100% OPEN SOURCE

EU GDPR COMPLIANT

PEN Test Passed

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

SNAP4 Appliances and Dockers Installations

SNAP4CITY

KM4CITY



Be smart in a SNAP!

LIVING LAB

General Overview



16 January 2021, Course
https://www.snap4city.org/577

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES

UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DEPARTMENT OF INFORMATION ENGINEERING | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

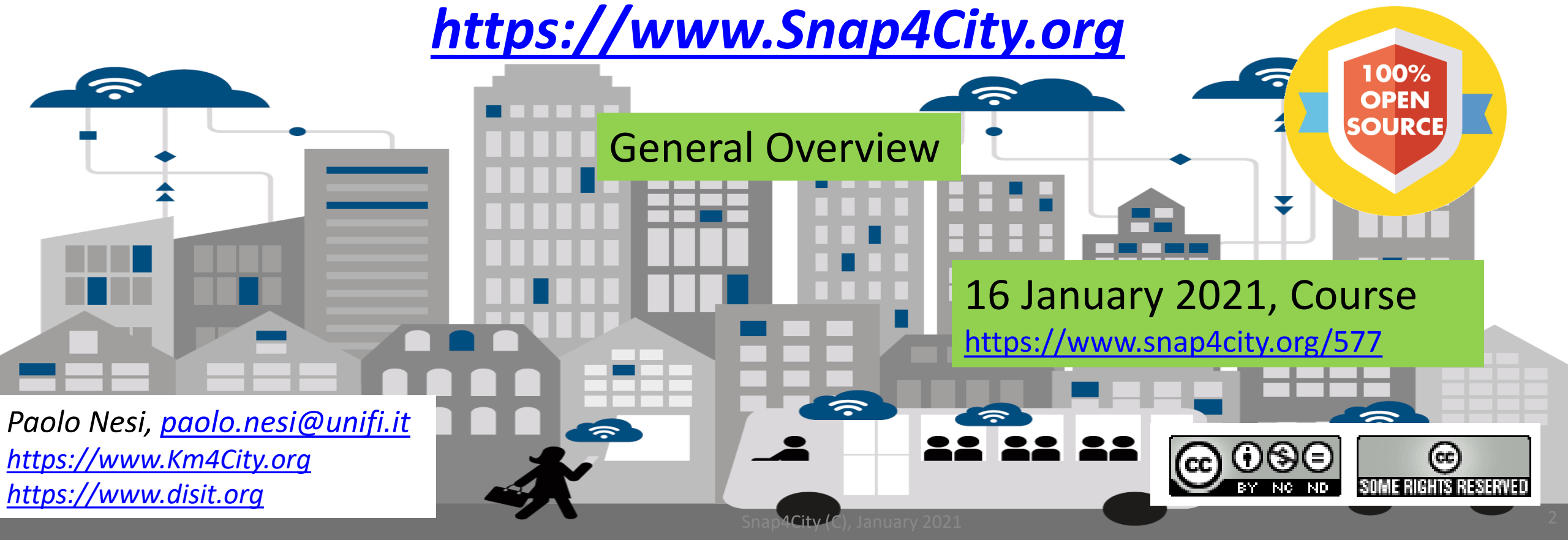
UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

SNAP4CITY

Powered by KM4CITY

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

https://www.Snap4City.org



General Overview

16 January 2021, Course
https://www.snap4city.org/577

Paolo Nesi, paolo.nesi@unifi.it
https://www.Km4City.org
https://www.disit.org

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SNAP4CITY
www.snap4city.org

KM4CITY

Powered by FIWARE

SNAP4 Appliances and Dockers Installations

FREE TRIAL

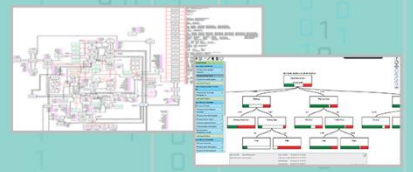
PEN Test Passed

EU GDPR COMPLIANT

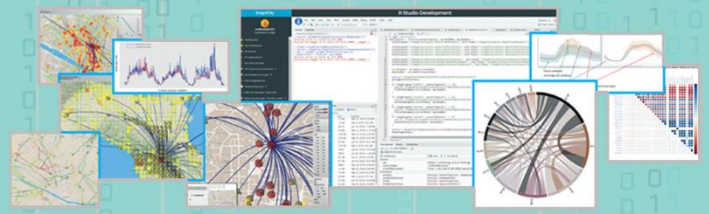
100% OPEN SOURCE



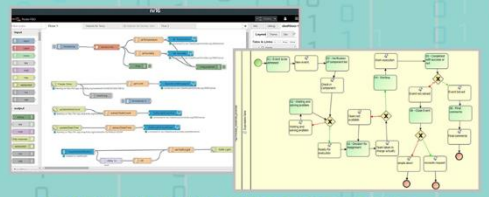
DASHBOARDS AND APPS - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS



EXPERT SYSTEM
KNOWLEDGE BASE
STORAGE



BIG DATA ANALYTICS
ARTIFICIAL INTELLIGENCE
BUSINESS INTELLIGENCE
MACHINE LEARNING

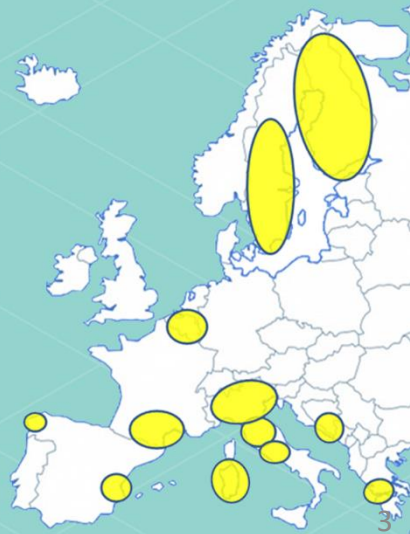


DATA FLOWS, WORKFLOWS
MICROSERVICES
MANAGEMENT



METHODOLOGIES
COURSES AND COMMUNITY
LIVING LABS
DEVELOPMENT TOOLS





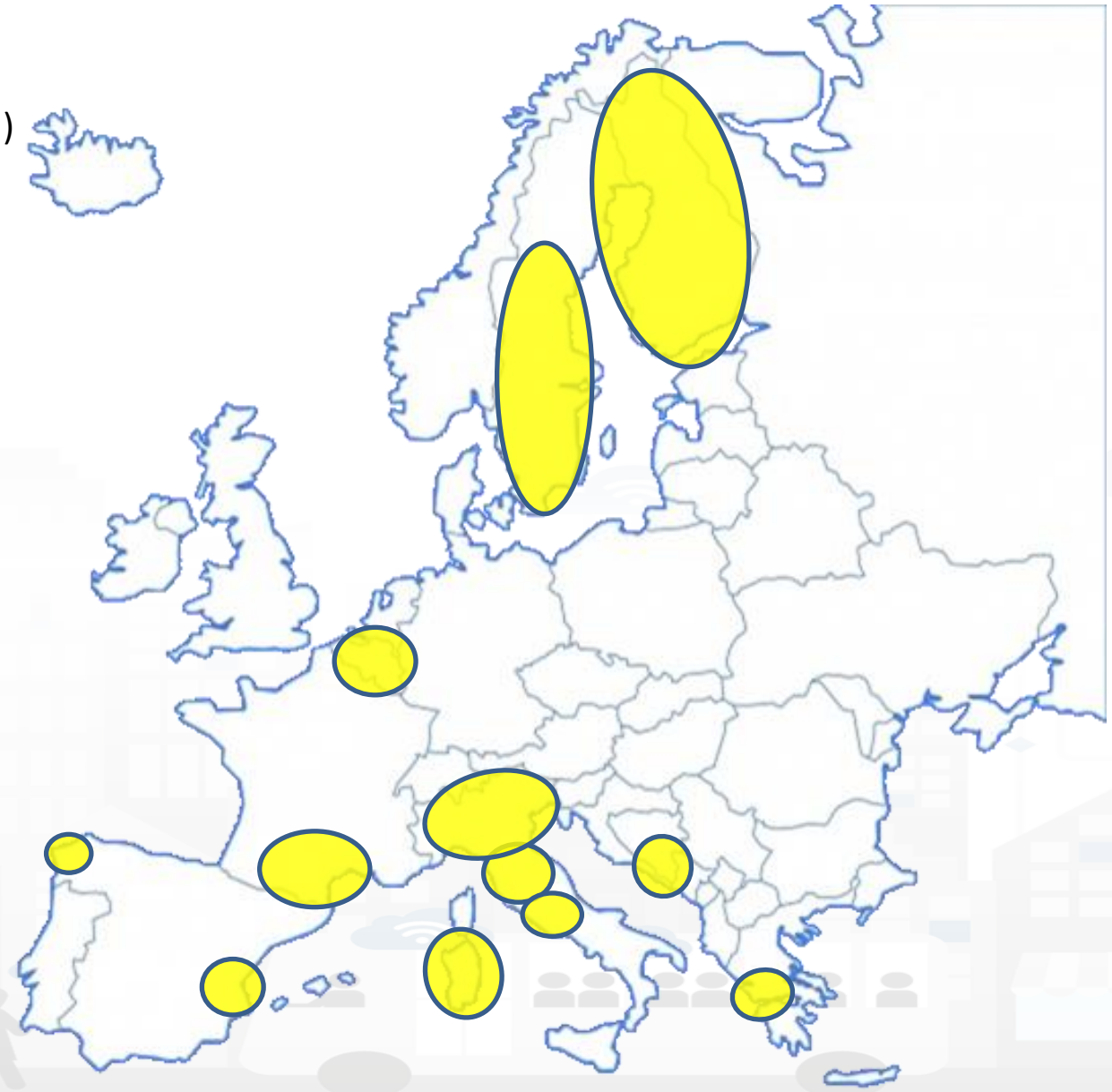
Snap4City/Industry structure

- The **Snap4xxxx** solution is released in Open Source, VM and Docker with fully support of MultiTenant/multiple-Organizations
  - Each Organization may be configured for a separate environment with a set of Maps, Menus, Users, Data, Dashboards, IOT Apps, MicroApplications, Custom Widgets, Models, resources, open data, etc.
- **Https://www.Snap4City.ORG** is the main instance of Snap4xxxx solution managed by DISIT Lab. The main documentation is located and updated on Snap4City.org, GitHUB, dockerHub and Node-Red Library. Snap4City.org is where the last tools are tested and news published.
  - Organizations on Snap4City.org have been created with contracts as for *Platform as a Service*, for testing and for providing *SmartCity as a Service* as well as *Industry 4.0 as a Service*

Coverage 2020

Main Organizations/areas

- Antwerp area (Be)
- Capelon (Sweden: Västerås, Eskilstuna, Karlstad)
- DISIT demo (multiple)
- Dubrovnik, Croatia
- Firenze area (I)
- Garda Lake area (I)
- Helsinki area (Fin)
- Livorno area (I)
- Lonato del Garda (I)
- Modena (I)
- Mostar, Bosnia-Herzegovina
- Pisa area (I)
- Pont du Gard, Occitanie (Fr)
- Roma (I)
- Santiago de Compostela (S)
- Sardegna Region (I)
- SmartBed (multiple)
- Toscana Region (I), SM
- Valencia (S)
- Venezia area (I)
- WestGreece area (Gr)



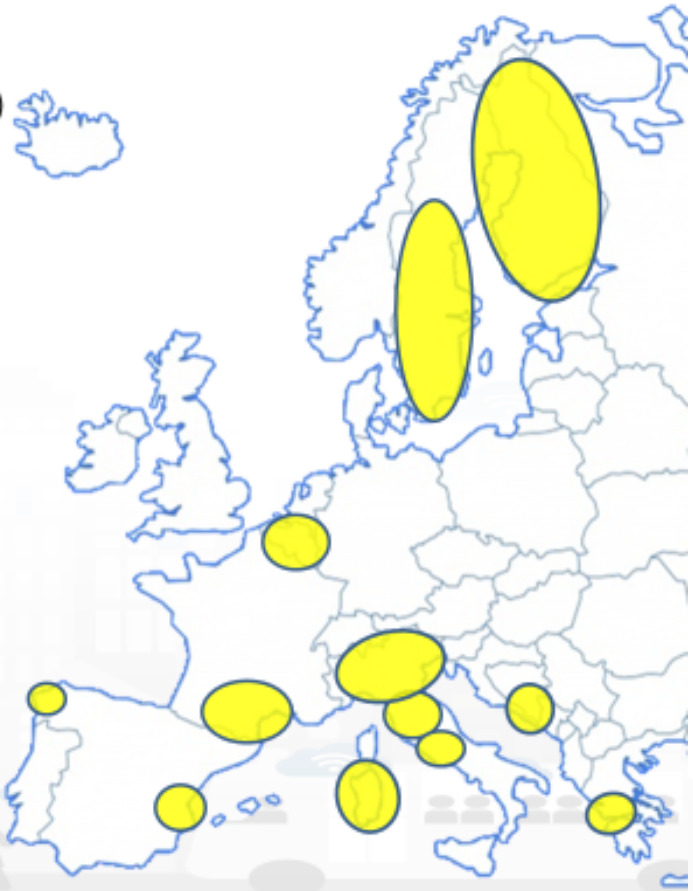
Snap4City/Industry Community

- Most of Organizations on Snap4City.org also correspond to companies or institutions that have an installation of Snap4City tools on their Premise,
  - such as: Pisa, SmartGarda Lake, Snap4, ALTAIR, etc.
- This double way allows them to:
  - test the news,
  - share experiences with other groups,
  - get visibility,
  - work in the collaborative environment, and
  - be better supported by Snap4City.org and DISIT Lab personnel.
- Each instance of Snap4xxxx solution ***can decide to join the federation*** of SmartCity API to exploit shared data.
  - This allows to exploit regional data for city installations applications (web, mobile, dashboards, etc.) without reloading them for example.

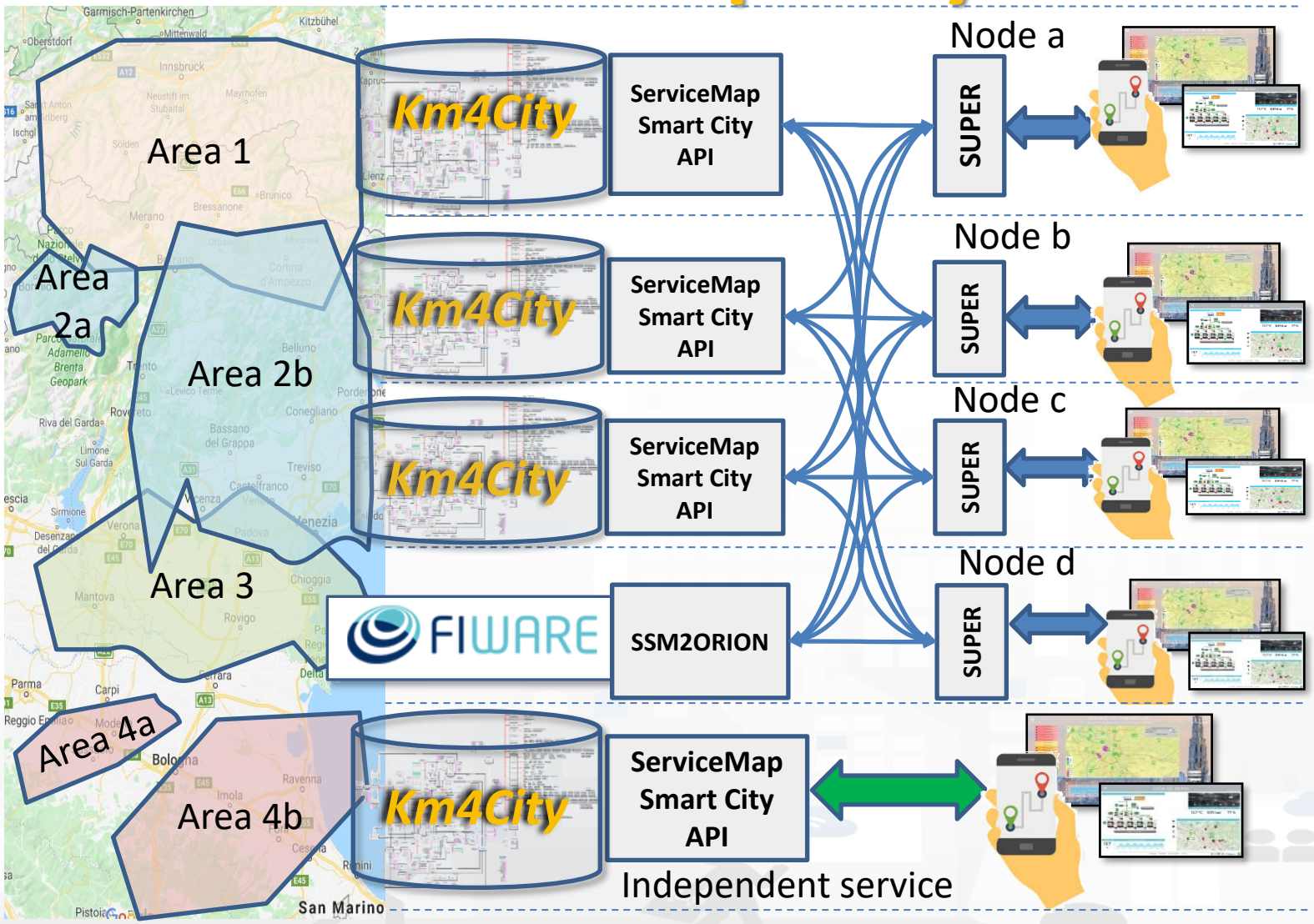
Main Organizations/areas

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- SmartBed (multiple)
- Toscana Region (I), SM
- Valencia (S)
- Venezia area (I)
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Snap4City (C), October 2020



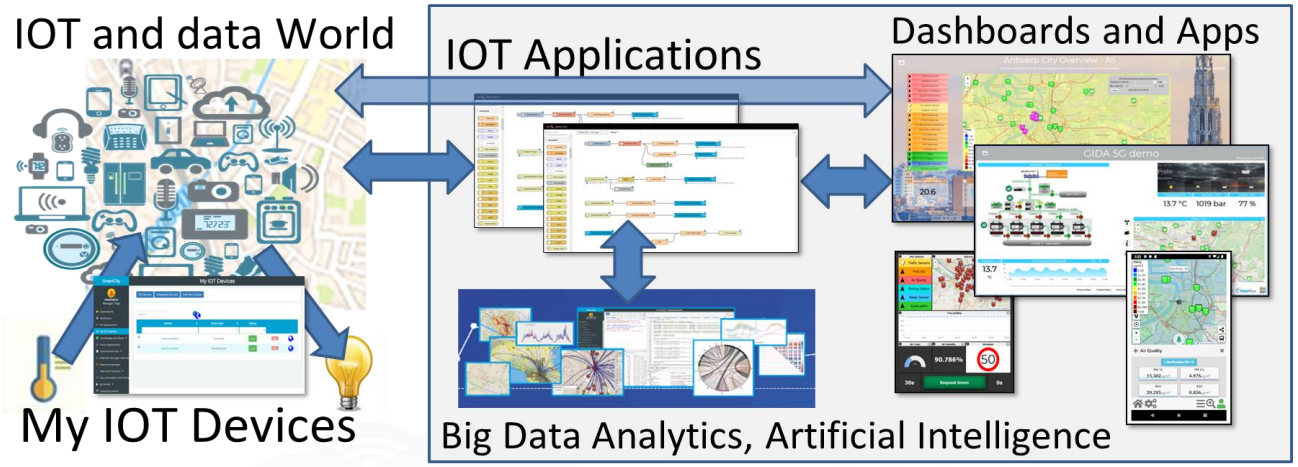
Federation of Snap4City Services



- A Mobile App may refer to one Smart City API Server (for Area 1) via SUPER and receive data from the Federated SUPERS (Area 2) if navigation, queries, etc. are leading to discover out of the addressed KB.
  - SUPER can be used for creating redundant and/or balanced distributed solutions for Federated KB. See Area 2, the two KB in the front.
  - Federated SUPER can have overlapped KB even totally.
  - A Mobile App can be developed to support multiple Smart City API servers, for balancing and
- The usage of Super is not mandatory so that separate services can be produced as well
- Super and Nodes presents the same Smart City APIs.

Free Trial

- Register on WWW.snap4city.org
  - Subscribe on **DISIT Organization**
- **You can:**
  - Access on basic Tools
  - Access to a large volume of Data
  - Create Dashboards
  - Create IOT Applications
  - Connect your IOT Devices
  - Exploit Tutorials and Demonstrations



IF you need to go more in deep you can ask us to pass at the next Role becoming full AreaManager with full rights of development, also for Data Analytics, machine learning, etc.

https://www.snap4city.org/577

On Line Training Material (free of charge)

	1st part (*)	2nd part (*)	3rd part (*)	4th part (*)	5th part (*)	6th part (*)	7th part (*)
what	General	Dashboards	IOT App, IOT Network	Data Analytics	Data Ingestion processes	System and Deploy Install	Smart City API: Web & Mob. App
PDF							
Inter active							
Video1							
Video2							
Video3							
Video4				none		none	none
duration	2:55	3:16	3:41	2:00	2:48	2:35	1:47


SNAP4city
Be smart in a SNAP!
LIVING LAB
9 July 2019, 2° Training day of 3 Florence
Coll@bora
Welcome: how to start using Snap4City for beginners
We suggest you:
Search
Organization Groups
Recent content

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SNAP4CITY | KM 4 CITY



SMART CITY EXPO WORLD CONGRESS

19-21 November 2019 - Barcelona

See you at Snap4City Stand A118

General Overview of the full Course

- ***1st part:*** *General Overview*
- ***2nd part:*** *Dashboards Creation and Management*
- ***3rd part:*** *IOT Applications development, IOT Devices, IOT Networks*
- ***4th part:*** *Data Analytics, in R Studio, in Python, how to Exploit and Manage Data Analytics in IOT Applications*
- ***5th part:*** *Data Ingestion, Data Warehouse, Data Gate, IOT Device Data ingestion, IOT App for Data Ingestion, etc.*
- ***6th part:*** *Snap4City Architecture, How To Install and Manage Snap4City*
- ***7th part****: Smart city API (internal and external) Web and Mobile App development tool kit*

A number of the training sections include exercitations

Updated versions on: https://www.snap4city.org/577

See also courses in ITALIANO: https://www.snap4city.org/485

this part Agenda

- GO • Overview
  - Examples of: Firenze, Helsinki, Pisa, Livorno, Antwerp, Santiago, Lonato, etc..
- GO • Urban Platform (main concepts vs Living Lab)
- GO • Snap4City Architecture
- GO • Dashboards: from City Dashboards to Applications (overview)
  - Demo Control Room for Decision Makers and for Operators
  - Real time tracking
  - Dashboard Intelligence
  - Smart City Control Rooms
- GO • Data Gathering and City Data Knowledge Management (overview)
  - interoperability
- GO • IOT Applications, Devices and Dashboards (Overview)
- GO • Forging & Managing Flexible Mobile Apps, Web App, MicroApplications (Overview)
- GO • Data Analytic, Big Data Science (Overview)
- GO • Snap4City Living Lab for Collaborative Work (overview)
  - Development environment, tools, GDPR
- GO • Snap4City and Km4City Projects
- GO • Acknowledgment

TOP

Platform Real Cases



100% OPEN SOURCE

SNAP4 Appliances and Dockers **Installations**

Florence



Smart City Control Room
Florence Metropolitan City

COMUNE DI FIRENZE

reference

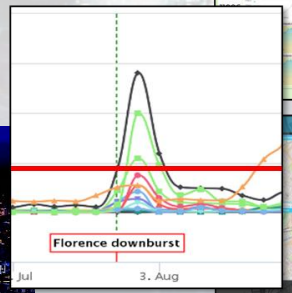
SNAP4CITY

KM 4 CITY

- **Multiple Domain Data**
  - mobility and transport, accidents, public transport, parking, traffic flow, Traffic Reconstruction, …
  - civil protection, gov data, covid-19, social & social media, people flow, tourism, energy, …
- **Multiple dash/tool Levels & Decision Makers**
- **Historical and Real Time data**
  - Billions of Data
  - Predictions, what-if analysis
- **Services Exploited on:**
  - Multiple Levels, Mobile Apps, API
- **Since 2017**











http://www.darionardella.it/il-sindaco-dario-nardella-in-missione-a-madrid-e-barcellona/

Firenze Oggi 2019

Fri 25 Oct 23:29:38

43666
Totale utenti WIFI

COLONNINE RICARICA
176 INSTALLATE
71 % ATTIVE
5.1 % IN USO

GENERAL | METEO

MINIMO	BASSO	MEDIO	ALTO

RISCHIO IDRAULICO
RISCHIO TEMPORALI
RISCHIO IDROGEOLOGICO
RISCHIO NEVE
RISCHIO GHIACCIO
RISCHIO VENTO

SITUAZIONE VIABILITA
0 INCIDENTI
0 CHIUSURE AL TRAFFICO (TOT)
0 CHIUSURE PER CANTIERI
0 PROGR. | 0 NON PROG.
0 LIMITAZIONI AL TRAFFICO (TOT)
0 LIMITAZIONI PER CANTIERI
0 NON PROG. | 0 PROGR.
0 TOT. EVENTI SULLA RETE

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

ANALYSIS
Energy | Environment | Mobility | Social | Resilience

FLUSSI INGRESSO CITTA
26 393.2 / 19 794.9 / 13 196.6 / 6598.3 / 0 — 12:00 — Current / Previous

TOTALE
284094
VEICOLI

FLUSSI INGRESSO ZTL
5522 / 4141.5 / 2761 / 1380.5 / 0 — 12:00 — Current / Previous

TOTALE ZTL
57499
VEICOLI

Nati Italiani	Nati stranieri	Deceduti	Matrimoni	Unioni Civili
163 ultimo mese consolidato	49 ultimo mese	395 ultimo mese	19 ultimi 7 giorni	0 ultimi 7 giorni

Segnalazioni ricevute in attesa	In Lavorazione	Risolte	Chiuse senza risoluzion...
1116 ultimo mese	524	305	285

Manutenzioni Stradali	Verde Pubbli...	Decoro Urbano	Relitti
54 oggi	4	6	3

Attesa media alla fermata

Linea 6	Linea 13
3 min	13 min
Linea 17	**Linea 23**
4 min	5 min
Linea 31	**Linea 36**
19 min	2 min

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTQzOA==

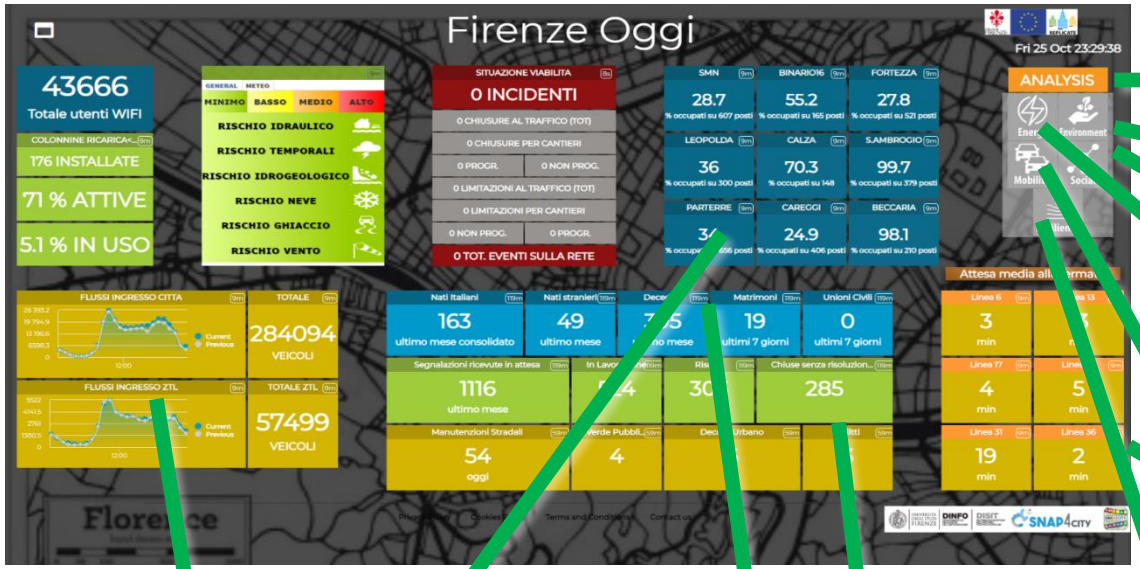
Smart City Control Room

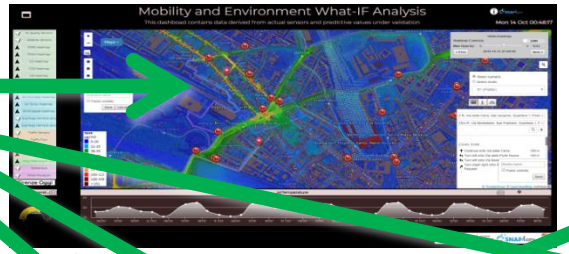
a set of dashboards and tools

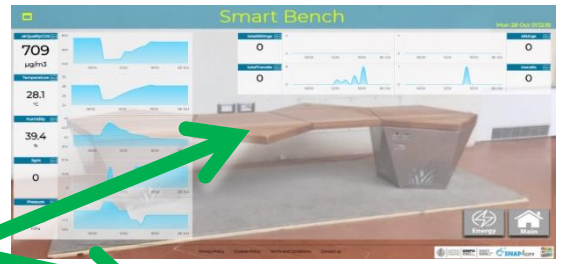
This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement Nº 691735

REPLICATE

FIRENZE CITTÀ FARO



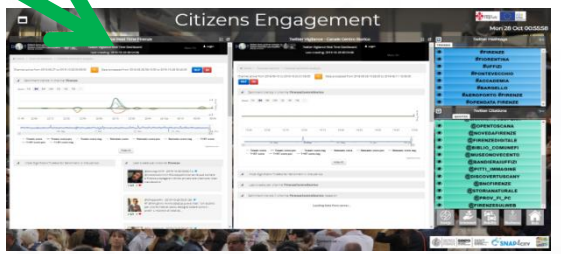


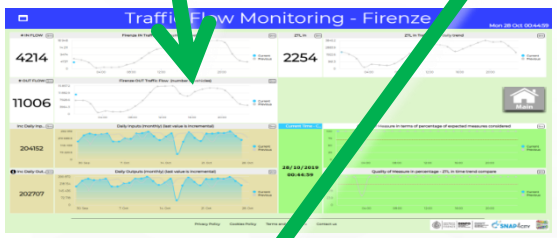




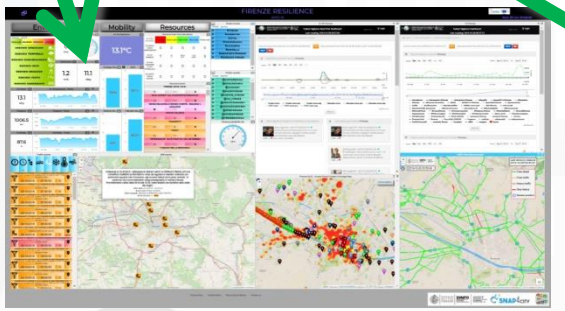


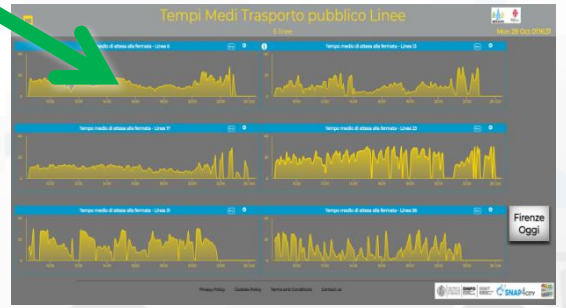
















Smart City Control Room (Data View)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement Nº 691735

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



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

Analysis:

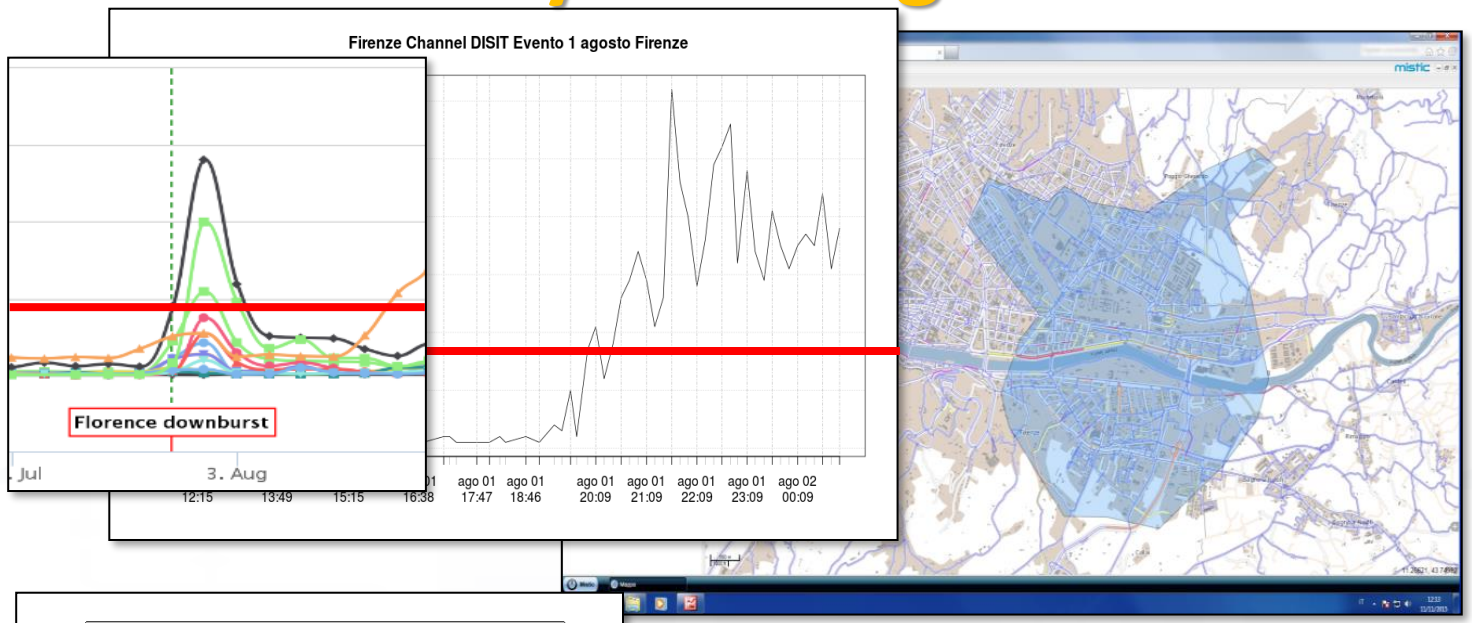
- what-if routing, scenarios,
- traffic flow, environmental predictions

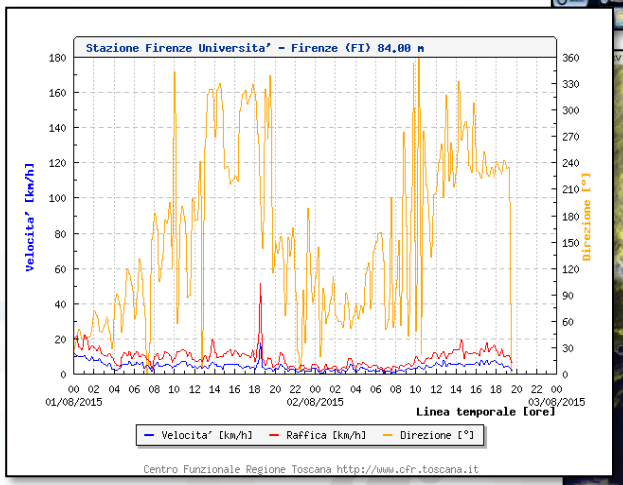


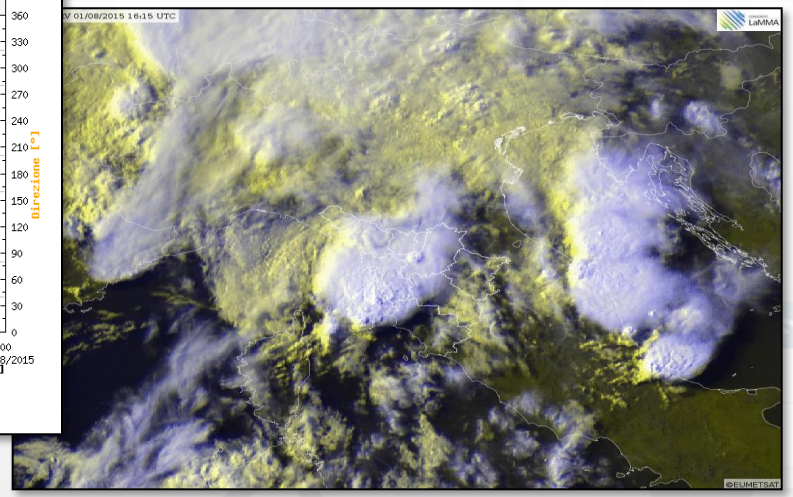
FIRENZE CITTÀ FARO

Twitter Vigilance

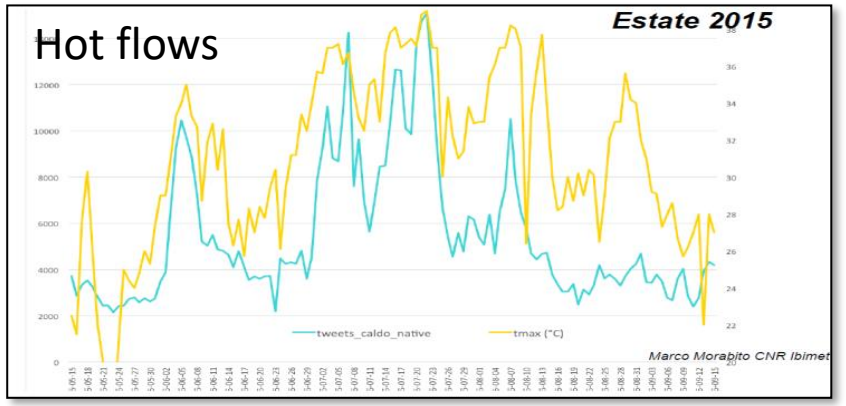
Early Warning







Predictive models



Attendance at long lasting events: EXPO2015

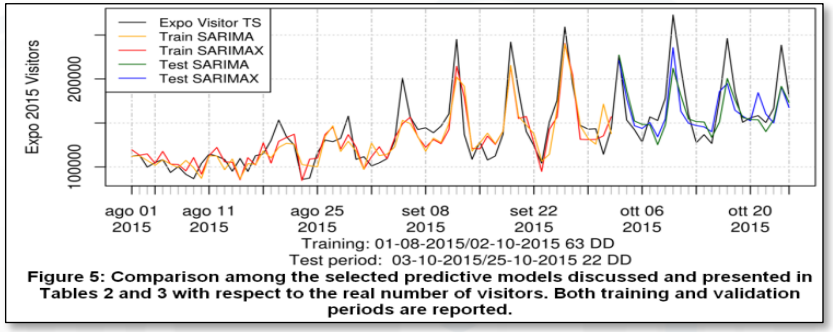
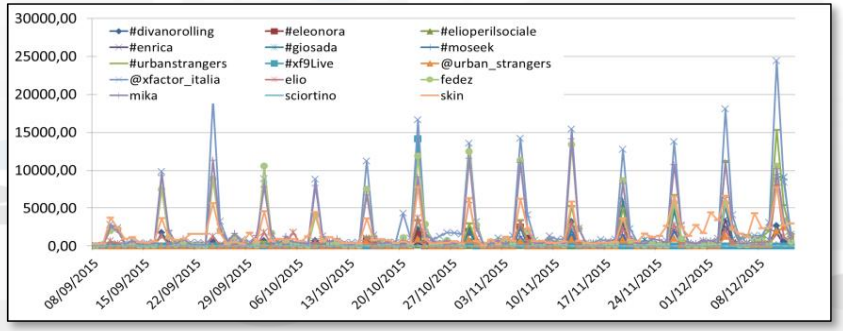
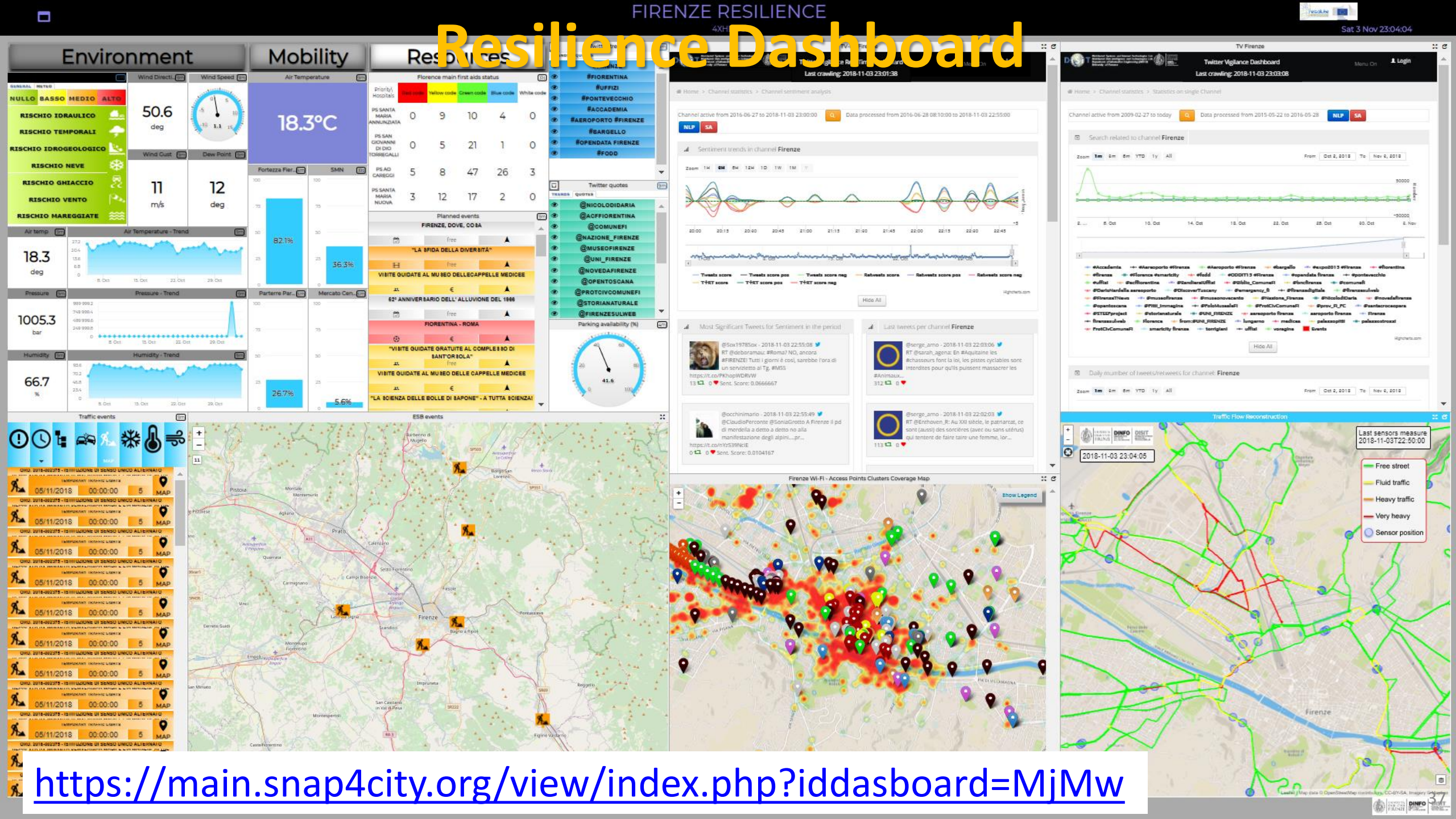


Figure 5: Comparison among the selected predictive models discussed and presented in Tables 2 and 3 with respect to the real number of visitors. Both training and validation periods are reported.

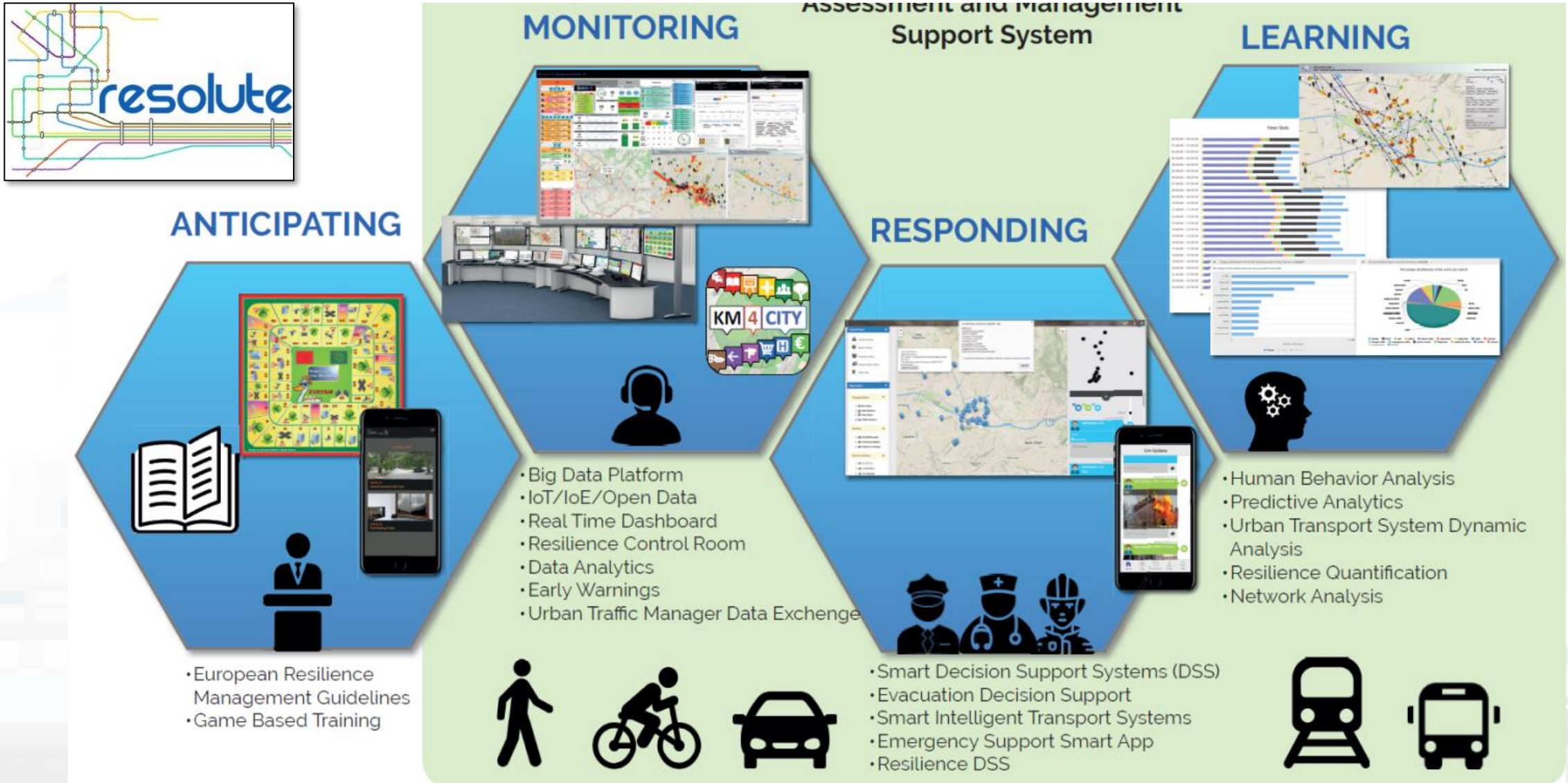
Attendance at recurrent events: TV, footbal




SIGNORVINO


FIRENZE RESILIENCE
Sat 3 Nov 23:04:04
Resilience Dashboard
Environment
Mobility
Resources
RISCHIO IDRAULICO
RISCHIO TEMPORALI
RISCHIO IDROGEOLOGICO
RISCHIO NEVE
RISCHIO GHIACCIO
RISCHIO VENTO
RISCHIO MAREGGIATE
50.6 deg
11 m/s
12 deg
18.3°C
18.3 deg
1005.3 bar
66.7 %
Florence main first aids status
PS SANTA MARIA ANNUNZIATA 0 9 10 4 0
PS SAN GIOVANNI DI DIO TORREGALLI 0 5 21 1 0
PS AD CAREGGI 5 8 47 26 3
PS SANTA MARIA NUOVA 3 12 17 2 0
Planned events
FIRENZE, DOVE, COSA
"LA SFIDA DELLA DIVERSITÀ"
VISITE GUIDATE AL MUSEO DELLECAPPELLE MEDICEE
62° ANNIVERSARIO DELL' ALLUVIONE DEL 1966
FIORENTINA - ROMA
"VISITE GUIDATE GRATUITE AL COMPLESSO DI SANTORSOLA"
VISITE GUIDATE AL MUSEO DELLE CAPPELLE MEDICEE
"LA SCIENZA DELLE BOLLE DI SAPONE" - A TUTTA SCIENZA!
#FIORENTINA
#UFFIZI
#PONTEVECCHIO
#ACCADEMIA
#AEROPORTO #FIRENZE
#BARGELLO
#OPENDATA FIRENZE
#FOOD
Twitter quotes
@NICOLODIDARIA
@ACFFIORENTINA
@COMUNEFI
@NAZIONE_FIRENZE
@MUSEOFIRENZE
@UNI_FIRENZE
@NOVEDAFIRENZE
@OPENTOSCANA
@PROTCIVCOMUNEFI
@STORIANATURALE
@FIRENZESULWEB
Parking availability (%)
Traffic events
ESB events
Firenze Wi-Fi - Access Points Clusters Coverage Map
Show Legend
TV Firenze
Twitter Vigilance Dashboard
Last crawling: 2018-11-03 23:03:08
Traffic Flow Reconstruction
Last sensors measure 2018-11-03T22:50:00
2018-11-03 23:04:06
Free street
Fluid traffic
Heavy traffic
Very heavy
Sensor position
https://main.snap4city.org/view/index.php?iddasboard=MjMw

ERMG: European Resilience Management Guide

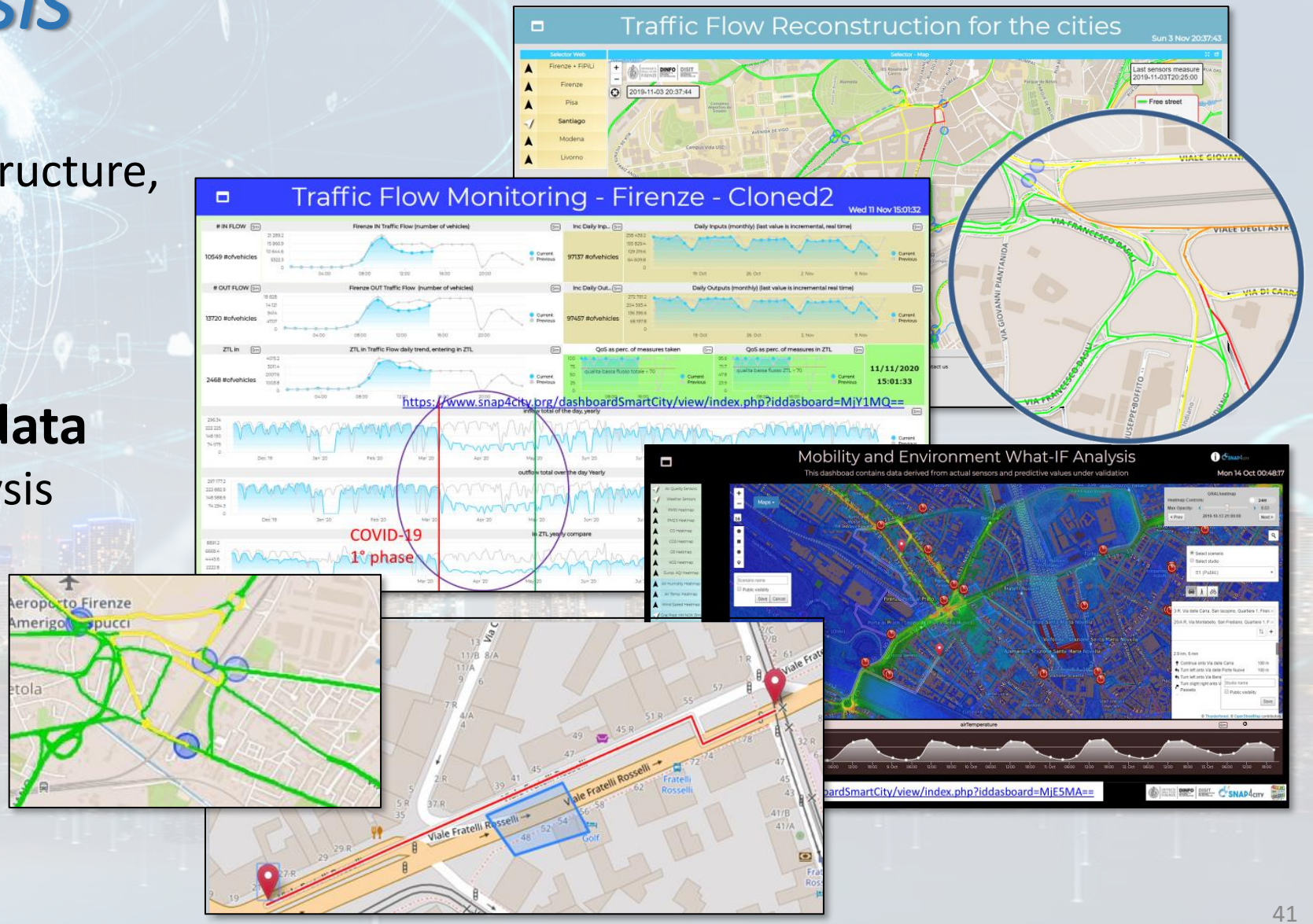


Mobility and Transport
Traffic Flow Analysis

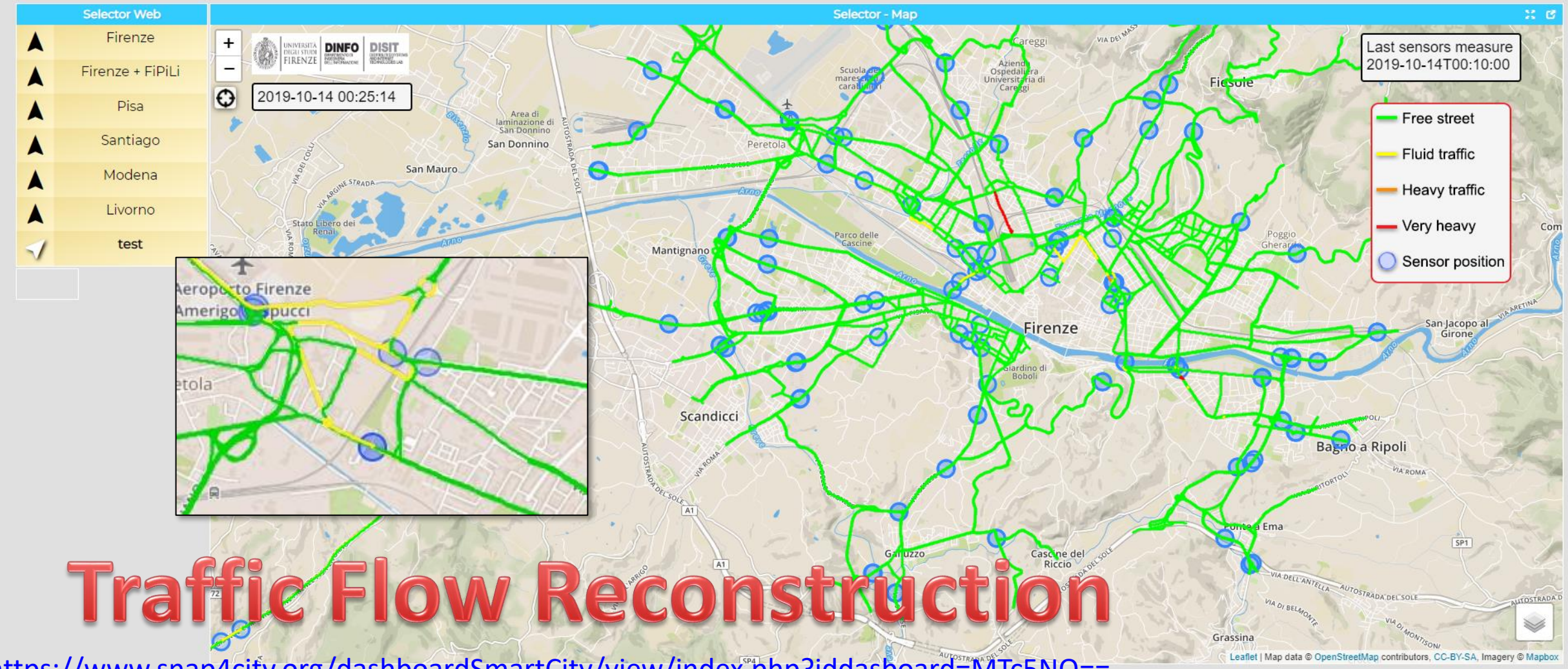
- **Multiple Domain Data**
  - Traffic Flow sensors, city structure, weather
- **Decision Makers Multiple Locations**
- **Historical and Real Time data**
  - Dashboards, What-IF analysis
  - Traffic Flow Predictions, Reconstructions, routing
- **Services Exploited on:**
  - Dashboards, Mobile App
- **Since 2017, 2019**

Cities: Firenze, Pisa, Livorno, Modena, Santiago di Compostela

reference



Traffic Flow Reconstruction for the cities



Traffic Flow Reconstruction

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc5NQ==

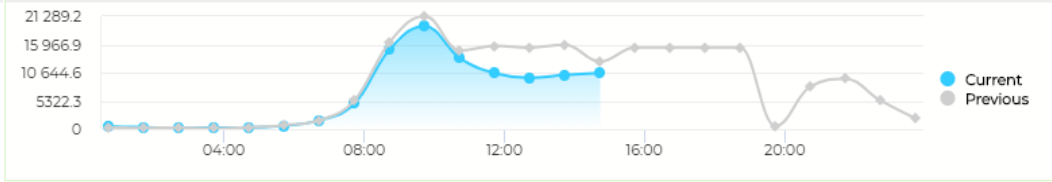
Traffic Flow Monitoring - Firenze - Cloned2

Wed 11 Nov 15:01:32

 # IN FLOW 9m

10549 #ofvehicles

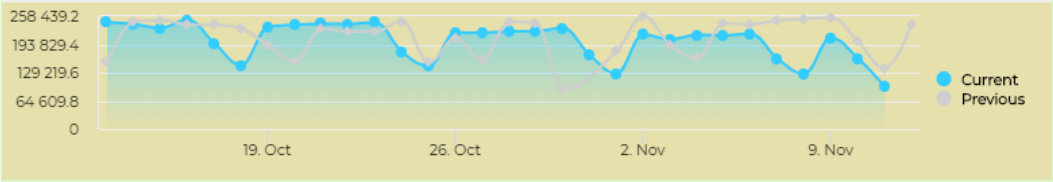
Firenze IN Traffic Flow (number of vehicles) 9m



Inc Daily Inp... 9m

97137 #ofvehicles

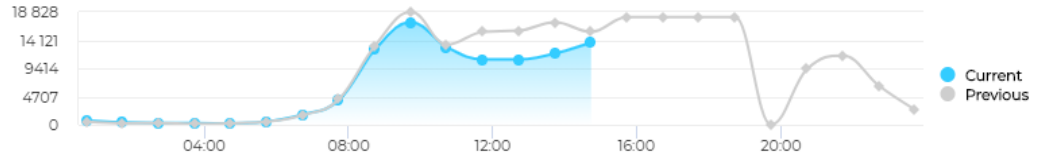
Daily Inputs (monthly) (last value is incremental, real time) 9m



 # OUT FLOW 9m

13720 #ofvehicles

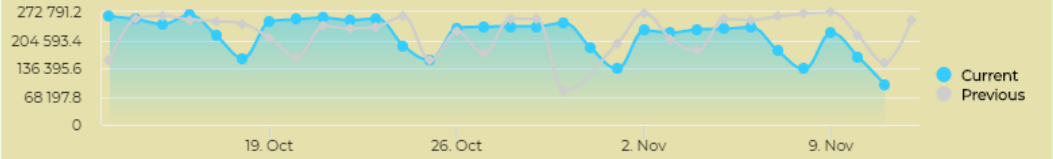
Firenze OUT Traffic Flow (number of vehicles) 9m



Inc Daily Out... 9m

97457 #ofvehicles

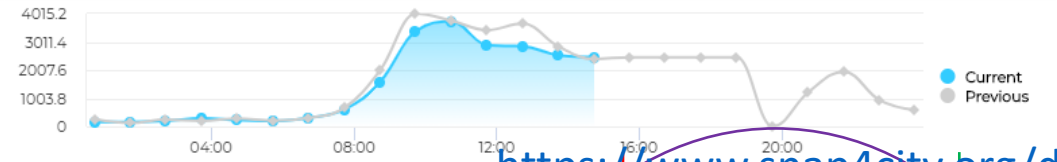
Daily Outputs (monthly) (last value is incremental real time) 9m



ZTL in 9m

2468 #ofvehicles

ZTL in Traffic Flow daily trend, entering in ZTL 9m



QoS as perc. of measures taken 9m



QoS as perc. of measures in ZTL 9m

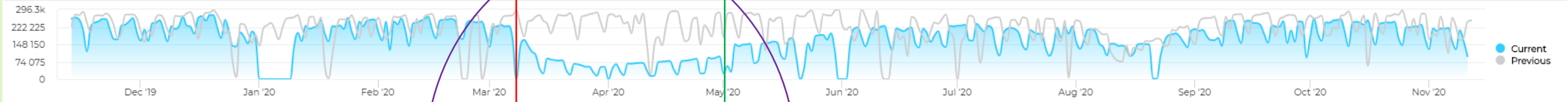


11/11/2020

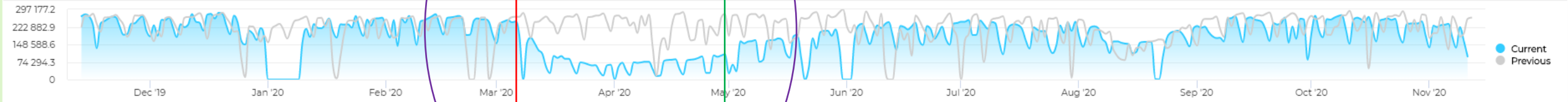
15:01:33

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjY1MQ==

inflow total of the day, yearly 9m



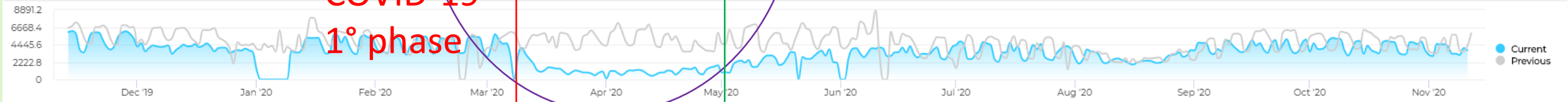
outflow total over the day Yearly 9m



COVID-19

1° phase

in ZTL yearly compare 9m



Mobility and Environment What-IF Analysis

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

Mon 14 Oct 00:48:17

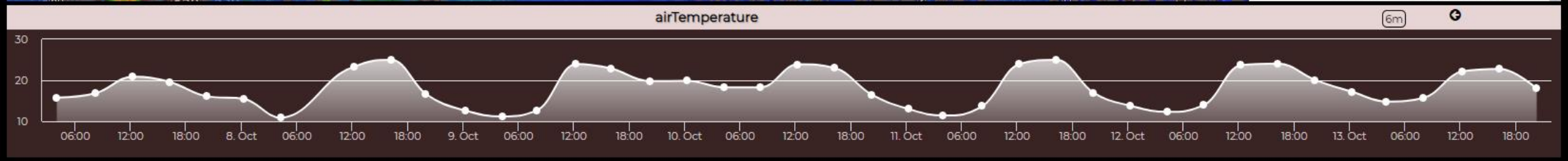
- Air Quality Sensors
- Weather Sensors
- PM10 Heatmap
- PM2.5 Heatmap
- CO Heatmap
- CO2 Heatmap
- O3 Heatmap
- NO2 Heatmap
- Europ. AQI Heatmap
- Air Humidity Heatmap
- Air Temp. Heatmap
- Wind Speed Heatmap
- Gral Pred. HM NOX (3m)
- Gral Pred. HM NOX (6m)
- Traffic Sensors
- Traffic Flow
- Cycling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

Firenze Oggi

Air Temperat... 6m







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

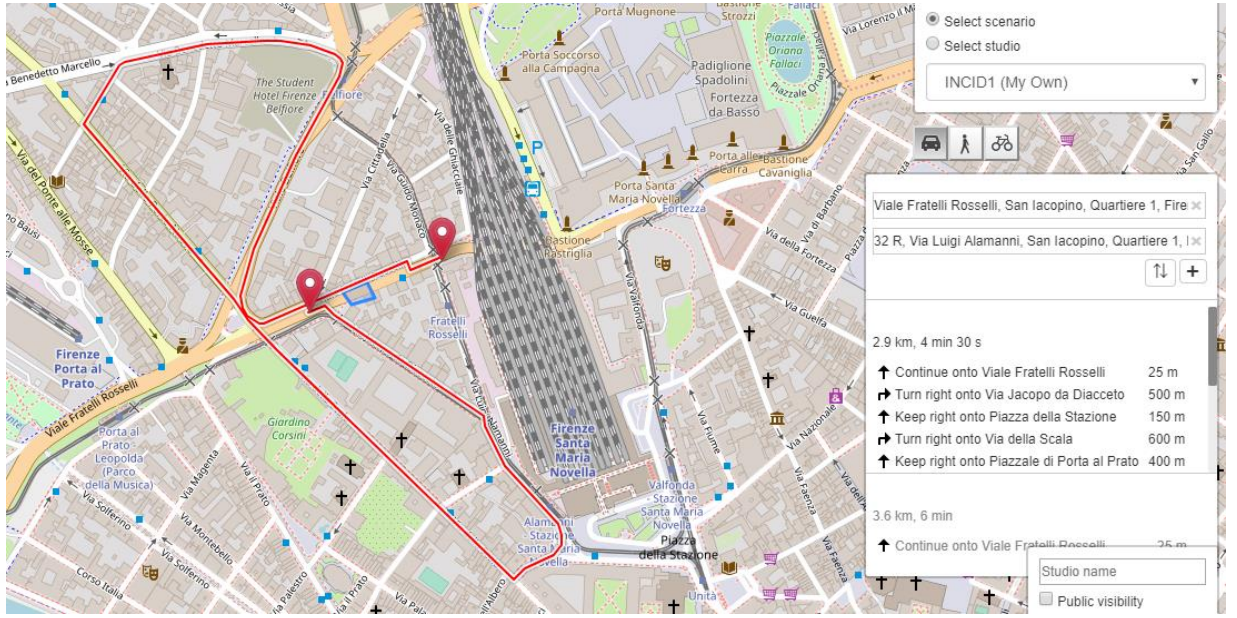
What-If Analysis

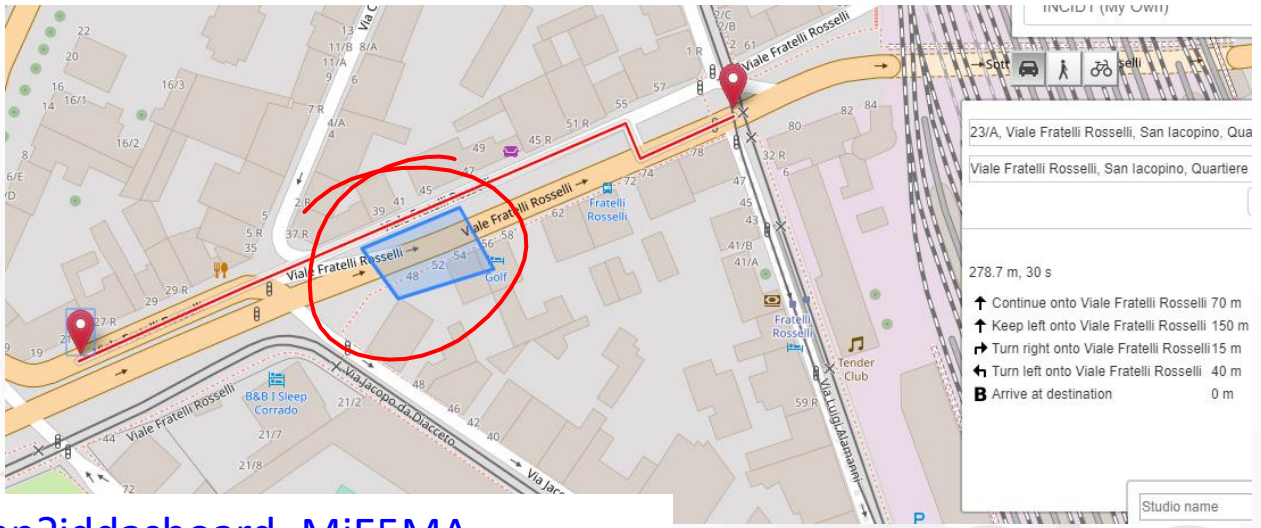
Accidents and elements blocking Points and Shapes taken into account for:

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

Assessment on the basis of changes:

- Mobility demand assessment
- Mobility Offer assessment





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

Tuscany Region

Firenze, Pisa, Livorno, Prato, etc.







Environment and Quality of Life
Air Quality Predictions

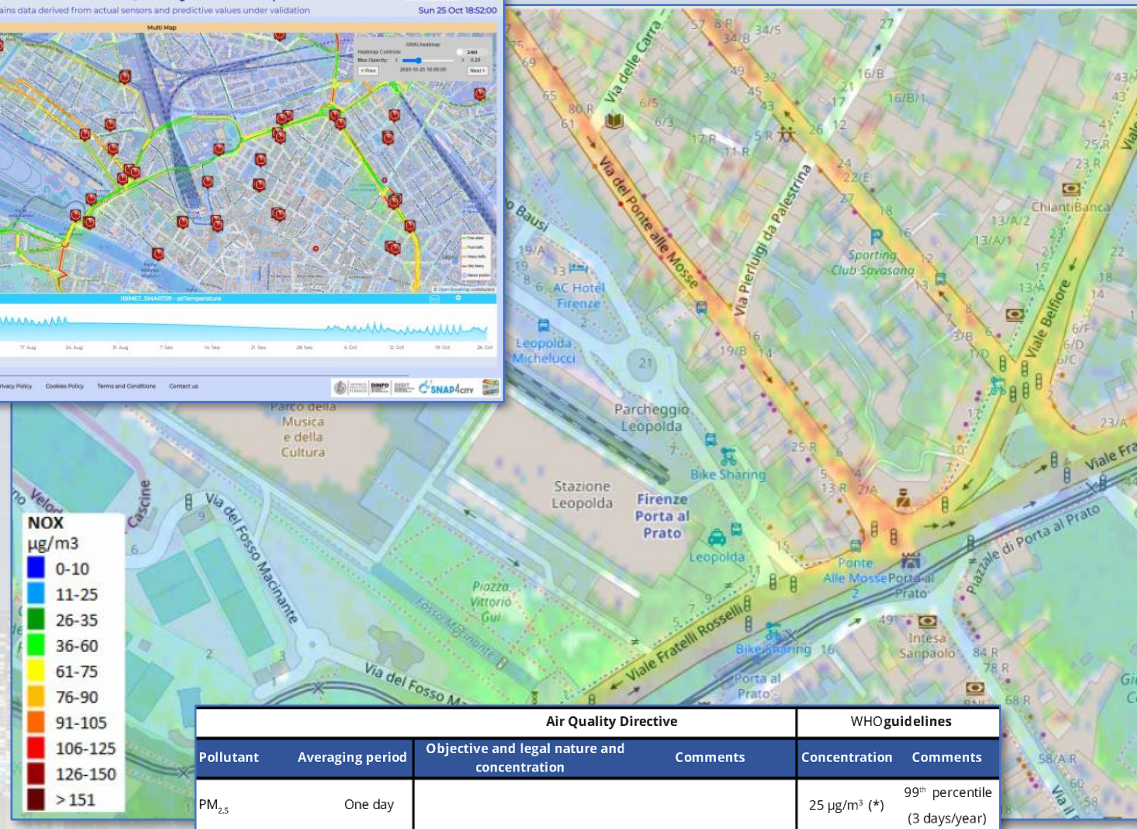
reference

Cities of: Firenze, Pisa, Livorno

- **Multiple Domain Data**
  - Traffic Flow data, Pollutant, 3D City structure, weather, …
- **Multiple Decision Makers**
  - City officers, energy industries
- **Historical and Real Time data**
  - Dashboards, What-IF analysis
  - Pollutant Predictions,
  - Traffic Flow Reconstruction
- **Services Exploited on:**
  - Dashboards, Mobile App
- **Since 2020**



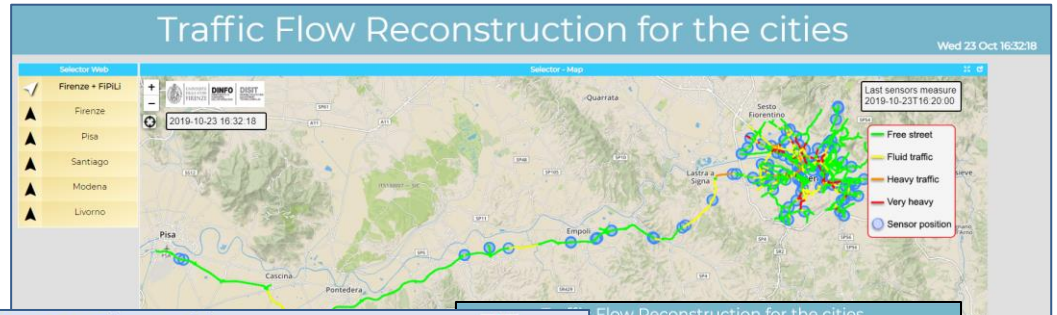


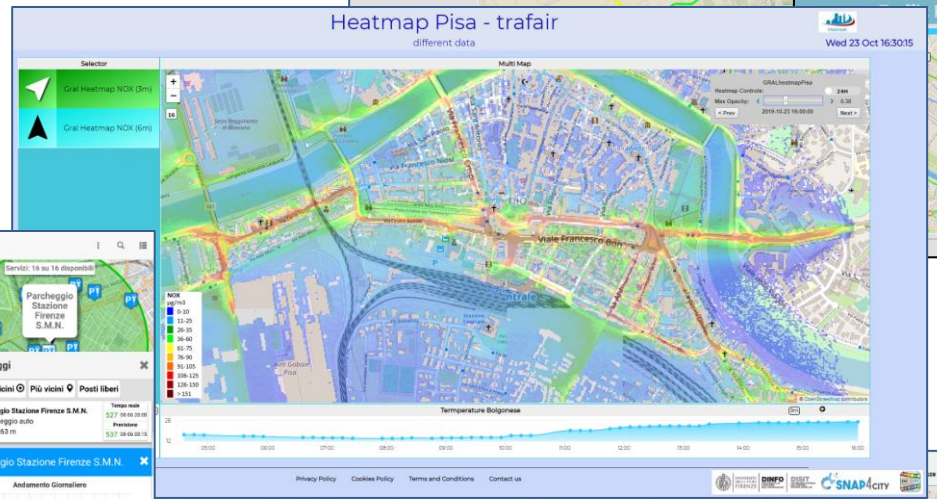


		Air Quality Directive		WHO guidelines	
Pollutant	Averaging period	Objective and legal nature and concentration	Comments	Concentration	Comments
$PM_{2.5}$	One day			25 µg/m³ (*)	99th percentile (3 days/year)
$PM_{2.5}$	Calendar year	Target value, 25 µg/m³	The target value has become a limit value since 1 January 2015	10 µg/m³	
PM_{10}	One day	Limit value, 50 µg/m³	Not to be exceeded on more than 35 days per year.	50 µg/m³ (*)	99th percentile (3 days/year)
PM_{10}	Calendar year	Limit value, 40 µg/m³ (*)		20 µg/m³	
O_3	Maximum daily 8-hour mean	Target value, 120 µg/m³	Not to be exceeded on more than 25 days per year, averaged over three years	100 µg/m³	
NO_2	One hour	Limit value, 200 µg/m³ (*)	Not to be exceeded more than 18 times a calendar year	200 µg/m³ (*)	
NO_2	Calendar year	Limit value, 40 µg/m³		40 µg/m³	

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
    - **Weather** Forecast,
  - **Culture** and **Tourisms**
  - Etc.
- **Mobile App and MicroApplications:**
  - Tuscany in a Snap (all stores)
  - Tuscany where what… km4city (all stores)
- **Numbers**: 1.5 M complex events per day

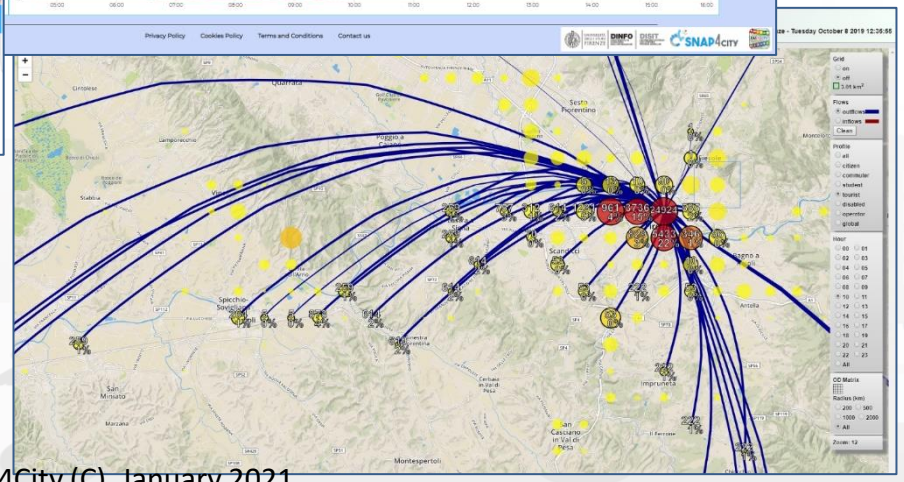


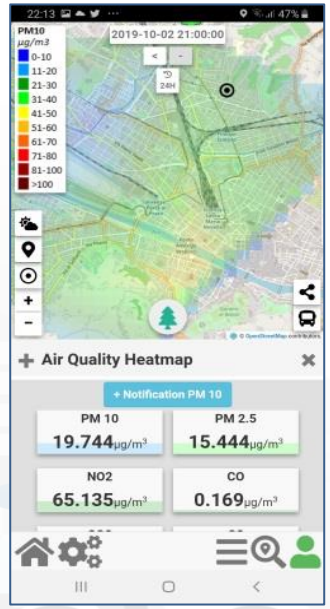






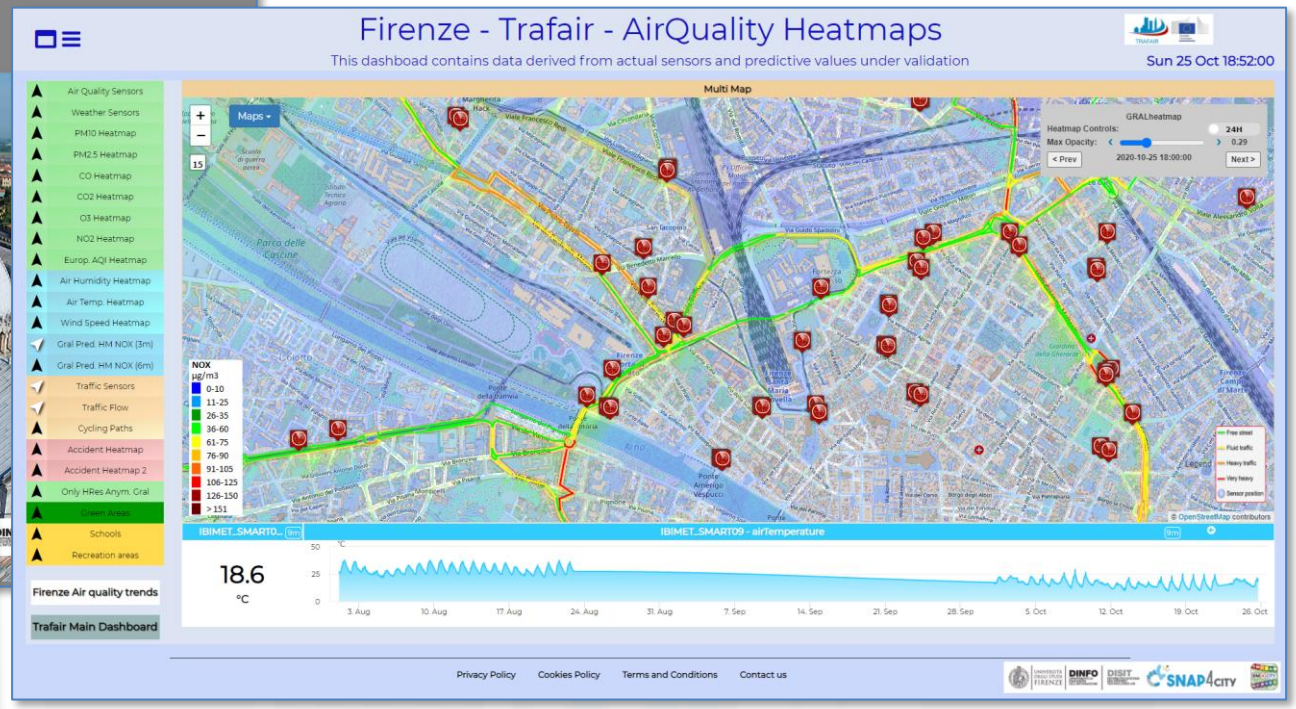




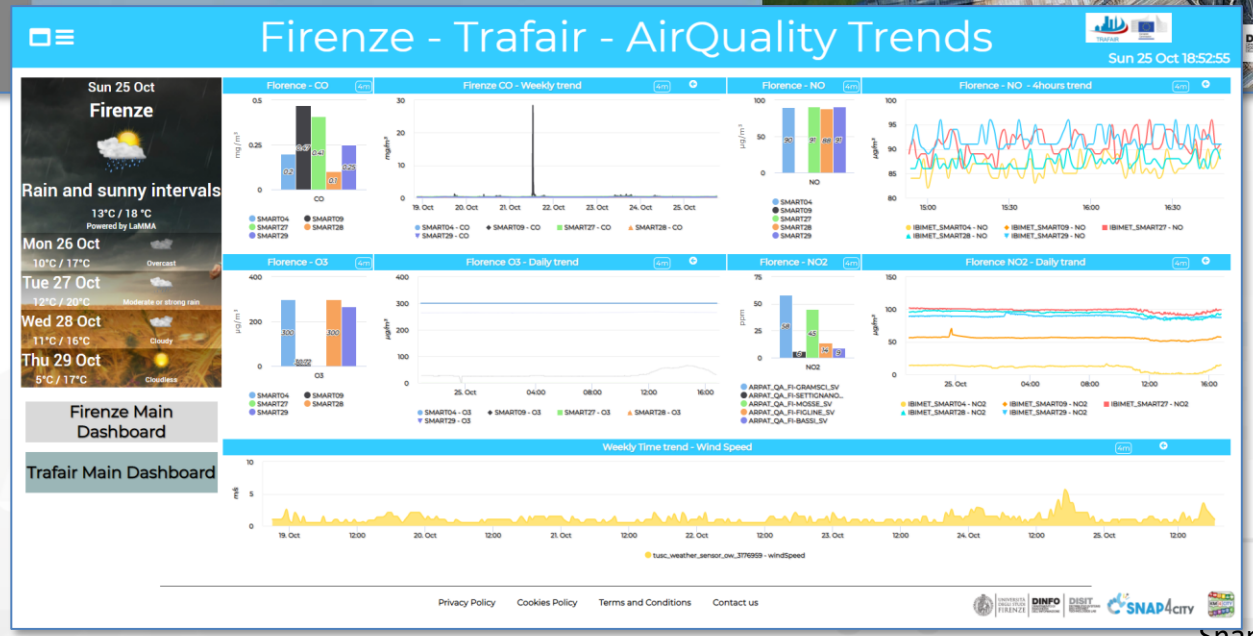


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjY4MQ==



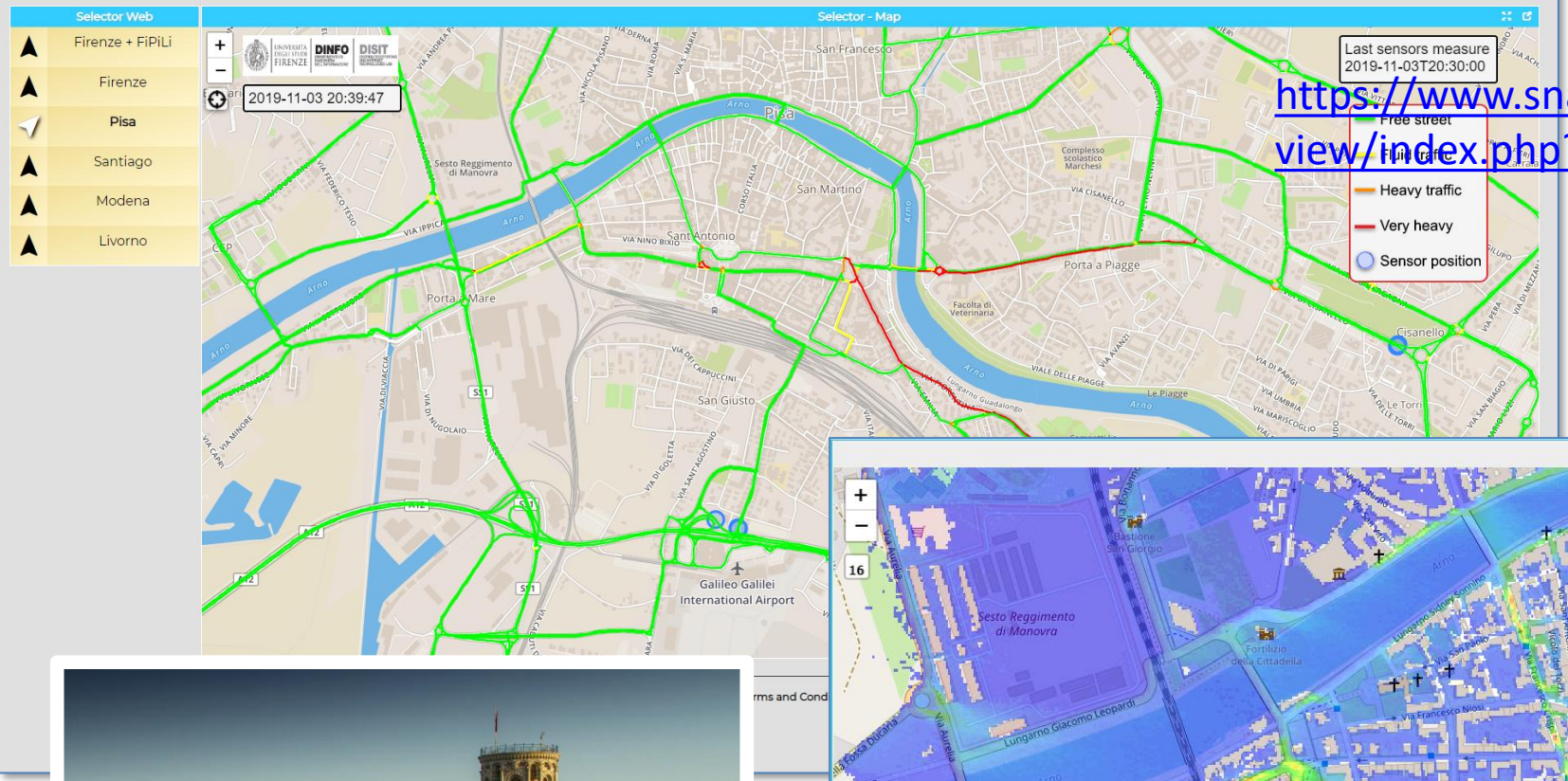


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTUzMg==



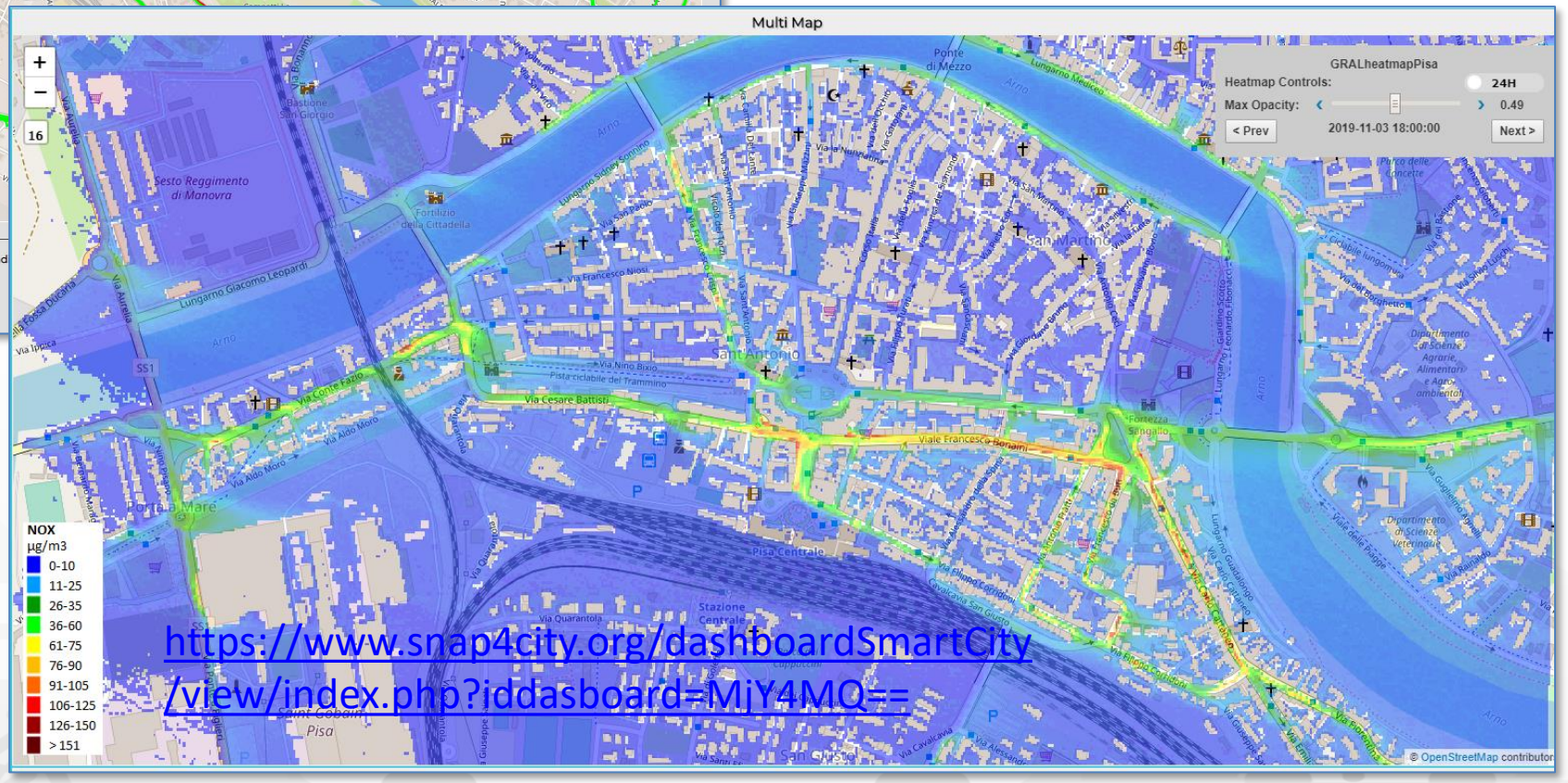
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjU0Mg==

Traffic Flow Reconstruction for the cities



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjY3OA==





https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjY4MQ==

Heatmap Pisa - trafair

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

Thu 26 Nov 23:34:38

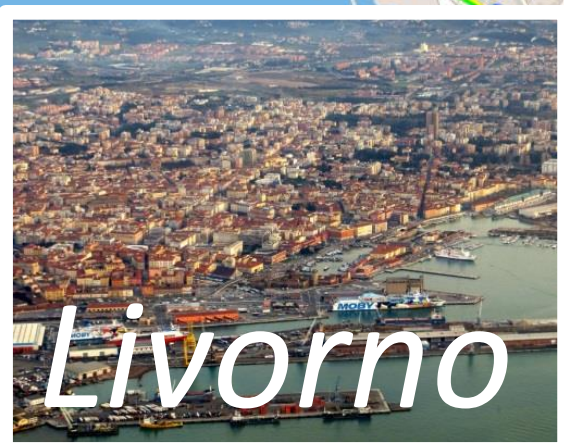


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Selector - Map

2019-11-03 20:44:08

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc5NQ==



Livorno

Multi Map

NOX
µg/m3
0-10
11-25
26-35
36-60
61-75
76-90
91-105
106-125
126-150
>151

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjY3NQ==

Pistoia


Pistoia overview 2020
Sun 25 Oct 15:05:52
Museum
Police_headquarters
HealthCare
Restaurant
Accommodation
Sports_facility
Tax_advice
Doctor_office
Small_shop
Weather_sensor
COVID-19
Air quality sensors
Pollination
BusStop
Train Station
Traffic Sensors
Maps
© OpenStreetMap contributors
18.6
°C
tusc_weather_sensor_ow_3170621 - airTemperature
Sun 25 Oct
Pistoia
Overcast
13°C / 18 °C
Powered by LaMMA
Mon 26 Oct
10°C / 17°C
Cloudy
Tue 27 Oct
12°C / 19°C
Moderate or strong rain
Wed 28 Oct
11°C / 15°C
Cloudy
Thu 29 Oct
6°C / 17°C
Cloudless
Privacy Policy
Cookies Policy
Terms and conditions
Contact us

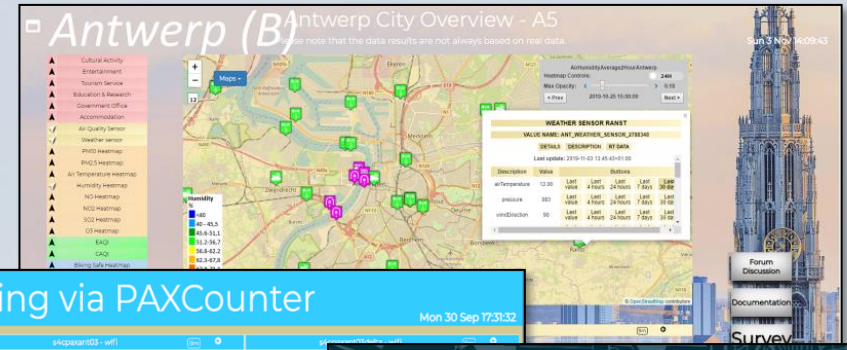
Antwerp

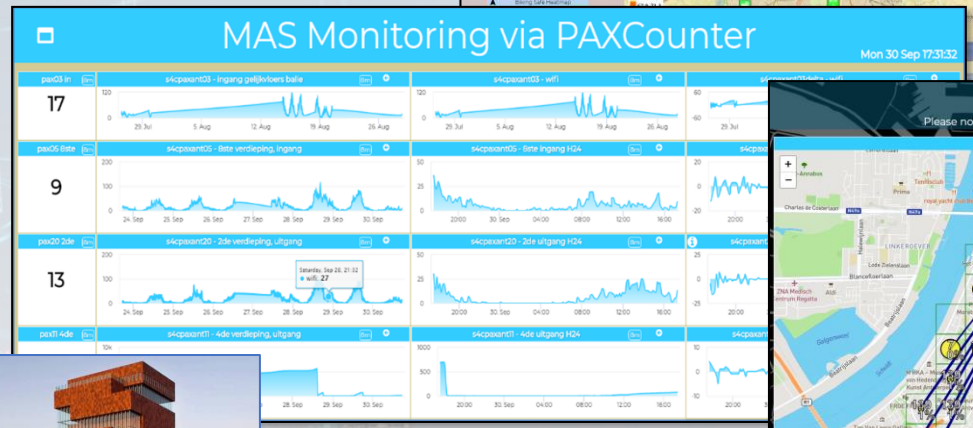


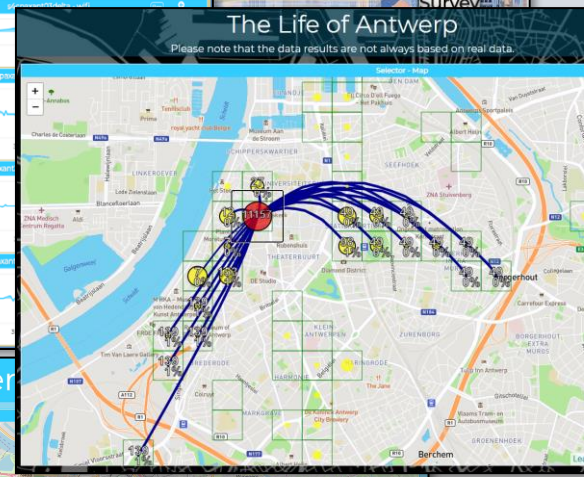
People Control on Pub Services
DIGIPOLIS Antwerp

reference

- **Multiple Domain Data**
  - PAX Counters: museum, pub services, COVID-19
- **Multiple Levels & Decision Makers**
- **Historical and Real Time data**
  - 20 fixed PaxCounters
  - 2 Mobile PaxCounters
  - Business Intelligence Dashboards
- **Services Exploited on:**
  - Dashboards, Mobile Apps, API
  - Fully Controlled Devices by Digipolis
- **Since 2019**





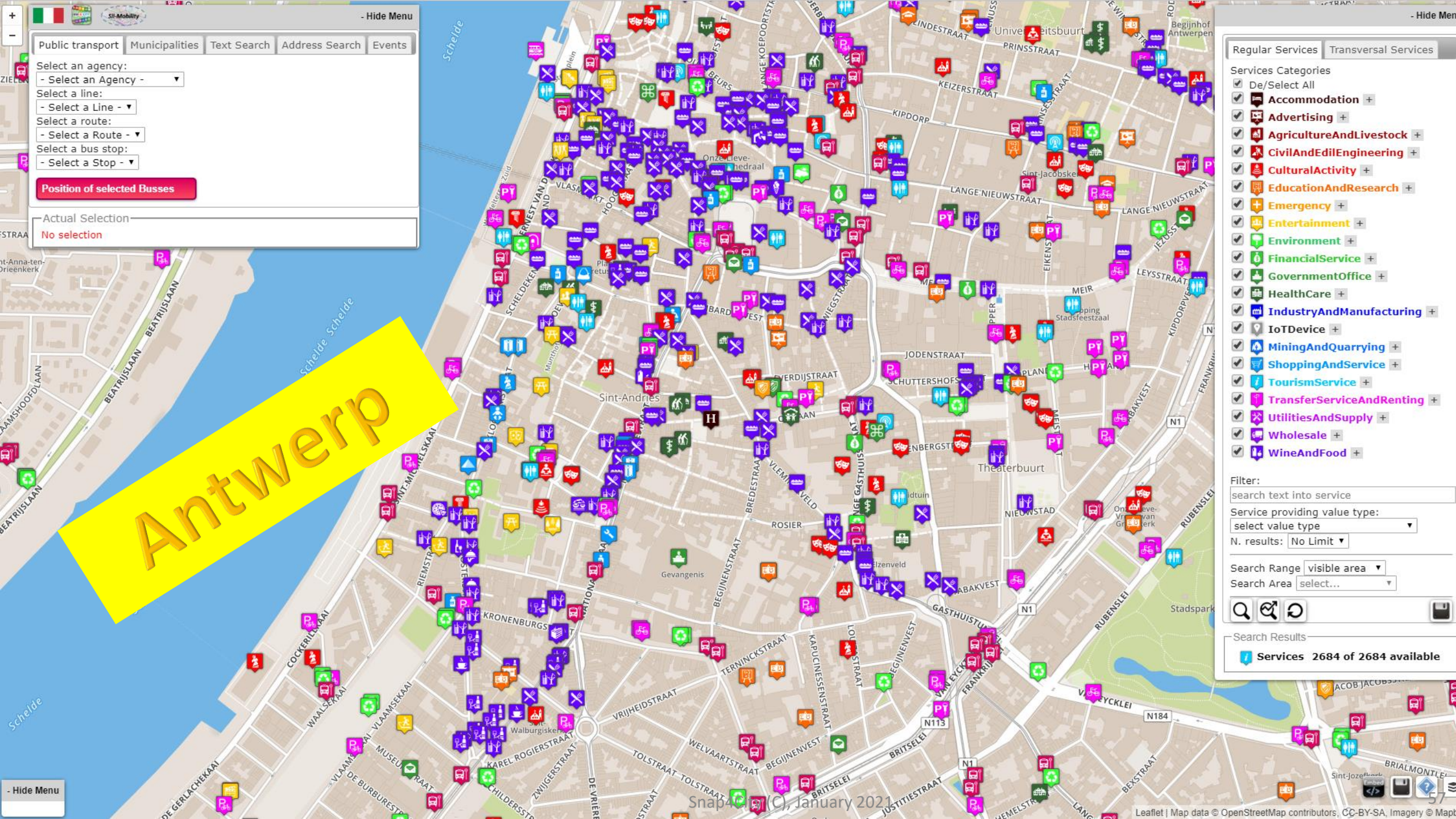




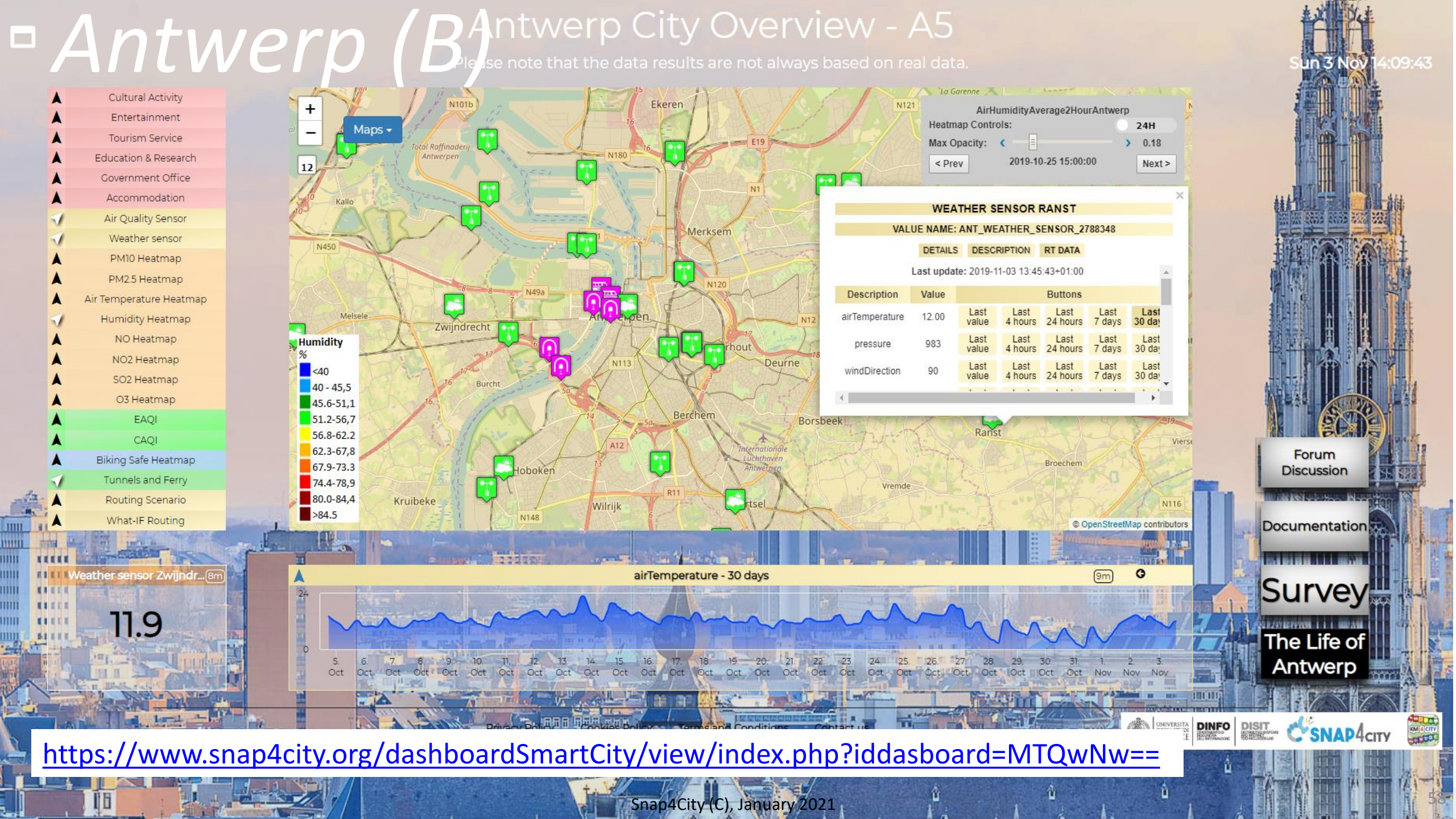







- Hide Menu
Public transport
Municipalities
Text Search
Address Search
Events
Select an agency:
- Select an Agency -
Select a line:
- Select a Line -
Select a route:
- Select a Route -
Select a bus stop:
- Select a Stop -
Position of selected Busses
Actual Selection
No selection
Antwerp
- Hide Menu
Regular Services
Transversal Services
Services Categories
De/Select All
Accommodation
Advertising
AgricultureAndLivestock
CivilAndEdilEngineering
CulturalActivity
EducationAndResearch
Emergency
Entertainment
Environment
FinancialService
GovernmentOffice
HealthCare
IndustryAndManufacturing
IoTDevice
MiningAndQuarrying
ShoppingAndService
TourismService
TransferServiceAndRenting
UtilitiesAndSupply
Wholesale
WineAndFood
Filter:
search text into service
Service providing value type:
select value type
N. results:
No Limit
Search Range
visible area
Search Area
select...
Search Results
Services 2684 of 2684 available
Schelde
Sint-Andries
Gevangenis
Theaterbuurt
Stadspark
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapb

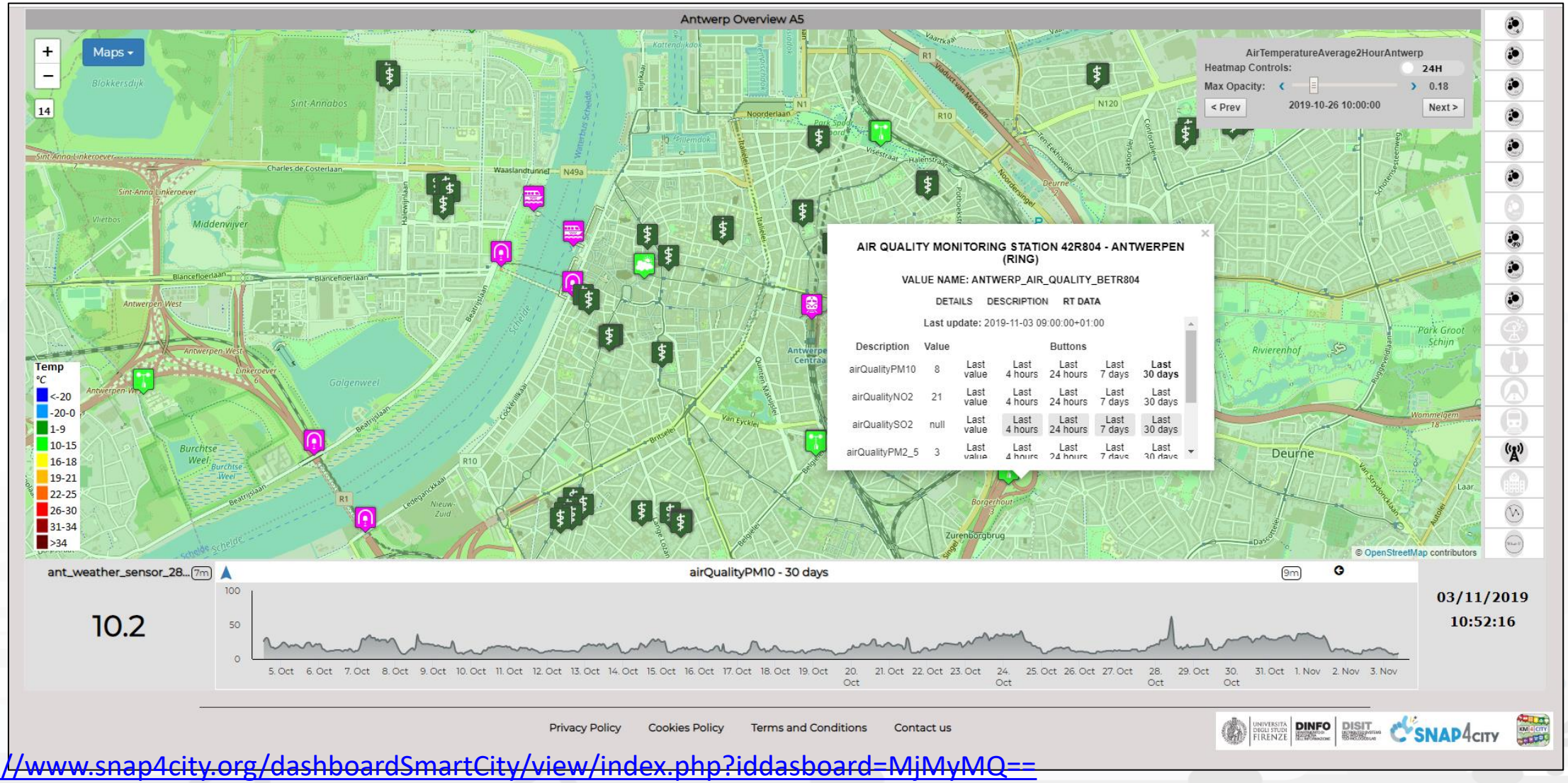
Antwerp (B)



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTQwNw==

Antwerp

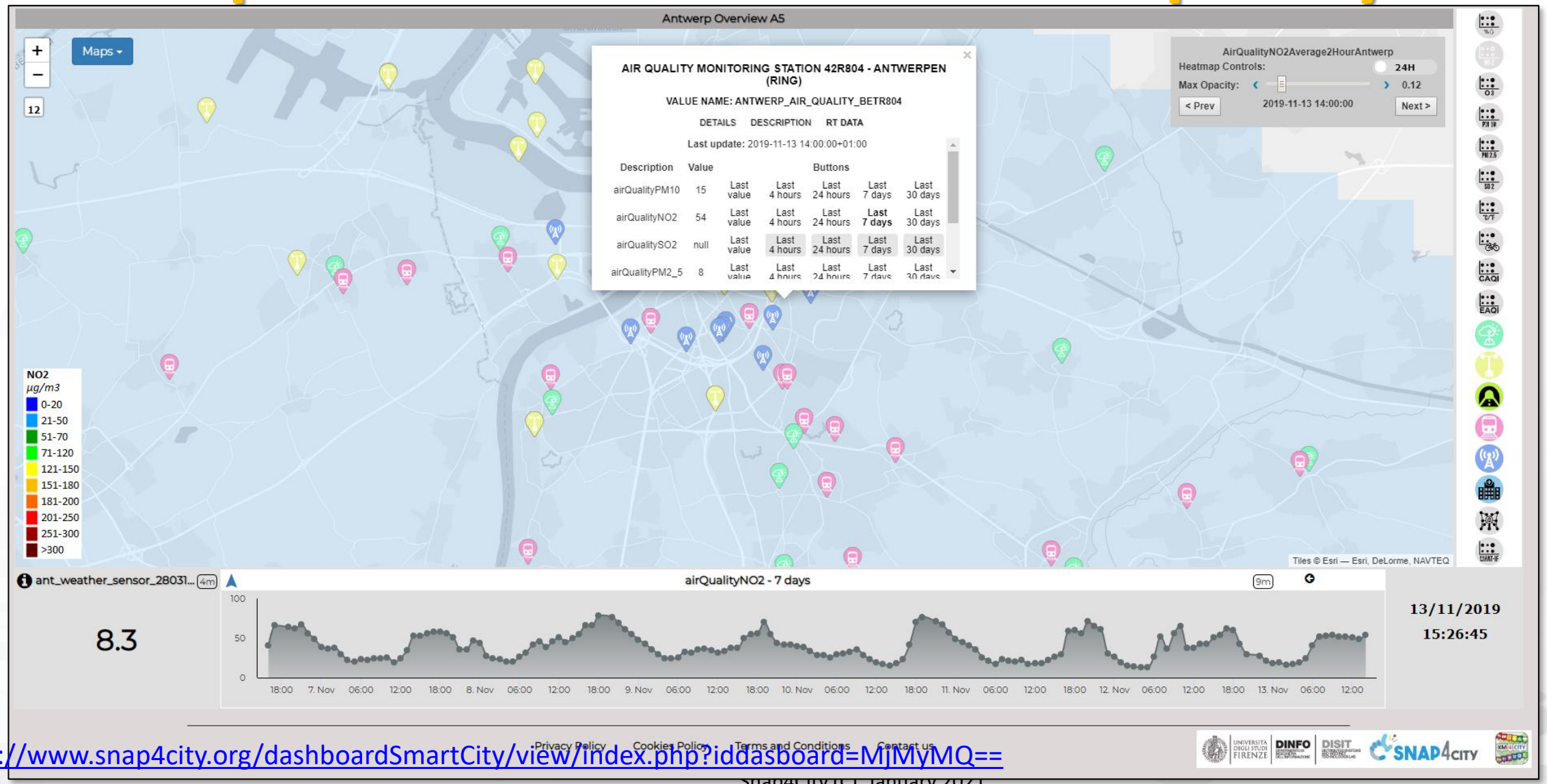
Unique Dashboard builder Multiple Styles



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjMyMQ==

Antwerp

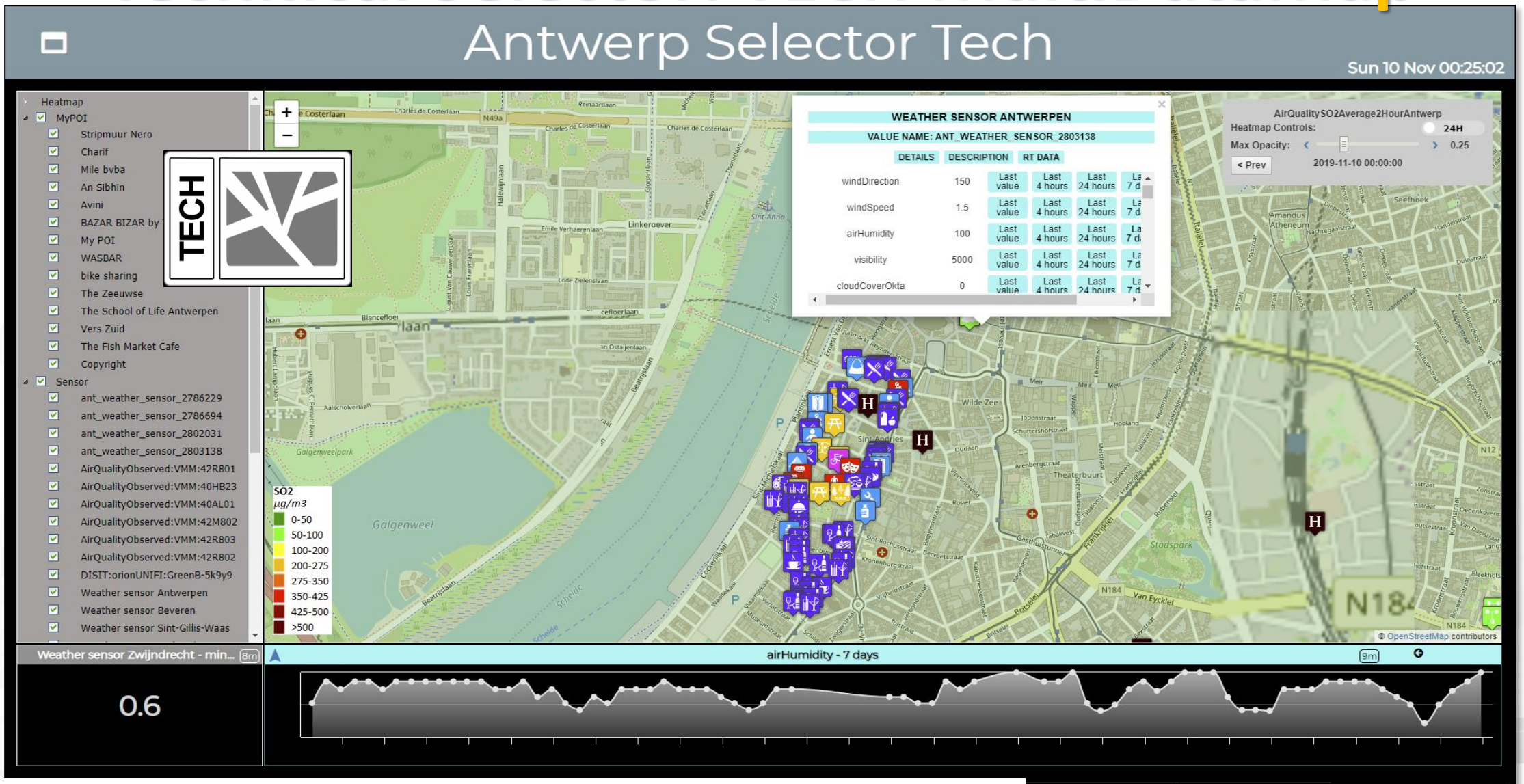
Unique Dashboard builder Multiple Styles



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjMyMQ==

Antwerp

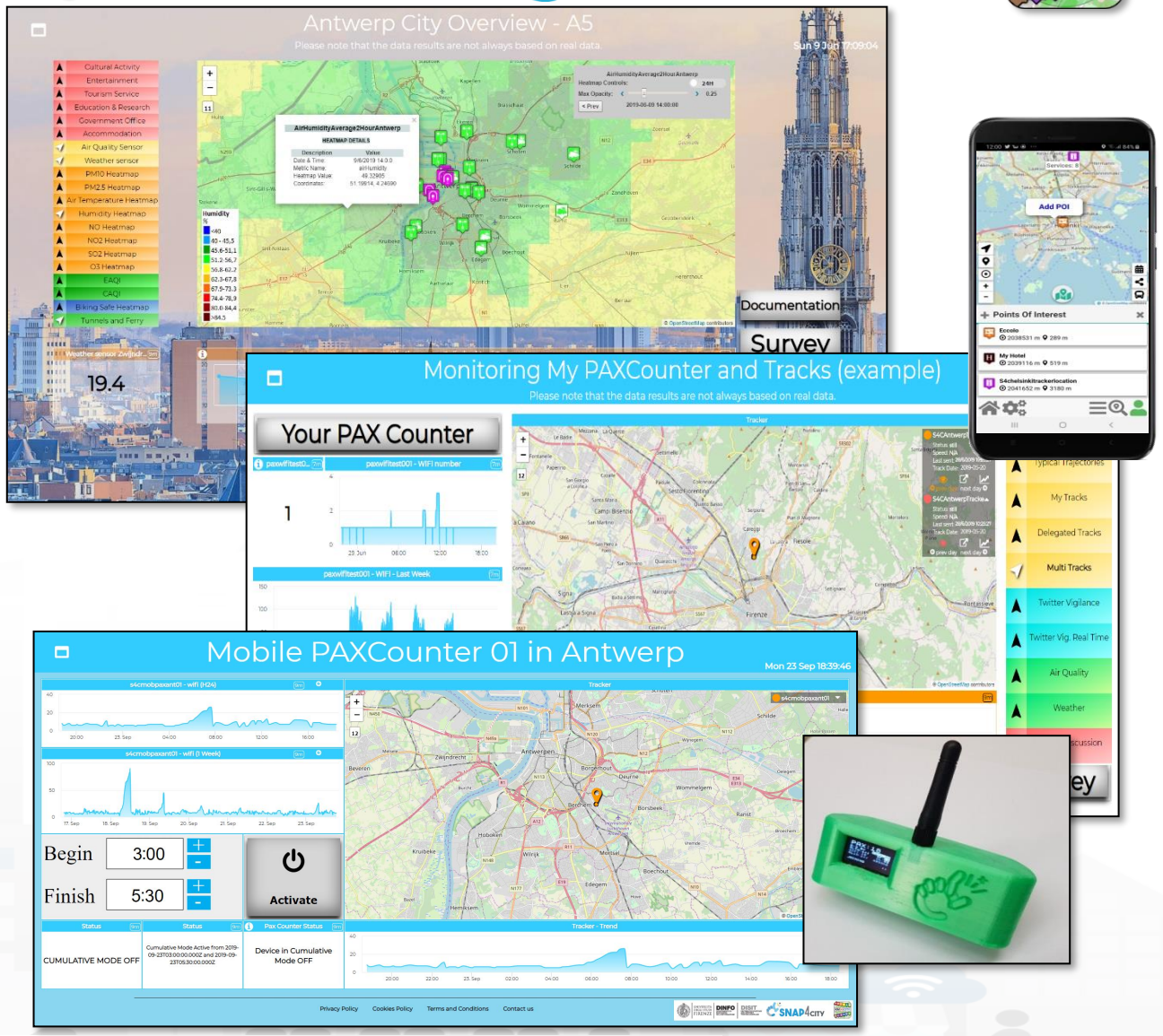
Technical Selector: TECH MultiDataMap



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjMxOA==

Antwerp Case

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



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTQwNw==

PaxCounter devices







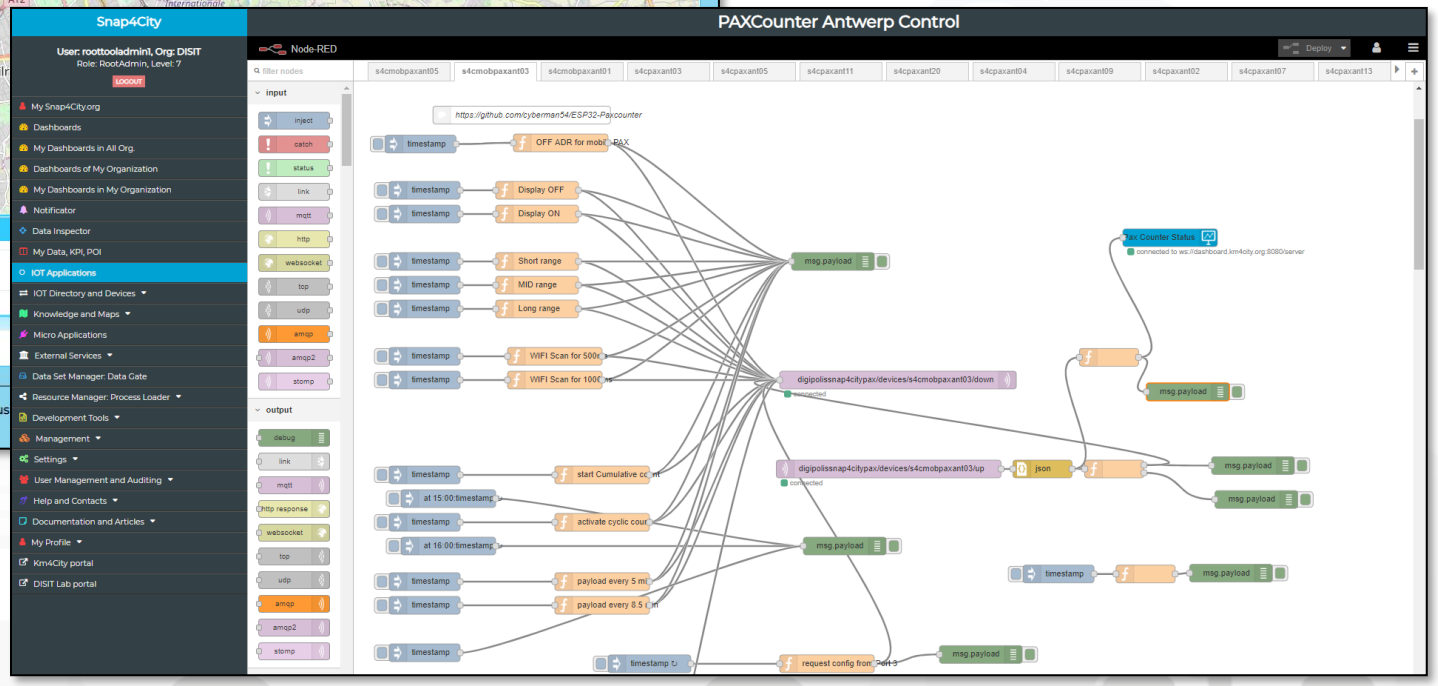
- **Fix PaxCounter LoraWan**
  - sniffing on: Wi-Fi, Bluetooth
  - Sending data via LoraWan
- **Mobile PaxCounter LoraWan**
  - sniffing on: Wi-Fi, Bluetooth
  - Sending data via LoraWan
- **Fix PaxCounter, multiple out**
  - Sending data via LoraWan and Wi-Fi
  - sniffing on: Wi-Fi, Bluetooth

LoRa® Wi Fi Bluetooth™

https://www.snap4city.org/456

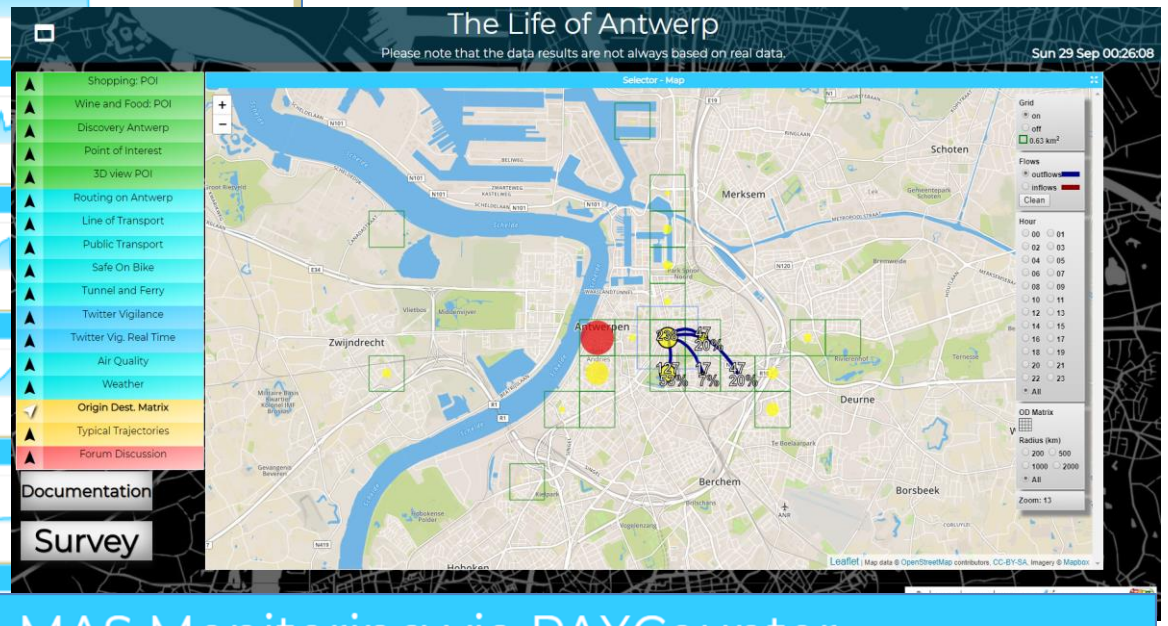
Programmable PAX counting



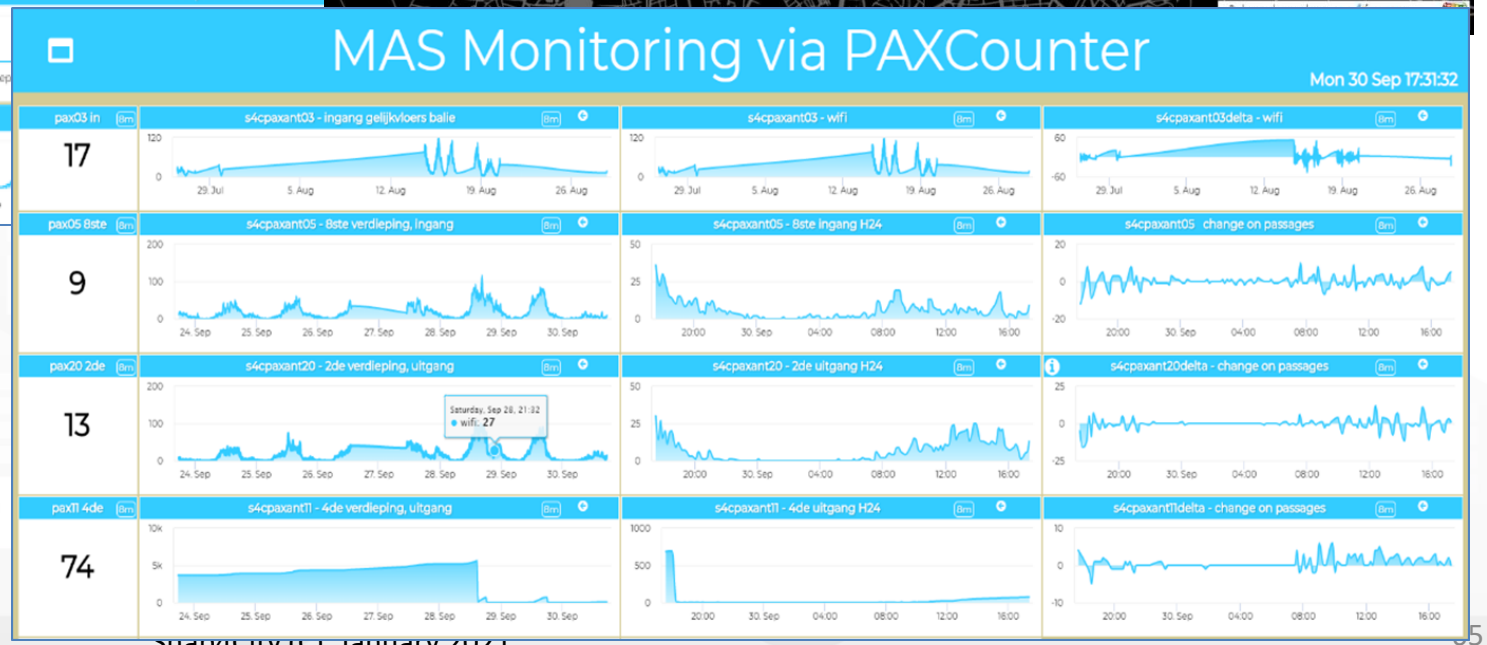


Antwerp


PAXCounter real time and trend
Mon 30 Sep 17:18:48
s4cpaxant01 - wifi
s4cpaxant11 - wifi
s4cpaxant02 - wifi
s4cpaxant12 - wifi
s4cpaxant03 - wifi
s4cpaxant13 - wifi
s4cpaxant04 - wifi
s4cpaxant14 - wifi
s4cpaxant05 - wifi
s4cpaxant15 - wifi
s4cpaxant06 - wifi
s4cpaxant16 - wifi
s4cpaxant07 - wifi


The Life of Antwerp
Please note that the data results are not always based on real data.
Sun 29 Sep 00:26:08
Shopping: POI
Wine and Food: POI
Discovery Antwerp
Point of Interest
3D view POI
Routing on Antwerp
Line of Transport
Public Transport
Safe On Bike
Tunnel and Ferry
Twitter Vigilance
Twitter Vig. Real Time
Air Quality
Weather
Origin Dest. Matrix
Typical Trajectories
Forum Discussion
Documentation
Survey
Antwerpen
Zwijndrecht
Merksem
Schoten
Deurne
Berchem
Borsbeek

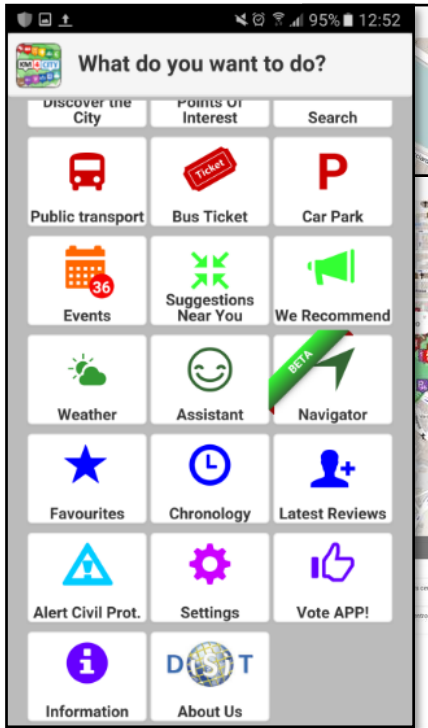

Antwerp

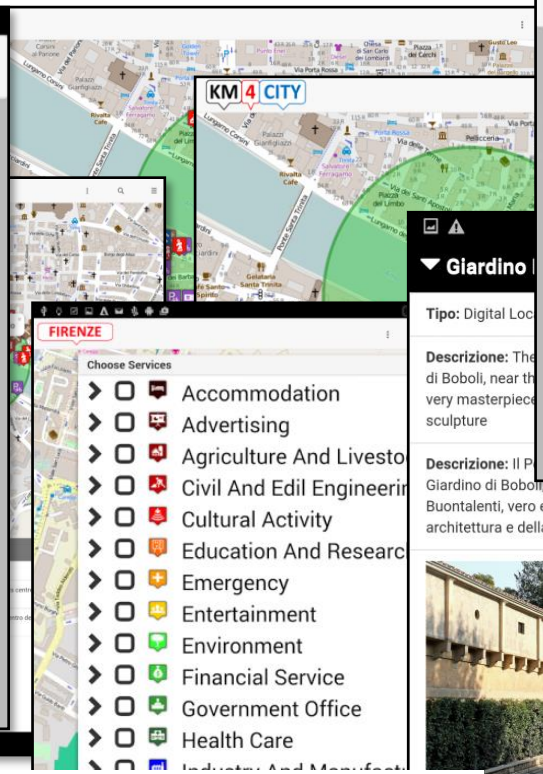

MAS Monitoring via PAXCounter
Mon 30 Sep 17:31:32
pax03 in
s4cpaxant03 - ingang gelijkvloers balie
s4cpaxant03 - wifi
s4cpaxant03delta - wifi
pax05 8ste
s4cpaxant05 - 8ste verdieping, ingang
s4cpaxant05 - 8ste ingang H24
s4cpaxant05 change on passages
pax20 2de
s4cpaxant20 - 2de verdieping, uitgang
s4cpaxant20 - 2de uitgang H24
s4cpaxant20delta - change on passages
pax11 4de
s4cpaxant11 - 4de verdieping, uitgang
s4cpaxant11 - 4de uitgang H24
s4cpaxant11delta - change on passages

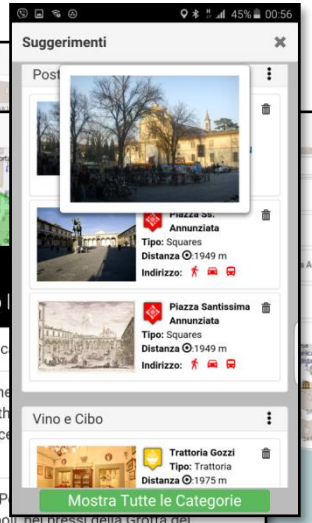
UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

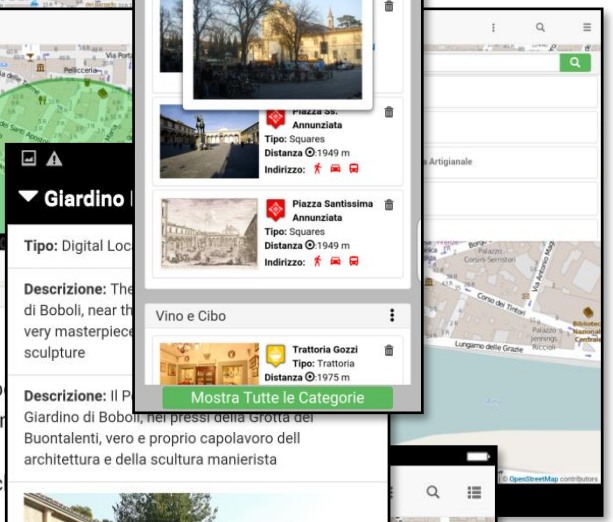
Mobile Apps

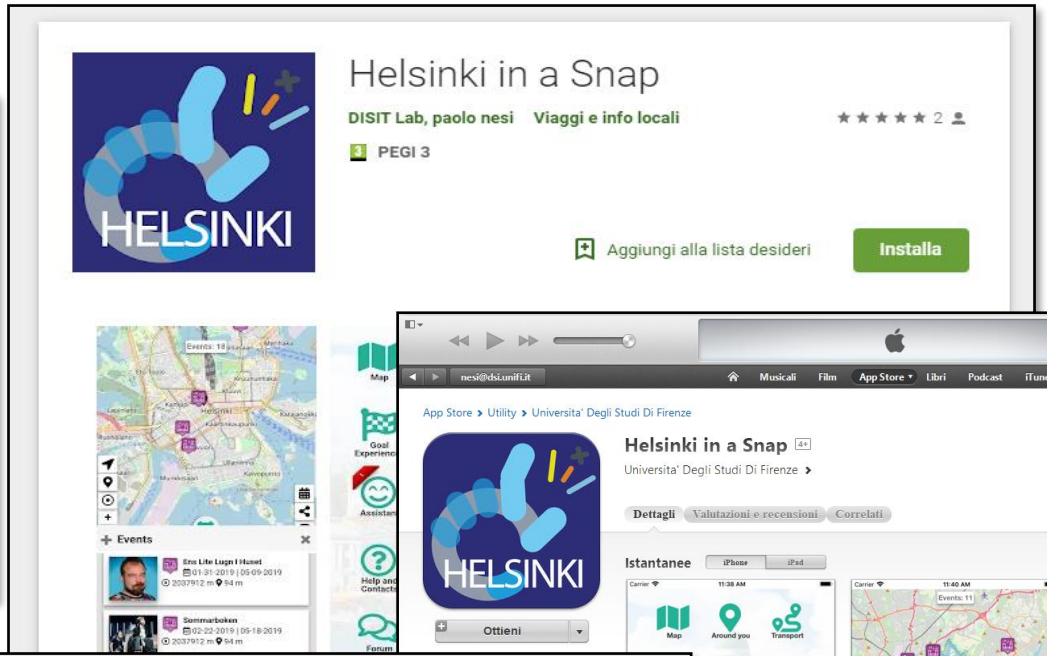
SNAP4CITY KM 4 CITY













DISPONIBILE SU Google play

Scarica da App Store

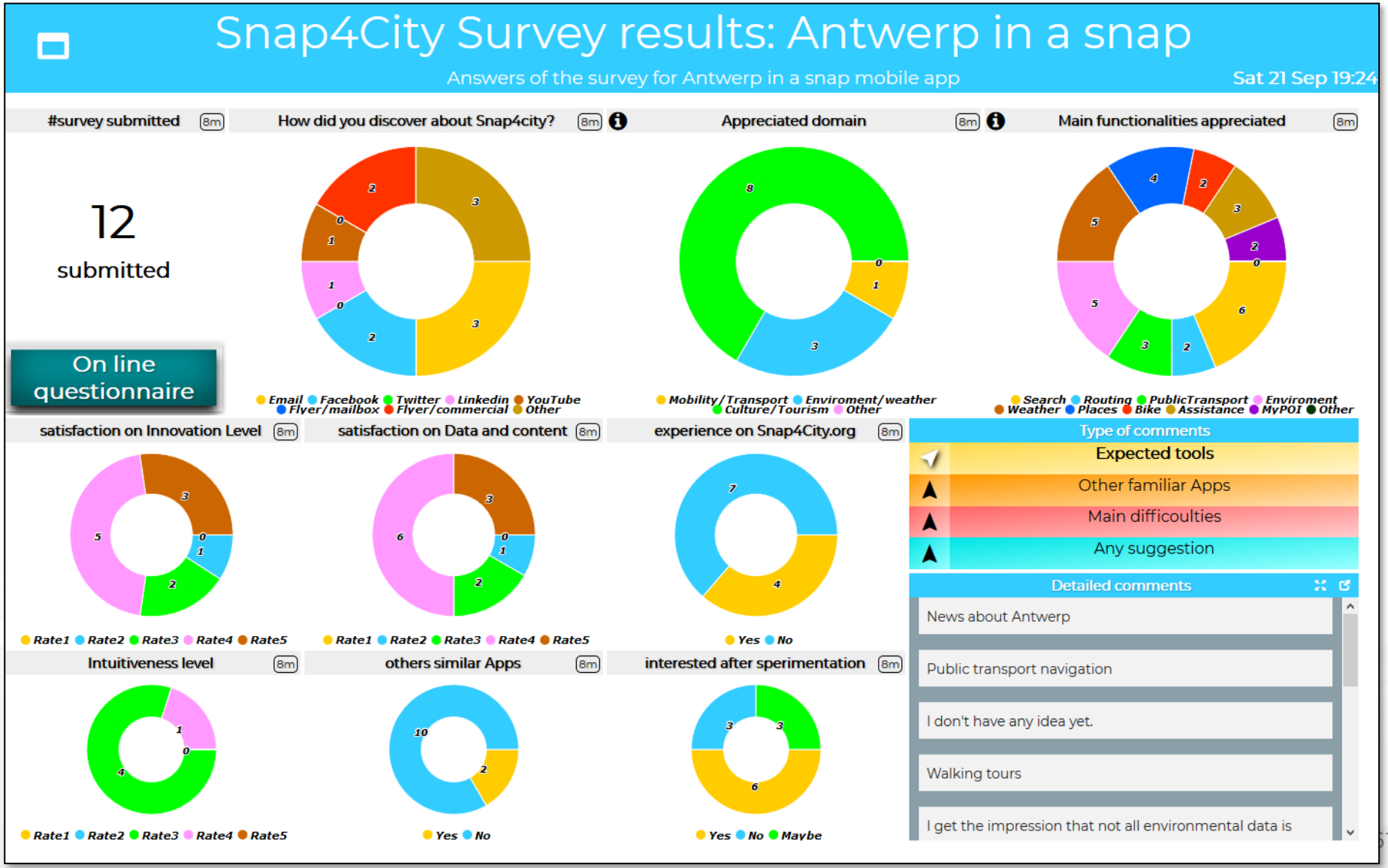
Scarica da Windows Store



SNAP4CITY

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc2OQ==

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

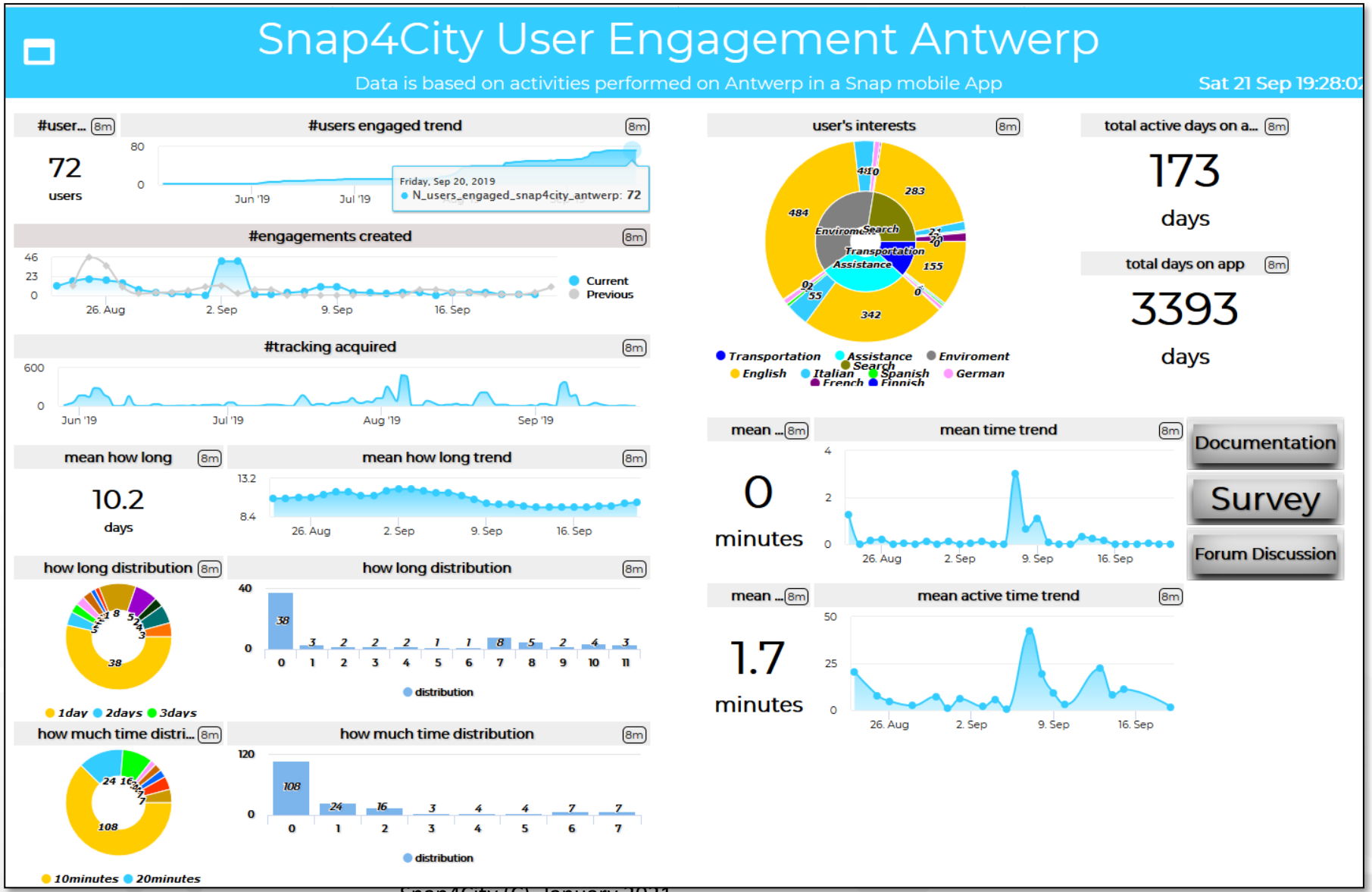


Antwerp

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc1OQ==

Dashboard monitoring the Mobile App:

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



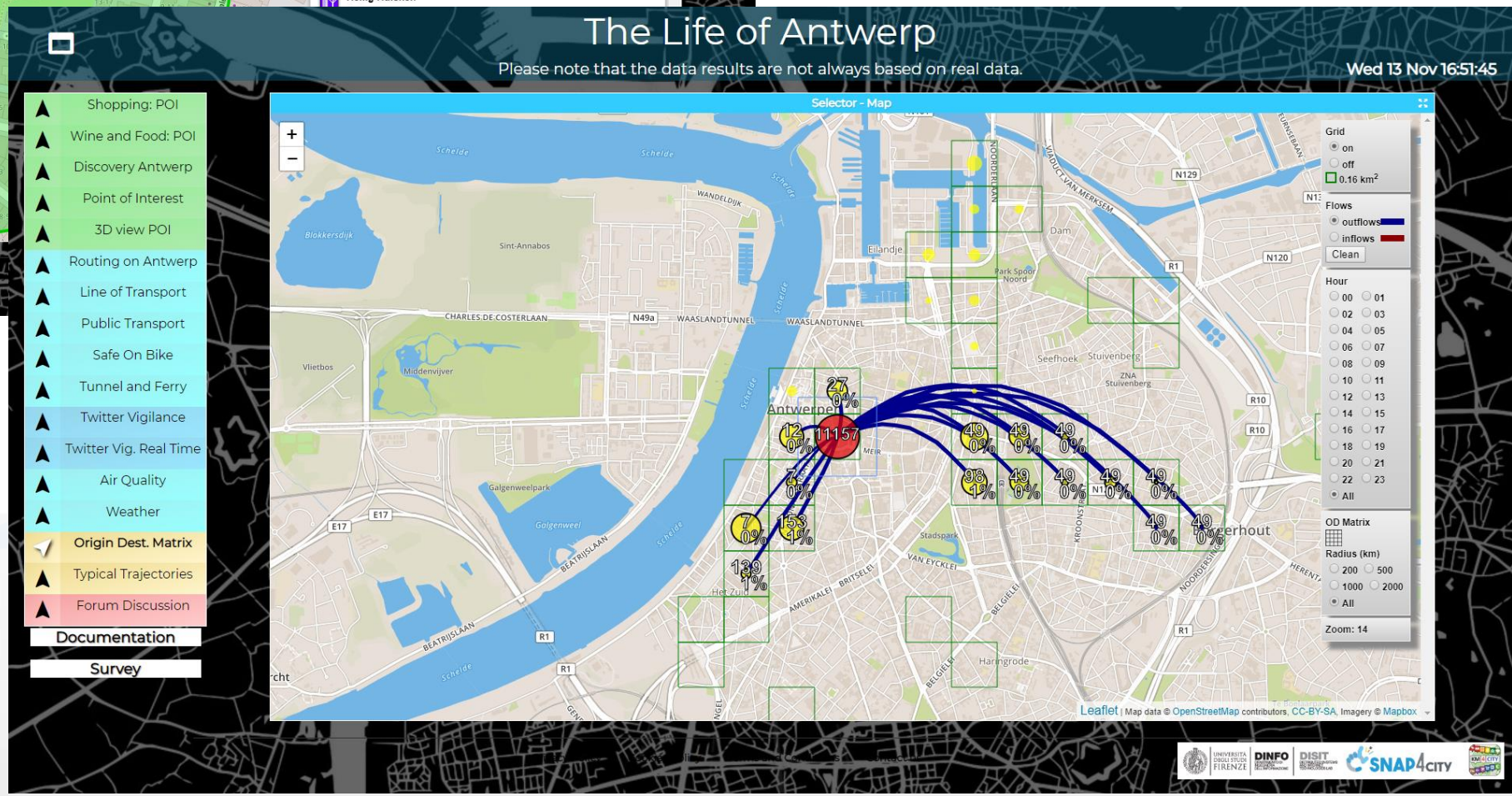
Antwerp



SNAP4CITY

KM4CITY

Antwerp



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTcwNg==

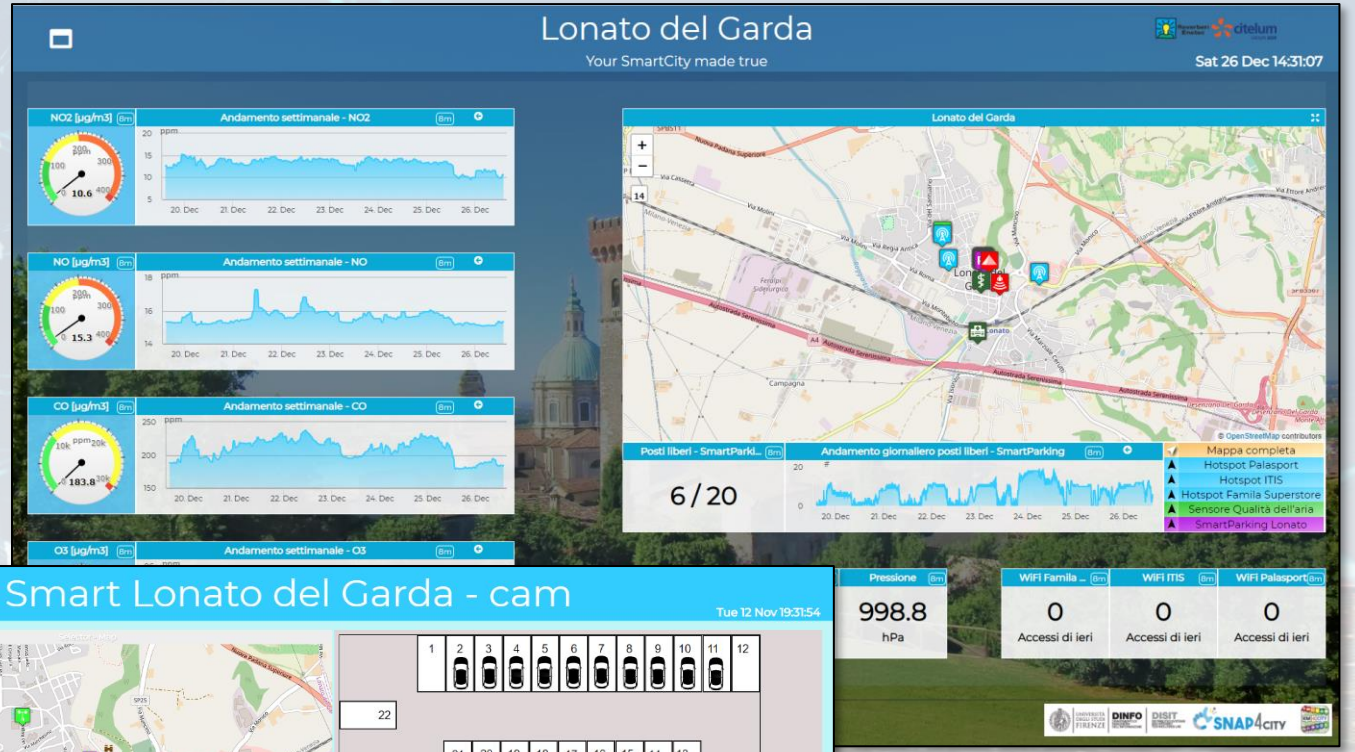


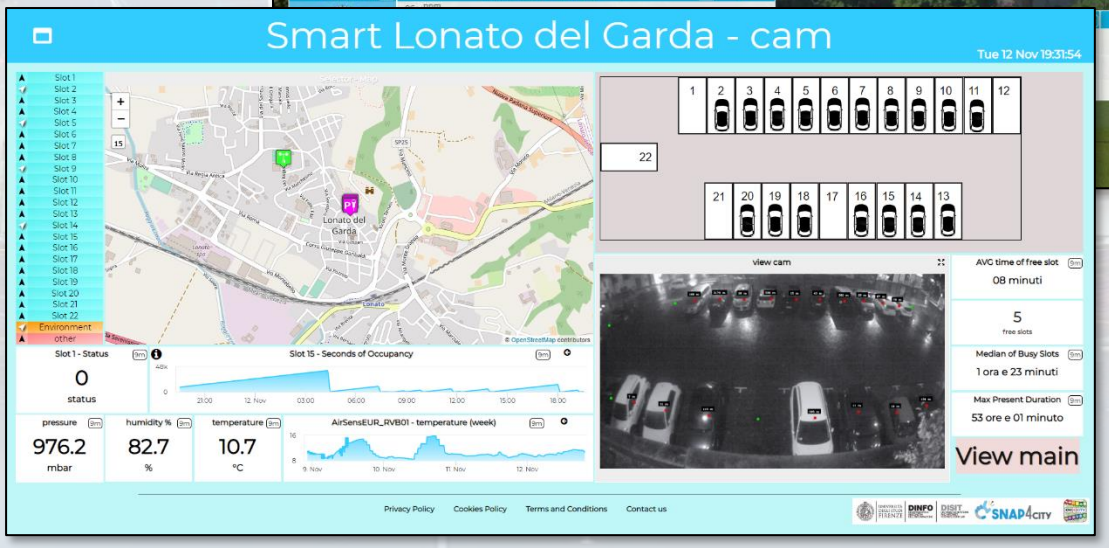
Lonato del Garda

Smart City / Smart Parking + Environment Reverberi, Lonato del Garda

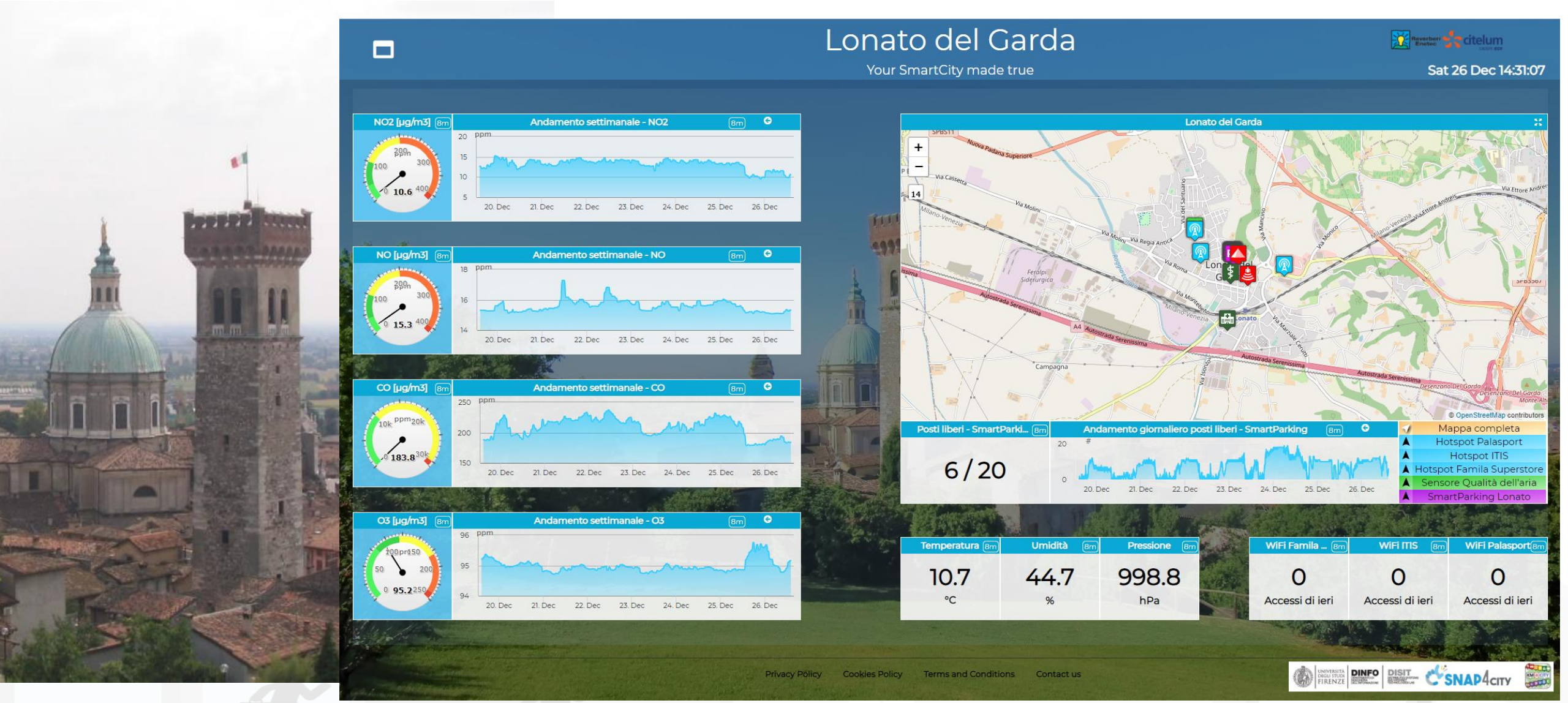
reference

- **Multiple Domain Data**
  - Smart Parking, Environment, Wi-Fi
- **Multiple Decision Makers**
  - City Officer, operators
- **Historical and Real Time data**
  - Dashboards
- **Services Exploited on:**
  - Dashboards, API
- **Since 2019**



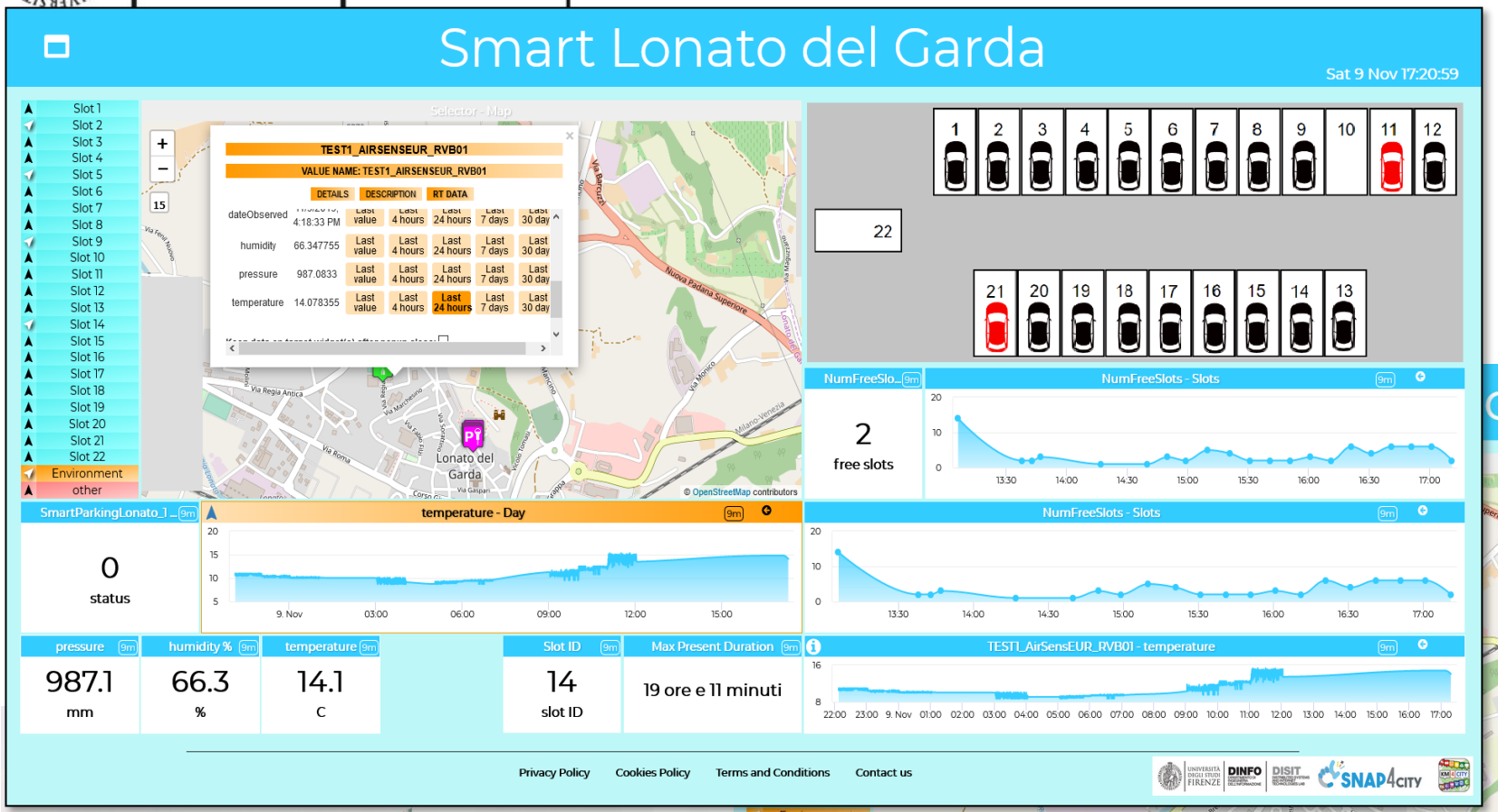


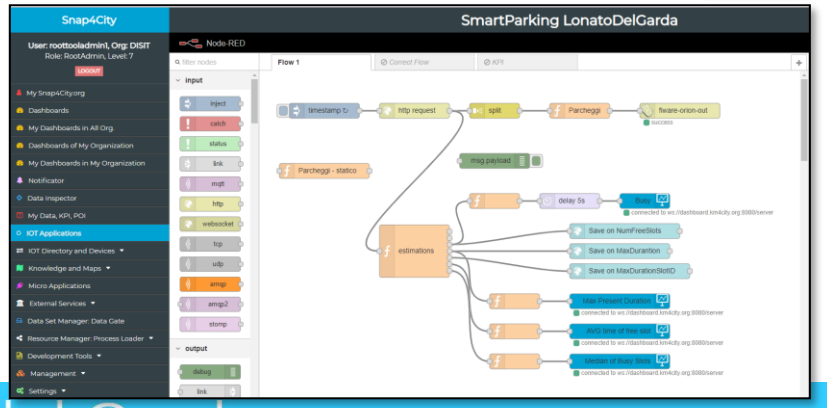
Lonato del Garda



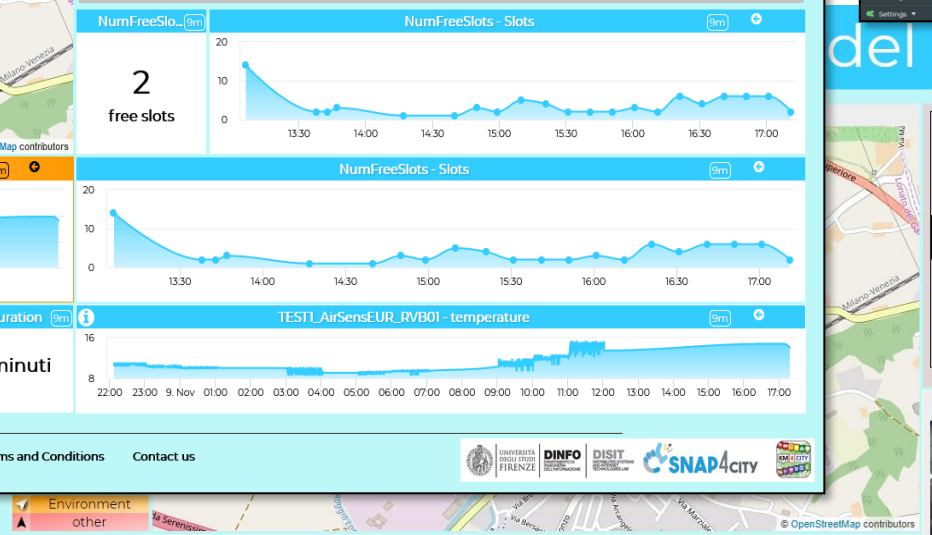
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjM1Mg==

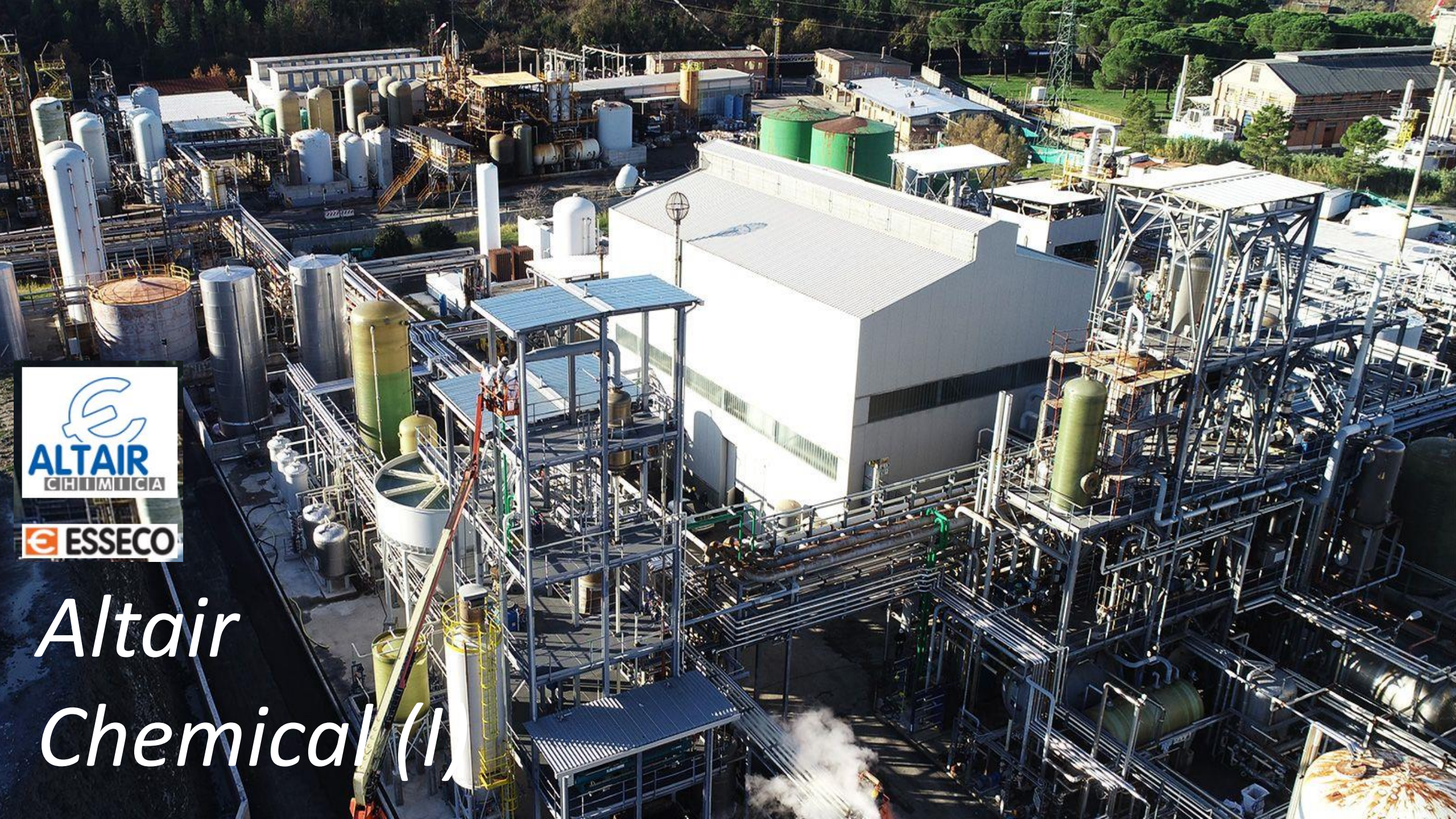
Smart Parking Monitoring











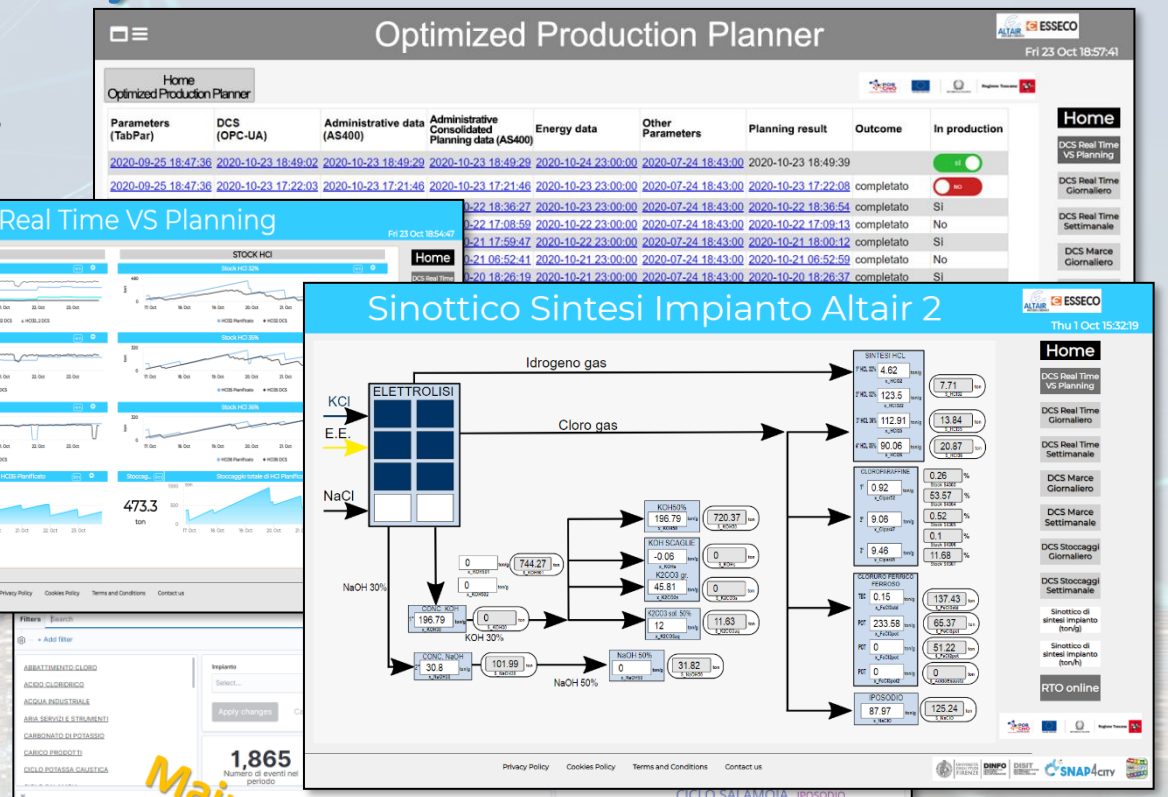
Altair Chemical (I)

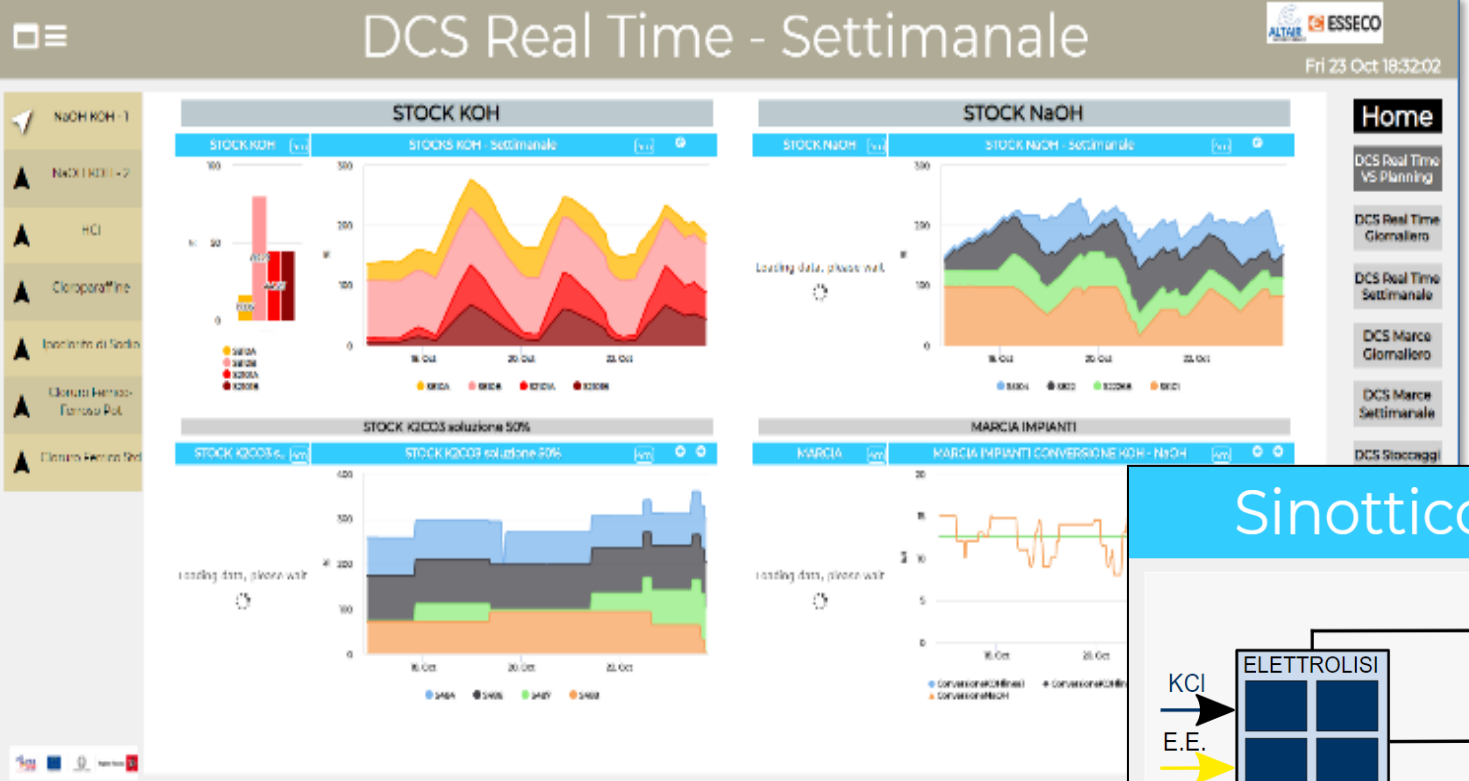
Snap4Altair Decision Support supervision and control, Industry 4.0

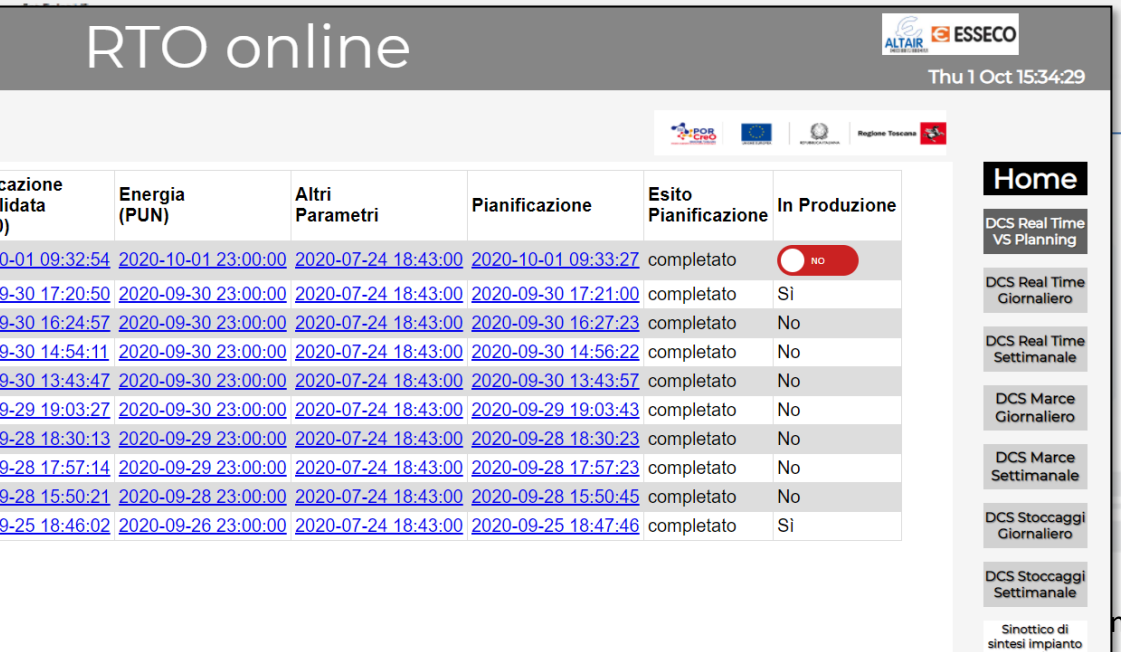
reference

- **Multiple Domain Data**
  - Distributed Control System: energy, flows, storage, chemical data, settings, ..
  - Cost of energy
  - Orders
  - Production Parameters
  - Maintenance data
- **Multiple Levels & Decision Makers**
- **Historical and Real Time data**
  - Billions of Data
  - Optimized planning on chemical model
  - Business Intelligence on Maintenance data
- **Services Exploited on:**
  - Multiple Levels, Mobile Apps, API
- **Since 2020**

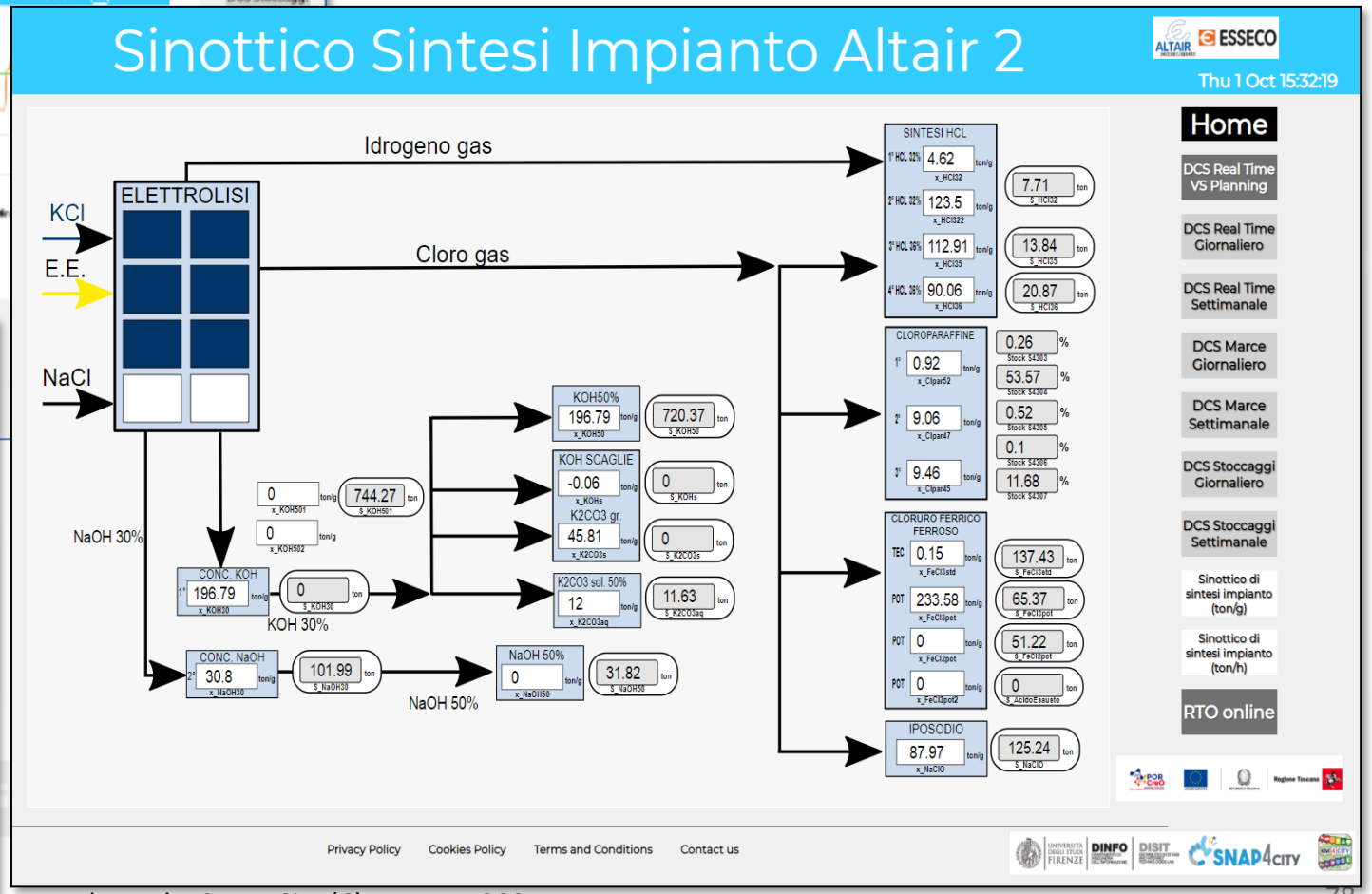








cazione lidata)	Energia (PUN)	Altri Parametri	Pianificazione	Esito Pianificazione	In Produzione
0-01 09:32:54	2020-10-01 23:00:00	2020-07-24 18:43:00	2020-10-01 09:33:27	completato	NO
9-30 17:20:50	2020-09-30 23:00:00	2020-07-24 18:43:00	2020-09-30 17:21:00	completato	Sì
9-30 16:24:57	2020-09-30 23:00:00	2020-07-24 18:43:00	2020-09-30 16:27:23	completato	No
9-30 14:54:11	2020-09-30 23:00:00	2020-07-24 18:43:00	2020-09-30 14:56:22	completato	No
9-30 13:43:47	2020-09-30 23:00:00	2020-07-24 18:43:00	2020-09-30 13:43:57	completato	No
9-29 19:03:27	2020-09-30 23:00:00	2020-07-24 18:43:00	2020-09-29 19:03:43	completato	No
9-28 18:30:13	2020-09-29 23:00:00	2020-07-24 18:43:00	2020-09-28 18:30:23	completato	No
9-28 17:57:14	2020-09-29 23:00:00	2020-07-24 18:43:00	2020-09-28 17:57:23	completato	No
9-28 15:50:21	2020-09-28 23:00:00	2020-07-24 18:43:00	2020-09-28 15:50:45	completato	No
9-25 18:46:02	2020-09-26 23:00:00	2020-07-24 18:43:00	2020-09-25 18:47:46	completato	Sì

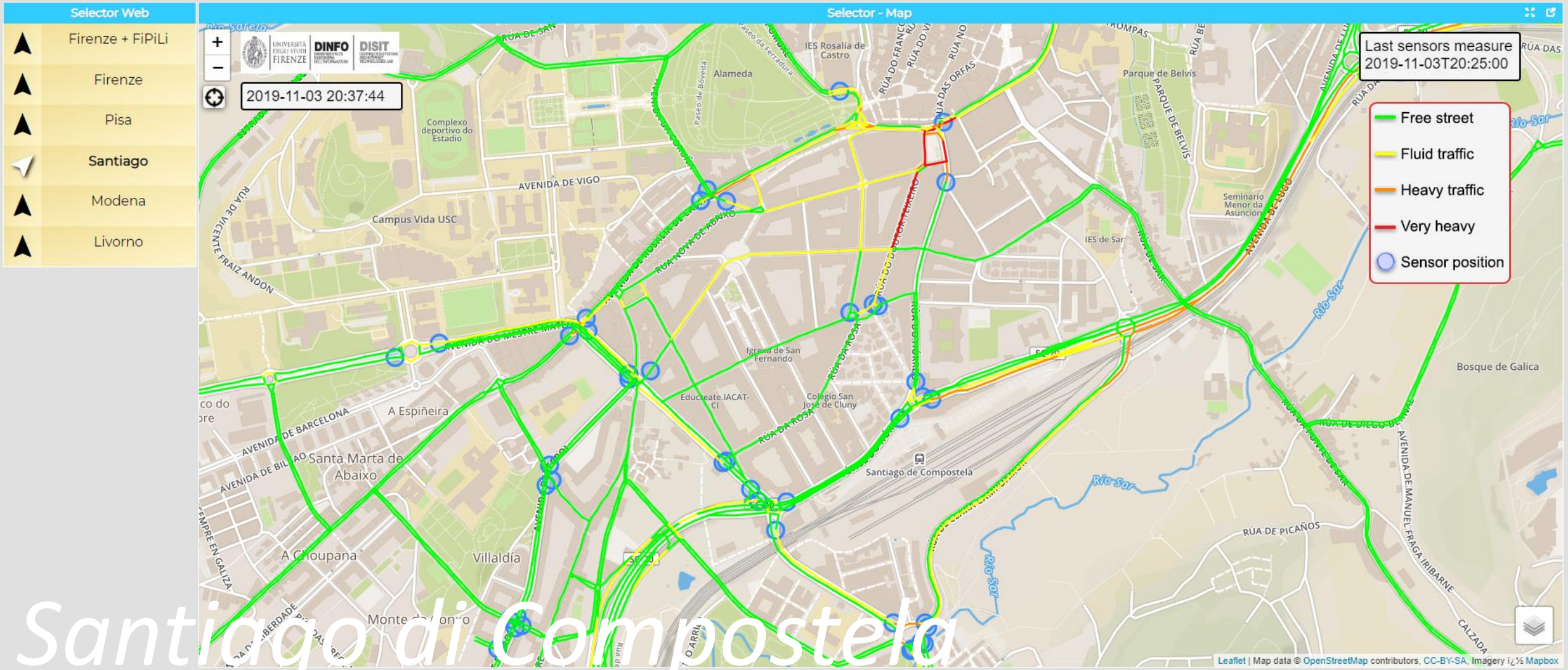




Santiago di Compostela

Traffic Flow Reconstruction for the cities

Sun 3 Nov 20:37:43



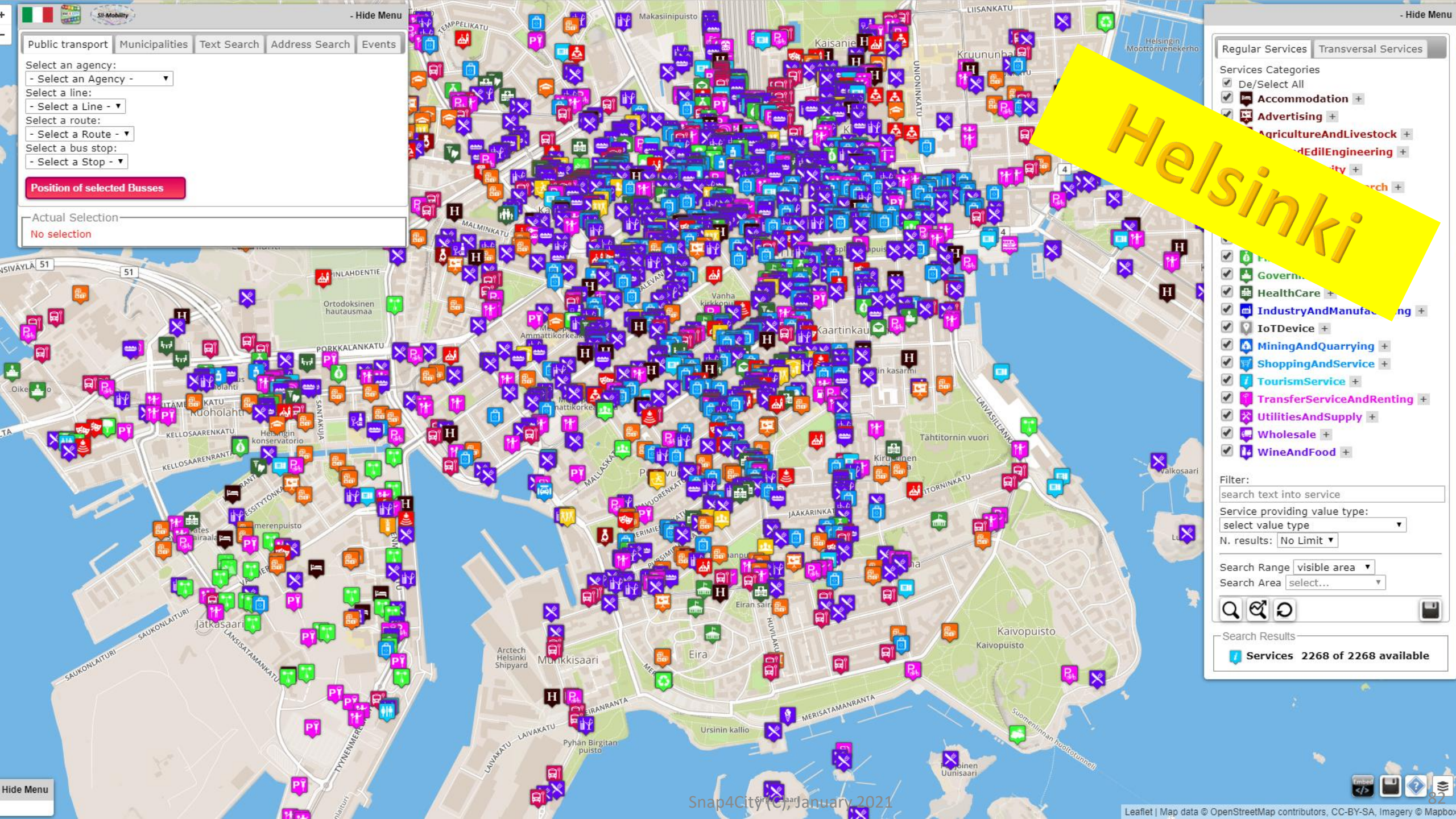
Santiago di Compostela

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https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc5NQ==

Helsinki




- Hide Menu
Public transport
Municipalities
Text Search
Address Search
Events
Select an agency:
- Select an Agency -
Select a line:
- Select a Line -
Select a route:
- Select a Route -
Select a bus stop:
- Select a Stop -
Position of selected Busses
Actual Selection
No selection
Helsinki
- Hide Menu
Regular Services
Transversal Services
Services Categories
De/Select All
Accommodation
Advertising
HealthCare
IoTDevice
MiningAndQuarrying
ShoppingAndService
TourismService
TransferServiceAndRenting
UtilitiesAndSupply
Wholesale
WineAndFood
Filter:
search text into service
Service providing value type:
select value type
N. results:
No Limit
Search Range
visible area
Search Area
select...
Search Results
Services 2268 of 2268 available
Hide Menu
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

Helsinki Case

- **Dashboards & Services**:
  - **Environment** & **Weather**, PM10, PM2.5,NO, SO2, CO, noise, etc.
    - Sensors values, Heatmap & **Alerts** on critical
    - FMI Enfuser prediction: PM10, PM2.5, ..
    - GRAL predictions PM10, validations
    - Private sensors in Jätkäsaari area (personal dashboards)
  - **Mobility**: Traffic Sensors, Operators, routing, multimodal routing, whatif
  - **Social**: Twitter Vigilance, early warning
  - **Life in Helsinki**: OD matrix people flow, Twitter Vigilance SA, hot places, etc.
  - **Tourism and Culture**
- **Mobile App and MicroApplications:**
  - Helsinki in a Snap (all stores)



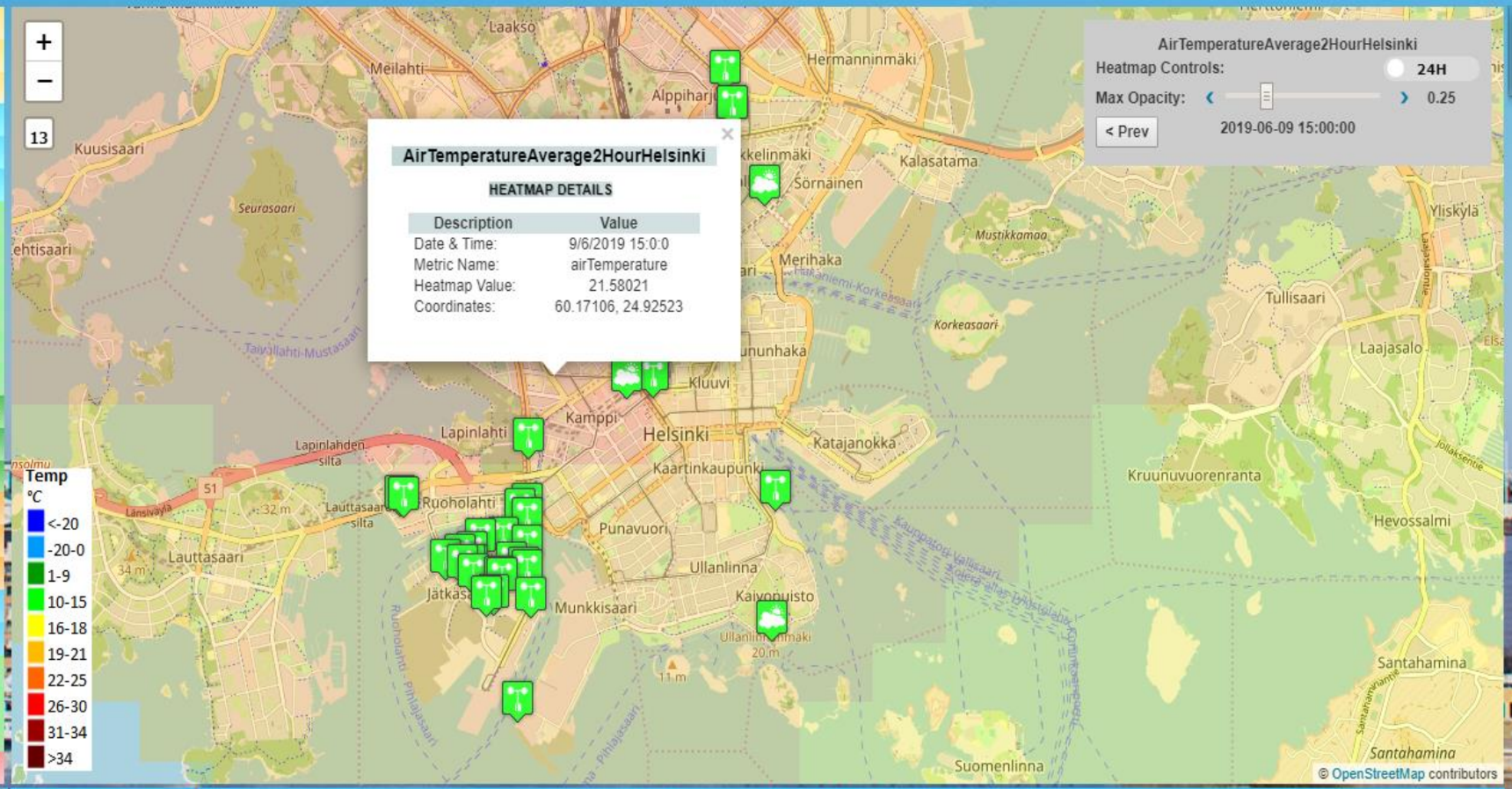
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTQwNg==

Helsinki City Overview (H5a)

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

Sun 9 Jun 17:07:25

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





Weather sen... 9m

20.5

Weather sensor Helsinki Kaisaniemi - airTemperature 9m



The Life of Helsinki

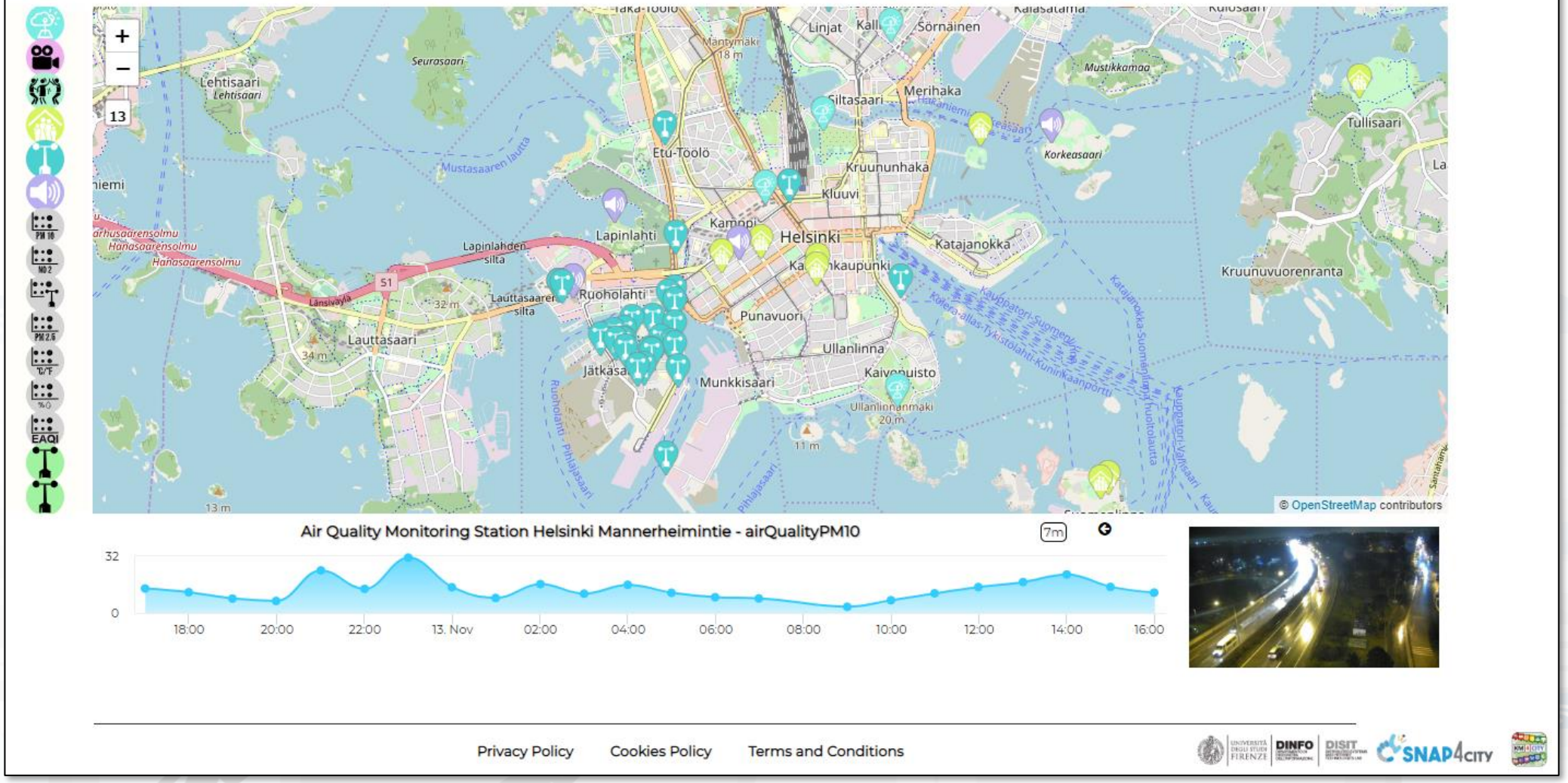
Documentation

Forum Discussion

Survey

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

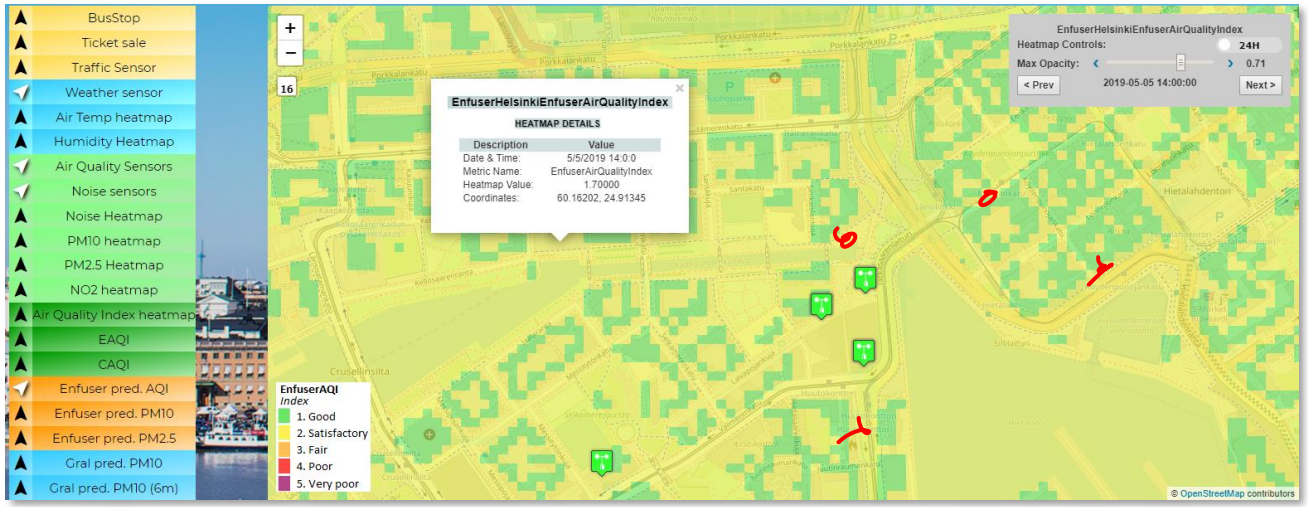
Helsinki icon

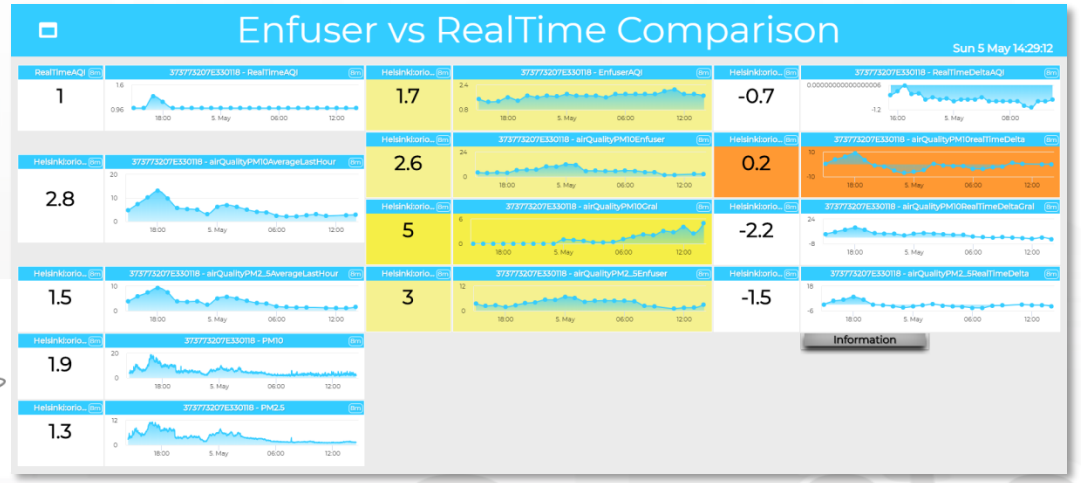


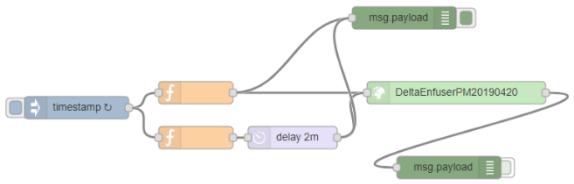
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjM1NQ==

Data Analytics: Enfuser predictions

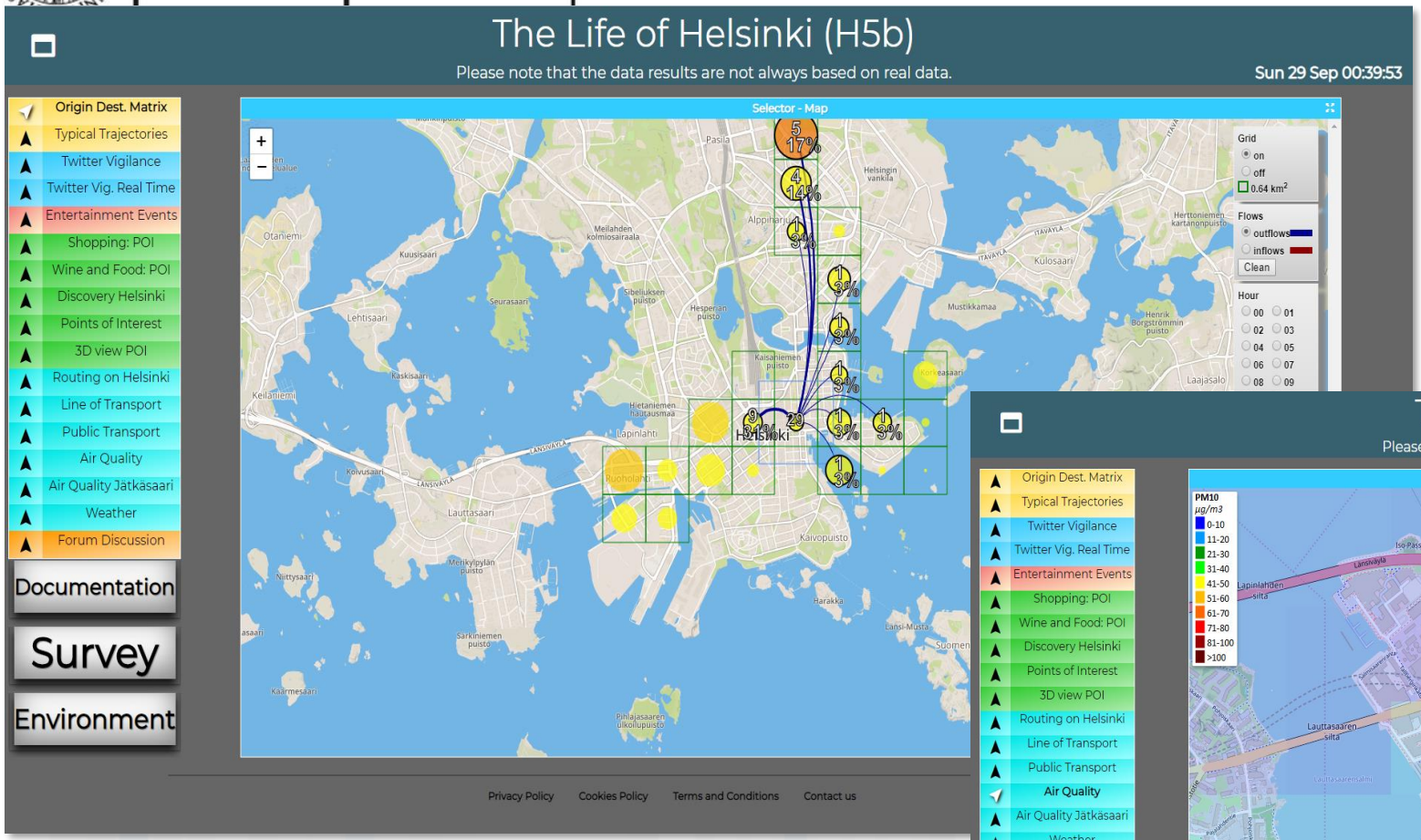
- **Enfuser predictions: AQI, PM10, PM2.5**
  - Data gathering, data processing for Piking
  - Delta Estimation Predictions vs Actual: on 12 points/sensors via R-Studio and IOT App
  - API for accessing data of Heatmaps in real time

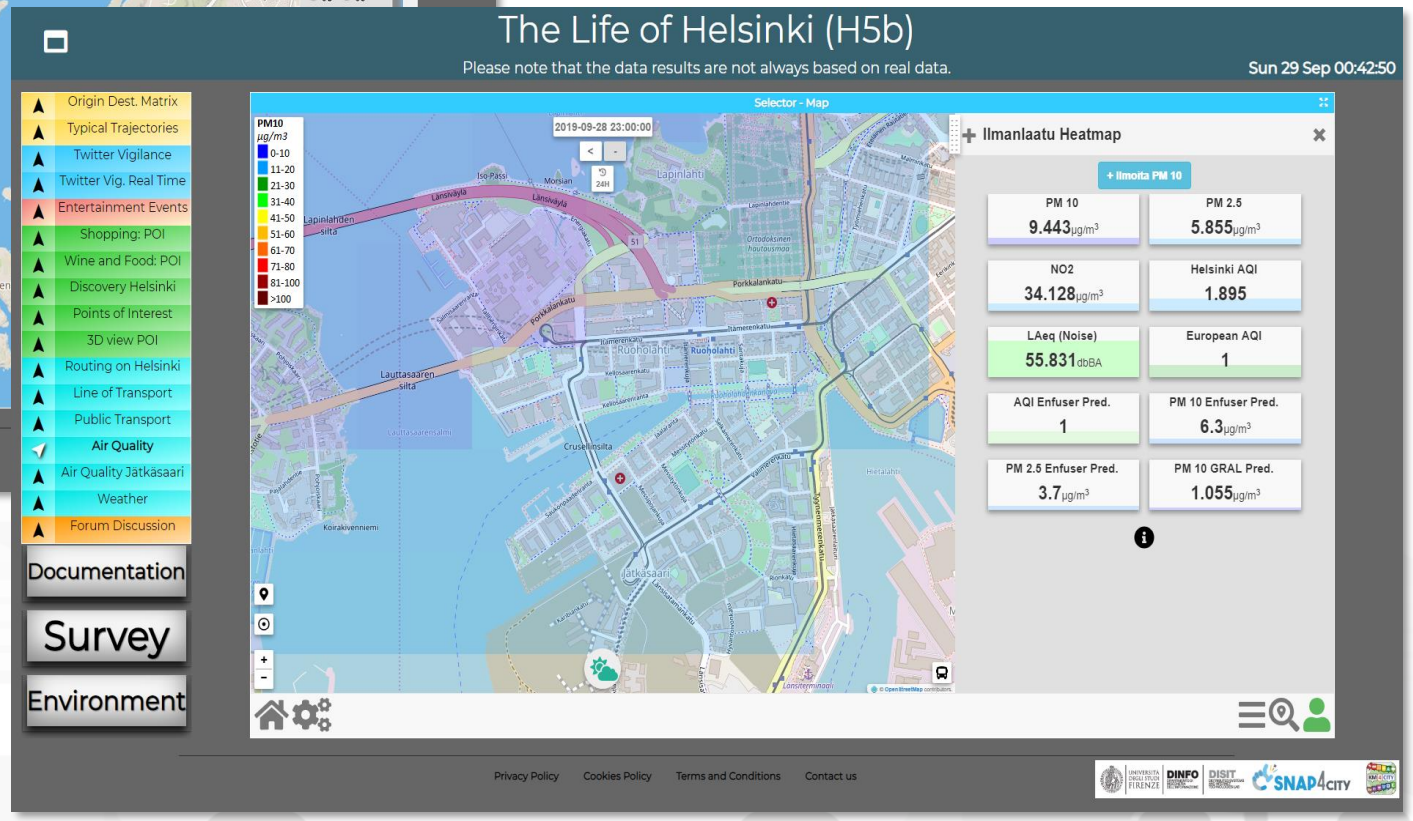






Helsinki





https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc1Mg==

Environmental Data Predictions: GRAL

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

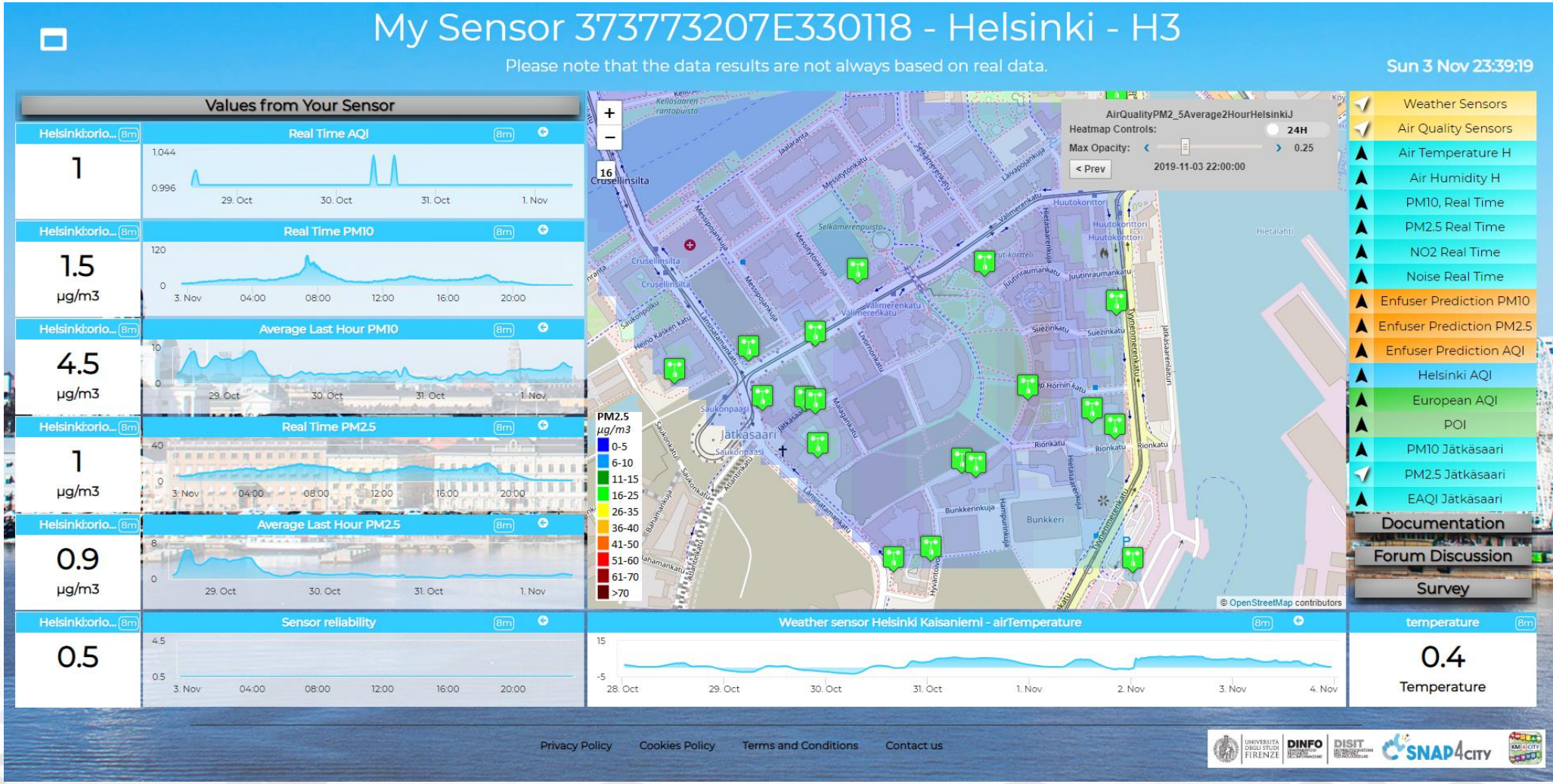


TRAFAIR

Environmental Devices hosted by Citizens









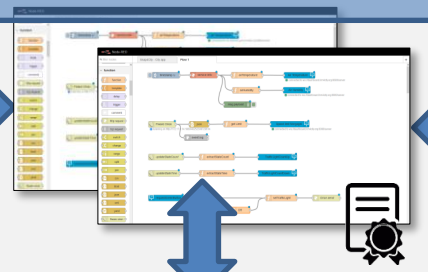
Prato
Smart City vs Industry 4.0

GIDA set up

Smart City data from many sources



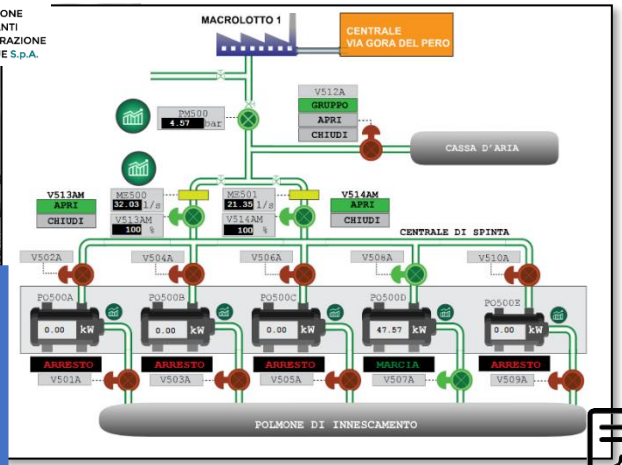
IOT Applications



Dashboards and Apps







IOT Data Shadow Snap4City

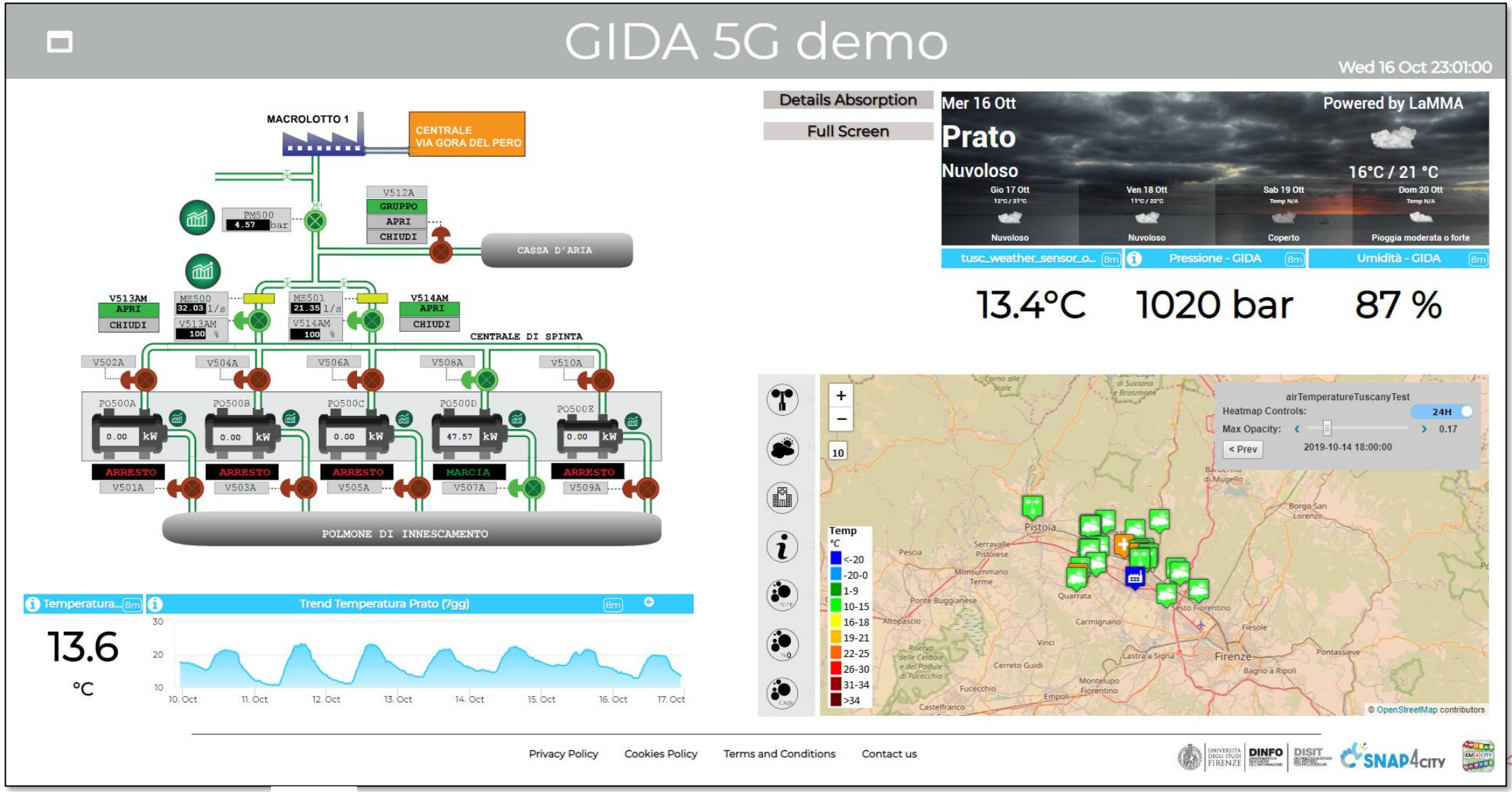
Big Data Analytics, Artificial Intelligence

ModBus to Snap4City Gateway Edge

5G network devices

Telemonitoring
Telecontrol

Dashboards & Services:

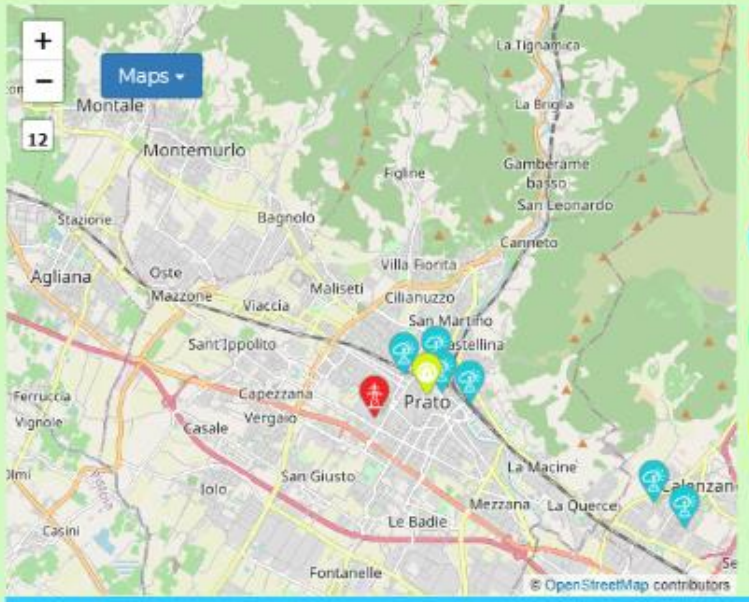


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjIyNg==

Snap4Home 5G Demo

Thu 11 Jun 18:07:32









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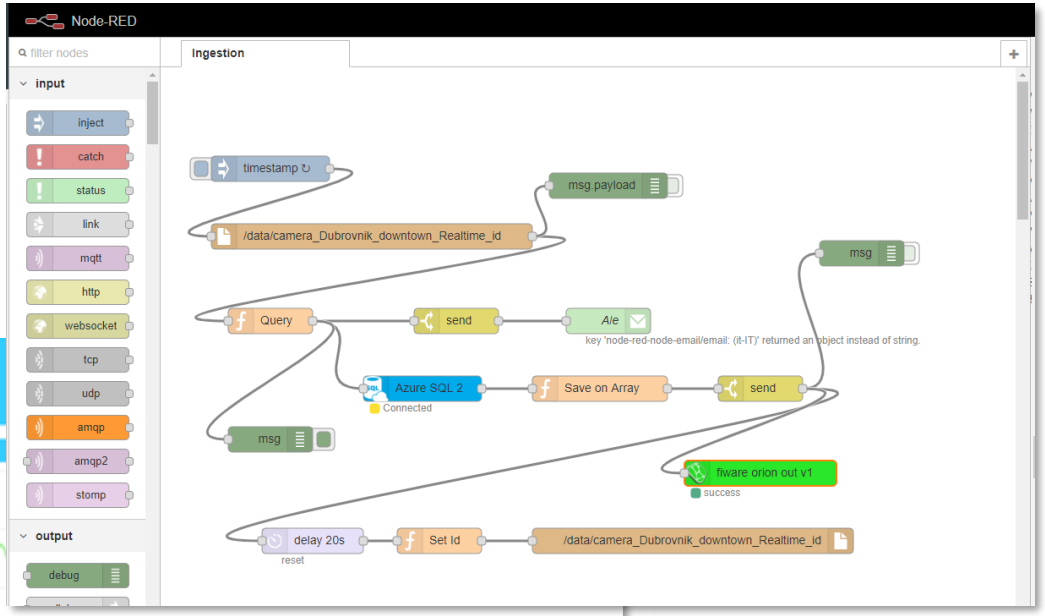
open fiber WIND 3 ZTE estra

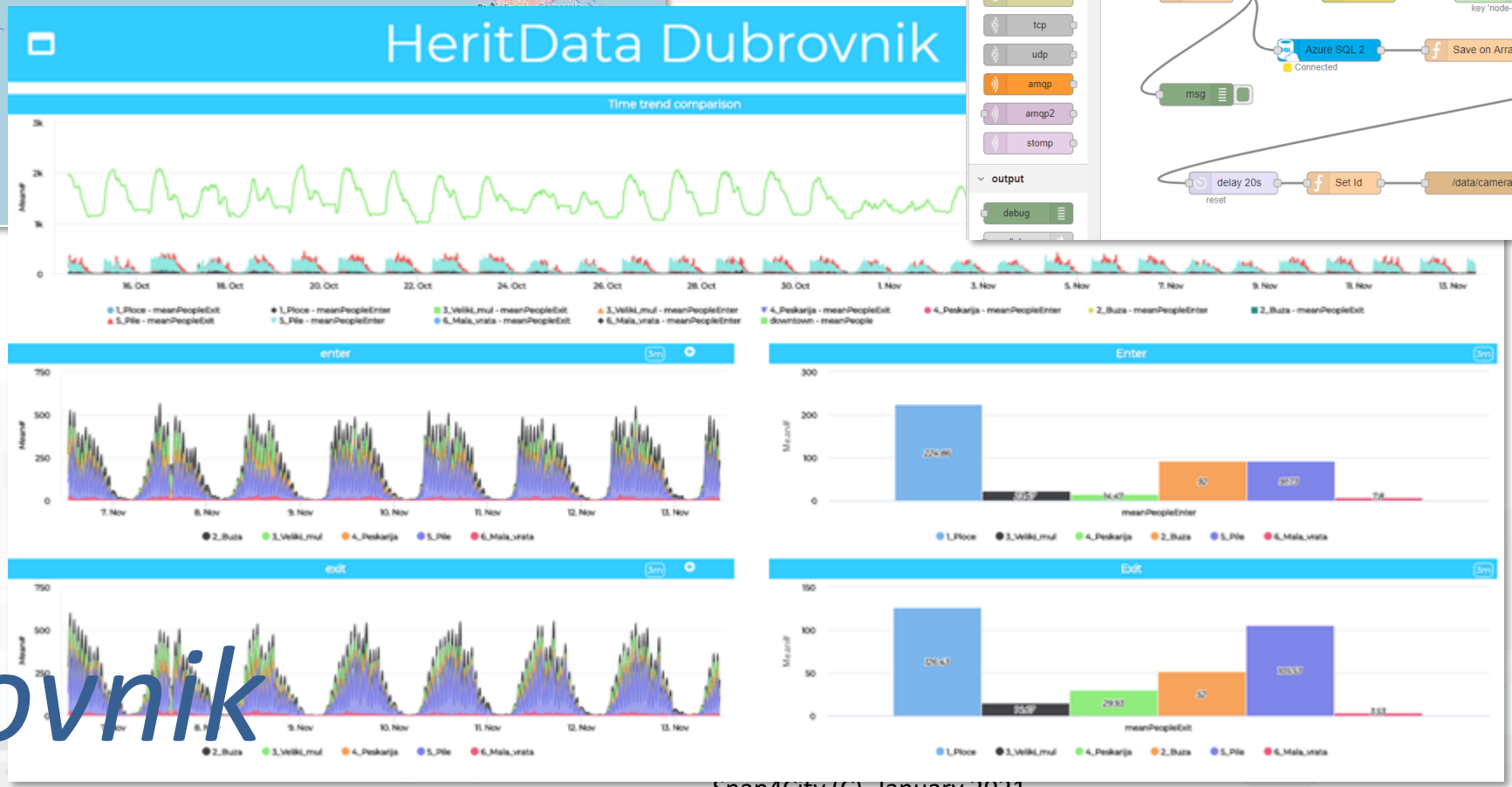

Dubrovnik

People Flows







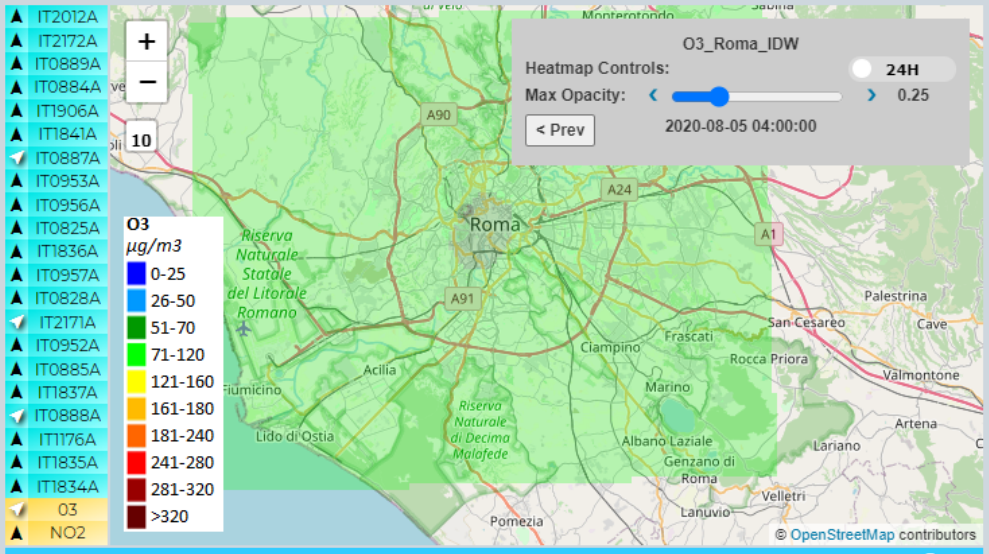


Dubrovnik

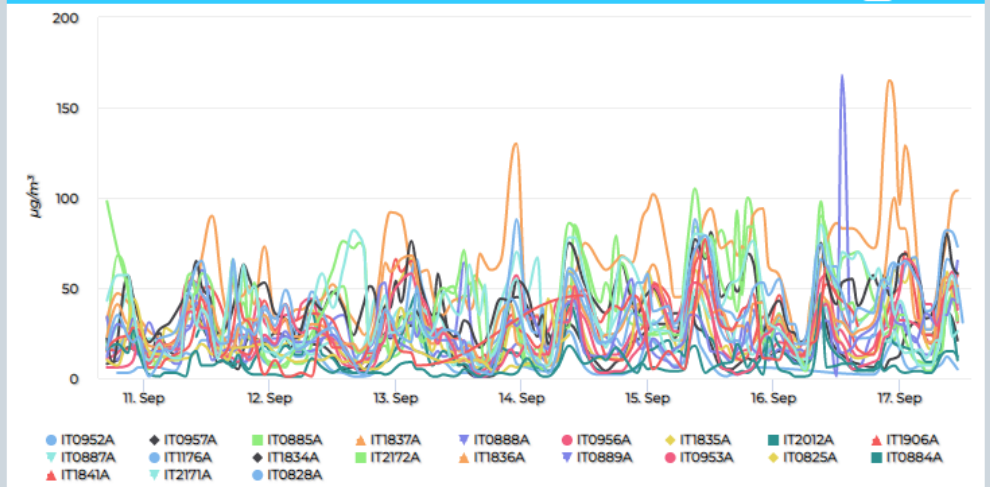

Roma (I)

Roma Demo3 (Qualità dell'Aria)

Thu 17 Sep 16:13:28



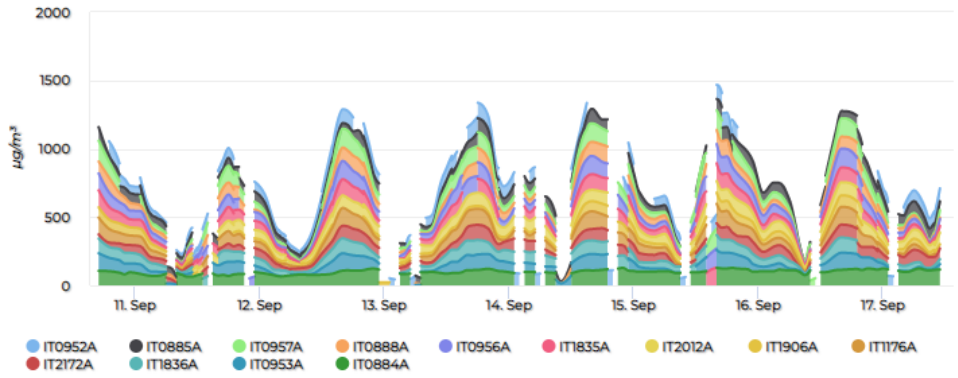
Andamento nel Tempo di NO2 rilevato nelle stazioni in Roma



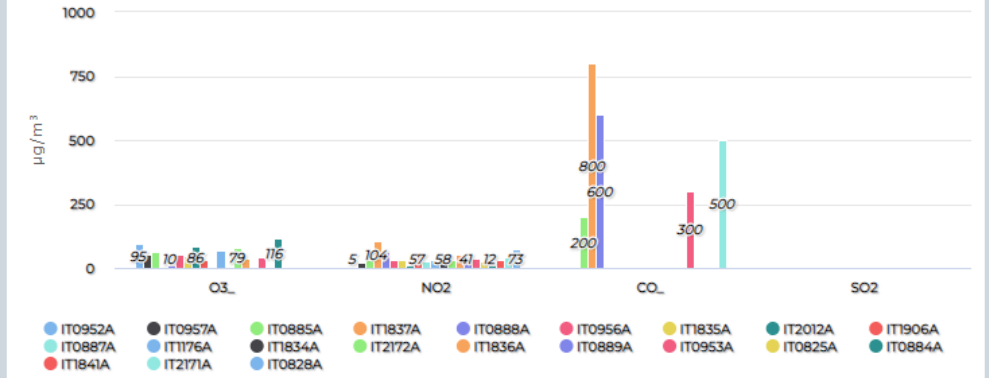
Valori Inquinanti in tempo reale, mappe

value type / value name	O3_	NO2	CO_	SO2
IT0952A	95	5		
IT0957A	54	21		
IT0885A	65	31	200	
IT1837A		104	800	
IT0888A	10	65	600	
IT0956A	51	31		
IT1835A	48	34		
IT2012A	86	10		
IT1906A	30	57		
IT0887A		26		
IT1176A	67	31		
IT1834A		58		
IT2172A	79	32		
IT1836A	36	51		
IT0953A	40	38	300	1.2
IT0889A		41		
IT0825A		24		
IT0884A	116	12		
IT1841A		29		
IT2171A		42	500	
IT0828A		73		

Andamento nel Tempo di O3 rilevato nelle stazioni in Roma (stacked)



Dati in Tempo reale inquinanti in Roma e provincia

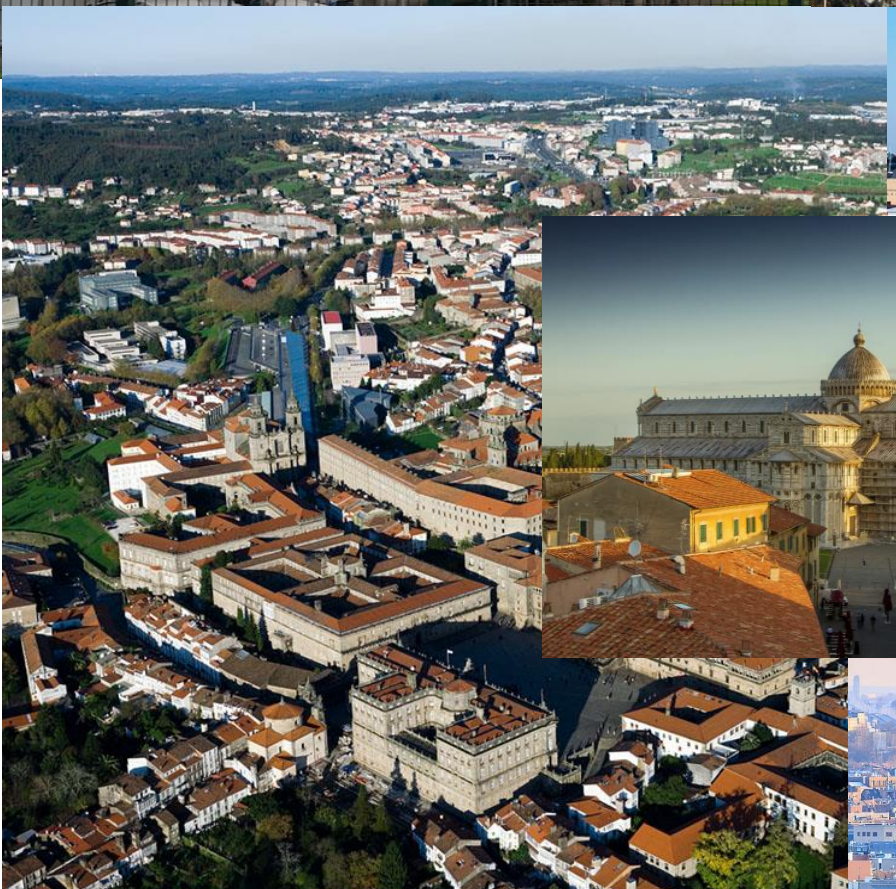


Home

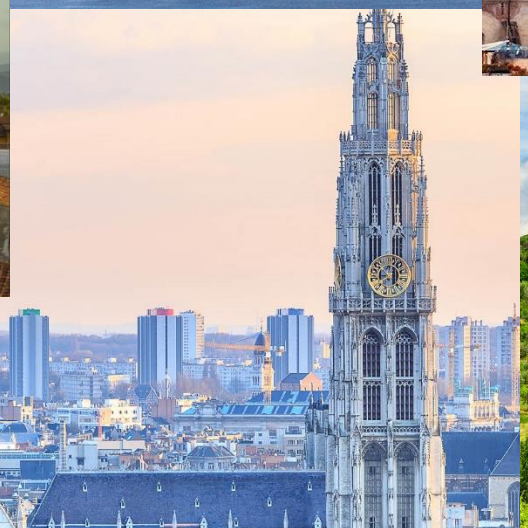
Trasporti

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjcyNg==









https://www.snap4city.org/4



- Scenario: SnapBot: Real Time Smart City services via Telegram
- Scenario: Copernicus Satellite Data
- Scenario: SmartBed, Materasso Intelligente
- MicroServices Suite for Smart City Applications
- Scenario: MODBUS for Snap4Industry Snap4City Applications
- Scenario: MOBIMART Interreg: MOBilità Intelligente MARe Terra
- Scenario: City of Roma case, mobility and environmental data
- Scenario: Herit-Data video and aims
- Scenario: Control Room vs Video Wall
- Scenario: Snap4Home the case of: Alexa, Philips, Sonoff, TP-link, etc. (Italiano)
- Scenario: how to manage maintenance and accidents workflows
- Scenario: Snap4Home, how to exploit Snap4City solution on home automation
- Scenario: Energy Monitoring
- Scenario: Multipurpose User Engagement Tools
- Scenario: 5G Enabled Water Cleaning Control (smart city, industry 4.0)
- Scenario: High Level Control of Industrial Plant (industry 4.0)
- Scenario: Vehicle Monitoring via OBD2
- Scenario: Events and Museums Monitoring in Antwerp
- Scenario: High Resolution Prediction of Environmental Data
- Scenario: Mobility and Transport Analyses in multiple cities
- Scenario: People Flow Analysis via Wi-Fi
- Scenario: Antwerp Pilot on Environmental Data
- Scenario: Helsinki Pilot on Environmental Data
- Scenario: Firenze Smart City Control Room
- Scenario: Mobile & Web App: Toscana Where What … Km4City, Toscana in a Snap
- Scenario: Helsinki Pilot on User Behaviour
- Scenario: Antwerp Pilot on User Behaviour

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

MORE data in other locations that we manage

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

Many data analytics, for example:

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

TOP



Overview

Scalable Sentient Cities Builder

SNAP4
Appliances and Dockers
Installations

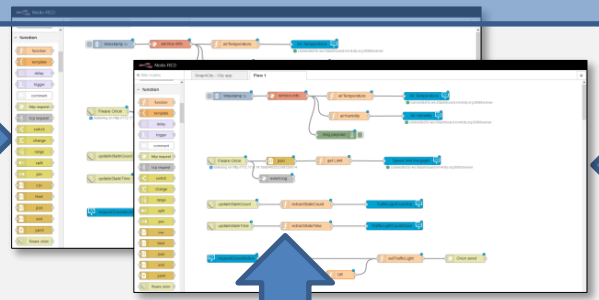
Snap4City: Builder of Sentient Cities Solutions

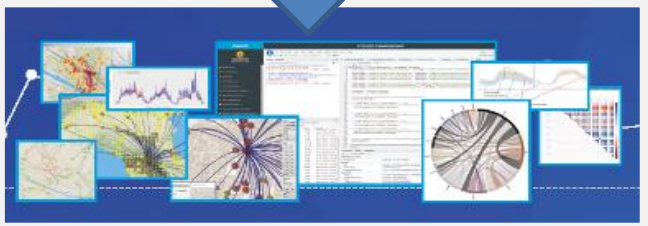
Dashboards with data driven IOT Applications enforcing intelligence

IOT and data World

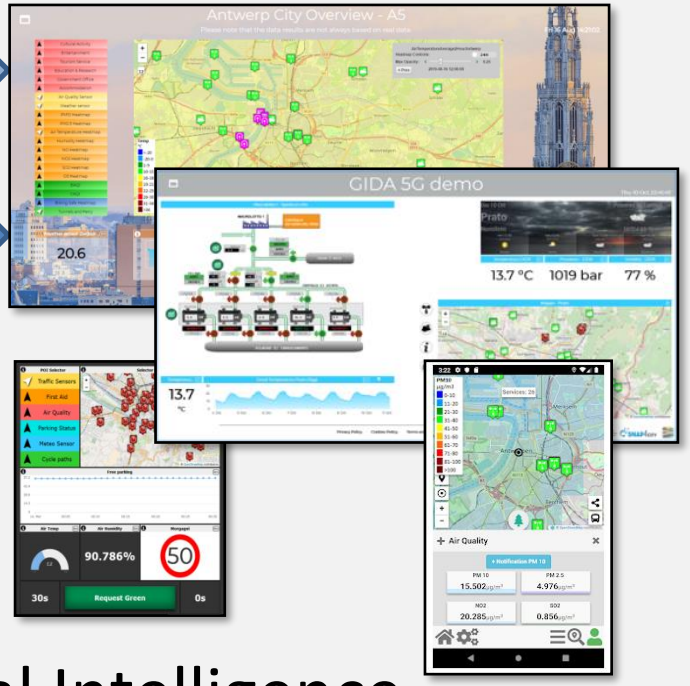


IOT Applications





Dashboards and Apps



Big Data Analytics, Artificial Intelligence

SNAP4CITY

KM4CITY

URBAN PLATFORM: SMART CITY IOT AS A SERVICE AND ON PREMISE

100% OPEN SOURCE

APPLIANCES CONTAINERS



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

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

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

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

IOT APPLICATIONS - INSTANT APPS



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

DASHBOARDS & APPLICATIONS



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

MOBILE & WEB APPLICATIONS



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

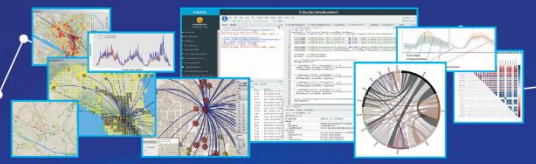
MICROSERVICES & ADVANCED SMART CITY API

LIVING LAB - DEV TOOLS - COWORKING

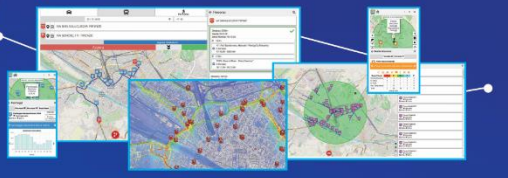


IOT DIRECTORY • SERVICE MAP • RESOURCE MANAGER • DATA GATE • R STUDIO • ETL

BIG DATA - DATA ANALYTICS



DATA ANALYTICS TOOLS - MICRO-APPLICATIONS



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

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

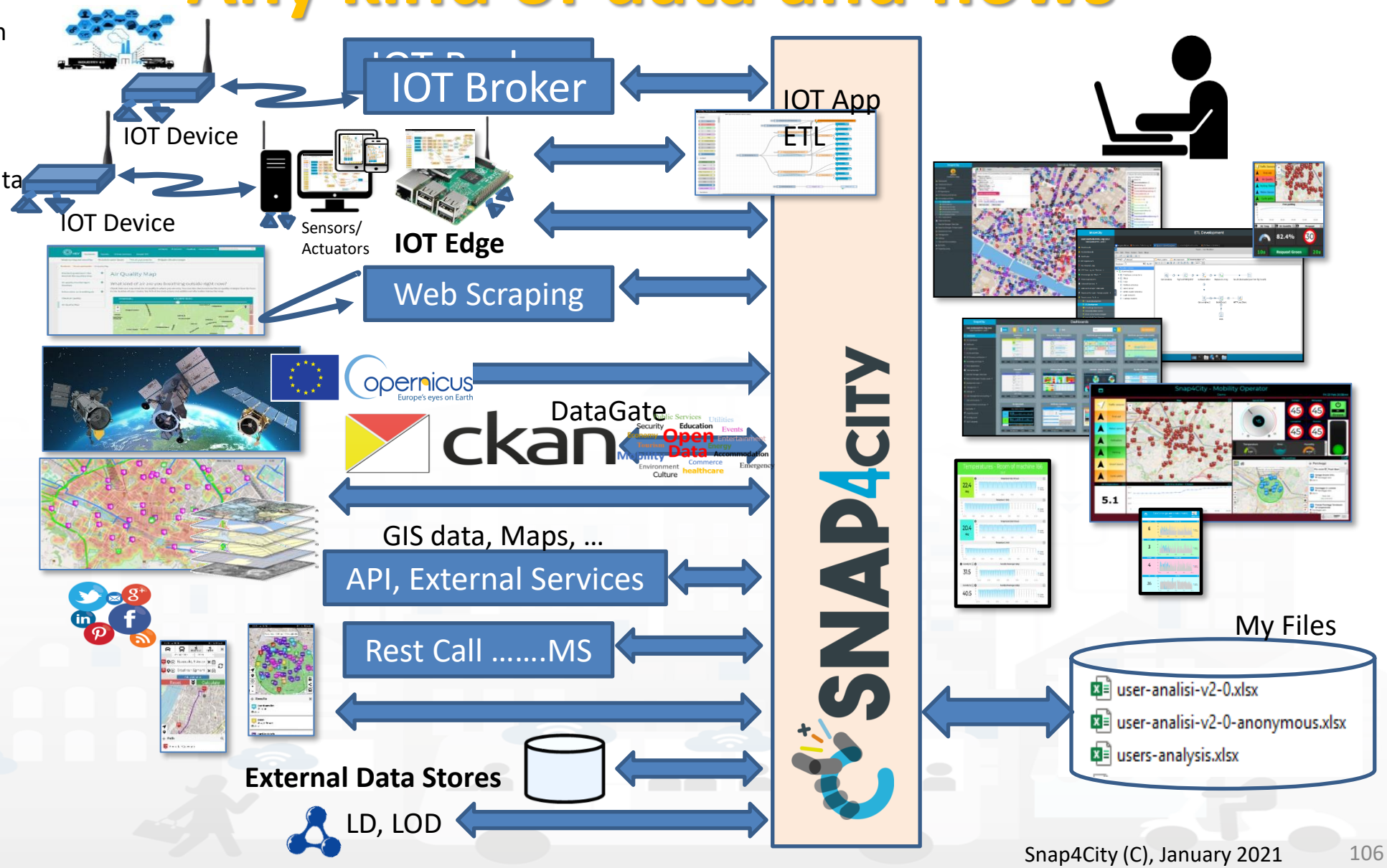
IOT MNG - DATA MNG - DATA INSPECTOR – PROCESS MNG – USER ENGAGEMENT – GDPR MNG ...

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



Any kind of data and flows

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



Standards and Interoperability

Compliant with: AMQP, COAP, MQTT, OneM2M, HTTP, HTTPS, TLS, Rest Call, SMTP, TCP, UDP, NGSI, LoRa, LoRaWan, TheThingsNetwork, SigFOX, DATEX II, SOAP, WSDL, Twitter, FaceBook, Telegram, SMS, OLAP, MySQL, Mongo, HBASE, SOLR, SPARQL, EMAIL, FTP, FTPS, WebSocket, WebSocket Secure, ModBUS, OPC, GML, RS485, RS232, WFS, WMS, ODBC, JDBC, Elastic Search, Phoenix, XML, JSON, CSV, db, GeoJSON, Enfuser FMI, Android, Raspberry Pi, Local File System, ESP32, Libelium, IBIMET/IBE, OBD2, SVG, XLS, XLSX, TXT, HTML, CSS, KNX, Enocean, Zigbee, DALI, ISEMC, Alexa, Sonoff, HUE Philips, Tplink, BACnet, TALQ, Copernicus, etc. https://www.snap4city.org/65

Smart City Functional Architecture

Transport systems Mobility, parking



Public Services, Govern, events, …



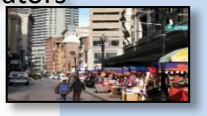
Sensors, IOT Cameras, Wi-Fi



Environment, Water, energy



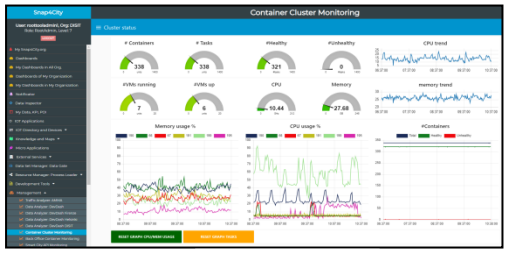
Shops, services, operators



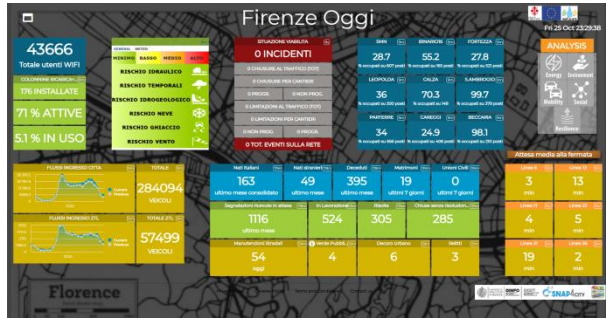
Social Media

Social Media Crawler and Manager









Back-End ← → Front-End

Data Sources, External Services *PULL Data*

Data Sources, Brokers, External Services *Data Driven, Real Time*

Data Ingestion, aggregation, regularizatio n, reconcile: IOT Directory, NIFI, special tools

Knowledge base Semantic Reasoners

Indexing and aggregating Elastic Search

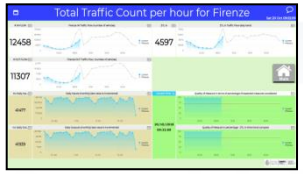
Federation

Search and Query, Smart City API, Web Socket Server, GIS, Facet, semantic

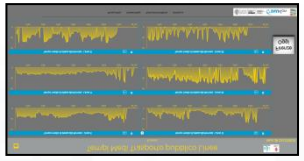
Data Analytics, Simulations, Special Tools R Studio, Tensor Flow, Python, ….

IOT Applications, Business Logic Node-RED + Snap4City MicroServices

Rendering Acting, Widgets, Synoptics, MicroApps User interface, Drill down, maps, heatmaps

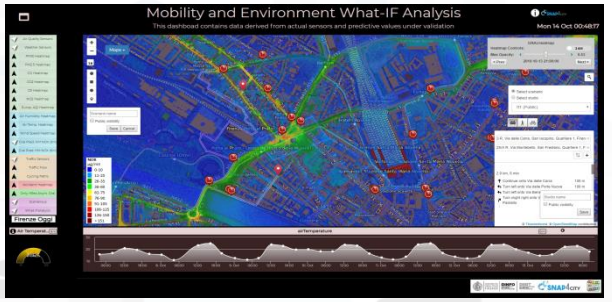












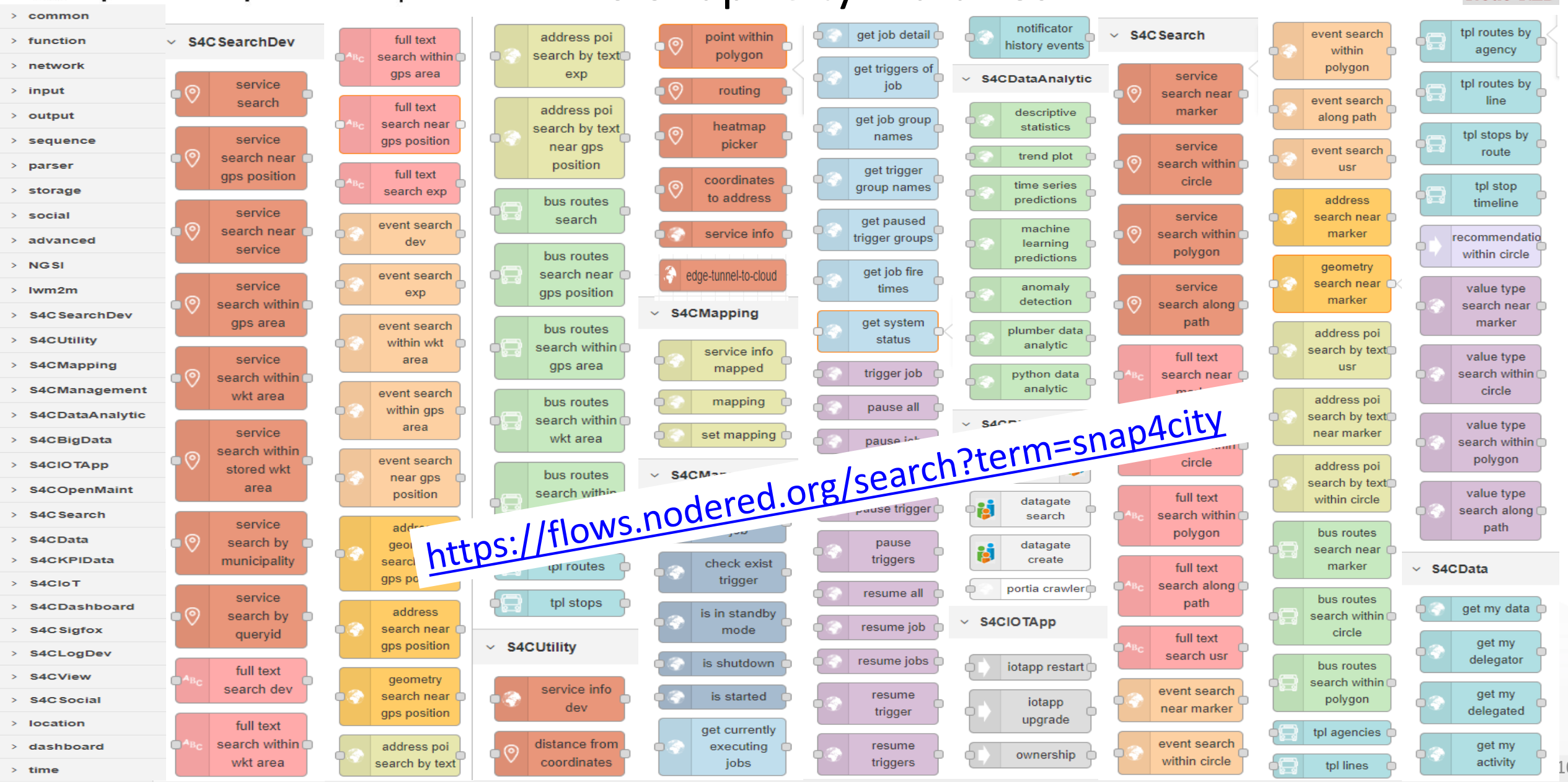
Inform, announce, Act!, warning, alarms, What-IF, ..

Authentication, Authorization, Platform & Processes Management, Data Inspector, Digital Twin, …

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Nov. 2020 collection
Two Snap4City Libraries

SNAP4CITY | Node-RED



https://flows.nodered.org/search?term=snap4city

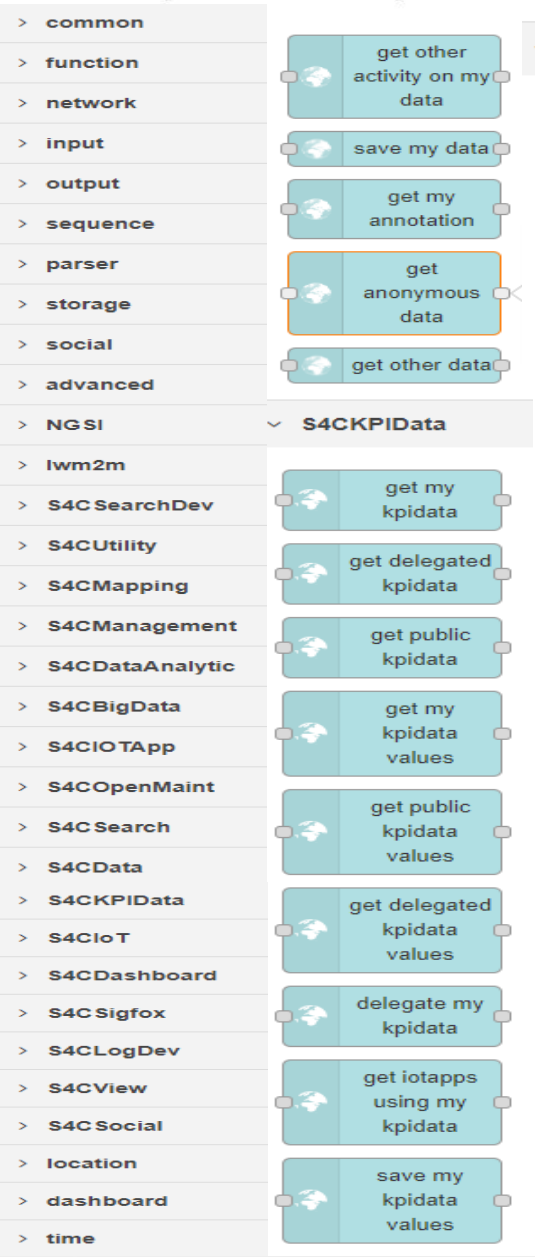
UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

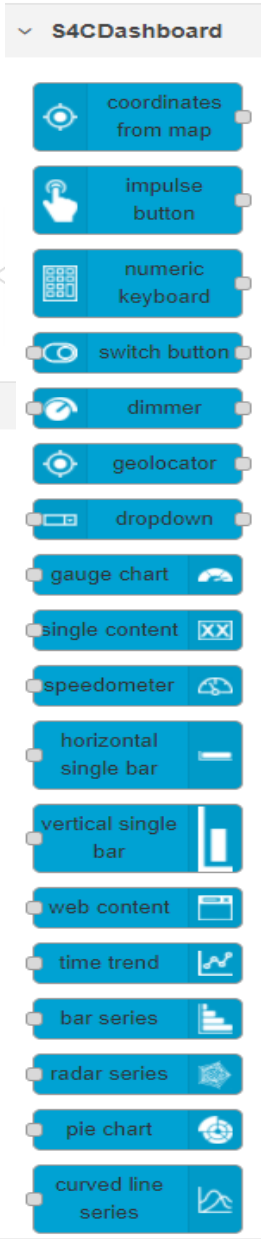
Nov. 2020 collection

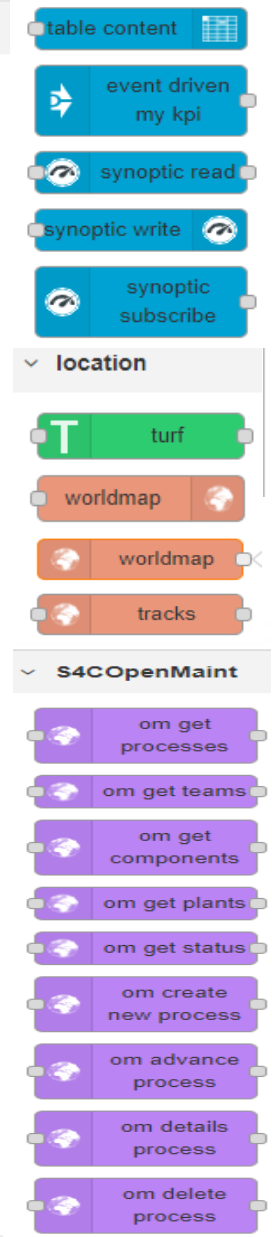
Two Snap4City Libraries

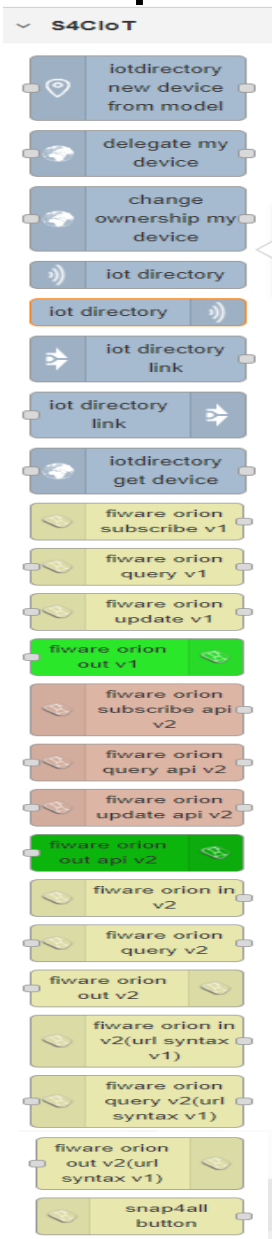
SNAP4CITY | Node-RED

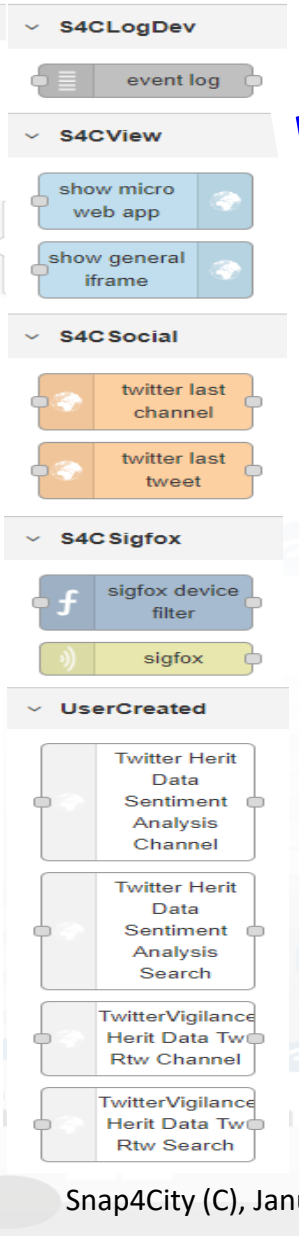
https://flows.nodered.org/search?term=snap4city



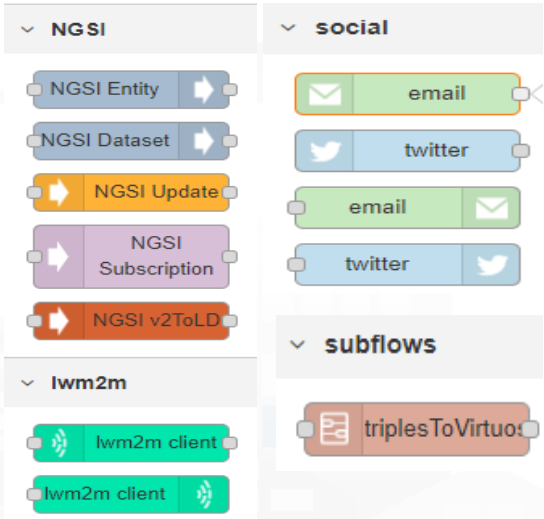








We suggest also to install:



Nov. 2020 collection
Two Snap4City Libraries

-Search and management of Services, POI, Parking, Public Transport, etc.

-Event management, ticket management

-Routing, Data Analytic, Open Data processing

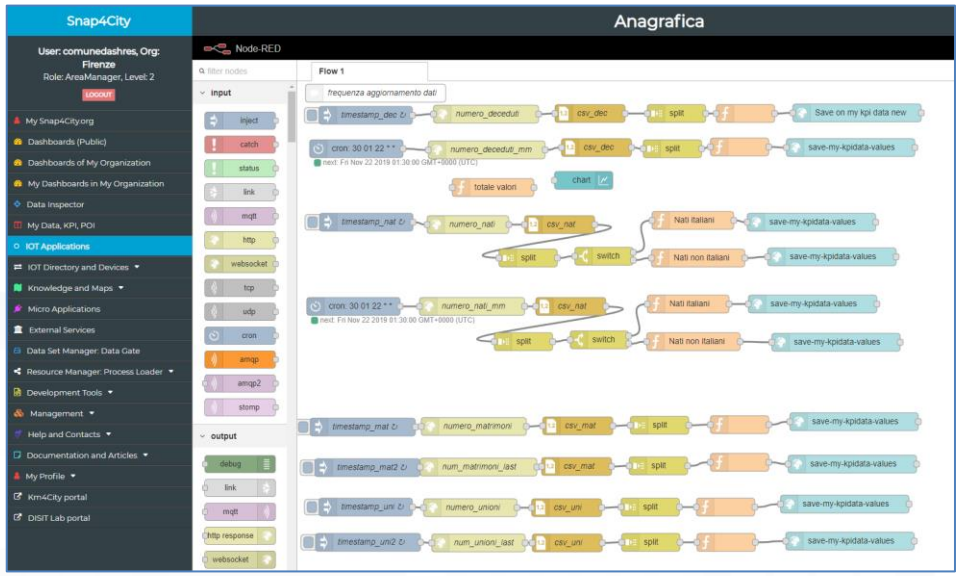
-IOT network management

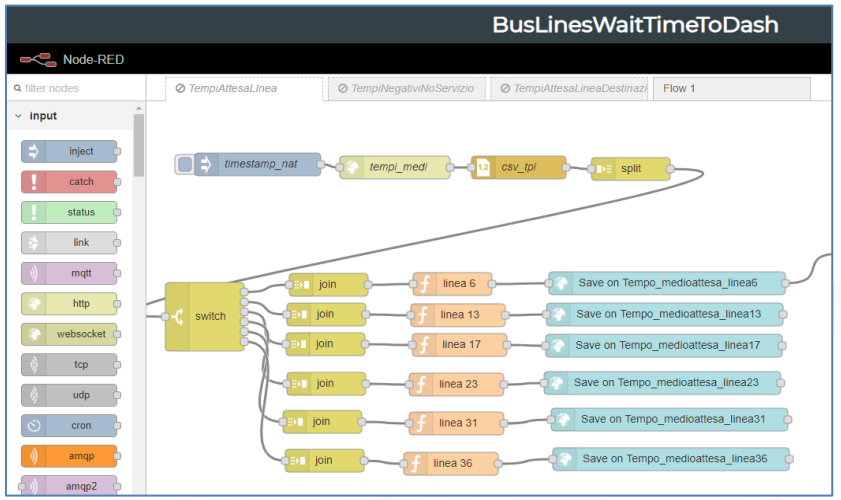
-Dashboard management

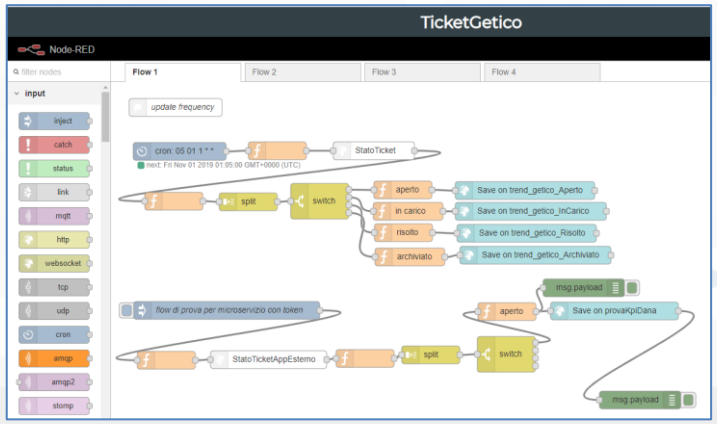
-Personal data management, KPI, etc.

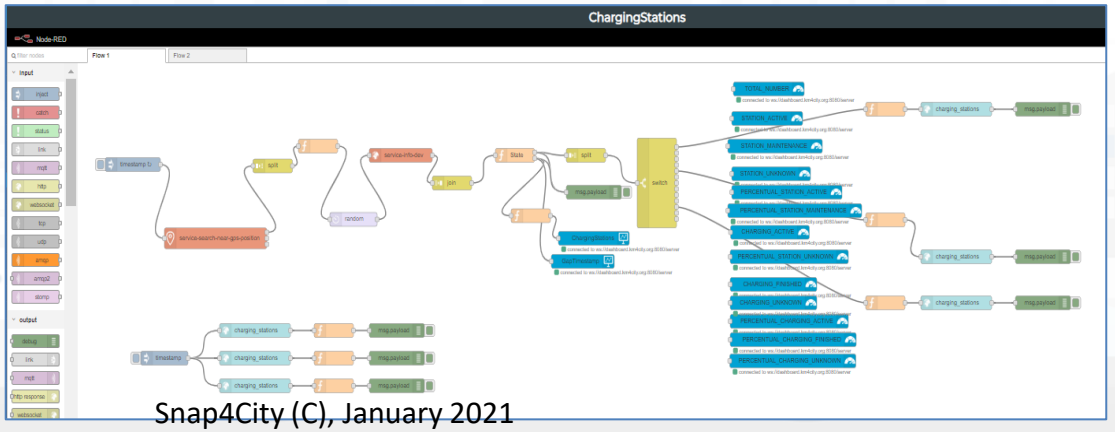
…..

The Back-Office Data Flows (selection) Exploiting *the Snap4City Node-RED MicroServices*



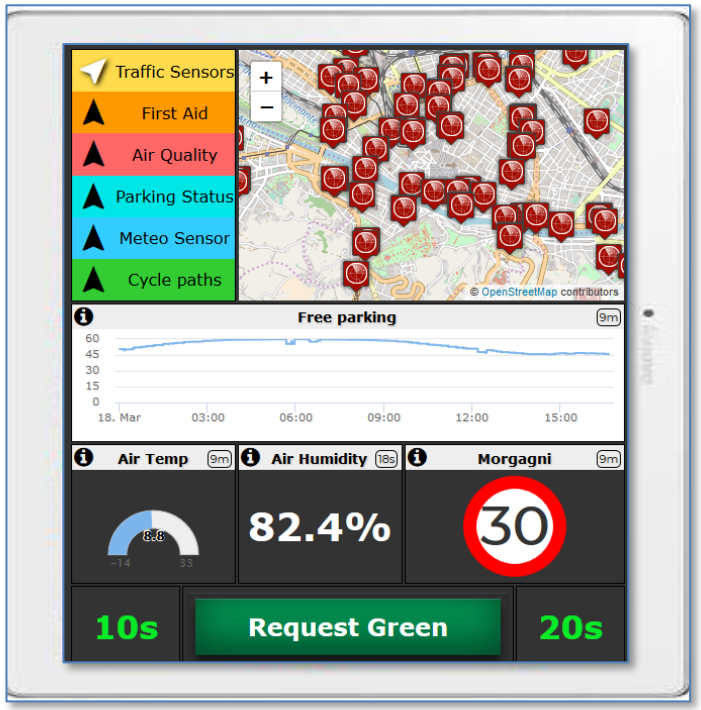


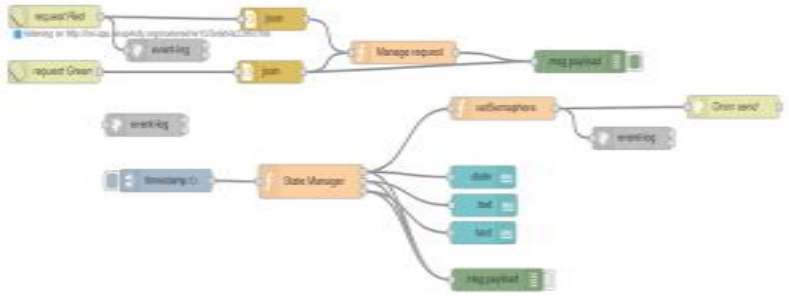




The usage of IOT Applications

- IOT Applications = Node-RED + Snap4City Libraries
- Used for:
  - **Data Ingestion, Transformation, Extract, Load, and Adaptation** (format and protocol), See Part 5 of the Course
  - **IOT Edge Devices logic**, for implementing logic on IOT Edge, including **IOT Device control** (see on Part 3 of the course)
  - **Business Logic** control of Dashboards, via Web Sockets secure
    - see Part 2 of the Course
  - **Control and schedule of Data Analytic**, and Machine Learning (see part 4 of the Course)
  - **Firing and condition identification and alerting**.


Traffic Sensors
First Aid
Air Quality
Parking Status
Meteo Sensor
Cycle paths
© OpenStreetMap contributors
Free parking
9m
60
45
30
15
0
18. Mar
03:00
06:00
09:00
12:00
15:00
Air Temp
9m
Air Humidity
18s
Morgagni
9m
82.4%
30
10s
Request Green
20s





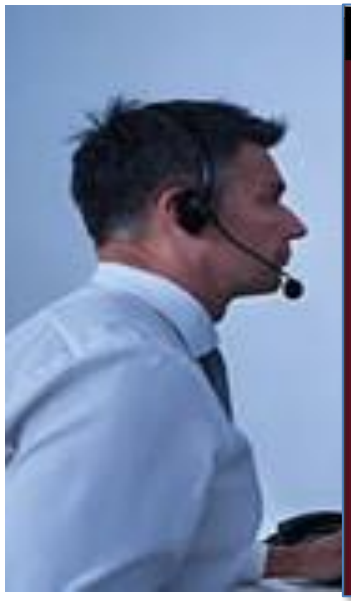


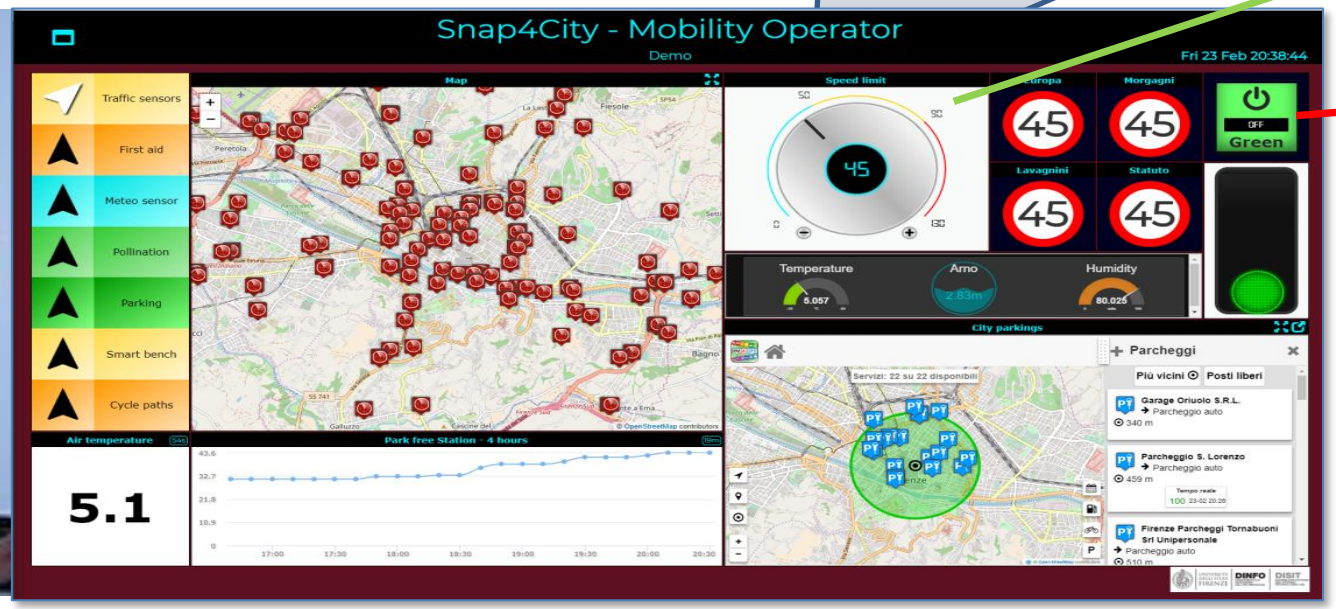


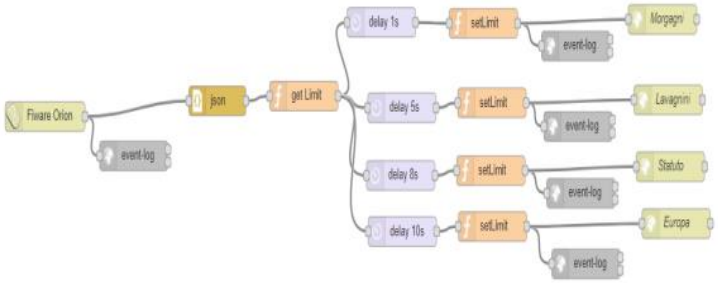




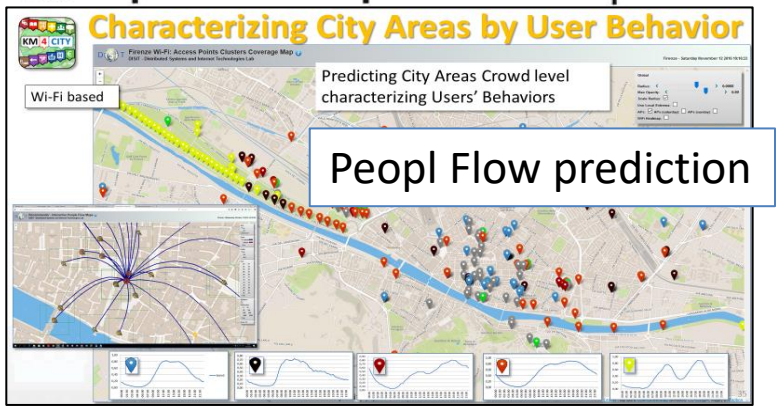




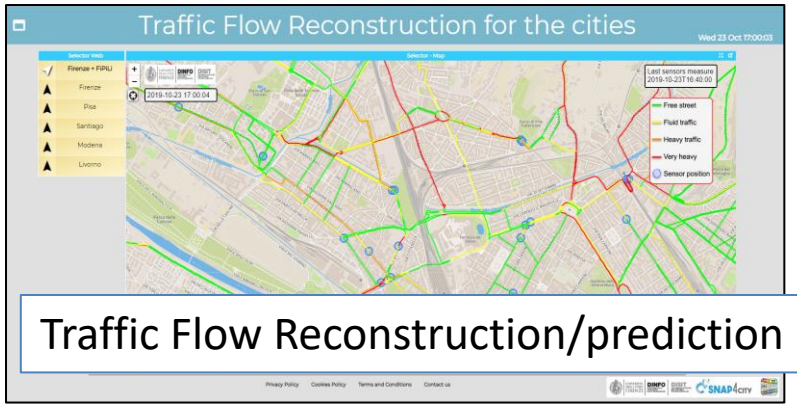

Snap4City - Mobility Operator
Demo
Fri 23 Feb 20:38:44
Traffic sensors
First aid
Meteo sensor
Pollination
Parking
Smart bench
Cycle paths
Map
Speed limit
Europa
Morgagni
Lavagnini
Statuto
45
OFF
Green
Temperature
Arno
Humidity
5.057
80.025
City parkings
Parcheggi
Più vicini
Posti liberi
Garage Oriuolo S.R.L.
Parcheggio S. Lorenzo
Firenze Parcheggi Tornabuoni Srl Unipersonale
Air temperature
Park free Station - 4 hours
5.1


Fiware Orion
event-log
json
get Limit
delay 1s
delay 5s
delay 8s
delay 10s
setLimit
Morgagni
Lavagnini
Statuto
Europa

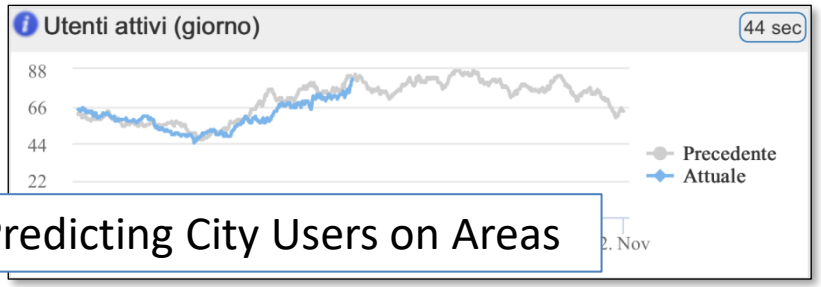
Data Analytics



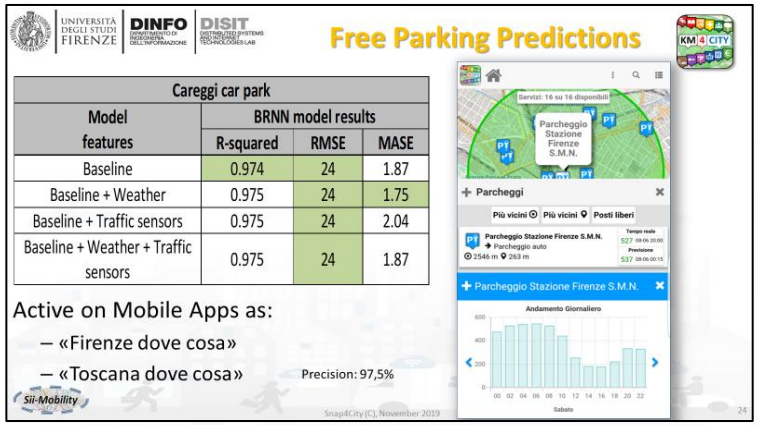
Peopl Flow prediction

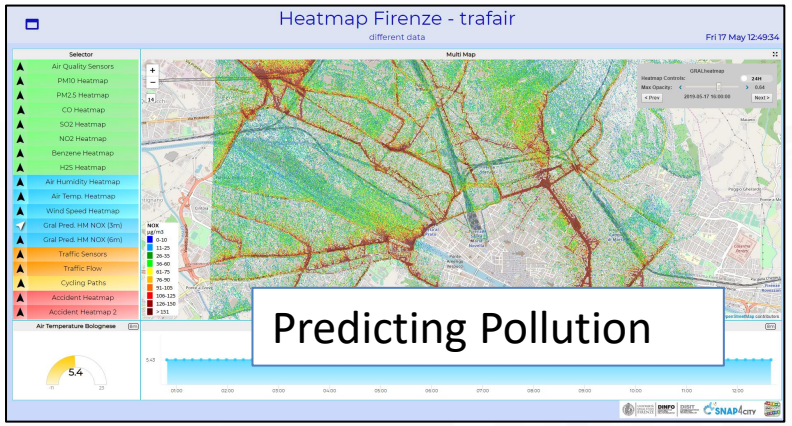


Traffic Flow Reconstruction/prediction

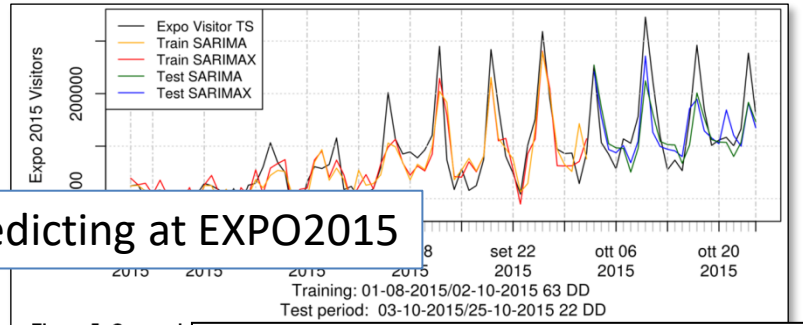


Predicting City Users on Areas

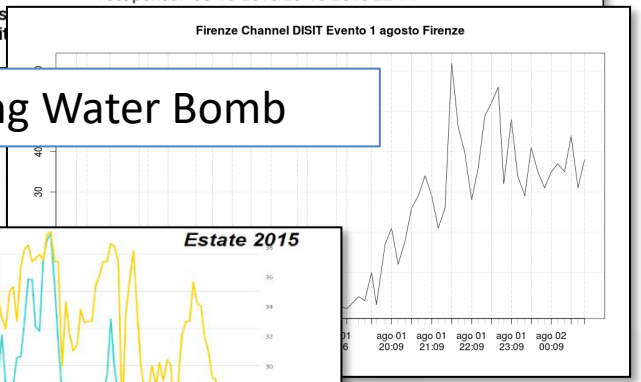




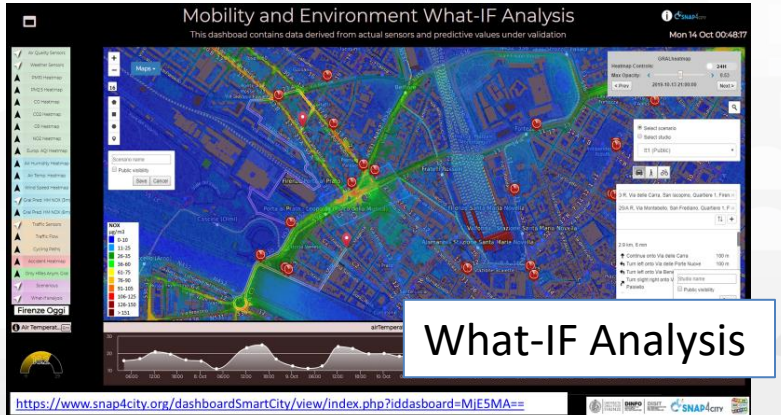
Predicting Pollution



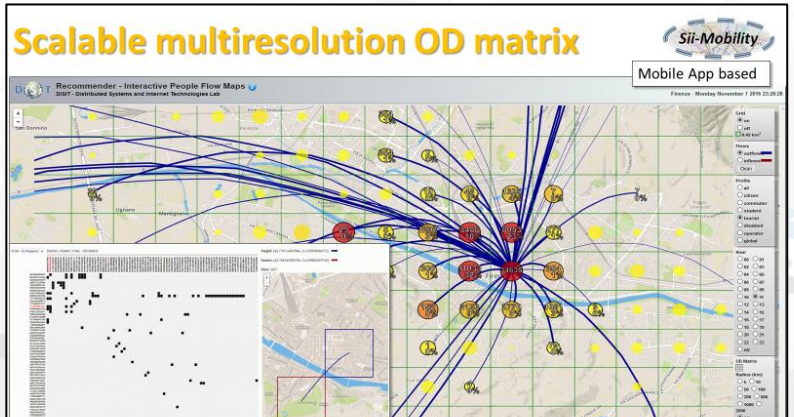
Predicting at EXPO2015

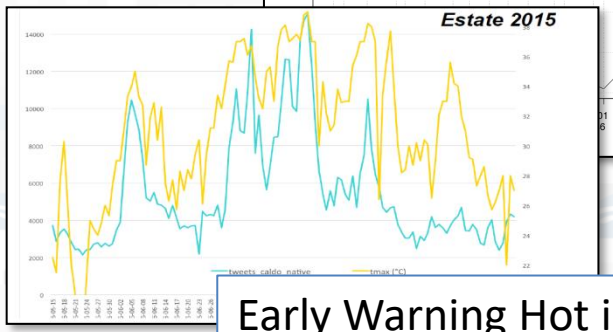


Early Warning Water Bomb



What-IF Analysis





Early Warning Hot in Tuscany

UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

Disappearing Data Analytics

SNAP4CITY | KM 4 CITY

SNAP4CITY	Antwerp					Helsinki								Where				
	City official	ICT official	Developer	Citizen, tourist, visitor	Business owner	City officials	City officials Domain experts	City officials City developers	Third party developers	Citizen	Citizens with respiratory problems	Tourists	Business owners	Mobile	MicroApplication	Tool, via Portal (ICT Developers)	Dashboards	RULE OF THUMB Main Data Sources
Discovery near to me	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			POI, OSM
Discovery along a path	x	x	x	x		x		x	x	x	x	x		x	x			POI, OSM
Discovery in an area, shape	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		POI, OSM
browsing Public Transport	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			OSM, GTFS
Full Text search	x	x	x	x	x	x		x	x	x	x	x	x	x		x		POI, OSM
Routing: pedestrian				x	x			x	x	x	x	x	x	x	x			OSM
Routing: pedestrian quite				x	x			x	x	x	x	x	x	x	x			OSM
Routing: private vehicles	x		x	x		x		x	x	x	x	x		x	x			OSM
Routing: Multimodal Public Transport				x					x	x	x	x		x	x	x		OSM, GTFS
heatmaps: weather (Temp, Humidity)	x	x		x	x	x	x		x	x	x	x	x	x			x	Sensors data, OSM
heatmaps: environmental variables, PM10, PM2.5, NO2, EAQI	x	x		x	x	x	x		x	x	x	x	x	x			x	Sensors data, OSM
heatmaps: environmental variables, Noise						x	x		x	x	x	x	x	x			x	Sensors data, OSM
heatmaps: safe on bike (Antwerp)	x	x		x	x									x			x	Spec. Portal
heatmaps: Enfuser prediction, PM10, PM2.5, AQI						x	x		x	x	x	x	x	x			x	Enfuser data
heatmaps piking values any place	x	x			x	x	x	x	x				x				x	Computed Heatmps
heatmaps: GRAL prediction, PM10						x	x		x	x	x	x	x	x			x	OSM, Traffic, Weather
Comparsison: Enfuser, Gral, Real Time						x	x										x	Enfuser, Sensors, GRAL
Sensors Data Time Trends, & drill down	x	x	x		x	x	x	x					x			x	x	Sensors data, OSM
Weather Forecast	x	x		x	x	x	x		x	x	x	x	x	x			x	Forecast Service
Origin Destination Matrices	x	x	x		x	x	x	x	x				x				x	Snap4City Mobile App
Typical trajectories	x	x	x	x	x	x	x	x	x				x			x	x	Snap4City Mobile App
Hot Area in the city	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	Snap4City Mobile App
Hot Places in Smart Zone	x	x	x	x	x									x		x	x	Snap4City PAXcounters
Services Suggestions on mobiles				x						x	x	x		x	x			Snap4City Mobile App
Alerts on critical cases: several variables	x			x	x	x	x			x	x		x	x				Sensors data, OSM
The most used services		x		x	x		x			x	x	x	x				x	Snap4City Mobile App
Twitter Trends Daily	x	x	x		x	x	x	x	x				x			x	x	Twitter Vigilance
The auditing of user and living lab		x				x		x								x		Snap4City Portal
Self assessment	x	x	x	x	x	x	x	x	x	x	x	x	x			x		Snap4City Portal
Trajectories reg from mobile PAX Counters	x	x	x			x	x	x							x		x	PAX Counters
Engagement real time assessment	x	x	x			x	x	x									x	Snap4City Mobile App



Dashboards (Public)
Knowledge and Maps
Service Map (Toscana)
Service Map 3D (Firenze)
Helsinki Service Map
Garda Lake Service Map
Cagliari Service Map
Service Map 3D (Helsinki)
Micro Applications
External Services
Data Set Manager: Data Gate
Resource Manager
Development Tools
Management
Help and Contacts
Documentation and Articles
Km4City portal
DISIT Lab portal

Snap4City - scalable Smart aNalytic APplication builder for sentient Cities



Tutorials Scenarious Innovations Interoperability Installations What People say

Mobile Apps IOT Devices IOT Applications Data Analytics Dashboards Living Lab Smart City API

Smart City Ontology Articles

SMARTCITY EXPO WORLD CONGRESS 19-21 Nov. 2019 *See you at Stand A118*

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

SNAP4CITY HACKATHON BUILD YOUR APP FOR A CONNECTED CITY

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

Login

Registration

- New Registration
- Request a new password

Search

Search

-Any-

Training Snap4City from Data to Sentient Cities in a Snap
Program and Interactive Slides

Powered by www.km4city.org

FI-WARE Node-RED

Virtual Assistant

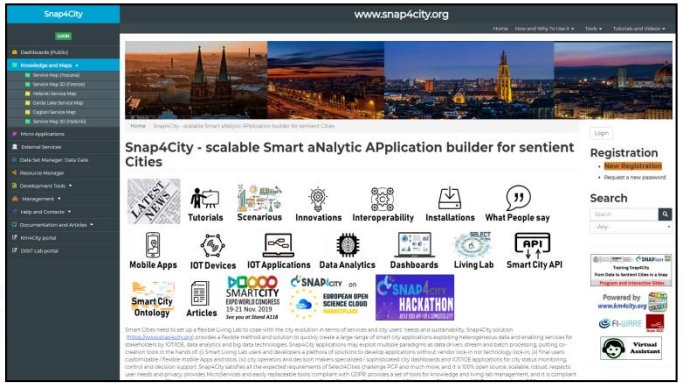
https://www.snap4city.org/577

On Line Training Material (free of charge)

	1st part (*)	2nd part (*)	3rd part (*)	4th part (*)	5th part (*)	6th part (*)	7th part (*)
what	General	Dashboards	IOT App, IOT Network	Data Analytics	Data Ingestion processes	System and Deploy Install	Smart City API: Web & Mob. App
PDF							
Inter active							
Video1							
Video2							
Video3							
Video4				none		none	none
duration	2:55	3:16	3:41	2:00	2:48	2:35	1:47

How to adopt Snap4City

Https://www.snap4city.org



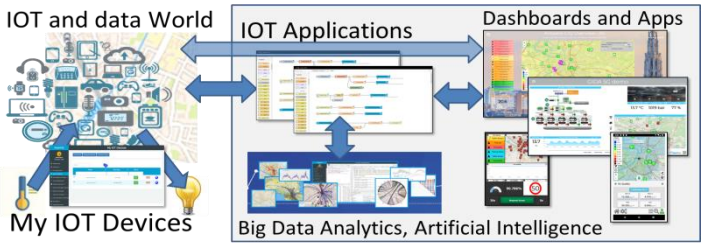
Smart City as a Service

- Supporting Org
- 100% Open Source Platform: Github
- Further developments
- Publishing Appliances and Dockers
- Training courses, docs
- Consulting
- Forums
- Etc.

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

Download and deploy

On your premise





Installation on your premise

- Virtual Machines or Dockers
- Different configurations
  - From small to scalable
  - Exploiting your legacy tools
  - Interoperable with any tool
- No vendor lock-in, No tech lock-in

Mixed solutions! For example:

- Start on Cloud as Smart City as a Service
  - Migrate on premise on the fly
- Start on Cloud into a sand box
  - Pass to install on premise what you need

DISIT lab roadmap vs model and tools' usage

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
Km4City 1.5

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

ckan, resolute

H2020 (2015-18)

2016
(2016-21) H2020 REPLICATE

- Smart Energy
- Sustainable Mobility
- Control Room
- Dashboard

Km4City 1.6.2

Sii-Mobility (2016-21) MIUR

SII-MOBILITY SCN

- Infomobility
- Mobile App
- Routing
- Multimodality

FIWARE

2017
Km4City 1.6.4

Sii-Mobility

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

E0l5 digital ecosystem (Powered by EXPO MILANO 2015)

(2016-19) MIUR

GHOST SIR

- Sardinia Region Smart City Strategies and plan

GREEN IMPACT C.A.P.A.C.I.T.Y.

GREEN IMPACT
POR FESR 2014-2020

- Industry 4.0
- Critical Plant
- Monitoring

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

life weee (2017-20)

- Smart Waste

2018
MOSAiC MObility 4.0 for SmArt (i) City (2018-20)

- Mobility Demand / Offer Analytics and Strategy

Sii-Mobility

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

IOT/IOE

Km4City 1.6.6

Node-RED

SNAP4CITY

SELECT for Cities H2020 (2017-19)

2019
5G (2018-21)

- 5G tech
- Energy
- Industry 4.0
- Synoptics

TRAFAIR

CEF (2018-21)

- Traffic and Mobility Impact on Pollution
- NOX predictions

EUROPEAN OPEN SCIENCE CLOUD

SIRIUS

LAID Smart Bed

- Smart Health

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

- Industry 4.0

bee smart city

- Smart Lonato

Reverberi Enetec Gruppo MPES

- PCP Award



2020
…2022

2021
- CAPELON
- Sweden

smartGARDAlake

Interreg MARITTIMO-IT FR-MARITIME MOBI MART

- Smart Mobility
- PISA, PUMS
- Living lab

Interreg Mediterranean HERIT-DATA

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

SNAP4CITY

UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

Projects

Sii-Mobility, REPLICATE, resolute, GHOST, TRAFAIR, MOSAiC, life weee, smartGARDAlake, SELECT for Cities, SIRIUS, GREEN IMPACT C.A.P.A.C.I.T.Y., GREEN FIELD PEAS Soda4.0, LAID Smart Bed, 5G

Interreg Mediterranean HERIT-DATA

Interreg MARITTIMO-IT FR-MARITIME MOBI MART

Co-founding institutions on projects

EUROPEAN COMMISSION

MIUR MINISTERO DELL'ISTRUZIONE, DELL'UNIVERSITÀ E DELLA RICERCA

POR CreO

Regione Toscana

Qualified Partners

COMUNE DI FIRENZE

CITTÀ METROPOLITANA DI FIRENZE

comune di PRATO

Comune di LIVORNO

Comune di Modena

COMUNE DI CAGLIARI

CITTÀ METROPOLITANA DI CAGLIARI

REGIONE AUTÒNOMA DE SARDIGNA
REGIONE AUTONOMA DELLA SARDEGNA

JRC EUROPEAN COMMISSION

Technical Partnerships

Powered by FIWARE

sigfox partner network

ckan

GJL

LABGEO

esri Italia THE SCIENCE OF WHERE

With the support of NVIDIA

Marketplaces

Node-RED

JS Foundation

FIWARE

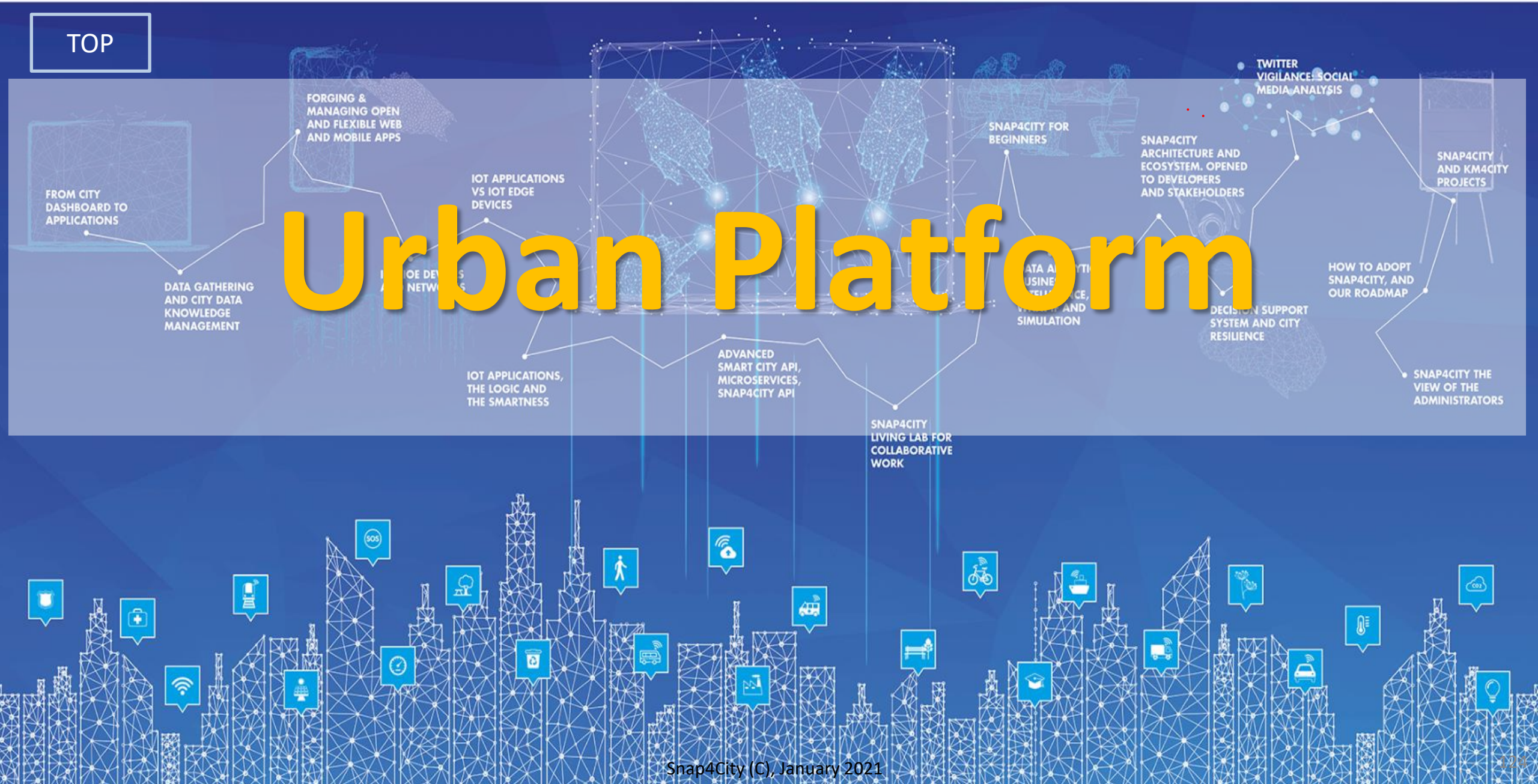
bee smart city

EUROPEAN OPEN SCIENCE CLOUD

EØ15 digital ecosystem
Powered by EXPO MILANO 2015

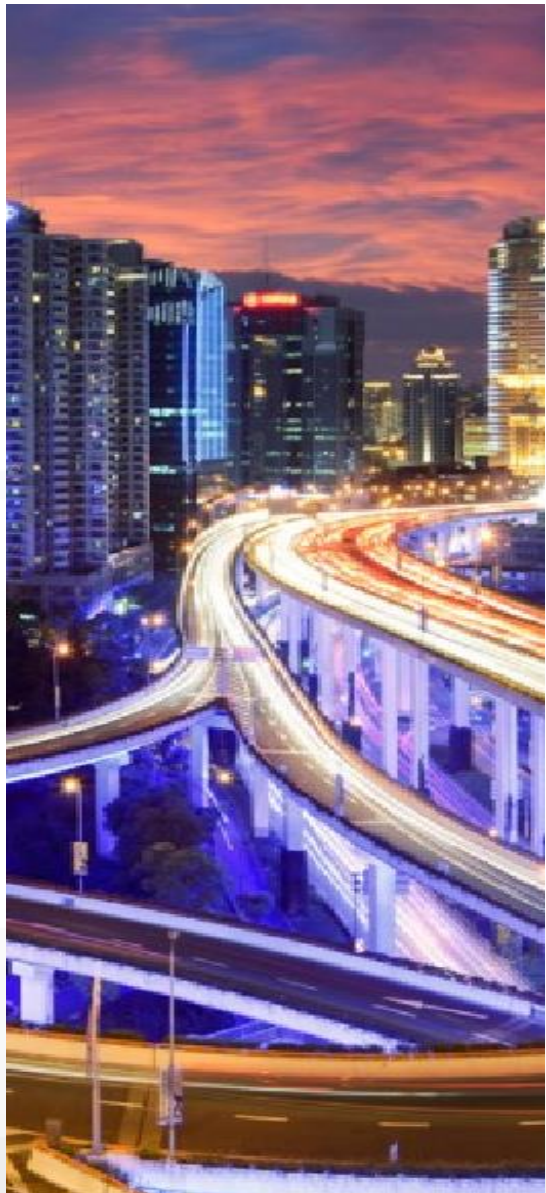
TOP

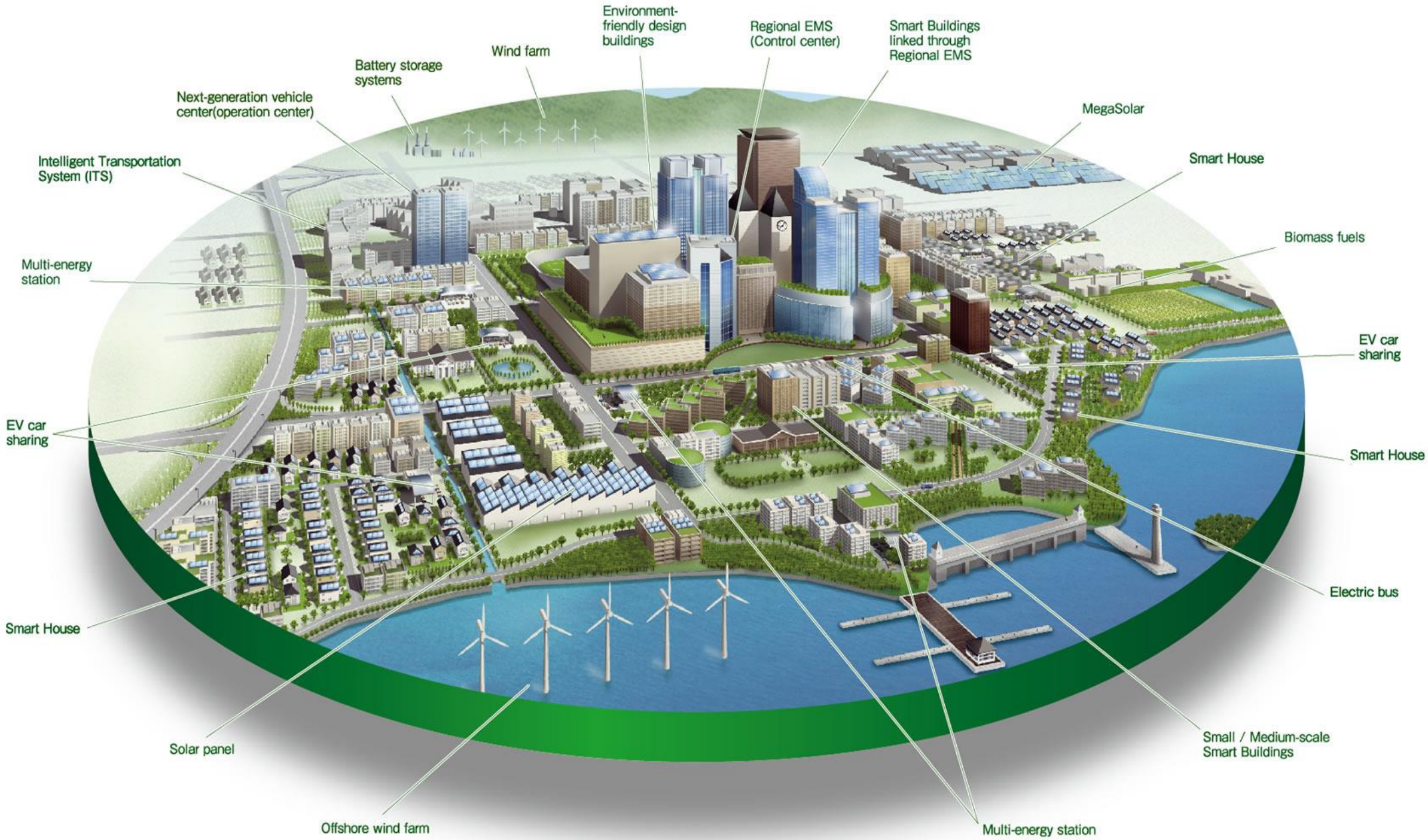
Urban Platform



Motivations of the Smart City

- Migration towards cities: in the 2050 more than the 75% of population will live in the cities.
  - More opportunities, higher salaries, etc.
- Cities have to cope with the increment of citizens providing higher quality of services & efficiency:
  - To this end, they have to conquer a high level of
    - control on: expenses, quality of services,….
    - quality of services, new services, etc.
    - sustainability of services …



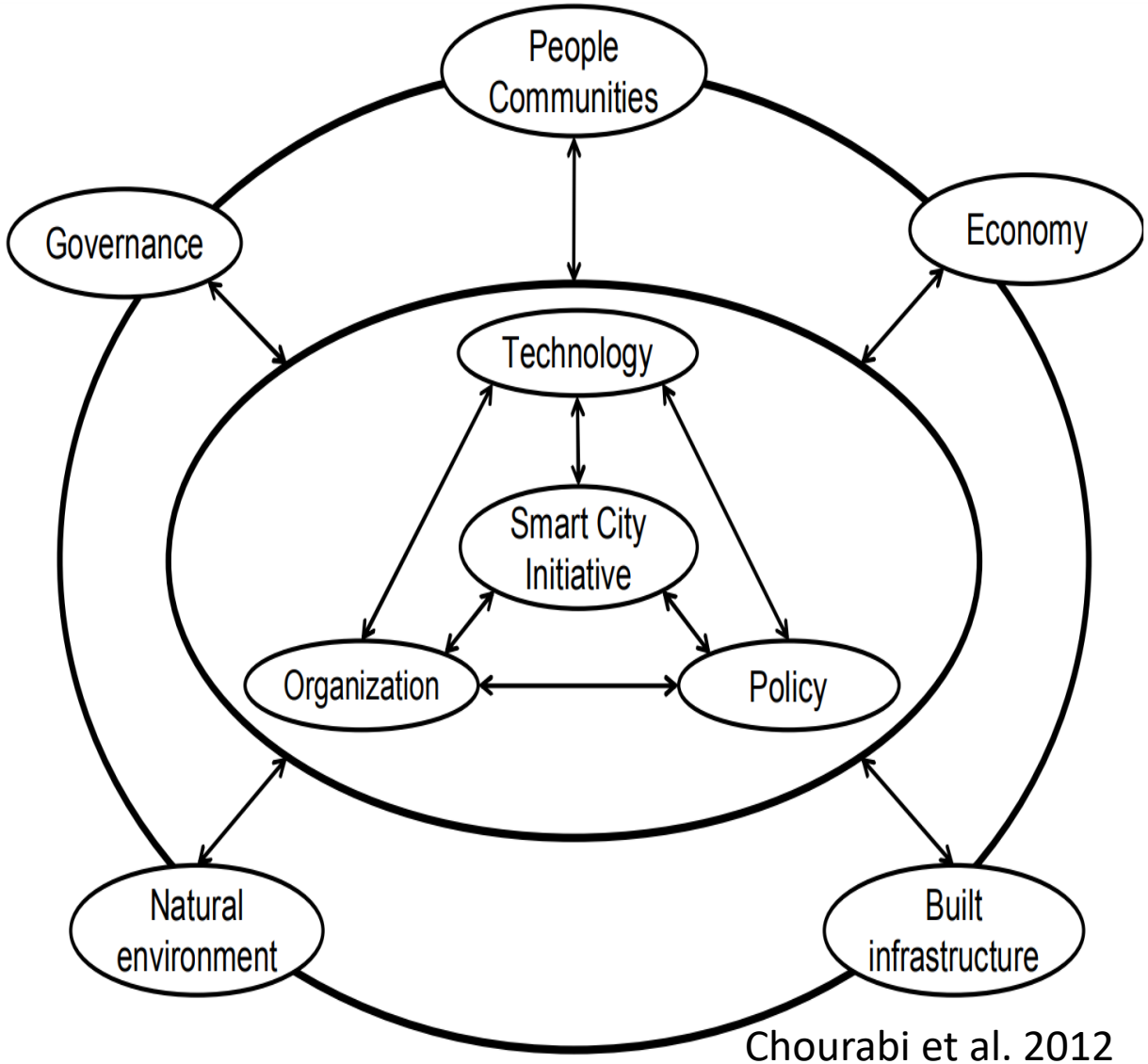

Environment-friendly design buildings
Regional EMS (Control center)
Smart Buildings linked through Regional EMS
Wind farm
Battery storage systems
Next-generation vehicle center(operation center)
MegaSolar
Intelligent Transportation System (ITS)
Smart House
Biomass fuels
Multi-energy station
EV car sharing
EV car sharing
Smart House
Electric bus
Smart House
Small / Medium-scale Smart Buildings
Solar panel
Offshore wind farm
Multi-energy station

Smart City Process

- Many aspects should be taken into account for a successful Smart City transformation

- → *The influence of each of them depends on context, attitude of the institutions, internal structure, etc.*
  - *Parallel actions can conflict, compete …*
  - *Spreading of efforts may distance the goals*
  - *……*

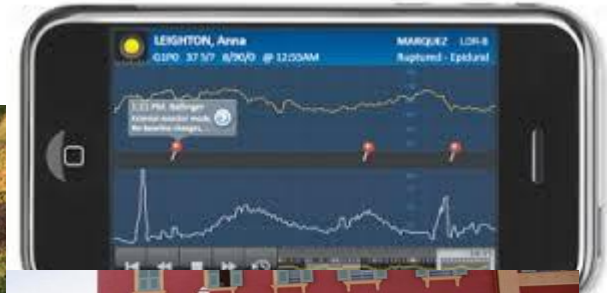
- → *The process may become sustainable, harmonized and faster with a Living Lab Strategy and Support*



Chourabi et al. 2012

Smart City Domains

- Health
- Education
- Economy & commercial
- Energy
- Environment
- Mobility & Transport
- People & Living
- Governmental
  - Risk management, Resilience
- …









Sustainability of the Growth

- To be **planned and managed** with respect to increment of population and their needs
  - Increment of quality of life, more services or more efficient services
  - provisioning of new services in place of older services
  - Decision support for strategic aspects:
    - Corrections, prediction, new services, etc.
- **Towards citizens**
  - Informing citizens on the new adaptations, making them aware about that
  - Forming citizens to adopt virtuous behaviour in the usage of services and resources
  - Collecting their feedback continuosly via a multichannel

Challenges: Requests and Deductions

Public Admin.



Pub. Admin: detection of critical conditions, improving services

Mobility Operators





Tune the service, reselling data and services , prediction







Commercial: customers prediction and profiles, promotions via ads

Tourism Museums



Tune the service, prediction

API for SME

Smart City Engine

User profiling
Collective profiles
User segmentation

Services & Suggestions
Transport, Mobility, Commercial (retail), Tourism, Cultural



Personal Time Assistant
dynamic ticketing, whispers to save time and money, geoloc information, offers, etc.







User Behavior
Crowd Sources



Data: Public and Private, Static and Real Time

Private: user movements, social media, crowd sources, commercial (retail)
Public: infomobility, traffic flow, TV cameras, flows, ambient, weather, statistic, accesses to LTZ, services, museums, point of interests, …

Snap4City tools and Living lab Solution have been Created to satisfy requirements of international organizations as:

- **ENOLL**: https://www.openlivinglabs.eu/
  - European Network **of Living Labs**
- **EIP-SCC**: European Innovation Partnership on Smart Cities and Communities
  - https://eu-smartcities.eu/
- **Select4Cities**: Pre-Commercial Procurement Project to develop a data-driven, Internet-of-Everything (IoE) platform for large-scale urban co-creation
  - https://www.select4cities.eu/

SELECT

for Cities

CERTIFICATE OF ACHIEVEMENT

1° place award to

UNIVERSITY OF FLORENCE - DEPARTMENT OF INFORMATION ENGINEERING

for SNAP4CITY

https://www.snap4city.org/558

for successfully completing the
SELECT for Cities PCP competition
19.11.2019

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

DIGIPOLIS
FORUM VIRIUM HELSINKI
CITY OF COPENHAGEN
Buyers Group

Requirements and Objectives

- Serve as a **City Dashboard**, **App User Interface**, etc.
  - Real time and historical data, any device, sensors and actuators
  - Sensors, KPI, maps, data trends, real time data, charts, etc.
- Referral / **historical data, and Open Data**:
  - shadow, access (API, storage, any protocol), production of OD, export
- **Data Driven Real Time communication &** processing:
  - IOT Applications, IOT edge, multiple operating systems, embedded systems, **MicroServices**
  - in/out data driven from/to the field into: applications, notifications, etc.
- **Data Analytics**: Machine Learning, statistics, reasoning, …
- **Serve as Living Lab**: open innovation, coworking; collaborative work; sharing: data, processes, dashboard, experiences, solutions, ….
- Experimented on **large scale cases**

Non functional requirements

- **Open Source** and based on Open Source Tools and OS
- Open **Standard** for communication and API for In/Out
- **Scalable, Robust, Distributed** and Decoupled, modular, Service Oriented, open to external services and data sets
- **Data driven**, for reading and data analytic
- **Heterogeneous**: any device, private and public, custom and..
- **Interoperability**: protocols, internal API, Smart City API, capable to integrate with legacy conditions in place, modular, reusable,…
- Communication with things: any protocol, any format, …
- **Security** by Design: HTTPS, TLS, …
- **User Centric** Design: privacy by Design (and **GDPR**), personalized, personal data management, ...

Security/Privacy Requirements

- **Managing** private data together with public data
- **Private data management** according to GDPR
  - Browsing, downloading, controlling rights, delegating access, revoking accesses, etc.
  - Keep them safe
- Secure enough to delegate management of data regarding public security:
  - Data that could be used against us by some terrorist, or anyway by someone with some bad intention, for example to access in our home when we are far away, etc.

Data Driven Decision Support

- Decision Support system
- Assessment / Strategies
- Data Rendering, visual analytics
- Data Processing
- Data aggregation, Storage, indexing
- Data Ingestion



Data Collection, ingestion (processes)

- **Data**
  - Open and private: Open Data: CKAN
    - licensing, private, GDPR
  - Static vs Real time
  - Any protocol, any standard: Push and Pull
  - Any format
- From **observations and milestones**:
  - sensors, database, KPI, etc.
- From **legacy services** of in-place operators
  - External Services: call of any kind
  - MicroServices, MicroApplications
  - Local databases
- From **citizens, city users, tourists, operators, ..**:
  - participated processes, feedback, Apps, etc.
  - Crawling web pages, etc.





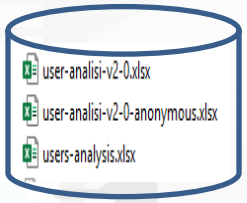
IOT Device

ckan









Private and static

- Fiscal Code, SSN
- Non shared pictures
- Level aspects
- Patient health record
- ..

- Personal movements
- GPS traces
- Relationships among people

- User Behaviour
- social media
- Contributions
- Consumption of energy, gas
- banking

Real time private

- Personal traffic
- Position of cars
- Position of taxi
- Position of CarSharing ...

Static Public (open data)

statistics: accidents, census, votations

- # Accesses to RTZ ZTL
- Data from Public GOV

- Position of commercial activities, POI

- Museums
- City services data, almost
- Active services

- TV cameras

Real time public (open data)

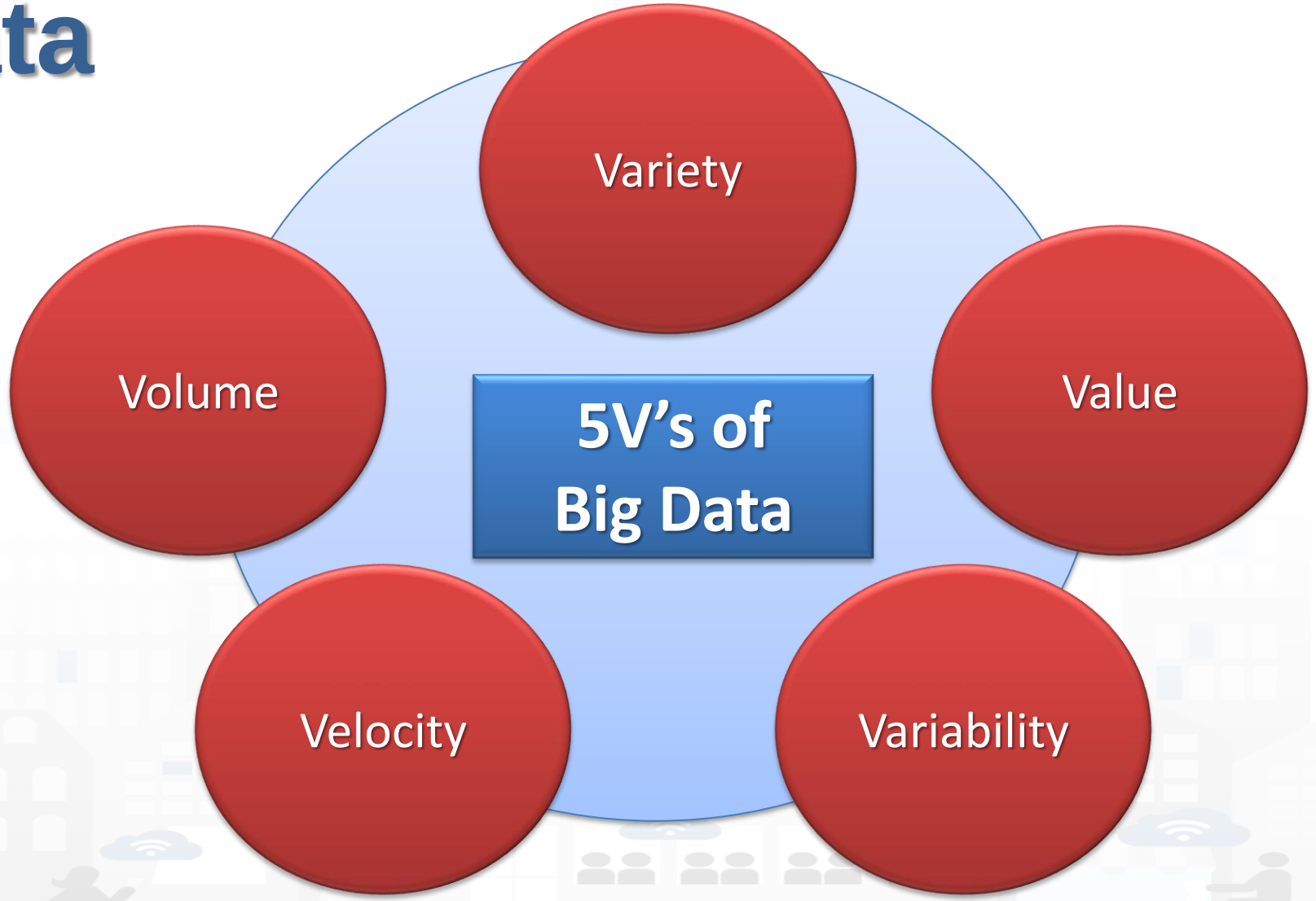
- Info traffico
- video camere
- Info weather
- Info environment
- Status of the queue at Museums
- earthquake data
- parking

- Stato accessi alla ZTL
- Stato dei servizi

5V of Big Data

When data are BIG data?

The excel file size?

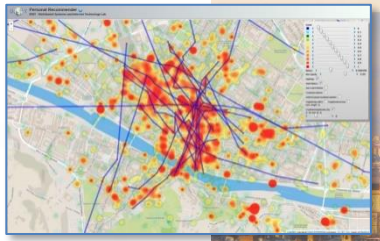


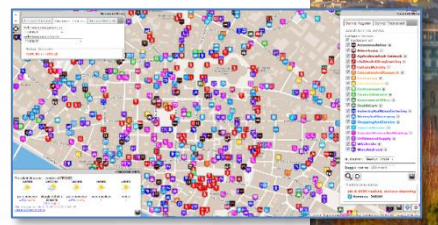
Other Vs have been also proposed…

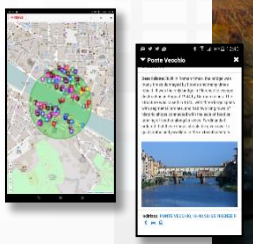
Integrated Urban Platform

- **Produce value from data supporting Living lab**
  - Stimulate virtuous behavior, influence City Users!
  - Put in action CITY Strategies
- **Data Exploitation performing**
  - predictions, reasoning, business intelligence, ..
  - users behavior analysis, decision support system, ..
  - Control Room, Real Time Monitoring tools, ….
- **Aggregate & integrate data**
  - Multiple protocols from urban operators, ….
  - open data, IOT, sensors, internet of everything, cloud, mobile devices, Wi-Fi, social media, ...









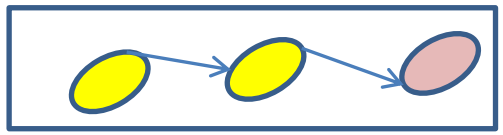
Data Indexing & Semantic Data Indexing

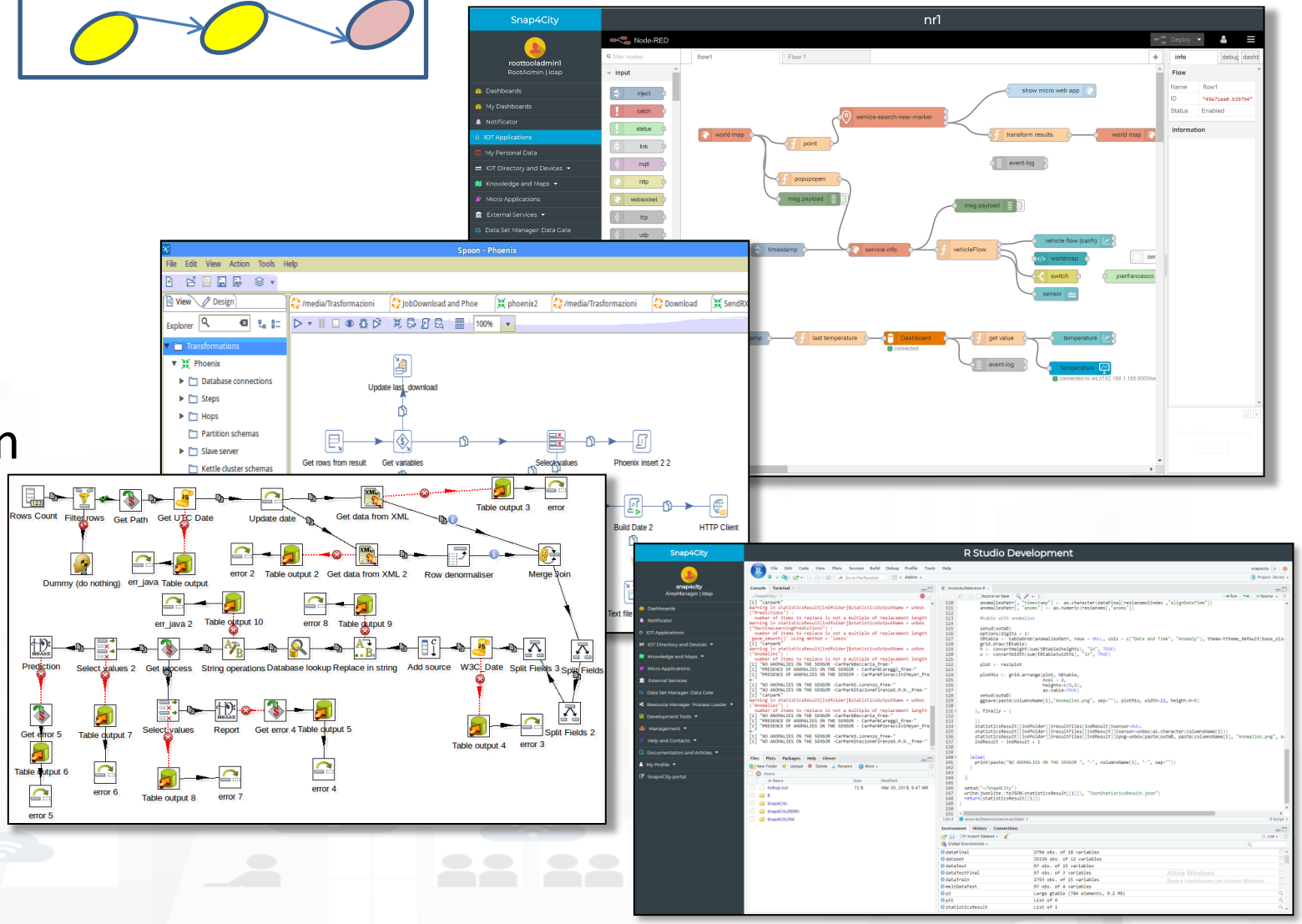
- **Textual**, multilingual, NLP (Natural Language Processing)
  - For social media data, but also for metadata, descriptions
- **Spatial**, **geographical**, georeversing → Knowledge Base, Km4City
  - Around a point, along a line/path, near a path, into a polyline, etc.
- **Temporal** → Historical data
- **Semantic:** relationships among city entities.
- **Data Value** different data type (Data Lake/normalization), data unit, etc. → the so called IOT shadowing of Azure, AWS
  - Relating to Knowledge Base reciprocally

- ***Traffic** / volume of Data (KBps) → Network Analysis, monitoring*

Data processing

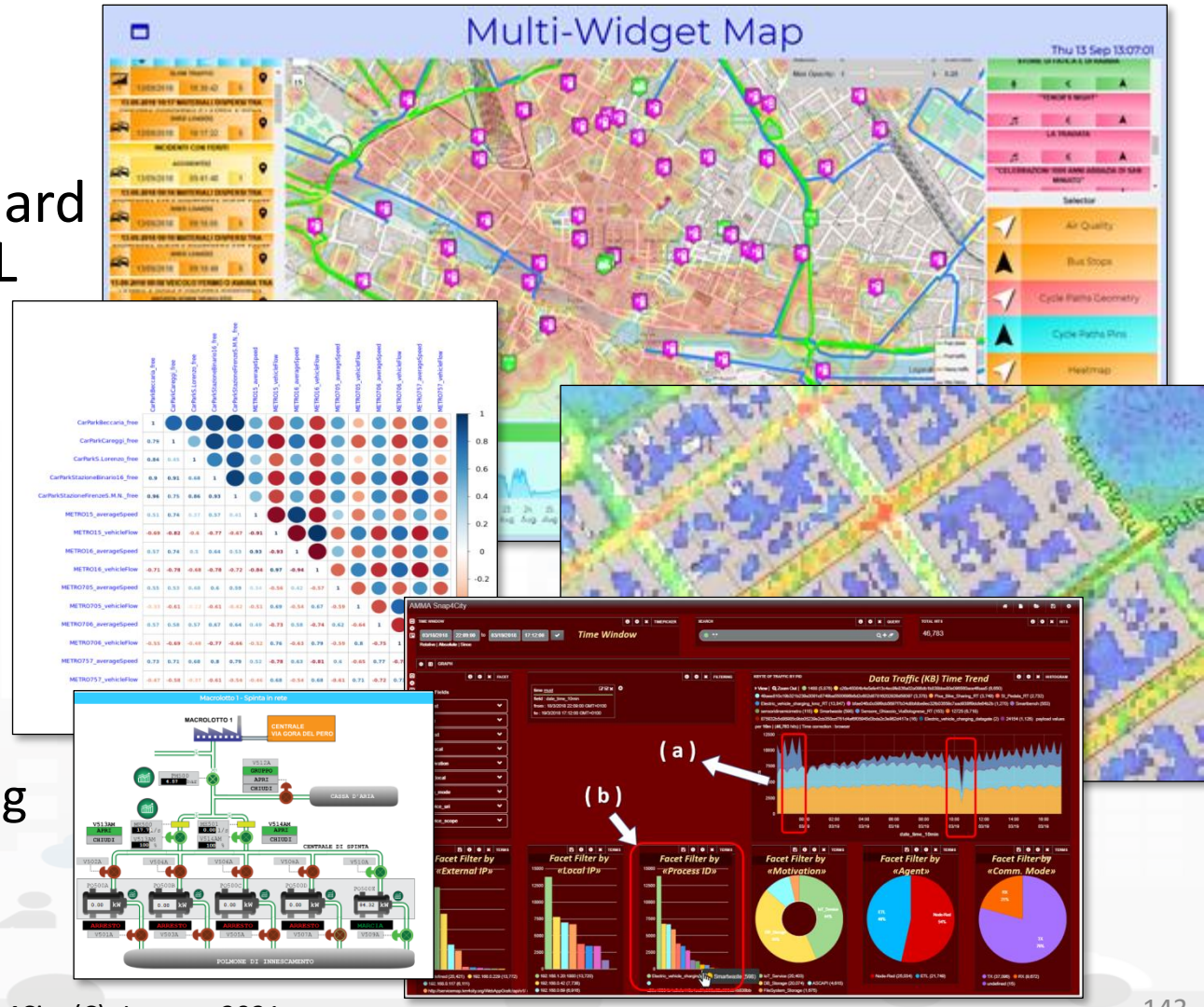
- **Data analytics**
  - Periodic or event driven
    - On demand
  - Data transformation
    - ETL: extract transform load
  - Control Flow, data transform
    - Node-RED: Node.JS
- **For example**:
  - Assessment/monitoring
  - Predictions
  - Anomaly detection
  - Simulations
  - Etc.





Data Rendering vs Control Room Dashboards

- **GIS** rendering by layers
- **Business intelligence** mainly focused on making statistics from tabular: no layer, hard relationships, ... Exploit Data Analytic, ETL
- **Visual Analytics**, data understanding
  - Rendering and drill down
  - Faceting/grouping (Elastic Search/SOLR)
  - Cross filtering (Kibana, Grafana, Banana)
  - Interactive, Cross Widgeting
- **Control Room Dashboards:**
  - Need: Visual Analytics, Data Analytic, geospatial reasoning, data driven processing
  - H24, alerting, Flexible rendering, custom widgets, interactive dashboards

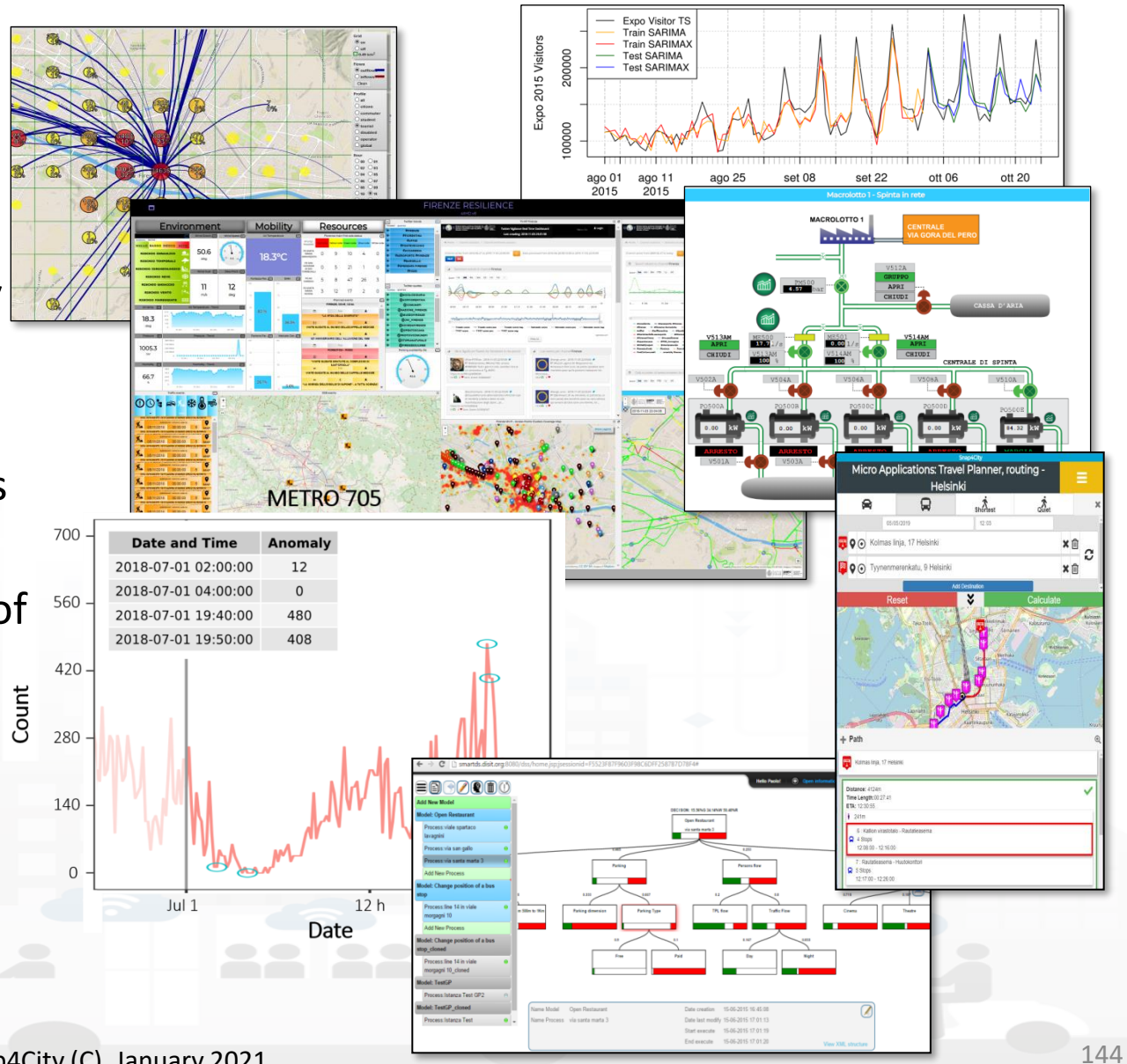


Decision Support, Act!

Smart City Control Room, SCCR, SCR

- Not only a collection of verticals

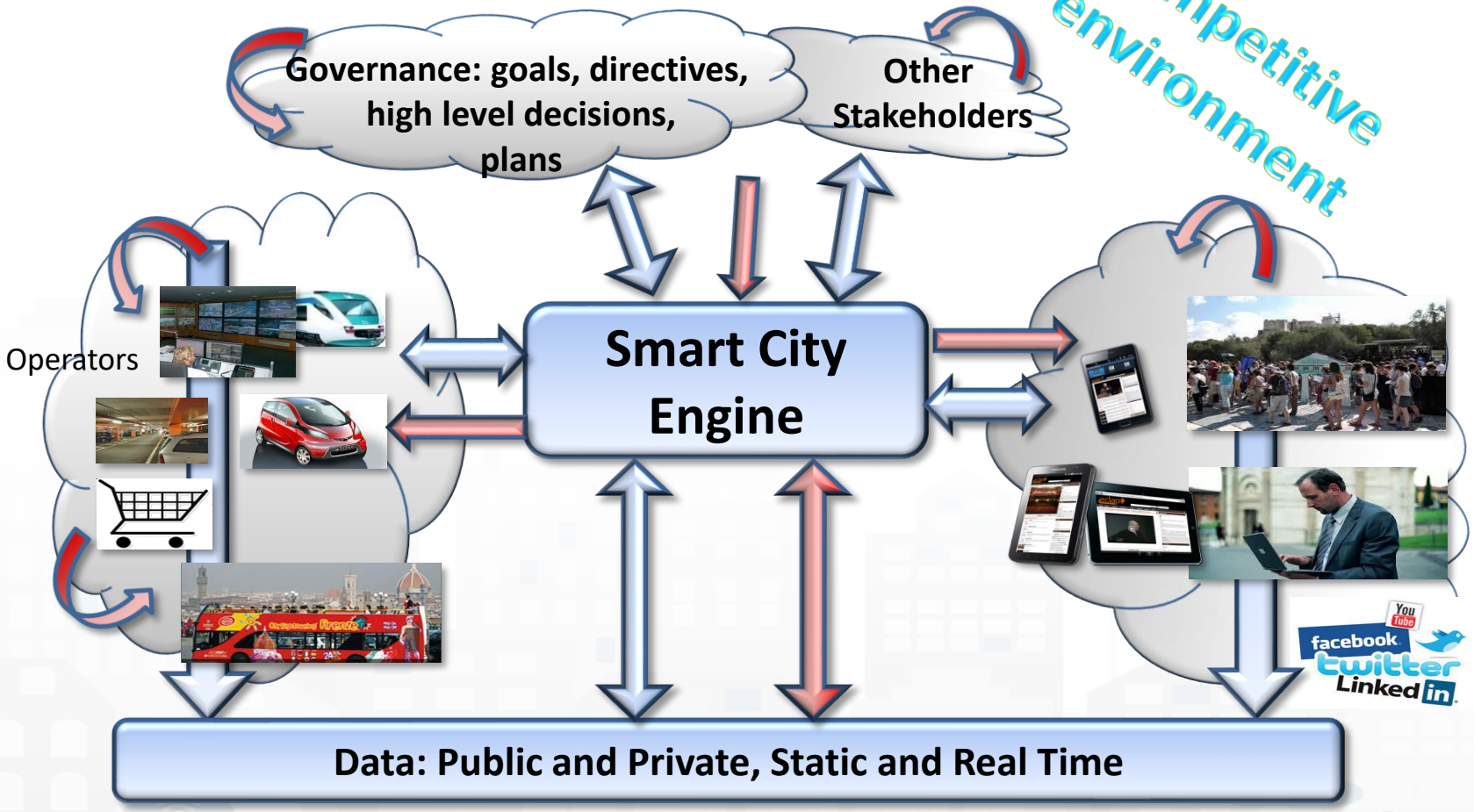
- **Exploiting analytics**: prediction, simulations, anomaly detection. ..
  - Big data approach to Data Analytics
- **Connecting Heterogeneous data** to defined strategies and alerting
- **Connected interactive dashboards** for different kind of decision makers: operators and majors
- **What-if Analysis taking into account multiple data sources**



From strategies to Actions

From Strategies to (re-)Actions

- Informing
- Suggesting
- Engaging
- Alerting, Early Warning
- Making Decision active
- New Plan

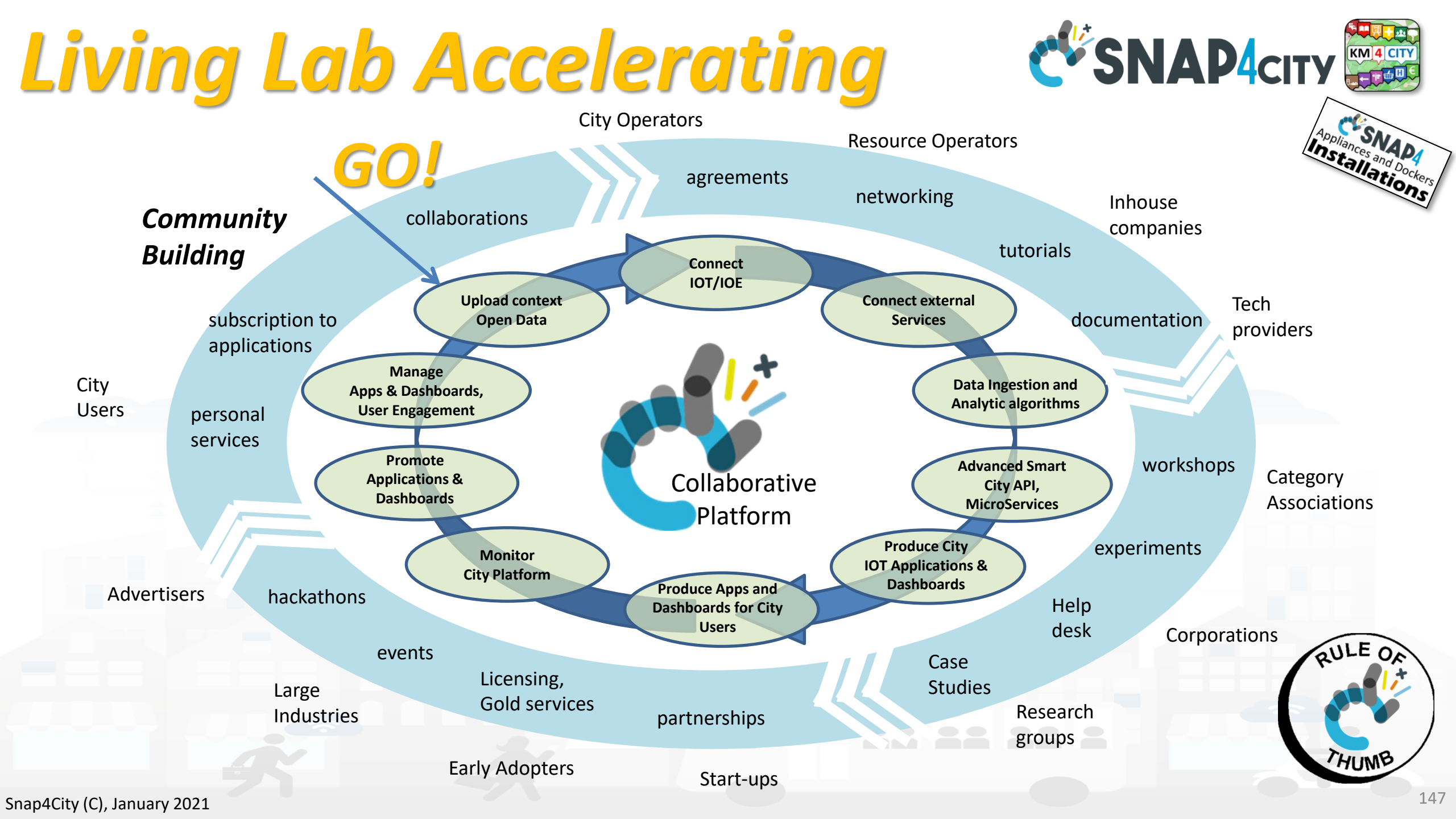


Living Lab Flexibility

Snap4City Satisfies all Requirements of ENOLL Select4Cities and EIP-SCC

- **Multiple modalities to perform the same activities**
- **Tuned for Beginners and Skilled people**
- **Visual interface and programming tools**
- **Resources and artefacts sharing for learn acceleration and co-working**
- **Open Living and co-working Portal**: https://www.Snap4City.org

Living Lab Accelerating



Snap4City

User: adifino, Org: DISIT
Role: Manager, Level: 4

Your Level

- Dashboards (Public)
- Dashboards of My Organization
- My Dashboards in My Organization
- IOT Applications
- My IOT Devices
- Knowledge and Maps
- Micro Applications
- External Services
- Data Set Manager: Data Gate
- Resource Manager
- Help and Contacts
- Documentation and Articles
- My Profile
- Snap4City portal
- Km4City portal
- DISIT Lab portal

All Tools

Snap4City

Home | Partners and Interoperability | Tools | Tutorials and Videos | Blog | Contributions

Home / Tutorials and Videos / Welcome: how to start using Snap4City for beginners

Welcome: how to start using Snap4City for beginners

Personalized Suggestions

Snap4City developers suggest you reading:

You have already created a **Dashboard**. Now, you may decide to make it public (visible and accessible) to all on WEB, or to provide access in view to other specific users that you know by nickname.
In addition, you can pass the Ownership of a **Dashboard** to some other user of the system, and you can clone the **Dashboard** as well. So that you can create **Dashboard** for other users as well.
We sugget to test these functionaltiies since you can:

- access to Data Set **Manager** to upload/download, share data sets as files in CSV: https://datagate.snap4city.org/ssologin_handler
- upload data for the **knowledge base** and **dashboards** via Data Set **Manager**,
- access and share of resources as: **dashboards**, **IOT Applications**, blocks, etc.; https://processloader.snap4city.org/.../ssoLogin.php?redirect=page.php%3FshowFrame=false
- access to help and contacts, FAQ, documentation and articles
- manage personal data: profile, IOT Sensors, **Annotations**, Personal Data, **Dashboards**..; https://www.snap4city.org/drupal/myprofiledata
- Auditing Access to My Data according to **GDPR**.

See this ... case ... development ... above possibilities:

TC1.10. Dashboard delegation to access, and passage of ownership, and/or cloning

Exercises

If you are not registred please apply for a **free registration from https://www.snap4city.org** and then pass to ACCESS AT THE TOOLS and full Snap4City environment

Snap4City puts in the hands of City Users a flexible environment to quickly create a large range of smart city applications/views exploiting heterogeneous data and services of stakeholders by IOT/IOE and big data technologies. For Snap4City, City Users can be citizens, students, operators, researchers, decision makers, developers, etc. see Users' Roles on Snap4City.

- **Manager:** is a **final user**, has the capability of: accessing and creating Dashboards with a large set of data (high level types as: POI, sensors, KPI, micro applications, external services, etc.), attaching alerts and notifications; registering IOT Devices; creating IOT Applications exploiting MicroServices; loading and sharing data sets; managing personal data and annotations; full access to documentation, help desk, FAQ, coworking; managing personal profile and data according to GDPR; **NOTE:** accessible features are mainly visual and simple to understand and to use, and provide a limited number of parameters on each dialog and for each action. Default values of created elements can be changed editing elements.
- **AreaManager:** is a **Developer/researcher, students, city operator**, with additional capabilities with respect to the Manager to: register IOT Brokers; creating advanced IOT applications; create massive data transformation processes; create data analytics in multiple languages, testing and load them, create microservices; adding external services; sharing results, loading shapes; analyzing performance of the back office; **NOTE:** technical views and details are fully accessible

SLIDES



Flyer



News

VIDEOS

Suggested Activities to be performed to Learn HOW to use Snap4City:

This page would guide you along few steps to ... how the solution allows you to incrementally pass from **Level 0 to 5, from a Manager to an Area Manager:**

- Level 0 user: access at data/services views of the city by using public Dashboards; (Public User) **(overview on dashboards)**
- Level 1 user: create personal/professional views/dashboards on data; (Manager) (Snap4City (C), January 2021 **... how Dashboards can be created)**

Username: adifino

Powered by www.km4city.org

Full Search

Search

Search

Organization Groups

Your Org

DISIT
- Operativo

Recent comments

- 1 month 6 days ago

Recent content

Last Art.

Ti Suggeriamo come realizzare la tua prima Dashboard (Step 1) new
roottooladmin1

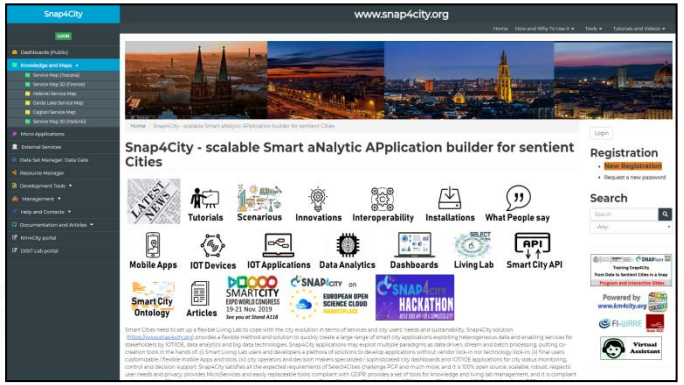
Benvenuto al nostro Sindaco ed al suo Team
new
roottooladmin1

We sugges to Antwerp Developers: How to manange my Dashboards

How to adopt Snap4City

Smart City as a Service

Https://www.snap4city.org

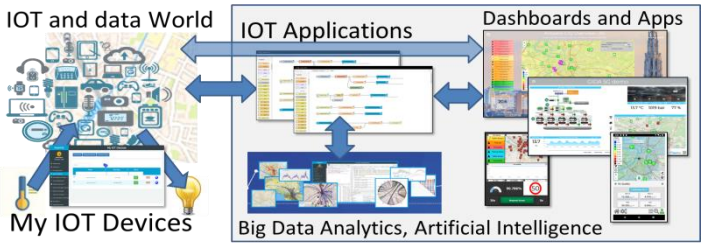


- Supporting Org
- 100% Open Source Platform: Github
- Further developments
- Publishing Appliances and Dockers
- Training courses, docs
- Consulting
- Forums
- Etc.

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

Download and deploy

On your premise





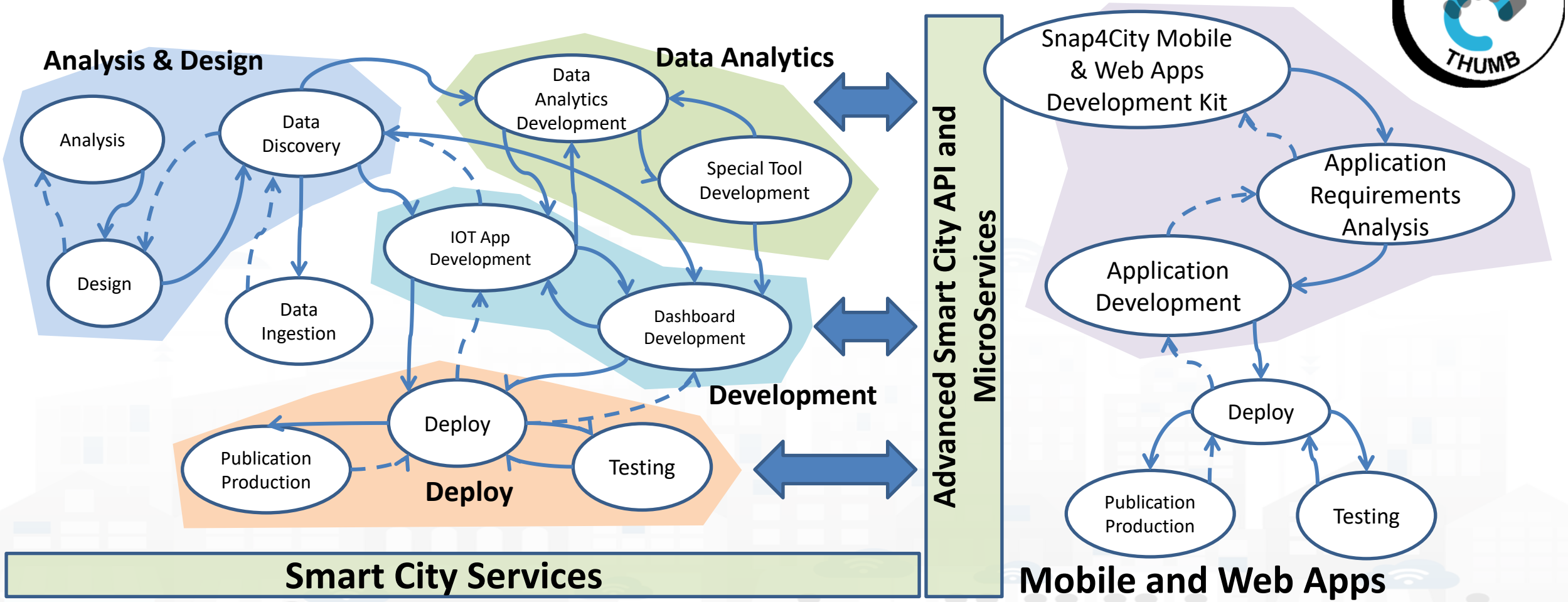
Installation on your premise

- Virtual Machines or Dockers
- Different configurations
  - From small to scalable
  - Exploiting your legacy tools
  - Interoperable with any tool
- No vendor lock-in, No tech lock-in

Mixed solutions! For example:

- Start on Cloud as Smart City as a Service
  - Migrate on premise on the fly
- Start on Cloud into a sand box
  - Pass to install on premise what you need

Develop Mobile & Web Applications Exploiting Snap4City Smart City Services

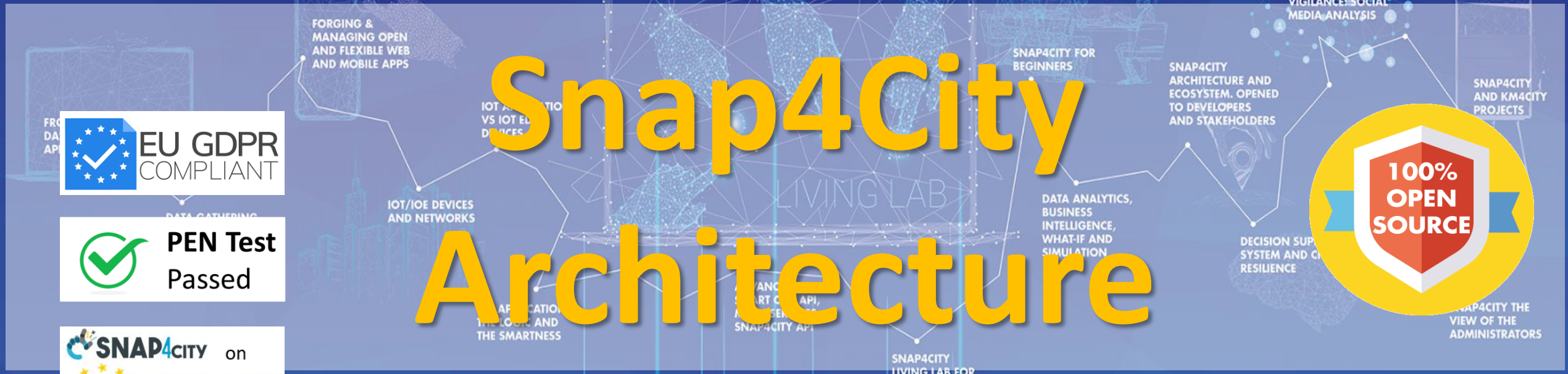


Documentation on Https://www.snap4city.org

- **We suggest you to start:**
  - HOW TO: create a Dashboard in Snap4City
  - HOW TO: add a device to the Snap4City Platform
  - HOW TO: add data sources to the Snap4City Platform
  - HOW TO: define privacy rules for personal data, produced by the end-users own device
- **Plus, more than**
  - 150 Test Cases for training, with training sources for IOT Applications, ETL, Data Analytics on the Resource Manager
  - 40 Video of training
  - 30 articles
- **Please follow the personalized suggestions** Snap4City proposes you!
- **A course in Italiano: https://www.snap4city.org/drupal/node/485**

TOP

Snap4City Architecture



EU GDPR COMPLIANT

PEN Test Passed

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

100% OPEN SOURCE

SNAP4 Appliances and Dockers Installations

SNAP4CITY

KM4CITY

URBAN PLATFORM: SMART CITY IOT AS A SERVICE AND ON PREMISE

100% OPEN SOURCE

APPLIANCES CONTAINERS



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

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

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

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

IOT APPLICATIONS - INSTANT APPS



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

DASHBOARDS & APPLICATIONS



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

MOBILE & WEB APPLICATIONS



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

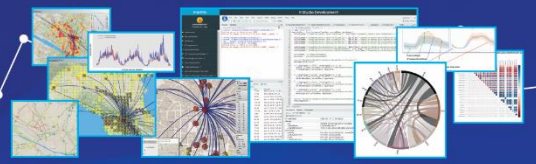
MICROSERVICES & ADVANCED SMART CITY API

LIVING LAB - DEV TOOLS - COWORKING

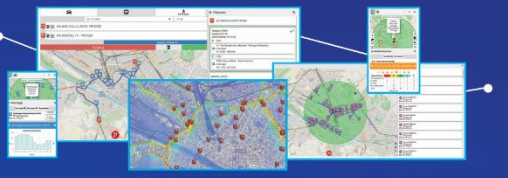


IOT DIRECTORY • SERVICE MAP • RESOURCE MANAGER • DATA GATE • R STUDIO • ETL

BIG DATA - DATA ANALYTICS



DATA ANALYTICS TOOLS - MICRO-APPLICATIONS



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

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

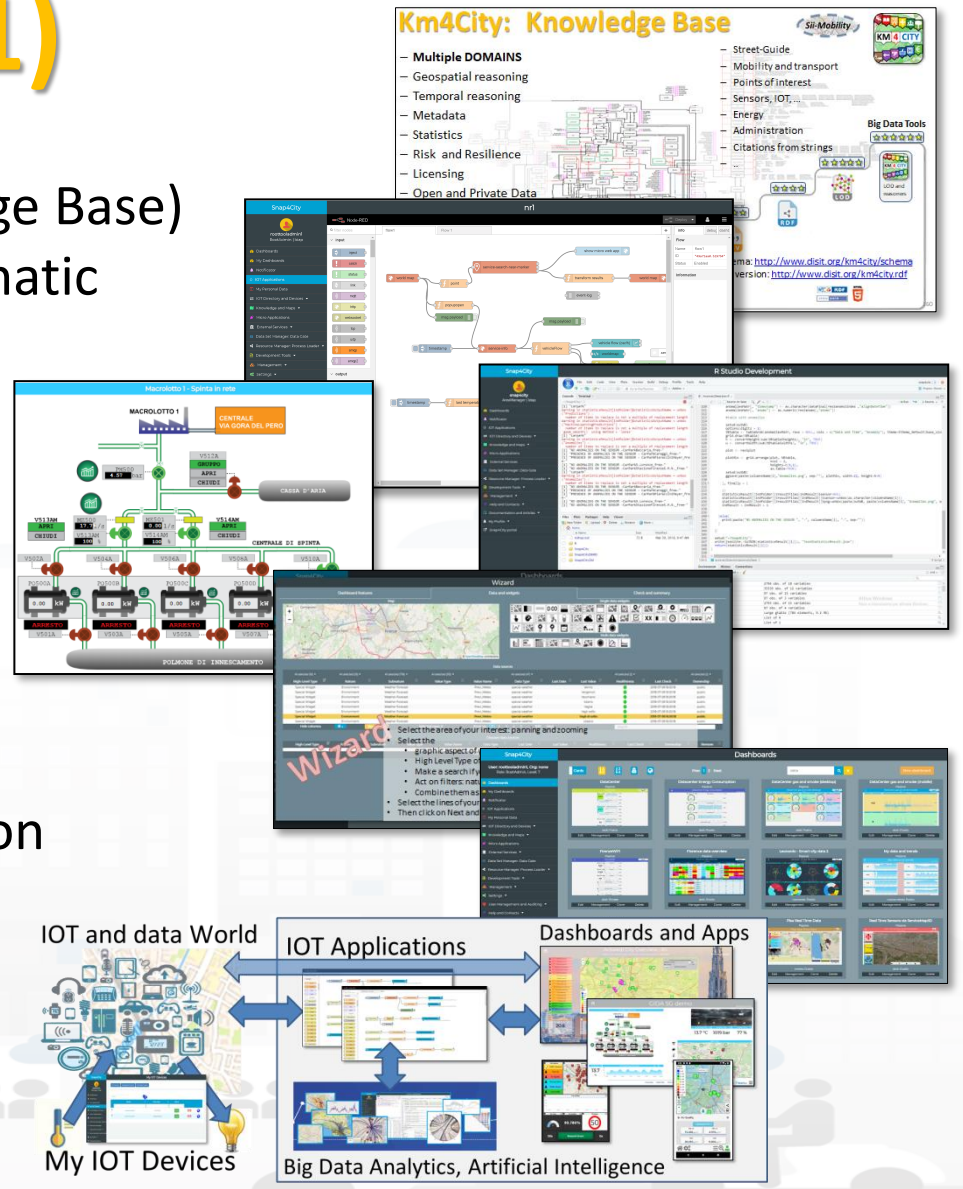
IOT MNG - DATA MNG - DATA INSPECTOR – PROCESS MNG – USER ENGAGEMENT – GDPR MNG ...

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



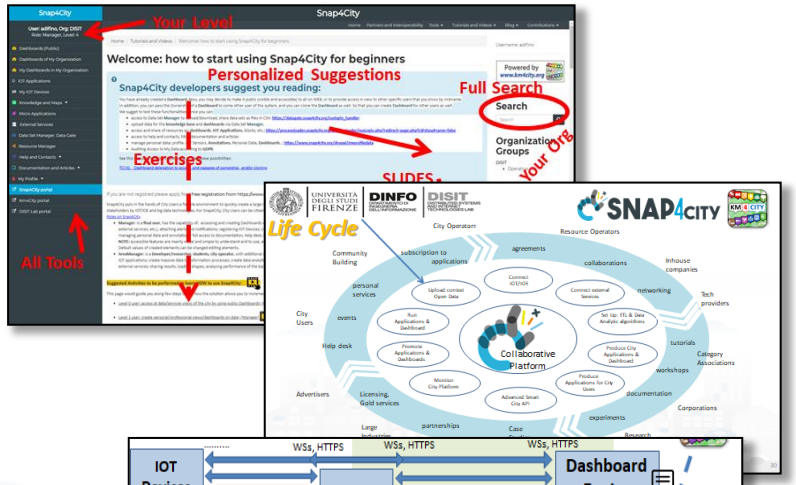
Unique of Snap4City Platform (1)

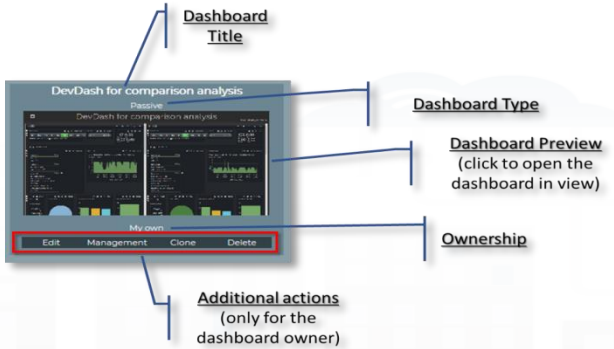
- Data ingestion and model
  - **Unified data model** (exploited in the Wizard and Knowledge Base)
  - **Semantic Reasoner** modelling city entities, supporting sematic search, spatial search, expert system, Digital Twin, etc.
  - **IOT Directory abstracting complexity of IOT Devices, Edge, Brokers**, protocols and data formats
- Data Analytics and Data Processes
  - **Flexible and extensible IOT Applications**
  - **Data Analytic:** multiple programming languages
- Visual Analytics, dashboarding, Apps
  - **Wizard: expert system** for immediate dashboard production matching data vs graphics representation
  - **Dashboards specialized** multidomain for Smart Cities
  - **Custom Widgets and Synoptics**
  - **Ready to use Mobile App, instant App, MicroApplication**
  - **Strategies** formalization supports

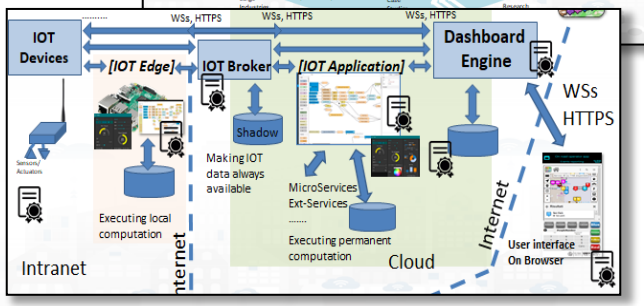


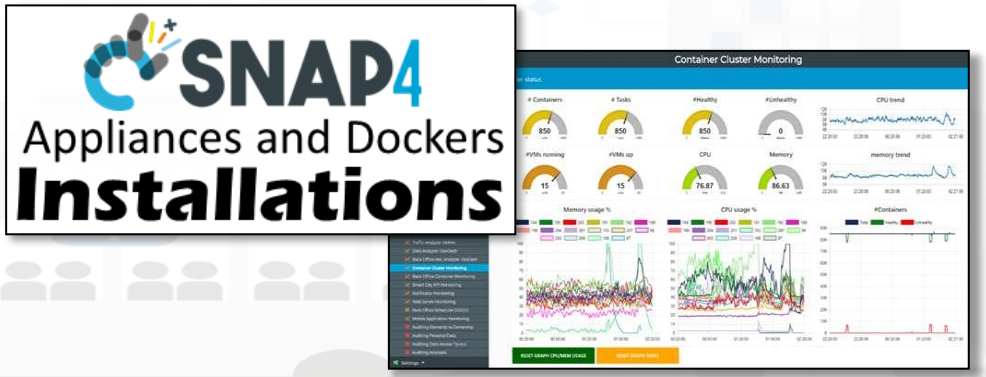
Unique of Snap4City Platform (2)

- Openness to any developers
  - **Living Lab support for co-working, sharing, and delegating**
  - **Advanced Smart City APIs and MicroServices**
  - **100% Open Source, Open hardware**
- Security and Privacy
  - **End-2-end encrypted communication**, on devices, platform, ... dashboards
  - **GDPR compliant** privacy/security
  - **PENtest and Vulnerability test *PASSED***
- Non functional requirements as:
  - **on cloud and on premise,** your private installation
  - **Ready to use Appliance** Virtual Machines and/or Containers for a modules and tools.
  - **Flexible, Modular, Elastic, scalable and robust**









Smart City Functional Architecture

Transport systems
Mobility, parking



Public Services,
Govern, events, …



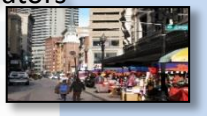
Sensors, IOT Cameras,
Wi-Fi



Environment, Water,
energy



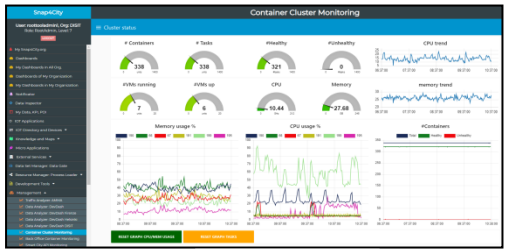
Shops, services,
operators

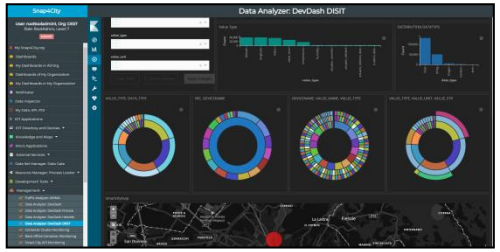


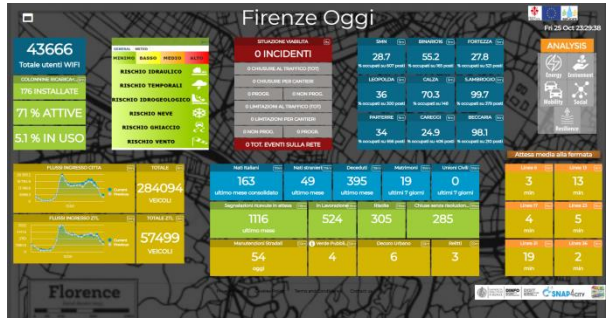
Social Media

Social Media Crawler and Manager









Back-End ⟵ ⟶ Front-End

Data Sources, External Services *PULL Data*

Data Sources, Brokers, External Services *Data Driven, Real Time*

Data Ingestion, aggregation, regularization, reconcile: IOT Directory, NIFI, special tools

Knowledge base Semantic Reasoners

Indexing and aggregating Elastic Search

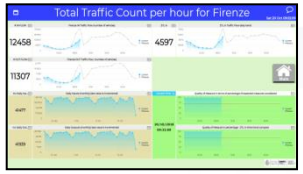
Federation

Search and Query, Smart City API, Web Socket Server, GIS, Facet, semantic

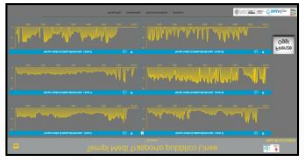
Data Analytics, Simulations, Special Tools R Studio, Tensor Flow, Python, ….

IOT Applications, Business Logic Node-RED + Snap4City MicroServices

Rendering Acting, Widgets, Synoptics, MicroApps User interface, Drill down, maps, heatmaps

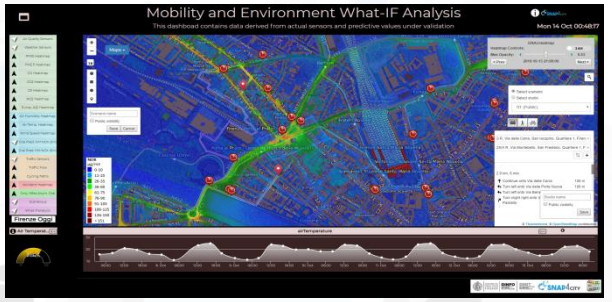












Inform, announce, Act!, warning, alarms, What-IF, ..

Authentication, Authorization, Platform & Processes Management, Data Inspector, Digital Twin, …

TOP

DASHBOARDS: FROM CITY DASHBOARD TO APPLICATIONS




City Today
0 ACCIDENTS
KPI Dashboard
ANALYSIS


Snap4Ispra – KPI Dashboard
SVG Energy ISPRA HighLevel
City Today
0 ACCIDENTS
ANALYSIS

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https://www.snap4City.org , KM4CITY

Public Dashboards for your perusal

Snap4City

LOGIN

- Dashboards (Public)
- Knowledge and Maps
- Micro Applications
- External Services
- Data Set Manager: Data Gate
- Resource Manager
- Development Tools
- Management
- Help and Contacts
- Documentation and Articles
- Km4City portal
- DISIT Lab portal

Dashboards (Public by (ORG))

Prev 1 ... 12 13 14 15 16 ... 20 Next

Filter by dashboard title

ServiceMap for data comparison
Passive


Public (DISIT)

Servizi agli utenti
Passive


Public (DISIT)

Smart City Control Room Console
Passive


Public (DISIT)

Smart City Control Room Console - new
Passive

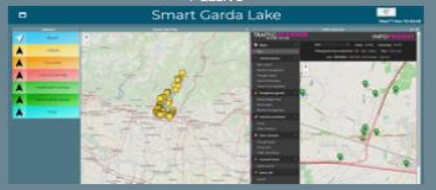

Public (DISIT)

Smart City Data Overview
Passive


Public (DISIT)

Smart City Data Overview 2
Passive


Public (DISIT)

Smart Garda Lake
Passive


Public (DISIT)

SmartCity processes
Passive

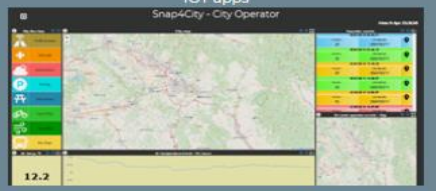

Public (DISIT)

Snap4City - App dashboard
IOT apps

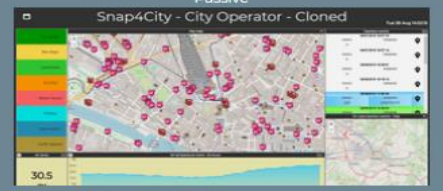

Public (DISIT)

Snap4City - Buttons with images
Passive


Public (DISIT)

Snap4City - City Operator
IOT apps


Public (DISIT)

Snap4City - City Operator - Cloned
Passive


Public (DISIT)



We expect you at Stand 120, Hall P2 , Level 0, Street A
Smart City Expo World Congress 2018
13-15 Novembre 2018, Barcelona, Gran Via Venue

SMARTCITY EXPO WORLD CONGRESS

http://www.darionardella.it/il-sindaco-dario-nardella-in-missione-a-madrid-e-barcellona/

Firenze Oggi

Fri 25 Oct 23:29:38

43666
Totale utenti WIFI

COLONNINE RICARICA<... 9m
176 INSTALLATE
71 % ATTIVE
5.1 % IN USO

METEO 9m

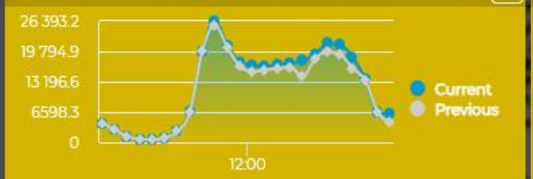
MINIMO	BASSO	MEDIO	ALTO

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

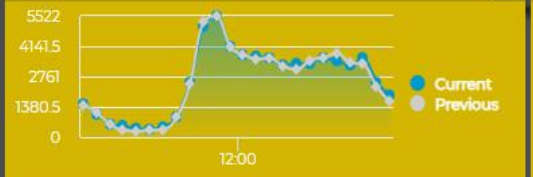
SITUAZIONE VIABILITA 8s
0 INCIDENTI
0 CHIUSURE AL TRAFFICO (TOT)
0 CHIUSURE PER CANTIERI
0 PROGR. | 0 NON PROG.
0 LIMITAZIONI AL TRAFFICO (TOT)
0 LIMITAZIONI PER CANTIERI
0 NON PROG. | 0 PROGR.
0 TOT. EVENTI SULLA RETE

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

ANALYSIS
Energy · Environment · Mobility · Social · Resilience

FLUSSI INGRESSO CITTA 9m


TOTALE 9m
284094
VEICOLI

FLUSSI INGRESSO ZTL 9m


TOTALE ZTL 9m
57499
VEICOLI

Nati Italiani 119m	Nati stranieri 119m	Deceduti 119m	Matrimoni 119m	Unioni Civili 119m
163 ultimo mese consolidato	49 ultimo mese	395 ultimo mese	19 ultimi 7 giorni	0 ultimi 7 giorni

Segnalazioni ricevute in attesa 119m	In Lavorazione 119m	Risolte 119m	Chiuse senza risoluzion... 119m
1116 ultimo mese	524	305	285

Manutenzioni Stradali 59m	Verde Pubbli... 59m	Decoro Urbano 59m	Relitti 59m
54 oggi	4	6	3

Attesa media alla fermata

Linea 6 9m	Linea 13 9m
3 min	13 min
Linea 17 9m	**Linea 23 9m**
4 min	5 min
Linea 31 9m	**Linea 36 9m**
19 min	2 min

Firenze Oggi

Fri 8 May 08:45:44

4027
Totale utenti WIFI

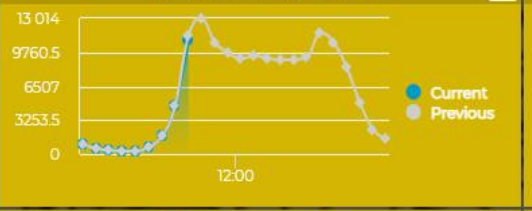
COLONNINE RICARICA 13m
173 INSTALLATE
86 % ATTIVE
5 % IN USO
9 % NON ATTIVE

8m
GENERAL METEO
MINIMO BASSO MEDIO ALTO
RISCHIO IDRAULICO
RISCHIO TEMPORALI
RISCHIO IDROGEOLOGICO
RISCHIO NEVE
RISCHIO GHIACCIO
RISCHIO VENTO

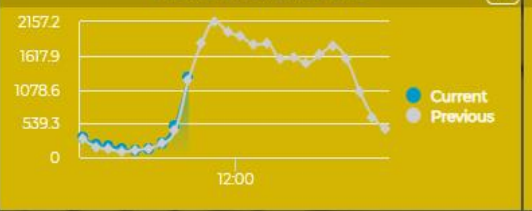
SITUAZIONE VIABILITA 19s
0 INCIDENTI
0 CHIUSURE AL TRAFFICO (TOT)
0 CHIUSURE PER CANTIERI
0 PROGR. 0 NON PROG.
0 LIMITAZIONI AL TRAFFICO (TOT)
0 LIMITAZIONI PER CANTIERI
0 NON PROG. 0 PROGR.
0 TOT. EVENTI SULLA RETE

SMN 8m	BINARIO16 8m	FORTEZZA 8m
19.8 % occupati su 607 posti	38.2 % occupati su 165 posti	6 % occupati su 521 posti
LEOPOLDA 8m	**CALZA 8m**	**S.AMBROGIO 8m**
26.3 % occupati su 300 posti	35.8 % occupati su 148	26.4 % occupati su 379 posti
PARTERRE 8m	**CAREGGI 8m**	**BECCARIA 8m**
32.3 % occupati su 656 posti	36.5 % occupati su 406 posti	28.1 % occupati su 210 posti

ANALYSIS
Energy
Environment
Mobility
Social
Resilience

FLUSSI INGRESSO CITTA 8m


TOTALE 8m
15596
VEICOLI

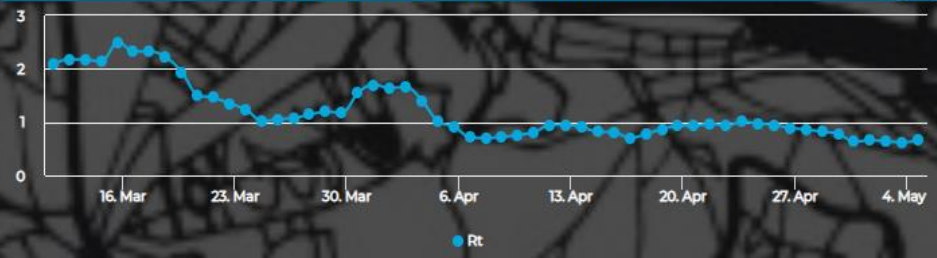
FLUSSI INGRESSO ZTL 8m


TOTALE ZTL 8m
1778
VEICOLI

Nati Italiani 118m	Nati stranieri 118m	Deceduti 118m	Matrimoni 118m	Unioni Civili 118m
150 ultimo mese consolidato	43 ultimo mese	473 ultimo mese	10 ultimi 7 giorni	1 ultimi 7 giorni

Manutenzioni Stradali 58m	Verde Pubbli... 58m	Decoro Urbano 58m	Relitti 58m
0 oggi	0	0	0

Indicatore Rt per la provincia di Firenze 118m



Rt 118m
0.66

Attesa media alla fermata

Linea 6 8m	Linea 13 8m
5 min	5 min
Linea 17 8m	**Linea 23 8m**
4 min	7 min
Linea 31 8m	**Linea 36 8m**
9 min	10 min

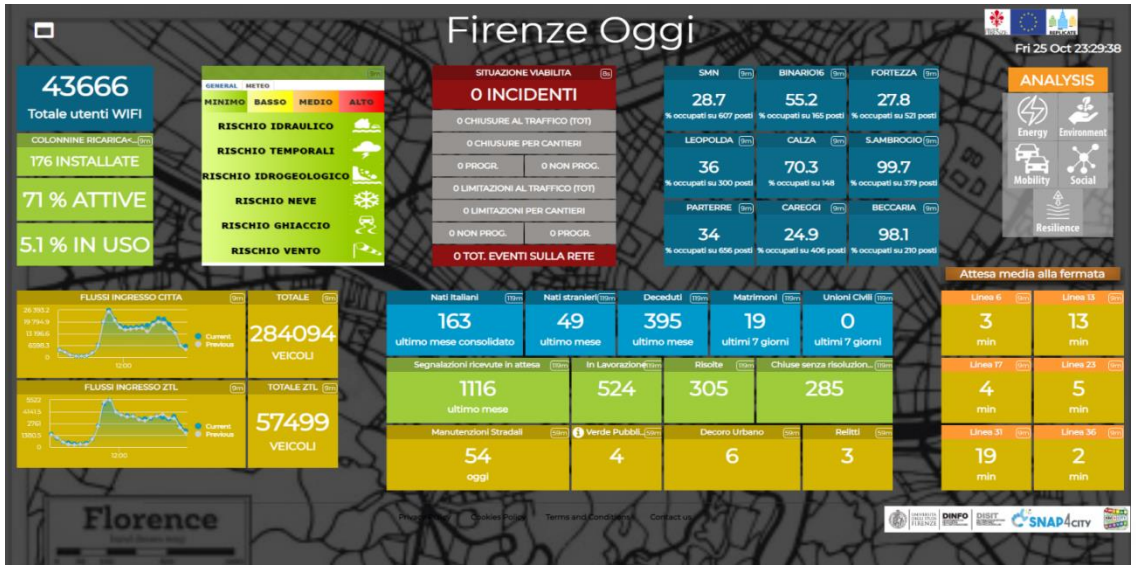
Privacy Policy Cookies Policy Terms and Conditions Contact us

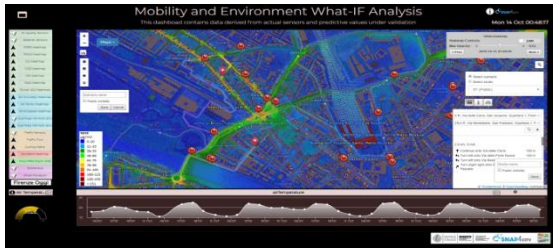
Smart City Control Room
a set of dashboards and tools

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement Nº 691735

REPLICATE

FIRENZE CITTÀ FARO



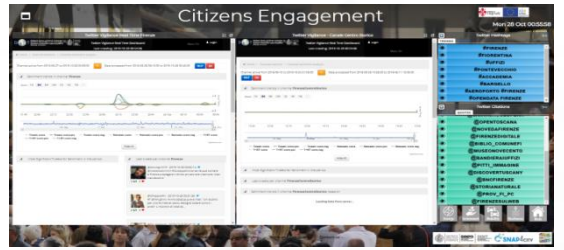


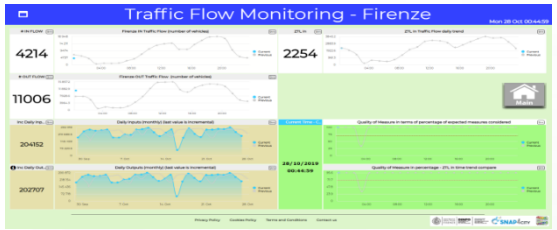






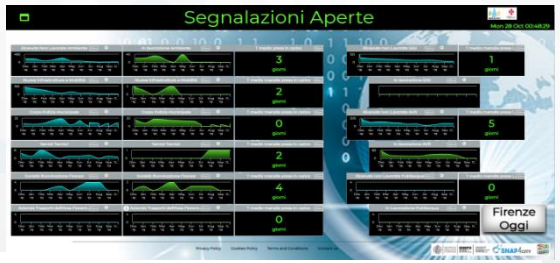


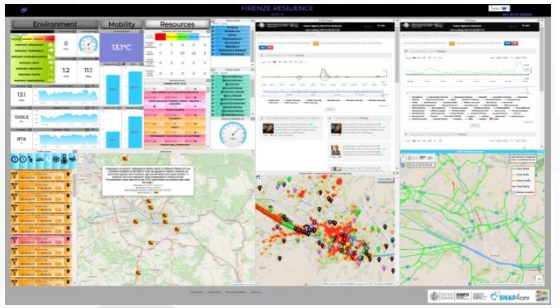


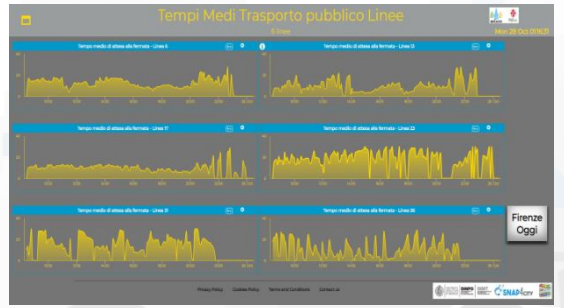












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SNAP4CITY

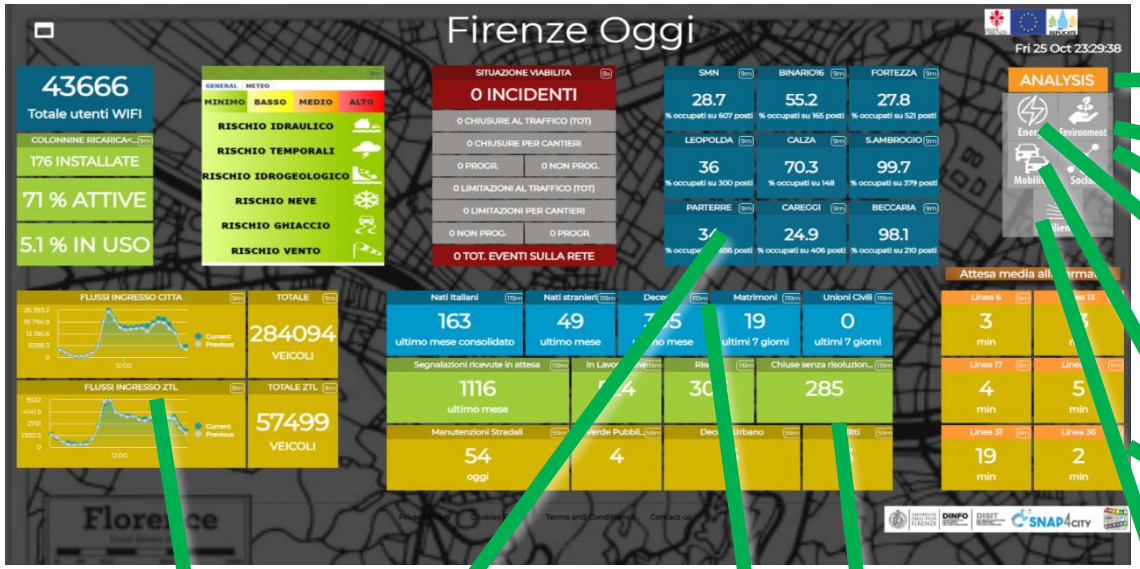
KM4CITY

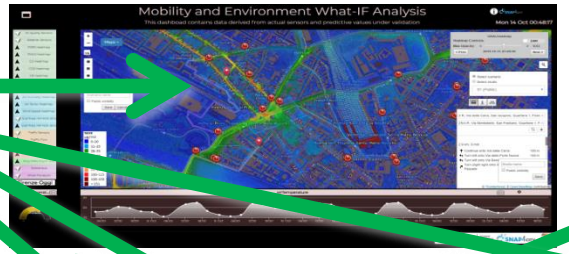
Smart City Control Room

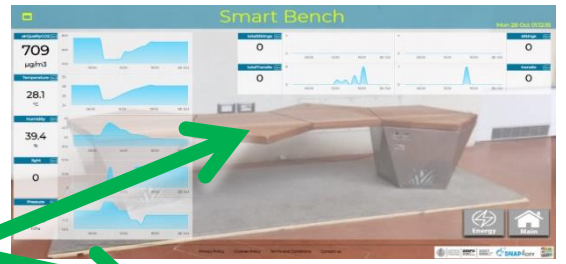
a set of dashboards and tools

REPLICATE

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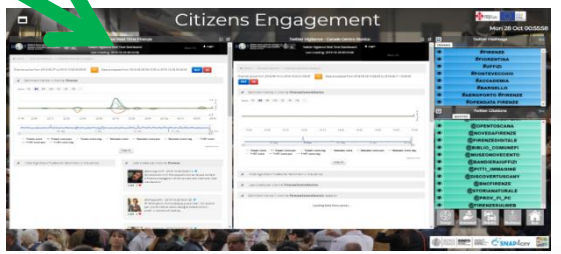


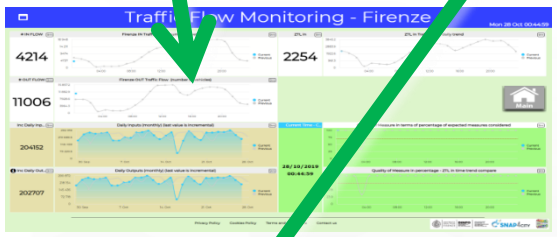




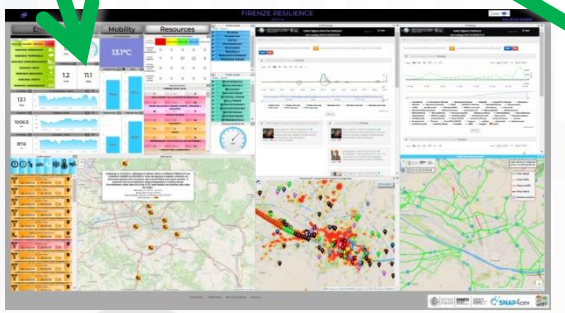


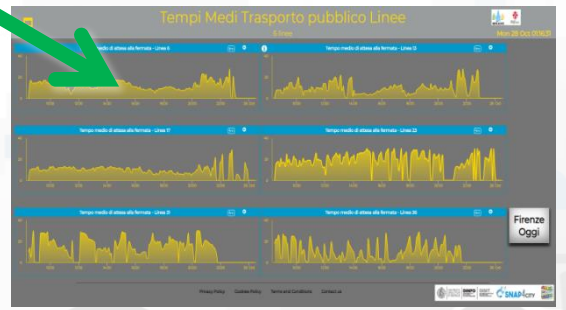
















FIRENZE CITTÀ FARO

Mobility and Environment What-IF Analysis

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

Mon 14 Oct 00:48:17

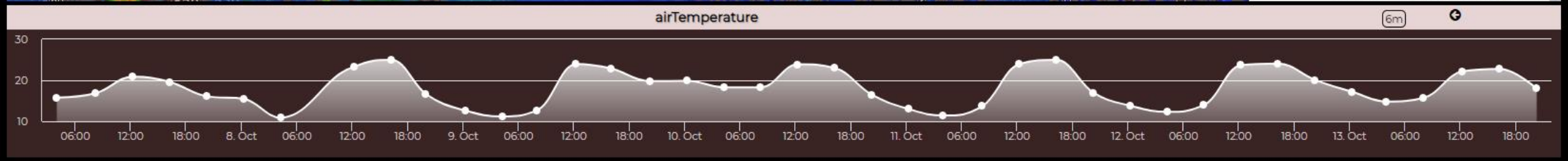
- Air Quality Sensors
- Weather Sensors
- PM10 Heatmap
- PM2.5 Heatmap
- CO Heatmap
- CO2 Heatmap
- O3 Heatmap
- NO2 Heatmap
- Europ. AQI Heatmap
- Air Humidity Heatmap
- Air Temp. Heatmap
- Wind Speed Heatmap
- Gral Pred. HM NOX (3m)
- Gral Pred. HM NOX (6m)
- Traffic Sensors
- Traffic Flow
- Cycling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

Firenze Oggi

Air Temperat... 6m





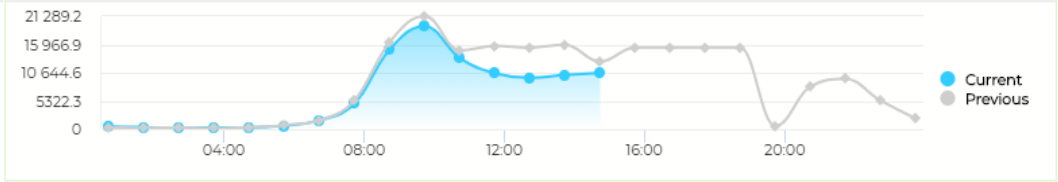


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjE5MA==

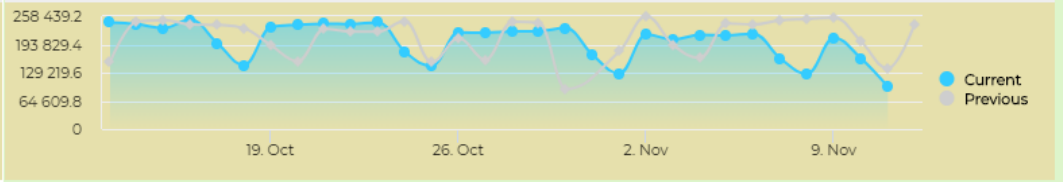
Traffic Flow Monitoring - Firenze - Cloned2

Wed 11 Nov 15:01:32

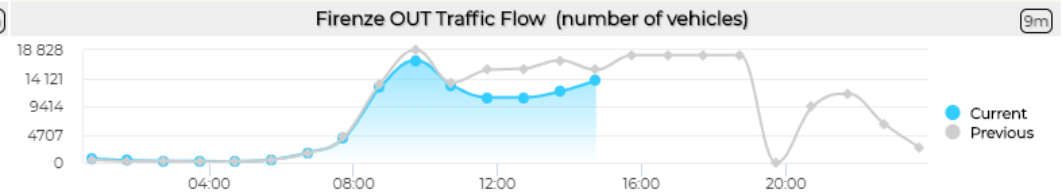
 # IN FLOW — 10549 #ofvehicles



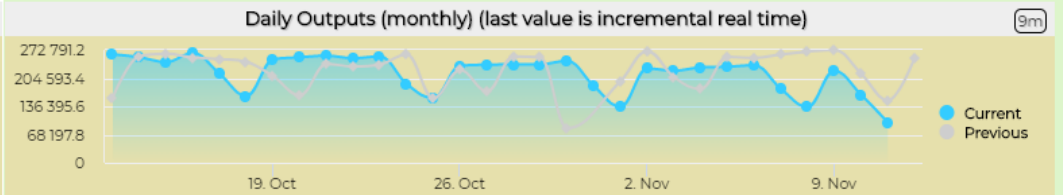
Inc Daily Inp... — 97137 #ofvehicles



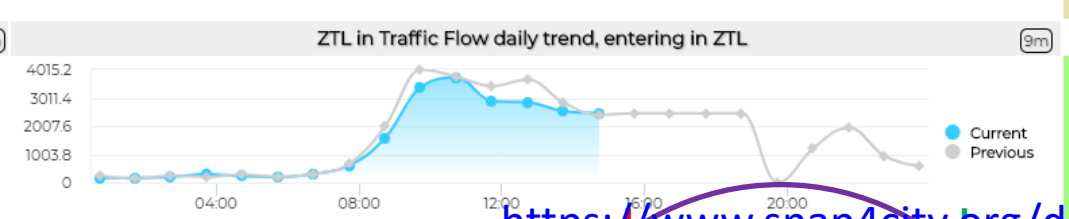
 # OUT FLOW — 13720 #ofvehicles

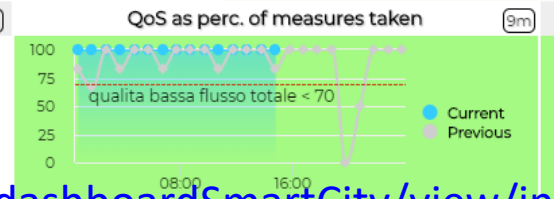


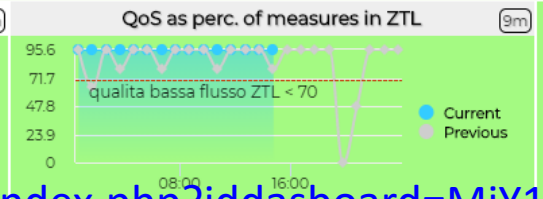
Inc Daily Out... — 97457 #ofvehicles



ZTL in — 2468 #ofvehicles

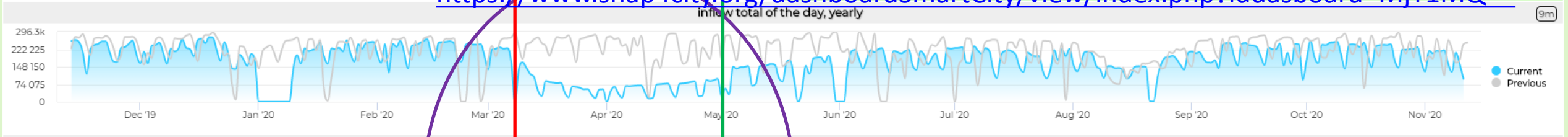


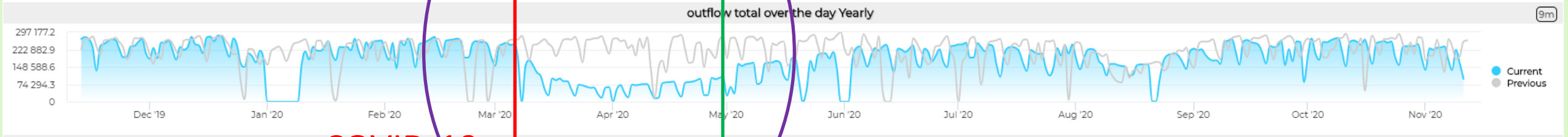


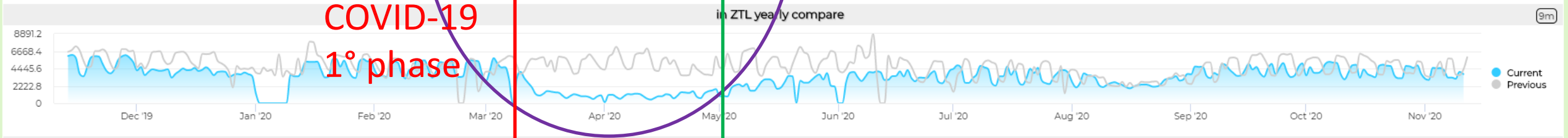


11/11/2020
15:01:33

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjY1MQ==





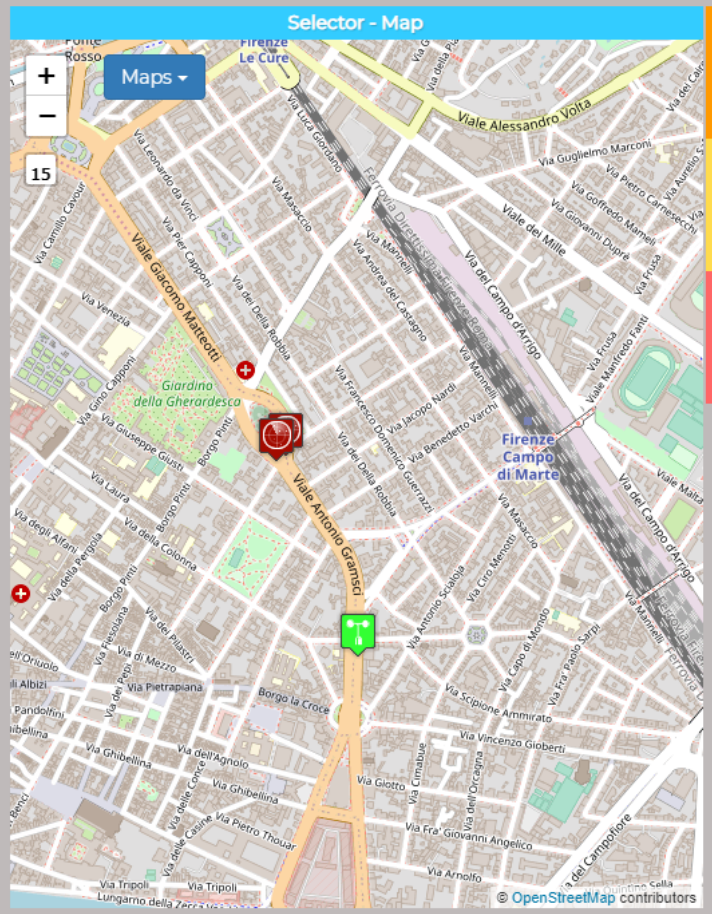


COVID-19
1° phase

NOX reduction for COVID

Monitoraggio Area Gramsci: NO2 vs Traffico

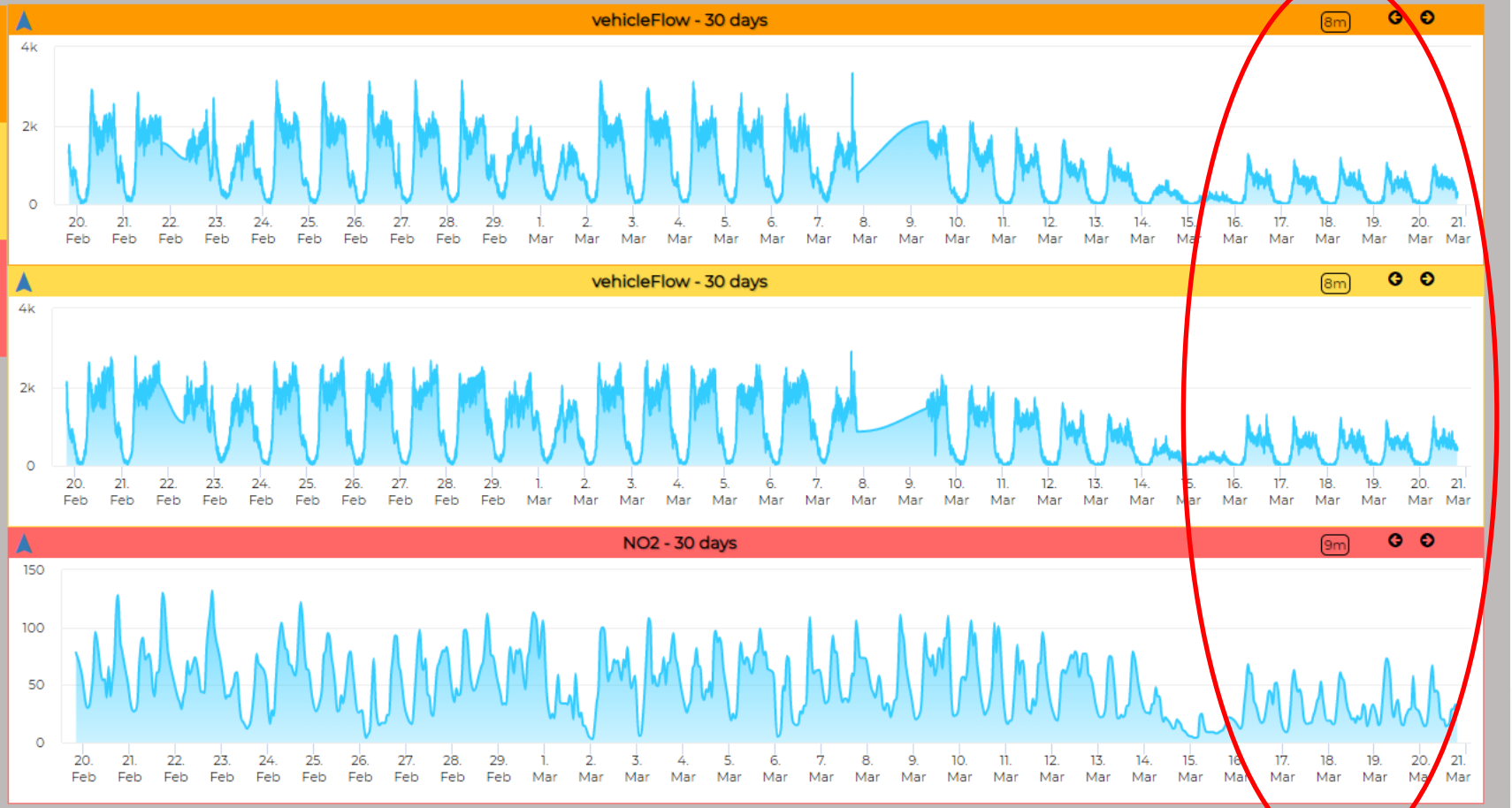
Sun 19 Apr 19:16:42



InOut traffic Firenze

NOX Predictions

Real Time Traffic



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjI4OQ==

Andamenti Nazionali e Regionali infezione COVID-19

Sulla base dei dati della protezione civile, elaborazioni DISITLab

Sun 19 Apr 19:21:39

per evidenziare gli andamenti di vostro interesse: eliminare le curve che non interessano selezionandole in legenda.
Alcuni dati in passato non sono pervenuti alla protezione civile

486	nuovi_att_positivi
108257	Attualmente_positivi
23660	deceduti
47055	dimessi_guariti

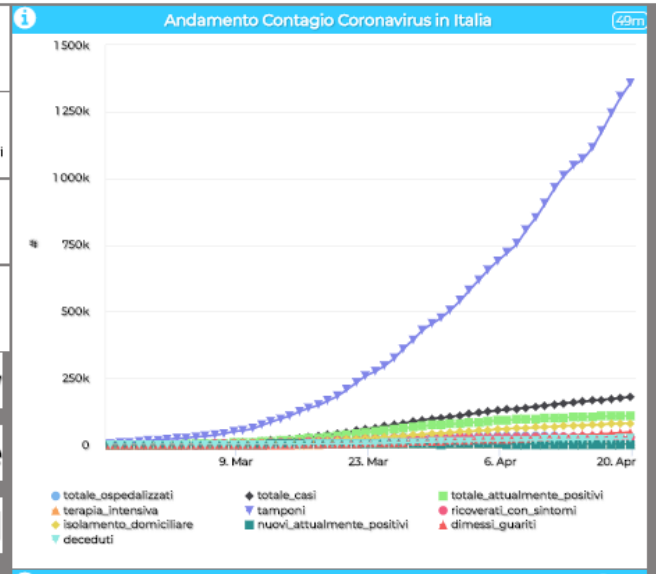
LOG view

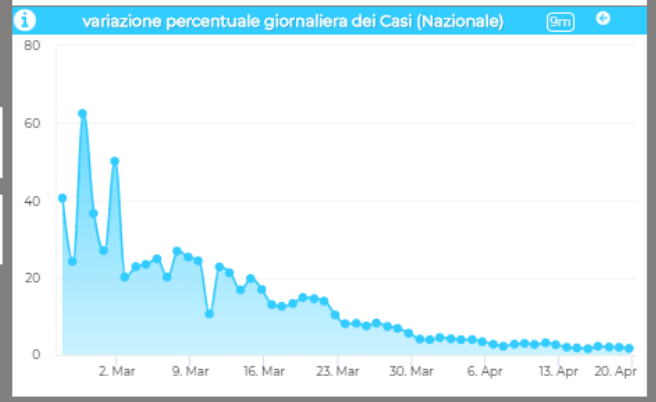
Mobile

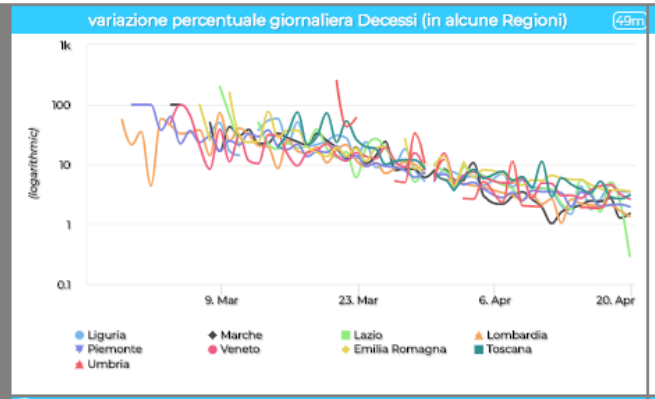
Staked

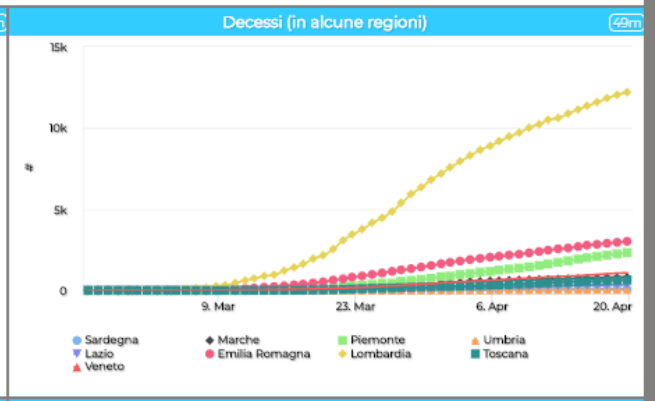
Regione Toscana

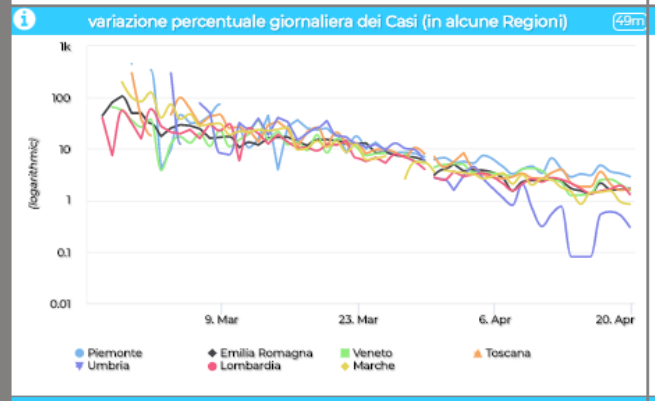
Regione LOG

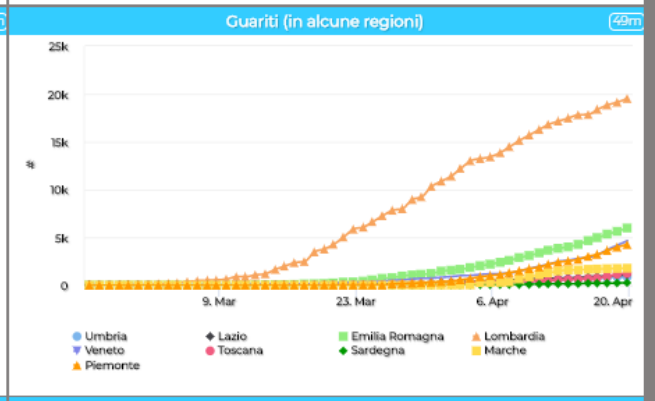


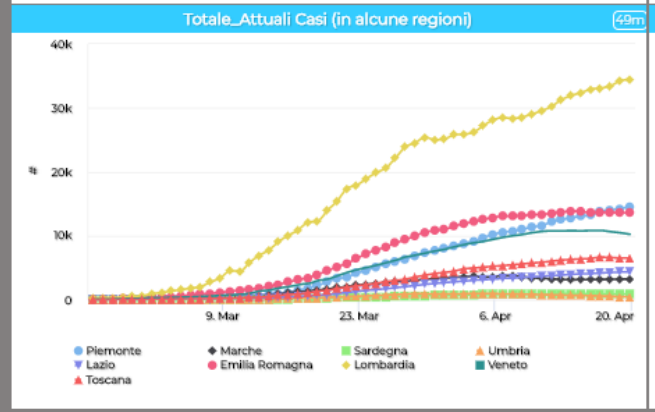


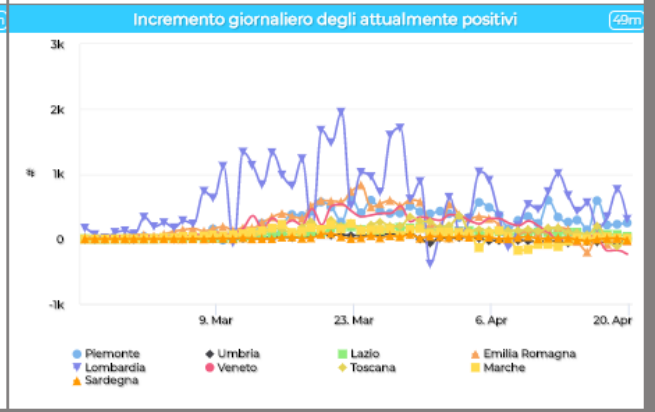












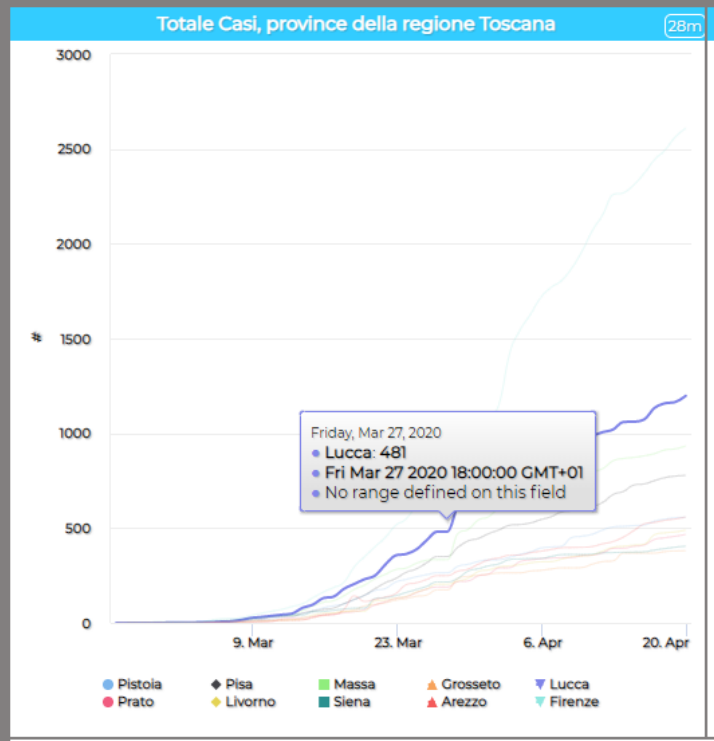
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjU2OQ==

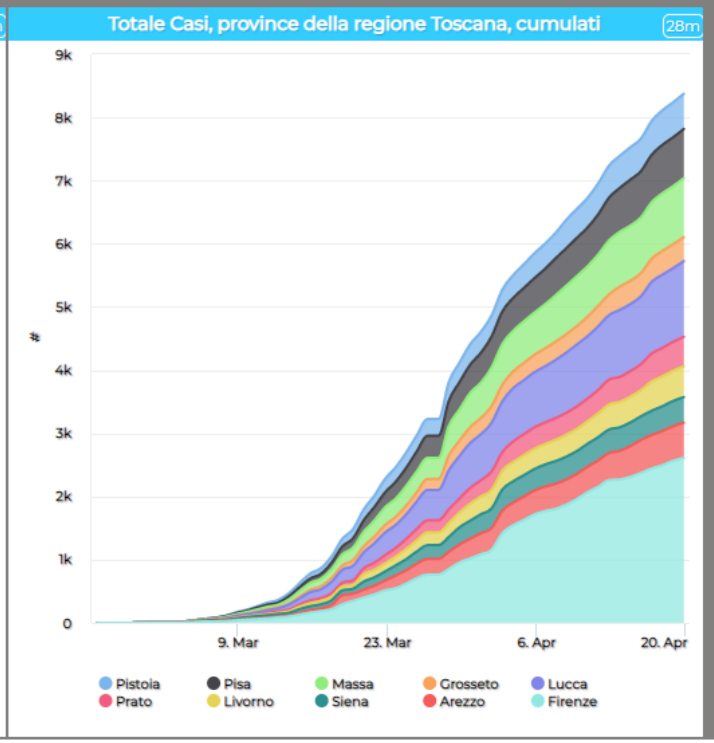
Main IT Provinces vs Tuscany Provinces: COVID-19

Andamento Regione Toscana e Province, COVID-19

Sulla base dei dati della protezione civile, elaborazioni DISITLab

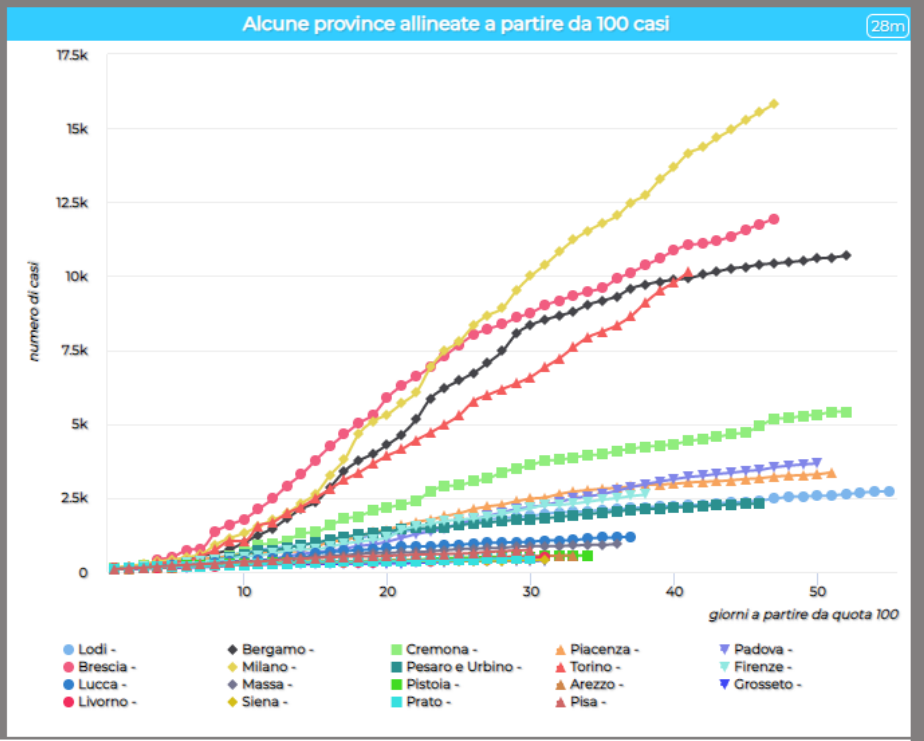
Sun 19 Apr 19:19:56





passa al Nazionale Regionale

Log view



per evidenziare gli andamenti di vostro interesse: eliminare le curve che non interessano selezionandole in legenda.

Alcuni dati in passato non sono pervenuti alla protezione civile

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjU3NQ==

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DEMO
Section 1

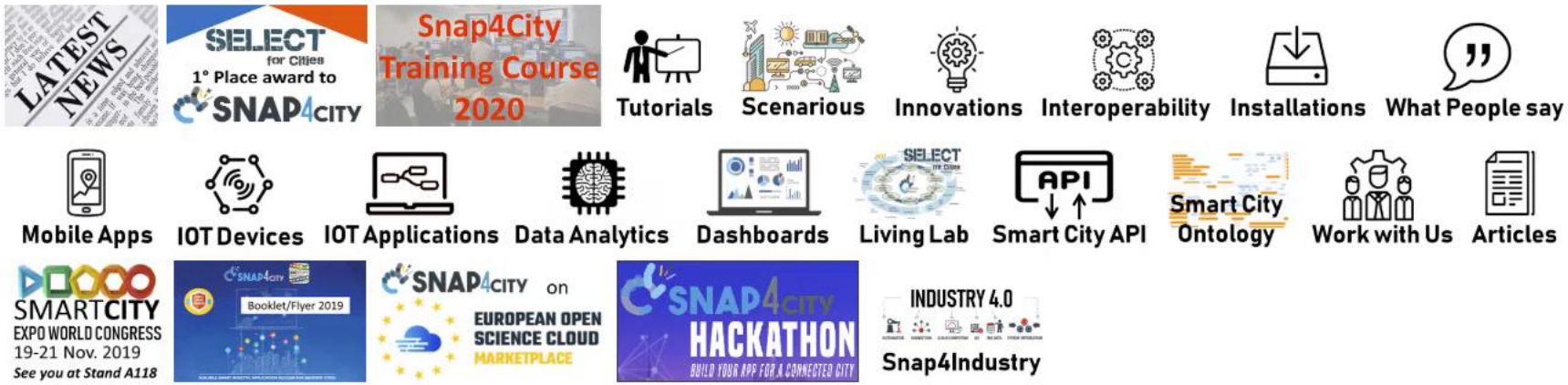
My Snap4City.org
Dashboards
My Dashboards in All Org.
Dashboards of My Organization
My Dashboards in My Organization
Notificator
Data Inspector
My Data, KPI, POI
My Groups of Entities
IOT Applications
IOT Directory and Devices
Knowledge and Maps
Micro Applications
External Services
Data Set Manager: Data Gate
Synoptics
Resource Manager: Process Loader
Development Tools
Management
Settings
User Management and Auditing
Help and Contacts
Documentation and Articles



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

Snap4City - scalable Smart aNalytic APplication builder for sentient Cities

View | Edit | Track | Access control | Convert



Smart Cities need to set up a flexible Living Lab to cope with the city evolution in terms of services and city users' needs and sustainability. Snap4City solution (https://www.snap4city.org) provides a flexible method and solution to quickly create a large range of smart city applications exploiting heterogeneous data and enabling services for stakeholders by IOT/IOE, data analytics and big data technologies. Snap4City applications may exploit multiple paradigms as data driven, stream and batch processing, putting co-creation tools in the hands of: (i) Smart Living Lab users and developers a plethora of solutions

Username: roottooladmin1

Search
Search
-Any-

Snap4City Training Course 2020
Training Snap4City from Data to Sentient Cities in a Snap
Program and Interactive Slides

Powered by www.km4city.org
FI-WARE
Node-RED

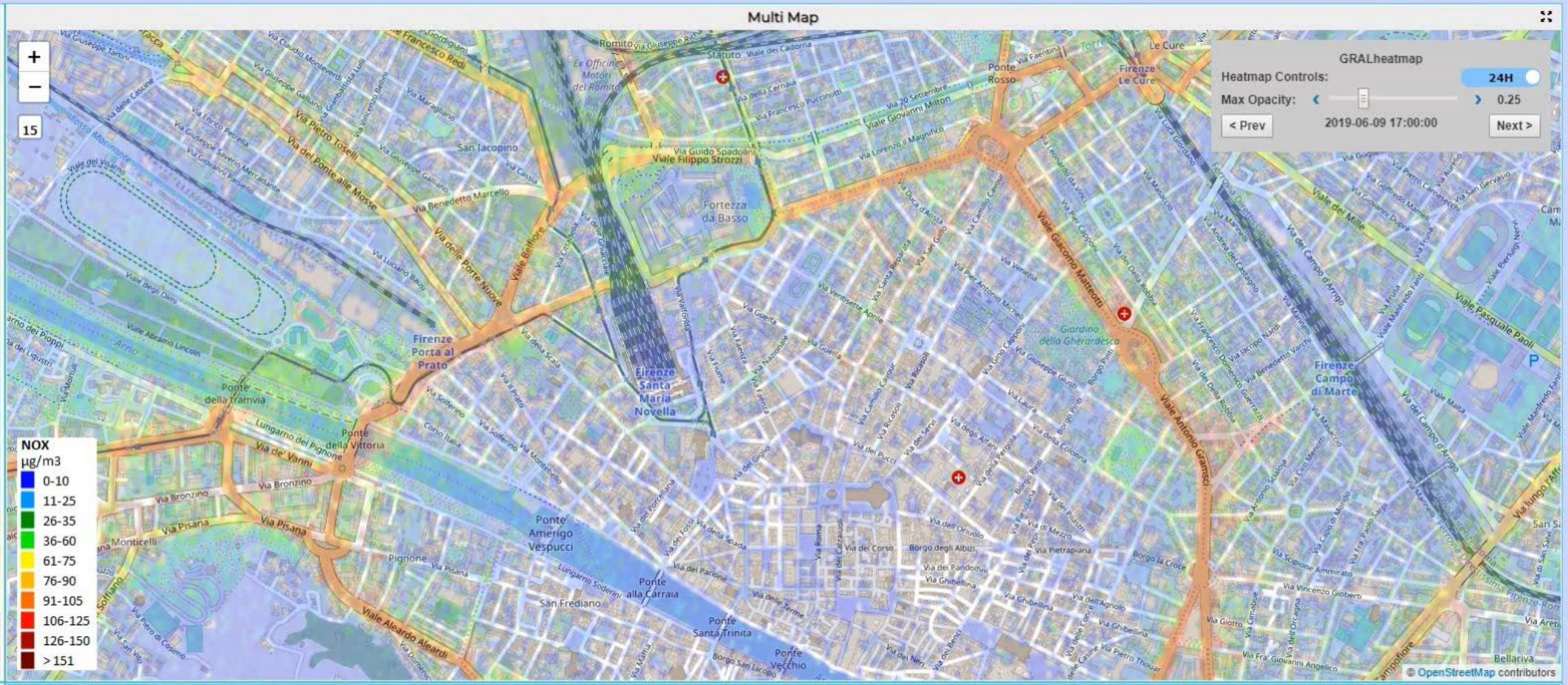
Who's online

Firenze - Trafair - AirQuality Heatmaps

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

Sun 9 Jun 17:41:58

- Air Quality Sensors
- PM10 Heatmap
- PM2.5 Heatmap
- CO Heatmap
- CO2 Heatmap
- SO2 Heatmap
- O3 Heatmap
- NO2 Heatmap
- Benzene Heatmap
- H2S Heatmap
- Air Humidity Heatmap
- Air Temp. Heatmap
- Wind Speed Heatmap
- Gral Pred. HM NOX (3m)
- Gral Pred. HM NOX (6m)
- Traffic Sensors
- Traffic Flow
- Cycling Paths
- Accident Heatmap
- Accident Heatmap 2



Air Temperature Bolognese 7m



SIRSensor_TOS01001095 - airTemperature 7m



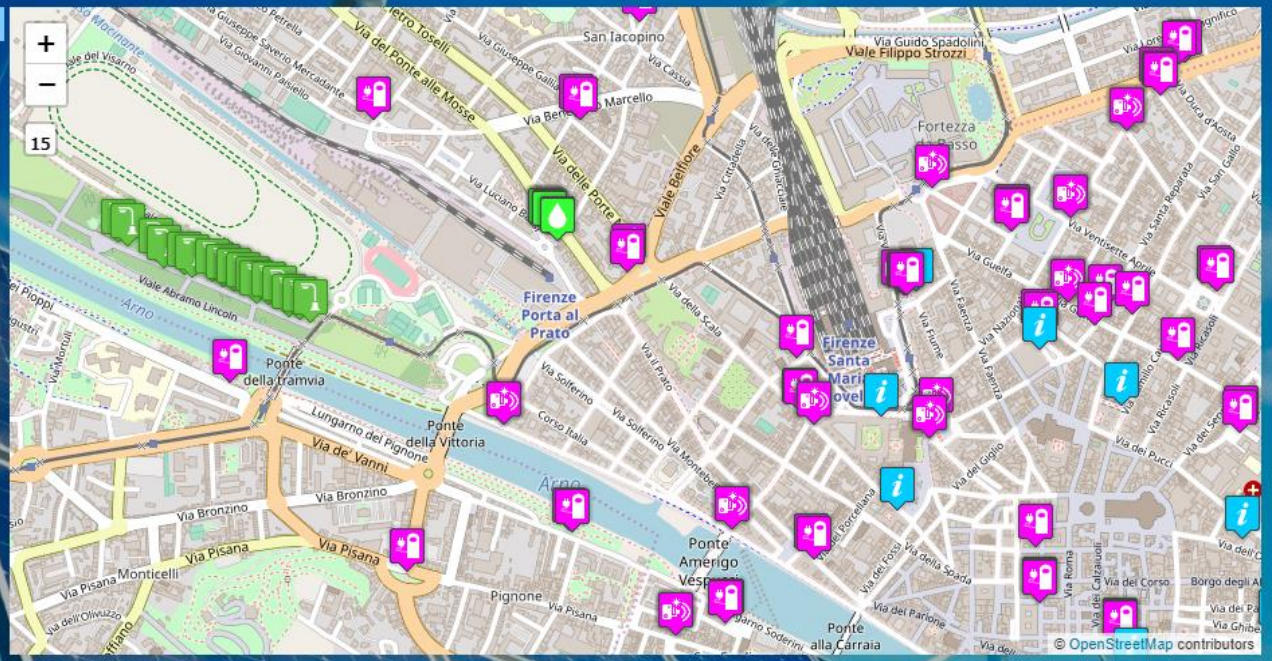
- Energy -

Sun 3 Nov 22:44:41

Environment | Mobility | Social | Resilience | Main

Selector - Click the icon

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


Via del Ponte alle Mosse
Viale Belfiore
Via delle Porte
Firenze Porta al Prato
Firenze Santa Maria Novella
Viale Abramo Lincoln
Ponte della tramvia
Lungarno del Pignone
Ponte della Vittoria
Via de' Vanni
Via Bronzino
Via Pisana
Via Pisana Monticelli
Corso Italia
Via Solferino
Via Montebello
Via del Parione
Ponte Amerigo Vespucci
Ponte alla Carraia
Pignone
Via Guido Spadolini
Viale Filippo Strozzi
Fortezza da Basso
San Iacopino
Via Cassia
Marcello
Via Guelfa
Via Faenza
Via Fiume
Via Nazionale
Via Ricasoli
Via del Giglio
Via del Corso
Via Roma
Via dei Cerretani
Via dei Pucci
Via del Porcellana
Via della Spada
Via dei Fossi
Via della Scala
Via il Prato
Via Ventisette Aprile
Via Santa Reparata
Via San Gallo
Via Duca d'Aosta
Via Cavour
Via Ghibellina
Via dei Pandolfini
Via dei Servi
Via dei Ginori
Via dei Tornabuoni
Via Vigna Nuova
Via Strozzi
Via Tornabuoni
Via Porta Rossa
Via Calimala
Via Lambertesca
Via Orsanmichele
Via Arte della Lana
Via Por Santa Maria
Via Lamarmora
Via Ghibellina
Via Giuseppe Giusti
Via Giovanni Pascoli
Via Giuseppe Saverio Mercadante
Via Luciano Bausi
Via Mozzante
Via del Visarno
Via dei Pioppi
Via Mortuli
Via dell'Oliviuzzo
Via Pisana
Via Bronzino
Via de' Vanni
Via Solferino
Via Montebello
Via del Parione

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SNAP4CITY | KM4CITY

- Mobility -

Tue 5 Nov 17:47:56

Traffic Events in Firenze

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

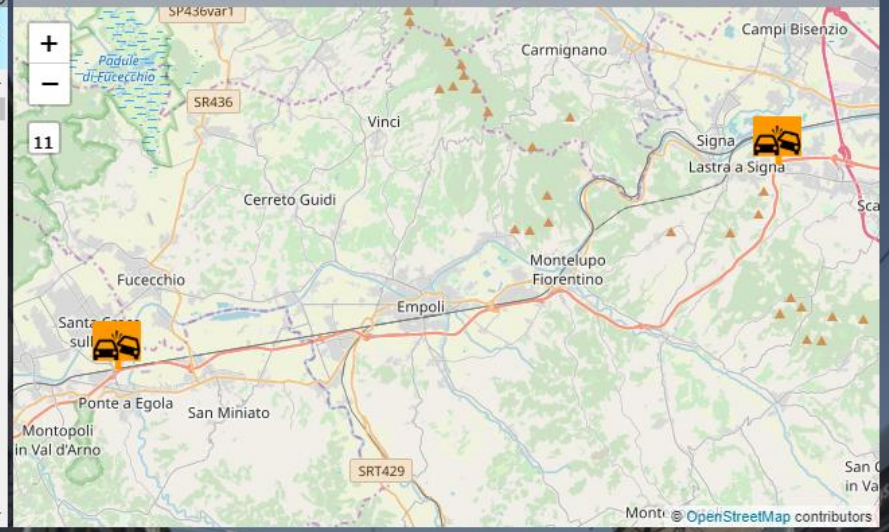
05-11-2019 17:13 VEICOLO FERMO O AVARIA
BROKEN DOWN VEHICLE(S) | 05/11/2019 | 17:13:07 | 5

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

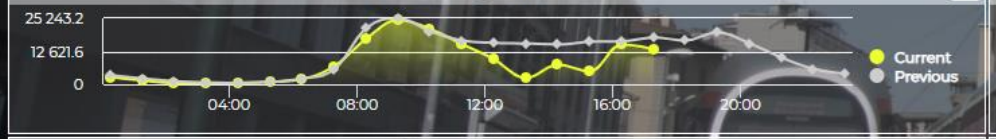
05-11-2019 17:12 TRAFFICO RALLENTATO
SLOW TRAFFIC | 05/11/2019 | 17:12:17 | 5

05-11-2019 16:40 CODA IN USCITA A LASTRA
QUEUING TRAFFIC | 05/11/2019 | 16:40:32 | 5

Traffic Events - Firenze



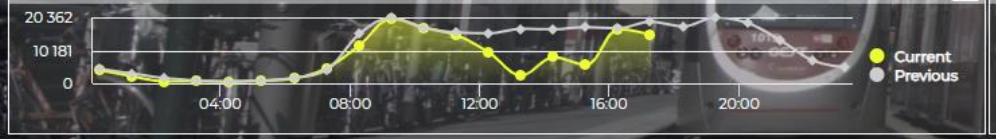
Traffic Daily Inflow trend



N. veicoli totali Inflow

144137 n.

Traffic Daily Outflow trend



N. veicoli totali Outflow

132220 n.

SMN

411 free

Stazione S.M.N. Parking Slots Availability Trend



Parterre

355 free

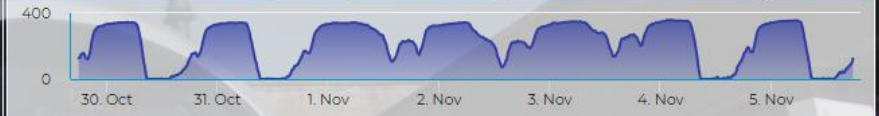
Parterre Parking Slots Availability Trend



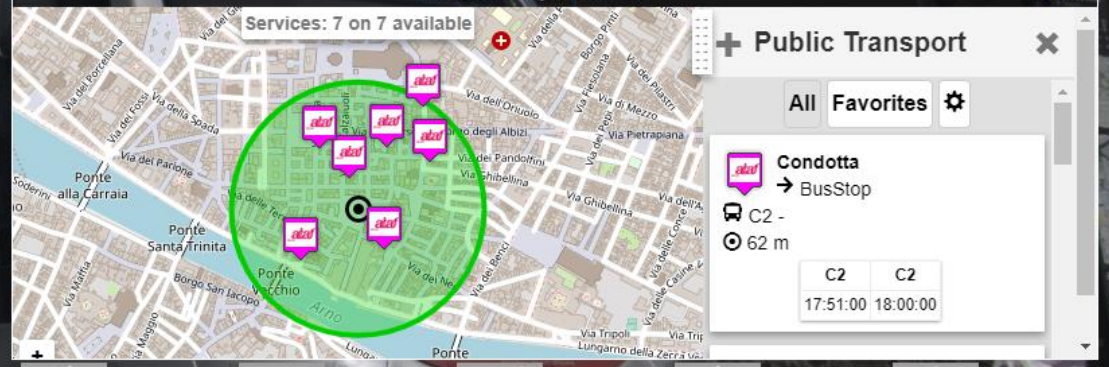
Careggi

123 free

Careggi Parking Slots Availability Trend



Public Transport Search



Energy | Environment | Social | Resilience | Main

Valutazione Trasporto Pubblico

Firenze - 6 linee

Tue 5 Nov 17:49:00

Linea 13

395

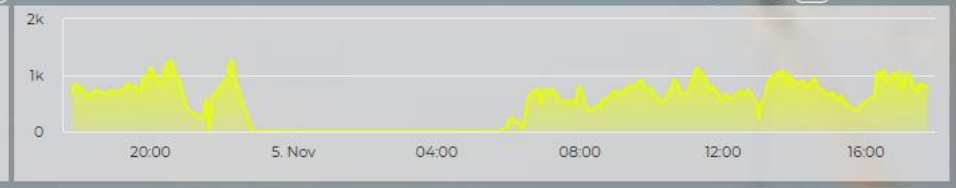
Ritardo medio corse attive nei 5min in sec



Linea 31

793

Ritardo medio corse attive nei 5min in sec



Linea 17

182

Ritardo medio corse attive nei 5min in sec



Linea 36

923

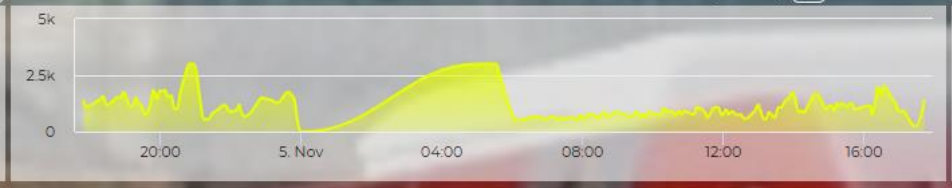
Ritardo medio corse attive nei 5min in sec



Linea 23

1369

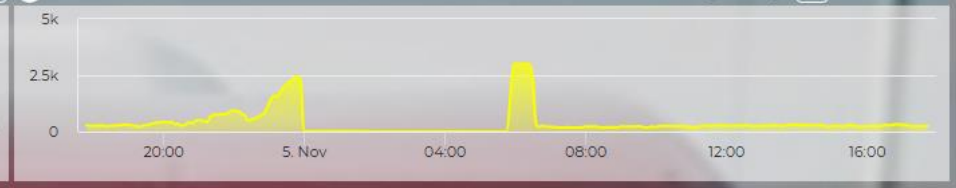
Ritardo medio corse attive nei 5min in sec



Linea 6

254

Ritardo medio corse attive nei 5min in sec









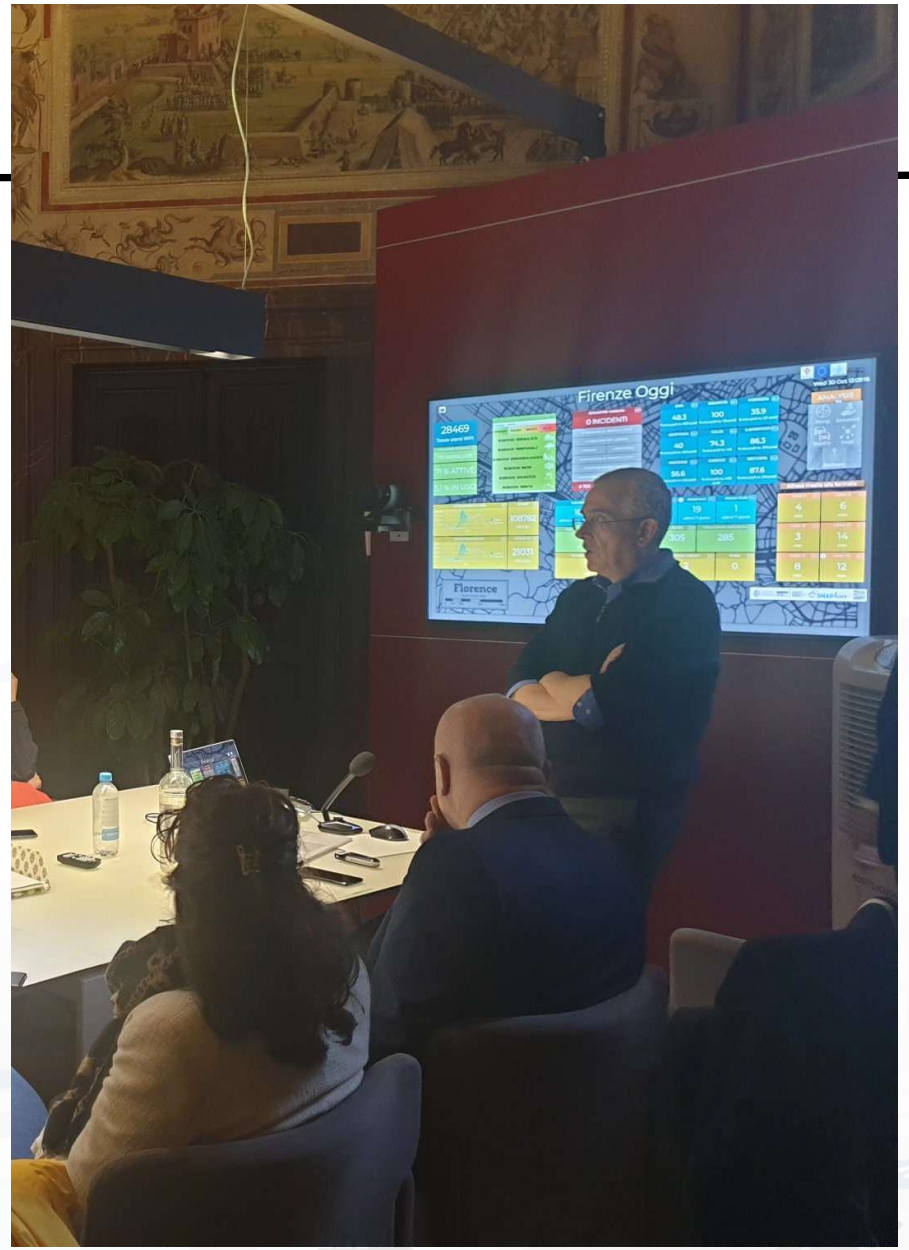






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g from
2020
ramme
691735

FIRENZE
CITTÀ FARO

Replicate Project @ReplicateEU · Oct 30

Last stop allowed to see the #smartcity #controlcenter an exciting experience and impressive

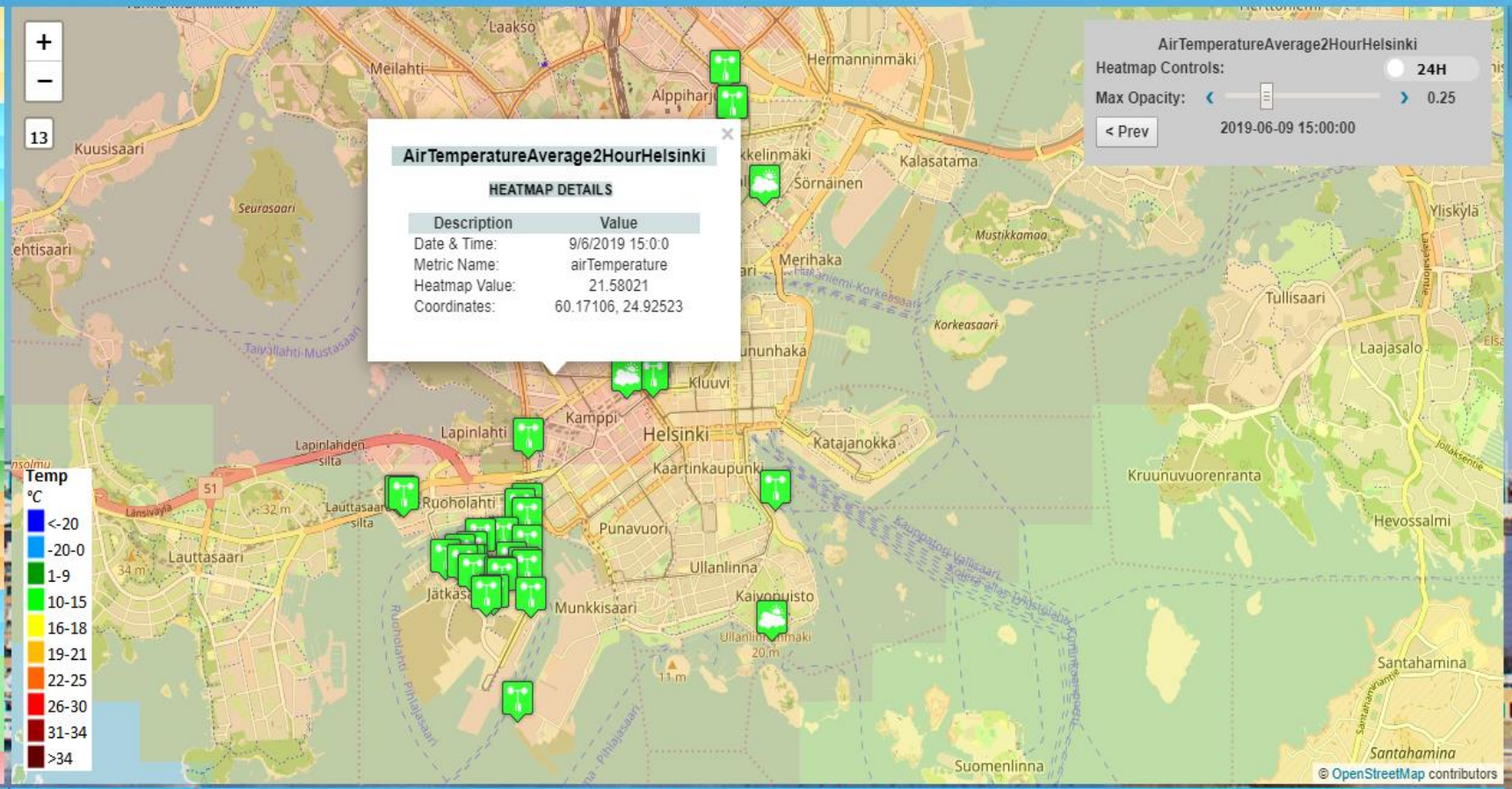


Helsinki City Overview (H5a)

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

Sun 9 Jun 17:07:25

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





Weather sen... 9m

20.5

Weather sensor Helsinki Kaisaniemi - airTemperature 9m



The Life of Helsinki

Documentation

Forum Discussion

Survey

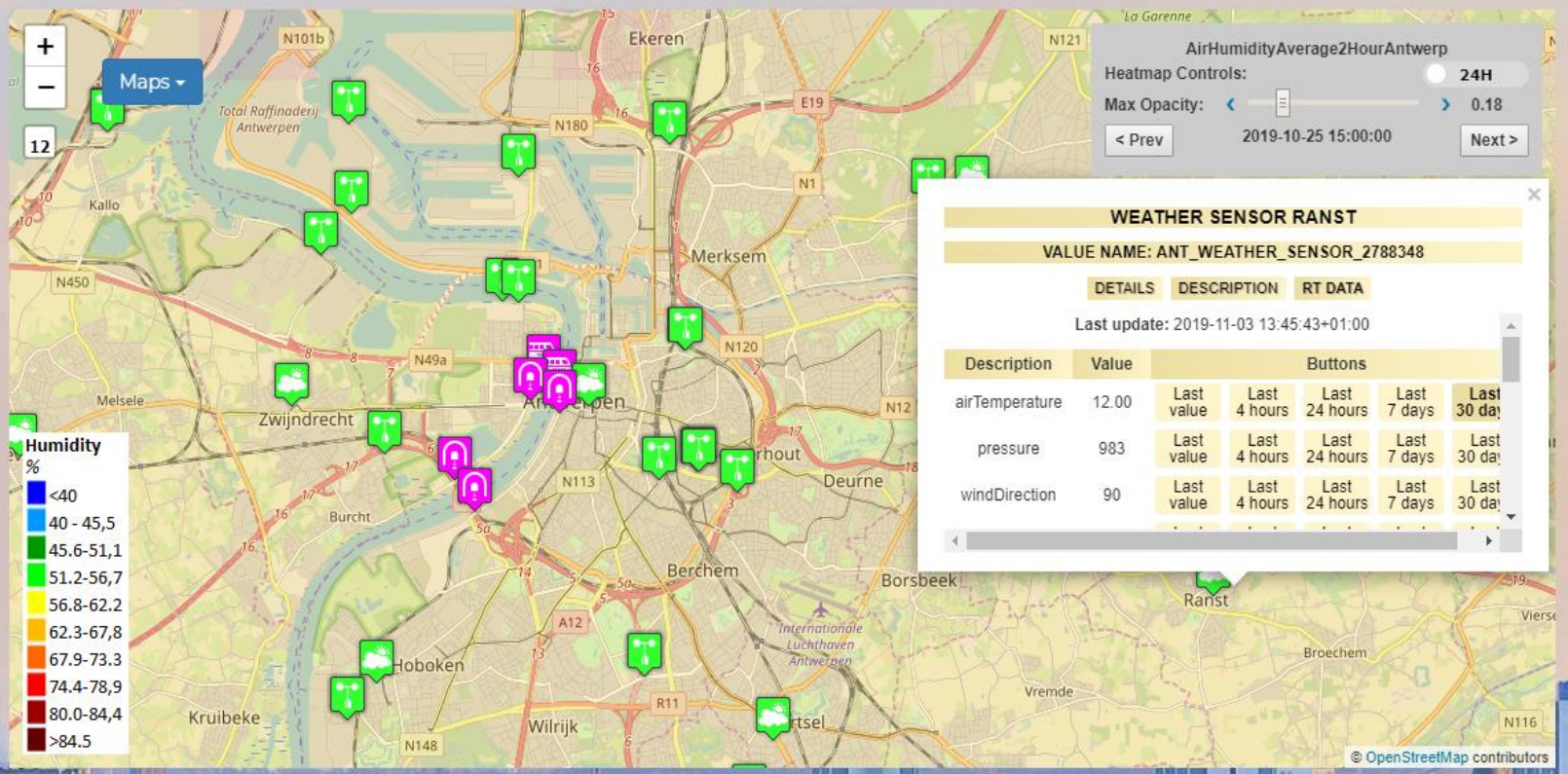
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTQwNg==

Antwerp City Overview - A5

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

Sun 3 Nov 14:09:43

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



Weather sensor Zwijndr... 8m

11.9



Forum Discussion

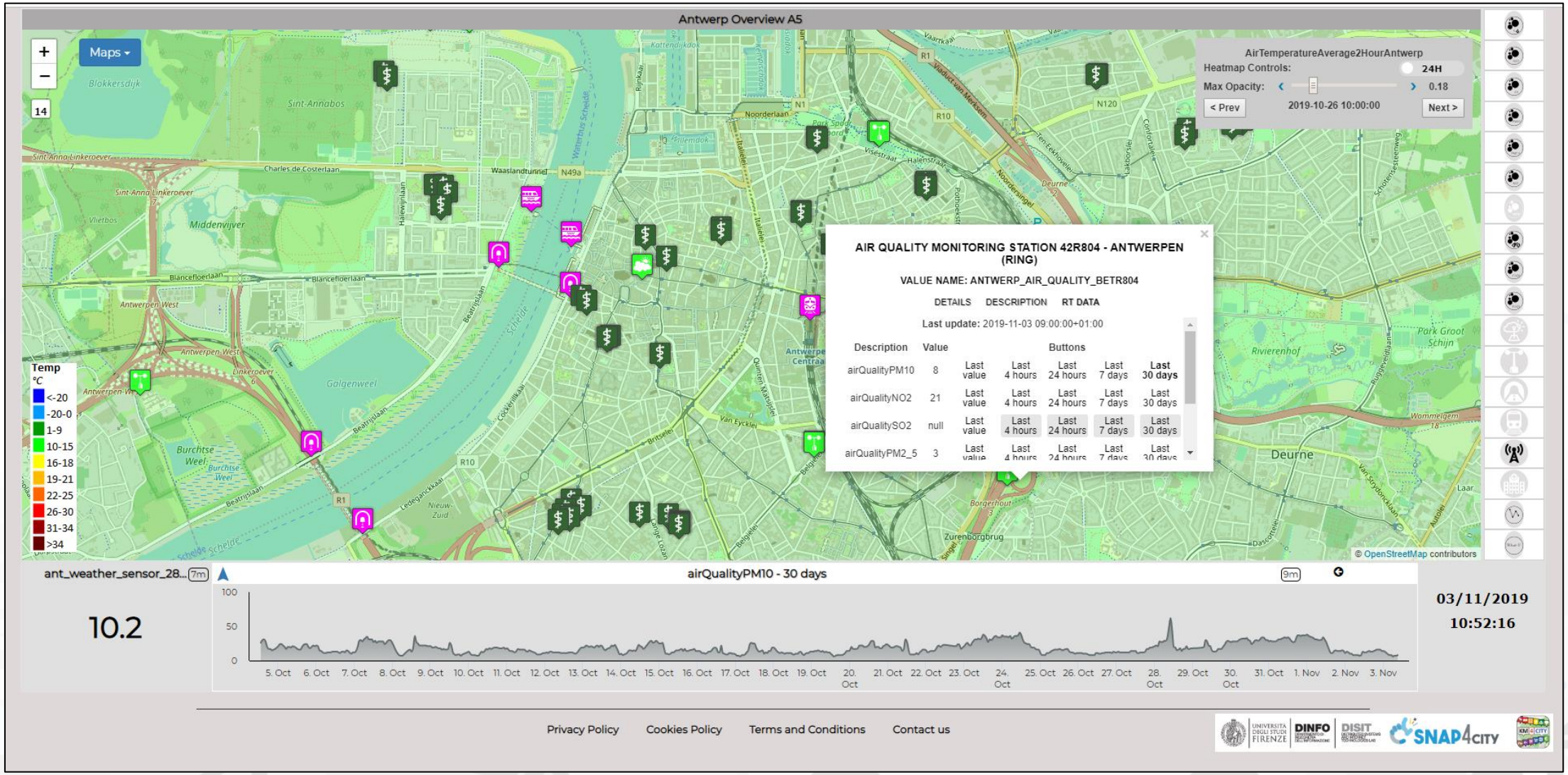
Documentation

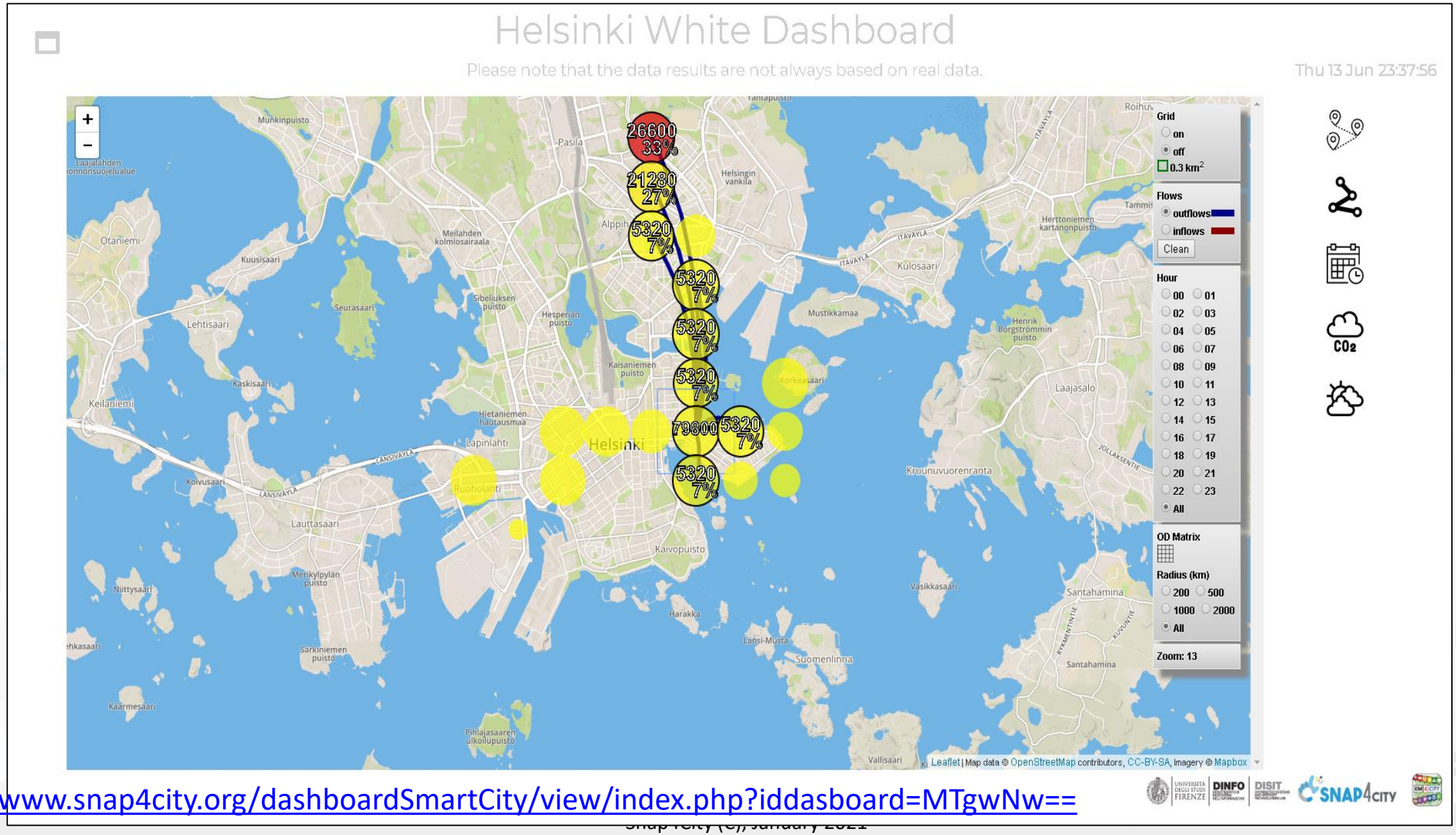
Survey

The Life of Antwerp

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTQwNw==

Unique Dashboard builder Multiple Styles

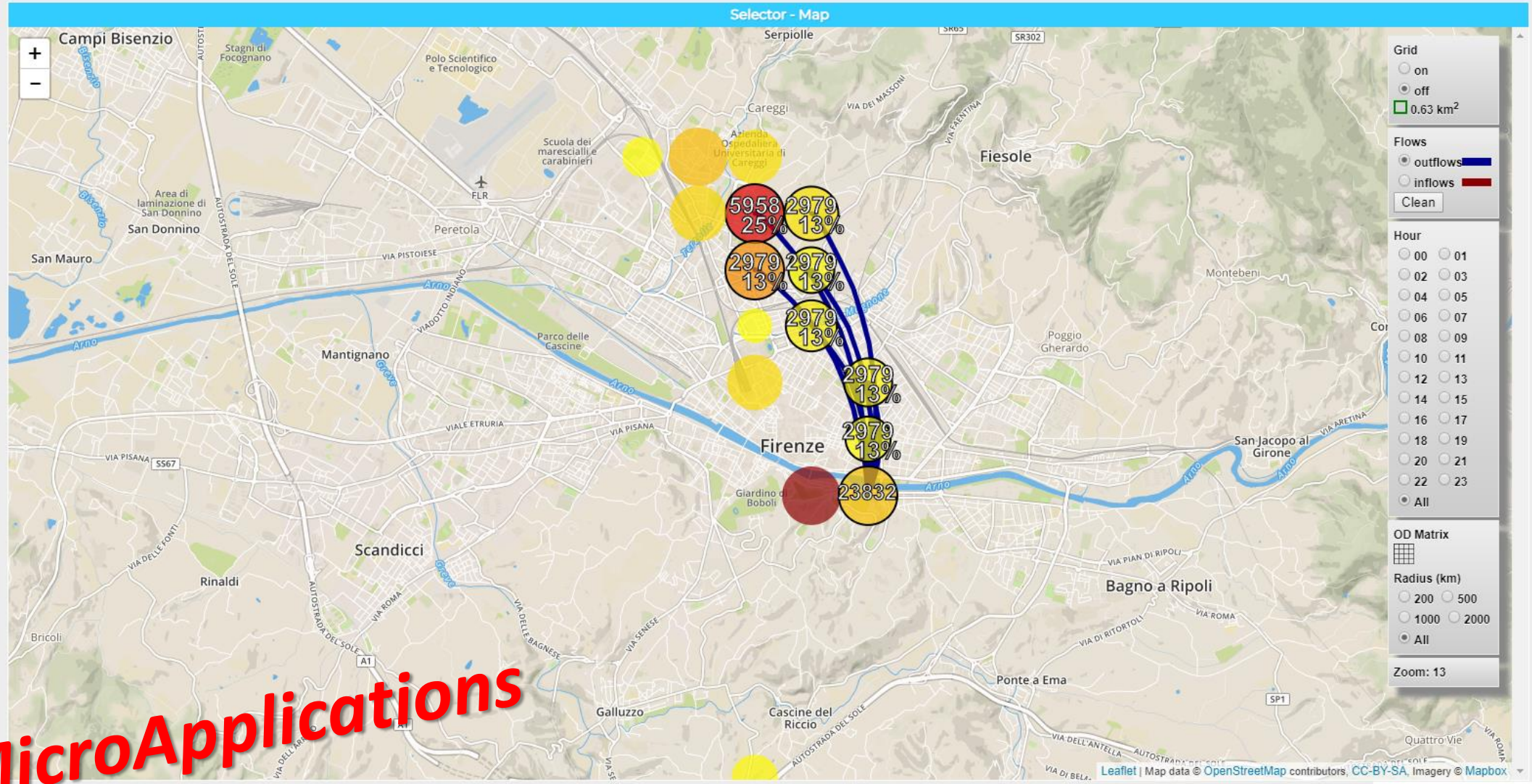




https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTgwNw==

Life in Toscana: Dashboard

Mon 24 Jun 09:19:20

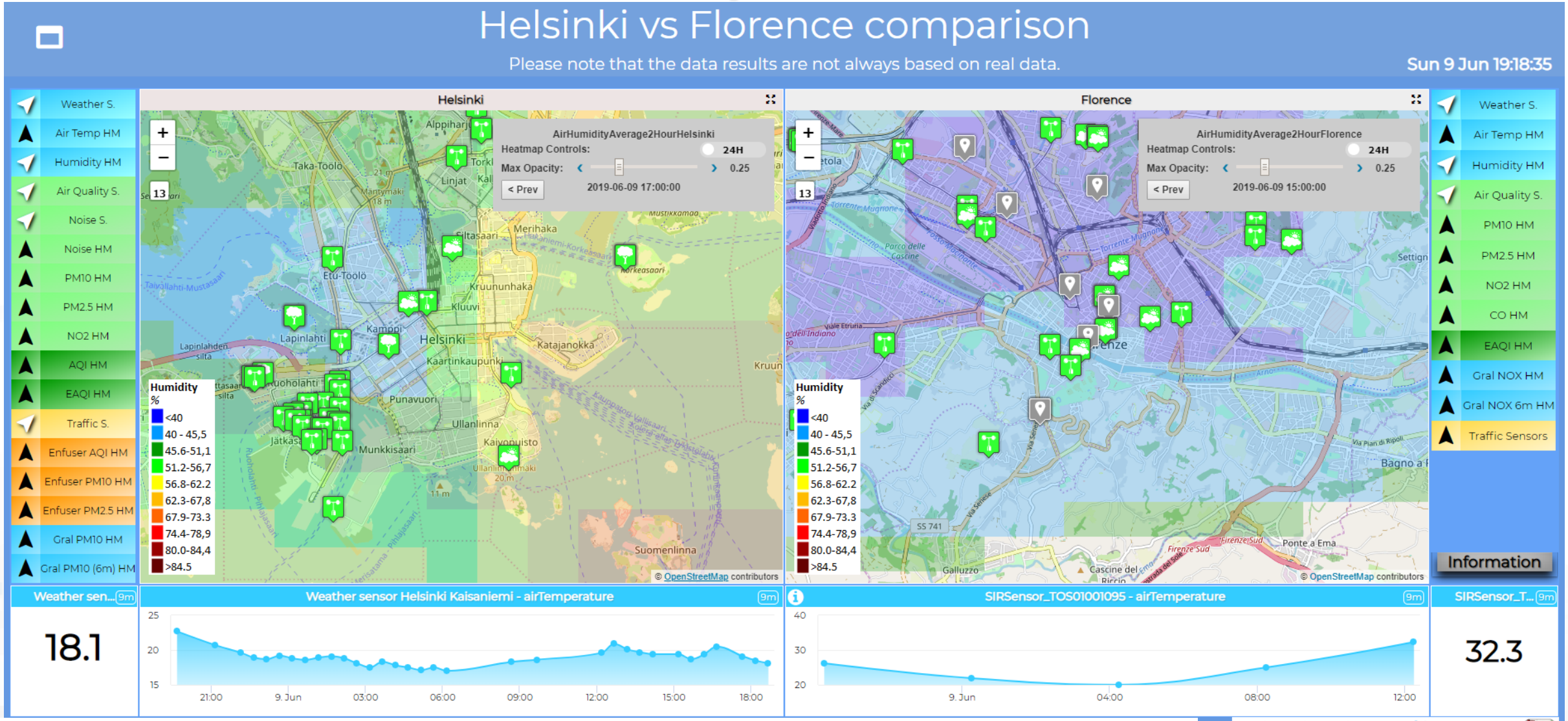


Line of Transport
Public Transport
Travel Plan
Air Quality
Weather
Origin Dest. Matrix
Typical Trajectories
Cultural Activities
Forum Discussion

MicroApplications

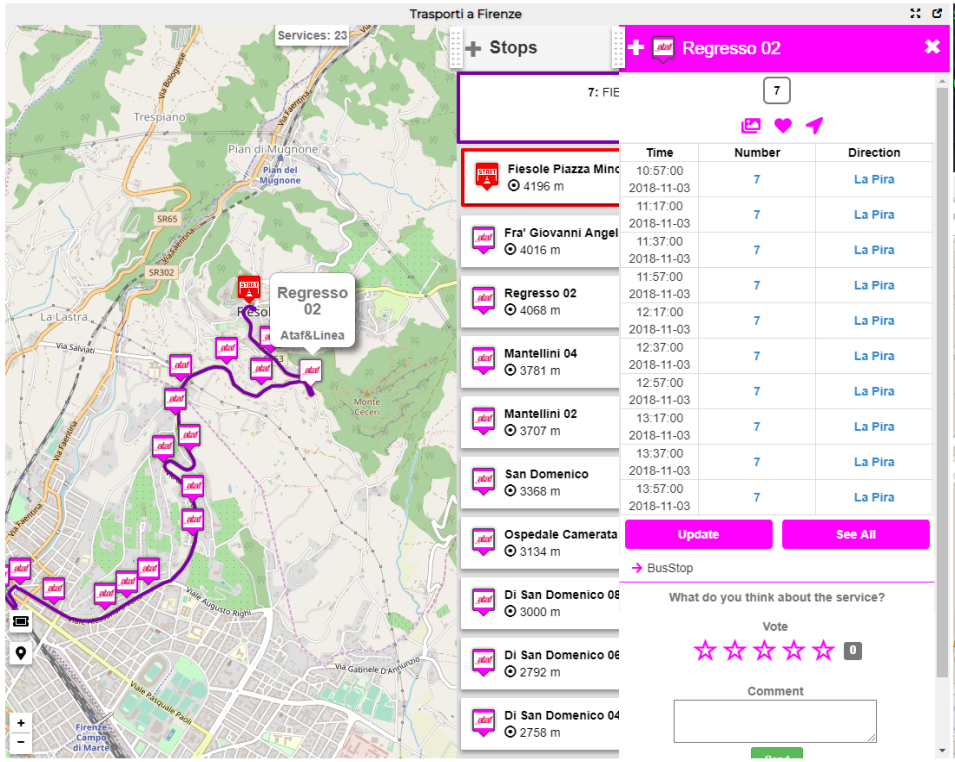
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc3NA==

Helsinki vs Florence comparison



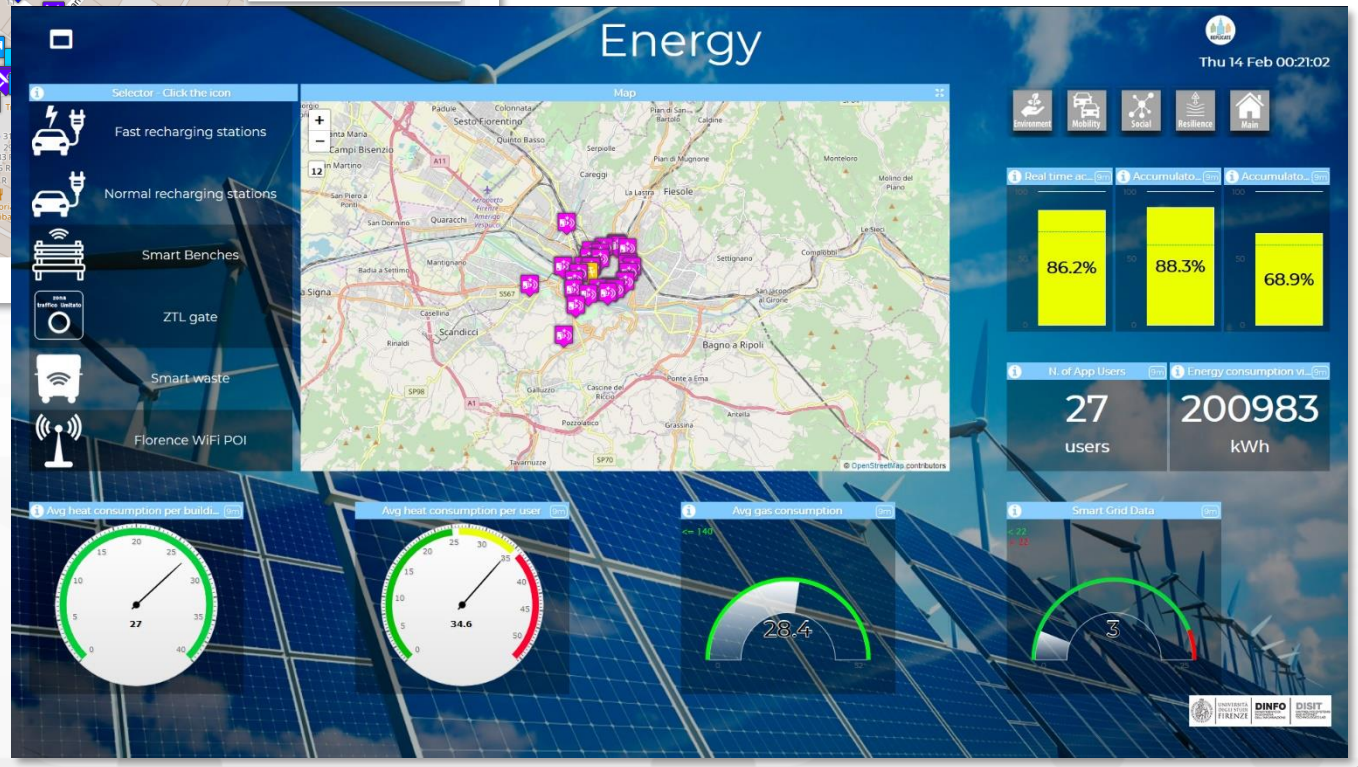
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc0MQ==

Infomobility Dashboard MicroApplications





https://main.snap4city.org/view/index.php?iddasboard=OTQw



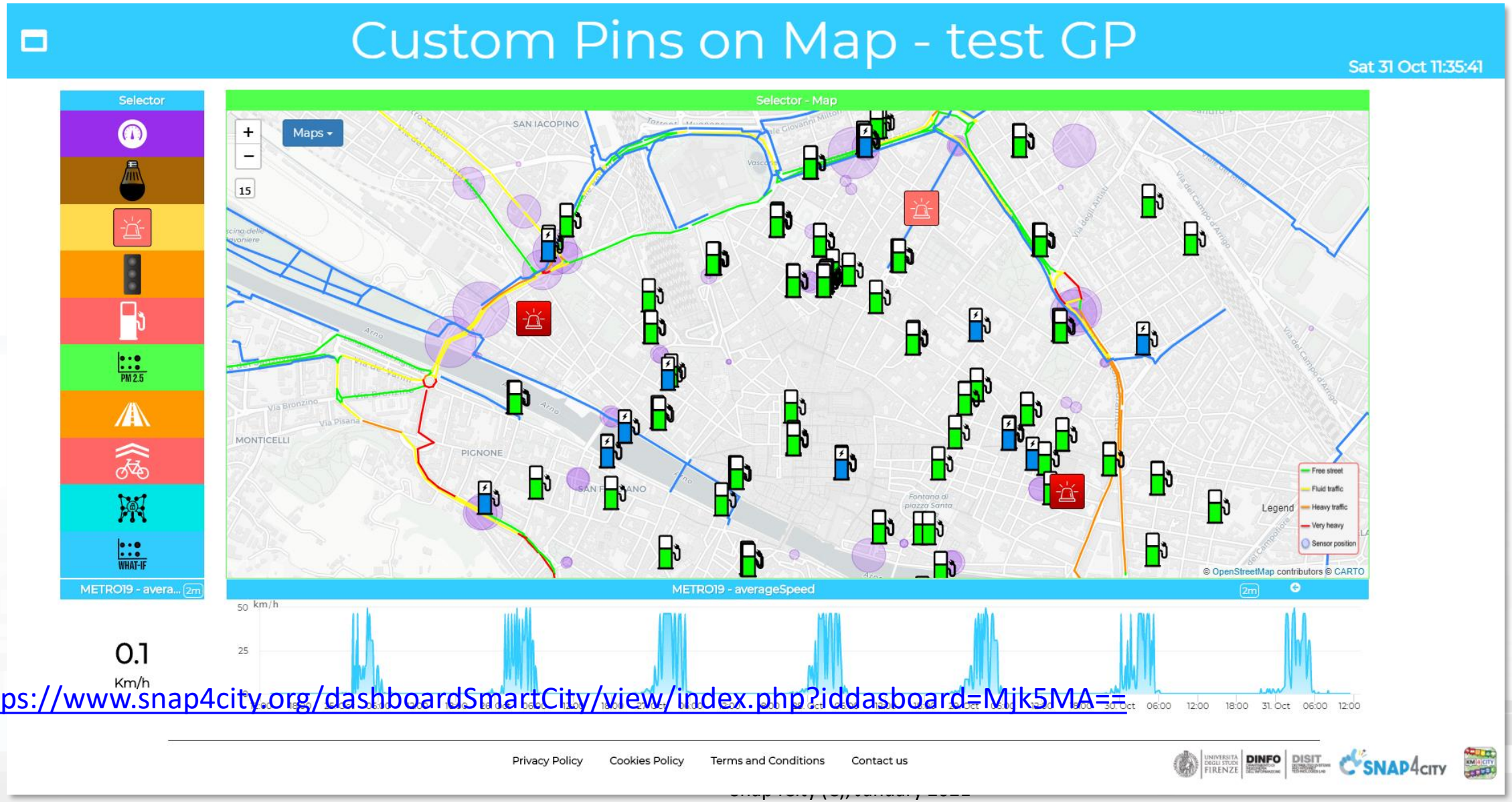
https://main.snap4city.org/view/index.php?iddasboard=MjE0

3D Map beta Testing



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjM2MA==

Custom Dynamic Pins



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjk5MA==

Real Time Sensors via ServiceMap3D

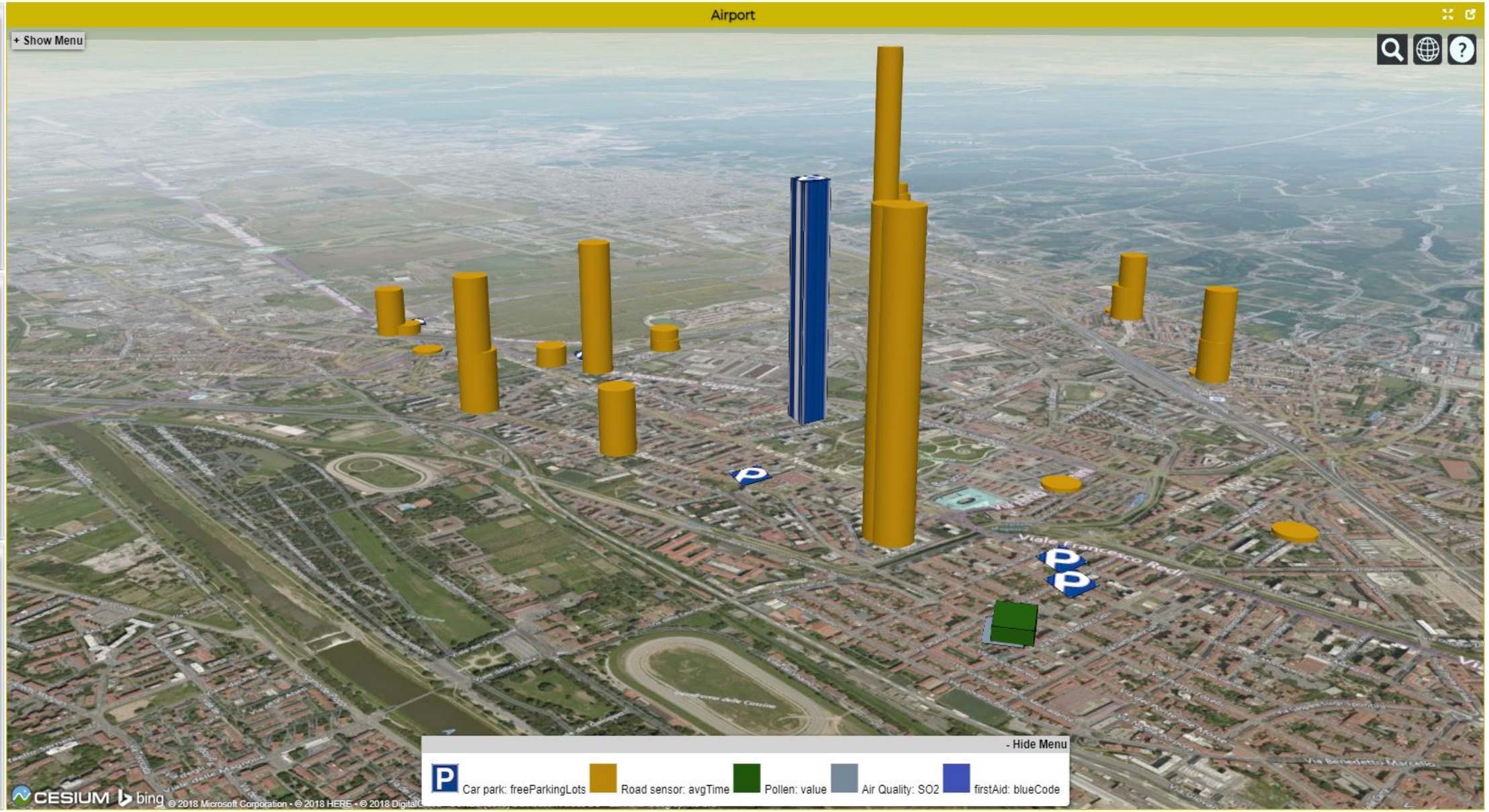
3D data rendering

Sat 1 Dec 16:57:33

Firenze

Airport

Empoli



https://main.snap4city.org/view/index.php?iddasboard=MTY2

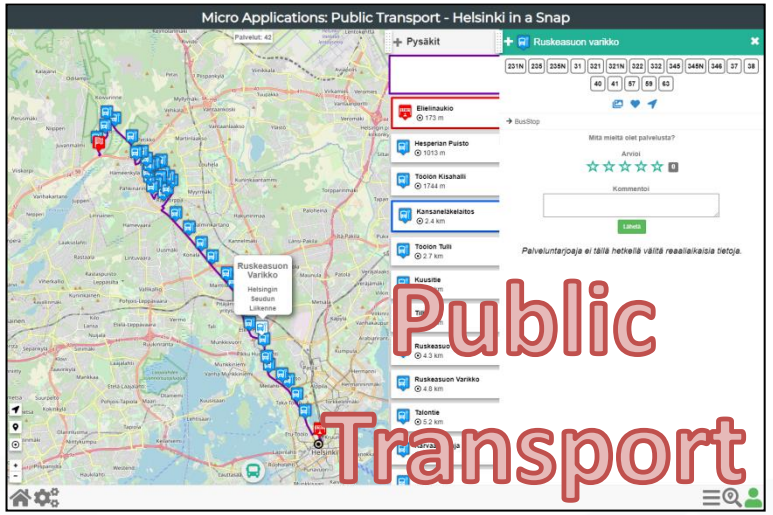
Smart Bench

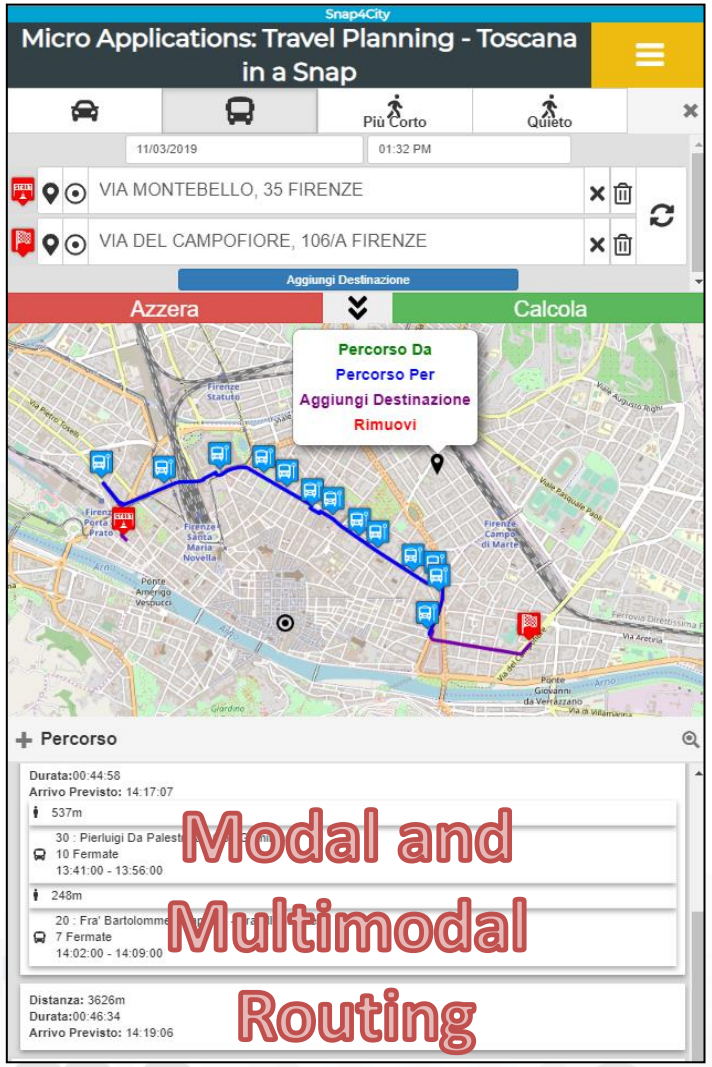
Sat 22 Jun 15:45:23

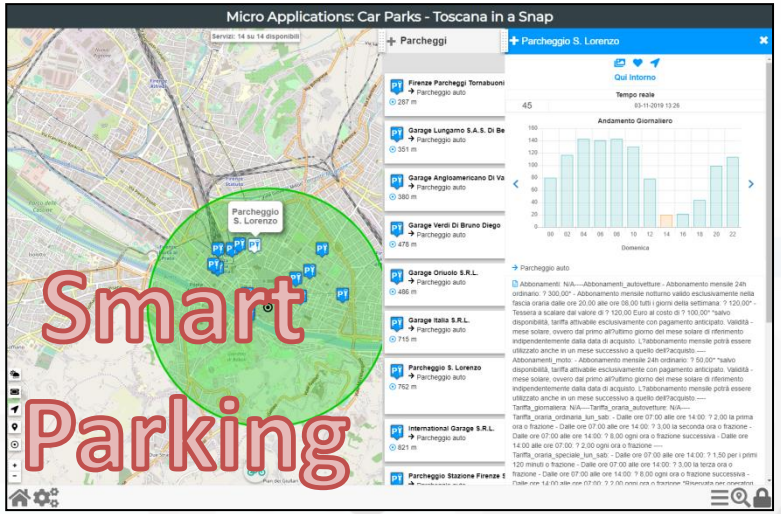


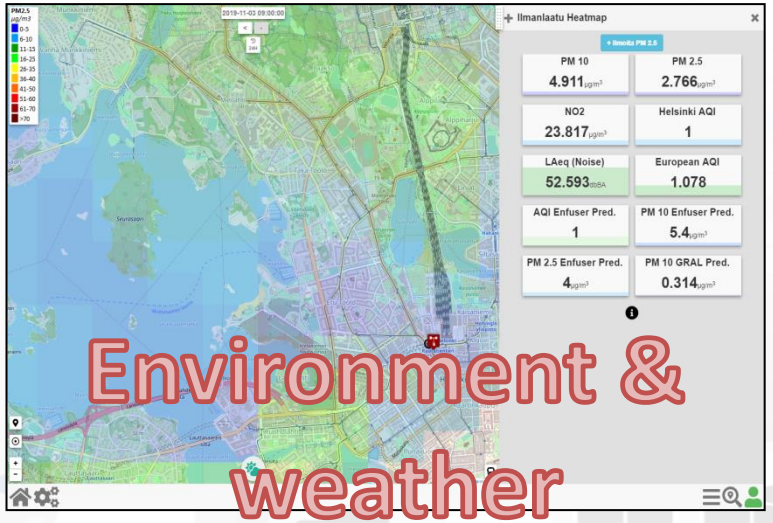
MIcroApplications





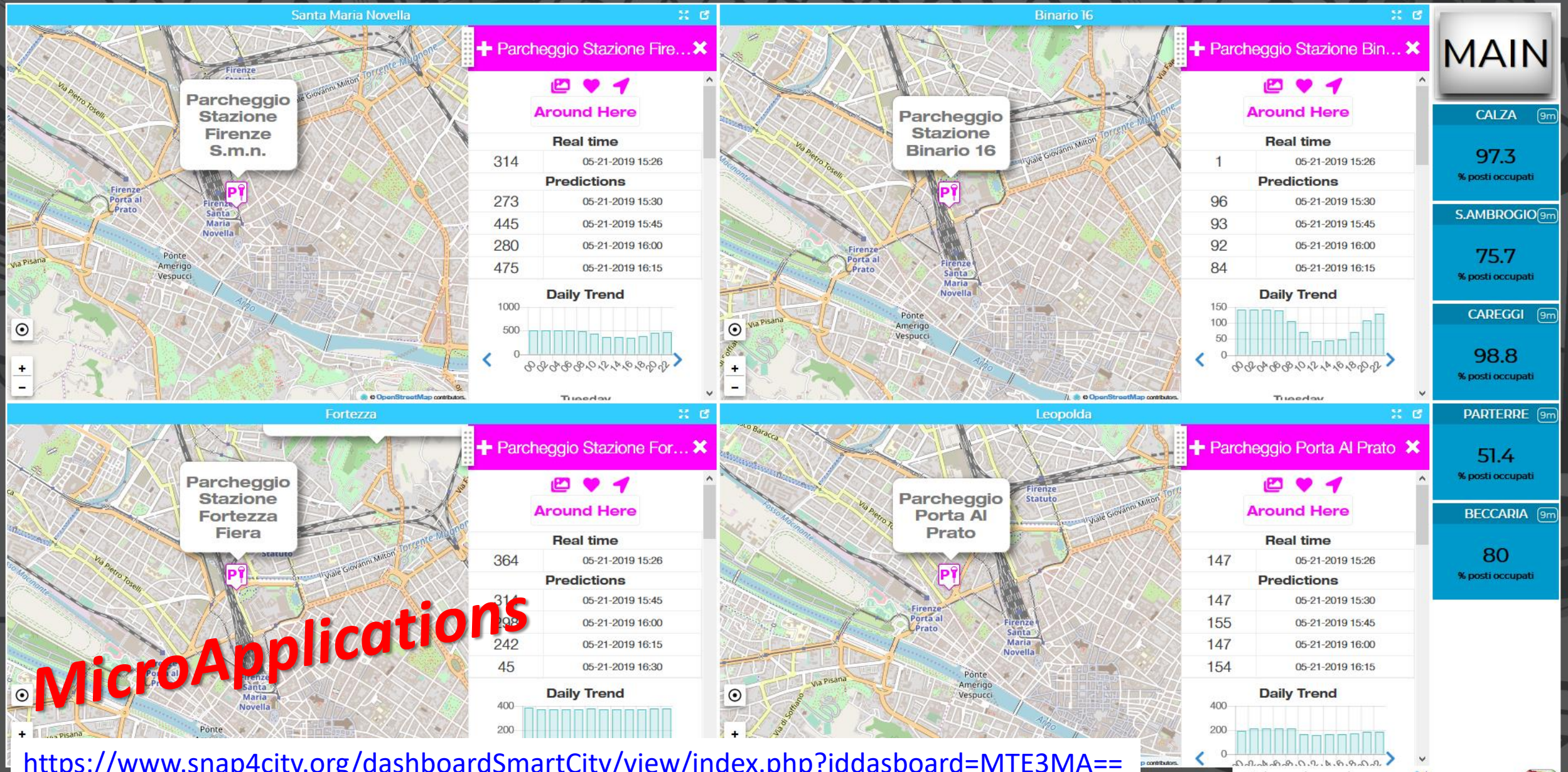






Parking Monitoring Firenze

Tue 21 May 15:23:09



MicroApplications

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

Operator Dashboards at different levels




MAPPA FIRENZE
Fri 19 Oct 17:24:39
Colonnine Ricarica
Colonnine ricarica Fast
Pannelli a Messaggio Variabile
Parcheggi
Piste Ciclabili
Sensori del Traffico
Stazioni ambientali
Stazioni meteo
Traffico Real Time
Varchi ZTL
Wi-Fi
Eventi Traffico a Firenze
Concentration - 7 days
Main



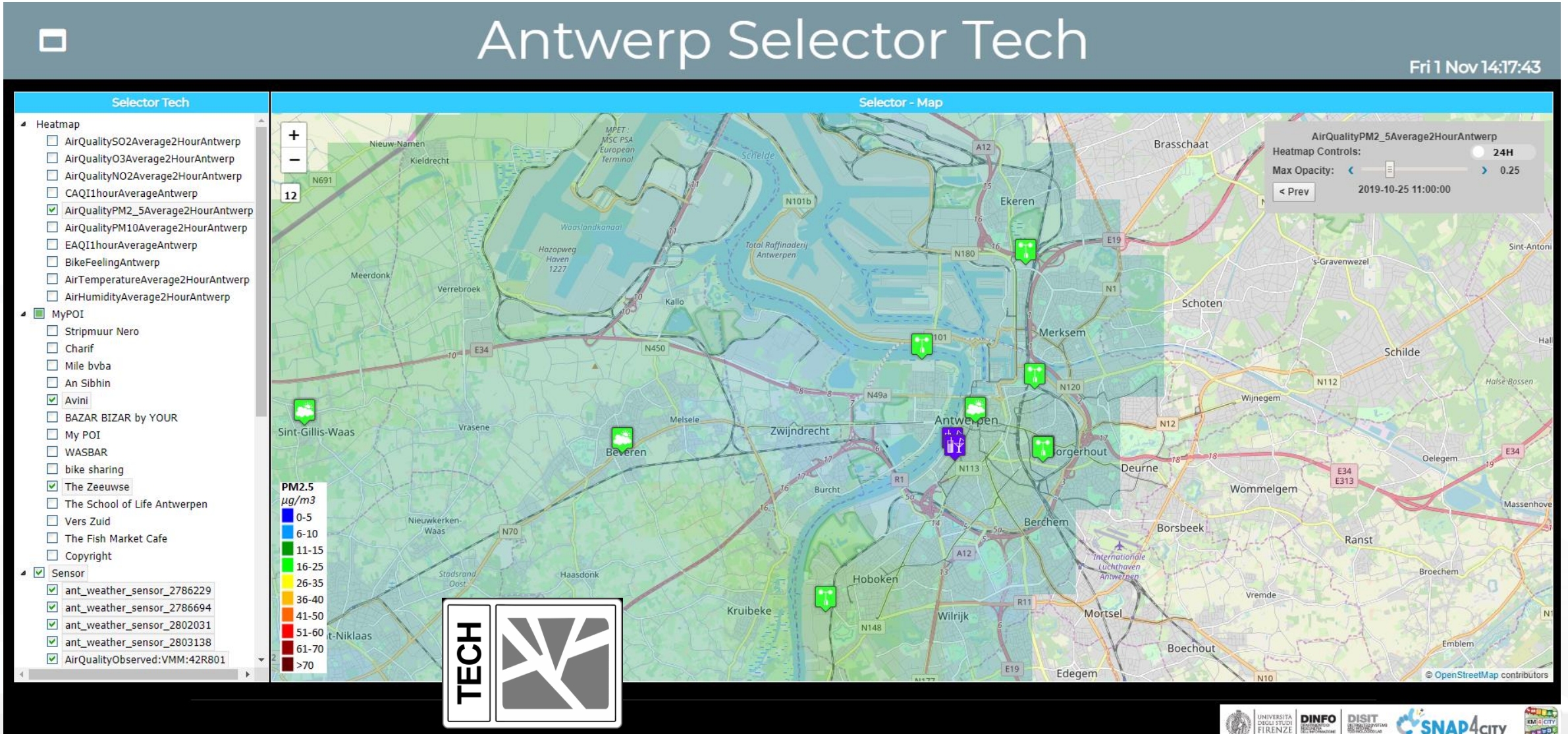


Chemical Plant Dashboard Green Impact Capacity (GIC)

Altair Control room



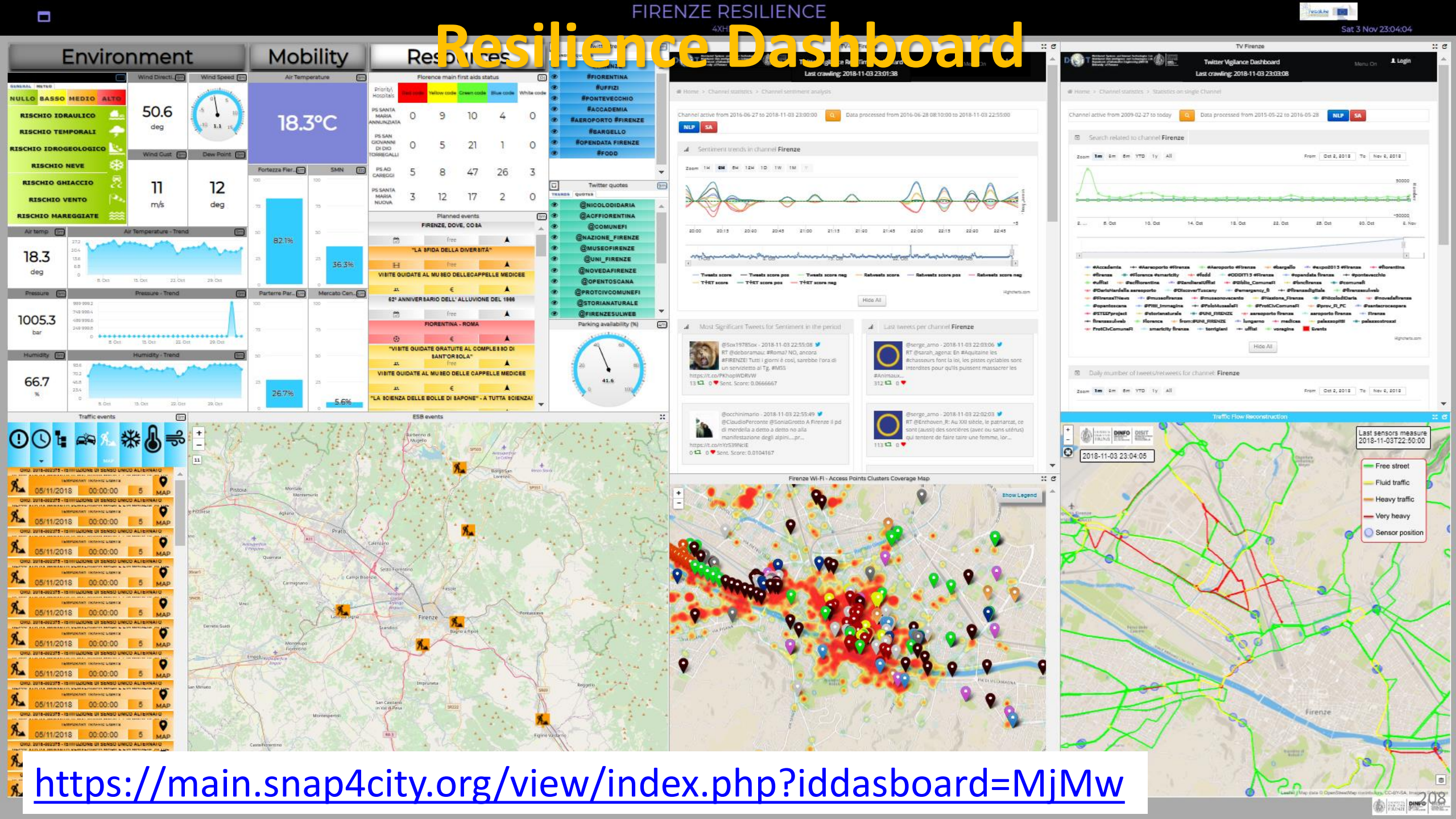
Technical Selector: TECH MultiDataMap



Multi-Widget Map



https://main.snap4city.org/view/index.php?iddasboard=OTc2


FIRENZE RESILIENCE
Sat 3 Nov 23:04:04
Resilience Dashboard
Environment
Mobility
Resources
RISCHIO IDRAULICO
RISCHIO TEMPORALI
RISCHIO IDROGEOLOGICO
RISCHIO NEVE
RISCHIO GHIACCIO
RISCHIO VENTO
RISCHIO MAREGGIATE
Wind Direction
50.6
deg
Wind Speed
Wind Gust
11
m/s
Dew Point
12
deg
Air Temperature
18.3°C
Air temp
18.3
deg
Air Temperature - Trend
Pressure
1005.3
bar
Pressure - Trend
Humidity
66.7
%
Humidity - Trend
Fortezza Fier...
82.1%
SMN
36.3%
Parterre Par...
26.7%
Mercato Cen...
5.6%
Florence main first aids status
Planned events
FIRENZE, DOVE, COSA
"LA SFIDA DELLA DIVERSITÀ"
VISITE GUIDATE AL MUSEO DELLECAPPELLE MEDICEE
62° ANNIVERSARIO DELL' ALLUVIONE DEL 1966
FIORENTINA - ROMA
"VISITE GUIDATE GRATUITE AL COMPLESSO DI SANTORSOLA"
VISITE GUIDATE AL MUSEO DELLE CAPPELLE MEDICEE
"LA SCIENZA DELLE BOLLE DI SAPONE" - A TUTTA SCIENZA!
Twitter quotes
@NICOLODIDARIA
@ACFFIORENTINA
@COMUNEFI
@NAZIONE_FIRENZE
@MUSEOFIRENZE
@UNI_FIRENZE
@NOVEDAFIRENZE
@OPENTOSCANA
@PROTCIVCOMUNEFI
@STORIANATURALE
@FIRENZESULWEB
Parking availability (%)
#FIORENTINA
#UFFIZI
#PONTEVECCHIO
#ACCADEMIA
#AEROPORTO #FIRENZE
#BARGELLO
#OPENDATA FIRENZE
#FOOD
Traffic events
ESB events
Firenze Wi-Fi - Access Points Clusters Coverage Map
Show Legend
Twitter Vigilance Dashboard
Traffic Flow Reconstruction
Last sensors measure
2018-11-03T22:50:00
2018-11-03 23:04:06
Free street
Fluid traffic
Heavy traffic
Very heavy
Sensor position
https://main.snap4city.org/view/index.php?iddasboard=MjMw

First aids overview - Tuscany

Service status of main first aids

Thu 25 May @ 11:00:34

Careggi hospital (Florence) - Details

9m

Priority\Status	Red code	Yellow code	Green code	Blue code	White code
Addressed	1	4	3	0	0
Waiting	0	2	9	2	0
In visit	1	9	18	3	0
In observation	4	19	2	0	0
Totals	6	34	32	5	0

Santa Chiara hospital (Pisa) - Details

9m

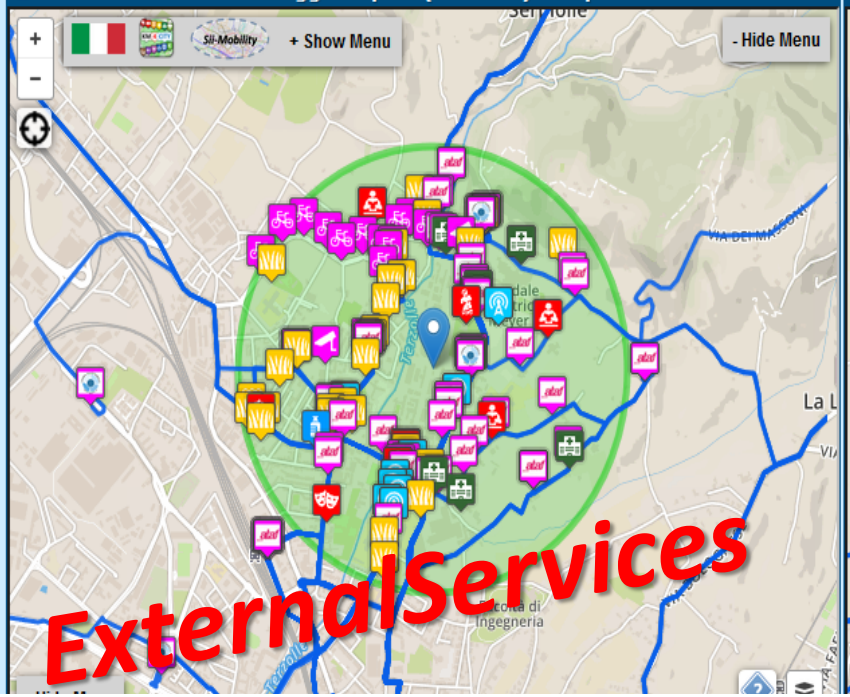
Priority\Status	Red code	Yellow code	Green code	Blue code	White code
Waiting	0	1	7	9	3
In visit	0	7	1	1	6
Totals	0	8	8	10	9

Other hospitals - Summary

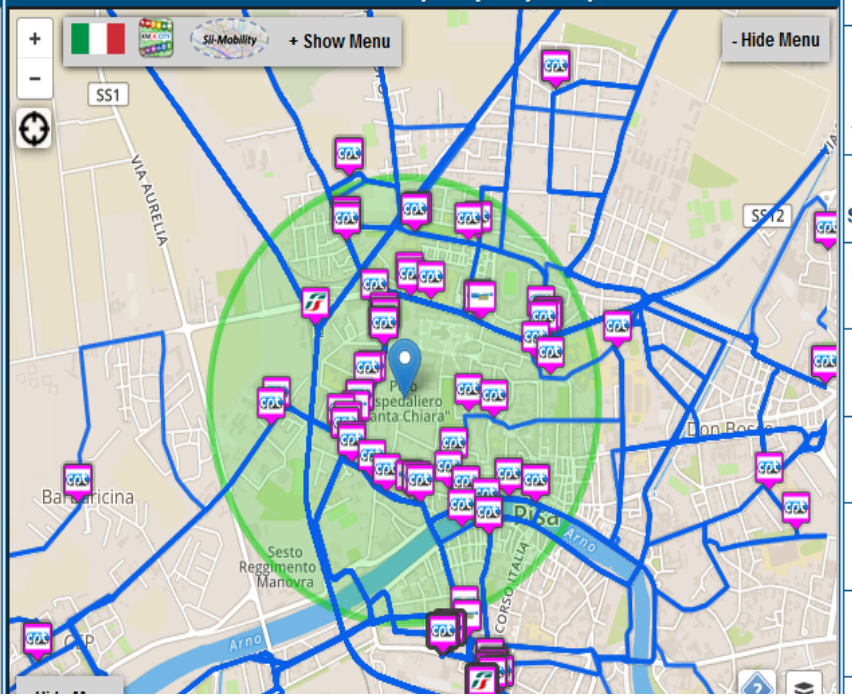
9m

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

Careggi hospital (Florence) - Map



Santa Chiara hospital (Pisa) - Map



ExternalServices

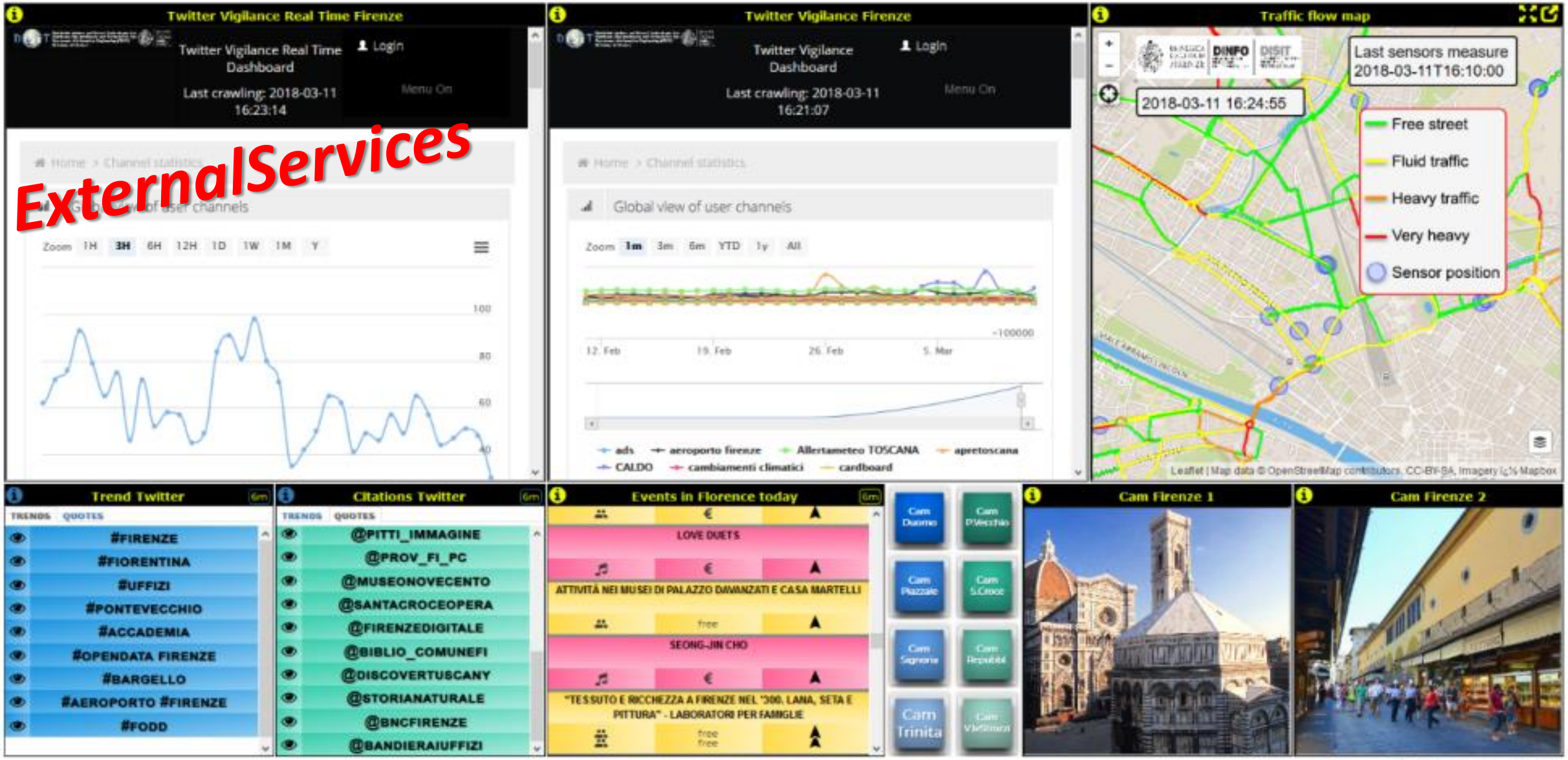


https://main.snap4city.org/view/index.php?iddasboard=MTIy

Firenze Social and Social Media new

Demo cams

Sun 11 Mar 16:24:55



https://dashboard.km4city.org/view/index.php?iddasboard=MjY3

Cross widget interaction 2

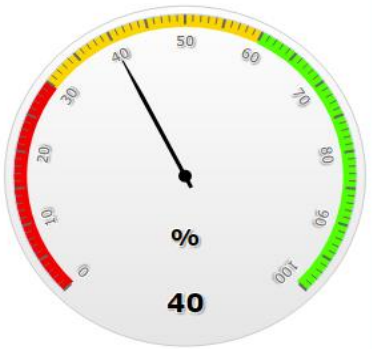
Experimental

Mon 15 Jan 15:16:37

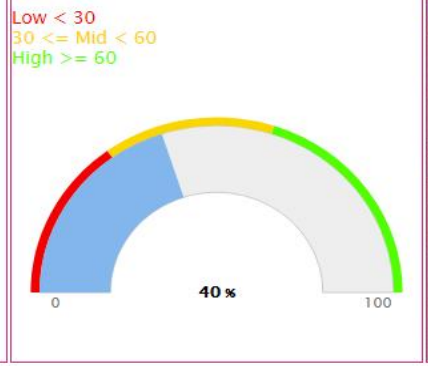
Any data
Real time updated
Flexible design
Easy to produce
Highly interactive

PARKING Station | PARKING Parterre | PARKING M. Centrale | PARKING Fortezza | Duomo | Michelangelo | P. Signoria | Pollution | Rivers | Polls

Park free - Speedometer (2m)



Park free - Gauge (2m)



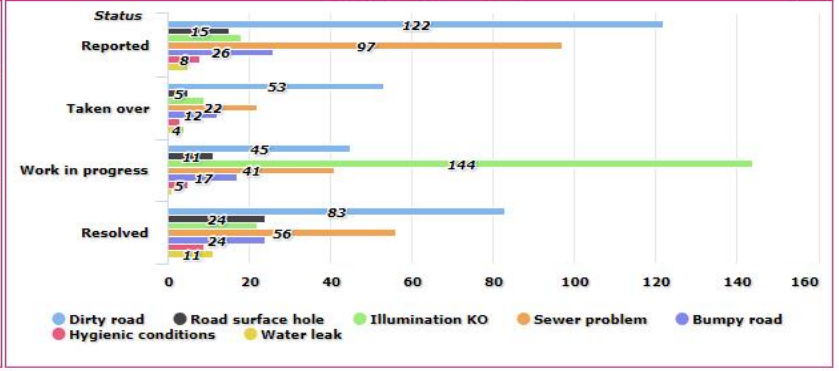
City webcams



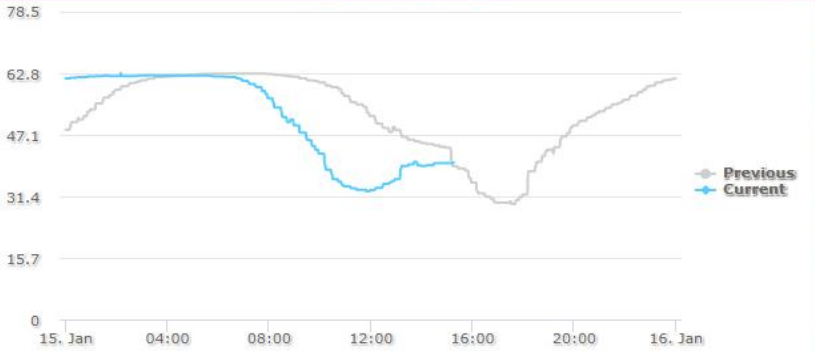
Traffic events (5m)



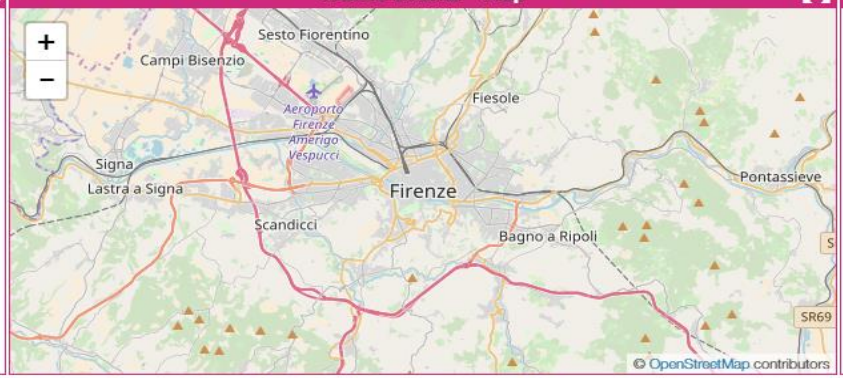
Urban faults - Bars (8m)



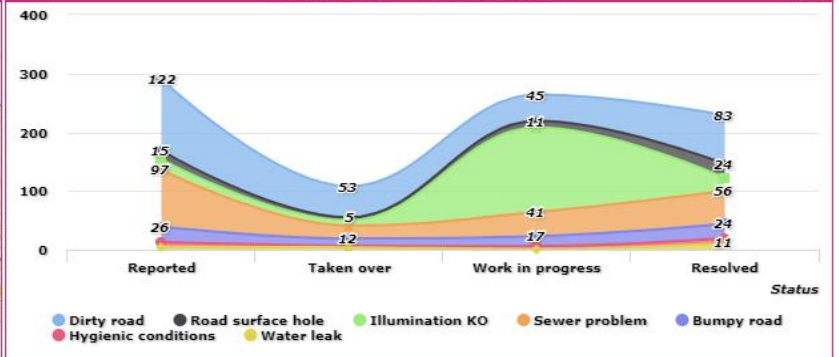
Park free - 24 hours (3m)



Traffic events - Map



Urban faults - Stacked areas (8m)



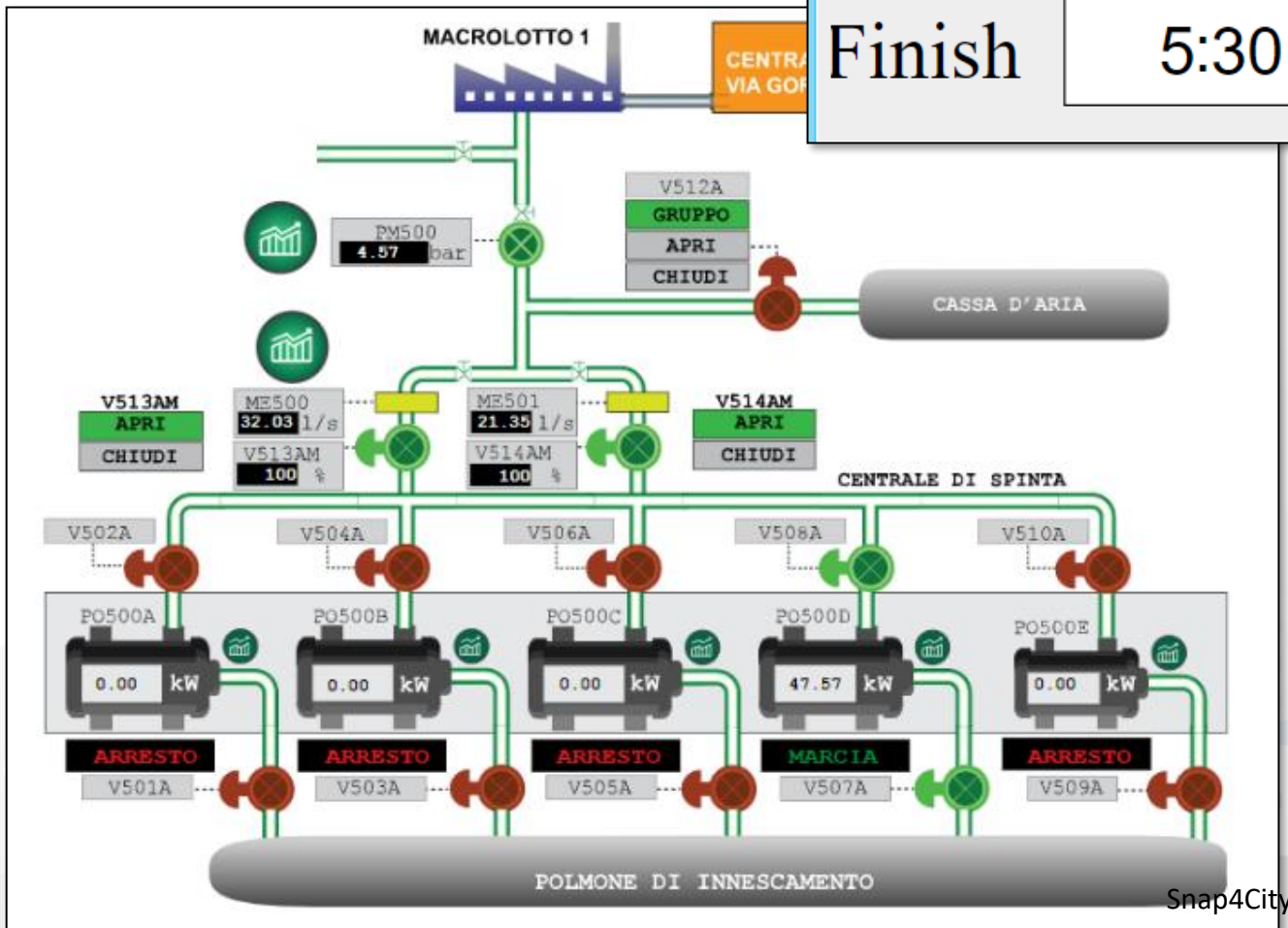
https://main.snap4city.org/view/index.php?iddasboard=MTU1

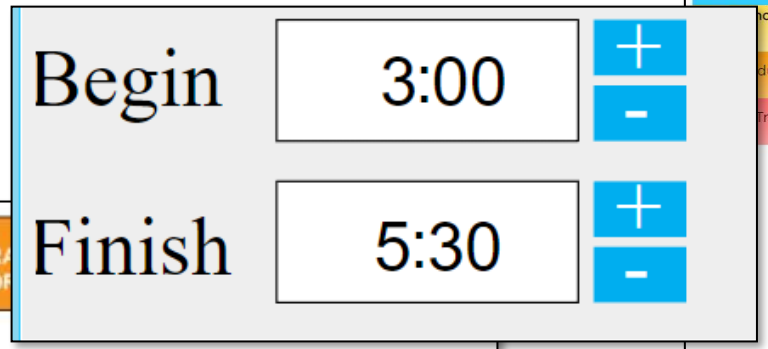
Custom Widgets

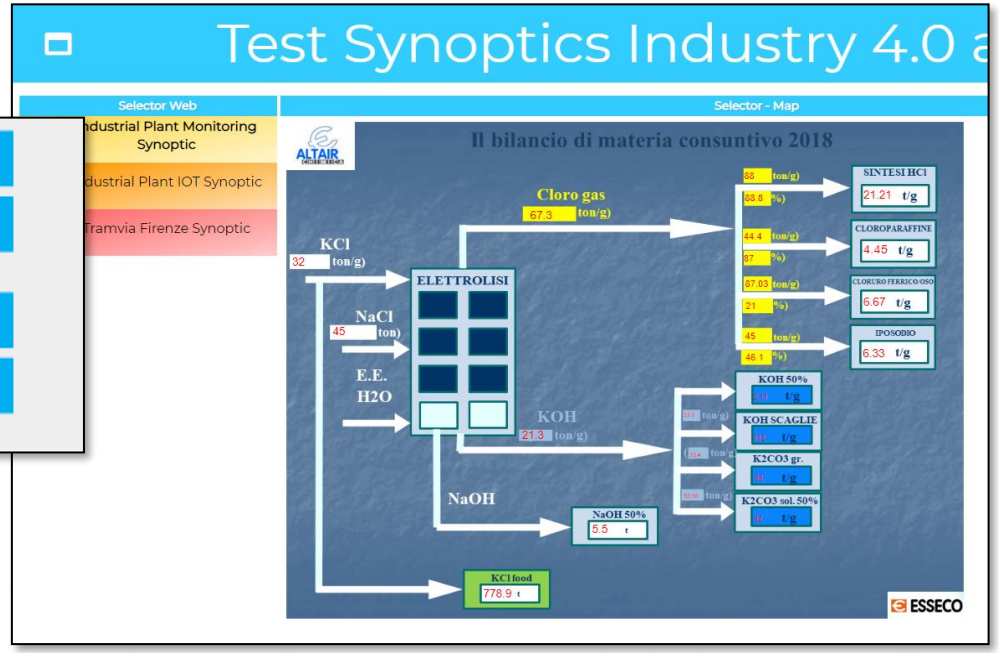
Custom Dashboards and Widgets (interactive, Animations, etc.)

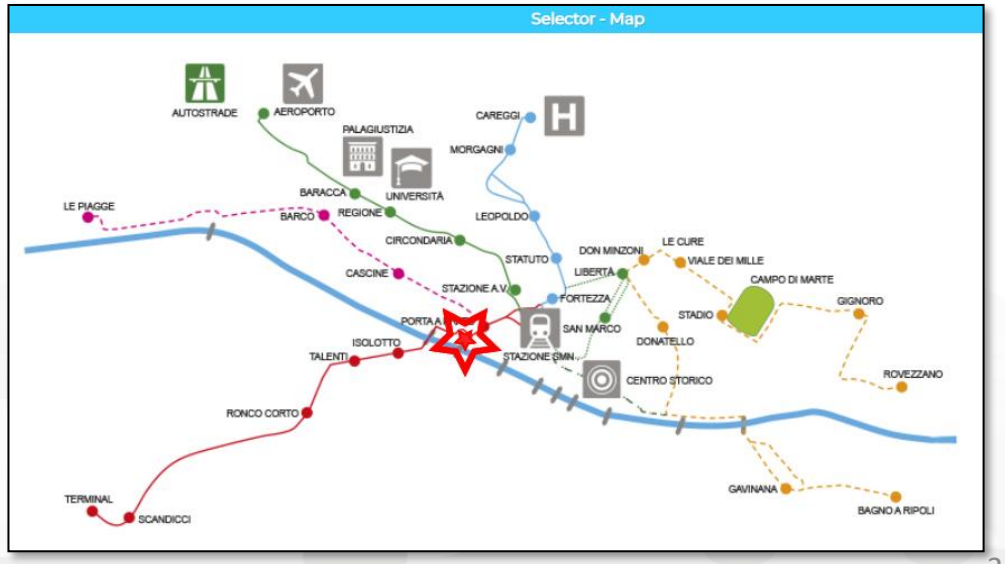
-- SVG for graphic design

-- MyKPI for collecting data



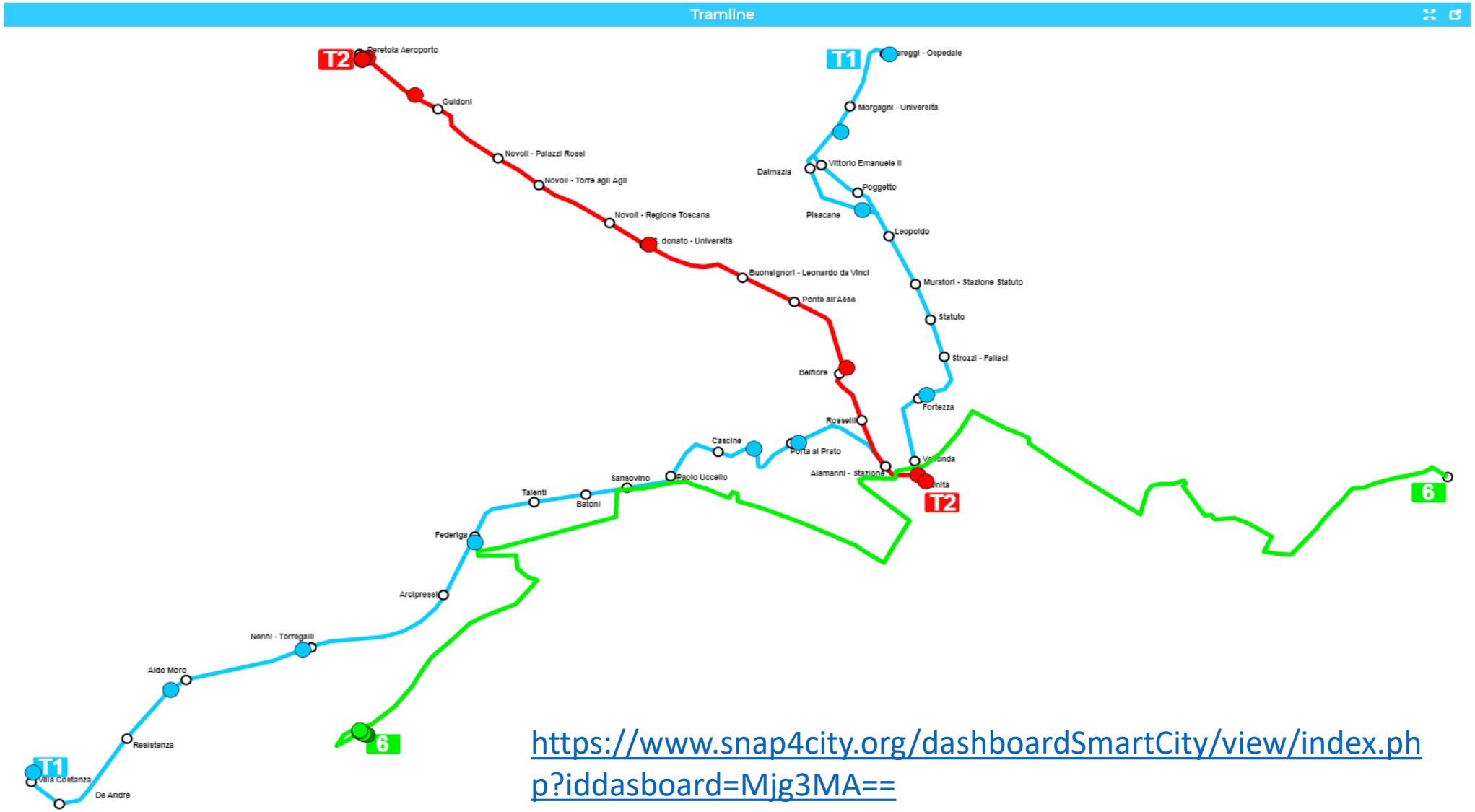






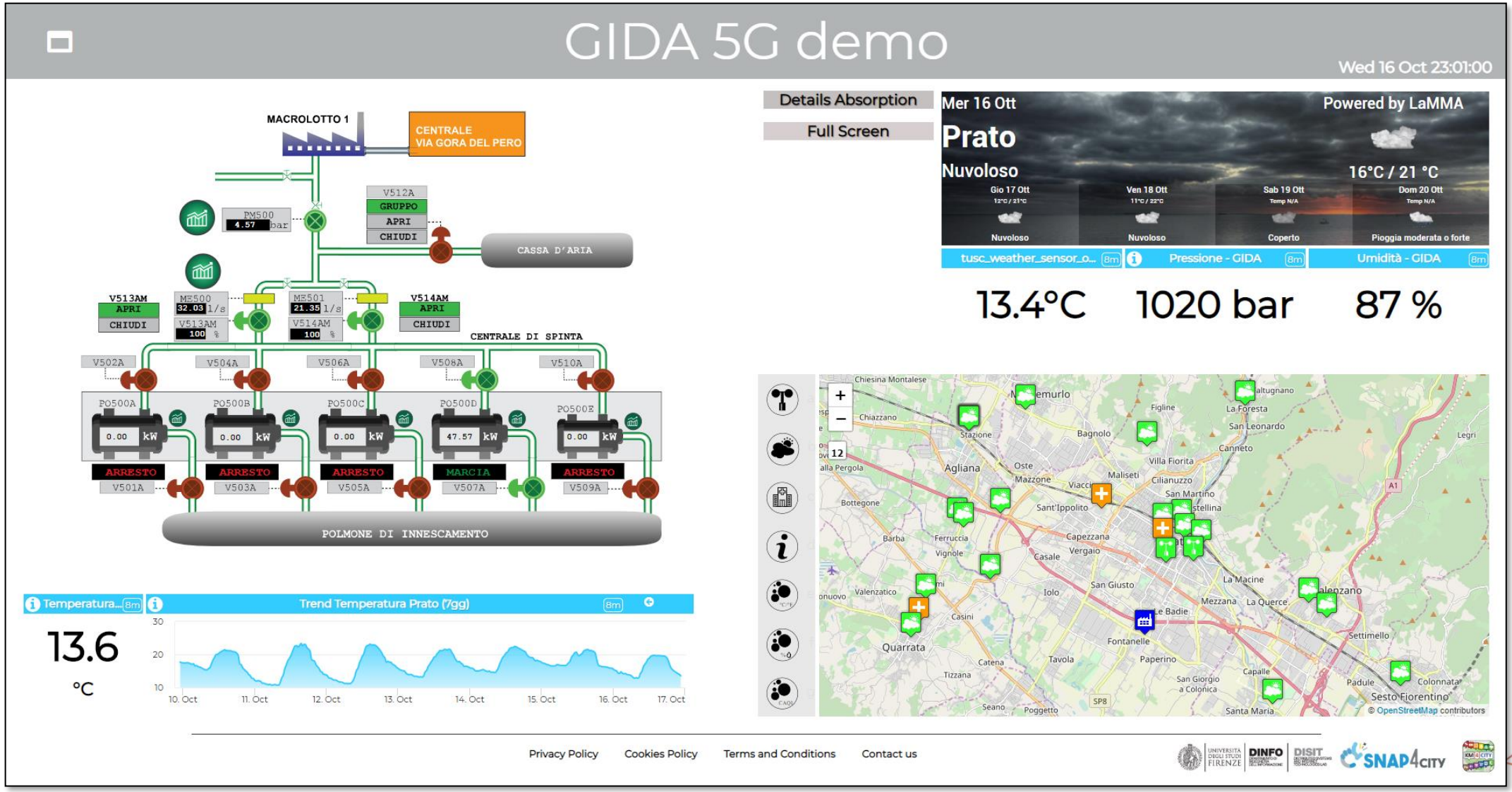
Firenze SVG Tramline Multi rides

Fri 17 Jul 18:29:50



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjg3MA==

Demo UC5 GIDA



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjIyNg==

Smart Lonato del Garda

Sat 9 Nov 17:20:59

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

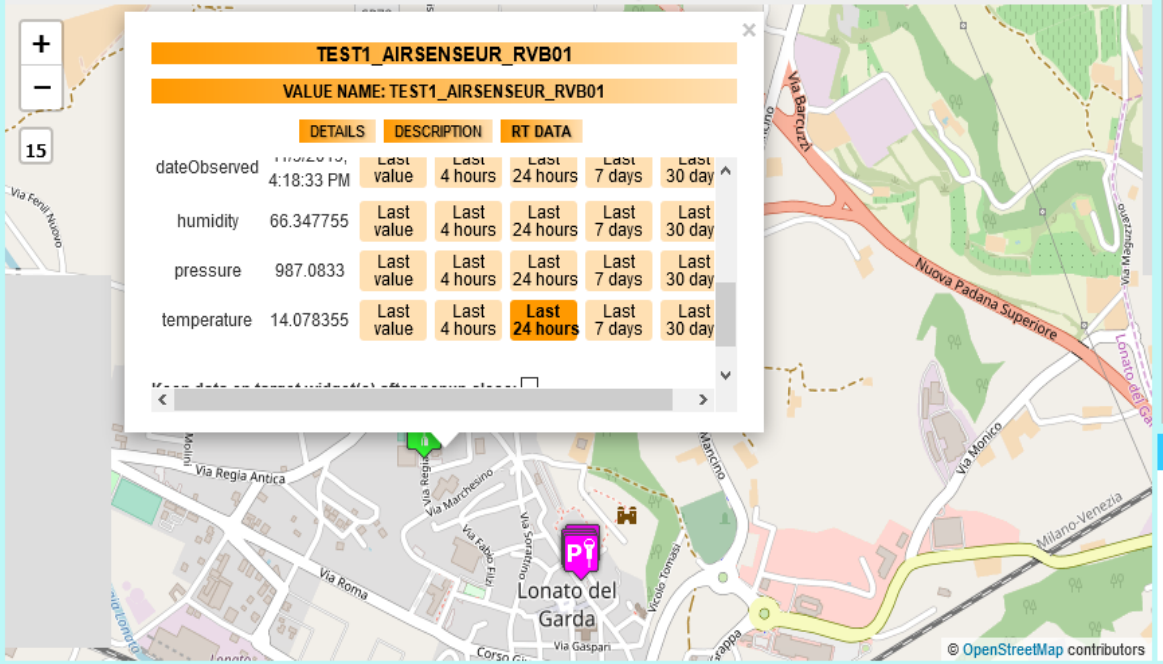
Selector - Map

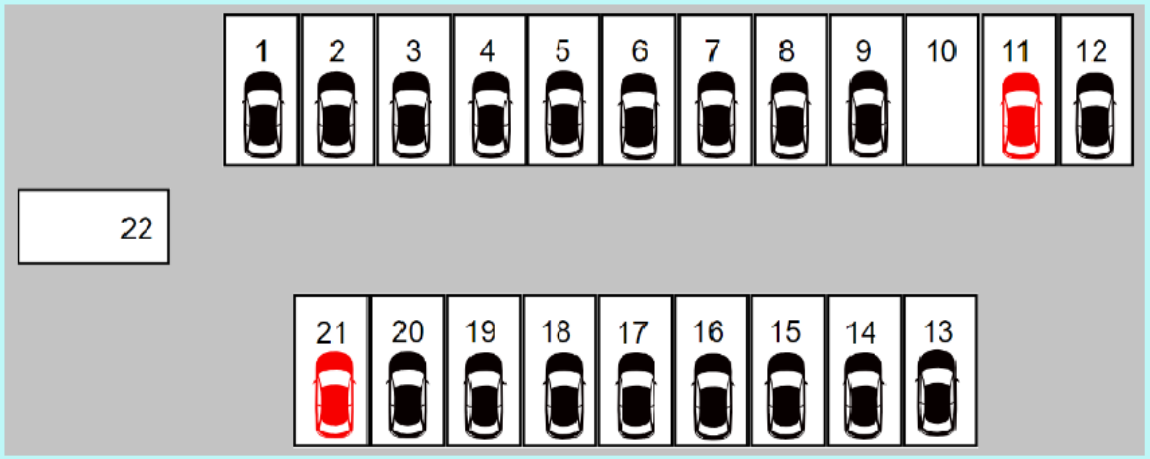
TEST1_AIRSENSEUR_RVB01

VALUE NAME: TEST1_AIRSENSEUR_RVB01

DETAILS | DESCRIPTION | RT DATA

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



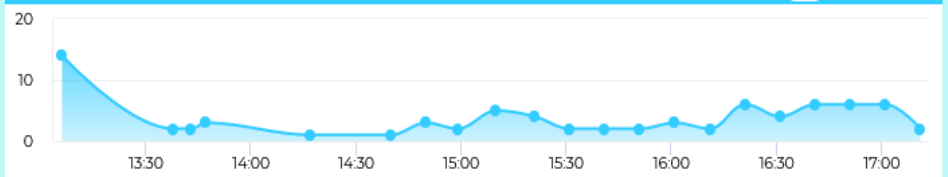


NumFreeSlo... 9m

2

free slots

NumFreeSlots - Slots 9m

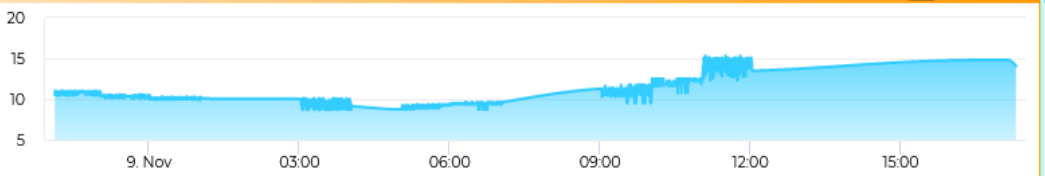


SmartParkingLonato_1 ... 9m

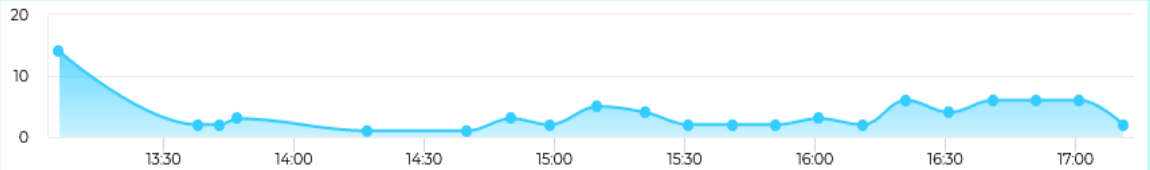
0

status

temperature - Day 9m



NumFreeSlots - Slots 9m



pressure 9m

987.1

mm

humidity % 9m

66.3

%

temperature 9m

14.1

C

Slot ID 9m

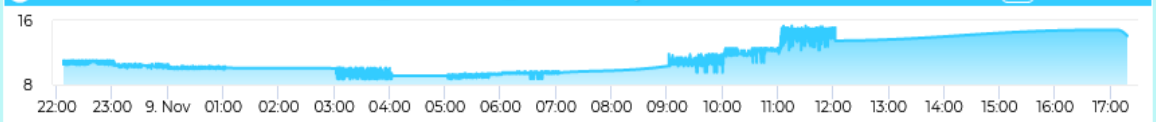
14

slot ID

Max Present Duration 9m

19 ore e 11 minuti

TEST1_AirSensEUR_RVB01 - temperature 9m

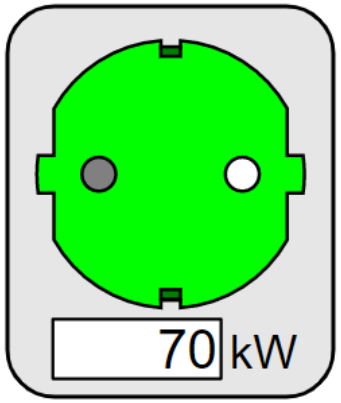


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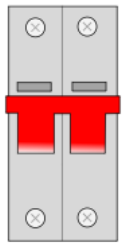
SVG Custom Widgets Examples 2

Tue 17 Nov 18:46:47

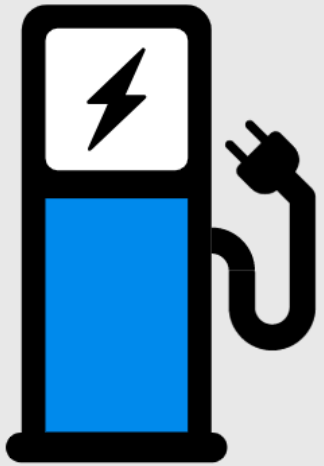
SVG shucko plug



Schuko switch



Charging Station Status



Legenda

Charging Station Status

Set on the keypad one of the following values

0 = ERROR (RED)

1 = AVAIBLE (GREEN)

2 = BOOKED (YELLOW)

3 = CHARGING

9999 = white icon

Charging Station status

New | Last confirmed: None

7	8	9
4	5	6
1	2	3
0	.	Canc
Confirm		

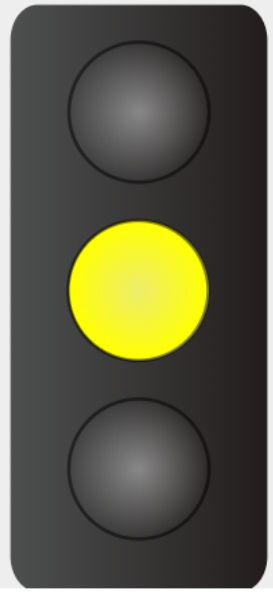
Underpass



Set tunnel st...



Traffic Light



Traffic Light status set

YELLOW LIGHT

Speed Limit Set

New | Last confirmed: None

7	8	9
4	5	6
1	2	3
0	.	Canc
Confirm		

Dynamic Speed Limit Sign



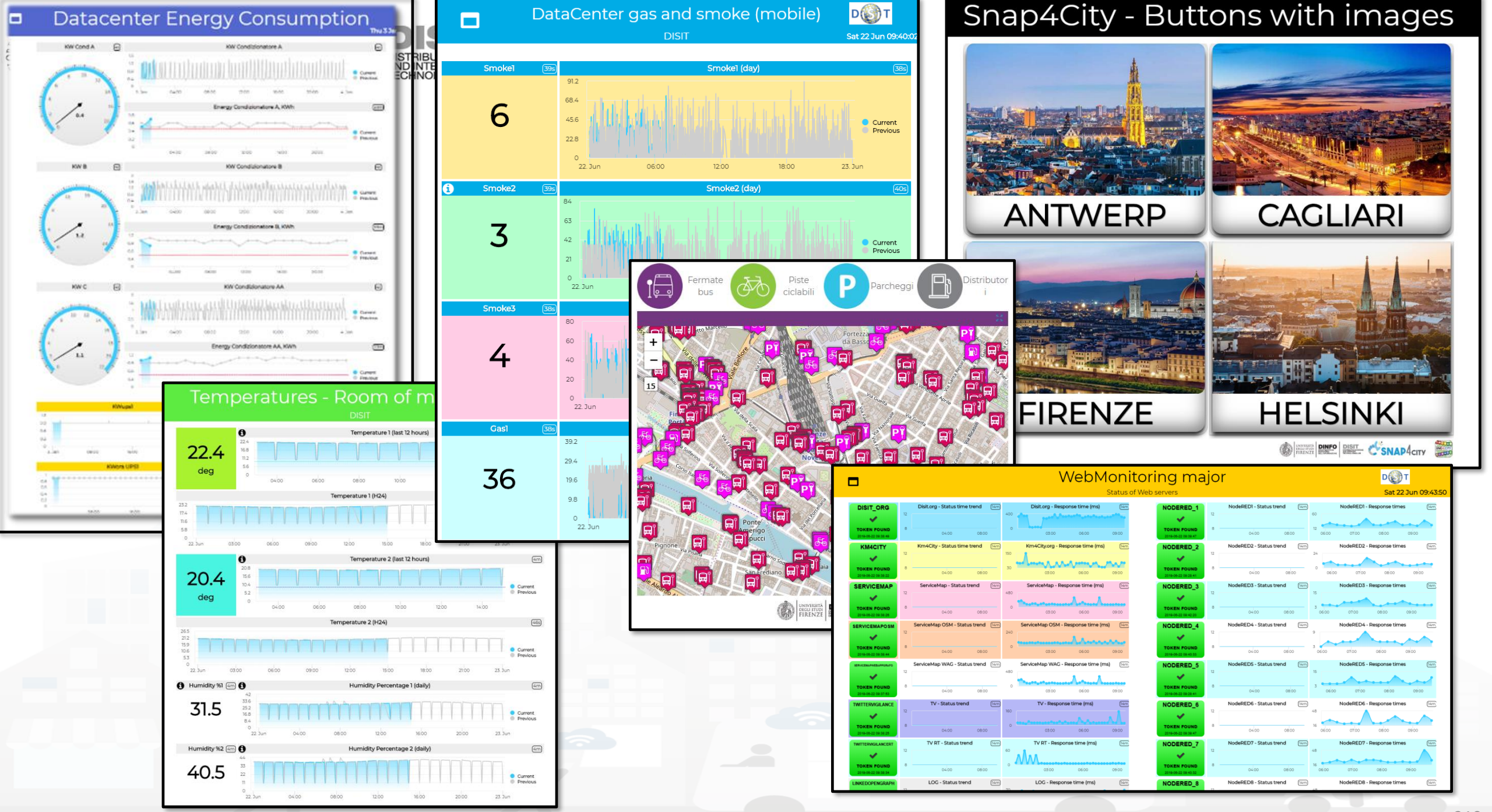
Speed Limit Explaination

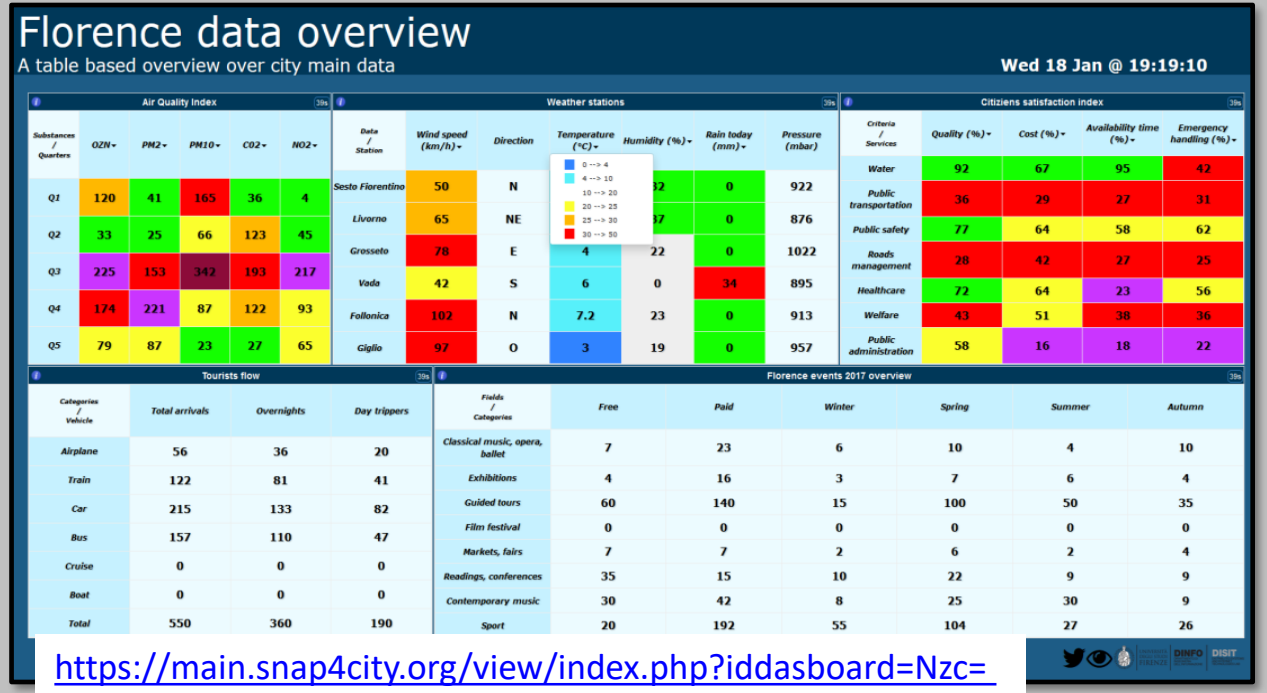
Speed Limit Custom Widget example

Write the speed limit by using the keypad and click CONFIRM.

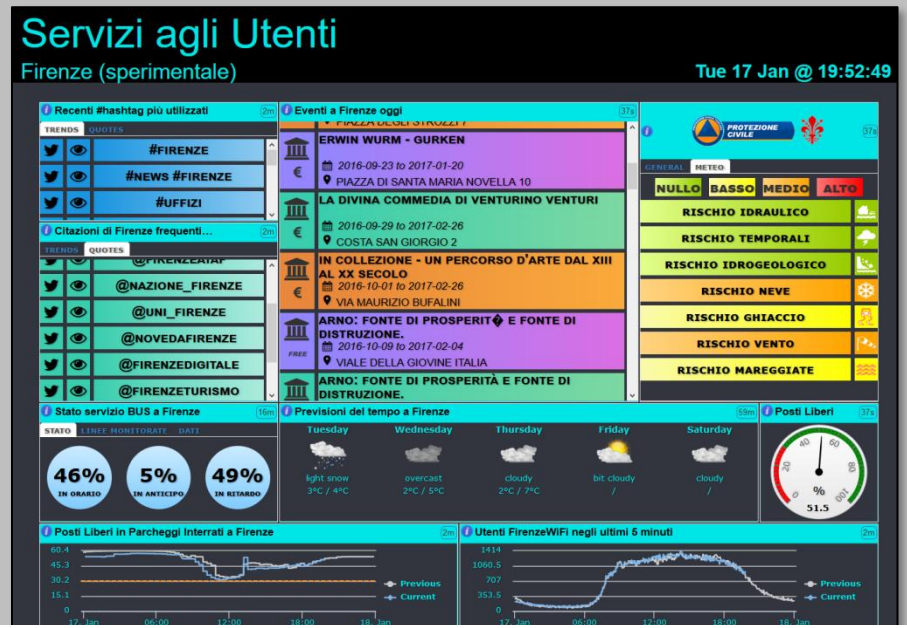
9999 = white sign.

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjk4Ng==

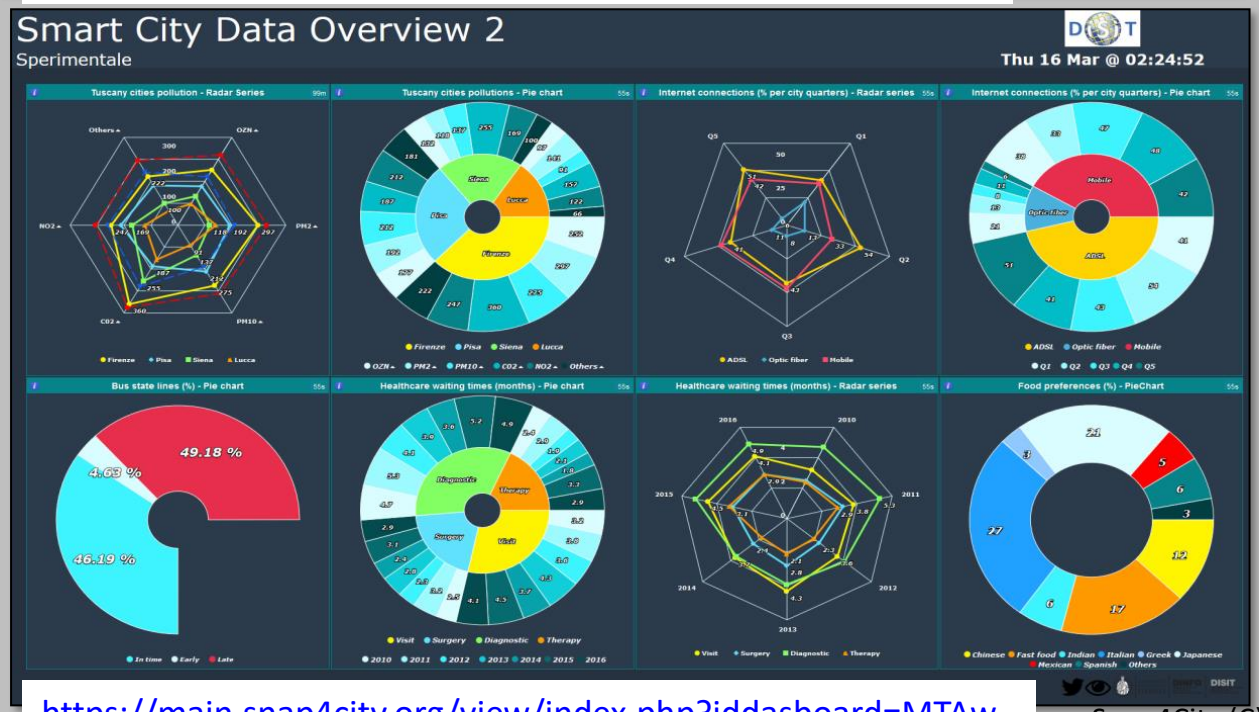

Datacenter Energy Consumption
DataCenter gas and smoke (mobile)
DISIT
Smoke1
6
Smoke1 (day)
Smoke2
3
Smoke2 (day)
Smoke3
4
Gas1
36
Snap4City - Buttons with images
ANTWERP
CAGLIARI
FIRENZE
HELSINKI
Fermate bus
Piste ciclabili
Parcheggi
Distributori
Temperatures - Room of m
DISIT
22.4 deg
Temperature 1 (last 12 hours)
Temperature 1 (H24)
20.4 deg
Temperature 2 (last 12 hours)
Temperature 2 (H24)
Humidity %1
31.5
Humidity Percentage 1 (daily)
Humidity %2
40.5
Humidity Percentage 2 (daily)
WebMonitoring major
Status of Web servers



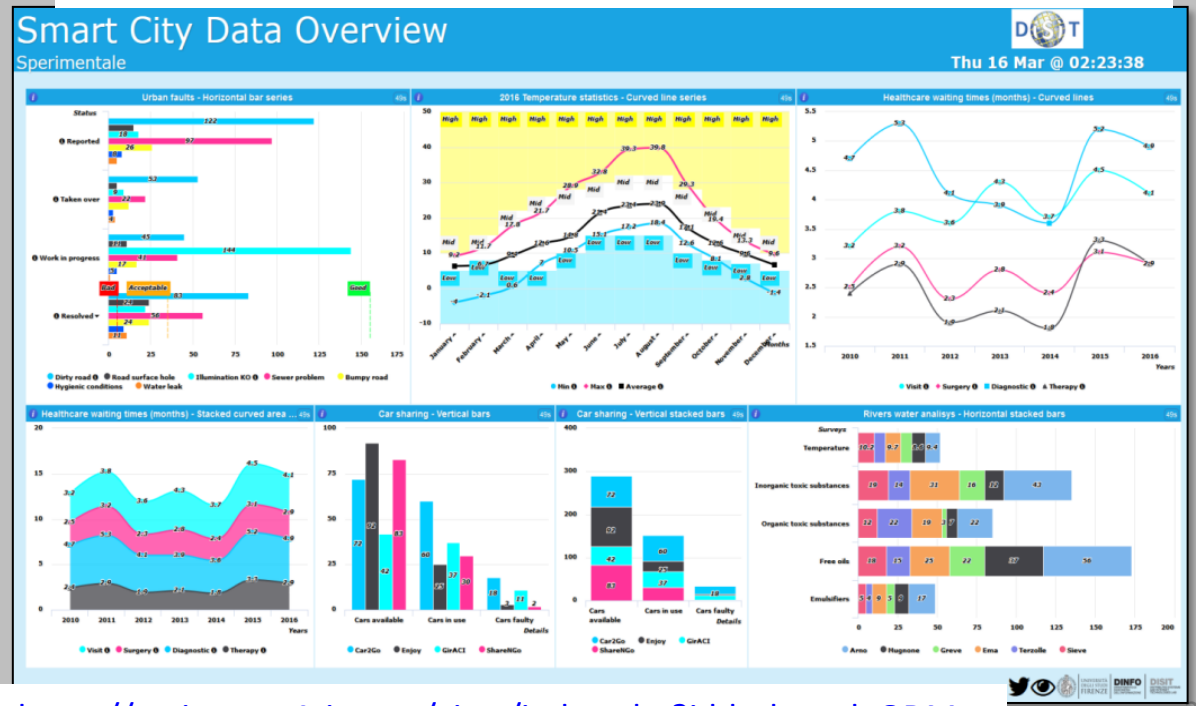
https://main.snap4city.org/view/index.php?iddasboard=Nzc=



https://main.snap4city.org/view/index.php?iddasboard=NjQ=



https://main.snap4city.org/view/index.php?iddasboard=MTAw

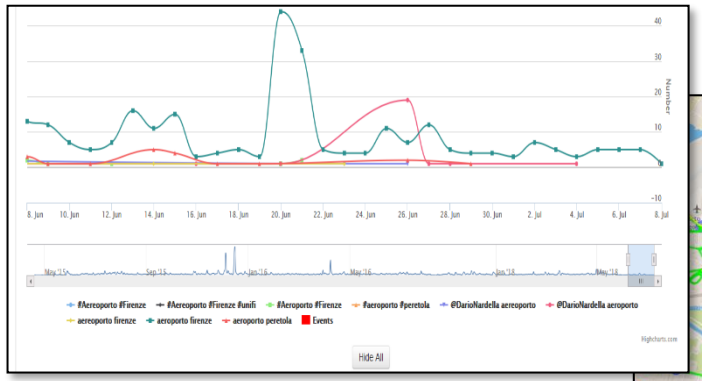


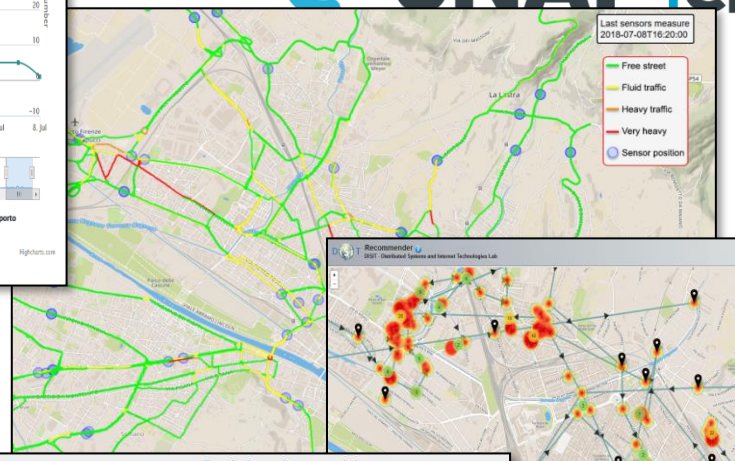
https://main.snap4city.org/view/index.php?iddasboard=ODM=

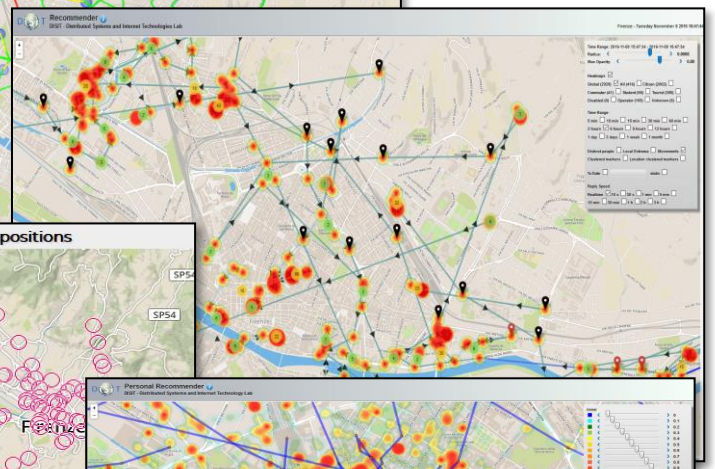
External Services

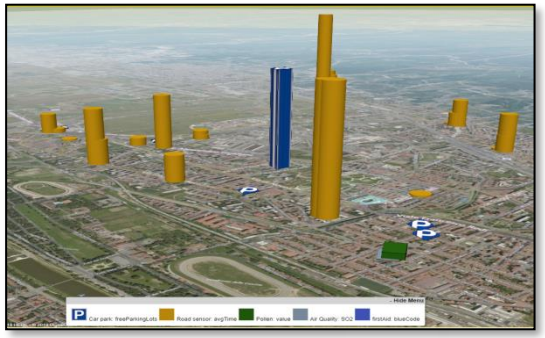
Nature

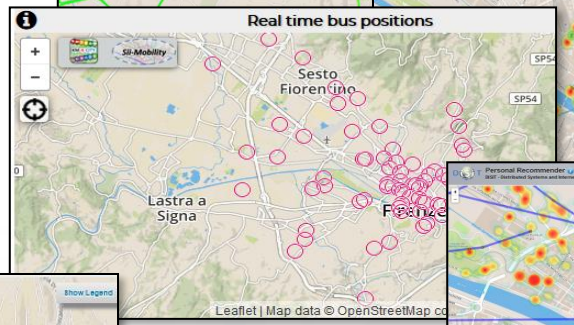
- Twitter Vigilance:
  - Daily and real time
  - Volume and sentiment analysis
- Services on Maps, GIS, ArcGIS
- Real time sensors on 3D
- Web HTML5 Applications
- Origin Destination Matrix
- Real Time fleets
- Routing, Multimodal tools
- IPCAM connector
- Synoptics
- **Third party tools!**
- **…..**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

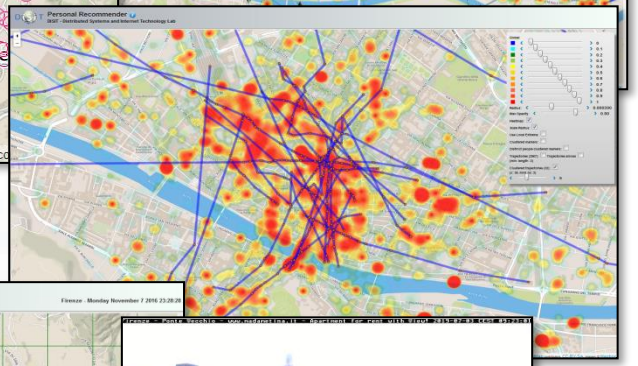


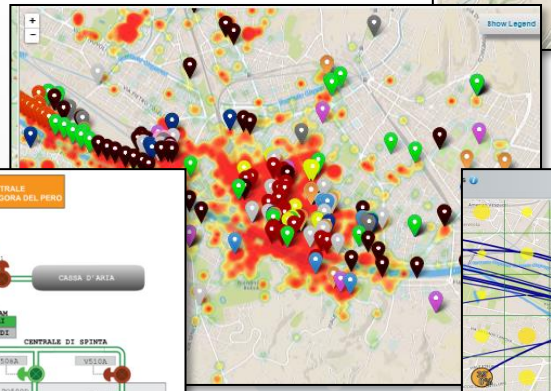


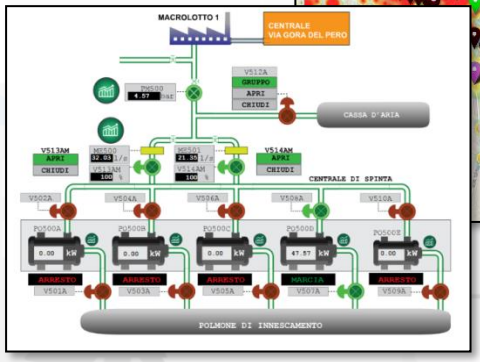


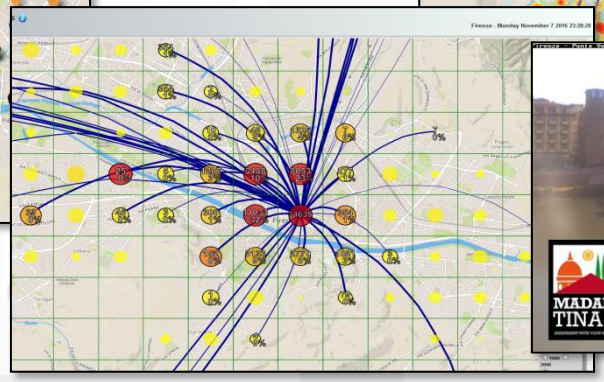










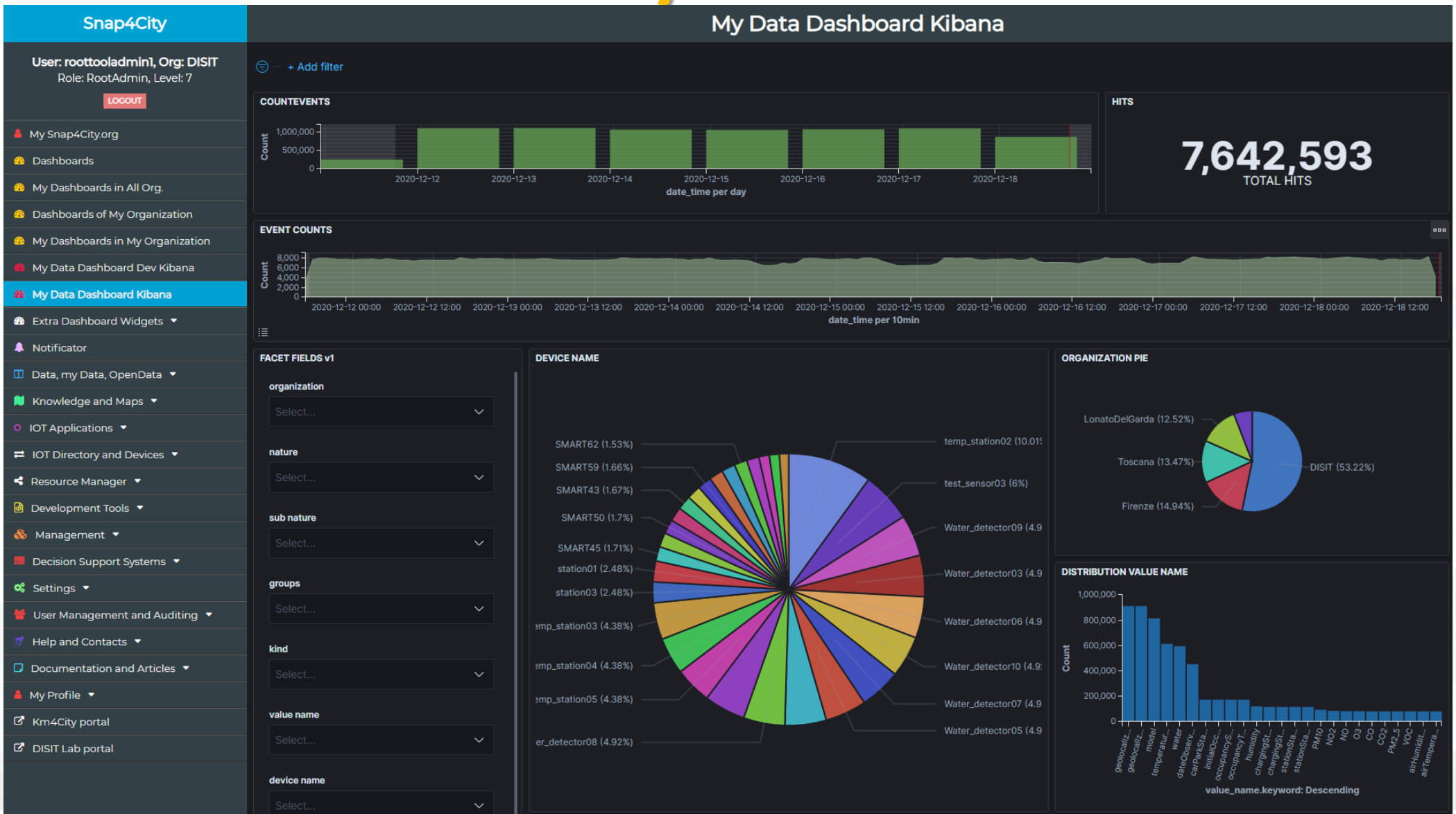


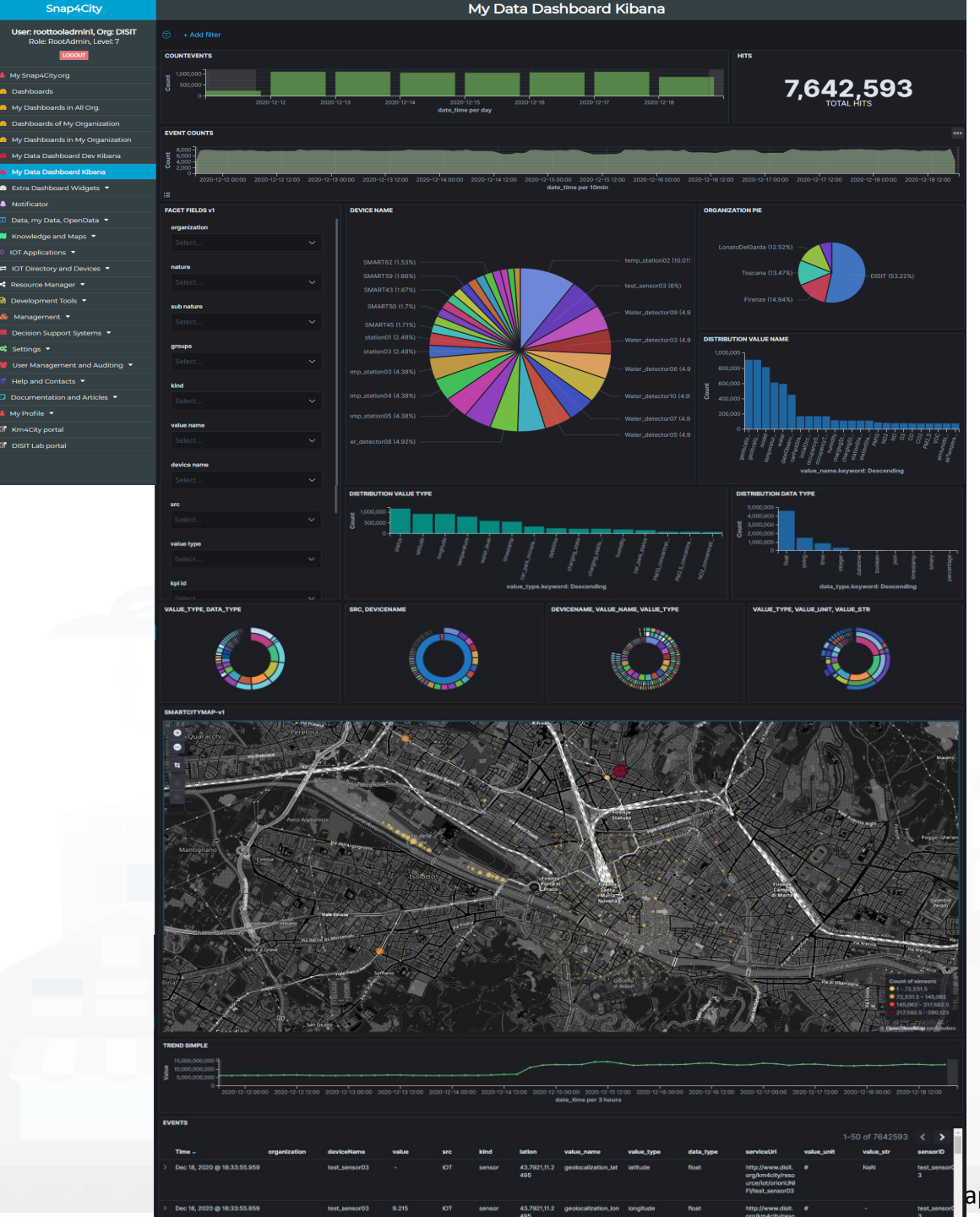


ICT Officers: Digital Twin, Tools and Dashboards



DevDash: My Data Dashboard Kibana



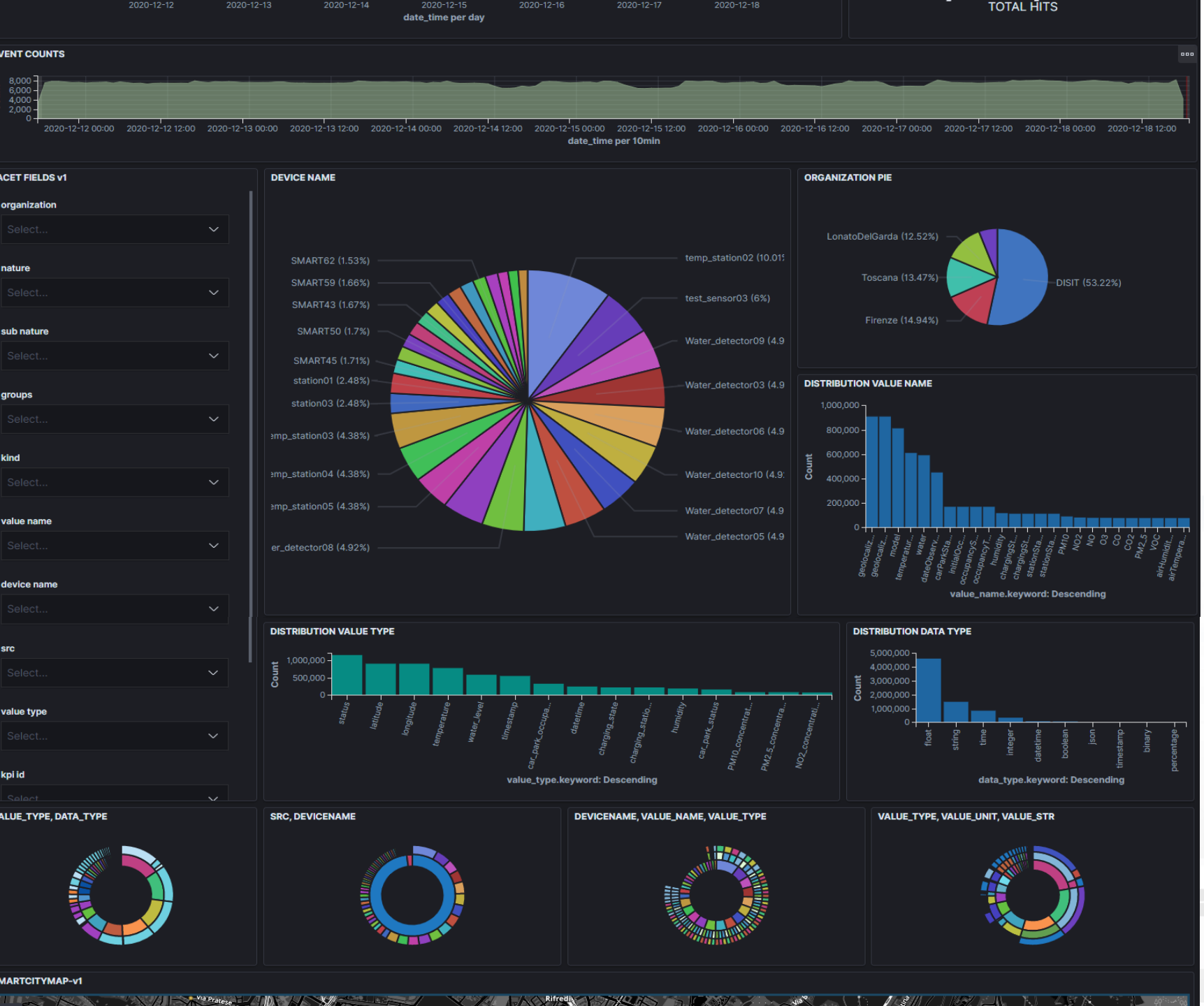


kibana

SNAP4CITY

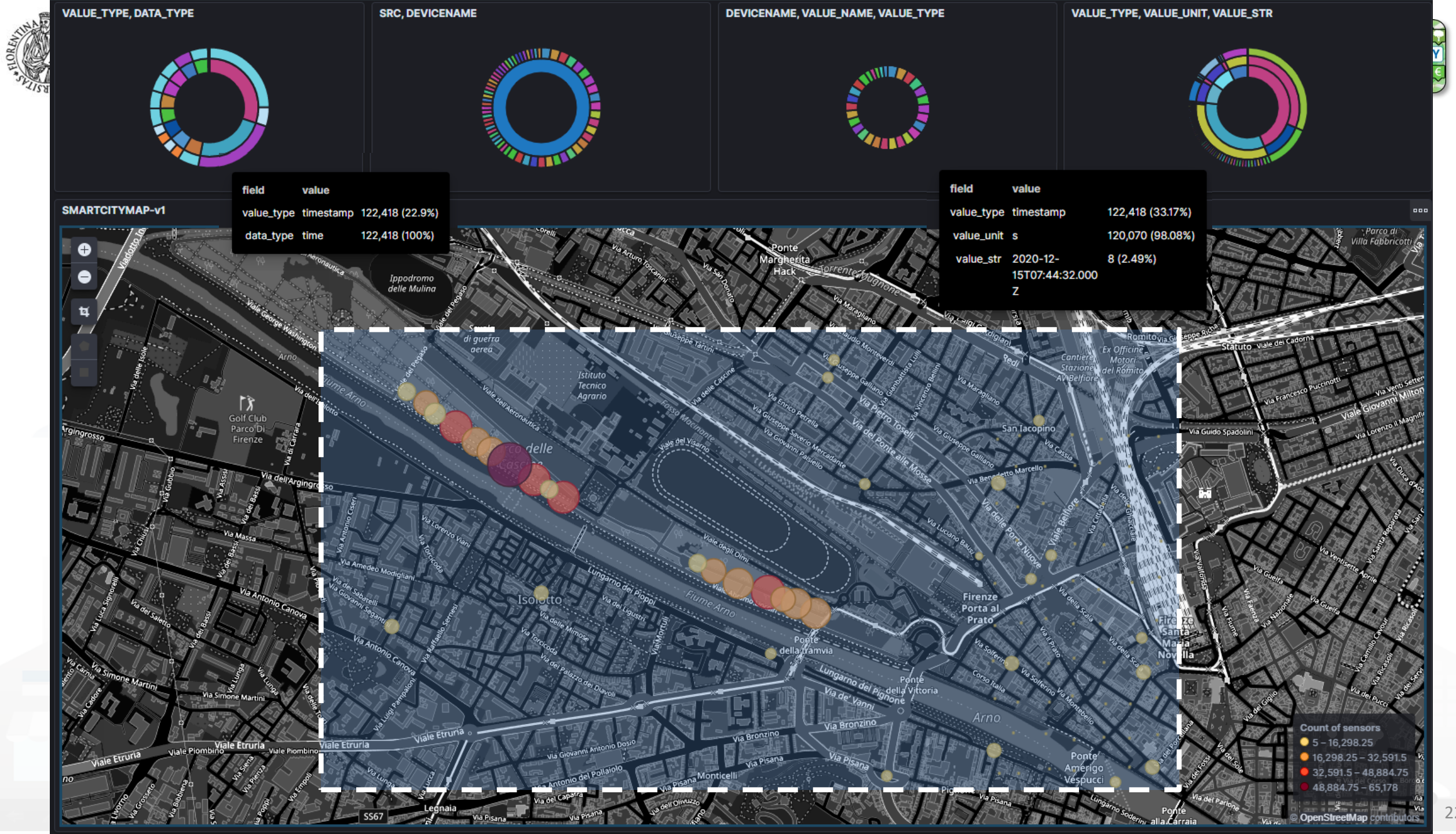
Business Analysis Dashboards For all kind of users: DevDash

- Dynamic Filtering, Adaptable, …
- Full data details, drill down,…
- Synergic with **Data Inspector** which addresses data relationships, processing and information
- **Only Your Data for**
  - Manager and Area Managers
- **All Accessible Data for**
  - ToolAdmin and RootAdmin



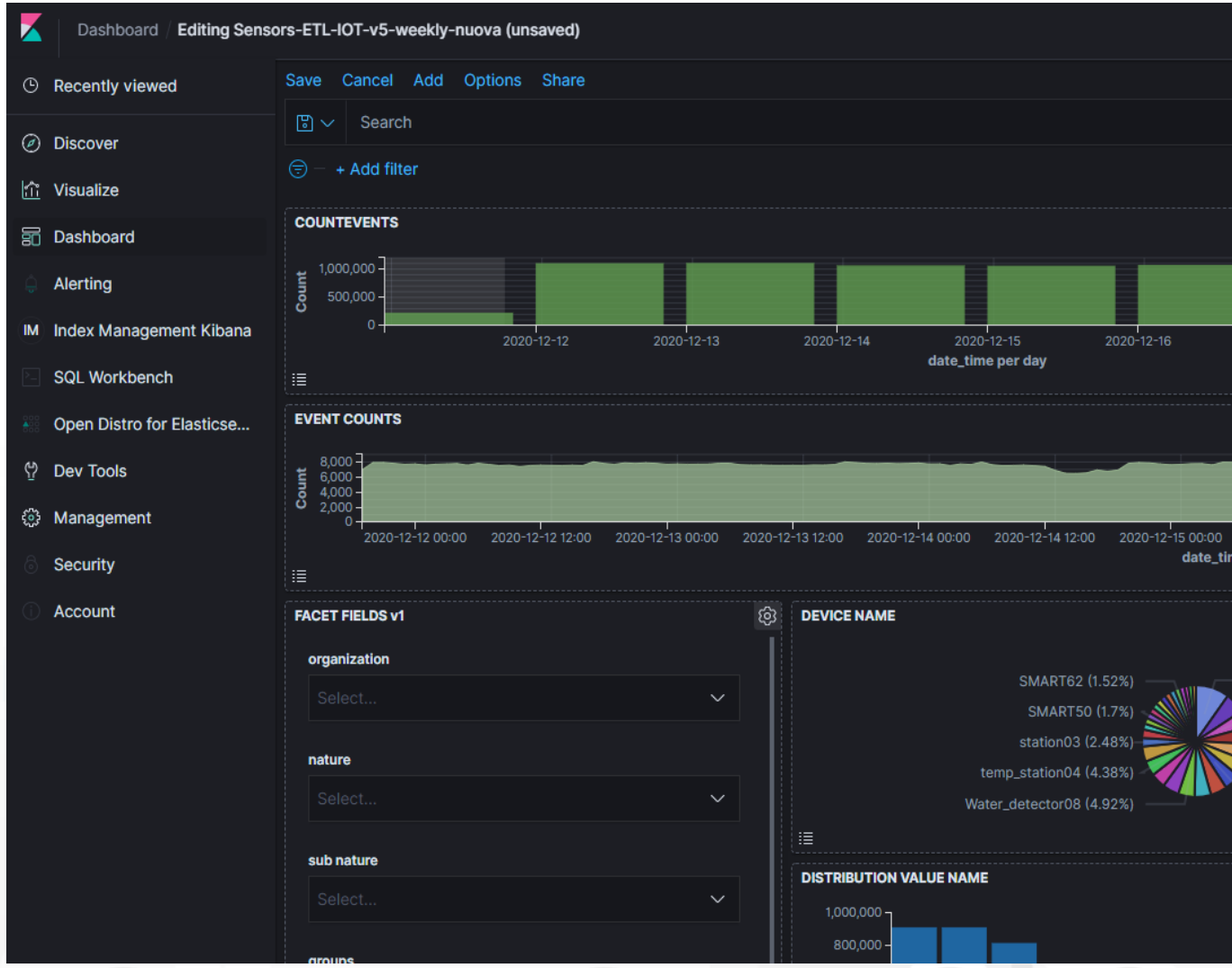
- Multi faceted Search by
  - Devices
  - Organization
  - Drill on Time
  - Drill on Map
  - Value Types
  - Data Type
  - Value name
  - Data table
  - Etc.

- Respect Privacy and GDPR


VALUE_TYPE, DATA_TYPE
SRC, DEVICENAME
DEVICENAME, VALUE_NAME, VALUE_TYPE
VALUE_TYPE, VALUE_UNIT, VALUE_STR
field value
value_type timestamp 122,418 (22.9%)
data_type time 122,418 (100%)
field value
value_type timestamp 122,418 (33.17%)
value_unit s 120,070 (98.08%)
value_str 2020-12-15T07:44:32.000Z 8 (2.49%)
SMARTCITYMAP-v1
Count of sensors
5 – 16,298.25
16,298.25 – 32,591.5
32,591.5 – 48,884.75
48,884.75 – 65,178
© OpenStreetMap contributors

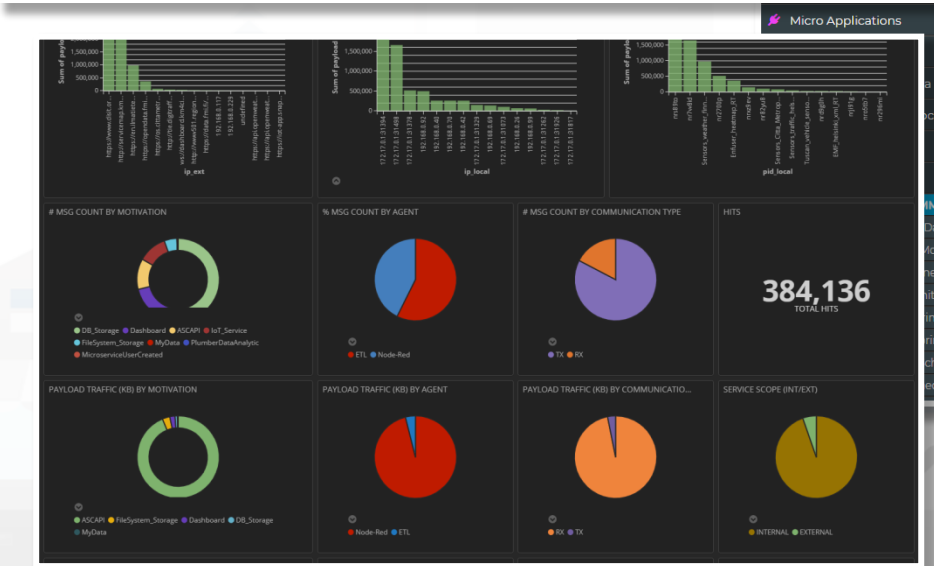
My Data Dashboard Customization

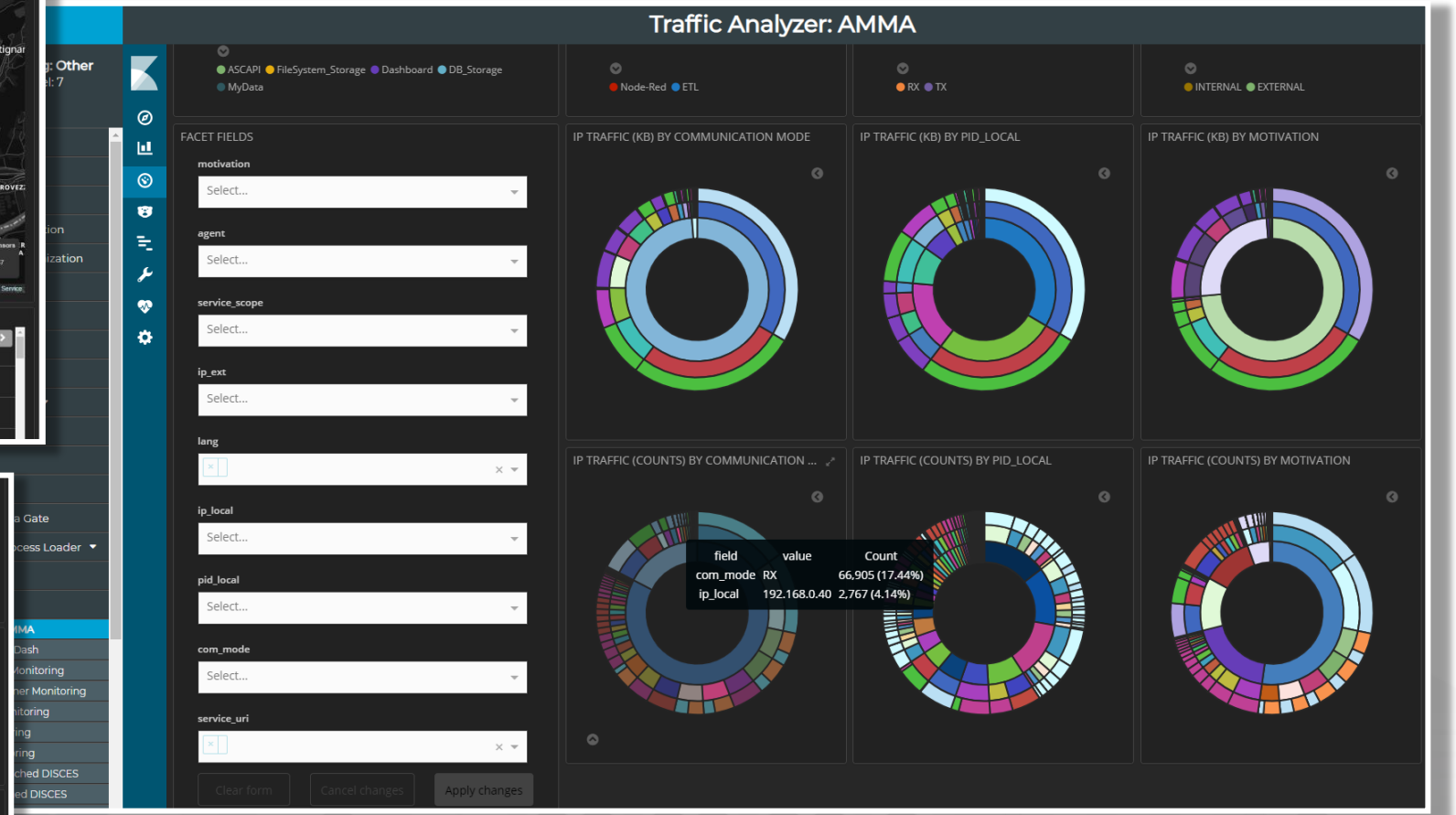
- My Data Dashboards (for Developers and for Managers) can be customized by RootAdmin.
  - Authority for Customizzation can be also extended to other role on Premise solutions
- Customizations is based on Full editing Capabilities of Kibana Elastic Search 7, and with multiple indexes of Snap4City

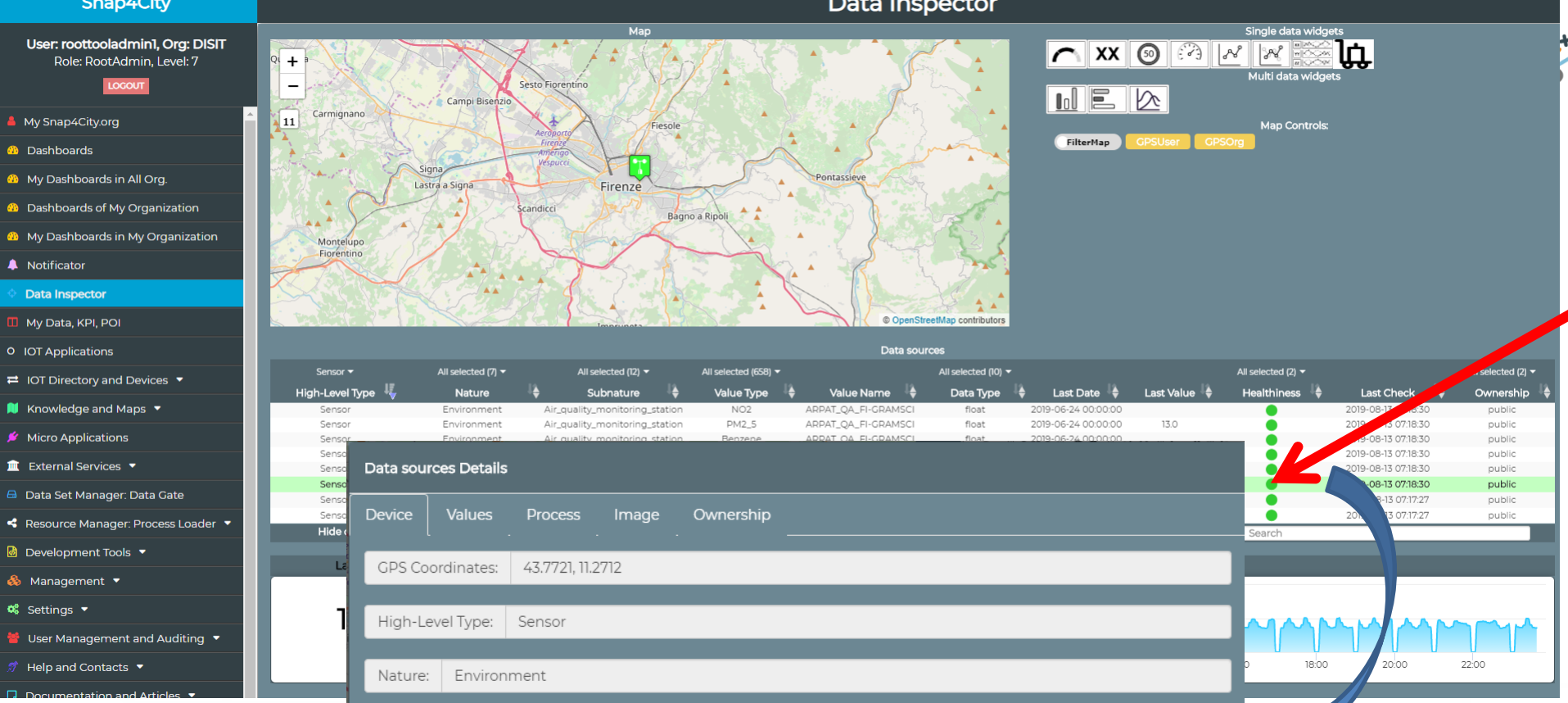


AMMA by Elastic Search + Kibana







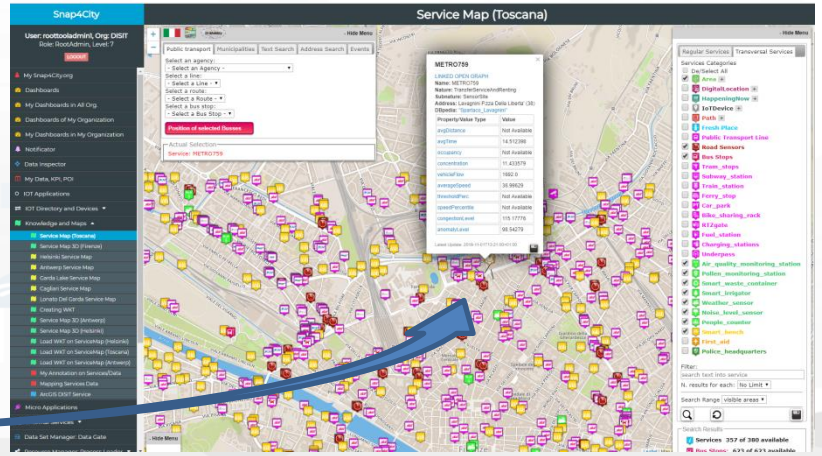


SNAP4CITY

- Click with the mouse

HLT: Sensor

Knowledge Base view: **ServiceMAP**



HLT: Sensor

Data sources Details

Device | Values | Process | Image | Ownership

Value Type: annualPM10ExceedCount

Data Type: integer

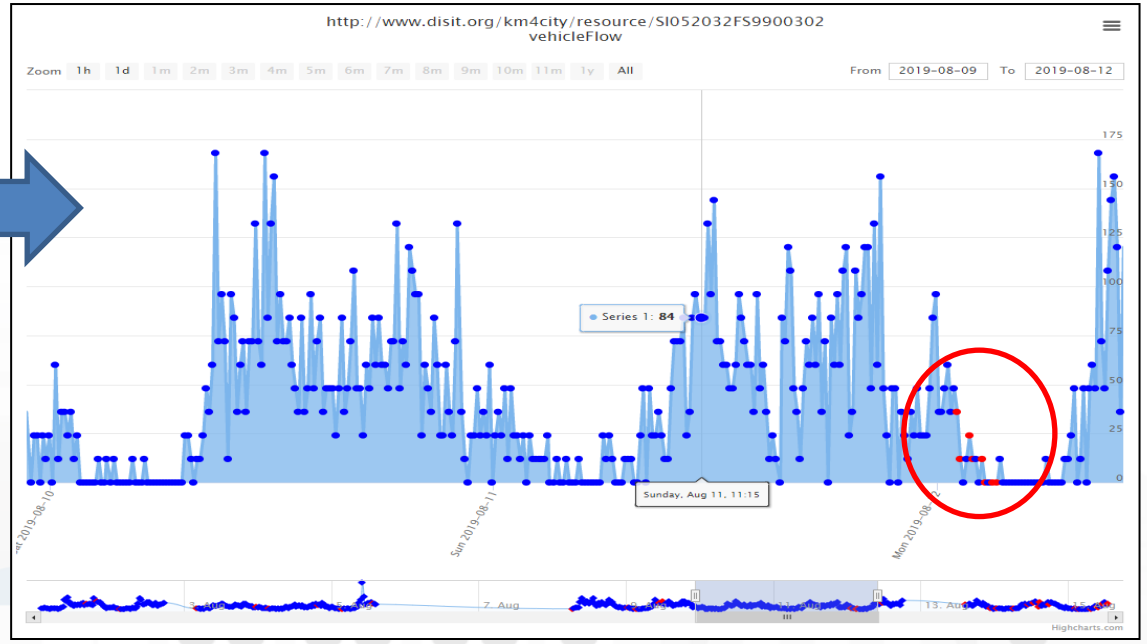
Last Date: 2019-06-24 00:00:00

Last Value: 13

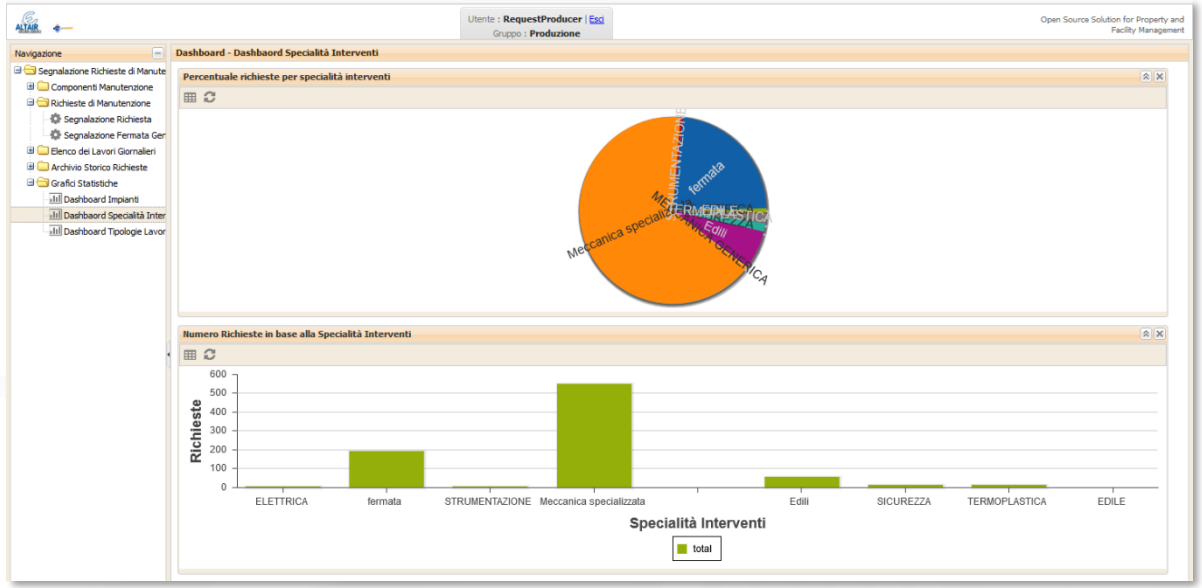
Value Type	Healthy	Delay (s)	Reason	Healthiness Criteria	Refresh Rate (s)	Data type	Unit	Value	Time Trend
Benzene	false	8984804	too old data 8984804>=21600 and delay>=172800	refresh_rate	21600	float	ppm		VIEW
annualPM10ExceedCount	false	8984804	too old data 8984804>=21600 and delay>=172800	refresh_rate	21600	integer	#		VIEW
SO2	false	8984804	too old data 8984804>=21600 and delay>=172800	refresh_rate	21600	float	ppm		VIEW
hourO3Max	false	8984804	too old data 8984804>=21600 and delay>=172800	refresh_rate	21600	integer			VIEW
PM2_5	false	8984804	too old data 8984804>=21600 and delay>=172800	refresh_rate	21600	float	ppm		VIEW
PM10	false	8984804	too old data 8984804>=21600 and delay>=172800	refresh_rate	21600	float	ppm		VIEW
O3	false	8984804	too old data 8984804>=21600 and delay>=172800	refresh_rate	21600	float	ppm		VIEW
NO2	false	8984804	too old data 8984804>=21600 and delay>=172800	refresh_rate	21600	float	ppm		VIEW
H2S	false	8984804	too old data 8984804>=21600 and delay>=172800	refresh_rate	21600	float	ppm		VIEW
CO	false	8984804	too old data 8984804>=21600 and delay>=172800	refresh_rate	21600	float	ppm		VIEW
dailyO3ExceedCount	false	8984804	too old data 8984804>=21600 and delay>=172800	refresh_rate	21600	integer	#		VIEW
airQualityNOxGral_3m	false	8984804	too old data 8984804>=3600 and delay>=172800	any	3600	float			VIEW
airQualityNOxGral_6m	false	8984804	too old data 8984804>=3600 and delay>=172800	any	3600	float			VIEW

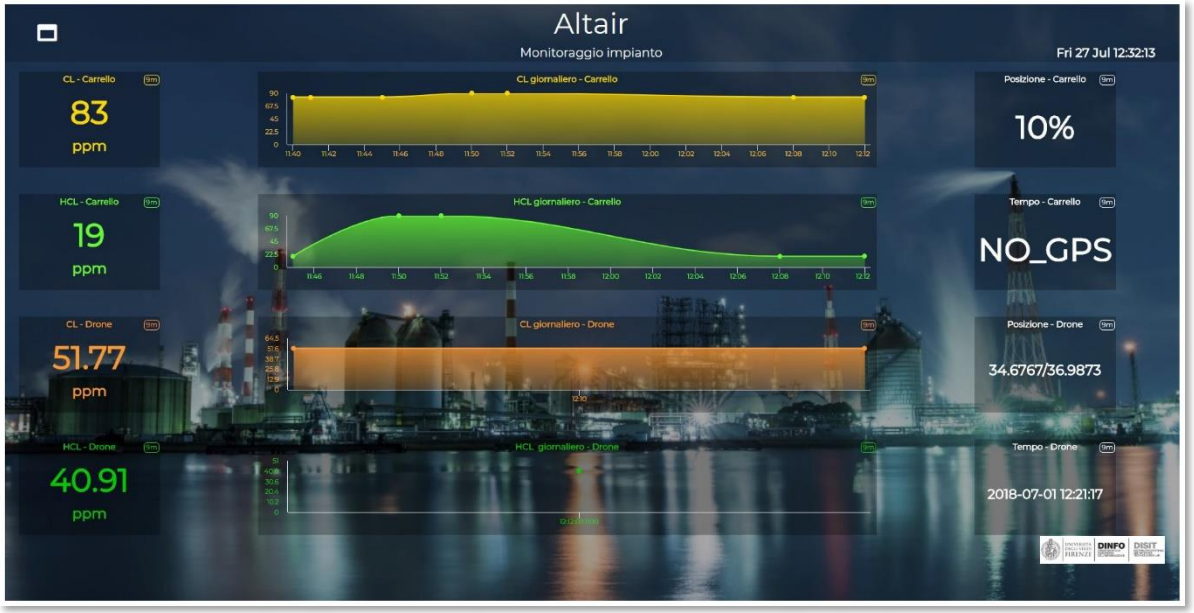
Cancel

- Specific values of selected
- Infomation of the values of the other sensors on the same device
- Trends and marking of problems, for machine learning

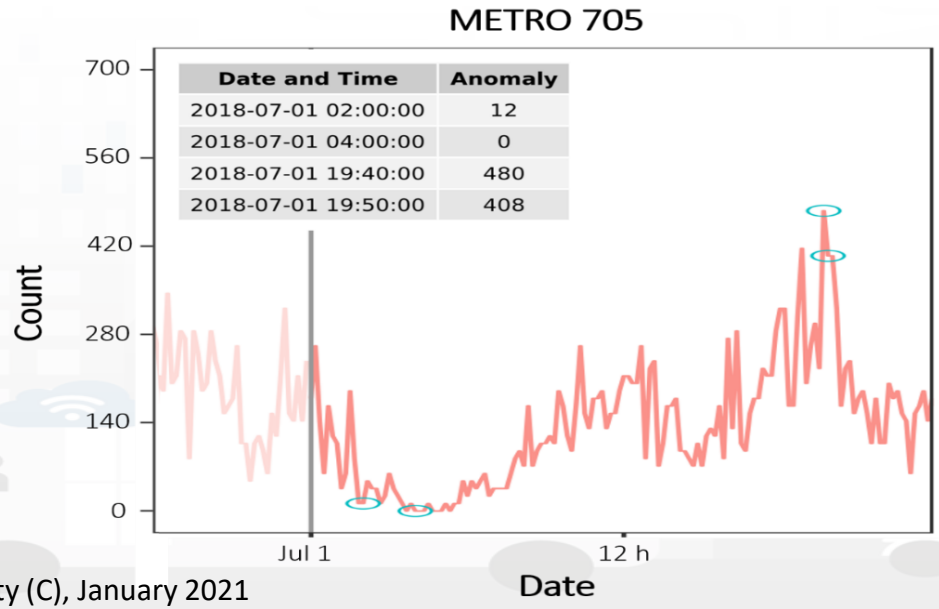


Reports and Dashboards

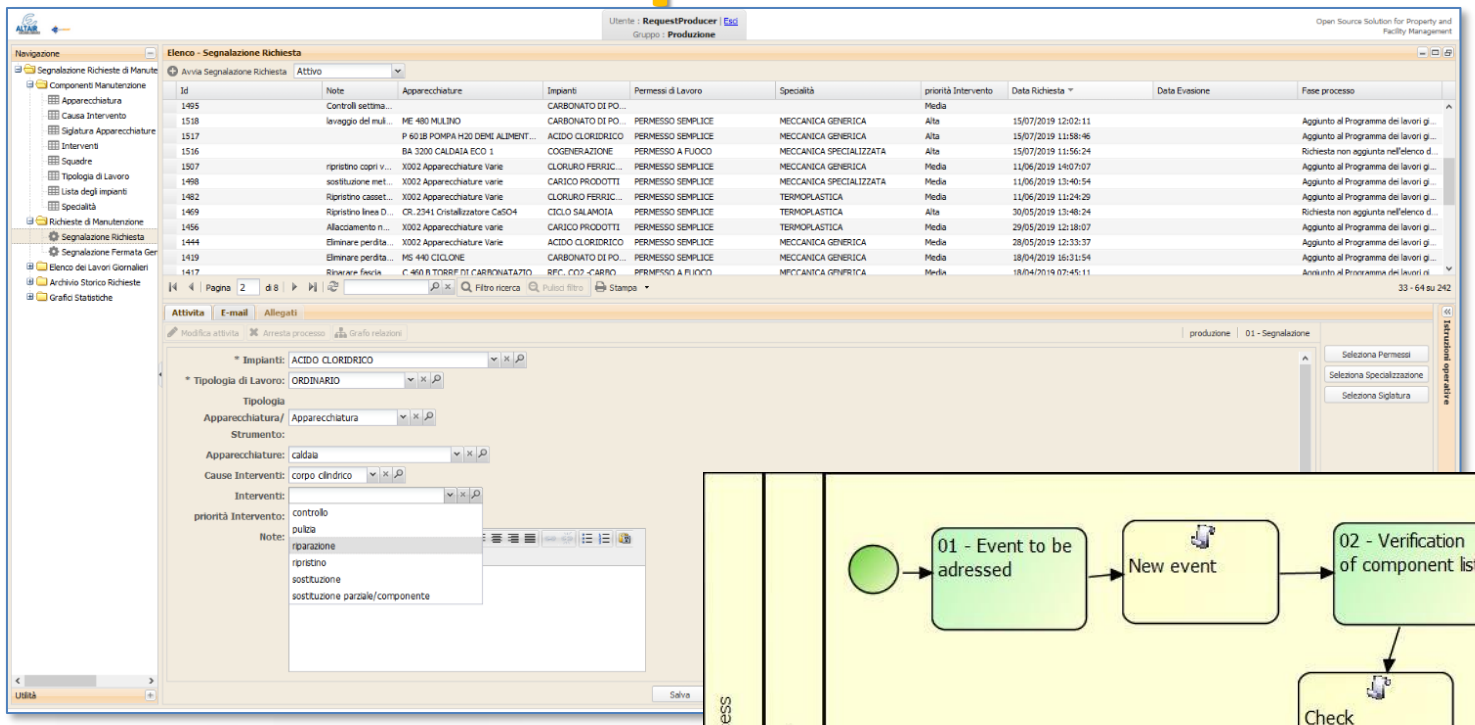




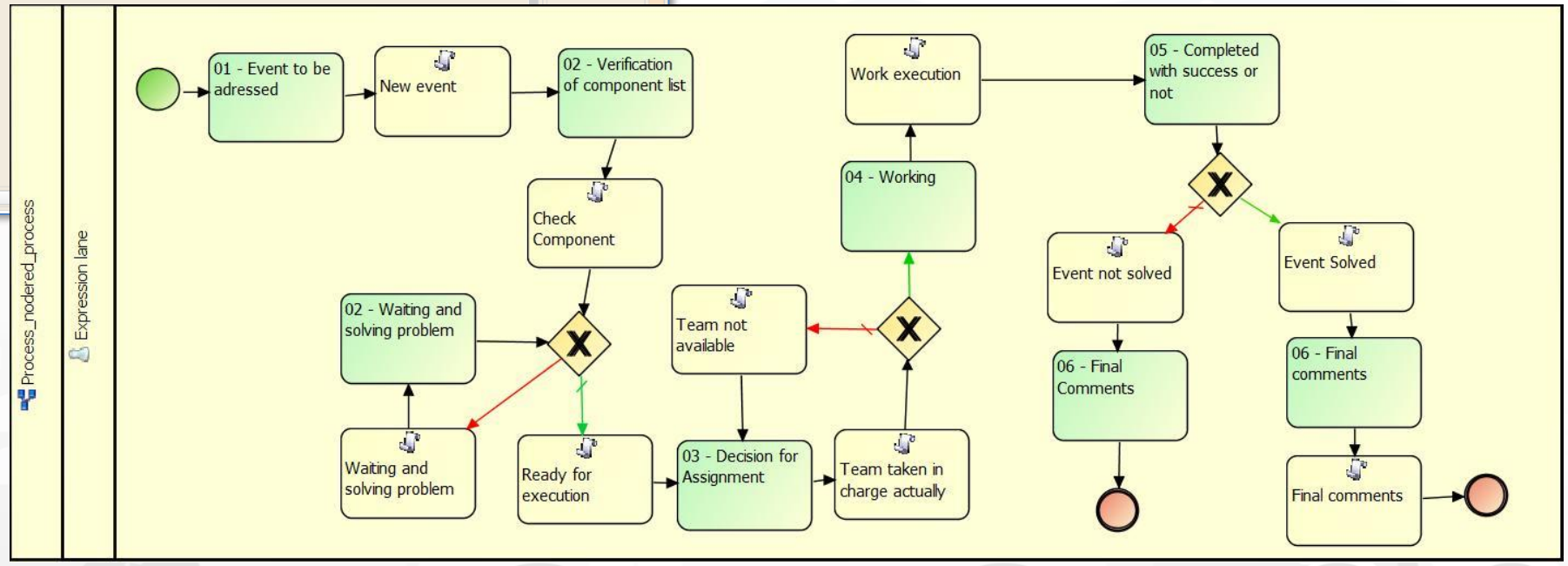
Anomaly detection Early Warning



OpenMaint Ticketing System



- Define the workflow
  - Activate events
  - Manage steps
  - Collecting feedbacks and results from teams



- Activities
- Teams
- Phases
- Athorization
- Checking points
- Events and conditions
- …

Filters | Search | KQL | Last 1 year | Show dates | Refresh

+ Add filter

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

Impianto: Select...

Specialità: Select...

Tipologia Lavoro: Select...

Siglatura: Select...

Apply changes | Cancel changes | Clear form

1,865
Numero di eventi nel periodo

264.491
50th percentile of ore tra inizio e fine lavoro

673.151
Media ore passate tra inizio e fine lavoro

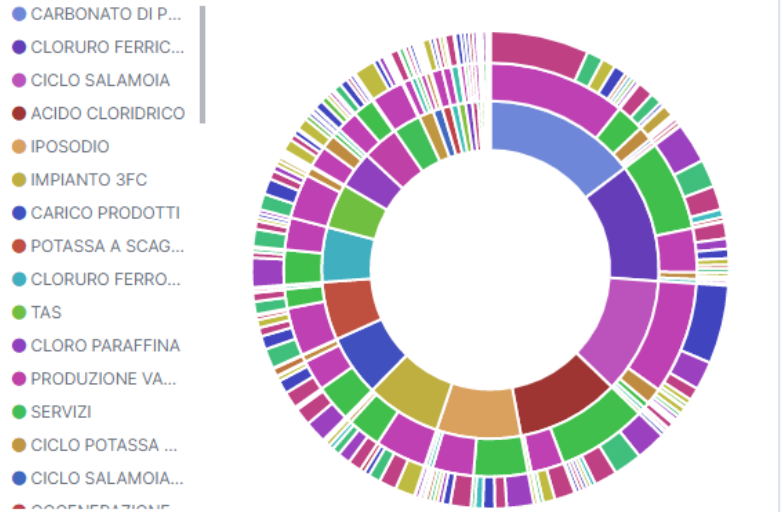
CLORURO FERRICO STANDARD
CARBONATO DI POTASSIO
CICLO SALAMOIA
IPOSODIO
IMPIANTO 3FC
CARICO PRODOTTI

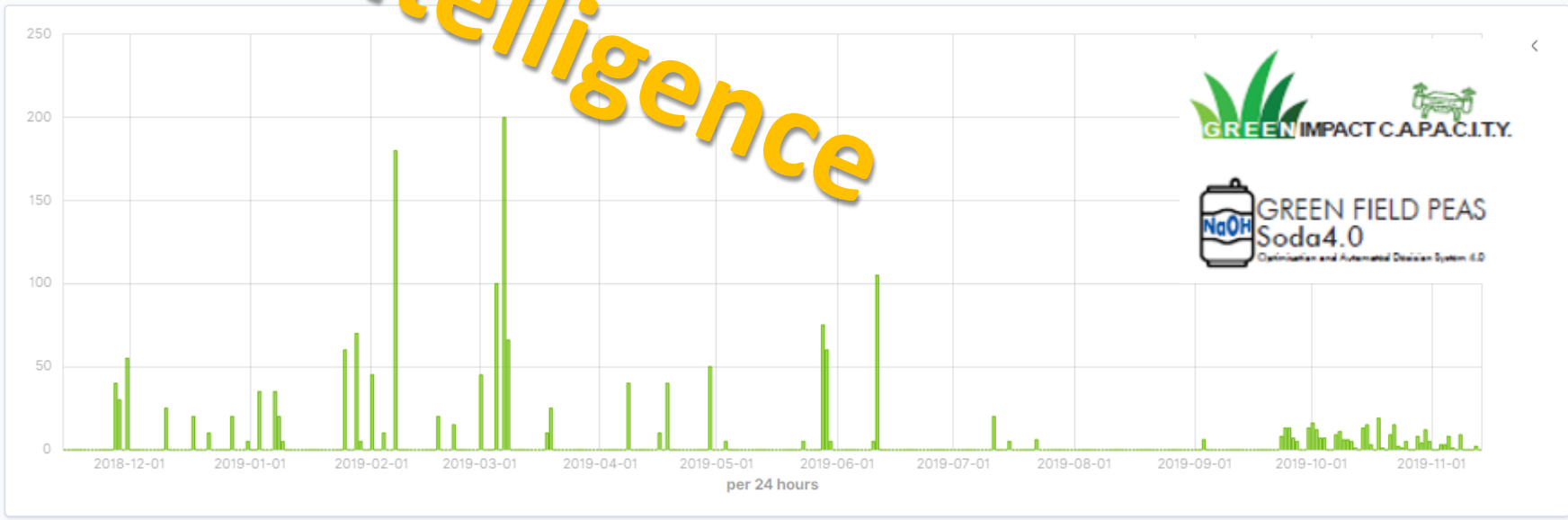




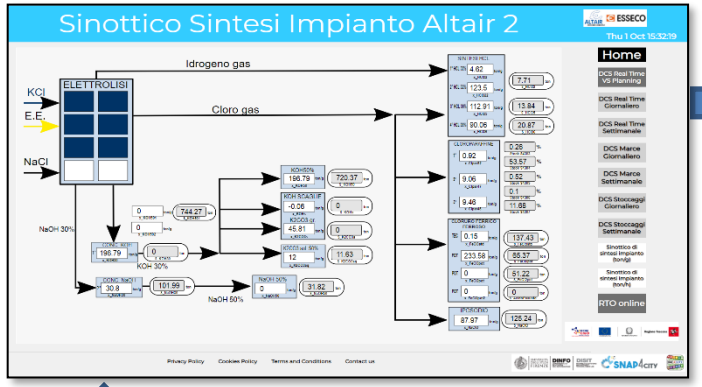


Maintenance Intelligence



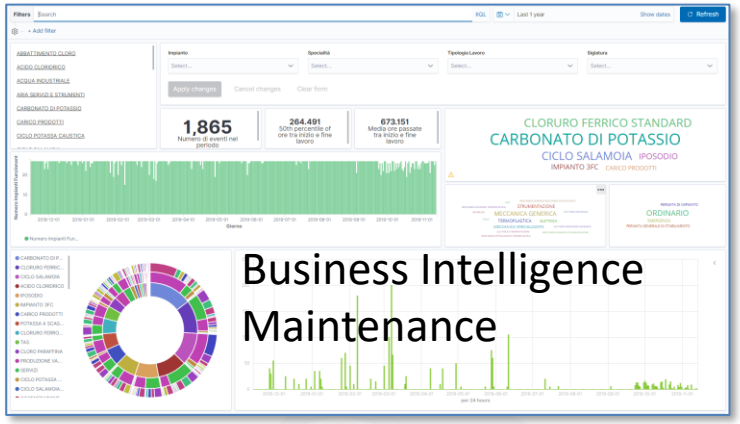


Example of Integrated workflow

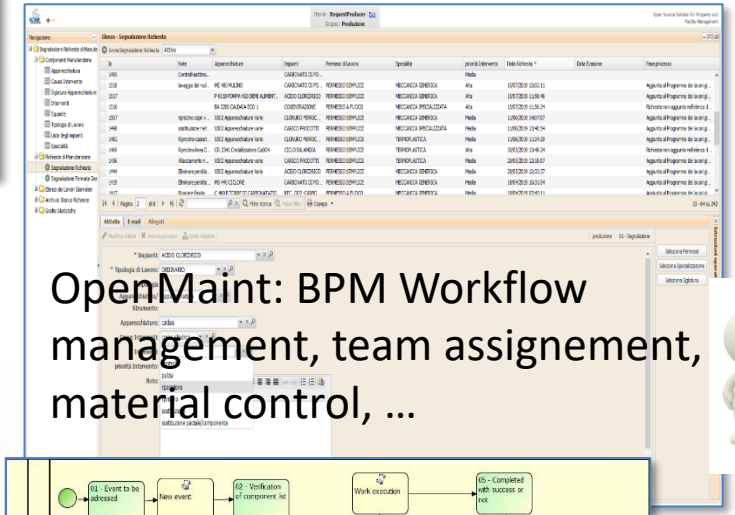


Dashboards and actions

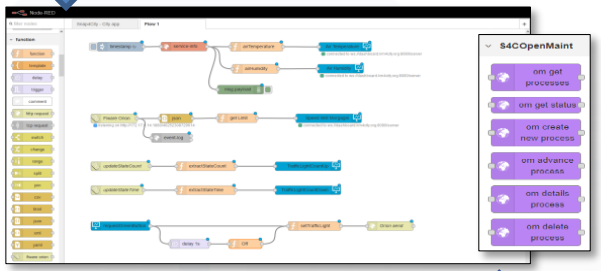
Consumptions/productions



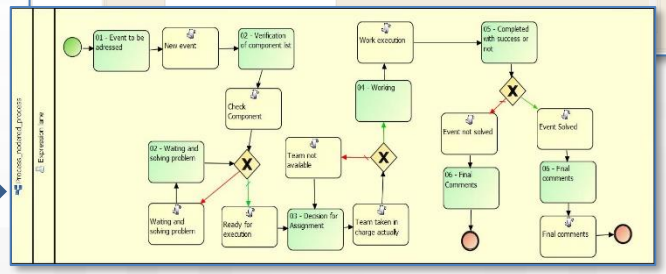
Events/actions



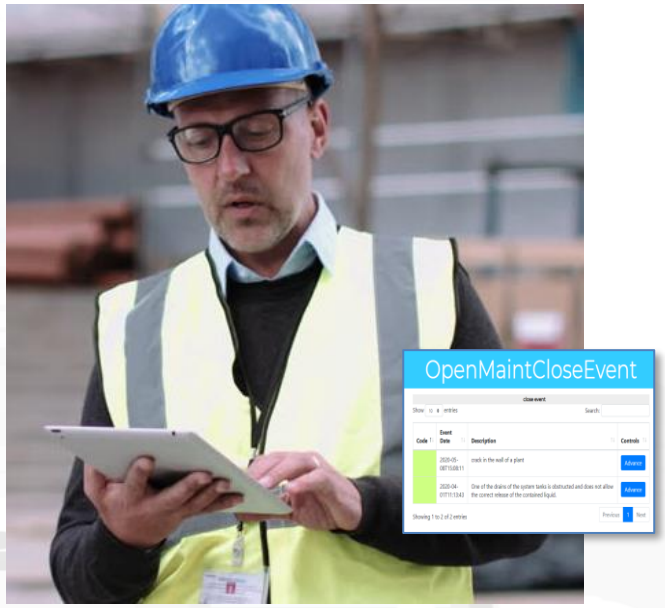
OpenMaint: BPM Workflow management, team assignement, material control, …



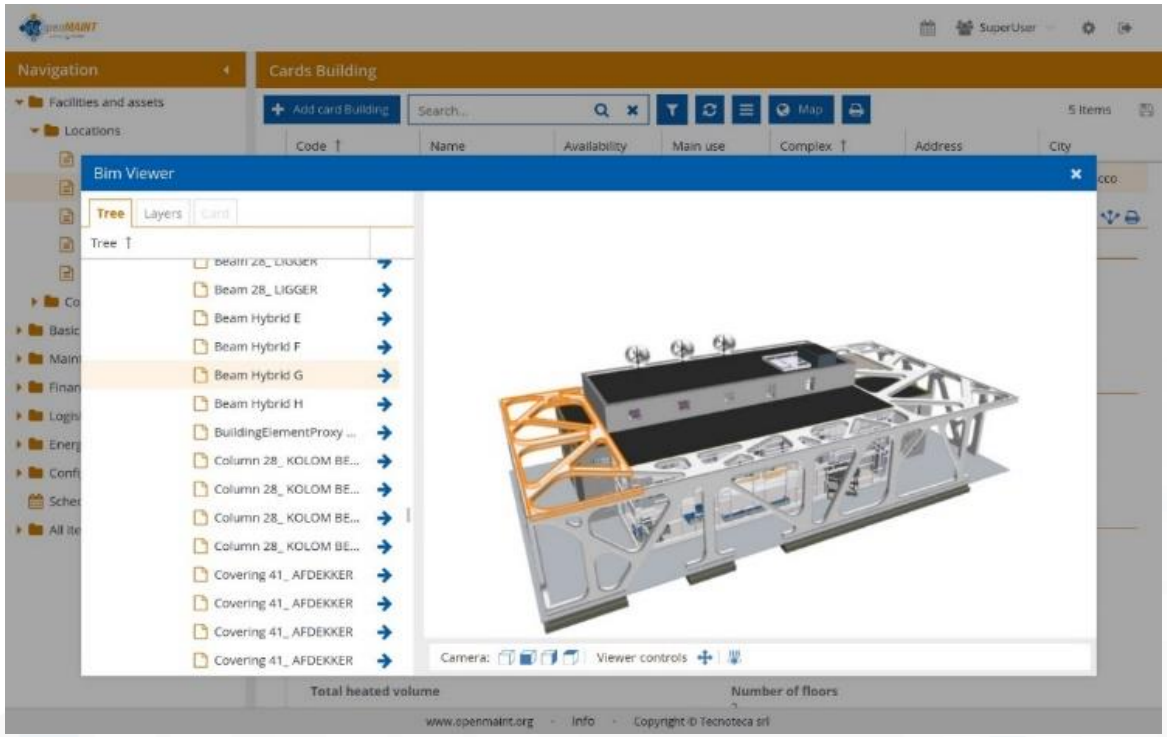


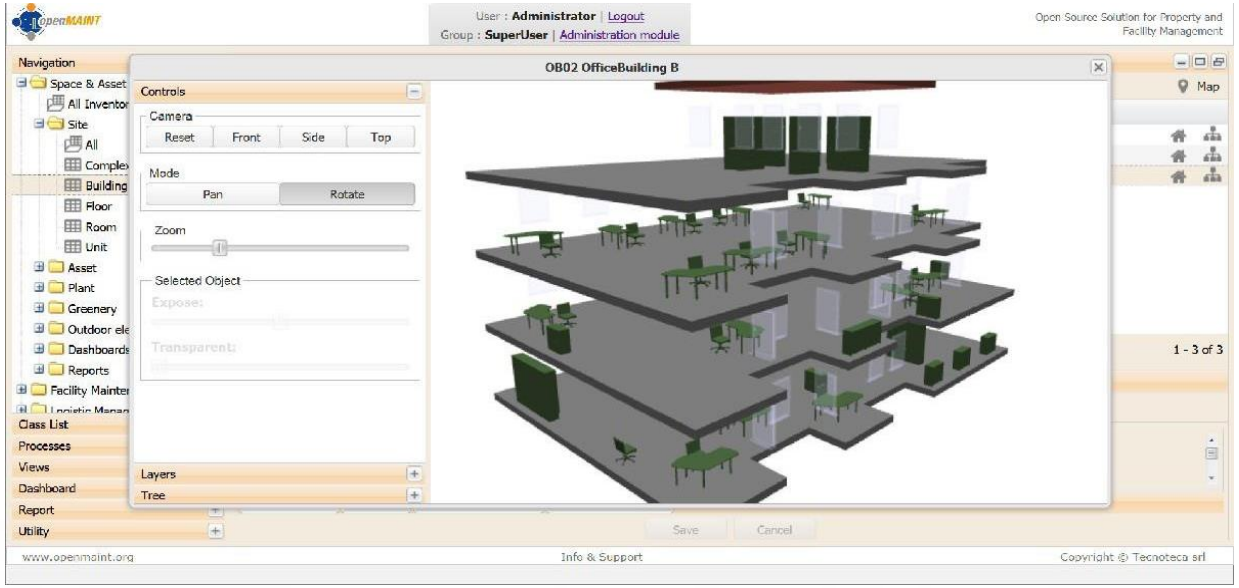


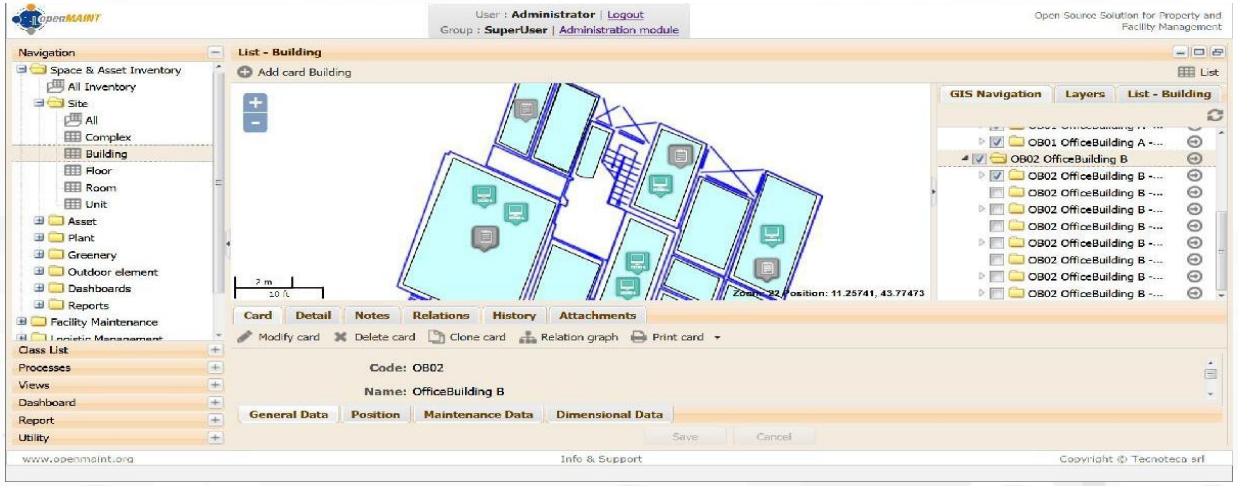
IOT App, Data event firing, event detection and firing Critical event management



OpenMaint BPM, BIM







Trajectories and Real Time Tracking



MyKPI: Tracking of Devices and Mobiles

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



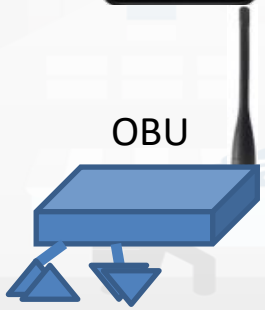
Mobile
PAX Counter



Apps

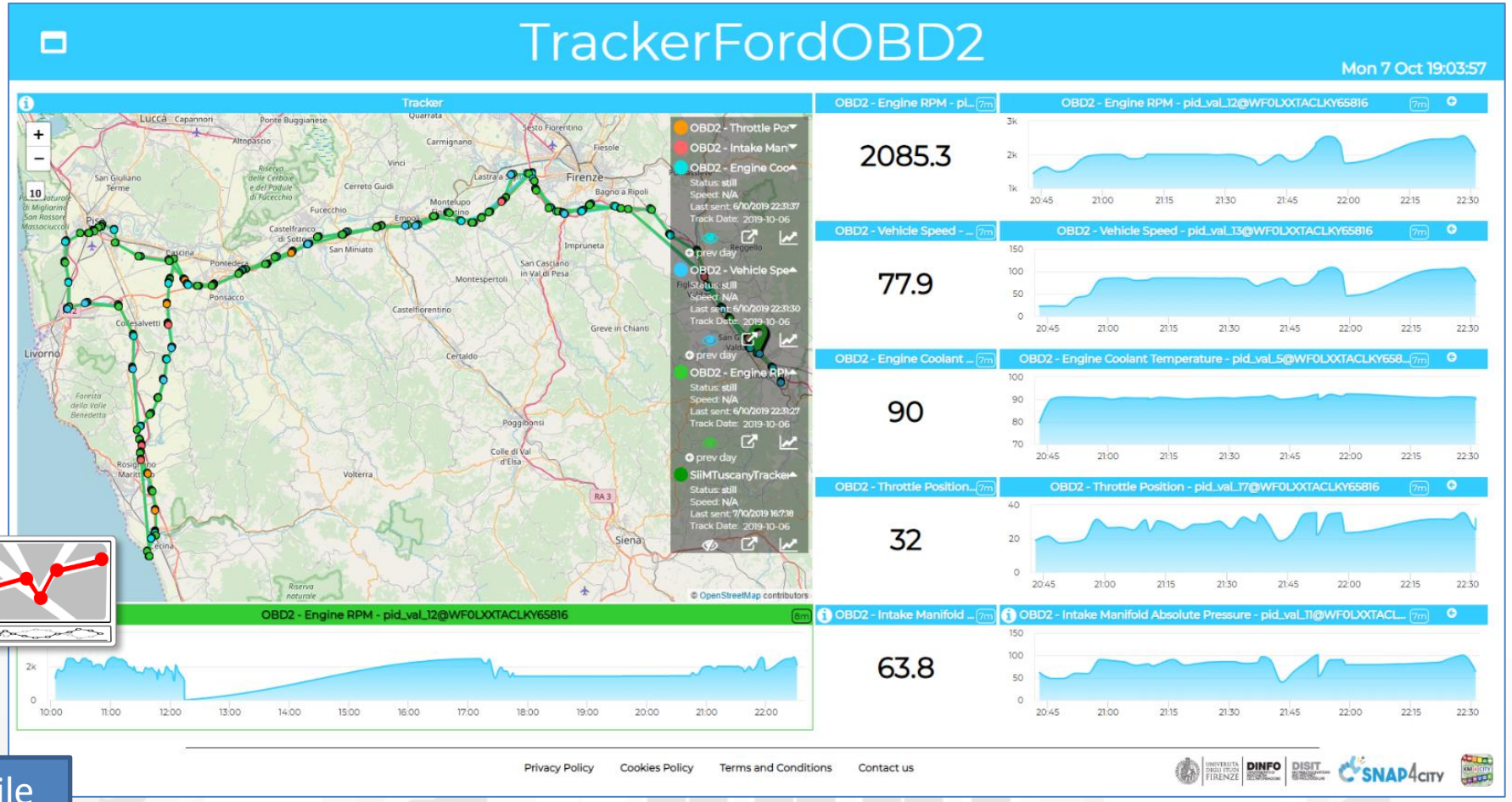


OBD2



OBU

Mobile sensors



Real Time Tracking

From mobile app:

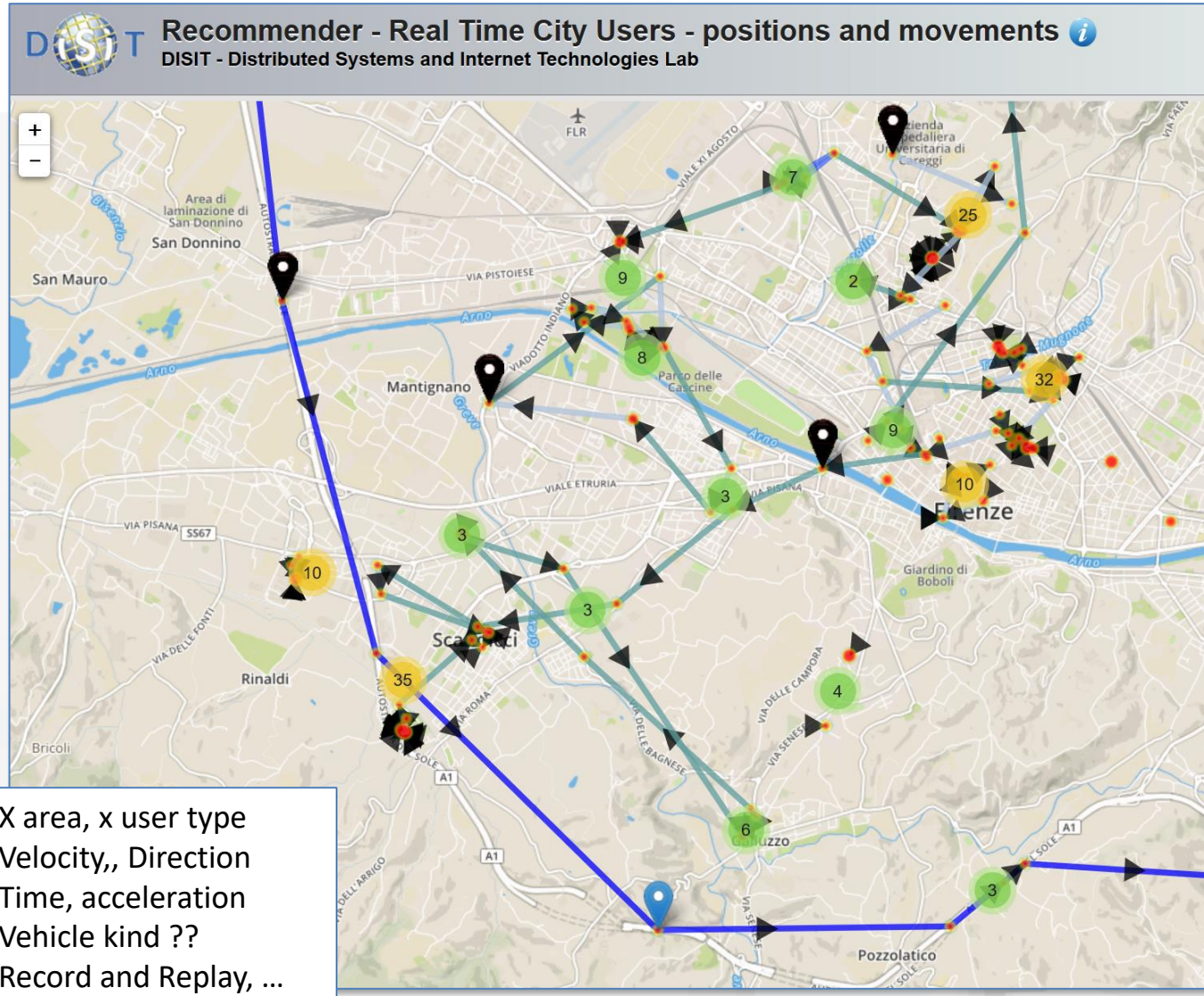
- Resolving GPS location: GPS, cells, wifi-network, … mixt
- Noisy, different kind of devices, …
- Smart algorithm on devices for location acquisition
- Anonymized data, terms of use on mobile

Filtering:

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

Clustering:

- time, space, user kind, etc.



- X area, x user type
- Velocity,, Direction
- Time, acceleration
- Vehicle kind ??
- Record and Replay, …

Dashboards' Intelligence on Web and Mobile Devices



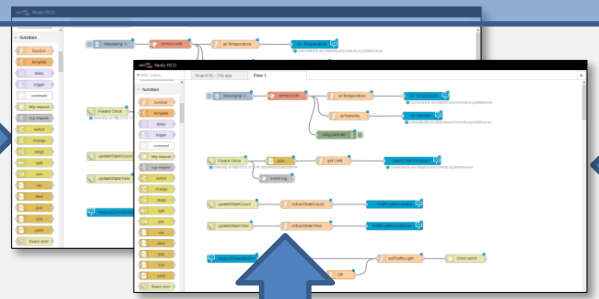
Snap4City: Builder of Sentient Cities Solutions

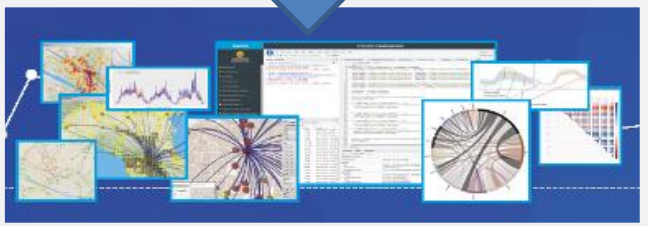
Dashboards with data driven IOT Applications enforcing intelligence

IOT and data World

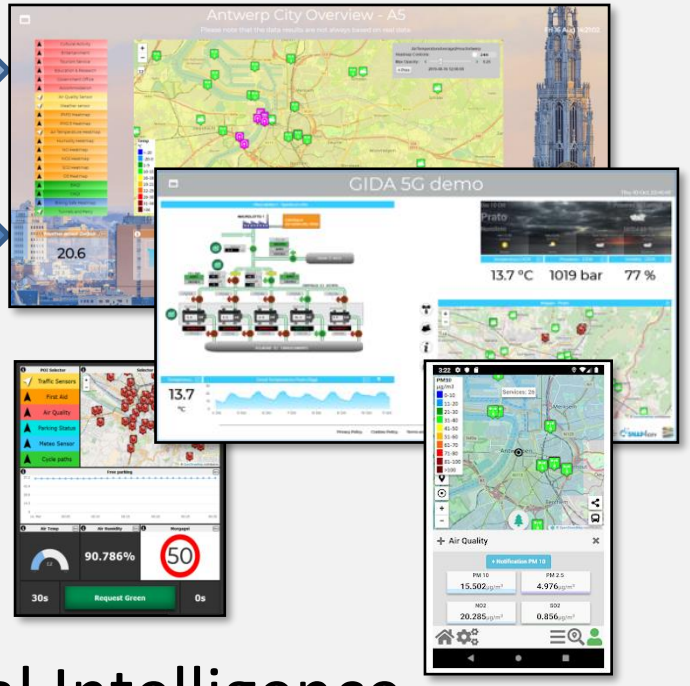


IOT Applications





Dashboards and Apps



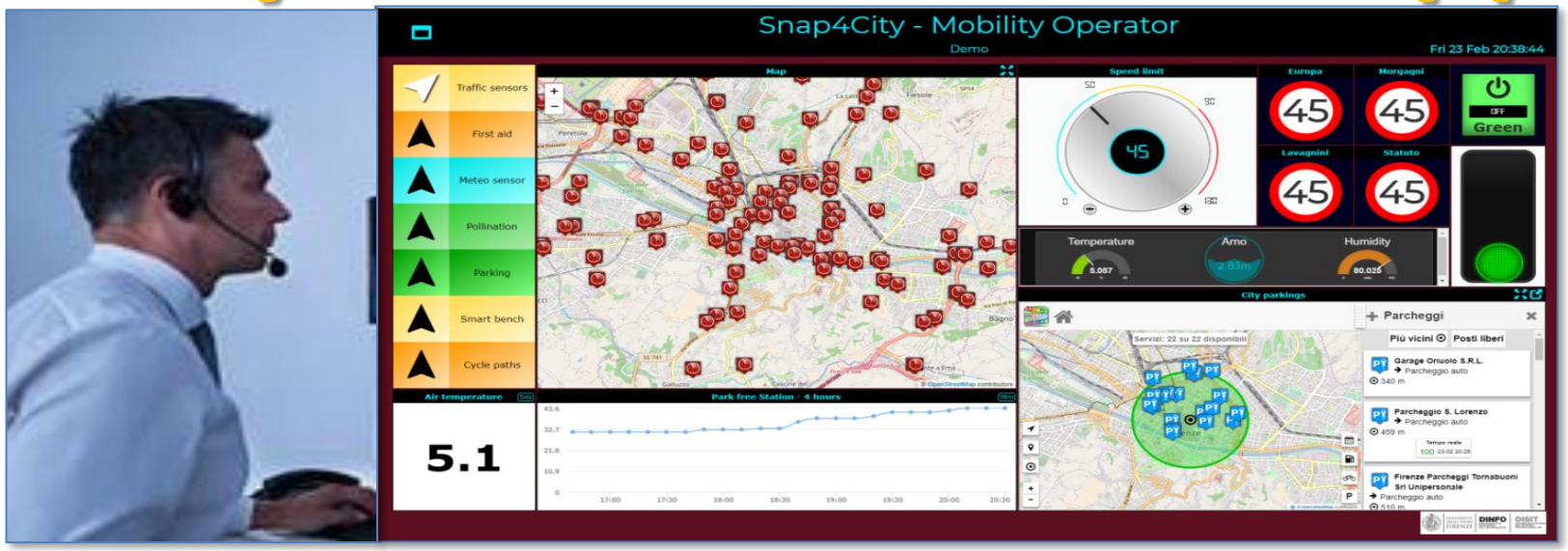
Big Data Analytics, Artificial Intelligence

City Dashboard + IOT App

Control Room Operator

Would like to:

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

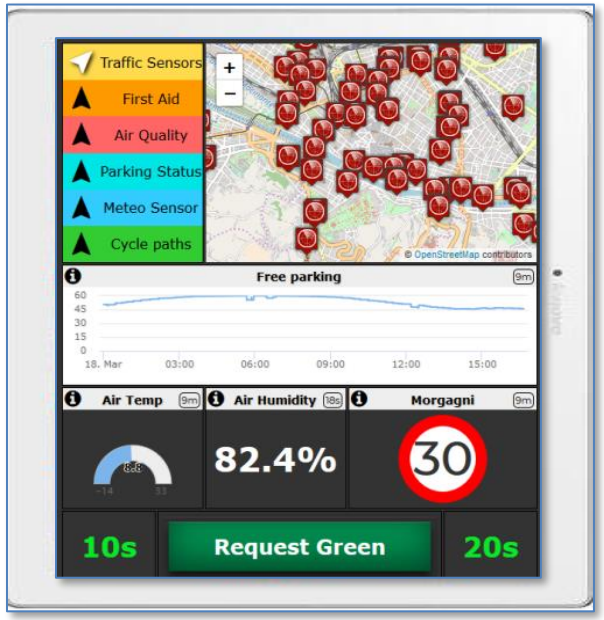


Driver, Policeman

Would like to:

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

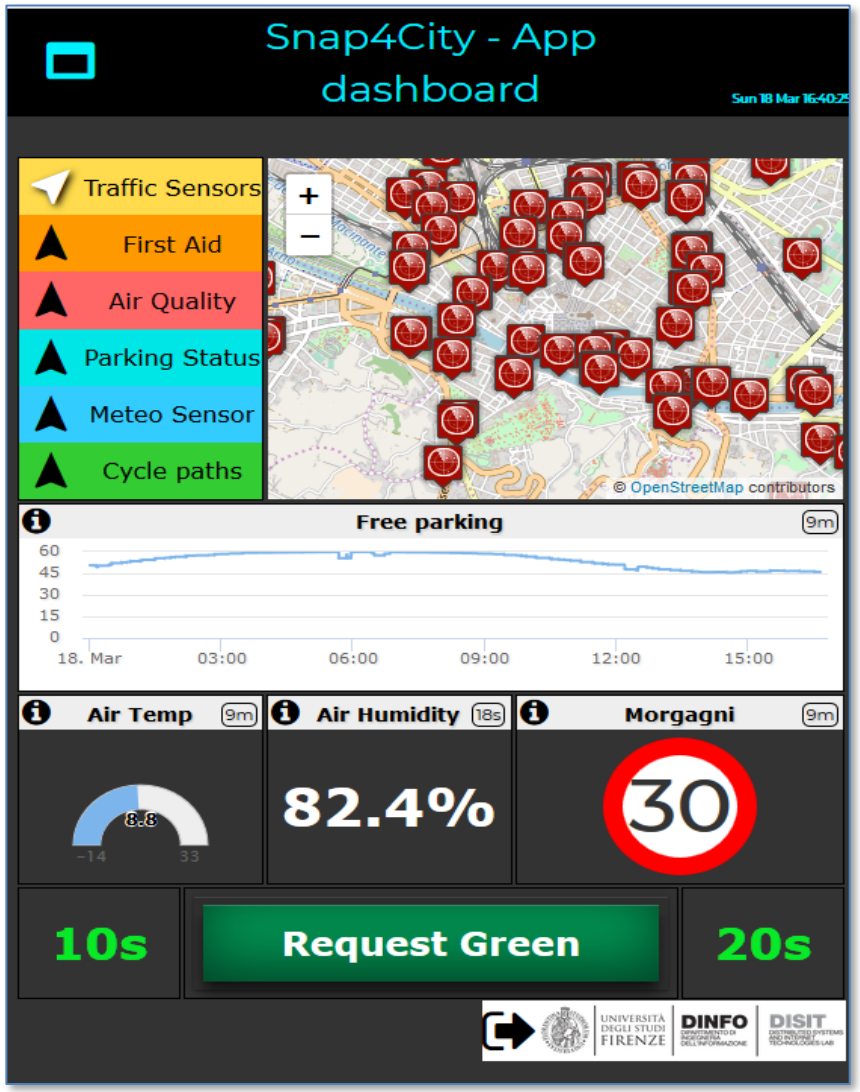


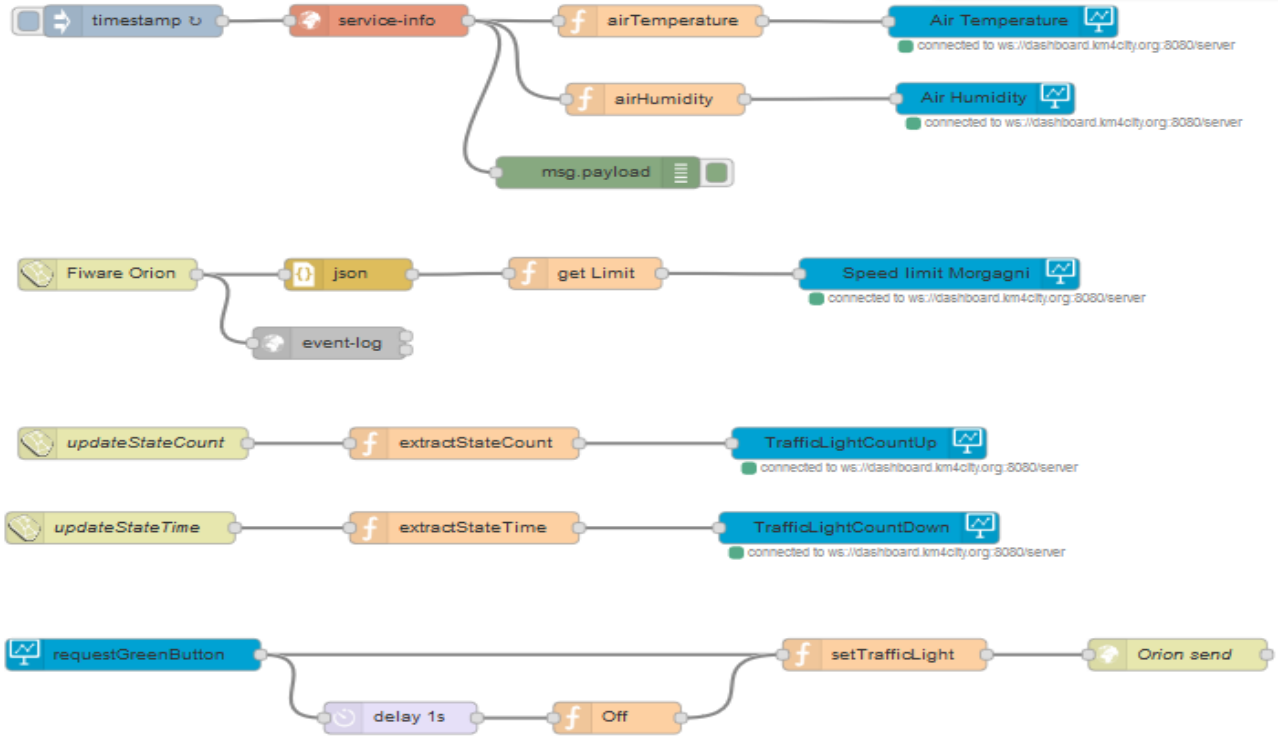



RADIO
MEDIA
TEL
MYCAR
SOUND
AUTO
AC
MENU
EXIT

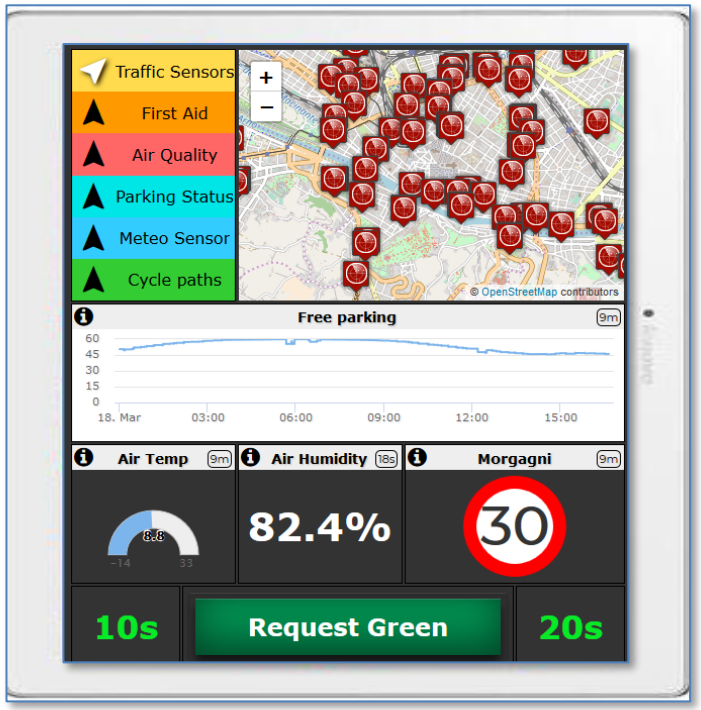
IOT Application with City Dashboard Simple development

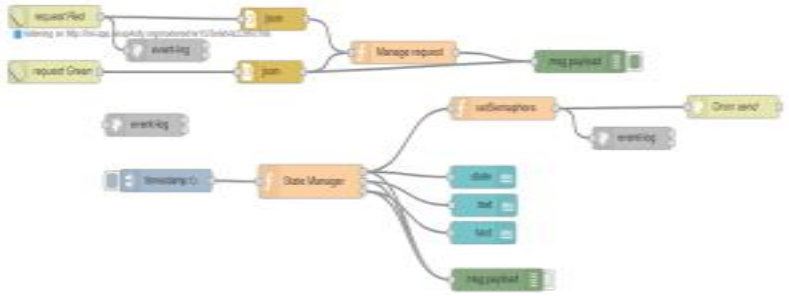






-Virtual Sensors and Virtual Actuators
-From Dashboard to IOT App and viceversa
-From Dashboard to IOT Brokers/Devices and viceversa


Traffic Sensors
First Aid
Air Quality
Parking Status
Meteo Sensor
Cycle paths
© OpenStreetMap contributors
Free parking
9m
60
45
30
15
0
18. Mar
03:00
06:00
09:00
12:00
15:00
Air Temp
9m
Air Humidity
18s
Morgagni
9m
82.4%
30
10s
Request Green
20s





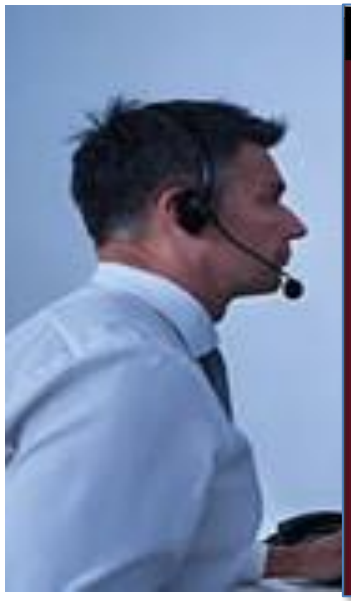


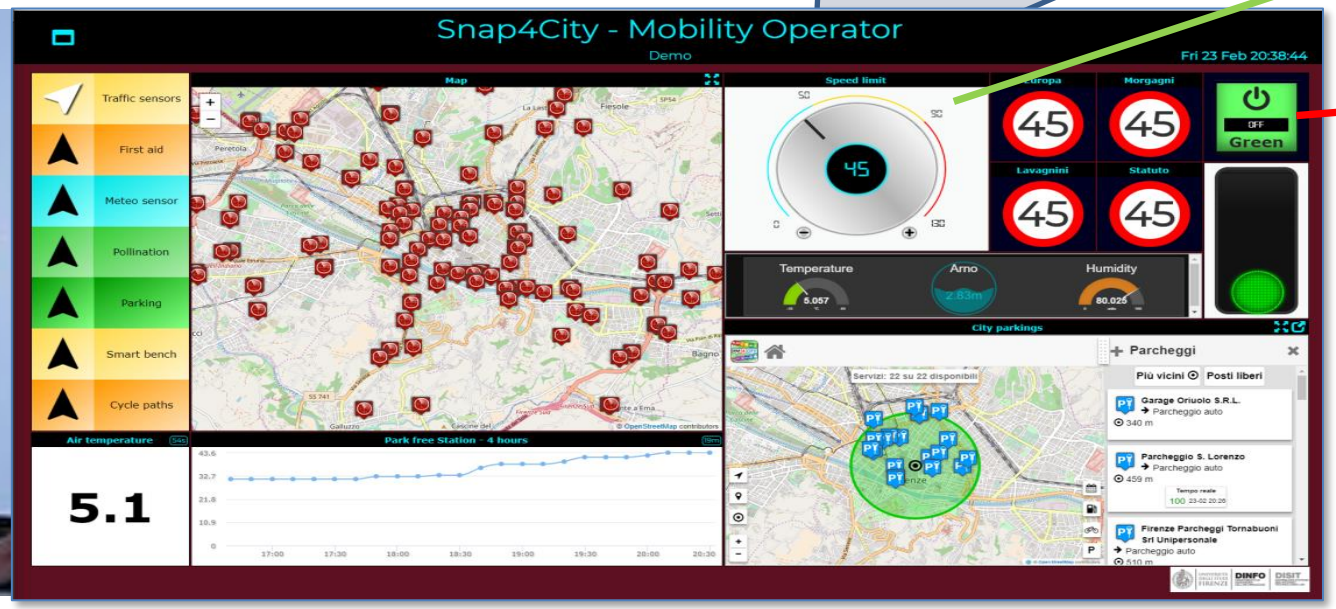


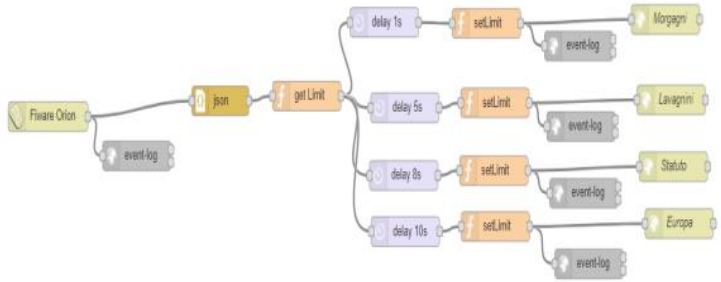




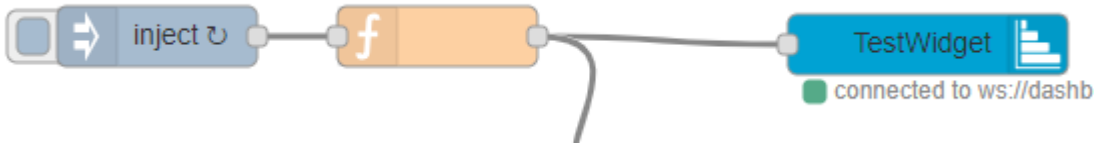





Snap4City - Mobility Operator
Demo
Fri 23 Feb 20:38:44
Traffic sensors
First aid
Meteo sensor
Pollination
Parking
Smart bench
Cycle paths
Map
Speed limit
Europa
Morgagni
Lavagnini
Statuto
45
OFF
Green
Temperature
Arno
Humidity
5.057
80.025
City parkings
Parcheggi
Più vicini
Posti liberi
Garage Oriuolo S.R.L.
Parcheggio S. Lorenzo
Firenze Parcheggi Tornabuoni Srl Unipersonale
Air temperature
Park free Station - 4 hours
5.1

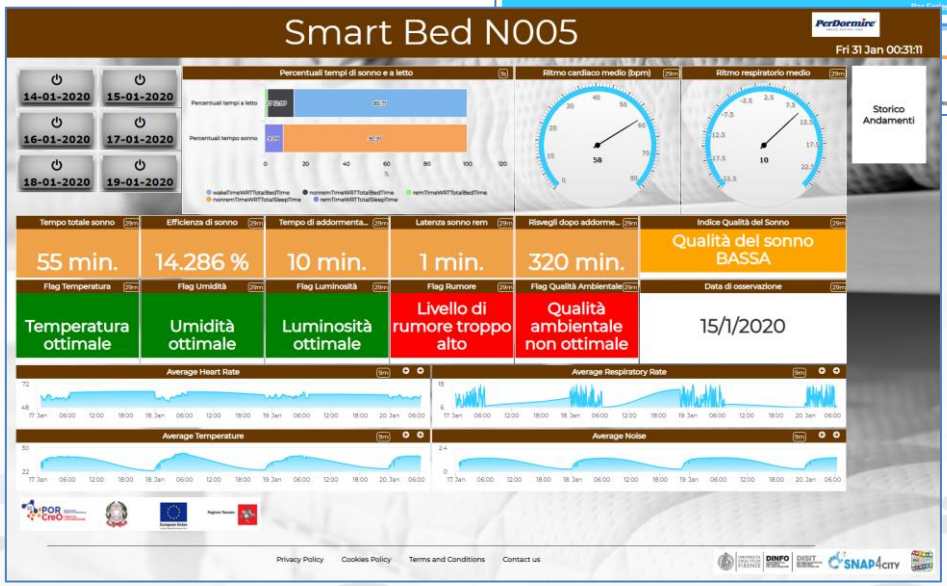

Fiware Orion
event-log
json
get Limit
delay 1s
delay 5s
delay 8s
delay 10s
setLimit
event-log
Morgagni
Lavagnini
Statuto
Europa

Dynamic Dashboards: changing from IOT App



- Dynamic Creation of Widget Content: BarSeries, trends, maps, single content, etc.
- Temporary data pushed on Dashboards





IOT Applications vs Dashboards

- **IOT Applications**, realized by using Snap4City Node-RED and integrated with Snap4City Nodes/MicroServices block, can be behind dashboards to get data from them with Virtual Sensors and Actuators.
  - Dashboards may be connected to multiple IOT Applications and IOT devices
  - IOT Applications may be connected with multiple Dashboards and IOT devices
- **A network of Dashboards, IOT Apps and IOT Devices** and data is easily realized exchanging data via secure connections.
- **Training Cases**:
  - US2. Using and Creating Snap4City Applications with Dashboards
  - US9. Creating Snap4City IOT Applications, different formats, protocols, brokers, communications

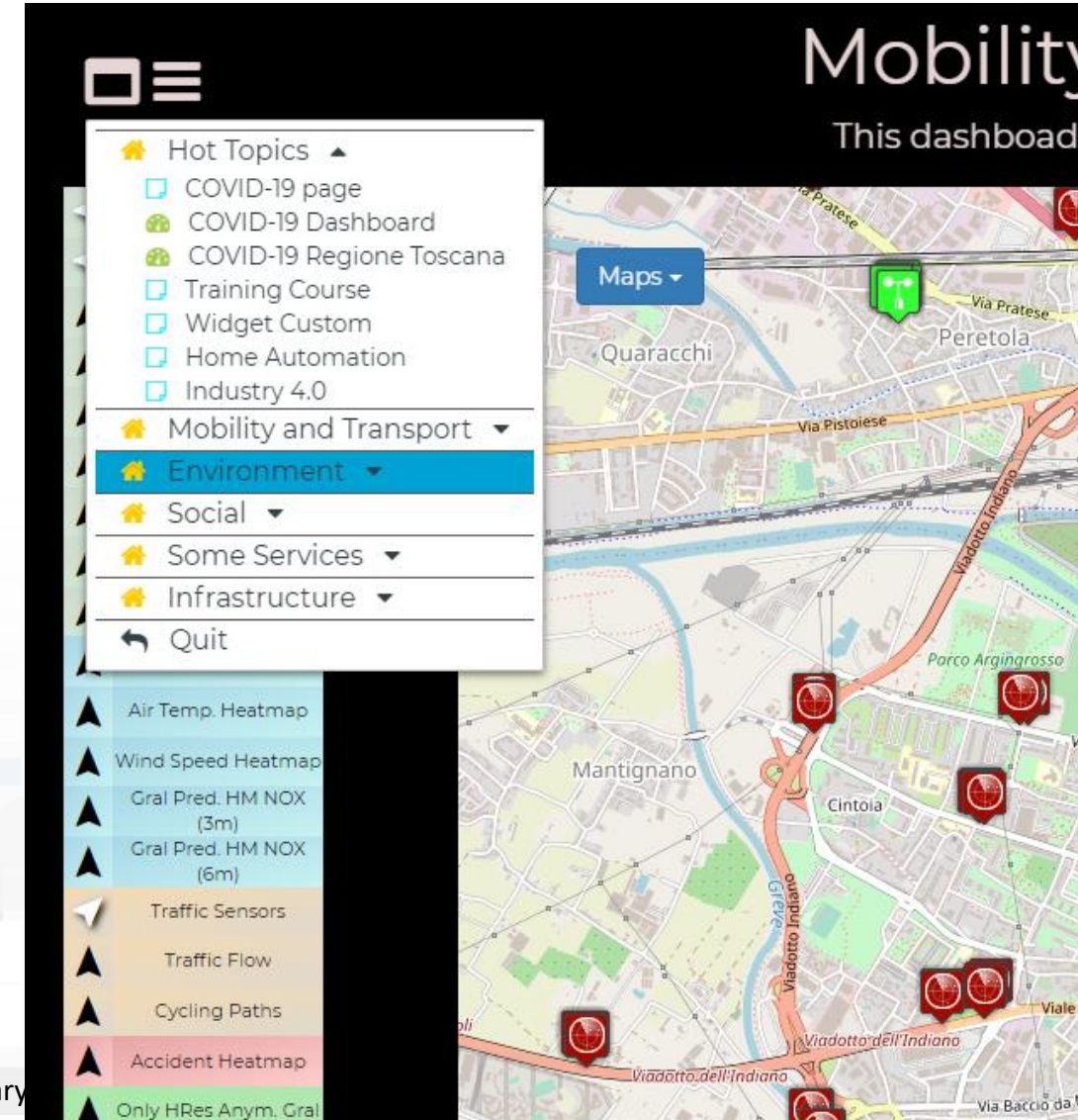
Dashboard Menu - Chatroom - - Notifications

(support for Virtual Control Rooms)



Dashboard Menu a Short Cut for other…..

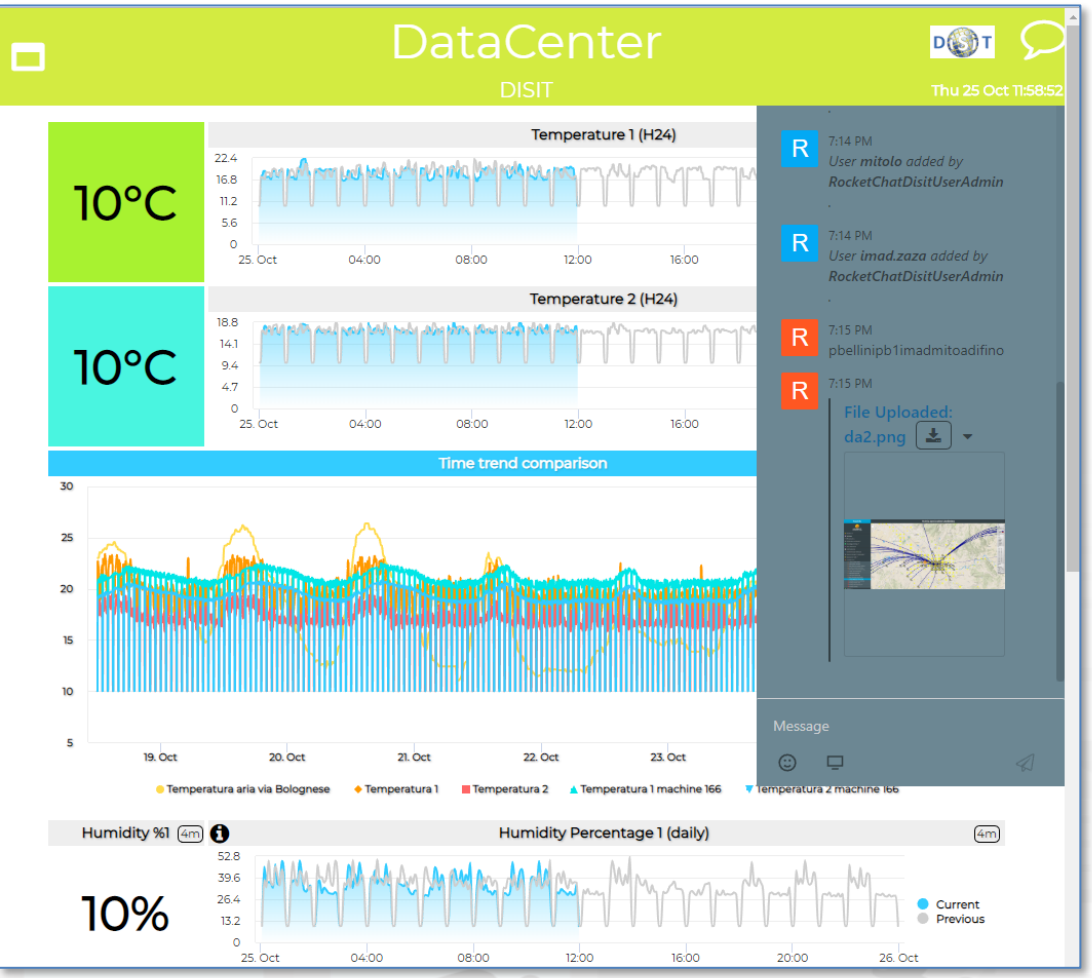
- **Each Organization** on Snap4City may define its own Menu on Dashboards
  - The Menu can be activated or not in each single Dashboard of the ORG
- **Definition includes a** list of Items and Subitems, each of which with
  - colors & icons
  - Links to web pages/dashboards to be activated and modality
  - User Roles at which it has to be proposed
  - Etc.



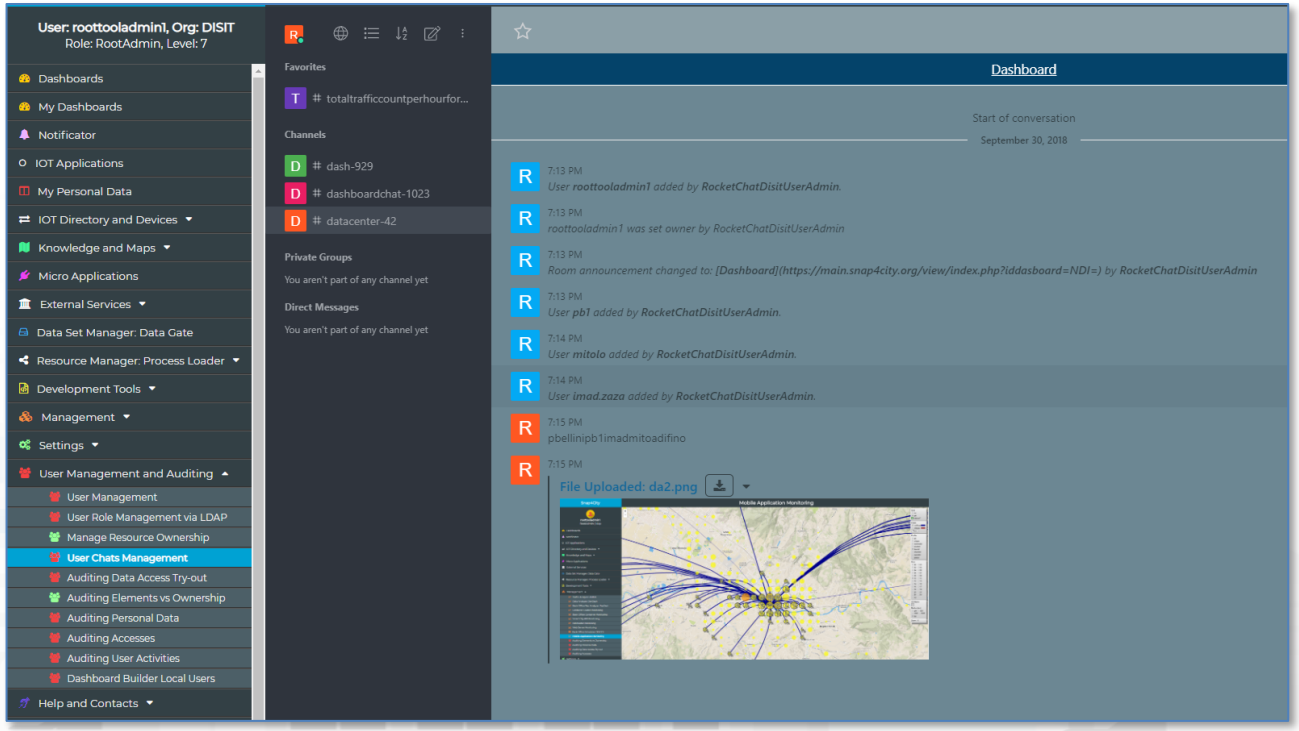
TC 1.23 – Dashboard Menu management per Organization

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

ChatRoom Per Dashboard

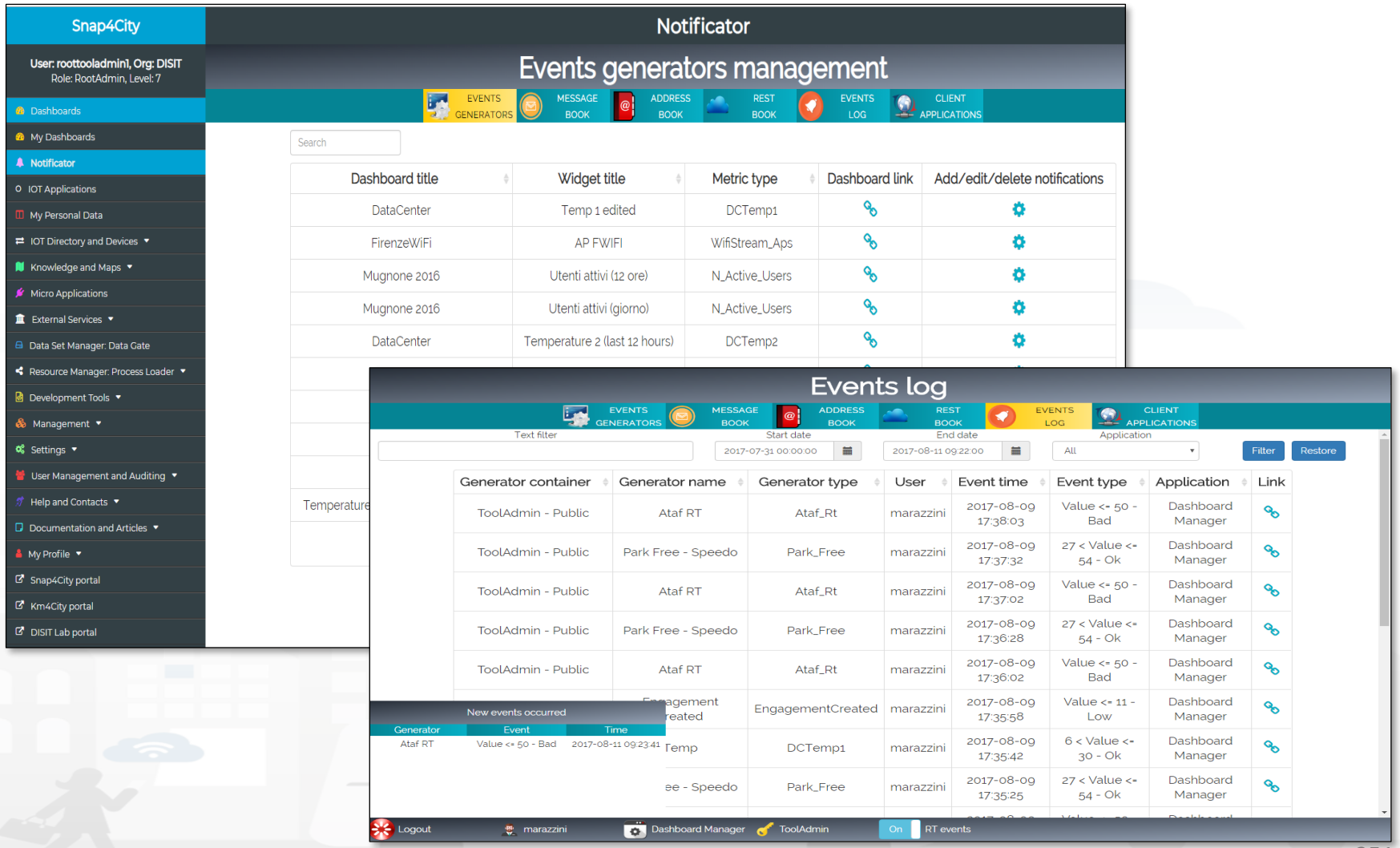


Chat Management



Smart City Monitoring: Notificator

- Notifications may arrive via Facebook, Telegram, SMS, email, etc., by exploiting IOT App behind the dashboard
- Integration with workflow management system for ticketing



Smart City Control Room: Video Wall, Situation Room



Control Rooms

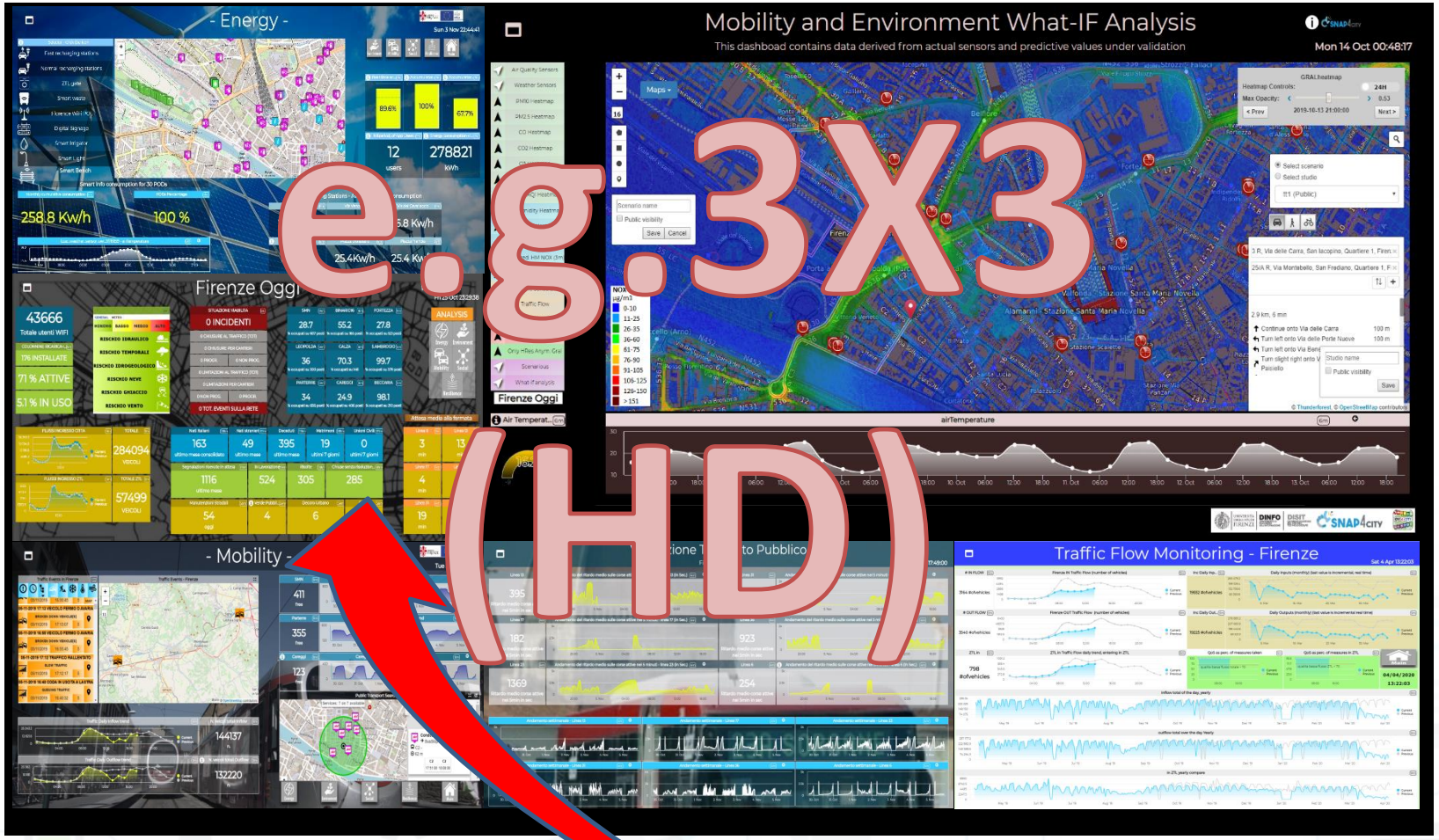
- **Multiple dashboards**, different features and tools for different users and contexts:
  - decision makers, operators, tablet for operators, mobile phones,…
  - **situation room** with touch screen,
  - **Chat room** for each dashboard, network of dashboards, etc.
  - **Interactive and animated widgets**: custom widgets, dynamic pins,
- **Unique Visual Prog. IoT App**: Business Logic, Integration, Connectors, Data Transform, ….
- **Large range of data, beyond GIS and IoT, also derived data**
  - historical and real time even driven
  - rendering data and acting on the field, actuators, agents, final users, operators..
- **Easy to Reshape, adapt, evolve:** according to the City's Needs
- **Easy to Add Features:** data analytics, custom modules, integration, interoperable, ….
- **Controlling Control Room, video walls**:
  - automated reconfiguration on the basis of the events
  - passing from operators to wall, etc..
  - Multiple operators stations with multiple monitors

Control Room





Video Wall







From Consolle Operator to the Video Wall



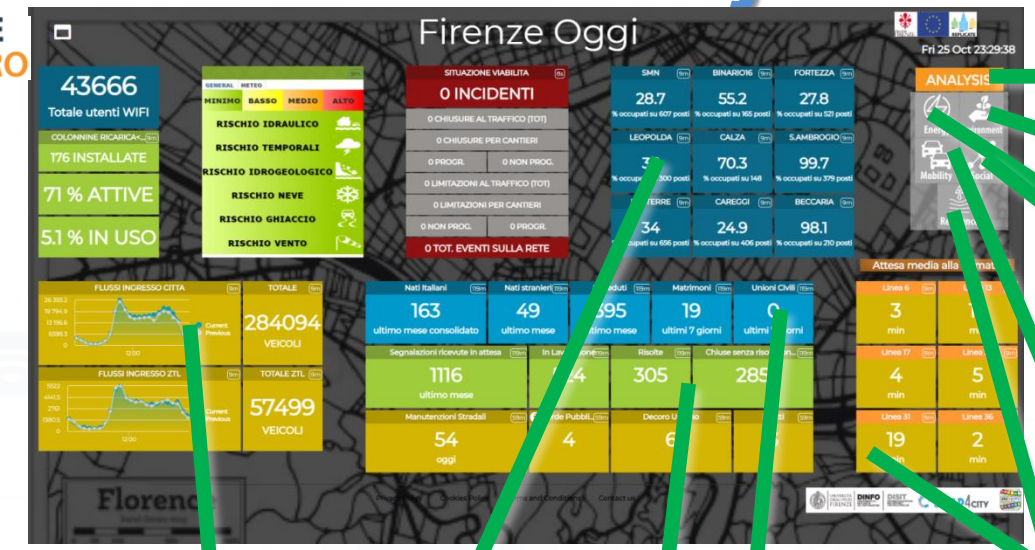
We expect you at Stand 120, Hall P2 , Level 0, Street A
Smart City Expo World Congress 2018
13-15 Novembre 2018, Barcelona, Gran Via Venue

SMARTCITY EXPO WORLD CONGRESS

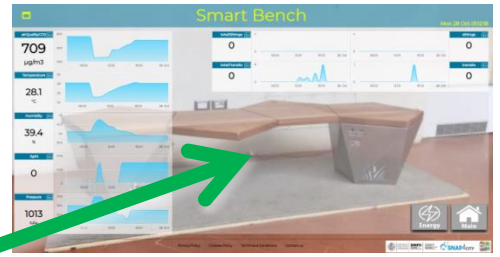
http://www.darionardella.it/il-sindaco-dario-nardella-in-missione-a-madrid-e-barcellona/

Smart City Control Room

a set of dashboards and tools



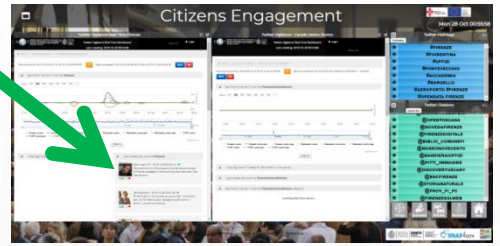


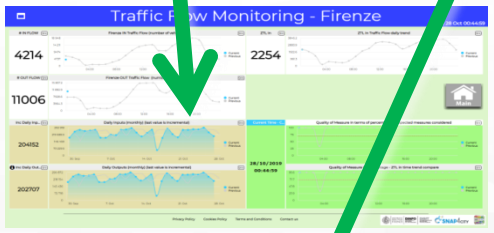








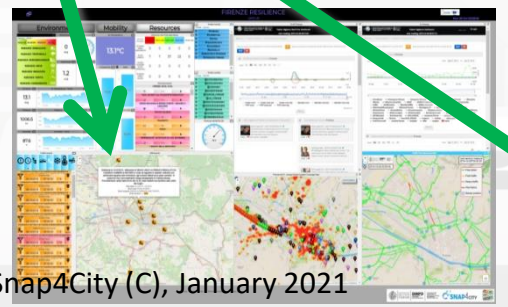


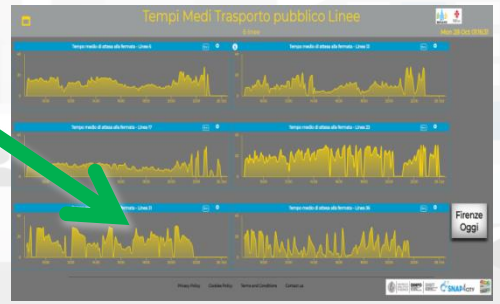












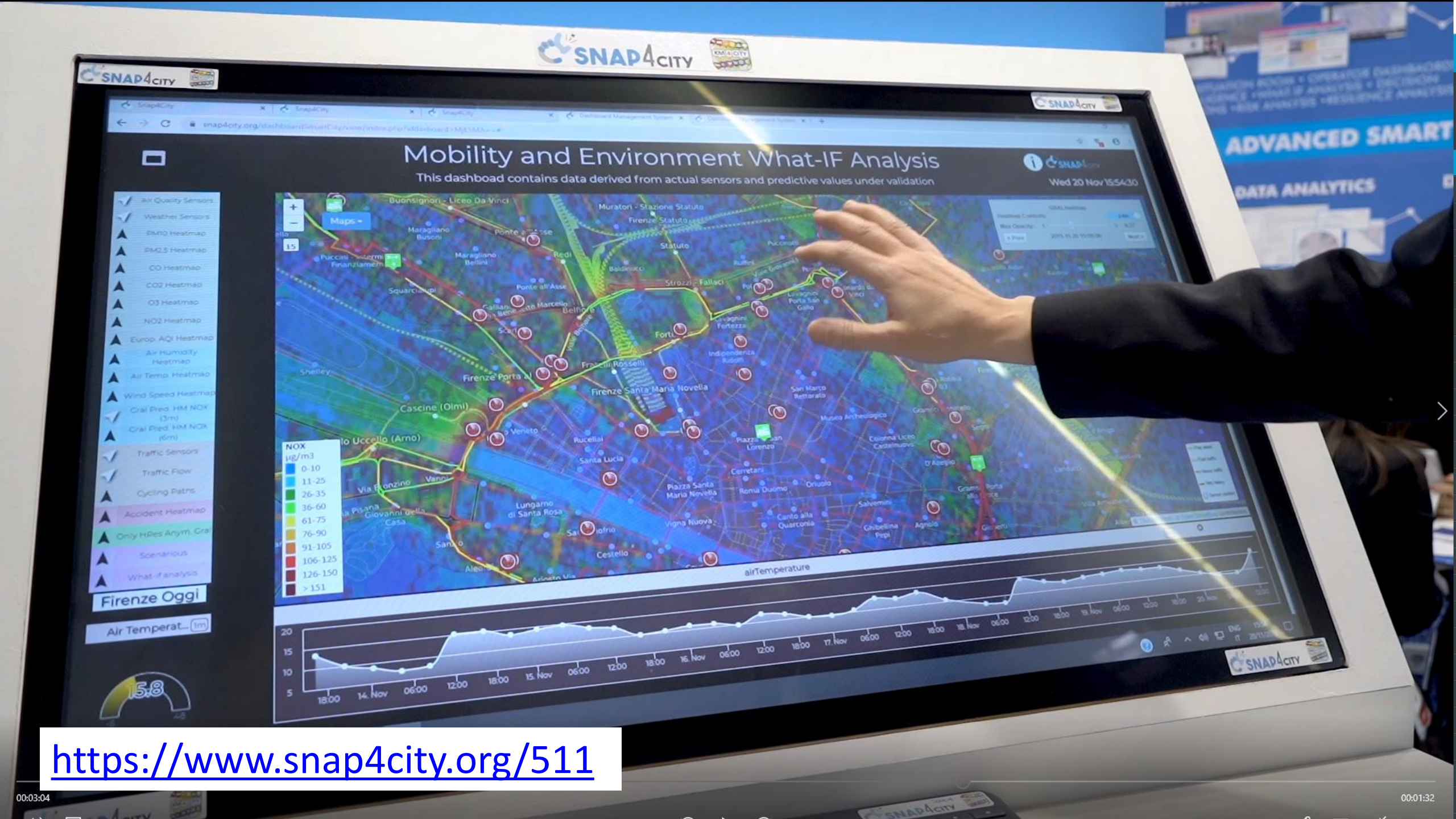




Chemical Plant Dashboard Green Impact Capacity (GIC)

Altair Control room





https://www.snap4city.org/511

00:03:04

00:01:32

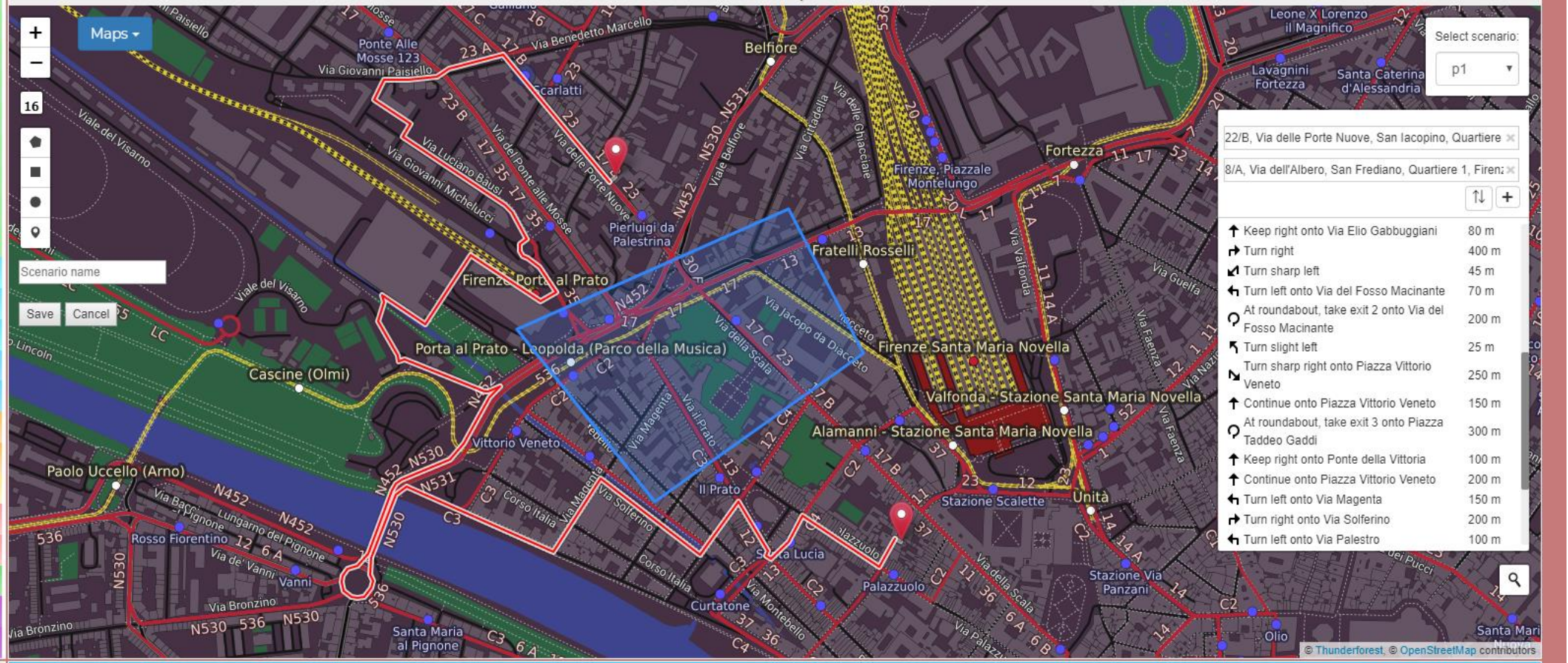
Firenze & Toscana - Background Orthomaps Test

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

Sat 7 Sep 10:37:31

- Air Quality Sensors
- Weather Sensors
- PM10 Heatmap
- PM2.5 Heatmap
- CO Heatmap
- CO2 Heatmap
- O3 Heatmap
- NO2 Heatmap
- Europ. AQI Heatmap
- Air Humidity Heatmap
- Air Temp. Heatmap
- Wind Speed Heatmap
- Gral Pred. HM NOX (3m)
- Gral Pred. HM NOX (6m)
- Traffic Sensors
- Traffic Flow
- Cycling Paths
- Accident Heatmap
- Accident Heatmap 2
- Only HRes Anym. Gral
- Scenarious
- What-if analysis

Multi Map

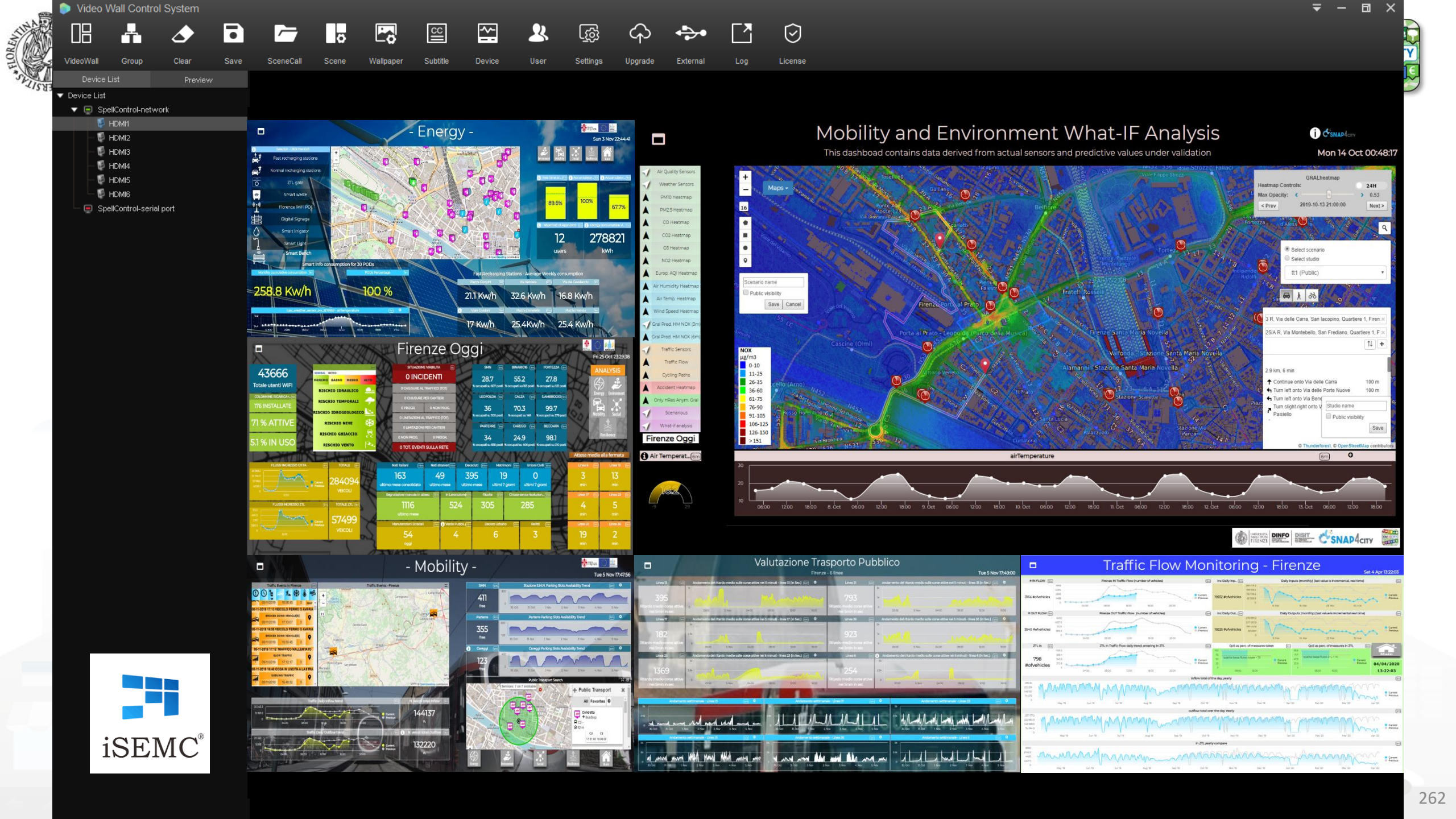


Air Temperature Bolognese 6m

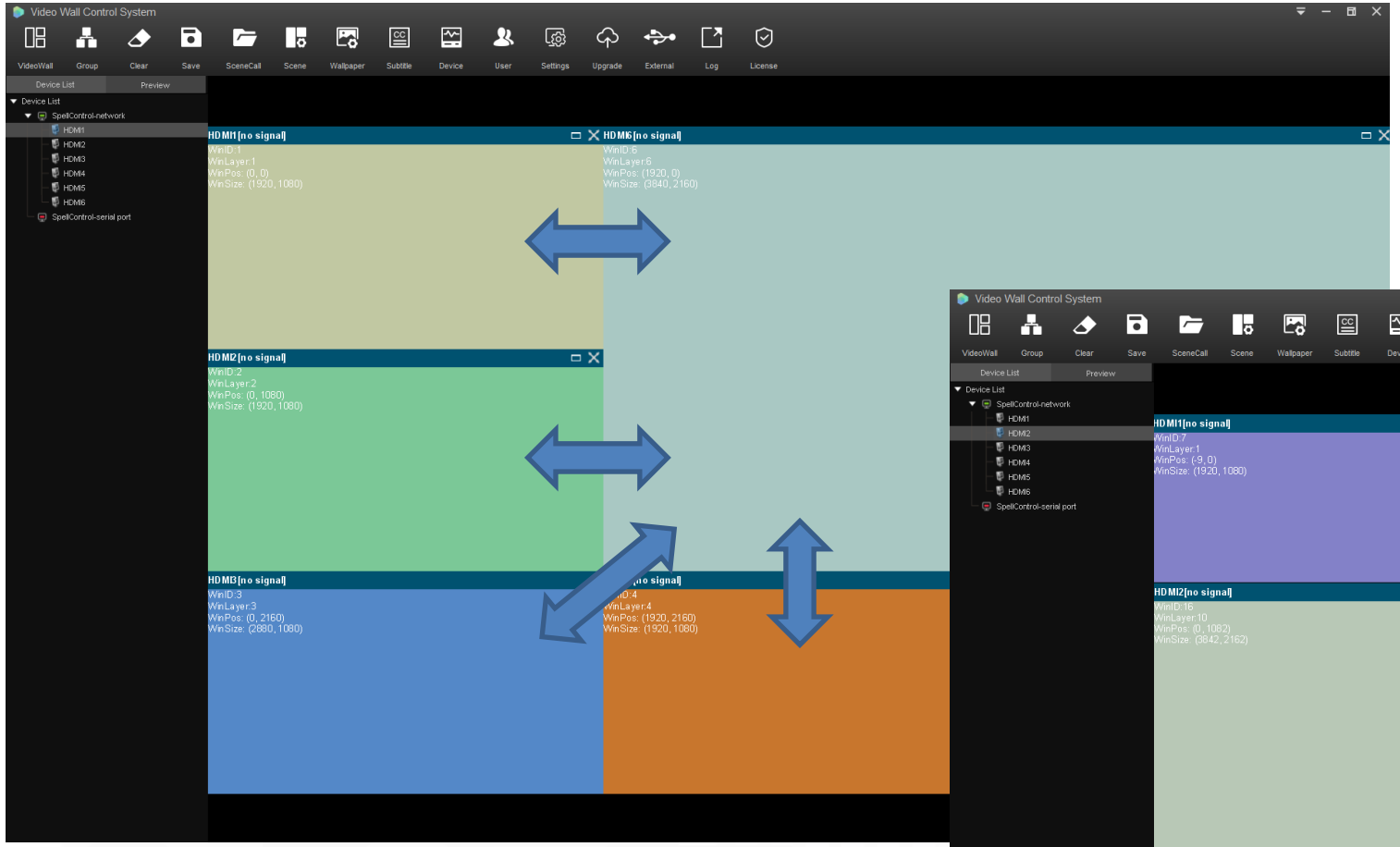


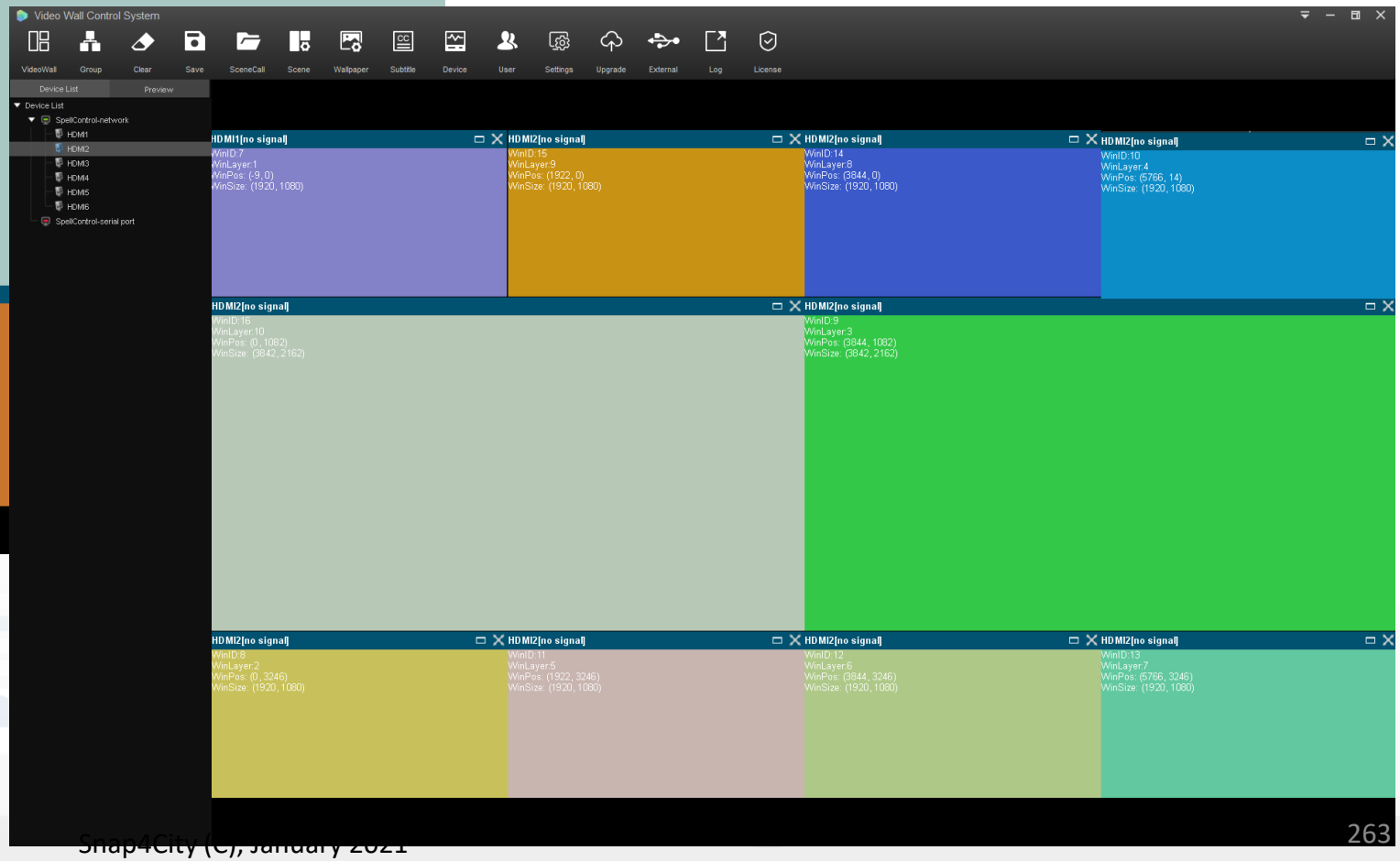
SIRSensor_TOS01001095 - airTemperature 6m




Video Wall Control System
VideoWall
Group
Clear
Save
SceneCall
Scene
Wallpaper
Subtitle
Device
User
Settings
Upgrade
External
Log
License
Device List
Preview
Device List
SpellControl-network
HDMI1
HDMI2
HDMI3
HDMI4
HDMI5
HDMI6
SpellControl-serial port
- Energy -
Fast recharging stations
Normal recharging stations
ZTL gate
Smart waste
Florence WiFi PO
Digital Signage
Smart Irrigator
Smart Light
Smart Bench
89.6%
100%
67.7%
12
users
278821
kWh
Smart Info consumption for 30 PODs
258.8 Kw/h
100 %
Fast Recharging Stations - Average Weekly consumption
21.1 Kw/h
32.6 Kw/h
16.8 Kw/h
17 Kw/h
25.4Kw/h
25.4 Kw/h
Firenze Oggi
43666
Totale utenti WIFI
176 INSTALLATE
71 % ATTIVE
5.1 % IN USO
RISCHIO IDRAULICO
RISCHIO TEMPORALI
RISCHIO IDROGEOLOGICO
RISCHIO NEVE
RISCHIO GHIACCIO
RISCHIO VENTO
0 INCIDENTI
ANALYSIS
284094
VEICOLI
57499
VEICOLI
163
49
395
19
0
1116
524
305
285
54
4
6
3
Air Quality Sensors
Weather Sensors
PM10 Heatmap
PM2.5 Heatmap
CO Heatmap
CO2 Heatmap
O3 Heatmap
NO2 Heatmap
Europ. AQI Heatmap
Air Humidity Heatmap
Air Temp. Heatmap
Wind Speed Heatmap
Traffic Sensors
Traffic Flow
Cycling Paths
Accident Heatmap
Only HRes Anym. Grid
Scenarious
What-if analysis
Firenze Oggi
Mobility and Environment What-IF Analysis
This dashboad contains data derived from actual sensors and predictive values under validation
Mon 14 Oct 00:48:17
Maps
NOX µg/m3
0-10
11-25
26-35
36-60
61-75
76-90
91-105
106-125
126-150
> 151
airTemperature
- Mobility -
144137
132220
Valutazione Trasporto Pubblico
Traffic Flow Monitoring - Firenze
iSEMC®

A number of Scenarios



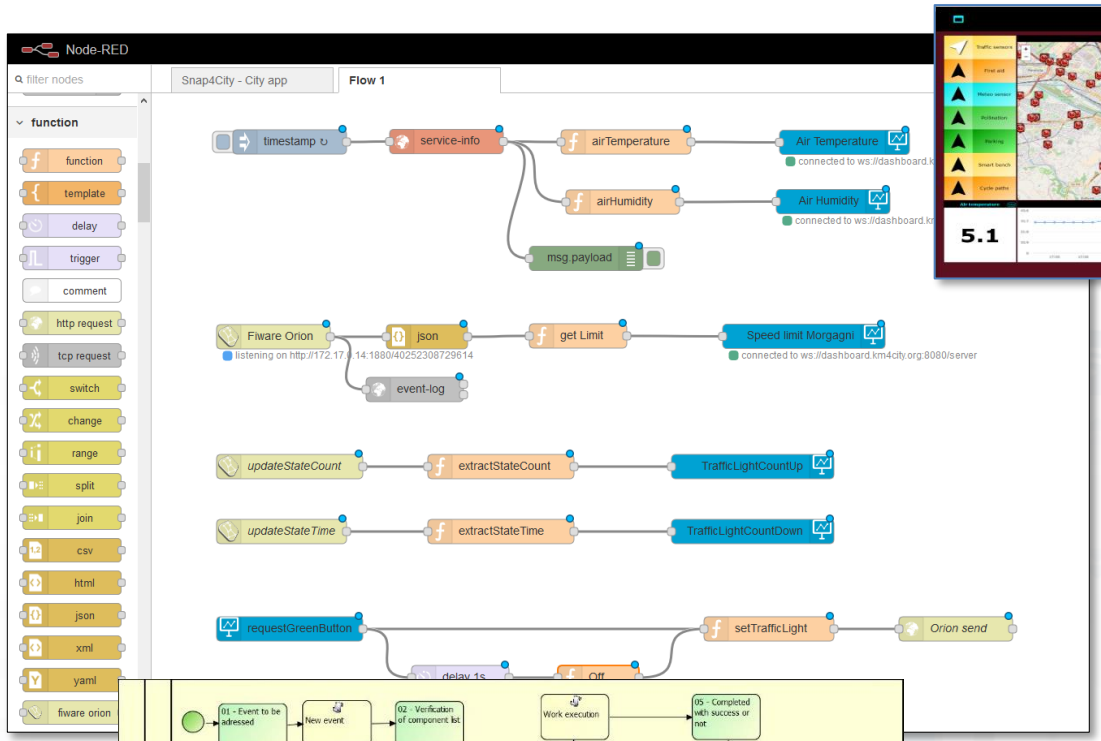


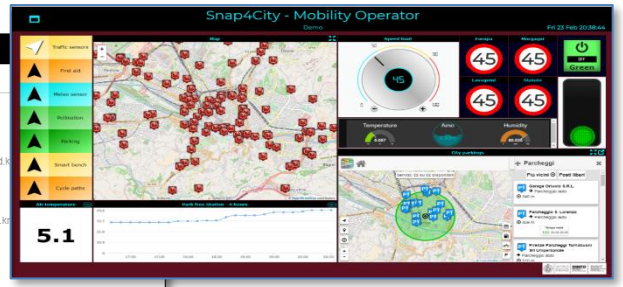
For example

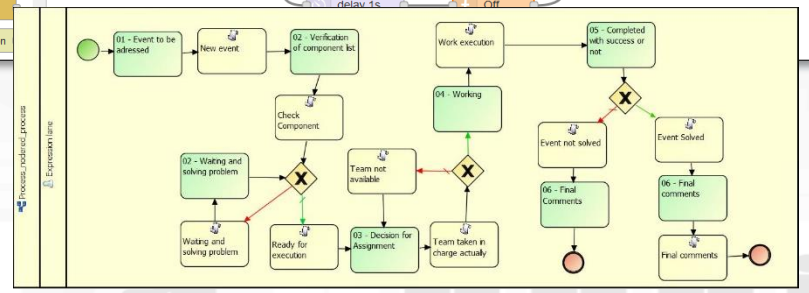
Smart City Monitoring: notifications, alerting

Notification with IOT App may

- Fire on any kind of condition exploiting on IOT App logic
- produce messages/events on
  - **Facebook, Telegram,**
  - **SMS, MMS, IOT Devices, ..**
  - **email, LOGS, FTP, ..**
  - **dashboards**, mobiles, …
  - **Workflow/incident** management system for **ticketing**
  - **video wall** management,
  - etc. etc.











facebook

Dashboards Production



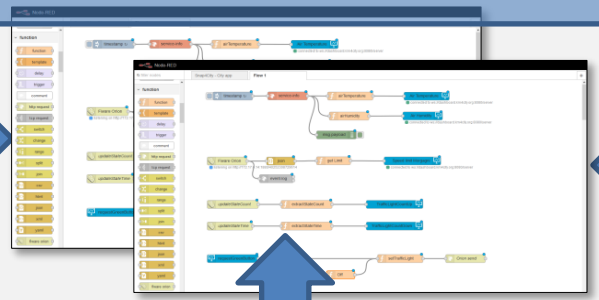
Snap4City: Builder of Sentient Cities Solutions

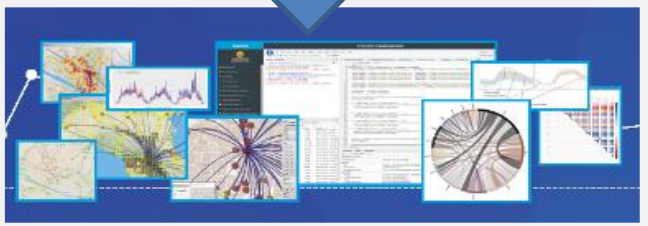
Dashboards with data driven IOT Applications enforcing intelligence

IOT and data World

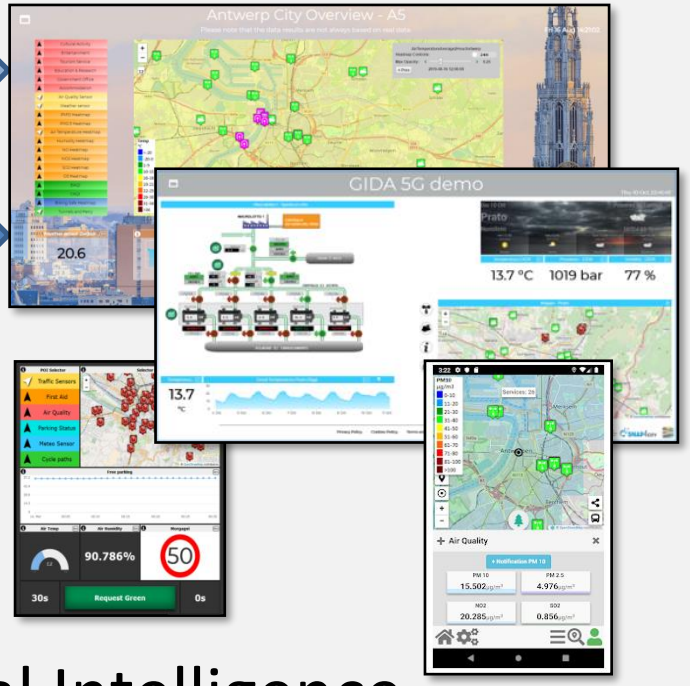


IOT Applications



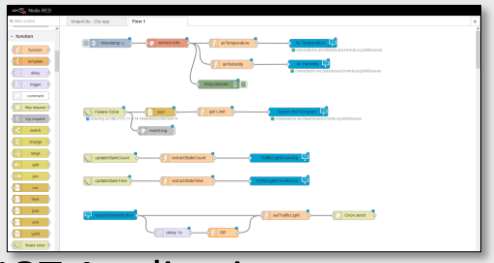


Dashboards and Apps



Big Data Analytics, Artificial Intelligence

Dashboard Development



IOT Applications

Knowledge Base, Km4City



Knowledge and Storage Data from the Field and City + MyKPI ++

Widget Collection





Micro Applications

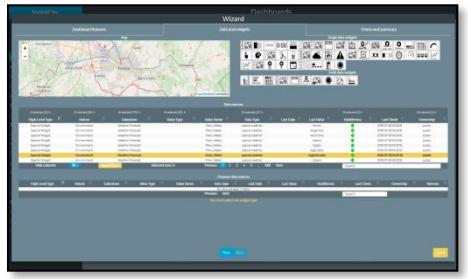


External Services



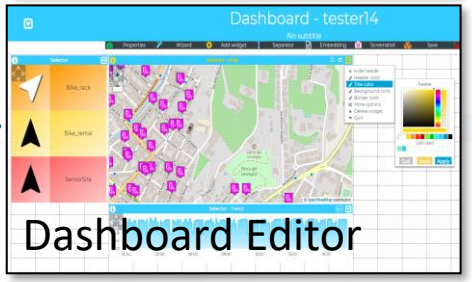
Custom Widgets/ Synoptics

Dashboard Wizard

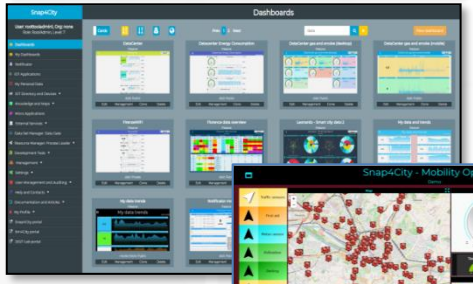


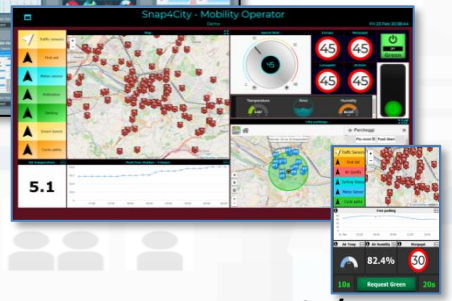
Create, save, load, delegate, grant access





Dashboard Editor



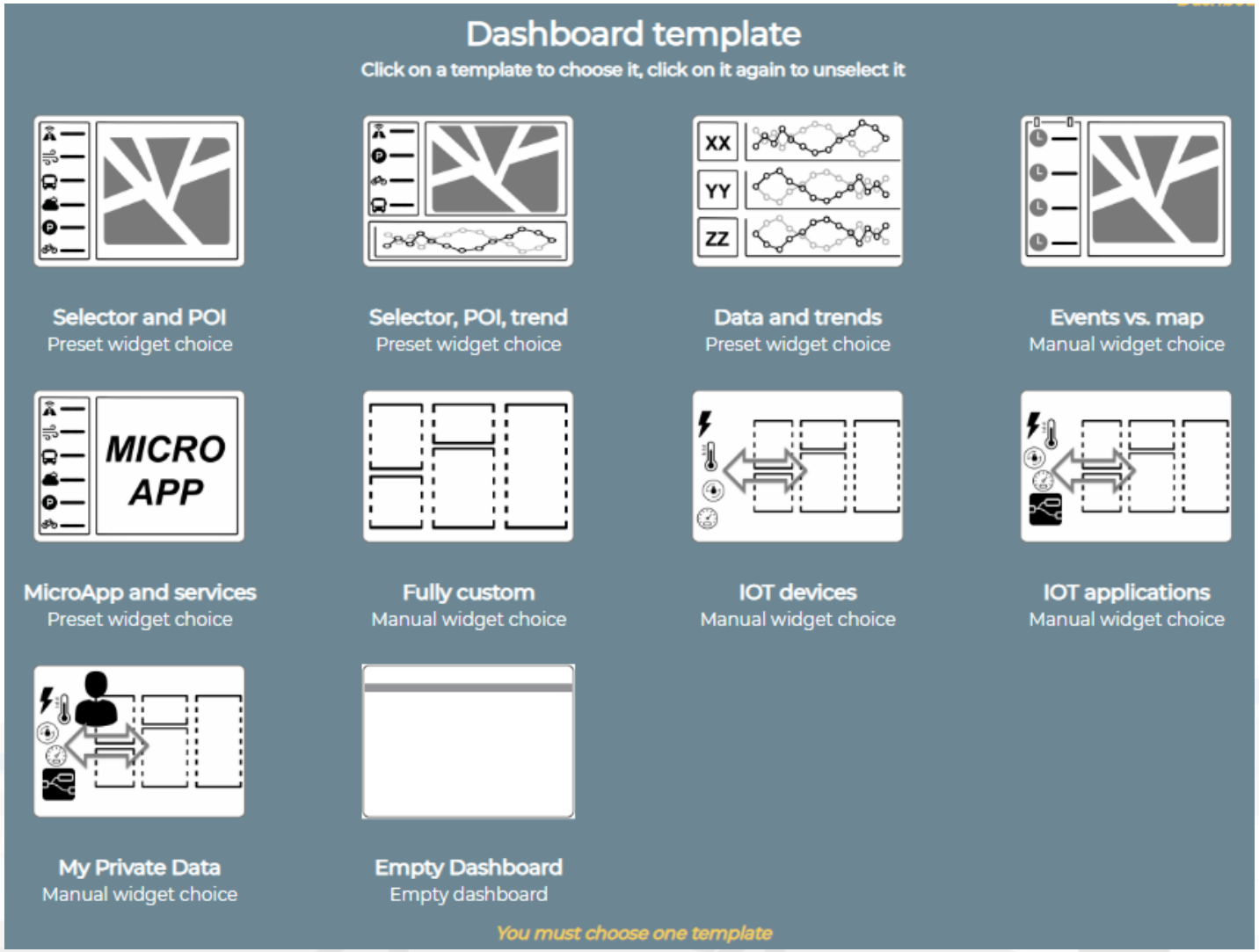


Public Dashboard Collection



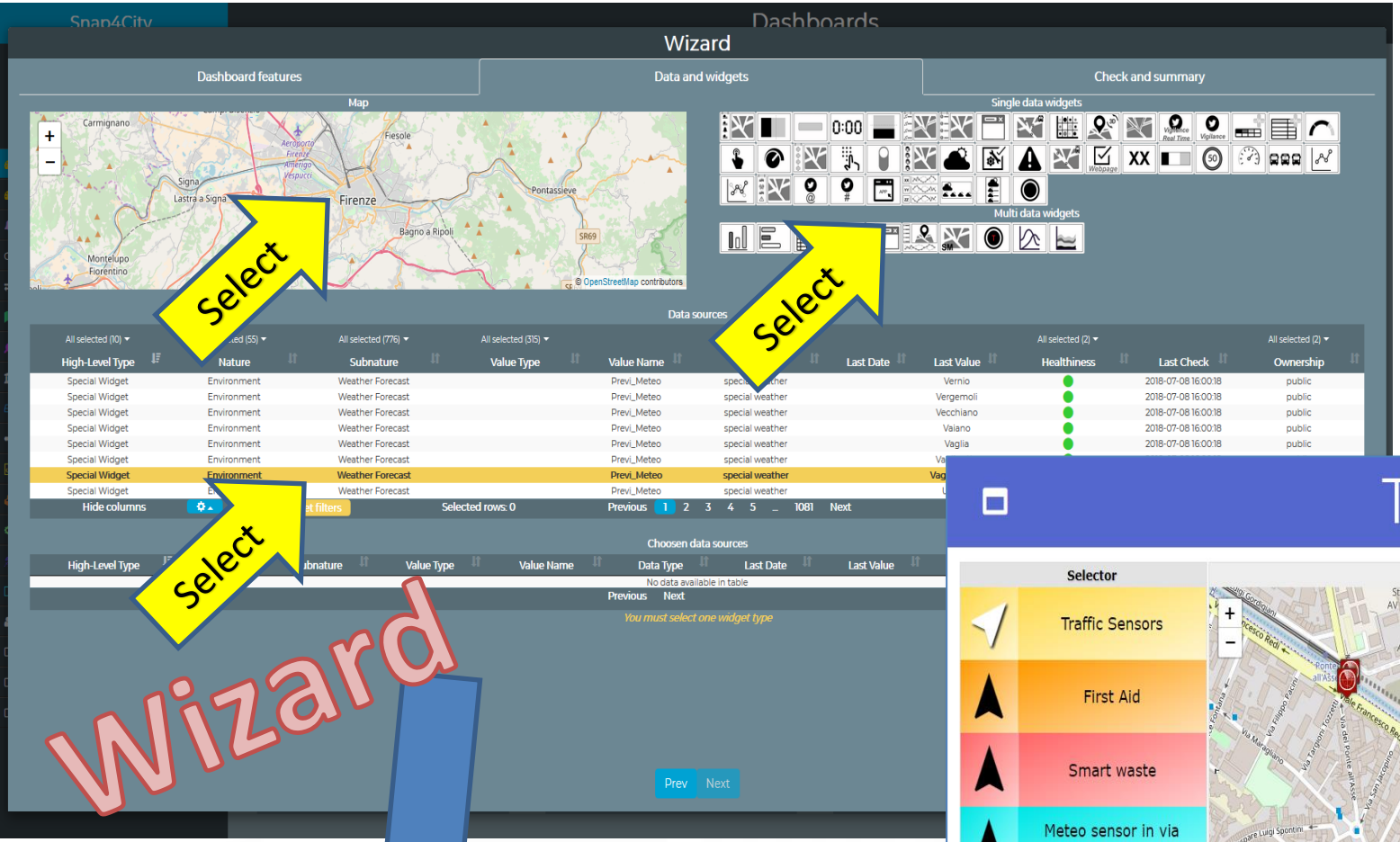
My Own Dash/App

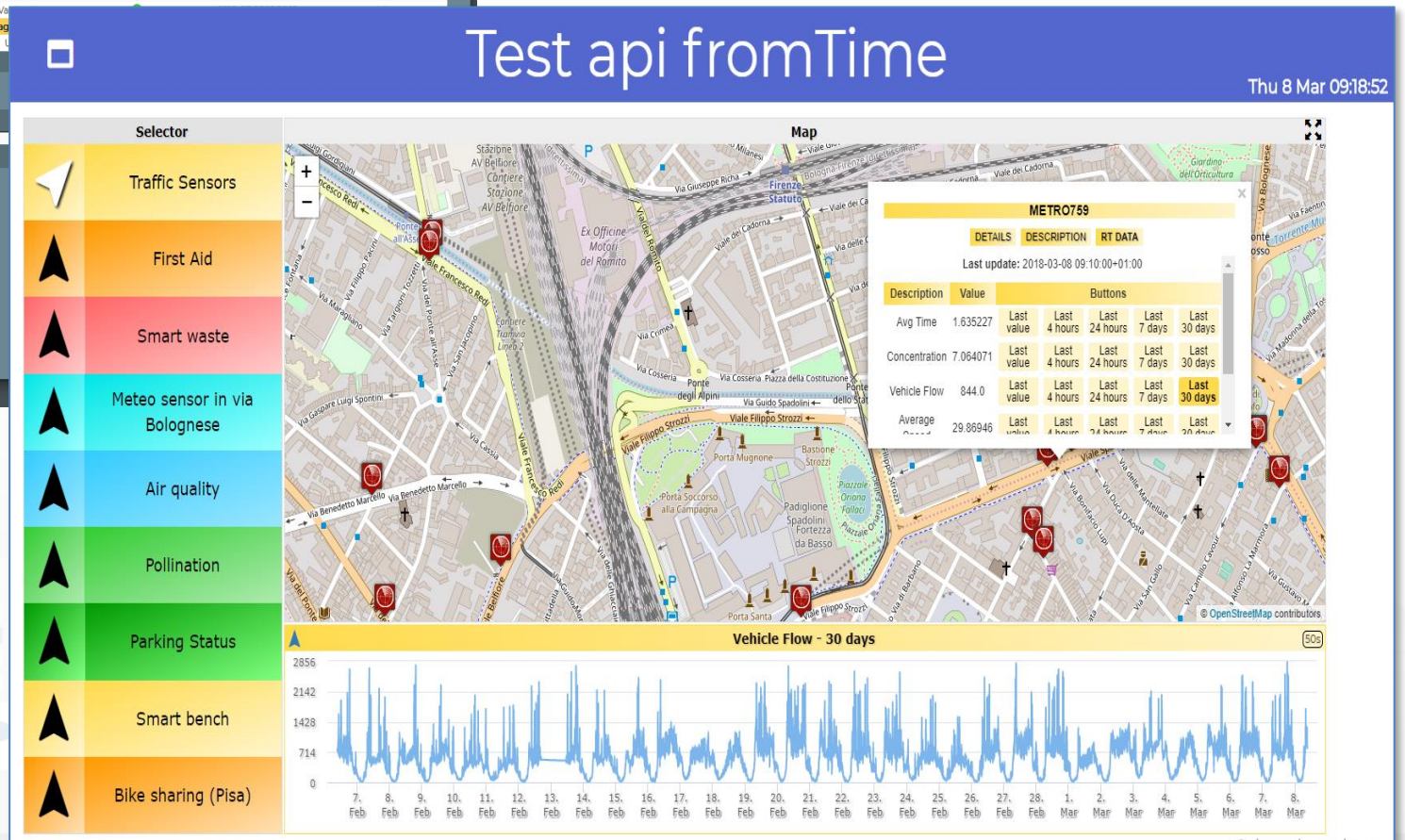
From Templates to Wizard and Dashboards



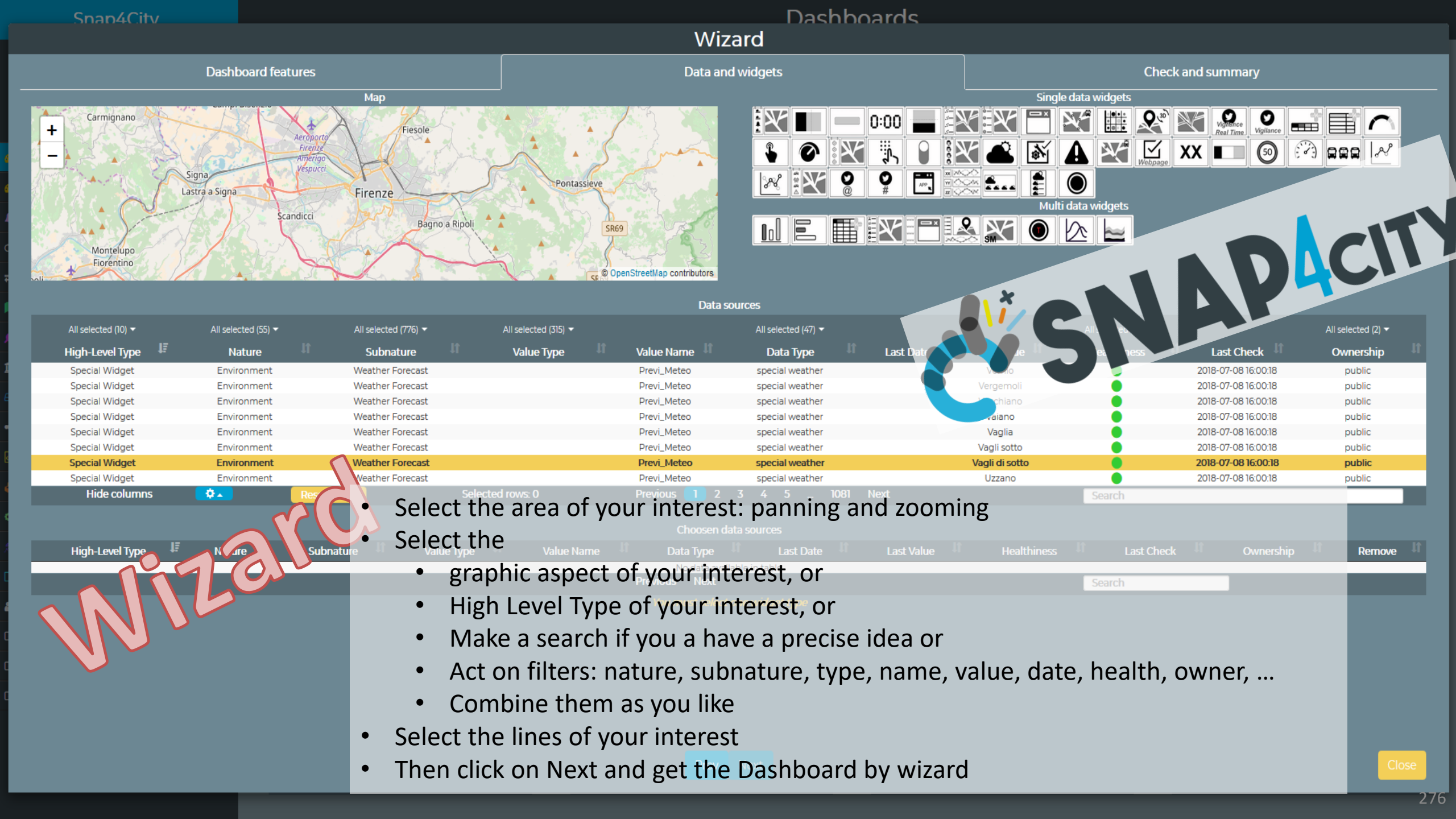
- to create a new Dashboard
- to add widgets and/or groups of them on any Dashboard

Dashboard Wizard



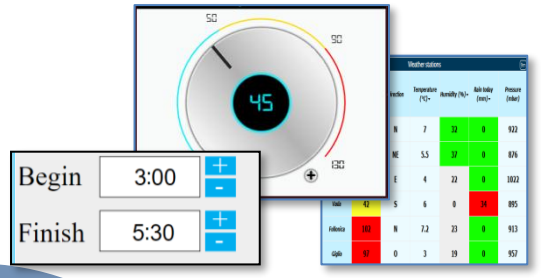


The Wizard help you in selecting only possible combination of data vs graphic representation


Wizard
Dashboard features
Data and widgets
Check and summary
Map
Carmignano
Fiesole
Aeroporto Firenze Amerigo Vespucci
Signa
Lastra a Signa
Firenze
Pontassieve
Scandicci
Bagno a Ripoli
SR69
Montelupo Fiorentino
© OpenStreetMap contributors
Single data widgets
Multi data widgets
Data sources
All selected (10)
All selected (55)
All selected (776)
All selected (315)
All selected (47)
All selected (2)
High-Level Type
Nature
Subnature
Value Type
Value Name
Data Type
Last Check
Ownership
Special Widget Environment Weather Forecast Previ_Meteo special weather 2018-07-08 16:00:18 public
Vergemoli
Vaglia
Vagli sotto
Vagli di sotto
Uzzano
Hide columns
Selected rows: 0
Previous 1 2 3 4 5 1081 Next
Search
Choosen data sources
Remove
Close
SNAP4CITY
Wizard
Select the area of your interest: panning and zooming
Select the
graphic aspect of your interest, or
High Level Type of your interest, or
Make a search if you a have a precise idea or
Act on filters: nature, subnature, type, name, value, date, health, owner, …
Combine them as you like
Select the lines of your interest
Then click on Next and get the Dashboard by wizard

Dashboard List and Editor



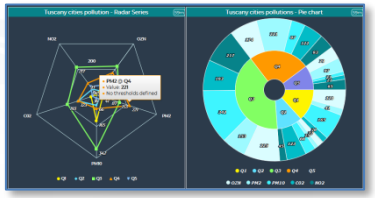


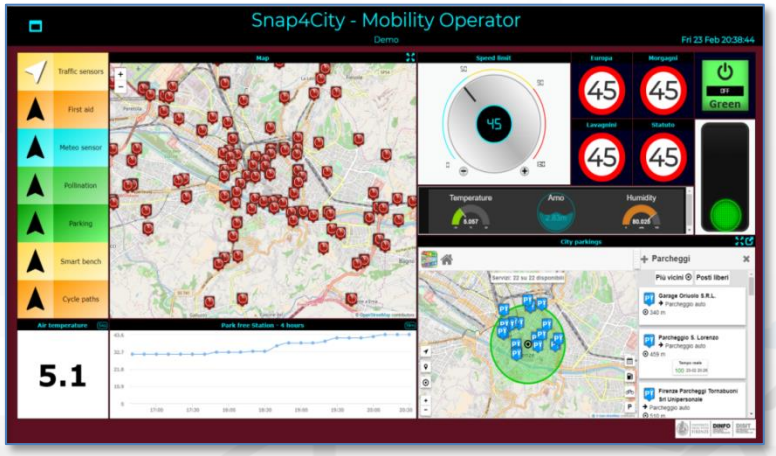


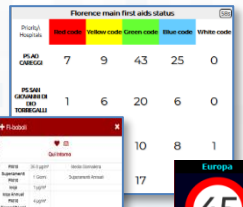


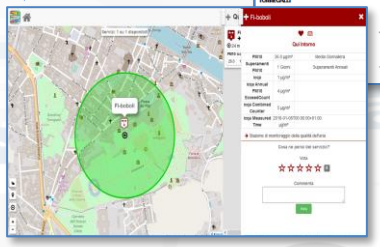




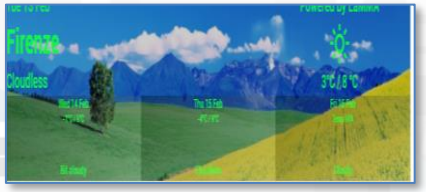


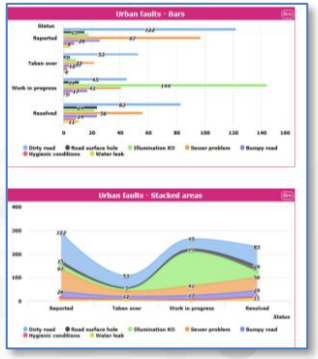












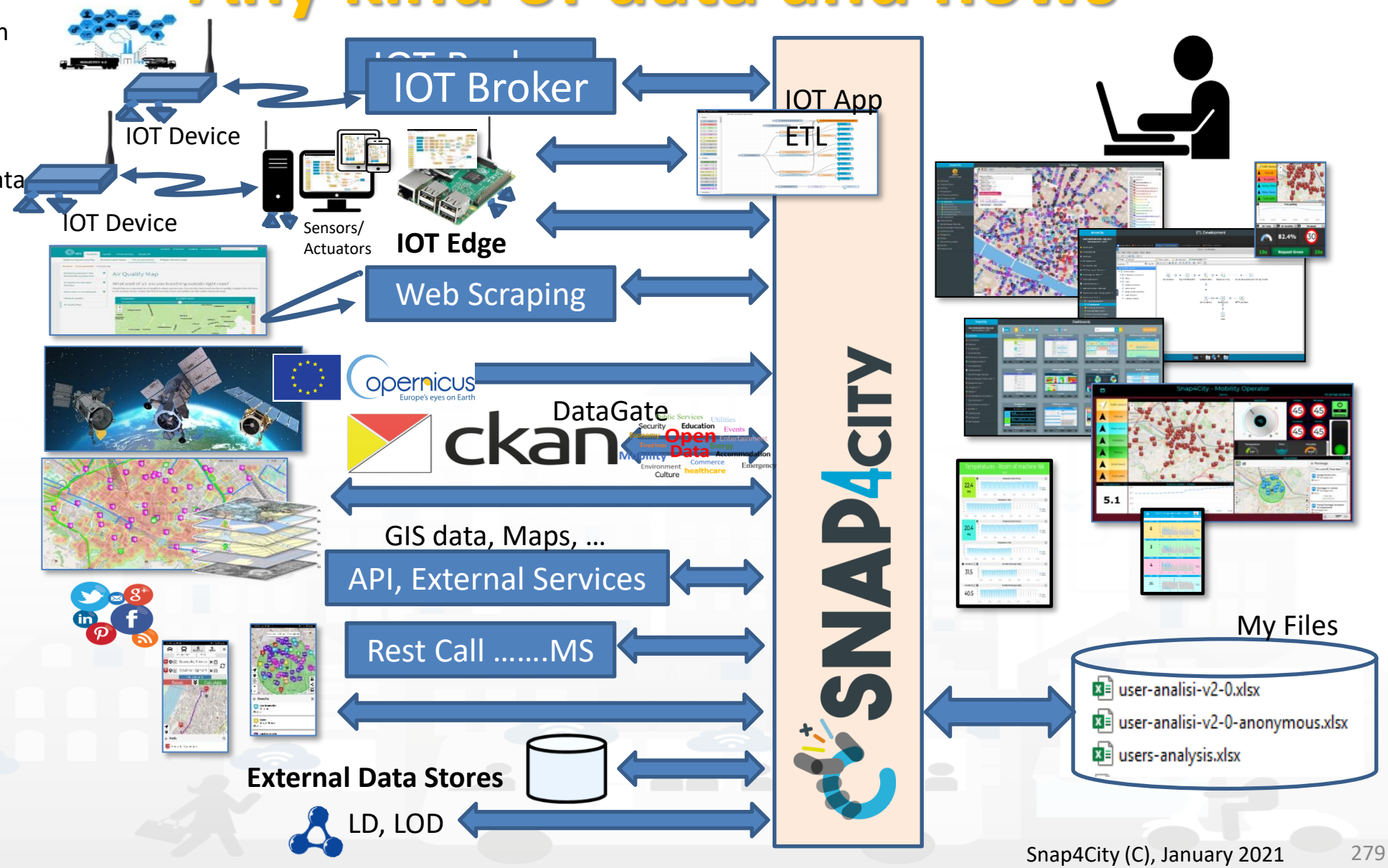
TOP

DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT



Any kind of data and flows

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



Smart City Functional Architecture

Transport systems Mobility, parking



Public Services, Govern, events, …



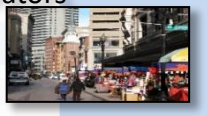
Sensors, IOT Cameras, Wi-Fi



Environment, Water, energy



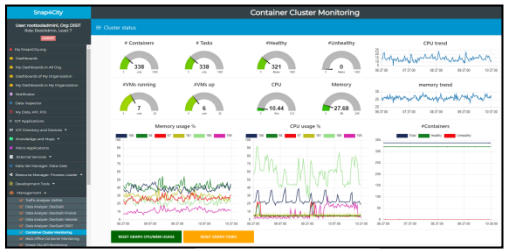
Shops, services, operators

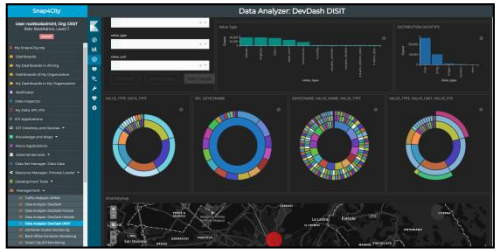


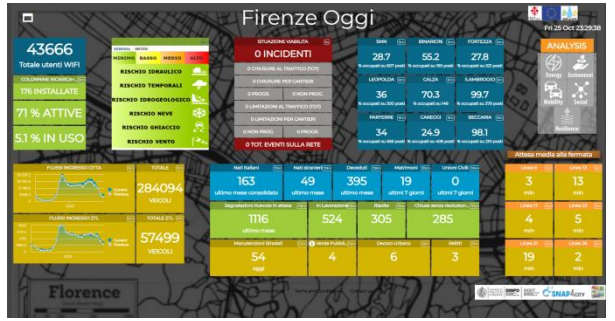
Social Media

Social Media Crawler and Manager









Back-End

Front-End

Data Sources, External Services *PULL Data*

Data Sources, Brokers, External Services *Data Driven, Real Time*

Data Ingestion, aggregation, regularizatio n, reconcile: IOT Directory, NIFI, special tools

Knowledge base Semantic Reasoners

Indexing and aggregating Elastic Search

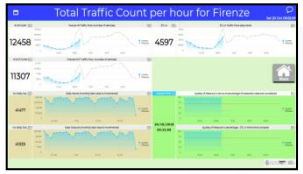
Federation

Search and Query, Smart City API, Web Socket Server, GIS, Facet, semantic

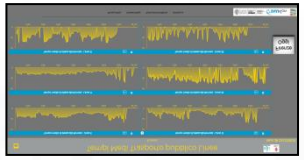
Data Analytics, Simulations, Special Tools R Studio, Tensor Flow, Python, ….

IOT Applications, Business Logic Node-RED + Snap4City MicroServices

Rendering Acting, Widgets, Synoptics, MicroApps User interface, Drill down, maps, heatmaps

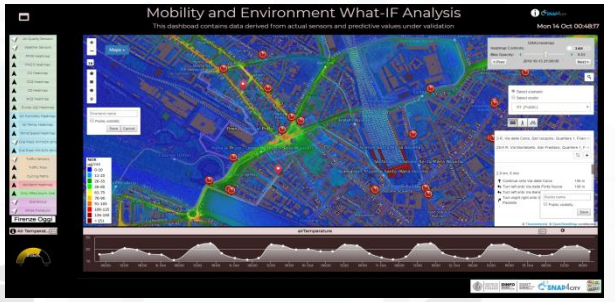








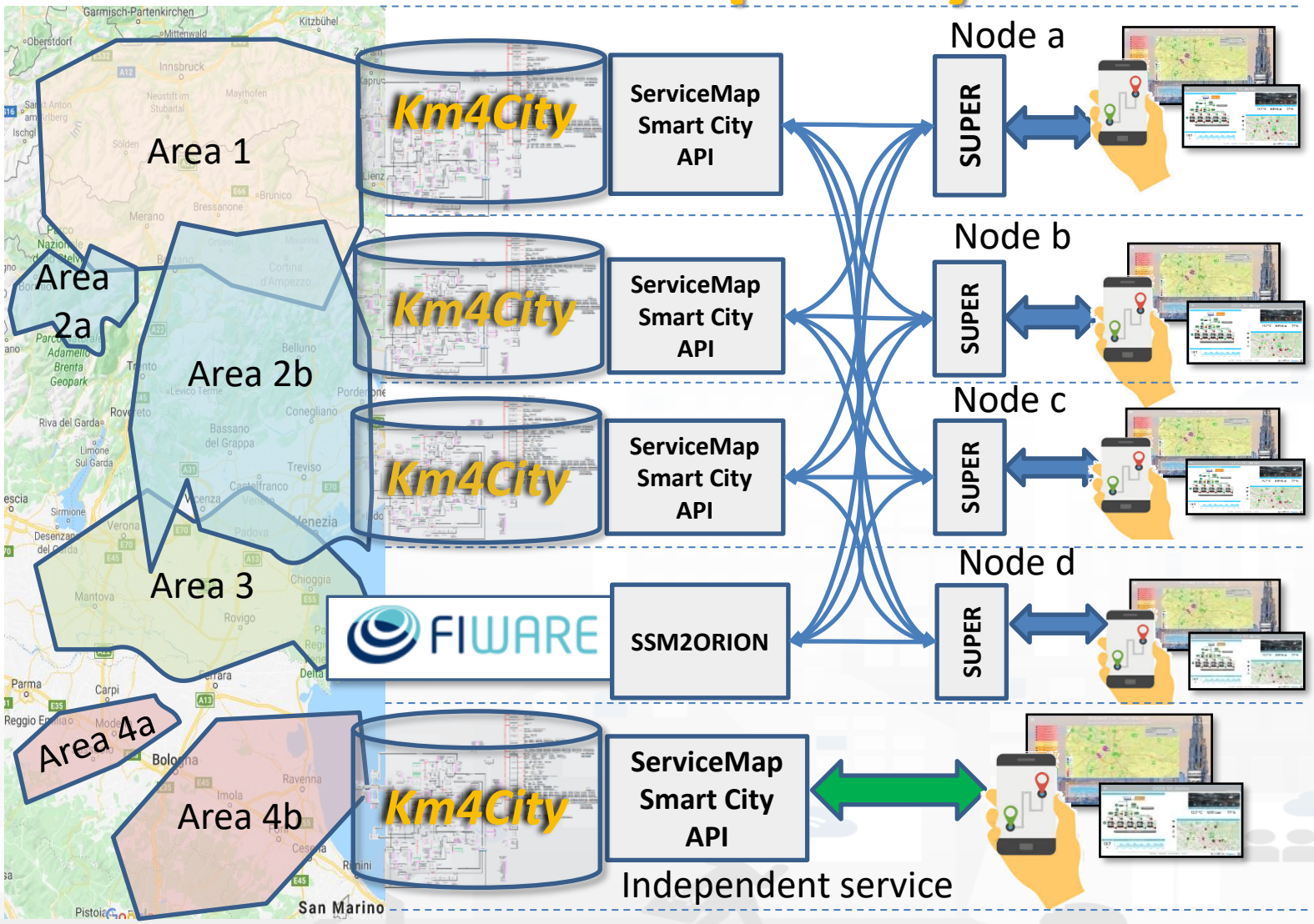




Inform, announce, Act!, warning, alarms, What-IF, ..

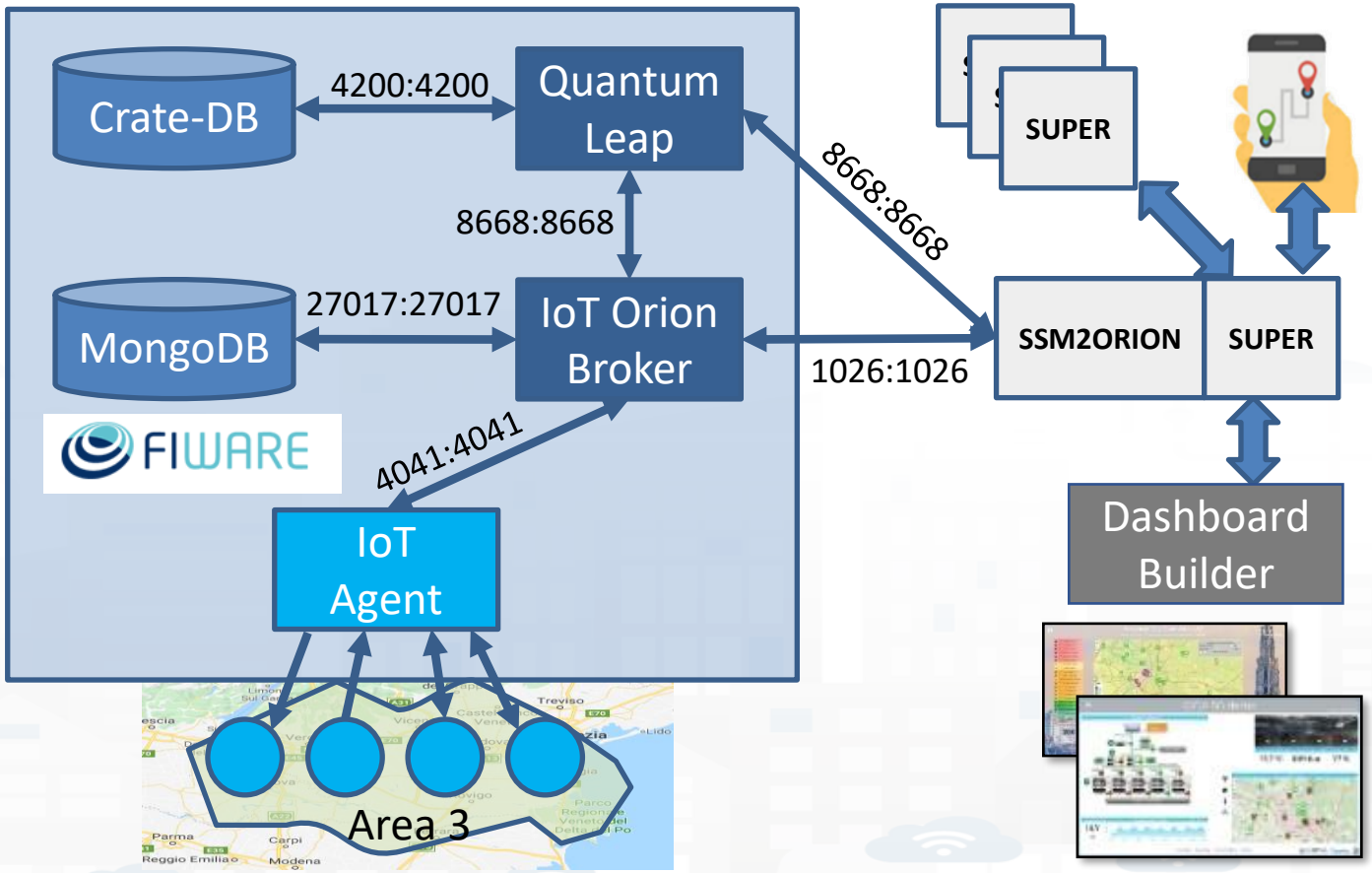
Authentication, Authorization, Platform & Processes Management, Data Inspector, Digital Twin, …

Federation of Snap4City Services

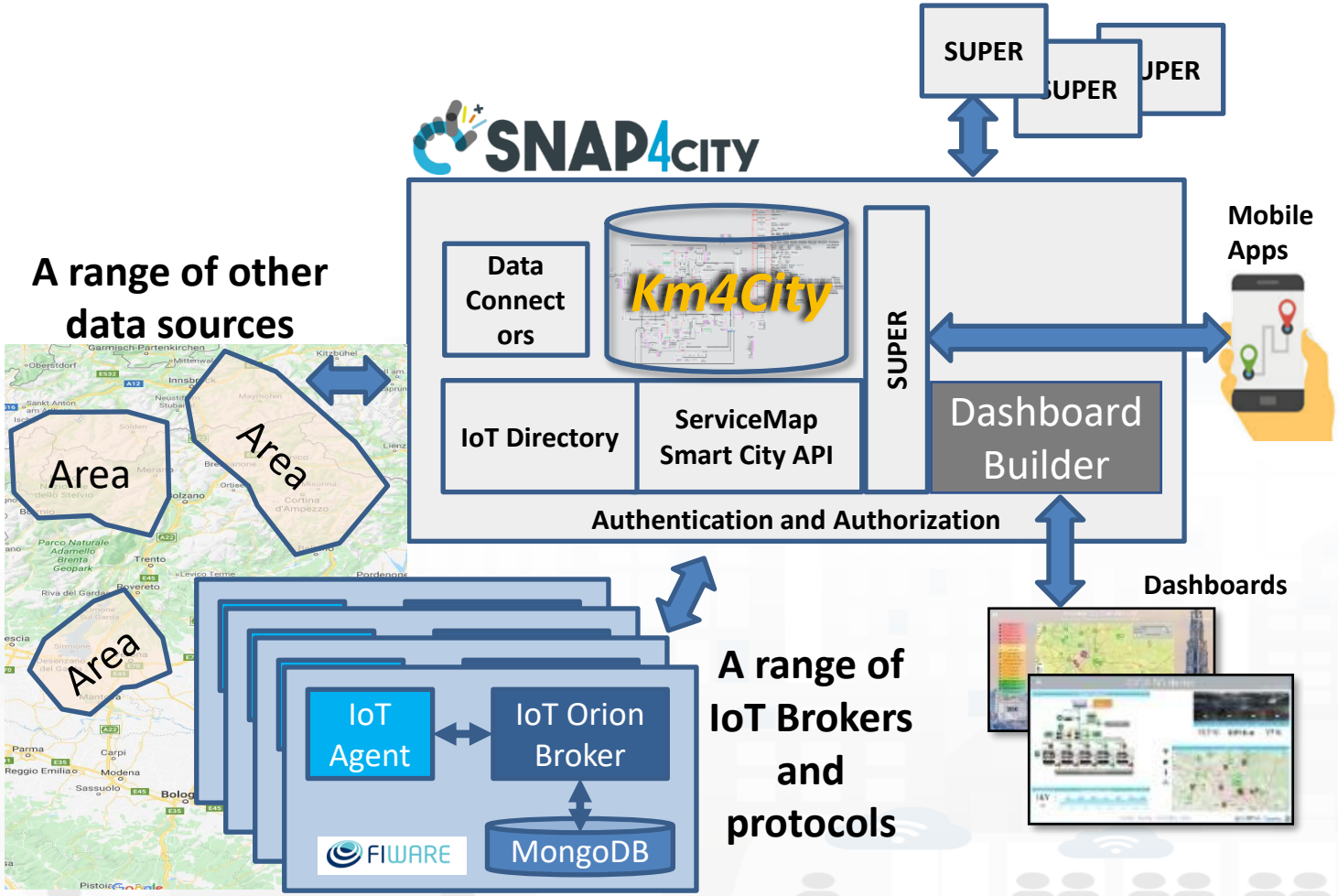


- A Mobile App may refer to one Smart City API Server (for Area 1) via SUPER and receive data from the Federated SUPERS (Area 2) if navigation, queries, etc. are leading to discover out of the addressed KB.
  - SUPER can be used for creating redundant and/or balanced distributed solutions for Federated KB. See Area 2, the two KB in the front.
  - Federated SUPER can have overlapped KB even totally.
  - A Mobile App can be developed to support multiple Smart City API servers, for balancing and
- The usage of Super is not mandatory so that separate services can be produced as well
- Super and Nodes presents the same Smart City APIs.

Federation of Snap4City vs IOT ORION Broker



Snap4City IoT Registration and Access

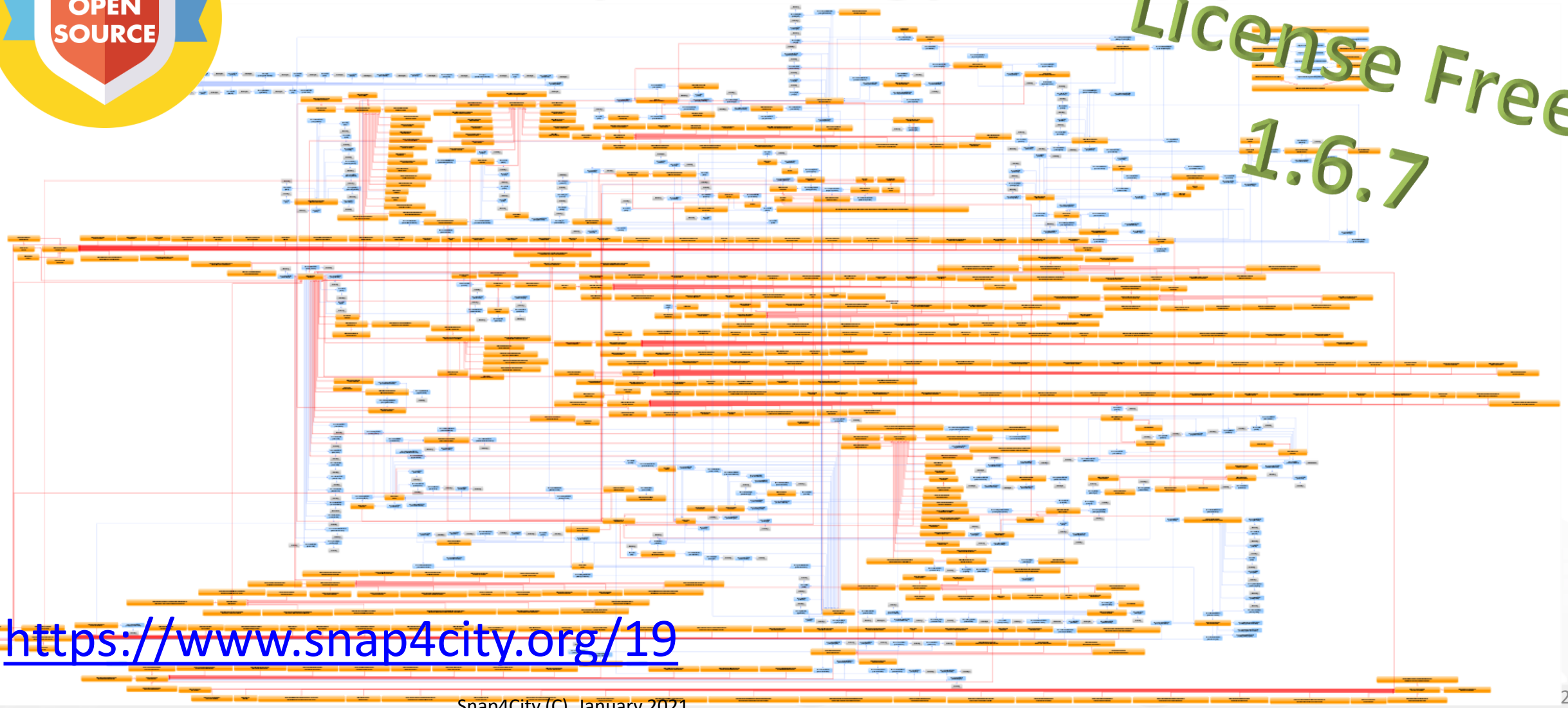


100% OPEN SOURCE

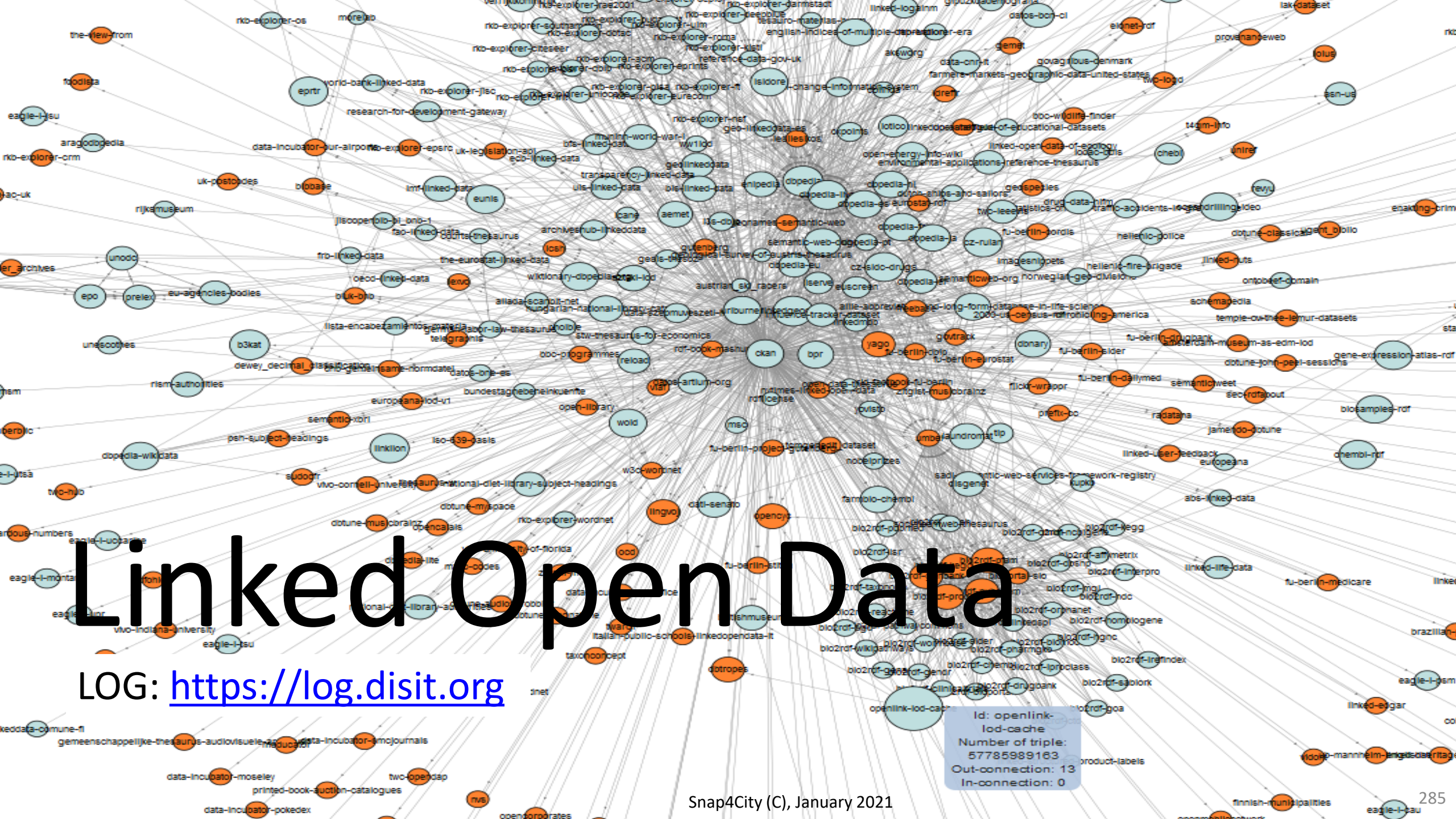
Smart-city Ontology km4city

License Free

1.6.7



https://www.snap4city.org/19

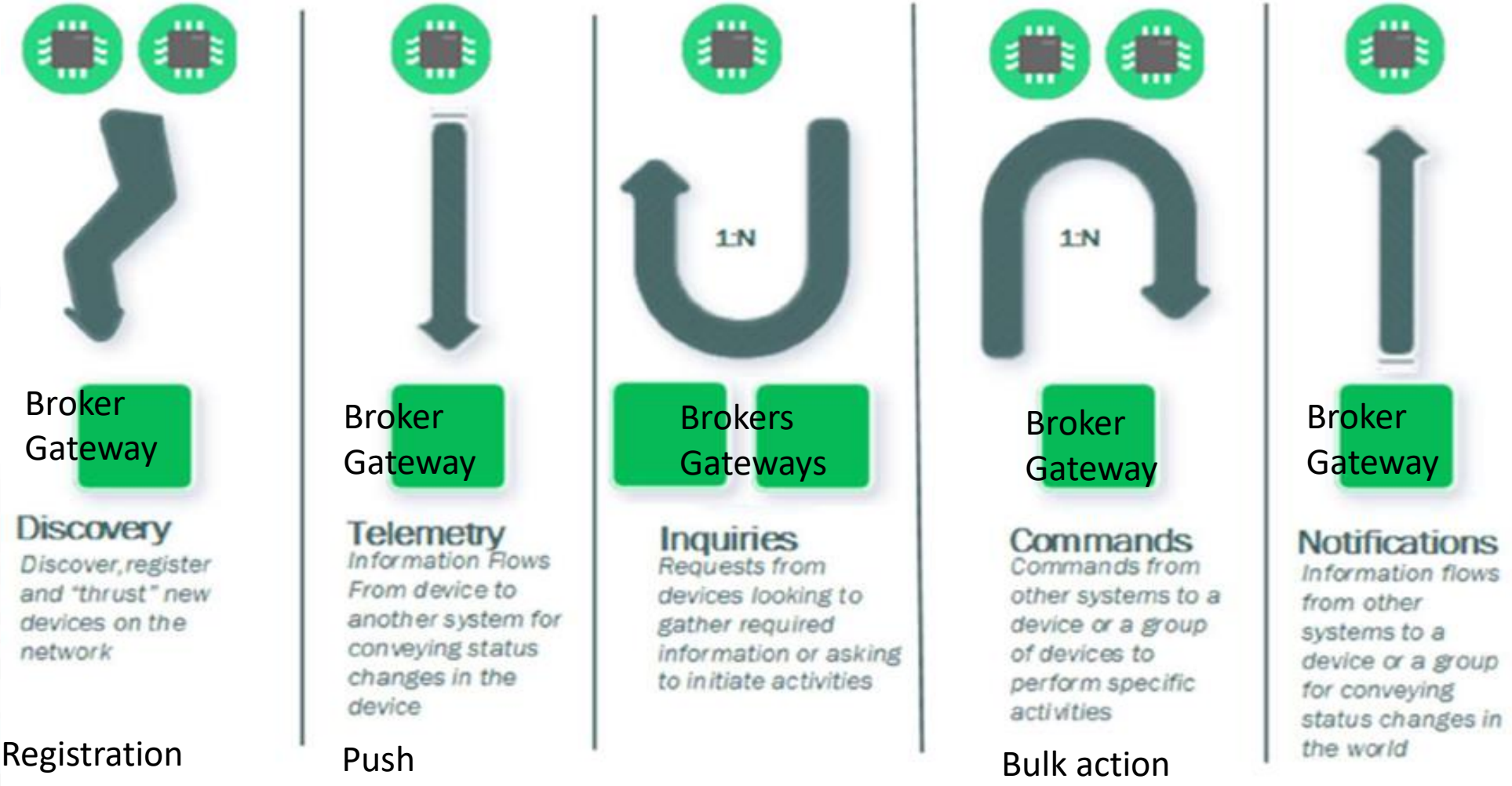

Linked Open Data
LOG: https://log.disit.org
Id: openlink-lod-cache
Number of triple: 57785989163
Out-connection: 13
In-connection: 0

Standards and Interoperability

Compliant with: AMQP, COAP, MQTT, OneM2M, HTTP, HTTPS, TLS, Rest Call, SMTP, TCP, UDP, NGSI, LoRa, LoRaWan, TheThingsNetwork, SigFOX, DATEX II, SOAP, WSDL, Twitter, FaceBook, Telegram, SMS, OLAP, MySQL, Mongo, HBASE, SOLR, SPARQL, EMAIL, FTP, FTPS, WebSocket, WebSocket Secure, ModBUS, OPC, GML, RS485, RS232, WFS, WMS, ODBC, JDBC, Elastic Search, Phoenix, XML, JSON, CSV, db, GeoJSON, Enfuser FMI, Android, Raspberry Pi, Local File System, ESP32, Libelium, IBIMET/IBE, OBD2, SVG, XLS, XLSX, TXT, HTML, CSS, KNX, Enocean, Zigbee, DALI, ISEMC, Alexa, Sonoff, HUE Philips, Tplink, BACnet, TALQ, Copernicus, etc. https://www.snap4city.org/65

IOT/IOE Protocols

Communication Patterns

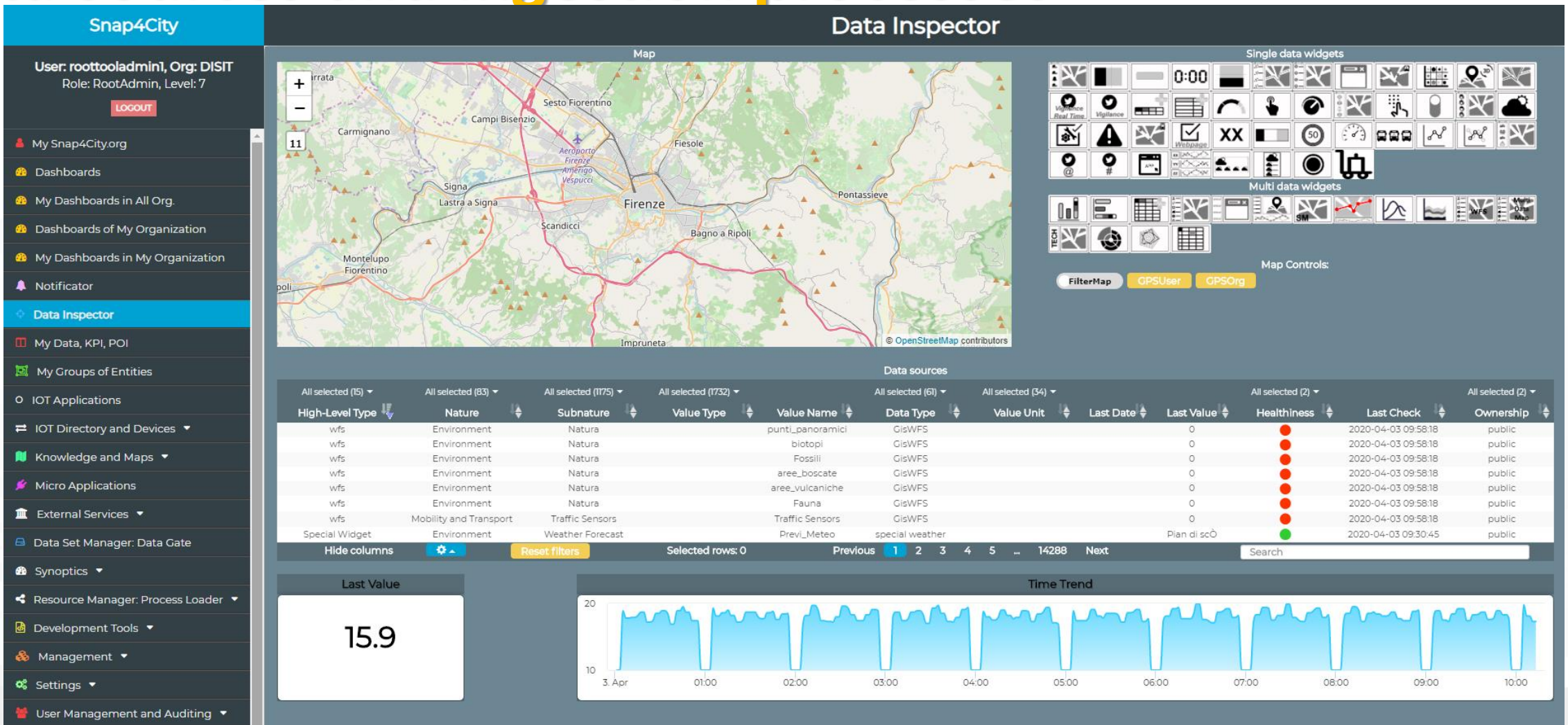


- MQTT
- HTTP(s)
- AMQP
- COAP
- NGSI
- OneM2M
- WebSockets
- ……..
- Etc.

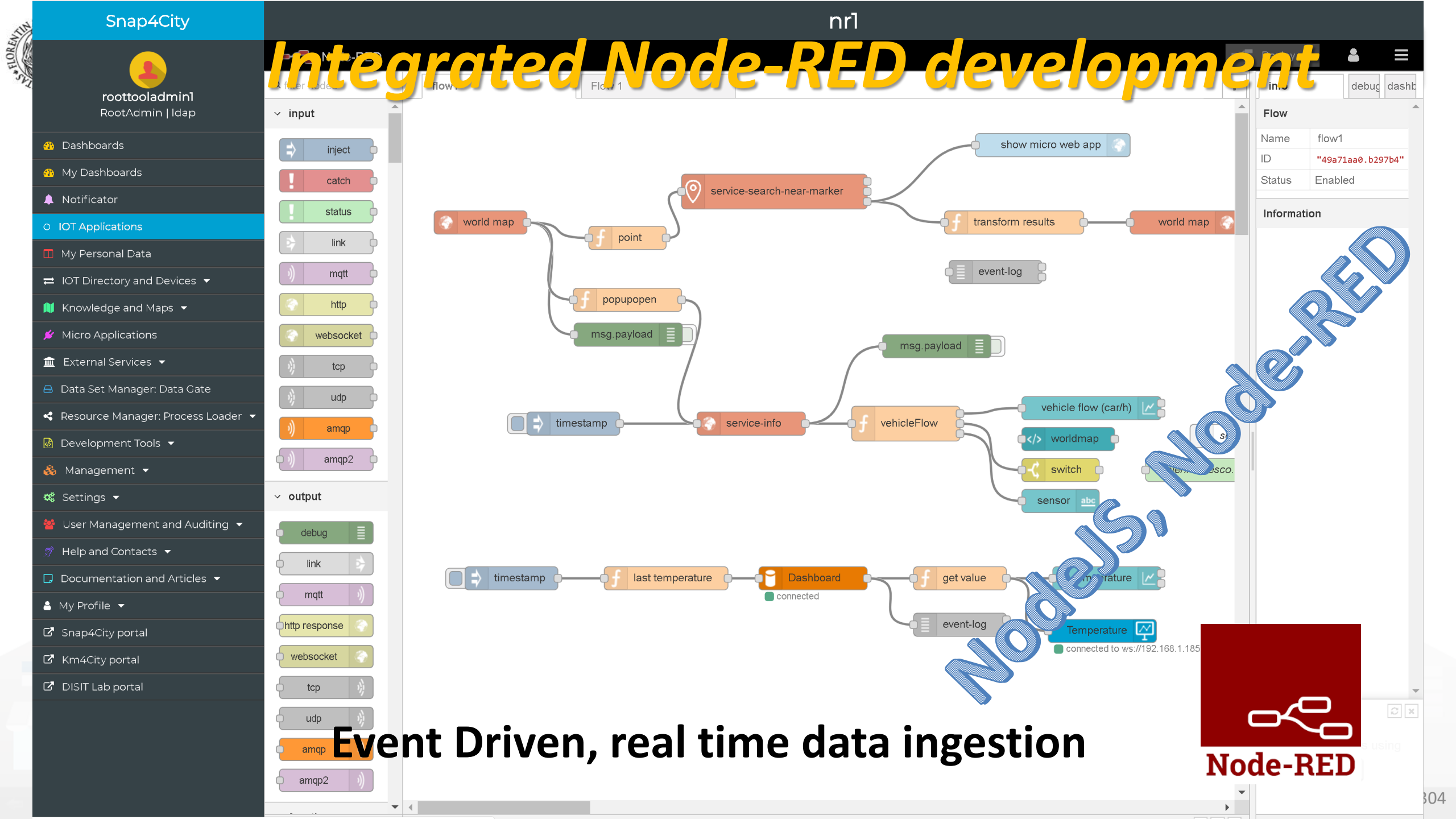
Data Inspector (Digital Twin info) Major Submodels

- **Digital Twin**
  - Device and sensors data
  - Values
  - Healthiness criteria and values
    - Machine learning tools
  - Images and physical world
  - Licensing
  - Users
- **Users**
  - Defined the Data and Devices
  - Defined the processes
  - Create dashboards
  - Etc.
- **Process Views**
  - Device Management tool
  - Data ingestion processes
    - ETL, IOT Apps
  - Data storage access views
    - Index views
    - Relationships view
  - Data Analytics and Transformation
    - IOT App, R Studio, Python
  - Data Rendering Dashboards
    - Synoptics
  - Processes' Developers

Data Inspector: all you need to know about data, data sources and ingestion processes

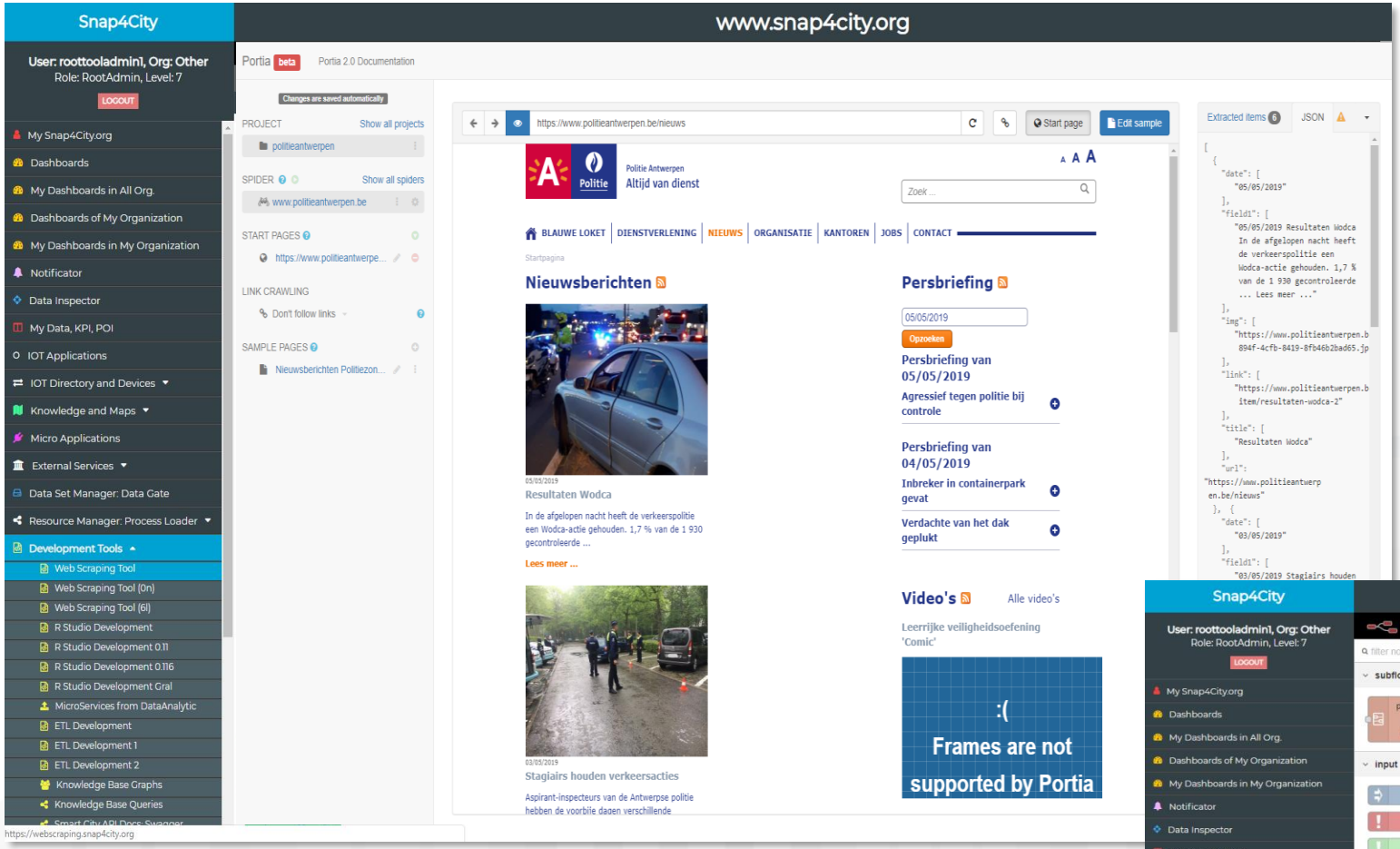


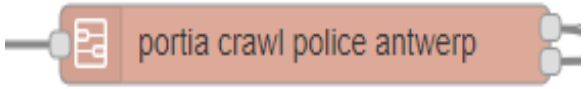
Integrated Node-RED development

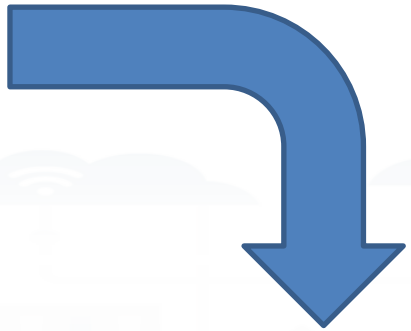


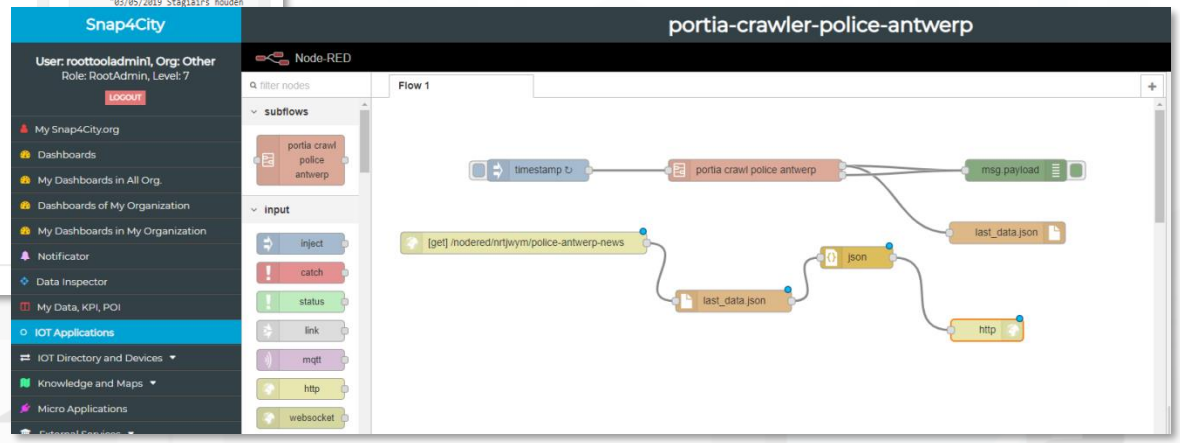
Event Driven, real time data ingestion

Web Scraping





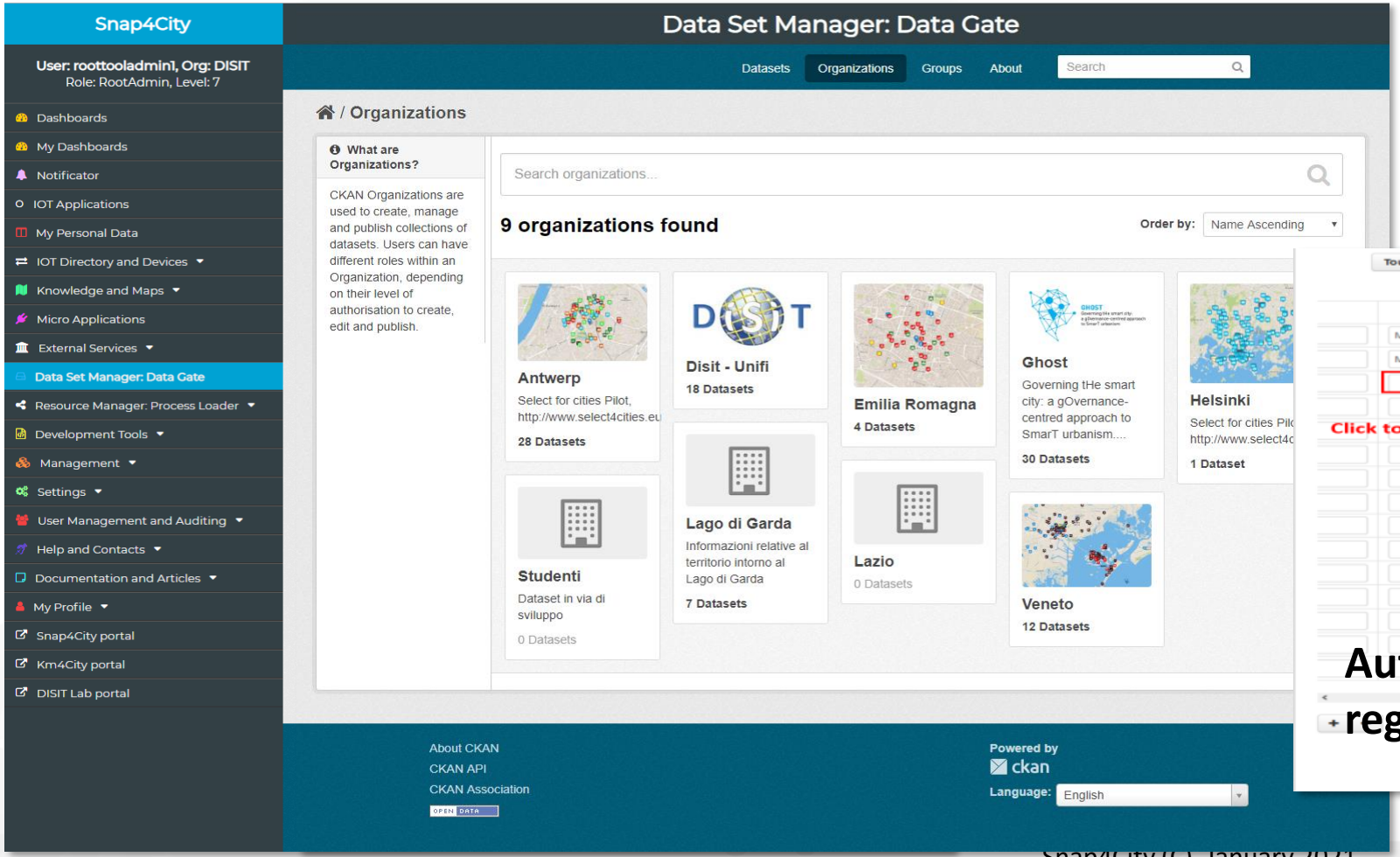


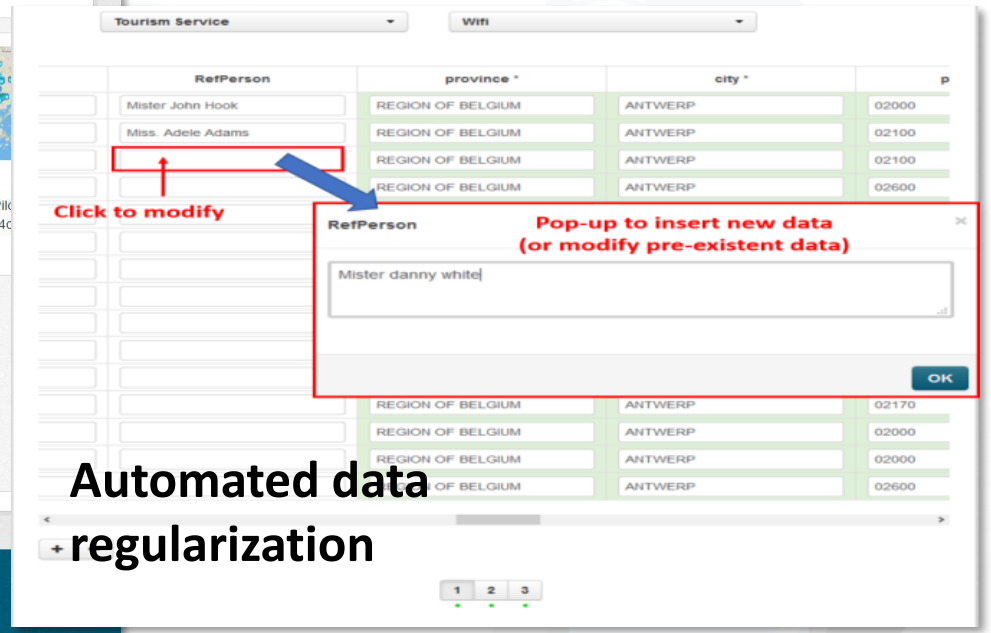


Integrated DataGate/CKAN
Static open data ingestion

Federated Crawling
Federated Distribution

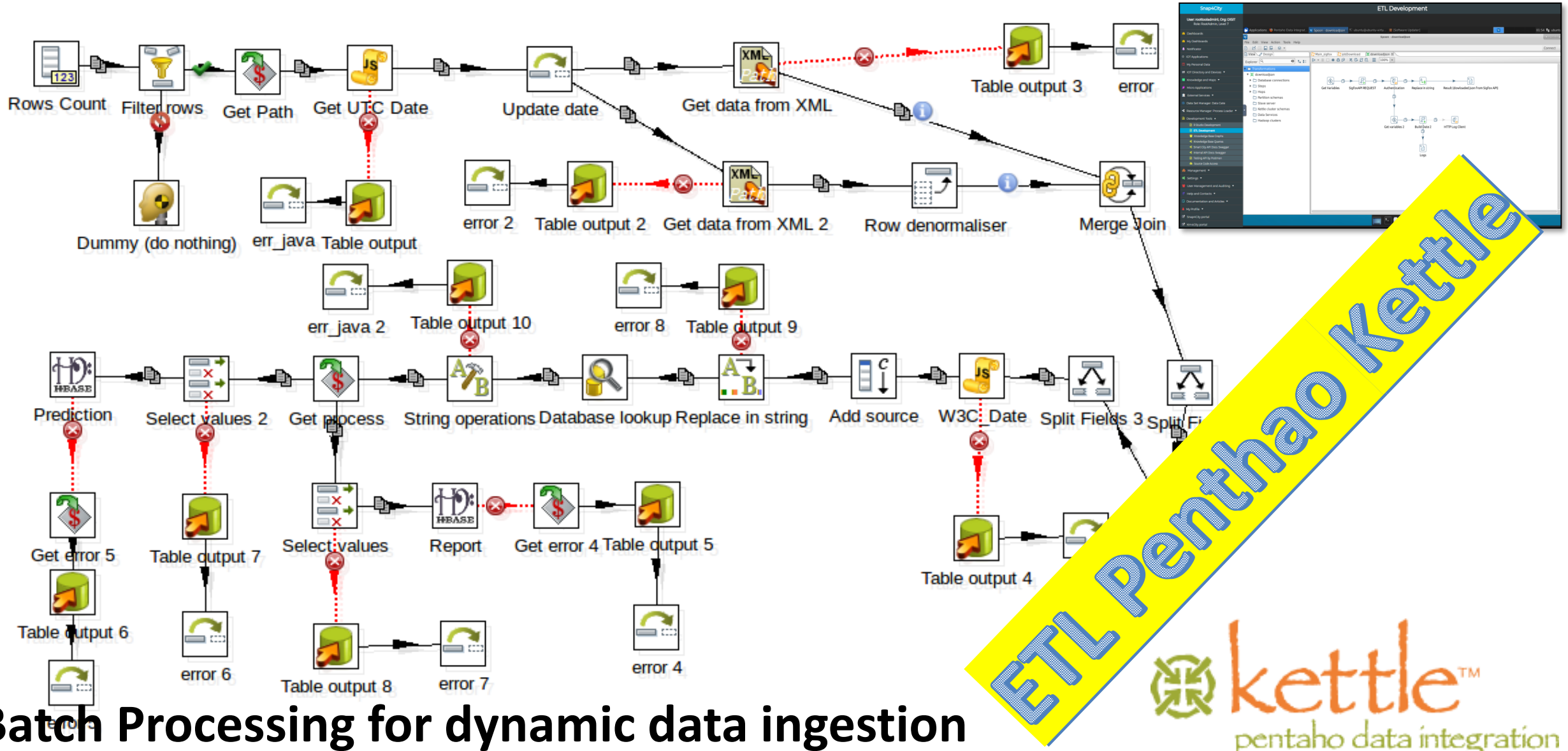
Data Set:
- Search
- Loading
- Download
- Share
- Publish
- Also automated





Automated data regularization

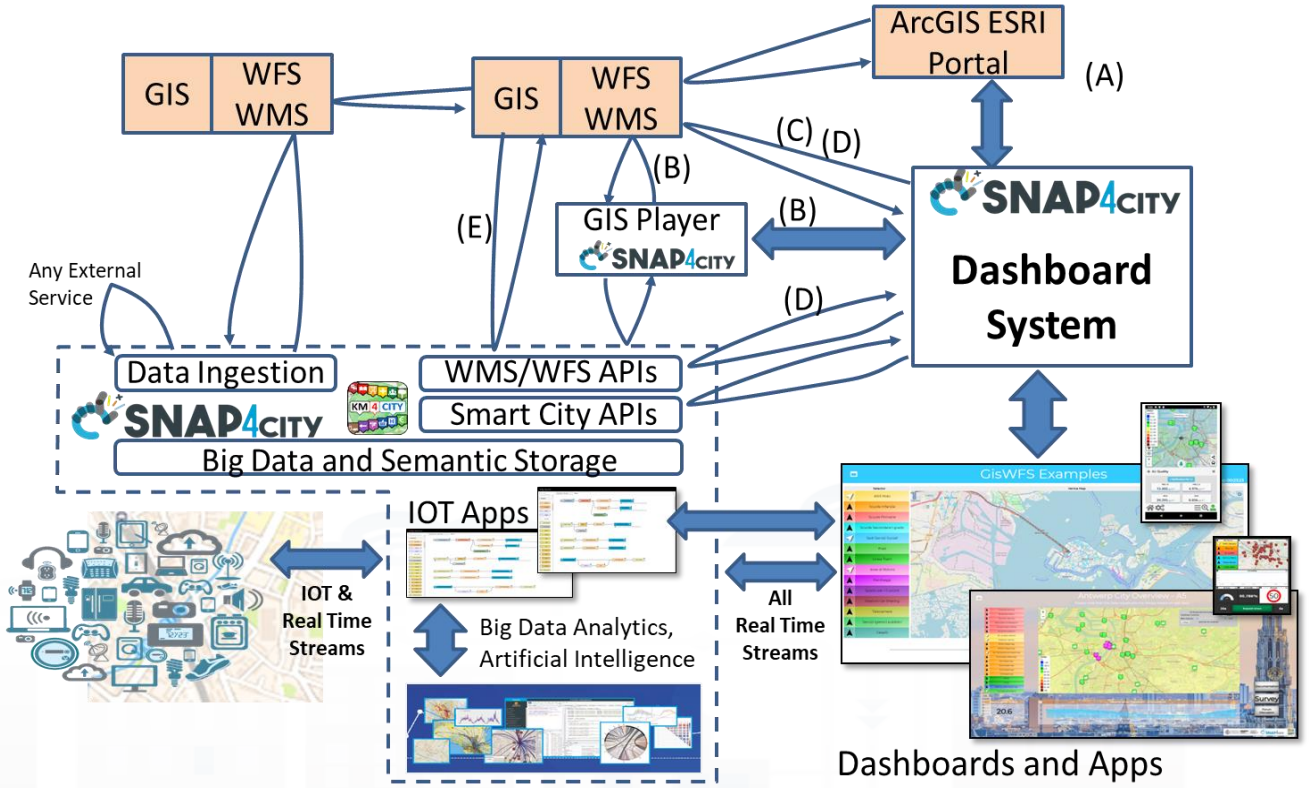
Integrated ETL development



Batch Processing for dynamic data ingestion

Interoperability ESRI

- **Snap4City is interoperable with**
  - ESRI ArcGIS Enterprise, Portal, Pro/MAP, ...
  - other GIS tools supporting WFS, WMS, GeoJSON, GML
- **Snap4City is interoperable since:**
  - **Provides** info/data in WFS, WMS
  - **Exploits** data/info from WFS, WMS
  - **Import** data/info from WFS/WMS



- The Snap4City platform can be installed on premise using **Snap4City Appliance** https://www.snap4city.org/drupal/node/471
  - **StartSNAP4CITYVM** includes the Dashboard Builder that is capable to work with WFS WMS protocols for the integration with GIS platforms as ESRI ArcGIS, QGIS, directly or using **Snap4City GIS player**.
  - **KBSSMVM** includes the Smart City API and WFS API which can be used to data harvest from any GIS servers and GIS desktop tool

TOP

IOT Applications, Devices and Dashboards



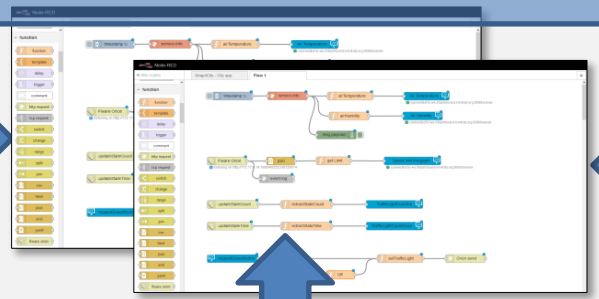
Snap4City: Builder of Sentient Cities Solutions

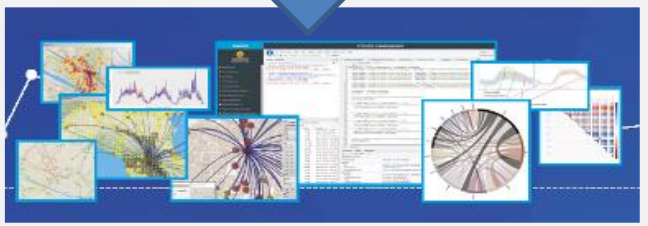
Dashboards with data driven IOT Applications enforcing intelligence

IOT and data World

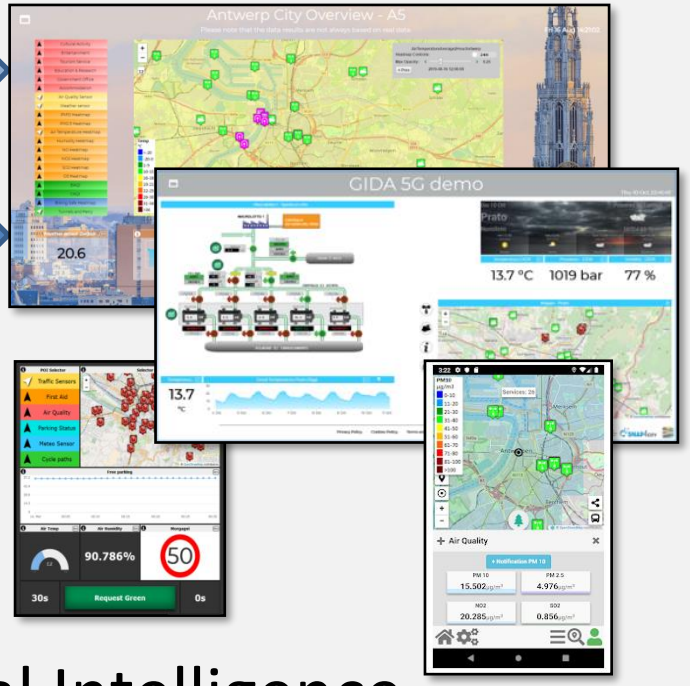


IOT Applications



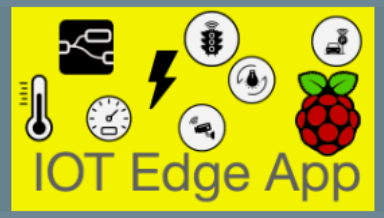


Dashboards and Apps

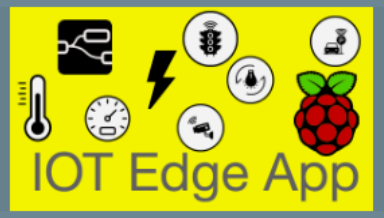


Big Data Analytics, Artificial Intelligence

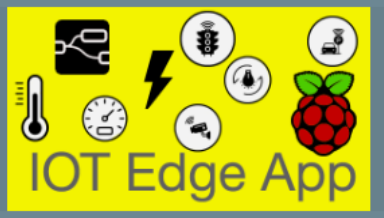
IOT Applications

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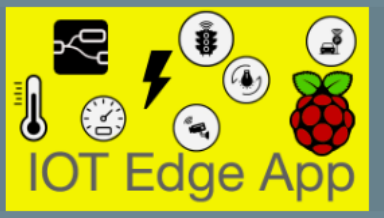
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Management

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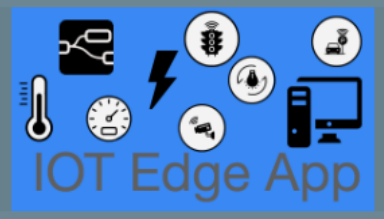
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Management

2018-10-19T16:07


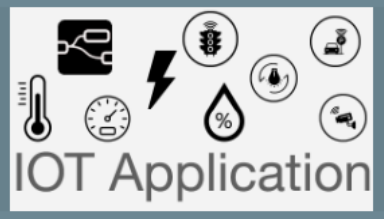
owner: pb3
Management

2018-10-19T17:17


owner: pb3
Management

2018-10-22T11:57


owner: semolarudy
Management

application


owner: tester5
Management

Bib APP

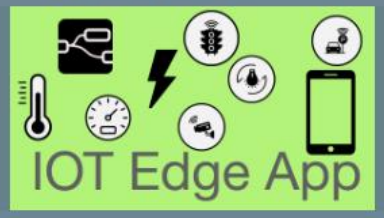

owner: semolarudy
Management

ChargingStations


owner: comunedashres
Management

Deprecated - SiiMobilityControlRoom


owner: badii
Management

SamsungGalaxyS4BarCode


owner: badii
Management

esercitazione

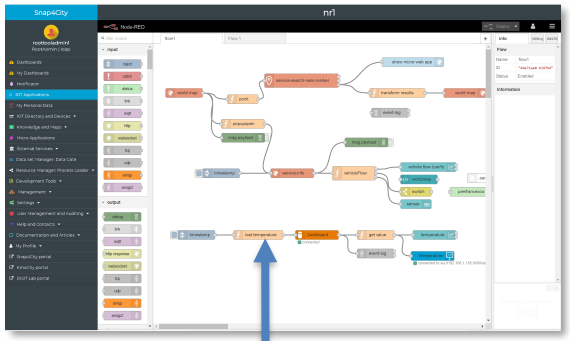

owner: tester2
Management

Iot-App

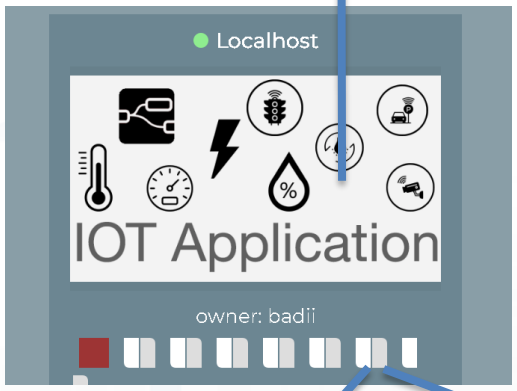

owner: tester14
Management

IOT Applications

- Basic / Advanced
- On IOT Edge Raspberry Pi
- On IOT Edge Android
- On IOT Edge Win/Linux



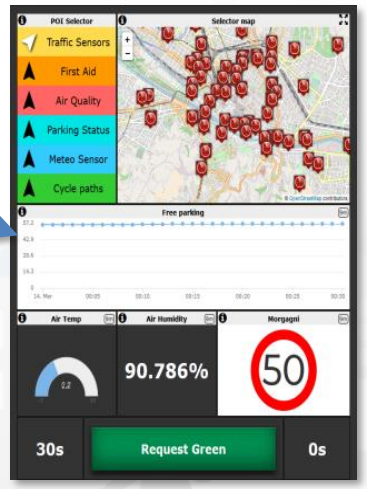
EDIT IOT APP



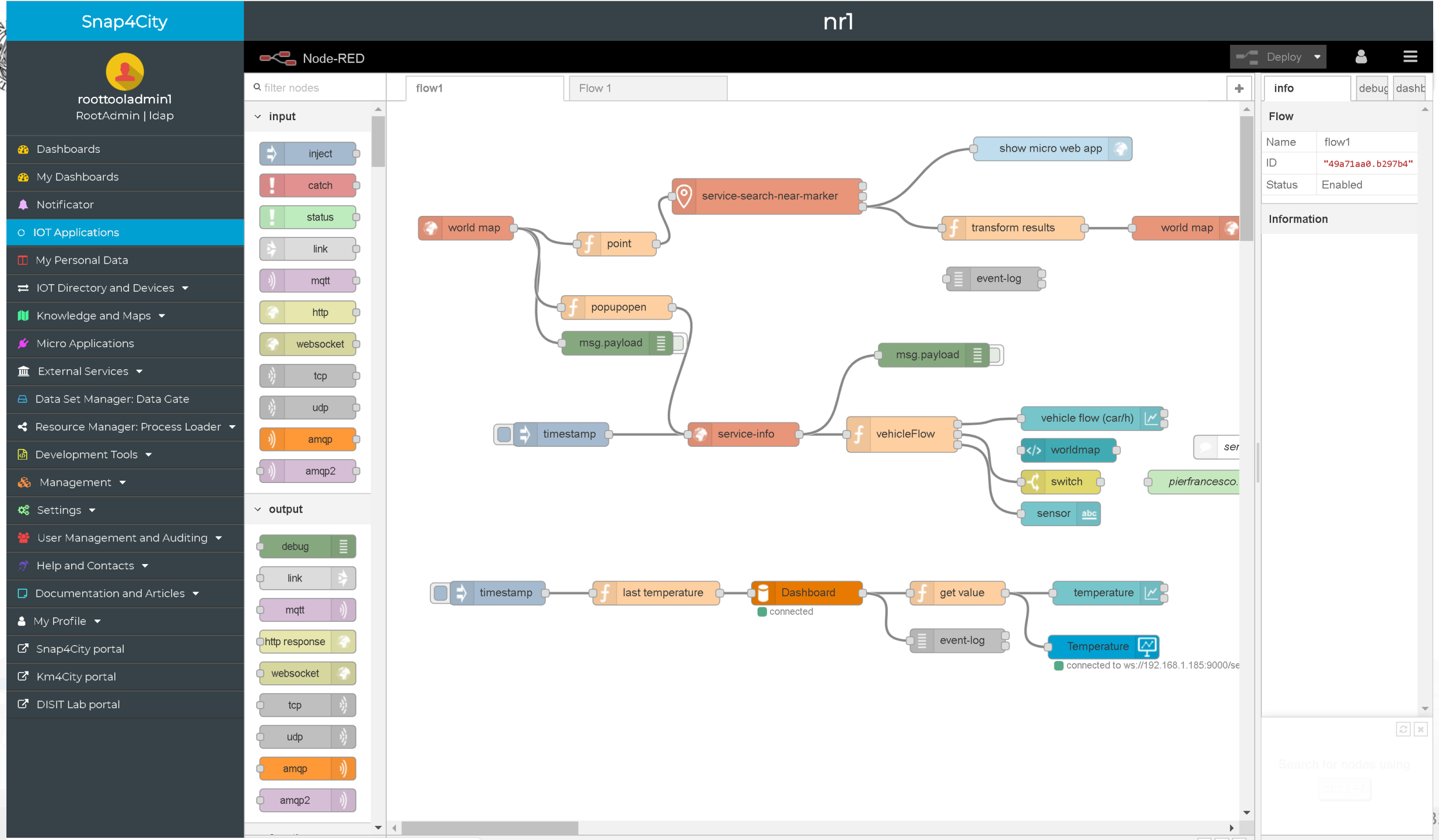
VIEW

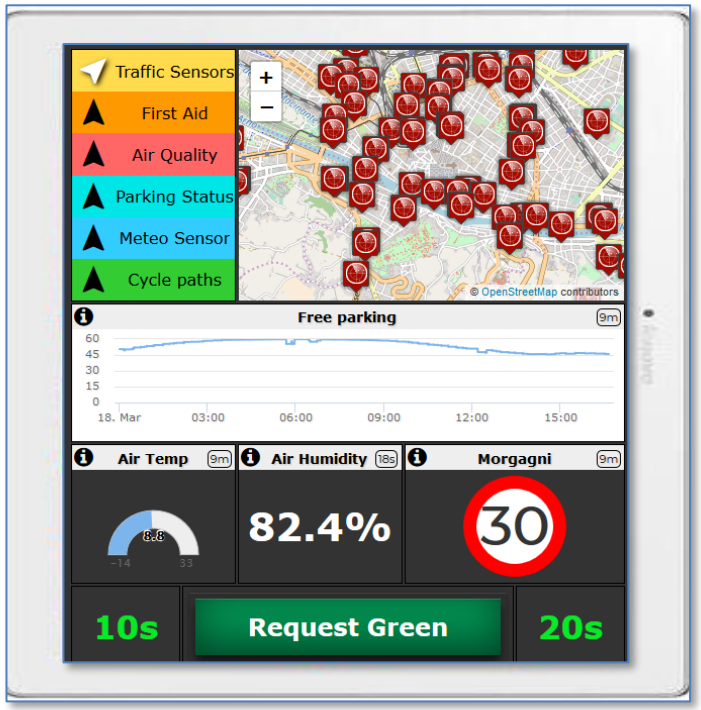
EDIT

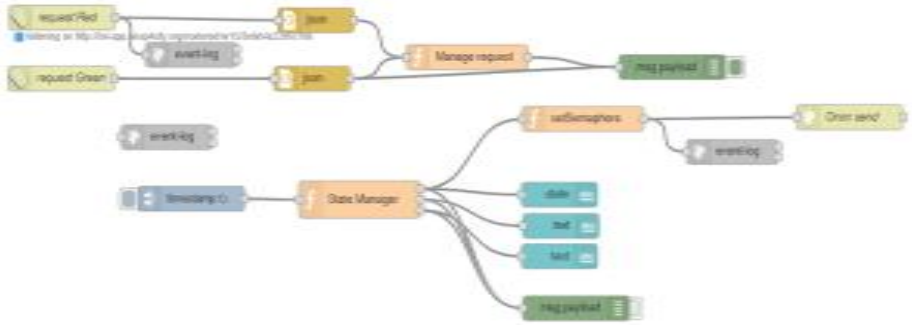







Snap4City
nr1
roottooladmin1
RootAdmin | ldap
Dashboards
My Dashboards
Notificator
IOT Applications
My Personal Data
IOT Directory and Devices
Knowledge and Maps
Micro Applications
External Services
Data Set Manager: Data Gate
Resource Manager: Process Loader
Development Tools
Management
Settings
User Management and Auditing
Help and Contacts
Documentation and Articles
My Profile
Snap4City portal
Km4City portal
DISIT Lab portal
Node-RED
Deploy
filter nodes
input
inject
catch
status
link
mqtt
http
websocket
tcp
udp
amqp
amqp2
output
debug
link
mqtt
http response
websocket
tcp
udp
amqp
amqp2
flow1
Flow 1
world map
point
service-search-near-marker
show micro web app
transform results
world map
event-log
popupopen
msg.payload
msg.payload
timestamp
service-info
vehicleFlow
vehicle flow (car/h)
worldmap
switch
sensor
timestamp
last temperature
Dashboard
connected
get value
temperature
event-log
Temperature
connected to ws://192.168.1.185:9000/se
info
debug
dashb
Flow
Name
flow1
ID
"49a71aa0.b297b4"
Status
Enabled
Information


Traffic Sensors
First Aid
Air Quality
Parking Status
Meteo Sensor
Cycle paths
© OpenStreetMap contributors
Free parking
9m
60
45
30
15
0
18. Mar
03:00
06:00
09:00
12:00
15:00
Air Temp
9m
Air Humidity
18s
Morgagni
9m
82.4%
30
10s
Request Green
20s







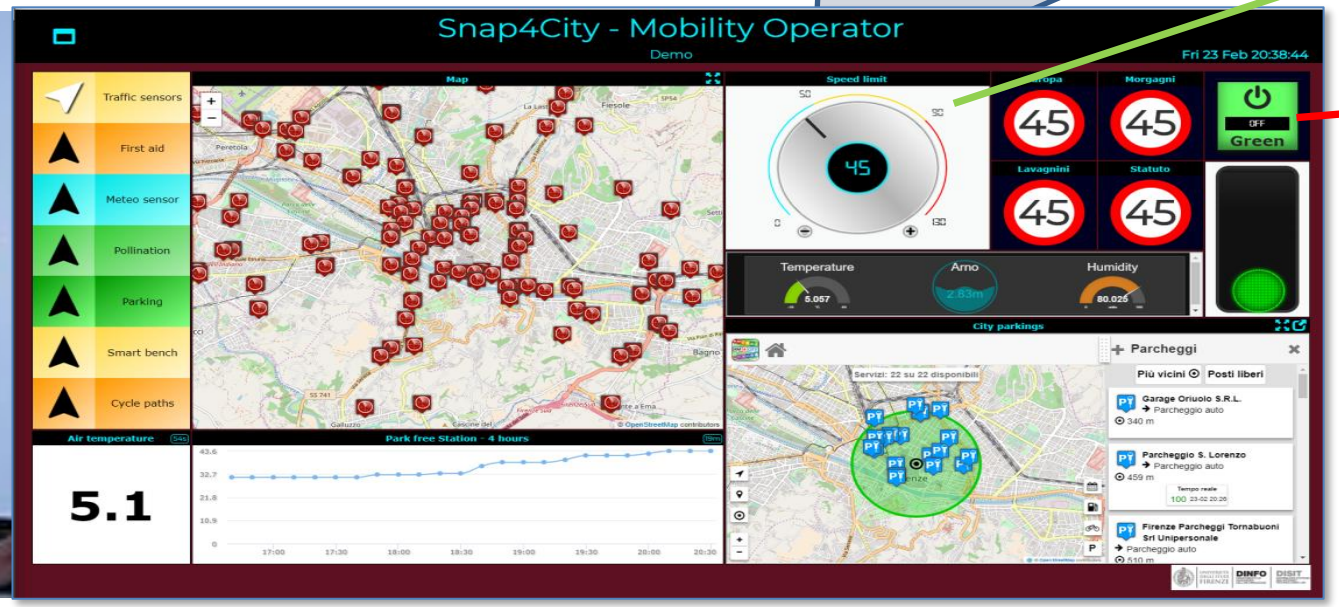


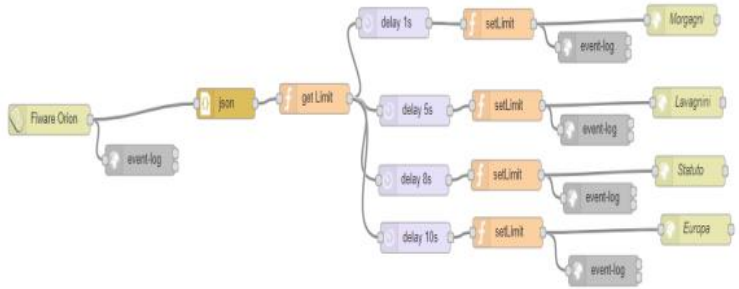






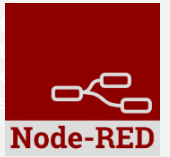


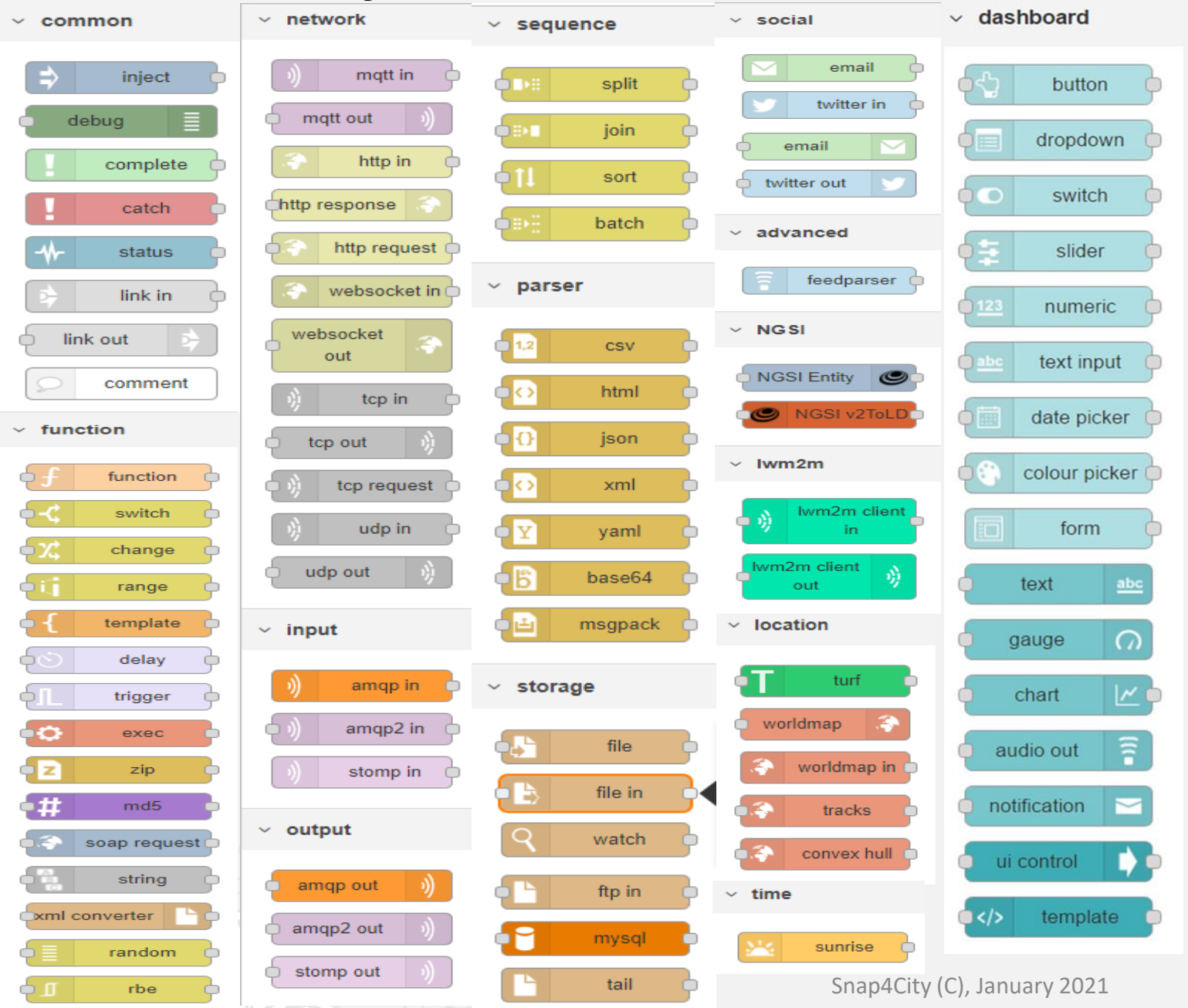

Snap4City - Mobility Operator
Demo
Fri 23 Feb 20:38:44
Traffic sensors
First aid
Meteo sensor
Pollination
Parking
Smart bench
Cycle paths
Map
Speed limit
45
Europa
Morgagni
Lavagnini
Statuto
OFF
Green
Temperature
Arno
Humidity
City parkings
Parcheggi
Più vicini
Posti liberi
Garage Oriuolo S.R.L.
Parcheggio S. Lorenzo
Firenze Parcheggi Tornabuoni Srl Unipersonale
Air temperature
5.1
Park free Station - 4 hours


Fiware Orion
event-log
json
get Limit
delay 1s
delay 5s
delay 8s
delay 10s
setLimit
Morgagni
Lavagnini
Statuto
Europa

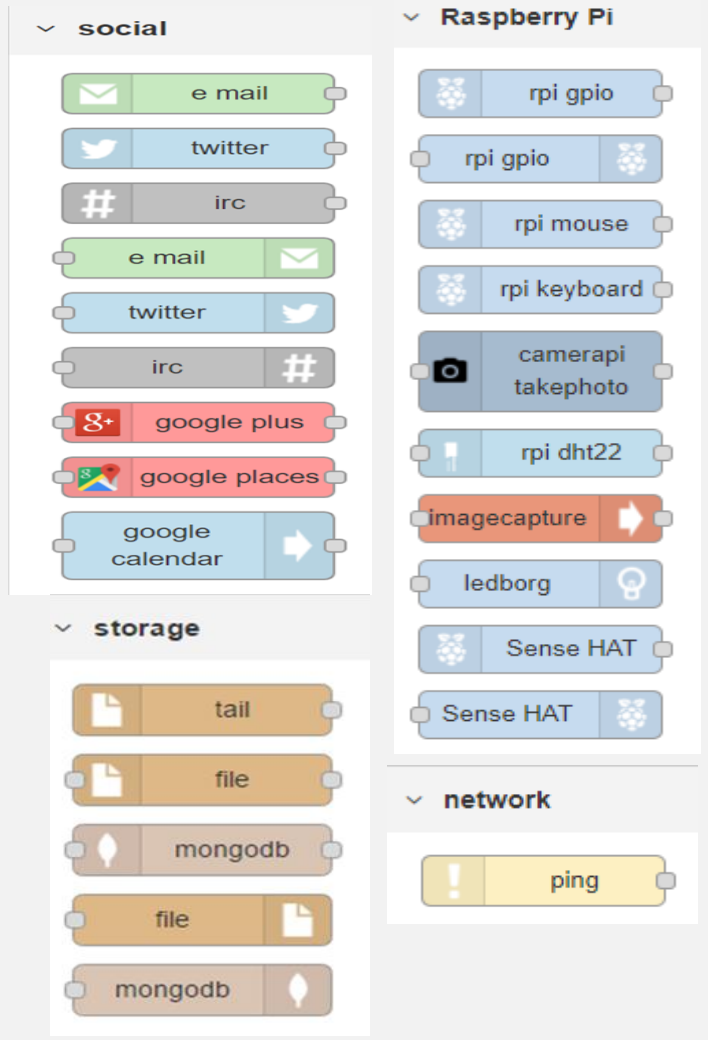
Basic Node.js Blocks on NodeRed on our Advanced IOT Apps

DISIT Lab, Distributed Data Intelligence and
ICT Systems and Internet
Information Engin
http://www.di





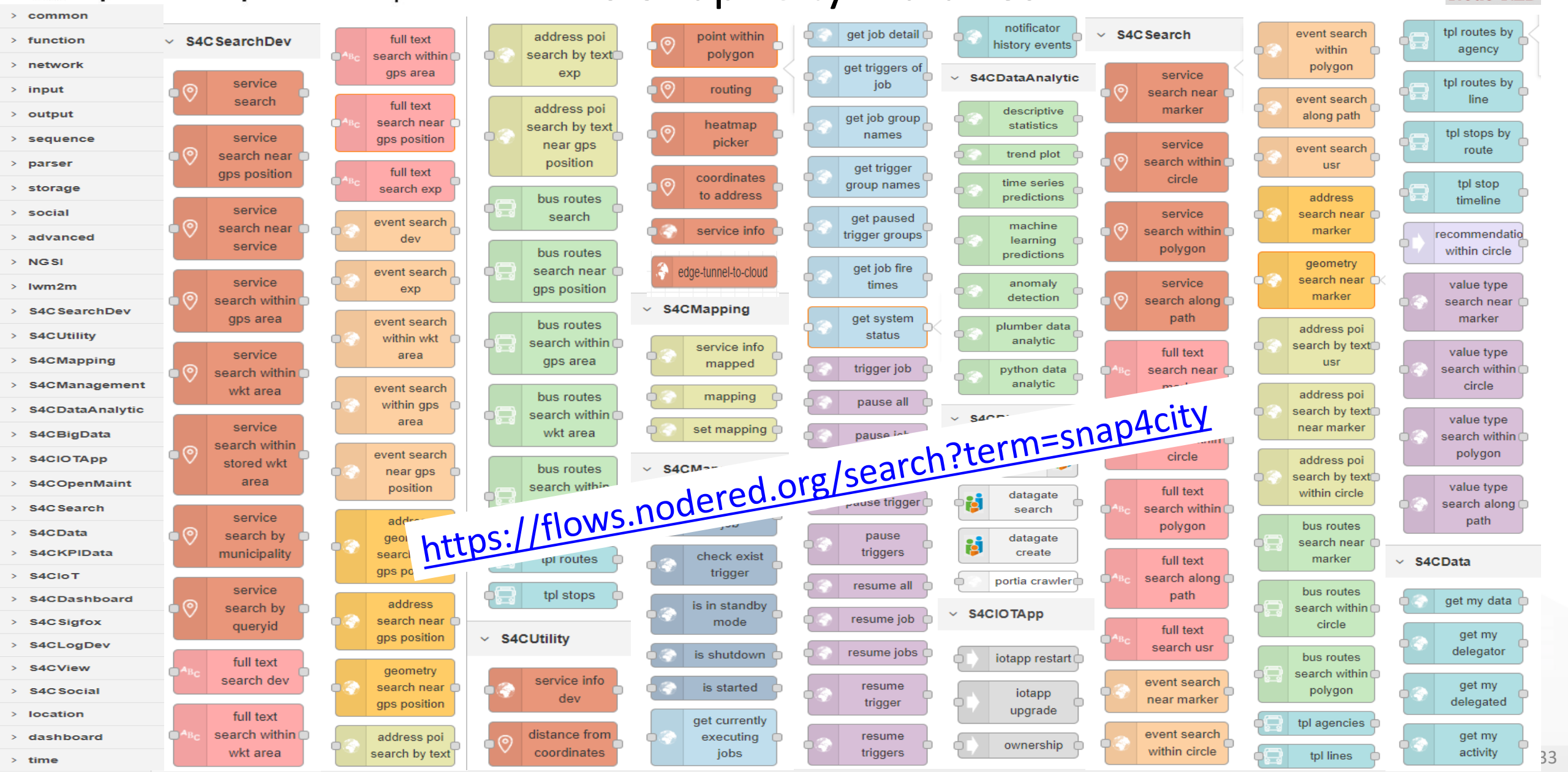
+ on IOT Edge Raspberry



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Nov. 2020 collection
Two Snap4City Libraries

SNAP4CITY | Node-RED



https://flows.nodered.org/search?term=snap4city

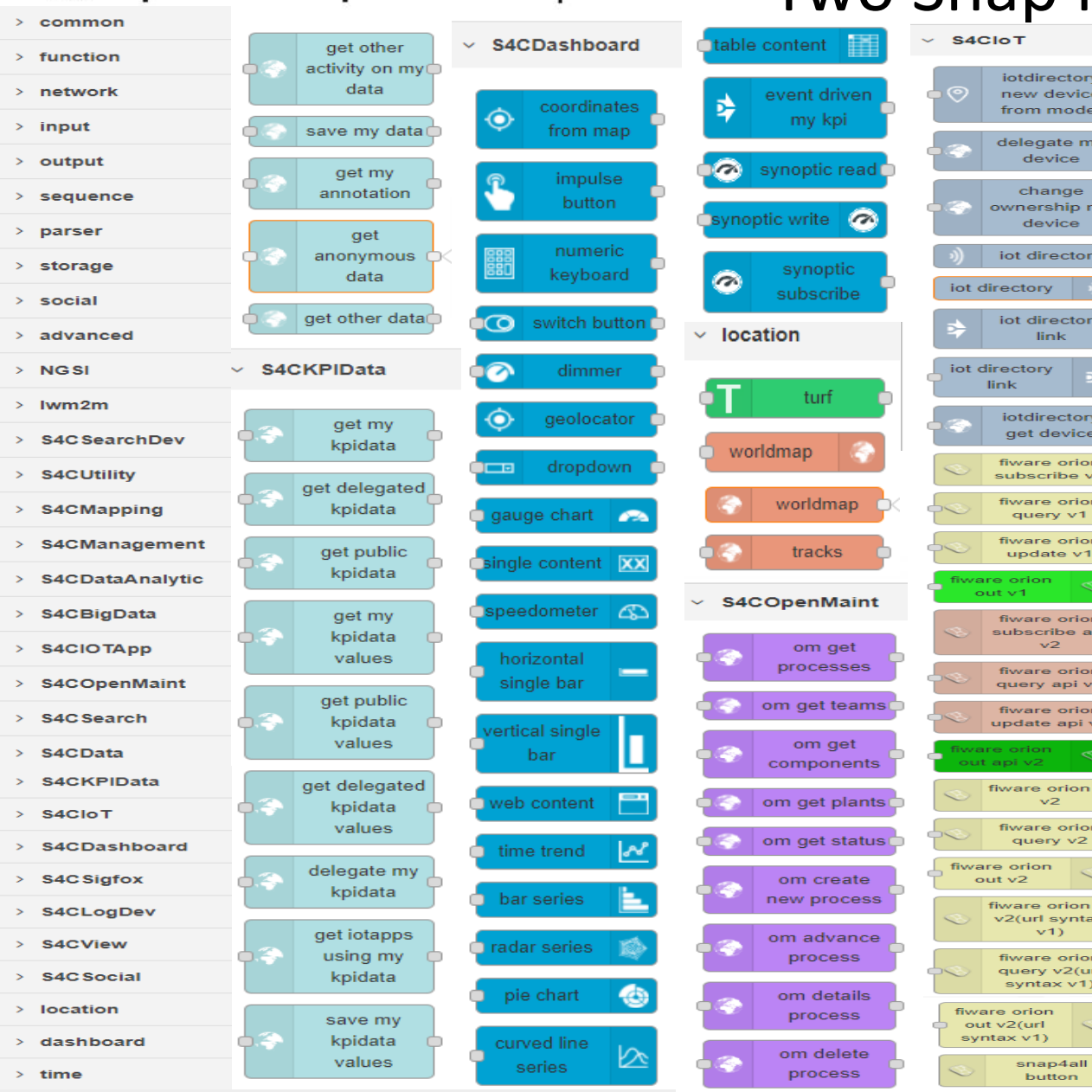
UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

Nov. 2020 collection

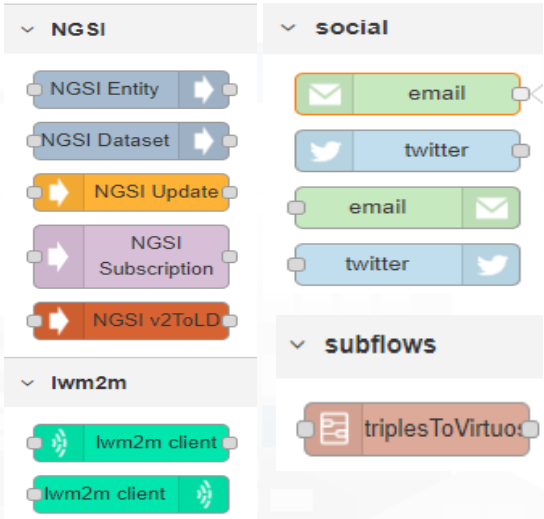
Two Snap4City Libraries

SNAP4CITY | Node-RED

https://flows.nodered.org/search?term=snap4city



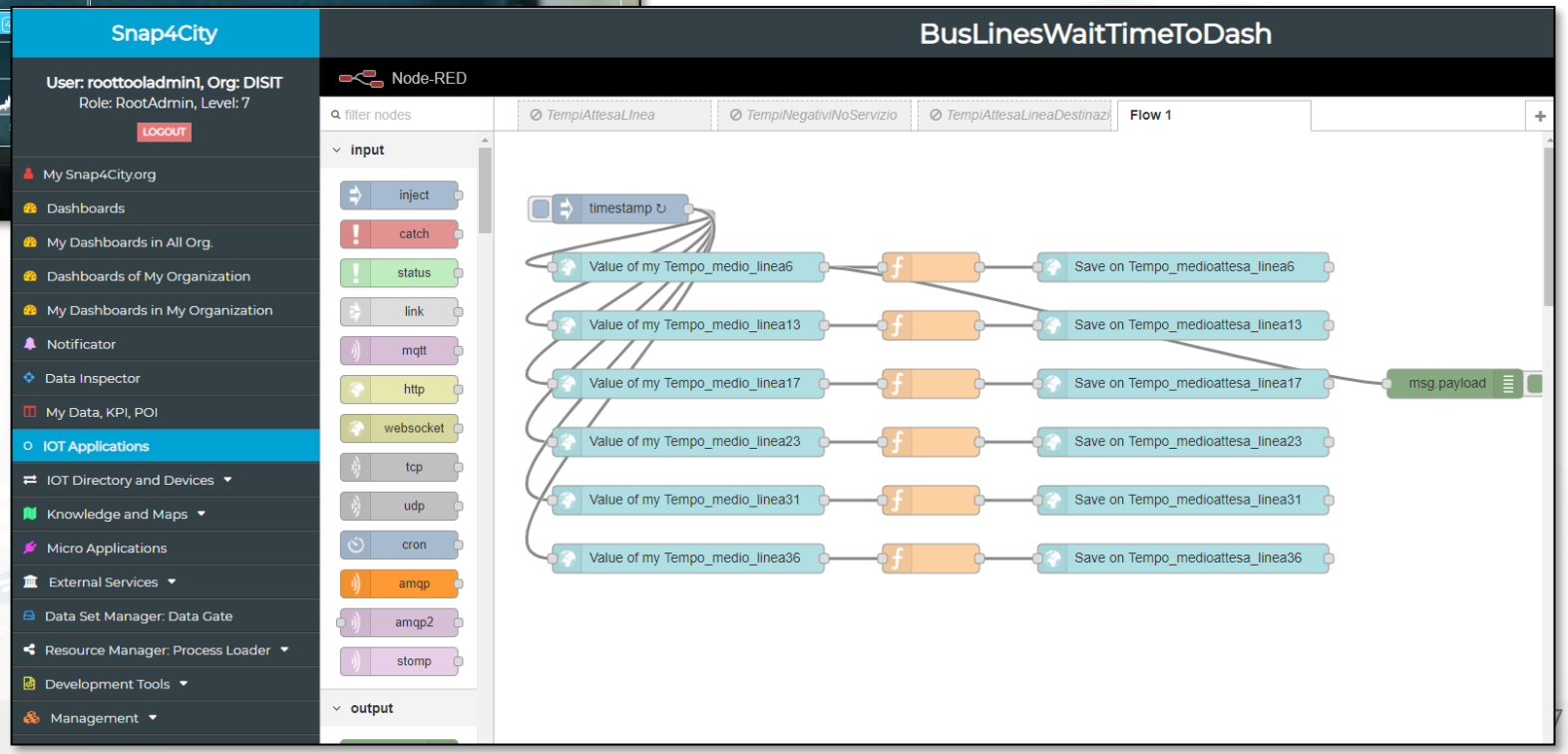
We suggest also to install:



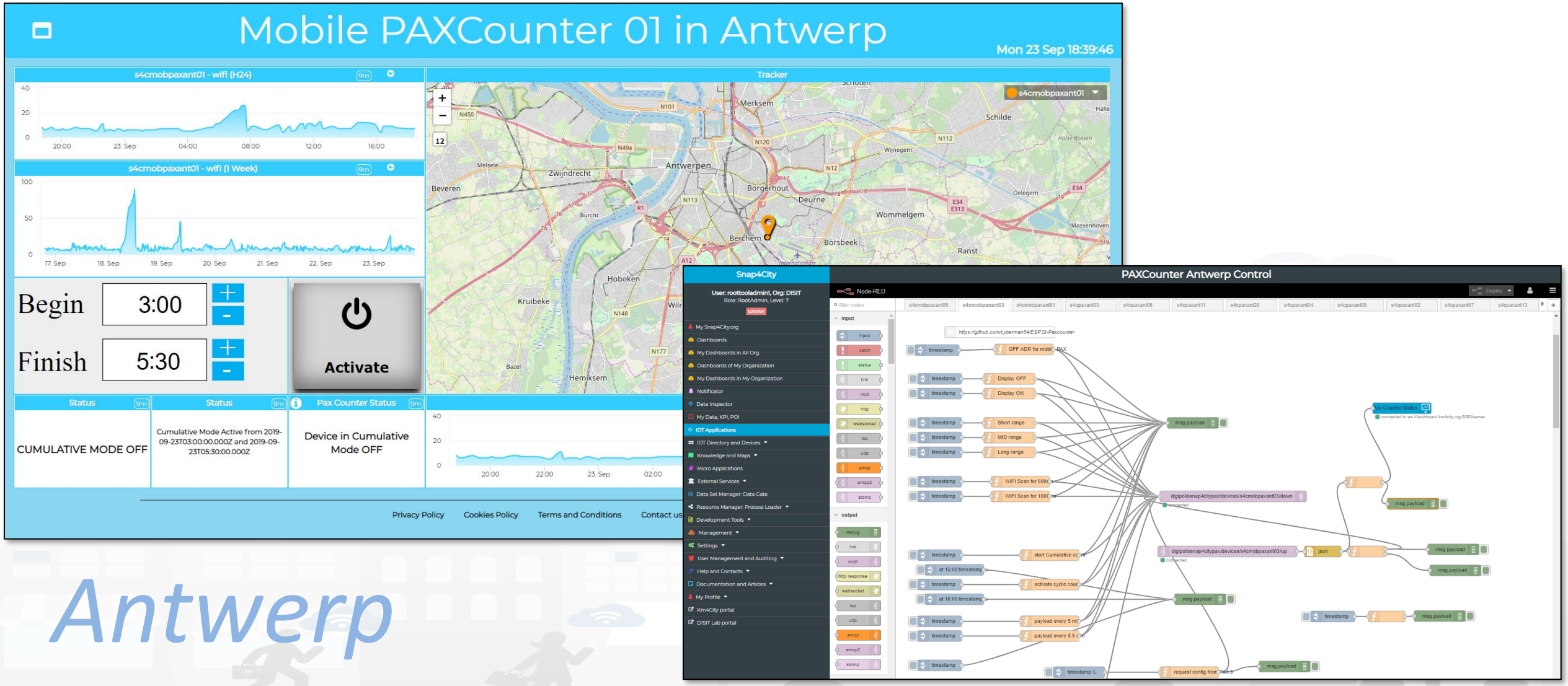
Estimation of the mean waiting time at bus stops







Programmable PAX counting

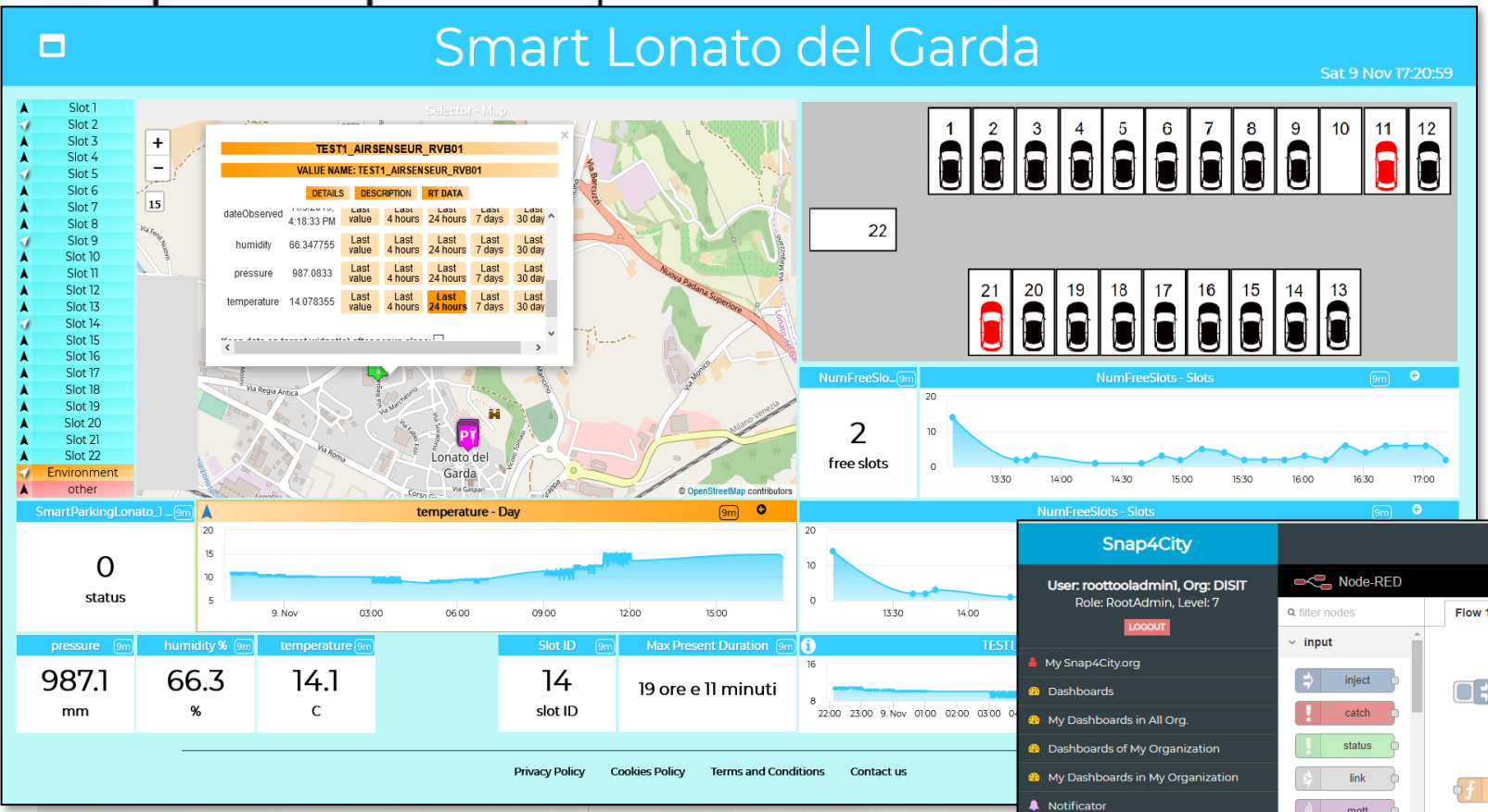


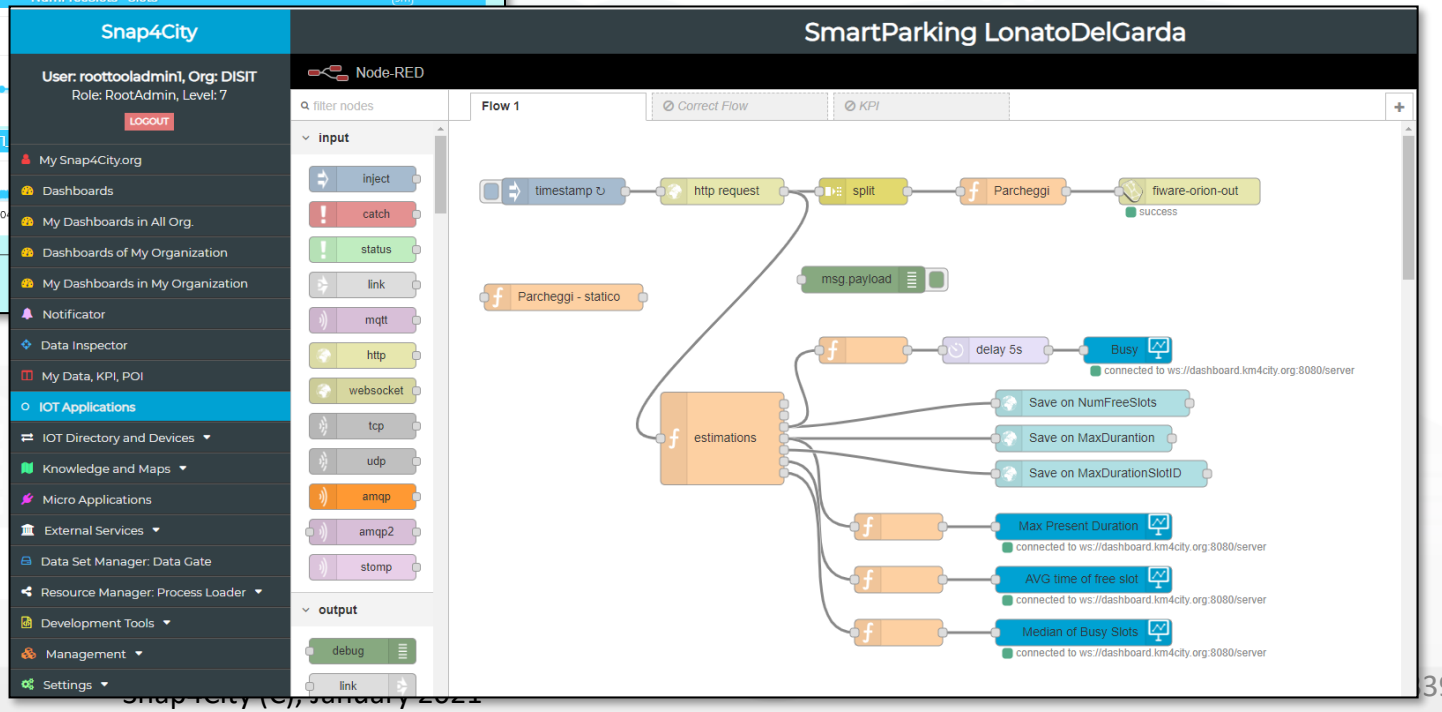
Antwerp

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SNAP4CITY KM4CITY

Smart Parking Monitoring

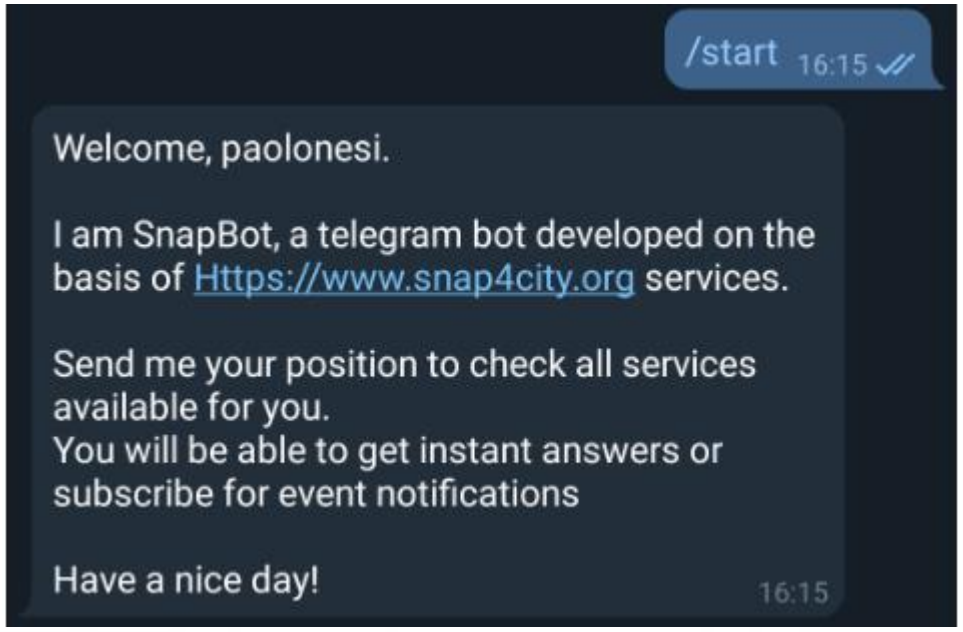




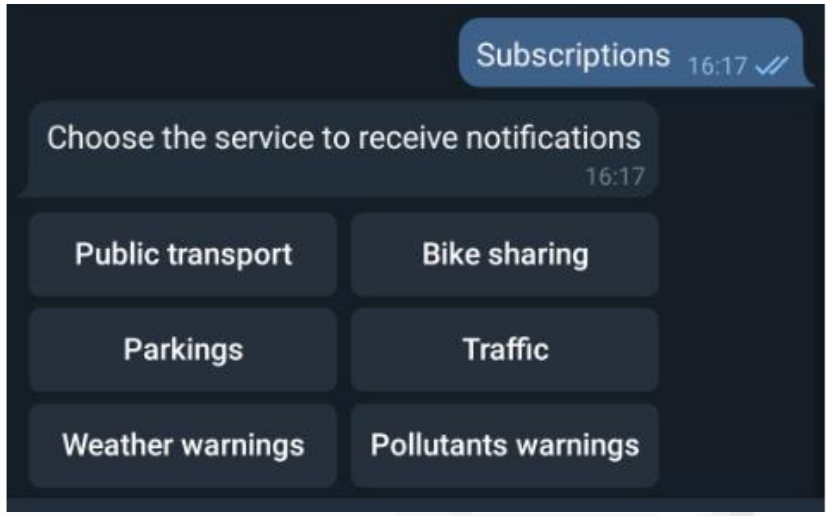


SnapBot

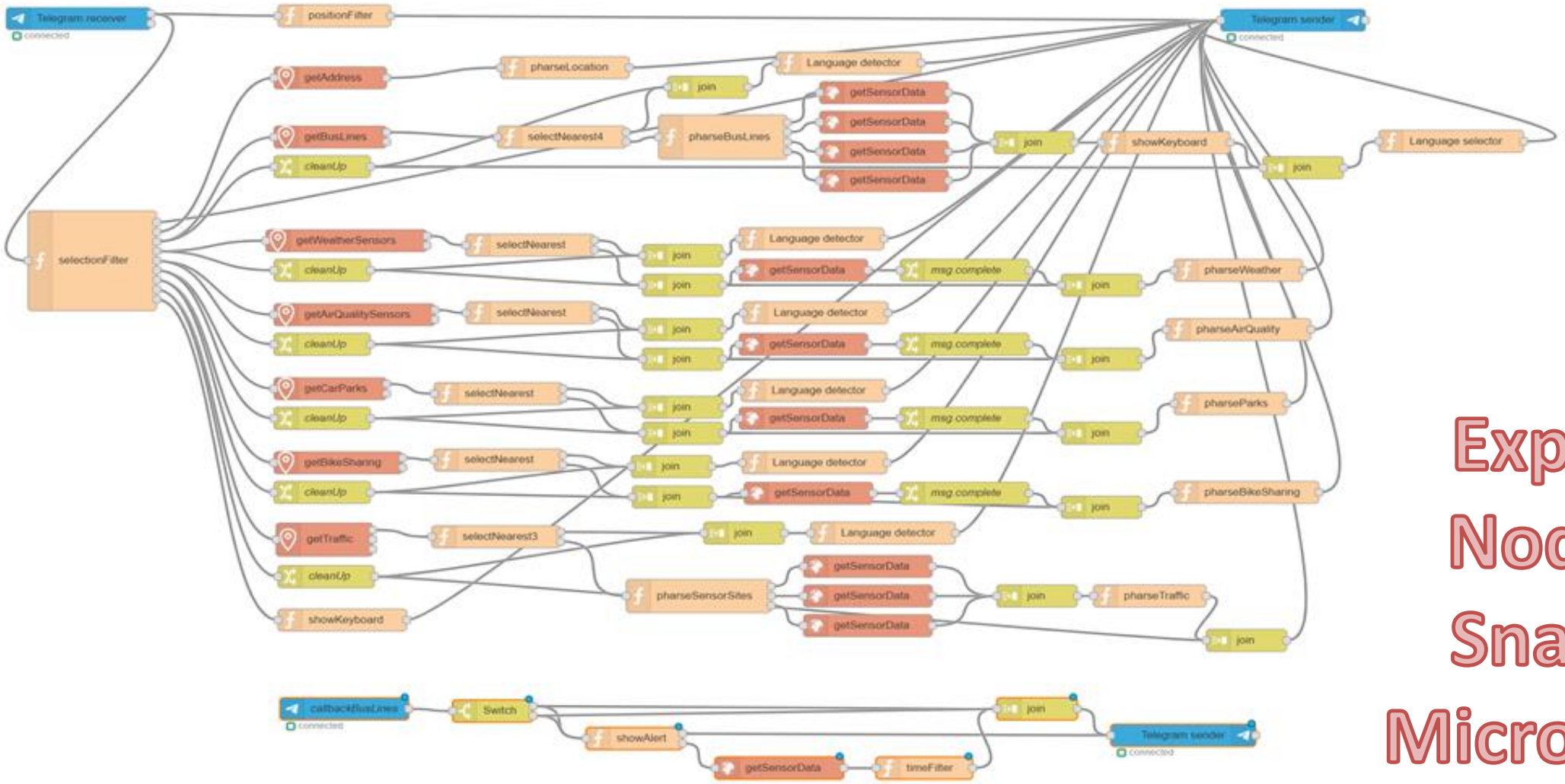
- provides real time smart city services to Telegram users, geolocalized, when you like, what you like
- active on Tuscany in all provinces and cities according to the data accessible on Https://www.snap4city.org
- Services on
  - Public Transport (more than 10 different operators),
  - bike sharing, parking lots,
  - traffic flow, weather warnings,
  - Air quality, pollutant,
  - find your location, etc.







IOT App of SnapBot: OneShot Services



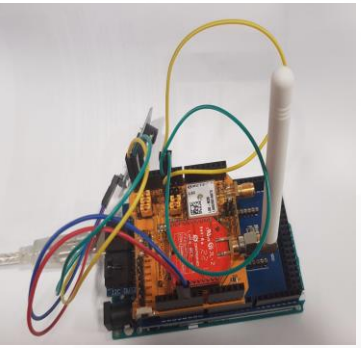
Exploiting Node-RED Snap4City MicroServices

IOT Devices

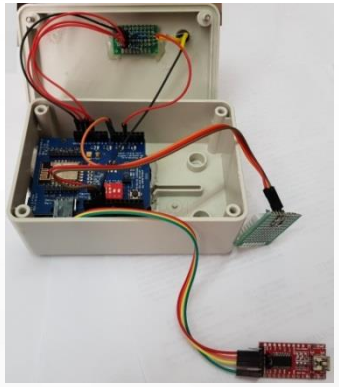
Sensors/
Actuators

IOT Edge Devices

LoraWAN +
Arduino +
I2C, NGSI



Arduino,
Wi-Fi, NGSI



Snap4All
IOT Button
ESP, NGSI,
Wi-FI, BT



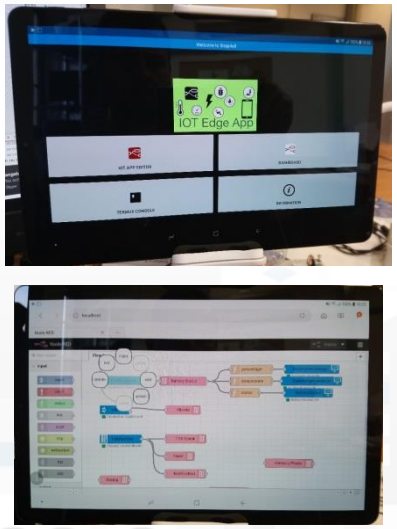
Snap4All PAX
Counter
LoraWAN
WIFI, NGSI,
GPS



IOT Edge
NodeRED:
Raspberry Pi,
NGSI, WiFi,
RJ45,..



IOT Edge
NodeRED:
Android, LINUX,
Windows, …



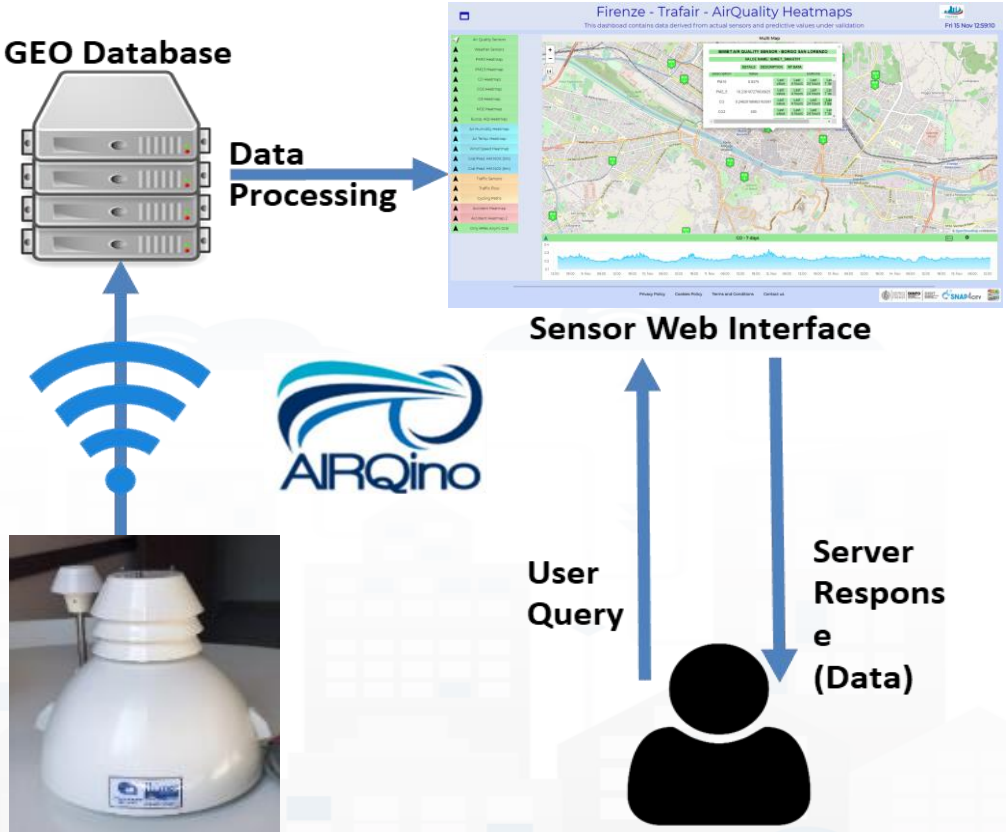
LoraWan
Gateway:
IOT Edge, NGSI,
WIFI, RJ45, GPS



Any Sensor / Actuator
Open to other protocols

AIRQino Low cost air quality monitor





Humidity, Temperature, CO, CO2, O3, NO2, VOC, PM2.5, PM10) in urban environment

Libelium





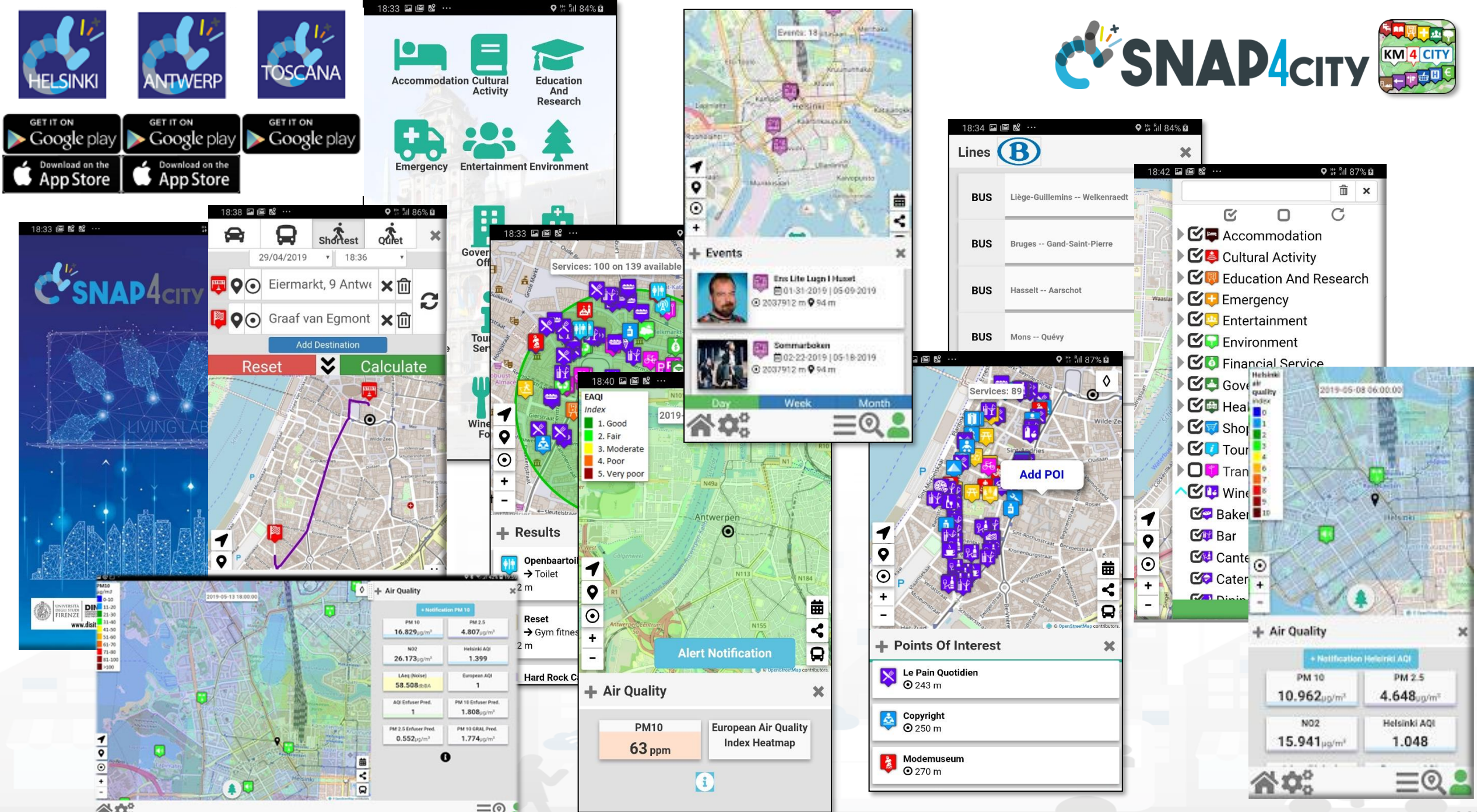
- PM10
- Temp
- Humidity
- Pm2.5
- NO
- NO2
- CO2
- Etc.

https://www.snap4city.org/659 how to set up on Snap4City

TOP



FORGING & MANAGING FLEXIBLE MOBILE APPS, Web Apps and MicroApplications

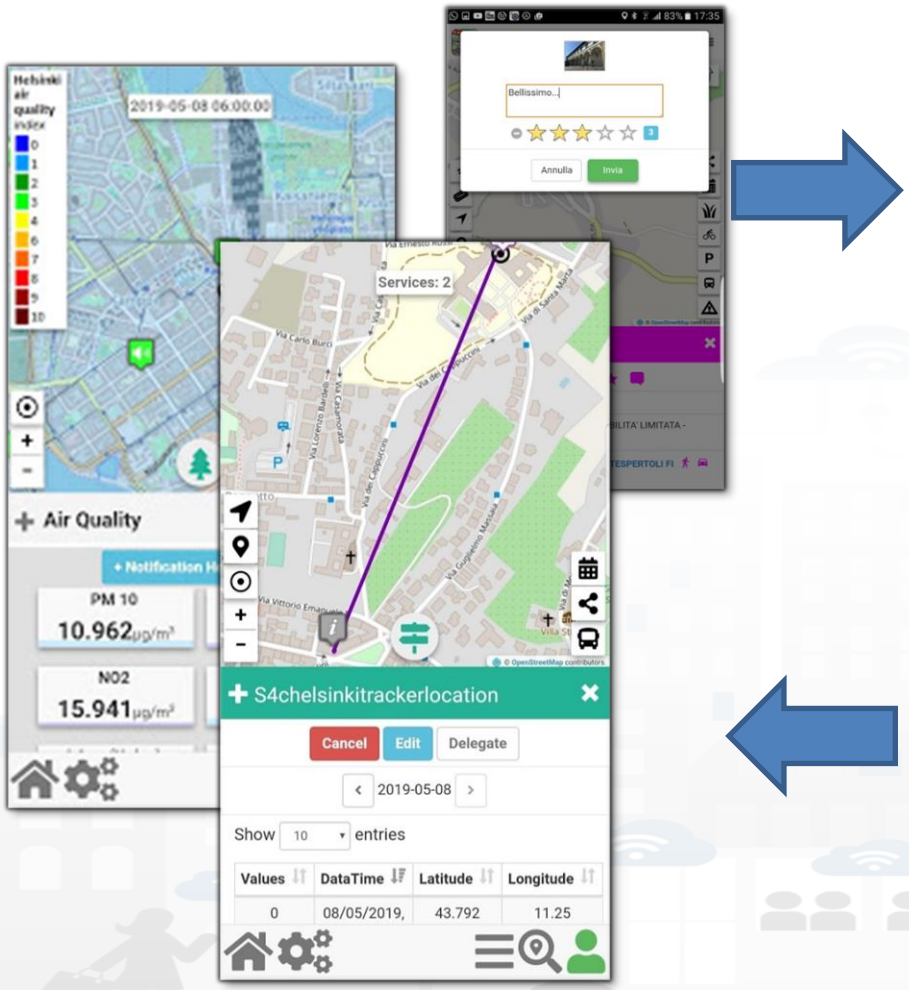

HELSINKI
ANTWERP
TOSCANA
GET IT ON Google play
Download on the App Store
SNAP4CITY
KM 4 CITY
Accommodation
Cultural Activity
Education And Research
Emergency
Entertainment
Environment
Shortest
Quiet
Add Destination
Reset
Calculate
Events
Day
Week
Month
Services: 100 on 139 available
EAQI
Index
1. Good
2. Fair
3. Moderate
4. Poor
5. Very poor
Results
Antwerpen
Alert Notification
Air Quality
PM10
63 ppm
European Air Quality Index Heatmap
Lines
BUS
Liège-Guillemins -- Welkenraedt
Bruges -- Gand-Saint-Pierre
Hasselt -- Aarschot
Mons -- Quévy
Add POI
Points Of Interest
Le Pain Quotidien
243 m
Copyright
250 m
Modemuseum
270 m
Air Quality
PM 10
10.962
PM 2.5
4.648
NO2
15.941
Helsinki AQI
1.048

The App is a Bidirectional Device

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

Produced information

- Accepted ?
- Performed ?
- …



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
- …..

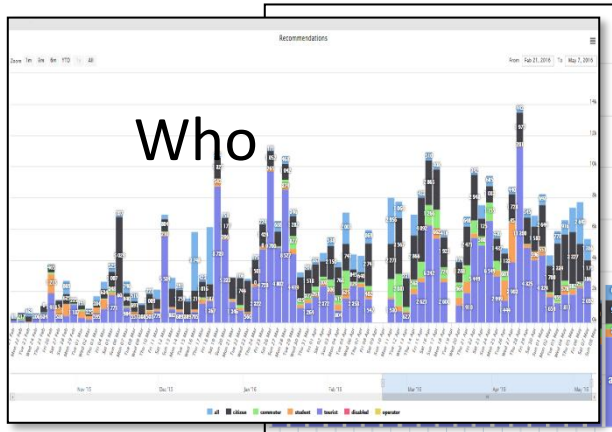
Produced information

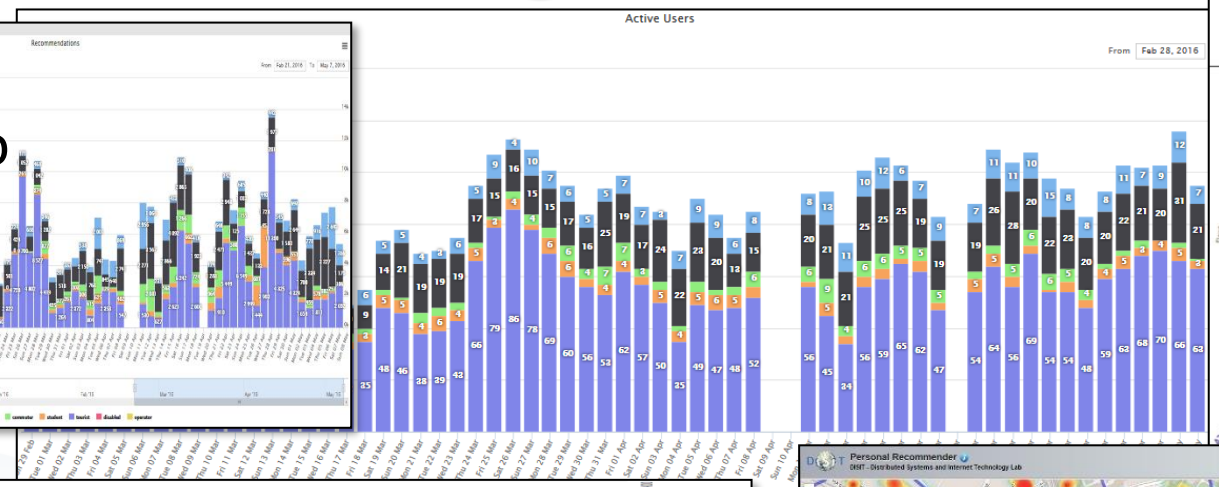
- Suggestions
- Engagements
- Notifications
- …

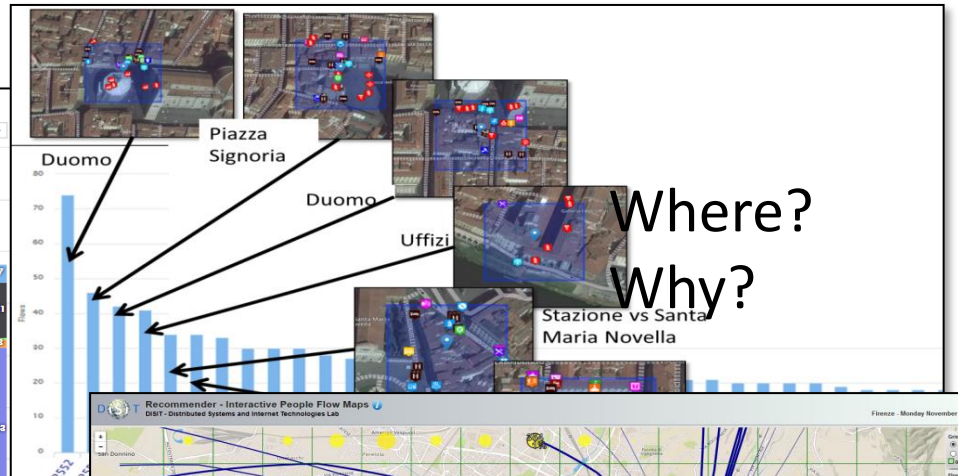
Users

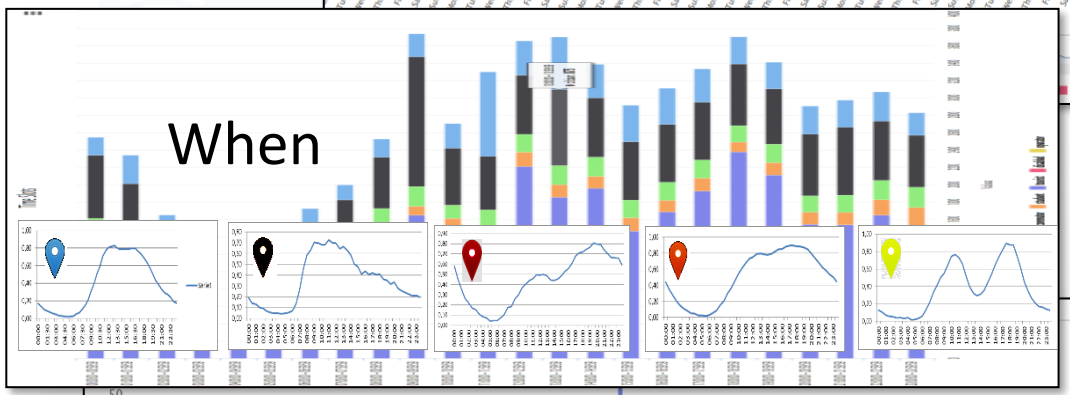
System

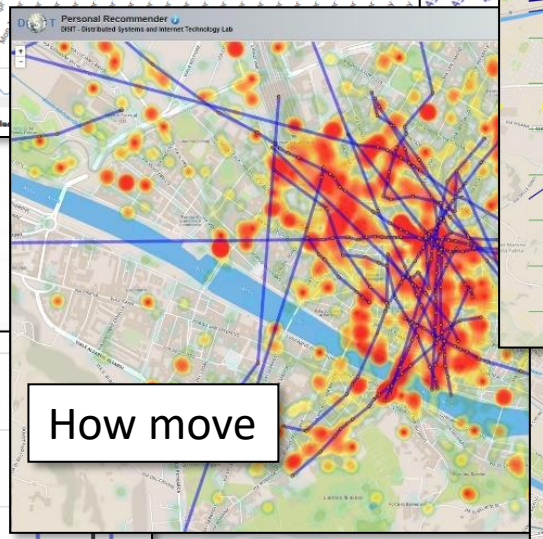
User Behavior Analyser for Collective Profiling

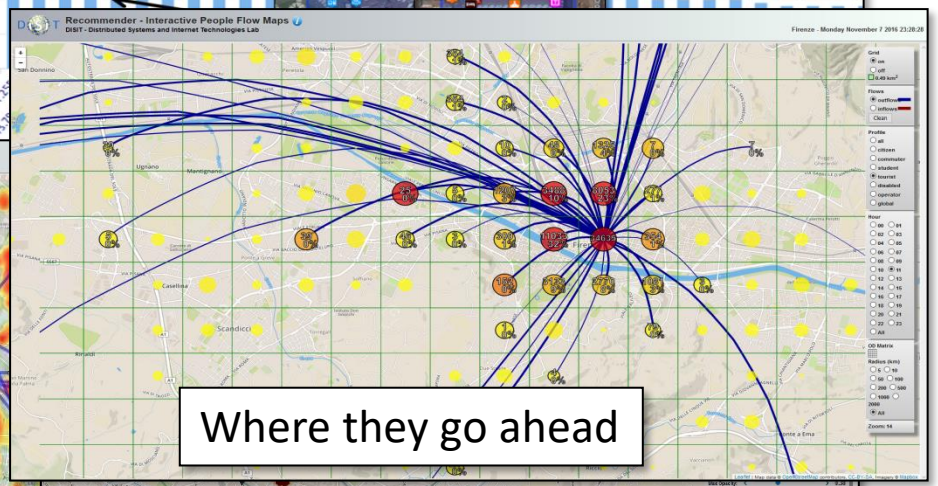


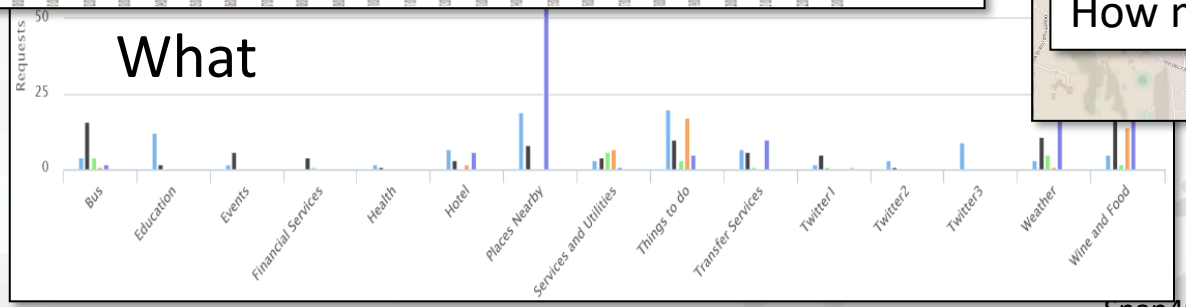


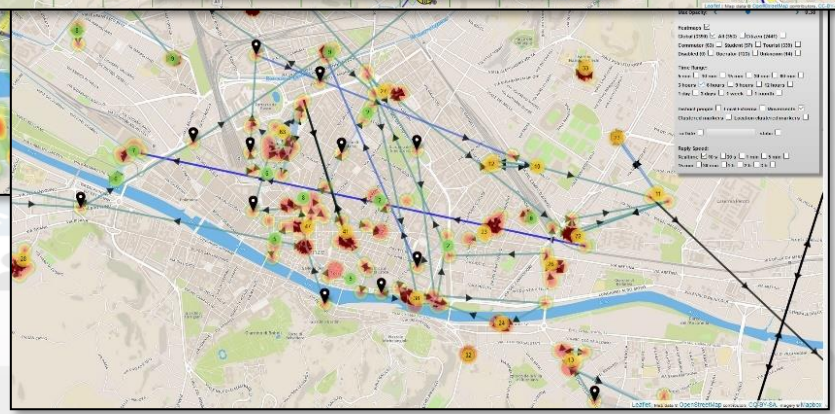




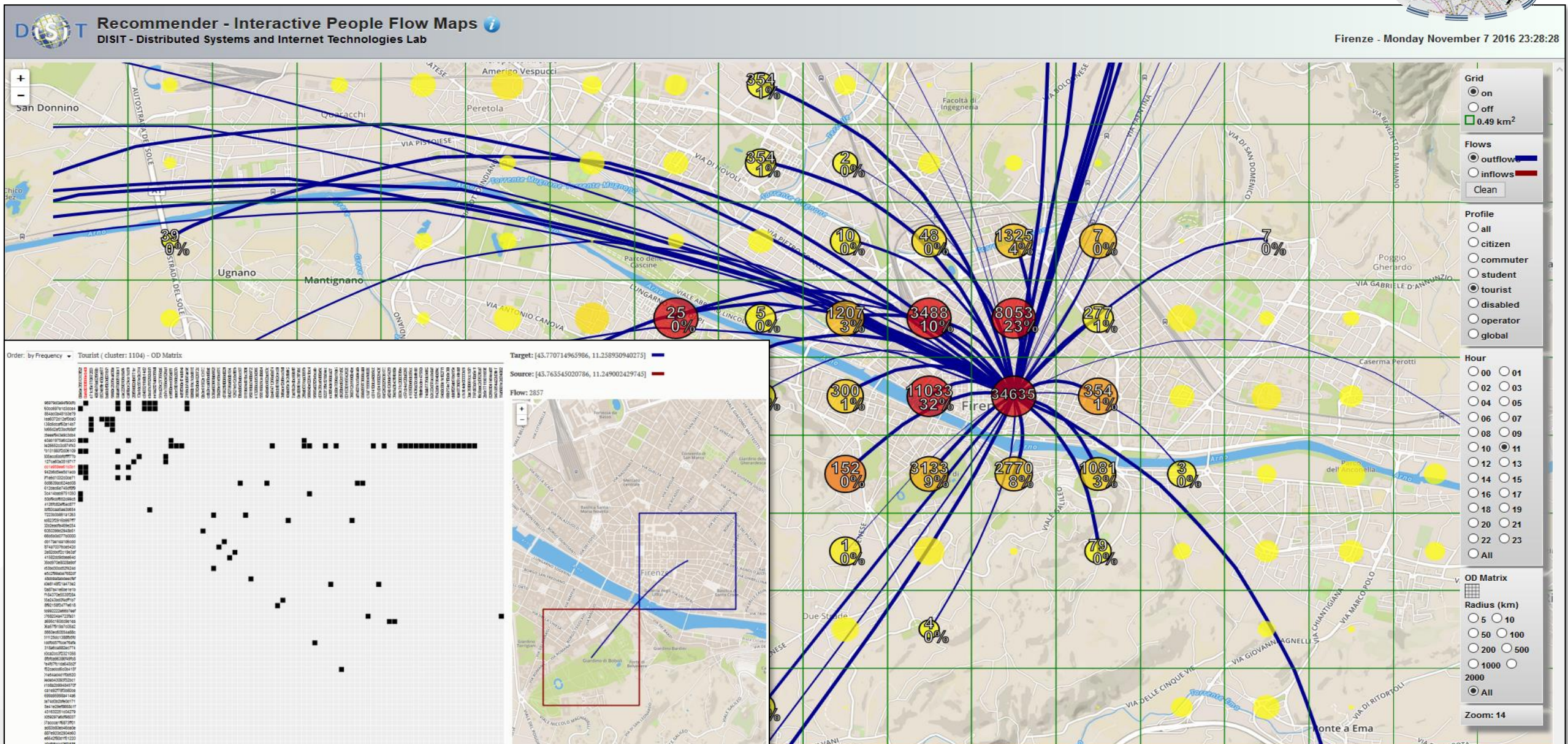






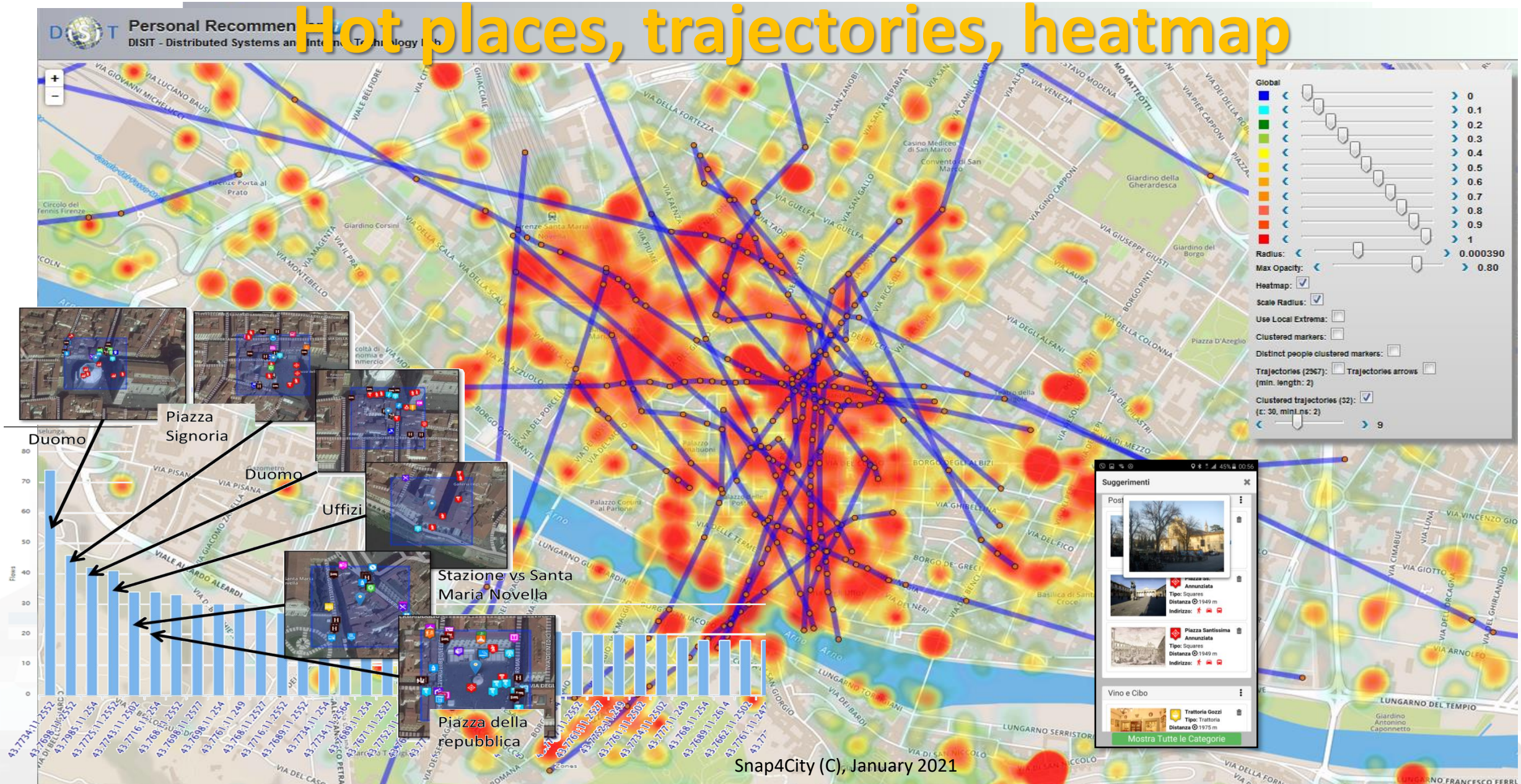


Scalable OD Matrix



User Behaviour Analyser

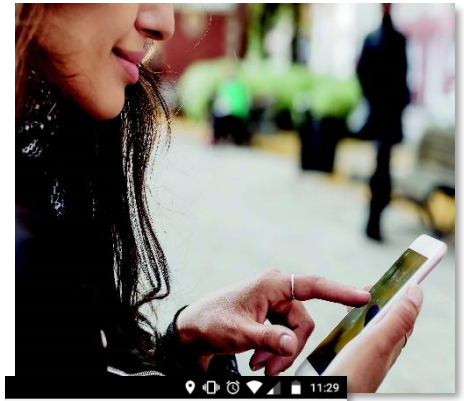
Hot places, trajectories, heatmap



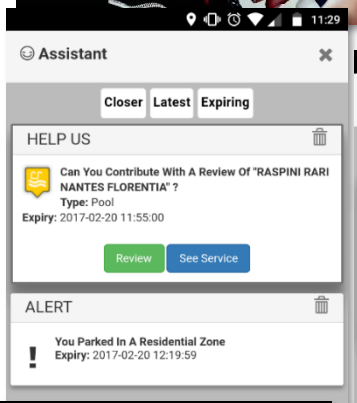
Engaging City Users Towards Virtuous Behaviours (real time)

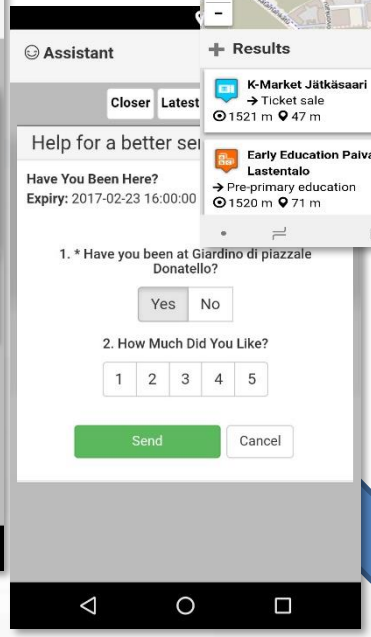


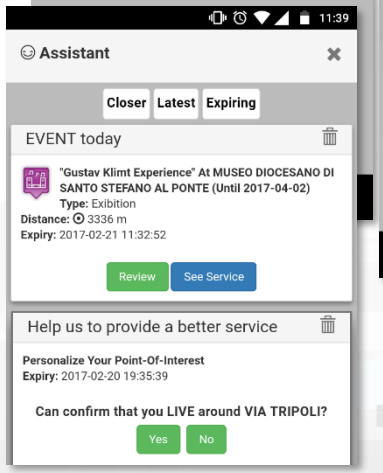
Users' Engagement

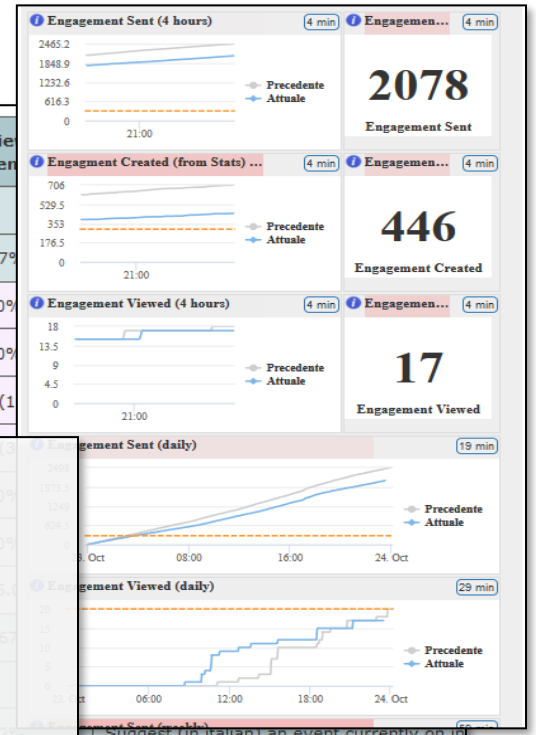












Rule name	Type	#sent	#viewed	#vie #sen
daily_event_de	ENGAGEMENT	1 (0%)	0 (0%)	0%
daily_event_en	ENGAGEMENT	1720 (2.12%)	70 (7.1%)	4.07%
	- commuter	5 (0.29%)	0 (0%)	0 (0%
	- student	14 (0.81%)	0 (0%)	0 (0%
	- tourist	1462 (85%)	25 (35.71%)	25 (1

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

Suggest (in italian) an event currently on in
Alert (in english) if the user parked in a res
Alert (in spanish) if the user parked in a res
Alert (in italian) if the user parked in a resid
Ask (in german) a contribution for a nearby

Rules

User context

City context



Campaing on Sustainable Mobility

Sii smart.
Sii-Mobility!
Scarica, viaggia, vinci!

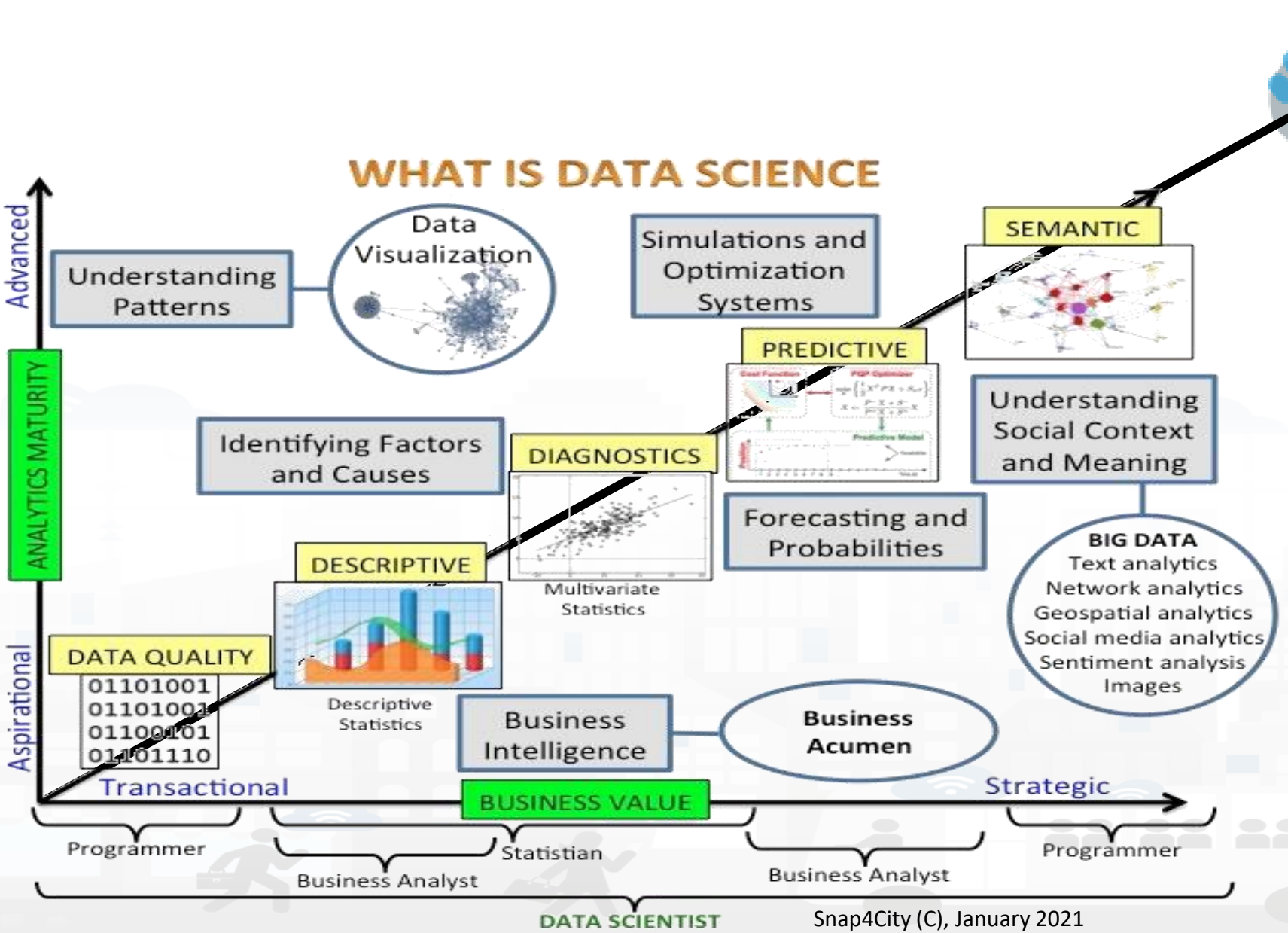


Dal 15 aprile al 15 luglio scegliere il trasporto pubblico ti premia!
Scarica l'app "Toscana dove, cosa", guadagna punti viaggiando in autobus e vinci tanti fantastici premi.
Per maggiori informazioni visita il sito info.sii-mobility.org
TOSCANA
ataf
BUSITALIA
GRUPPO FERROVIE DELLO STATO ITALIANE
MIUR
UNIVERSITÀ DEGLI STUDI FIRENZE
DINFO
DISIT

TOP

DATA ANALYTICS, Big Data Science





Sentient and active processes

- Big Data
- Semantic Computing
- Machine Learning
- Geo Spatial Reasoning
- Sentiment Analysis
- What If Analysis
- Text Analysis
- Simulations
- Visual Analytics
- MicroServices
- Scalability
- Engagement Analysis
- ….

DATA ANALYTICS



- Resilience
  - Resilience and risk analysis
  - Early warning computation
  - What-if analysis, dynamic routing, origin destination matrices production from a large range of sources
- Mobility and transport
  - Traffic flow reconstruction from sensors and other sources: parking predictions: wi-fi people flow prediction and reconstruction
  - Analysis of the demand vs offer of mobility according to public transportation and multiple data sources
  - Accidents heatmaps
  - Traffic flow predictions
  - Tracking fleets, people, devicesOBD2 support
- Environment and weather
  - NOX pollution prediction on the basis of traffic flow, 48 hours see
  - Pollution prediction at 48 hours, every hour
- User and Social
  - User engagement for sustainable mobility
  - User's behaviour analysis, data reconstruction and calibration
  - People flow analysis from PAX Counters
  - Social media analysis on specific channel, specific keywords: see Twitter Vigilance, for NLP and Sentiment Analysis, SA
  - ReTweet proneness, retweet-ability of tweets
  - Audience prediction to TV channels and physical events
- Generic
  - Data quality assessment, prediction, anomaly detection
  - Maintenance prediction and costs predictions

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Disappearing Data Analytics

SNAP4CITY | KM 4 CITY

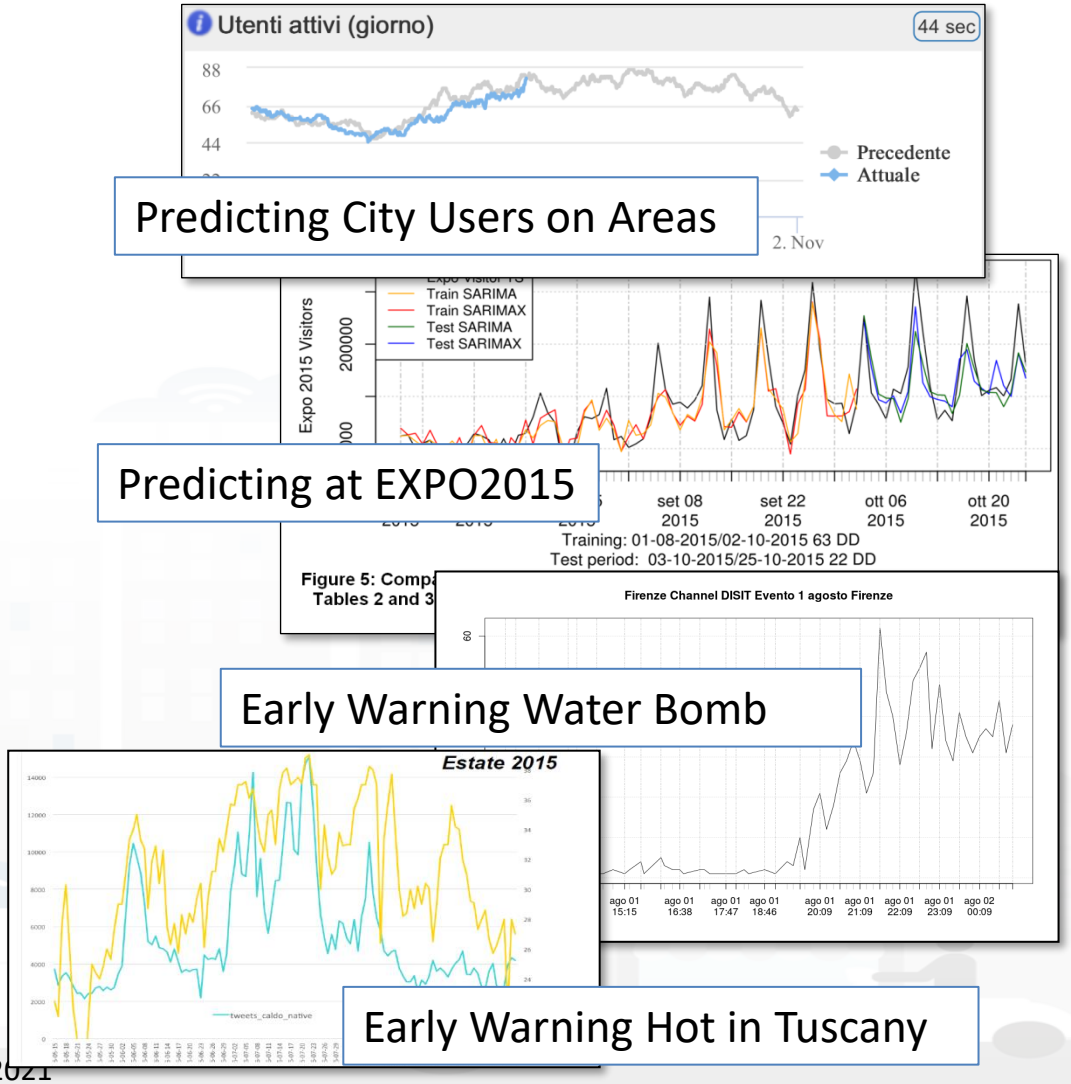
	Antwerp					Helsinki								Where				
SNAP4CITY	City official	ICT official	Developer	Citizen, tourist, visitor	Business owner	City officials	City officials Domain experts	City officials City developers	Third party developers	Citizen	Citizens with respiratory problems	Tourists	Business owners	Mobile	MIcroApplication	Tool, via Portal (ICT Developers)	Dashboards	RULE OF THUMB Main Data Sources
Discovery near to me	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			POI, OSM
Discovery along a path	x	x	x	x		x		x	x	x	x	x		x	x			POI, OSM
Discovery in an area, shape	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		POI, OSM
browsing Public Transport	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			OSM, GTFS
Full Text search	x	x	x	x	x	x		x	x	x	x	x	x	x		x		POI, OSM
Routing: pedestrian				x	x			x	x	x	x	x	x	x	x			OSM
Routing: pedestrian quite				x	x			x	x	x	x	x	x	x	x			OSM
Routing: private vehicles	x		x	x		x		x	x	x	x	x		x	x			OSM
Routing: Multimodal Public Transport				x					x	x	x	x		x	x	x		OSM, GTFS
heatmaps: weather (Temp, Humidity)	x	x		x	x	x	x		x	x	x	x	x	x			x	Sensors data, OSM
heatmaps: environmental variables, PM10, PM2.5, NO2, EAQI	x	x		x	x	x	x		x	x	x	x	x	x			x	Sensors data, OSM
heatmaps: environmental variables, Noise						x	x		x	x	x	x	x	x			x	Sensors data, OSM
heatmaps: safe on bike (Antwerp)	x	x		x	x									x			x	Spec. Portal
heatmaps: Enfuser prediction, PM10, PM2.5, AQI						x	x		x	x	x	x	x	x			x	Enfuser data
heatmaps piking values any place	x	x			x	x	x	x	x				x				x	Computed Heatmps
heatmaps: GRAL prediction, PM10						x	x		x	x	x	x	x	x			x	OSM, Traffic, Weather
Comparsison: Enfuser, Gral, Real Time						x	x										x	Enfuser, Sensors, GRAL
Sensors Data Time Trends, & drill down	x	x	x		x	x	x	x					x			x	x	Sensors data, OSM
Weather Forecast	x	x		x	x	x	x		x	x	x	x	x	x			x	Forecast Service
Origin Destination Matrices	x	x	x		x	x	x	x	x				x				x	Snap4City Mobile App
Typical trajectories	x	x	x	x	x	x	x	x	x				x			x	x	Snap4City Mobile App
Hot Area in the city	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	Snap4City Mobile App
Hot Places in Smart Zone	x	x	x	x	x									x		x	x	Snap4City PAXcounters
Services Suggestions on mobiles				x						x	x	x		x	x			Snap4City Mobile App
Alerts on critical cases: several variables	x			x	x	x	x			x	x		x	x				Sensors data, OSM
The most used services		x		x	x		x			x	x	x	x				x	Snap4City Mobile App
Twitter Trends Daily	x	x	x		x	x	x	x	x				x			x	x	Twitter Vigilance
The auditing of user and living lab		x				x		x								x		Snap4City Portal
Self assessment	x	x	x	x	x	x	x	x	x	x	x	x	x			x		Snap4City Portal
Trajectories reg from mobile PAX Counters	x	x	x			x	x	x							x		x	PAX Counters

Data Analytics: Predictions



Predicting Models for Administrators & City Users

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



Free Parking Predictions

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

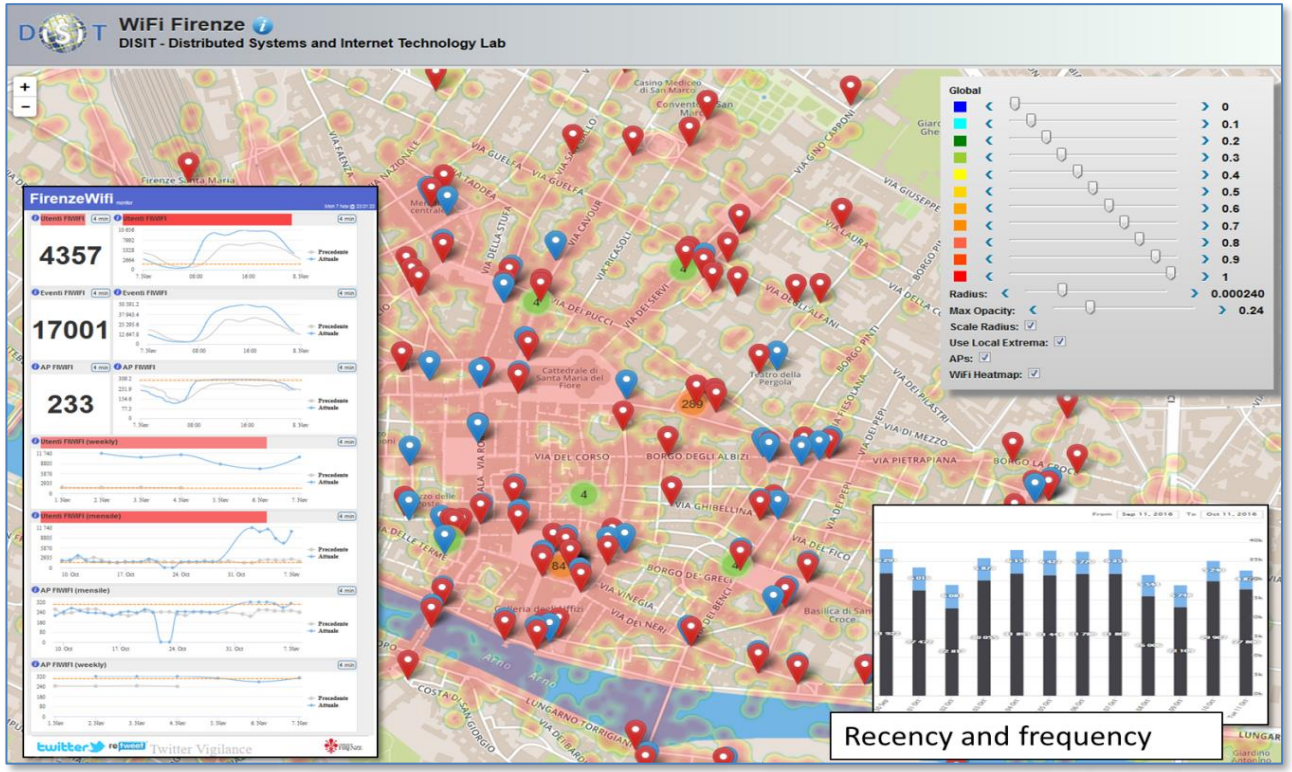


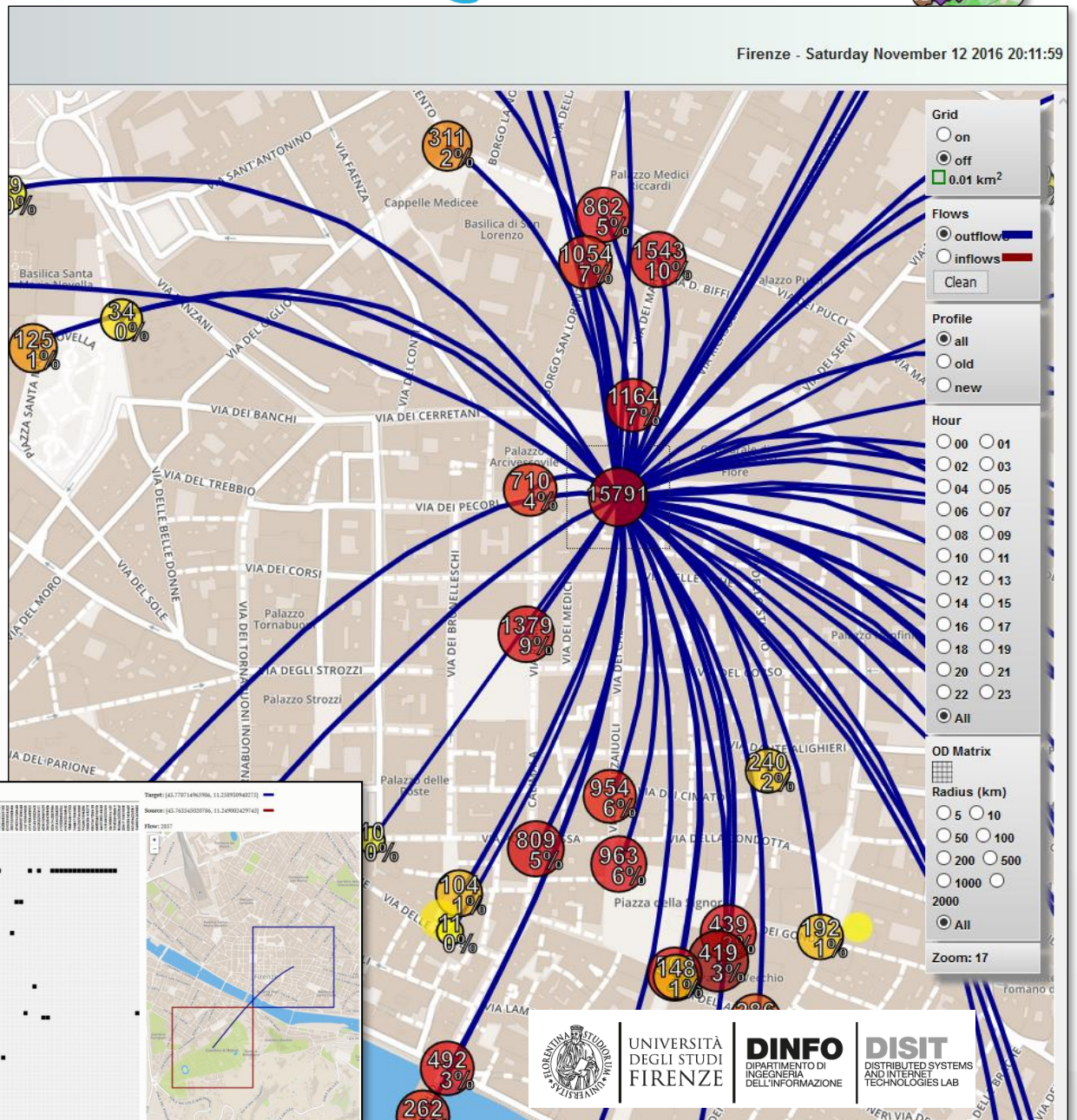
Active on Mobile Apps as:

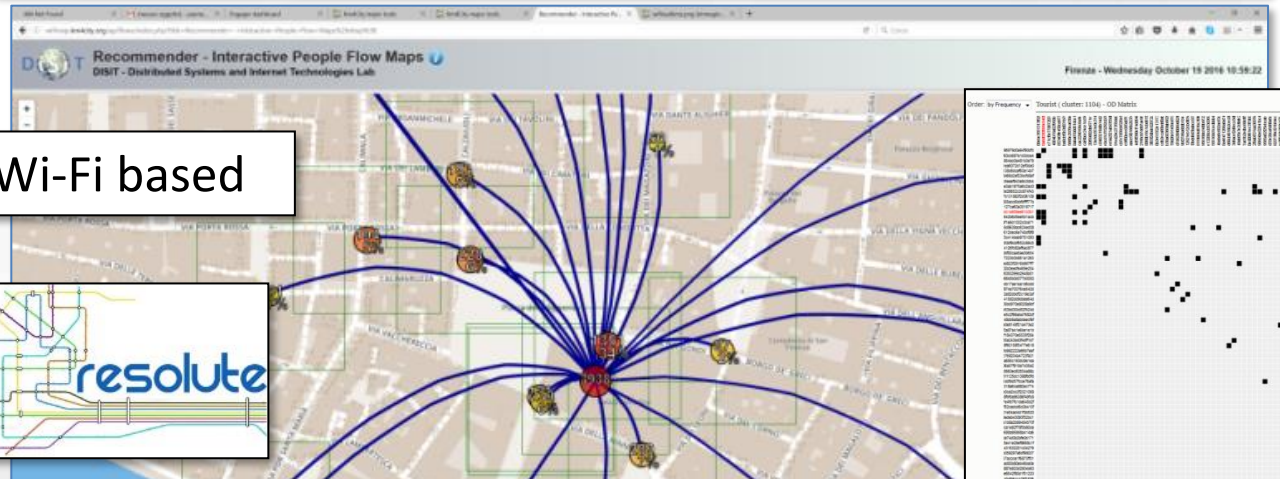
- «Firenze dove cosa»
- «Toscana dove cosa»

Precision: 97,5%

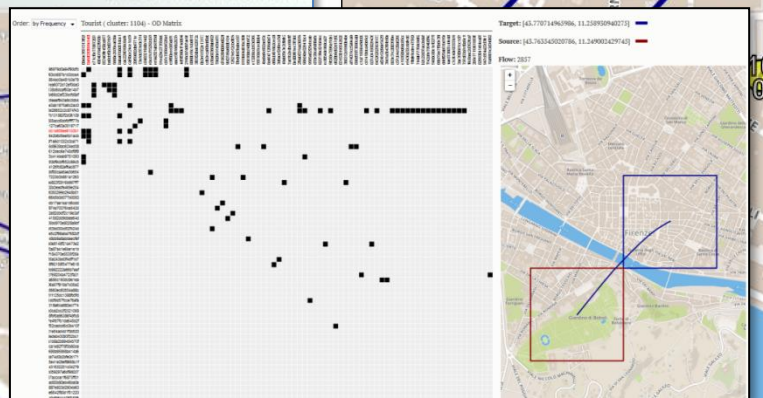
Origin Destination Matrix Estimation







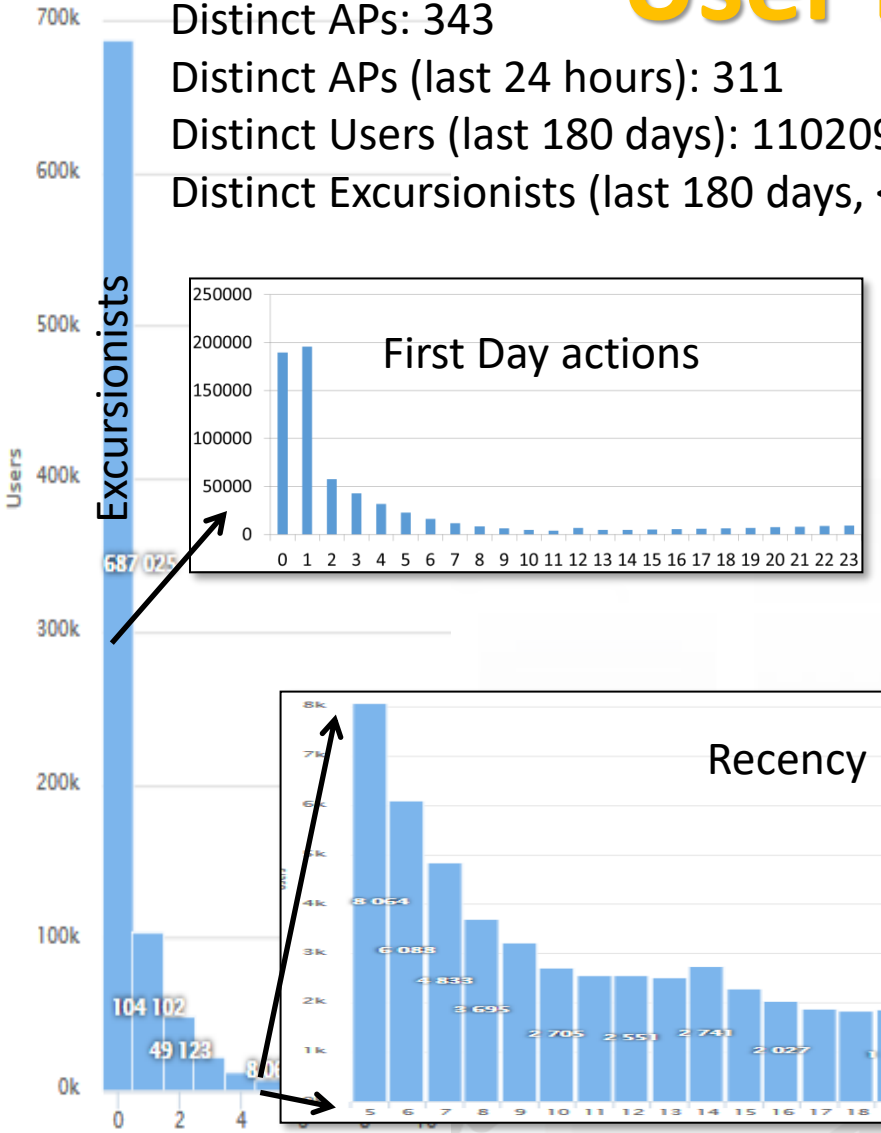
Wi-Fi based

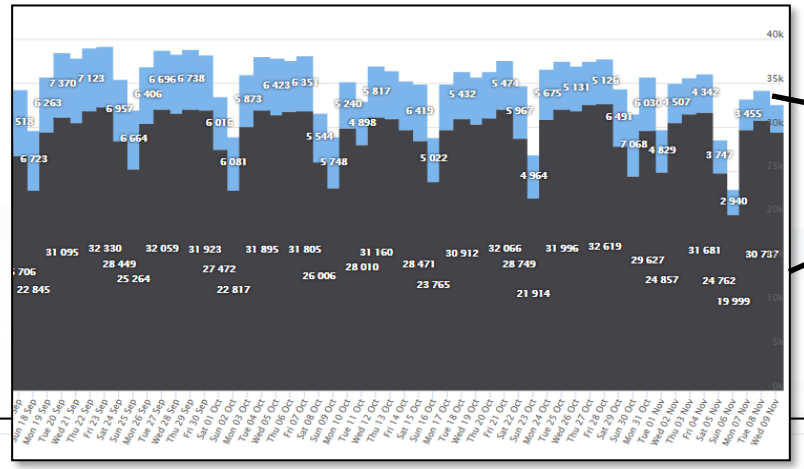


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User Behaviour Analysis

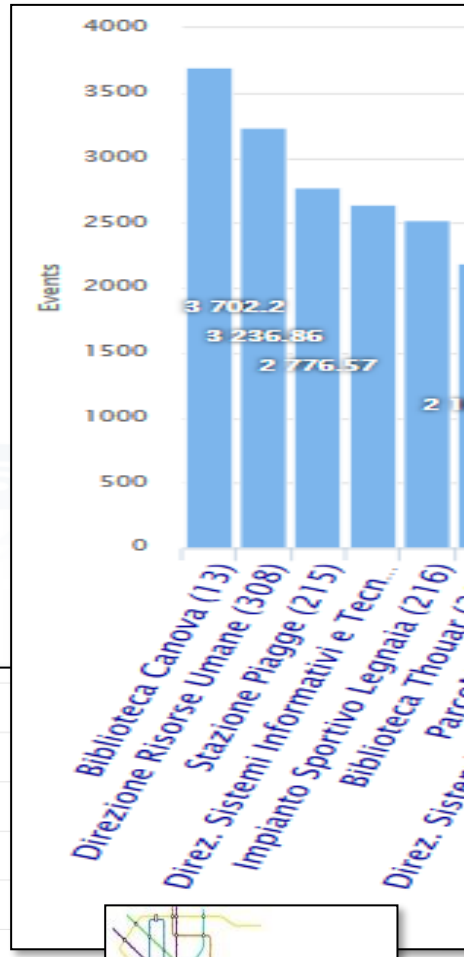
Distinct APs: 343
Distinct APs (last 24 hours): 311
Distinct Users (last 180 days): 1102098
Distinct Excursionists (last 180 days, < 24 h): 687025



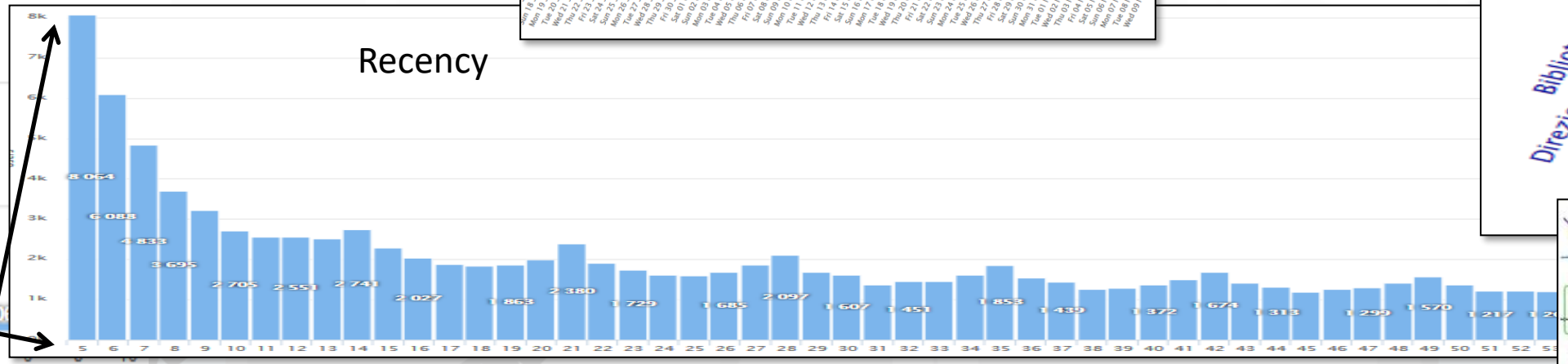


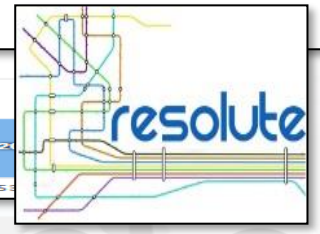
New City Users
VS
Returning

Where



Recency

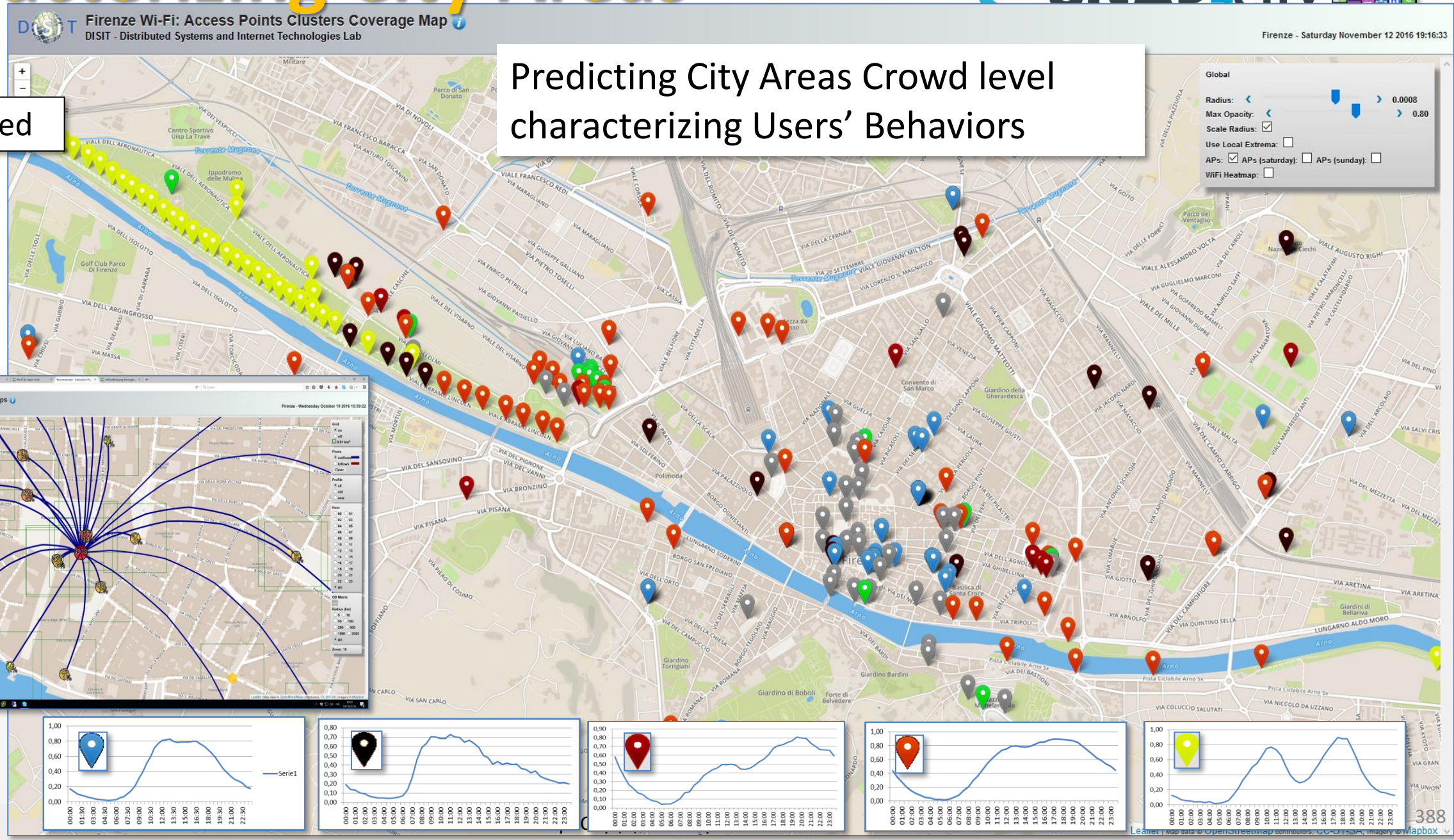




Characterizing City Areas

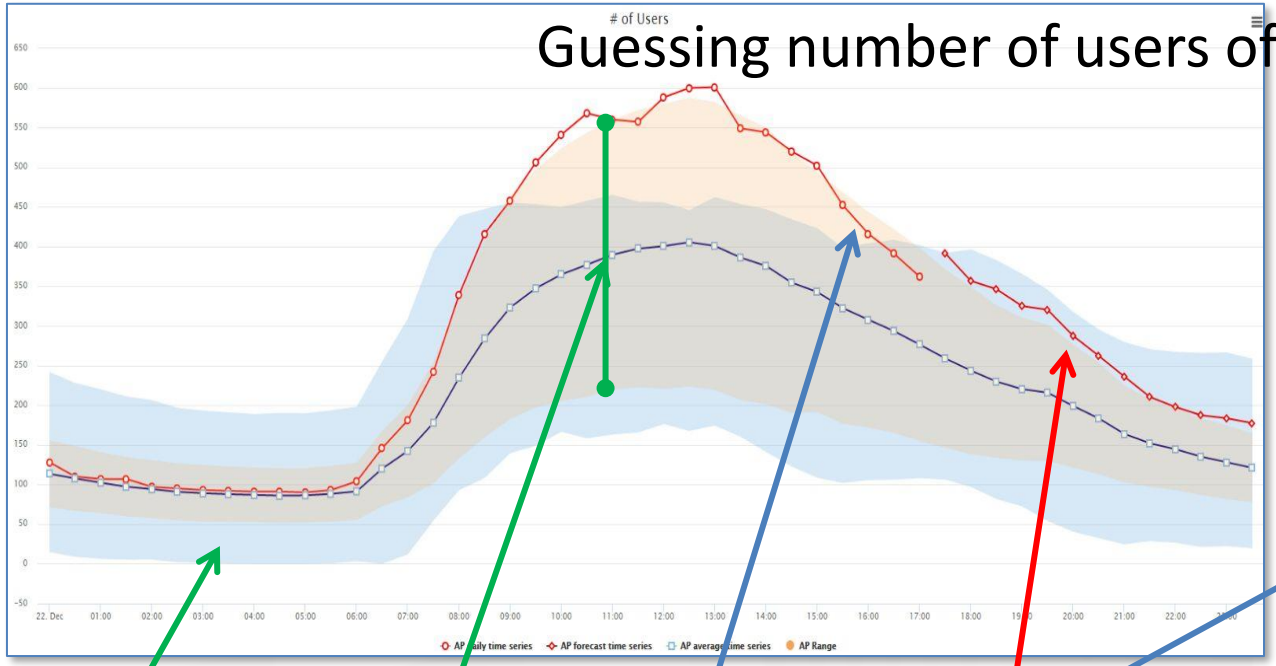
Wi-Fi based

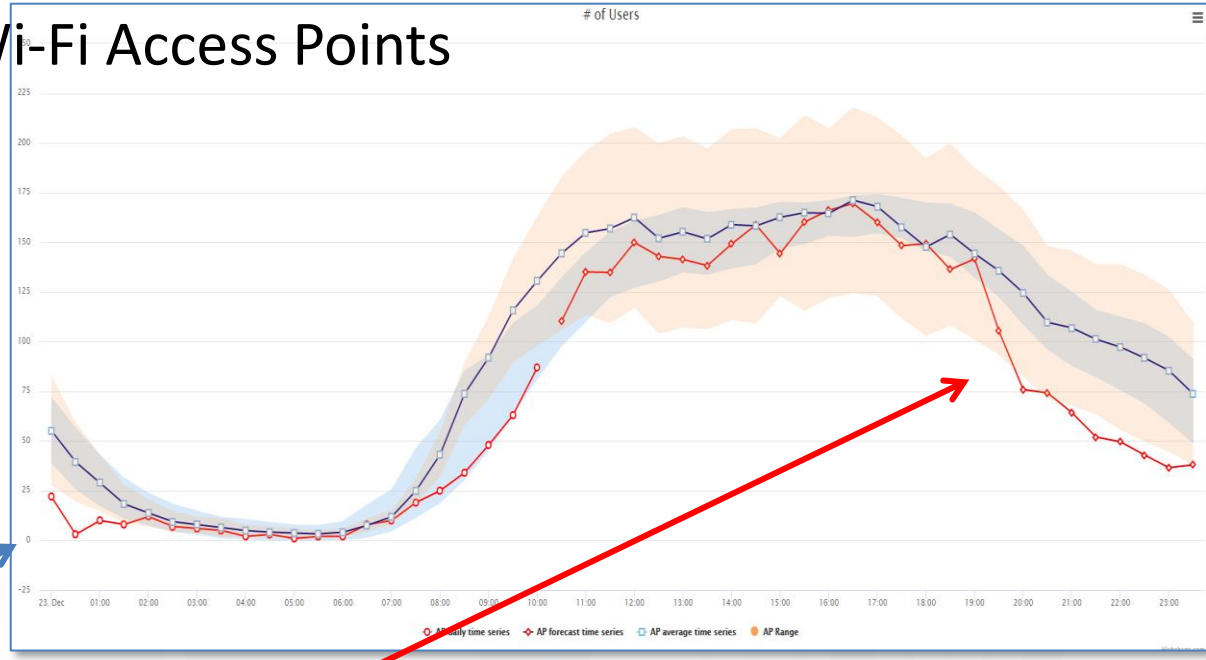
Predicting City Areas Crowd level characterizing Users' Behaviors



Prediction and Identification of Anomalies

Guessing number of users of Wi-Fi Access Points





Cluster confidence

AP average and confidence

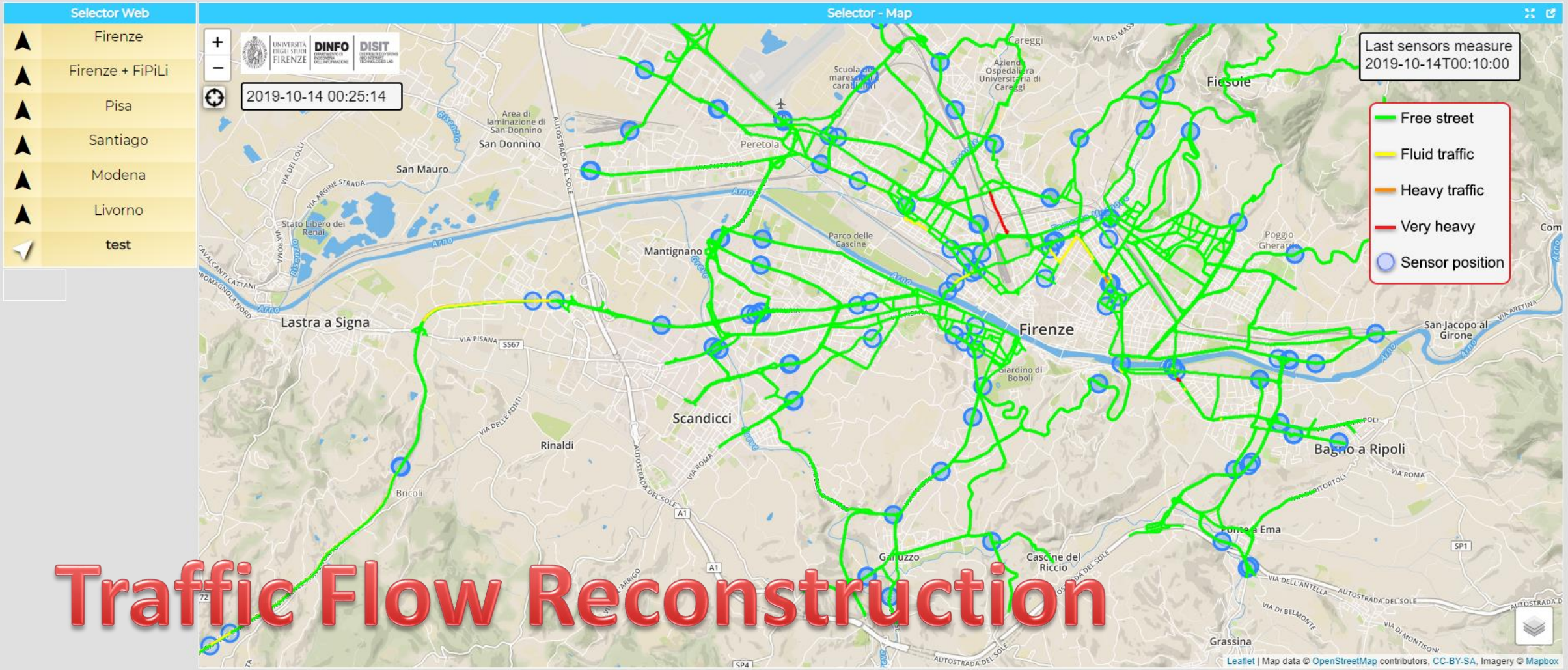
Actual AP trend for today

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

Predictive precision of the 95%

Traffic Flow Reconstruction for the cities

Mon 14 Oct 00:25:15

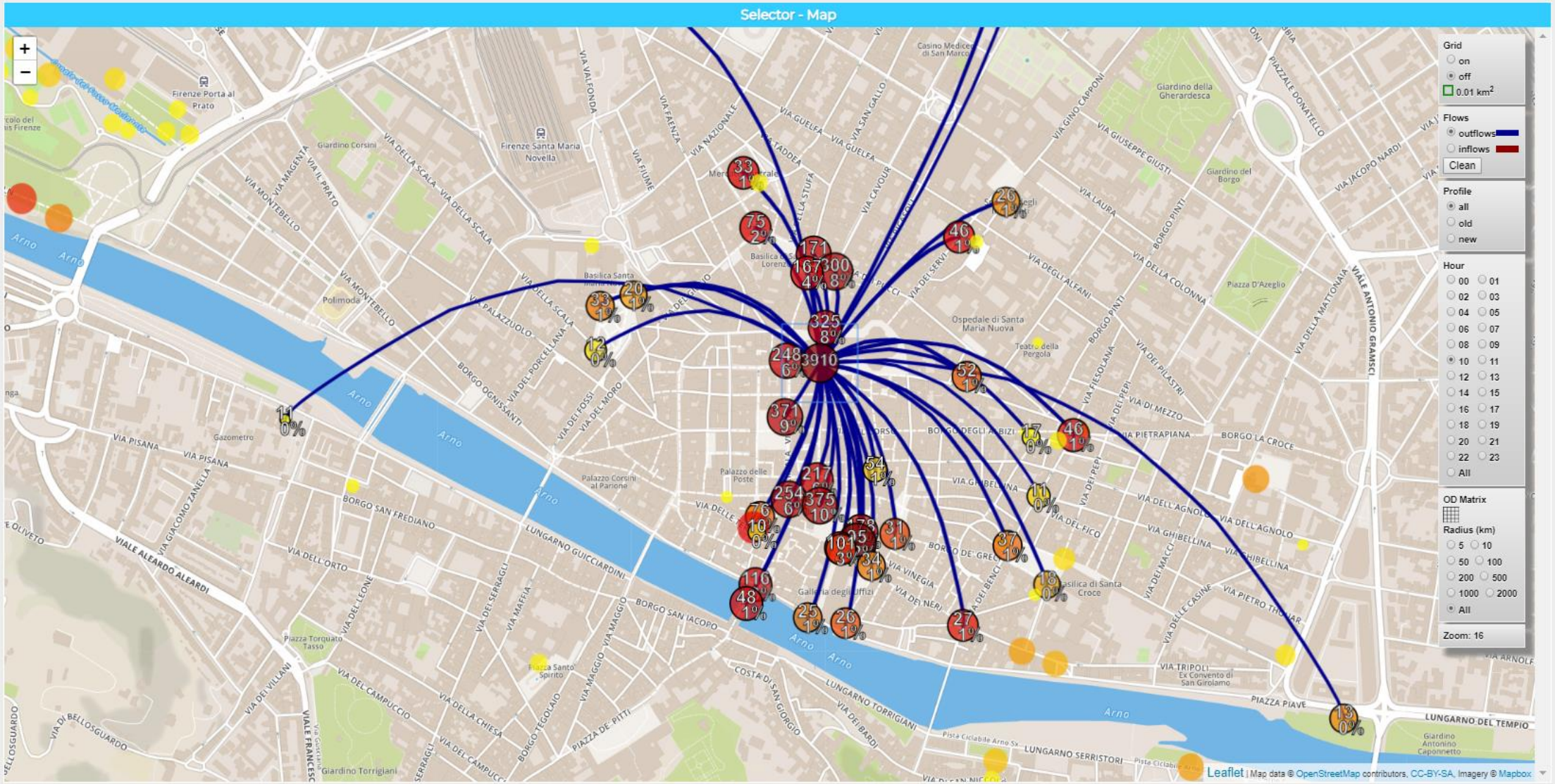


Traffic Flow Reconstruction

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc5NQ==

Life in Toscana: Dashboard

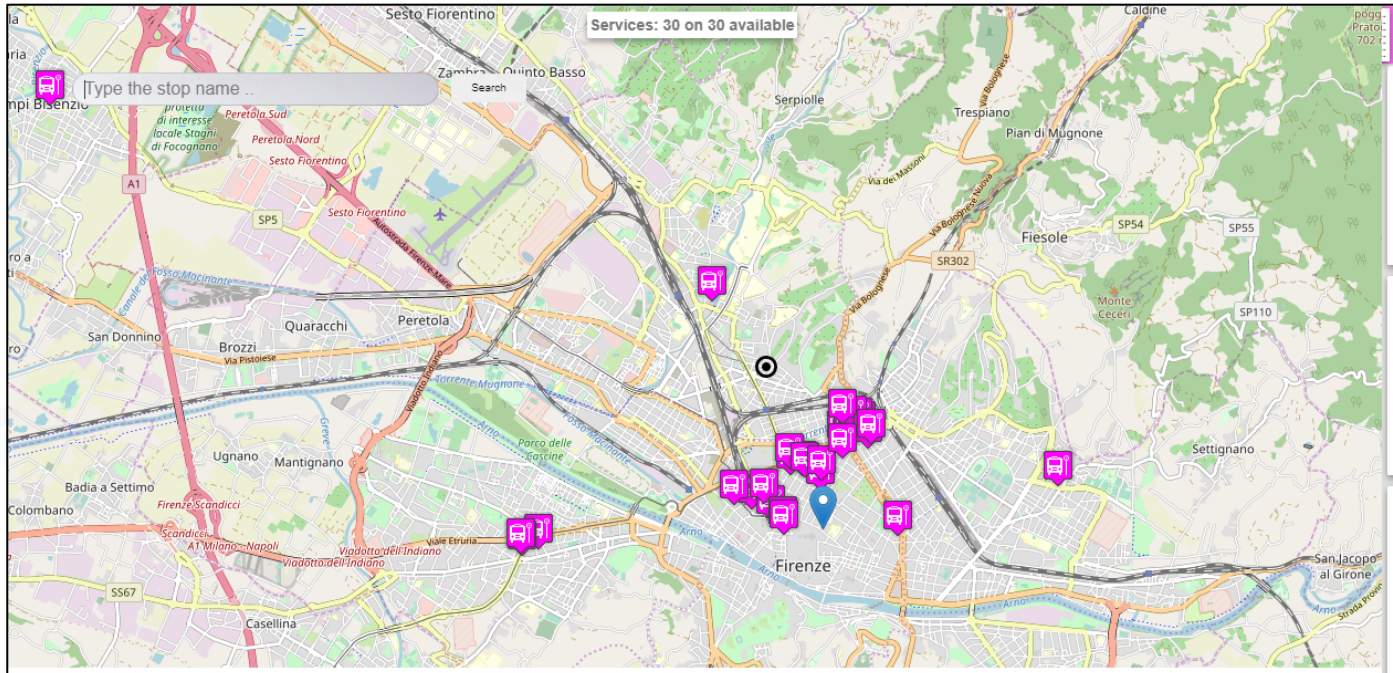
Sun 20 Oct 23:44:05

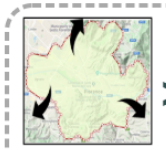


- Line of Transport
- Public Transport
- Travel Plan
- Traffic Flow FIPILI
- Air Quality
- Weather
- Origin Dest. Matrix
- Typical Trajectories
- People Flow WIFI
- People Flow KM App
- Cultural Activities
- Forum Discussion
- CAM
- Ponte Vecchio
- Real Time Busses

Main

Bus Stop Analysis: identification of criticalities





> 42300

Daily individual Production Trips



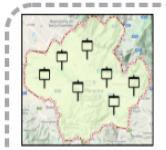
> 52900

Daily Individual Attraction Trips



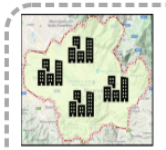
21289

Daily bus trips



1875

Bus Stops



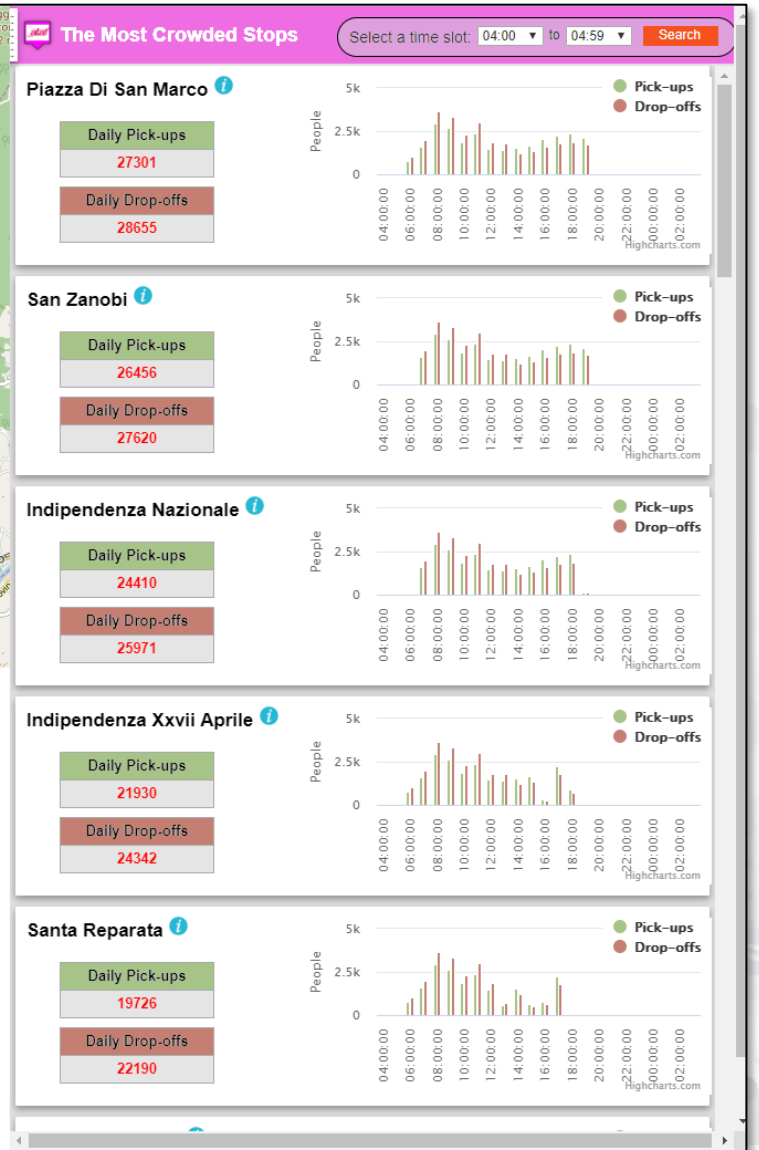
31070

Residential Buildings



31059

Service Providers



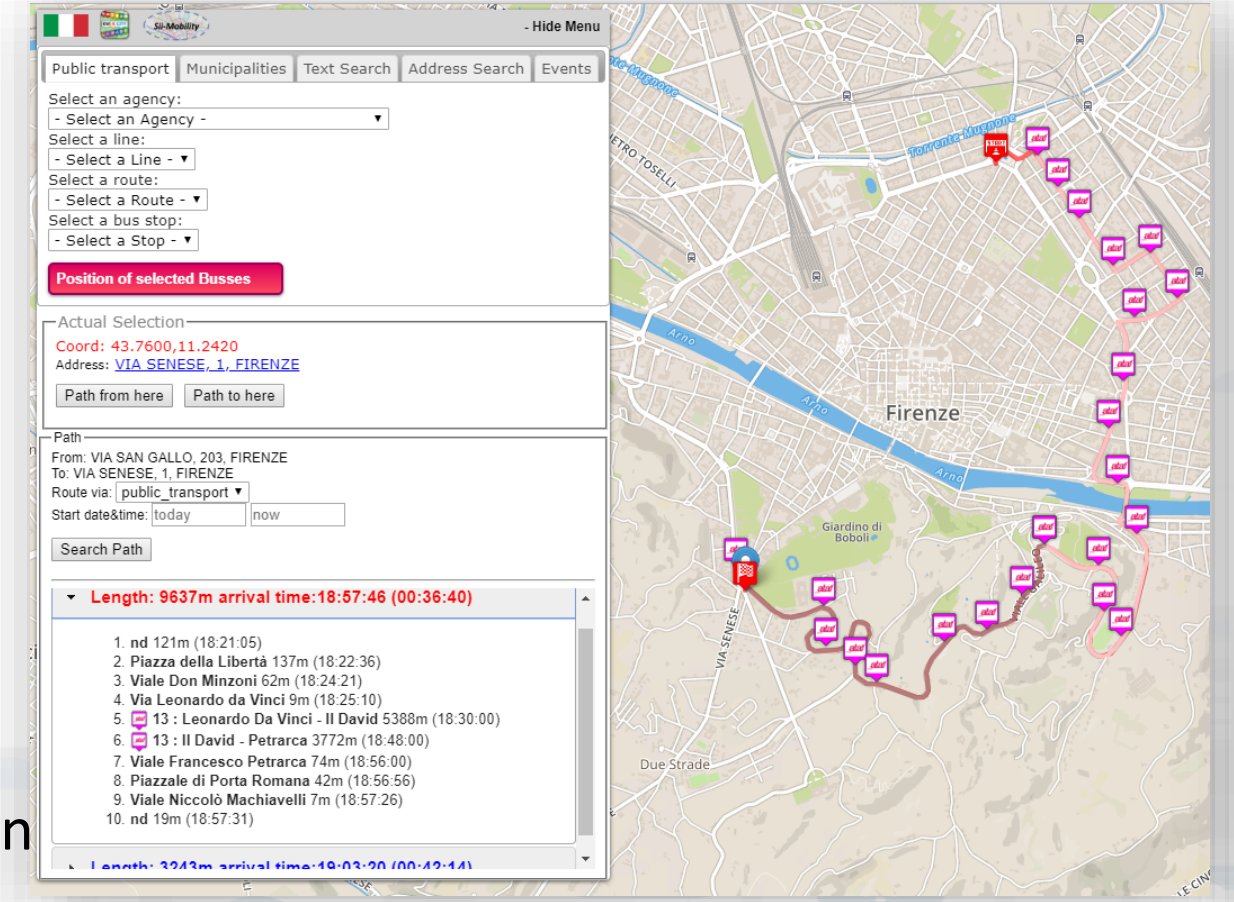
Routing and Multimodal Routing

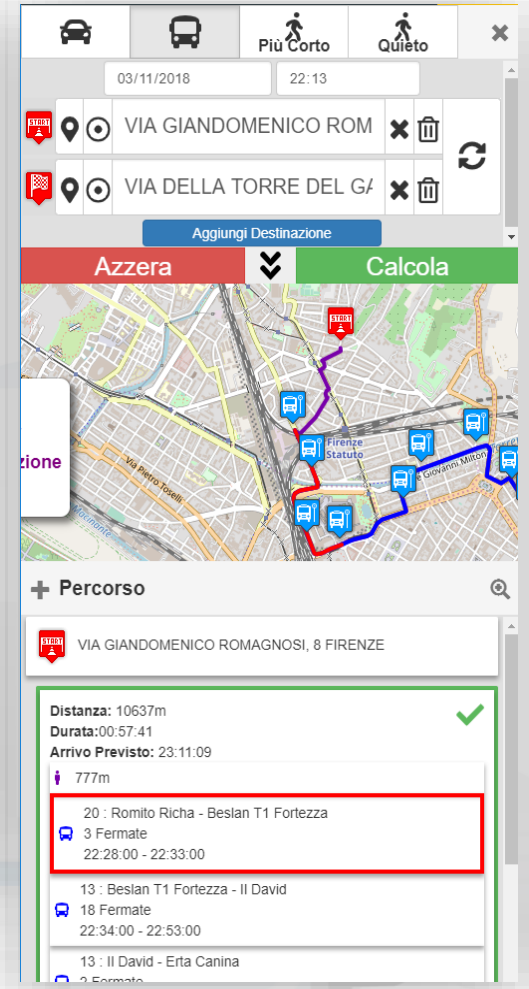
Modes:

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

Test it on our:

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

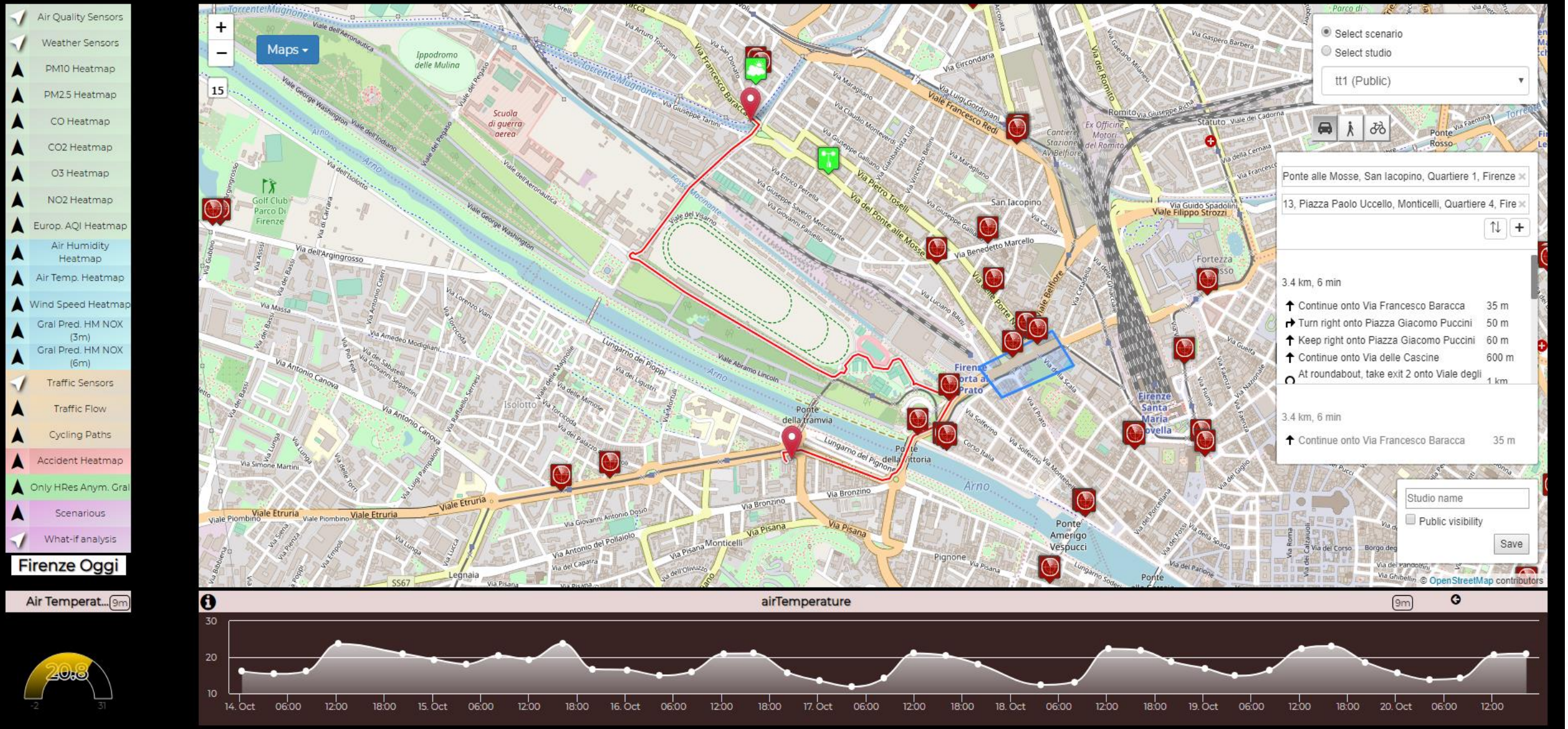




Mobility and Environment What-IF Analysis

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

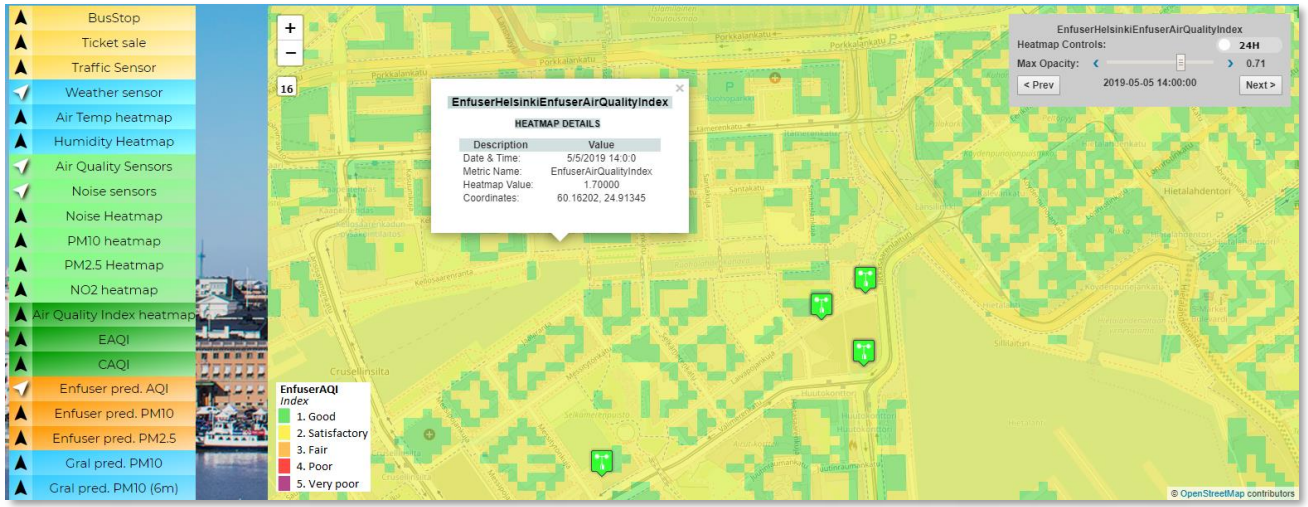
Sun 20 Oct 23:50:38

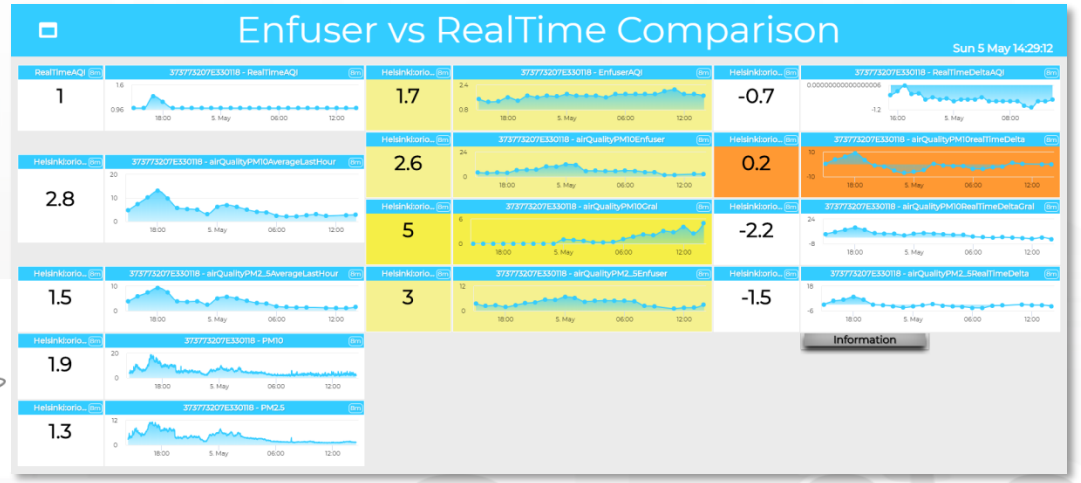


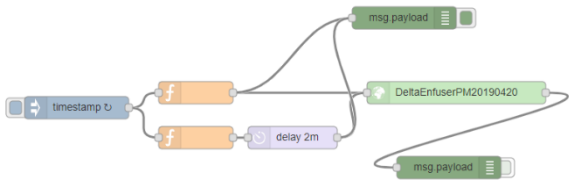
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjE5MA==

Data Analytics: Enfuser predictions

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







Heatmap Firenze - trafair

different data

Fri 17 May 12:49:34

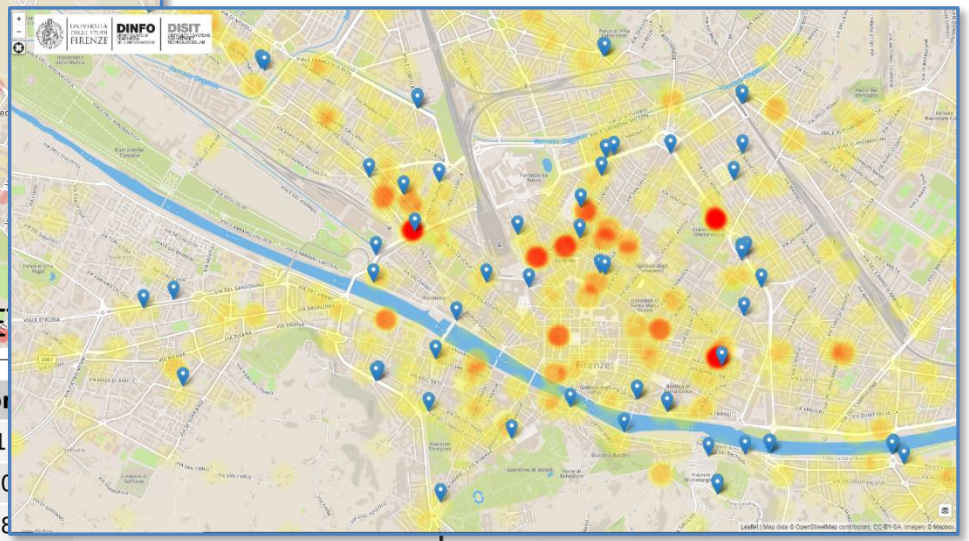


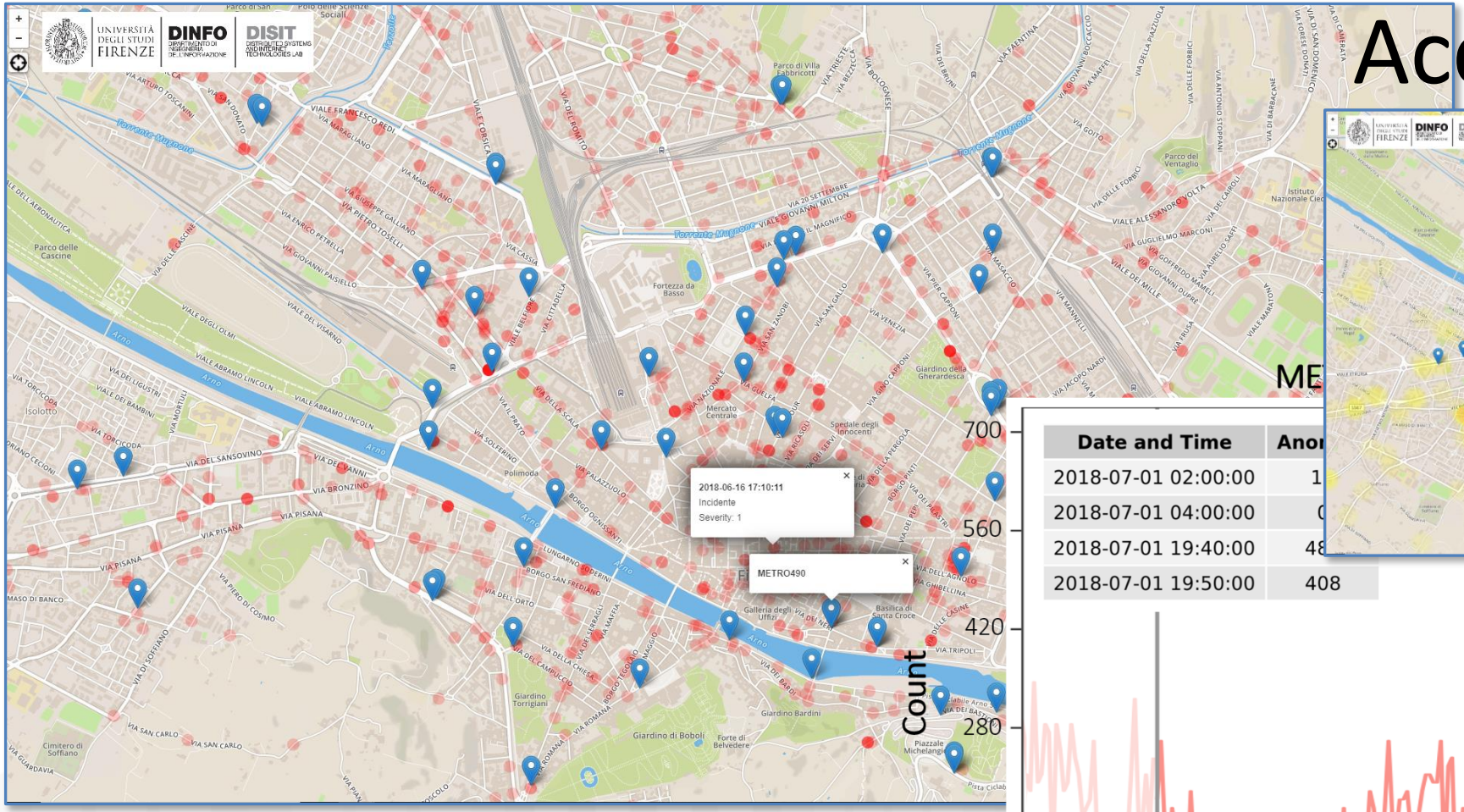
Florence, Pisa, Livorno

https://main.snap4city.org/view/index.php?iddasboard=MTUzMg==

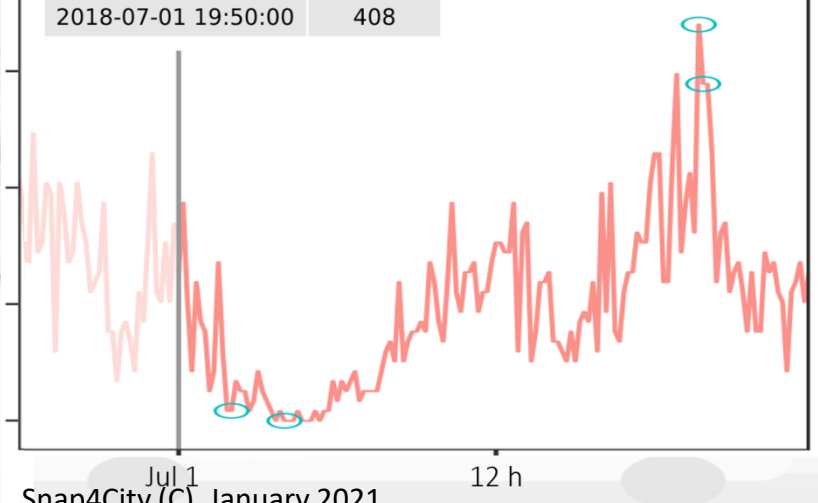
Anomaly Detection

Accidents Density





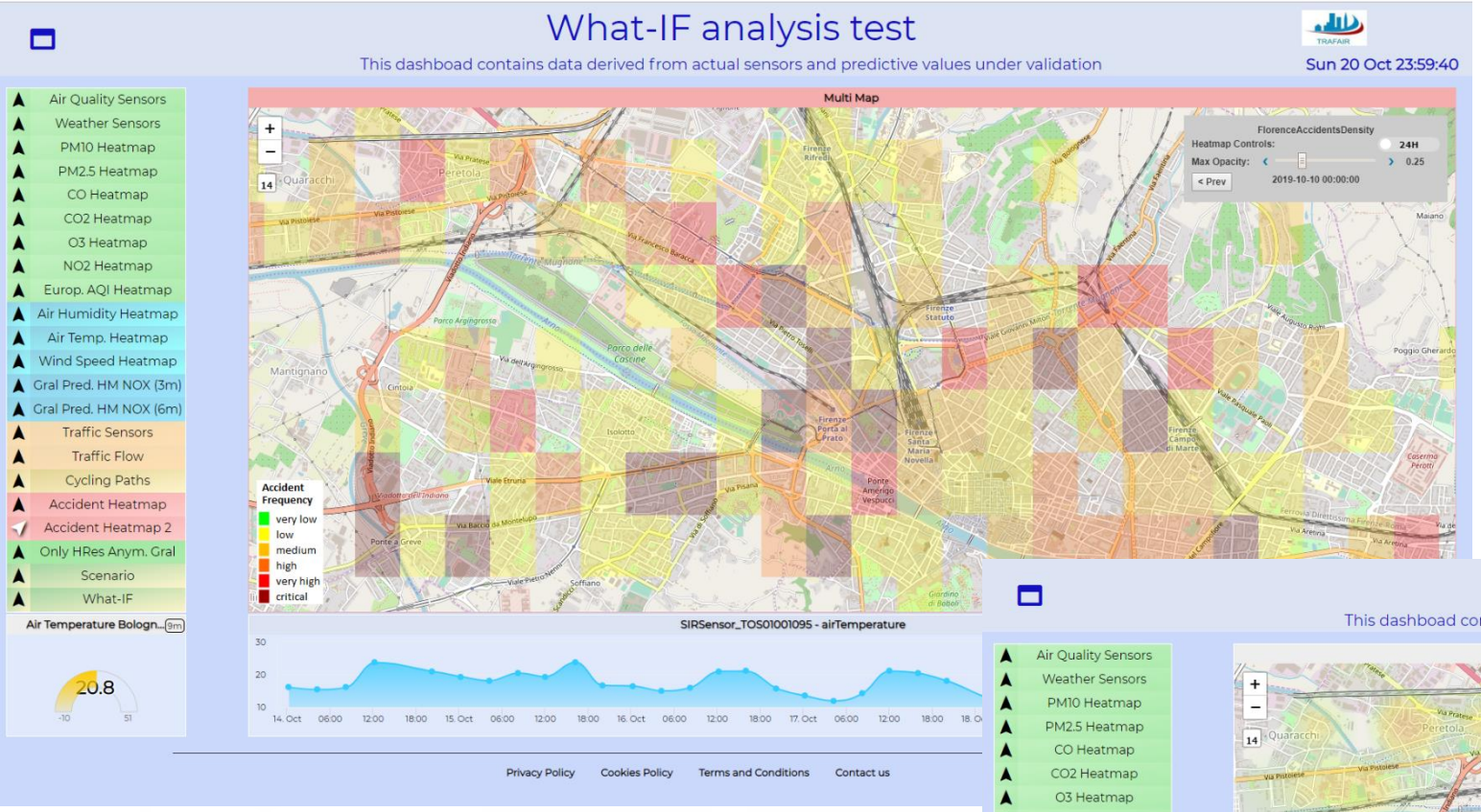
Date and Time	Anor
2018-07-01 02:00:00	1
2018-07-01 04:00:00	0
2018-07-01 19:40:00	48
2018-07-01 19:50:00	408

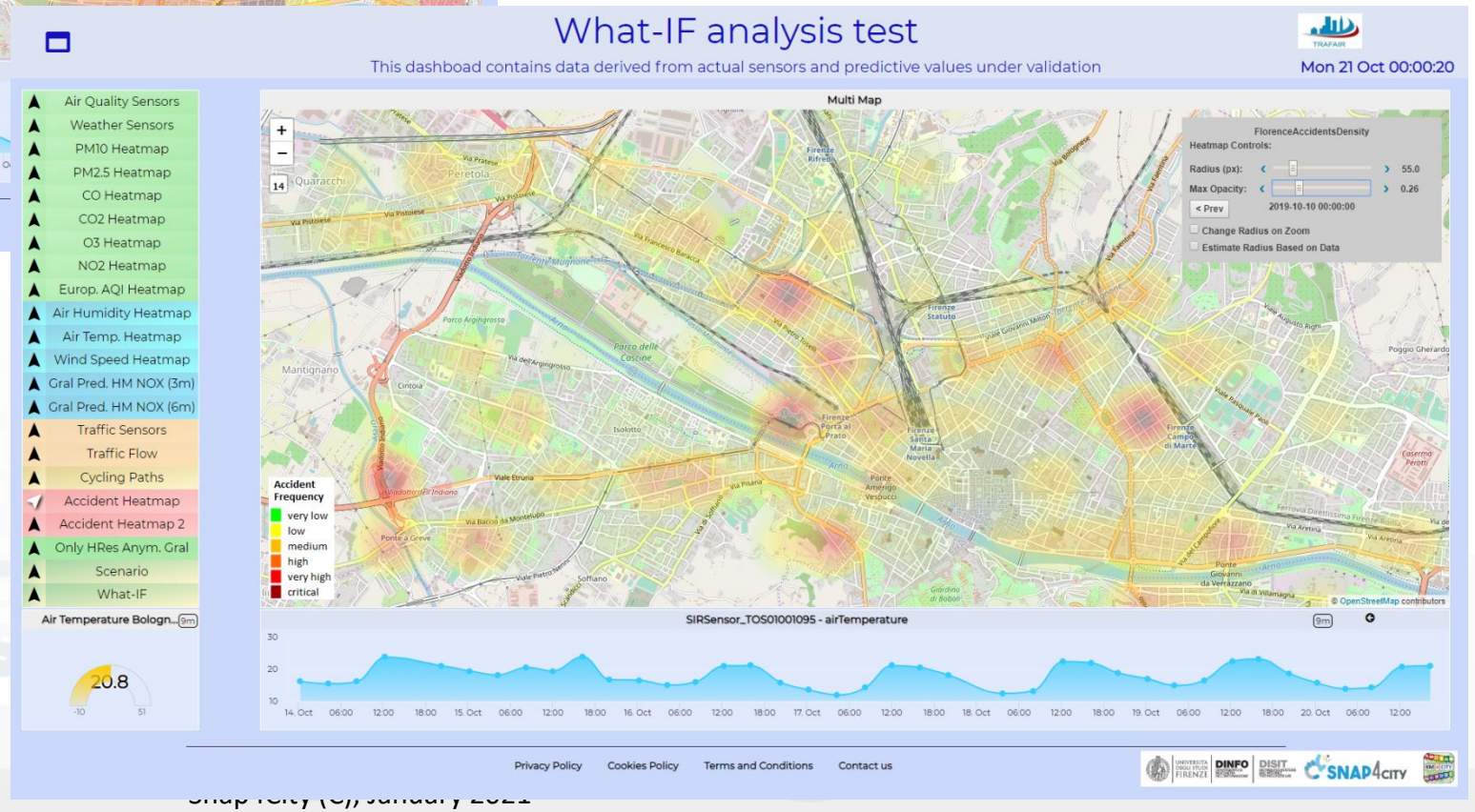


Accidents vs Traffic

Florence

Accidents Density





https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjE4Nw==

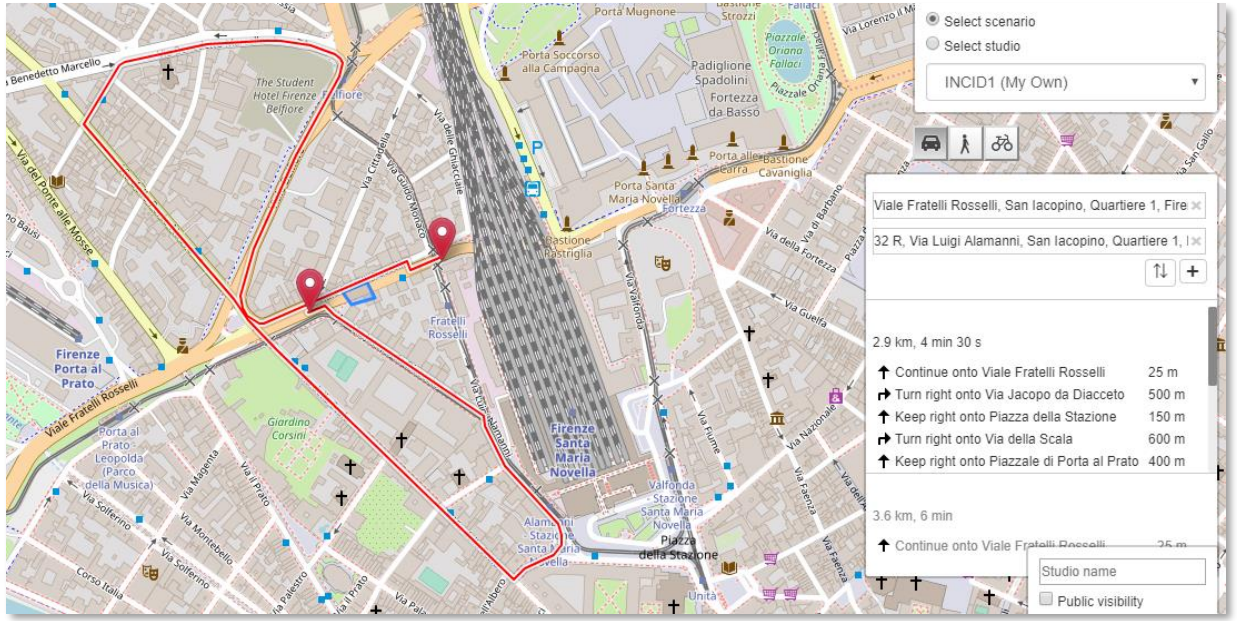
What-If Analysis

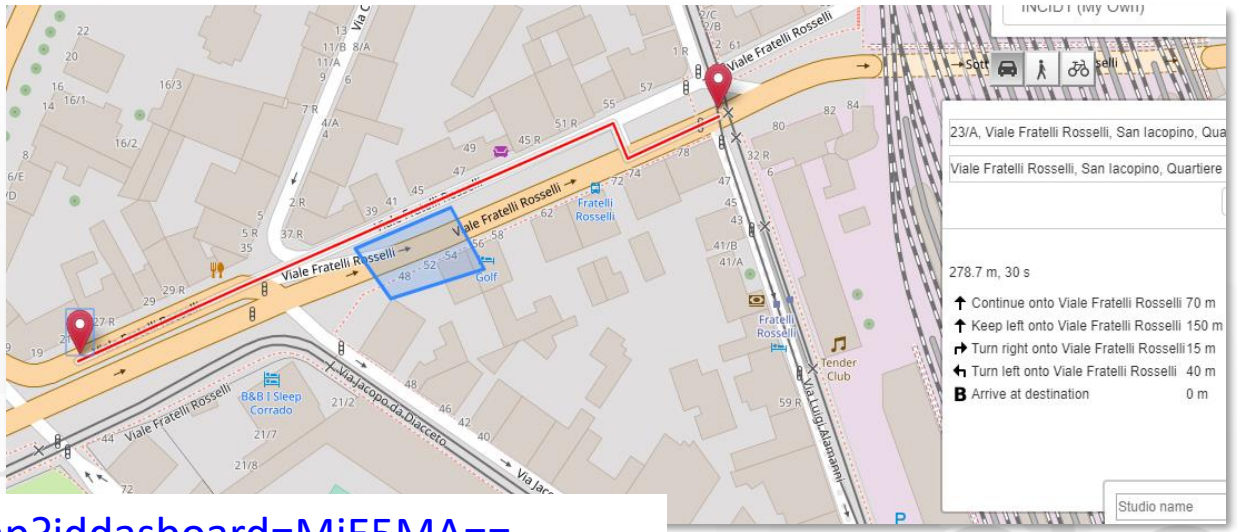
Accidents and elements blocking Points and Shapes taken into account for:

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

Assessment on the basis of changes:

- Mobility demand assessment
- Mobility Offer assessment





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

Mobility and Environment What-IF Analysis

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

Mon 14 Oct 00:48:17

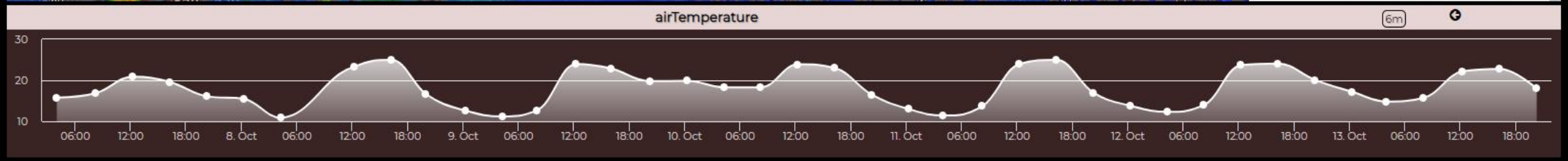
- Air Quality Sensors
- Weather Sensors
- PM10 Heatmap
- PM2.5 Heatmap
- CO Heatmap
- CO2 Heatmap
- O3 Heatmap
- NO2 Heatmap
- Europ. AQI Heatmap
- Air Humidity Heatmap
- Air Temp. Heatmap
- Wind Speed Heatmap
- Gral Pred. HM NOX (3m)
- Gral Pred. HM NOX (6m)
- Traffic Sensors
- Traffic Flow
- Cycling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

Firenze Oggi

Air Temperat... 6m



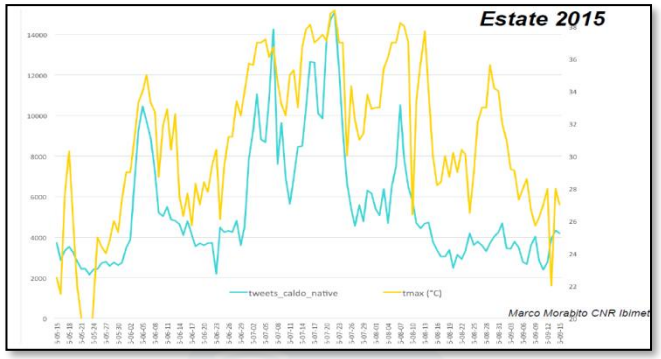




https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjE5MA==

Prediction/Assessment

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



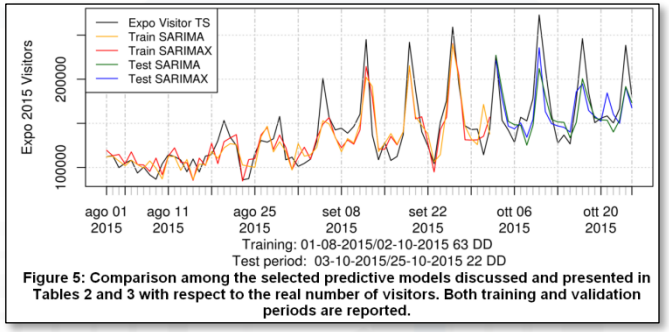
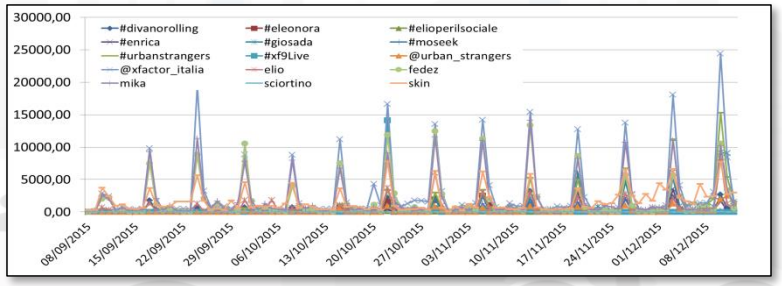
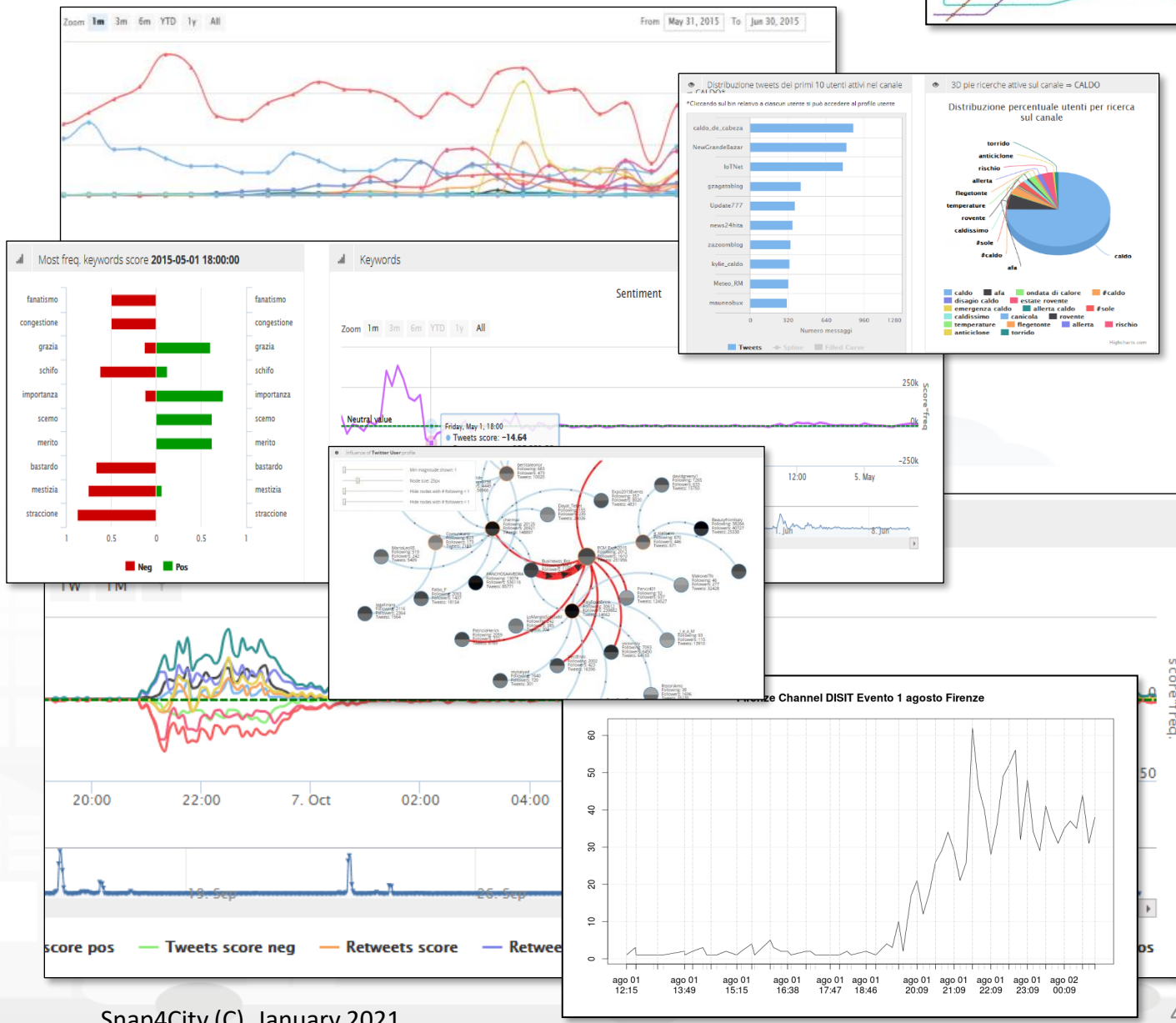


Figure 5: Comparison among the selected predictive models discussed and presented in Tables 2 and 3 with respect to the real number of visitors. Both training and validation periods are reported.



Twitter Vigilance

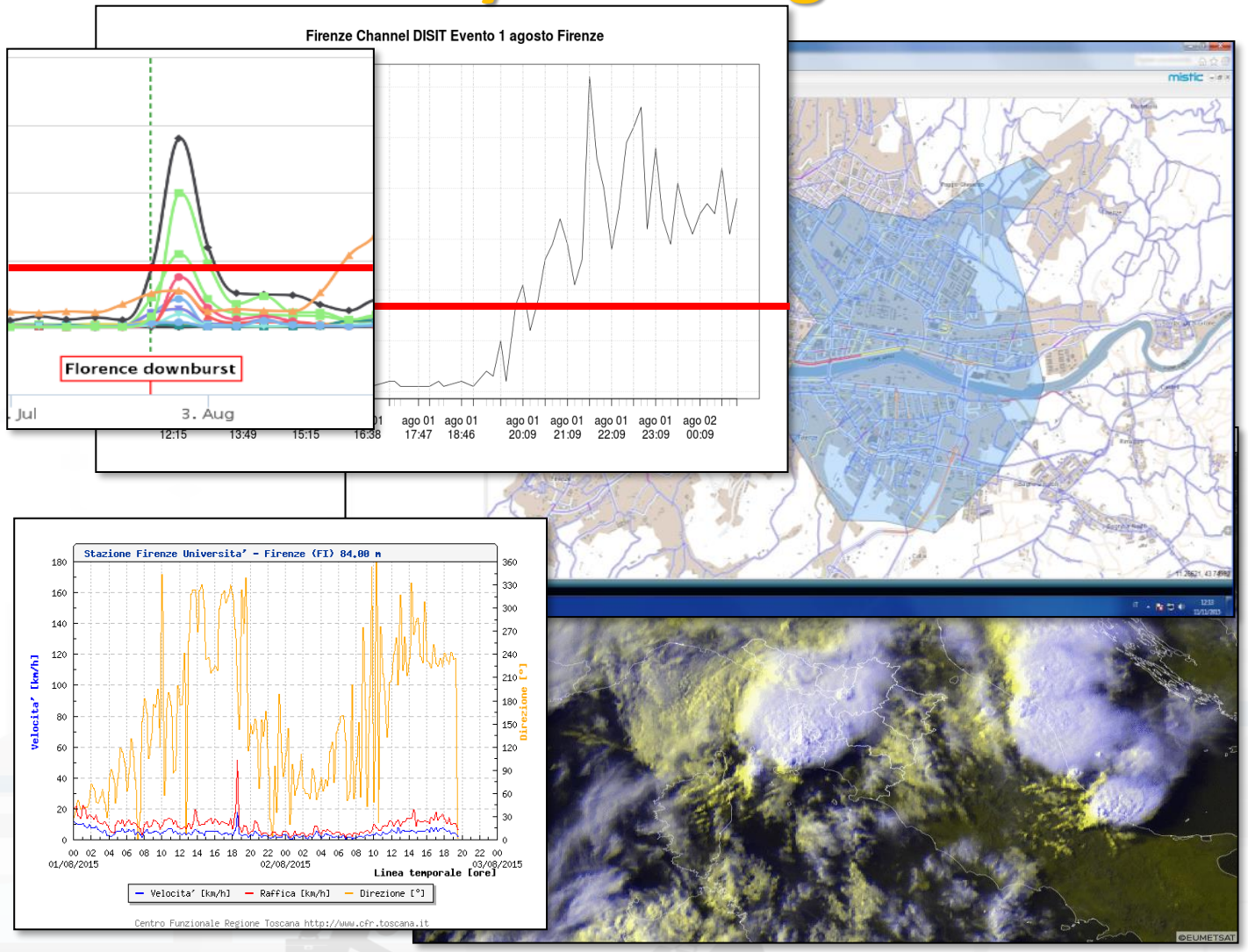
- http://www.disit.org/tv
- http://www.disit.org/rttv
- Citizens as sensors to
  - Assess sentiment on services, events, …
  - Response of consumers wrt, …
  - Early detection of critical conditions
  - Information channel
  - Opinion leaders
  - Communities
  - Formation
  - Predicting volume of visitors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



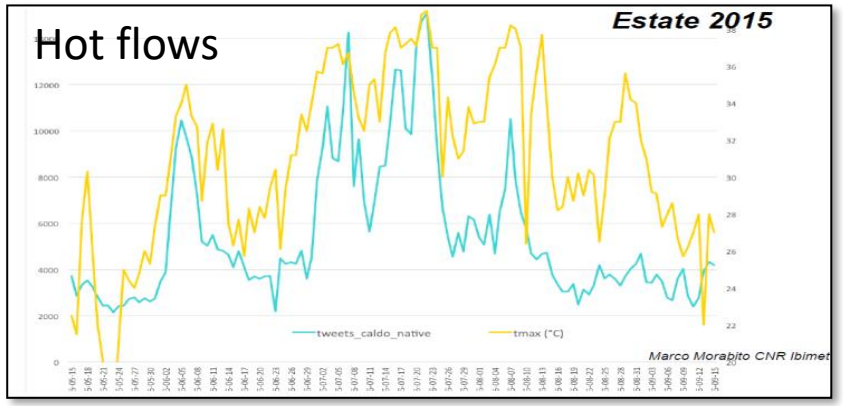
Twitter Vigilance

Twitter Vigilance

Early Warning



Predictive models



Attendance at long lasting events: EXPO2015

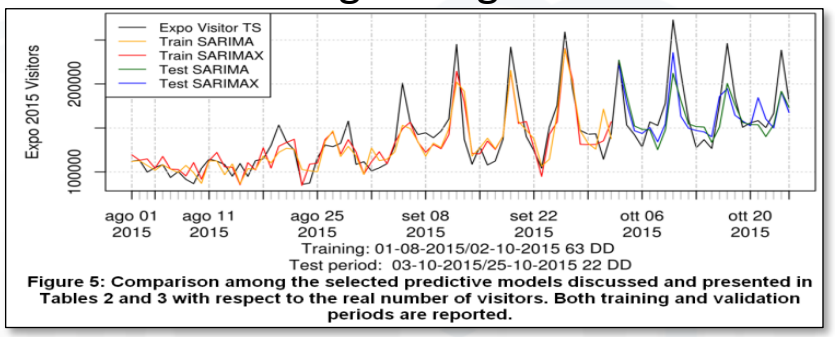
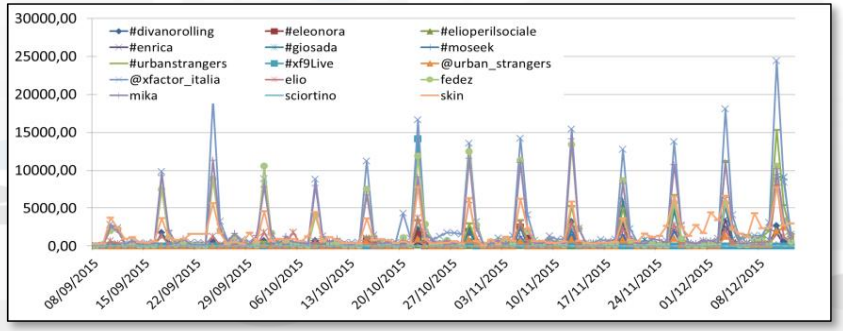


Figure 5: Comparison among the selected predictive models discussed and presented in Tables 2 and 3 with respect to the real number of visitors. Both training and validation periods are reported.

Attendance at recurrent events: TV, footbal

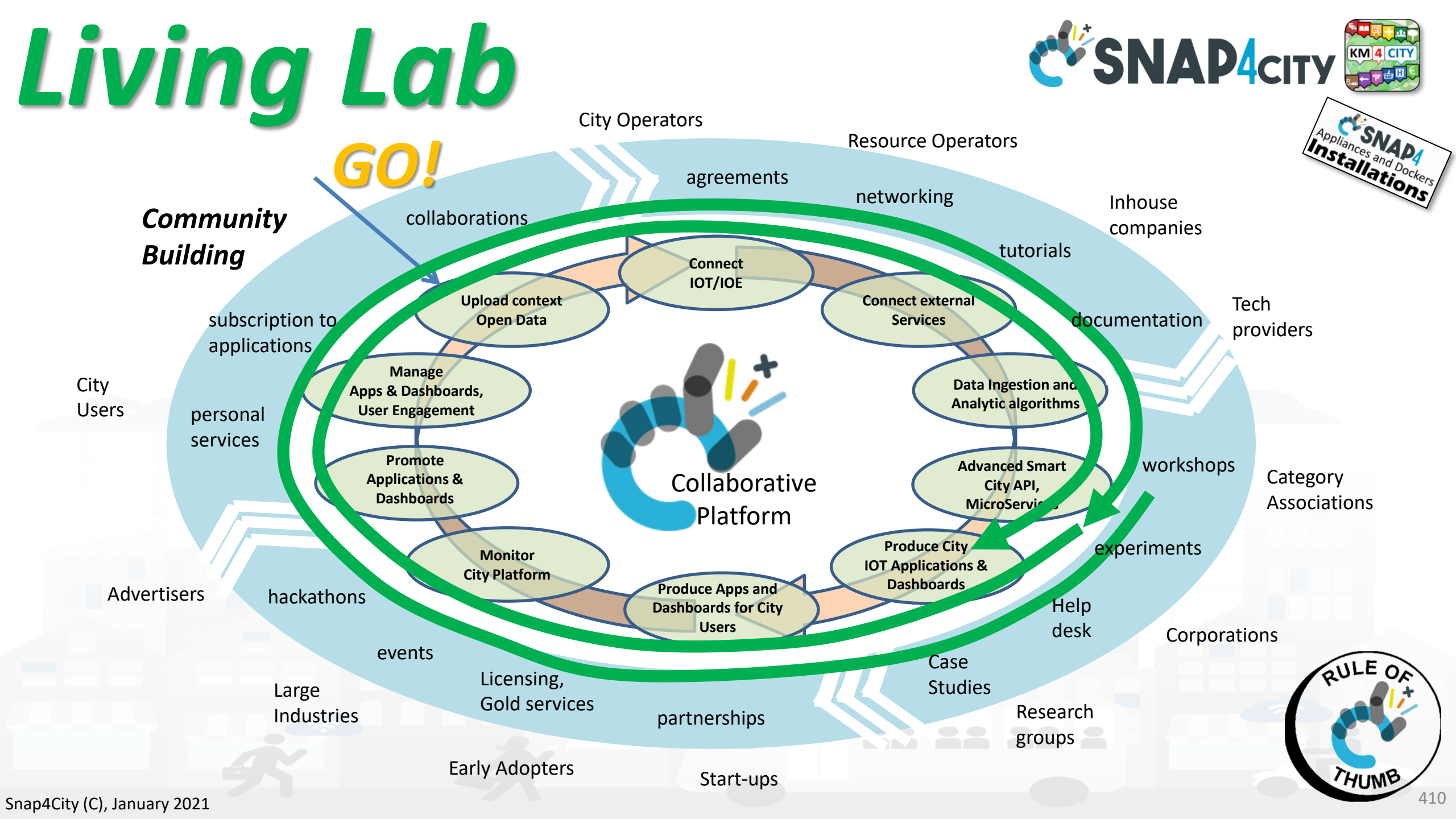


TOP



SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK

Living Lab


GO!
Community Building
City Operators
Resource Operators
agreements
networking
collaborations
Inhouse companies
tutorials
Connect IOT/IOE
Upload context Open Data
Connect external Services
subscription to applications
documentation
Tech providers
City Users
Manage Apps & Dashboards, User Engagement
Data Ingestion and Analytic algorithms
personal services
Promote Applications & Dashboards
Advanced Smart City API, MicroServices
workshops
Category Associations
Collaborative Platform
Monitor City Platform
Produce City IOT Applications & Dashboards
experiments
Advertisers
hackathons
Produce Apps and Dashboards for City Users
Help desk
Corporations
events
Case Studies
Large Industries
Licensing, Gold services
partnerships
Research groups
Early Adopters
Start-ups

Welcome: how to start using Snap4City for beginners

Snap4City developers suggest you reading:

You have already created a **Dashboard**. Now, you may decide to make it public (visible and accessible) to all on WEB, or to provide access in view to other specific users that you know by nickname.
In addition, you can pass the Ownership of a **Dashboard** to some other user of the system, and you can clone the **Dashboard** as well. So that you can create **Dashboard** for other users as well.
We sugget to test these functionaltiies since you can:

- access to Data Set **Manager** to upload/download, share data sets as files in CSV: https://datagate.snap4city.org/ssologin_handler
- upload data for the **knowledge base** and **dashboards** via Data Set **Manager**,
- access and share of resources as: **dashboards**, **IOT Applications**, blocks, etc.; https://processloader.snap4city.org/.../ssoLogin.php?redirect=page.php%3FshowFrame=false
- access to help and contacts, FAQ, documentation and articles
- manage personal data: profile, IOT Sensors, **Annotations**, Personal Data, **Dashboards**..; https://www.snap4city.org/drupal/myprofiledata
- Auditing Access to My Data according to **GDPR**.

See this ... case for the development of the above possibilities:

TC1.10. Dashboard delegation to access, and passage of ownership, and/or cloning

If you are not registred please apply for a **free registration from https://www.snap4city.org** and then pass to ACCESS AT THE TOOLS and full Snap4City environment

Snap4City puts in the hands of City Users a flexible environment to quickly create a large range of smart city applications/views exploiting heterogeneous data and services of stakeholders by IOT/IOE and big data technologies. For Snap4City, City Users can be citizens, students, operators, researchers, decision makers, developers, etc. see Users' Roles on Snap4City.

- **Manager:** is a **final user**, has the capability of: accessing and creating Dashboards with a large set of data (high level types as: POI, sensors, KPI, micro applications, external services, etc.), attaching alerts and notifications; registering IOT Devices; creating IOT Applications exploiting MicroServices; loading and sharing data sets; managing personal data and annotations; full access to documentation, help desk, FAQ, coworking; managing personal profile and data according to GDPR; **NOTE:** accessible features are mainly visual and simple to understand and to use, and provide a limited number of parameters on each dialog and for each action. Default values of created elements can be changed editing elements.
- **AreaManager:** is a **Developer/researcher, students, city operator**, with additional capabilities with respect to the Manager to: register IOT Brokers; creating advanced IOT applications; create massive data transformation processes; create data analytics in multiple languages, testing and load them, create microservices; adding external services; sharing results, loading shapes; analyzing performance of the back office; **NOTE:** technical views and details are fully accessible

Suggested Activities to be performed to Learn HOW to use Snap4City:

This page would guide you along few steps to ... how the solution allows you to incrementally pass from **Level 0 to 5, from a Manager to an Area Manager:**

- Level 0 user: access at data/services views of the city by using public Dashboards; (Public User) **(overview on dashboards)**
- Level 1 user: create personal/professional views/dashboards on data; (Manager) (Snap4City Manager, January 2024 ... how Dashboards can be created)

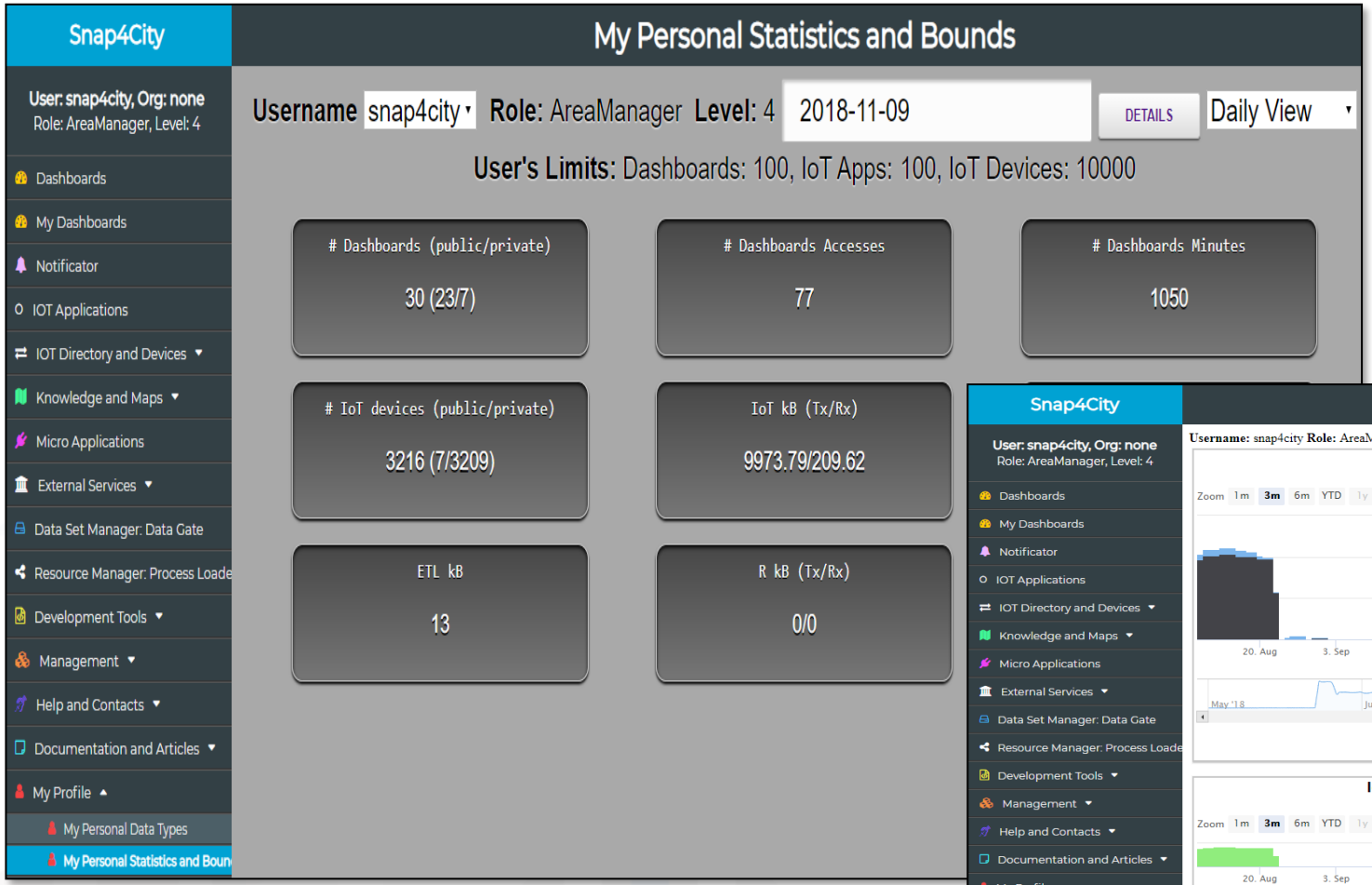
Your Level
Personalized Suggestions
Full Search
Exercises
SLIDES
Your Org
Last Art.
All Tools
VIDEOS
News
Flyer

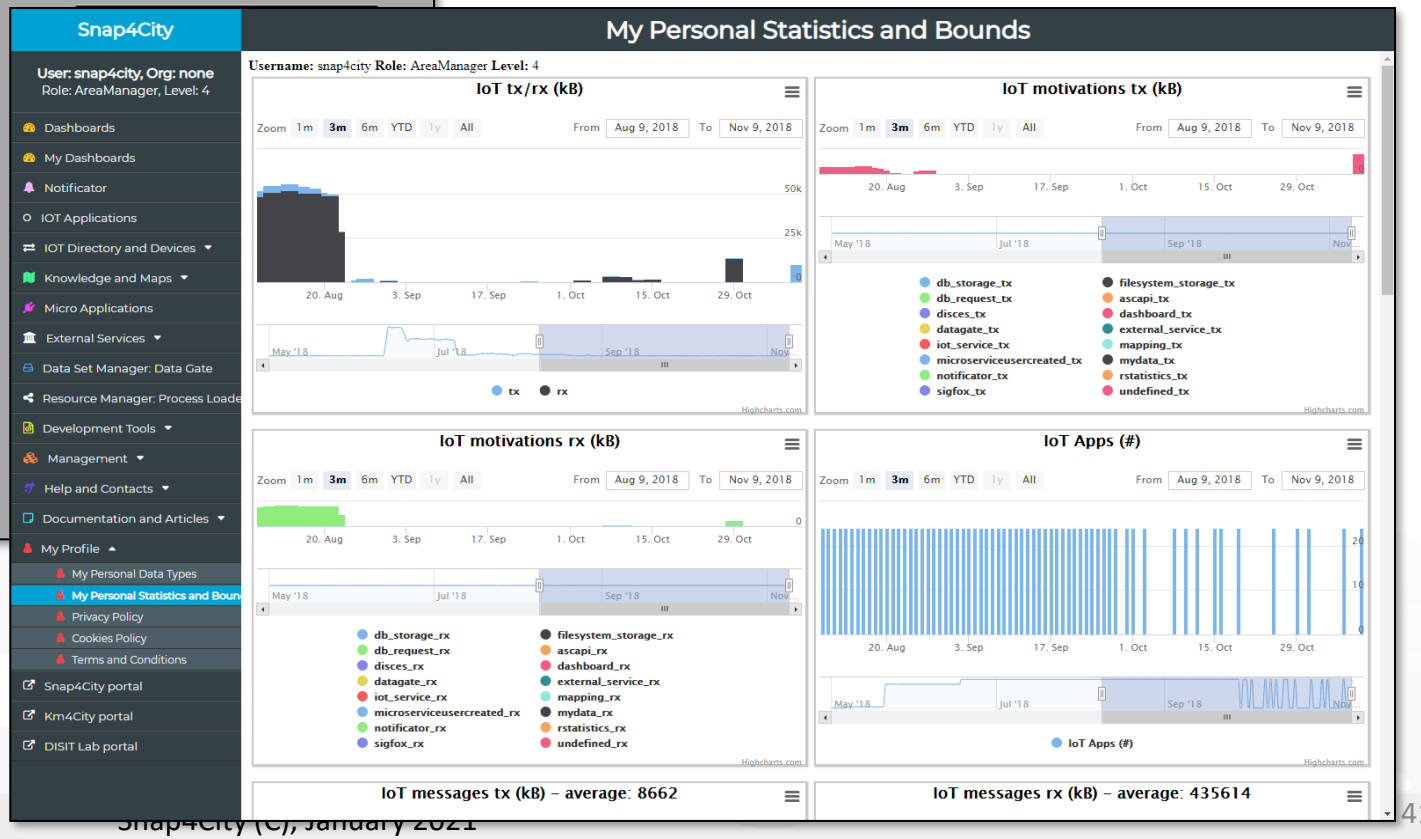
Living Lab Flexibility

Snap4City Satisfies all Requirements of ENOLL Select4Cities and EIP-SCC

- **Multiple modalities to perform the same activities**
- **Tuned for Beginners and Skilled people**
- **Visual interface and programming tools**
- **Resources and artefacts sharing for learn acceleration and co-working**
- **Open Living and co-working Portal**: https://www.Snap4City.org

Self Assessment

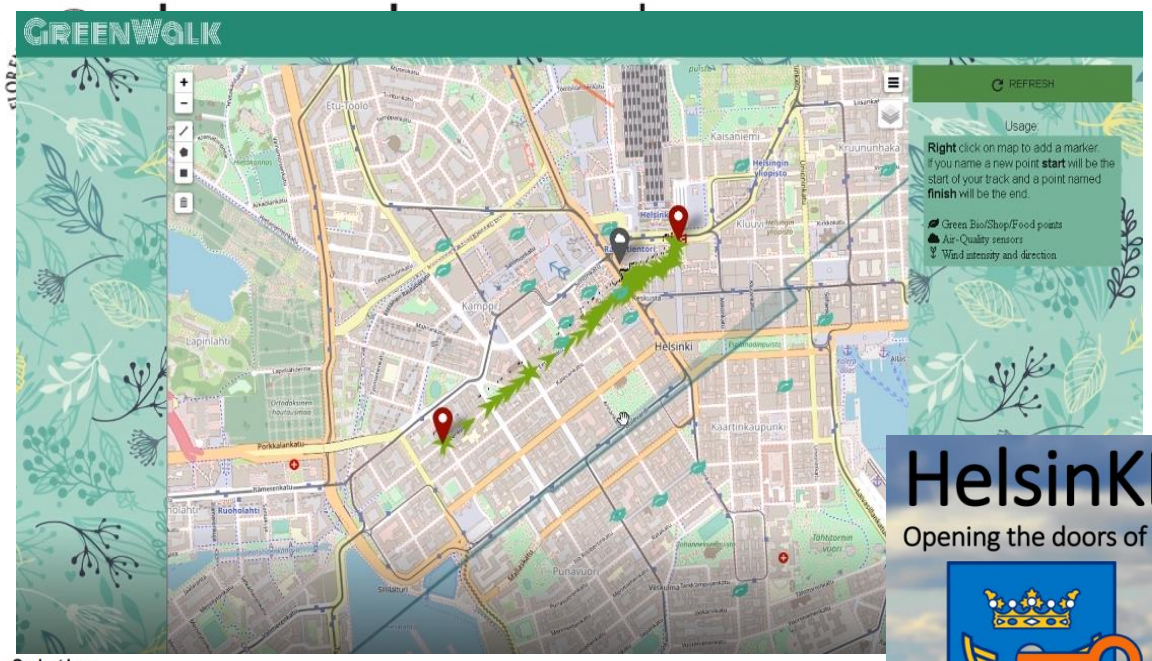




LOGIN

Dashboards (Public)
Knowledge and Maps
Micro Applications
External Services
Data Set Manager: Data Gate
Resource Manager
Development Tools
Knowledge Base Graphs
Smart City API Docs: Swagger
Testing API by Postman
Source Code Access
Management
Smart City API Monitoring
Web Server Monitoring
Smart Decision Support Sys
Resilience Decision Support Sys
Help and Contacts
Help Desk and contacts
Contact Us, Problem Reporting
FAQ
Help Us with Your Feedback!!!
Documentation and Articles
Km4City portal
DISIT Lab portal







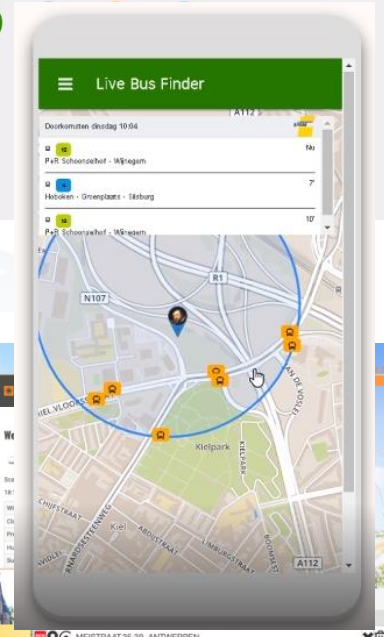
Greenifiers

BIG DATA FOR SMART CITIES

An app for sustainable mobility

Andrea Pescetti





Solution

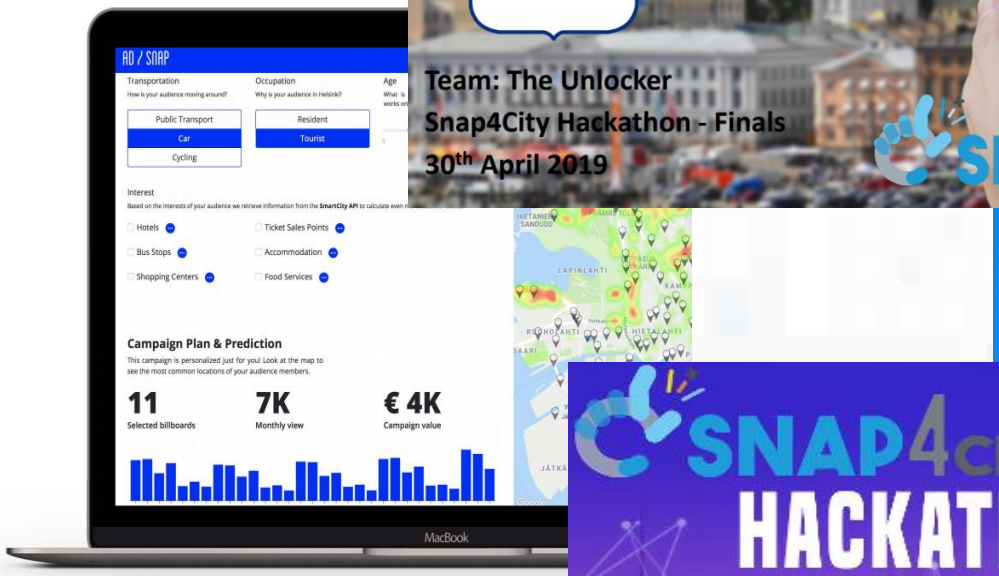
Data-driven design platform for offline advertising

Built on big data to determine the most popular location for a customer group

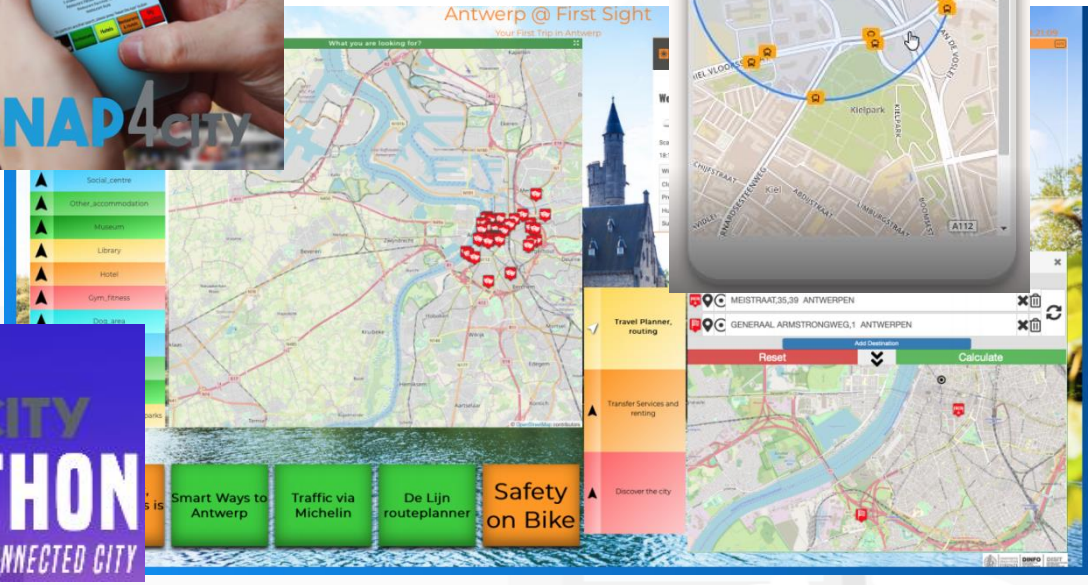
Automatically select billboards with the highest traction. The platform is capable of predicting the reach of every location on a city based on big data analytics.

Skyrocket the traction of offline campaigns

Citizens will run into more relevant advertisements resulting in higher conversion rates and more successful campaigns.



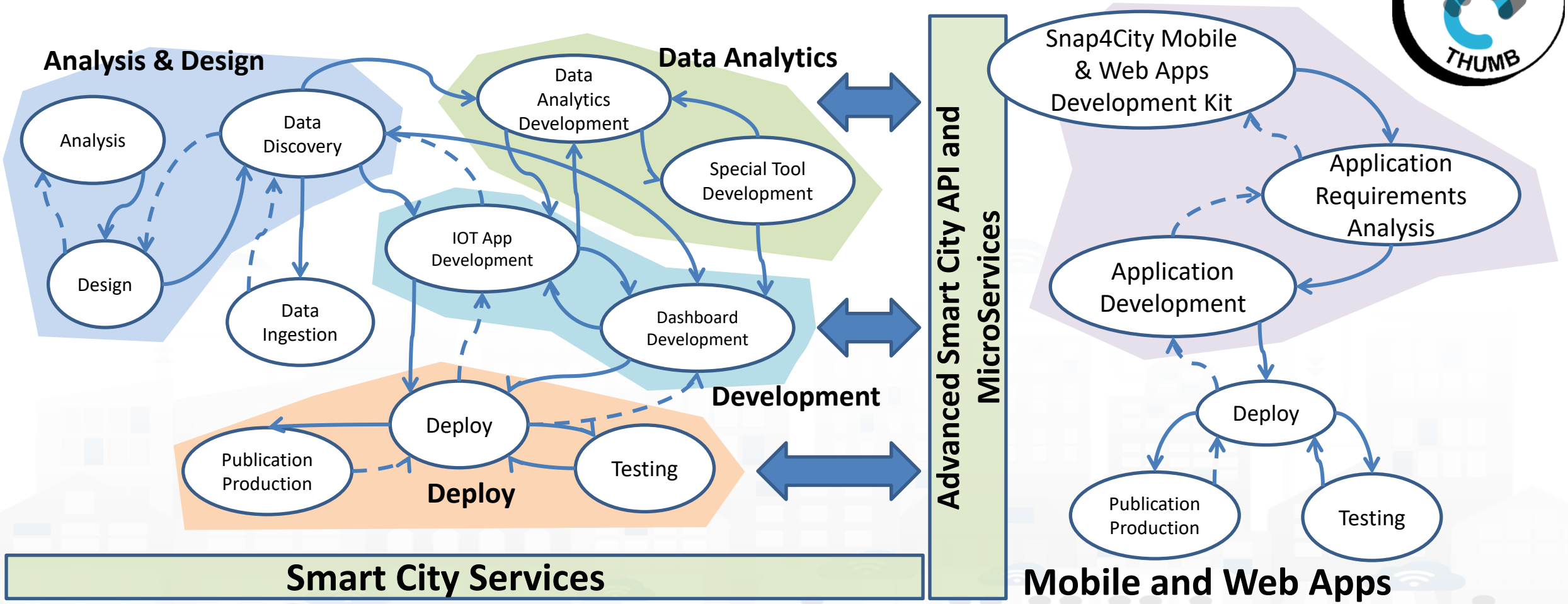




Development Life Cycle



Develop Mobile & Web Applications Exploiting Snap4City Smart City Services



Development Tools



IOT Network Manager vs Final User

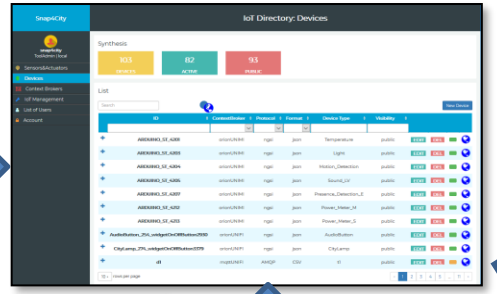
Network of IOT Brokers

IOT Broker

External

Internal

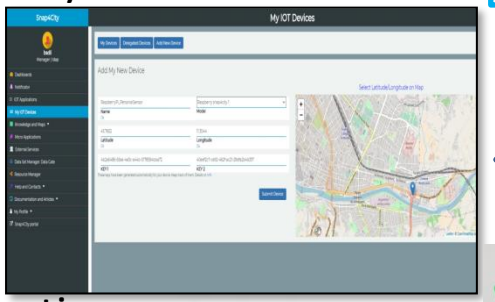
IOT Directory



IOT Network Manager



My IOT Device



Register



Registering

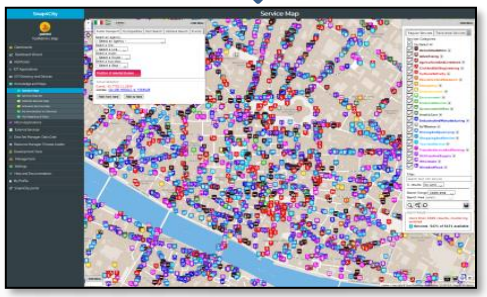
Discovering

Knowledge Base, Km4City



Knowledge and Storage
Data from the Field and City

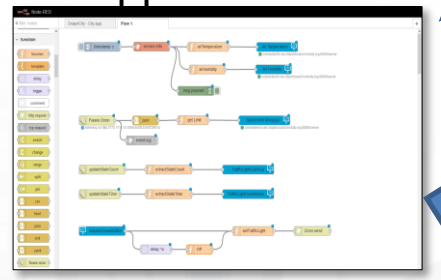
Browsing



ServiceMap Knowledge Base

Discovering

IOT Application



Final user Manager





Dashboard Wizard



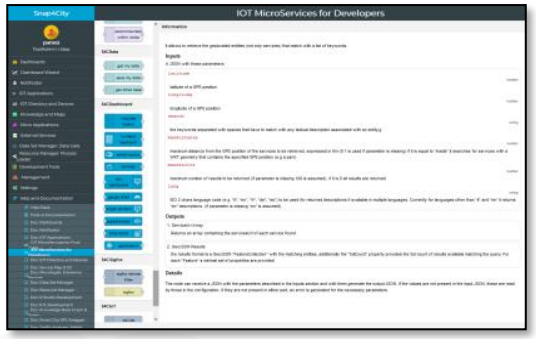
Prepare
Deep Manage

Exploit

IOT Applications Development

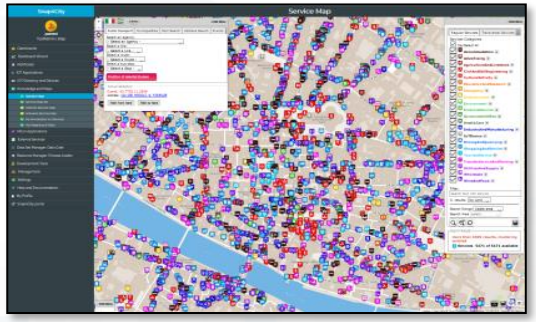
IOT Discovering

MicroServices collections

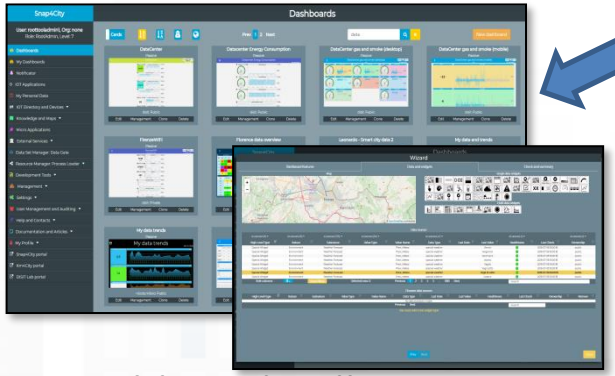


My IOT Applications



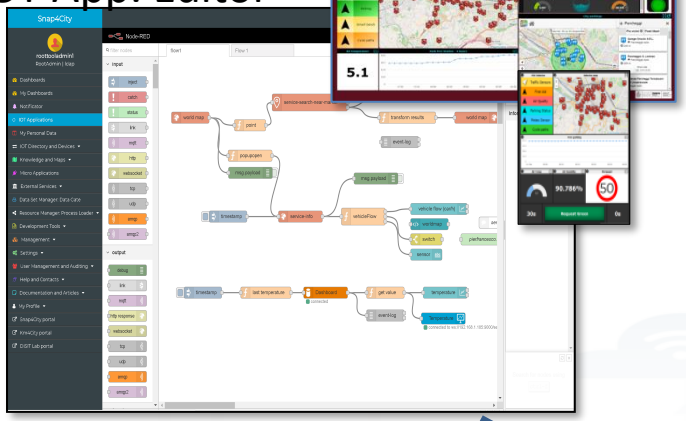


ServiceMap Discovery



Dashboard Collection, Editor and Wizard

IOT App. Editor





Generating IOT App With Dashboard

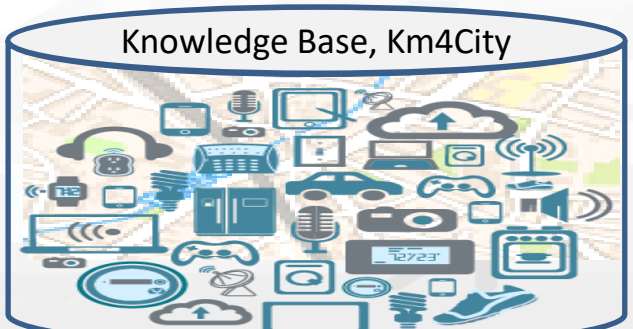


Sharing/saving reusing IOT App



Resource Manager



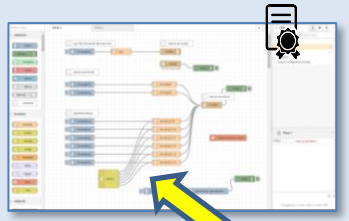


Remote Control/Management of IOT Edge

SNAP4CITY

edge-tunnel-to-cloud

IOT Edge Device

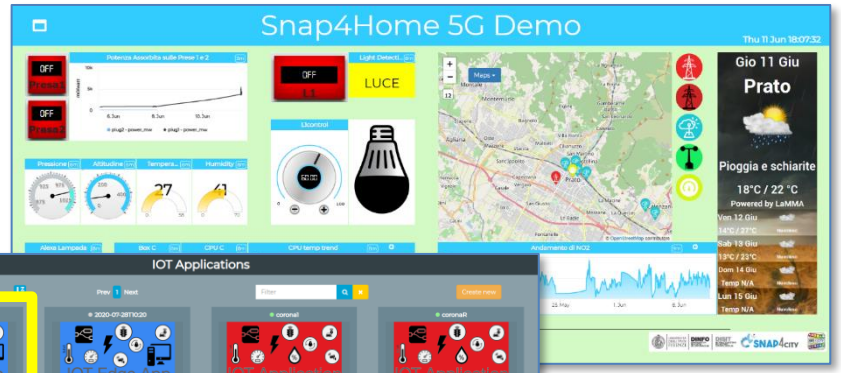


FireWall Gateway

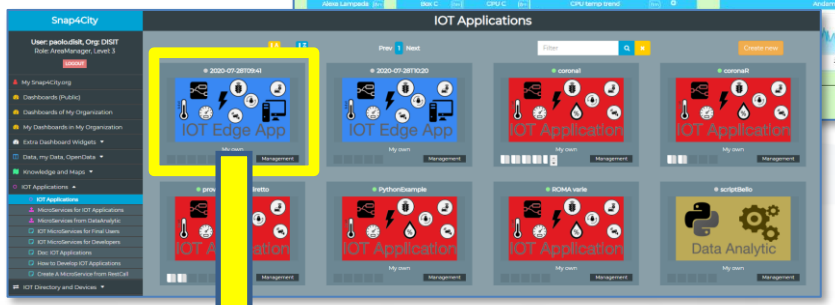
SNAP4CITY On Cloud

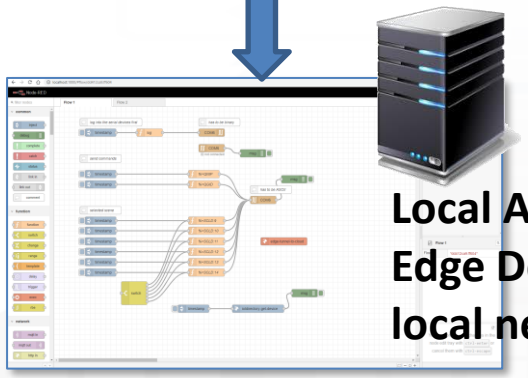
Internet

Intranet



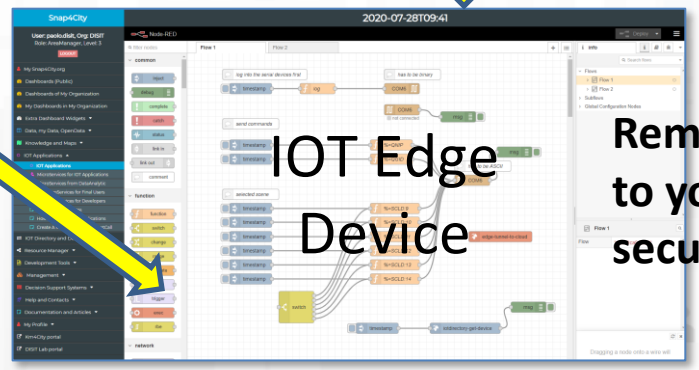
Click on it





Local Access on IOT Edge Device on your local network

On premise, on your local plant/home

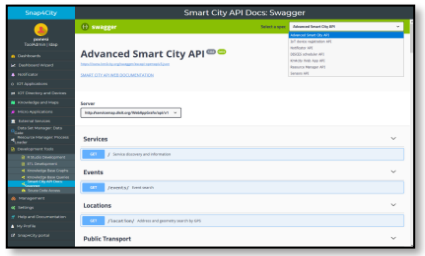


IOT Edge Device

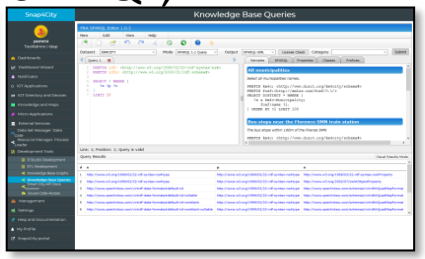
Remote Access/Control/program to your IOT Applications via secure connection

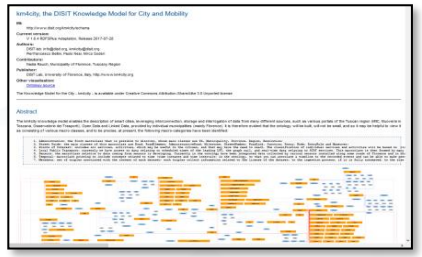
Data Analytics Dev. in R Studio and/or Tensor Flow

Swagger



SPARQL, FLINT





Ontology Schema



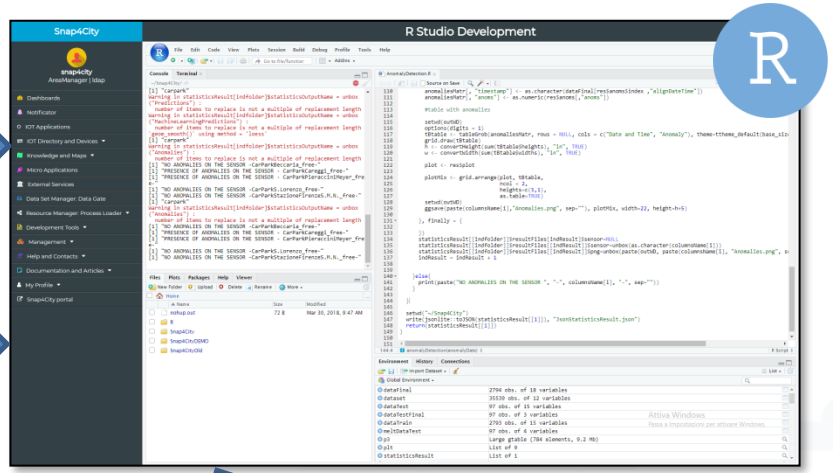
LOG.disit.org

Knowledge Base, Km4City



Big Data Store Facility

Smart City API from Knowledge Base and other tools



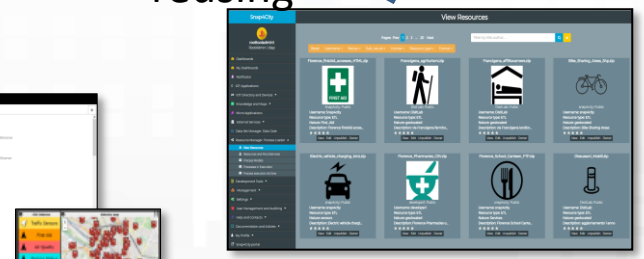
R Studio



Creating MicroServices



Using them into IOT Applications



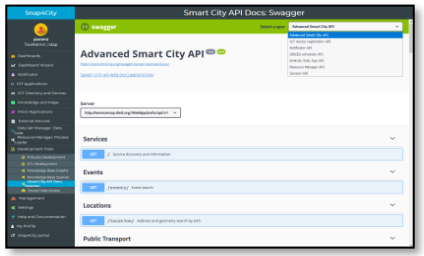
Saving / Sharing reusing

Resource Manager

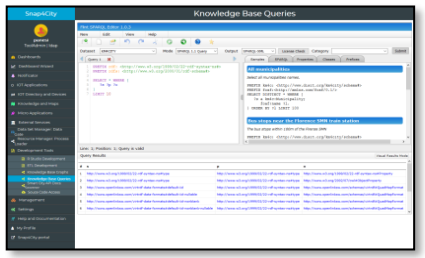


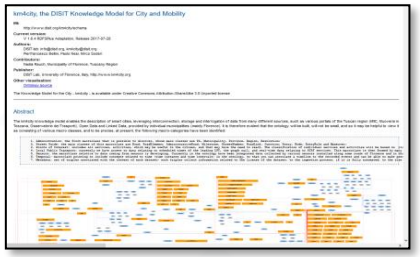
Data Analytics Development in Python,

Swagger



SPARQL, FLINT





Ontology Schema



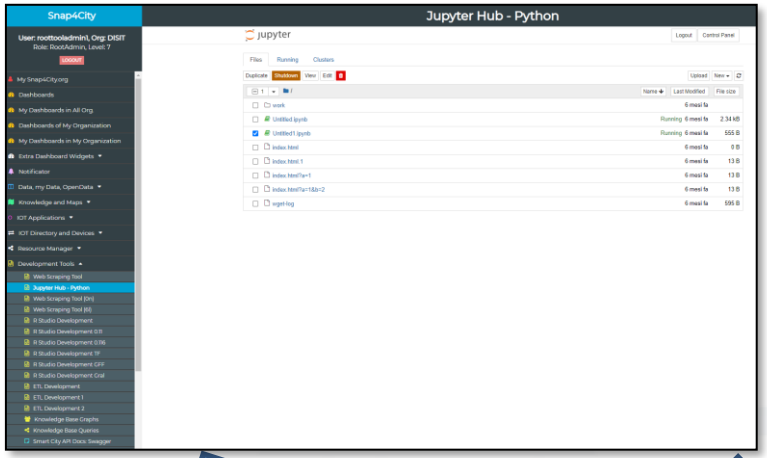
LOG.disit.org

Knowledge Base, Km4City



Big Data Store Facility

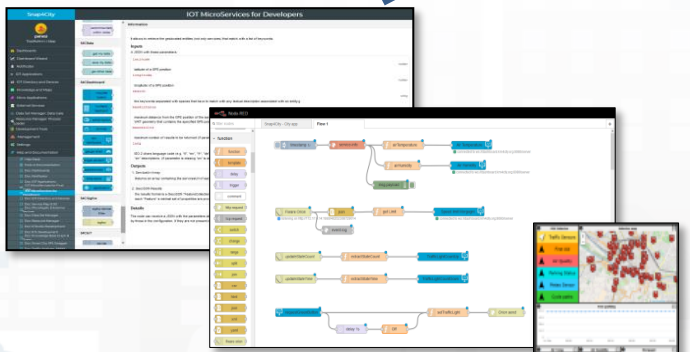
Smart City API from Knowledge Base and other tools

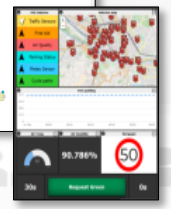


Coding
Testing



Creating
Micro Services





Using them into
IOT Applications

Saving
Sharing
Reusing

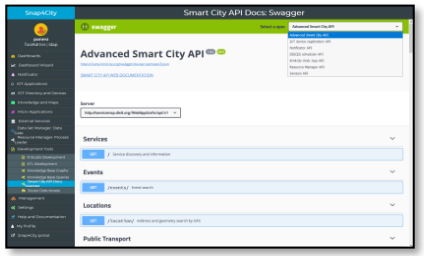


Resource Manager

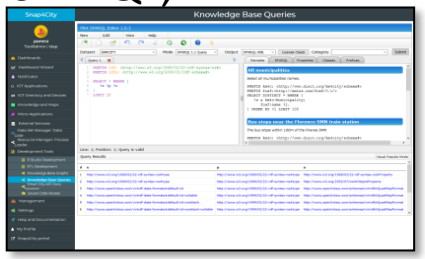


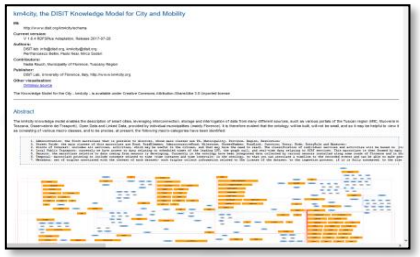
Data Analytics Dev. in Java

Swagger



SPARQL, FLINT





Ontology Schema

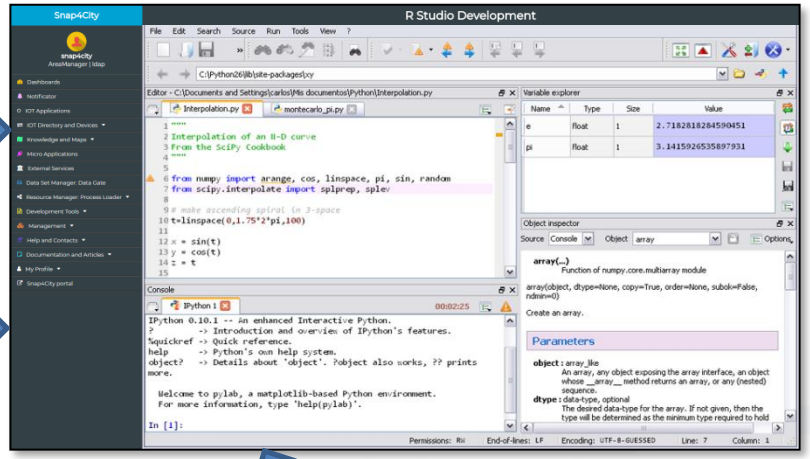


LOG.disit.org



Big Data Store Facility

Smart City API from Knowledge Base and other tools

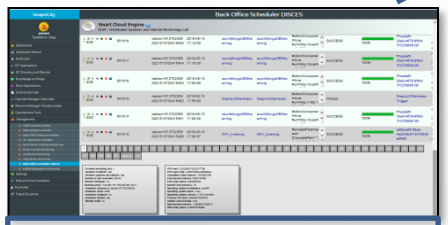


Coding
Testing



Saving /
Sharing
resusing

DISCES scheduler



Monitoring



Resource Manager



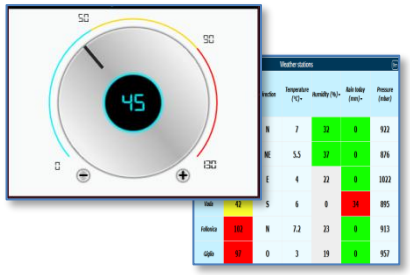
Process

Data sources

Distributed Back Office

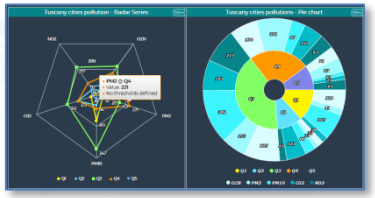
Dashboard List and Editor







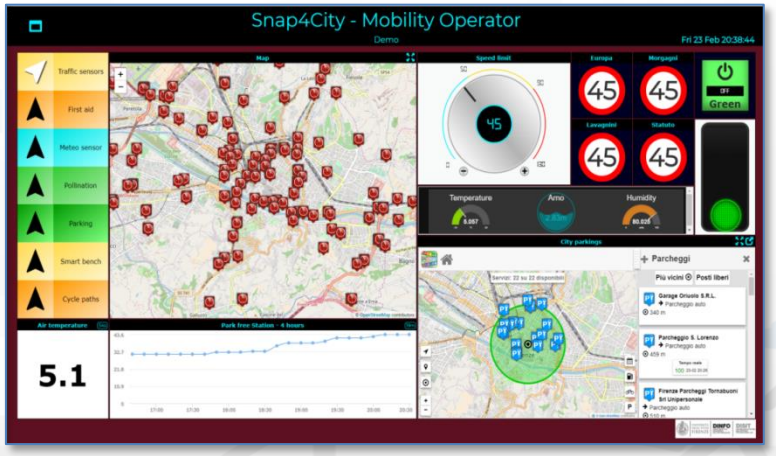




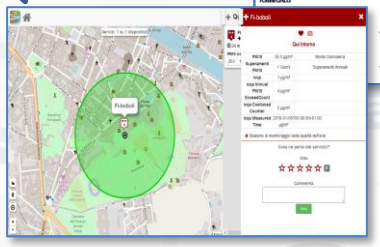




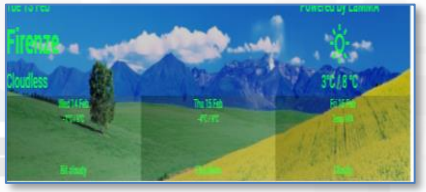


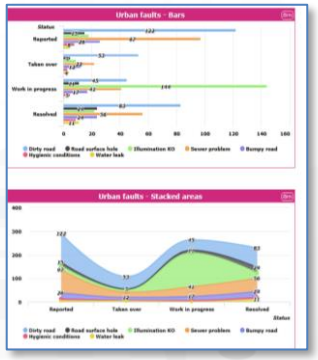






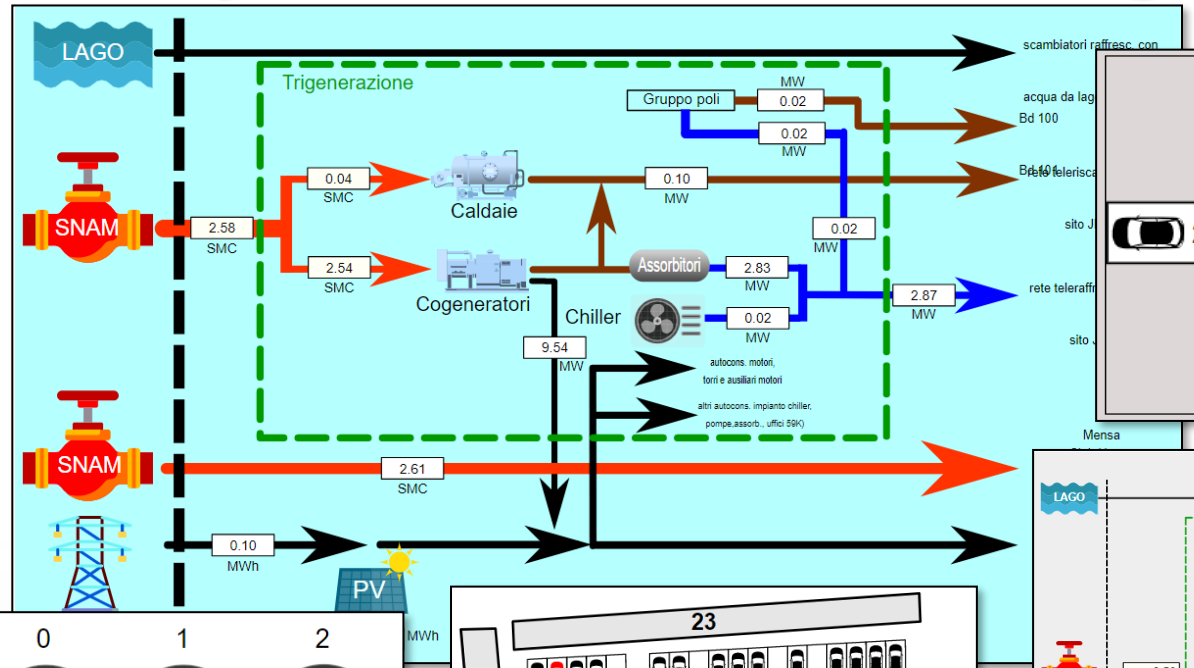


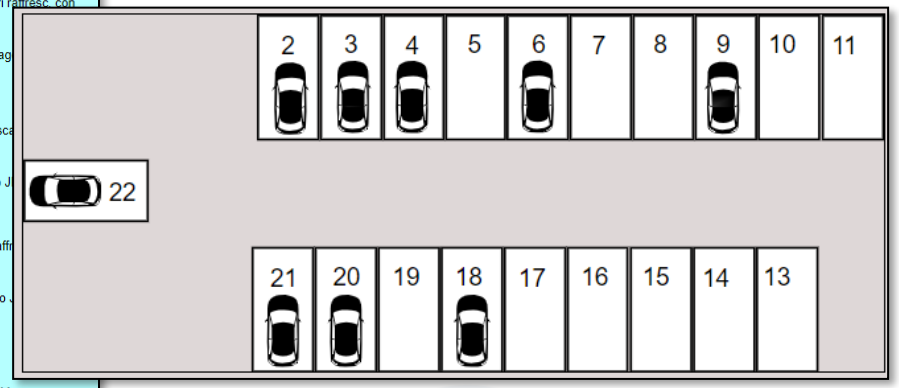


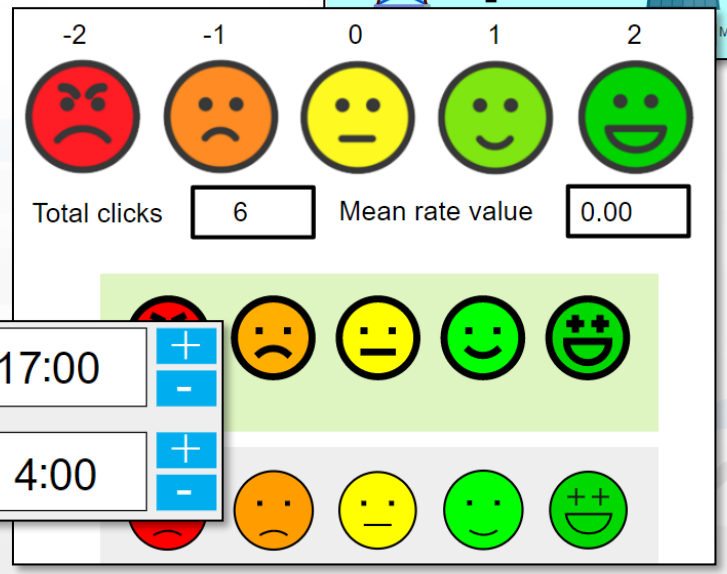


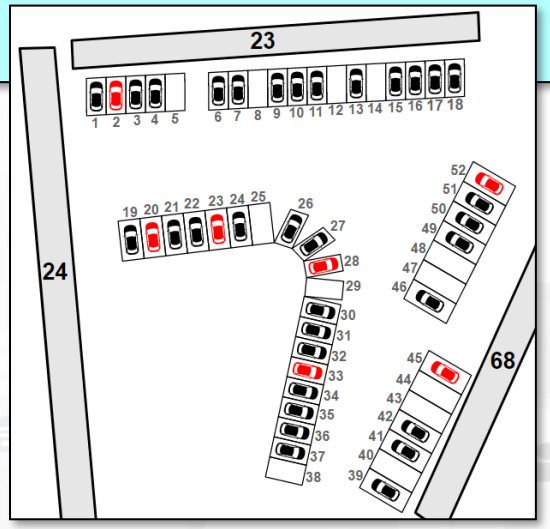
Special Custom Widgets

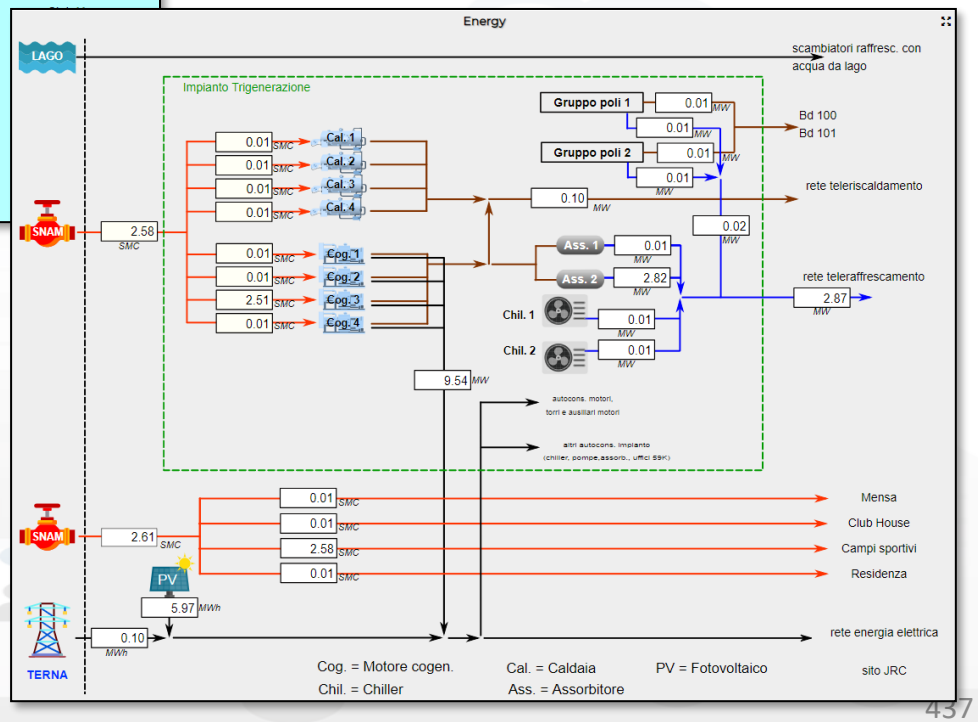
- Smart parking
- Smart Energy
- Smart Light
- Smart ….
- Energy View
- Custom Controls



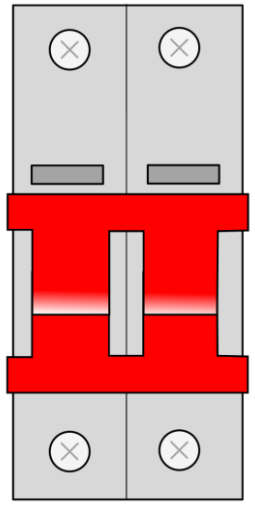






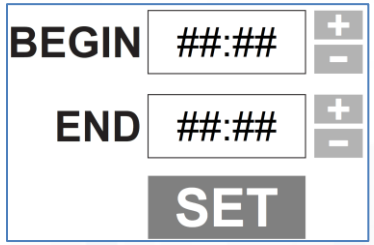


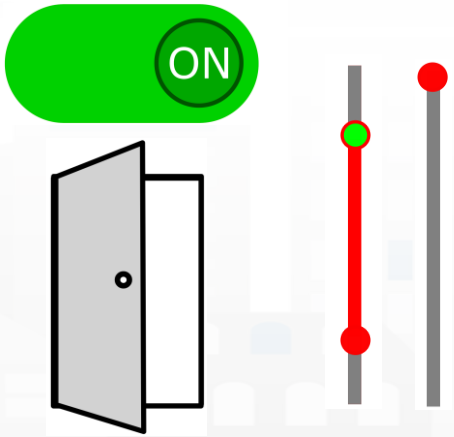
Other examples



- **Virtual Actuators (sensor-actuator)**
  - From: Dashboard
  - To: IOT App, MyKPI, other Synoptics







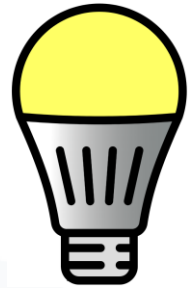




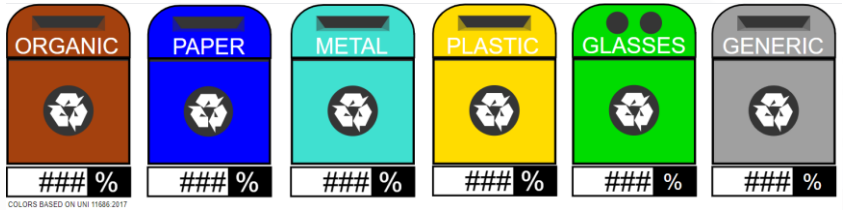
- **Virtual Sensors**
  - From: MyKPI, Sensors, IOT App, other Synoptics
  - To: Dashboards

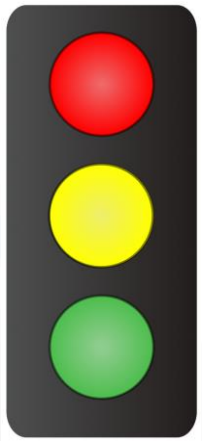


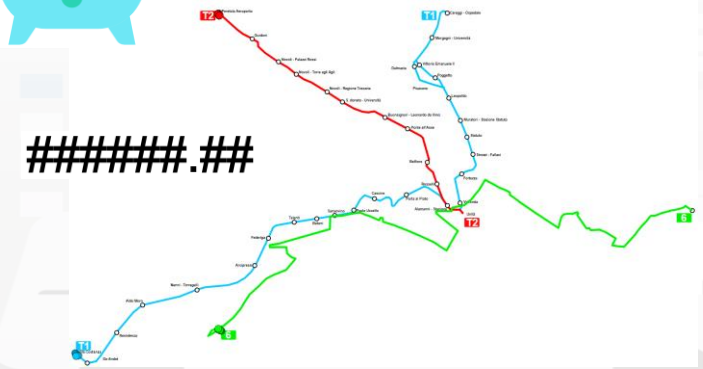


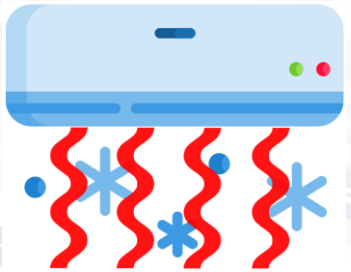




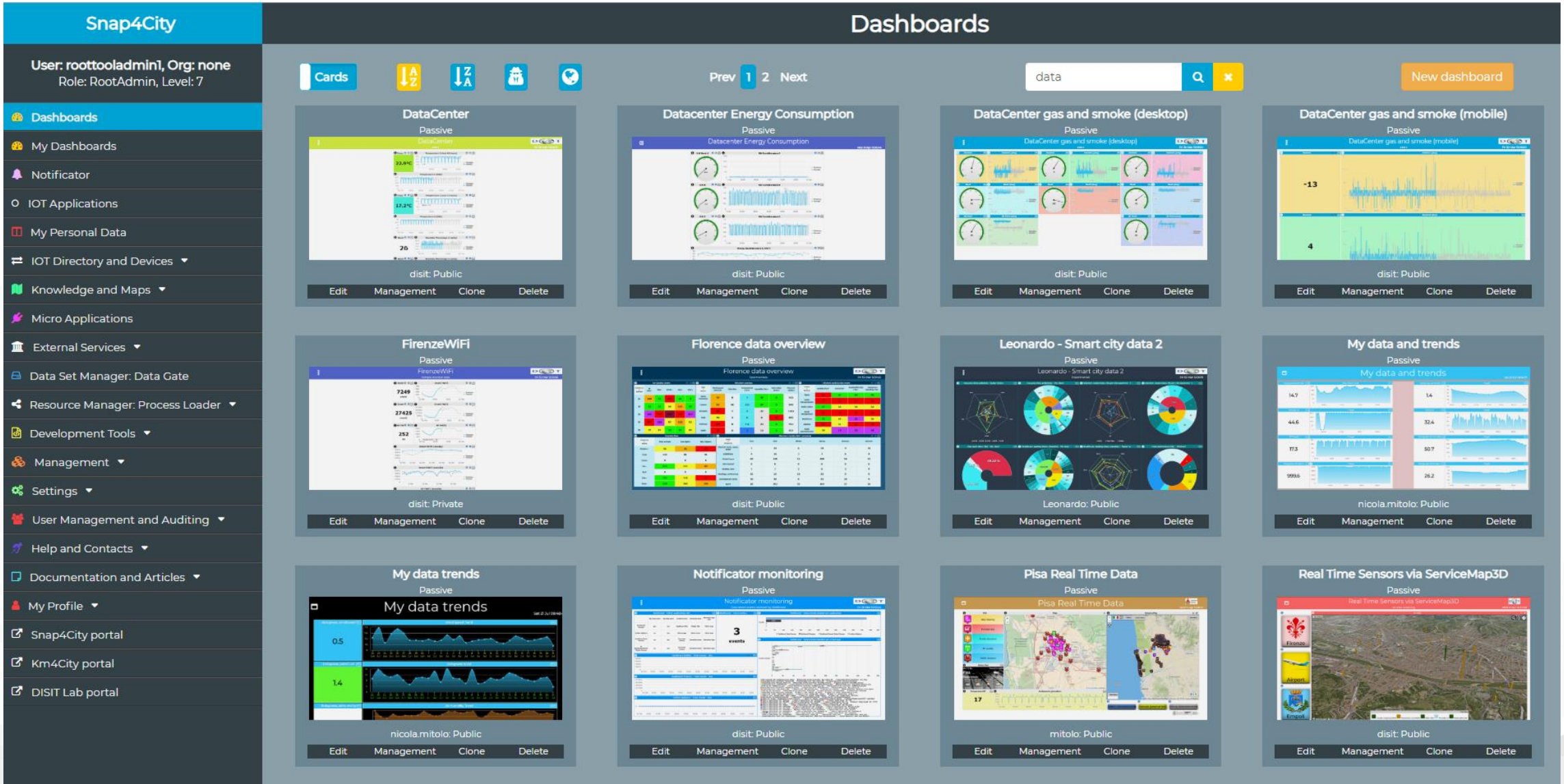




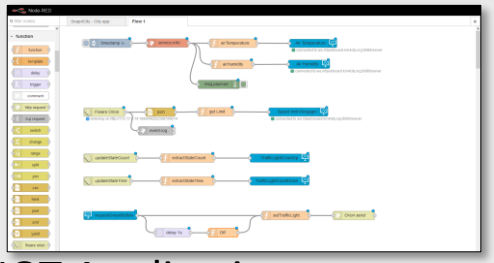




Dashboard List and Editor



Dashboard Development



IOT Applications

Knowledge Base, Km4City



Knowledge and Storage Data from the Field and City + MyKPI ++

Widget Collection





Micro Applications

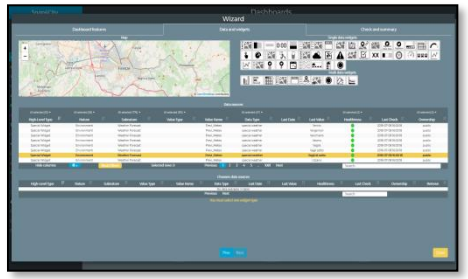


External Services



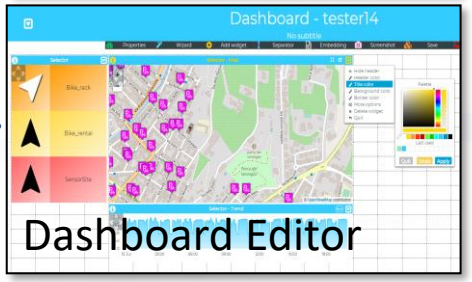
Custom Widgets/ Synoptics

Dashboard Wizard

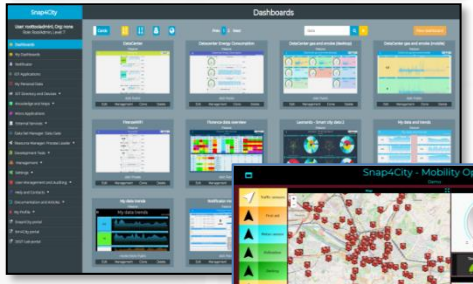


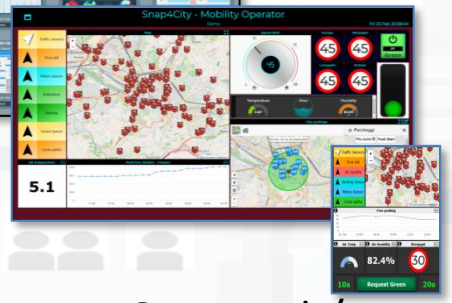
Create, save, load, delegate, grant access





Dashboard Editor





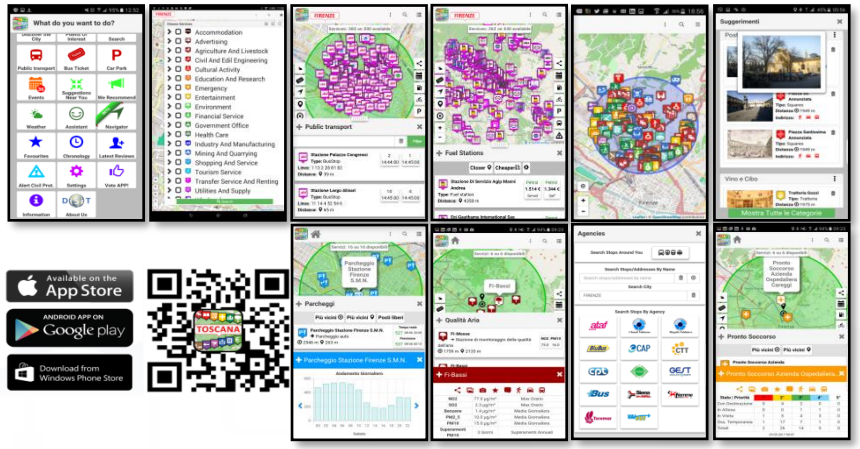
Public Dashboard Collection



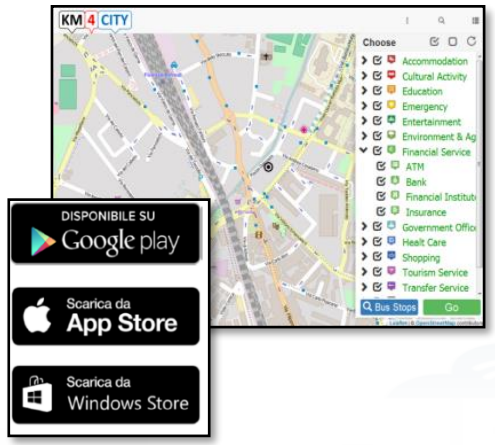
My Own Dash/App

Developing Web and Mobile Apps, MicroApps,..

Mobile Apps



Web App HTML5, MicroApplications



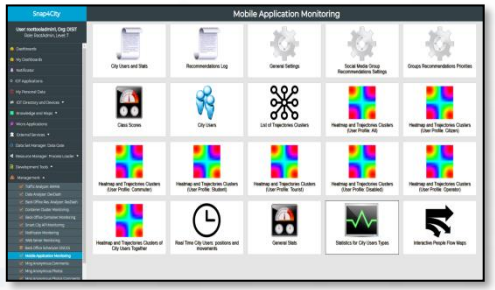
Embed into Web pages



City User



Advanced Smart City API



Mobile Application Monitoring Administrator



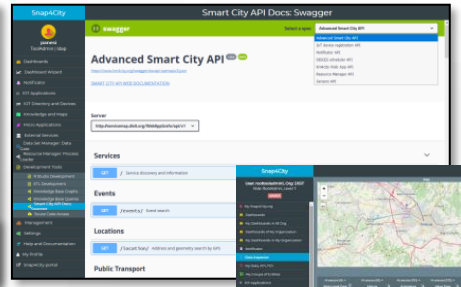
Knowledge Base, Km4City



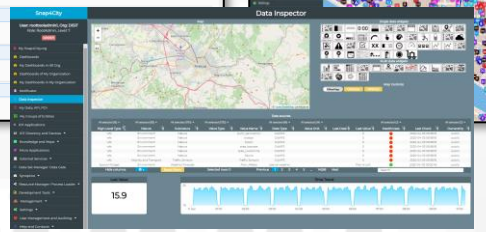
GitHub

Snap/Km4City Open Source development tool kit

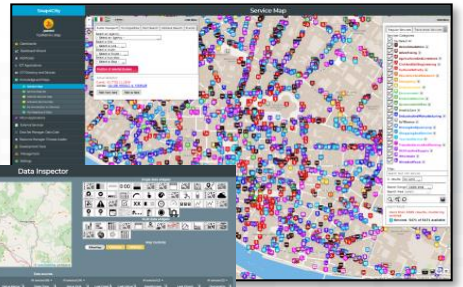




Swagger



DataInspector



ServiceMap

Developer



Data Protection, Personal Data vs GDPR



GDPR: General Data Protection Regulation

Users may decide to:

- provide access to who, for do what, until when consented
- accept terms of use by **signed** consent **for** data management **service**

From each service, the user is capable to:

- **See** what we collect in terms of Data Type: traces, logs, paths, profiles, accesses, IOT devices, sensors, maps, etc.
- **Download**, **delete**, **inspect** Data
- **Auditing** and **Revoke access** or **grant** access right to each **single Data**
- **Delete all Data in single shot** or singularly (**forget all about me**)

- Correctness
- Transparency
- Security
- Integrity
- Privacy
- Auditing
- …

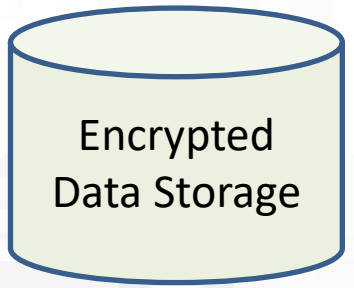
GDPR: General Data Protection Regulation

If personal data are **published by the owner:**

- the data are **released anonymously**,
  → also in this case they can be **revoked at any time**:

Snap4City is also compliant to GDPR **Technical Constraints** as:

- **Secure connection** in any private data exchange
- **Encrypted** data store for all private data
- **Decoupling** data and personal IDs
- Allow the **Auditing** of private data usage



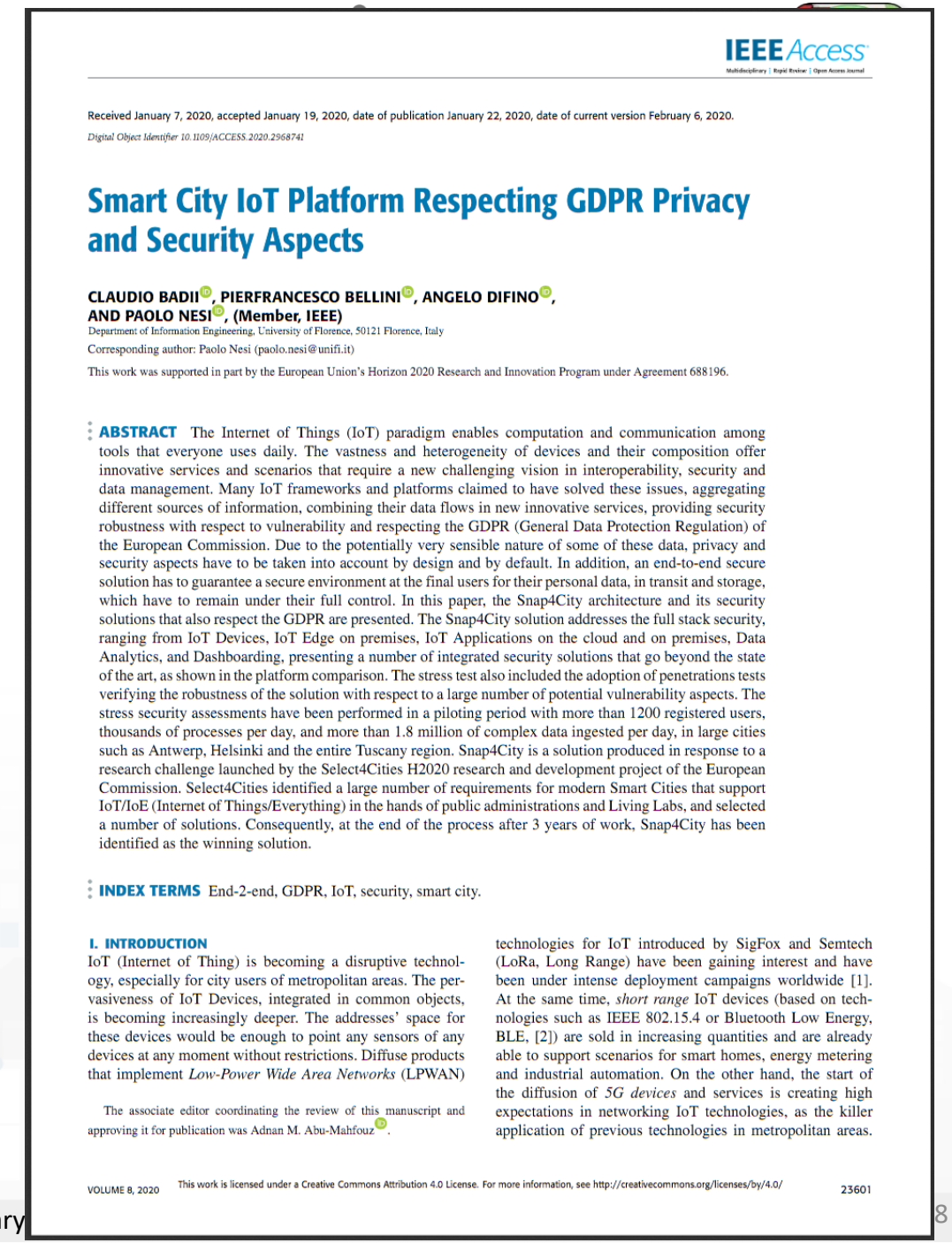
GDPR vs Snap4City

GDPR Compliance Verification Feature	Verif.	Reqs.
Signed consent	UI	R8
User profile management and control	UI	R13
Data Type private as default	UI	R8
Rights to access per element	UI	R9
Rights to transfer per element	UI	R10
Rights to erase per element and total	UI	R13
Rights to revoke/change per Data Type	UI	R10
An interface for Right management for Data Type	UI	R9
Clear Terms of Use and Privacy Policy	UI	--
Auditing Tools for Data Type	UI	R14
Publish as Anonymous	UI	R9
Encrypt personal users' data	Code	R12
Secure Authentication and Authorization	Code	R3
Data protection by Design	Code	R17
Secure connection	Code	R6
Security Control, data breach control, anonymization, etc.	PEN Test	R15, R16, R18

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IEEE Access

- C. Badii, P. Bellini, A. Difino, P. Nesi, "Smart City IoT Platform Respecting GDPR Privacy and Security Aspects", accepted for publication on IEEE Access, 2020. 10.1109/ACCESS.2020.2968741 https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8966344



IEEE Access

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Digital Object Identifier 10.1109/ACCESS.2020.2968741

Smart City IoT Platform Respecting GDPR Privacy and Security Aspects

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This work was supported in part by the European Union's Horizon 2020 Research and Innovation Program under Agreement 688196.

ABSTRACT The Internet of Things (IoT) paradigm enables computation and communication among tools that everyone uses daily. The vastness and heterogeneity of devices and their composition offer innovative services and scenarios that require a new challenging vision in interoperability, security and data management. Many IoT frameworks and platforms claimed to have solved these issues, aggregating different sources of information, combining their data flows in new innovative services, providing security robustness with respect to vulnerability and respecting the GDPR (General Data Protection Regulation) of the European Commission. Due to the potentially very sensible nature of some of these data, privacy and security aspects have to be taken into account by design and by default. In addition, an end-to-end secure solution has to guarantee a secure environment at the final users for their personal data, in transit and storage, which have to remain under their full control. In this paper, the Snap4City architecture and its security solutions that also respect the GDPR are presented. The Snap4City solution addresses the full stack security, ranging from IoT Devices, IoT Edge on premises, IoT Applications on the cloud and on premises, Data Analytics, and Dashboarding, presenting a number of integrated security solutions that go beyond the state of the art, as shown in the platform comparison. The stress test also included the adoption of penetrations tests verifying the robustness of the solution with respect to a large number of potential vulnerability aspects. The stress security assessments have been performed in a piloting period with more than 1200 registered users, thousands of processes per day, and more than 1.8 million of complex data ingested per day, in large cities such as Antwerp, Helsinki and the entire Tuscany region. Snap4City is a solution produced in response to a research challenge launched by the Select4Cities H2020 research and development project of the European Commission. Select4Cities identified a large number of requirements for modern Smart Cities that support IoT/IoE (Internet of Things/Everything) in the hands of public administrations and Living Labs, and selected a number of solutions. Consequently, at the end of the process after 3 years of work, Snap4City has been identified as the winning solution.

INDEX TERMS End-2-end, GDPR, IoT, security, smart city.

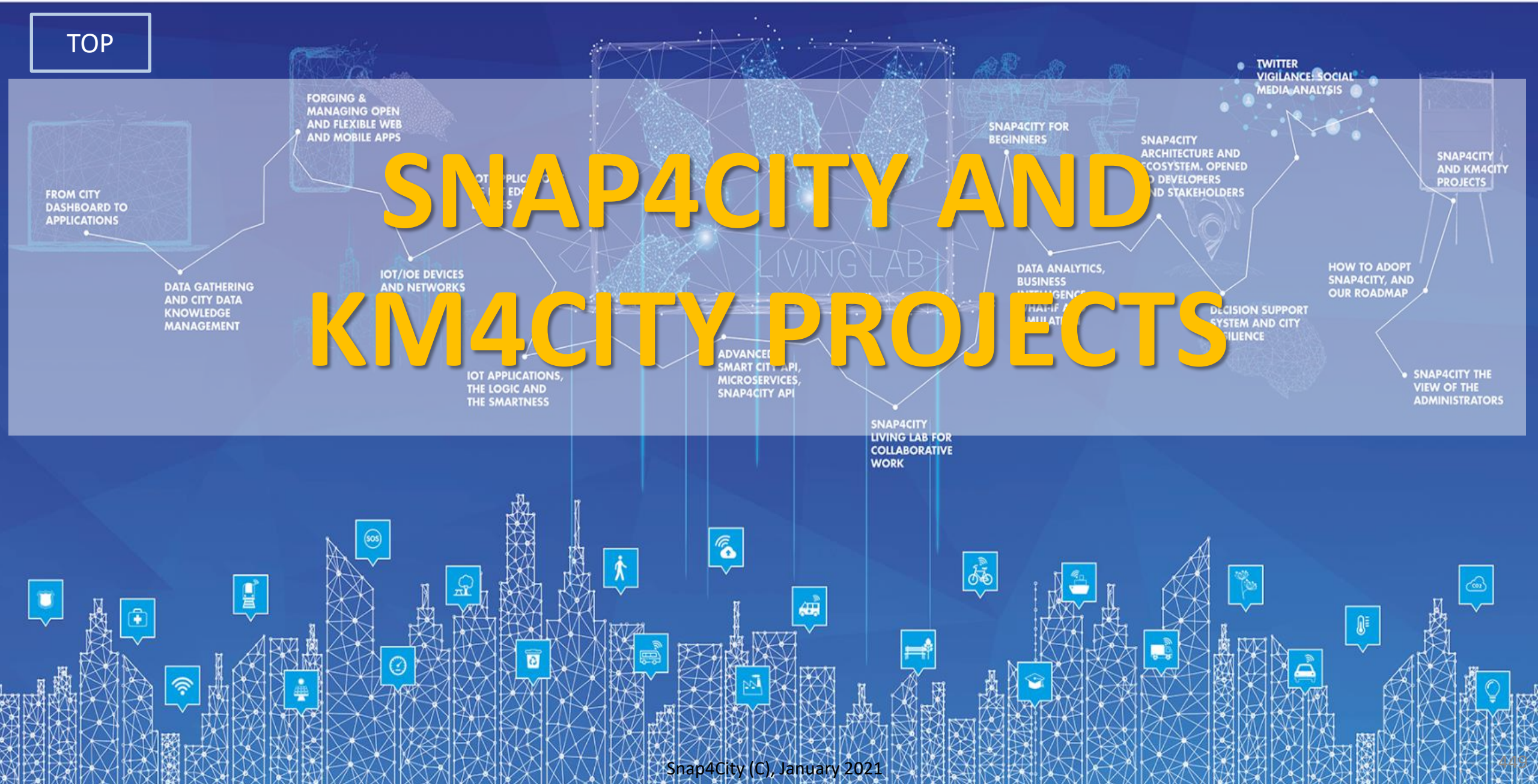
I. INTRODUCTION

IoT (Internet of Thing) is becoming a disruptive technology, especially for city users of metropolitan areas. The pervasiveness of IoT Devices, integrated in common objects, is becoming increasingly deeper. The addresses' space for these devices would be enough to point any sensors of any devices at any moment without restrictions. Diffuse products that implement *Low-Power Wide Area Networks* (LPWAN) technologies for IoT introduced by SigFox and Semtech (LoRa, Long Range) have been gaining interest and have been under intense deployment campaigns worldwide [1]. At the same time, *short range* IoT devices (based on technologies such as IEEE 802.15.4 or Bluetooth Low Energy, BLE, [2]) are sold in increasing quantities and are already able to support scenarios for smart homes, energy metering and industrial automation. On the other hand, the start of the diffusion of *5G devices* and services is creating high expectations in networking IoT technologies, as the killer application of previous technologies in metropolitan areas.

The associate editor coordinating the review of this manuscript and approving it for publication was Adnan M. Abu-Mahfouz.

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TOP



SNAP4CITY AND KM4CITY PROJECTS

DISIT lab roadmap vs model and tools' usage

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
Km4City 1.5

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

ckan, resolute

H2020 (2015-18)

2016
(2016-21) H2020 REPLICATE

- Smart Energy
- Sustainable Mobility
- Control Room
- Dashboard

Km4City 1.6.2

Sii-Mobility (2016-21) MIUR

SII-MOBILITY SCN

- Infomobility
- Mobile App
- Routing
- Multimodality

FIWARE

2017
Km4City 1.6.4

Sii-Mobility

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

E0l5 digital ecosystem (Powered by EXPO MILANO 2015)

(2016-19) MIUR

GHOST SIR

- Sardinia Region Smart City Strategies and plan

GREEN IMPACT C.A.P.A.C.I.T.Y.

GREEN IMPACT
POR FESR 2014-2020

- Industry 4.0
- Critical Plant
- Monitoring

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

life weee (2017-20)

- Smart Waste

2018
MOSAiC MObility 4.0 for SmArt (i) City (2018-20)

- Mobility Demand / Offer Analytics and Strategy

Sii-Mobility

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

IOT/IOE

Km4City 1.6.6

Node-RED

SNAP4CITY

SELECT for Cities H2020 (2017-19)

2019
5G (2018-21)

- 5G tech
- Energy
- Industry 4.0
- Synoptics

TRAFAIR

CEF (2018-21)

- Traffic and Mobility Impact on Pollution
- NOX predictions

EUROPEAN OPEN SCIENCE CLOUD

SIRIUS

LAID Smart Bed

- Smart Health

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

- Industry 4.0

bee smart city

- Smart Lonato

Reverberi Enetec Gruppo MPES

- PCP Award



2020
…2022

2021
- CAPELON
- Sweden

smartGARDAlake

Interreg MARITTIMO-IT FR-MARITIME MOBI MART

- Smart Mobility
- PISA, PUMS
- Living lab

Interreg Mediterranean HERIT-DATA

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

UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

Main running instances

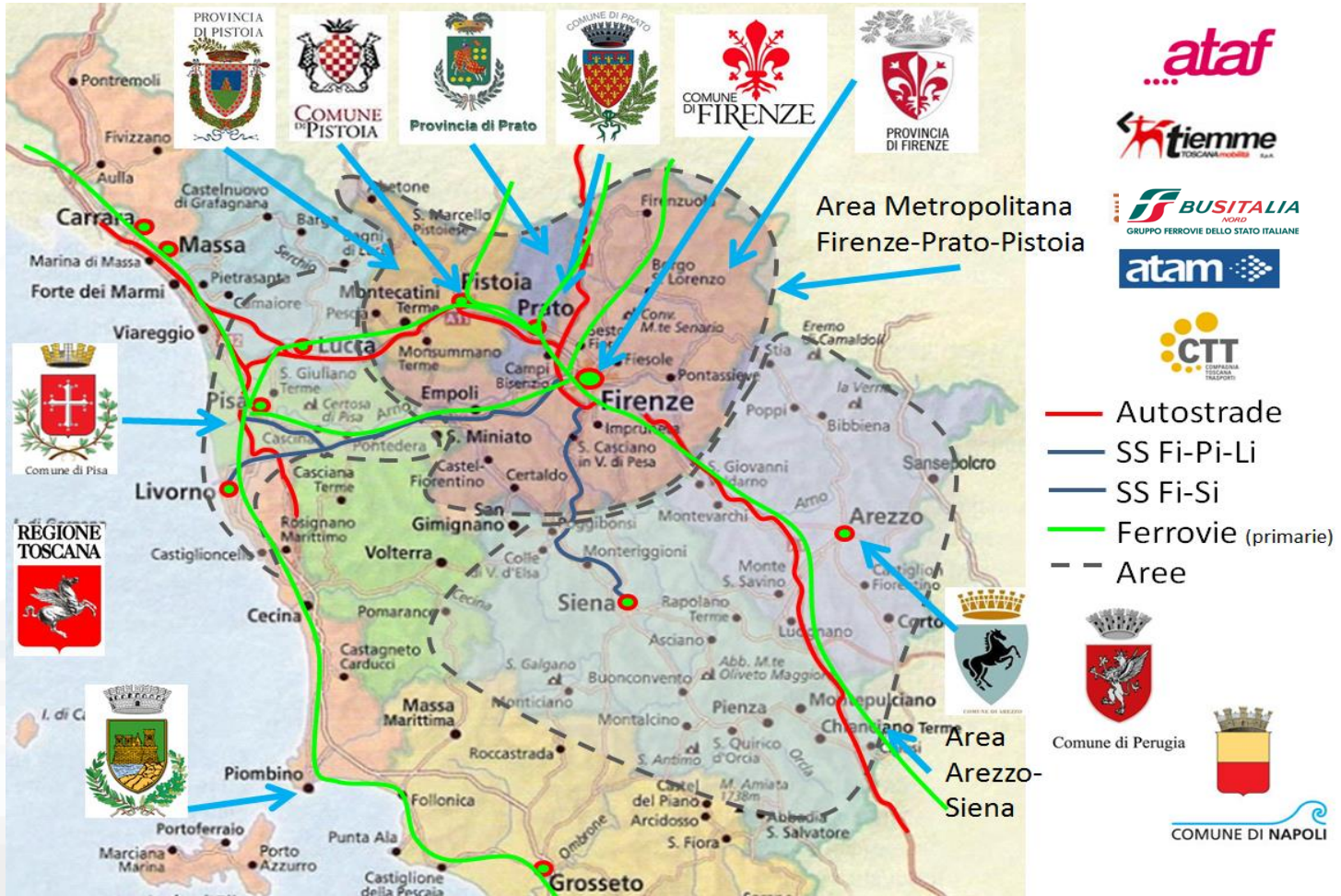
- Sii-Mobility → mobility and transport, sustainability
- REPLICATE → ICT, smart City Control room, Energy, IOT
- RESOLUTE → Resilience, ICT, Big Data
- GHOST → Strategies, smart city
- TRAFAIR → Environment & transport
- MOSAIC → mobility and transport
- WEEE Life → Smart waste, environment
- Smart Garda Lake → Castelnuovo del Garda
- 5G → Industry 4.0 vs SmartCity
- Green Impact → Industry 4.0, Chemical Plant
- SmartBed (laid → smart health
- Green Field Peas (soda) → Industry 4.0, Chemical plant
- MobiMart and PISA Agreement → data aggregation, Living Lab
- Lonato del Garda → smart parking, environment
- Herit Data → tourism, culture and management
- ISPRA JRC → site management and services
- Capelon (Sweden) → smart light solutions

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Sii-Mobility

http://www.Sii-Mobility.org

- *Experimentations and validation in Tuscany*
- *Integration with present central station and subsystems*
- *DISIT lab, Università di Firenze, is the tech-scientific coordinator*



ECM; Swarco Mizar; Inventi In20; Geoin; QuestIT; Softec; T.I.M.E.; LiberoLogico; MIDRA (autostrade, motorola); ATAF; Tiemme; CTT Nord; BUSITALIA; A.T.A.M.; Effective Knowledge; eWings; Argos Engineering; Elfi; Calamai & Agresti; Project; Negentis

UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

Sii-Mobility

MIUR MINISTERO DELL'ISTRUZIONE DELL'UNIVERSITÀ E DELLA RICERCA

KM 4 CITY

http://www.Sii-Mobility.org

Commenti dei cittadini, Social Media





AVM trasporto Pubblico

Merci







Sensori su trasporto Privato



Sensori, sistema monitoraggio



UTC

Sensori Parcheggi







Infomobility





Varchi Telematici, ZTL

Monitoraggio traffico, autostrade





Rete Ferroviaria

Parametri ambientali





Servizi ed enti



Ordinanze: eventi, lavori pubblici, ..



Emergenze, polizia, 118



General Objectives

http://www.Sii-Mobility.org

- Reduce the social costs of mobility
  - minor inconvenience,
  - greater efficiency,
  - greater sensitivity to the needs of the citizen,
  - lower emissions,
  - better environmental conditions;
  - info-training programs to help city user in getting virtuous habits;
  - reduce transportation costs and travel times for users, for operators and administrations,
  - optimization solutions.
- **simplify the use of mobility systems**
  - innovative sensors for AVM and private transport on the territory
  - integrated systems for payment and identification
  - driving / offline routing solutions
  - connect the drive, smart drive or walk
  - Integration of data from operators and different type sources
  - advanced management of resources measurement of flows realization of sensors, actuators
- **Testing on municipalities and provinces of Tuscany**
- **Contribute to the improvement of national and international standards**

REPLICATE

Horizon 2020
European Union Funding
for Research & Innovation

REnaissance of PLaces
with Innovative Citizenship
And TEchnology

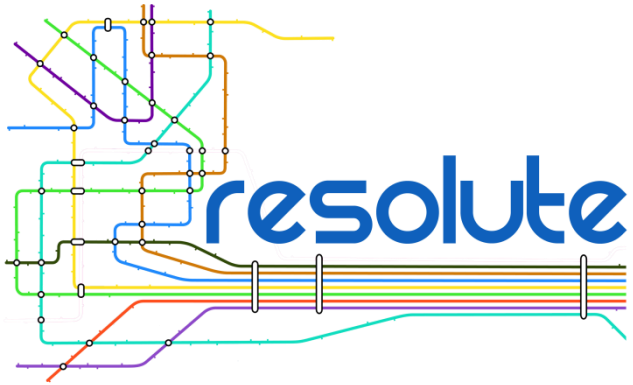
http://replicate-project.eu/

- Demonstrate Smart City technologies in energy, transport and ICT in districts in:
  - San Sebastian, Florence and Bristol,
  - follower cities of Essen, Nilufer and Lausanne
- Cities are the customer: considering local specificities
- Solutions must be replicable, interoperable and scalable:
  - Integrated Infrastructure: deployment of ICT architecture, from internet of things to applications
  - Low energy districts
  - Urban mobility: sustainable and smart urban services

SNAP4CITY

KM 4 CITY

1 (coordinator) FOMENTO DE SAN SEBASTIAN FSS SPAIN
2 AYUNTAMIENTO DE SAN SEBASTIAN SAN SEBASTIAN SPAIN
3 COMUNE DI FLORENCE FLORENCE ITALY
4 BRISTOL COUNCIL BRISTOL UNITED KINGDOM
5 STADT ESSEN ESSEN GERMANY
6 NILUFER BELEDIYESI NILUFER TURKEY
7 VILLE DE LAUSANNE LAUSANNE SWITZERLAND
8 IKUSI ANGEL IGLESIAS, S.A. IKUSI SPAIN
9 ENDESA ENERGÍA, S.A. ENDESA SPAIN
10 EUROHELP CONSULTING, S.L. EUROHELP SPAIN
11 ILUMINACION INTELIGENTE LUIX, S.L. LUIX SPAIN
12 FUNDACION TECNALIA RESEARCH & INNOVATION TECNALIA SPAIN
13 EUSKALTEL, S.A. EUSKALTEL SPAIN
14 COMPAÑÍA DEL TRANVÍA DE SAN SEBASTIÁN DBUS SPAIN
15 CONSIGLIO NAZIONALE DELLE RICERCHE CNR ITALY
16 ENEL DISTRIBUZIONE, SPA ENEL ITALY
17 MATHEMA, SRL MATHEMA ITALY
18 SPES CONSULTING SPES ITALY
19 TELECOM ITALIA, SPA TELECOM ITALY
20 UNIVERSITA DEGLI STUDI DI FLORENCE UNIFI ITALY: DINFO.DISIT Lab and DIEF
21 THALES ITALIA, SPA THALES ITALY
22 ZABALA INNOVATION CONSULTING ZABALA SPAIN
23 TECHNOMAR TECHNOMAR GERMANY
24 UNIVERSITY OF BRISTOL UOB UNITED KINGDOM
25 UNIVERSITY OF OXFORD UOXF UNITED KINGDOM
26 BRISTOL IS OPEN, LTD BIO UNITED KINGDOM
27 ZEETTA NETWORKS ZEETTA UNITED KINGDOM
28 KNOWLE WEST MEDIA CENTRE, LGB KWMC UNITED KINGDOM
29 TOSHIBA RESEARCH EUROPE, LTD TREL UNITED KINGDOM
30 ROUTE MONKEY, LTD ROUTE MONKEY UNITED KINGDOM
31 ESOTERIX SYSTMES, LTD ESOTERIX UNITED KINGDOM
32 NEC LABORATORIES EUROPE, LTD NEC UNITED KINGDOM
33 COMMONWHEELS CAR CLUB CIC CO-WHEELS UNITED KINGDOM
34 UNIVERSITY OF THE WEST OF ENGLAND UWE UNITED KINGDOM
35 ESADE BUSINESS SCHOOL ESADE SPAIN
36 SISTELEC SOLUCIONES DE TELECOMUNICACION, S.L. SISTELEC SPAIN



Horizon 2020
European Union Funding
for Research & Innovation

http://www.resolute-eu.org

- **Develop European Resilience Management Guidelines (ERMG)**
  - Develop a conceptual framework for creating/ maintaining Urban Transport Systems
- **Enhance resilience** through improved support of human decision making processes, particularly by training professionals and civil users on the ERMG and the RESOLUTE system
- **Operationalize and validate the ERMG** by implementing the RESOLUTE Collaborative Resilience Assessment and Management Support Systems (CRAMSS) for Urban Transport Systems addressing Road and Urban Rail Infrastructures
  - Pilots in **Florence and Athens**
- Adoption of the ERMG at EU and Associated Countries level

University of Florence: DISIT lab DINFO (Proj coordinator), DISIA and DST	UNIFI	IT
THALES	THALES	IT
ATTIKOMetro	ATTIKO	GR
Comune di Firenze	CDF	IT
Centre for Research and Technology Hellas	CERTH	GR
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.	FHG	DE
HUMANIST	HUMANIST	FR
SWARCO Mizar	SWMIZ	IT
Associação para o Desenvolvimento da Investigação no Instituto Superior de Gestão	ADI-ISG	PT
Consorzio Milano Ricerche	CMR	IT

GHOST: Governing tHe smart city: a gOvernance-centred approach to SmarT urbanism

General Objectives

- Offer a **comprehensive framework** for measuring and reassessing urban smart development and related rankings
- **Critical assessment** of Smart City ranking index existence
- Definition of an **enabling technology** supporting the action plans for strengthening multi-level place-based governance, applied in the tourism context
- Definition of **strategies for good smart governance**, with the purpose of providing recommendations to start or implement an institutional and development process leading towards smart city governance.

Partners:

University of Cagliari (Coordinator) DICAAR and DMI

University of Florence SAGAS and DISIT

University of Turin ESOMAS

University of Sassari DADU

Under the patronage of the Municipality of Cagliari

COMUNE DI CAGLIARI

Duration: 23/09/2015 - 23/09/2018

http://sites.unica.it/ghost

Understanding Traffic Flows to Improve Air quality

- **Objective:** http://trafair.eu/
  - to develop a service that **combines traffic data on air quality**, weather conditions, and traffic flows in order to allow citizens and municipalities to estimate the level of pollution resulting from varying traffic flow conditions.
- **Where:**
  - **Zaragoza, Florence, Modena, Livorno, Santiago de Compostela, and Pisa**

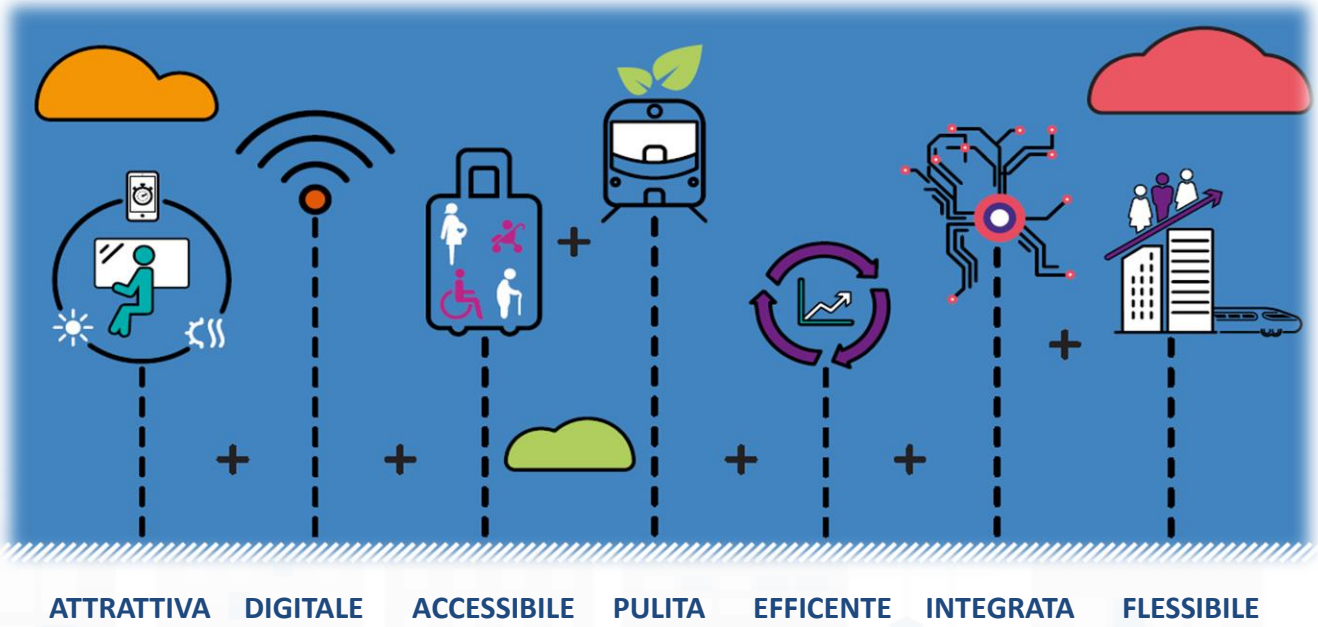
- Università degli studi di Modena e Reggio Emilia (UNIMORE) -- Italy
- **Università degli Studi di Firenze – DISIT DINFO -- Italy**
- Universidade de Santiago de Compostela (USC) - Spain
- Comune di Modena (CMO) - Italy
- Regione Toscana (TR) - Italy
- Concello de Santiago de Compostela (CSC) - Spain
- Fundación Pública Gallega Centro Tecnológico de Supercomputación de Galicia (Fundacion CESGA) - Spain
- Universidad de Zaragoza (UNIZAR) - Spain
- Lepida S.p.A. (LP) - Italy

MObility 4.0 for SmArt (i) City

Tools for Mobility operators

- Demand Analysis
- Prediction on Parking
- Connected Drive
- Offer Analysis
- Simulation of Mobility
- Etc.

Where: in Tuscany



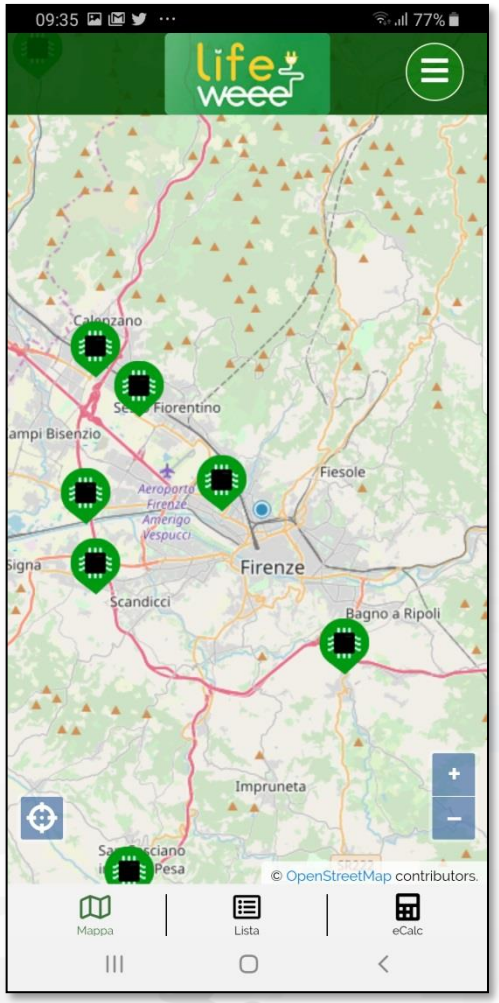
WEEE: Waste from Electrical and Electronic Equipment

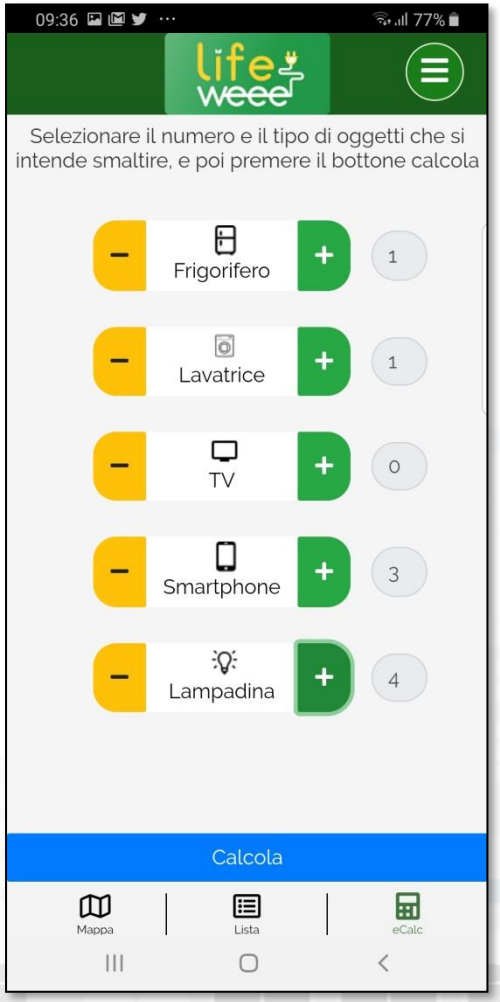
- **maximize the collection of WEEE** in Tuscany through a new governance model based on the involvement of SMEs and awareness raising activities towards citizens and its **replication in Andalucía**.
- Actions:
  - Improve the regional governance
  - Support municipalities in capacity building of public officials and improving services to citizens.
  - Develop a system of **services and incentives for SMEs**
  - Develop IT tools for companies and citizens: a **software** and **guidelines** for the simplification of administrative and bureaucratic activities and an **App** to easily locate collection sites.
  - Develop an awareness raising **information campaign** to increase public attention on the topic.
  - Test the **replicability and transferability** of project results through the implementation of actions in the Region of Andalucía.

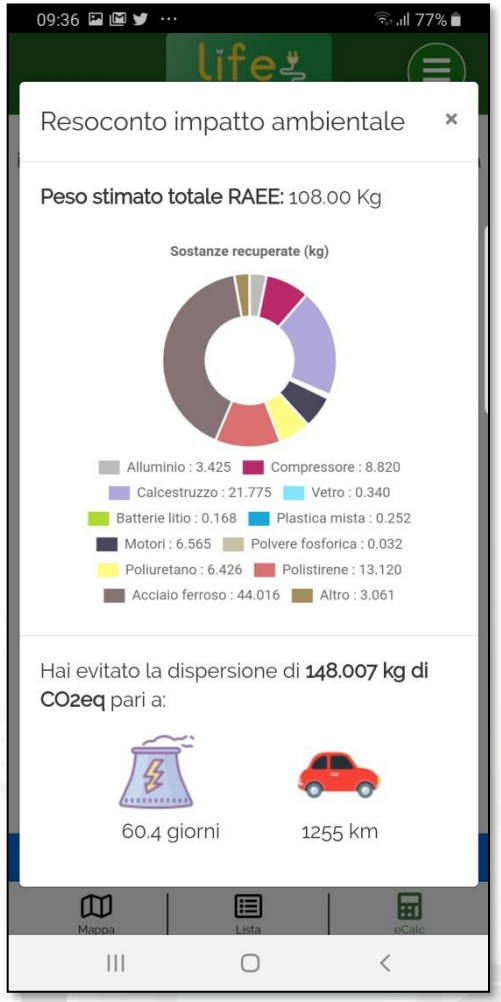
http://www.regione.toscana.it/-/life-weee

Example of Mobile App on Stores









smartGARDAlake

www.smartgardalake.it

1



INTELLIGENT
PUBLIC LIGHTING

SMART
NETWORK



SENSORS



INFRASTRUCTURE

2



OPEN DATA, IoT, SOCIAL

SNAP4CITY

3





APP E SERVIZI ON DEMAND
SMART CITY & SMART TOURISM

4



CONTROL ROOM FOR SMART
GOVERNCANCE

Experimenting 5G

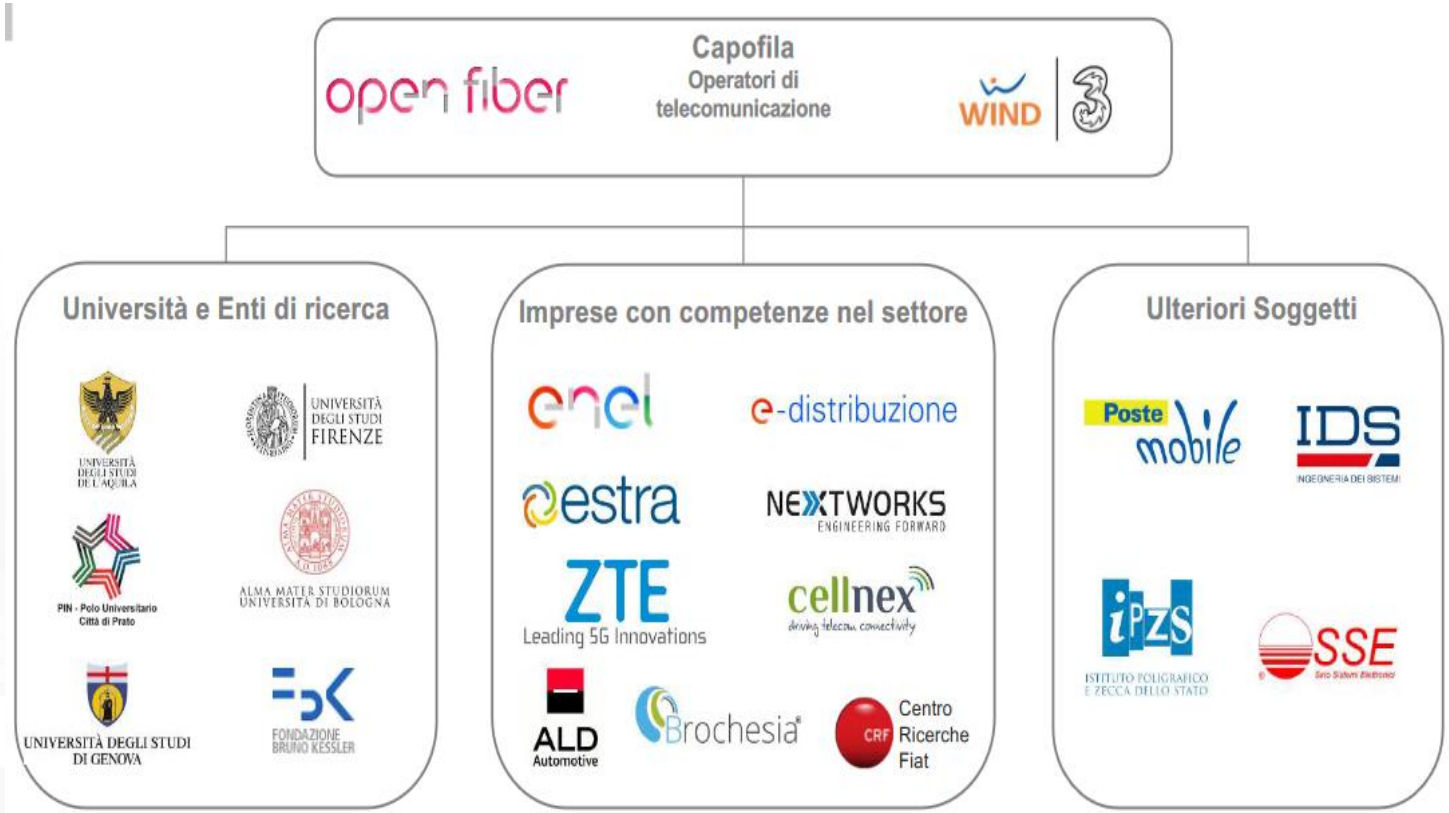
Fields:

- Internet of Things: Industry IOT, Smart City
- Mobility and transport
- Safety & Security: video analysis
- Culture and Tourism, Education, Health

Where in Italy:

- Prato and L'Aquila

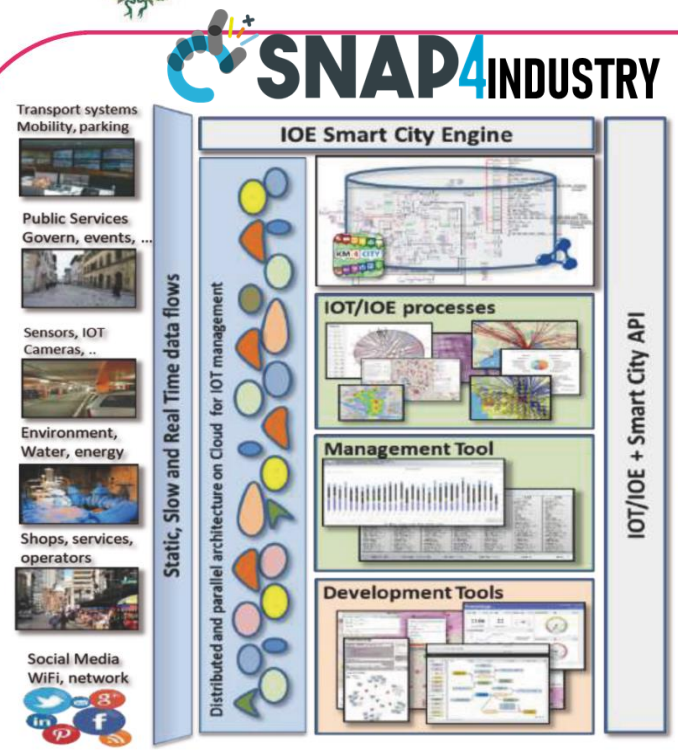
Partners:



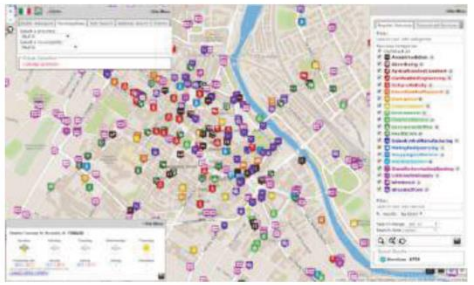
SENSORI E IOT - PRATO

Piattaforma IoT/IoE abilitata dal 5G per applicazioni di:

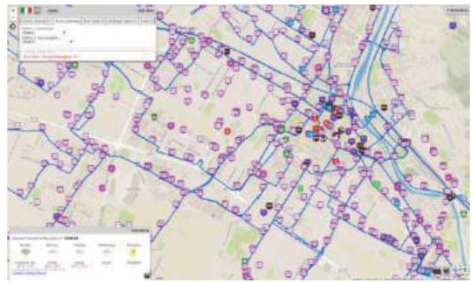
- Smart City management (in ottica Smart City)
- monitoraggio utenze in modo smart
- industrial automation (in ottica Industria 4.0)







Punti di interesse e servizi su Prato



Use Case LEADER estra

Partner coinvolti open fiber, ZTE Leading 5G Innovations, Università degli Studi Firenze, cellnex driving telecom connectivity, SSE Sirio Sistemi Elettronici, PIN - Polo Universitario Città di Prato

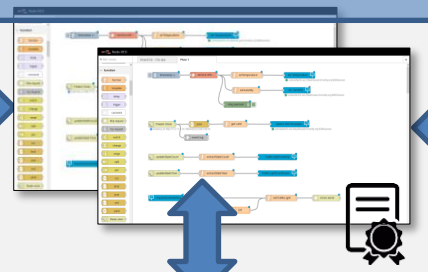
Aziende/Enti Coinvolti Qualcomm, Interporto della Toscana Centrale, Unione Industriale Pratese Confindustria Prato, centria Reti Gas, Publiacqua, GIDA, Programma Ambiente

GIDA set up

Smart City data from many sources



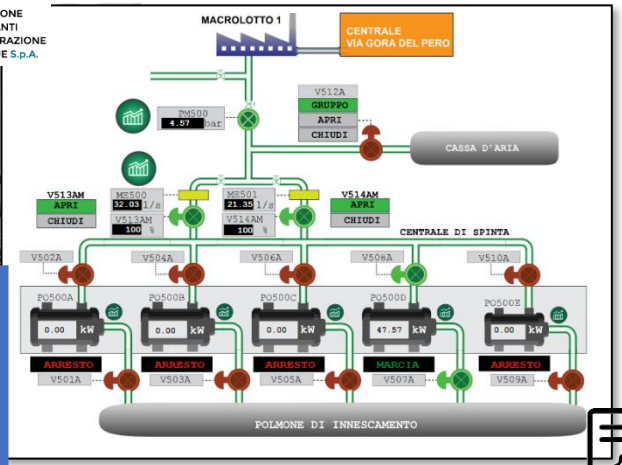
IOT Applications



Dashboards and Apps







IOT Data Shadow Snap4City

Big Data Analytics, Artificial Intelligence

Modbus

ModBus to Snap4City Gateway Edge

5G network devices

Telemonitoring Telecontrol

Green Impact Capacity (GIC)



- Improve productivity of chemical plant
- Keep GREEN the environmental impact
- Exploiting innovative technologies
- Diversify the production
- Monitoring environmental conditions





ALTAIR CHIMICA

PRINZ

Sigma ingegneria

GIGAPIU planning and development

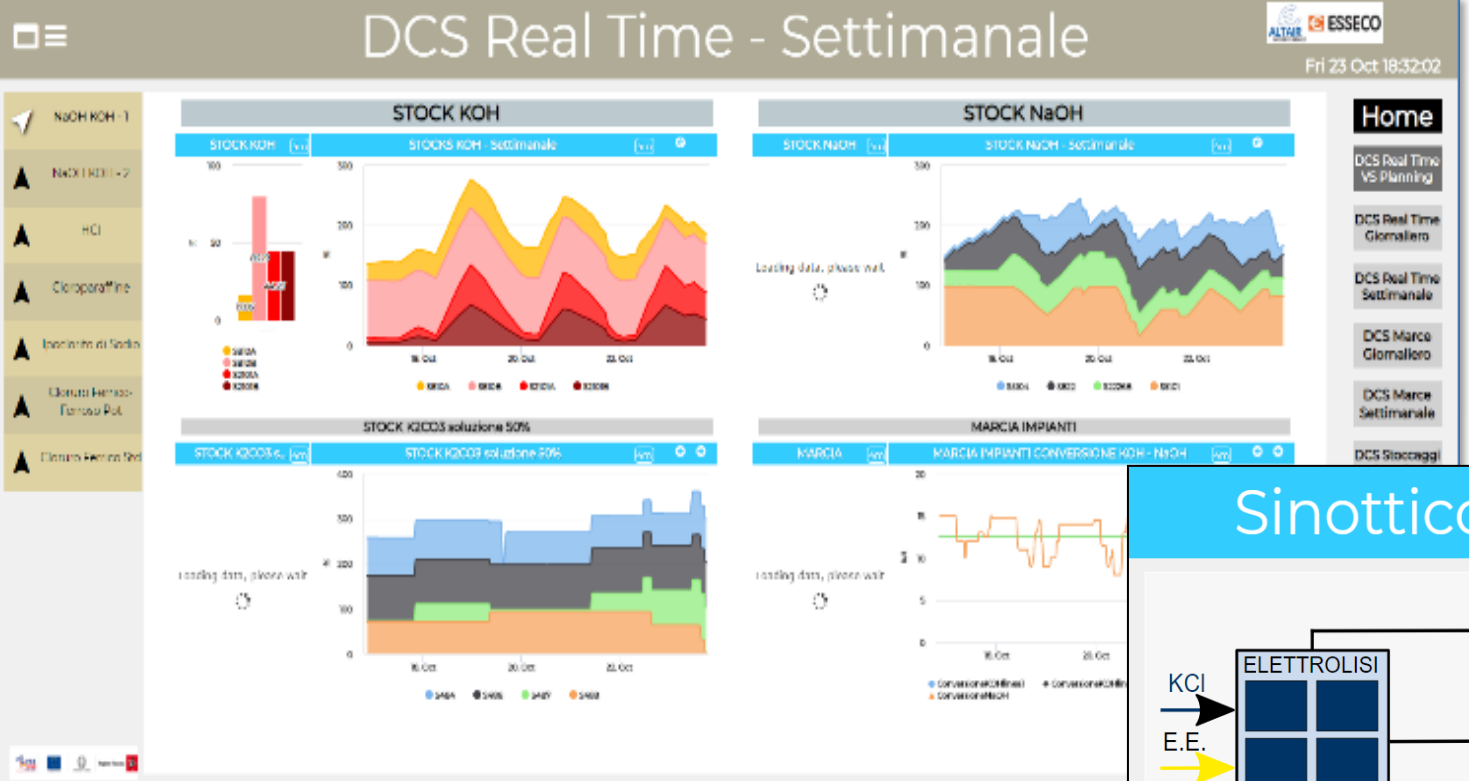


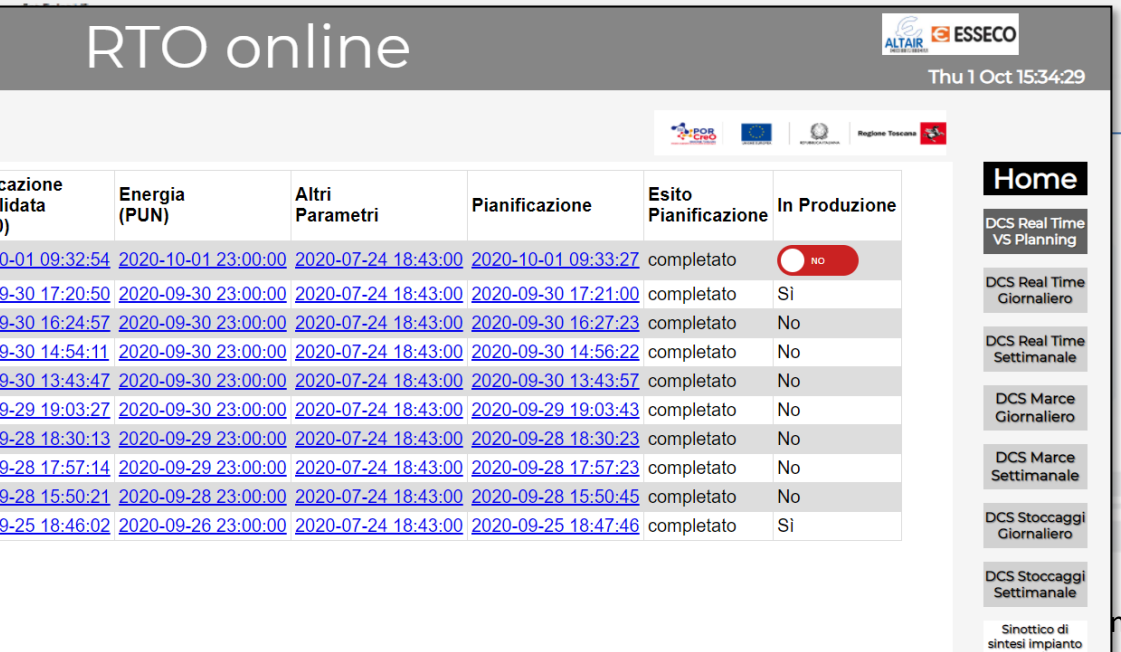


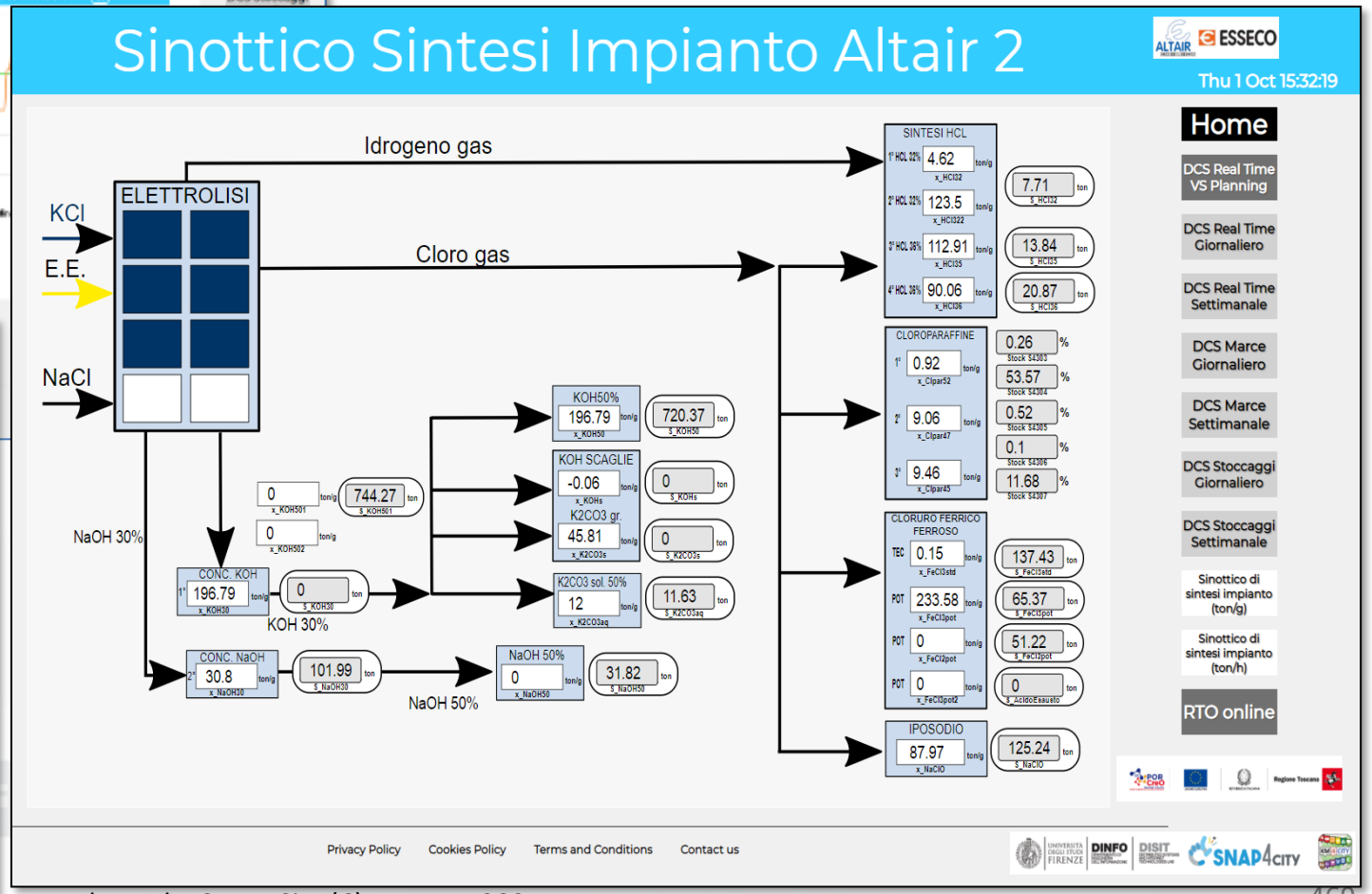
Chemical Plant Dashboard Green Impact Capacity (GIC)

Altair Control room

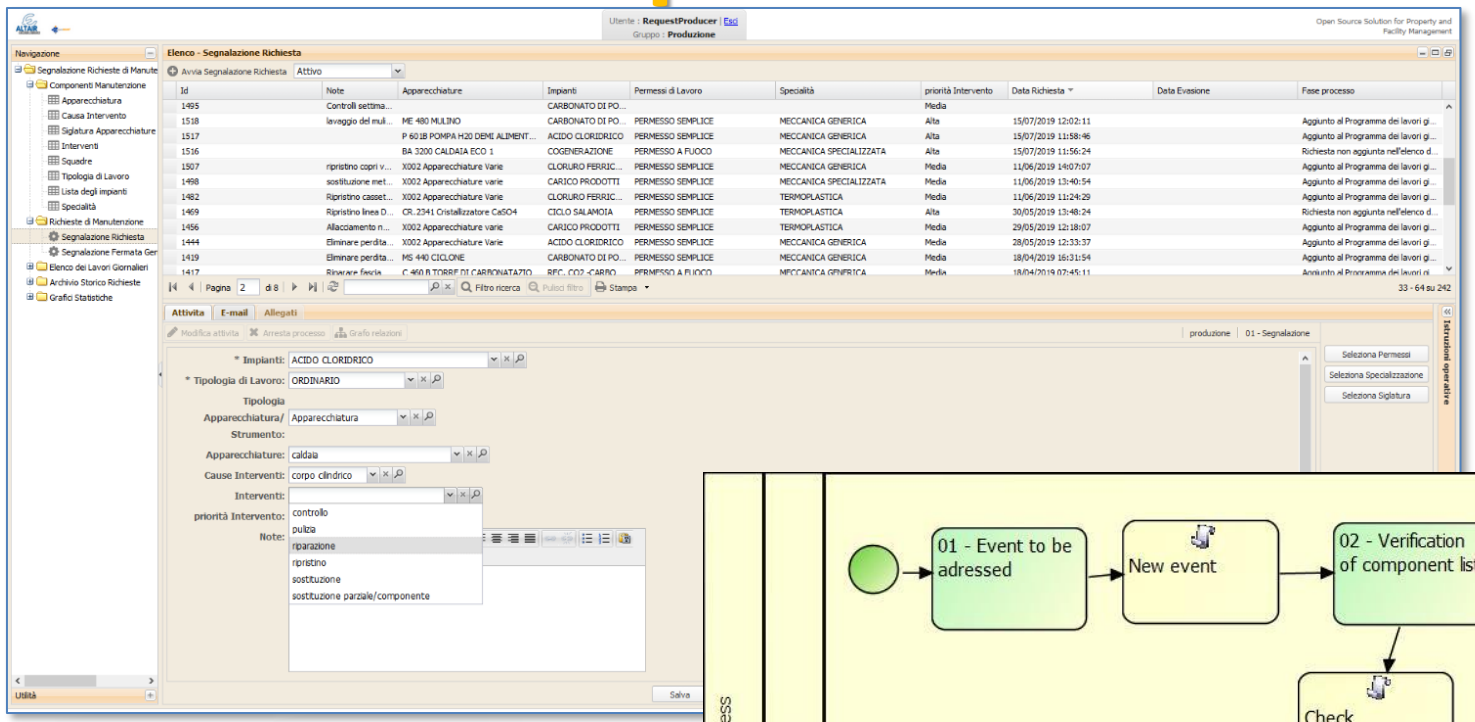



DCS Real Time - Settimanale
ESSECO
Fri 23 Oct 18:32:02
STOCK KOH
STOCK NaOH
STOCK K2CO3 soluzione 50%
MARCIA IMPIANTI
Home
DCS Real Time VS Planning
DCS Real Time Giornaliero
DCS Real Time Settimanale
DCS Marce Giornaliero
DCS Marce Settimanale
DCS Stoccaggi

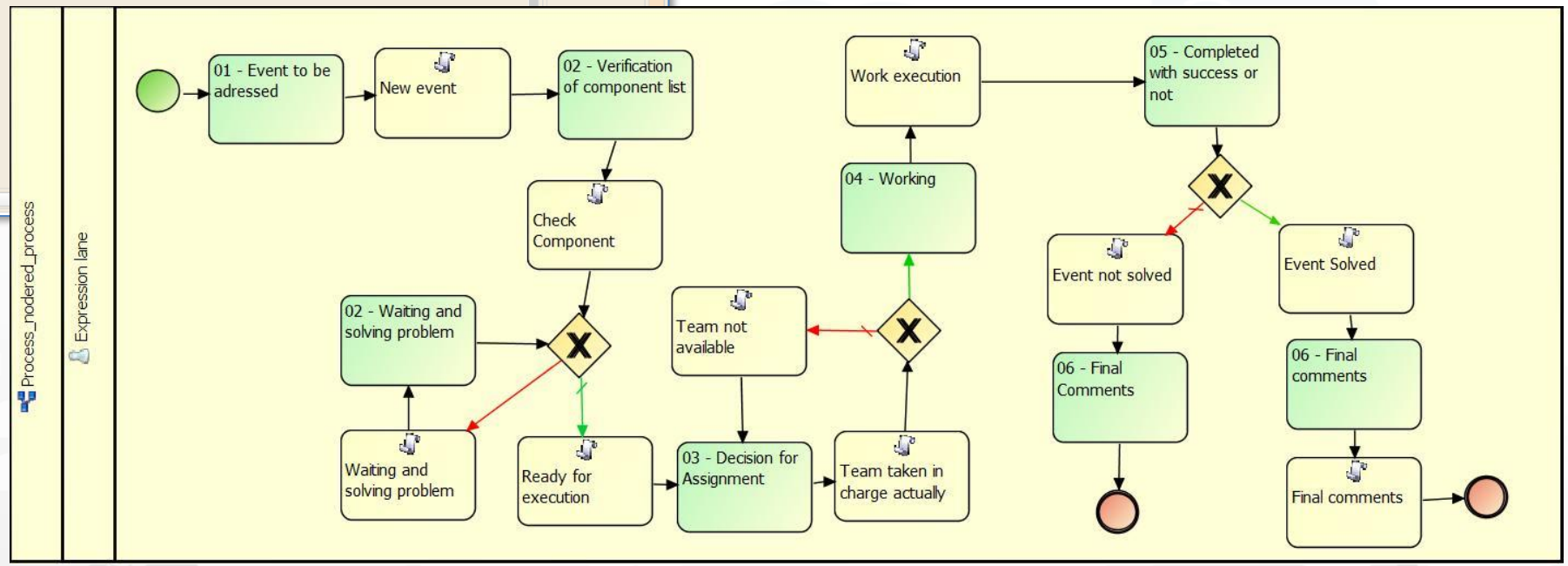

RTO online
ESSECO
Thu 1 Oct 15:34:29
Energia (PUN)
Altri Parametri
Pianificazione
Esito Pianificazione
In Produzione
2020-10-01 09:32:54 2020-10-01 23:00:00 2020-07-24 18:43:00 2020-10-01 09:33:27 completato NO
2020-09-30 17:20:50 2020-09-30 23:00:00 2020-07-24 18:43:00 2020-09-30 17:21:00 completato Sì
2020-09-30 16:24:57 2020-09-30 23:00:00 2020-07-24 18:43:00 2020-09-30 16:27:23 completato No
2020-09-30 14:54:11 2020-09-30 23:00:00 2020-07-24 18:43:00 2020-09-30 14:56:22 completato No
2020-09-30 13:43:47 2020-09-30 23:00:00 2020-07-24 18:43:00 2020-09-30 13:43:57 completato No
2020-09-29 19:03:27 2020-09-30 23:00:00 2020-07-24 18:43:00 2020-09-29 19:03:43 completato No
2020-09-28 18:30:13 2020-09-29 23:00:00 2020-07-24 18:43:00 2020-09-28 18:30:23 completato No
2020-09-28 17:57:14 2020-09-29 23:00:00 2020-07-24 18:43:00 2020-09-28 17:57:23 completato No
2020-09-28 15:50:21 2020-09-28 23:00:00 2020-07-24 18:43:00 2020-09-28 15:50:45 completato No
2020-09-25 18:46:02 2020-09-26 23:00:00 2020-07-24 18:43:00 2020-09-25 18:47:46 completato Sì
Home
DCS Real Time VS Planning
DCS Real Time Giornaliero
DCS Real Time Settimanale
DCS Marce Giornaliero
DCS Marce Settimanale
DCS Stoccaggi Giornaliero
DCS Stoccaggi Settimanale
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Sinottico Sintesi Impianto Altair 2
ESSECO
Thu 1 Oct 15:32:19
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KCl
E.E.
NaCl
ELETTROLISI
Cloro gas
NaOH 30%
KOH 30%
NaOH 50%
SINTESI HCL
CLOROPARAFFINE
CLORURO FERRICO FERROSO
IPOSODIO
Home
DCS Real Time VS Planning
DCS Real Time Giornaliero
DCS Real Time Settimanale
DCS Marce Giornaliero
DCS Marce Settimanale
DCS Stoccaggi Giornaliero
DCS Stoccaggi Settimanale
Sinottico di sintesi impianto (ton/g)
Sinottico di sintesi impianto (ton/h)
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Cookies Policy
Terms and Conditions
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OpenMaint Ticketing System



- Define the workflow
  - Activate events
  - Manage steps
  - Collecting feedbacks and results from teams



- Activities
- Teams
- Phases
- Athorization
- Checking points
- Events and conditions
- …

Interreg Mediterranean

HERIT-DATA

https://herit-data.interreg-med.eu/

Sustainable Heritage Management towards **Mass Tourism Impact** thanks to a holistic use of **Big and Open Data**

BUDGET: 4.195.515,20 €

- City of Dubrovnik development agency (Croatia)
- Turisme Comunitat Valenciana (Spain)
- AVITEM (France)
- Center for Spatial Research (Bosnia and Herzegovina)
- Conference of peripheral maritime regions of Europe (France)
- Santa María Real Foundation for Historical Heritage (Spain)
- Valenciaport Foundation (Spain)
- Foundation for Research and Innovation (Italy)
- Region of Western Greece (Greece)
- Occitanie Region (France)
- Faculty of Sciences and Technology (Portugal)

Sustainable and responsible Tourism Management

Key aspect: **Carrying Capacity**

consider **European Tourism Indicators ETIS**

Respectful of the **ICZM recommendations**

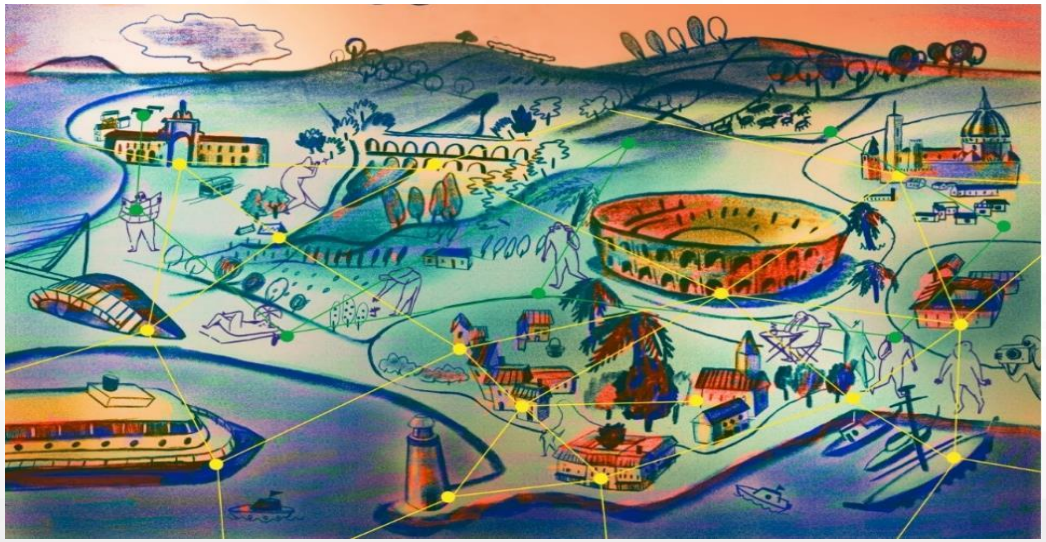
Evaluation of impact

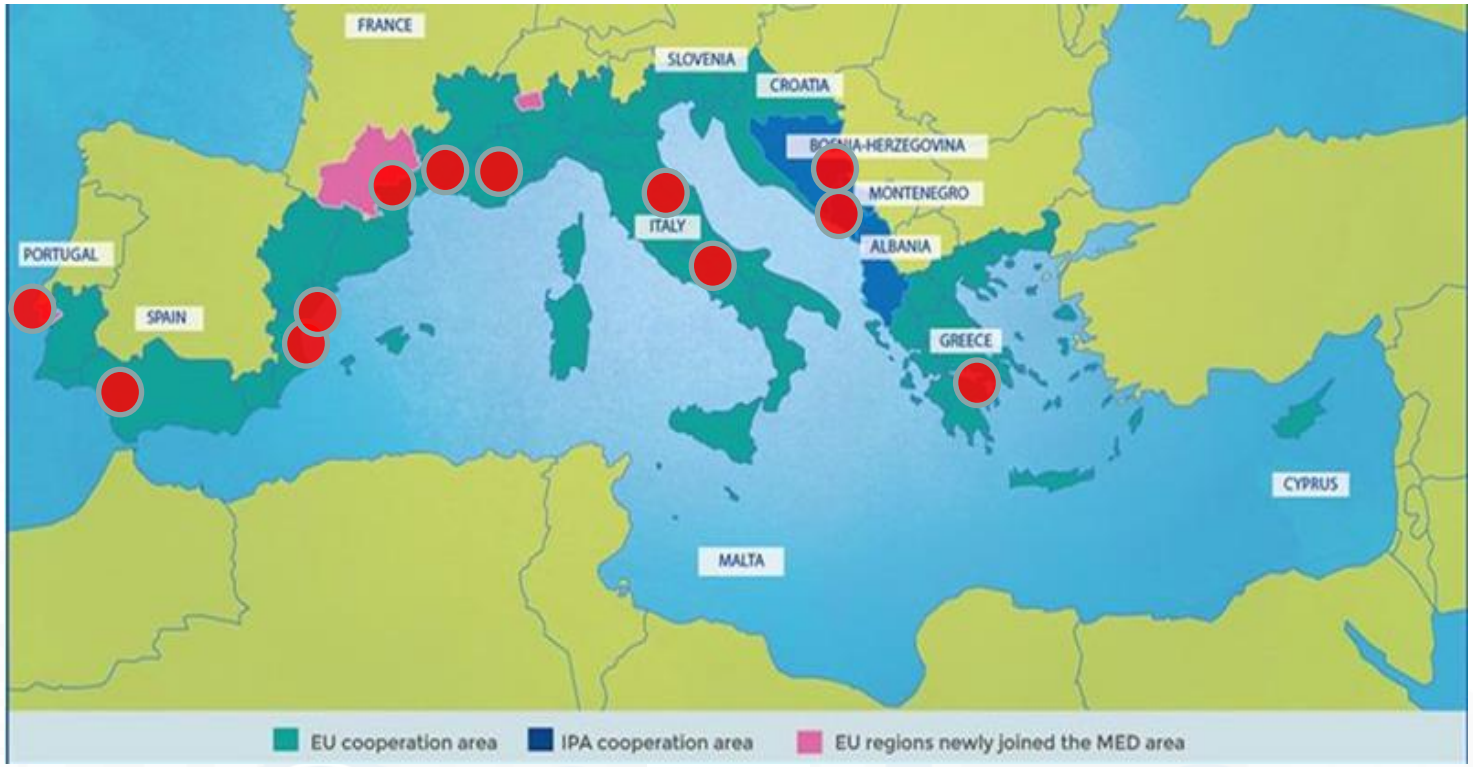
Cultural heritage

Special interest on **UNESCO World Heritage Sites**

Big & Open data

At service of Planners, visitors, local stakeholders and dwellers





Regione Toscana

Fondazione per la ricerca e l'innovazione

Interreg

UNIONE EUROPEA

MARITTIMO-IT FR-MARITIME

Fondo Europeo di Sviluppo Regionale

MOBIMART

MOBilità Intelligente MARe Terra

http://interreg-maritime.eu/web/mobimart

MOBI MART

REGIONE TOSCANA

REGIONE LIGURIA

CORSE CORSICA

REGIONE AUTÒNOMA DE SARDIGNA
REGIONE AUTONOMA DELLA SARDEGNA

RÉGION SUD PROVENCE ALPES CÔTE D'AZUR

Autorità di Sistema Portuale del Mar Tirreno Settentrionale

PROVINCIA DI LIVORNO

COMUNE DI GENOVA

Autorità di Sistema Portuale del Mare di Sardegna

Dalla **Sardegna** alla **Costa Azzurra**, passando per **Corsica**, **Toscana** e **Liguria**: un **unico strumento di infomobilità** per consentire a cittadini, turisti e pendolari di viaggiare tra le 5 regioni, pianificare gli spostamenti ed essere informati in tempo reale.

Questo l'obiettivo di **MOBIMART** - MOBilità Intelligente MARe Terra, proposto da una partnership di 11 Enti pubblici. Focus del progetto è l'**integrazione dei servizi di trasporto** che gli utenti utilizzano durante il viaggio, considerato come un unico tragitto dalla partenza all'arrivo, indipendentemente dal mezzo- nave, bus, treno, aereo - e a prescindere dalle barriere amministrative e morfologiche dei territori attraversati.

Cuore delle attività, la realizzazione di una **piattaforma integrata** per fare comunicare tra loro in modo intelligente i servizi di trasporto, facilitando gli **spostamenti intermodali** e rendendo più semplice l'**accesso alle informazioni**.

Il progetto intende intervenire su:
1) **L'innovazione dello scambio informativo tra sistemi** al momento non dialoganti, con l'obiettivo di sviluppare servizi anche oltre il termine del progetto, per consolidare le relazioni tra territori transfrontalieri.
2) **La molteplicità e la digitalizzazione dei prodotti realizzati**: siti web, travel planner – strumenti per la pianificazione dei viaggi da punto a punto - app per device mobili, canali social.

Per giungere a questi obiettivi il progetto sarà strutturato in un percorso triennale suddiviso in due step principali:
1) la standardizzazione delle informazioni sulla mobilità provenienti dai sistemi dei partner, in modo che siano tutte utilizzabili in un'unica piattaforma
2) la creazione di servizi di infomobilità specifici relativi ai porti, ai territori di Province e Comuni, alle Regioni.

Il progetto MOBIMART è finanziato nell'ambito del Programma Interreg Italia-Francia Marittimo 2014-2020 per un totale complessivo di 6.098.030,52 euro, di cui 5.183.325,94 euro provenienti dal Fondo Europeo di Sviluppo Regionale (FESR).



Comparison With other platforms



State of the Art Solutions vs Snap4City

	IOT Discovery Abstraction	Authentication, Authorization	Security end-2-end, secure on IOT and Dashboards	Open HW and Open SW	Integrated Community management	Data Types: IOT Devices, IOT App, Dashboard, Data	Data Type: Publish/share, Delegation, Consent and change	Data Type: Download and Delete	Auditing on Data Type Access	Open Source end-to-end	Scalability IOT	Visual Programming end-to-end applications	Advanced Smart City API, MicroServices	Multi Domain Semantic Platform	Standard based Modules and IOT, Open Devices	Resource Sharing	Data Analytics integrated	Dashboard H24/7, protected connection	Multi-protocol on IOT
		G				G	G	G	G										
Snap4City	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
KAA [53]	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	N	(Y)	N	N	Y	Y
Thingsboard [55]	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	N	N	N	N	N	Y	MQTT,coap, http
IOT eclipse.org [56]	N	N	N	(Y)	N	Y	N	N	N	Y	Y	N	N	N	Y	N	N	N	Y
IOT IGNITE [57]	N	Y	N	Y	N	Y	N	Y	Y	Y	Y	Y	N	N	N	N	N	Y	MQTT
FIWARE [47]	N	Y	N	Y	N	N	N	Y	N	Y	(Y)	(N)	Y	N	Y	N	N	Y	Y
ARM mbed IoT [48]	Y	Y	Y	Y	Y	N	(N)	N	Y	Y	Y	N	N	N	Y	N	N	Y	Limited
Airvantage [51]	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	N	N	N	N	N	Y	MQTT, HTTP
AWS [43]	Y	Y	Y	Y	N	Y	(N)	Y	Y	N	Y	N	N	N	Y	Y	(Y)	Y	Limited
Azure IOT [44]	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	N	Y	Y	(Y)	Y	Limited
PTC ThingWorkx [59]	N	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	N	N	Y	N	N	Y	Y
Bosch IoT Suite [58]	Y	Y	Y	Y	Y	(Y)	(N)	Y	Y	N	Y	Y	Y	N	Y	N	Y	Y	Y
CISCO Jasper [55]	Y	Y	Y	Y	N	(Y)	(N)	N	Y	N	Y	N	N	N	N	--	(Y)	Y	N
Siemens MindSphere [60]	Y	Y	Y	(Y)	N	Y	(N)	Y	Y	N	Y	Y	N	N	Y	N	Y	Y	Y
Carriots [54]	Y	Y	Y	(Y)	N	Y	N	N	Y	N	Y	N	N	N	--	N	N	Y	MQTT
Google IOT [45]	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	N	N	N	N	(Y)	(Y)	MQTT, HTTP
Homekit Apple [50]	Y	Y	Y	Y	N	Y	N	N	Y	N	(Y)	N	N	N	N	Y	N	Y	Limited
Smarthing Samsung [52]	Y	Y	Y	Y	Y	Y	(Y)	Y	Y	N	(Y)	N	N	N	N	N	N	Y	Limited

GDPR vs Snap4City

GDPR Compliance Verification Feature	Verif.	Reqs.
Signed consent	UI	R8
User profile management and control	UI	R13
Data Type private as default	UI	R8
Rights to access per element	UI	R9
Rights to transfer per element	UI	R10
Rights to erase per element and total	UI	R13
Rights to revoke/change per Data Type	UI	R10
An interface for Right management for Data Type	UI	R9
Clear Terms of Use and Privacy Policy	UI	--
Auditing Tools for Data Type	UI	R14
Publish as Anonymous	UI	R9
Encrypt personal users' data	Code	R12
Secure Authentication and Authorization	Code	R3
Data protection by Design	Code	R17
Secure connection	Code	R6
Security Control, data breach control, anonymization, etc.	PEN Test	R15, R16, R18

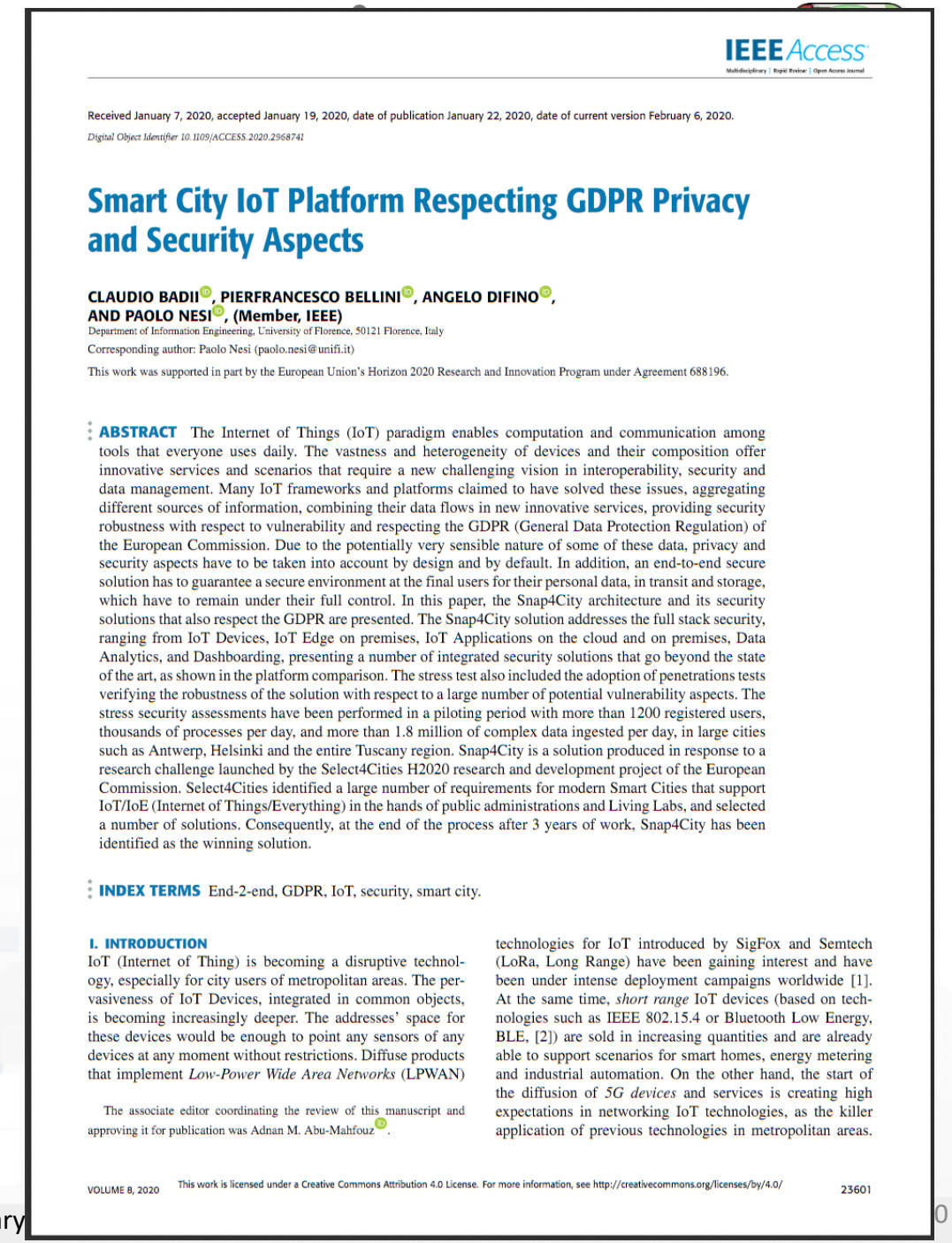
Self Training articles

- C. Badii, P. Bellini, A. Difino, P. Nesi, "Smart City IoT Platform Respecting GDPR Privacy and Security Aspects", accepted for publication on IEEE Access, 2020. 10.1109/ACCESS.2020.2968741 https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8966344
- C. Badii, P. Bellini, A. Difino, P. Nesi, G. Pantaleo, M. Paolucci, MicroServices Suite for Smart City Applications, Sensors, MDPI, 2019. https://doi.org/10.3390/s19214798
- C. Badii, P. Bellini, A. Difino, P. Nesi, "Sii-Mobility: an IOT/IOE architecture to enhance smart city services of mobility and transportation", Sensors, MDPI, 2019. https://doi.org/10.3390/s19010001 https://www.mdpi.com/1424-8220/19/1/1/pdf
- See also courses in ITALIANO: https://www.snap4city.org/485

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IEEE Access

- C. Badii, P. Bellini, A. Difino, P. Nesi, "Smart City IoT Platform Respecting GDPR Privacy and Security Aspects", accepted for publication on IEEE Access, 2020. 10.1109/ACCESS.2020.2968741 https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8966344



IEEE Access

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Digital Object Identifier 10.1109/ACCESS.2020.2968741

Smart City IoT Platform Respecting GDPR Privacy and Security Aspects

CLAUDIO BADII, PIERFRANCESCO BELLINI, ANGELO DIFINO, AND PAOLO NESI, (Member, IEEE)

Department of Information Engineering, University of Florence, 50121 Florence, Italy

Corresponding author: Paolo Nesi (paolo.nesi@unifi.it)

This work was supported in part by the European Union's Horizon 2020 Research and Innovation Program under Agreement 688196.

ABSTRACT The Internet of Things (IoT) paradigm enables computation and communication among tools that everyone uses daily. The vastness and heterogeneity of devices and their composition offer innovative services and scenarios that require a new challenging vision in interoperability, security and data management. Many IoT frameworks and platforms claimed to have solved these issues, aggregating different sources of information, combining their data flows in new innovative services, providing security robustness with respect to vulnerability and respecting the GDPR (General Data Protection Regulation) of the European Commission. Due to the potentially very sensible nature of some of these data, privacy and security aspects have to be taken into account by design and by default. In addition, an end-to-end secure solution has to guarantee a secure environment at the final users for their personal data, in transit and storage, which have to remain under their full control. In this paper, the Snap4City architecture and its security solutions that also respect the GDPR are presented. The Snap4City solution addresses the full stack security, ranging from IoT Devices, IoT Edge on premises, IoT Applications on the cloud and on premises, Data Analytics, and Dashboarding, presenting a number of integrated security solutions that go beyond the state of the art, as shown in the platform comparison. The stress test also included the adoption of penetrations tests verifying the robustness of the solution with respect to a large number of potential vulnerability aspects. The stress security assessments have been performed in a piloting period with more than 1200 registered users, thousands of processes per day, and more than 1.8 million of complex data ingested per day, in large cities such as Antwerp, Helsinki and the entire Tuscany region. Snap4City is a solution produced in response to a research challenge launched by the Select4Cities H2020 research and development project of the European Commission. Select4Cities identified a large number of requirements for modern Smart Cities that support IoT/IoE (Internet of Things/Everything) in the hands of public administrations and Living Labs, and selected a number of solutions. Consequently, at the end of the process after 3 years of work, Snap4City has been identified as the winning solution.

INDEX TERMS End-2-end, GDPR, IoT, security, smart city.

I. INTRODUCTION

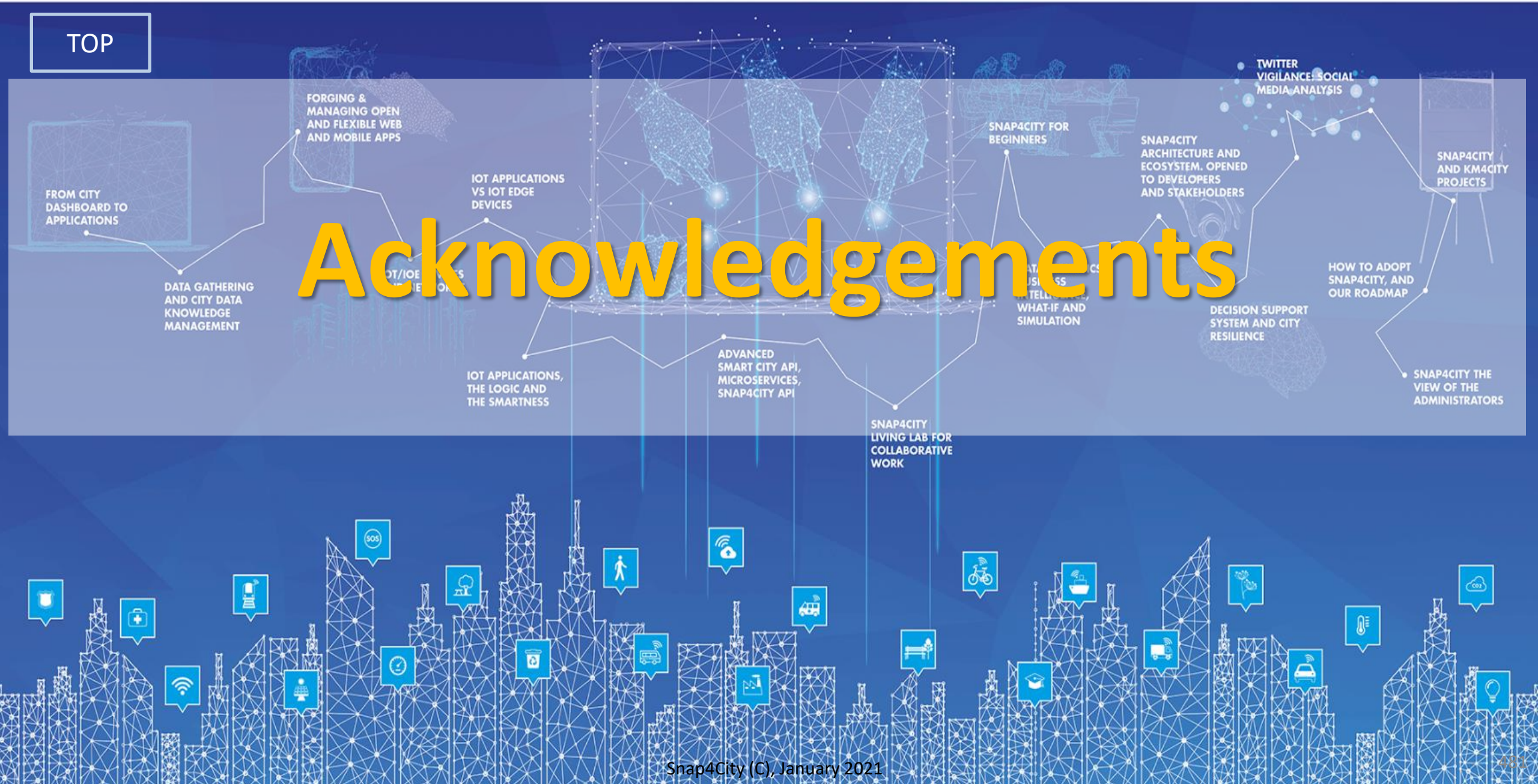
IoT (Internet of Thing) is becoming a disruptive technology, especially for city users of metropolitan areas. The pervasiveness of IoT Devices, integrated in common objects, is becoming increasingly deeper. The addresses' space for these devices would be enough to point any sensors of any devices at any moment without restrictions. Diffuse products that implement *Low-Power Wide Area Networks* (LPWAN) technologies for IoT introduced by SigFox and Semtech (LoRa, Long Range) have been gaining interest and have been under intense deployment campaigns worldwide [1]. At the same time, *short range* IoT devices (based on technologies such as IEEE 802.15.4 or Bluetooth Low Energy, BLE, [2]) are sold in increasing quantities and are already able to support scenarios for smart homes, energy metering and industrial automation. On the other hand, the start of the diffusion of *5G devices* and services is creating high expectations in networking IoT technologies, as the killer application of previous technologies in metropolitan areas.

The associate editor coordinating the review of this manuscript and approving it for publication was Adnan M. Abu-Mahfouz.

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TOP

Acknowledgements



Snap4City managed to provide a maximum of information, flows, in depth analysis with the data provided.

There is no other platform that collects all city actors together.

The City officials and ICT officials were impressed with the performance of the Platform when loading the heavy, "resource-" demanding applications and dashboard.

The technical level of the Platform and its strong points such as the way real-time data is used, the algorithms, data clean-up possibilities of the Platform, presented data and information is state-of-the-art and impressive.

The data handling throughout the Platform is considered as one of the strong points in the Platform and of an extremely sophisticated level.



What People say about us

DISIT lab roadmap vs model and tools' usage

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
Km4City 1.5

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

ckan, resolute

H2020 (2015-18)

2016
(2016-21) H2020 REPLICATE

- Smart Energy
- Sustainable Mobility
- Control Room
- Dashboard

Km4City 1.6.2

Sii-Mobility (2016-21) MIUR

SII-MOBILITY SCN

- Infomobility
- Mobile App
- Routing
- Multimodality

FIWARE

2017
Km4City 1.6.4

Sii-Mobility

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

E0l5 digital ecosystem (Powered by EXPO MILANO 2015)

(2016-19) MIUR

GHOST SIR

- Sardinia Region Smart City Strategies and plan

GREEN IMPACT C.A.P.A.C.I.T.Y.

GREEN IMPACT
POR FESR 2014-2020

- Industry 4.0
- Critical Plant
- Monitoring

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

life weee (2017-20)

- Smart Waste

2018
MOSAiC MObility 4.0 for SmArt (i) City (2018-20)

- Mobility Demand / Offer Analytics and Strategy

Sii-Mobility

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

IOT/IOE

Km4City 1.6.6

Node-RED

SNAP4CITY

SELECT for Cities H2020 (2017-19)

2019
5G (2018-21)

- 5G tech
- Energy
- Industry 4.0
- Synoptics

TRAFAIR

CEF (2018-21)

- Traffic and Mobility Impact on Pollution
- NOX predictions

EUROPEAN OPEN SCIENCE CLOUD

SIRIUS

LAID Smart Bed

- Smart Health

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

- Industry 4.0

bee smart city

- Smart Lonato

Reverberi Enetec Gruppo MPES

- PCP Award



2020
…2022

2021
- CAPELON
- Sweden

smartGARDAlake

Interreg MARITTIMO-IT FR-MARITIME MOBI MART

- Smart Mobility
- PISA, PUMS
- Living lab

Interreg Mediterranean HERIT-DATA

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

Main running instances

- Sii-Mobility → mobility and transport, sustainability
- REPLICATE → ICT, smart City Control room, Energy, IOT
- RESOLUTE → Resilience, ICT, Big Data
- GHOST → Strategies, smart city
- TRAFAIR → Environment & transport
- MOSAIC → mobility and transport
- WEEE Life → Smart waste, environment
- Smart Garda Lake → Castelnuovo del Garda
- 5G → Industry 4.0 vs SmartCity
- Green Impact → Industry 4.0, Chemical Plant
- SmartBed (laid → smart health
- Green Field Peas (soda) → Industry 4.0, Chemical plant
- MobiMart and PISA Agreement → data aggregation, mobility and transport, Living Lab
- Lonato del Garda → smart parking, environment
- Herit Data → tourism, culture and management
- ISPRA JRC → site management and services
- Capelon (Sweden) → smart light solutions

Acknowledgements

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

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DISIT thanks to

Herit Data: Tourism and Mng. https://herit-data.interreg-med.eu/
Snap4City: IOT/IOE smart city www.snap4city.org
Trafair: CEF project with several Cities http://trafair.eu/
Mosaic: Mobility and transport model
Km4City: http://www.km4city.org
REPLICATE H2020, SCC1, EC flagship
http://replicate-project.eu/
Sii-Mobility SCN MIUR: http://www.sii-mobility.org
Feedback: retail and GDO Big Data analytics
5G with 3G-Wind, Open Fiber, Estra
Coll@bora Social Innovation, MIUR:
http://www.disit.org/5479
RESOLUTE H2020, EC:
http://www.resolute-eu.org
TRACE-IT, RAISSS, TESYSRAIL, …
Mobile Emergency:
http://www.disit.org/5404



SNAP4CITY

REPLICATE

resolute

Sii-Mobility

TRAFAIR

GREEN IMPACT C.A.P.A.C.I.T.Y.

LAID Smart Bed

GREEN FIELD PEAS Soda4.0

5G

MOSAiC

Coll@bora

TESYS RAIL



feedback

Trace-IT

RAISSS

Smart COMMUNITIES Tech Italian Technology Cluster for Smart Communities

Regione Toscana

MIUR

Horizon 2020 European Union Funding for Research & Innovation

Further readings

https://www.snap4city.org/108

- HOW TO: create a Dashboard in Snap4City
- HOW TO: add a device to the Snap4City Platform
- HOW TO: add data sources to the Snap4City Platform
- HOW TO: define privacy rules for personal data, produced by the end-users own device
- HOW TO: Develop Smart Applications, Snap4City development Life Cycle
- HOW TO: HLT vs Ingestion, and HLT vs Widgets
- HOW TO: Develop an IOT Application for Data Ingestion
- HOW TO: Upload data into Knowledge Base, ServiceMap (triple upload)
- HOW TO: Create as set of Devices with BulkProcessing
- HOW TO: Create an IOT Device Model
- HOW TO: Create an IOT Device Instance from IOT Directory tool

TOP

SNAP4CITY

KM 4 CITY

Be smart in a SNAP!



SNAP4
Appliances and Dockers
Installations

CONTACT

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Università degli Studi di Firenze - School of Engineering

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