



UNIVERSITÀ
DEGLI STUDI
FIRENZE

DINFO
DIPARTIMENTO DI
INGEGNERIA
DELL'INFORMAZIONE

DISIT
DISTRIBUTED SYSTEMS
AND INTERNET
TECHNOLOGIES LAB



Powered by

Oltre la Smart City. Ripensare ai Modelli della città del Futuro

Paolo Nesi, paolo.nesi@unifi.it

<https://www.Km4City.org>

<https://www.disit.org>

<https://www.Snap4City.org>

Geografia e Tecnologia

01/2022

Pisa, 30 giugno – 1 luglio 2022

Università di Pisa, Dipartimento di Civiltà e Forme del Sapere



Digital Twin

- **Digital Twin**

- **Connected** with real systems
- **Modelling aspects:** structural, visual, informative, real time data sensors (context), POI, functional, resource managements, etc.
- **Integration of AI/XAI techniques** with simulations and modeling

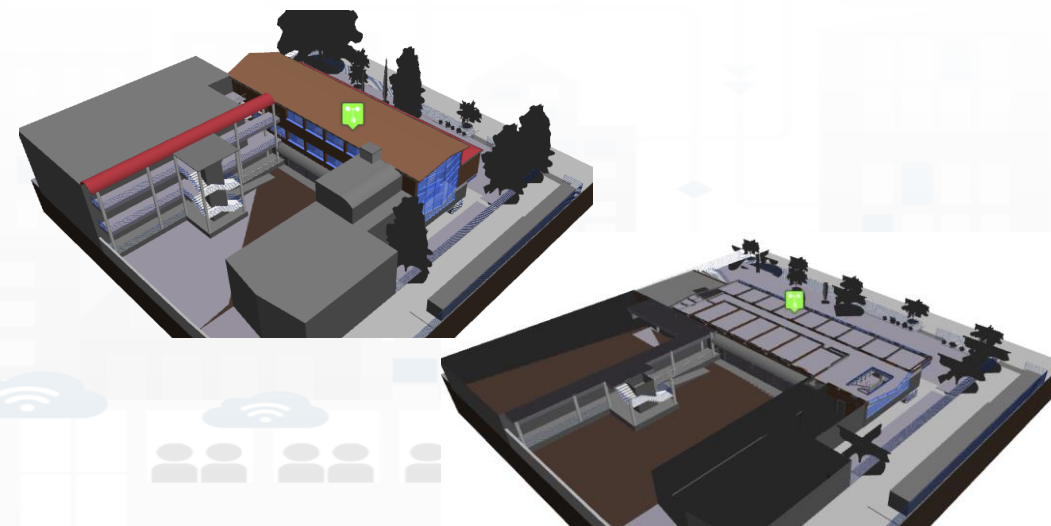
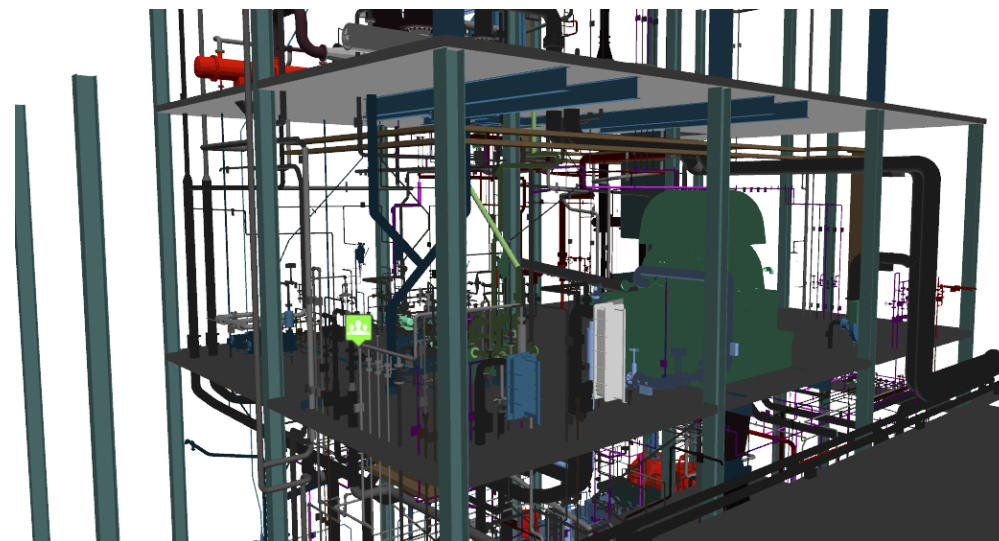
- **Utility to perform**

- By Case Experiments for analysing
 - New solutions, impact of disaster (natural and provoked)
 - Reduction of costs in the analysis, in reduction of mistakes
- For
 - Discussion with city users
 - Support decision makers
 - Easier to understand the context, review from multiple points of view



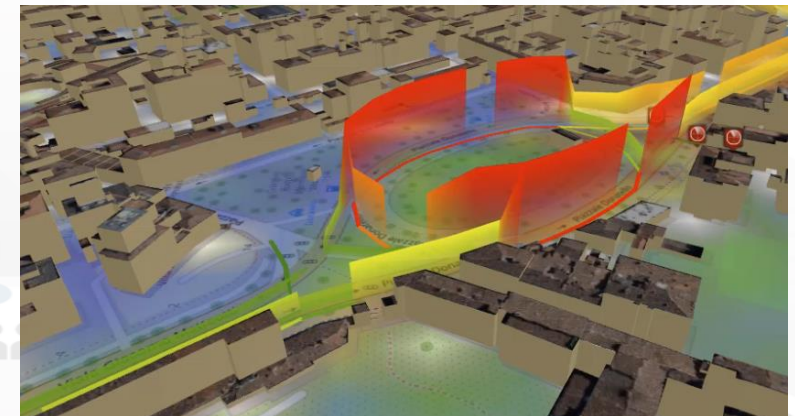
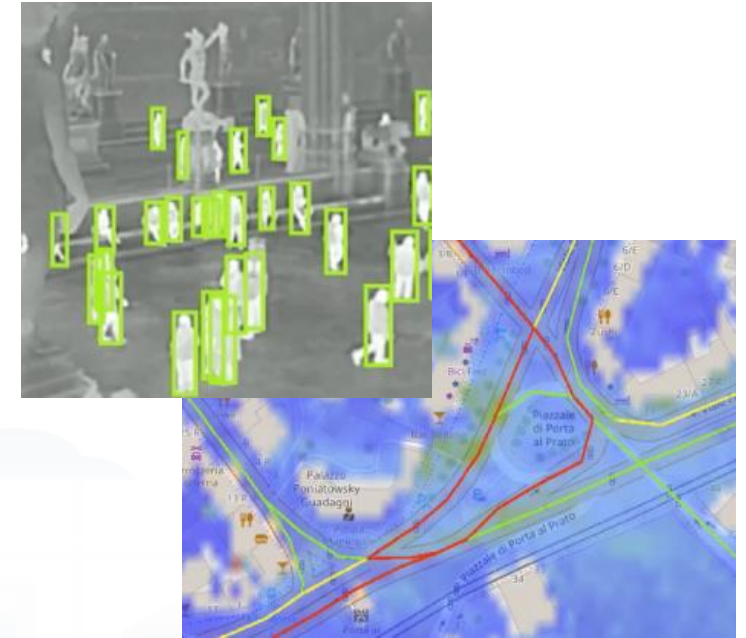
Digital Twin

Global vs Local



Awareness to manage and improve

- **Infrastructures** of the cultural cities:
 - **Security and Safety:** roads, buildings, squares
 - **Mobility and Transport:** traffic flow, parking, public transp. etc.
 - **Environment:** microclimate, predictions, assessment for acting
- **Services / events:** assessment and plan:
 - **Most of the cities provide diffuse cultural heritage as a wall**
 - Security, clean, public transport, environment, delivery, etc.
 - **Global and Local:** events vs actions
 - **Local Structures:** museums, events, shopping, attractions, ..
- **People and Transport Means** (city users: citizens, tourists, etc.) :
 - **Understand:**
 - flows, density, behaviour, classifications of user/means
 - reputation, appreciation Trip Advisor, Twitter, etc.
 - **Nagging, Suggest, Recommend, Engage, Guide..**
 - Context based



TOP

How

FROM CITY
DASHBOARD TO
APPLICATIONS

DATA GATHERING
AND CITY DATA
KNOWLEDGE
MANAGEMENT

FORGING &
MANAGING OPEN
AND FLEXIBLE WEB
AND MOBILE APPS

IOT/IOE DEVICES
AND NETWORKS

IOT APPLICATIONS
VS IOT EDGE
DEVICES

IOT APPLICATIONS,
THE LOGIC AND
THE SMARTNESS

ADVANCED
SMART CITY API,
MICROSERVICES,
SNAP4CITY API

SNAP4CITY
LIVING LAB FOR
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SNAP4CITY FOR
BEGINNERS

DATA ANALYTICS,
BUSINESS
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WHAT-IF AND
SIMULATION

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ECOSYSTEM. OPENED
TO DEVELOPERS
AND STAKEHOLDERS

DECISION SUPPORT
SYSTEM AND CITY
RESILIENCE

HOW TO ADOPT
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AND KM4CITY
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SNAP4CITY THE
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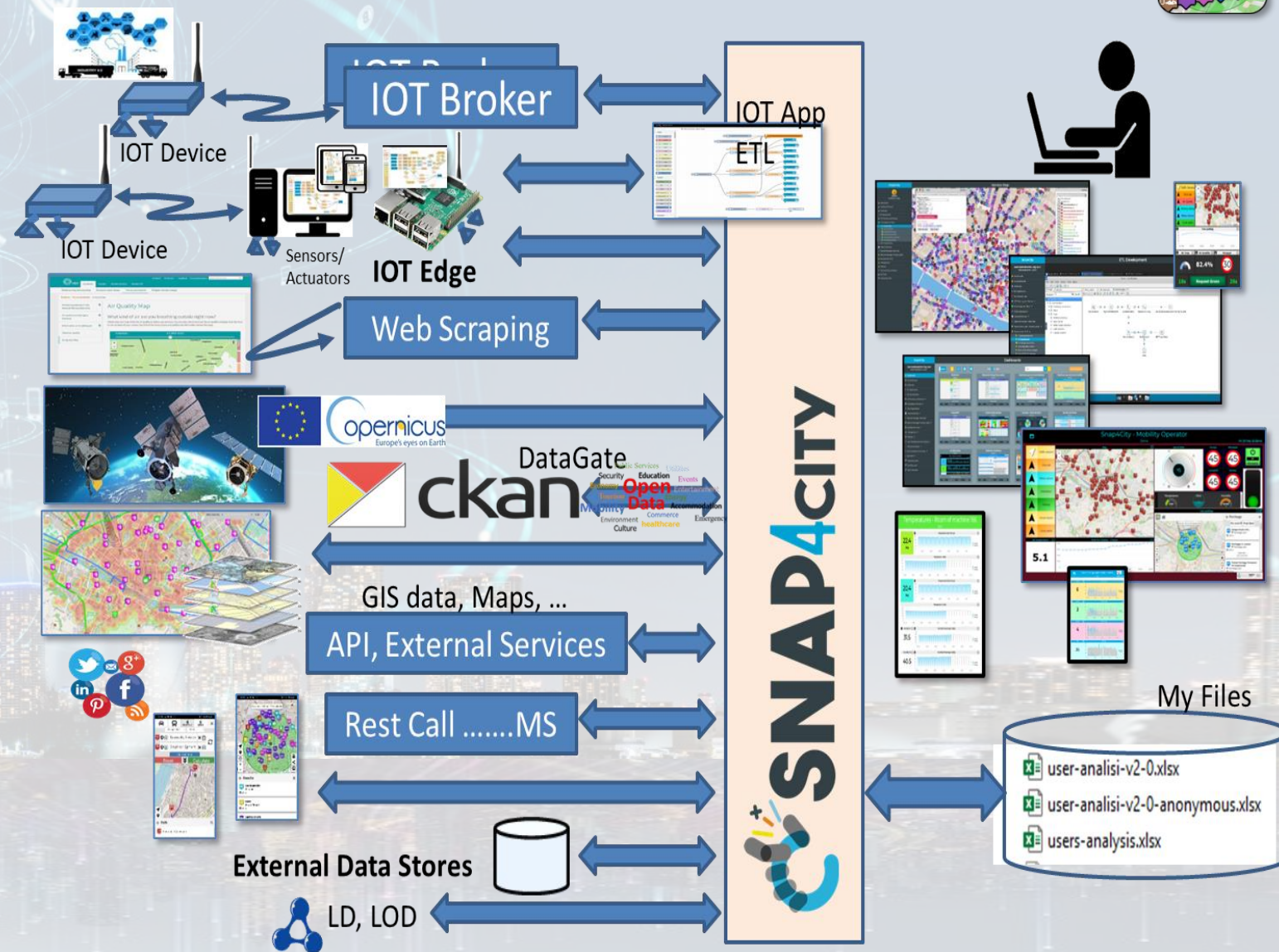
TWITTER
VIGILANCE: SOCIAL
MEDIA ANALYSIS

100%
OPEN
SOURCE

 **SNAP4**
Appliances and Dockers
Installations

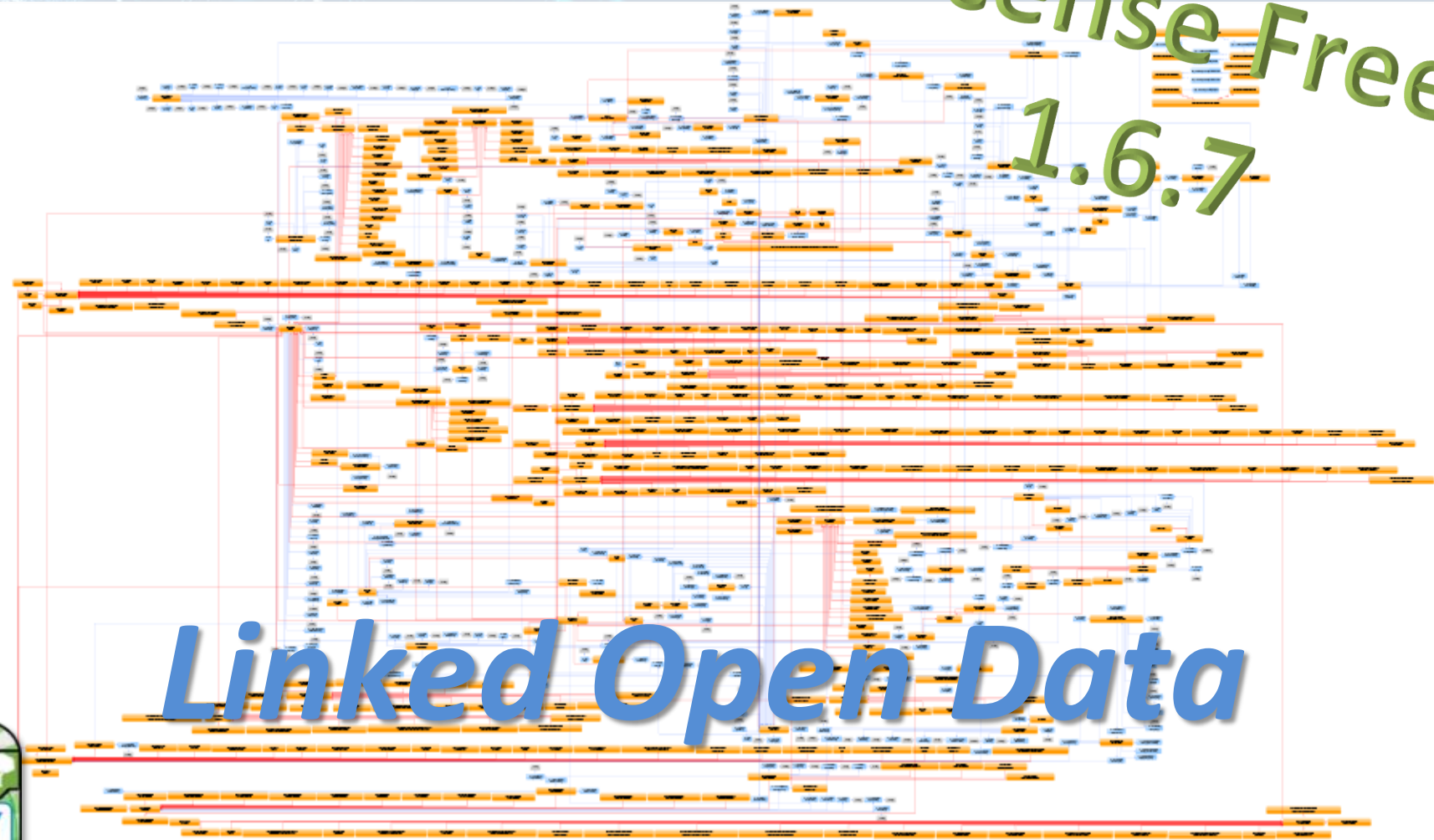
Ingestion, agg. → exploitation

- **Snap4City** efficient tools for
 - Bidirectional data channels
 - Any format, any channel, any data, any broker, any protocol, ...
- **Km4City** Knowledge base Ontology reasoning on geo, space, time, relationships



Expert System semantic queries

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



<https://www.snap4city.org/19>

Big Data Analytics + Artificial Intelligence

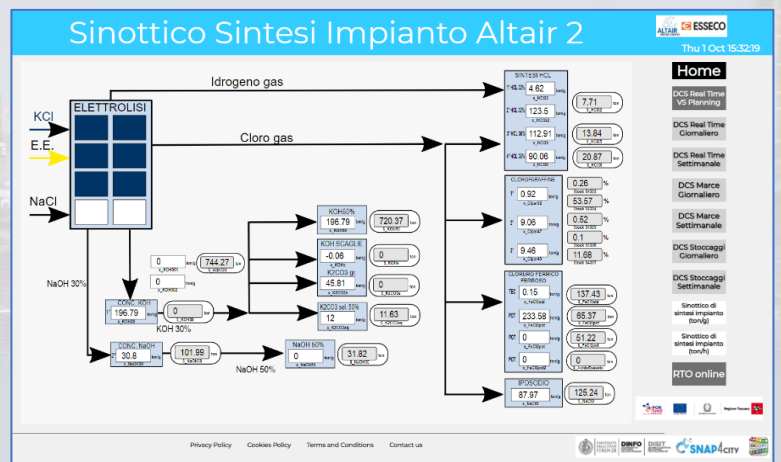
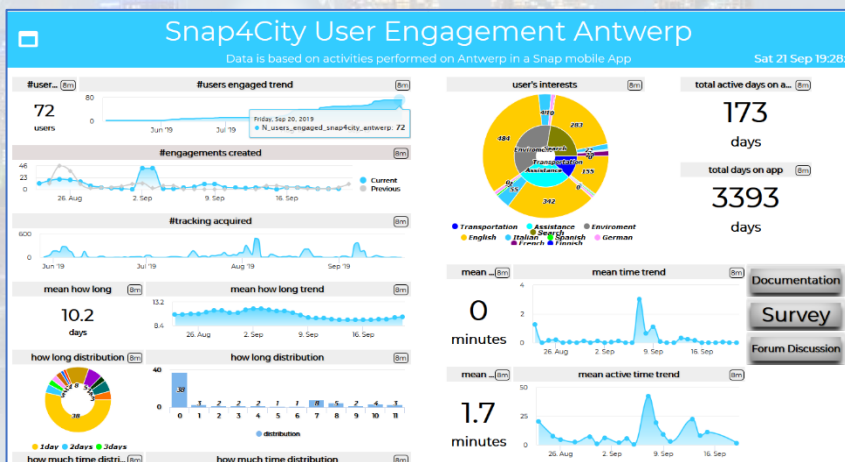
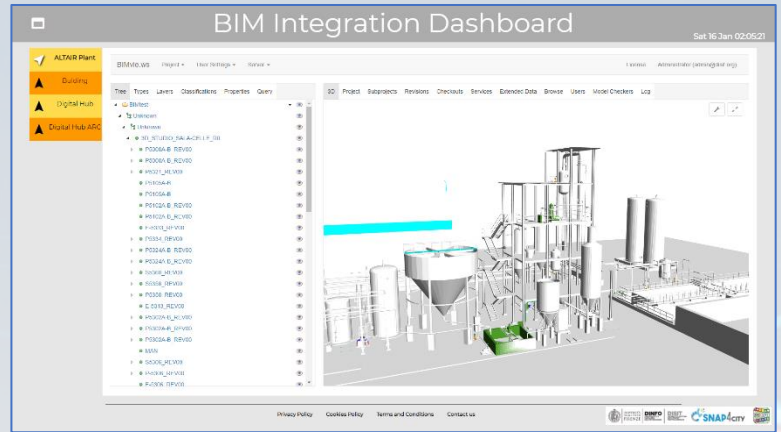
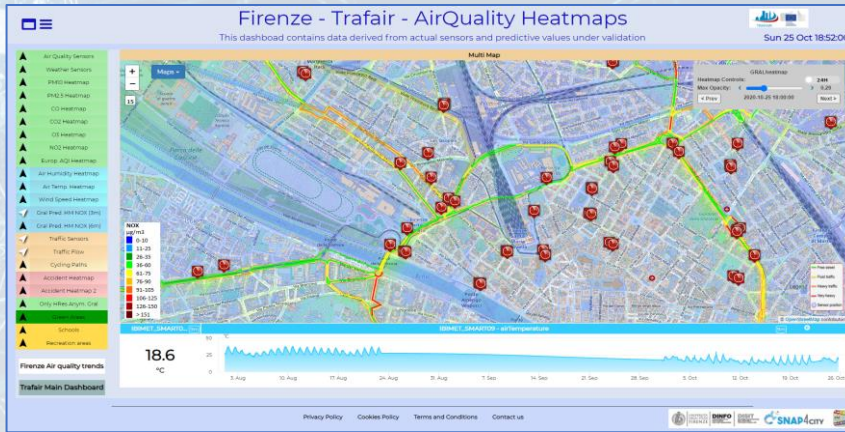
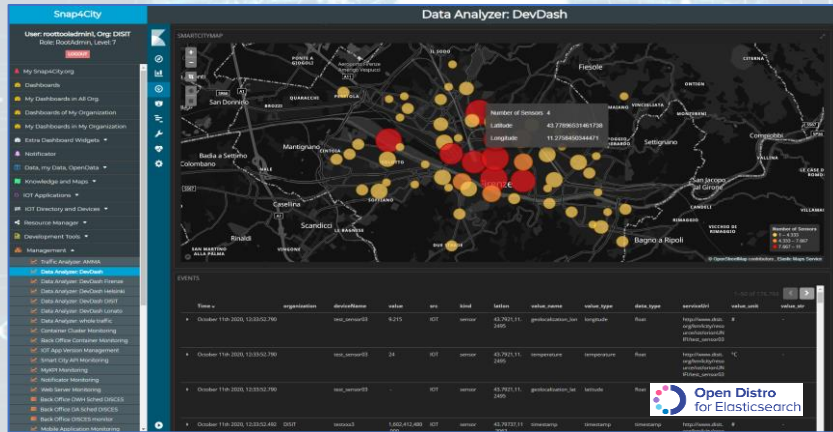
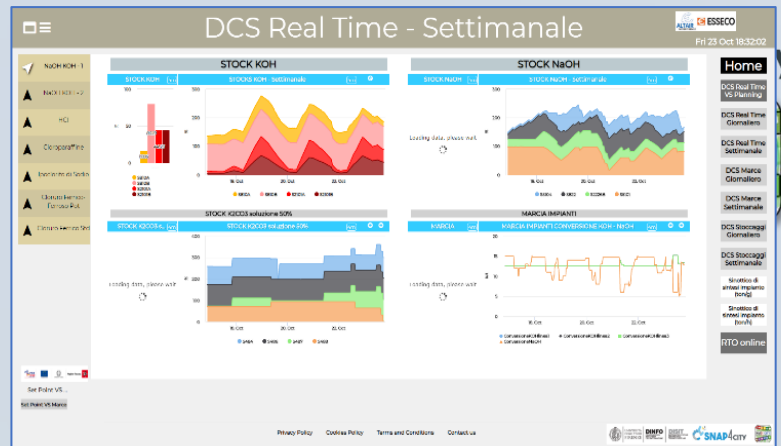
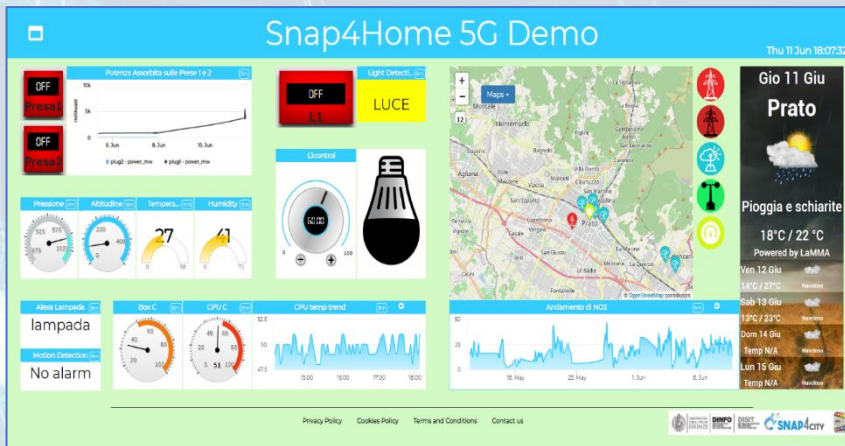
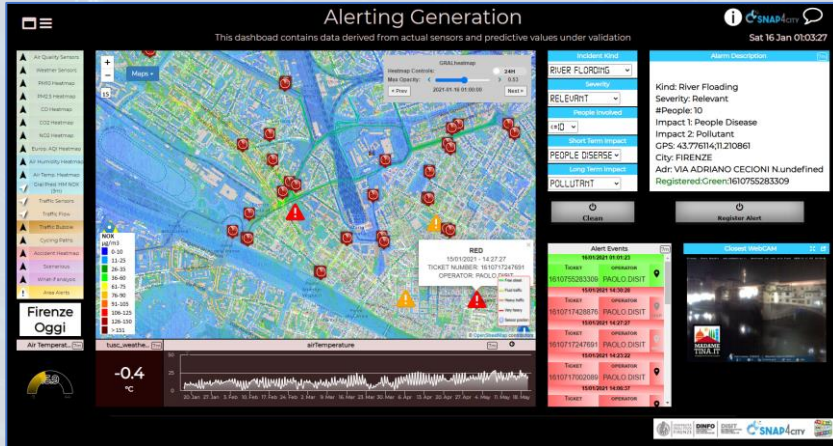


- **Short and Long terms predictive models on:**
 - traffic, parking, people flow, maintenance, land sliding, NO2
- **3D Flow prediction:** Pollutant (NOX, NO2, ...)
- **Early warning, City Indexes, etc.**
- **AI & XAI:**
 - RF, XGBoost, BRNN, RNN, SVR, DNN, LSTM, CNN-LSTM, Autoencoders, ...
 - Clustering: 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/course2020/da/Snap4City-4th-slot-Data-Analytic-v4-6.pdf>



HERIT-DATA DUBROVNIK CALENDAR - NEWGUI

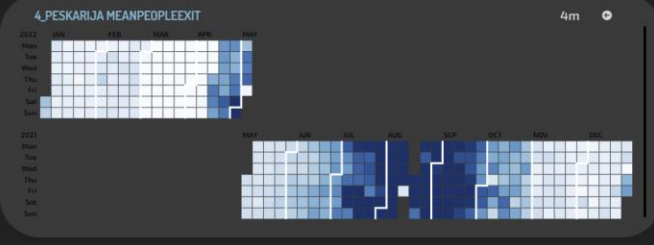
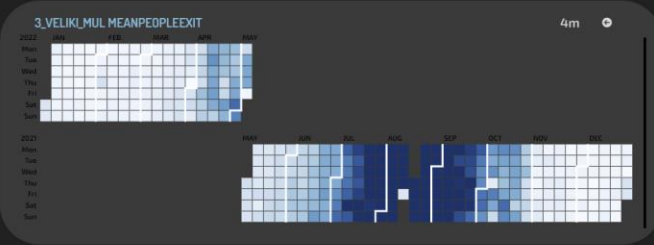



HERIT DATA

Herit Data Main

Dubrovnik Main

Trends of Counting





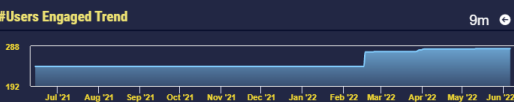
Snap4City User Engagement - Newgui

Tue 14 Jun 20:12:58


#Users E... 9m

282 users


#Users Engaged Trend 9m



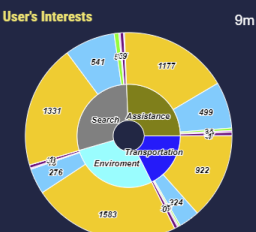
#Engagements Created 9m



#Tracking Acquired 9m



User's Interests 9m



Total Active Days On App 9m

847 days

Total Days On App 9m

244809 days

Ciao roottooladmin!

Tue 3 May 20:14:59

15 MINUTI INDEX BOLOGNA CITTÀ METROPOLITANA - NEWGUI

SELECTOR - MAP

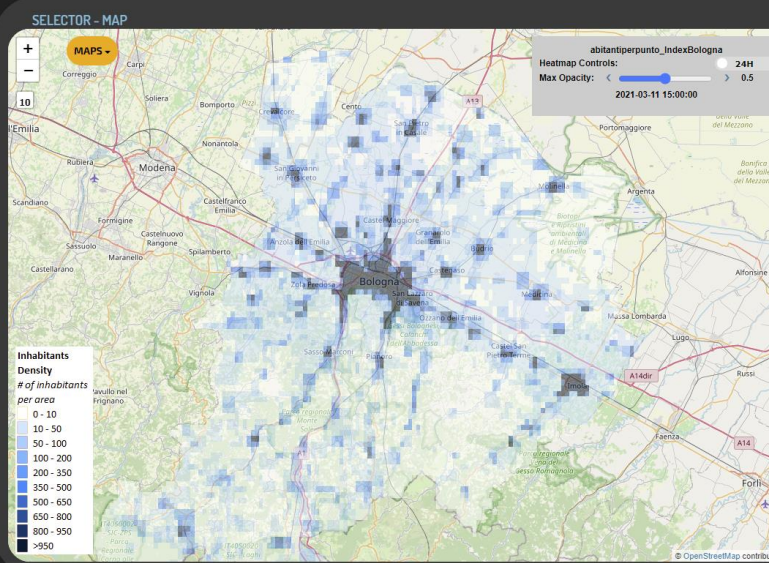
MAPS -

abitanteripunto_IndexBologna

Heatmap Controls:

Max Opacity: 0.5

2021-03-11 15:00:00



Inhabitants Density

of inhabitants per area

- 0 - 10
- 10 - 50
- 50 - 100
- 100 - 200
- 200 - 350
- 350 - 500
- 500 - 650
- 650 - 800
- 800 - 950
- >950

THE PICKED POINT 9m

City Argelato

Address: Via Casadio N.1

lat:lon: 44.61882;11.35437



Argelato: Via Casadio N.1

4m



KIVIAT 4m



BAR SERIES 4m



Mean Time 9m

0 minutes

Mean Time Trend 9m



Mean Active Time 9m

17.5 minutes

Mean Active Time Trend 9m



TOP

Florence Case

FROM CITY
DASHBOARD TO
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DATA GATHERING
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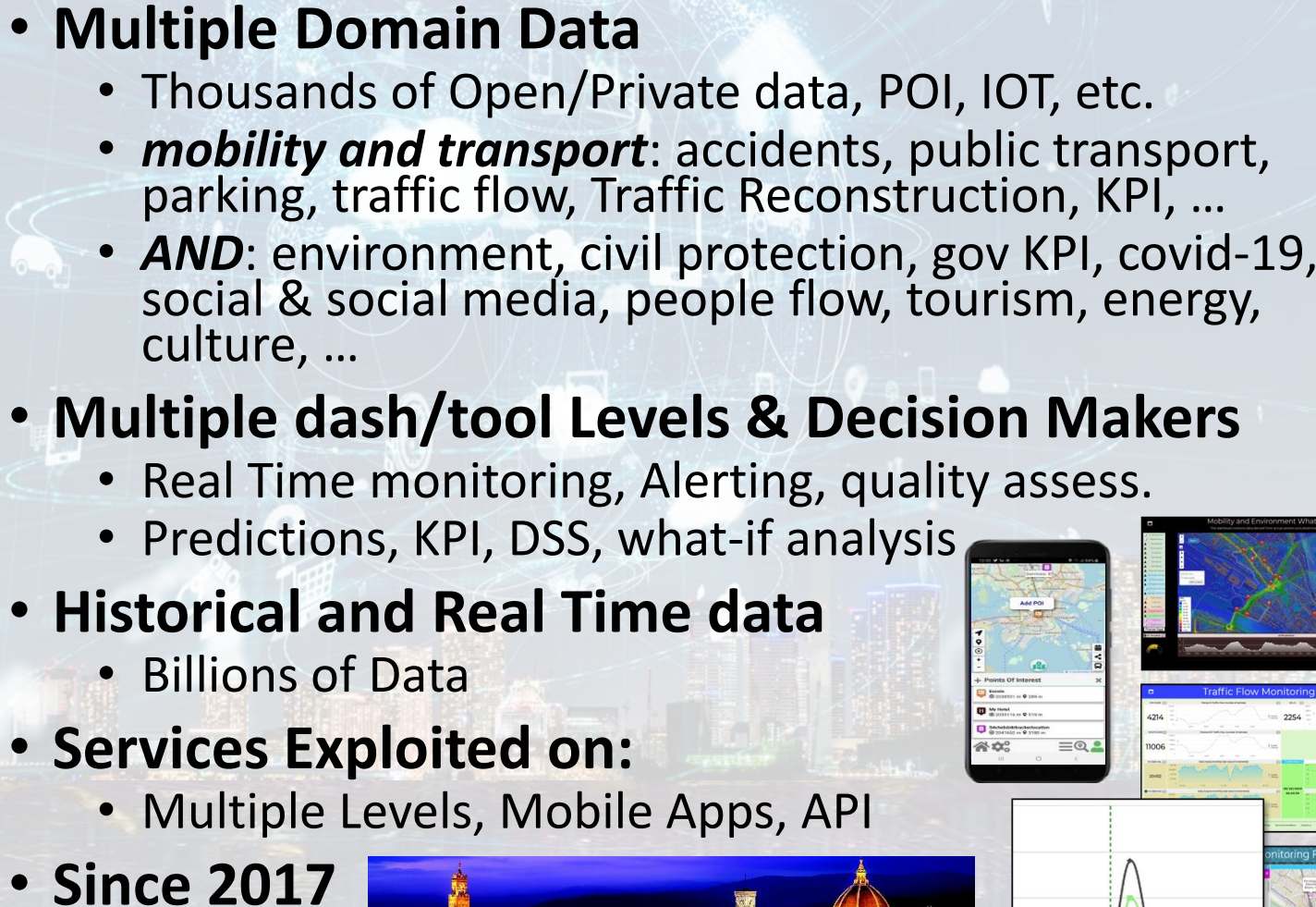
 **SNAP4**
Appliances and Dockers
Installations

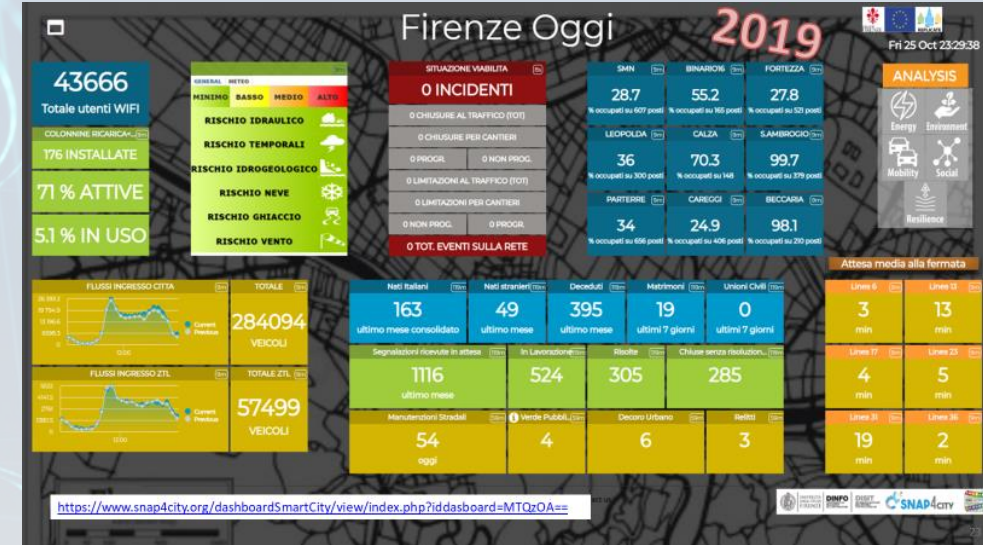
Smart City Control Room Florence Metropolitan City



reference



- **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>

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

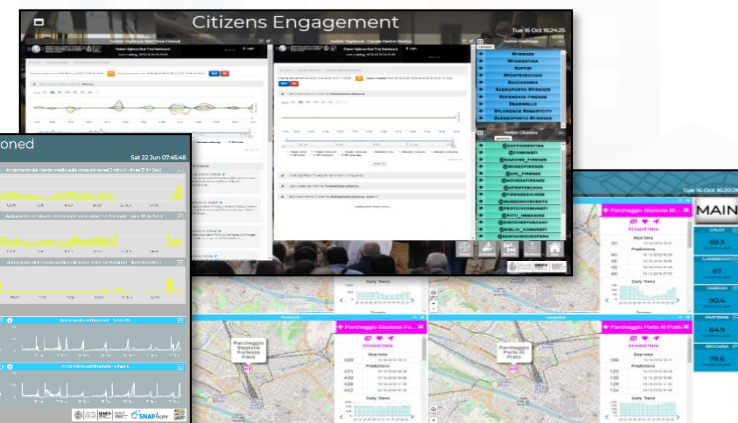
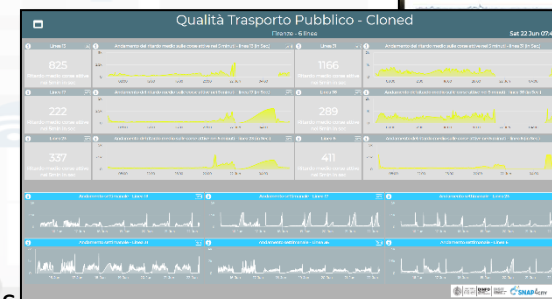
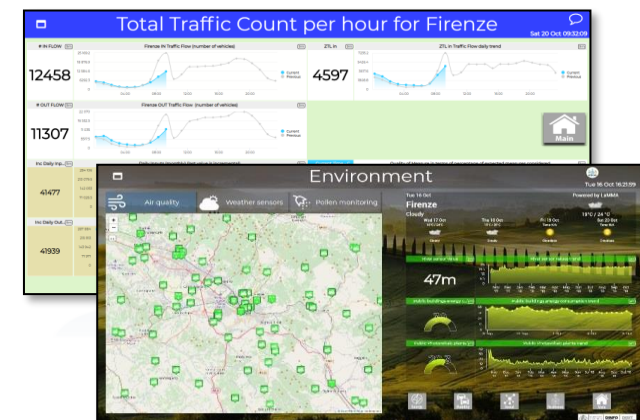
Weather

- 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 Multi Data Map - Digital Twin Global - Firenze

demonstrator

Sun 3 Apr 16:03:52

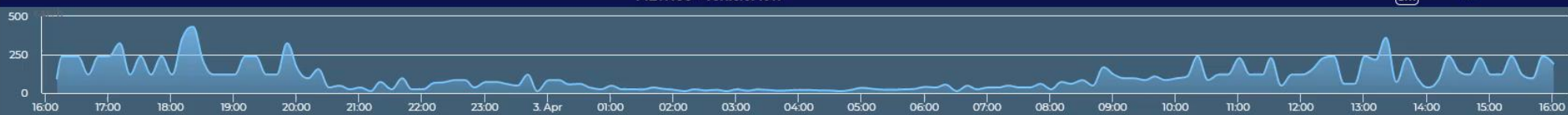


METRO9 - vehicL 9m

192

METRO9 - vehicleFlow

9m





Ciao roottooladmin!

Thu 16 Jun 15:15:03

3D MAP DECK TEST-NEWGUI

demonstrator



3D MAP

MAPS ▾

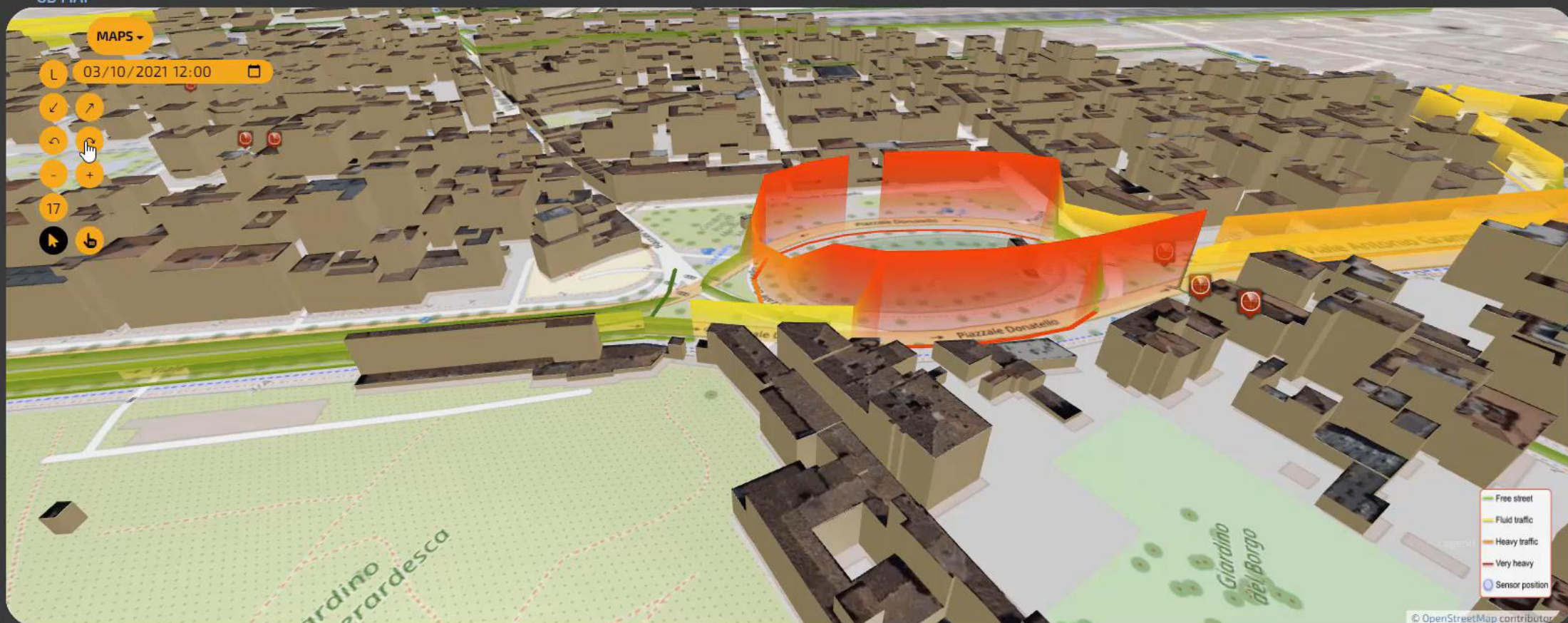
L 03/10/2021 12:00

✓ ↻

⏮ ⏭

17

📍 🏠



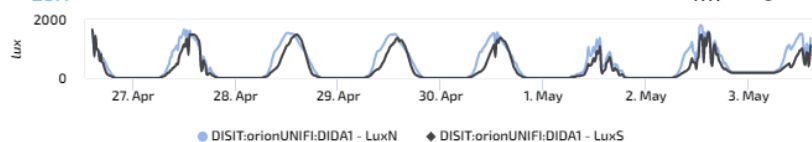
- Free street
- Fluid traffic
- Heavy traffic
- Very heavy
- Sensor position

© OpenStreetMap contributors

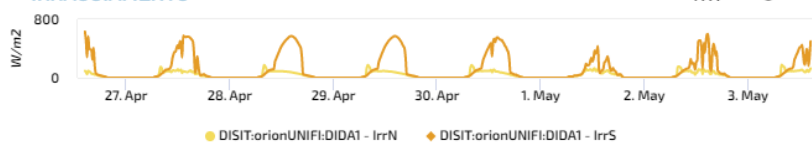
Ciao roottooladmin!

Tue 3 May 14:37:14

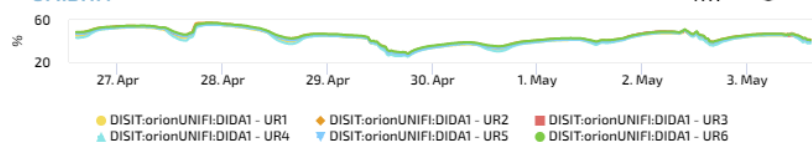
LUX



IRRAGGIAMENTO



UMIDITÀ



PRESSIONE



DIDA DATA 2 - NEWGUI

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

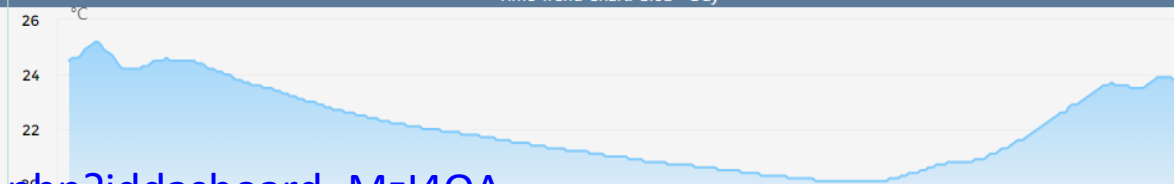
BIM SANTA VERDIANA



Last Value

Time Trend Chart: Glob - Day

No data



<https://www.snap4city.org/dashboardSmartCity/view/index.php?idashboard=MzI4OA==>

TOP

Data Analytics *ML to AI/XAI and Modeling*

FROM CITY
DASHBOARD TO
APPLICATIONS

DATA GATHERING
AND CITY DATA
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 **SNAP4**
Appliances and Dockers
Installations



- **15 Minute City Index:**
 - 13 different 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 consumption,
- business intelligence tools for decision makers,
- Reduction production costs



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



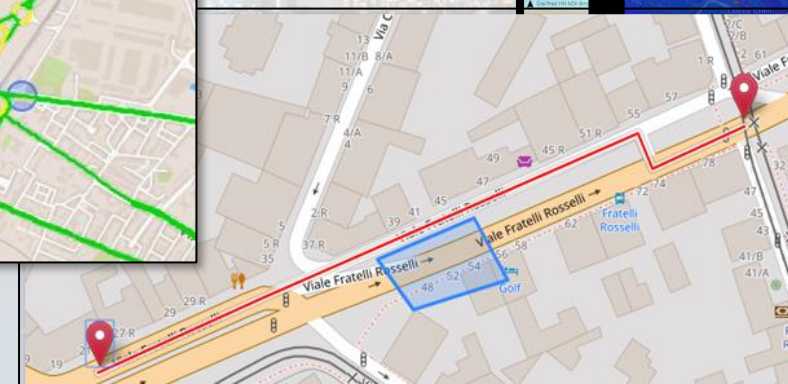
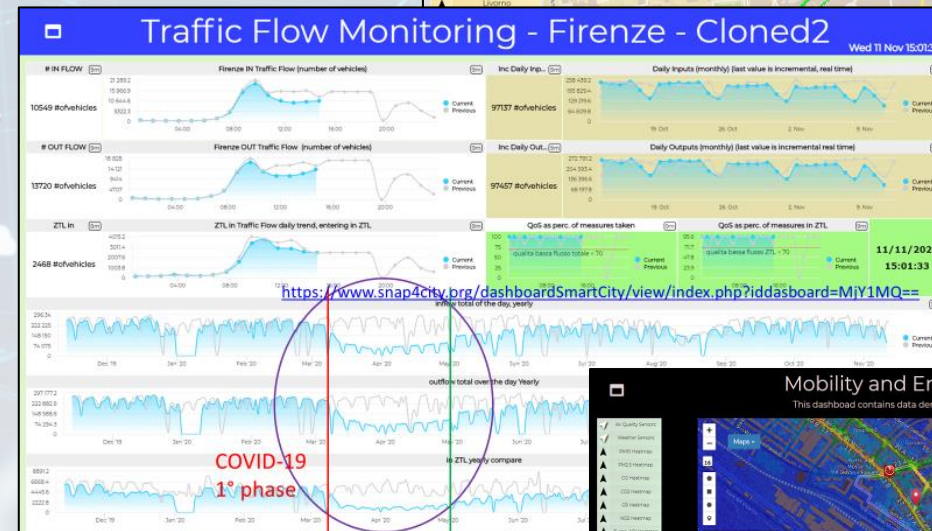
- Shortening justice time
- Prediction of mediation proneness
- Ethical Explainable Artificial Intelligence

Mobility and Transport Traffic Flow Analysis

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



- **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**



Tuscany Region

• Dashboards & Services:

- **Mobility:** public transport operators schedule and paths, traffic Fi-Pi-Li main road, parking status and predictions, traffic sensors, Origin Destination matrix, routing, multimodal routing, etc.

- **Social:** Hospitals and triage, etc.

- **Environment:** sensors, heatmaps, alerting,

- **Pollution Forecast:** NOX, NO2

- **Weather Forecast,**

- **Culture and Tourism**

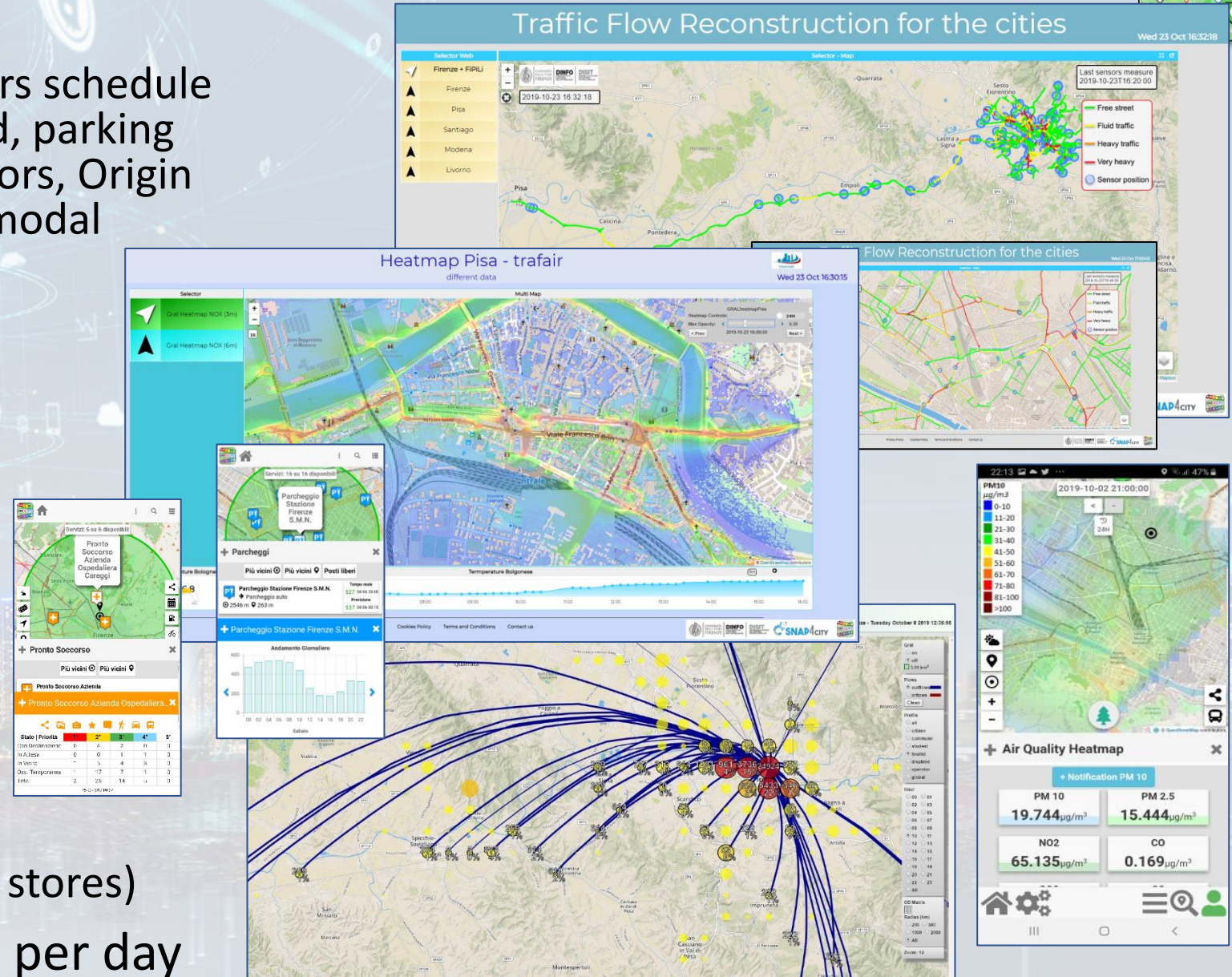
- Etc.

• Mobile App and MicroApplications:

- Tuscany in a Snap (all stores)
- Tuscany where what... km4city (all stores)

• Numbers: 1.5 M complex events per day

Geografia Tecnologia- Snap4City (C), July 2022

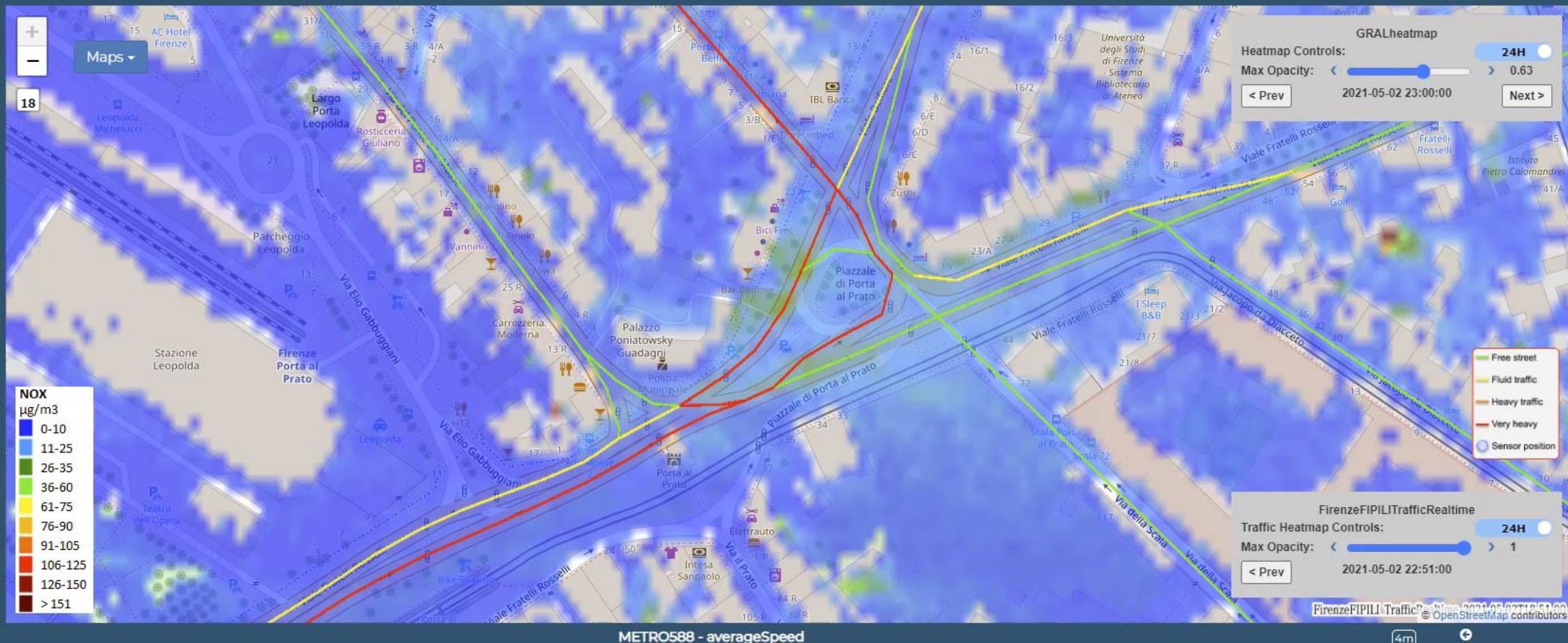




Traffic Flow Manager on multiple cities

Sun 2 May 23:16:31

- Traffic Sensors
- Weather_sensor
- AirTemperatureAverage2HourFlorence
- PM2.5 Heatmap
- GRAL Heatmap
- Gral HRES
- Accident Heatmap
- Traffic Flow
- TFM FIRENZE Real Time
- TFM FIPILI Real Time
- TFM Pisa Real Time
- TFM Livorno Real Time
- TFM Modena Real Time
- TFM Santiago Real Time
- prova hres fipili 2k
- prova hres fipili 4k
- prova hres fipili 8k
- Scenario
- What-if

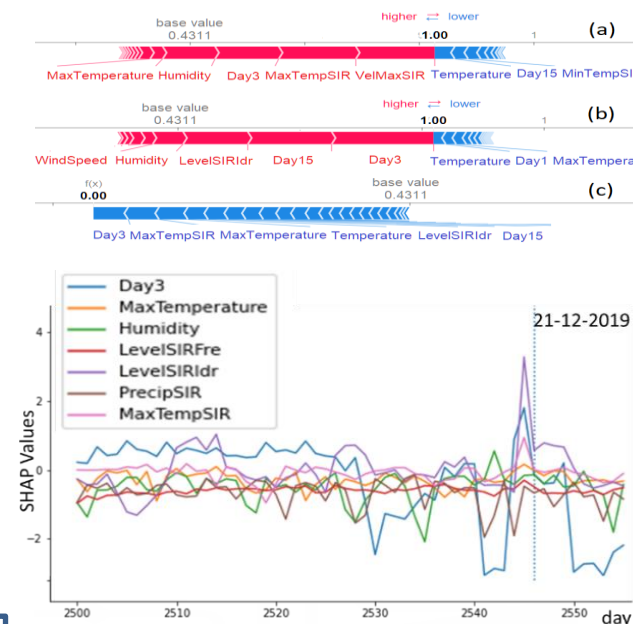
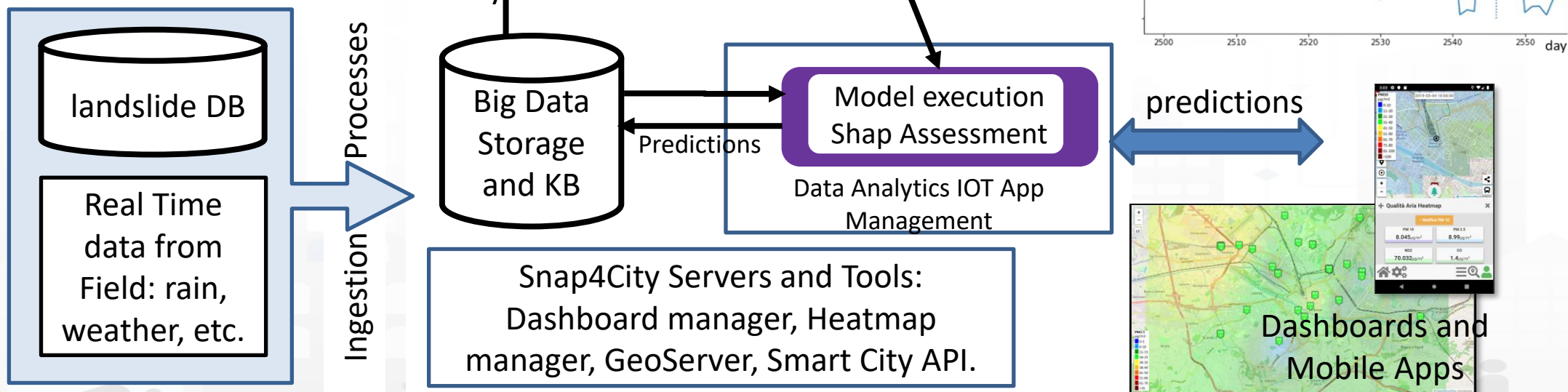
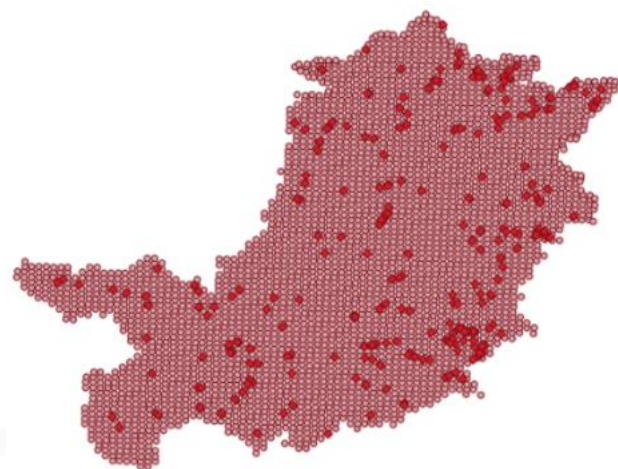


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<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MzEyNg==>

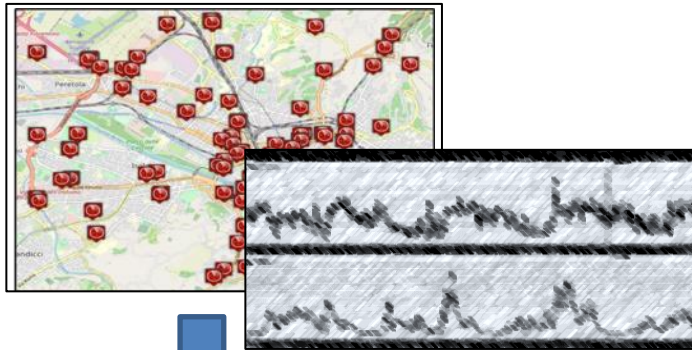
Predicting Land slides



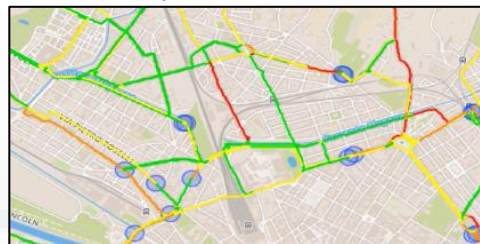
E. Collini, L. A. I. Palesi, P. Nesi, G. Pantaleo, N. Nocentini and A. Rosi, "Predicting and Understanding Landslide Events with Explainable AI," in *IEEE Access*, doi: 10.1109/ACCESS.2022.3158328.

<https://ieeexplore.ieee.org/abstract/document/9732490>

Estimating City Local CO2 from Traffic Flow Data



Computing Traffic Flow
into CO2 sensor area



Traffic Flow data

- Traffic Flow is one the main source of CO2
- **Dense estimation of CO2 into the city** is very useful to know to target EC's KPIs

Computing CO2 on the basis of
traffic flow data

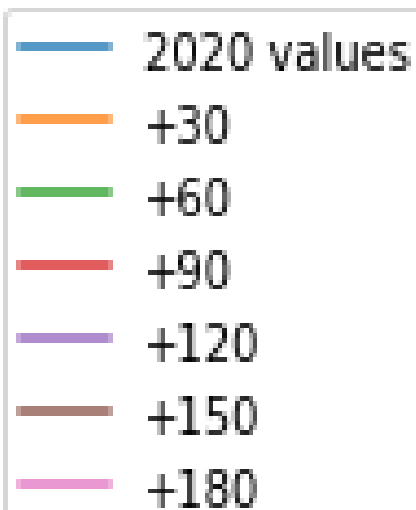
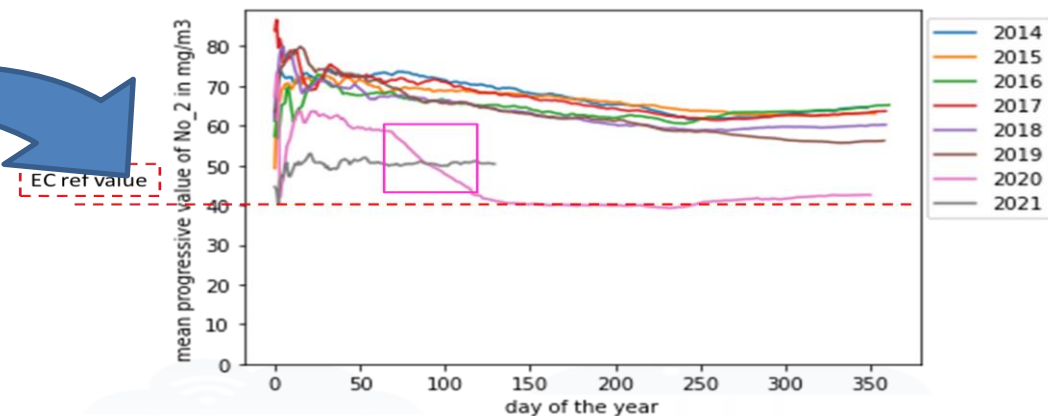
Detailed CO2 estimation



S. Bilotta, P. Nesi, "Estimating CO2 Emissions from IoT Traffic Flow Sensors and Reconstruction", Sensors, MDPI, 2022. <https://www.mdpi.com/1424-8220/22/9/3382/>

Predicting EC's KPI on NO2 months in advance

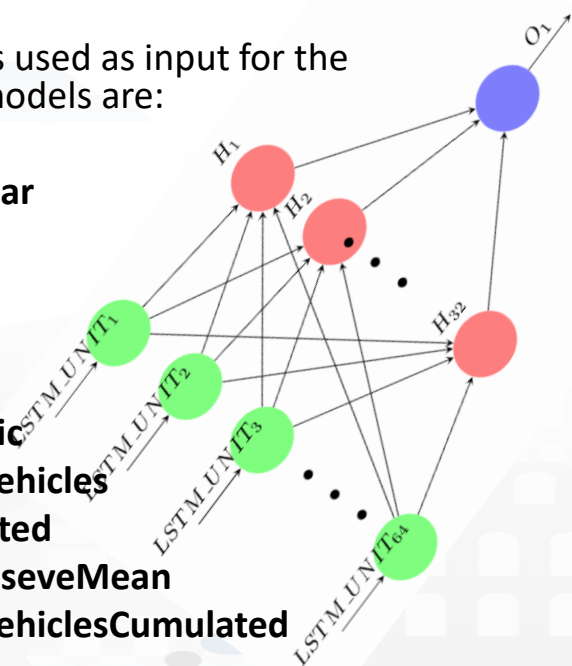
Deep Learning Long Terms Predictions of NO2 mean values, From 30 to 180 days in advance



Air Quality Directive				WHO guidelines	
Pollutant	Averaging period	Objective and legal nature and concentration	Comments	Concentration	Comments
PM _{2.5}	One day			25 µg/m ³ (*)	99 th percentile (3 days/year)
PM _{2.5}	Calendar year	Target value, 25 µg/m ³	The target value has become a limit value since 1 January 2015	10 µg/m ³	
PM ₁₀	One day	Limit value, 50 µg/m ³	Not to be exceeded on more than 35 days per year.	50 µg/m ³ (*)	99 th percentile (3 days/year)
PM ₁₀	Calendar year	Limit value, 40 µg/m ³ (*)		20 µg/m ³	
O ₃	Maximum daily 8-hour mean	Target value, 120 µg/m ³	Not to be exceeded on more than 25 days per year, averaged over three years	100 µg/m ³	
NO ₂	One hour	Limit value, 200 µg/m ³ (*)	Not to be exceeded more than 18 times a calendar year	200 µg/m ³ (*)	
NO ₂	Calendar year	Limit value, 40 µg/m ³		40 µg/m ³	

The features used as input for the predictive models are:

- Month
- dayOfTheYear
- NO2
- Tmean
- Humidity
- windMean
- NoxDomestic
- numberOfVehicles
- NO2cumulated
- NO2progresseveMean
- numberOfVehiclesCumulated



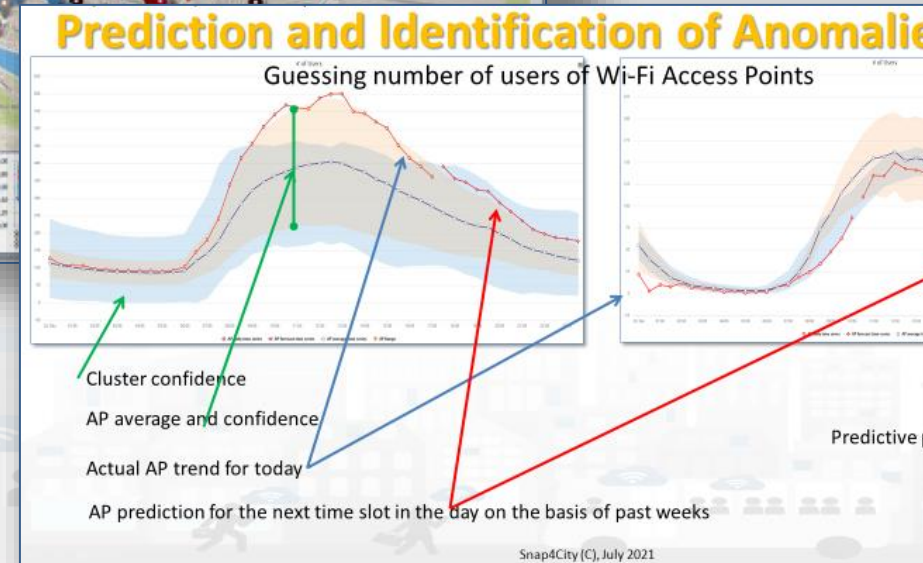
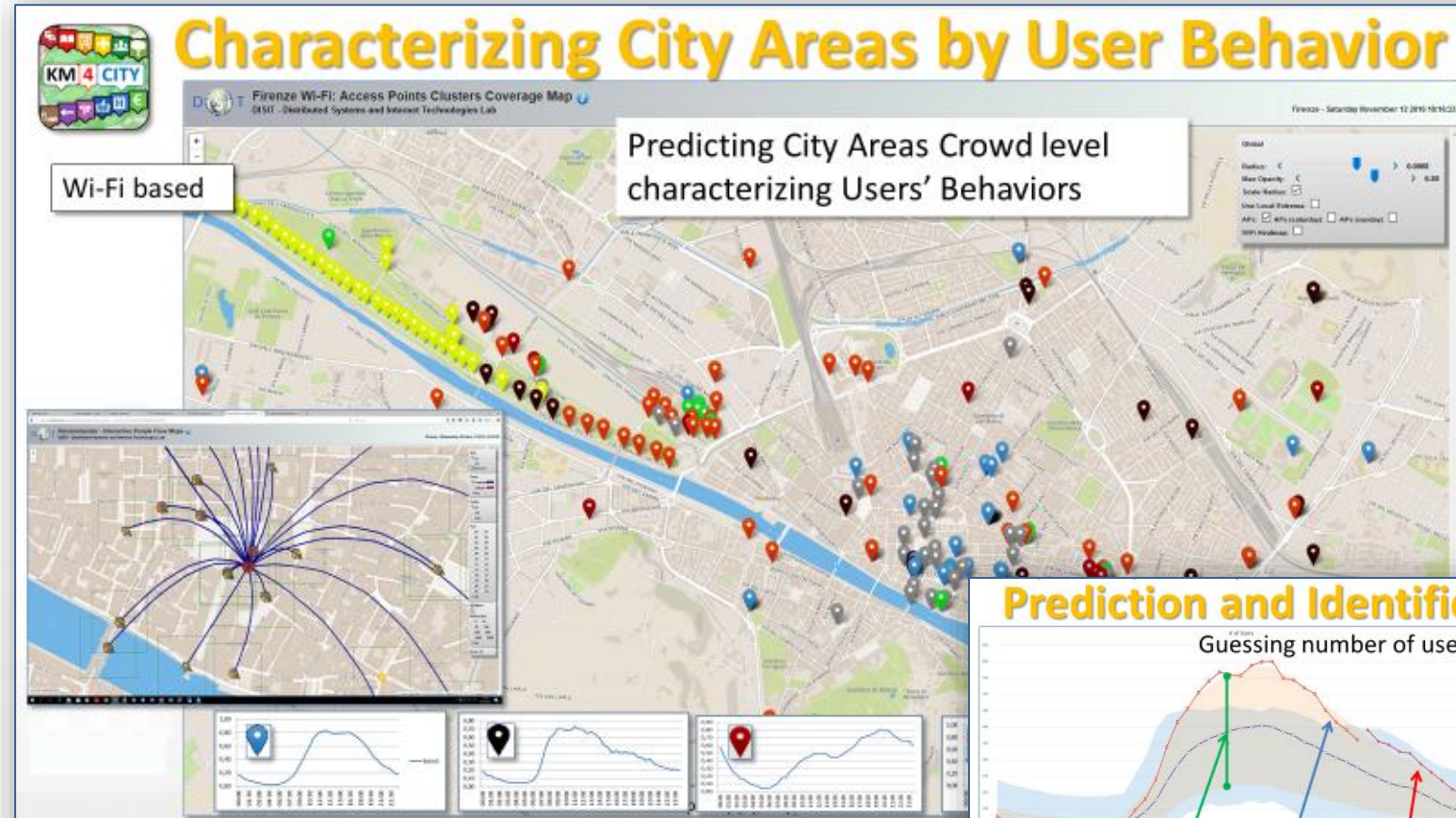
A view and data from the Thermal Camera



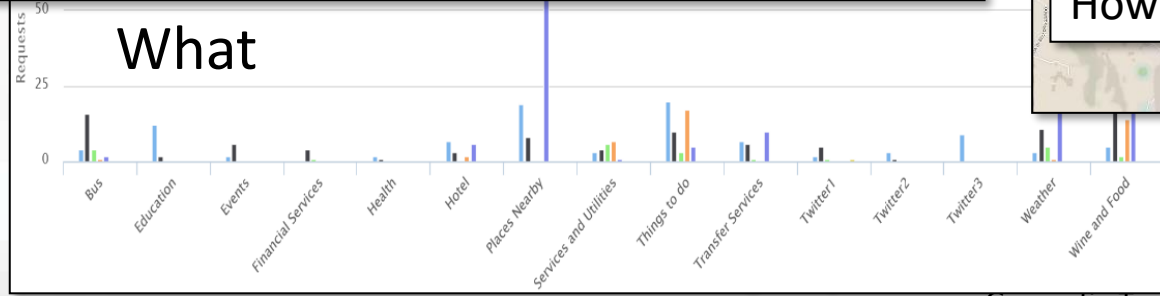
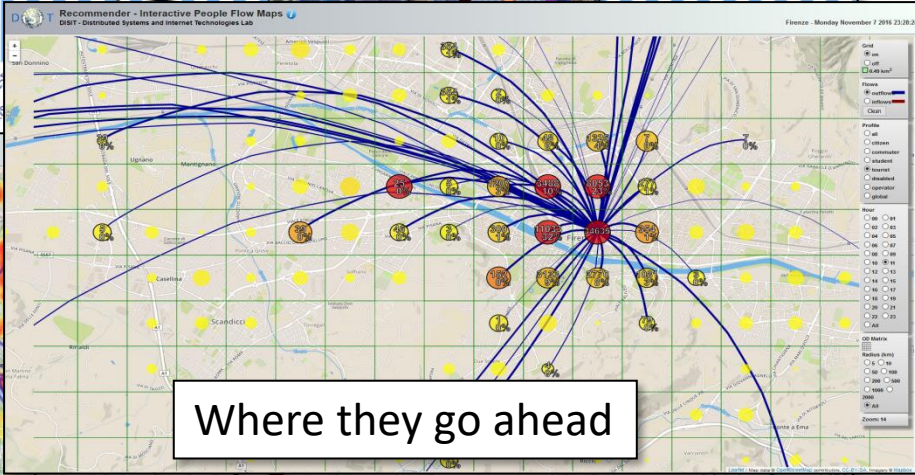
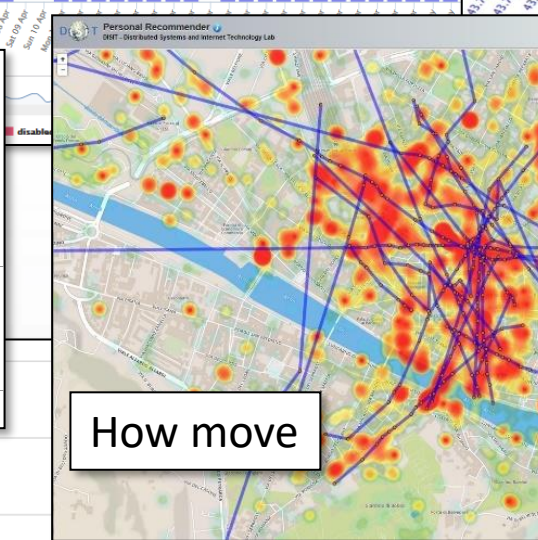
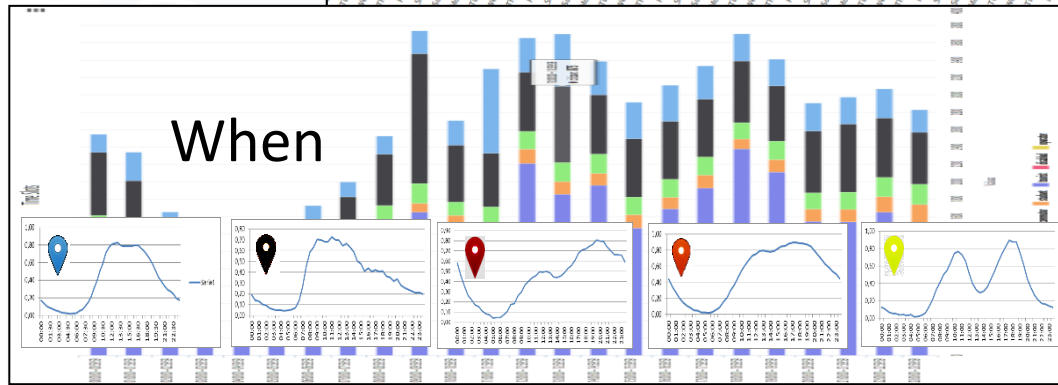
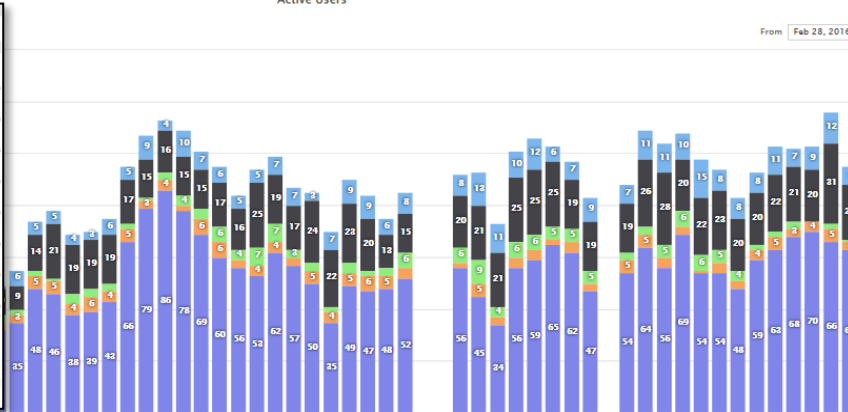
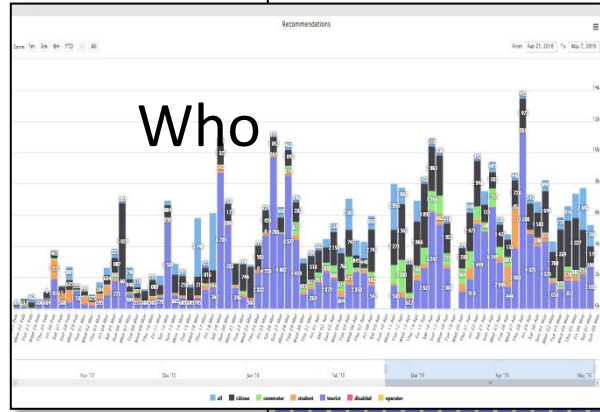
Detection BOX Snap4Thermal PV Firenze Tue 15 Mar 13:30:41



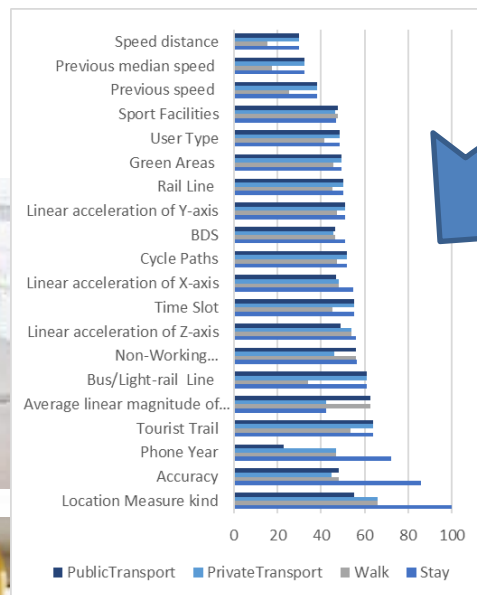
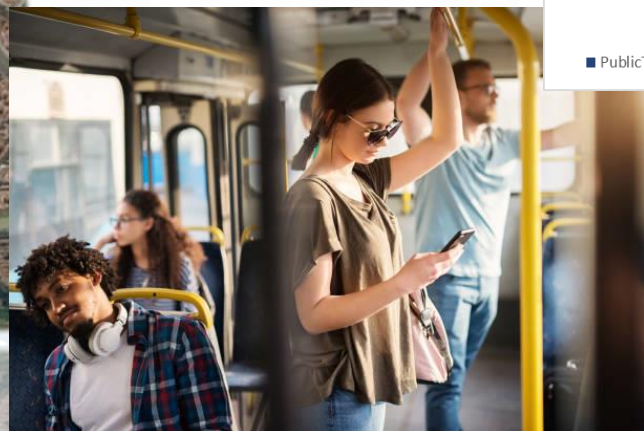
- **Prediction of people flows** on the basis of Wi-Fi data
- **Anomaly detection**
- **Resolute H2020**
- **Classification of city areas**



User Behavior Analyser for Collective Profiling

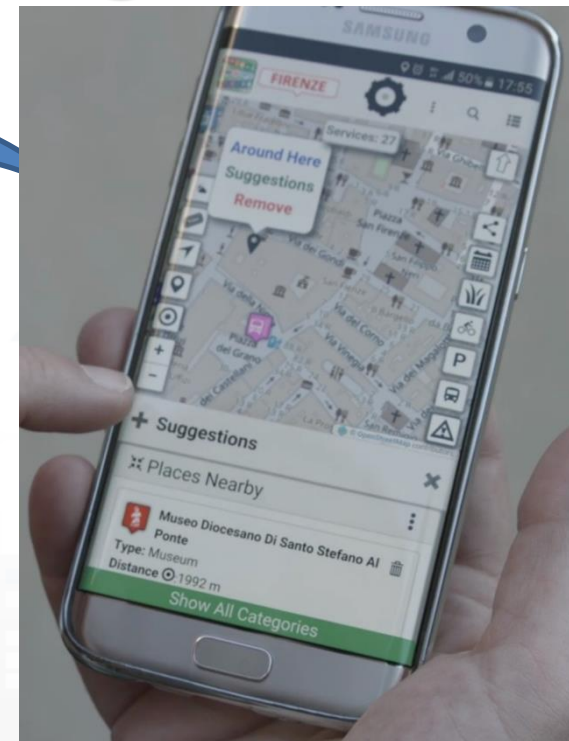


To propose suggestions and Engage city user I need to know how they are moving



Artificial Intelligence
Classification

Suggestions



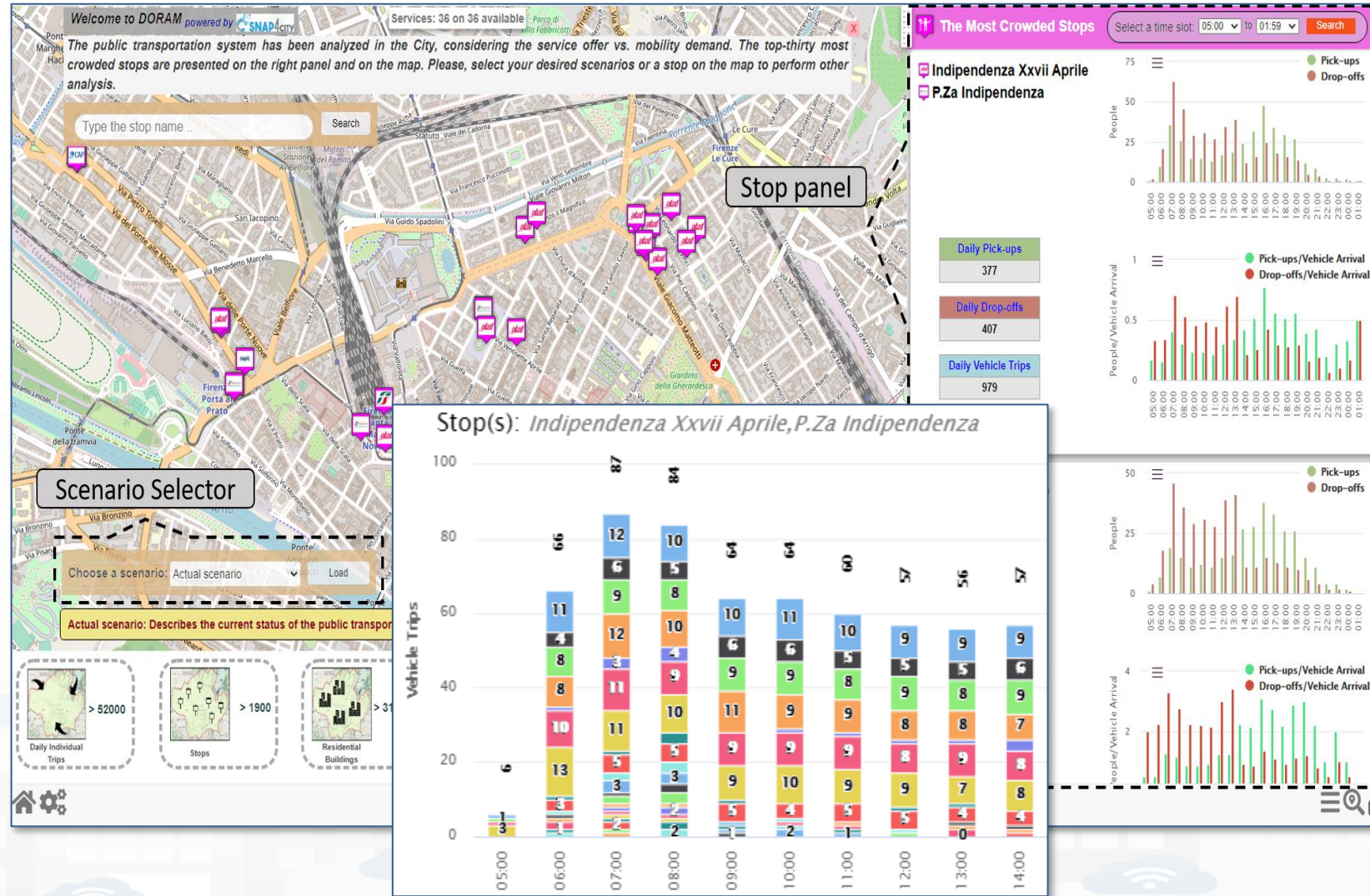
Analysis of

- **Demand of Mobility**
 - Via OD matrices
 - POI, city structure, etc.

With respect to

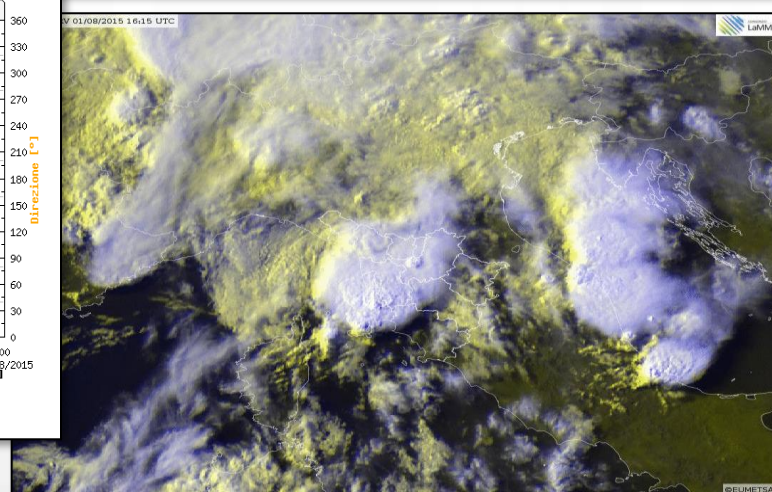
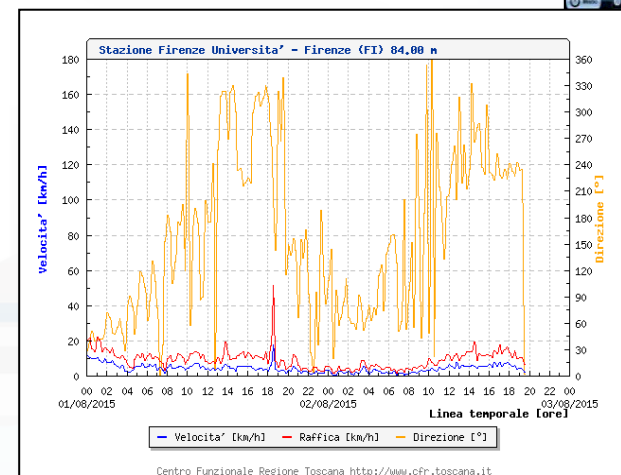
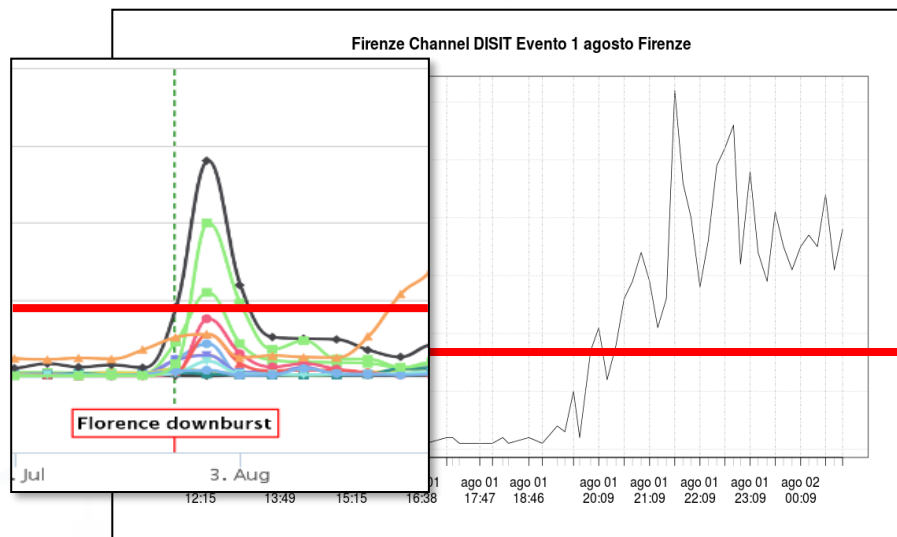
- **Offert of Transportation:**
 - Public services
 - Private services
 - Multiple agencies
 - GTFS

Critical Busses, bus-stops, paths, rides, etc.



<https://www.snap4city.org/odanalyzer/#b>

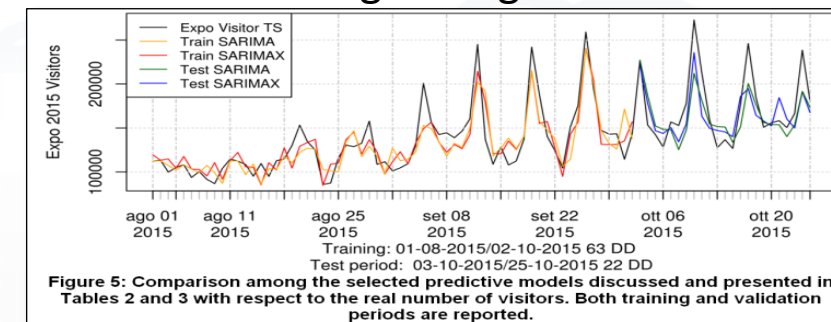
Early Warning



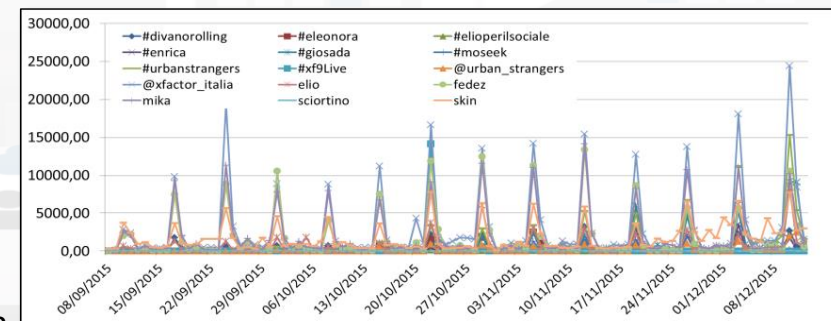
Predictive models



Attendance at long lasting events: EXPO2015



Attendance at recurrent events: TV, football



TV on Florence

#4thIndustrialRevolution #affitti #affittibrevi #airbnb
#airbnbification #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

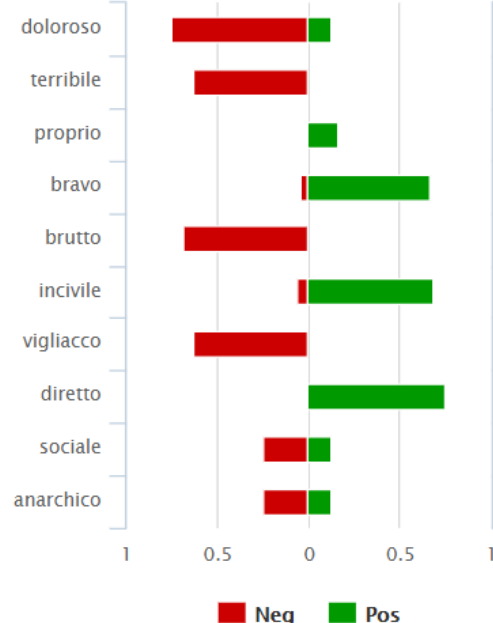
Sentiment analysis: #firenze

Zoom 1m 3m 6m YTD 1y All

From Aug 1, 2020 To N



Most freq. adjectives score 2020-10-31



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

- Search parameters
- Crawler Statistics
- Config Twitter API
- Data analysis 3
- Channel Statistics**
- Search statistics
- Retweet Statistics
- Twitter Users statistics
- Sentiment analysis 1
- LOGS 9
- Processes
- INFO

Twitter Vigilance Herit-Data Dashboard
Last crawling: 2020-11-17 13:42:32

Home > Channel statistics > Statistics on single Channel

Channel active from 2020-01-30 to 2020-11-17 13:15:00 Data processed from 2020-02-01 00:00:00 to 2020-11-17 13:15:00

Search related to channel Italy

Zoom 1H 3H 6H 12H 1D 1W 1M all

Manifestation

16. Oct 18. Oct 20. Oct 22. Oct 24. Oct 26. Oct 28. Oct 30. Oct 1. Nov 3. Nov 5. Nov

Legend: #4thIndustrialRevolution, #affitti, #affittibrevi, #airbnb, #airbnbification, #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

TOP

Decision Support System What-if Analysis

DATA GATHERING
AND CITY DATA
KNOWLEDGE
MANAGEMENT

FORGING &
MANAGING OPEN
AND FLEXIBLE WEB
AND MOBILE APPS

IOT/IOE DEVICES
AND NETWORKS

IOT APPLICATIONS,
THE LOGIC AND
THE SMARTNESS

ADVANCED
SMART CITY API,
MICROSERVICES,
SNAP4CITY API

SNAP4CITY
LIVING LAB FOR
COLLABORATIVE
WORK

SNAP4CITY FOR
BEGINNERS

SNAP4CITY
ARCHITECTURE AND
ECOSYSTEM, OPENED
DEVELOPMENT
AND SOURCE CODES

DATA ANALYTICS,
BUSINESS
INTELLIGENCE,
WHAT-IF AND
SIMULATION

DECISION SUPPORT
SYSTEM AND CITY
RESILIENCE

HOW TO ADOPT
SNAP4CITY, AND
OUR ROADMAP

SNAP4CITY
AND KM4CITY
PROJECTS

SNAP4CITY THE
VIEW OF THE
ADMINISTRATORS

 **SNAP4**
Appliances and Dockers
Installations

15MinCityIndex

What would support my neighborhood to become a 15-Minute City?

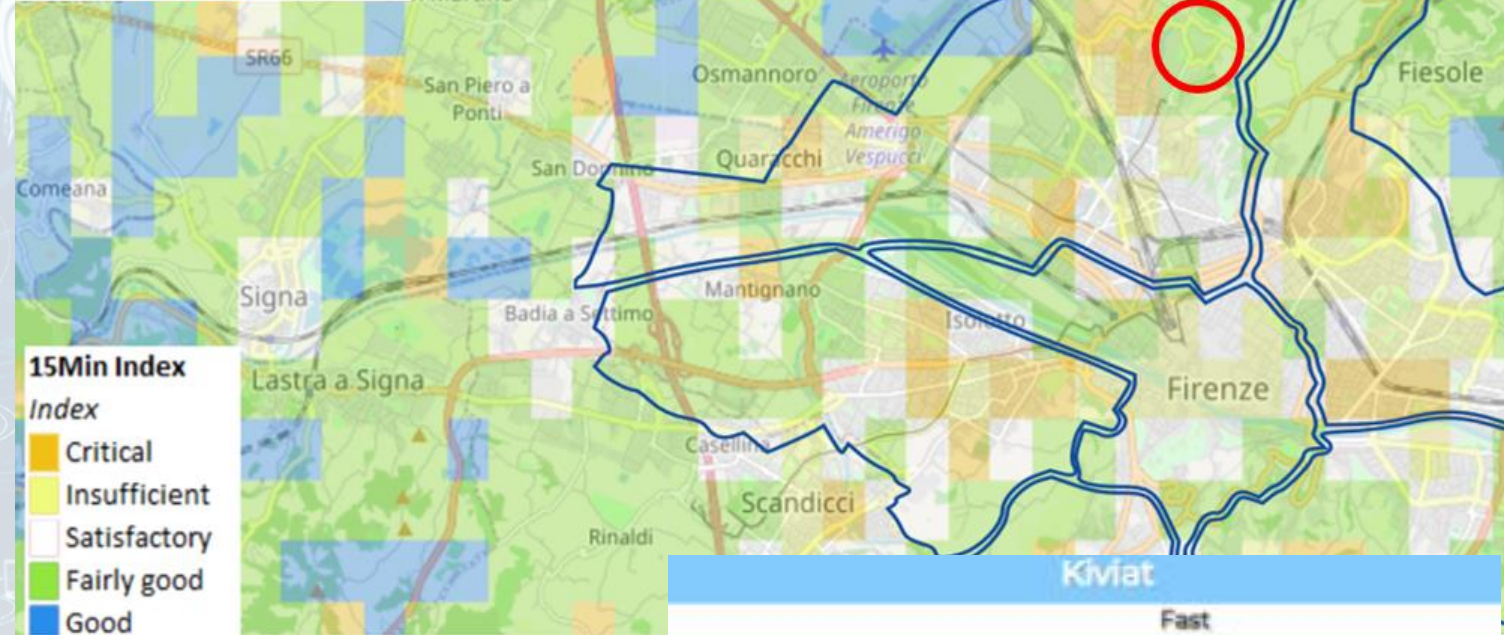
Using the Open Data:

We developed a data analytic tool based on municipal and national open data to assess services adequacy for people living in each 15 minutes areas of the city.

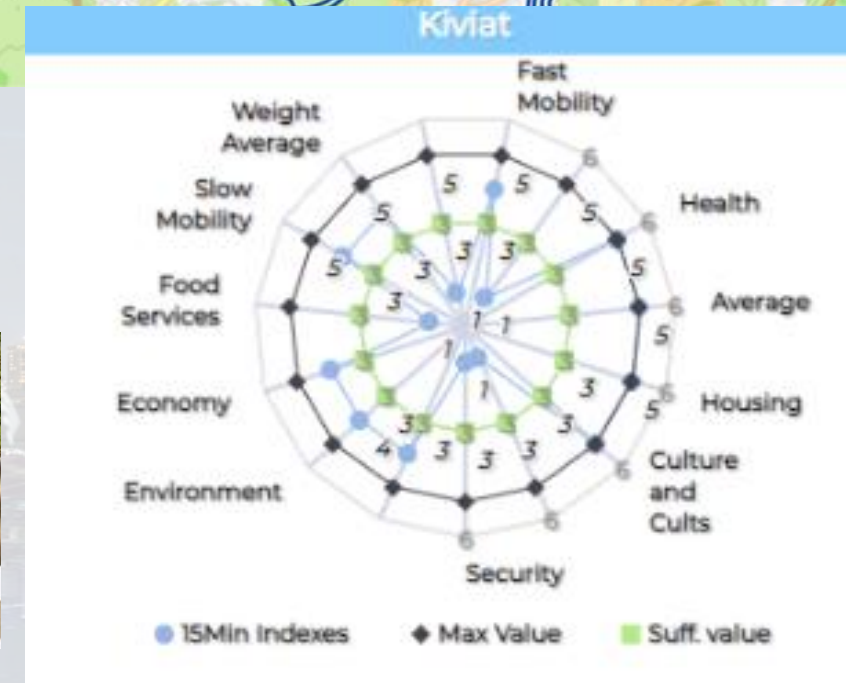
Good public transport services: bus, new tram line, train stations, cycle paths.



Careggi/Rifredi is a relevant district in Florence because of hosting the main Florence/Tuscany hospitals Careggi and Meyer, but also university headquarters and many other workplaces.



The tool supports the becoming of a 15-Minute city evaluating the service level in various domains.



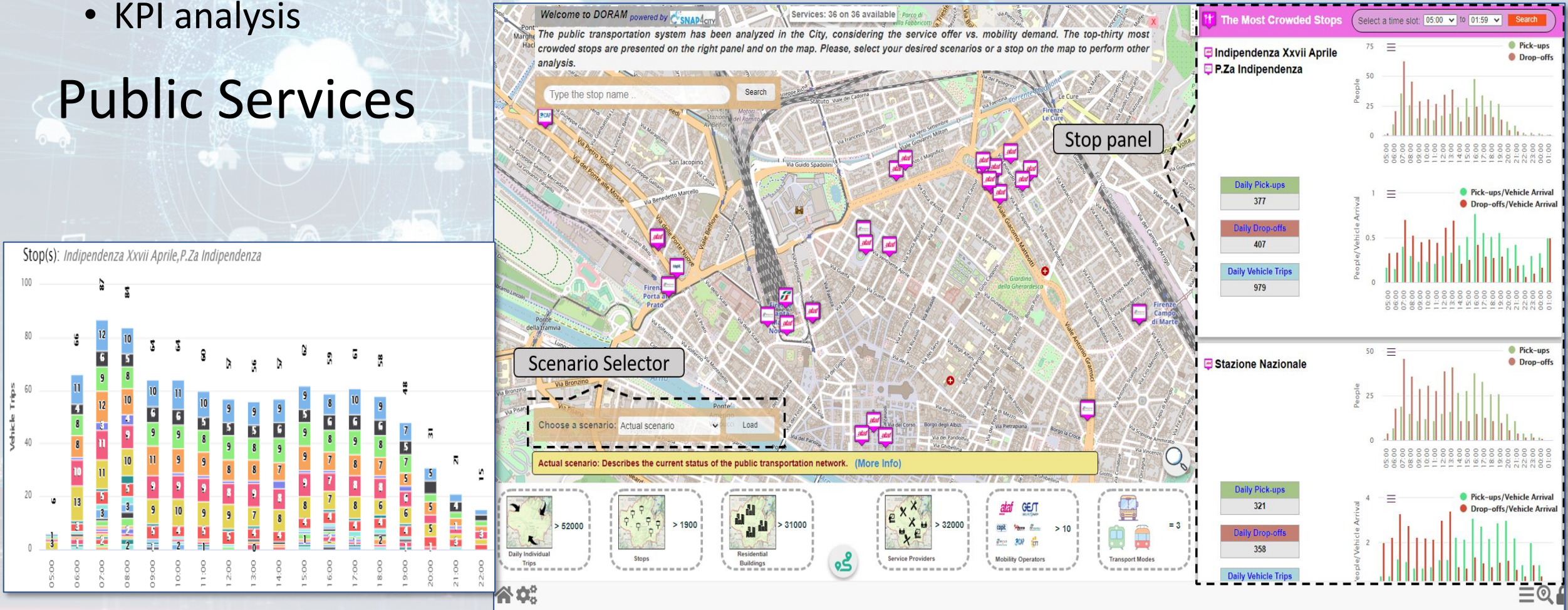
<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjkzOA==>

What-if Analysis on Pub Transport



- Definition of scenarios impact on
 - Traffic, Pollutant, parking, public transport, private flows, etc.
 - KPI analysis

Public Services



Decision Support Systems, What-if

○ Event planning, via what-if analysis

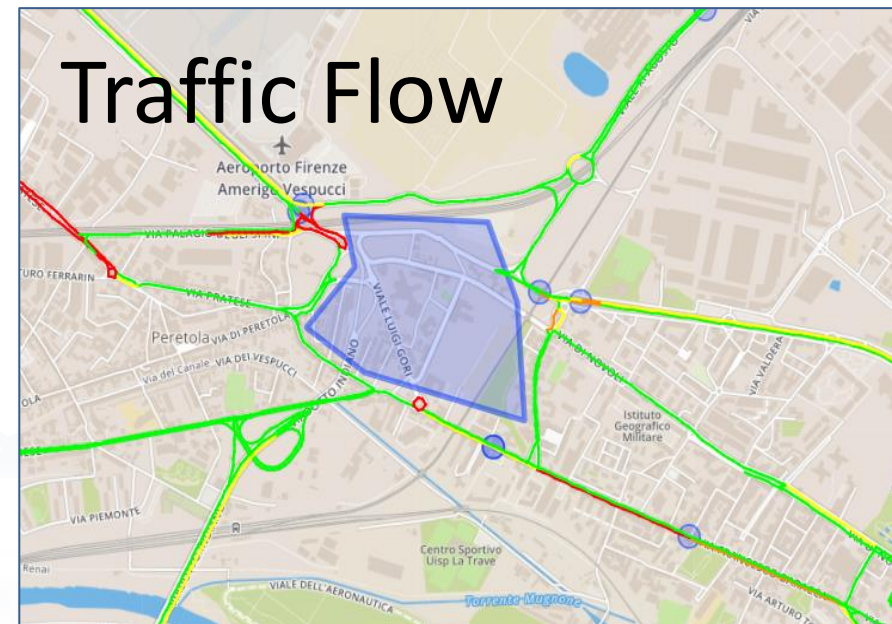
- Change in the graph structure of the city
- Impact on the flow of people and vehicles
- Adaptation: public transport, traffic, pedestrian management, etc.

○ Immediate reaction to natural events or not

- Everything is ready and updated in real time
- Each view is contextualized in terms of data: descriptive and prescriptive

○ Digital Twin

- More detail in the context integrated data
- Greater realism in deductions and representations
- Less fragmentation and non-uniformity in the views to support decisions



Conclusions

• Technology and Innovation

– Decision support Systems

- Discussion with city users, decision makers
- Support: decision makers, proposers of solutions

– Digital Twin:

- global and local,

– AI/XAI techniques + simulations/modelling

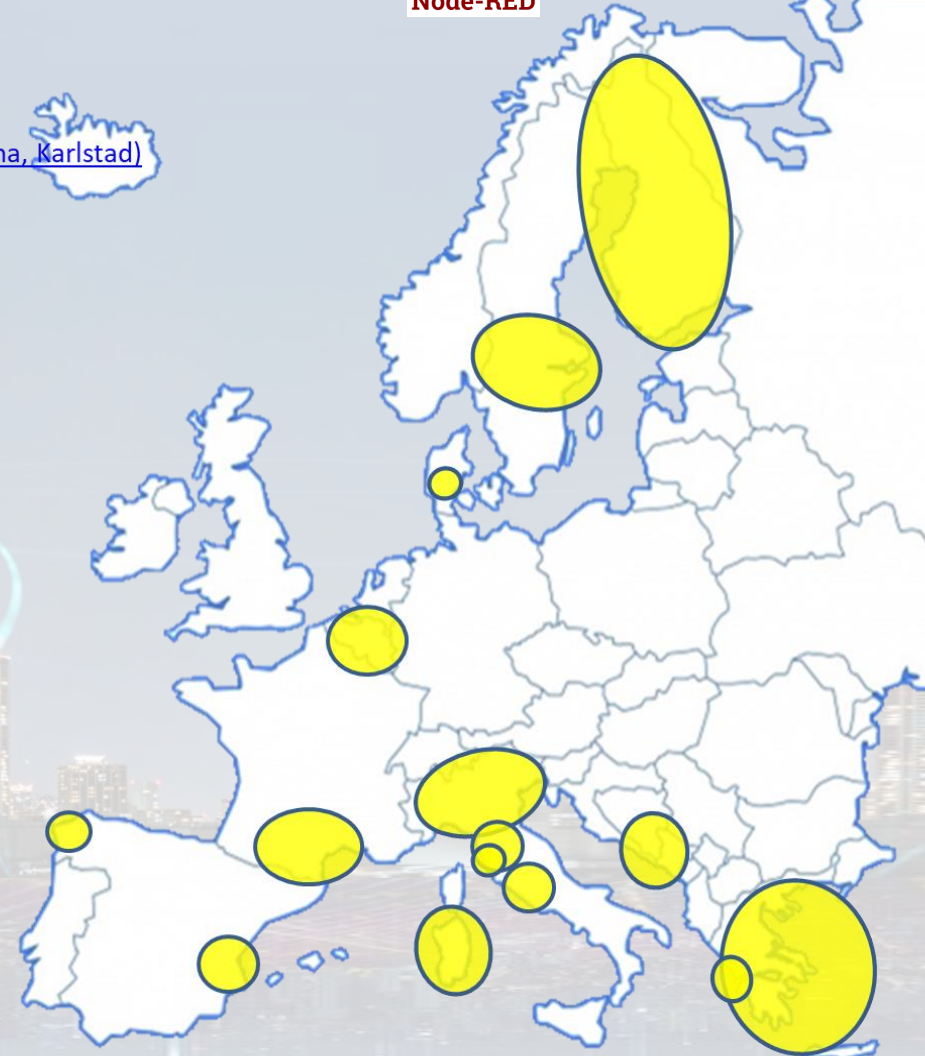




<https://www.snap4city.org/download/video/cov/>

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 \(Gr\)](#)

















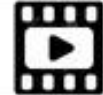





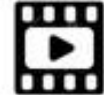


















- Trials in Israel, Colombia, Australia, India, etc.....



- > 7 running installations
 - Toscana, Pisa, Sweden, ISPRA, Snap4.eu,
 - Altair, Italmatic,
- 13 actions, 12 pilots on 10 Countries
 - >40 cities/areas
- **Wide MULTI-tenant deploy, e.g.,**
 - 19 Tenants / Organizations
 - > 7700 users on
 - > 1400 Dashboards
 - > 16 mobile Apps
 - > **2 Million of structured data per day**
 - > 520 IoT Applications/node-RED
 - > 700 web pages with training
 - > 75 videos, training videos

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

TOP



Be smart in a SNAP!

CONTACT

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<https://www.disit.org>

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DISTRIBUTED SYSTEMS
AND INTERNET
TECHNOLOGIES LAB