SNAP4INDUSTRY

by Snap4City tech.

https://www.snap4city.org

SNAP4
Appliances and Dockers
Installations

100% OPEN SOURCE

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

SNAP4CITY
www.snap4city.org

KM4CITY

Powered by FIWARE

SNAP4 Appliances and Dockers Installations

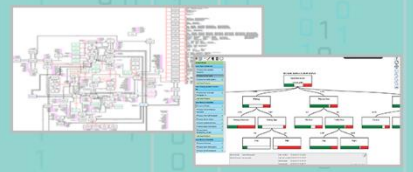
FREE TRIAL

PEN Test Passed

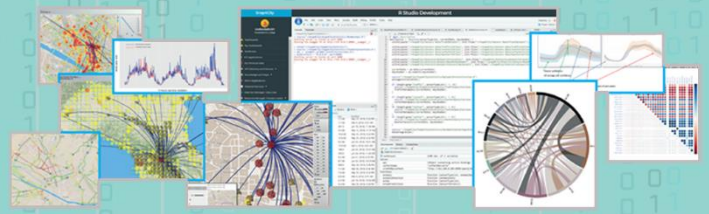
EU GDPR COMPLIANT

100% OPEN SOURCE

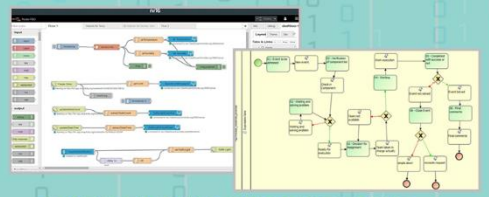
DASHBOARDS AND APPS - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS



EXPERT SYSTEM
KNOWLEDGE BASE
STORAGE

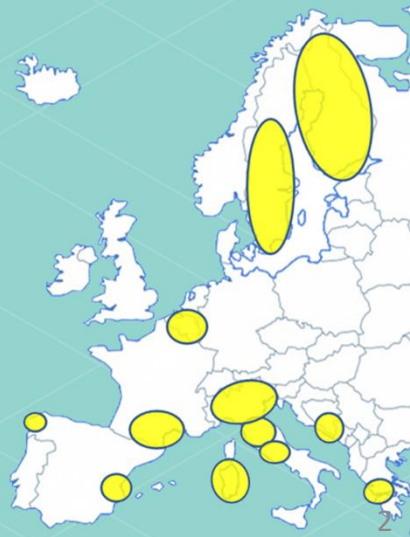


BIG DATA ANALYTICS
ARTIFICIAL INTELLIGENCE
BUSINESS INTELLIGENCE
MACHINE LEARNING



DATA FLOWS, WORKFLOWS
MICROSERVICES
MANAGEMENT

METHODOLOGIES
COURSES AND COMMUNITY
LIVING LABS
DEVELOPMENT TOOLS



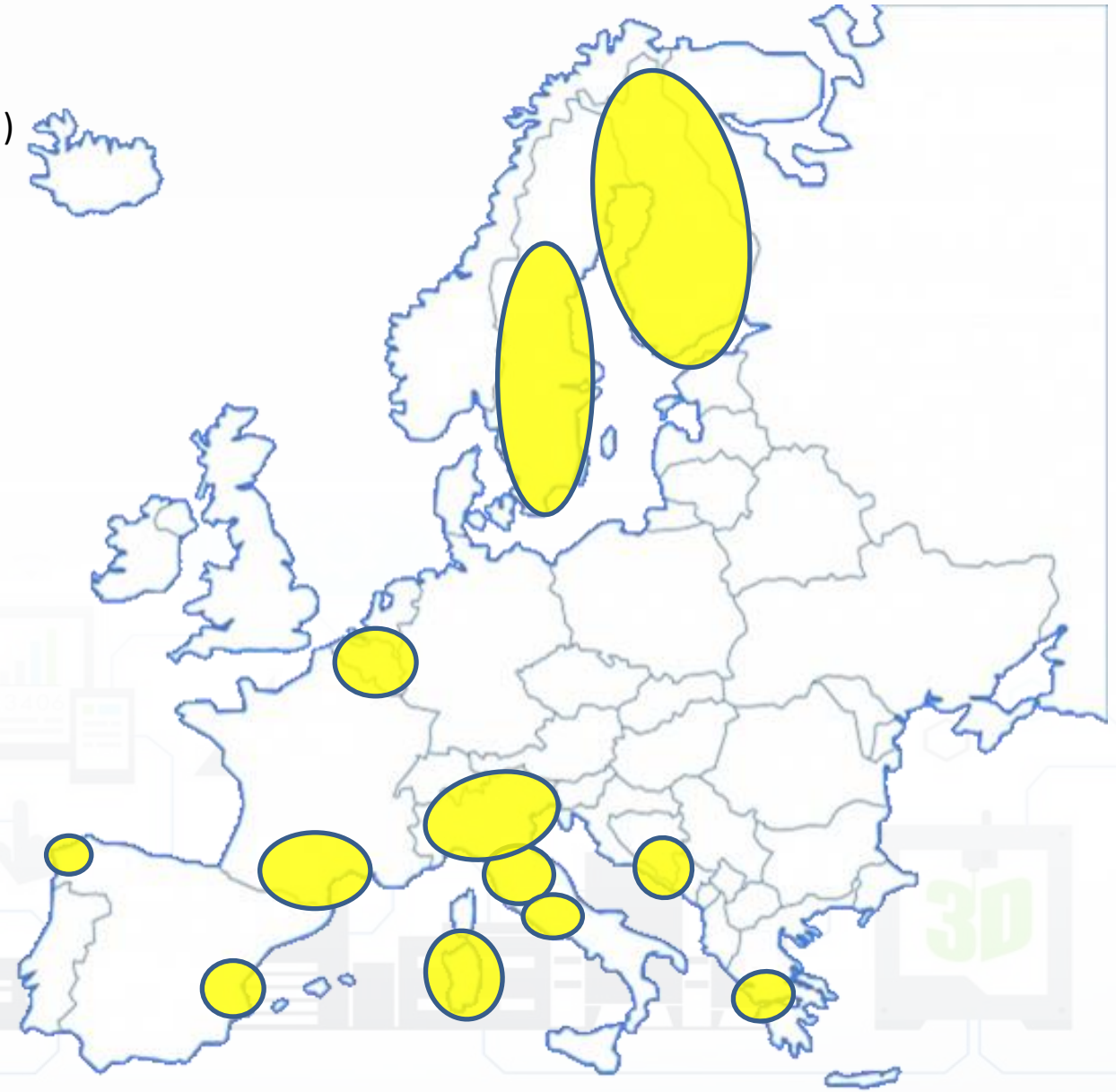
Snap4City/Industry structure

- The **Snap4xxxx** solution is released in Open Source, VM and Docker with fully support of MultiTenacy/multiple-Organizations
  - Each Organization may be configured for a separate environment with a set of Maps, Menus, Users, Data, Dashboards, IOT Applications, MicroApplications, Custom Widgets, 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 and GitHUB and 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* or *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)



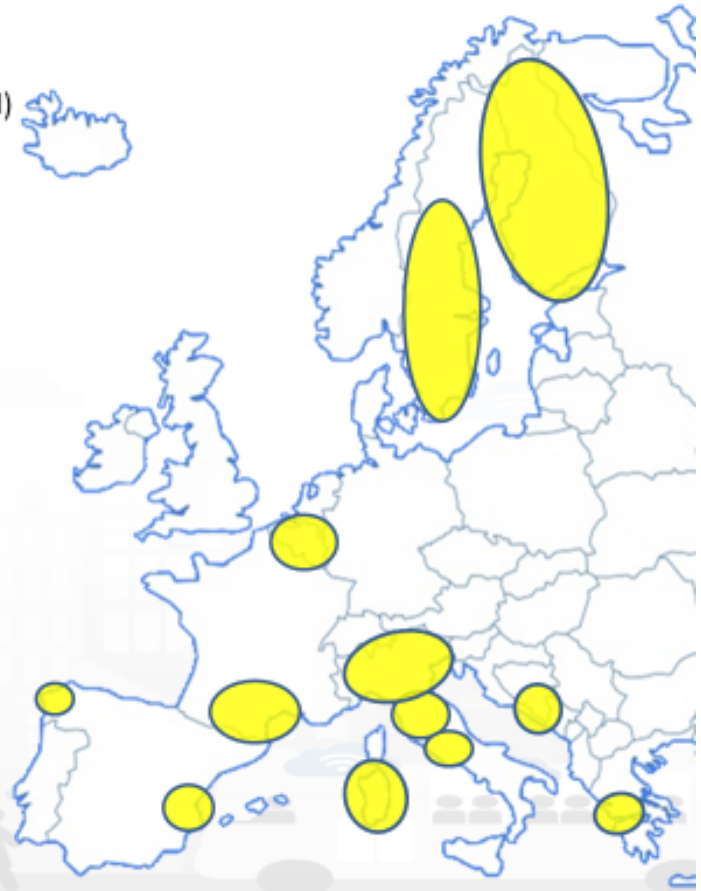
Snap4City/Industry Community

- 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

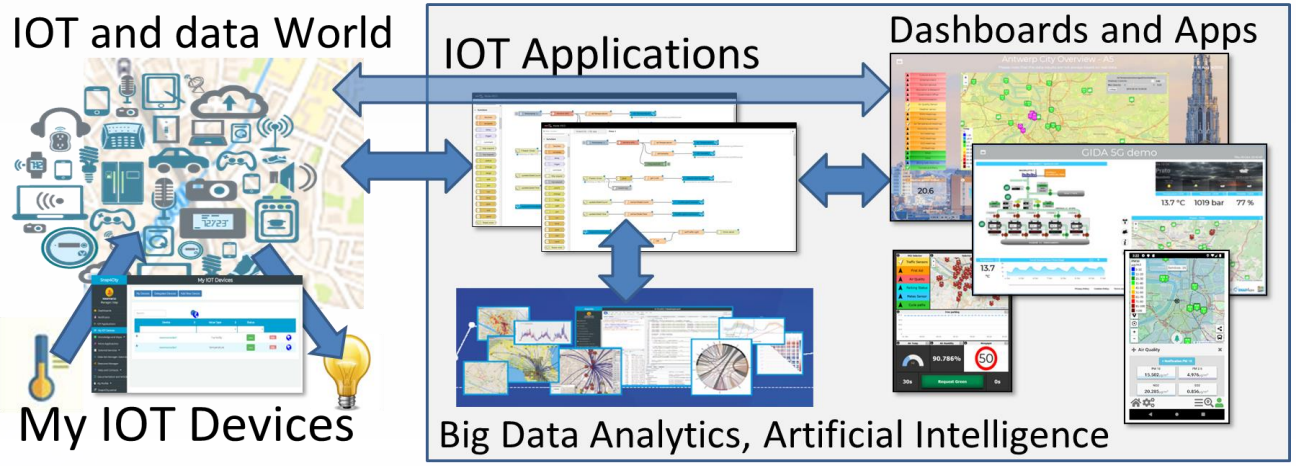
- Antwerp area (Be)
- Capelon (Sweden: Västerås, Eskilstuna, Karlstad)
- DISIT demo (multiple)
- Dubrovnik, Croatia
- Firenze area (I)
- Garda Lake area (I)
- Helsinki area (Fin)
- Livorno area (I)
- Lonato del Garda (I)
- Modena (I)
- Mostar, Bosnia-Herzegovina
- Pisa area (I)
- Pont du Gard, Occitanie (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 (C), October 2020



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.

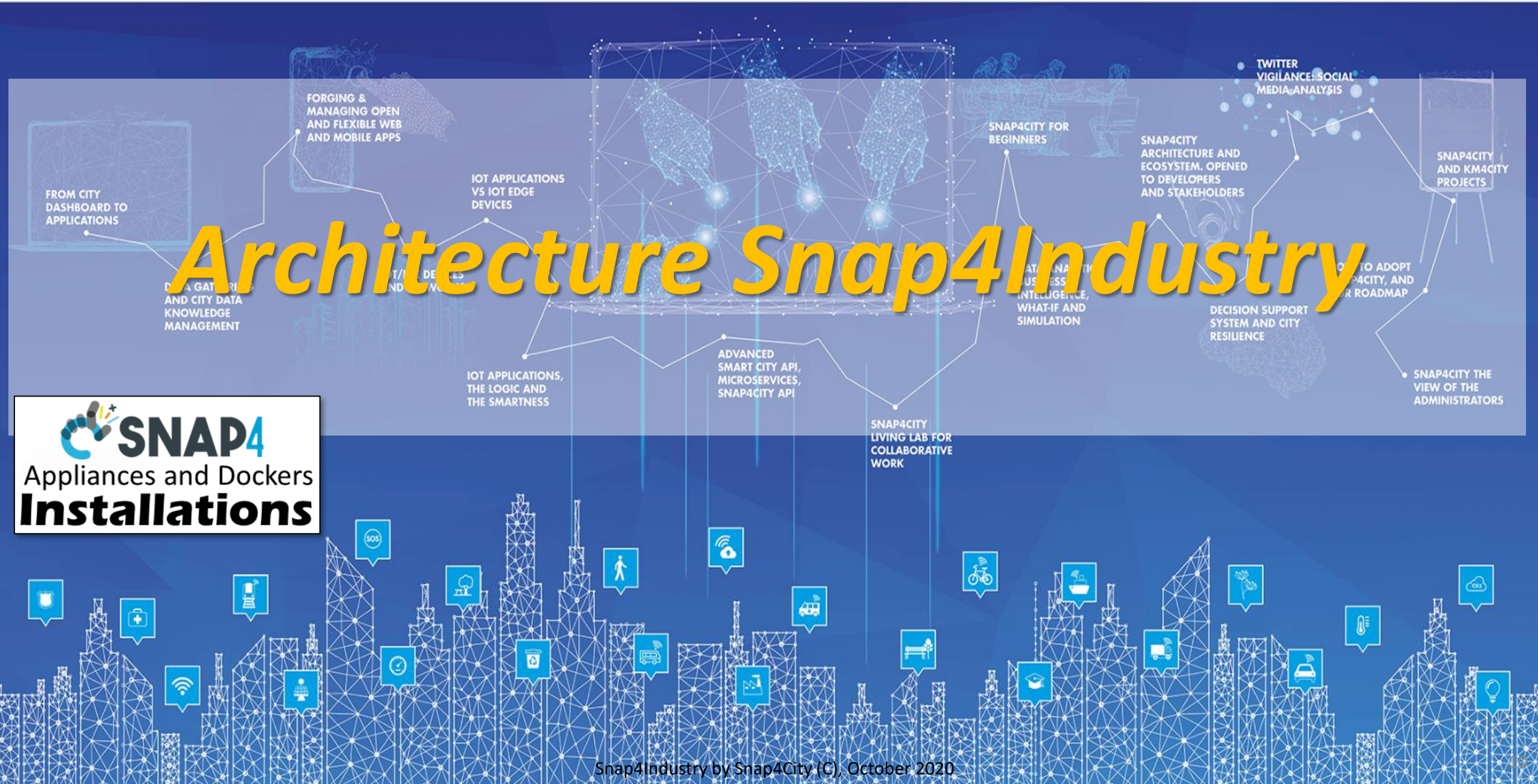
https://www.snap4city.org/577

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

Overview

- Architecture of Snap4Industry
  - Creation of Dashboards and Applications
  - Dashboards' Intelligence on Web and Mobile Devices
  - IOT Applications: virtual sensors and actuators
  - IOT Applications integration with Synoptics
- Data Gathering and Knowledge Management 4.0
- IOT Devices and IOT Applications
  - IOT Application vs IOT Edge Devices
  - Managing IOT Applications
  - Remote Control of IOT Applications on IOT Edge Devices
  - Secure IOT Devices, IOT Edge Sensor and Dev Networking
- Integration with Ticketing System Workflows
  - Managing Maintenance, predictive maintenance, anomaly detection
- Data Analytics, Big Data Science
  - Anomaly detection
- Living Lab for Collaborative Work
- Roadmap and Projects
- Acknowledgements

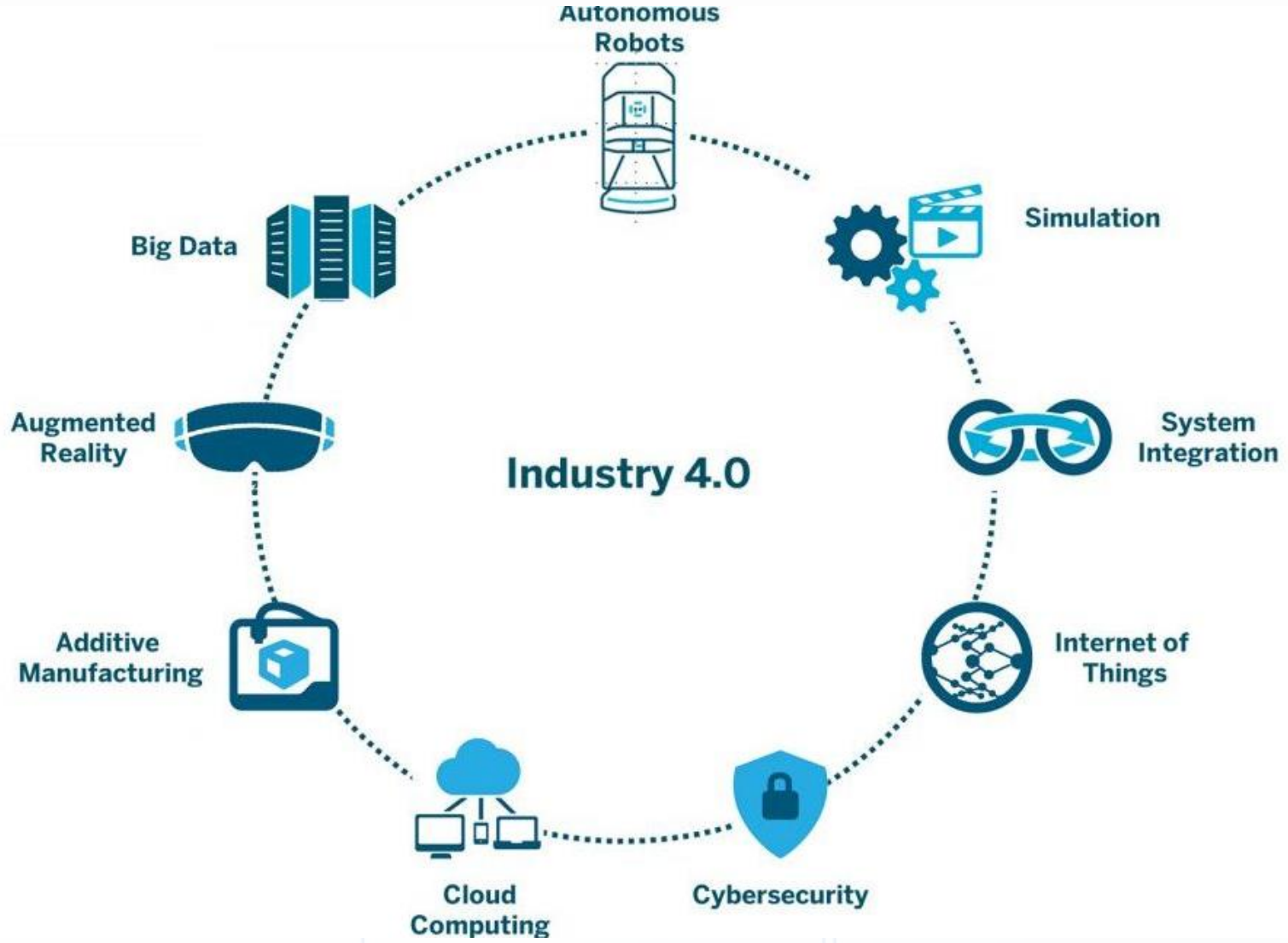


Architecture Snap4Industry

SNAP4
Appliances and Dockers
Installations

Industry 4.0

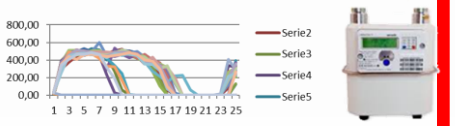
- Big Data
- Cloud Computing
- Cybersecurity
- IOT/IOE
- System Integration
- Simulation
- Data Analytics



Objective

- Industry
  - Integration of SCADA (Supervisory control and data acquisition), DCS (Distributed Control Systems), RTU (remote terminal units) concepts
  - Industry 4.0 protocols
- IOT:
  - **Abstraction of IOT Devices** (Edge) on IOT Directory and IOT App
  - High integration with IOT Networks and IOT Directory for IOT net abstraction
  - Usage of Node-RED as IOT Edge, **controllable/editable from remote**
- Scalability
  - Big Data: MicroServices for data access and retrieval, discovery
  - Cloud Management on dockers and scalability
- **Secure connection** for Data and Dashboards: SSO, TLS
  - Privacy with GDPR compliance
- **Exploitation of Data Analytic** on Edge and Cloud, from Edge and Cloud
- **Synoptics via Secure WebSockets, custom widgets**

External Services



Fleet management

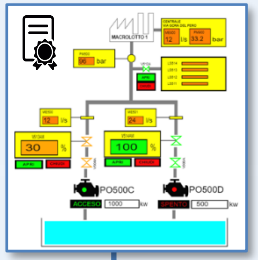
IoT Devices/Edge

IoT Broker

Internet

SECURE

Admin



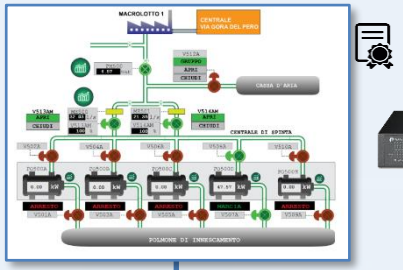
DCS

IoT Broker

PLC

IoT Devices/Edge

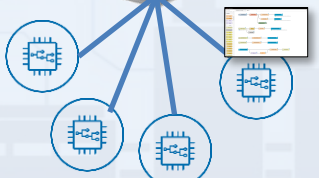
Industry Plant1.....



SCADA

PLC/ RTU

IoT Broker

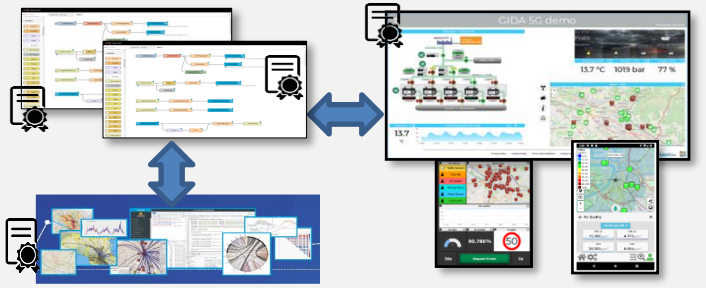


IoT Devices/Edge

Industry Plant2.....

IOT Applications

Dashboards and Apps

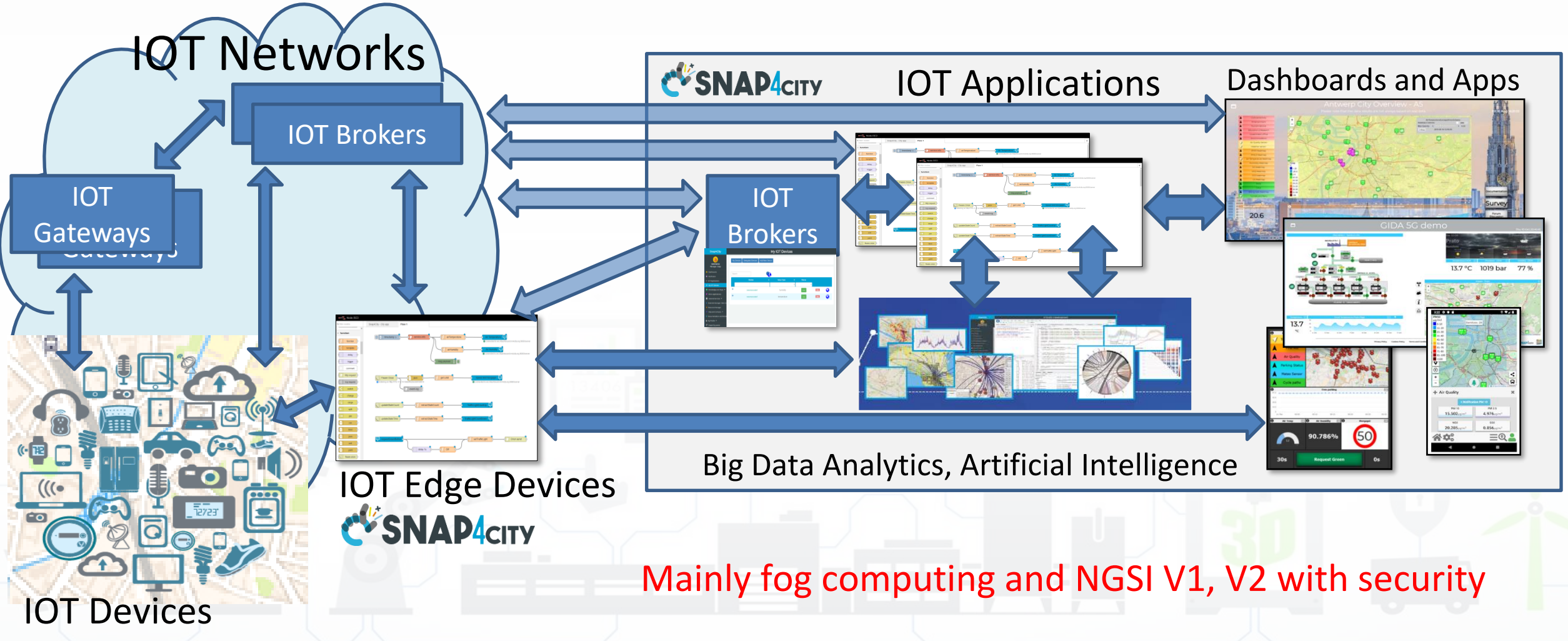


Big Data Analytics, Artificial Intelligence

Control and Supervision on Multiple Supply Chains

Industry 4.0 as a Service

Snap4 Services also on IOT Edge!!!



Mainly fog computing and NGSI V1, V2 with security

Snap4Industry Architecture, V2

Data Sources, External Services *PULL Data*

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

Data Ingestion, aggregation, regularization, reconcile:

NIFI, IOT App

Back-End

Knowledge base
Semantic reasoners

Indexing and aggregating
Elastic search

Search and Query, Smart City API
Facet, semantic search

Data Analytics, Machine Learning
Prediction, anomaly detection, alerting, …

IOT Applications, Business Logic
Node-RED + Snap4City MicroServices

Front-End

Rendering Acting, Widgets, MicroApps
User interface, Interactive Dashboard, Drill down, maps, heatmaps

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

Standards and Interoperability

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

https://www.snap4city.org/65

https://www.snap4city.org/369

Measuring any kind of sensors values

Controlling Energy Power

Measuring
Energy Consumption

Any kind of notification channel

IOT Edge:
Node-RED
+
Snap4City

Local Control

DCS

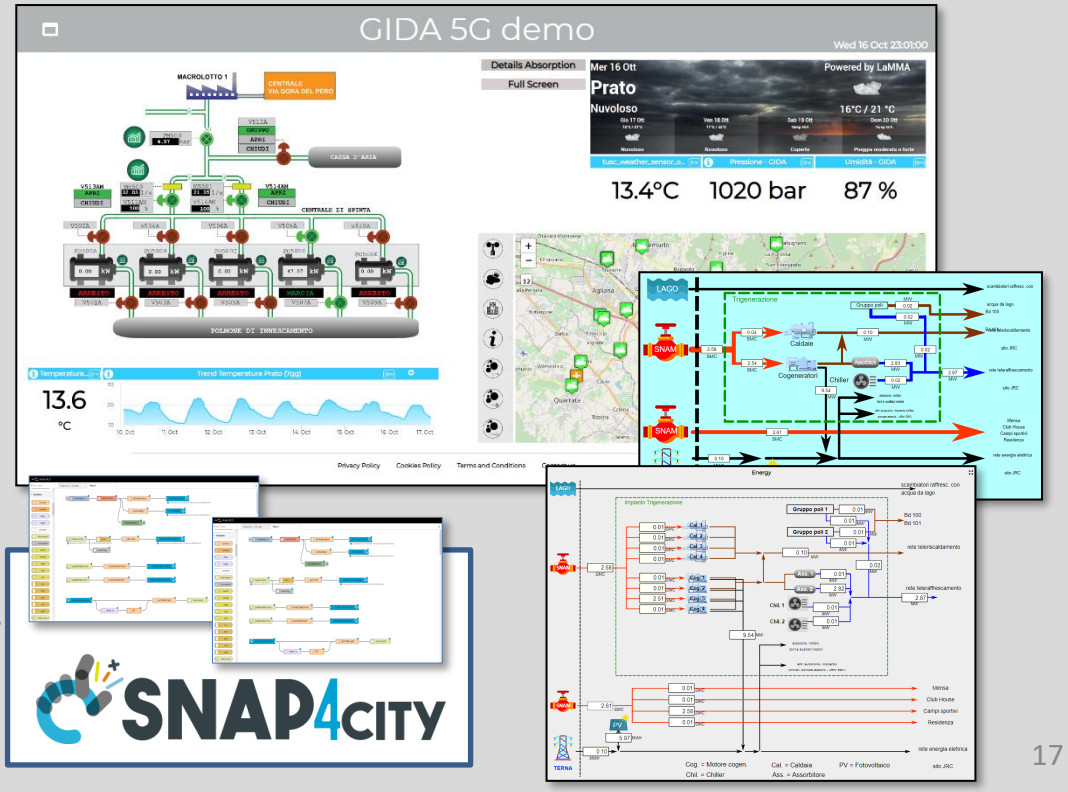
SCADA

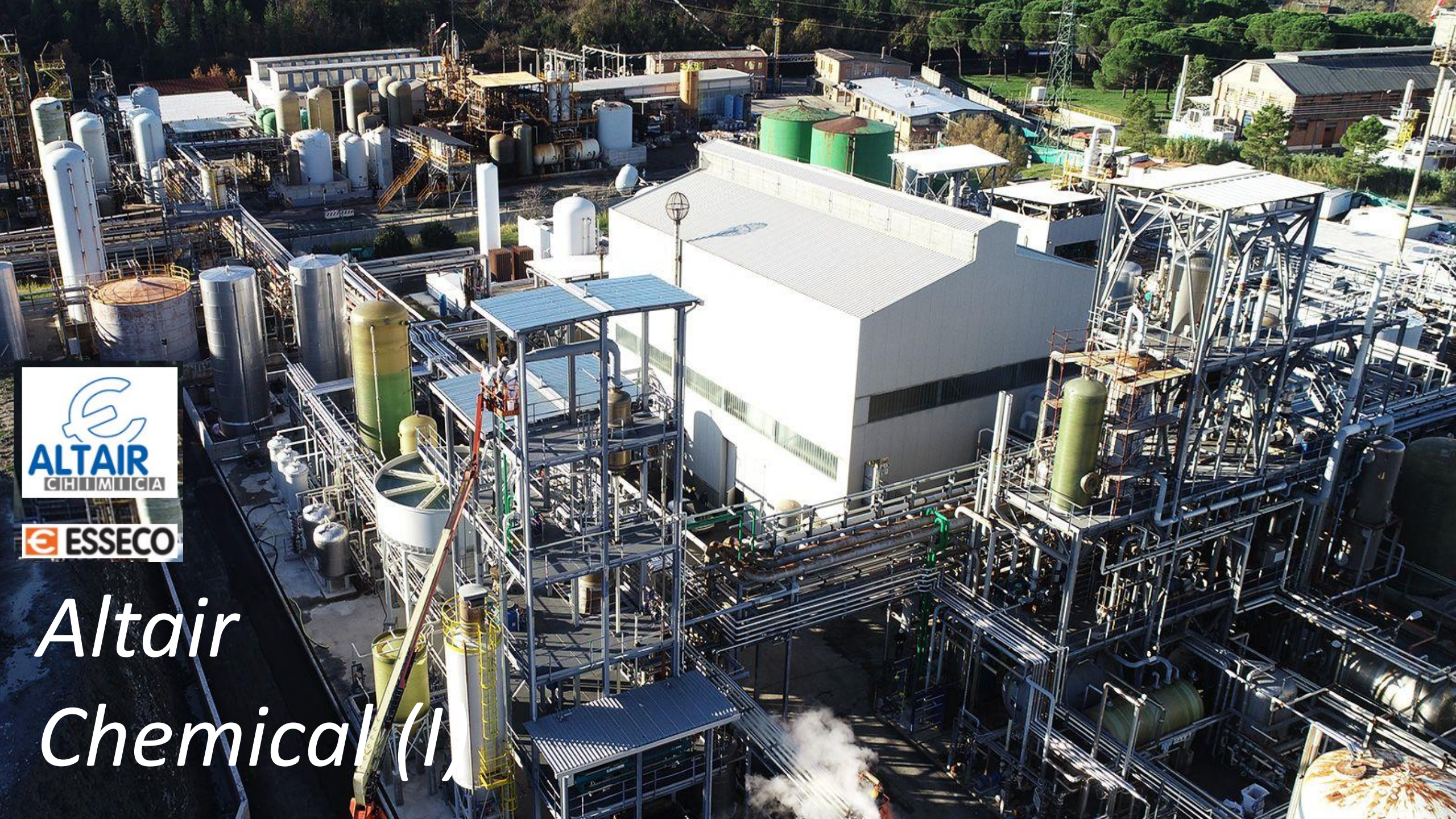
Administrative Servers

ODBC

Alexa: Voice Commands

Contextual (smart city/home) data, Data Analytics
Historical Data, Remote Control, Mobile App



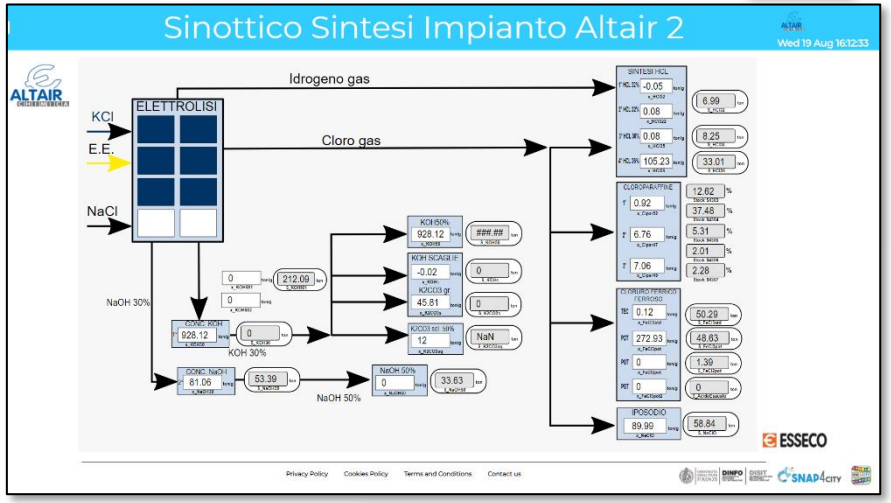


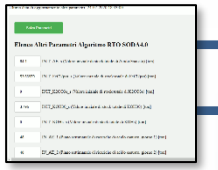
Altair Chemical (I)

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

SNAP4INDUSTRY | KM4CITY

SNAP4ALTAIR





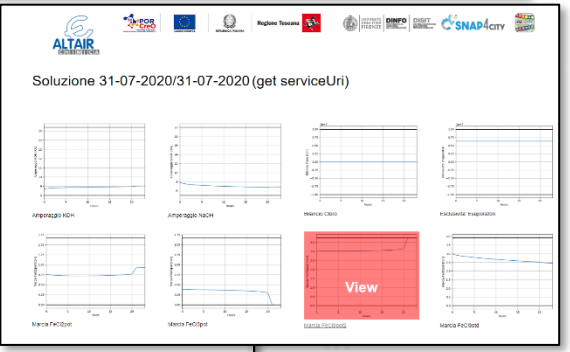
Parameters

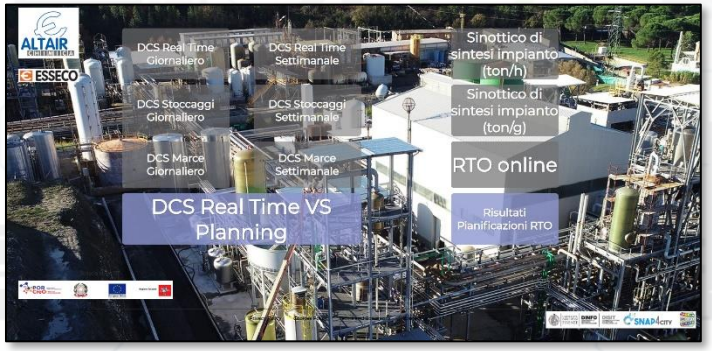
AS400 (orders)

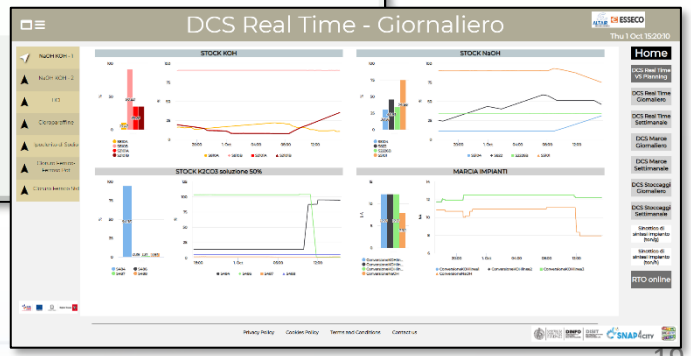
PUN (energy)

Snap4Altair *OnLine*

Monitoring Planning



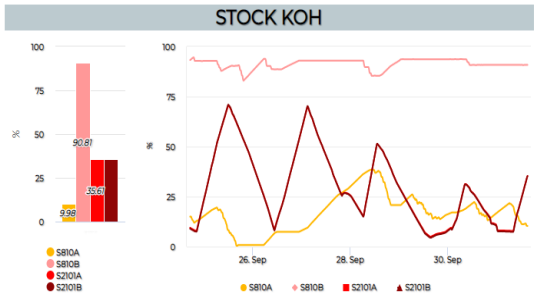


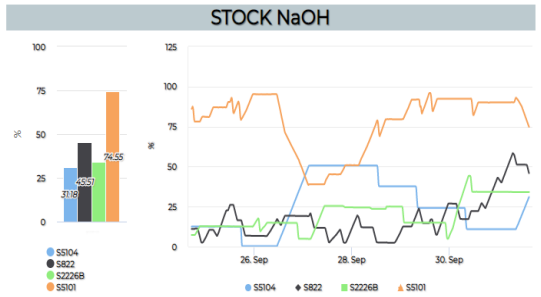


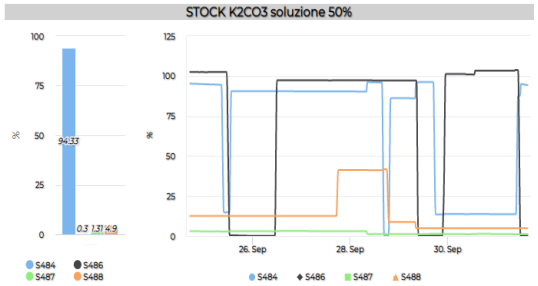
DCS Real Time - Settimanale

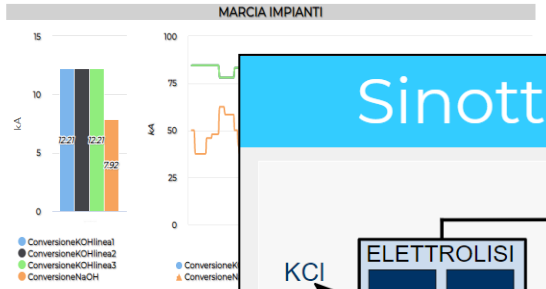
Thu 1 Oct 15:25:11

NaOH KOH - 1
NaOH KOH - 2
HCl
Cloroparaffine
Ipoclorito di Sodio
Cloruro Ferrico-Ferroso Pot
Cloruro Ferrico Std









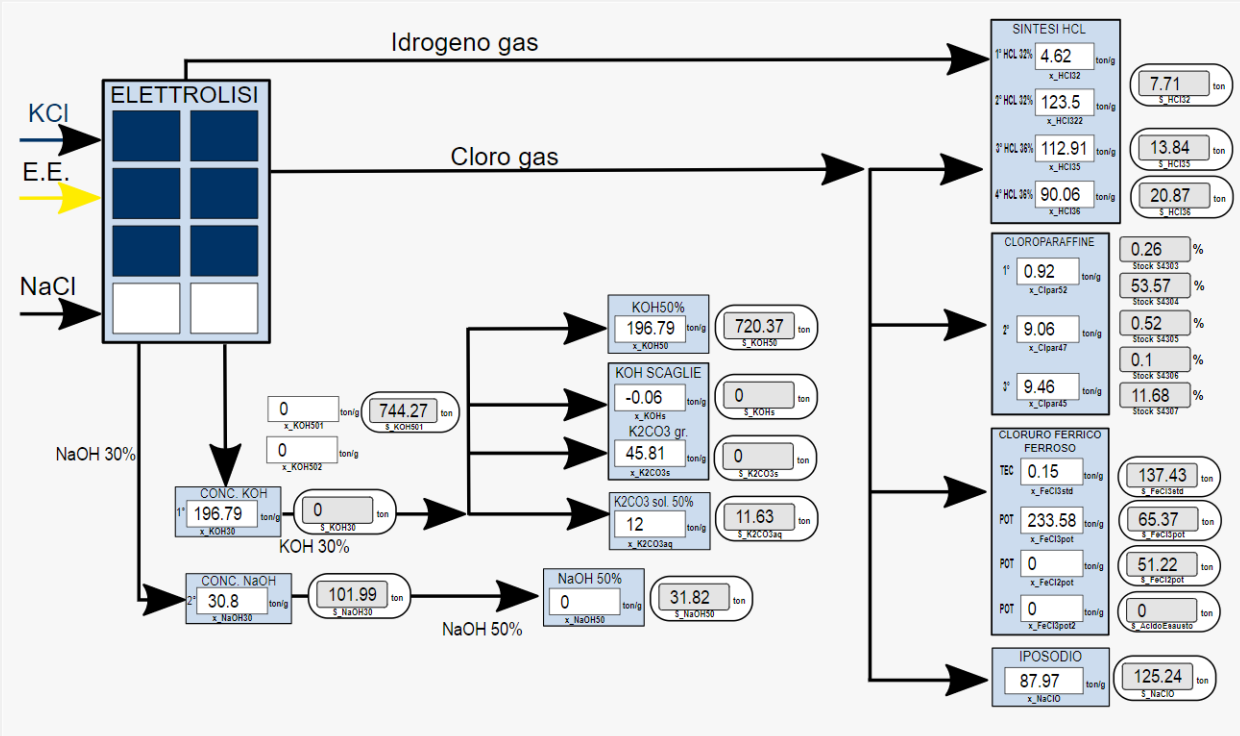
Home
DCS Real Time VS Planning
DCS Real Time Giornaliero
DCS Real Time Settimanale
DCS Marce Giornaliero
DCS Marce Settimanale
DCS Stoccaggi Giornaliero

SNAP4INDUSTRY

SNAP4ALTAIR

Sinottico Sintesi Impianto Altair 2

Thu 1 Oct 15:32:19



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)
RTO online

Privacy Policy | Cookies Policy | Terms and Conditions | Contact us

RTO online

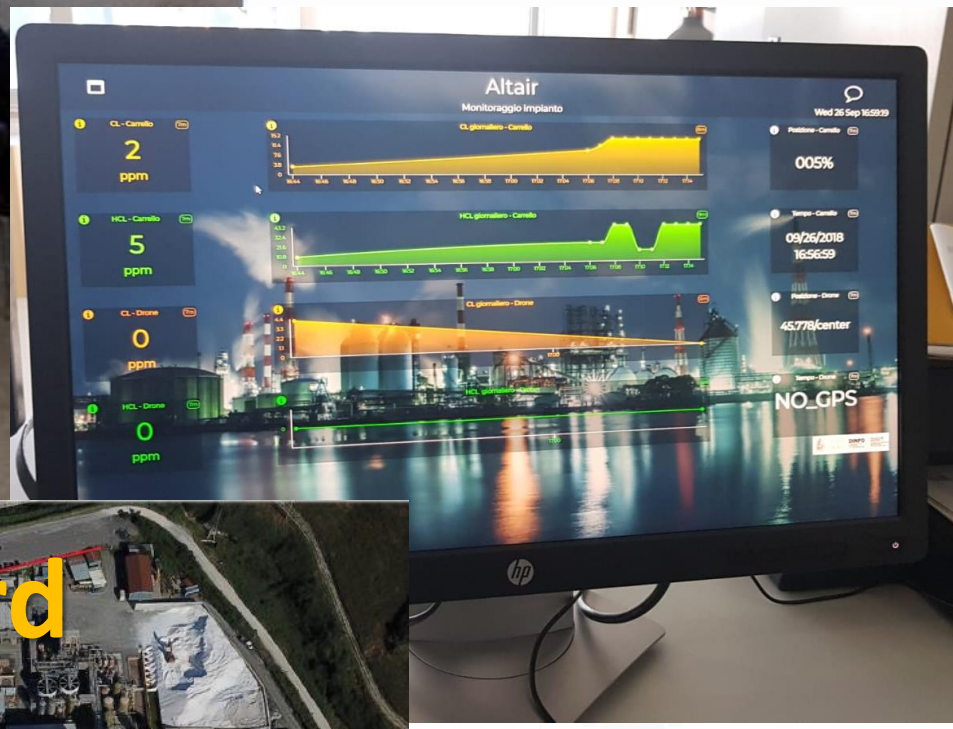
Home RTO online

Parametri (TabPar)	DCS (OPC-UA)	Amministrazione (AS400)	Pianificazione Consolidata (AS400)	Energia (PUN)	Altri Parametri
2020-09-25 18:47:36	2020-10-01 09:33:01	2020-10-01 09:32:54	2020-10-01 09:32:54	2020-10-01 23:00:00	2020-07-24 18:43:00
2020-09-25 18:47:36	2020-09-30 17:20:02	2020-09-30 17:20:50	2020-09-30 17:20:50	2020-09-30 23:00:00	2020-07-24 18:43:00
2020-09-25 18:47:36	2020-09-30 16:27:02	2020-09-30 16:24:57	2020-09-30 16:24:57	2020-09-30 23:00:00	2020-07-24 18:43:00
2020-09-25 18:47:36	2020-09-30 14:56:02	2020-09-30 14:54:11	2020-09-30 14:54:11	2020-09-30 23:00:00	2020-07-24 18:43:00
2020-09-25 18:47:36	2020-09-30 13:43:02	2020-09-30 13:43:47	2020-09-30 13:43:47	2020-09-30 23:00:00	2020-07-24 18:43:00
2020-09-25 18:47:36	2020-09-29 19:03:01	2020-09-29 19:03:27	2020-09-29 19:03:27	2020-09-30 23:00:00	2020-07-24 18:43:00
2020-09-25 18:47:36	2020-09-28 18:30:02	2020-09-28 18:30:13	2020-09-28 18:30:13	2020-09-29 23:00:00	2020-07-24 18:43:00
2020-09-25 18:47:36	2020-09-28 17:57:02	2020-09-28 17:57:14	2020-09-28 17:57:14	2020-09-29 23:00:00	2020-07-24 18:43:00
2020-09-25 18:47:36	2020-09-28 15:50:02	2020-09-28 15:50:21	2020-09-28 15:50:21	2020-09-28 23:00:00	2020-07-24 18:43:00
2020-09-25 18:47:36	2020-09-25 18:47:02	2020-09-25 18:46:02	2020-09-25 18:46:02	2020-09-26 23:00:00	2020-07-24 18:43:00

<< 1 2 3 4 5 6 7 8 >>

Sinottico di sintesi impianto (ton/g)

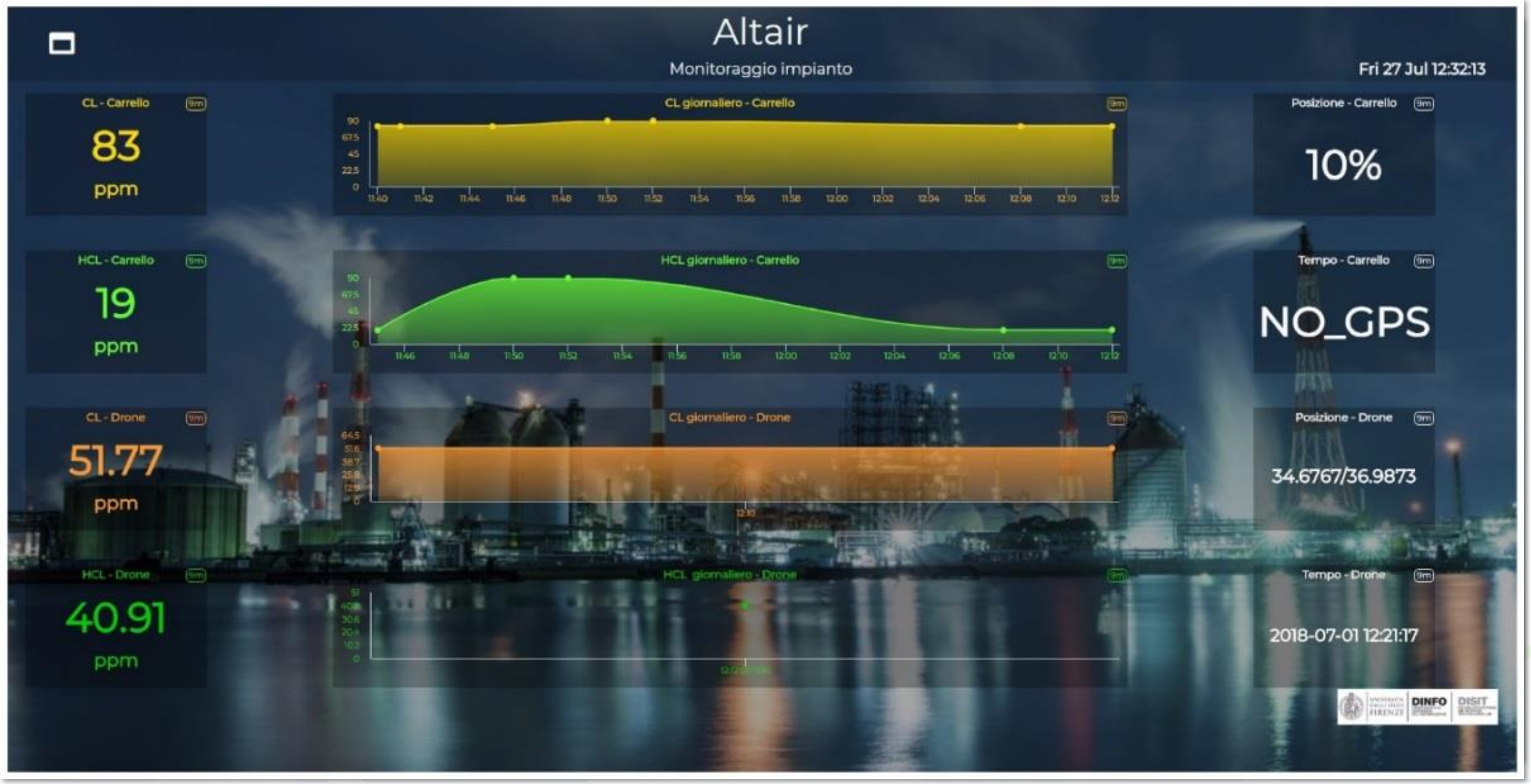
ber 2020



Chemical Plant Dashboard

Green Impact Capacity (GIC)

Altair Control room


Altair
Monitoraggio impianto
Fri 27 Jul 12:32:13
CL - Carrello
83
ppm
CL giornaliero - Carrello
Posizione - Carrello
10%
HCL - Carrello
19
ppm
HCL giornaliero - Carrello
Tempo - Carrello
NO_GPS
CL - Drone
51.77
ppm
CL giornaliero - Drone
Posizione - Drone
34.6767/36.9873
HCL - Drone
40.91
ppm
HCL giornaliero - Drone
Tempo - Drone
2018-07-01 12:21:17

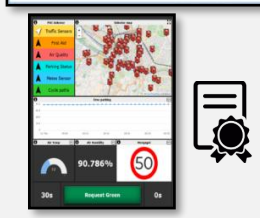
Prato
Smart City vs Industry 4.0

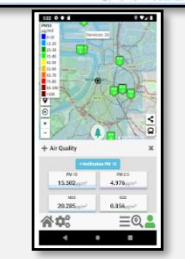
GIDA set up

Smart City data from many sources

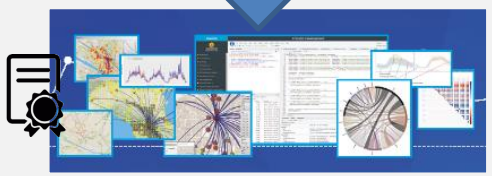
IOT Applications

Dashboards and Apps

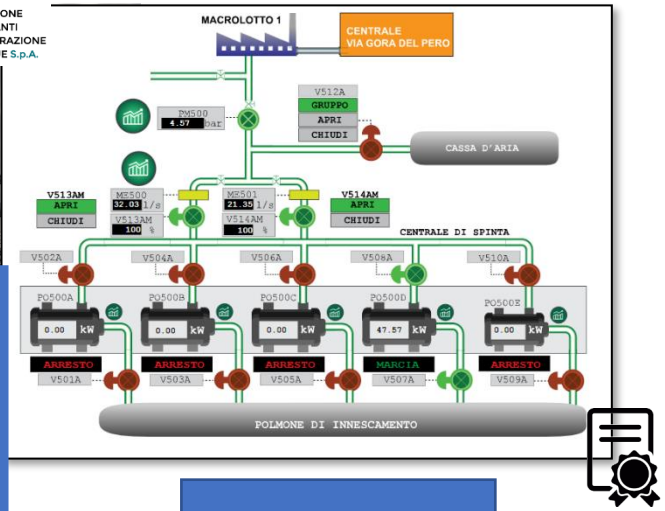




IOT Data Shadow Snap4City



Big Data Analytics, Artificial Intelligence



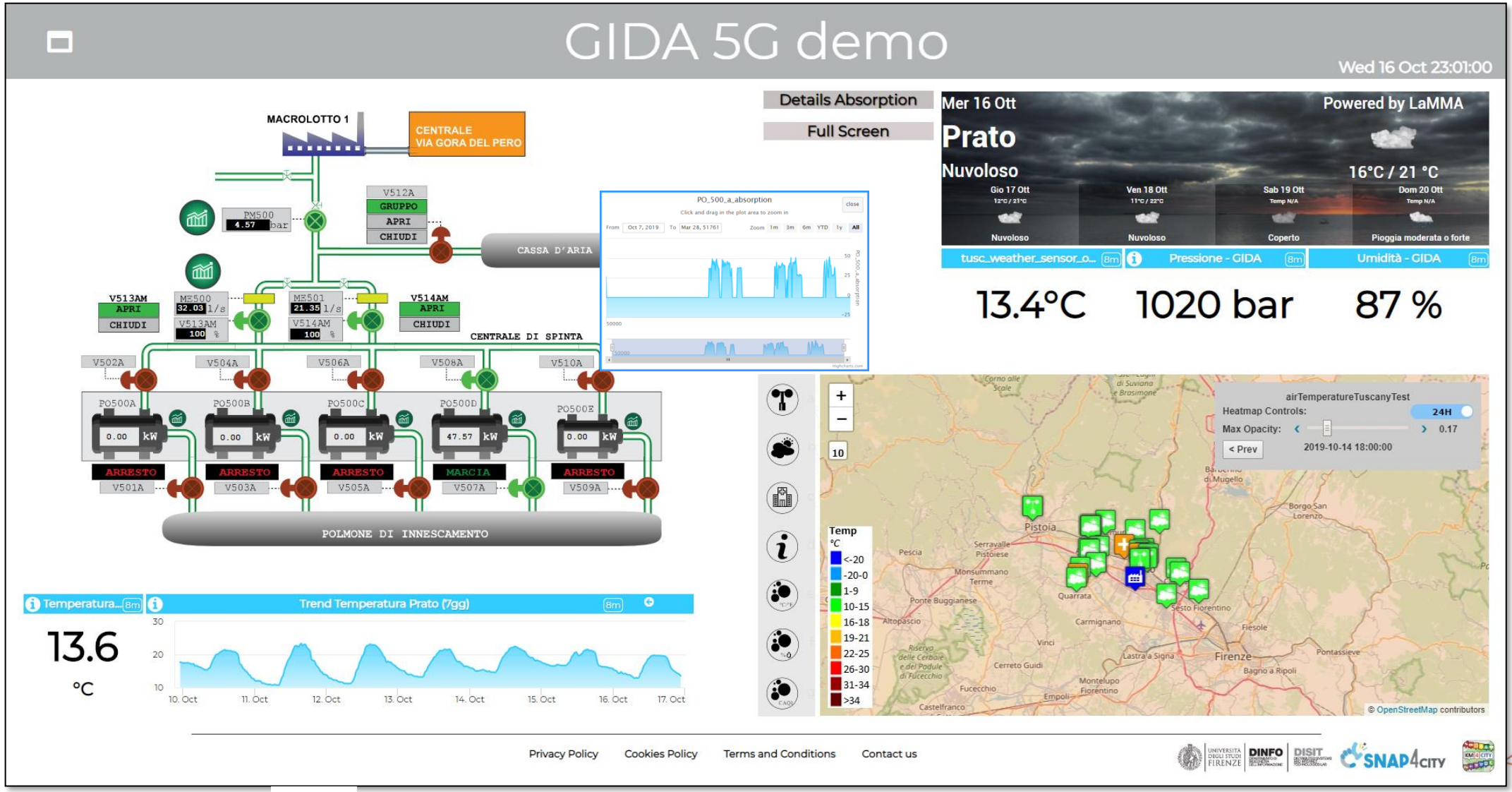
Modbus

ModBus to Snap4City Gateway Edge

5G network devices

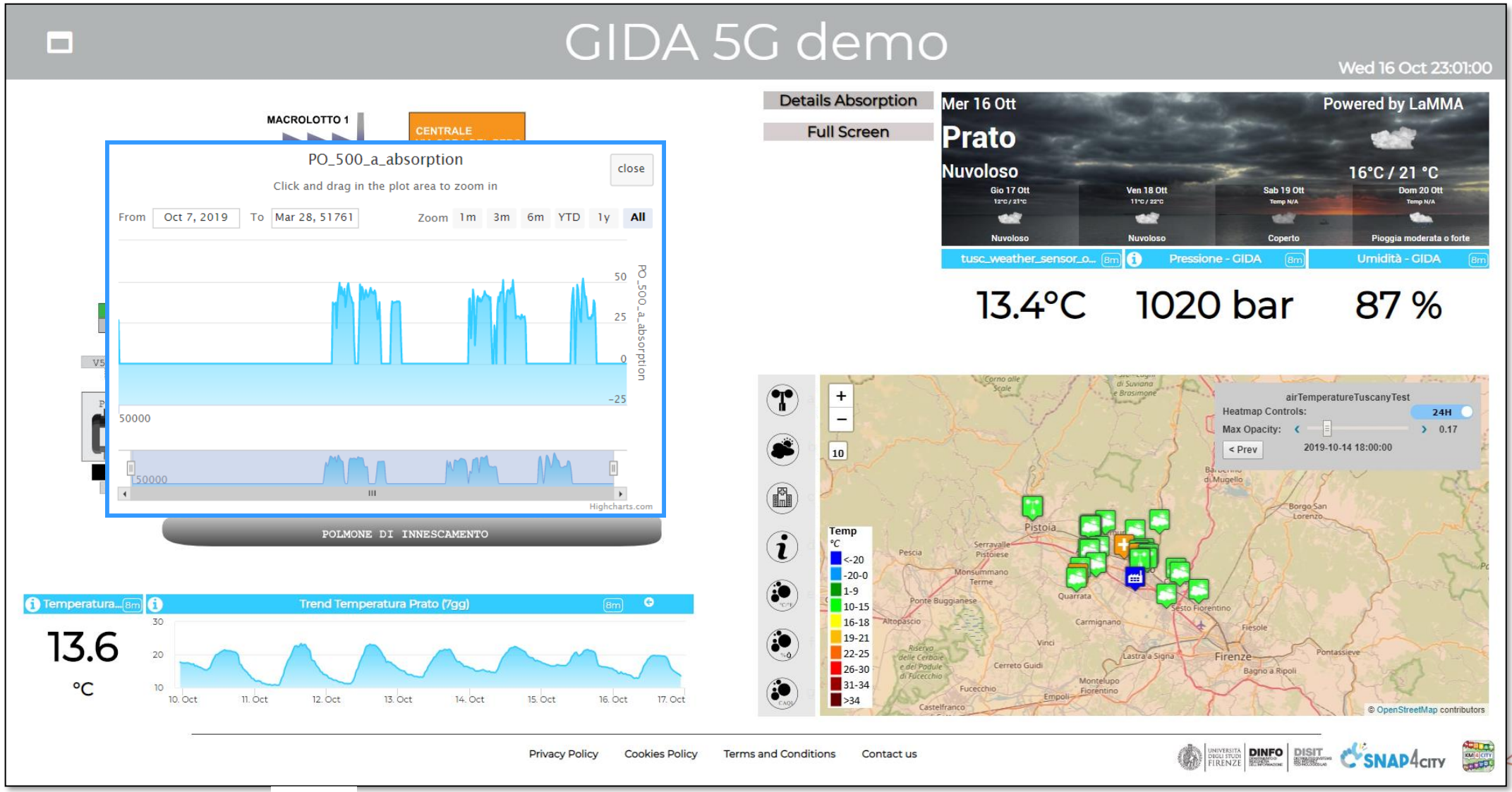
Telemonitoring
Telecontrol

Demo UC5 GIDA



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

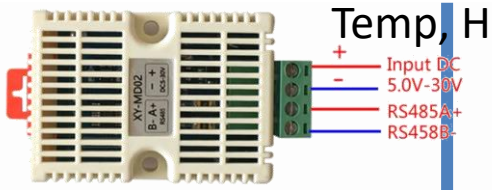
Demo UC5 GIDA



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

IOT App Smart Industry 4.0
ModBus Integration

Devices

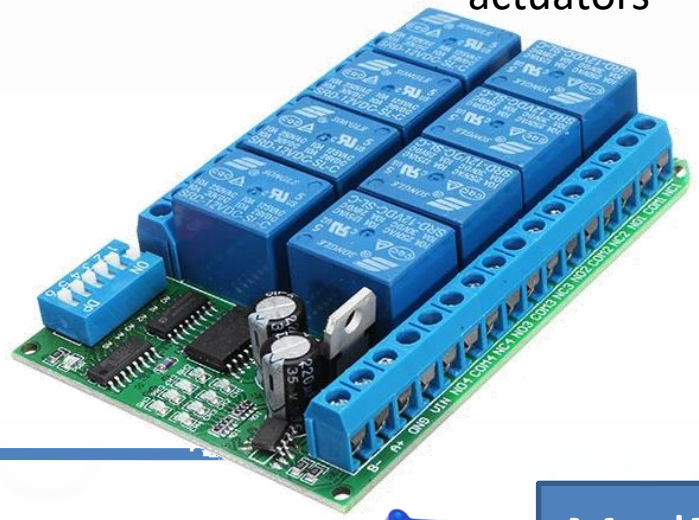


Temp, Humidity

Energy Metering

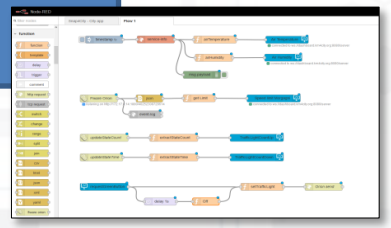
Modbus

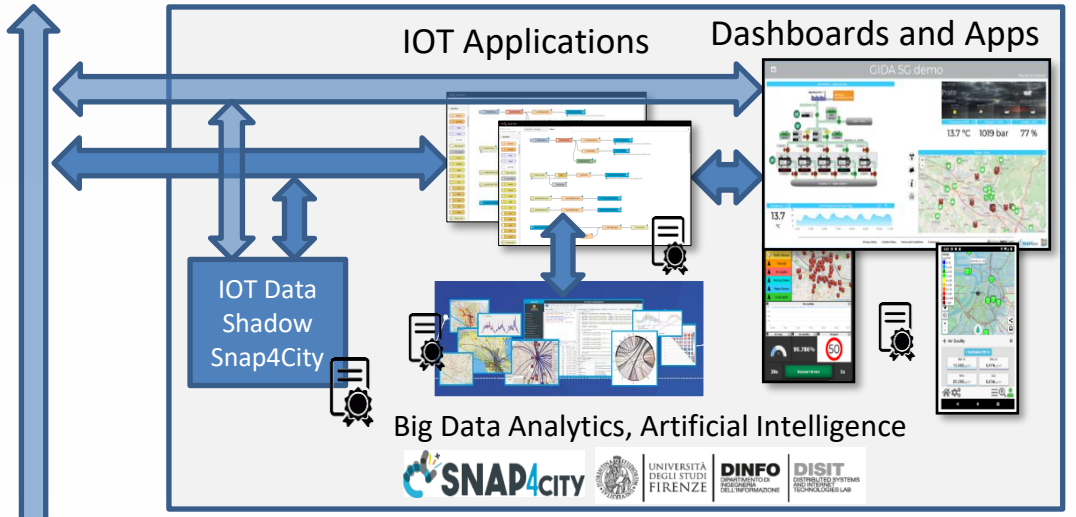
8 Relais, actuators



USB -- ModBus

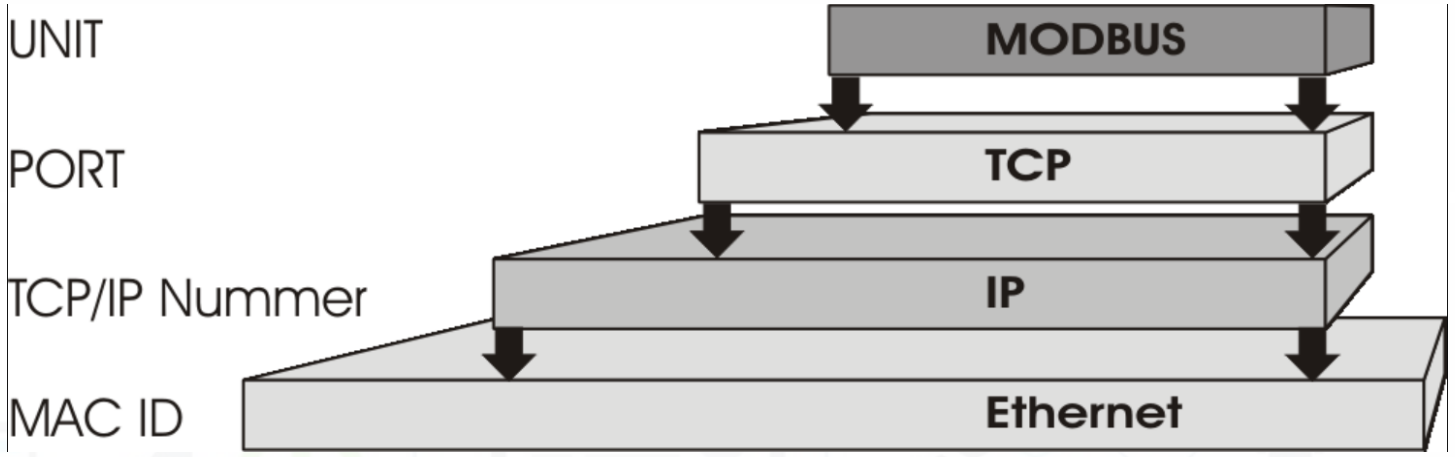
ModBus to Snap4City Gateway Edge





- A large range of devices: sensors and actuators
- Over serial as RS485 and/or IP

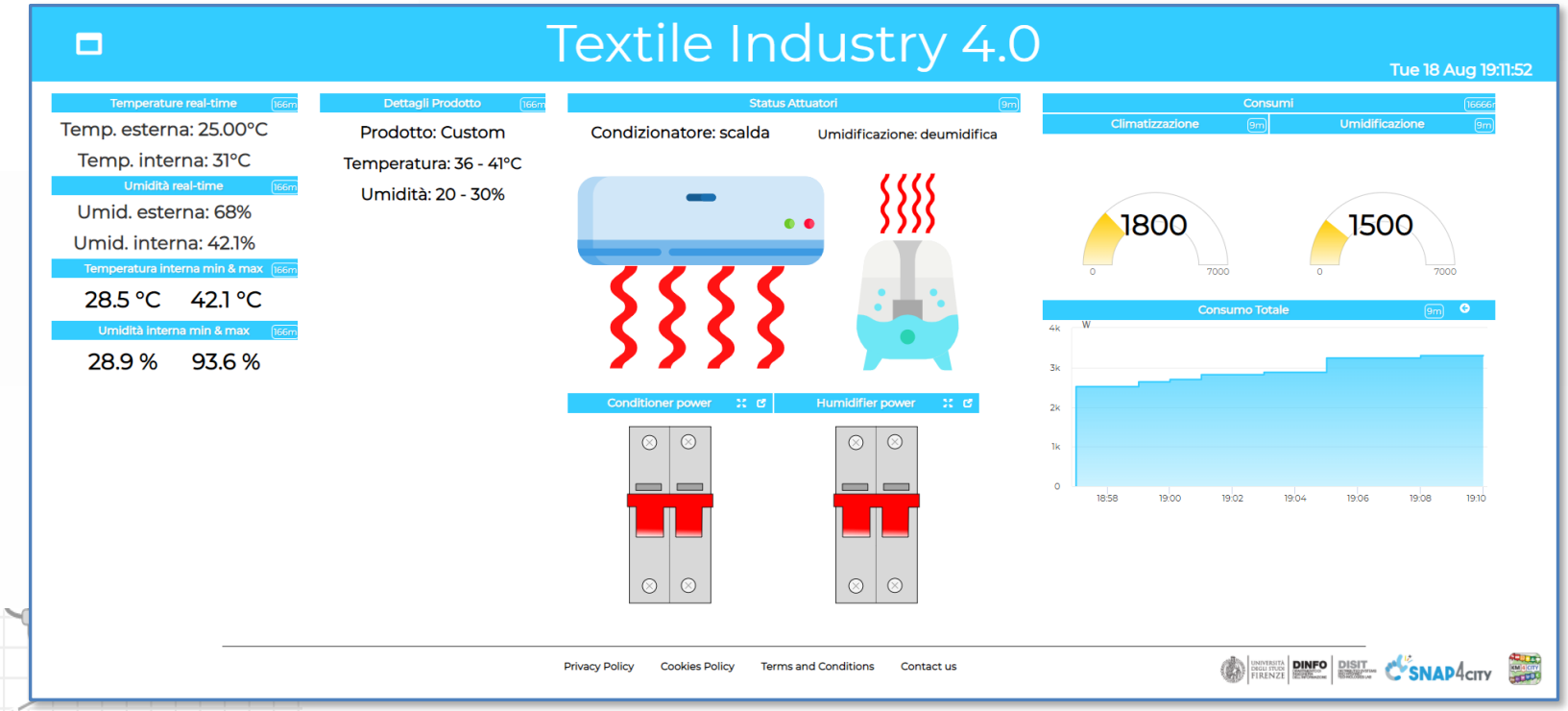
- modbus-response
- modbus-read
- modbus-getter
- modbus-flex-getter
- modbus-write
- modbus-flex-write
- modbus-server
- modbus-flex-server
- modbus-queue-info
- modbus-flex-connector
- modbus-io-config
- modbus-response-filter

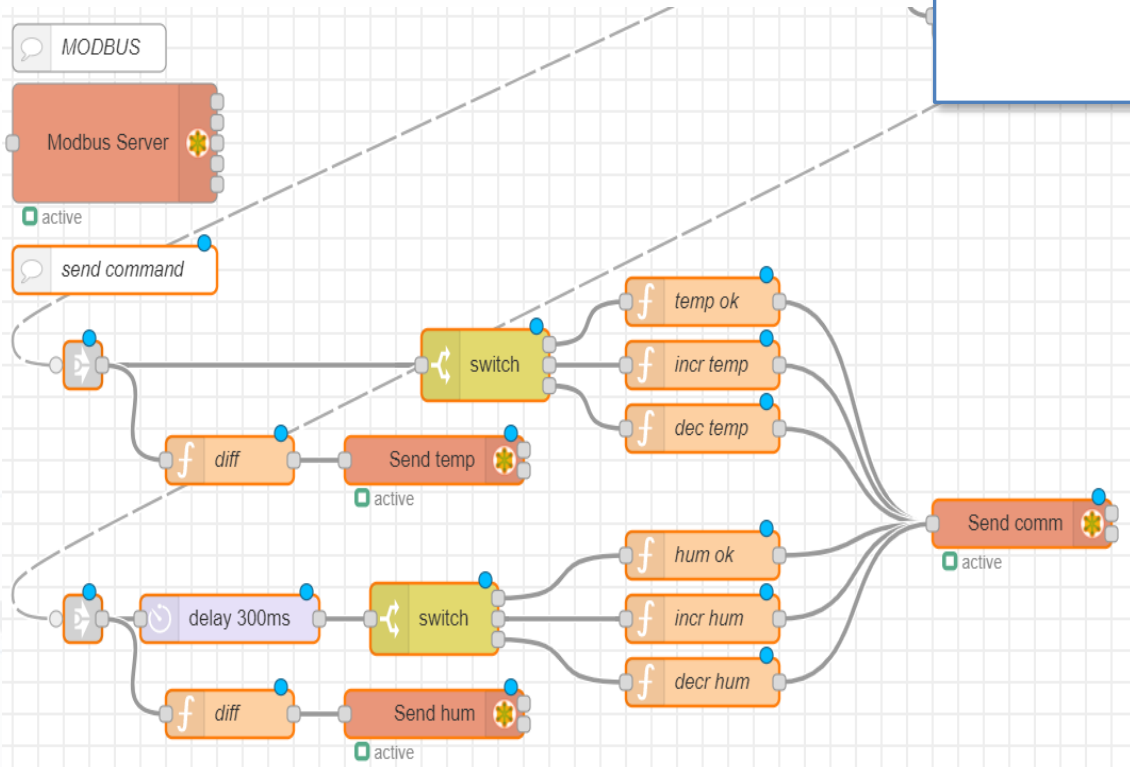


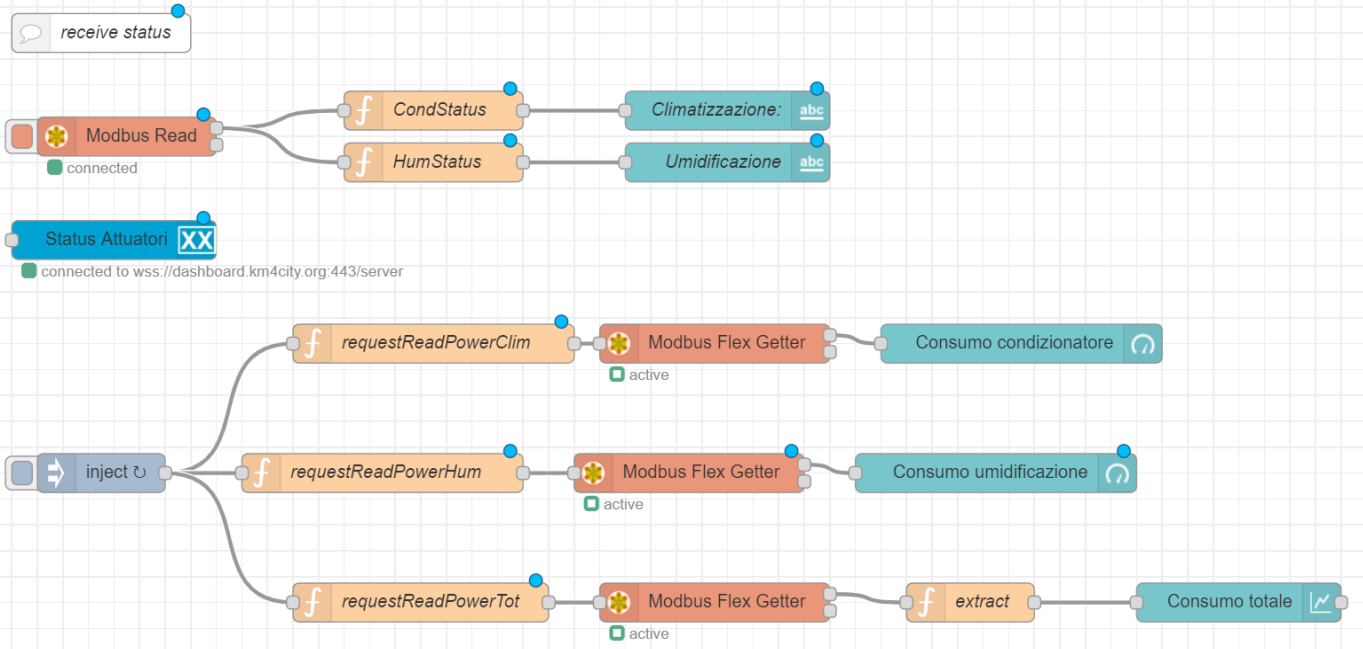
- ..

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

Modbus







IOT App vs Smart Home Snap4Home

Snap4Home

Sonoff: Controlling Energy Power

Philips Hue: Controlling Lights

Hue: Motion Control / Alarm

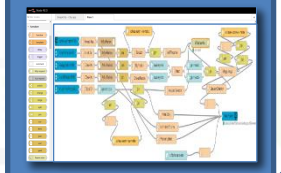
Measuring
Energy Consumption

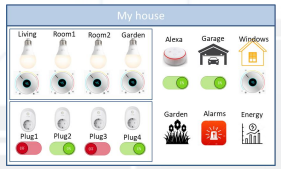
TP Link: Controlling / Measuring Energy Plugs

Alexa: Voice Control

IOT Edge:

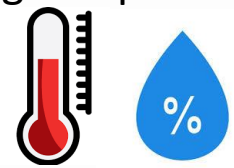
Raspberry pi: Node-RED + Snap4City





Local Control

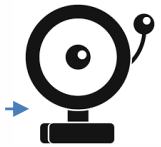
Measuring Temperature and Humidity



Garage Door

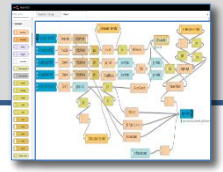
Window
Roller Shutters

Controlling Motors

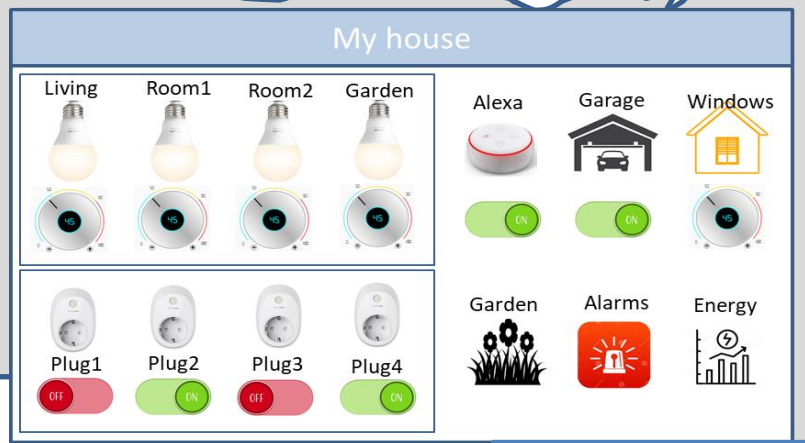


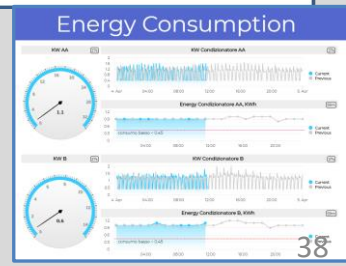
Alarm sound
and light

Controlling
Irrigators



SNAP4CITY

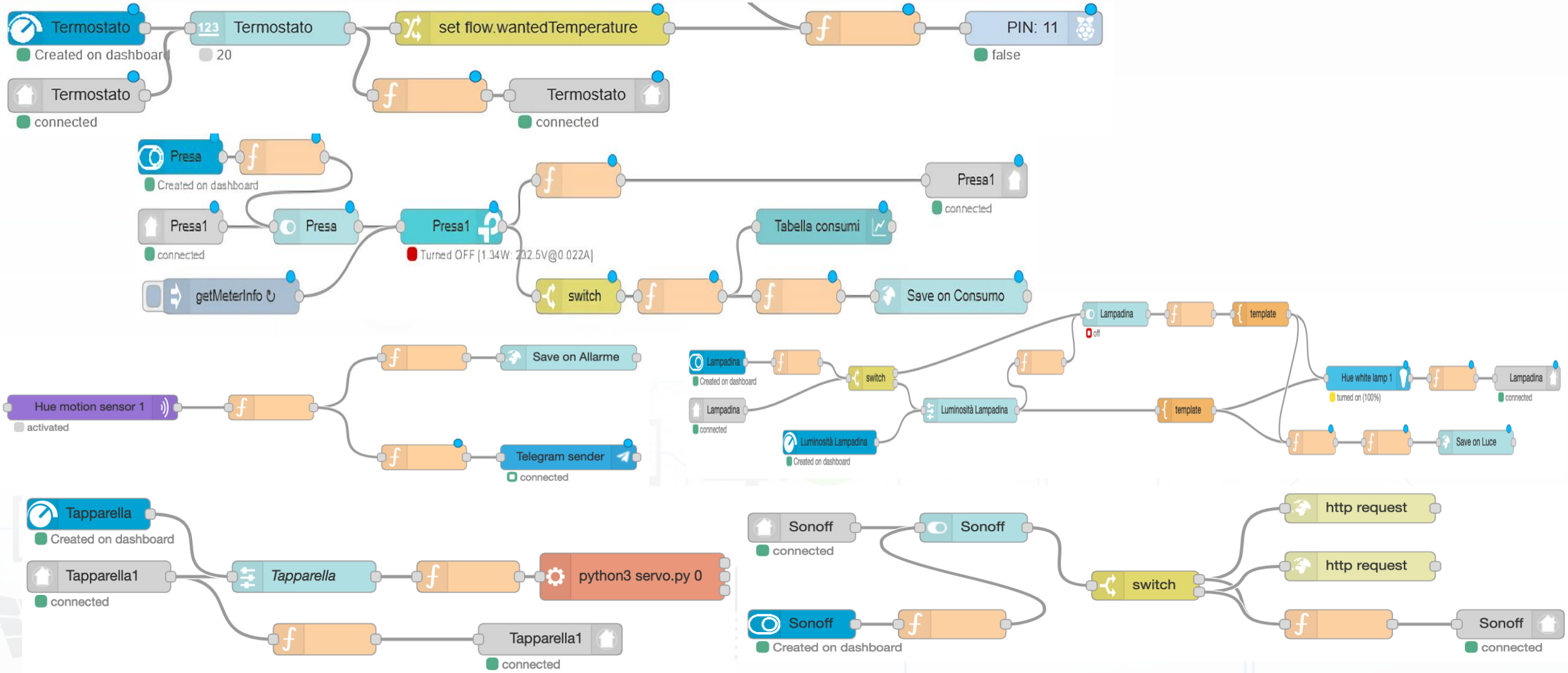




Environmental Contextual data from the city
Historical Data, Remote Control, Mobile App

https://www.snap4city.org/620

Example: IOT App on Snap4Home



Snap4Home

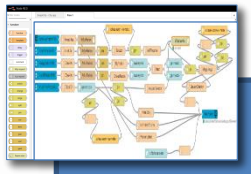
Philips Hue: Controlling Lights

Hue Hub

Hue: Motion Control / Alarm

TP Link: Controlling / Measuring Energy Plugs

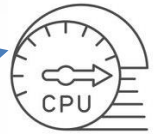
Alexa: Voice Control



IOT Edge:

Raspberry pi: Node-RED + Snap4City

Measuring: Temperature, Humidity, light in the room

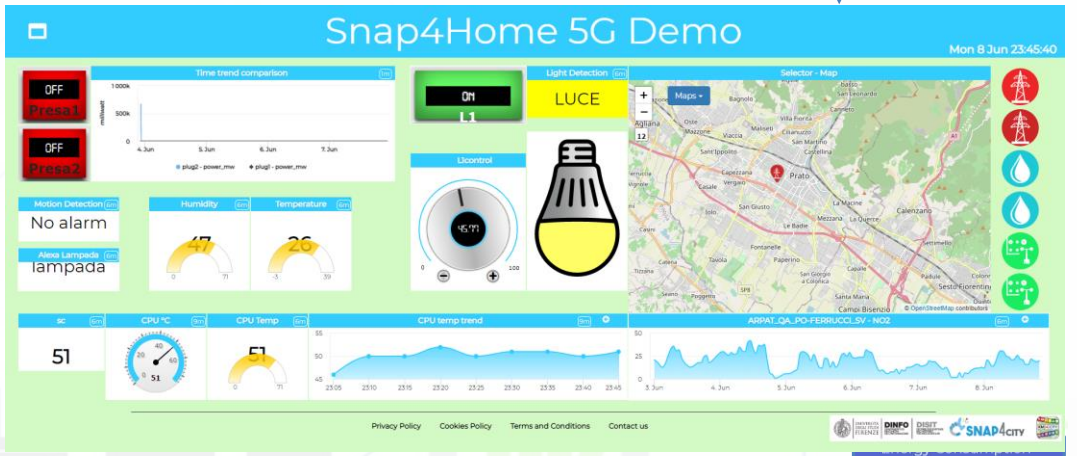


Monitoring: CPU clock, status

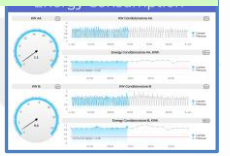
5G gateway

Internet

SNAP4CITY



Environmental Contextual data from the city.
Historical Data, Remote Control, Mobile App



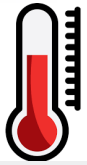
Snap4Home

Hue Hub

Motion Control / Alarm

TP Link plugs: meter

Alexa: Voice Control



SNAP4CITY

IOT Edge:

Raspberry pi: Node-RED + Snap4City MicroService Library

5G gateway

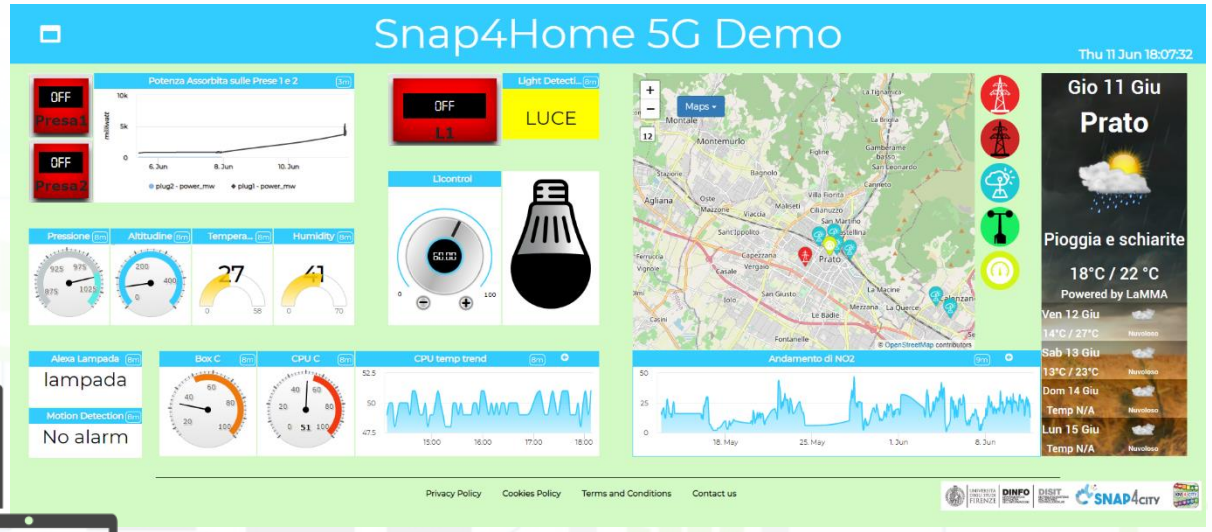
FIWARE Orion Broker

Dashboards

Advanced Smart City API

SNAP4CITY

Environmental Contextual data from the city. Historical Data, Remote Control, Mobile App

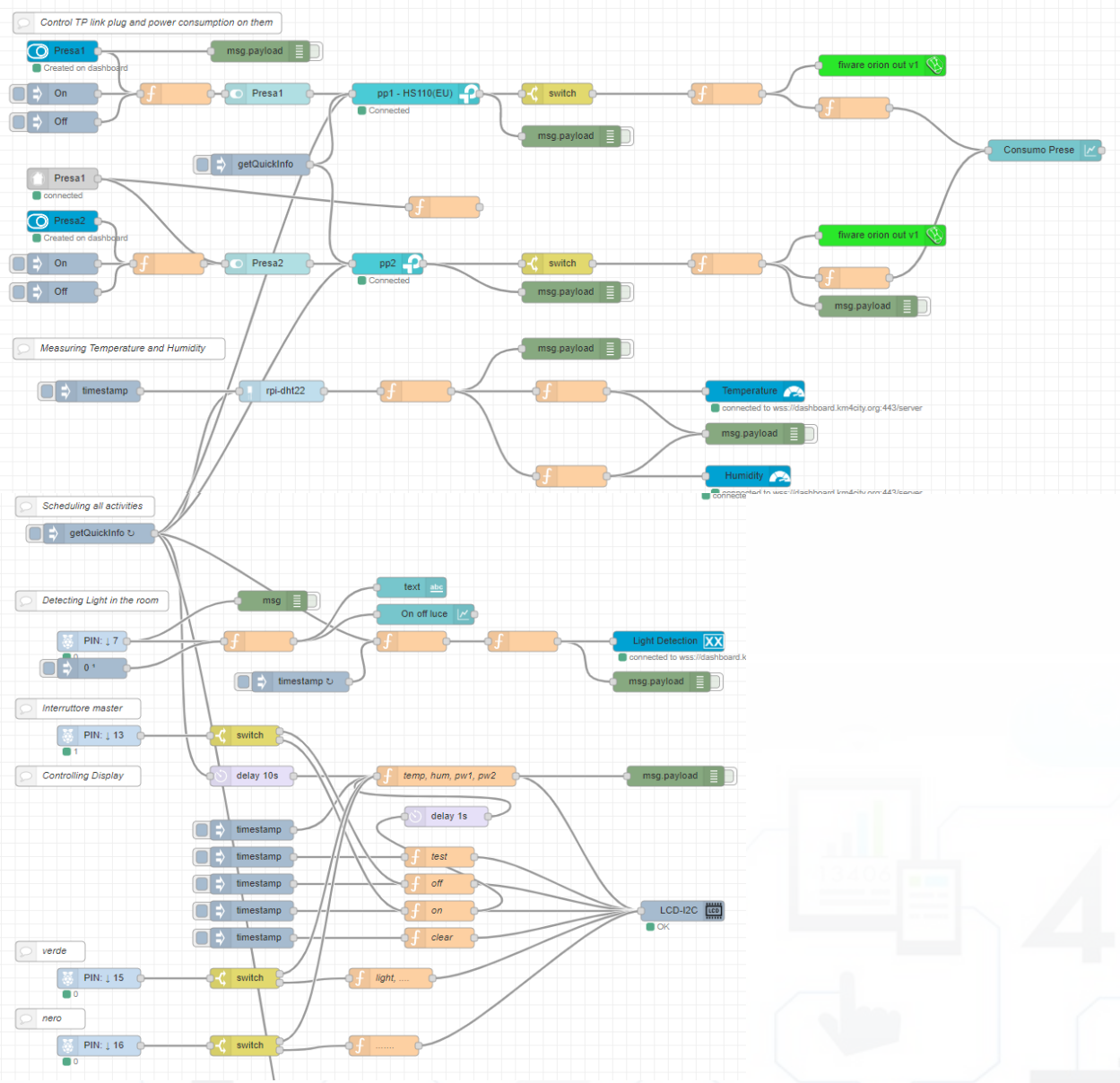


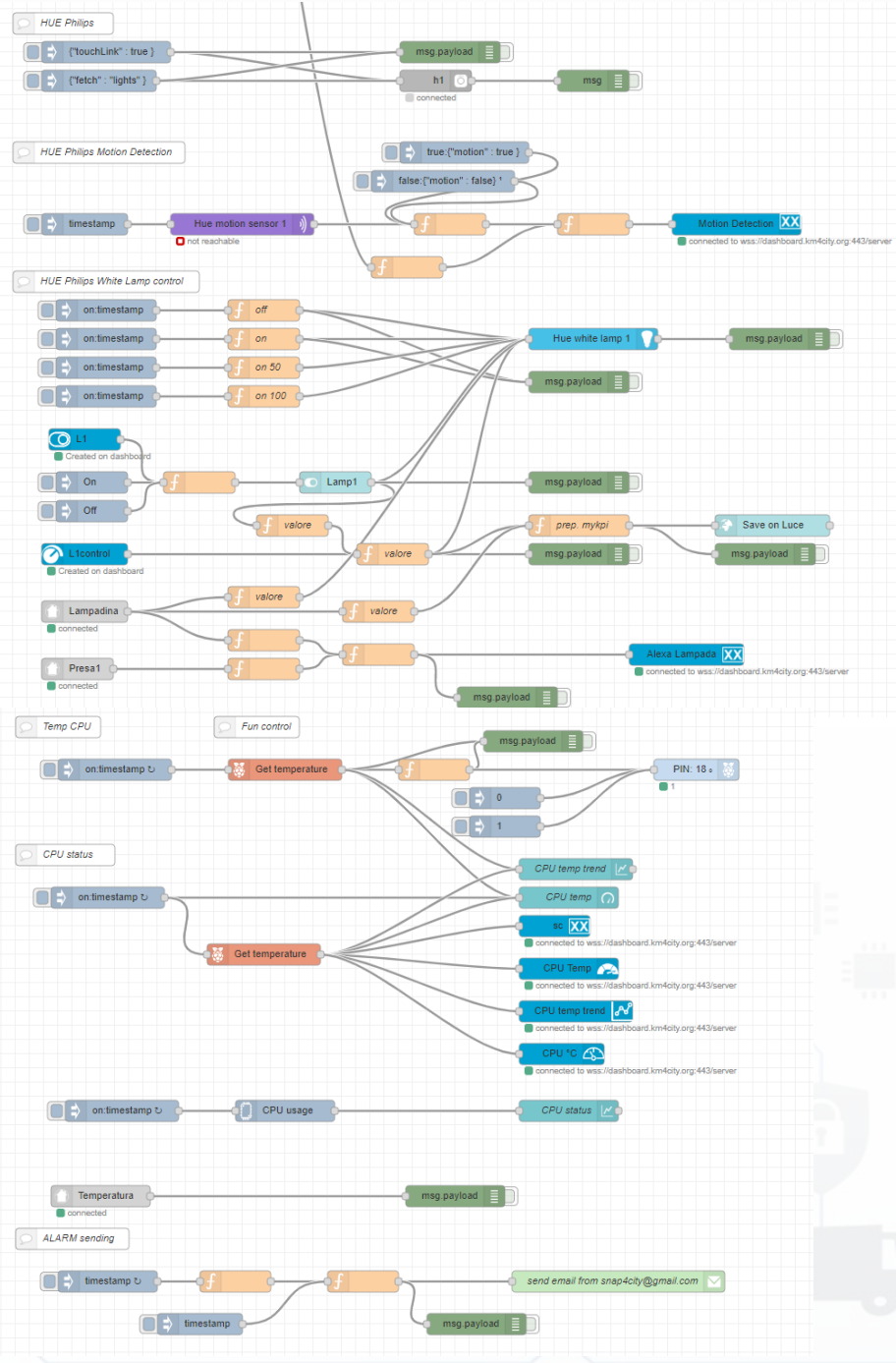
Snap4Home 5G Demo

Thu 11 Jun 18:07:32

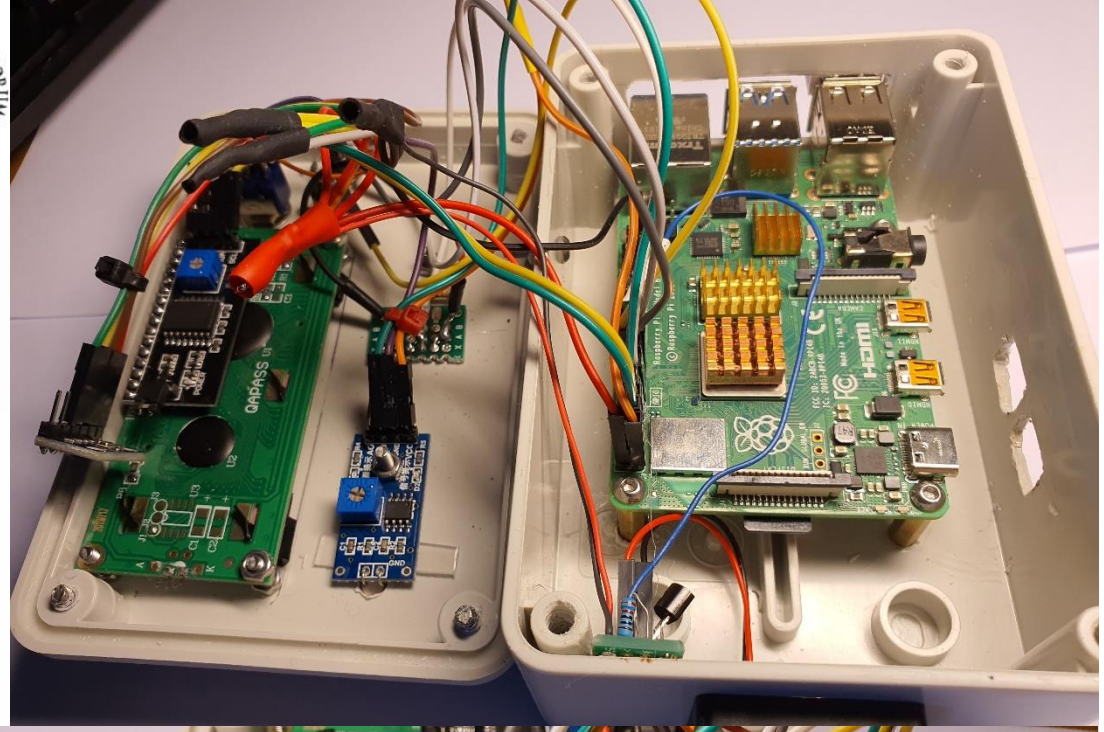
Privacy Policy Cookies Policy Terms and Conditions Contact us

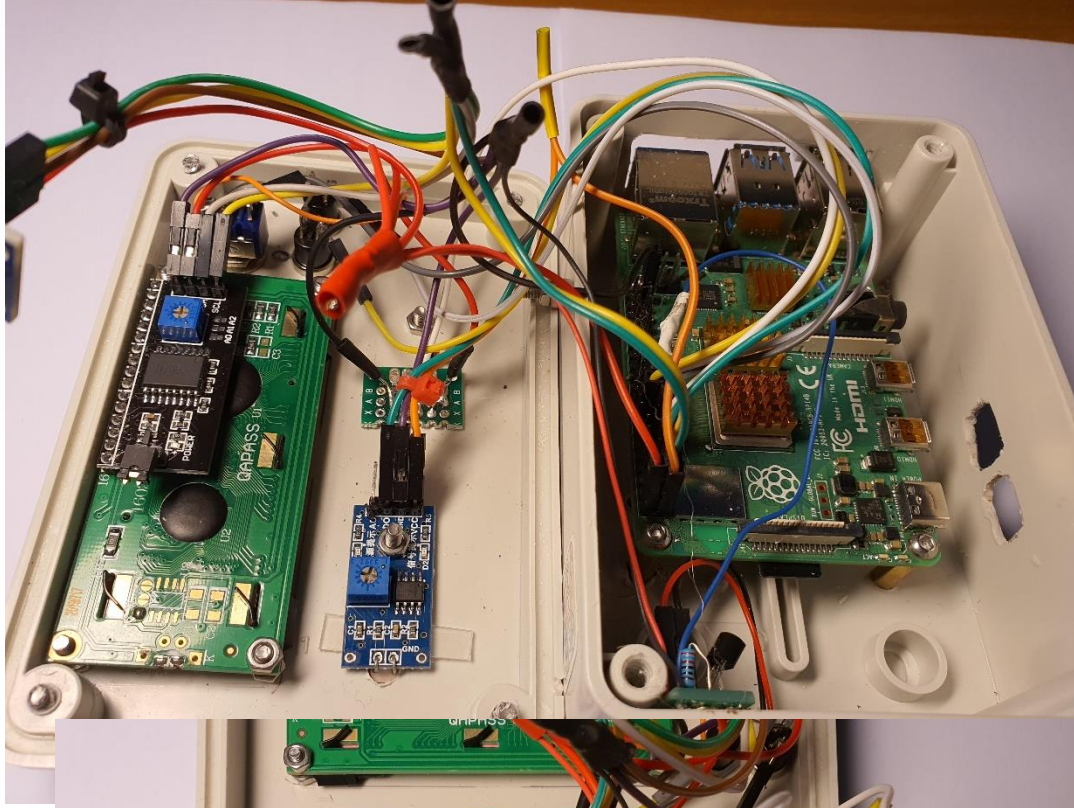
open fiber WIND 3 ZTE estra

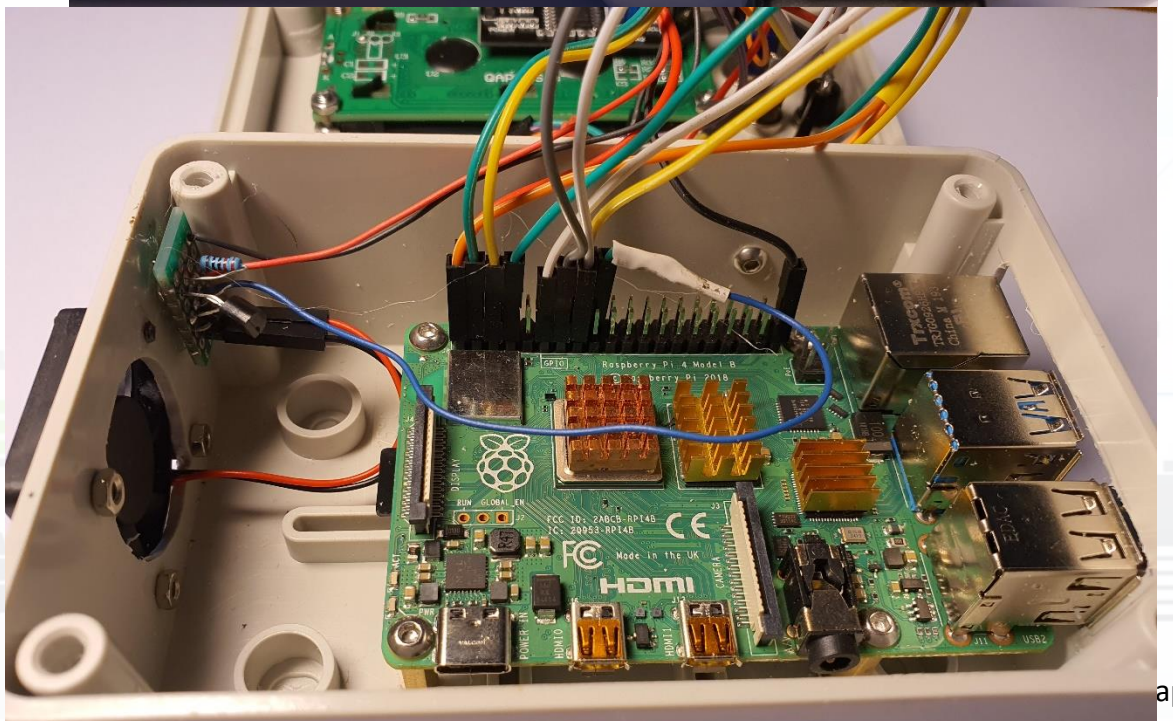

Control TP link plug and power consumption on them
Presa1
Created on dashboard
msg.payload
On
Off
Presa1
pp1 - HS110(EU)
Connected
switch
fiware orion out v1
msg.payload
Consumo Prese
getQuickInfo
Presa1
connected
Presa2
Created on dashboard
On
Off
Presa2
pp2
Connected
switch
fiware orion out v1
msg.payload
Measuring Temperature and Humidity
timestamp
rpi-dht22
msg.payload
Temperature
connected to wss://dashboard.km4city.org:443/server
msg.payload
Humidity
Scheduling all activities
getQuickInfo
Detecting Light in the room
msg
text
On off luce
PIN: 7
0
timestamp
Light Detection
connected to wss://dashboard.k
msg.payload
Interruttore master
PIN: 13
1
switch
delay 10s
temp, hum, pw1, pw2
msg.payload
Controlling Display
timestamp
timestamp
timestamp
timestamp
timestamp
delay 1s
test
off
on
clear
LCD-I2C
OK
verde
PIN: 15
0
switch
light, ...
nero
PIN: 16
0
switch
.....

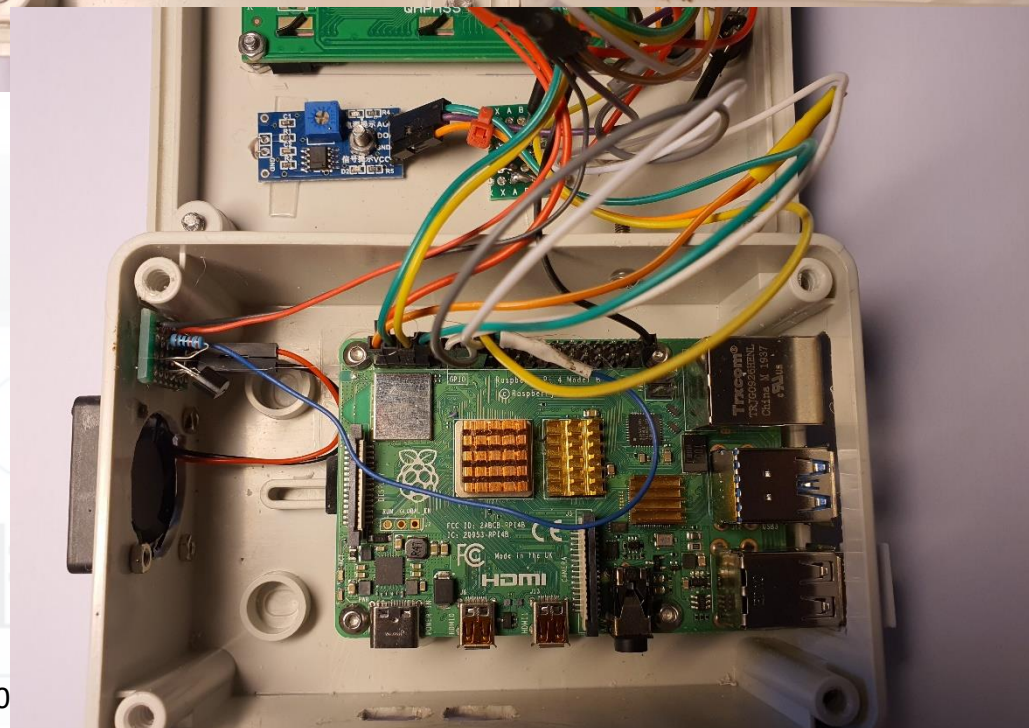

HUE Philips
{"touchLink" : true }
{"fetch" : "lights" }
msg.payload
h1
connected
msg
HUE Philips Motion Detection
true:{"motion" : true }
false:{"motion" : false} *
timestamp
Hue motion sensor 1
not reachable
Motion Detection
connected to wss://dashboard.km4city.org:443/server
HUE Philips White Lamp control
on:timestamp
on:timestamp
on:timestamp
on:timestamp
off
on
on 50
on 100
Hue white lamp 1
msg.payload
msg.payload
L1
Created on dashboard
On
Off
Lamp1
msg.payload
valore
prep. mykpi
Save on Luce
msg.payload
L1control
Created on dashboard
valore
valore
msg.payload
Lampadina
connected
valore
valore
Presa1
connected
Alexa Lampada
connected to wss://dashboard.km4city.org:443/server
msg.payload
Temp CPU
Fun control
on:timestamp
Get temperature
msg.payload
PIN: 18
1
0
1
CPU status
on:timestamp
Get temperature
CPU temp trend
CPU temp
sc
connected to wss://dashboard.km4city.org:443/server
CPU Temp
connected to wss://dashboard.km4city.org:443/server
CPU temp trend
connected to wss://dashboard.km4city.org:443/server
CPU °C
connected to wss://dashboard.km4city.org:443/server
on:timestamp
CPU usage
CPU status
Temperatura
connected
msg.payload
ALARM sending
timestamp
timestamp
send email from snap4city@gmail.com
msg.payload


T:27'C; Hum:43%
P1:NaNW;P2:NaNW
SNAP4CITY
PHILIPS
tp-link



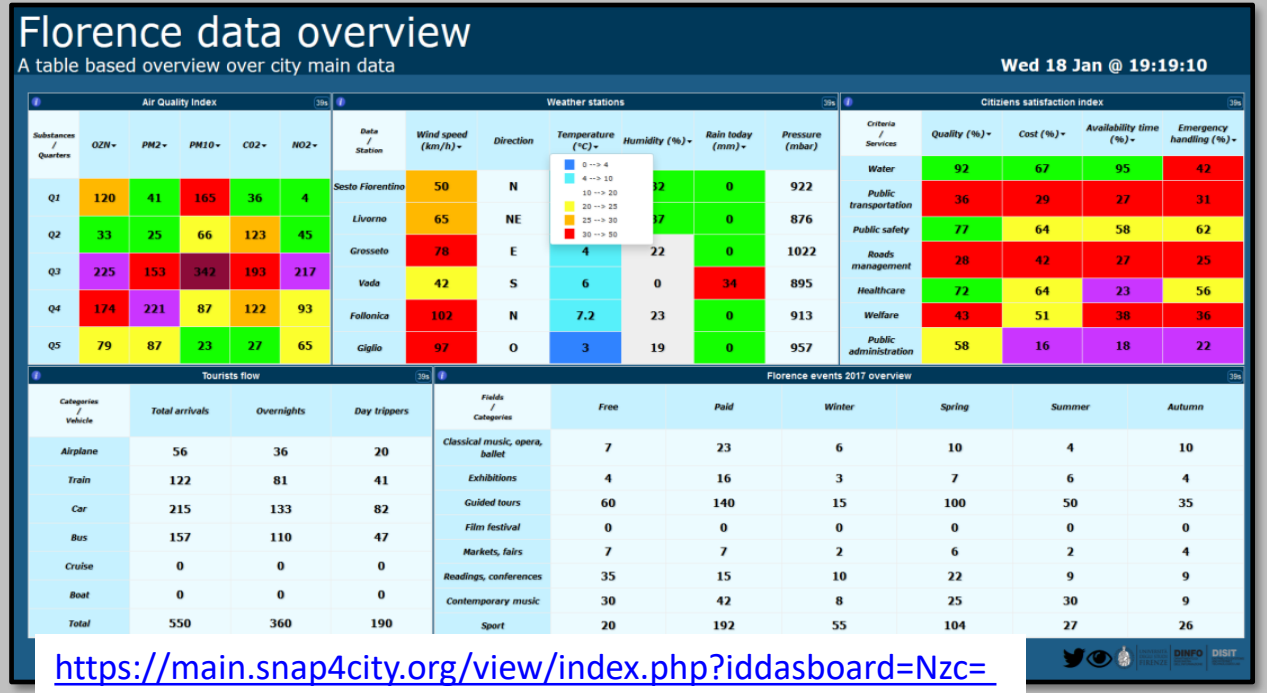




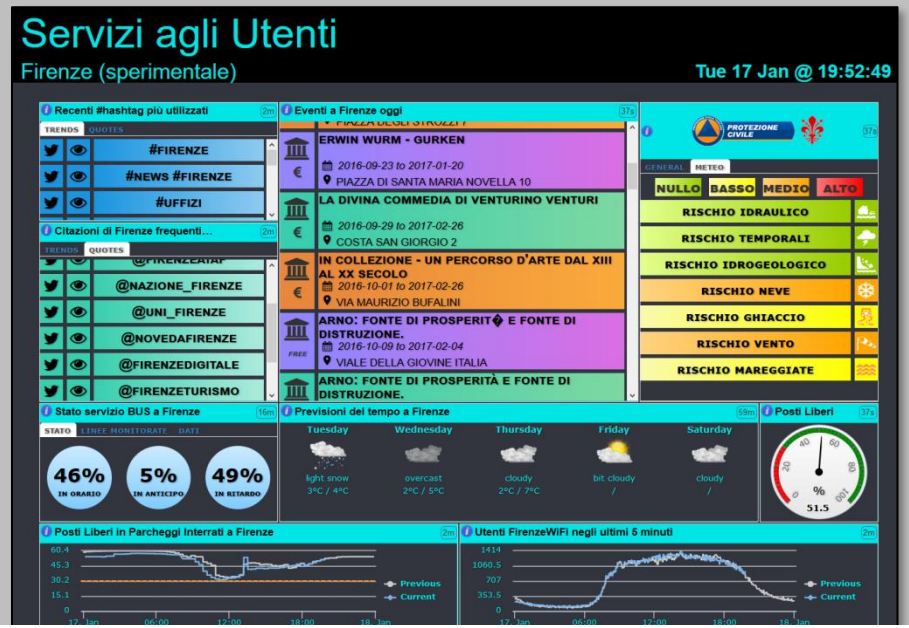


Creation of Dashboards and Applications

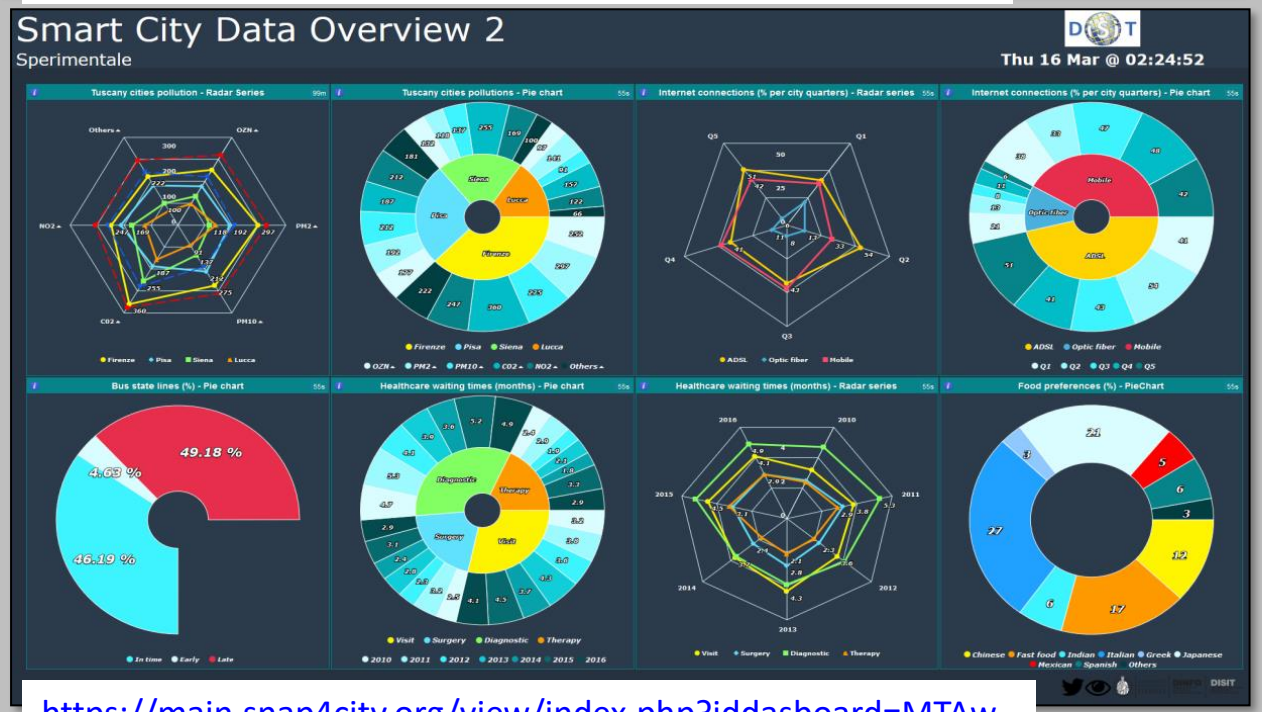

Datacenter Energy Consumption
DataCenter gas and smoke (mobile)
DISIT
Sat 22 Jun 09:40:02
Smoke1
6
Smoke1 (day)
Smoke2
3
Smoke2 (day)
Smoke3
4
Smoke3 (day)
Gas1
36
Current
Previous
Temperatures - Room of machine 166
DISIT
22.4
deg
Temperature 1 (last 12 hours)
Temperature 1 (H24)
20.4
deg
Temperature 2 (last 12 hours)
Temperature 2 (H24)
Humidity %1
31.5
Humidity Percentage 1 (daily)
Humidity %2
40.5
Humidity Percentage 2 (daily)
WebMonitoring major
Status of Web servers
Sat 22 Jun 09:43:50
DISIT_ORG
KM4CITY
SERVICEMAP
SERVICEMAPOSM
TWITTERVIGILANCE
LINKEDOPENGRAPH
NODERED_1
NODERED_2
NODERED_3
NODERED_4
NODERED_5
NODERED_6
NODERED_7
NODERED_8
TOKEN FOUND



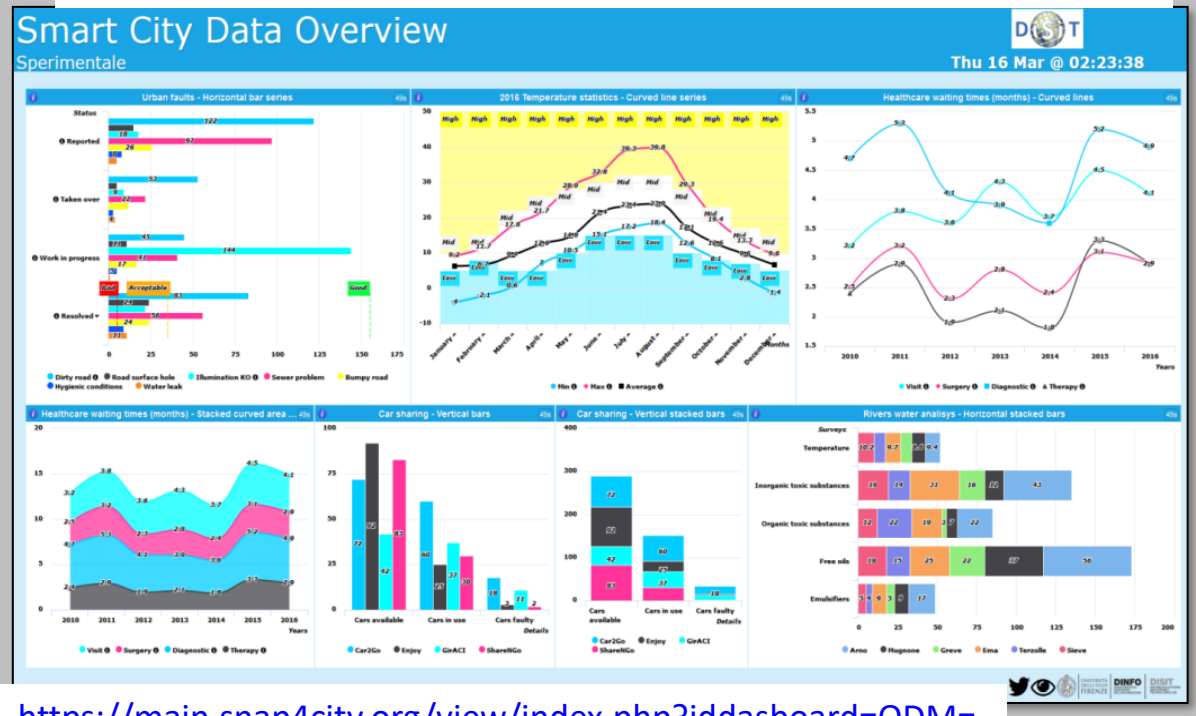
https://main.snap4city.org/view/index.php?iddasboard=Nzc=



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



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



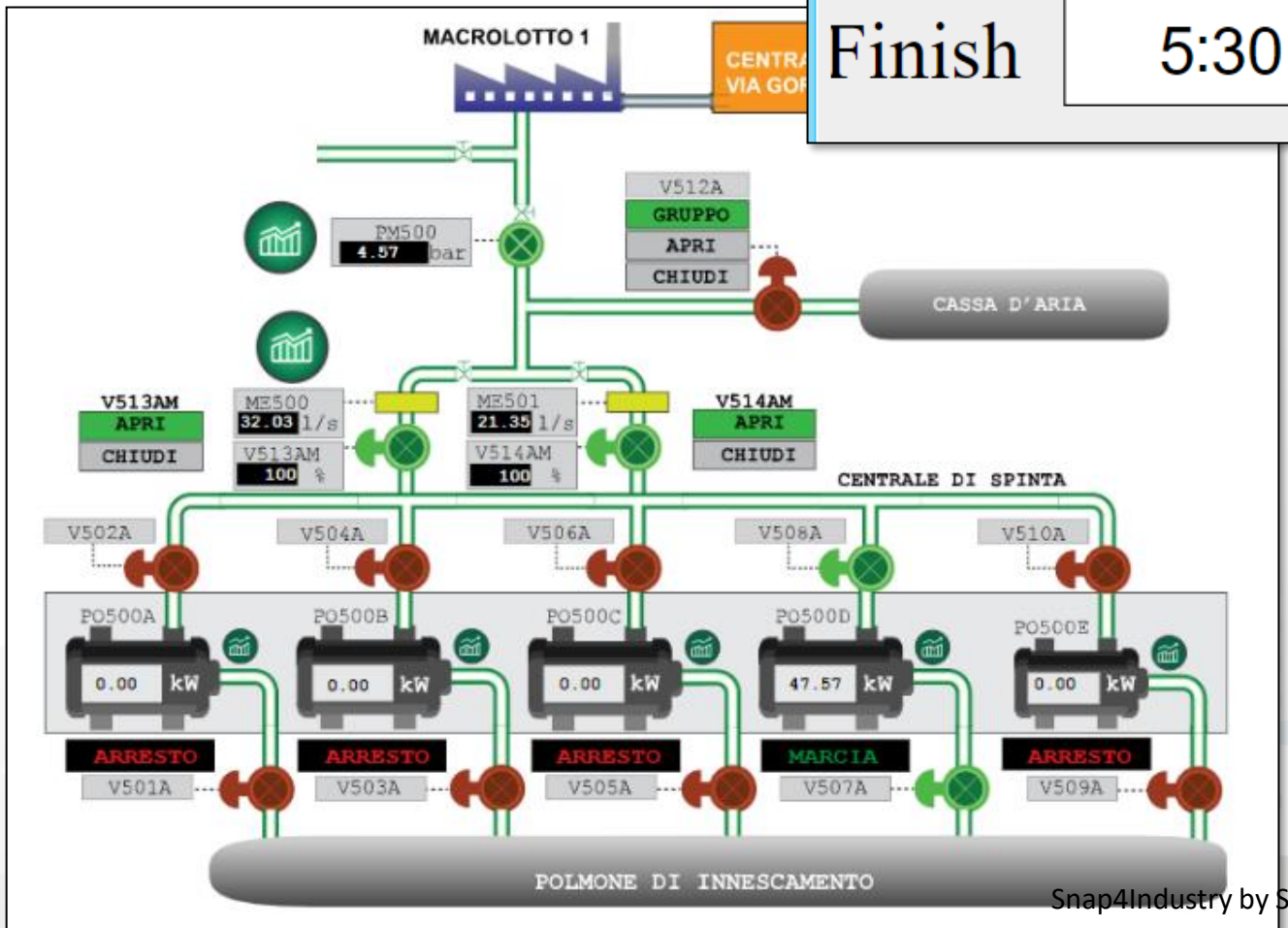
https://main.snap4city.org/view/index.php?iddasboard=ODM=

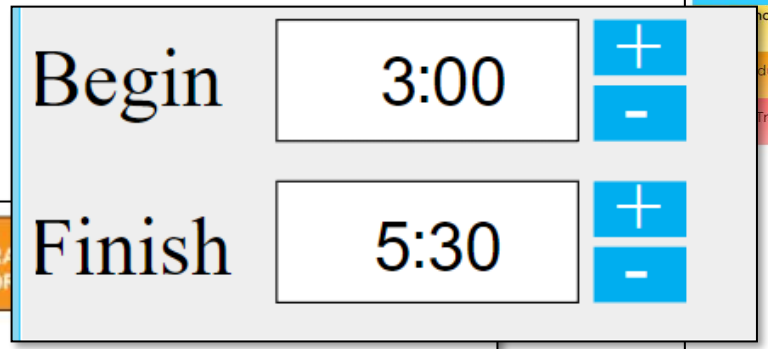
Custom Widgets

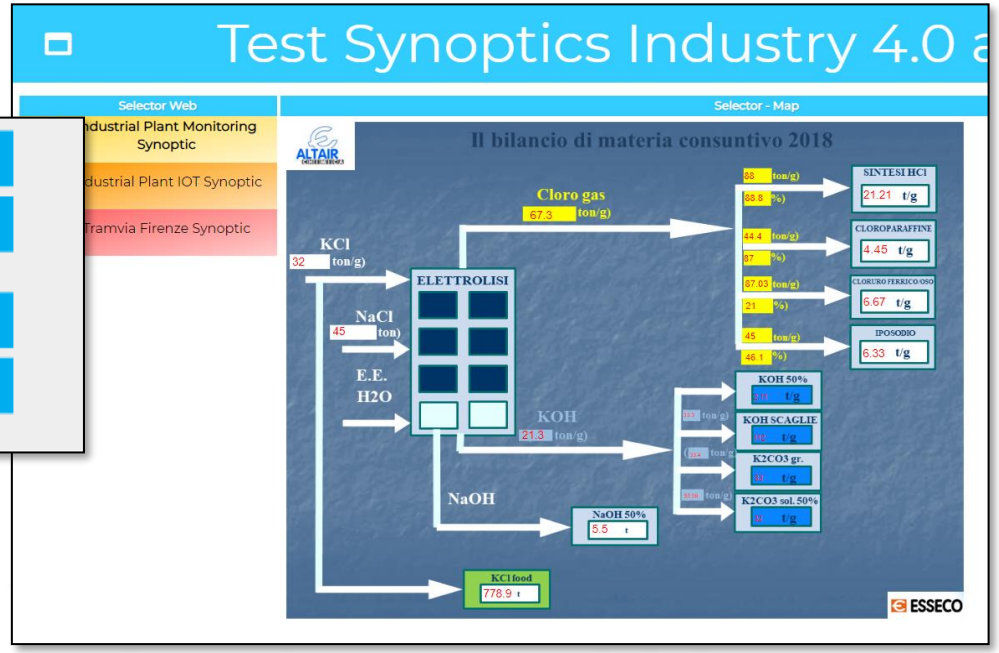
Custom Dashboards and Widgets (interactive, Animations, etc.)

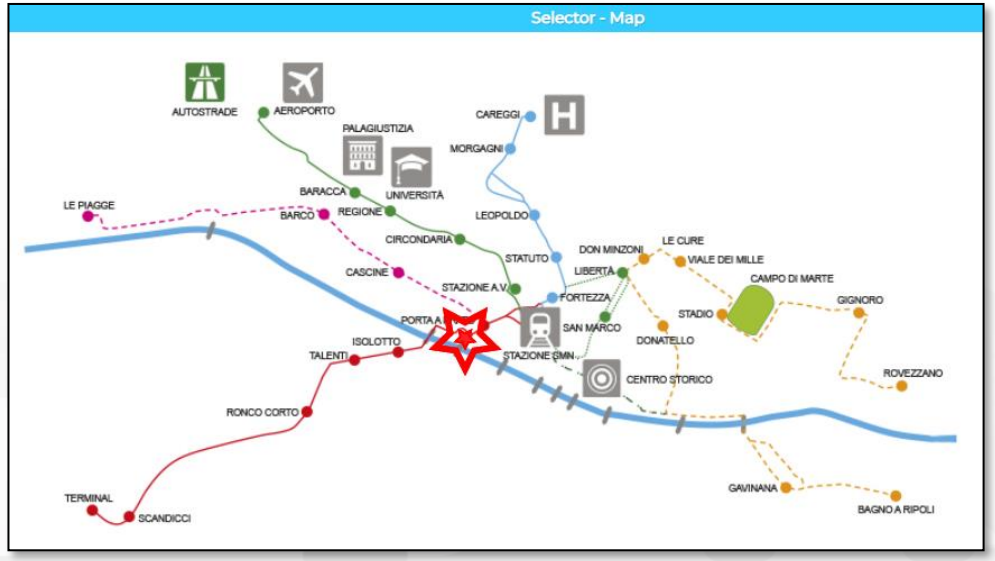
-- SVG for graphic design

-- MyKPI for collecting data









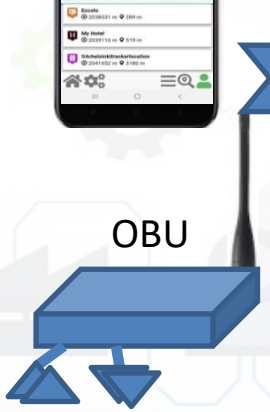
MyKPI: Tracking of Devices and Mobiles

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

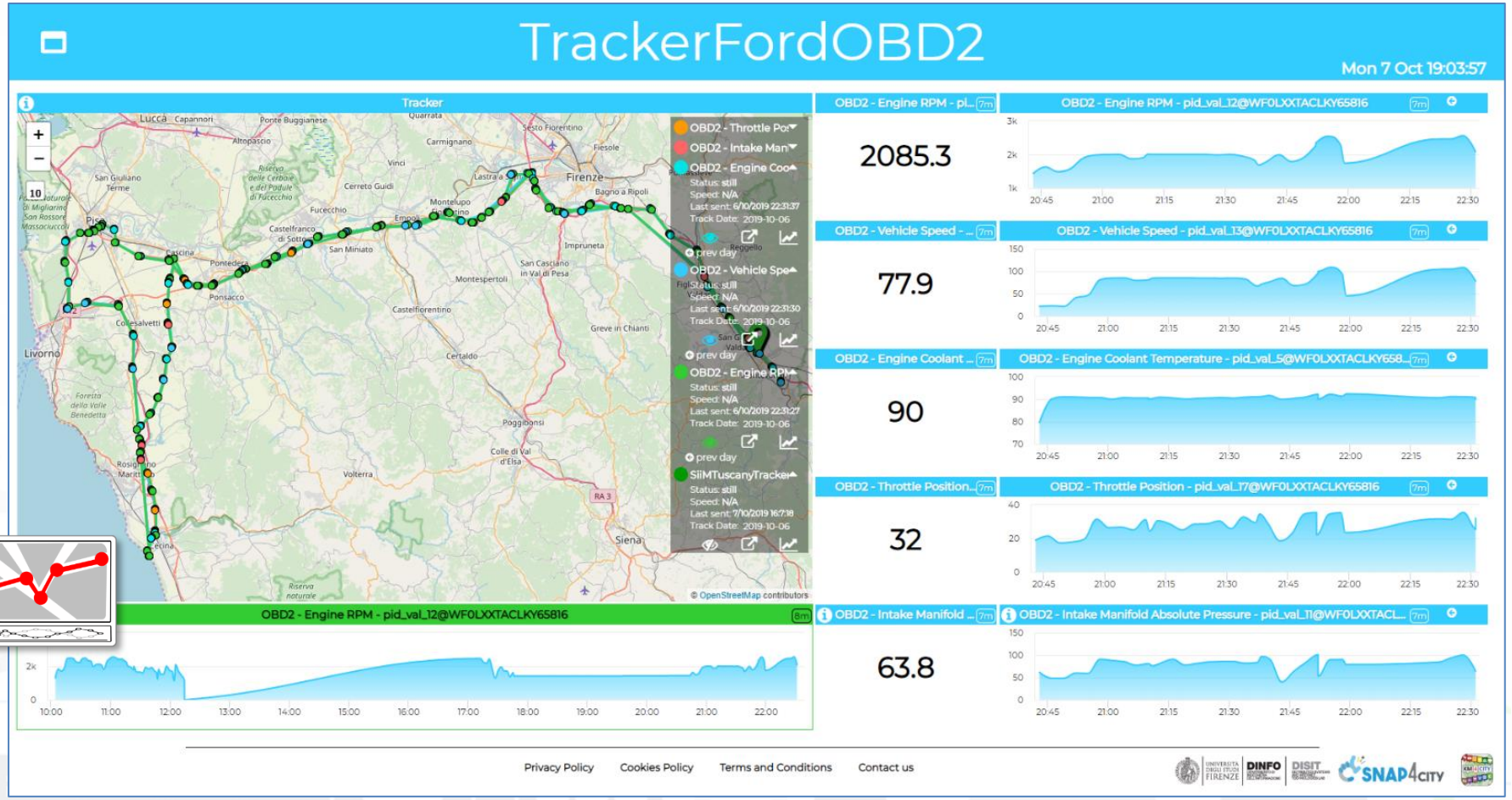
Mobile
PAX Counter

Apps

OBD2

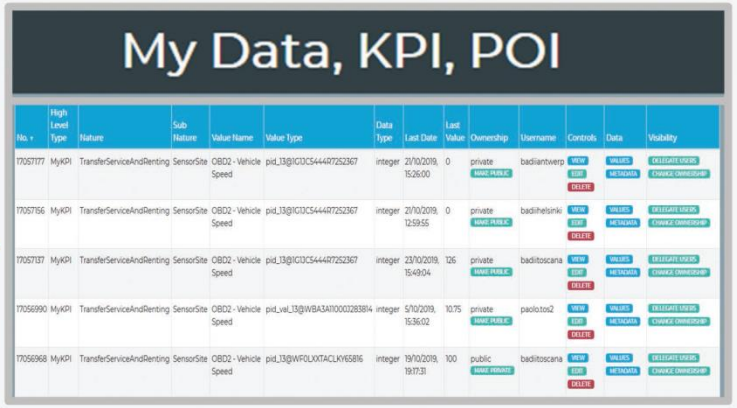


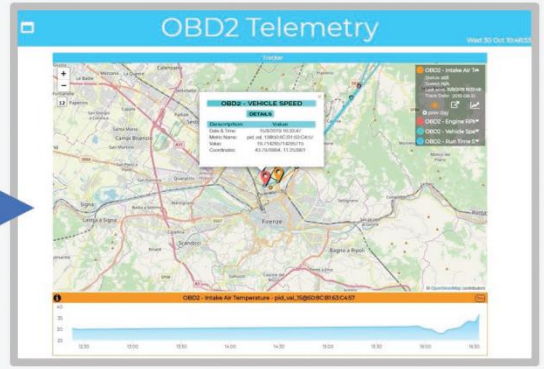
OBU



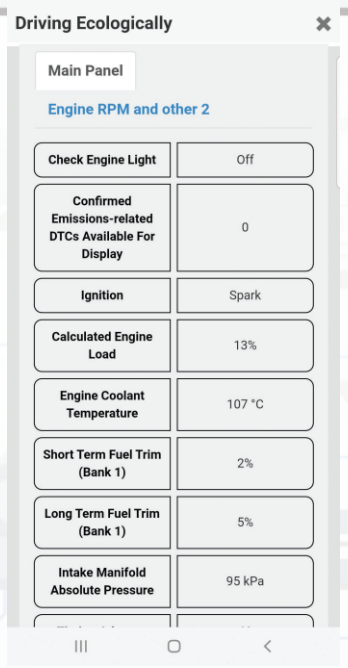
IOE – Vehicle Monitoring

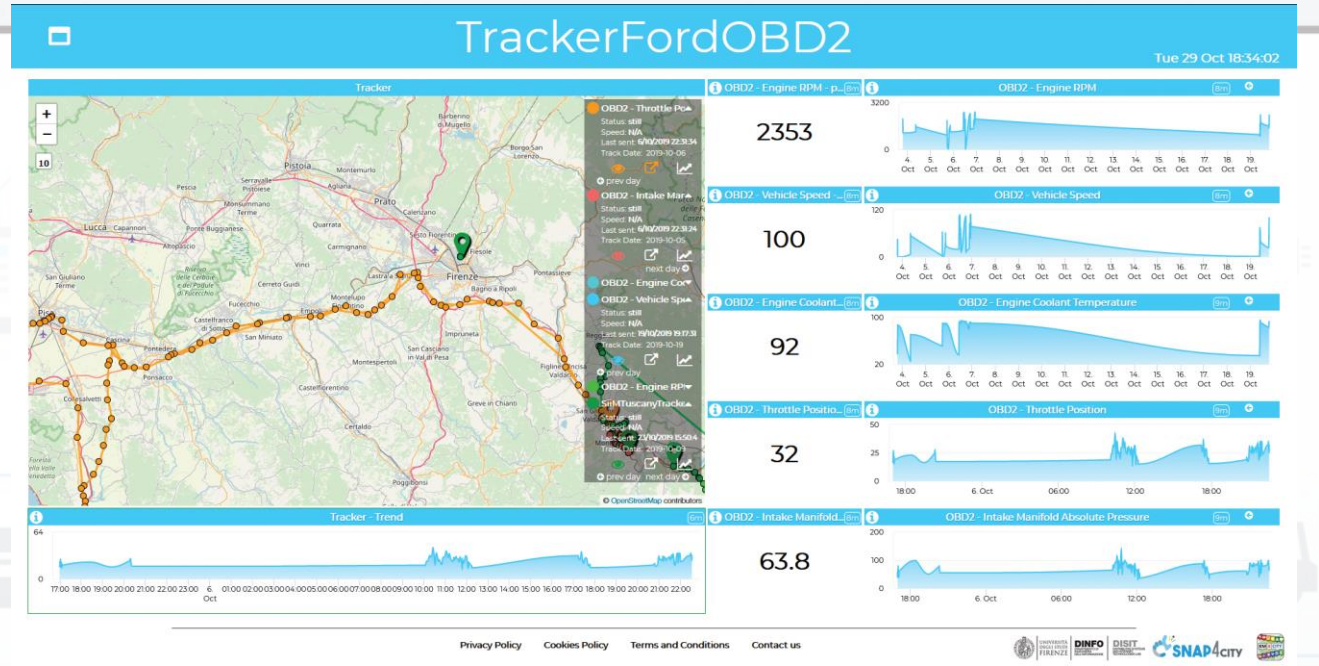
CANBUS sniffer





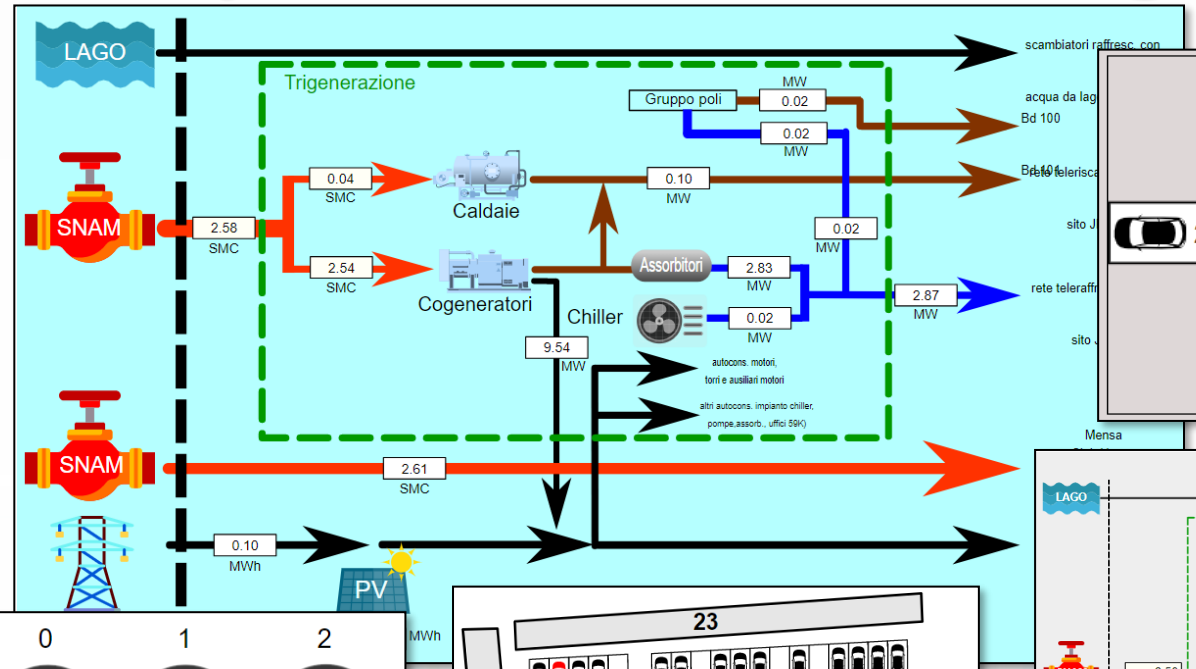
Tuscany in a Snap Mobile App on Android

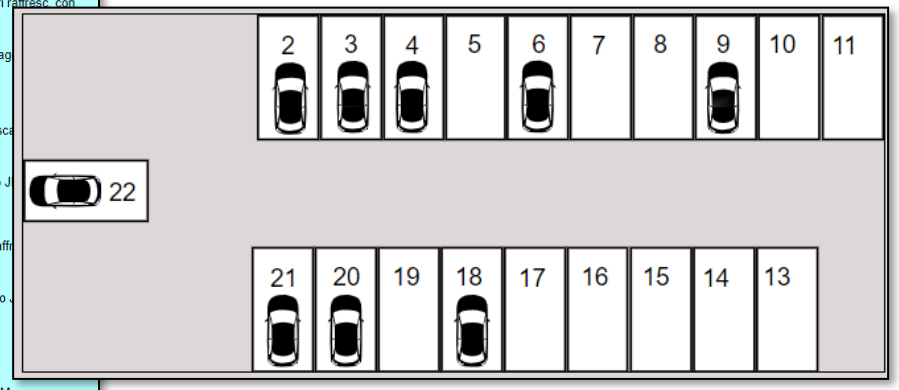


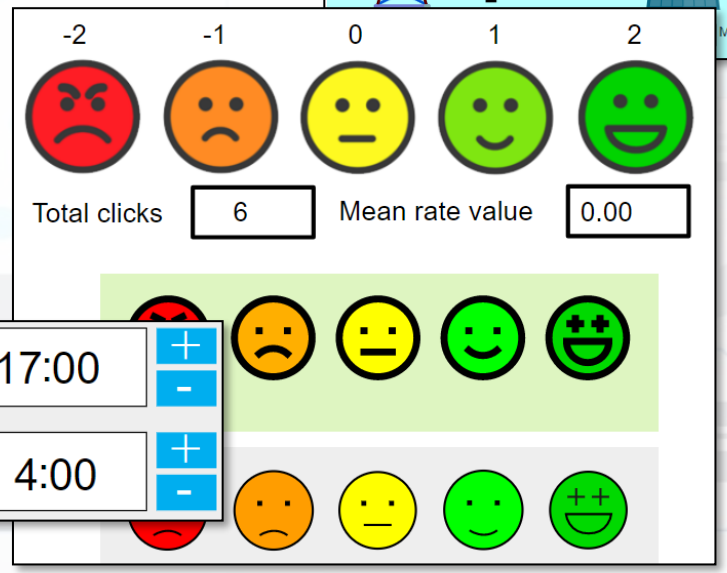


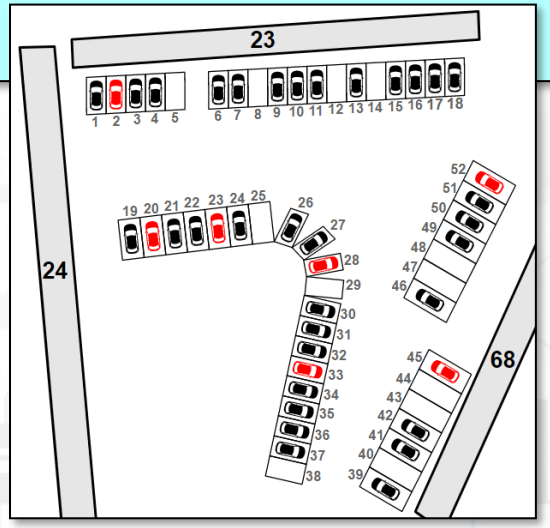
Special Custom Widgets

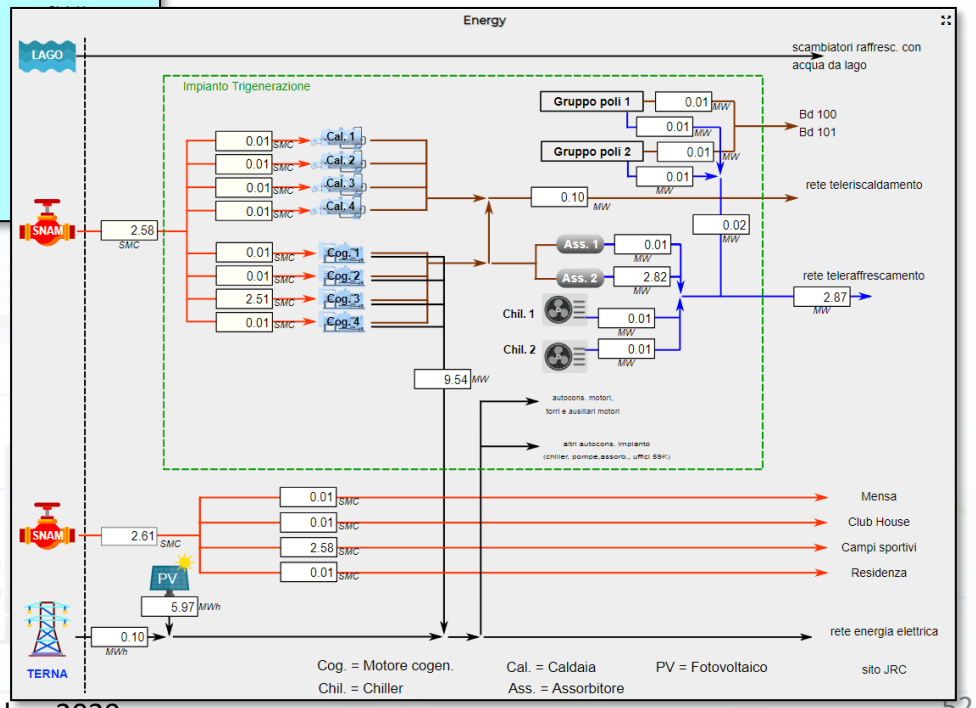
- Smart parking
- Smart Energy
- Smart Light
- Smart ….
- Energy View
- Custom Controls



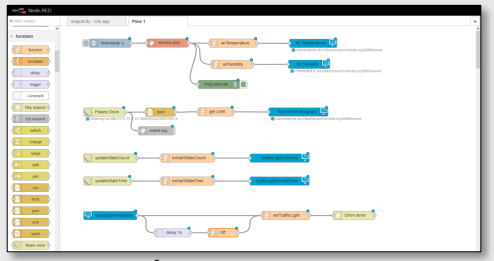








Dashboard Development



IOT Applications

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

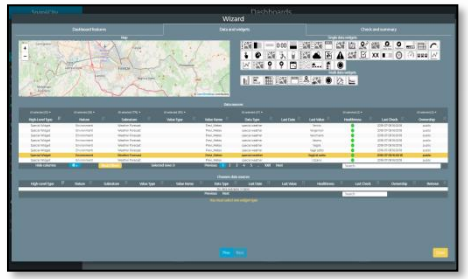
Widget Collection

Micro
Applicat
ions

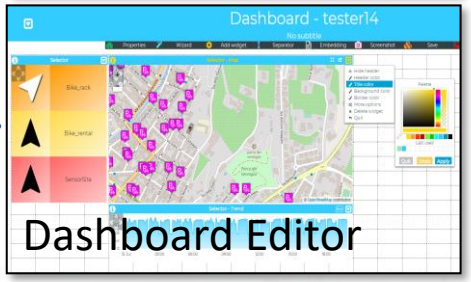
External
Services

Custom
Widgets/
Synoptics

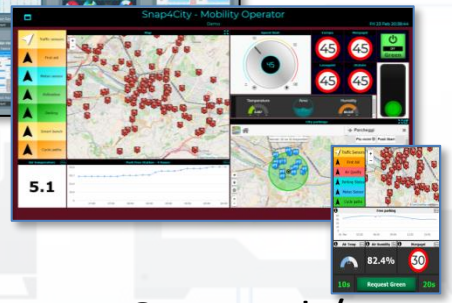
Dashboard Wizard



Create, save, load,
delegate, grant access



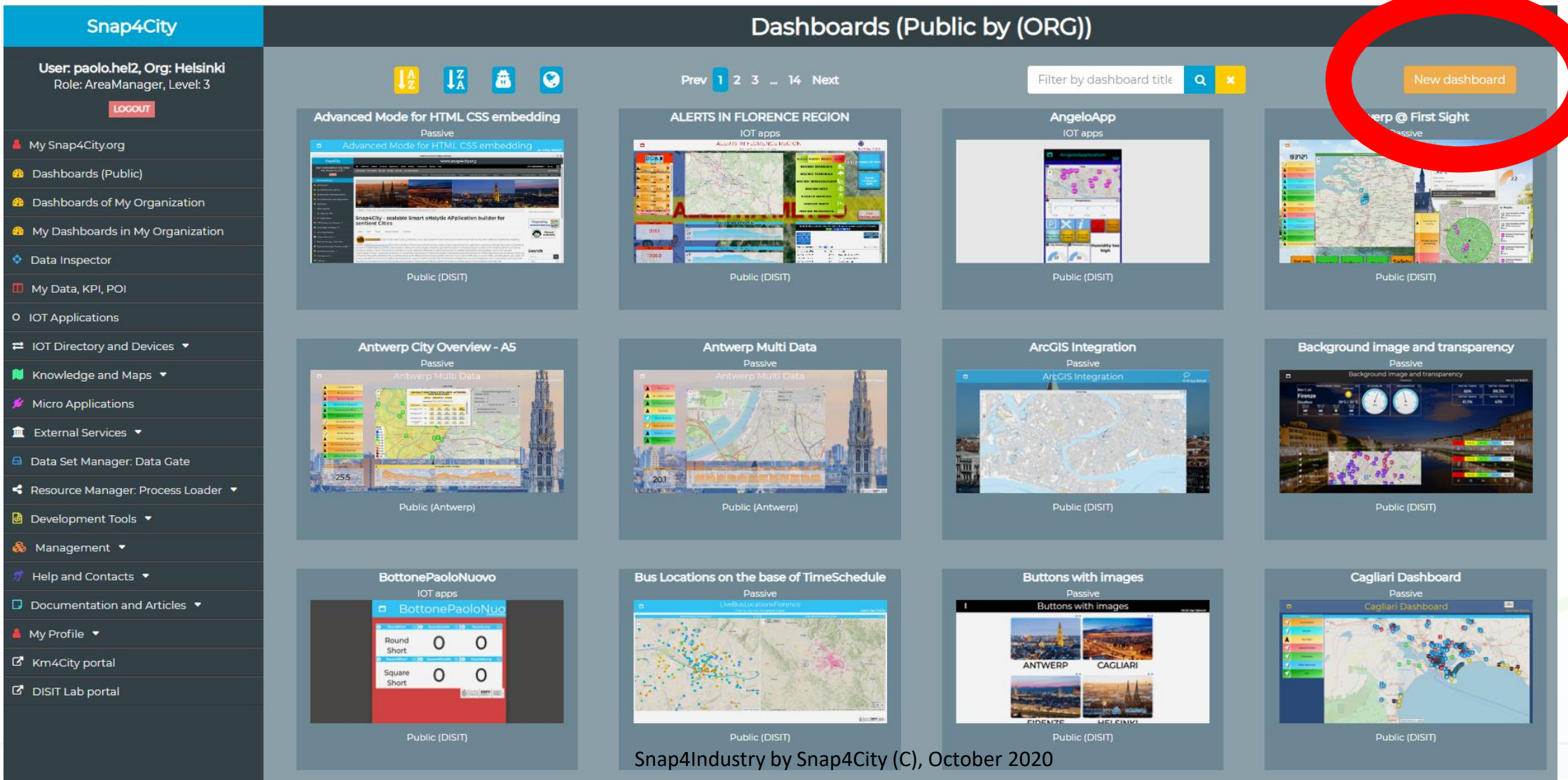
Dashboard Editor



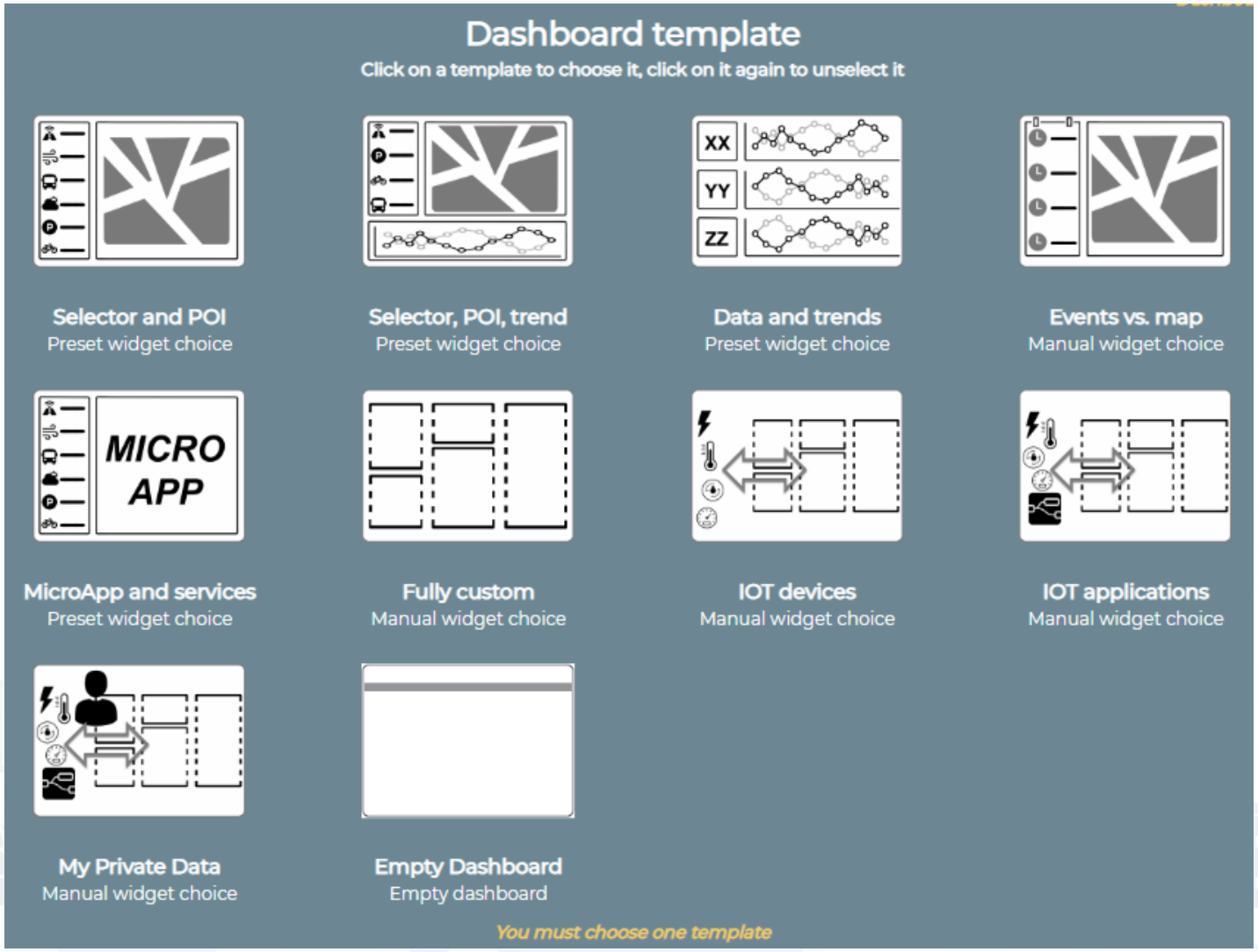
Public
Dashboard
Collection

My Own Dash/App

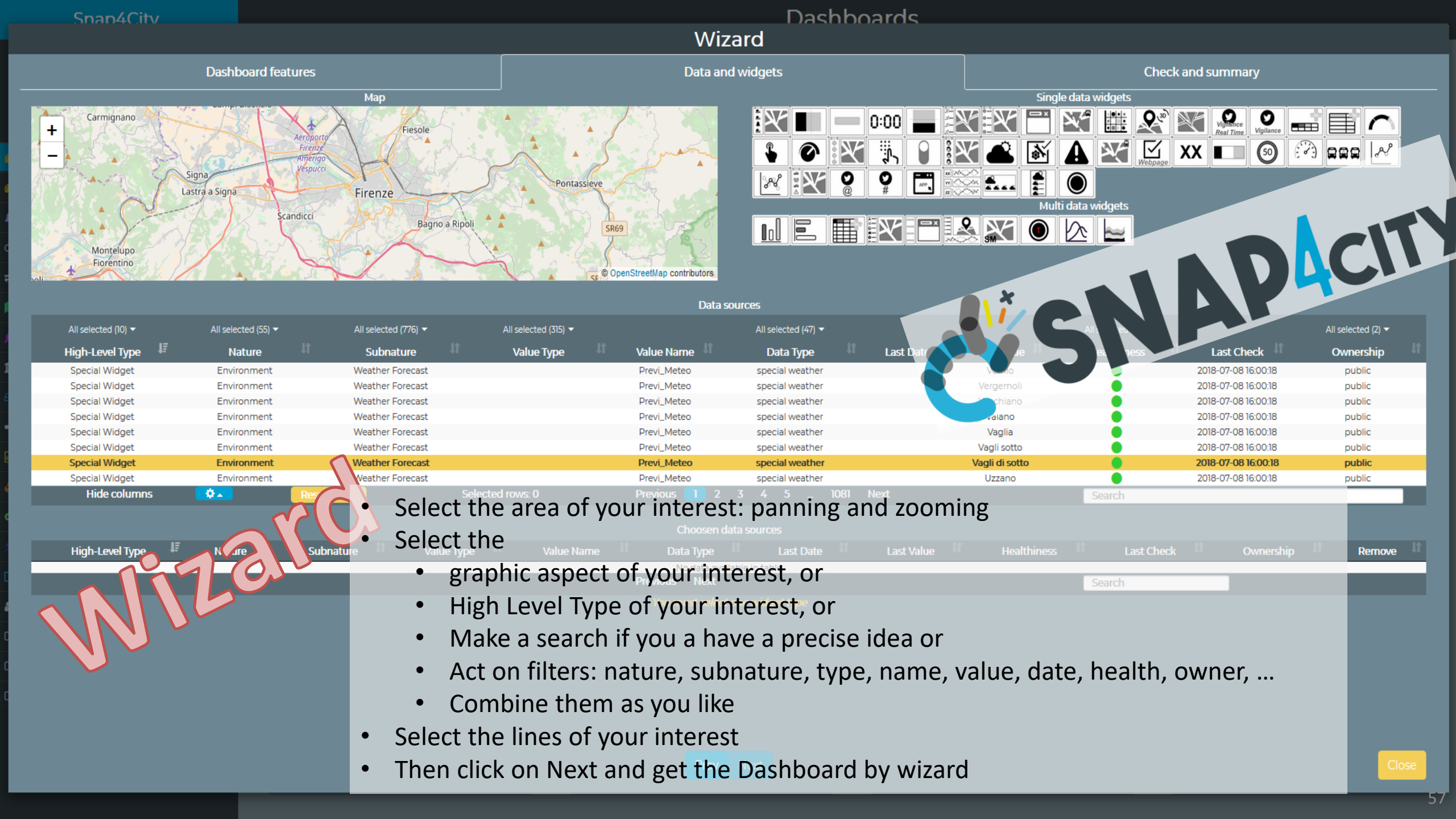
Dashboard List and Editor



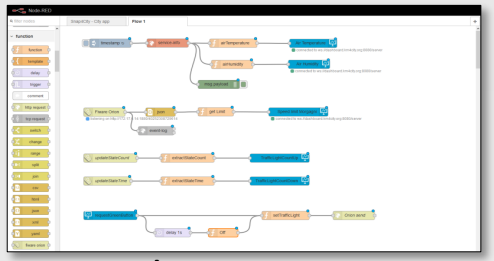
From Templates to Wizard and Dashboards



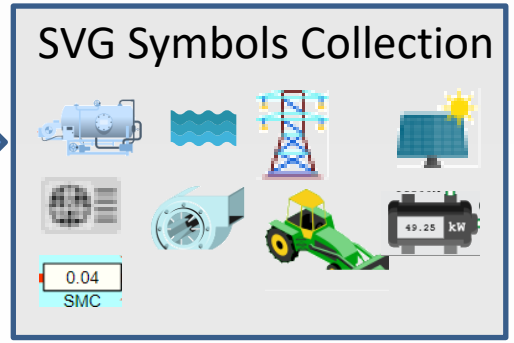
- to create a new Dashboard
- to add widgets and/or groups of them on any Dashboard


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

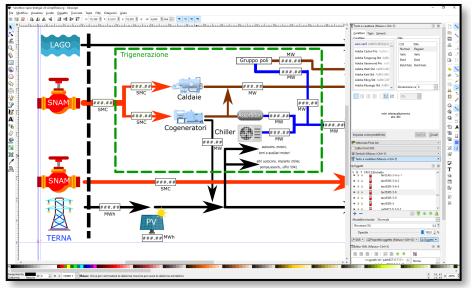
Custom Widget / Synoptic Development



IOT Applications

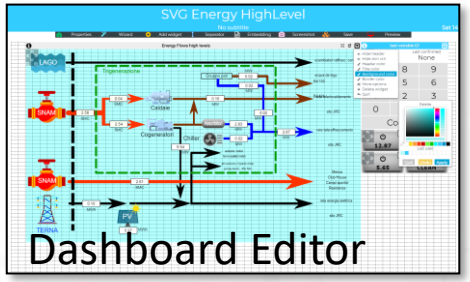


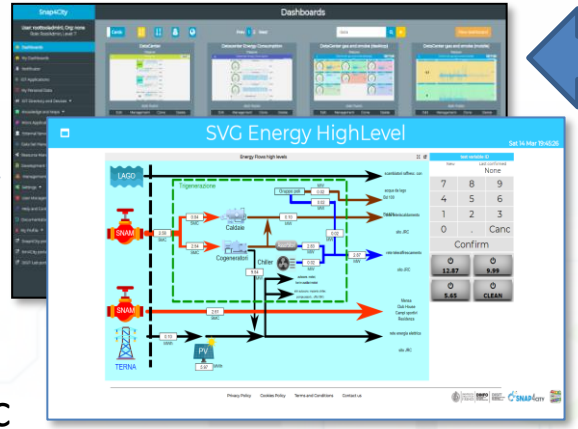
Inkscape editor on your computer



Create, save a Custom Widget in SVG

Create, save, load, delegate, grant access



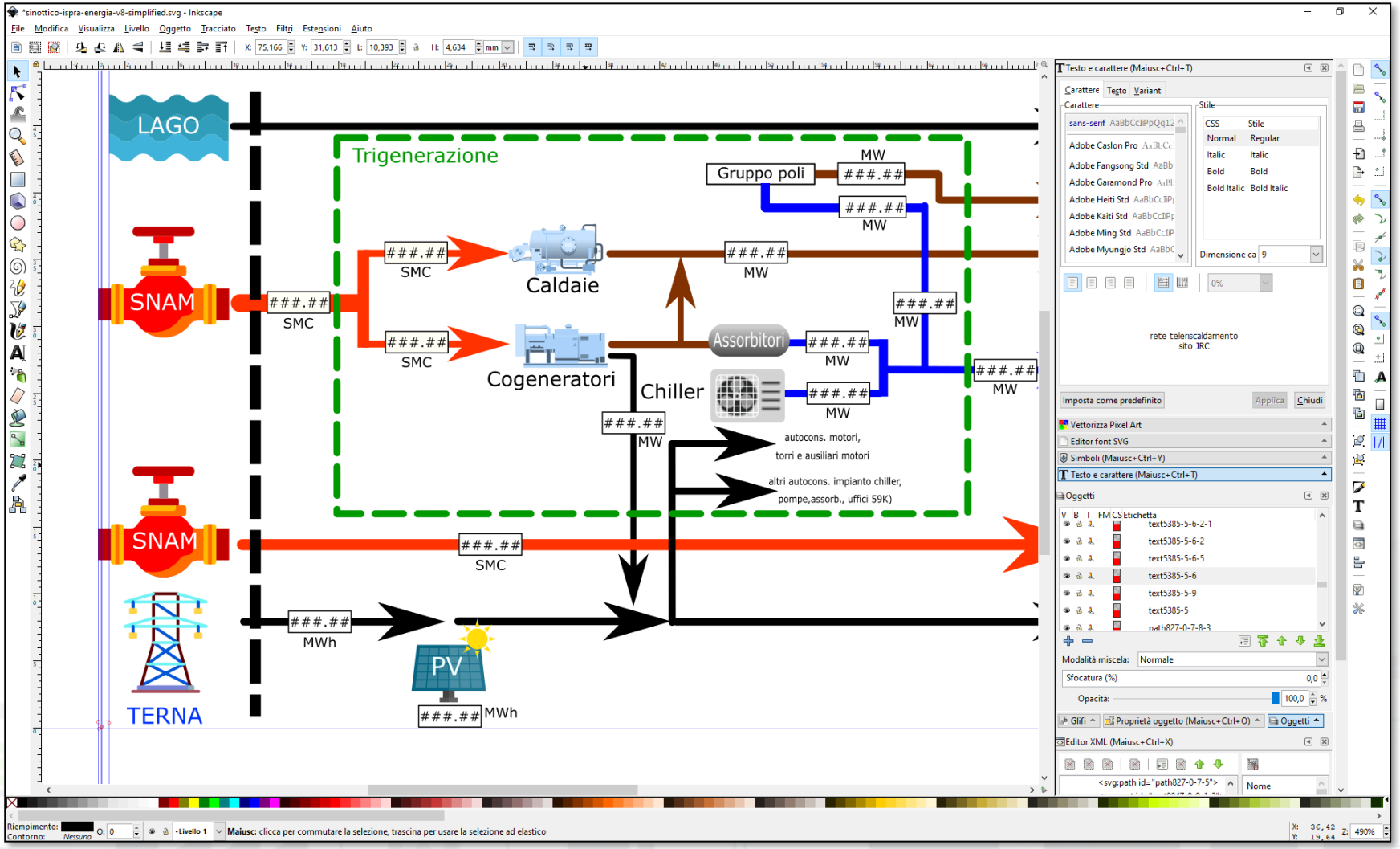


Public Dashboard Collection

My Own Dash/App

Knowledge and Storage Data from the Field and City

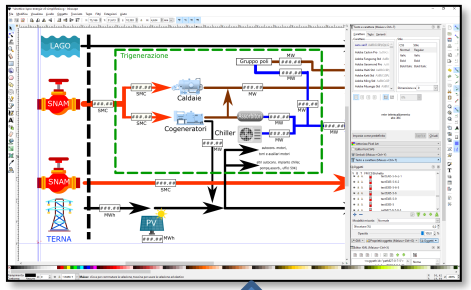
1. Create and Load a Custom SVG
2. Select/Reuse an SVG
3. Make and Instance of Synoptic by Associate Variables with MyKPI
4. Create on Dashboard a Widget based on Synoptic HLT such as Ext. Srv.:
   - https://www.snap4city.org/synoptic/v2/synoptic.html?id=xxxx



How to create a custom Widget

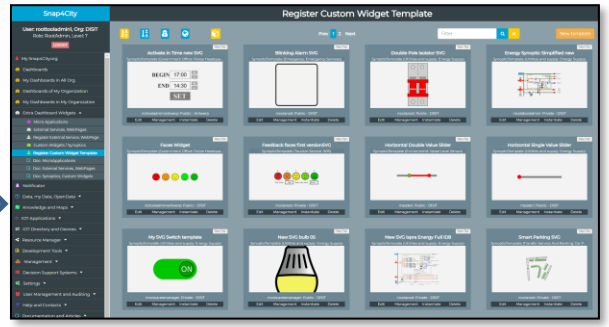
- [User manual on: https://www.snap4city.org/595](https://www.snap4city.org/595)

Create, save a Custom Widget in SVG

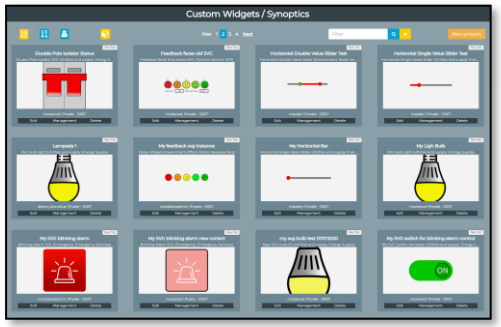


SVG

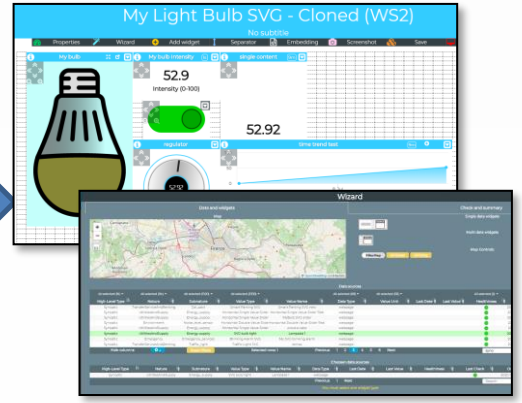
Upload as Custom Widget Template



List of Custom Widgets / Synoptics



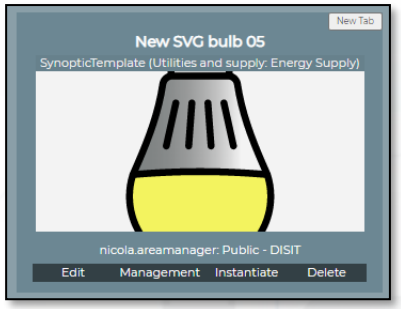
Dashboard Editing

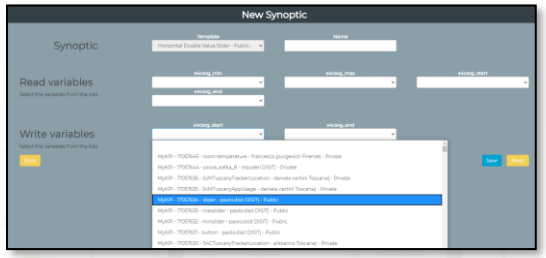


SVG Symbols Collection

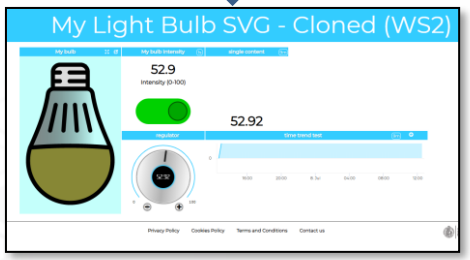
From any open library

select





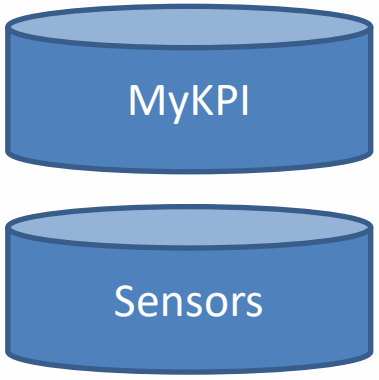
Instantiate as Custom Widgets / Synoptics Connect with WebSockets



Final Dashboard

Select MyKPI and Sensor Data for Synoptics cases

From-To Custom Widgets / Synoptics to Storage in WS



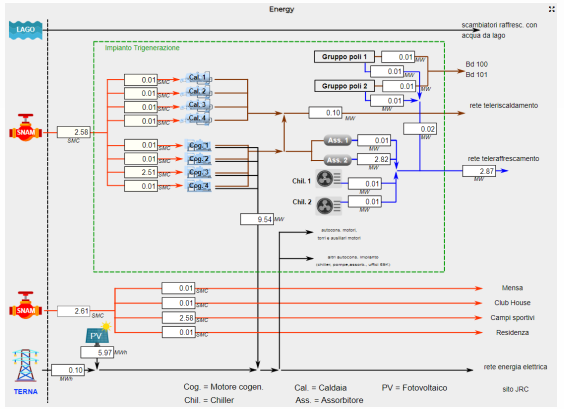
MyKPI

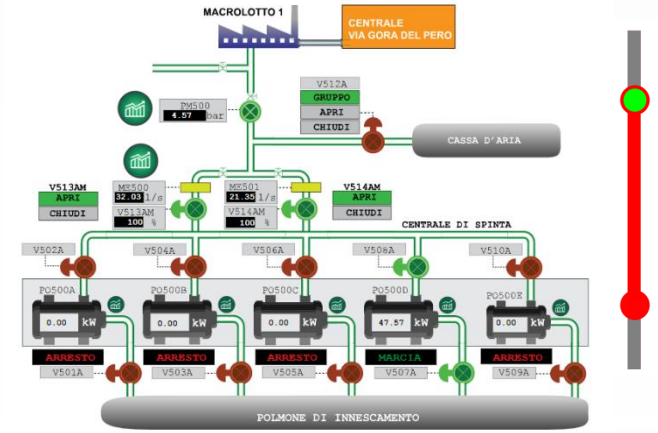
Sensor

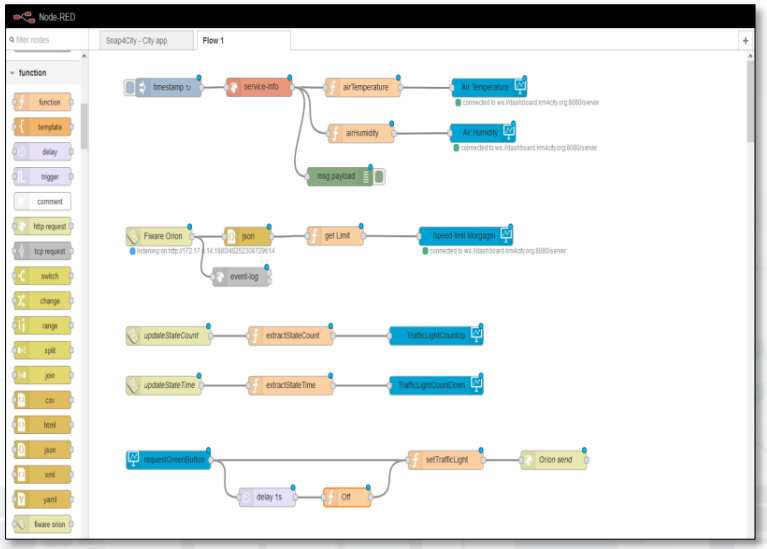
[ ]

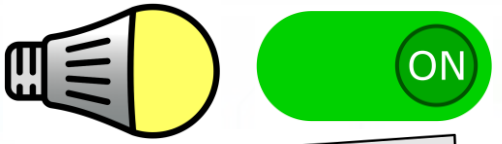
New Shared Variables

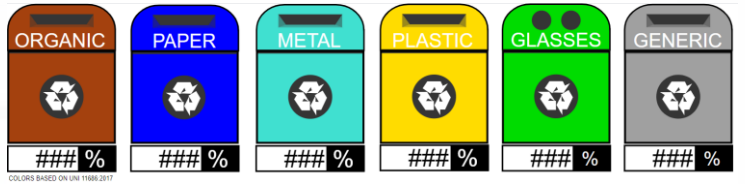
Constant Values

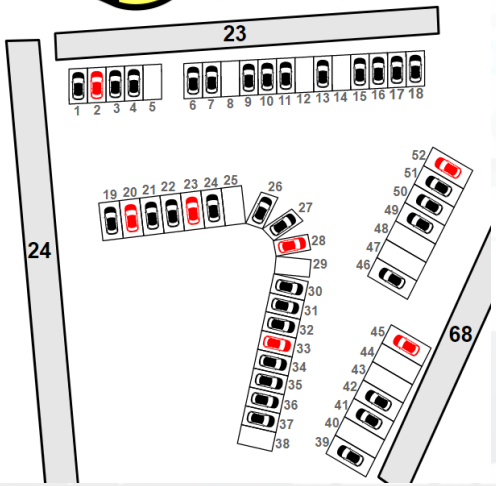


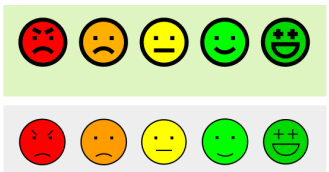


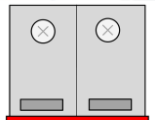


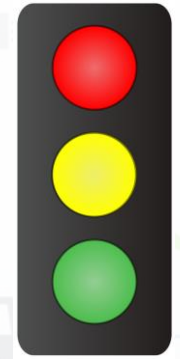




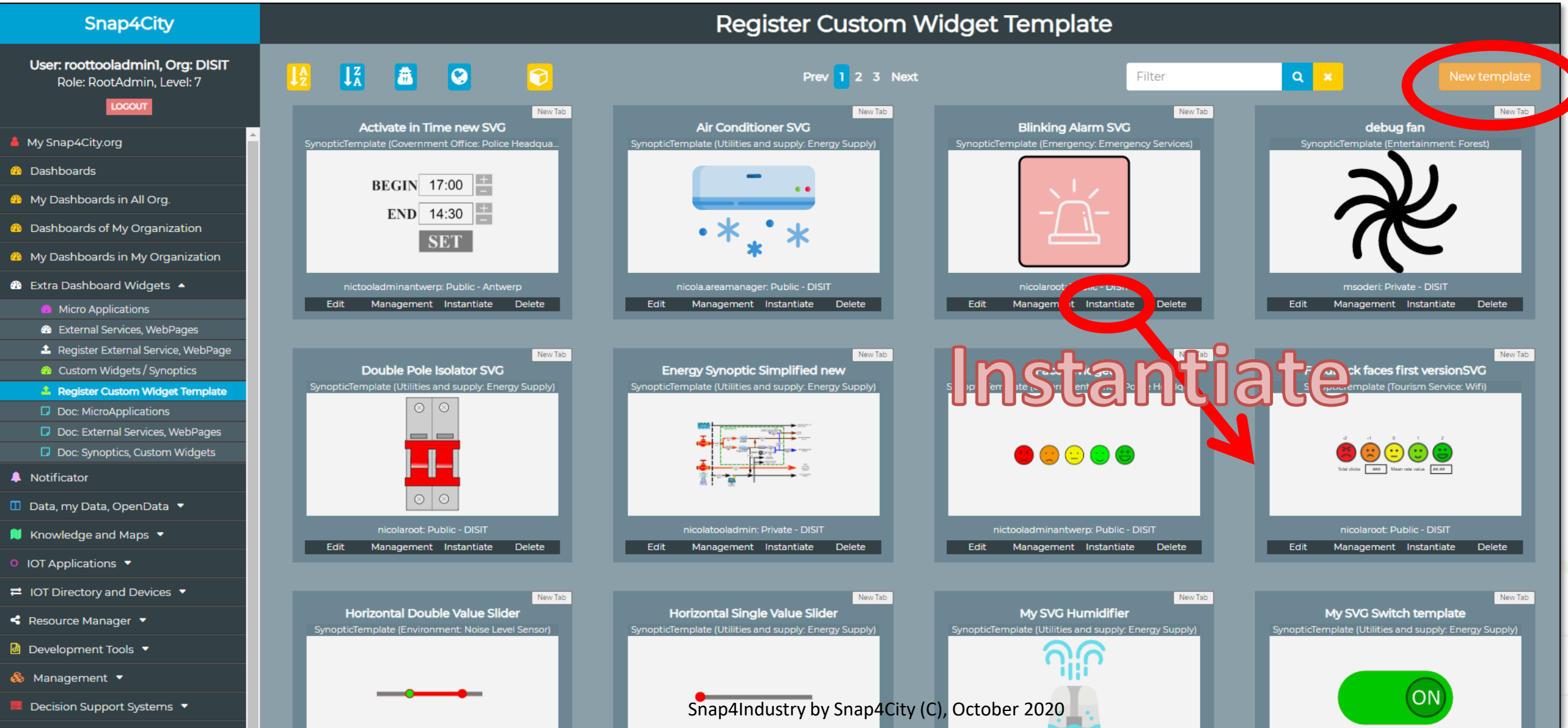








Custom Widgets Templates



Dashboards summary and further readings

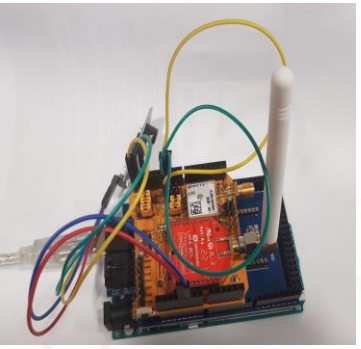
- **Suitable** as: City Dashboard, App interface, and Control Room Dashboards, Situation Room Dashboard, Operator Dashboard
- **Created** visually compounding graphic Widgets
  - Each widget can be set to have an autonomous update
  - Each metric/data-source may have associated with an alarm: blinking 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**

IOT Devices

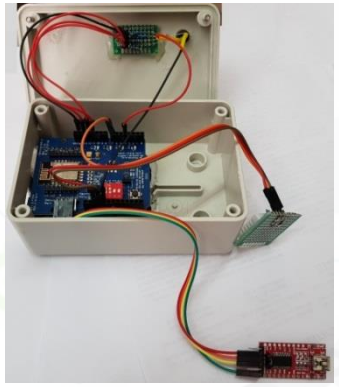
Sensors/
Actuators

IOT Edge Devices

LoraWAN +
Arduino +
I2C, NGSI



Arduino,
Wi-Fi, NGSI

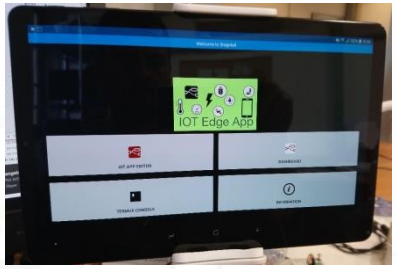


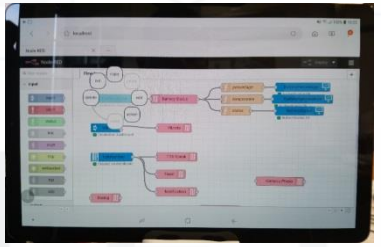
Snap4All
IOT Button
ESP, NGSI,
Wi-FI, BT

Snap4All PAX
Counter
LoraWAN
WIFI, NGSI,
GPS

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

IOT Edge
NodeRED:
Android, LINUX,
Windows, …





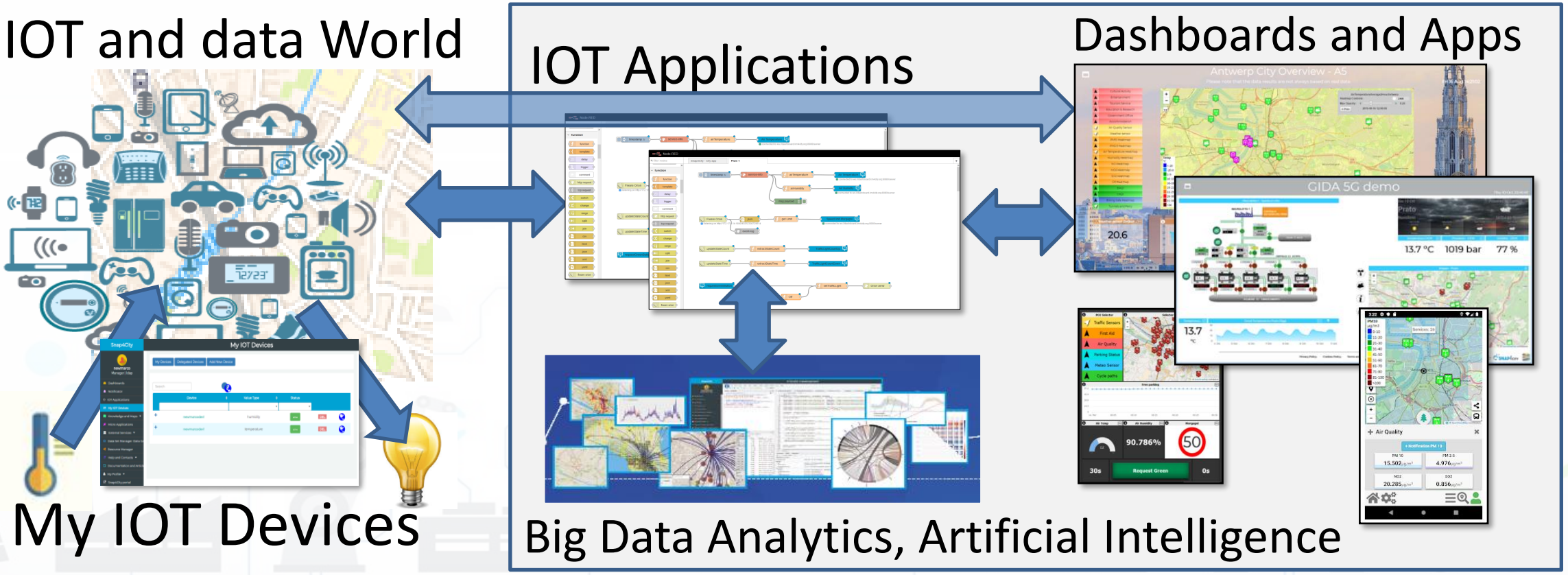
LoraWan
Gateway:
IOT Edge, NGSI,
WIFI, RJ45, GPS

Any Sensor / Actuator
Open to other protocols

Dashboards' Intelligence on Web and Mobile Devices

Sentient Solutions

Dashboards with data driven IOT Applications enforcing intelligence

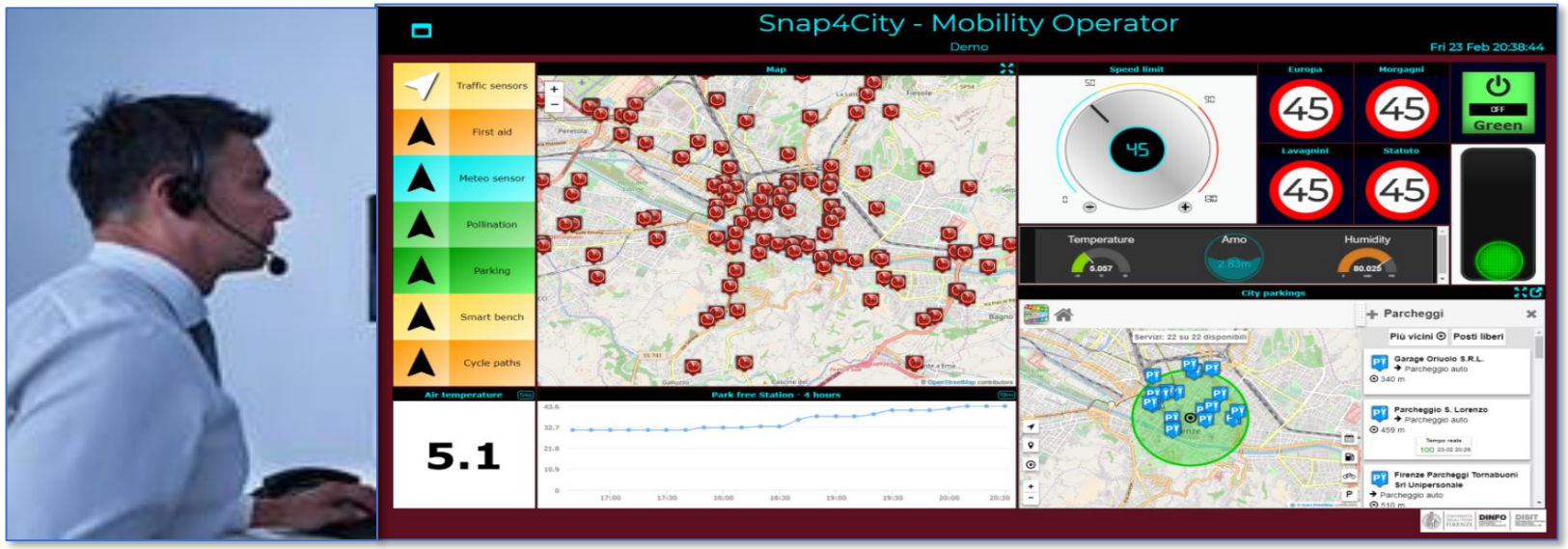


Dashboard + IOT App

Control Room Operator

Would like to:

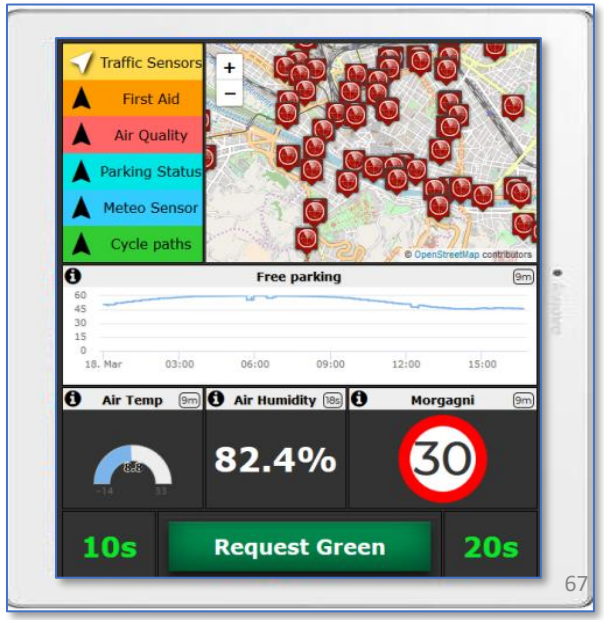
- **Monitor** traffic flow, Environment, Car parking, Cycling, First aid, temp., …
- **Act and monitor** Dynamic Plates
- **Act and monitor** red lights



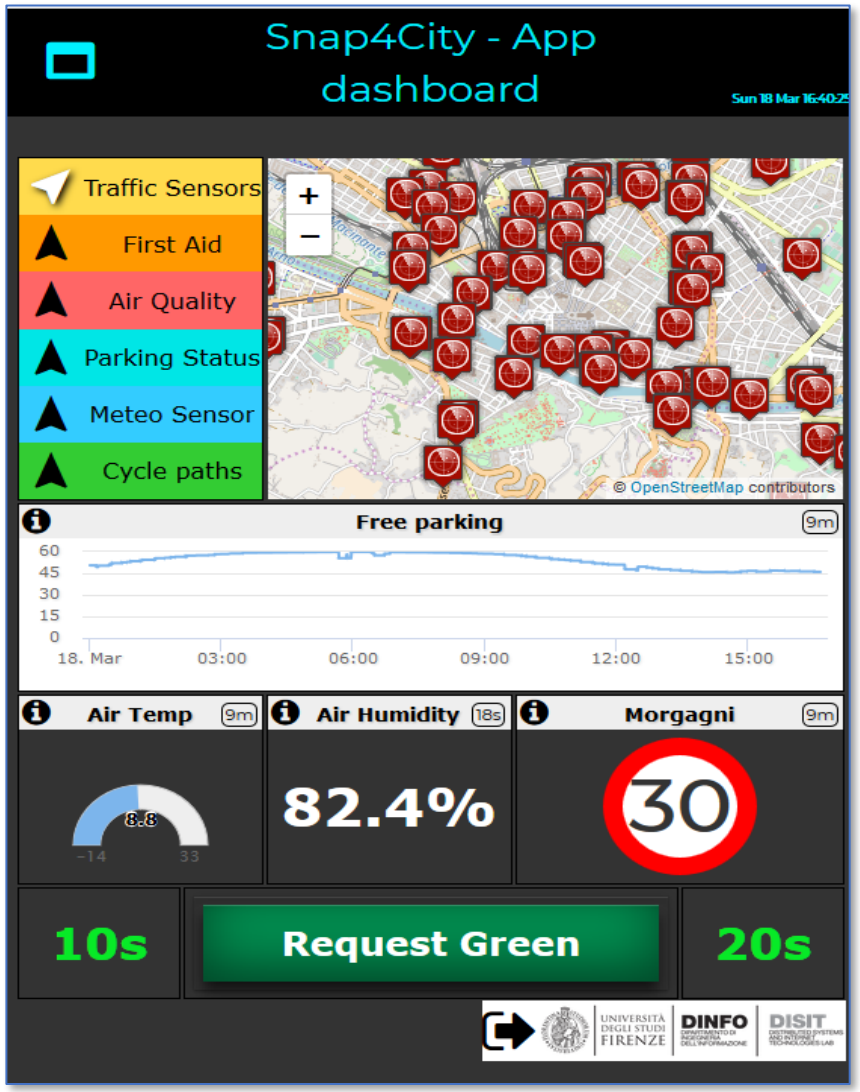
Driver, Policeman

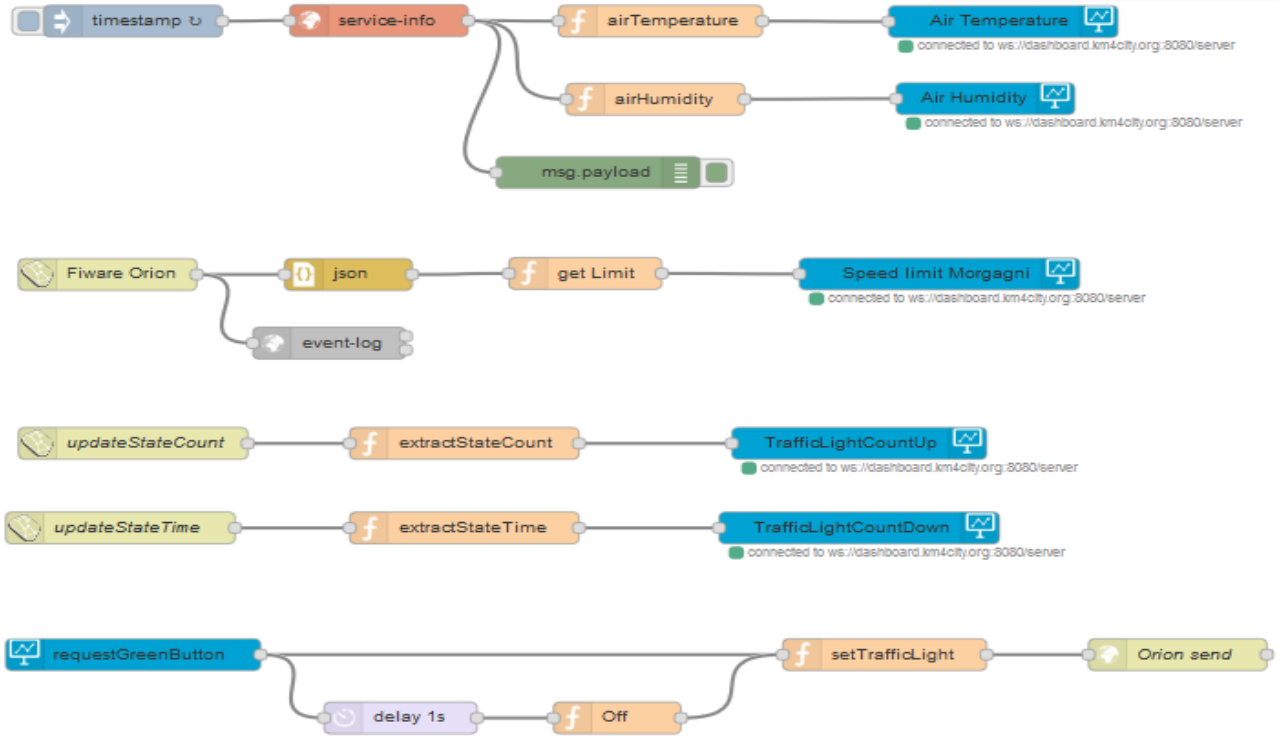
Would like to:

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

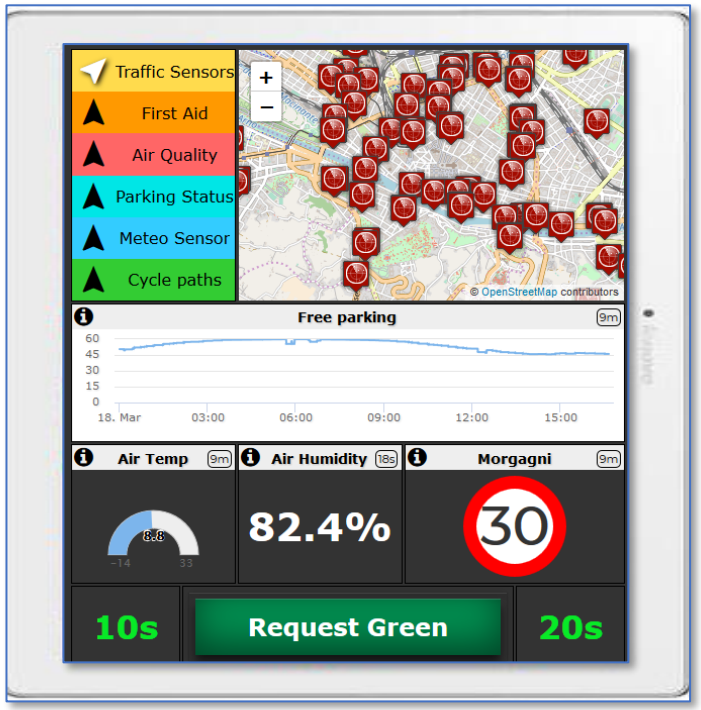


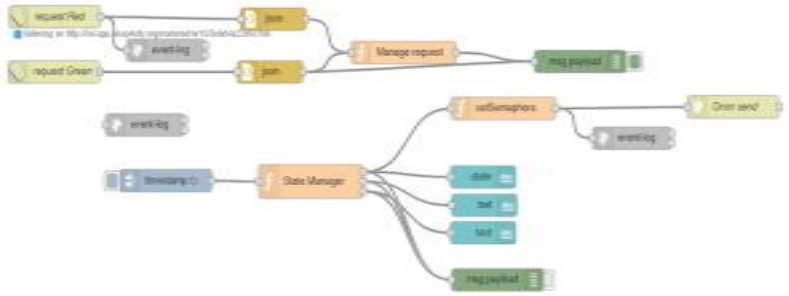
IOT Application with Dashboard Simple development





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

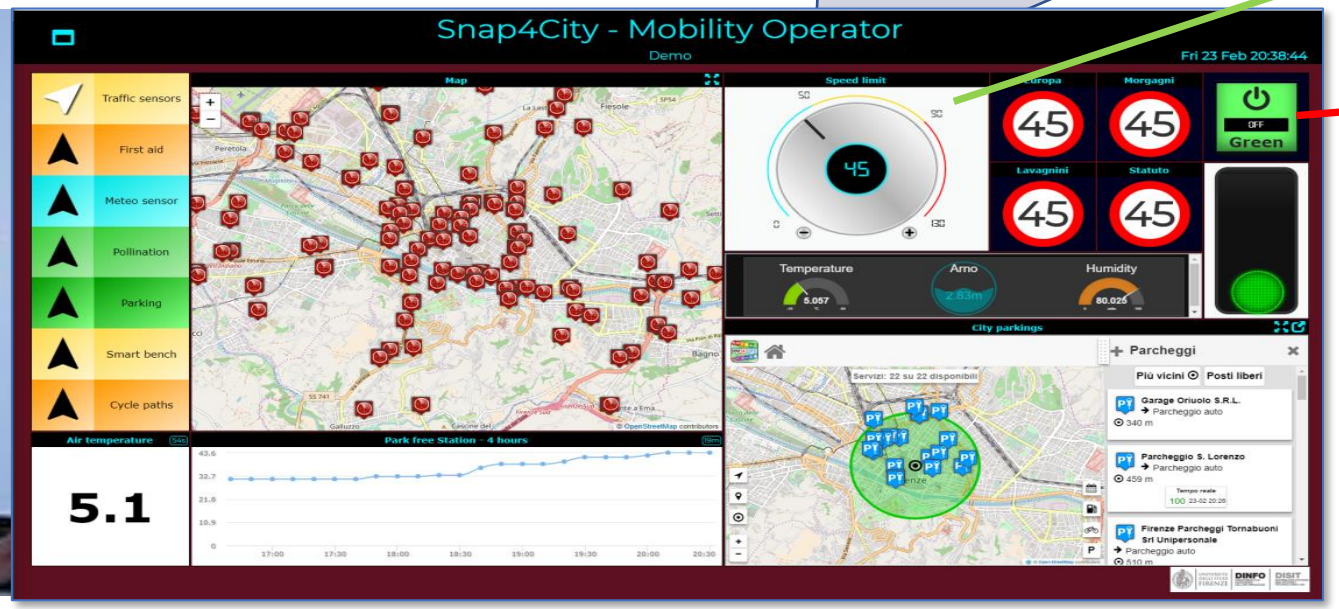

Traffic Sensors
First Aid
Air Quality
Parking Status
Meteo Sensor
Cycle paths
© OpenStreetMap contributors
Free parking
9m
60
45
30
15
0
18. Mar
03:00
06:00
09:00
12:00
15:00
Air Temp
9m
Air Humidity
18s
Morgagni
9m
82.4%
30
10s
Request Green
20s

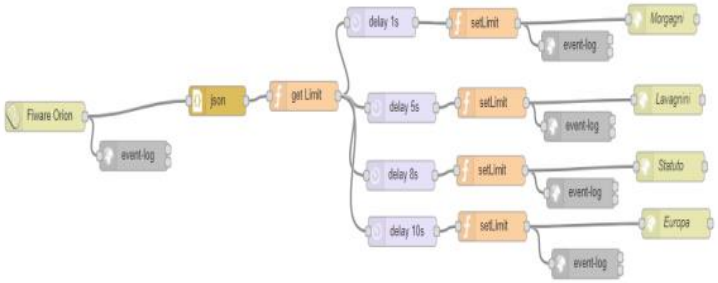



30


30


30

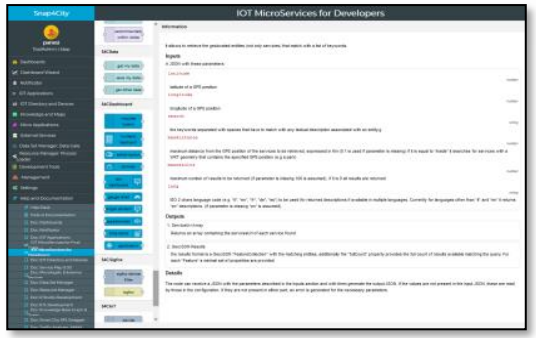

Snap4City - Mobility Operator
Demo
Fri 23 Feb 20:38:44
Traffic sensors
First aid
Meteo sensor
Pollination
Parking
Smart bench
Cycle paths
Map
Speed limit
45
Europa
45
Morgagni
45
Lavagnini
45
Statuto
45
OFF
Green
Temperature
5.057
Arno
Humidity
80.025
City parkings
Parcheggi
Più vicini
Posti liberi
Garage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


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

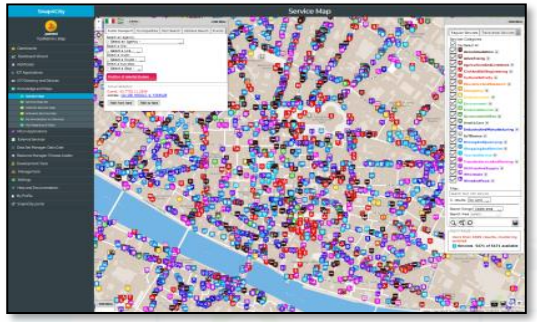
IOT Applications Development

IOT Discovering

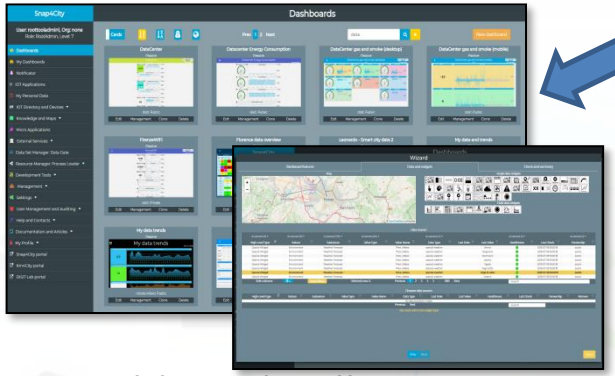
MicroServices collections



My IOT Applications

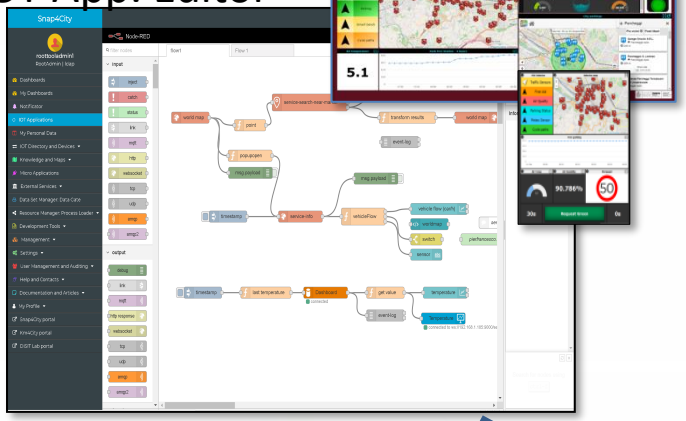


ServiceMap Discovery



Dashboard Collection, Editor and Wizard

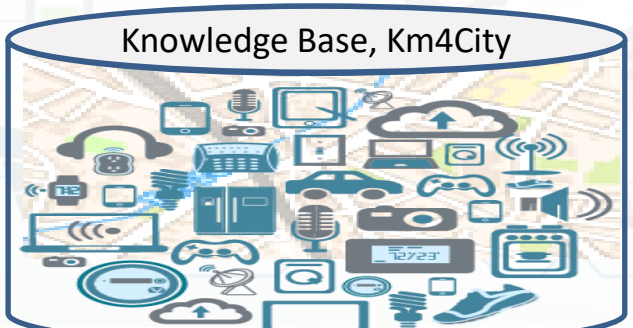
IOT App. Editor



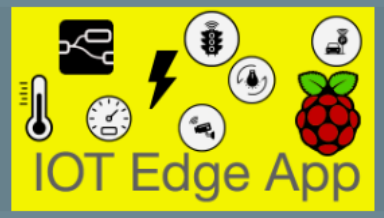
Generating IOT App With Dashboard

Sharing/saving reusing IOT App

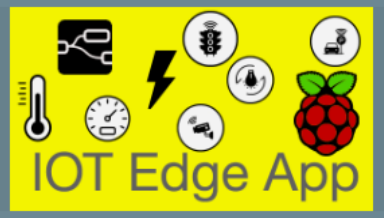
Resource Manager



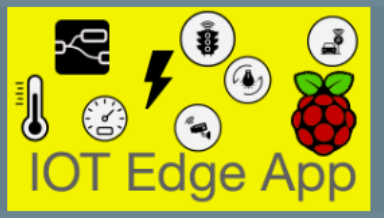
IOT Applications

2018-09-14T04:44


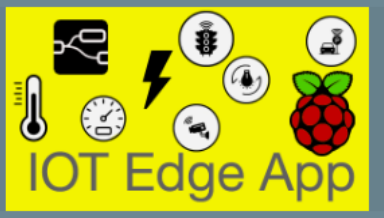
owner: badii
Management

2018-09-21T03:19


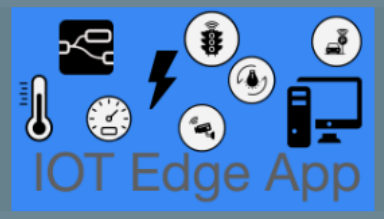
owner: panesi
Management

2018-10-19T16:07


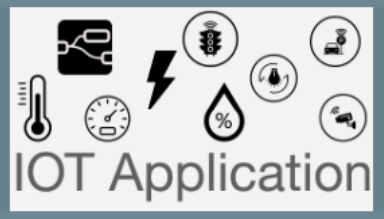
owner: pb3
Management

2018-10-19T17:17


owner: pb3
Management

2018-10-22T11:57


owner: semolarudy
Management

application


owner: tester5
Management

Bib APP

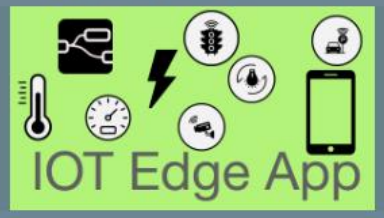

owner: semolarudy
Management

ChargingStations


owner: comunedashres
Management

Deprecated - SiiMobilityControlRoom


owner: badii
Management

SamsungGalaxyS4BarCode


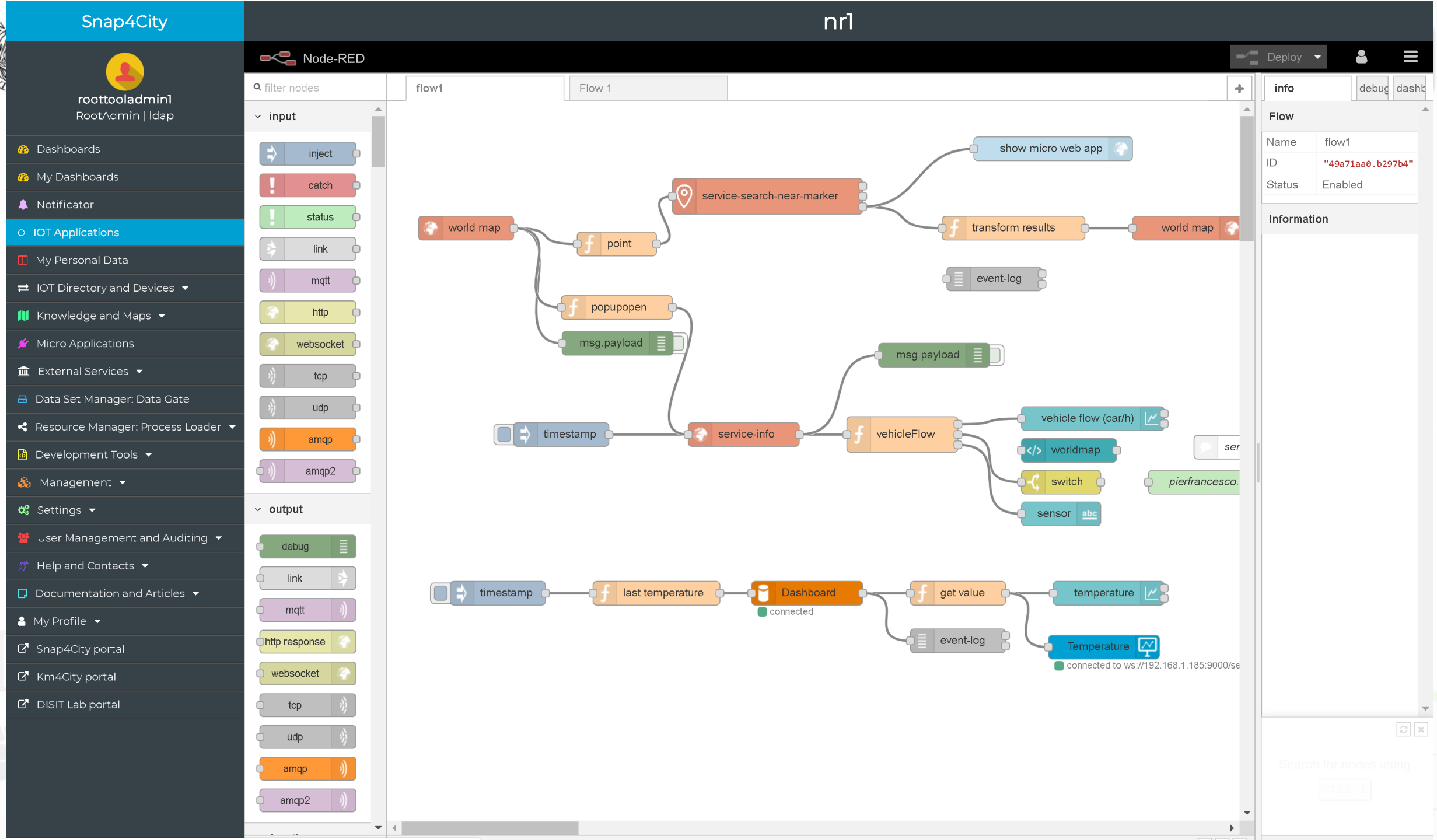
owner: badii
Management

esercitazione

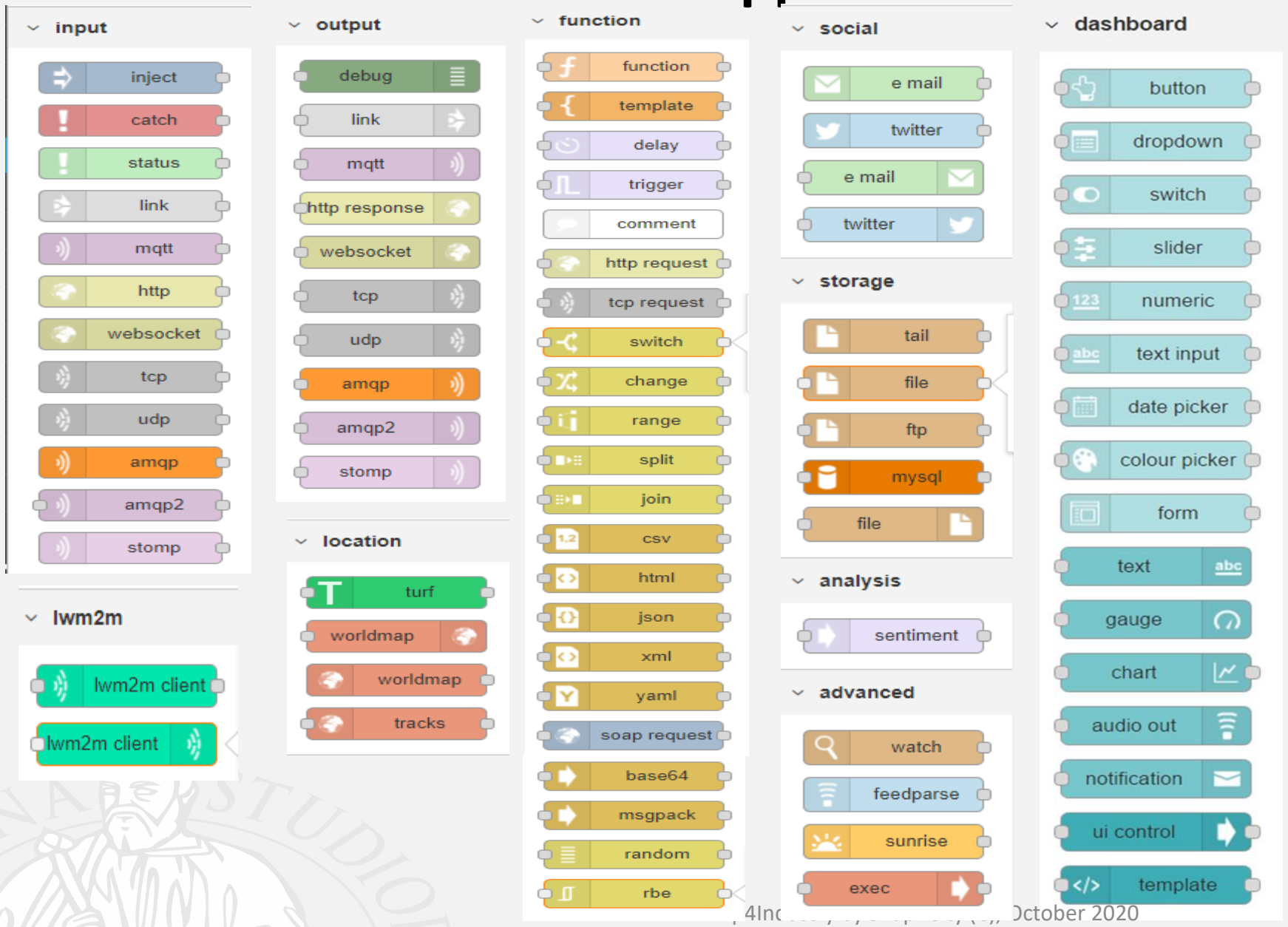

owner: tester2
Management

Iot-App

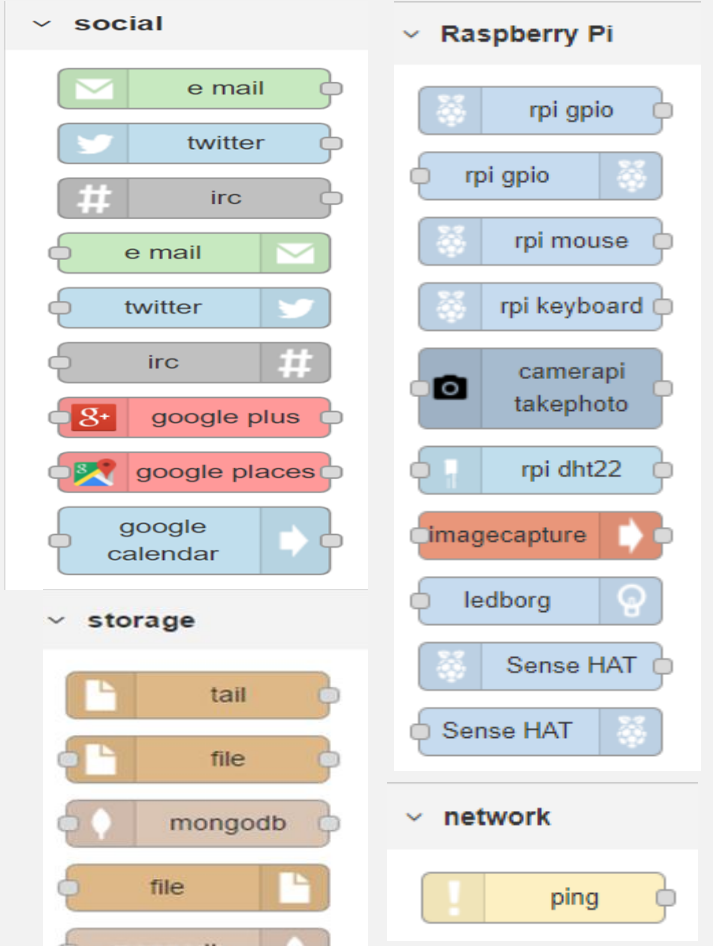

owner: tester14
Management


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

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



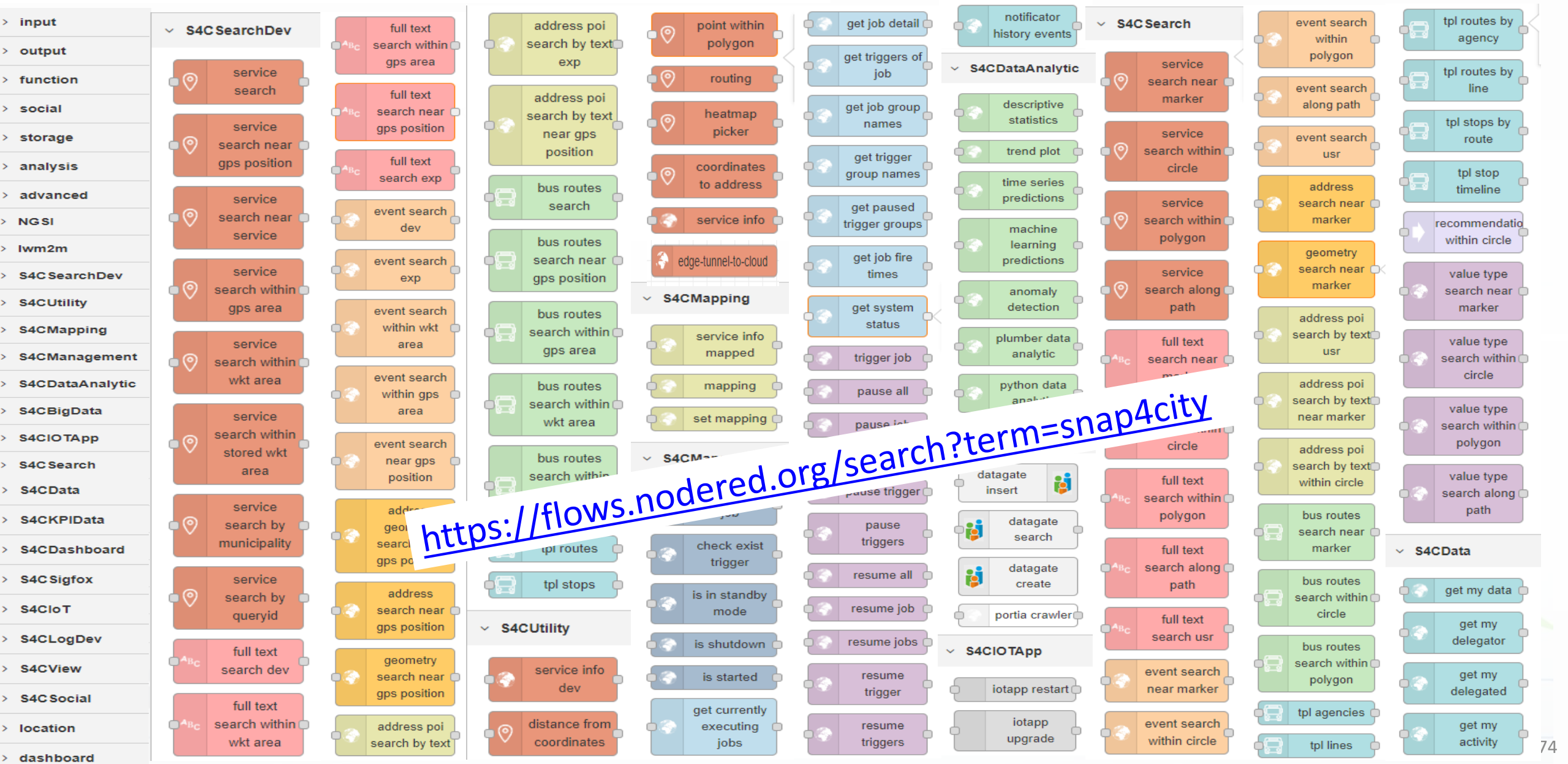
+ on IOT Edge Raspberry



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

Aug 2020 collection
Two Snap4City Libraries

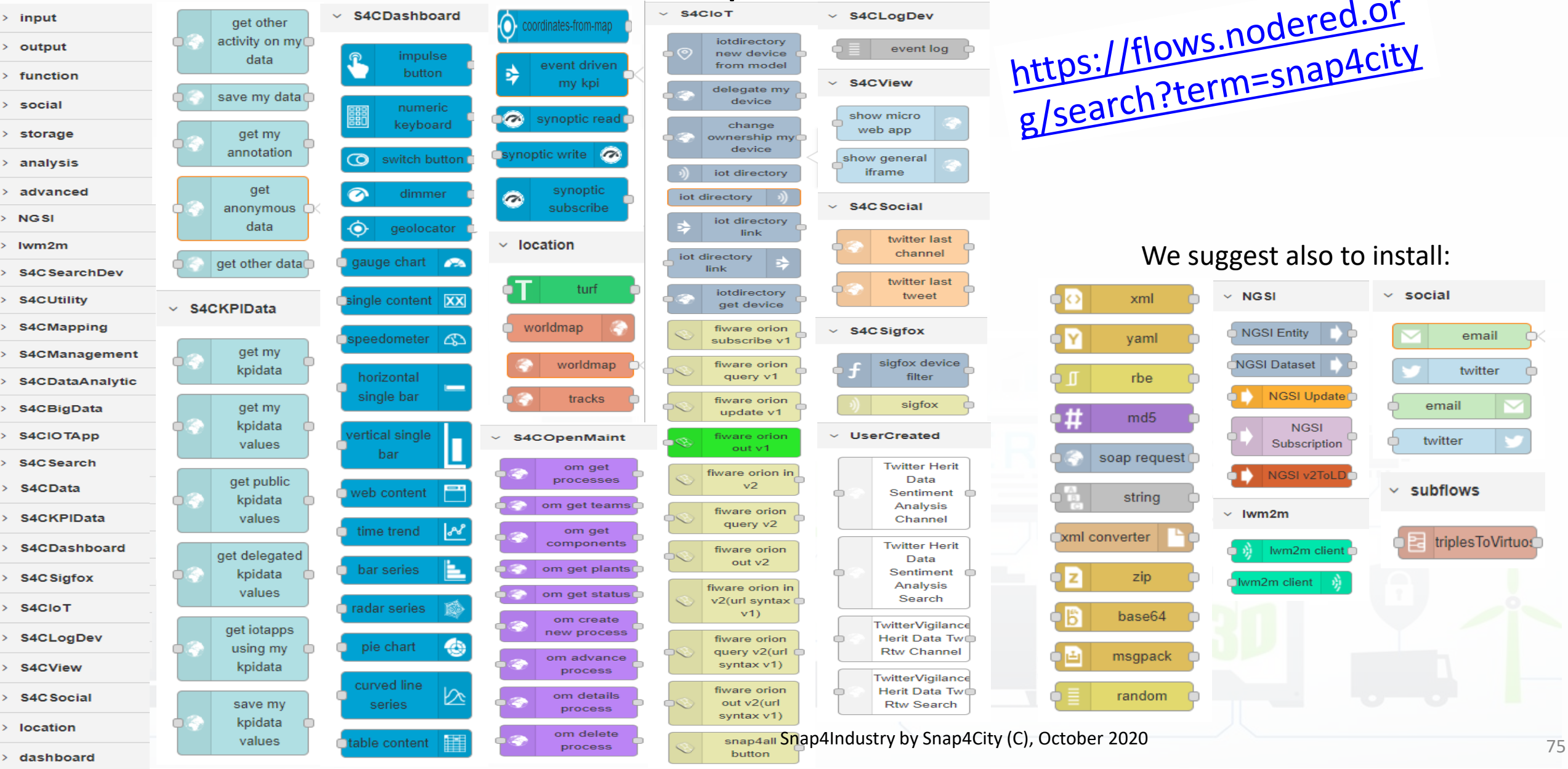
SNAP4INDUSTRY | Node-RED



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

Aug 2020a collection
Two Snap4Citv Libraries

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



We suggest also to install:

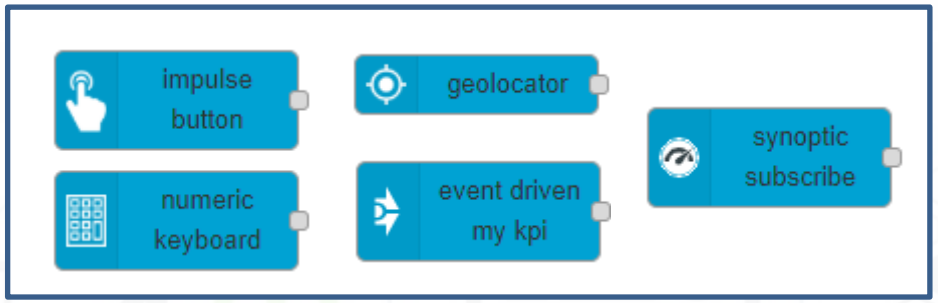
IOT Applications vs Dashboards

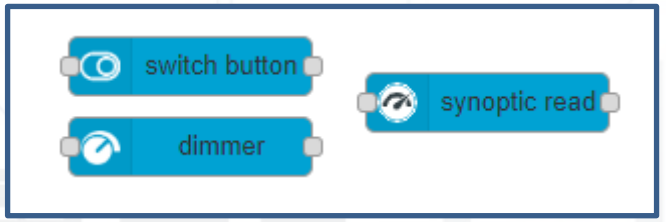
- **IOT Applications**, realized by using Node-RED and integrated with Snap4City Nodes/MicroServices block, can be behind dashboards to get data from them with Virtual Sensors and Actuators.
  - Dashboards may be connected to multiple IOT Applications and IOT devices
  - IOT Applications may be connected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

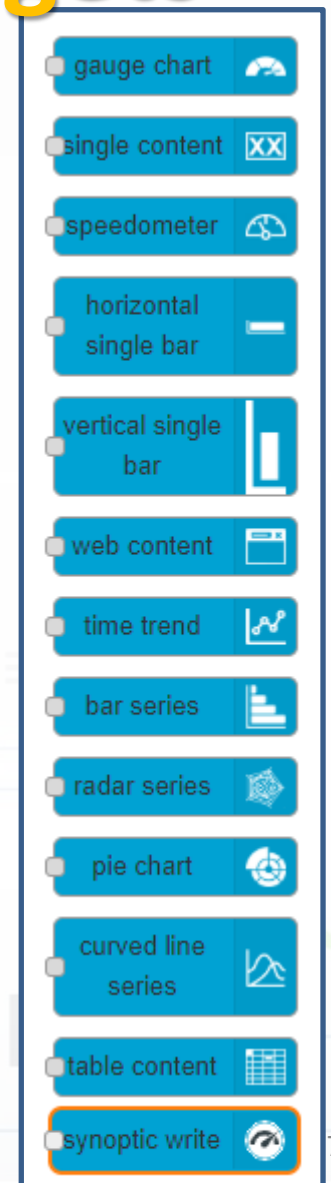
IOT Application stressing Virtual Sensors Actuators concepts

Advanced Feature of Snap4City Dash Widgets

- Dashboard widgets can be classified in:
  - **Virtual Sensors**
    - Those that produce the data
      From IOT App on Dashboard
  - **Virtual Actuators**
    - Those that produce the data
      From Dashboard to IOT App
  - **Virtual Sensors Actuators**
    - Those that produce/receive the data
      From/to Dashboard to/from IOT App

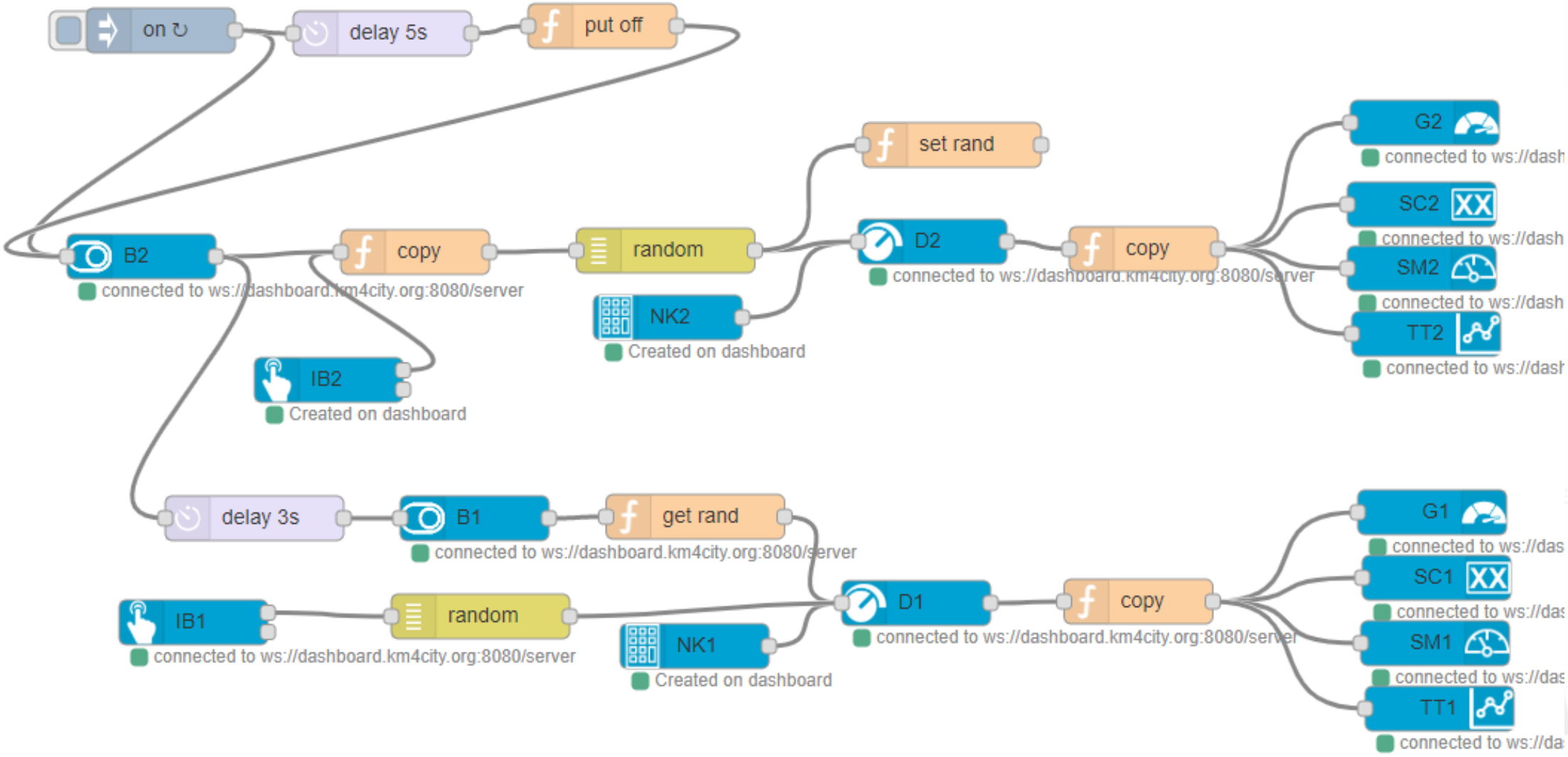




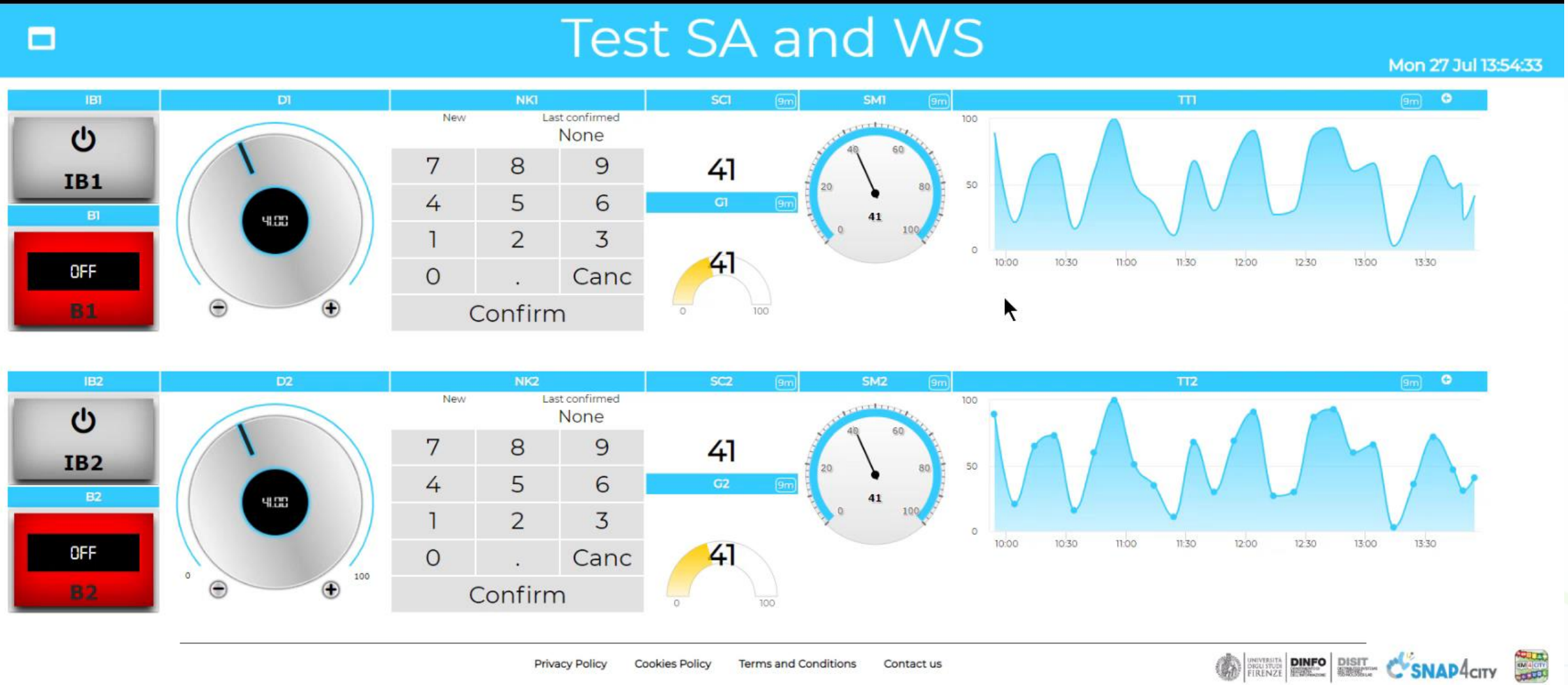


[TC9.18: Advanced Features of Sensors Actuators of Dashboards vs IOT App]

Sensors Actuators Allow to change the set up

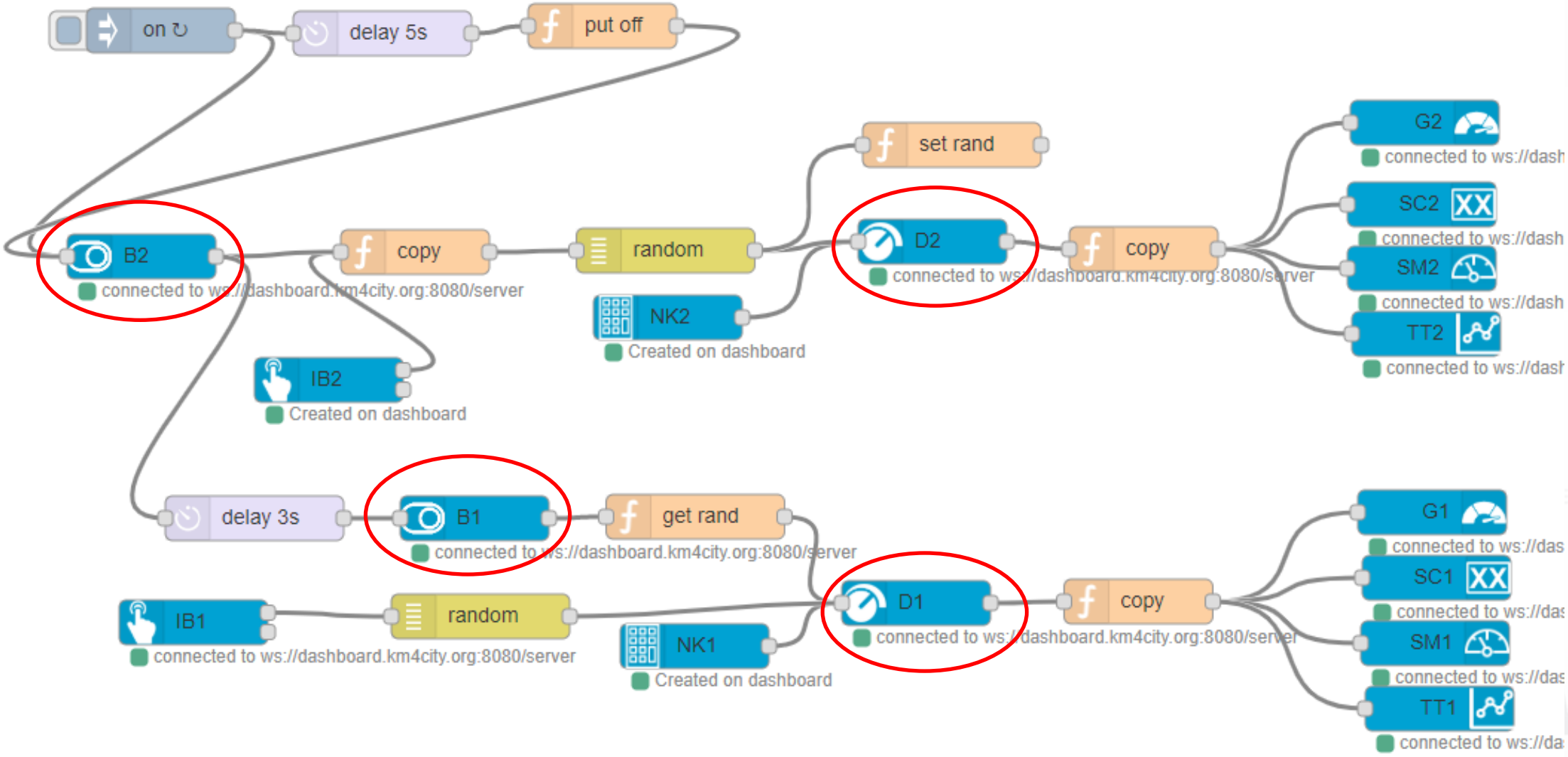


The SATEST Dash



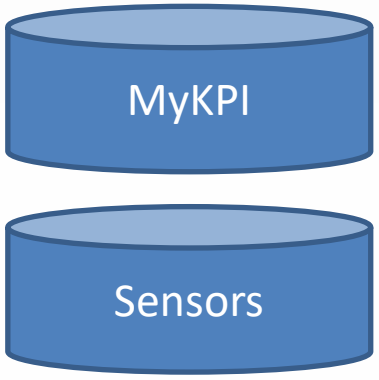
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjc2NA==

Sensors Actuators Allow to change the set up



IOT Application Integration with Synoptics

From-To Custom Widgets / Synoptics to Storage in WS



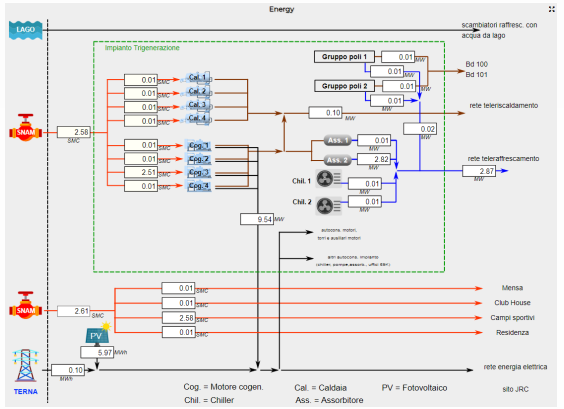
MyKPI

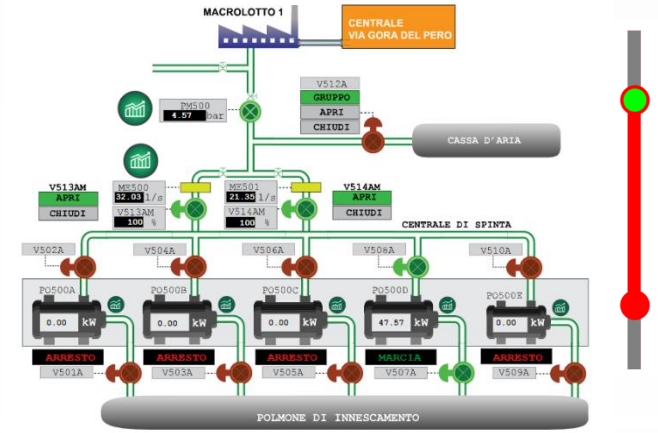
Sensor

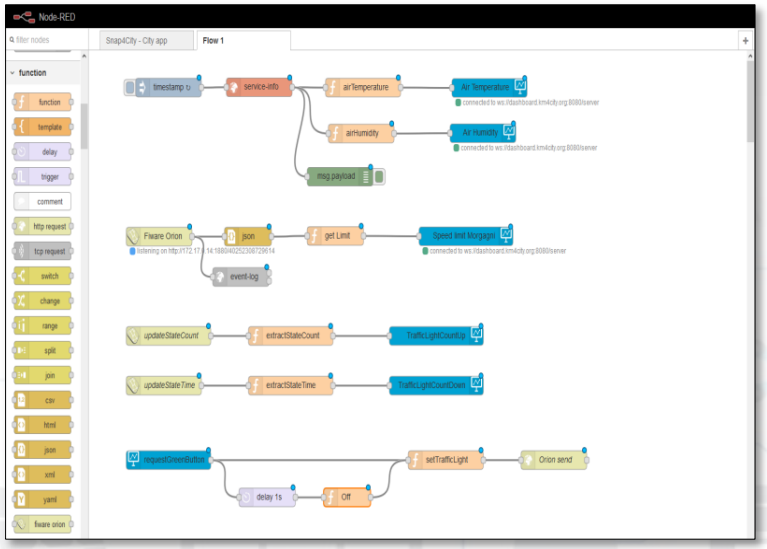
[ ]

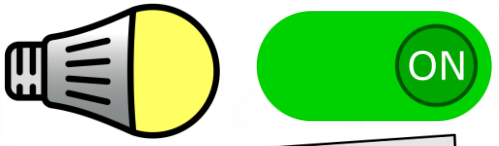
New Shared Variables

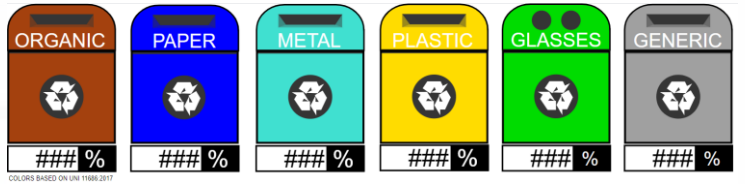
Constant Values

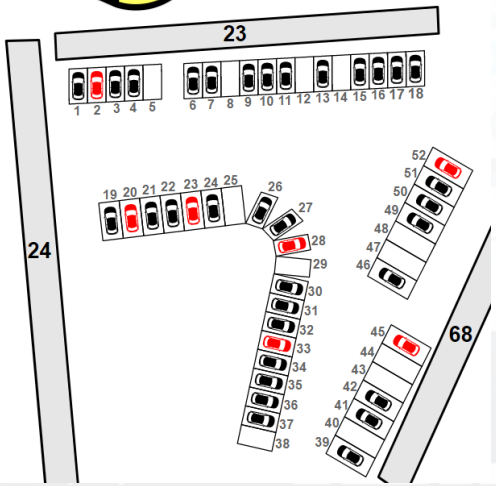


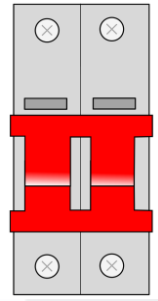


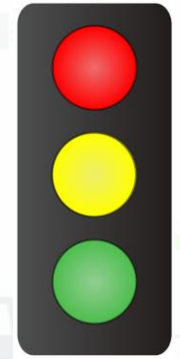








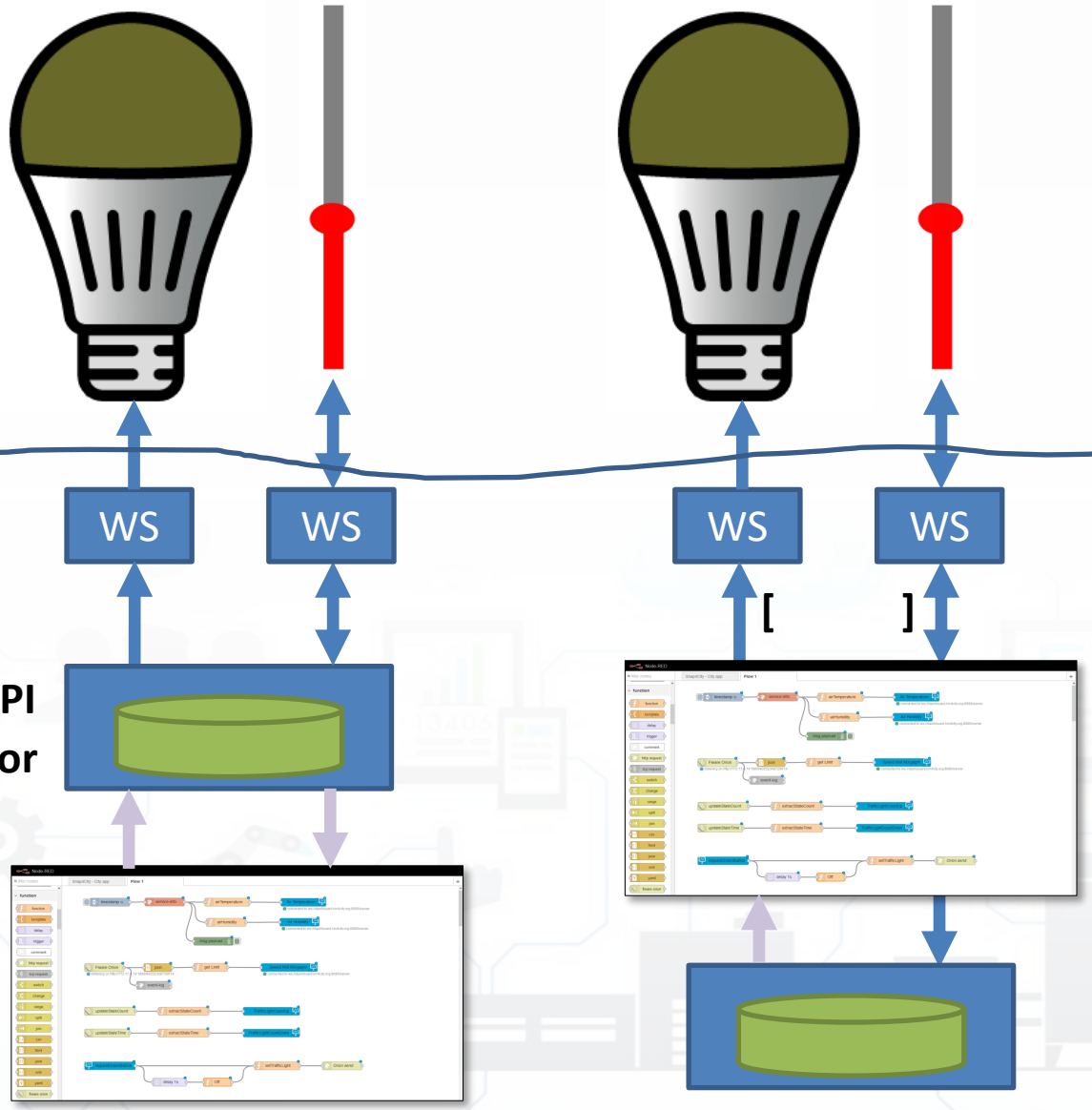




Dashboard on Browser

Internet

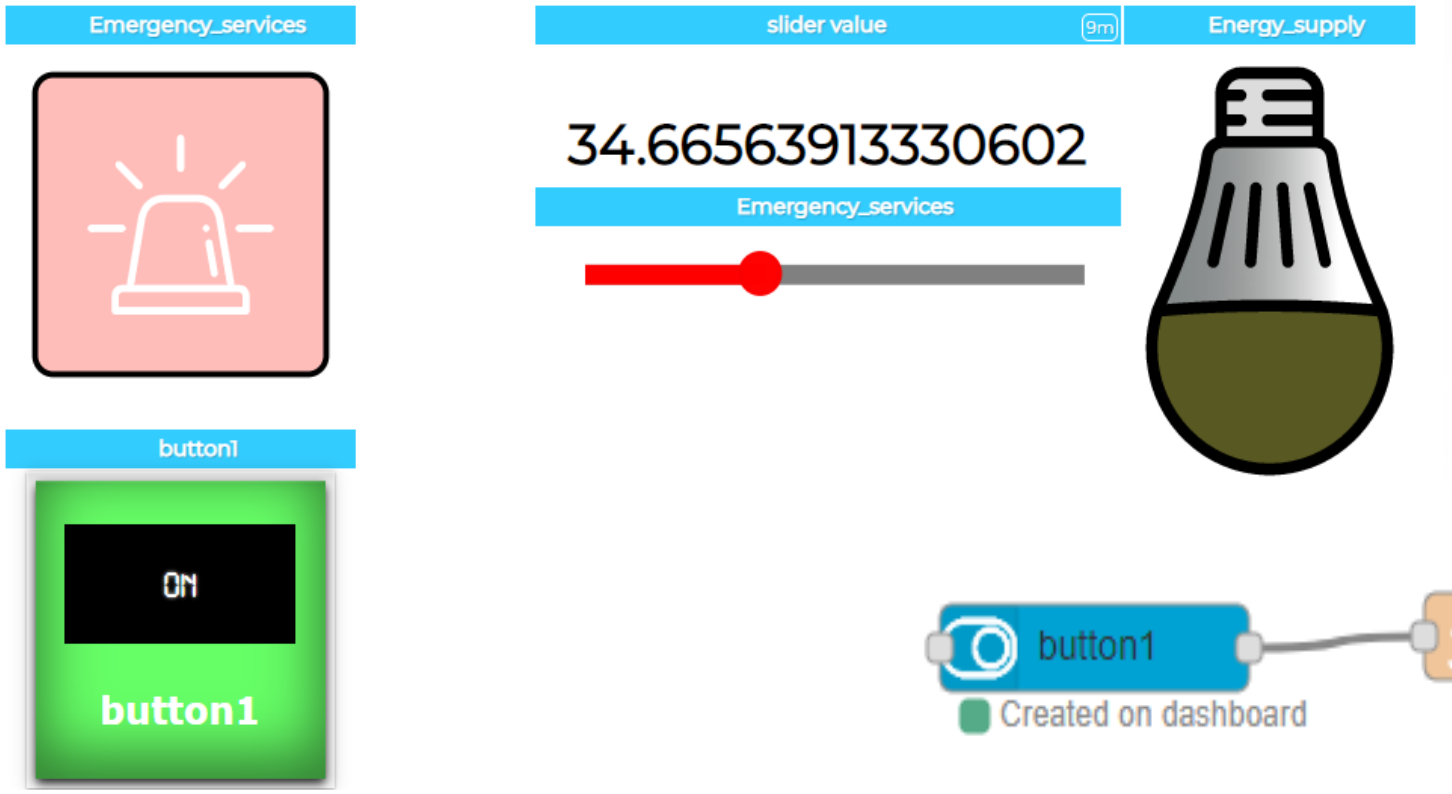
Storage and IOT App on cloud or on Premise



Case 1 Case 2 Case 3

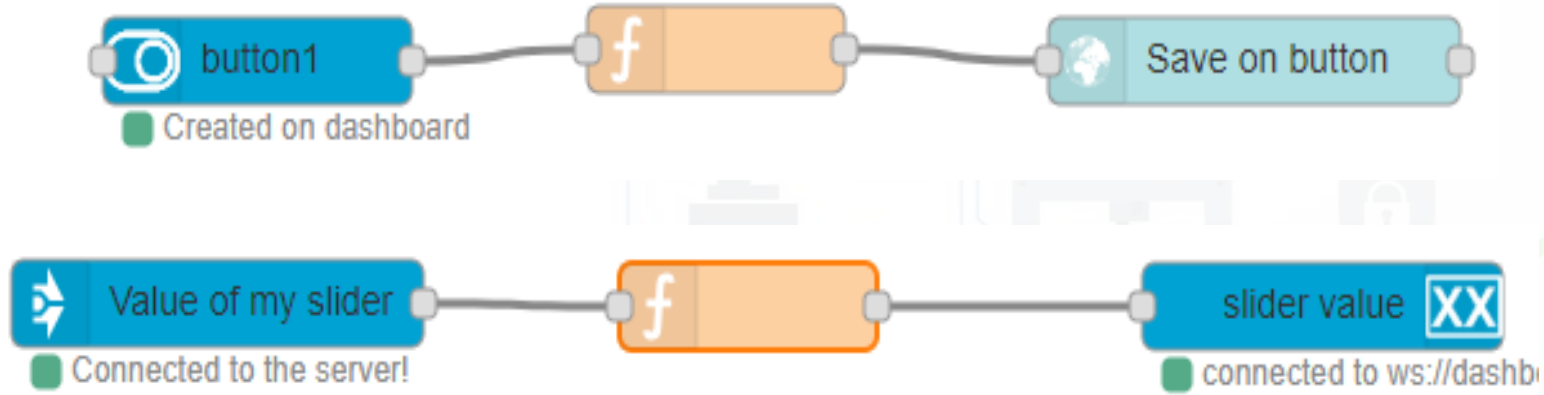
Case 1

Case 1 SVG ws3

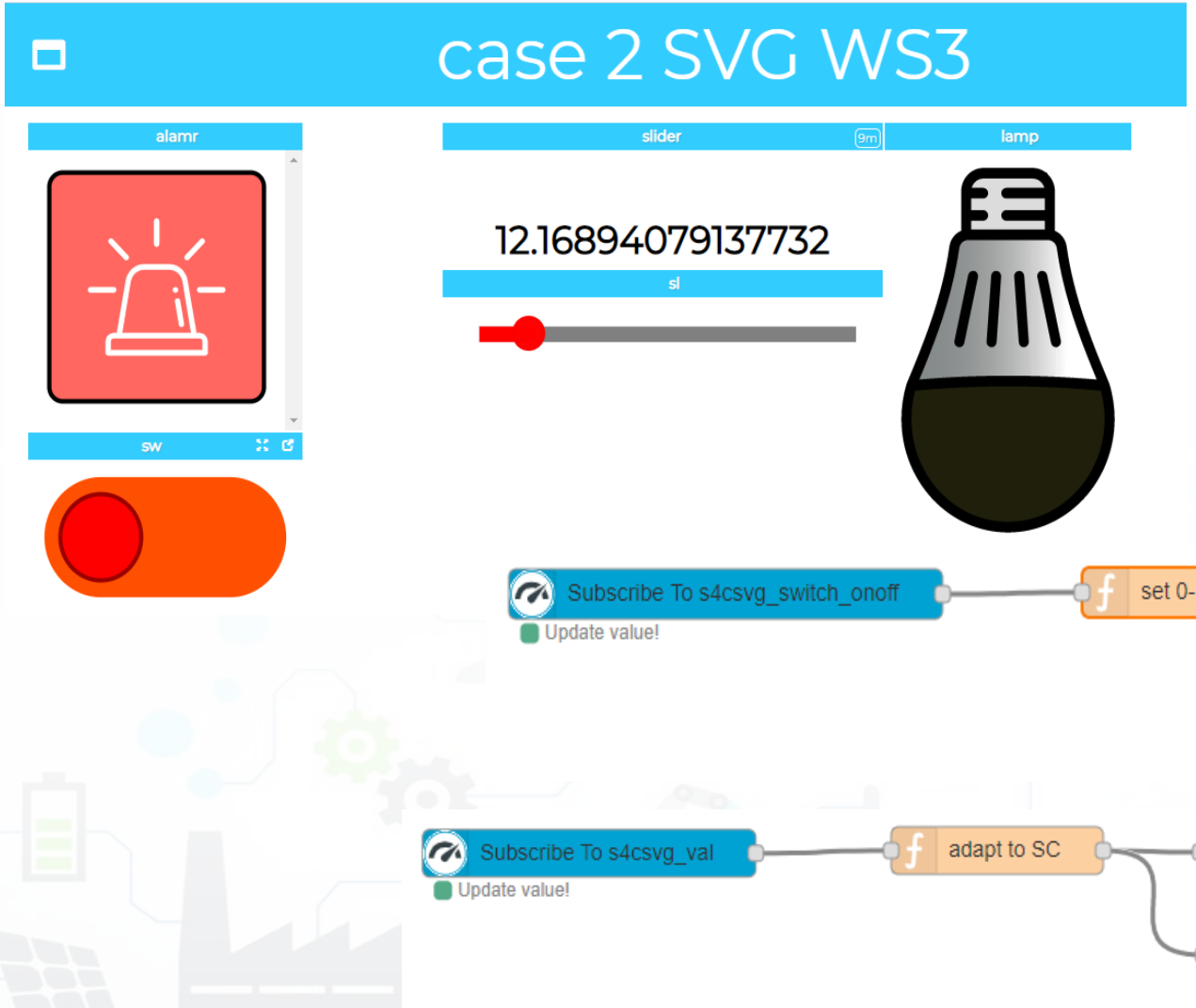


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjc4NA==

10 WS messages per second

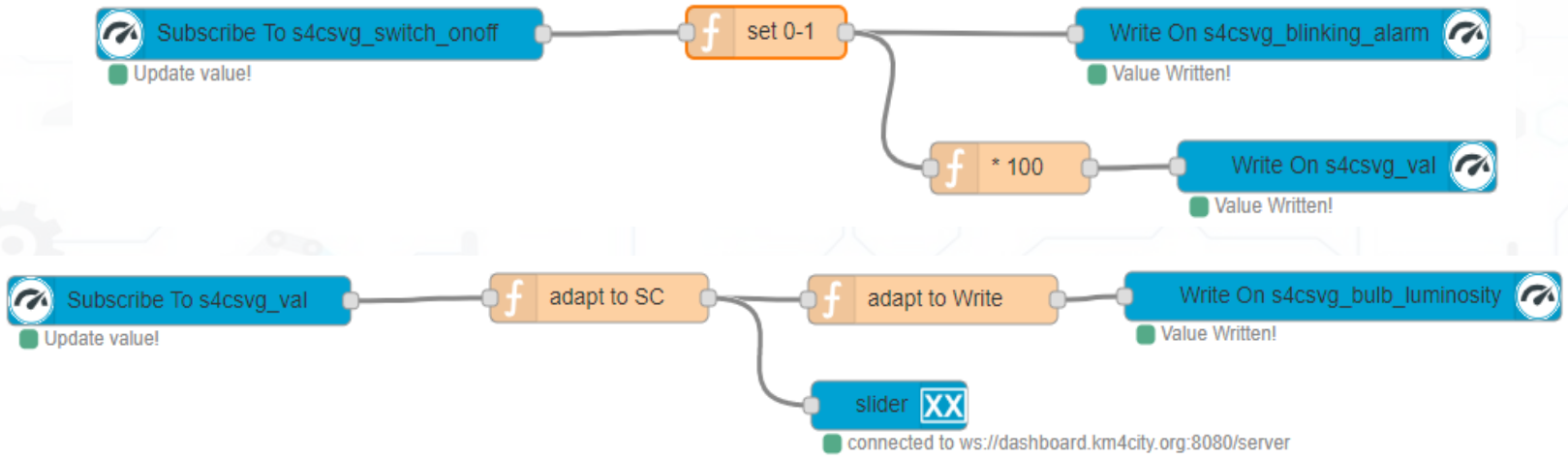


Case 2: Event Driven 100%



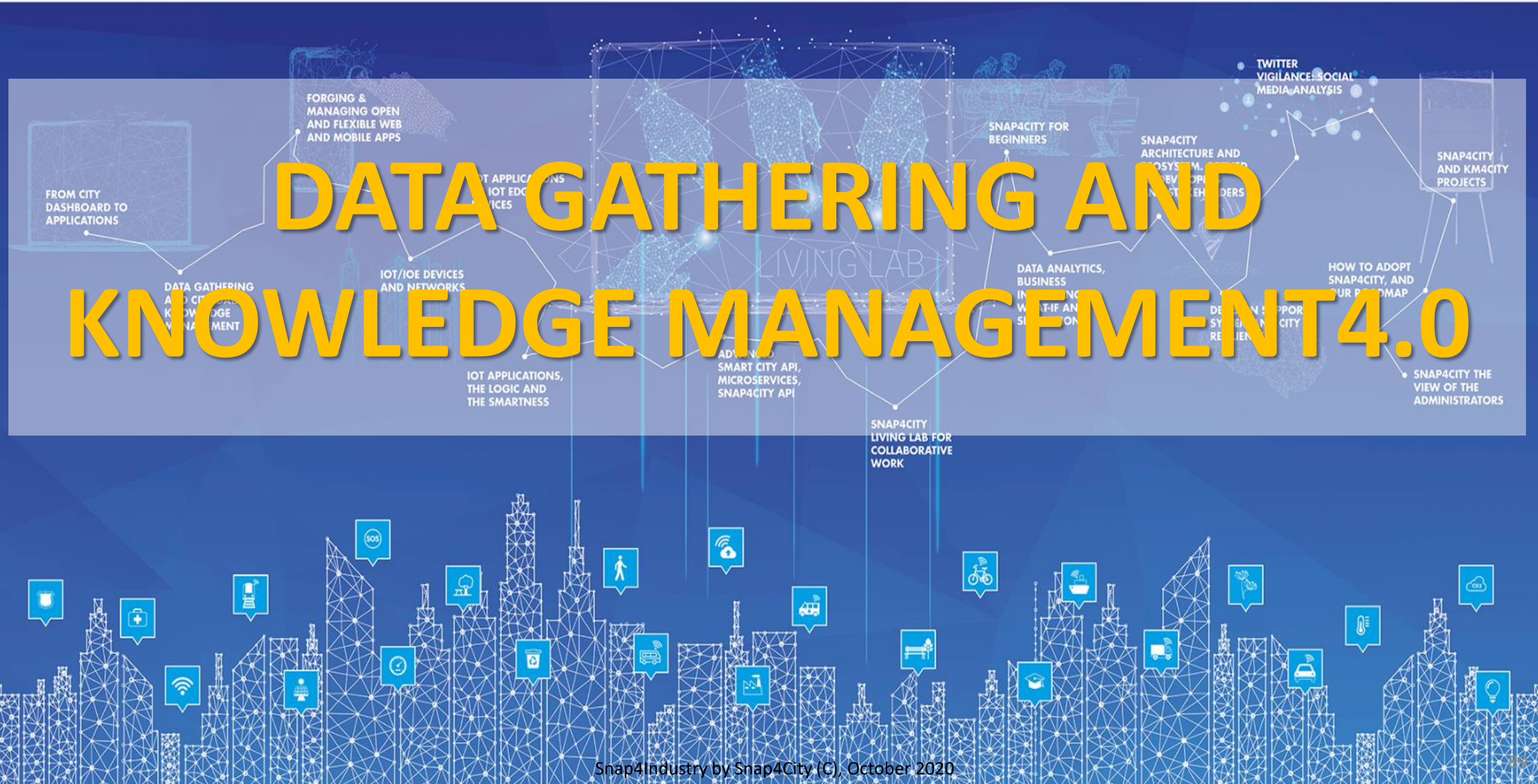
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjc4NQ==

40 messages per second



Read more on

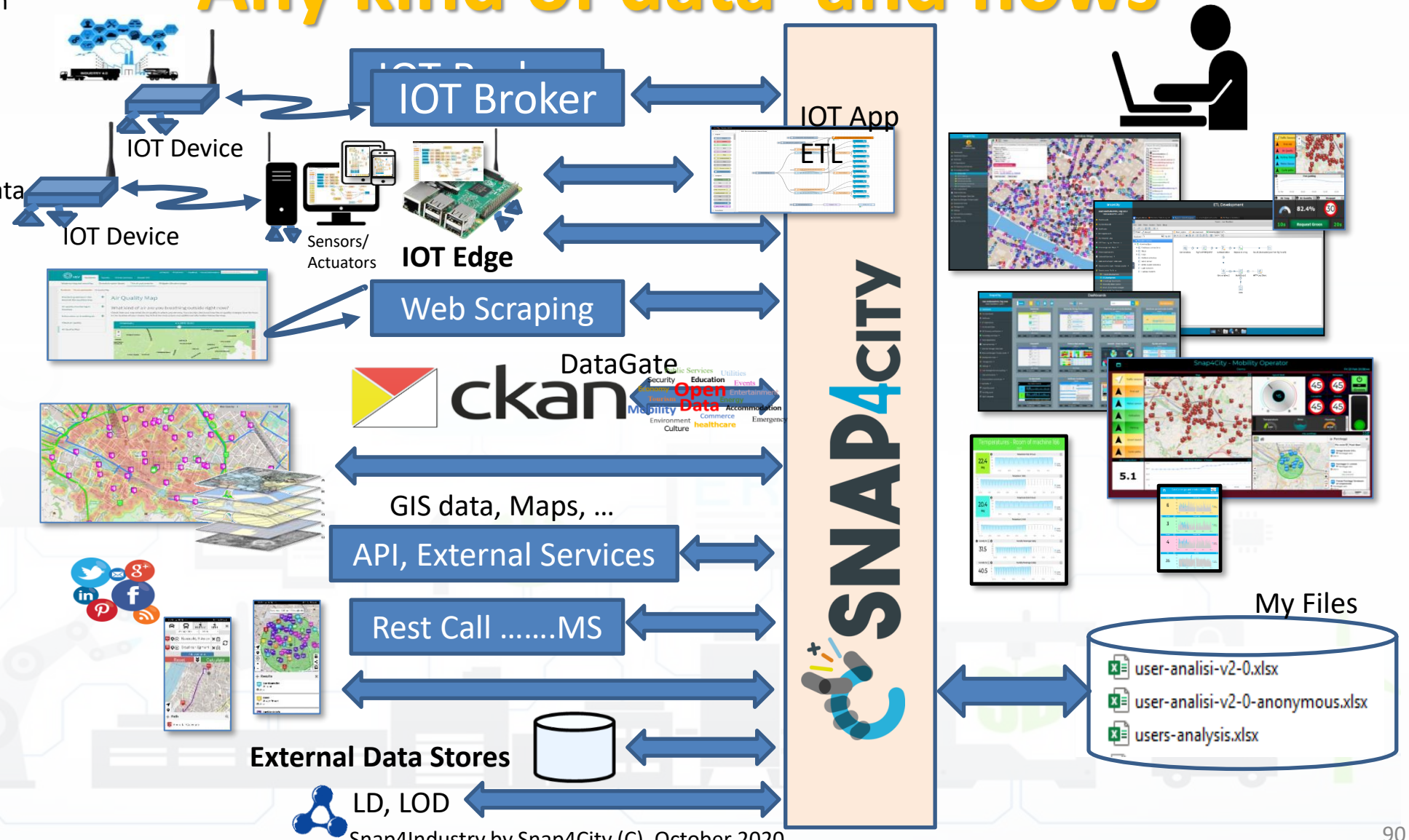
- TC9.19: Custom Widgets / Synoptics controlled by IOT Applications
- Custom Synoptics and Widgets for Dashboards
- Scenario: 5G Enabled Water Cleaning Control
- Snap4Industry: Snap4City for Industry 4.0
- TC1.22: Create and configure a Snap4City SVG Custom Widget for real-time interaction



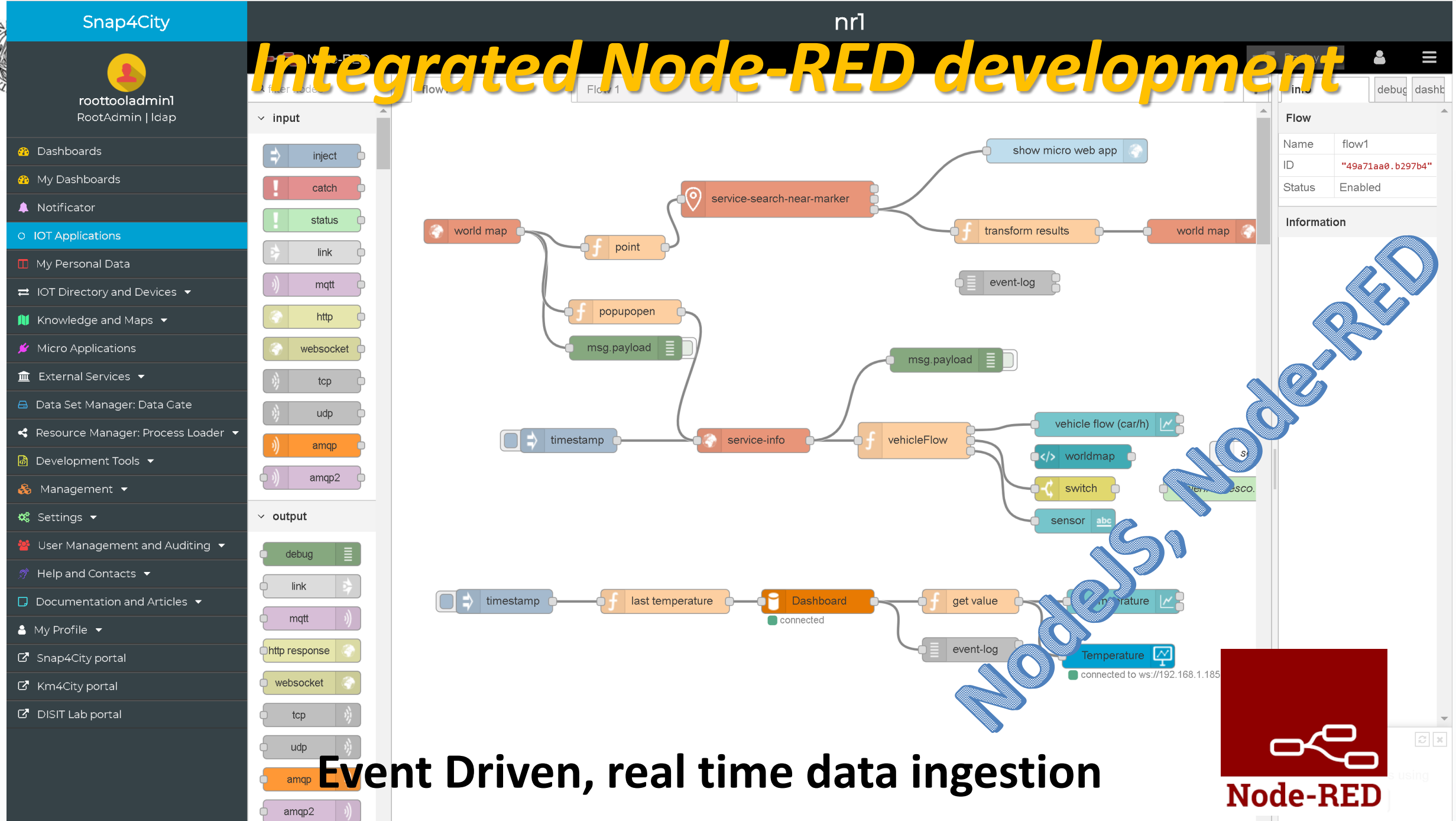
DATA GATHERING AND KNOWLEDGE MANAGEMENT4.0

Any kind of data and flows

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



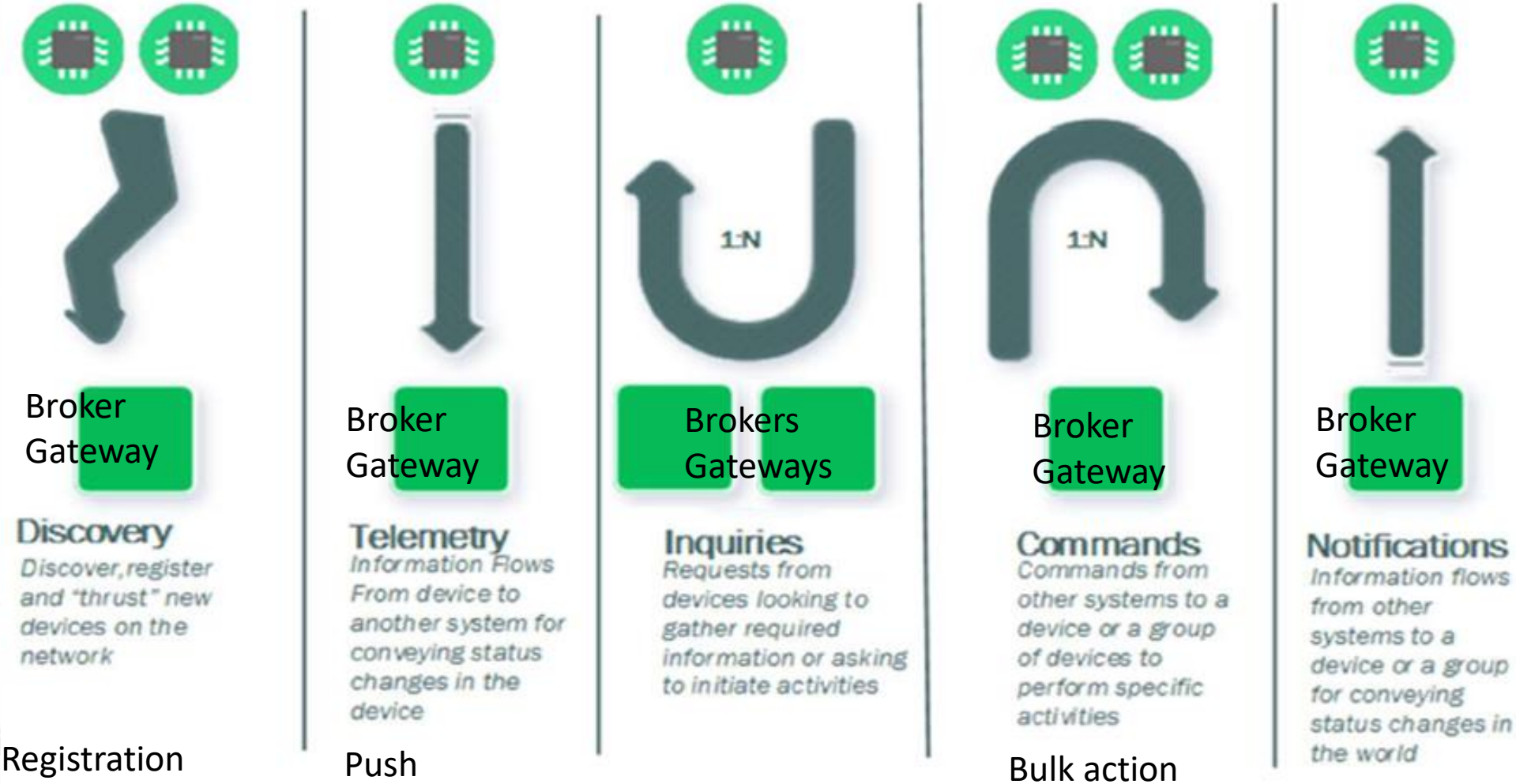
Integrated Node-RED development



Event Driven, real time data ingestion

IOT/IOE Protocols

Communication Patterns



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

Standards and Interoperability

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

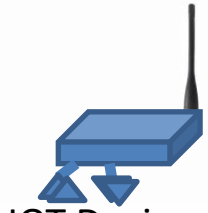
https://www.snap4city.org/65

Snap4Industry vs Formats

- Snap4City is capable to ingest and work with any format:
  - Data **exchange**: JSON, GeoJSON, XML, HTML, HTML5, DATEX, GTFS, binary, etc.
  - **Table**: CSV, XLSX, XLS, database, …
  - Any **archive** file format: zip, rar, 7z, tgz, …
  - Any **image** format: png, gif, tiff, ico, jpg, …
  - Any **video** format: mp4, avi, mov, …
- Search the format you need to cope on the search box of Snap4City portal!

In which case you are?

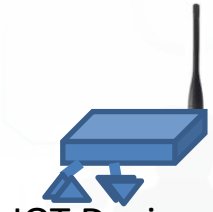
https://www.snap4city.org/drupal/node/474



IOT Broker — SNAP4CITY — Case B2

IOT Broker → SNAP4CITY — Case B1

i) Registered IOT Broker on Snap4City



IOT Broker — SNAP4CITY — Case A1.2

a) Registered IOT Device on Broker

IOT Broker → SNAP4CITY — Case A2

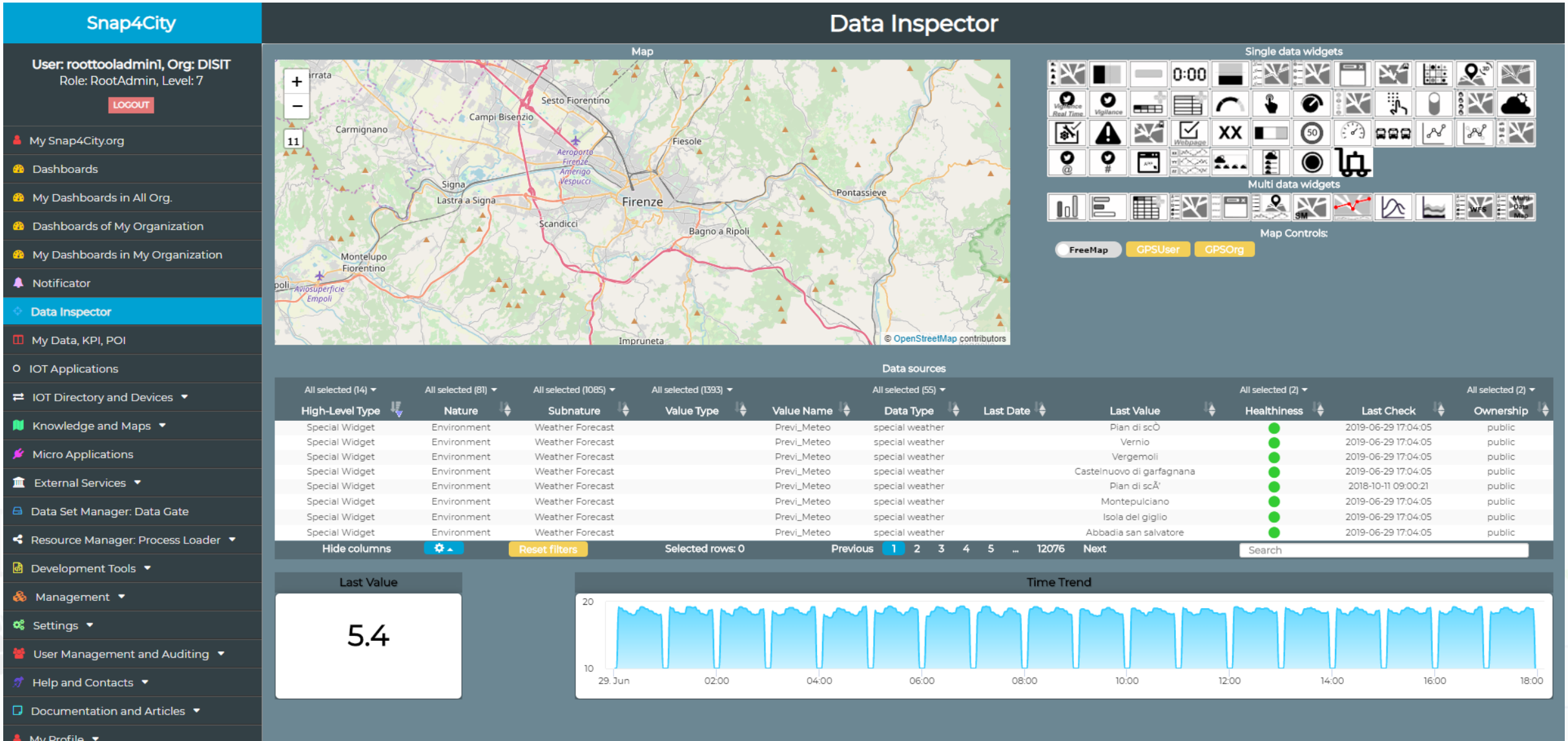
a) Registered IOT Device on Broker

i) Registered IOT Broker on Snap
ii) Registered IOT Device on Snap

Protocols/formats

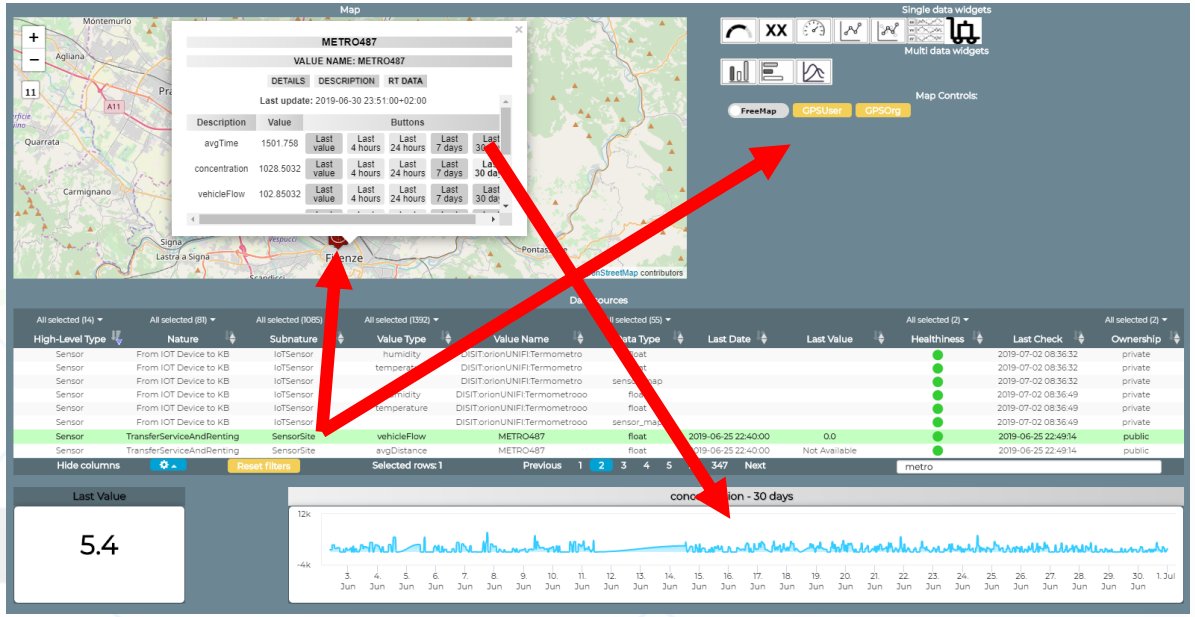
- Snap4City supports a large range of protocols for communicating with servers, services, IOT devices, legacy systems, GIS, etc., and format
- See also
  - Supported Protocols
  - High Levels IOT Protocols
  - TC9.2 - Managing heterogeneous File Ingestion, protocols, formats via IOT applications, and open standards
  - US9. Creating Snap4City IOT Applications, different formats, protocols, brokers, communications
  - TC2.14 - IOT Applications using multiple protocols, and formats for files Creating IOT Applications coping with heterogeneous data

Data Inspector

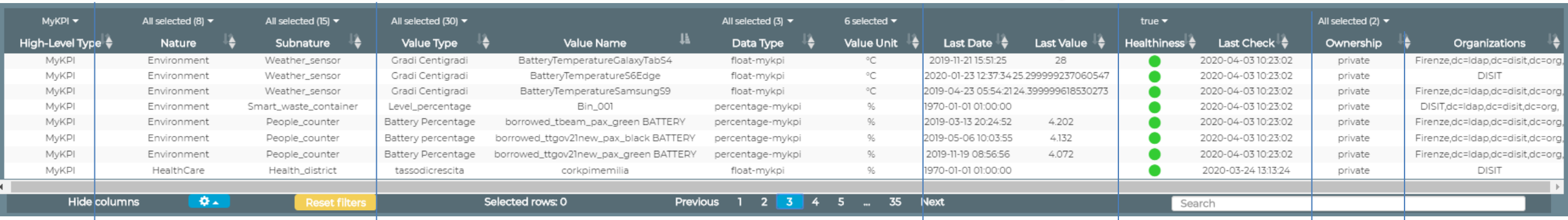


Data Inspector (open on your left side menu)

- **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

RealTime

Status

For Admin

For examples

- HLT: MyKPI
- Nature: Industry and manufacturing
- Subnature: Chemical
- Value Type: Density percentage
- Value name: CloroParaffine
- Data Type: float mykpi
- Value Unit: %
- Last Date: 2019-02-25
- 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 name: Irrigator fioriera Gag
- Data Type: float
- Value Unit: V
- Last Date: 2020-04-01 12:59:00
- 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

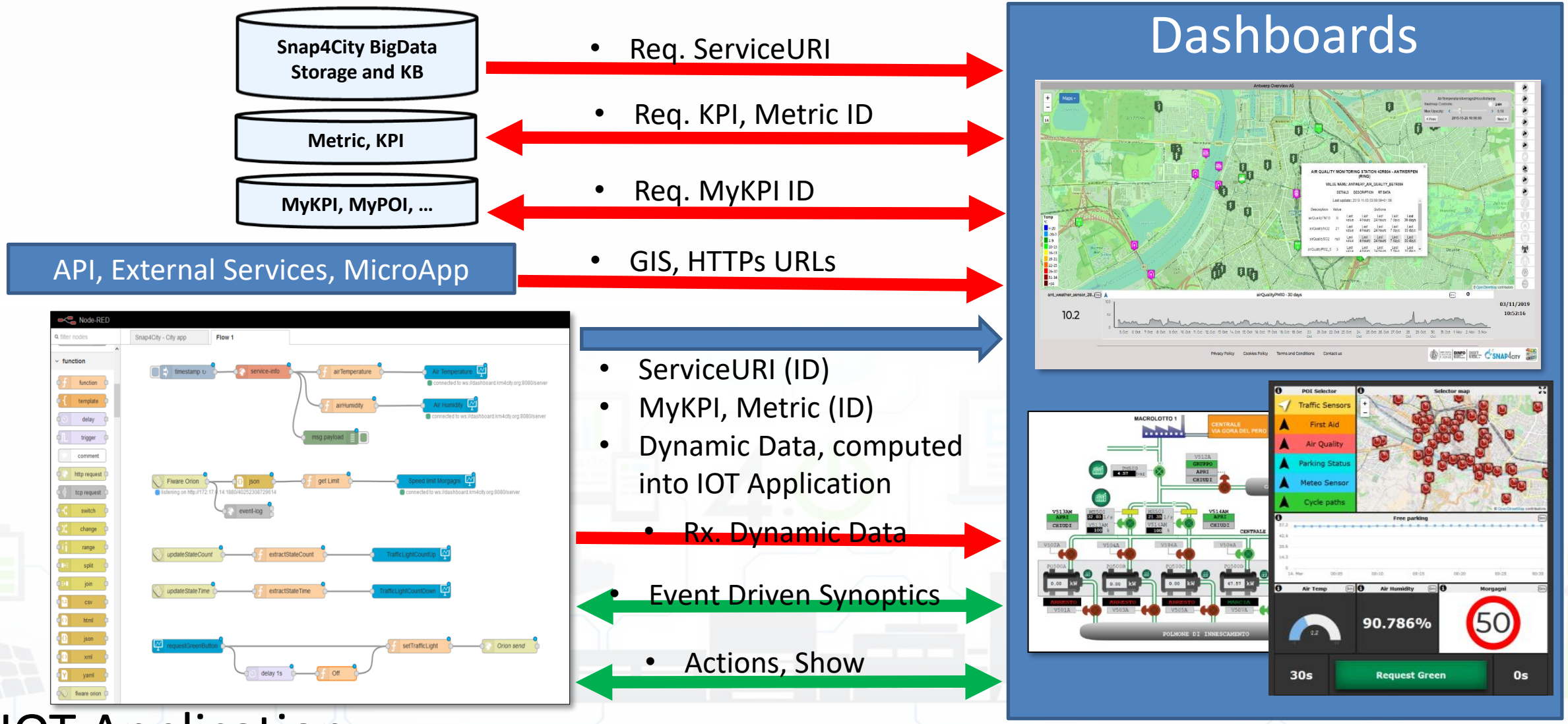
Legenda: How to ingest/change/manage

- **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

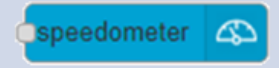
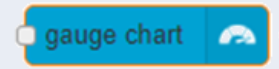
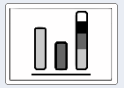
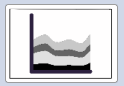
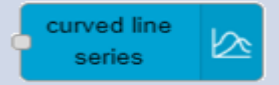
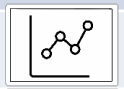
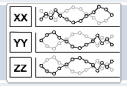
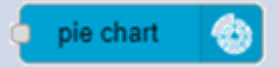
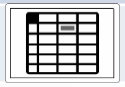
- **As MyPersonalData**: they are substantialy MyPersonalData
- **From third party tools**: they can be manipulated by using third party tools

How the Dashboards exchange data



IOT Application

Dynamic (+)

Widgets ICONS	Widget Name, Description	IOT App	Dashboard-IOT App	KPI (metric)	MyPersonal Data	MyData	My KPI	Sensor
XX	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	X	X	X	X	X
	Table 	X (cs)	X	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)

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
```

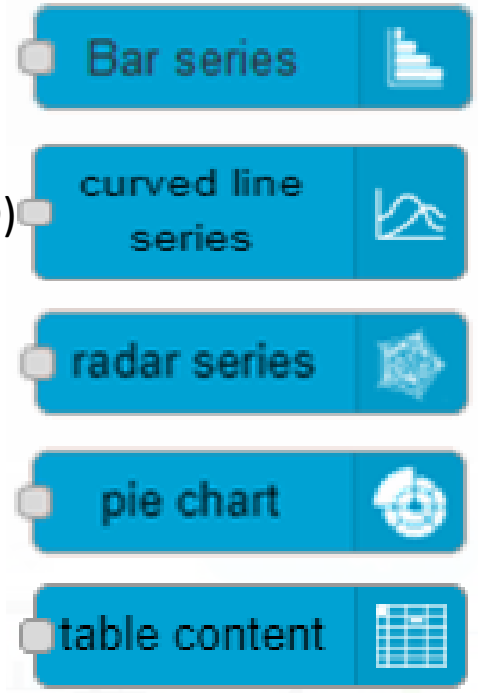

ServiceURI (ID)

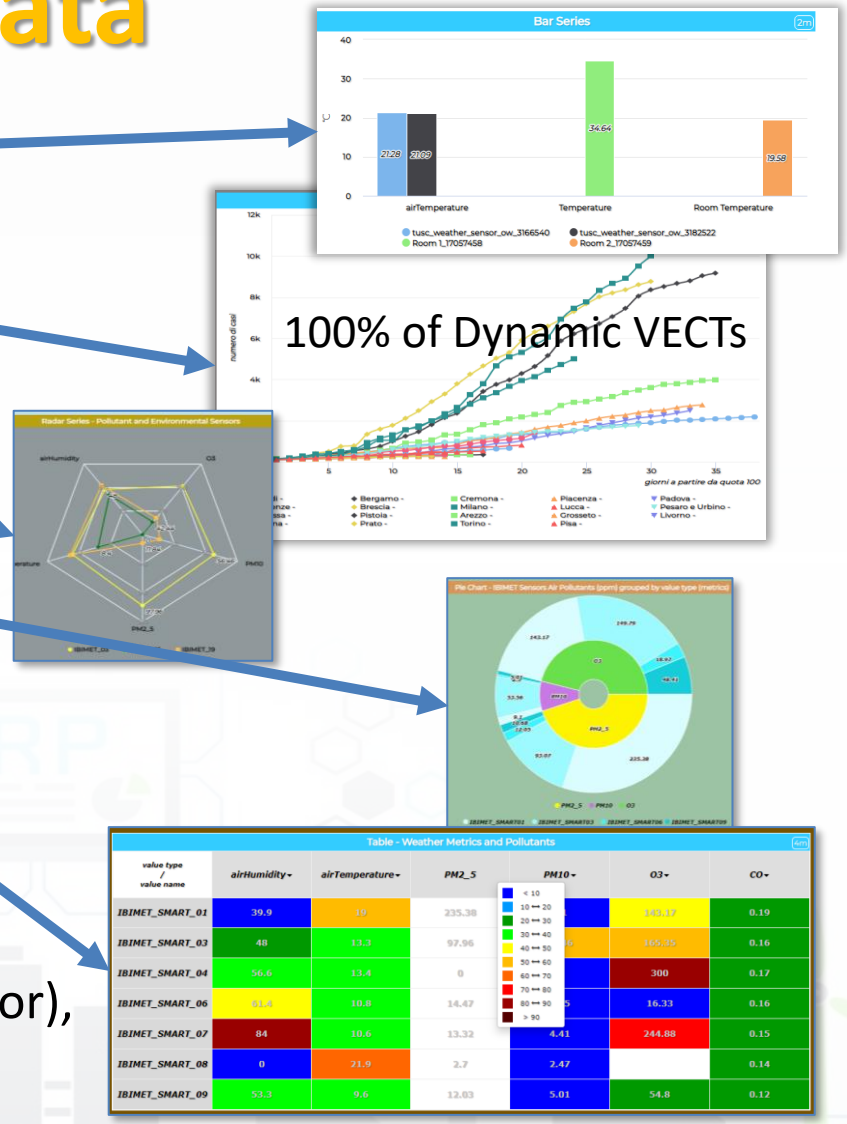
ServiceURI (ID)

MyKPI (ID)

Dynamic

Dynamic





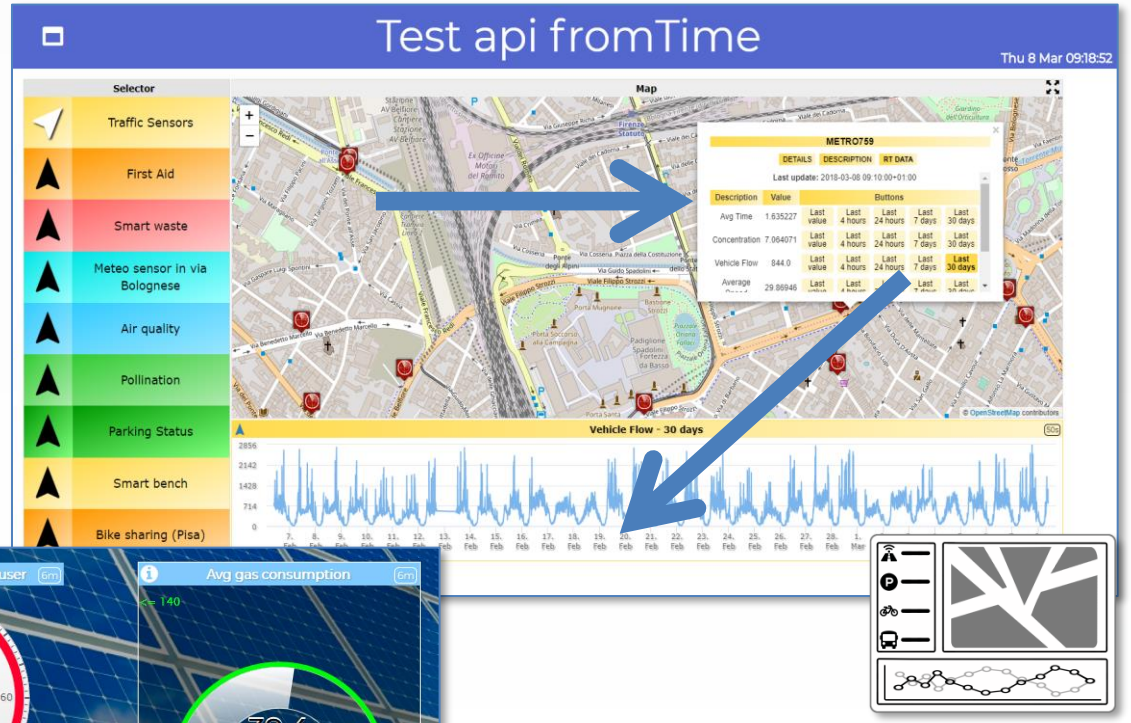
- **ServiceURI** (ID)
- **MyKPI (ID)**, Metric (ID)
- **Dynamic** Data in JSON (single or Vector), computed into IOT Application

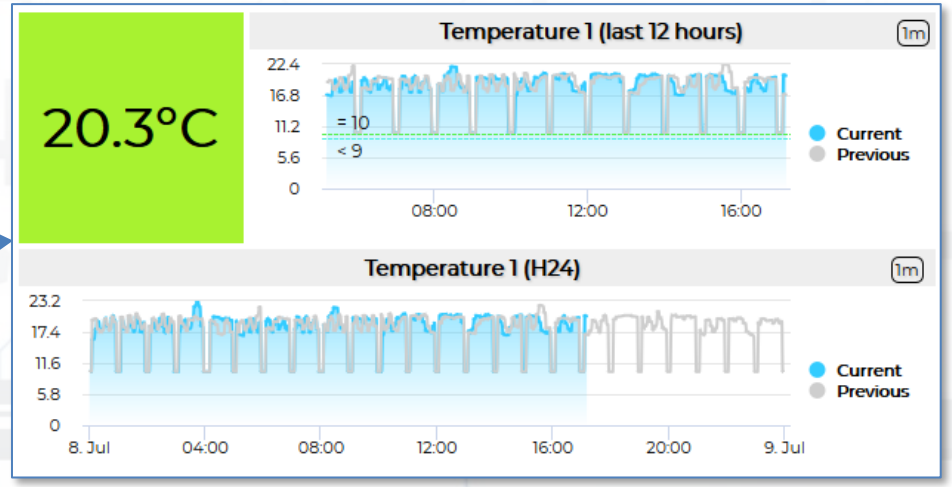
[TC4.9: New Support Widgets for Bars, Barseries, Trend, and Series, on Dashboards and IOT Applications]

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

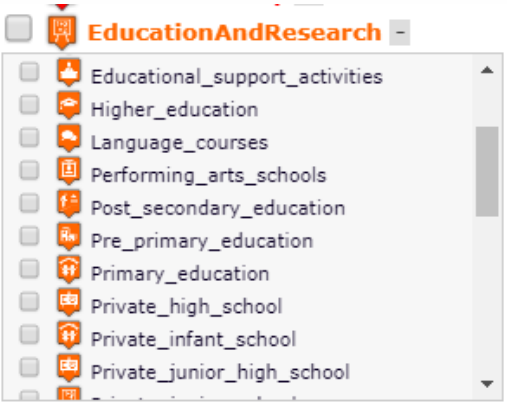
- Sensors can arrive in platform as follows (see **Nature**)
  - ***ETL processes*** in PULL
    - **As Periodic processes**

IOT Data Driven

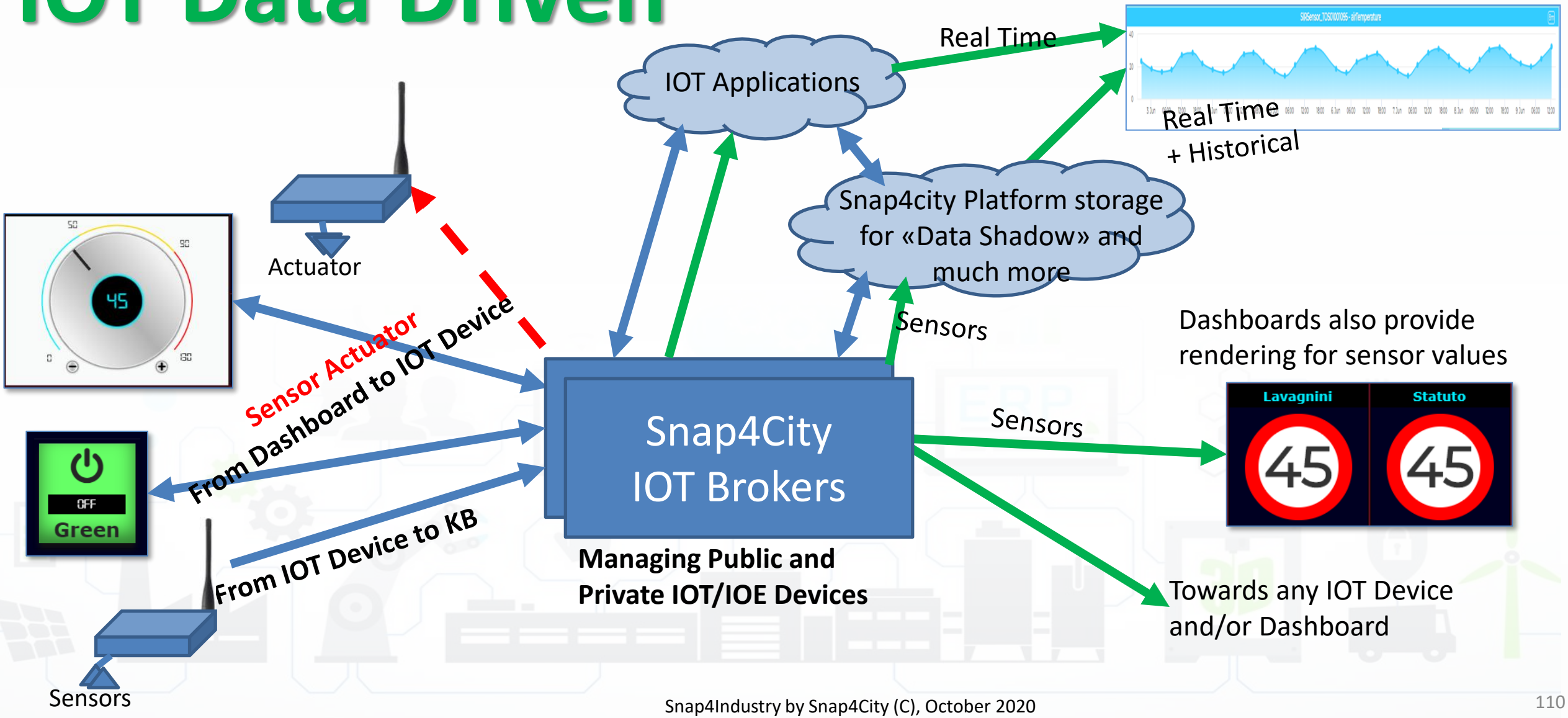
- **From IOT Devices to KB** (knowledge base). Registered via IOT Directory, arriving via IOT Broker and saved into the Data Shadow,
  - **IOT data driven process** in PUSH
- **From Dashboard to IOT Devices** (echo) is a virtual sensor **Sensor Actuators (HLT)**,
  - **IOT data driven process** in PUSH

Nature

SubNature

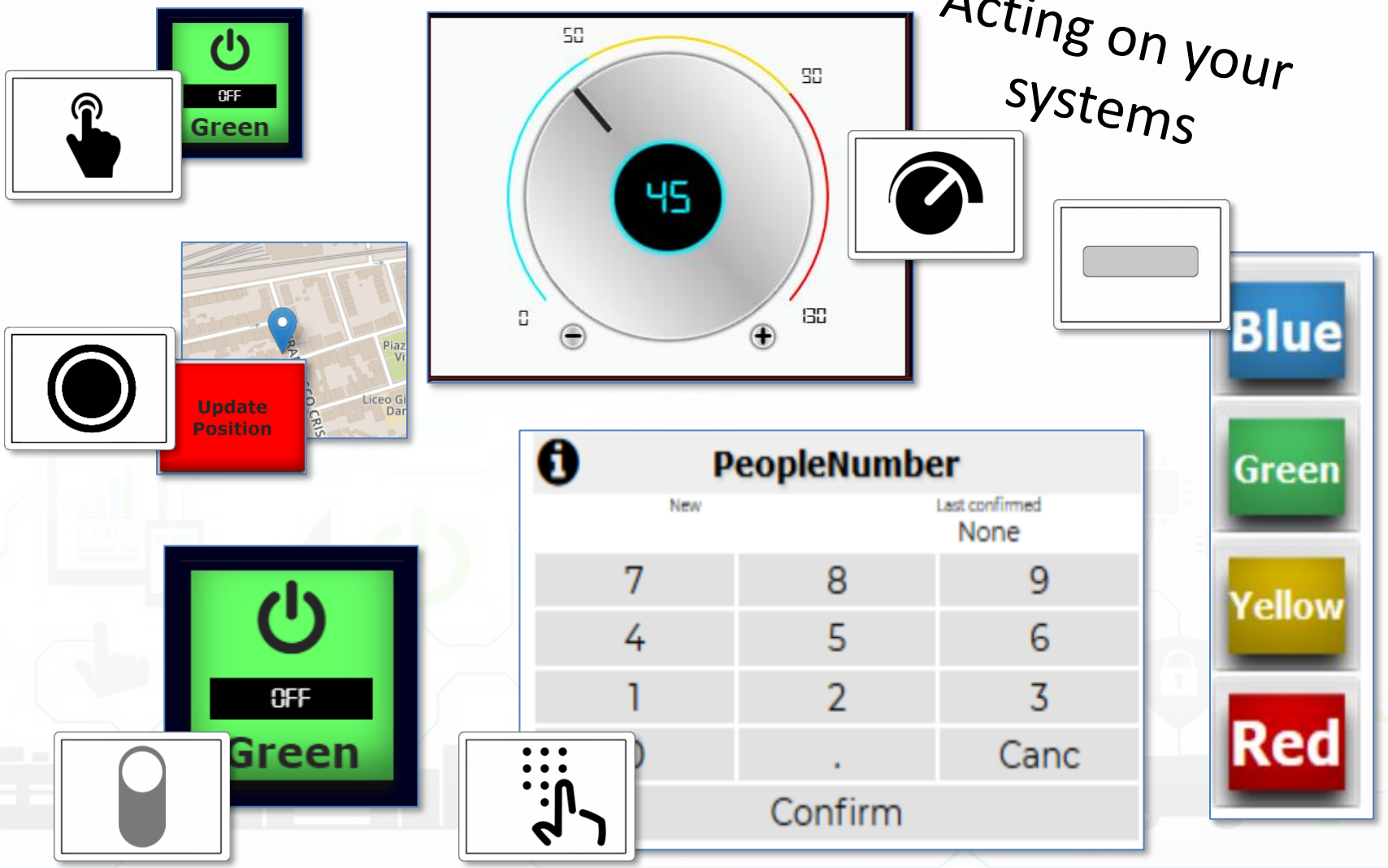


IOT Data Driven



From Dashboard to IOT Devices

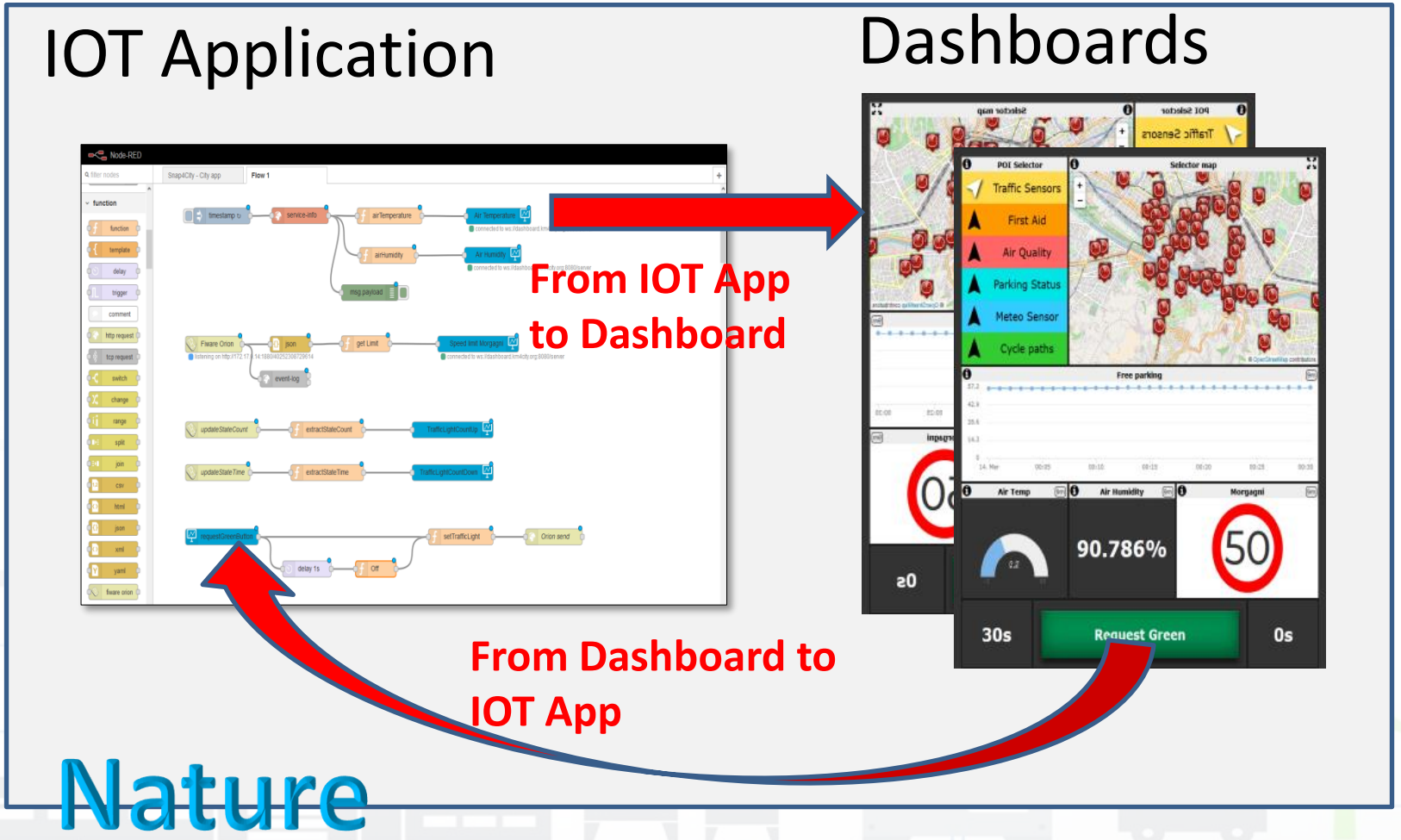
- **Widgets:**
  - Impulse Button
  - Button
  - Switch
  - Dimer/Knowb
  - KeyPad
  - geolocator
- **Registered** on some IOT brokers with NGSI mutual authentication



HLT: Sensors-Actuators

High Level Types

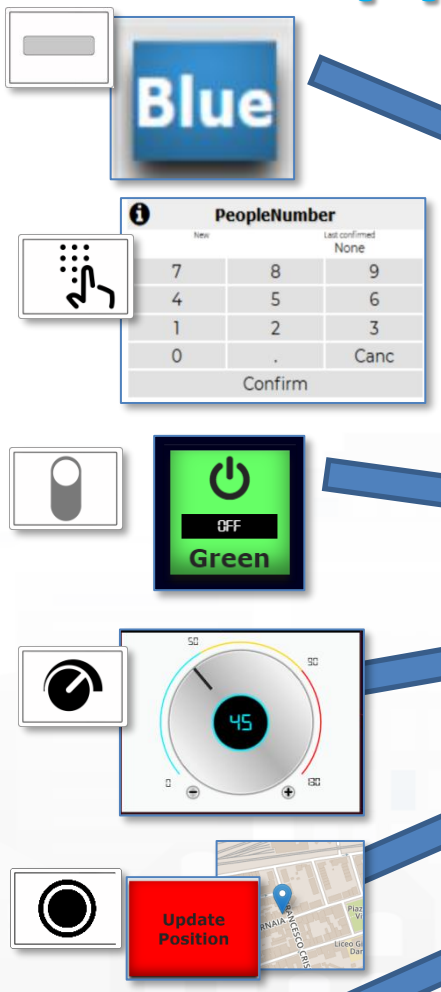
- **Complex Event**
- **Dashboard-IOT App**
- **External Service**
- **Heatmap**
- **KPI (Key Performance Indicator)**
- **MicroApplication**
- My Personal Data
- MyKPI
- MyPOI
- **POI (Point of Interest)**
- **Sensor**
- **Sensor Actuator**
- **Special Widget**
- Wfs (GIS)



Nature

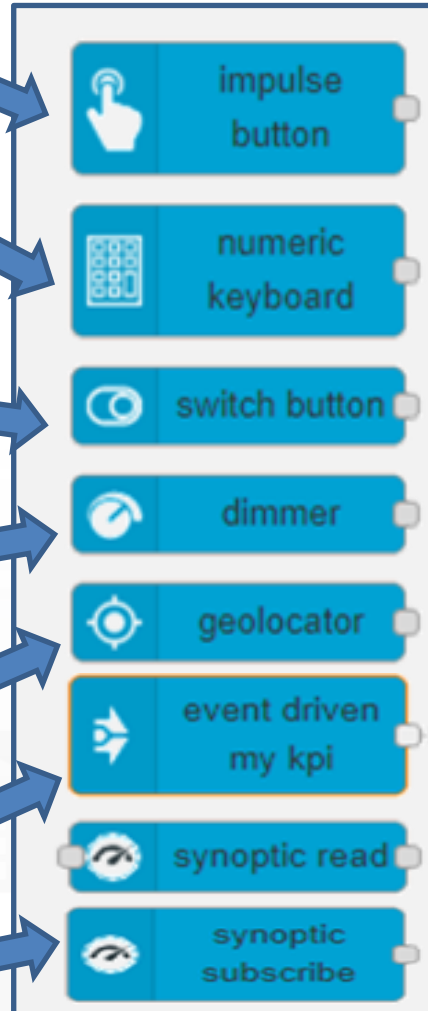
Dashboard-IOT App

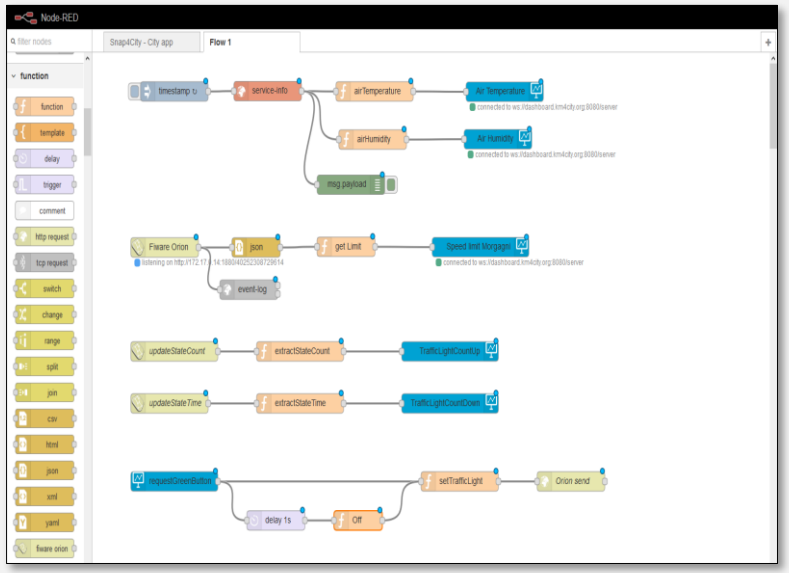
From Dashboard to IOT App



MyKPI variable

Synoptics

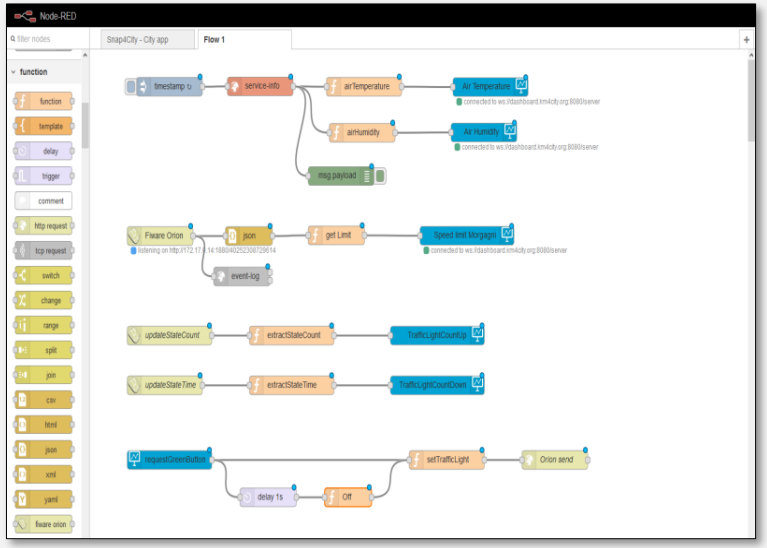




IOT Application

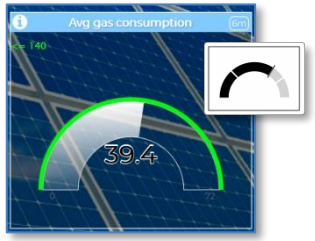
Dashboard-IOT App

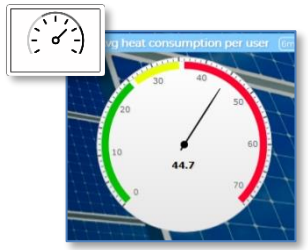
From IOT App to Dashboard

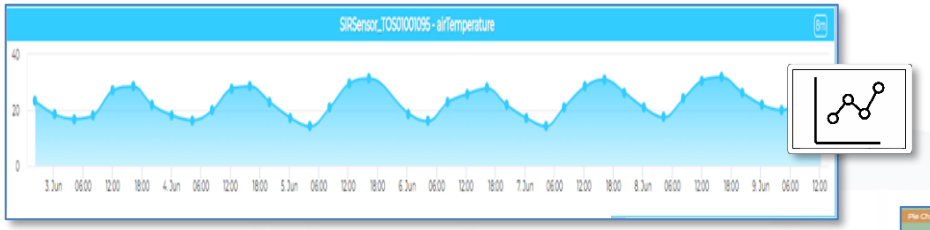


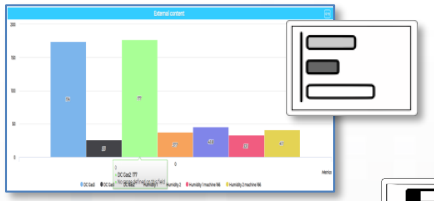
IOT Application

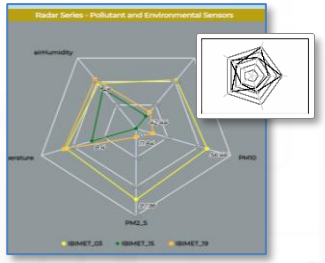
- gauge chart
- single content
- speedometer
- horizontal single bar
- vertical single bar
- web content
- time trend
- bar series
- radar series
- pie chart
- curved line series
- table content
- synoptic write

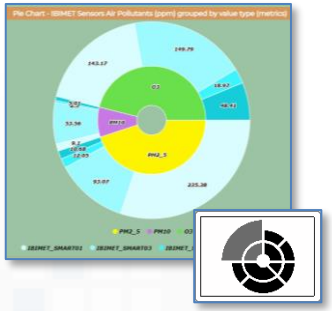


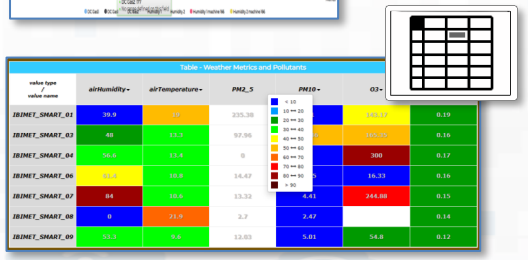


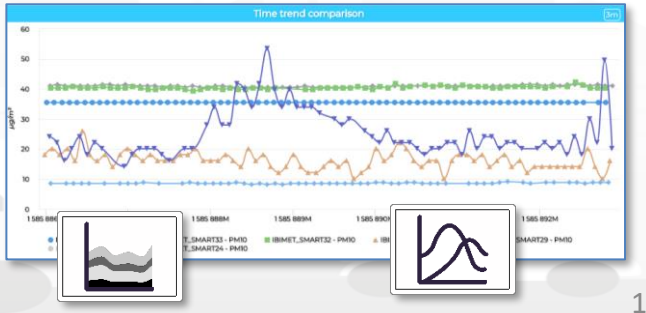


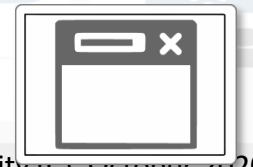








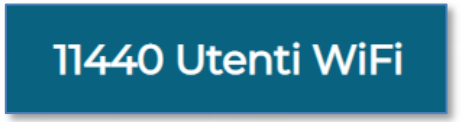


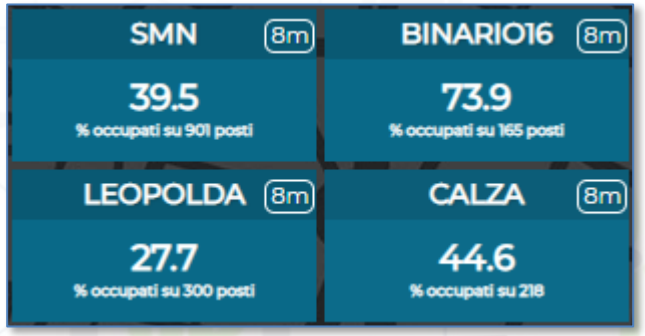


Single Content Widget (flexibility)

From Dashboard Editor and IOT Applications, accepts in input:

- Numbers
- String
- HTML code

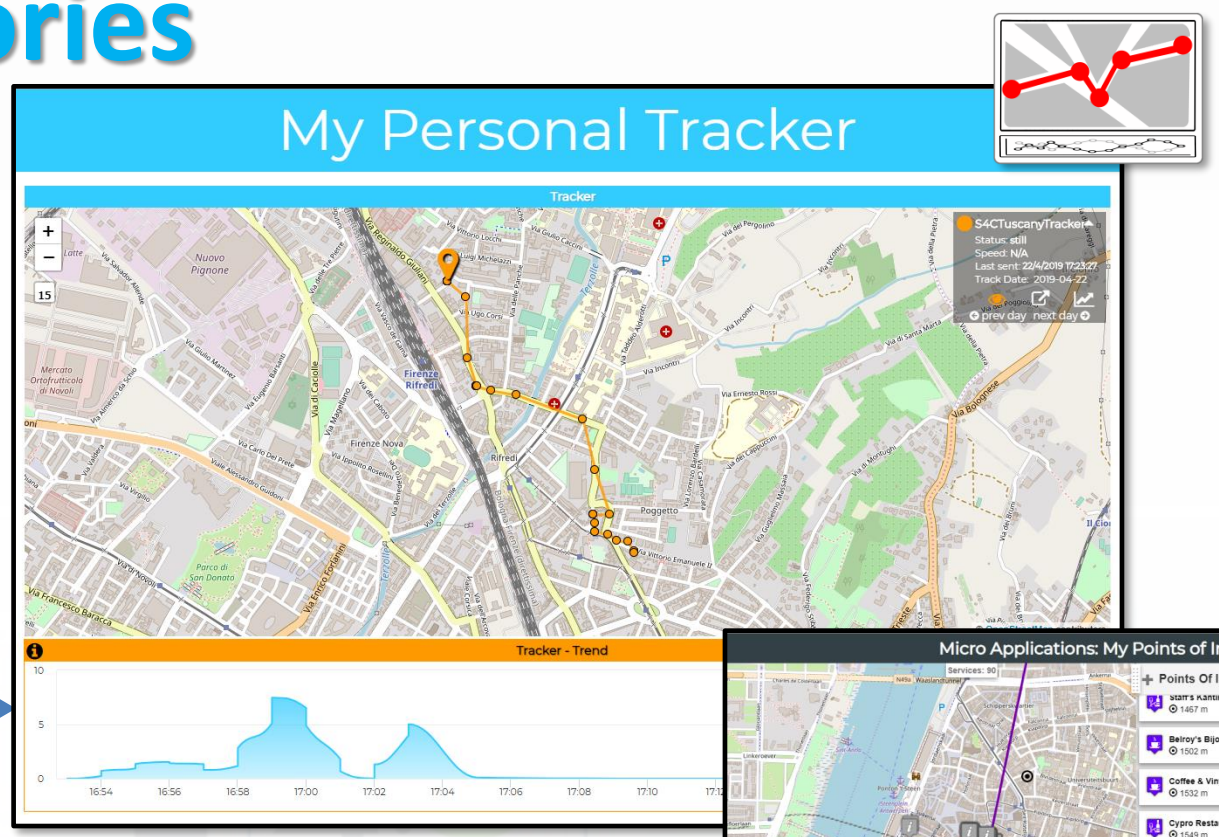


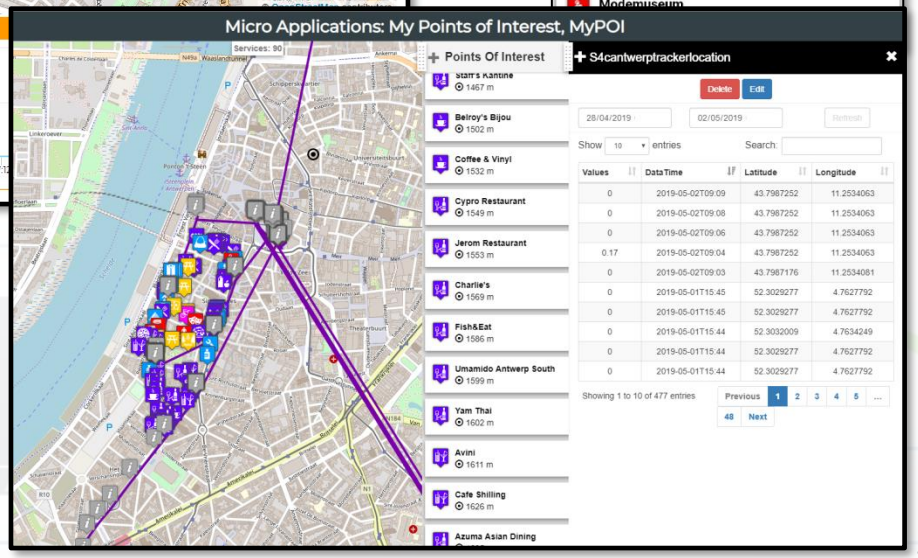


MyKPI as Trajectories

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)

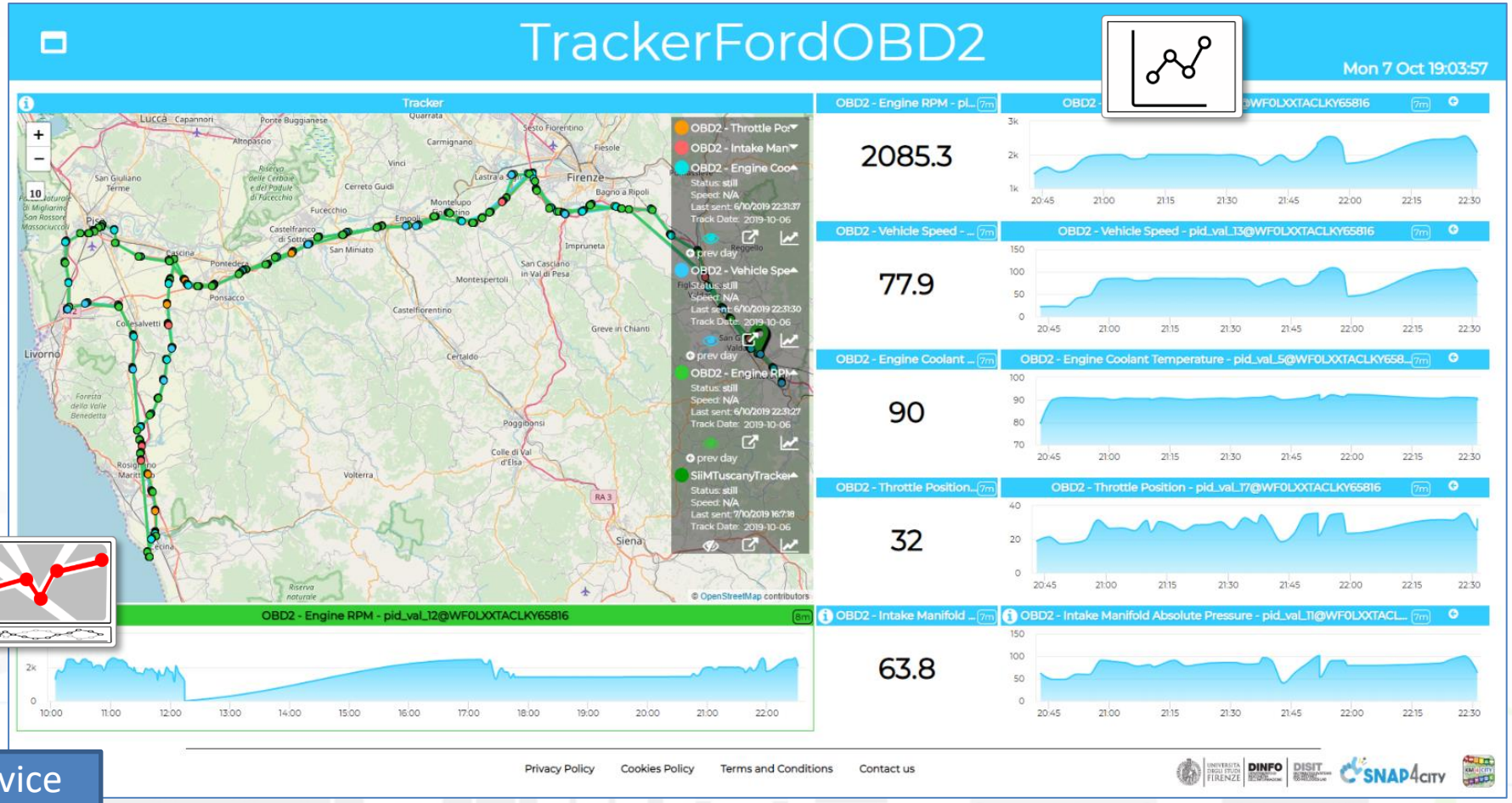




- Real Time Tracking
- Hystorical Tracks
- MicroApplications

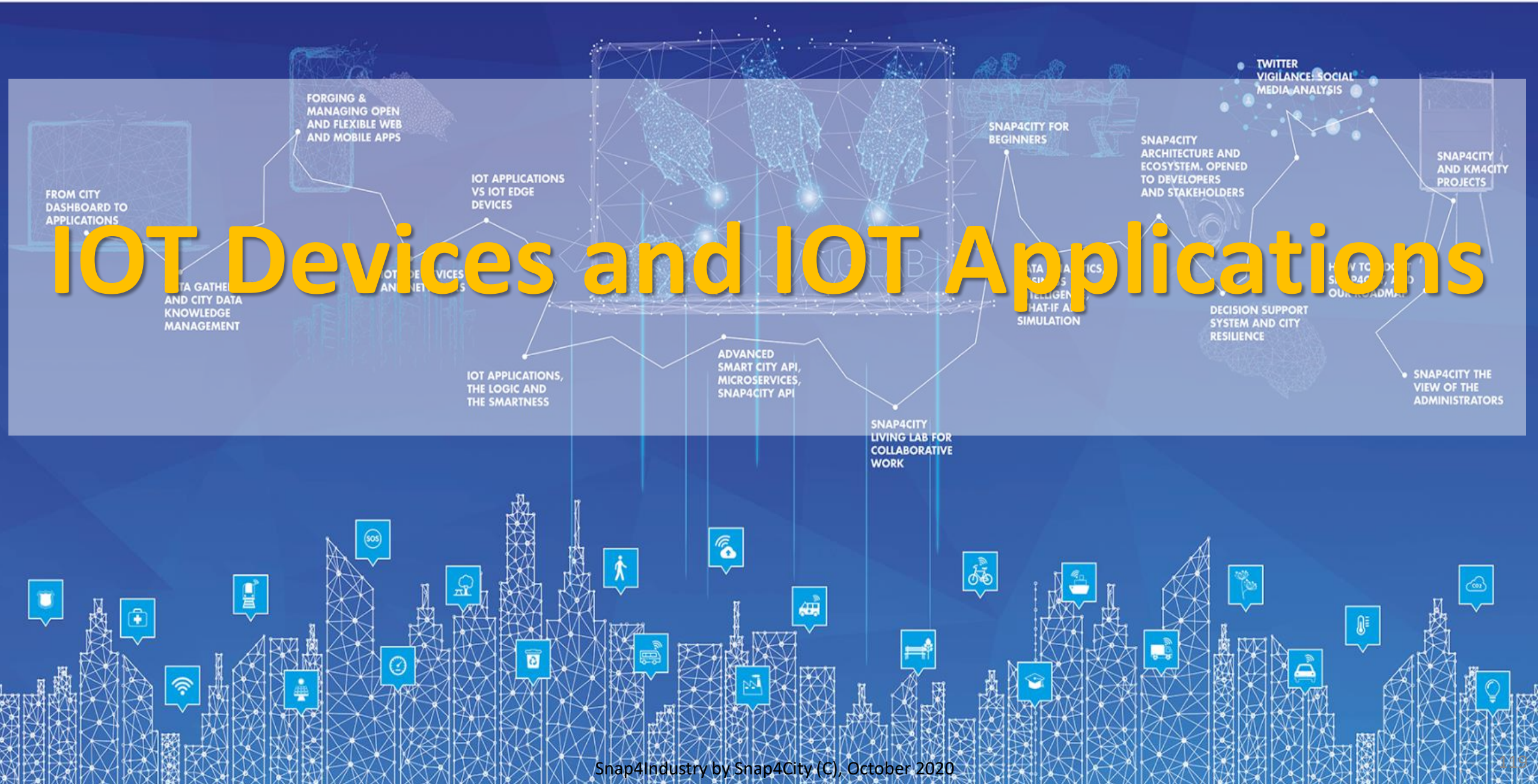
MyKPI: Tracking of Devices and Mobiles

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



Data Gathering and Knowledge Management

- Data ingestion can be performed by using multiple tools:
  - ETL processes, IOT Applications, Data Gate, WebScraping. We suggest:
    - ETL for static / periodic data in PULL
    - IOT App for real time data and flow, from IOT Brokers/Devices
    - DataGate for Static Data, upload them as files, or collected from other CKAN
    - WebScraper for scraping data from Web Pages, when authorized!
- See how to test cases:
  - **HOW TO: add data sources to the Platform**
  - **HOW TO: define privacy rules for personal data, produced by the end-users own device**
  - **US6. Developing and using processes for data transformation**
  - **TC6.1 - Managing DataSets via DataGate: ingest, search, download, upload, annotate, share**
  - **TC6.3 - Creating ETL processes for automated data ingestion and data transformation**
  - **TC6.5 - Managing Heterogeneous File Ingestion via ETL processes**
  - **TC6.9 - ETL processes for multiprotocol and format data ingestion, see on GITHUB for library**
  - **TC9.2 - Managing heterogeneous File Ingestion, protocols, formats via IOT applications, and open standards**



IOT Devices and IOT Applications

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 data World

Dashboards Applications

IOT Network Manager vs Final User

Network of IOT Brokers

IOT Broker

IOT Directory

My IOT Device

Register

IOT Network Manager

Registering

Discovering

Knowledge Base, Km4City

IOT Application

Final user Manager

Discovering

Browsing

ServiceMap Knowledge Base

Knowledge and Storage Data from the Field and From the City if needed

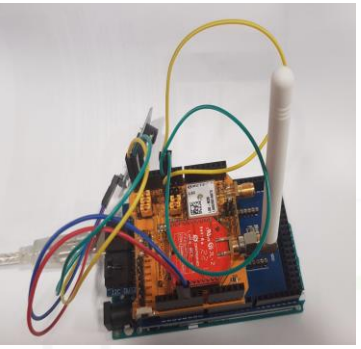
Dashboard Wizard

IOT Devices

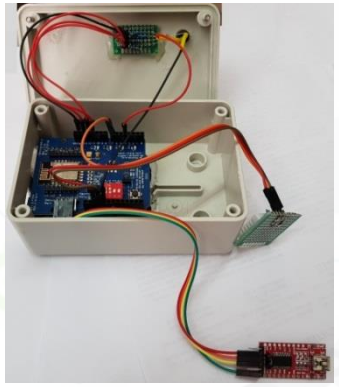
Sensors/
Actuators

IOT Edge Devices

LoraWAN +
Arduino +
I2C, NGSI



Arduino,
Wi-Fi, NGSI

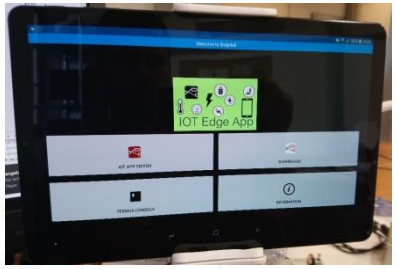


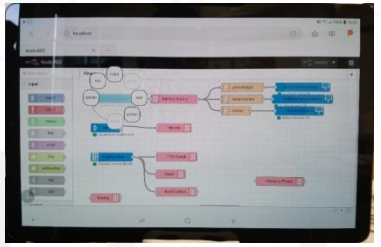
Snap4All
IOT Button
ESP, NGSI,
Wi-FI, BT

Snap4All PAX
Counter
LoraWAN
WIFI, NGSI,
GPS

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

IOT Edge
NodeRED:
Android, LINUX,
Windows, …





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

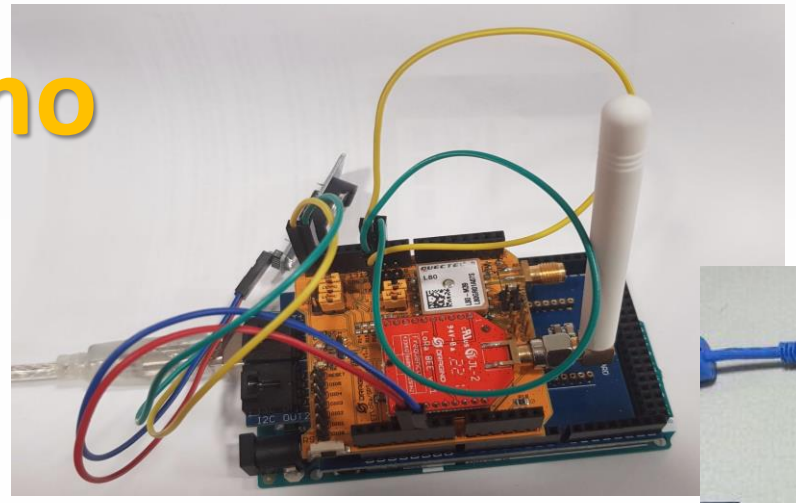
Any Sensor / Actuator
Open to other protocols

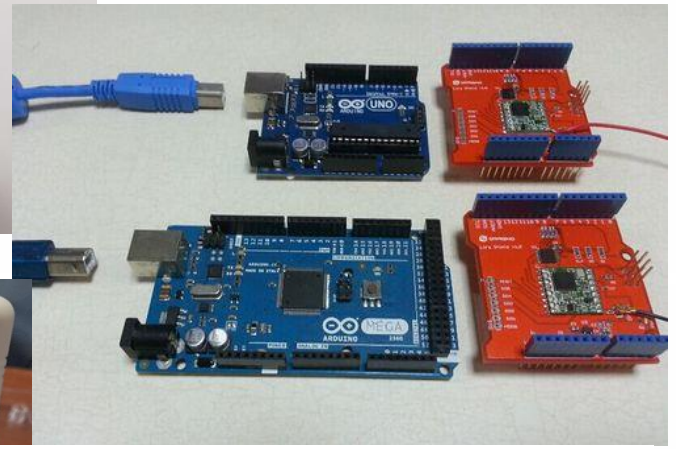
IOT Dev Management: activities

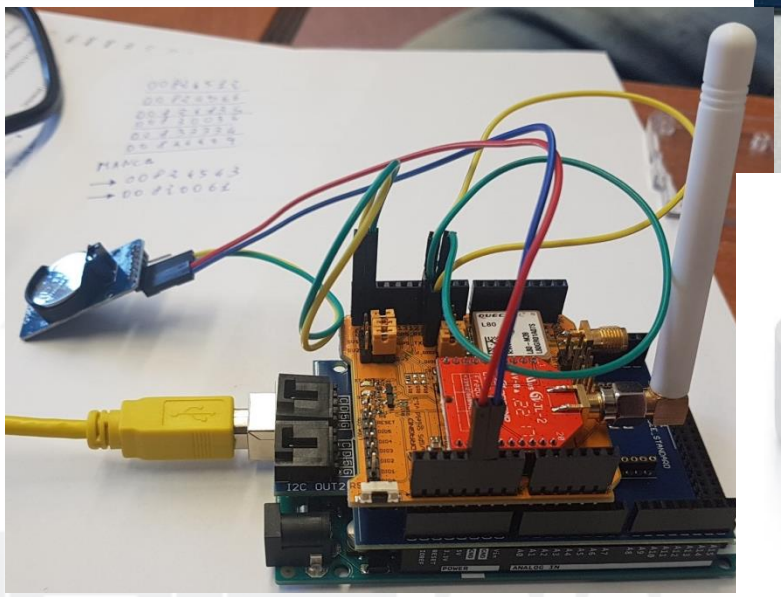
- **IOT Devices can be open or proprietary**
- **IOT Devices**: a large range of protocols, formats and kind
  - IOT Devices (single or in bulk) are **registered** on IOT Directory and thus according to Knowledge base are registered to be used in IOT Applications, Dashboards, etc. with Shadow values, etc.
  - IOT Models are saved on IOT Directory for shortening the registration process
  - IOT Device healthiness is monitored automatically
- **IOT Devices can be public or private**
  - **Full support of Proprietary protocols and devices**
  - **Providing Open Hardware and Open Software** IOT Devices/IOT Edge: NGSI fully secure
- **IOT Edge** are devices with some computing capability, realized by using: Raspberry, Android, Linux, Windows, etc.
  - **Release as**: OS images on SD, APK for Android, Virtual Machine, Docker Container, etc.
- IOT Devices are connected via **Secure Encrypted Mutual Authenticated** channel of communication

Lora IOT Device, Arduino

- Arduino Uno, Mega
- LoraWan Connection
- Any sensor, + I2C
- Fully Customizable
- Open Source
- NGSI or any other protocols
- Gateway: Dragino



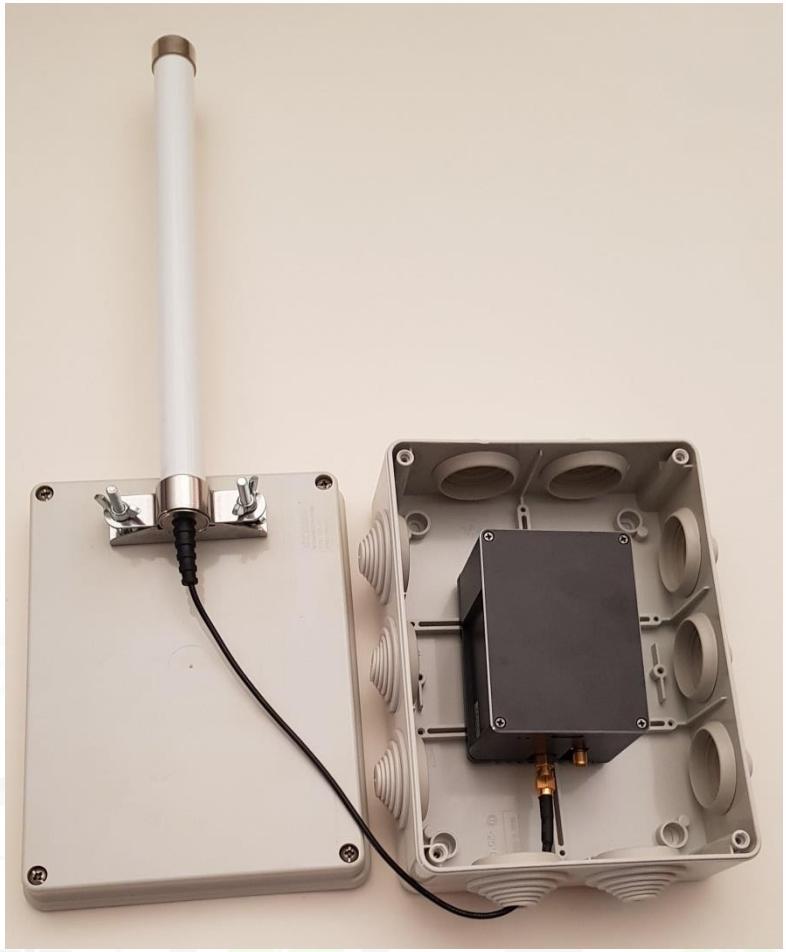




https://www.snap4city.org/drupal/node/216

LoraWan Gateway out of the Box

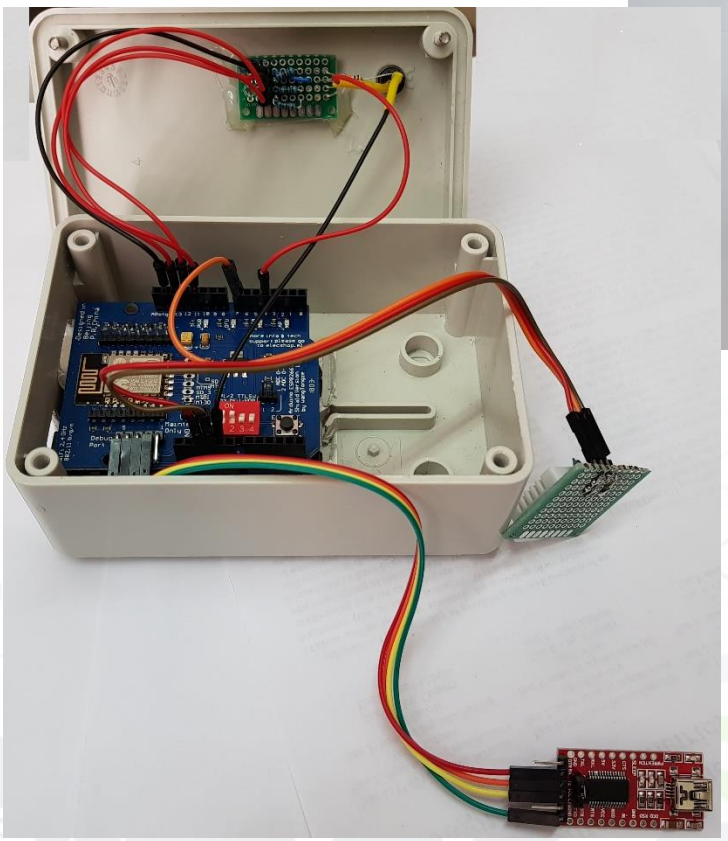
- Raspberry Pi Based LoraWan Gateway
- Physical UpLink as: Wi-Fi, RJ45
- Logical UpLink: LoraWAN TheThingsNetwork, NGSI V2 (mutual authenticated Snap4City)
- Powered 5V
- GeoLocated GPS Antenna
- IOT Edge Snap4City Included if needed

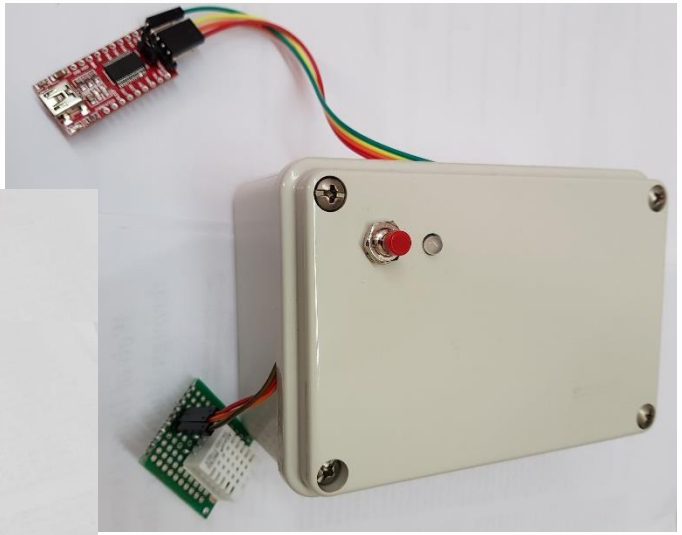


FIWARE LoRa Wi Fi

IOT Device with Arduino

- Arduino Uno
- Wi-Fi shield, standard
- Mutual Authentication with certificates, or K1,K2,sha
- Secure encrypted connection, NGSI
- Open Source
- Fully Customizable
  - Any sensor
  - NGSI or any other protocol





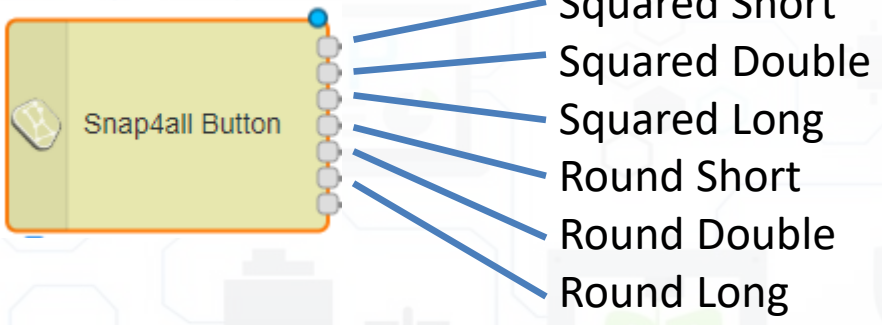
FIWARE

Wi Fi

Snap4All IOT Button

- Multi Wi-Fi
- Ready to use BLE
- ESP based, cheap & easy
  - low/no energy consumption/ standby
- Mutual Authentication with certificates, or K1,K2,sha
- secure encrypted connection, NGSI
- Open Source, Fully Customizable
- HW extensible to sensors

version: 3

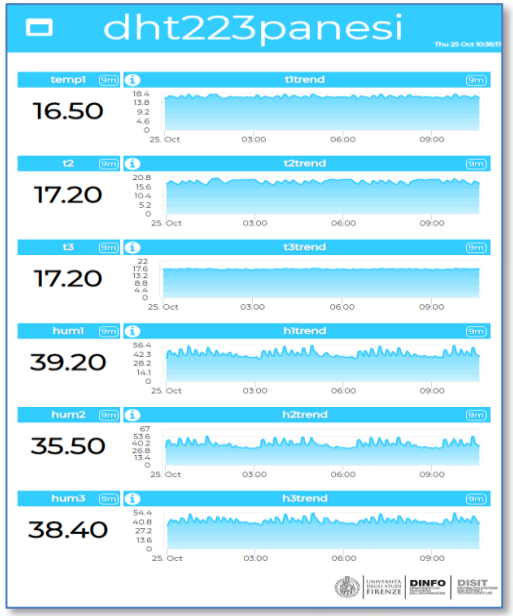


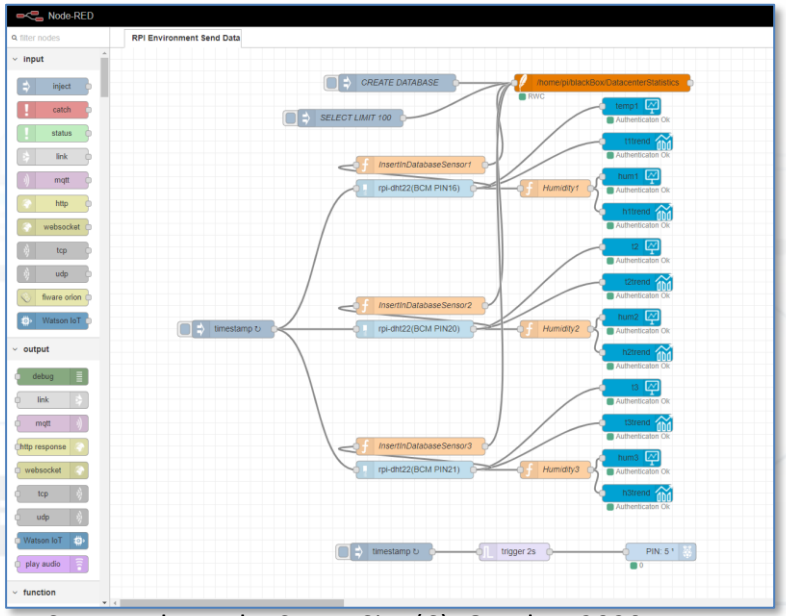
https://www.snap4city.org/drupal/node/276
https://www.snap4city.org/drupal/node/297 help config

IOT Applications and IOT Edge Devices

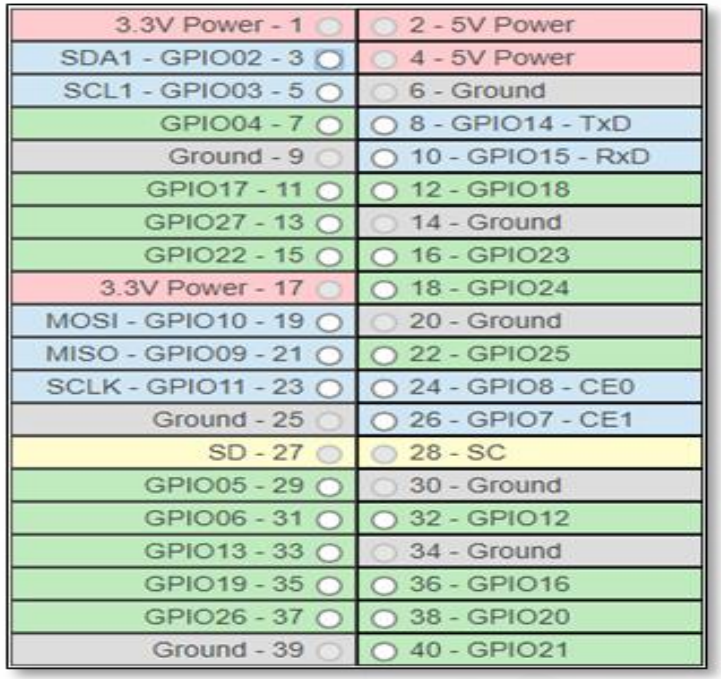
IOT Edge on Raspberry Pi

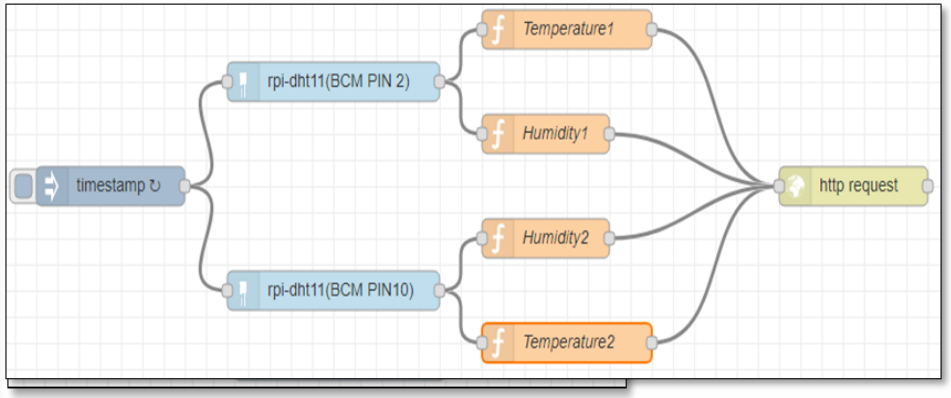
- Raspberry Pi
- Mutual Authentication with certificates
- Secure encrypted connection
- IOT Application inside
- Any sensor
- Any protocol from IOT devices
- NGSI or any other protocol
- Fully Customizable
- Local and Cloud Dashboard
- **Special MicroServices**

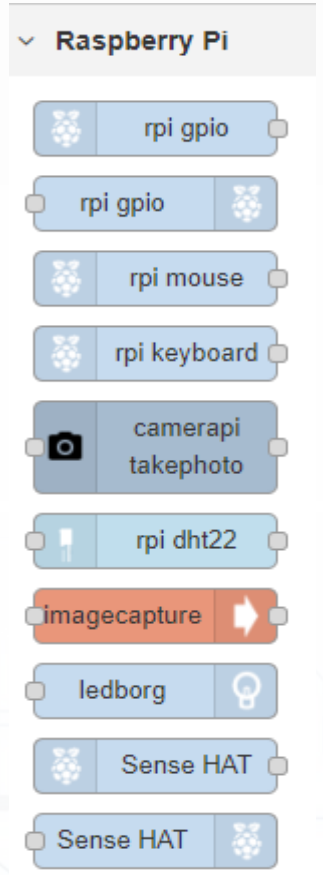


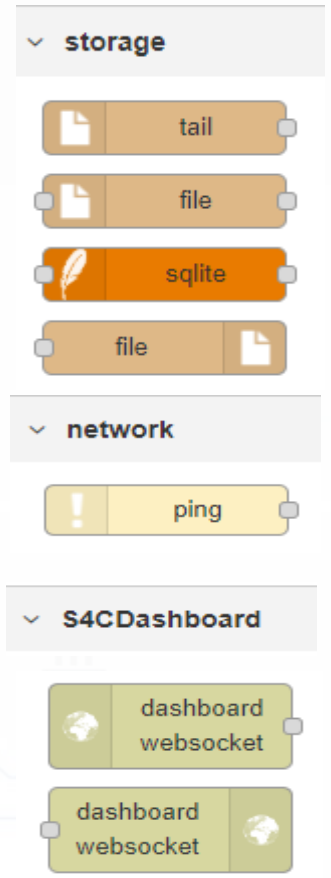


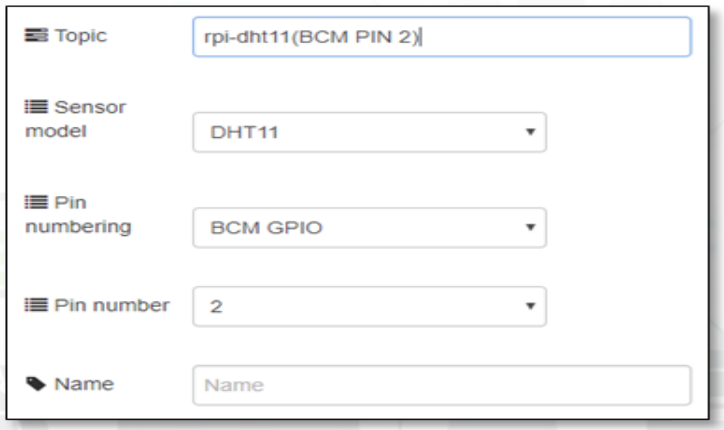
MicroServices:
- DHT
- ModBus
- any shield
- etc….

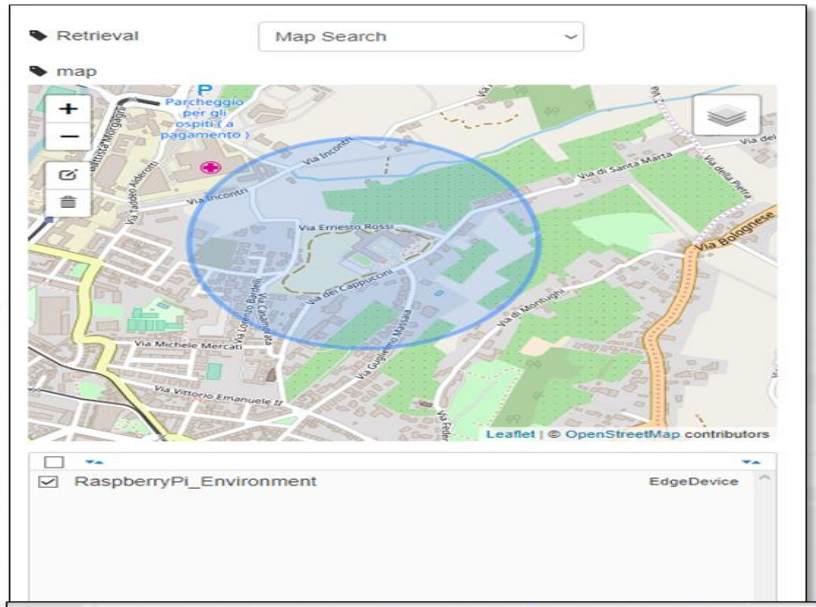













```
msg.payload={"temperature1":{"value":msg.payload , "type":"Float"}};
return msg;
```

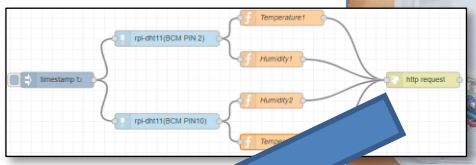
Snap4 on Raspberry Pi, IOT edge

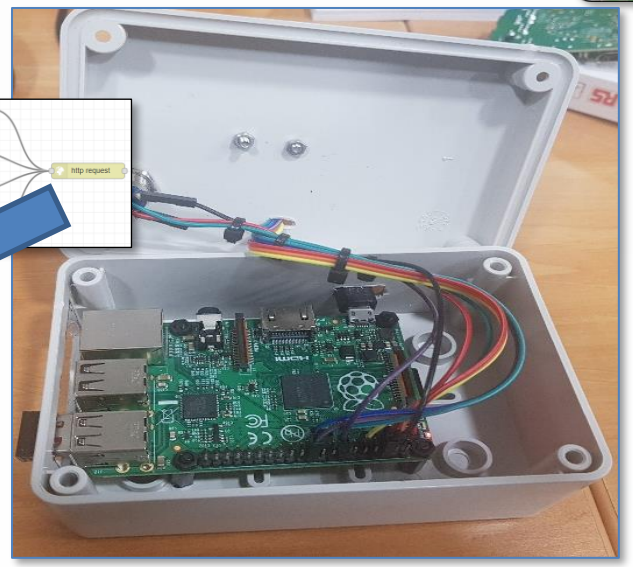
IOT Edge Computing

City user

Would like to:

- **Monitor and exploit temperature and humidity**
- **Manage sensors**
- **Perform edge computing**
- **Using these data for multiple applications**



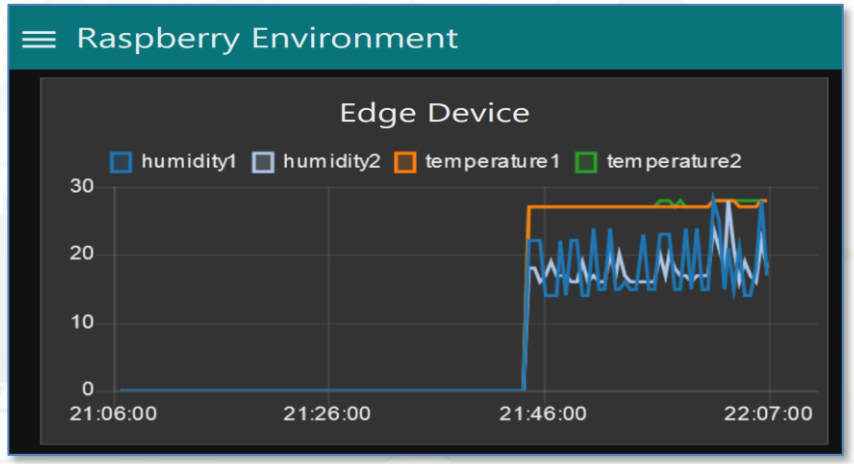


IOT Broker

Click here

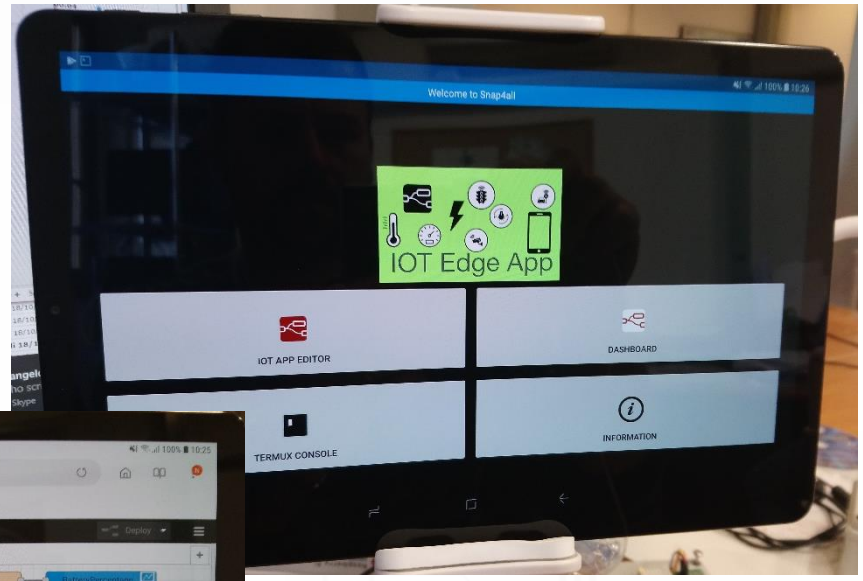
Steps:

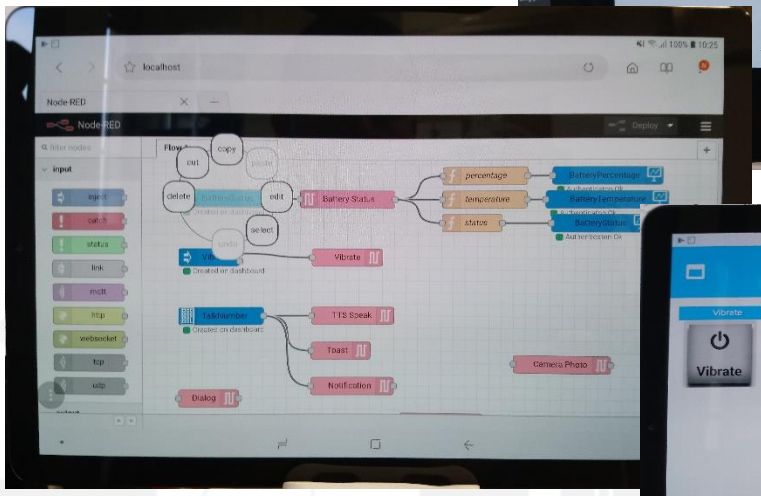
1. **Registering the device and sensors**
2. **Create flow on edge device using NodeRed with Snap4City, sending data to Broker**
3. **Use data from Broker on Snap4City IOT App**

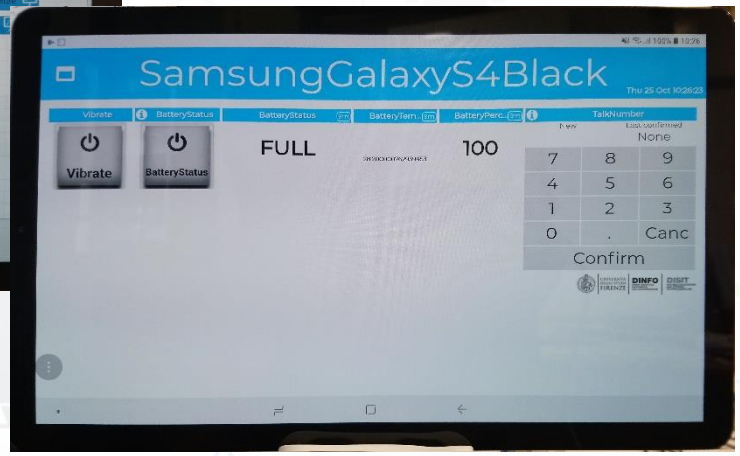


IOT Edge Snap4All App for Android

- **Android**, any version, App from: https://www.snap4city.org/download/video/Snap4All.apk
- **Mutual Authentication** with certificates
- *Secure encrypted connection*, NGSI
- **IOT Application inside**
- **Any sensor** + Local device sensors
- **Any protocol** from IOT devices
- **NGSI** or any other protocol
- **Fully Customizable**
- Local and Cloud Dashboard
- **Special MicroServices**

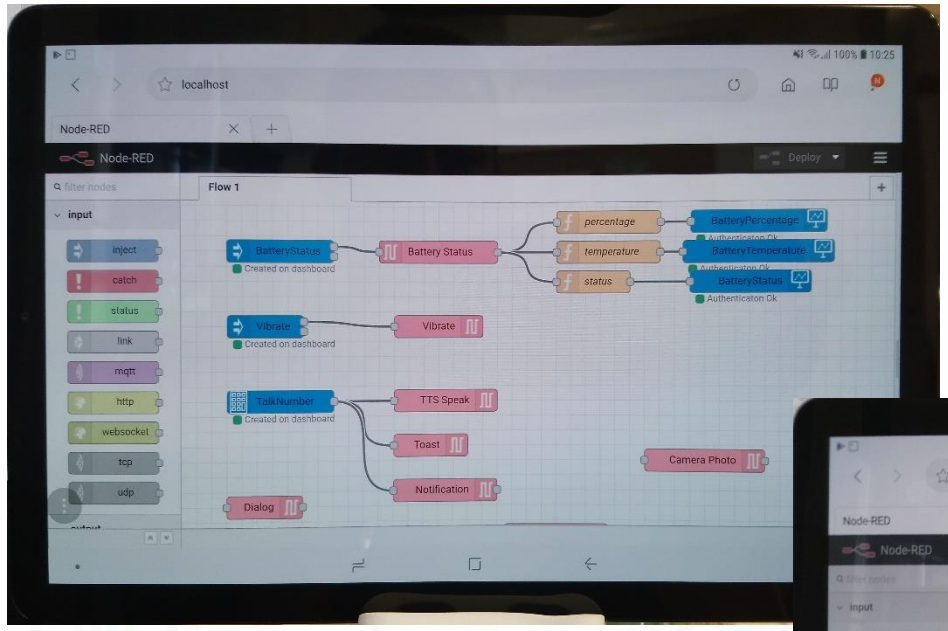


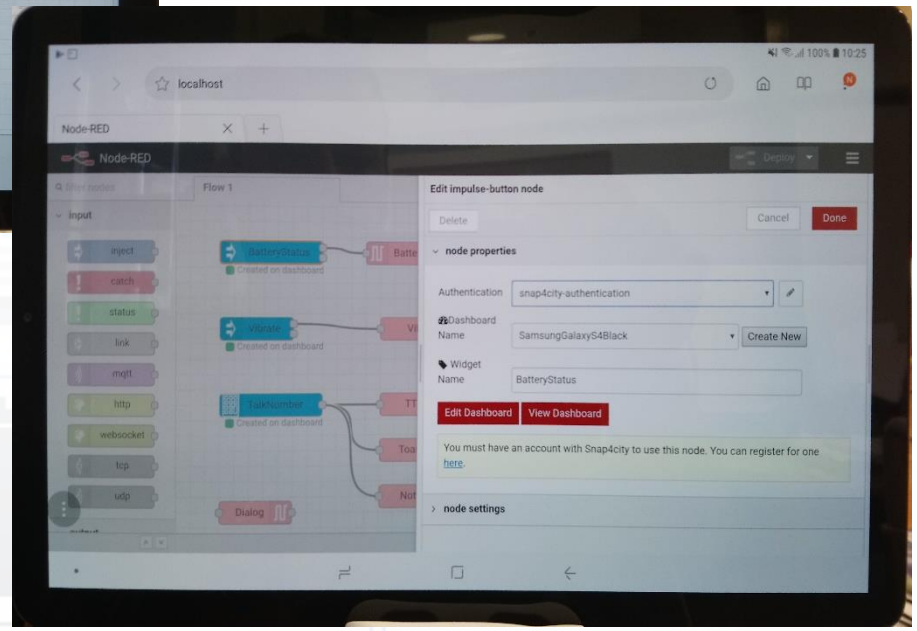




IOT Edge Snap4All App for Android

- termux-battery-status
- termux-camera-info
- termux-clipboard-get
- termux-contact-list
- termux-telephony-cellinfo
- termux-telephony-deviceinfo
- termux-tts-engines
- termux-camera-photo
- termux-clipboard-set
- termux-dialog
- termux-download
- termux-location
- termux-tts-speak
- termux-vibrate
- termux-sms-inbox
- termux-toast
- termux-sms-send
- termux-share
- termux-notification
- termux-wifi-connectioninfo
- termux-wifi-scaninfo

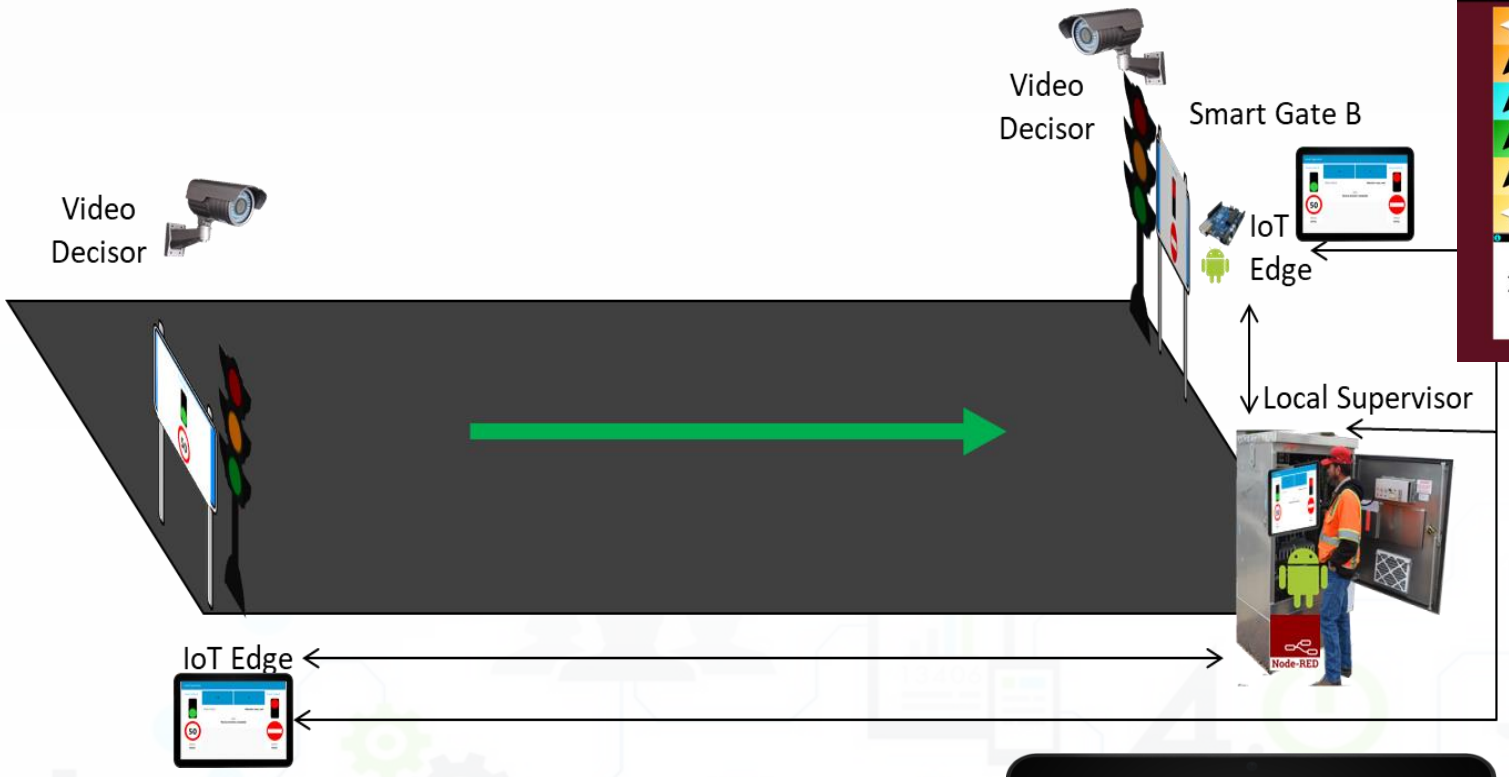


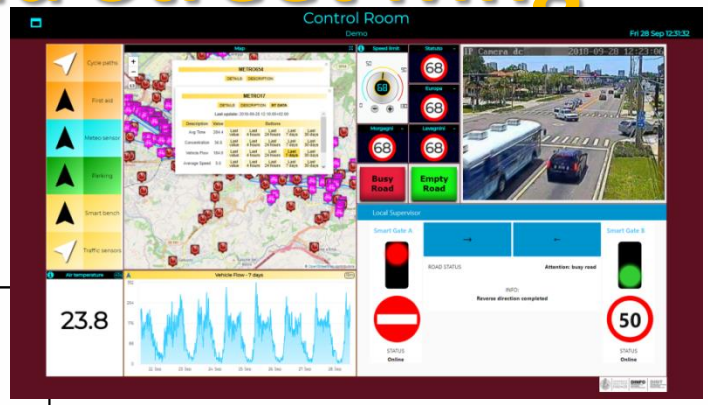


MicroServices:

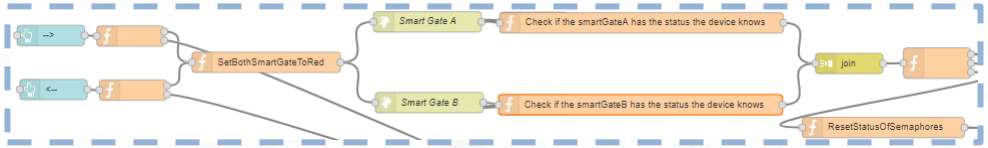
- Snap4City
- Termux Snap4City specific
- etc.

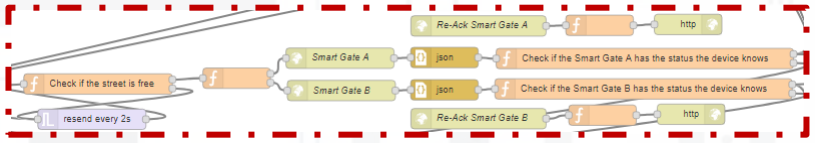
Sii-Mobility: Dynamic Signage and Street Mng

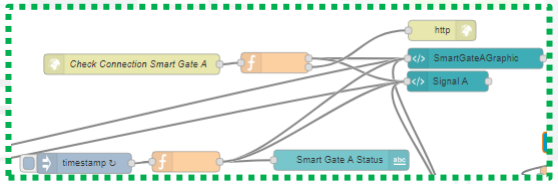




Control Room







Local Control Dashboard

Safe and resilient solution manging Degradated conditions

IOT Devices and IOT Edge

- **A large range of Devices** can be used on Snap4City:
  - Proprietary or Open HW/SW.
  - Devices of/for makers on which we provide Open source code
- **Documentation and instructions:**
  - TC9.4 - IOT application exploiting Edge computing with Raspberry
  - TC9.7 - Connection from LoraWan Dragino/arduino to Orion broker
  - Snap4City: Arduino & ESP8266 IOT Device NGSI
  - Snap4City IOT Devices Registration
  - Snap4All IOT Button: based on ESP32, NGSI compliant secure connection
  - IDE Setup for Snap4All IOT Button, and source code
  - Registering IOT Edge: example of Raspberry Pi, total security
  - Creating: IOT Device, Raspberry Pi based, totally compliant with Snap4City

Moving IOT Devices / Sensors, Tracking Devices

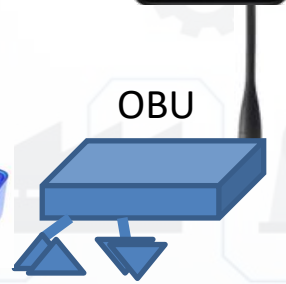
MyKPI: Tracking of Devices and Mobiles

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

Mobile
PAX Counter

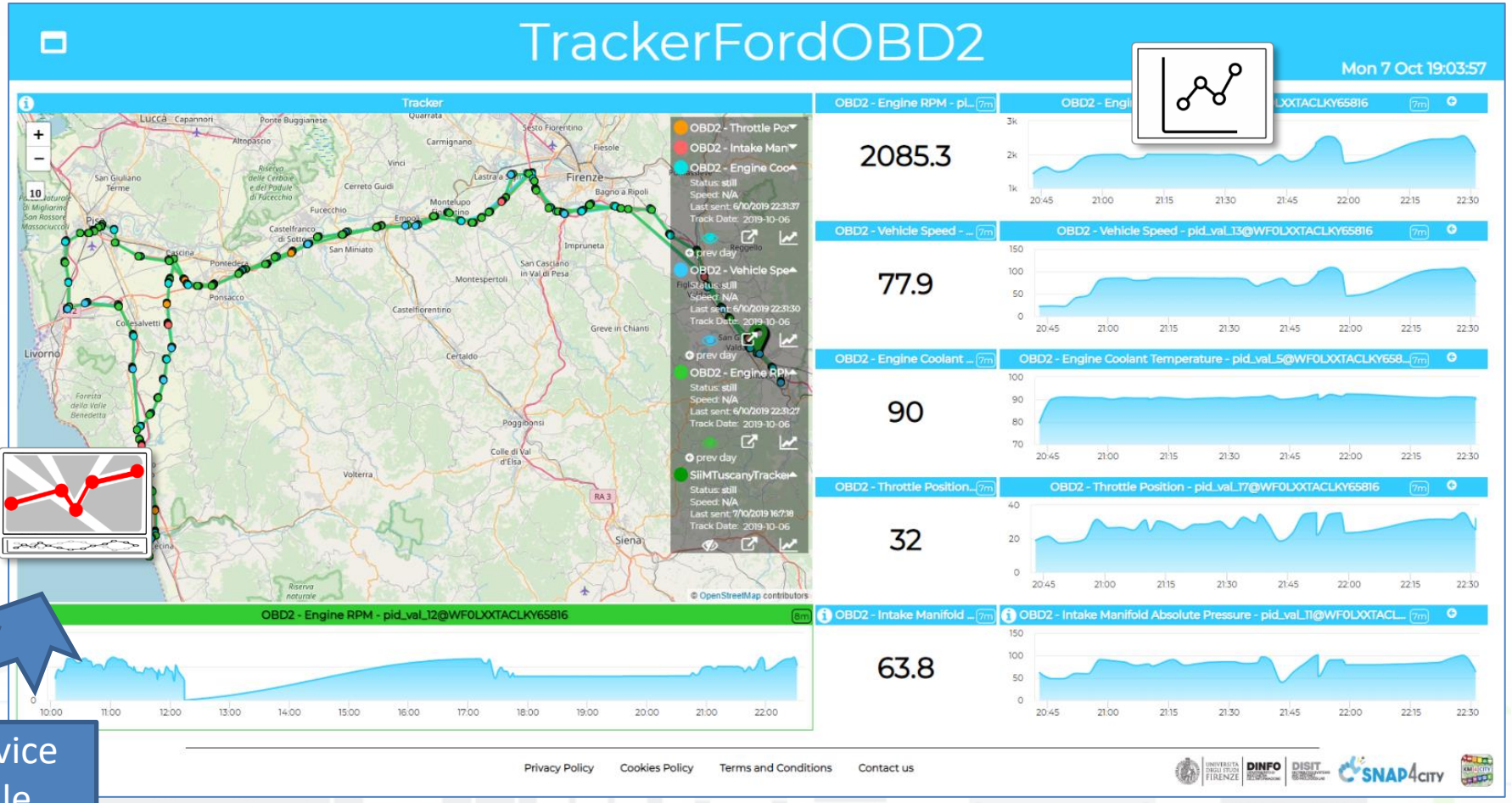
Apps

OBD2



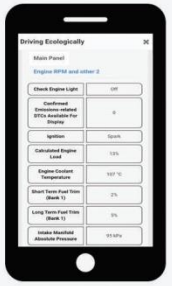
OBU

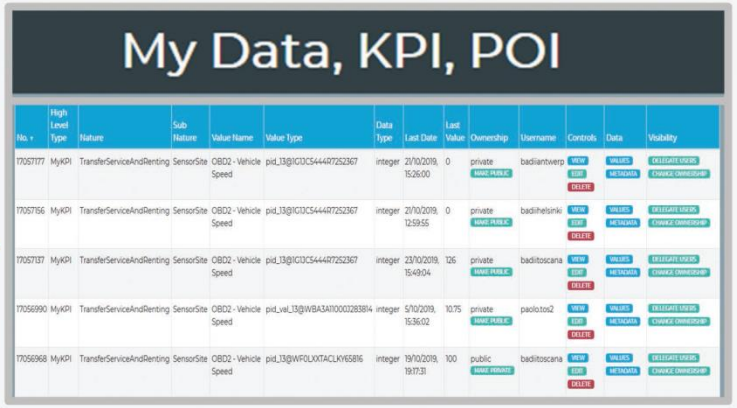
IOT Device
MObile

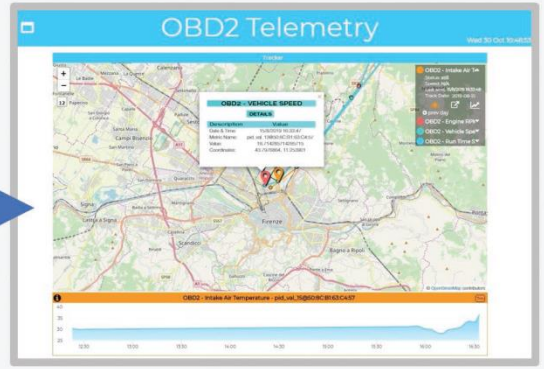


IOE – Vehicle Monitoring

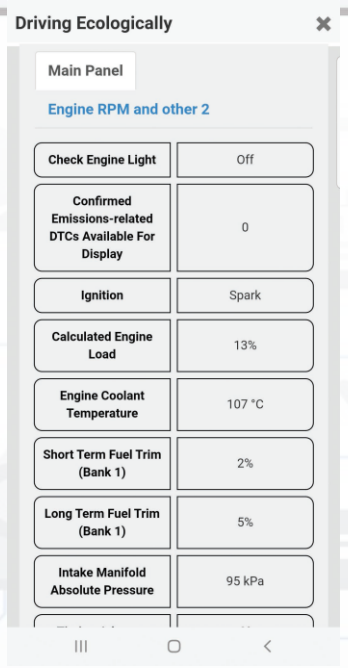
CANBUS sniffer

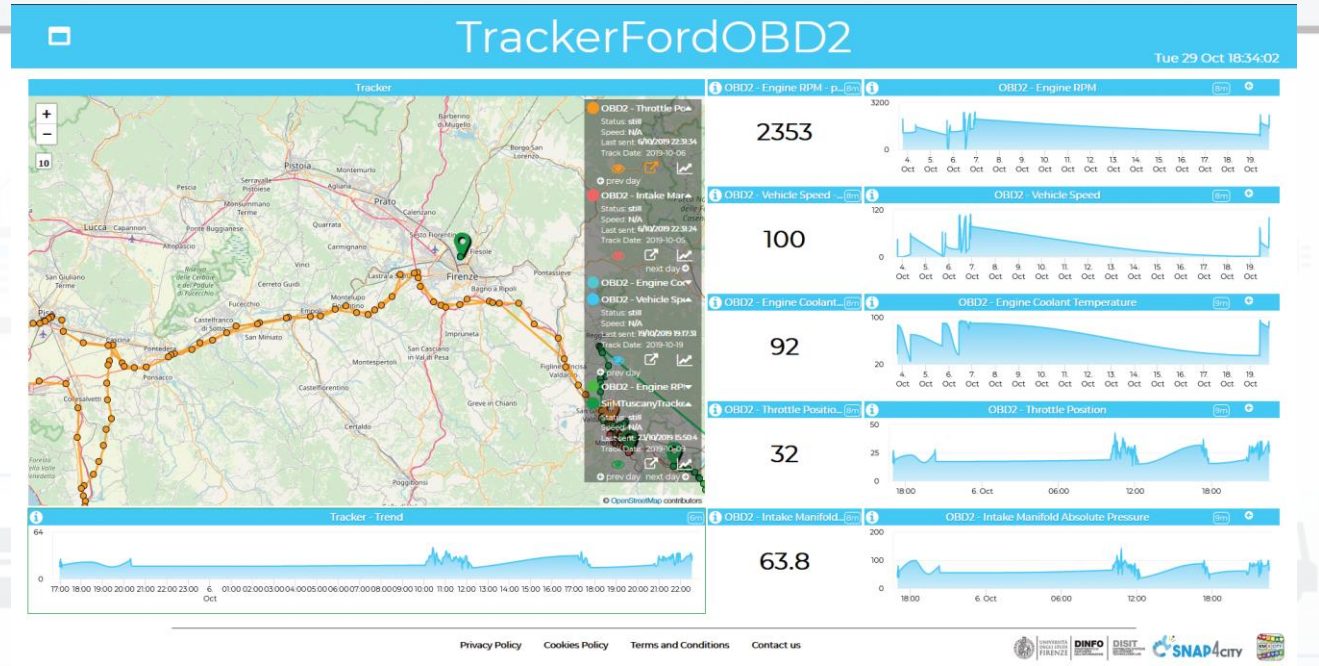






Tuscany in a Snap Mobile App on Android





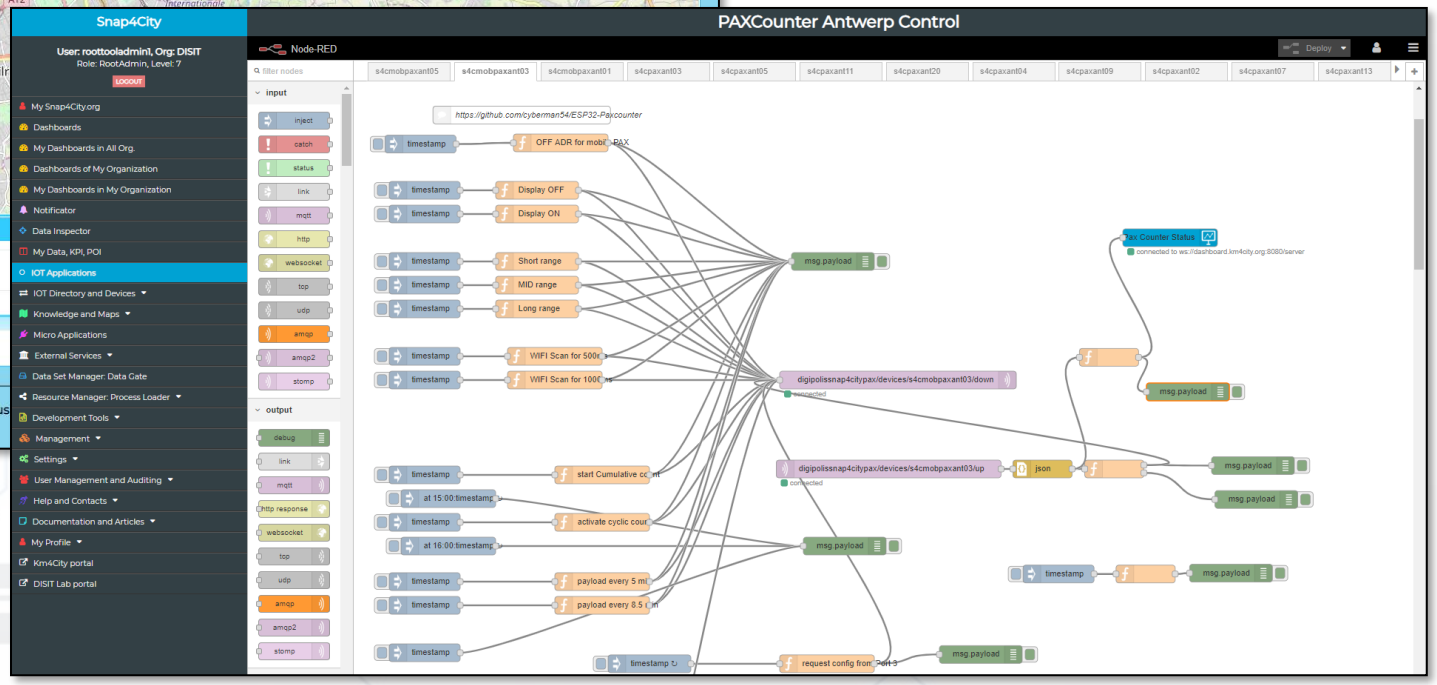
PaxCounter devices

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

LoRa® Wi Fi Bluetooth™

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

Programmable PAX counting

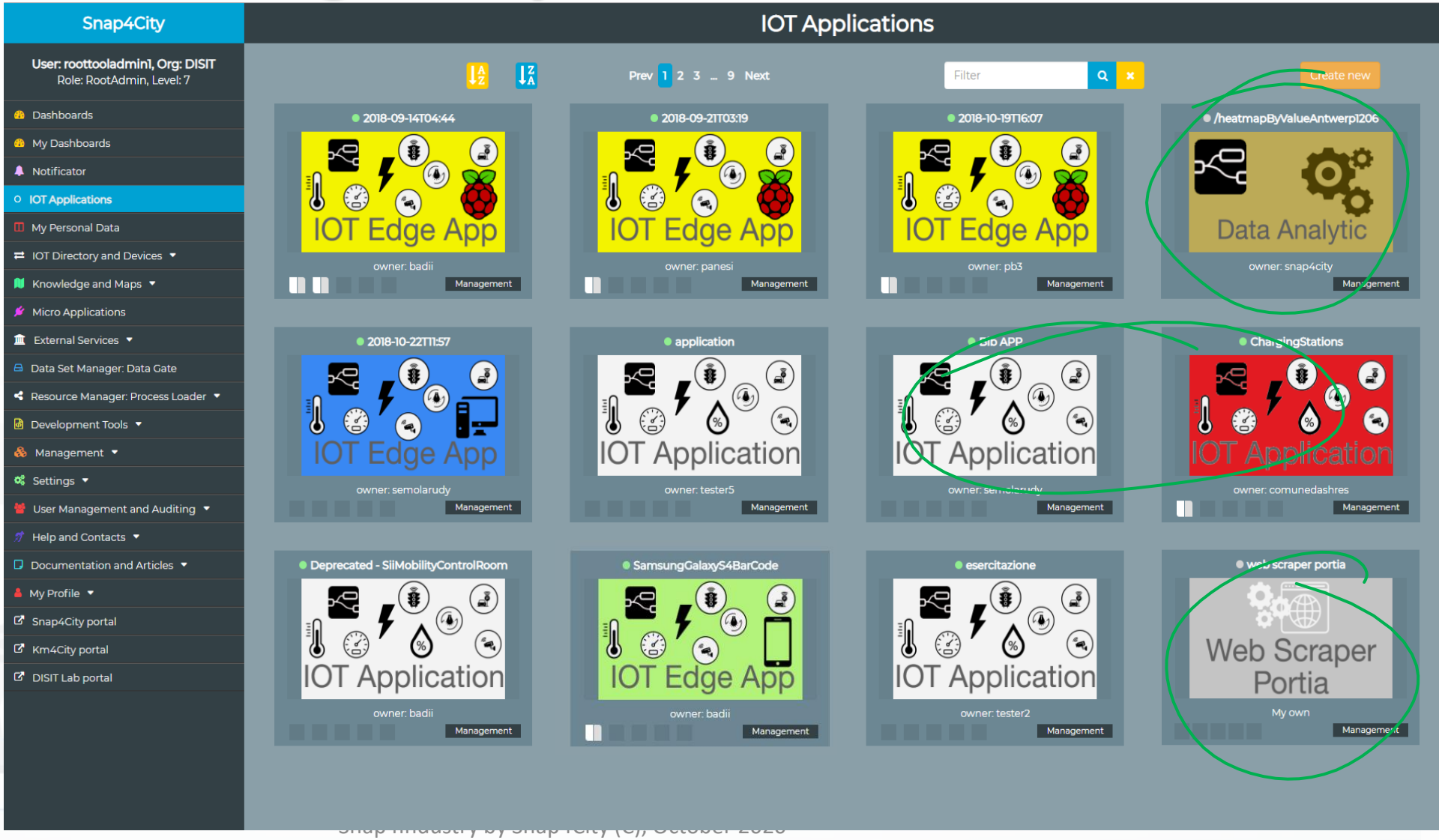


Antwerp

Managing IOT Applications

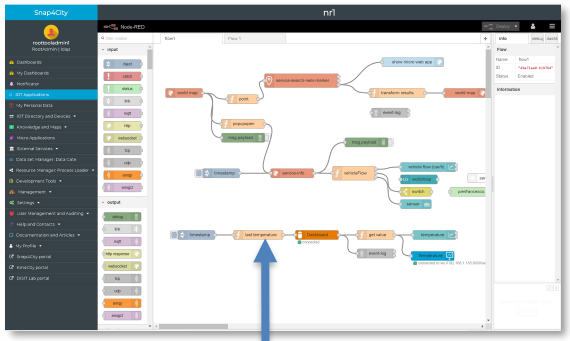
IOT Application Listing, they can be

- Basic (white)
- Advanced (red)
- IOT Edge
  - Raspberry Pi
  - Android
  - Win/Linux
- Data Analytic (Plumber)
- Web Scraper (Portia)

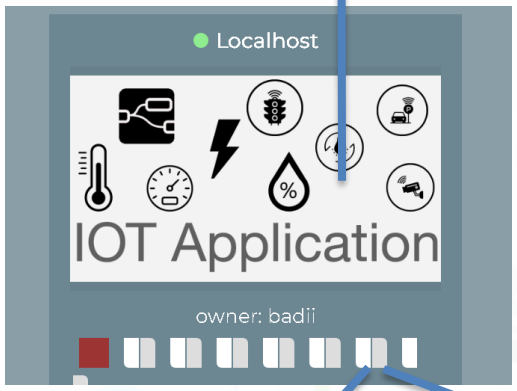


IOT Applications Listing

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

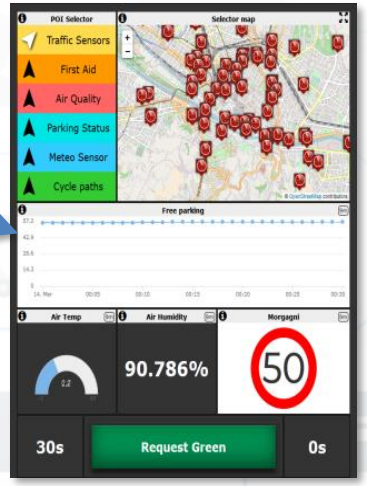


EDIT IOT APP



VIEW

EDIT



IOT App title

Click the icon to edit the IOT App

Ownership of the IOT App

Click to open the Node-RED IOT App dashboard

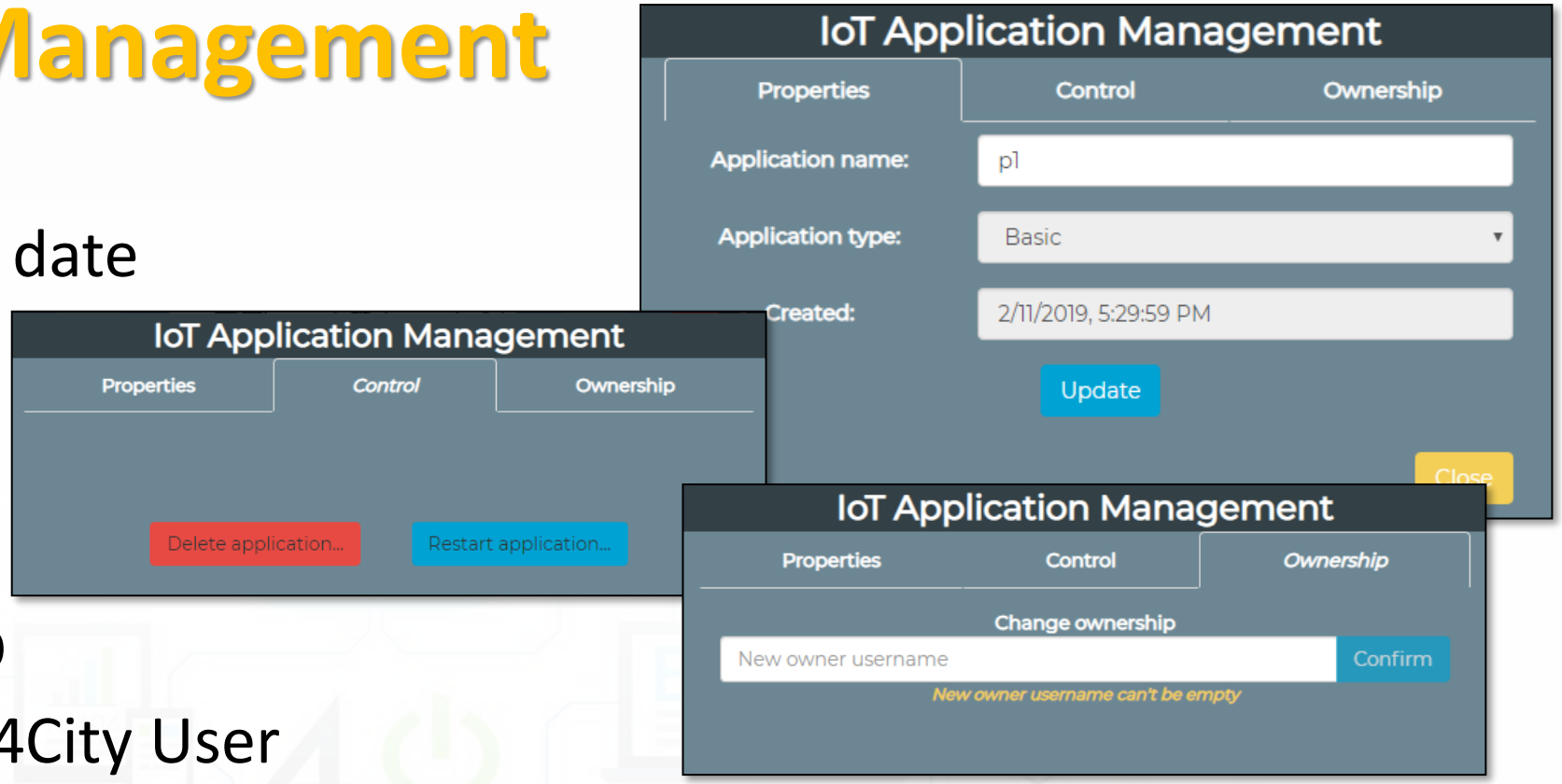
Click to edit IOT App properties

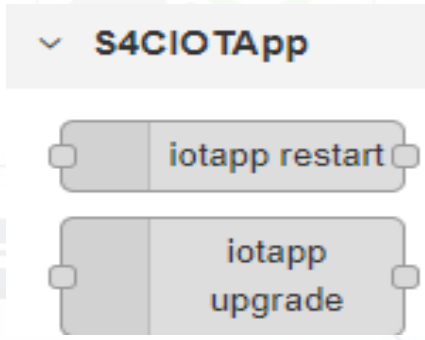
Click to edit the Snap4City Dashboard

Click to view the Snap4City Dashboard

IOT Application Management

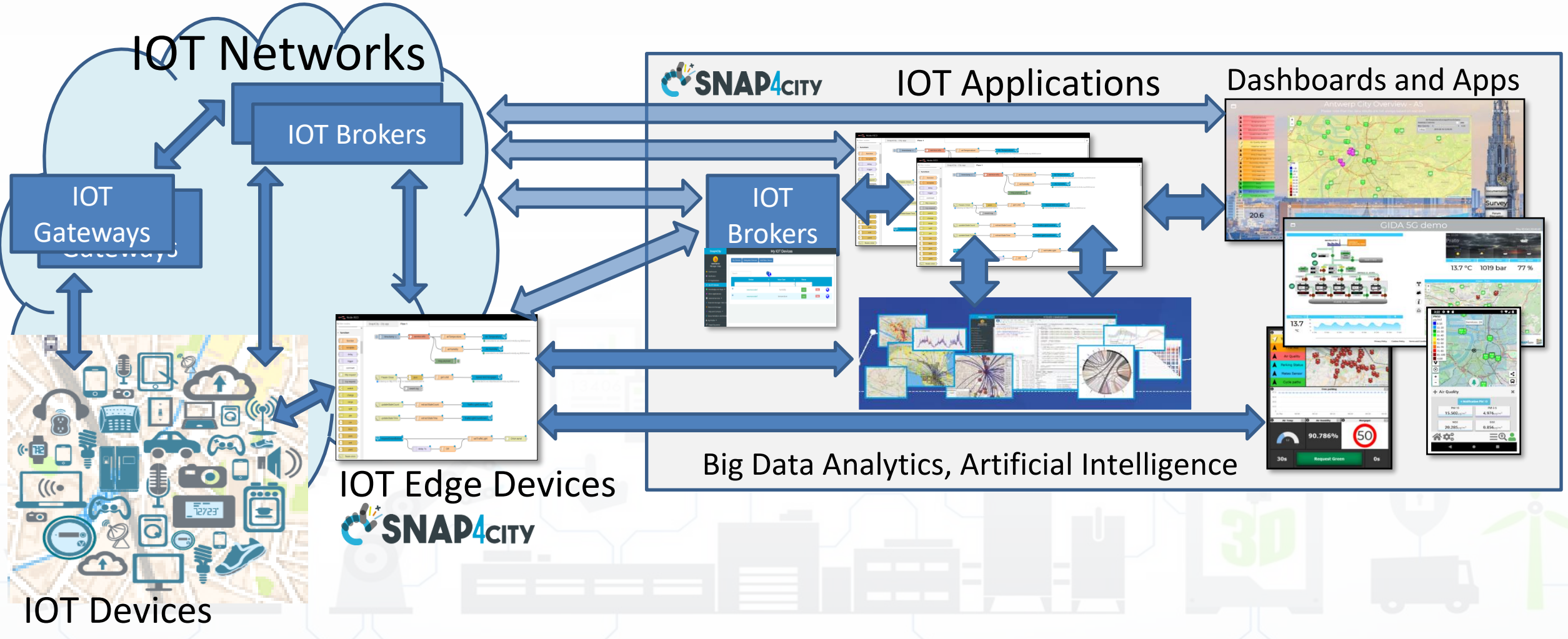
- **Properties**
  - Name, Type, Creation date
- **Control**
  - Restart
  - Delete
- **Change of ownership**
  - Toward another Snap4City User
- **From inside the flow**
  - Restart
  - Update





Remote Control of IOT Applications on IOT Edge Devices

Snap4City Services also on IOT Edge!!!



Why it is useful

- **Need to transform** data from your local devices to Snap4City devices or data storage or dashboards,

- **Need to play the role of multiprotocol HUB** as in:
  - **Snap4Home**: Scenario: Snap4Home, how to exploit Snap4City solution on home automation
  - **Snap4Industry**:
    - **Scenario: High Level Control of Industrial Plant**
    - **Snap4Industry: Snap4City for Industry 4.0**
    - **Scenario: 5G Enabled Water Cleaning Control**

IOT Edge Device for Snap4City

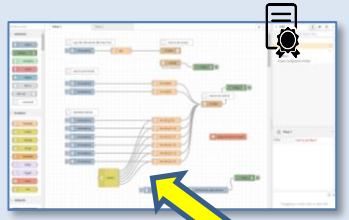
- **Computer based solutions with *Node-RED + Snap4City Library***
- **Node-red supports:**
  - Raspberry pi, Linux based, Windows based, android with Termux, and also on a several servers. https://nodered.org/docs/getting-started/
- **Snap4City Library:**
  - From Node-RED: "manage palette" in the main menu'.
  - From Node-RED library: https://flows.nodered.org/search?term=snap4city
- ***You can add any kind of protocol and interface to IOT Edge Device***

Remote Control/Management of IOT Edge

SNAP4CITY

edge-tunnel-to-cloud

IOT Edge Device

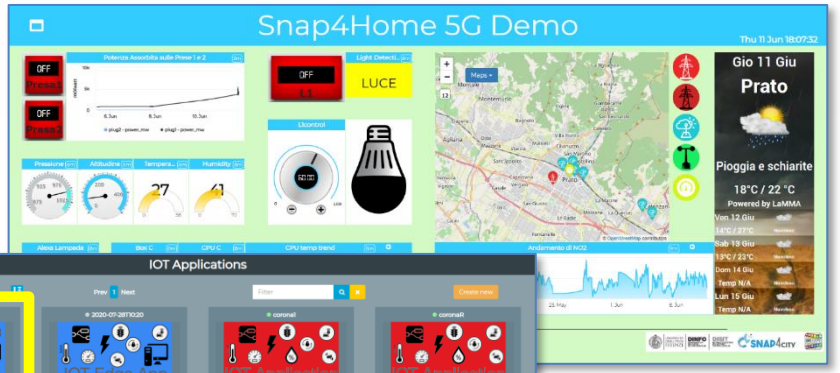


FireWall Gateway

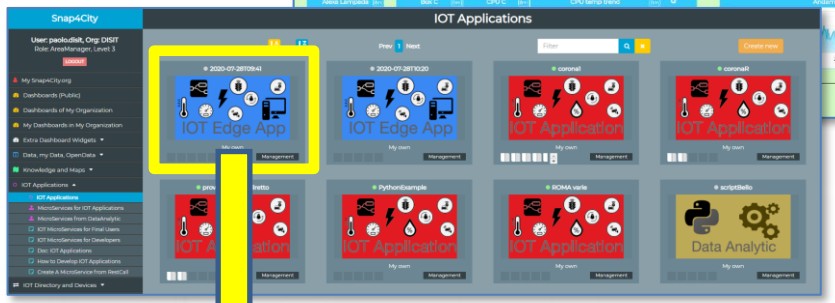
SNAP4CITY On Cloud

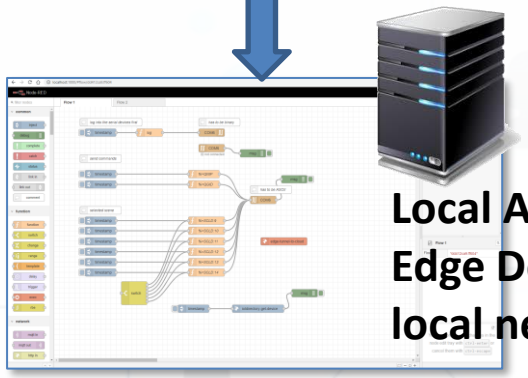
Internet

Intranet



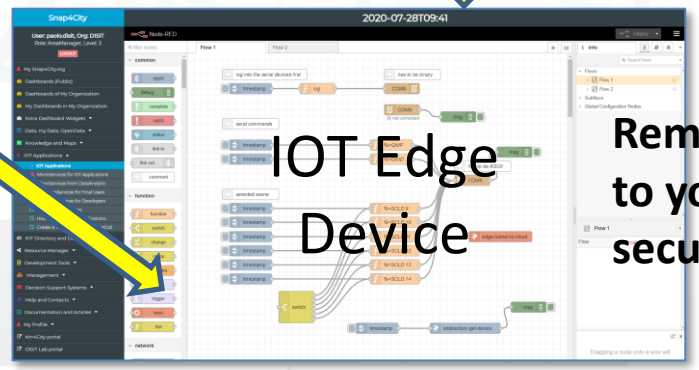
Click on it





Local Access on IOT Edge Device on your local network

On premise, on your local plant/home



IOT Edge Device

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

Advantages of IOT Edge remote control/program

- You do not need to be/move in the local network to access at Your IOT Edge Devices for programming or maintenance, SINCE With Snap4City:
  - ***You can update the logic flow of your IOT Edge Devices from remote,***
  - ***You can perform remote maintenance of your IOT Edge Devices and programms without moving from your office***

AND

- You can access to the IOT edge from remote by using a secure connection
- You can activate the remote control feature singularly for each IOT Edge Device
- You do not need to reconfigure your Firewall or Gateway in most of the cases

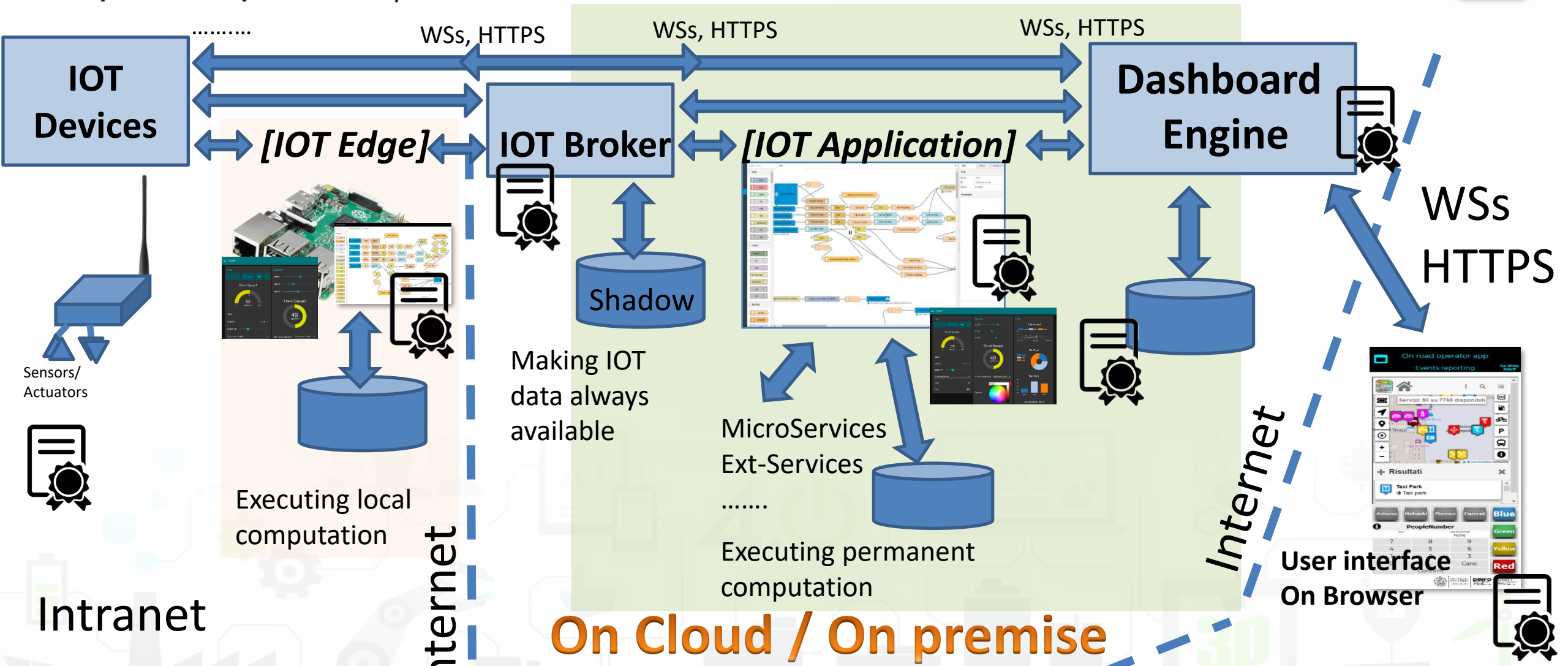
HOW To install IOT Edge Remote Control feature

- **The installation is very simple**

1. install Snap4City basic library
2. Drag and drop block from S4CUtility

3. Configure the block with your credentials
4. Deploy of the IOT App
5. Go in the list of Your IOT Applications on Snap4City.org or other cloud or on premise installations
6. Identify the IOT Edge IOT App and click on it to open the view on the IOT Applications flows

Secure IOT Devices, IOT Edge Sensor and Dev Networking


.....
WSs, HTTPS
WSs, HTTPS
WSs, HTTPS
IOT Devices
[IOT Edge]
IOT Broker
[IOT Application]
Dashboard Engine
WSs
HTTPS
Sensors/
Actuators
Shadow
Making IOT data always available
MicroServices
Ext-Services
.....
Executing local computation
Executing permanent computation
Internet
Internet
User interface
On Browser
Intranet
On Cloud / On premise
End 2 end security

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

SNAP4CITY

IOT/IOE on the field

On Cloud

(1) Registration

(0) Sensors & Actuators

Raspberry pi

Sensors/ Actuators

IOT Directory

(2) Discovery

Sensors/ Actuators

Sensors/ Actuators

Internet

-- PC: Win, Linux

Sensors/ Actuators

IOT Edge
With IOT App distributed

(1) Registration

Sensors/ Actuators

IOT Button

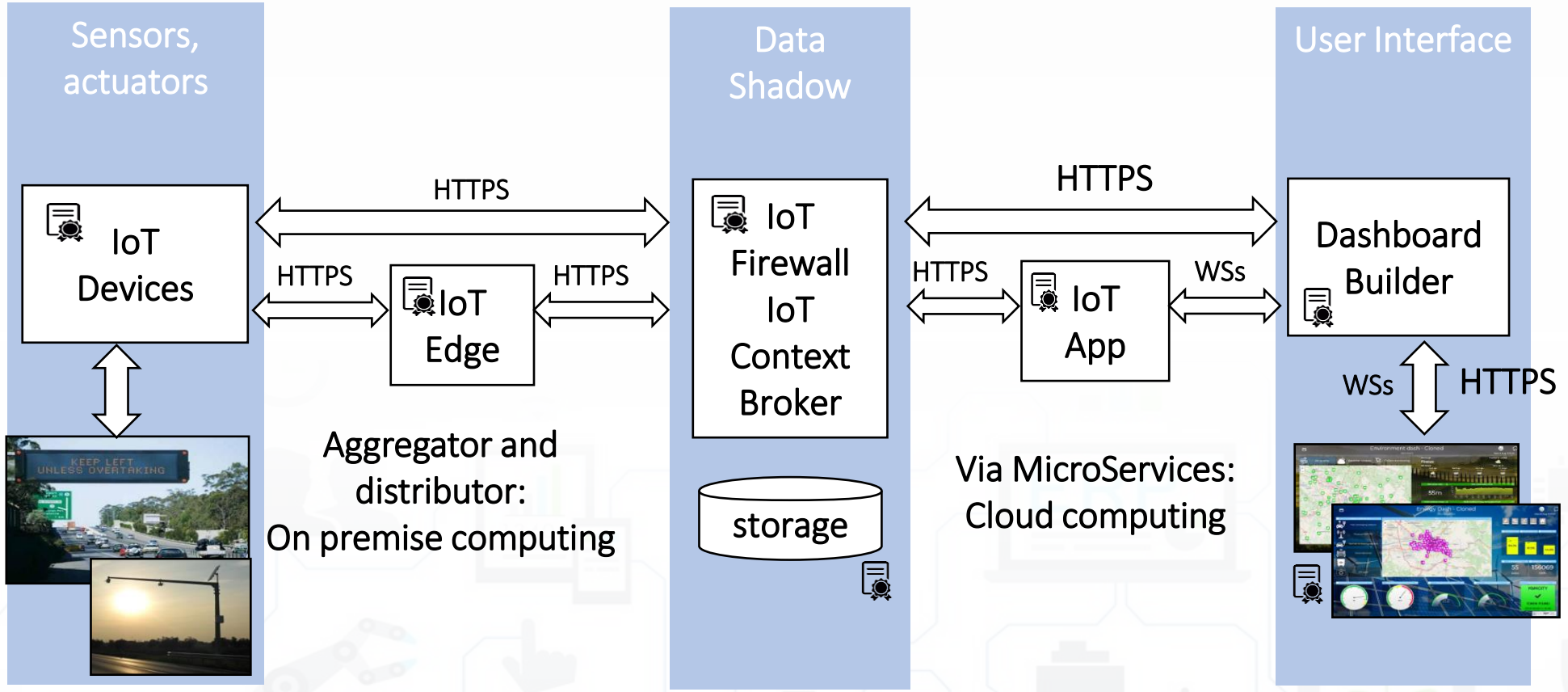
IOT Brokers

Mobiles

Sensors/Actuators

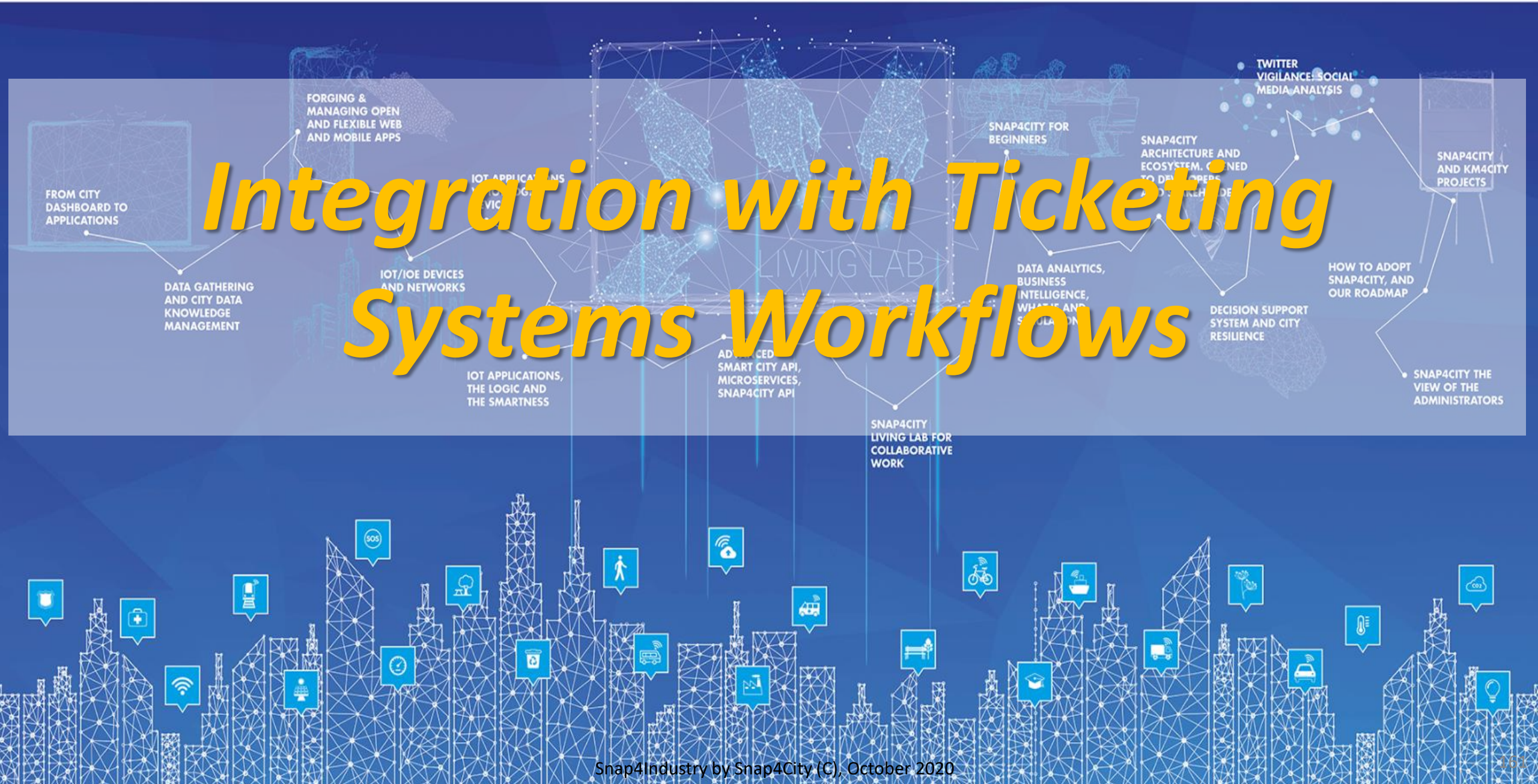
IOE Devices

The secure stack



Capabilities

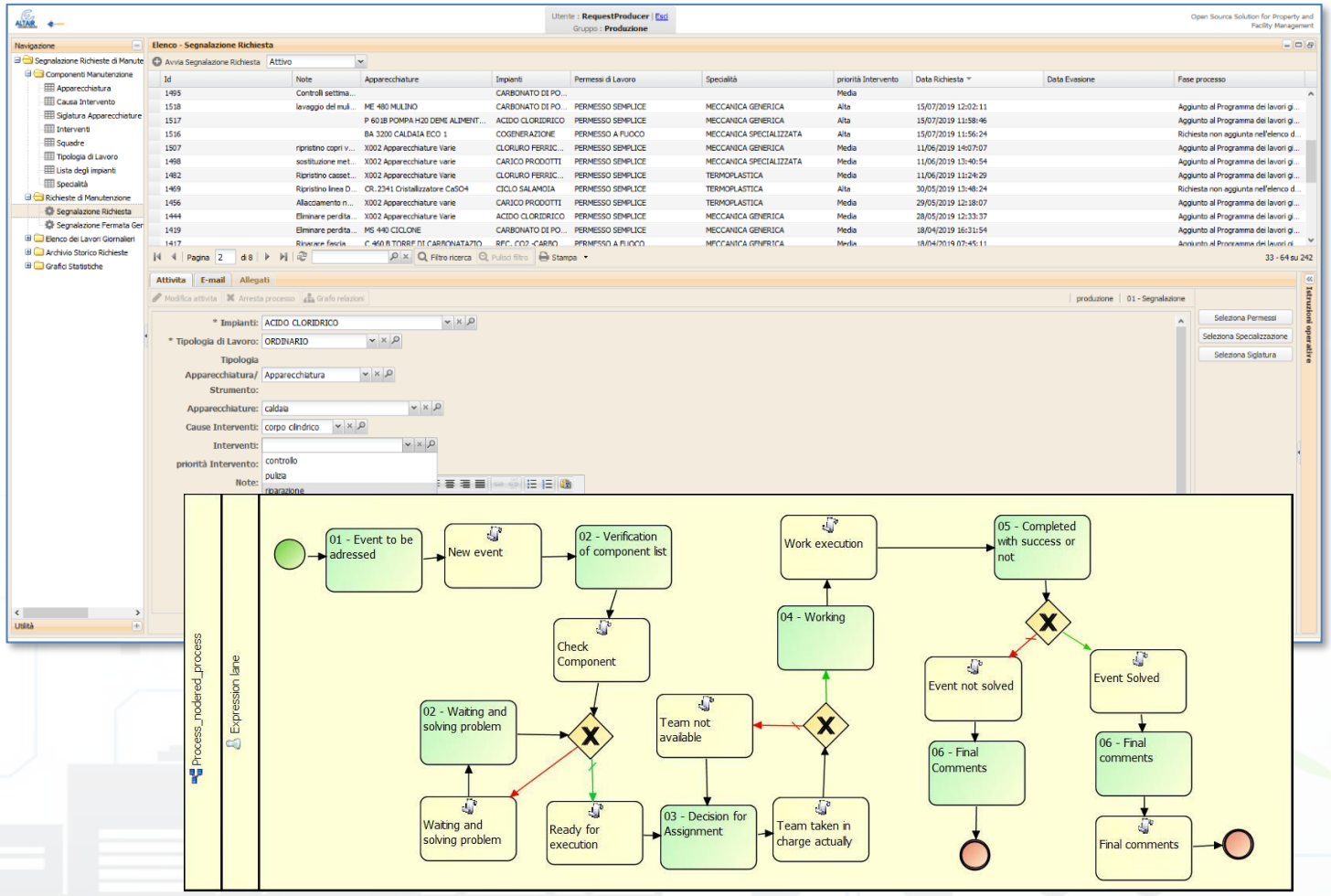
- **Creating IOT Applications for:**
  - **Controlling industrial/local processes** locally and globally
  - **Exploiting IOT Edge for local IOT Applications**
    - Local smartness, limited computational capabilities, limited dashboarding
    - Resilience wrt lack of power and connectivity: autonomous
  - **Sending data on Cloud** via secure connection and for:
    - business intelligence, data analytics, machine learning
    - Global scale and local scale analytics
    - Dashboarding at global scale
    - remote control and actions on industrial processes
    - Logging of the activities



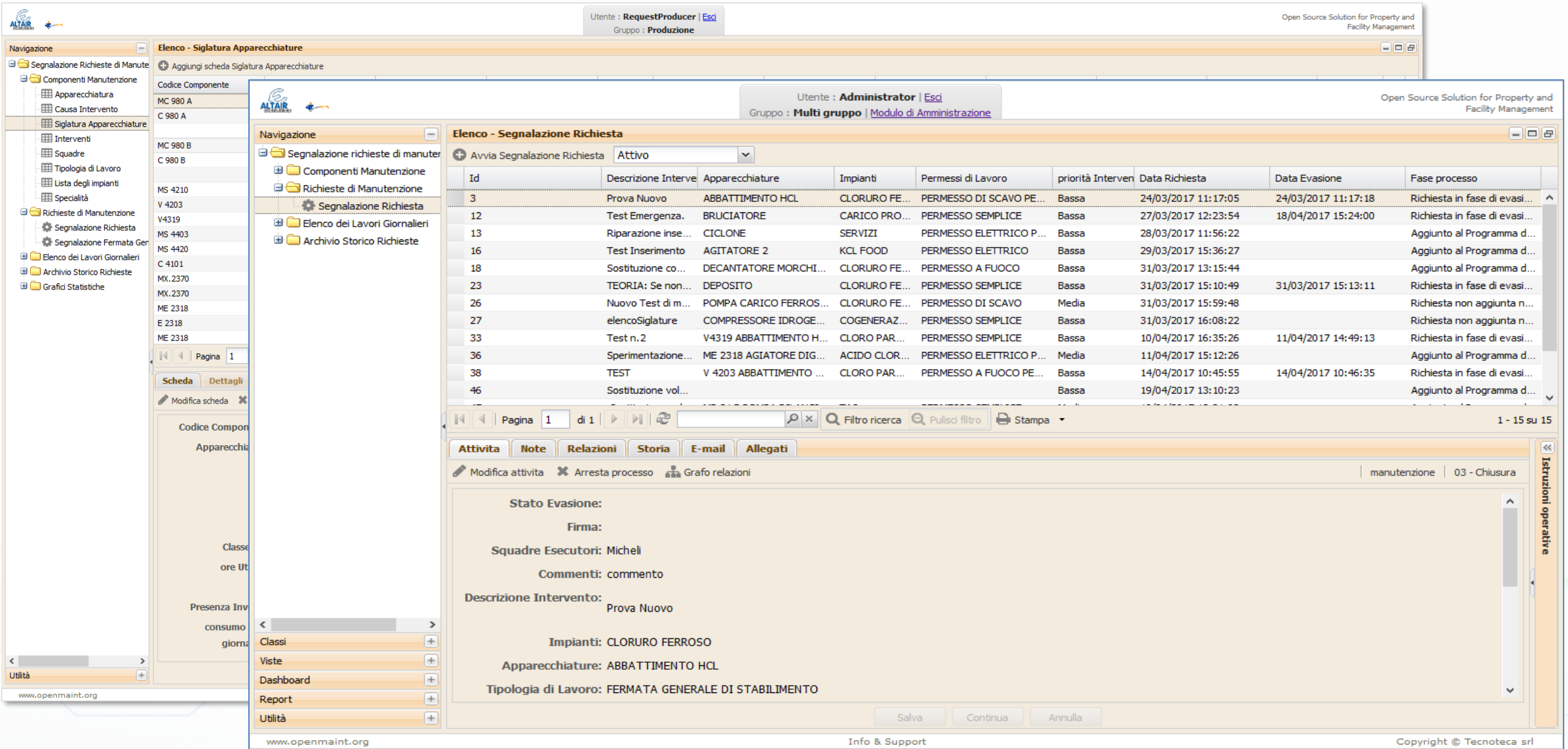
Integration with Ticketing Systems Workflows

Integration with Ticketing Systems Workflow

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



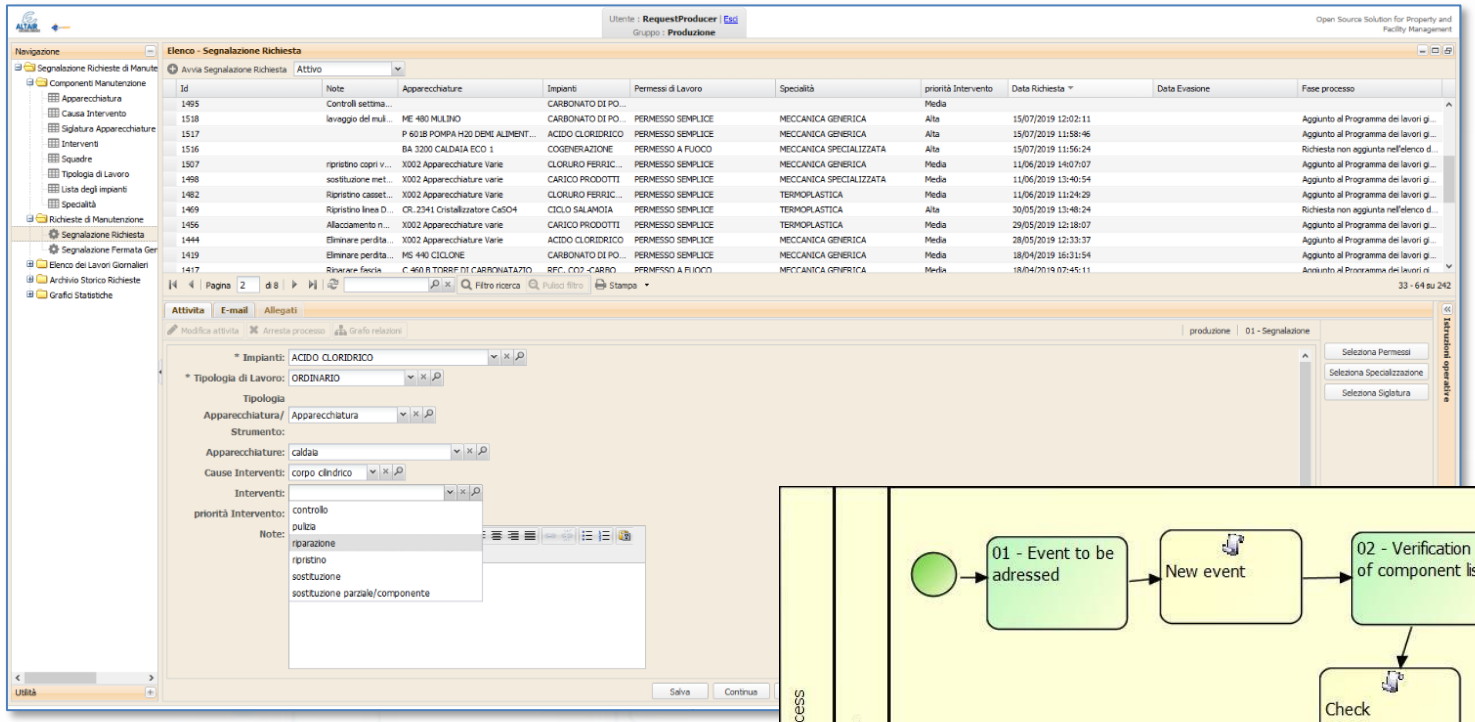
Assets inventory and management



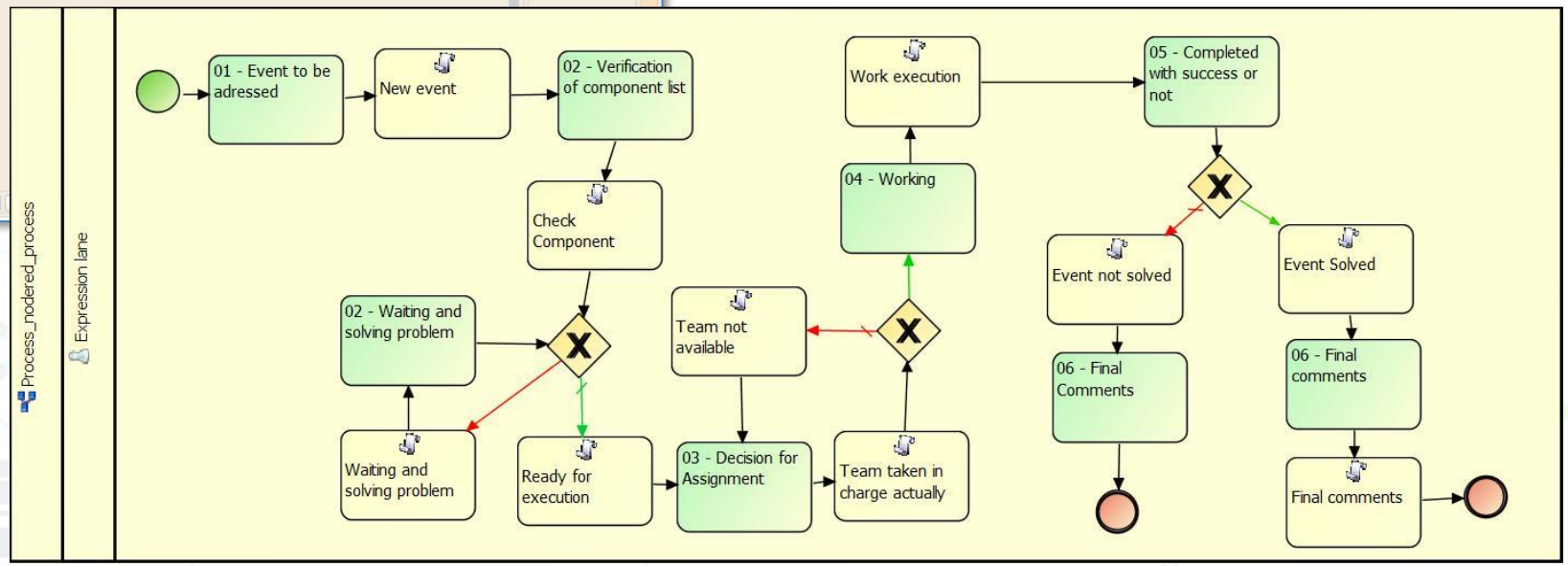
Solution for Asset Management and Maintenance

- Inventory of industry assets (movable, logistics, equipments, etc.)
- Tickets management for corrective maintenance
- Reports and Dashboards
- Predictive maintenance and Early Warning support via analytics
- Business Intelligence support
- User management with different levels of access

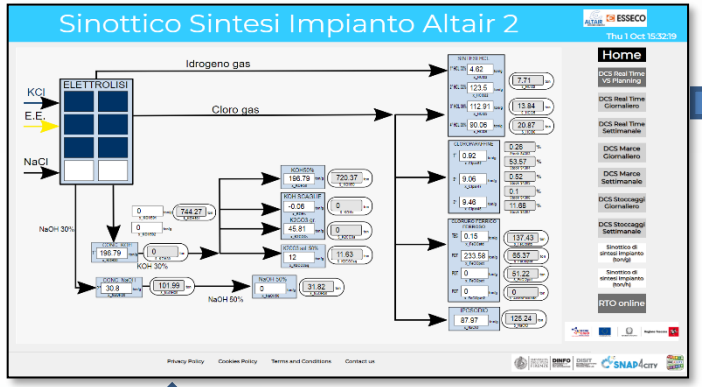
OpenMain Ticketing System



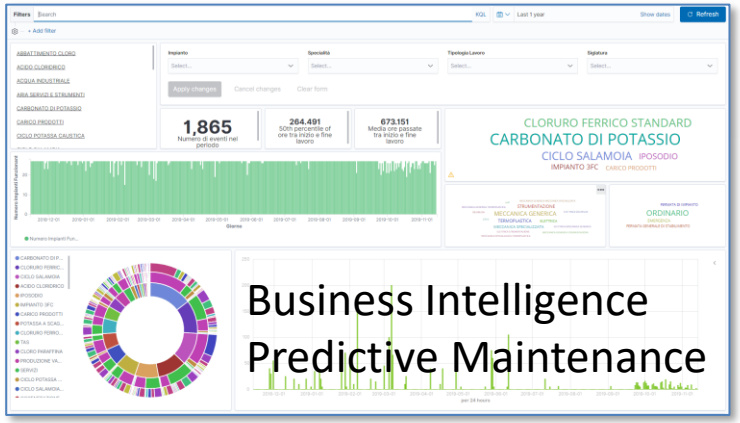
- Activate events
- Manage steps
- Collecting feedbacks and results from teams



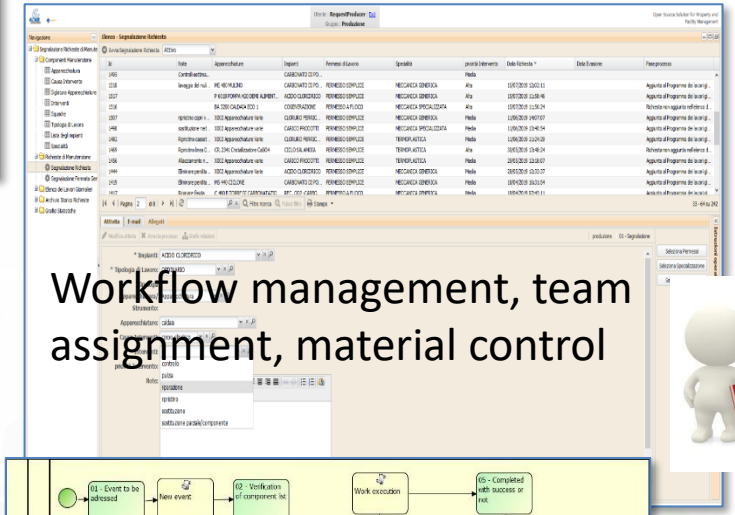
Example of Integrated workflow



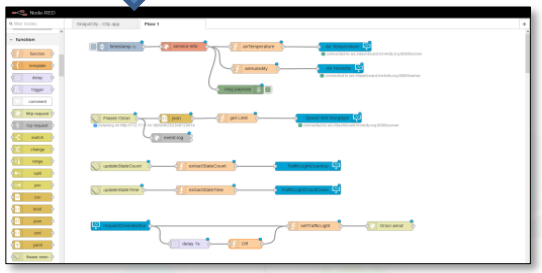
Consumptions/productions



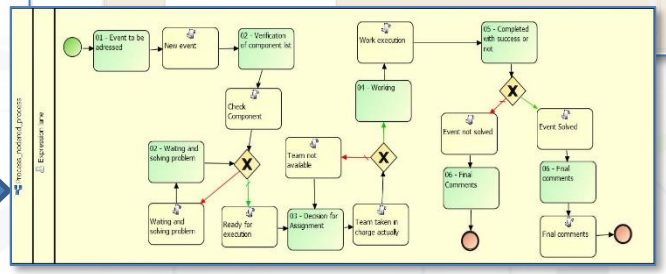
Events/actions

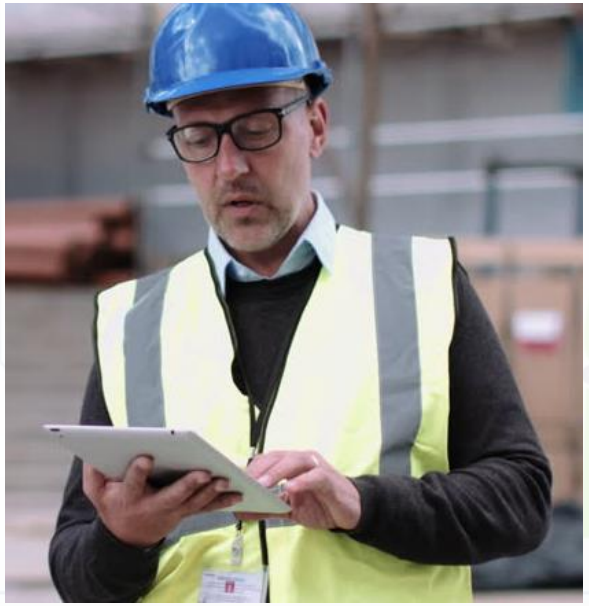


Workflow management, team assignment, material control

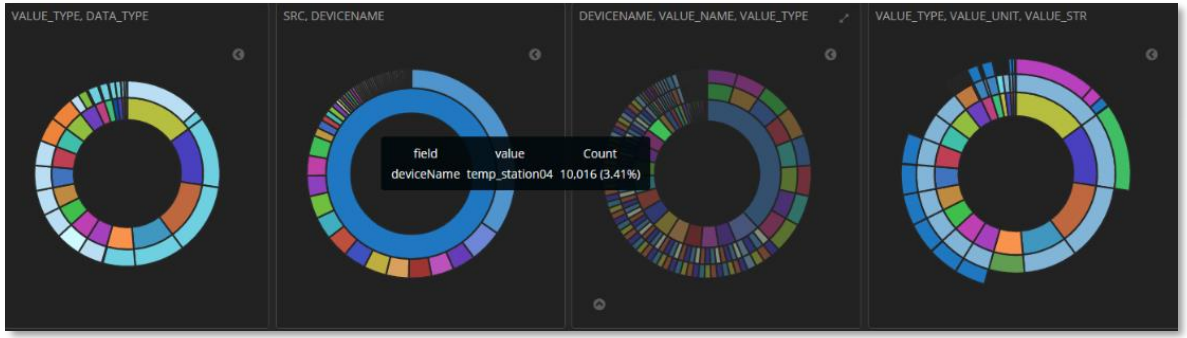


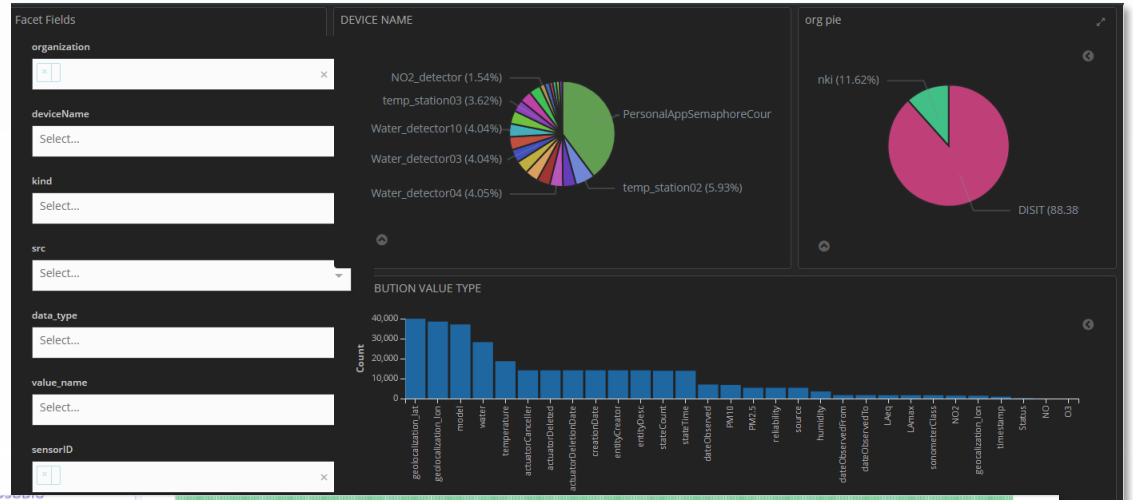
Event detection and firing Critical event management

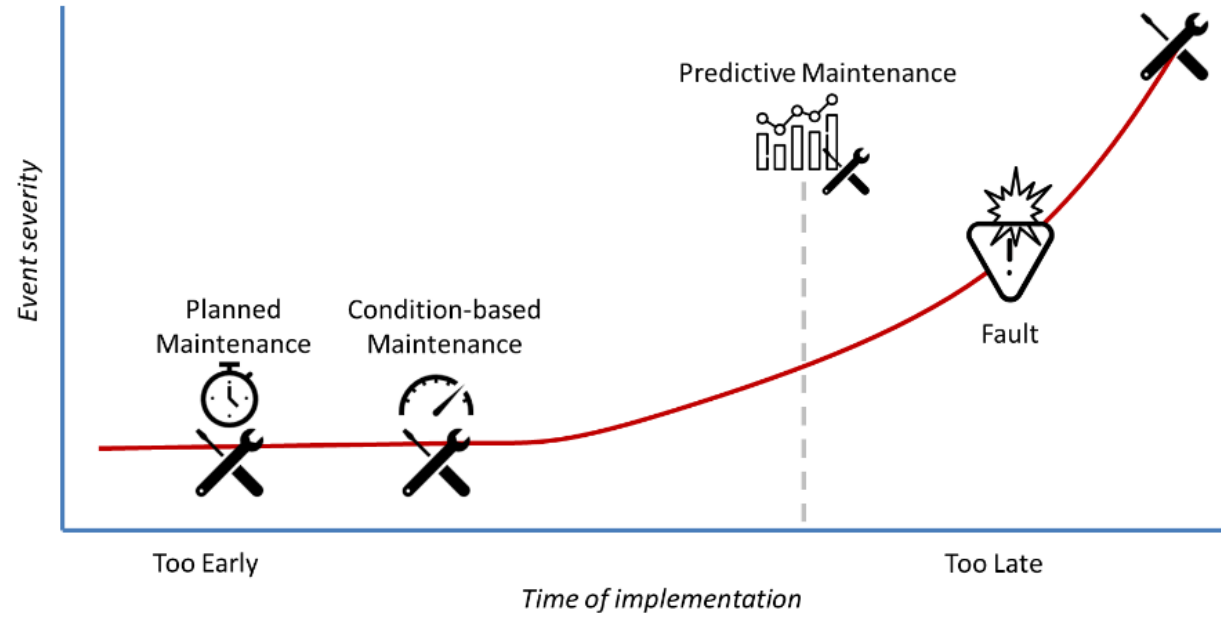


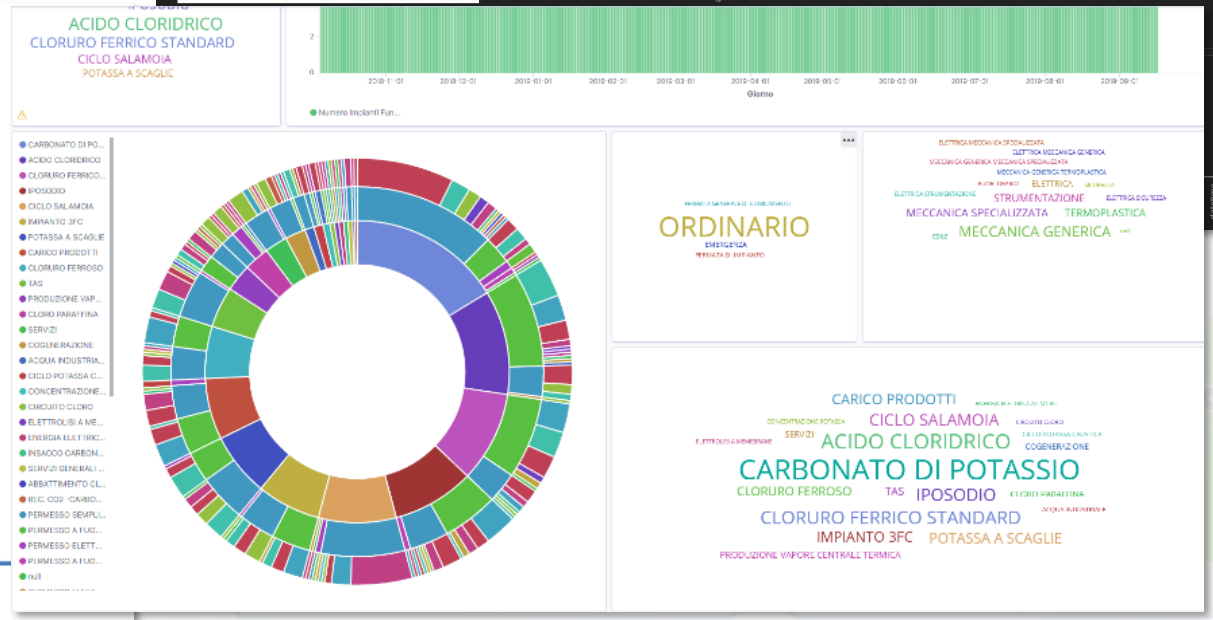


Business Intelligence and Predictive Maintenance









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...

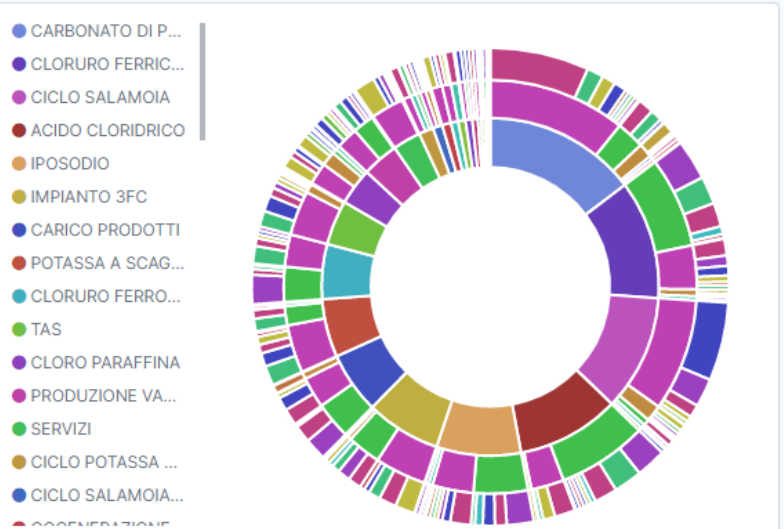
Apply changes | Cancel changes | Clear form

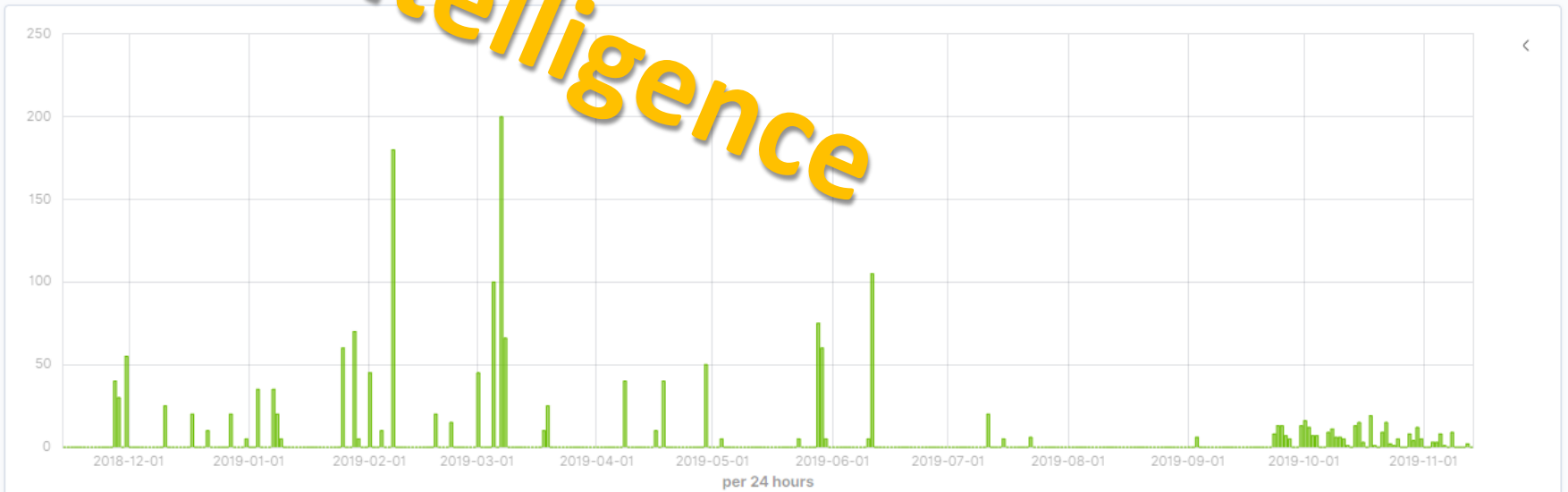
1,865
Numero di eventi nel periodo

264.491
50th percentile of ore tra inizio e fine lavoro

673.151
Media ore passate tra inizio e fine lavoro

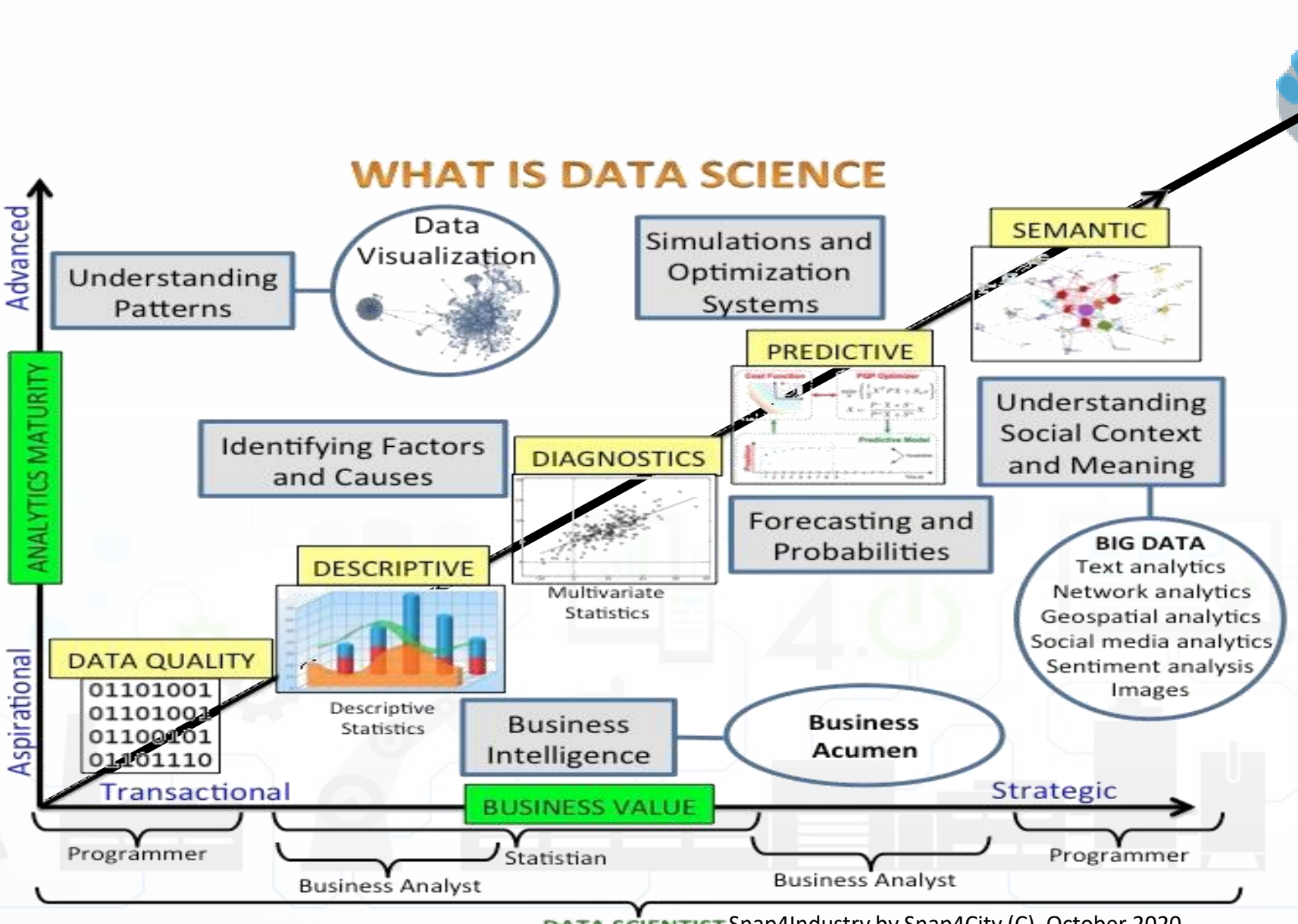
CLORURO FERRICO STANDARD
CARBONATO DI POTASSIO
CICLO SALAMOIA
IPOSODIO
IMPIANTO 3FC
CARICO PRODOTTI





Maintenance Intelligence

DATA ANALYTICS, Big Data Science

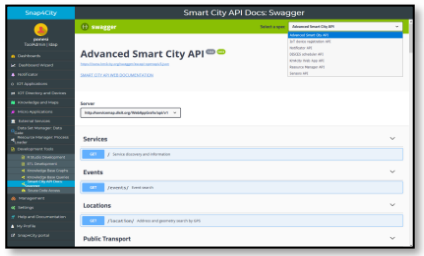


Sentient and active processes

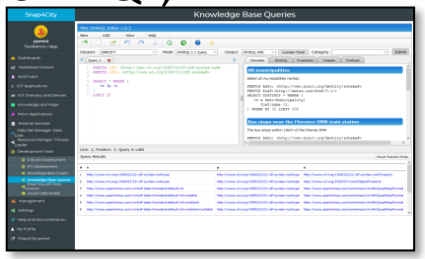
- Big Data
- Semantic Computing
- Machine Learning
- Geo Spatial Reasoning
- Sentiment Analysis
- What If Analysis
- Text Analysis
- Simulations
- Visual Analytics
- MicroServices
- Scalability
- Engagement Analysis
- ….

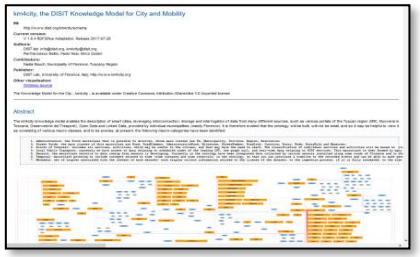
Data Analytics Dev. in R Studio and/or Tensor Flow

Swagger



SPARQL, FLINT





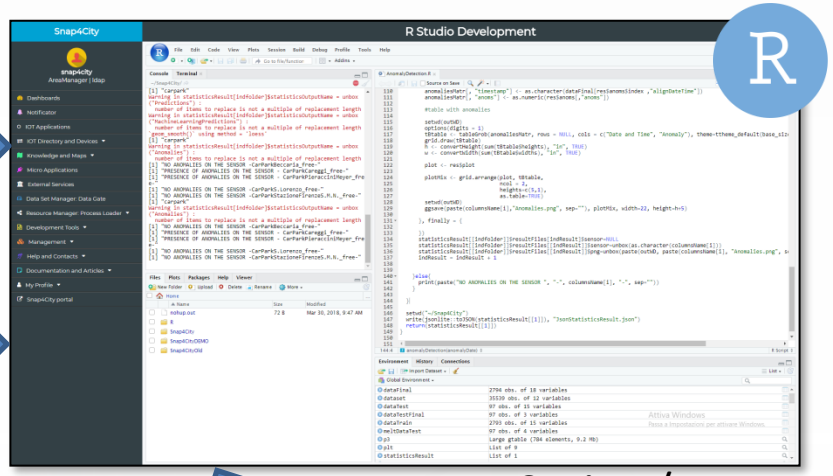
Ontology Schema

LOG.disit.org

Knowledge Base, Km4City

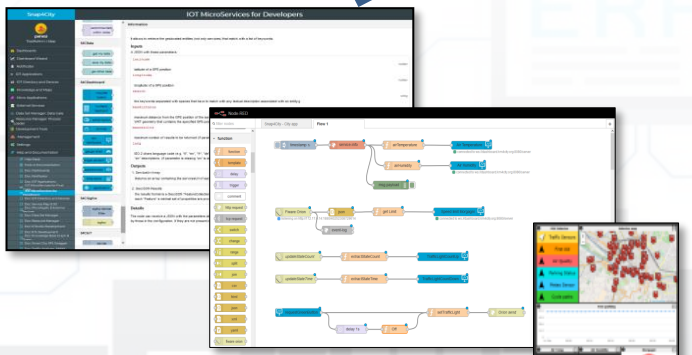
Big Data Store Facility

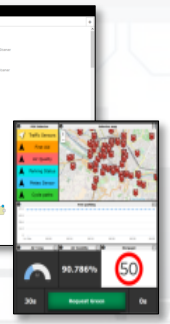
Smart City API from Knowledge Base and other tools



R Studio

Creating MicroServices





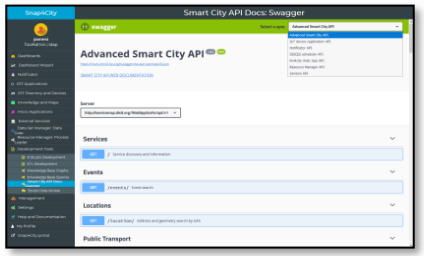
Using them into IOT Applications

Saving / Sharing reusing

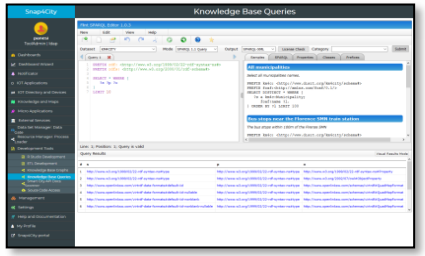
Resource Manager

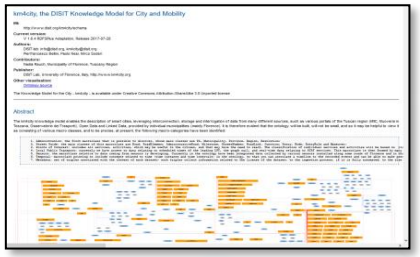
Data Analytics Development in Python,

Swagger



SPARQL, FLINT

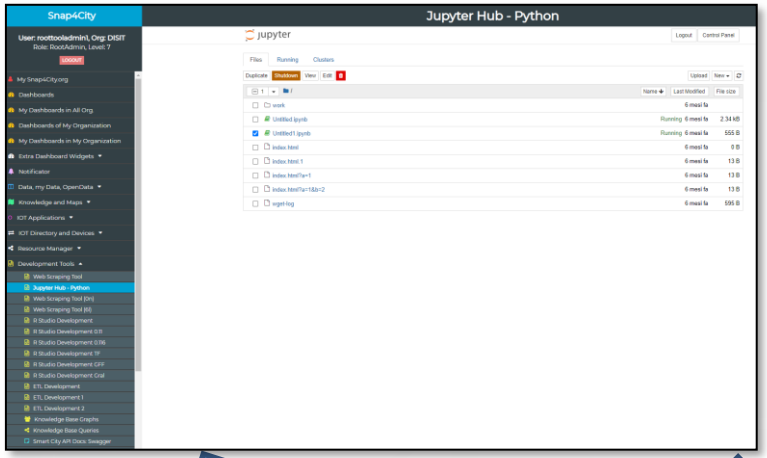




Ontology Schema

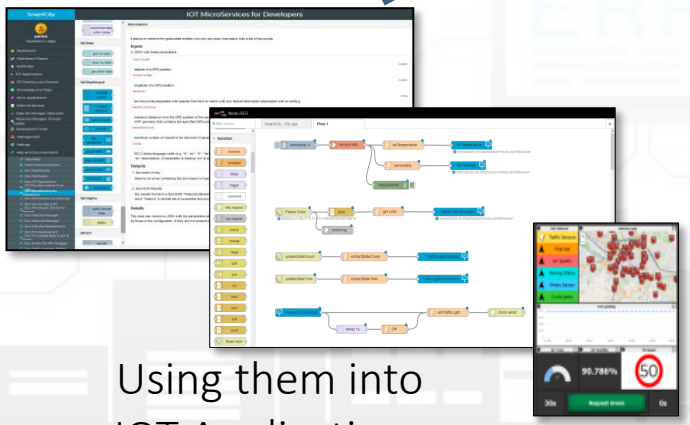
LOG.disit.org

Smart City API from Knowledge Base and other tools



Coding
Testing

Creating
Micro Services



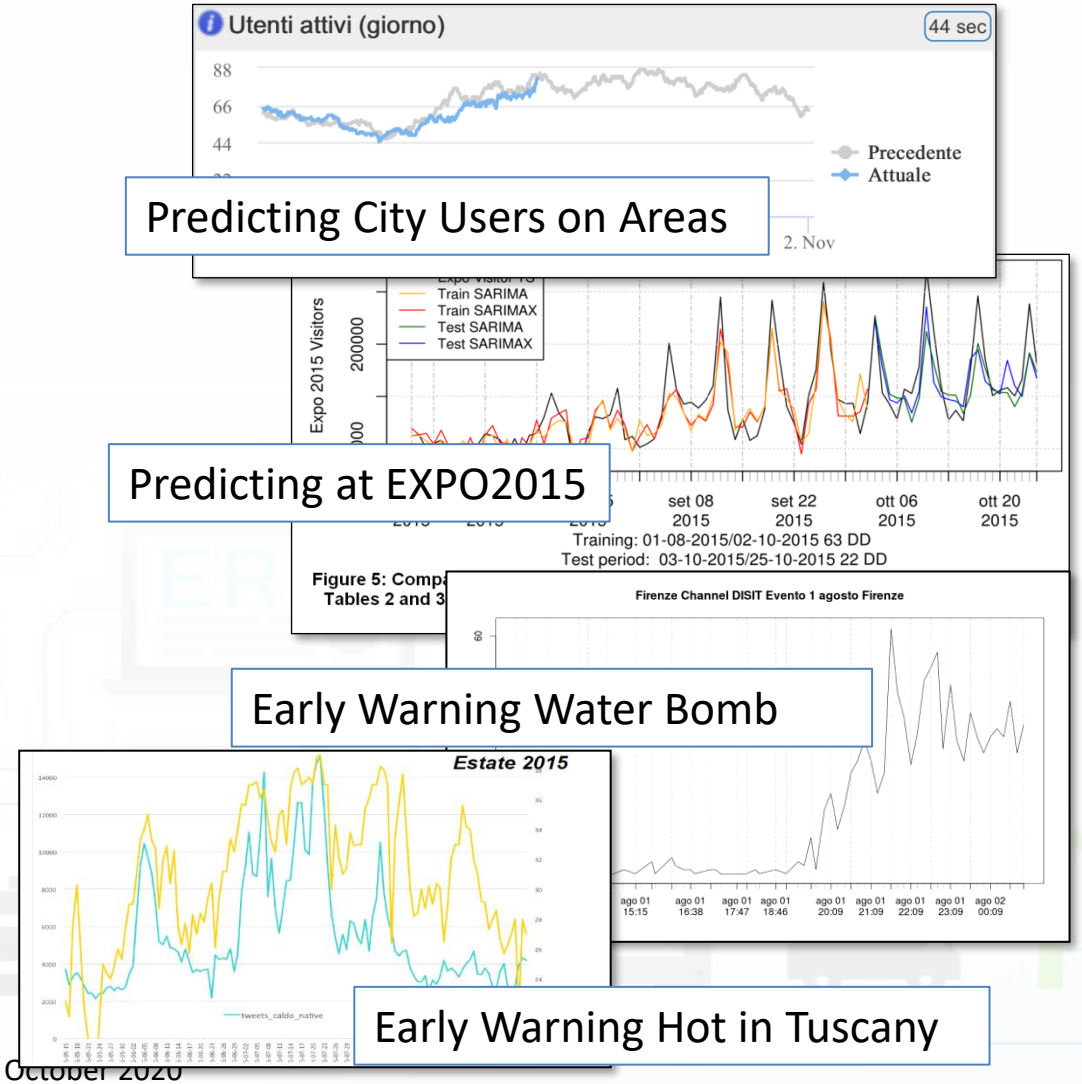
Using them into
IOT Applications

Saving
Sharing
Reusing

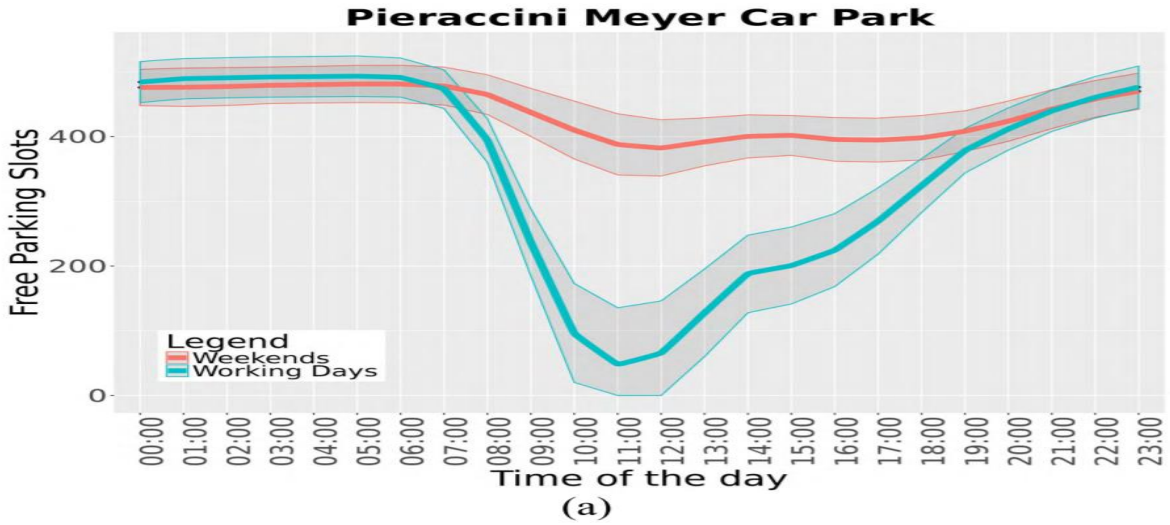
Resource Manager

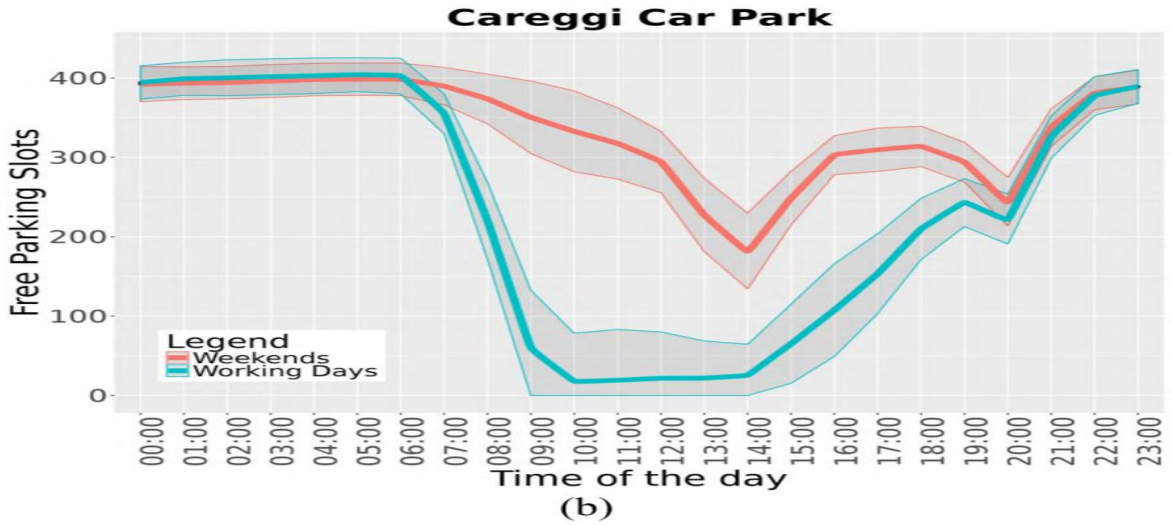
Predicting Models

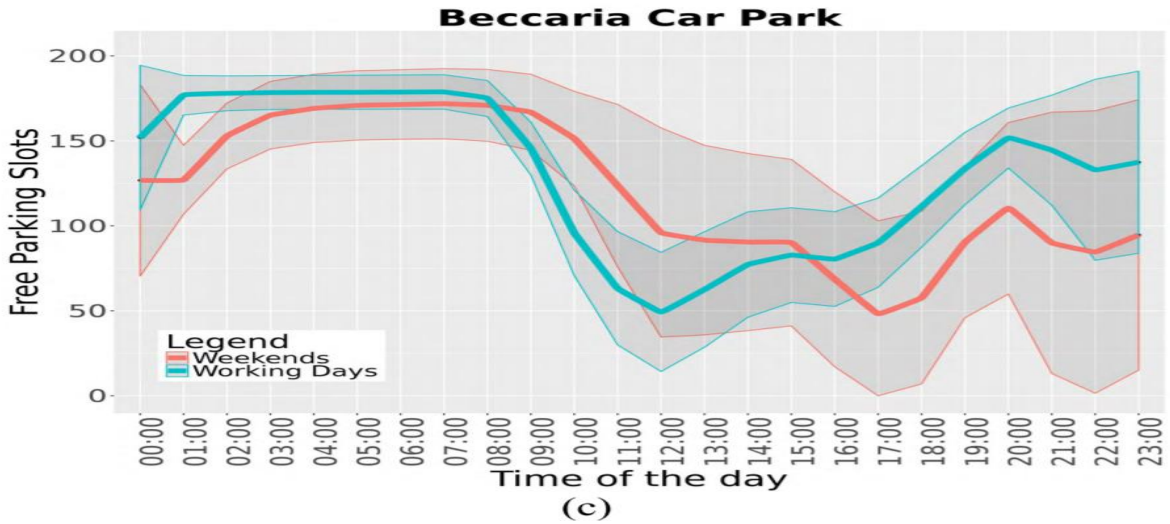
- **Aiming at improving**
  - quality of service, distributing workload
  - early warning
- **Predictions**: **Short** (15 min, 30 Min) and mid Term (1 week)
- **Data Analytics**: ML, NLP/SA, Clust., …
  - Traffic Flows → multi-flow reconstruction
  - Parking Status → free slots
  - Environmental Alarms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

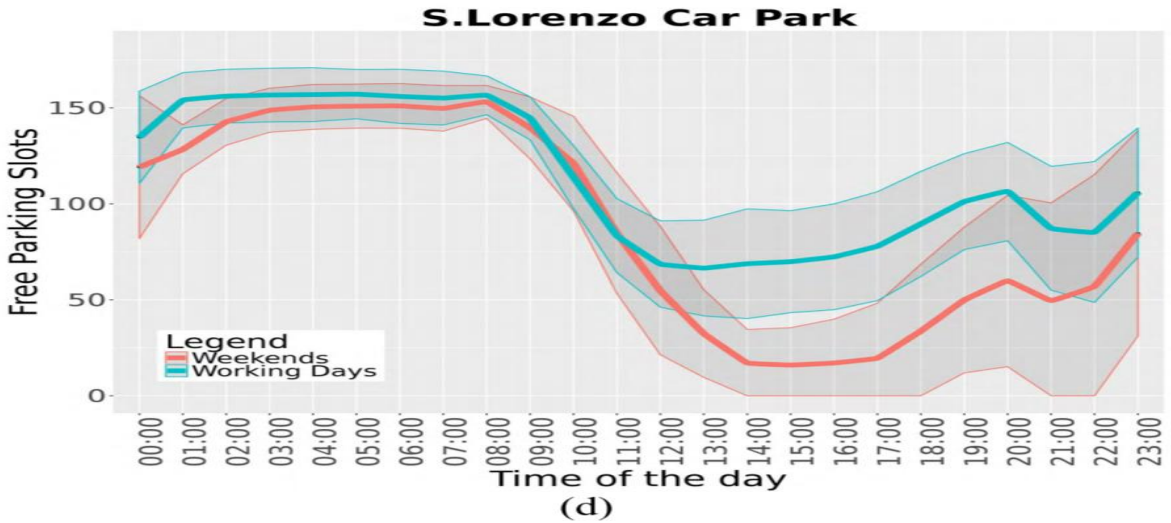


Free Parking space trends









12 parking areas in Florence

Free Parking Predictions

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

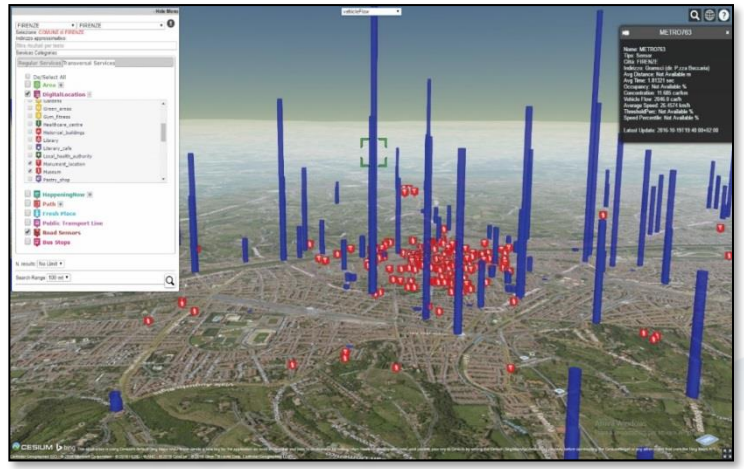
Active on Mobile Apps as:

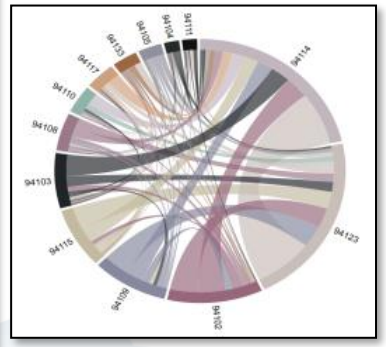
- «Firenze dove cosa»
- «Toscana dove cosa»

Precision: 97,5%

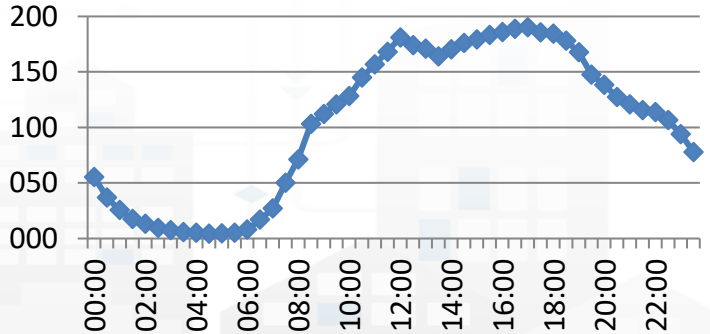
Predicting users movements

- **Issue:**
  - **How they move: vehicles, pedestrian, bike, ferry, metro,**
  - **Where they go….**
- **Impact:**
  - **Tuning the services: cleaning, police, control, security**
- **Several metrics related to**
  - **Knowledge of the Context**
  - **Monitoring traffic and people flow**
  - **…….**



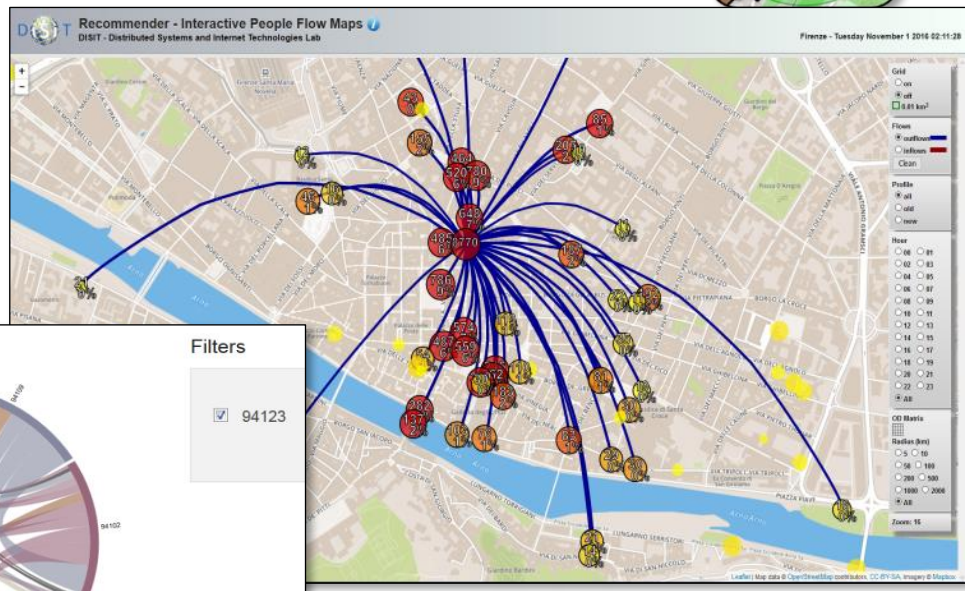


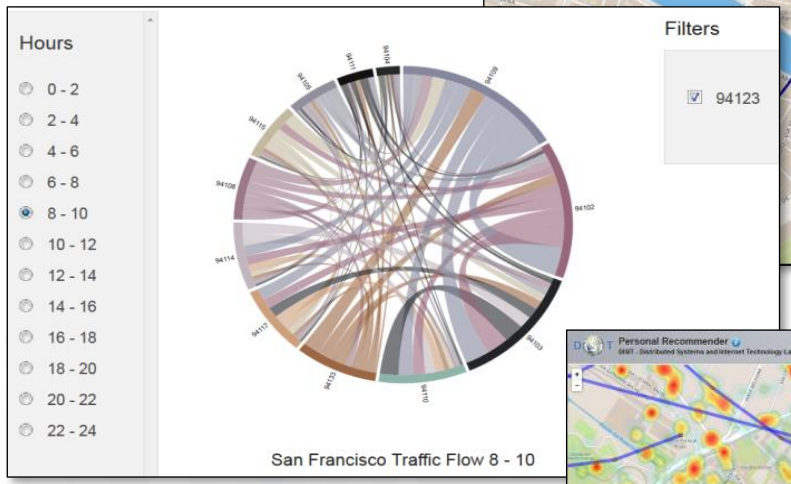
- Daily trends
- OD matrices
- Trajectories
- Prediction models

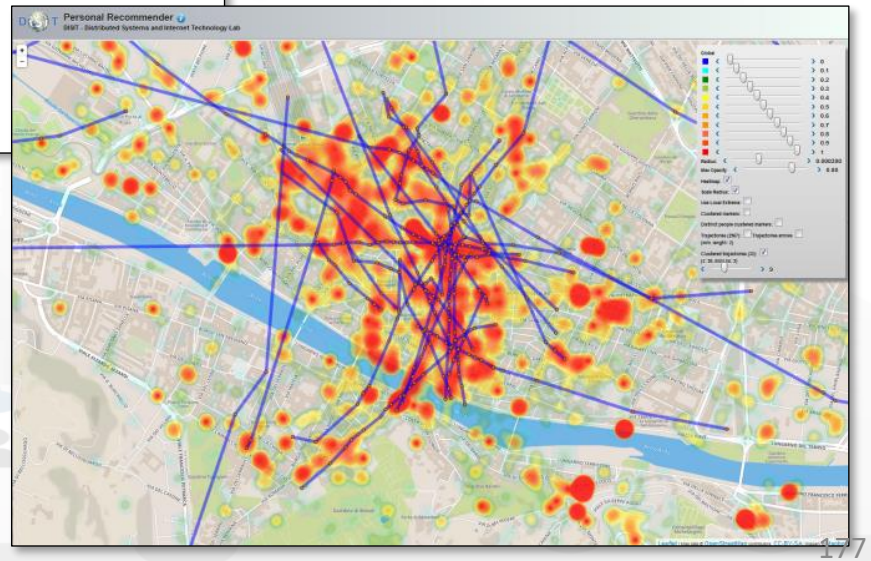


User Behaviour Analysis

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

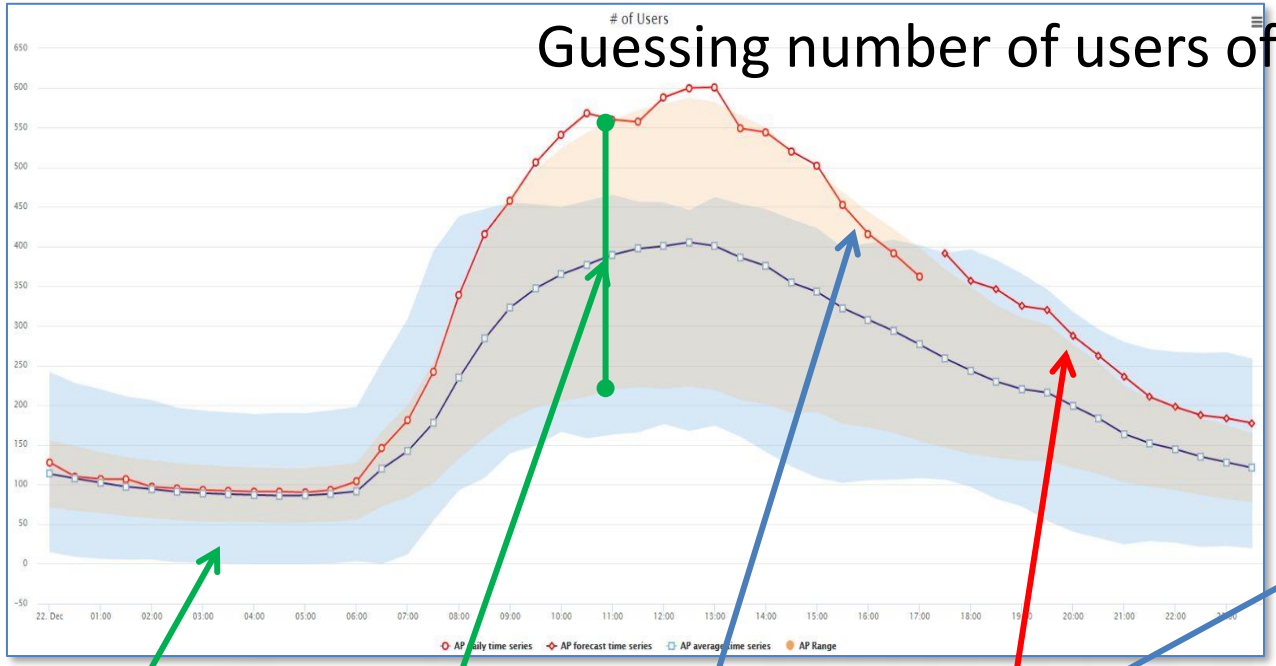


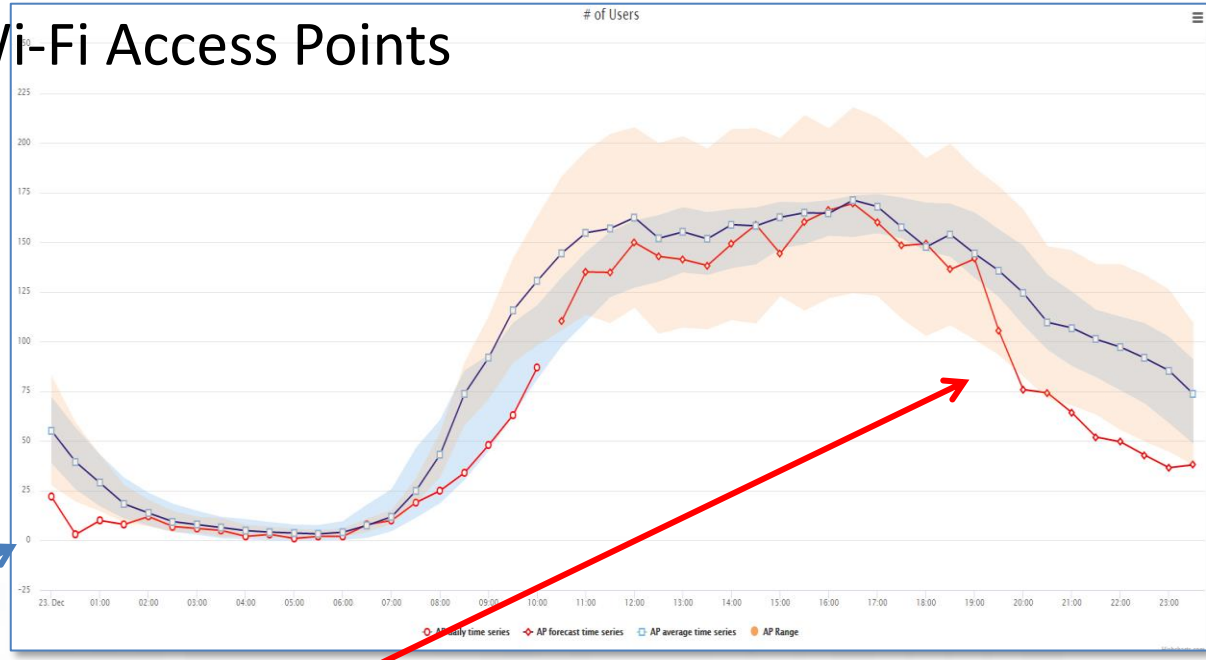




Prediction and Identification of Anomalies

Guessing number of users of Wi-Fi Access Points





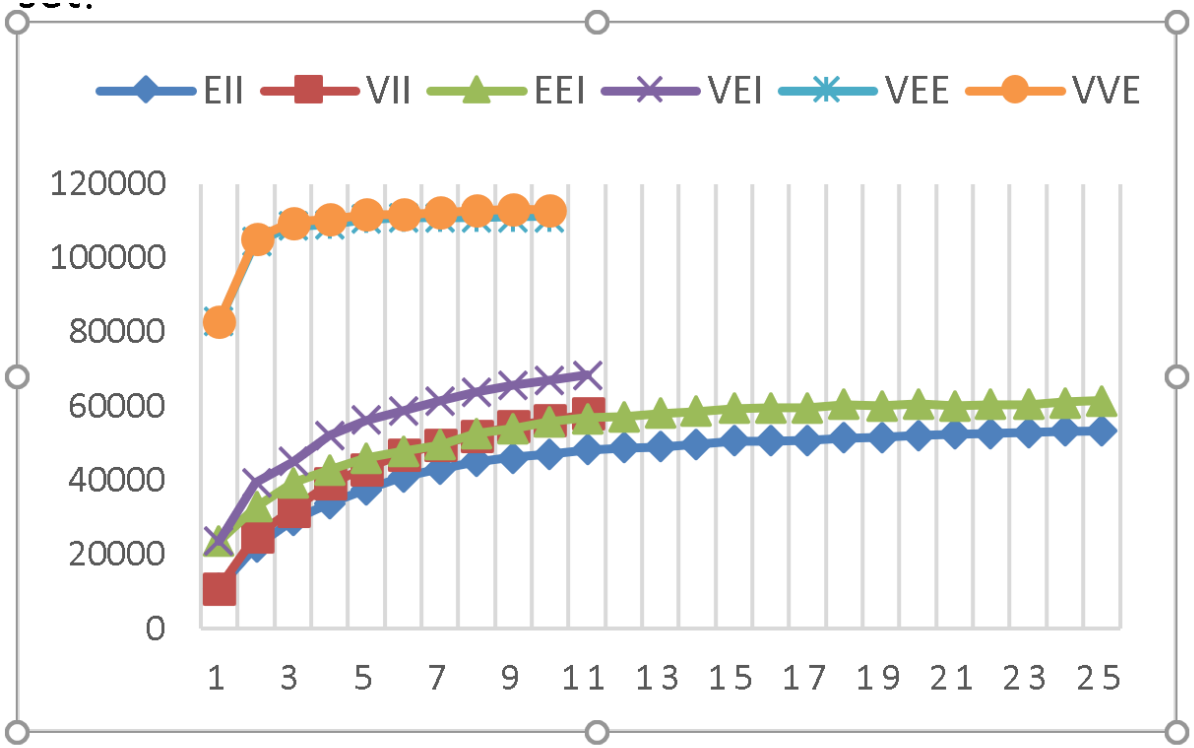
Cluster confidence

AP average and confidence

Actual AP trend for today

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

Predictive precision of the 95%



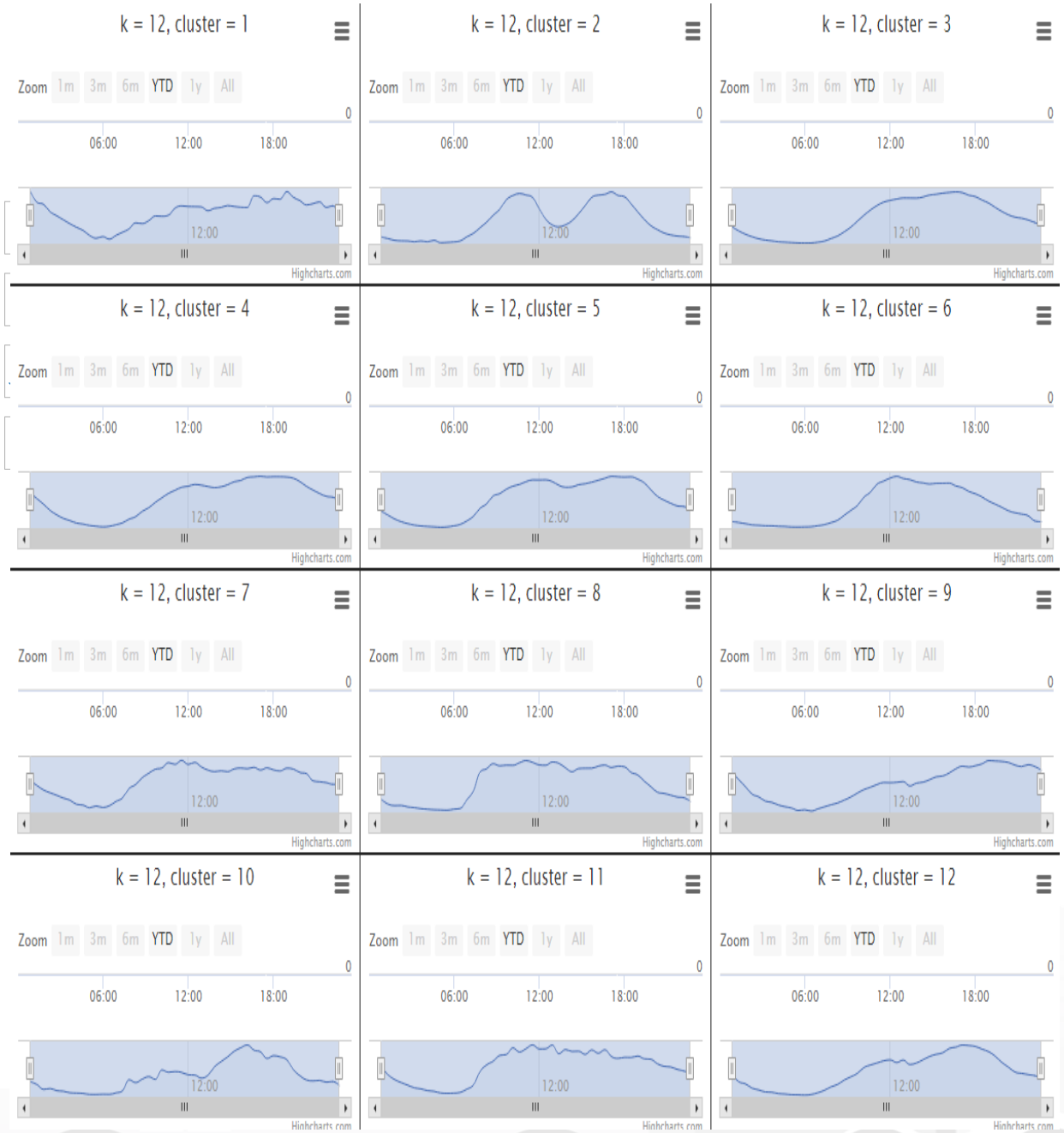
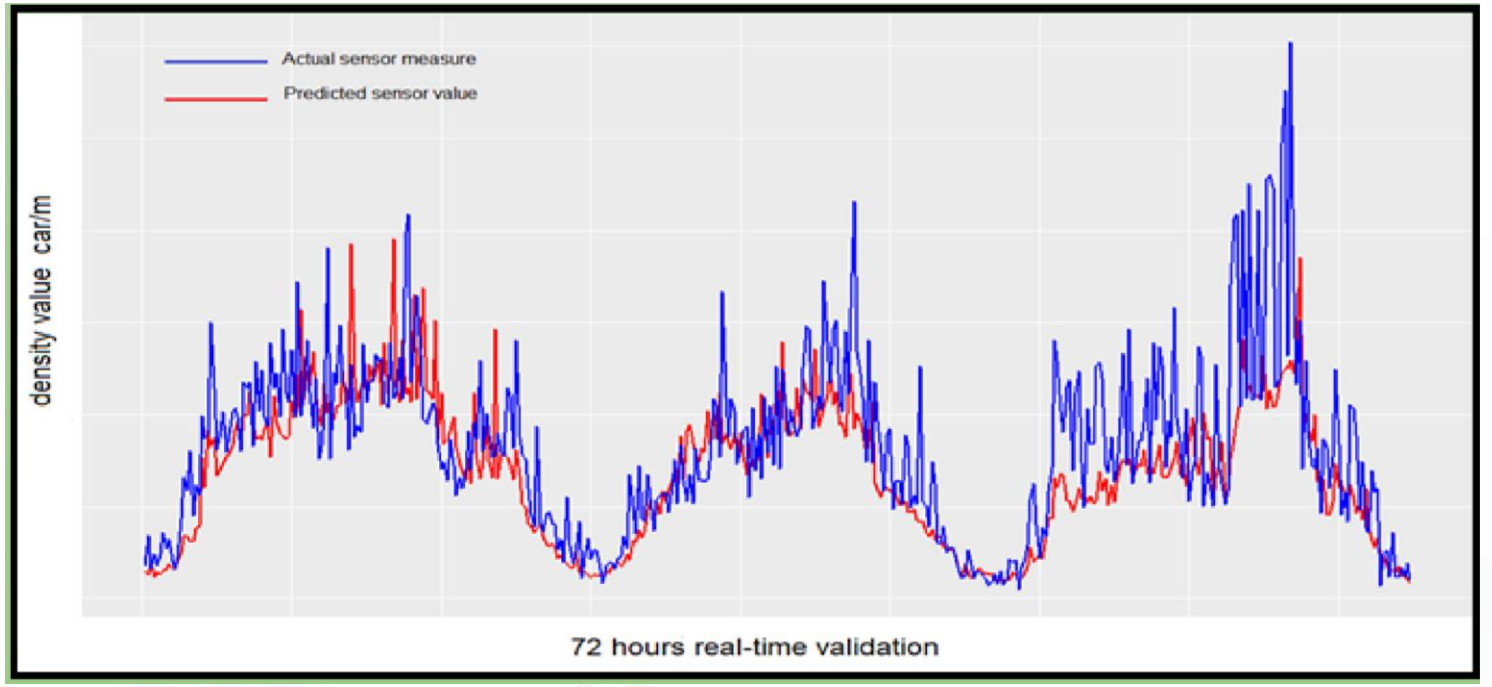
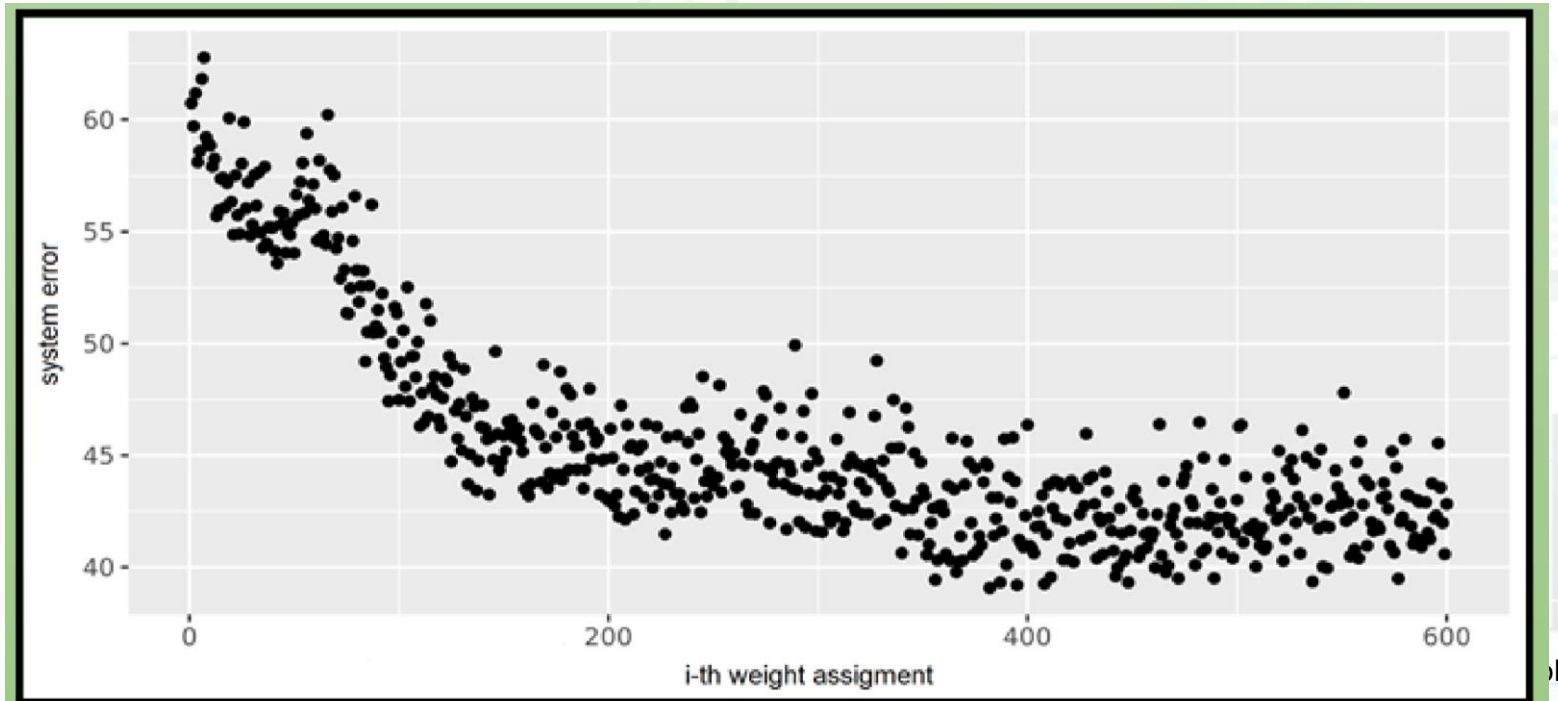


Figure 14 – Average BIC for mixture models vs K number of cluster, higher values are better, the curves are truncated at the best value for K they found.

Convergence of learning phase





Traffic Flow reconstruction, real time

Qualità Trasporto Pubblico - Cloned

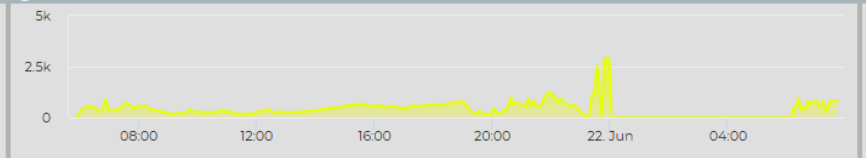
Firenze - 6 linee

Sat 22 Jun 07:45:48

Linea 13

825

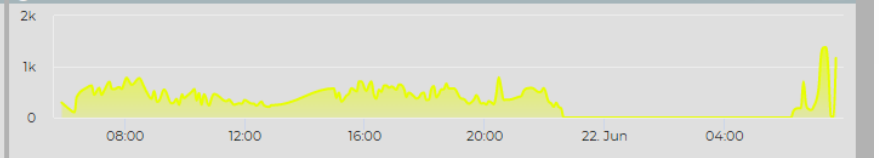
Ritardo medio corse attive nei 5min in sec



Linea 31

1166

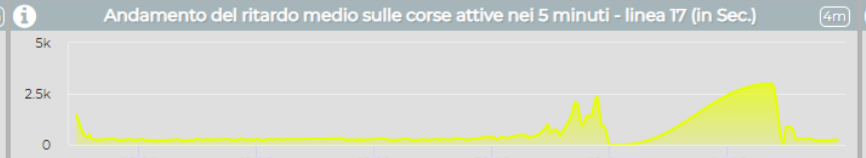
Ritardo medio corse attive nei 5min in sec



Linea 17

222

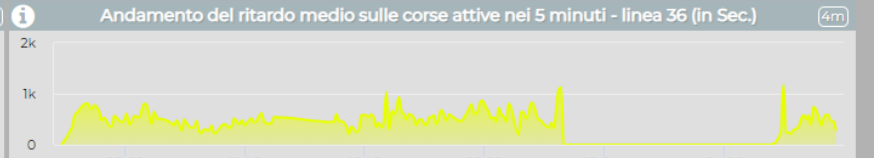
Ritardo medio corse attive nei 5min in sec



Linea 36

289

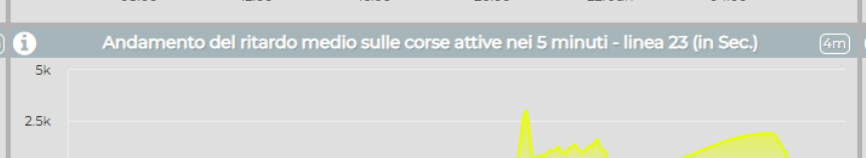
Ritardo medio corse attive nei 5min in sec



Linea 23

337

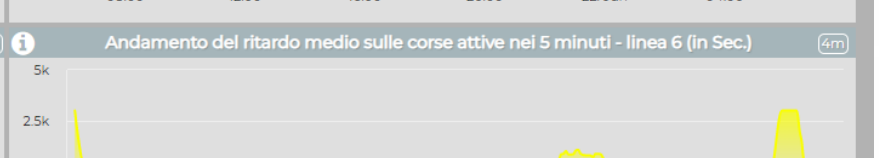
Ritardo medio corse attive nei 5min in sec

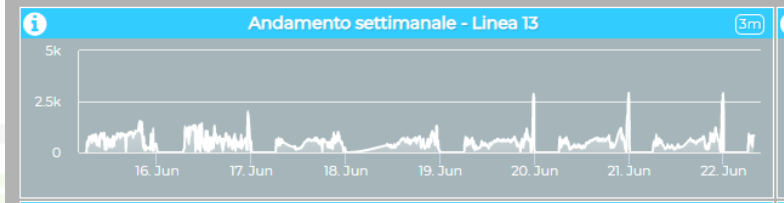


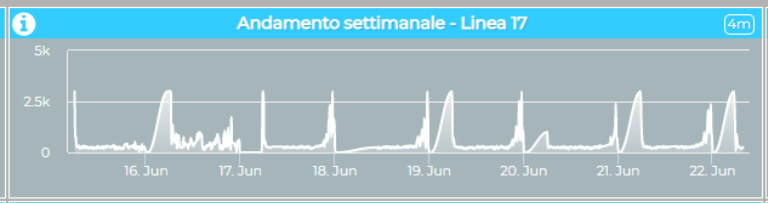
Linea 6

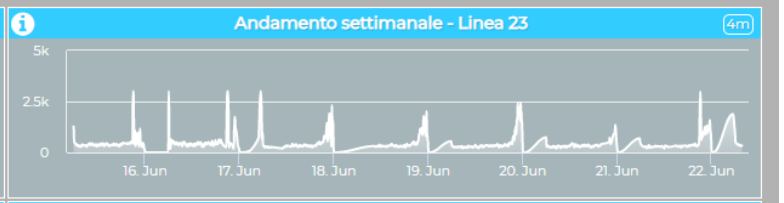
411

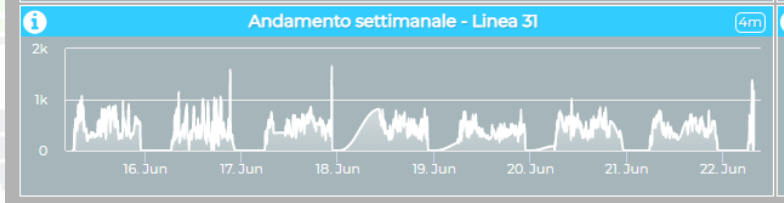
Ritardo medio corse attive nei 5min in sec

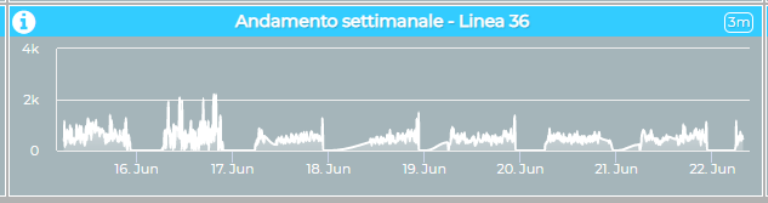


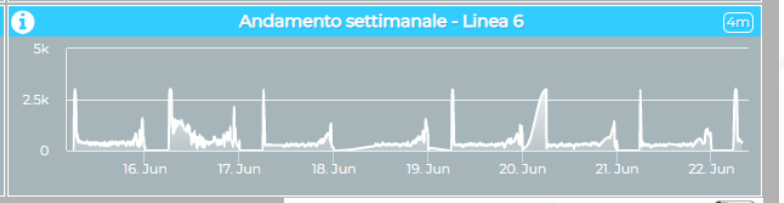






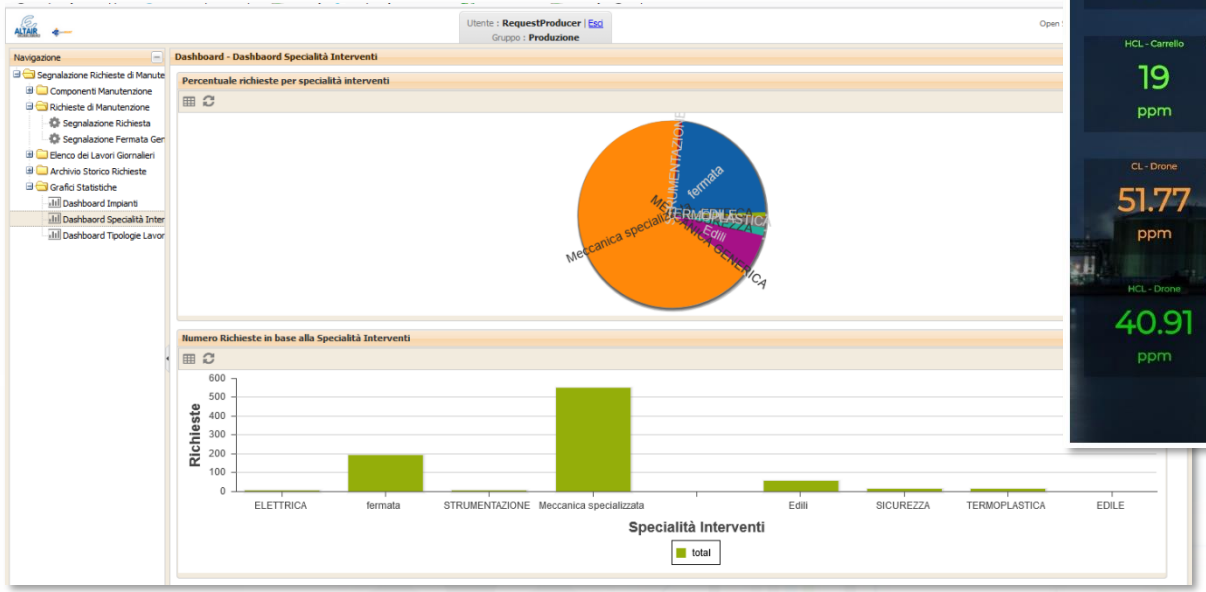


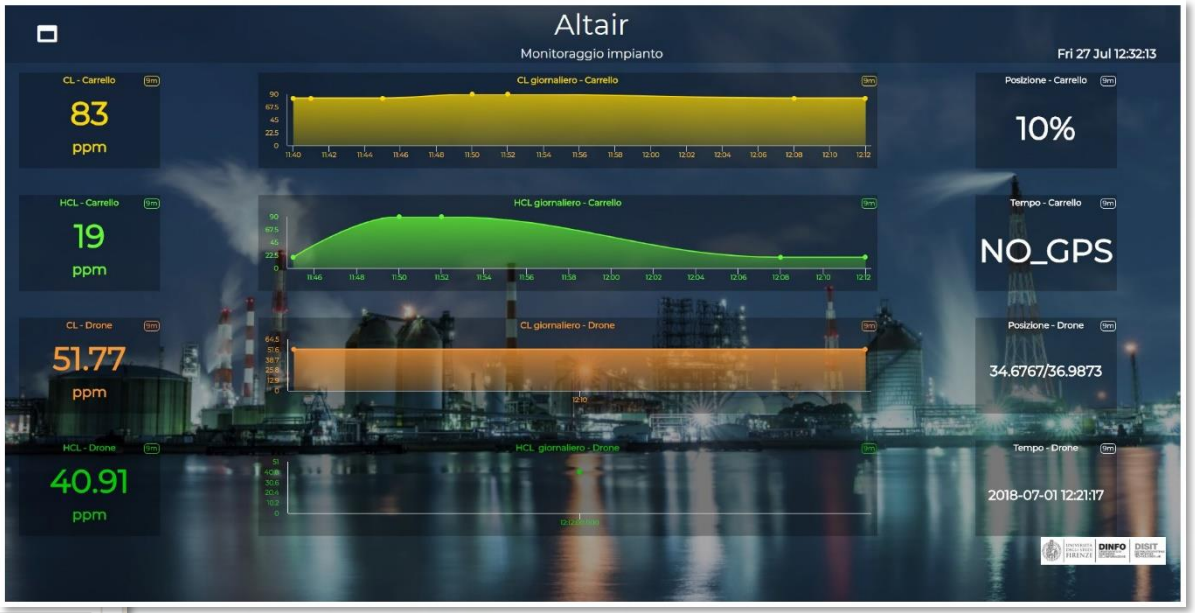




Anomaly Detection

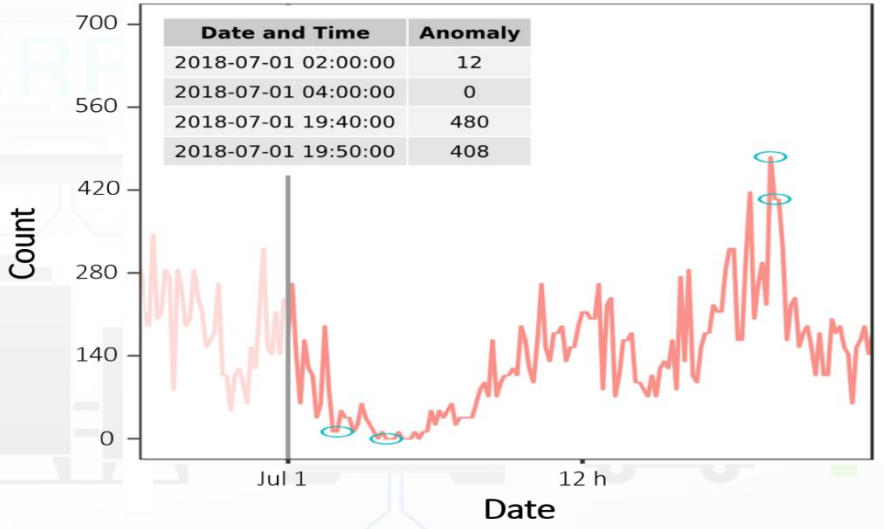
Reports and Dashboards





Anomaly detection Early Warning

Date and Time	Anomaly
2018-07-01 02:00:00	12
2018-07-01 04:00:00	0
2018-07-01 19:40:00	480
2018-07-01 19:50:00	408



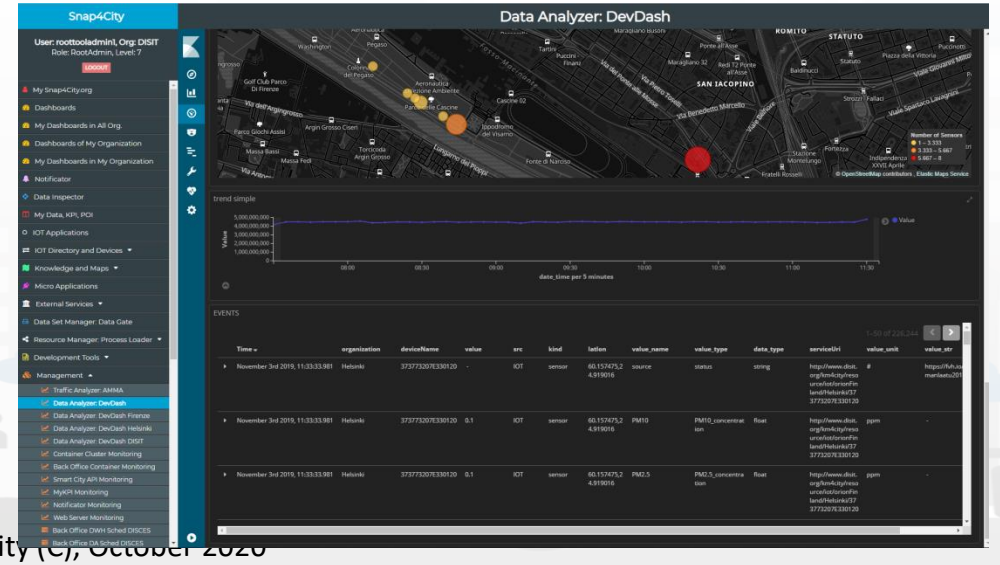
kibana

SNAP4CITY

KM4CITY

Operator Business Analysis Dashboards: DevDash, AMMA

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



Data Analyzer: DevDash

Snap4City

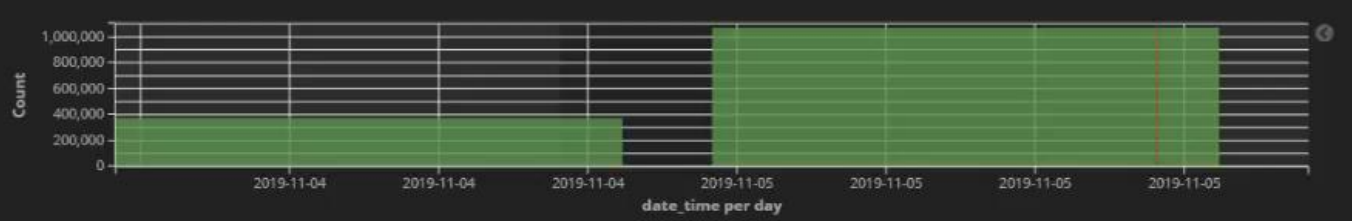
User: roottooladmin1, Org: DISIT
Role: RootAdmin, Level: 7
LOGOUT

Dashboard / Sensors-ETL-IOT-v4 Full screen Share Clone Edit Auto-refresh Last 24 hours

Search... (e.g. status:200 AND extension:PHP) Options

Add a filter +

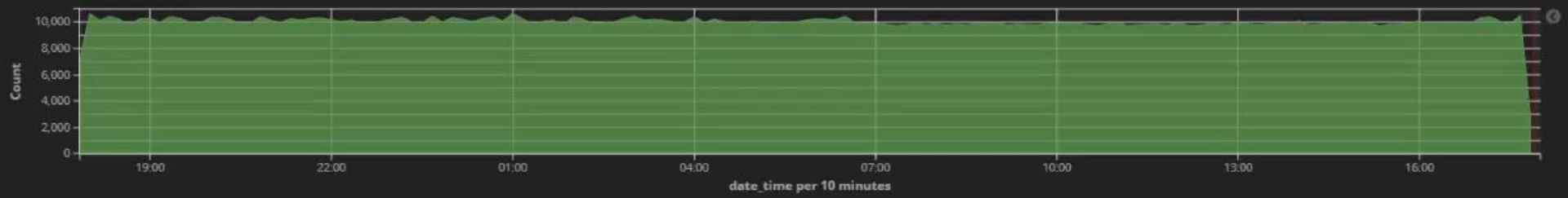
COUNTEVENTS



HITS

1,444,442
HITS

EVENT COUNTS



Facet Fields

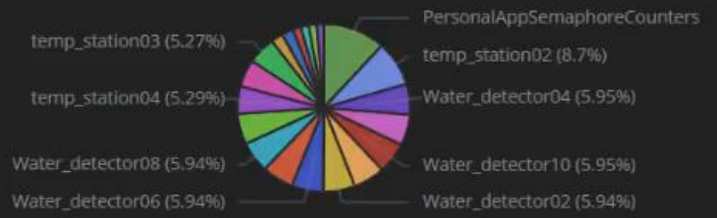
organization

deviceName
Select...

kind
Select...

src
Select...

DEVICE NAME



org pie

DISTRIBUTION VALUE TYPE

LIVING LAB FOR COLLABORATIVE WORK

Your Level

Snap4City

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

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

All Tools

Snap4City

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

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

Welcome: how to start using Snap4City for beginners

Personalized Suggestions

Snap4City developers suggest you reading:

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

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

See this ove possibilities:

Exercises

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

SLIDES

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

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

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

NEWS

Flyer

News

VIDEOS

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

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

- Level 0 user: access at data/services views of the city by using public Dashboards; (Public User) (overview on dashboards)
- Level 1 user: create personal/professional views/dashboards on data; (Man ards can be created)

Username: adifino

Powered by www.km4city.org

Full Search

Search

Search

Your Org

Organization Groups

DISIT
- Operativo

Recent comments

- 1 month 6 days ago

Last Art.

Recent content

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

Benvenuto al nostro Sindaco ed al suo Team new
roottooladmin1

We sugges to Antwerp Developers: How to manange my Dashboards

Living Lab Flexibility

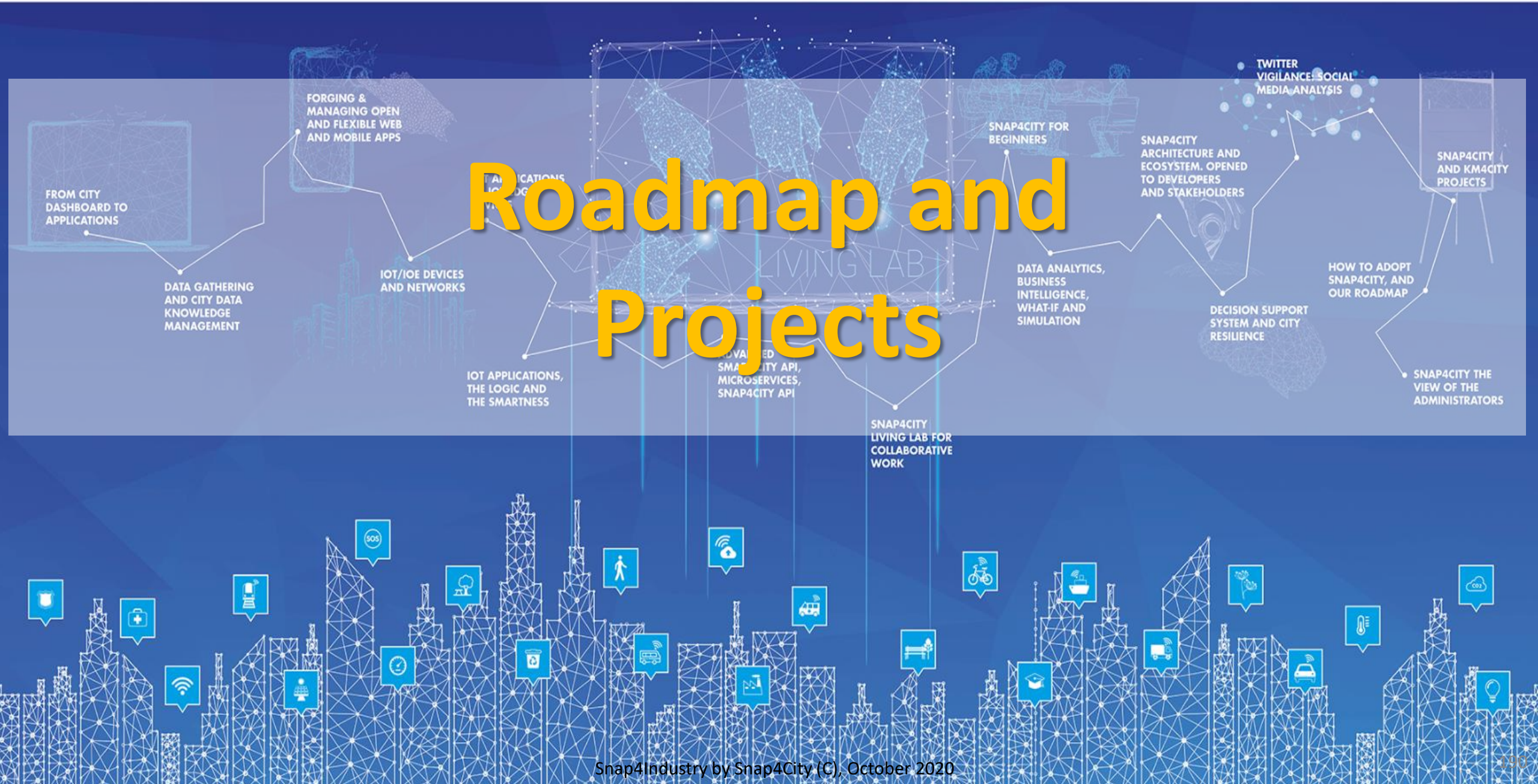
Snap4City Satisfies all Requirements of ENOLL Select4Cities and EIP-SCC

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

Living Lab training

- Snap4City Living Lab Life Cycle
- TC8.6 - Snap4City Living Lab Life Cycle
- US8. Using the Living Lab Support tools
- Snap4City platform: from cloud to data analytic as a Living Lab for Student and Researchers
- Contributing as city stakeholder: company, citizen/developer, researcher, etc., to the Living Lab
- TC8.1 - Snap4City Portal as a support for Living Labs, collaborative and co-work, Snap4City Portal as a single point to information Access and Discussion

Satisfy all Requirements of ENOLL



Roadmap and Projects

DISIT lab roadmap vs model and tools' usage

2013
Km4City Ontology 1.1
- Tuscany, Road Graph
- Mobility
- culture, tourism
- Events
- Parking
- Services
- Linked open graph

2014
- Weather Forecast
- Real Time Wi-Fi
- Entertainment
- LOD
- Twitter Vigilance
- Social Media Analytics, Sentiment Analysis

Km4City 1.4

2015
Km4City 1.5
- Resilience Decision Support
- Smart First Aid
- User Behaviour Analysis, predictions
- Risk Analysis

ckan, resolute, H2020 (2015-18)

2016
(2016-21) H2020 REPLICATE
- Smart Energy
- Sustainable Mobility
- Control Room
- Dashboard

Km4City 1.6.2

Sii-Mobility (2016-21) MIUR
SII-MOBILITY SCN
- Infomobility
- Mobile App
- Routing
- Multimodality

FIWARE

Km4City 1.6.4
- Origin-Destination and trajectories
- Traffic Reconstruction
- Offer Analysis
- OBU, smart devices

Sii-Mobility, 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.

2017
GREEN IMPACT
POR FESR 2014-2020
- Industry 4.0
- Critical Plant
- Monitoring

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

life weee (2017-20)
- Smart Waste

2018
MOSAiC MObility 4.0 for SmArt (i) City (2018-20)
- Mobility Demand / Offer Analytics and Strategy

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

IOT/IOE
Km4City 1.6.6

Node-RED

SNAP4CITY
SELECT for Cities H2020 (2017-19)

2019
5G (2018-21)
- 5G tech
- Energy
- Industry 4.0
- Synoptics

TRAFAIR
CEF (2018-21)
- Traffic and Mobility Impact on Pollution
- NOX predictions

EUROPEAN OPEN SCIENCE CLOUD

SIRIUS, LAID Smart Bed
- Smart Health

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

bee smart city
- Smart Lonato

Reverberi Enetec Gruppo MPES

- PCP Award

SELECT for Cities 1° place award to SNAP4CITY

2020
- Smart Tourism
- 6 Pilots
- Data Analytics
- Extended platform

Interreg Mediterranean HERIT-DATA

2021
- CAPELON
- Sweden

smartGARDAlake

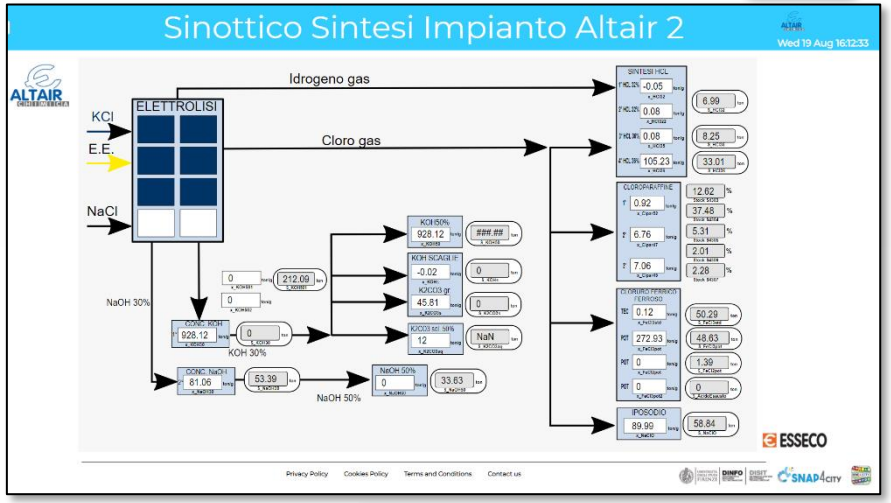
Interreg MARITTIMO-IT FR-MARITIME MOBI MART
- Smart Mobility
- PISA, PUMS
- Living lab

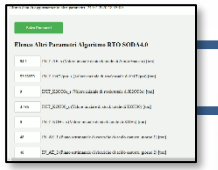
…2022

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

SNAP4INDUSTRY | KM4CITY

SNAP4ALTAIR





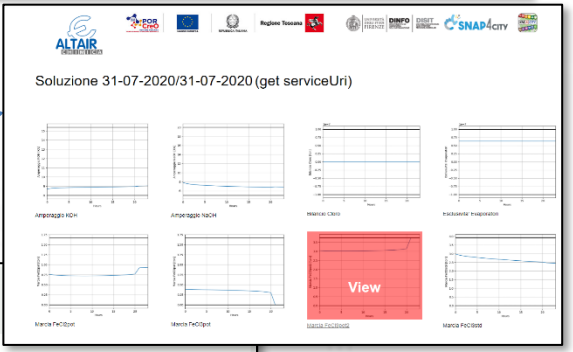
Parameters

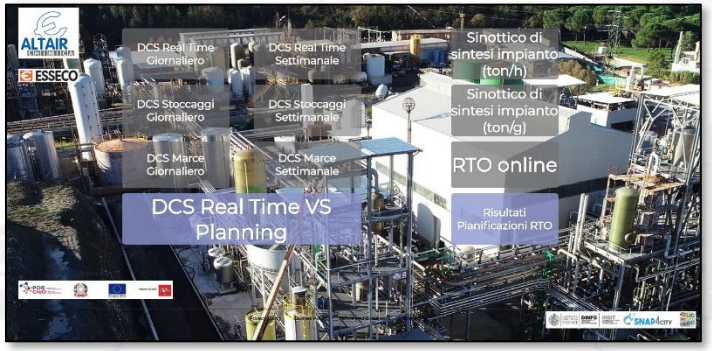
AS400 (orders)

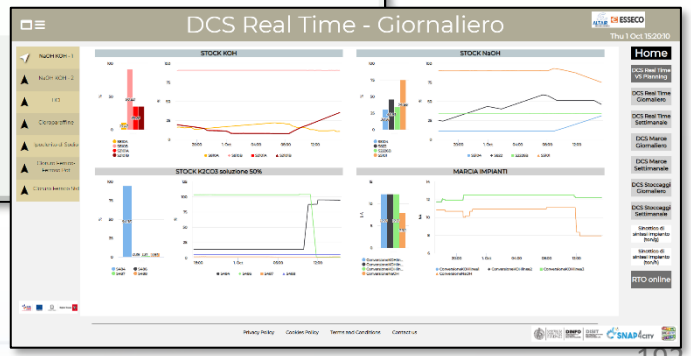
PUN (energy)

Snap4Altair *OnLine*

Monitoring Planning

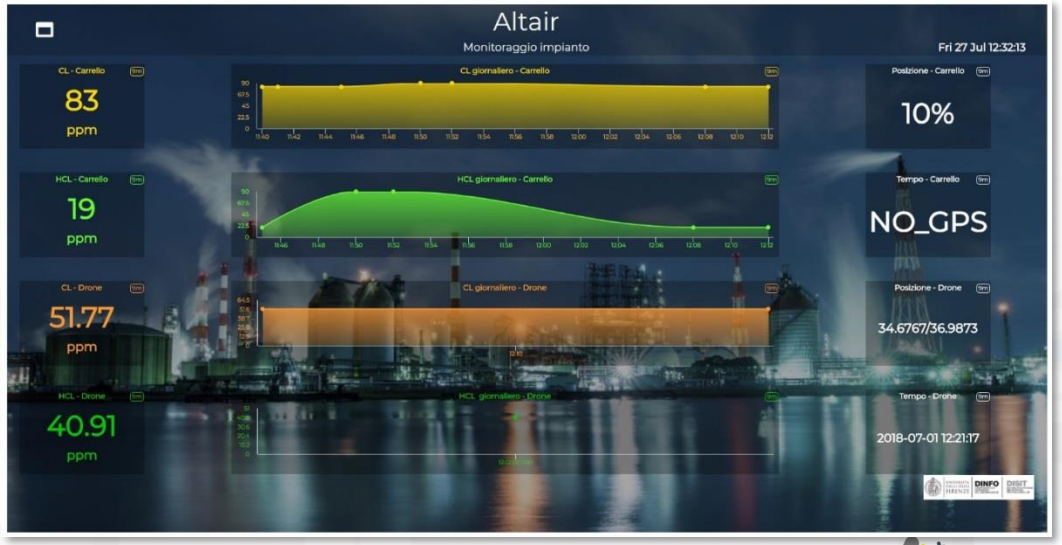


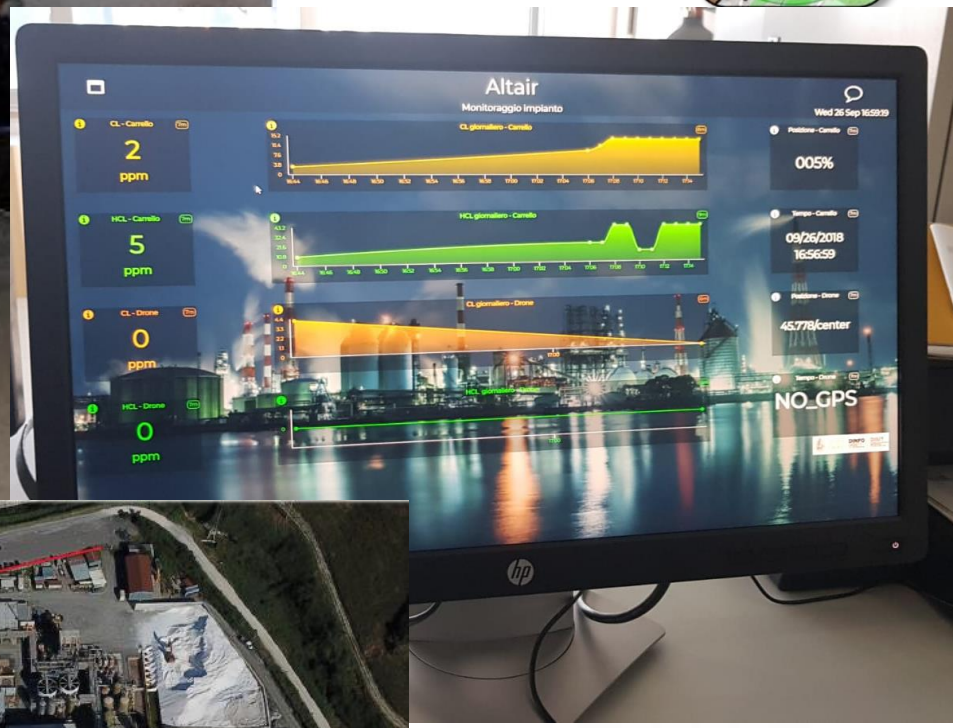




Green Impact Capacity (GIC)

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





Green Impact Capacity (GIC)

Altair Control room

SNAP4INDUSTRY

Experimenting 5G

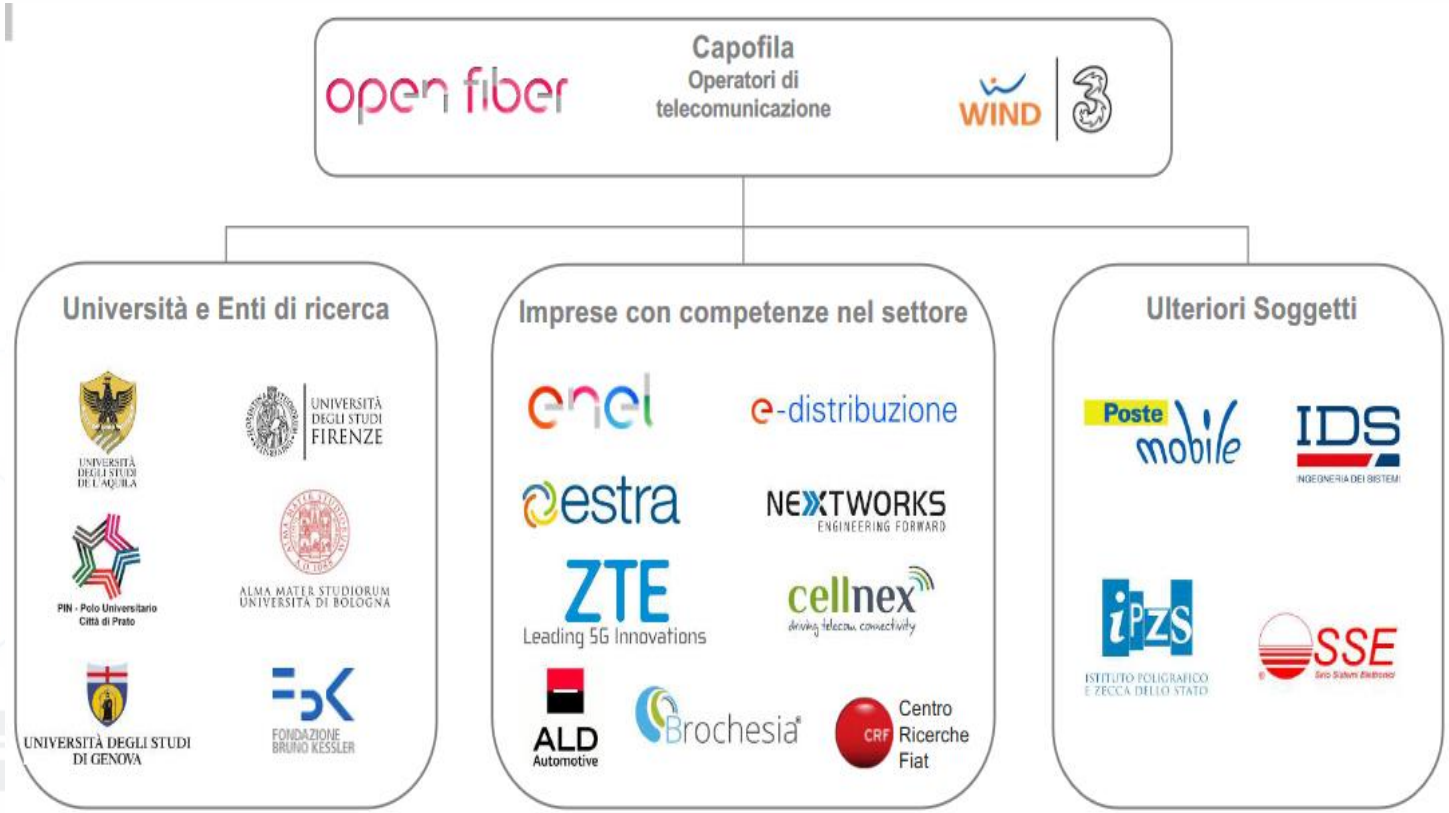
Fields:

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

Where in Italy:

- Prato and L'Aquila

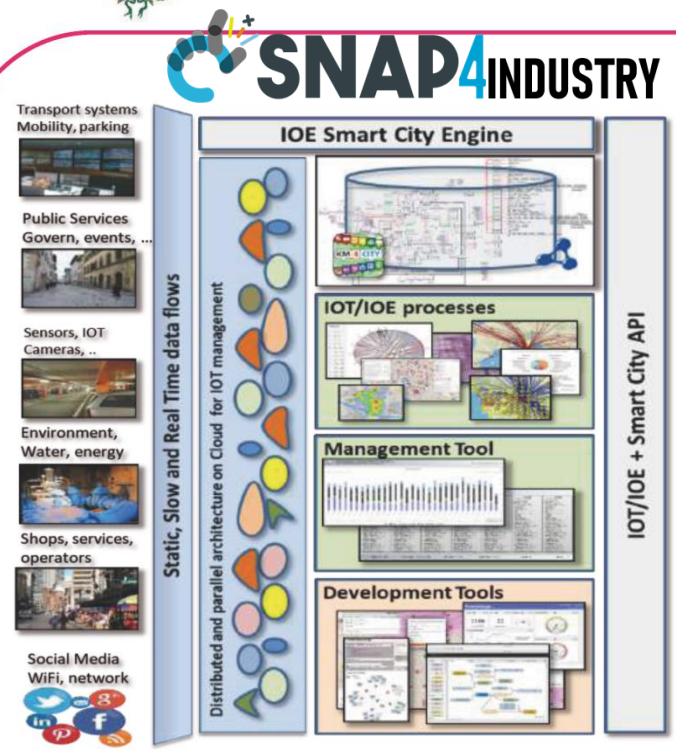
Partners:

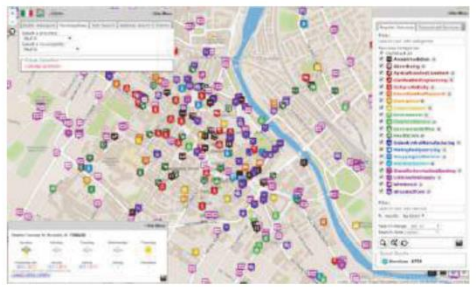


SENSORI E IOT - PRATO

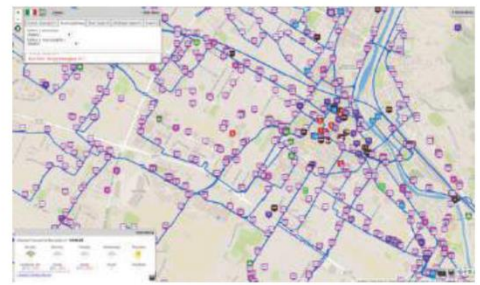
Piattaforma IoT/IoE abilitata dal 5G per applicazioni di:

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





Punti di interesse e servizi su Prato

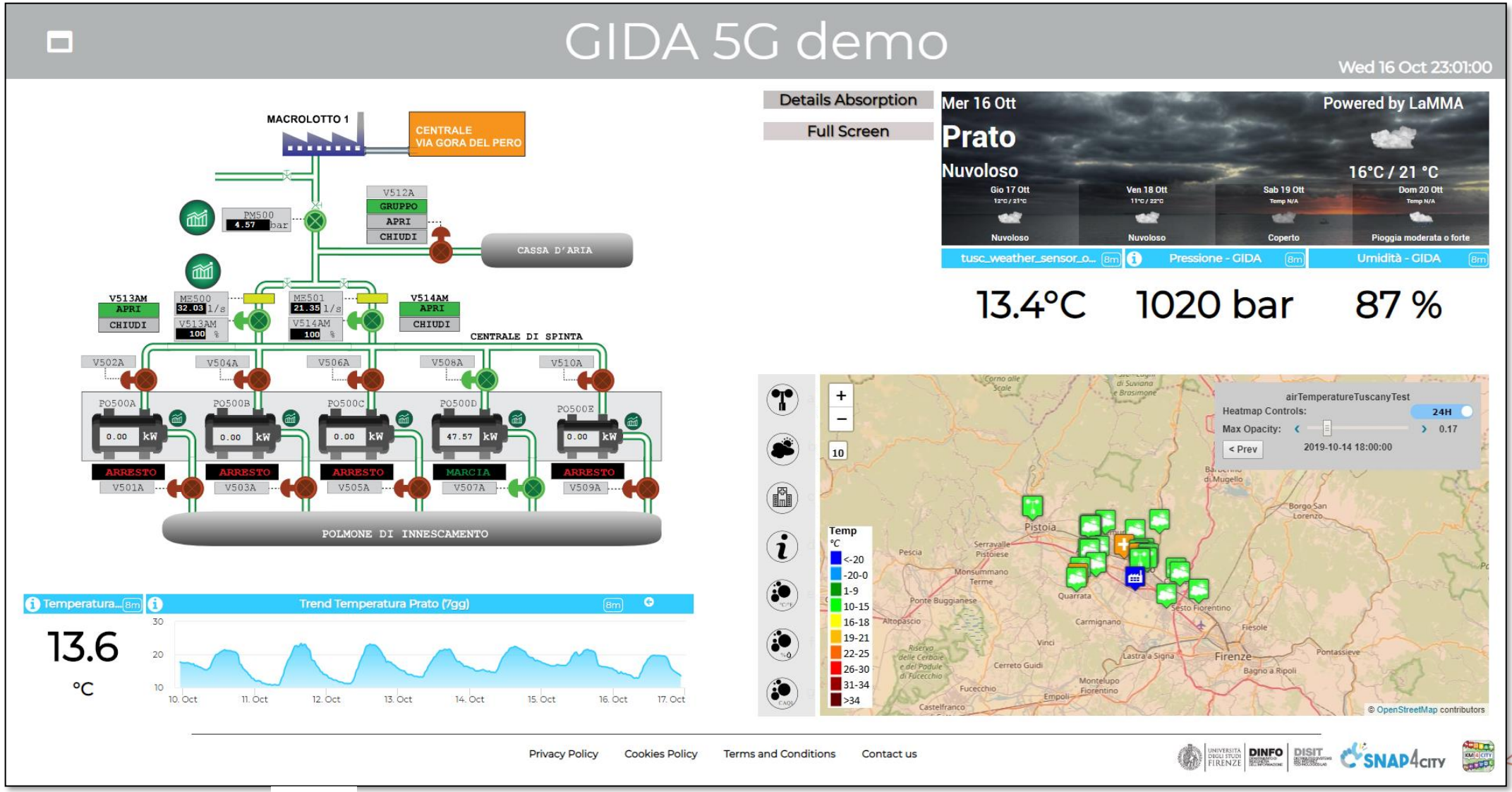


Use Case LEADER estra

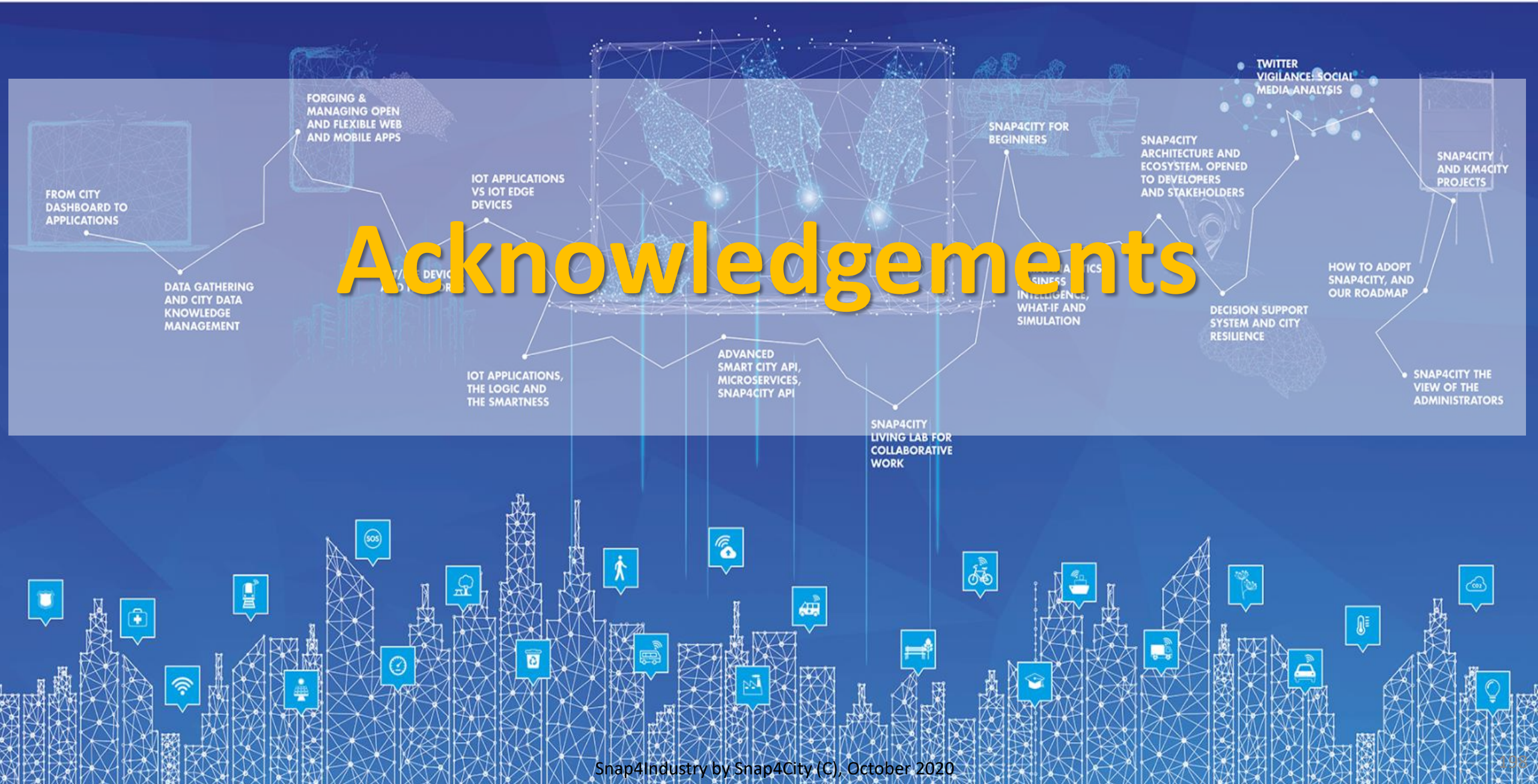
Partner coinvolti open fiber, ZTE Leading 5G Innovations, Università degli Studi Firenze, cellnex driving telecom connectivity, SSE Sirio Sistemi Elettronici, PIN - Polo Universitario Città di Prato

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

Dashboards & Services:



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



Acknowledgements

Main running instances

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

Acknowledgements

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

SNAP4INDUSTRY

KM 4 CITY

Be smart in a SNAP!

SNAP4
Appliances and Dockers
Installations

CONTACT

DISIT Lab, DINFO: Department of Information Engineering
Università degli Studi di Firenze - School of Engineering

Via S. Marta, 3 - 50139 Firenze, ITALY
https://www.disit.org

www.snap4city.org

Email: snap4city@disit.org

Office: +39-055-2758-515 / 517
Cell: +39-335-566-86-74
Fax.: +39-055-2758570

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