SNAP4CITY

KM4CITY

SNAP4 Appliances and Dockers Installations

100% OPEN SOURCE

EU GDPR COMPLIANT

PEN Test Passed

Powered by FIWARE

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

Node-RED

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https://www.snap4city.org

A Framework for rapid implementation of - Sustainable Smart Solutions - Decision Support Systems as a no-coding, low-coding

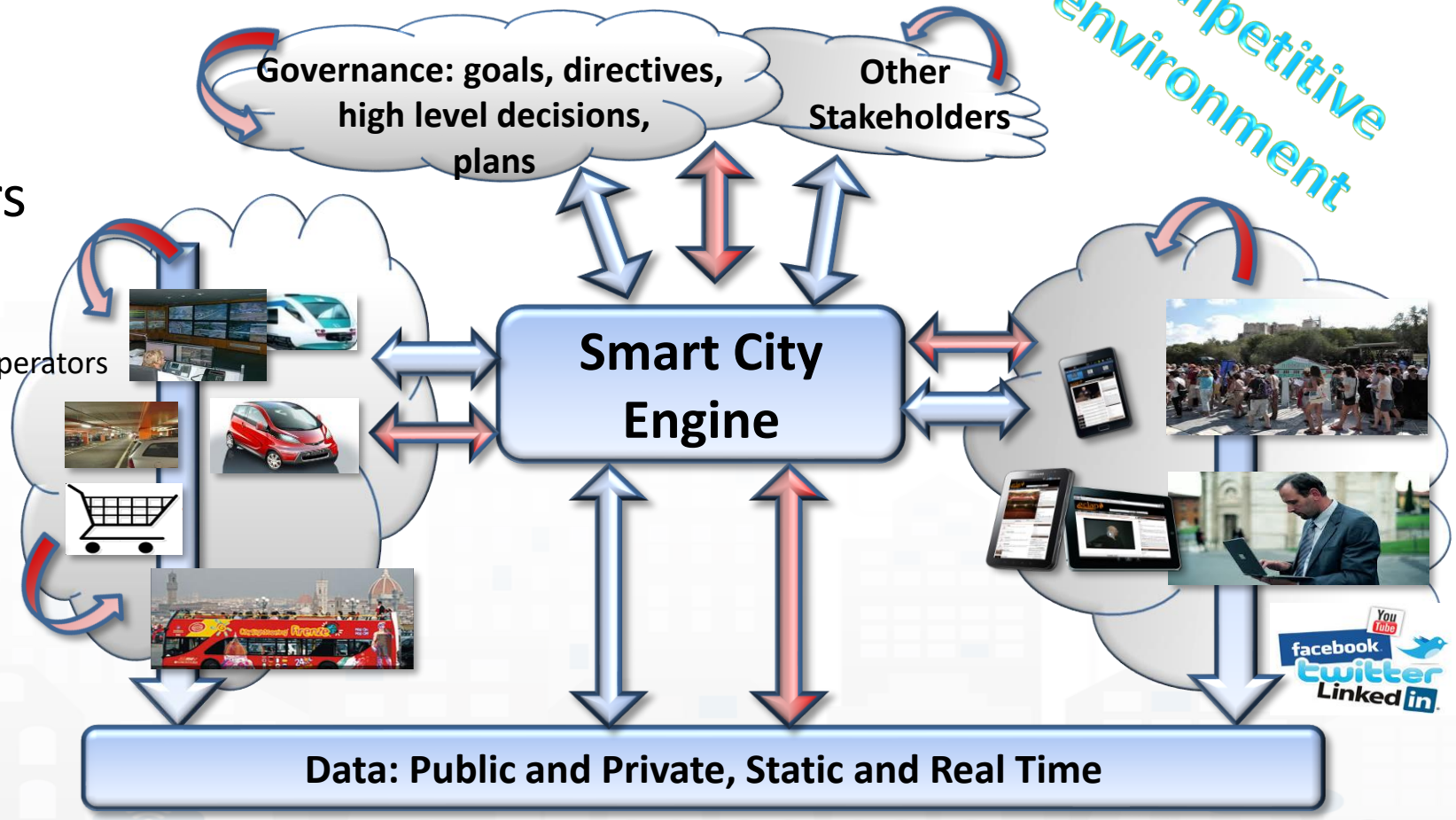
Study Visit, Firenze, 28/09/2022

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES

UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO | DISIT

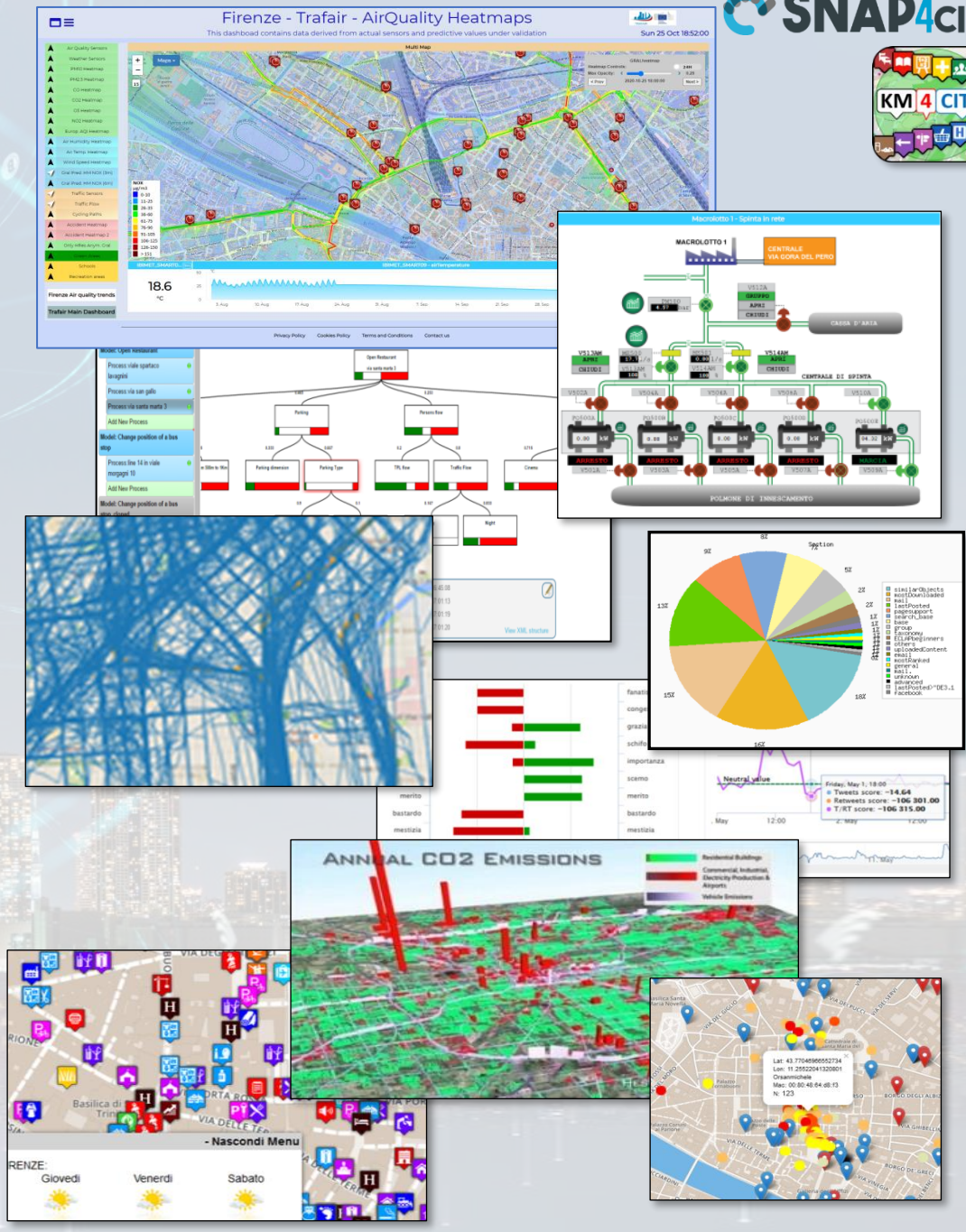
From Strategies to (re-)Actions

- Analyze
- Alerting, Early Warning
- Support Decision makers
- Plans
- Prescriptions
- Inform
- Suggest
- Engage
- Research



Data Driven Decision Support

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



Domains

- Smart City, control room
- Green Deal, smart light, ..
- Environment, pollutant, ..
- Mobility and transport
- Tourism and People
- Energy , Industry
- Social Media

- Big Data
- Artificial Intelligence
- Public and private data

Publications http://www.disit.org/5487

SUSTAINABLE DEVELOPMENT GOALS

100% OPEN SOURCE

Powered by FIWARE

FREE TRIAL

PEN Test Passed

EU GDPR COMPLIANT

SNAP4 Appliances and Dockers Installations

EUROPEAN OPEN SCIENCE CLOUD

Node-RED

JS Foundation

EØ15 digital ecosystem

NVIDIA

SNAP4CITY

KM4CITY

SMART SOLUTIONS AND DECISION SUPPORT SYSTEMS

CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - BUSINESS INTELLIGENCE - SIMULATIONS - SMART APPLICATIONS

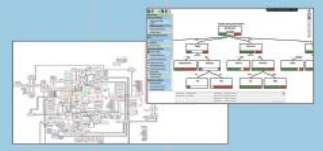
DASHBOARDS - VISUAL ANALYTICS - SYNOPTICS - DIGITAL TWIN - GRAPHICAL WIDGETS - ANALYTICS - GUI CUSTOM STYLES - VISUAL PROGRAMMING

DASHBOARDS, WIDGETS
TEMPLATES

PREDICTION - ANOMALY DETECTION - CLUSTERING - ROUTING - SENTIMENT NLP - TRAFFIC FLOW
PEOPLE FLOWS - SDG - 15 MIN CITY INDEX - KPI - HEATMAPS - ORIGIN DESTINATION - ETC...

API - MICROSERVICES - GIS - BPM
VIDEO - REPORTS - MAPS - 3D ...

ANY: DATA, BROKER, NETWORK AND VERTICAL



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

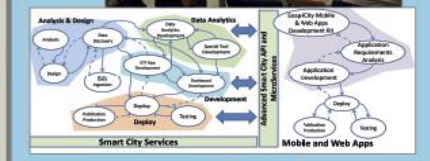
BIG DATA ANALYTICS, ARTIFICIAL INTELLIGENCE
EXPLAINABLE AI, MACHINE LEARNING
OPERATIVE RESEARCH, STATISTICS

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

Native and External Applications

- Smart Parking
- Smart Light
- Smart Waste
- Smart Energy
- Social Media Analysis

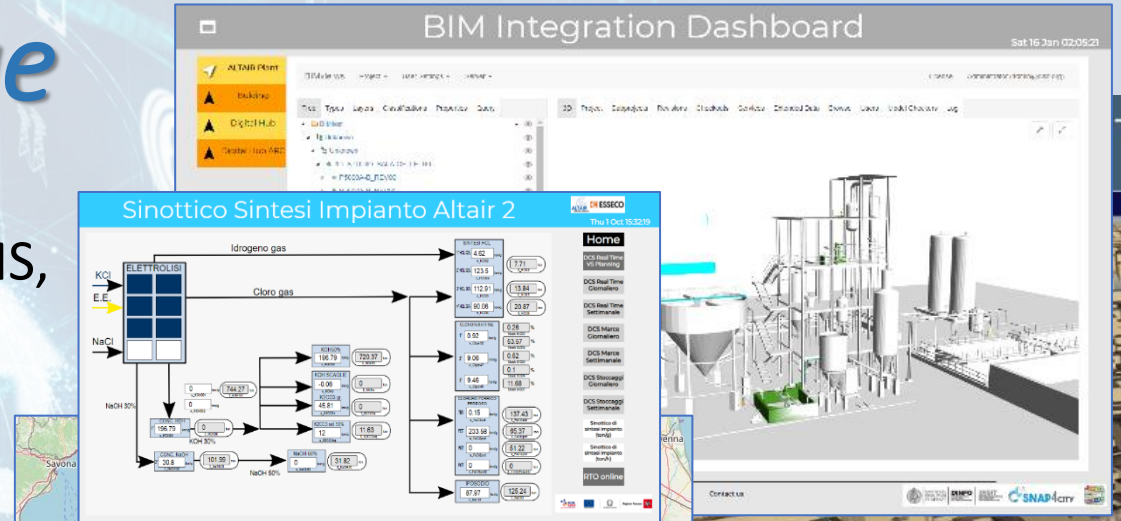
...

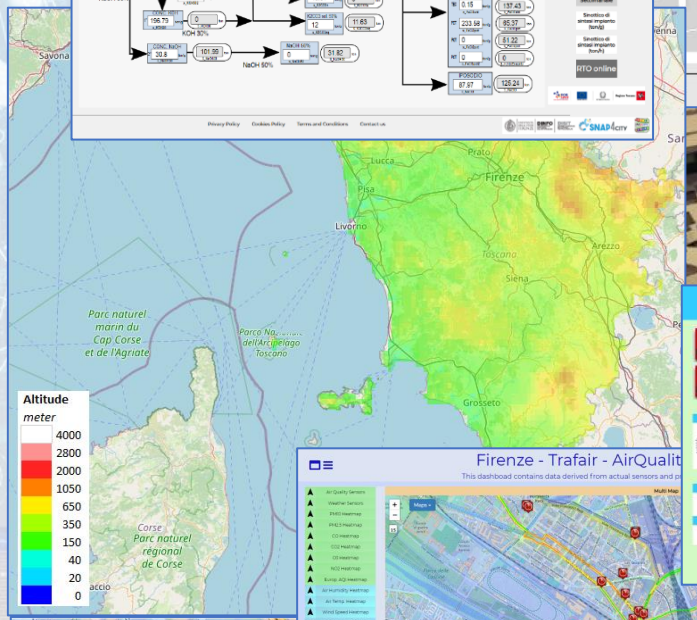


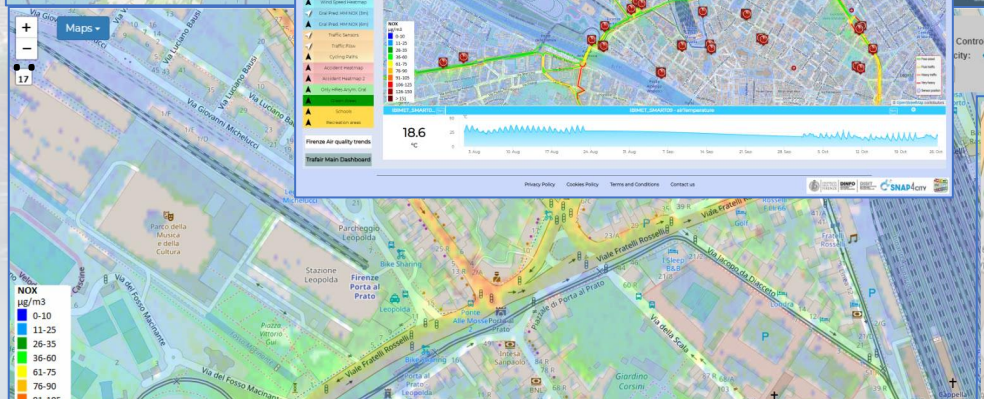
METHODOLOGIES
LIVING LABS
COURSES AND COMMUNITY
DEVELOPMENT TOOLS

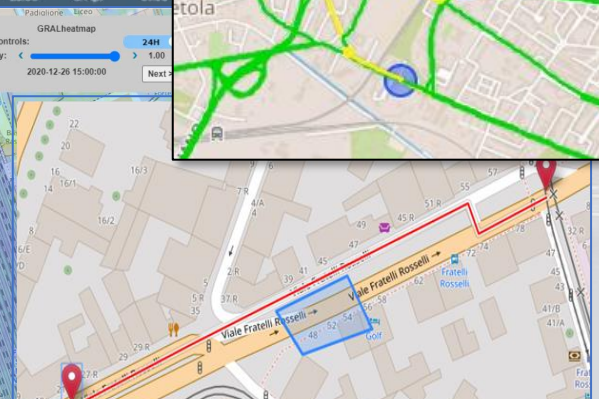
Data Type Coverage

- POI, IOT Devices, shapes,..
- GIS, maps, orthomaps, WFS/WMS, GeoTiff, calibrated heatmaps, ..
- Satellite data, ..
- traffic flow, typical trends, ..
- trajectories, events, Workflow, ..
- 3D, BIM, ..
- Dynamic icons/pins, ..
- OD Matrices of several kinds, ..
- Synoptics, animations, ..
- KPI, personal KPI,..
- social media data, TV Stream,
- routing, multimodal, constraints,
- decision scenarios, ….
- prediction models, ….
- etc.









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

Standards and Interoperability (9/2022)

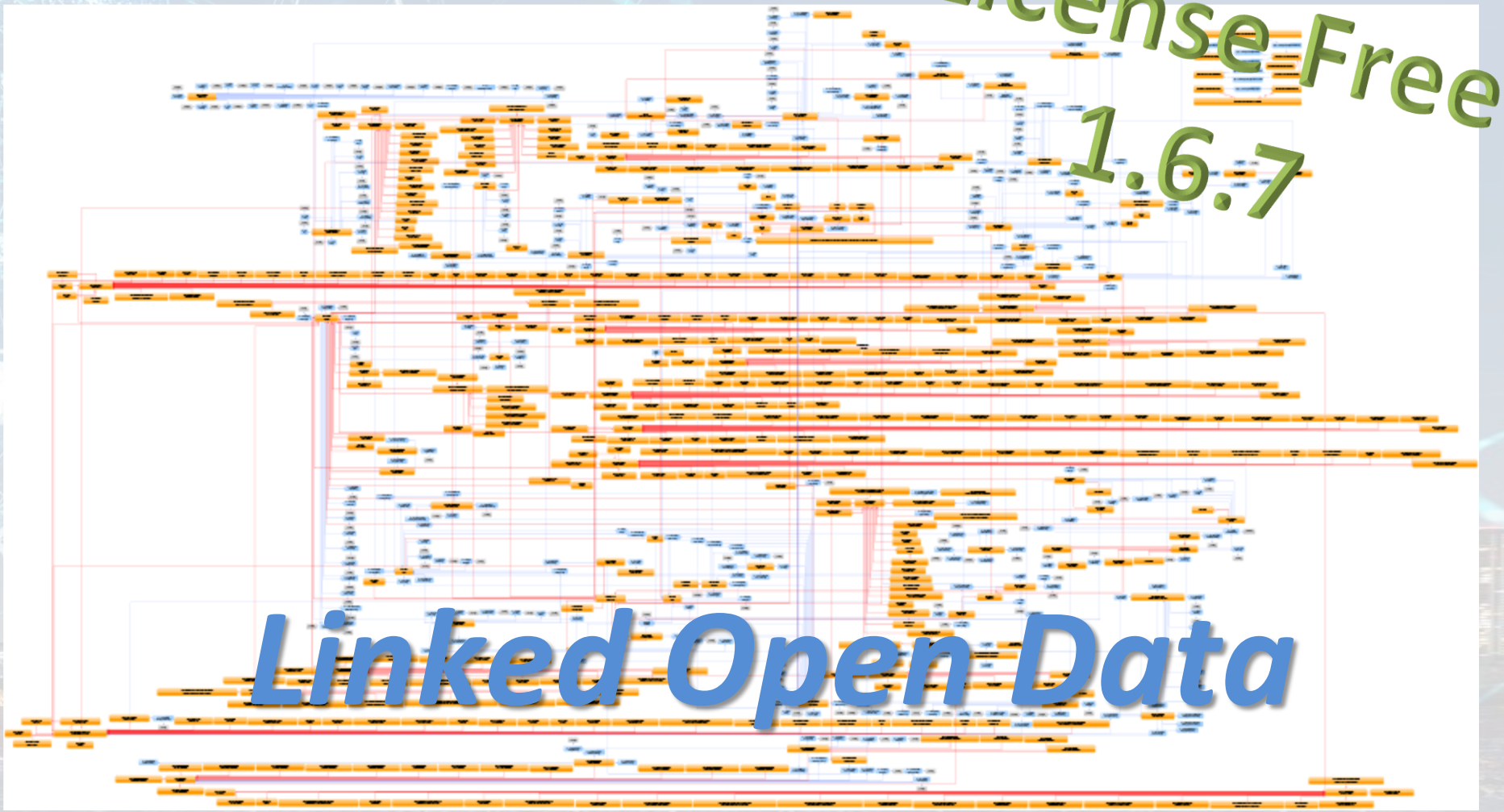
Compliant with:

- **IoT:** NGSI V2/LD, LoRa, LoRaWan, MQTT, AMQP, COAP, OneM2M, TheThingsNetwork, SigFOX, Libelium, IBIMET/IBE, Enocean, Zigbee, DALI, ISEMC, Alexa, Sonoff, HUE Philips, Tplink, BACnet, TALQ, Protocol Buffer, KNX, OBD2, Proximus, ..
- **IoT model:** FIWARE Smart Data Model, Snap4City IoT Device Models
- **General**: HTTP, HTTPS, TLS, Rest Call, SMTP, TCP, UDP, SOAP, WSDL, FTP, FTPS, WebSocket, WebSocket Secure, GML, WFS, WMS, RTSP, ONVIF, AXIS TVCam, CISCO Meraki, OSM, Copernicus, The Weather Channel, Open Weather, OLAP, ….
- **Formats**: JSON, GeoJSON, XML, CSV, GeoTIFF, OWL, WKT, KML, SHP, db, XLS, XLSX, TXT, HTML, CSS, SVG, IFC, XPDL, OSM, Enfuser FMI, Lidar, glTF, GLB, DTM, GDAL, Satellite, D3 JSON, …
- **Database**: Open Search, MySQL, Mongo, HBASE, SOLR, SPARQL, ODBC, JDBC, Elastic Search, Phoenix, PostGres, MS Azure, ..
- **Industry**: OPC/OPC-UA, OLAP, ModBUS, RS485, RS232,..
- **Mobility**: DATEX, GTFS, Transmodel, ETSI, ..
- **Social**:Twitter, FaceBook, Telegram, ..
- **Events**: SMS, EMAIL, CAP, RSS Feed, ..
- **OS**: Linux, Windows, Android, Raspberry Pi, Local File System, AXIS, ESP32, etc.

https://www.snap4city.org/65

Expert System semantic queries

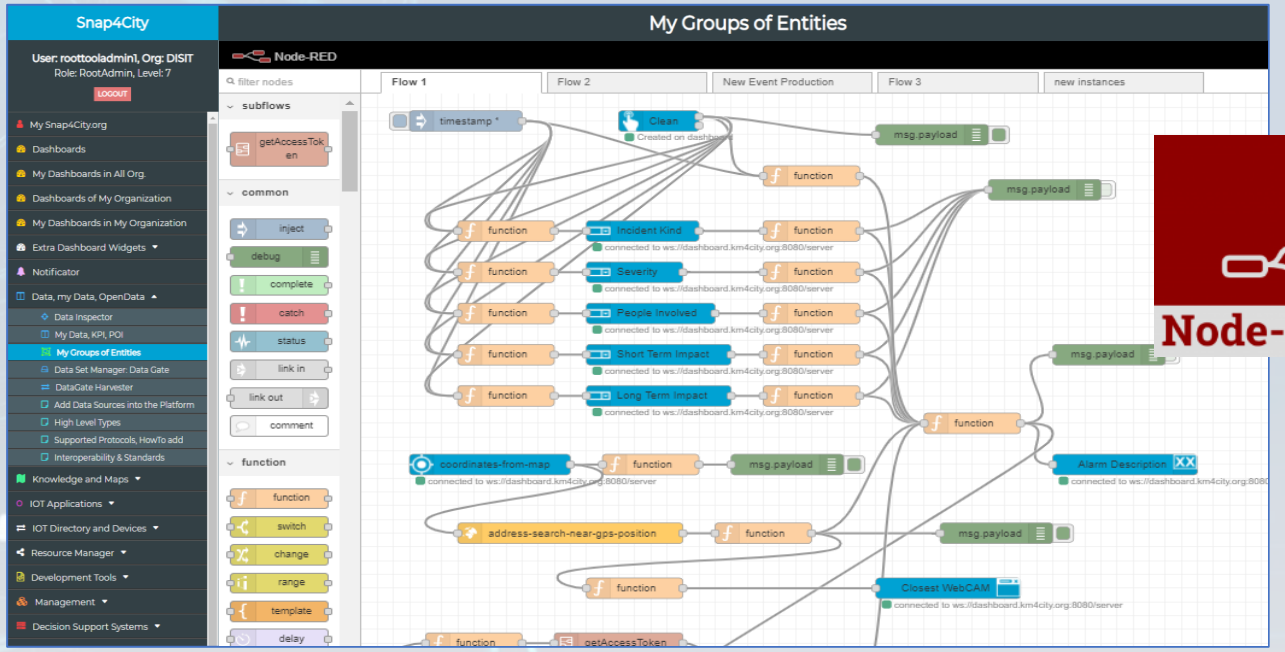
- **via**:
- **Smart City API** for Apps and third party
- **MicroServices** data driven develop via visual language Node-RED

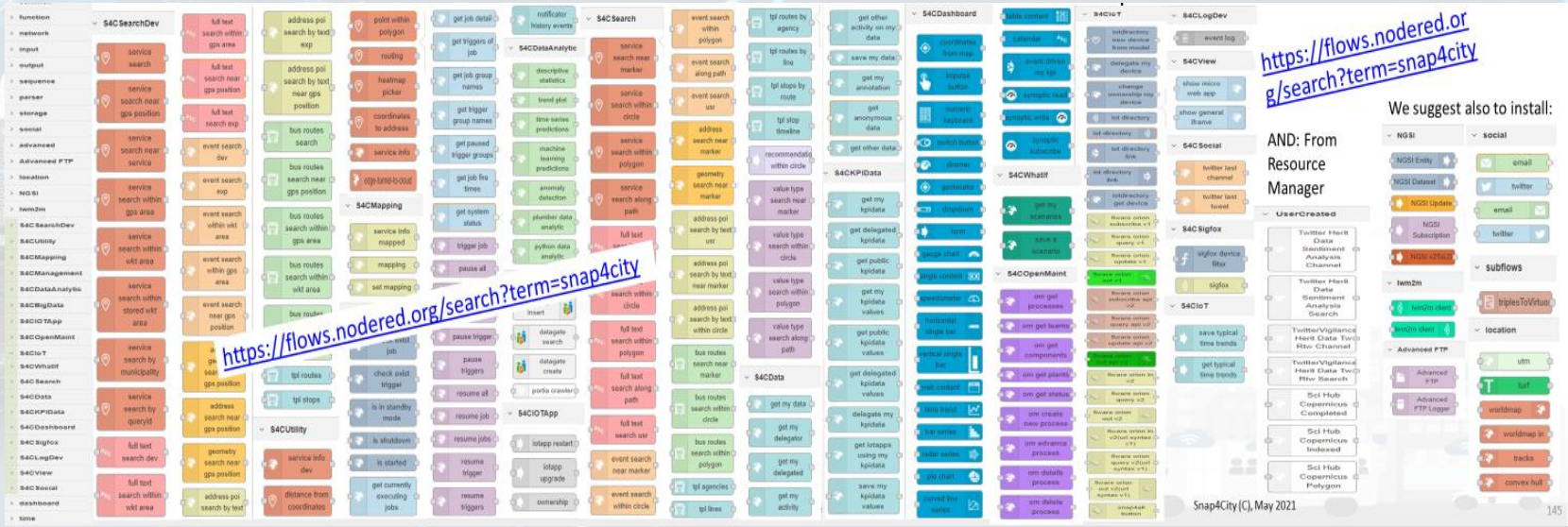


https://www.snap4city.org/19

Ingestion, aggreg. → exploitation

- **IoT App Visual Programming, no coding**
  - **Data transformation**
  - **Integration**
  - **Scripting Data Analytics**
  - **Data ingestion**
  - **Business logic**
- **MicroServices** data driven develop via visual language Node-RED

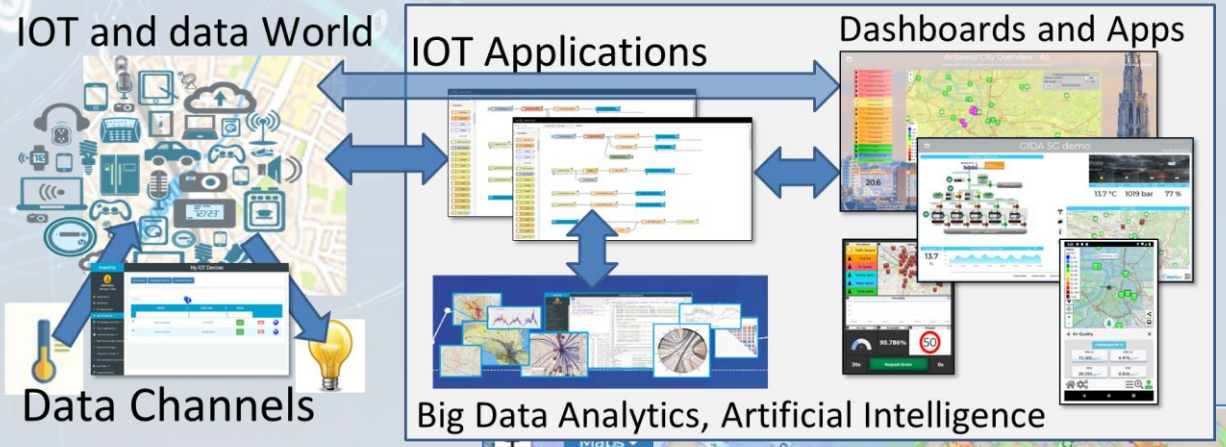


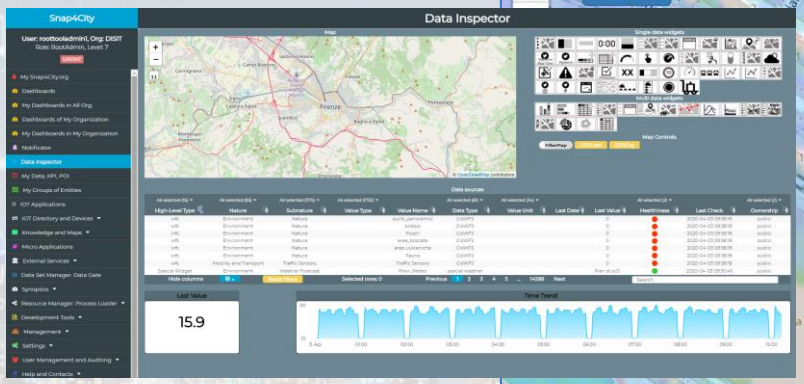


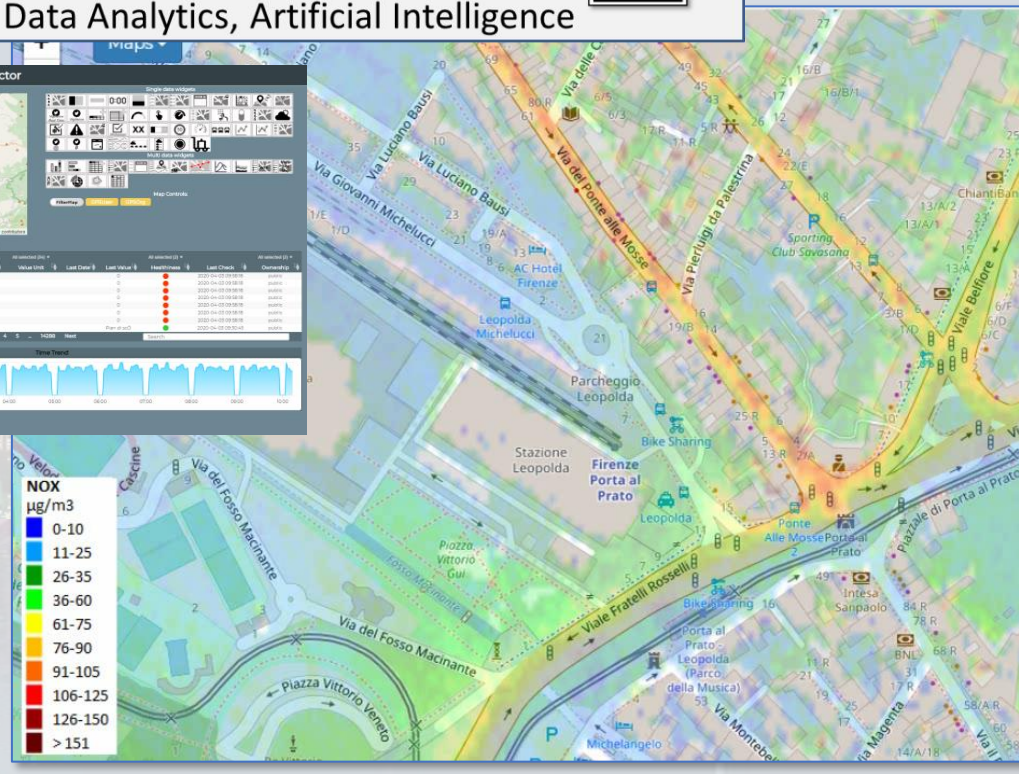
Solutions: reliable, secure and fast to realize

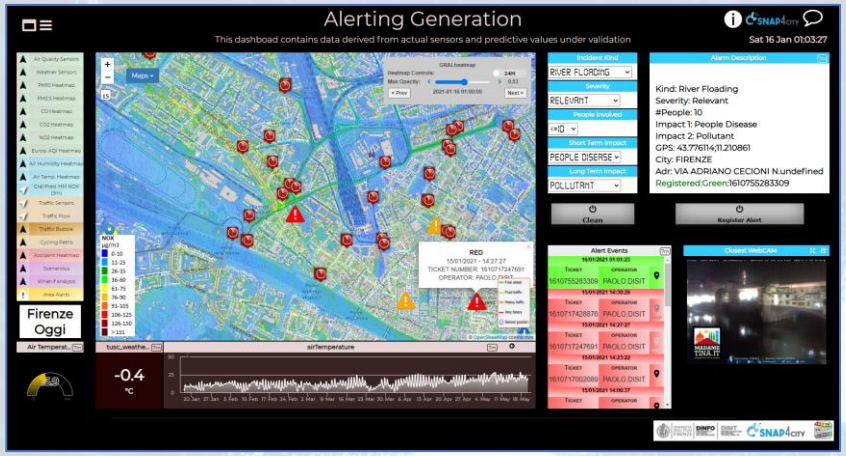
- **Via Snap4City tools**
  - **Dashboard Wizard**
  - **Dashboard Builder**
  - **Data/Visual Analytic**

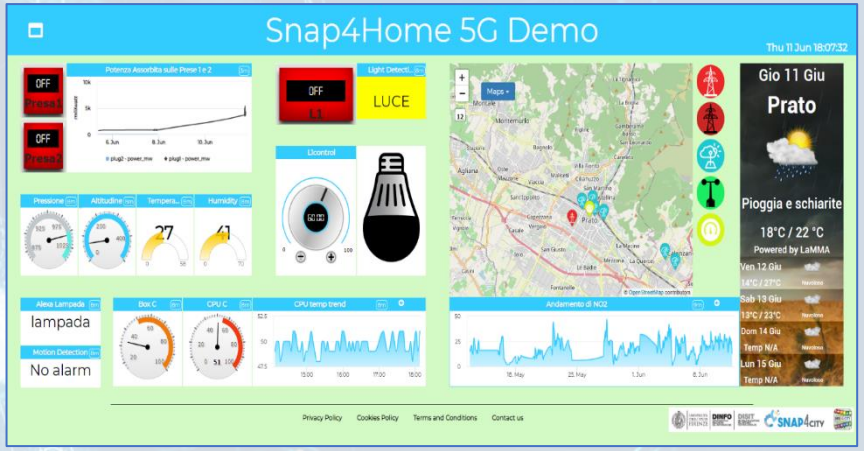
- **Smart Solutions results to be**
  - **Real time data drive**
  - **Secure end-to-end**
  - **GDPR compliant**
  - **Reliable, interoperable**
  - **Auditable, marketable**

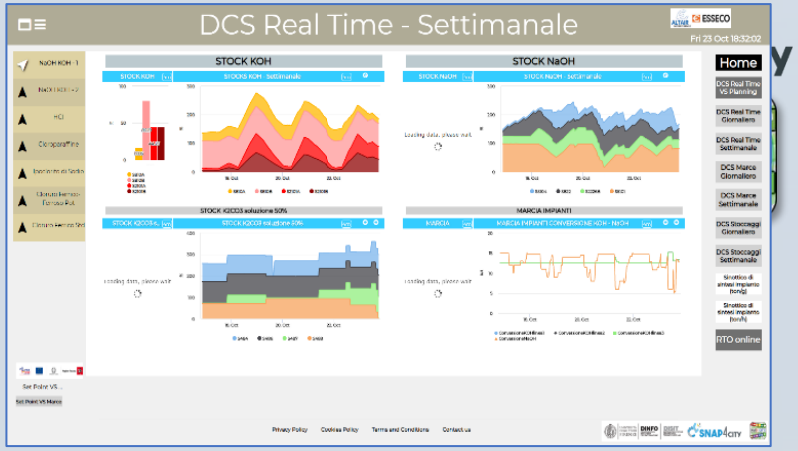


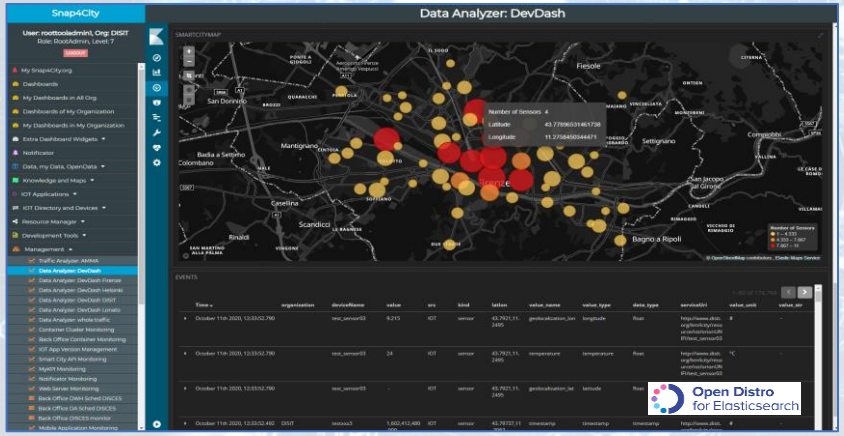


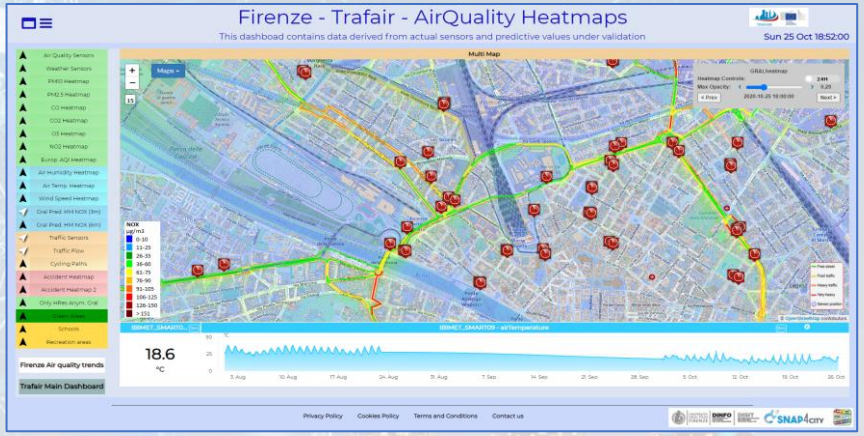


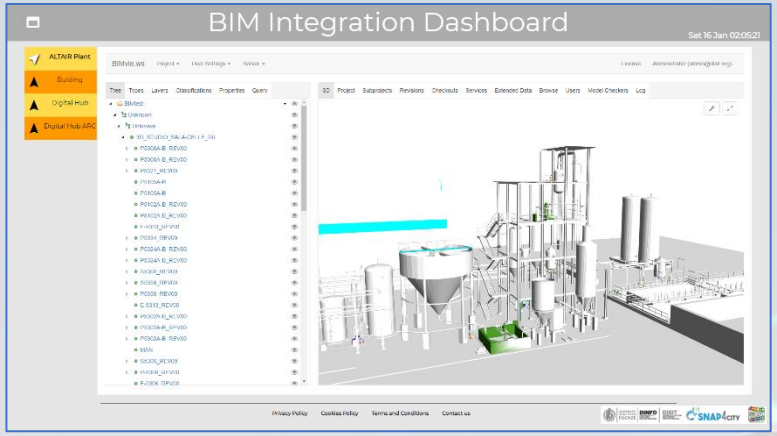

Alerting Generation
This dashboad contains data derived from actual sensors and predictive values under validation
Sat 16 Jan 01:03:27
Firenze Oggi
-0.4

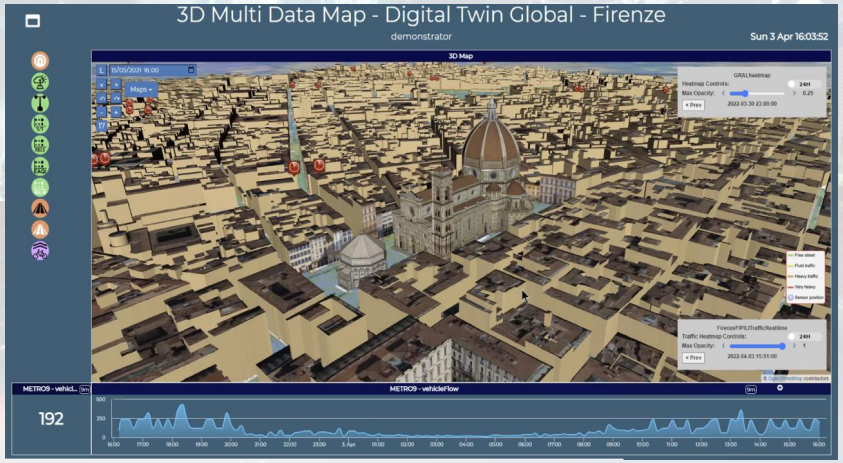

Snap4Home 5G Demo
Thu 11 Jun 18:07:32
LUCE
lampada
No alarm
Gio 11 Giu
Prato
Pioggia e schiarite
18°C / 22 °C
Powered by LaMMA

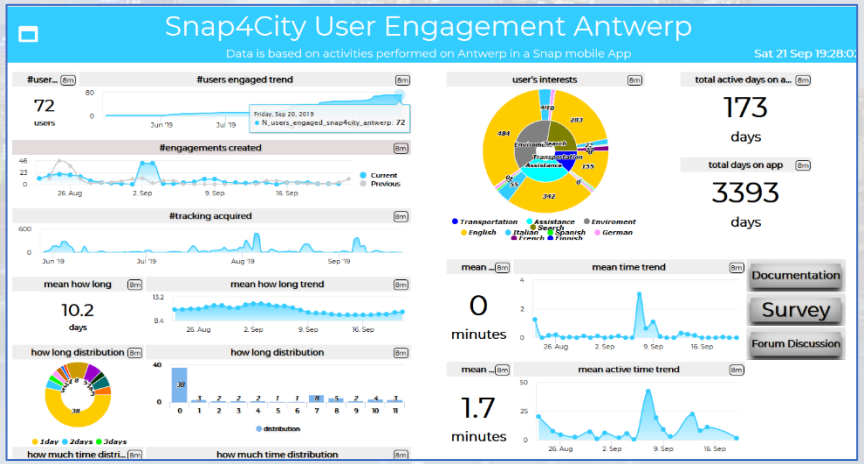

DCS Real Time - Settimanale
Fri 23 Oct 18:32:02
STOCK KOH
STOCK NaOH
Home

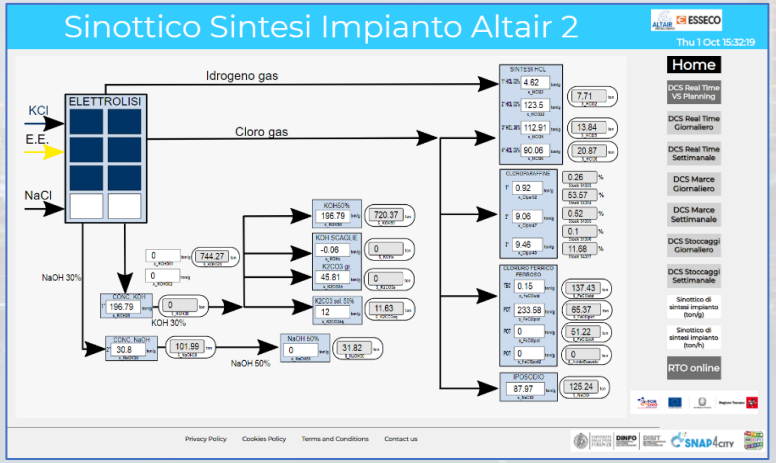

Data Analyzer: DevDash
Open Distro for Elasticsearch

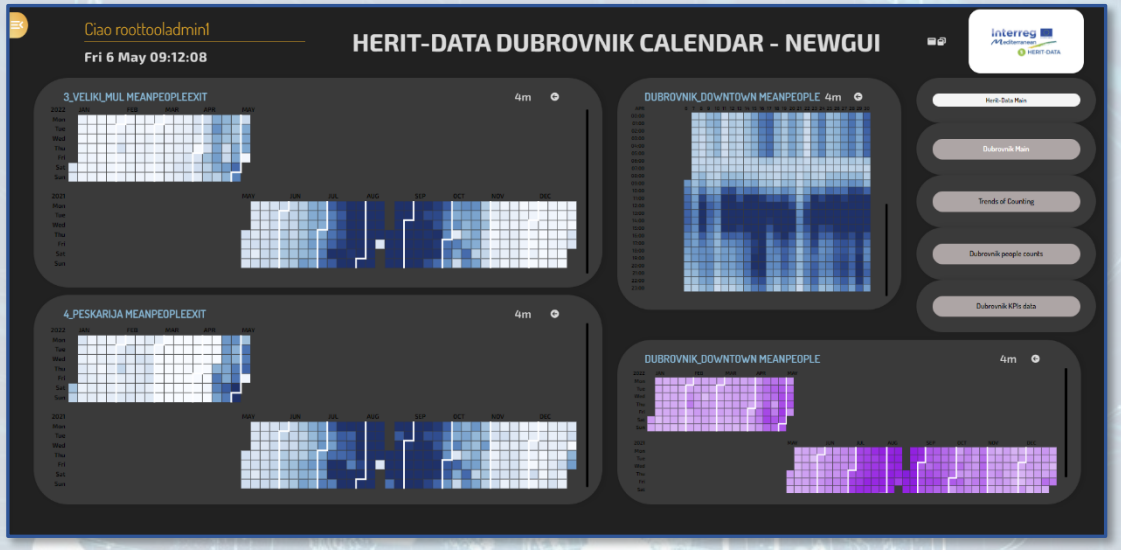

Firenze - Trafair - AirQuality Heatmaps
This dashboad contains data derived from actual sensors and predictive values under validation
Sun 25 Oct 18:52:00
18.6

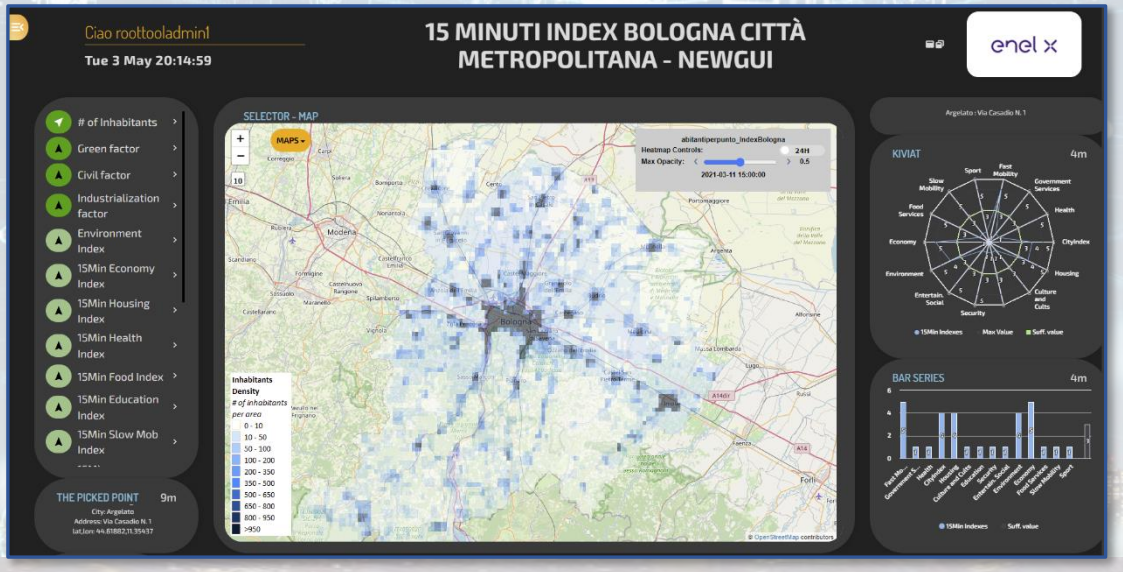

BIM Integration Dashboard
Sat 16 Jan 02:05:21

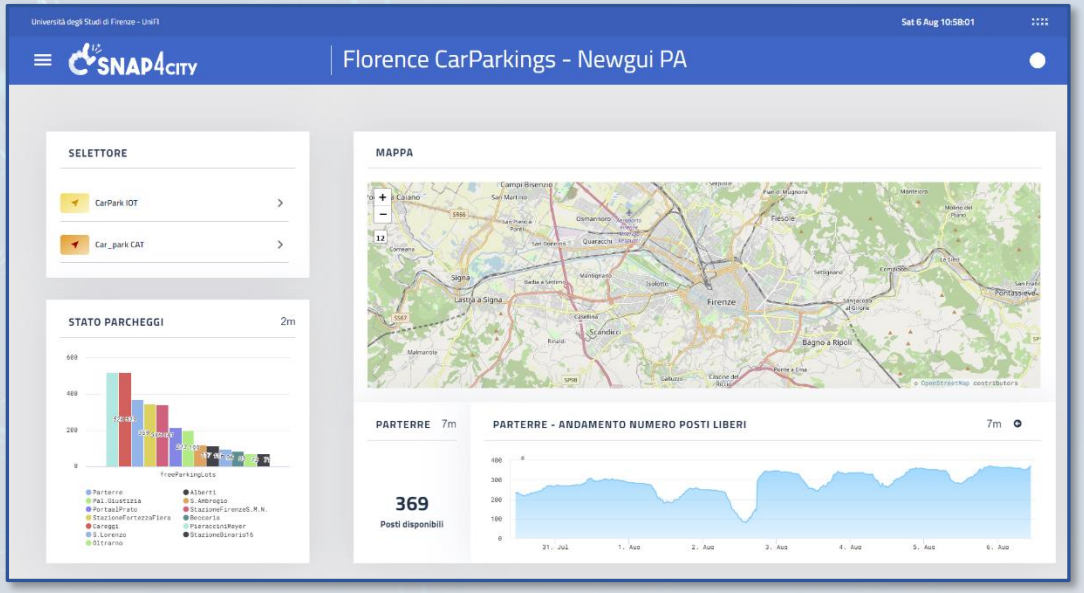

3D Multi Data Map - Digital Twin Global - Firenze
demonstrator
Sun 3 Apr 16:03:52
192

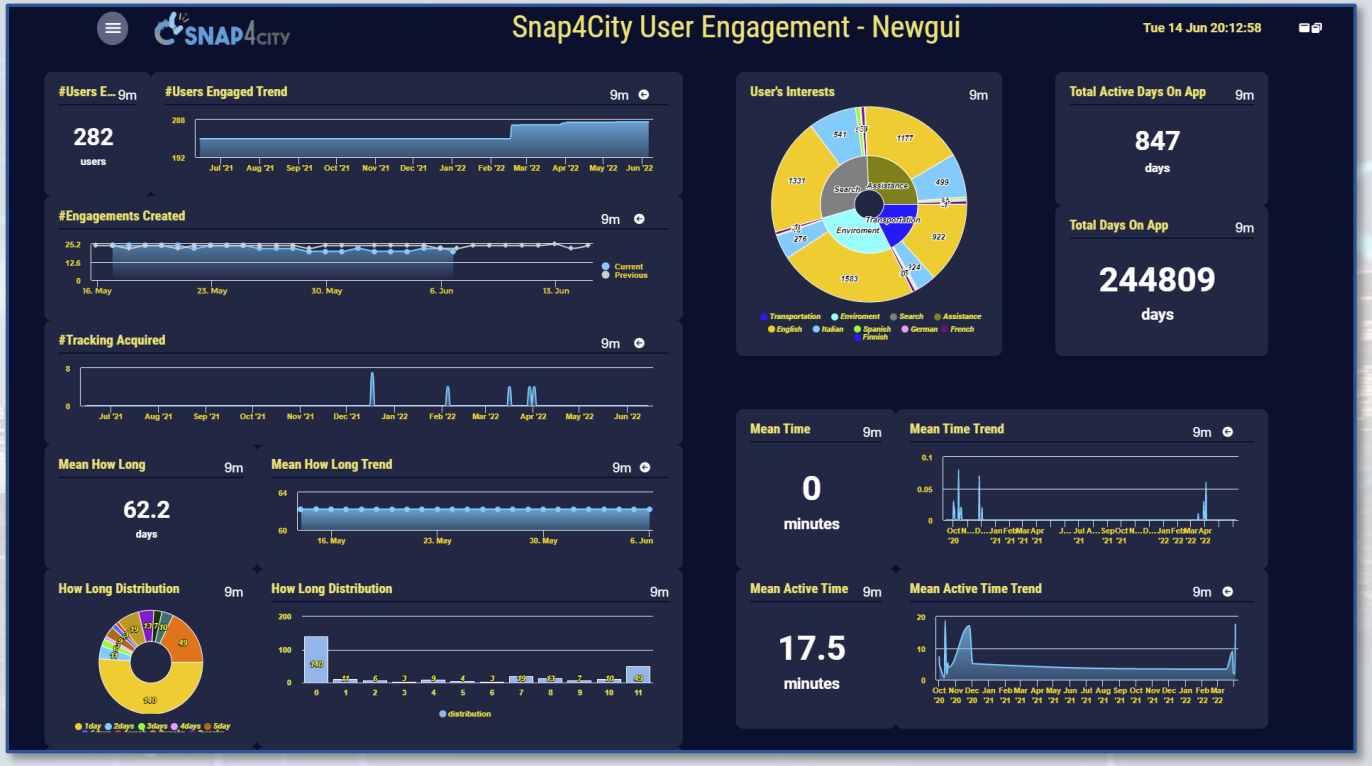

Snap4City User Engagement Antwerp
Data is based on activities performed on Antwerp in a Snap mobile App
Sat 21 Sep 19:28:0
72
users
173
days
3393
days
10.2
days
0
minutes
1.7
minutes
Documentation
Survey
Forum Discussion


Sinottico Sintesi Impianto Altair 2
Thu 1 Oct 15:32:19
Home
Idrogeno gas
Cloro gas
ELETTROLISI
KCl
E.E.
NaCl
NaOH 30%
KOH 30%
NaOH 50%





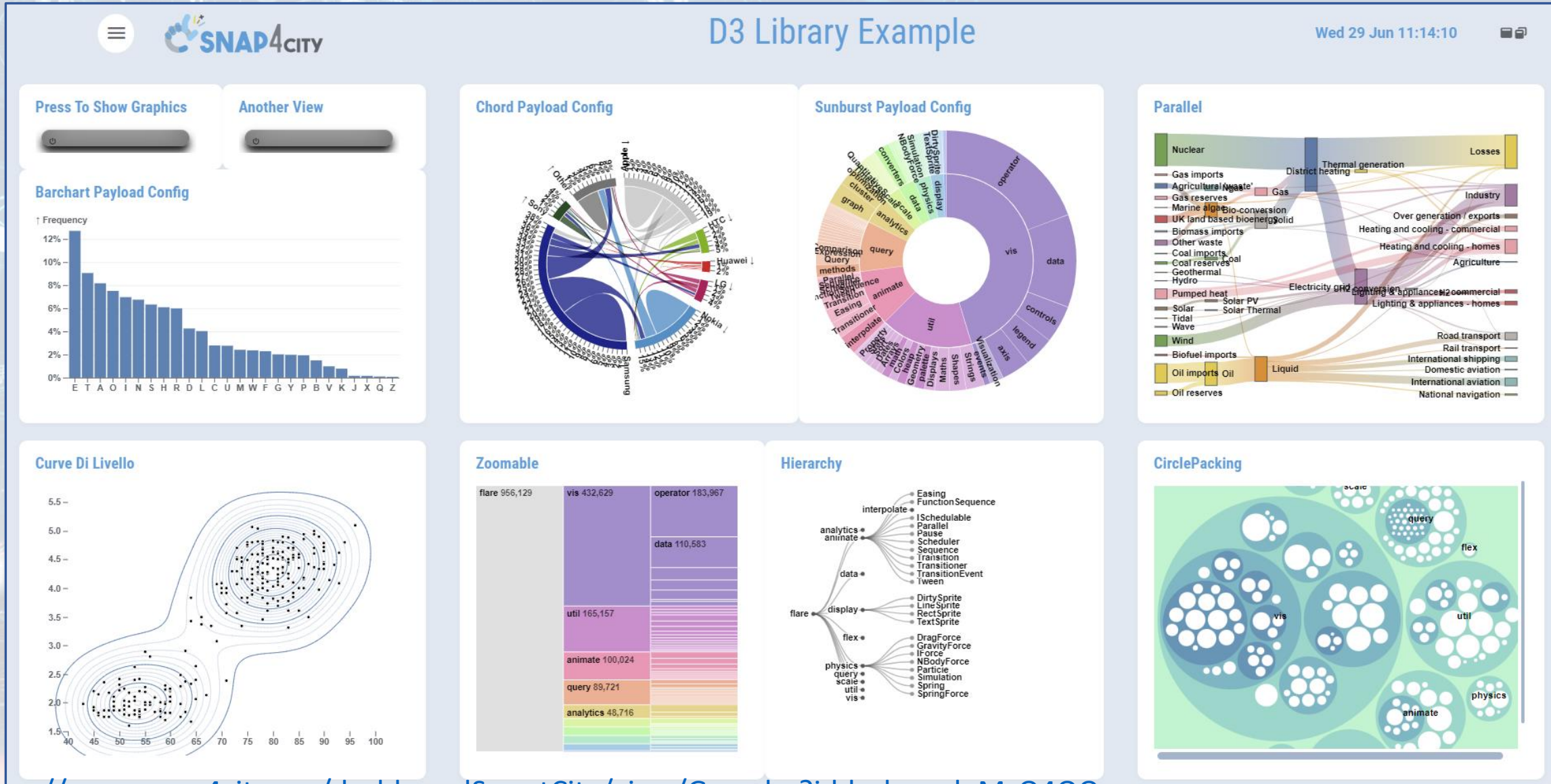




New styles/themes can be developed by specializing a few files from open source

https://www.snap4city.org/793

D3 Graph library capability



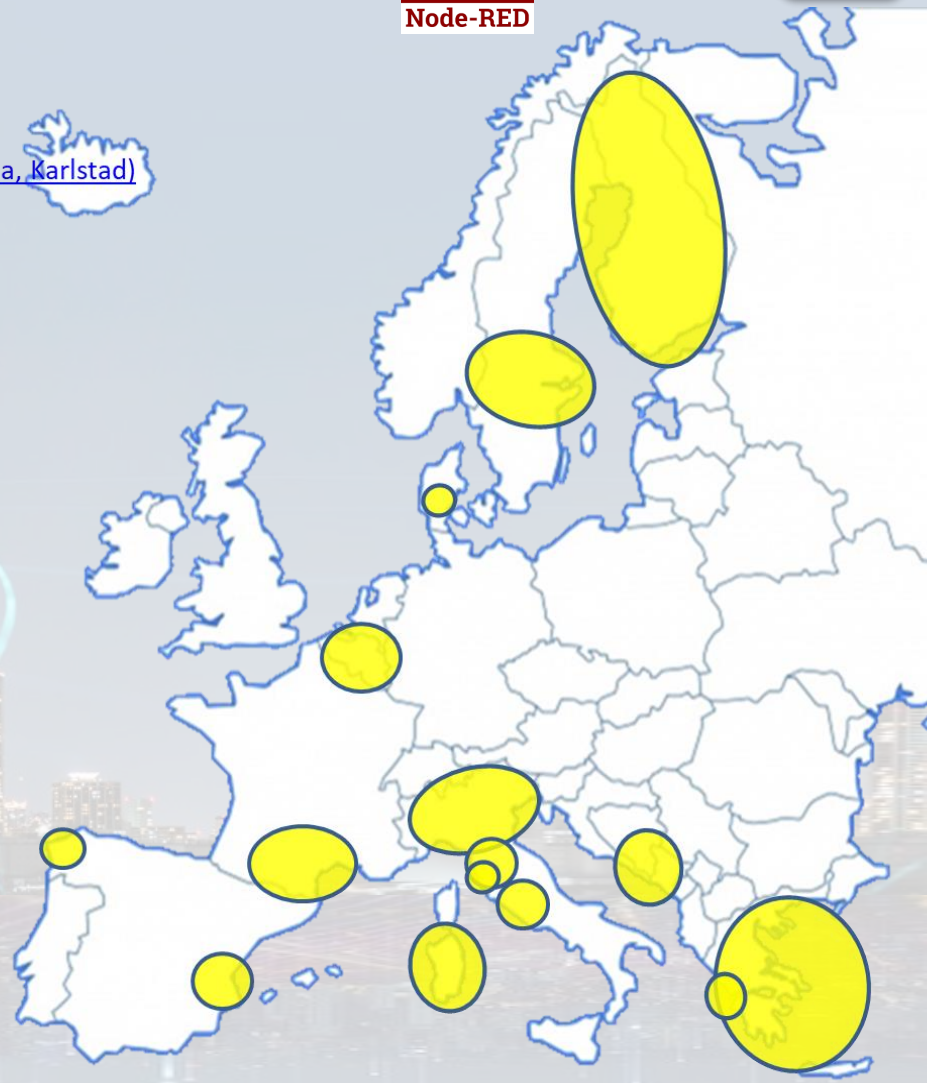
https://www.snap4city.org/dashboardSmartCity/view/Gea.php?iddasboard=MzQ4OQ==

https://www.Snap4City.org

- 8 running installations in Europe
  - Toscana, Pisa, Sweden, ISPRA, Snap4.eu,
  - Altair, Italmatic, Denmark, ….
- 13 projects, 12 pilots on 10 Countries
  - >40 cities/area
- **Wide MULTI-tenant deploy, e.g.,**
  - 18 Organizations / tenant
  - > 7400 users on
  - > 1400 Dashboards
  - > 16 mobile Apps
  - **> 2 Million of structured data per day**
  - > 520 IoT Applications/node-RED
  - > 700 web pages with training
  - > 60 videos, training videos

Main Organizations/areas

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



- **Trials in Israel, Colombia, Brasile, Australia, India, Romania, etc.**

Florence

https://www.snap4city.org/747

Smart City Control Room
Florence Metropolitan City

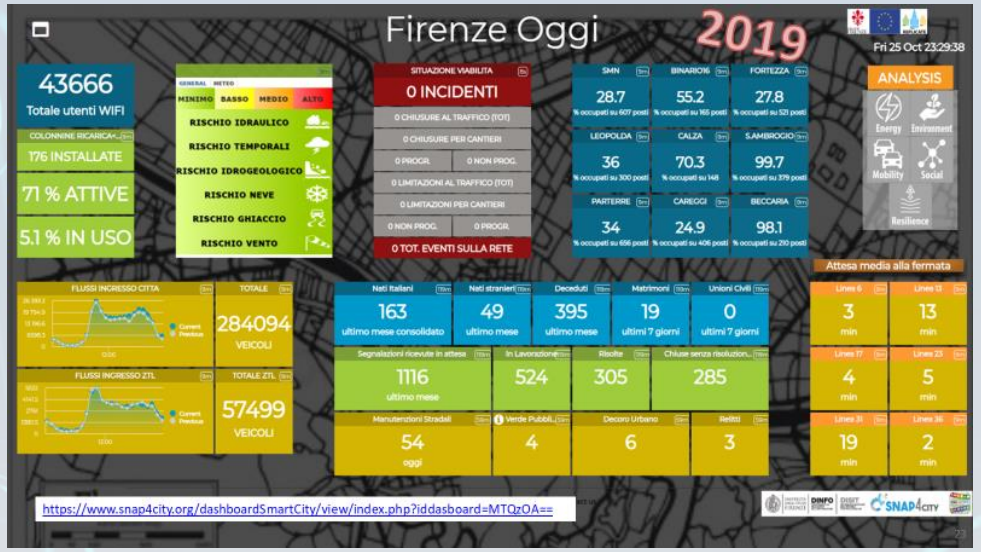
COMUNE DI FIRENZE

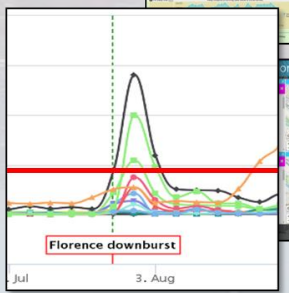
reference

SNAP4CITY

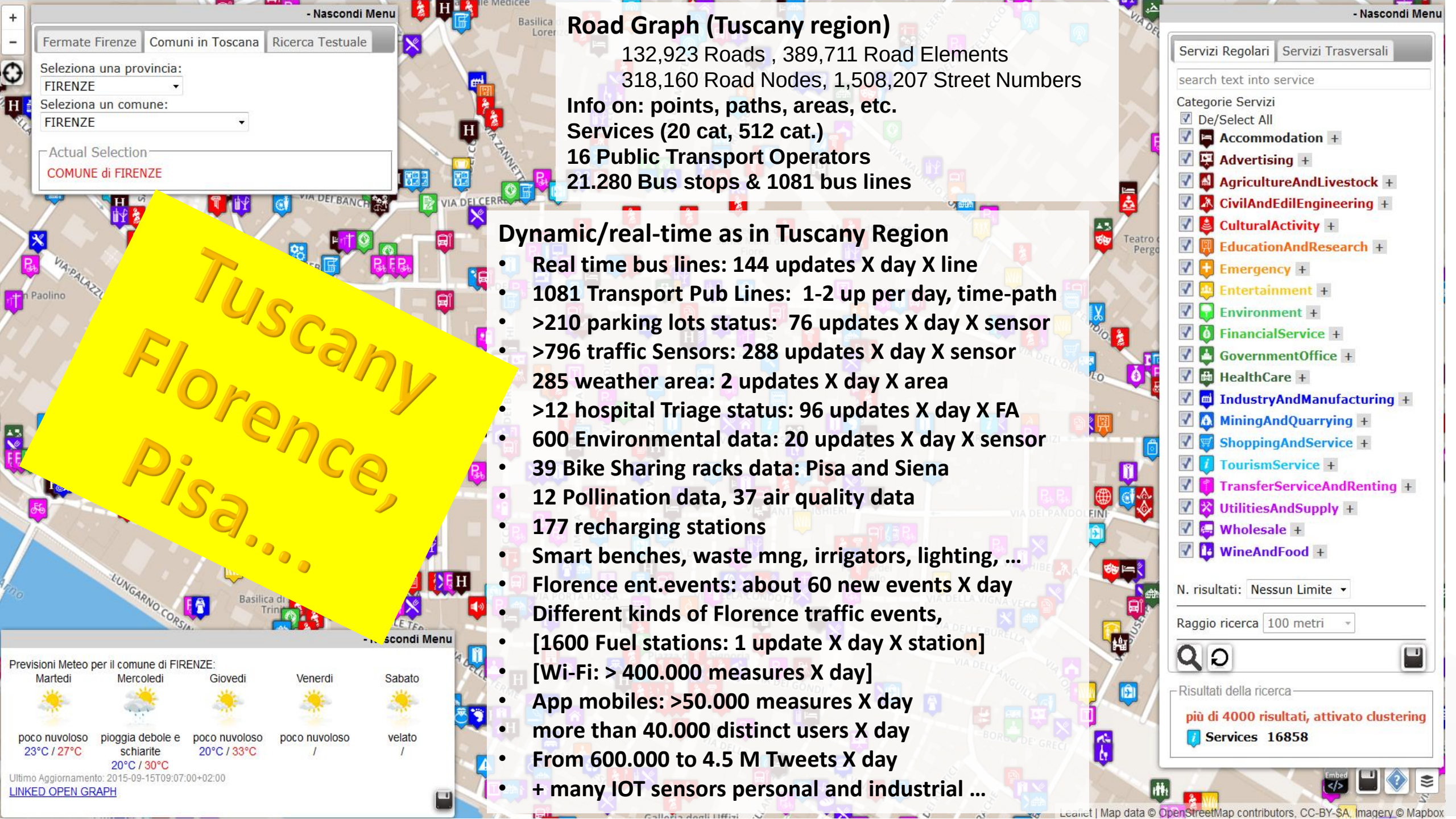
KM 4 CITY

- **Multiple Domain Data**
  - Thousands of Open/Private data, POI, IOT, etc.
  - ***mobility and transport***: accidents, public transport, parking, traffic flow, Traffic Reconstruction, KPI, …
  - ***AND***: environment, civil protection, gov KPI, covid-19, social & social media, people flow, tourism, energy, culture, …
- **Multiple dash/tool Levels & Decision Makers**
  - Real Time monitoring, Alerting, quality assess.
  - Predictions, KPI, DSS, what-if analysis
- **Historical and Real Time data**
  - Billions of Data
- **Services Exploited on:**
  - Multiple Levels, Mobile Apps, API
- **Since 2017**





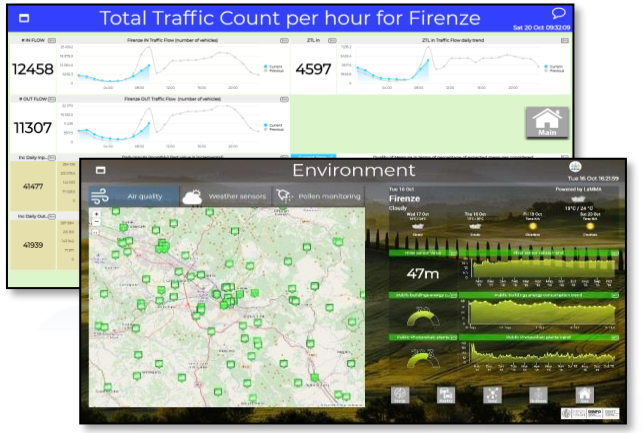
https://www.snap4city.org/747


- Nascondi Menu
Fermate Firenze
Comuni in Toscana
Ricerca Testuale
Seleziona una provincia:
FIRENZE
Seleziona un comune:
FIRENZE
Actual Selection
COMUNE di FIRENZE
Tuscany
Florence,
Pisa....
Road Graph (Tuscany region)
132,923 Roads , 389,711 Road Elements
318,160 Road Nodes, 1,508,207 Street Numbers
Info on: points, paths, areas, etc.
Services (20 cat, 512 cat.)
16 Public Transport Operators
21.280 Bus stops & 1081 bus lines
Dynamic/real-time as in Tuscany Region
• Real time bus lines: 144 updates X day X line
• 1081 Transport Pub Lines: 1-2 up per day, time-path
• >210 parking lots status: 76 updates X day X sensor
• >796 traffic Sensors: 288 updates X day X sensor
285 weather area: 2 updates X day X area
• >12 hospital Triage status: 96 updates X day X FA
• 600 Environmental data: 20 updates X day X sensor
• 39 Bike Sharing racks data: Pisa and Siena
• 12 Pollination data, 37 air quality data
• 177 recharging stations
• Smart benches, waste mng, irrigators, lighting, …
• Florence ent.events: about 60 new events X day
• Different kinds of Florence traffic events,
• [1600 Fuel stations: 1 update X day X station]
• [Wi-Fi: > 400.000 measures X day]
• App mobiles: >50.000 measures X day
• more than 40.000 distinct users X day
• From 600.000 to 4.5 M Tweets X day
• + many IOT sensors personal and industrial …
- Nascondi Menu
Previsioni Meteo per il comune di FIRENZE:
Martedi
poco nuvoloso
23°C / 27°C
Mercoledi
pioggia debole e schiarite
20°C / 30°C
Giovedi
poco nuvoloso
20°C / 33°C
Venerdi
poco nuvoloso
/
Sabato
velato
/
Ultimo Aggiornamento: 2015-09-15T09:07:00+02:00
LINKED OPEN GRAPH
- Nascondi Menu
Servizi Regolari
Servizi Trasversali
search text into service
Categorie Servizi
De/Select All
Accommodation
Advertising
AgricultureAndLivestock
CivilAndEdilEngineering
CulturalActivity
EducationAndResearch
Emergency
Entertainment
Environment
FinancialService
GovernmentOffice
HealthCare
IndustryAndManufacturing
MiningAndQuarrying
ShoppingAndService
TourismService
TransferServiceAndRenting
UtilitiesAndSupply
Wholesale
WineAndFood
N. risultati: Nessun Limite
Raggio ricerca 100 metri
Risultati della ricerca
più di 4000 risultati, attivato clustering
Services 16858
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

Firenze Oggi
20991
92207
15964
ANALYSIS
The European House
Ambrosetti

Florence Case

- **Smart City Control Room**
- **Dashboards and Services**
- **Mobile App:** Firenze Where What

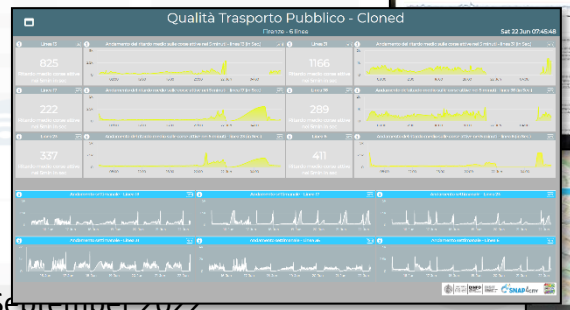


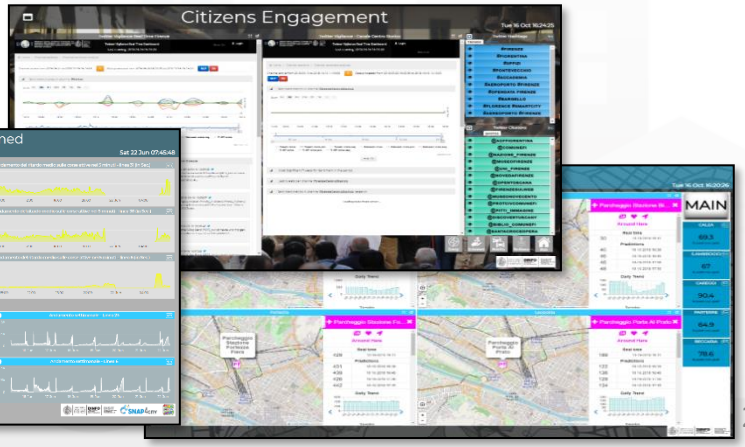
- **Mobility**:
  - quality of public transportation service (mean delay on bus-stops)
  - public transport operators schedule and paths, routing, multimodal routing
  - traffic flow reconstruction
  - Smart parking: predictions
  - Accidents and events, Log, heatmaps
- **Environment**:
  - smart irrigators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

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

Analysis:

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





3D views

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

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

SNAP4CITY KM4CITY

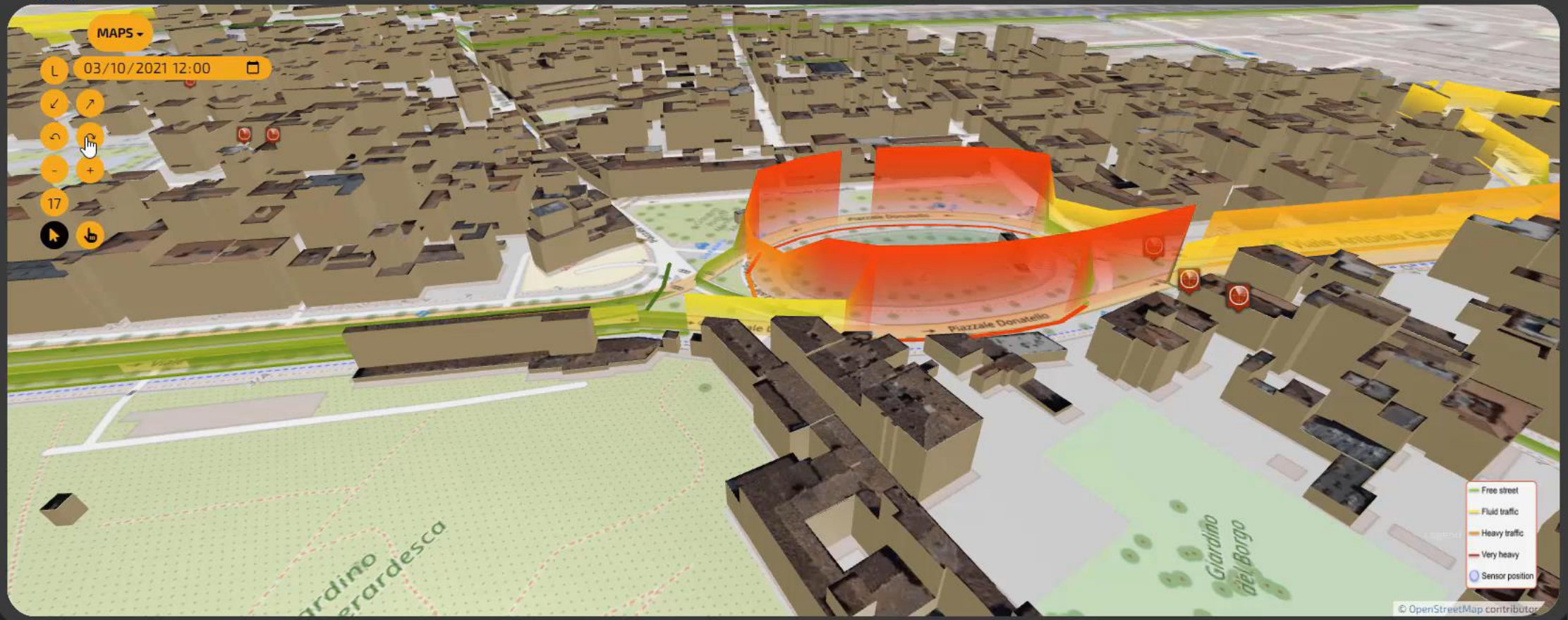
Ciao roottooladmin1

Thu 16 Jun 15:15:03

3D MAP DECK TEST-NEWGUI

demonstrator

3D MAP

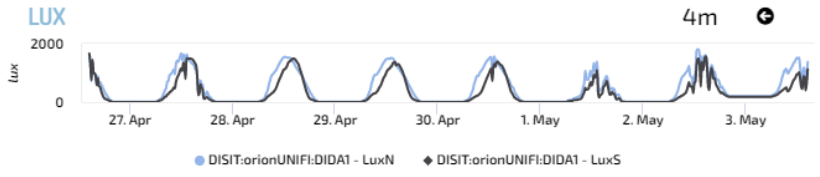


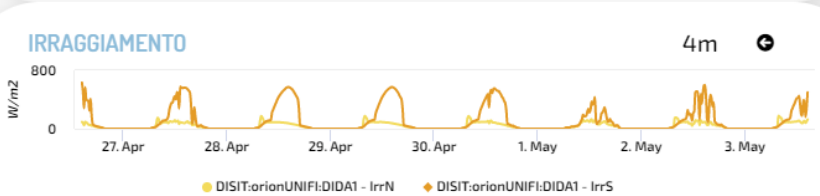
Smart Building

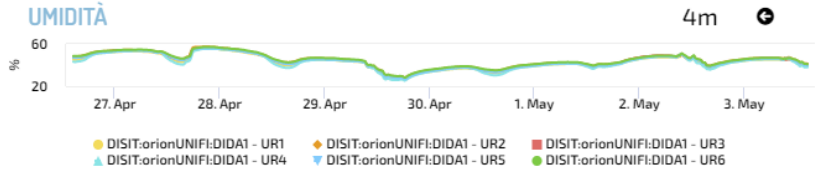
Ciao roottooladmin1

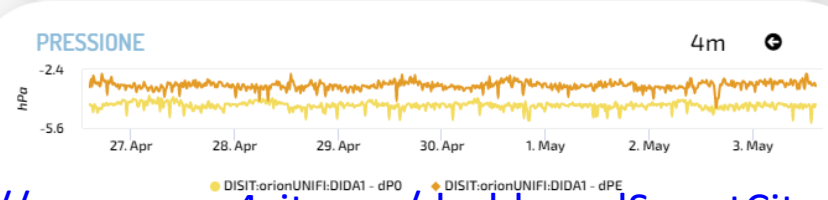
Tue 3 May 14:37:14

DIDA DATA 2 - NEWGUI



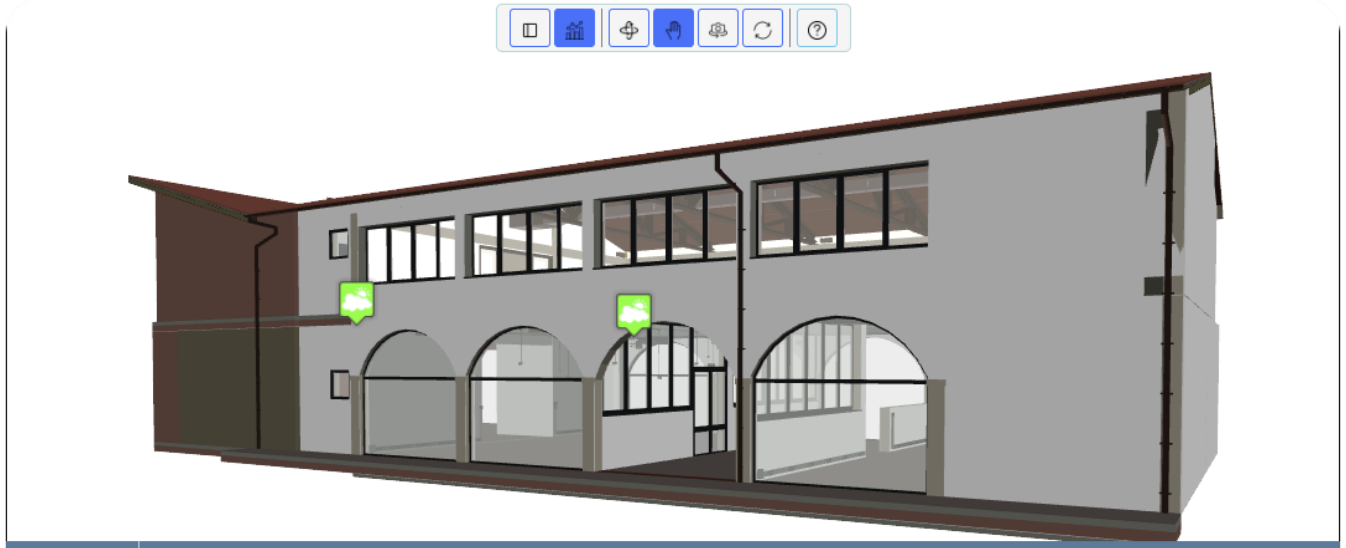






to see BIM log as user: info@disit.org, passwd: guest

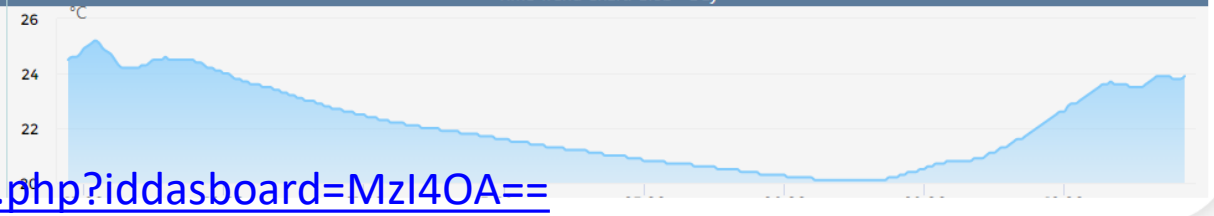
BIM SANTA VERDIANA



Last Value

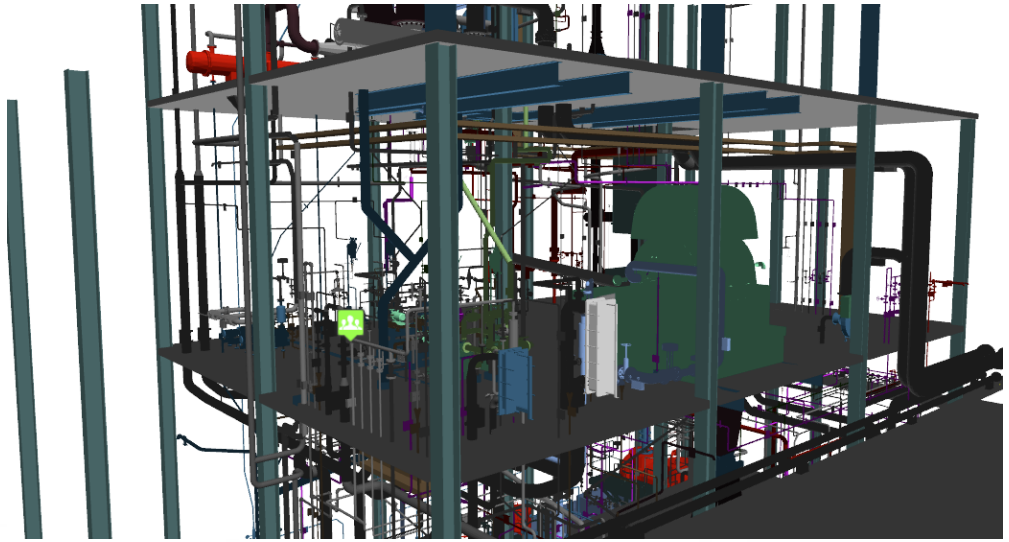
No data

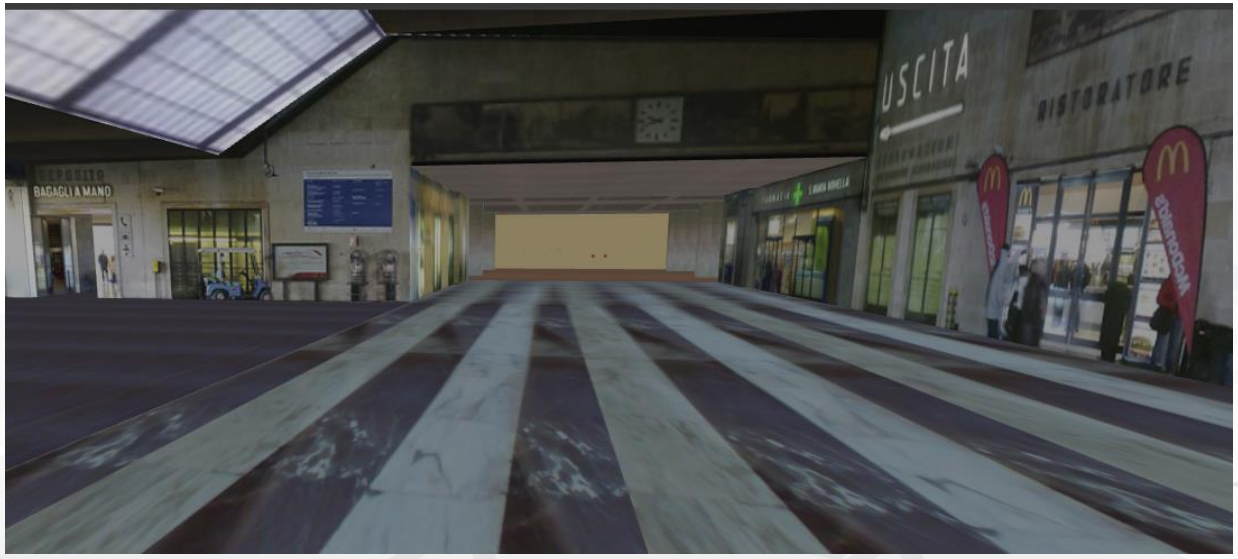
Time Trend Chart: Glob - Day

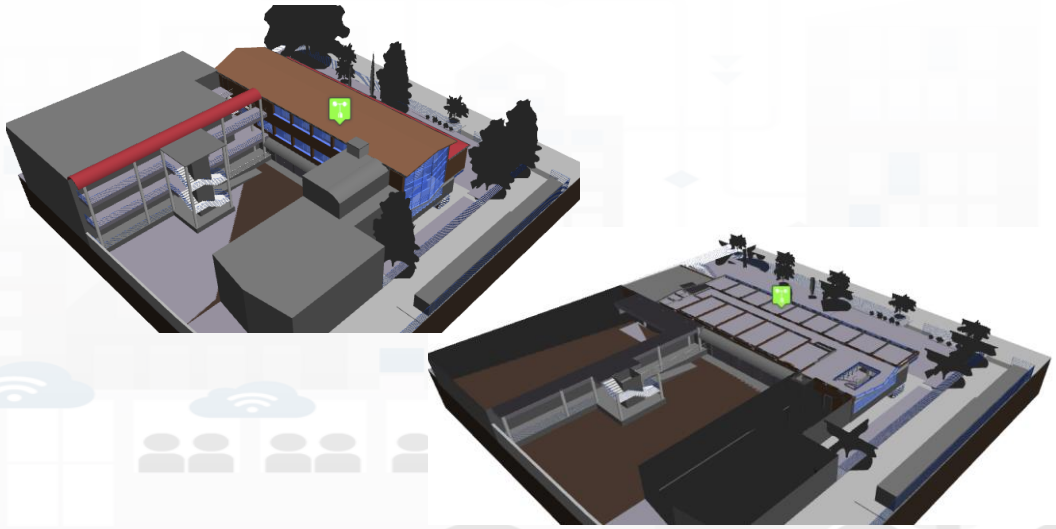


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzI4OA==

Digital Twin
Global vs Local







Big Data Analytics + Artificial Intelligence

- **Short and Long terms predictive models on:**
  - traffic, parking, people flow, maintenance, land sliding, NO2
- **3D Flow prediction:** Pollutant (NOX, NO2, …)
- **Early warning, City Indexes, etc.**
- **AI & XAI:**
  - RF, XGBoost, BRNN, RNN, SVR, DNN, LSTM, CNN-LSTM, BI-LSTM, Autoencoders, …
  - Clustering: K-means, K-Medoid, …
  - XAI: Shap, variations, ..
- **Modelling, simulation, routing**
  - **Traffic Flow reconstruction**
  - **Constrained Routing**
- **What-IF analysis** (simulation + AI + data)
- **Based on several computational models**:
  - trajectories, OD matrices, Typical Time Trends, etc.

to cope with

- *any data, format*
- *any channel, protocol*
- *any AI/ML*
- *any place*
- *online development*
- *multi-tenant*
- *Secure, PENTest*
- *GDPR, privacy*
- ***→ low costs***
- ***→ easy to evolve***

https://www.snap4city.org/download/video/course/da/

SUSTAINABLE DEVELOPMENT GOALS

SNAP4CITY

KM 4 CITY

- ***15 Minute City Index:***
  - 13 differente subindexes

- Monitoring and Prediction of energy consumption
- Stimulating: Bike sharing, e-bikes, car charge, etc.

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

- Smart City infrastructure: monitoring and resilience
- Effective and Low cost smart solutions
- What-if analysis, Simulations

- Monitoring resource consuption,
- business intelligence tools for decision makers,
- Reduction production costs

- Monitoring and Predictions for
  - NO2, NOX, CO2, Traffic flow, pollutant, landslide, etc.
  - Traffic flow reconstruction

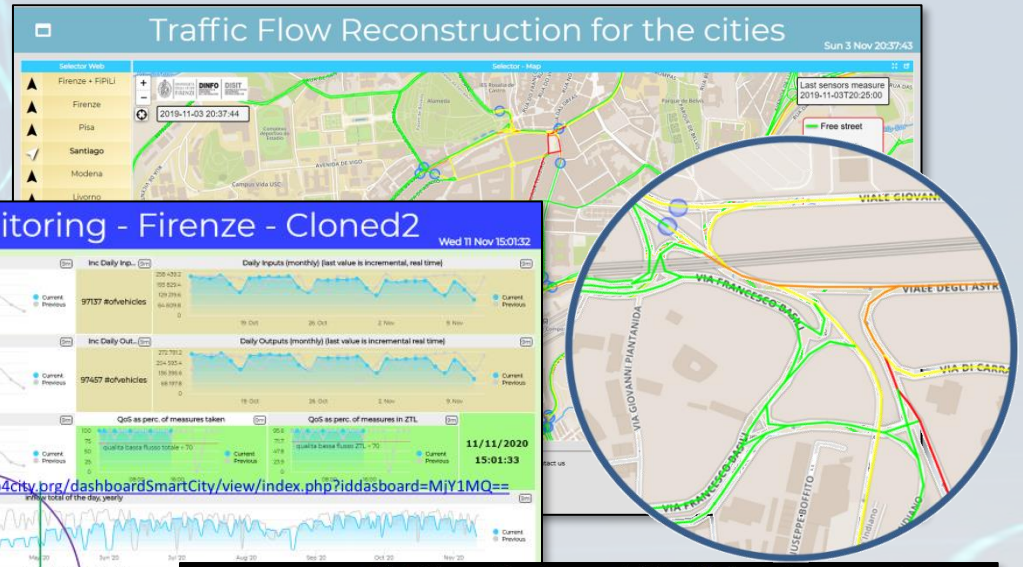
- Shortening justice time
- Predictiction of mediation proneness
- Ethical Explainable Artificial Intelligence

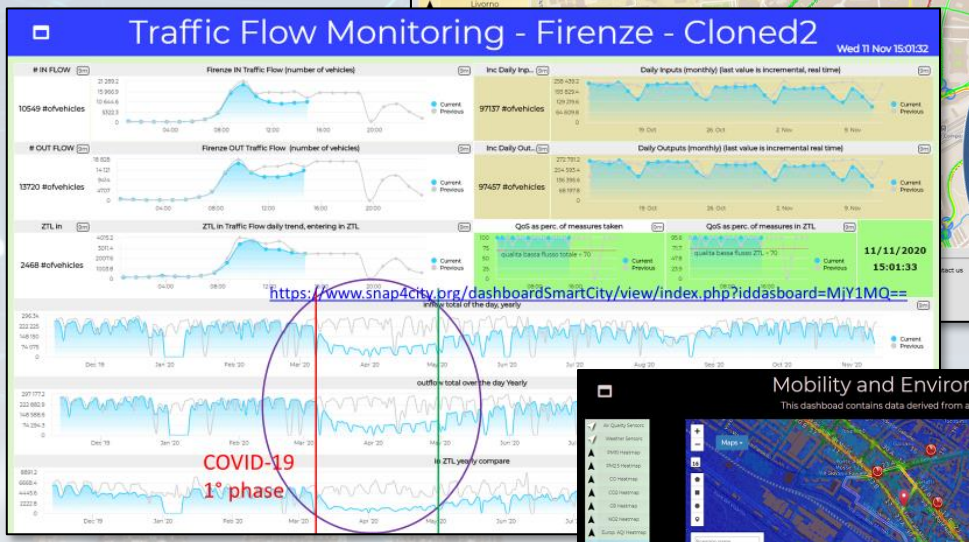
Mobility and Transport Traffic Flow Analysis

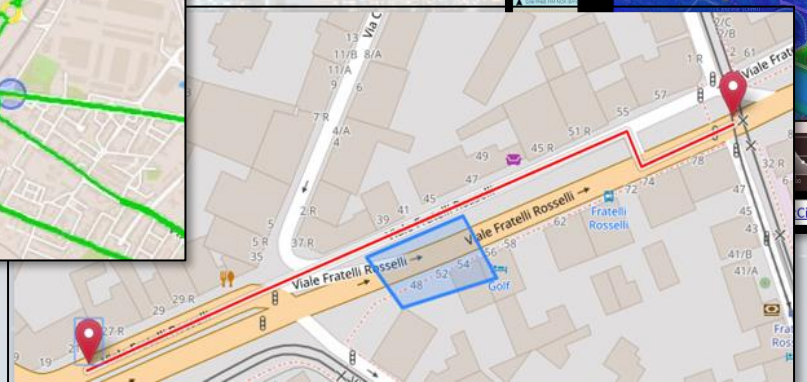
Cities: Firenze, Pisa, Livorno, Modena, Santiago di Compostela

reference

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





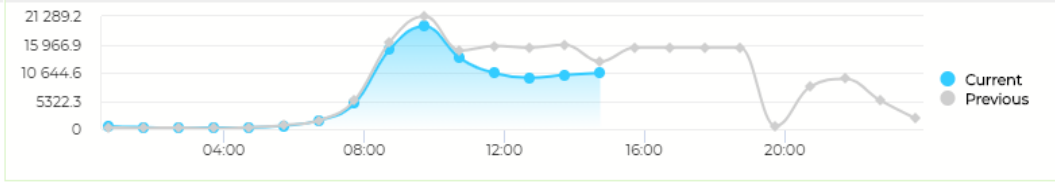


Traffic Flow Reconstruction
2018-02-01T00:10:00
Last sensors measure
2018-02-01T00:10:00
Free street
Fluid traffic
Heavy traffic
Very heavy
Sensor position
Firenze
FiPiLi
Pisa
Modena
real time
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery ©¿½ Mapbox

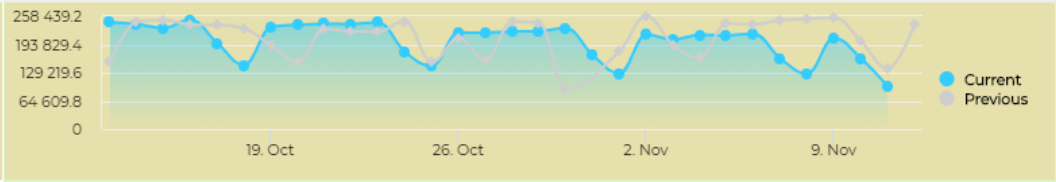
Traffic Flow Monitoring - Firenze - Cloned2

Wed 11 Nov 15:01:32

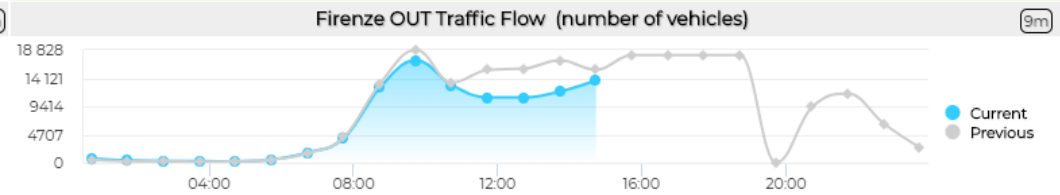
 # IN FLOW — 10549 #ofvehicles



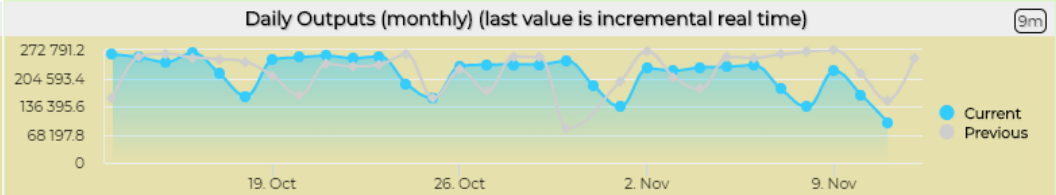
Inc Daily Inp... — 97137 #ofvehicles



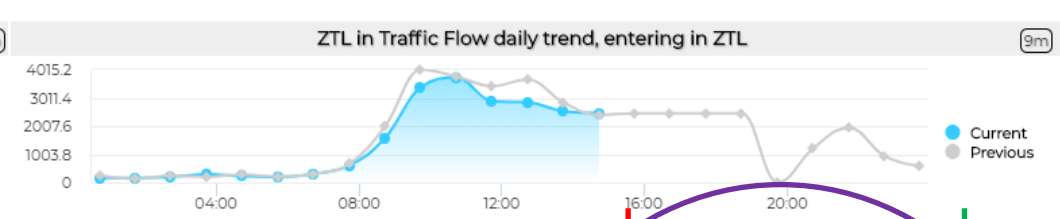
 # OUT FLOW — 13720 #ofvehicles

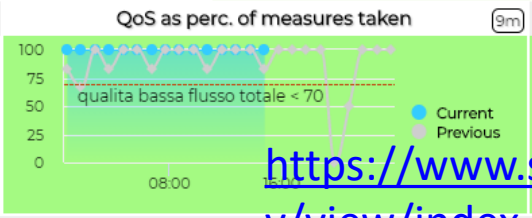


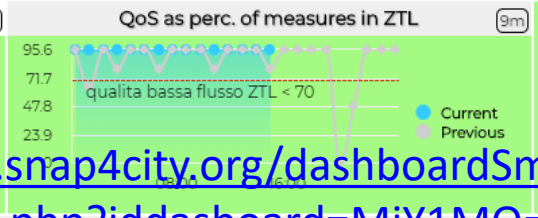
Inc Daily Out... — 97457 #ofvehicles



ZTL in — 2468 #ofvehicles







11/11/2020

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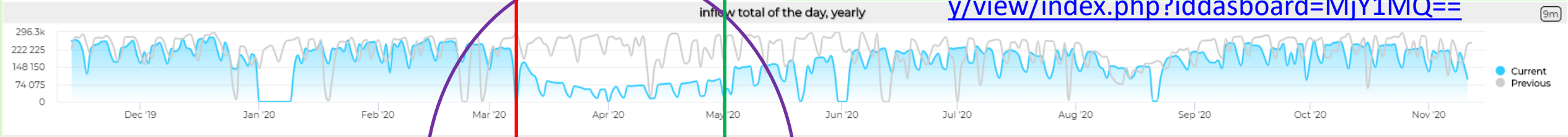
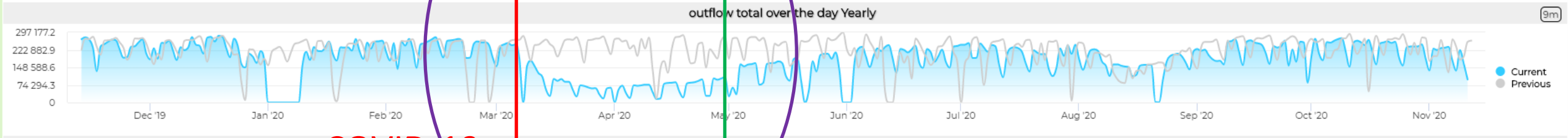
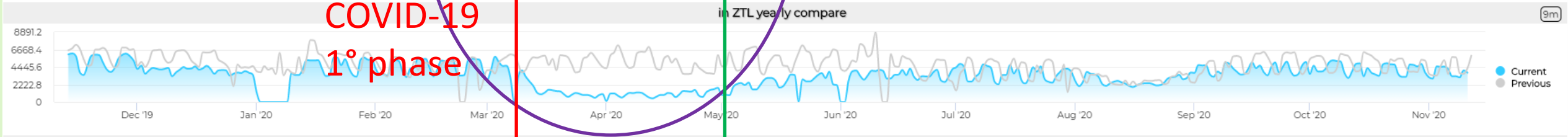
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjY1MQ==



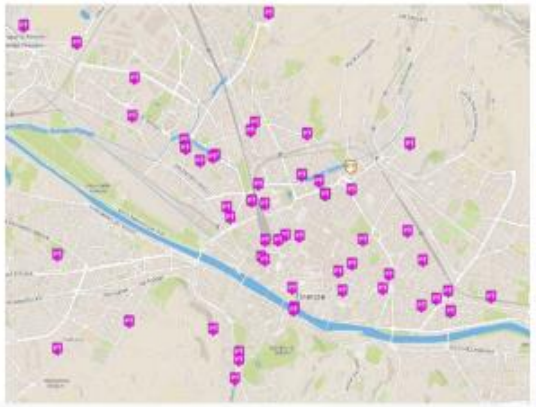




COVID-19

1° phase

Different Reduction of parking for Covid

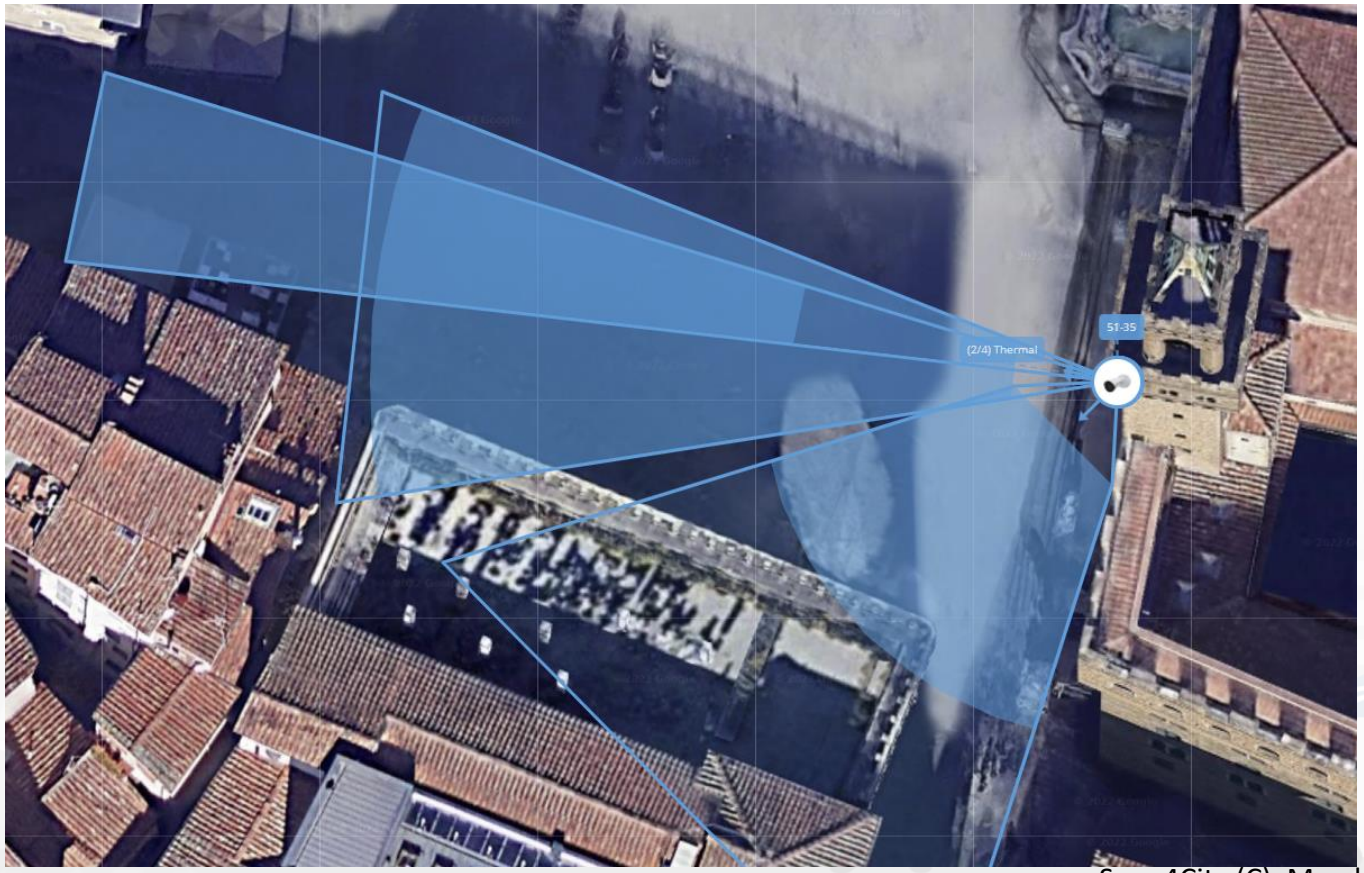


main Purpose	% of reduction in Lockdown	Recover in July 2020
Hospitals	55,9	31%
railway stations	84,2	60%
social hubs	85,8	72%
markets	45,1	25%
justice	96,1	82%

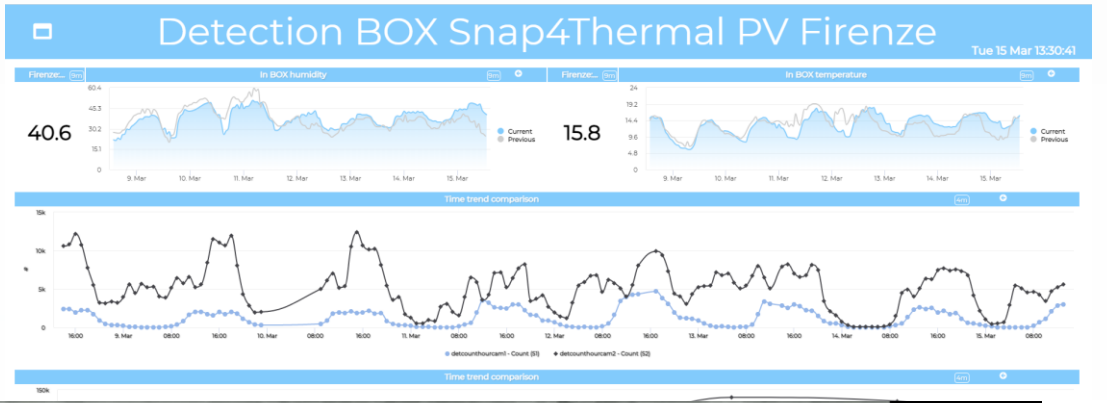
Impact on Pollutant on LockDown 2020

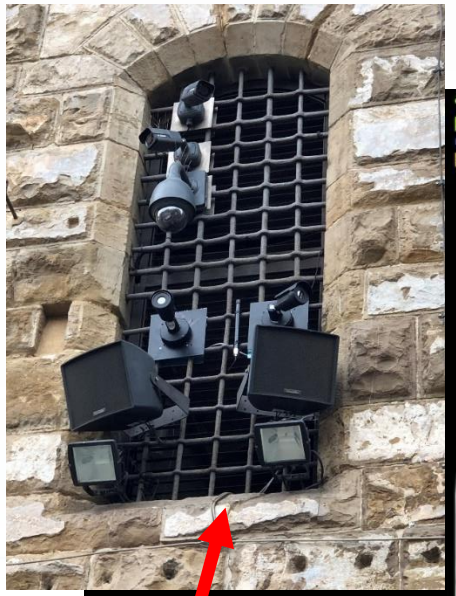
	CO2	CO	NO2	PM10
Percentage at which the average value of the pollutant has been reduced (February wrt April, 2020)	41,06	47,54	38,84	61,99
Percentage at which the MAX value of the pollutant has been reduced (February wrt April 2020)	38,89	34,62	63,02	60,21

Tracking People
AXIS Camera with Snap4City



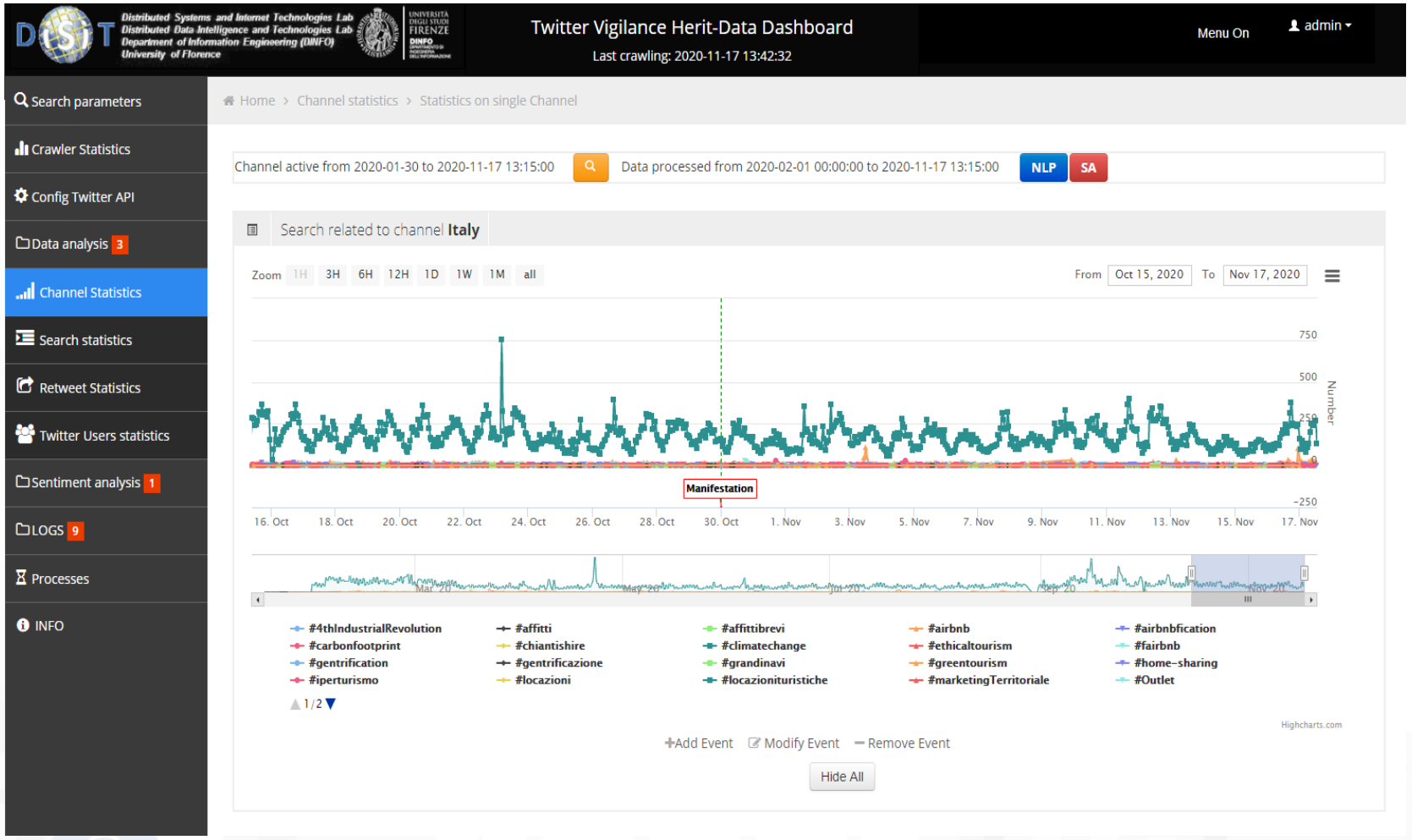
A view and data from the Thermal Camera





TV on Florence

#4thIndustrialRevolution #affitti #affittibrevi #airbnb
#airbnbfication #carbonfootprint #chiantishire #climatechange
#ethicaltourism #fairbnb #gentrification #gentrificazione
#grandinavi #greentourism #home-sharing #iperturismo
#locazioni #locazionituristiche #marketingTerritoriale #Outlet
#overtourism #responsibletravel #sharingEconomy
#socialtourism #SustainableDevelopmentGoals
#sustainabletourism #Tourism4SDGs #turismoEnogastronomico
#turismoEsperenziale #turismoetico #turismoSmart
#turismosostenibile #turismoverde #voluntourism



Twitter Vigilance

Event: clashes between police and demonstrators in Florence, during an unauthorized demonstration against the restrictions of Covid-19 government measures (on 30th October 2020 night).

Italy: Protests flare in Florence over restrictions

31 Oct, 2020

Facebook Twitter Mi piace 655 Tweet

Florence mayor condemns violence and vandalism in historic centre in "surreal, terrible and painful night" for Tuscan city.

Protesters clashed with police in central Florence last night during an unauthorised protest over Italy's latest restrictions aimed at curbing the spread of covid-19.

In partnership with la Repubblica FIRENZE.it

Oct. 30 Protest Devastates Florence

10/31/2020

During the unauthorized evening demonstration against recent social lockdown pandemic measures lasting four hours in downtown Florence on the evening of October 30 saw

TOP NEWS STORIES

Oct. 30 Protest Devastates Florence
During the unauthorized evening demonstration against recent social lockdown pandemic measures lasting four hours in downtown Florence [...]

COVID Demonstrations Hit Florence
Unlike the U.S. protesters in Italy reserve public space for peaceful demonstrations which are organized to communicate a [...]

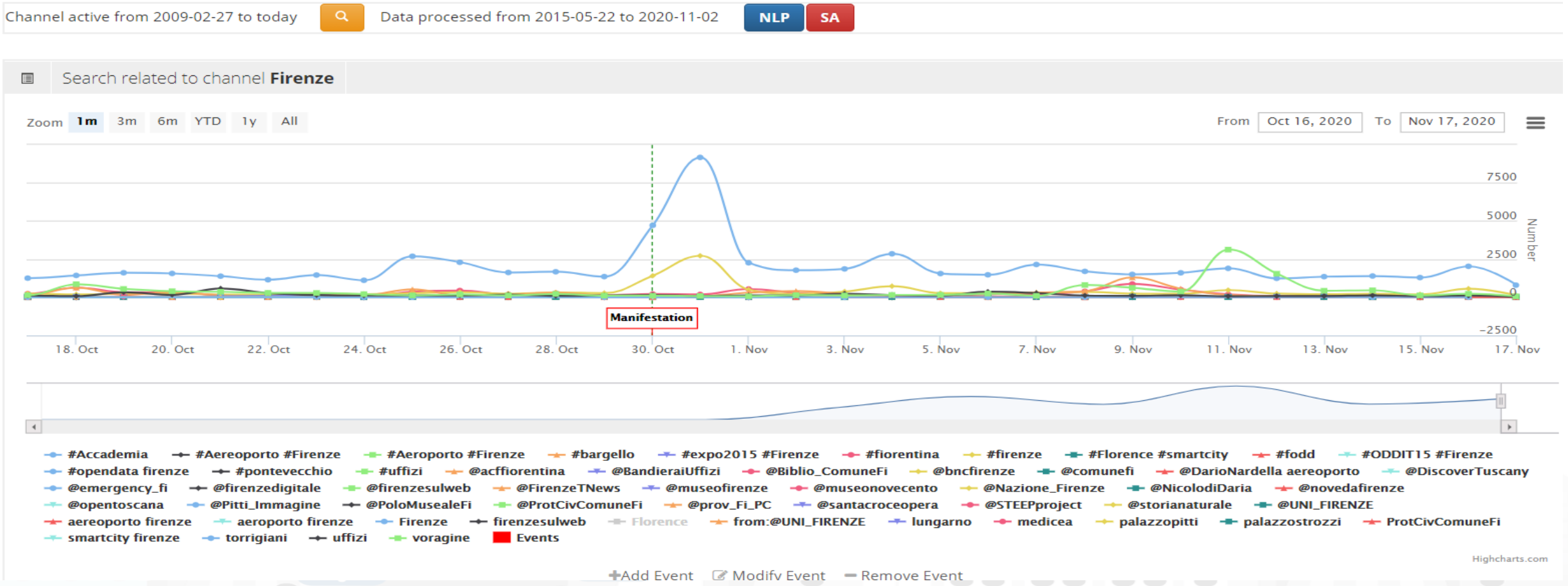
New Anti-Covid Regulations: Dos & Dont's
Given the upswing in Coronavirus infections and consequent hospital admissions since the beginning of October, Italian Prime Minister [...]

New Pandemic Regulations in Italy
In the face of the rise of Coronavirus infections, the Italian government has extended the national state [...]

LA COMPAGNIA
Original Language Movies
International Film Festivals

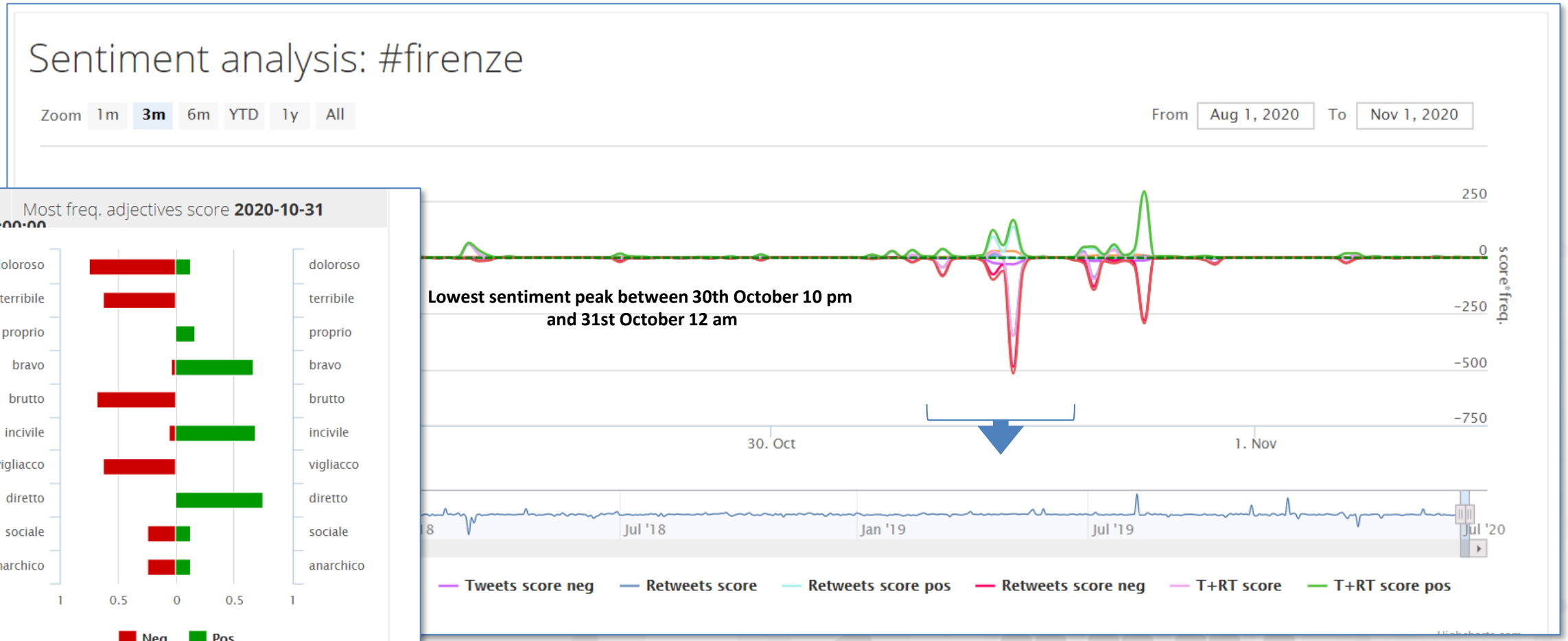
ORCHESTRA DELLA TOSCANA

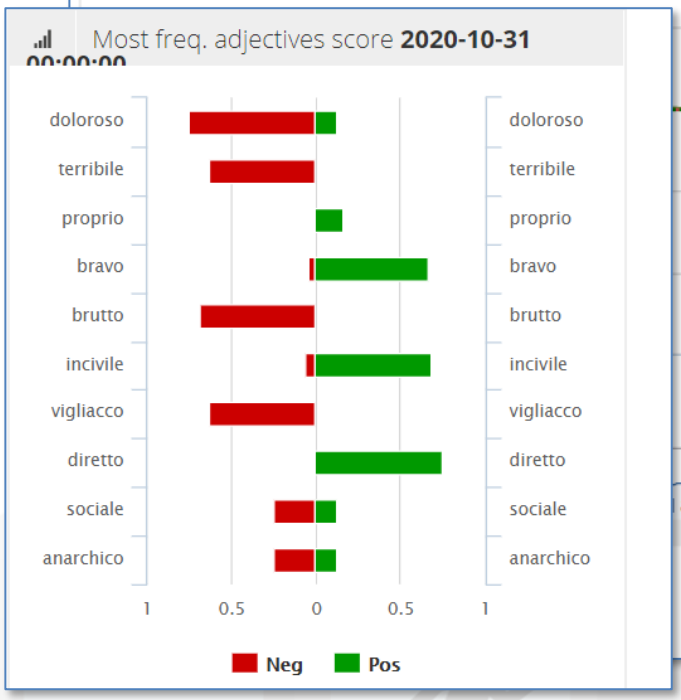
30 October Manifestation



Twitter Vigilance

Sentiment Analysis for search «Firenze»



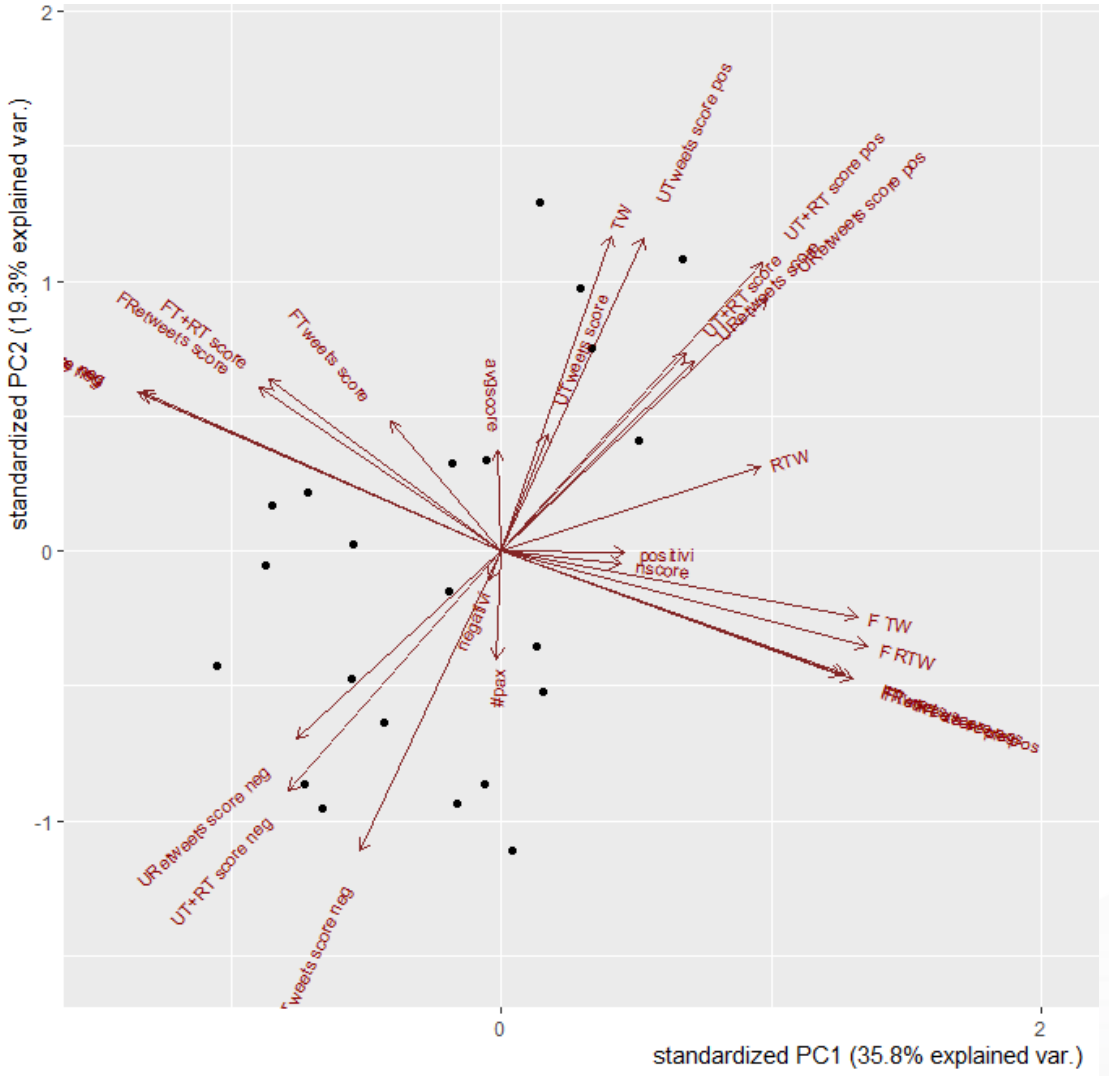


http://disit.org/tv/index.php?p=sa_ricerche&ricerca=436

Twitter Vigilance

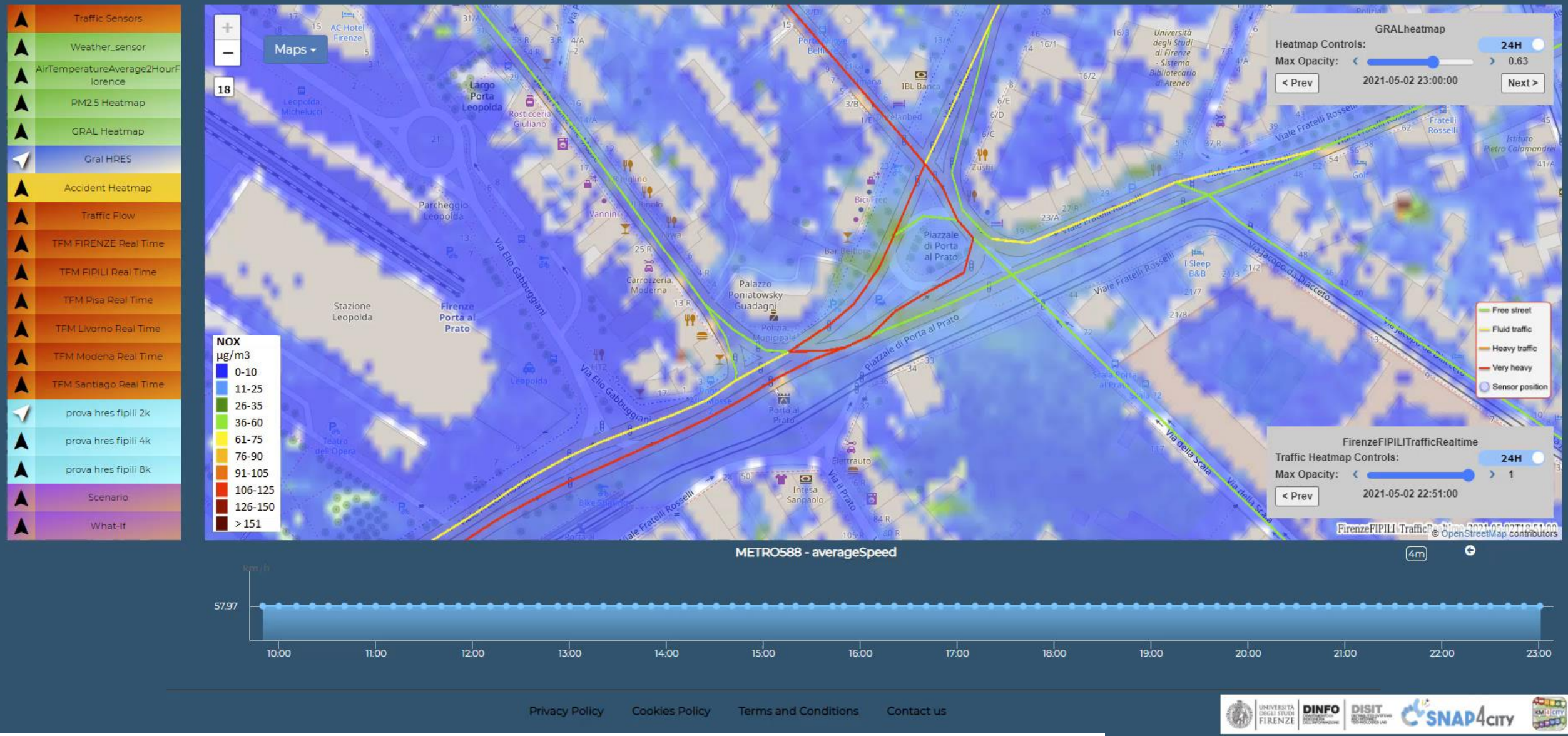
Reputation

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



Traffic Flow Manager on multiple cities

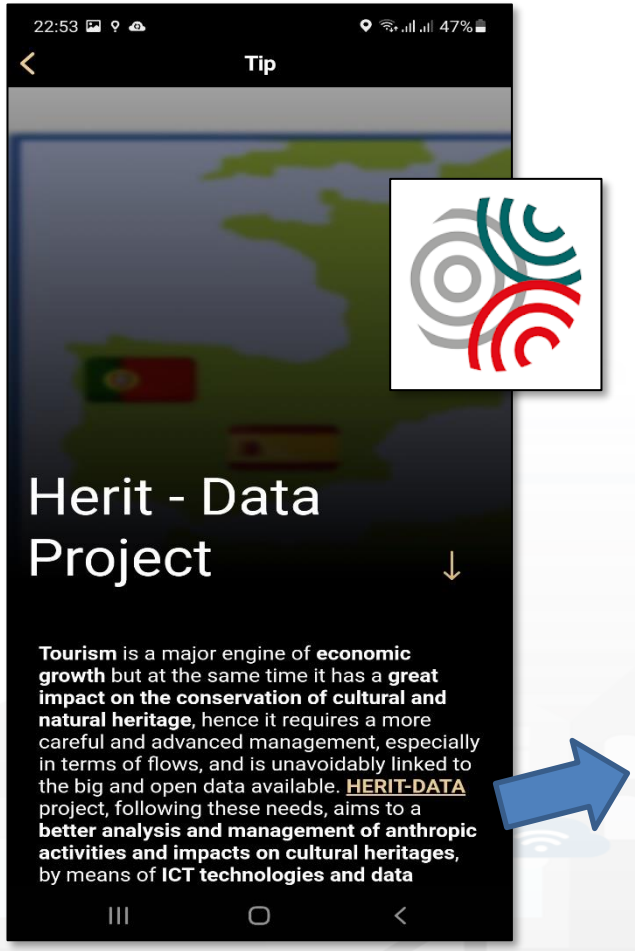
Sun 2 May 23:16:31

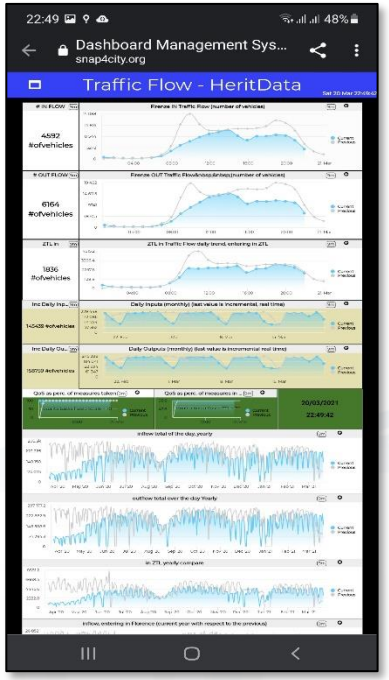


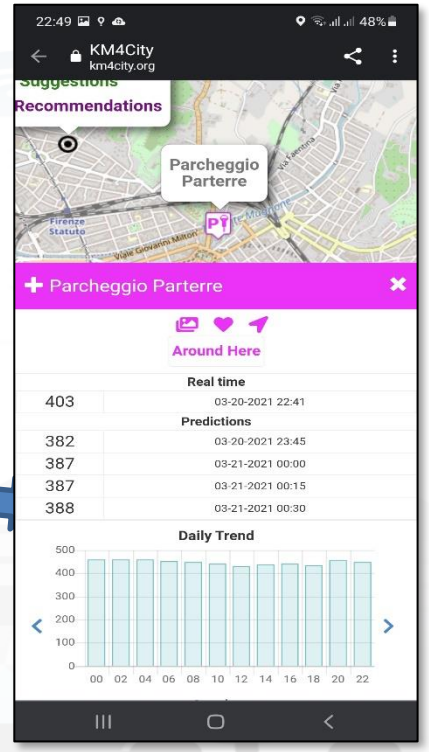
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzEyNg==

Florence Dashboard

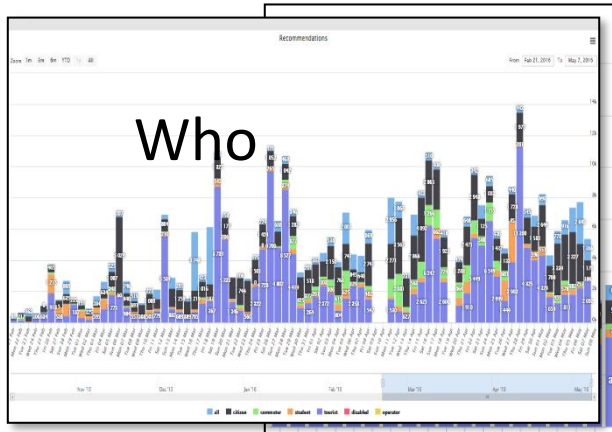
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzAwNA==

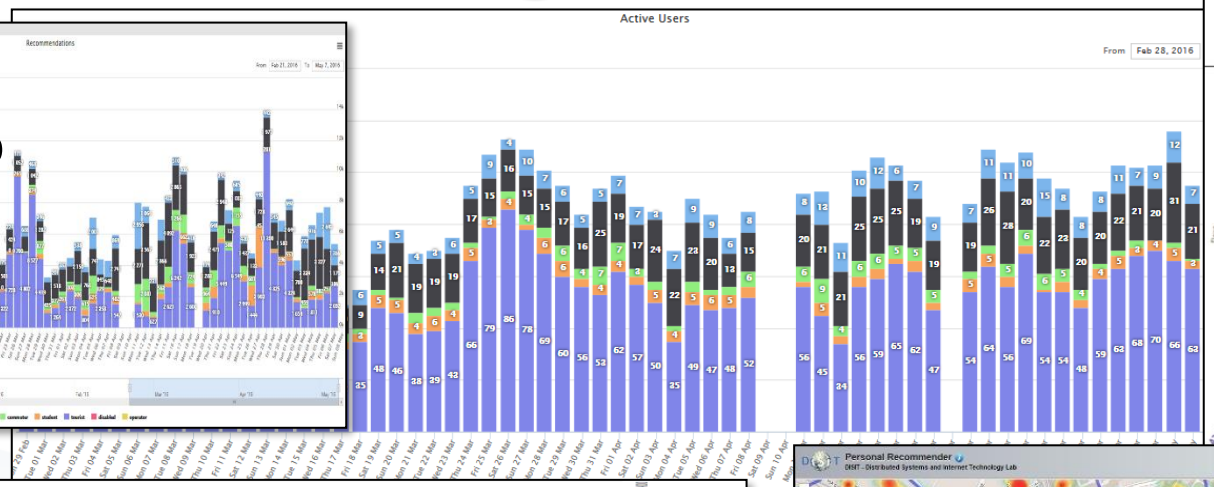


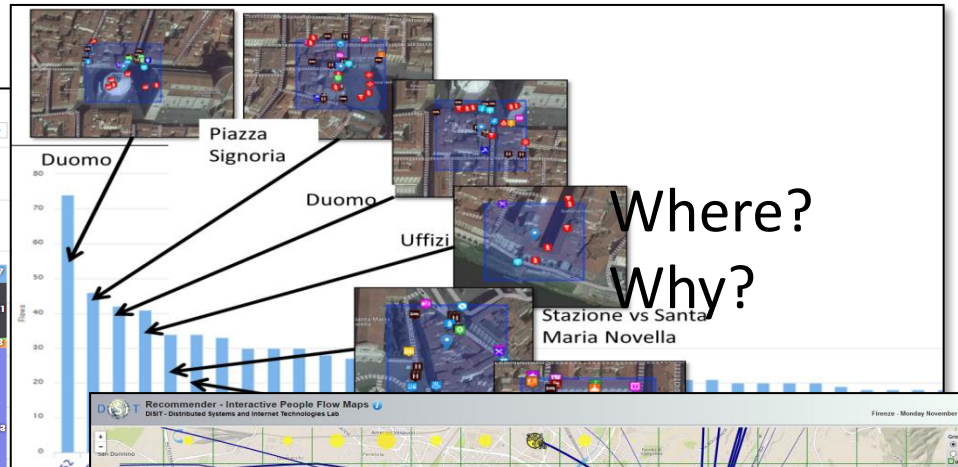


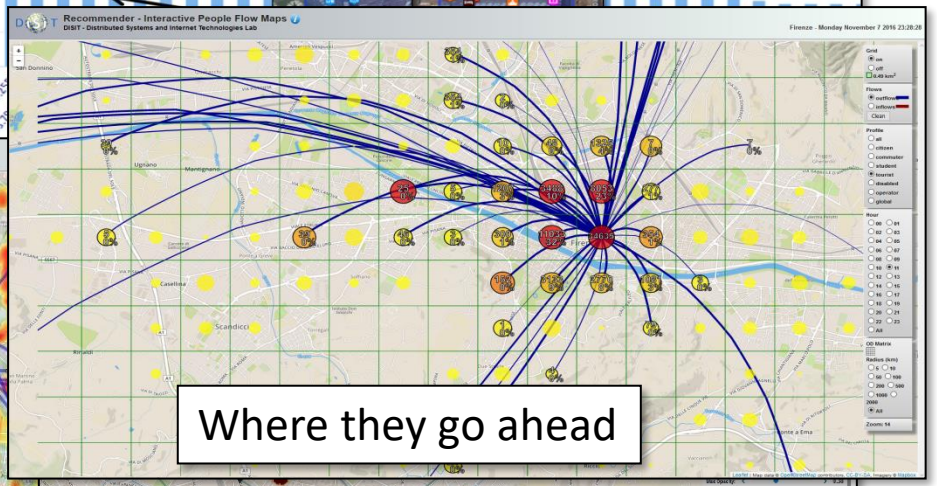


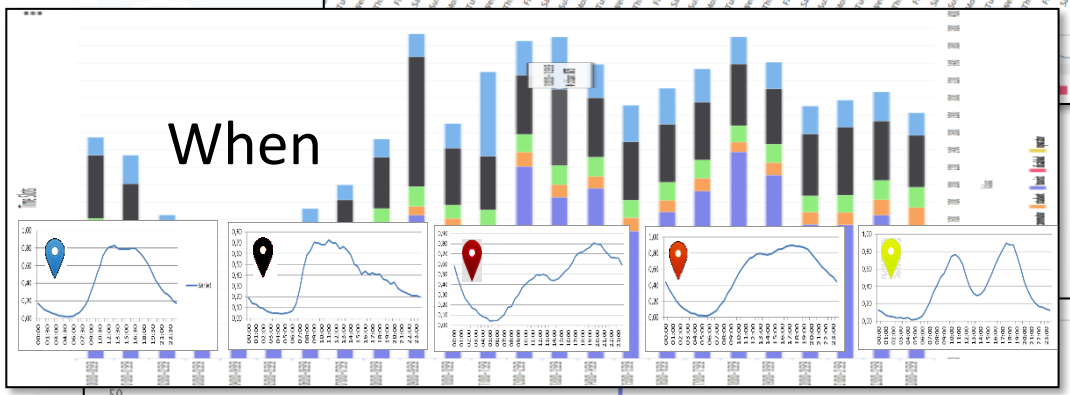
User Behavior Analyser for Collective Profiling

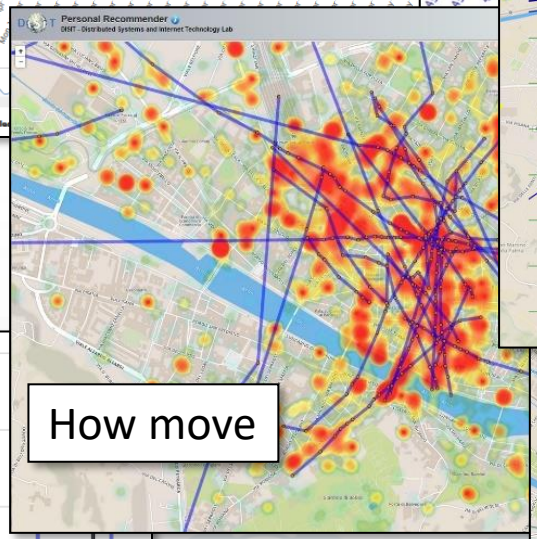


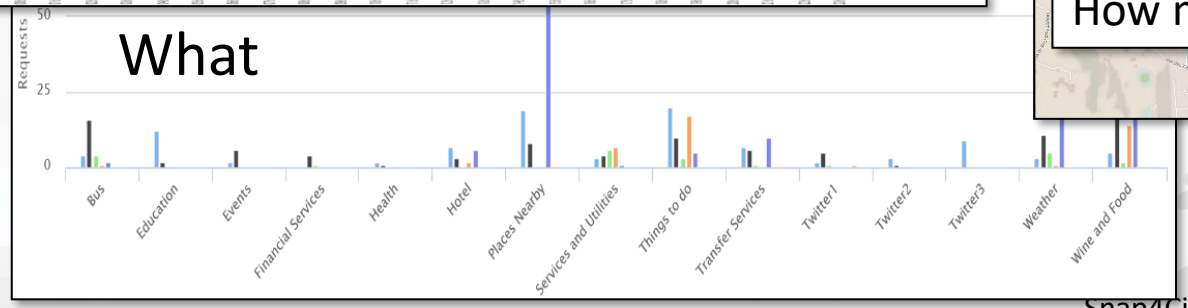


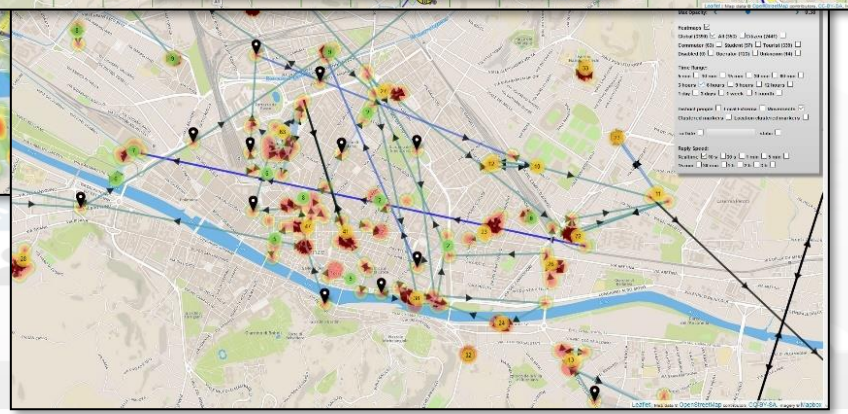












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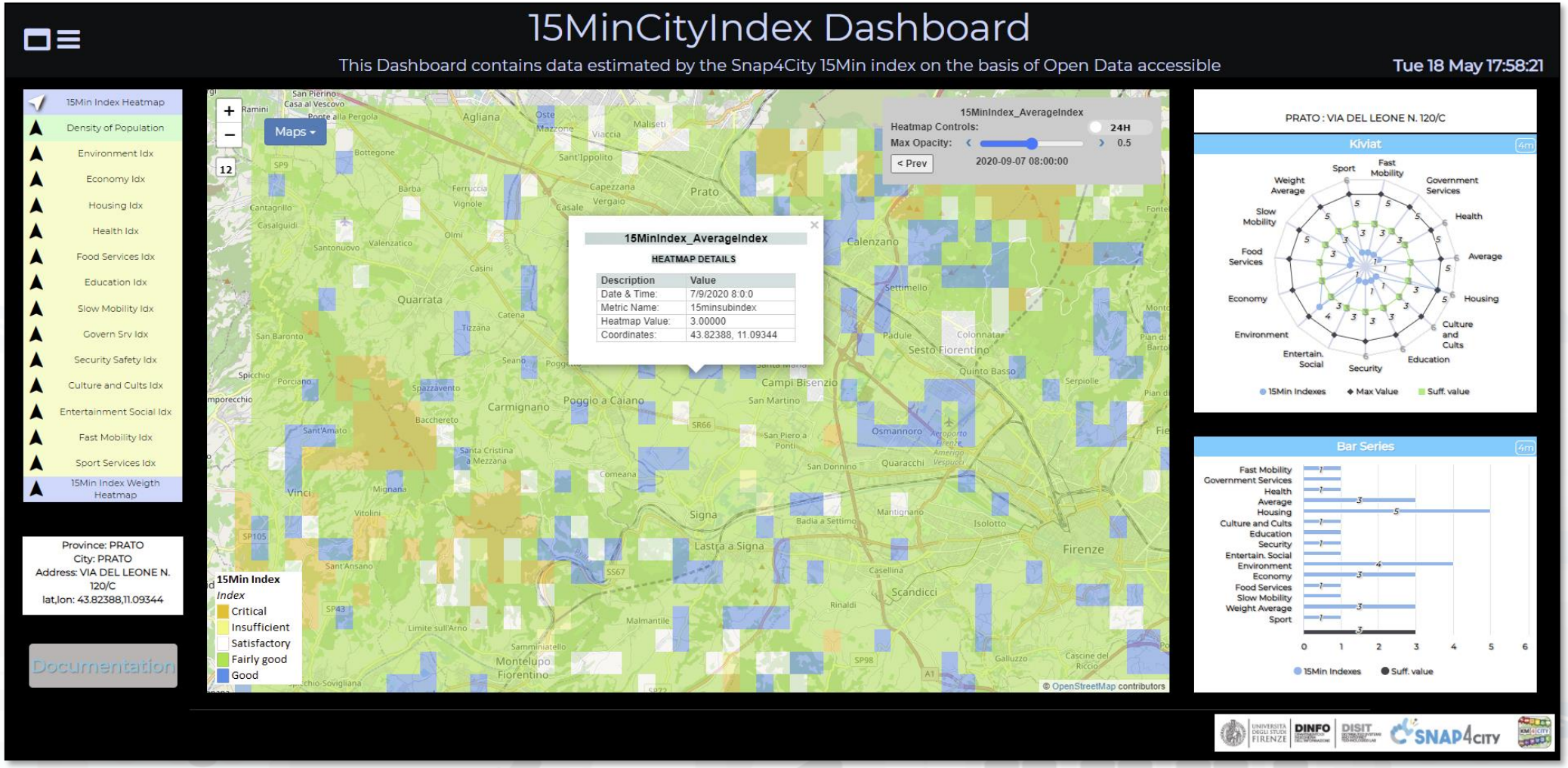

- https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjkzOA==

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES

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Get other info on……

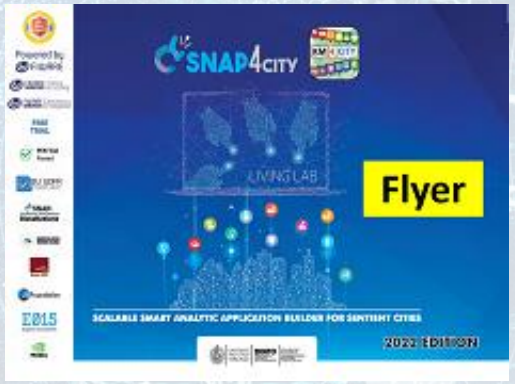
https://www.snap4city.org/577

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

2022 booklets

- Snap4City

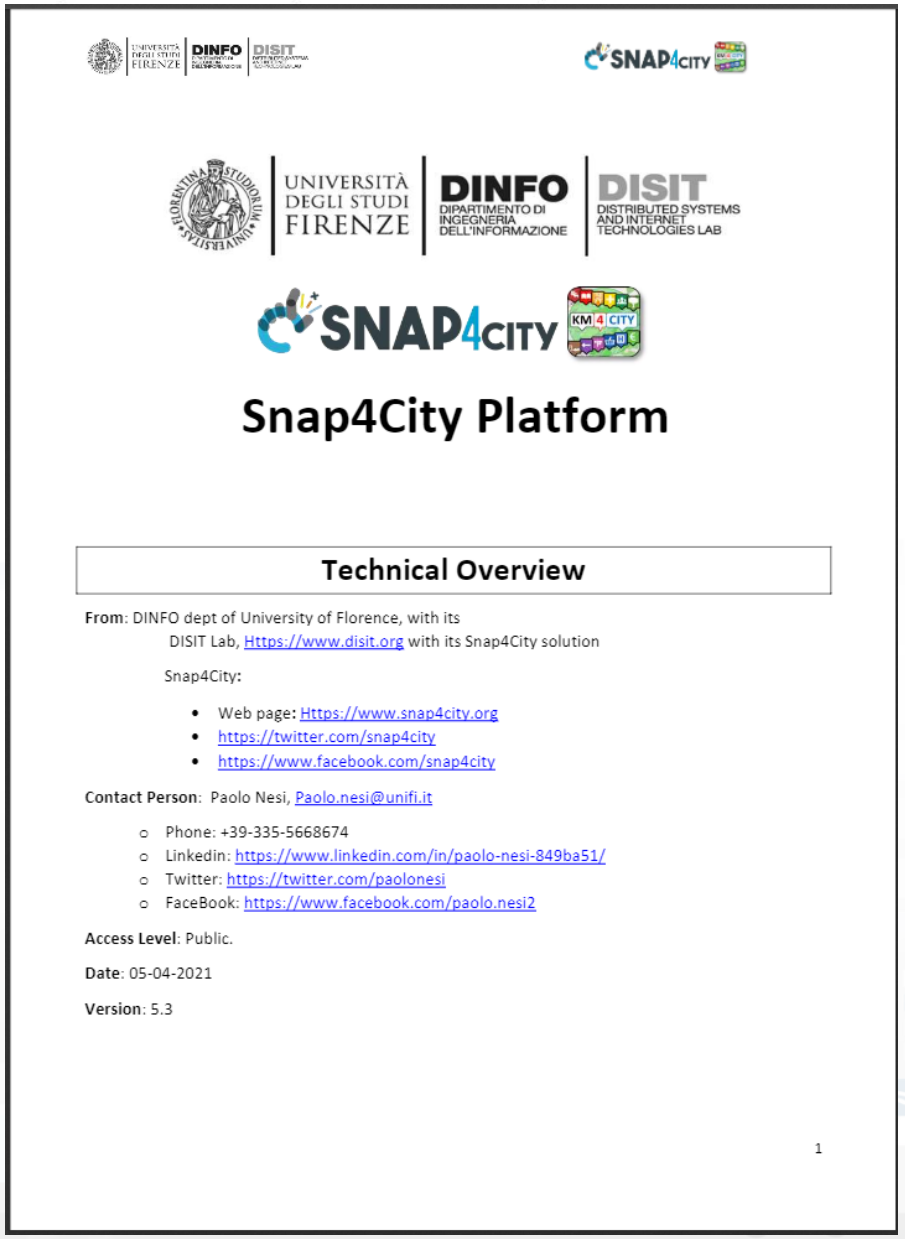


https://www.snap4city.org/download/video/DPL_SNAP4CITY_2022-v02.pdf

- Snap4Industry

https://www.snap4city.org/download/video/DPL_SNAP4INDUSTRY_2022-v03.pdf

Overview



Snap4City Platform

Technical Overview

From: DINFO dept of University of Florence, with its
DISIT Lab, Https://www.disit.org with its Snap4City solution

Snap4City:

- Web page: Https://www.snap4city.org
- https://twitter.com/snap4city
- https://www.facebook.com/snap4city

Contact Person: Paolo Nesi, Paolo.nesi@unifi.it

- Phone: +39-335-5668674
- Linkedin: https://www.linkedin.com/in/paolo-nesi-849ba51/
- Twitter: https://twitter.com/paolonesi
- FaceBook: https://www.facebook.com/paolo.nesi2

Access Level: Public.

Date: 05-04-2021

Version: 5.3

1

- https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf

Overview

- https://fiware-foundation.medium.com/snap4city-fiware-powered-smart-app-builder-for-sentient-cities-acfe24df49d5
- https://www.snap4city.org/drupal/sites/default/files/files/FF_ImpactStories_Snap4City.pdf

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SNAP4CITY

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CONTACT

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Università degli Studi di Firenze - School of Engineering

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