UNIVERSITÀ DEGLI STUDI FIRENZE

DINFO
DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

DISIT
DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

Distributed Data Intelligence and Technologies Lab
Distributed Systems and Internet Technologies Lab

Paolo Nesi

Department of Information Engineering, DINFO

University of Florence

Via S. Marta 3, 50139, Firenze, Italy

tel: +39-055-2758515, fax: +39-055-2758570

http://www.disit.dinfo.unifi.it/ , https://www.snap4city.org

paolo.nesi@unifi.it , http://www.disit.dinfo.unifi.it/nesi/

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

http://www.disit.org

http://www.disit.dinfo.unifi.it

https://www.disit.org

https://www.Snap4City.org

Corsi di docenti afferenti al Disit

- Corsi triennale e magistrale
  - **Big Data Architecture** – Prof. Paolo Nesi (Big Data, Architecture, Cloud, IoT)
  - **Knowledge Engineering and Security-** Prof. Pierfrancesco Bellini
  - **Sistemi Distribuiti** – Prof. Paolo Nesi
  - **Sistemi Operativi** – Prof. Pierfrancesco Bellini
  - Fondamenti di Informatica per Ingegneria Gestionale – Michela Paolucci
  - Fondamenti di Informatica per Infermieristica – Gianni Pantaleo
- Altri corsi:
  - Master in Big Data-Mabida: architetture, Big Data, Knowledge engineering, Natural Language Processing, cloud, etc. (P. Nesi, G. Pantaleo, P. Bellini, D. Cenni, M. Paolucci)
  - Master in Industria 4.0 (PISA): Big data Analytics (P. Nesi)
  - Data Intelligence – Corso di Intelligence e Sicurezza Nazionale – Prof. Paolo Nesi

UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB
http://www.disit.org

http://www.disit.dinfo.unifi.it

Distributed Systems and Internet Technologies Lab
Distributed Data Intelligence and Technologies Lab
Department of Information Engineering (DINFO)
University of Florence

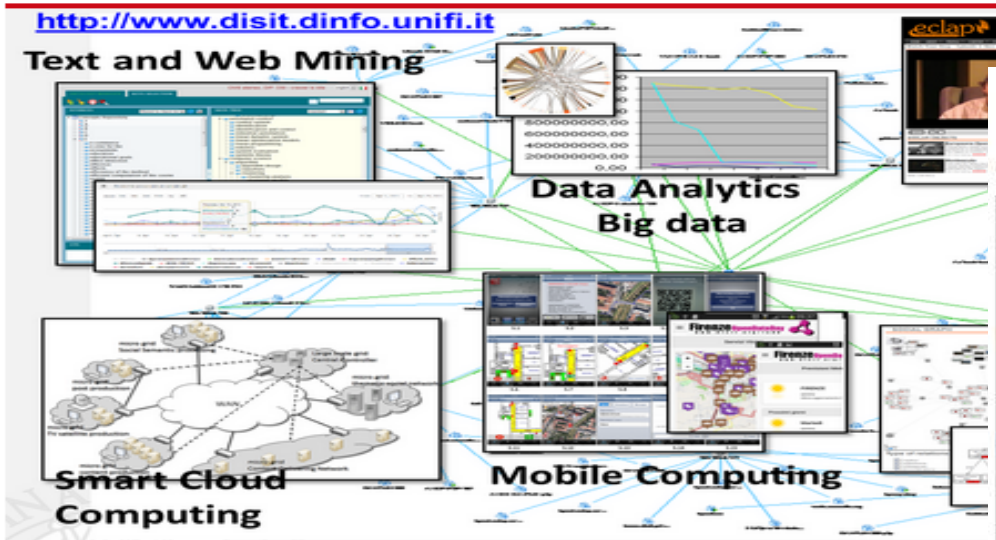
http://www.disit.dinfo.unifi.it

qualsiasi tipo | deep search

HOME | ABOUT | RESEARCH | INNOVATION | CORSI E TESI | COME FARE | EVENTI | MIO PROFILO | root | Uscire

Mostra | Modifica | Log | Translate | Devel

DISIT LAB OVERVIEW



DISIT lab and research group is active since 1994. It is one of the most active ICT labs of the University of Florence, metropolitan Tuscany area. DIS successfully developed a relevant number of International and National

performing activities of dissemination and assessment. DISIT has received a relevant number of awards and is directly involved into top level internationa conferences, advisory boards, and committees.

DISIT research areas: big data, artificial intelligence, natural language

CONTENUTI

- *Ultime Attività*
- *In primo piano*

https://www.snap4city.org/577

SNAP4CITY

On Line Training Material (free of charge)

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

Snap4City (C), January 2021

https://www.disit.org

Con chi lavoriamo

UNIVERSITÀ DEGLI STUDI FIRENZE

DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

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

Some DISIT Projects

MobiMart: mobility in the mediterraneous

Herit-Data: Tourism and Mng. https://herit-data.interreg-med.eu/

Snap4City: IOT/IOE smart city www.snap4city.org

Trafair: CEF project with several Cities http://trafair.eu/

REPLICATE H2020, SCC1, EC flagship
http://replicate-project.eu/

Feedback: retail and GDO Big Data analytics

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

5G with 3G-Wind, Open Fiber, Estra

ENELX, ISPRA JRC, SODA, WEEE Life, etc…

Mosaic: Mobility and transport model

Km4City: http://www.km4city.org

Coll@bora Social Innovation, MIUR:
http://www.disit.org/5479

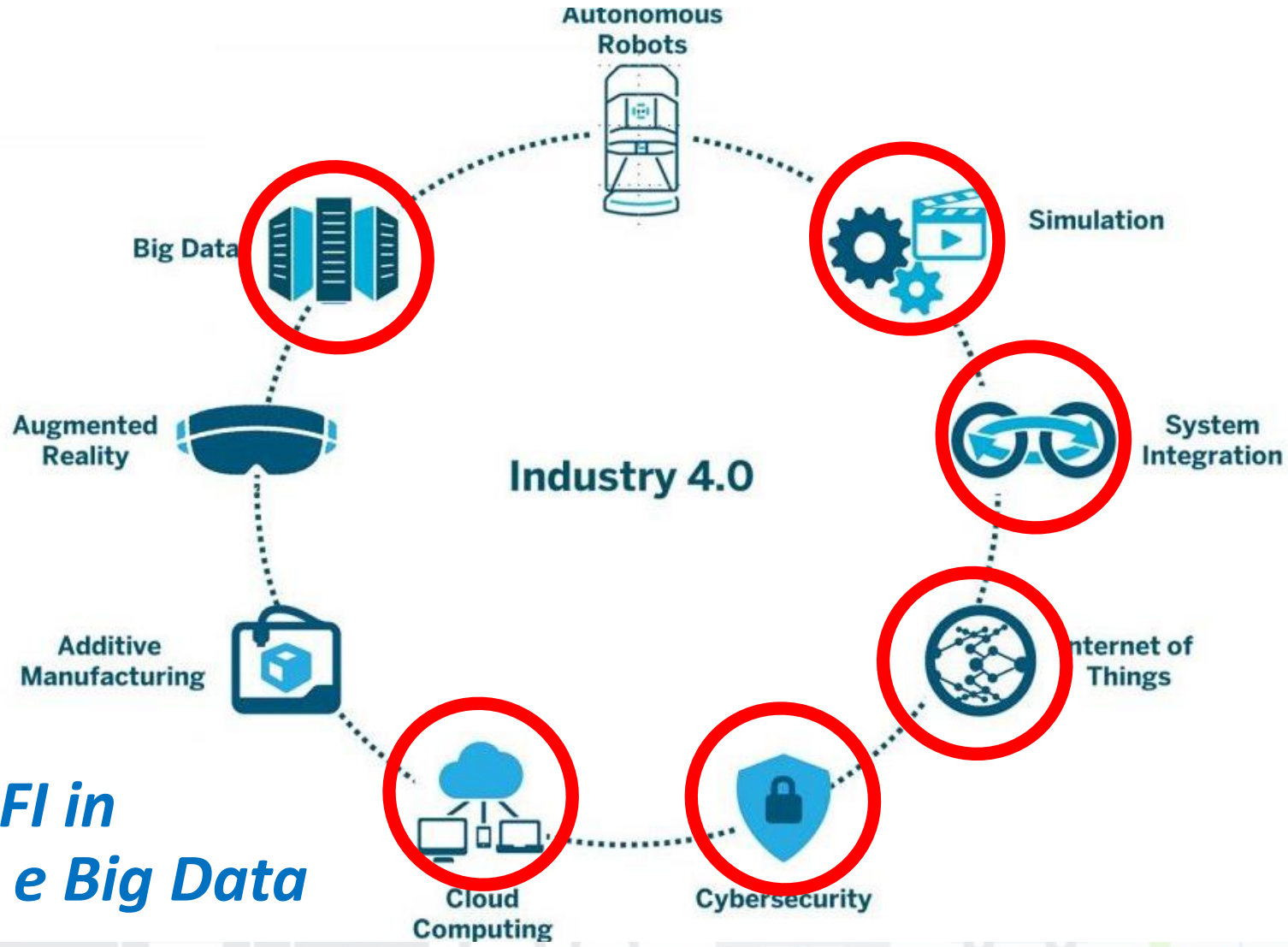
RESOLUTE H2020, EC:
http://www.resolute-eu.org

TRACE-IT, RAISSS, TESYSRAIL, …

Mobile Emergency:

Industria 4.0 vs DISIT Lab

- Big Data
- Cloud Computing
- Cybersecurity
- IOT/IOE
- System Integration
- Simulation
- +
- Data Analytics
- ***P. Nesi è referente per UNIFI in RegioneToscana per Cloud e Big Data***

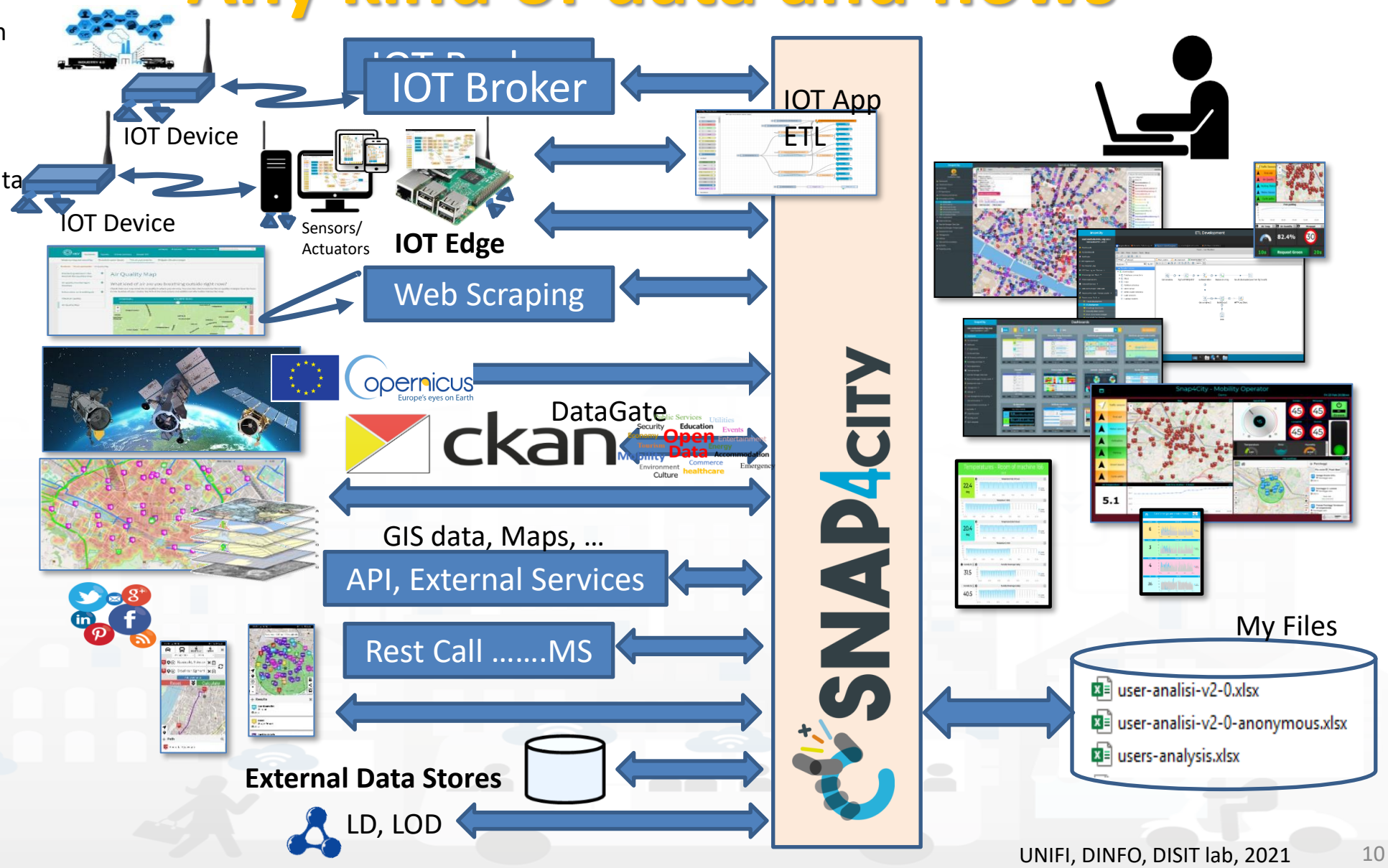


DISIT: Competences

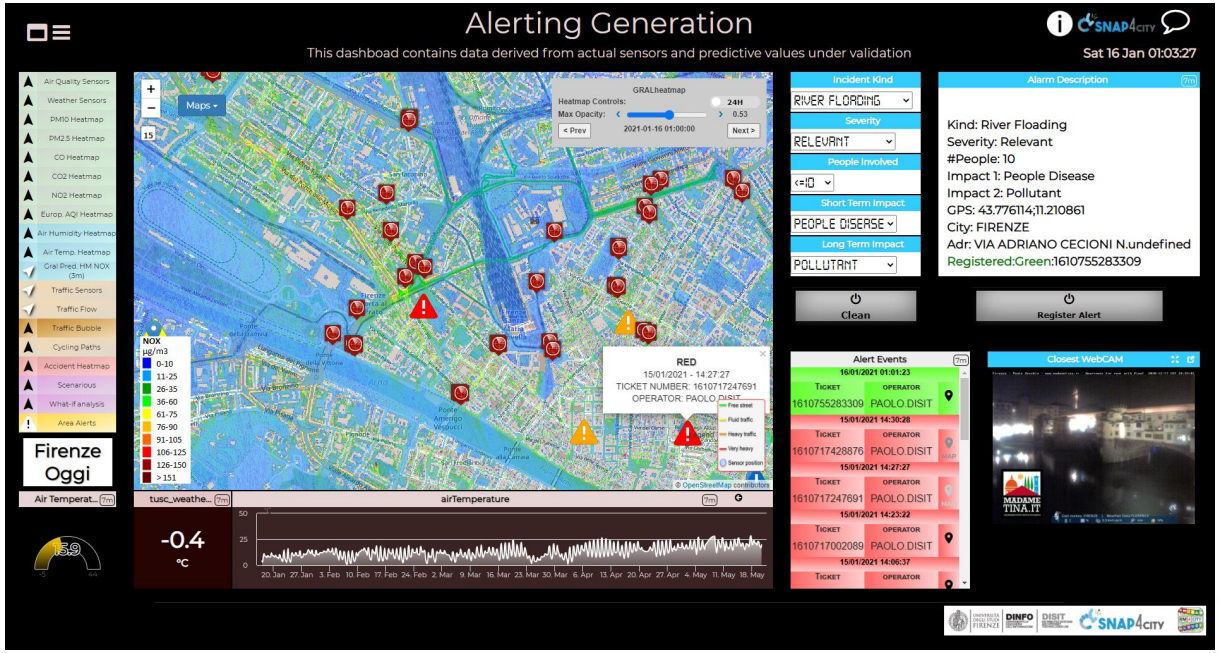
- **Technologies**:
  - **Big Data and Analytics:** data management, user analysis, user engagement, prediction, predictive maintenance, early detection, anomaly detection, data intelligence, What-IF analysis, …
  - **Data Mining:** artificial intelligence, machine learning, natural language processing, semantic computing, semantic reasoner, expert systems, statistic analysis, ..
  - **IOT/IOE:** internet of things/everything, brokers, microservices, ..
  - **Cloud:** smart cloud, cloud simulation, optimization, containers, ..
  - **Mobile Computing:** mobile application, user behavior analysis, ..
  - **NLP and Sentiment Analysis:** response vigilance, interaction, answering, Personal Assistant, NLP, SA, ..
- **See projects on: http://www.disit.org/5501**

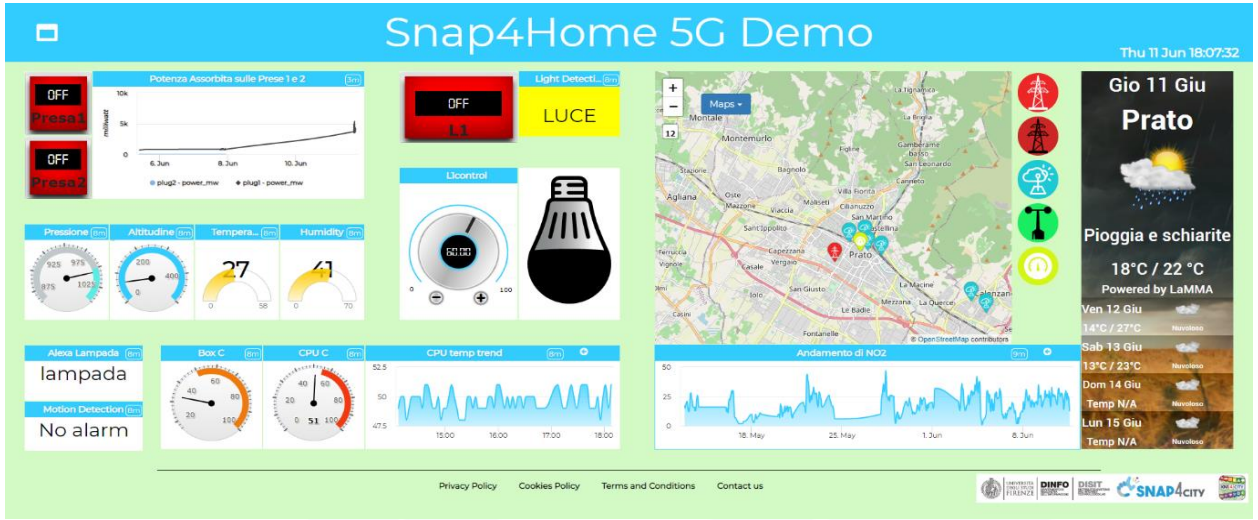
Any kind of data and flows

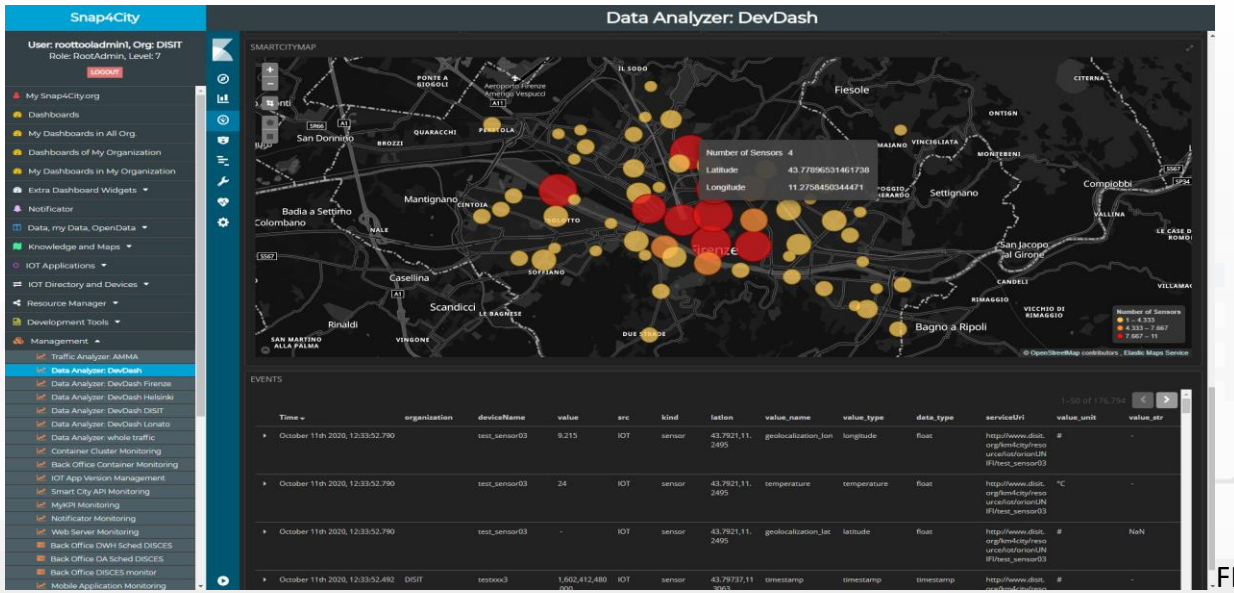
- **Open Data:**
  - Data gate, federation of Open Data Portals
  - IOT App, ETL proc(PULL)
- **IOT Networks:**
  - IOT Application processes, data driven or PULL
  - IOT Brokers (Push) → IOT Shadow
- **Web Pages:**
  - Web scraping, crawling processes
- **Satellite data**
- **Social media: Twitter,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

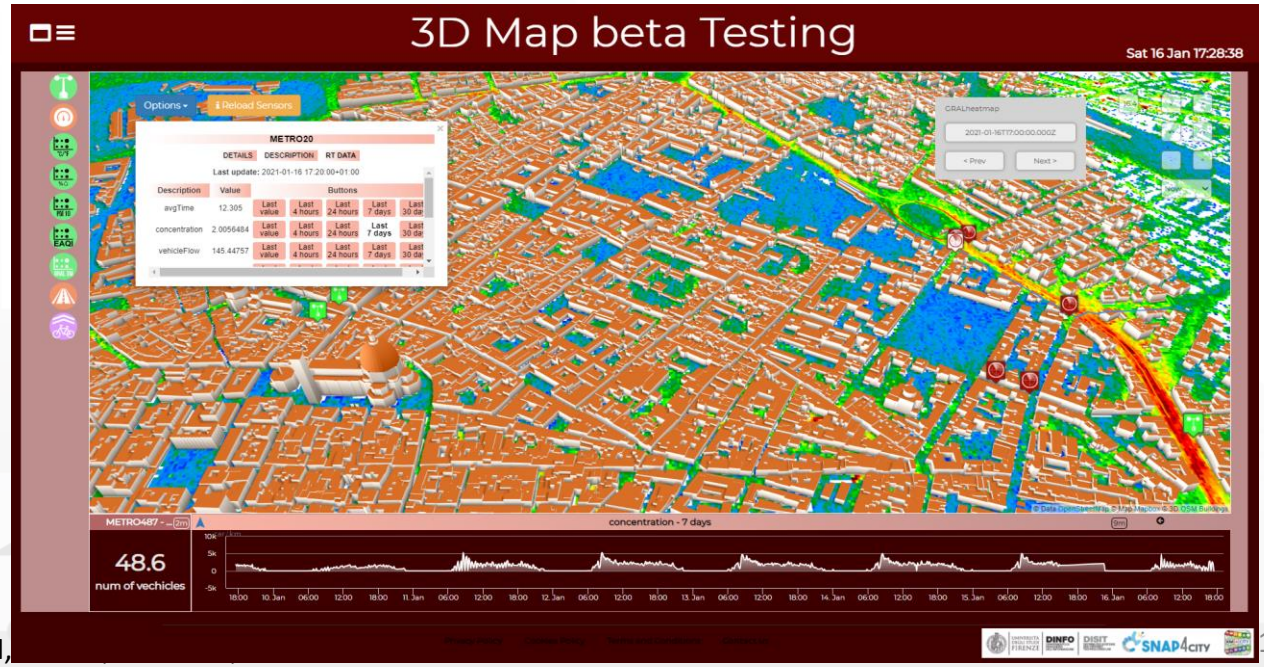


Dashboards

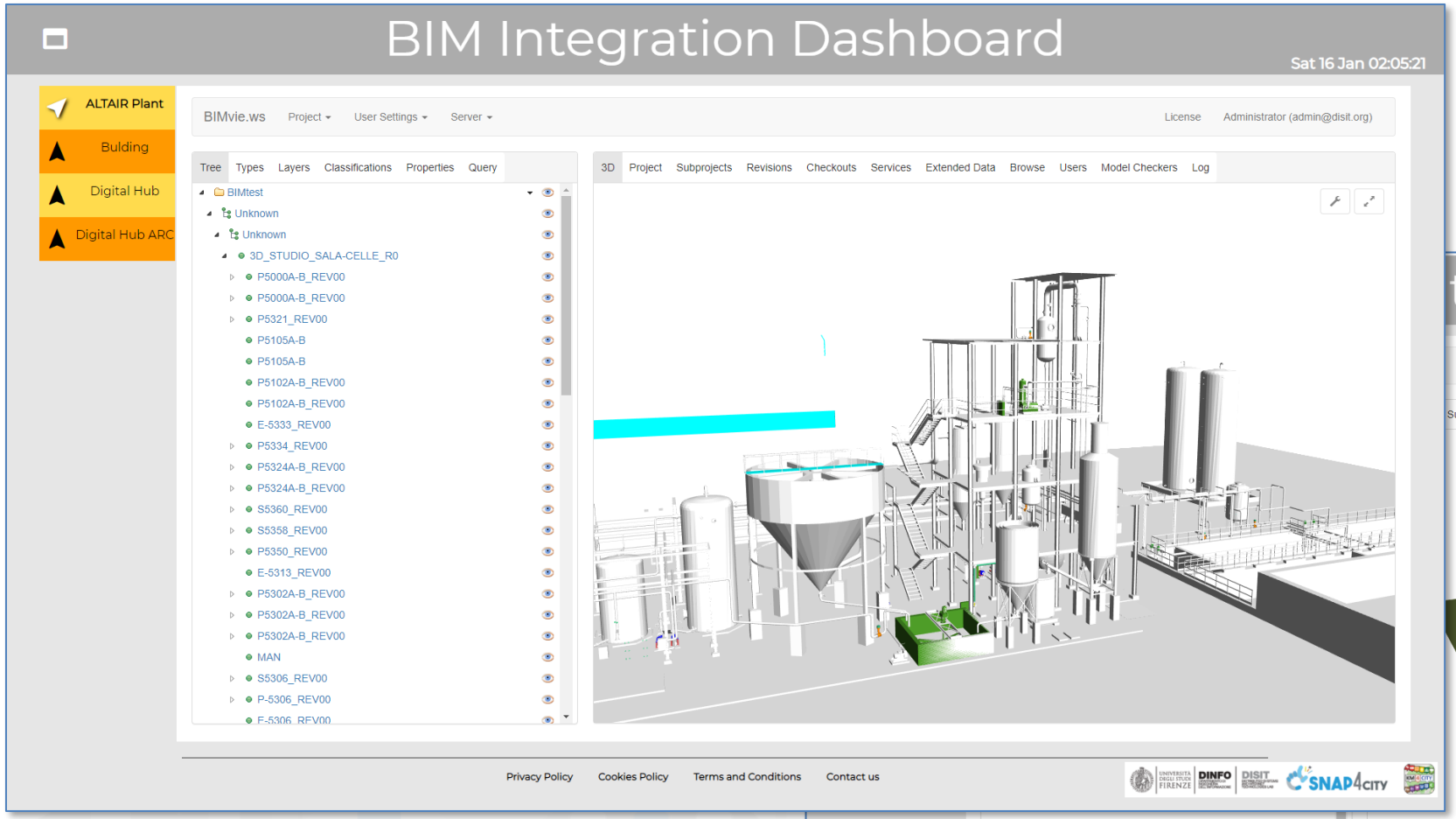

Alerting Generation
This dashboad contains data derived from actual sensors and predictive values under validation
Sat 16 Jan 01:03:27
Incident Kind
RIVER FLOADING
Severity
RELEVANT
People Involved
Short Term Impact
PEOPLE DISEASE
Long Term Impact
POLLUTANT
Alarm Description
Kind: River Floading
Severity: Relevant
#People: 10
Impact 1: People Disease
Impact 2: Pollutant
GPS: 43.776114;11.210861
City: FIRENZE
Adr: VIA ADRIANO CECIONI N.undefined
Registered:Green:1610755283309
Clean
Register Alert
Alert Events
Closest WebCAM
airTemperature
-0.4
Firenze Oggi

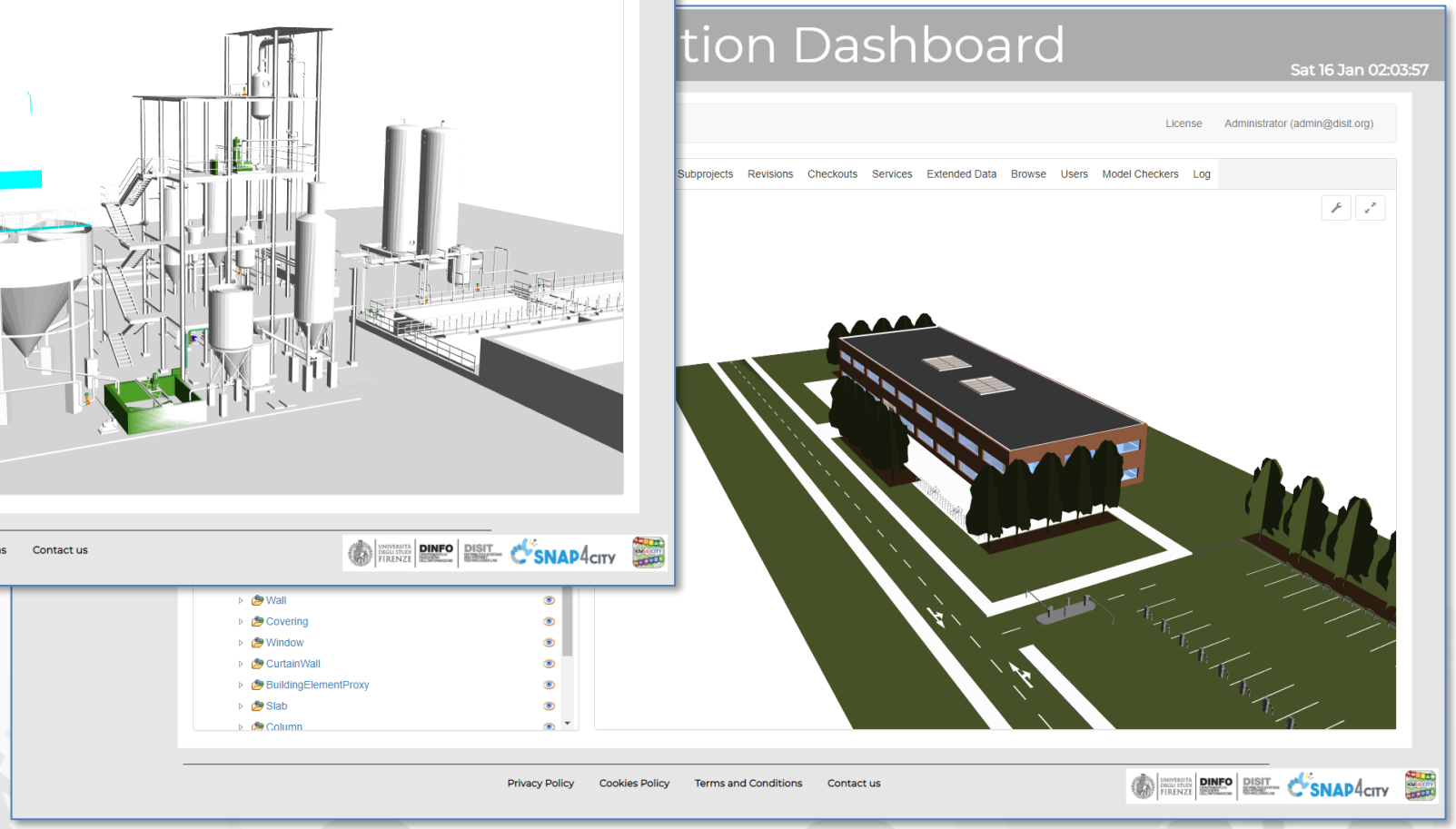

Snap4Home 5G Demo
Thu 11 Jun 18:07:32
Potenza Assorbita sulle Prese 1 e 2
Light Detecti...
LUCE
Pressione
Altitudine
Tempera...
Humidity
Alexa Lampada
lampada
Motion Detection
No alarm
Box C
CPU C
CPU temp trend
Andamento di NO2
Gio 11 Giu
Prato
Pioggia e schiarite
18°C / 22 °C
Powered by LaMMA
Privacy Policy
Cookies Policy
Terms and Conditions
Contact us


Snap4City
Data Analyzer: DevDash
SMARTCITYMAP
EVENTS


3D Map beta Testing
Sat 16 Jan 17:28:38
METRO20
concentration - 7 days
48.6
num of vechicles

BIM Server





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

Smart City Control Room
Florence Metropolitan City

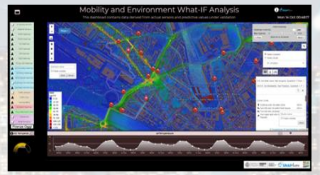
COMUNE DI FIRENZE

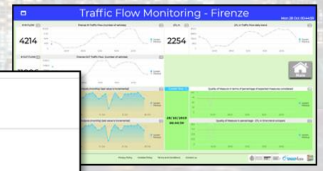
reference

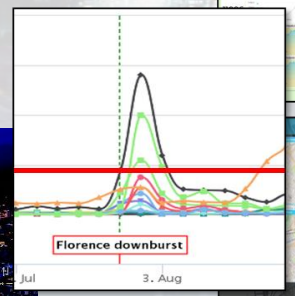
SNAP4CITY

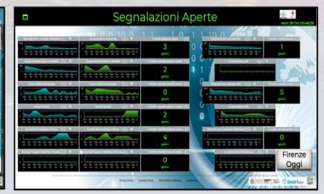
KM 4 CITY

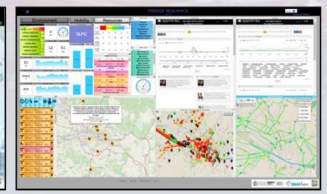
- **Multiple Domain Data**
  - mobility and transport, accidents, public transport, parking, traffic flow, Traffic Reconstruction, …
  - civil protection, gov data, covid-19, social & social media, people flow, tourism, energy, …
- **Multiple dash/tool Levels & Decision Makers**
- **Historical and Real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

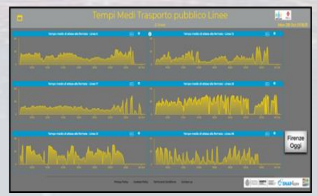












FIRENZE

Tue 16 Oct 16:18:39

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

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

39492 Utenti WiFi

STATI DI ALLERTA 9m

GENERAL | METEO

MINIMO	BASSO	MEDIO	ALTO

RISCHIO IDRAULICO

RISCHIO TEMPORALI

RISCHIO IDROGEOLOGICO

RISCHIO NEVE

RISCHIO GHIACCIO

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

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

TPL

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

COLONNINE RICARICA 9m

180 INSTALLATE

81.1 % ATTIVE

8.9 % IN USO

REPLICATE

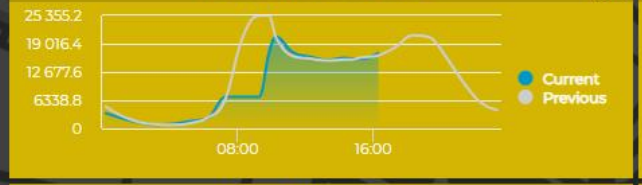
DISIT

FLORENCE DASHBOARD

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

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

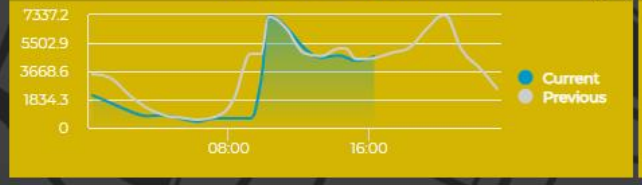
FLUSSI INGRESSO CITTA 9m



TOTALE 9m

141608 VEICOLI

FLUSSI INGRESSO ZTL 9m



TOTALE ZTL 9m

41146 VEICOLI

SITUAZIONE VIABILITA 54s

4 INCIDENTI

0 CHIUSURE AL TRAFFICO (TOT)

0 CHIUSURE PER CANTIERI

0 PROGR. | 0 NON PROG.

0 LIMITAZIONI AL TRAFFICO (TOT)

0 LIMITAZIONI PER CANTIERI

0 NON PROG. | 0 PROGR.

4 TOT. EVENTI SULLA RETE

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

STATO TRIAGE CAREGGI 9m

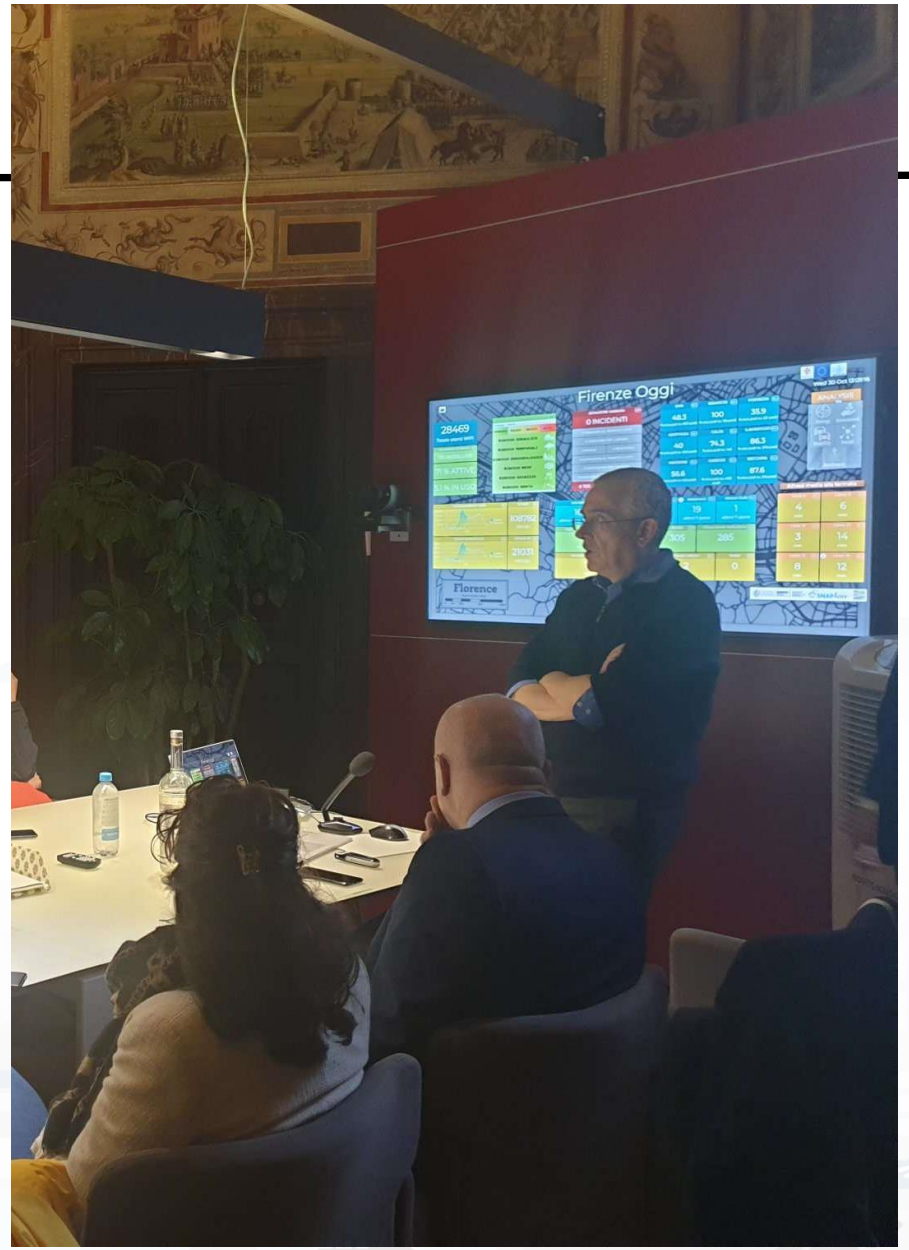
Red code	Yellow code	Green code	Blue code	White code
3	12	83	37	9

MAPPA

Energy | Environment | Mobility | Social | Resilience

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

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



g from
2020
ramme
691735

FIRENZE
CITTÀ FARO

Replicate Project @ReplicateEU · Oct 30

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

UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB | SNAP4CITY | KM4CITY

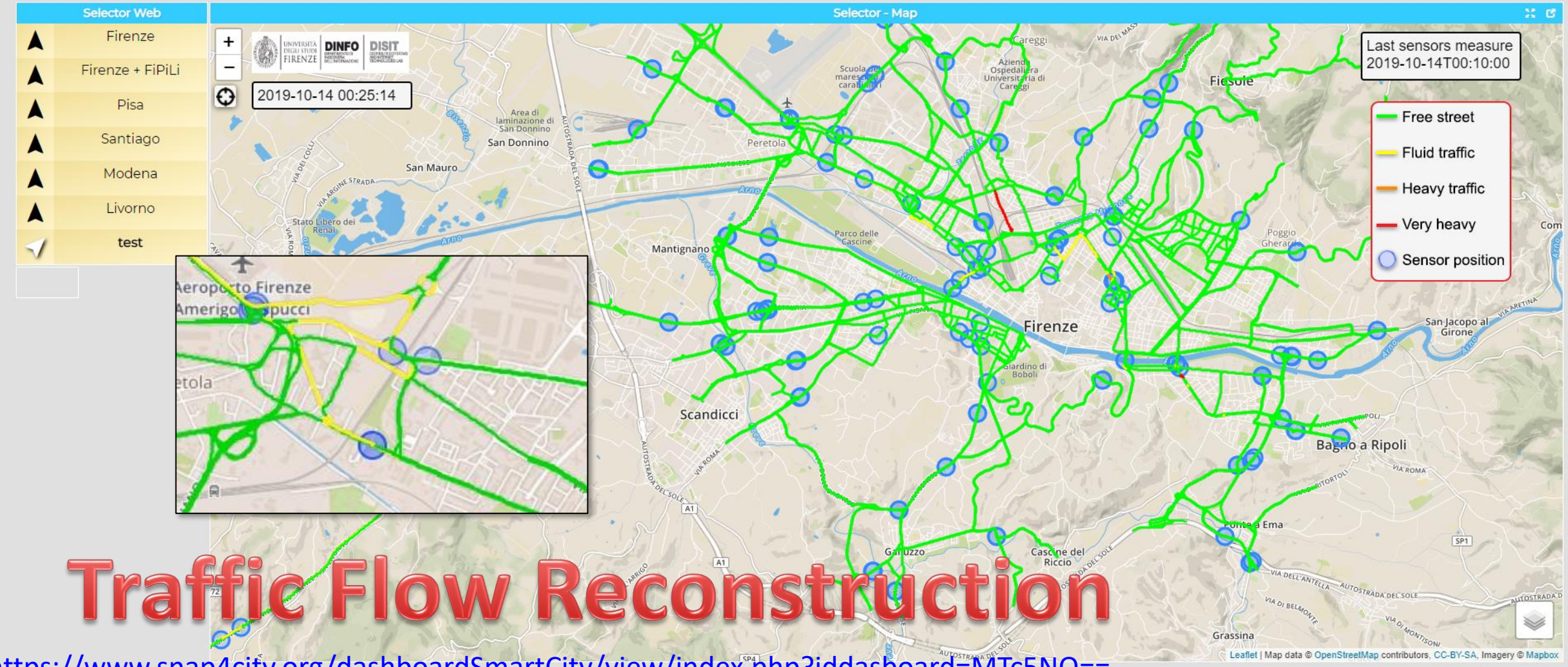
Mobility and Transport Traffic Flow Analysis

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

reference

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

Traffic Flow Reconstruction for the cities



Traffic Flow Reconstruction

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

UNIVERSITÀ DEGLI STUDI FIRENZE
DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE
DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB
http://www.disit.org

Sii-Mobility

http://www.Sii-Mobility.org

MIUR MINISTERO DELL'ISTRUZIONE DELL'UNIVERSITÀ E DELLA RICERCA

KM 4 CITY

Commenti dei cittadini, Social Media

AVM trasporto Pubblico

Merci

Sensori su trasporto Privato

Sensori, sistema monitoraggio

Sensori Parcheggi

UTC

Infomobility

Varchi Telematici, ZTL

Monitoraggio traffico, autostrade

Rete Ferroviaria

Parametri ambientali

Servizi ed enti

Ordinanze: eventi, lavori pubblici, ..

Emergenze, polizia, 118

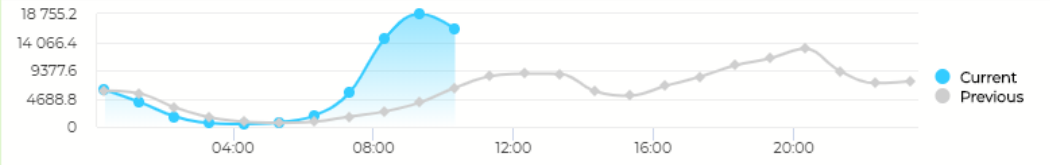
Traffic Flow Monitoring - Firenze - Cloned2

Mon 27 Jul 10:42:17

 # IN FLOW 9m

16219 #ofvehicles

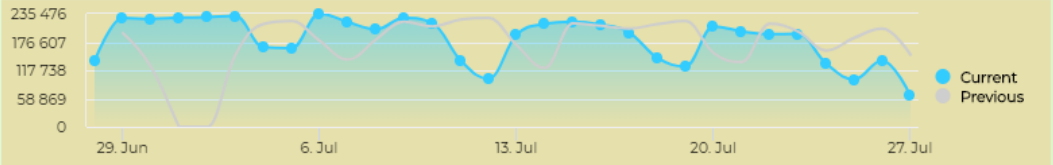
Firenze IN Traffic Flow (number of vehicles) 9m



Inc Daily Inp... 9m

65025 #ofvehicles

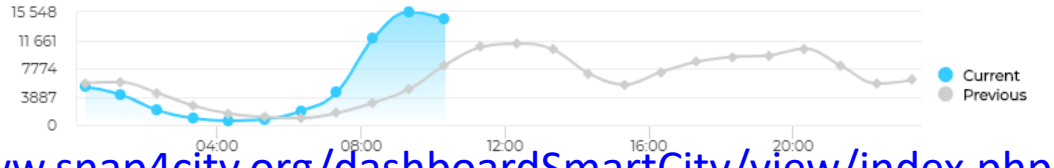
Daily Inputs (monthly) (last value is incremental, real time) 9m



 # OUT FLOW 9m

14510 #ofvehicles

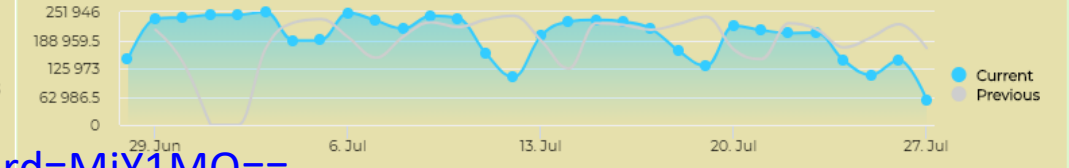
Firenze OUT Traffic Flow (number of vehicles) 9m



Inc Daily Out... 9m

56810 #ofvehicles

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

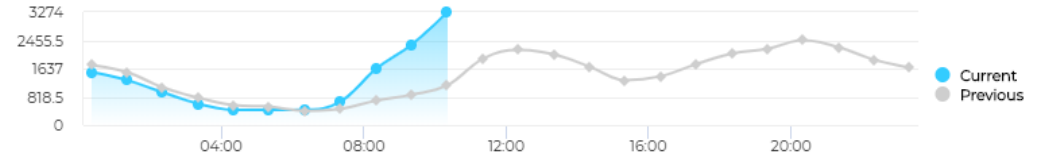


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjY1MQ==

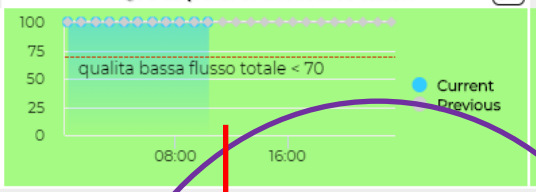
ZTL in 9m

3274 #ofvehicles

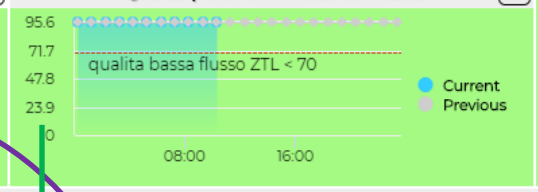
ZTL in Traffic Flow daily trend, entering in ZTL 9m



QoS as perc. of measures taken 9m



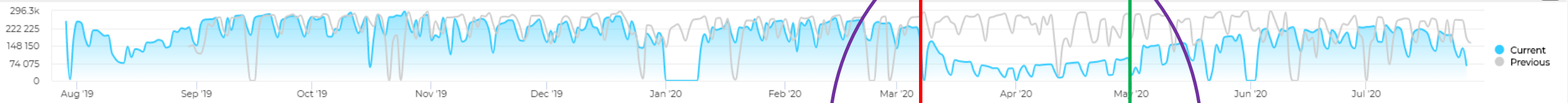
QoS as perc. of measures in ZTL 9m



27/07/2020

10:42:17

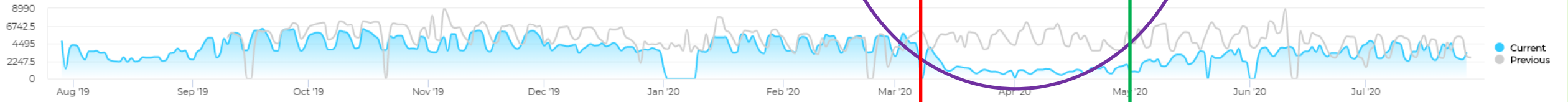
inflow total of the day, yearly 9m

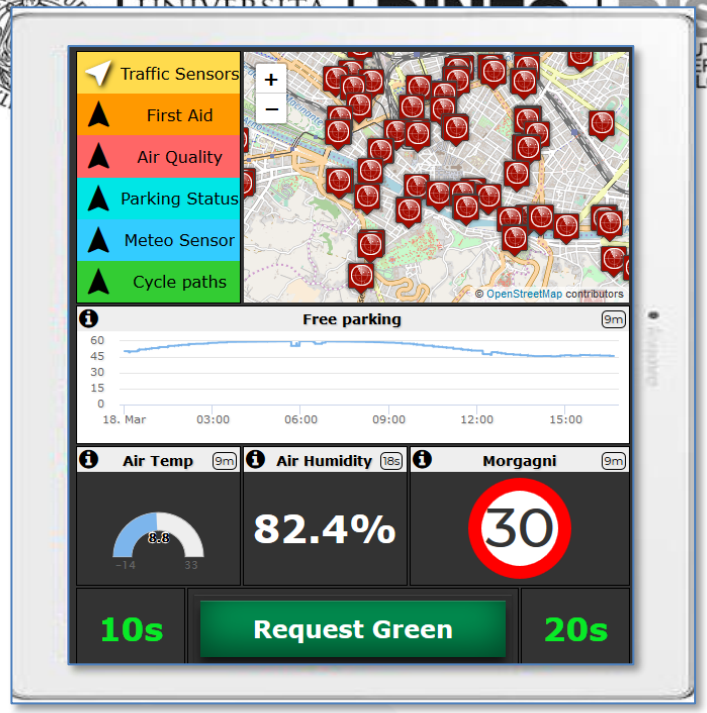


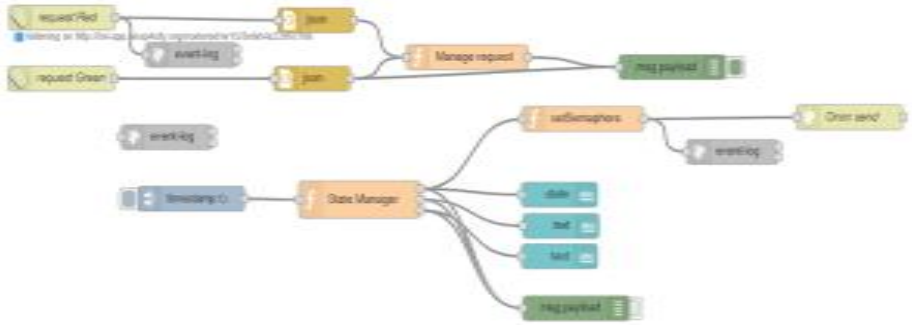
outflow total over the day Yearly 9m

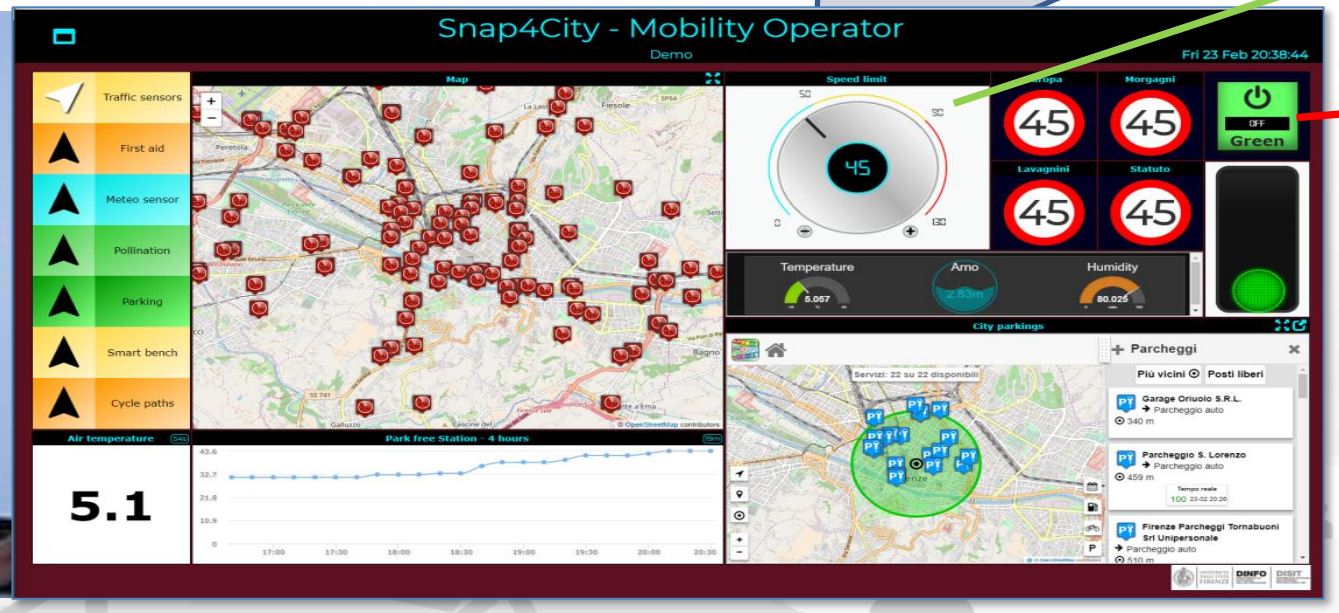
COVID-19 time

in ZTL yearly compare 9m




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
82.4%
Morgagni
9m
30
10s
Request Green
20s



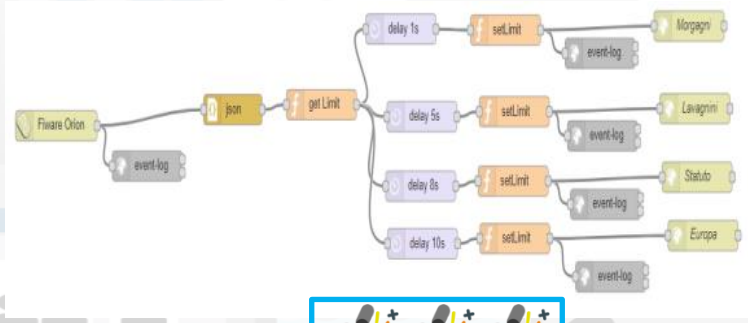

Snap4City - Mobility Operator
Demo
Fri 23 Feb 20:38:44
Traffic sensors
First aid
Meteo sensor
Pollination
Parking
Smart bench
Cycle paths
Map
Speed limit
45
Europa
45
Morgagni
45
Lavagnini
45
Statuto
45
OFF
Green
Temperature
6.057
Arno
Humidity
80.025
City parkings
Parcheggi
Più vicini
Posti liberi
Garage Oriuolo S.R.L.
Parcheggio S. Lorenzo
Firenze Parcheggi Tornabuoni Srl Unipersonale
Air temperature
5.1
Park free Station - 4 hours


30


30

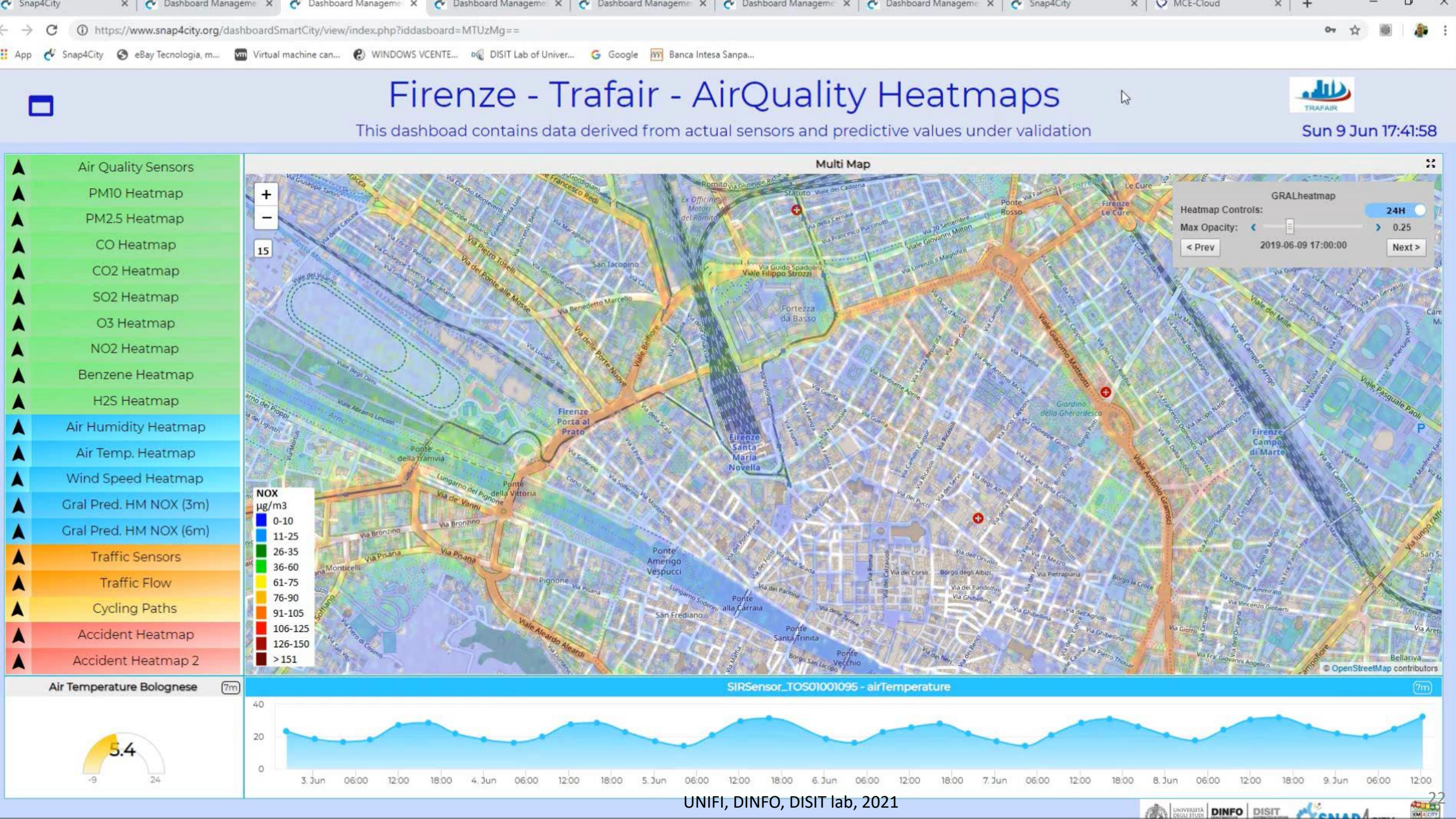

30


30


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

Alert Registration

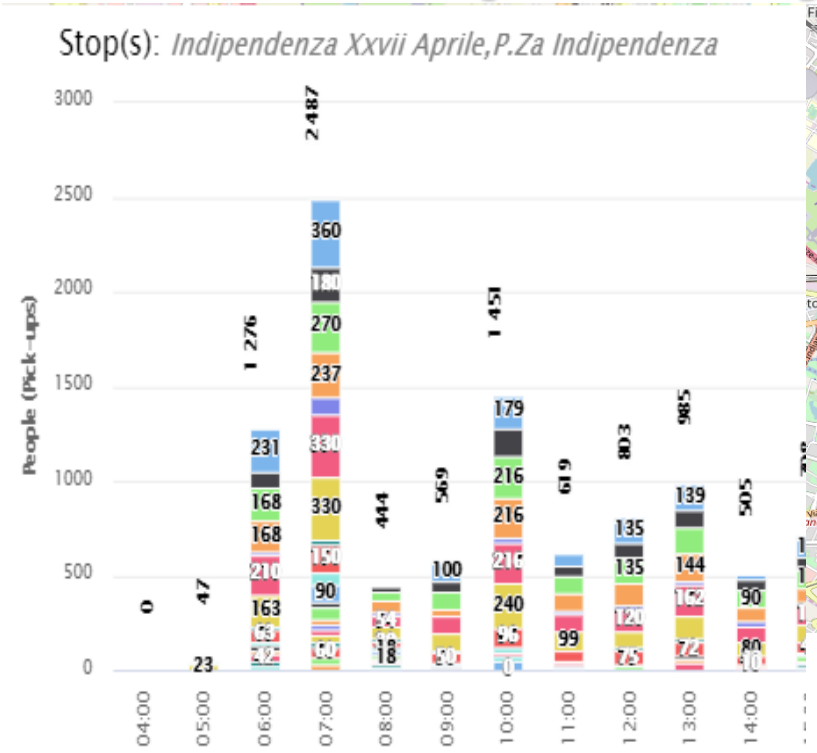
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzA0OQ==

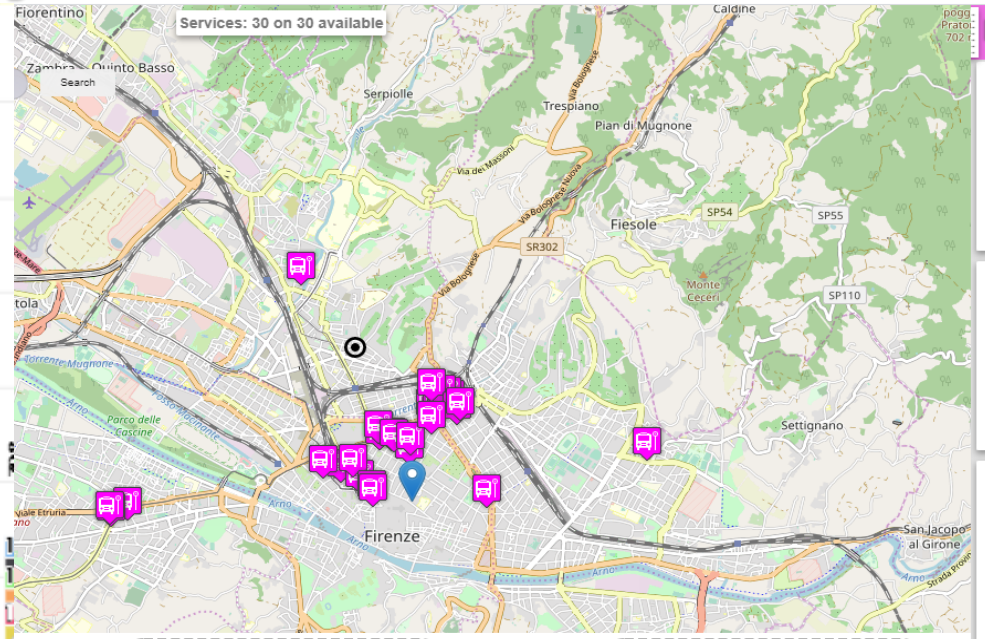

Firenze - Trafair - AirQuality Heatmaps
This dashboad contains data derived from actual sensors and predictive values under validation
Sun 9 Jun 17:41:58
Air Quality Sensors
PM10 Heatmap
PM2.5 Heatmap
CO Heatmap
CO2 Heatmap
SO2 Heatmap
O3 Heatmap
NO2 Heatmap
Benzene Heatmap
H2S Heatmap
Air Humidity Heatmap
Air Temp. Heatmap
Wind Speed Heatmap
Gral Pred. HM NOX (3m)
Gral Pred. HM NOX (6m)
Traffic Sensors
Traffic Flow
Cycling Paths
Accident Heatmap
Accident Heatmap 2
Multi Map
GRALheatmap
Heatmap Controls:
24H
Max Opacity:
0.25
< Prev
2019-06-09 17:00:00
Next >
NOX
µg/m3
0-10
11-25
26-35
36-60
61-75
76-90
91-105
106-125
126-150
>151
© OpenStreetMap contributors
Air Temperature Bolognese
7m
5.4
-9
24
SIRSensor_TOS01001095 - airTemperature
7m
40
20
0
3. Jun
06:00
12:00
18:00
4. Jun
06:00
12:00
18:00
5. Jun
06:00
12:00
18:00
6. Jun
06:00
12:00
18:00
7. Jun
06:00
12:00
18:00
8. Jun
06:00
12:00
18:00
9. Jun
06:00
12:00

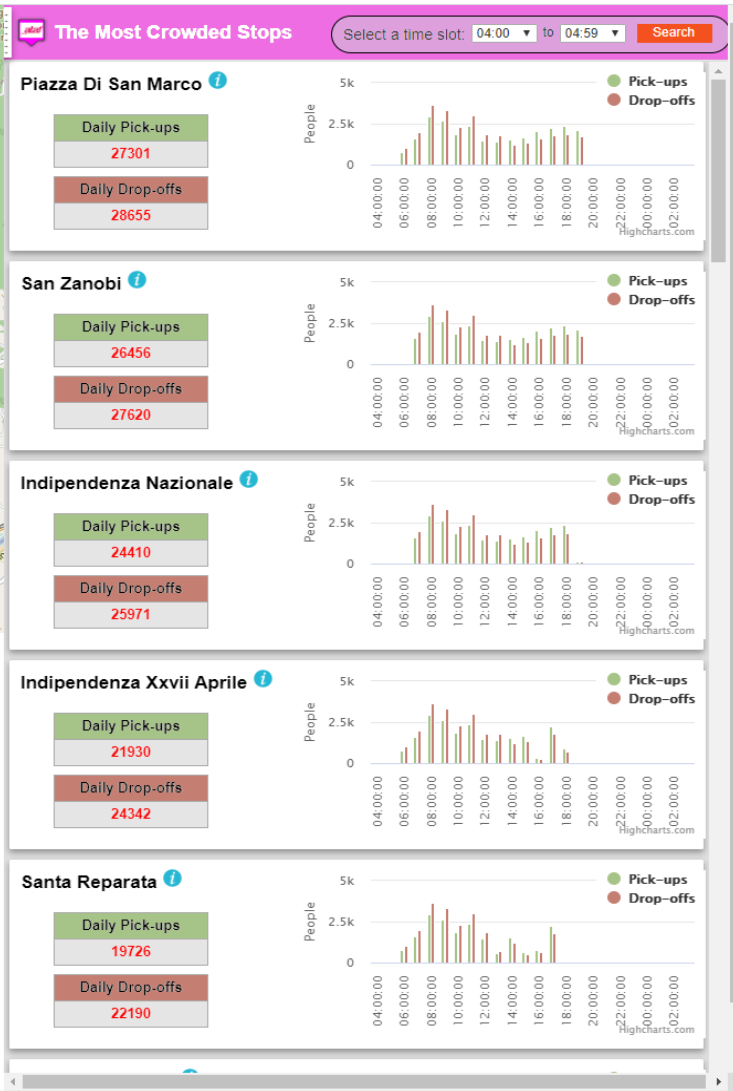
UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

SNAP4CITY | KM4CITY

Bus Stop Analysis: identification of criticalities



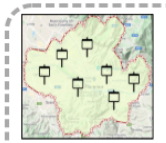


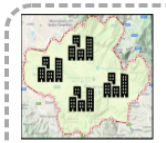



Daily individual Production Trips

> 52900
Daily Individual Attraction Trips


21289
Daily bus trips

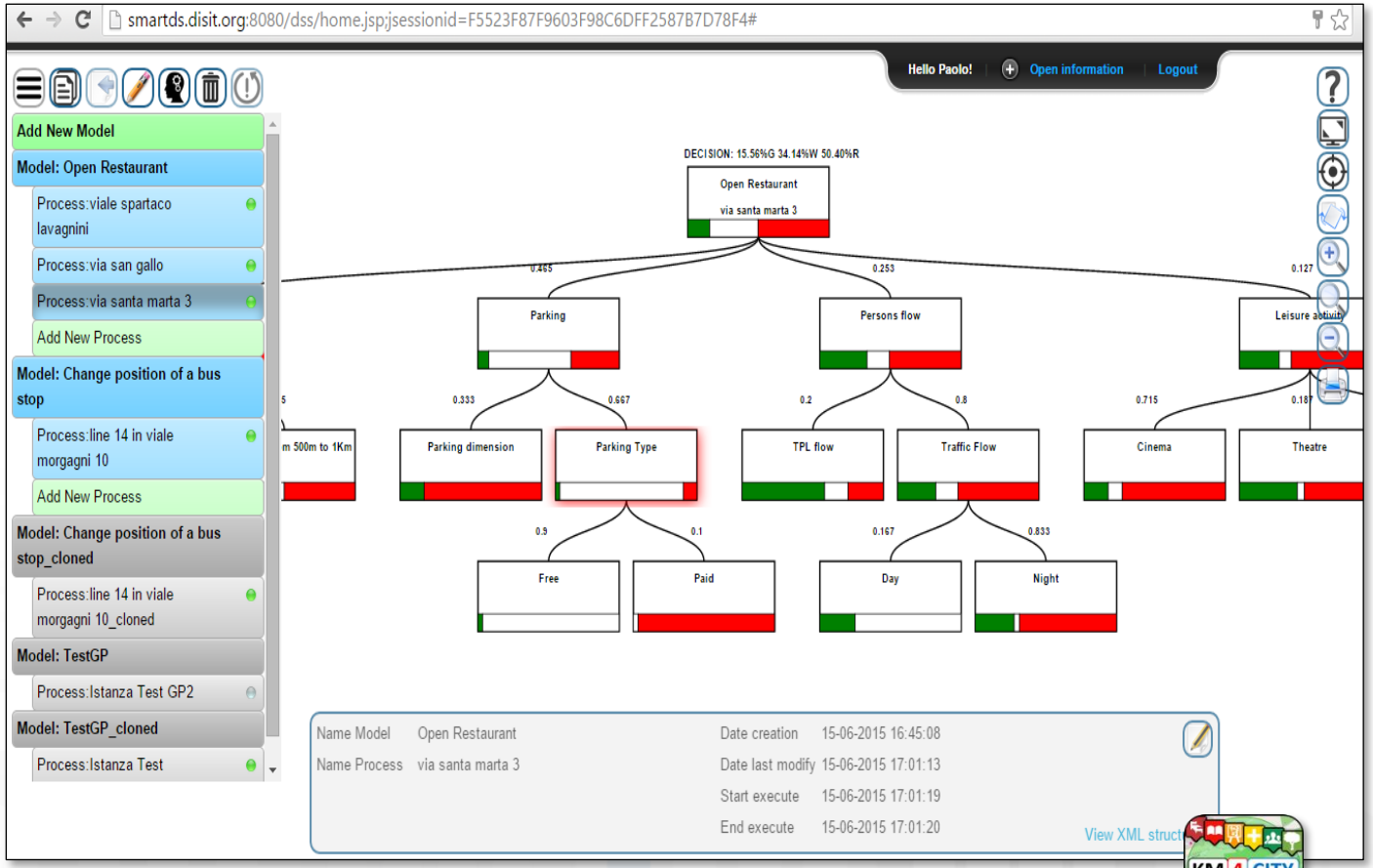

1875
Bus Stops


31070
Residential Buildings


31059
Service Providers

Smart Decision Support , system thinking

- **Smart Decision Support System** based on System Thinking plus
- Actions to city reaction, resilience, smartness, …
- Enforcing Mathematical model for propagation of decision confidence..
- Collaborative work, …
- Processes connected to city data: DB, RDF Store, Twitter, etc.
- Production of alerts/alarms
- Data analytics process
- Twitter Processes
- reuse, copy past, …

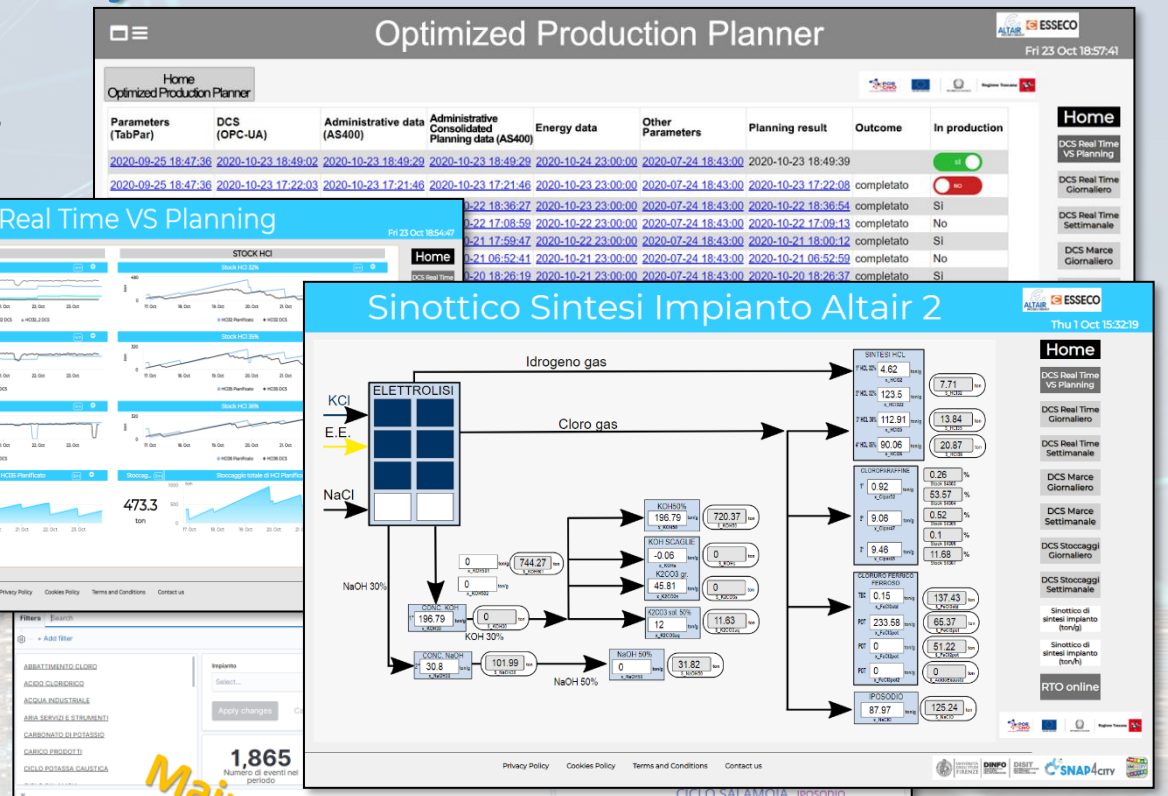


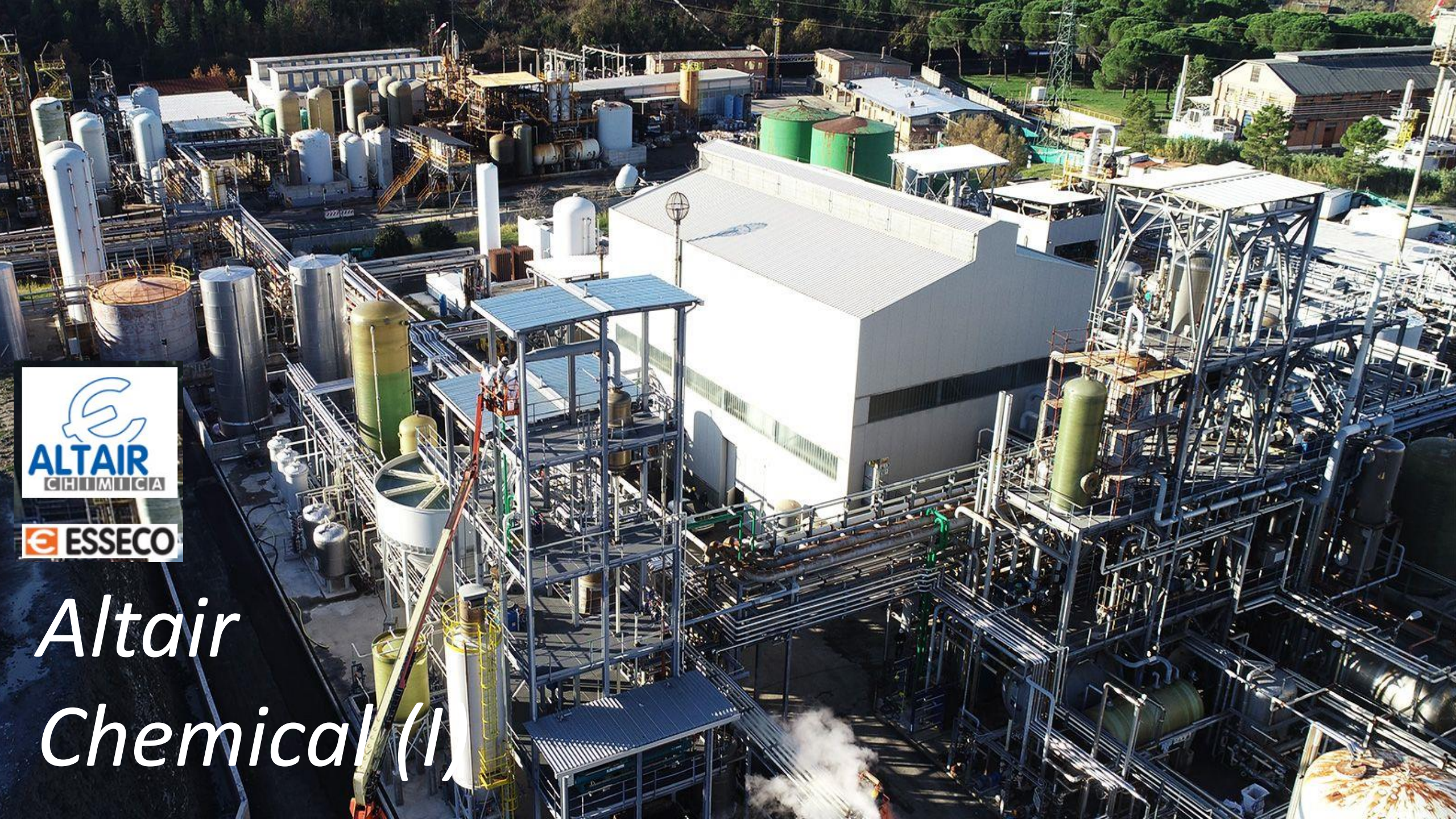
http://smartds.km4city.org

Snap4Altair Decision Support supervision and control, Industry 4.0

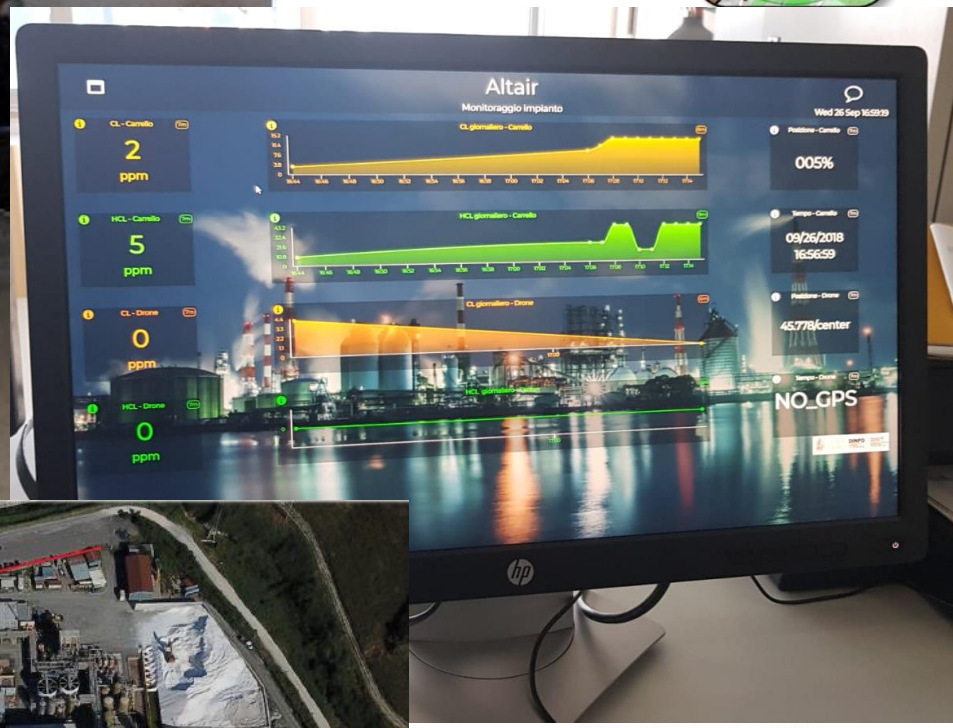
reference

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





Altair Chemical (I)



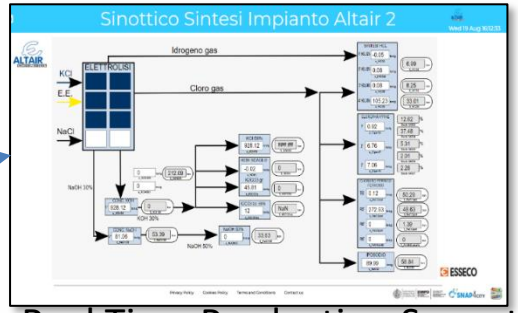
Green Impact Capacity (GIC)

Altair Control room

Green Impact Capacity (GIC)

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

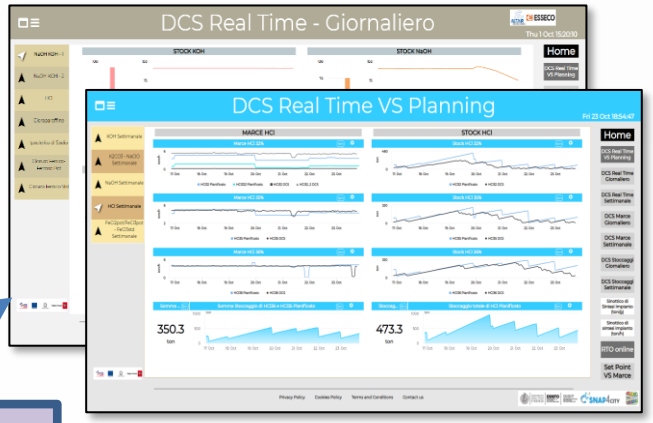
Plant Status



Real Time Production Synoptic

Production Plan

Production vs Planning



AS400

Orders

Energy Service

Transportation

Other Costs

Data Ingestion

Data Storage

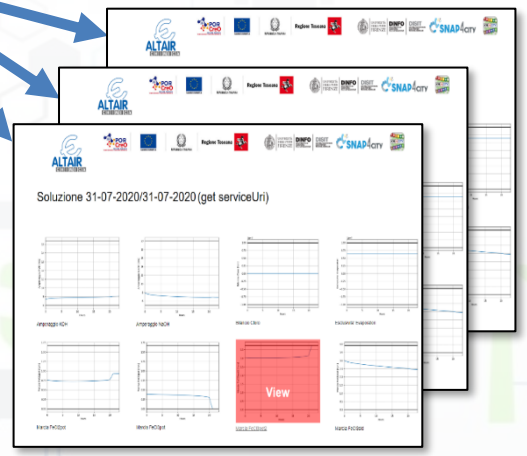
Decision Support

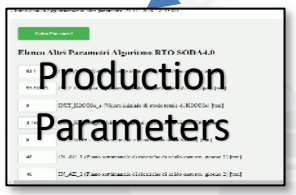
Production Plant Management

Optimized Production Planner

Possible Plan

Possible Plans





Plant Management

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...

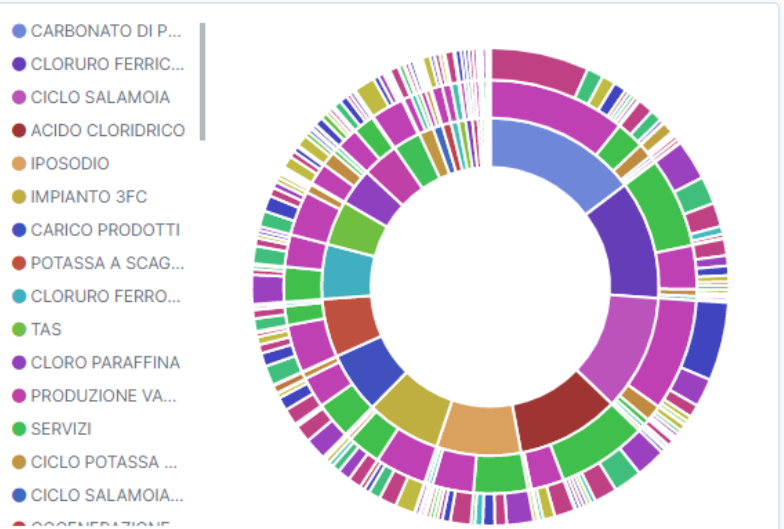
Apply changes | Cancel changes | Clear form

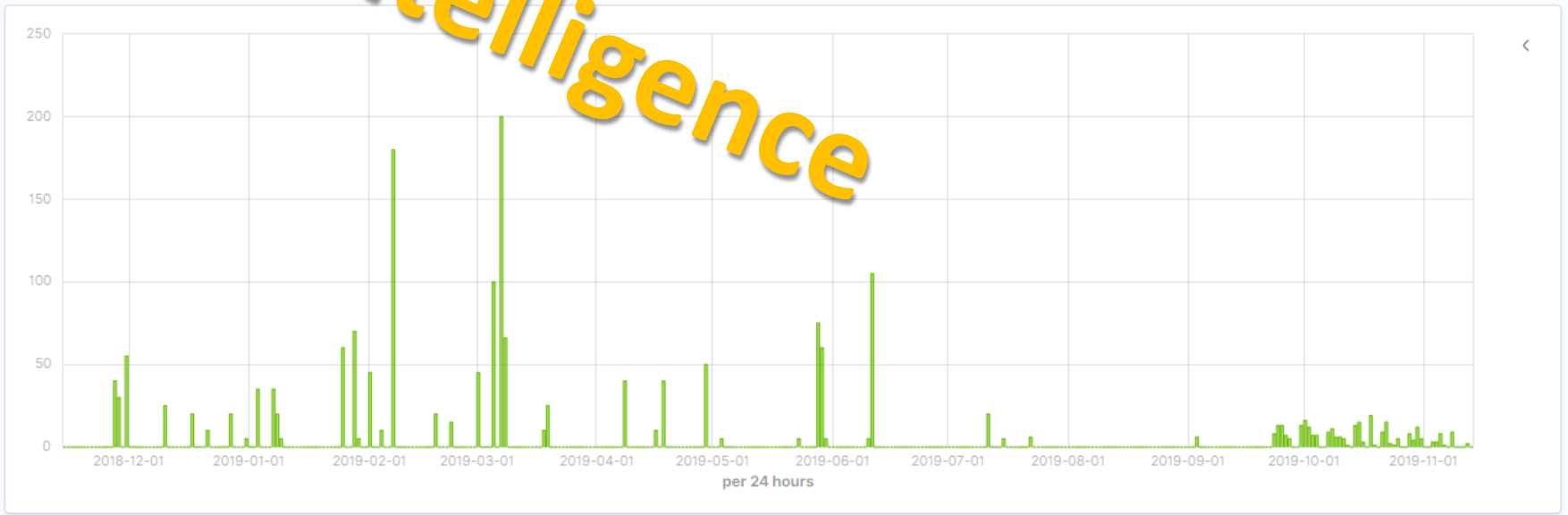
1,865
Numero di eventi nel periodo

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



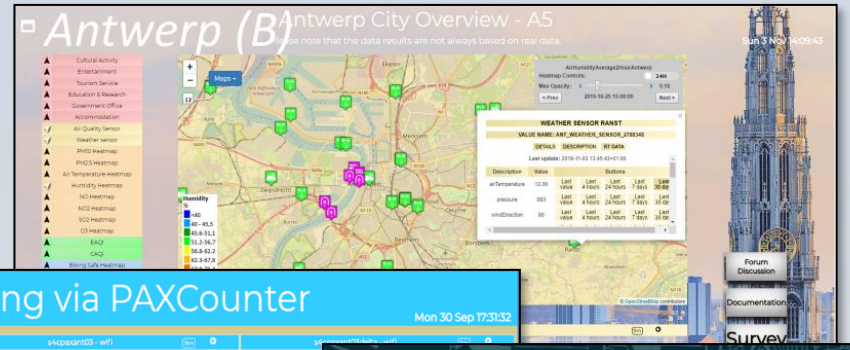


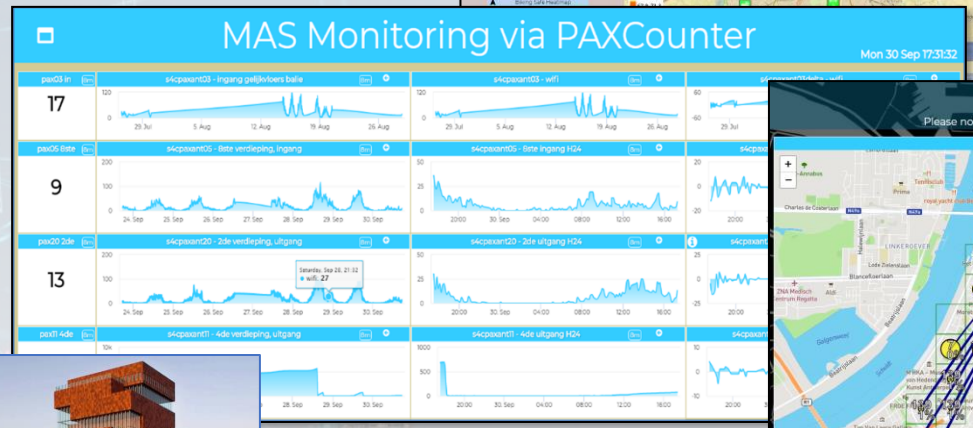
Maintenance Intelligence

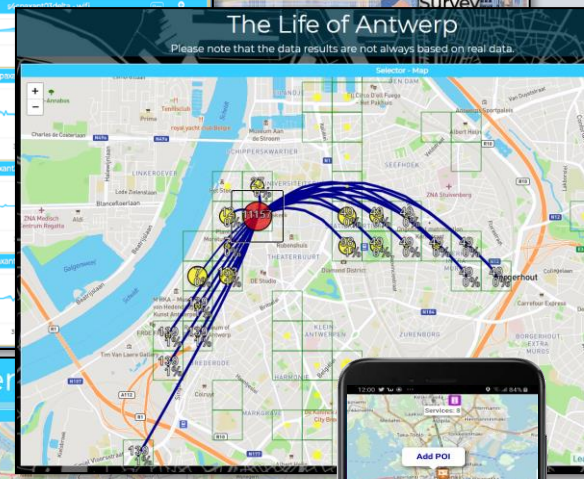
People Control on Pub Services
DIGIPOLIS Antwerp

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

reference





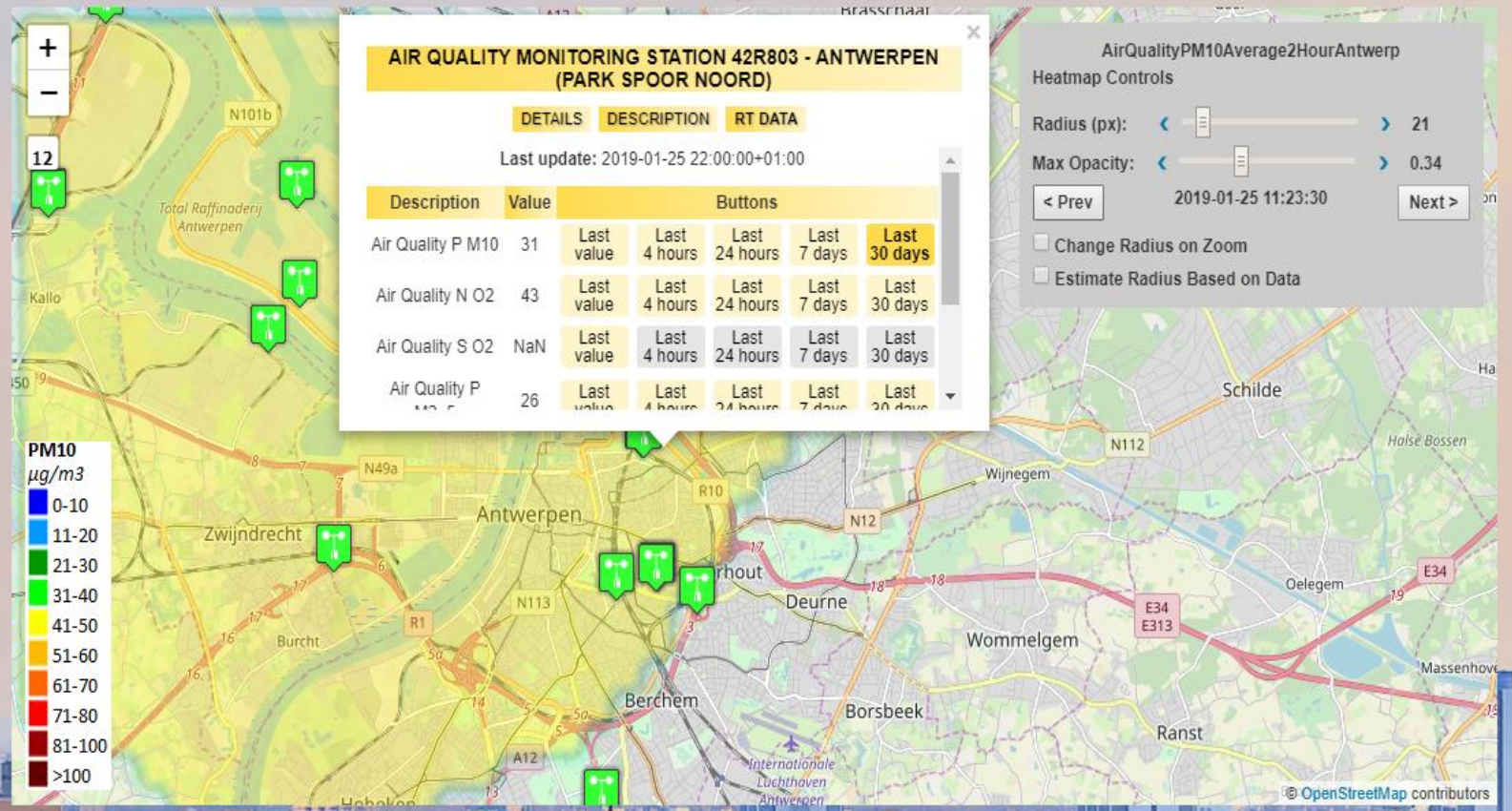


Antwerp Multi Data

Fri 25 Jan 23:46:00

- Cultural Activity
- Entertainment
- Tourism Service
- Education & Research
- Government Office
- Accommodation
- Air Quality Sensor
- Weather sensor
- PM10 Heatmap
- PM2.5 Heatmap
- Air Temperature Heatmap
- Humidity Heatmap
- Biking Safe Heatmap

map multi



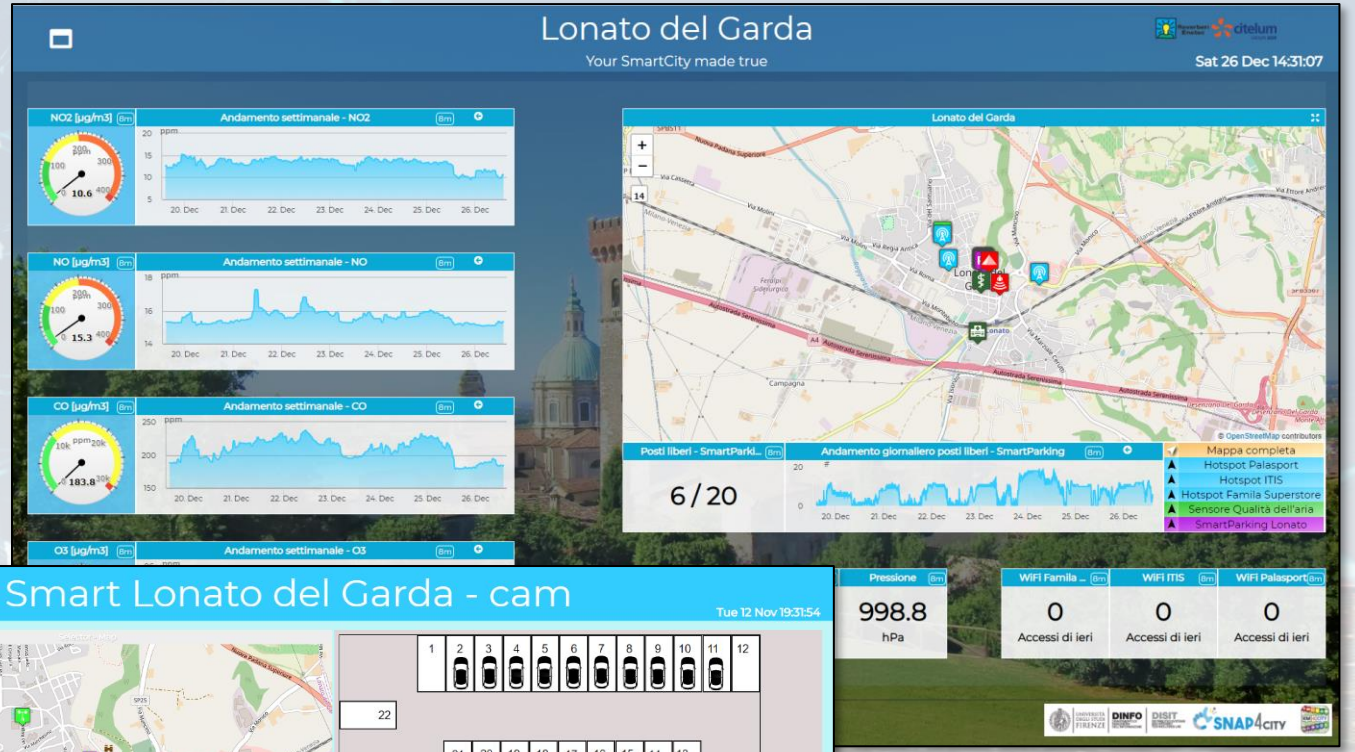
Last value 5m

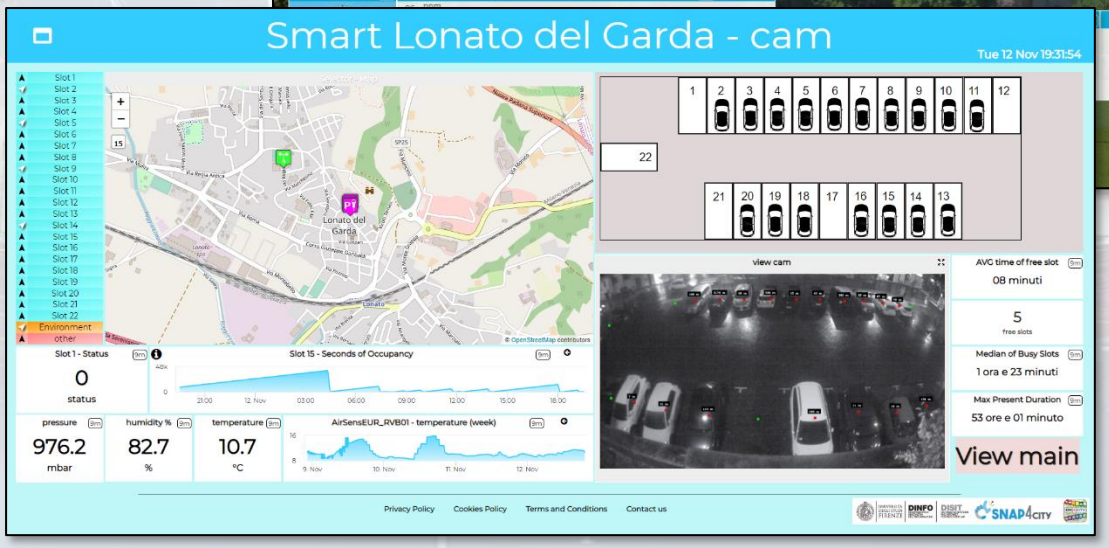
25.5

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

reference

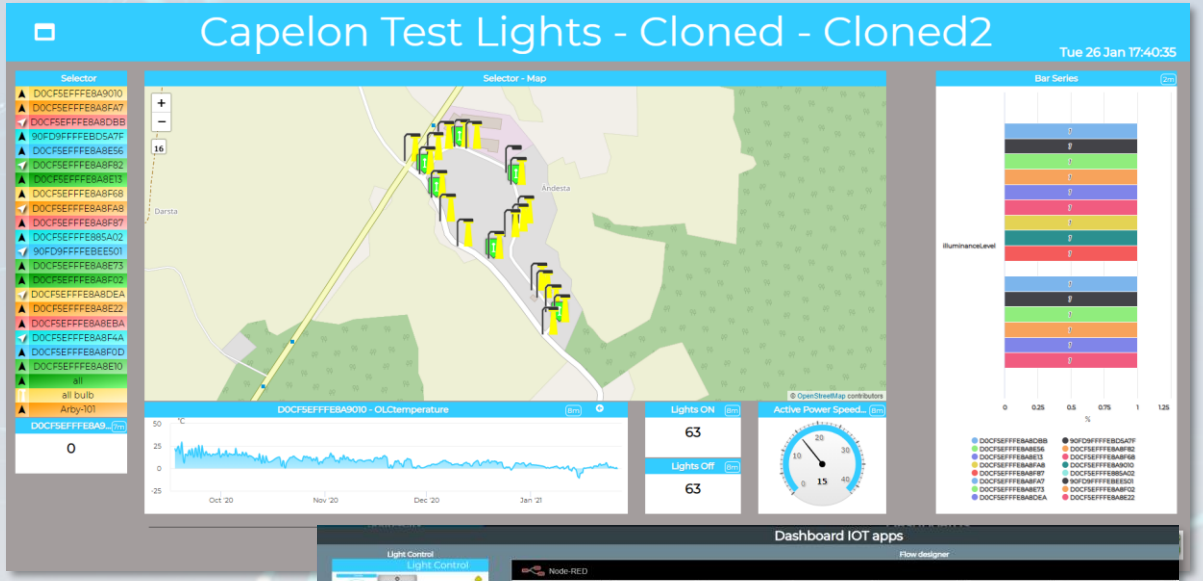
- **Multiple Domain Data**
  - Smart Parking, Environment, Wi-Fi
- **Multiple Decision Makers**
  - City Officer, operators
- **Historical and Real Time data**
  - Dashboards
- **Services Exploited on:**
  - Dashboards, API
- **Since 2019**

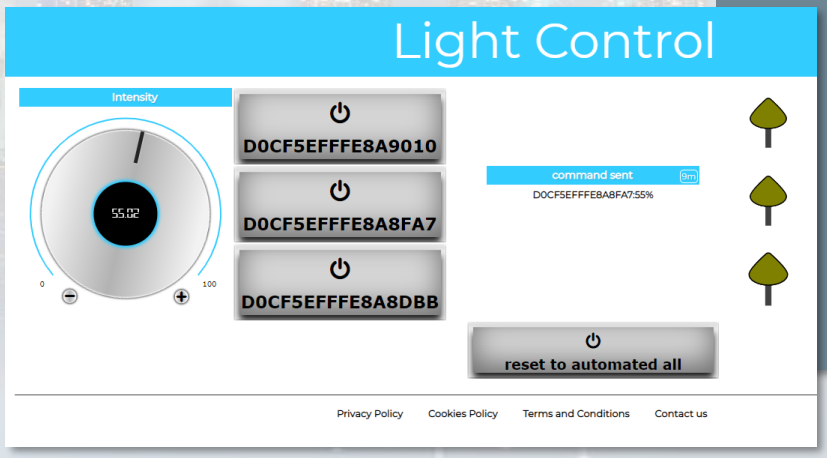




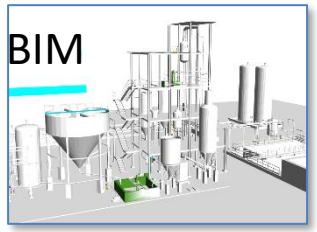
Smart Light Control of CAPELON *reference*

- **Energy Domain**
  - Smart Light
  - FiWare Orion Broker
- **Dashboards**
  - Map coverage on Sweden
  - Monitoring and real time control
- **Historical and Real Time data**
- **Services Exploited on:**
  - Multiple Levels, API
- **Since 2020**





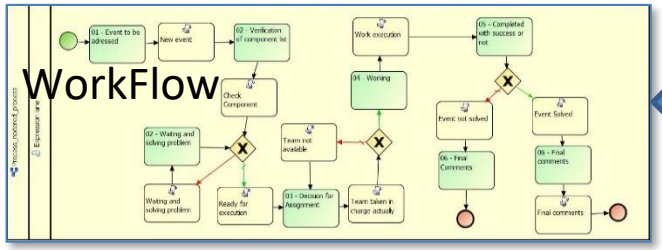
Concept

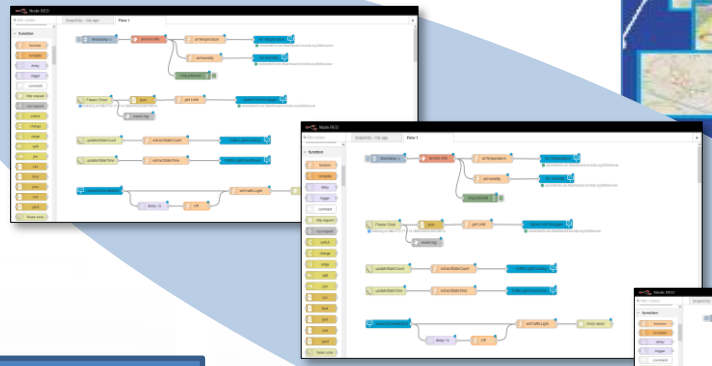


KPI, POI, MyKPI, …

API, External Services

Web Scraping

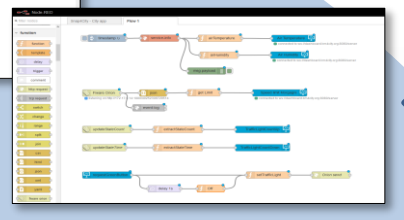


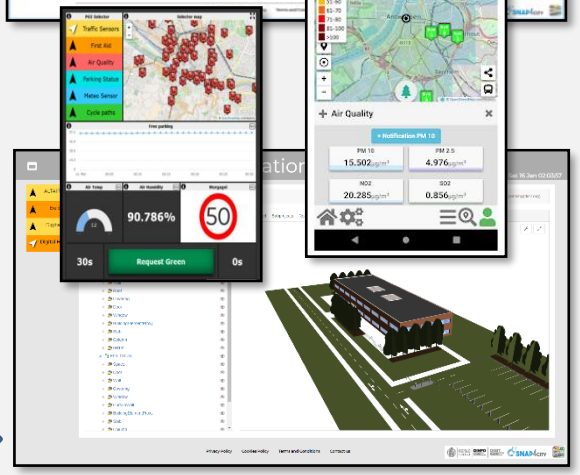


Data Analytics,
Artificial Intelligence

IOT Broker

IOT Apps





FIWARE

ckan

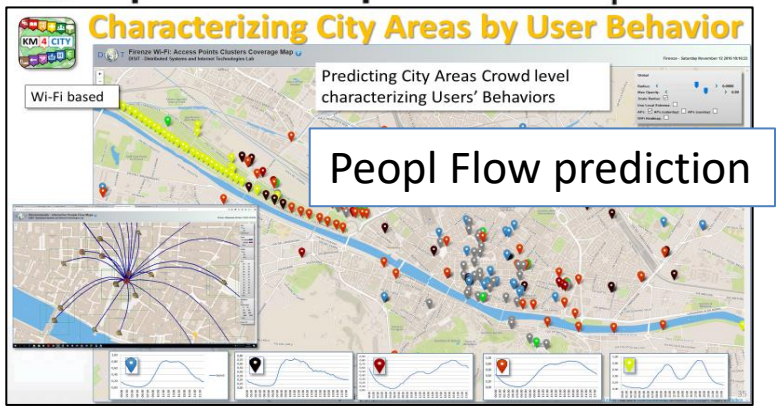
LD, LOD

Big Data

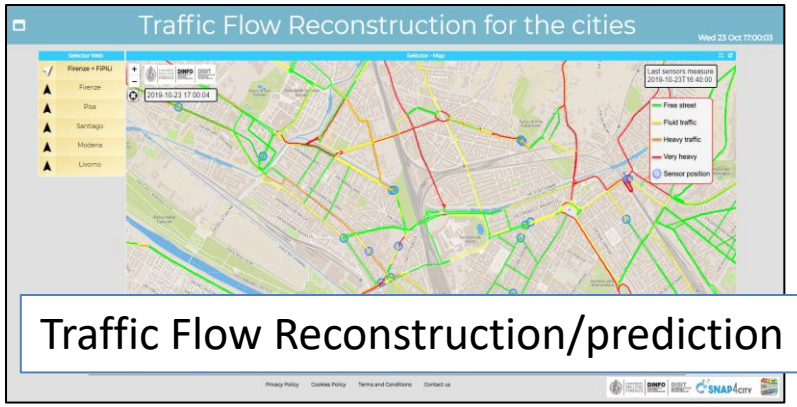
KB

Dashboards and Apps

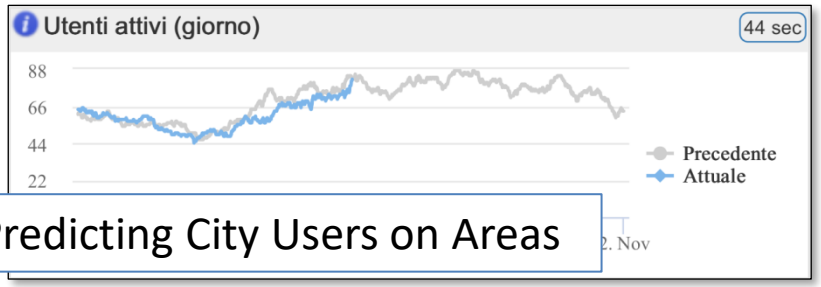
Data Analytics



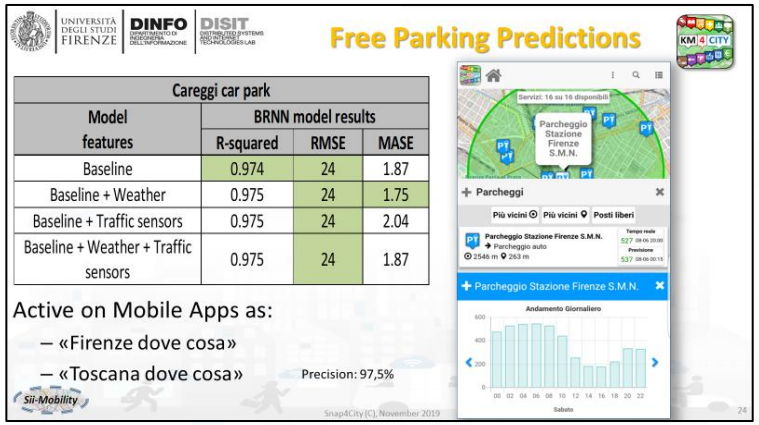
Peopl Flow prediction

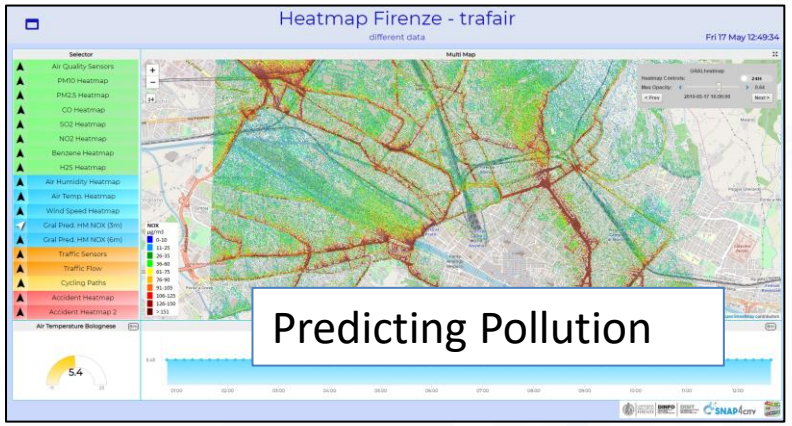


Traffic Flow Reconstruction/prediction

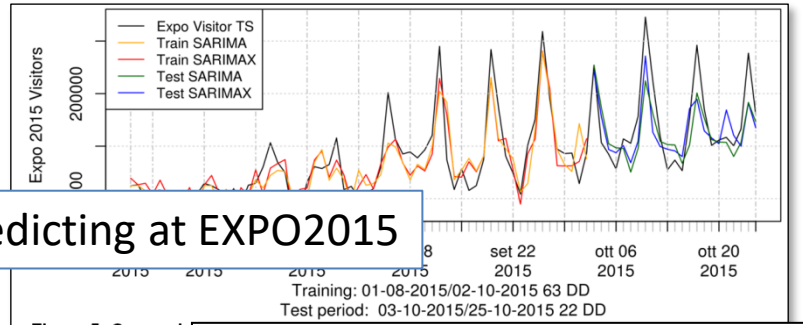


Predicting City Users on Areas

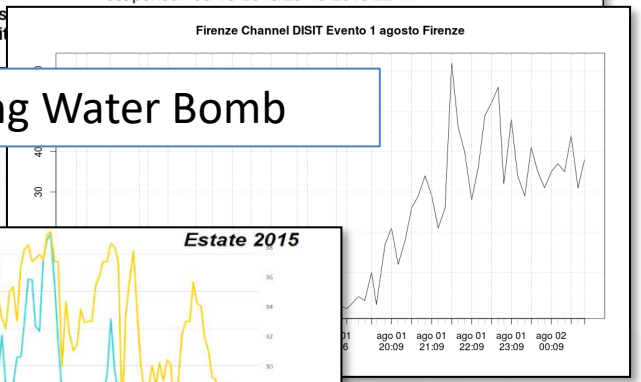




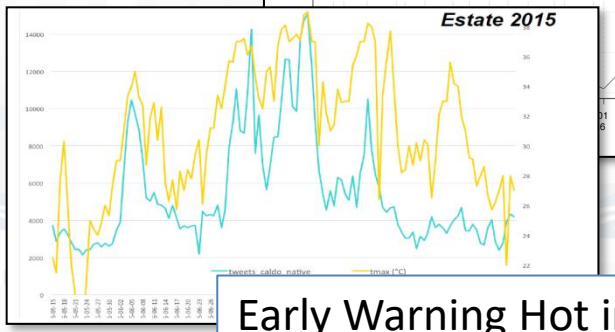
Predicting Pollution



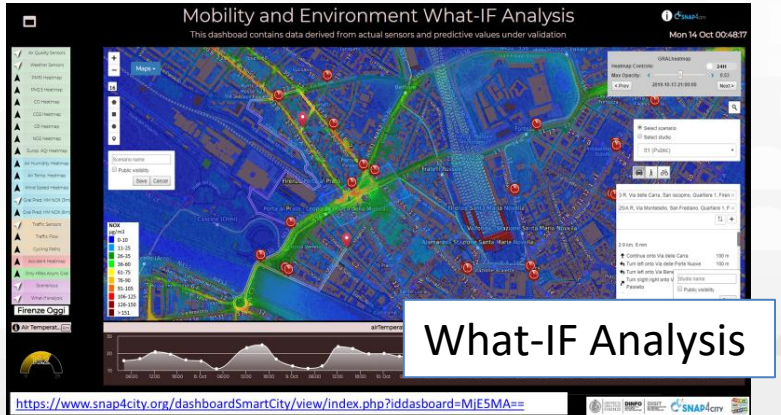
Predicting at EXPO2015



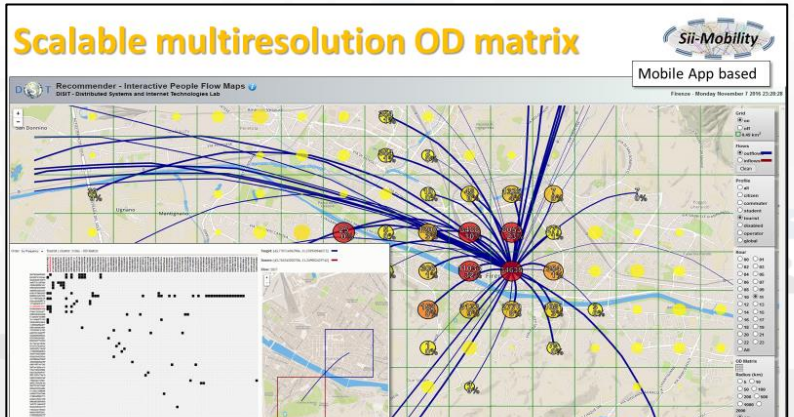
Early Warning Water Bomb



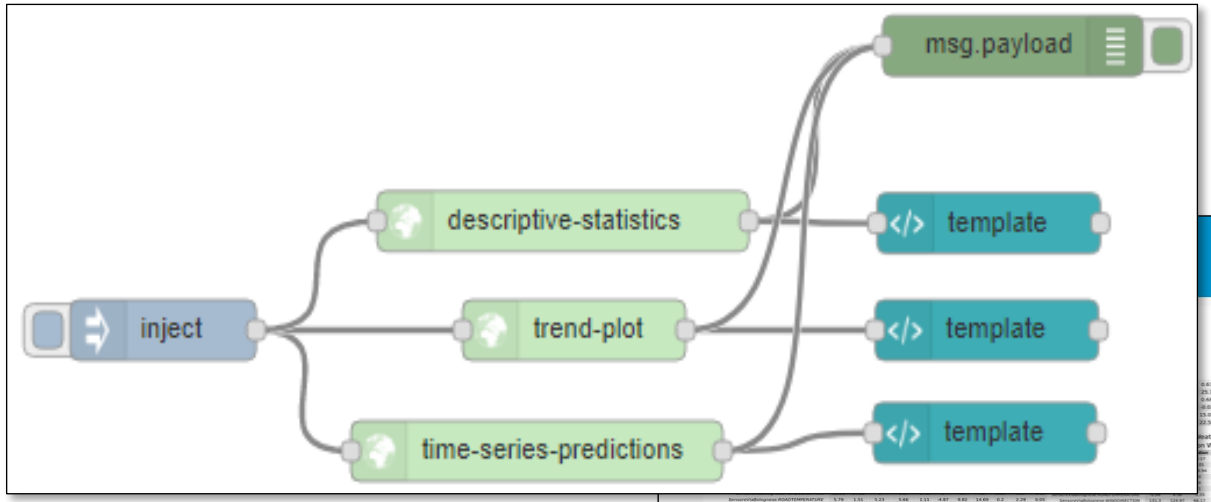
Early Warning Hot in Tuscany



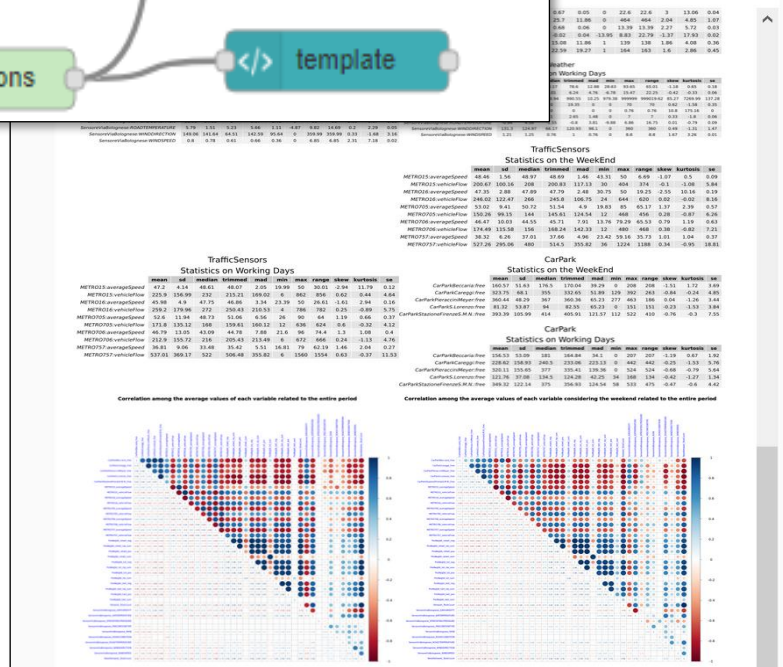
What-IF Analysis

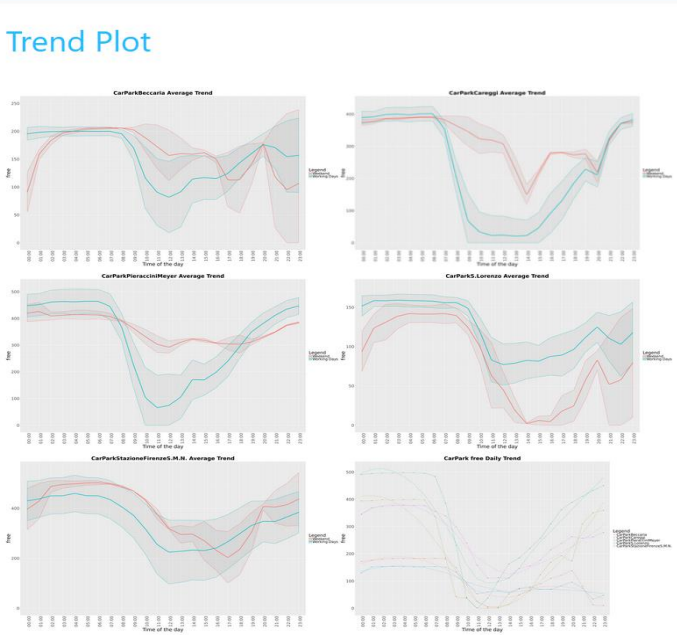


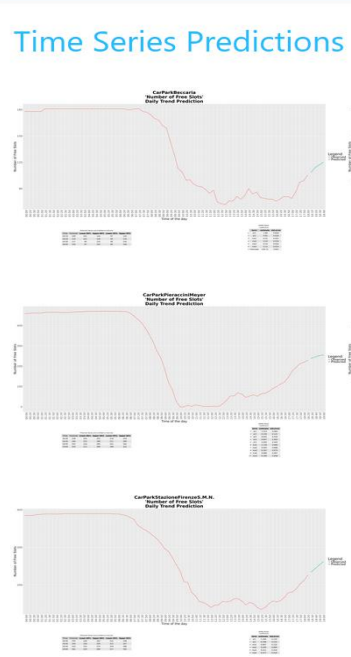
From R studio data analytics to MicroService



R Studio algorithms are automatically transformed into MicroServices for your IOT Applications

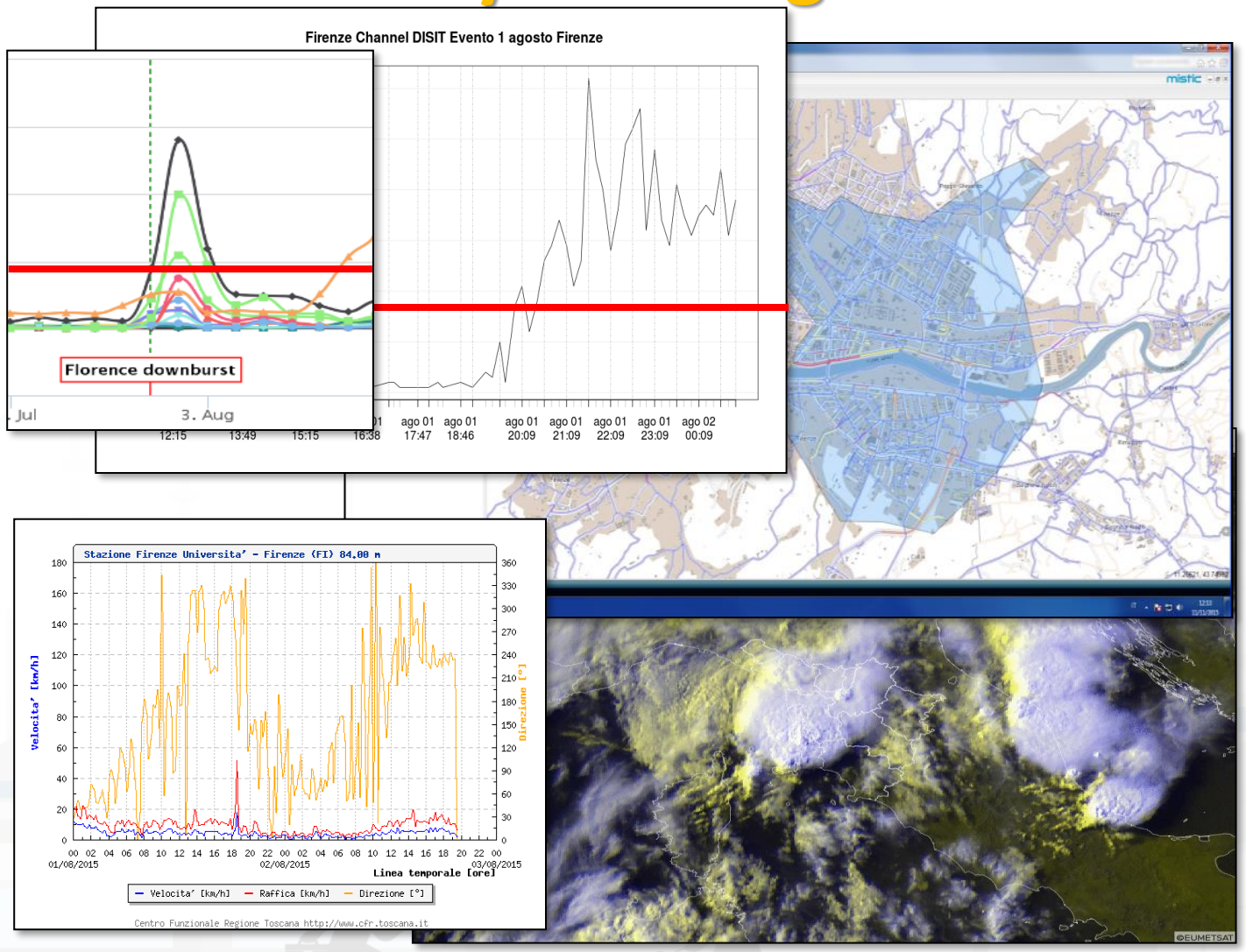




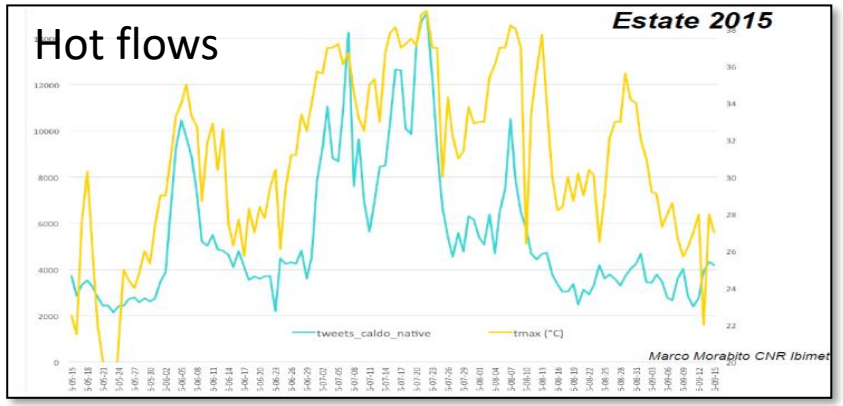


Twitter Vigilance

Early Warning



Predictive models



Attendance at long lasting events: EXPO2015

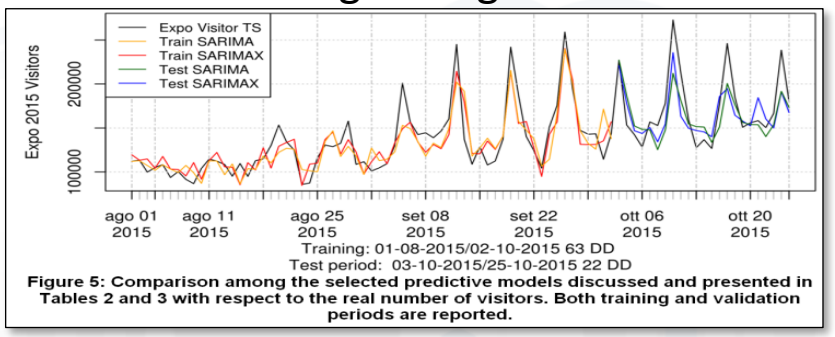
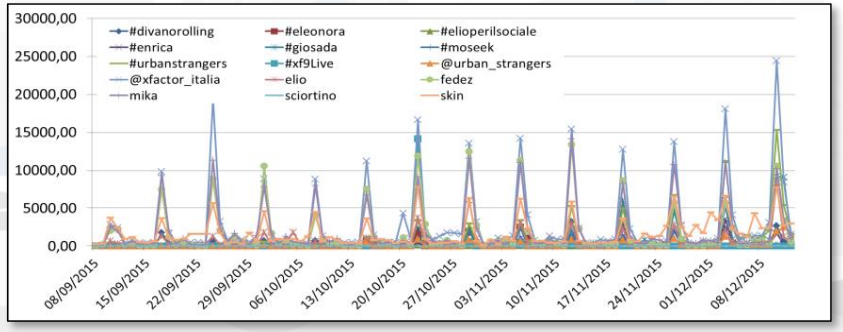


Figure 5: Comparison among the selected predictive models discussed and presented in Tables 2 and 3 with respect to the real number of visitors. Both training and validation periods are reported.

Attendance at recurrent events: TV, footbal

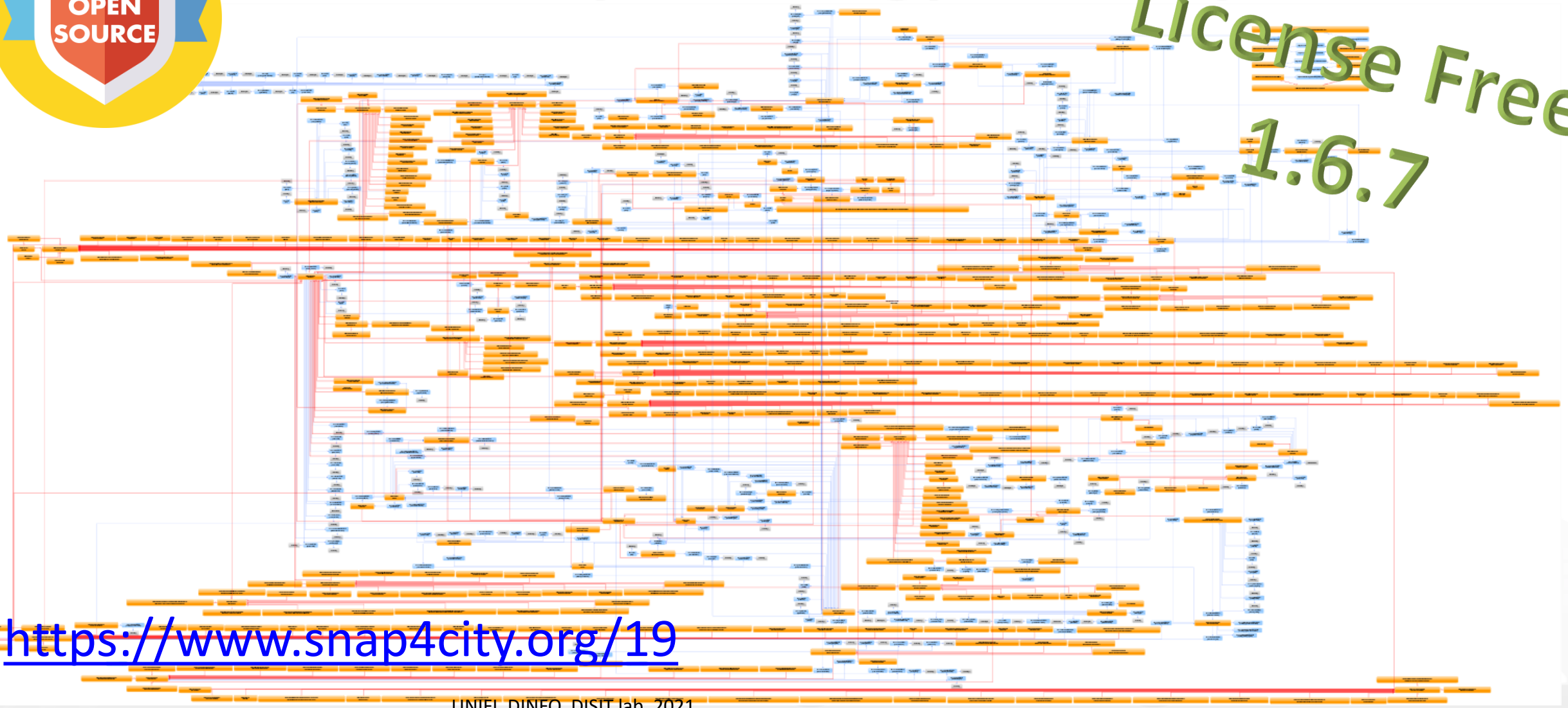


100% OPEN SOURCE

Smart-city Ontology km4city

License Free

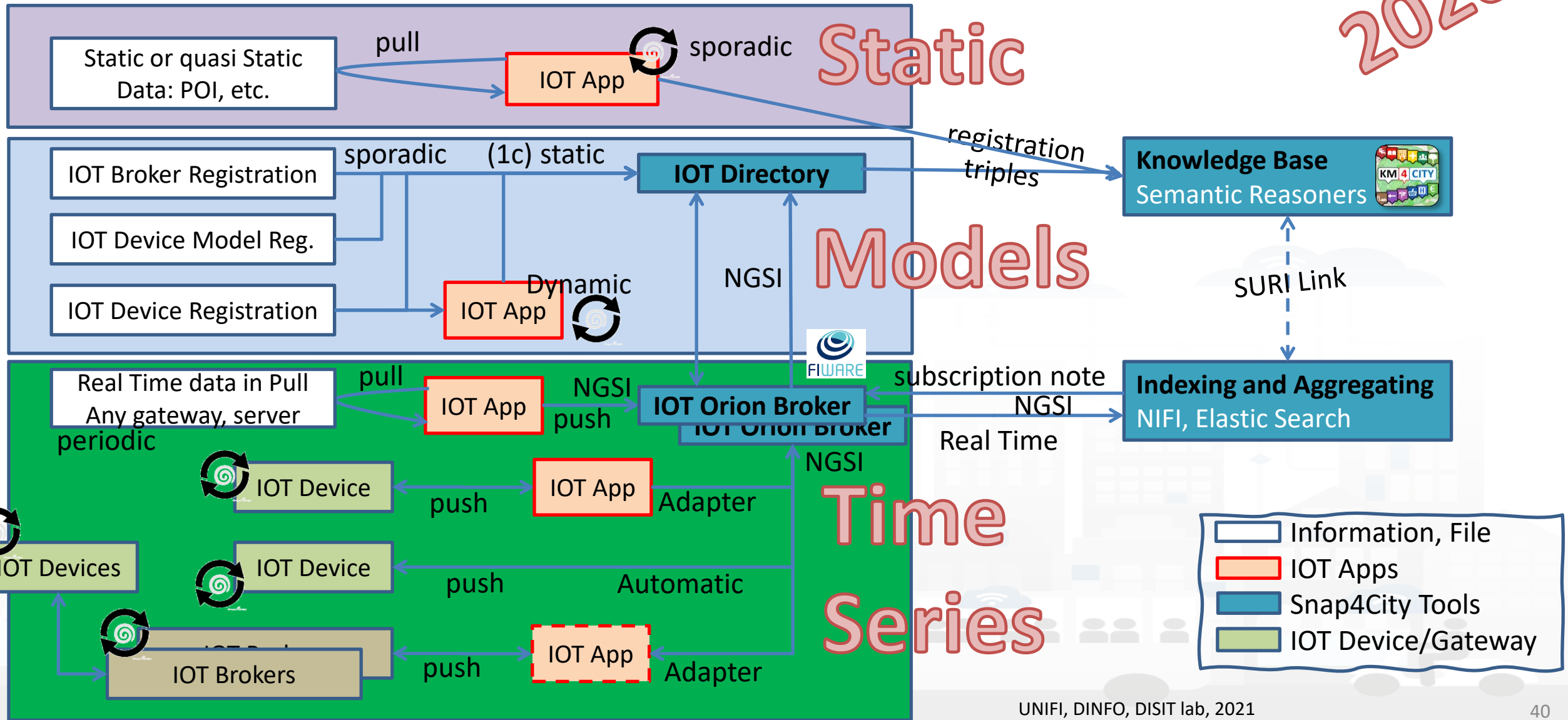
1.6.7



https://www.snap4city.org/19

Snap4city Data Ingestion Flow Diagram

2020



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

https://www.snap4city.org/369

SNAP4CITY KM4CITY

Measuring any kind of sensors values

Controlling Energy Power

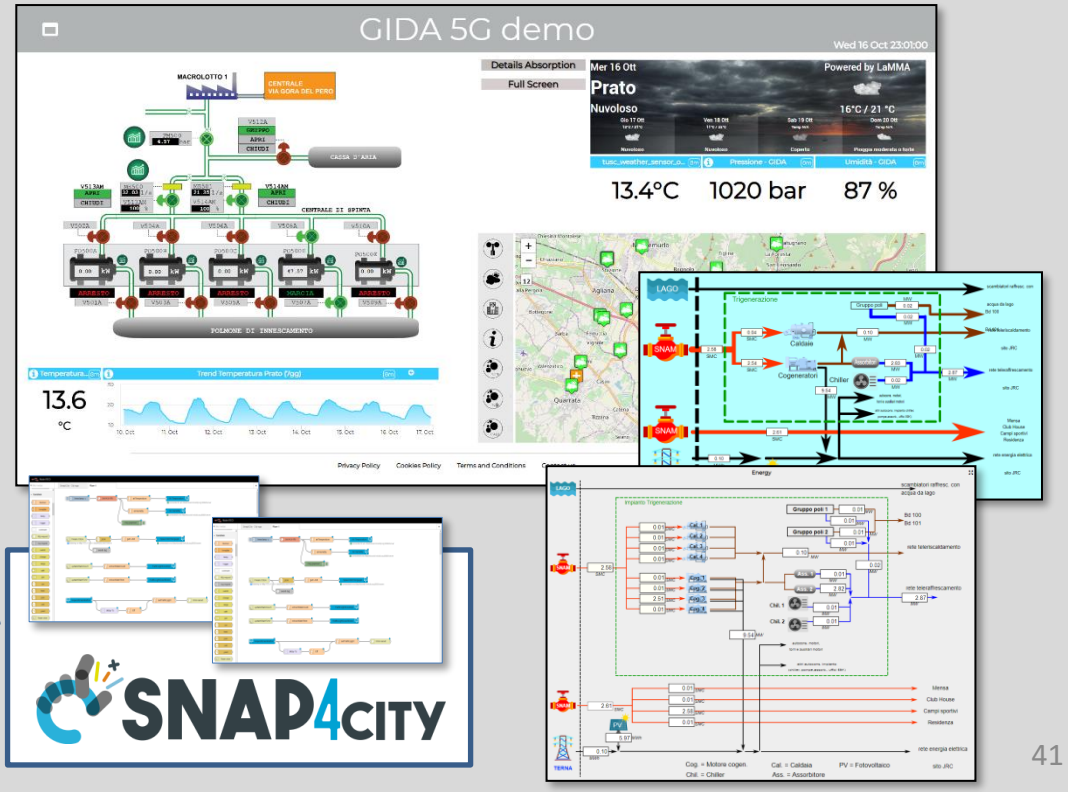
Measuring
Energy Consumption

Any kind of notification channel

IOT Edge:
Node-RED
+
Snap4City

Local Control

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



DCS

Administrative Servers

Alexa: Voice Commands

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

Snap4Home

SNAP4CITY | KM 4 CITY

Sonoff: Controlling Energy Power

Philips Hue: Controlling Lights

Hue: Motion Control / Alarm

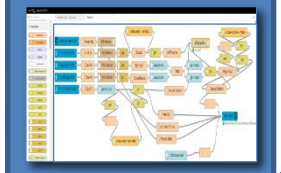
Measuring Energy Consumption

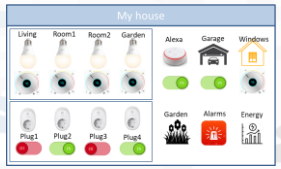
TP Link: Controlling / Measuring Energy Plugs

Alexa: Voice Control

IOT Edge:

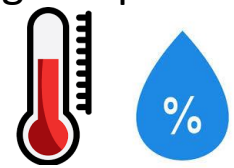
Raspberry pi: Node-RED + Snap4City





Local Control

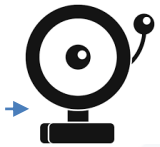
Measuring Temperature and Humidity



Garage Door

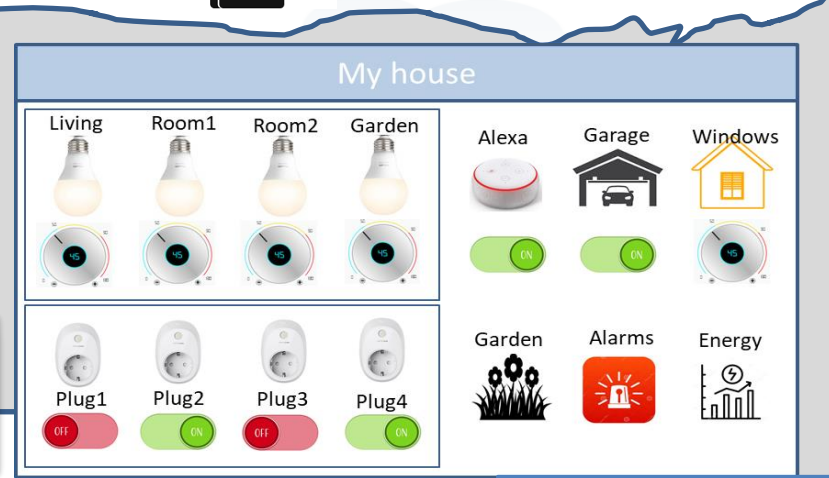
Window Roller Shutters

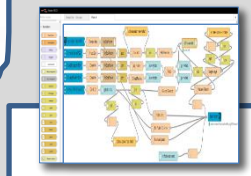
Controlling Motors



Alarm sound and light

Controlling Irrigators





SNAP4CITY

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

https://www.snap4city.org/620

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

FIWARE | LoRa | Wi Fi | Bluetooth | SNAP4CITY | KM 4 CITY

IOT Devices

Sensors/ Actuators

IOT Edge Devices

LoraWAN + Arduino + I2C, NGSI

Arduino, Wi-Fi, NGSI

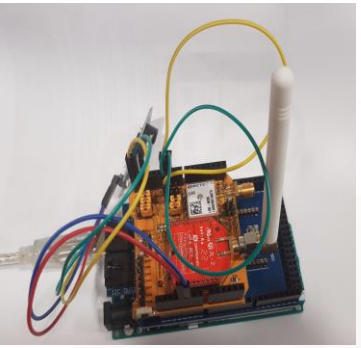
Snap4All IOT Button ESP, NGSI, Wi-FI, BT

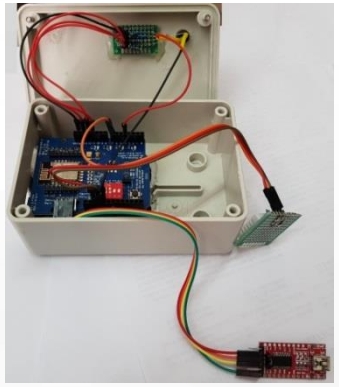
Snap4All PAX Counter LoraWAN WIFI, NGSI, GPS

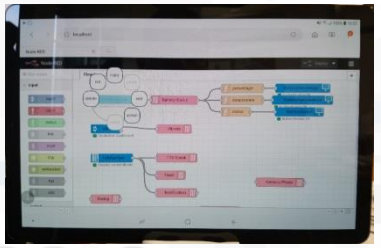
IOT Edge NodeRED: Raspberry Pi, NGSI, WiFi, RJ45,..

IOT Edge NodeRED: Android, LINUX, Windows, …

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







Any Sensor / Actuator
Open to other protocols

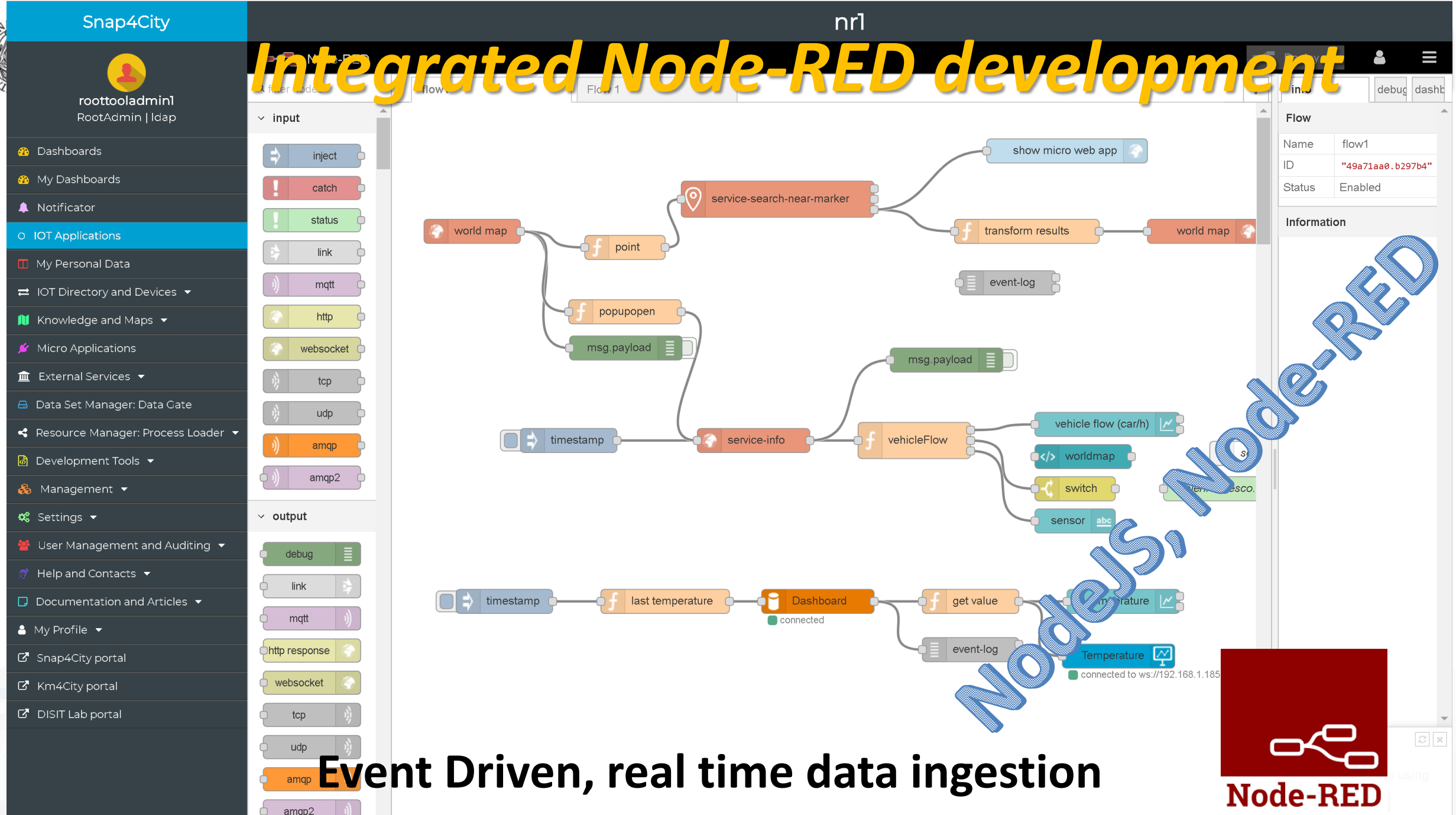
Standards and Interoperability

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

Node-RED | JS Foundation | FI-WARE | E015 digital ecosystem | bee smart city

sigfox partner network | ckan | GJL | LABGEO | esri Italia | EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

Integrated Node-RED development



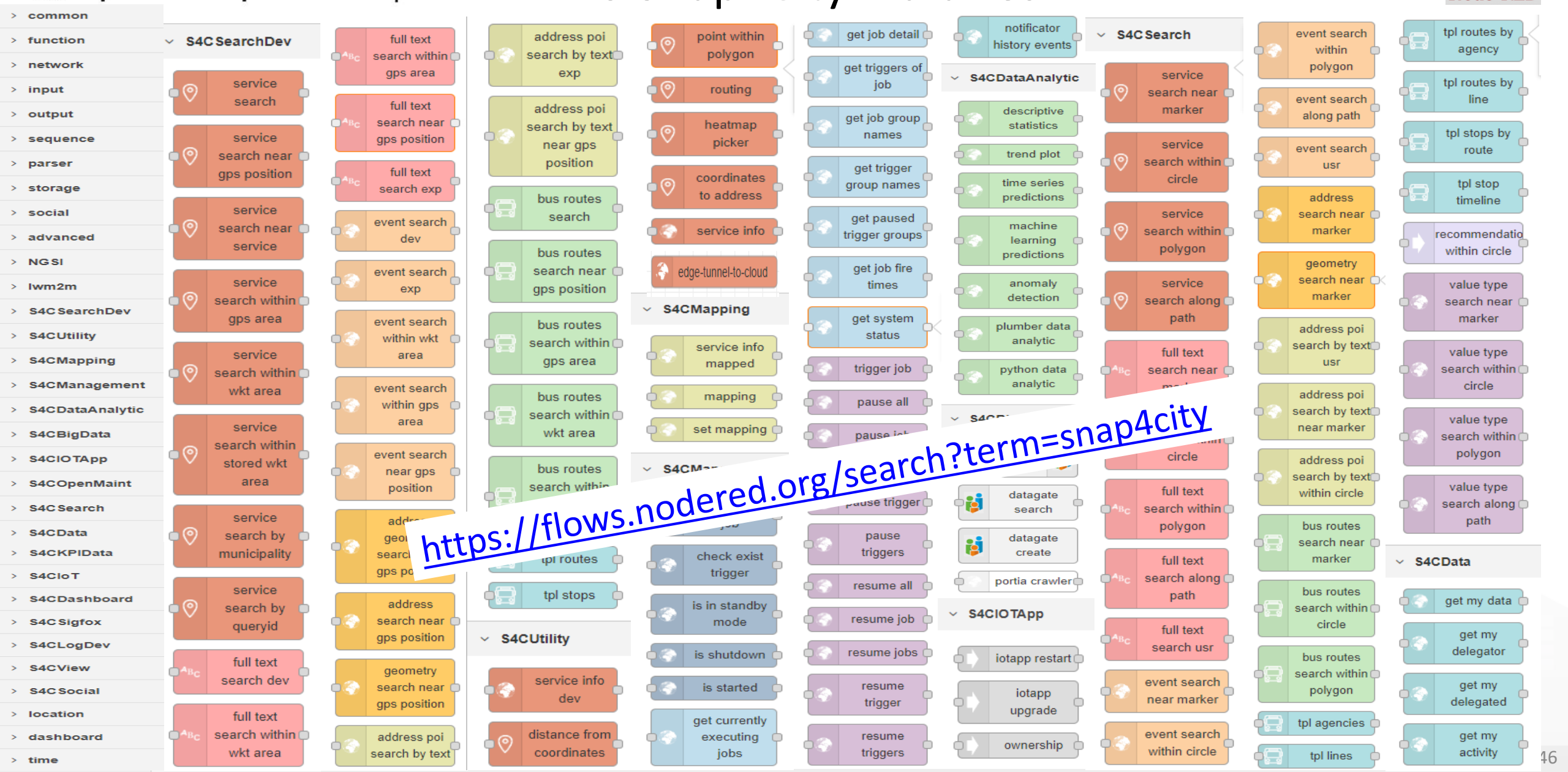
Event Driven, real time data ingestion

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

Nov. 2020 collection

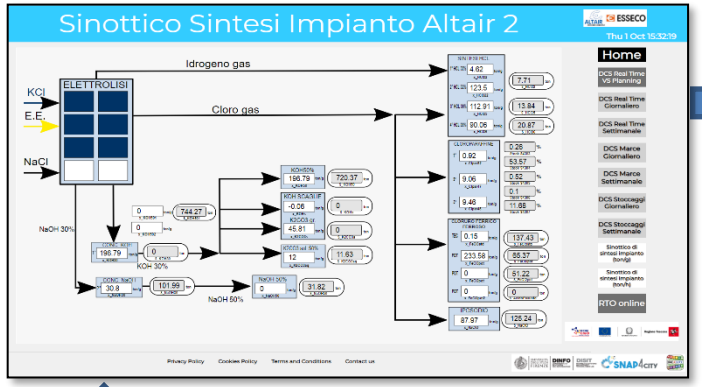
Two Snap4City Libraries

SNAP4CITY | Node-RED

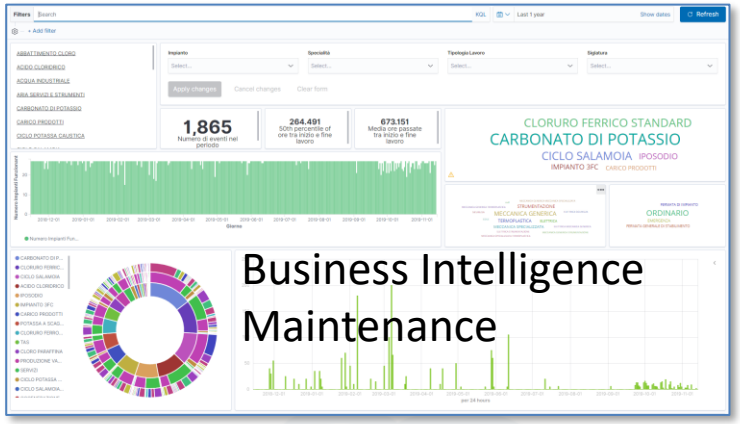


https://flows.nodered.org/search?term=snap4city

Example of Integrated workflow

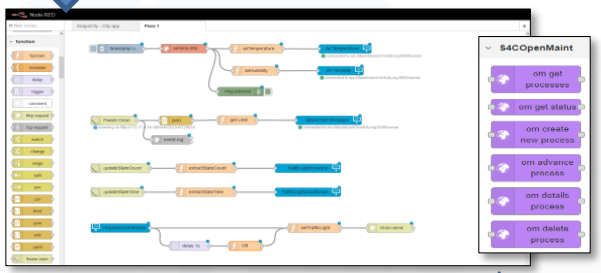


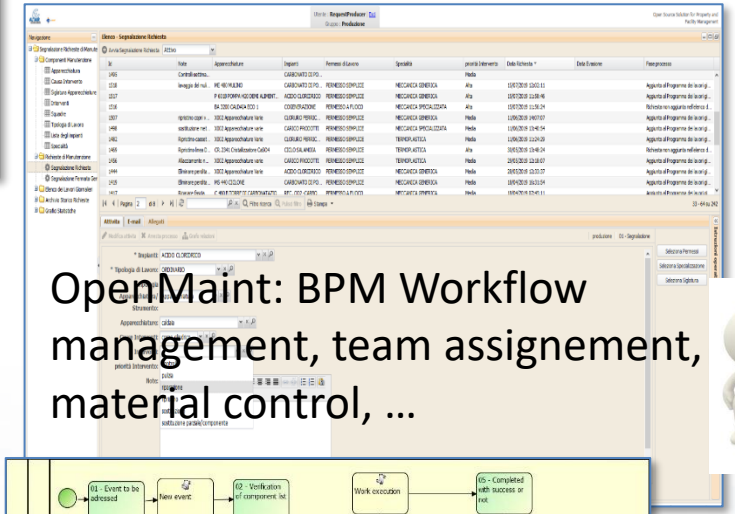
Consumptions/productions



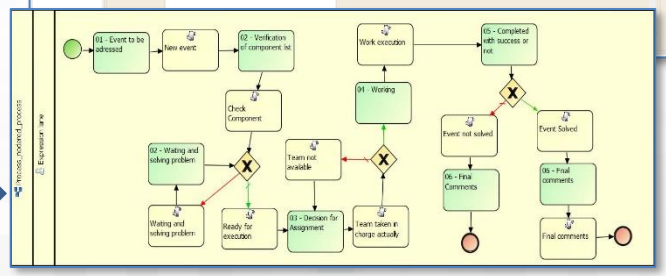
Events/actions

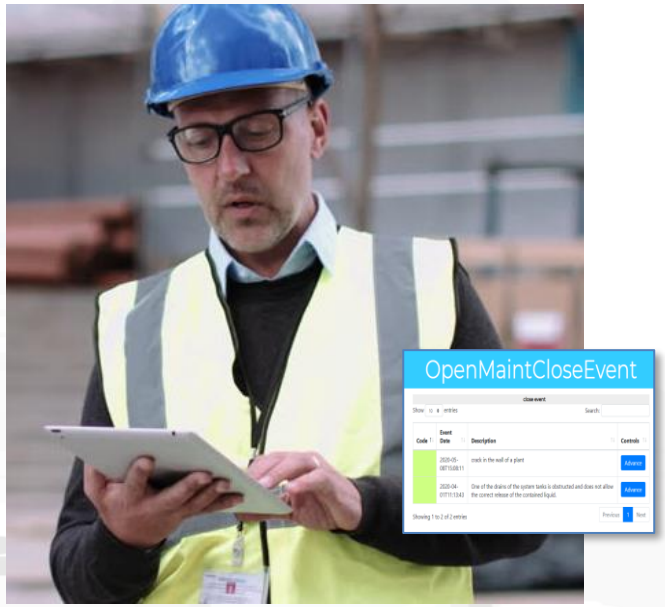
Dashboards and actions





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





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

Control Room

UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DIS DISTRIBU AND INTE TECHNO http://wv

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, SMARTEA
- 5G → Industry 4.0 vs SmartCity
- Green Impact → Industry 4.0, Chemical Plant
- SmartBed (Laid) → smart health
- Green Field Peas (Soda) → Industry 4.0, Chemical plant
- MobiMart and PISA Agreement → data aggregation, mobility and transport, Living Lab
- Lonato del Garda → smart parking, environment
- Herit Data → tourism, culture and management
- ISPRA JRC → site management and services
- Capelon (Sweden) → smart light solutions

Acknowledgements

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