12:30:01 PM
- Capacity: 2936 #
- Allocation: 1995 #
- Occupancy: 883 #
  - DAC: -941 #
  - DOA: -1112 #
  - DOC: -2053 #
  - PAC: 67.95 %
  - POA: 44.26 %
  - POC: 30.07 %
- Energy Hot: 4473978 kWh
- Energy Cold: 916361 kWh
- Power Hot: 36 kW
- Power Cold: 0 kW
- Outdoor Temperature: 14.07 °C
- Total Number of Buildings: 76 of 304 #
- Total Number of Floors: 104 #
- Total Number of Zones: 139 #
- Total Number of Parking Areas: 4 #

See Trends

Parking Overview

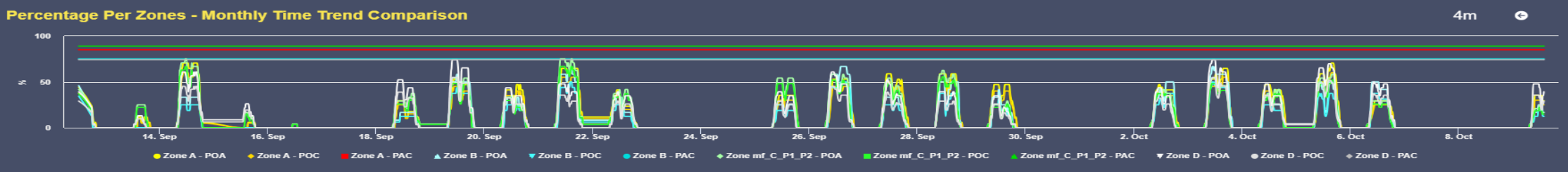
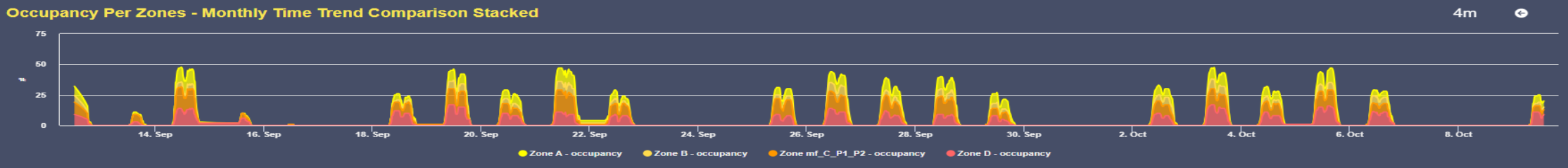
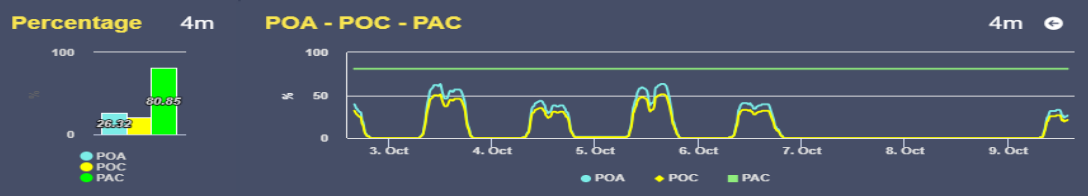
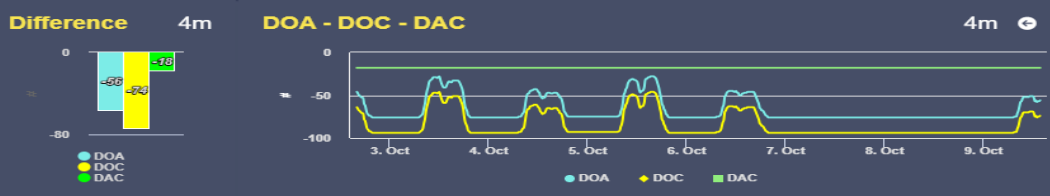
person My Profile





**Office Mq** 9m  
803.9 m<sup>2</sup>

**Temp.** 9m  
20.6 °C

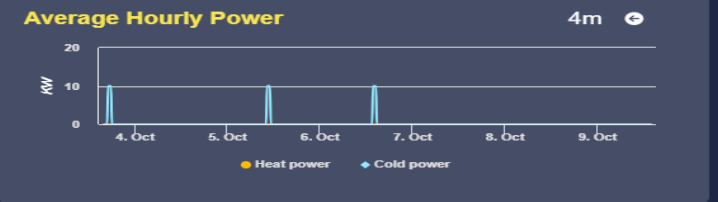
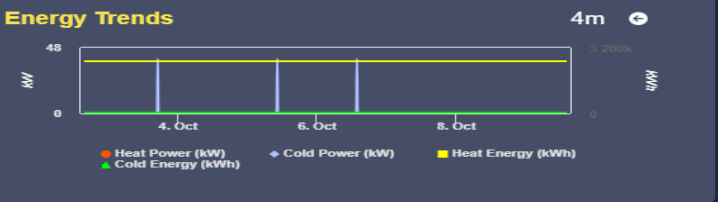


**Heat Power** 9m  
0 kW

**Heat Energy** 9m  
1931279 kWh

**Cold Power** 9m  
0 kW

**Cold Energy** 9m  
888311 kWh

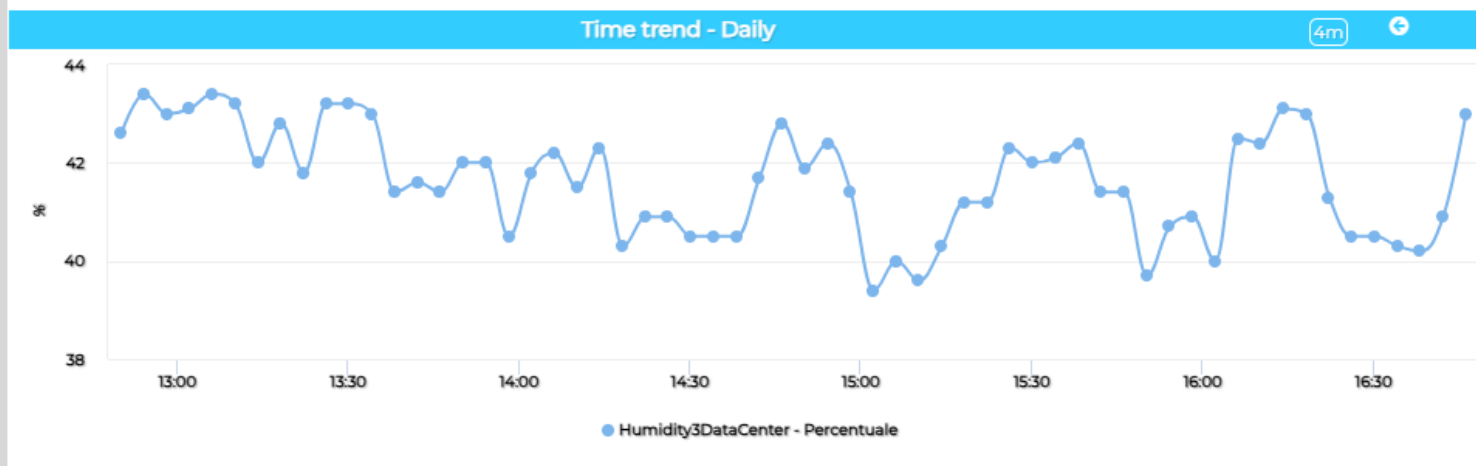
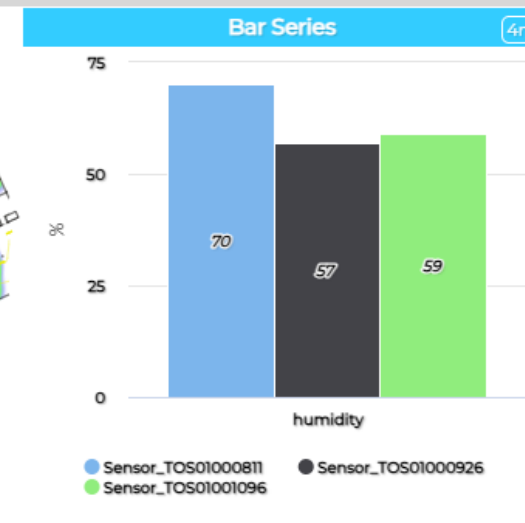
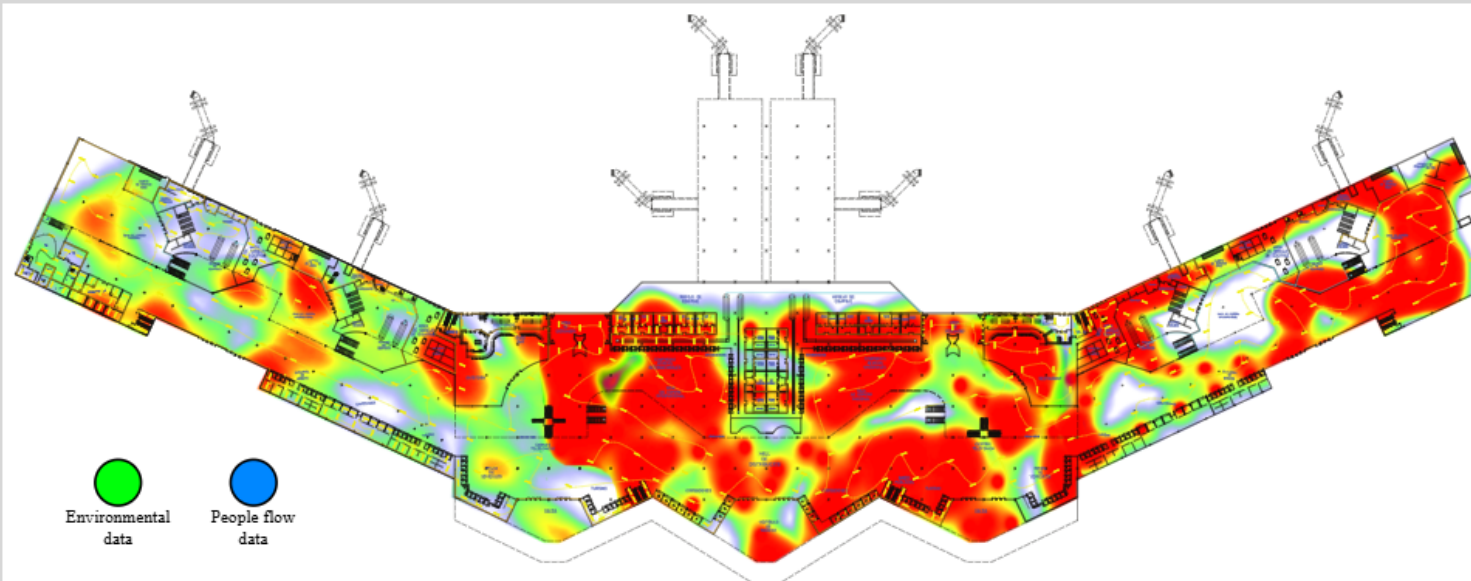


**En./Mq** 9m  
0 kWh

**En./Pax** 9m  
0 kWh



# People Flow densities

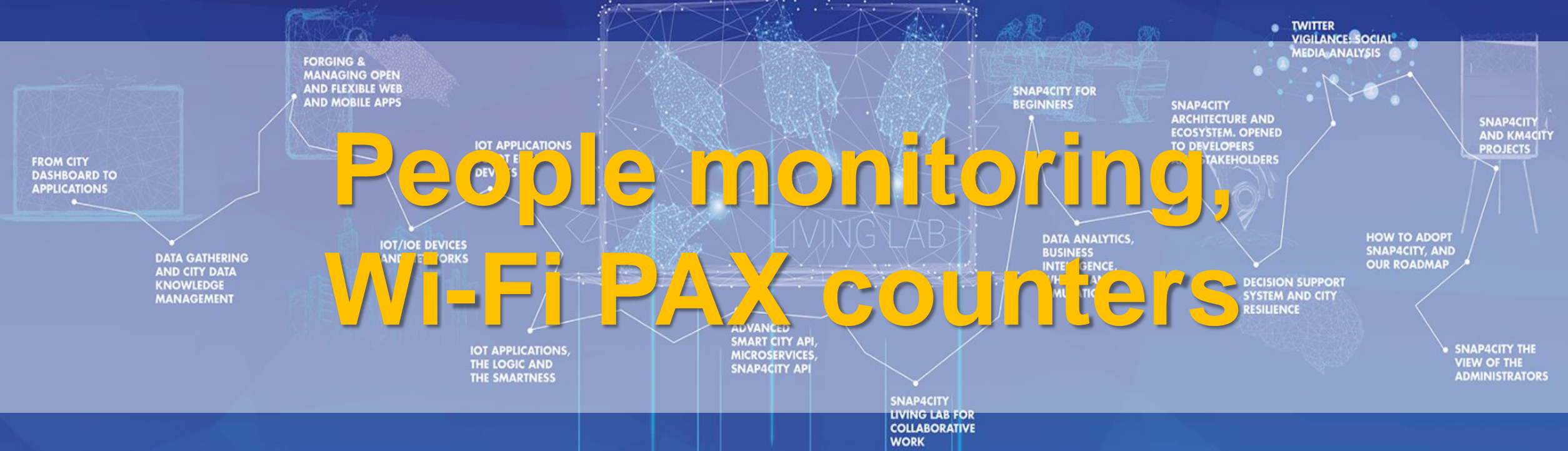


**Environment zone  
A**

**Environment  
Zone B**



# People monitoring, Wi-Fi PAX counters





# Tourism management, over-tourism

- **Operation:**

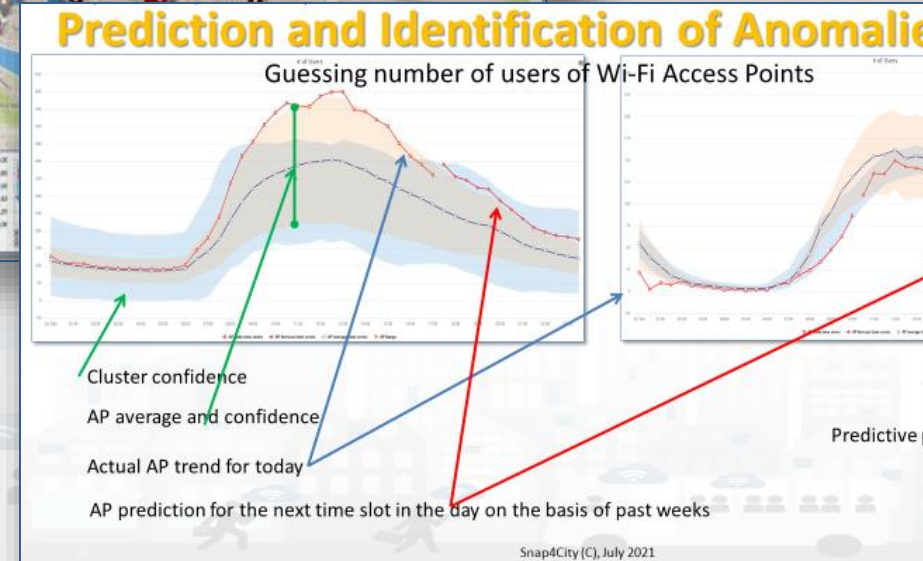
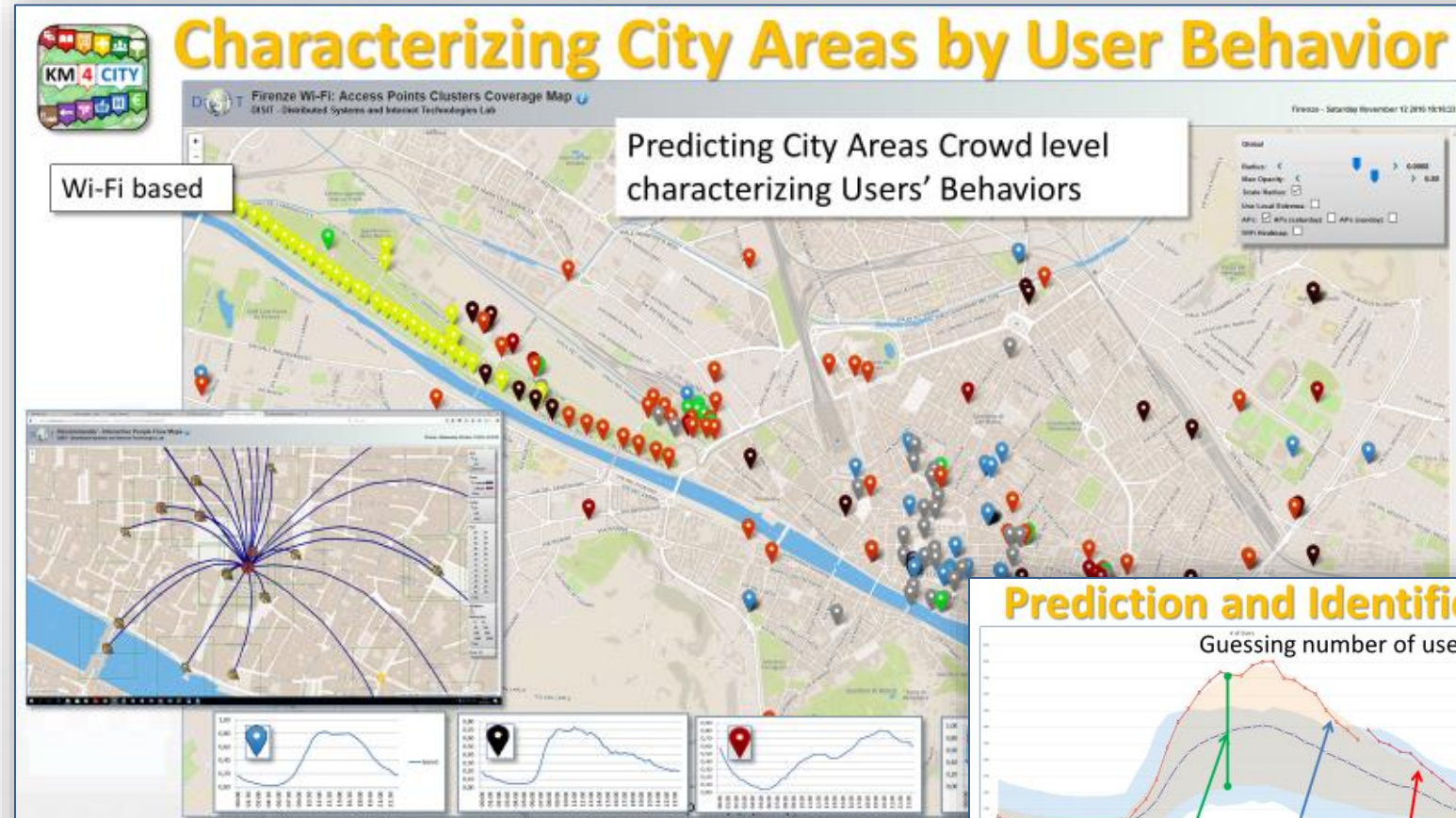
- Monitoring: counting, tracking, flows, ODM, etc.
  - Differentiating: tourists, commuters, resident, students, etc.
  - Differentiating on Restricted zone: permissions
- Early warning detection, predictions, etc.
- Collecting participation, complains, etc.
- Producing suggestions towards second offers, diversification
- Informing of crowded conditions

- **Management**

- Promoting best moments for visiting, pushing event organizers
- Simulation and plan, improve services: transportation, sharing
- Assessing and predicting reputation



- **Prediction of people flows** on the basis of Wi-Fi data
- **Anomaly detection**
- **Resolute H2020**
- **Classification of city areas**





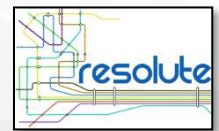
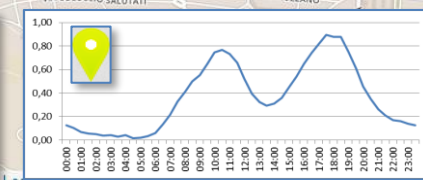
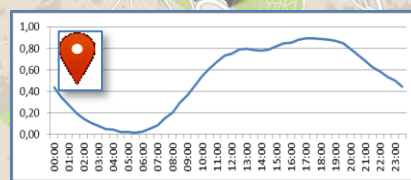
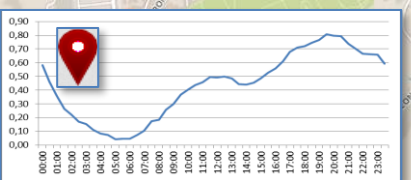
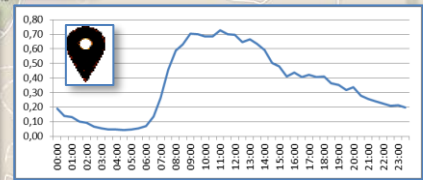
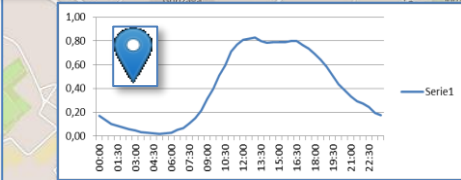
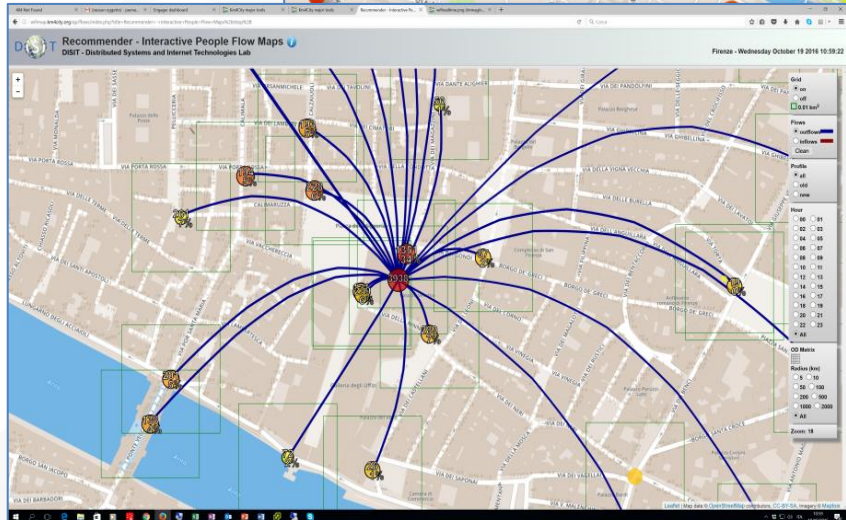
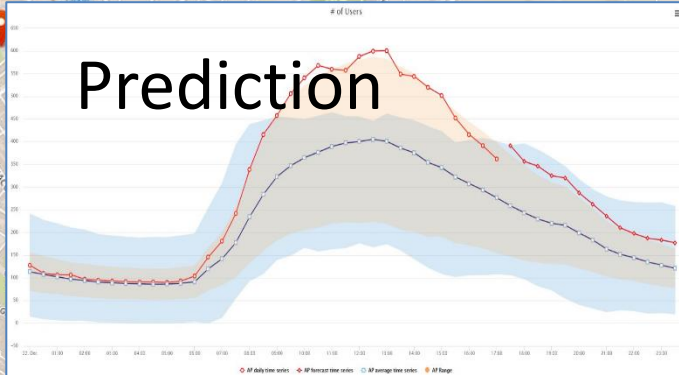
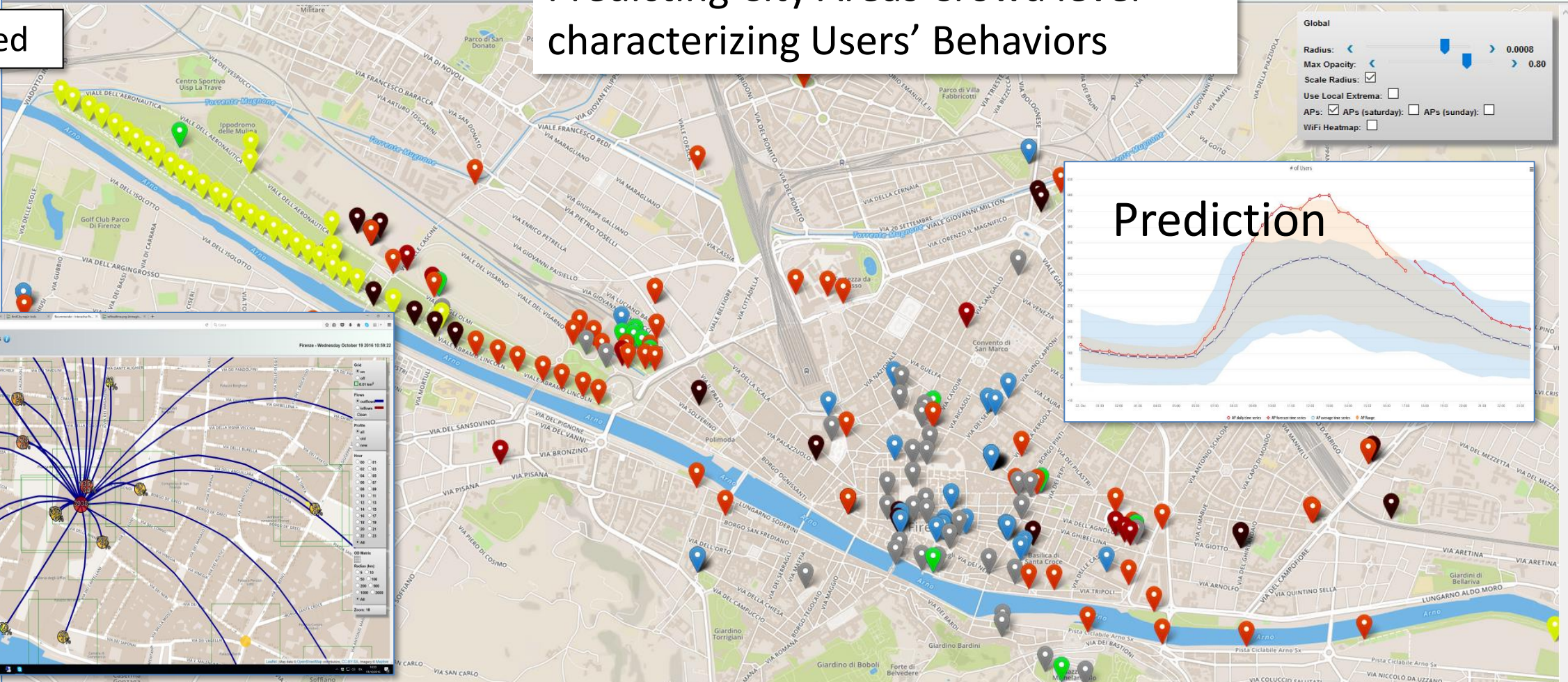
# Characterizing City Areas

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

Wi-Fi based

## Predicting City Areas Crowd level characterizing Users' Behaviors

Firenze - Saturday November 12 2016 19:16:33





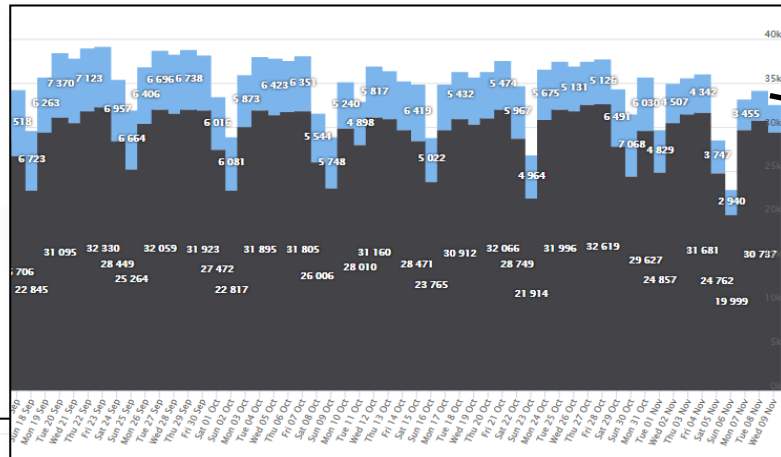
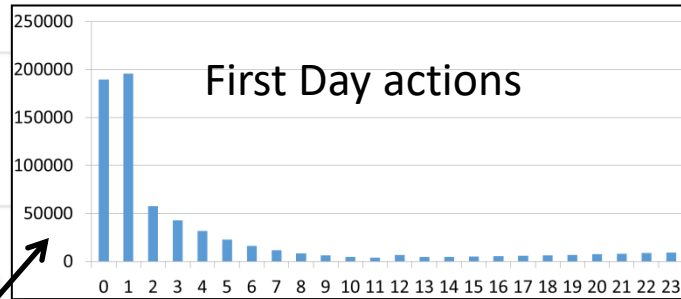
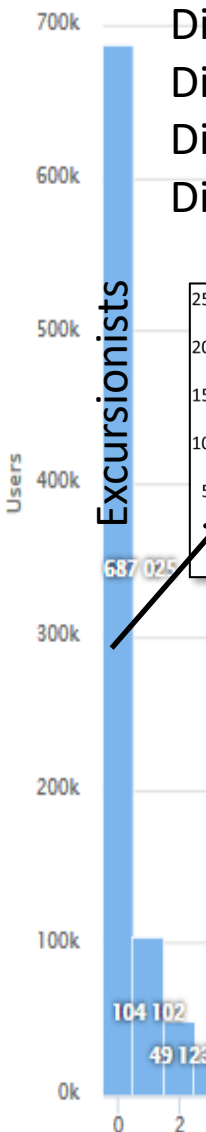




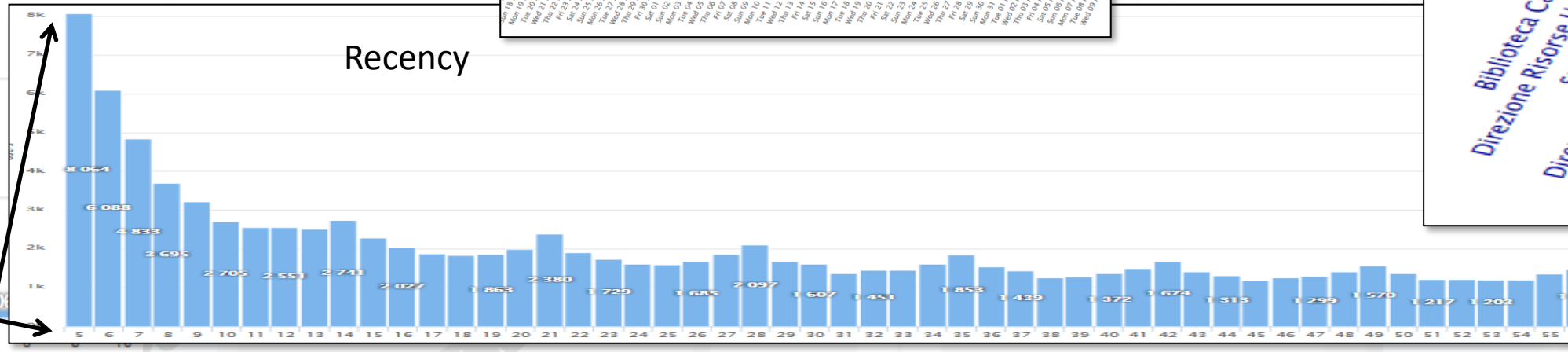
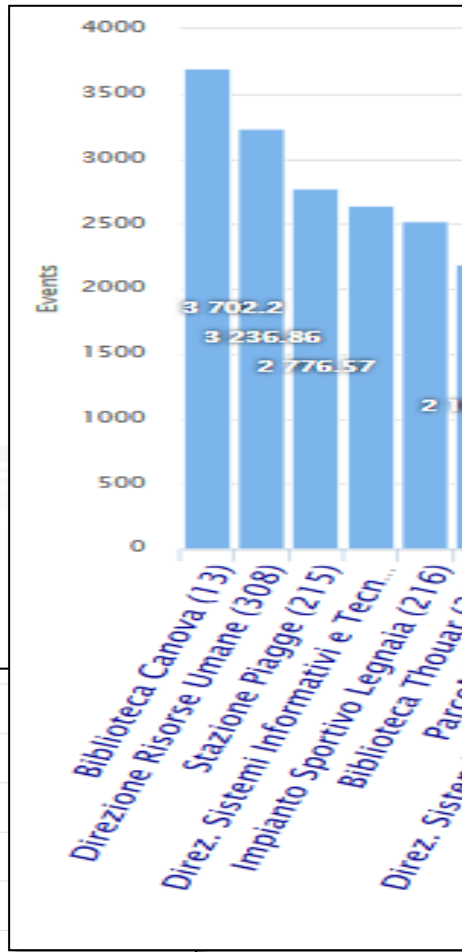
# User Behaviour Analysis

Where

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



New City Users  
VS  
Returning





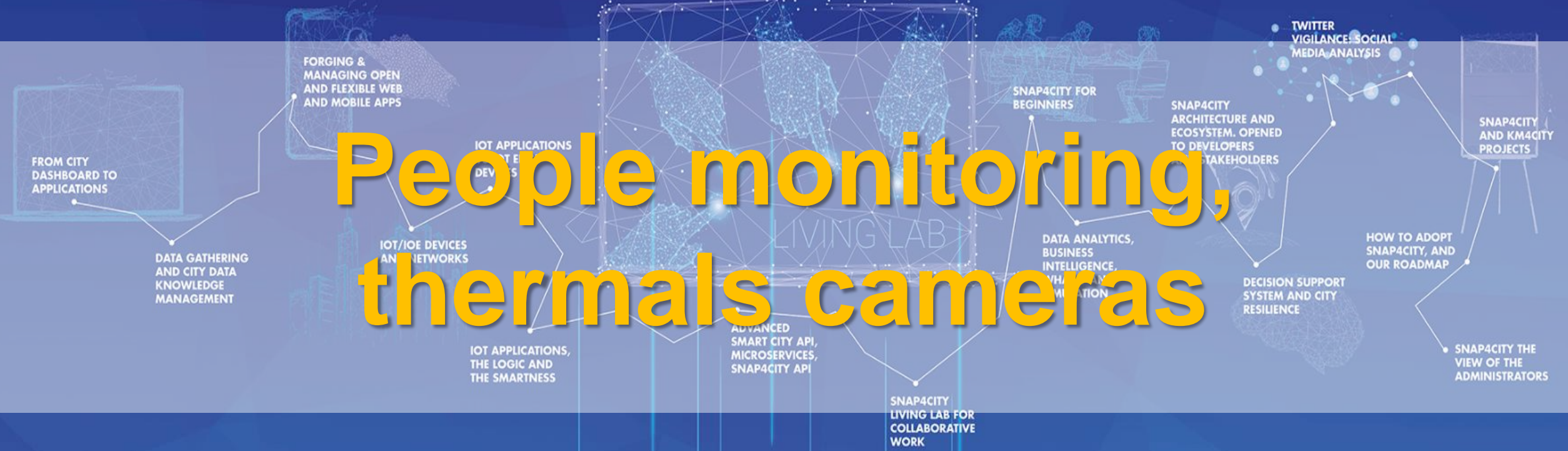


Dimensioni sniffers Libelium: 27cm x 17cm x 10cm  
Alimentatore: 17cm x 18cm x 13cm





# People monitoring, thermals cameras





# People counting and tracking

**# People Monitoring Dashboard** Wed 30 Oct 17:11:10

**People Count** 2m

**13**  
#

**People Count 5 Minutes Mean Value** 2m

My Profile

The dashboard displays two line charts and a video feed. The top chart, 'People Count', shows a steady flow of people over time with a current count of 13. The bottom chart, 'People Count 5 Minutes Mean Value', shows a similar trend with a 5-minute average. The video feed on the right shows a crowd of people with bounding boxes around them, indicating tracking and counting capabilities.



# People Detection Plugin on AXIS Camera

- **Machine Learning**
- **Detection, classification, count:**
  - people, bikes/scooters, and strollers, ..
  - Age, ...
  - critical conditions
  - Trajectories, origin destination matrix
  - Statistics over time, counting people in the area
- **Counting Accuracy: 92-99%**
  - mAP\_0.5 (0-75): 0.92-0.99
- **Supported and tested models:**
  - Q1951 (tele), Q1952 (wide angle)
- **Output** on MQTT, NGSI
- Large range of application no tuning



Video Stream



Box Output

```
1/1
Time: 18.467603
Results: [[359.103638,246.654480,383.342926,320.320862,0.908089,person],
[206.960709,361.242645,245.294067,455.995239,0.904191,person],
[289.708099,268.565735,317.013062,355.144409,0.892965,person],
[504.246674,346.042816,529.062439,434.507538,0.891071,person],
[445.203094,370.814117,476.298676,469.302185,0.886001,person],
[121.531105,404.572266,158.478043,532.019104,0.884107,person],
```



# A view and data from the Thermal Camera



## Detection BOX Snap4Thermal PV Firenze Tue 15 Mar 13:30:41



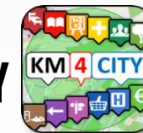
**11** SUSTAINABLE CITIES AND COMMUNITIES











<https://www.snap4city.org/dashboardSmartCity/view/Gea.php?iddashboard=MzM3Ng==>



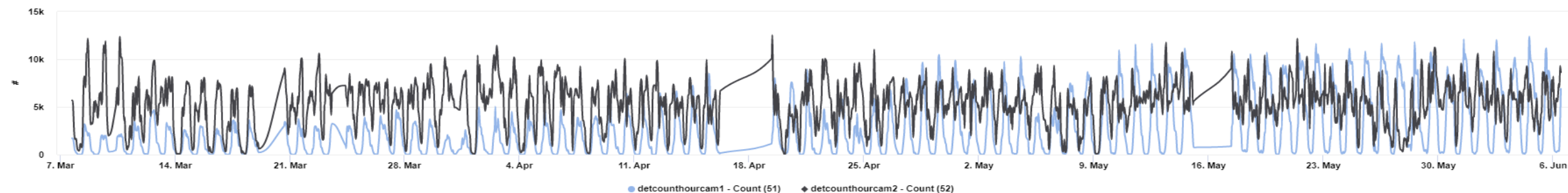
## Detection BOX Snap4Thermal PV Firenze

Thu 30 Mar 23:55:16



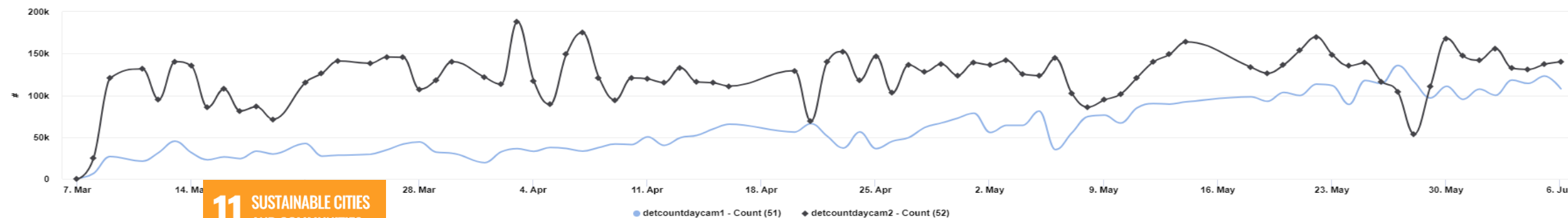
### Time Trend Comparison

4m



### Time Trend Comparison

4m



**11 SUSTAINABLE CITIES  
AND COMMUNITIES**

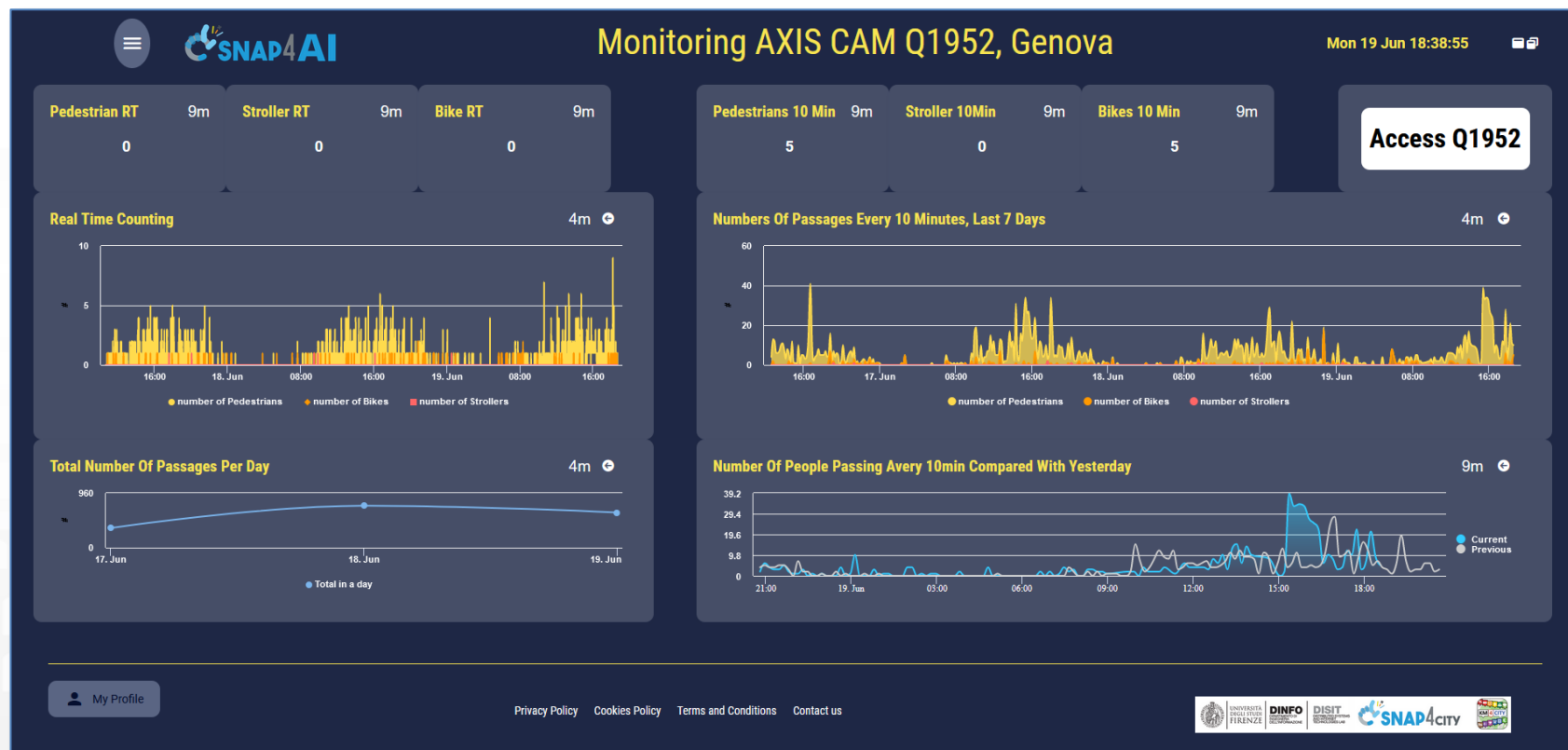






# Monitoring Passages AXIS Q1952

- Genova: Ocean Race, 2023



11 SUSTAINABLE CITIES  
AND COMMUNITIES





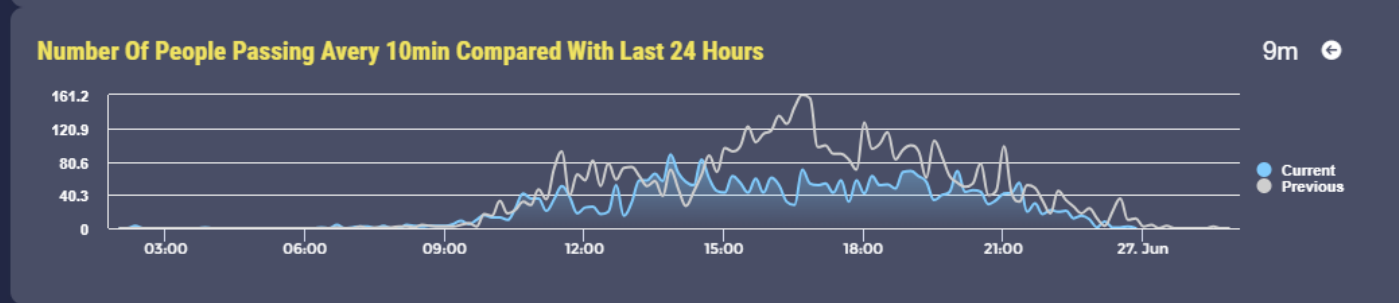
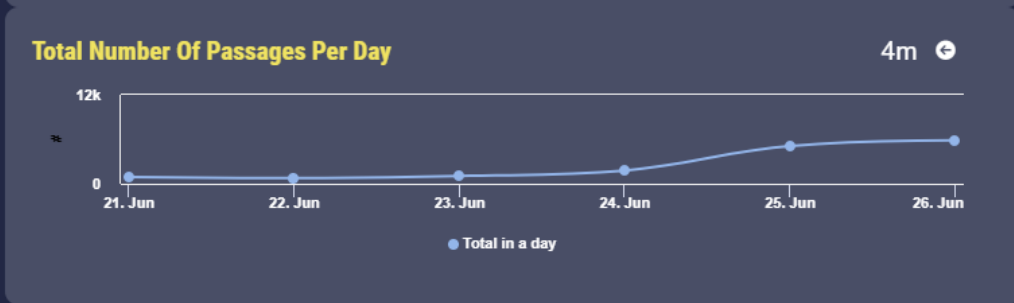
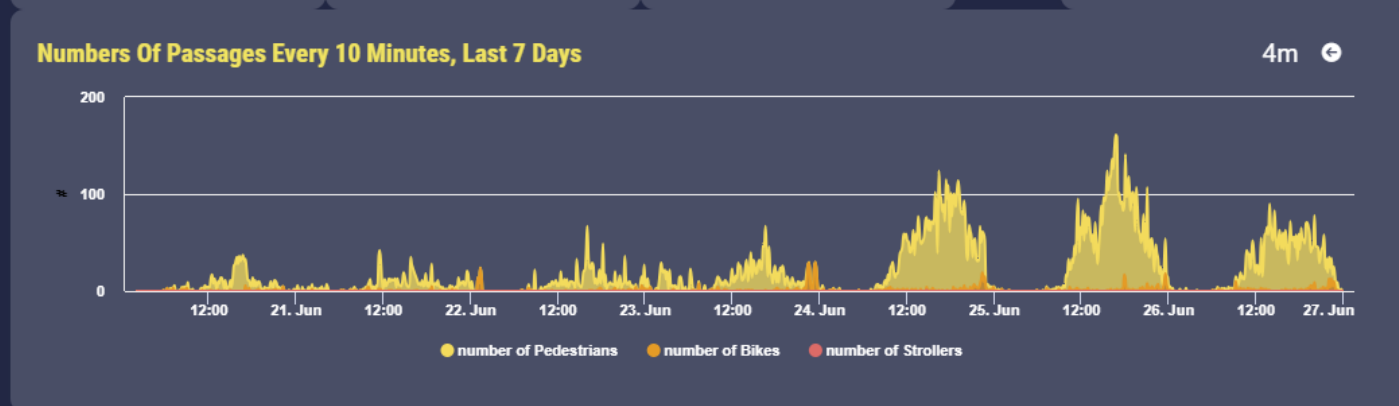
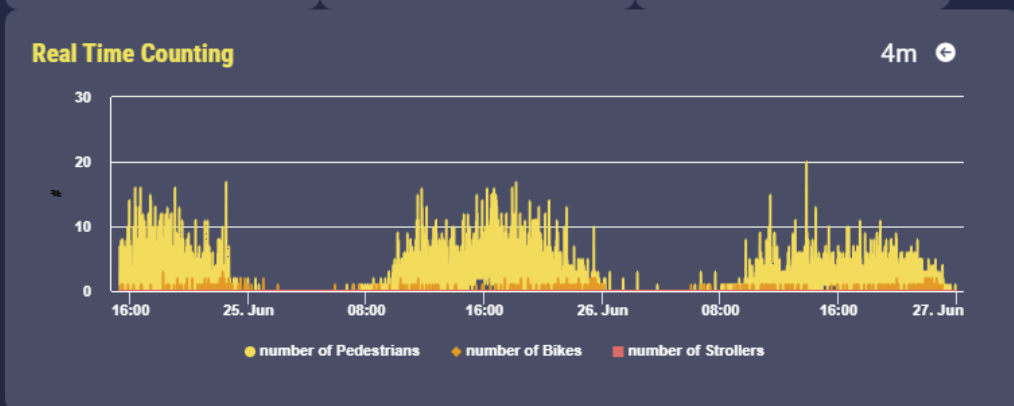
**Pedestrian RT** 9m **Stroller RT** 9m **Bike RT** 9m

0 0 0

**Pedestrians 10 Min** 9m **Stroller 10Min** 9m **Bikes 10 Min** 9m

0 0 0

**Access Q1952**



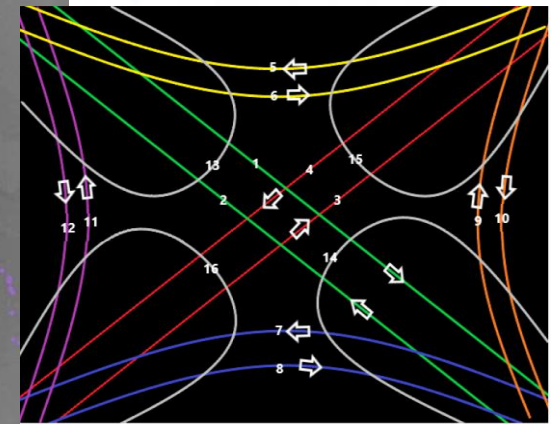
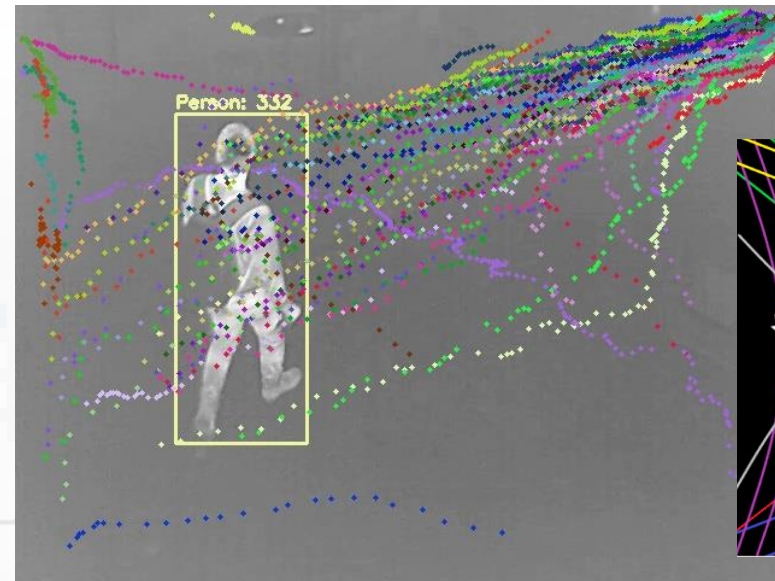


# Barc 2022





# People Counting and Tracking



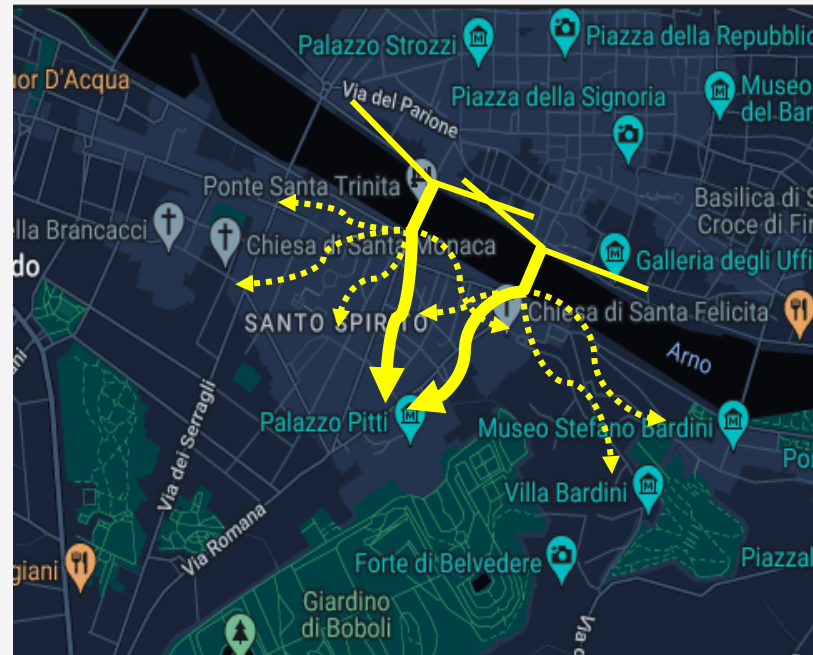
**11** SUSTAINABLE CITIES  
AND COMMUNITIES

**3X**





# Florence (Italy) – Scenario: City Centre



## Target:

Anticipate and mitigate negative or unexpected unknown events, predict flows and virtuously orient them

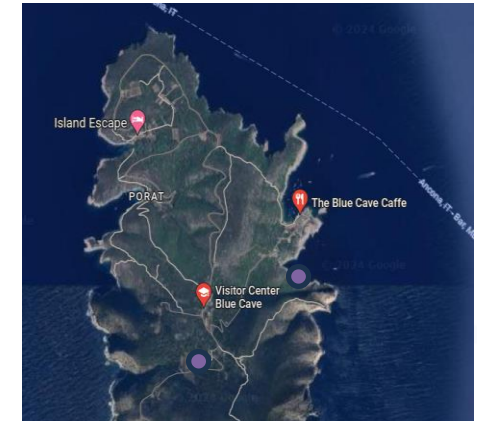
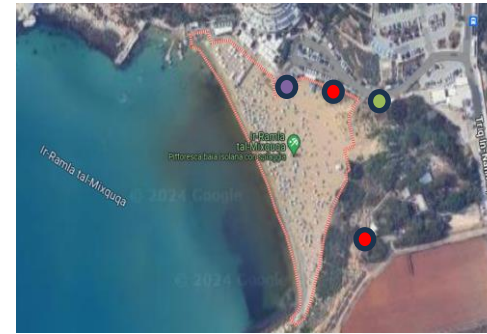
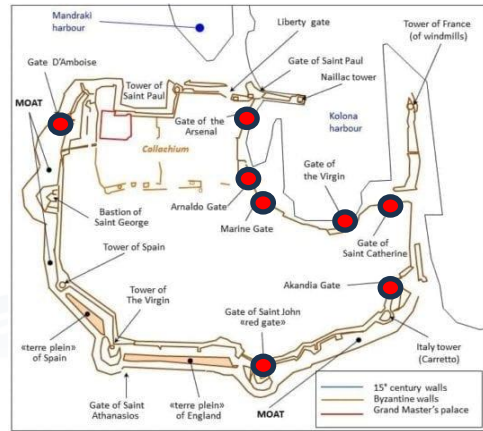
## Equipment:

- 2 Thermal cameras
- 3 Pax counters: sniffer
- counting devices





# TOURISMO INTERREG ACTION OF THE EC

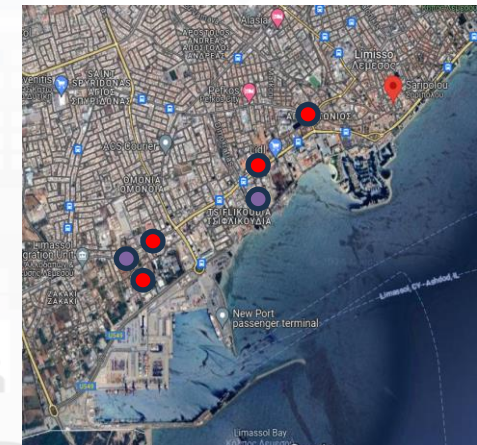


**Interreg**  
Euro-MED



Co-funded by  
the European Union

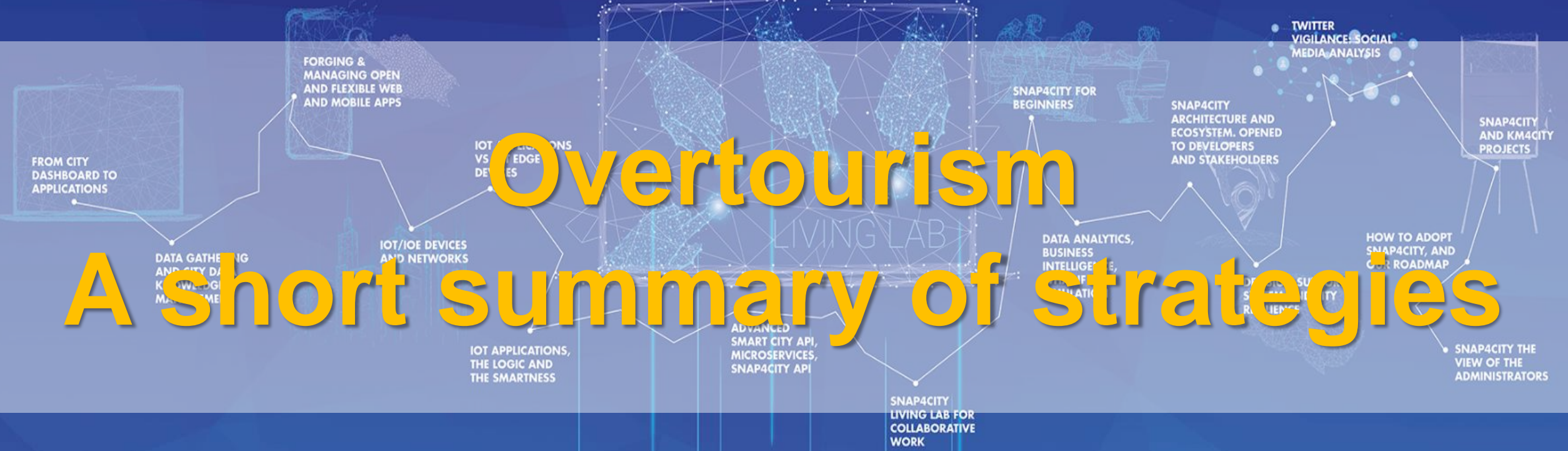
**TOURISMO**





# Overtourism

## A short summary of strategies





## Examples of Strategies

- Focus promotion, reduce price and increase the events in less relevant attractions
- Increase/decrease the time spendable at the attractions
- Promote guided tours with specific attractions and areas
- Prepare specific dynamic prices depending on time, season, day of the week, etc. → accept reservation to jump the queue.
- Usage of Digital Signages for reporting and suggesting:
  - PROS / CONS: Queues, time to reach it, people density, etc.
  - Alternatives, etc.
- Prepare the emergency plan, etc..



# mobile apps, kiosks, video wall, info screens, QR

- Not so aggressive!







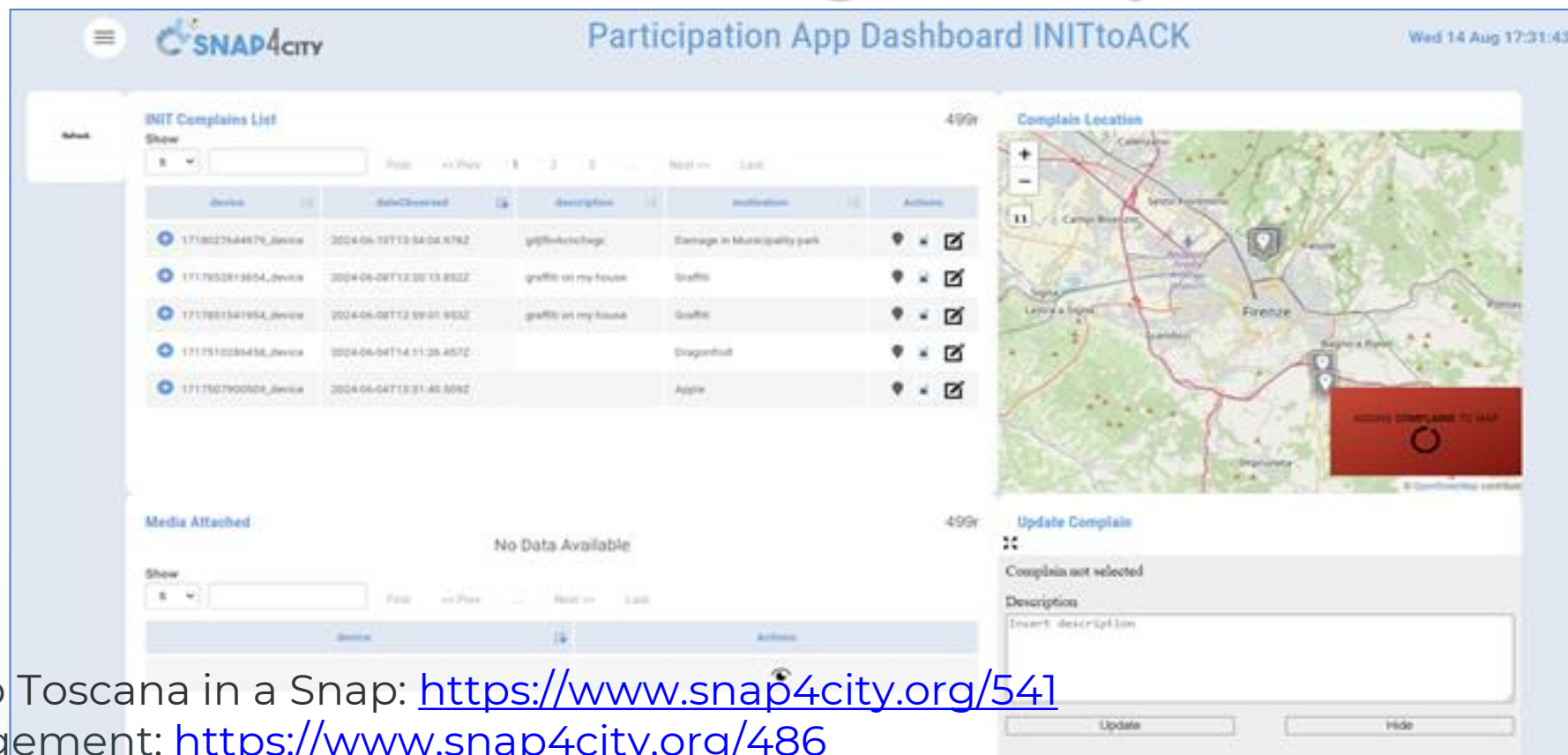
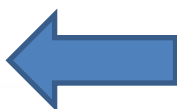
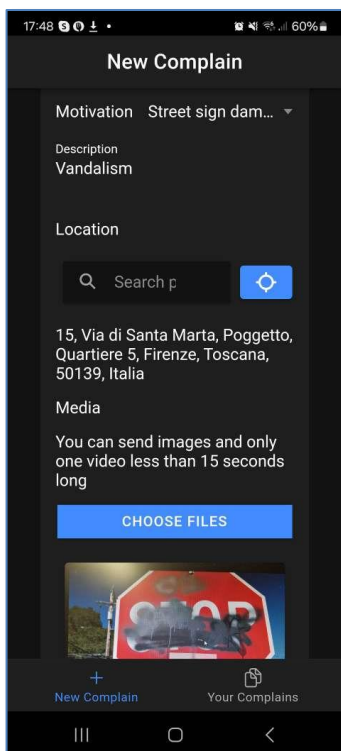


# Participation and Engagement

- **City users:** residents, students, commuters, tourists, visitors, business visitors, etc.
- **Participation**
  - Collect complaints about city services
  - Multichannel: mobile Apps, open call numbers, web pages and blogs, social media, help desk, info points, white boxes in the city, telegrams, SMS, etc.
  - Data integration, usage of LLM, AI deep learning for sentiment analysis, text understanding, etc.
- **Engagement**
  - Involving city users to perform actions: take photo, provide a suggestion a rank, etc.
- **Commonalities:** data collection, workflow management, operators, etc.



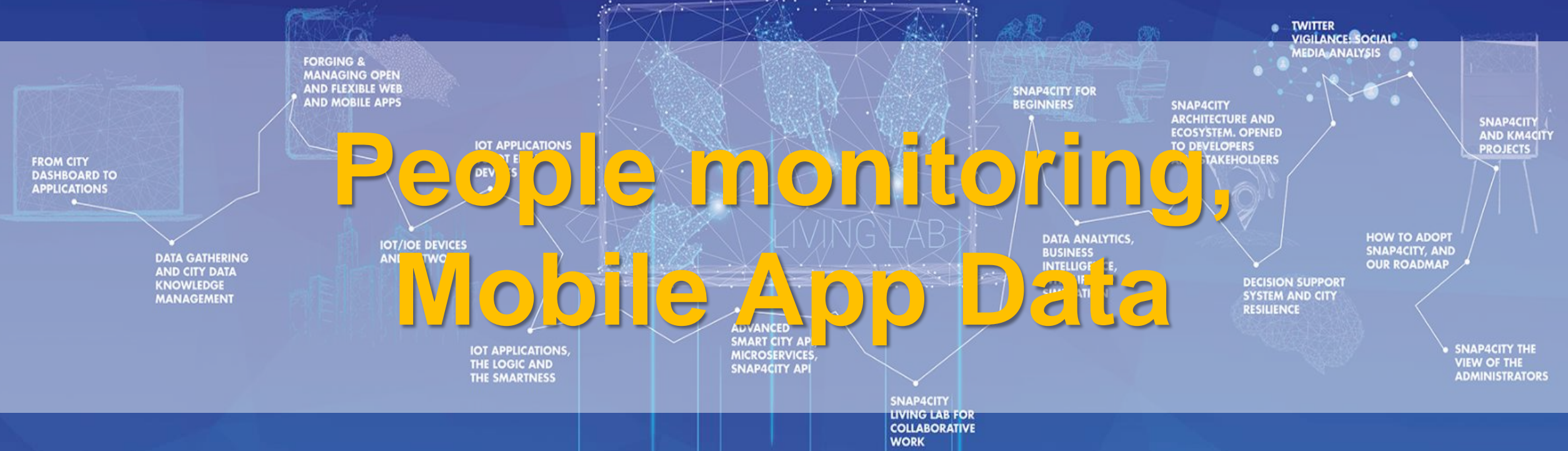
# Operator Interface to manage complains



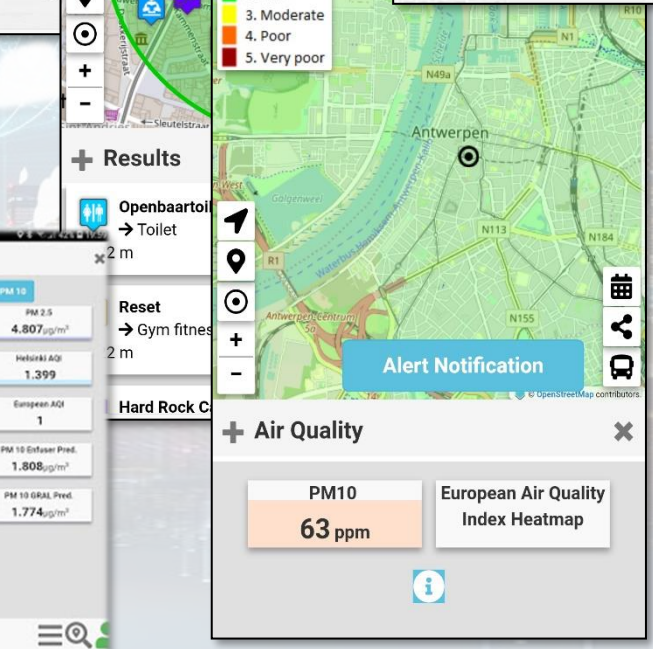
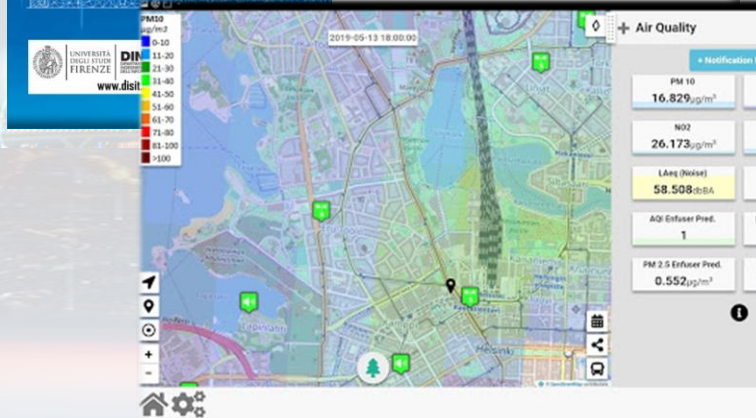
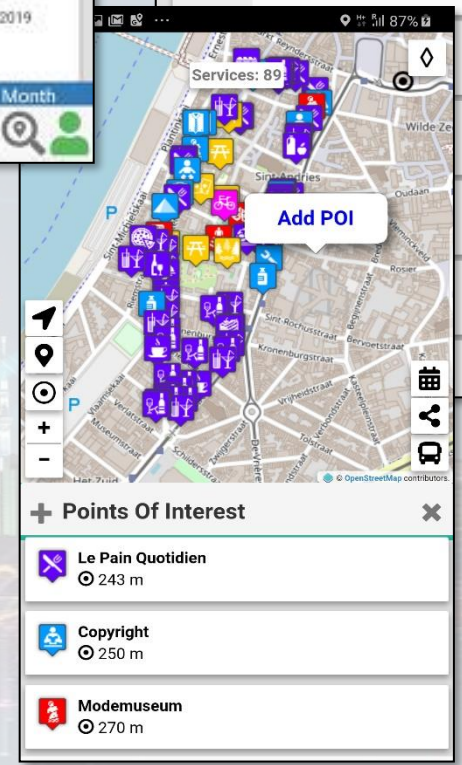
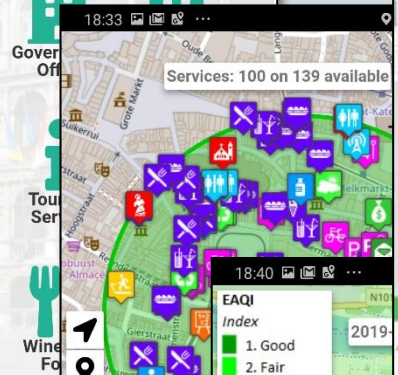
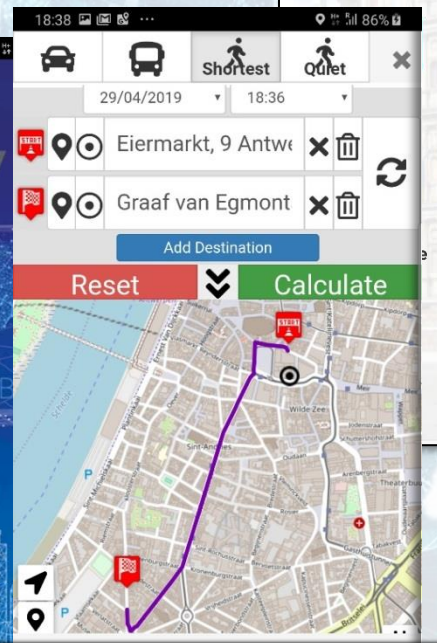
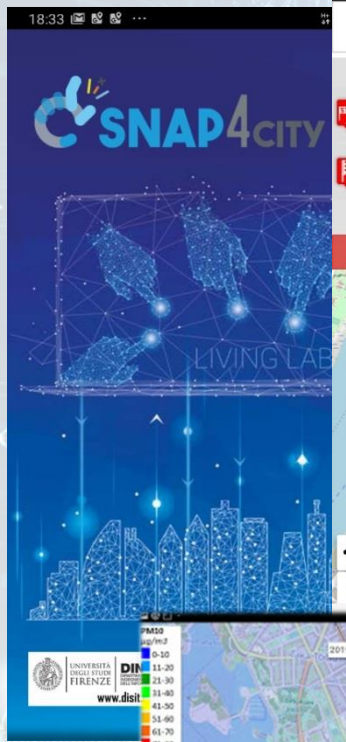
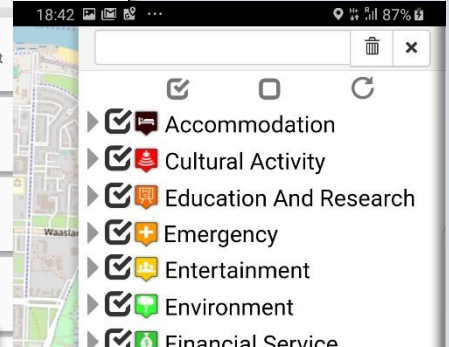
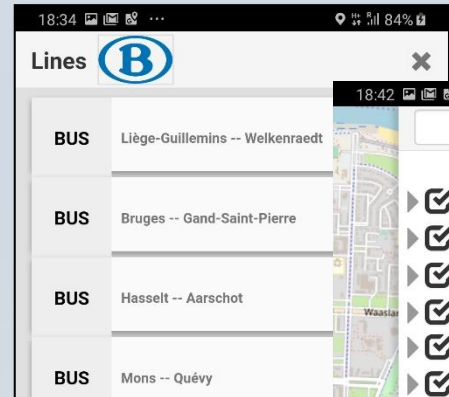
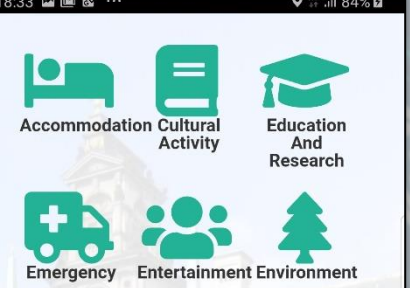
- mobile app Toscana in a Snap: <https://www.snap4city.org/541>
- User Engagement: <https://www.snap4city.org/486>
- MultiPurpose user engagement: <https://www.snap4city.org/548>
- User Engagement admin: <https://www.snap4city.org/472>
- <https://www.snap4city.org/1018>



# People monitoring, Mobile App Data











# Citizen Engagement/Participation via Mobile Apps

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

## Produced information

- Viewed ?
- Accepted ?
- Performed ?
- ...

Users



## 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
- **Cumulated Scores from Actions**
- Requested information
- Routing performed
- ....



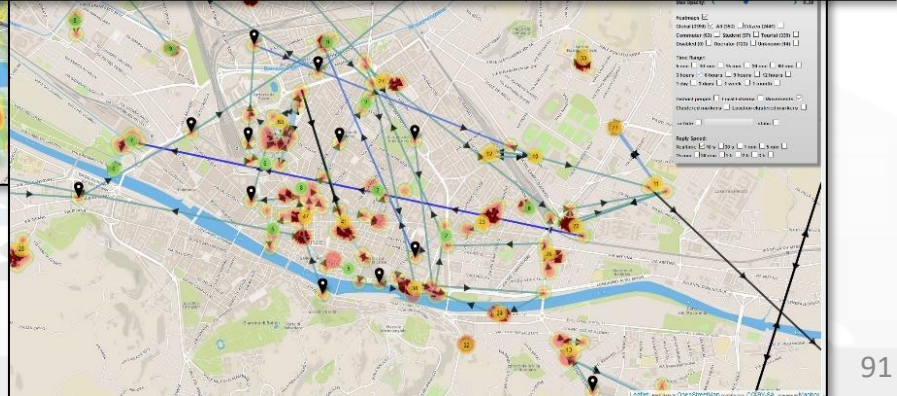
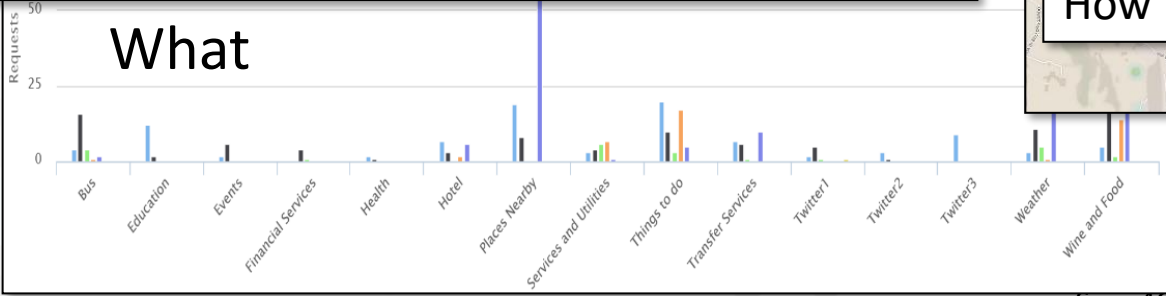
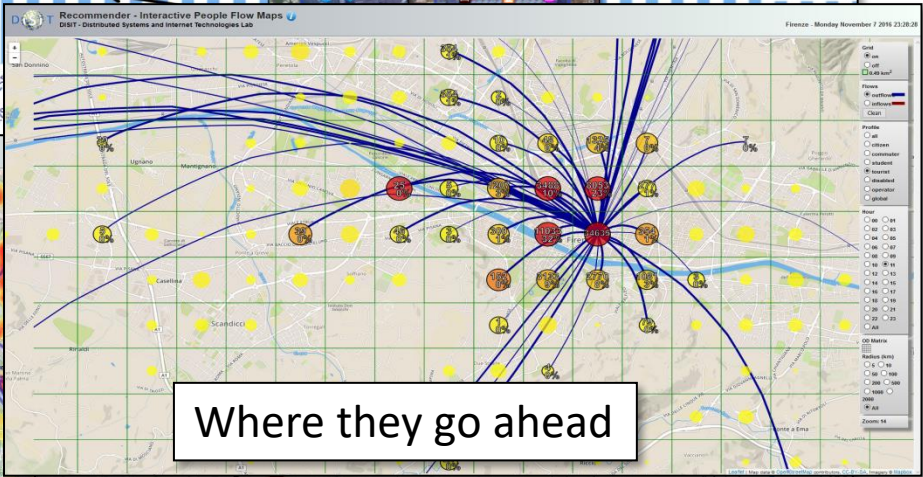
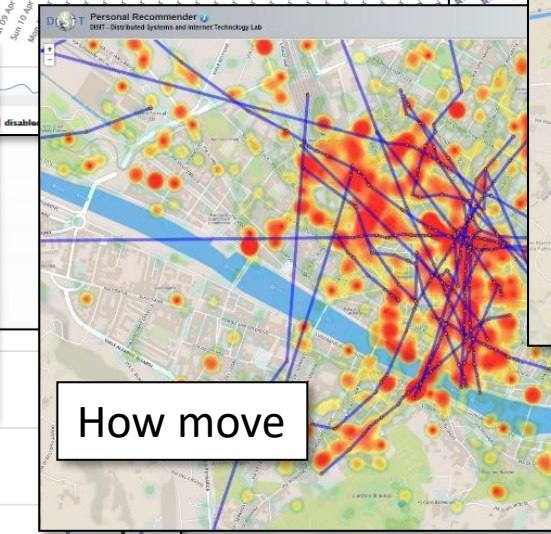
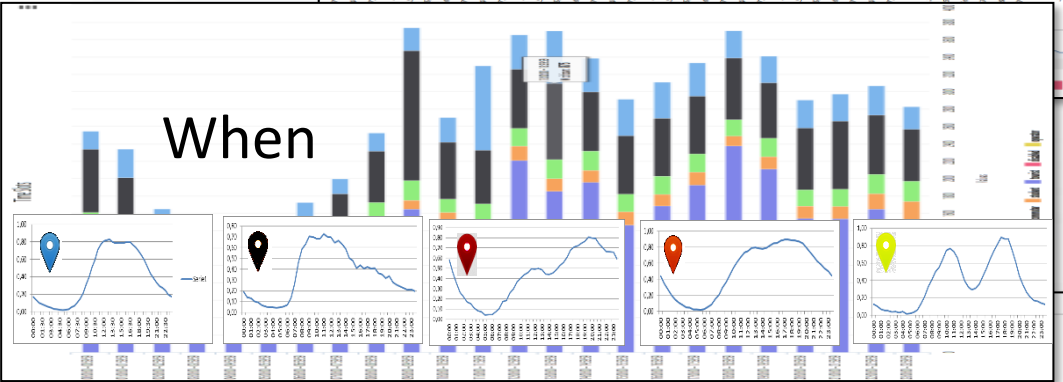
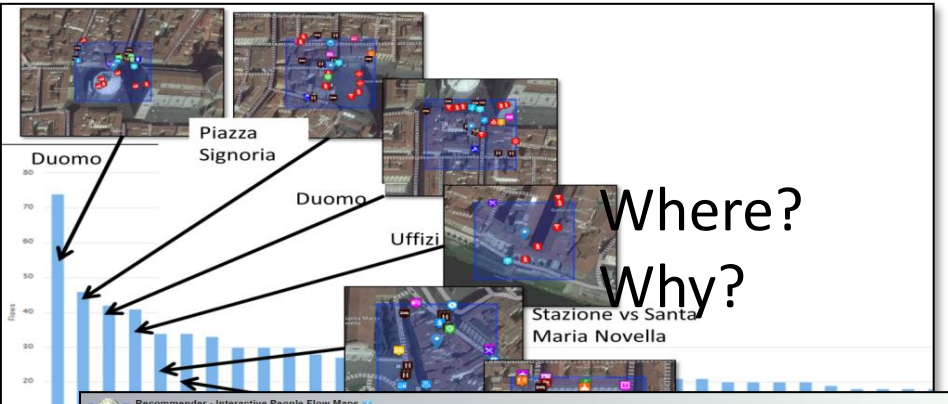
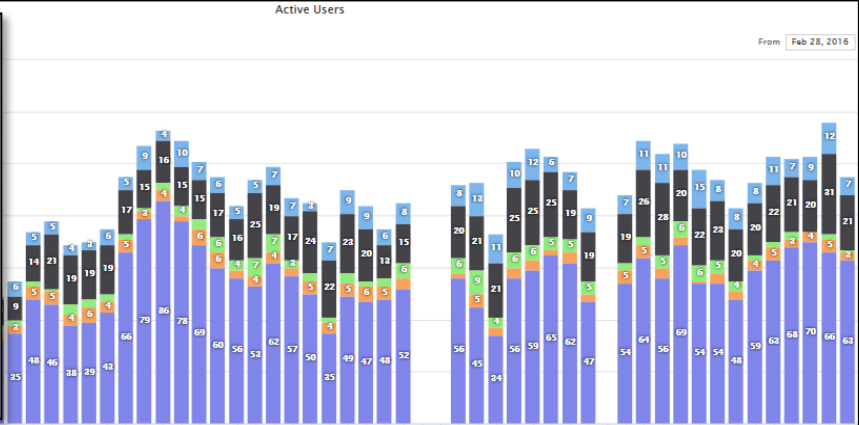
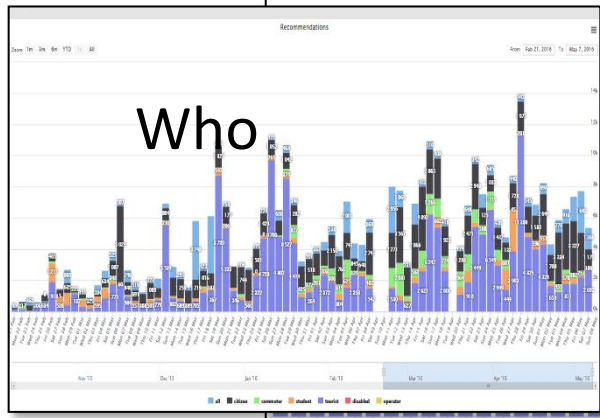
## Produced information

- Suggestions
- Engagements
- Notifications
- ...

System

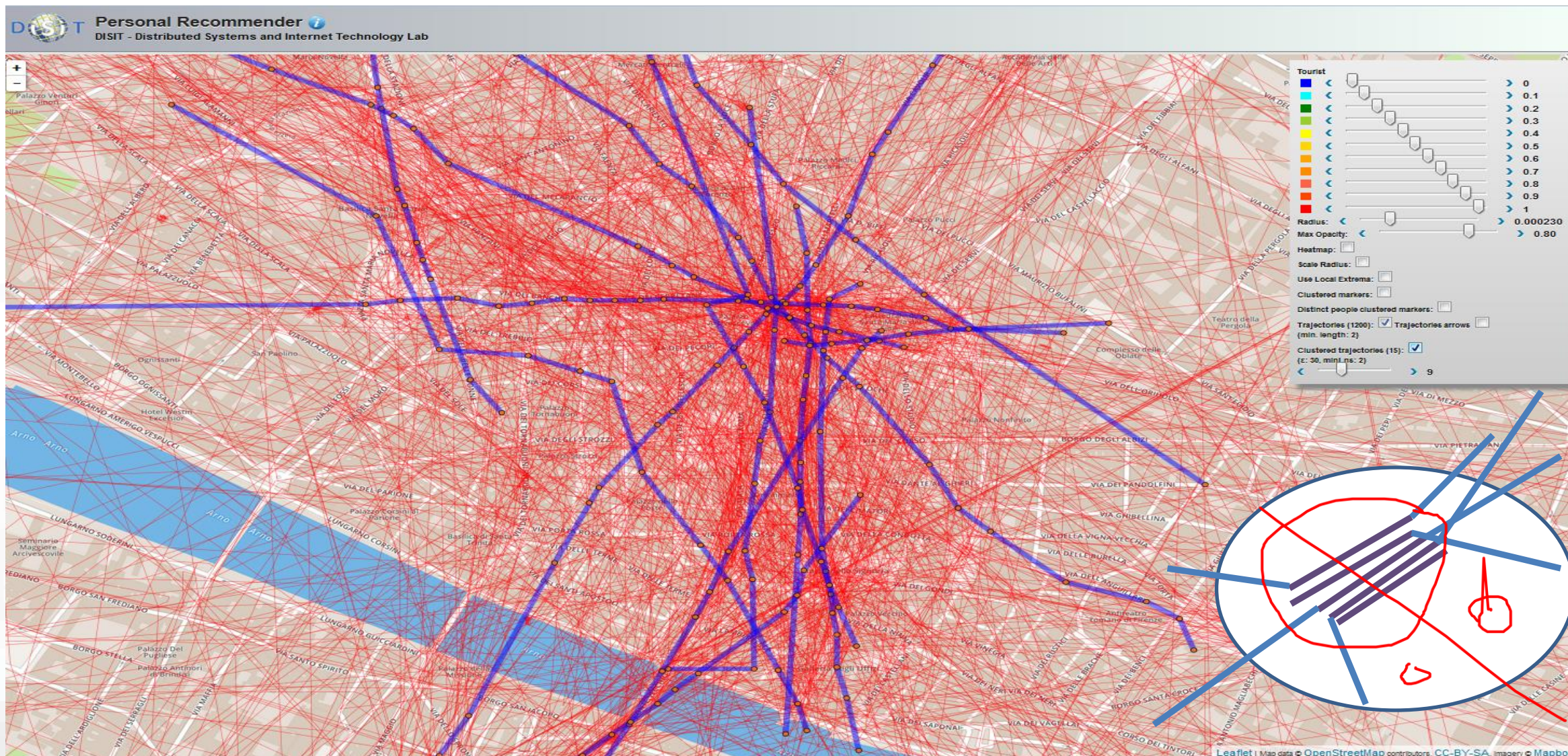


# User Behavior Analyser for Collective Profiling



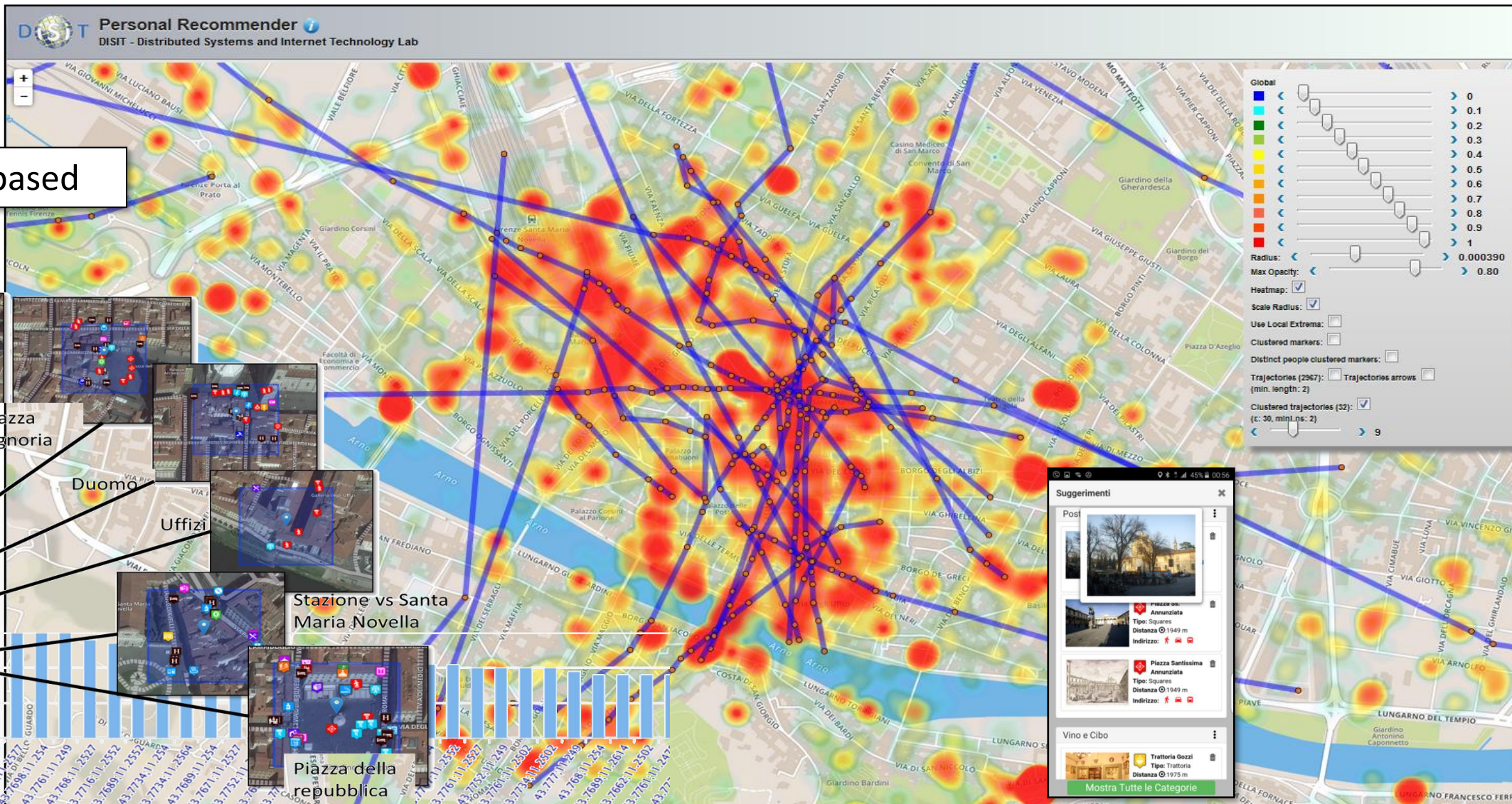


# Cluster di Trajectories

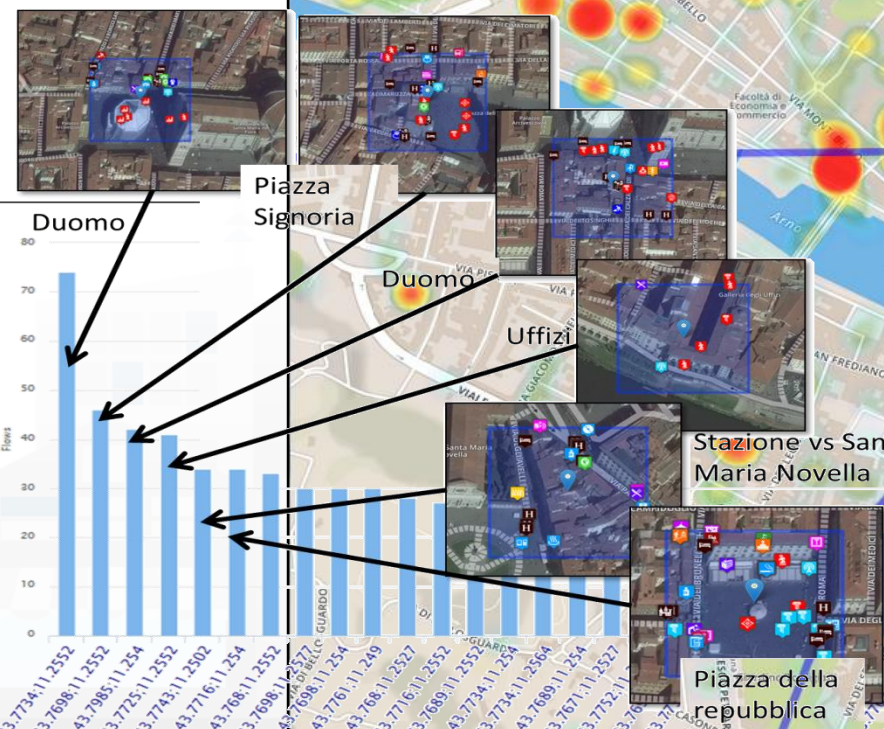




# User Behavior Analyzer



Mobile App based





# Engaging via Mobile Apps

FROM CITY  
DASHBOARD TO  
APPLICATIONS

DATA GATHERING  
AND CITY DATA  
KNOWLEDGE  
MANAGEMENT

IOT APPLICATIONS  
VS IOT EDGE  
DEVICES

SNAP4CITY FOR  
BEGINNERS

SNAP4CITY  
ARCHITECTURE AND  
ECOSYSTEM. OPENED  
TO DEVELOPERS  
AND STAKEHOLDERS

SNAP4CITY  
AND KM4CITY  
PROJECTS

HOW TO ADOPT  
SNAP4CITY, AND  
OUR ROADMAP

DECISION SUPPORT  
SYSTEM AND CITY  
RESILIENCE

SNAP4CITY THE  
VIEW OF THE  
ADMINISTRATORS



100%  
OPEN  
SOURCE



# Informing and nudging via mobile App / QR

## • About:

- Good practices wrt: litter, queues, ticketing, water, services, ....
- Opening hours of attractions/services
- Info Mobility
- Services for disables
- How to actively participate ....
- How to solve ...
  - Emergency cases ...
  - Evacuation roots





# To propose suggestions and Engage city user we need to know how they are moving



By Car



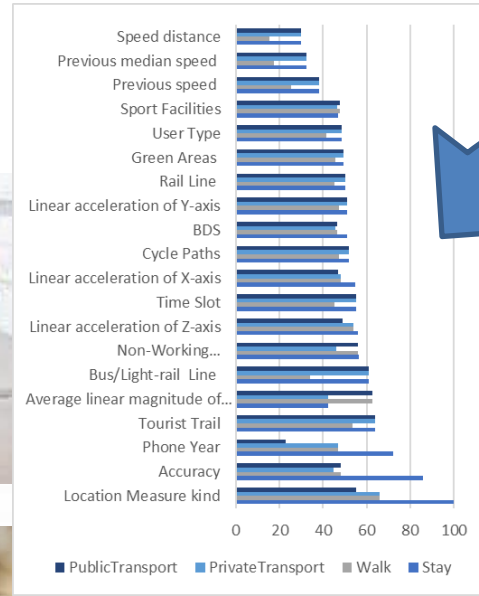
Walk



By BUS



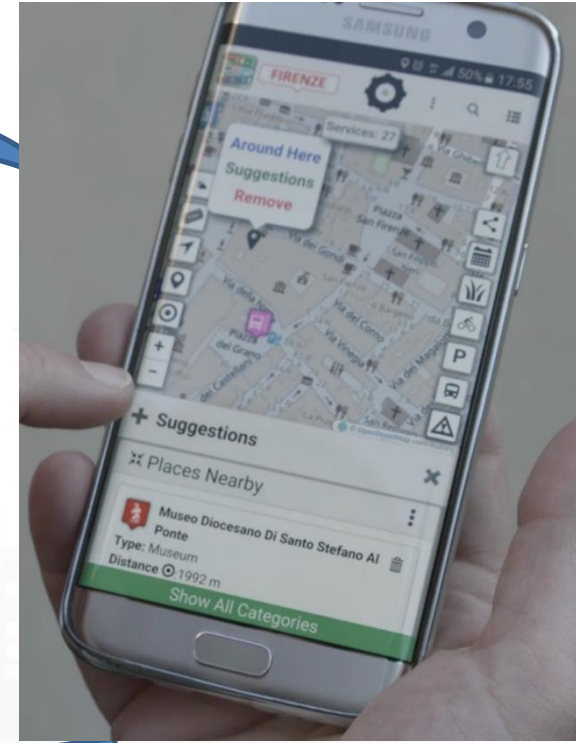
Run



User behavior  
recognition

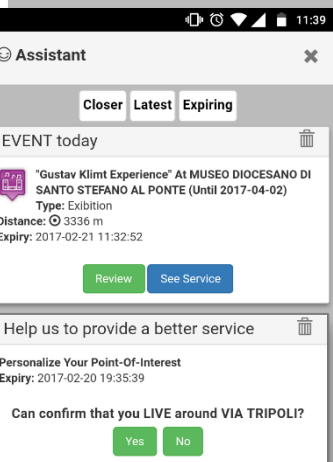
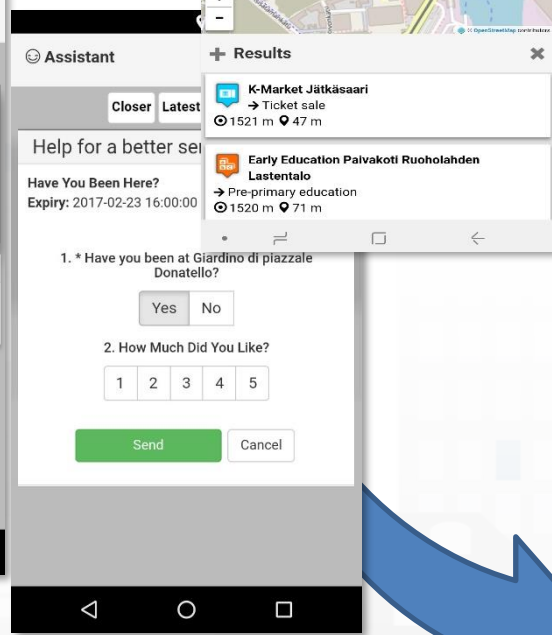
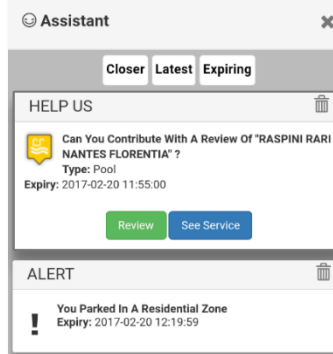
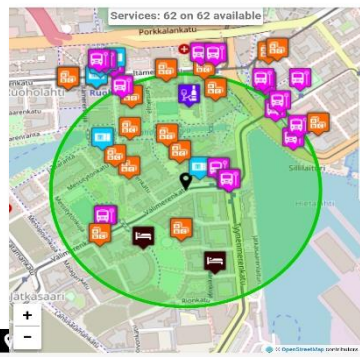
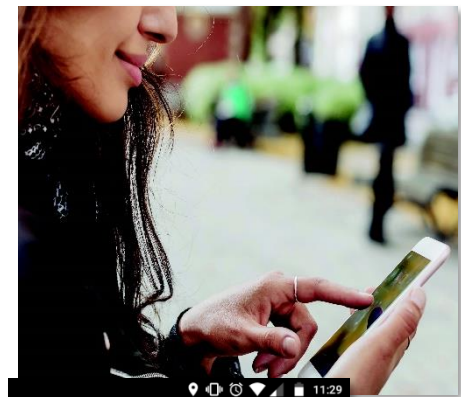
Artificial Intelligence  
Classification

Suggestions

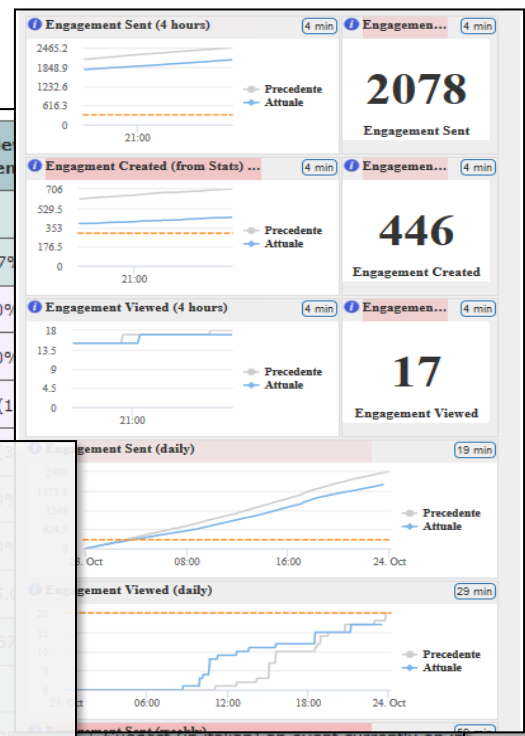




# Users' Engagement



| 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

User context

City context

Rules



# Safety Control Integration with Video Management Systems

FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS

FROM DASHBOARD APPLICATION

IOT APPLICATIONS AND DEVICES

SNAP4CITY FOR BEGINNERS

SNAP4CITY ARCHITECTURE AND ECOSYSTEM. OPENED TO DEVELOPERS

TWITTER VIGILANCE SOCIAL MEDIA ANALYSIS

SNAP4CITY AND KM4CITY PROJECTS

IOT/IOE DEVICES AND NETWORK

DATA ANALYTICS, BUSINESS INTELLIGENCE, WORKFLOW AND SIMULATION

HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP

ADVANCED SMART CITY API, MICROSERVICES, SNAP4CITY API

SNAP4CITY THE VIEW OF THE ADMINISTRATORS

IOT APPLICATIONS, THE LOGIC AND THE SMARTNESS

SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK

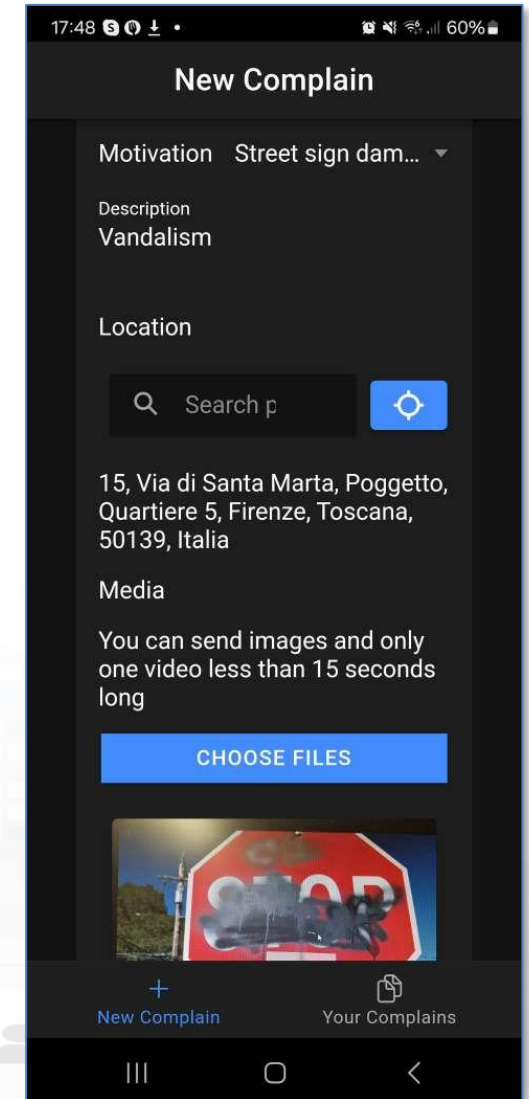
Integration with MILESTONE XProtect Video Management





# Event Managements

- **Bidirectional events:** from VMS to Snap4City and viceversa
  - From/to Snap4City to any service...
- **Snap4City collects and manages events from:**
  - Video Management System
  - Mobile Apps, city user complaints, operators, etc.
  - Web Apps, city users and operators
  - Early warning detected from Snap4City, etc.
  - Maintenance management tools, ...
  - Other channels, ...





# Event Management

The screenshot shows the SNAP4CITY Event Registration web application. The interface is dark-themed and includes a top navigation bar with various utility links. The main content area is divided into several sections:

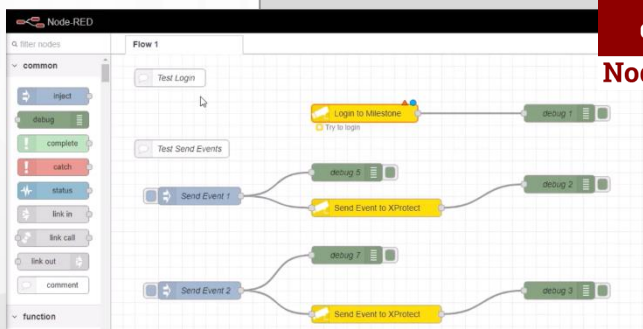
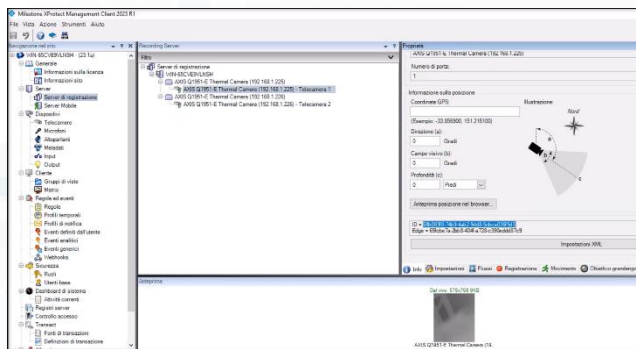
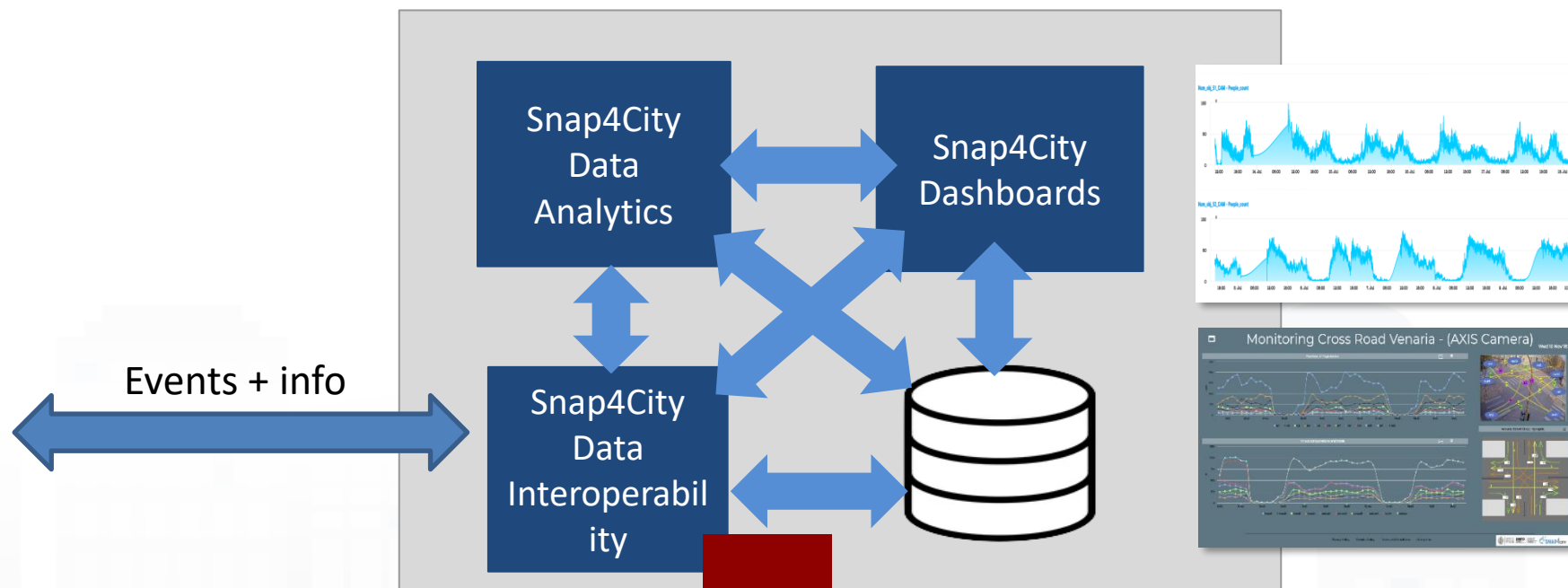
- Left Sidebar:** Contains filters for Severity and Status, and a list of categories: Cameras, Hospital, Traffic Flow, and Weather. At the bottom is an 'EventWebCam' button.
- Map:** A central map of Florence, Italy, showing streets and landmarks like the Arno river and various districts.
- Form (Insert Alarm Data):** A form for creating an event with fields for Name, Kind, Severity, People Involved, Impact, and Description.
- Table (Event List):** A table displaying a list of registered events with columns for device ID, severity, date observed, status, and actions.

| device                                | Severity | dateObserved             | status | Actions |
|---------------------------------------|----------|--------------------------|--------|---------|
| fireonplazgardon20231031T221304273Z   | Yellow   | 2023-10-31T22:13:04.273Z | init   | [Icons] |
| Telecamera4_22320231031T14213584Z     | Yellow   | 2023-10-31T14:21:35.84Z  | init   | [Icons] |
| CarCrash20231031T134436250Z           | Orange   | 2023-10-31T13:44:36.250Z | init   | [Icons] |
| CriticalTrafficJam20231031T132718888Z | Red      | 2023-10-31T13:27:18.888Z | init   | [Icons] |
| FloodedRoad20231031T132309212Z        | White    | 2023-10-31T13:23:09.212Z | init   | [Icons] |

At the bottom of the page, there are links for Privacy Policy, Cookies Policy, Terms and Conditions, and Contact us, along with logos for the University of Florence, DINFO, DISIT, and SNAP4CITY.



# VMS vs Snap4City: sending and getting events, AI solutions



Node-RED





# Cuneo Assets' Monitoring, Safety



Monitoraggio Generale
Thu 4 Jan 18:13:19

- ▶ CameraModelP1448-LE
- ▶ UpsModelRiello
- ▶ UpsModelSeltec
- ▶ SwitchModelMicrosense
- ▶ SwitchModelNetonix

**Legenda**

| Valore | Significato                         | Simbolo                               |
|--------|-------------------------------------|---------------------------------------|
| 0      | Buono stato                         | <span style="color: green;">●</span>  |
| 1      | Non raggiungibile                   | <span style="color: gray;">●</span>   |
| 2      | Raggiungibile, dati non disponibili | <span style="color: yellow;">●</span> |
| 3      | Identificata anomalia               | <span style="color: red;">●</span>    |

**SWITCH015**

VALUE NAME: 1721615250

DETAILS DESCRIPTION RT DATA

Last update: 2024-01-04 13:34:24.334Z

| Description   | Value                 | Buttons                         |
|---------------|-----------------------|---------------------------------|
| dateObserved  | 01/04/24, 02:34:24 PM | Last 4h 24h 7d 30d 6m 1y 2y 10y |
| fanSpeed      | 4985                  | Last 4h 24h 7d 30d 6m 1y 2y 10y |
| generalStatus | 0                     | Last 4h 24h 7d 30d 6m 1y 2y 10y |
| poeValue1     | 48                    | Last 4h 24h 7d 30d 6m 1y 2y 10y |
| poeValue10    | 0                     | Last 4h 24h 7d 30d 6m 1y 2y 10y |
| poeValue11    | 0                     | Last 4h 24h 7d 30d 6m 1y 2y 10y |
| poeValue12    | 0                     | Last 4h 24h 7d 30d 6m 1y 2y 10y |
| poeValue13    | 0                     | Last 4h 24h 7d 30d 6m 1y 2y 10y |
| poeValue14    | 0                     | Last 4h 24h 7d 30d 6m 1y 2y 10y |

TempValu... 9m

**49**

TempValue1 - 7 Days

• More than 400 devices

Monitoraggio Dettagliato
Thu 4 Jan 18:05:15

**Tabella Device**

Cerca per Indirizzo, ID o device...

Camera UPS Switch ● ● ● ●

| ID        | Stato                                | Tipo device | Indirizzo                                   | IP            | Azioni |
|-----------|--------------------------------------|-------------|---|---------------|--------|
| TC010182  | <span style="color: green;">●</span> | Camera      | Cuneo Sud Palo Angolo Parco Giochi          | 172.16.12.185 | 📍      |
| TC010178  | <span style="color: green;">●</span> | Camera      | Cuneo Sud Palo Alto verso Asilo             | 172.16.12.181 | 📍      |
| TC010181  | <span style="color: green;">●</span> | Camera      | Cuneo Sud Palo davanti Biblioteca           | 172.16.12.184 | 📍      |
| TC010179  | <span style="color: green;">●</span> | Camera      | Biblioteca Cuneo Sud Esterna Sopra Ingresso | 172.16.12.182 | 📍      |
| TC010184  | <span style="color: green;">●</span> | Camera      | Cuneo Sud Angolo verso Parco Giochi         | 172.16.12.187 | 📍      |
| TC010185  | <span style="color: green;">●</span> | Camera      | Cuneo Sud Angolo verso Bar                  | 172.16.12.188 | 📍      |
| TC010183  | <span style="color: green;">●</span> | Camera      | Cuneo Sud Angolo davanti Megafresco         | 172.16.12.186 | 📍      |
| TC010203  | <span style="color: green;">●</span> | Camera      | Rotonda Corso Francia Croce Rossa           | 172.16.12.203 | 📍      |
| TC010204  | <span style="color: green;">●</span> | Camera      | Rotonda Corso Francia Distributore          | 172.16.12.204 | 📍      |
| SWITCH041 | <span style="color: green;">●</span> | Switch      | Rotonda Corso Francia Croce Rossa           | 172.16.15.222 | 📍      |
| TC010202  | <span style="color: green;">●</span> | Camera      | Rotonda Corso Francia Tabaccaio             | 172.16.12.202 | 📍      |
| SWITCH040 | <span style="color: gray;">●</span>  | Switch      | Rotonda Corso Francia Croce Rossa           | 172.16.15.223 | 📍      |

**Tabella Dettaglio**

**TC010185**

dateObserved: 04/01/2024, 14:34

generalStatus: ●

tempStatus1: 1

**TEMP STATUS**

| Valore | Significato          |
|--------|----------------------|
| 1      | Buono stato          |
| 2      | Letture dato fallita |

**Legenda**

● 115 ● 13 ● 22 ● 4

Non raggiungibile

- TV Cams: color, Thermal
- Traffic Gates
- Switches
- UPS



# Cuneo Assets' Monitoring, Safety



Browser address bar: cuneo.snap4.eu/dashboardSmartCity/management/dashboards.php?queries[search]=My+own&fromSubmenu=false&sorts[title\_header]=1&param=My+orgMy&pageTitle=My+Dashboards+in+My+Organization&linkId=dashboar...  
Bookmarks: Calcio: ultime news..., Diffusioni in diretta..., La Repubblica.it - H..., Corriere dello Sport.it, TIM Mail | Tim.it | E..., Gmail, YouTube, Maps, Telecom Italia ROUT..., Firenze Traffic Flow, Snap4Altair, dashboard/iotapp/n..., Tutti i preferiti

## My Dashboards in My Organization

**Snap4Cuneo**

Switch To New Layout (Beta)

User: userareamanager, Org: Organization  
Role: AreaManager, Level: [LOGOUT]

- Dashboards (Public)
- Dashboards of My Organization
- My Dashboards in My Organization**
- Kibana
- Extra Dashboard Widgets
- Data, my Data, OpenData
- Knowledge and Maps
- IOT Applications
- IOT Directory and Devices
- Resource Manager
- Development Tools
- Management
- Decision Support Systems
- Deploy and Installation
- Help and Contacts
- Documentation and Articles
- My Profile
- Km4City portal
- DISIT Lab portal

Navigation: A-Z, Z-A, Home, Refresh, Share, Prev 1 Next, Search: My own, New dashboard

### Conteggi Persone e Biciclette

Passive

My own (Organization)  
Edit Management Clone Delete

### Conteggi Telecamere

Passive

My own (Organization)  
Edit Management Clone Delete

### Cruscotto Videosorveglianza

Passive

My own (Organization)  
Edit Management Clone Delete

### Dashboard varchi

Passive

My own (Organization)  
Edit Management Clone Delete

### Monitoraggio dettagliato

Passive

My own (Organization)  
Edit Management Clone Delete

### Monitoraggio dettagliato - WIP

Passive

My own (Organization)  
Edit Management Clone Delete

### Monitoraggio generale

Passive

My own (Organization)  
Edit Management Clone Delete

### Telecamere Cuneo

Passive

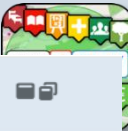
My own (Organization)  
Edit Management Clone Delete

### test delega

Passive

My own (Organization)

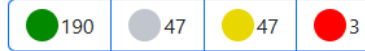




### Tabella Device

Cerca per Indirizzo, ID o device...

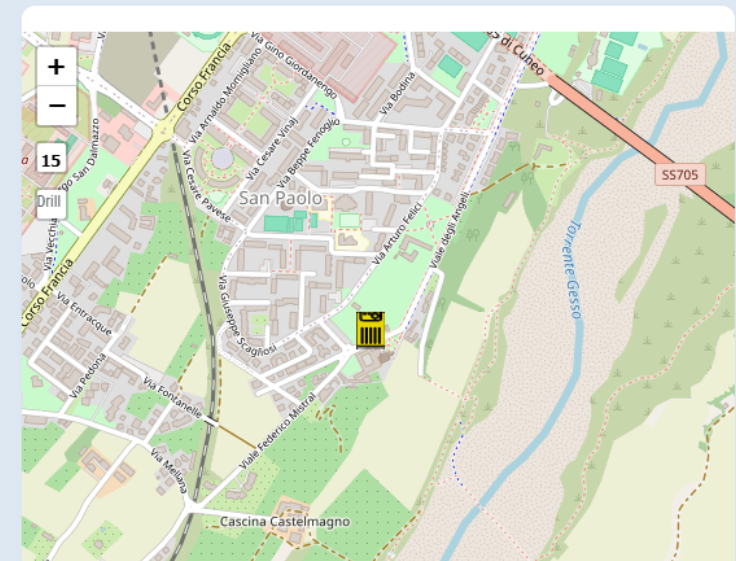
Camera UPS Switch



| ID        | Stato | Tipo device | Indirizzo                                  | IP            | Azioni |
|-----------|-------|-------------|--|---------------|--------|
| UPS052    | ●     | UPS         | Infomobilità - Santuario Angeli            | 172.16.15.76  | 📍      |
| SWITCH095 | ●     | Switch      | Infomobilità - Santuario Angeli            | 172.16.15.169 | 📍      |
| TC010178  | ●     | Camera      | Cuneo Sud Palo Alto verso Asilo vista 2    | 172.16.12.181 | 📍      |
| TC010178  | ●     | Camera      | Cuneo Sud Palo Alto verso Asilo vista 3    | 172.16.12.181 | 📍      |
| TC010182  | ●     | Camera      | Cuneo Sud Palo Angolo Parco Giochi vista 3 | 172.16.12.185 | 📍      |
| TC010182  | ●     | Camera      | Cuneo Sud Palo Angolo Parco Giochi vista 4 | 172.16.12.185 | 📍      |
| TC010182  | ●     | Camera      | Cuneo Sud Palo Angolo Parco Giochi         | 172.16.12.185 | 📍      |
| TC010182  | ●     | Camera      | Cuneo Sud Palo Angolo Parco Giochi vista 2 | 172.16.12.185 | 📍      |
| TC010178  | ●     | Camera      | Cuneo Sud Palo Alto verso Asilo vista 4    | 172.16.12.181 | 📍      |
| TC010178  | ●     | Camera      | Cuneo Sud Palo Alto verso Asilo            | 172.16.12.181 | 📍      |
| TC010181  | ●     | Camera      | Cuneo Sud Palo davanti Biblioteca vista 4  | 172.16.12.184 | 📍      |
| TC010181  | ●     | Camera      | Cuneo Sud Palo davanti Biblioteca vista 3  | 172.16.12.184 | 📍      |
| TC010181  | ●     | Camera      | Cuneo Sud Palo davanti Biblioteca vista 2  | 172.16.12.184 | 📍      |
| TC010181  | ●     | Camera      | Cuneo Sud Palo davanti Biblioteca          | 172.16.12.184 | 📍      |

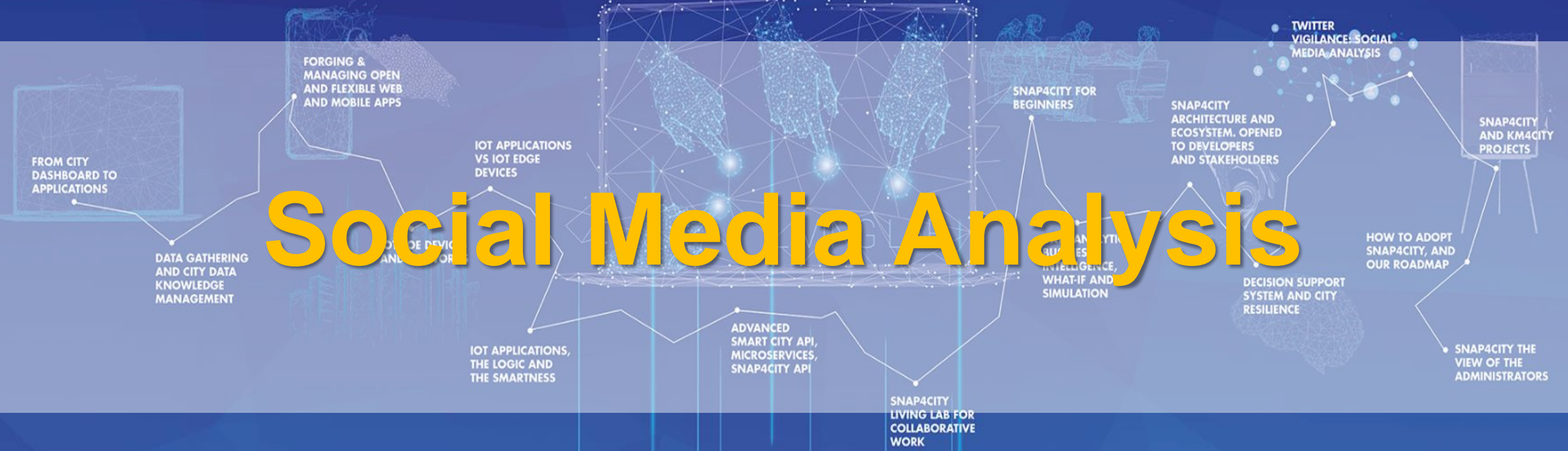
### Tabella Dettaglio

| UPS052        |                   |
|---------------|-------------------|
| dateObserved  | 30/10/2024, 11:21 |
| generalStatus | ●                 |





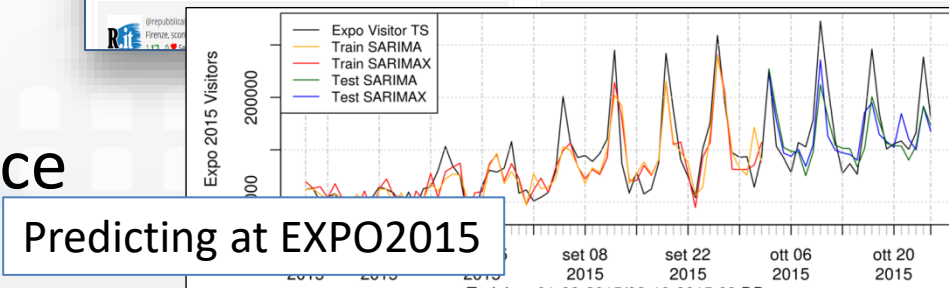
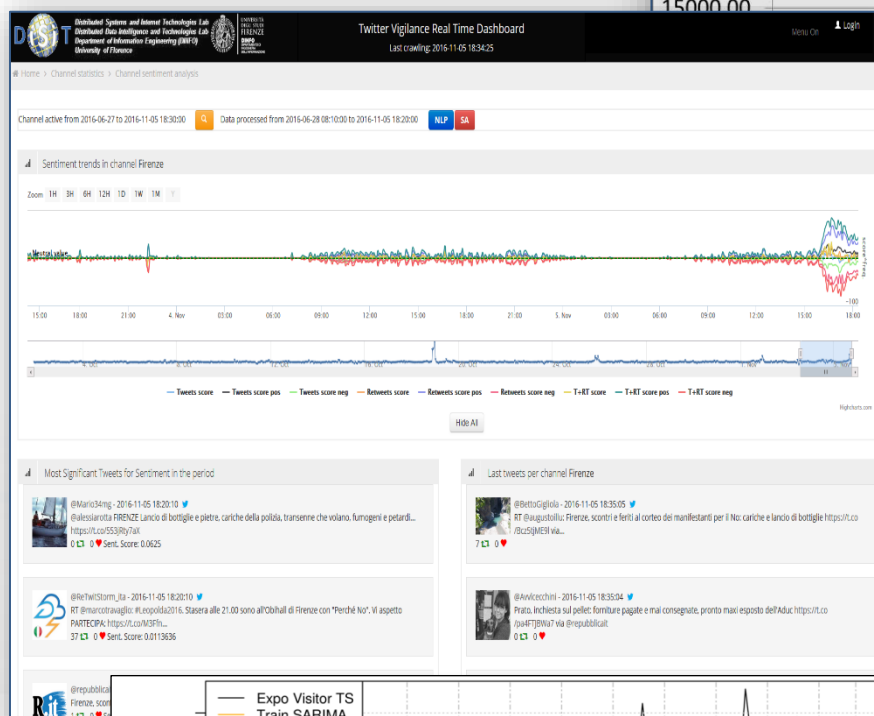
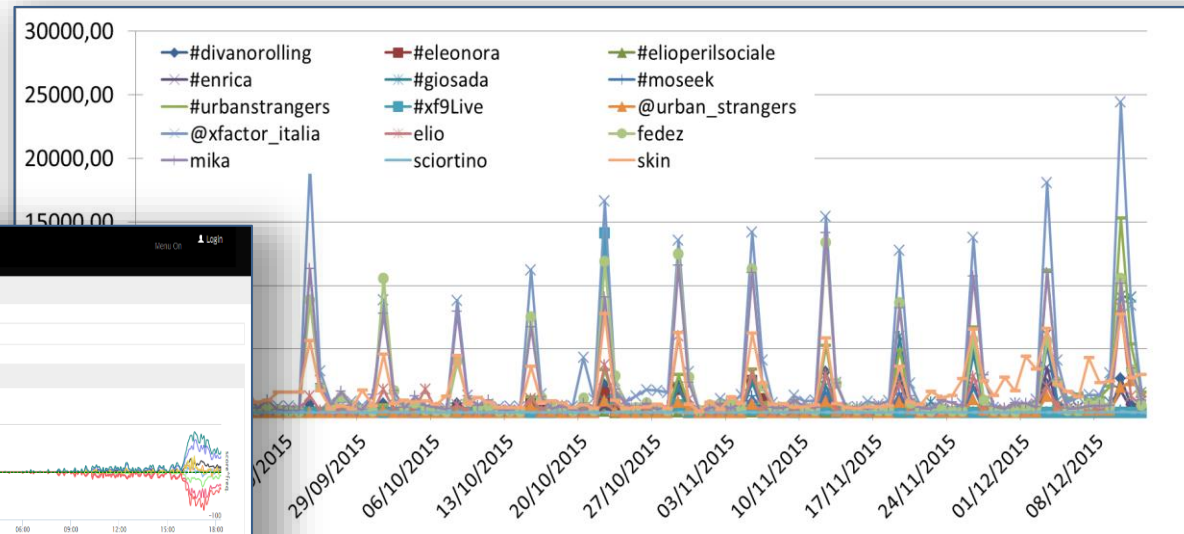
# Social Media Analysis





## Twitter Vigilance

- Prediction of Audience on TV programme
- Prediction of retweet proneness: RF, GBM, ..
- Project
  - TwitterVigilance
  - +NLP, SA



Predicting at EXPO2015

## Predictive models VS metrics relevance

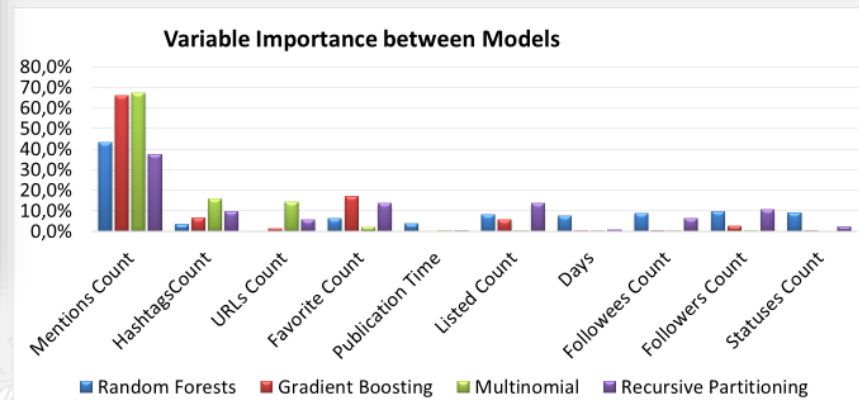
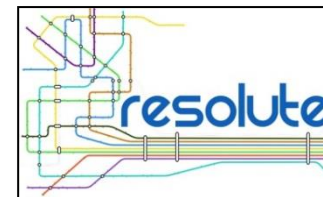


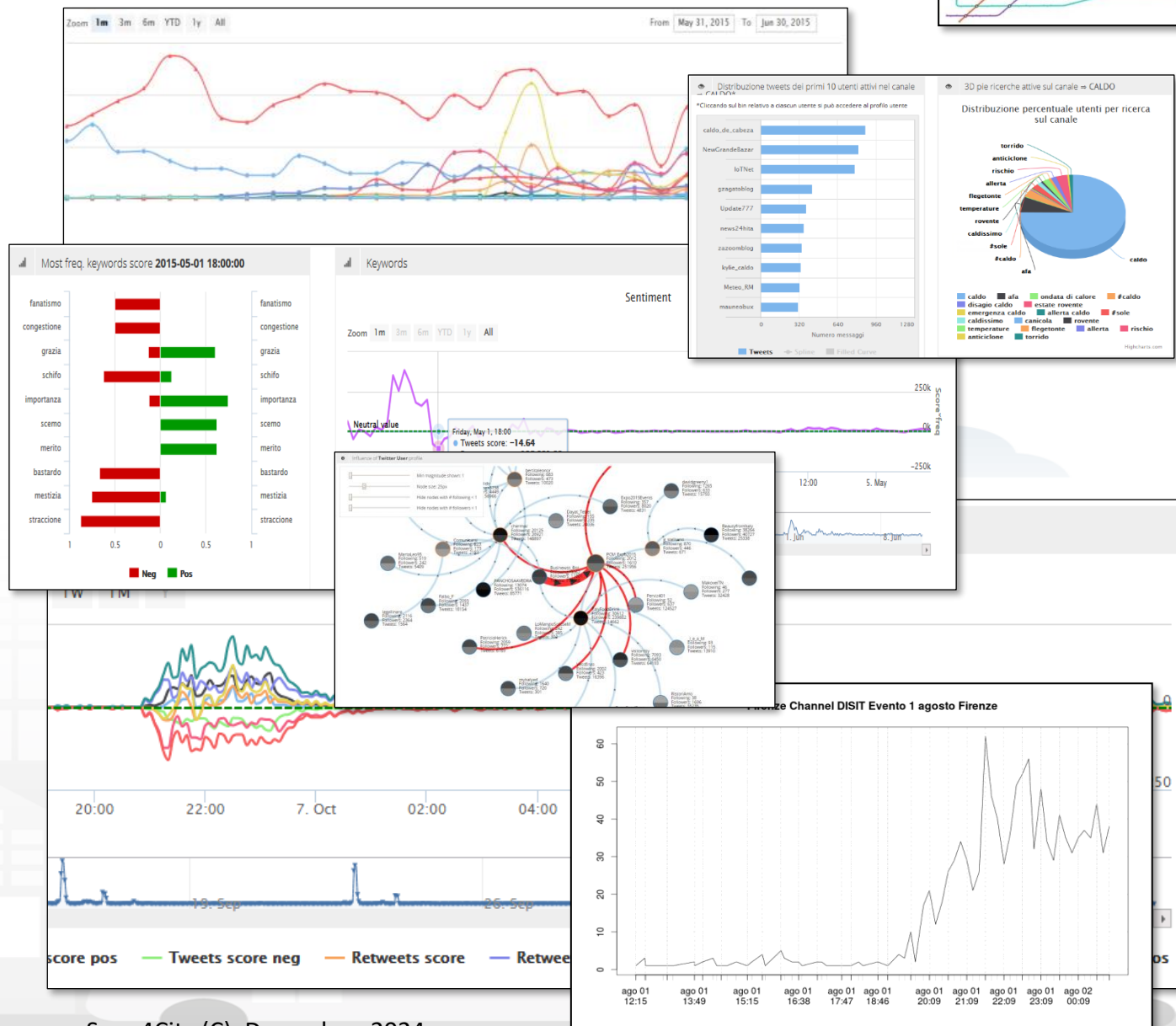
Figure 5: Comparison among the selected predictive models discussed and presented in Tables 2 and 3 with respect to the real number of visitors. Both training and validation



# 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







# Several Channels



Last crawling: 2015-12-11 01:20:20

Search parameters

Data analysis 4

Channel statistics

Search statistics

Retweet statistics

Twitter Users statistics

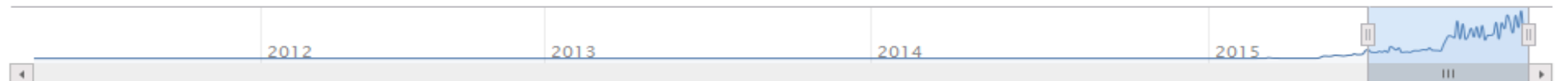
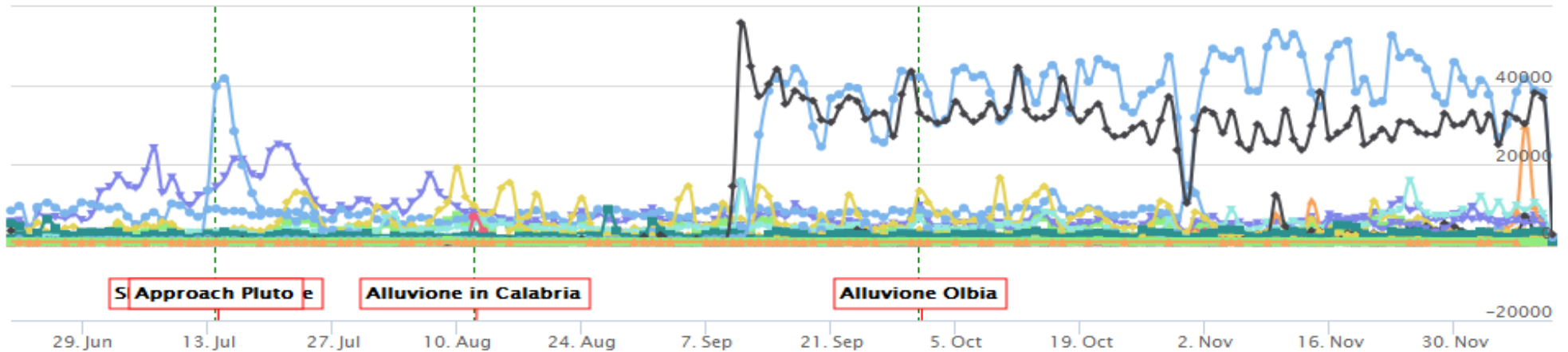
INFO

Home > Channel statistics

Global view of user channels

Zoom 1m 3m 6m YTD 1y All

From Jun 20, 2015 To Dec 11, 2015



- ads
- aeroporto firenze
- Allertameteo TOSCANA
- apretoscana
- CALDO
- cambiamenti climatici
- Codified Hashtags Allerta
- ConsumoSuolo
- Emergenza\_acqua
- Europea
- EXPO2015
- Firenze
- FirenzeICT
- Giubileo
- iononrischio
- LaMMA
- Maltempo
- maturità 2015
- MeteoUSER
- mymeteo
- NASA New Horizons
- papafrancesco
- PA\_social\_PA
- protezione civile toscana
- resilienza
- rossano
- siena
- smartcity
- smartcitybigdata2015
- SOLO allertameteoTOSCANA
- tech
- uber
- Univ-Firenze
- zanzara
- Events





# A Channel



Channel active from 2009-10-23 to today



Data processed from 2015-05-15 to 2015-09-15

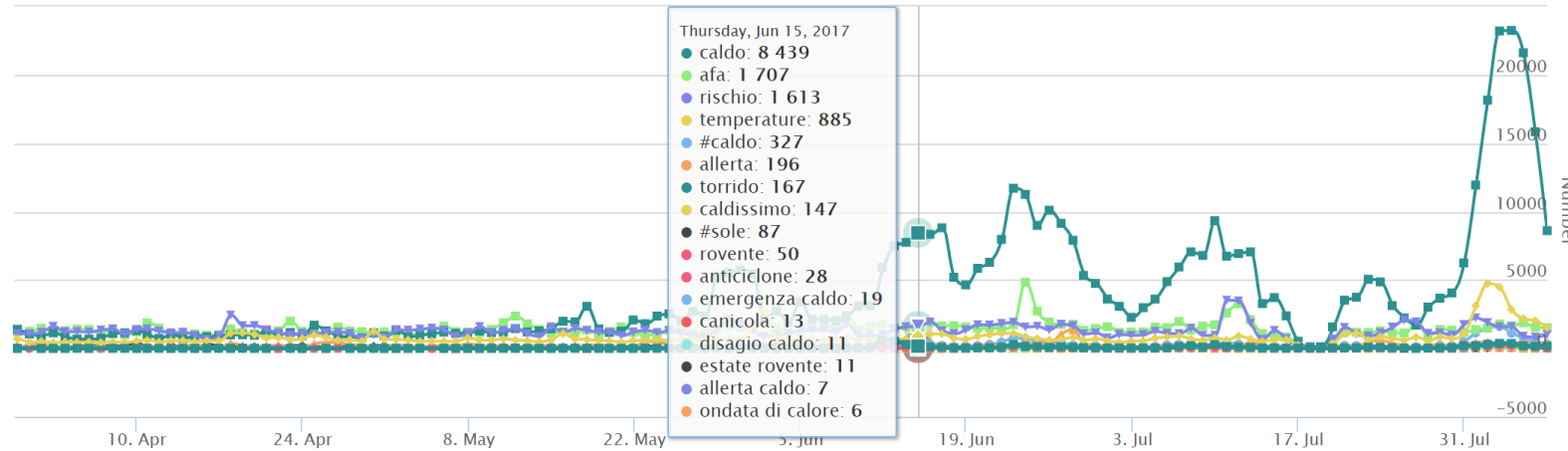
NLP

SA

Search related to channel **CALDO**

Zoom 1m 3m 6m YTD 1y All

From Mar 30, 2017 To Aug 7, 2017



05-15 to 2015-09-15

NLP

SA

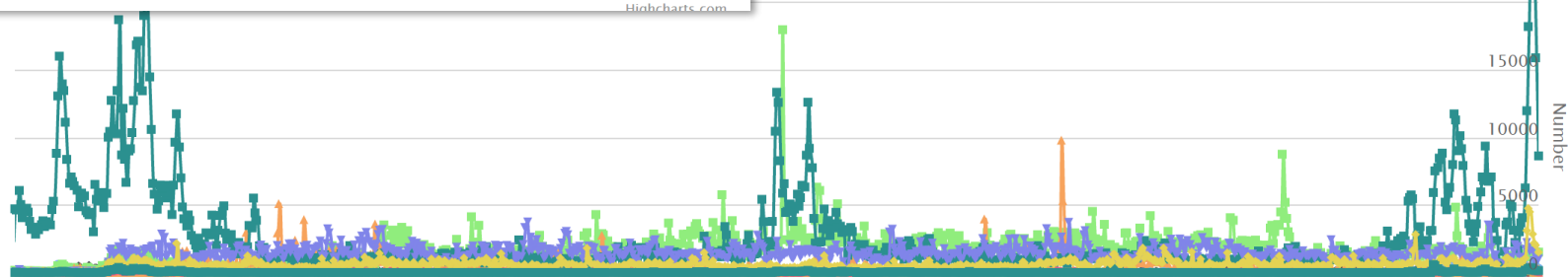
From May 11, 2015 To Aug 7, 2017

#caldo #sole #afa #allerta #allerta caldo #anticiclone #caldissimo #caldo #canicola #disagio caldo #emergenza caldo  
 #estate rovente #flegetonite #ondata di calore #rischio #rovente #temperature #torrido Events

## Its searches



**Twitter Vigilance**

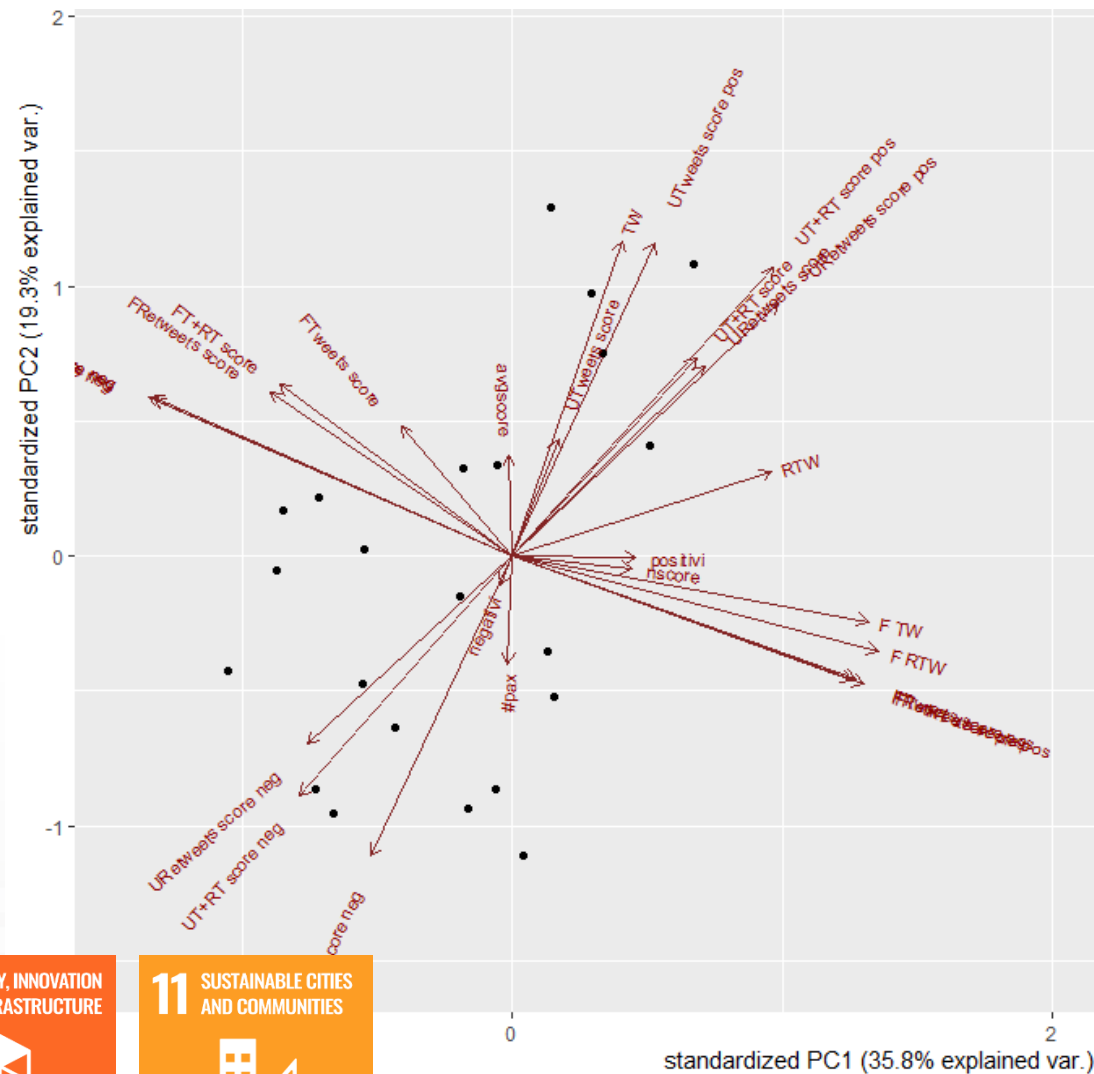


Snap4City (C), December 2024



# Reputation

- Prediction/estimation of **Average Score of Trip Advisor** as a function of *Twitter Vigilance Metrics + other information*
- Prediction/estimation of **Negative Scores on specific Museum or service** as a function of *Twitter Vigilance Metrics + other information*



**Twitter Vigilance**







- **Feedback Project:**

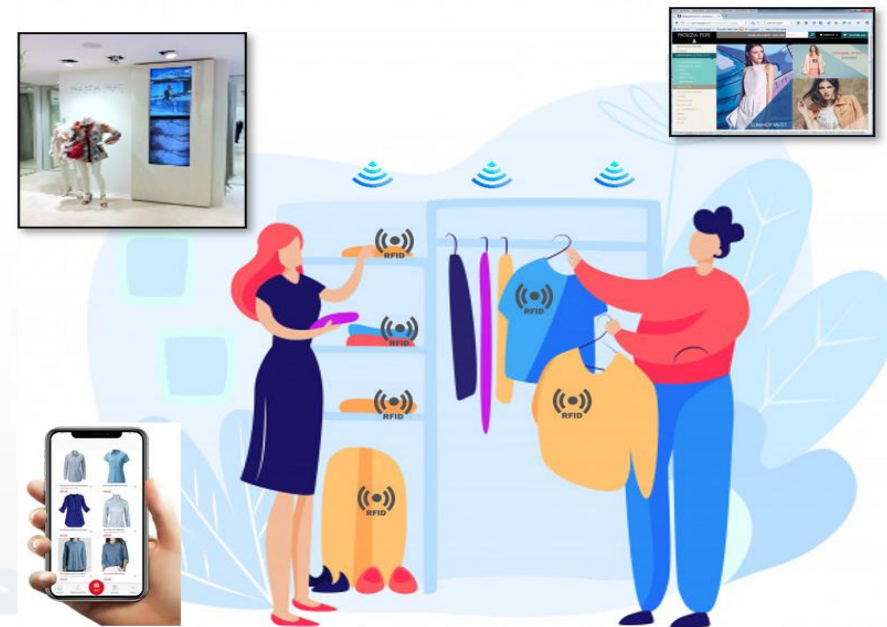
- Flexible Advanced Engagement Exploiting User Profiles and Product/Production Knowledge
- VAR, PatriziaPepe (Tessilform), DISIT, SICE
- Keywords: retail, GDO, ...

- **Goals and drivers:**

- adaptive user engagement, customer experience
- Advanced user profiling, user behaviour analysis
- IOT and instrumentation
- Predictive models for engagement
- Integrated in city customer experience

- **Aiming to solve current State of the Art issues:**

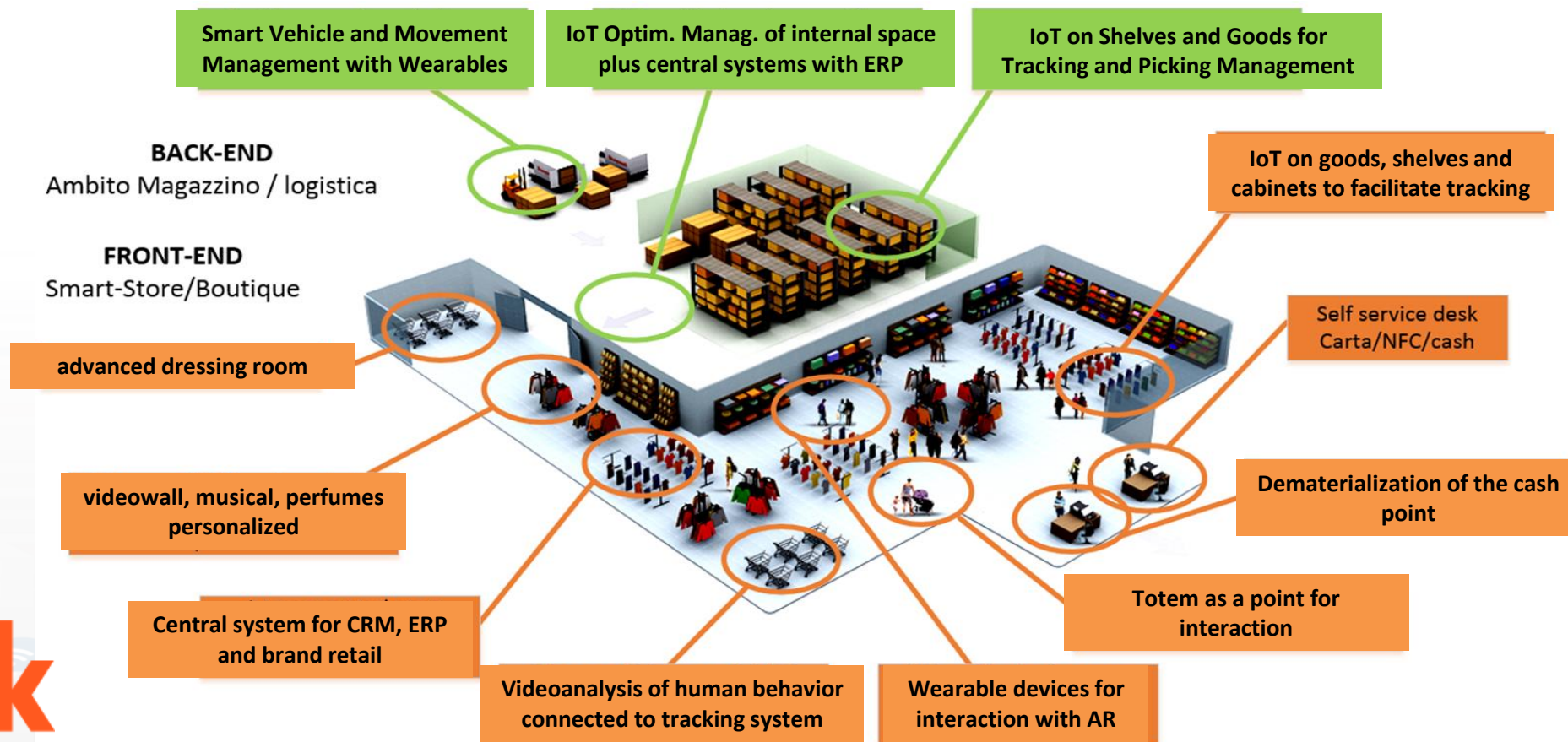
- Cold start problems in generating recommendations for new users, also addressing seasonality of products and items
- GDPR compliance



feedback



- Using the stimulus of the recommendation system, we have increased the customers' attention of the 3.48%
- The solution is also functional in presence of a low number of customers and items
- The solution solved the cold start problems
- GDPR compliant



# feedback



## FeedBack Admin Tools

## FeedBack Engagement Tools

Tool Admin

Tool Engager

Recommender

Intranet

Totem

Surfaces

Web site - App

Checkout

Sensor  
Manager

Network  
Manager



Sensors and Markers

Apps and Tags

# feedback



# Suggestions

**customer similarity** for each customer cluster the most representative items are suggested;

**item similarity:** considering the last items purchased by the customer according to the information contained into its profile, and randomly selecting items in the same item clusters;

**item complementary:** considering items that may complement the last items that have been bought by the customer according to a table of complementary items;

**item associated:** in order to improve a customer's purchase frequency, we generated suggestions for customers who purchased an item in the last three months;

**suggestions for serendipity:** randomly selecting items to be suggested from the whole present collection, taking also into account what is available in the physical shop;

## Item selection

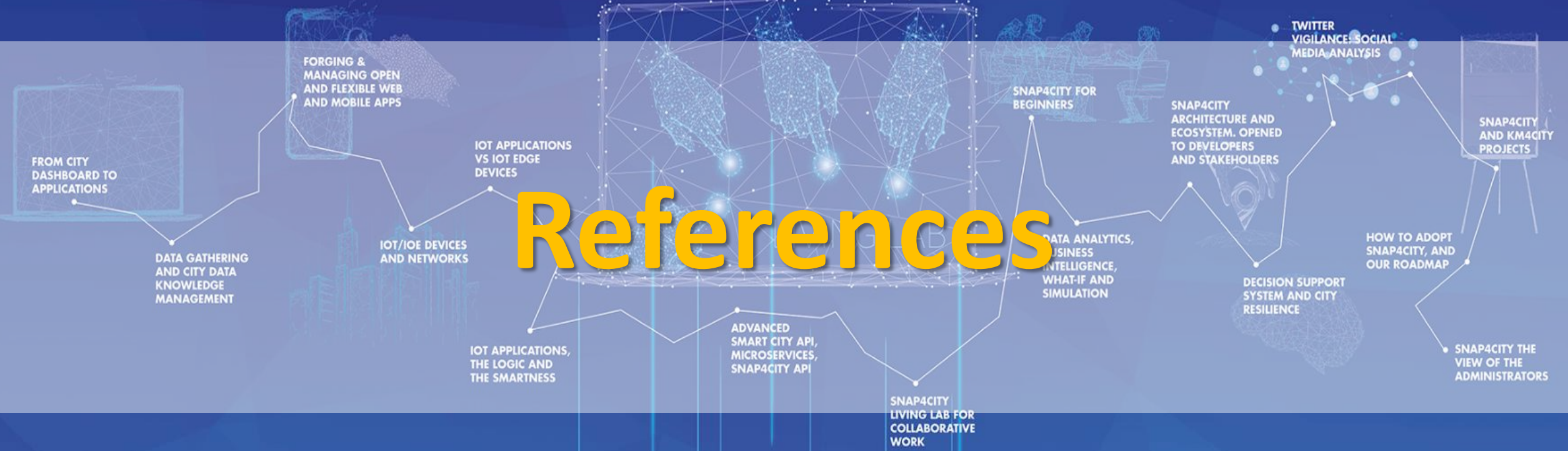
1. Item previously not purchased
2. Confidence recommended item. Confidence established with Market Basket Analysis

- 20% of suggestions produced have been issued
- 9.84% of suggestions have led to transaction and/or trial
- 3.48% of increment of interest with respect of the previous period without recommendation

**feedback**



# References





# booklets



- Smart City



[https://www.snap4city.org/download/video/DPL\\_SNAP4CITY.pdf](https://www.snap4city.org/download/video/DPL_SNAP4CITY.pdf)

- Industry



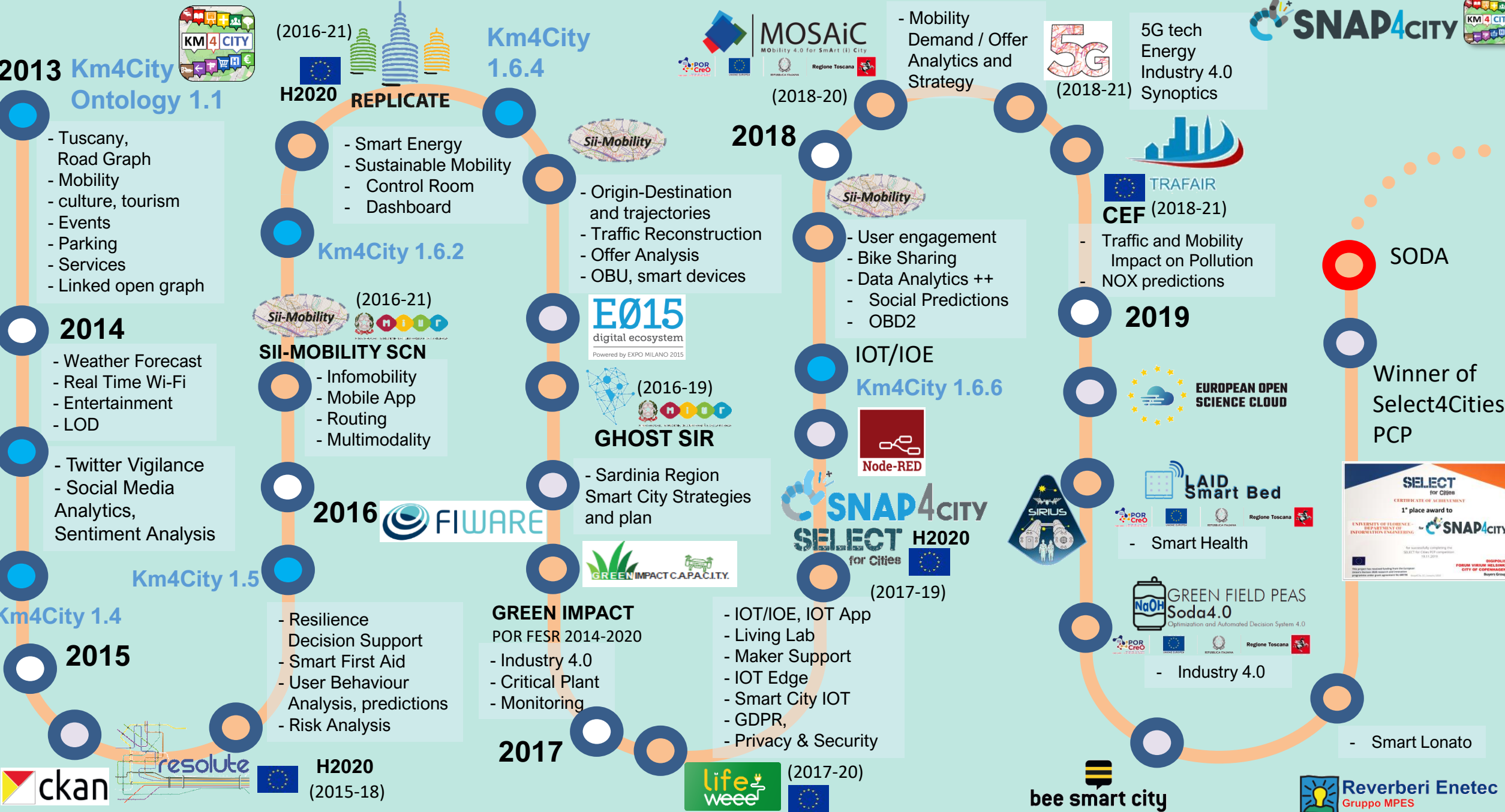
[https://www.snap4city.org/download/video/DPL\\_SNAP4INDUSTRY.pdf](https://www.snap4city.org/download/video/DPL_SNAP4INDUSTRY.pdf)

- Artificial Intelligence



[https://www.snap4city.org/download/video/DPL\\_SNAP4SOLU.pdf](https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf)





## 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
- LOD

- Twitter Vigilance
- Social Media Analytics, Sentiment Analysis

## Km4City 1.4

## 2015

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



## (2016-21) H2020 REPLICATE Km4City 1.6.4

- Smart Energy
- Sustainable Mobility
- Control Room
- Dashboard

## Km4City 1.6.2

(2016-21) Sii-Mobility

### SII-MOBILITY SCN

- Infomobility
- Mobile App
- Routing
- Multimodality

2016 FIWARE

## Km4City 1.5

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

## MOSAiC (2018-20) - Mobility Demand / Offer Analytics and Strategy

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

E015 digital ecosystem

Powered by EXPO MILANO 2015

(2016-19) GHOST SIR

- Sardinia Region Smart City Strategies and plan

GREEN IMPACT CAPACITY

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

## 2017

- Smart Waste

(2018-21) TRAFAIR CEF

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

IOT/IOE Km4City 1.6.6

Node-RED

SNAP4CITY SELECT for Cities H2020 (2017-19)

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

(2017-20) life weee

5G tech Energy Industry 4.0 Synoptics

- Traffic and Mobility Impact on Pollution
- NOX predictions

## 2019

EUROPEAN OPEN SCIENCE CLOUD

LAI Smart Bed

- Smart Health

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

- Industry 4.0

- Smart Lonato

bee smart city

Reverberi Enetec Gruppo MPES

SODA

Winner of Select4Cities PCP

SELECT for Cities

CERTIFICATE OF ACHIEVEMENT

1<sup>st</sup> place award to

UNIVERSITY OF FERRARA - DEPARTMENT OF INFORMATION ENGINEERING

SNAP4CITY

DISIT lab roadmap vs model and tools' usage





Smart Ambulance (2021-22)

Enterprise (2021-22)  
Industry 4.0

Almafluida Industry 4.0 (2021-22)

Contract, 2022-23

CN MOST, 2022-26

ELLIE IA 2025-2027

**2020**



Contract



- Smart Tourism
- 6 Pilots
- Data Analytics
- Extended platform



- Smart Mobility
- PISA, PUMS
- Living lab



**2021**

PC4City (2020-21)  
Monitoring Terrain



**CAPĒLON**

- Smart Light
- Sweden

**Km4City 1.6.7**



AMPERE (2021-22)  
Industry 4.0

SYN-RG-AI  
SmartCity



Industry 4.0

uni.systems

SmartCity, 2021-23



AXIS collab  
SmartCity

**2022**



Asymmetrica  
Smart City, 2022-23



Contract, 2022-23



2022-2023



Contract, 15min



Security and Risk



Italferr, Smart City



Co-funded by the European Union

**2023**



EI THE, 2022-26

G. Agile, 2021-23



2023-26



Merano, smart light

OceanRace, Genova, AWS

Cuneo, smart city

**2024**

Km4City 1.6.8

TOURISMO



UrbanDT4TF



Contract, 2024-25

CAI4DSA



Future Artificial Intelligence Research



OPTIFaaS



Rhodes, smart city

eShare



AMMIRARE







PEN Test  
Passed



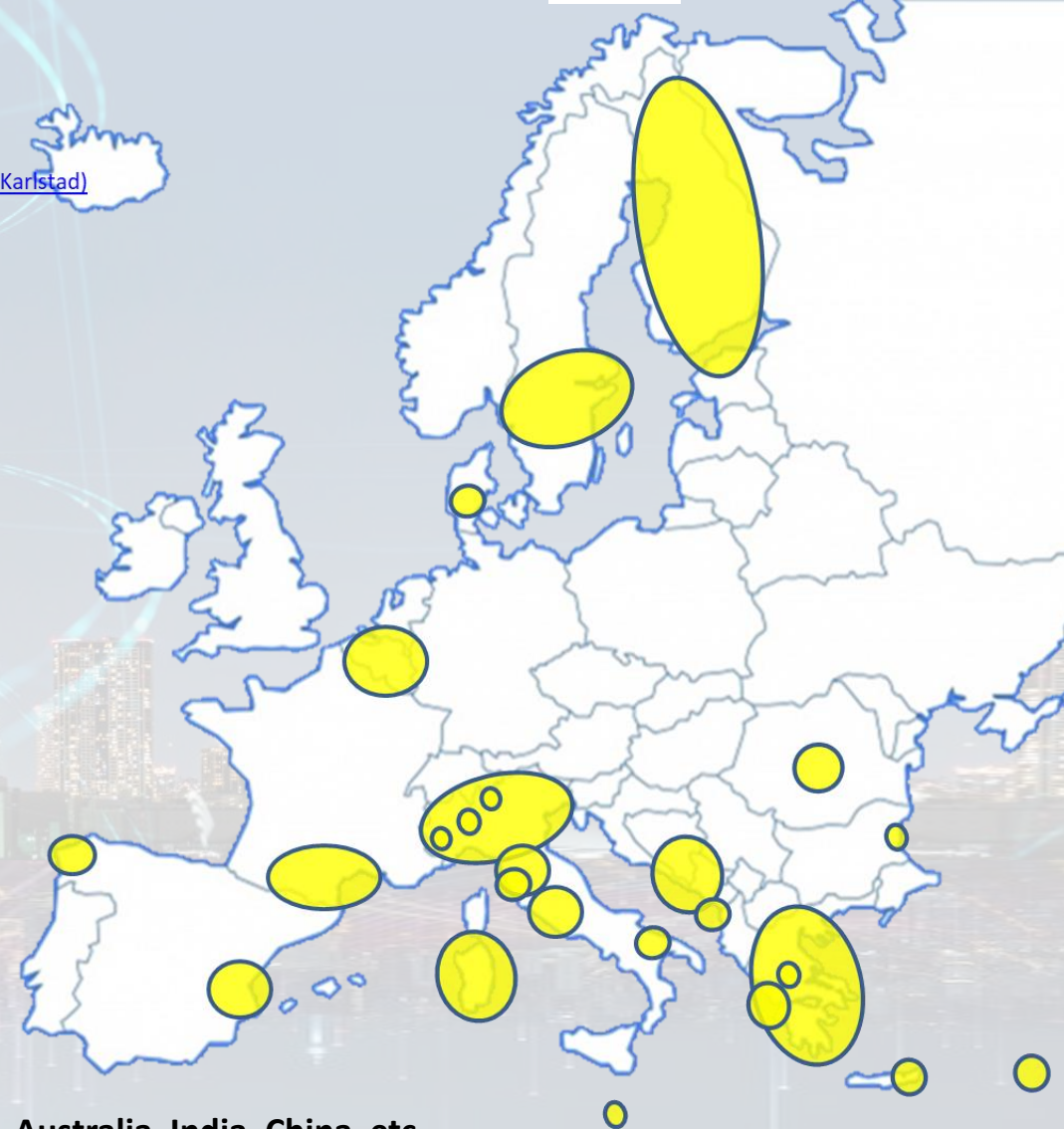
EU GDPR  
COMPLIANT



- Update: 29-10-2024
- 12 running installations in Europe
  - Snap4.city.org, Greece, Merano, Cuneo, ..
  - Toscana, Pisa, Sweden, ISPRA, Snap4.eu,
  - Altair, Italmatic, Romania, Rhodes, .....
- 16 projects, 12 pilots on 10 Countries
  - >40 cities/area
- **Widest MULTI-tenant deploy has**
  - 24 Organizations / tenant
  - > 8850 users on
  - > 1800 Dashboards
  - > 17 mobile Apps
  - > **2.2 Million of structured data per day**
  - > 580 IoT Applications/node-RED
  - > 750 web pages with training
  - > 75 videos, training videos

#### Main Organizations/areas

- [Antwerp area \(Be\)](#)
- [Bari \(I\)](#)
- [Bisevo, Croatia](#)
- [Bologna \(I\)](#)
- [Brasov \(Ro\)](#), by ICEBERG
- [Capelon \(Sweden: Västerås, Eskilstuna, Karlstad\)](#)
- [Cuneo \(I\)](#)
- [DISIT demo \(multiple\)](#)
- [Dubrovnik, Croatia](#)
- [Firenze area \(I\)](#)
- [Garda Lake area \(I\)](#)
- [Greece \(Gr\)](#)
- [Helsinki area \(Fin\)](#)
- [Limassol \(Cy\)](#)
- [Livorno area \(I\)](#)
- [Lonato del Garda \(I\)](#)
- [Malta \(Malta\)](#)
- [Merano \(I\)](#)
- [Modena \(I\)](#)
- [Mostar, Bosnia-Herzegovina](#)
- [Oslo & Padova \(Impetus\)](#)
- [Pisa area \(I\)](#)
- [Pistoia \(I\)](#)
- [Pont du Gard, Occitanie \(Fr\)](#)
- [Prato \(I\)](#)
- [Rhodes \(Gr\)](#)
- [Roma \(I\)](#)
- [Santiago de Compostela \(S\)](#)
- [Sardegna Region \(I\)](#)
- [Siena \(I\)](#)
- [SmartBed \(multiple\)](#)
- [Toscana Region \(I\), SM](#)
- [Valencia \(S\)](#)
- [Varna \(Bulgaria\)](#)
- [Venezia area \(I\)](#)
- [WestGreece area \(Gr\)](#)

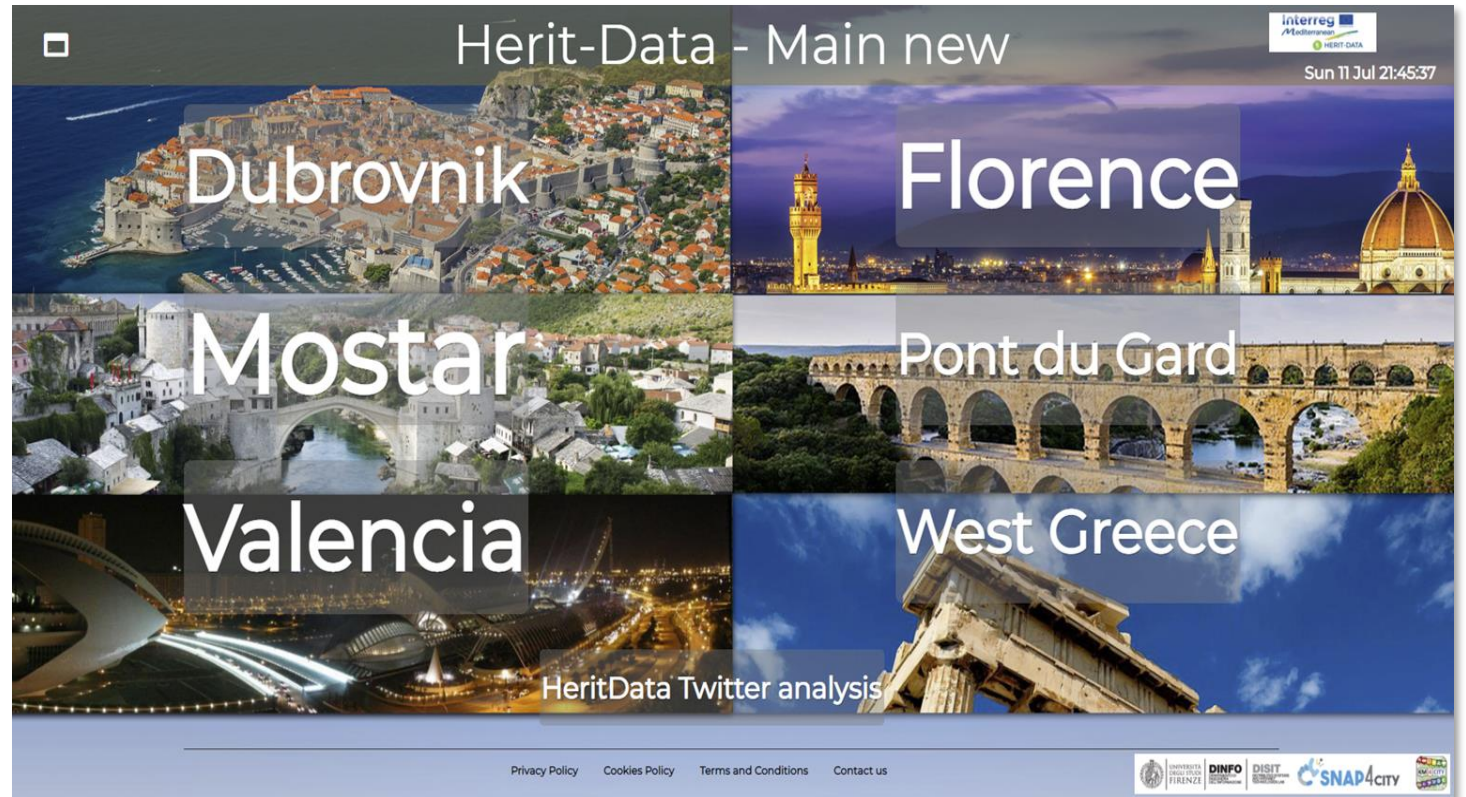


- + Israel, Colombia, Brasile, Australia, India, China, etc.



<https://www.snap4city.org>

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



PROGETTO STRATEGICO

TERRITORI



# HERIT-Data Approach

**RESULTS**

**> BENCHMARK**

- What is overtourism exactly?
- How do you define "tourist density" and "tourist overload"?
- What exactly is the impact of overtourism on cultural and natural heritage as far?
- Managing tourism flows with local laws which areas/areas should have been identified?
- What is the role of technology in the analysis and management of overtourism tourist sites?

**> INDICATORS SYSTEMS**

HERIT-DATA is about using data to generate knowledge in order to prevent the negative effects of mass tourism on heritage sites. But how does this happen in practice? The first step is to know which data we want to collect.

**> HERIT-DATA PLATFORM**

The DSIT (Distributed Systems and Internet Technologies) Lab of the University of Florence has joined the project consortium to support the development of the HERIT-DATA platform by using an existing one they have developed: Snap4City.

Exploiting existing and new data on Snap4City platform and Digital Twin.

- Big Data, Open Data, pub./priv. data, any format/protocol
- people flow, mobility, pollutant, weather, events, reputation, social media, etc.
- Admin ad service data
- Social, IoT, Satellite, etc.

Assessing conditions via Indicators and Benchmarks

Providing hints and services for decision support to:

- **Citizens:** improve quality of life, distribution of impacts, socio-economic effects.
- **Tourists:** access/selecting services, Focused offers, alternative offers, recommendations, information, diversification.
- **Public administration:** Support in decision-making and planning processes
- **Tourist and Heritage managers:** to develop sustainable tourist products, management recommendations, better management of the human pressure on the heritage



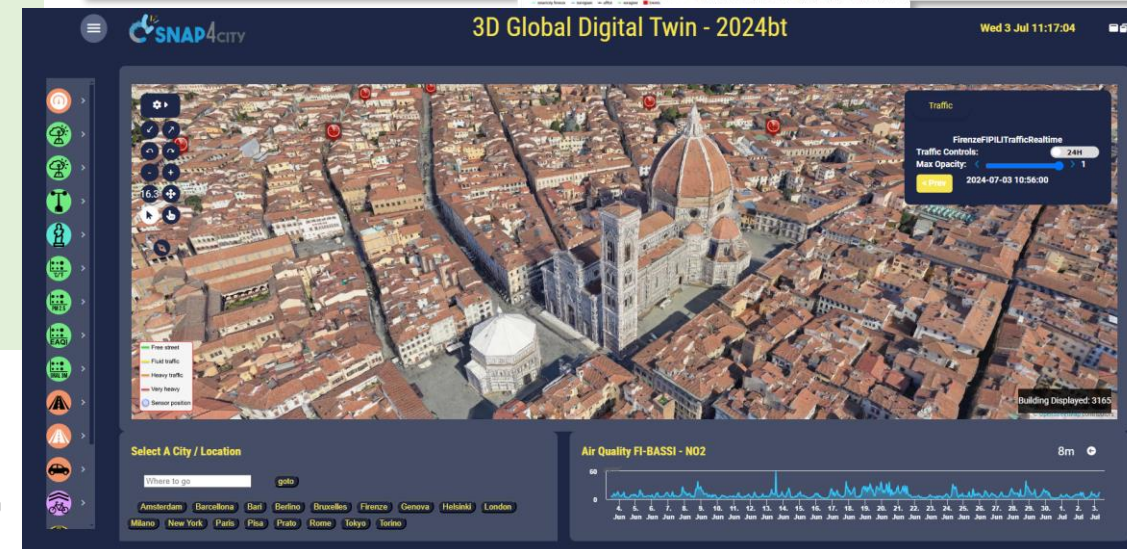
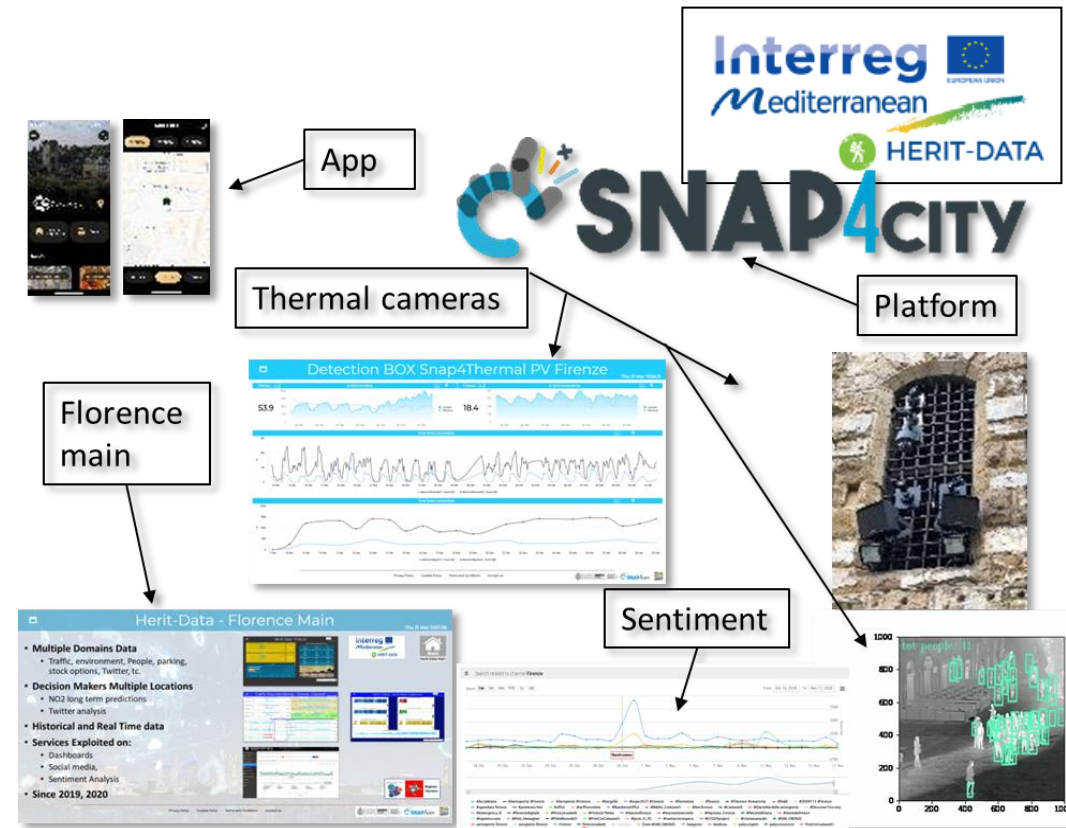
# Florence Pilot

## Objectives:

- **Managing Touristic Flow in the UNESCO area**
- **Benchmark/KPI**
- **Providing actual TOOLS to decision makers as decision support systems**

## Digital Twin including (for Tourism)

- **Knowledge: POI, context, GIS data**
- **Monitoring**
  - People flow, traffic flow, parking
  - Pollutant, (NO, O<sub>3</sub>, NO<sub>2</sub>, CO, SO<sub>2</sub>),
  - Weather
  - Social Media: Twitter, TA..
- **Computing via AI, XAI**
  - **Predictions on reputation**
  - **Sentiment analysis**
  - **Predictions & early warning**
    - Presences, critical conditions
  - **Suggestions / nudging**



PROGETTO STRATEGICO

TERRITORI

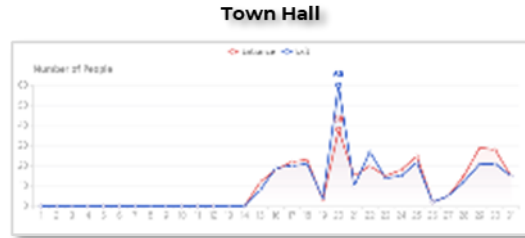
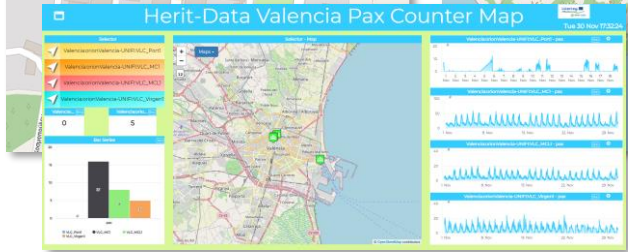
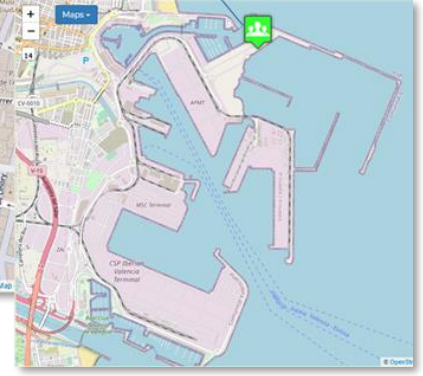
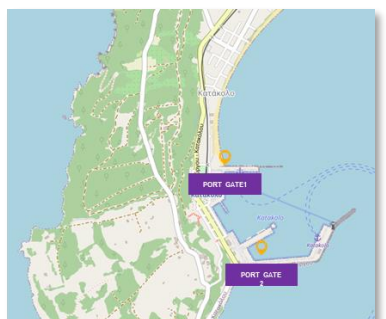
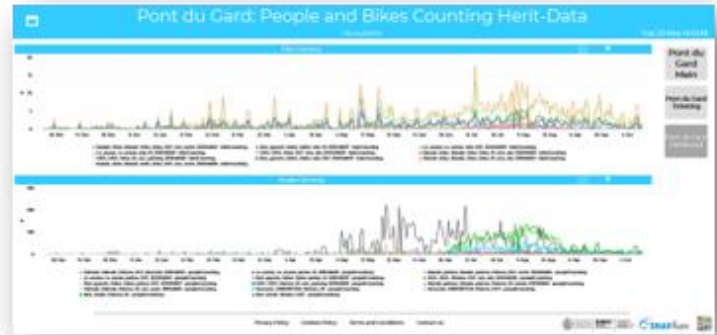


# Other Pilots' Examples



## Objectives:

- Managing Touristic Flows
- Benchmark/KPI
- Providing TOOLS to decision makers as decision support systems



PROGETTO STRATEGICO **TERRITORI**



**Interreg**  
Euro-MED



Co-funded by  
the European Union

# TOURISMO EURO MED

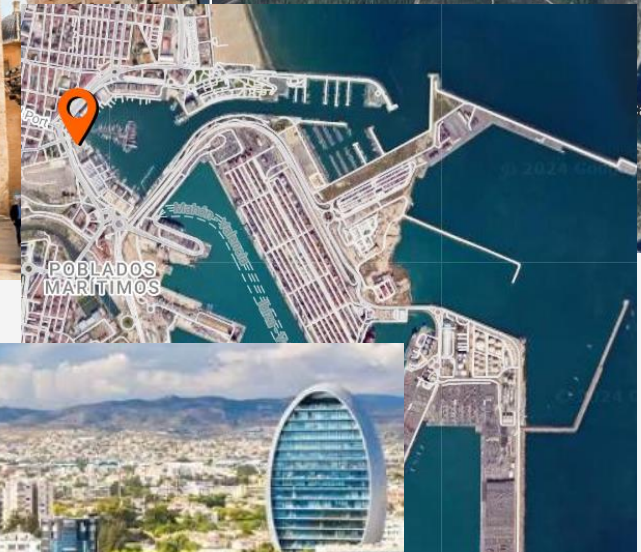
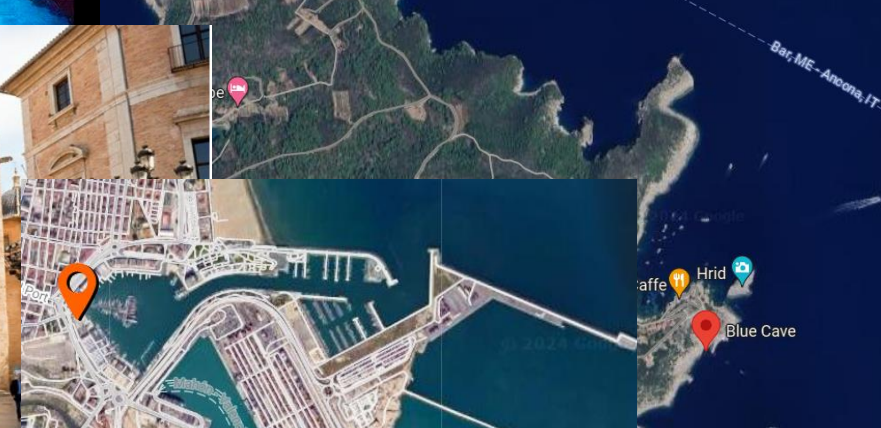
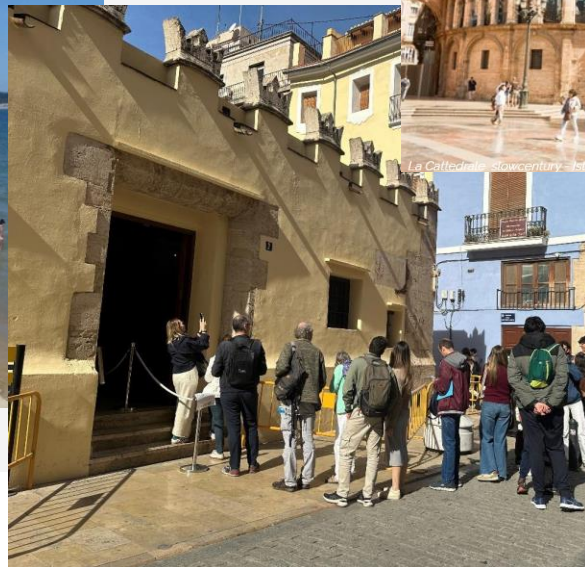
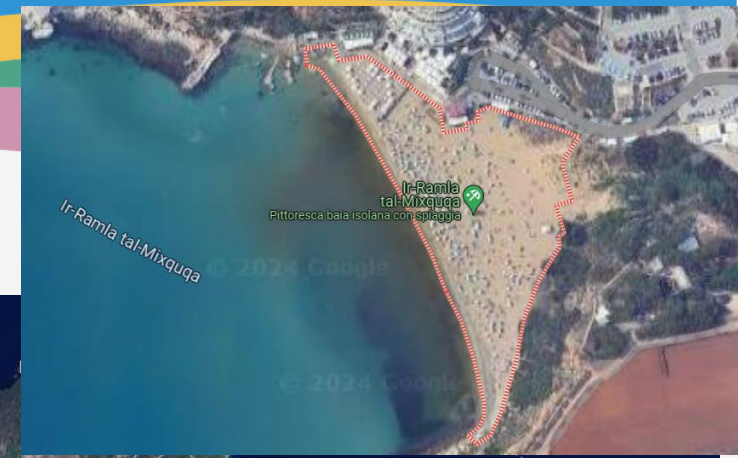
TOURism Innovative and Sustainable Management of fLOws





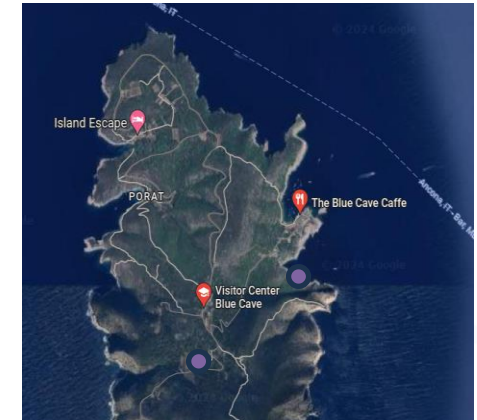
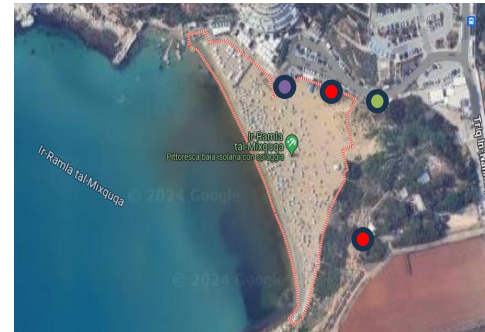
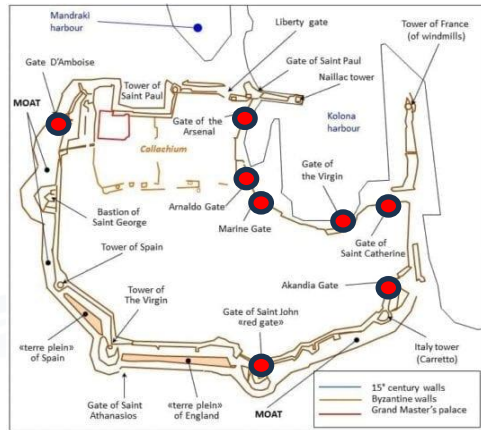
# • Pilots of Snap4City on:

- Greece - READ S.A.: Rodi
- Italy – FRI, UNIFI: Firenze
- Spain – FV, FSMLR: Valencia
- Cyprus – ANELEM: Limassol
- Bulgaria – VEDA: Varna
- Croatia – RERA SD: Splitsko-dalmatinska županija
- Malta – MRDDDF: La Valletta





# TOURISMO INTERREG ACTION OF THE EC

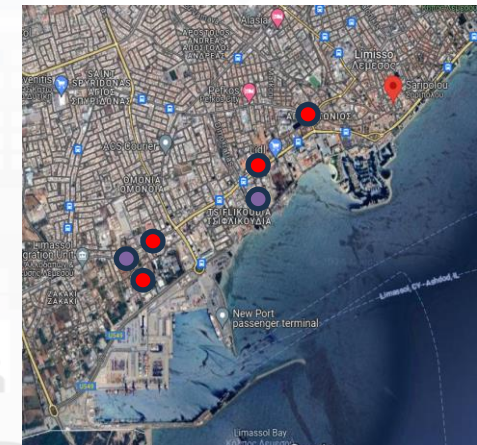


Interreg  
Euro-MED



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TOURISMO







# Rhodes (Greece) – Scenario: Medieval city







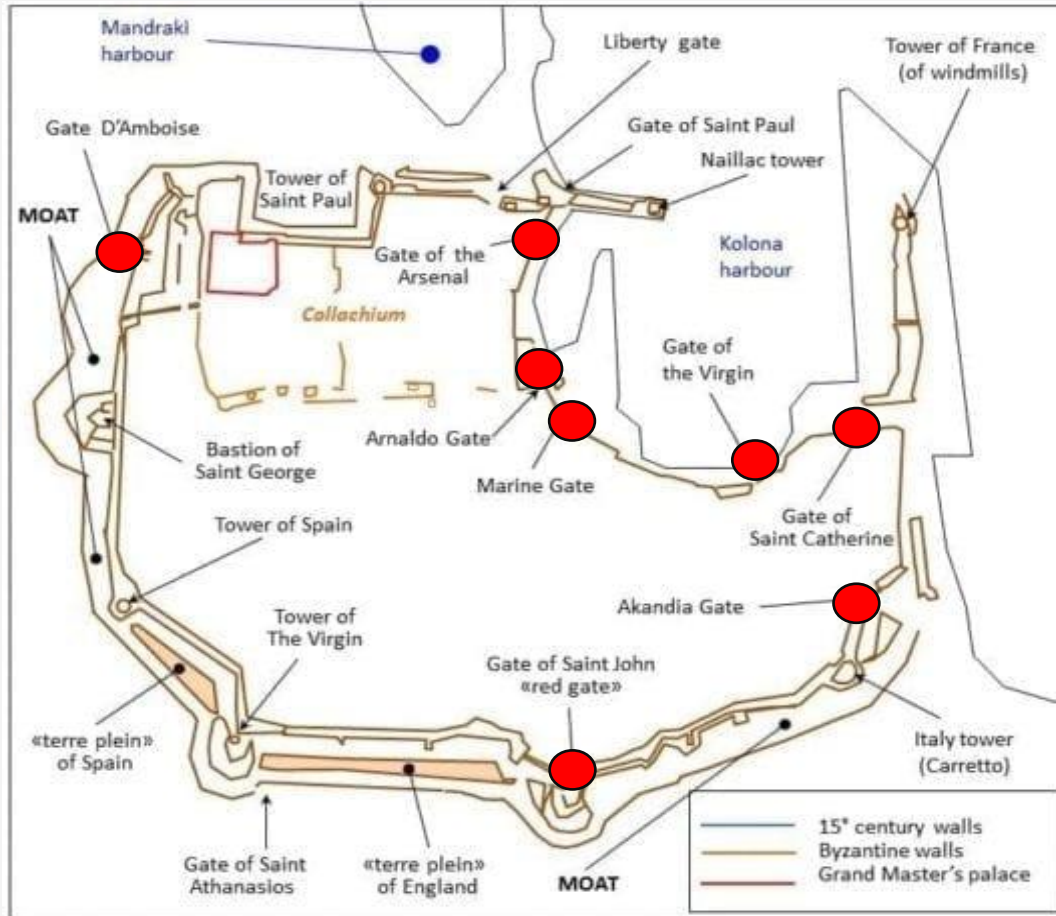
# Rhodes (Greece) – Scenario: Medieval city

## Target:

Medieval City's carrying capacity by comparing the data from higher and lower tourist seasons

## Equipment:

- 8 Thermal cameras, one for each gate of Medieval City







# Valencia (Spain) – Scenario: Valencia Port







# Valencia (Spain) – Scenario: Valencia Port



## Target:

Anticipate and develop methods to analyse the situation regarding the flow of cruise tourists, identify trends, and manage the tourist flows to prevent future overcrowding.

## Equipment:

- 2 Thermal cameras ●
- 3 Pax counters ●







# Valencia (Spain) – Scenario: Historic City Centre







# Valencia (Spain) – Scenario: Historic City Centre



## Target:

Monitor the impact of tourism on the architectural heritage of Valencia's historic centre: real-time occupancy in La Lonja and in the Museum of the City (Palacio del Marqués de Campo)



## Equipment:

Indoor pax counters: Entrance and exit sensors in the buildings





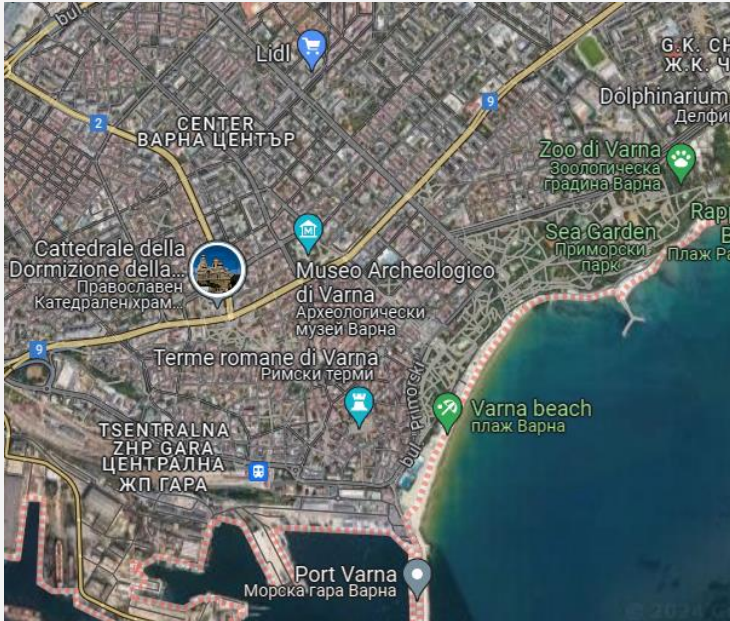
# Varna (Bulgaria) – Scenario: City Centre







# Varna (Bulgaria) – Scenario: City Centre



**Target:** Data collection and processing of the tourists' flows in key locations of the city of Varna to analyse crowd density and queue formations

**Equipment:** Drones: people flows images during the day







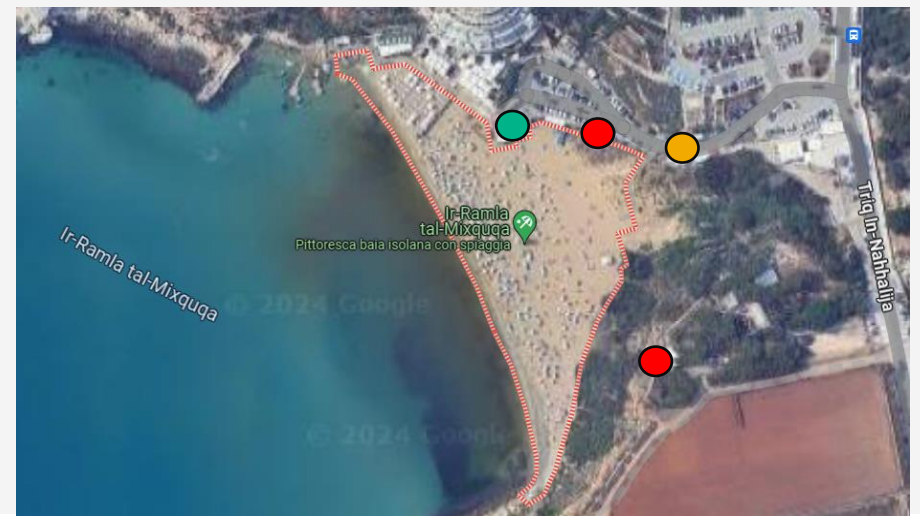
# Malta – Scenario: Golden Bay



**Target:** Visitor behaviour analysis at the Golden Bay, with the intention of proposing a carrying capacity limit during peak seasons for conservation policy recommendations.

**Equipment:**

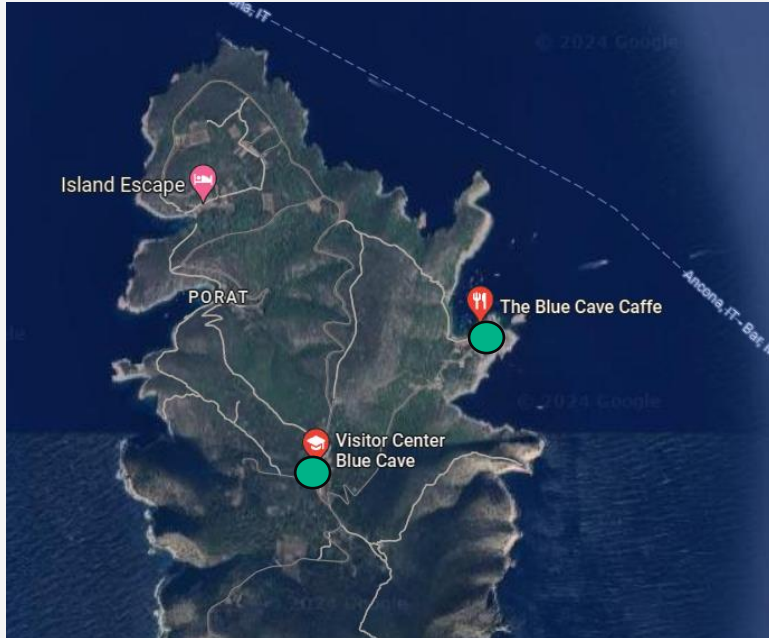
- 2 Thermal Cameras ●
- 4 Pax counters ●
- 1 Traffic counter ●







# Croatia – Scenario: Island of Biševo



**Target:** Achieve sustainable tourism on the islands of Biševo and Komiža by covering the flow of guests entering the famous ‘Blue cave’ on Biševo island.

## **Equipment:**

2 Pax counters:  
sniffer counting  
devices ●







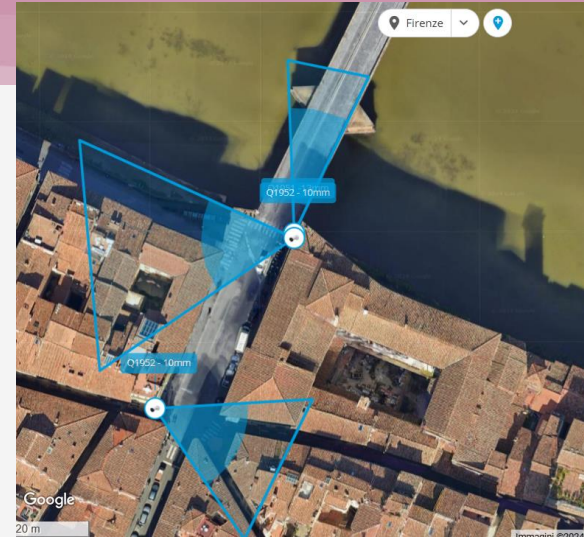
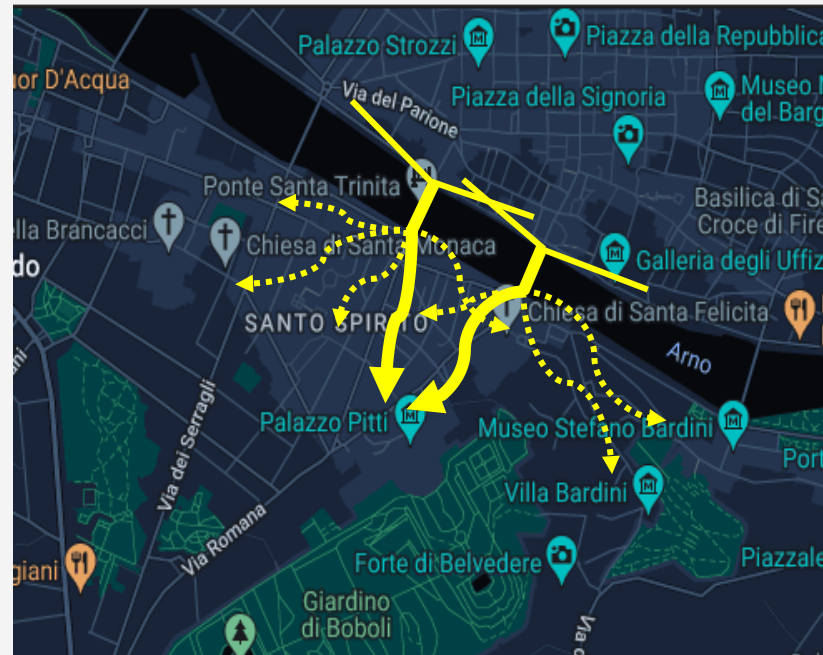
# Florence (Italy) – Scenario: City Centre







# Florence (Italy) – Scenario: City Centre



## Target:

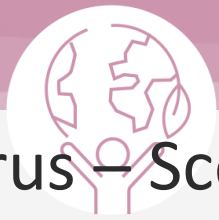
Anticipate and mitigate negative or unexpected unknown events, predict flows and virtuously orient them

## Equipment:

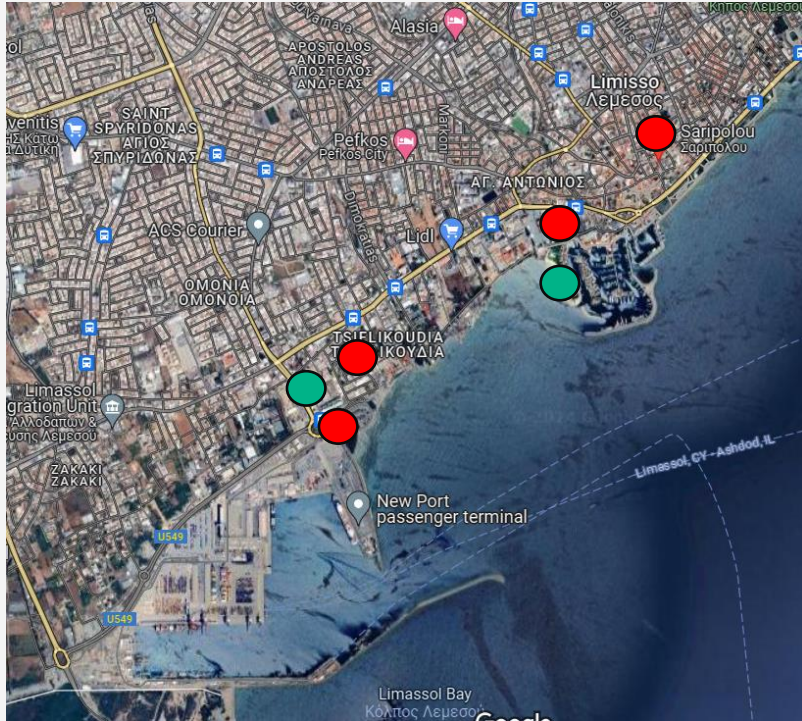
- 2 Thermal cameras
- 3 Pax counters: sniffer
- counting devices







# Cyprus – Scenario: Limassol Port



**Target:** Measure and Analyse the Tourist flow within Old port of Limassol and Port of Limassol. Understand the patterns of tourist movement and behaviours.



## Equipment:

- 4 Thermal cameras ●
- 10 Pax counters ●





# SNAP4CITY



CITY



INDUSTRY



ARTIFICIAL INTELLIGENCE

SNAP4CITY AND KM4CITY PROJECTS

FROM CITY DASHBOARD TO APPLICATIONS



SASUAM, OPTIFaas



LUTECH



UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II



CAI4DSA



AMMIRARE



MARITTIMO-IT FR-MARITIME



UNIVERSITÀ DEGLI STUDI DI CAGLIARI



ASM Merano Stadtwerke Meran



Città di Cuneo



Rodhes



Santa María la Real fundación



FUNDACIÓN VALENCIAPORT



READ S.A. Development Agency of South Aegean Region

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Joint Research Centre



FREE TRIAL



AP4CITY THE W OF THE MINISTRATORS