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

Dashboards Creation and Management

16 January 2021, Course

https://www.snap4city.org/577

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES

UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO | DISIT

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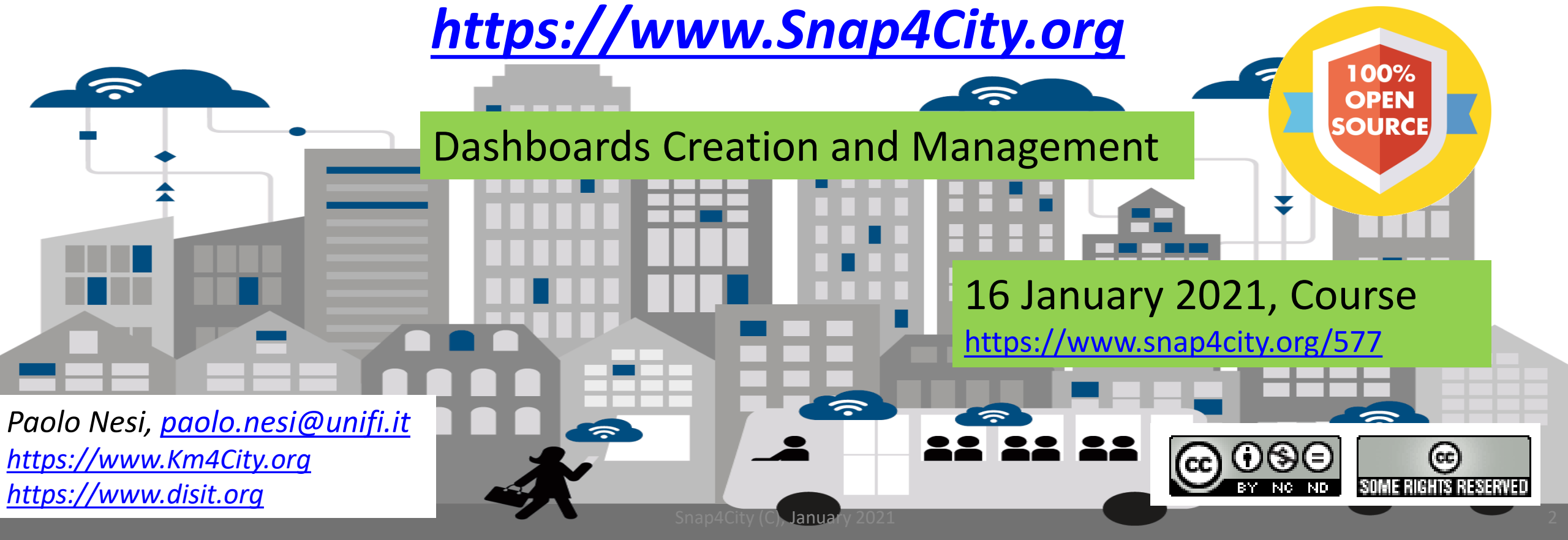
SNAP4CITY

Powered by KM4CITY

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

https://www.Snap4City.org



Dashboards Creation and Management

100% OPEN SOURCE

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

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Powered by FIWARE

SNAP4 Appliances and Dockers Installations

FREE TRIAL

PEN Test Passed

EU GDPR COMPLIANT

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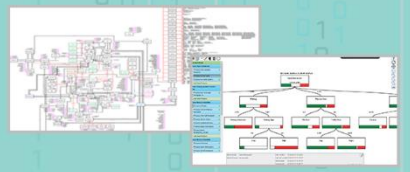
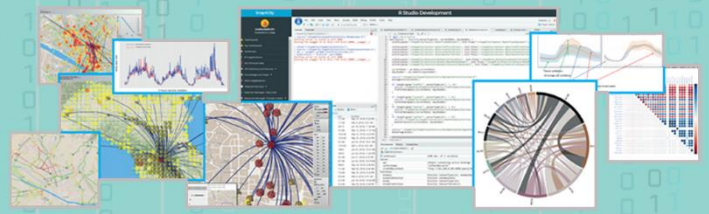
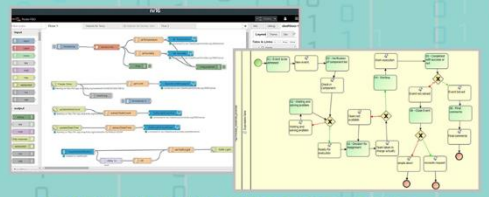
DASHBOARDS AND APPS - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS



EXPERT SYSTEM
KNOWLEDGE BASE
STORAGE

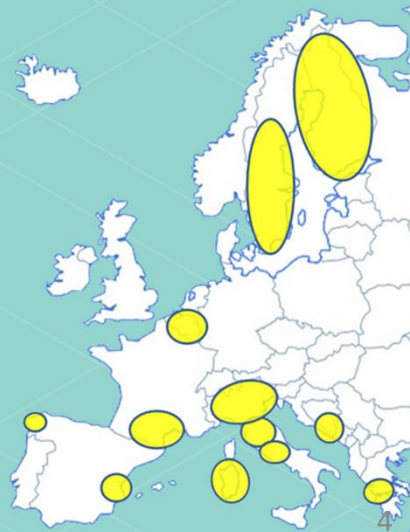


BIG DATA ANALYTICS
ARTIFICIAL INTELLIGENCE
BUSINESS INTELLIGENCE
MACHINE LEARNING



DATA FLOWS, WORKFLOWS
MICROSERVICES
MANAGEMENT

METHODOLOGIES
COURSES AND COMMUNITY
LIVING LABS
DEVELOPMENT TOOLS



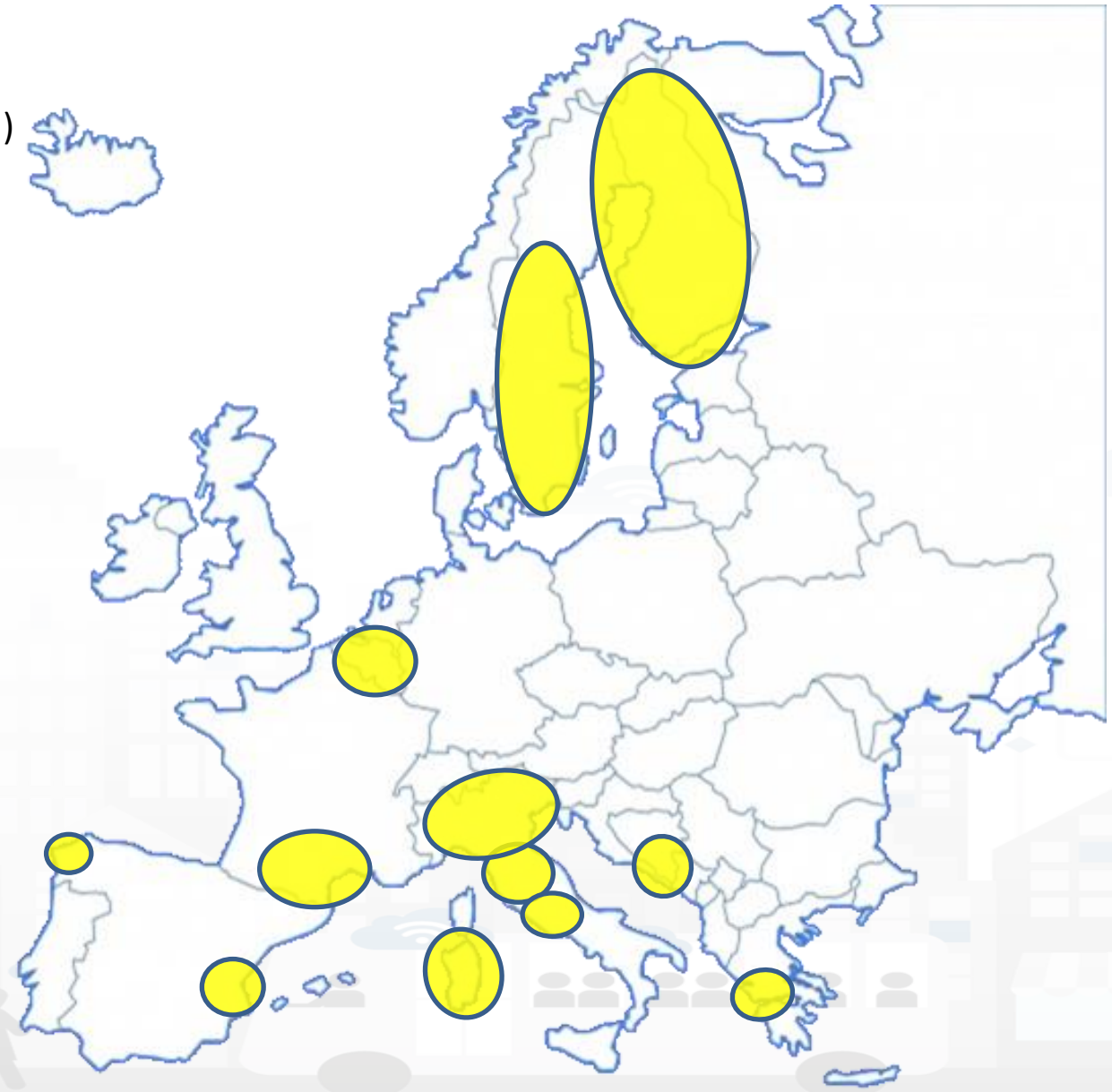
Snap4City/Industry structure

- 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

- Antwerp area (Be)
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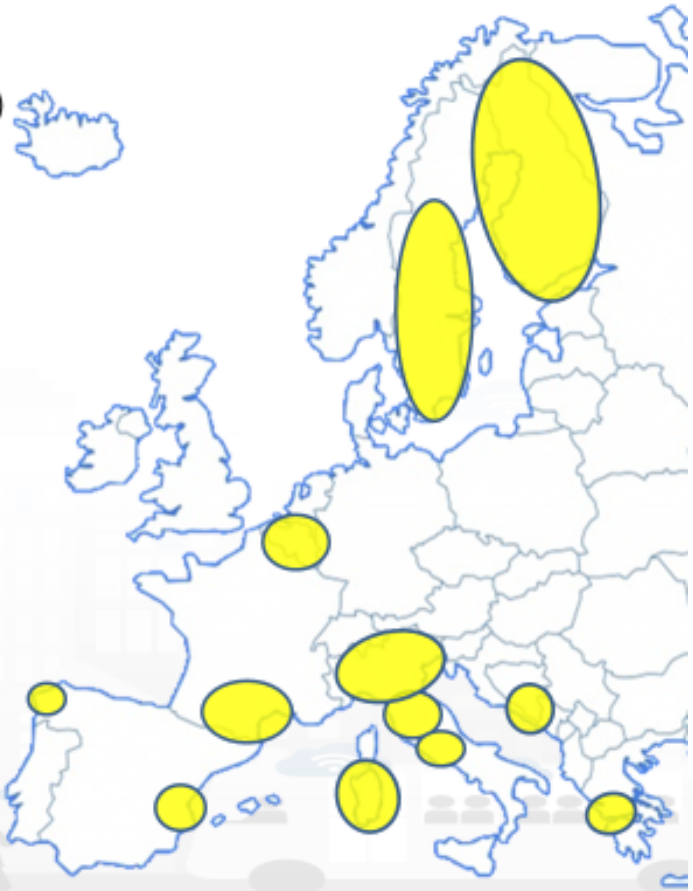
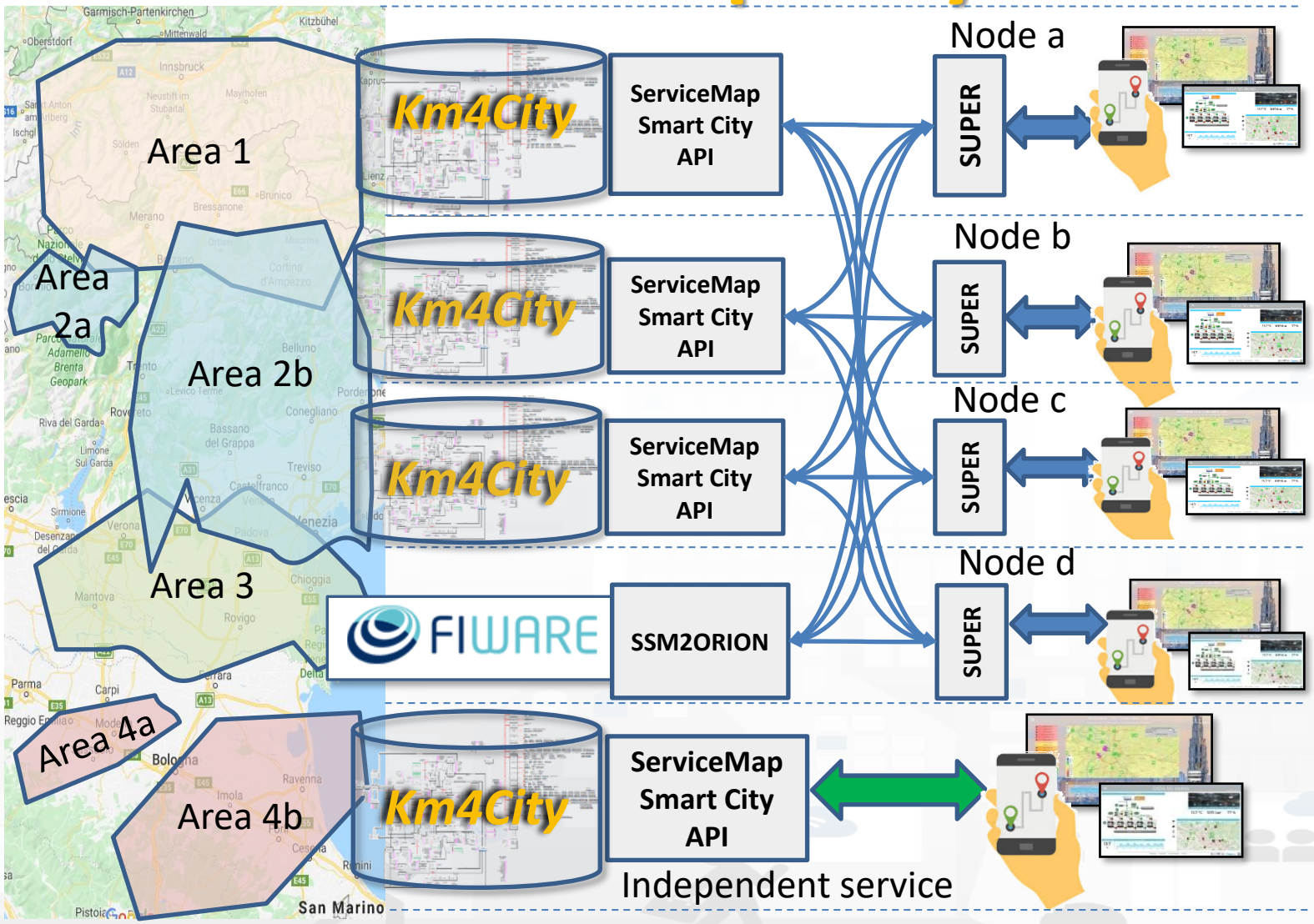
Snap4City (C), October 2020



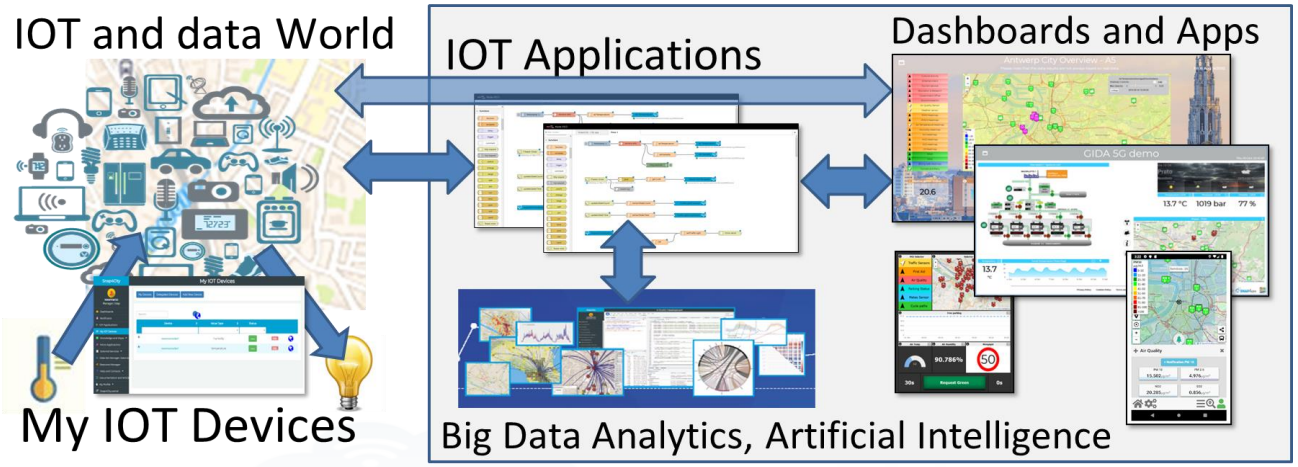
Federation of Snap4City Services



- 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

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

2nd part Agenda

GO
- **Recall on Snap4City Architecture**

GO
- **Dashboard Usage and Authoring**
  - Dashboard usage vs Widgets, Multi Data Map Widget,
  - Data Kinds vs Graphic Widgets, Special Widgets vs Special Data
  - Dashboard Menus of Organizations

GO
- **External Services (integration of) your of third party web pages**
  - external service widget and family, Custom Widgets are see as External Services
  - Event Driven Custom Widgets, dynamic widgets

GO
- **GIS Data Import, Export and Exploitation**

GO
- **Unified Data Model (for All) and Data Inspection (for Admin)**
  - Data Inspector vs Data Processes Details (for Admin), Digital Twin

GO
- **Dashboard Creation by Wizard & Exercitation**
  - Dashboard Creation, Exercitation
  - Mechanisms of Selector for the Multi Data Map widget

GO
- **Dashboard Business Logic Via IOT Applications USAGE AND AUTHORING**
  - IOT App Business Intelligence for Dashboards, Web and Mobile Apps
  - Widgets Interacting with IOT Apps virtual Sensors and Actuators
  - Dynamic Widgets data on Dashboard from IOT Applications
  - Synoptics and Custom Widgets Creation

GO
- **Flexible What-If Capabilities as Decision Support System**

GO
- **Dashboard Event Management**
  - Private Dashboard ChatRoom, Notifications from Dashboard and from any Data Condition

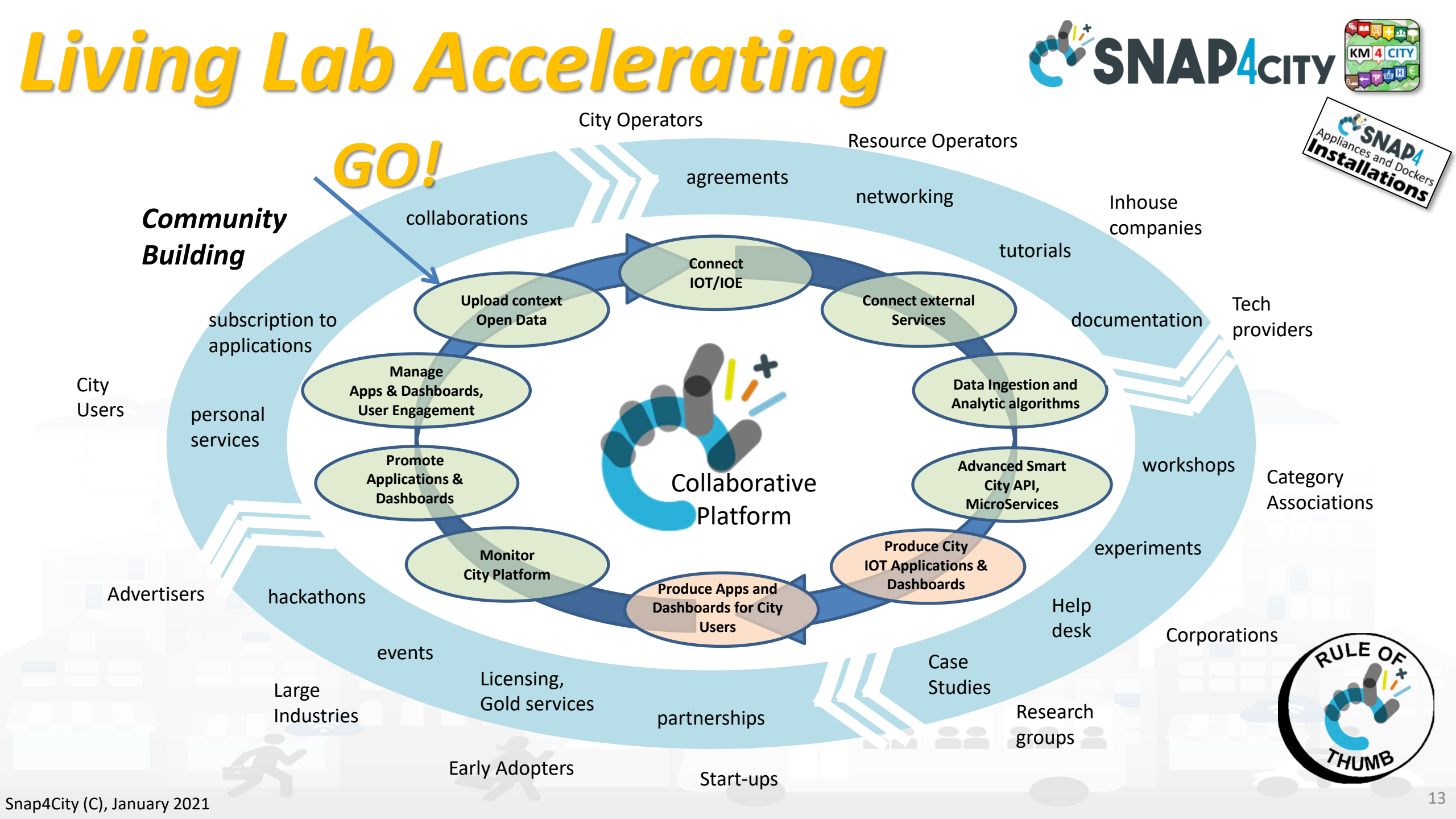
GO
- **Dashboard other Features**
  - Dashboard Embedding into third party Web Sites/pages, controlling header and footer, etc.

GO
- **Dashboards Listing, Managing, Sharing, Delegation**
  - Dashboard Listing, Managing, Sharing, Delegation

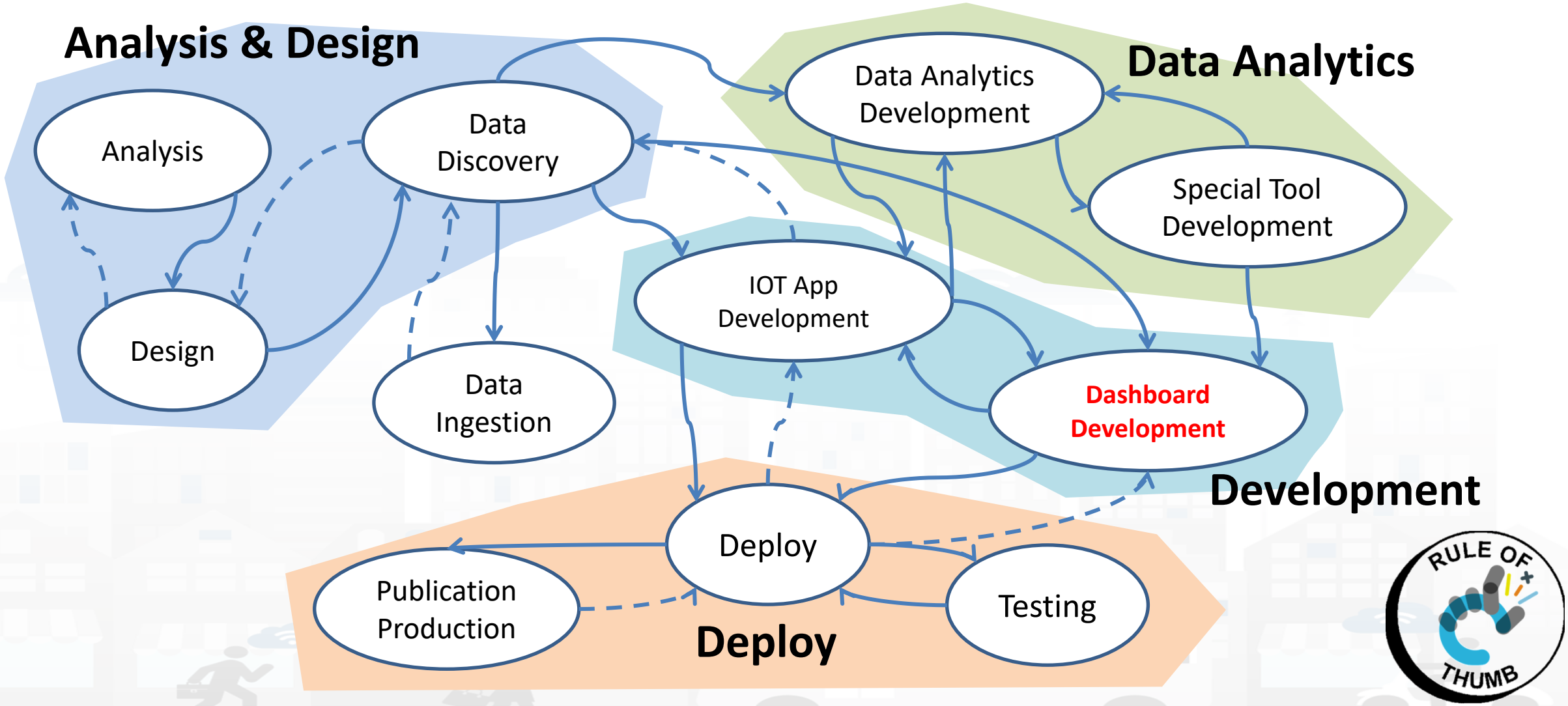
GO
- **Data Type Management GDPR Compliant**
  - Dashboards GDPR Management, Personal Data Management GDPR Compliant: POI, Data, KPI

- **Acknowledgments**

Living Lab Accelerating



Development Life Cycle
Smart City Services



TOP

Recall on Snap4City Architecture

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

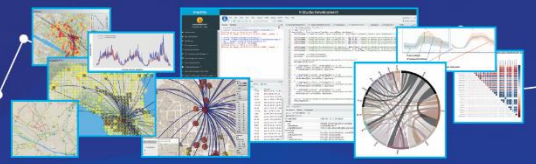
DEVELOPMENT KIT • SUGGESTIONS • MOBILE APPS • MONITORING PANELS • PLATFORM UTILITIES • READY TO USE SMART APPLICATIONS

MICROSERVICES & ADVANCED SMART CITY API

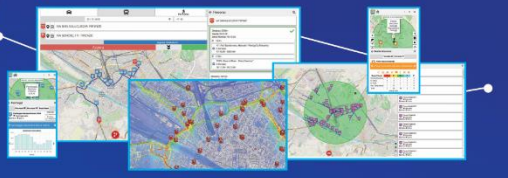
LIVING LAB - DEV TOOLS - COWORKING

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

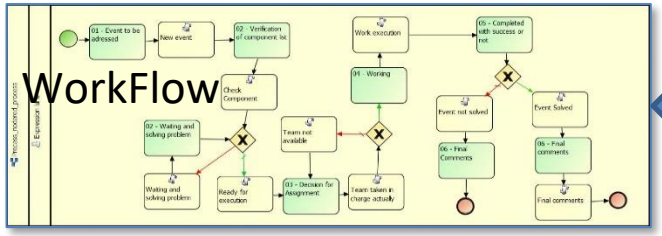
IOT MNG - DATA MNG - DATA INSPECTOR – PROCESS MNG – USER ENGAGEMENT – GDPR MNG ...

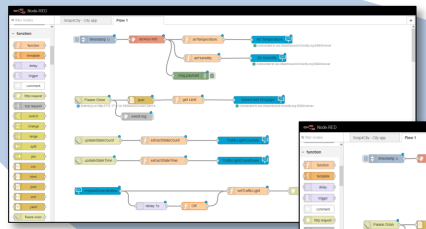
GIS	CITY UTILITIES	OPEN DATA	LEGACY & EXTERNAL SERVICES	PERSONAL DATA	IOT / IOE	BROKERS	KPI	INDUSTRY 4.0	SOCIAL MEDIA

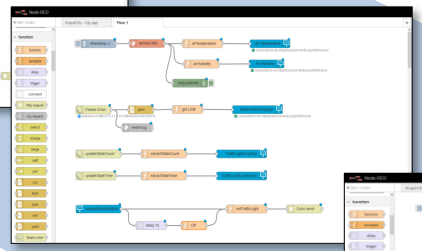
KPI, POI, MyKPI, …

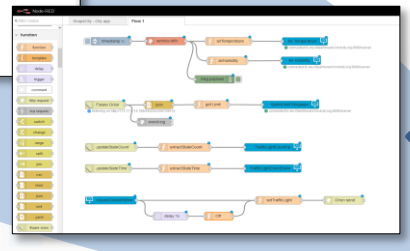
API, External Services

Web Scraping









Data Analytics,
Artificial Intelligence

IOT Apps

IOT Broker

ckan

LD, LOD

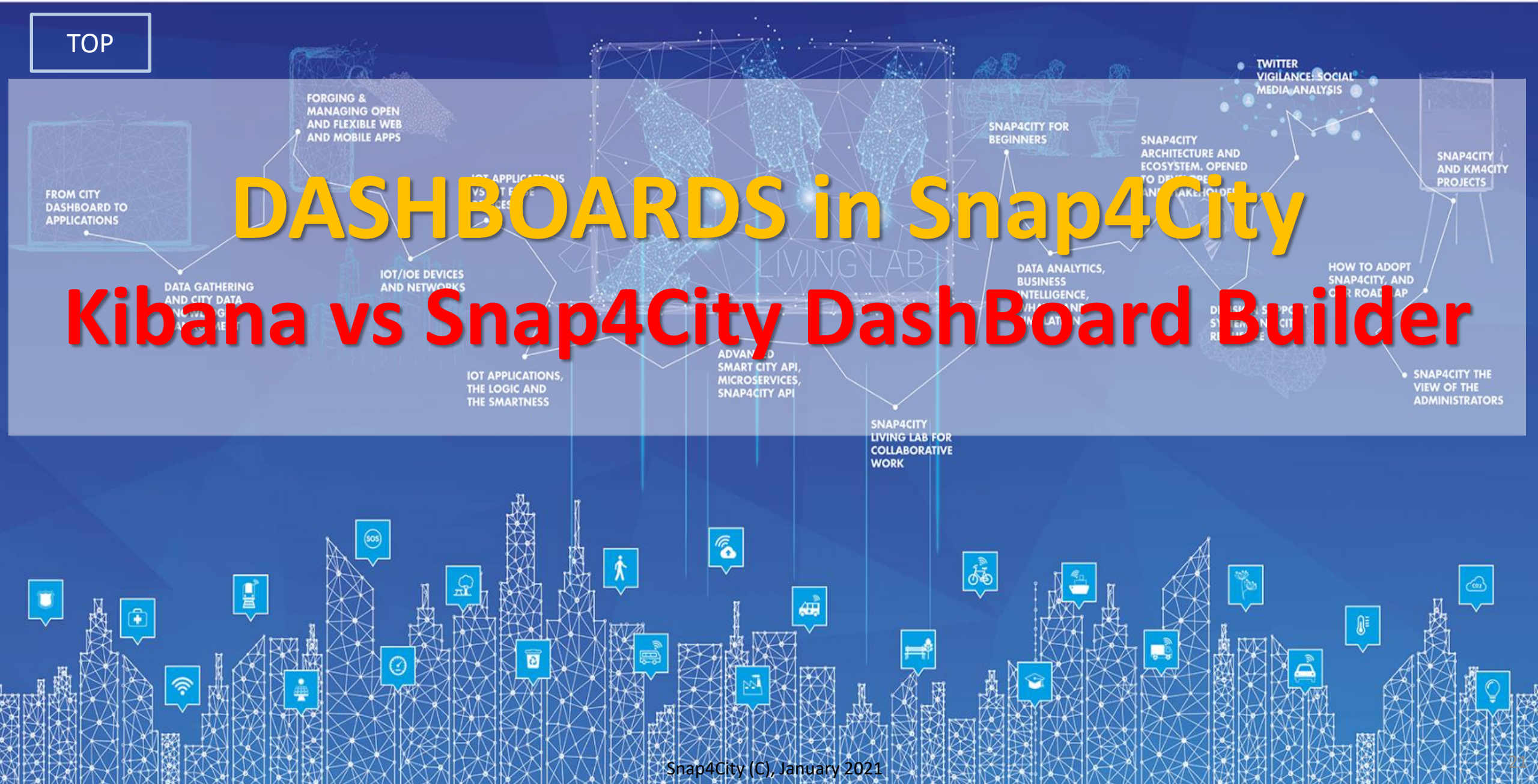
Big Data

Dashboards and Apps

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 (this part)
  - **Control and schedule of Data Analytic**, and Machine Learning (see part 4 of the Course)
  - **Firing and condition identification and alerting**.

TOP



DASHBOARDS in Snap4City

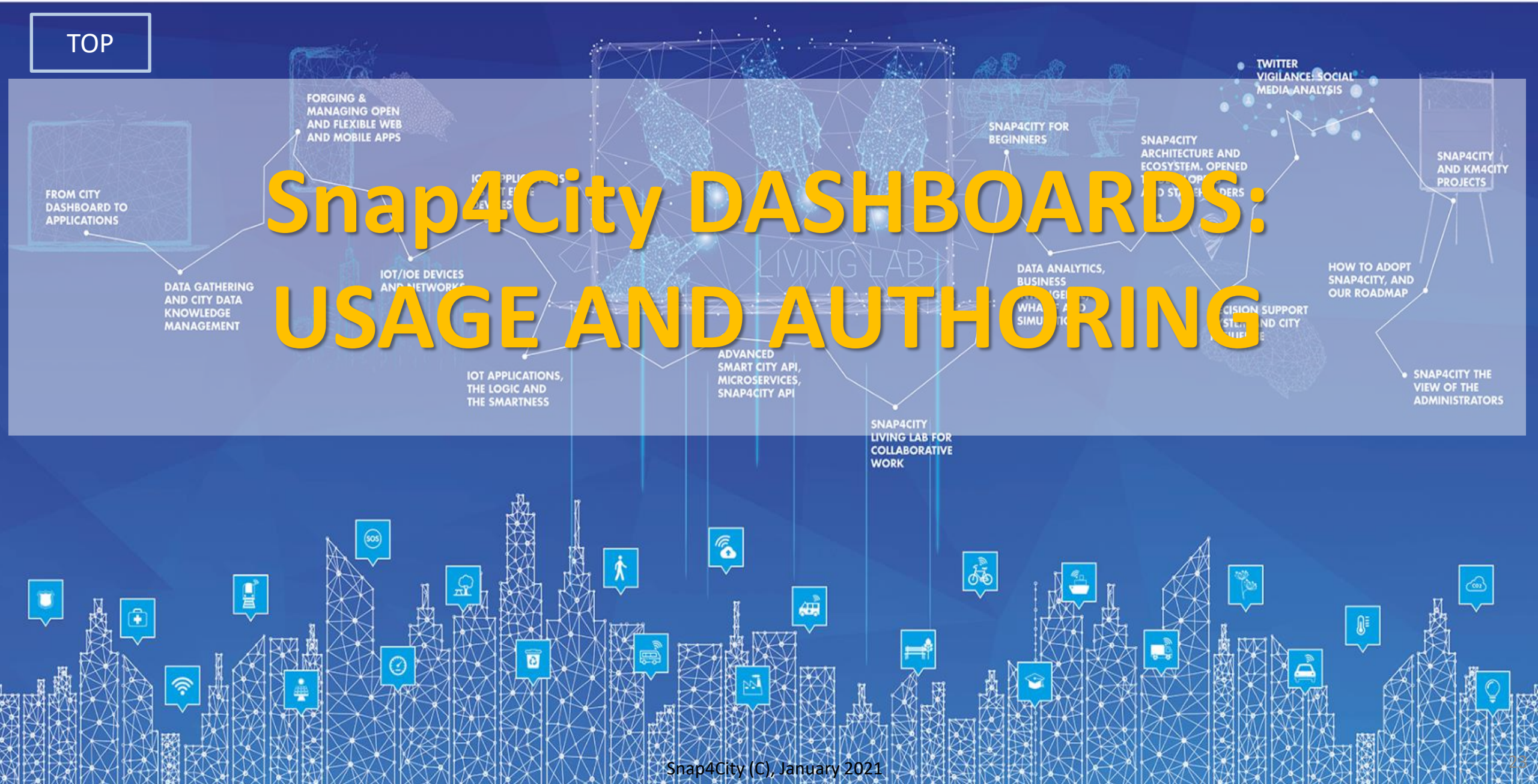
Kibana vs Snap4City DashBoard Builder

Two Main Lines for Dashboarding are present

- **Dashboard Builder of Snap4City**
  - For accessing and browsing data on: Elastic Search, Mongo, MySQL, Smart City API, Super and thus from federated Smart City API, etc.
  - Supports sensors/actuators: data driven data, maps in extended manner, data driven widgets, large collection of widgets, direct IoT Connections, custom widgets, animated PIN on maps, a large set of panel/widgets, etc.
  - Very simple to be used for control room, decision makers, situation rooms, operators, etc.
  - Very well integrated with IoT App, Custom widgets, animation, external services.
  - Very simple to be customized for non programmers since all the tools are visual.
  - Support for GDPR and deep control of access.

- **Kibana** (so called **DevDash**, **AMMA** and recently **My Dashboard (Dev) Kibana**), also accessible as Grafana
  - For accessing and browsing data on Elastic Search storage and other sources supported
  - No Support for real time event driven widgets/panels, actuators and synoptics, no sophisticated maps, etc.
  - Not simple for control room, decision makers, etc.
  - Not integrated with IoT App, Custom widgets, animation, external services.
  - Oriented to developers, complex production of custom views, etc.
  - Partial support of GDPR and deep control of access.

TOP



Snap4City DASHBOARDS: USAGE AND AUTHORING

Public Dashboards (see them on the Portal)

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

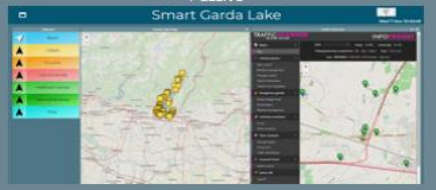
Public (DISIT)

Smart City Data Overview
Passive

Public (DISIT)

Smart City Data Overview 2
Passive

Public (DISIT)

Smart Garda Lake
Passive


Public (DISIT)

SmartCity processes
Passive

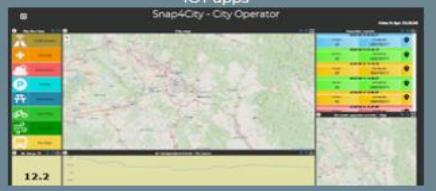
Public (DISIT)

Snap4City - App dashboard
IOT apps

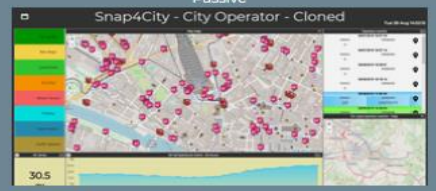
Public (DISIT)

Snap4City - Buttons with images
Passive

Public (DISIT)

Snap4City - City Operator
IOT apps


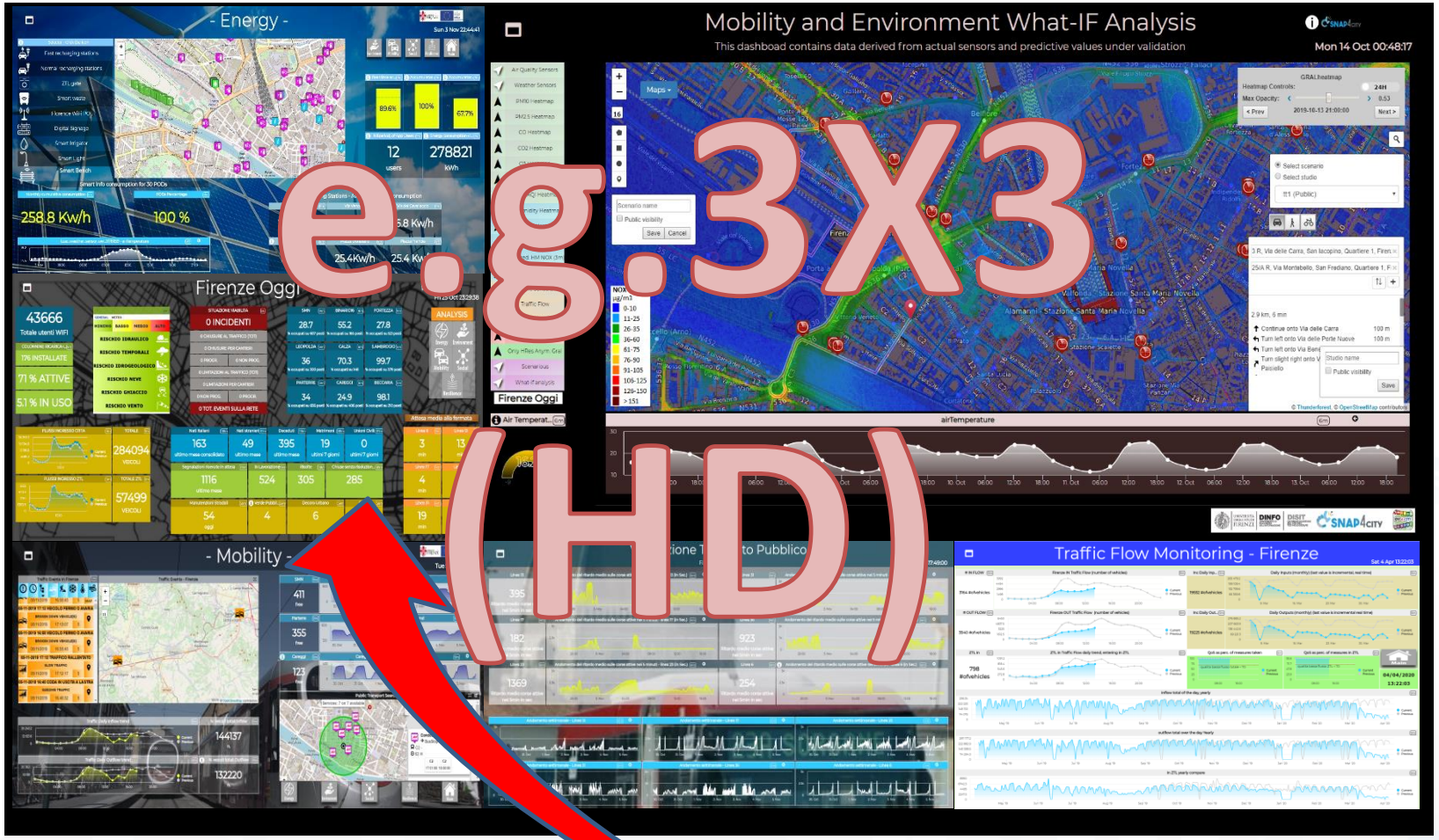
Public (DISIT)

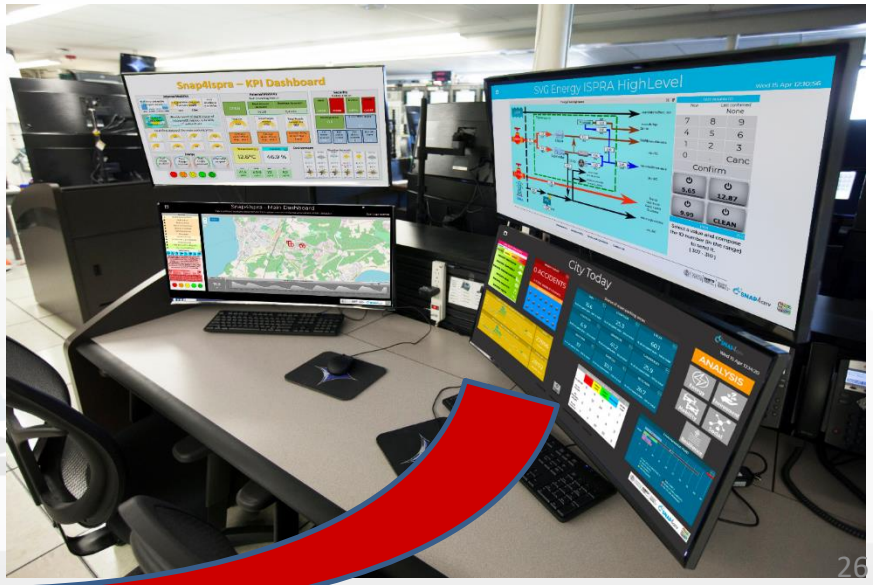
Snap4City - City Operator - Cloned
Passive


Public (DISIT)

DEMO Section

Video Wall





From Consolle Operator to the Video Wall

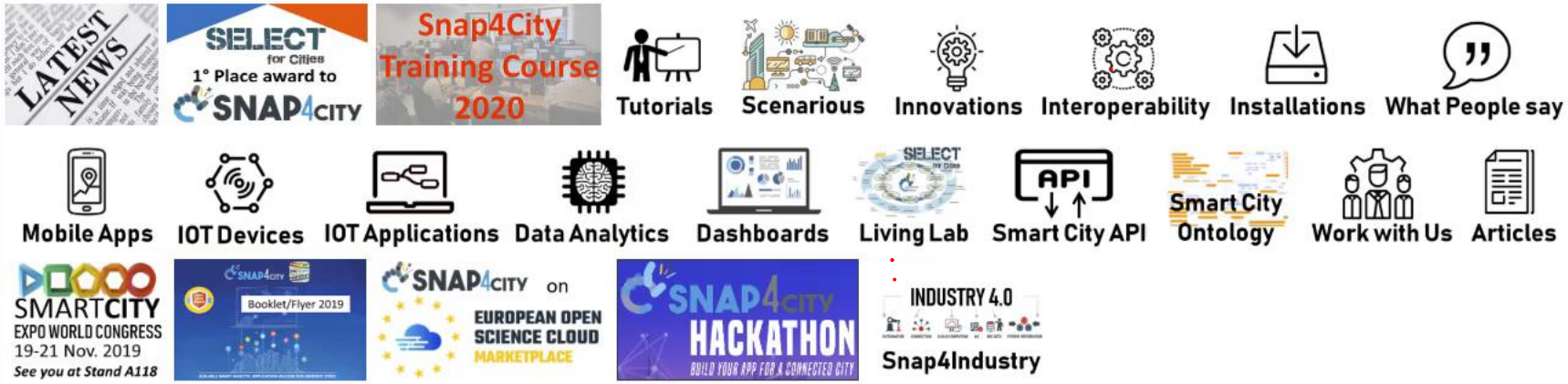
Control Room

https://www.snap4city.org/621

https://www.snap4city.org/511

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

Snap4City - scalable Smart aNalytic APplication builder for sentient Cities



Smart Cities need to set up a flexible Living Lab to cope with the city evolution in terms of services and city users' needs and sustainability. Snap4City solution (https://www.snap4city.org) provides a flexible method and solution to quickly create a large range of smart city applications exploiting heterogeneous data and enabling services for stakeholders by IOT/IOE, data analytics and big data technologies. Snap4City applications may exploit multiple paradigms as data driven, stream and batch processing, putting co-creation tools in the hands of: (i) Smart Living Lab users and developers a plethora of solutions to develop applications without vendor lock-in nor technology lock-in, (ii) final users customizable / flexible mobile Apps and tools, (iii) city operators and decision makers specialized / sophisticated city dashboards and IOT/IOE applications for city status monitoring, control and decision support. Snap4City satisfies all the expected requirements of Select4Cities challenge PCP and much more, and it is 100% open source, scalable, robust, respects user needs and privacy; provides MicroServices and easily replaceable tools; compliant with GDPR; provides a set of tools for knowledge and living lab management, and it is compliant with more than 60 protocols including end-to-end encrypted communication. Snap4City is an official platform of FiWare, an official library of JS Foundation Node-RED, registered on E015, present on EOSC marketplace, and BeeSmartCity MarketPlace, etc. Snap4City obtained the 1st place award by Select4Cities partners and PCP (Antwerp, Copenhagen and Helsinki).

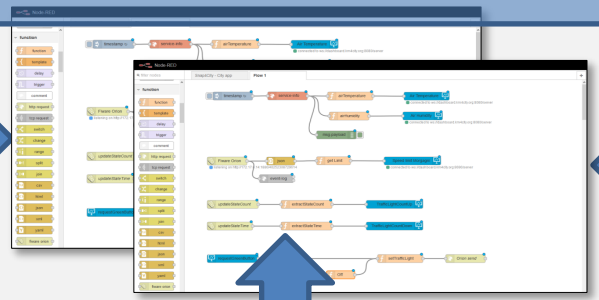
Dashboards Usage vs Widgets

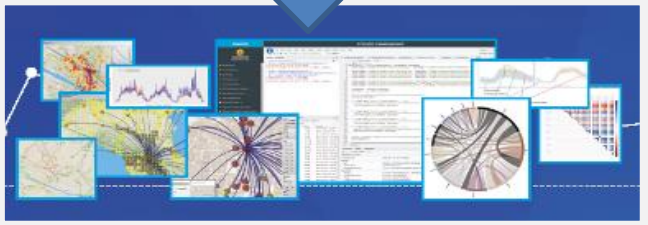
Snap4City: Builder of Sentient Cities Solutions

Dashboards with data driven IOT Applications enforcing intelligence

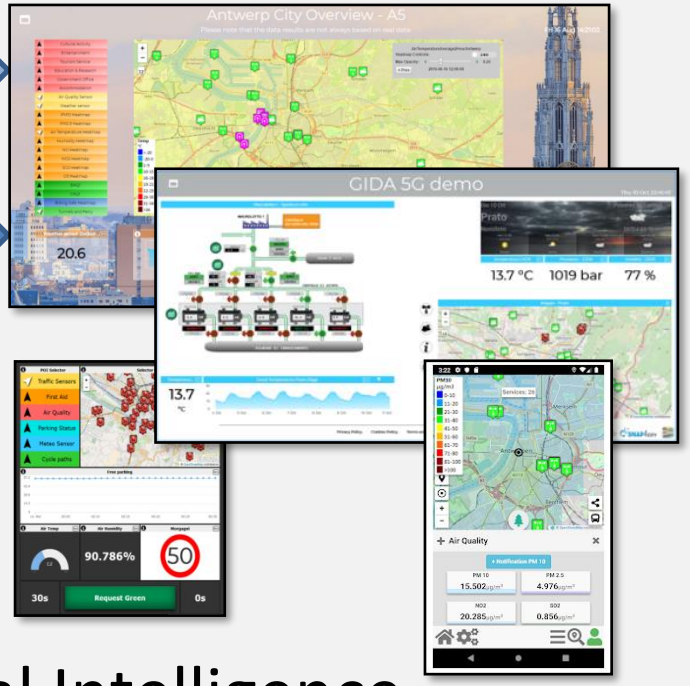
IOT and data World

IOT Applications





Dashboards and Apps

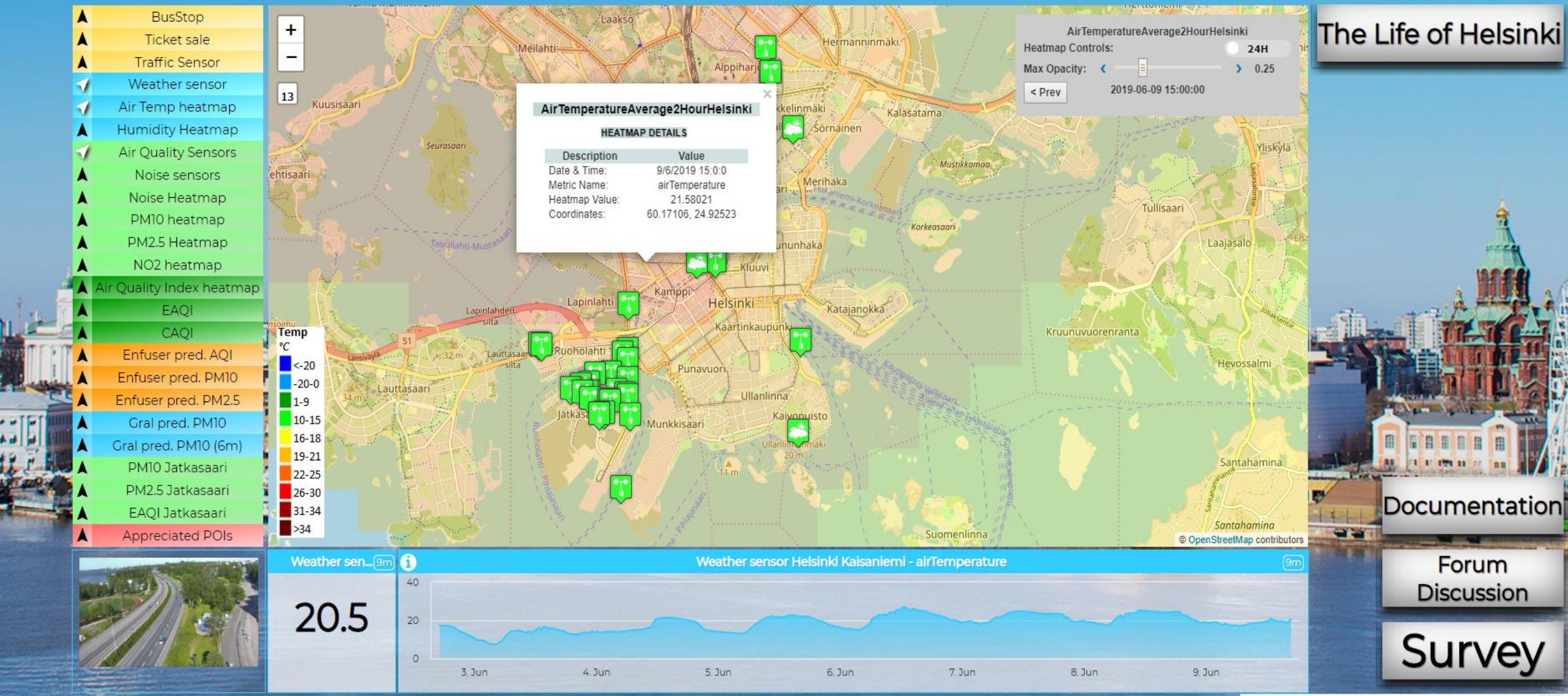


Big Data Analytics, Artificial Intelligence

Helsinki City Overview (H5a)

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

Sun 9 Jun 17:07:25



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

Selection

- Bus stop
- 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

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

AirTemperatureAverage2HourHelsinki

HEATMAP DETAILS

Description	Value
Date & Time:	9/6/2019 15:0:0
Metric Name:	airTemperature
Heatmap Value:	21.58021
Coordinates:	60.17106, 24.92523

AirTemperatureAverage2HourHelsinki
Heatmap Controls: 24H
Max Opacity: 0.25
< Prev 2019-06-09 15:00:00

Widget Map (multi data map)

© OpenStreetMap contributors

The Life of Helsinki Button

Documentation
Forum Discussion
Survey

Buttons

External Content

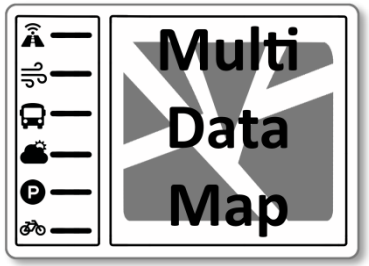
Weather sen... 9m
20.5
Weather sensor Helsinki Kaisaniemi - airTemperature 9m
3. Jun 4. Jun 5. Jun 6. Jun 7. Jun 8. Jun 9. Jun

Single Content

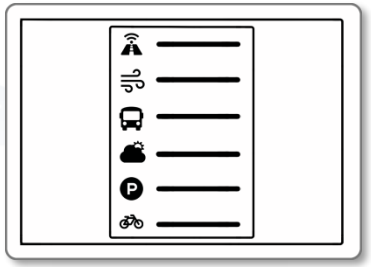
Time Trend

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

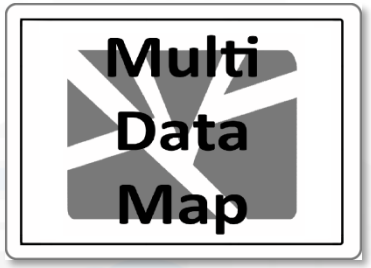
Dashboard Usage & Recipe



- https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTQwNg==
- **Selector Widget**: (of different kinds) present “Information”, according to the HighLevelType (**HLT**), as overlapped layers on Target
  - **Additive**: PIN (POI, sensors, etc.), Cycling Paths, shapes, ...
  - **Mutual Exclusive by group**:
    - Heatmaps,
    - traffic,
    - Scenarios + what-if,
    - etc.

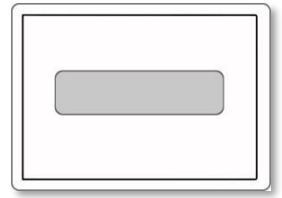


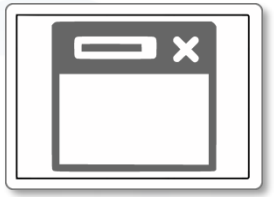
- **MultiDataMap Widget (Target**: (may be of different kind), this one may manage
  - Multiple representations on the same map
  - Each representation may provide specific interaction modalities and controls

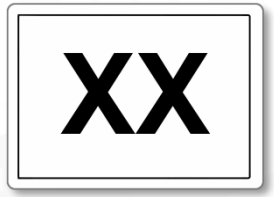


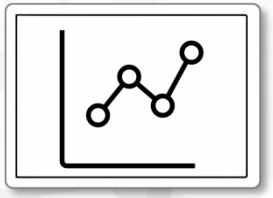
Other Widgets in the dashboard

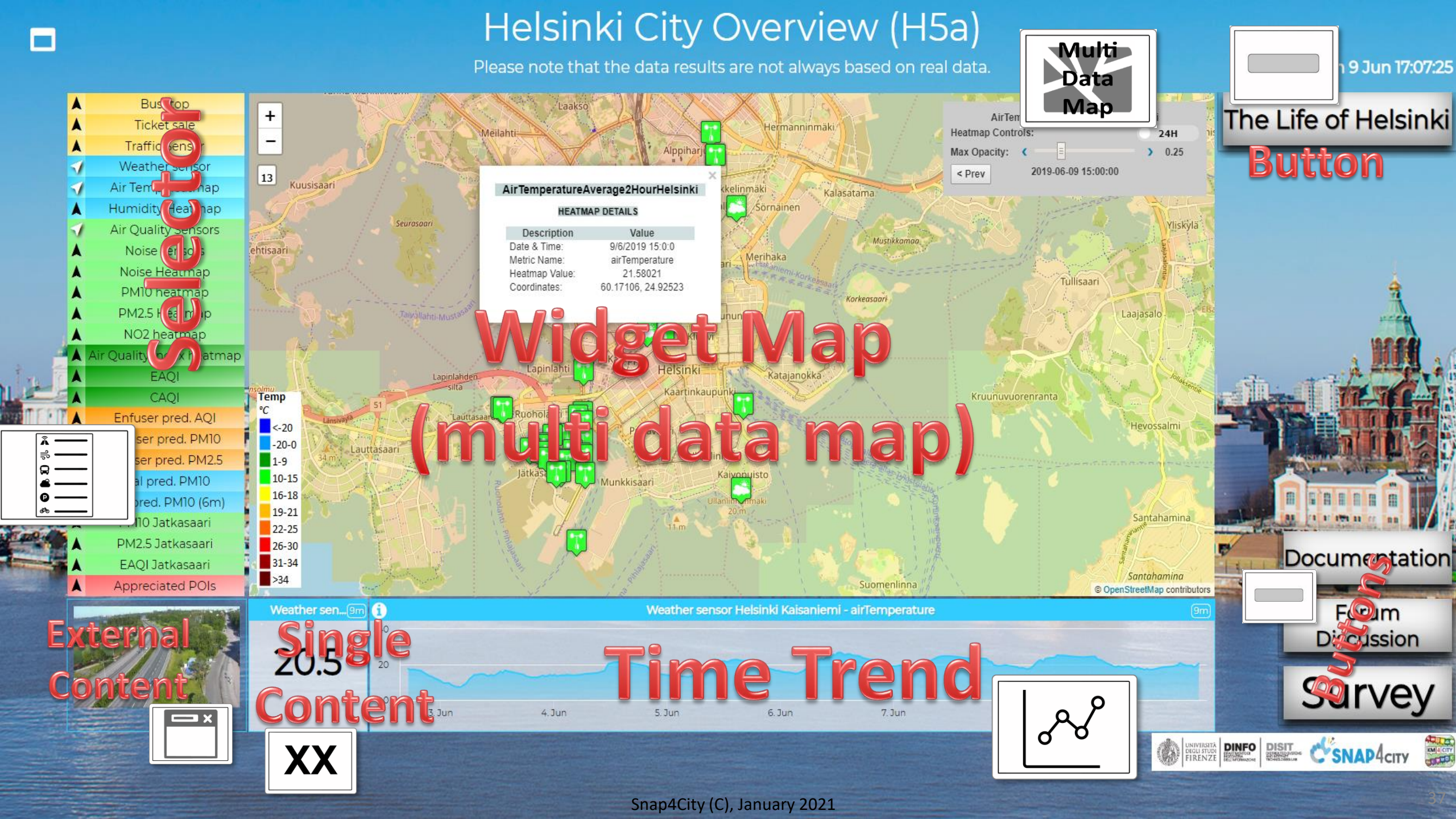
- **Button Widget** may be of different kind and may
  - Open external web pages, services, forum, surveys, etc.
  - Send messages on the field (IOT), etc.
- **External Content**:
  - Web pages, Video Streams
  - Many many other tools see next exercise
- **Single Content**
  - Single value: numeric, string, HTML, etc.
- **Time Trend**
  - Time Series: numeric values over time










Helsinki City Overview (H5a)
Please note that the data results are not always based on real data.
Multi Data Map
The Life of Helsinki Button
Bus stop
Ticket sale
Traffic sensor
Weather sensor
Air Temp heatmap
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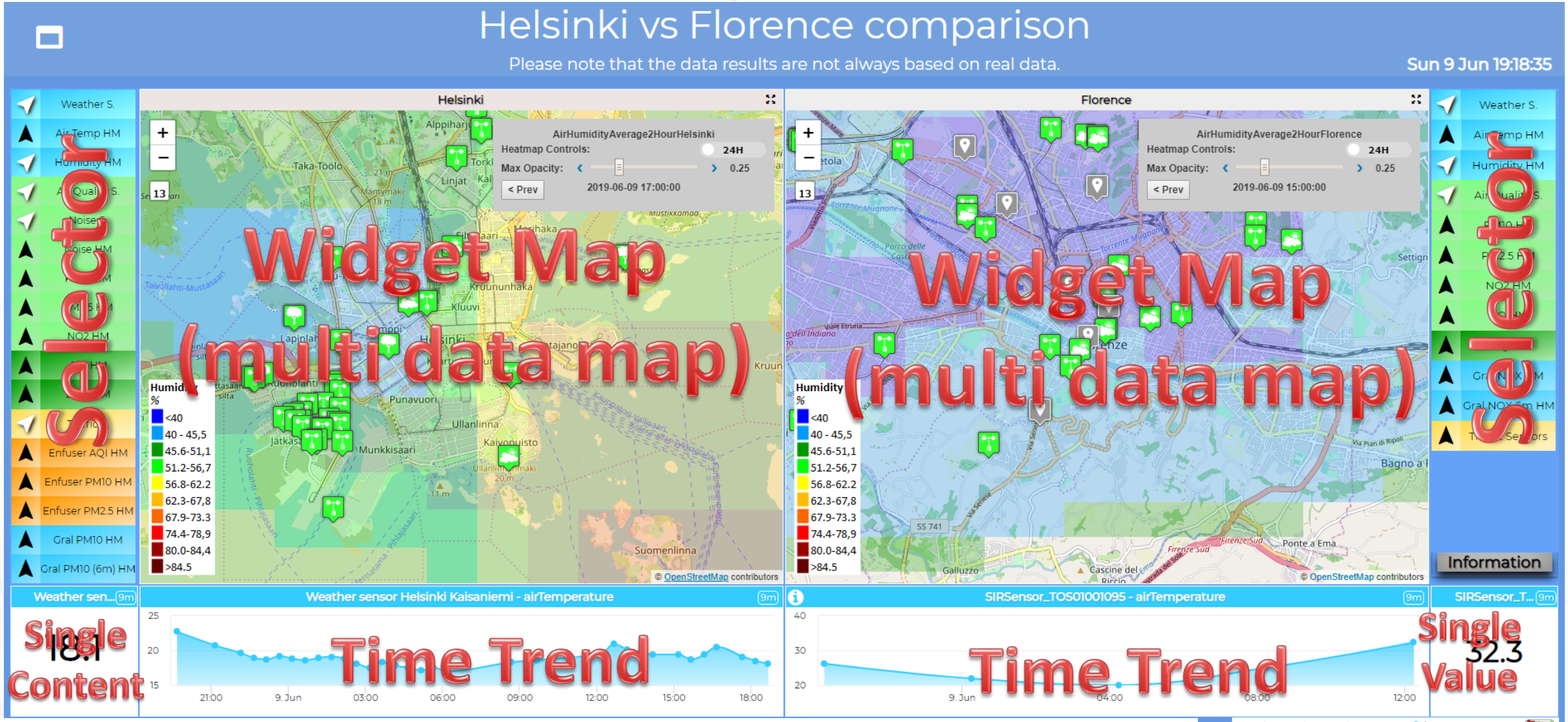
PM10 heatmap
PM2.5 Heatmap
NO2 heatmap
Air Quality Index heatmap
EAQI
CAQI
Enfuser pred. AQI
Enfuser pred. PM10
Enfuser pred. PM2.5
Enfuser pred. PM10
Enfuser pred. PM10 (6m)
PM10 Jatkasaari
PM2.5 Jatkasaari
EAQI Jatkasaari
Appreciated POIs
Selection
AirTemperatureAverage2HourHelsinki
HEATMAP DETAILS
Description Value
Date & Time: 9/6/2019 15:0:0
Metric Name: airTemperature
Heatmap Value: 21.58021
Coordinates: 60.17106, 24.92523
Heatmap Controls:
24H
Max Opacity:
0.25
< Prev
2019-06-09 15:00:00
Temp °C
<-20
-20-0
1-9
10-15
16-18
19-21
22-25
26-30
31-34
>34
Widget Map
(multi data map)
Helsinki
Lapinlahti
Kaartinkaupunki
Katajanokka
Kruunuvuorenranta
Hevossalmi
Santahamina
Suomenlinna
Munkkisaari
Lauttasaari
Ruoholahti
Kaivopuisto
Tullisaari
Laajasalo
Merihaka
Kalasatama
Hermanninmäki
Meilahti
Laakso
Kuusisaari
Seurasaari
Mustikkamaa
Korkeasaari
Yliskylä
© OpenStreetMap contributors
Documentation
Forum Discussion
Survey
Buttons
External Content
Single Content
XX
Weather sen... 9m
20.5
Weather sensor Helsinki Kaisaniemi - airTemperature 9m
Time Trend
3. Jun
4. Jun
5. Jun
6. Jun
7. Jun
SNAP4CITY

Helsinki vs Florence comparison

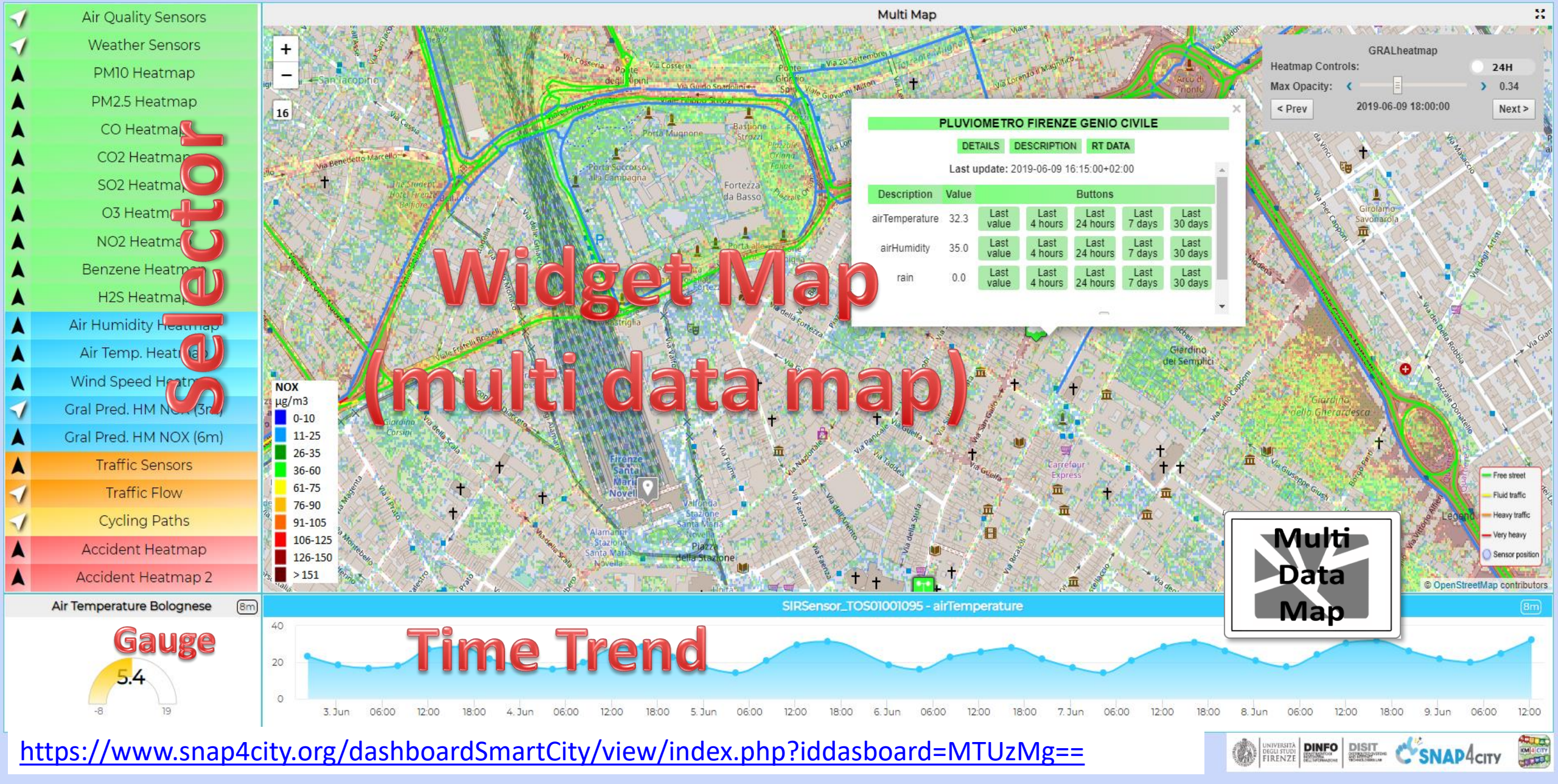


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc0MQ==

Firenze - Trafair - AirQuality Heatmaps

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

Sun 9 Jun 18:53:01



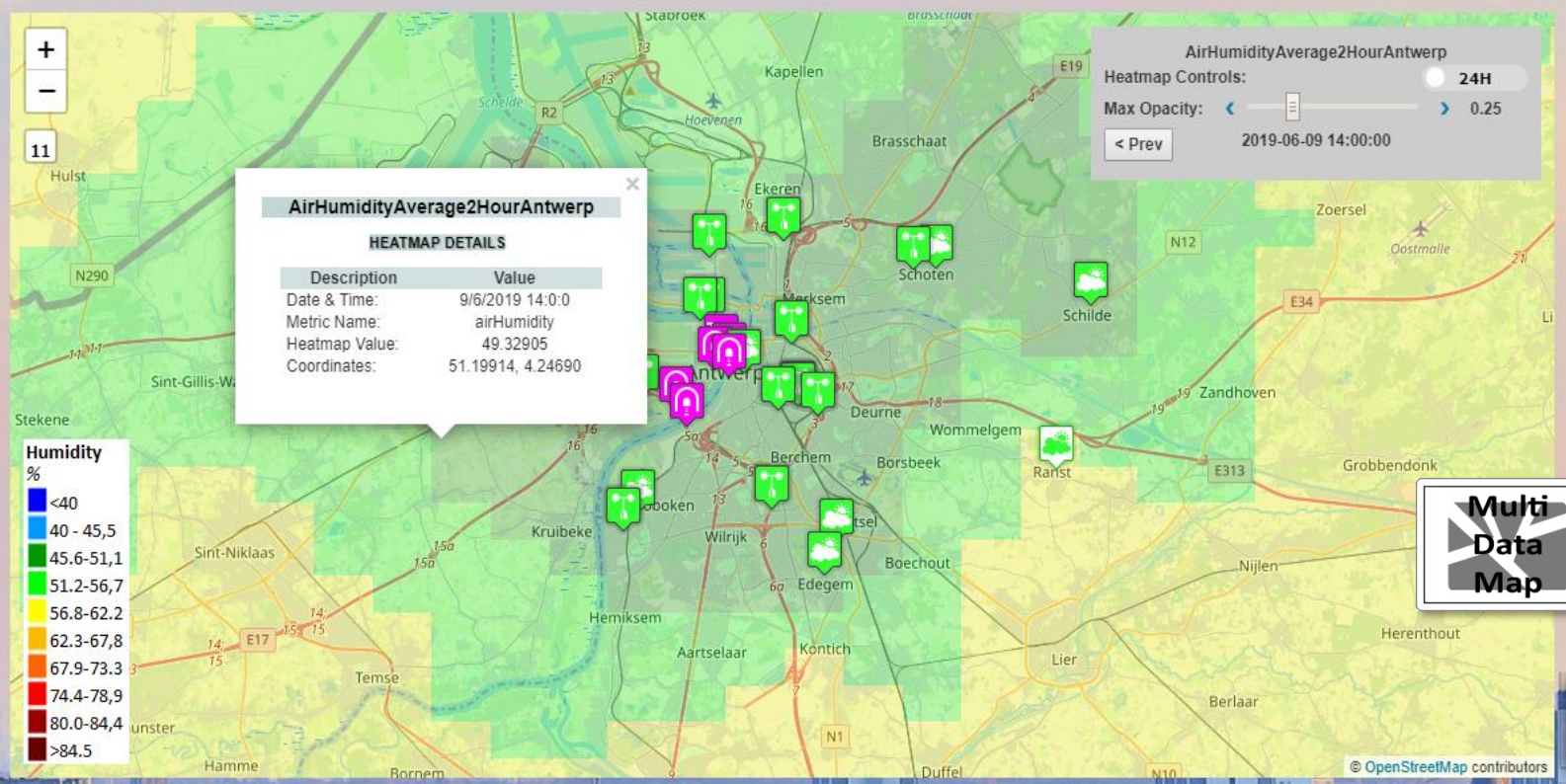
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTUzMg==

Antwerp City Overview - A5

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

Sun 9 Jun 17:09:04

- 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



Multi Data Map

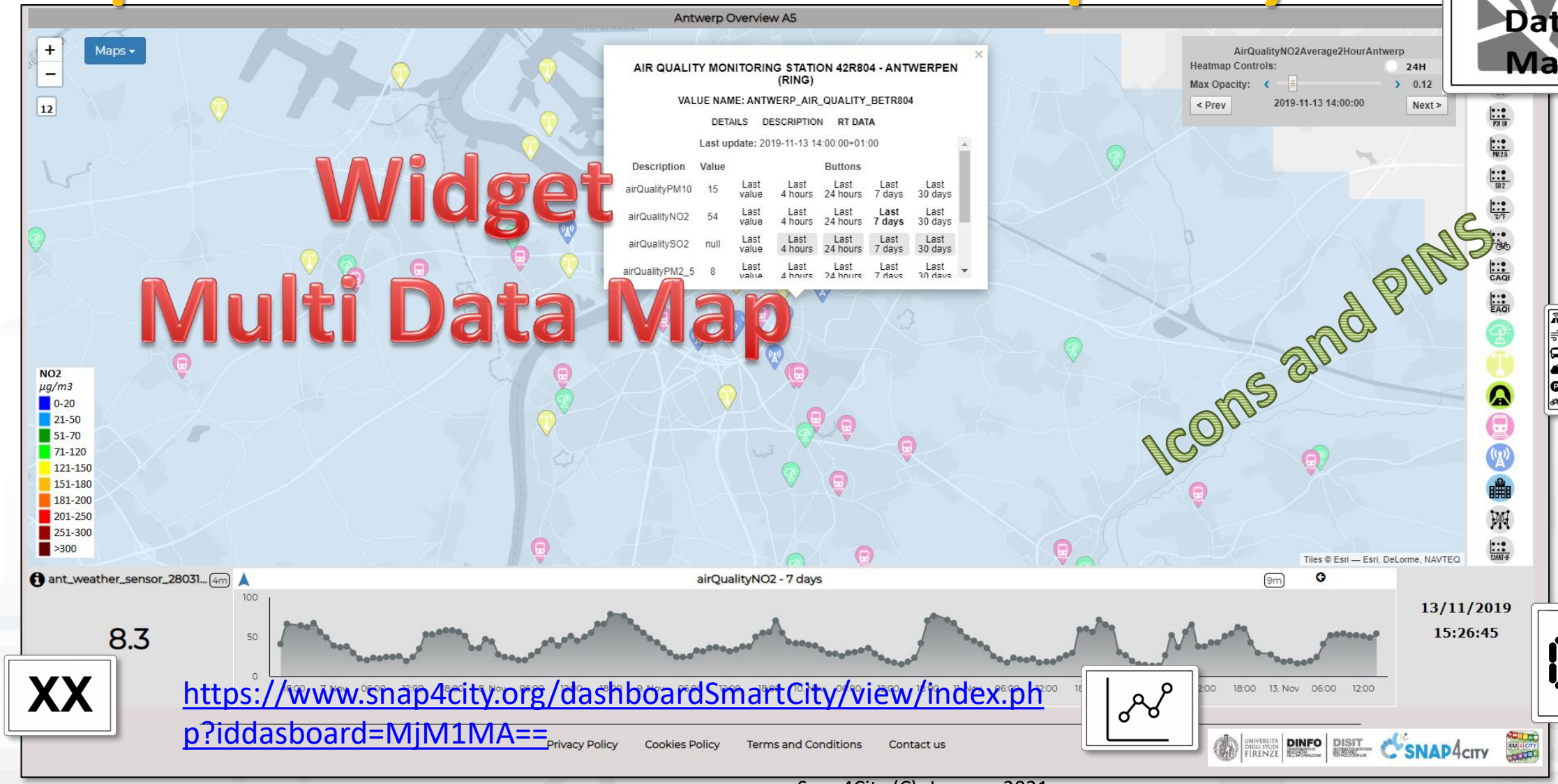
Documentation

Survey

Forum Discussion

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

Unique Dashboard builder Multiple Styles



Widget Multi Data Map

Icons and PINS

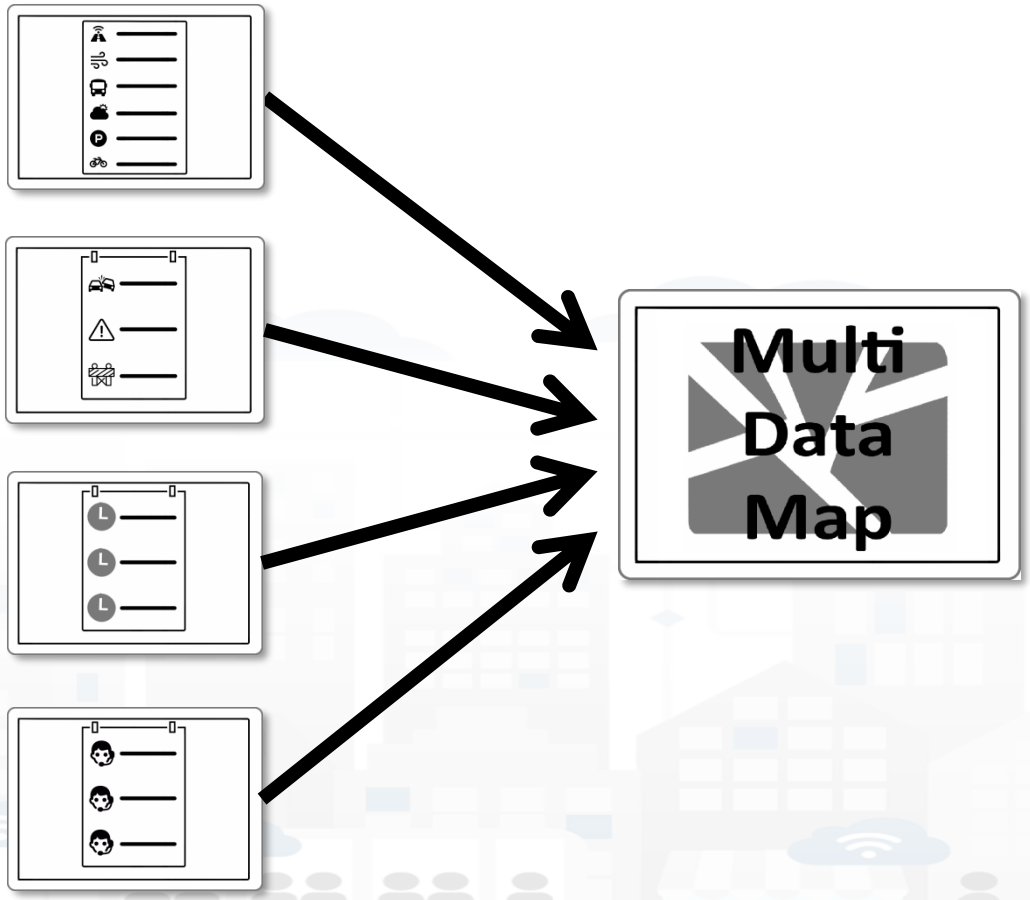
Multi Data Map

Multi Data Map

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjM1MA==

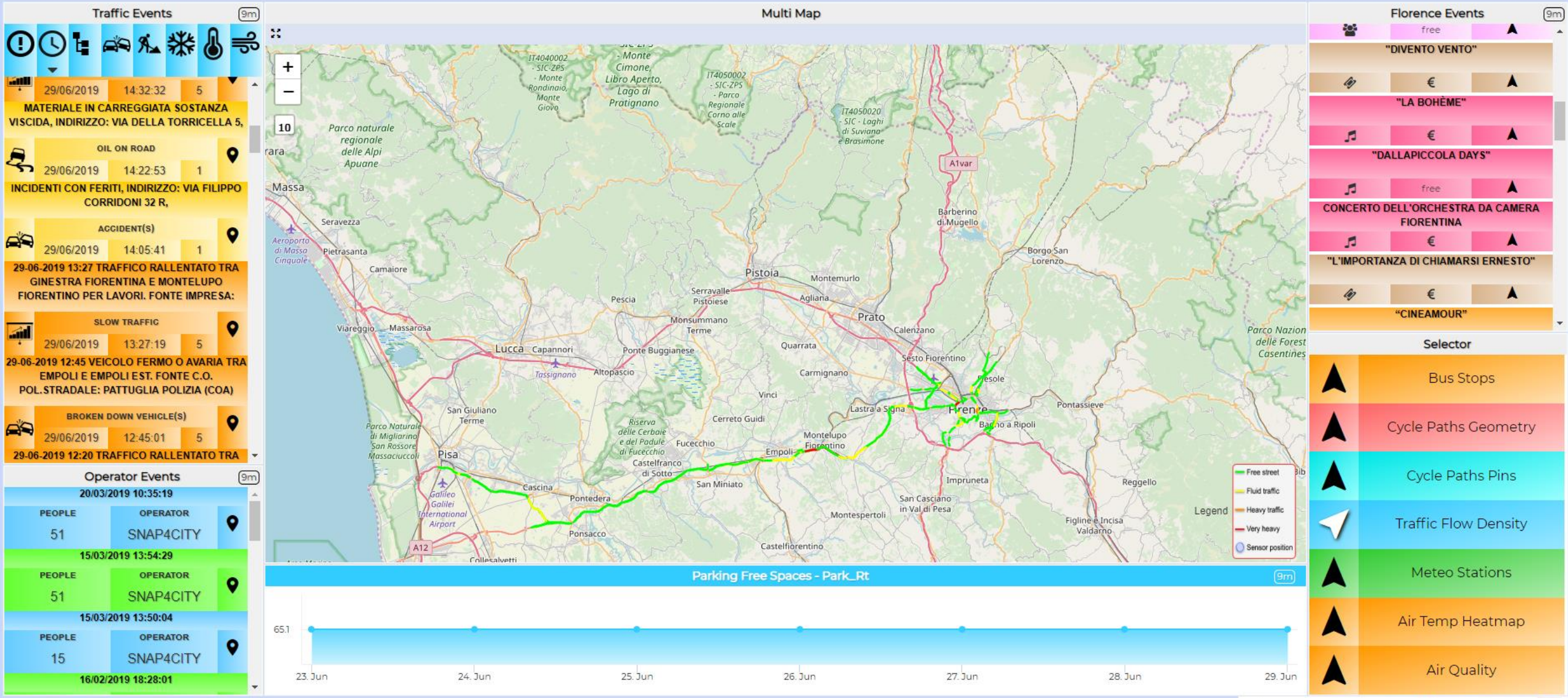
Dashboard Usage and recipe: Event map target

- **Selector**
  - **POI, Heatmap, traffic, etc.**
- **Traffic Events:**
  - From gestore (manager)
- **Entertainment events:**
  - From several sources
- **Mobile Operator Events:**
  - From operators with Mobile Apps



Multi-Widget Map - Demo

Sat 29 Jun 16:42:24



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Multi-Widget Map - Demo

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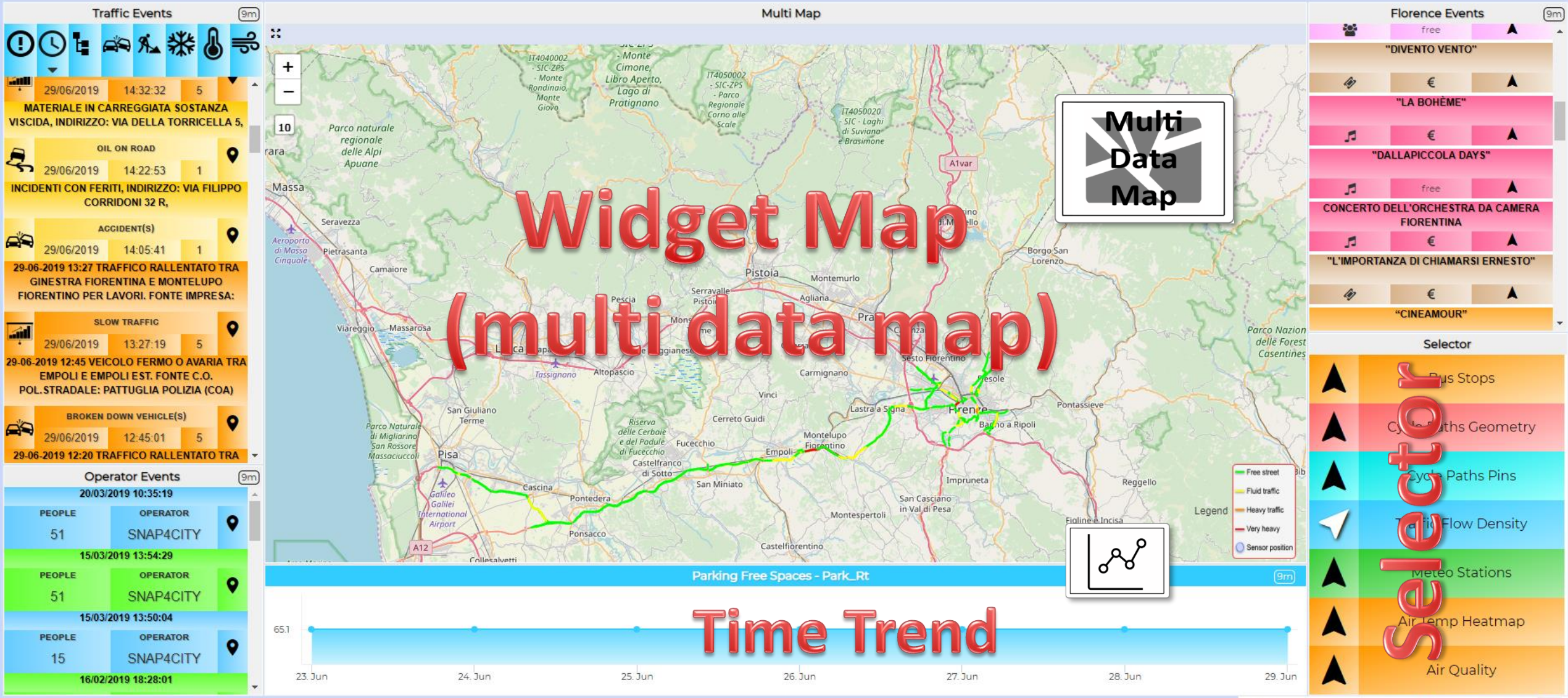

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Multi-Widget Map - Demo

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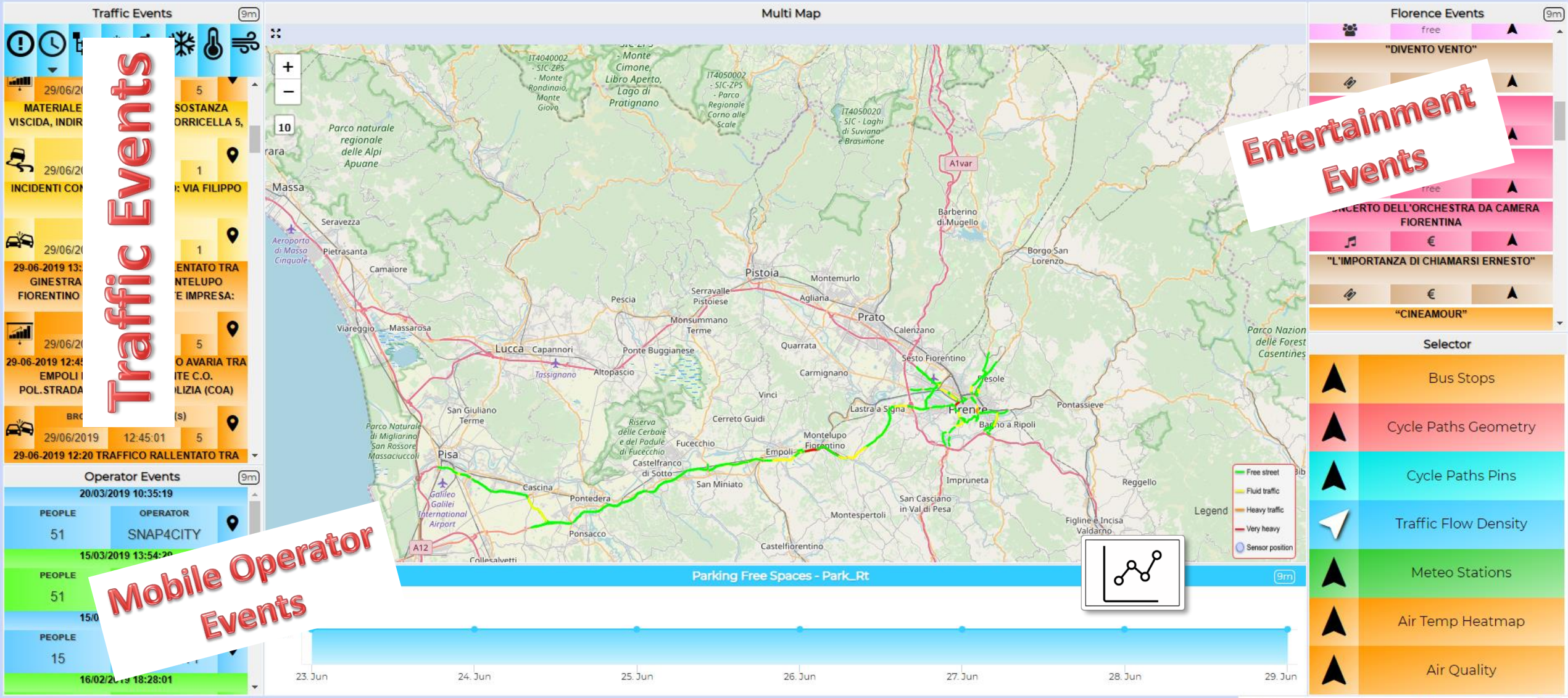

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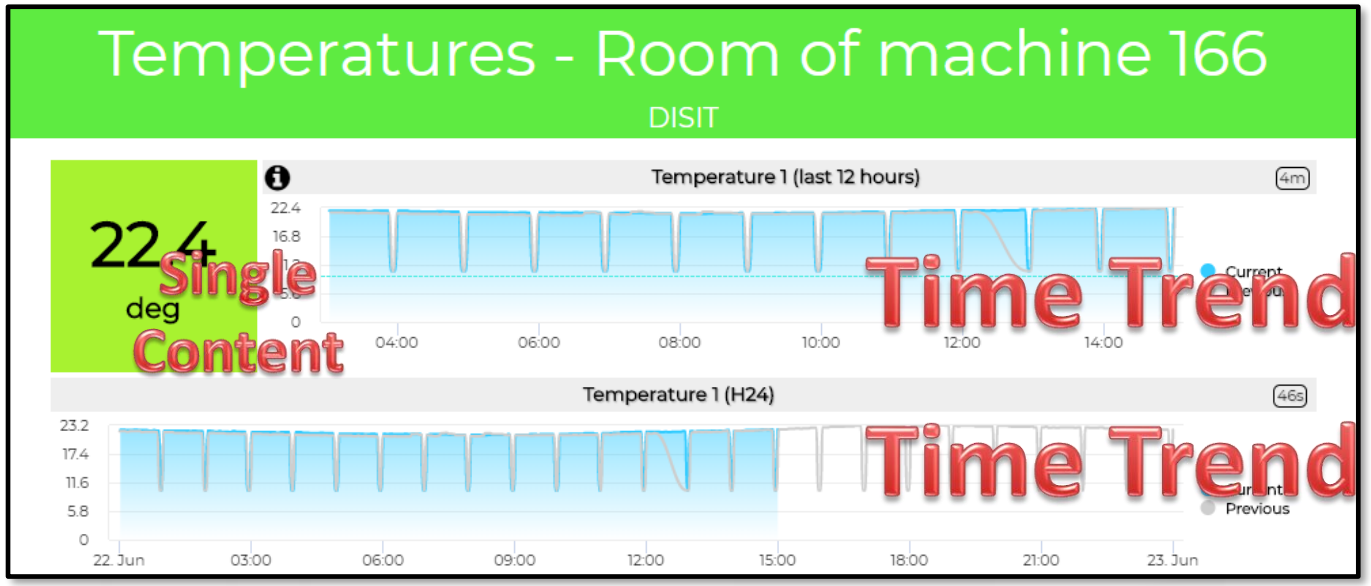
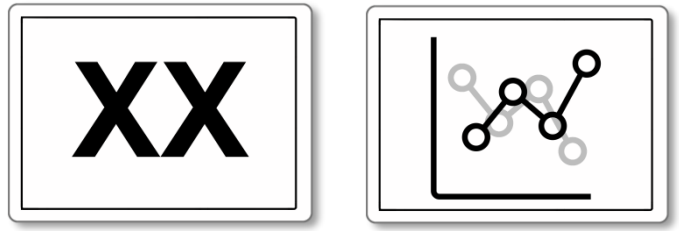
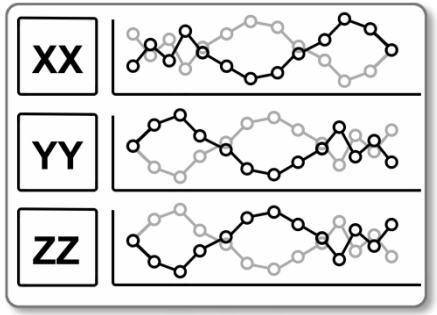


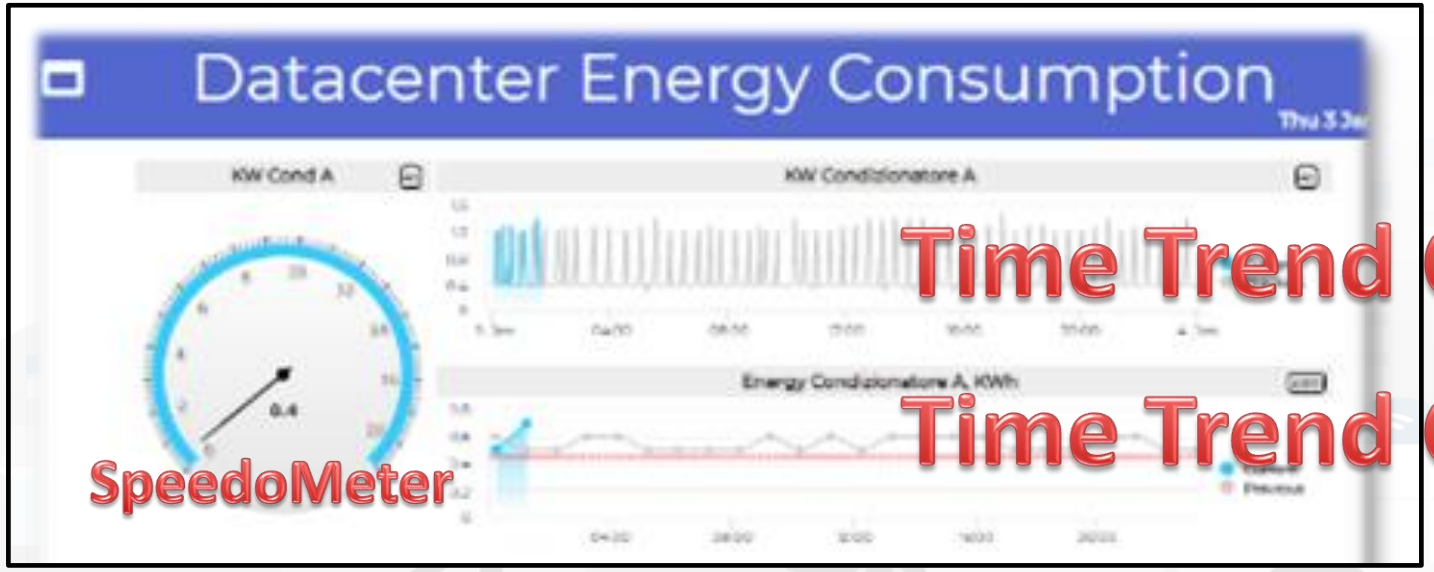
Single Content

Time Trend Compare

Time Trend Compare



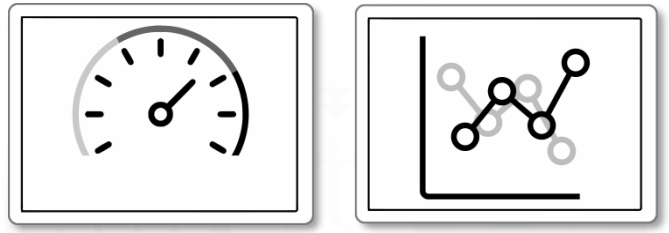




SpeedoMeter

Time Trend Compare

Time Trend Compare



MultiSeries

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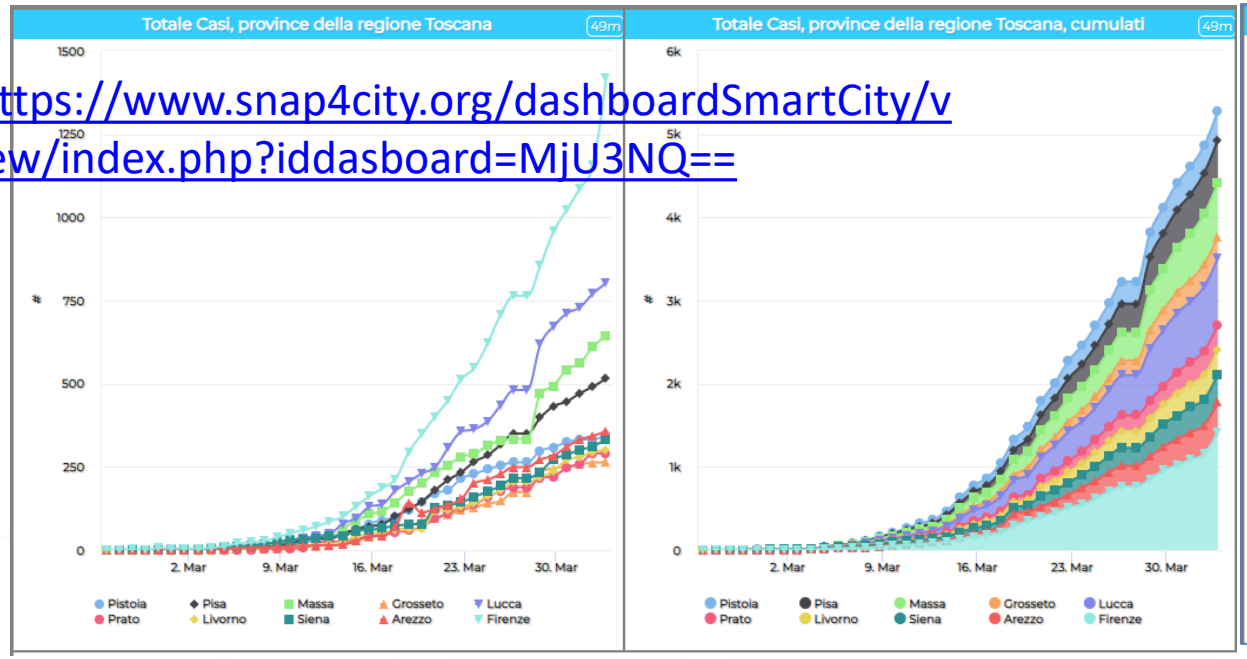
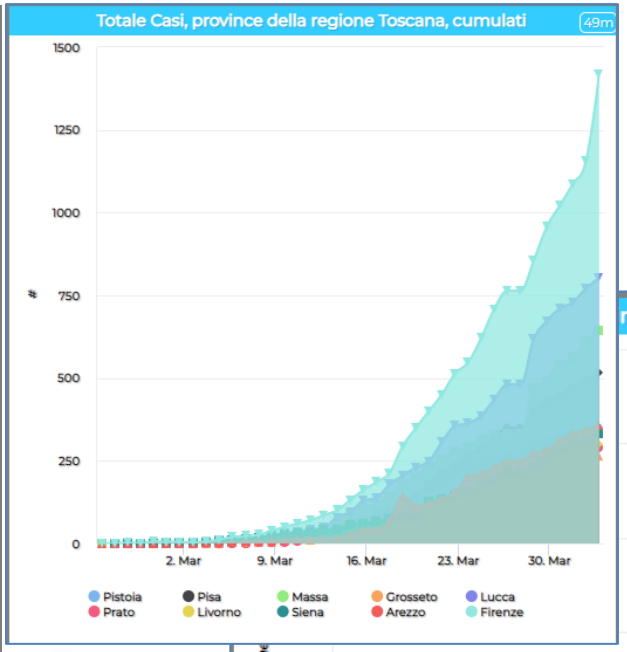
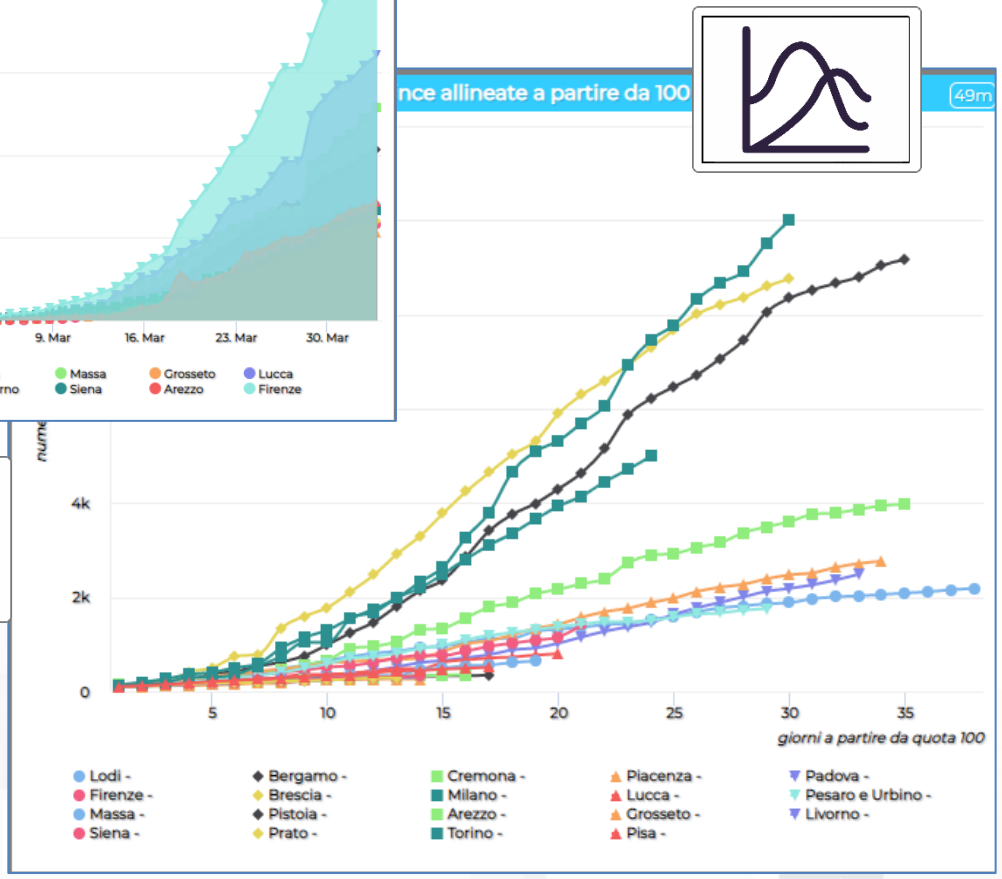
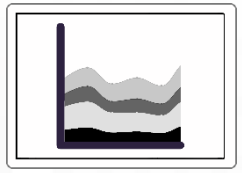
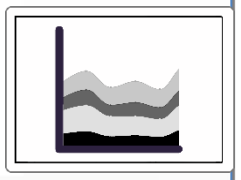








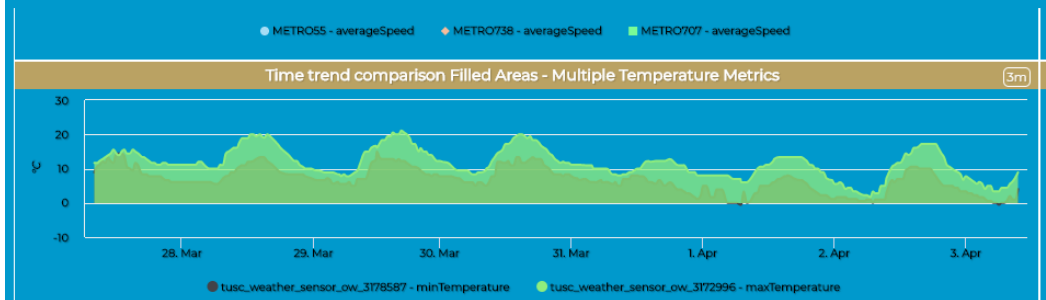


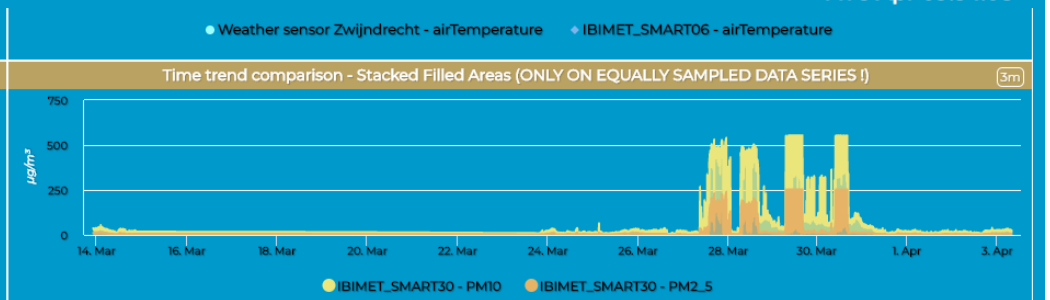
- **Staked, shaded or regular**,
- Grouped by Value_unit, **linear** or **Logaritmic**
- From historical data and/or **dynamic** data from IOT Applications

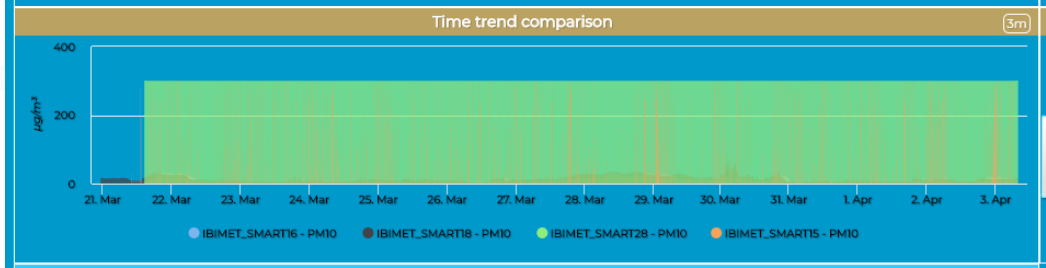
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjUzMg=

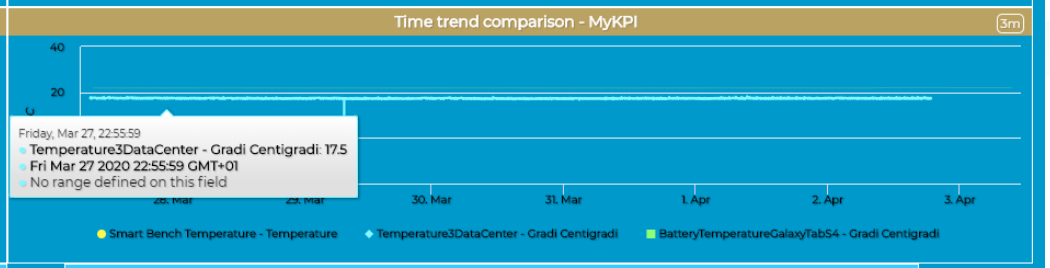
Time Series Test - Cloned

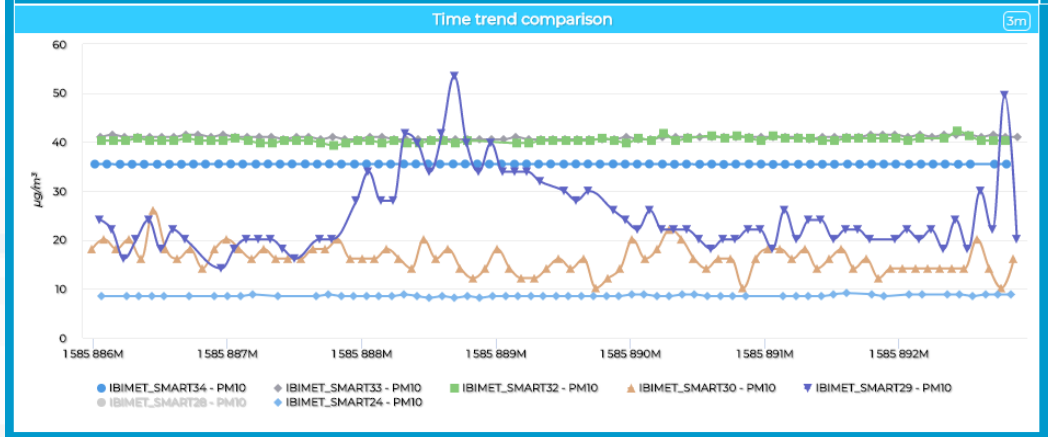
Fri 3 Apr 09:54:08

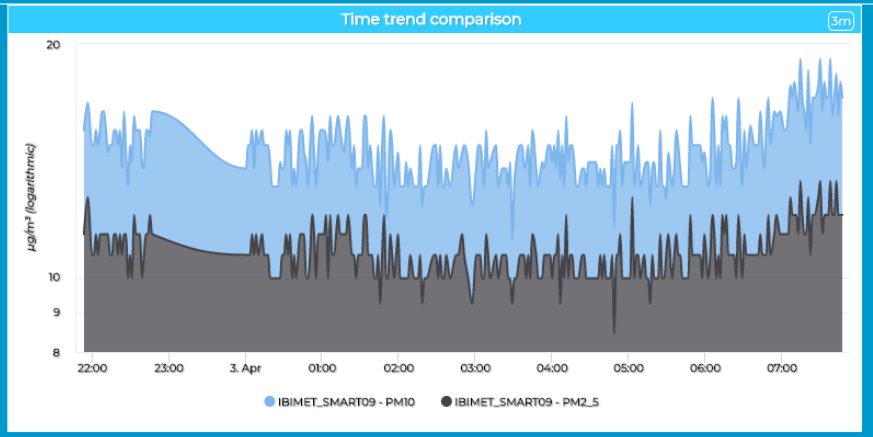












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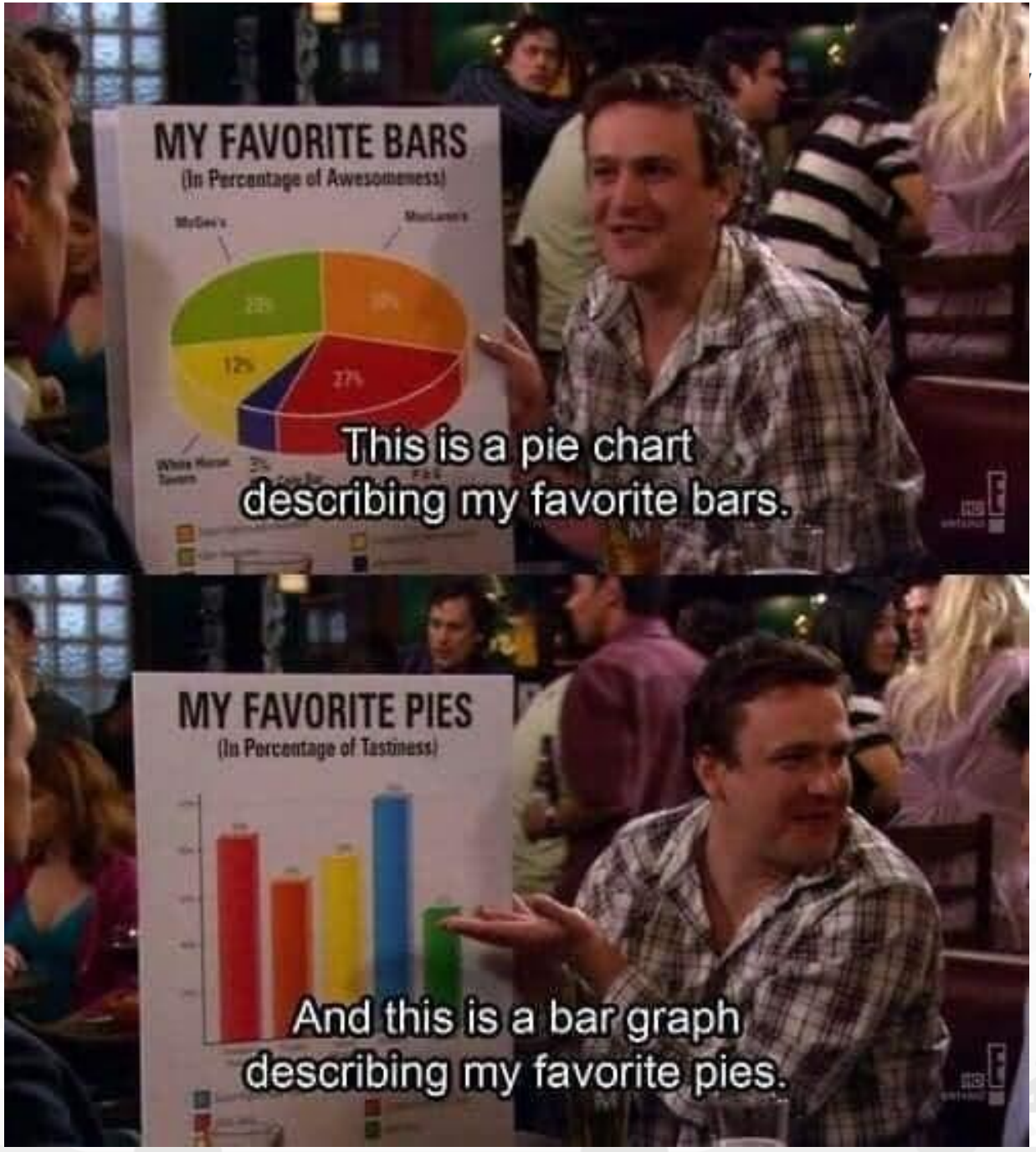
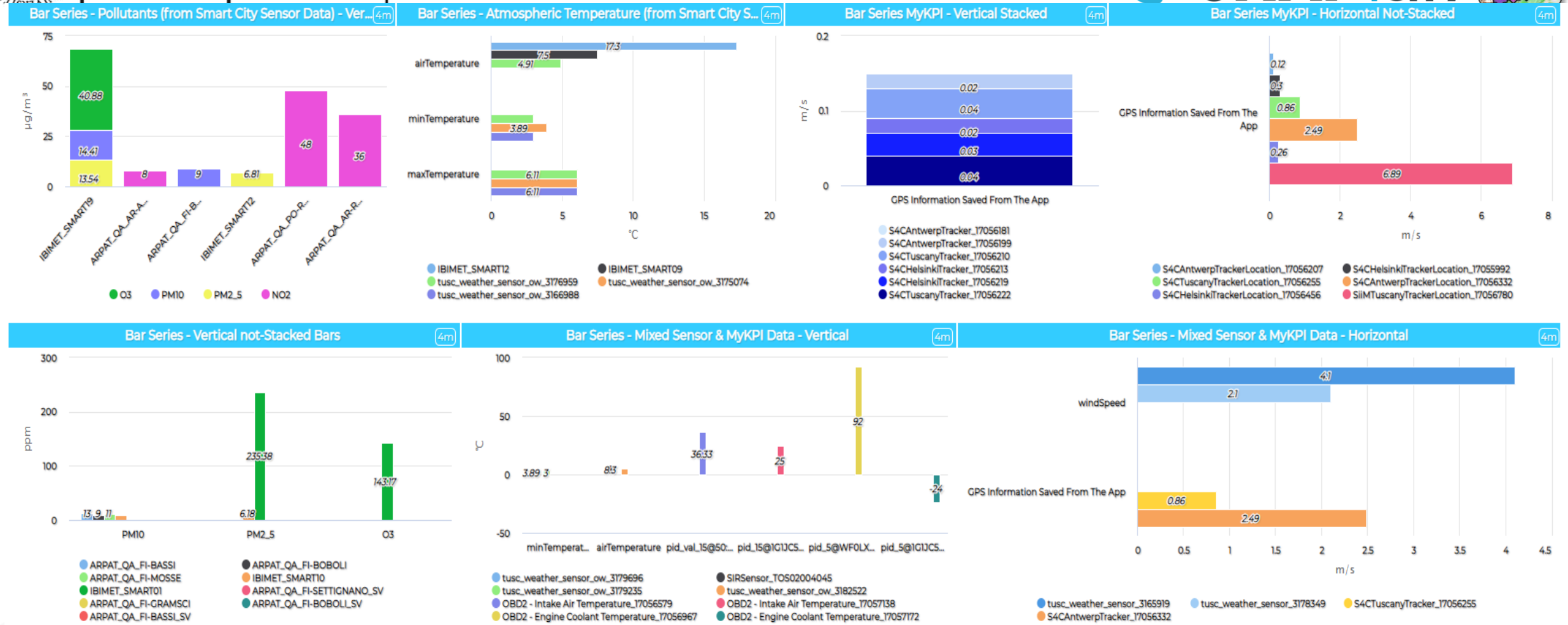
Bars & Pies



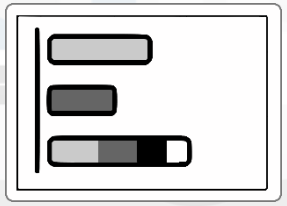
How I met your mother

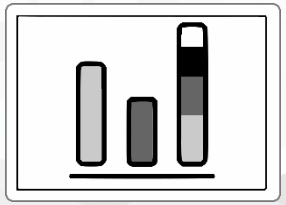
Barseries



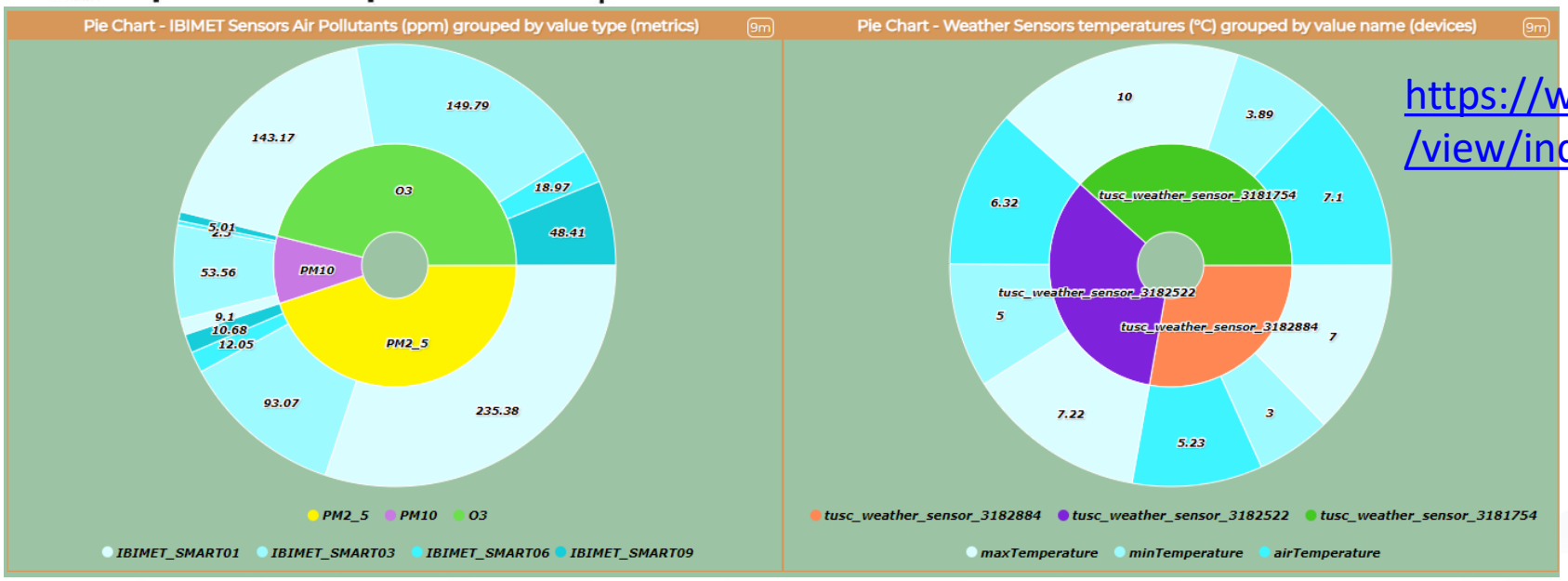
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjQwMA==

- Staked and grouped by Value_Name / Value_Type
- Vertical and Orizontal
- From historical data and/or dynamic data from IOT Applications

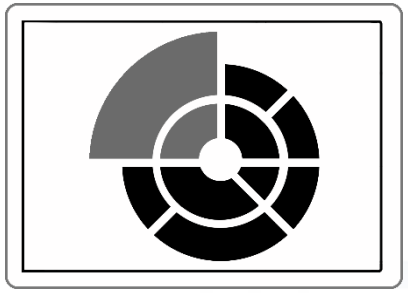




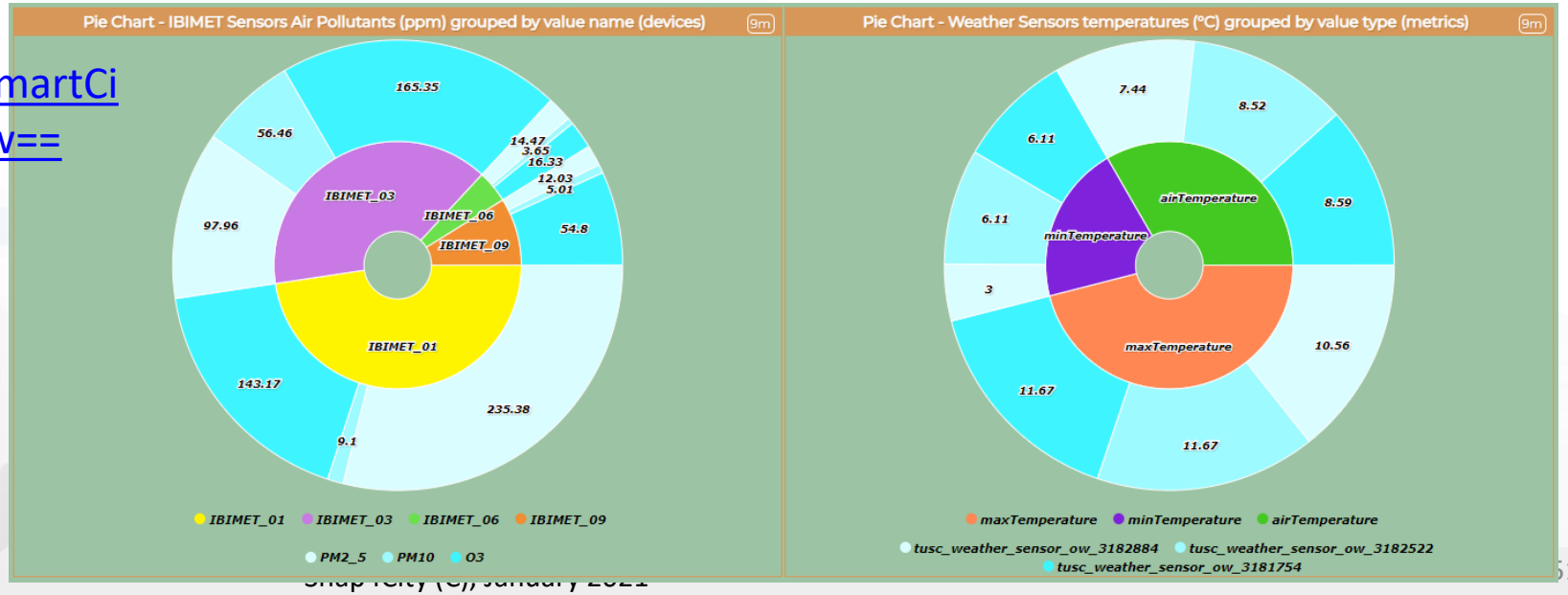
Pie & Dunot



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

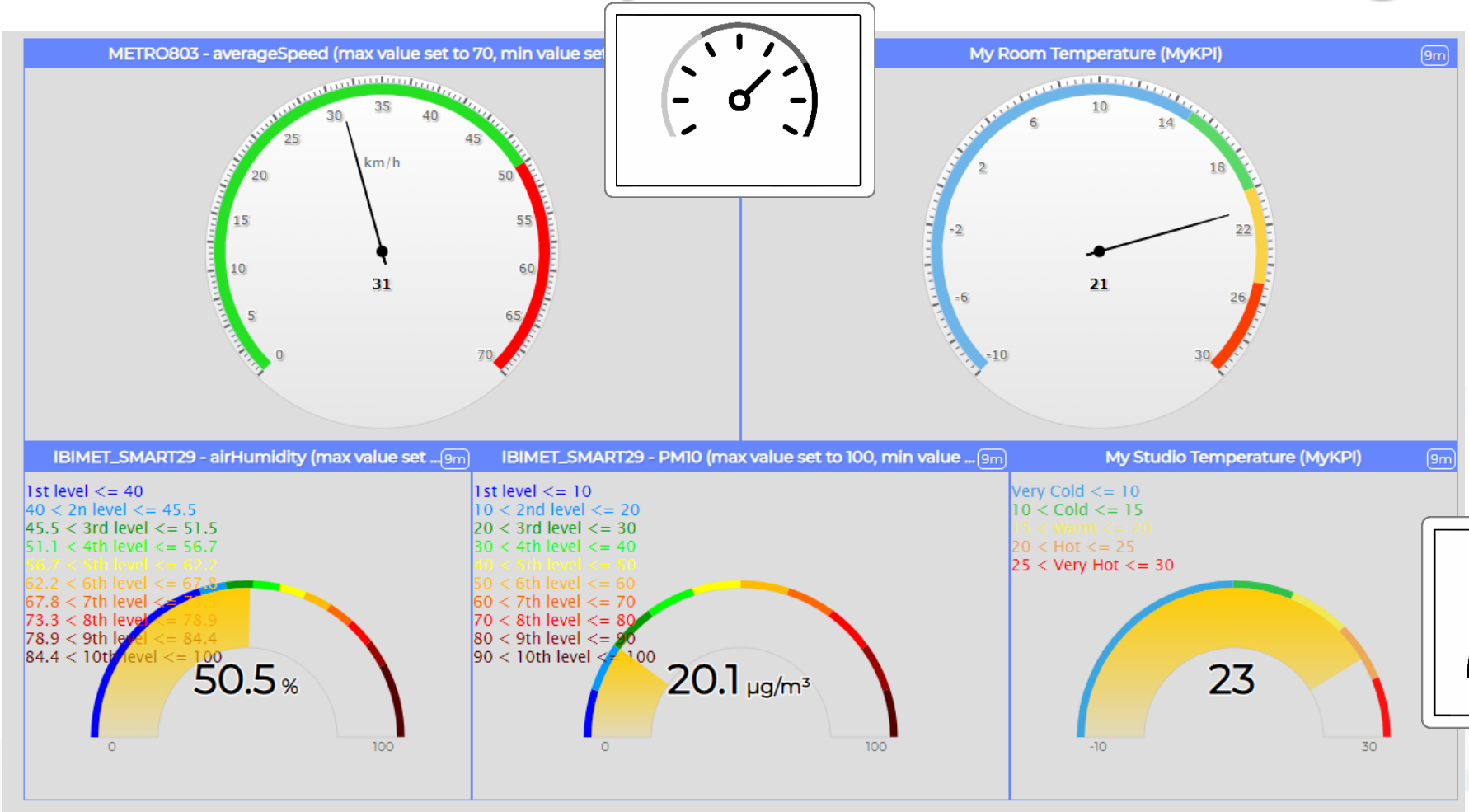


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjUyNw==



- Single level Pie and two levels Dunot
- Grouped ValueType, ValueUnit

Speedometers- Gauges



- Coloured custom
- Unit of measure
- Bounds
- ….

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjU0MA==

tables

Table - Weather Metrics and Pollutants

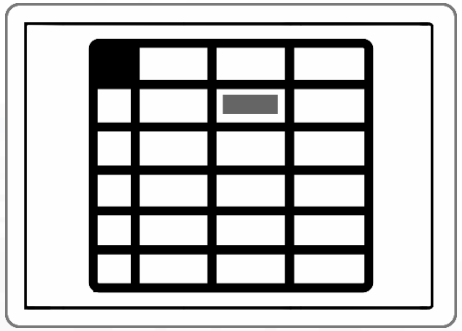
value type / value name	airHumidity	airTemperature	PM2_5	PM10	O3	CO
IBIMET_SMART_01	39.9	19	235.38		143.17	0.19
IBIMET_SMART_03	48	13.3	97.96		165.35	0.16
IBIMET_SMART_04	56.6	13.4	0		300	0.17
IBIMET_SMART_06	61.4	10.8	14.47		16.33	0.16
IBIMET_SMART_07	84	10.6	13.32	4.41	244.88	0.15
IBIMET_SMART_08	0	21.9	2.7	2.47		0.14
IBIMET_SMART_09	53.3	9.6	12.03	5.01	54.8	0.12

< 10
10 ⟷ 20
20 ⟷ 30
30 ⟷ 40
40 ⟷ 50
50 ⟷ 60
60 ⟷ 70
70 ⟷ 80
80 ⟷ 90
> 90

Table

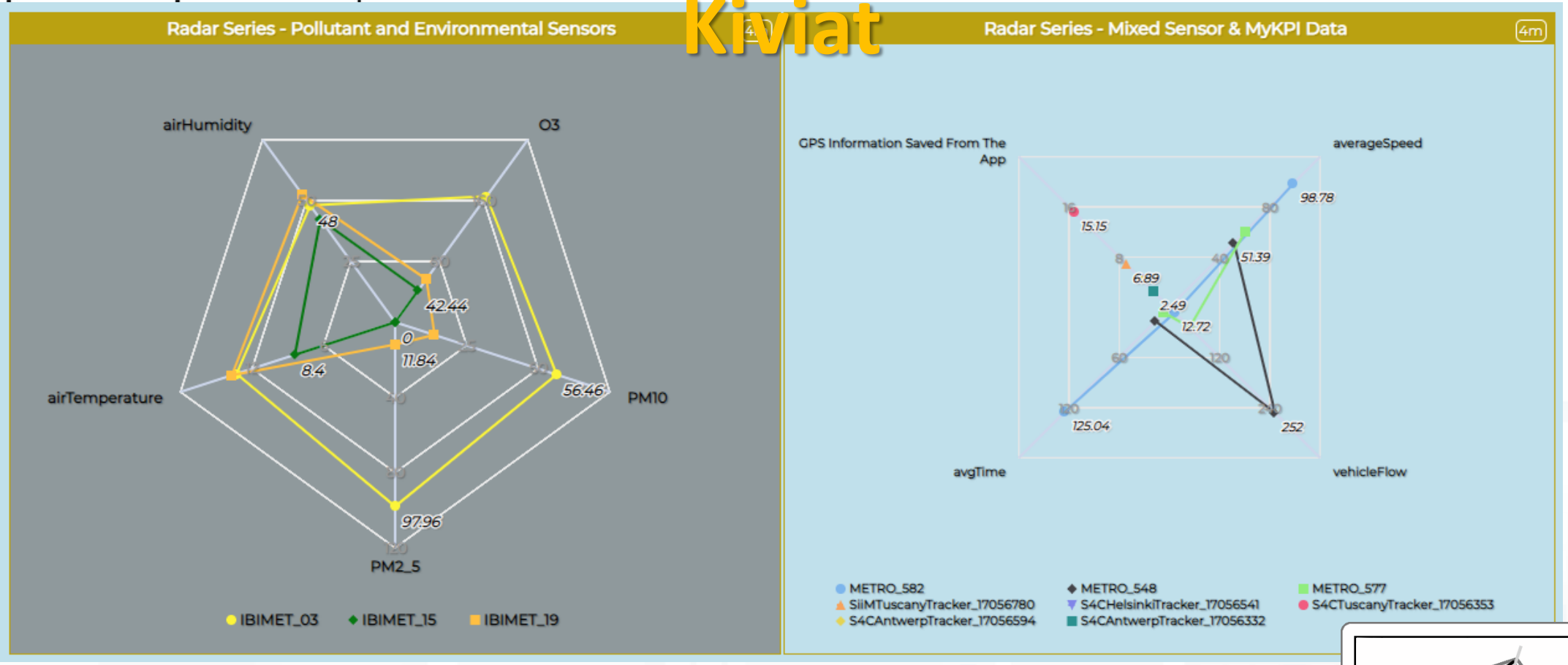
value type / value name	chargingState	stationState
eCharging_15EP22T2AA1S000001	AVAILABLE	ACTIVE
eCharging_15EP22T2AA1S000002	FAULT	MAINTENANCE
eCharging_15EP22T2AA1S000003	AVAILABLE	ACTIVE
eCharging_15EP22T2AA1S000004	AVAILABLE	ACTIVE
eCharging_15EP22T2AA1S000006	FAULT	MAINTENANCE
eCharging_15EP22T2AA1S000007	AVAILABLE	ACTIVE
eCharging_15EP22T2AA1S000008	AVAILABLE	ACTIVE
eCharging_15EP22T2AA1S000009	AVAILABLE	ACTIVE

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

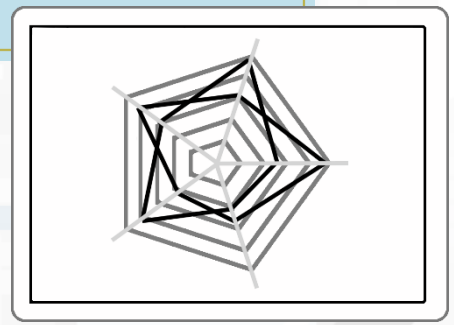


- Neutral or Colormapped, the same of heatmaps
- Number/text

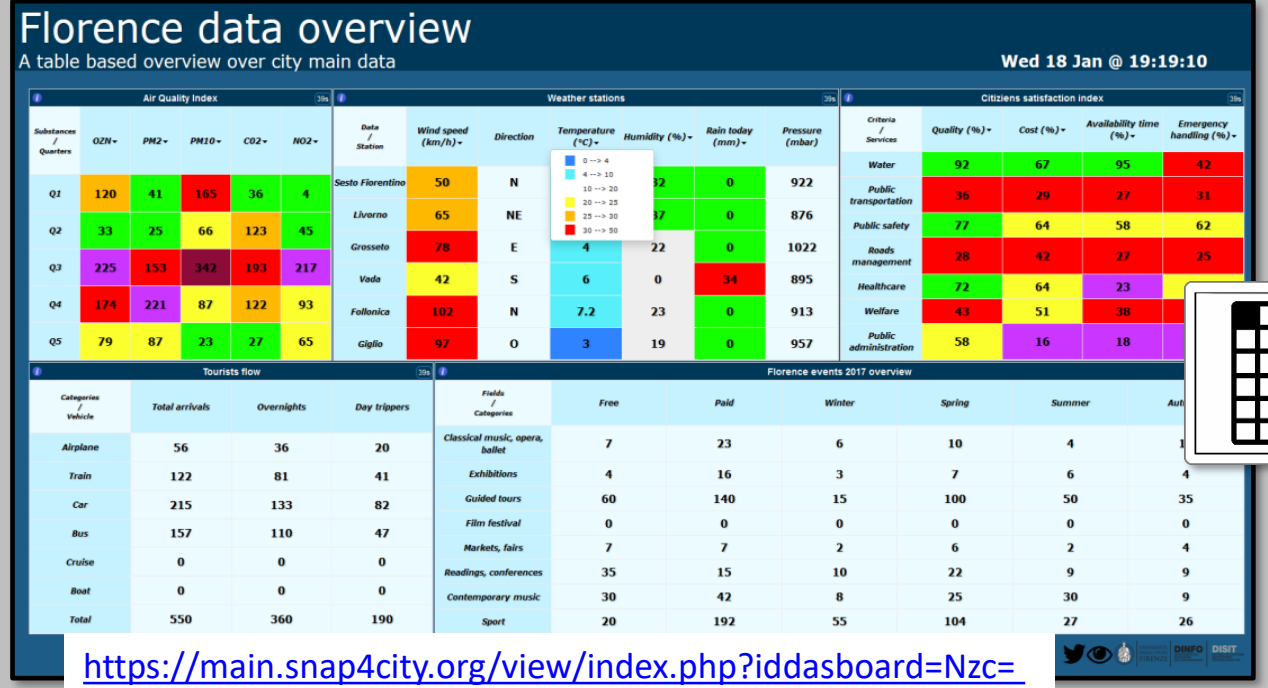
Radar, SpiderNet Kiviat



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



- Normalized, multiple value units
- Hystorical, KPI and Dynamic from IOT App

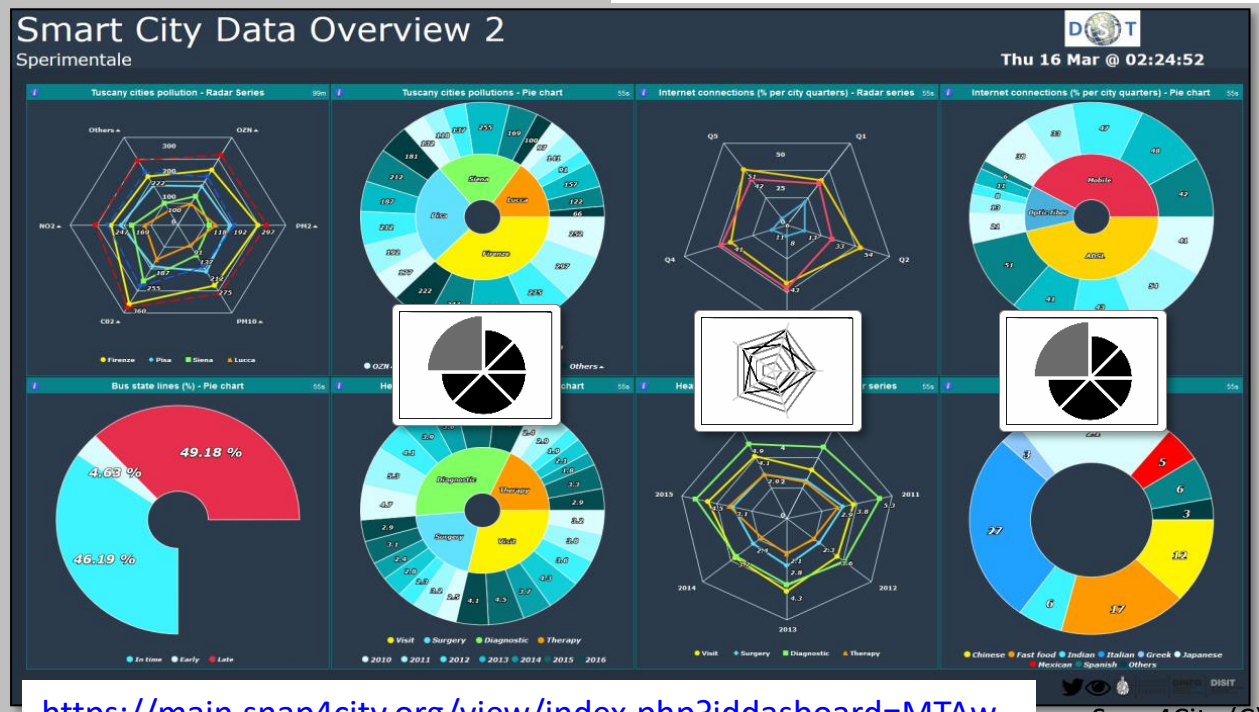


Table

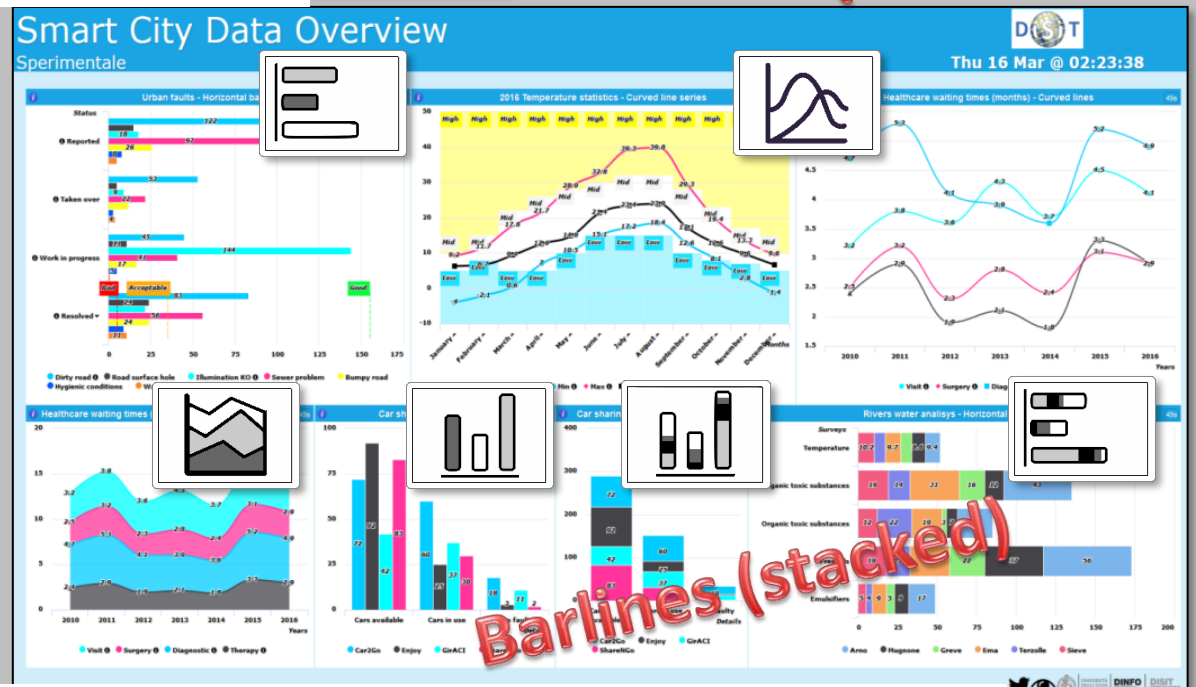
Kiviat and Pies

Curved Lines (stacked)

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



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



Barlines (stacked)

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

Mixt per Roma

MENU

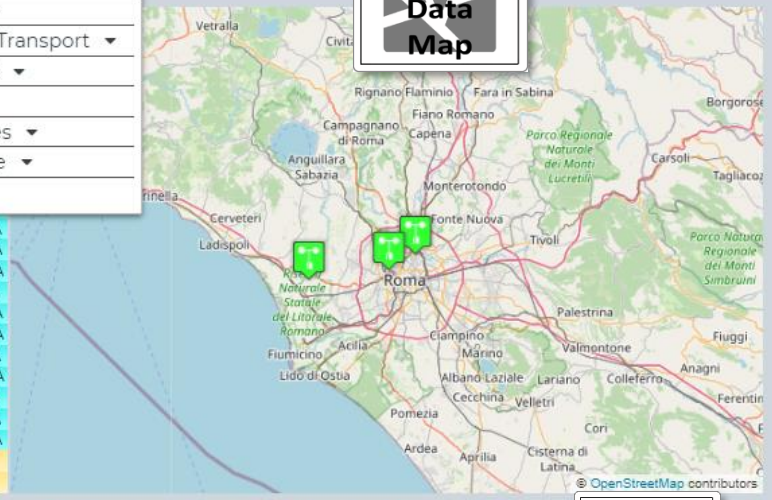
Roma Demo3 (Qualità dell'Aria)

Thu 23 Jul 13:35:09

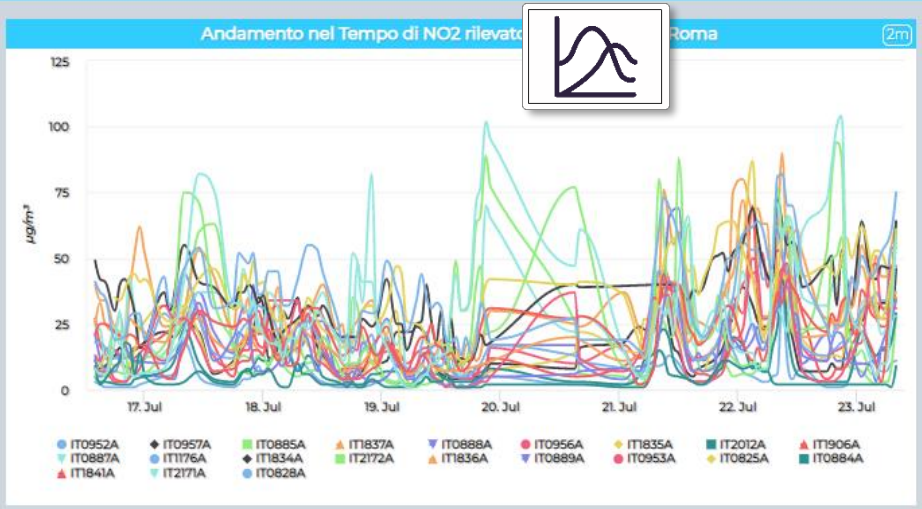
- Mobility and Transport
- Environment
- Social
- Some Services
- Infrastructure
- Quit

Multi Data Map

IT1836A
IT0957A
IT0828A
IT2171A
IT0952A
IT0885A
IT1837A
IT0888A
IT1176A
IT1835A
IT1834A
O3
NO2



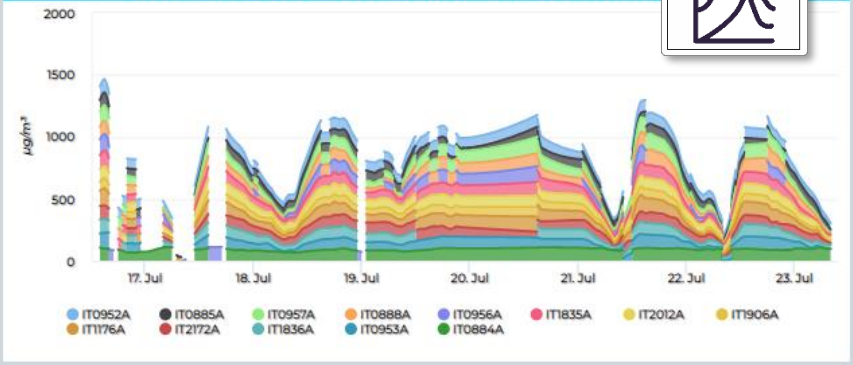
Andamento nel Tempo di NO2 rilevato [illegible] Roma



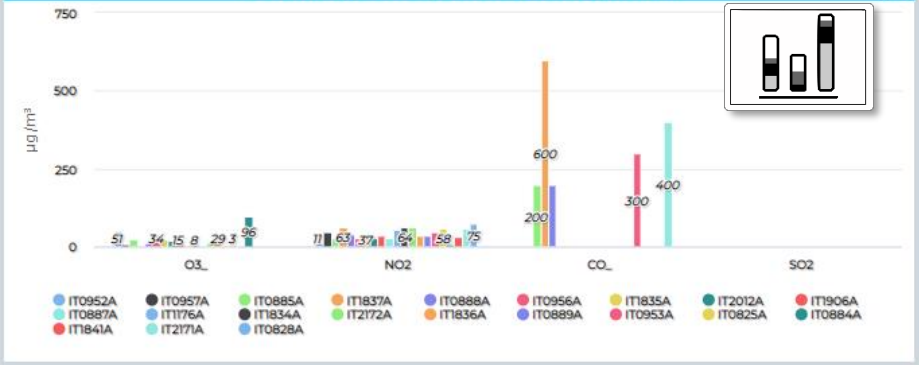
Valori Inquinanti in tempo reale, mappe

value type / value name	O3_	NO2	CO_	SO2
IT0952A	51	11		
IT0957A	7	46		
IT0885A	25	29	200	
IT1837A		63	600	
IT0888A	11	37	200	
IT0956A	34	29		
IT1835A	24	37		
IT2012A	20	29		
IT1906A	15	34		
IT0887A		28		
IT1176A	8	54		
IT1834A		64		
IT2172A	15	61		
IT1836A	29	35		
IT0953A	3	47	300	1.3
IT0889A		34		
IT0825A		58		
IT0884A	96	9		
IT1841A		31		
IT2171A		57	400	
IT0828A		75		

Andamento nel Tempo di O3 rilevato nelle stazioni in Roma (st[illegible]



Dati in Tempo reale inquinanti in Roma e provincia



Home Trasporti

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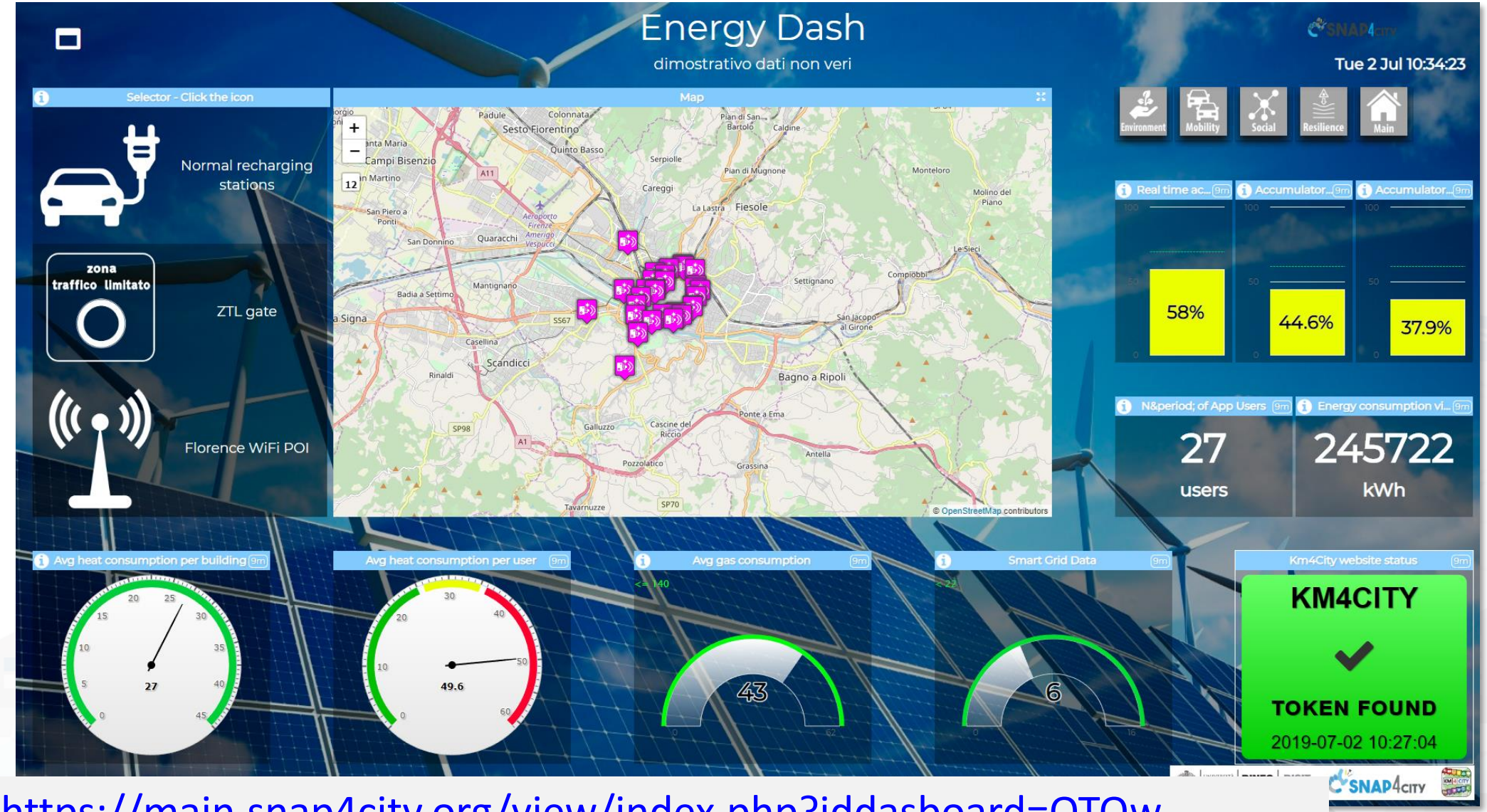
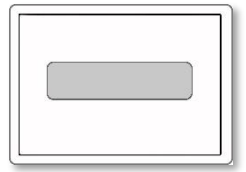
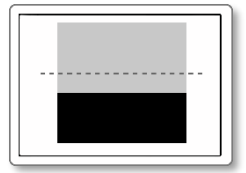
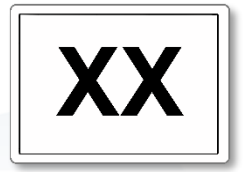
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjcyNg==

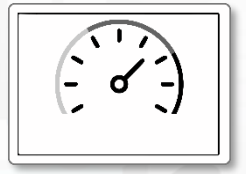
Match Widget vs Icon









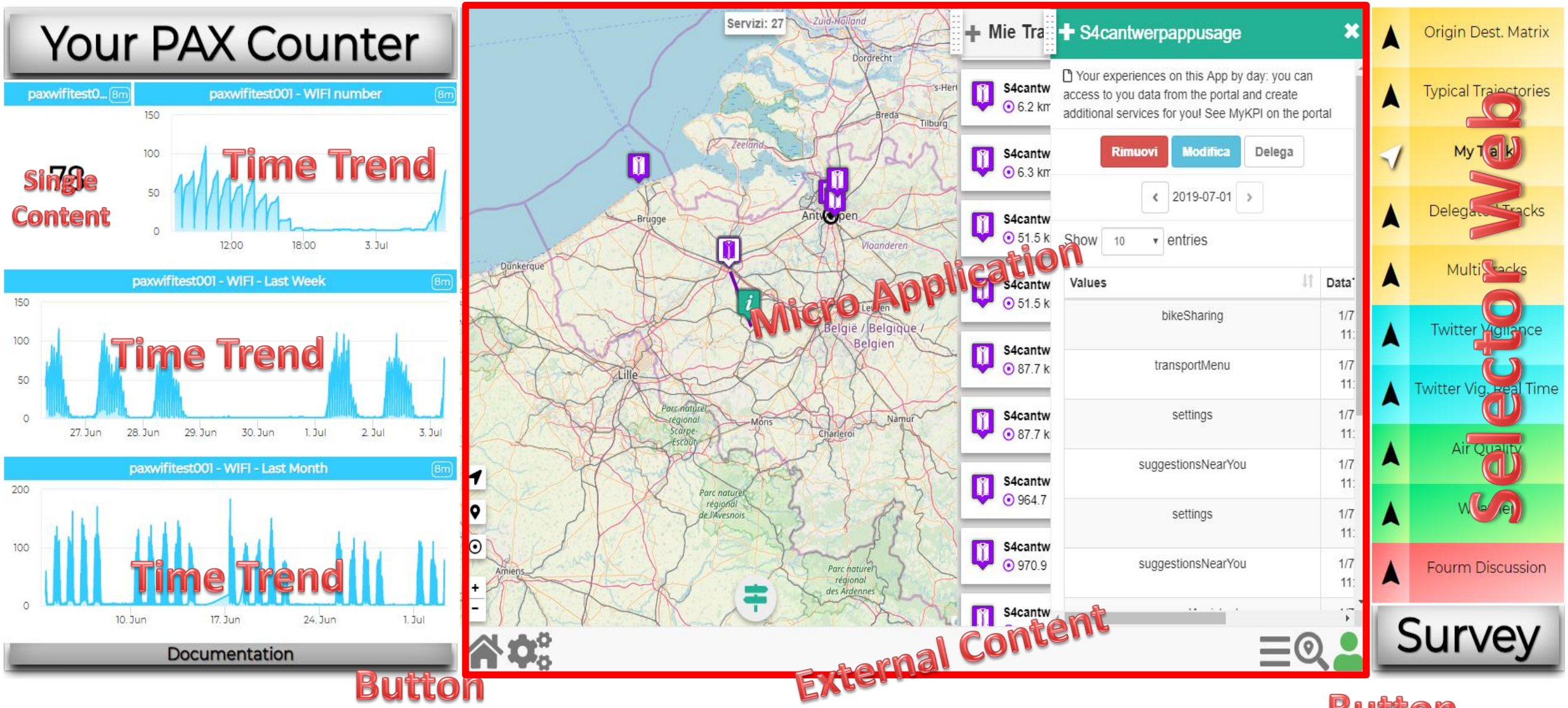


https://main.snap4city.org/view/index.php?iddasboard=OTQw

Monitoring My PAXCounter and Tracks (example)

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

Wed 3 Jul 09:18:07

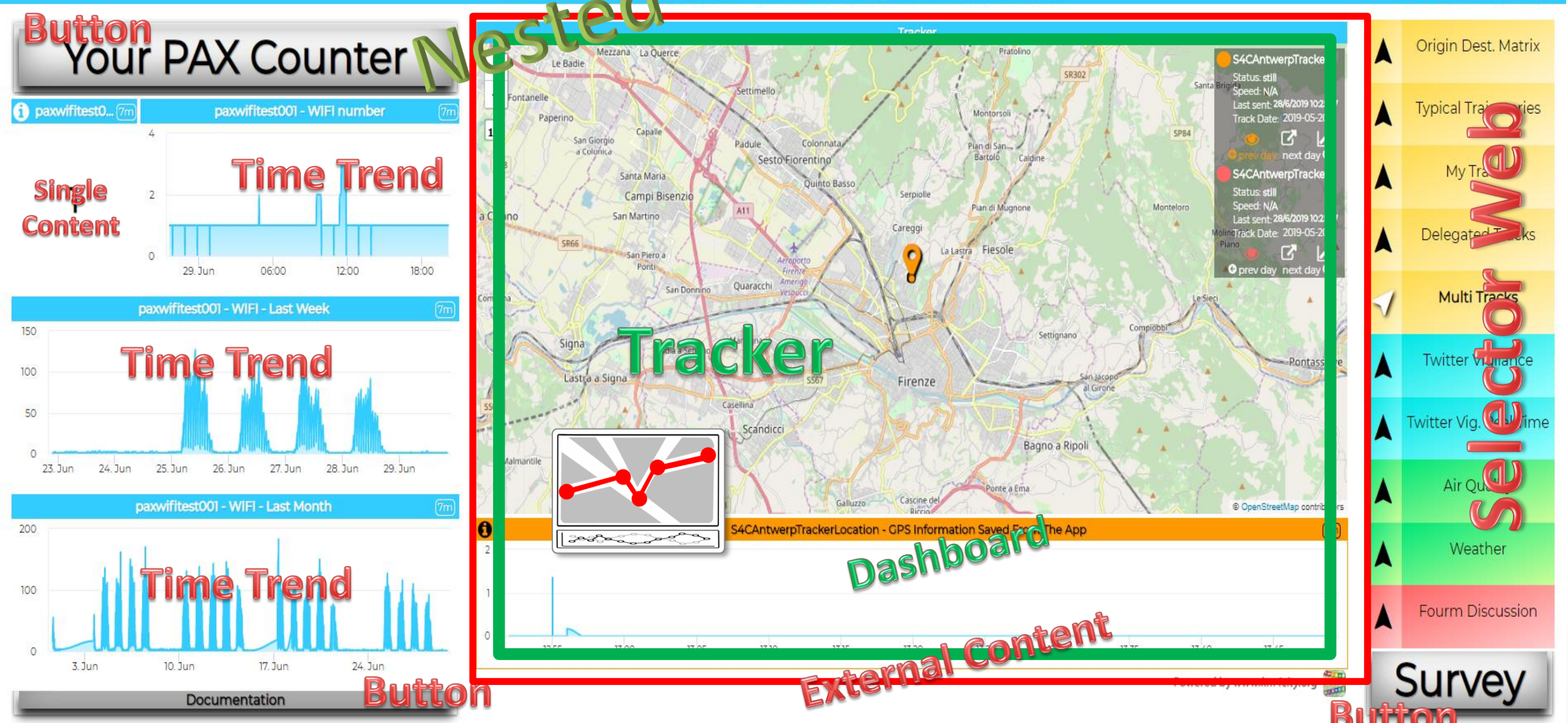


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc0NQ==

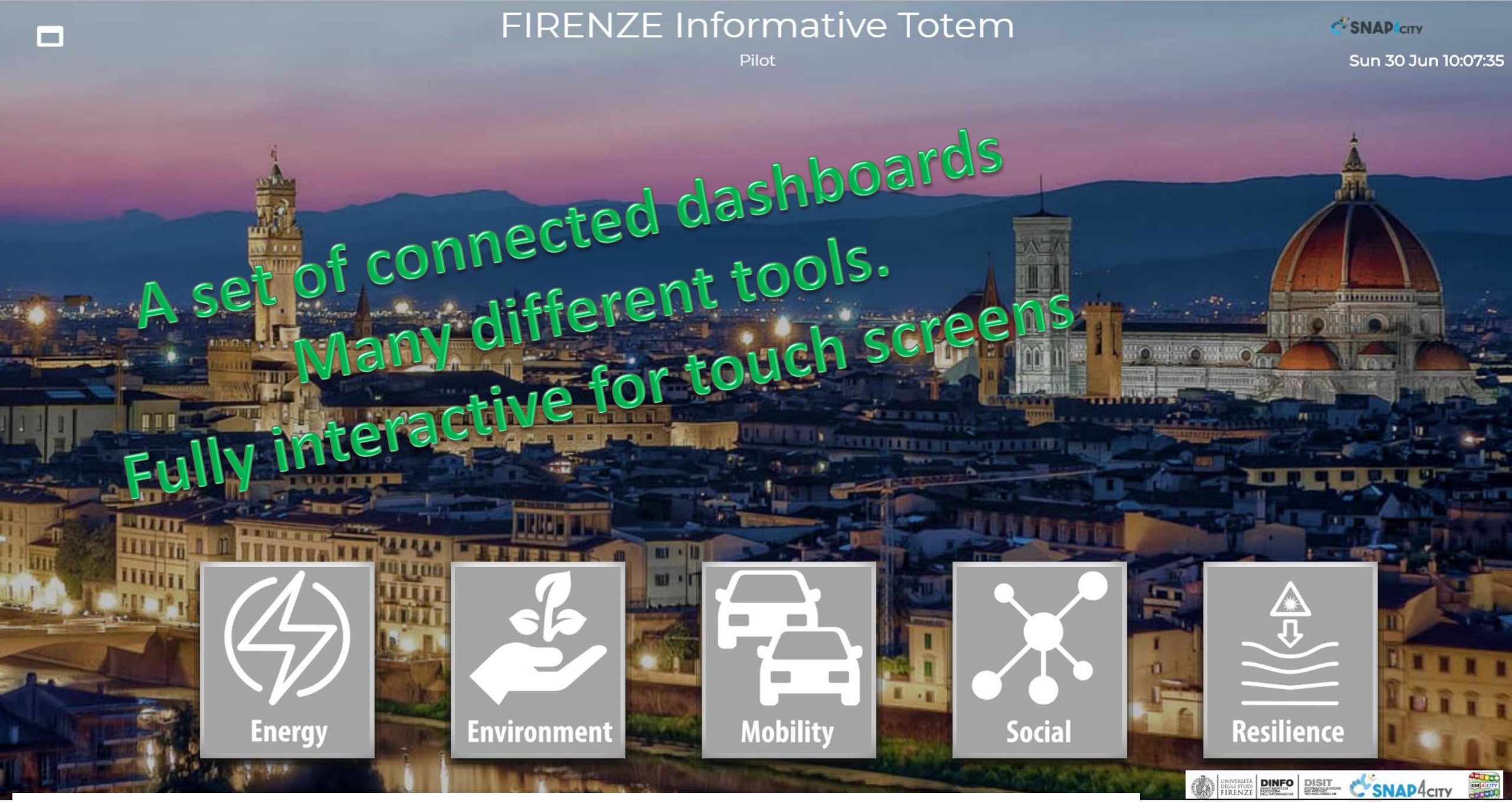
Monitoring My PAXCounter and Tracks (example)

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

Sat 29 Jun 23:42:05



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc0NQ==



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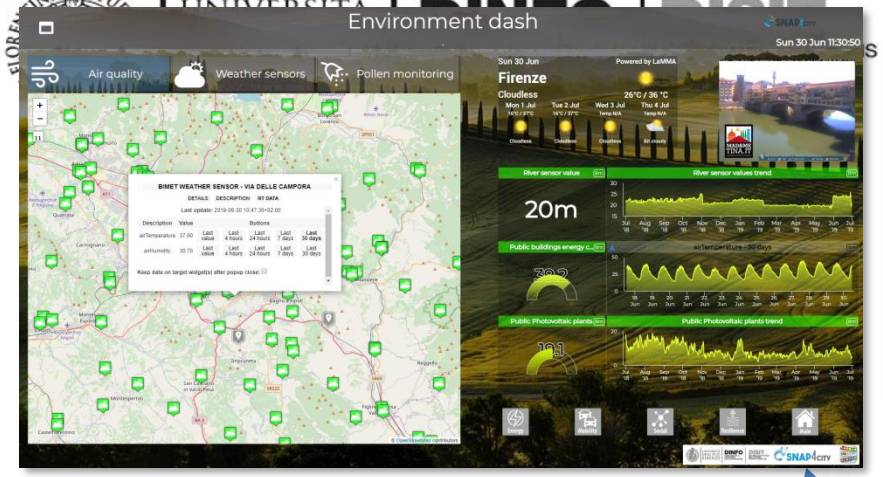
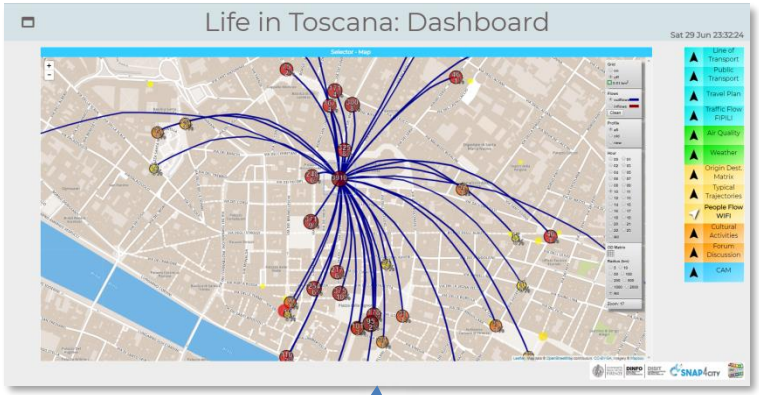
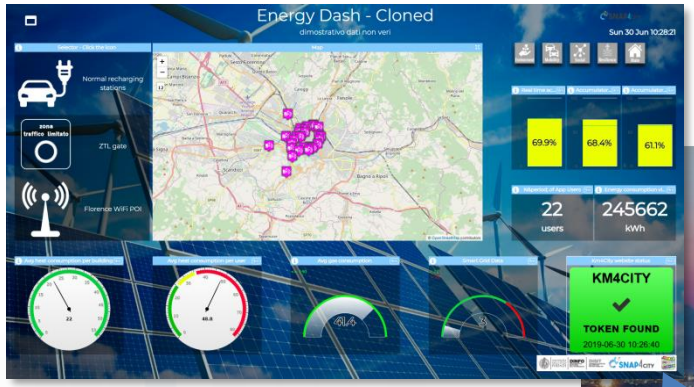
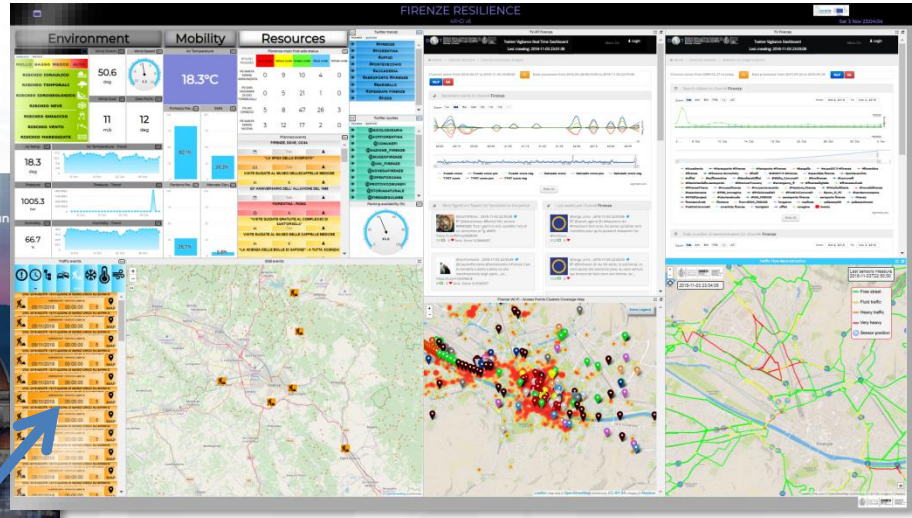

Environment dash
Air quality
Weather sensors
Pollen monitoring
Firenze
20m


Life in Toscana: Dashboard

Citizens Engagement


Energy Dash - Cloned
KM4CITY
TOKEN FOUND

FIRENZE Informative Totem
Pilot
Energy
Environment
Mobility
Social
Resilience


FIRENZE RESILIENCE
Environment
Mobility
Resources

FIRENZE

Tue 16 Oct 16:18:39

INDICI DI CRITICITA' DELLA QUALITA' DELL'ARIA (ICQA): 2 — inviata comunicazione alla cittadinanza

OZONO: 200 µ/m³ — superata la soglia di informazione

39492 Utenti WiFi

STATI DI ALLERTA 9m

GENERAL | METEO

MINIMO | BASSO | MEDIO | ALTO

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

Mar 16 Ott
Firenze
Nuvoloso
19°C / 24 °C
Powered by LaMMA

Mer 17 Ott 16°C / 24°C	Nuvoloso
Gio 18 Ott 15°C / 26°C	Nuvoloso
Ven 19 Ott Temp N/A	Sereno
Sab 20 Ott Temp N/A	Sereno

TPL

N	14	57	21
Attesa	3'	8'	5'
Ritardo	2'	0'	2'

COLONNINE RICARICA 9m

180 INSTALLATE

81.1 % ATTIVE

8.9 % IN USO

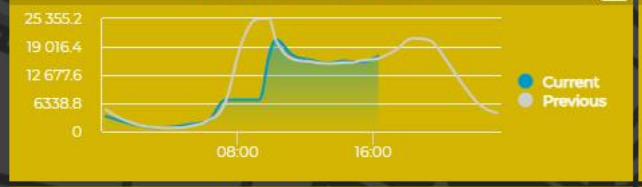
REPLICATE — DISIT

FLORENCE DASHBOARD

This dashboard is the main entry point to access dashbaords realised in the REPLICATE H2020 EC project.

REPLICATE has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No. 691735.

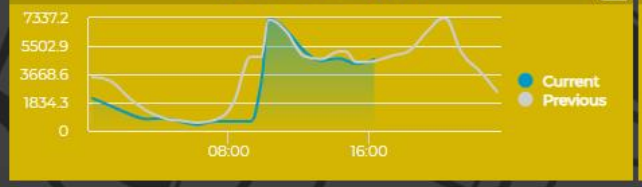
FLUSSI INGRESSO CITTA 9m



TOTALE 9m

141608 VEICOLI

FLUSSI INGRESSO ZTL 9m



TOTALE ZTL 9m

41146 VEICOLI

SITUAZIONE VIABILITA 54s

4 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.

4 TOT. EVENTI SULLA RETE

SMN 9m	BINARIO16 9m	FORTEZZA 9m
63.4 % occupati su 901 posti	83 % occupati su 165 posti	17.9 % occupati su 521 posti
LEOPOLDA 9m	**CALZA 9m**	**S.AMBROGIO 9m**
36.3 % occupati su 300 posti	69.3 % occupati su 218	67 % occupati su 379 posti
PARTERRE 9m	**CAREGGI 9m**	**BECCARIA 9m**
64.9 % occupati su 106 posti	90.4 % occupati su 406 posti	78.6 % occupati su 210 posti

STATO TRIAGE CAREGGI 9m

Red code	Yellow code	Green code	Blue code	White code
3	12	83	37	9

MAPPA

- Energy
- Environment
- Mobility
- Social
- Resilience

PM10	Riciclo rifiuto	Rifiuto per abitante	PIL residenti	Tasso di disoccupazione	Piste Ciclabili
26 superamenti/anno	56%	0,629 t/pers/anno	23.606 euro/pers	6,8%	19.7% km ciclabili/km totali

Most of the widgets are connected to an URL to jump to other views/dashboards

FIRENZE

Tue 16 Oct 16:18:39

Single Content

Single Content

Civil Protection

SOC

External Content

External Content

Meteo

Single Content

Single Content

Single Content

3 Single Content

Time Trend Compare

Single Content

10 Single Content

9 Single Content

Time Trend Compare

Single Content

6 Buttons

First AID

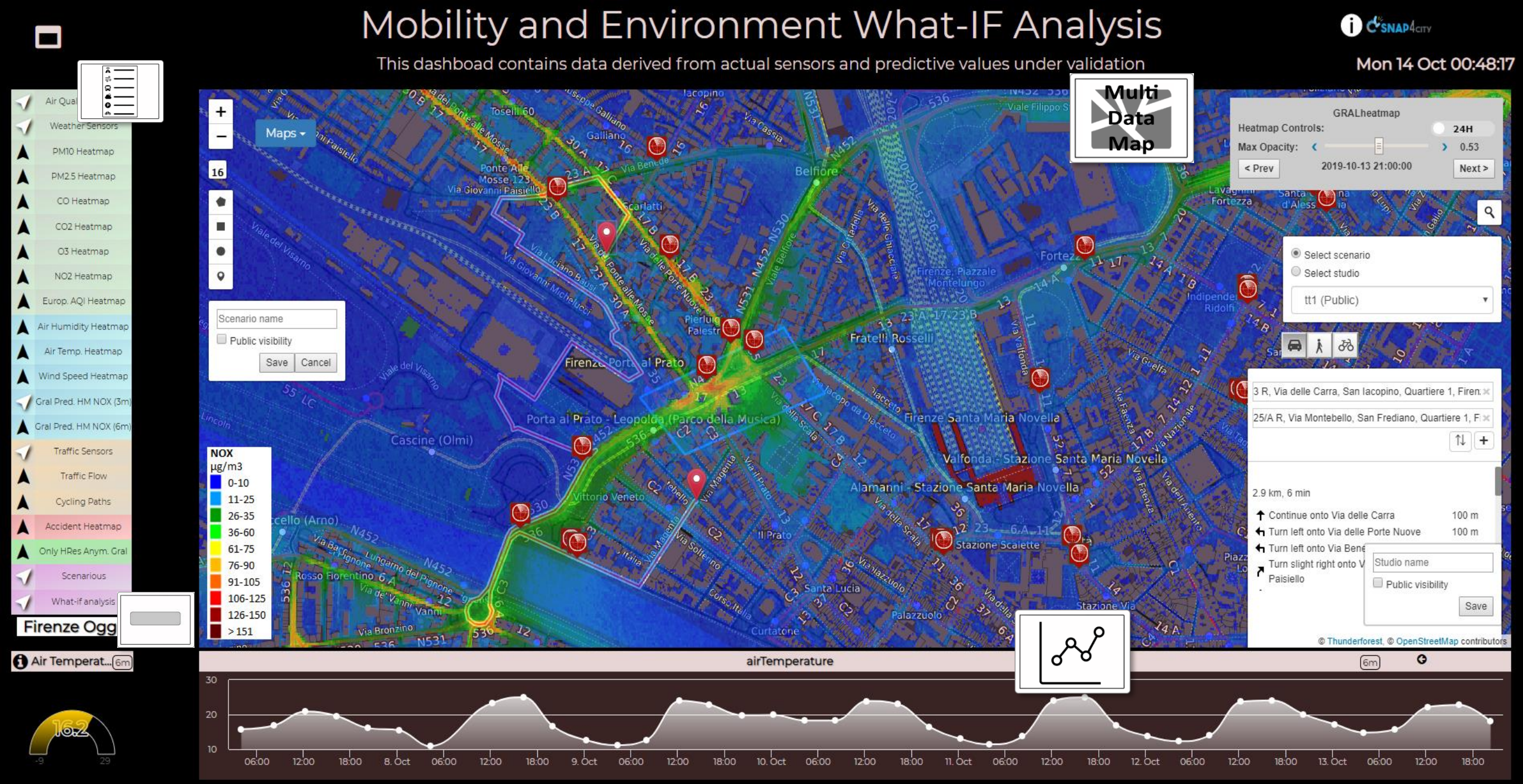
6 Buttons

Most of the widgets are connected to an URL to jump to other views/dashboards

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

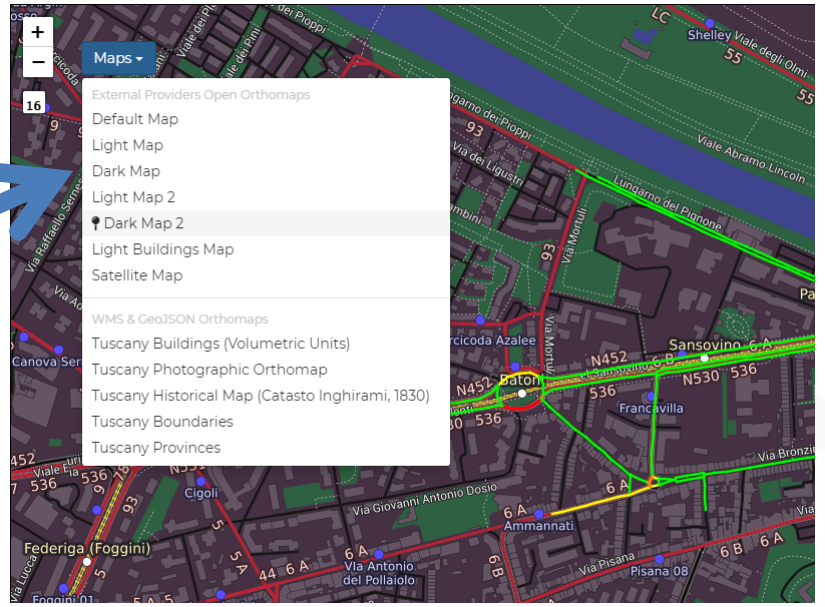


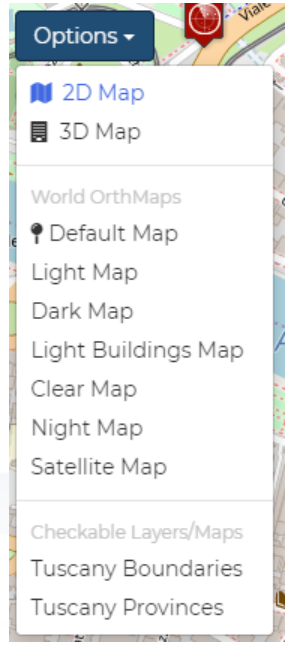
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjE5MA==

Multi Data Maps Widget

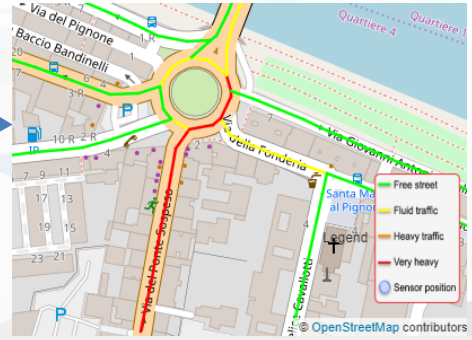
Multi Data Map Widget

- The most powerful Data Map rendering tool, it supports:
  - KB Sensor data: POI, sensors, actuators, etc. (see in the following)
  - WFS data (see in the following)
  - WMS background maps
    - Ask to a **RootAdmin** for activating this feature on your MultiDataMap widgets once created the dashboard
    - Maps can come from GIS servers, and WMS
  - WMS Heatmaps GeoTiFF
  - Special tools
    - Traffic flow
    - Scenario (see in the following)
    - What-IF (see in the following)

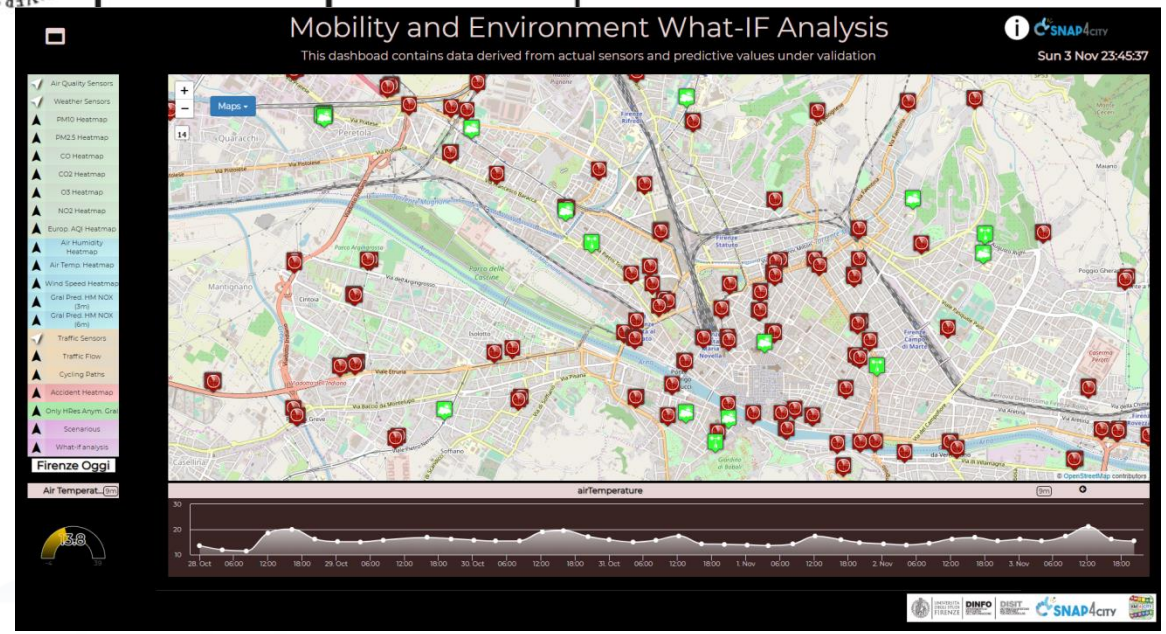


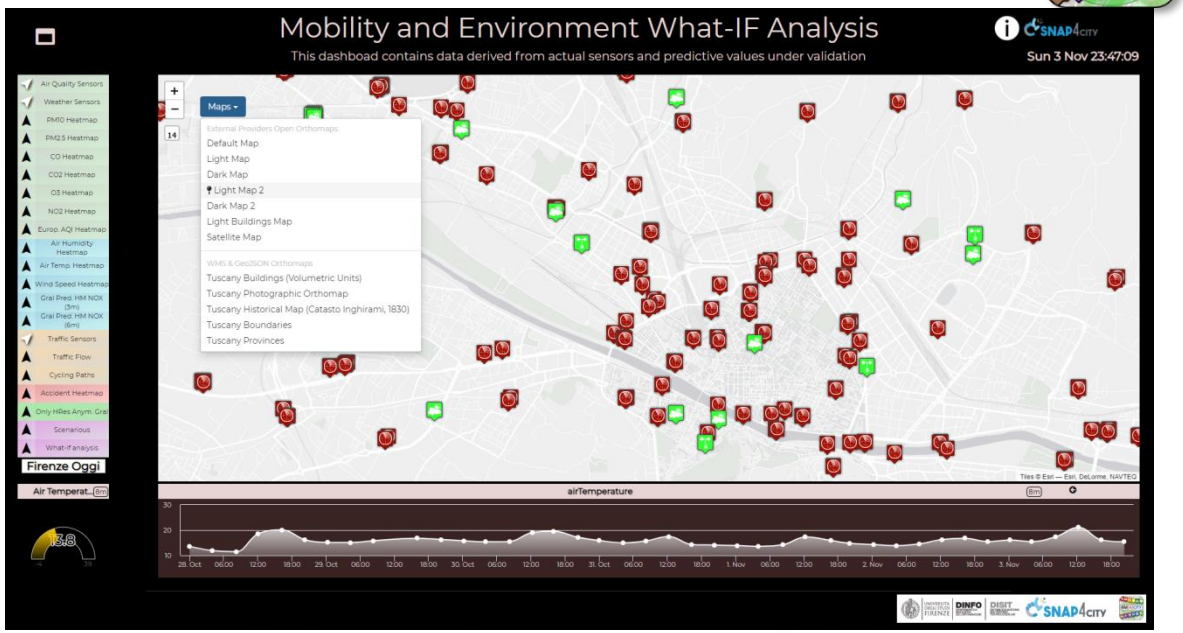


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjE5MA==#

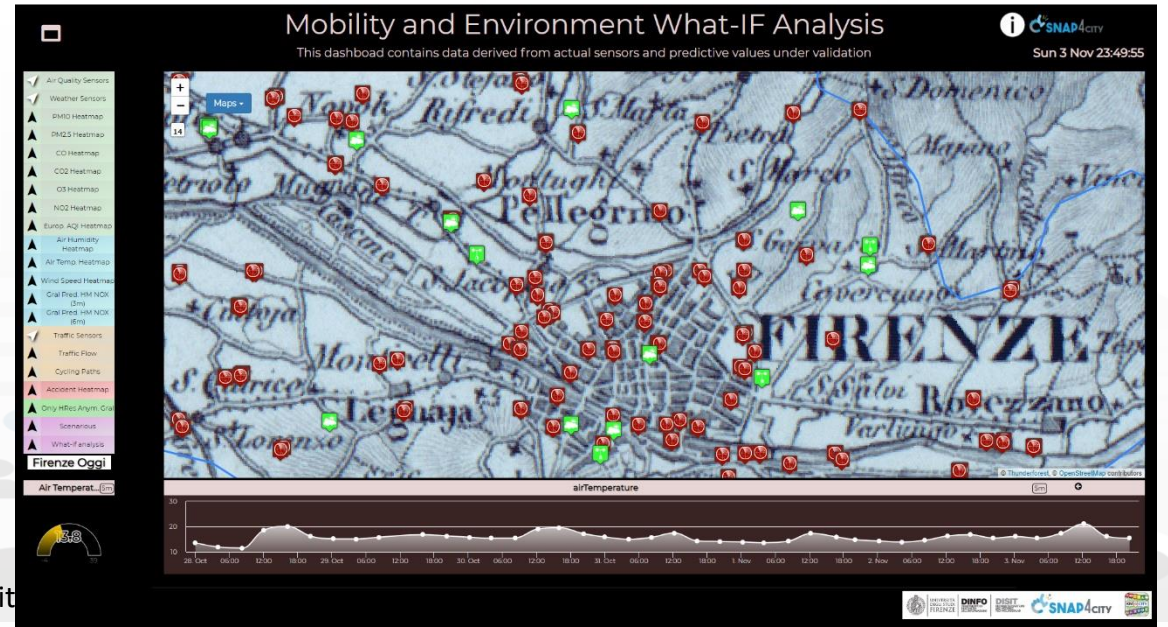


Orthomaps


Mobility and Environment What-IF Analysis
This dashboad contains data derived from actual sensors and predictive values under validation
Sun 3 Nov 23:45:37
Firenze Oggi
airTemperature


Mobility and Environment What-IF Analysis
This dashboad contains data derived from actual sensors and predictive values under validation
Sun 3 Nov 23:47:09
Default Map
Light Map
Dark Map
Light Map 2
Dark Map 2
Light Buildings Map
Satellite Map
Tuscany Buildings (Volumetric Units)
Tuscany Photographic Orthomap
Tuscany Historical Map (Catasto Inghirami, 1830)
Tuscany Boundaries
Tuscany Provinces
Firenze Oggi
airTemperature

Mobility and Environment What-IF Analysis
This dashboad contains data derived from actual sensors and predictive values under validation
Sun 3 Nov 23:48:22
Firenze Oggi
airTemperature

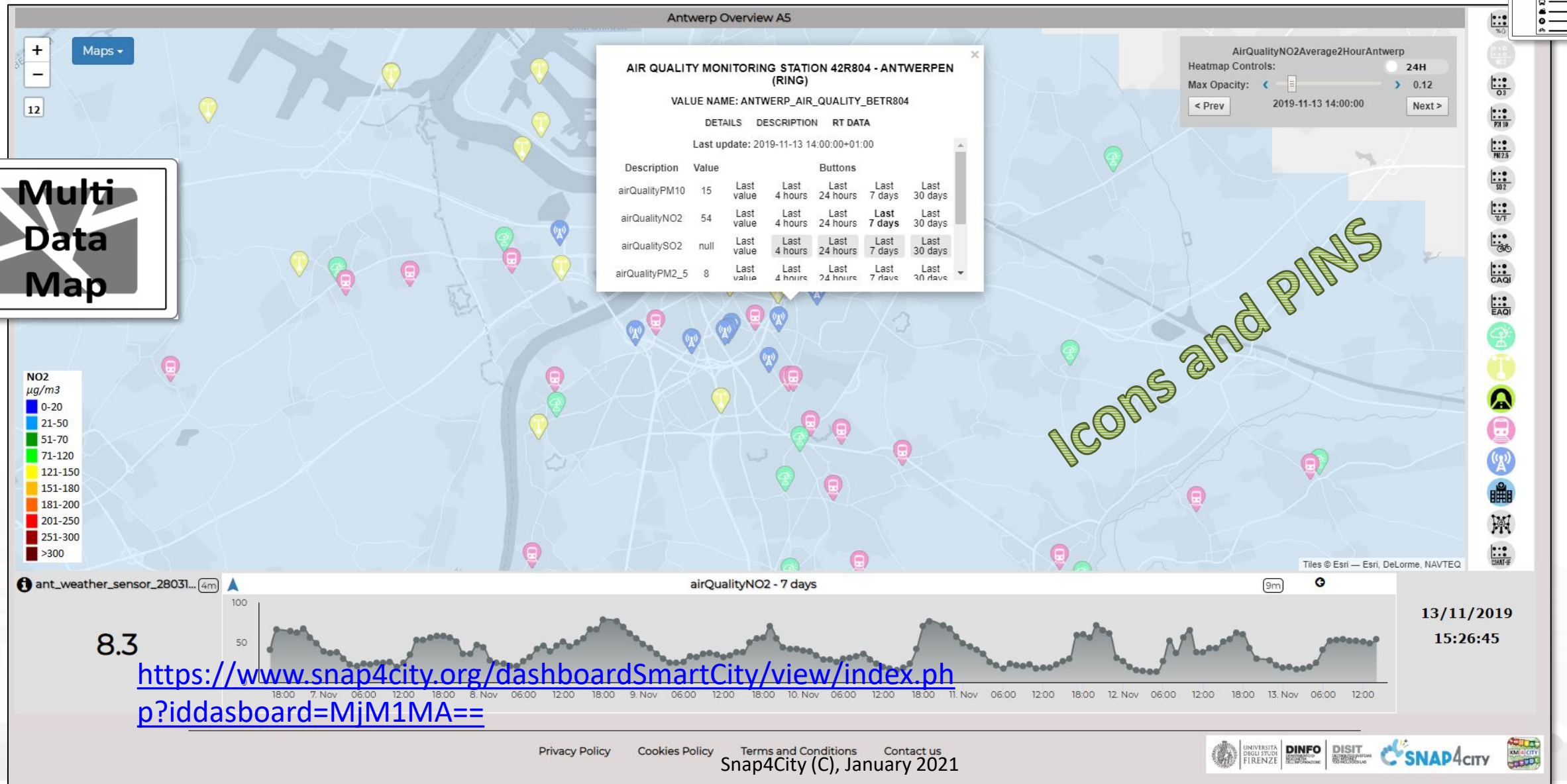

Mobility and Environment What-IF Analysis
This dashboad contains data derived from actual sensors and predictive values under validation
Sun 3 Nov 23:49:55
FIRENZE
Firenze Oggi
airTemperature

Orthomaps as graphic layers

- **Orthomaps can be**:
  - Directly exploited from public service via WMS protocol, from some GIS services as GeoServer
  - Loaded into the Snap4City GeoServer
  - Layered if they can be overlapped each other, such as map with gov border above.
- The Dashboard owner can
  - Select the Orthomaps to be used shown as default in the dashboard
- Each organization has its own set of Orthomaps

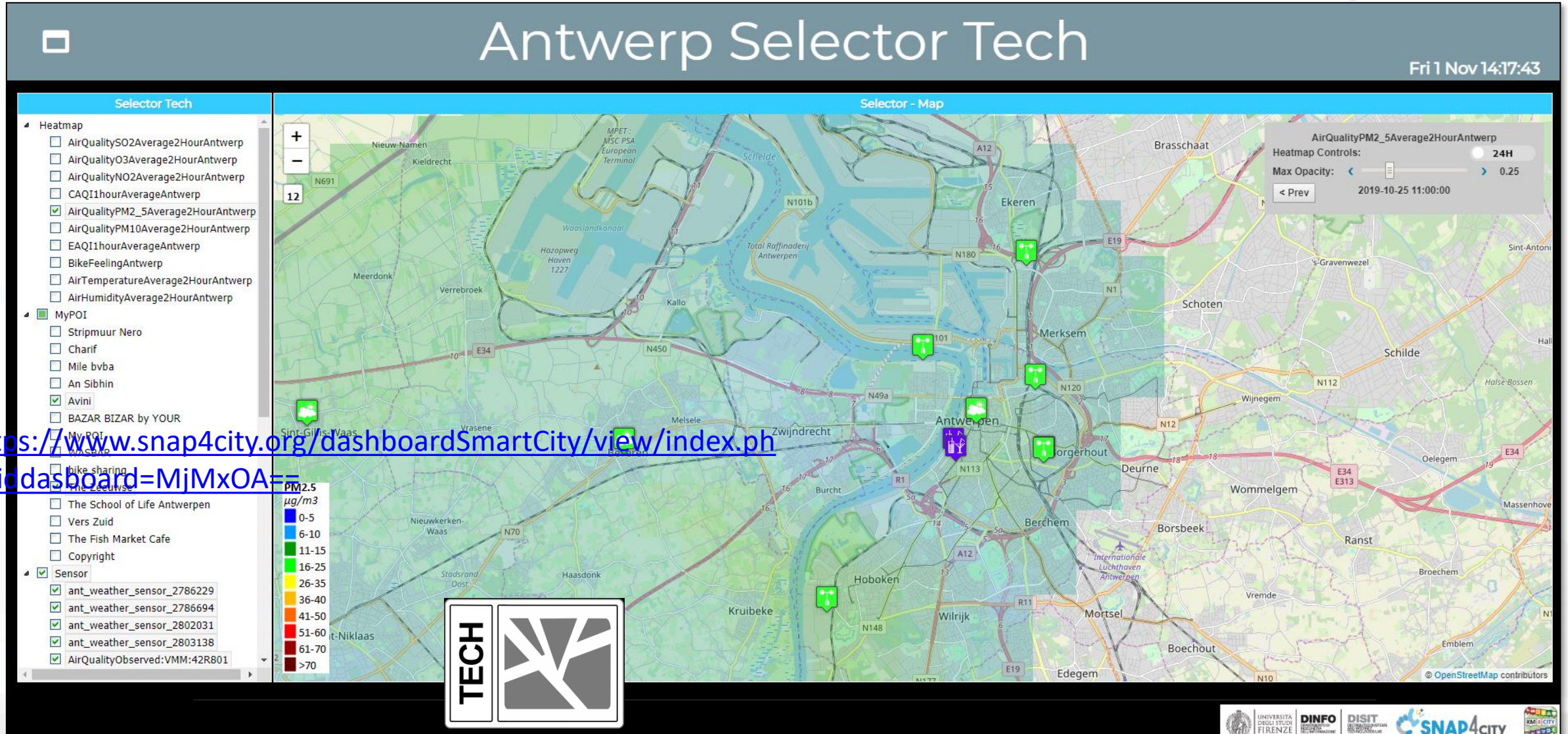
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjE5MA==

Menu Icon and PINs as Icons



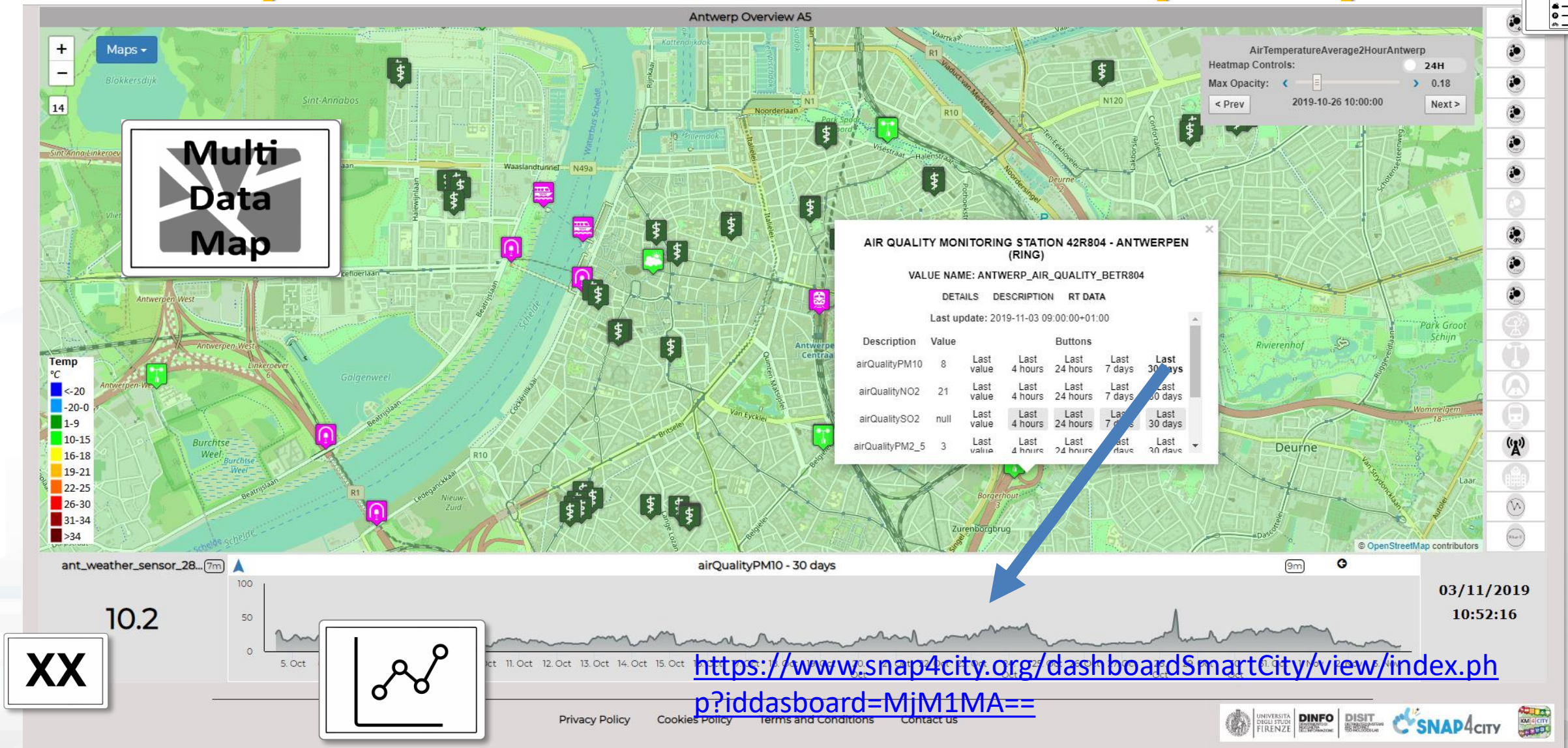
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjM1MA==

Technical Selector: TECH MultiDataMap



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

Unique Dashboard builder Multiple Styles



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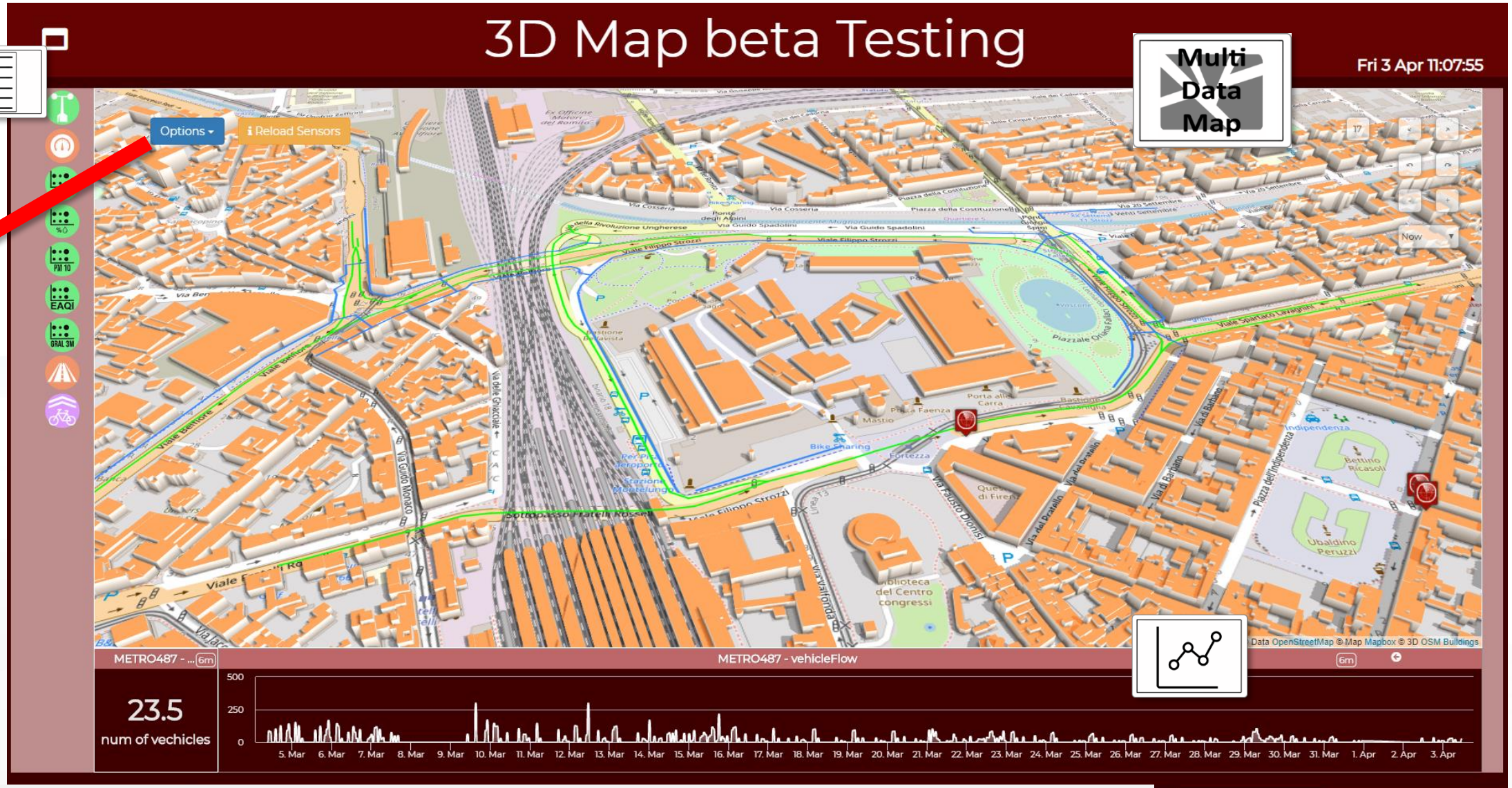
3D views



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

Firenze - Trafair - AirQuality Heatmaps

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

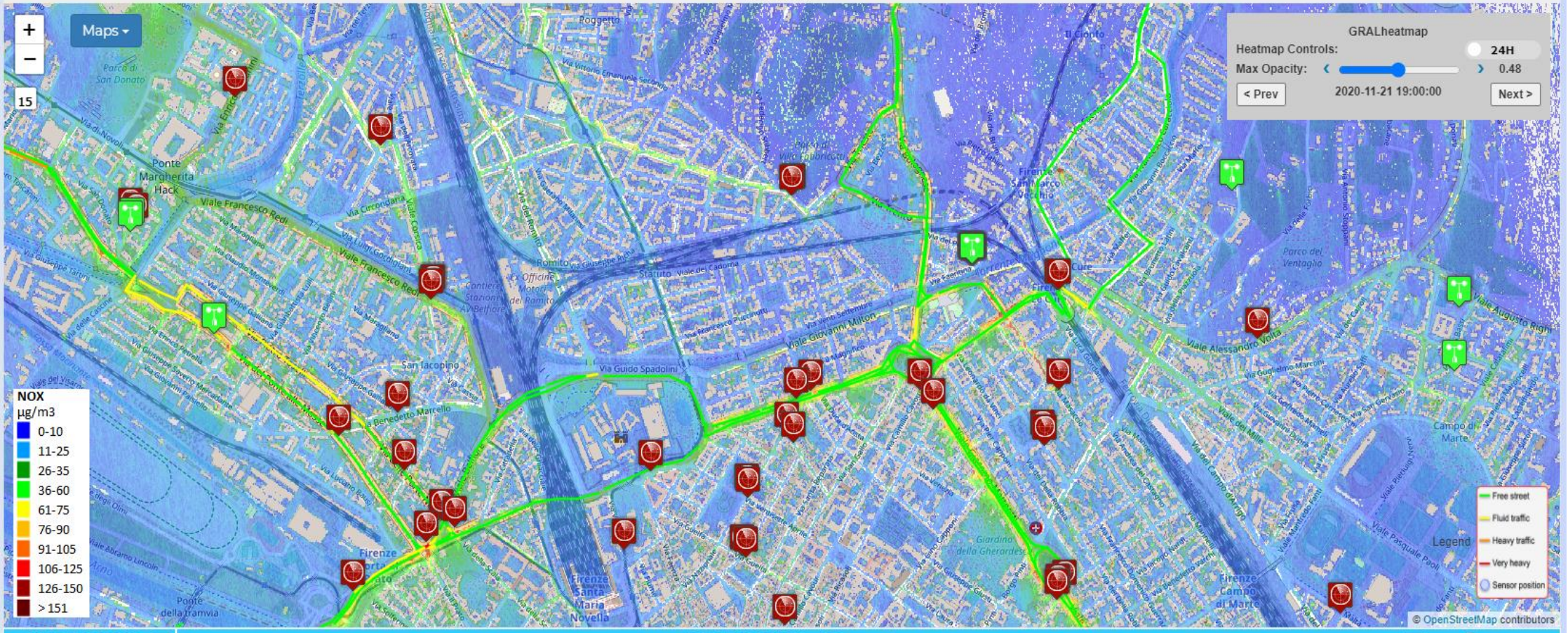
Sat 21 Nov 19:13:14

- Air Quality Sensors
- PM10 bars
- 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
- Green Areas
- Schools
- Recreation areas

Firenze Air quality trends

Trafair Main Dashboard

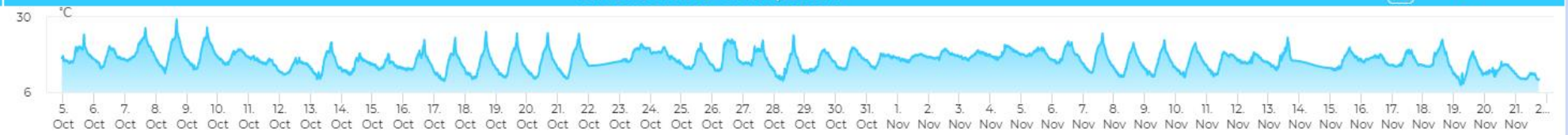
Multi Map



IBIMET_SMART0... 9m

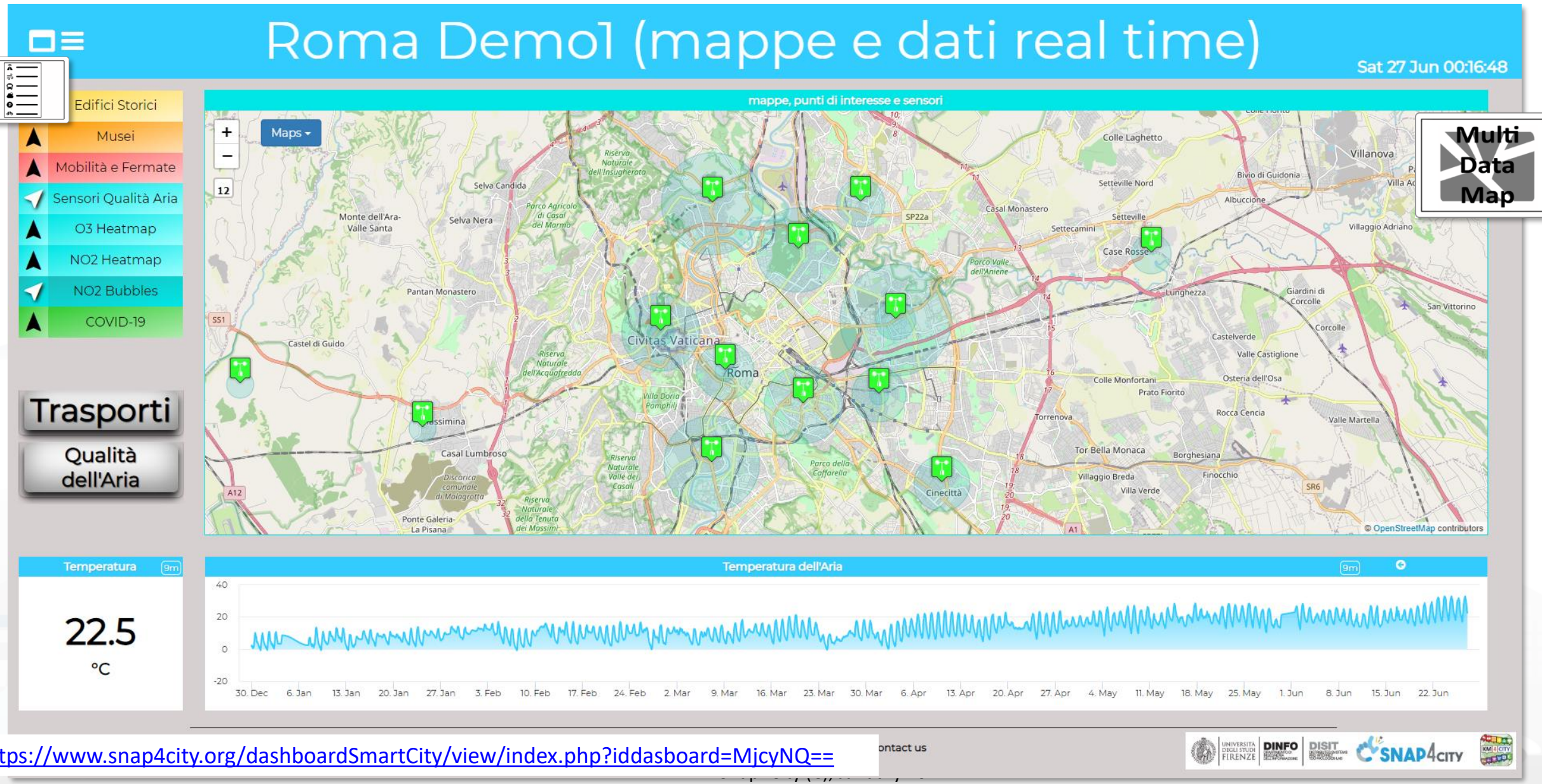
10 °C

IBIMET_SMART09 - airTemperature 9m



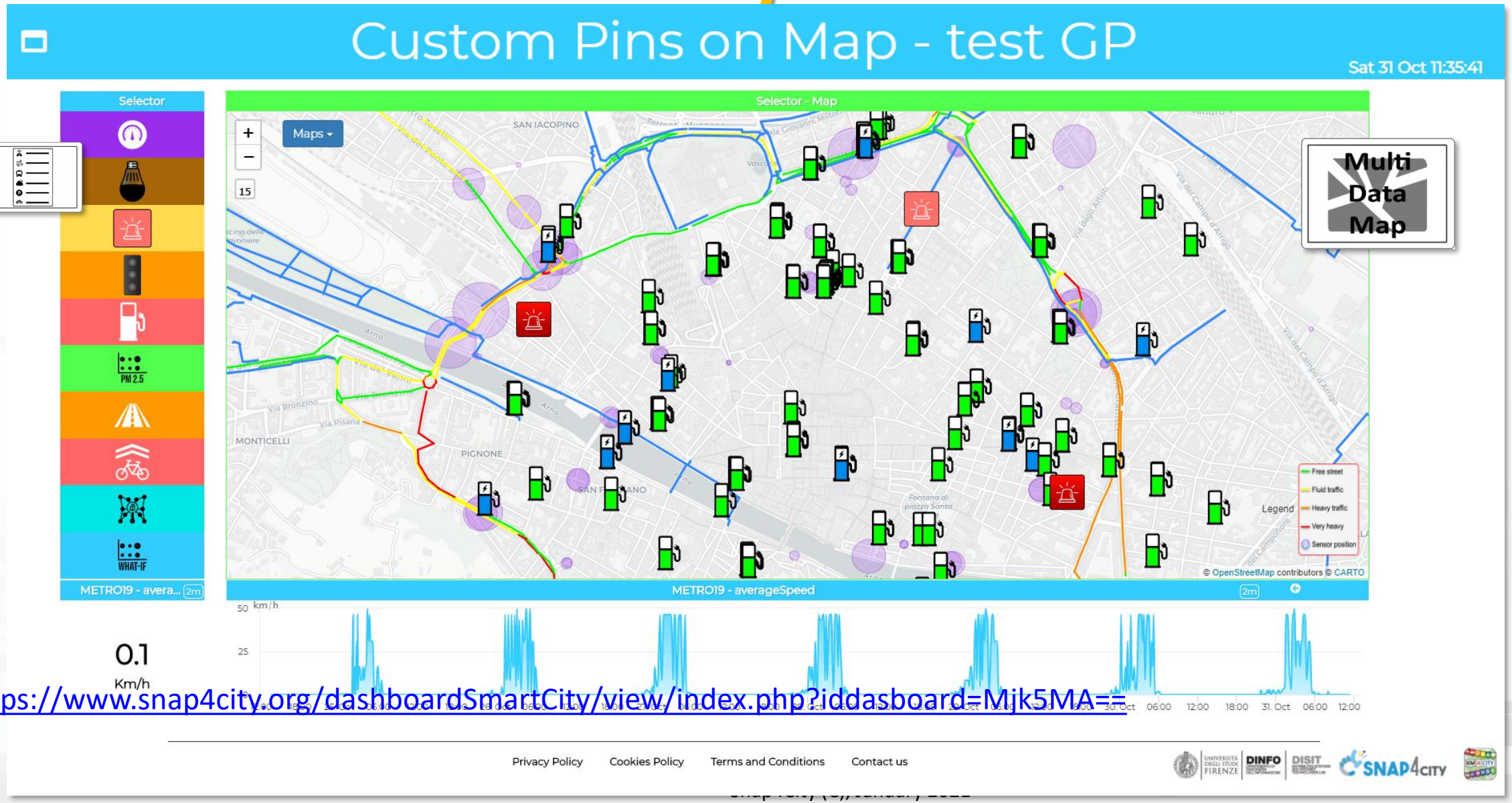
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTUzMg==

Weighted Bubbles



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

Custom Dynamic Pins



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

Other kinds of data on Multi Data Map

- **Orthomaps**: plain maps and and overlapped layers
- A range of **Pins Kinds** for marking Services, IOT Devices, etc.
- **Services**:
  - POI, MyPOI, IOT Devices, Sensors, Actuators, etc.
  - Cycling paths
  - Areas shapes: gardens, etc…
  - GIS data
- **Heatmaps**: different types
- **Special data:**
  - **Traffic Flows**
  - **Routing** and **What-If** analysis
    - Scenarious
- **3D** buildings
- ….

Pins on Multi Data Maps (1)

Normal Over

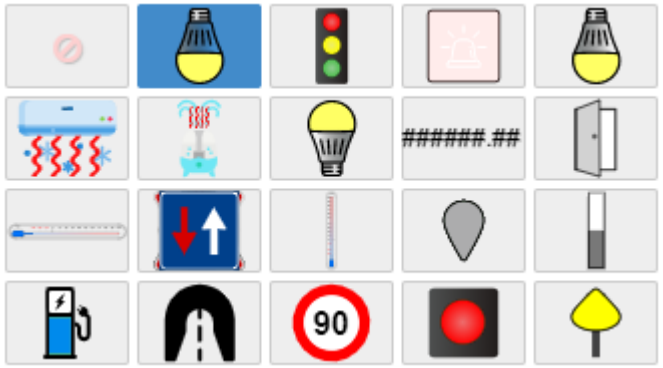
- **Classic**: (default)
  - Text menu or Icon Menu
    - Custom color of the Menu only
  - Fixed on the basis of Nature and Subnature

Normal Over Icon Menu

- **Icon**: (accessible as **Icon Mode** of selector)
  - Also usable with **Text Mode** of the menu
  - Selectable from a large set
  - Coherent with Icon on Menu
  - Custom Color

Pins on Multi Data Maps (2)

Bubble Pins



Pins and Menu icons

- **Bubble**:
  - Text Menu or Icon Menu
  - Custom Color
  - Size depending on ServiceURI Attribute, IOT Device ValueName
- **Custom**: (accessible from Alternate View Mode)
  - Can be created by AreaManagers as **Custom Widgets** https://www.snap4city.org/663
  - Selectable from a set
  - Coherent with Menu, also usable with text menu
  - Variable/Dynamic colors/animations associated with ServiceURI Attribute, IOT Dev ValueName

Data Kinds vs Graphic Widgets

How the Dashboards exchange data

Snap4City BigData Storage and KB

IOT Broker Orion Quantum Leap

ServiceMap Super ServiceMap

- Req. ServiceURI

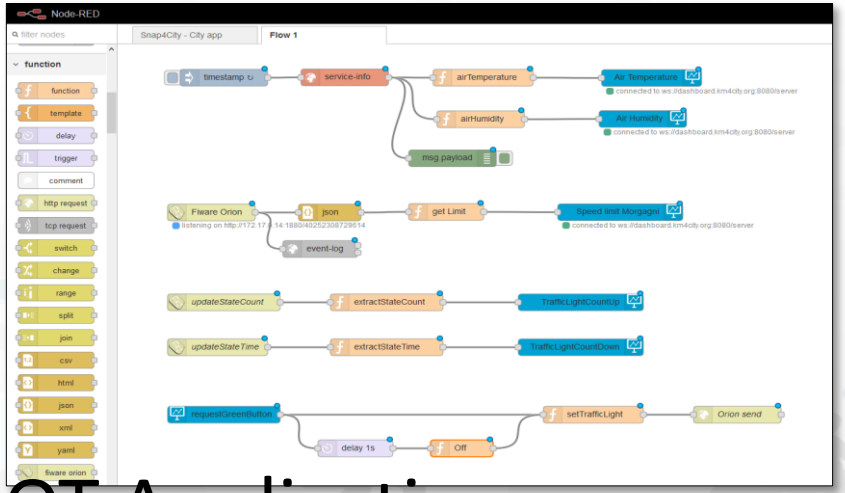
Metric, KPI

MyKPI, MyPOI, …

- Req. KPI, Metric ID
- Req. MyKPI ID

API, External Services, MicroApp

- Traffic Flow, MAPS, Heatmaps
- GIS, HTTPs URLs

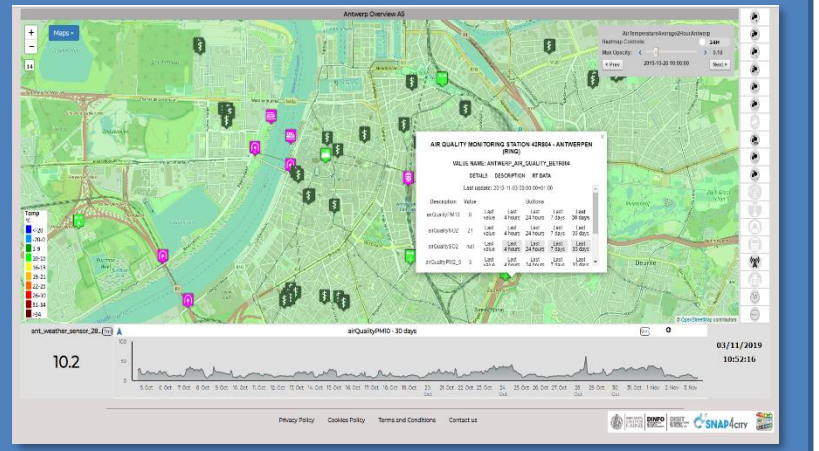


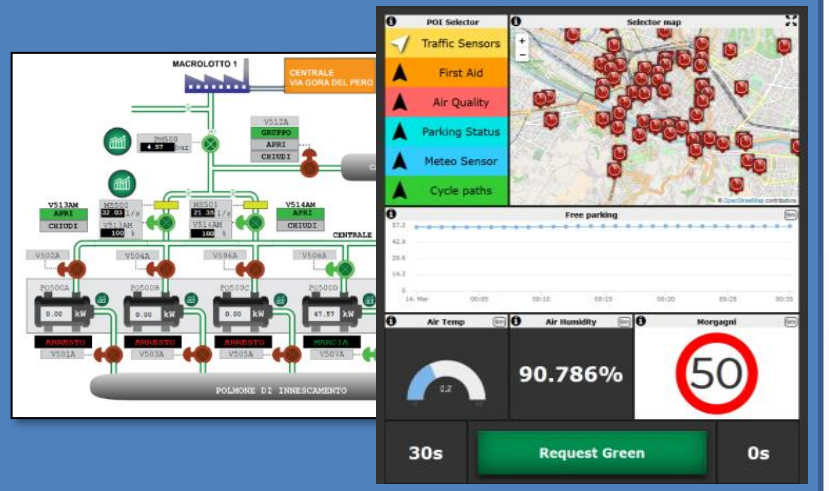
- ServiceURI (ID)
- MyKPI, Metric (ID)
- Dynamic Data, computed into IOT Application

- Rx. Dynamic Data
- Event Driven Synoptics
- Actions, Show

IOT Application

Dashboards





What the Dashboards can directly exploit

IOT Broker

IOT Broker

IOT Device

IOT Device

IOT Edge

Sensors/
Actuators

GIS data, Maps, …

Snap4City BigData
Storage and KB

External Data Stores

LD, LOD

API, External Services

DataGate

Web Scraping

IOT Application

From IOT App
to Dashboard

From Dashboard to IOT App

Dashboards

Big Data Analytics,
Artificial Intelligence
Access to all data

High Level Types

• **POI** (Point of Interest)	POI which define a data set from the Open Data or other collections
• **MyPOI**	POI generated from the IOT Applications, Mobile App

• **Sensor**	Real time data, IOT Devices, Time Series, elements of the a POI Collection, etc.
• **Sensor Actuator**	IOT Device element to Act on the field, e.g.: irrigator, light, setpoint, volume, etc.
• **Dashboard-IOT App**	Actions from Dashboards to IOT Applications

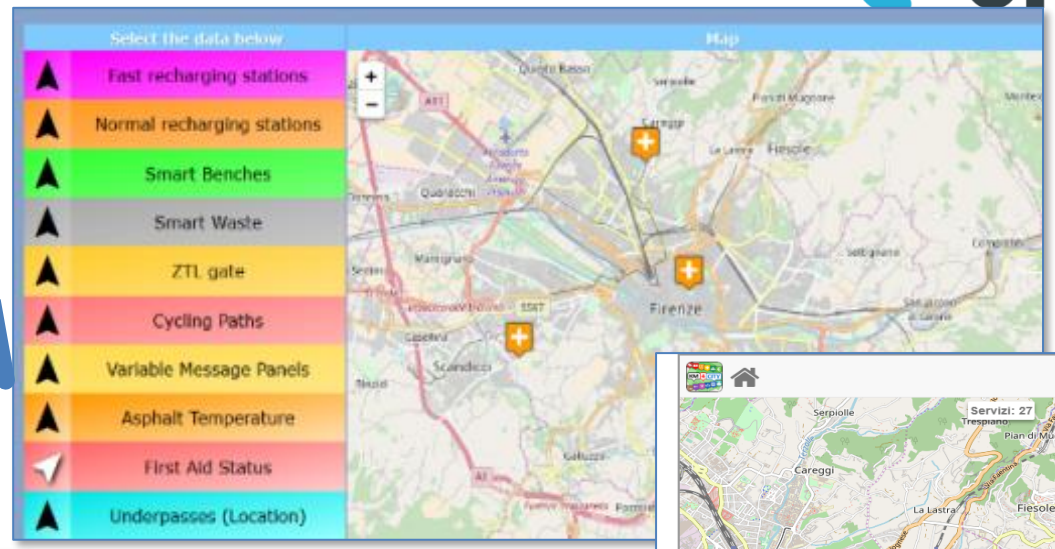
• **KPI** (metrics)	KPI defined from direct access to data base, usually for Industry, on premise
• **MyKPI**	time series also geolocalized over time generated from the IOT Applications, Mobile App
• **My Personal Data**	data which can be stored in a safer from the IOT Applications
• **My Data**	data which can be stored in a safer from the IOT Applications
• **Complex Event**	Events: critical or entertainment

• **Heatmap**	a) Heatmaps of different kind: PM10, NOX, people, accidents, altitude, vegetation, etc. b) **special tools** such as: traffic flow, scenario, what-if analysis
• **MicroApplication**	Views of Snap4City web applications
• **External Service**	External Web Pages or Tools: routing, traffic flow, people flow, etc.
• **Special Widget**	Clock, first aid, weather forecast, italian flag, Pub Transport quality, Twitter citations, etc.
• **WFS**/WMS (GIS)	data coming from GIS services
• **Synoptics**	Any kind of Custom Made Widgets created by using the SVG editor and dedicate tool.

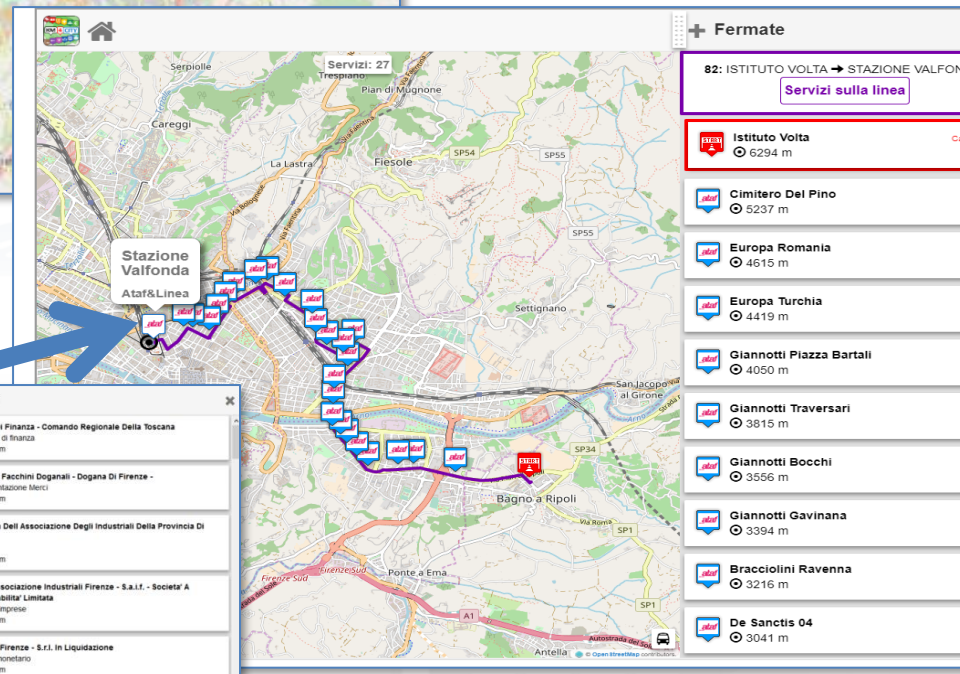
HLT: POI

High Level Types

- **Complex Event**
- Dashboard-IOT App
- **External Service**
- Heatmap
- KPI (Key Performance Indicator)
- **MicroApplication**
- My Personal Data
- MyKPI
- MyPOI
- **POI (Point of Interest)**
- Sensor
- Sensor Actuator
- **Special Widget**
- Wfs (GIS)



Categories

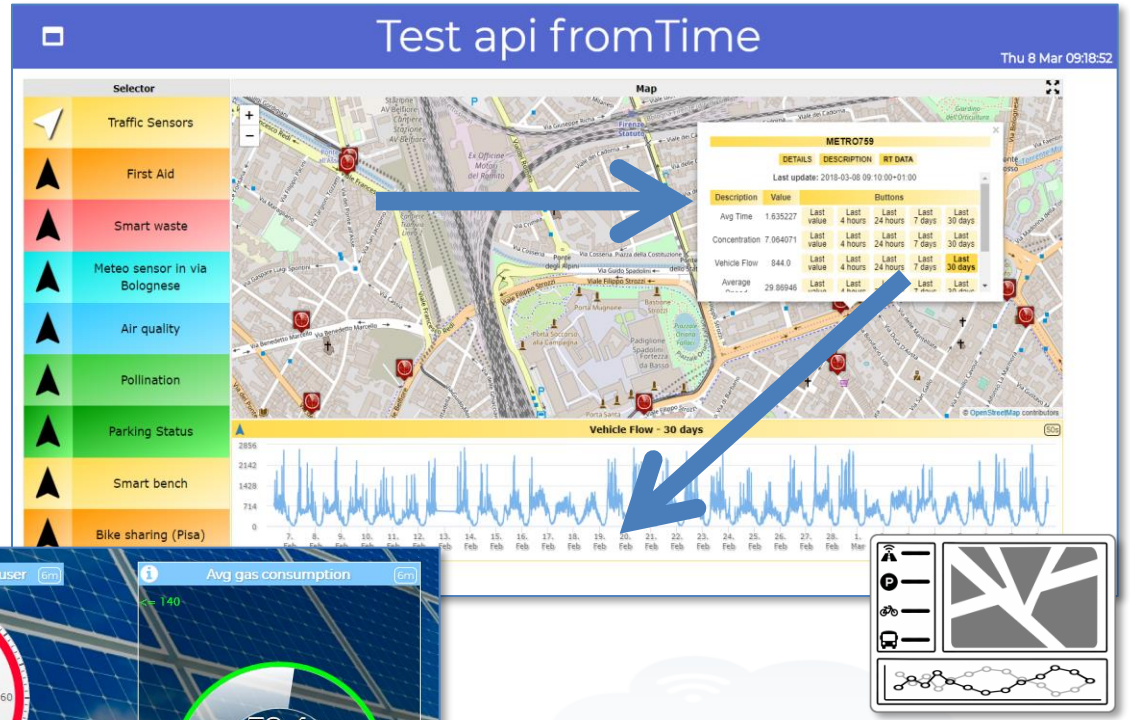


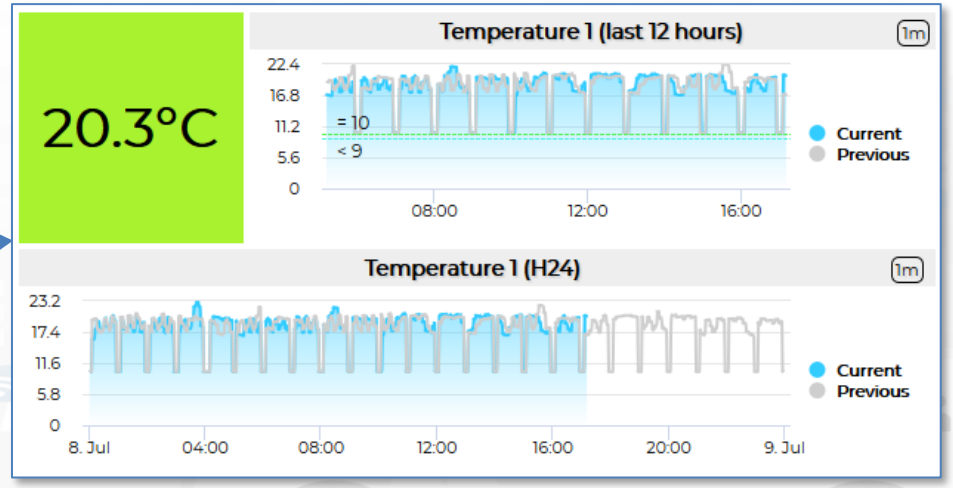
Single POI

HLT: Sensors

High Level Types

- **Complex Event**
- Dashboard-IOT App
- **External Service**
- **Heatmap**
- **KPI (Key Performance Indicator)**
- **MicroApplication**
- My Personal Data
- MyKPI
- MyPOI
- **POI (Point of Interest)**
- **Sensor**
- **(Sensor Actuator)**
- **Special Widget**
- Wfs (GIS)





Real Time
Event Driven
Historical Data

HLT: Sensors

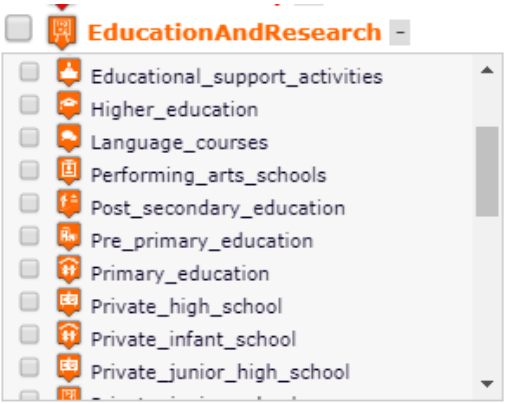
- Sensors can arrive in platform as follows (see **Nature**)
  - ***as processes*** in PULL
    - **As aPeriodic processes**
  - **From IOT Devices to KB** (knowledge base). Registered via IOT Directory, arriving via IOT Broker and saved into the Data Shadow,
    - **IOT data driven process** in PUSH
  - **From Dashboard to IOT Devices** (echo) is a virtual sensor **Sensor Actuators (HLT)**,
    - **IOT data driven process** in PUSH

IOT Data Driven

Nature

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

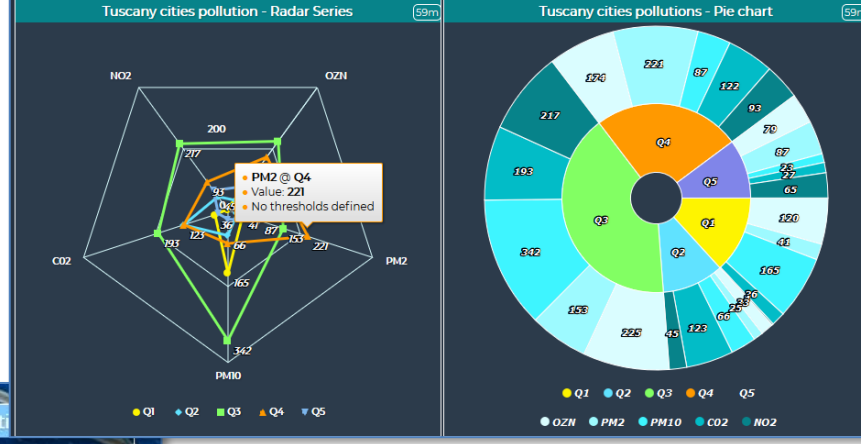
SubNature

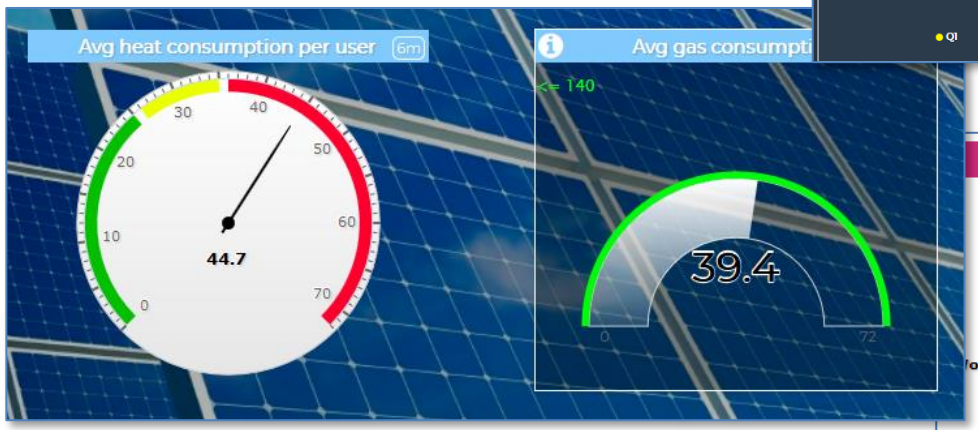


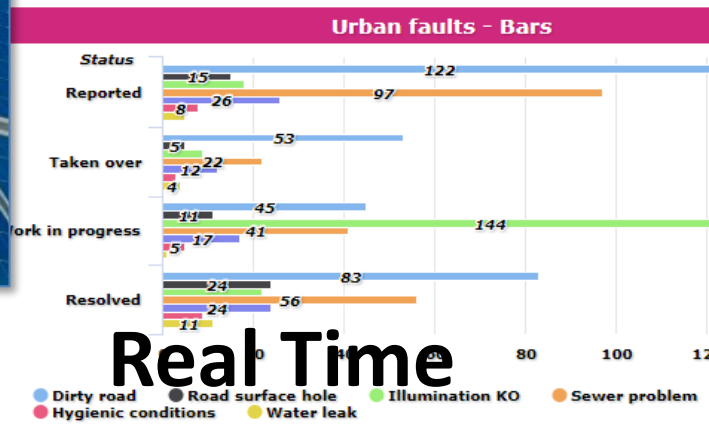
HLT: KPI (key Performance Indicator)

High Level Types

- **Complex Event**
- Dashboard-IOT App
- **External Service**
- **Heatmap**
- **KPI (Key Performance Indicator)**
- **MicroApplication**
- My Personal Data
- **MyKPI**
- MyPOI
- **POI (Point of Interest)**
- **Sensor**
- **Sensor Actuator**
- **Special Widget**
- Wfs (GIS)

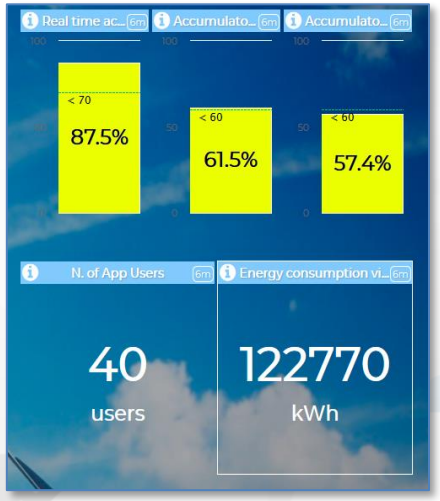




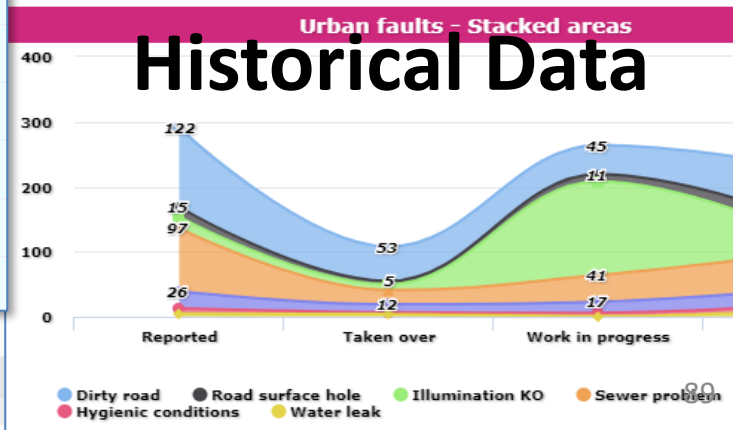


Real Time

Event Driven



Historical Data

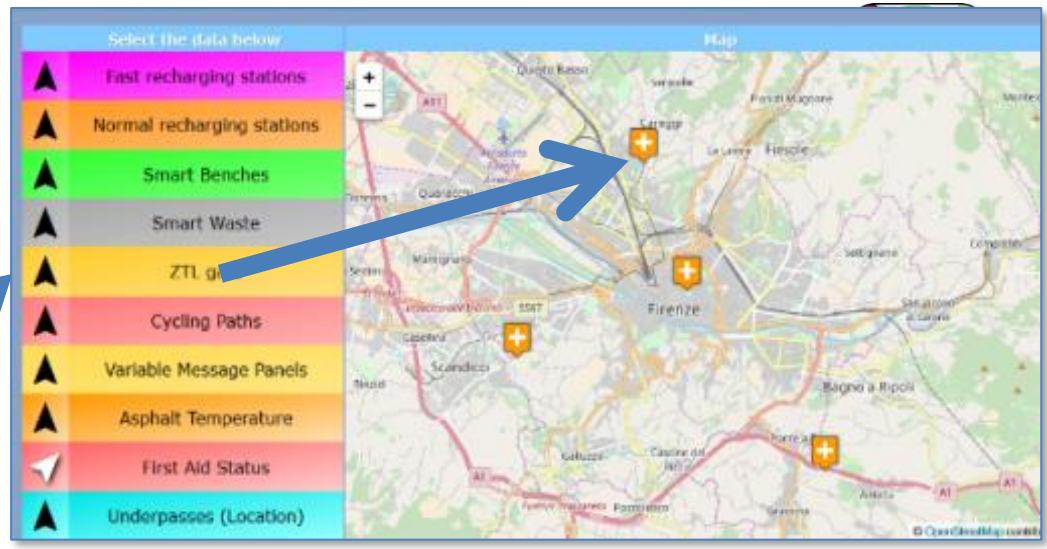


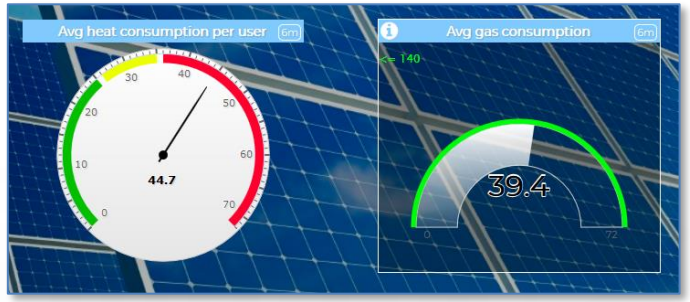
HLT: MyKPI, ……

High Level Types

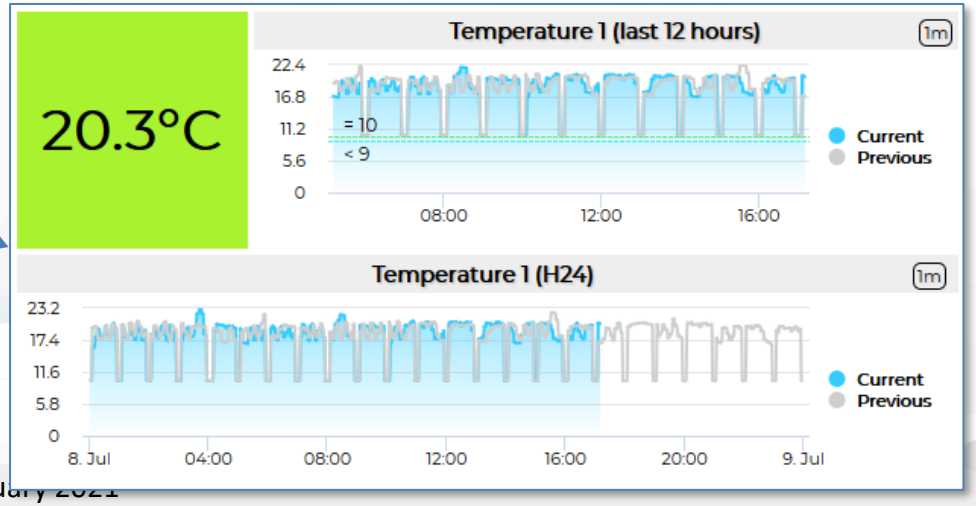
- Complex Event
- Dashboard-IOT App
- External Service
- Heatmap
- KPI (Key Performance Indicator)
- MicroApplication
- My Personal Data
- MyKPI
- MyPOI
- POI (Point of Interest)
- Sensor
- Sensor Actuator
- Special Widget
- Wfs (GIS)

MyPOI may become POI with the action of Admin





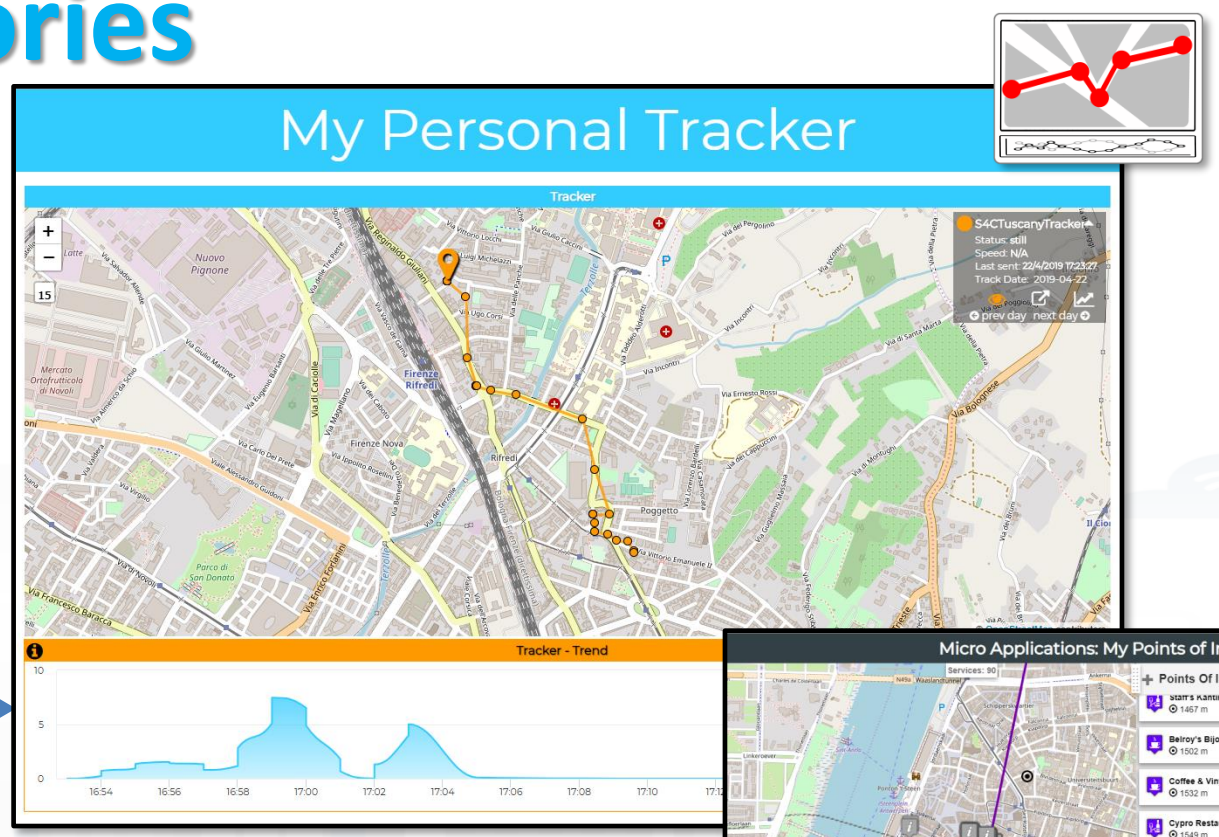
Real Time
Event Driven
Historical Data

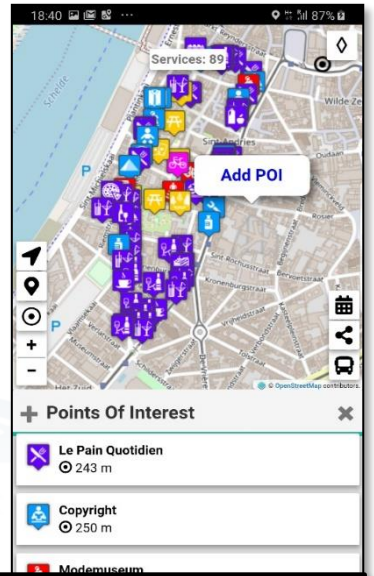


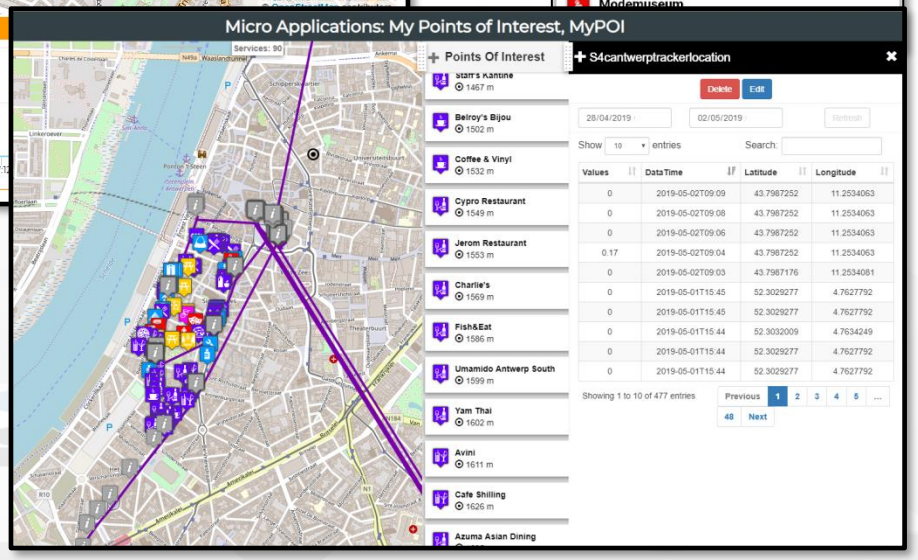
MyKPI as Trajectories

High Level Types

- Complex Event
- Dashboard-IOT App
- External Service
- Heatmap
- KPI (Key Performance Indicator)
- MicroApplication
- My Personal Data
- MyKPI
- MyPOI
- POI (Point of Interest)
- Sensor
- Sensor Actuator
- Special Widget
- Wfs (GIS)

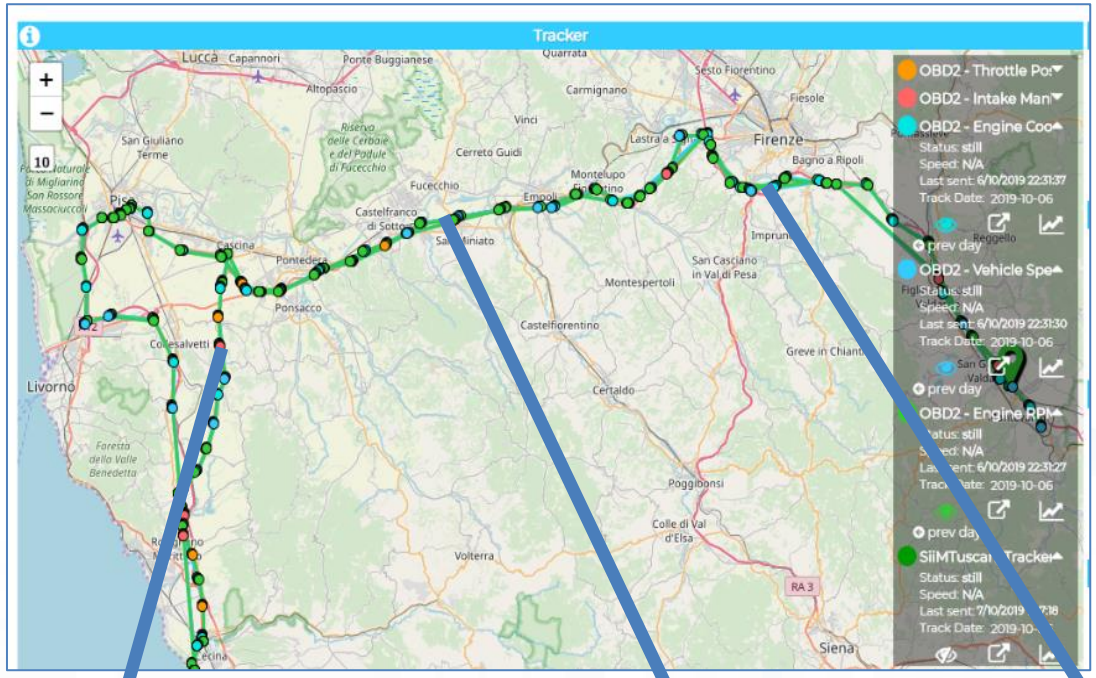


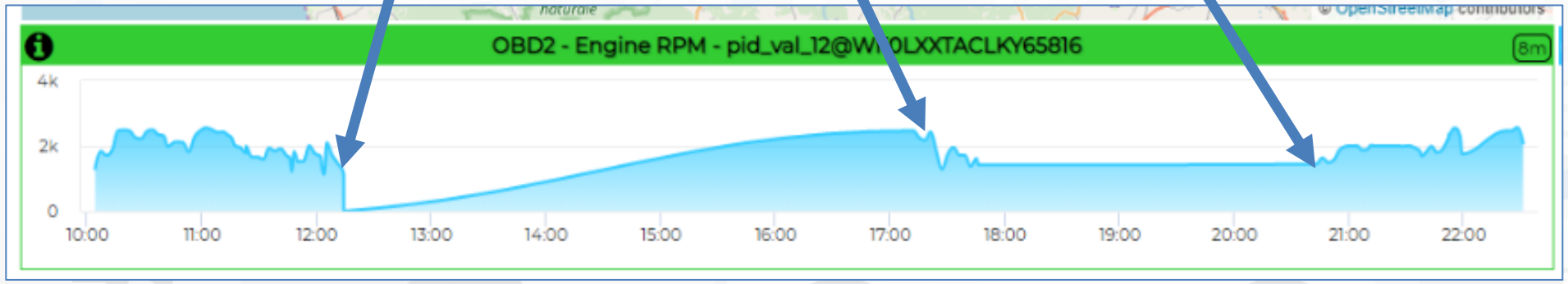




- Real Time Tracking
- Hystorical Tracks
- MicroApplications

MyKPI: Time Series over GSP locations





Moving Sensors
Moving devices
Tracking

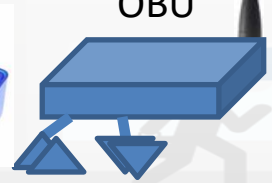
MyKPI: Tracking of Devices and Mobiles

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

Mobile
PAX Counter

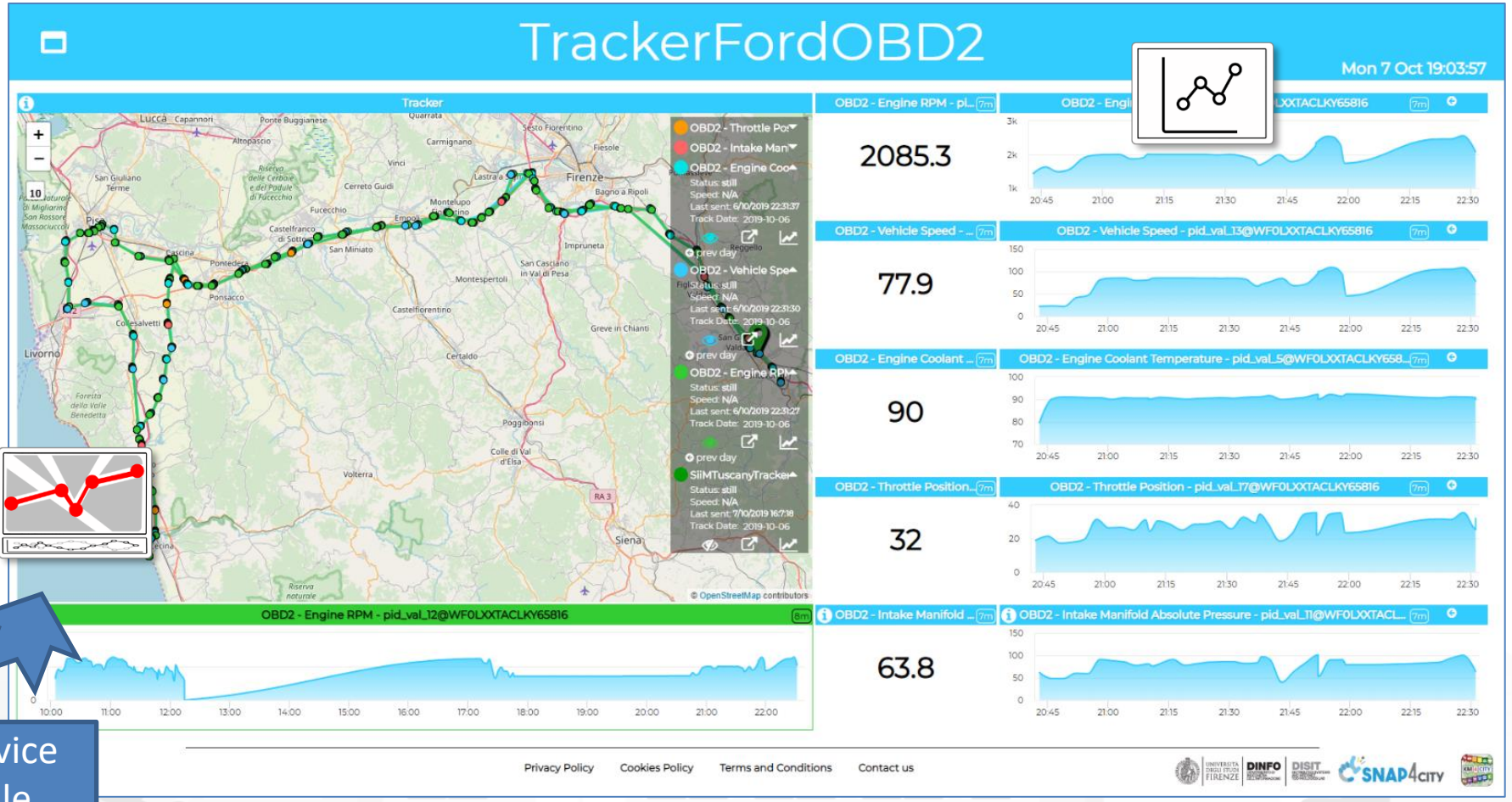
Apps

OBD2

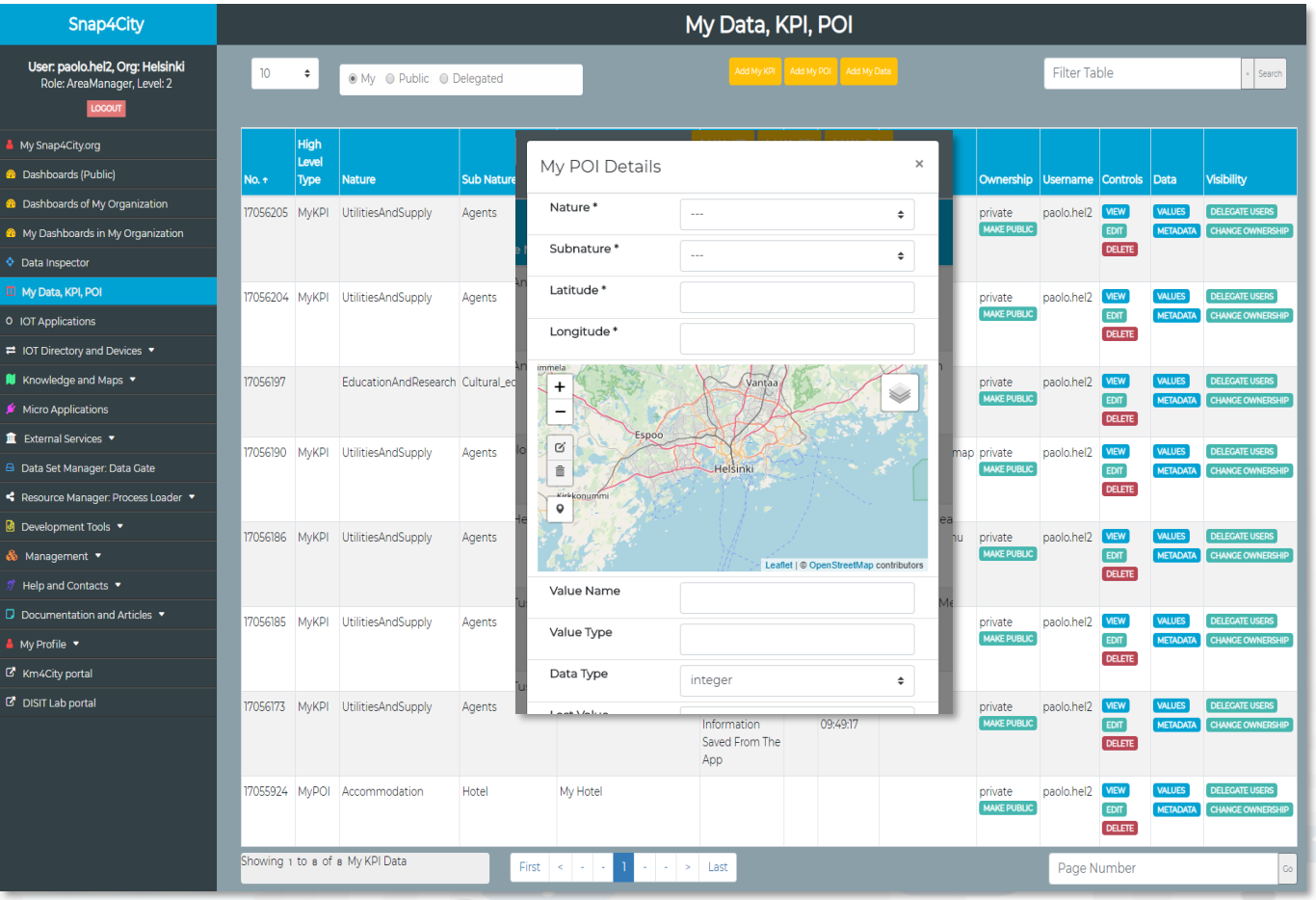


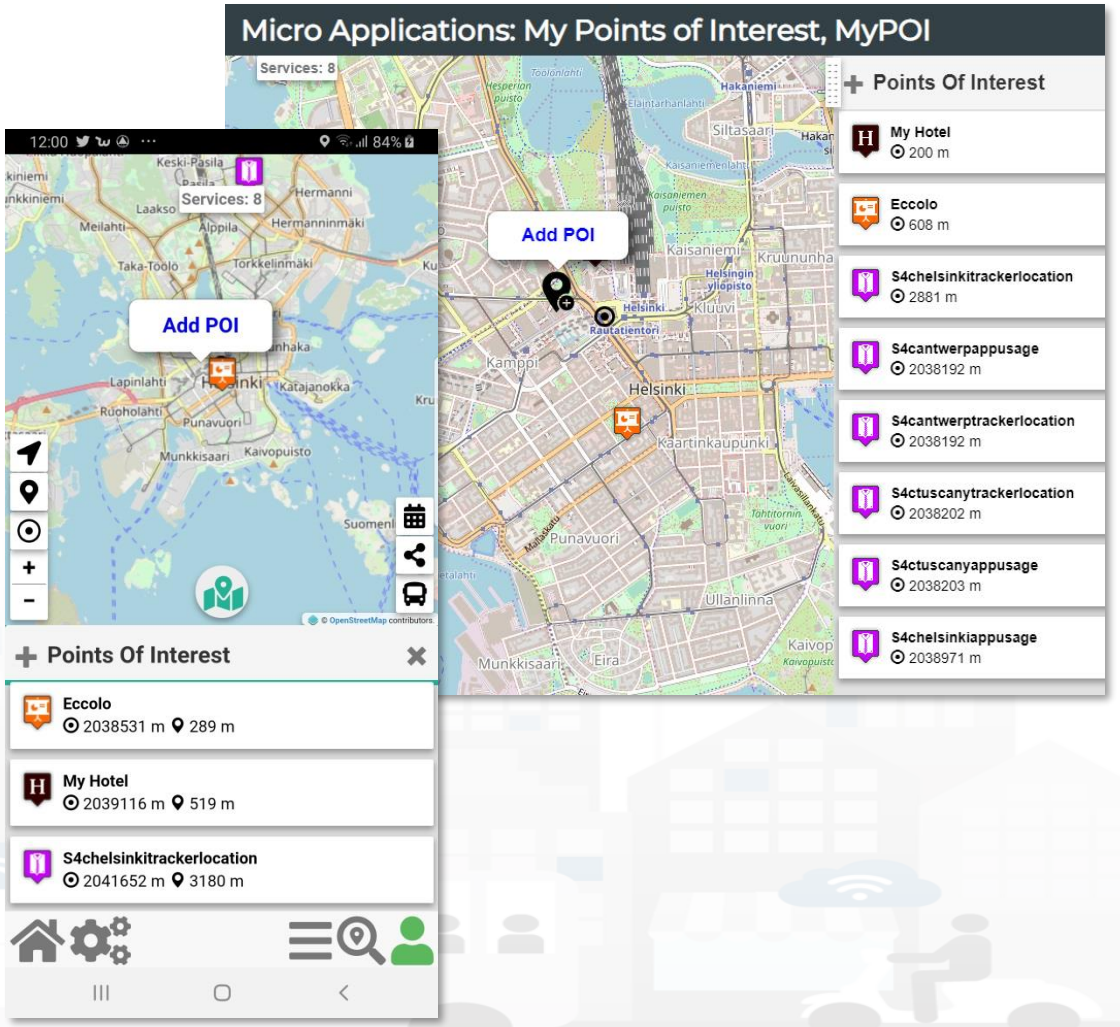
OBU

IOT Device
MObile



MyKPI, MyPOI: Management as GDPR



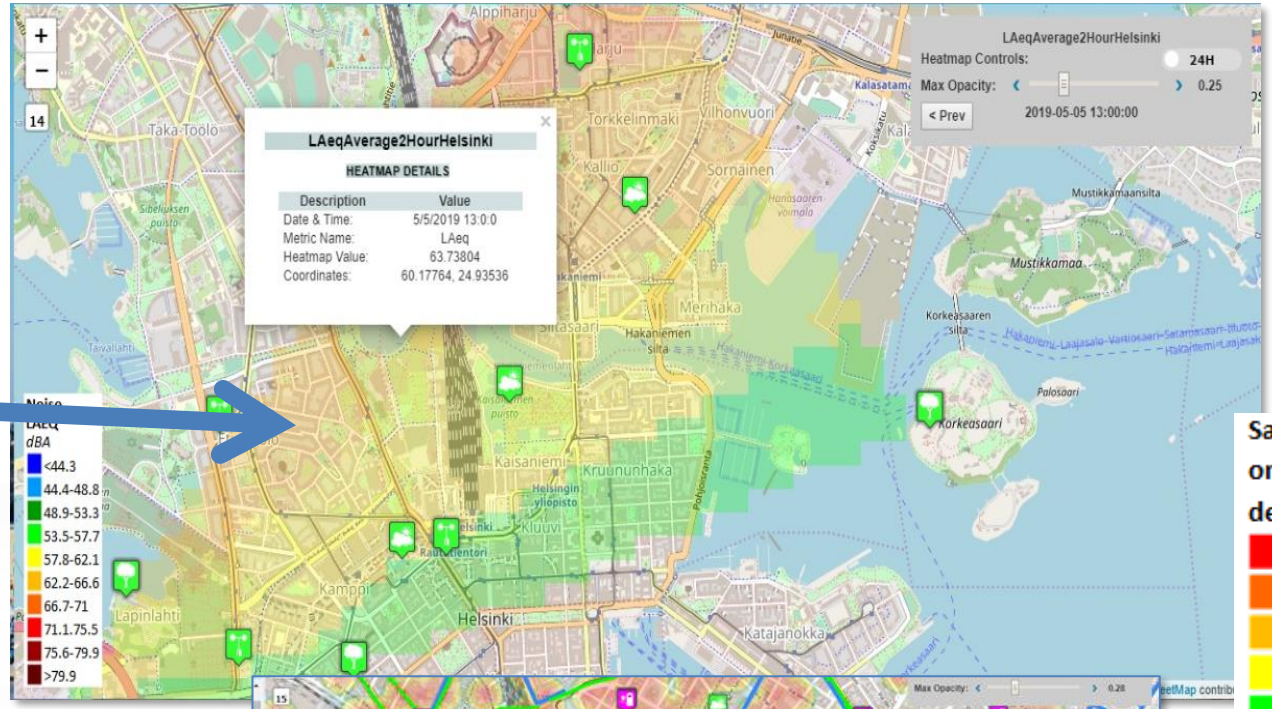


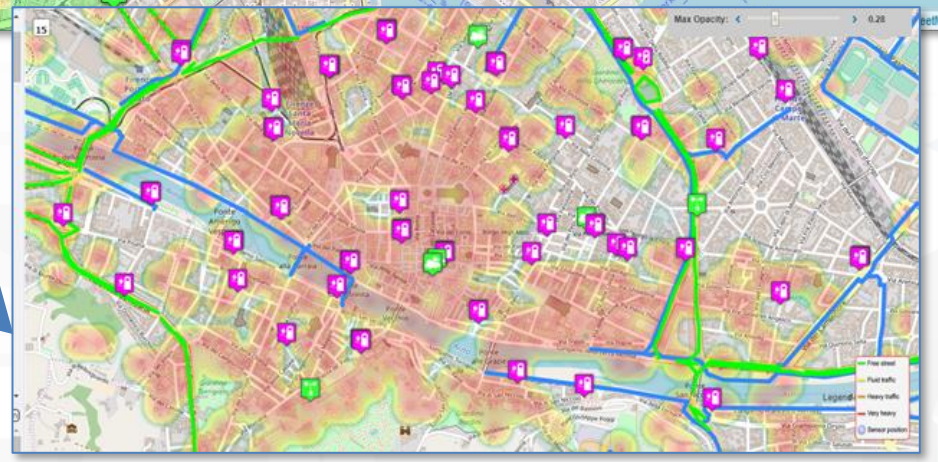
HLT: Heatmaps

High Level Types

- **Complex Event**
- Dashboard-IOT App
- **External Service**
- **Heatmap**
- KPI (Key Performance Indicator)
- **MicroApplication**
- My Personal Data
- MyKPI
- MyPOI
- **POI (Point of Interest)**
- Sensor
- Sensor Actuator
- **Special Widget**
- Wfs (GIS)

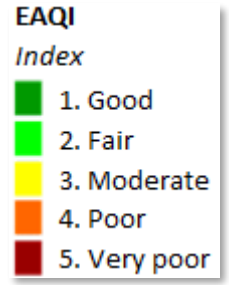
Type: calibrated

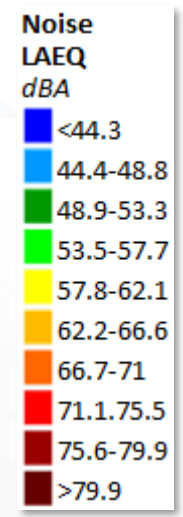




Type: Gaussian

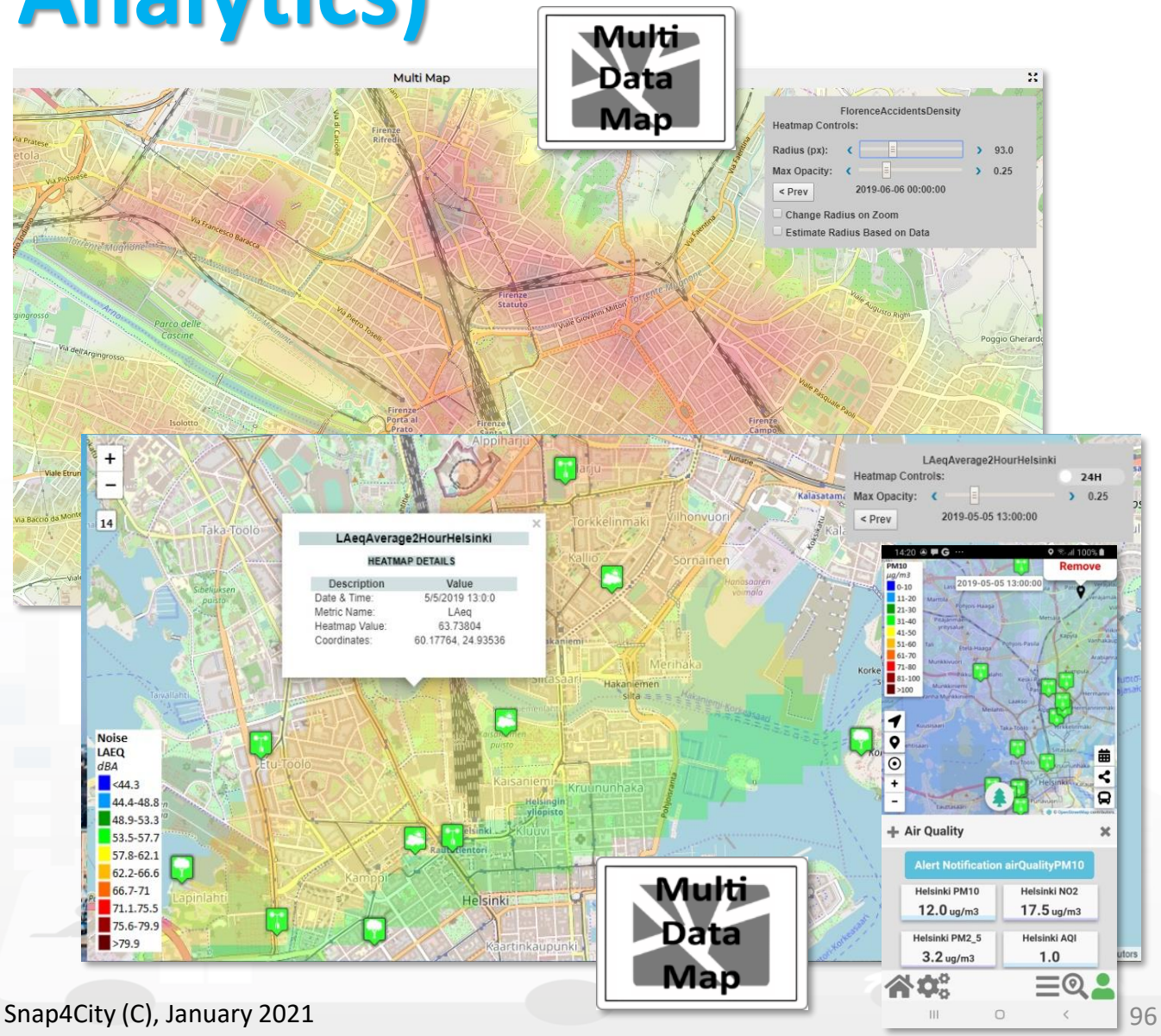
ColorMaps For Calibrated





Heatmaps (flexible Data Analytics)

- **Main:**
  - **Heatmaps are Time series**
- **A) Gaussian Heatmaps**
- **B) Calibrated heatmaps**
  - From KmxKm to 4x4 mt
  - PM10, PM2.5, SO2, NO2, Noise, NO, O3, Enfuser, **GRAL**,…. Copernicus
  - Any programmed ColorMap
  - Animations
  - Piking values in any place, values on their position.
  - On Web and Mobile App



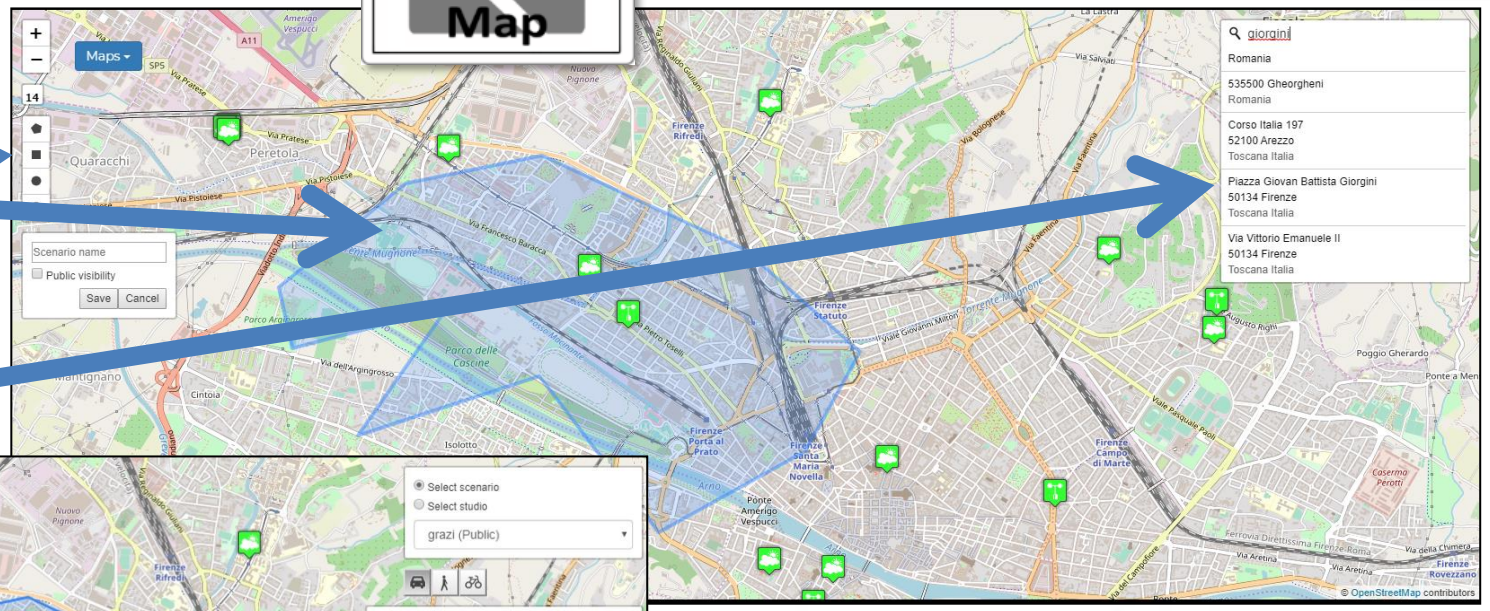
HeatMap Manager: managing, colormaps

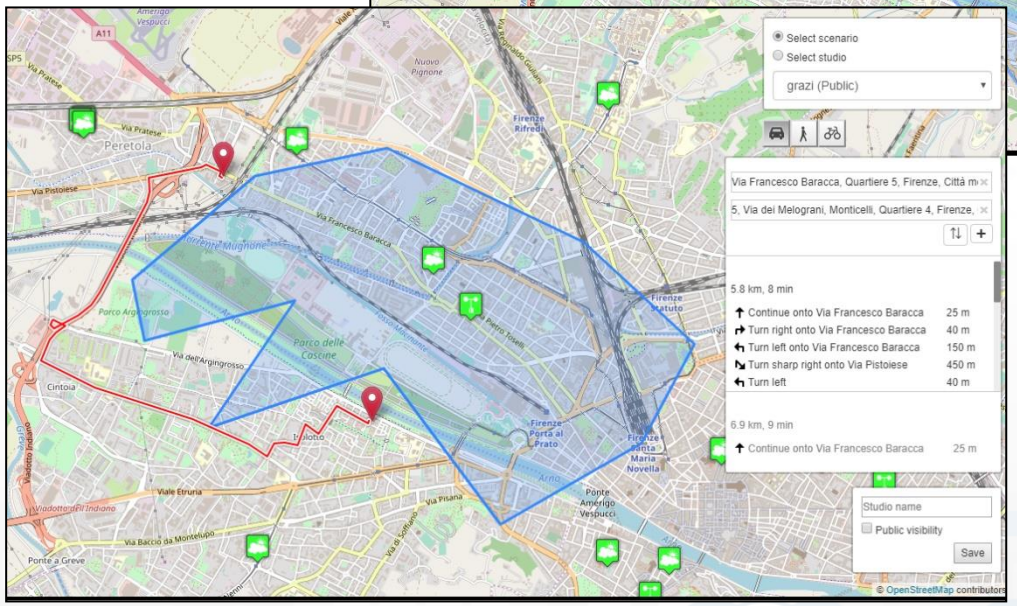
- Historical data, time series
- Huge amount of data and points per heatmap
- Data coming from: sensors, IOT App, Copernicus Satellite, …
- Multiple formats
- High speed computing
- WMS (GIS) compliant
- Animations
- Color maps: from few (5) to dense color scale (1000)
- Picking any place
- Smart City API to get them
- MicroServices for IOT Applications

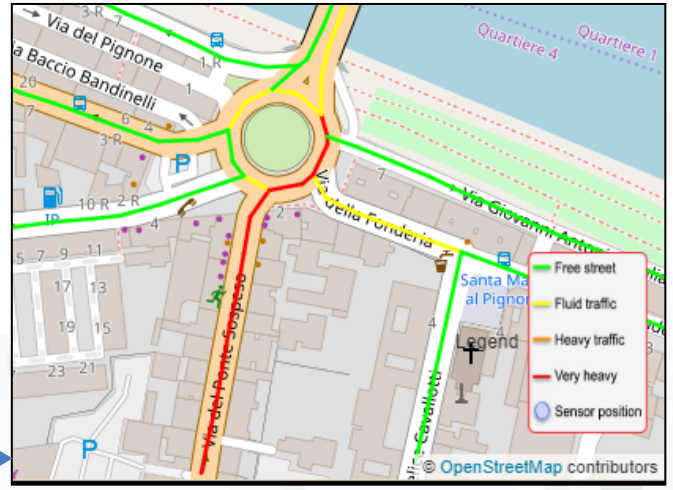
HLT: Special Tools

High Level Types

- **Scenarious**
  - Full text search of roads and geolocations. Global map of OSM
- **What-IF**
  - Conditional routing
  - Dynamic routing
  - Multiple paths
- **Traffic Flows**







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

HLT: WFS (GIS)

High Level Types

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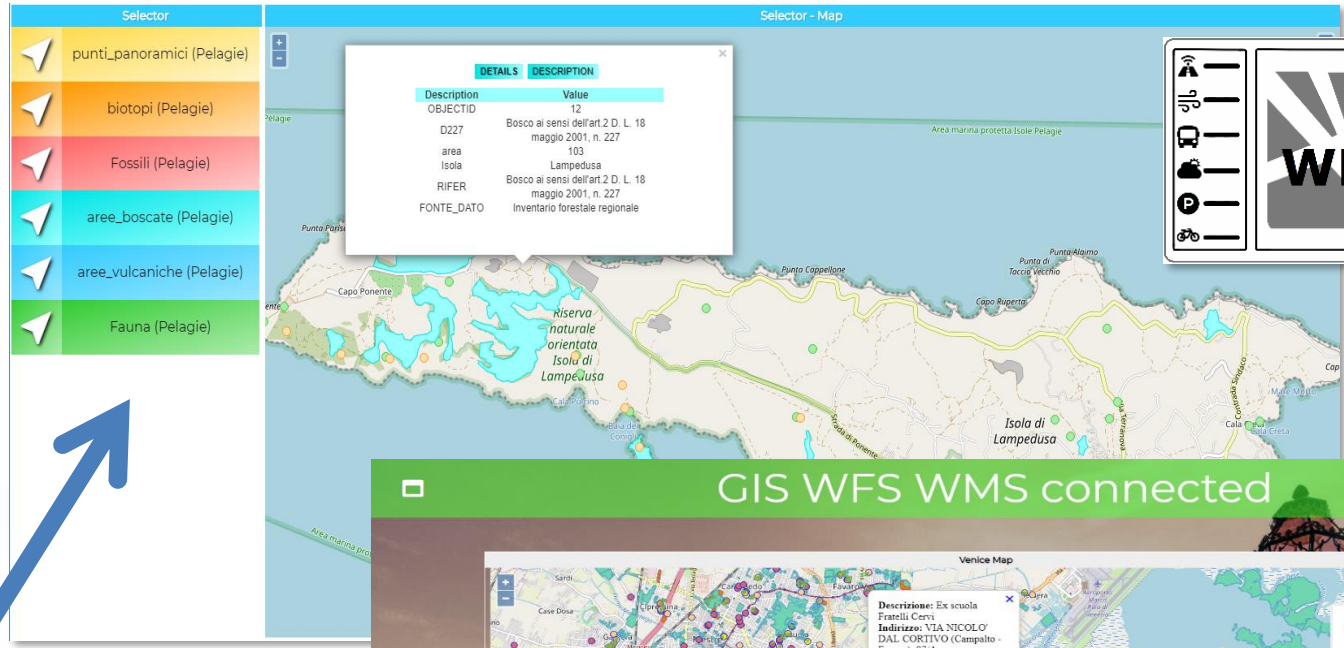
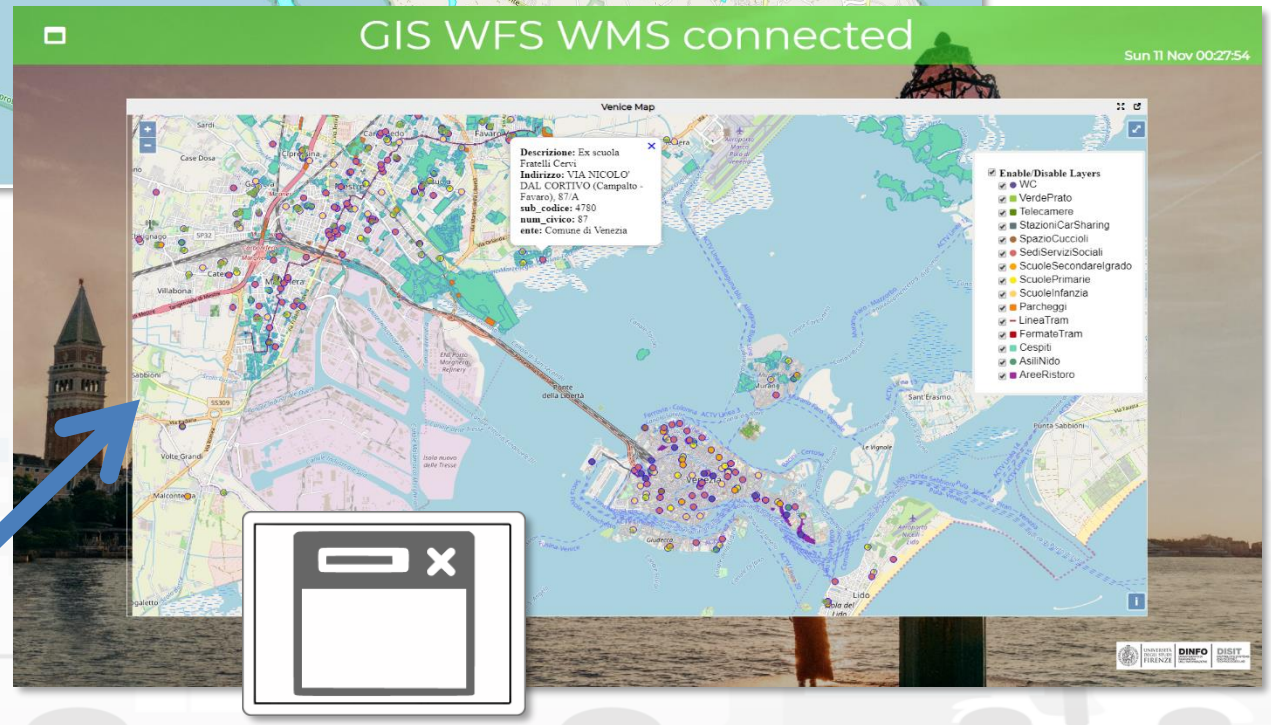
- Sensor
- Sensor Actuator
- Special Widget
- WFS (GIS)





-Points
-Shapes, paths
-Heatmaps
-.....

Snap4City WFS WMS Tools

HLT: WFS (GIS)

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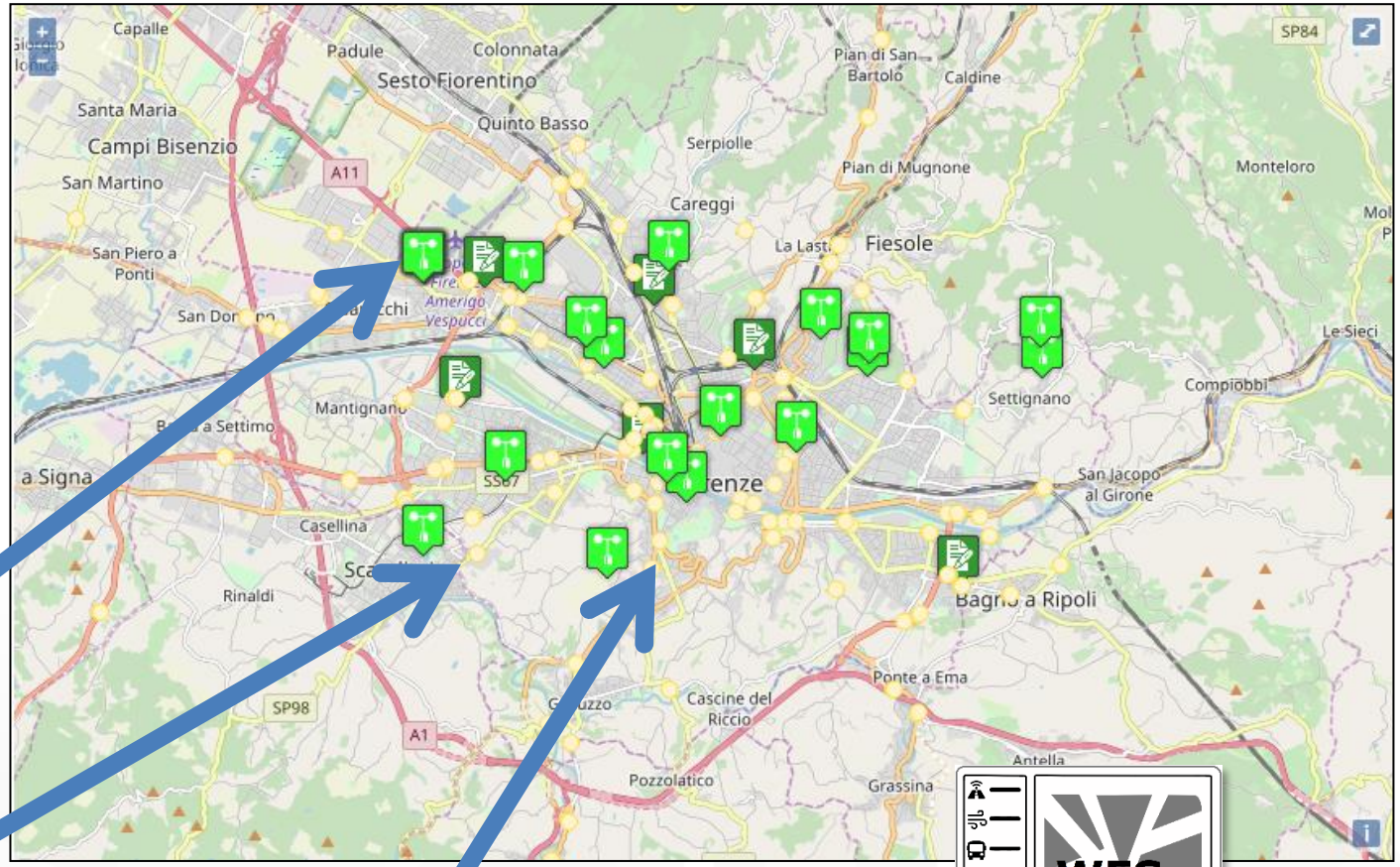

GIS WFS Servers

Special Widgets vs Special Data

HLT: Complex events

High Level Types

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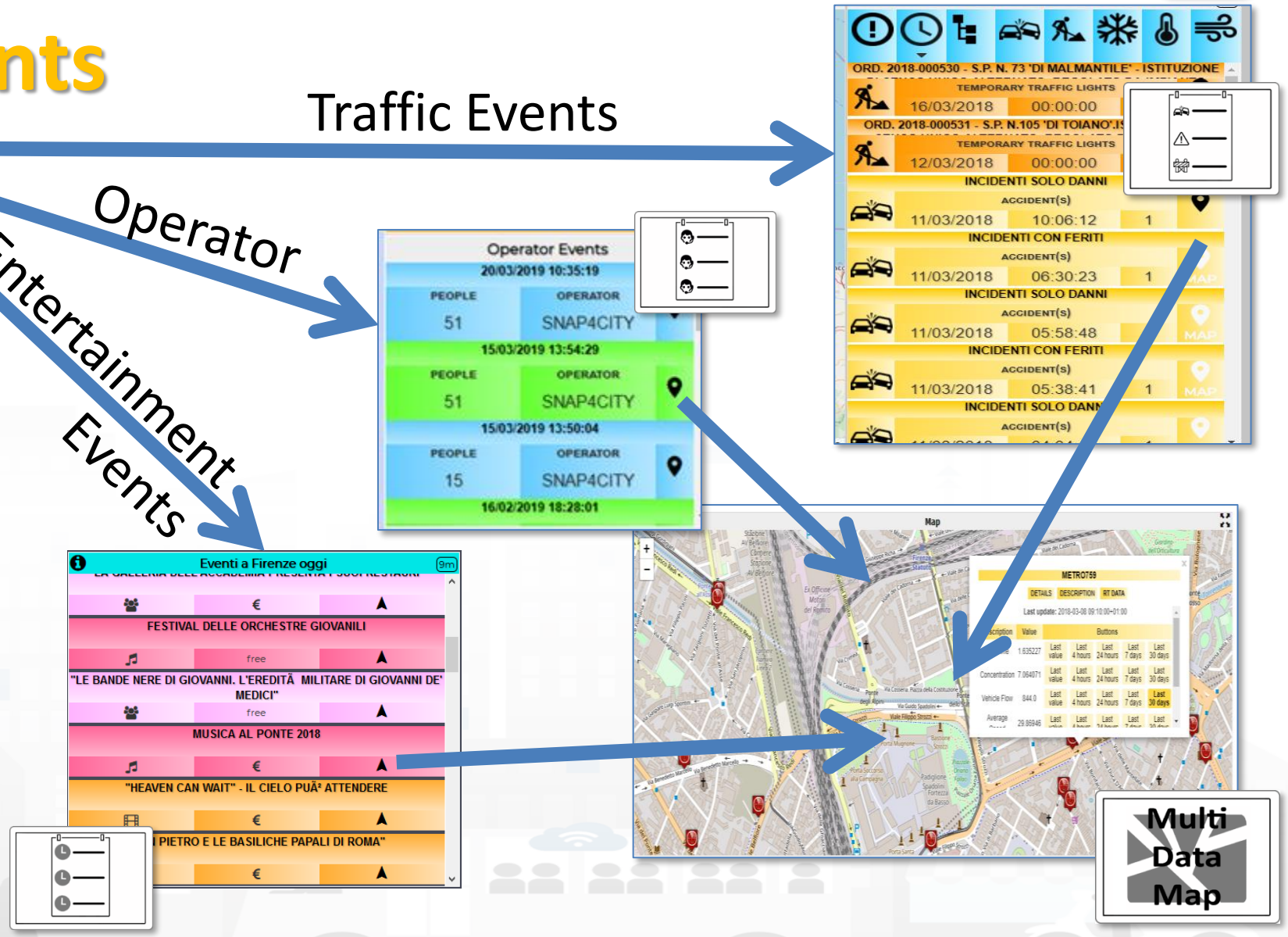

HLT: Special Widgets

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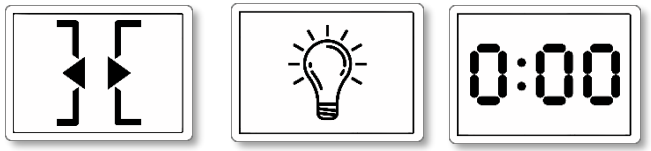
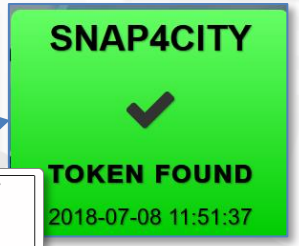
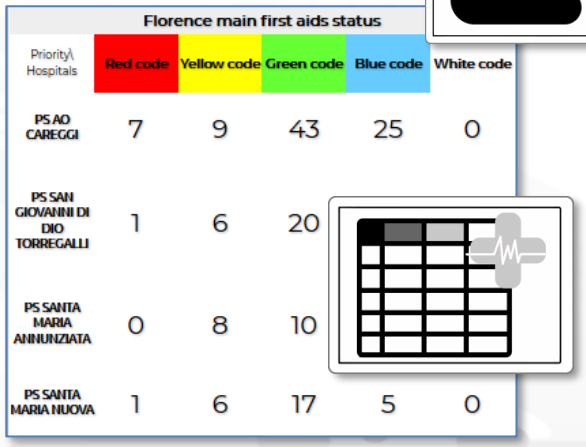
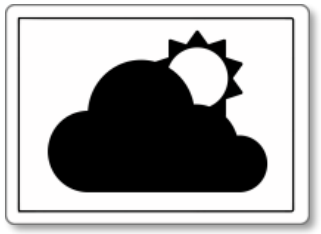
- Wfs (GIS)









Firenze Powered by LaMMA
Nuvoloso
8°C / 15 °C

Lunedì 2 Marzo
Pioggia debole
8°C / 13°C

Martedì 3 Marzo
Pioggia debole
10°C / 15°C

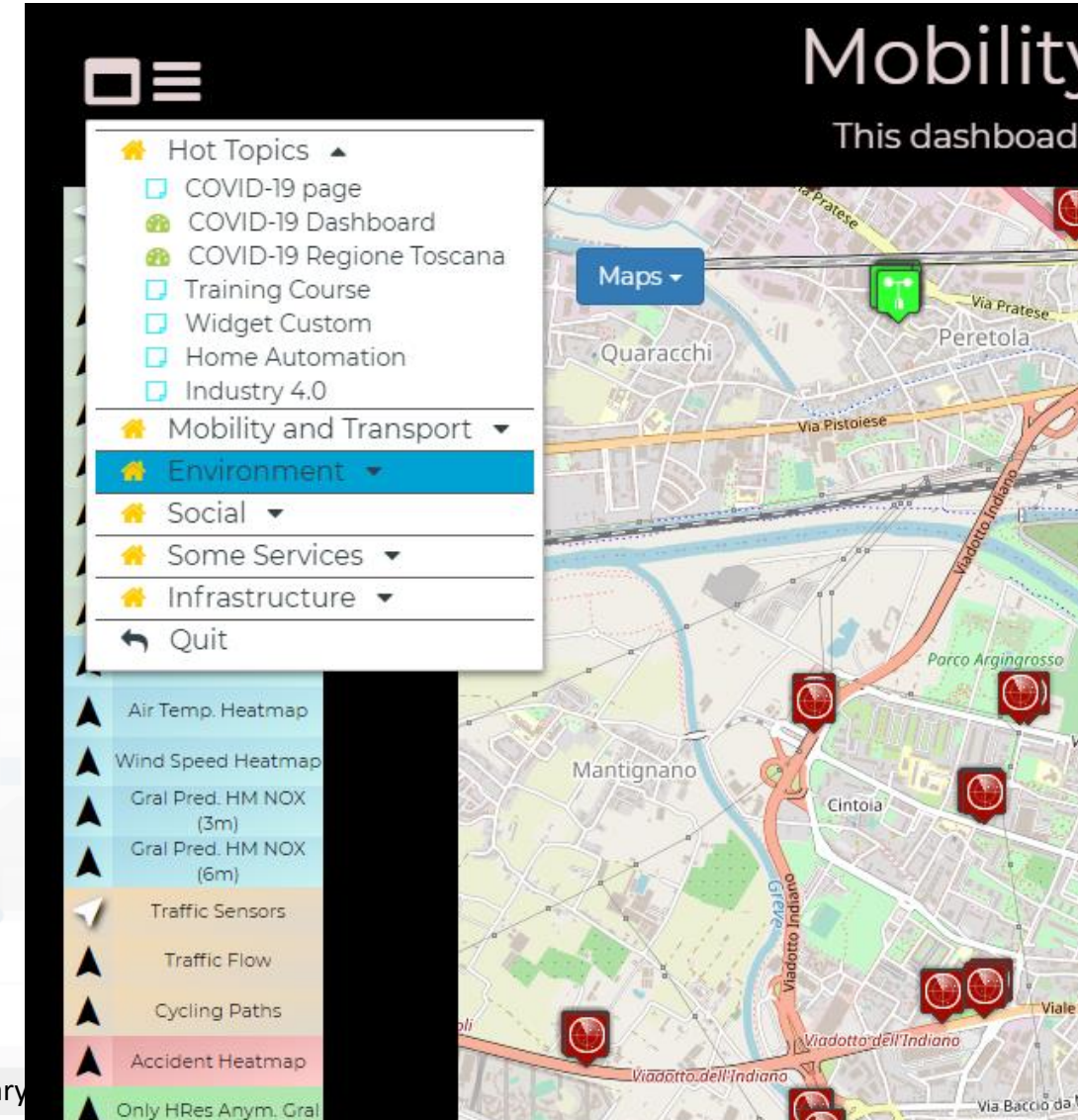
Mercoledì 4 Marzo
Pioggia e schiarite
Temp N/A

Giovedì 5 Marzo
Poco nuvoloso
Temp N/A

The Organization and its Dashboard menu

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==

Mixt per Roma

MENU

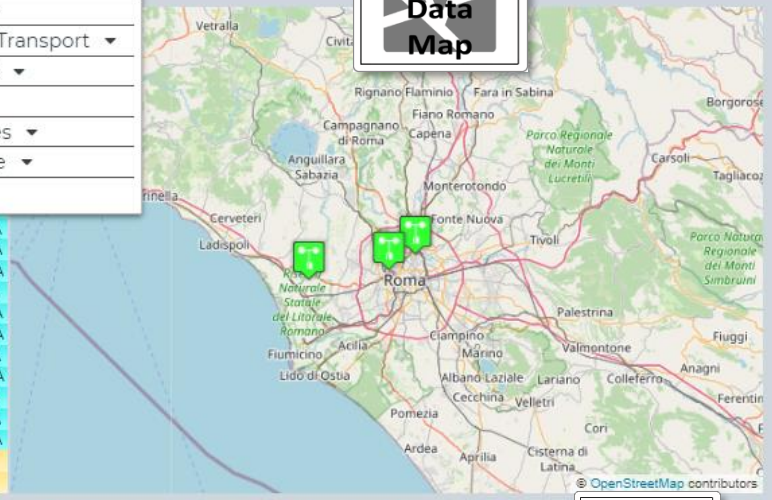
Roma Demo3 (Qualità dell'Aria)

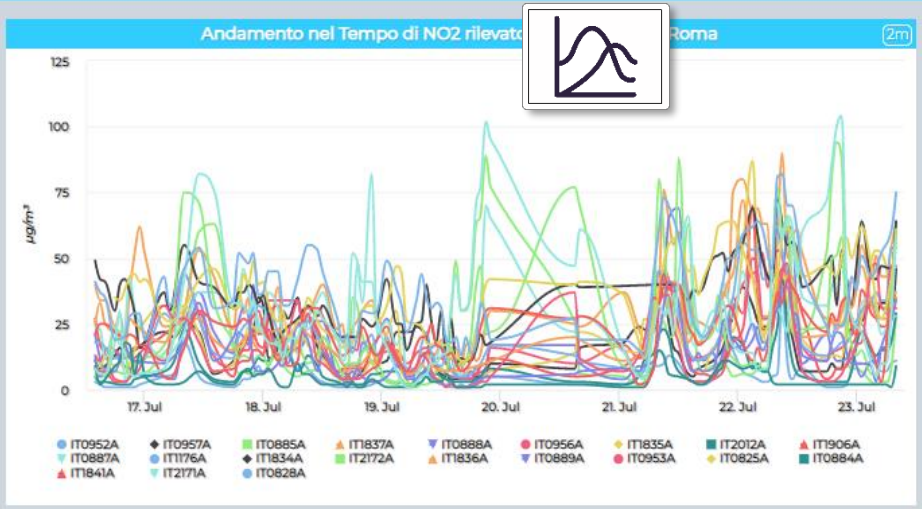
Thu 23 Jul 13:35:09

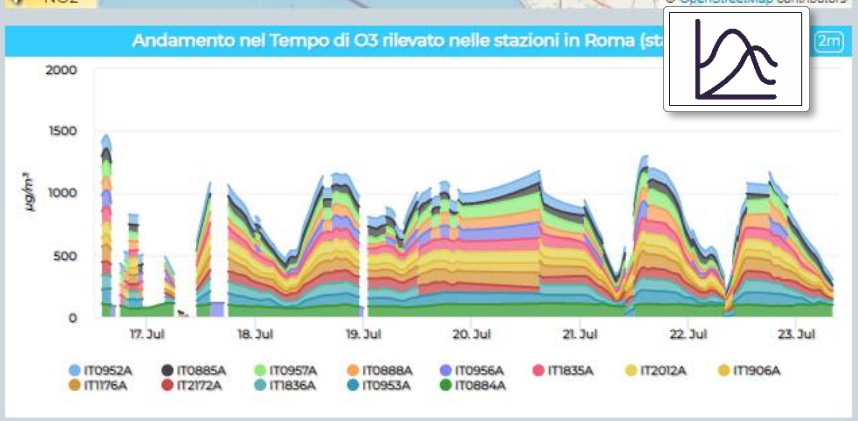
- Mobility and Transport
- Environment
- Social
- Some Services
- Infrastructure
- Quit

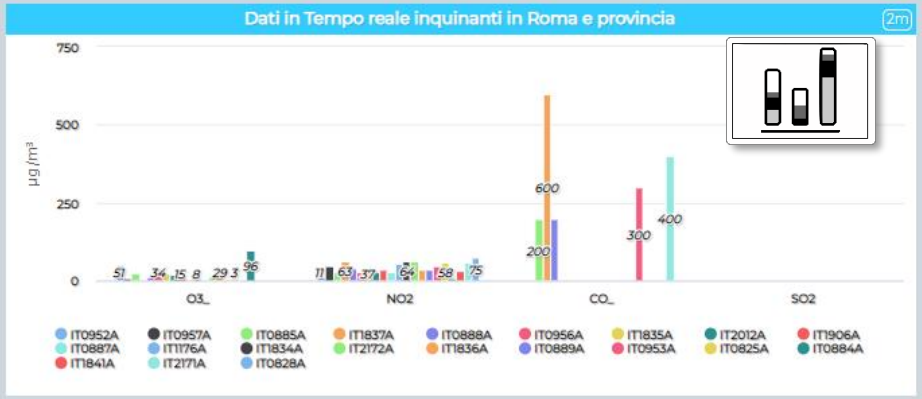
Multi Data Map

IT1836A
IT0957A
IT0828A
IT2171A
IT0952A
IT0885A
IT1837A
IT0888A
IT1176A
IT1835A
IT1834A
O3
NO2









Valori Inquinanti in tempo reale, mappe 2m

value type / value name	O3_	NO2	CO_	SO2
IT0952A	51	11		
IT0957A	7	46		
IT0885A	25	29	200	
IT1837A		63	600	
IT0888A	11	37	200	
IT0956A	34	29		
IT1835A	24	37		
IT2012A	20	29		
IT1906A	15	34		
IT0887A		28		
IT1176A	8	54		
IT1834A		64		
IT2172A	15	61		
IT1836A	29	35		
IT0953A	3	47	300	1.3
IT0889A		34		
IT0825A		58		
IT0884A	96	9		
IT1841A		31		
IT2171A		57	400	
IT0828A		75		

Home Trasporti

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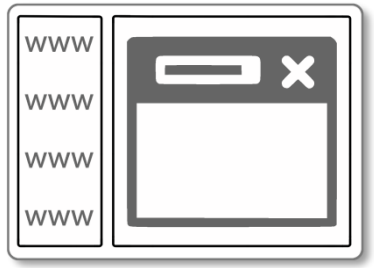
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjcyNg==

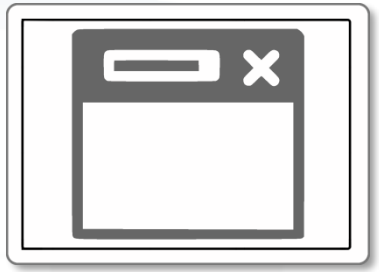
TOP

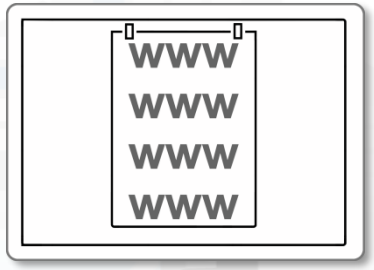
External Services (integration of) your of third party web pages

Dashboard Usage and Recipes

- https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc3NA==
- **External Content Widget (optional zoom feature):**
  - **External Services**: Web Pages, web sites, web tools (registered or not)
    - Tools: Twitter Vigilance, Origin Destination Matrices, WiFi Tool, …
    - GIS & MAPs: ServiceMap, ArcGIS, ServiceMap3D, GoogleMap, etc. etc.
    - TV CAM Proxy adapted, VideoCam Streams, …
  - **MicroApplications**
    - More than 300 micro applications based on Snap4City and Km4City Tech.
  - **Synoptics and Custom widgets**
  - **Snap4City pages**: Form discussion, help desk, user manual, …
  - **Snap4City Dashboards** for nested views, MultiDashboards views
    - Ultra ultra HD screens….
- **Selector WEB**
  - Anything that can be shown on External Content WG, one or more







HLT: External Services

High Level Types

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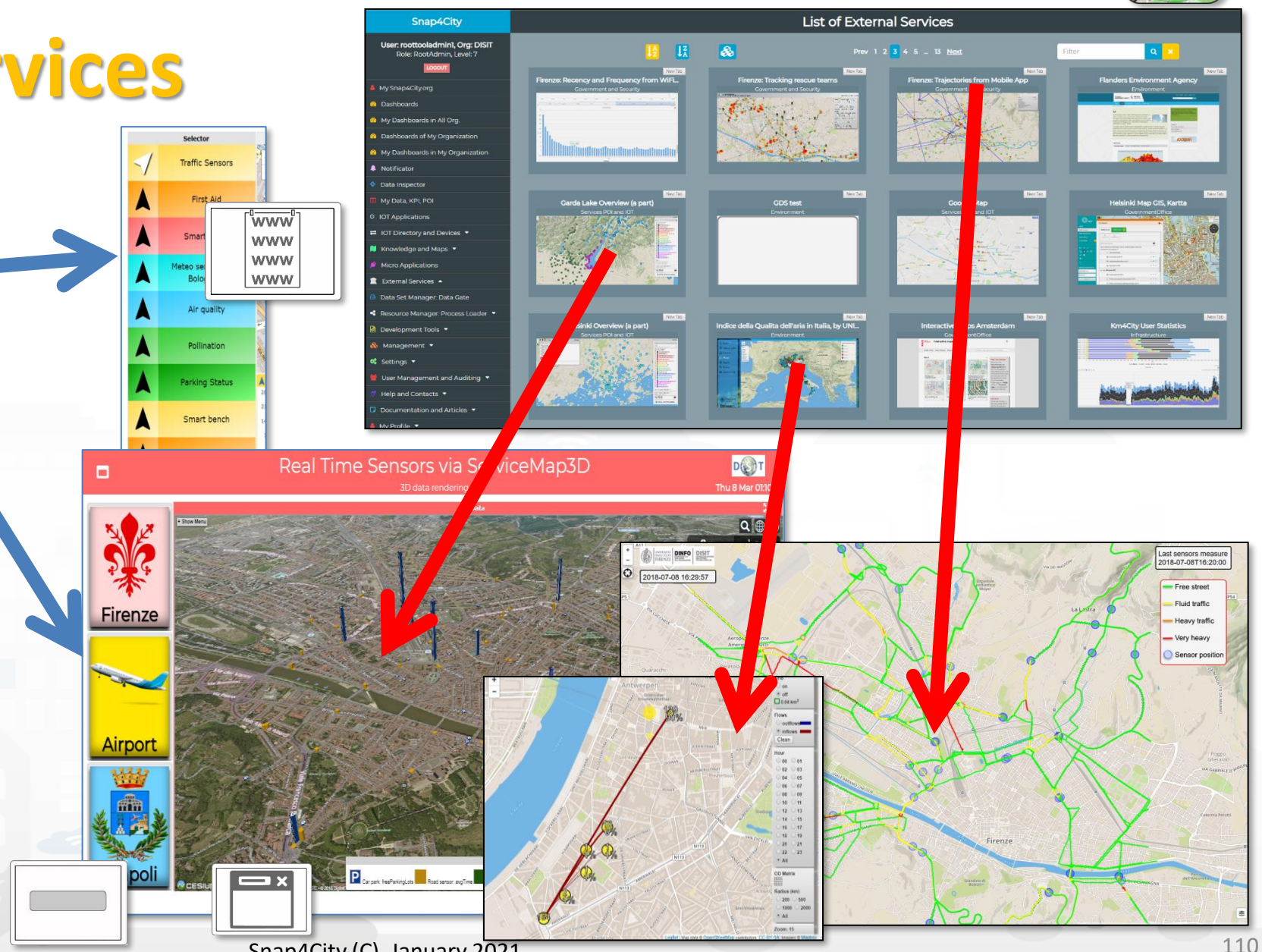


External Services (registered)

Snap4City

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

- 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
- IOT Applications
- 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

List of External Services

Prev 1 2 3 4 5 ... 13 Next

Filter

New Tab
Firenze: Recency and Frequency from WiFi...
Government and Security

New Tab
Firenze: Tracking rescue teams
Government and Security

New Tab
Firenze: Trajectories from Mobile App
Government and Security

New Tab
Flanders Environment Agency
Environment

New Tab
Garda Lake Overview (a part)
Services POI and IOT

New Tab
GDS test
Environment

New Tab
Google Map
Services POI and IOT

New Tab
Helsinki Map GIS, Kartta
GovernmentOffice

New Tab
Helsinki Overview (a part)
Services POI and IOT

New Tab
Indice della Qualita dell'aria in Italia, by UNI...
Environment

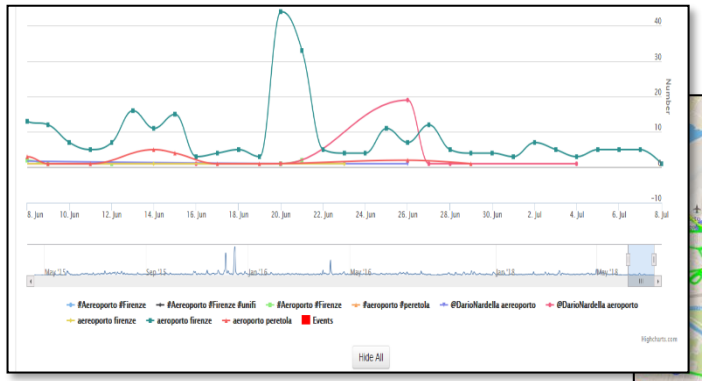
New Tab
Interactive Maps Amsterdam
GovernmentOffice

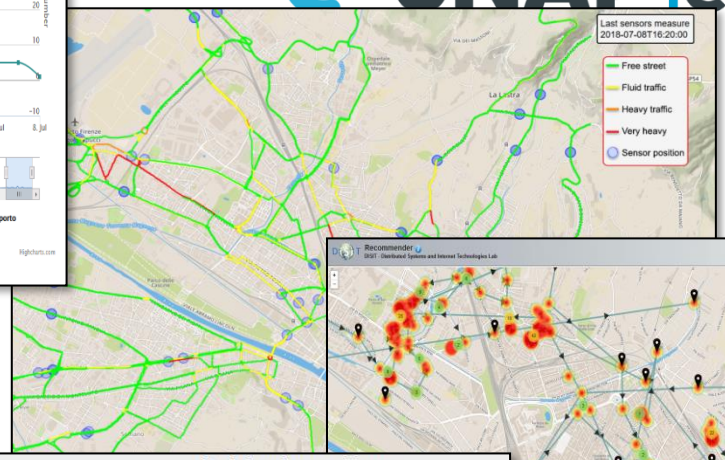
New Tab
Km4City User Statistics
Infrastructure

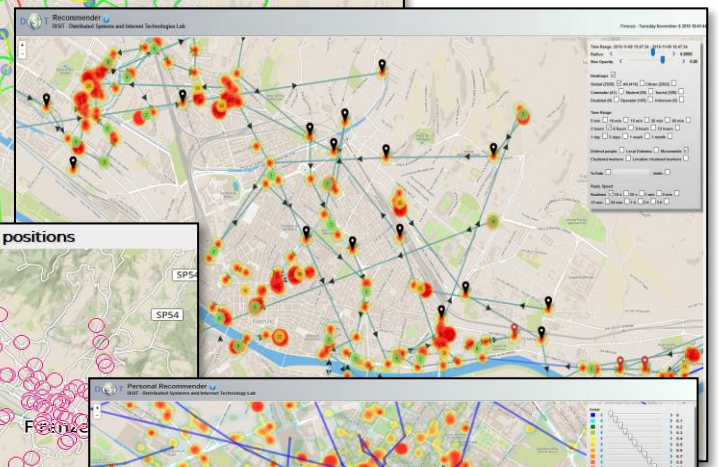
External Services

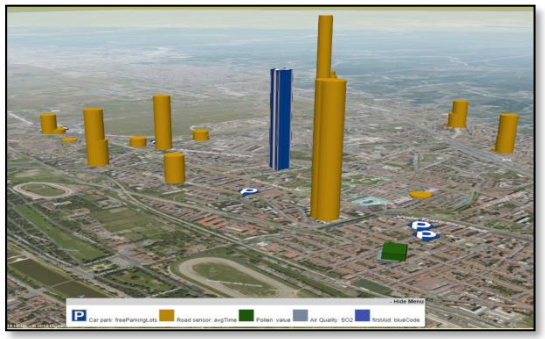
Nature

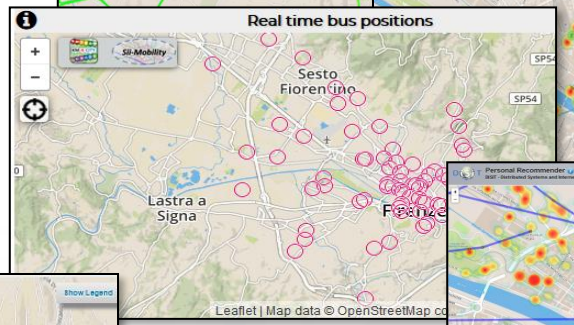
- Twitter Vigilance:
  - Daily and real time
  - Volume and sentiment analysis
- Services on Maps, GIS, ArcGIS
- Real time sensors on 3D
- Web HTML5 Applications
- Origin Destination Matrix
- Real Time fleets
- Routing, Multimodal tools
- IPCAM connector
- Synoptics
- **Third party tools!**
- **…..**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

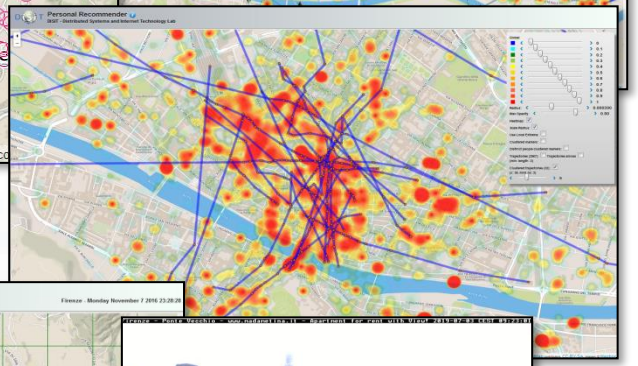


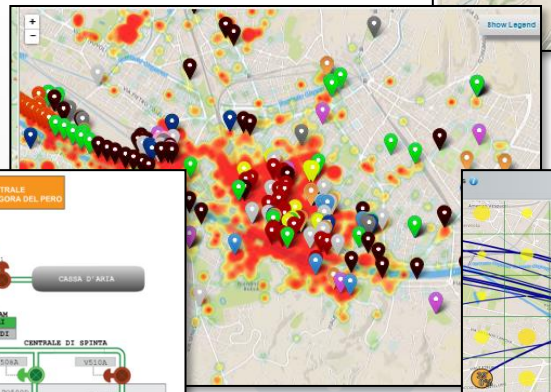


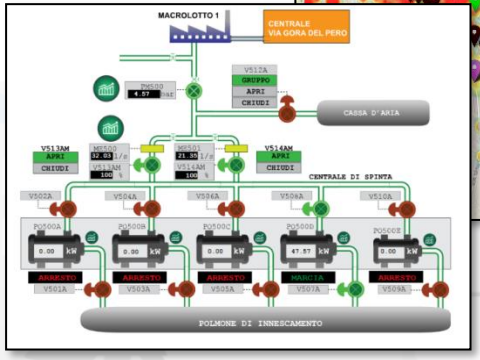


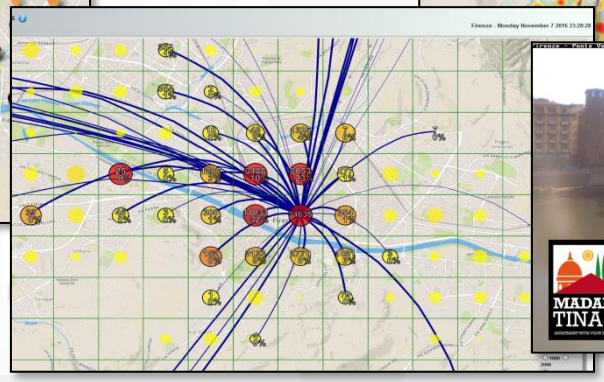












HLT: MicroApplications

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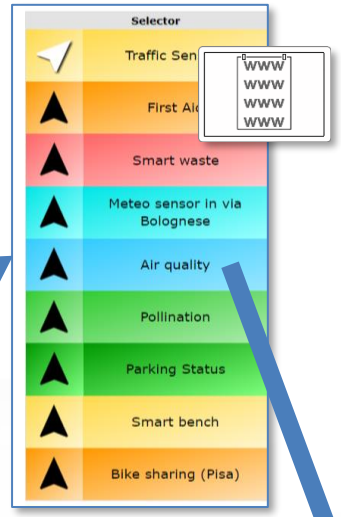
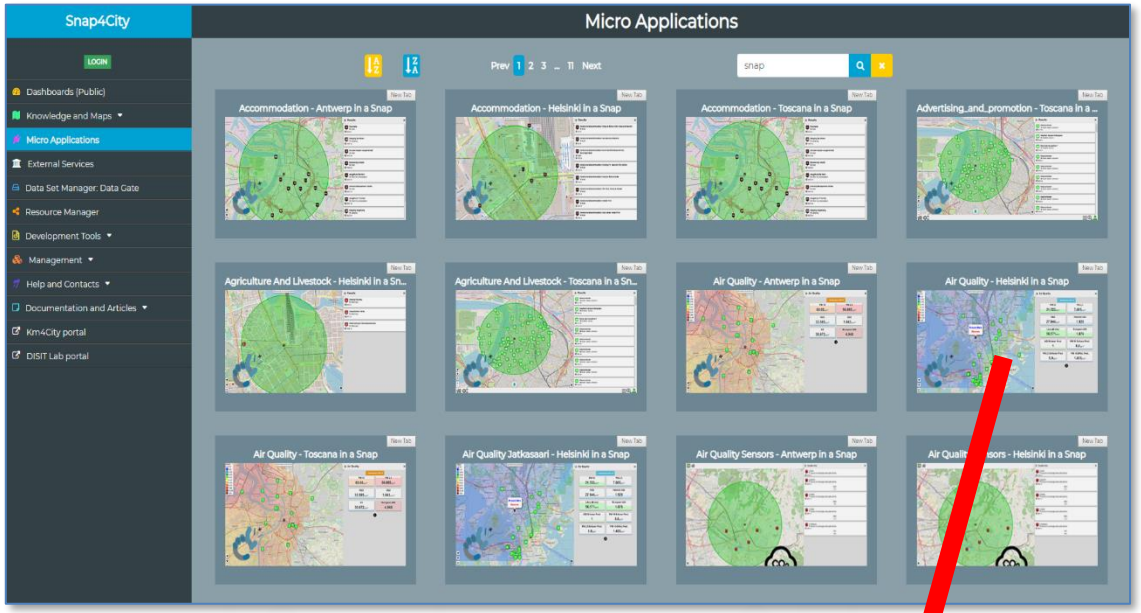
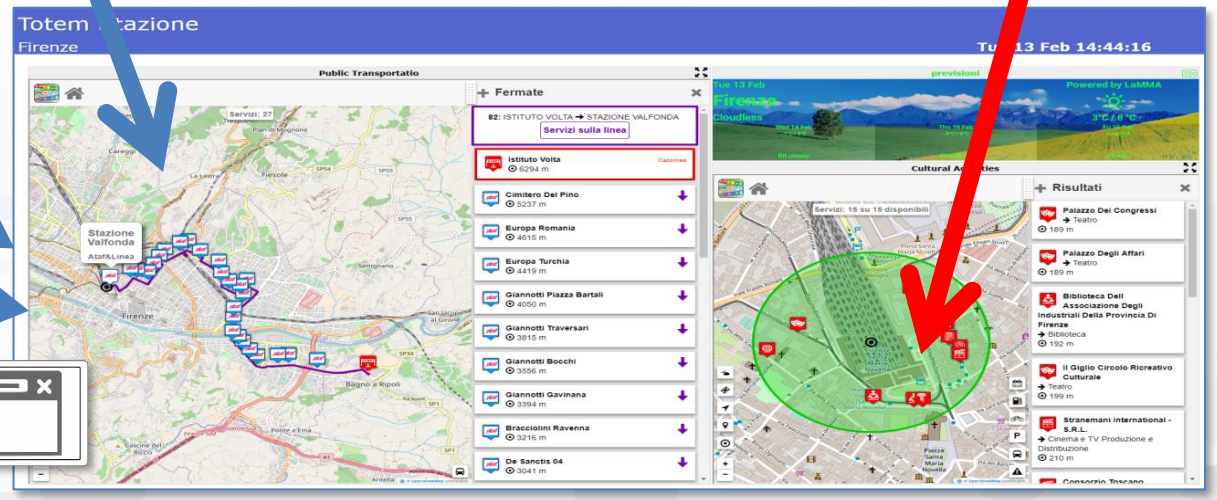


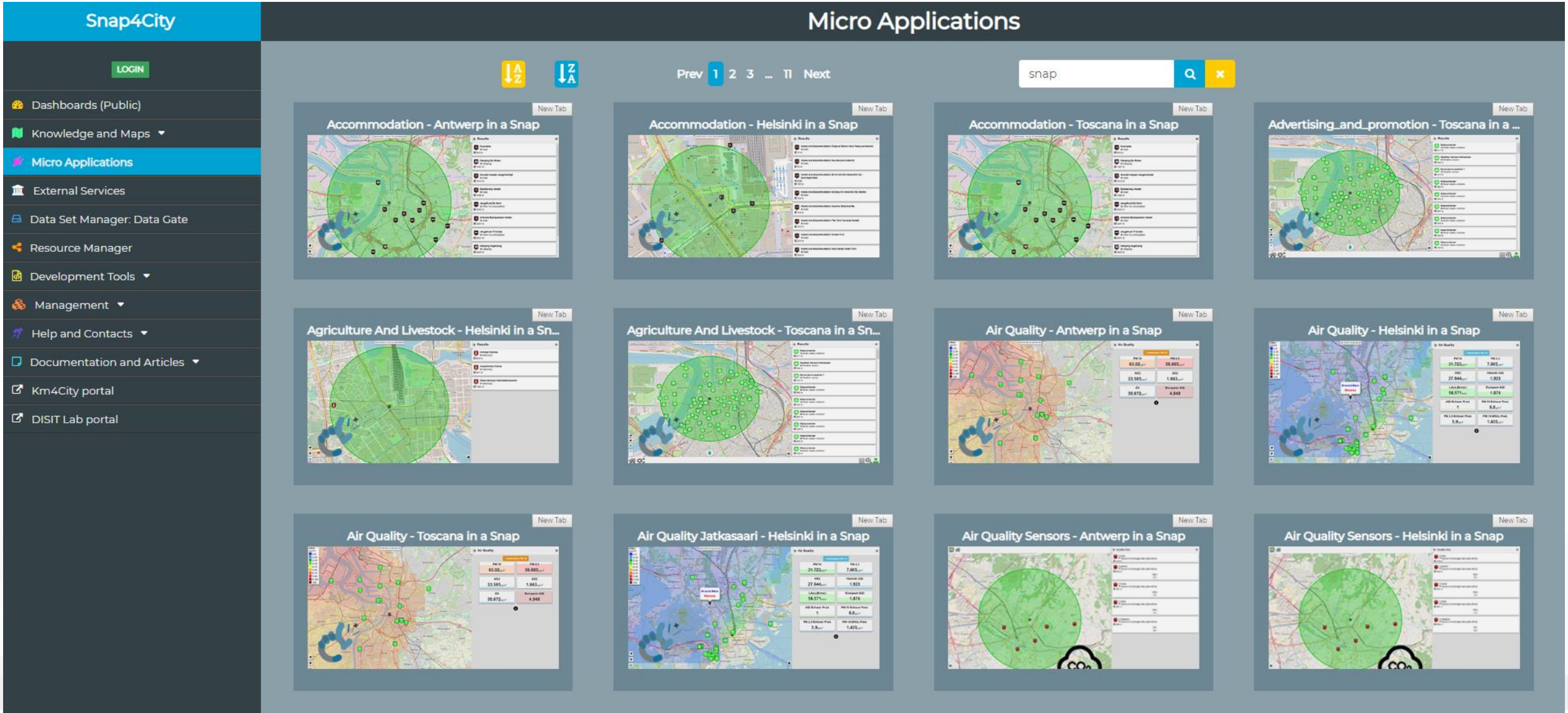




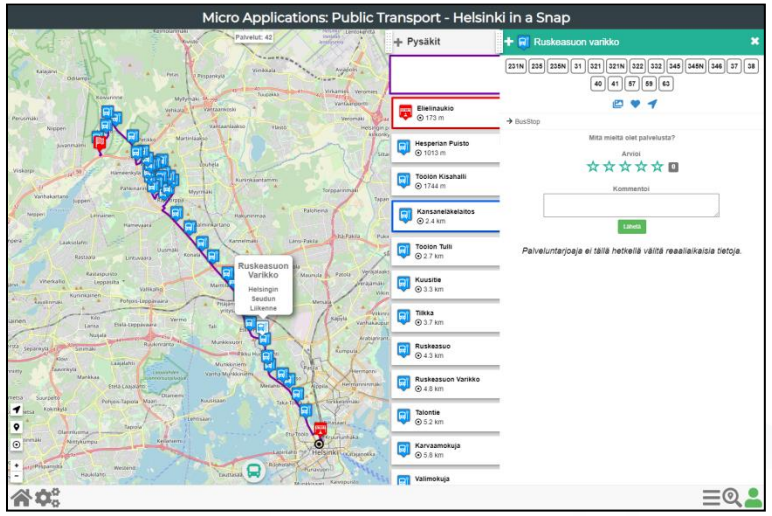
UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

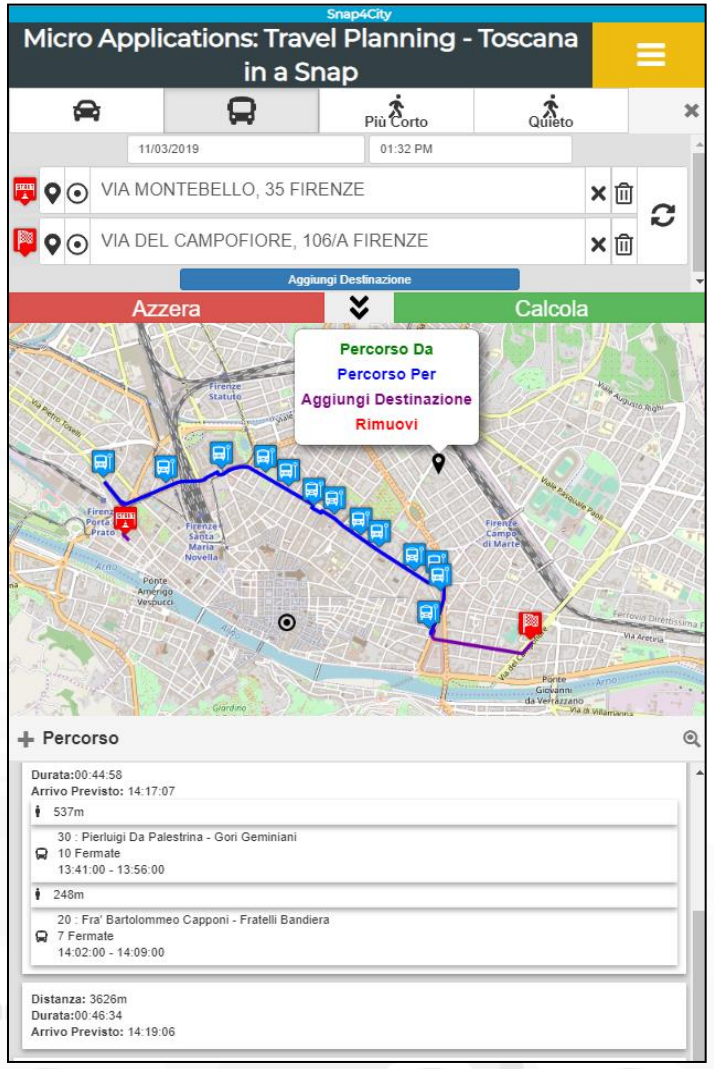
SNAP4CITY | KM4CITY

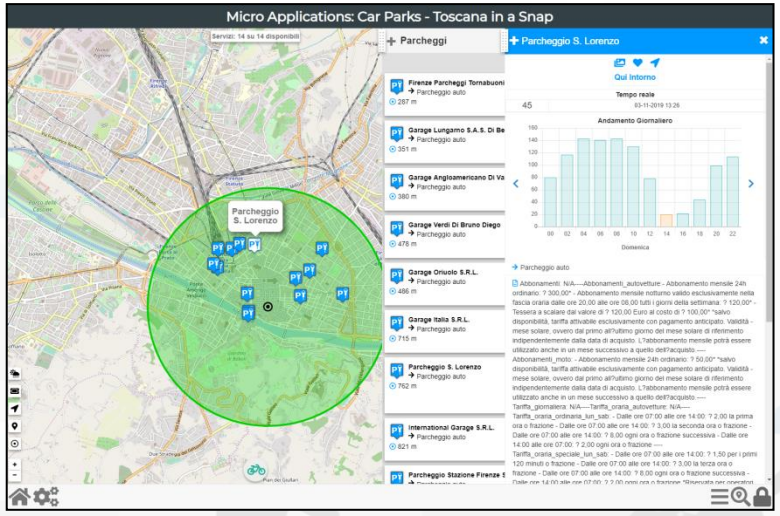
MicroApplications

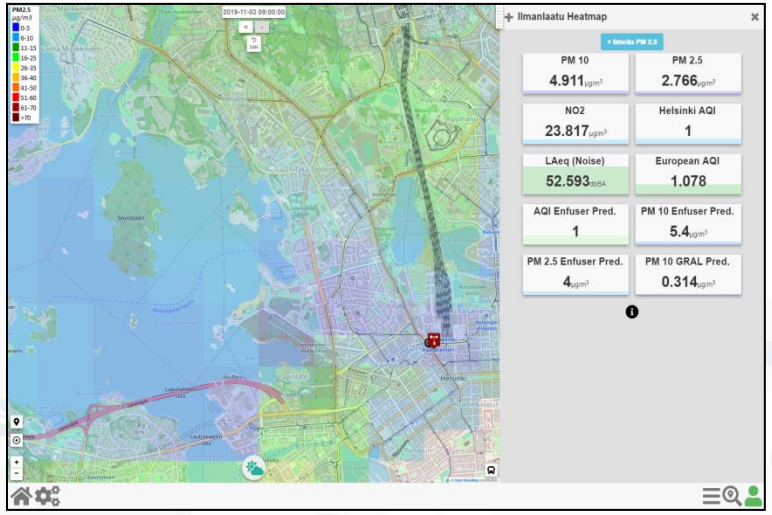


MIcroApplications for Dashboards

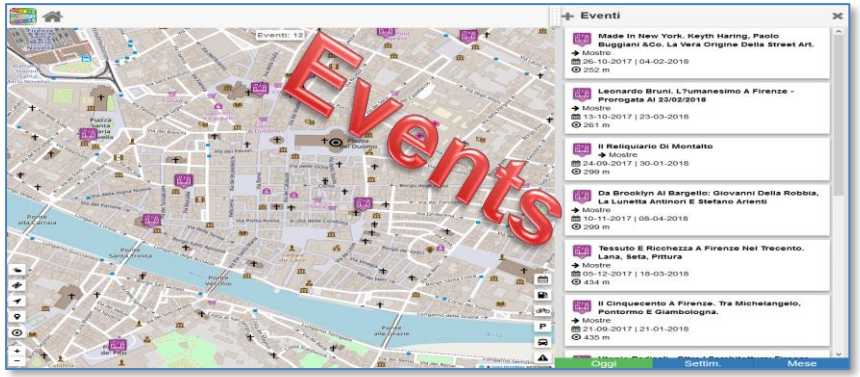


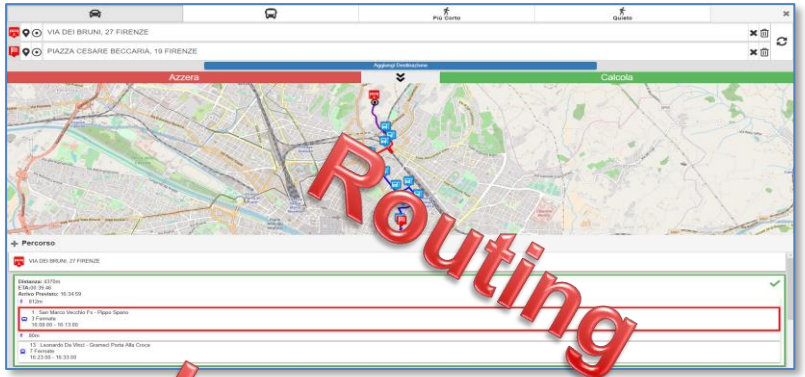


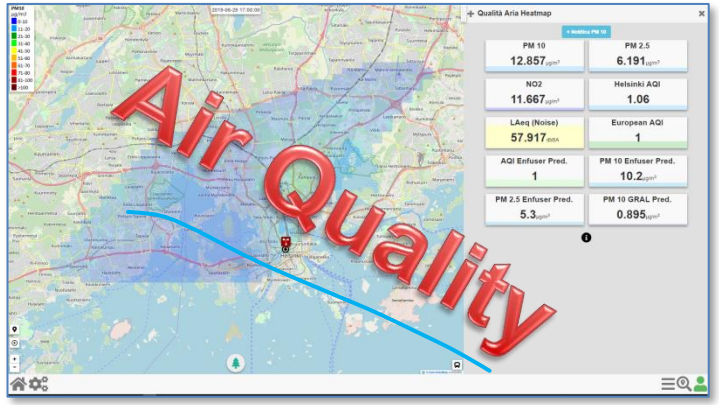


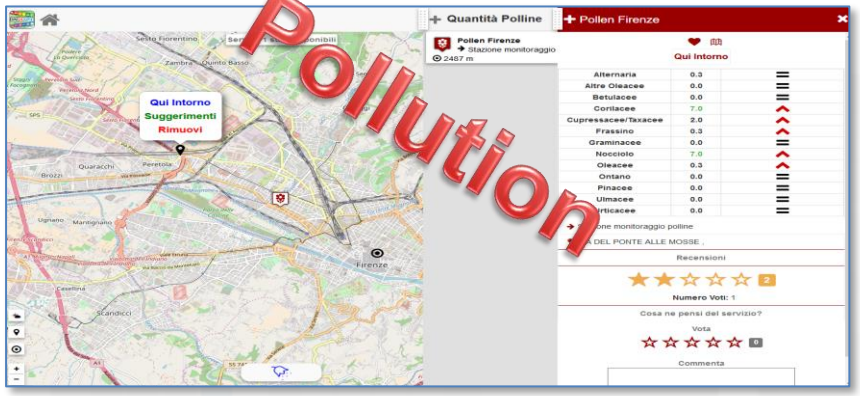


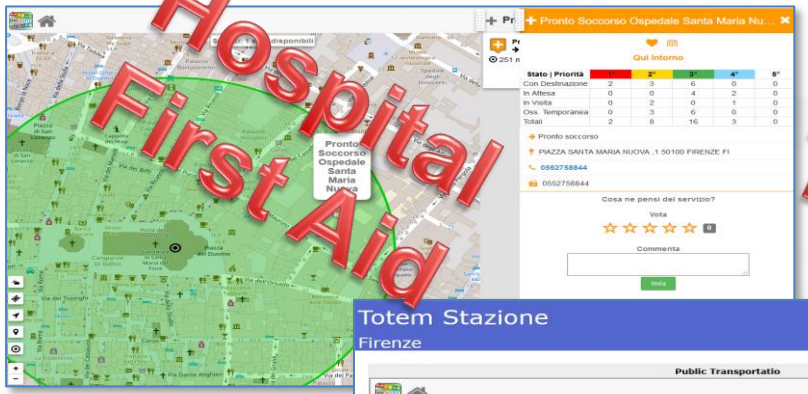
HTML5 MicroApplications

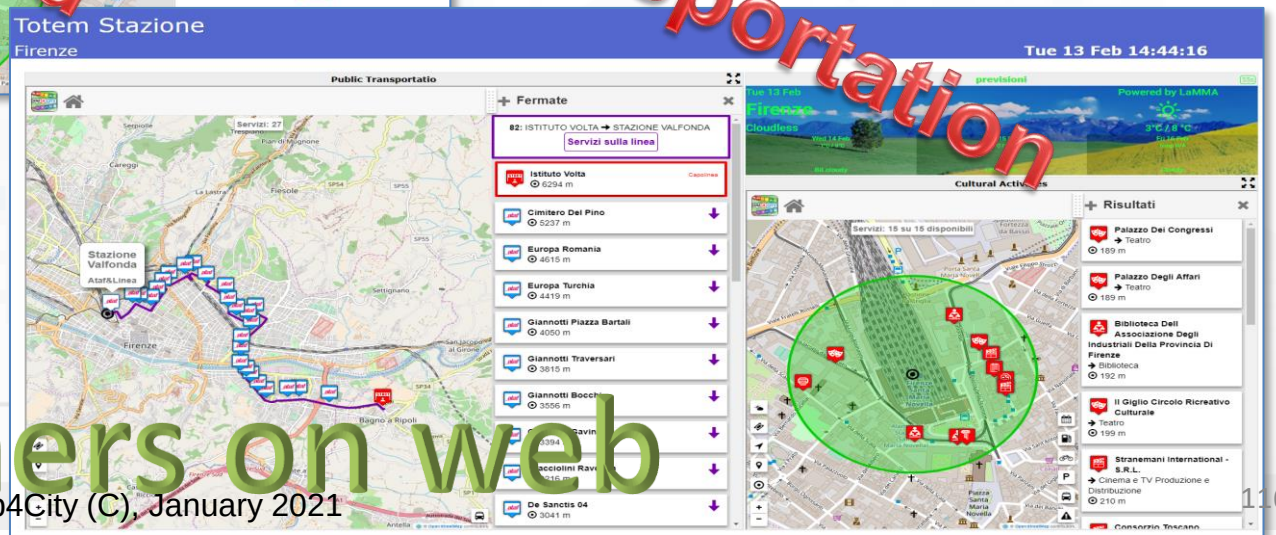


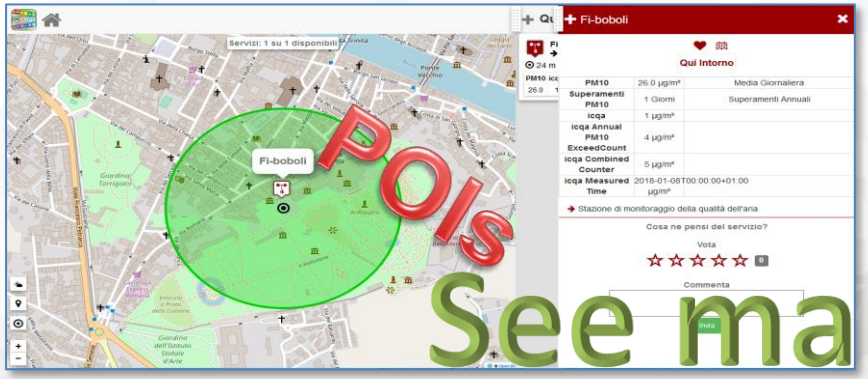








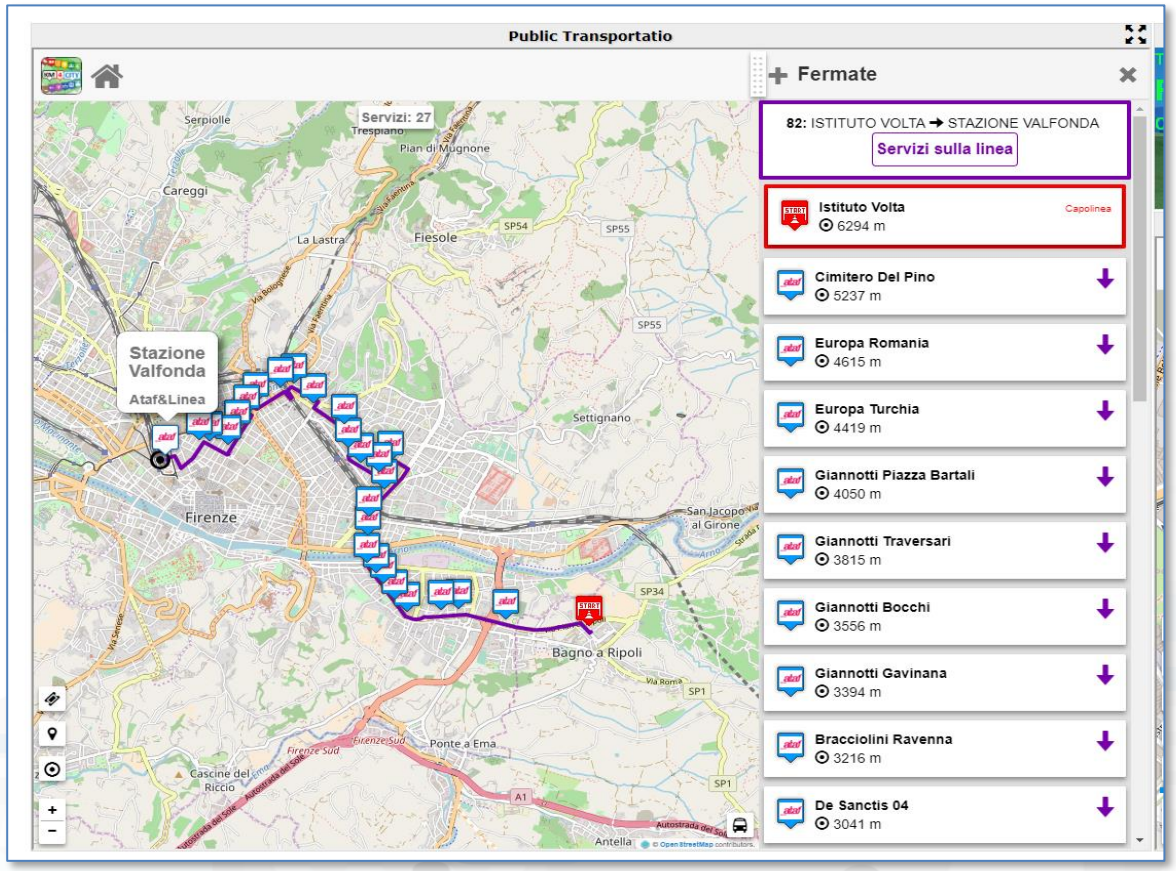




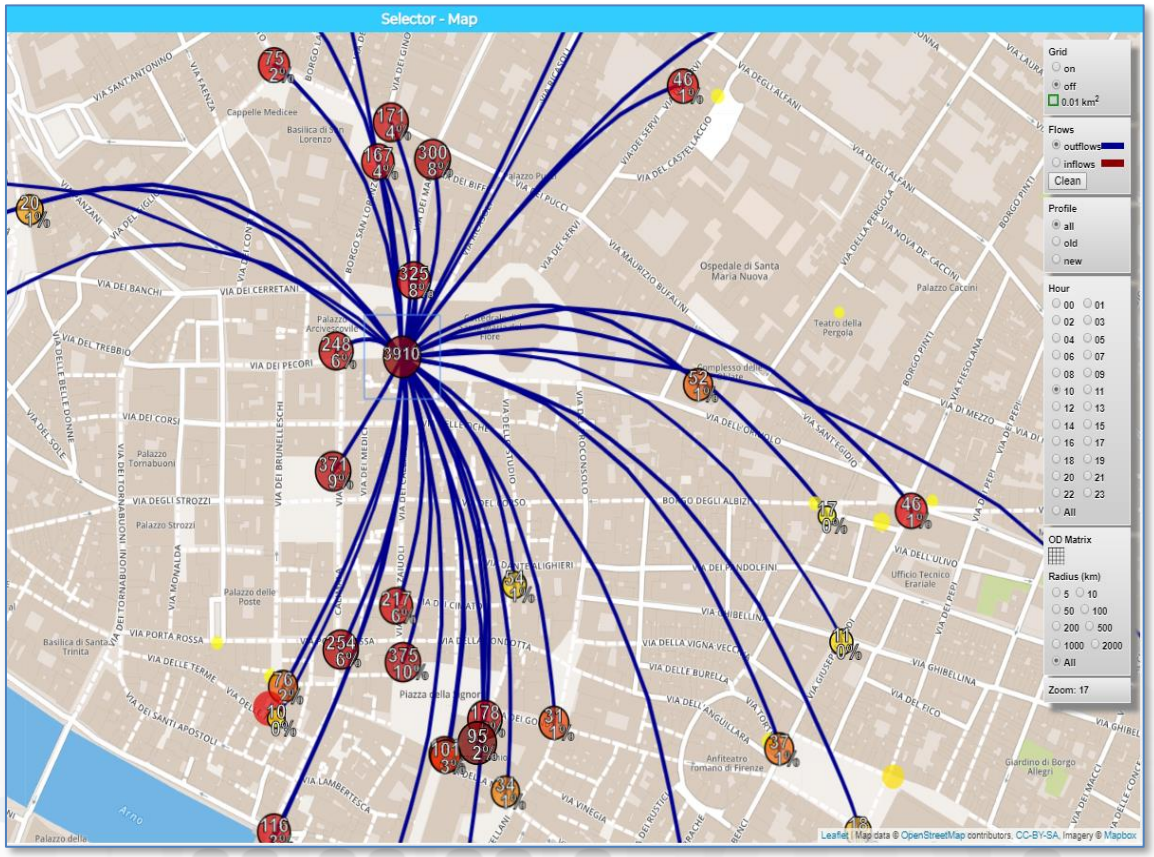
See many others on web

Special data are managed with Special Tools

- GTFS



- Origin Destination Matrices



HLT: MicroApplications, ExternalServices

External Services

- Are **Web Pages** *by you or by Third Parties*. They can be embedded into an **External Content Widget** only if they:
  - are HTTPS page for the limitation of the browser,
  - Not present limitations to be “iframed” imposed by third party, that is always possible to be imposed by the page owner.

- You can **exploit/integrate External Services** by:
  - put them into an External Content Widget
  - Call them from a Widget Button to be open into another Tab of the browser or into an External Content Widget.
  - Call them from a Selector Web Widget, if you have multiple of them with a menu you can make a selection among several of them to be open into an External Content Widget
  - Call of them from the Dashboard Menu, to be open into the current or separate Tab of the Browser

IPCAM Service

- Examples:
  - https://main.snap4city.org/cam/ipCam.php?IP=www.meteofirenzehoteldavid.com/webcam/pontevecchio.jpg
  - https://main.snap4city.org/cam/ipCam.php?IP=www.meteofirenzehoteldavid.com/webcam/Firenze-HotelDavid.jpg
  - https://main.snap4city.org/cam/ipCam.php?IP=192.168.0.240/tmpfs/auto.jpg
  - https://main.snap4city.org/cam/ipCam.php?IP=www.cagliarimeteo.it/images/webcam/1/Cam1.jpg
  - …
  - To access with credentials you need to add setting on an IP Cam Table on Dashboard Builder!
  - Use https://main.snap4city.org/cam/ipCams.php?IP= for IP CAM with HTTPS connections

First aids overview - Tuscany

Service status of main first aid

Thu 25 Ma

Careggi hospital (Florence) -

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

Santa Chiara hospital (Pisa) - D

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

Other hospitals - Sum

Priority\Hospitals	Red code	Yellow code	Green c		ode
PS SAN GIOVANNI DI DIO TORREGALLI	1	16	20	1	0
PS SANTA MARIA NUOVA	1		22	3	0
PS AO CAREGGI	6	34	32	5	0
PS SANTA MARIA ANNUNZIATA	1	8	11	1	0
RGO ENZO	0	3	3	4	0
PS OSPEDALI RIUNITI	3	8	18	1	1
PS CASENTINO	No data available for this hospital				
PS SANTA CROCE	No data available for this hospital				
PI PO CORTONA	No data available for this hospital				
PS CIVILE PIOMBINO	No data available for this hospital				
	No data available for this hospital				

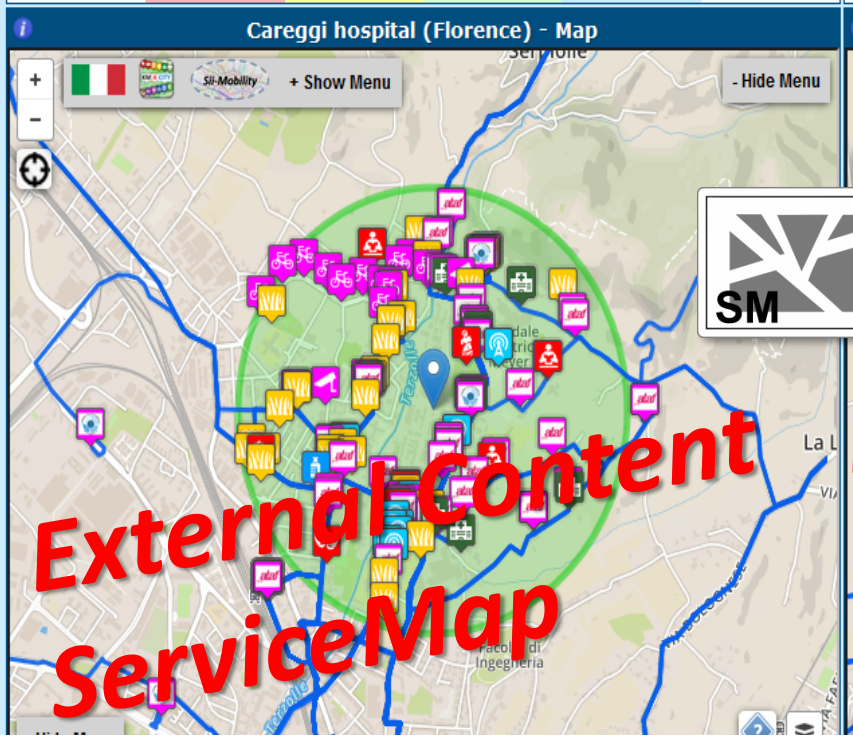
First AID

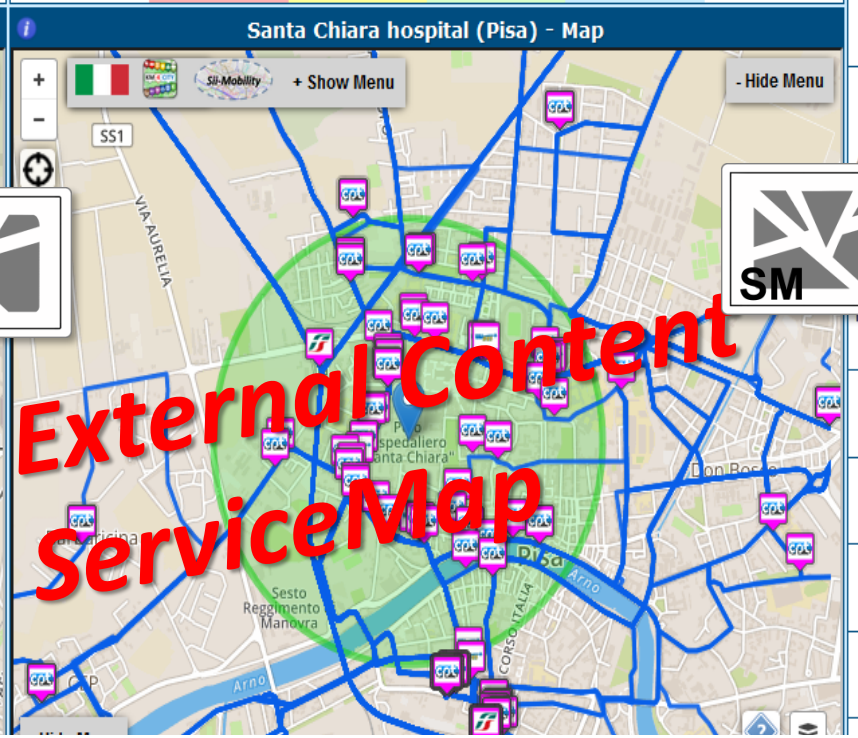
First AID

First AID Multi

Careggi hospital (Florence) - Map

Santa Chiara hospital (Pisa) - Map





External Content ServiceMap

External Content ServiceMap

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

Firenze Social and Social Media new

Demo cams

Sun 11 Mar 16:24:55

External Content TwitterVigilanceRT

External Content TwitterVigilance

External Content Traffic Flow

Twitter Trend

Twitter quotes

Events

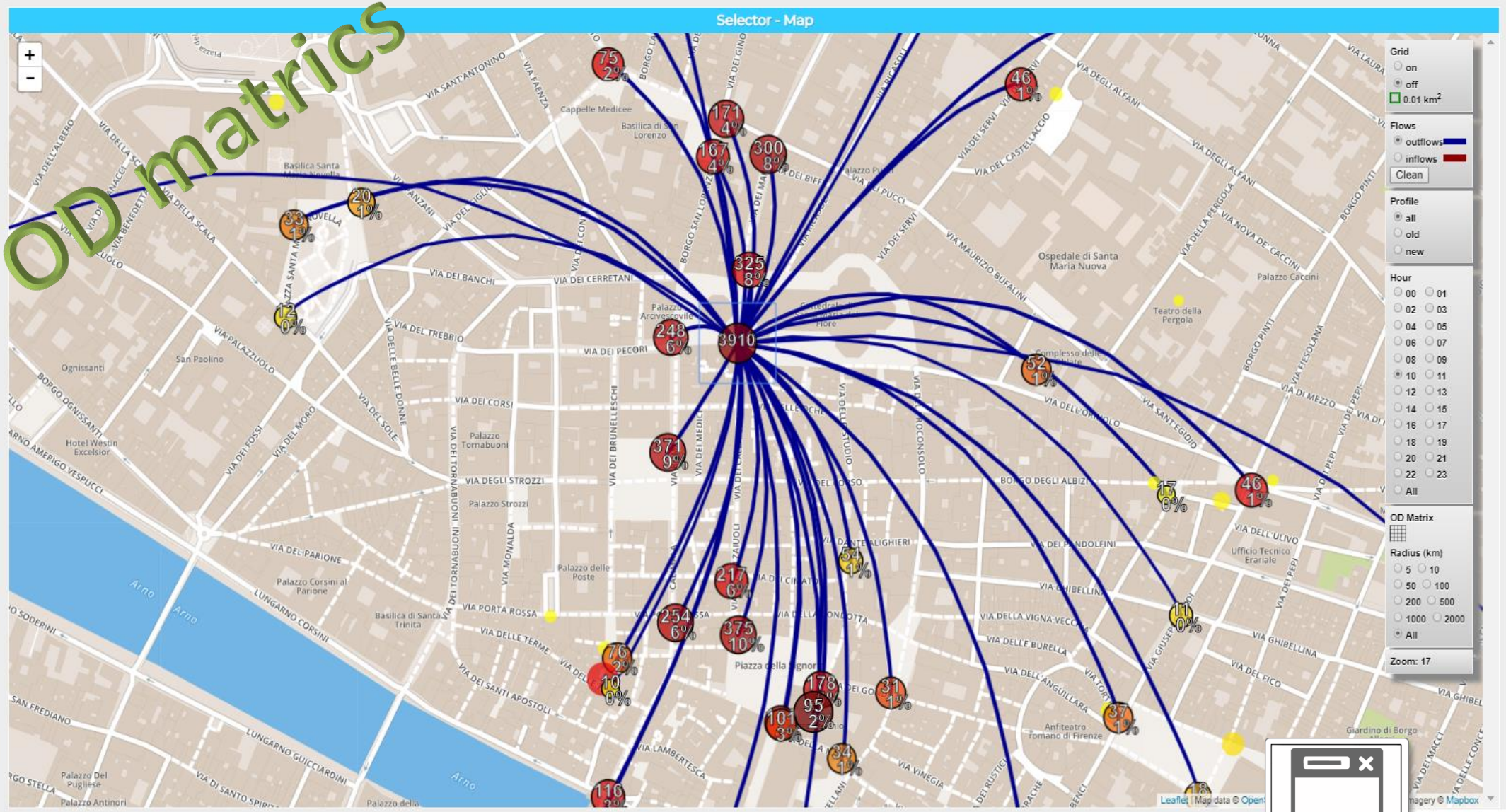
Buttons

External Content CAMStream

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

Life in Toscana: Dashboard

Sat 29 Jun 23:32:24



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

Life in Toscana: Dashboard

Sat 29 Jun 23:32:24

Selector web

- Line of Transport
- Public Transport
- Travel Plan
- Traffic Flow FIPILI
- Air Quality
- Weather
- Origin Dest. Matrix
- Typical Trajectories
- People Flow WIFI
- Cultural Activities
- Forum Discussion
- CAM

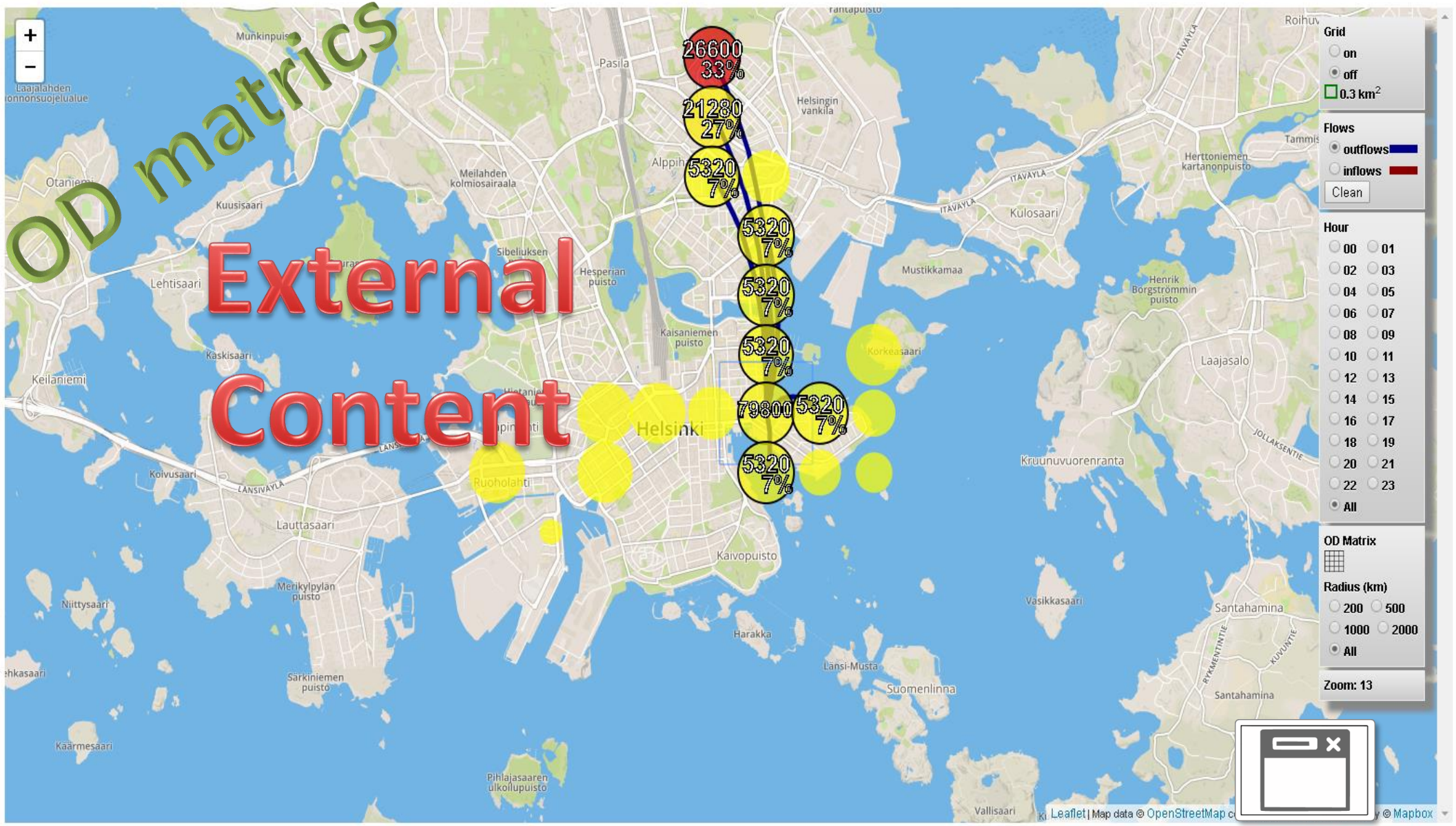
www www www www

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

Helsinki White Dashboard

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

Thu 13 Jun 23:37:56



Selector web

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Life in Toscana: Dashboard

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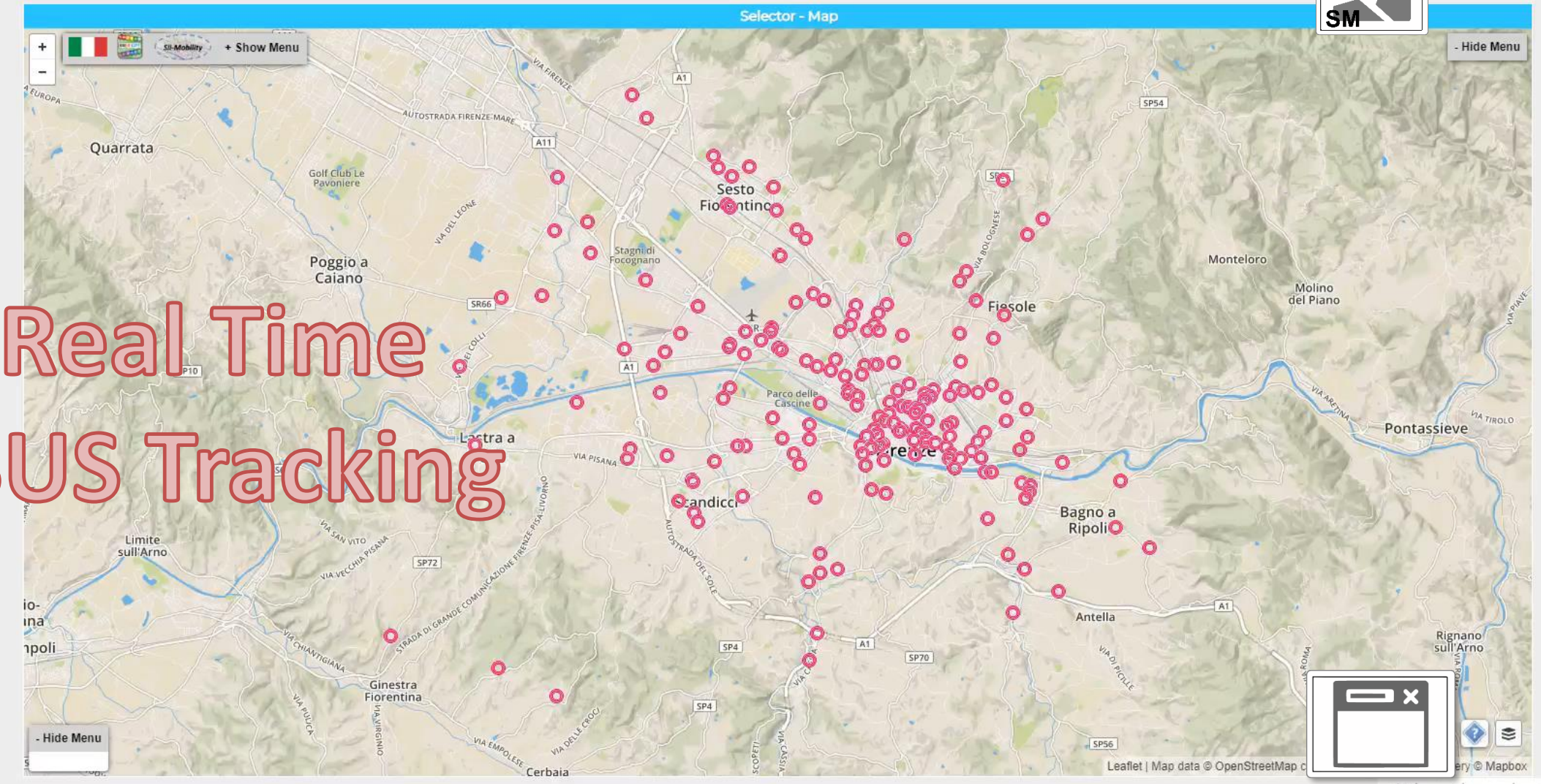
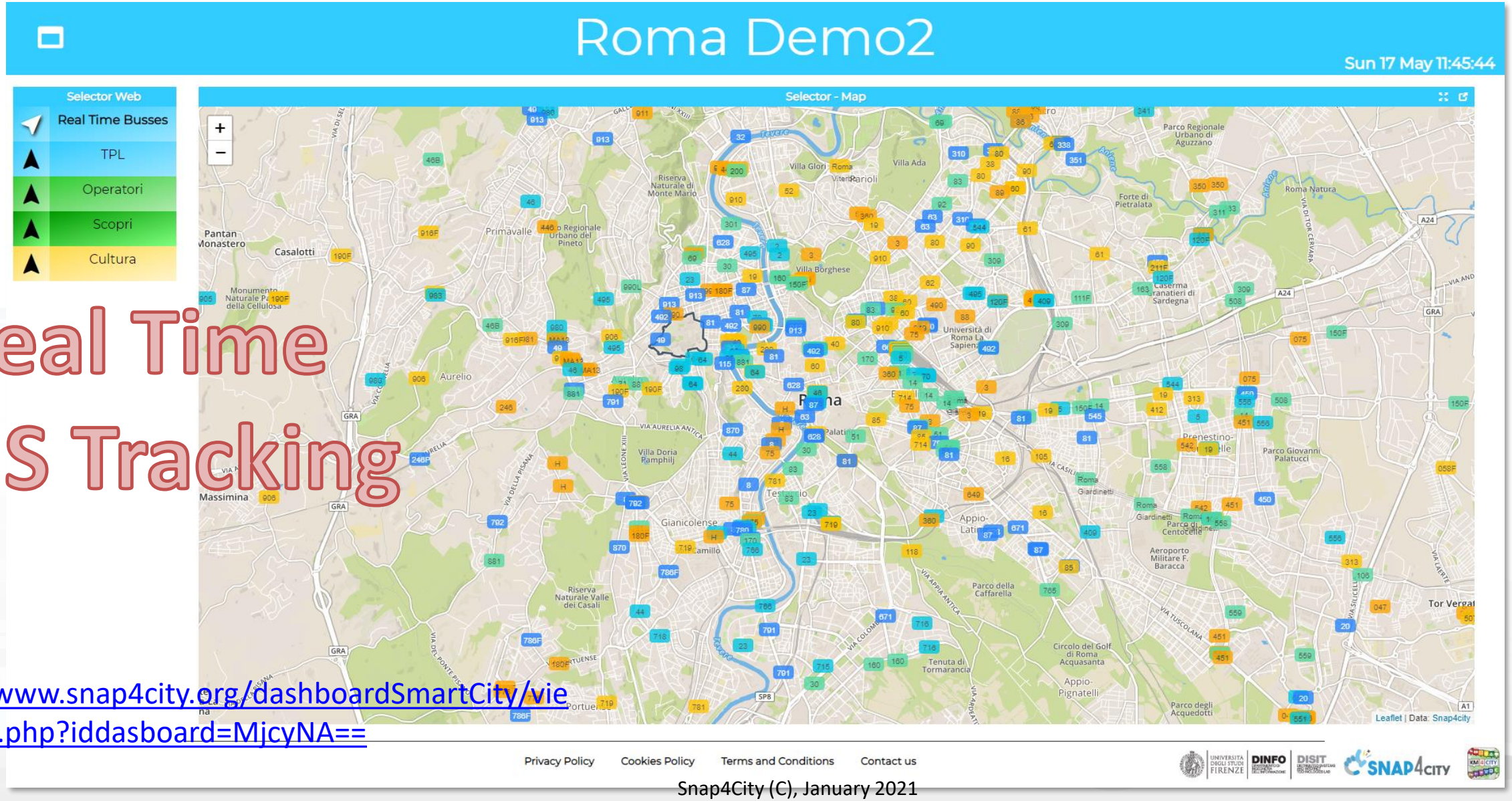


Real Time
BUS Tracking

SM

- Line of Transport
- Public Transport
- Travel Plan
- Traffic Flow FIPILI
- Air Quality
- Weather
- Origin Dest. Matrix
- Typical Trajectories
- People Flow WIFI
- Cultural Activities
- Forum Discussion
- Busses

Roma example



Real Time BUS Tracking

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

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

Real Time Sensors via ServiceMap3D

3D data rendering

Sat 1 Dec 16:57:33

Button

Firenze

Button

Airport

Button

Empol

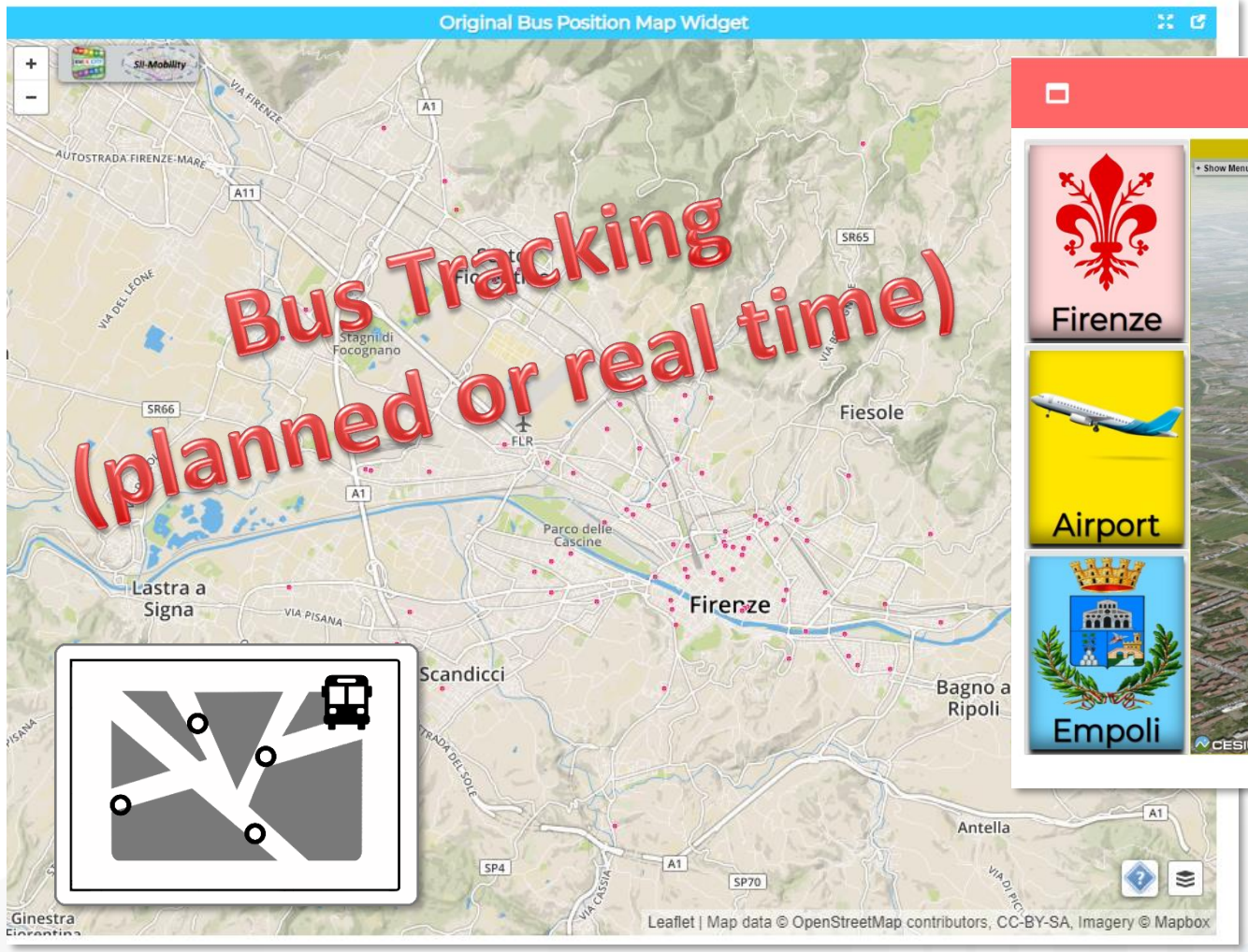
External Content

Airport

- Hide Menu

Car park: freeParkingLots | Road sensor: avgTime | Pollen: value | Air Quality: SO2 | firstAid: blueCode

CESIUM bing © 2018 Microsoft Corporation - © 2018 HERE - © 2018 Digital

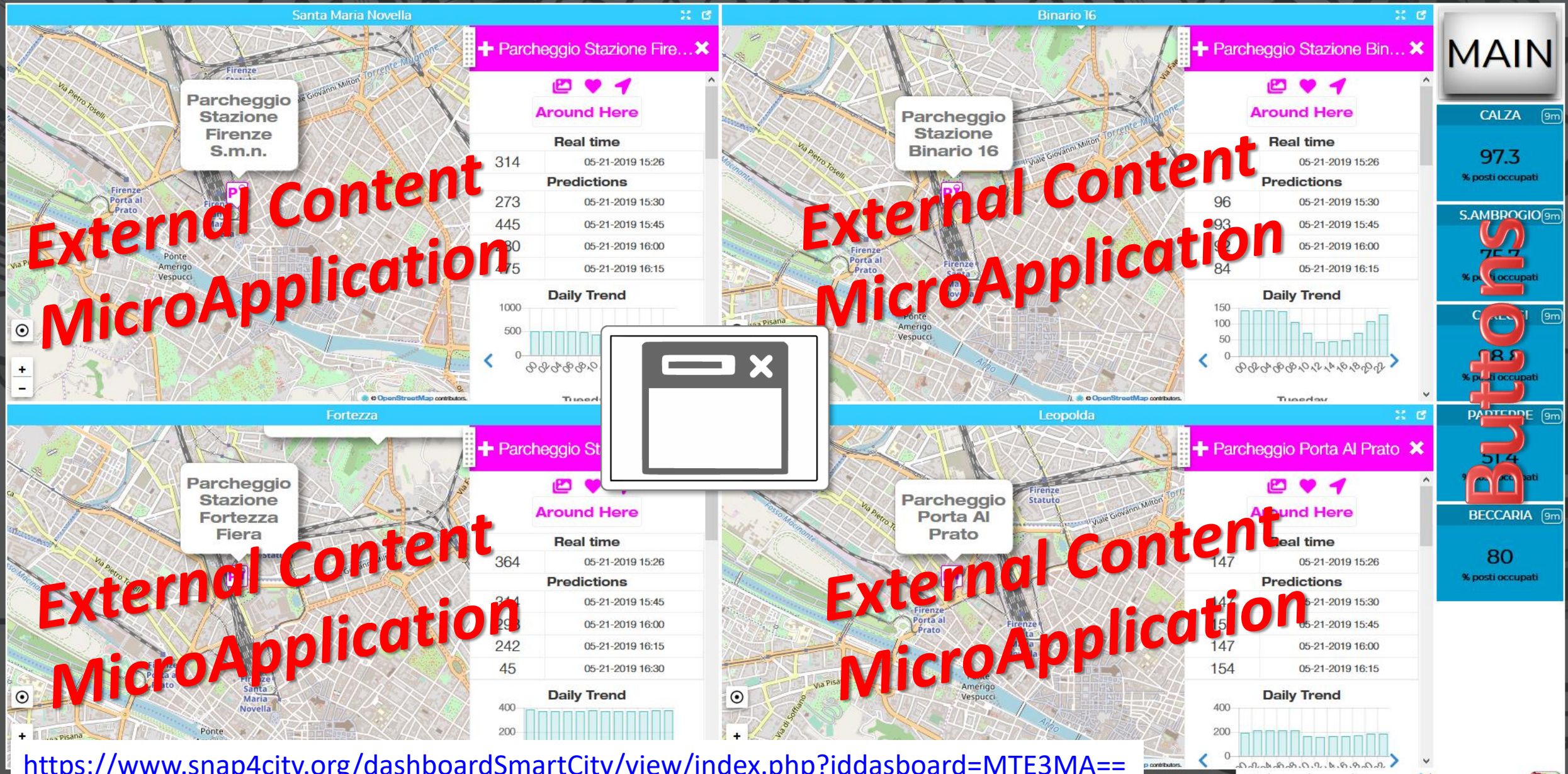


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTUxMQ==

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

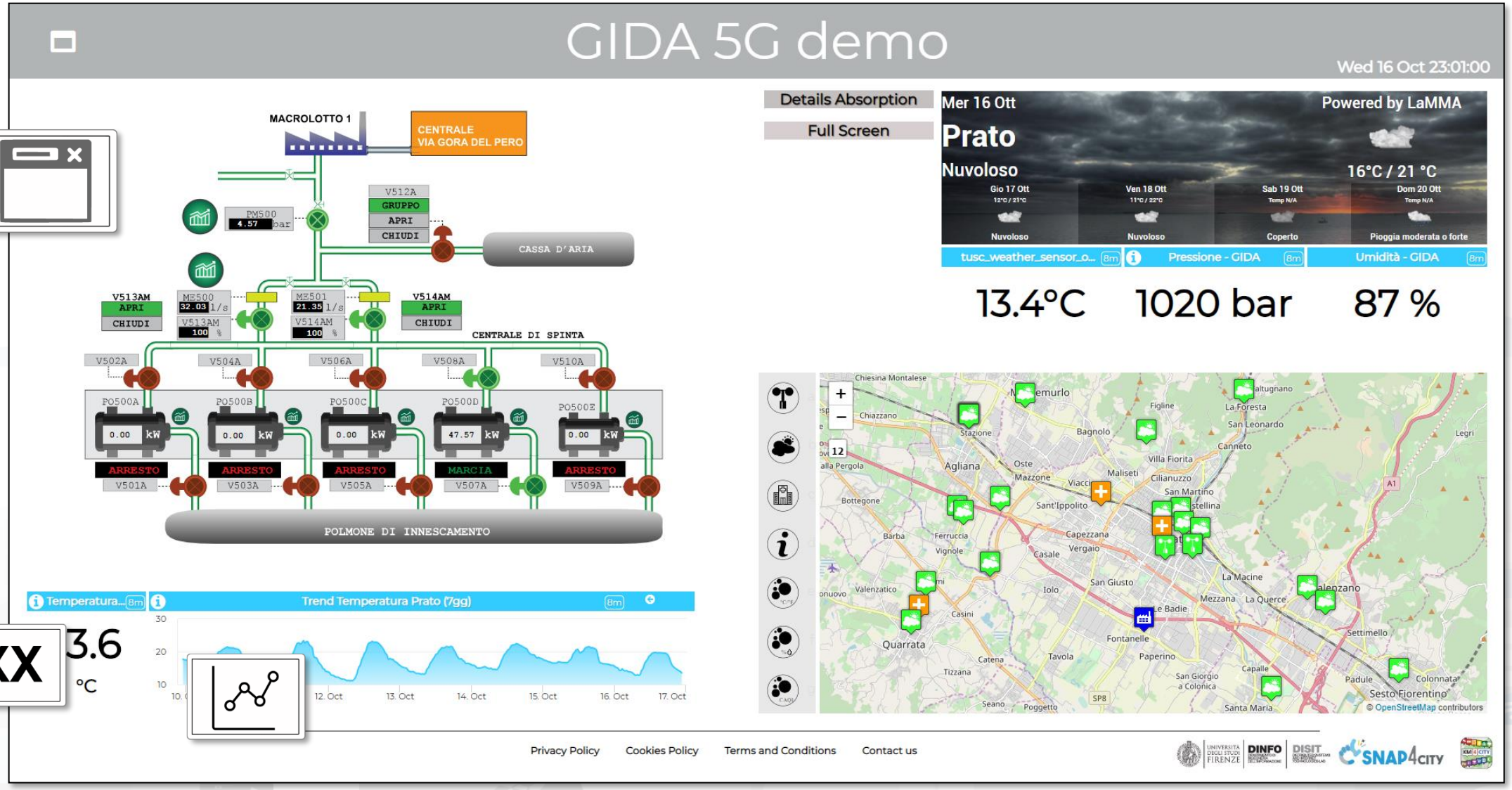
Parking Monitoring Firenze

Tue 21 May 15:23:09



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

Demo UC5 GIDA



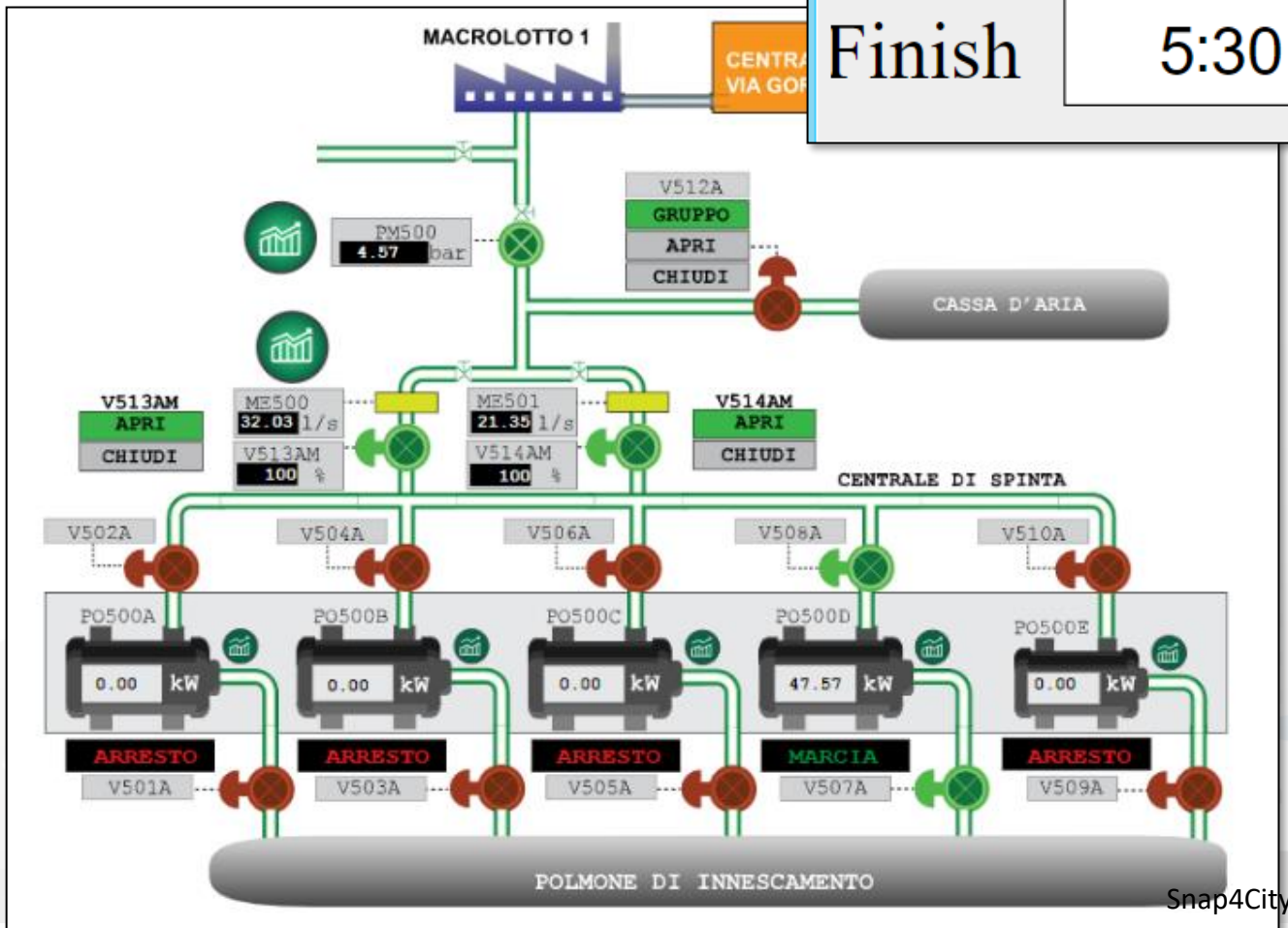
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjIyNg==

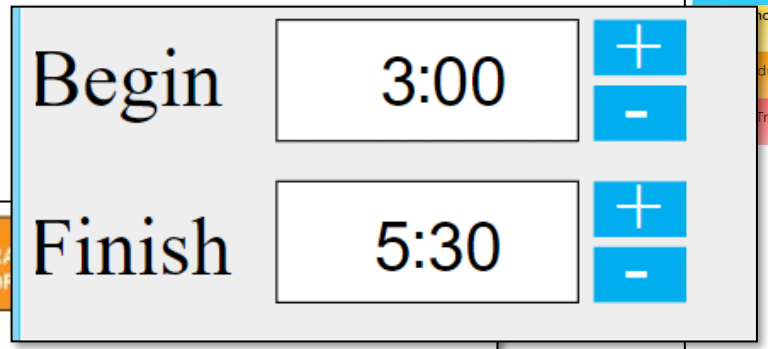
Custom Widgets

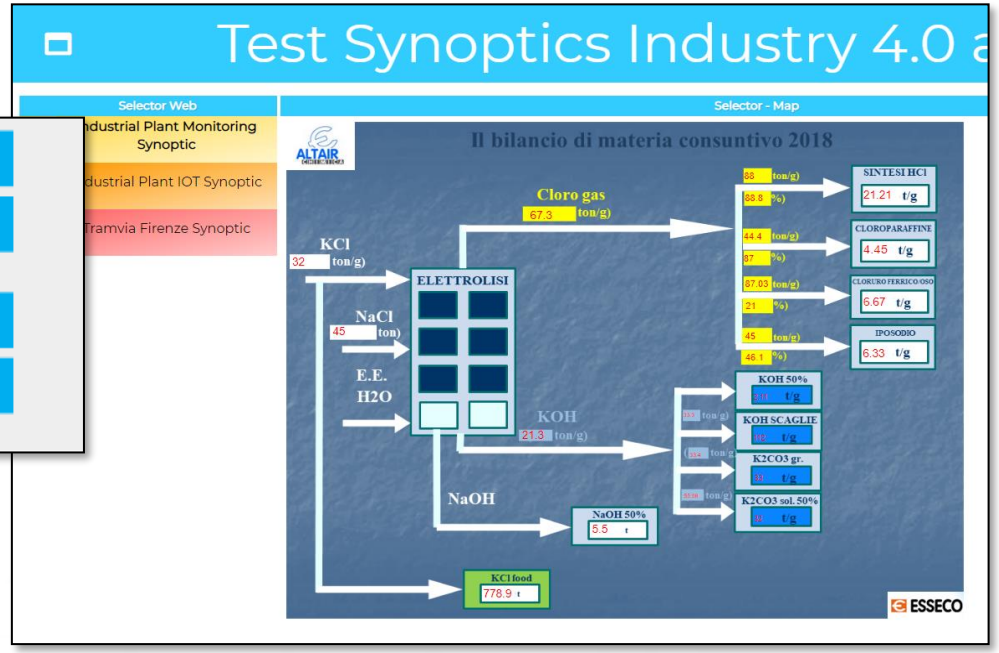
Custom Dashboards and Widgets (interactive, Animations, etc.)

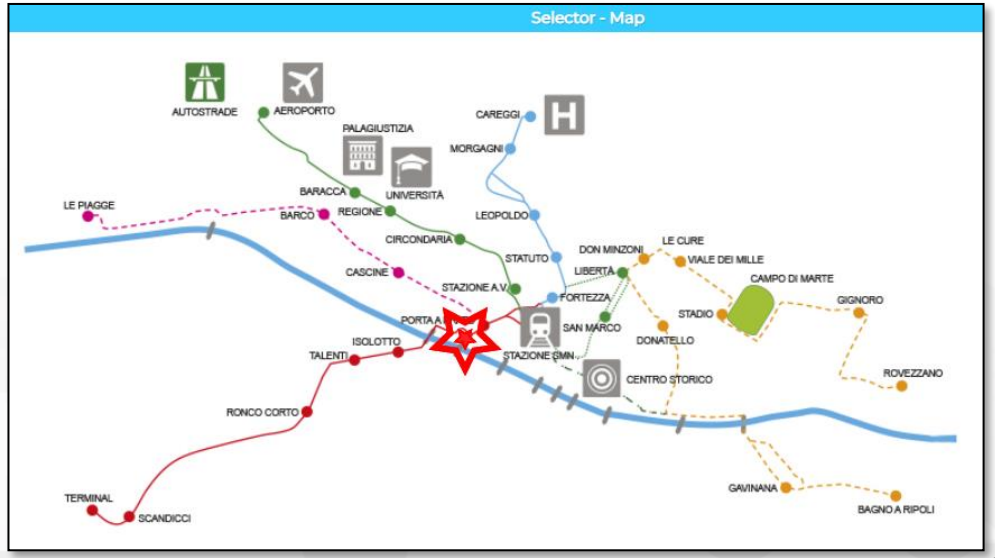
-- SVG for graphic design

-- MyKPI for collecting data



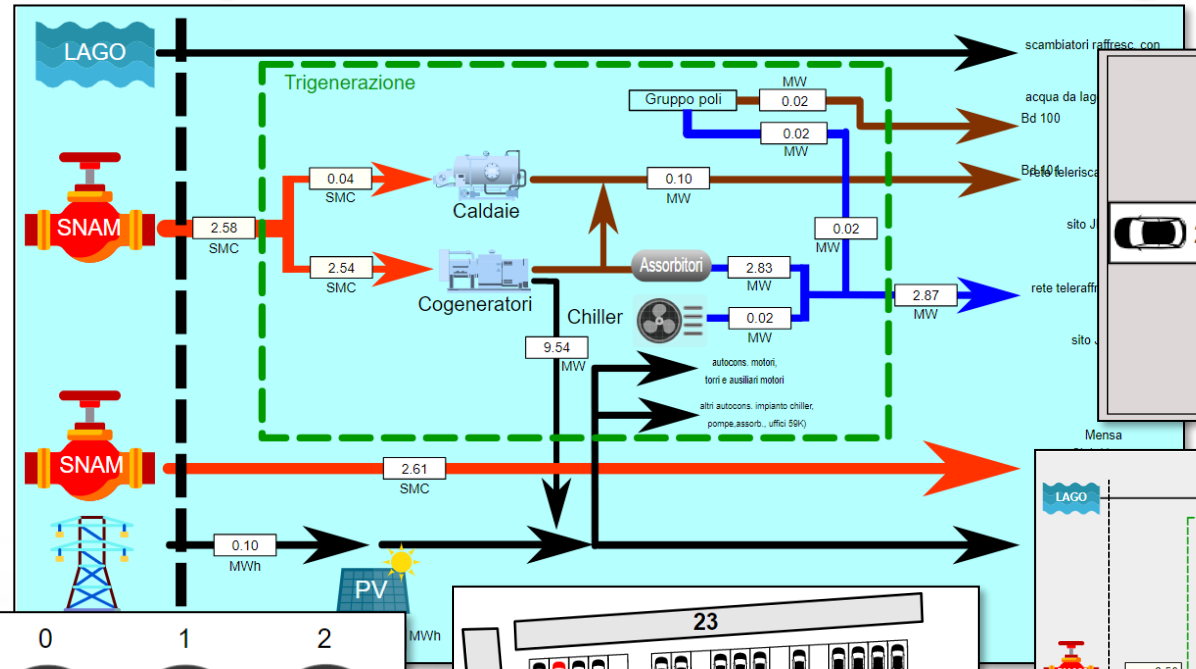


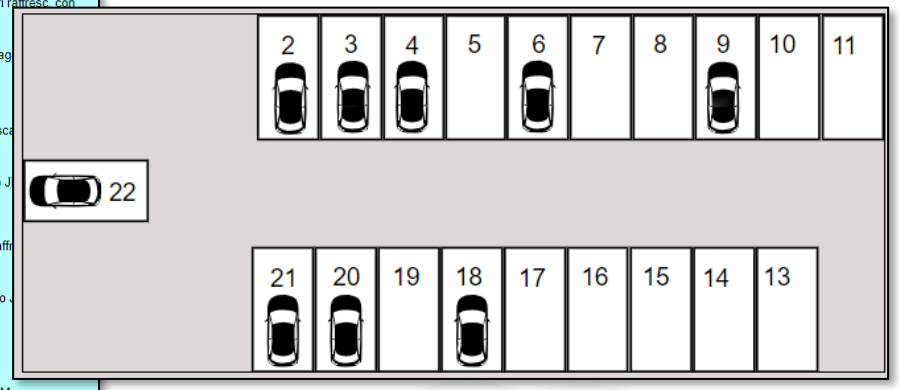


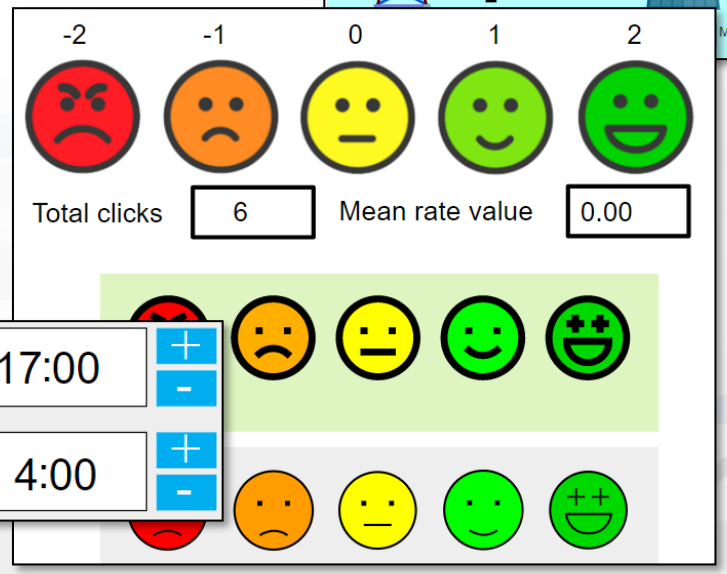


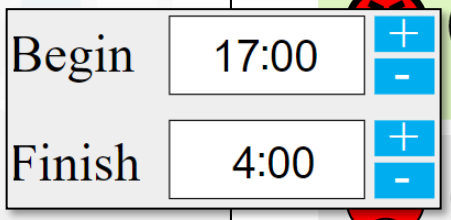
Special Custom Widgets

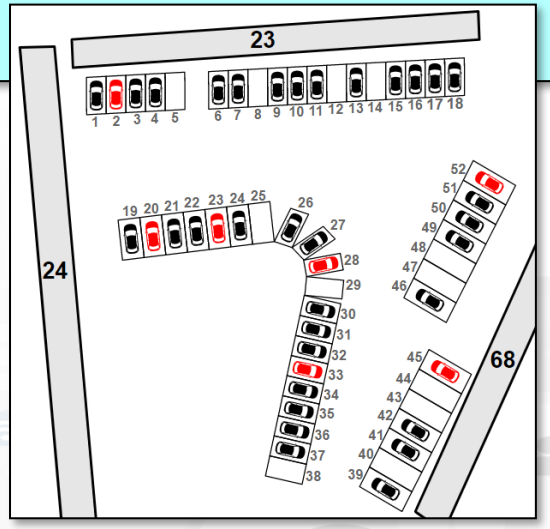
- Smart parking
- Smart Energy
- Smart Light
- Smart ….
- Energy View
- Custom Controls

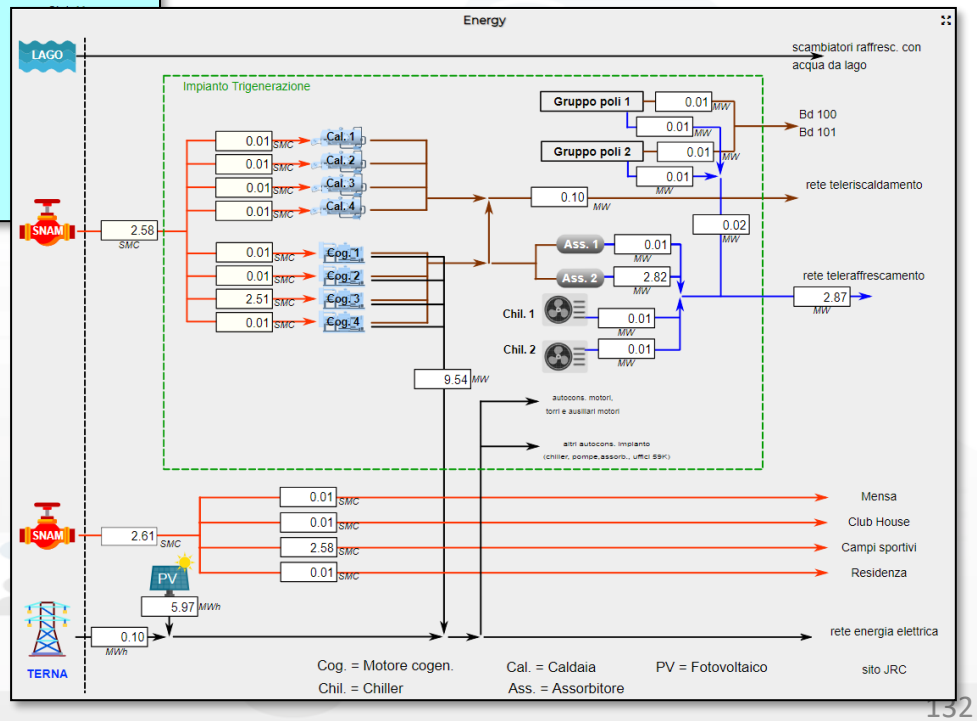




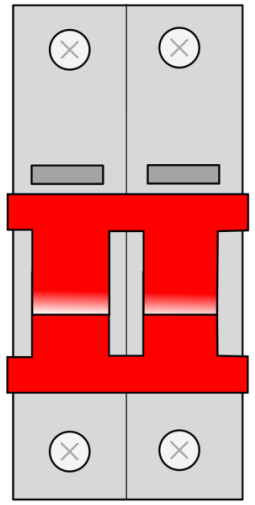




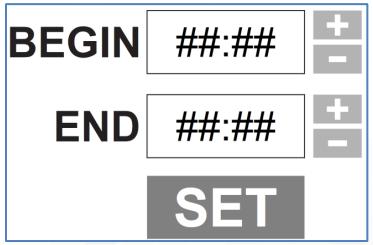


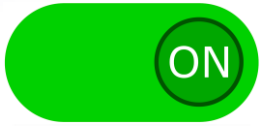


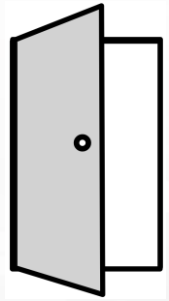
Other examples



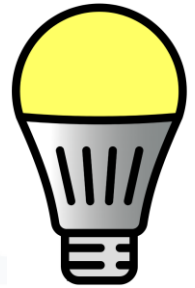
- **Virtual Actuators (sensor-actuator)**
  - From: Dashboard
  - To: IOT App, MyKPI, other Synoptics

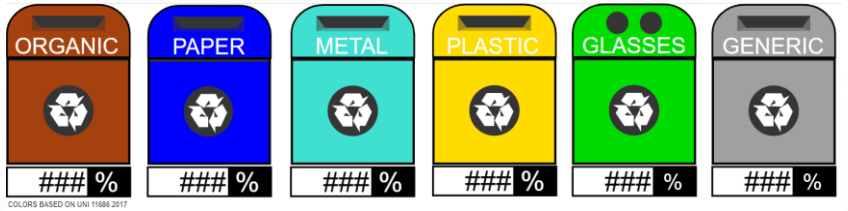


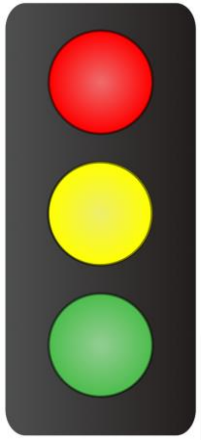


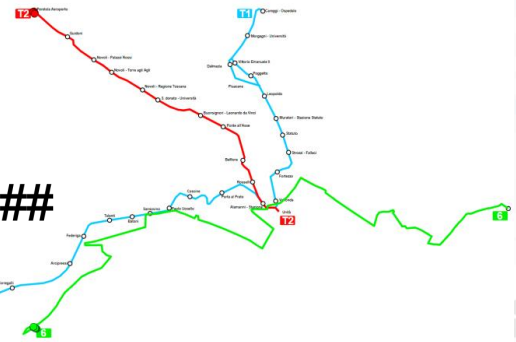


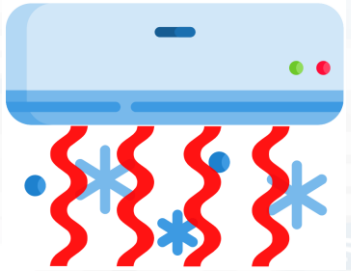
- **Virtual Sensors**
  - From: MyKPI, Sensors, IOT App, other Synoptics
  - To: Dashboards











https://www.snap4city.org/663

Snap4Home 5G Demo

Thu 11 Jun 18:07:32

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open fiber WIND ZTE estra

Custom Widgets are see as External Services

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 16
Slot 17
Slot 18
Slot 19
Slot 20
Slot 21
Slot 22
Environment
other

Selector - Map

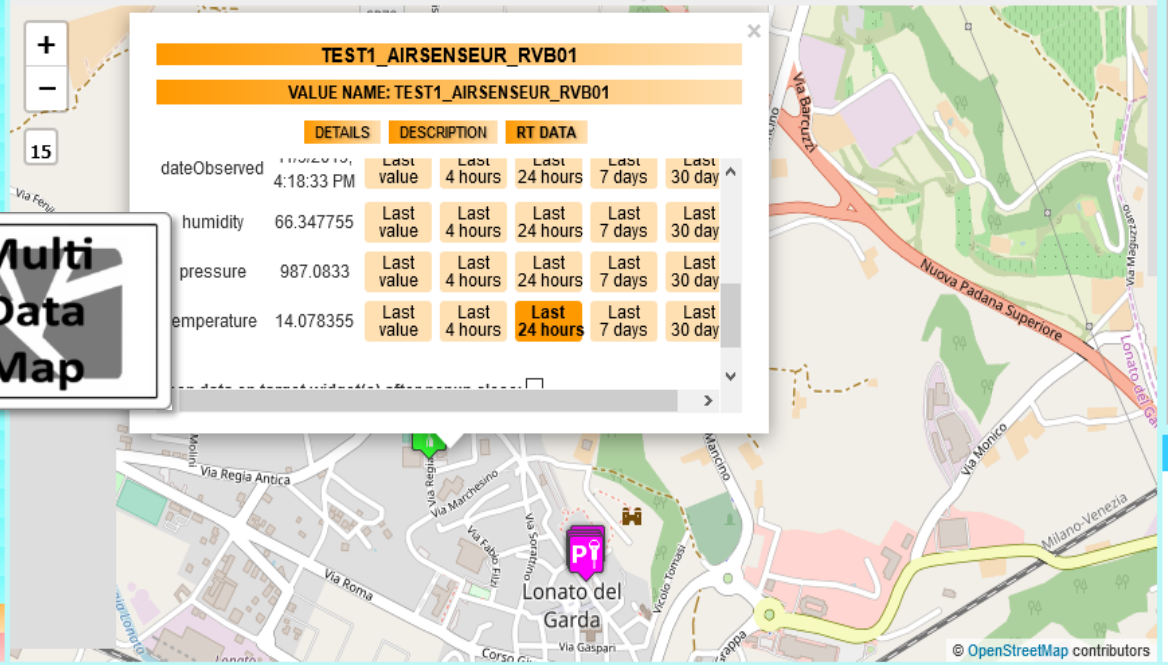
Multi Data Map

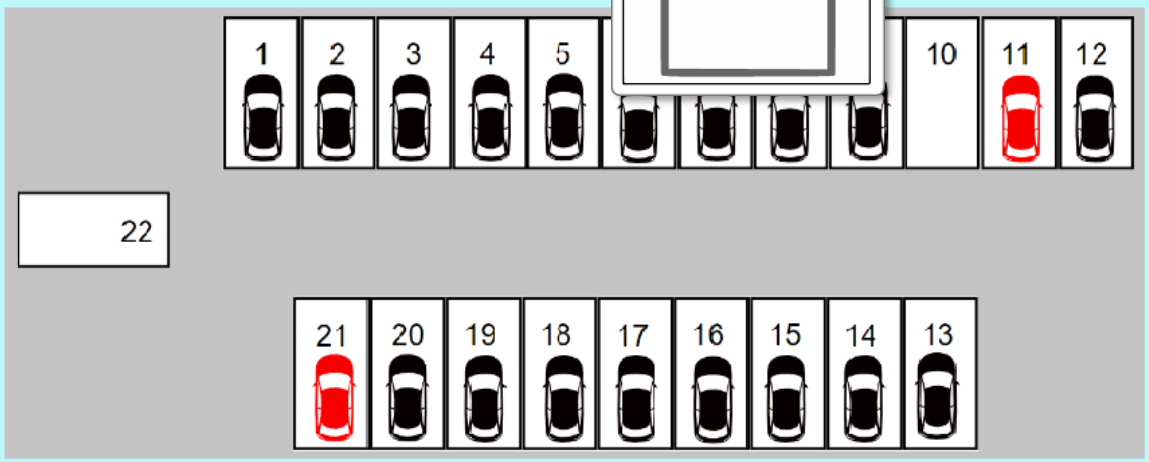
TEST1_AIRSENSEUR_RVB01

VALUE NAME: TEST1_AIRSENSEUR_RVB01

DETAILS | DESCRIPTION | RT DATA

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

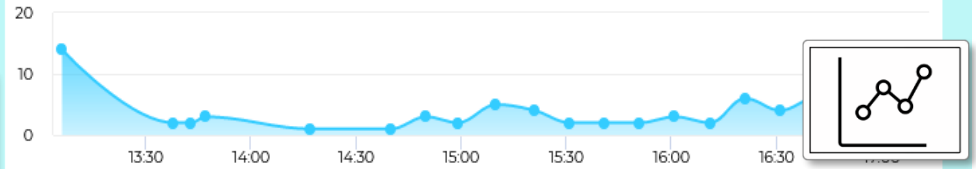




NumFreeSlo... 9m

XX

NumFreeSlots - Slots 9m



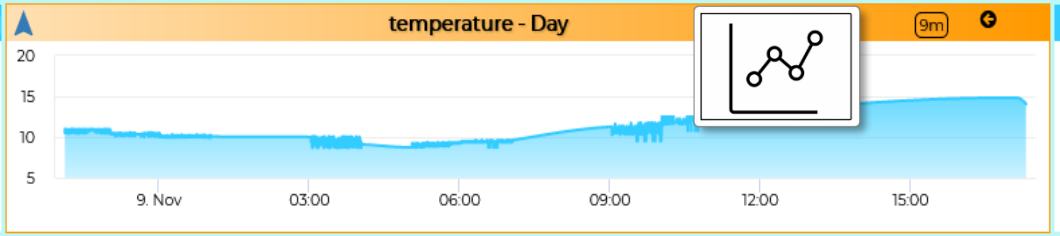
SmartParkingLonato_1 ... 9m

XX

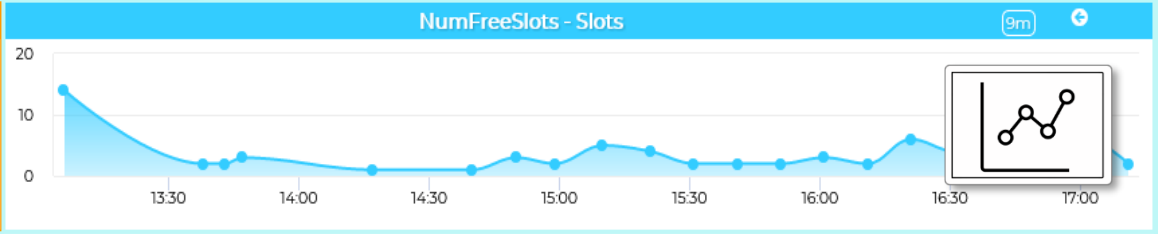
0

status

temperature - Day 9m



NumFreeSlots - Slots 9m



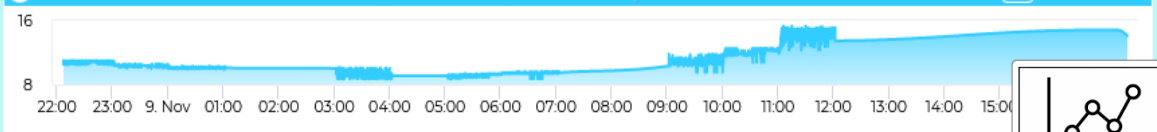
pressure 9m	humidity % 9m	temperature 9m
987.1	66.3	14.1
mm	%	

XX XX

Slot ID 9m	Max Present Duration 9m
14	19 ore e 11 minuti
slot ID	

XX

TEST1_AirSensEUR_RVB01 - temperature 9m



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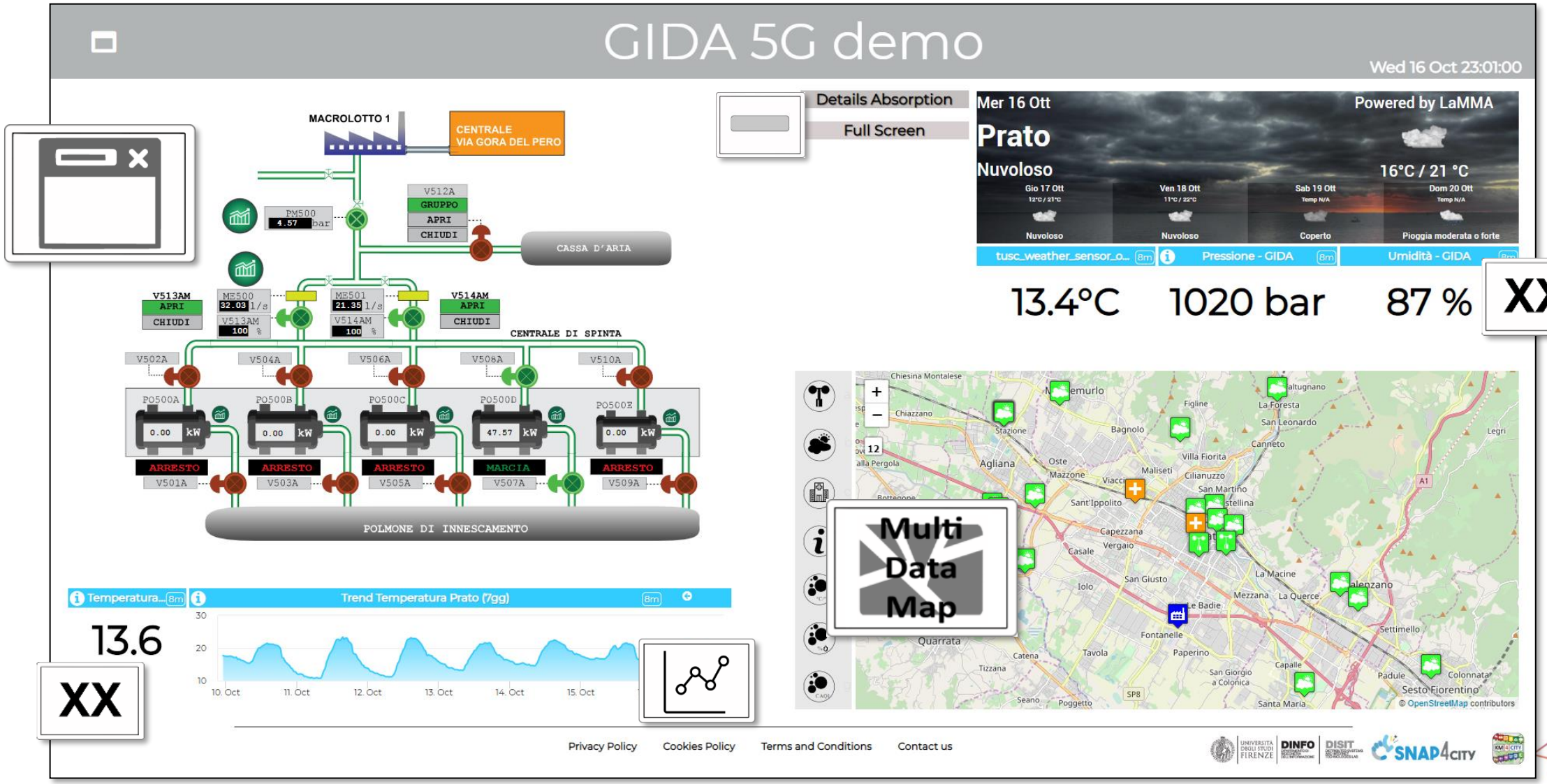
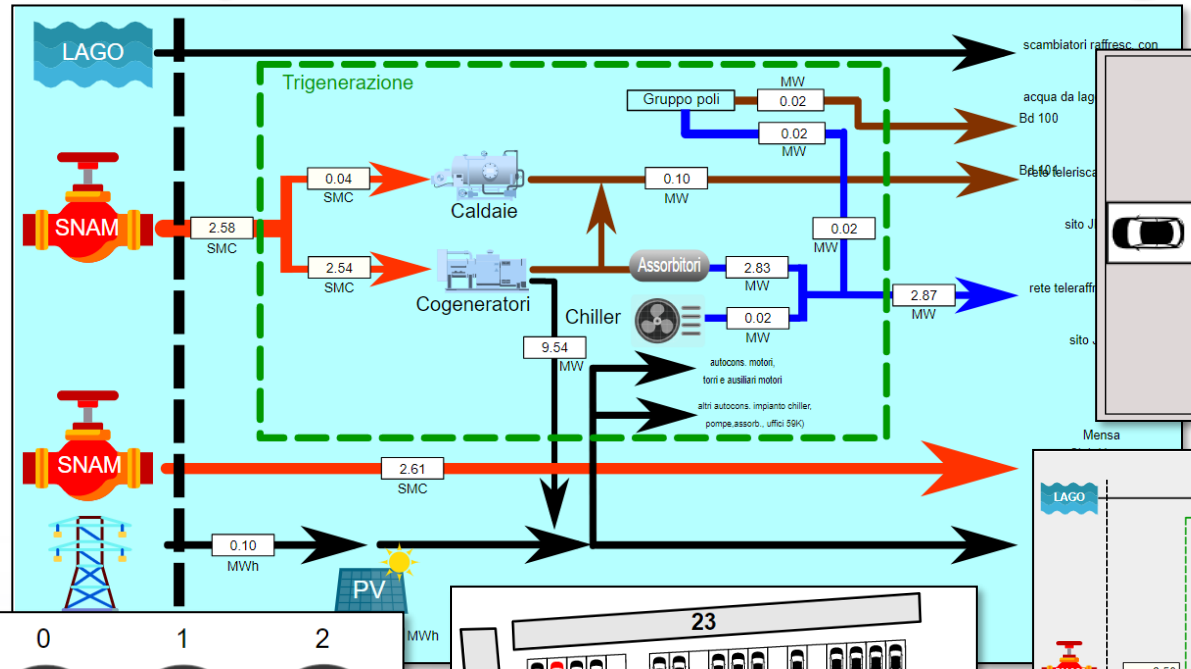
Demo UC5 GIDA

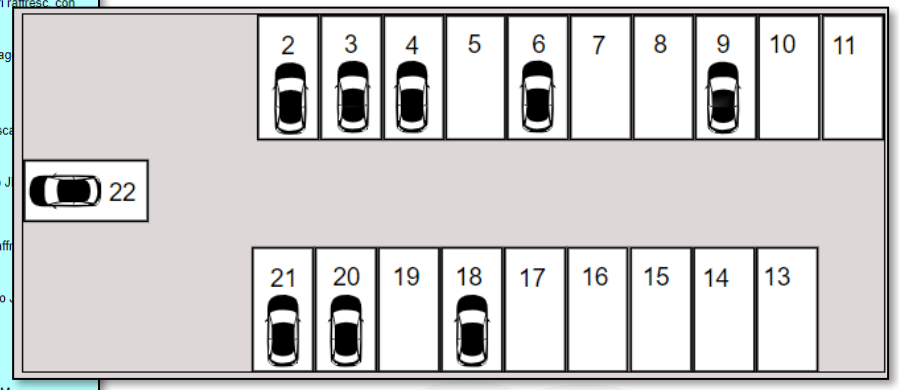


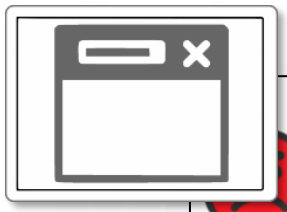
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjIyNg==

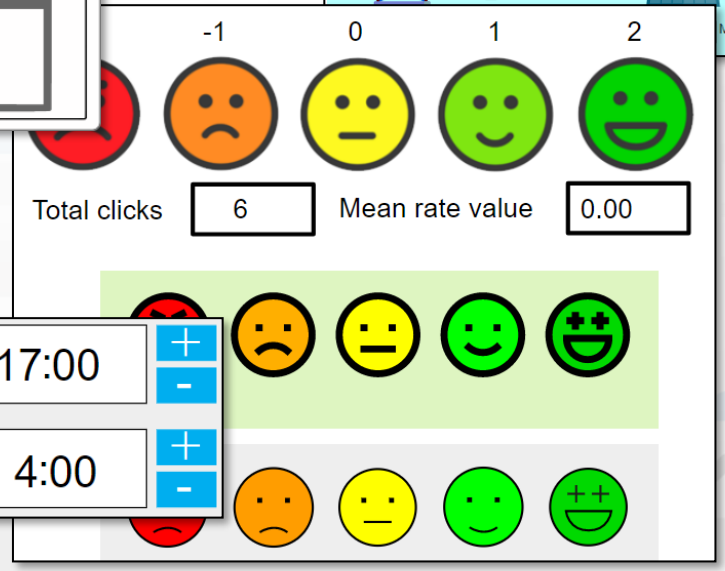
Special Custom Widgets

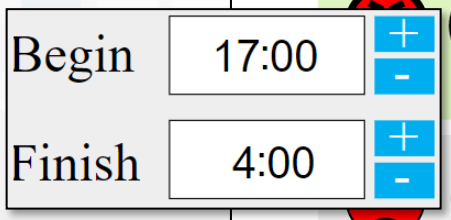
- Smart parking
- Smart Energy
- Smart Light
- Smart ….
- Energy View
- Custom Controls

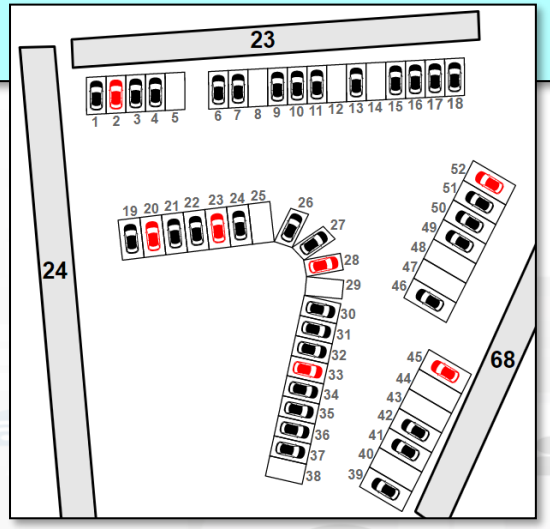


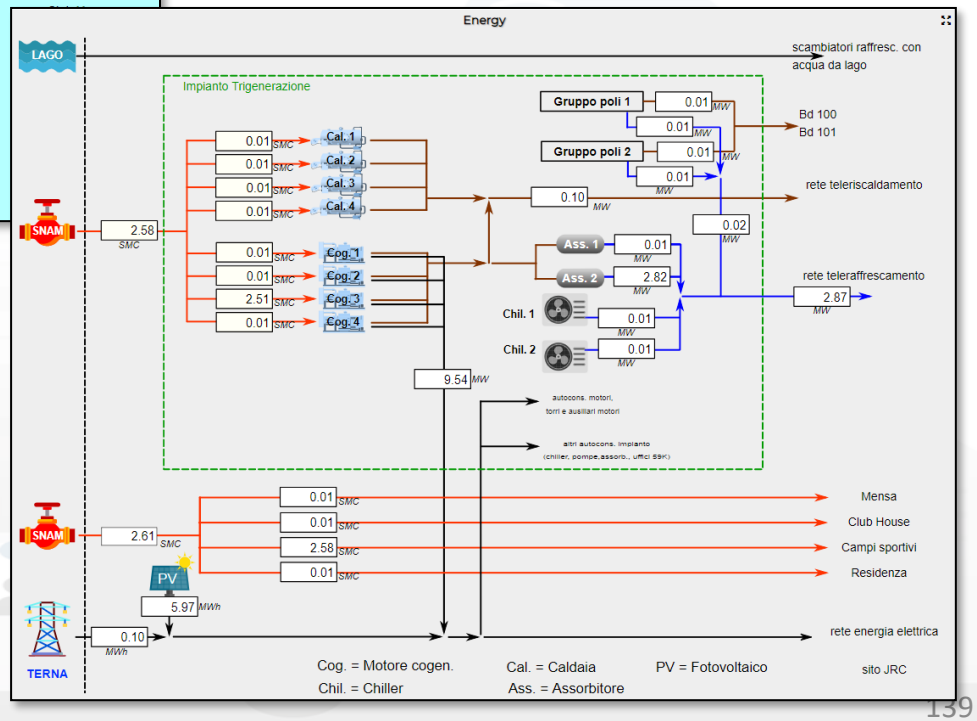


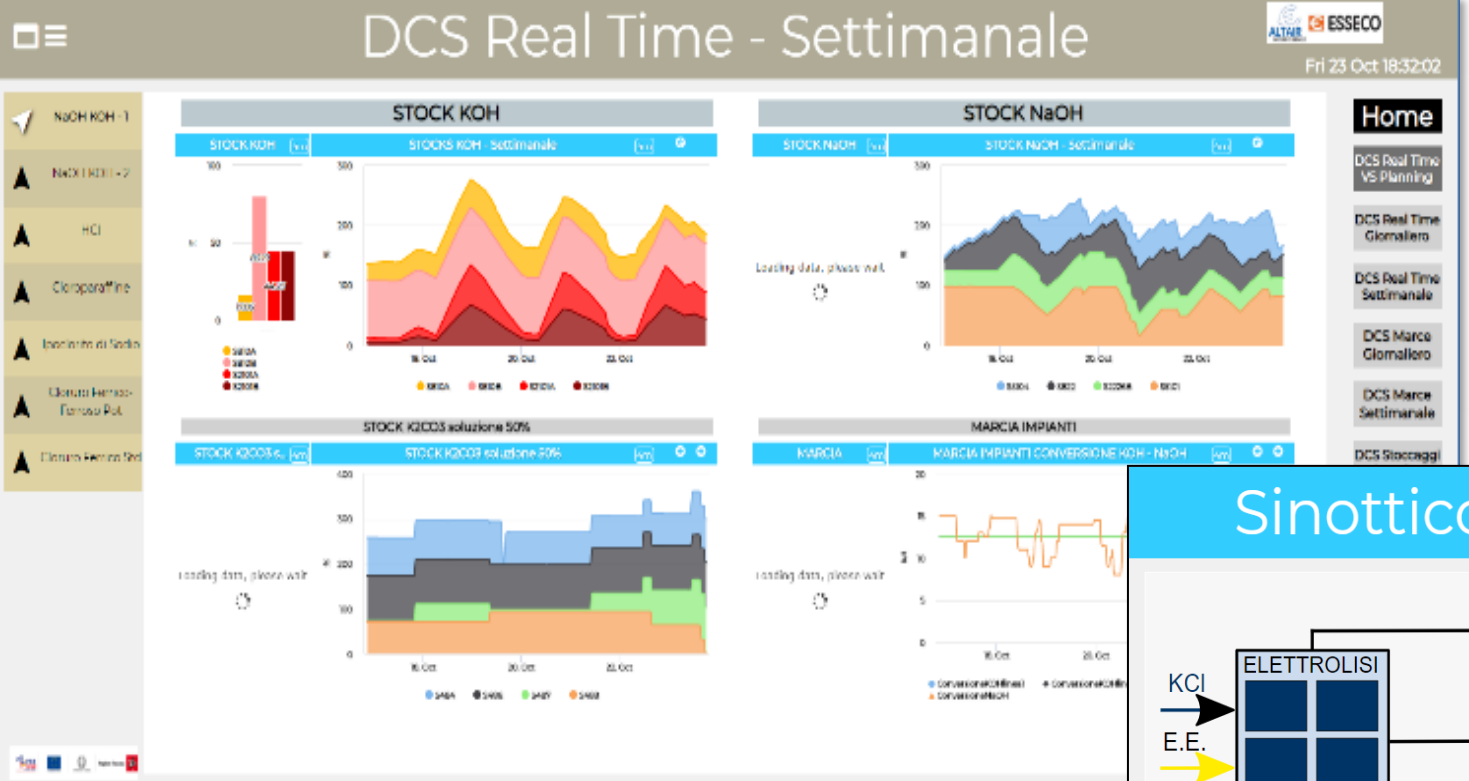


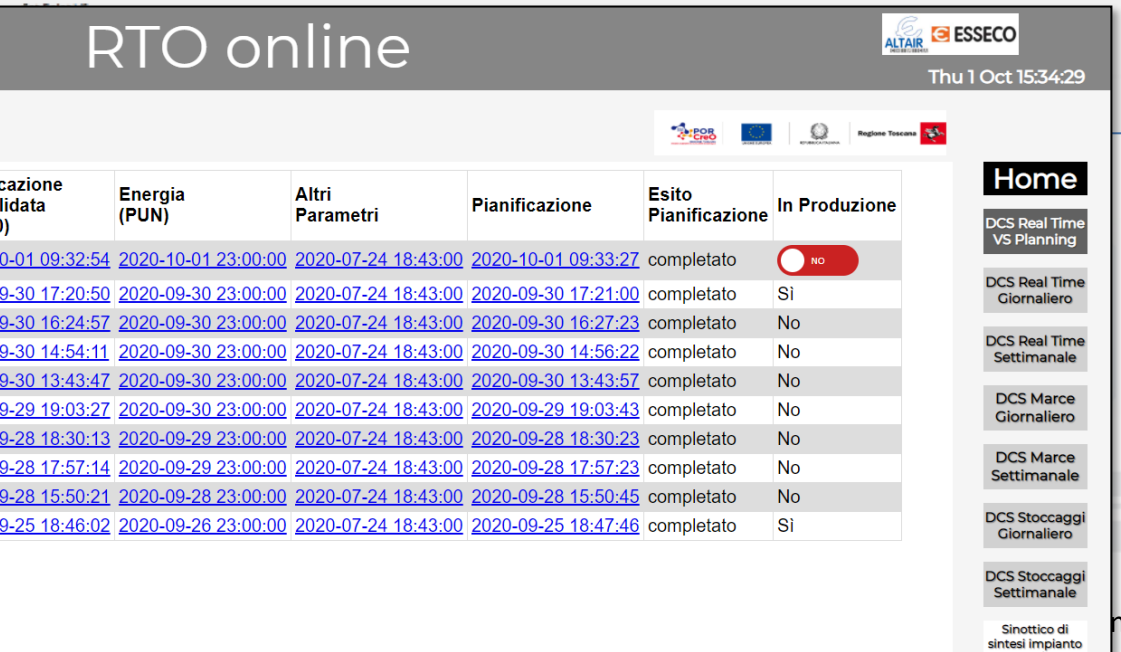


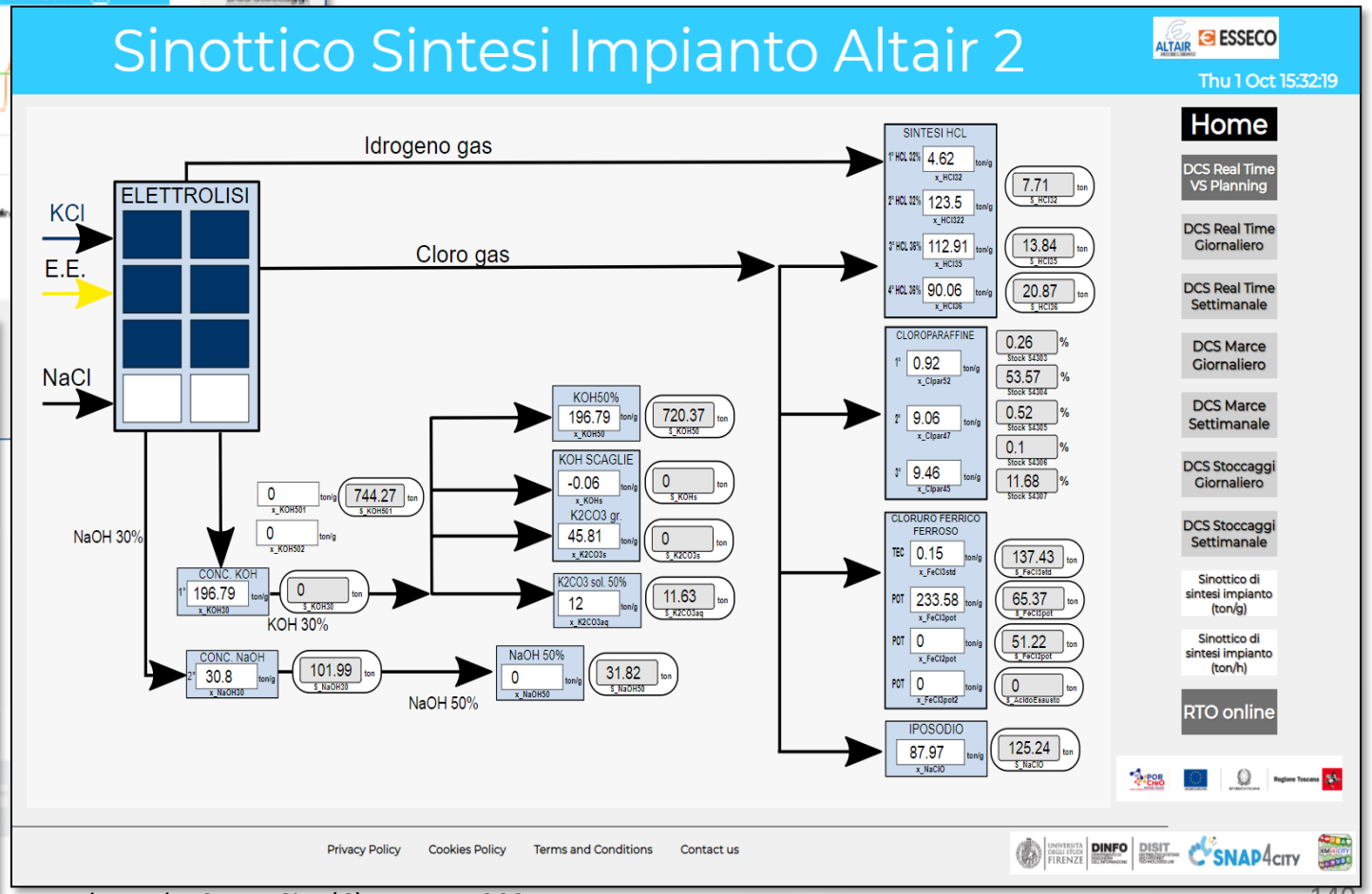







DCS Real Time - Settimanale
ESSECO
Fri 23 Oct 18:32:02
STOCK KOH
STOCK NaOH
STOCK K2CO3 soluzione 50%
MARCIA IMPIANTI
Home
DCS Real Time VS Planning
DCS Real Time Giornaliero
DCS Real Time Settimanale
DCS Marce Giornaliero
DCS Marce Settimanale
DCS Stoccaggi


RTO online
ESSECO
Thu 1 Oct 15:34:29
Energia (PUN)
Altri Parametri
Pianificazione
Esito Pianificazione
In Produzione
2020-10-01 23:00:00
2020-07-24 18:43:00
completato
2020-09-30 23:00:00
2020-09-29 23:00:00
2020-09-28 23:00:00
2020-09-26 23:00:00
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 Sintesi Impianto Altair 2
ESSECO
Thu 1 Oct 15:32:19
Idrogeno gas
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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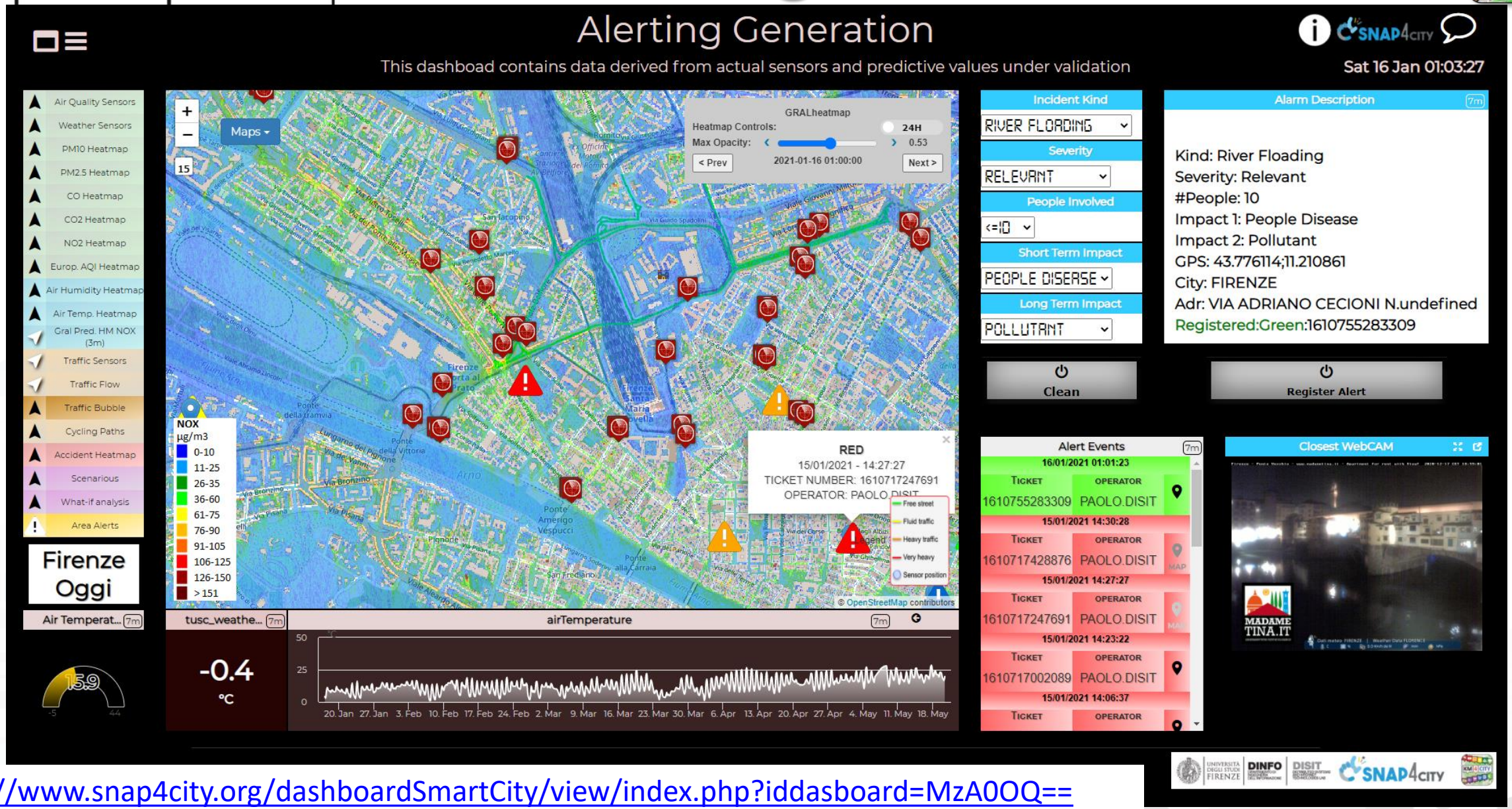
Event Driven Custom Widgets

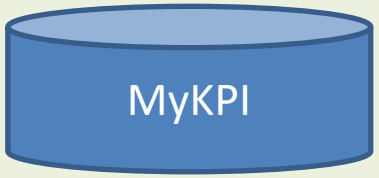
https://www.snap4city.org/663 for the manual

Alert Registration

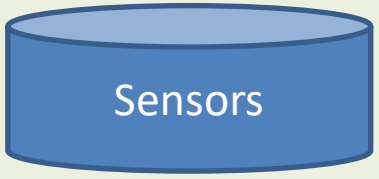


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzA0OQ==

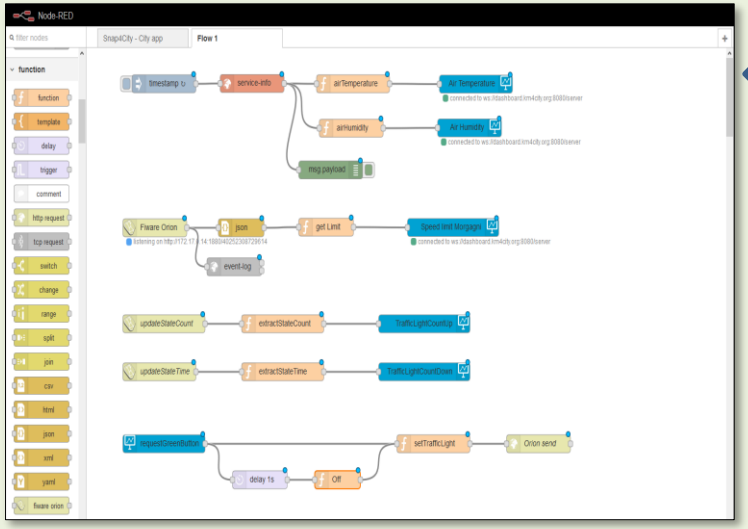
From-To Custom Widgets / Synoptics to Storage in WS



MyKPI



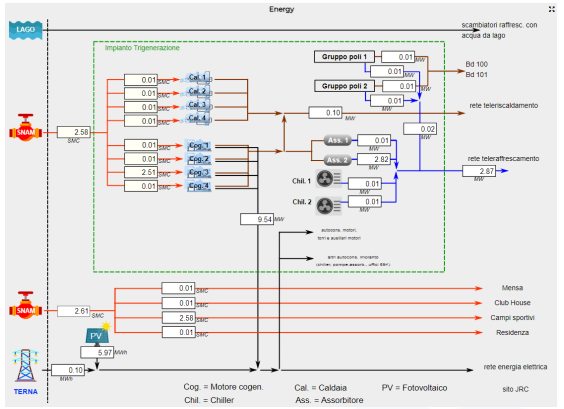
Sensor

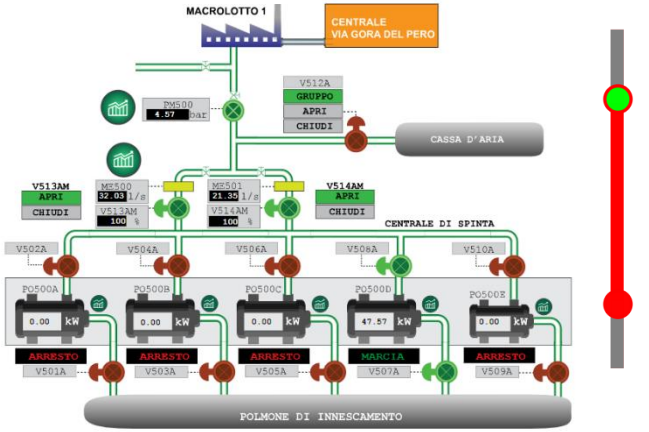


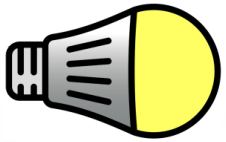
[ ]

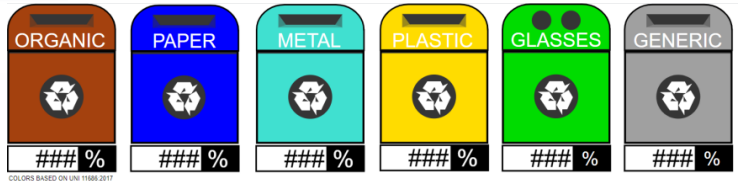
New Shared Variables

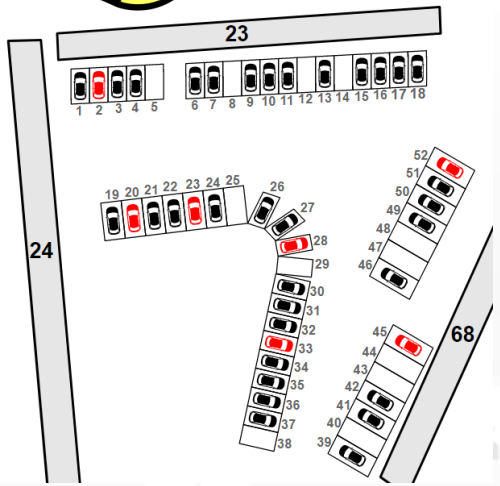
Constant Values

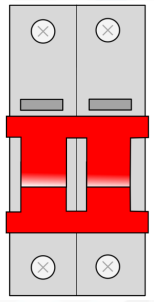








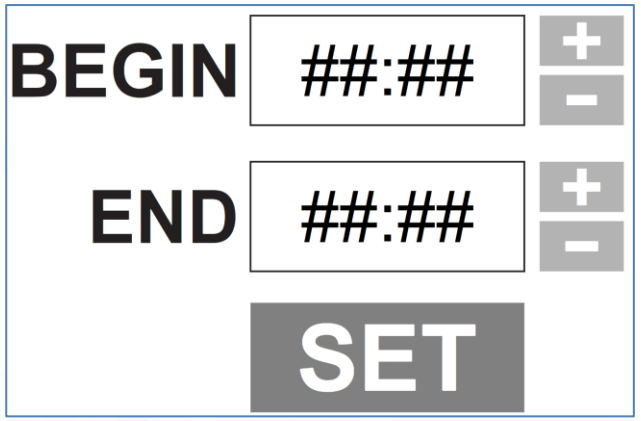


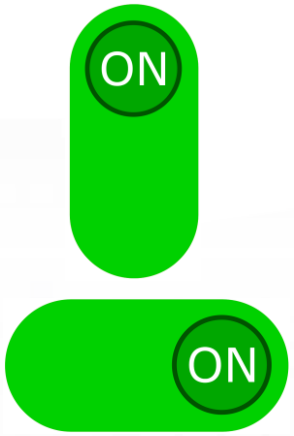


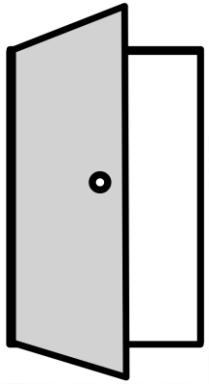
Web Socket Secure

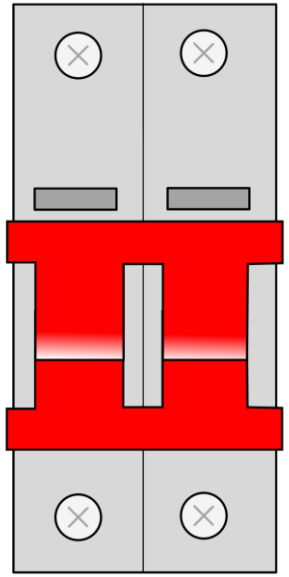
Other examples

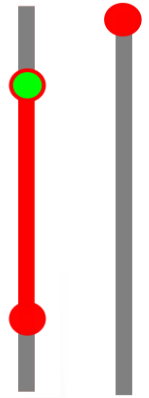
- **Virtual Actuators (sensor-actuator), Read and Write Variable**
  - From: Dashboard; To: IOT App, MyKPI, other Synoptics
  - And from IOT App to Dashboard





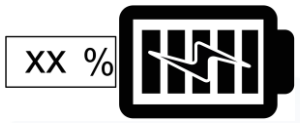


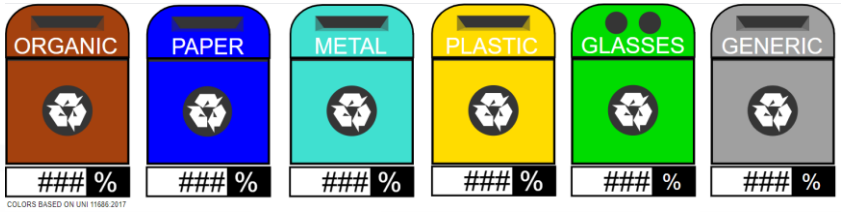


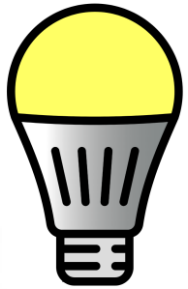


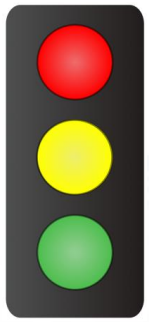
Other examples

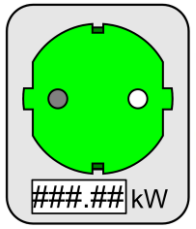
- **Virtual Sensors (only Read Variable)**
  - From: MyKPI, Sensors, IOT App, constants, other Synoptics
  - To: Dashboards

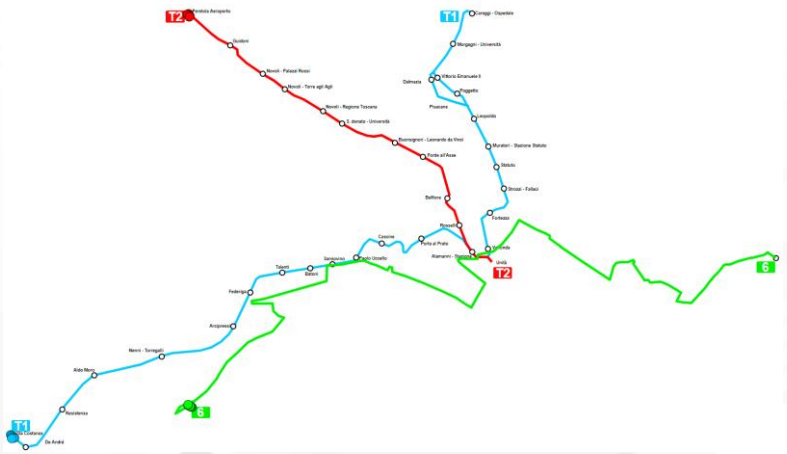


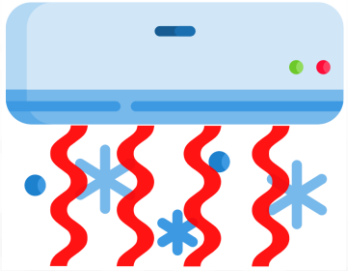


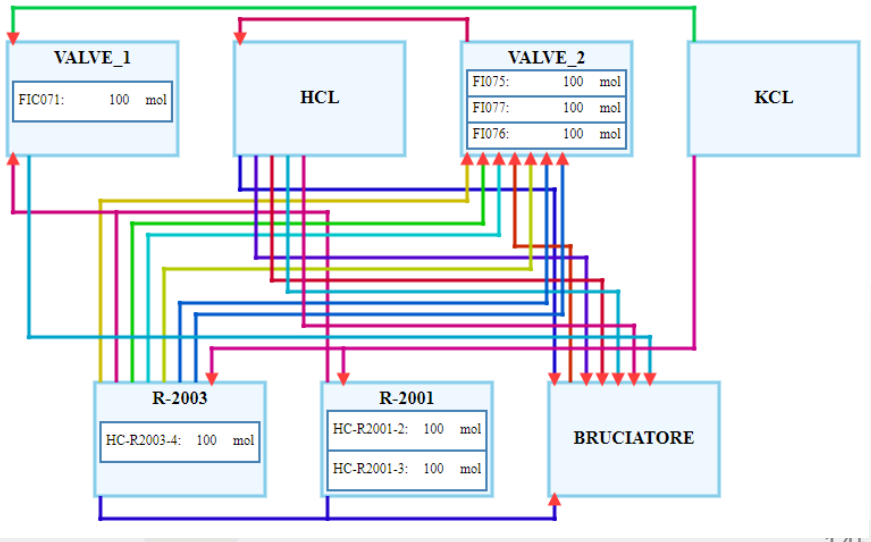












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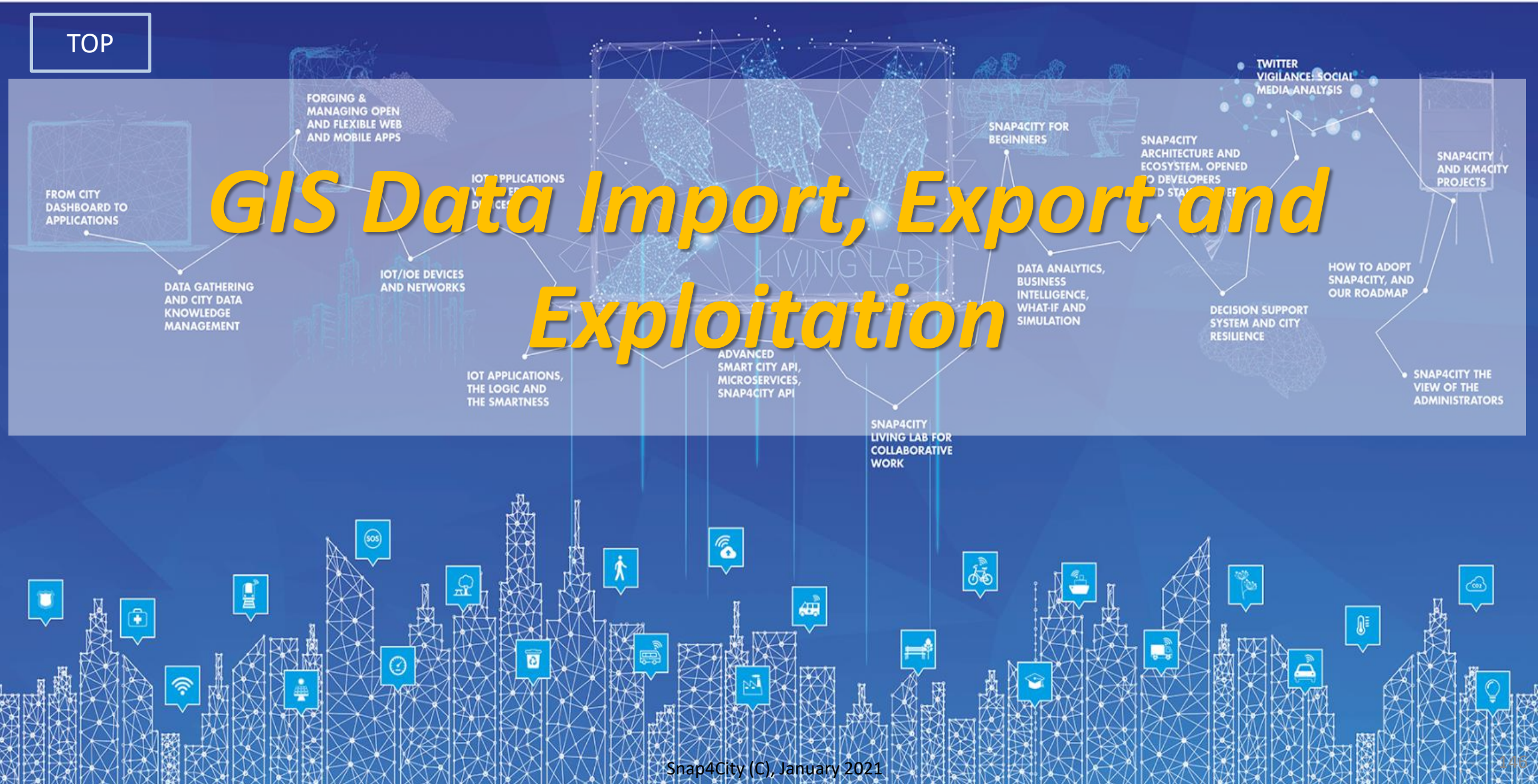
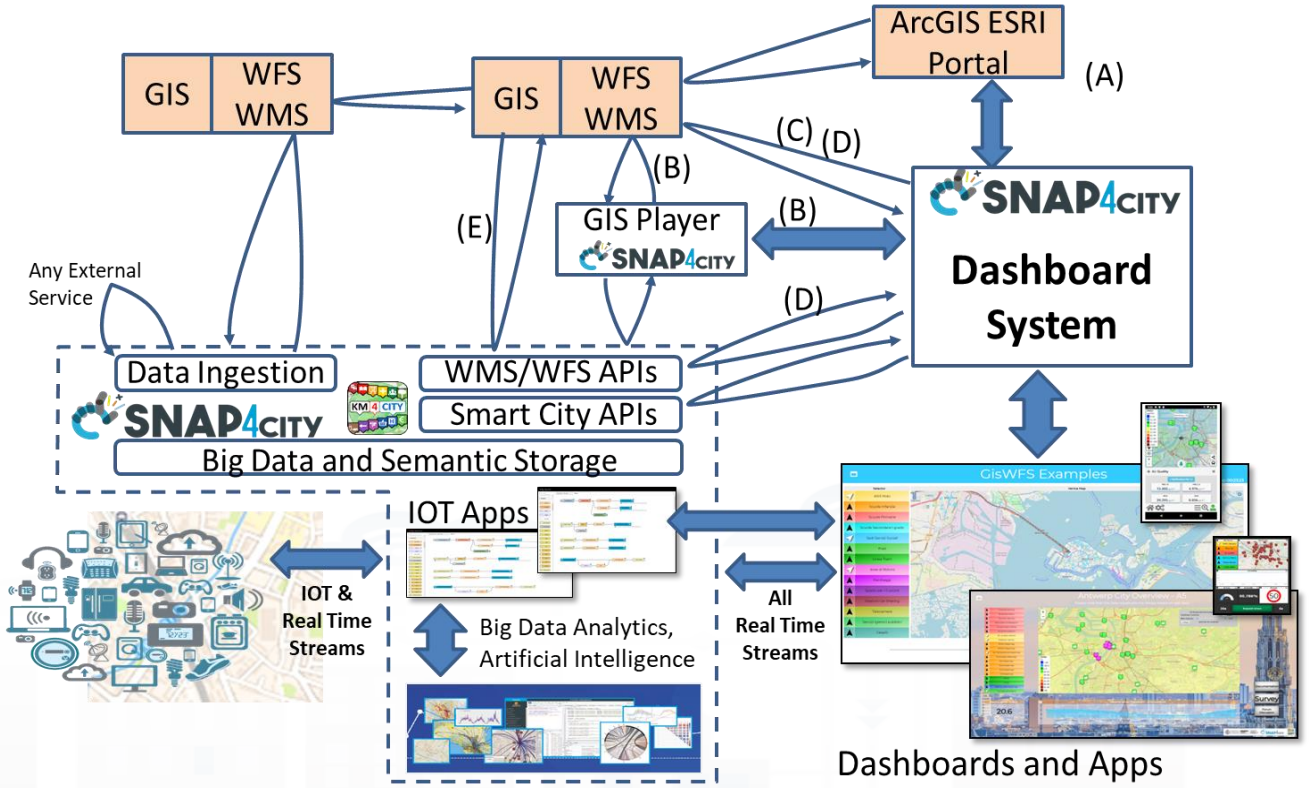


GIS Data Import, Export and Exploitation

Interoperability ESRI

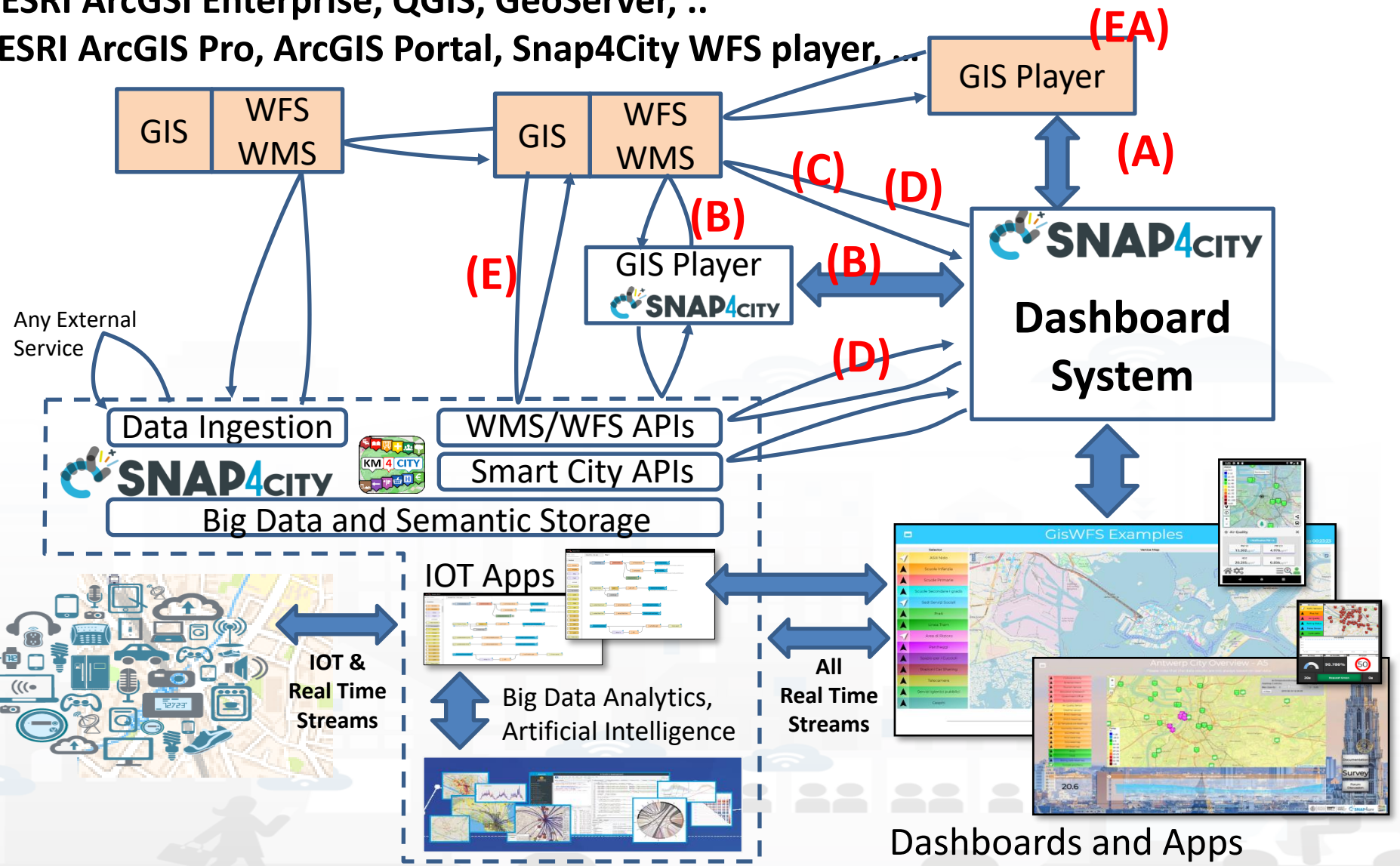
- **Snap4City is interoperable with**
  - ESRI ArcGIS Enterprise, Portal, Pro/MAP, ...
  - other GIS tools supporting WFS, WMS, GeoJSON, GML
- **Snap4City is interoperable since:**
  - **Provides** info/data in WFS, WMS
  - **Exploits** data/info from WFS, WMS
  - **Import** data/info from WFS/WMS



- The Snap4City platform can be installed on premise using **Snap4City Appliance** https://www.snap4city.org/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

Case ESRI ArcGIS

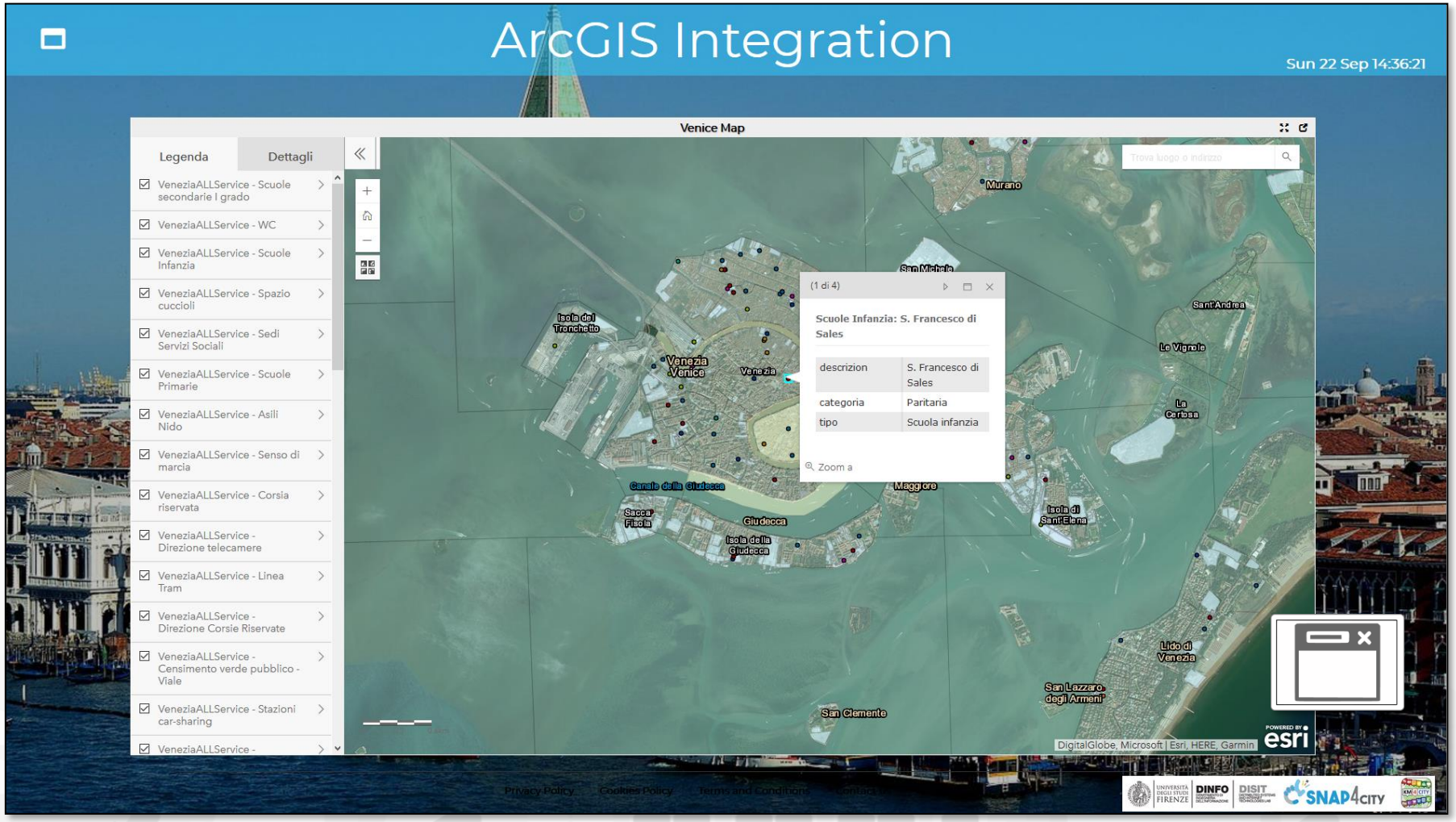
GIS Server can be: ESRI ArcGSI Enterprise, QGIS, GeoServer, ..
GIS Player can be: ESRI ArcGIS Pro, ArcGIS Portal, Snap4City WFS player, ...



- **GIS:**
  - Geographic Information System
- **WMS:**
  - Web Map Service
- **WFS:**
  - Web Feature Services

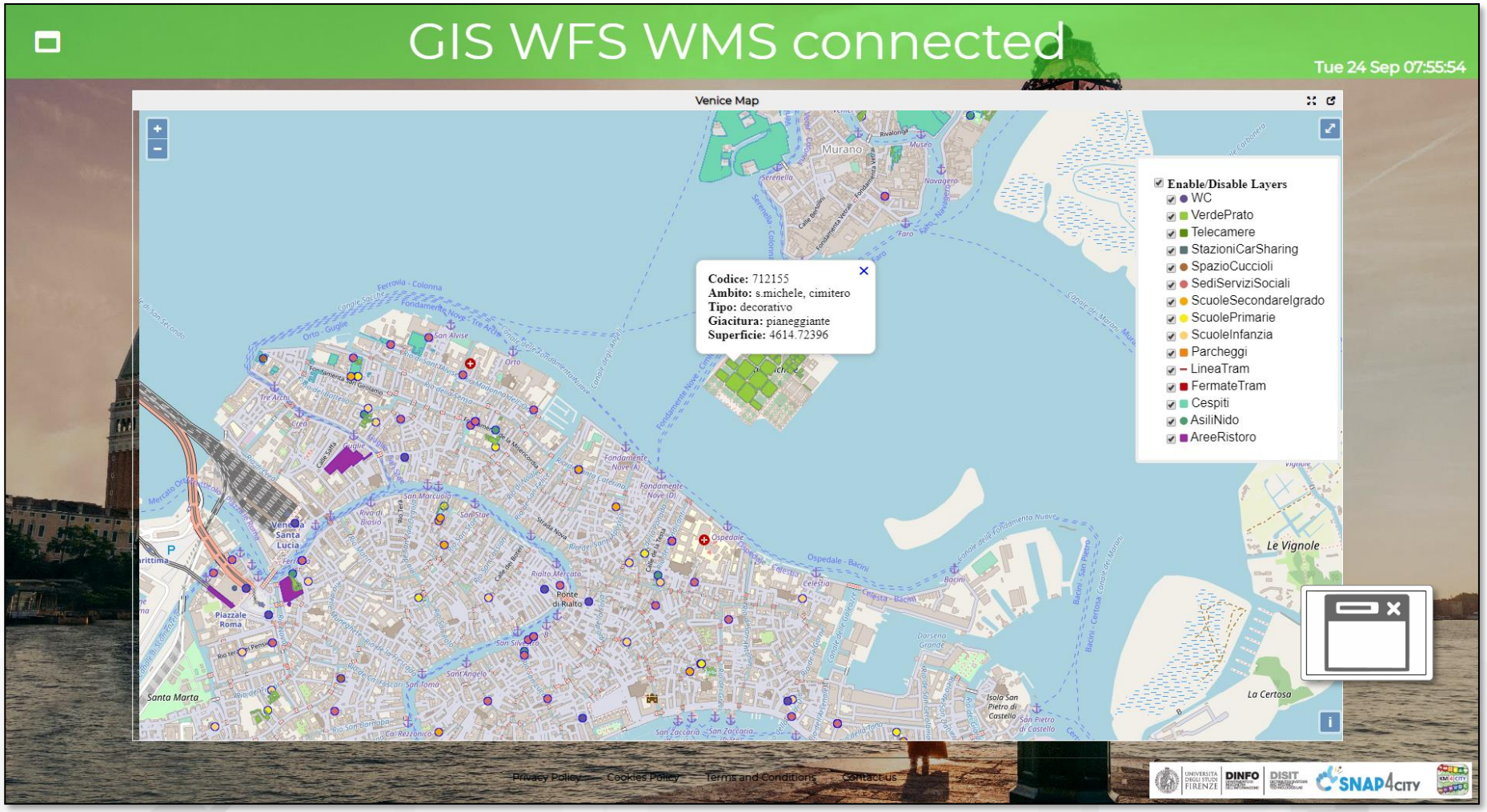
(A) ArcGIS ESRI as External Service

- DISIT Lab has ESRI ArcGIS Enterprise 10.6 installed
- ArcGIS Portal accesses to ArcGIS Enterprise server
  - https://arcgis.km4city.org/arcgisportal/apps/Embed/index.html?webmap=5774fa9d0f7f4a2fb2d7cd52dffcd8c9&extent=12.3144,45.4276,12.3461,45.4419&home=true&zoom=true&previewImage=false&scale=true&search=true&searchextent=true&details=true&legendlayers=true&active_panel=details&basemap_gallery=true&disable_scroll=true&theme=light
- Snap4City Dashboard uses as External Service: ArcGIS ESRI Portal
- https://main.snap4city.org/view/index.php?iddasboard=OTkw



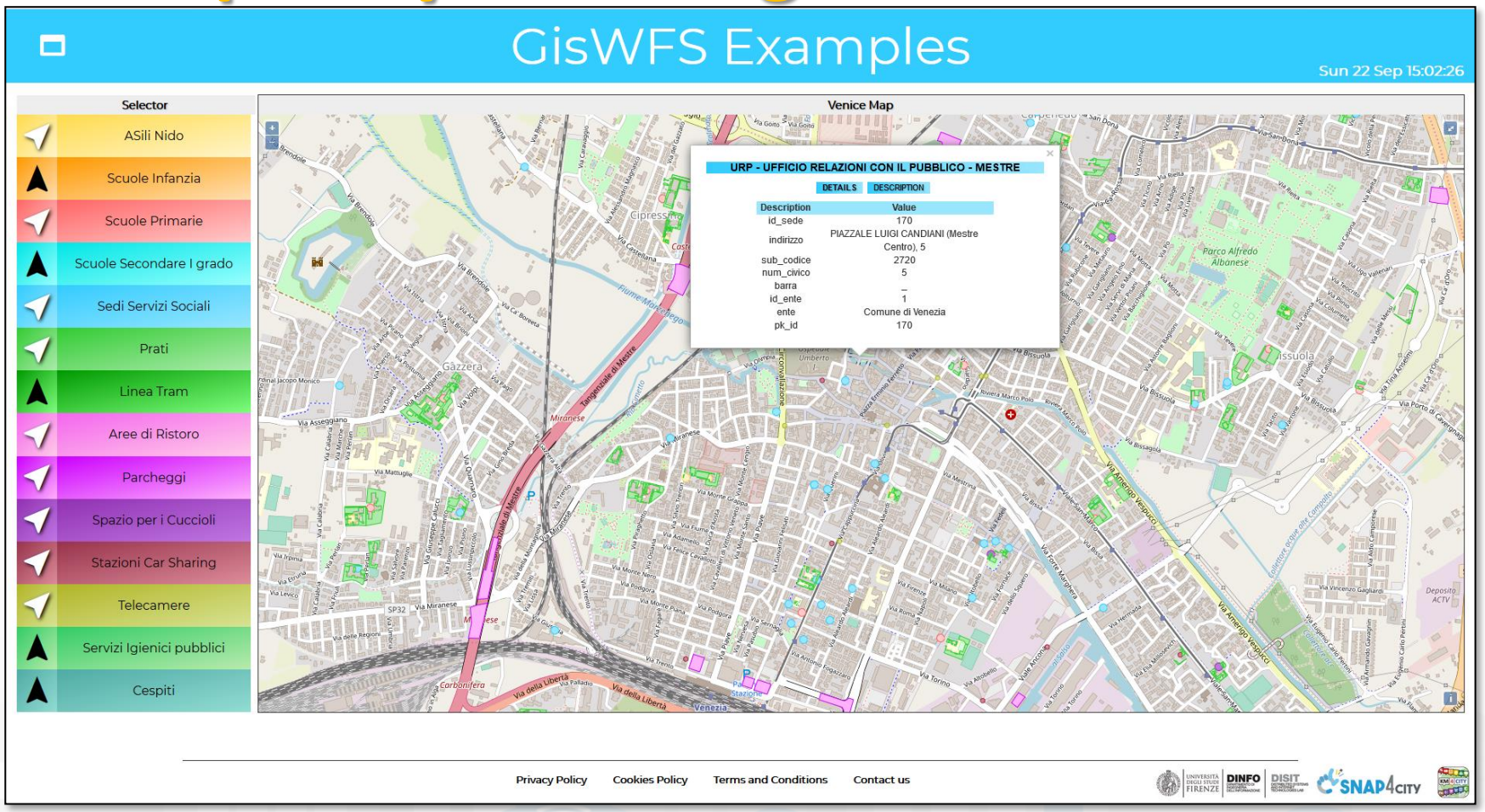
(B) GIS data on Dashboard via Snap4City GIS Player

- DISIT Lab has ESRI ArcGIS Enterprise 10.6 installed
- Snap4City has its WFS Player https://main.snap4city.org/widgets/venezia/index.php
- Snap4City Dashboard uses as External Service: Snap4City GIS viewer via WFS/WMS: https://main.snap4city.org/view/index.php?iddasboard=MTIxNg==



(C) Dash with Snap4City GIS widget and Selector

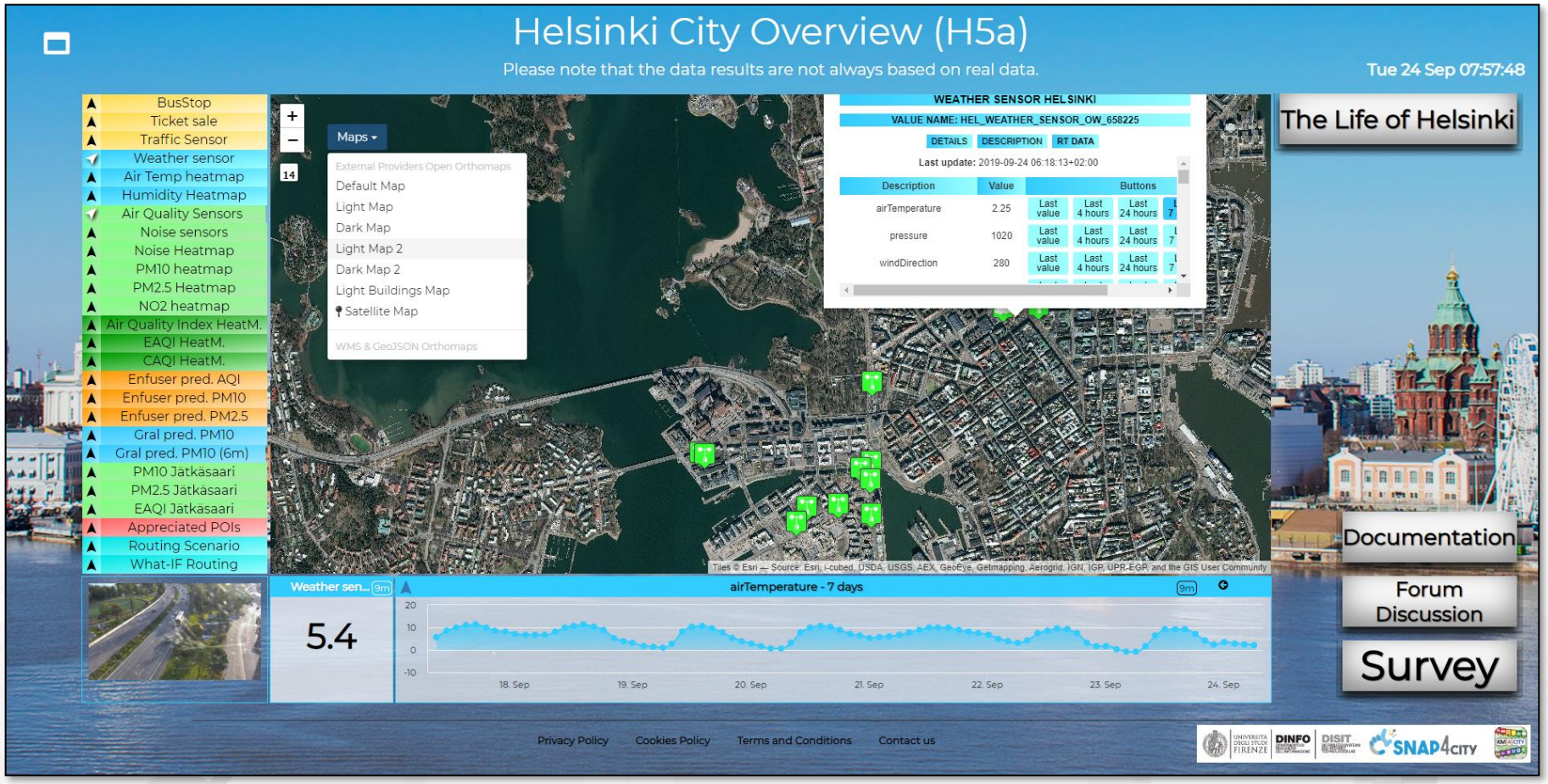
- DISIT Lab has ESRI ArcGIS Enterprise 10.6 installed
- Snap4City has its WFS / WMS widget / Player
- Snap4City Dashboard shows WFS/WMS data via Special GIS Widget Map:
  - https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTQwMw==
- Snap4City can use **Selector** to select WFS / WMS sources to be shown from ESRI ArcGIS (as well as from any other WFS service) on Widget map



The Snap4City Widget Map allows to **mixt WFS GIS sources with Smart City API**
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTM5NA==

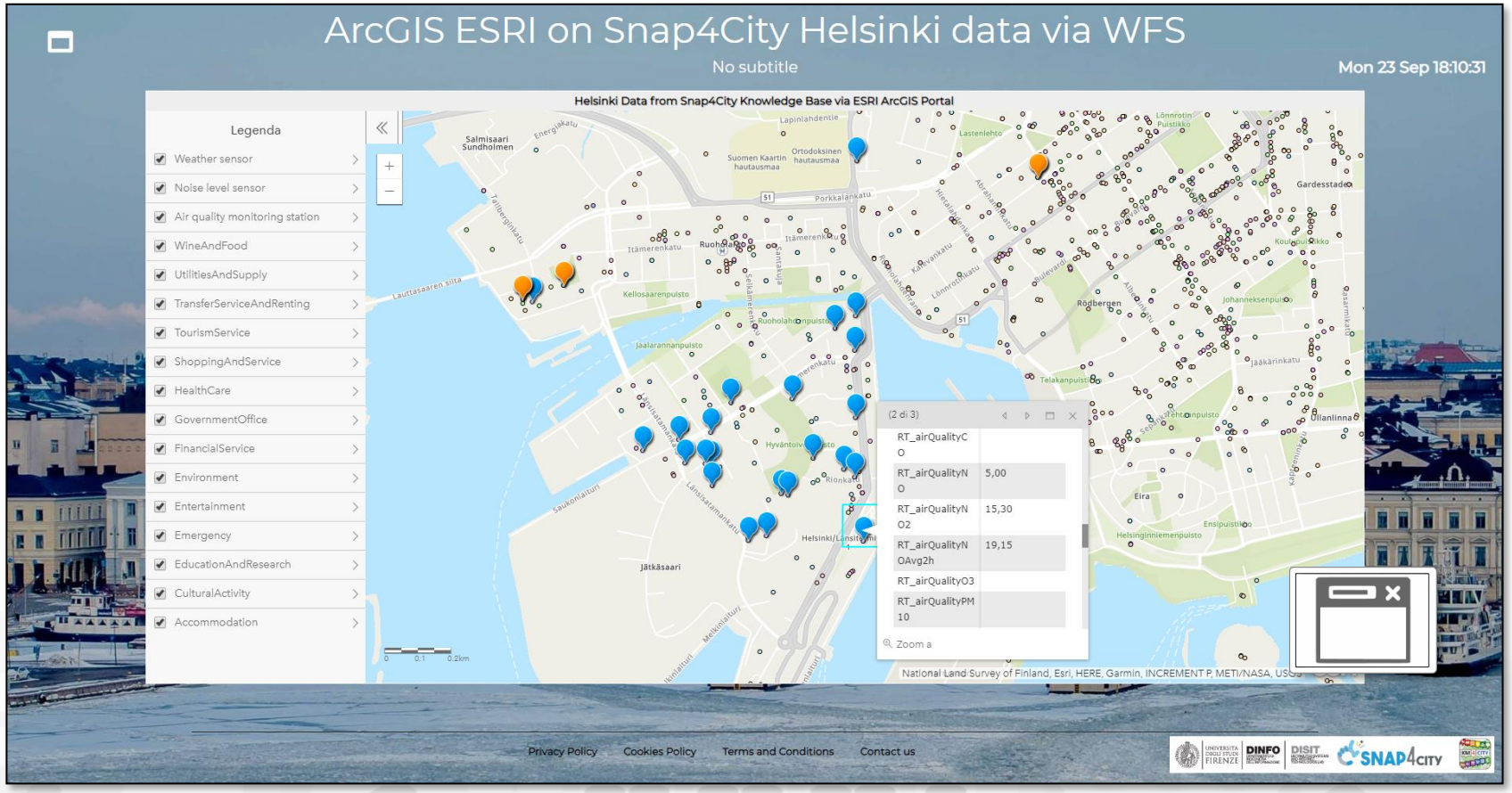
(D) Dashboard with Orthomaps and shapes layers based on WMS, GeoJSON

- DISIT Lab has ESRI ArcGIS Enterprise 10.6 installed, and GeoServer
- Snap4City main MultidataMap Widget can load WMS background images and shapes, the Orthomaps
- Also Heatmaps calibrated are provided from GeoServer using WMS protocol
- Maps in this case are directly **taken from ESRI Server, free of charge**
- https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTQwNg==#



(E) Snap4City via WFS on top of Smart City API provide data to ESRI ArcGIS Enterprise or ArcGIS Pro, and thus the data become accessible on ArcGIS ESRI Portal

- Snap4City provides a WFS service on top of SmartCity API. Thus providing data to any GIS/WFS client, including ESRI ArcGIS Enterprise, ArcGIS Pro, QGIS, etc.
- In the example, our ingested Helsinki Data have been harvested from ESRI ArcGIS via WFS.
- Once ingested on ESRI ArcGIS can be visualized, by using ArcGIS Portal
  - https://arcgis.km4city.org/arcgisportal/apps/Embed/index.html?webmap=fbcec7055a3446e29fc1e9c55cb53d79&extent=24.8335,60.1465,25.013,60.1965&zoom=true&previewImage=false&scale=true&legendlayers=true&disable_scroll=false&theme=light
- Snap4City Dashboard can show ESRI ArcGIS Portal **(A)** as External Services in a dashboard.
  - https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjIwNg==



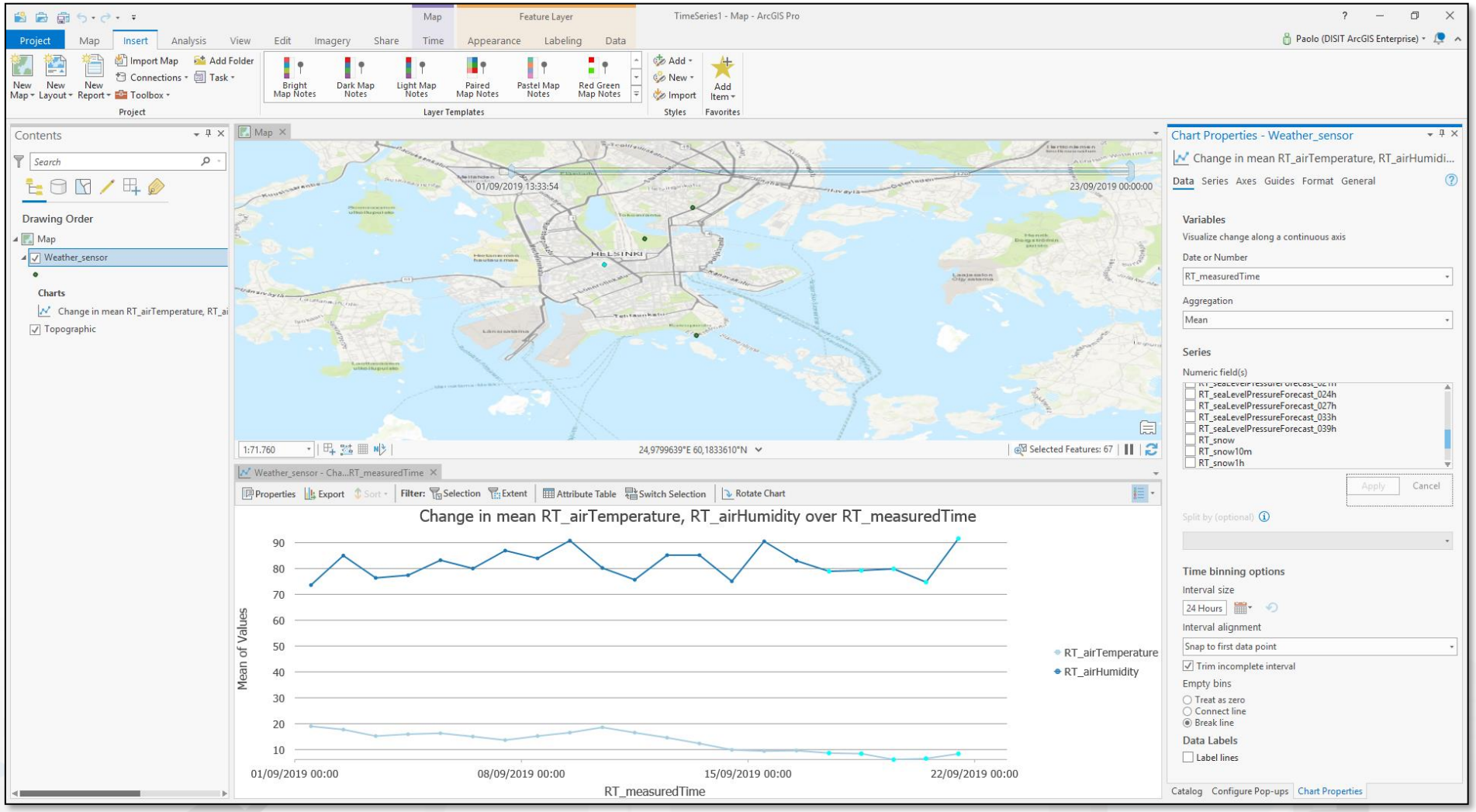
(EA) ArcGIS ESRI Pro as GIS / WFS play

To test you need to have installed ArcGIS pro on your pc and connect with Snap4City WFS/WMF server or with ArcGIS server which has done the same connection with our server WFS/WMS

On PC:

(i) Get data via WFS connected to ESRI ArcGIS Enterprise or other sources

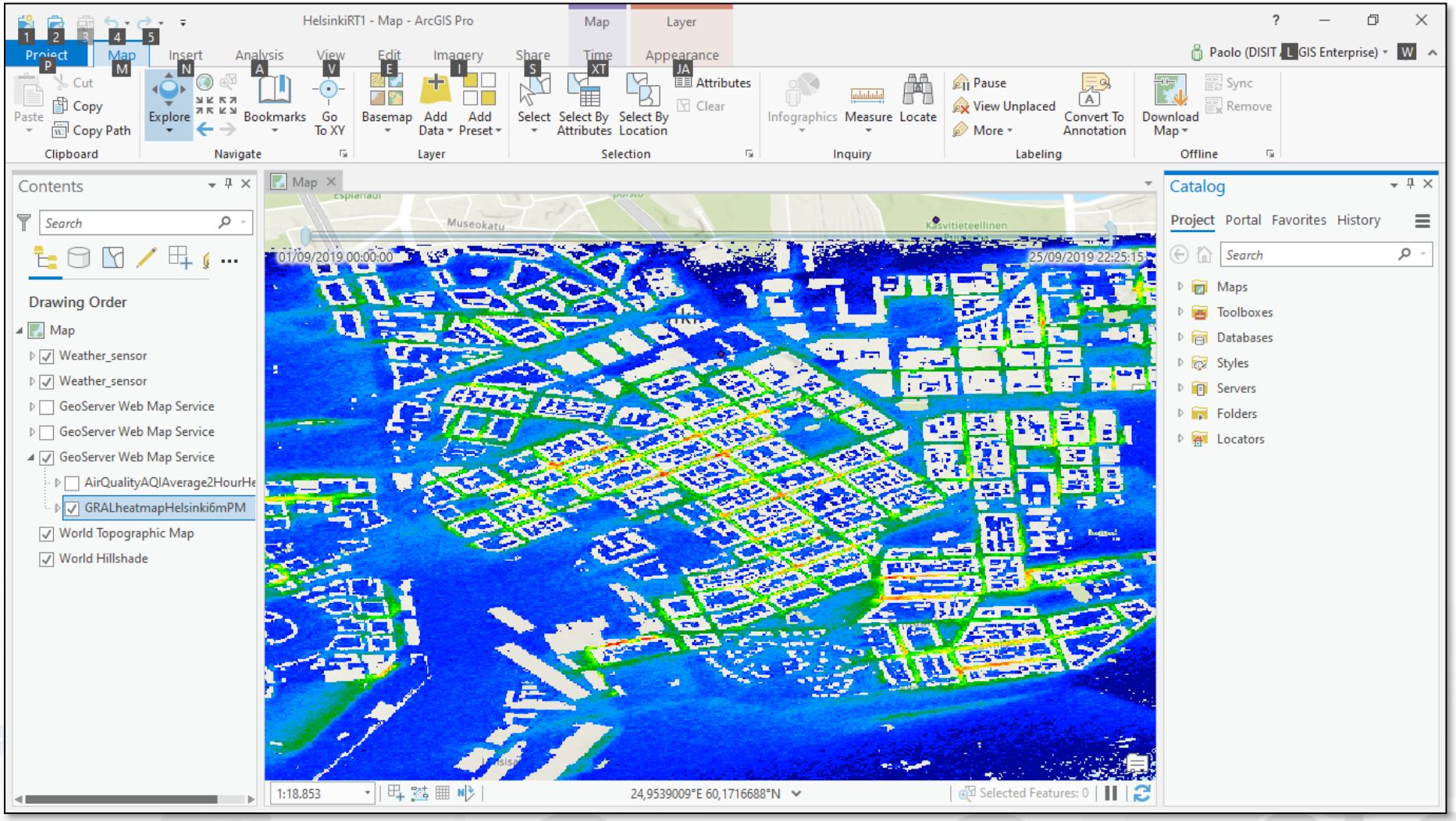
(ii) Download data via WFS … from…



(EA) ArcGIS ESRI Pro as GIS / WMS play

To test it you need to have installed ArcGIS pro on your pc and connect with our WFS/WMF server or with ArcGIS server which has done the same connection with our server WFS/WMS

Heatmap taken from Snap4City GeoServer via WMS protocol



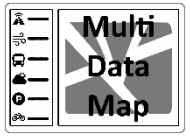
ESRI ArcGIS has an IOT solution based on ESRI GeoEvent, for real time data

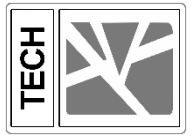
- **You need to have**
  - **ArcGIS Enterprise + GeoEvent Server + SpatioTemporal Big Data Store**
- **Limitations on the number of protocols addressed**
- **Snap4City solution solves the limitations** by ingesting data from a plethora of protocols and sources and
  - (a) posting the IOT data into their **Spatio-Temporal Big Data Store**
  - (b) collecting data from several protocols and posting them into **ESRI GeoEvent in MQTT**,
  - (c) making them available via WFS protocol.

Snap4City vs GIS, WFS/WMS

- GIS data:
  - Ingested via WFS/WMS protocols, and then managed as the other data. Data ingestion from GIS server can be performed via ETL processes, or directly from Dashboards
  - Shown on Dashboards via third party GIS tools as External Services
  - Shown on Dashboards using Special GIS Widget Map which directly access to GIS data via WFS/WMS
  - Heatmaps and Maps are distributed via a GeoServer
- Snap4City can interact with ArcGIS Real Time Events via MQTT protocol as well

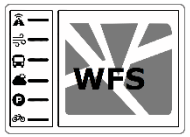
Maps, etc.





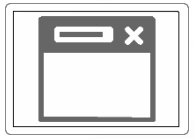
MultiDataMap: Heatmaps and special tools (as cycling paths, traffic flow, what if scenario, routing), MyData, MyKPI (not RT), MyPOI, POI, Sensors (include selector new, or tech (with some limitations)

- they may also include maps, orthomaps, and 3D (in beta), please ask to Snap4City Staff to activate those features in your widget/dashboard



WFS: WFS, POI (manually added) (include selector)

ServiceMap: POI, with integrated menu (usable with selector web)



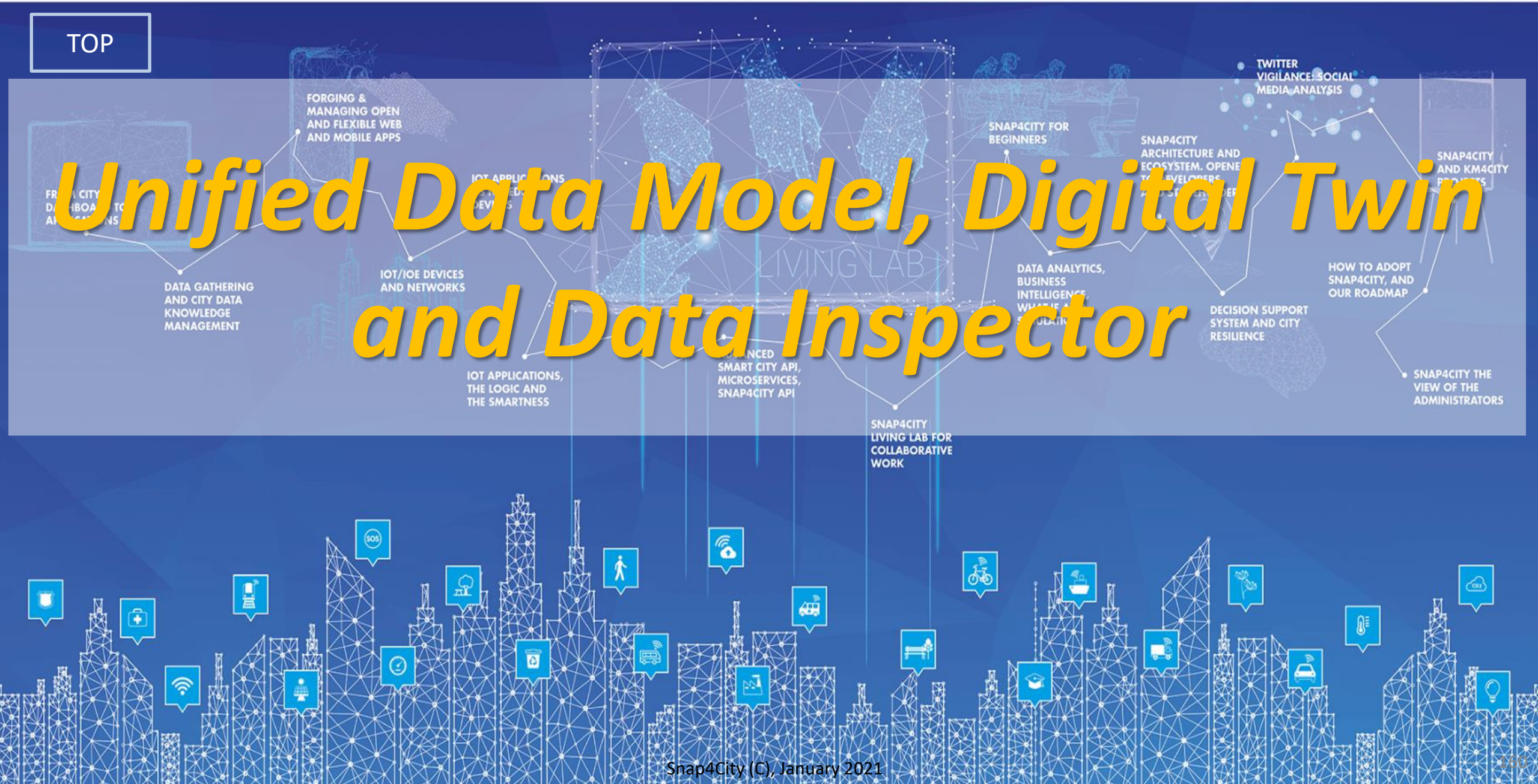
Web page

https://www.snap4city.org/408

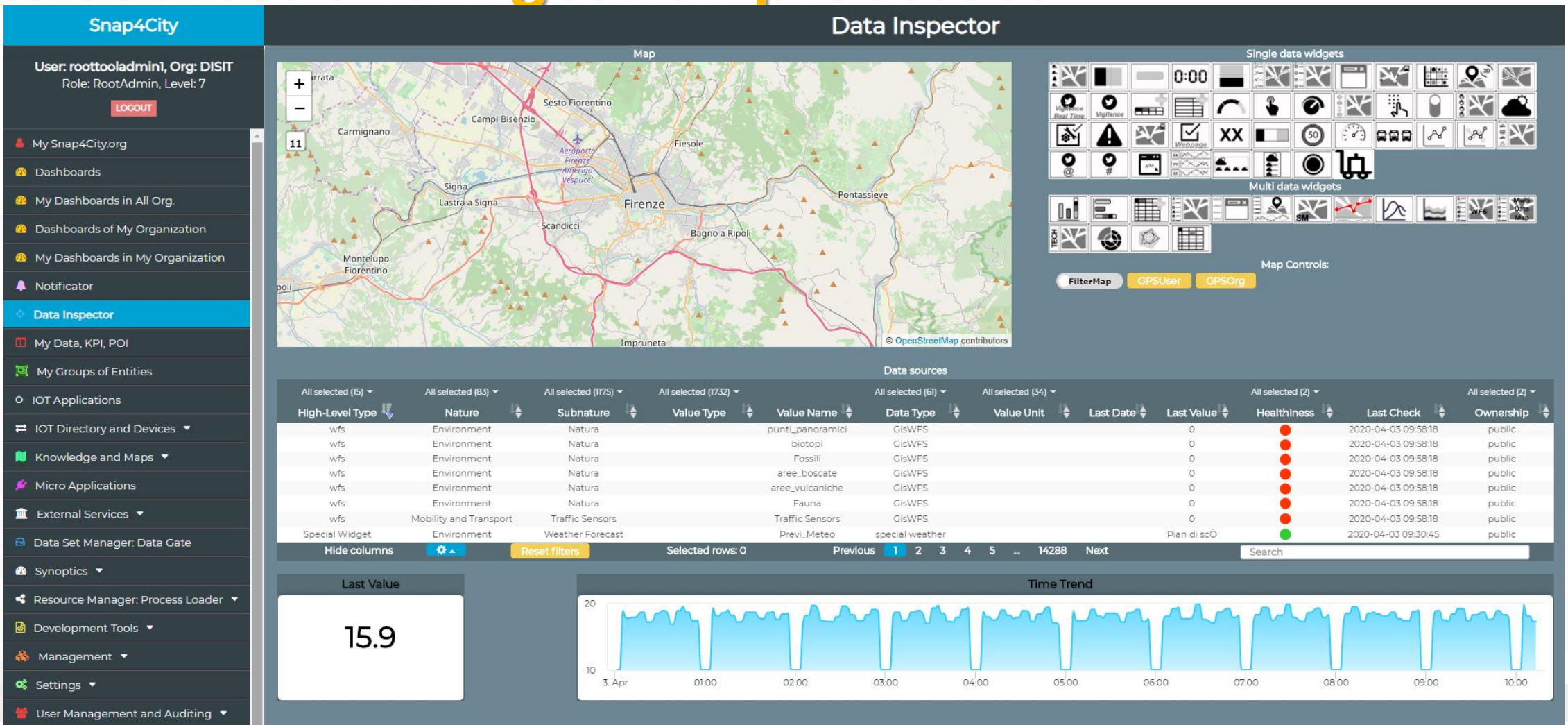
- IOT App: means that the widget data can be created and manipulated dynamically from the IOT App
- All the X represent feature available from Wizard production of Dashboard
- (*) means that the production is still manual and not via wizard
- (X) in progress
- "sensors" are data ingested via IOT Brokers, or ETL that in any case are indexed into the KB, may be on HBASE or on Elastic Search
- "MyKPI" are data ingested via Mobile Apps, IOT Apps, manually, etc.; They may be on MySQL, and recently are coming to Elastic Search
- "MyPersonalData" are ingested via IOT Apps, or manually; They may be on MySQL only
- "KPI, Metrics" are ingested via SQL, NoSQL queries (ODBC, JDBC, Mongo, SPARQL, etc.) from Database sources and are on MySQL
- etc.

TOP

Unified Data Model, Digital Twin and Data Inspector

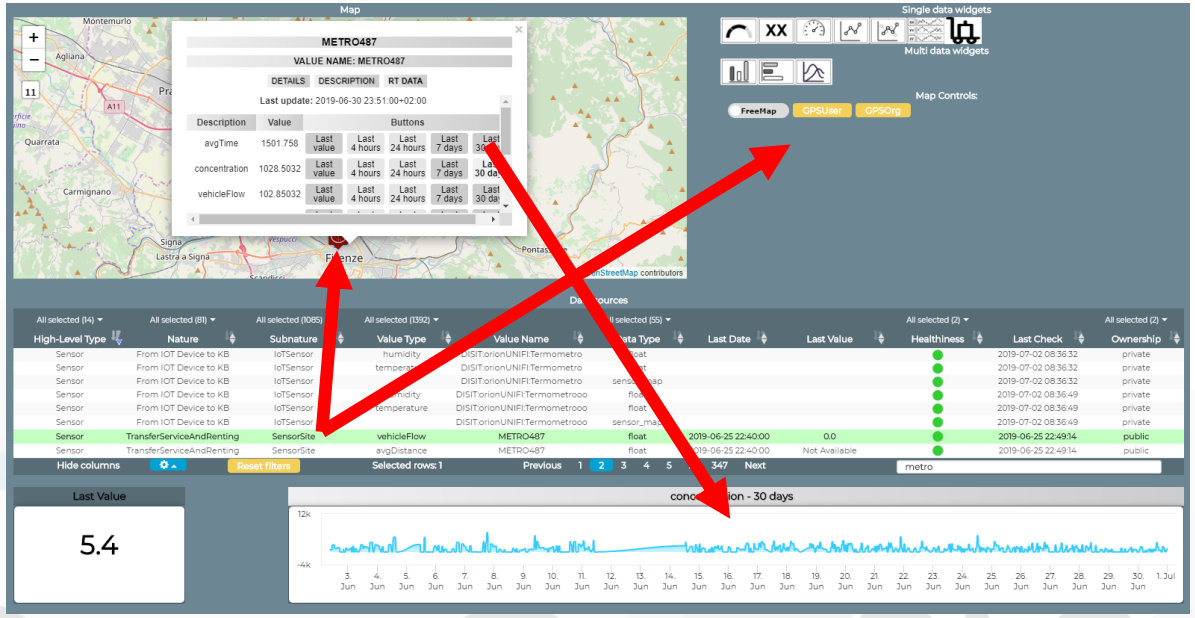


Data Inspector: all you need to know about data, data sources and ingestion processes



Data Inspector (open on your left side menu)

- **Cross Filtering on the basis of**:
  - MAP: pan and zoom → lock , center on GPS coordinates of the user
  - Data Source Classification:
    - faceted filtering
    - full text search
  - Click on data source to see it on map, and see the graphics representation, just to learn how widgeting it.
- **Selecting a Data Source on Map**: on its Pin you can see:
  - Real time data
  - Time trend: 4 hours, 12 hours, 1 day, 1 week, 30 days.
  - Full status and description (only for Administrators)



Unified Data and Services Model/Classification

MyKPI	All selected (8)	All selected (15)	All selected (30)		All selected (3)	6 selected			true		All selected (2)	
High-Level Type	Nature	Subnature	Value Type	Value Name	Data Type	Value Unit	Last Date	Last Value	Healthiness	Last Check	Ownership	Organizations
MyKPI	Environment	Weather_sensor	Gradi Centigradi	BatteryTemperatureGalaxyTabS4	float-mykpi	°C	2019-11-21 15:51:25	28		2020-04-03 10:23:02	private	Firenze,dc=ldap,dc=disit,dc=org,
MyKPI	Environment	Weather_sensor	Gradi Centigradi	BatteryTemperatureS6Edge	float-mykpi	°C	2020-01-23 12:37:34.25.299999237060547			2020-04-03 10:23:02	private	DISIT
MyKPI	Environment	Weather_sensor	Gradi Centigradi	BatteryTemperatureSamsungS9	float-mykpi	°C	2019-04-23 05:54:21.24.399999618530273			2020-04-03 10:23:02	private	Firenze,dc=ldap,dc=disit,dc=org,
MyKPI	Environment	Smart_waste_container	Level_percentage	Bin_001	percentage-mykpi	%	1970-01-01 01:00:00			2020-04-03 10:23:02	private	DISIT,dc=ldap,dc=disit,dc=org,
MyKPI	Environment	People_counter	Battery Percentage	borrowed_tbeam_pax_green BATTERY	percentage-mykpi	%	2019-03-13 20:24:52	4.202		2020-04-03 10:23:02	private	Firenze,dc=ldap,dc=disit,dc=org,
MyKPI	Environment	People_counter	Battery percentage	borrowed_ttgov21new_pax_black BATTERY	percentage-mykpi	%	2019-05-06 10:03:55	4.132		2020-04-03 10:23:02	private	Firenze,dc=ldap,dc=disit,dc=org,
MyKPI	Environment	People_counter	Battery Percentage	borrowed_ttgov21new_pax_green BATTERY	percentage-mykpi	%	2019-11-19 08:56:56	4.072		2020-04-03 10:23:02	private	Firenze,dc=ldap,dc=disit,dc=org,
MyKPI	HealthCare	Health_district	tassodicrescita	corkpimemilia	float-mykpi	%	1970-01-01 01:00:00			2020-03-24 13:13:24	private	DISIT

Hide columns | Reset filters | Selected rows: 0 | Previous 1 2 3 4 5 ... 35 Next | Search

High Level Types

Nature

SubNature

Value Type

Value Name

Data Type

Value Unit

Last Date/Time

Last Value

Healthiness

Last Check

Ownership

Organization

Semantic

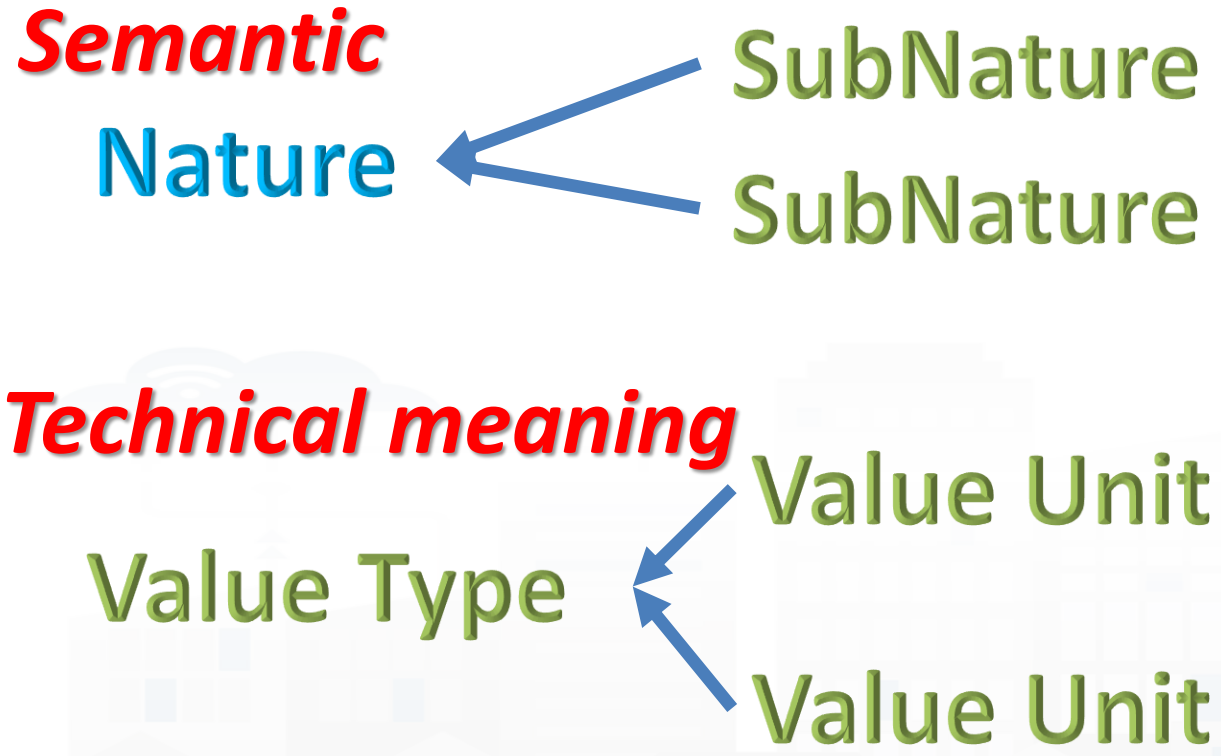
Technical meaning

RealTime

Status

For Admin

Unified Data and Services Model/Classification



- Exists a Dictionary for the 4 categories
- They are related each other and not all values are possible
- Right setting lead to right rendering on graphs and automated combinations and processing
- The Disctionary is used by many tools

Two Examples

- **HLT: MyKPI**
- **Nature: Industry and manufacturing**
- **Subnature: Chemical**
- **Value Type: Density percentage**
- **Value Unit: %**
- **Data Type**: float mykpi
- **Value name**: CloroParaffine
- **Last Date**: 2019-02-25 *«DateTime»*
- **Last Value**: 87.0
- **Healthiness**:
- **Last Check**: 2020-04-03 10:28:12
- **Ownership**: private
- **Organization**: Firenze

- **HLT: Sensor**
- **Nature: From IOT Device to KB**
- **Subnature: IOT Sensor**
- **Value Type: Battery Level**
- **Value Unit: V**
- **Data Type**: float
- **Value name**: Irrigator fioriera Gag
- **Last Date**: 2020-04-01 12:59:00 *«dateObserved»*
- **Last Value**: 5.18
- **Healthiness**:
- **Last Check**: 2020-04-03 03:28:12
- **Ownership**: public
- **Organization**: Firenze

How to Ingest

All of them can be shown on Dashboards, what about manipulate them!!!!

HLT, High Level Types++	GPS	Static	Dynamic	MacroCat	Single	Time Series	Trajectory	HTTP	How to ingest/change/manage
Complex Event (msg)	Yes	Yes	Yes	Yes	Yes	Yes			Dashboard, ETL, Special, IOT App, …
API (Ext. Srv., any prot.)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	ETL, Special, IOT App, …
External Service (web pag)		Yes	--					Yes	ETL, Special, IOT App, Web Scraper, …
KPI (metrics) data		Yes	Yes		Yes	Yes			Dashboard, IOT App, API, Metrics SQL calls
MicroApplication (webapp)		Yes	--					Yes	Dashboard, IOT App, API, FTP, …
Dashboard-IOT App (msg)		Yes	Yes		Yes	Yes			Dashboard, IOT App, API, …
My Personal Data		Yes	Yes		Yes	Yes			Dashboard, IOT App, UserInterf, API, …
MyKPI data	Yes	Yes	Yes		Yes	Yes	Yes		Dashboard, IOT App, UserInterf, API, …
MyPOI data	Yes	Yes		Yes	Yes				Dashboard, IOT App, UserInterf, API, …
Heatmap matrix	Yes	Yes	Yes		Yes	Yes			IOT App, MicroService, UserInterf, API, …
Sensor data	Yes	Yes	Yes	Yes	Yes	Yes			IOT Directory, IOT App, UserInterf, API, …
Sensor Actuator data	Yes	Yes	Yes	Yes	Yes	Yes			Dashboard, IOT App, UserInterf, API, …
POI (Point of Interest)	Yes	Yes		Yes	Yes				DataGate, ETL, IOT App, API, …
Special Widget (complex)		Yes	Yes		Yes	Yes		Yes	ETL, special, IOT App, API, …
Synoptics MyKPI (groups)		Yes	(Yes)		(Yes)	(Yes)		Yes	Special, API, …
Special Tools (functional)	(Yes)		(Yes)		(Yes)		(Yes)	Yes	As MyPersonalData, …
WFS/WMS (GIS data)	Yes	[yes]	[yes]					Yes	GIS tools, or GeoServer, IOT App, …

Legenda: How to ingest/change/manage

- **Dashboard**: by creating a Dashboard Widget that can act/change the values with actuators (2nd Day Slides)
- **API**: you can use the Smart City API to change / provide the values (see 3rd Day Slides)
- **IOT App**: by developing an IOT Application on Node-RED exploiting Snap4City MicroServices (4th Day Slide, and in part in these slides)

- **DataGate**: you can use the DataGate tool to ingest the data, and publish them
- **ETL**: by developing an ETL process, and put it in execution via DISCES
- **IOT Directory**: you can use the IOT Directory tool to change the parameters, and set up the ingestion process, via IOT Brokers, IOT Devices, IOT Edge.
- **Special**: by using a special tool for developing a process, or for creating SVG Synoptics
- **UserInterf**: there is a number of Tools with Graphic User Interface that you can use to change the values, see in the menu on the left.
- **Web Scraper**: by creating a Web Scraping process and exploiting the results into an IOT Application

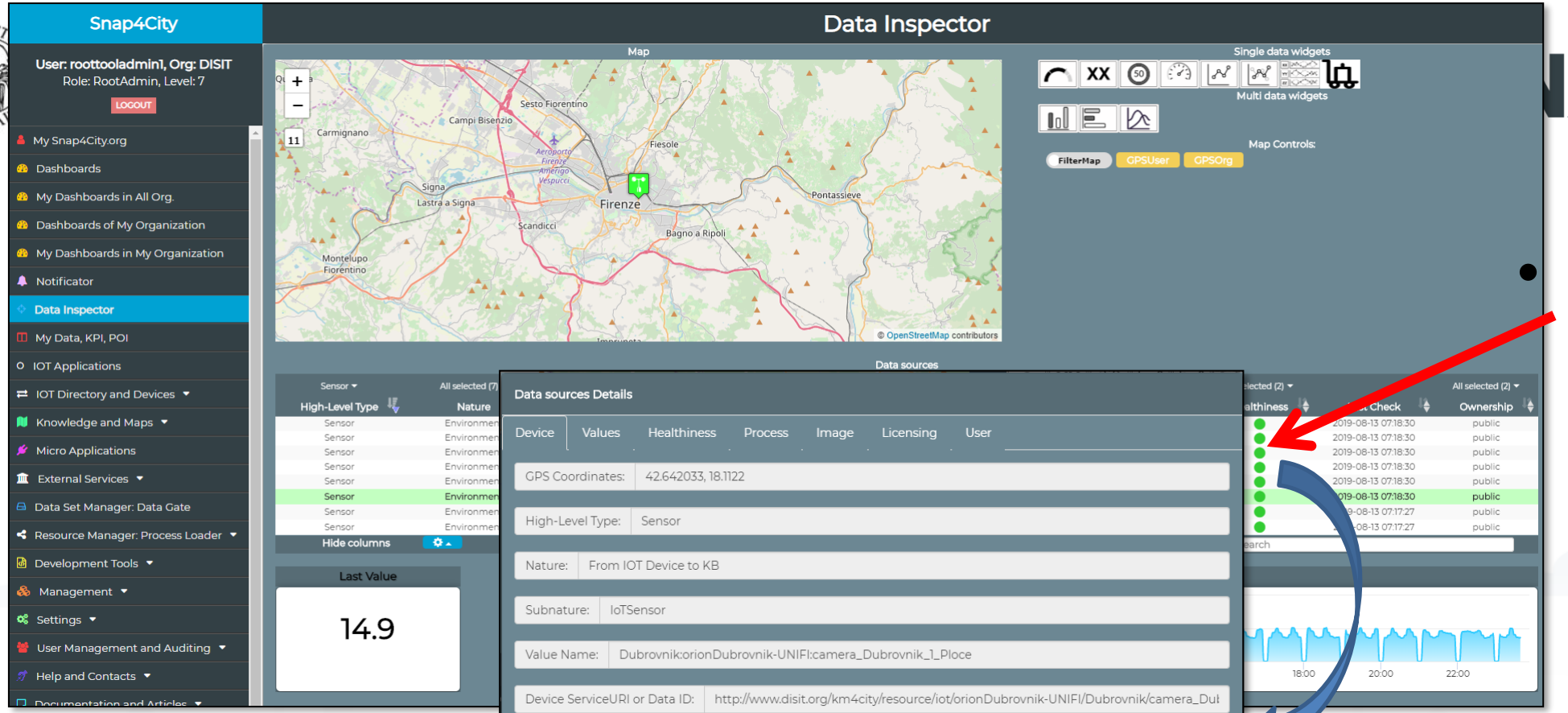
- **As MyPersonalData**: they are substantially MyPersonalData
- **From third party tools**: they can be manipulated by using third party tools

Data Inspector vs Data Processes Details

(some features are only accessible to *Admin roles)

Advanced Features of the Data Inspector

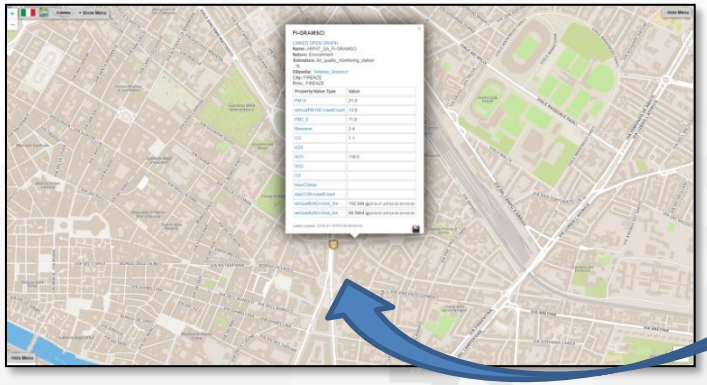
- Some features accessible only for the Owner and *Admin, such as:
  - Specific information on the basis of the High Level Type
  - Values connected to the data (structure of the single data)
  - Details regarding the ingestion process
  - Eventual image representing the City Entity, for example the sensor
  - Ownership (licensing) details regarding the data owner
- So that you can access on all of them in the Snap4City version if you install on premise.
- A part of these features can be activated for the Organization Managers, namely: «ToolAdmin» roles.

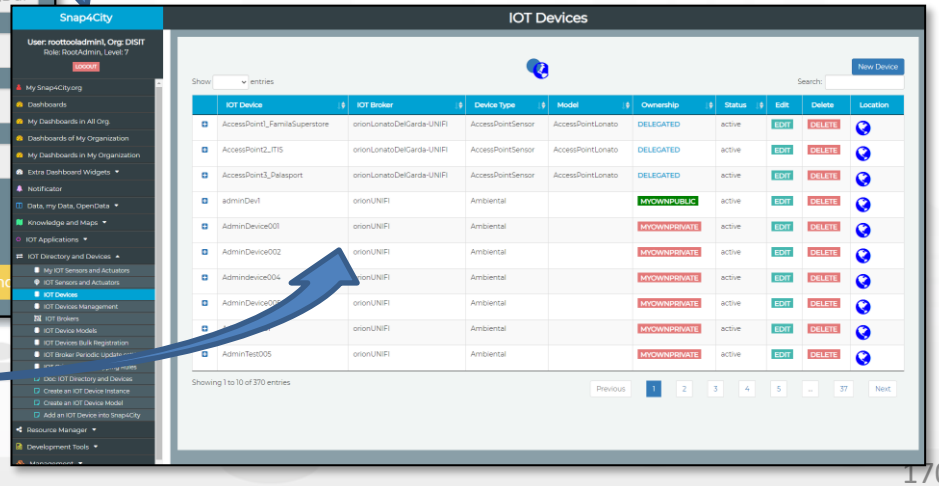


- Click with the mouse on it

HLT: Sensor

Knowledge Base view





HLT: Sensor

Data sources Details

Device | Values | Healthiness | Process | Image | Licensing | User

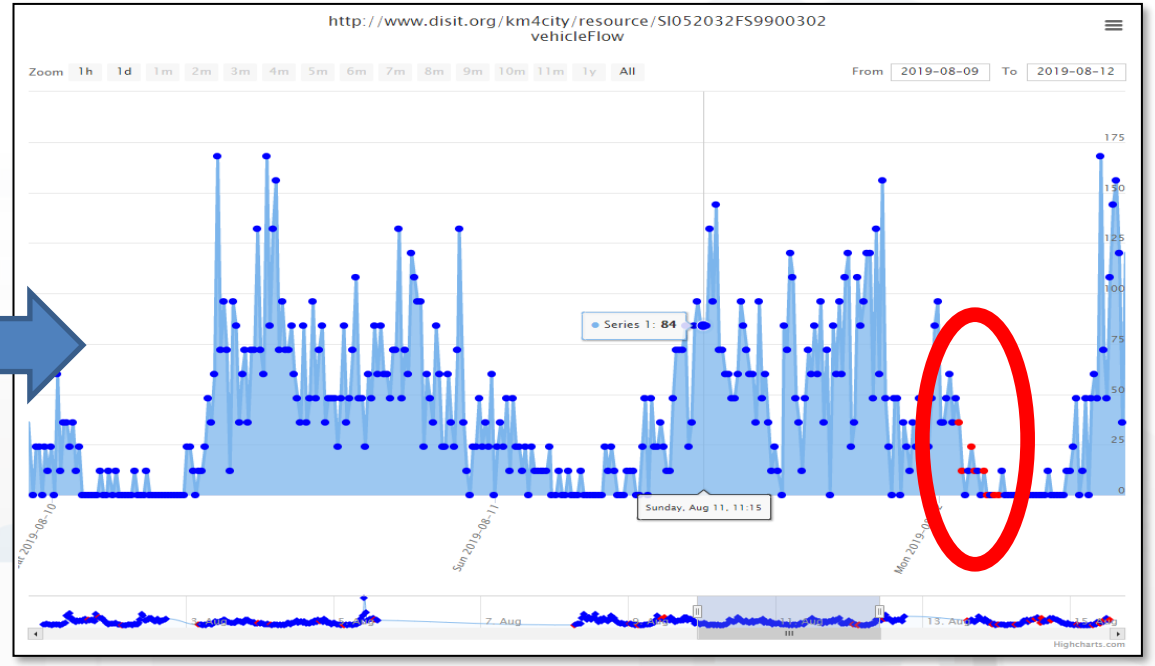
Last Date: 2020-07-21 19:00:00

Last Value:

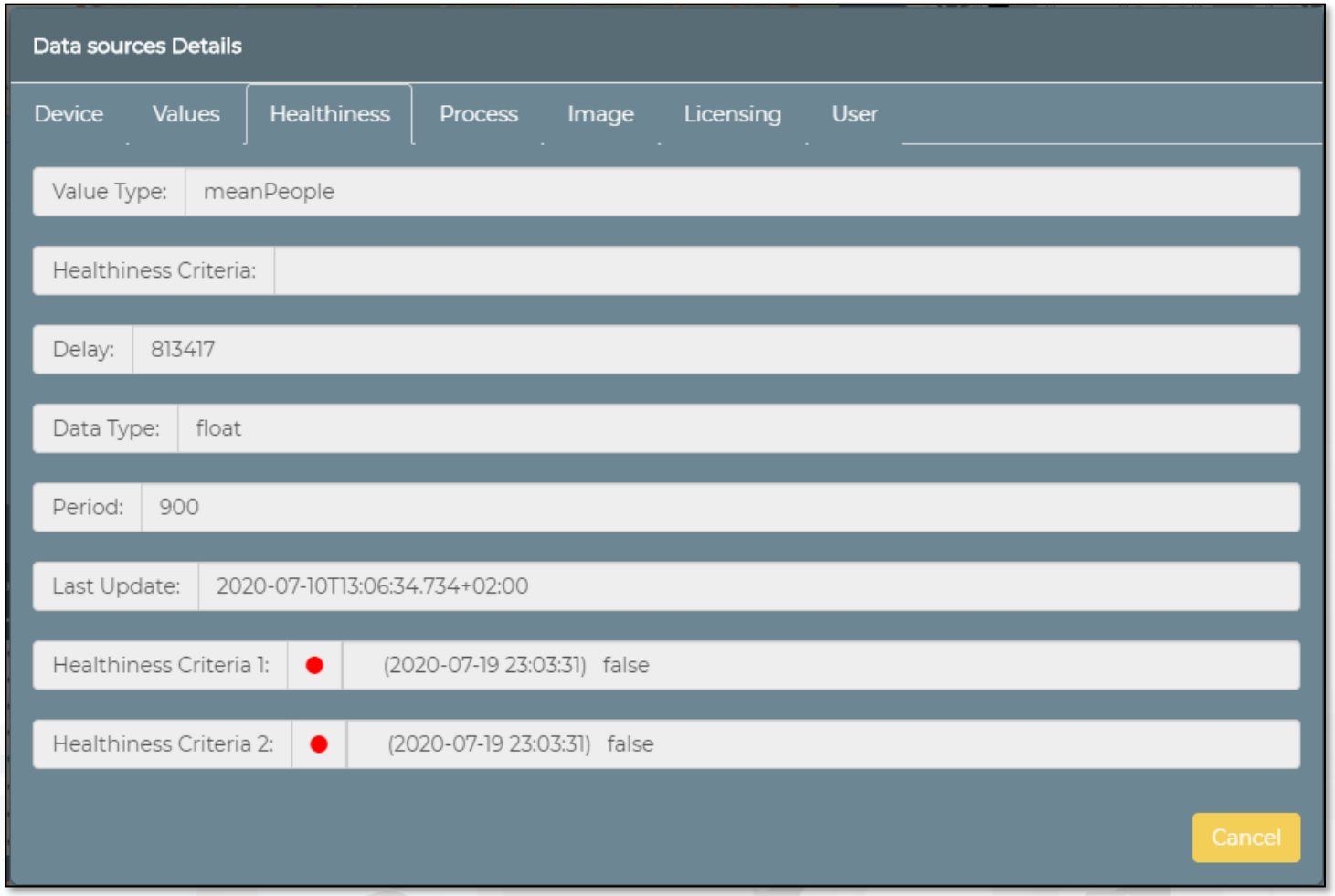
Value Type	Healthy	Delay (s)	Reason	Healthiness Criteria	Refresh Rate (s)	Data type	Unit	Value	Time Trend
dateObserved	●	61890	undefined	undefined	300	time	timestamp	2020-07-21T17:00:00.000Z	VIEW
deceduti	●	61890	undefined	undefined	300	integer	#	16797	VIEW
dimessi_guariti	●	61890	undefined	undefined	300	integer	#	71775	VIEW
isolamento_domiciliare	●	61890	undefined	undefined	300	integer	#	6838	VIEW
nuovi_attualmente_positivi	●	61890	undefined	undefined	300	integer	#	-131	VIEW
ricoverati_con_sintomi	●	61890	undefined	undefined	300	integer	#	151	VIEW
stato	●	61890	undefined	undefined	300	string	#	ITA	VIEW
tamponi	●	61890	undefined	undefined	300	integer	#	1212468	VIEW
terapia_intensiva	●	61890	undefined	undefined	300	integer	#	21	VIEW
totale_attualmente_positivi	●	61890	undefined	undefined	300	integer	#	7010	VIEW
totale_casi	●	61890	undefined	undefined	300	integer	#	95582	VIEW
totale_ospedalizzati	●	61890	undefined	undefined	300	integer	#	172	VIEW
codice_regione	●	61890	missing value	undefined	300	integer	status		VIEW
denominazione_regione	●	61890	missing value	undefined	300	string	status		VIEW

Cancel

- Specific values of selected
- Information of the values of the other sensors on the same device
- View Trends, marking problems, healthiness by point according to a Fuzzy model
- Marking problems for future machine learning processes (separate tool)



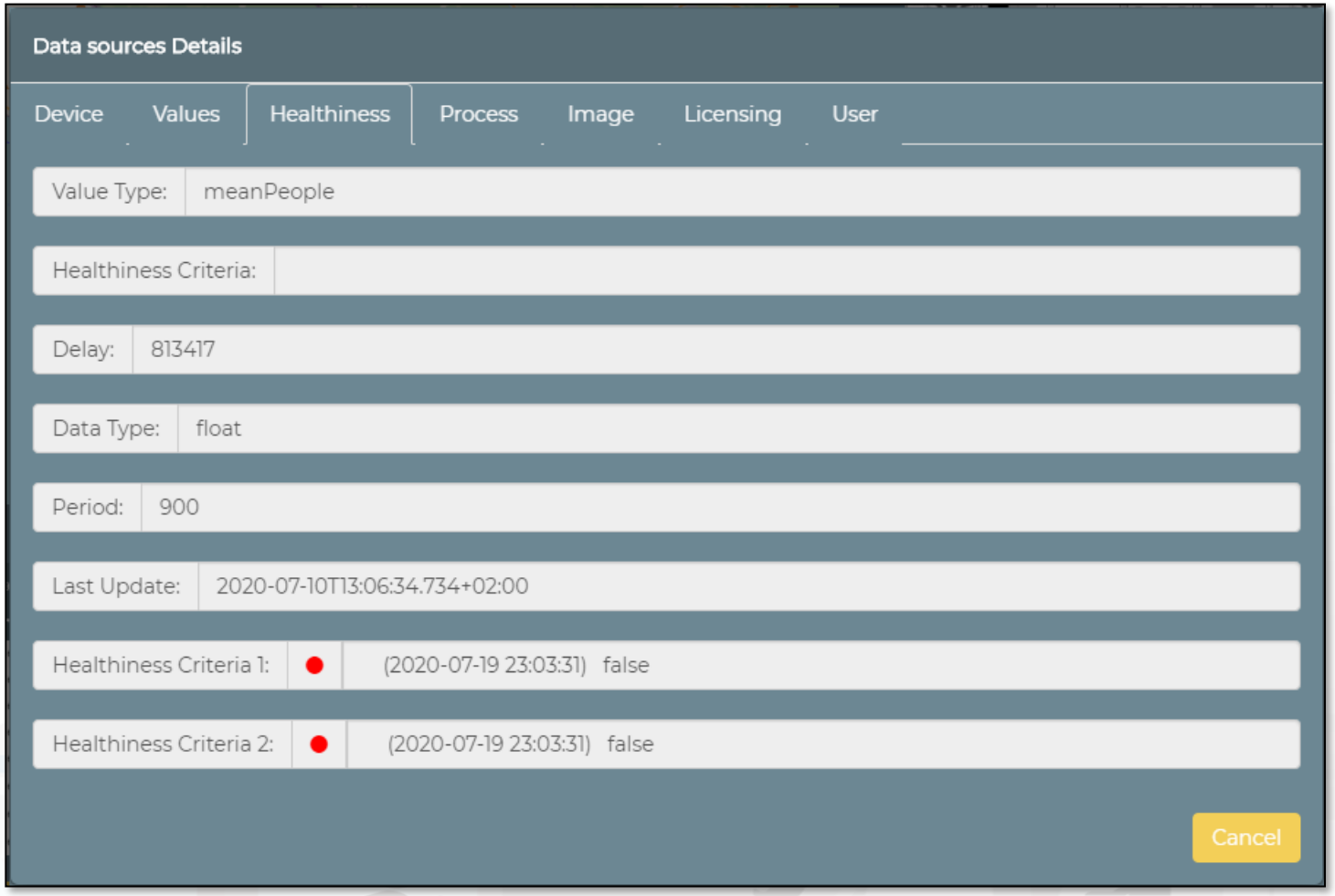
HLT: Sensor Healthiness



- Two different criteria
  - **H1**: at least an event i nthe last 24 hours
  - **H2**: machine learning for most of Sensors devices

Some functionalities are limited to certain roles

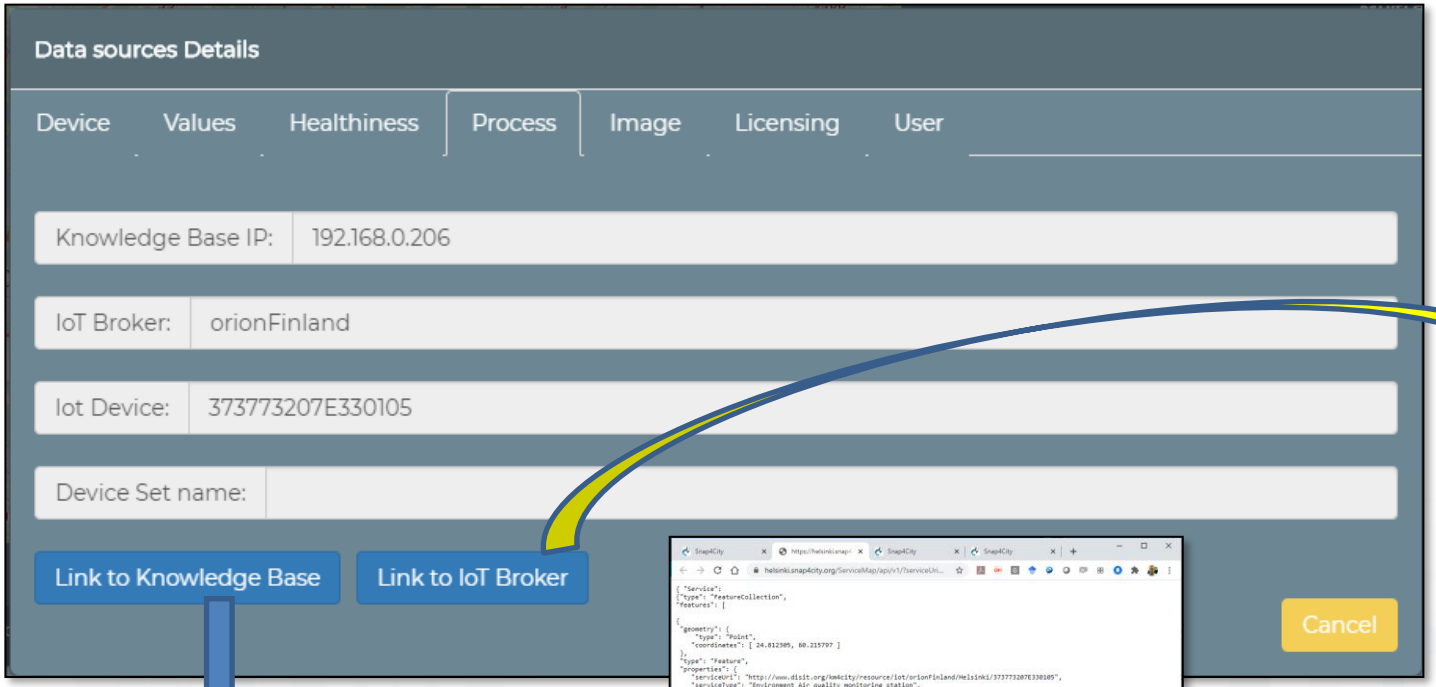
HLT: Sensor Healthiness

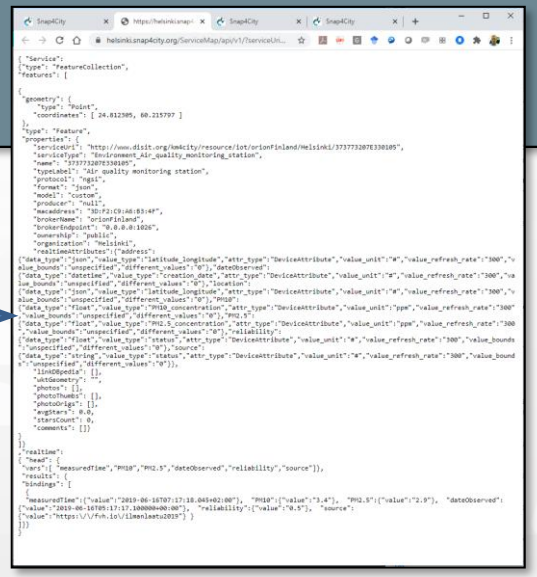


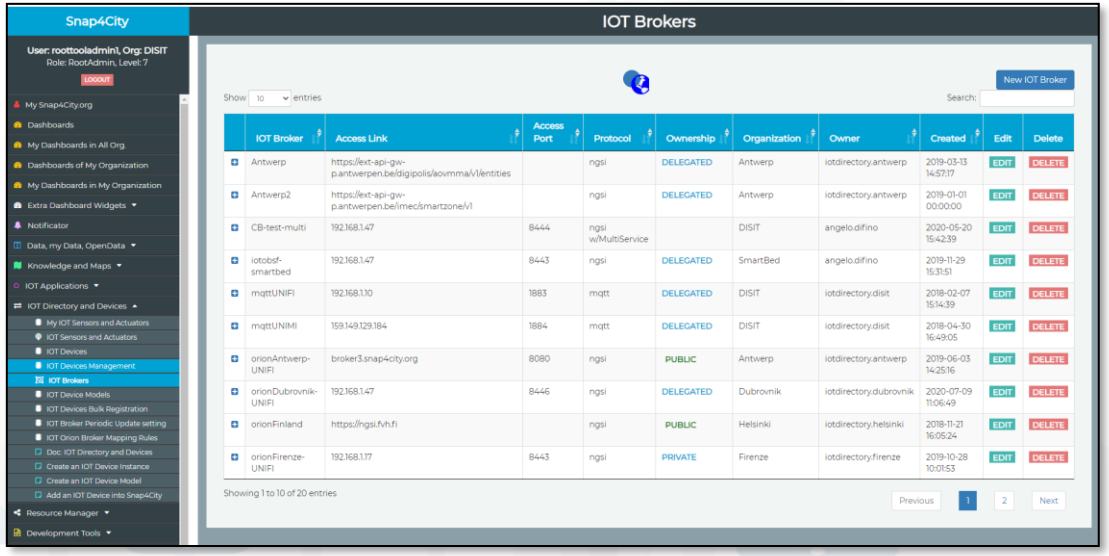
- Two different criteria
  - **H1**: at least an event i nthe last 24 hours
  - **H2**: machine learning for most of Sensors devices

Some functionalities are limited to certain roles

Details regarding the IOT Ingestion process





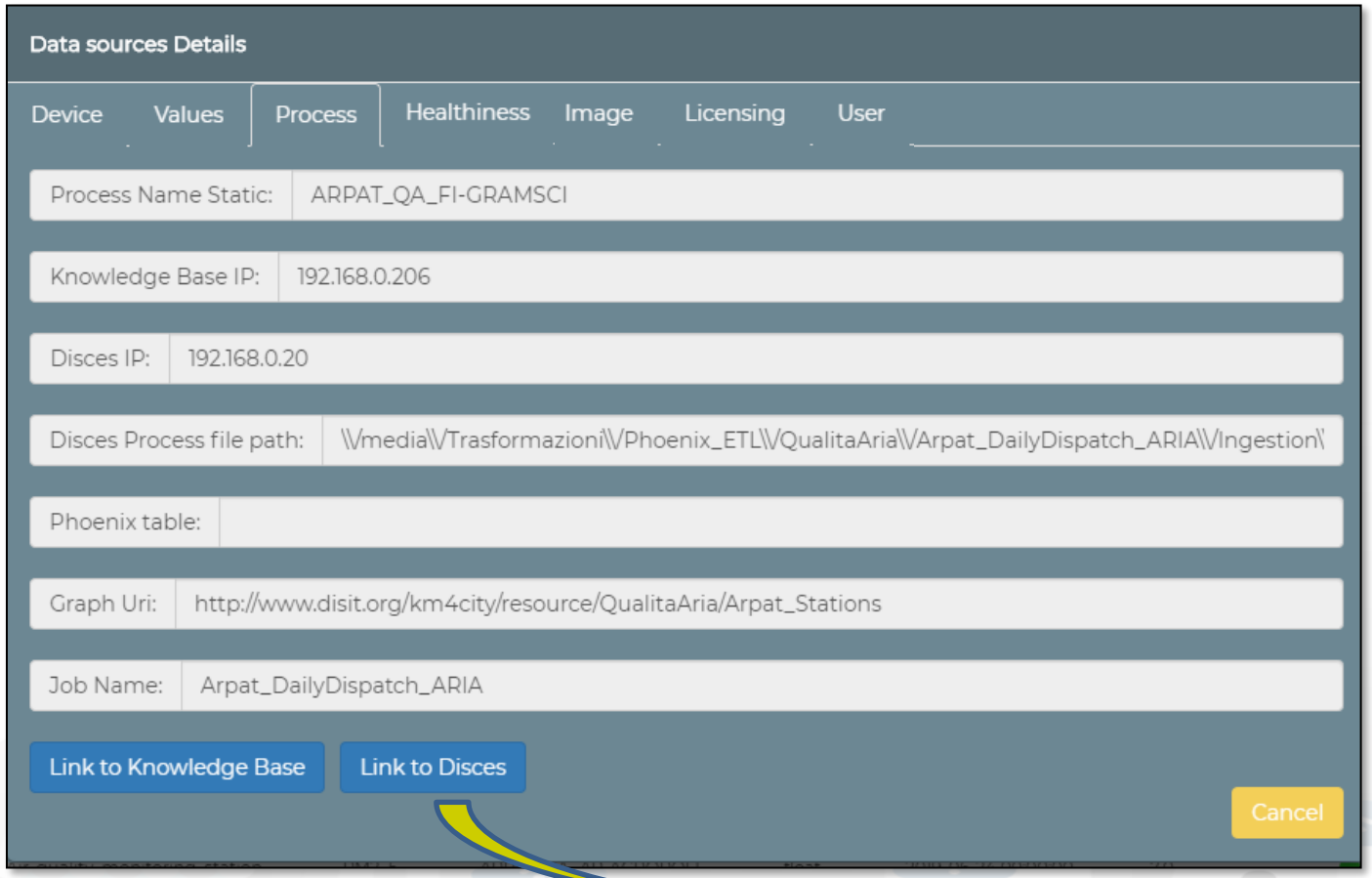


- For IOT Device data
- IOT Broker details

Some functionalities are limited to certain roles

HLT: Sensor

Details regarding the Ingestion process



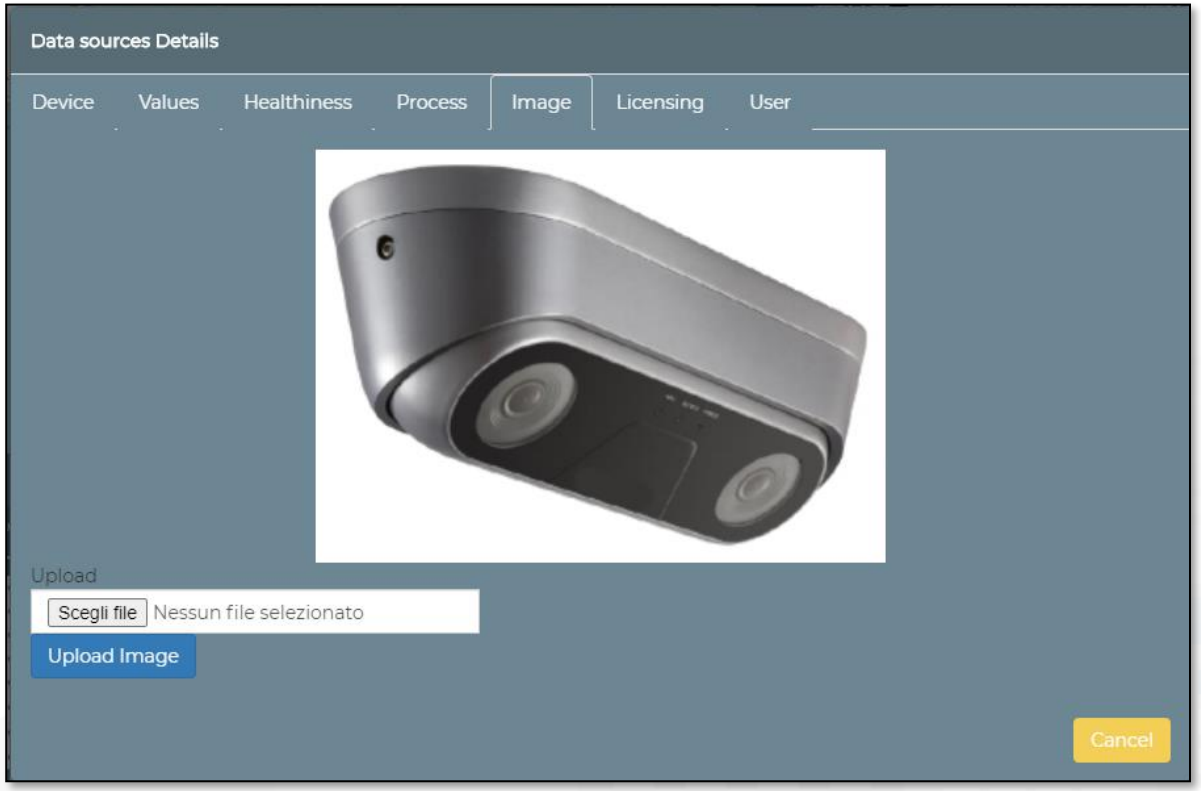
- For ETL processes
- Scheduling details and status

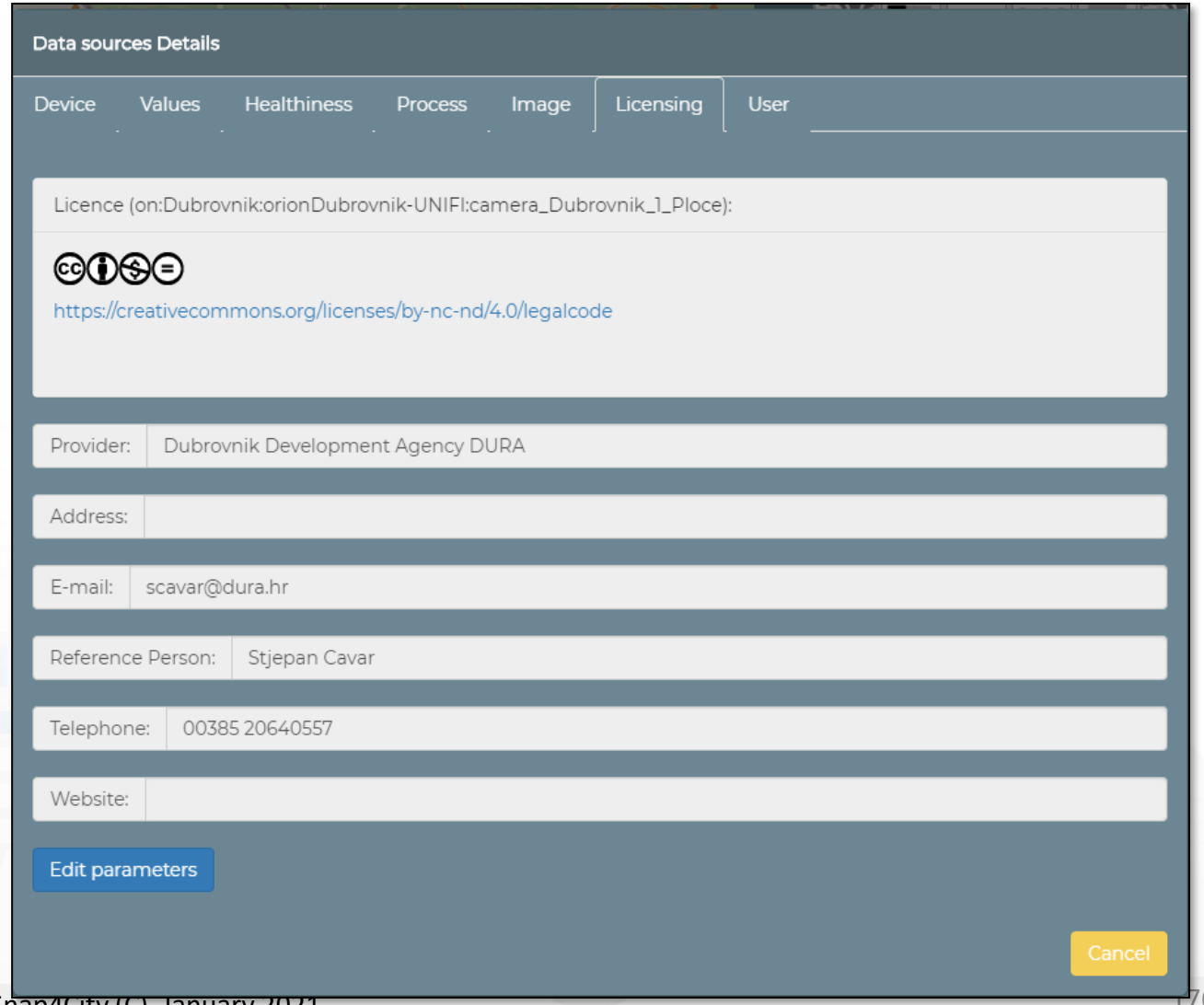
DISCES Process Scheduler view

Some functionalities are limited to certain roles

HLT: Sensor

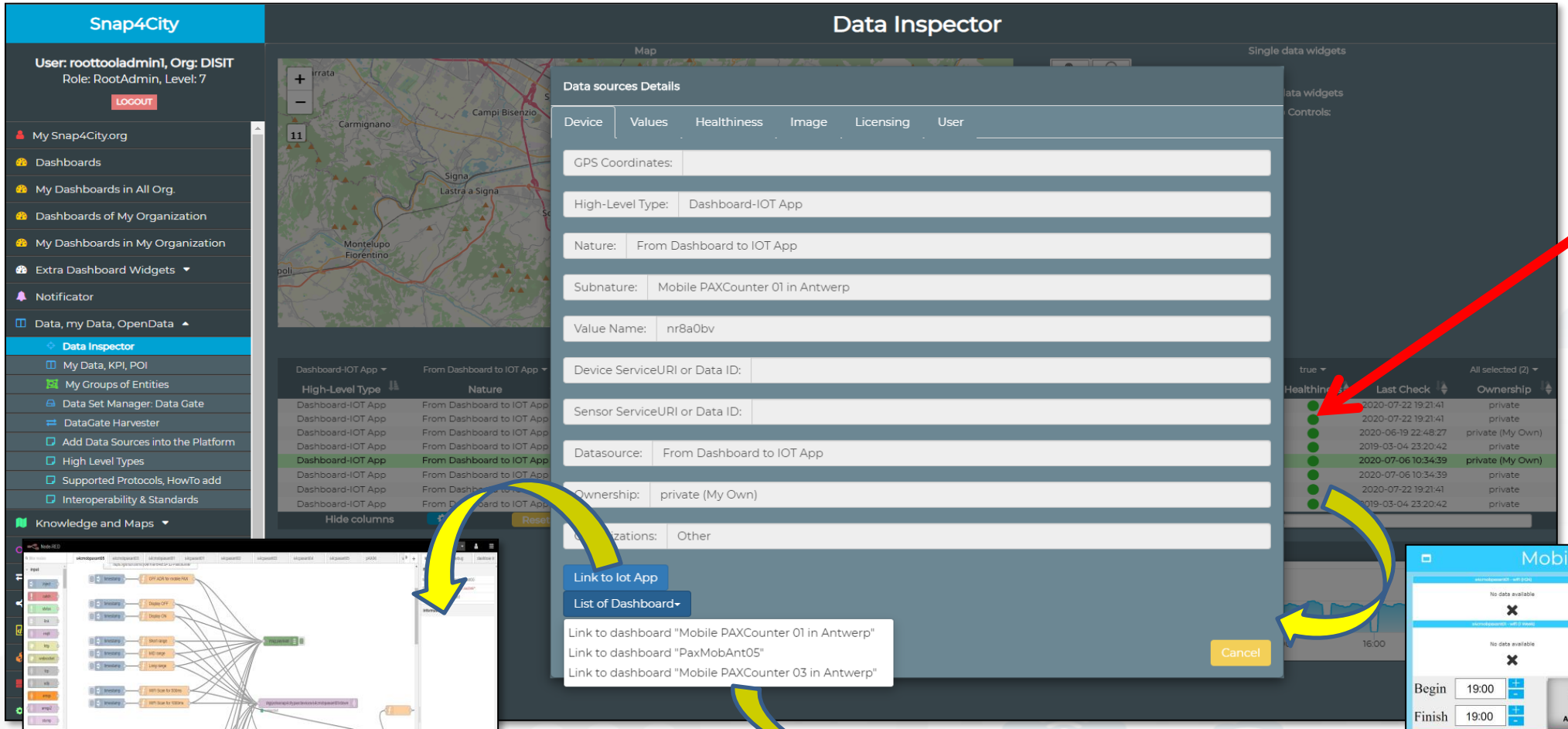
Image of the Devices and Licensing





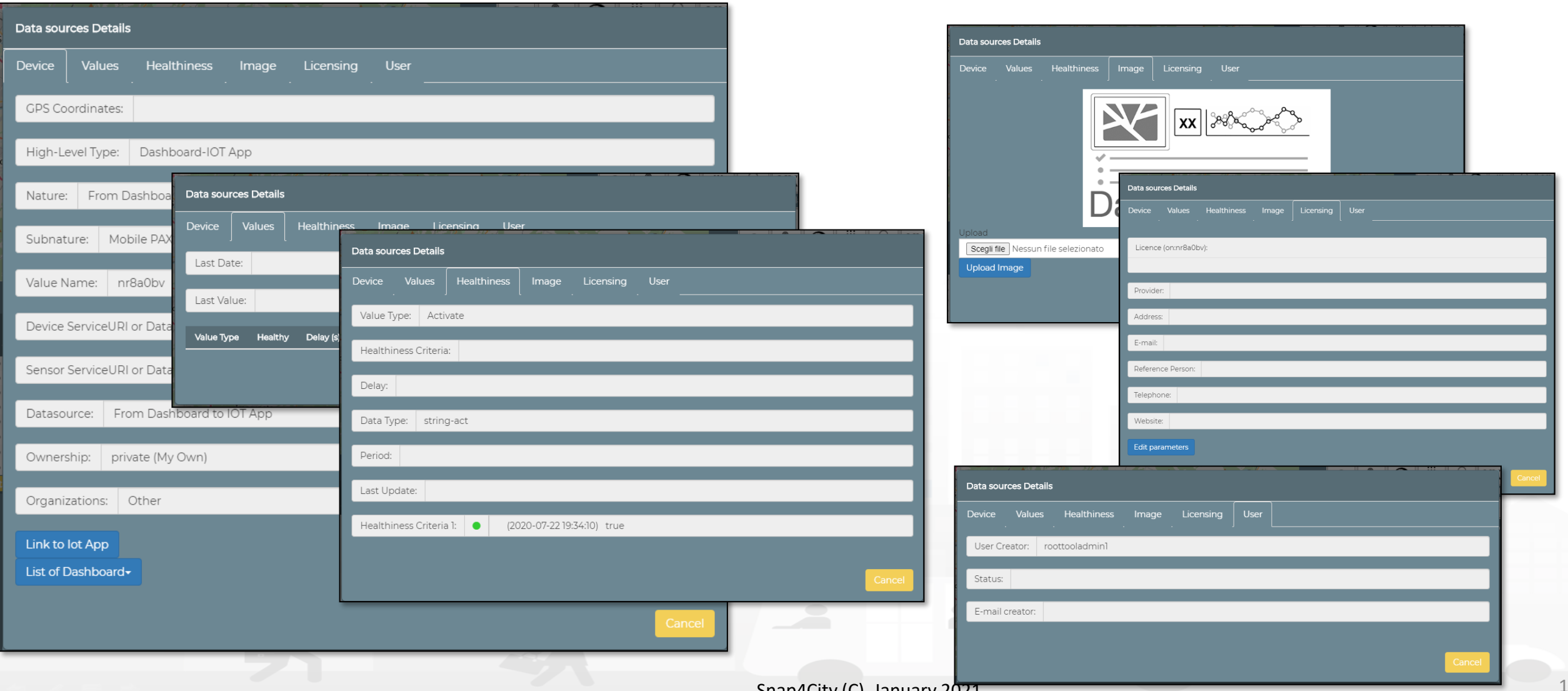
Some functionalities are limited to certain roles

HLT: From Dashboard to IOT APP

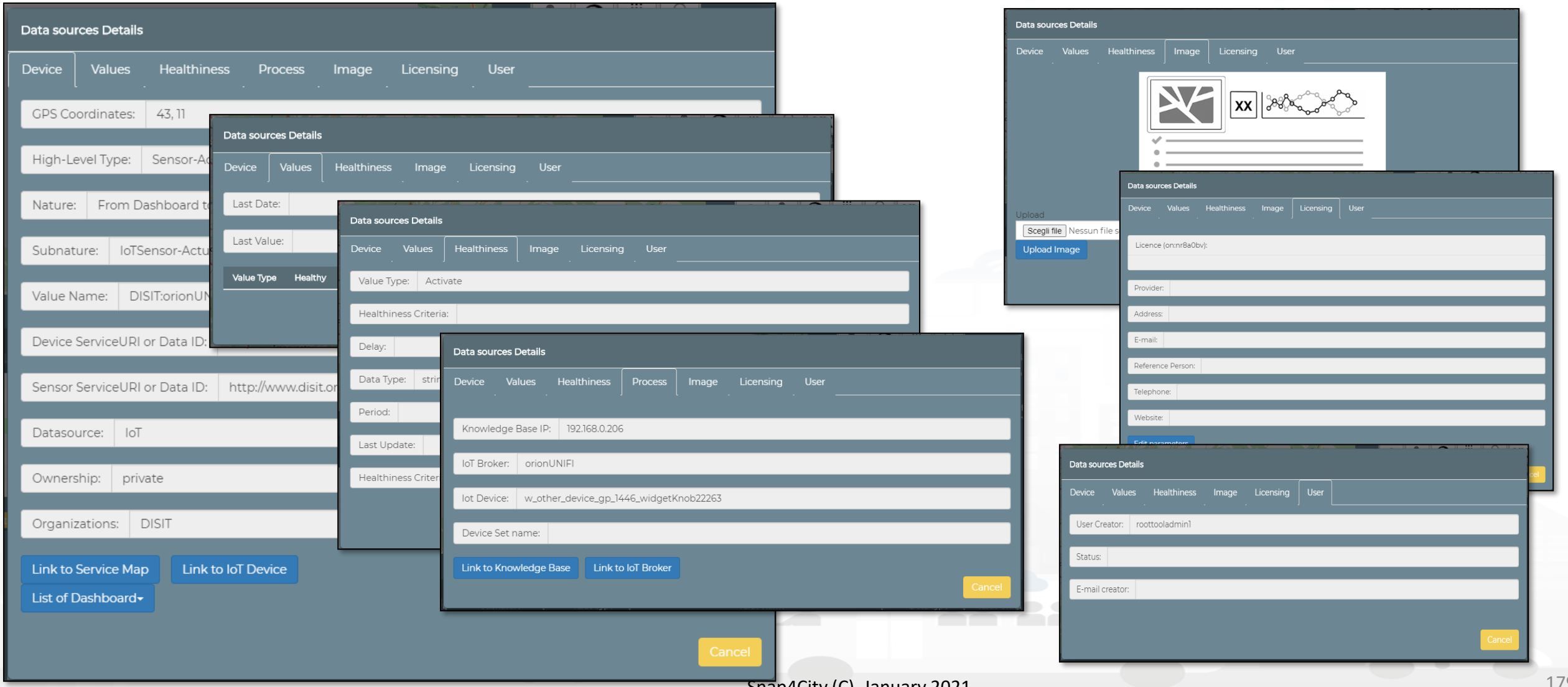


- Click with the mouse on it

HLT: Dashboard-IOT App (From Dashboard to IOT APP)

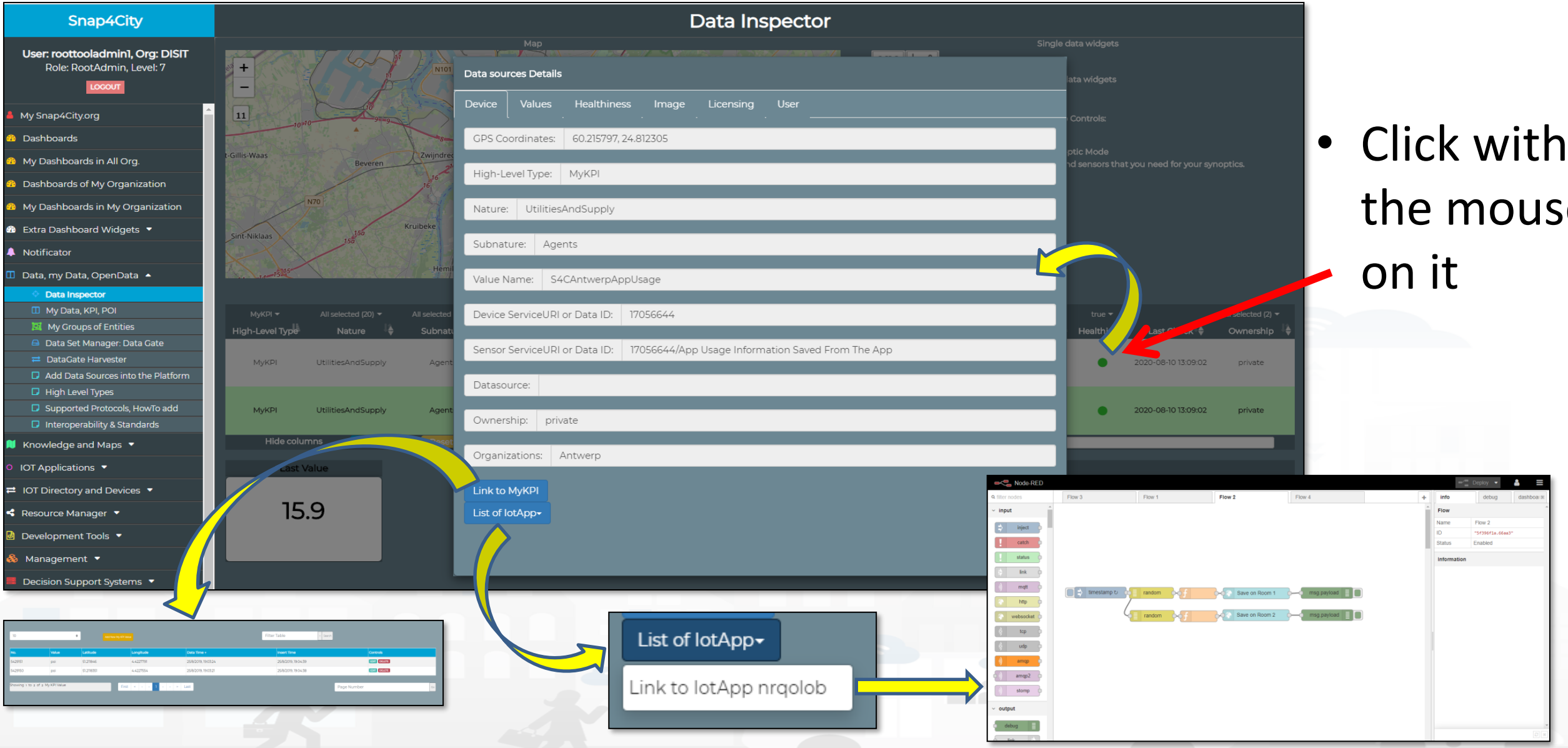


HLT: Sensor-Actuator (From Dashboard to IOT Device)



HLT: MyKPI

- Click with the mouse on it



Some functionalities are limited to certain roles

HLT: External Service

Data sources Details

Device | Values | Image | Ownership

GPS Coordinates: 51.222744, 4.405380

High-Level Type: External Service

Nature: Environment

Subnature: Antwerpen (park Spoor Noord) Air Pollution:

Value Name: ExternalContent

Datasource: Special Process

Ownership: public

Organizations: ['DISIT', 'Antwerp', 'Other']

Link to External Service

Data sources Details

Device | Values | Image | Ownership

Value Type:

Data Type: webpage

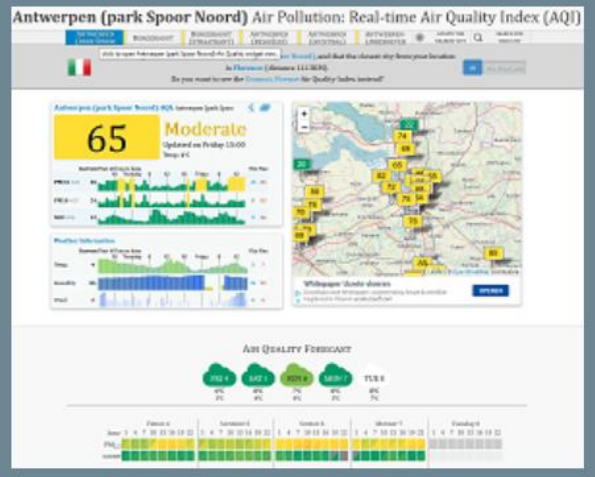
Last Date:

Last Value: Antwerp

Value Type | Healthy | Delay (s) | Reason | Health

Data sources Details

Device | Values | Image | Ownership



Data sources Details

Device | Values | Healthiness | Process | Image | Licensing | User

User Creator: angelo.difino.dubrovnik

Status:

E-mail creator:

Cancel

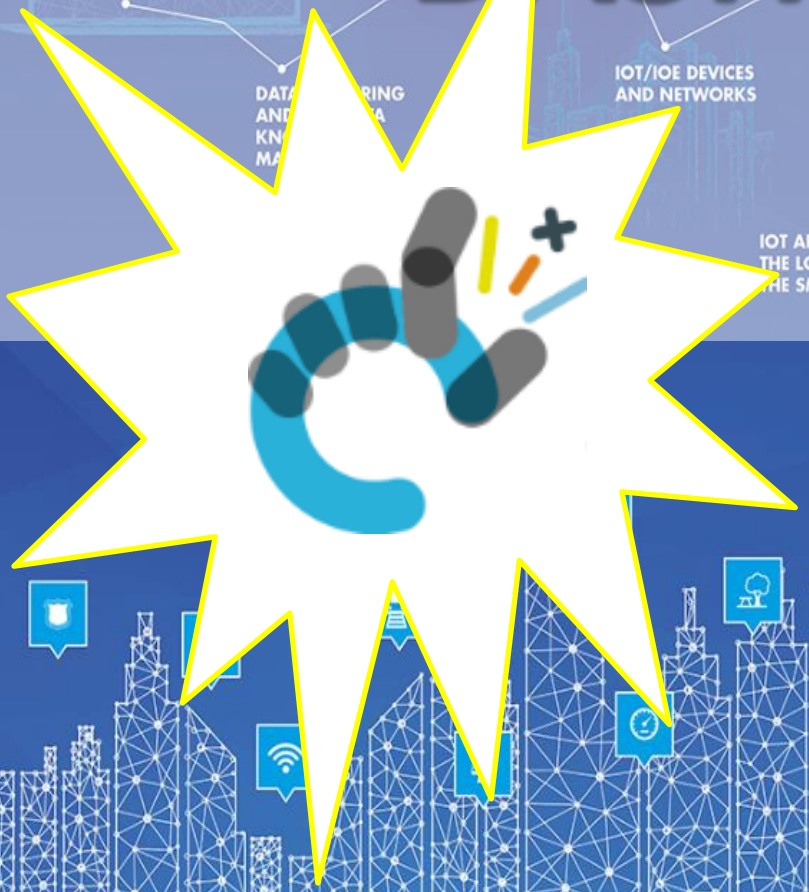
The fields shown may be present or not depending on the HLT and on the information received

Data Inspector recent and future features

- Specific views for the HLT
- Details on Healthiness
- More details on the Ingestion Process
- Capabilities of setting and changing the Healthiness criteria
- For data related to IOT App vs Dashboard, how the link to them
- A view about the data relationships, precisely to show the data used in dashboard, and used in IOT App, etc.
- For Sensors: a link to DevDash to see the time trend and relationships with other sensors and devices on the same Organization (for all in the case of RootAdmin)

TOP

DASHBOARD CREATION by Wizard

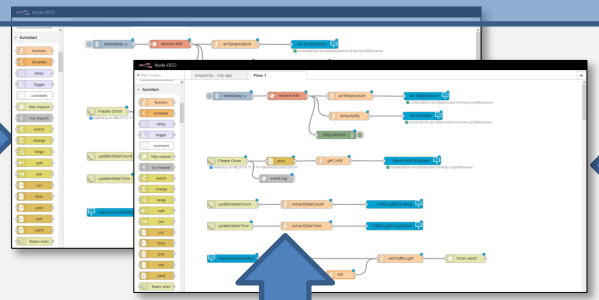


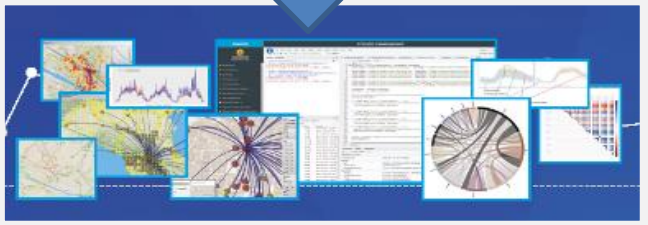
Snap4City: Builder of Sentient Cities Solutions

Dashboards with data driven IOT Applications enforcing intelligence

IOT and data World

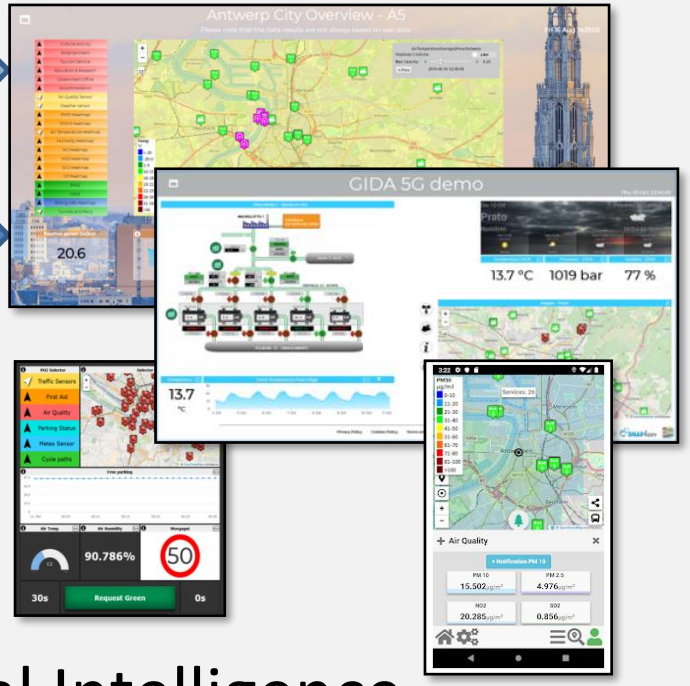
IOT Applications



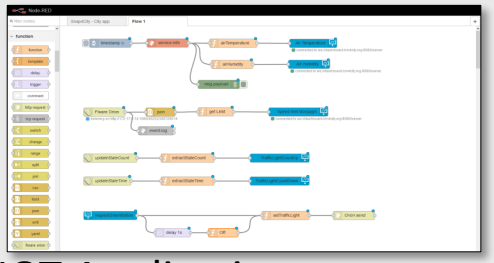


Big Data Analytics, Artificial Intelligence

Dashboards and Apps



Dashboard Development



IOT Applications

Knowledge Base, Km4City

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

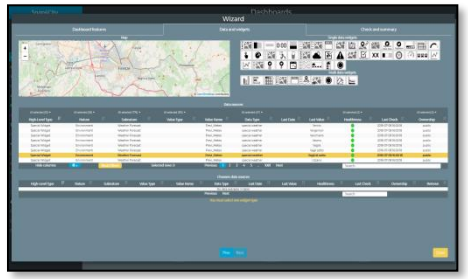
Widget Collection

Micro Applications

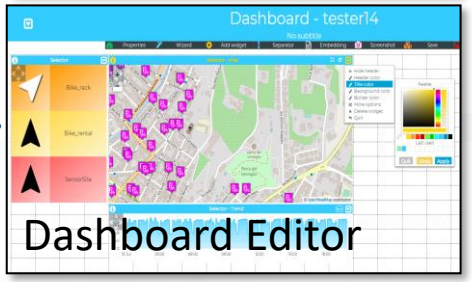
External Services

Custom Widgets/ Synoptics

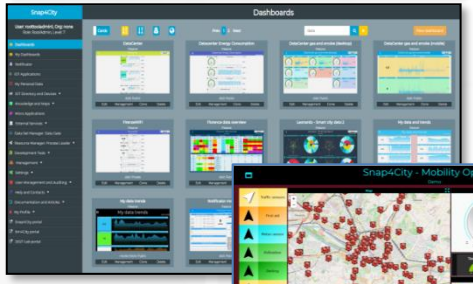
Dashboard Wizard

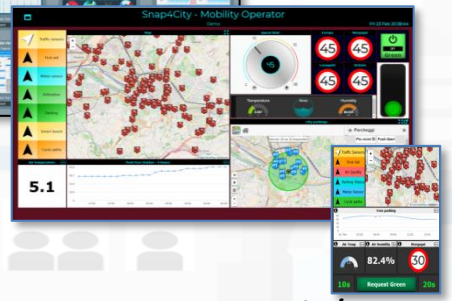


Create, save, load, delegate, grant access



Dashboard Editor



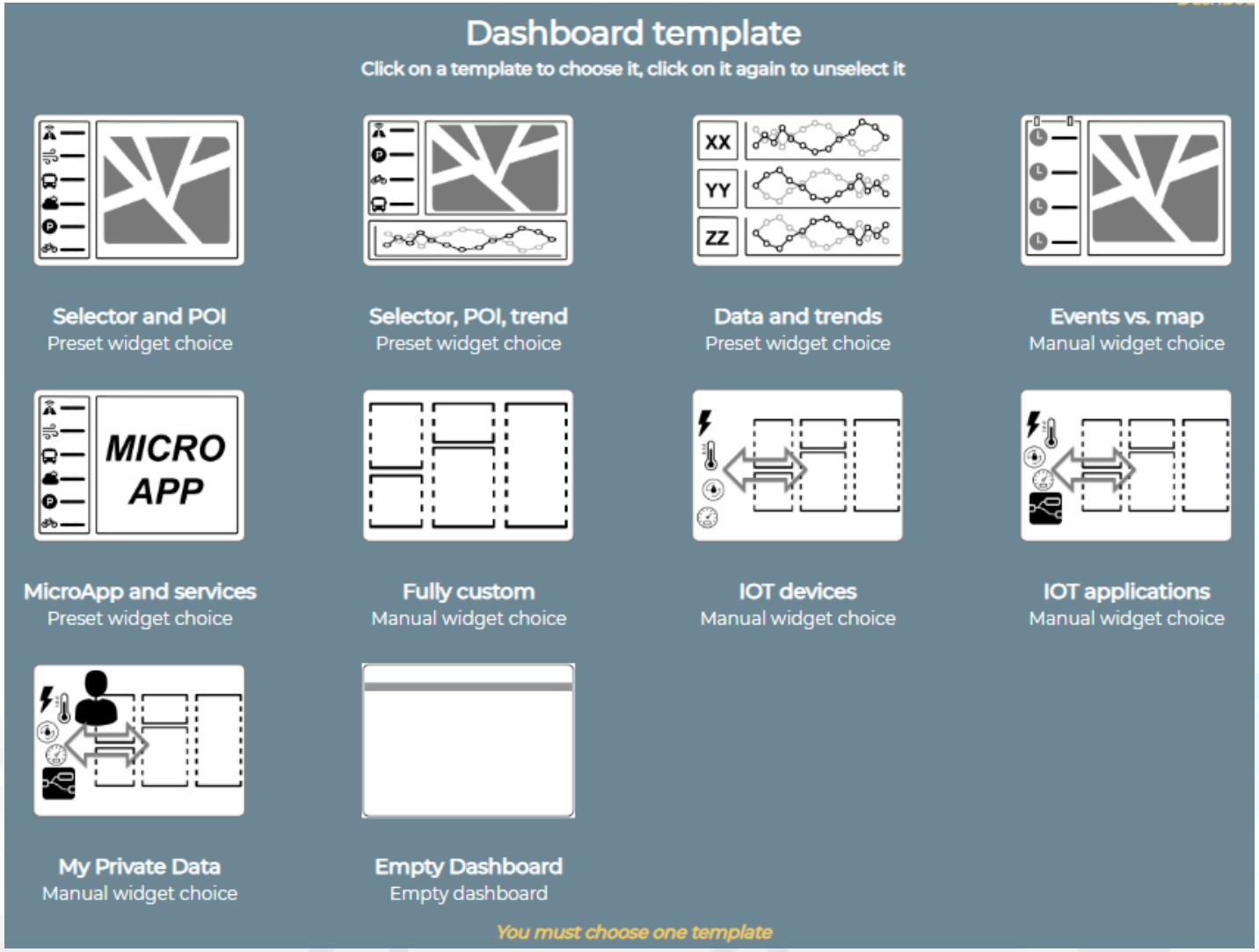


Public Dashboard Collection

My Own Dash/App

Dashboard List and Editor

From Templates to Wizard and Dashboards

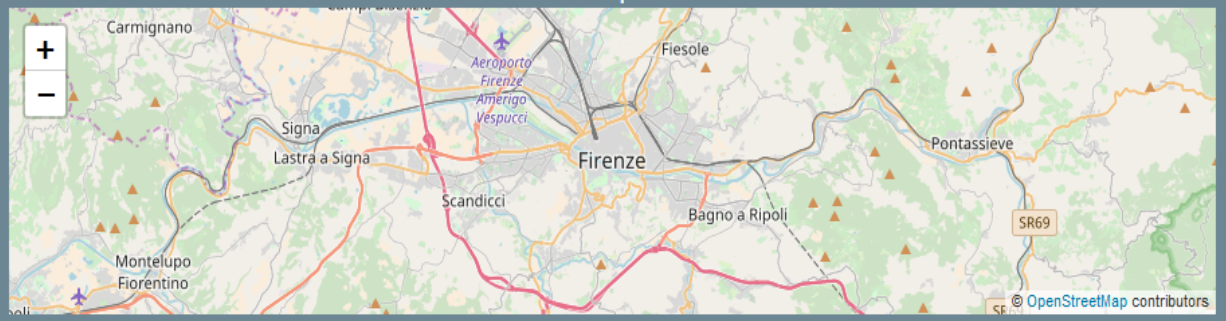


- to create a new Dashboard
- to add widgets and/or groups of them on any Dashboard

Wizard

Dashboard features | Data and widgets

Map



Single data widgets

Multi data widgets

Data sources

High-Level Type	Nature	Subnature	Value Type	Value Name	Data Type	Last Date	Last Value	Healthiness	Last Check	Ownership
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather				2018-07-08 16:00:18	public
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather				2018-07-08 16:00:18	public
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather				2018-07-08 16:00:18	public
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather				2018-07-08 16:00:18	public
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather				2018-07-08 16:00:18	public
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather				2018-07-08 16:00:18	public
Special Widget	**Environment**	**Weather Forecast**		**Previ_Meteo**	**special weather**		**Vagli di sotto**		**2018-07-08 16:00:18**	**public**
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather		Uzzano		2018-07-08 16:00:18	public

Hide columns | Selected rows: 0 | Previous 1 2 3 4 5 … 1081 Next | Search

Choosen data sources

High-Level Type	Nature	Subnature	Value Type	Value Name	Data Type	Last Date	Last Value	Healthiness	Last Check	Ownership	Remove

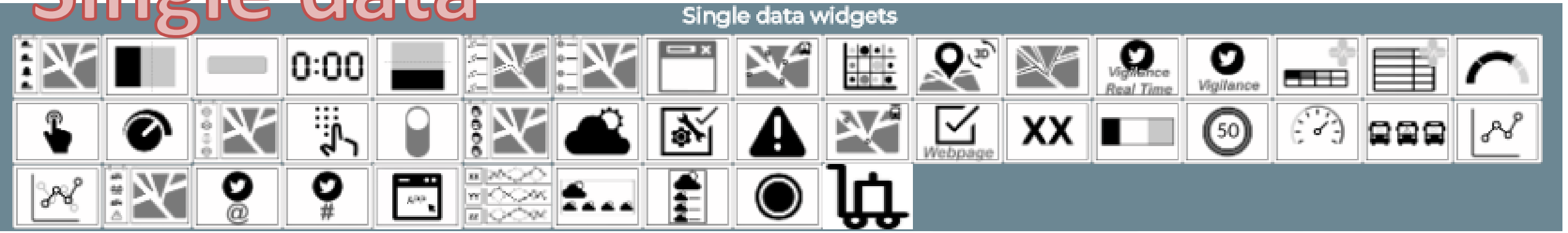
Close

Wizard

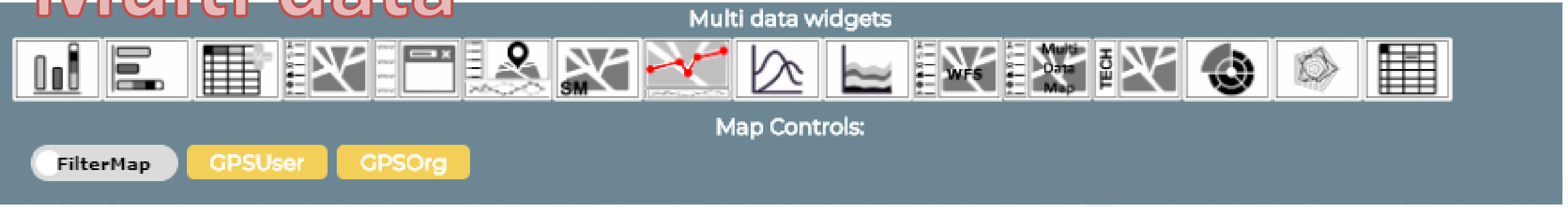
- Select the area of your interest: panning and zooming
- Select the
  - graphic aspect of your interest, or
  - High Level Type of your interest, or
  - Make a search if you a have a precise idea or
  - Act on filters: nature, subnature, type, name, value, date, health, owner, …
  - Combine them as you like
- Select the lines of your interest
- Then click on Next and get the Dashboard by wizard

ICONS of Widgets

Single data

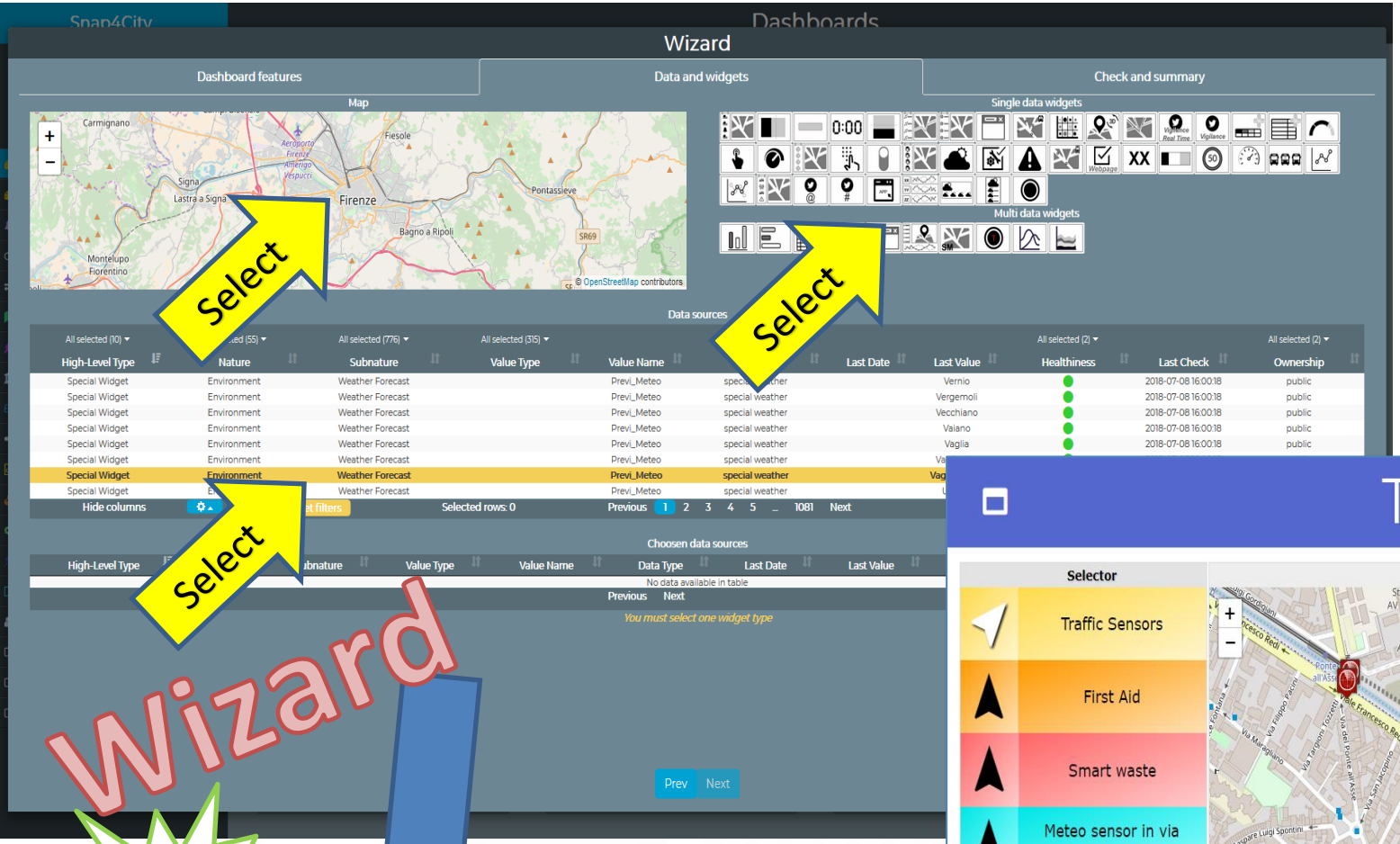


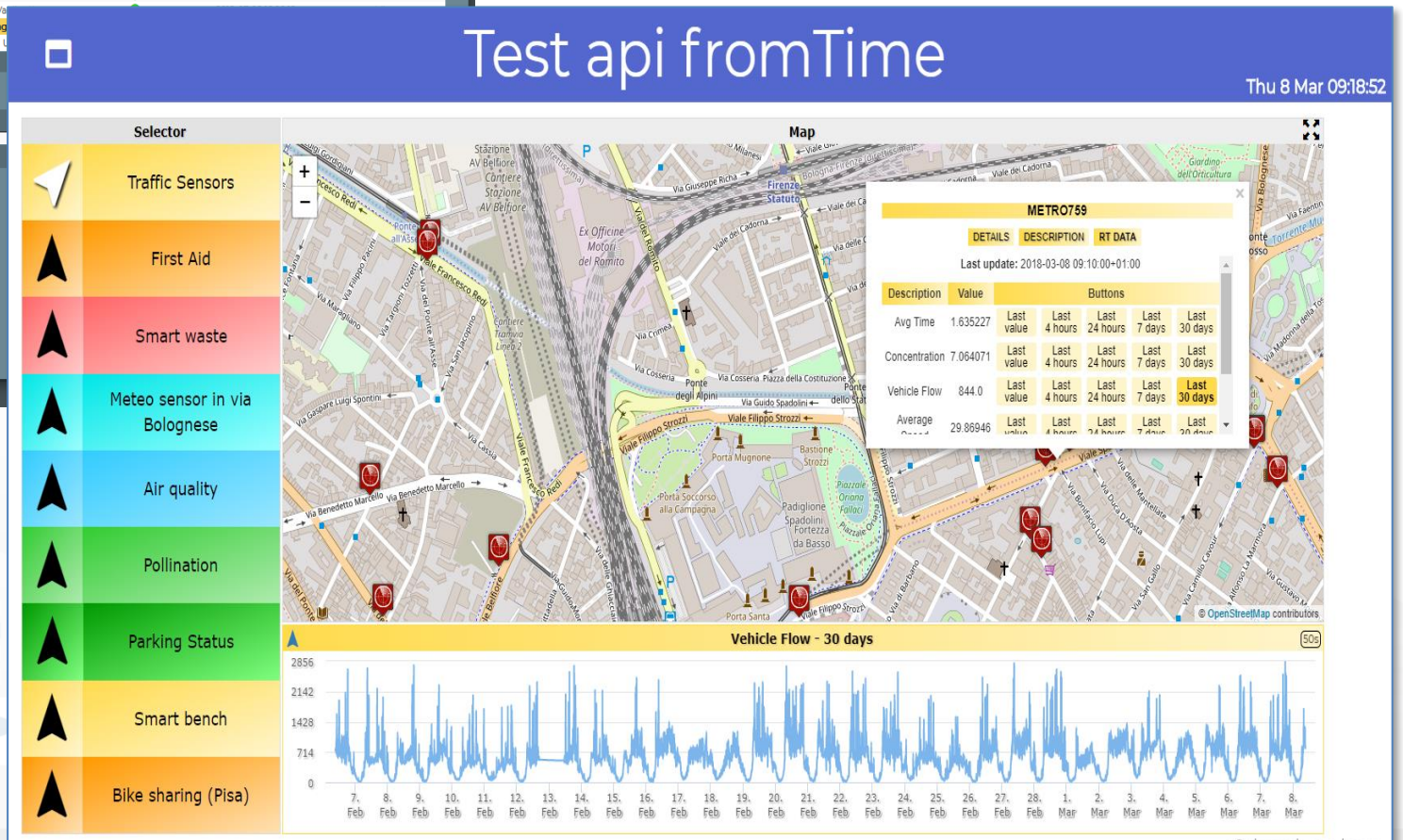
Multi data



Map Controls

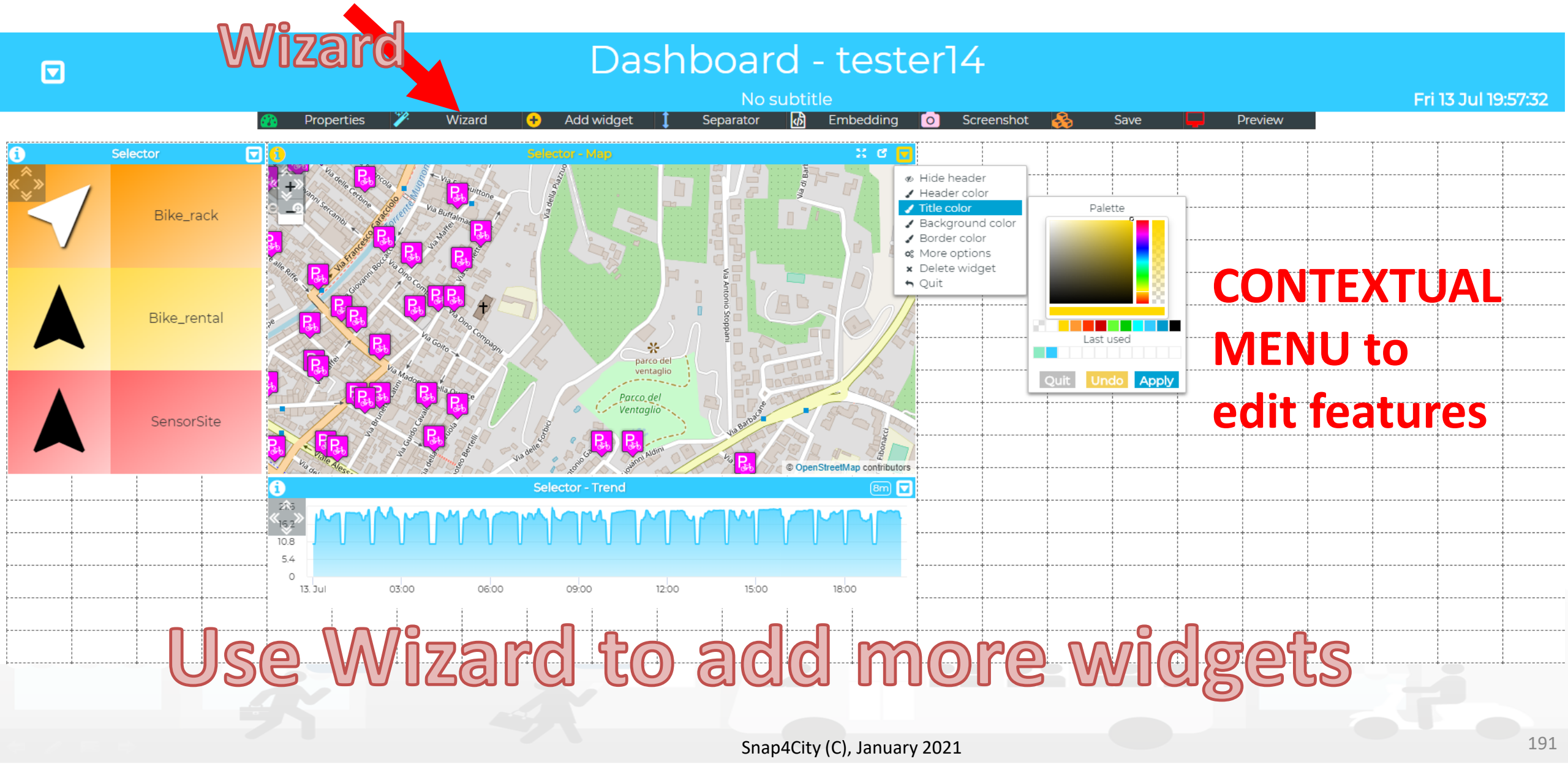
Dashboard Wizard





The Wizard helps you in selecting only possible combinations of data and graphic representations

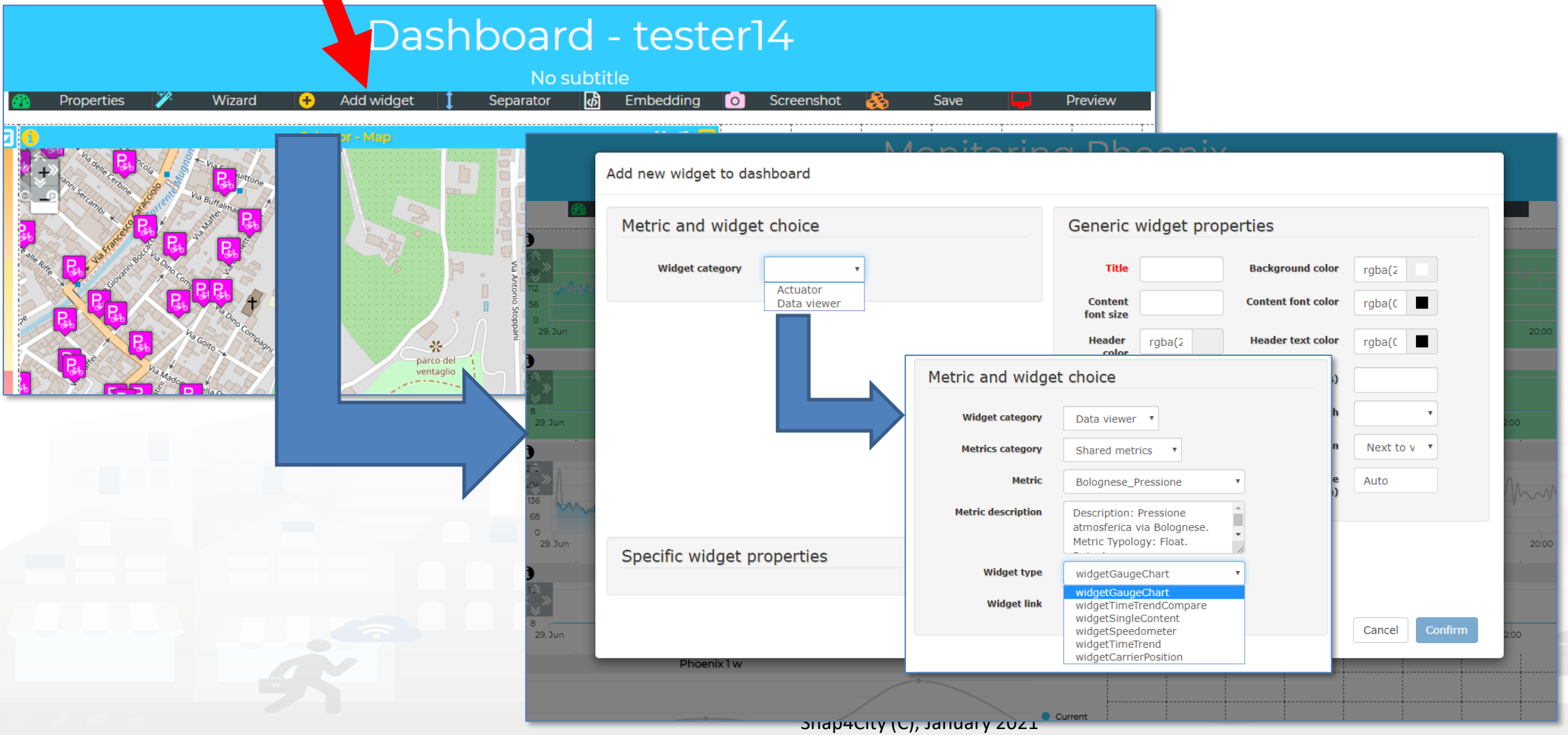
Wizard



CONTEXTUAL MENU to edit features

Use Wizard to add more widgets

Manual Addition of Widgets



Dashboards summary and further exercises

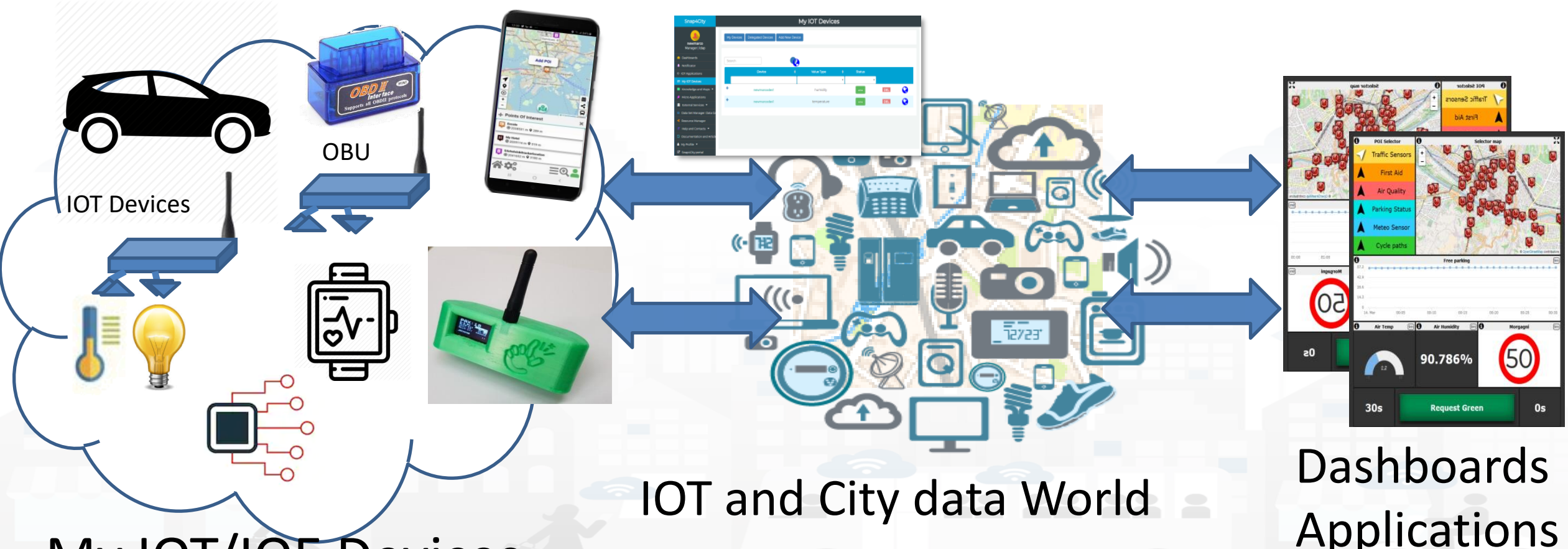
- **Suitable** as: City Dashboard, App interface, and Control Room Dashboards, Situation Room Dashboard, Operator Dashboard
- **Created** visually compounding graphic Widgets
  - Each widget can be set to have an autonomous update
  - Each metric/data-source may have associated with an alarm: blinking and sending events to people and machines in different manners
- **Can be**: public or private, private dash can be delegated or passed in ownership
- See https://main.snap4city.org/management/dashboards.php?linkId=dashboardsLink&fromSubmenu=false&sorts[title_header]=1
- See the following tutorials
  - **HOW TO: create a Dashboard in Snap4City**
  - **HOW TO: add data sources to the Snap4City Platform**
  - **US1. Using City Dashboards**
  - **US2. Using and Creating Snap4City Applications with Dashboards**
  - **US4. Creating City Dashboards and related Event Monitoring and Actions**

Dashboards Creation Exercitation

DEMO Section

To Start we are going to use Direct Dashboards

Dashboards accessing data available on Platform, including your own data coming from Mobile App, already registered!!!

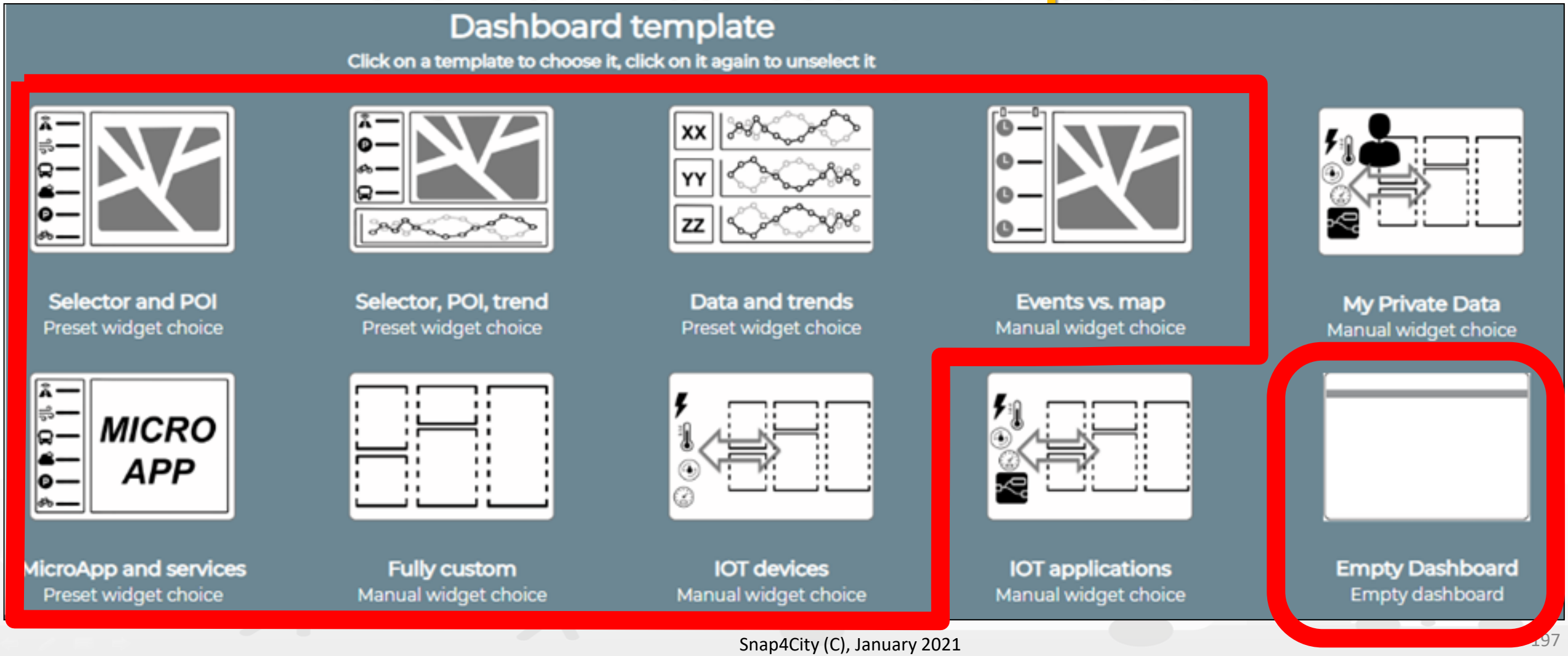


My IOT/IOE Devices

IOT and City data World

Dashboards Applications

In this exercitation we are going to use the main Dashboard Templates



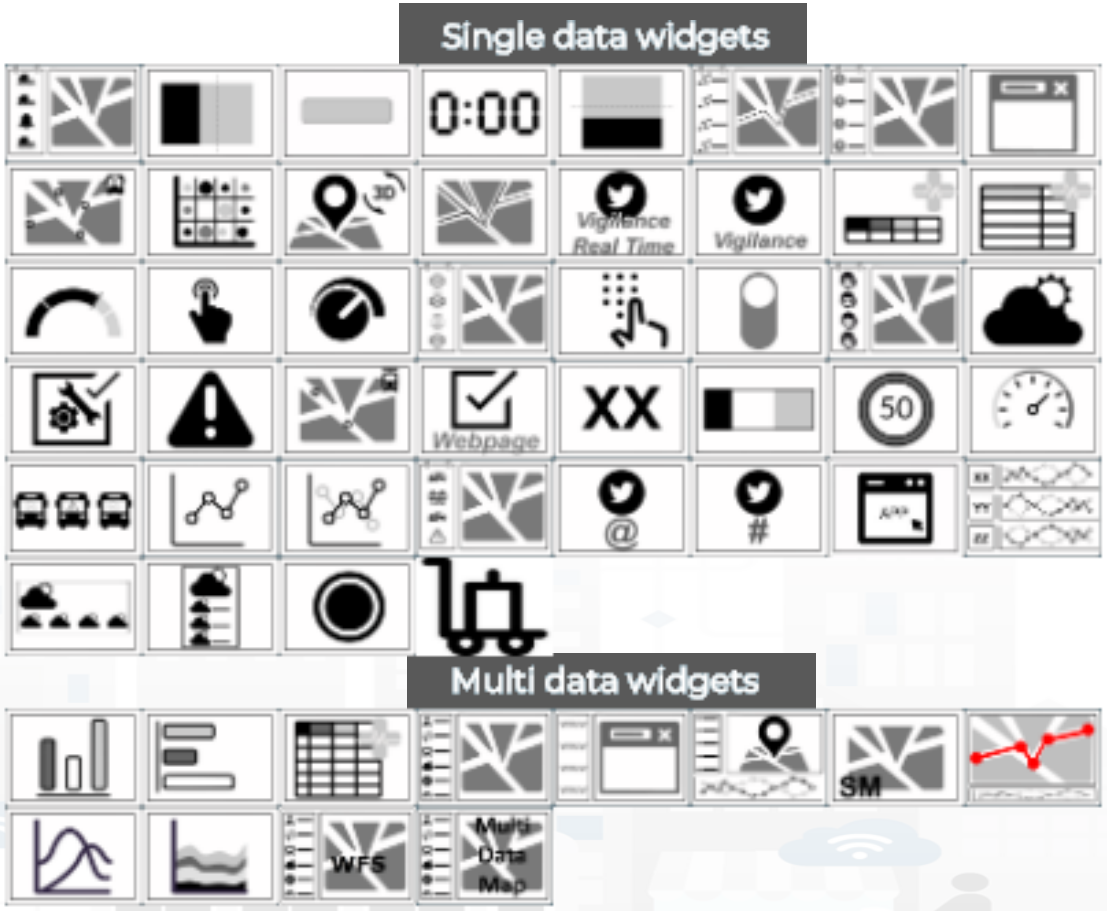
Exercitation on dashboard building

1. Create a Dashboard for the visualization of sensors values: actual and their trend
2. Create a Dashboard for the visualization of geolocated services (POI, Sensors, heatmap, etc.) and their selection on Map, with eventual target to see the time trend
3. Create a Dashboard for the visualization of MyKPI regarding my trajectories and eventually those of other users.

Nikname:.....

1) Create a Dashboard for the visualization of sensors values: actual and their trend

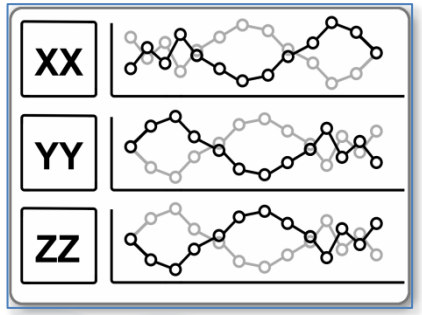
- The sensors to be selected should
  - Be located downtown in Florence around a POINT of YOUR interest: home, work, study, etc.
  - Report data regarding: environment, traffic, parking, pollution, etc.
- **We suggest to:**
  - Understand how to work with data by using the Data Inspector
  - Create a new Dashboard by Wizard
  - Customize look and fill of the Dashboard and widgets
- Time: 20 minutes

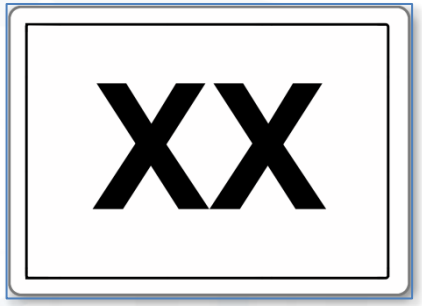


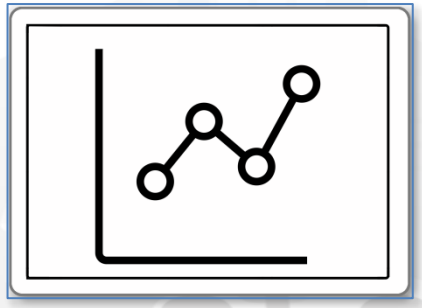
Identify your Widgets

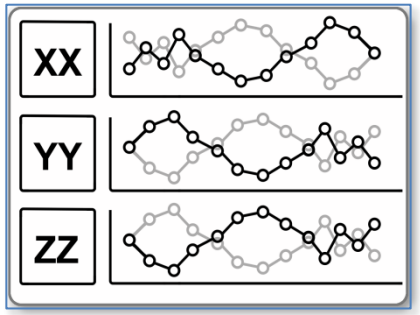
1) Create a Dashboard for the visualization of sensors values: actual and their trend

- The sensors to be selected should
  - Be located downtown in Florence around a POINT of YOUR interest: home, work, study, etc.
  - Report data regarding: environment, traffic, parking, pollution, etc.
- **We suggest to:**
  - Understand how to work with data by using the Data Inspector
  - Create a new Dashboard by Wizard
  - Customize look and fill of the Dashboard and widgets
- Time: 10-20 minutes



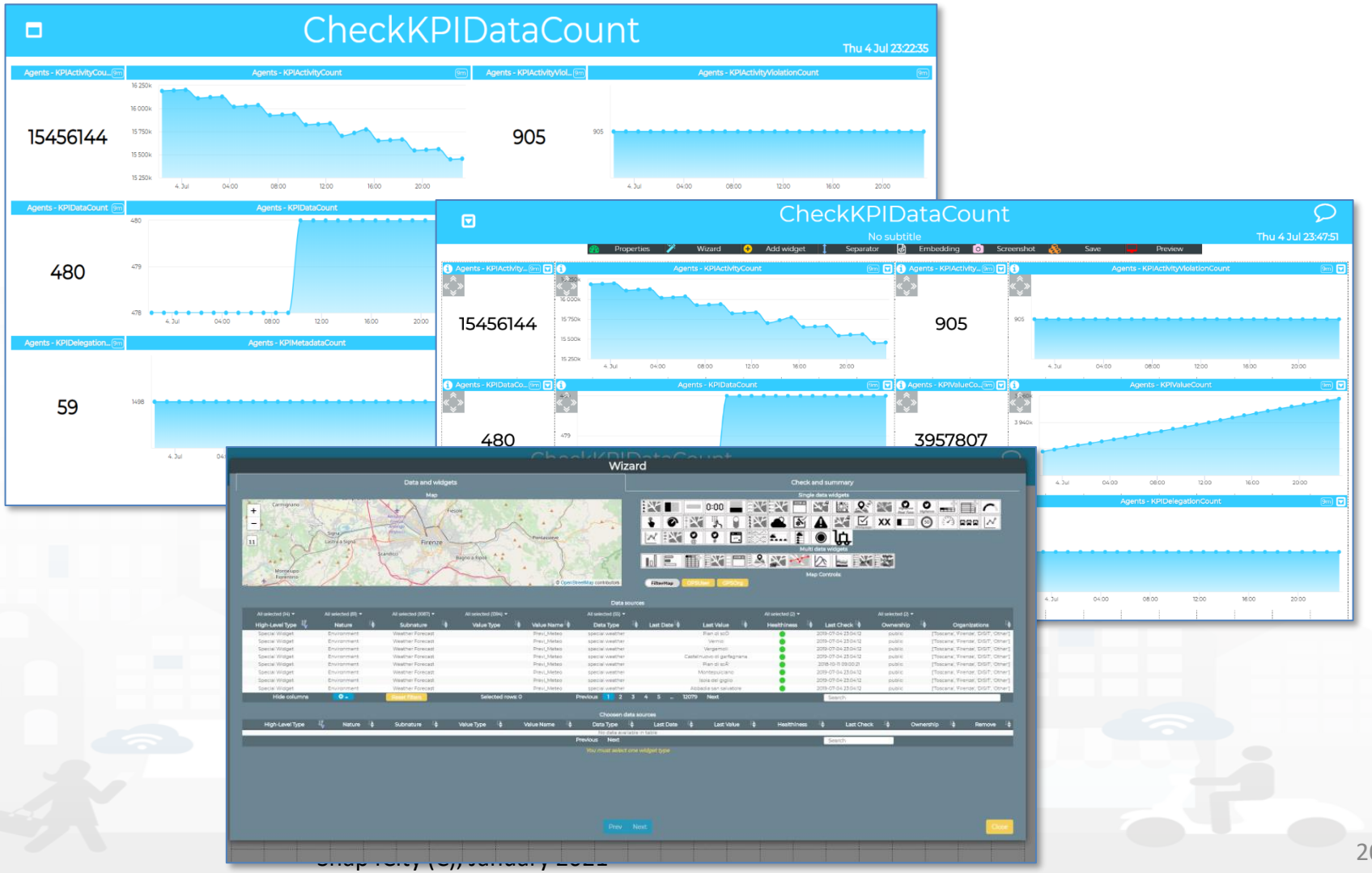






Result could be similar to

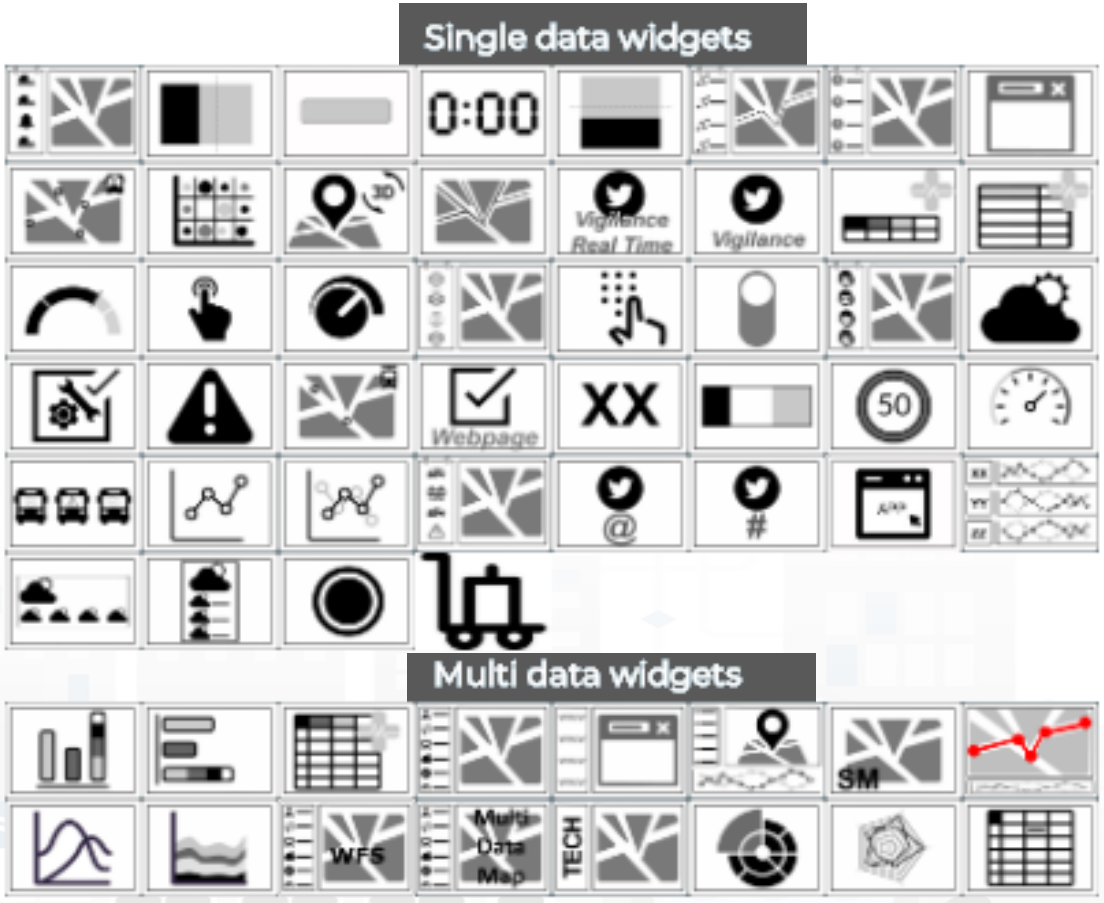
- You can add more Widgets by:
  - Wizard
  - Editor manually



Nikname:.....

2) Create a Dashboard for the visualization of geolocated services (POI, Sensors, heatmap, etc.) and their selection on Map, with eventual target to see the time trend

- **The HLT to be selected** should
  - Be located downtown in Florence
  - Could be of different kind **of** nature. At least 5 of them
  - Data regarding: environment, traffic, parking, pollution, etc.
- **We suggest to:**
  - Start creating the New Dashboard by Wizard
  - Customize look and fill of the Dashboard and widgets
- Time: 10-20 minutes
- There are different modalities to get similar results



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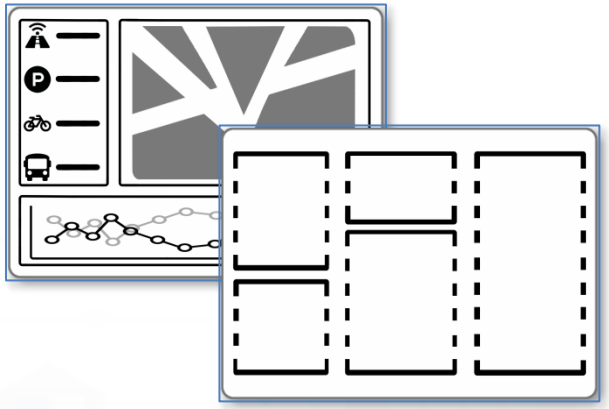
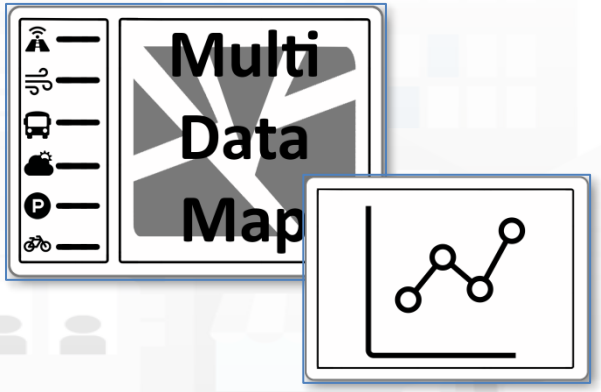
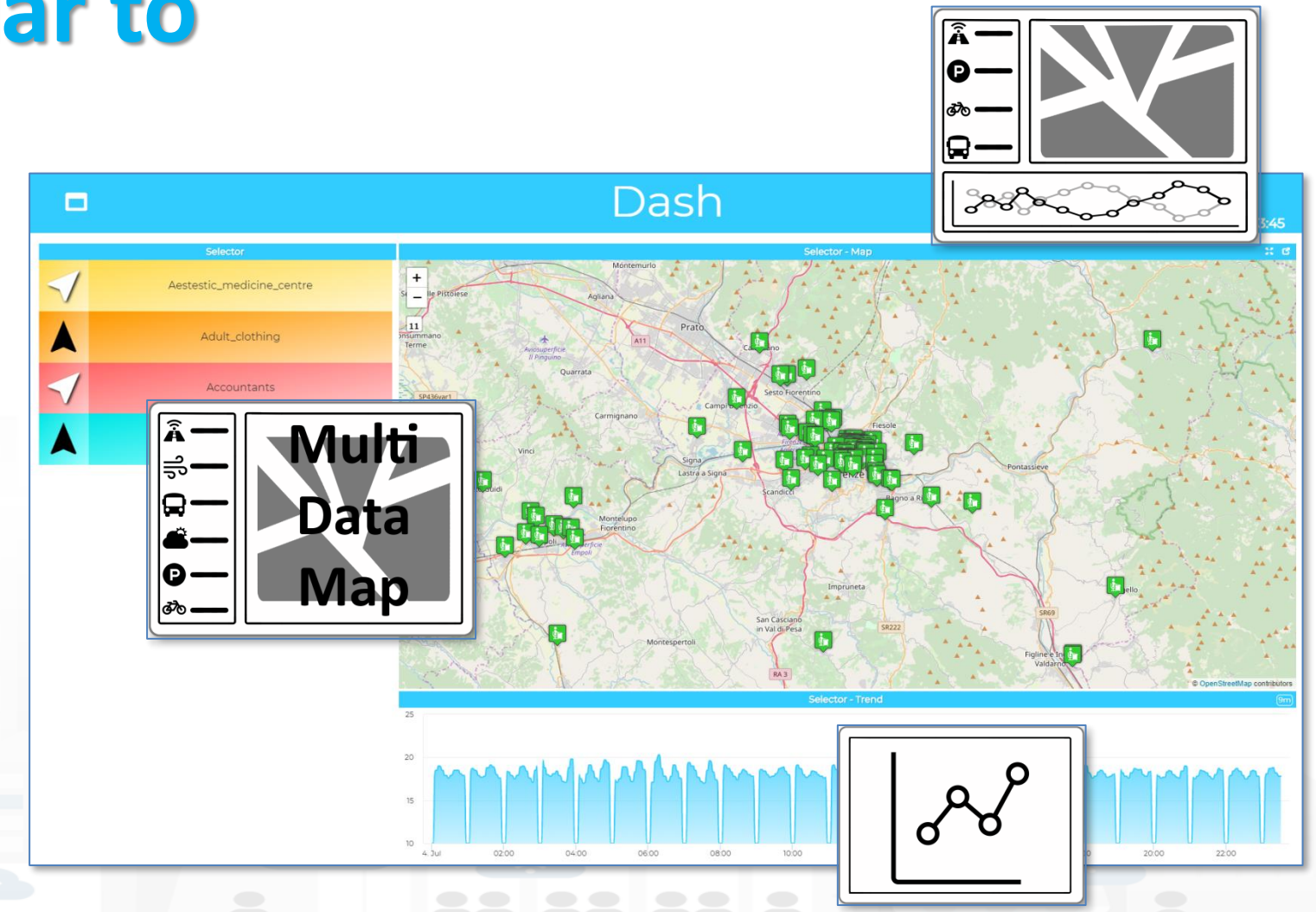




Result could be similar to

- Not all combinations provide the same effective result
- You can
  - customize the resulting dash
  - add other widgets by wizard
  - see how a Selector is built
  - .....

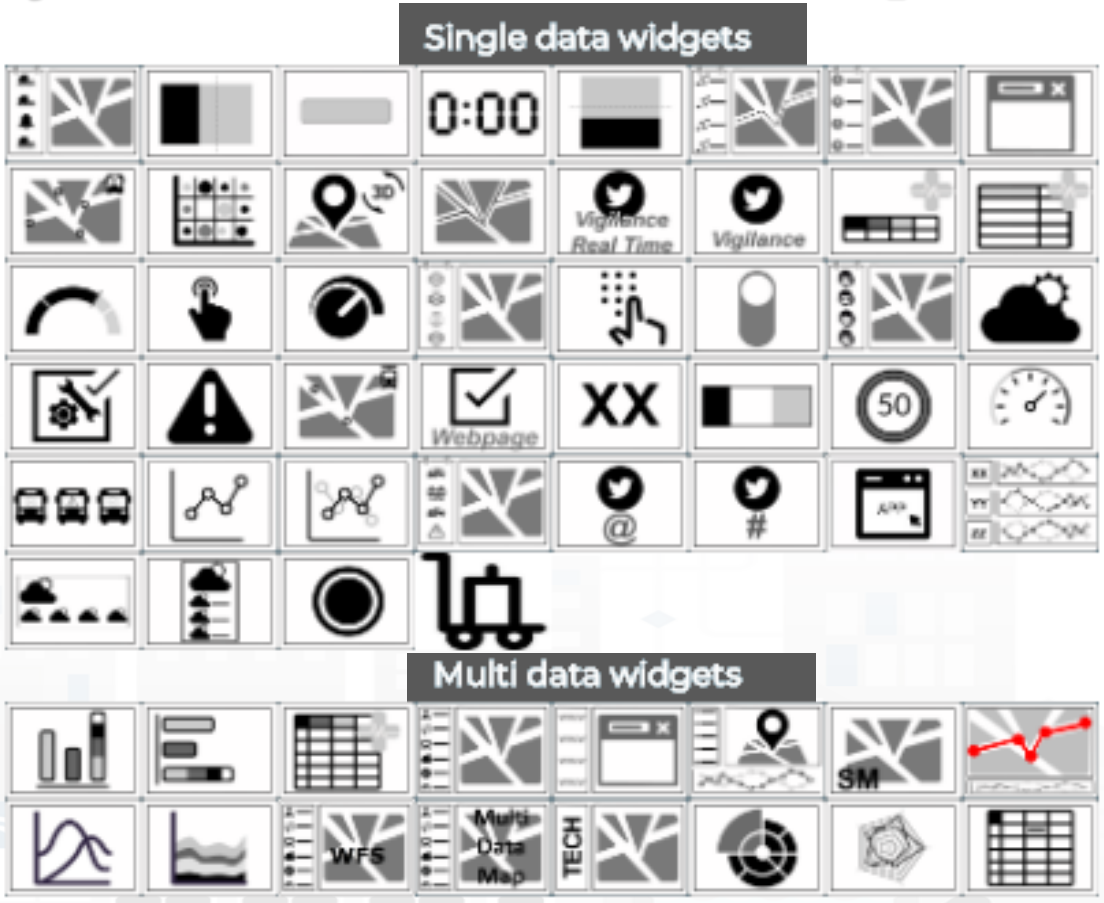


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjYxMg==

Nikname:.....

3) Create a Dashboard for the visualization of MyKPI regarding my trajectories and [eventually those of other users]

- **We suggest to:**
  - Open Dashboard Wizard
  - Search for your trajectory on mobile looking for MyKPI
  - Create a Dashboard exploiting the Widget Tracker
  - Customize look and fill of the Dashboard and widgets, change color of the header, etc.
- Time: 10-15 minutes



Identify your Widgets

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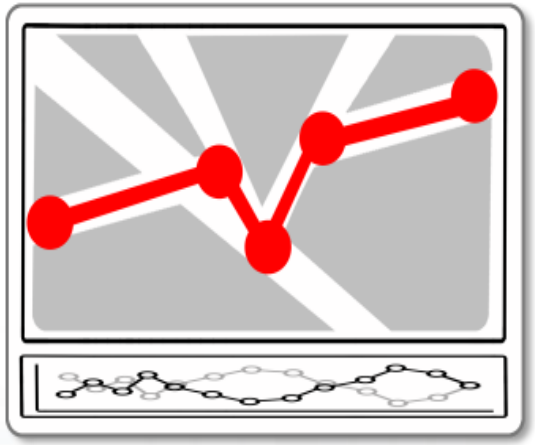
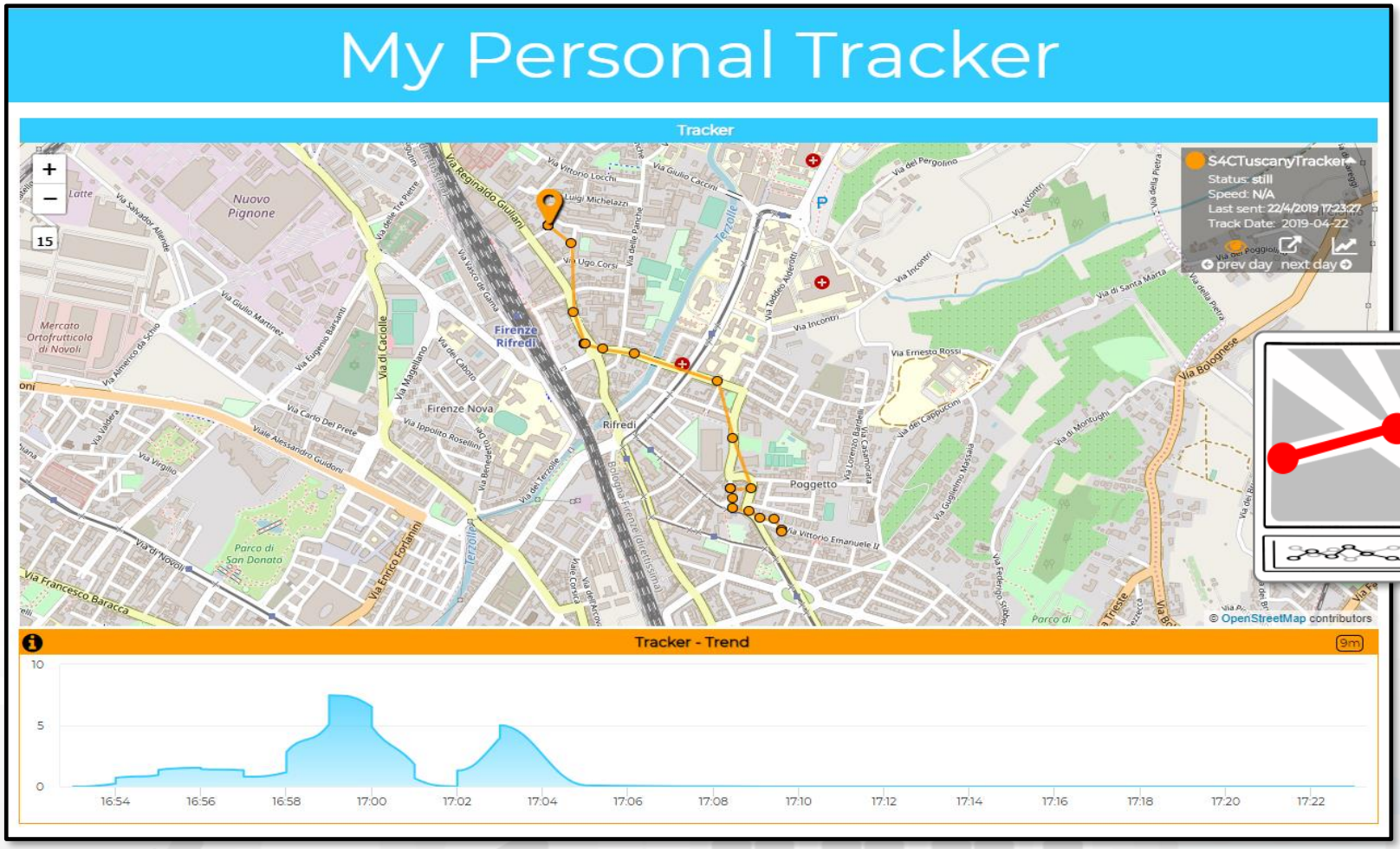


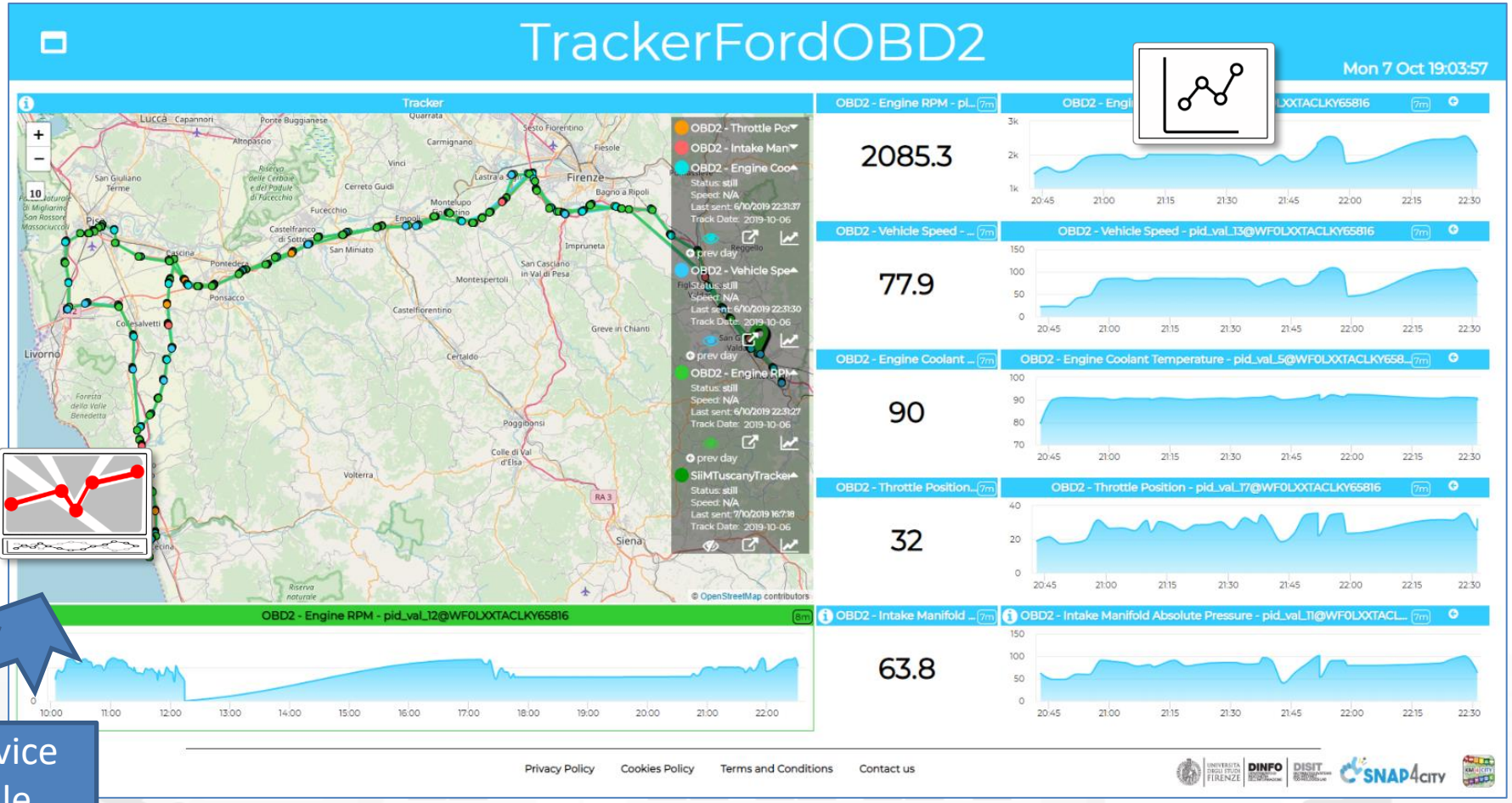
Result could be similar to

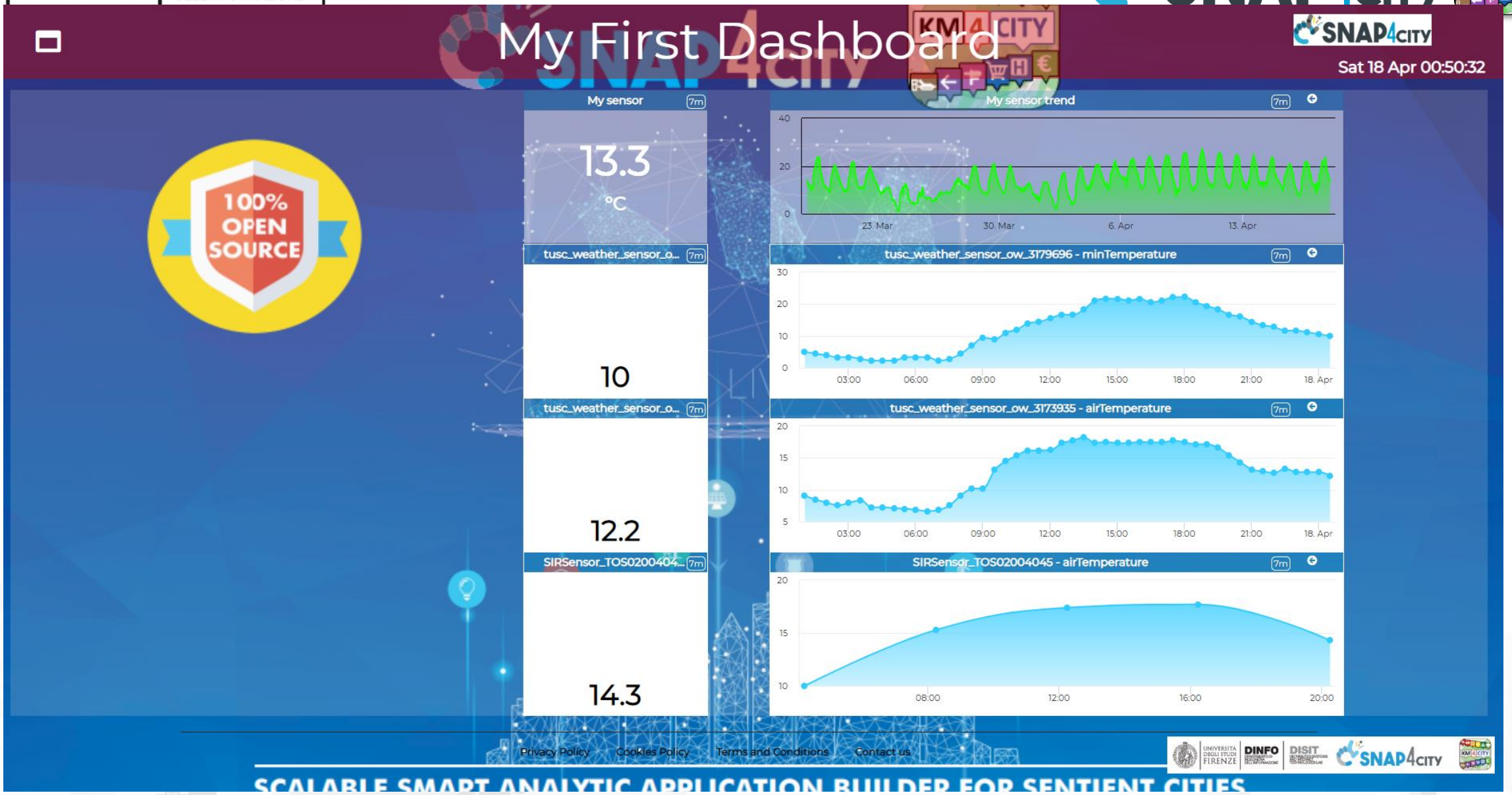


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjYxNA==

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





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

my example of dashboard

Sat 18 Apr 00:49:24

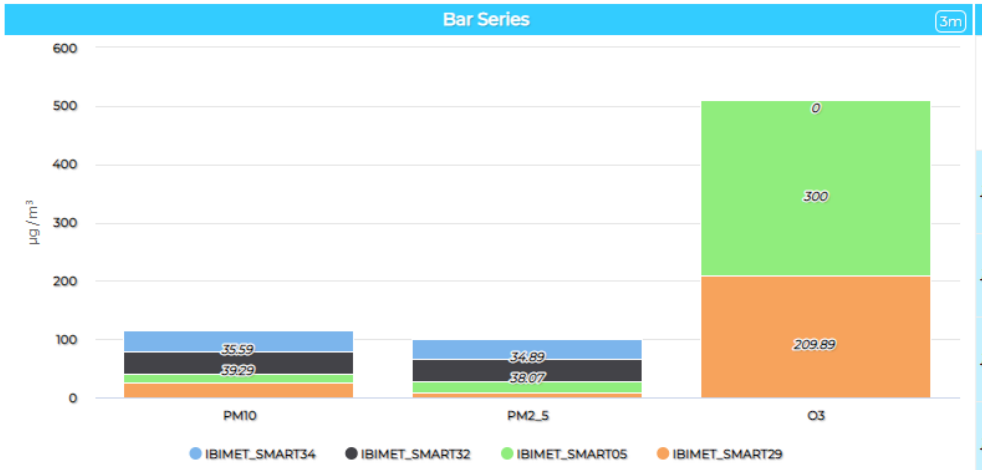
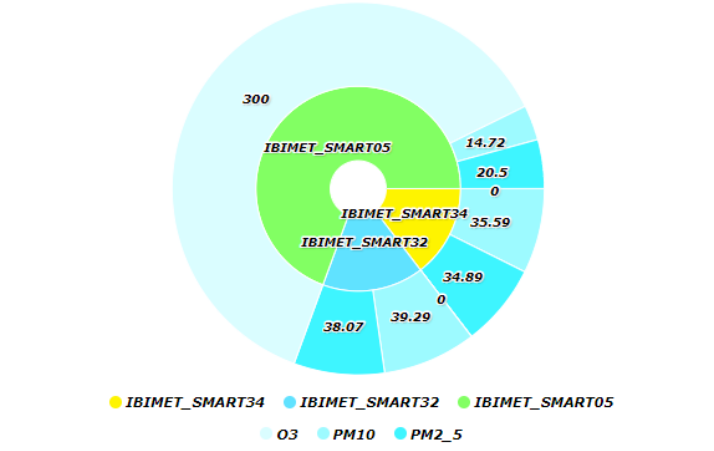
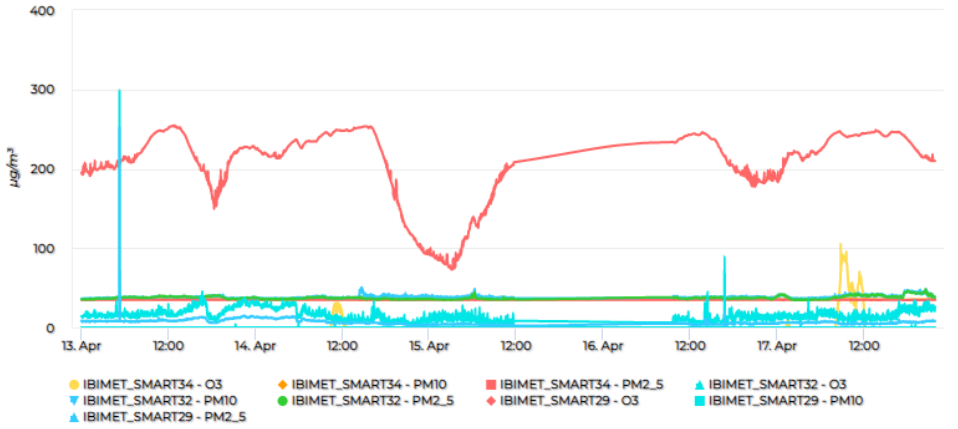


Table 3m

value type / value name	PM2_5	PM10	O3	airHumidity	airTemperature
IBIMET_SMART19	17.85	20.63	107.51		
IBIMET_SMART12	6.81		44.95	47.1	17.3
IBIMET_SMART17			300	0	0
IBIMET_SMART29				90.1	14.6





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

Mobility and Environment What-IF Analysis

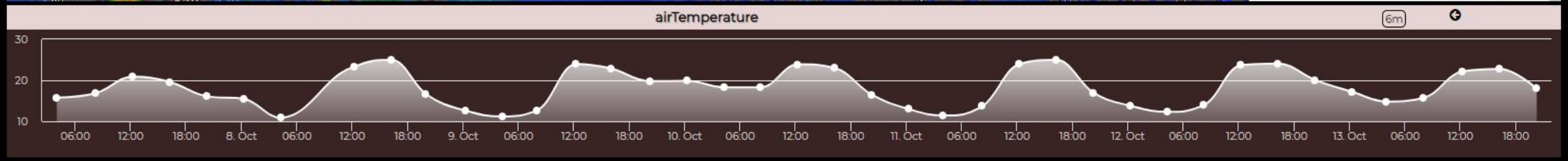
This dashboad contains data derived from actual sensors and predictive values under validation

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==

Mobility and Environment What-IF Analysis

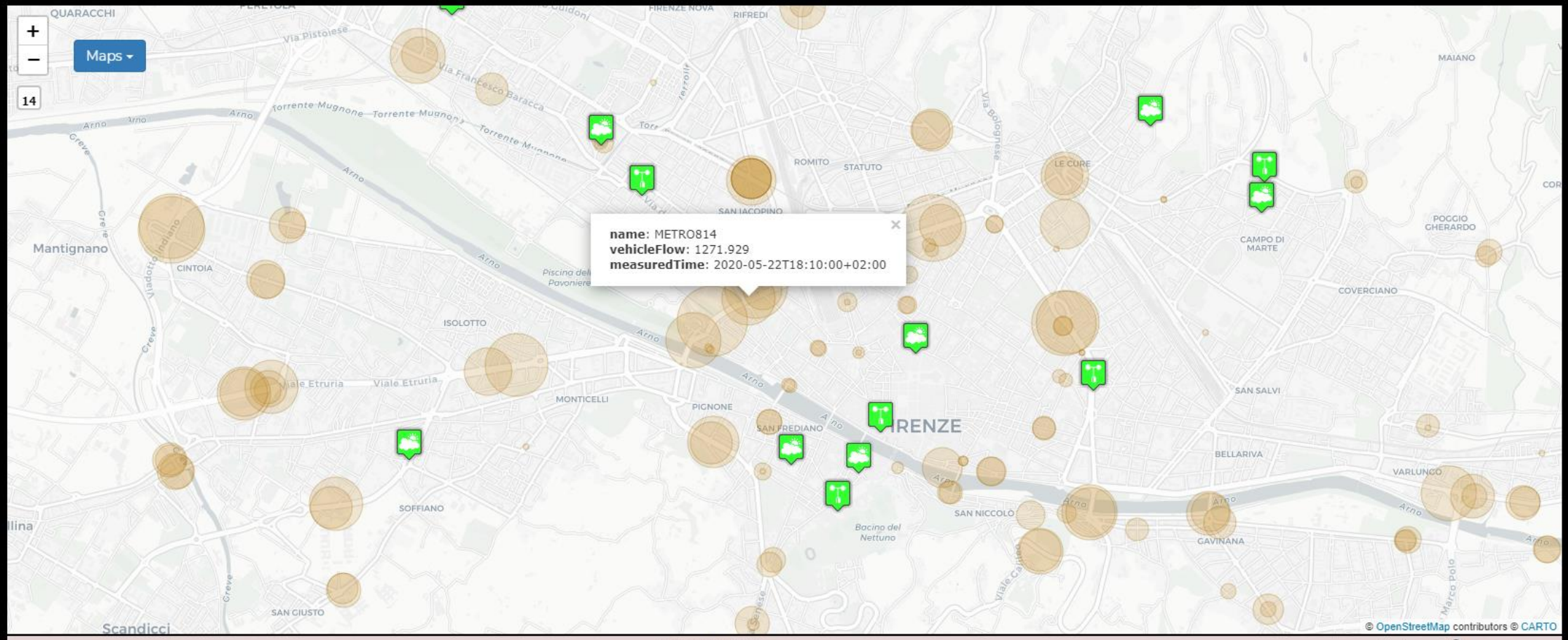
This dashboad contains data derived from actual sensors and predictive values under validation

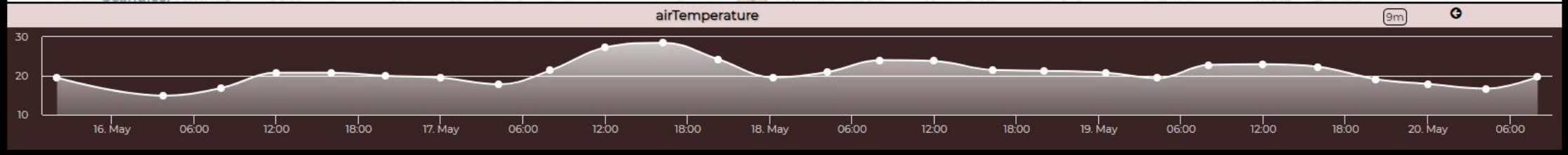
Fri 22 May 18:19:41

- 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
- Traffic Bubble
- Cycling Paths
- Accident Heatmap
- Only HRes Anym. Gral
- Scenarious
- What-if analysis

Firenze Oggi

Air Temperat... 9m





Dashboards

- **Suitable** as: City Dashboard, App interface, and Control Room Dashboards, Situation Room Dashboard, Operator Dashboard
- **Created** visually compounding graphic Widgets
  - Each widget has an autonomous update
  - Each metric/data-source may have associated with an alarm: blinking and sending events to people and machines in different manners
- **Can be**: public or private, private dash can be delegated or passed in ownership
- See https://main.snap4city.org/management/dashboards.php?linkId=dashboardsLink&fromSubmenu=false&sorts[title_header]=1
- See the following tutorials
  - **HOW TO: create a Dashboard in Snap4City**
  - **US1. Using City Dashboards**
  - **US2. Using and Creating Snap4City Applications with Dashboards**
  - **US4. Creating City Dashboards and related Event Monitoring and Actions**

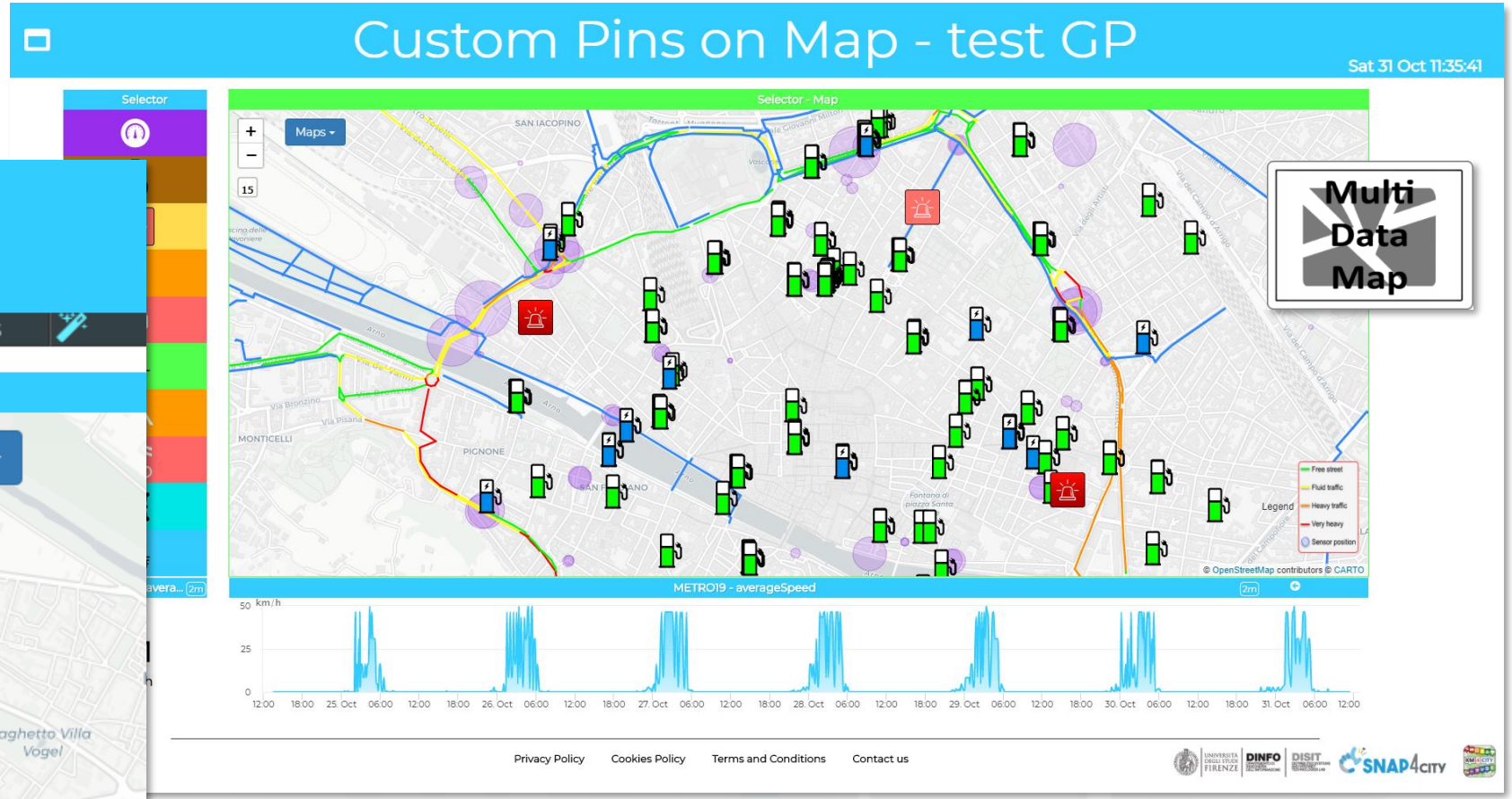
Mechanisms of Selector for the Multi Data Map widget

The Selector for Multi Data Maps

- **Different styles**
  - Icon and Text menu
  - Custom Menu Icon
  - Icon Menu buttons
  - Etc.
- **Features**
  - Removable header
  - Colours custom
  - Transparencies
  - Mixed modalities
- **Note:**
  - Manus can be realized also with a set of Buttons

The Selector is the Map Controller

Custom Dynamic Pins



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

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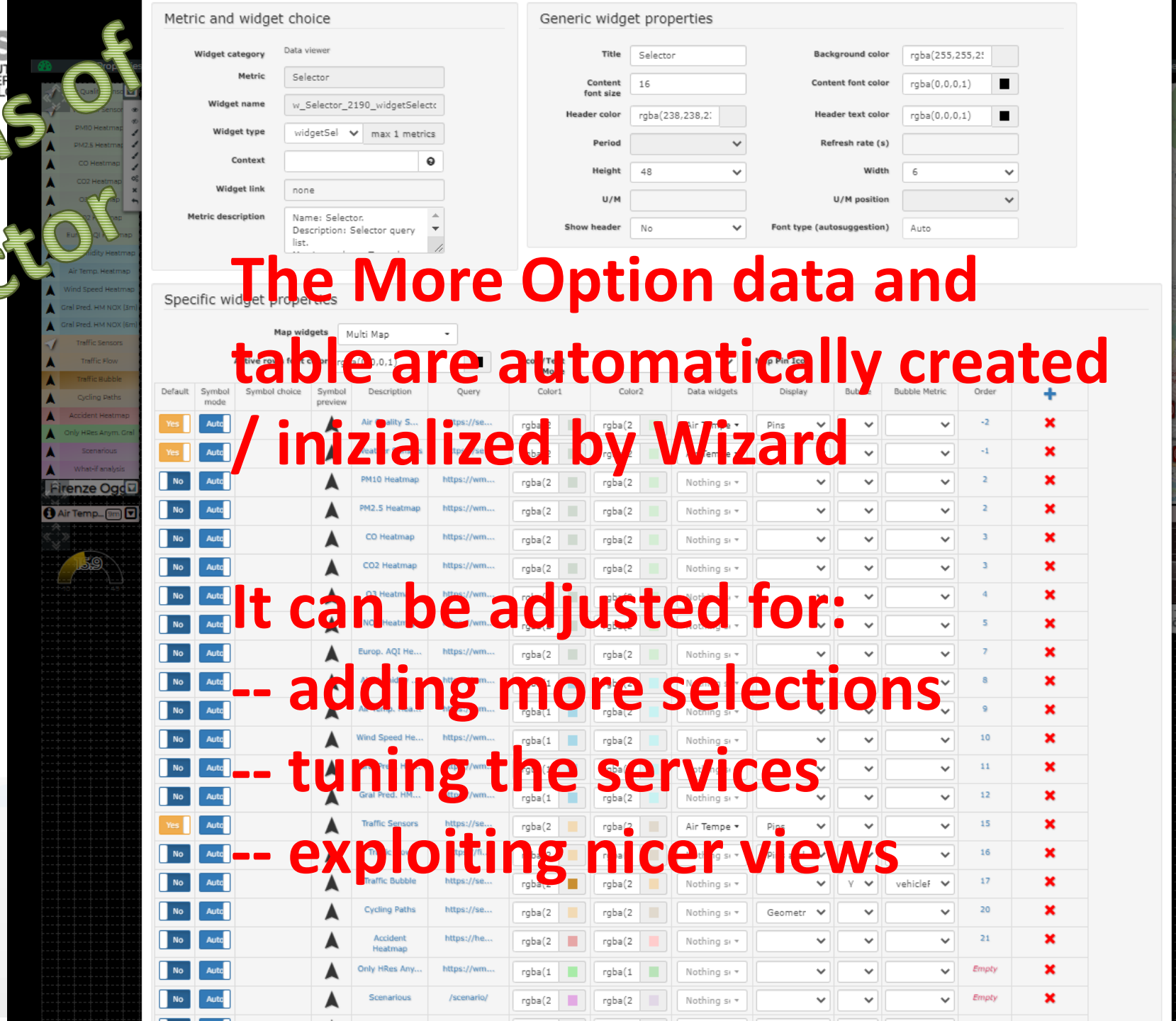
More Options of the Selector

- Setting:
  - Heatmaps
  - Bubbles
  - Icons
  - Custom
  - Traffic flow
  - Cycling path
  - What-if
  - Etc. etc.



The More Option data and table are automatically created / inizialized by Wizard

It can be adjusted for:

-- adding more selections

-- tuning the services

-- exploiting nicer views

Specific widget properties

MoreOptions (below part)

Map widgets Selector Ma

Active rows font color rgba(0,0,0,1)

Icon/Text Mode Icon Only

Map Pin Icon Pin Icon

Default	Symbol mode	Symbol choice	Symbol preview	Symbol color	Description	Query	Color1	Color2	Data widgets	Default View Mode	Map Icon color	Alternate View Mode	Variable Name	Order	
Yes	Auto				Traffic Bubbl...	https://se...	rgba(1!	rgba(1!	Nothing se			Bub	vehicleFl	1	✖
No	Auto				Psvgb_X-val3	https://se...	rgba(1(	rgba(1(	METRO19	Pir		Cus	val3	2	✖
No	Auto				Psvgb_X-val1	https://se...	rgba(2!	rgba(2!	METRO19	Pir		Cus	val1	3	✖
No	Auto			rgba((	Psvgb_X-val4	https://se...	rgba(2!	rgba(2!	METRO19	Pir		Cus	val4	4	✖
No	Auto			rgba(!	recharging st...	https://se...	rgba(2!	rgba(2!	METRO19		Symbol (	Cus	stationSt	5	✖
No	Auto	PM 2.5	PM 2.5		PM2_5 Heatmap	https://wm...	rgba(8:	rgba(8:	Nothing se					Empty	✖
No	Auto				Traffic Flow	https://fi...	rgba(2!	rgba(2!	Nothing se					Empty	✖
No	Auto				Cycling Paths	https://se...	rgba(2!	rgba(2!	Nothing se					Empty	✖
No	Auto				Scenario	/scenario/	rgba(0,	rgba(1!	Nothing se					Empty	✖
No	Auto	WHAT-IF	WHAT-IF		What-IF	/whatif/	rgba(5:	rgba(1!	Nothing se					Empty	✖

You may need to save and reopen the MoreOptions more than once to pass on different kinds of configurations

The Selector is the Map Controller

MoreOptions

Specific widget properties

Selector - Map

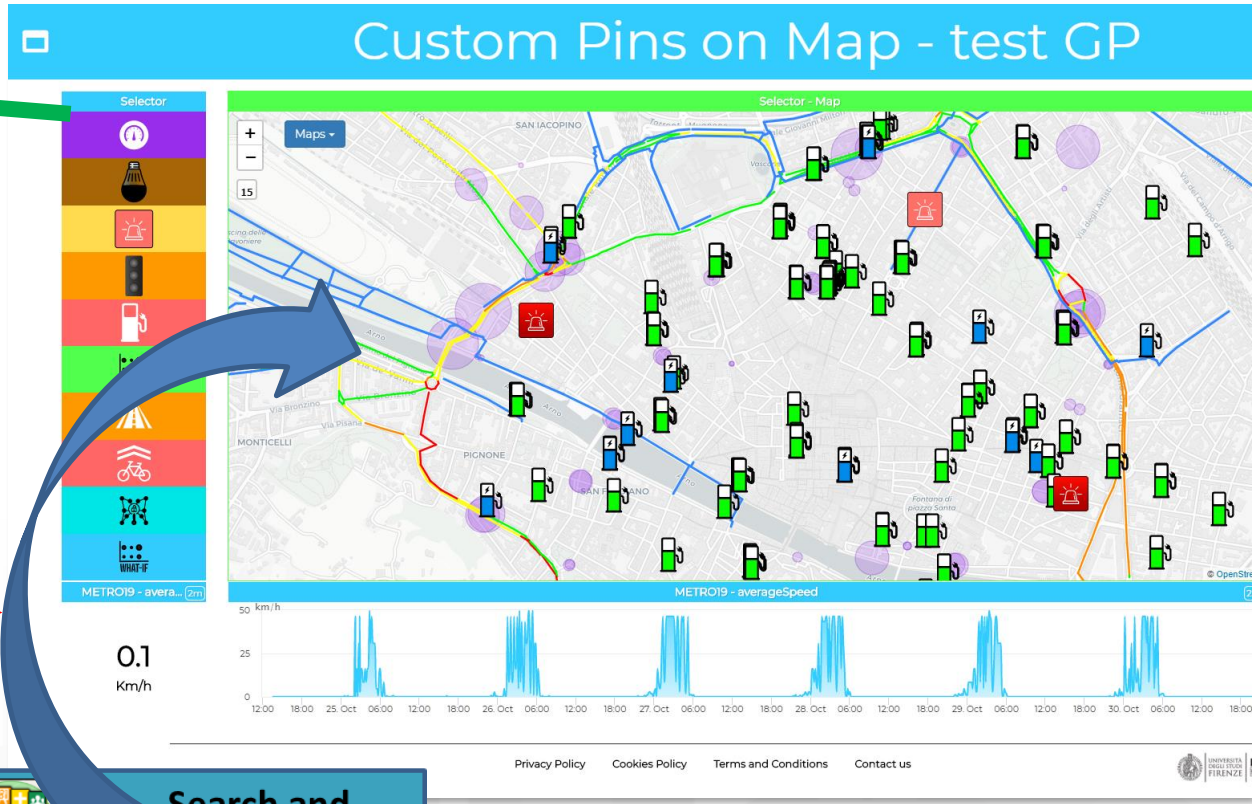
Active rows font color rgba(0,0,0,1)

Icon/Text Mode

Default	Symbol mode	Symbol choice	Symbol preview	Symbol color	Description	Query
Yes	Auto				Traffic Bubbl...	https://se...
No	Auto				Psvgb_X-val3	https://se...
No	Auto				Psvgb_X-val1	https://se...
No	Auto			rgba((	Psvgb_X-val4	https://se...
No	Auto			rgba((	recharging st...	https://se...
No	Auto	PM 2.5	PM 2.5		PM2_5 Heatmap	https://wm...
No	Auto				Traffic Flow	https://fi...
No	Auto				Cycling Paths	https://se...
No	Auto				Scenario	/scenario/
No	Auto	WHAT-IF	WHAT-IF		What-IF	/whatif/

More Options Edit

- Query ID
- REST CALL
- Command
- Heatmap



Knowledge base
Semantic reasoners

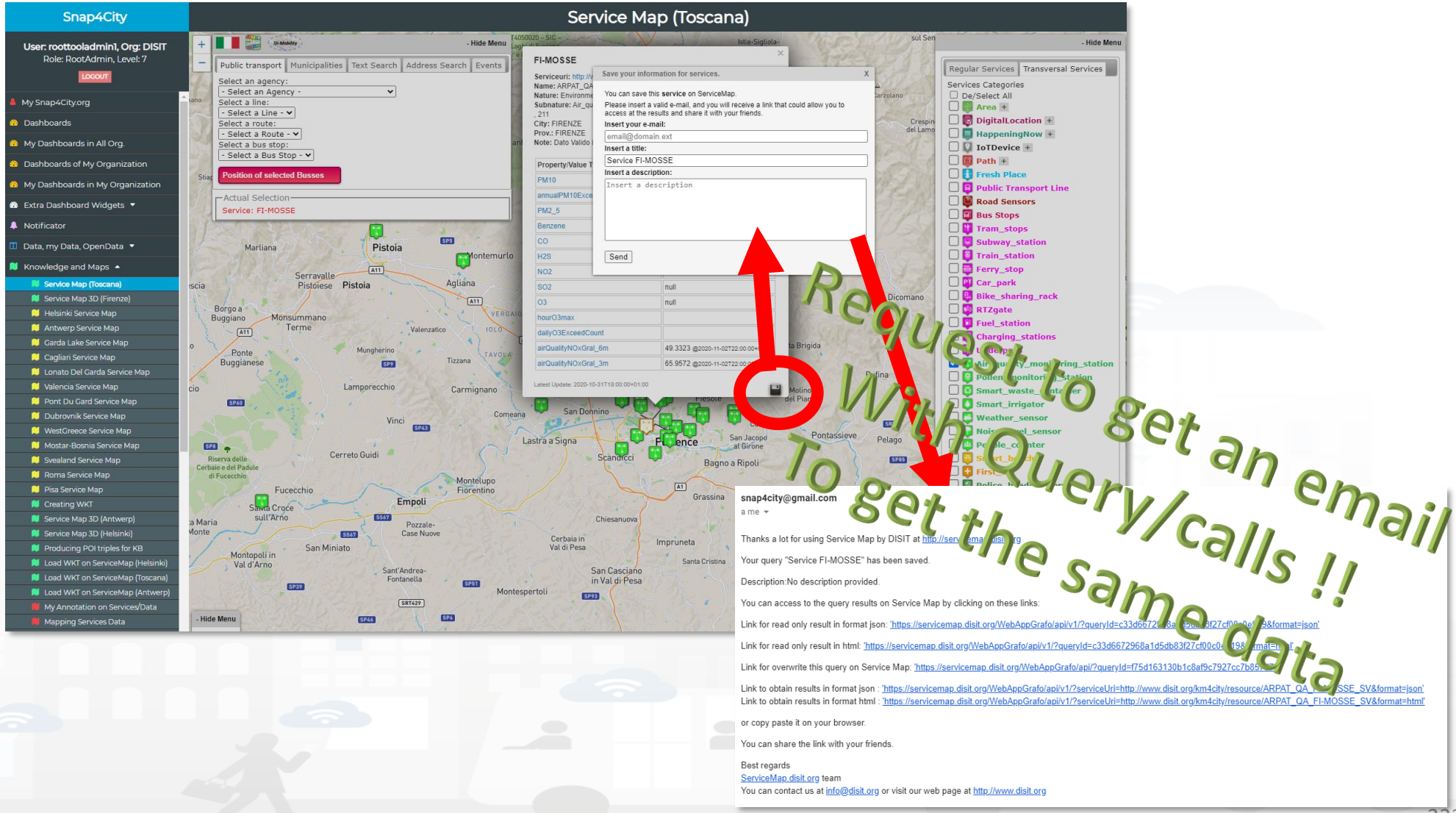
Indexing and aggregating
Elastic search

Search and Query, Smart City API
Facet, semantic search

- ***The Query is produced by Wizard but can be manually changed***

How to Get the «Query» used in More Options (1)

- **Query ID**
  - **only Read and Read/Write of the query**
- **REST CALL of the Smart City APIs**
  - **JSON**
  - **HTML (do not use into MoreOptions)**



The example of email from ServiceMap

snap4city@gmail.com

a me

Thanks a lot for using Service Map by DISIT at http://servicemap.disit.org

Your query "Service FI-MOSSE" has been saved.

Description:No description provided.

You can access to the query results on Service Map by clicking on these links:

Link for read only result in format json: 'https://servicemap.disit.org/WebAppGrafo/api/v1/?queryId=c33d6672968a1d5db83f27cf00c0e919&format=json'

Link for read only result in html: 'https://servicemap.disit.org/WebAppGrafo/api/v1/?queryId=c33d6672968a1d5db83f27cf00c0e919&format=html'

Link for overwrite this query on Service Map: 'https://servicemap.disit.org/WebAppGrafo/api/?queryId=f75d163130b1c8af9c7927cc7b857d70'

Link to obtain results in format json : 'https://servicemap.disit.org/WebAppGrafo/api/v1/?serviceUri=http://www.disit.org/km4city/resource/ARPAT_QA_FI-MOSSE_SV&format=json'
Link to obtain results in format html : 'https://servicemap.disit.org/WebAppGrafo/api/v1/?serviceUri=http://www.disit.org/km4city/resource/ARPAT_QA_FI-MOSSE_SV&format=html'

or copy paste it on your browser.

You can share the link with your friends.

Best regards
ServiceMap.disit.org team
You can contact us at info@disit.org or visit our web page at http://www.disit.org

How to Get the «Query» used in More Options (2)

- **REST CALL by category → JSON (Options in RED), they are REST ASCAPI calls**
  - **Requesting a category, so that to see all Services of the same category (subNature)**
    - http://svealand.snap4city.org/ServiceMap/api/v1/?selection=59.581458578537955;16.71183586120606;59.62875017053684;16.875171661376957&categories=Street_light&maxResults=100&format=json
    - https://servicemap.disit.org/WebAppGrafo/api/v1/?selection=43.64471;11.005751;43.89471;11.505751&categories=Green_areas&maxResults=200&format=json
    - Custom PINS note: “selection” coordinates are used for collecting attributes in custom PINS. Other options such as “maxDists” cannot be used in custom PIN. All parameters can be used in other cases.
    - Different KB links are identified by their ASCAPI links: svealand.snap4city.org, servicemap.disit.org, ….
  - **Requests to SuperServiceMap for the network of Federated KBs** by using /api/…….

    Without prefixed KB to obtain merged results from more KBs. For example as:
    - /api/v1/?categories=Air_quality_monitoring_station&format=json
  - **Requests from GIS servers** by using WFS API and services
    - https://os.cittametropolitana.fi.it/imobids/trafficsensors/1758EB9B47A3904E05673BFEEE61AB1776C4C0050E7BD7FB195EA33CC56767BE/ows?service=WFS&version=1.1.0&request=GetFeature&typeName=TrafficSensors

How to Get the «Query» used in More Options (2)

- **REST CALL by ServiceURI → JSON (ServiceURI in RED), they are ASCAPI calls**
  - **Requesting single Service**
    - https://servicemap.disit.org/WebAppGrafo/api/v1/?serviceUri=http://www.disit.org/km4city/resource/ARPAT_QA_FI-BOBOLI&format=json
    - https://servicemap.disit.org/WebAppGrafo/api/v1/?serviceUri=http://www.disit.org/km4city/resource/ARPAT_QA_FI-MOSSE_SV&format=json
      - Different KBs links are identified by their ASCAPI links: svealand.snap4city.org, servicemap.disit.org, ….
  - **Referring to SuperServiceMap** into the network of Federated KBs is possible by using /api/…….
    Without prefixed KB, to obtain merged data from more KBs, for example as:
    - /api/v1/?categories=Air_quality_monitoring_station&format=json

How to Get the «Query» used in More Options (3)

- **ServiceMap (specific KB) and Query service**
  - The Query performed is saved and can be recalled with a QueryID, valid for that specific KB, and not accessible via SuperServiceMap / Federated KB
  - The QueryID is communicated via email
  - Specific REST Call with HTML is also provided to change the Query in server associated with the QueryID received

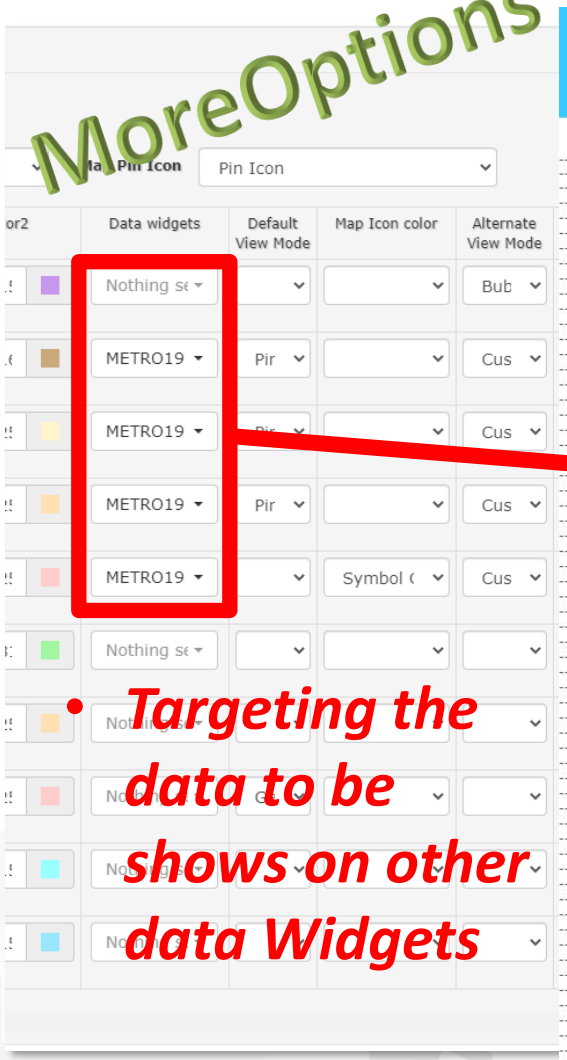
- **Query ID (only Read and Read/Write of the query)**
  - https://servicemap.disit.org/WebAppGrafo/api/v1/?queryId=1c8111893d40a2bb07a2078ffe299ced&format=json
  - Cannot be used for Custom PINs.
  - **Cannot be used to get data via ServiceMap since the Query ID is KB based**

Special Commands in «Query» of More Options (4)

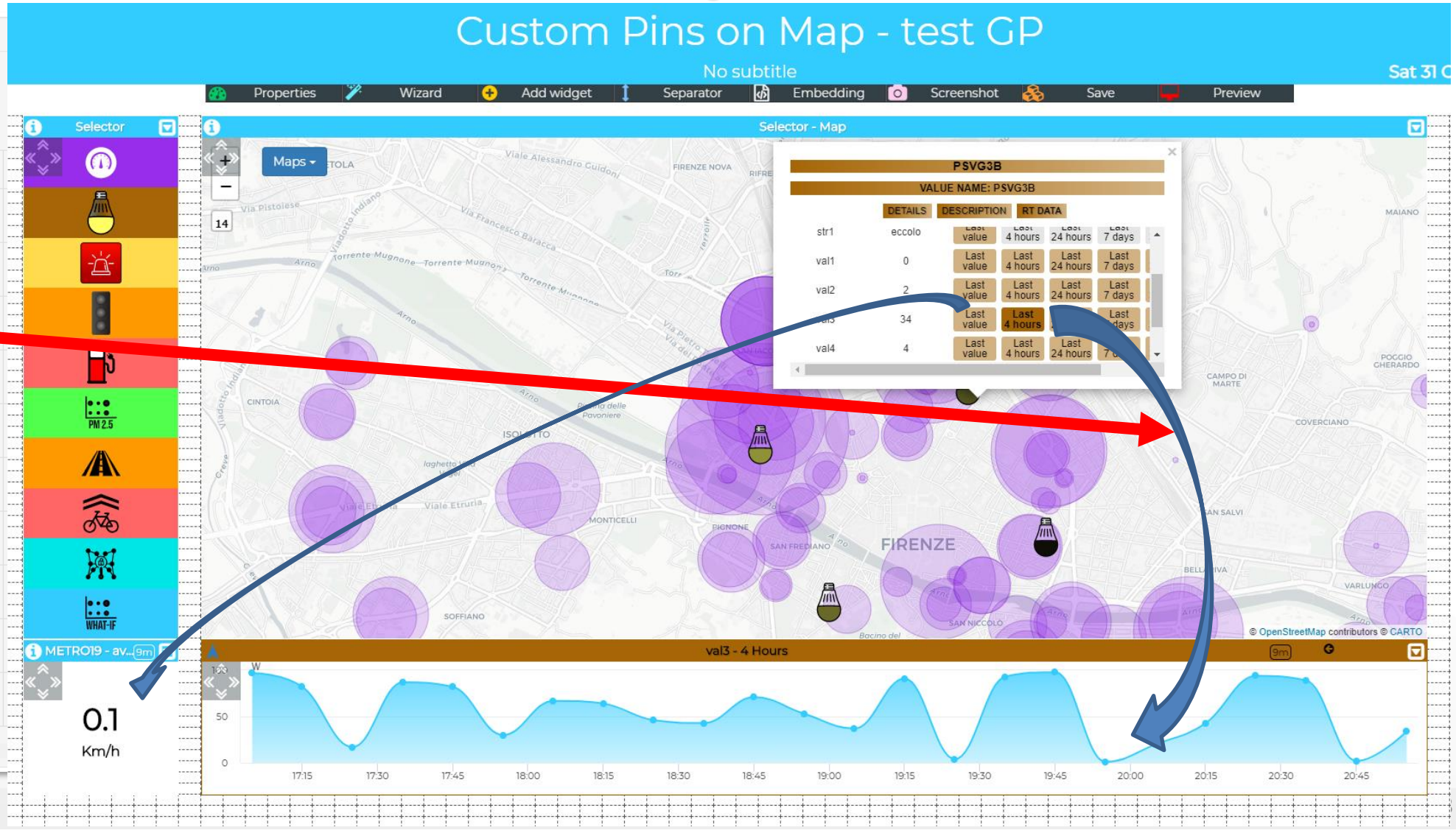
- **Commands for Special Tool**:
  - **Traffic Flow** tool: https://firenzetraffic.km4city.org/trafficRTDetails/roads/read.php
  - **Scenario** tool: /scenario/
  - **Whatif** tool: /whatif/
- **Heatmaps**, see Data Analytic part of the training for the several versions which can be used:
  - https://wmsserver.snap4city.org/geoserver/Snap4City/wms?service=WMS&layers=PM2_5Average24HourFlorence
  - https://wmsserver.snap4city.org/geoserver/Snap4City/wms?service=WMS&layers=denseNO2_Firenze_IDW
  - WMSServer that is a GeoServer may be different for different installations of Snap4City

The Selector is the Map Controller

MoreOptions

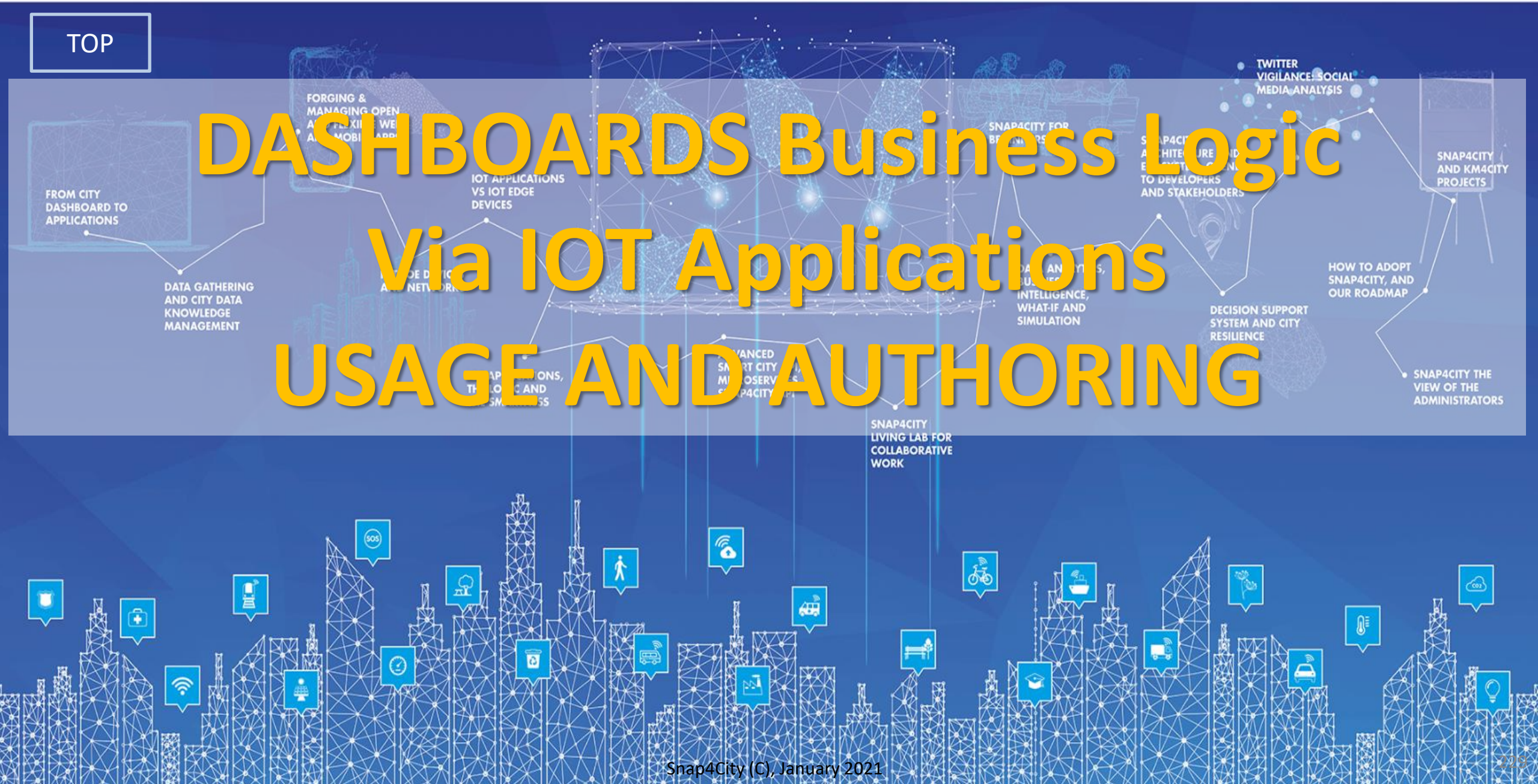


- *Targeting the data to be shows on other data Widgets*

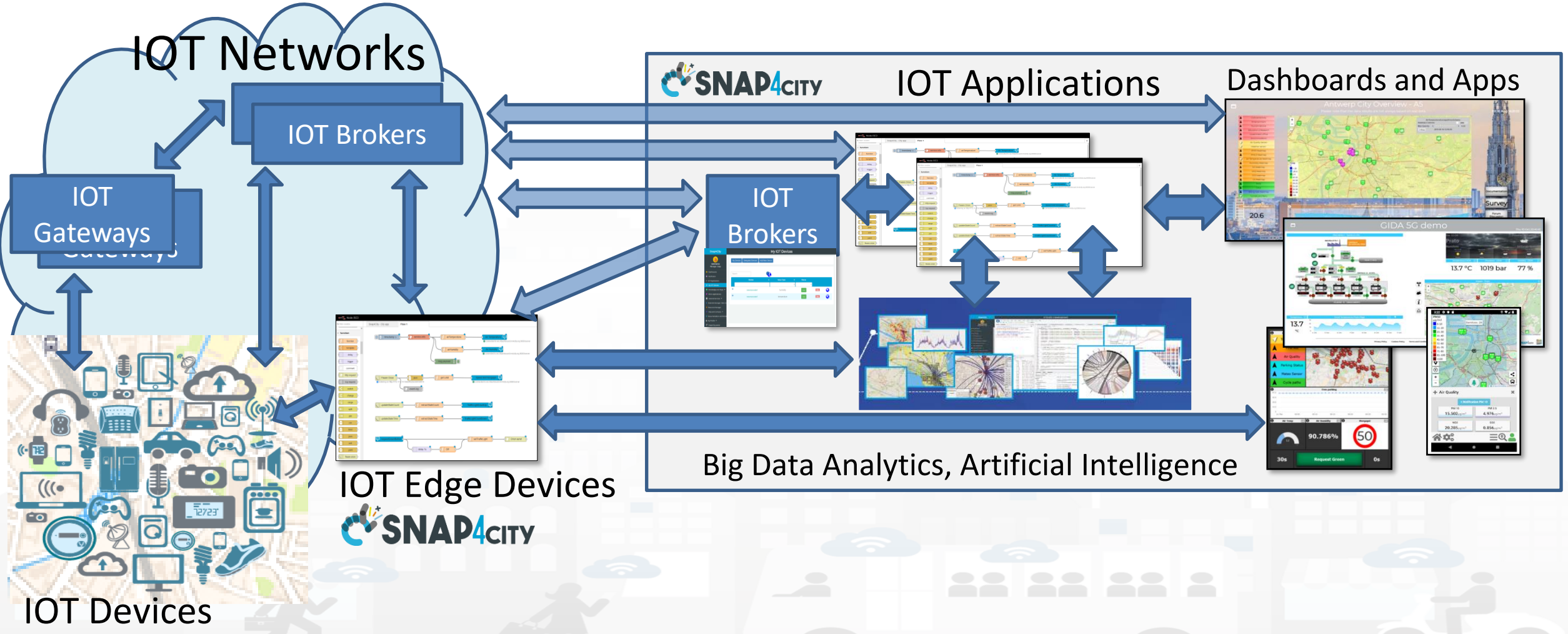


TOP

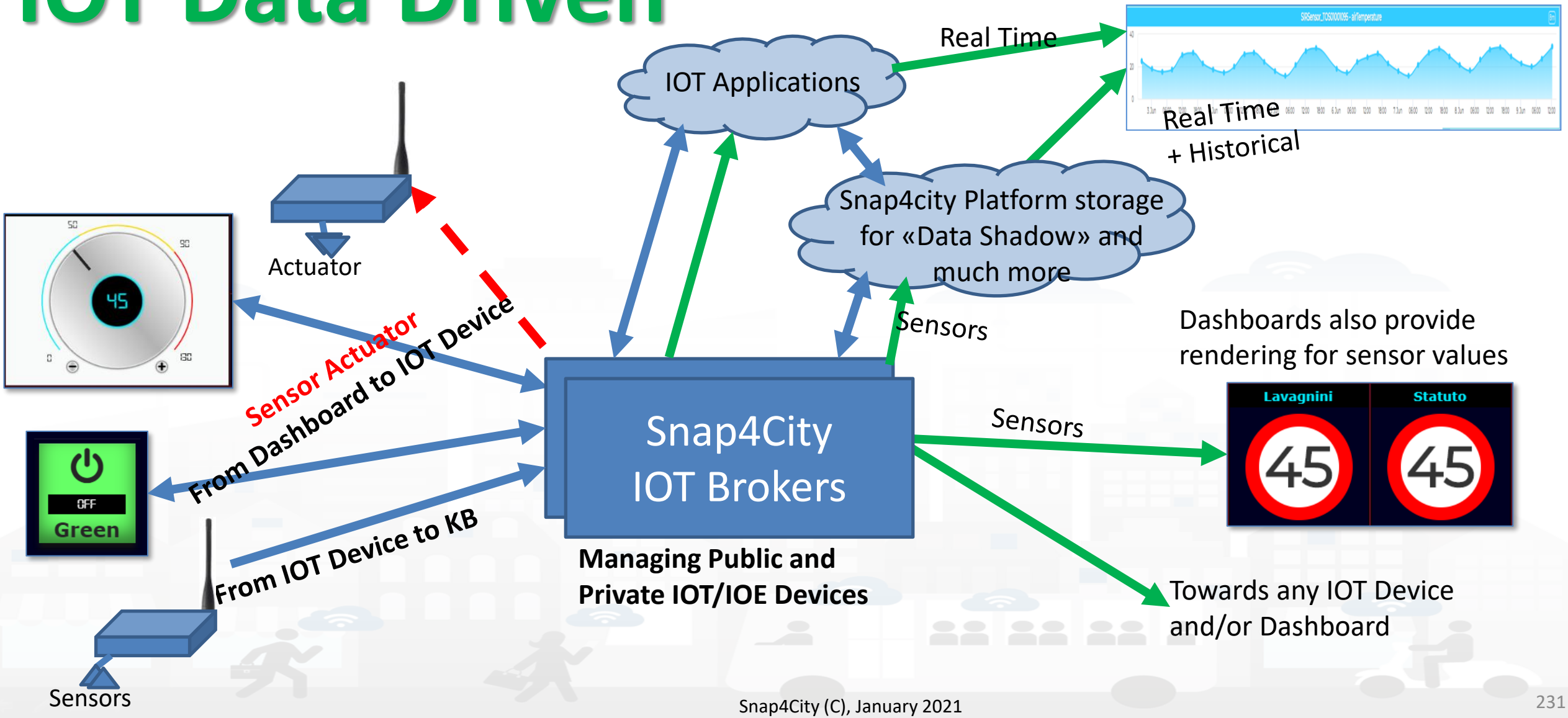
DASHBOARDS Business Logic Via IOT Applications USAGE AND AUTHORING



IOT App as Business Logic of Dashboards



IOT Data Driven



IOT App Business Intelligence for Dashboards, Web and Mobile Apps

How the Dashboards exchange data

Snap4City BigData Storage and KB

IOT Broker Orion Quantum Leap

ServiceMap Super ServiceMap

- Req. ServiceURI

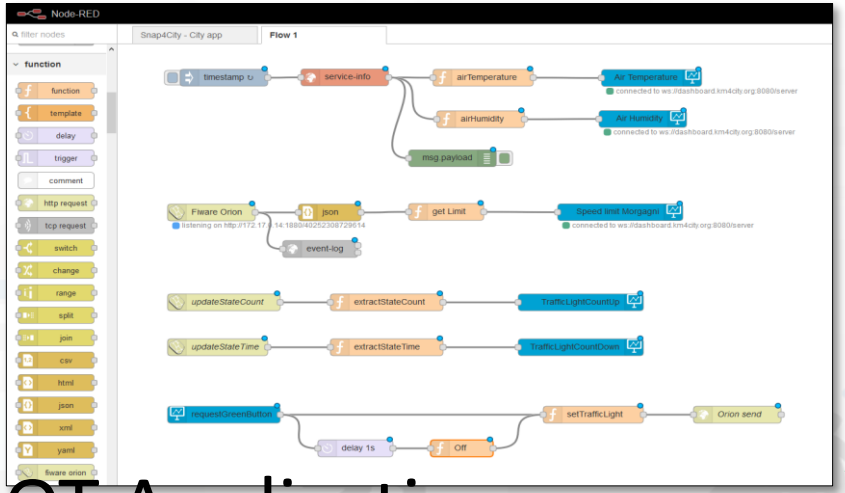
Metric, KPI

MyKPI, MyPOI, …

- Req. KPI, Metric ID
- Req. MyKPI ID

API, External Services, MicroApp

- Traffic Flow, MAPS, Heatmaps
- GIS, HTTPs URLs

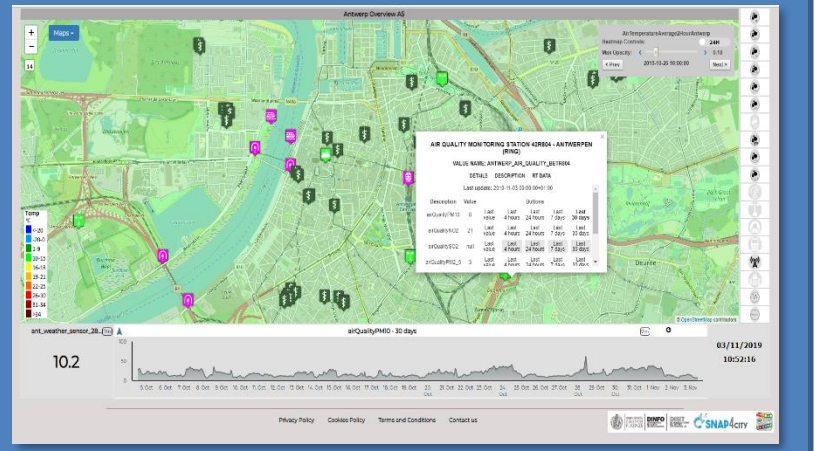


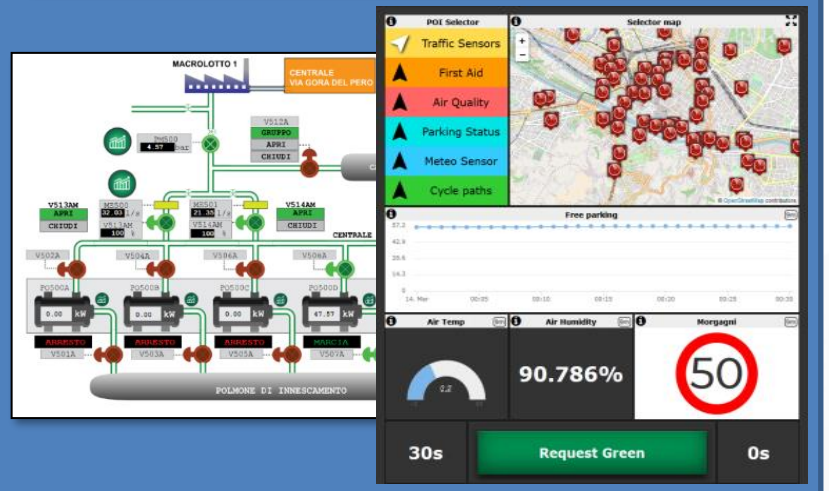
- ServiceURI (ID)
- MyKPI, Metric (ID)
- Dynamic Data, computed into IOT Application

- Rx. Dynamic Data
- Event Driven Synoptics
- Actions, Show

IOT Application

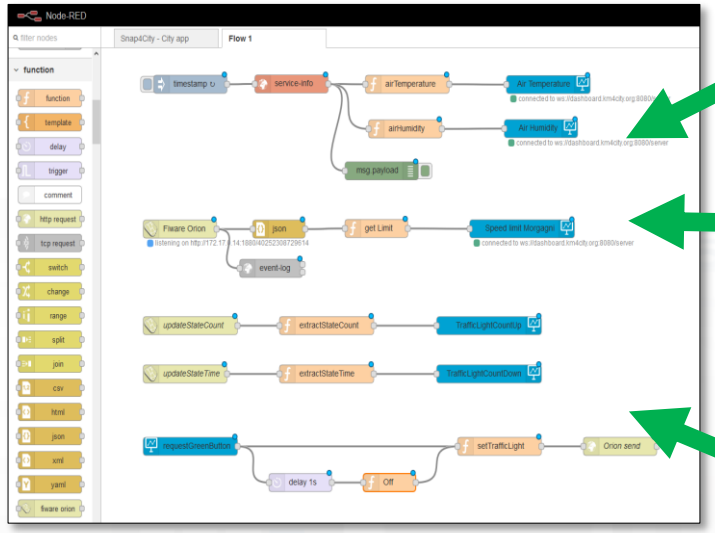
Dashboards



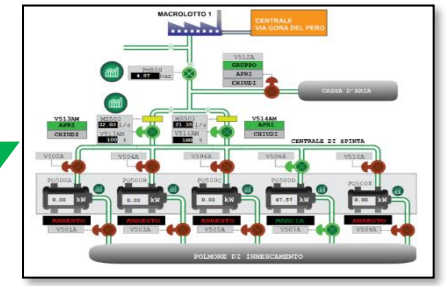


Advanced IOT Applications

- **Synoptics can ……**
  - **do all ☺**
- **Widgets can**
  - send/receive dynamic data,
  - change data sources, etc.
  - Provide interactive maps
- **HTML pages** can
  - be dynamically generated
  - provide forms to produce data for IOT Applications
  - Collect files on web and system
  - produce files on web ad system
  - have CSS and AJAX control

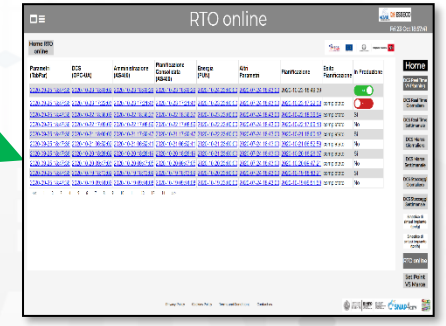


Synoptics
Custom
Widgets



Widgets
Maps
Buttons
Keypads
Controls
..

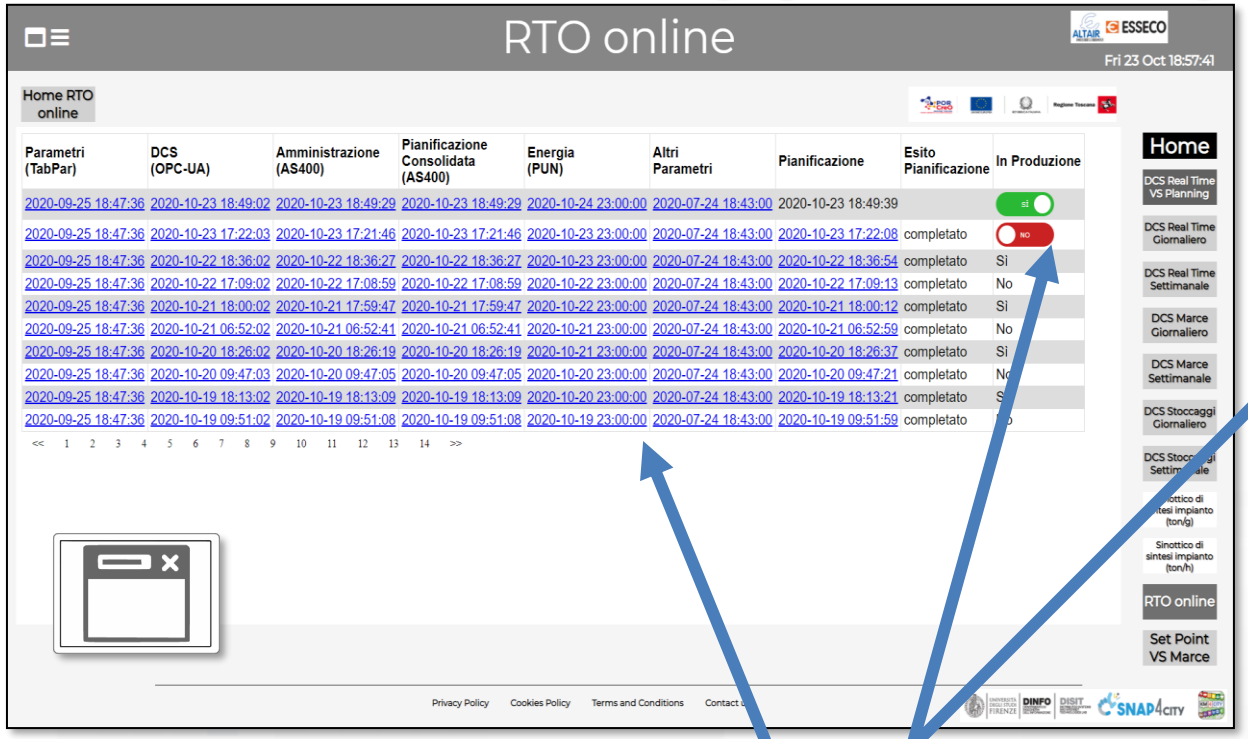
HTML pages
HTML Forms
Tables
..

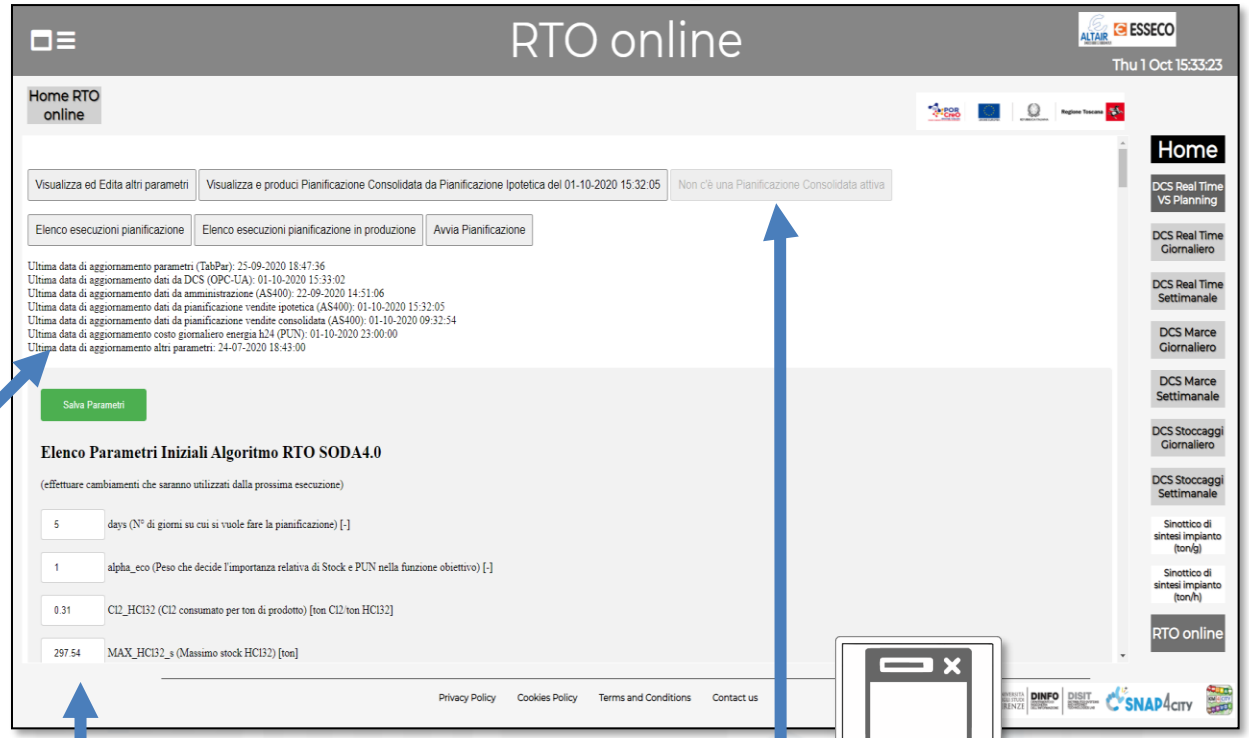


https://www.snap4city.org/394

https://www.snap4city.org/596

IOT App with Dynamic Web Pages





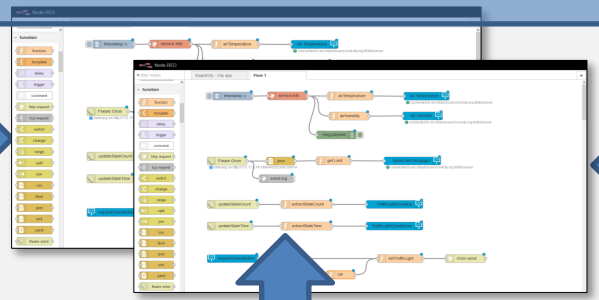
- **HTML pages** can
  - be dynamically generated from the IOT App
  - provide forms to produce data to the IOT App, also including interactive elements
  - collect file from users, and produce files to web and to the system
  - have CSS and AJAX controls

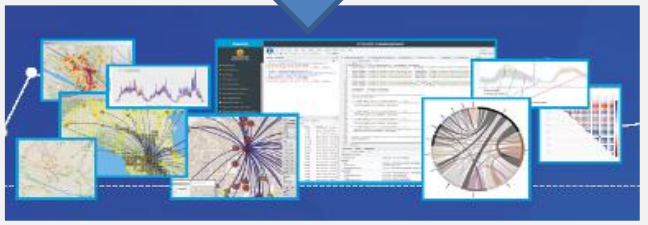
Snap4City: Builder of Sentient Cities Solutions

Dashboards with data driven IOT Applications enforcing intelligence

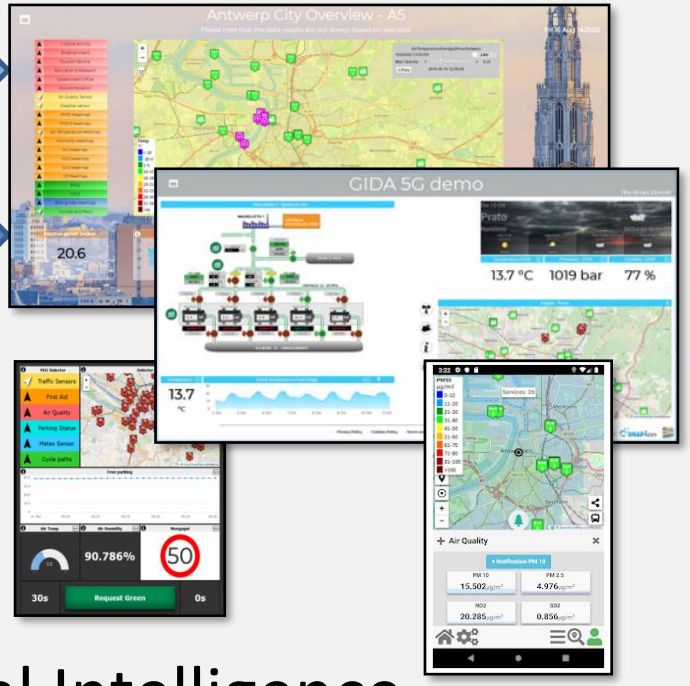
IOT and data World

IOT Applications



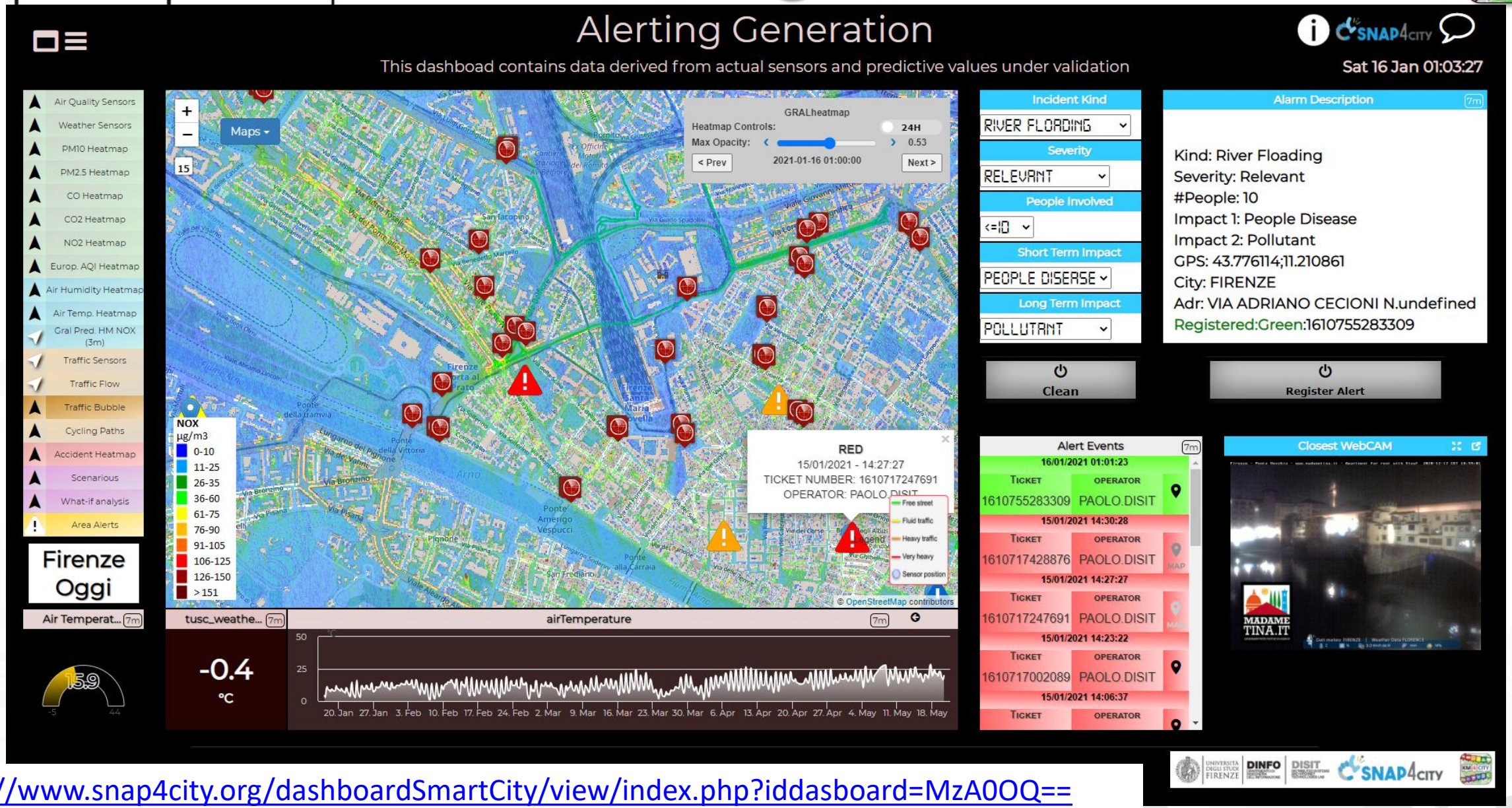


Dashboards and Apps



Big Data Analytics, Artificial Intelligence

Alert Registration



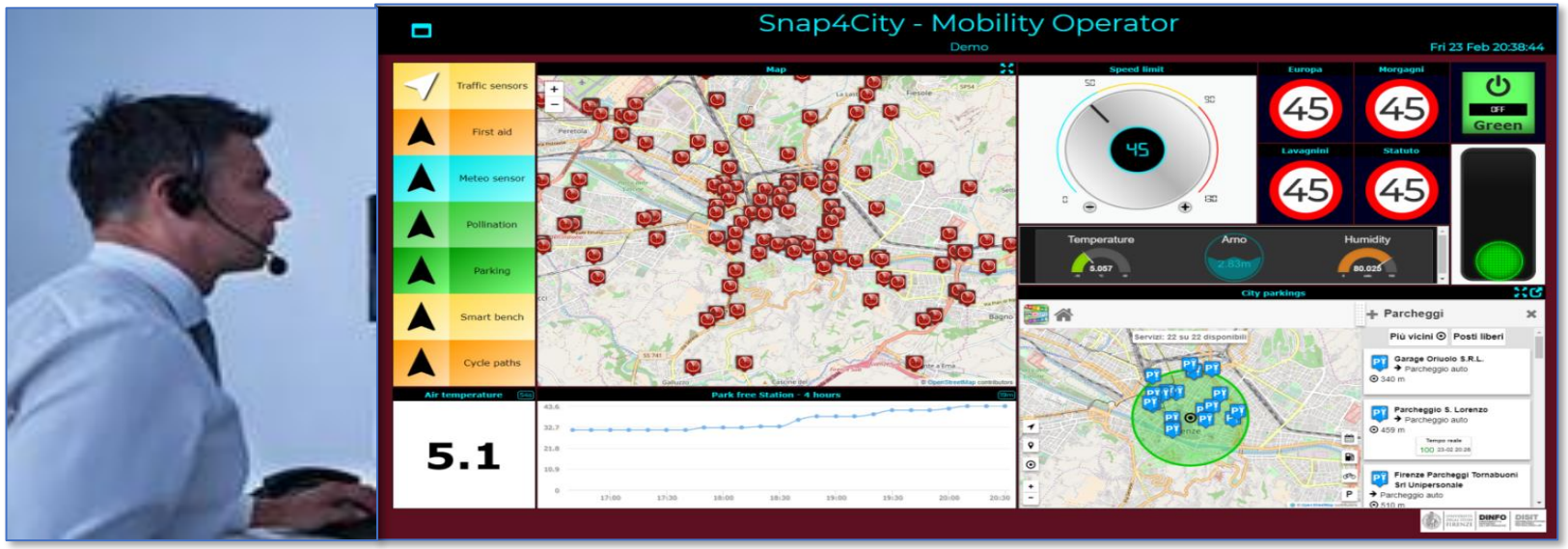
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzA0OQ==

City Dashboard + IOT App

Control Room Operator

Would like to:

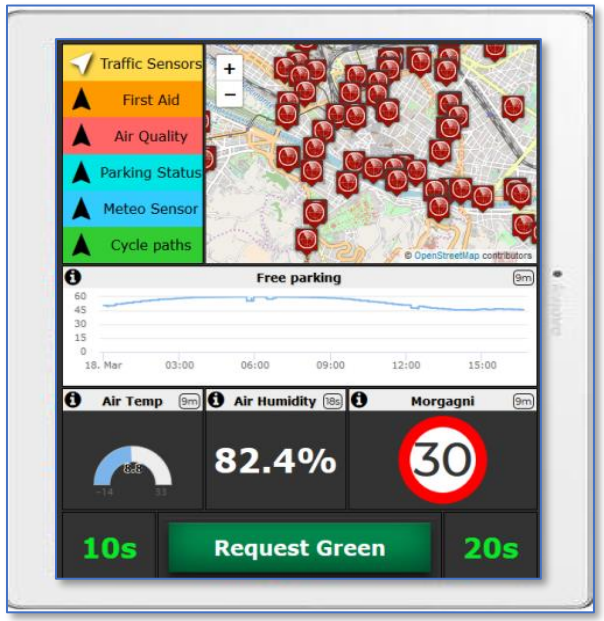
- **Monitor** traffic flow, Environment, Car parking, Cycling, First aid, temp., …
- **Act and monitor** Dynamic Plates
- **Act and monitor** red lights



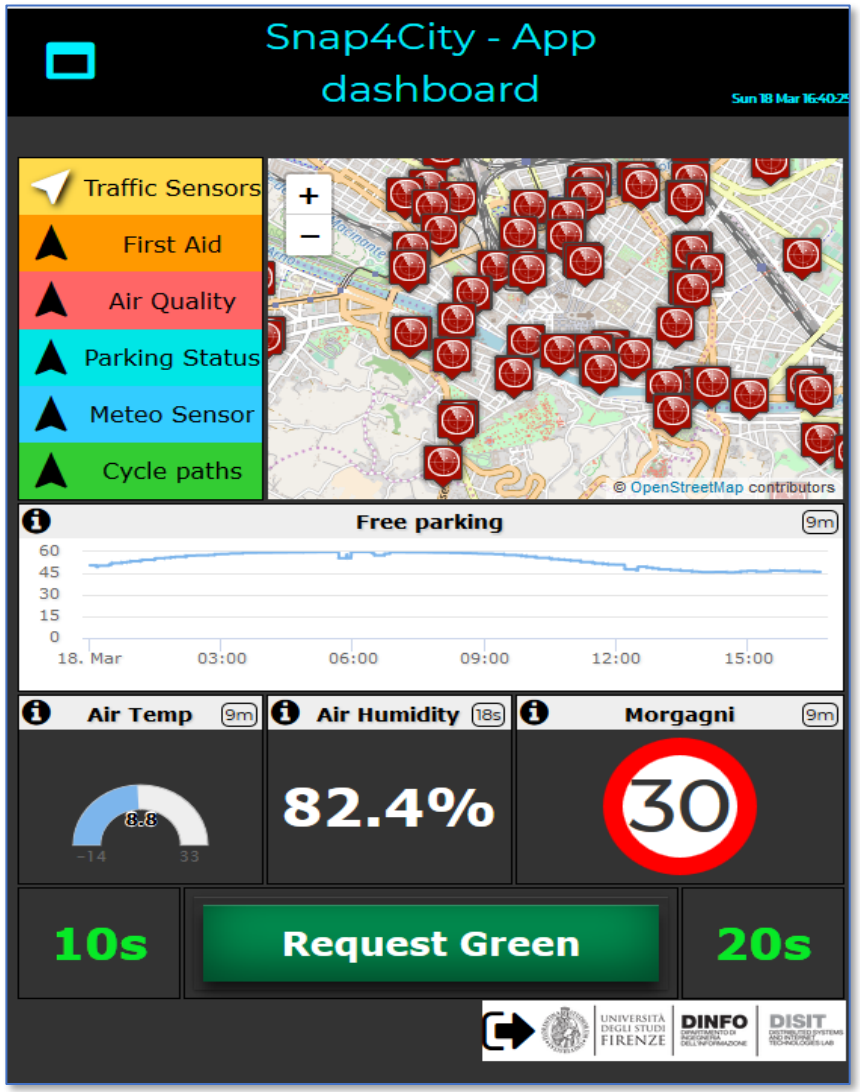
Driver, Policeman

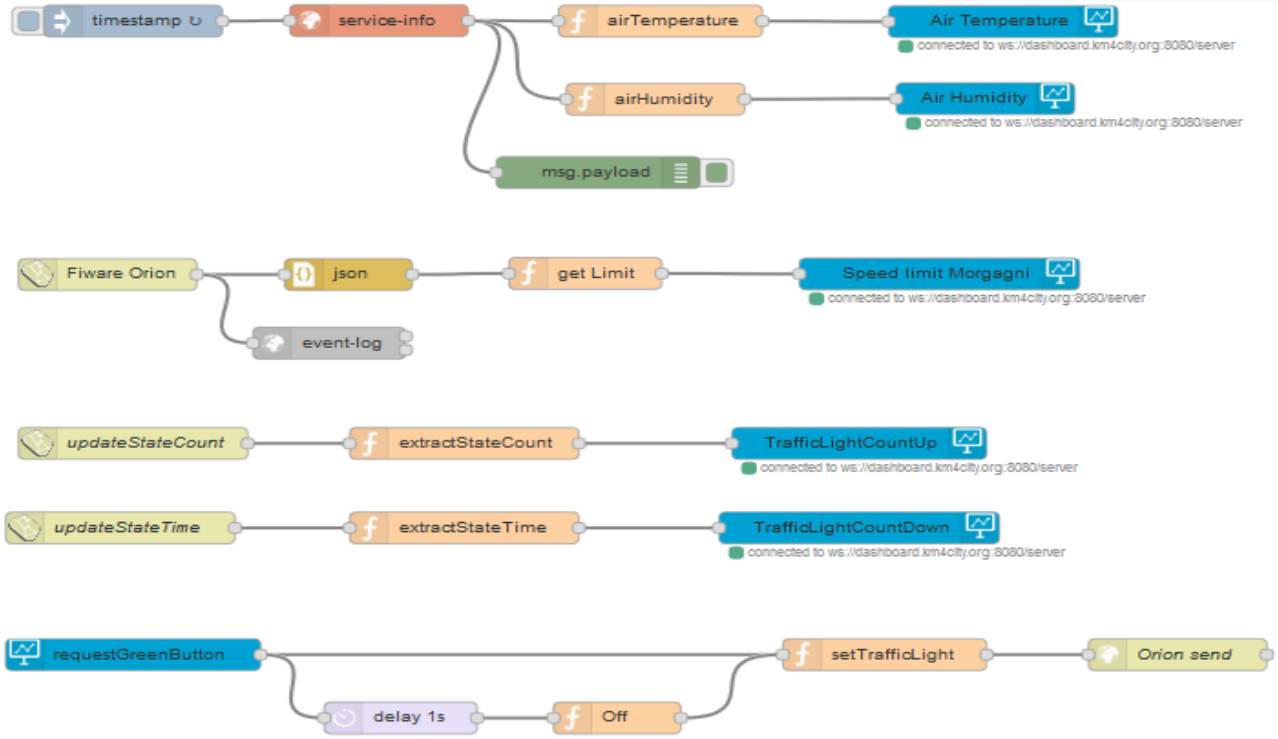
Would like to:

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

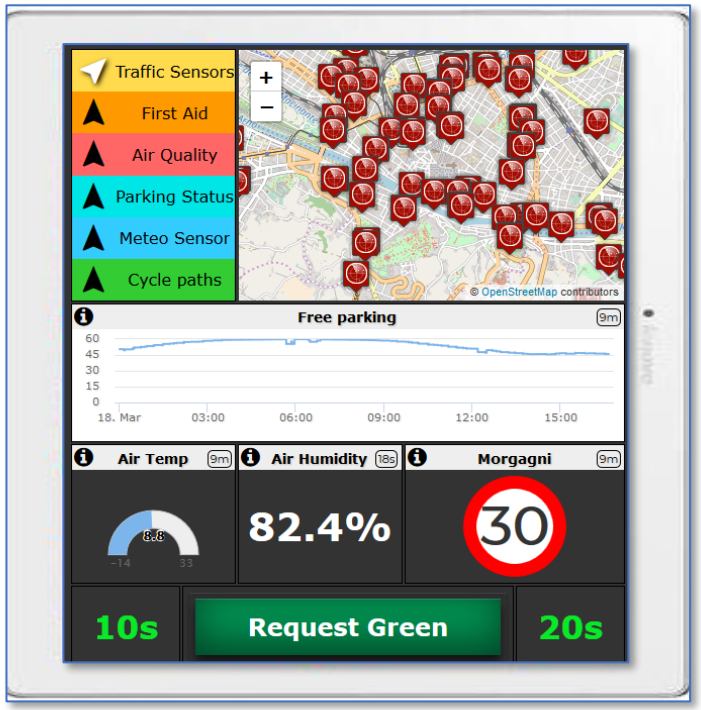


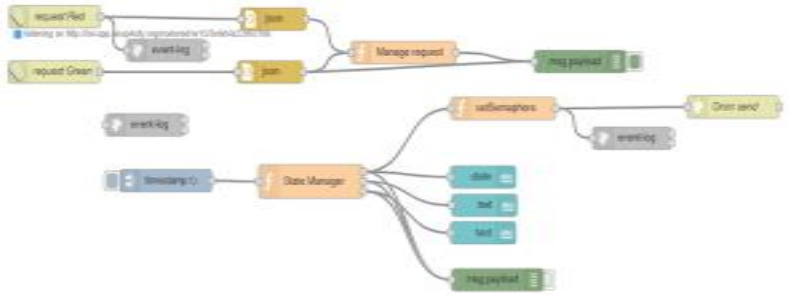
IOT Application with City Dashboard Simple development

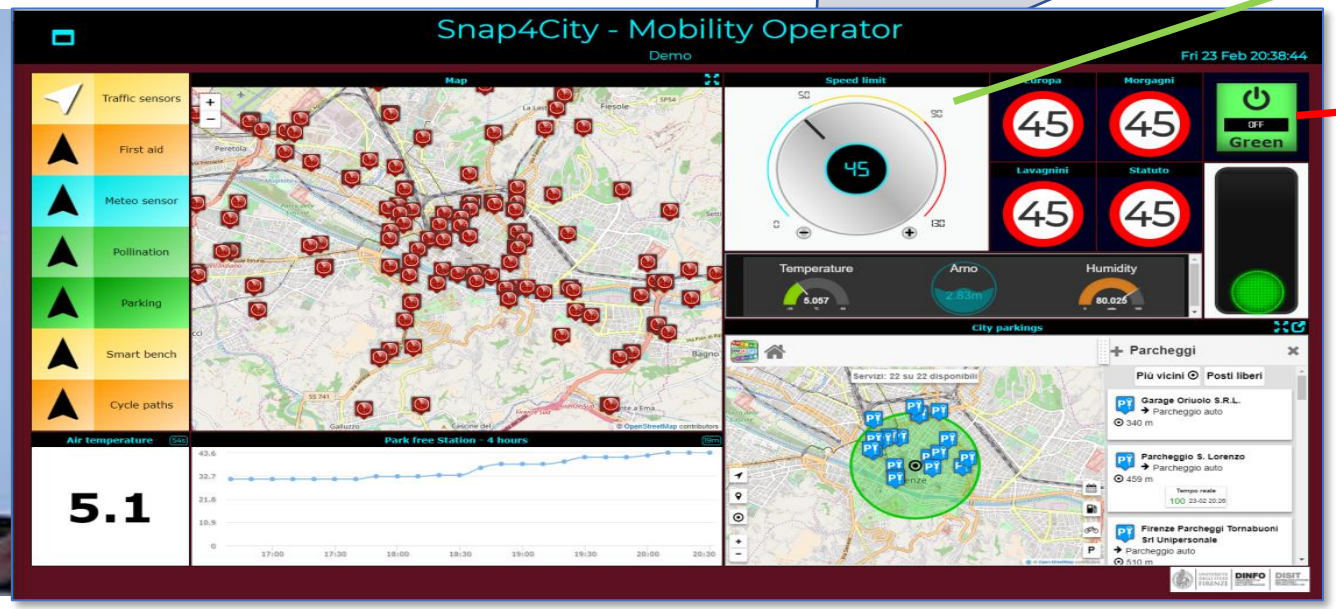


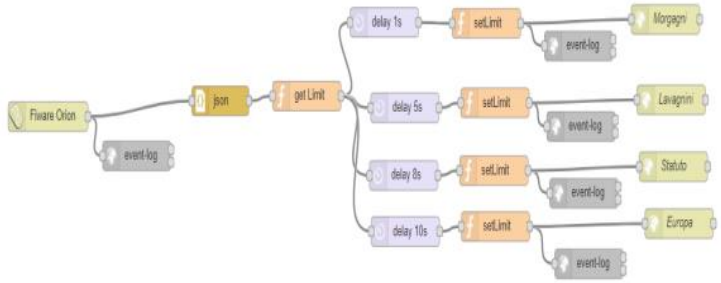


-Virtual Sensors and Virtual Actuators
-From Dashboard to IOT App and viceversa
-From Dashboard to IOT Brokers/Devices and viceversa


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

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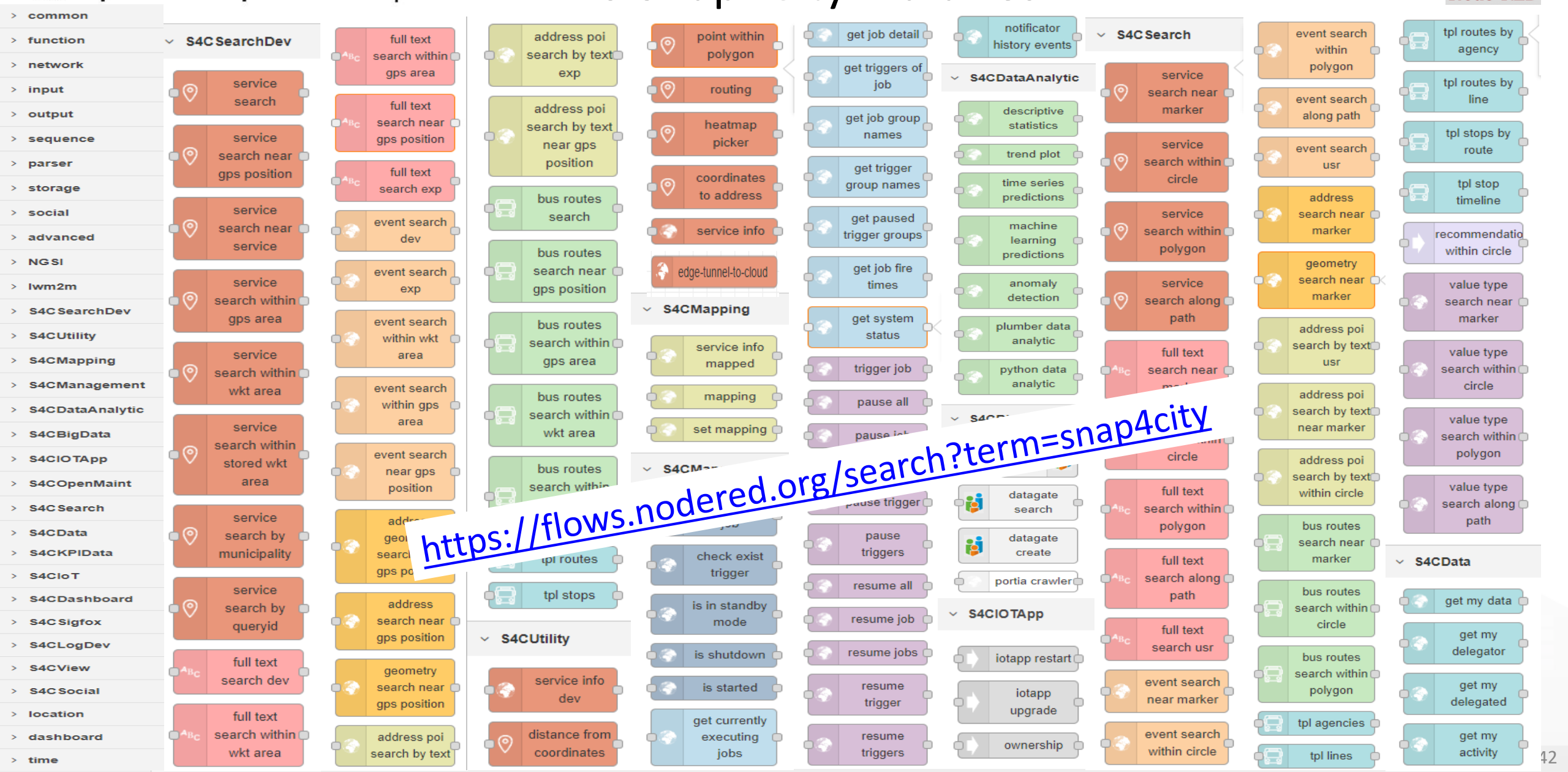
Nov. 2020 collection

Two Snap4City Libraries

SNAP4CITY | Node-RED



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

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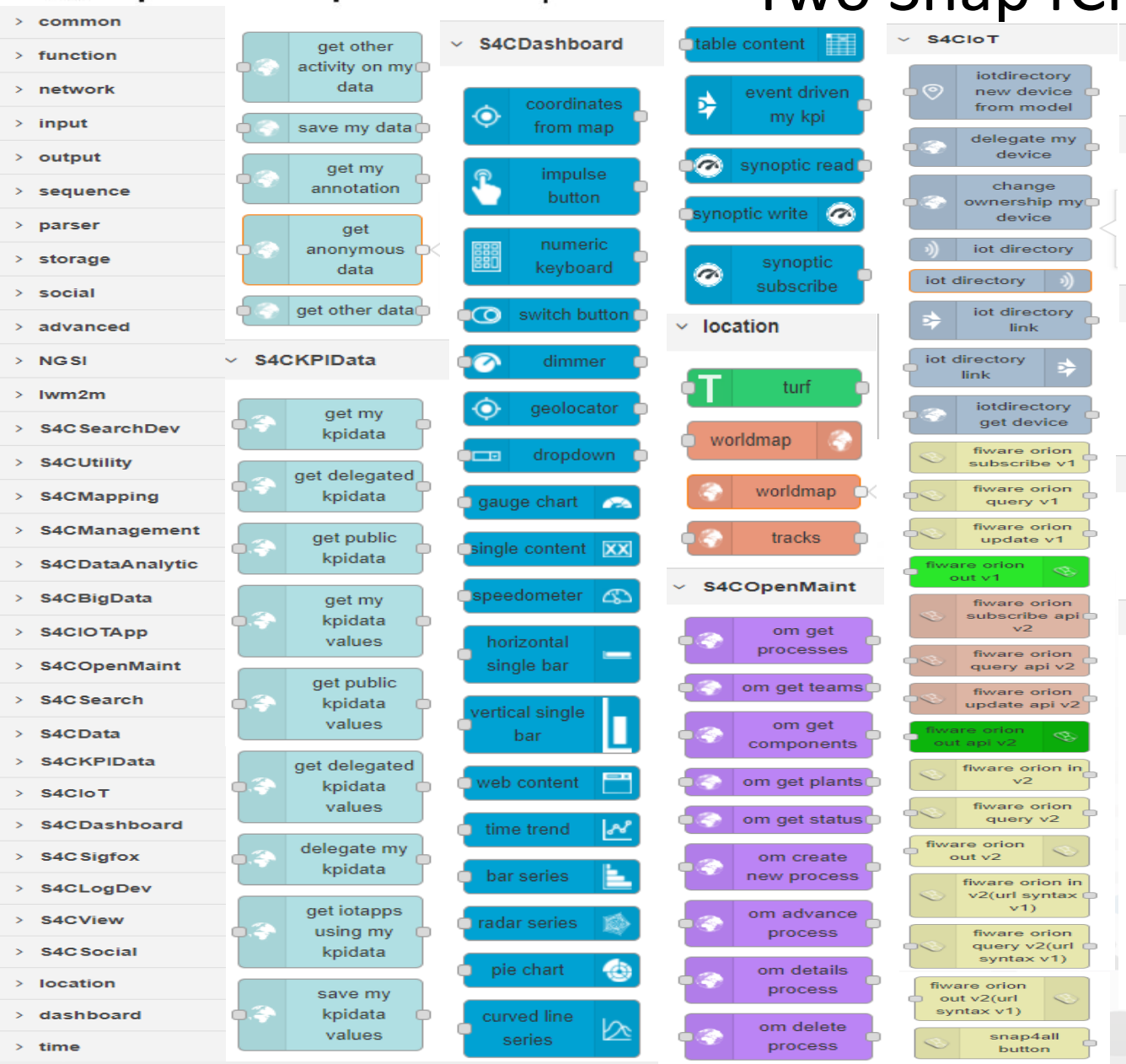
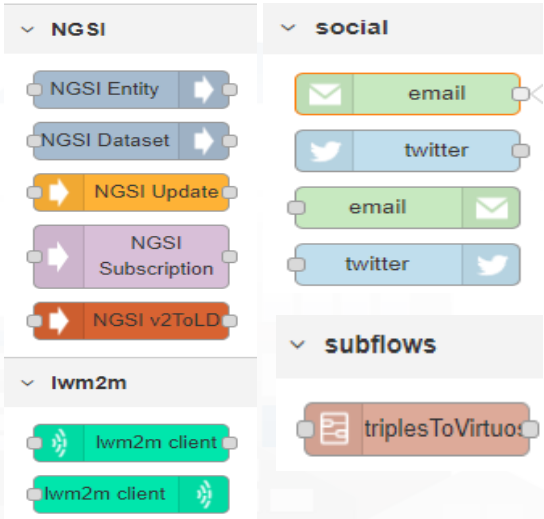


We suggest also to install:



IOT Applications vs Dashboards

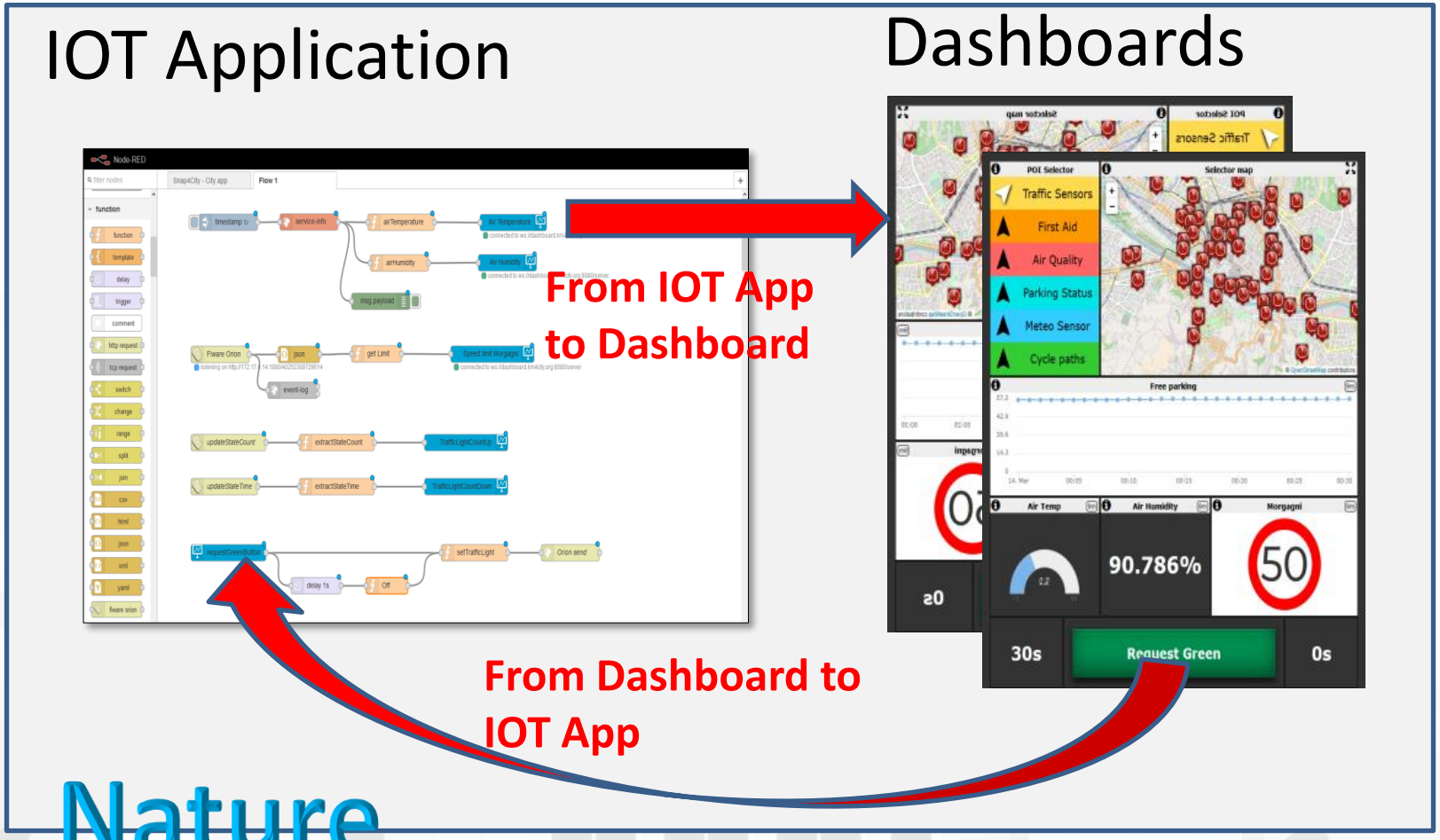
- **IOT Applications**, realized by using Snap4City Node-RED and integrated with Snap4City Nodes/MicroServices block, can be behind dashboards to get data from them with Virtual Sensors and Actuators.
  - Dashboards may be connected to multiple IOT Applications and IOT devices
  - IOT Applications may 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**

Widgets Interacting with IOT Apps virtual Sensors and Actuators

HLT: Sensors-Actuators

High Level Types

- **Complex Event**
- **Dashboard-IOT App**
- **External Service**
- **Heatmap**
- **KPI** (Key Performance Indicator)
- **MicroApplication**
- My Personal Data
- MyKPI
- MyPOI
- **POI** (Point of Interest)
- **Sensor**
- **Sensor Actuator**
- **Special Widget**
- Wfs (GIS)



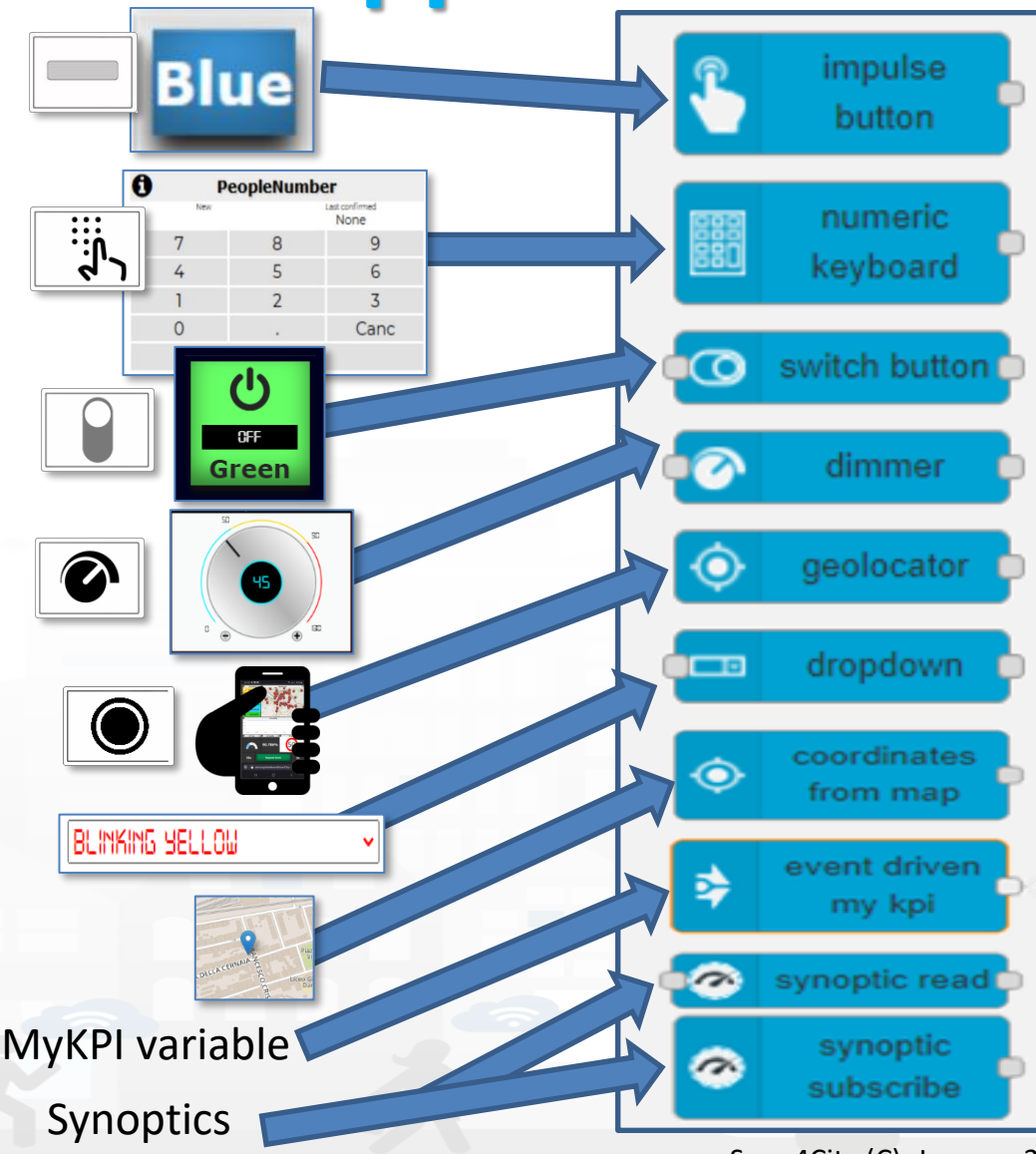
Dashboard Widgets vs IOT Apps

- IOT App may create new Dashboards with new Widgets inside
- Some of the Dashboard Widgets interacting with IOT App can be ONLY created by starting from the IOT App
  - The creation is performed by putting the Node/Block in the IOT App and creating the widget in a Your Dashboard
- The removal of the Node/Block is removing the Widget as well. While the removal of the Widget in Dashboard is not removing the Node/Block into the IOT App
- The change of name of the Widget in Dashboard and/or in IOT App may create disconnections each other

Nature

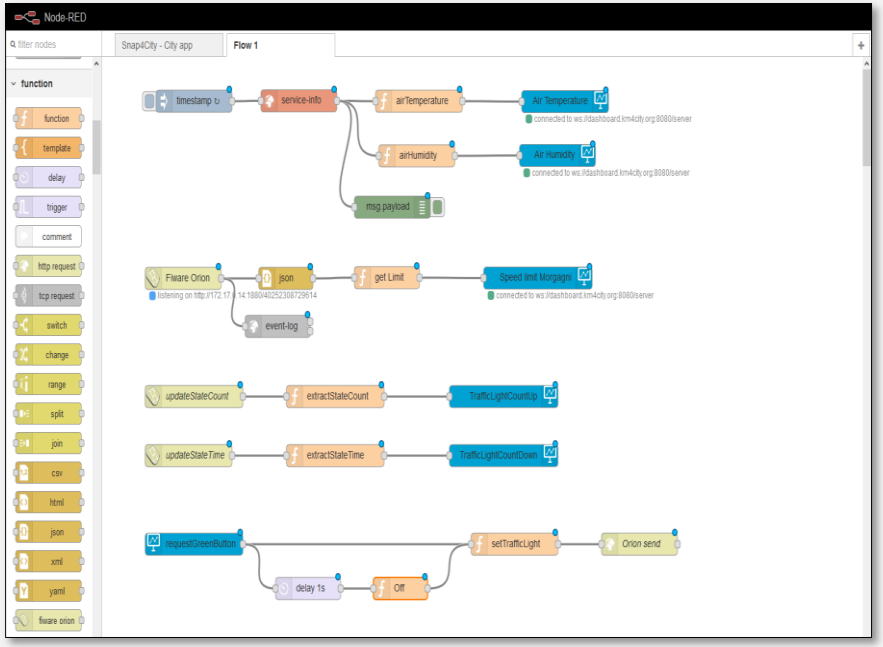
Dashboard-IOT App

From Dashboard to IOT App



MyKPI variable

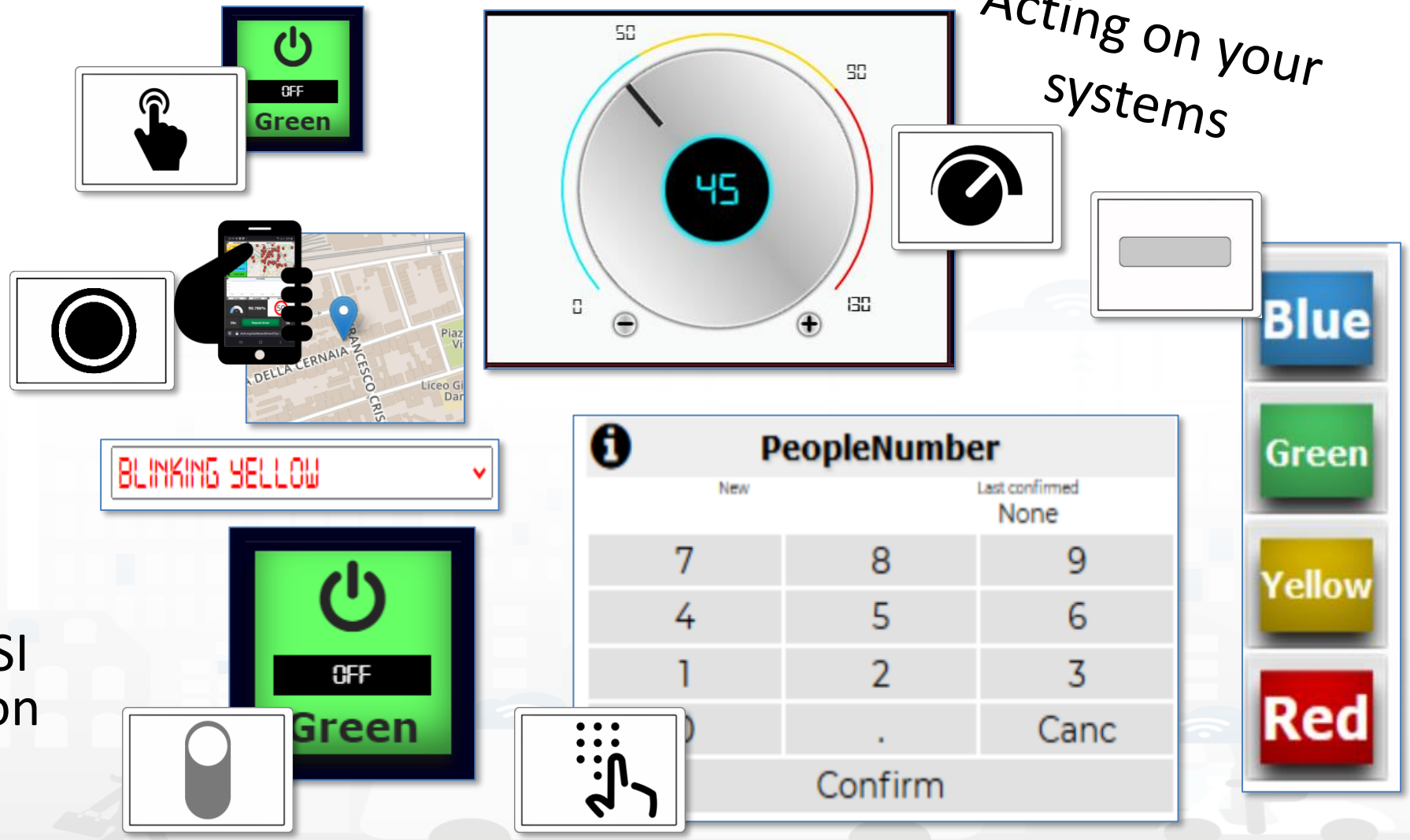
Synoptics



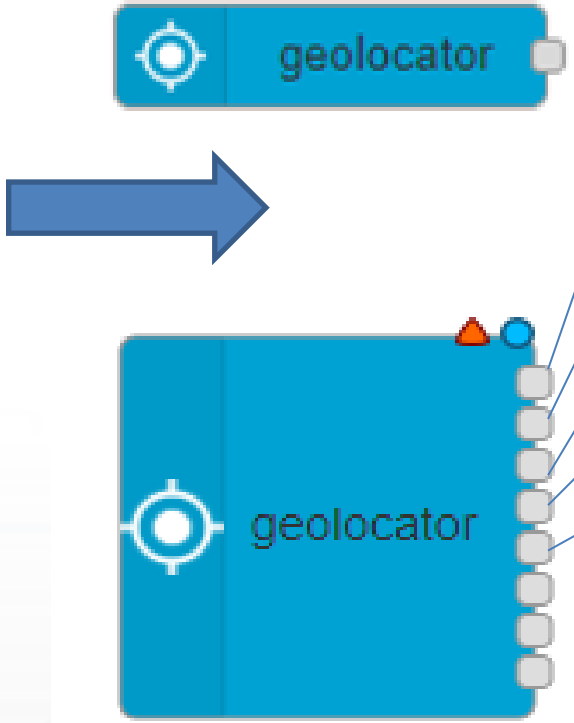
IOT Application

From Dashboard to IOT Devices/App

- **Widgets:**
  - Impulse Button
  - Button
  - Switch
  - Dimer/Knowb
  - KeyPad
  - Geolocator
  - Selection
  - Map Picking
- **Registered** on some IOT brokers with NGSI mutual authentication



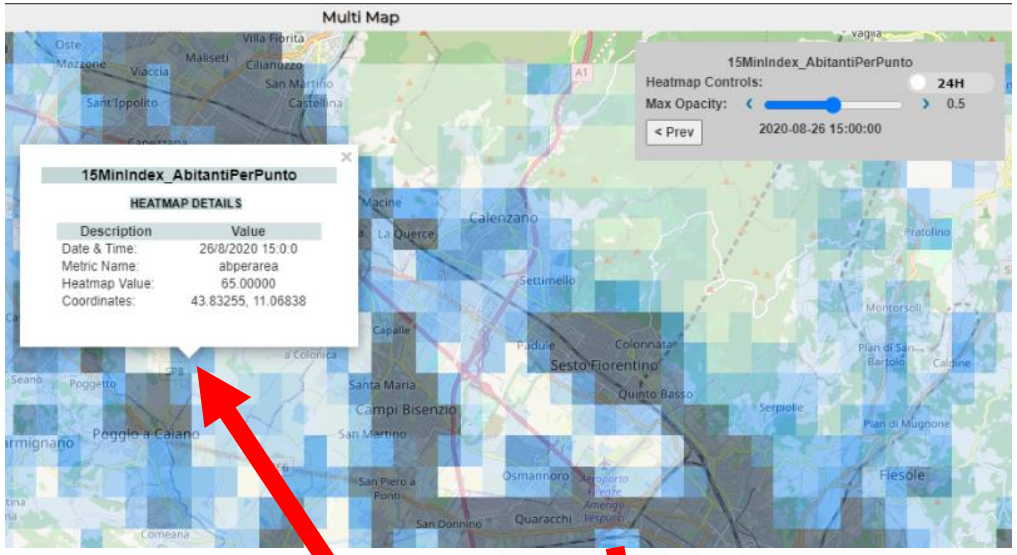
Geolocation of Mobile Device



- Complete message
  - Returns a JSON containing all information about geolocation
- Latitude
  - Returns the latitude
- Longitude
  - Returns the longitude
- Accuracy
  - Returns the accuracy of latitude and longitude
- Altitude
  - Returns the altitude
- Altitude Accuracy
  - Returns the altitude accuracy
- Heading
  - Returns the heading
- Speed
  - Returns the speed

Web Browser GPS data rendering the Snap4City Dashboard can be passed to IOT Applications and saved ☺

Multi Data Map GPS Location Picking



1) Click

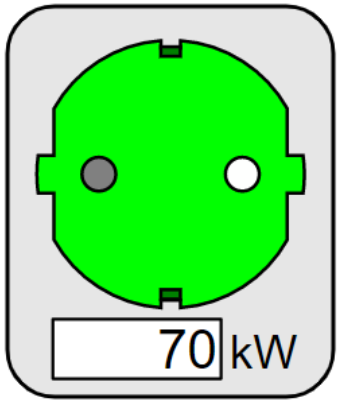
2) Send event: Lat,Long

- 3) The click on the map passes GPS coordinates into IOT App. Thus you can use them to:
  - search for location
  - picking the value of one or more heatmaps
  - dynamically change data on widgets and dashboards
  - Etc.

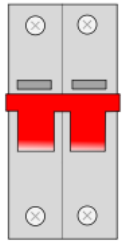
SVG Custom Widgets Examples 2

Tue 17 Nov 18:46:47

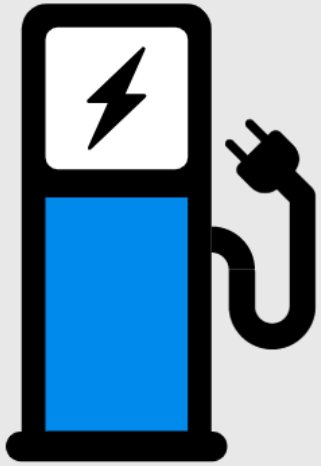
SVG shucko plug



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

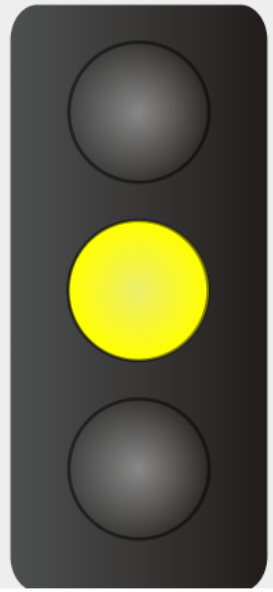
New | Last confirmed: None

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

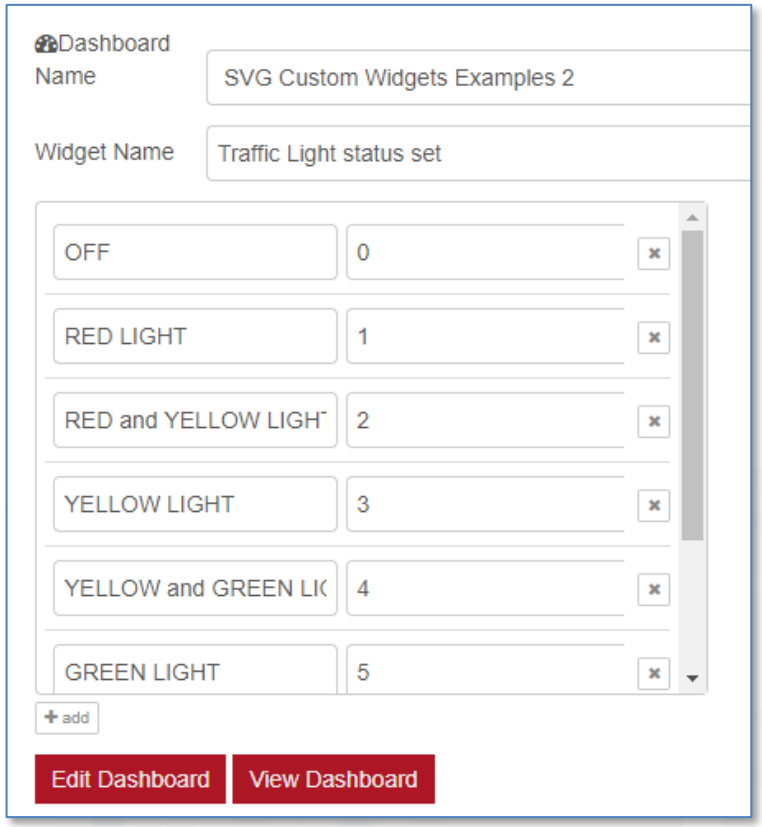
Speed Limit Custom Widget example

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

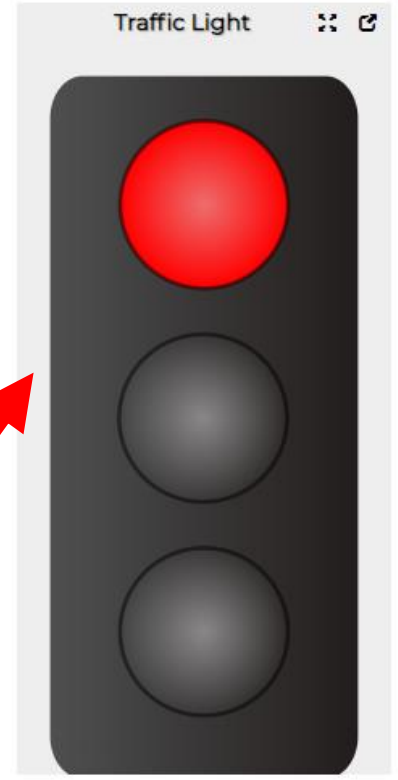
9999 = white sign.

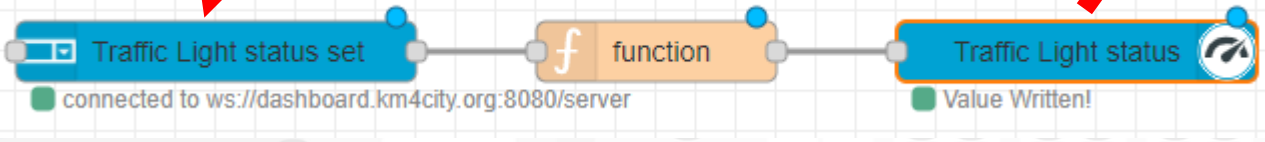
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjk4Ng==

Selector



- Selecting MSG to be sent on the Business Logic IOT Application



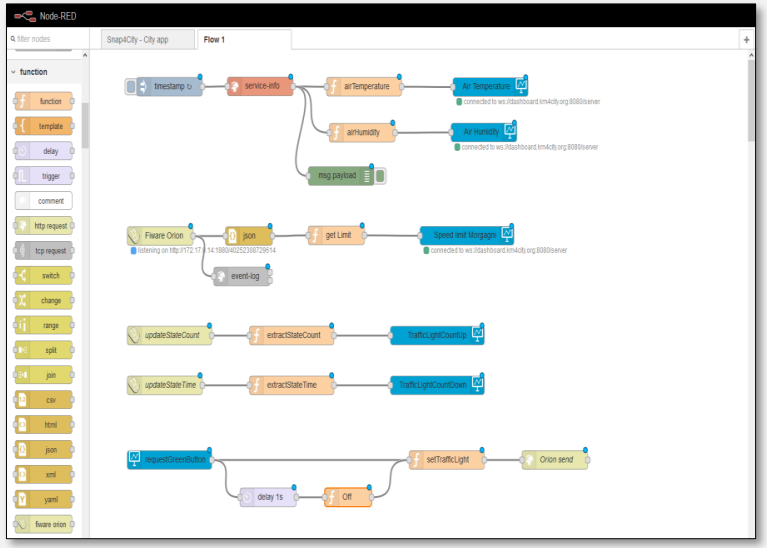



```
msg.payload = {value:JSON.parse(msg.payload).selected};
return msg;
```

Nature

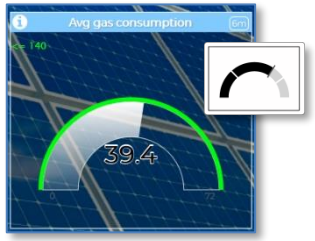
Dashboard-IOT App

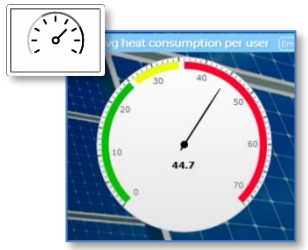
From IOT App to Dashboard

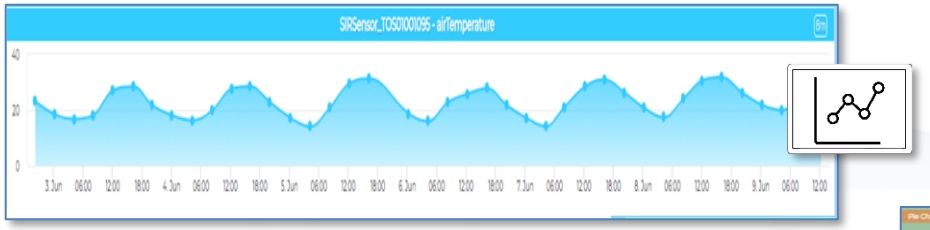


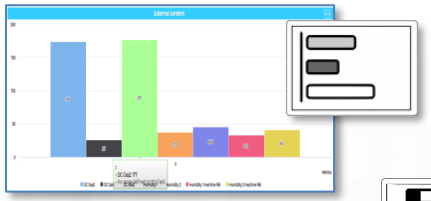
IOT Application

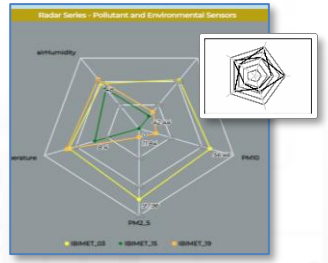
- gauge chart
- single content
- speedometer
- horizontal single bar
- vertical single bar
- web content
- time trend
- bar series
- radar series
- pie chart
- curved line series
- table content
- synoptic write

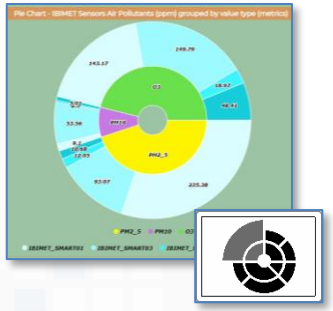


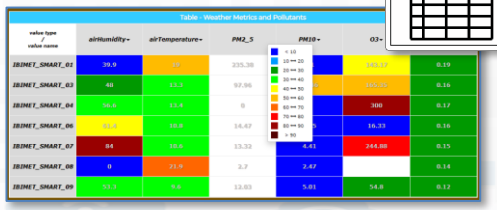


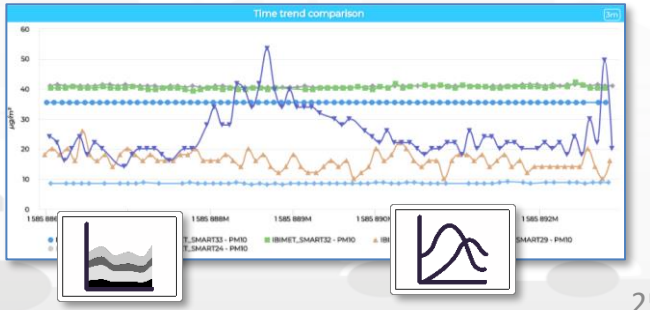


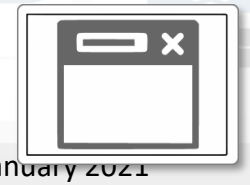








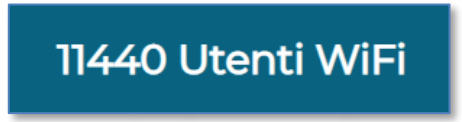




Single Content Widget (flexibility)

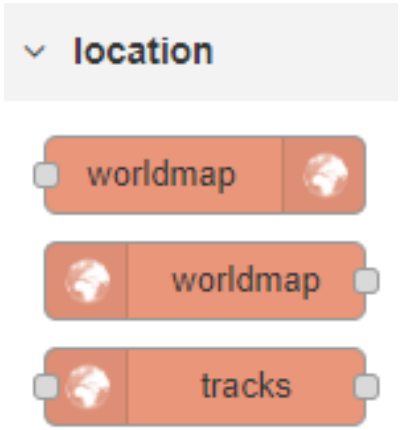
From Dashboard Editor and IOT Applications, accepts in input:

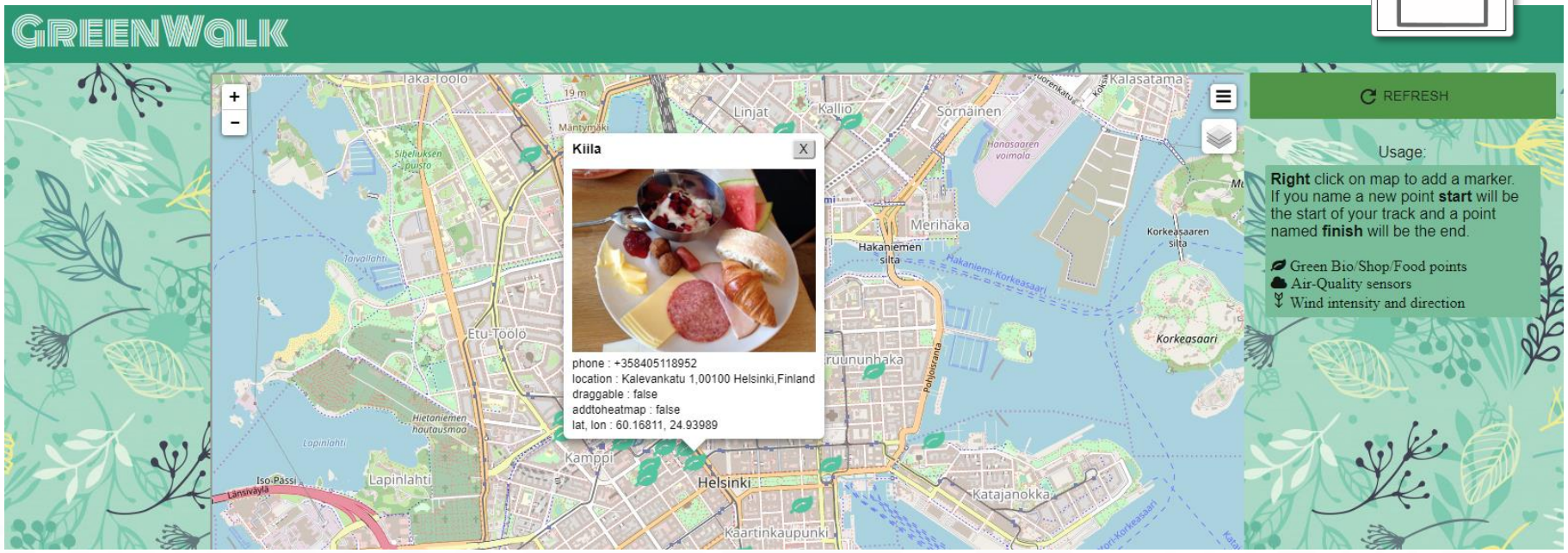
- Numbers
- String
- HTML code



https://www.snap4city.org/578

Controlling Maps from IOT Apps



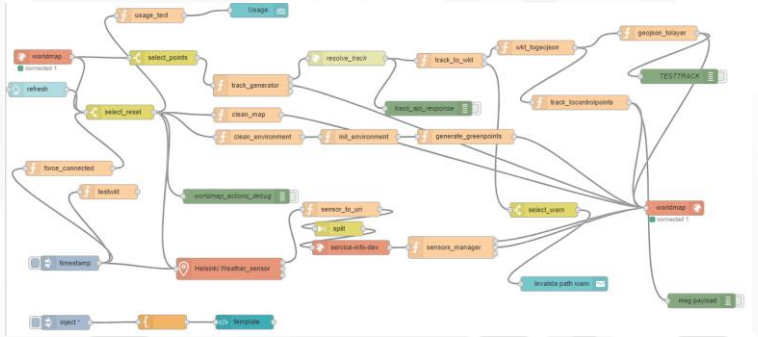


https://iot-app.snap4city.org/nodered/nrve0e3/ui/#!/0

- Show points on maps
- Get Points
- Tracks
- See examples on:

https://www.snap4city.org/409

https://www.snap4city.org/417



Dashboards vs IOT Applications

- See a lot of more detailed examples into the Tutorial on IOT Applications
  - https://www.snap4city.org/577

Dynamic Widgets data on Dashboard from IOT Applications

How the Dashboards exchange data

Snap4City BigData Storage and KB

IOT Broker Orion Quantum Leap

ServiceMap Super ServiceMap

- Req. ServiceURI

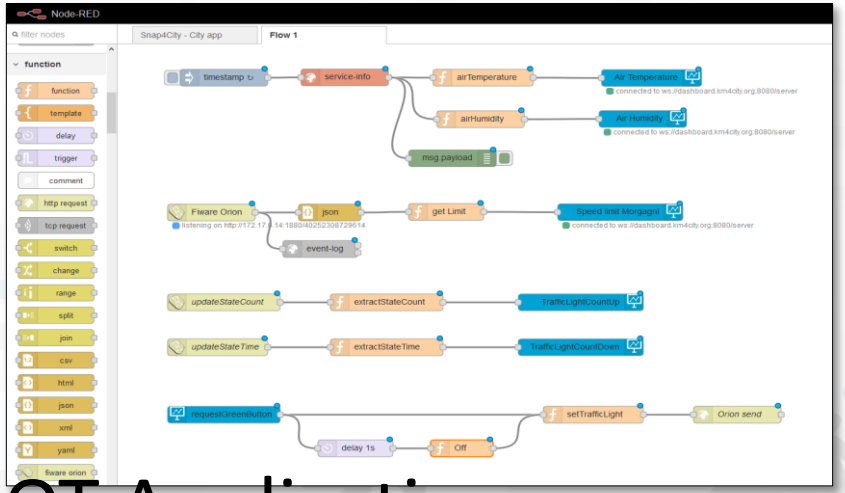
Metric, KPI

MyKPI, MyPOI, …

- Req. KPI, Metric ID
- Req. MyKPI ID

API, External Services, MicroApp

- Traffic Flow, MAPS, Heatmaps
- GIS, HTTPs URLs

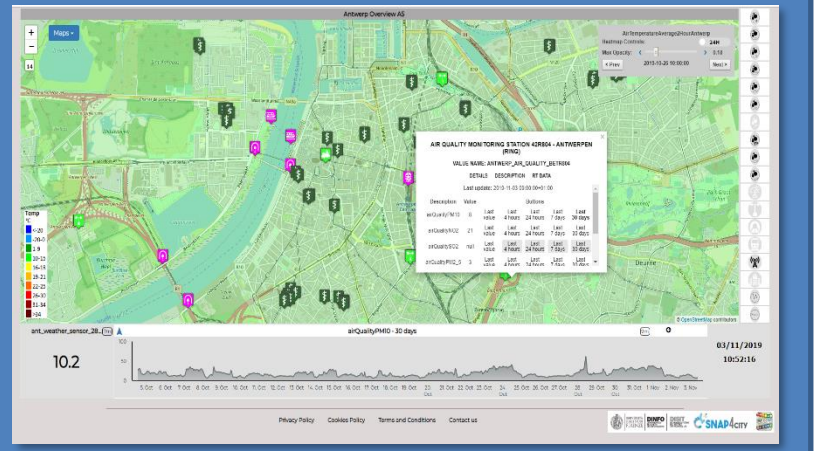


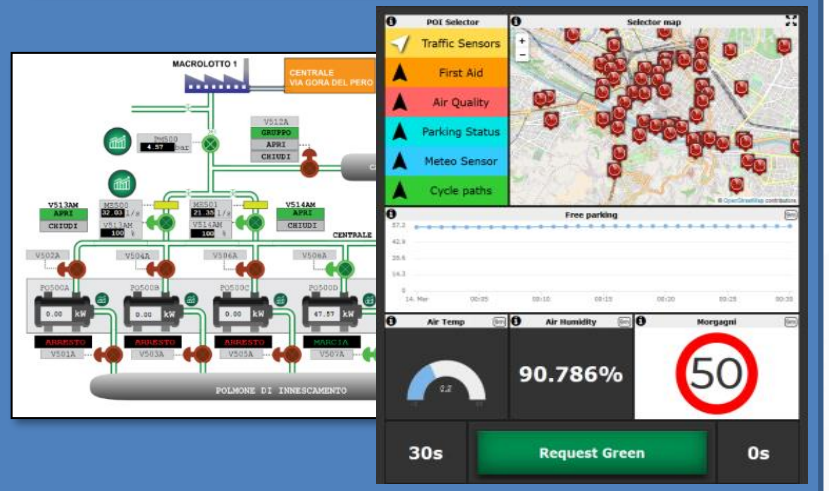
- ServiceURI (ID)
- MyKPI, Metric (ID)
- Dynamic Data, computed into IOT Application

- Rx. Dynamic Data
- Event Driven Synoptics
- Actions, Show

IOT Application

Dashboards





Dynamic Widget data


```
▾0: object
    metricId: "http://www.disit.org/km4city/resource/tusc_weather_sensor_ow_3166540"
    metricHighLevelType: "Sensor"
    metricName: "tusc_weather_sensor_ow_3166540"
    metricType: "airTemperature"
▾1: object
    metricId: "https://servicemap.disit.org/WebAppGrafo/api/v1/?
    serviceUri=http://www.disit.org/km4city/resource/tusc_weather_sensor_ow_3182522&format=json"
    metricHighLevelType: "Sensor"
    metricName: "tusc_weather_sensor_ow_3182522"
    metricType: "airTemperature"
▾2: object
    metricId: "17056320"
    metricHighLevelType: "MyKPI"
    metricName: "SiiMTuscanyTrackerLocation"
    metricType: "Velocity"
▾3: object
    metricId: ""
    metricHighLevelType: "Dynamic"
    metricName: "BatteryTemperatureGalaxyNote"
    metricType: "Gradi Centigradi"
    metricValueUnit: "°C"
    measuredTime: "2019-11-21T14:51:00Z"
    value: 6.688898111364505
▾4: object
    metricId: ""
    metricHighLevelType: "Dynamic"
    metricName: "BatteryTemperaturemia"
    metricType: "Gradi Centigradi"
    metricValueUnit: "°C"
    measuredTime: "2019-11-21T14:51:00Z"
    value: 62.8502788741156
```

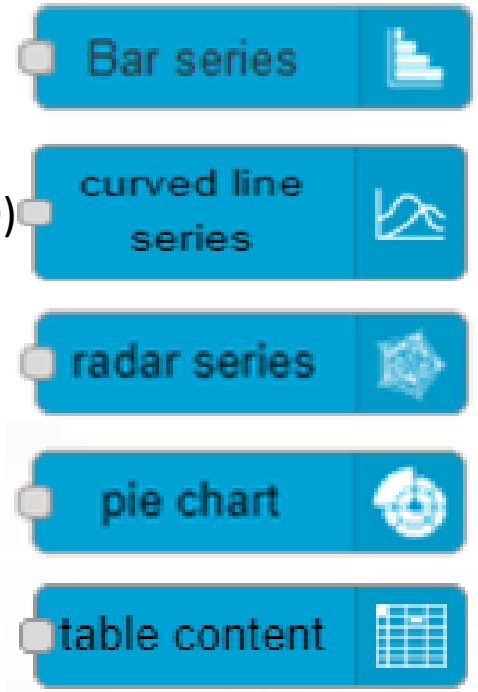

ServiceURI (ID)

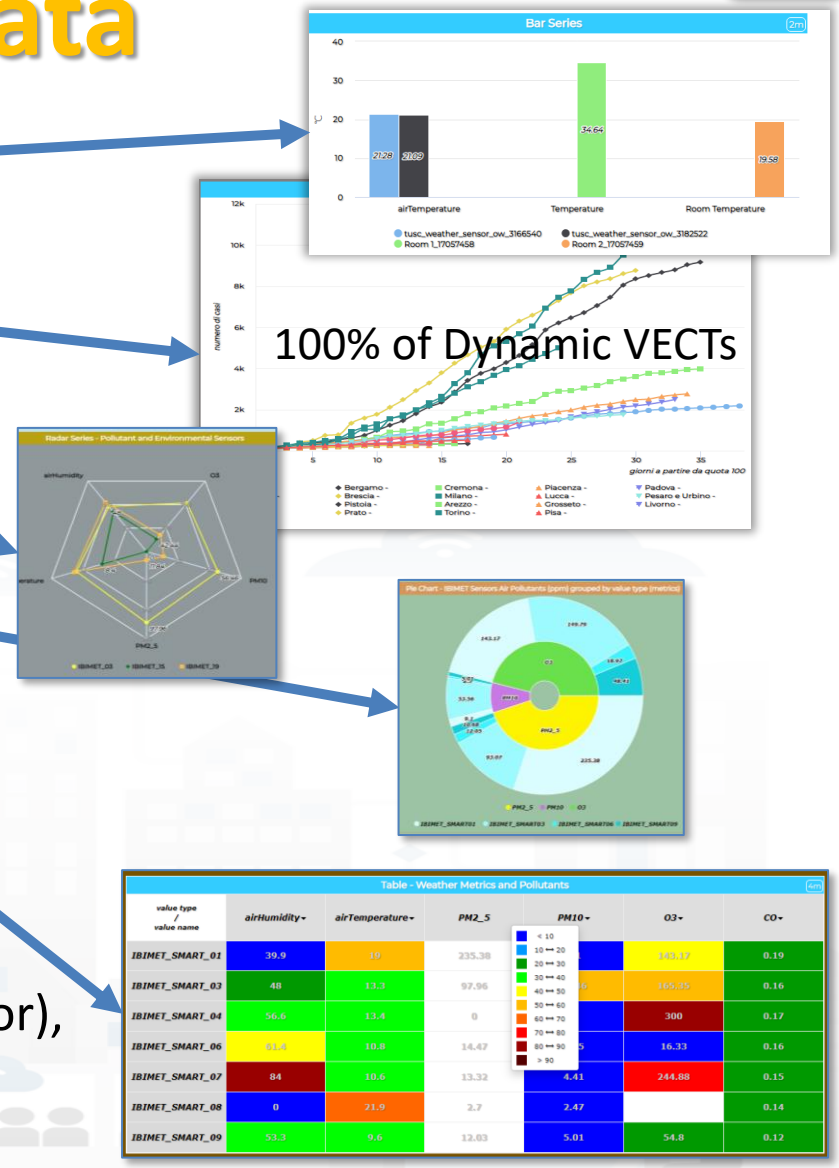
ServiceURI (ID)

MyKPI (ID)

Dynamic

Dynamic

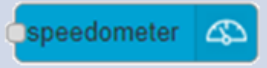
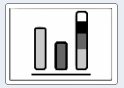
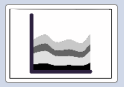
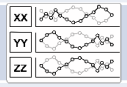
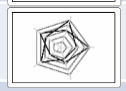
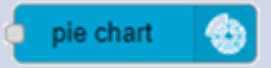
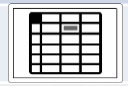
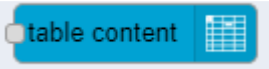




- **ServiceURI** (ID)
- **MyKPI (ID)**, Metric (ID)
- **Dynamic** Data in JSON (single or Vector), computed into IOT Application

[TC4.9: New Support Widgets for Bars, Barseries, Trend, and Series, on Dashboards and IOT Applications]

Dynamic (+++)

Widgets ICONS	Widget Name, Description	IOT App	Dashboard-IOT App	KPI (metric)	MyPersonal Data	MyData	My KPI	Sensor
	Single Content	X (cs)	X (DD)	X	X	X	X	X
	Speed Limit			X				X
	Speedometer 	X (cs)	X (DD)	X	X	X	X	X
	Gauge	X (cs)	X (DD)	X	X	X	X	X
	Single Bar, V/H	X	X (DD)	X				
	Single and Multiple Bars, stacked or not	X (cs)	X (DD)	X	X	X	X	X
	MultiSeries, shaded, staked and non staked	X (cs)	X	X	X	X	X	X
	Time Trend (single)	X	X (DD)	X	X	X	X	X
	Time trend Compare			X			X	X
	SpiderNet, radar, Kiviat	X (cs)	X (DD)	X	X	X	X	X
	Pie, Donut, 2 layers Donut 	X (cs)	X (DD)	X	X	X	X	X
	Table 	X (cs)	X (DD)	X	X	X	X	X

DD: Data Driven

Legenda

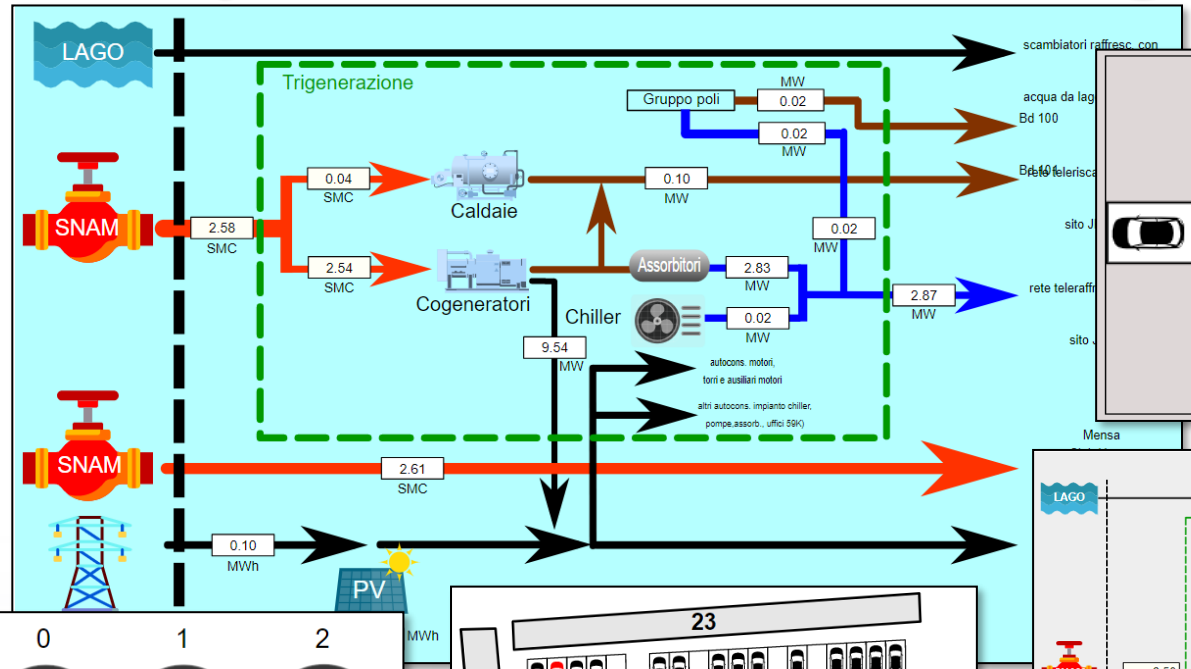
- **IOT APP column in previous table:**
  - **X**: means that from the IOT App you can send a new value or array to the widget directly, without the need to have is stored into Sensor or MYKPI variable, etc.
  - **CS, widget supports Change Source**, in the sense that: from the IOT App is possible to send a command to the Widget to change the data source. E.g., selecting sources among: Sensors (service URI), MyKPI (ID), any value produced on the IOT App directly. (cs) recent additions
- **Dashboard IOT App column in previous table**:
  - **X:** there is a MicroService / node on IOT App to act on those widgets on dashboard. The data are visualized.
  - **DD, widget is Data Driven**, in the sense that new data in push can be sent and the widget is updated in real time on web page without web page realoading

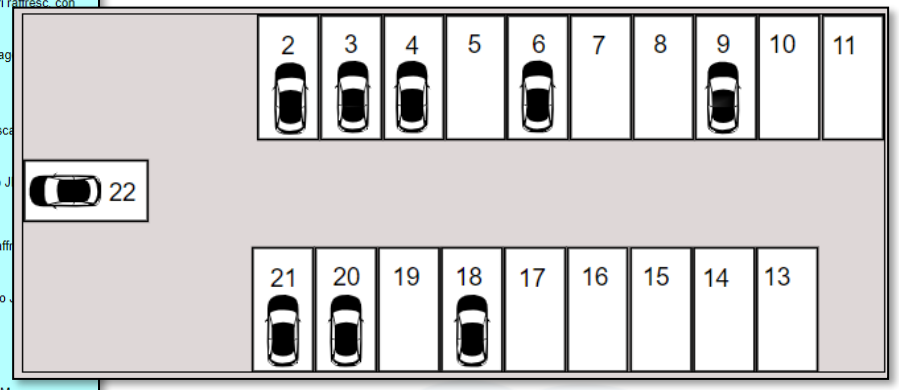
TC4.9: New Support Widgets for Bars, Barseries, Trend, and Series, on Dashboards and IOT Applications (partially obsolete)

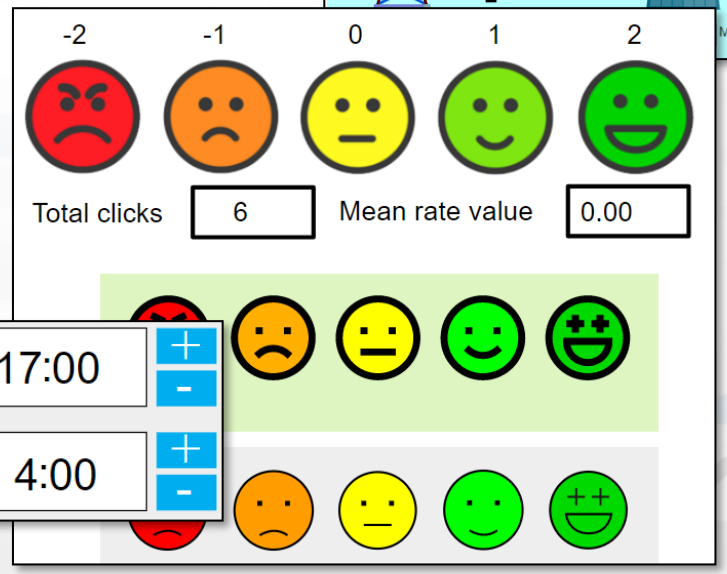
Synoptic, Custom Widgets and PINS Creation

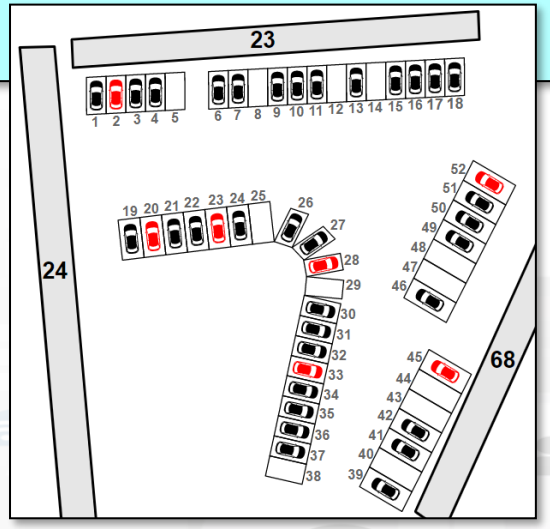
Special Custom Widgets

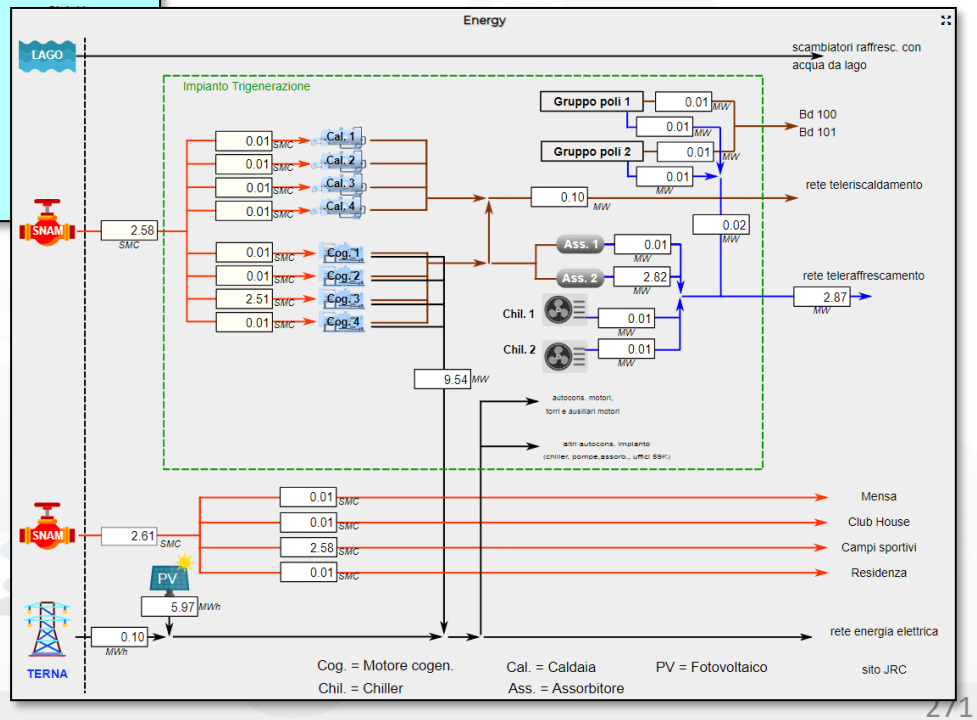
- Smart parking
- Smart Energy
- Smart Light
- Smart ….
- Energy View
- Custom Controls



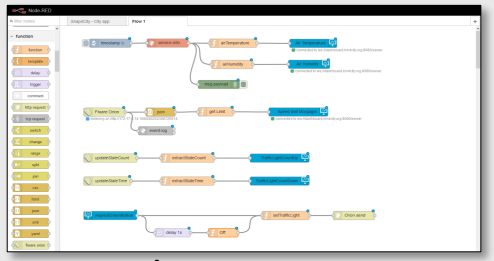








Custom Widget / Synoptic / PIN Development

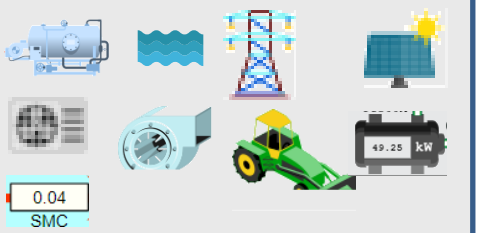


IOT Applications

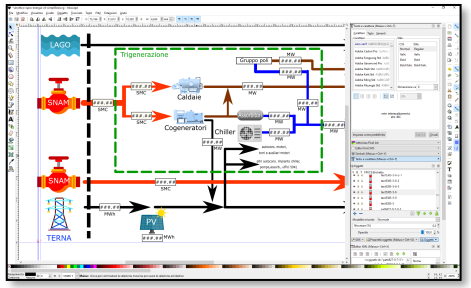
Knowledge Base,
Km4City

Knowledge and Storage
Data from the Field and
City

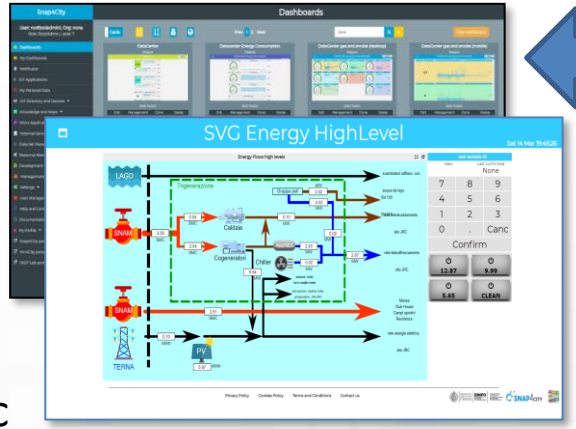
SVG Symbols Collection



Inkscape editor on your computer

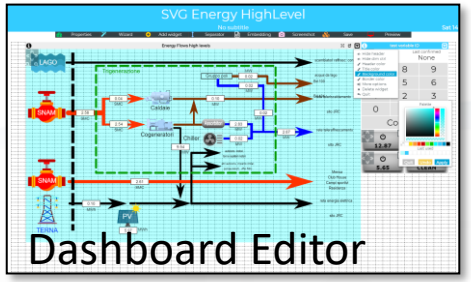


Create, save a Custom
Widget in SVG



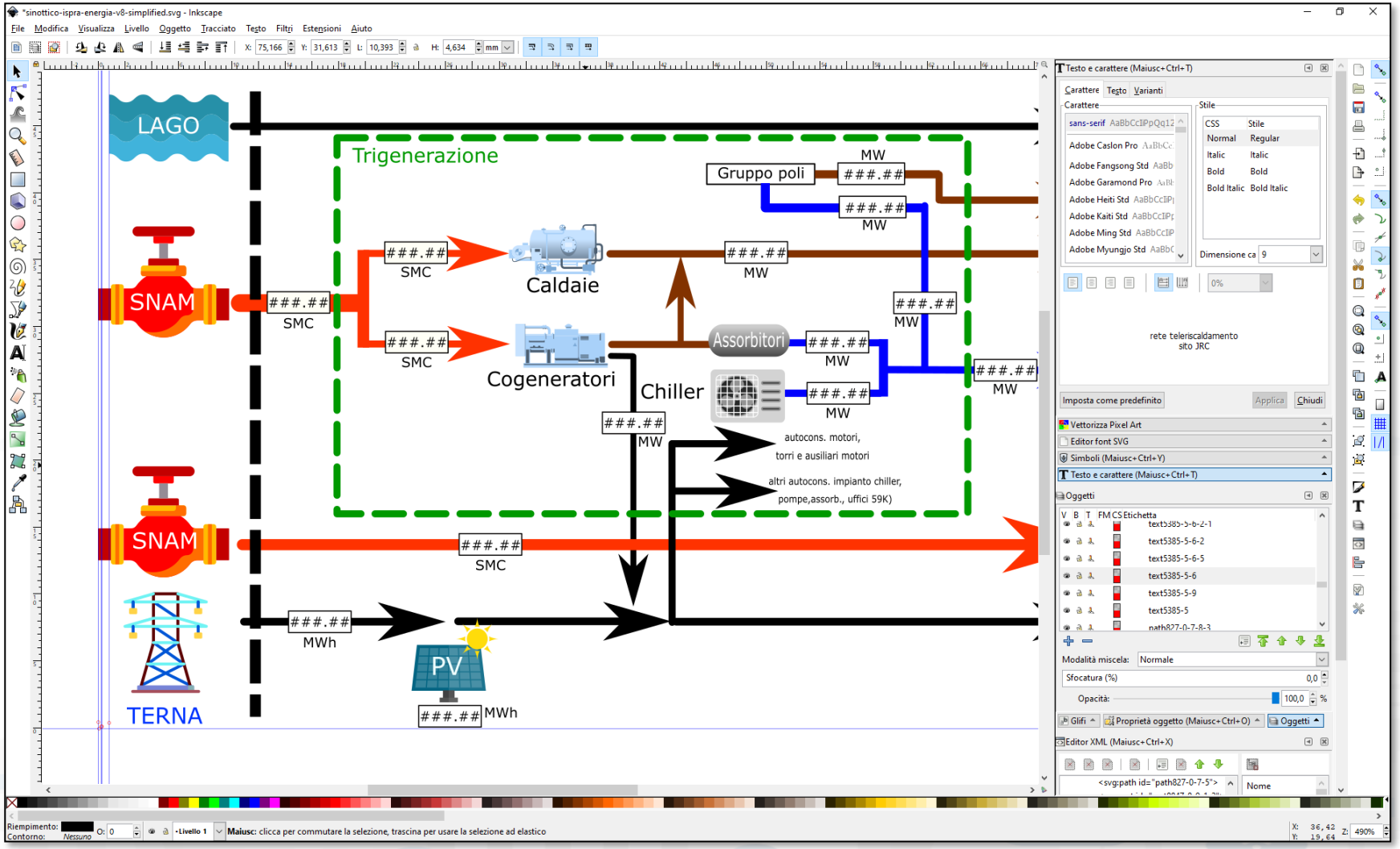
Public
Dashboard
Collection

My Own Dash/App



Create, save, load,
delegate, grant access

1. Create and Load a Custom SVG
2. Select/Reuse an SVG
3. Make and Instance of Synoptic by Associate Variables with MyKPI
4. Create on Dashboard a Widget based on Synoptic HLT such as Ext. Srv.:
   - https://www.snap4city.org/synoptic/v2/synoptic.html?id=xxxx

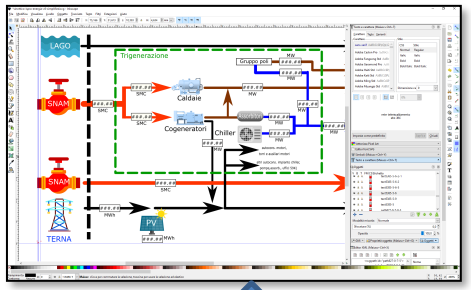


How to create a custom Widget

- [User manual on: https://www.snap4city.org/595](https://www.snap4city.org/595)

CW with a single READ Variable are automatically usable as PINS

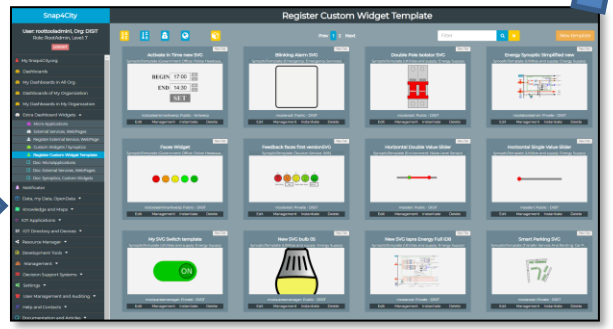
Create, save a Custom Widget in SVG



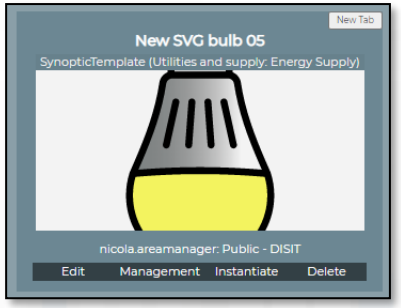
SVG Symbols Collection

From any open library

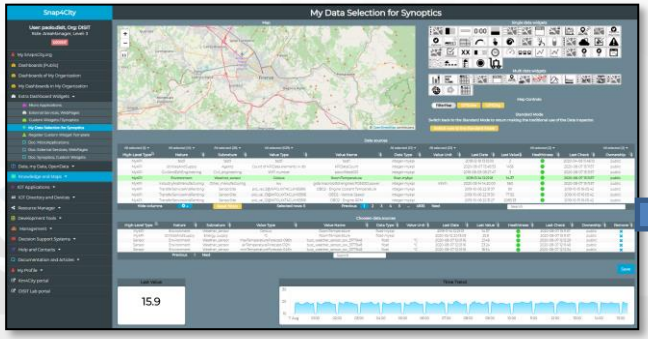
Upload as Custom Widget Template



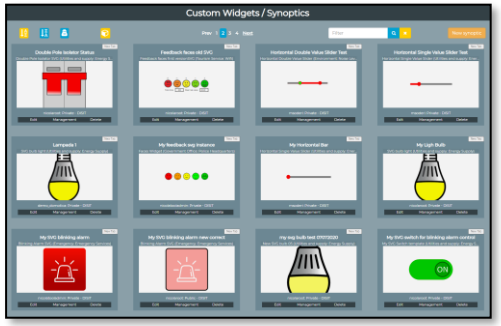
select

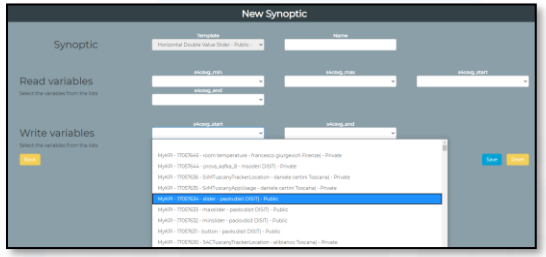


Select MyKPI and Sensor Data for Synoptics cases



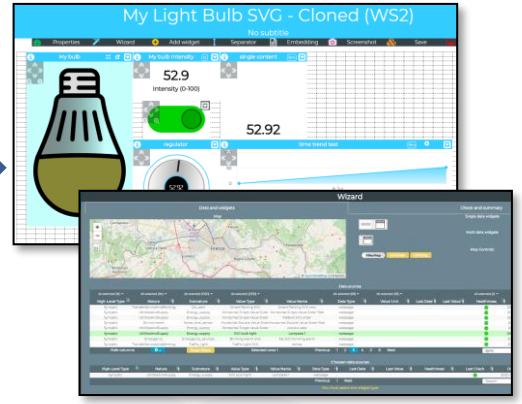
List of Custom Widgets / Synoptics

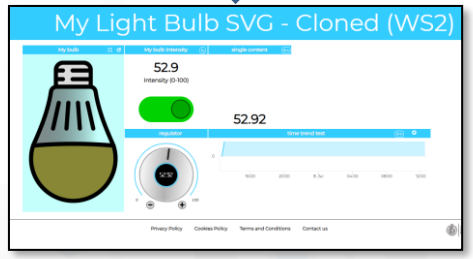




Instantiate as Custom Widgets / Synoptics Connect with WebSockets

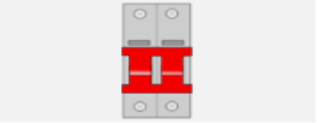
Dashboard Editing/wizard





Final Dashboard

Help on Custom Widgets

Custom Widget name and image	*Explanation*	*Variable(s)*	*Accepted values*
Activate in Time new SVG	Set the begin and the end hours by using the small + and – buttons. Click SET to send the defined hours to the server.	s4csvg_begin (read and write variable) Default value: ##:##	starting hour in the form HH:mm to be set by clicking the + and – button
		s4csvg_finish (read and write variable) Default value: ##:##	ending hour in the form HH:mm to be set by clicking the + and – button
Air Conditioner SVG	Change the image according to the value received.	s4csvg_airconditioner_status (read variable) Default value: undefined state, the SVG shows the overlapped cold and hot images.	0 = OFF, 1 = cold, 2 = hot
Blinking Alarm SVG	The image blink or stop to blink according to the value received. Example: https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjc4NQ==	s4csvg_blinking_alarm (read variable) Default value: 1, blinking	0 = OFF (fixed image), 1 = blinking
Double Pole Isolator SVG 	By clicking the SVG, the status of the switch changes accordingly and the corresponding value is sent to the server. Example: https://main.snap4city.org/view/index.php?iddasboard=Mjk4Ng==	s4csvg_isolator_onoff (read and write variable) Default value: undefined state, the SVG shows the overlapped position up and position down images.	0 = OFF (position down), 1 = ON (position up)
Faces Widget	By clicking a coloured face the corresponding value is sent to the server. Examples: https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjU0NA==	s4csvg_userFeedback: value sent to the server by clicking the corresponding face (write variable). Default value: no value sent. The SVG shows the five	-2 = very bad, -1 = bad, 0 = so-and-so, 1 = quite-good, 2=good

From-To Custom Widgets / Synoptics to Storage in WS

MyKPI

Sensors

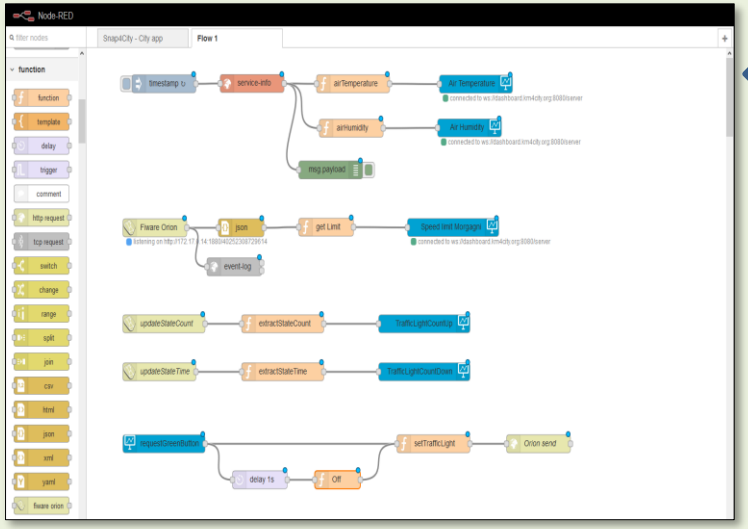
MyKPI

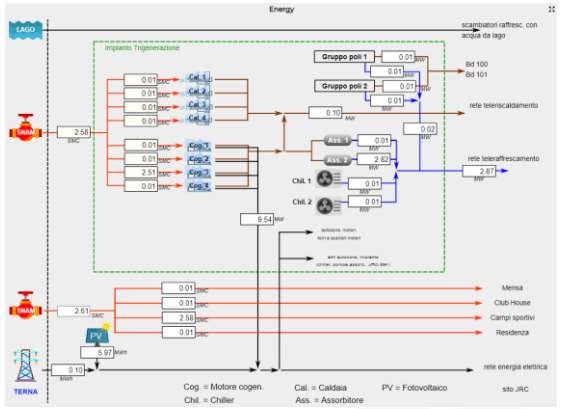
Sensor

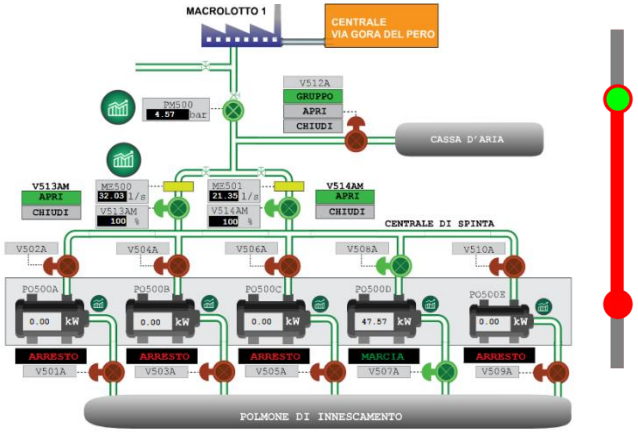
[ ]

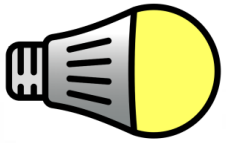
New Shared Variables

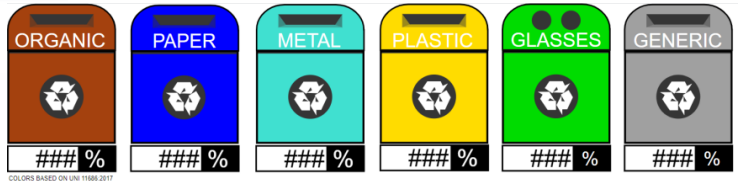
Constant Values

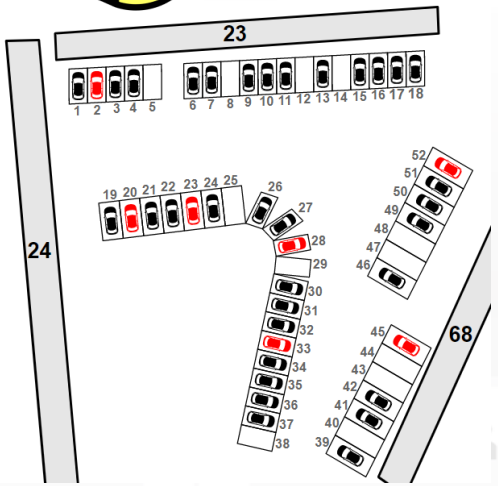


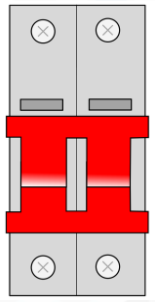


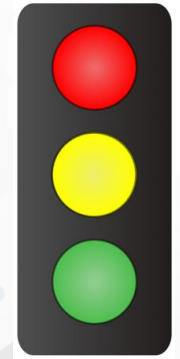






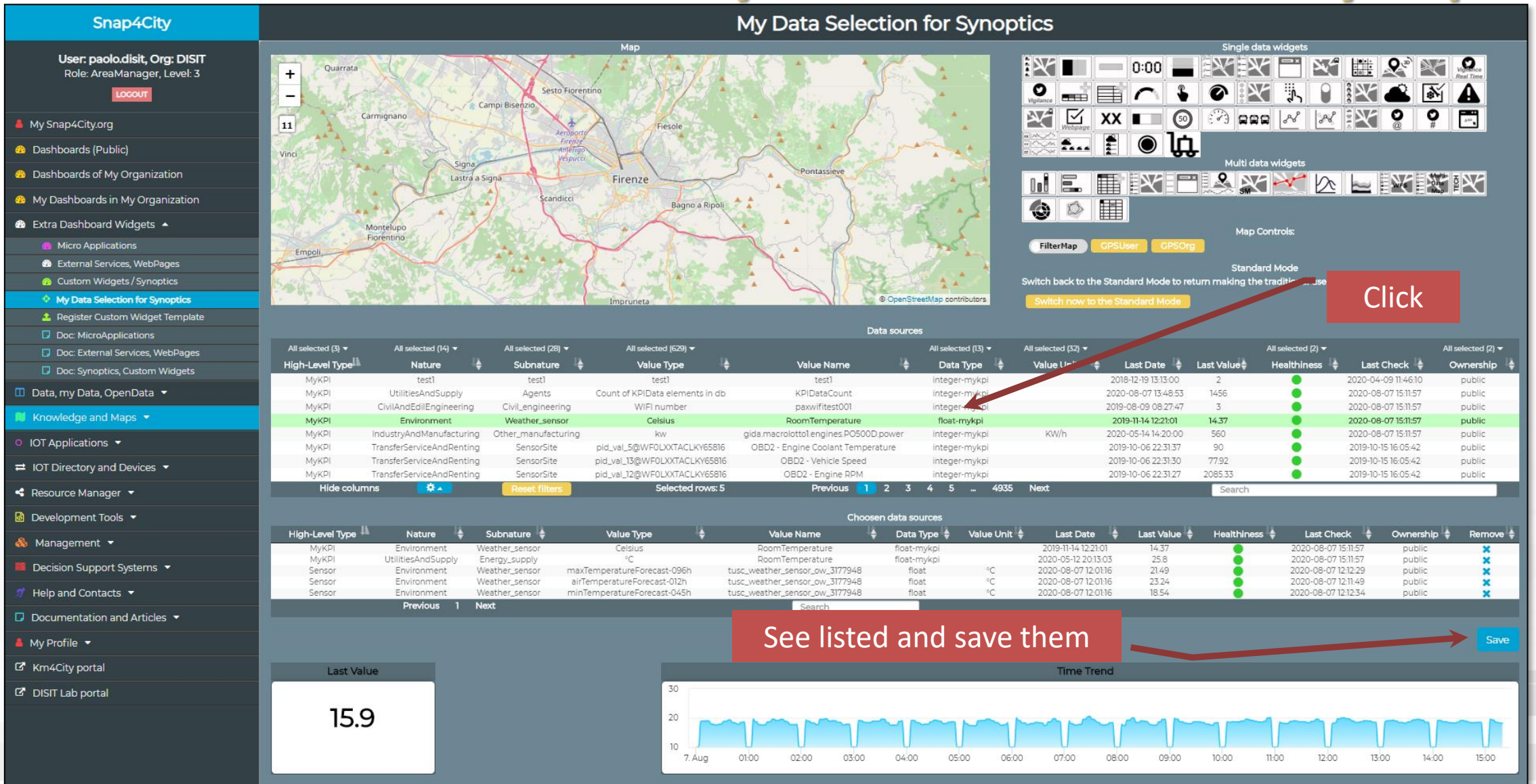




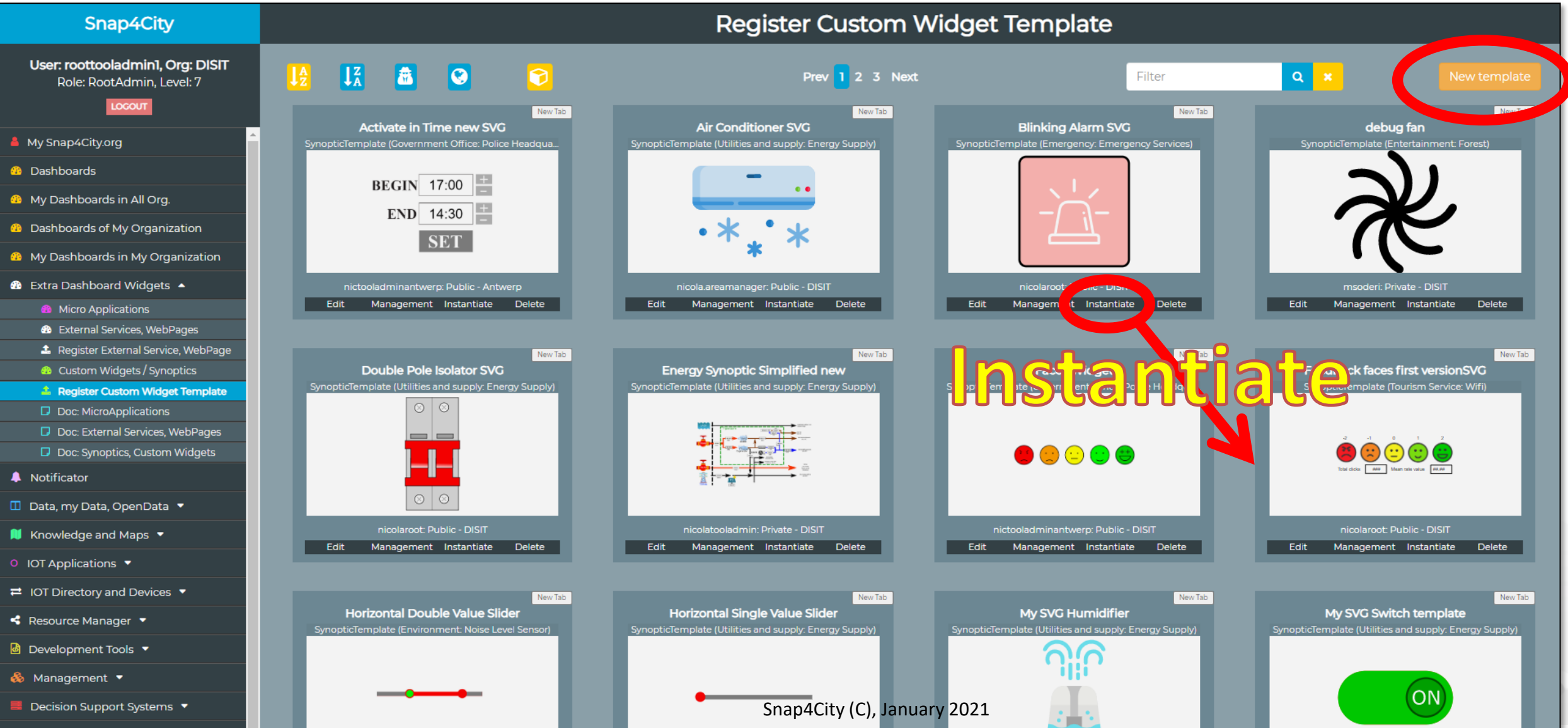


Web Socket Secure

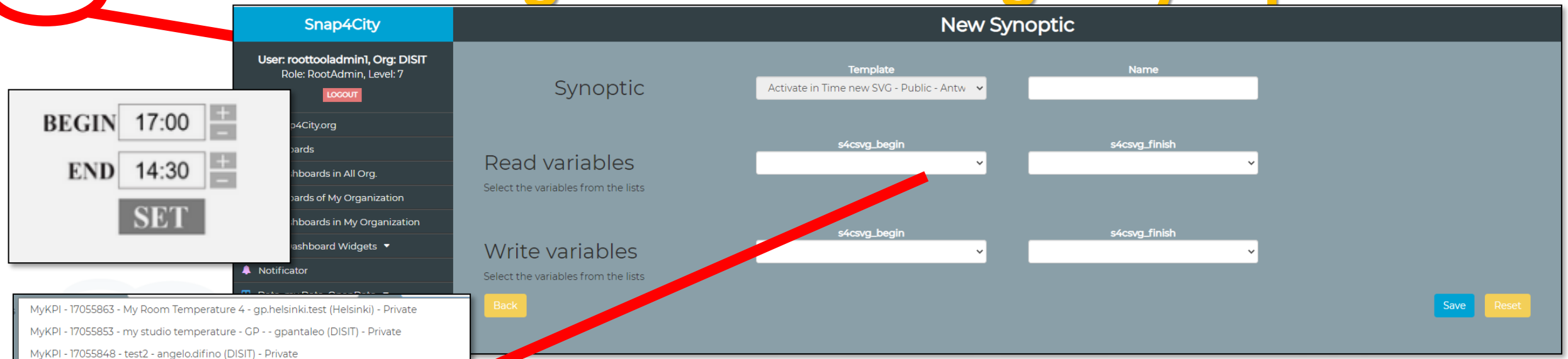
Select the Sensors and MyKPI to be used on Synoptics

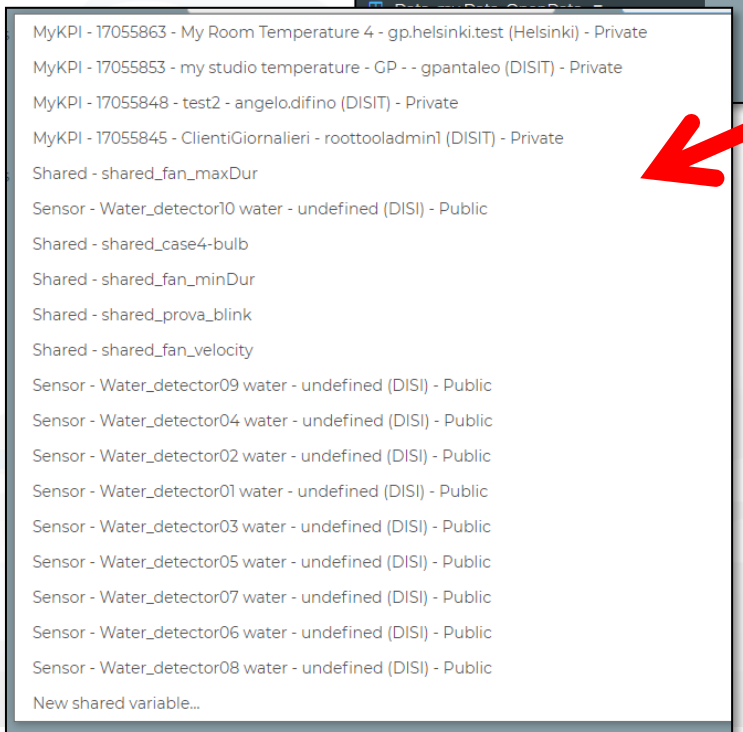


Custom Widgets Templates



Instantiating a Custom Widget Synoptic





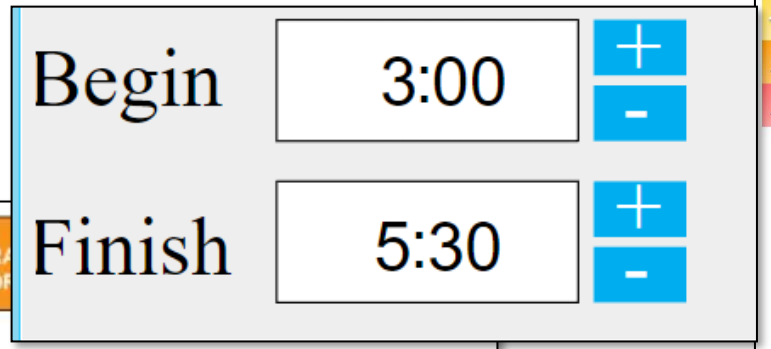
- [ ]
  - **leave it empty to connect later direcly from/to IOT APP**
- **MyKPI**
  - Read/write data, your KPI, and real time values
- **Sensors**
  - Your data collected as sensors only rendering data
- **New Shared Variables**
  - ….. Only for Case 3: Synoptic vs Synoptic Communications
  - No protection of data value

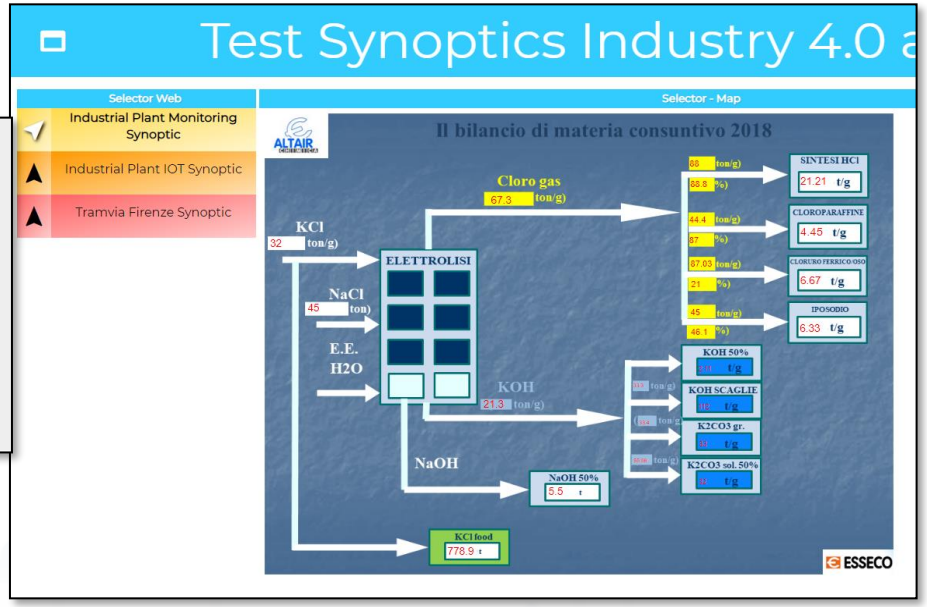
Custom Widgets

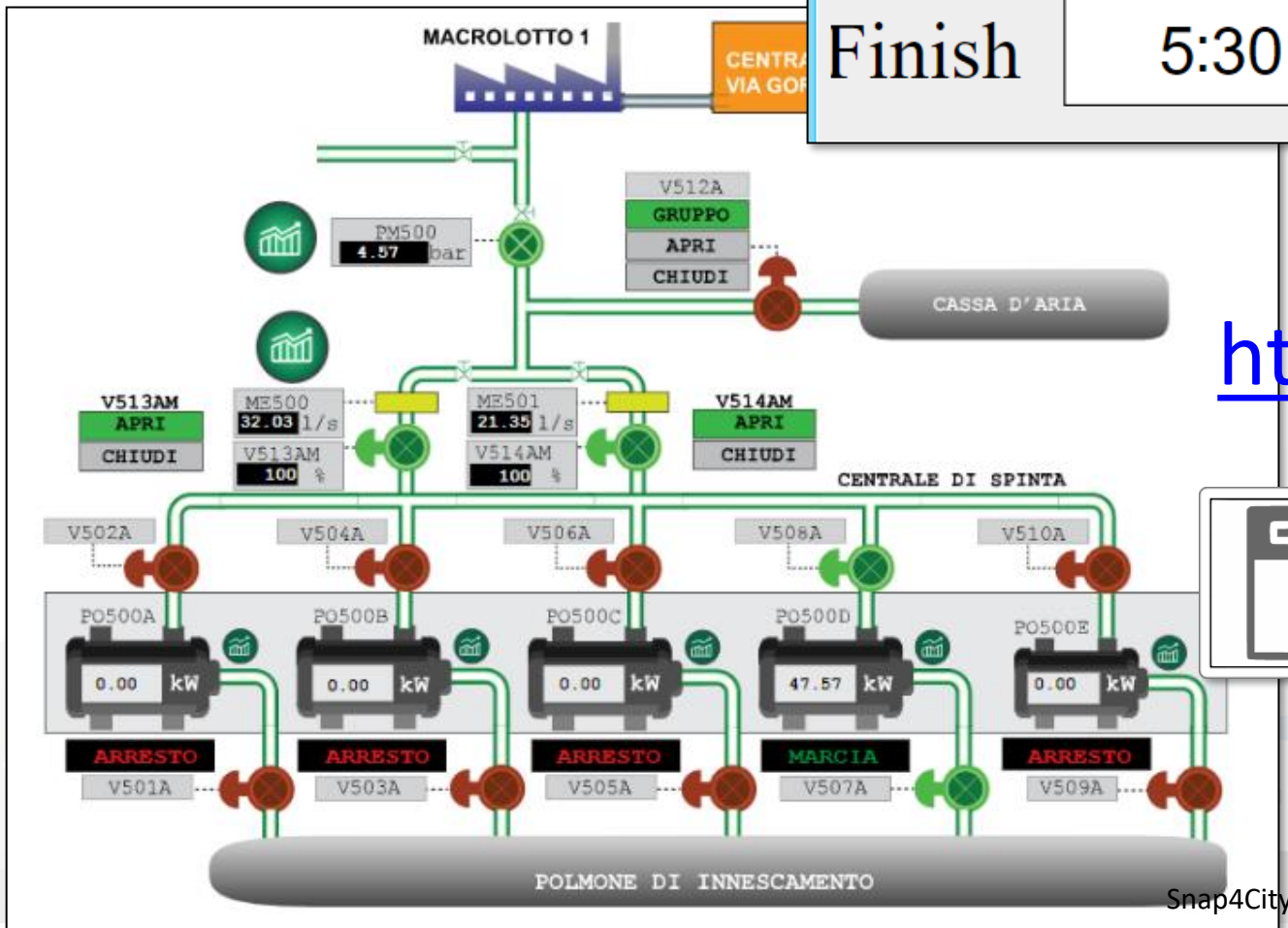
Custom Dashboards and Widgets (interactive, Animations, etc.)

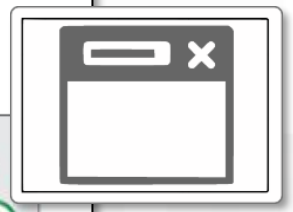
-- SVG for graphic design

-- MyKPI for collecting data

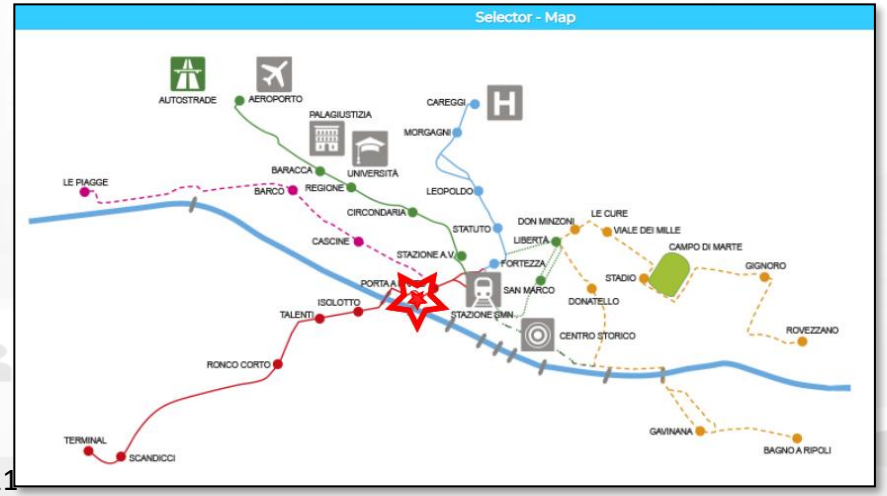








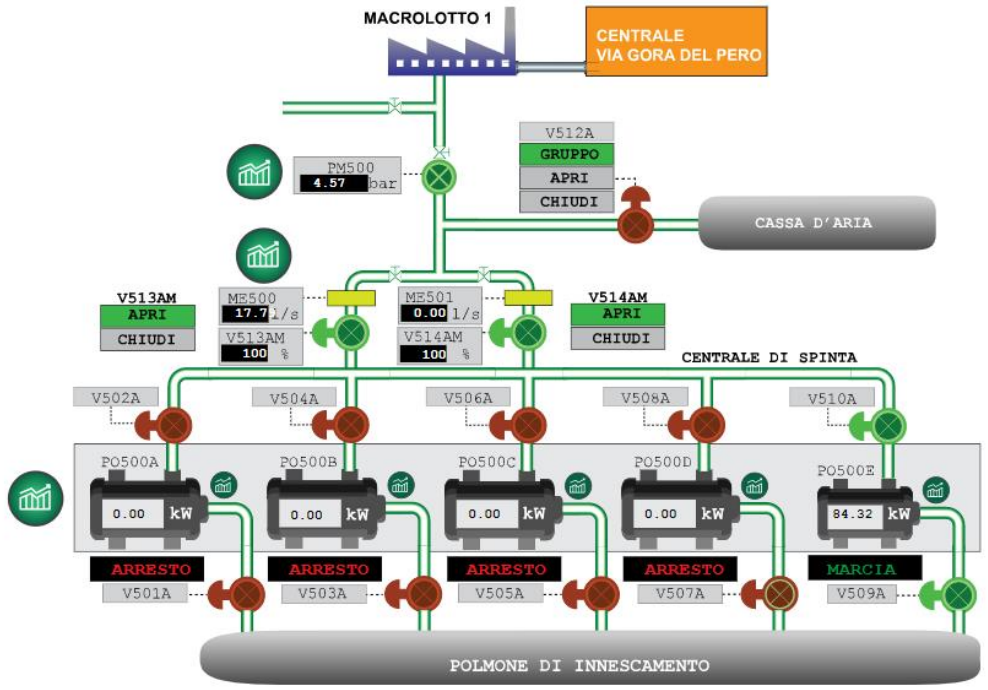
https://www.snap4city.org/504



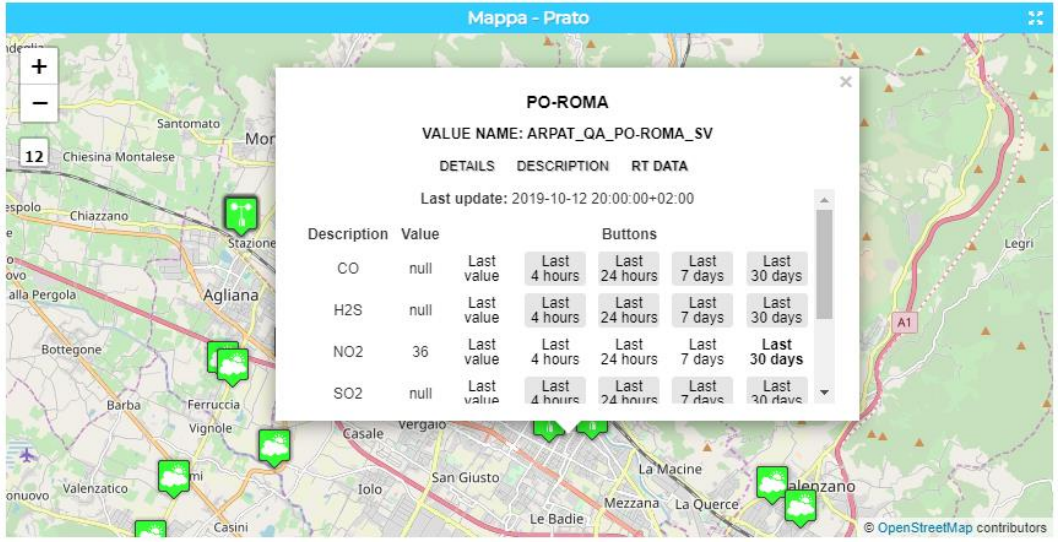
GIDA 5G demo

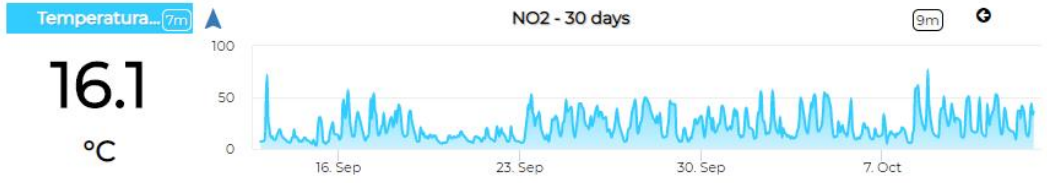
Sat 12 Oct 23:52:54

Macrolotto 1 - Spinta in rete



Temperatura GIDA 7m	Pressione - GIDA 7m	Umidità - GIDA 7m
16.1 °C	1023 bar	82 %





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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 16
Slot 17
Slot 18
Slot 19
Slot 20
Slot 21
Slot 22
Environment
other

Selector - Map

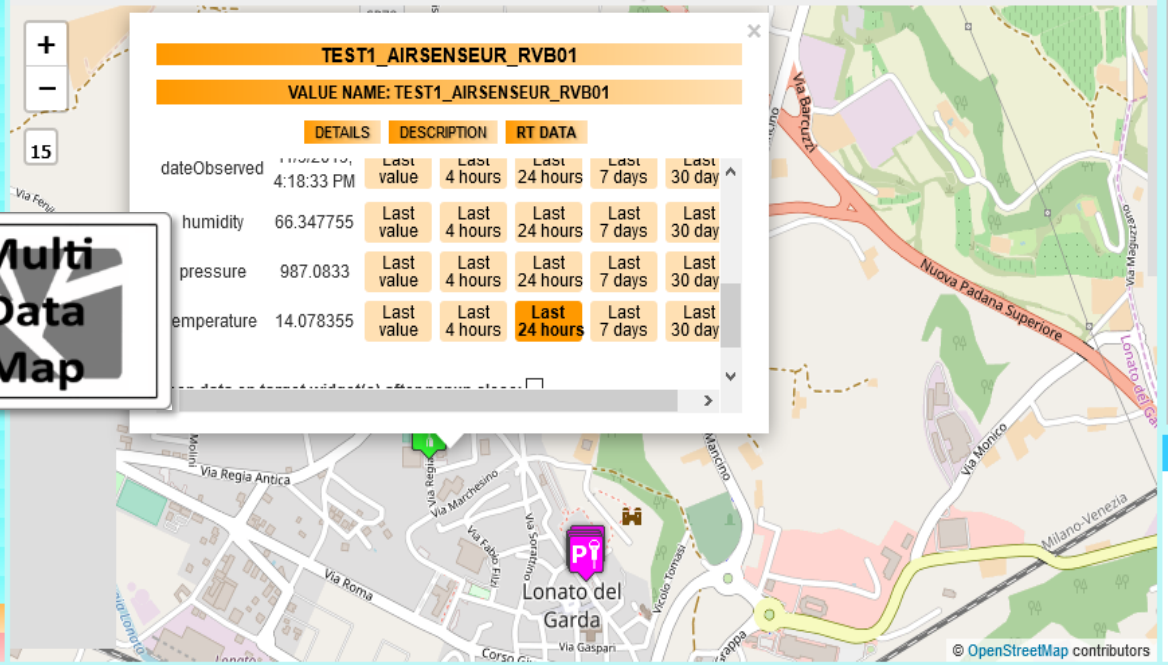
Multi Data Map

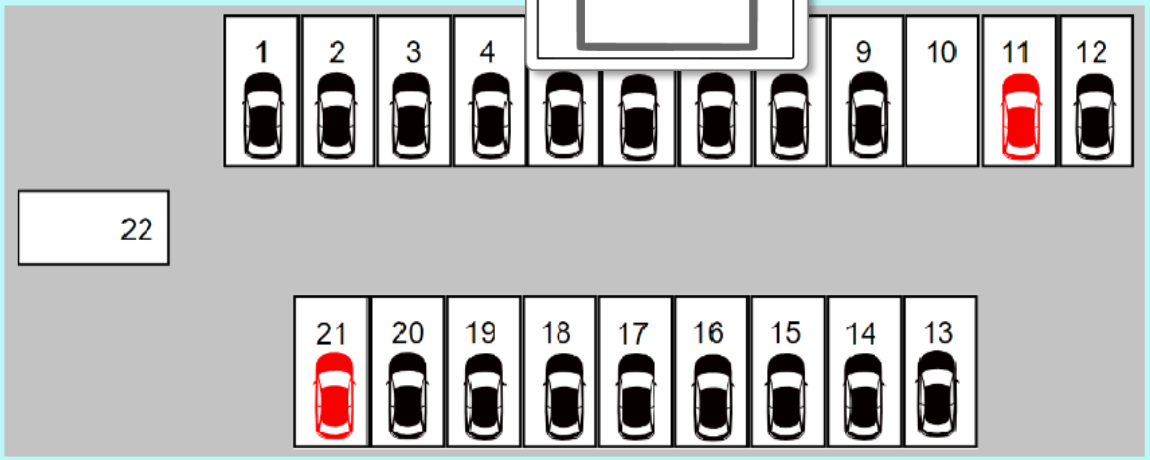
TEST1_AIRSENSEUR_RVB01

VALUE NAME: TEST1_AIRSENSEUR_RVB01

DETAILS | DESCRIPTION | RT DATA

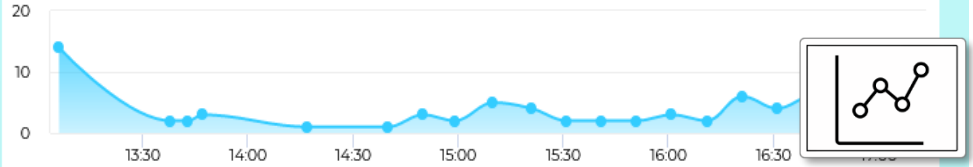
		Last value	Last 4 hours	Last 24 hours	Last 7 days	Last 30 day
dateObserved	4:18:33 PM					
humidity	66.347755					
pressure	987.0833					
temperature	14.078355					Last 24 hours





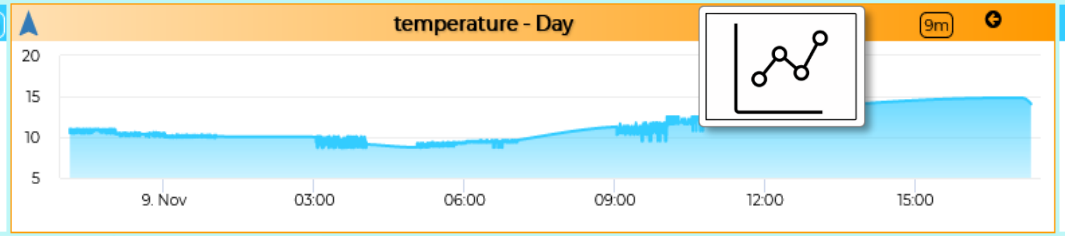
NumFreeSlo... 9m
XX

NumFreeSlots - Slots 9m

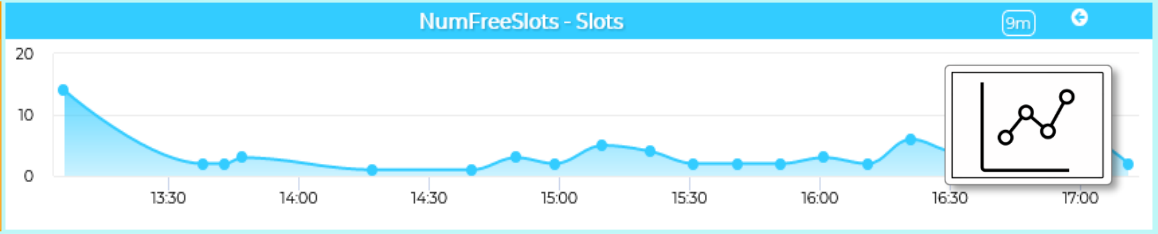


SmartParkingLonato_1 ... 9m
XX
0
status

temperature - Day 9m



NumFreeSlots - Slots 9m



pressure 9m
987.1
mm
XX

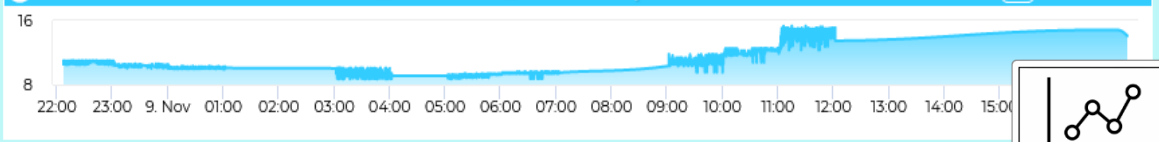
humidity % 9m
66.3
XX

temperature 9m
14.1
XX

Slot ID 9m
14
slot ID
XX

Max Present Duration 9m
19 ore e 11 minuti

TEST1_AirSensEUR_RVB01 - temperature 9m



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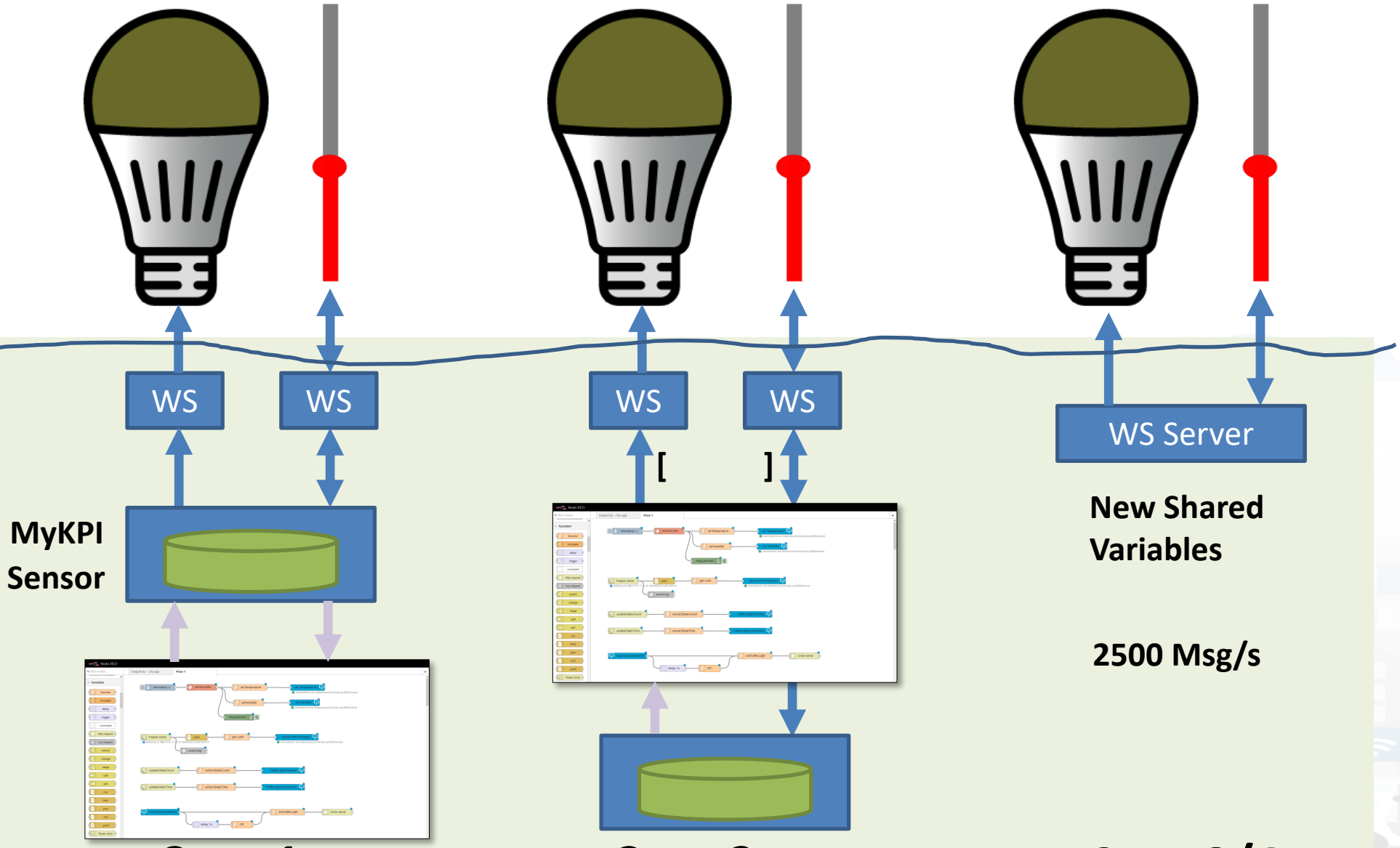
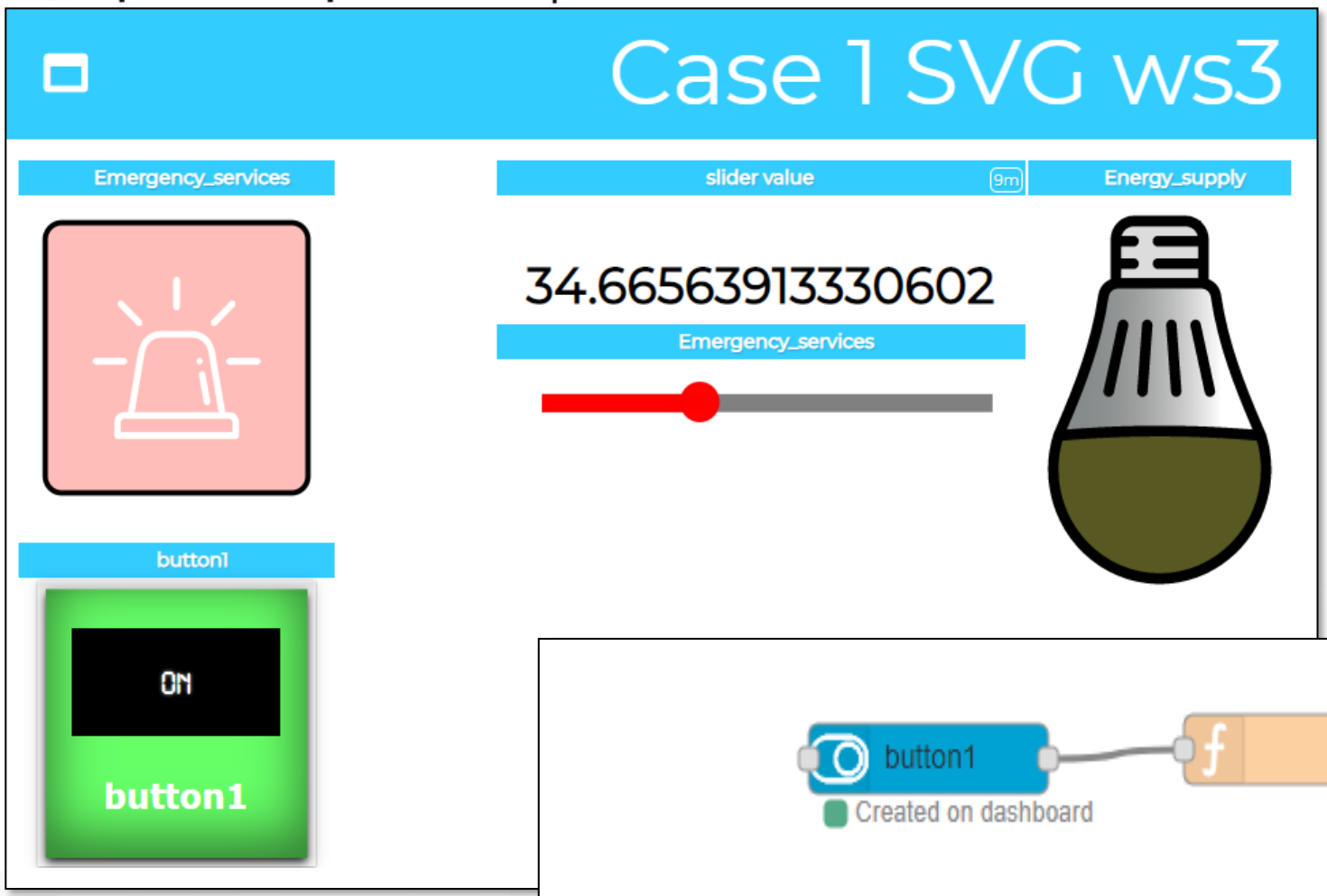
Dashboard on Browser

Internet

Storage and IOT App on cloud or on Premise

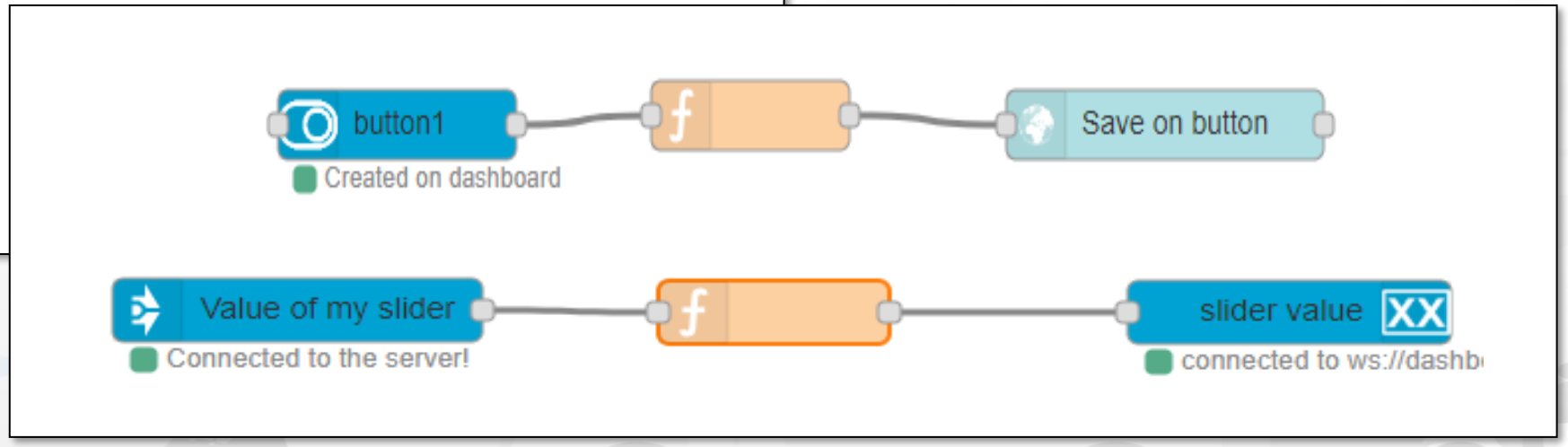


Case 1

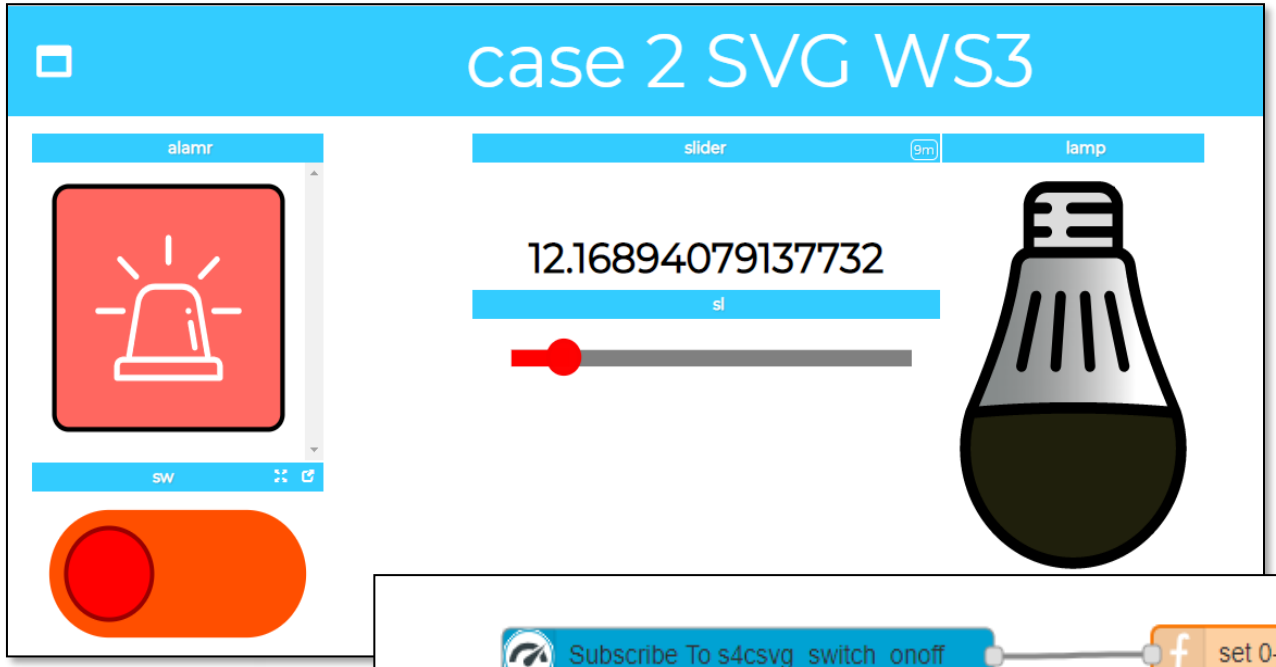


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjc4NA==

10 WS messages per second

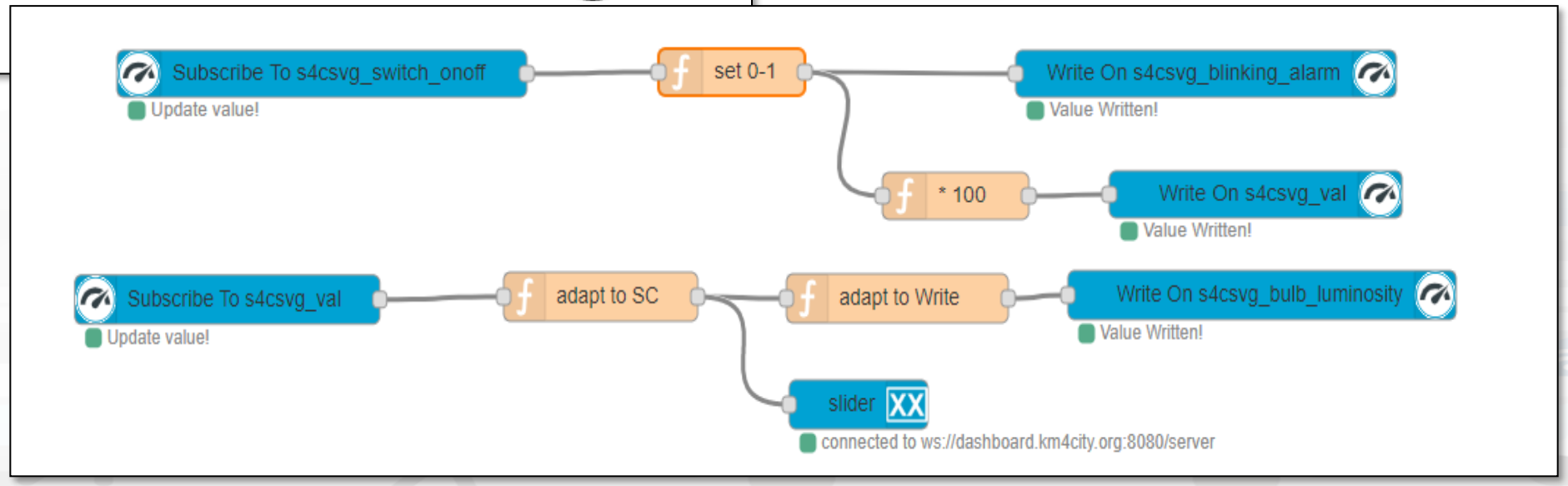


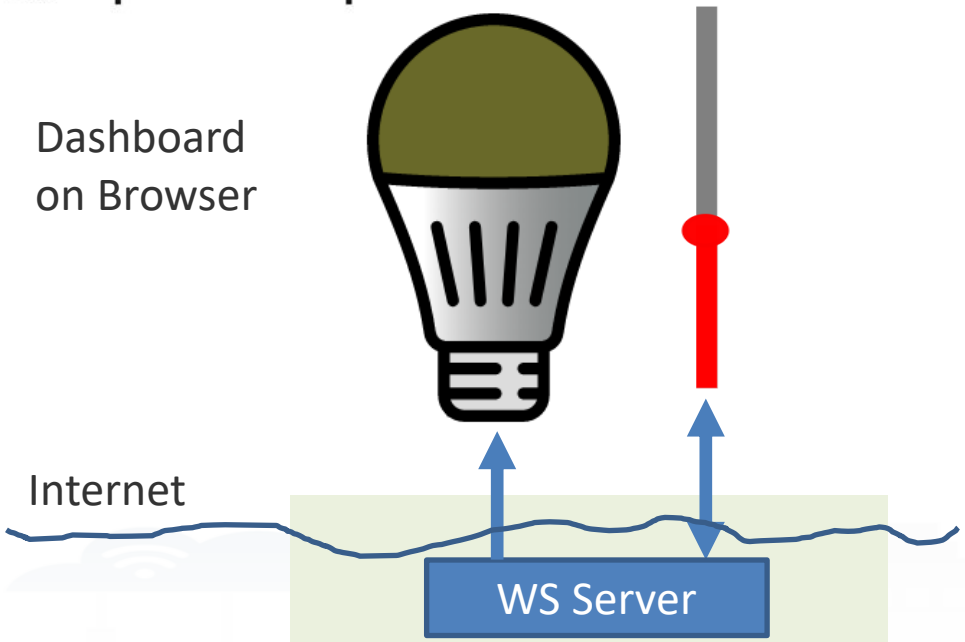
Case 2: Event Driven 100%



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjc4NQ==

40 messages per second

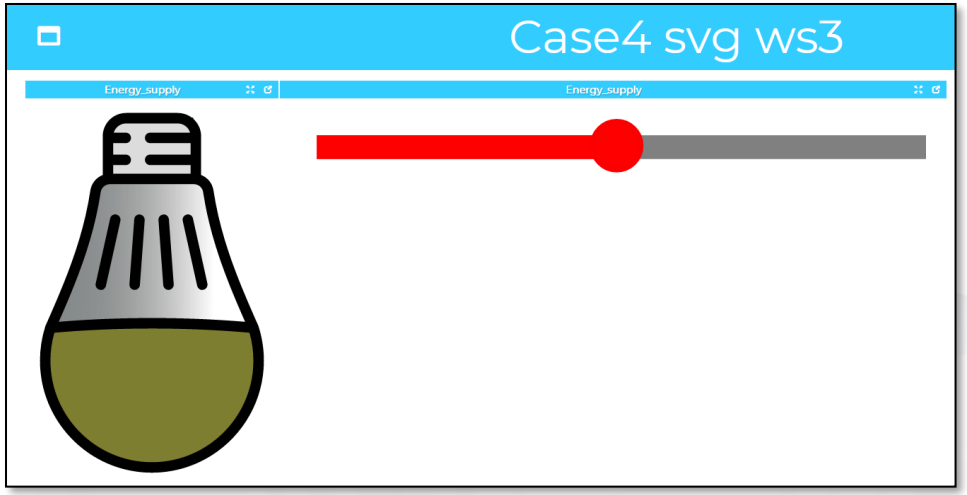




WS Server
on cloud or
on Premise

New Shared Variables

2500 Msg/s



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

Case 3/4

Snap4City

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

LOGOUT

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

Dashboards

Cards | Prev 1 2 3 ... 89 Next | Filter by dashboard title | New dashboard

- Energy -
Passive

comunedashres: Private - Firenze
Edit Management Clone Delete

- Environment -
Passive

comunedashres: Private - DISIT
Edit Management Clone Delete

- Mobility -
Passive

comunedashres: Private - Firenze
Edit Management Clone Delete

- Smart Lonato del Garda -
IOT apps

disit_lonatodelgarda: Private - LonatoDelGarda
Edit Management Clone Delete

- Social -
Passive

comunedashres: Private - Firenze
Edit Management Clone Delete

0 - Dashboard new
Passive
nicola.mitolo: Private - DISIT
Edit Management Clone Delete

3D Map beta Testing
Passive

gpantaleo1: Public - DISIT
Edit Management Clone Delete

3D Map beta Testing 2
Passive
gpantaleo1: Private - DISIT
Edit Management Clone Delete

3D Map test 2
Passive
gpantaleo1: Private - DISIT
Edit Management Clone Delete

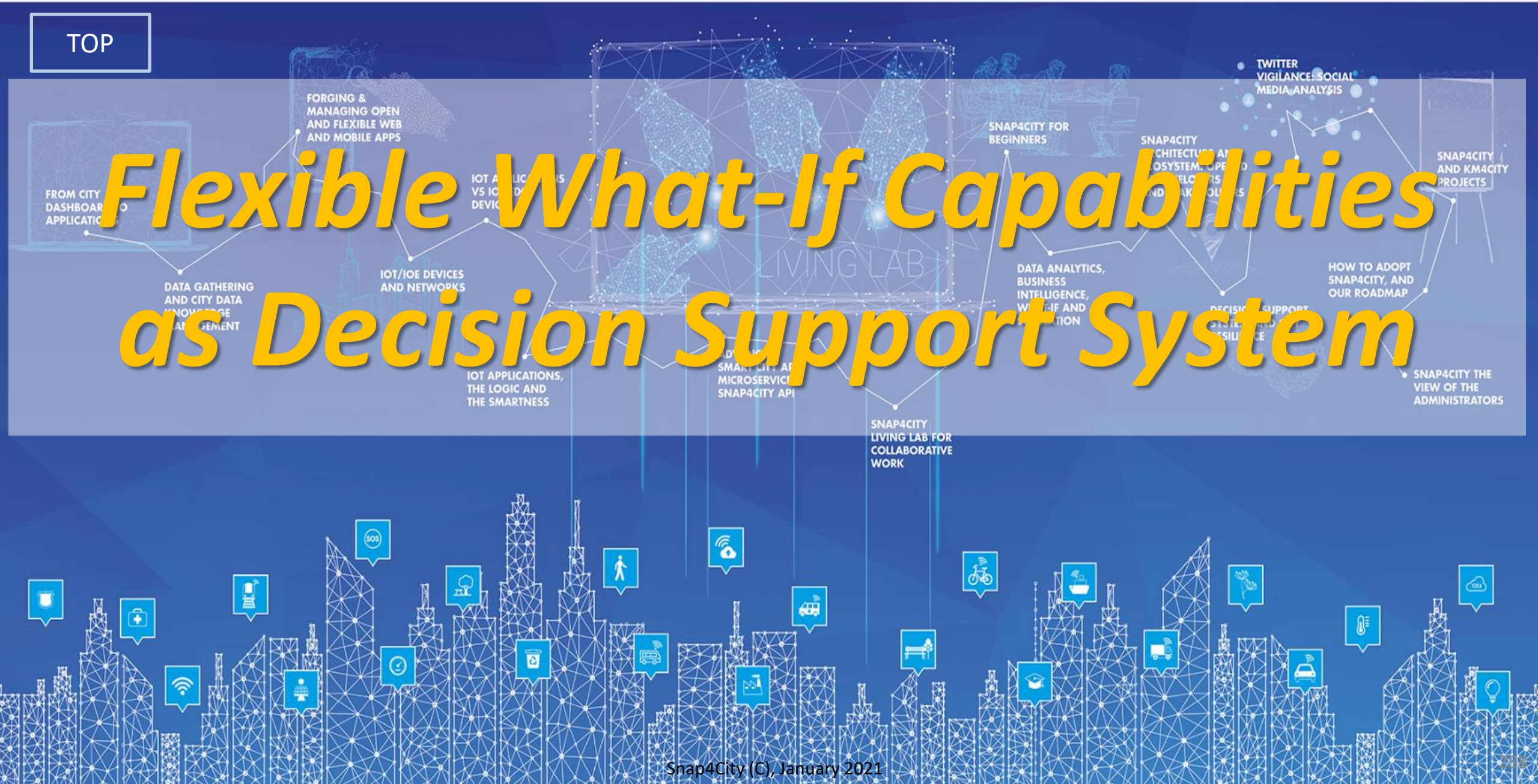
a
IOT apps
djqjq@163.com: Private - Antwerp
Edit Management Clone Delete

AA-DASHBOARD-TEST-01
Passive
andrea antonini: Private - DISIT
Edit Management Clone Delete

AA-DASHBOARD-TEST-02
Passive
andrea antonini: Private - DISIT
Edit Management Clone Delete

TOP

Flexible What-If Capabilities as Decision Support System



Mobility and Environment What-IF Analysis

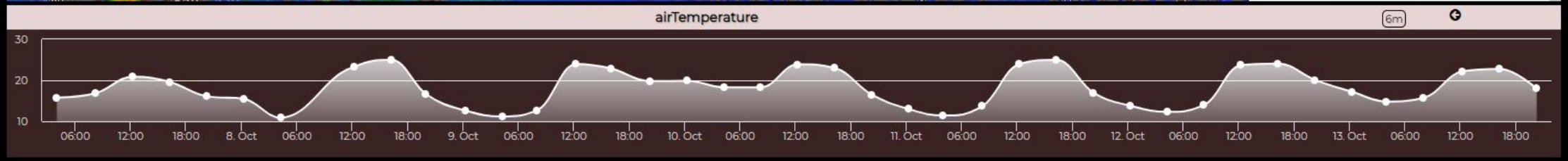
This dashboad contains data derived from actual sensors and predictive values under validation

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

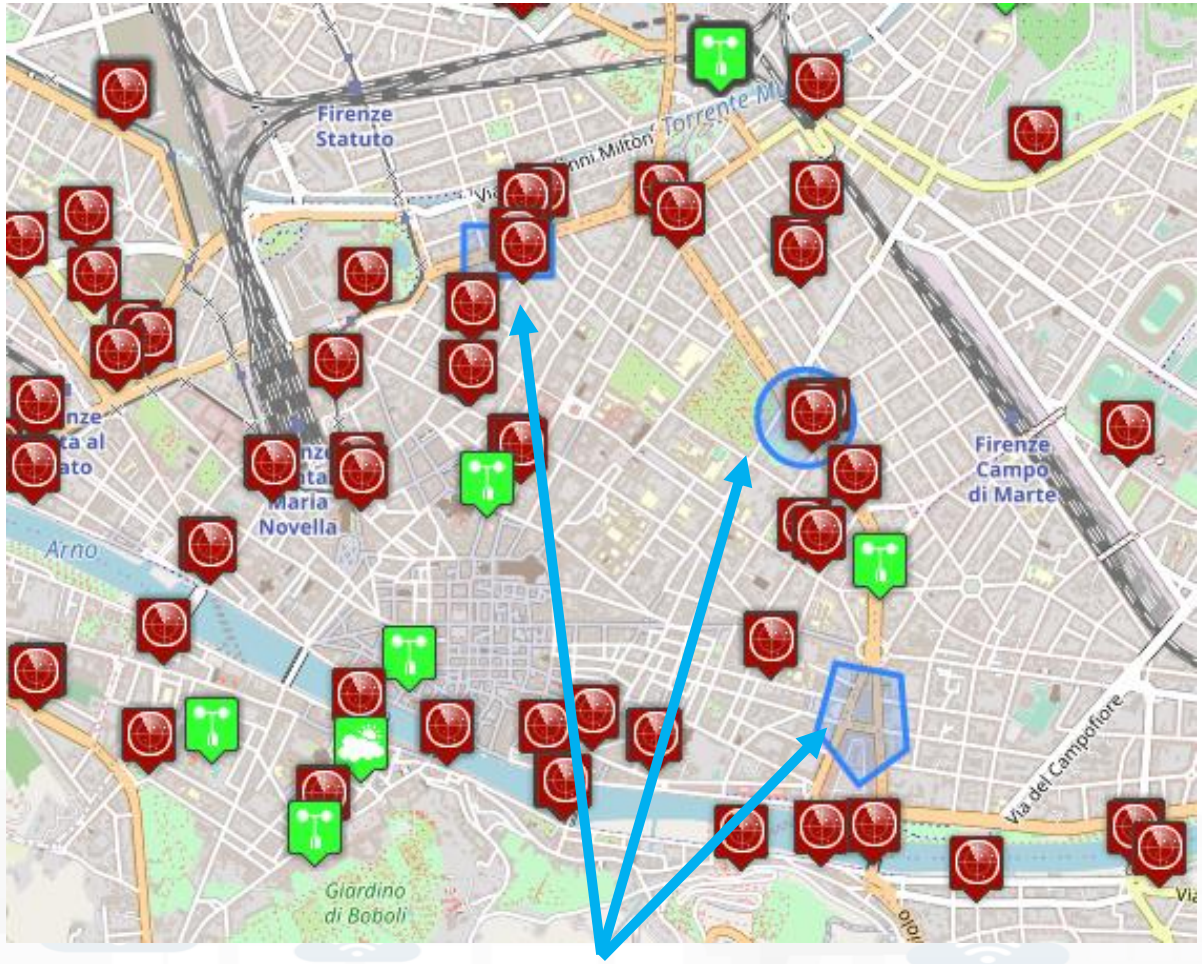
Air Temperat... 6m



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

What-If Analysis Concepts

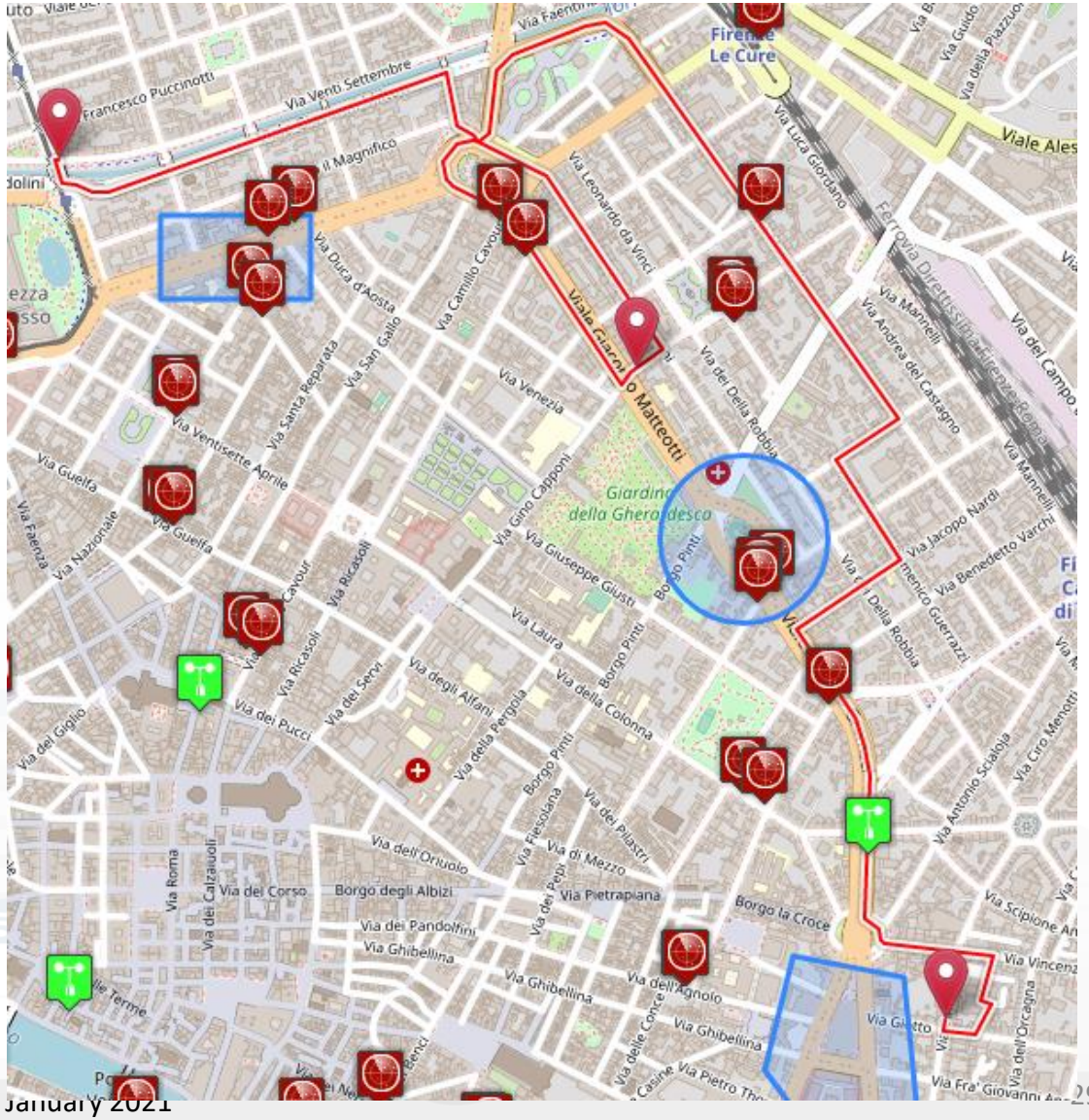
- What is going to happen at Services if certain conditions/cases are going to occur
- Formalize: Conditions/cases, Services
- Scenarios of Cases+Services Vs Solutions are Studios
- You can define, save, load:
  - Scenarios and Studios



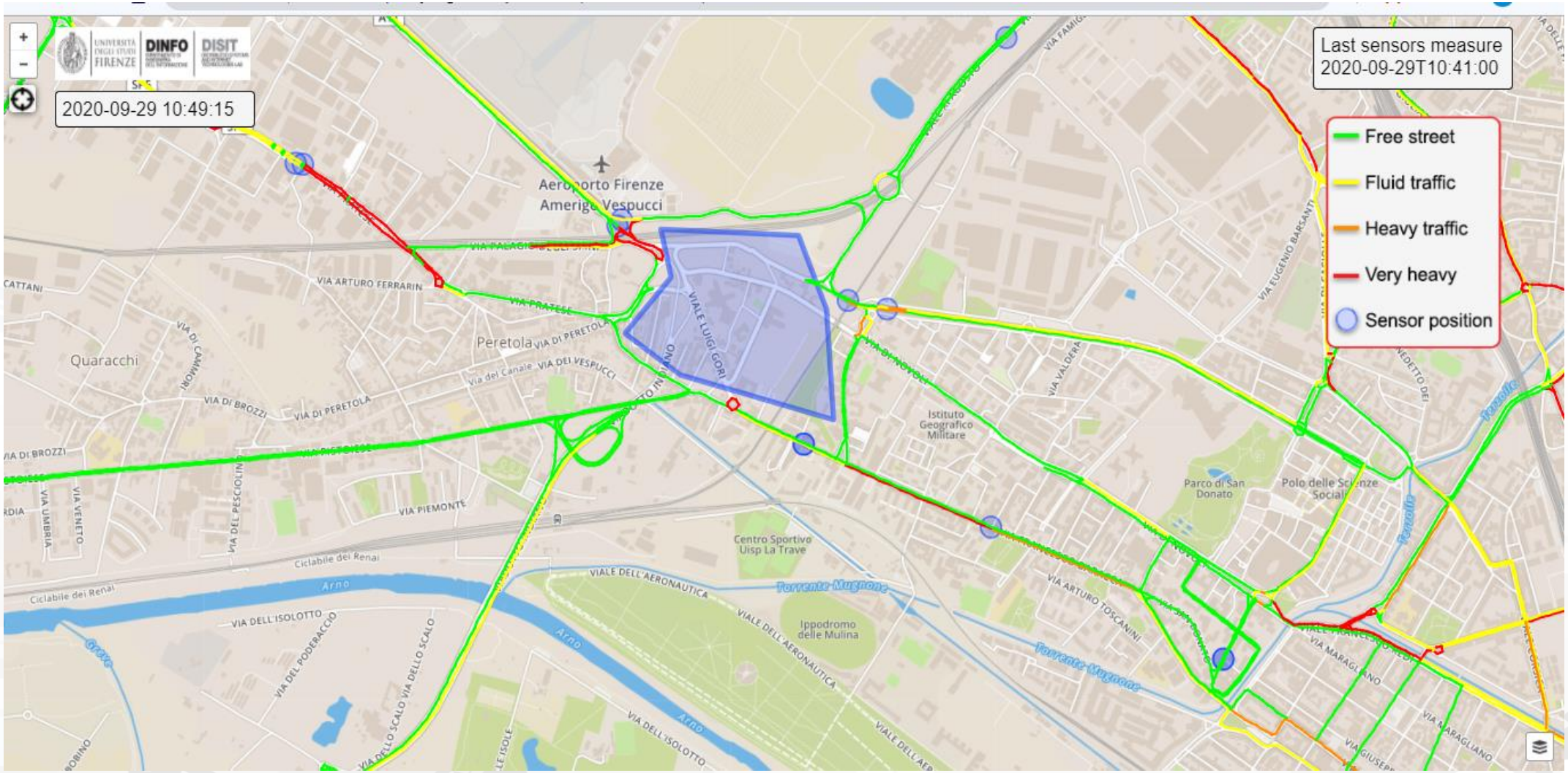
Scenario

Impact on Routing

- Scenario with multiple shapes
- Conditional Routing
  - avoiding areas or
  - reducing traffic in those areas
  - Multiple stop points



Computation of Traffic Flow Evolution



TOP

Dashboard Event Management

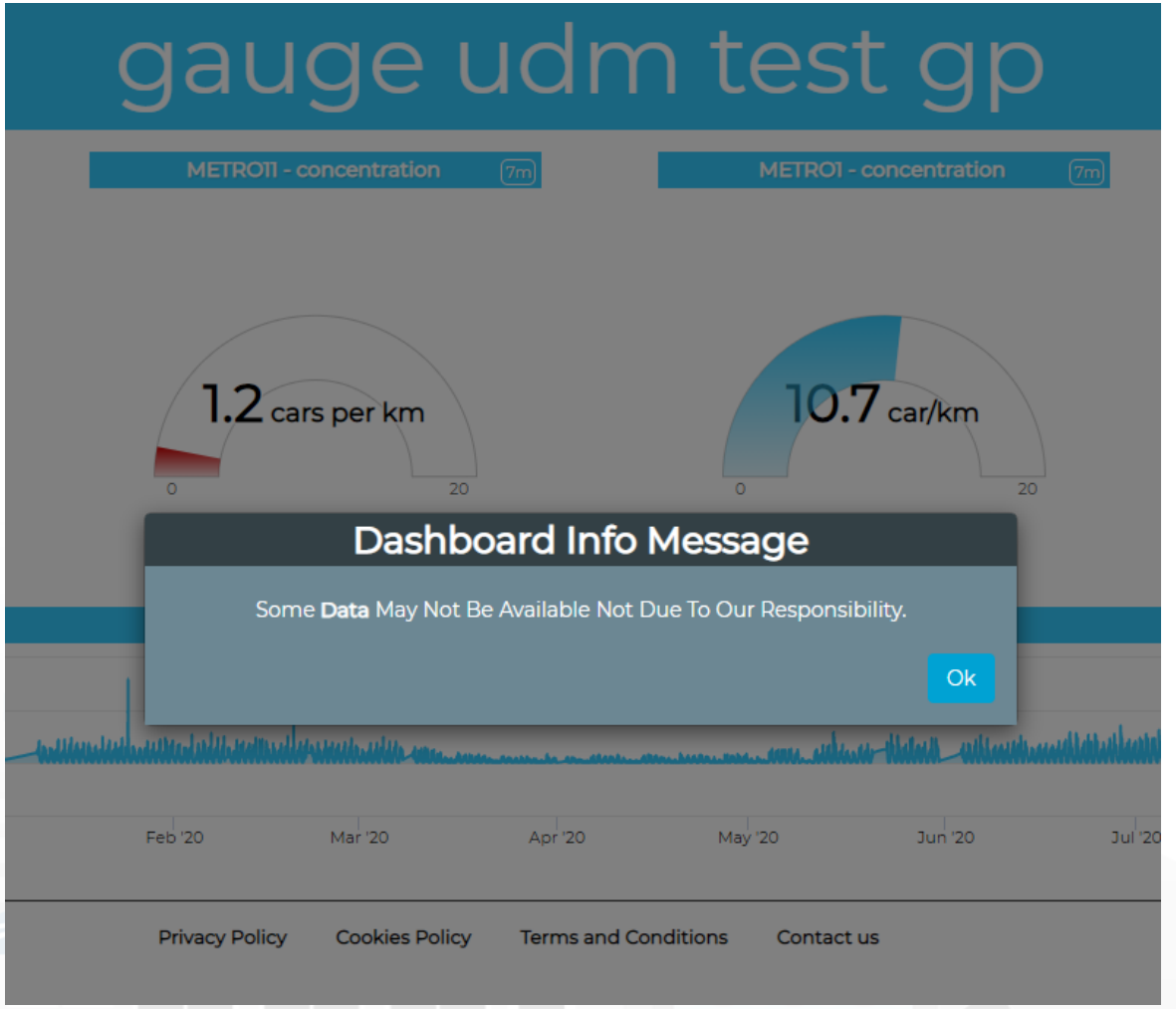
Alerting and events evidence on Dashboards

- Pop Up **Alarming** at the opening of the Dashboard, exploiting API and MicroService call when you need
- **Calling on the private Chat Room** of the dashboard.
- **Alerting via IOT Apps**, which may assess the firing conditions on the data and on the values/actions performed on Dashboards
  - Sending alerts via several channels
  - Blinking on Single Content Widgets, or on SVG Alarm of any shape
- Connection with **Ticketing System, Incident Management**
- Connection with **Notificator** (only for on premise)
  - Defining thresholds and blinking on Dashboard Widgets
- …etc..

Dashboard Pop Up
Alerting when needed

Dashboard Info/alarm Message

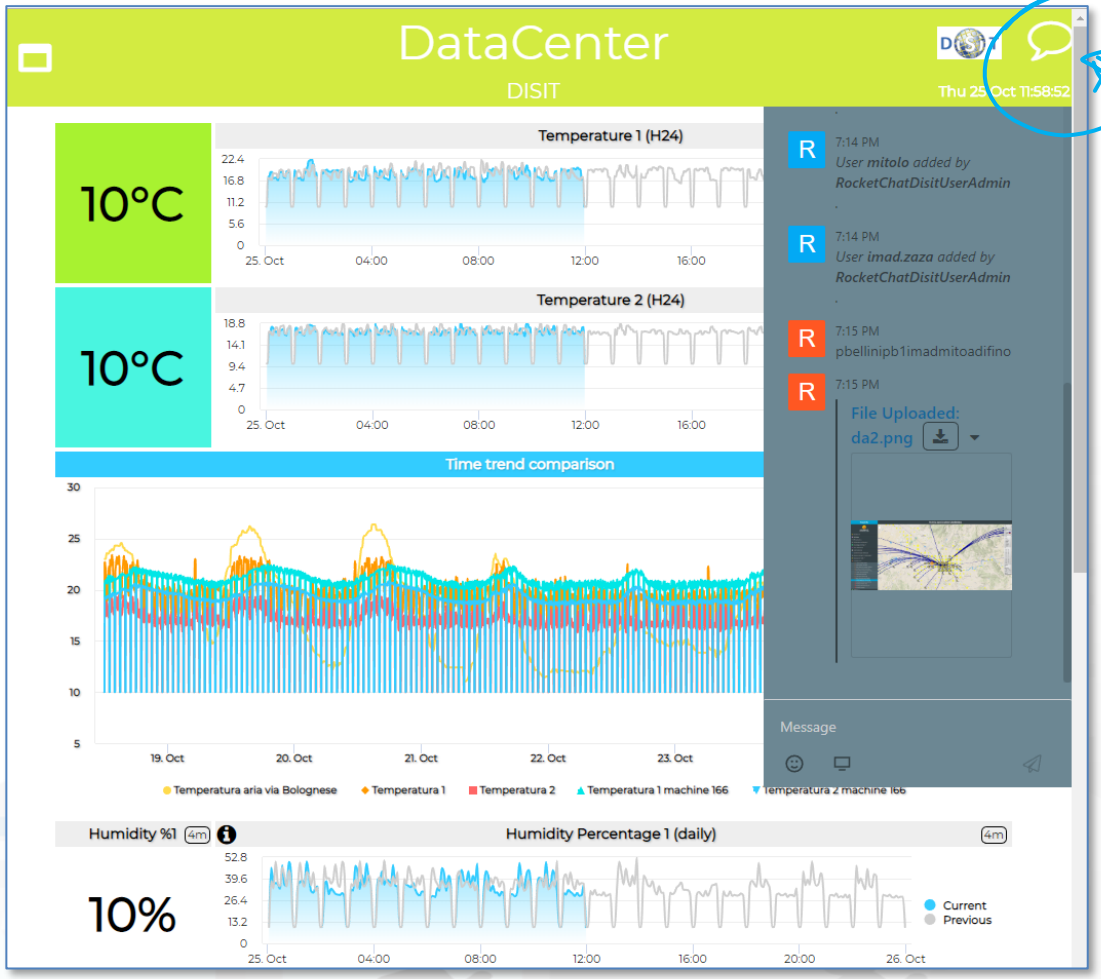
- Each Dashboard may have a custom IOT APP to control the data and the general services via APIs.
- The IOT App logic can Turn on/off the **Info Message** and customize its HTML text dynamically on the basis of the problem detected.



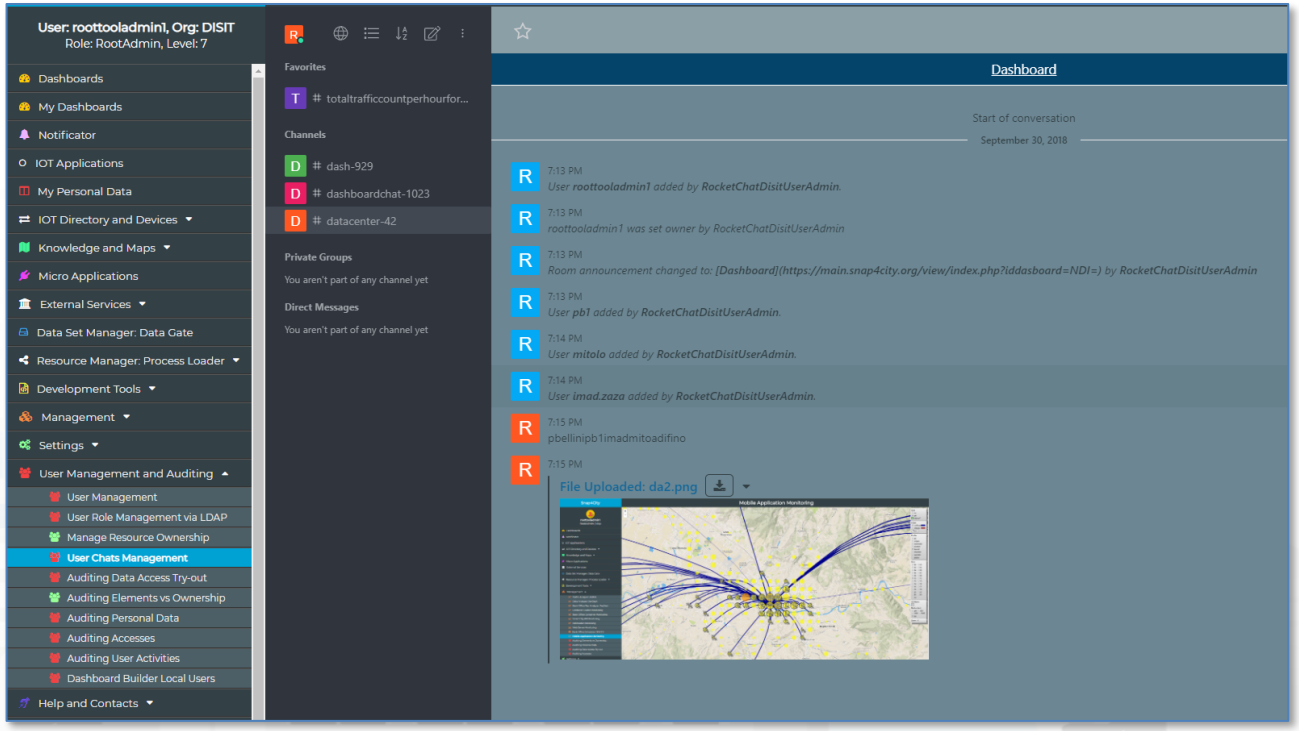
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjg5Nw==

Private Dashboard ChatRoom

Private ChatRoom per Dashboard



Chat Management



Chat Rooms

- **Activated** by the Dashboard creator which can invite a number of users of the platform to
  - Exchange Comments and Pictures
  - access on web and mobile
  - provoke notifications
- Accessible only under authentication
- The administrator can access to the log for review and log of the discussions.
- Chat Room capability is available as an additional appliance

Dashboard Chat Rooms

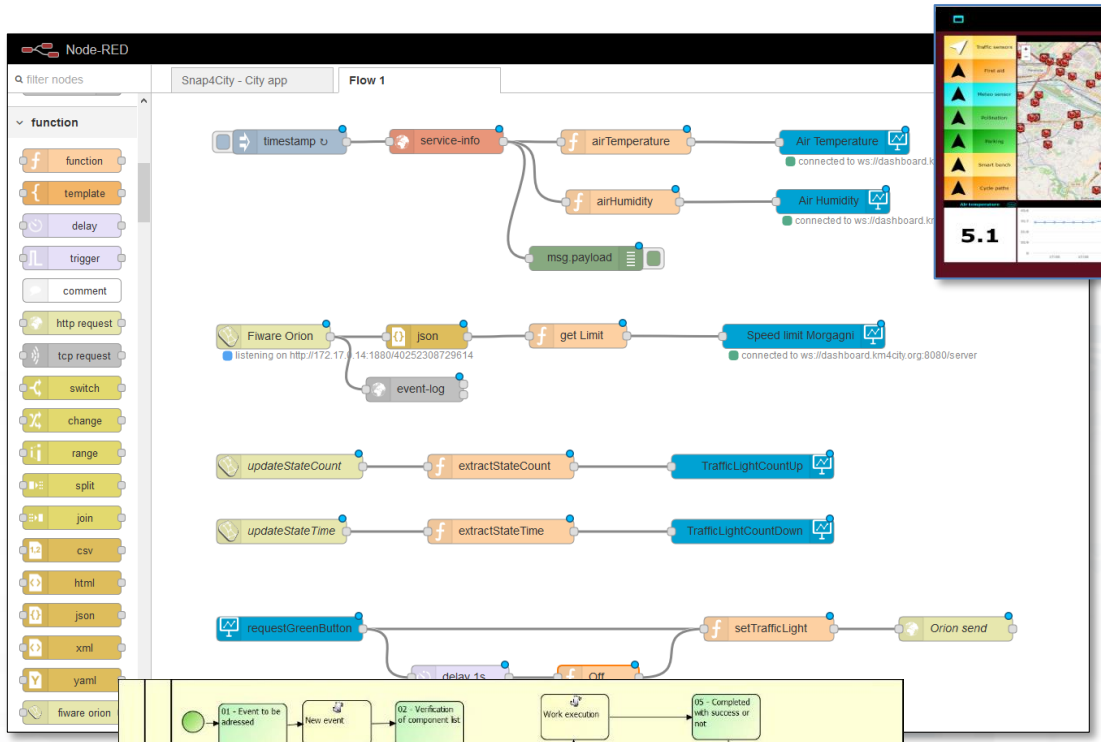
- Each Dashboard may have only **one separate ChatRoom**
- The Dashboard Owner can
  - Activate the Chat Room on Dashboard header in Edit
  - Add users of the platform to the chat room
- The **Chat** Room
  - Allows to Exchange Comments and Pictures
  - Can be Accessed on web and mobile
  - May Provoke notifications on the header of the Dashboard
  - Is accessible only under authentication
- The Administrators can access to the Log for review of the discussions

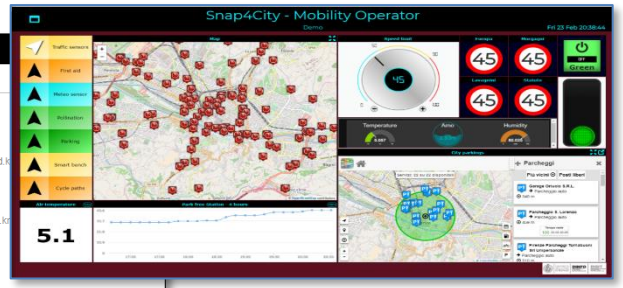
Notifications from Dashboard and from any Data Condition

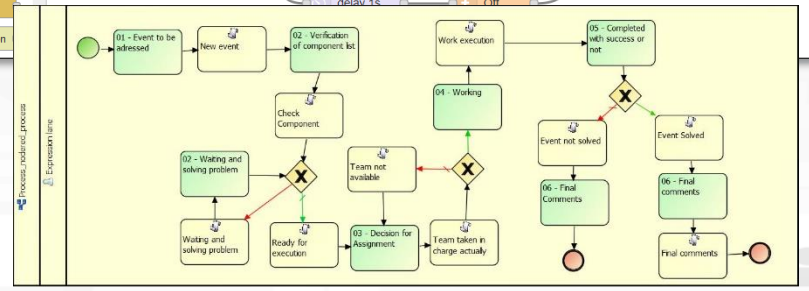
Smart City Monitoring: notifications, alerting

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.



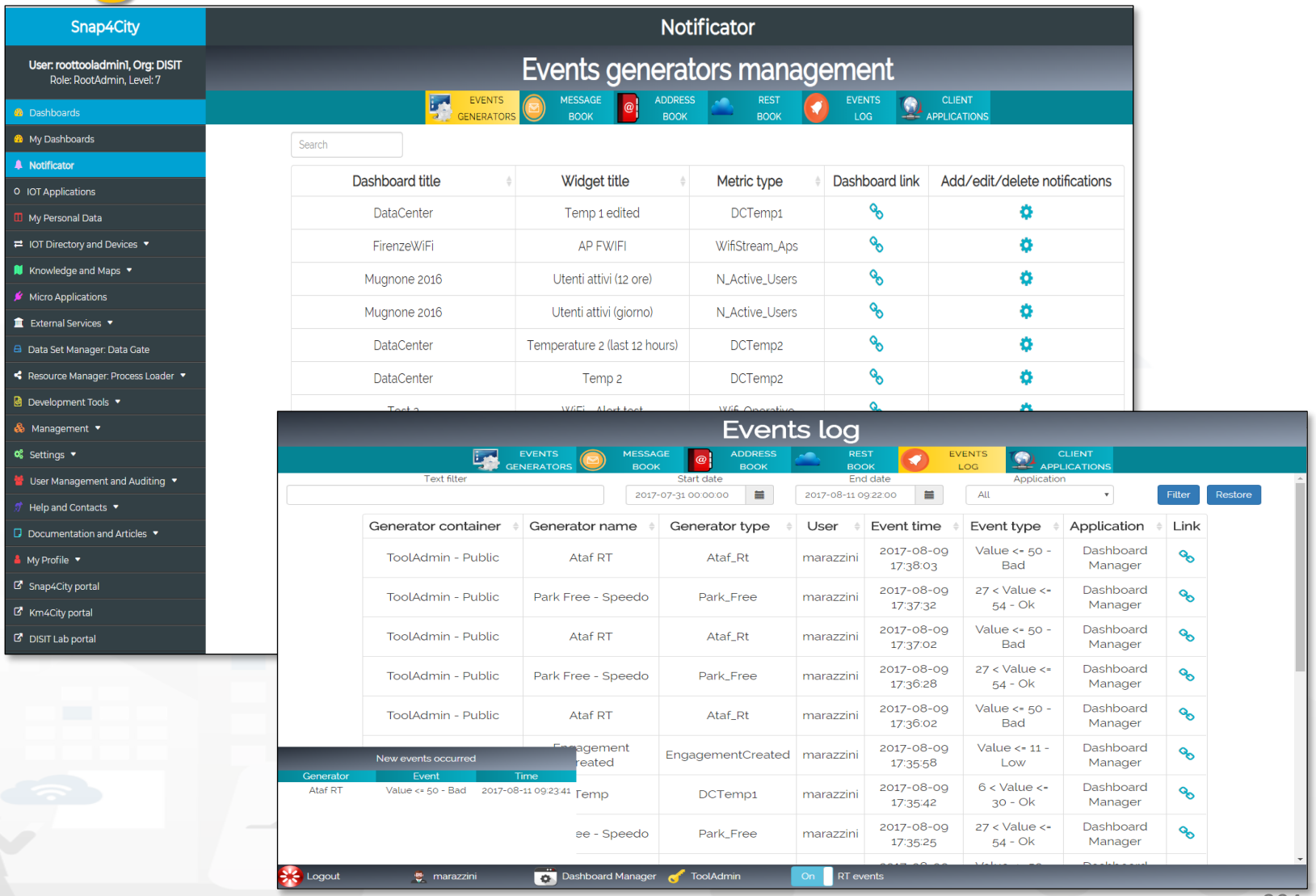




facebook

Smart City Monitoring: Notificator

- **Each single metrics and Widget may activate a notification on Notificator**
- **Notificator** tool is attached to Dashboard Builder and it is available on Premise and for high roles
- **Blinking** on Dashboards

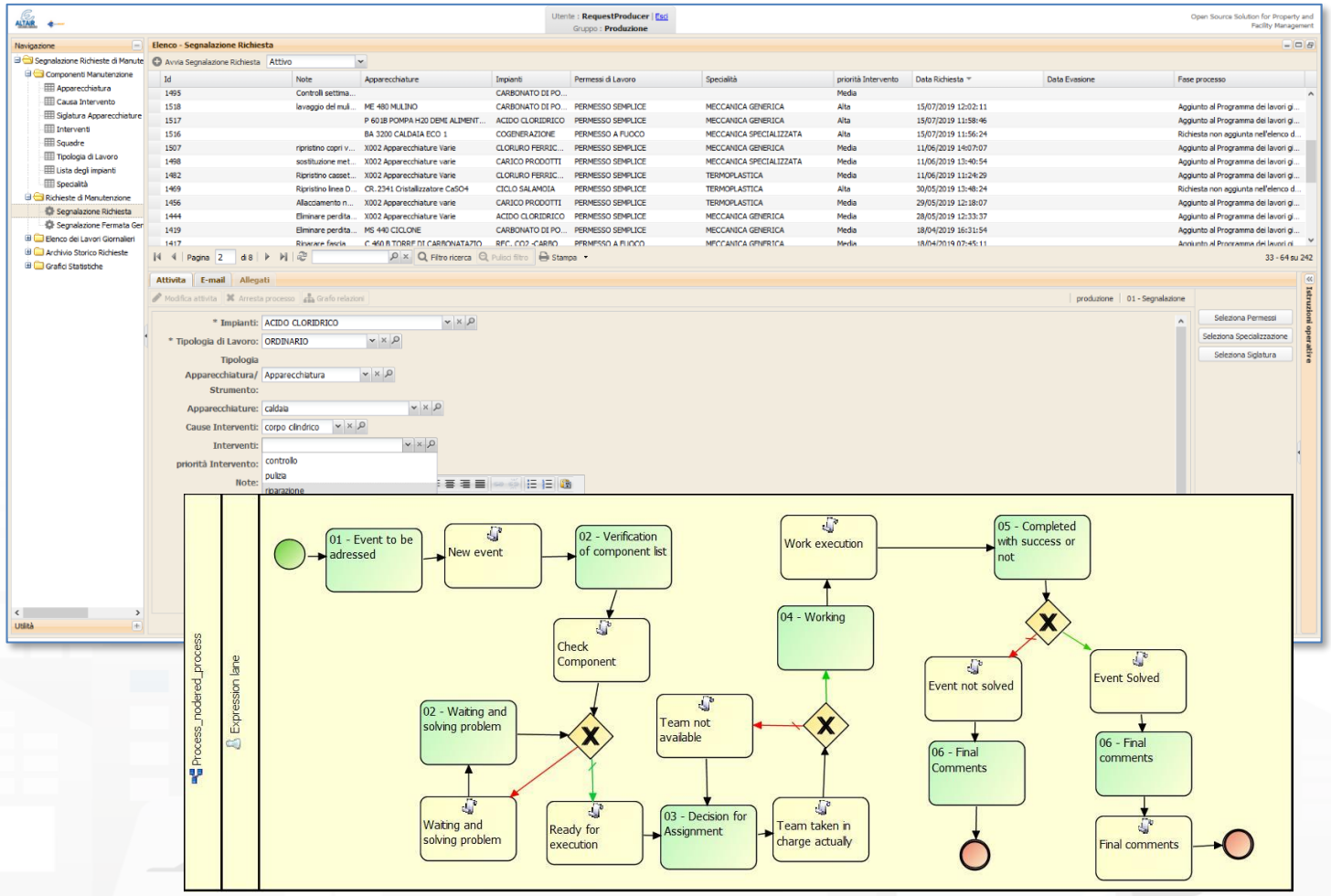


Integration with Ticketing Systems Workflows, Incident Management

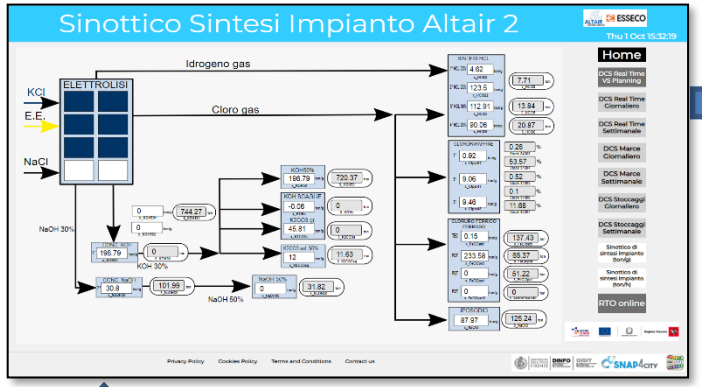
Integration with Ticketing Systems Workflow

- **Snap4City is integrated with OpenMaint Ticketing system. An Open Source solution for ticketing and workflow management, incident management.**

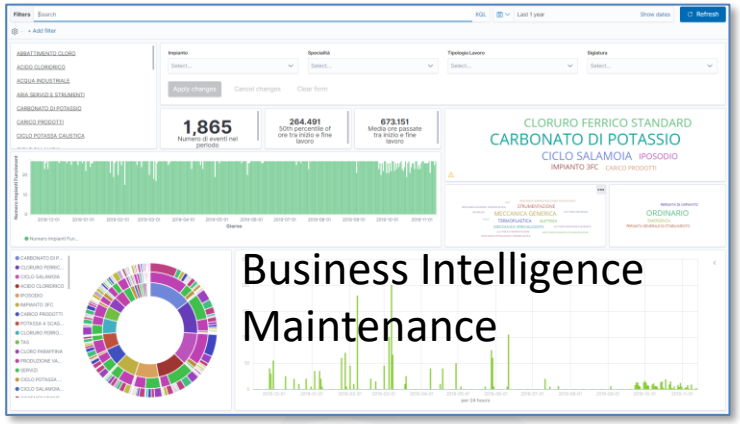
- Any ticketing systems can be integrated with Snap4City, by means of IOT Applications and Dashboards
- https://www.snap4city.org/597



Example of Integrated workflow

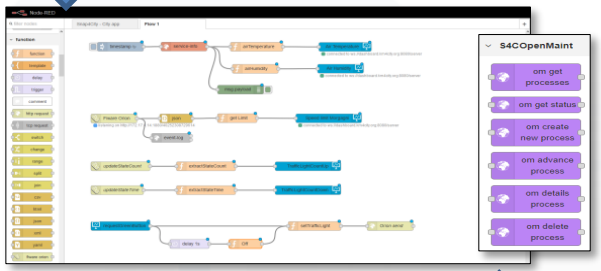


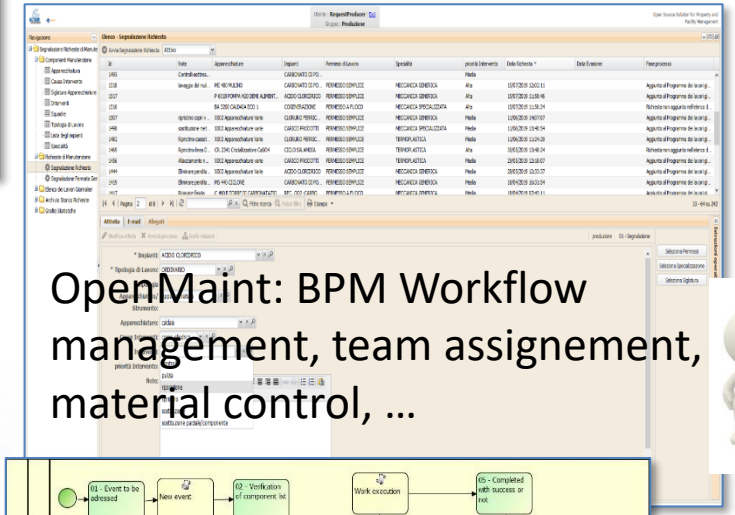
Consumptions/productions



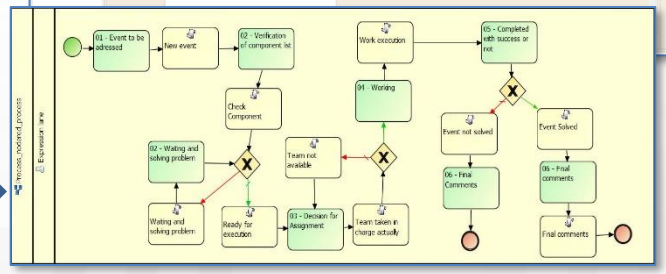
Events/actions

Dashboards and actions

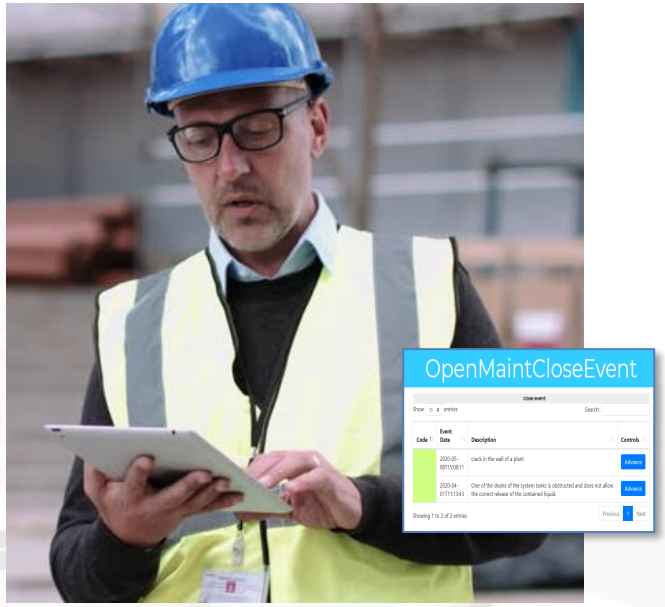




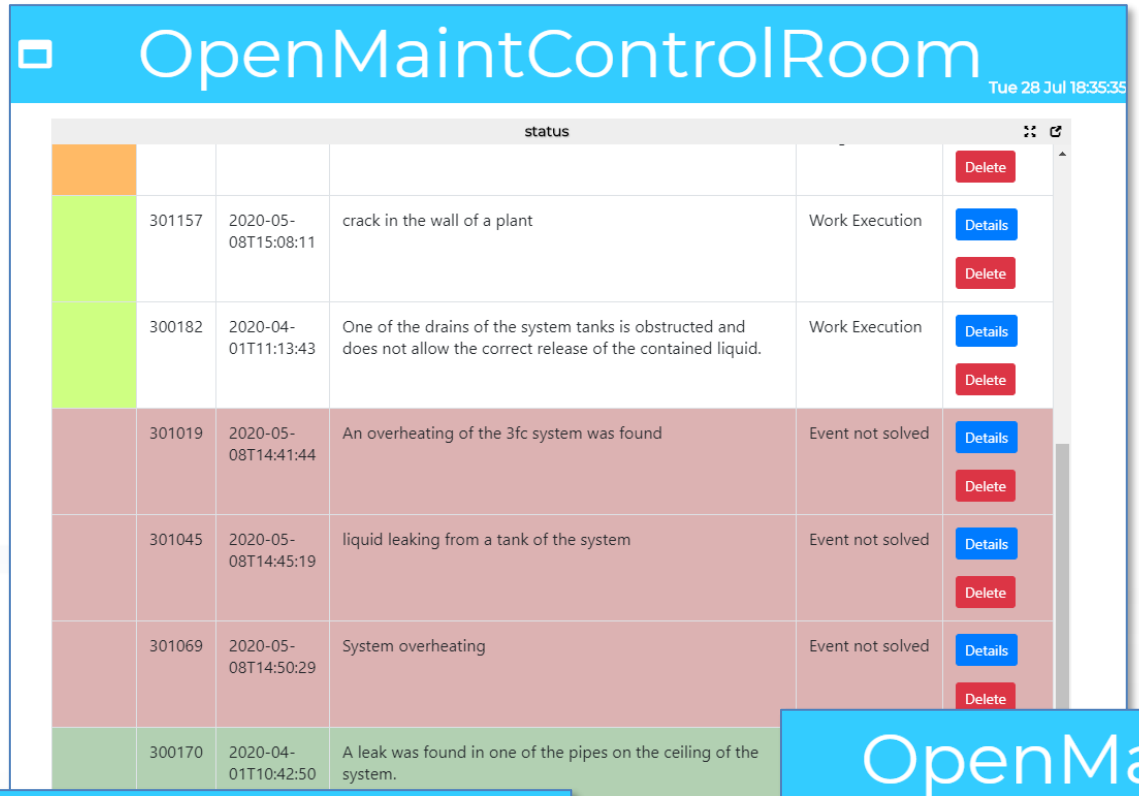
OpenMaint: BPM Workflow management, team assignement, material control, …

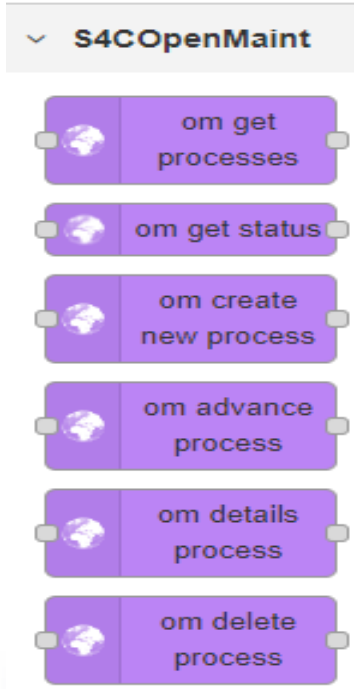


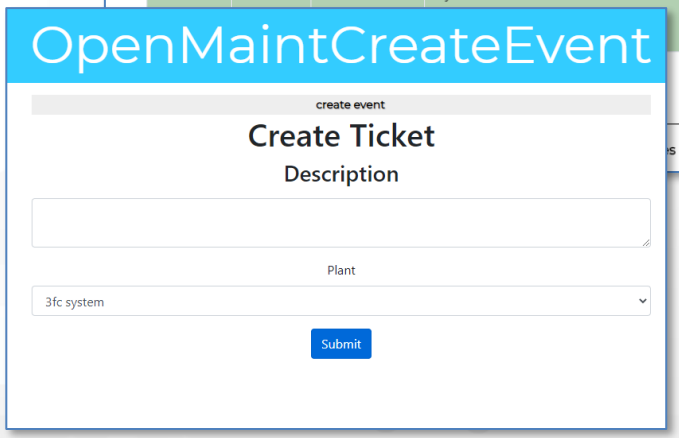
IOT App, Data event firing, event detection and firing Critical event management

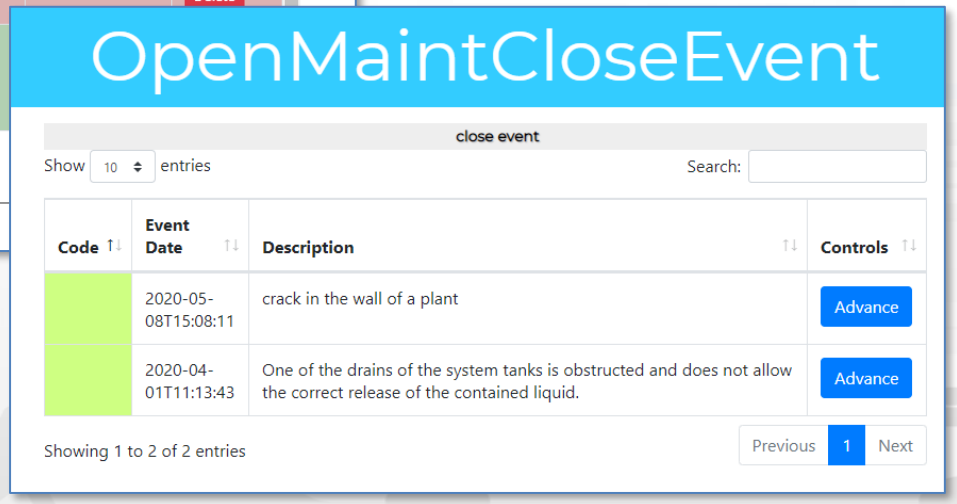


Dashboards









- **Snap4City can**
  - Create new tickets
  - Manage steps, workflow
  - Collecting feedbacks and results from teams
  - Manage all phases of the workflow on the fields via IOT Apps and logics
  - The integration if via API and MicroServices into IOT App.

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

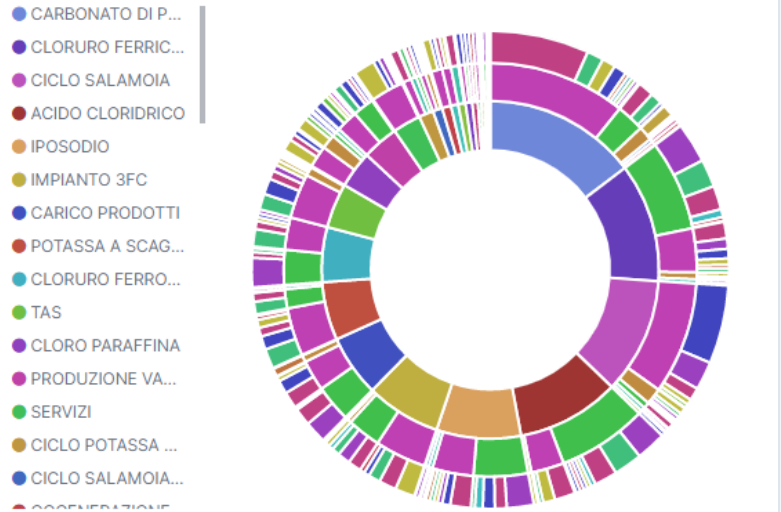
1,865
Numero di eventi nel periodo

264.491
50th percentile of ore tra inizio e fine lavoro

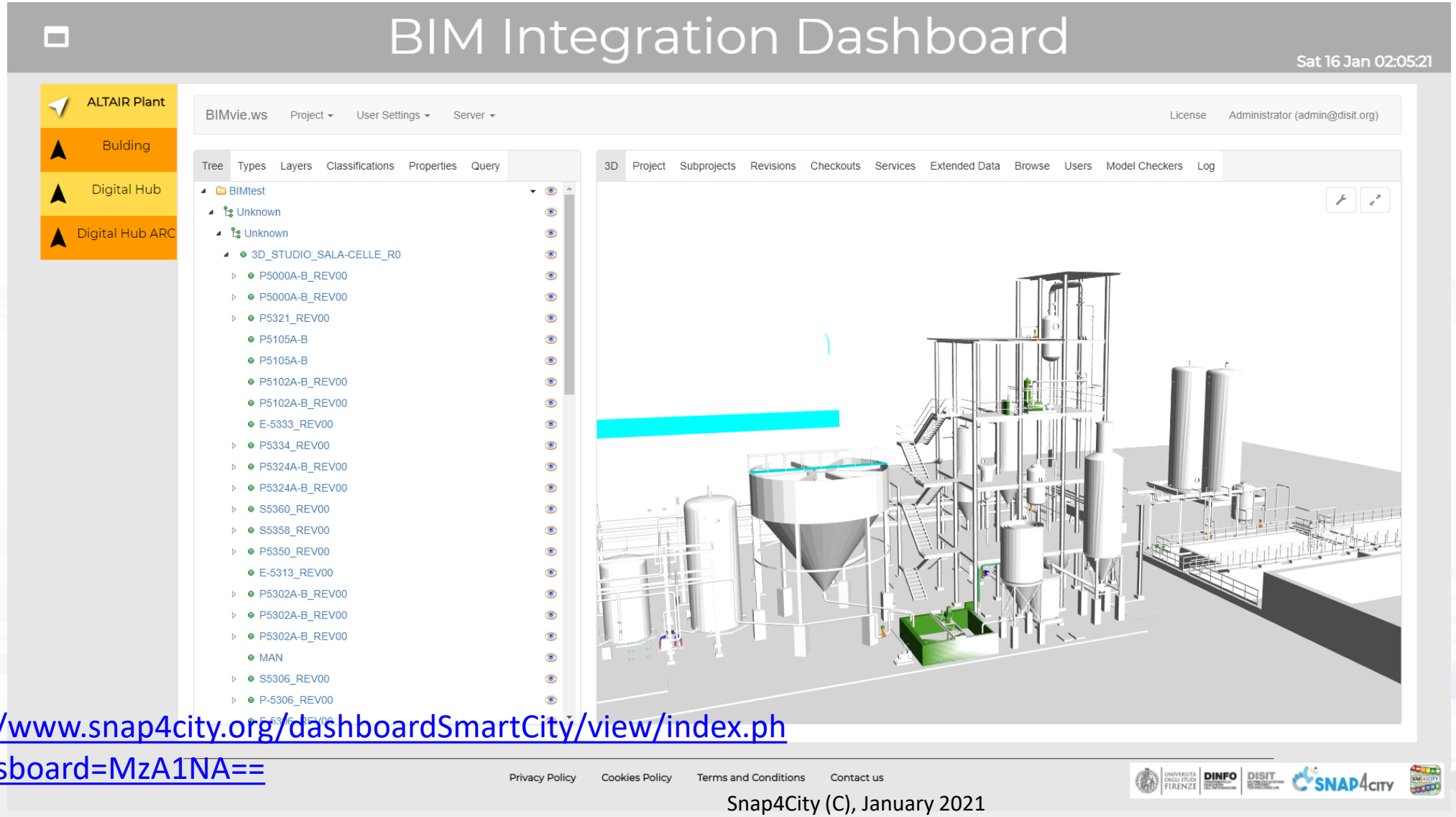
673.151
Media ore passate tra inizio e fine lavoro

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

Maintenance Intelligence



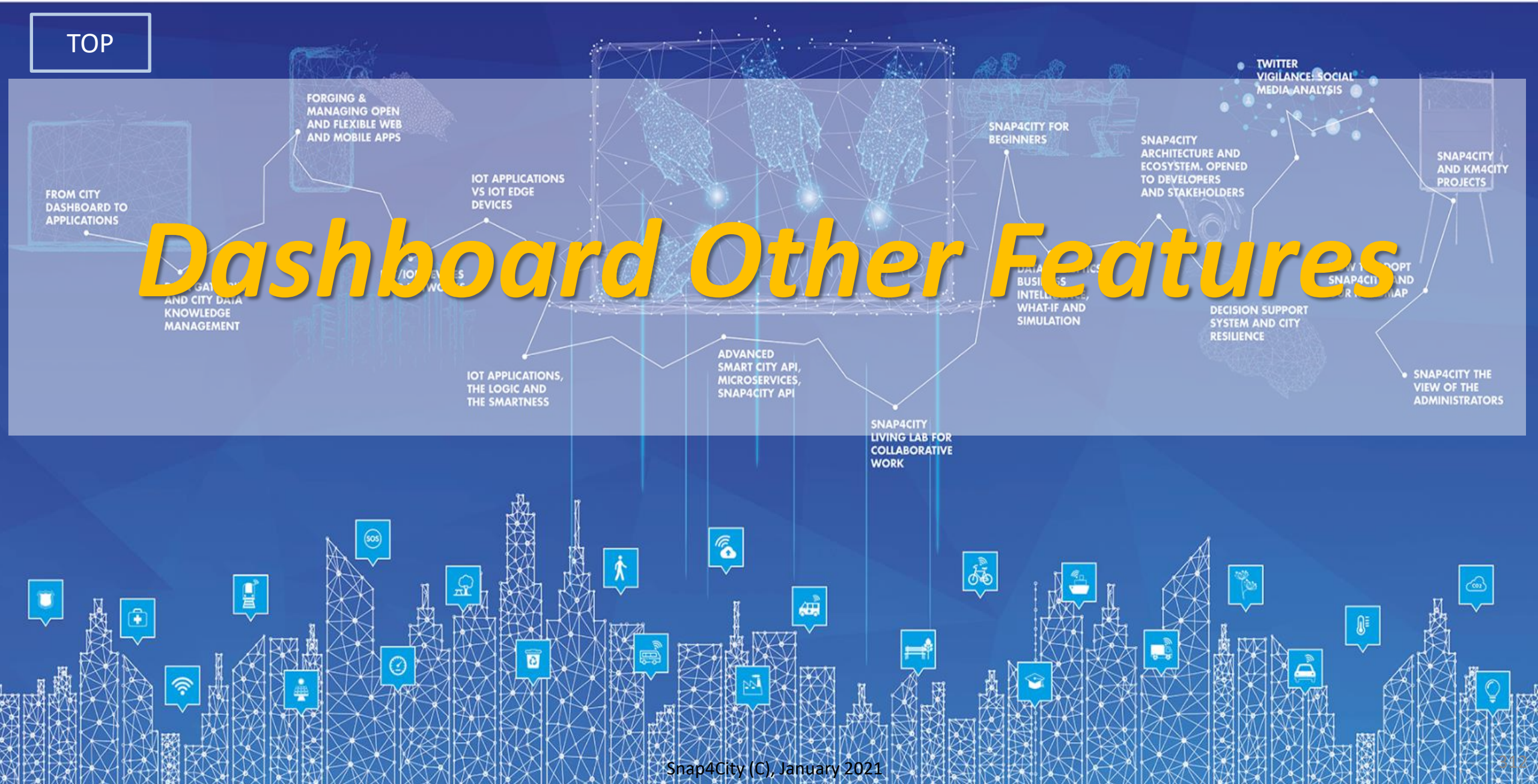
BIM view of the Altair Chemical Plant



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzA1NA==

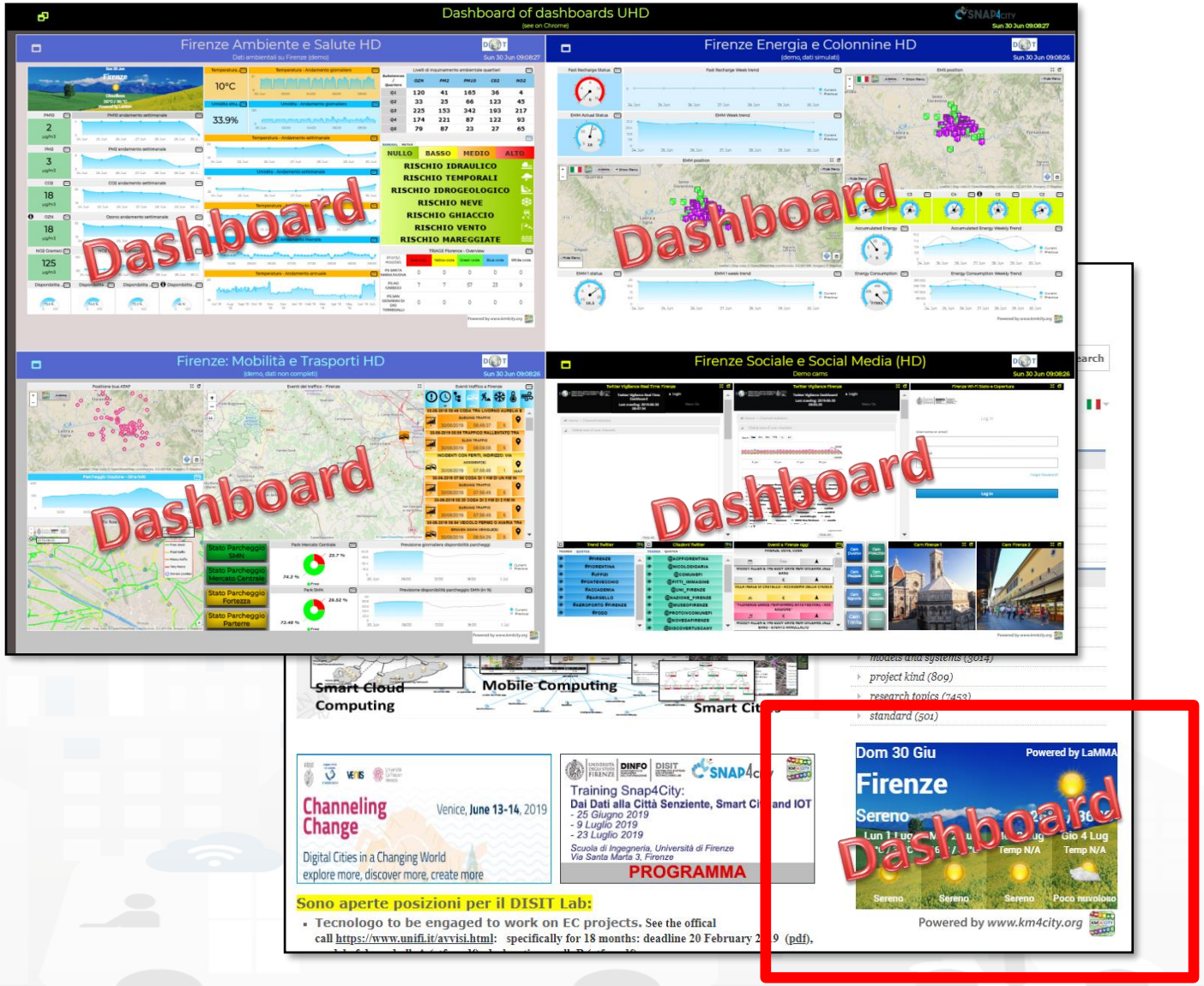
TOP

Dashboard Other Features



Additional Properties from Edit Dashboard

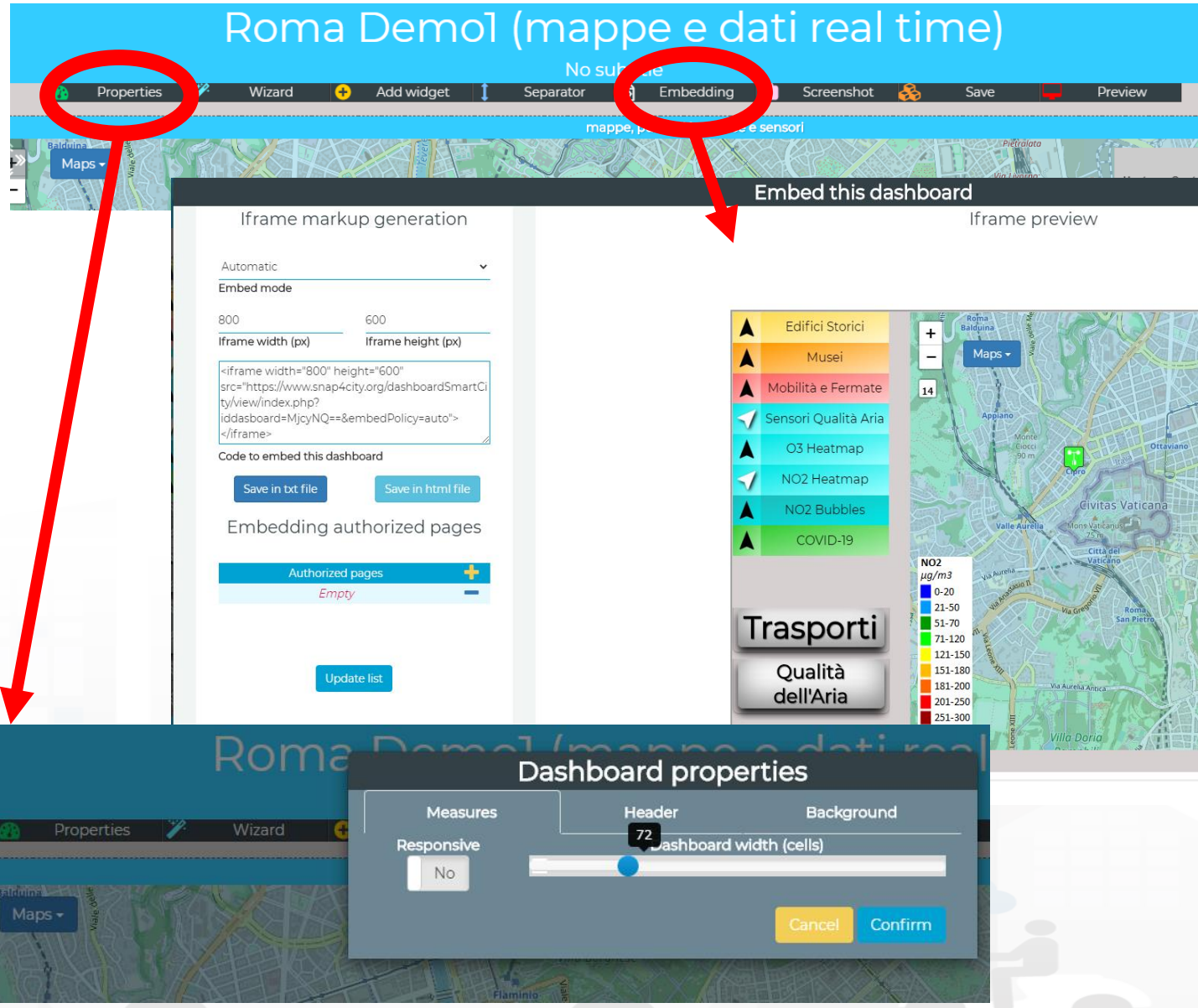
- **Embedding Dashboards into**
  - a Dashboard
  - third Party Web Page
- **Header** or not
- **Footer** or not
- **Responsive** or not
- **Size**: any
- **Background** Image: any
- Add / change Screenshot (**Thumbnails**)
- **Menu** on left upper corner or not



Dashboard Embedding into third party Web Sites/pages

Dashboard Embedding

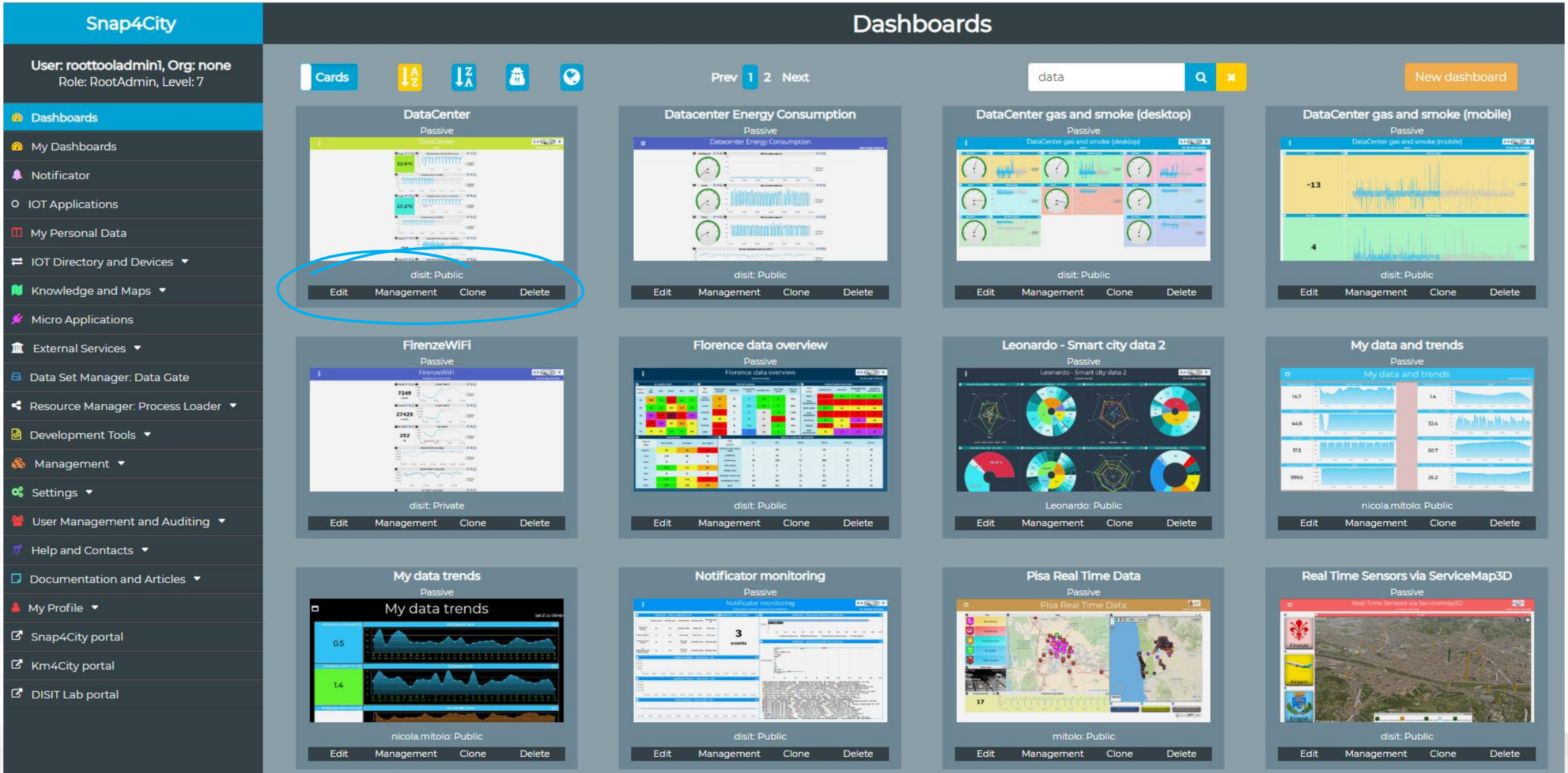
- go in Dashboard Edit
  - Get code for embedding
  - Providing domain on which you embed
  - See Iframe preview
- **Dashboard properties**
  - we suggest set Responsive
  - deciding on header On Off
  - Adjust size of Iframe and dashboard for tuning



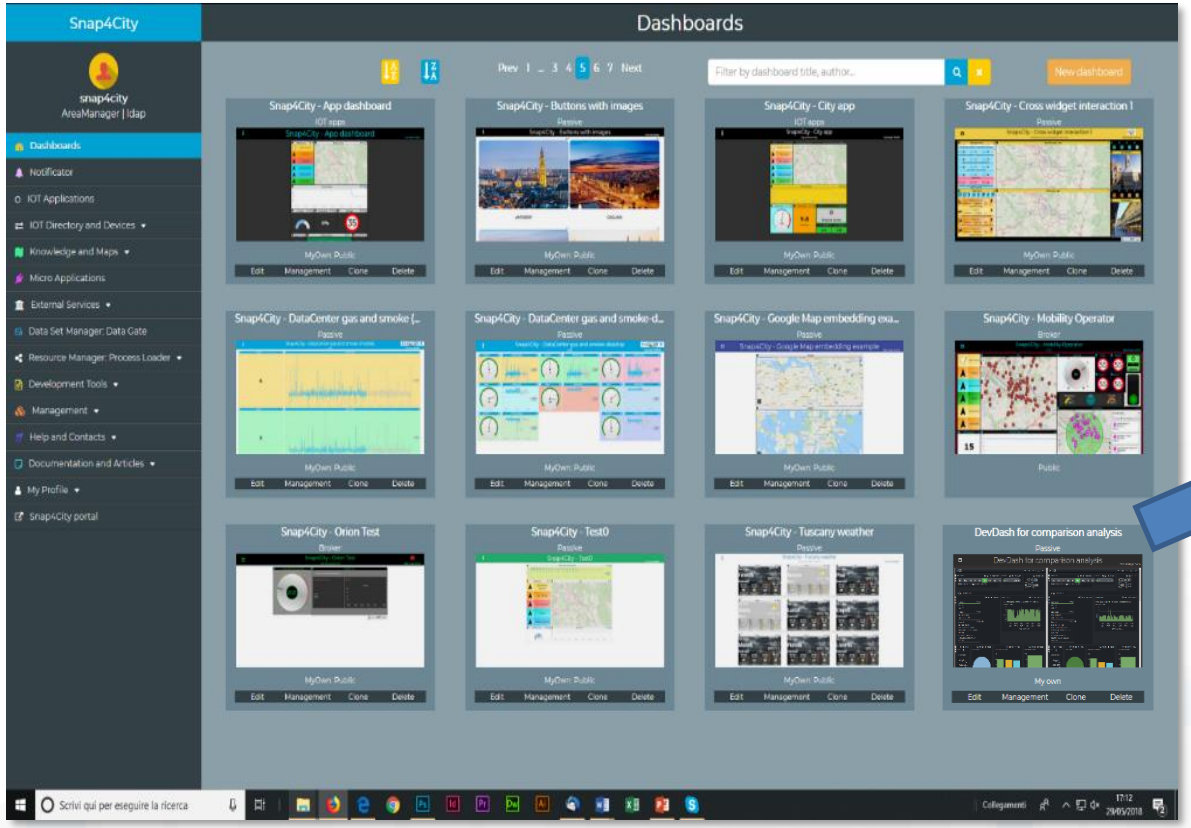
TOP

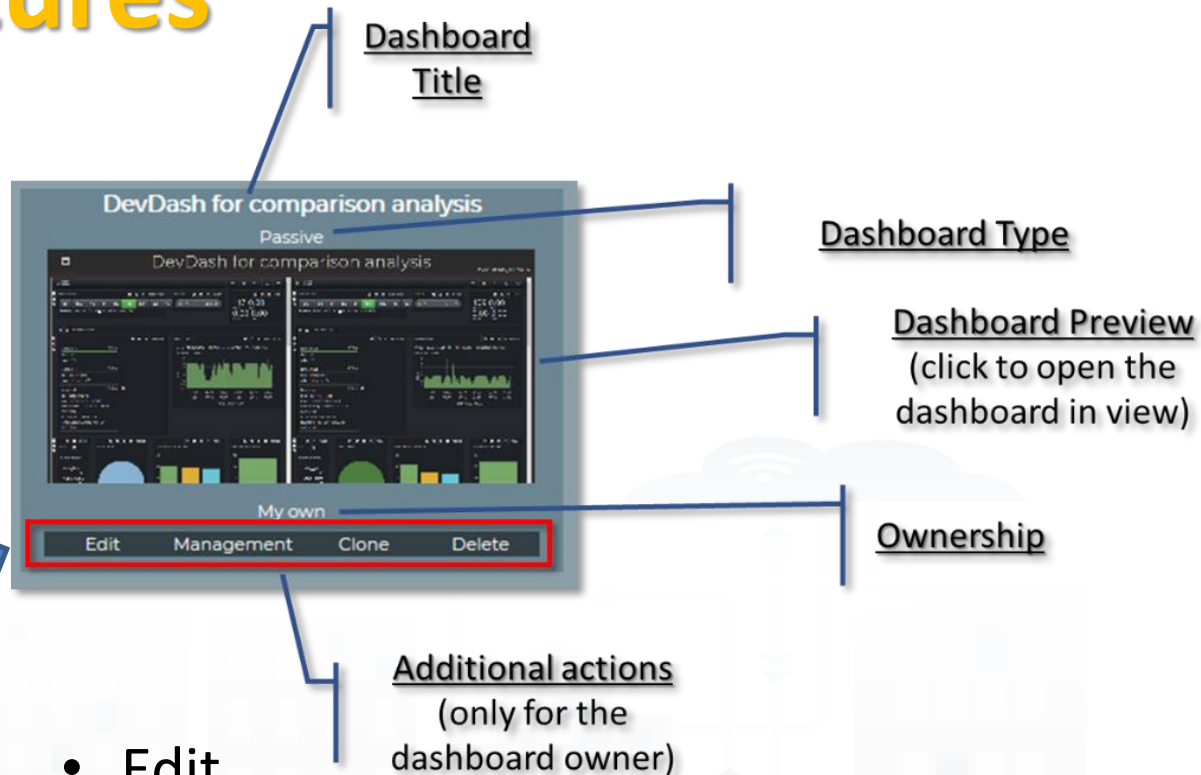
Dashboards Listing, Managing, Sharing, Delegation

Dashboard List and Editor



Dashboard Listing and Features

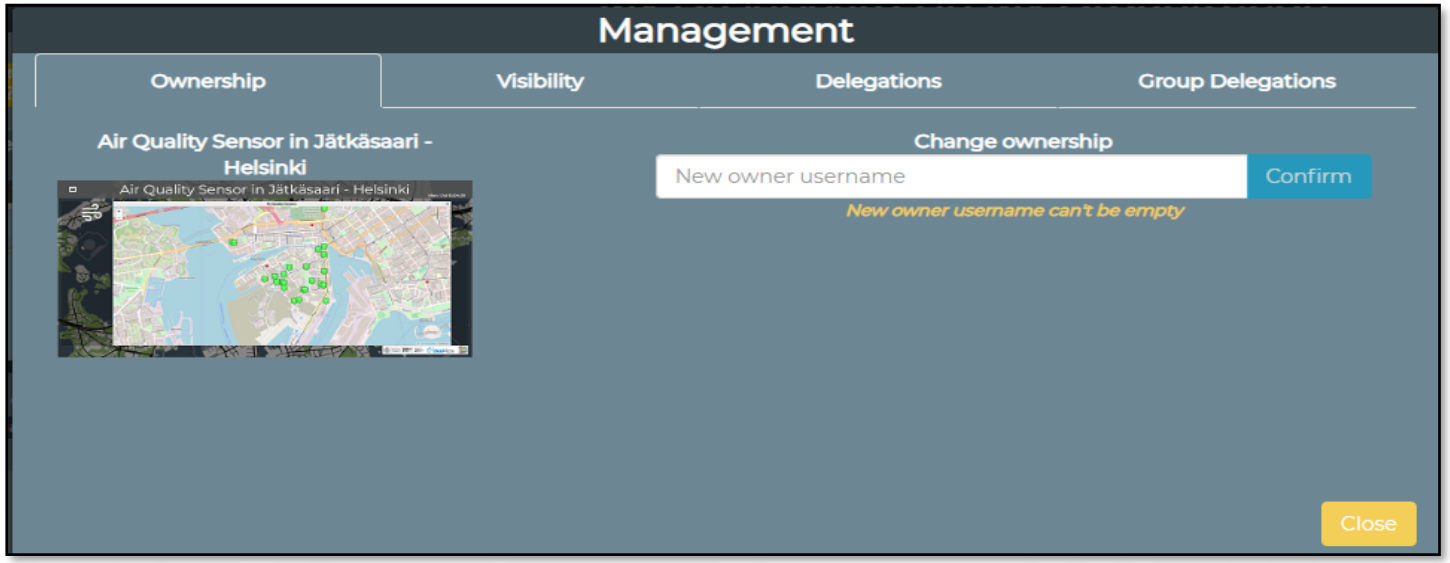




- Edit
- Management
- Clone
- Delete
- (add Thumbnail is inside Edit)

Dashboard Management

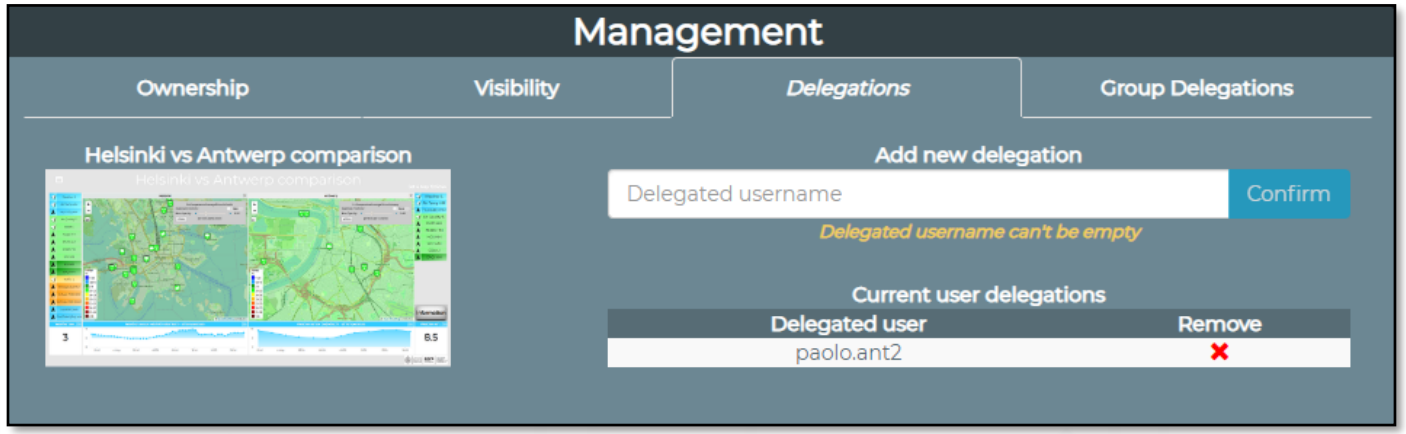
- Change Ownership
  - Towards any user
  - Knowing the nikname



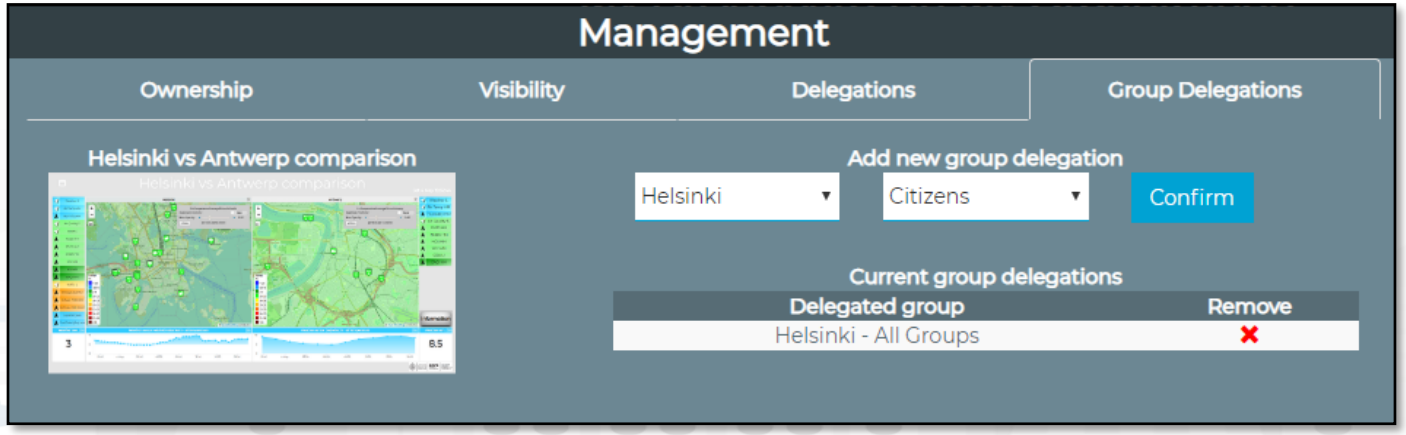
- Visibility
  - Public or Private

Dashboard Management

- Delegation access to other users

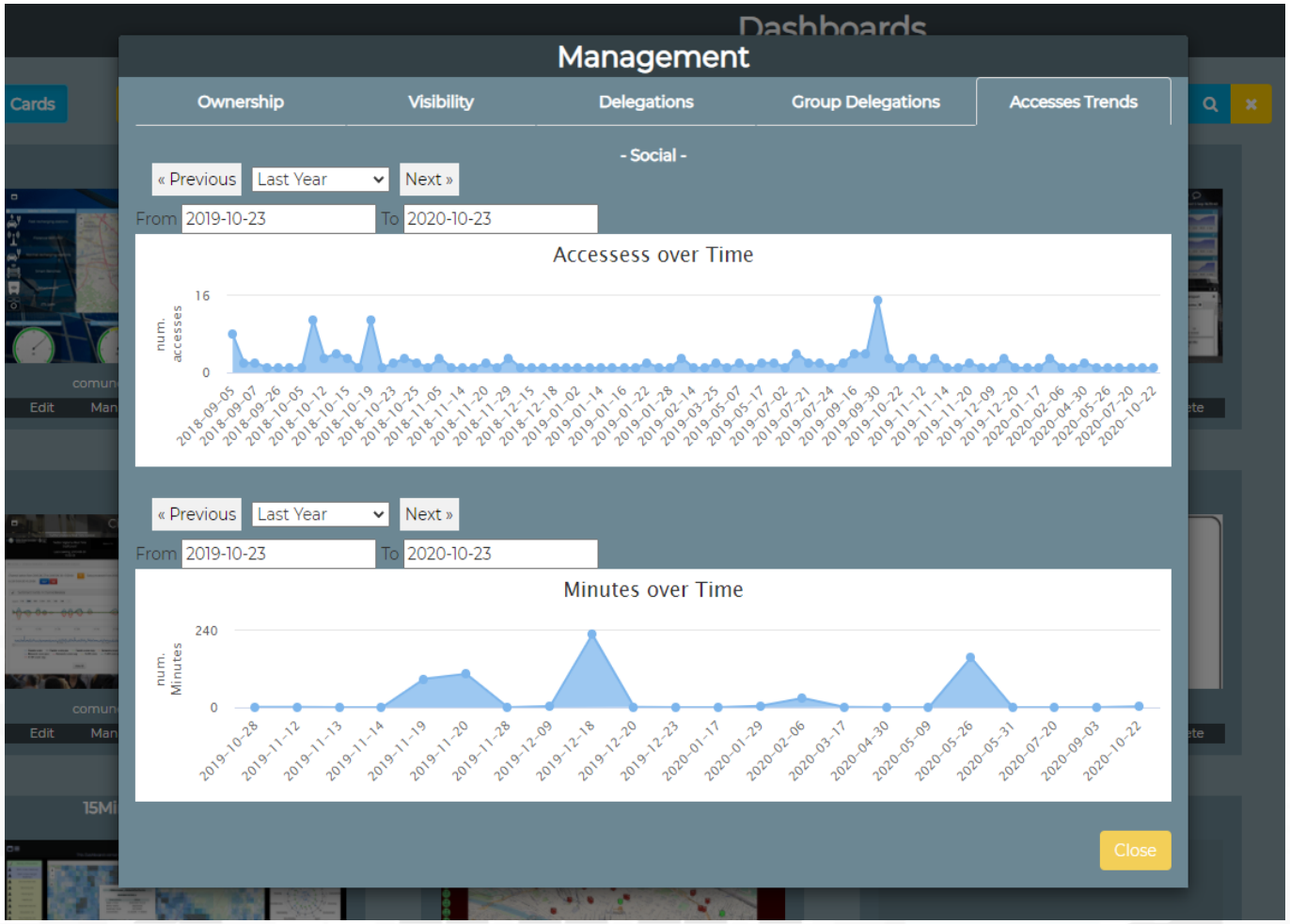


- Delegation Access to other Groups [Higher roles cross Organization]

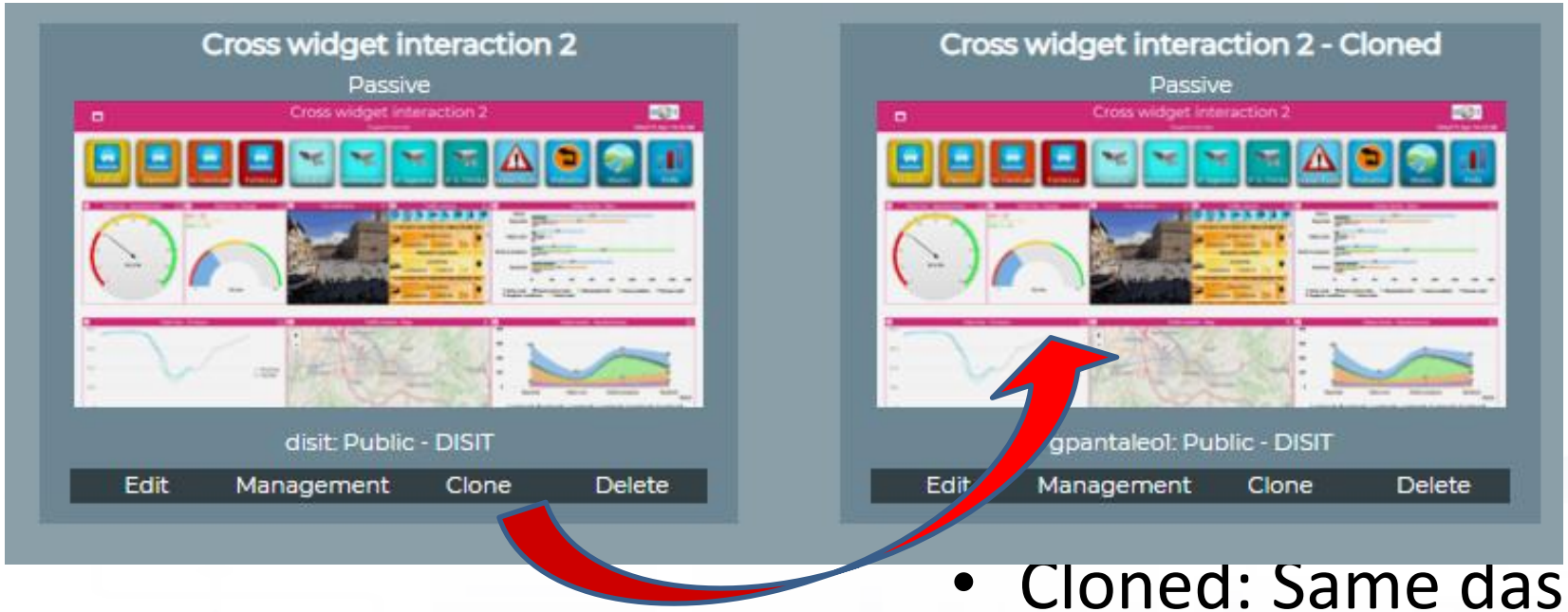


Monitoring Dashboard Usage

- **Key Performance Indicators**
  - Number of Accesses
  - Minutes of exposition
- **Time Periods:**
  - Day by Day
  - Week by Week
  - Month by Month
  - 6 months by 6 months
  - Year by Year



Clone Dashboard



- Cloned: Same dash with title having «- Cloned» at the end
  - You can: Clone, change name, pass to your colleague, edit, etc.
- Be carefull that exploited resources are not cloned

TOP

Data Type Management GDPR Compliant

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**

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

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**)

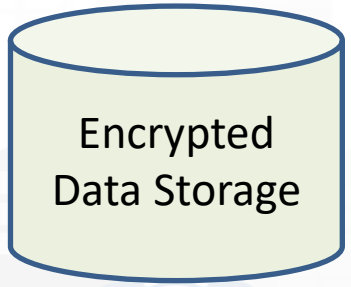
GDPR: General Data Protection Regulation

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

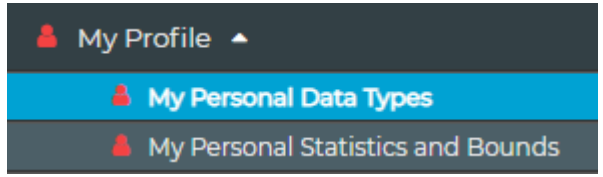
– the data are **released anonymously**,
→ also in this case they can be **revoked at any time**:

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

– **Performs Secure connections** in any private data exchange
– **Encrypts** data store for all private data
– **Decouples** data and personal IDs
– **Audits** private data usage



GDPR Compliant



My Personal Data Types

View | Edit | Track | Access control | Convert

This page allows you to access at your Data Types, which are your personal data that we c
most cases, a specific tool and view is provided to manage them.

- My profile data and Blogs
  - to manage your user profile data (name, email,): view, edit, delete
- My Personal Statistics and Bounds: daily or Monthly
  - to access at your statistics about the data access and volume of resources use
    that may depend on the Organization at which one belong and on the role in
- My Personal Data, My KPI and My POI
  - to manage your personal MyKPI, MyPOI and trajectories, if any: view, edit, dele
- My Personal Engagement
  - to manage your personal engagements recevied on the Mobile Apps, auditing
- My IOT Devices
  - to manage your IOT Devices in which it is possible to: edit, delete, make public
- My IOT Applications
  - to manage your IOT Applications in which it is possible to: delete, restart, char
- My Dashboards
  - to manage your Dashboards in which it is possible to: edit, delete, change owr
- My IOT sensor data service URI (for programmers)
  - to manage the Delegations to access at the ServiceURI of the knowledge base
- My IOT sensor data service GraphID (for programmers)
  - to manage the Delegations to access at the a Graph (data set) of the knowled
- My personal data by IOT App (partially deprecated)
  - to manage your MyPersonal Data, if any: view, edit, delete, delegation in acces
- My Annotation data
  - to manage the Delegation to access at the Annotations: delegation in access,
- Auditing Access to My Data
  - to audit the accesses to MyData

Manage Profile and MyPersonalData

For each Data Type:

- Start as private → making them public (anonymous) and revoke
- The Owner is the only one that can: (1) modify values; (2) change the ownership
- Define/revoke Delegation to Access
- Delete/forget per Data Type and “me all”!
- Auditing

GDPR vs Snap4City

GDPR Compliance Verification Features	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

Details on the paper cited in the following slide

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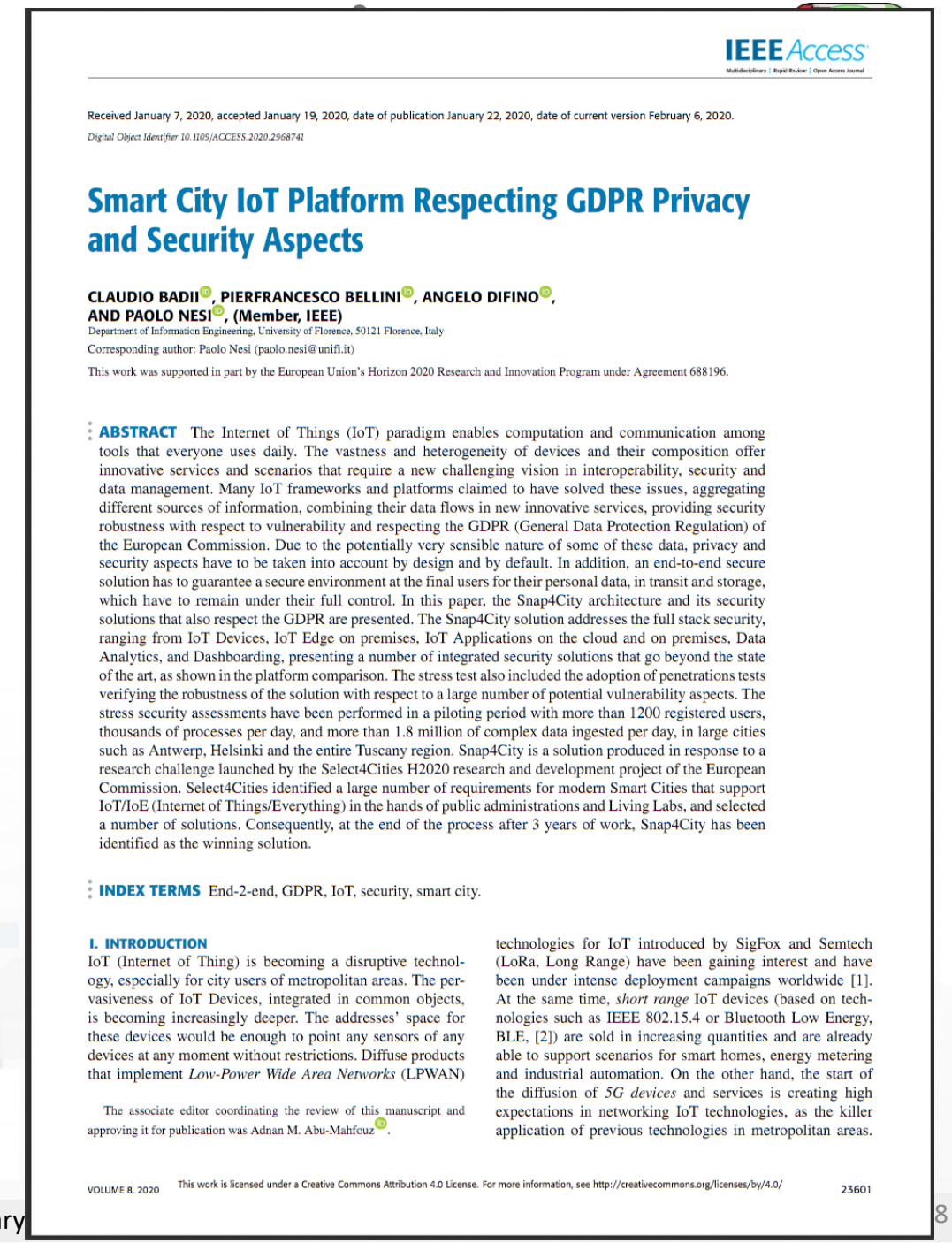
IEEE Access

- 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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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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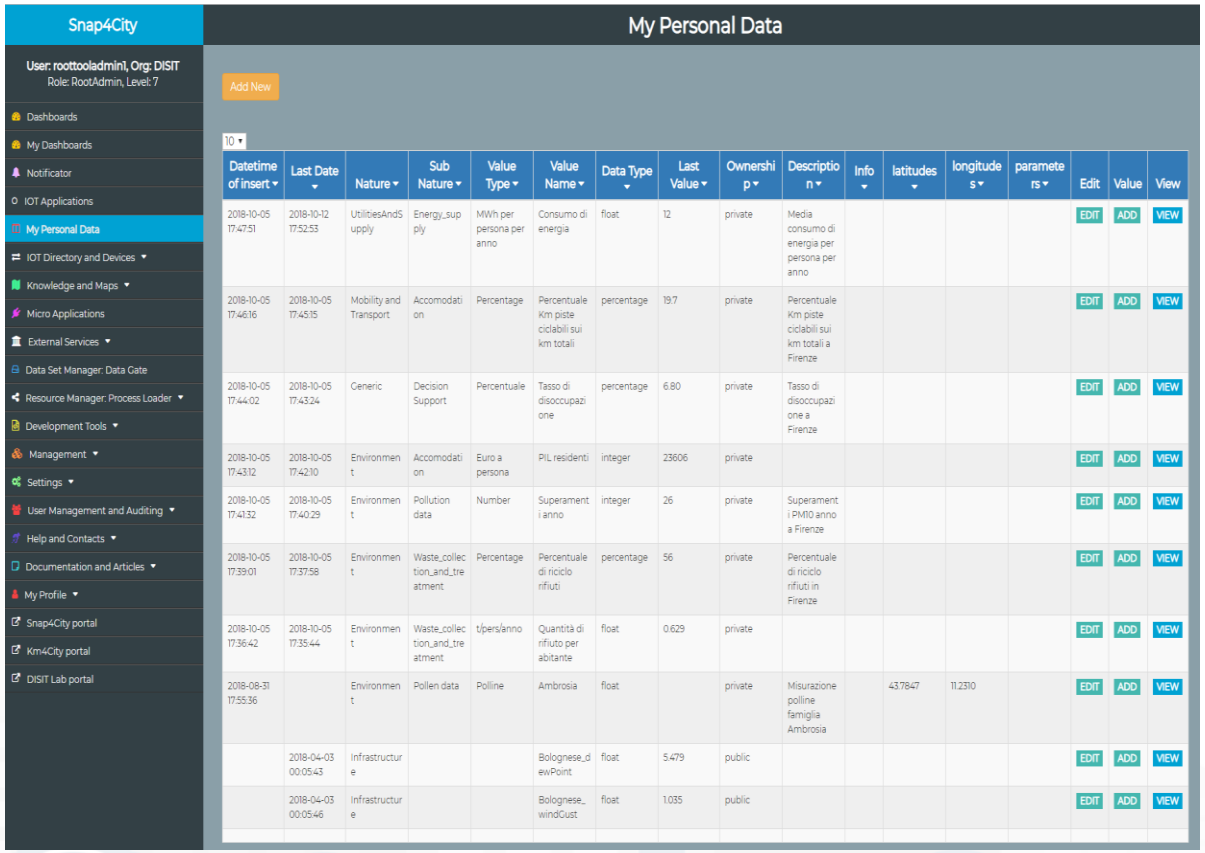
Personal Data Management, GDPR compliant: POI, Data, KPI

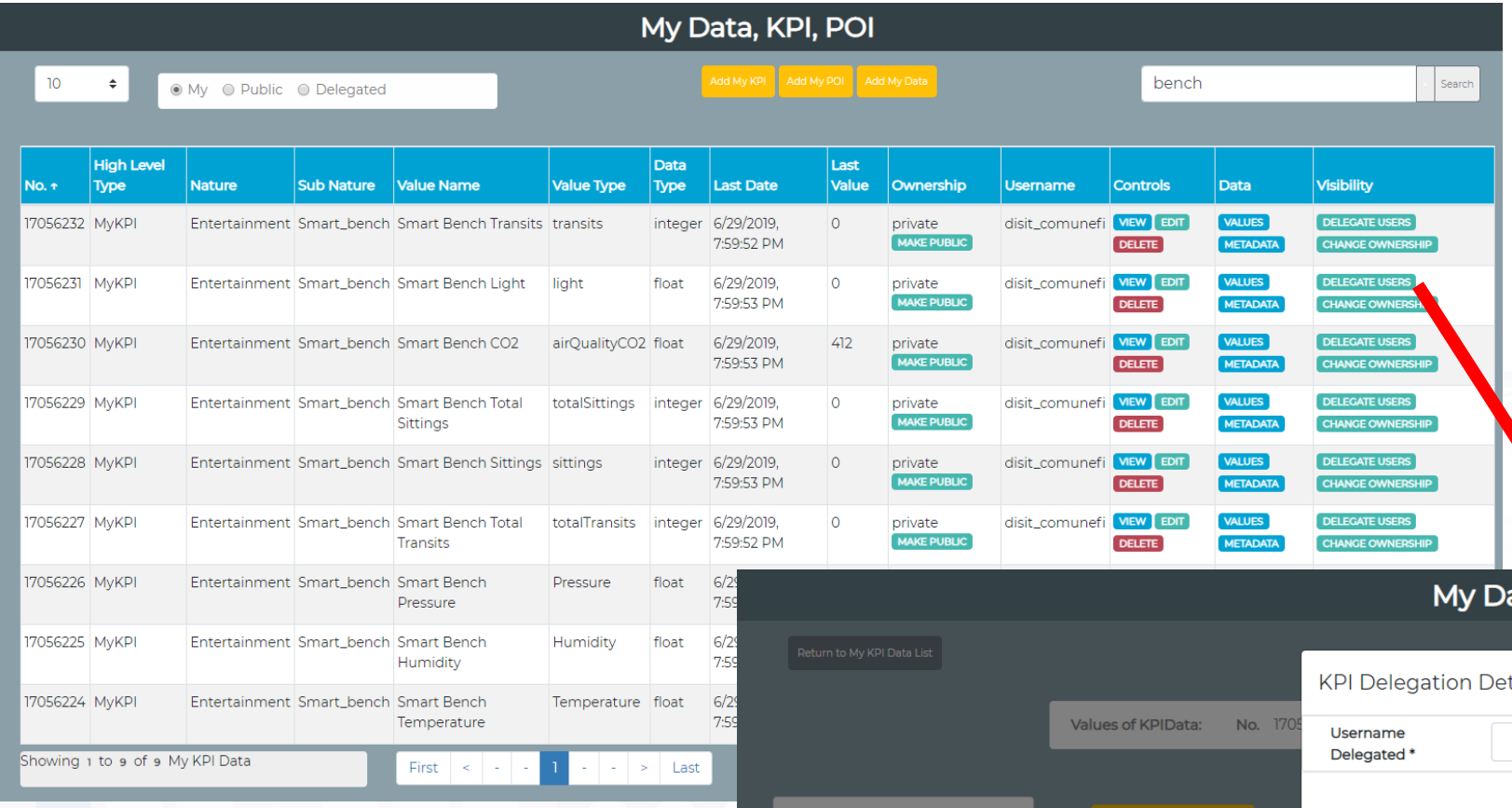
Managing Personal: KPI, Data, POIs

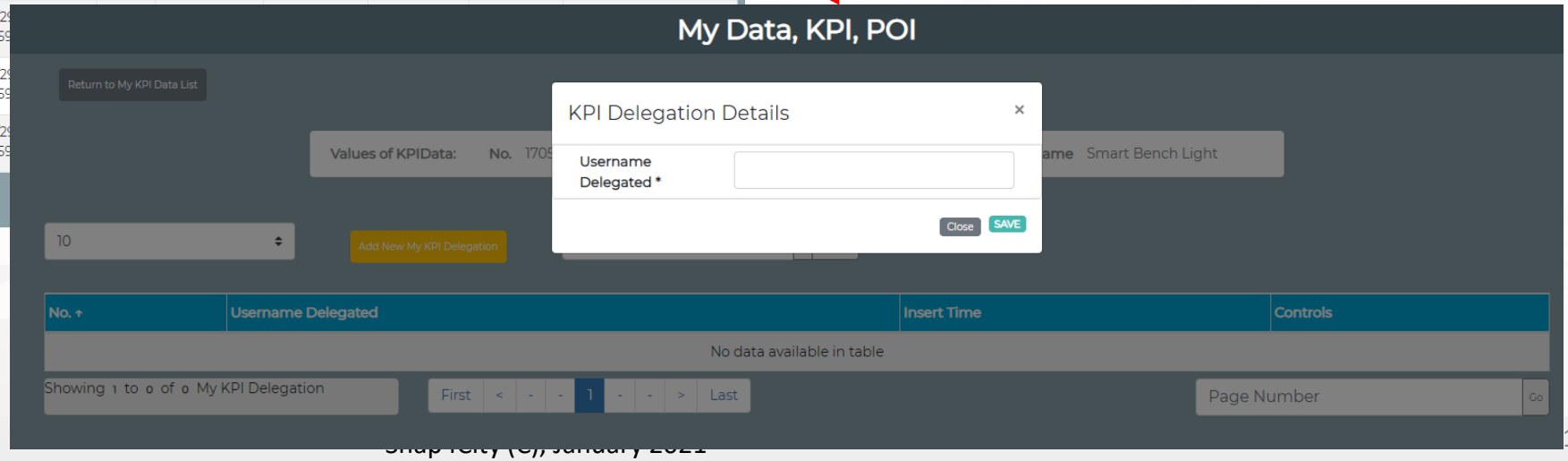
Which can be:

- **Acquired from any source:** SQL, SPARQL, API, etc., ODBC, JDBC, etc.
- **Computed** by means of IOT App, Data Analytics, ETL
- **Stored/retrieved** into personal safe or general storage
- **Edited** from tool, or from IOT App
- **Added** Manually or Automatically
- **Shown via Dashboard**

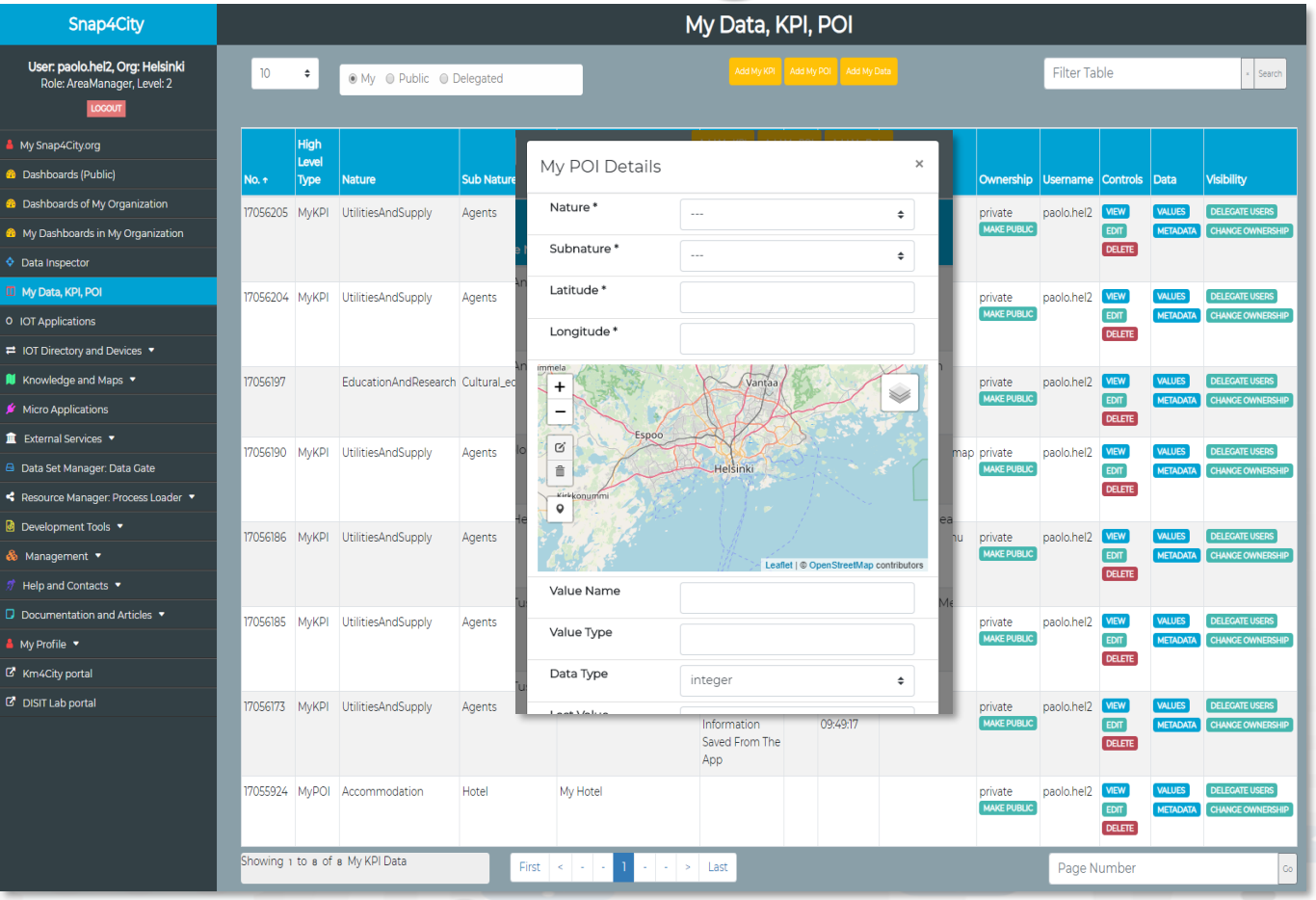


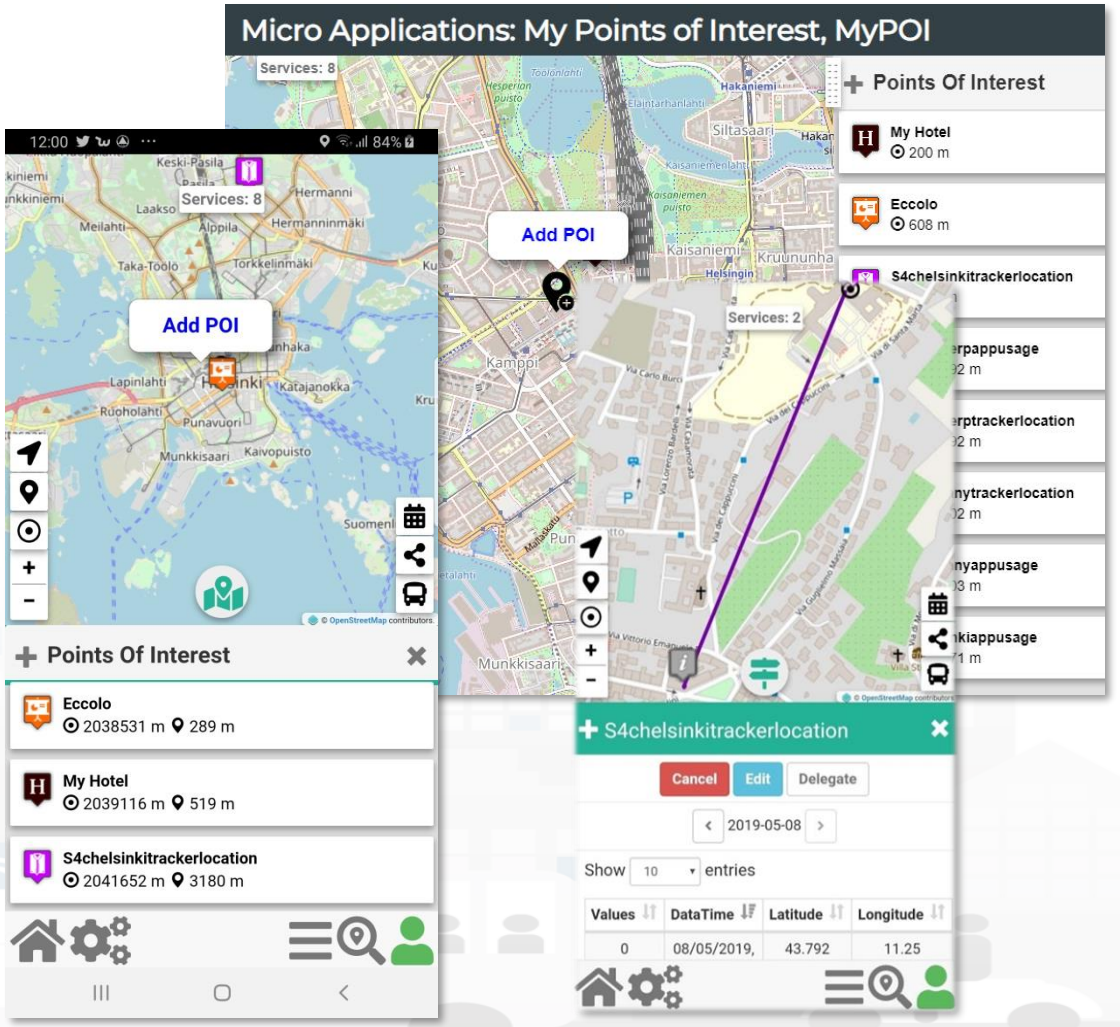
Smart Bench Data Delegation



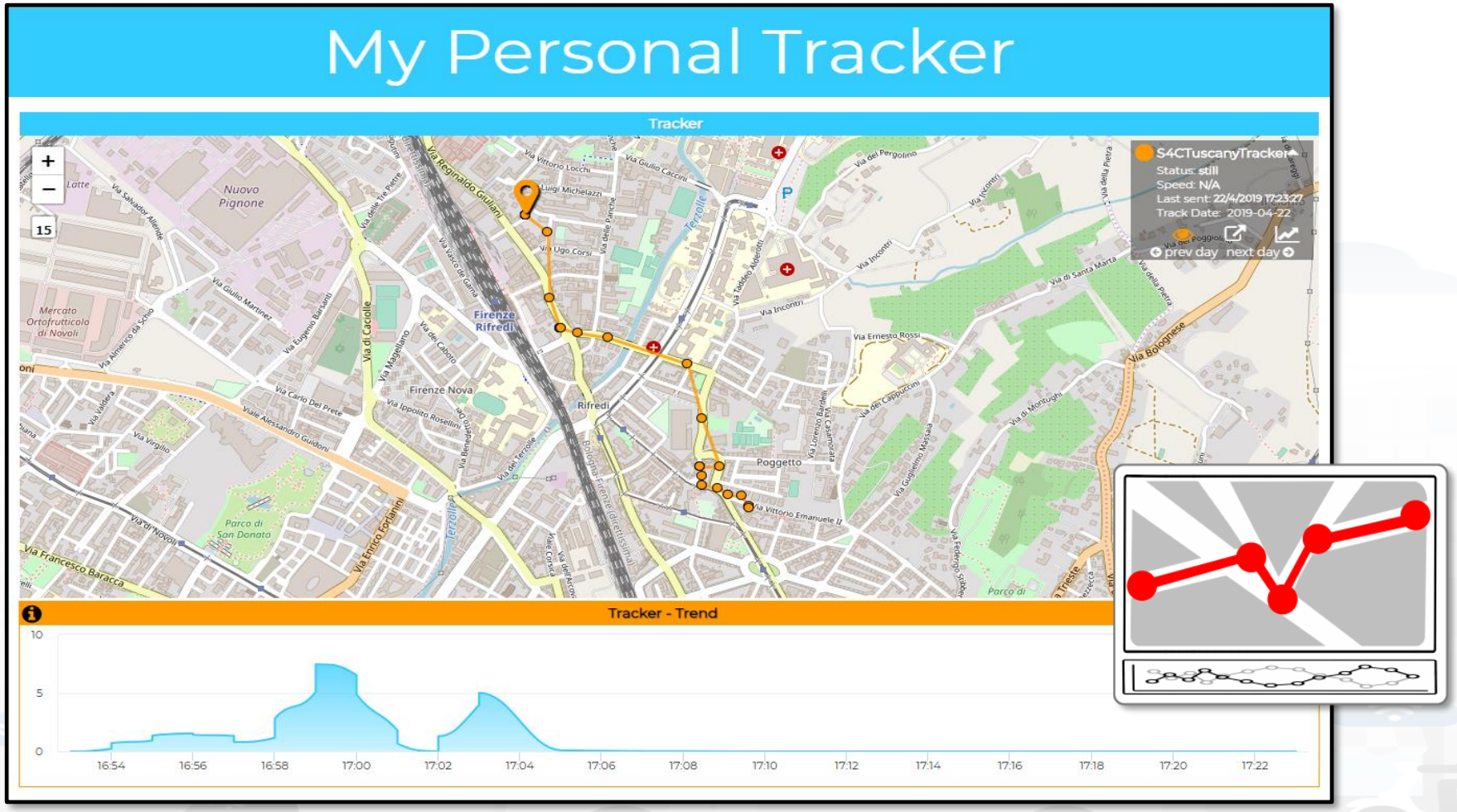


Management of MyKPI, MyPOI, …

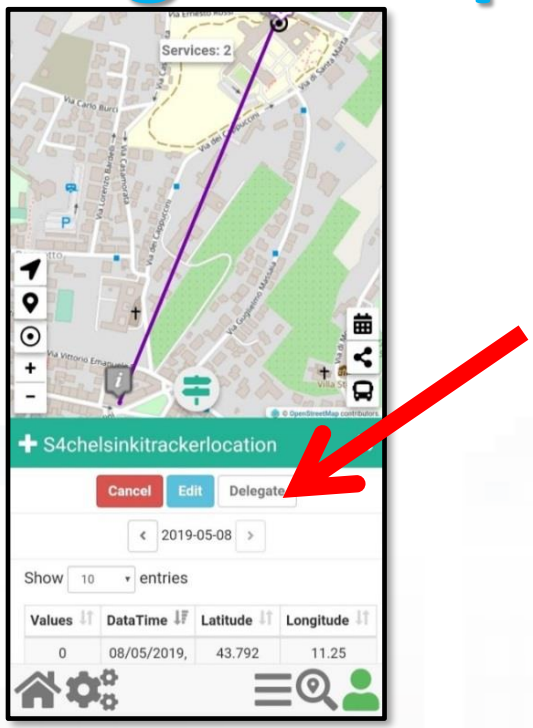


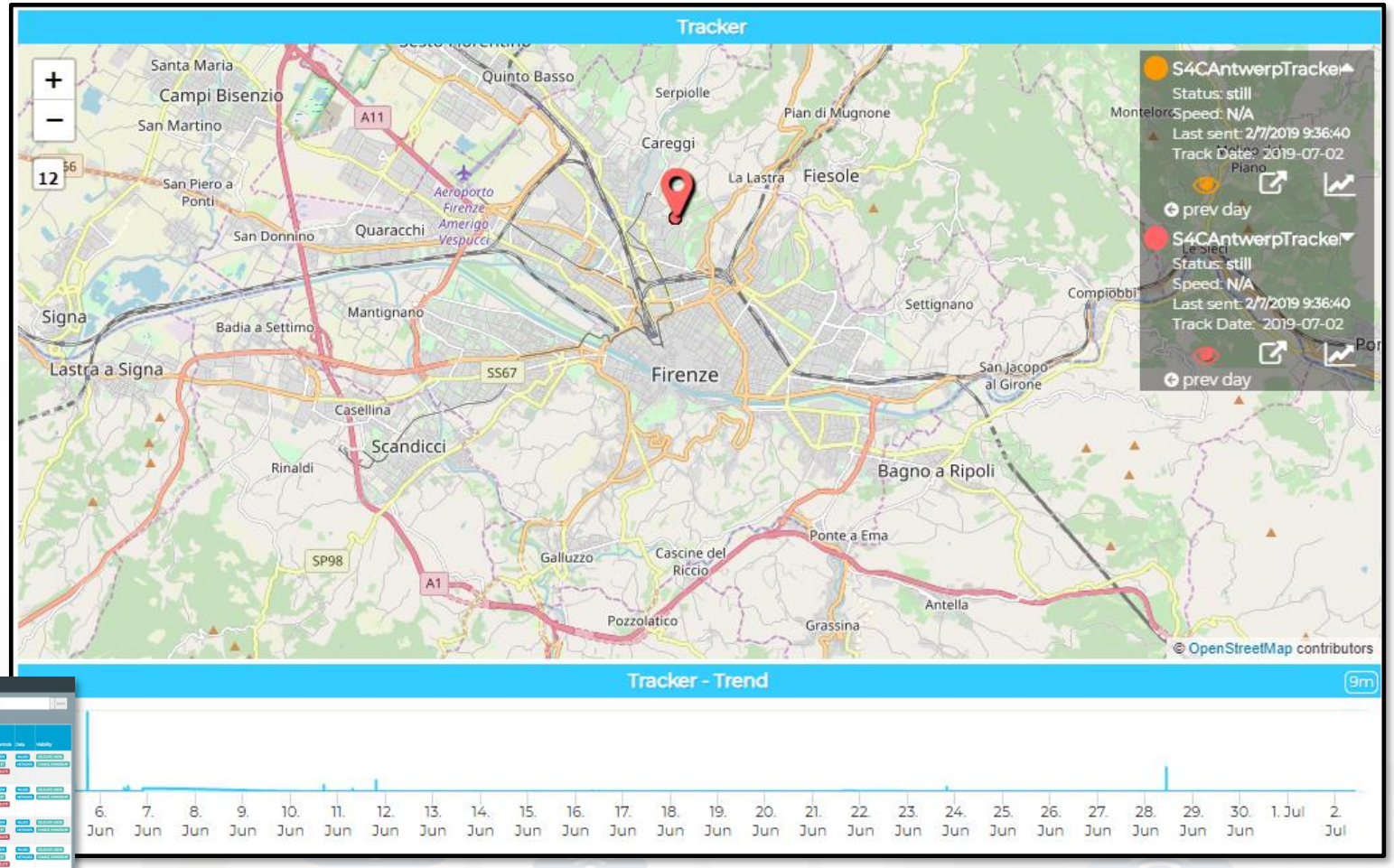


Recalling Exercize number 3

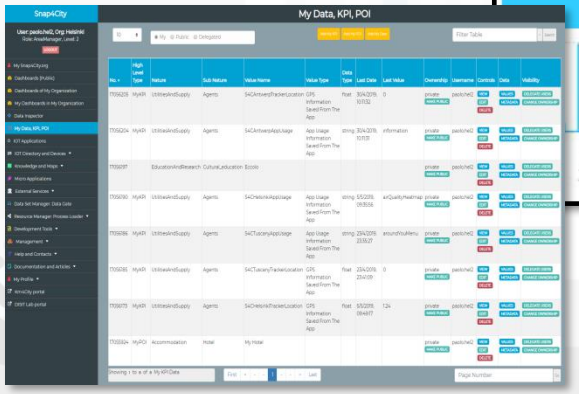


Accessing Multiple Trajectories

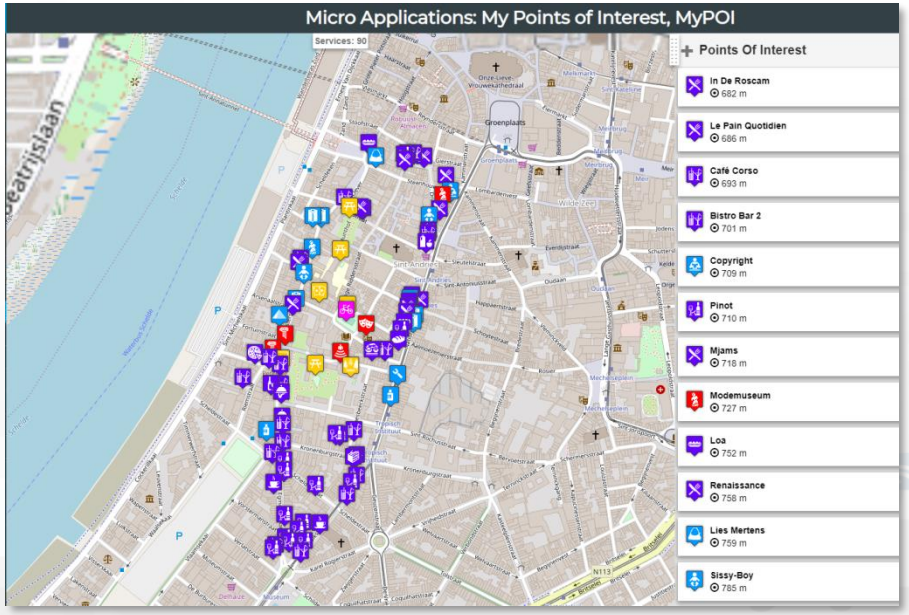


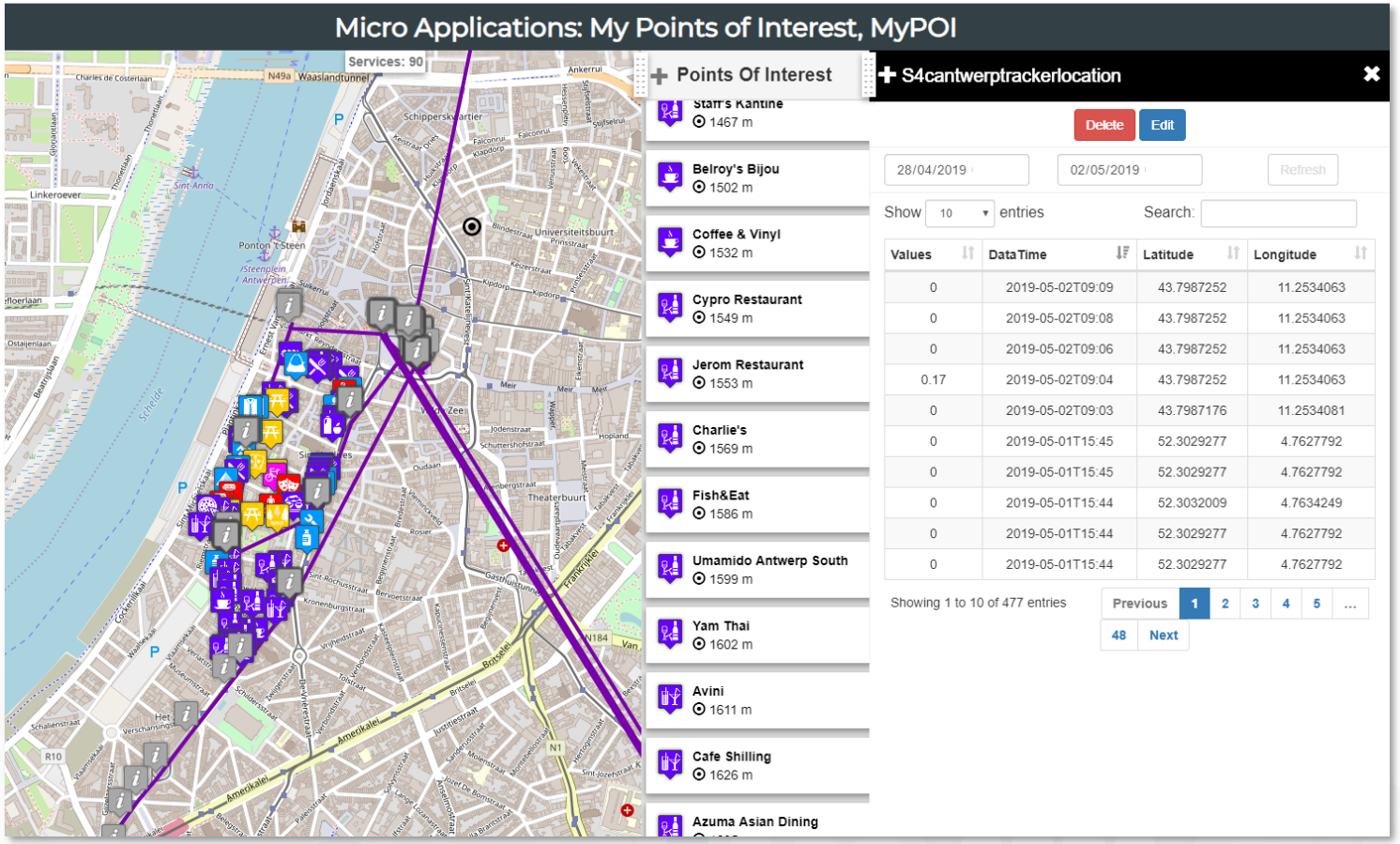


You can revoke at any instant from Web and mobile App



MicroApplications: several new





- Personal POI, KPI, Trajectories/trips

Advanced GDPR Aspects

- Snap4City has a model for Group of Smart City Entities that can be:
  - IOT Devices/sensors, My Data, MyKPI, Dashboards, MyPOI, …
- The user can create its own Groups
  - Each Group may contain a number of Smart City Entities
- This allows to delegate in access a complete Scenario with one delegation only. For example:
  - An user registered a set of device of an industrial plant with a 200 variables, some of them Sensors other KPI,
  - The user has also realized 10 Dashboards showing those data and some results from IOT Apps as well
  - The user can group these entities in a GROUP: for example Plant56.
  - Thus the user can delegate in access data of different kinds and Dashboards at a person producing a unique delegation action instead of performing a delegation for each entities that in this case could be hundreds. The same for revoking the access to that user.
  - This will avoid the user to remember all dependencies of a scenario, since they will be all listed. In the future these dependencies could be estimated automatically

Dashboard GDPR Management

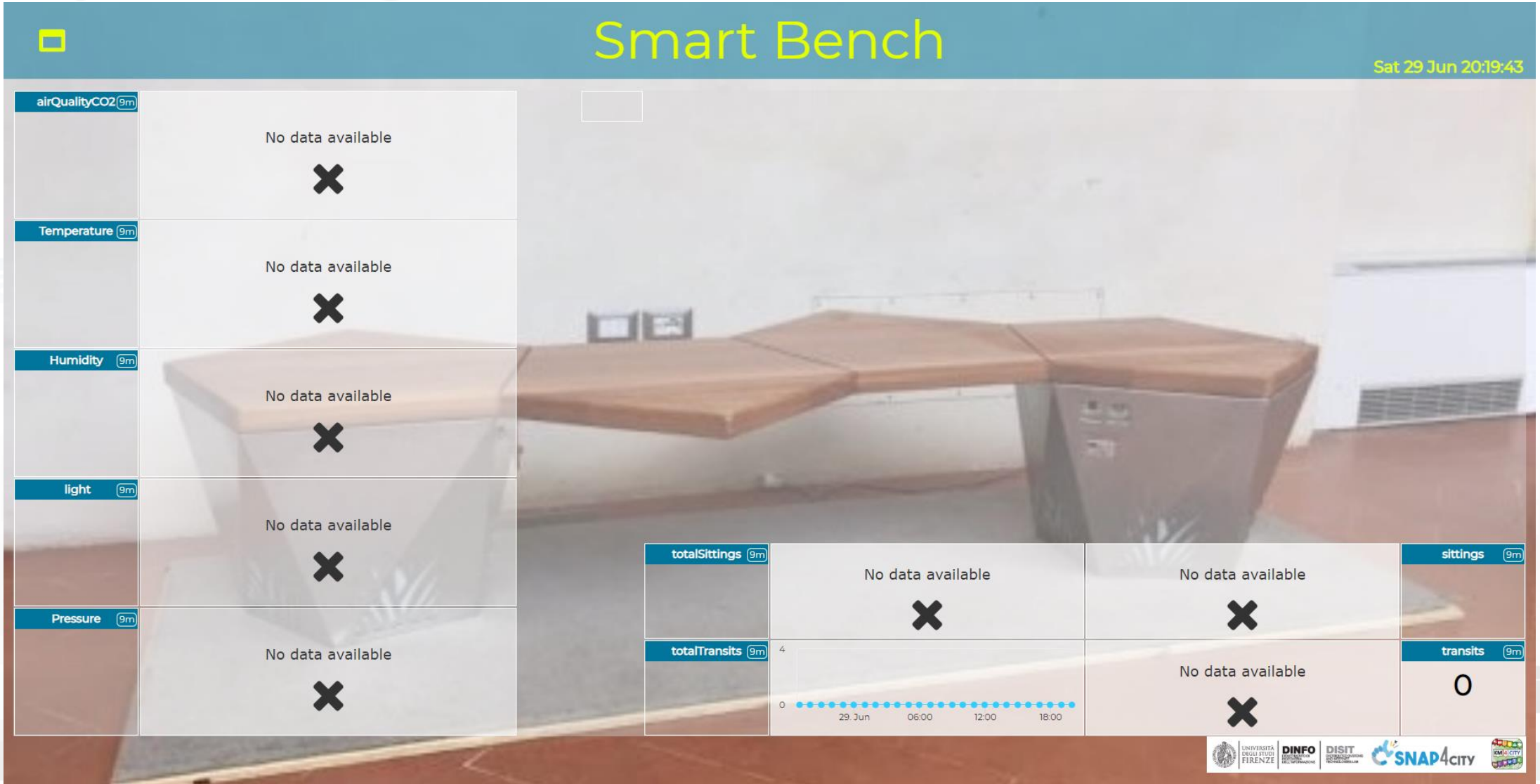
Details for Main Data Kinds

- **My Personal Data, My KPI and My POI**
  - to manage your personal MyKPI, MyPOI and trajectories, if any: view, edit, delete, delegation in access, revoke delegation, make public, change ownership
- **My Personal Engagement**
  - to manage your personal engagements received on the Mobile Apps, auditing, if any: view, delete
- **My IOT Devices**
  - to manage your IOT Devices in which it is possible to: edit, delete, make public, delegate in access, revoke delegation, change ownership
- **My IOT Applications**
  - to manage your IOT Applications in which it is possible to: delete, restart, change ownership.
- **My Dashboards**
  - to manage your Dashboards in which it is possible to: edit, delete, change ownership, delegate in access, revoke delegation, see list of delegations, make public.

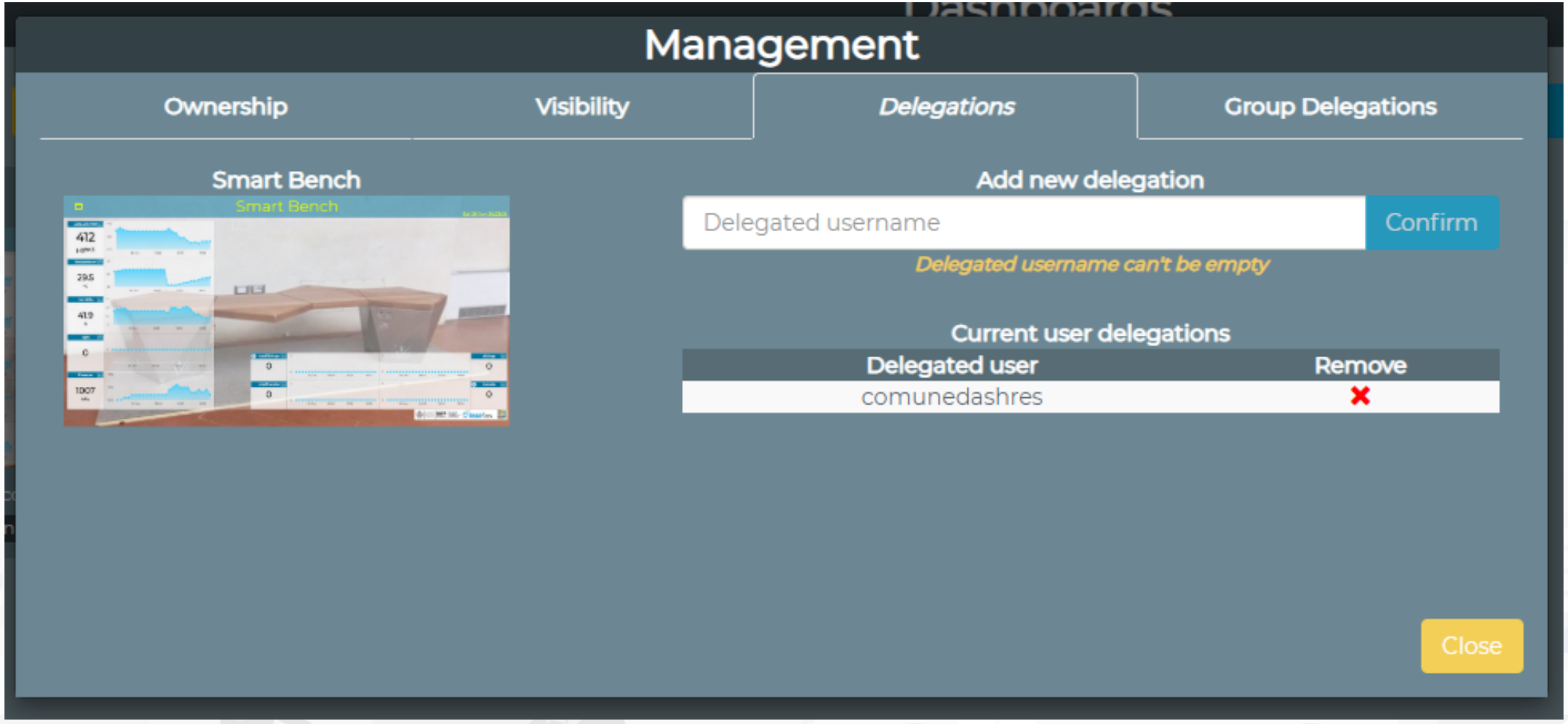
Smart Bench

Sat 22 Jun 15:45:23

Example: Delegated Dashboard but not all data



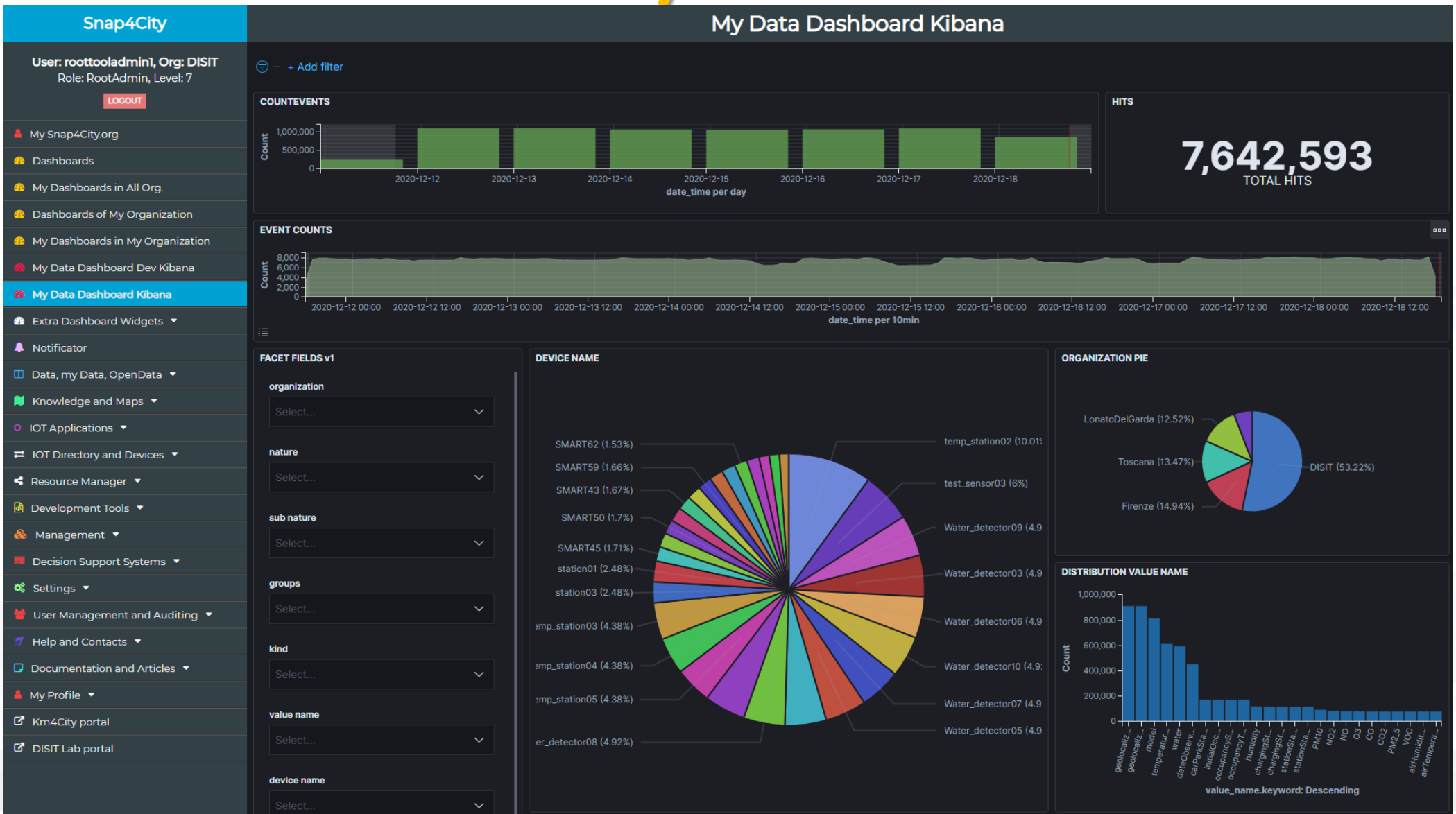
Dashboard Delegation

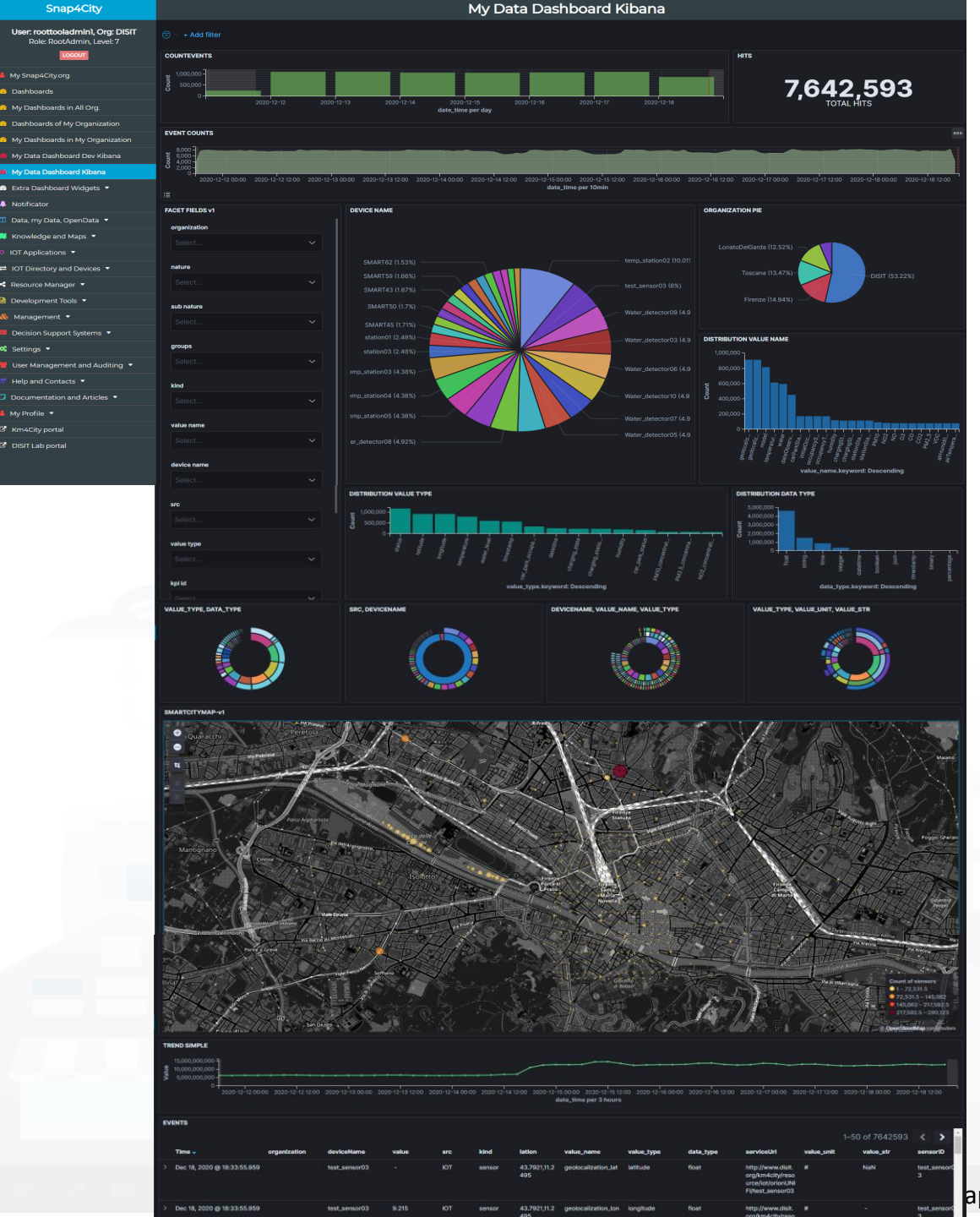


TOP

DevDash: My Data Dashboard based on Kibana and customization

DevDash: My Data Dashboard Kibana





kibana

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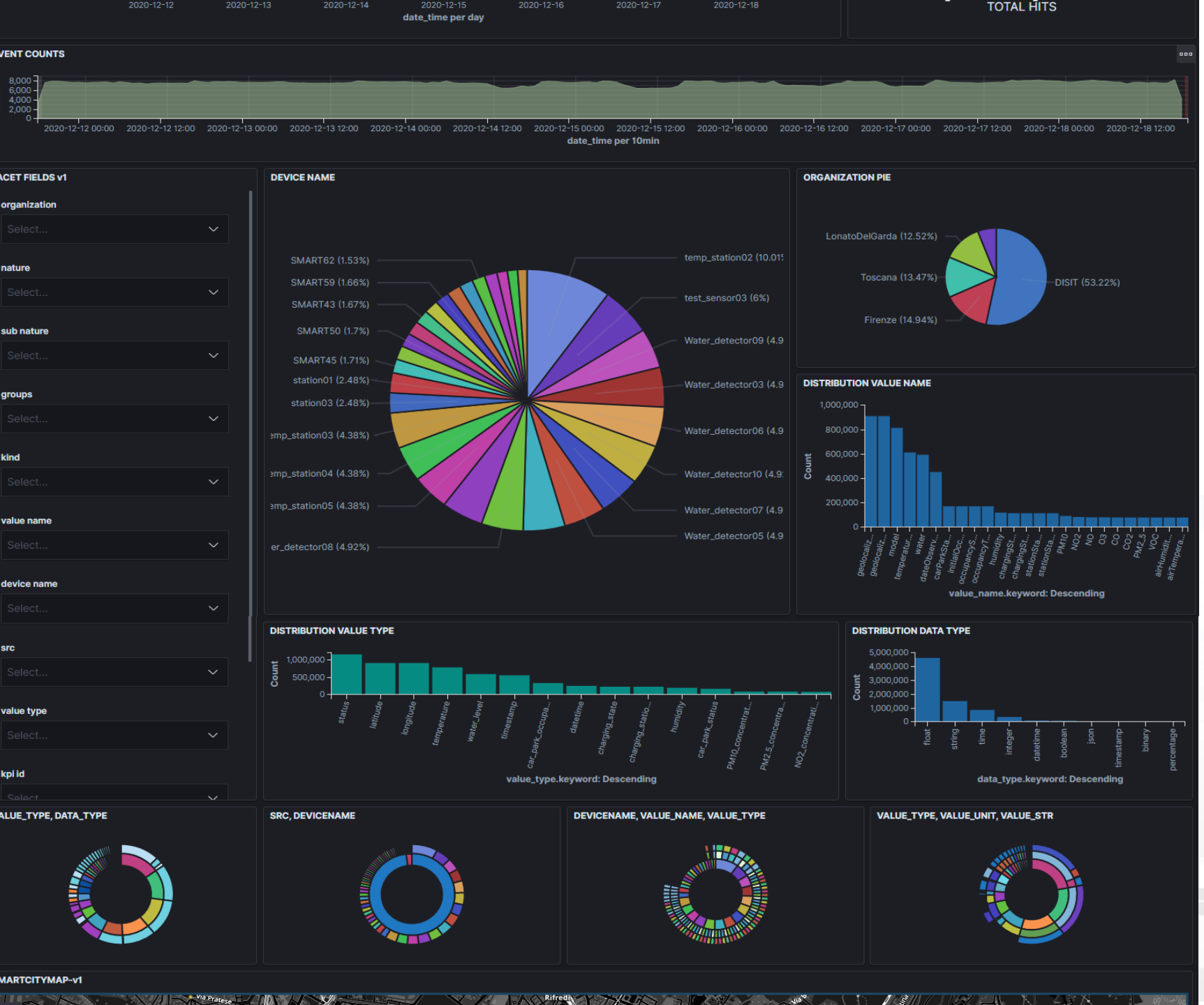
Business Analysis Dashboards For all kind of users: DevDash

- 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

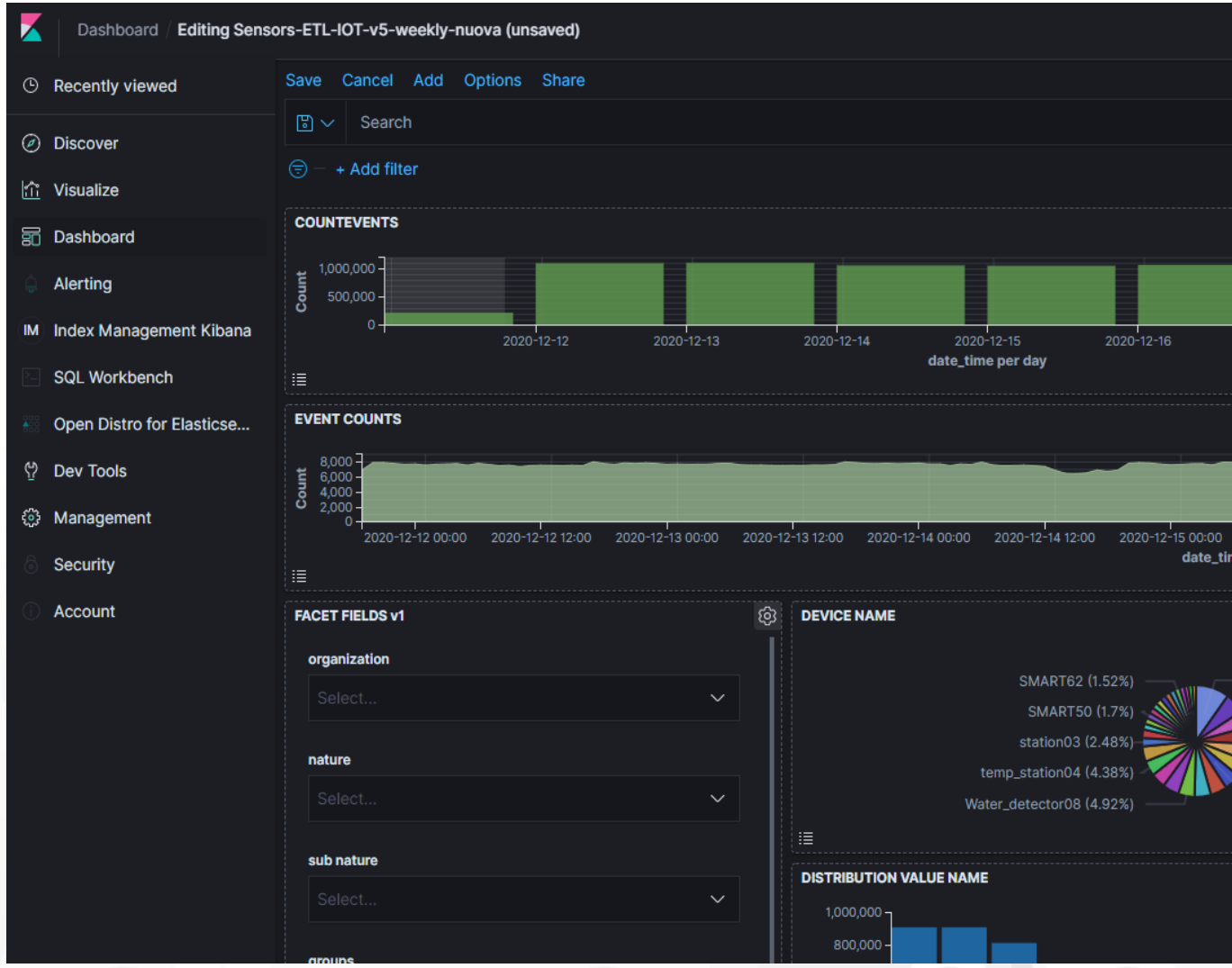


- Multi faceted Search by
  - Devices
  - Organization
  - Drill on Time
  - Drill on Map
  - Value Types
  - Data Type
  - Value name
  - Data table
  - Etc.
- Respect Privacy and GDPR

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

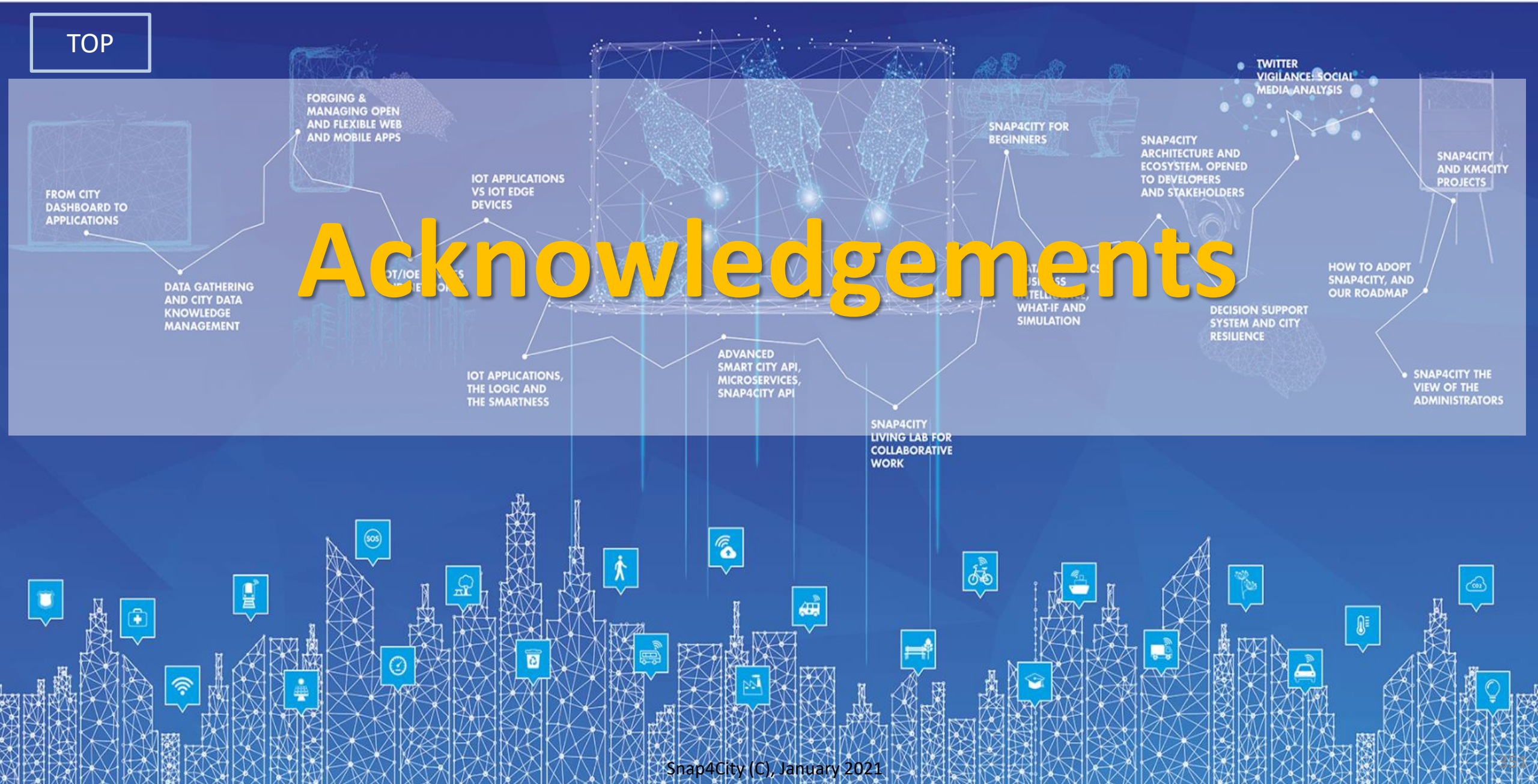
My Data Dashboard Customization

- 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



TOP

Acknowledgements



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

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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

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- 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)
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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

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REPLICATE

resolute

Sii-Mobility

TRAFAIR

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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

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KM 4 CITY

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SNAP4 Appliances and Dockers **Installations**

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