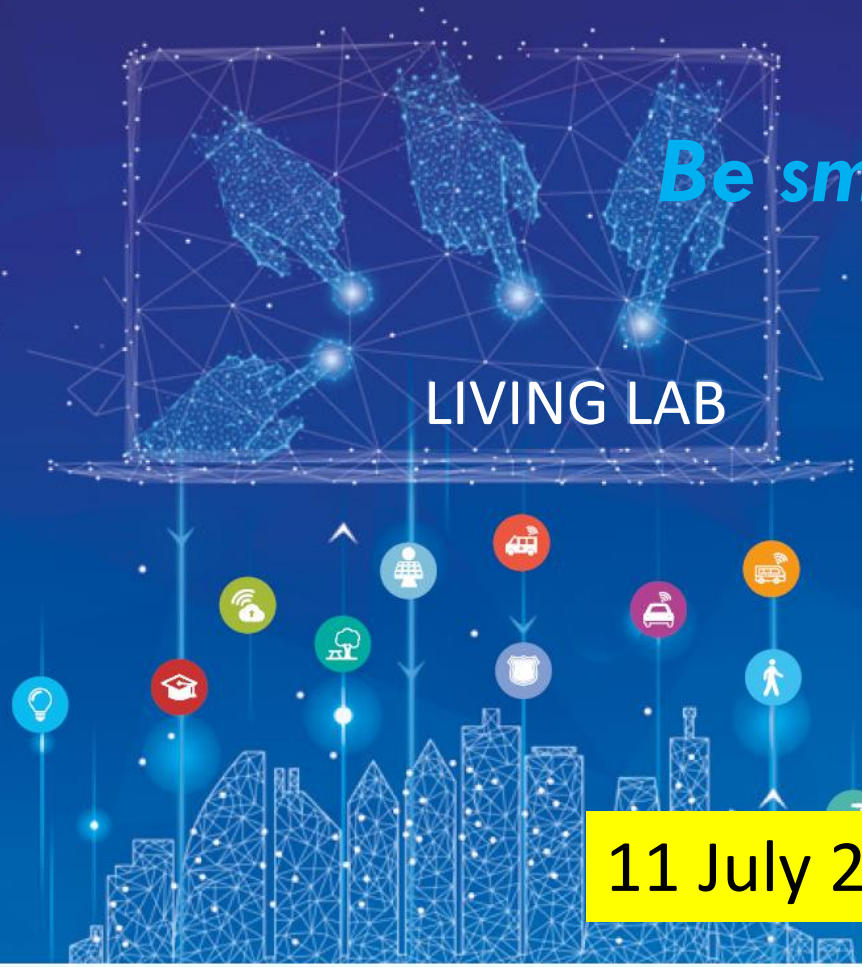
SNAP4CITY

KM4CITY

Be smart in a SNAP!



11 July 2019, Comune di Roma

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES

SNAP4APPLIANCE
Virtual Machines ready to use for Smart City and IOT Applications
DOWNLOAD

INDEX

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

SNAP4CITY

Powered by KM4CITY

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

https://www.Snap4City.org

Paolo Nesi, paolo.nesi@unifi.it
https://www.Km4City.org
https://www.disit.org

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TOP

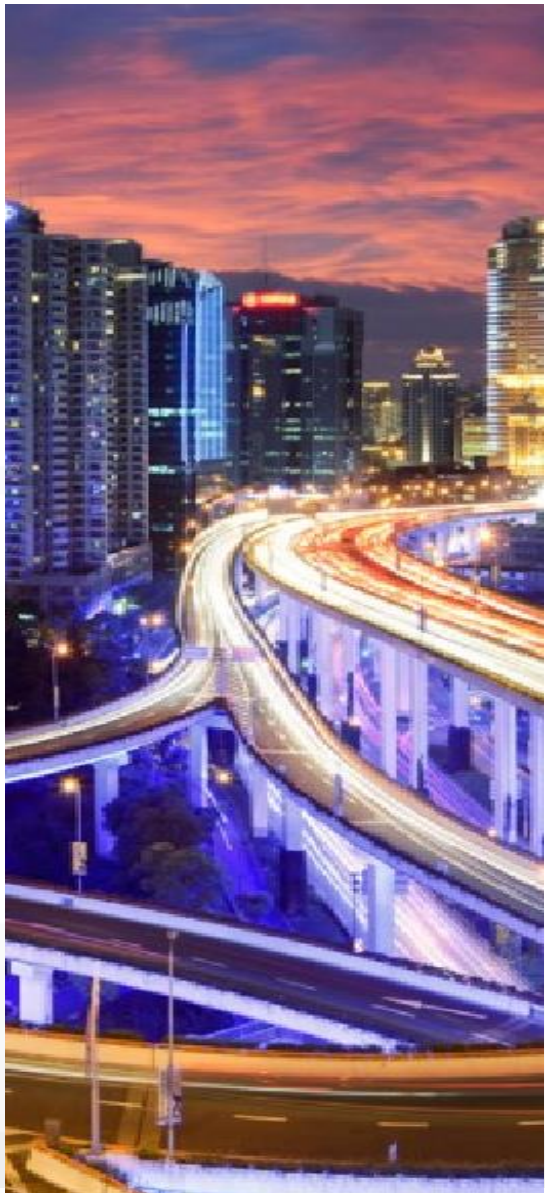
Urban Platform

ARC
INDEX

- *Motivations to become a Smart City*
- *Structure of a Smart City Urban Platform*
- *Comparison with the State of the Art*
- *Living Lab Support*

Motivations of the Smart City

- Migration towards cities: in the 2050 more than the 75% of population will live in the cities.
  - More opportunities, higher salaries, etc.
- Cities have to cope with the increment of citizens providing higher quality of services & efficiency:
  - To this end, they have to conquer a high level of
    - control on: expenses, quality of services,….
    - quality of services, new services, etc.
    - sustainability of services …

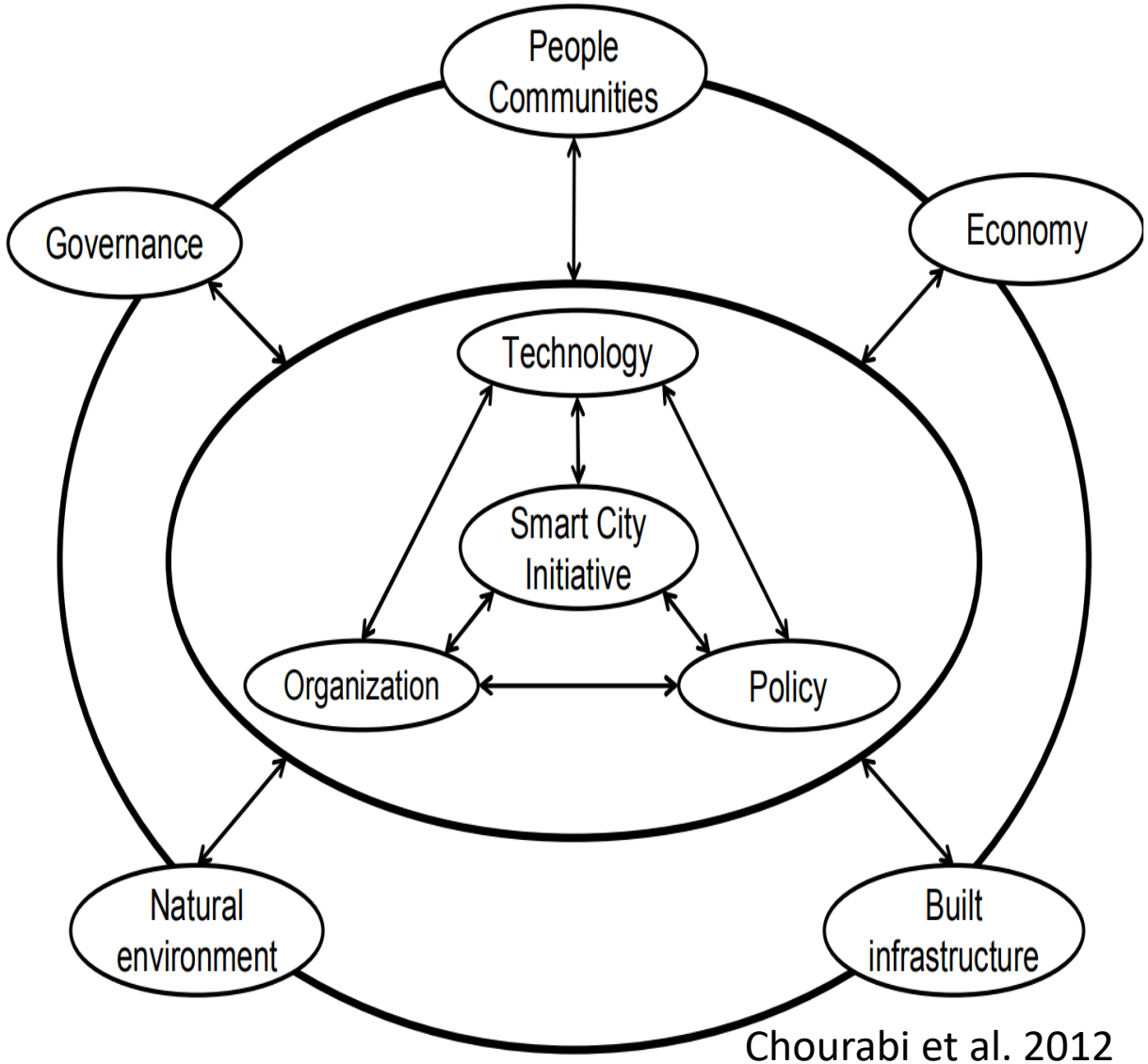


Smart City Process

- Many aspects should be taken into account for a successful Smart City transformation

- → *The influence of each of them depends on context, attitude of the institutions, internal structure, etc.*
  - *Parallel actions can conflict, compete …*
  - *Spreading of efforts may distance the goals*
  - *……*

- → *The process may become sustainable, harmonized and faster with a Living Lab Strategy and Support*



Chourabi et al. 2012

Smart City Domains

- Health
- Education
- Economy & commercial
- Energy
- Environment
- Mobility & Transport
- People & Living
- Governmental
  - Risk management, Resilience
- …

Challenges: Requests and Deductions

Public Admin.

Pub. Admin: detection of critical conditions, improving services

Mobility Operators

Tune the service, reselling data and services , prediction

Commercial: customers prediction and profiles, promotions via ads

Tourism Museums

Tune the service, prediction

API for SME

Smart City Engine

User profiling
Collective profiles
User segmentation

Services & Suggestions
Transport, Mobility, Commercial (retail), Tourism, Cultural

Personal Time Assistant
dynamic ticketing, whispers to save time and money, geoloc information, offers, etc.

User Behavior Crowd Sources

Data: Public and Private, Static and Real Time

Private: user movements, social media, crowd sources, commercial (retail)
Public: infomobility, traffic flow, TV cameras, flows, ambient, weather, statistic, accesses to LTZ, services, museums, point of interests, ...

Collection of requirements: creating,… validating

- **ENOLL**: https://www.openlivinglabs.eu/
  - European Network of Living Labs
- **EIP-SCC**: European Innovation Partnership on Smart Cities and Communities
  - https://eu-smartcities.eu/
- **Select4Cities**: Pre-Commercial Procurement Project to develop a data-driven, Internet-of-Everything (IoE) platform for large-scale urban co-creation
  - https://www.select4cities.eu/

Requirements and Objectives

- Serve as a **City Dashboard**, **App User Interface**, etc.
  - Real time and historical data, any device, sensors and actuators
  - Sensors, KPI, maps, data trends, real time data, charts, etc.
- Referral / **historical data, and Open Data**:
  - shadow, access (API, storage, any protocol), production of OD, export
- **Data Driven Real Time communication &** processing:
  - IOT Applications, IOT edge, multiple operating systems, embedded systems, **MicroServices**
  - in/out data driven from/to the field into: applications, notifications, etc.
- **Data Analytics**: Machine Learning, statistics, reasoning, …
- **Serve as Living Lab**: open innovation, coworking; collaborative work; sharing: data, processes, dashboard, experiences, solutions, ….
- Experimented on **large scale cases**

Non functional requirements

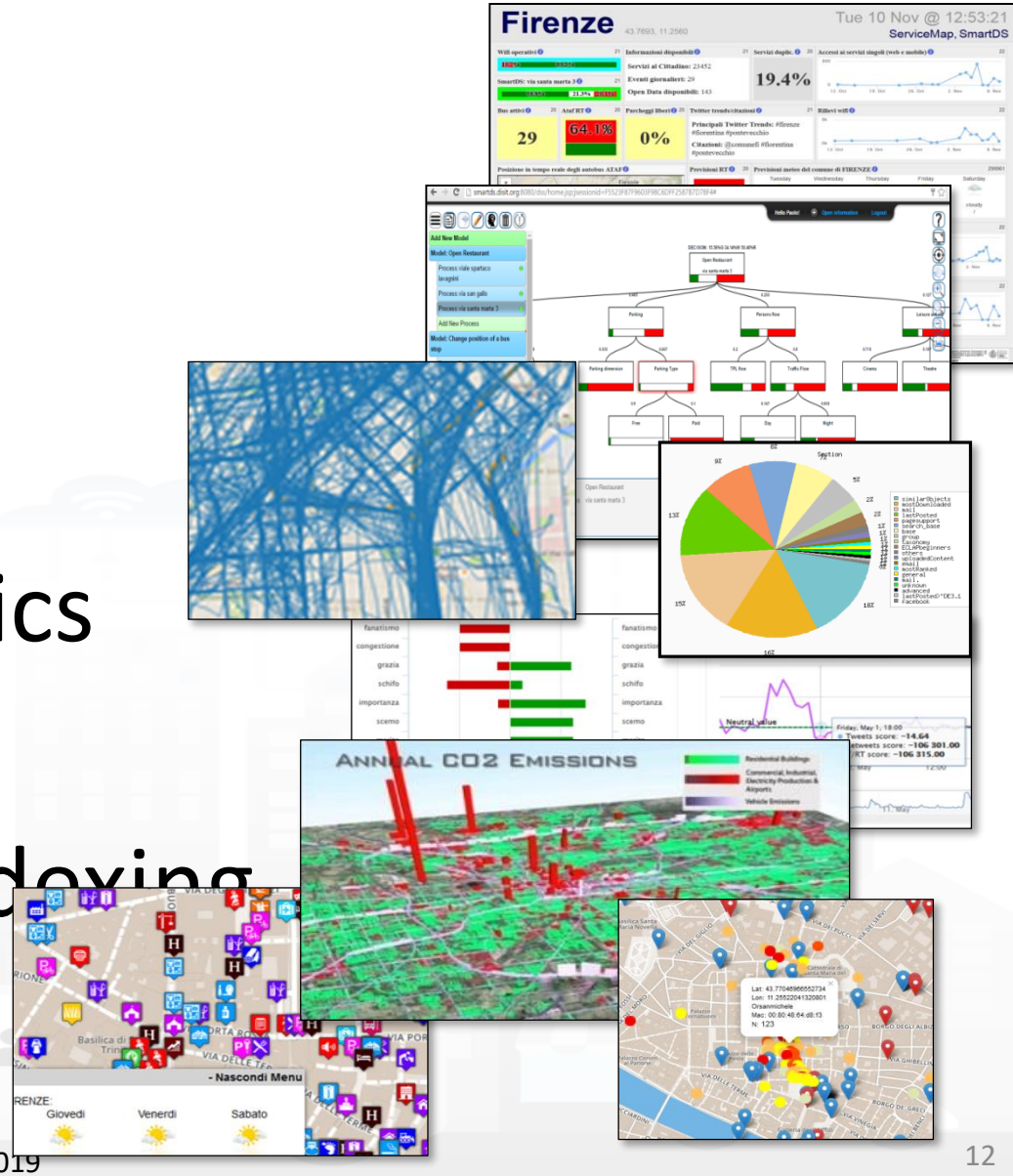
- **Open Source** and based on Open Source Tools and OS
- Open **Standard** for communication and API for In/Out
- **Scalable, Robust, Distributed** and Decoupled, modular, Service Oriented, open to external services and data sets
- **Data driven**, for reading and data analytic
- **Heterogeneous**: any device, private and public, custom and..
- **Interoperability**: protocols, internal API, Smart City API, capable to integrate with legacy conditions in place, modular, reusable,…
- Communication with things: any protocol, any format, …
- **Security** by Design: HTTPS, TLS, …
- **User Centric** Design: privacy by Design (and **GDPR**), personalized, personal data management, ...

Security/Privacy Requirements

- **Managing** private data together with public data
- **Private data management** according to GDPR
  - Browsing, downloading, controlling rights, delegating access, revoking accesses, etc.
  - Keep them safe
- Secure enough to delegate management of data regarding public security:
  - Data that could be used against us by some terrorist, or anyway by someone with some bad intention, for example to access in our home when we are far away, etc.

Data Driven Decision Support

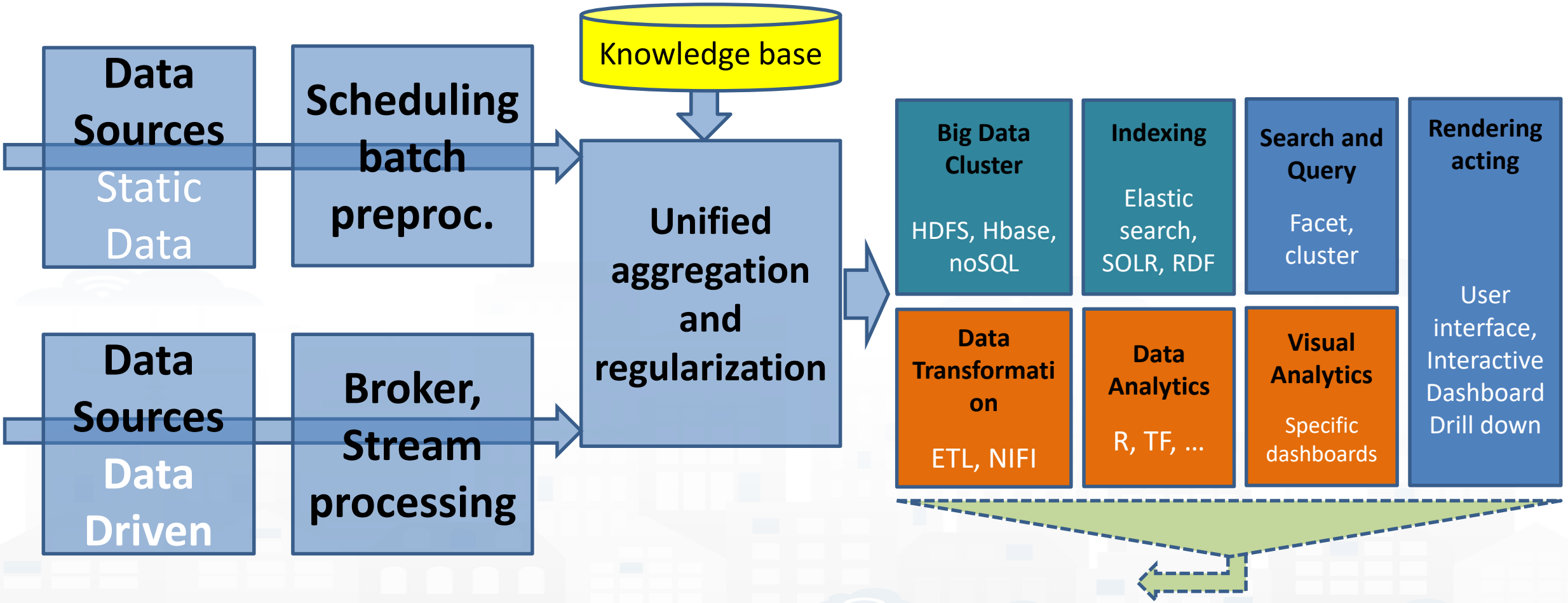
- Decision Support system
- Assessment / Strategies
- Smart Services
- Data Rendering, visual analytics
- Data Processing, Analytics
- Data aggregation, Storage, indexing
- Data Ingestion



Integrated Urban Platform

- **Produce value from data supporting Living lab**
  - Stimulate virtuous behavior, influence City Users!
  - Put in action CITY Strategies
  - Smart Services in place
- **Data Exploitation performing**
  - predictions, reasoning, business intelligence, ..
  - users behavior analysis, decision support system, ..
  - Control Room, Real Time Monitoring tools, ….
- **Aggregate & integrate data**
  - Multiple protocols from urban operators, ….
  - open data, IOT, sensors, internet of everything, cloud, mobile devices, Wi-Fi, social media, …

Lambda Architecture



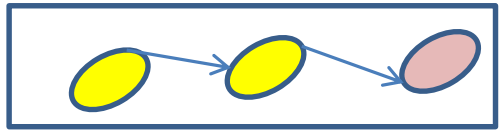
Data Indexing & Semantic Data Indexing

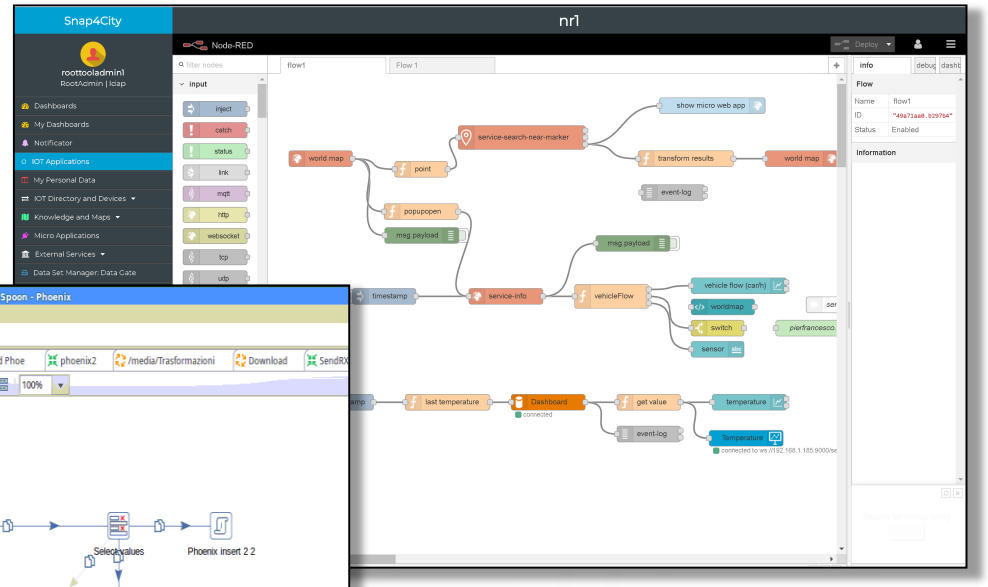
- **Textual**, multilingual, NLP (Natural Language Processing)
  - For social media data, but also for metadata, descriptions
- **Spatial**, **geographical**, georeversing → Knowledge Base, Km4City
  - Around a point, along a line/path, near a path, into a polyline, etc.
- **Temporal** → Historical data
- **Semantic:** relationships among city entities.
- **Data Value** different data type (Data Lake/normalization), data unit, etc. → the so called IOT shadowing of Azure, AWS
  - Relating to Knowledge Base reciprocally

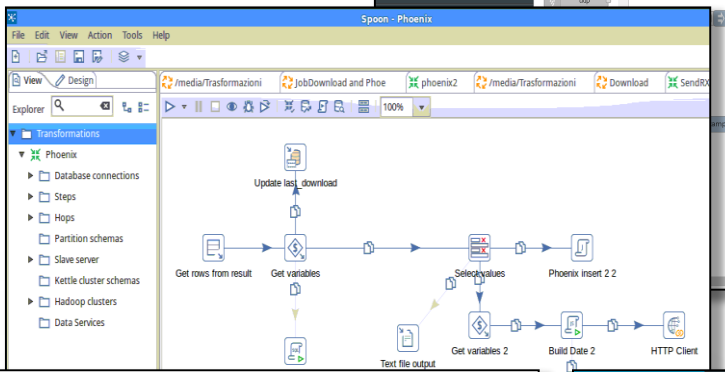
- ***Traffic** / volume of Data (KBps) → Network Analysis, monitoring*

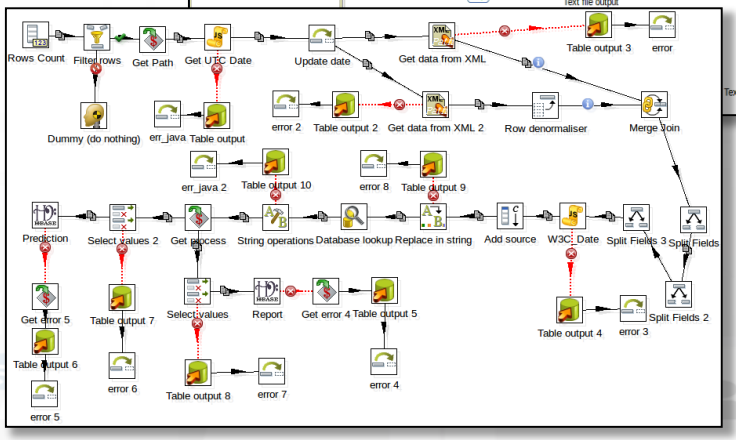
Data Processing

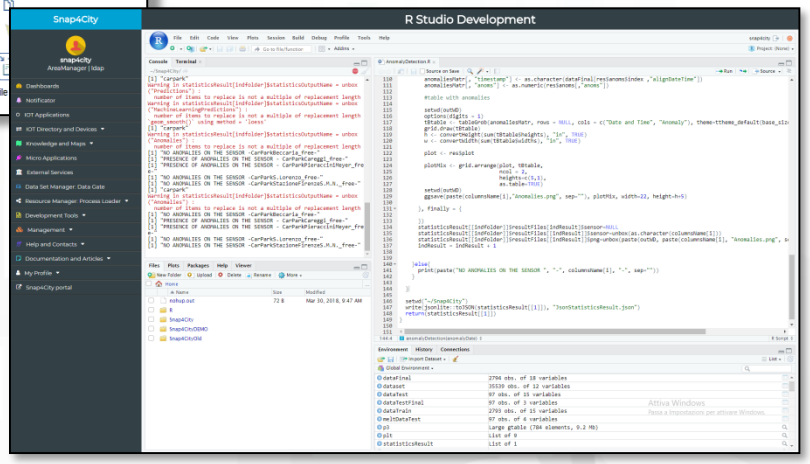
- **Data Analytics**
  - Periodic or event driven
    - On demand,
    - R Studio, Java, Python, etc.
  - Data transformation
    - ETL: extract transform load
  - Control Flow, data transform
    - Node-RED: Node.JS
- **Data Analytics examples**:
  - Assessment/monitoring
  - Predictions
  - Anomaly detection
  - Simulations, What-If analysis
  - Etc.





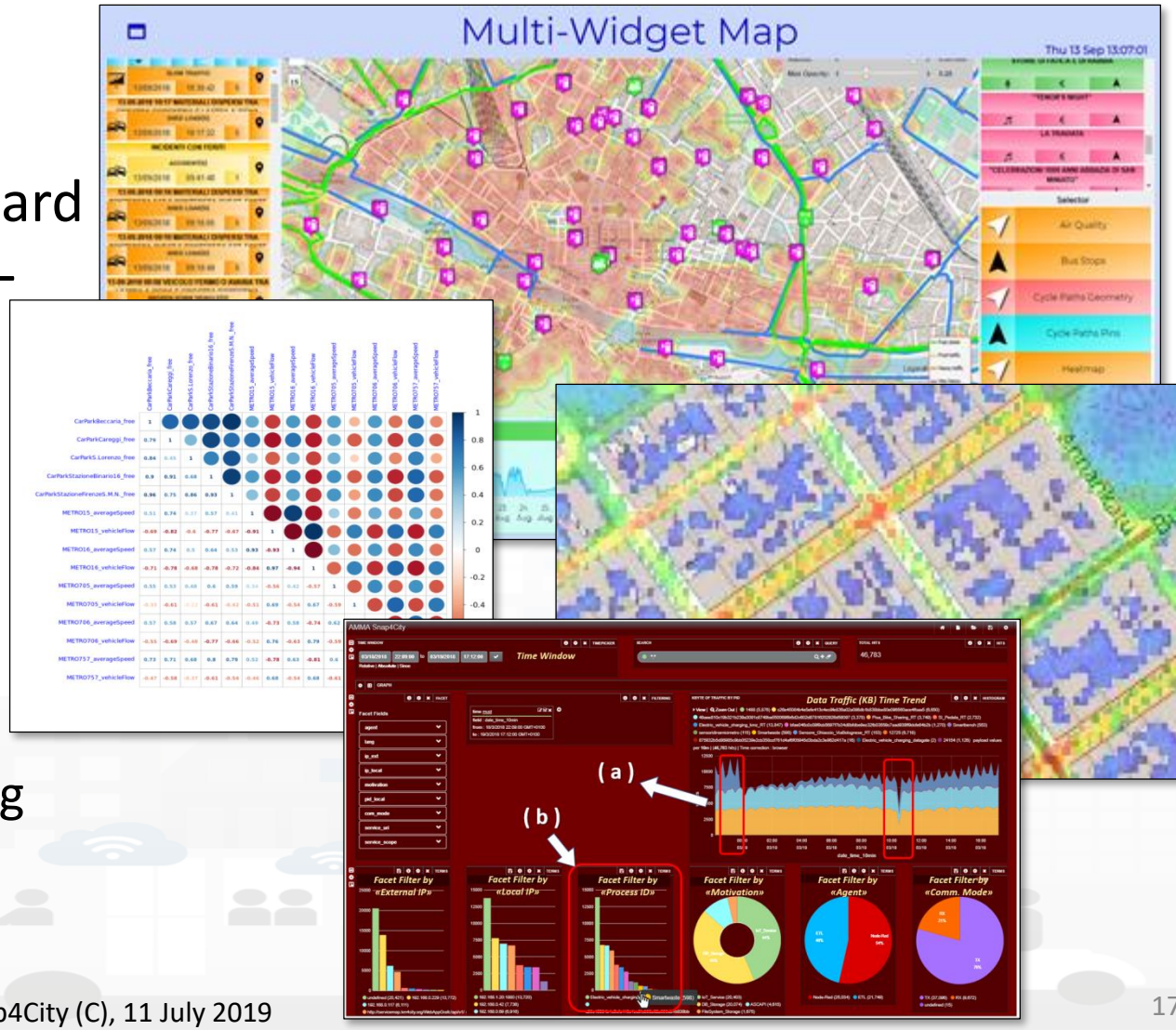






Data Rendering vs Control Room Dashboards

- **GIS** rendering by layers
- **Business intelligence** mainly focused on making statistics from tabular: no layer, hard relationships, ... Exploit Data Analytic, ETL
- **Visual Analytics**, data understanding
  - Rendering and drill down
  - Faceting/grouping (Elastic Search/SOLR)
  - Cross filtering (Kibana, Grafana, Banana)
  - Interactive, Cross Widgeting
- **Control Room Dashboards:**
  - Need: Visual Analytics, Data Analytic, geospatial reasoning, data driven processing
  - H24, alerting, Flexible rendering, custom widgets, interactive dashboards

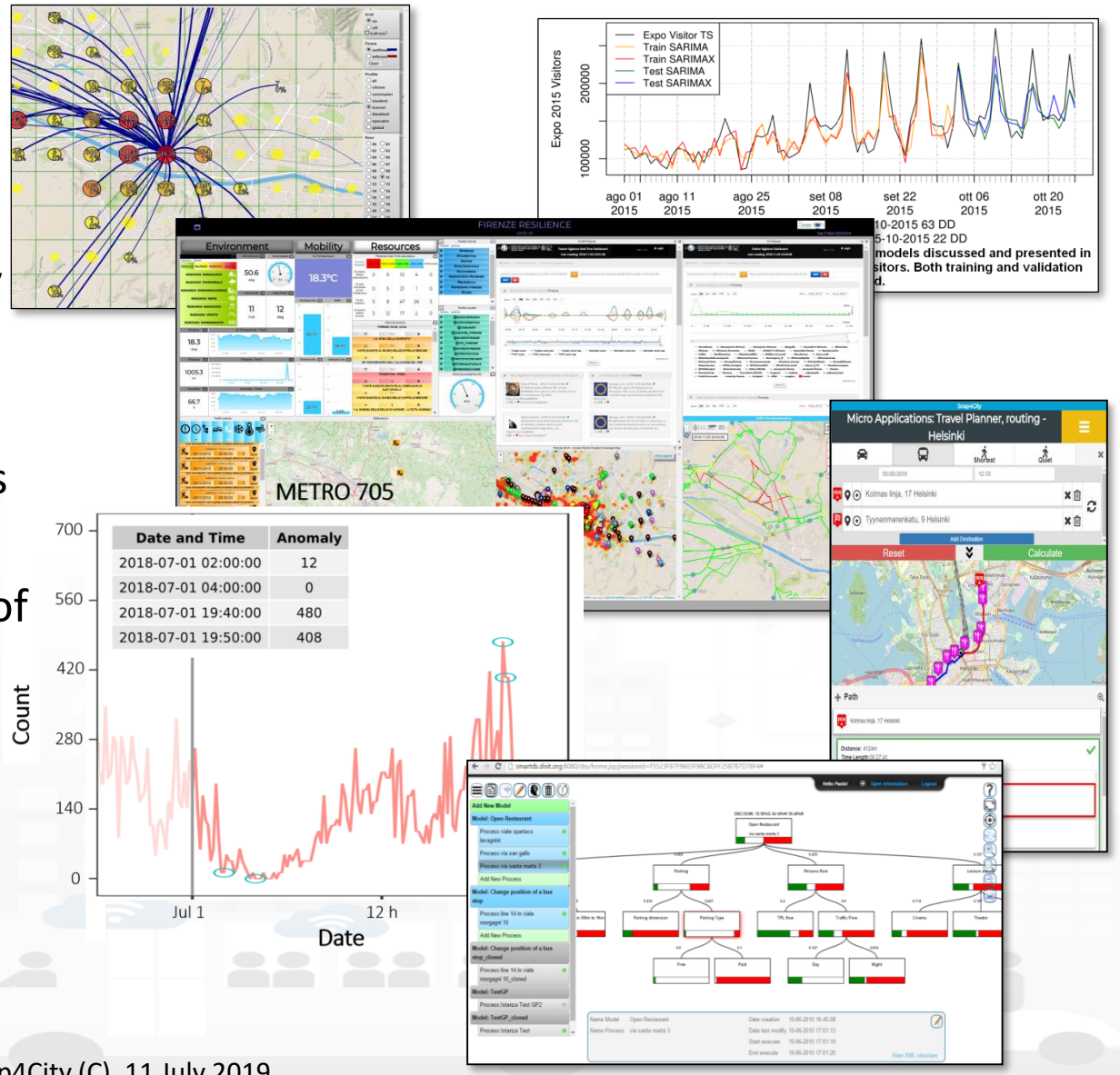


Decision Support, Act!

Smart City Control Room, SCCR, SCR

- Not only a collection of verticals

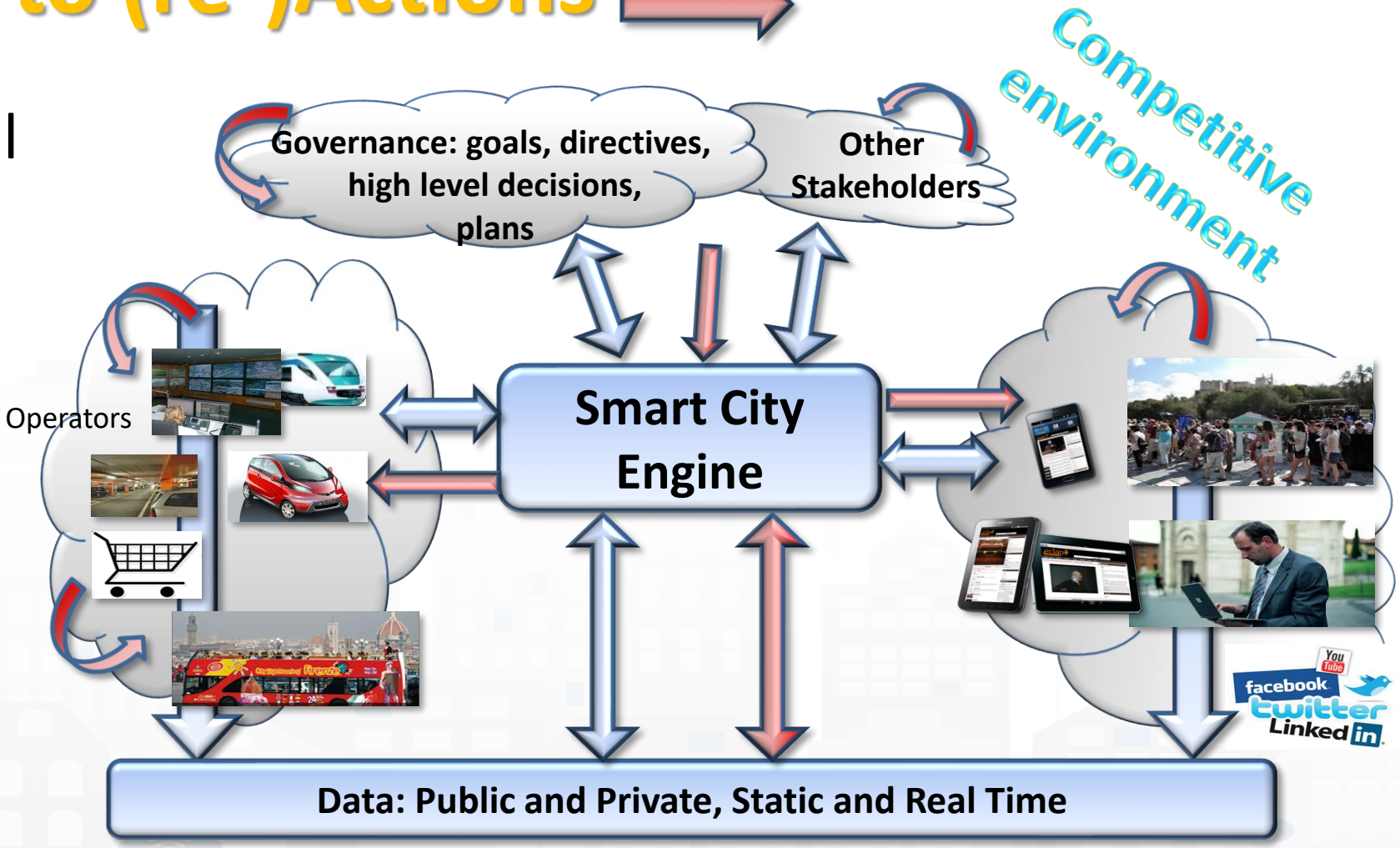
- **Exploiting analytics**: prediction, simulations, anomaly detection. ..
  - Big data approach to Data Analytics
- **Connecting Heterogeneous data** to defined strategies and alerting
- **Connected interactive dashboards** for different kind of decision makers: operators and majors
- **What-if Analysis taking into account multiple data sources**



From strategies to Actions

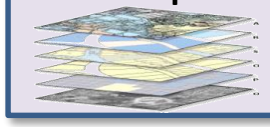
From Strategies to (re-)Actions

- Smart Services for all
  - Informing
  - Suggesting
  - Engaging
  - Alerting, Early Warning
- Support for
  - Making Decision active
  - New Plan



Open Data

GIS + Map Data



Proprietary Data

Personal Data

IoT/IoE

Industry 4.0

Social Media

Static, Quasi static and Real Time data flows

Data Processing, Data Analytics, Tools

Big Data Storage Knowledge Base

Smart City Cloud Infrastructure

Smart City API

Final Users' Tools

Dashboards

IOT / IOE Apps

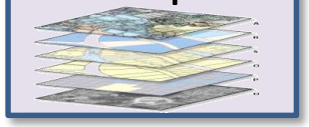
Mobile and Web Apps

Living Lab, Development and Management Tools

Authentication, Authorization, GDPR, Security Assessment

Open Data

GIS + Map Data



Proprietary Data

Personal Data

IoT/IoE

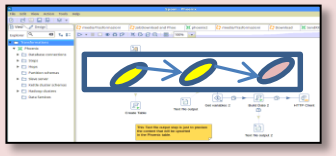
Industry 4.0

Social Media

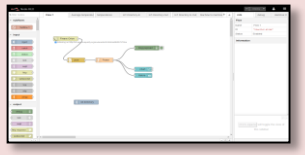
Static, Quasi static and Real Time data flows

Data Processing, Data Analytics Tools

ETL Processes, Data Analytic, R; IOT App; etc.



ETL Processes

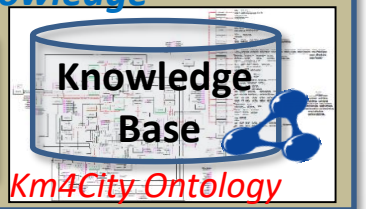


IoT/IoE Applications

Elastic Management of Containers

Big Data Storage Knowledge

Phoenix, Hbase + indexing



Km4City Ontology

Smart City Cloud Infrastructure

Smart City API

Final Users' Tools

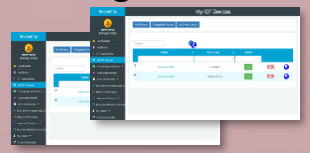
Dashboards

IOT / IOE Apps

Mobile and Web Apps

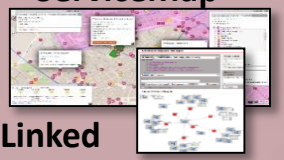
Living Lab, Development and Management Tools

Management



IOT Directory

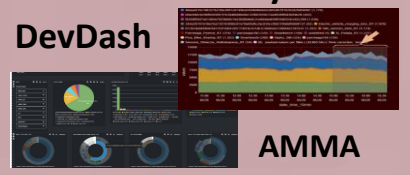
ServiceMap



Linked Open Graph

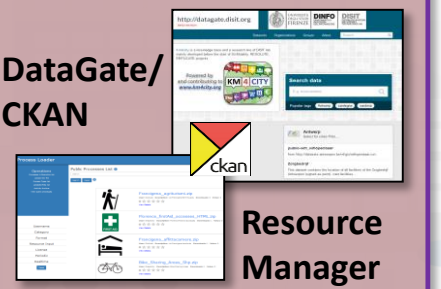
Data Flow Analysis

DevDash



AMMA

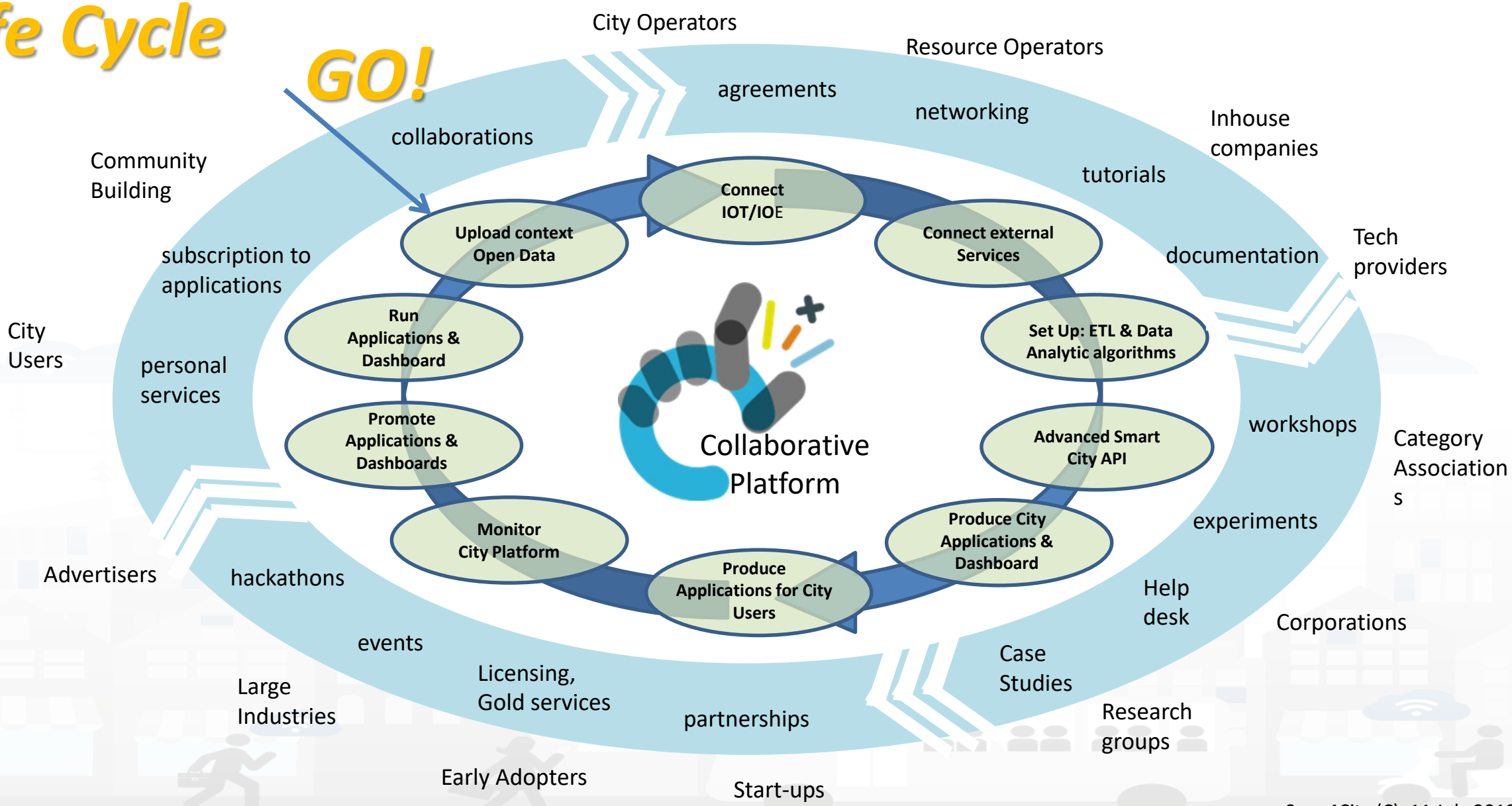
DataGate/ CKAN



Resource Manager

Authentication, Authorization, GDPR, Security Assessment

Life Cycle


GO!
City Operators
Resource Operators
agreements
networking
Inhouse companies
tutorials
collaborations
Community Building
Connect IOT/IOE
Upload context Open Data
Connect external Services
documentation
Tech providers
subscription to applications
City Users
Run Applications & Dashboard
Set Up: ETL & Data Analytic algorithms
personal services
Promote Applications & Dashboards
Collaborative Platform
Advanced Smart City API
workshops
Category Associations
Monitor City Platform
Produce City Applications & Dashboard
experiments
Advertisers
hackathons
Produce Applications for City Users
Help desk
Corporations
events
Case Studies
Licensing, Gold services
Large Industries
partnerships
Research groups
Early Adopters
Start-ups

Snap4City

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

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

Your Level

All Tools

Snap4City

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

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

Welcome: how to start using Snap4City for beginners

Personalized Suggestions

Snap4City developers suggest you reading:

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

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

See this test case to experiment some of the above possibilities:

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

Exercises

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

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

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

SLIDES

NEWS

News

Flyer

VIDEOS

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

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

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

Username: adifino

Powered by www.km4city.org

Full Search

Search

Search

Organization Groups

DISIT

- Operativo

Your Org

Recent comments

- 1 month 6 days ago

Recent content

Last Art.

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

Benvenuto al nostro Sindaco ed al suo Team new roottooladmin1

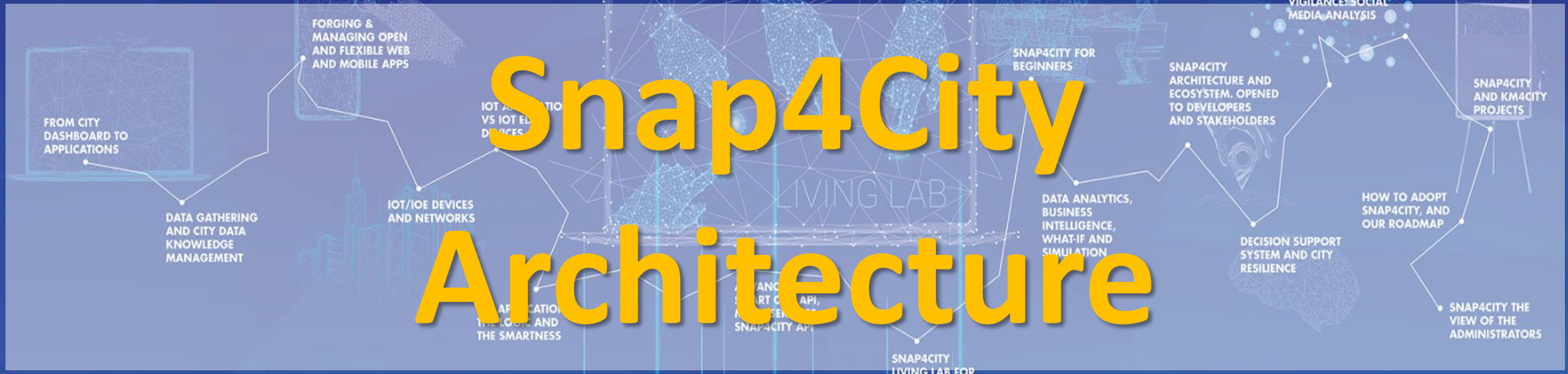
We sugges to Antwerp Developers: How to manange my Dashboards

Documentation on Https://www.snap4city.org

- **We suggest you to start:**
  - HOW TO: create a Dashboard in Snap4City
  - HOW TO: add a device to the Snap4City Platform
  - HOW TO: add data sources to the Snap4City Platform
  - HOW TO: define privacy rules for personal data, produced by the end-users own device
- **Plus, more than**
  - 150 Test Cases for training, with training sources for IOT Applications, ETL, Data Analytics on the Resource Manager
  - 40 Video of training
  - 30 articles
- **A course in Italiano: https://www.snap4city.org/drupal/node/485**
- **Please follow the personalized suggestions** Snap4City proposes you!

TOP

Snap4City Architecture



ARC
INDEX

DISIT lab roadmap vs model and tools' usage

2013 Km4City Ontology 1.1

- Tuscany Road Graph
- Mobility
- culture, tourism
- Events
- Parking
- Services
- Linked open graph

2014

- Weather Forecast
- Real Time Wi-Fi
- Entertainment
- Events
- LOD

Km4City 1.4

- Twitter Vigilance
- Social Media Analytics, Sentiment Analysis

2015

resolute (2015-18) H2020

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

Km4City 1.5

2016

Sii-Mobility (2016-19) MIUR

SII-MOBILITY SCN

- Infomobility
- Mobile App
- Routing
- Multimodality

Km4City 1.6.2

- Smart Energy
- Sustainable Mobility
- Control Room Dashboard

(2016-21) H2020 REPLICATE

Km4City 1.6.4

Sii-Mobility

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

2017

life weee (2017-20)

- Smart Waste

GREEN IMPACT
POR FESR 2014-2020

- Industry 4.0
- Critical Plant
- Monitoring

(2016-19) MIUR

GHOST SIR

- Sardinia Region Smart City Strategies and plan

Sii-Mobility

- User engagement
- Bike Sharing
- Data Analytics ++
- Social Predictions

2018

SNAP4CITY

SELECT for Cities H2020 (2017-19)

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

Km4City 1.6.6 IOT/IOE

MOSAiC Mobility 4.0 for SmArt (i) City (2018-20)

- Mobility Demand / Offer Analytics and Strategy

POR CreO · Regione Toscana

5G (2018-21)

5G tech
Energy
Industry 4.0

2019

TRAFAIR CEF (2018-21)

- Traffic and Mobility Impact on Pollution

…2021

SNAP4CITY

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

Projects

SELECT for Cities · Sii-Mobility · REPLICATE · resolute · GHOST · TRAFAIR · 5G · MOSAiC · life weee · smartGARDAlake

Green Impact

Co-founding institutions on projects

EUROPEAN COMMISSION · MIUR MINISTERO DELL'ISTRUZIONE, DELL'UNIVERSITÀ E DELLA RICERCA · POR CreO 2014 2020 REGIONE TOSCANA · UNIONE EUROPEA · REPUBBLICA ITALIANA · Regione Toscana

Qualified Partners

COMUNE DI FIRENZE · CITTÀ METROPOLITANA DI FIRENZE · comune di PRATO · REGIONE AUTÒNOMA DE SARDIGNA REGIONE AUTONOMA DELLA SARDEGNA · CITTA' METROPOLITANA DI CAGLIARI · COMUNE DI CAGLIARI · Comune di Castelnuovo del Garda

Technical Partnerships

Node-RED · JS Foundation · Powered by FIWARE · sigfox partner network · ckan · GJL · LABGEO · esri Italia THE SCIENCE OF WHERE

SNAP4CITY

100% OPEN SOURCE URBAN PLATFORM: SMART CITY AND LIVING LAB

- LOCAL GOVERN
- STAKEHOLDERS
- CITY USERS
- IN-HOUSE
- ENERGY OPERATORS
- MOBILITY OPERATORS
- COMMERCIAL OPERATORS
- SECURITY OPERATORS
- INDUSTRIES
- RESEARCHERS
- START-UPS
- ASSOCIATIONS

- GDPR
- SECURITY
- PRIVACY
- ASSESSMENT
- AUDITING

- OPEN HW/SW
- IOT EDGE
- IOT BUTTONS
- IOT DEVICES

IOT APPLICATIONS • INSTANT APPS

PERSONAL DATA • DATA DRIVEN • REAL TIME - ANY PROTOCOL & FORMAT

DASHBOARDS & APPLICATIONS

CONTROL ROOM • KPI • BUSINESS INTELLIGENCE • DECISION SUPPORT • WHAT-IF ANALYSIS

MOBILE & WEB APPLICATIONS

DEV KIT • SUGGESTIONS • USER ENGAGEMENT • COWORKING • SMART APPLICATIONS

MICROSERVICES & ADVANCED SMART CITY API

LIVING LAB - DEV TOOLS - COWORKING

IOT DIRECTORY • SERVICE MAP • RESOURCE MANAGER • DATA GATE • R STUDIO • ETL

BIG DATA ANALYTICS

SMART SOLUTIONS • PREDICTIONS • ANOMALY DETECTION • TRAFFIC RECONSTRUCTION • ORIGIN-DESTINATION MATRIX • SOCIAL MEDIA ANALYSIS • OFFER & DEMAND ANALYSIS • RISK & RESILIENCE ANALYSIS

SMART MICRO-APPLICATIONS – OPEN TO EXTERNAL SERVICES

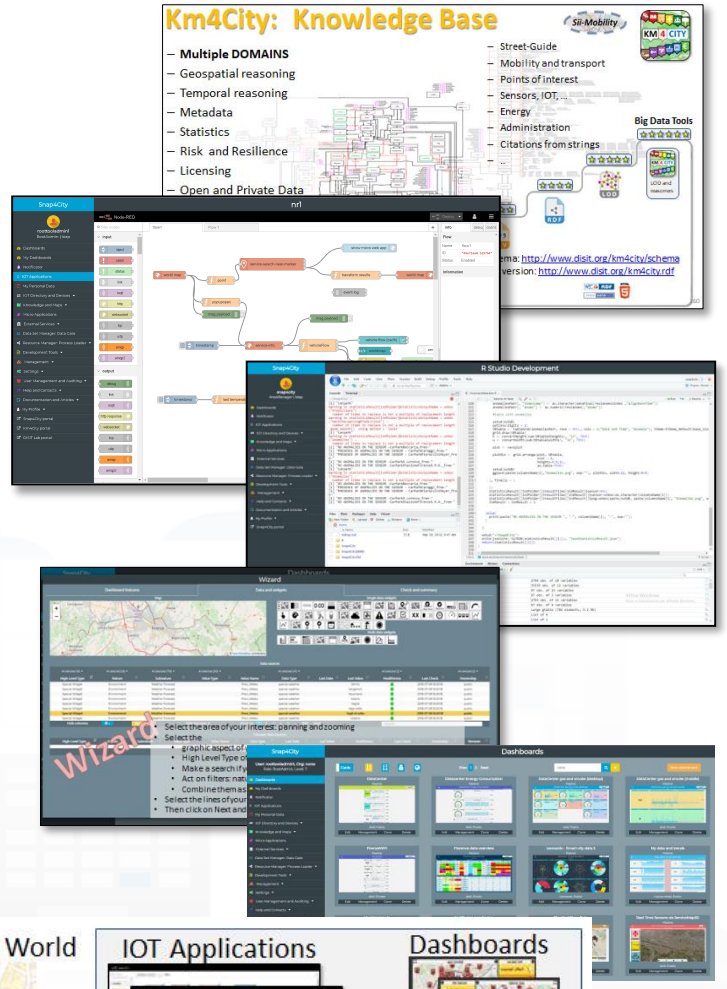
SMART PARKING • ROUTING • PERSONAL ASSISTANT • INFOMOBILITY • ALERTING • INFO TRIAGE

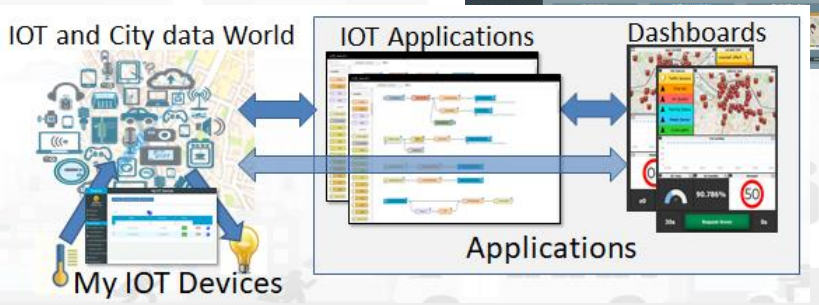
KM4CITY DATA AGGREGATOR, KNOWLEDGE BASE OF THE CITY

OPEN DATA	GIS+MAP DATA	PROPRIETARY DATA	PERSONAL DATA	IOT / IOE	INDUSTRY 4.0	SOCIAL MEDIA

Unique of Snap4City Platform (1)

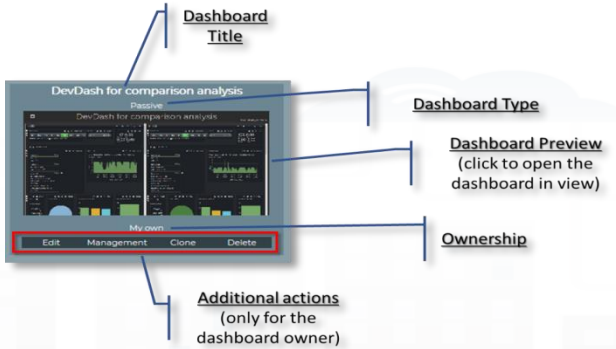
- Data ingestion and model
  - **Unified data model** (exploited in the Wizard and Knowledge base)
  - **Semantic Reasoner** modelling city entities, supporting sematic search, expert system, digital Twin, etc.
  - **IOT Directory abstracting complexity of IOT Devices, Edge, Brokers**, protocols and data formats
- Data Analytics and Data Processes
  - **Flexible and extensible IOT Applications**
  - **Data Analytic:** multiple programming languages,
- Visual Analytics, dashboarding, Apps
  - **Wizard expert system** for immediate dashboard production matching data vs graphics representation
  - **Dashboards specialized** multidomain for Smart Cities
  - **Ready to use Mobile App, instant App, MicroApplication**
  - **Strategies** formalization supports

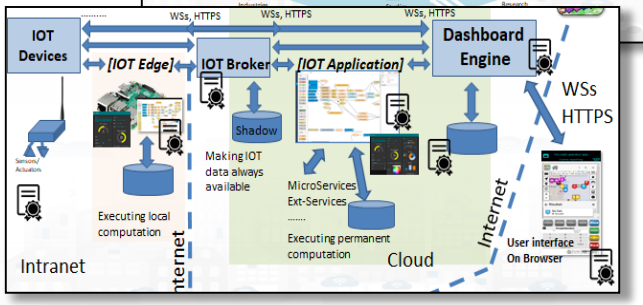


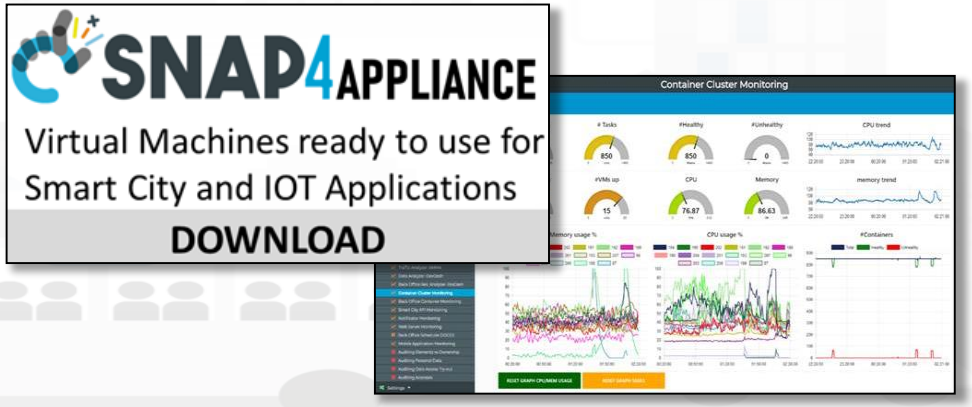


Unique of Snap4City Platform (2)

- Openness to any developers
  - **Living Lab support for coworking, sharing, and delegating**
  - **Advanced Smart City APIs and MicroServices**
  - **100% Open Source, Open hardware**
- Security and Privacy
  - **End-2-end encrypted communication**, on devices, platform, ... dashboards
  - **GDPR compliant** privacy/security
- Non functional
  - **on cloud and on premise,** your private installation
  - **Ready to use Appliance** Virtual Machines and/or Containers for a modules and tools.
  - **Flexible, Modular, Elastic, scalable and robust**







TOP

Schede di alcuni casi

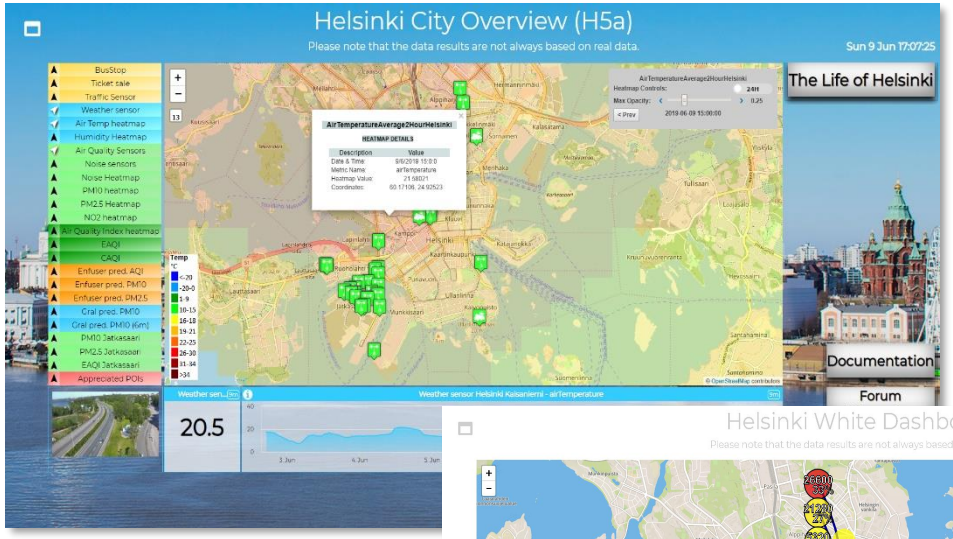
ARC
INDEX

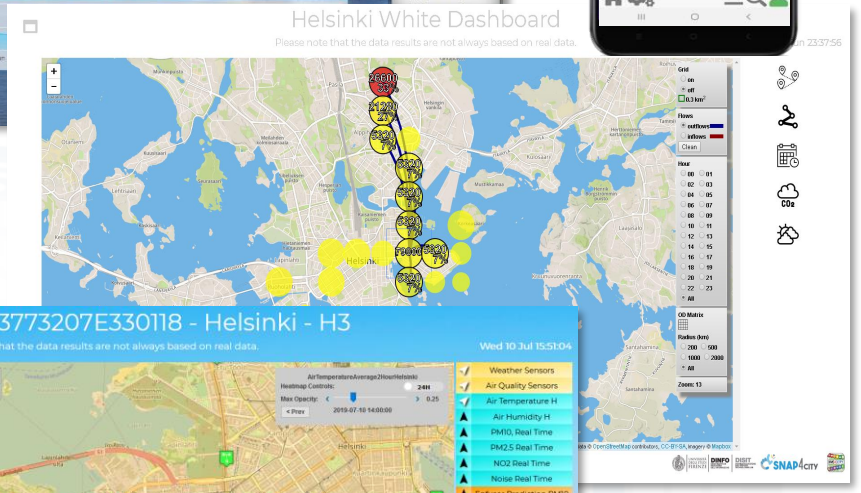
Florence Case

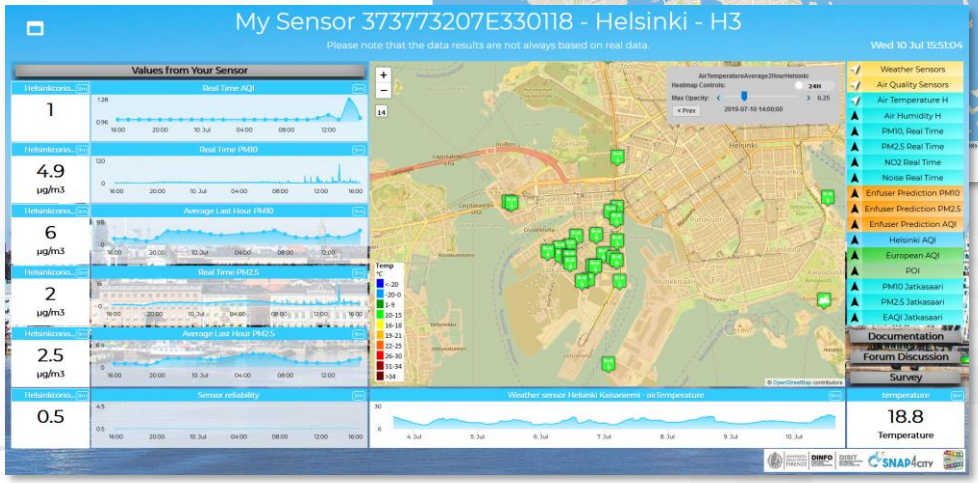
- Smart City Control Room
  - Dashboard del sindaco, Grappolo di Dashboard
- Servizi multipli:
  - KPI amministrativi, traffico, prediction parking, triage,
  - Ambiente, social, mappa, traffico, etc. etc.
  - Flussi entranti ed uscenti di veicoli
  - Qualità del trasporto pubblico a campione
  - Svariati dati in real time, molto privati
  - Analisi in tempo reale dei Tweet, Sentiment Analysis
  - Analisi dati sui flussi delle persone WIFI e APP based, OD matrix
- Plus con Regione Toscana
  - Heatmap qualità dell'aria, notifiche
  - Valutazioni ambientali, predizioni, traffic flow esteso
  - Mobile App, analisi estese sui flussi, OD matrix
  - Visualizzazione previsioni meteo
- Video segment

Helsinki Case

- Dashboard operatore, ambiente
  - Ambiente e meteo, PM10, PM2.5,NO, SO2, CO, etc….noise, etc.
    - Heatmap e allarmi sugli sforamenti
  - Sensori del Traffico
  - Twitter Vigilance, early warning
  - Predizioni FMI, predizioni GRAL, confronto e validazioni
  - Sensori di privati in Jatkasaari area (special dashboard per loro)
  - Life in Helsinki: OD matrix, Twitter Vigilance SA
- Dashboard per utenti con sensori personali
- App per city users, turisti







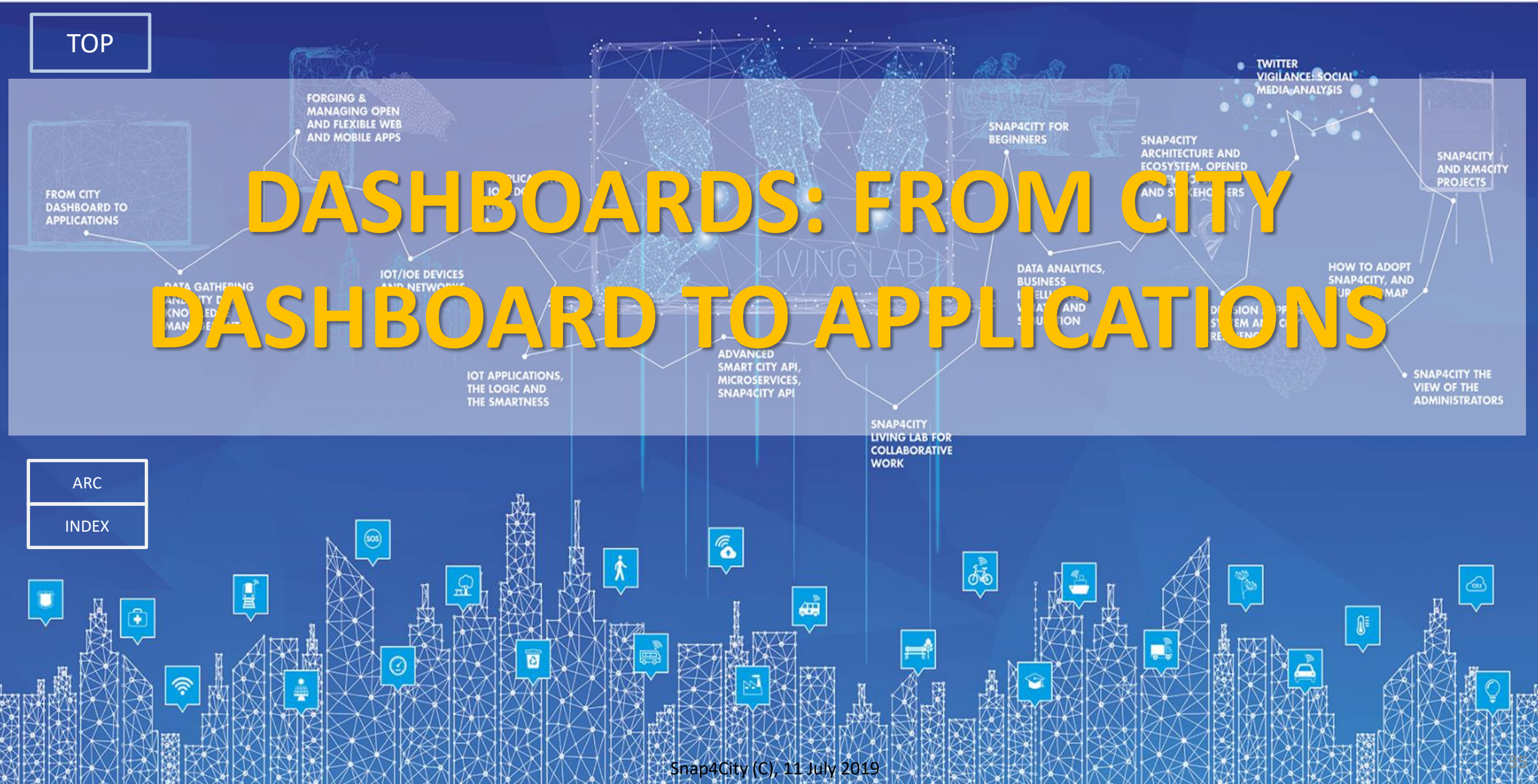
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTQwNg==

Antwerp Case

- Dashboard operatore, ambiente
  - Ambiente e meteo, PM10, PM2.5, etc….noise, etc.
    - Heatmap e allarmi sugli sforamenti
  - Life in Antwerp: OD matrix
  - Twitter Vigilance: early warning
  - PAX Counter in musei e servizi pubblici
  - Monitoraggio stato degli attraversamenti del fiume
- App per city users, turisti

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

TOP



DASHBOARDS: FROM CITY DASHBOARD TO APPLICATIONS

ARC
INDEX

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https://www.snap4City.org

Public Dashboards for your perusal

Snap4City

LOGIN

- Dashboards (Public)
- Knowledge and Maps
- Micro Applications
- External Services
- Data Set Manager: Data Gate
- Resource Manager
- Development Tools
- Management
- Help and Contacts
- Documentation and Articles
- Km4City portal
- DISIT Lab portal

Dashboards (Public by (ORG))

Prev 1 ... 12 13 14 15 16 ... 20 Next

Filter by dashboard title

ServiceMap for data comparison
Passive

Public (DISIT)

Servizi agli utenti
Passive

Public (DISIT)

Smart City Control Room Console
Passive

Public (DISIT)

Smart City Control Room Console - new
Passive

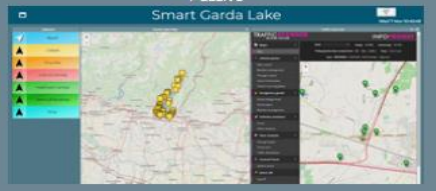
Public (DISIT)

Smart City Data Overview
Passive

Public (DISIT)

Smart City Data Overview 2
Passive

Public (DISIT)

Smart Garda Lake
Passive


Public (DISIT)

SmartCity processes
Passive

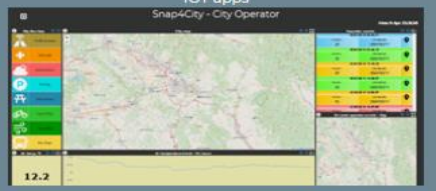
Public (DISIT)

Snap4City - App dashboard
IOT apps

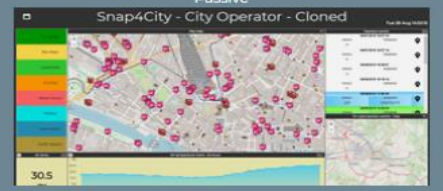
Public (DISIT)

Snap4City - Buttons with images
Passive

Public (DISIT)

Snap4City - City Operator
IOT apps


Public (DISIT)

Snap4City - City Operator - Cloned
Passive


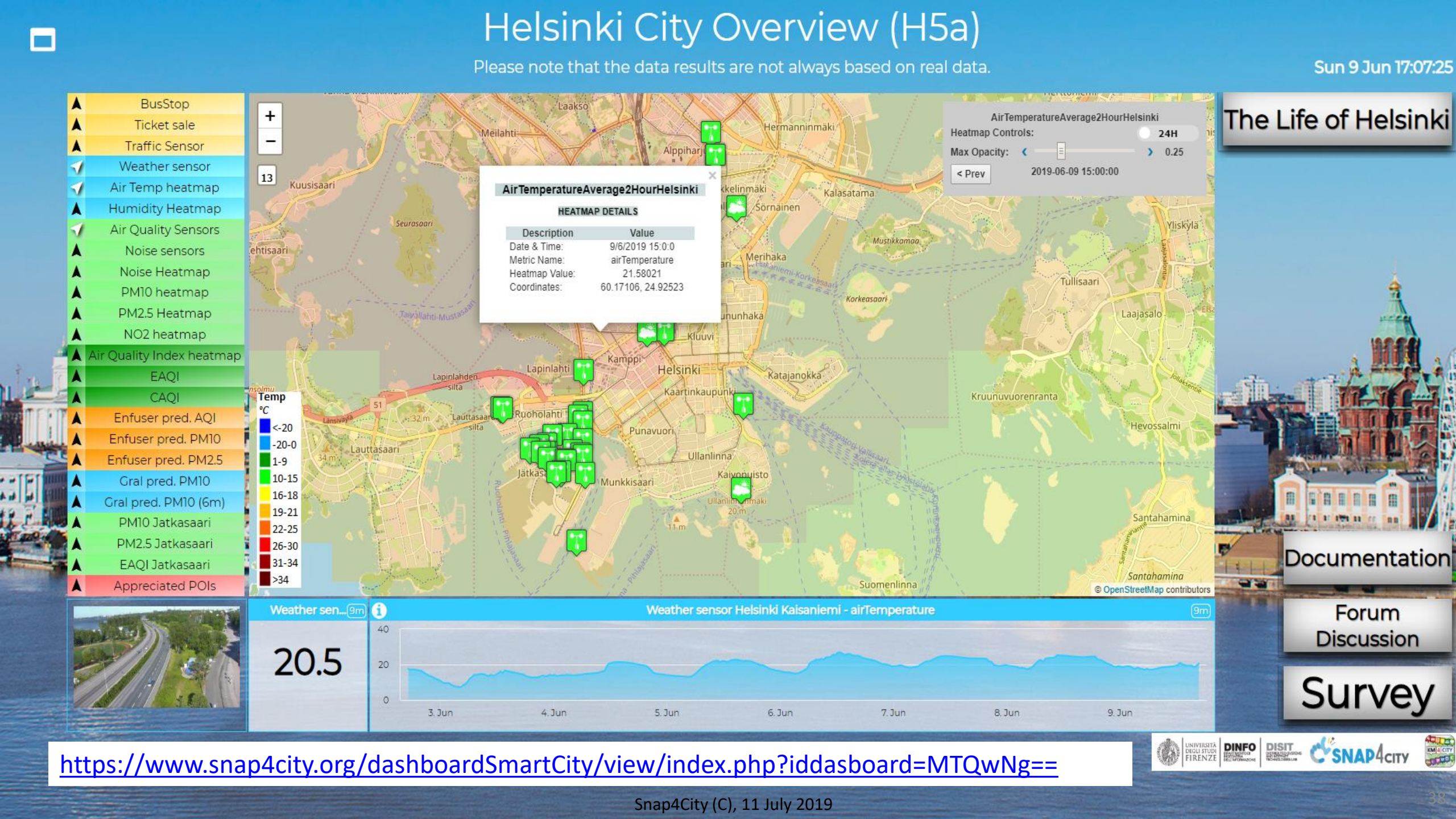
Public (DISIT)

MAPPA FIRENZE
Fri 19 Oct 17:24:39
Colonnine Ricarica
Colonnine ricarica Fast
Pannelli a Messaggio Variabile
Parcheggi
Piste Ciclabili
Sensori del Traffico
Stazioni ambientali
Stazioni meteo
Traffico Real Time
Varchi ZTL
Wi-Fi
Concentration - 7 days
Main

Helsinki City Overview (H5a)

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

Sun 9 Jun 17:07:25

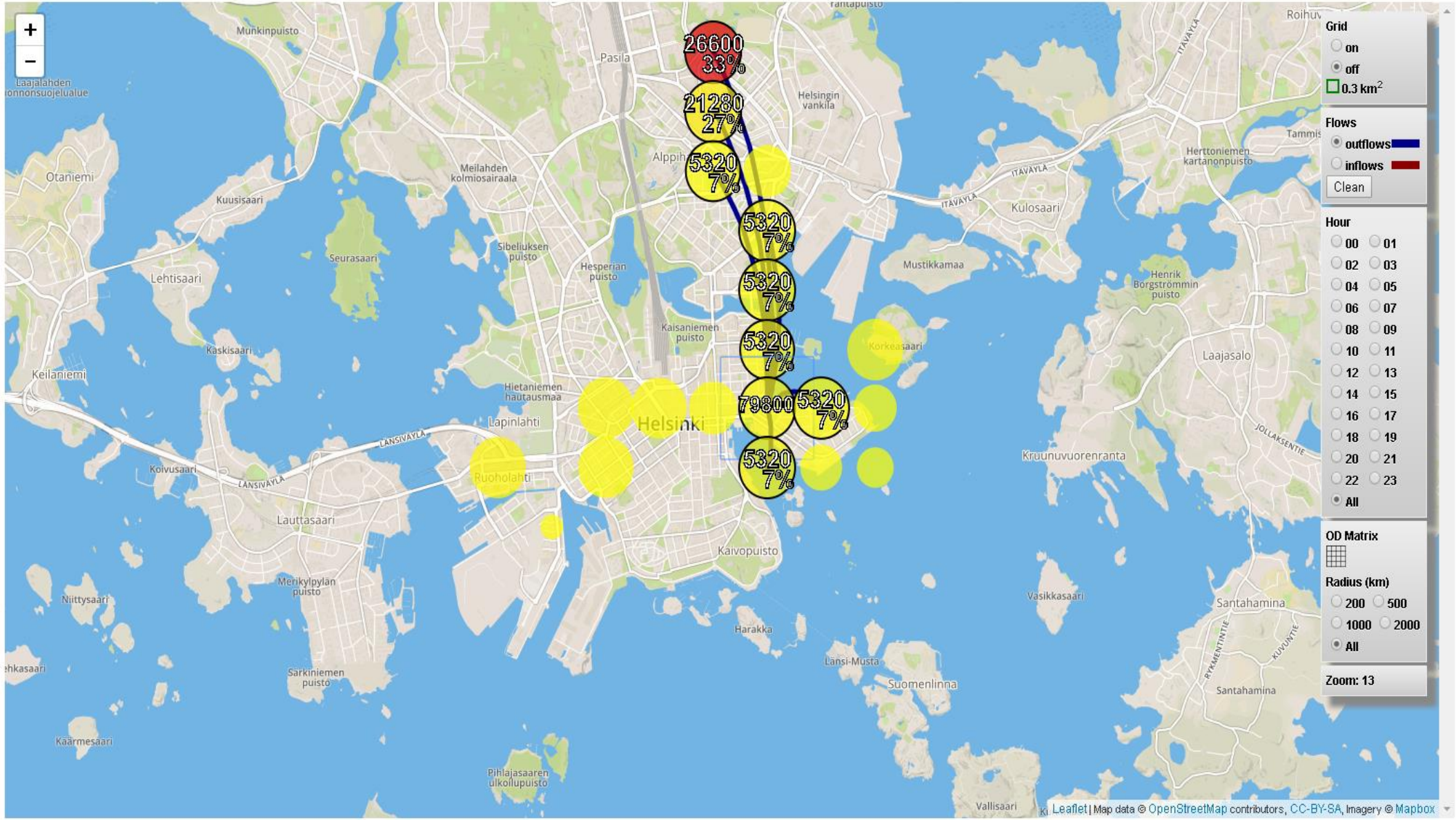


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTQwNg==

Helsinki White Dashboard

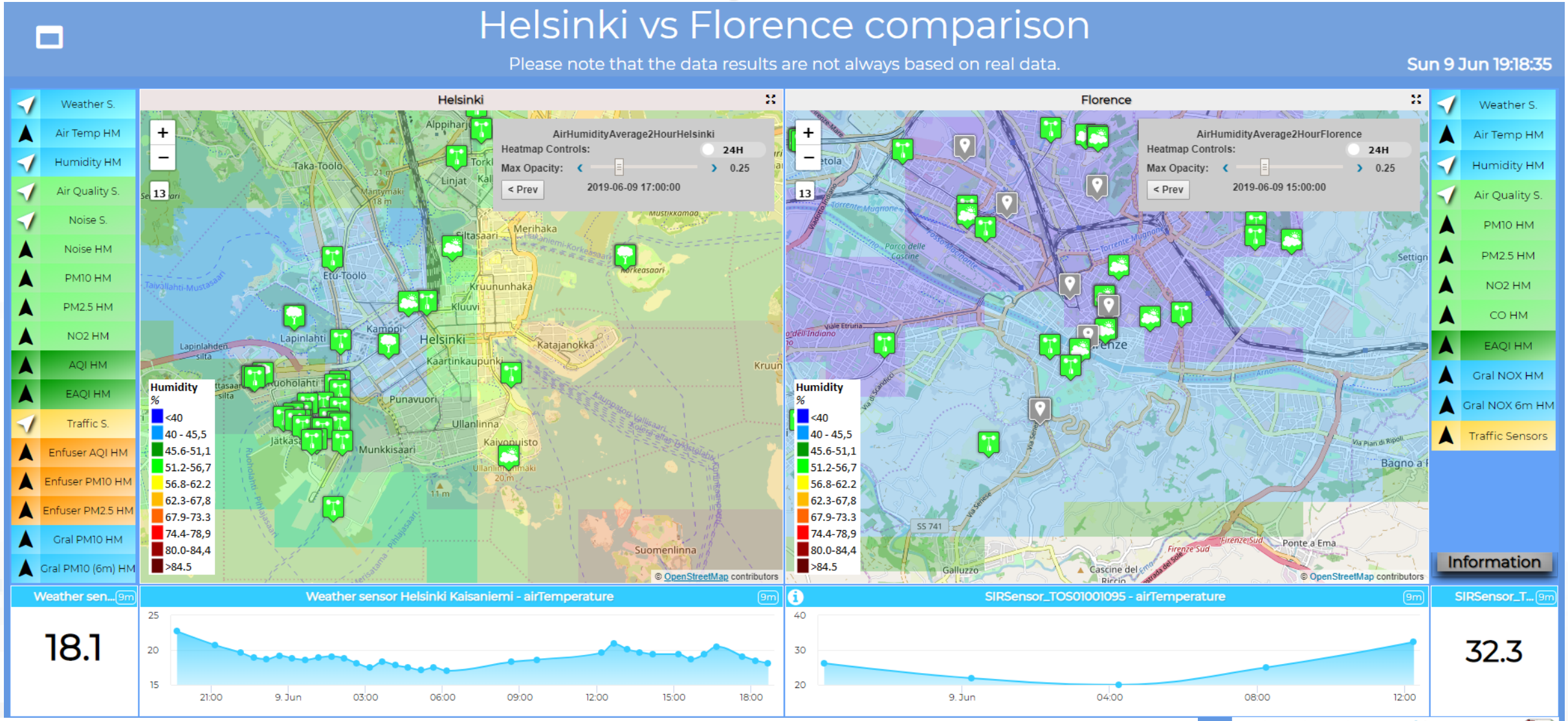
Please note that the data results are not always based on real data.

Thu 13 Jun 23:37:56



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

Helsinki vs Florence comparison



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

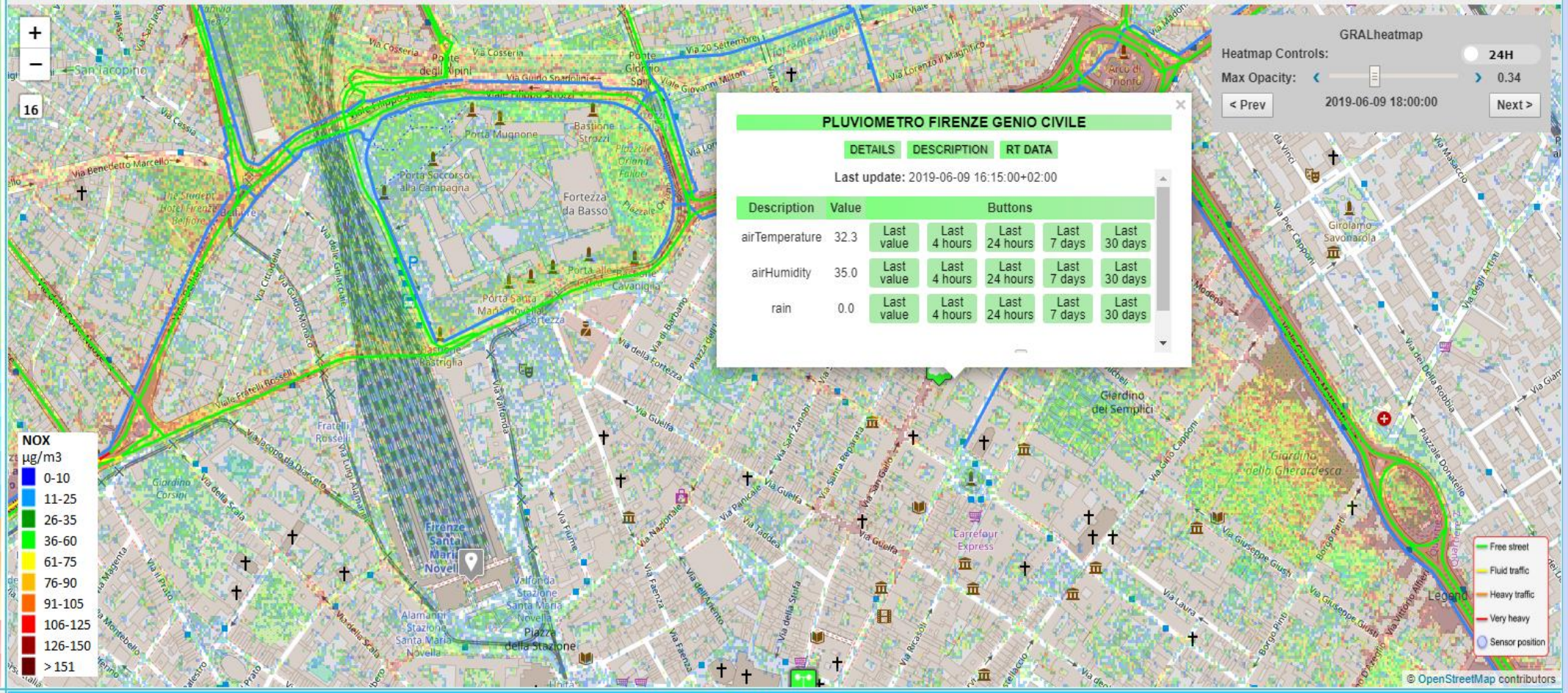
Firenze - Trafair - AirQuality Heatmaps

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

Sun 9 Jun 18:53:01

- Air Quality Sensors
- Weather 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

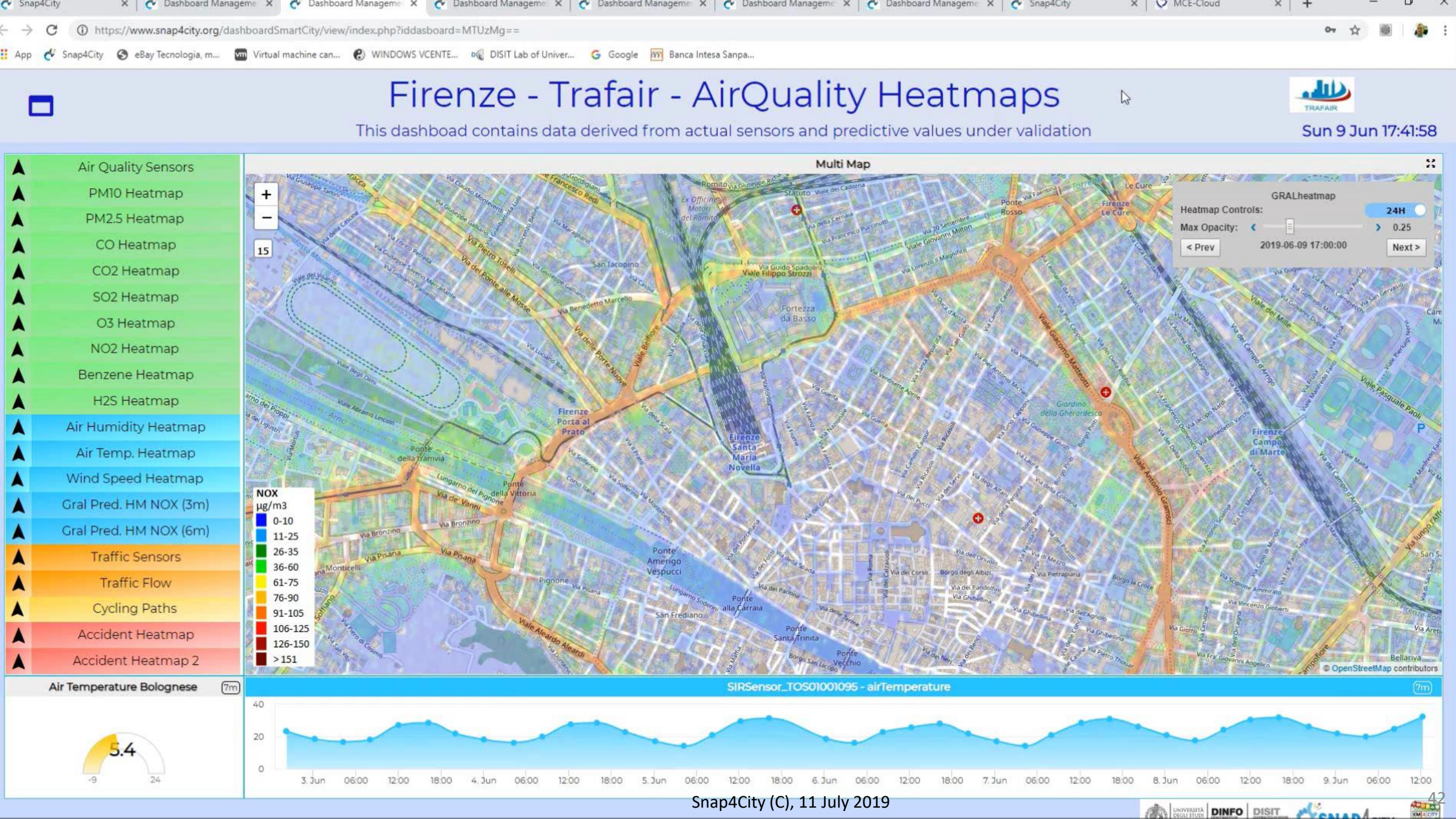
Multi Map



Air Temperature Bolognese 8m

SIRSensor_TOS01001095 - airTemperature 8m

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


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
SIRSensor_TOS01001095 - airTemperature
7m
40
20
0
3. Jun
4. Jun
5. Jun
6. Jun
7. Jun
8. Jun
9. Jun

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

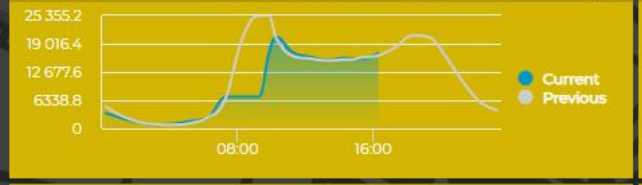
DISIT

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.

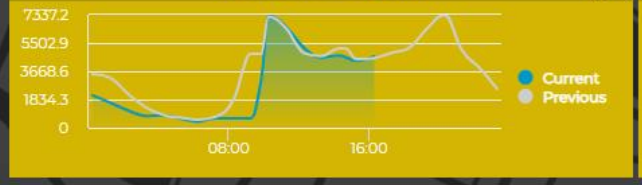
FLUSSI INGRESSO CITTA 9m



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

REPLICATE

We expect you at Stand 120, Hall P2 , Level 0, Street A
Smart City Expo World Congress 2018
13-15 Novembre 2018, Barcelona, Gran Via Venue

SMARTCITY EXPO WORLD CONGRESS

http://www.darionardella.it/il-sindaco-dario-nardella-in-missione-a-madrid-e-barcellona/

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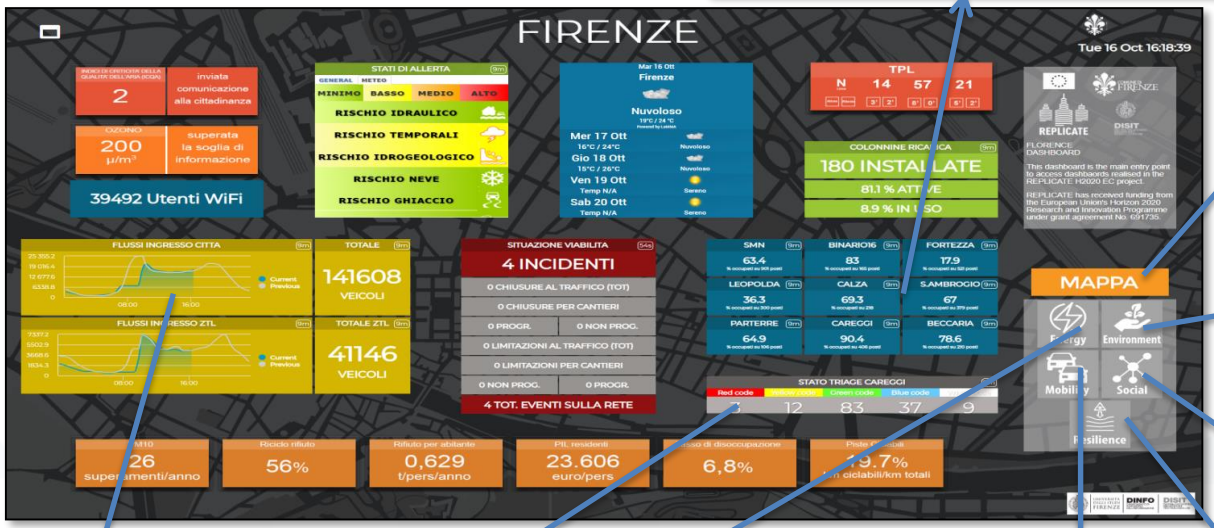
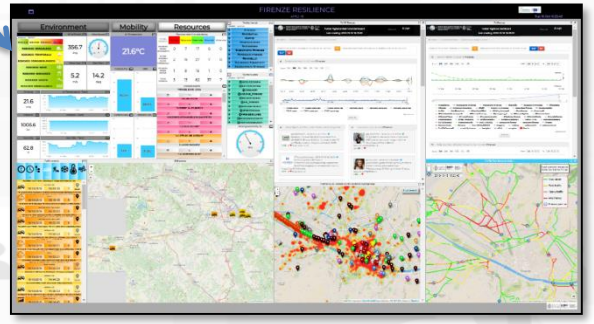
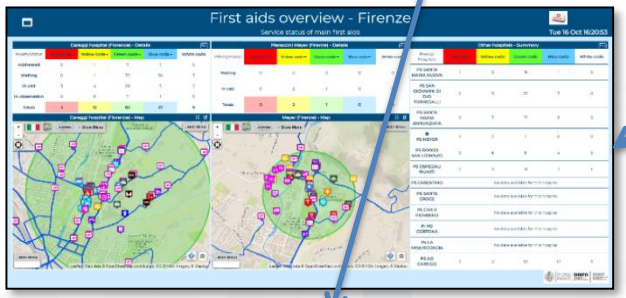
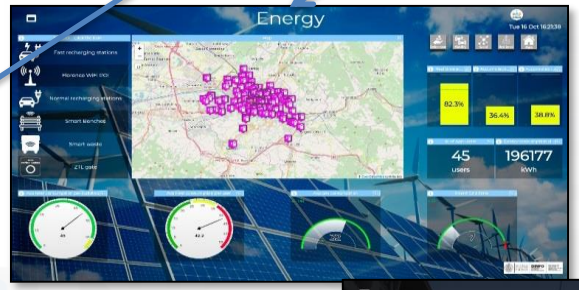
REPLICATE

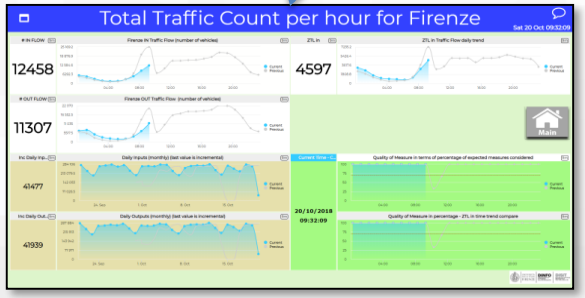
KM4CITY





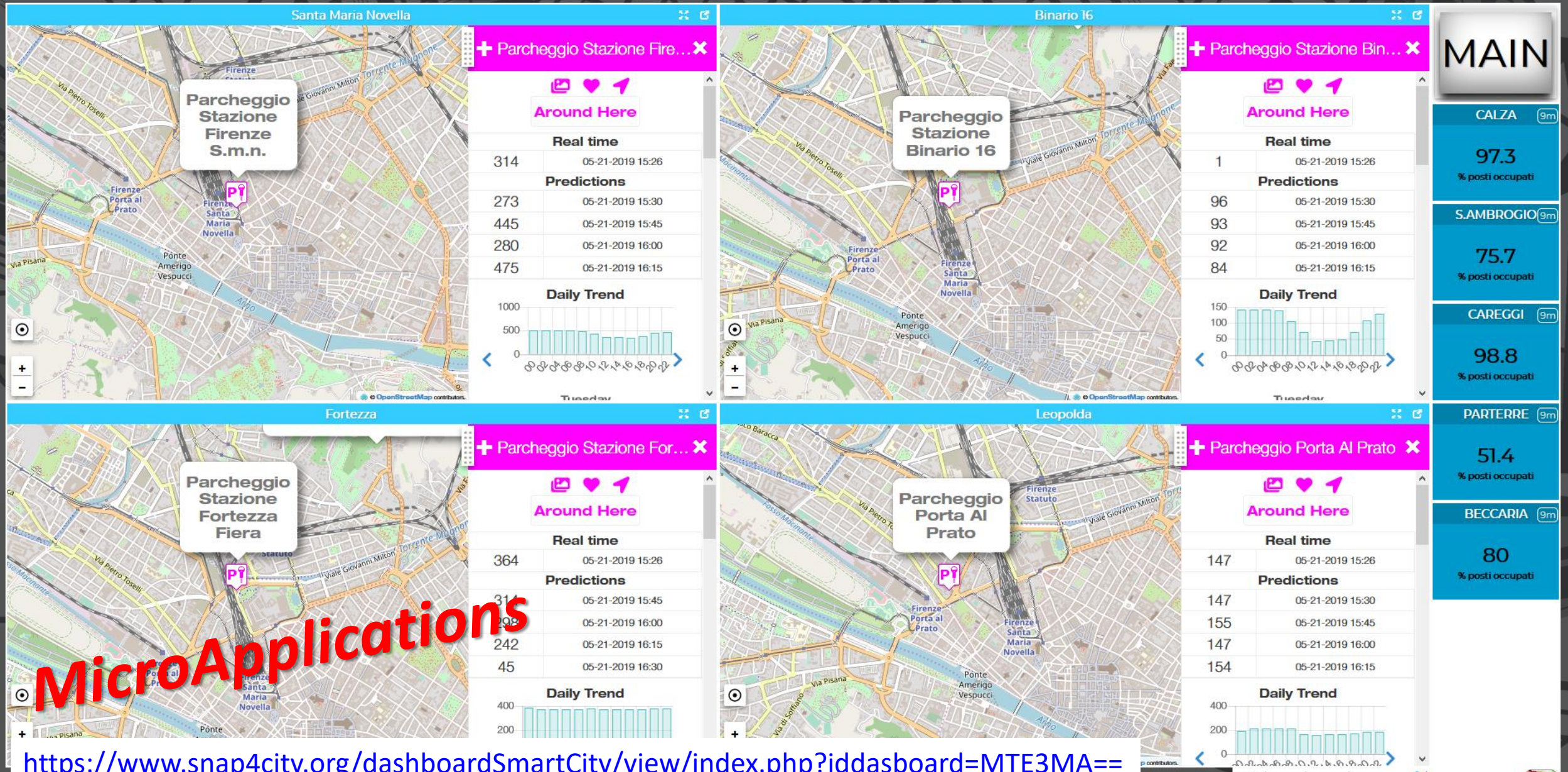






Parking Monitoring Firenze

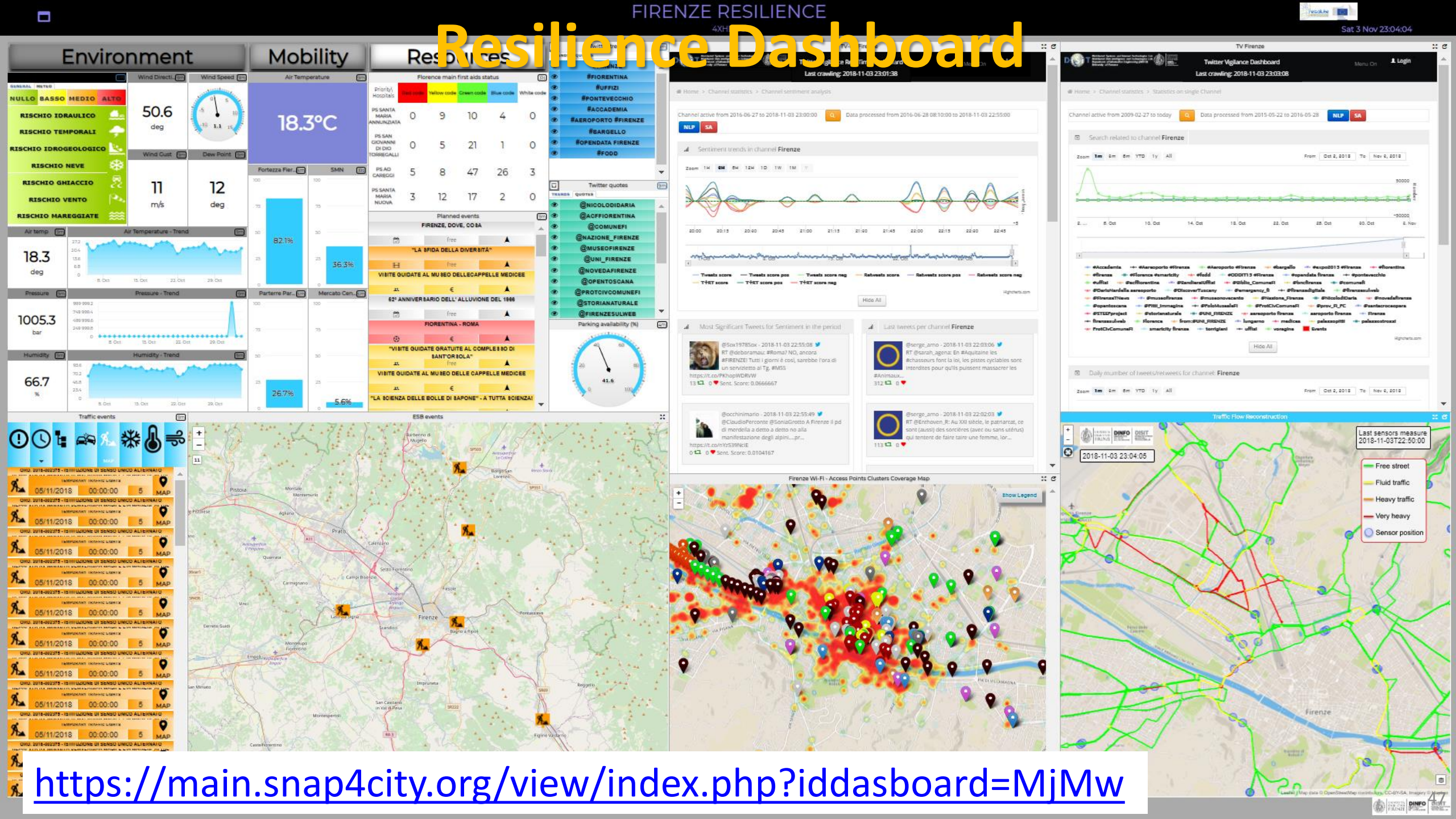
Tue 21 May 15:23:09



MicroApplications

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

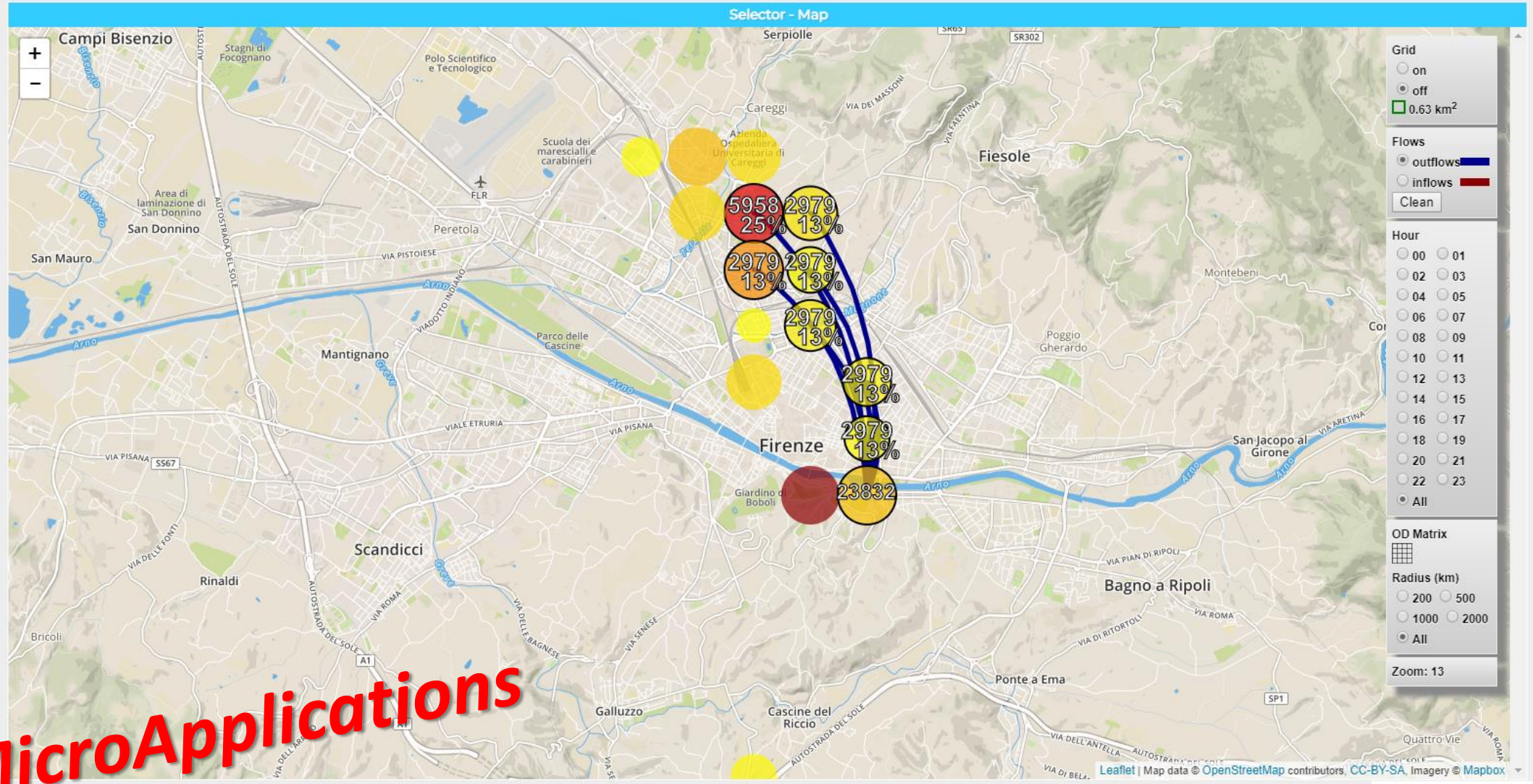
Resilience Dashboard



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

Life in Toscana: Dashboard

Mon 24 Jun 09:19:20



Line of Transport
Public Transport
Travel Plan
Air Quality
Weather
Origin Dest. Matrix
Typical Trajectories
Cultural Activities
Forum Discussion

MicroApplications

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

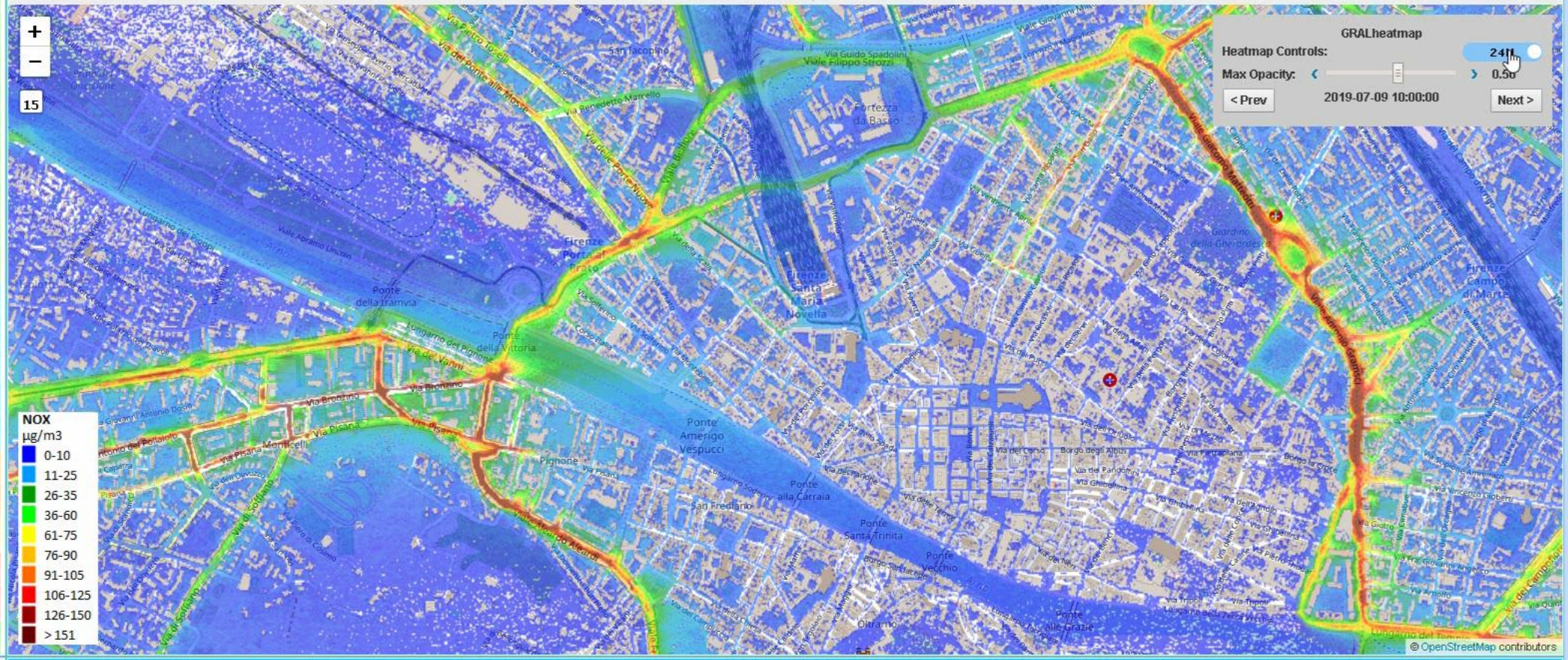
Firenze - Trafair - AirQuality Heatmaps

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

Tue 9 Jul 10:27:47

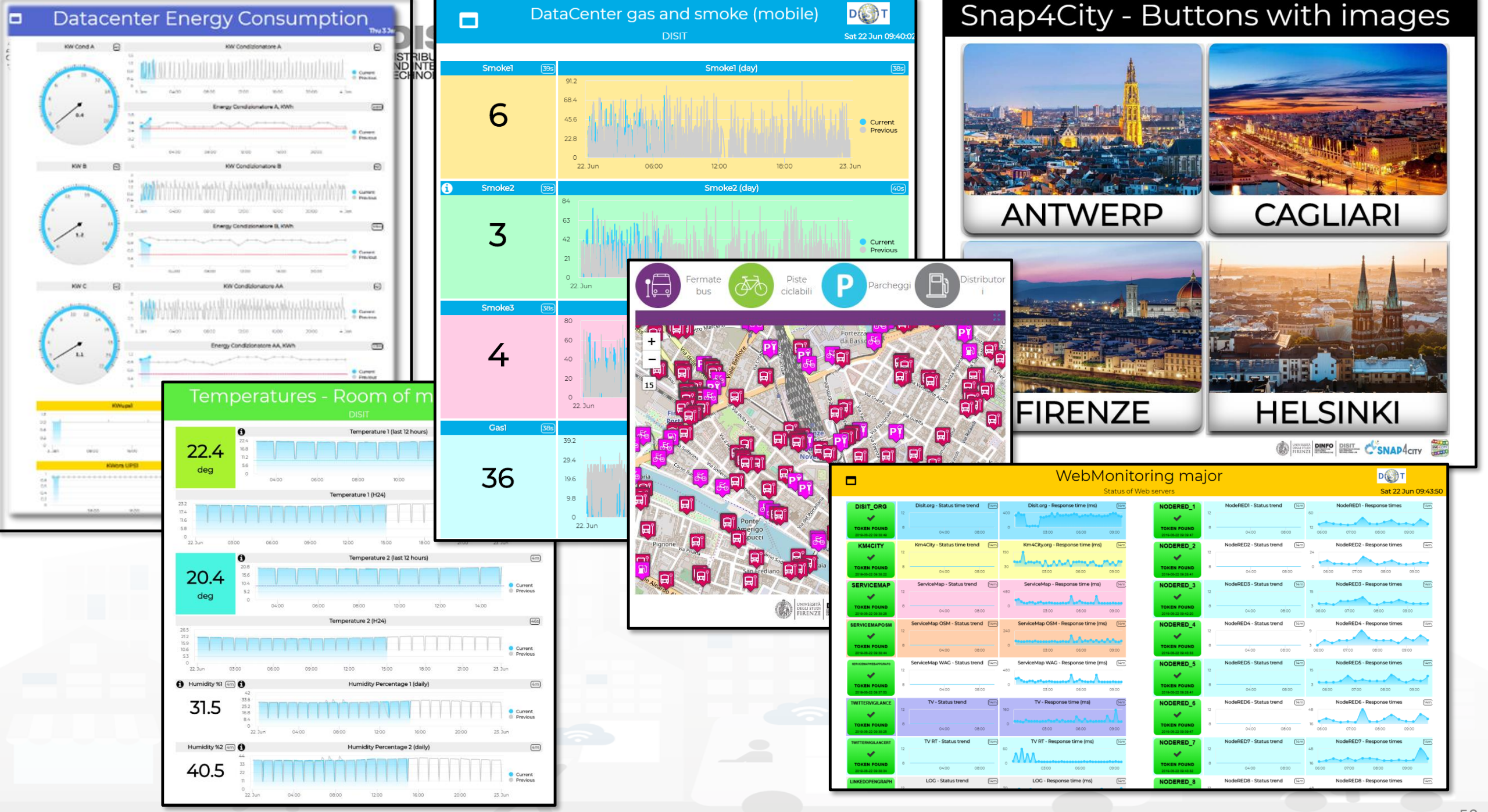
- Air Quality Sensors
- Weather Sensors
- PM10 Heatmap
- PM2.5 Heatmap
- CO Heatmap
- CO2 Heatmap
- O3 Heatmap
- NO2 Heatmap
- Europ. AQI Heatmap
- Air Humidity Heatmap
- Air Temp. Heatmap
- Wind Speed Heatmap
- Gral Pred. HM NOX (3m)
- Gral Pred. HM NOX (6m)
- Traffic Sensors
- Traffic Flow
- Cycling Paths
- Accident Heatmap
- Accident Heatmap 2
- Only HRes Anym. Gral

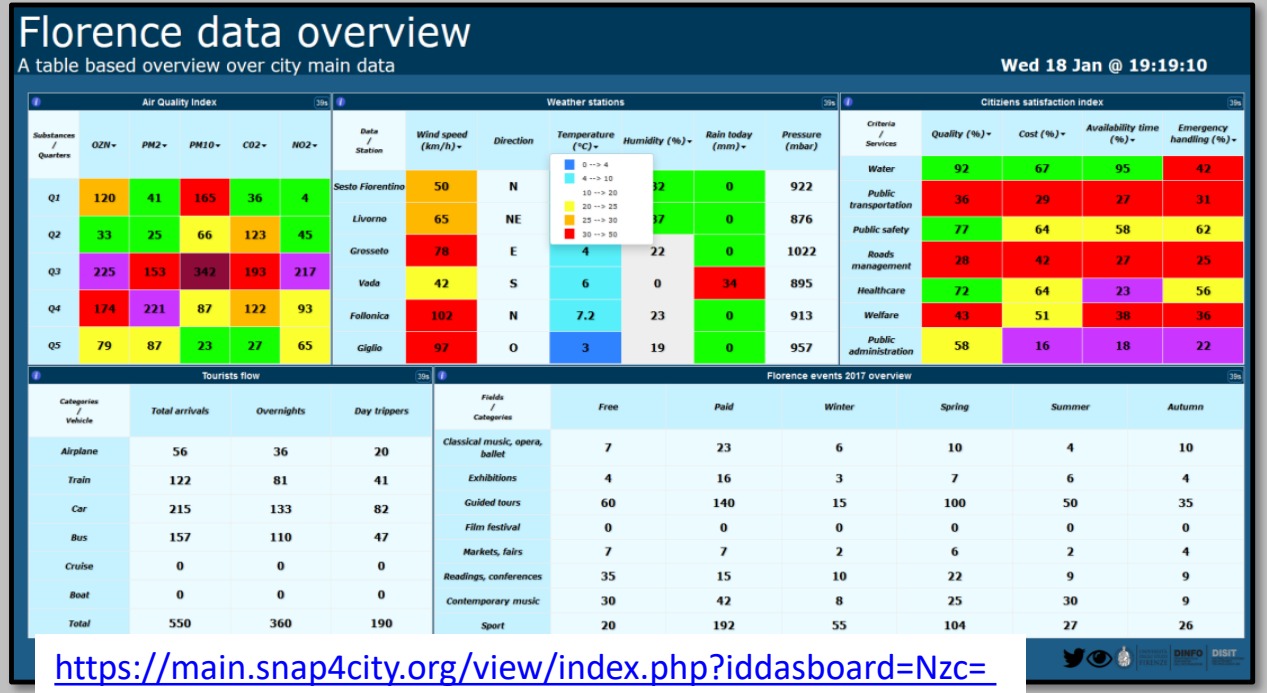
Multi Map



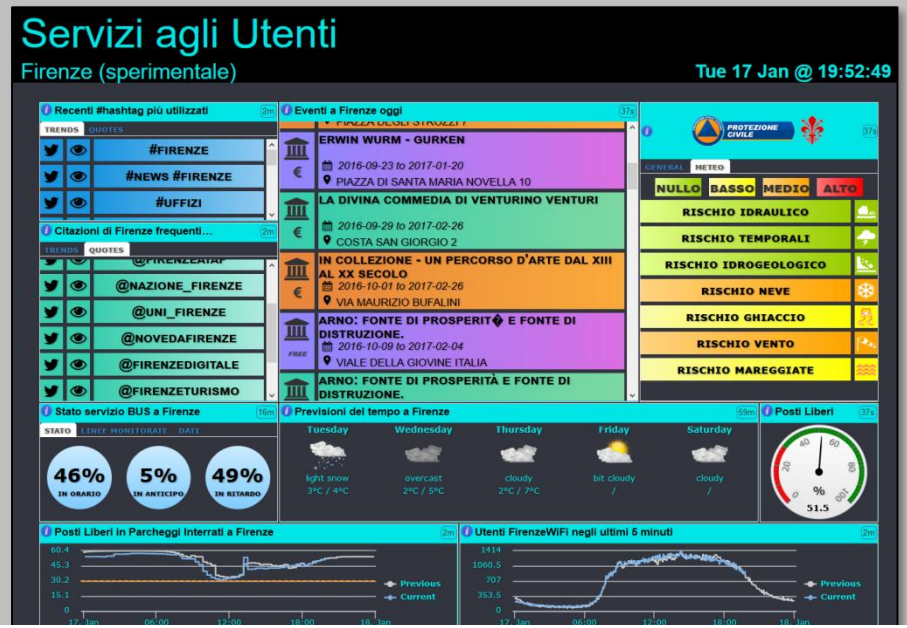
Air Temperature Bolognese 8m

SIRSensor_TOS01001095 - airTemperature 8m

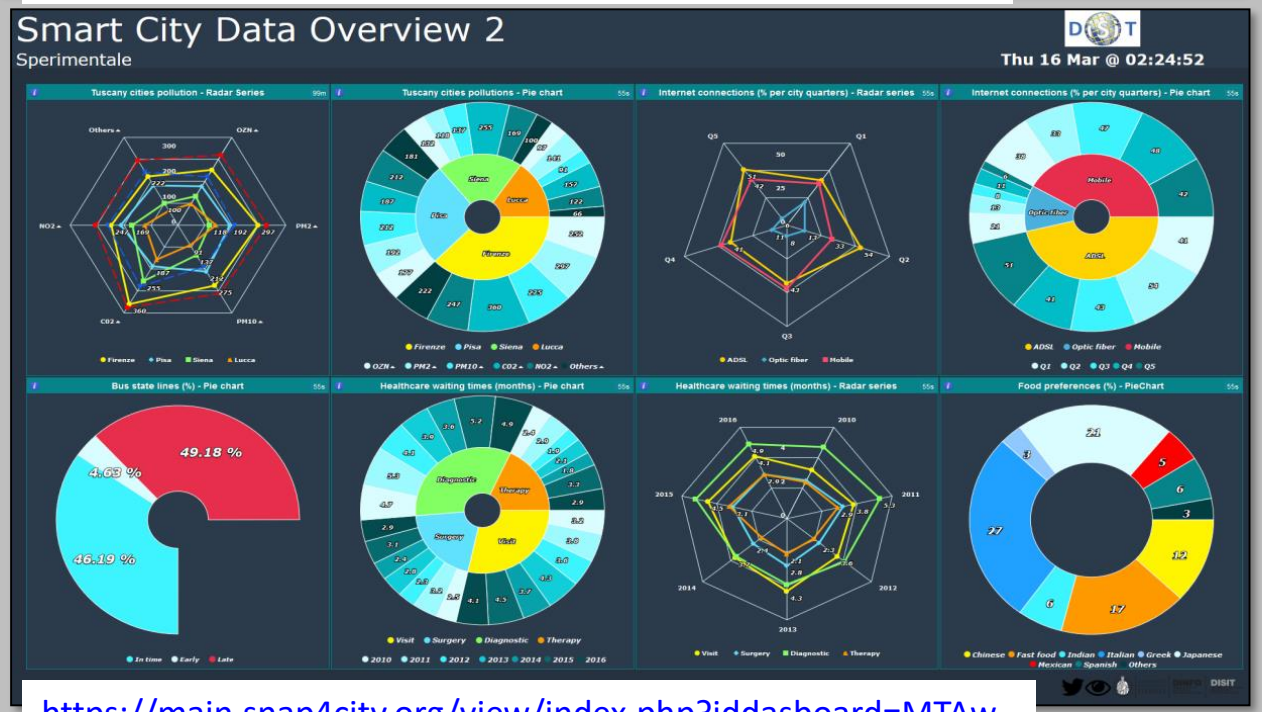

Datacenter Energy Consumption
DataCenter gas and smoke (mobile)
DISIT
Sat 22 Jun 09:40:02
Smoke1
6
Smoke1 (day)
Smoke2
3
Smoke2 (day)
Smoke3
4
Gas1
36
Current
Previous
Snap4City - Buttons with images
ANTWERP
CAGLIARI
FIRENZE
HELSINKI
Fermate bus
Piste ciclabili
Parcheggi
Distributori
Temperatures - Room of m
DISIT
22.4
deg
Temperature 1 (last 12 hours)
Temperature 1 (H24)
20.4
deg
Temperature 2 (last 12 hours)
Temperature 2 (H24)
Humidity %1
31.5
Humidity Percentage 1 (daily)
Humidity %2
40.5
Humidity Percentage 2 (daily)
WebMonitoring major
Status of Web servers
Sat 22 Jun 09:43:50
DISIT_ORG
KM4CITY
SERVICEMAP
SERVICEMAPOSM
TWITTERVIGILANCE
TWITTERVIGILANCERT
LINKEDOPENGRAPH
NODERED_1
NODERED_2
NODERED_3
NODERED_4
NODERED_5
NODERED_6
NODERED_7
NODERED_8
TOKEN FOUND



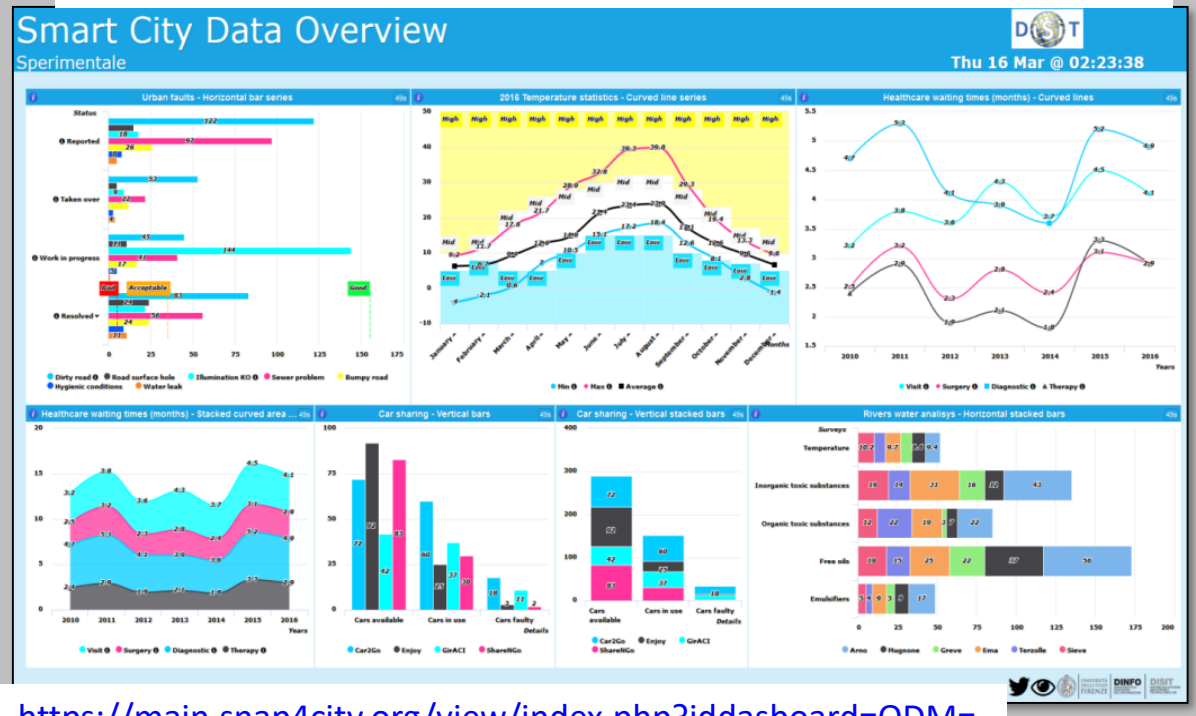
https://main.snap4city.org/view/index.php?iddasboard=Nzc=



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



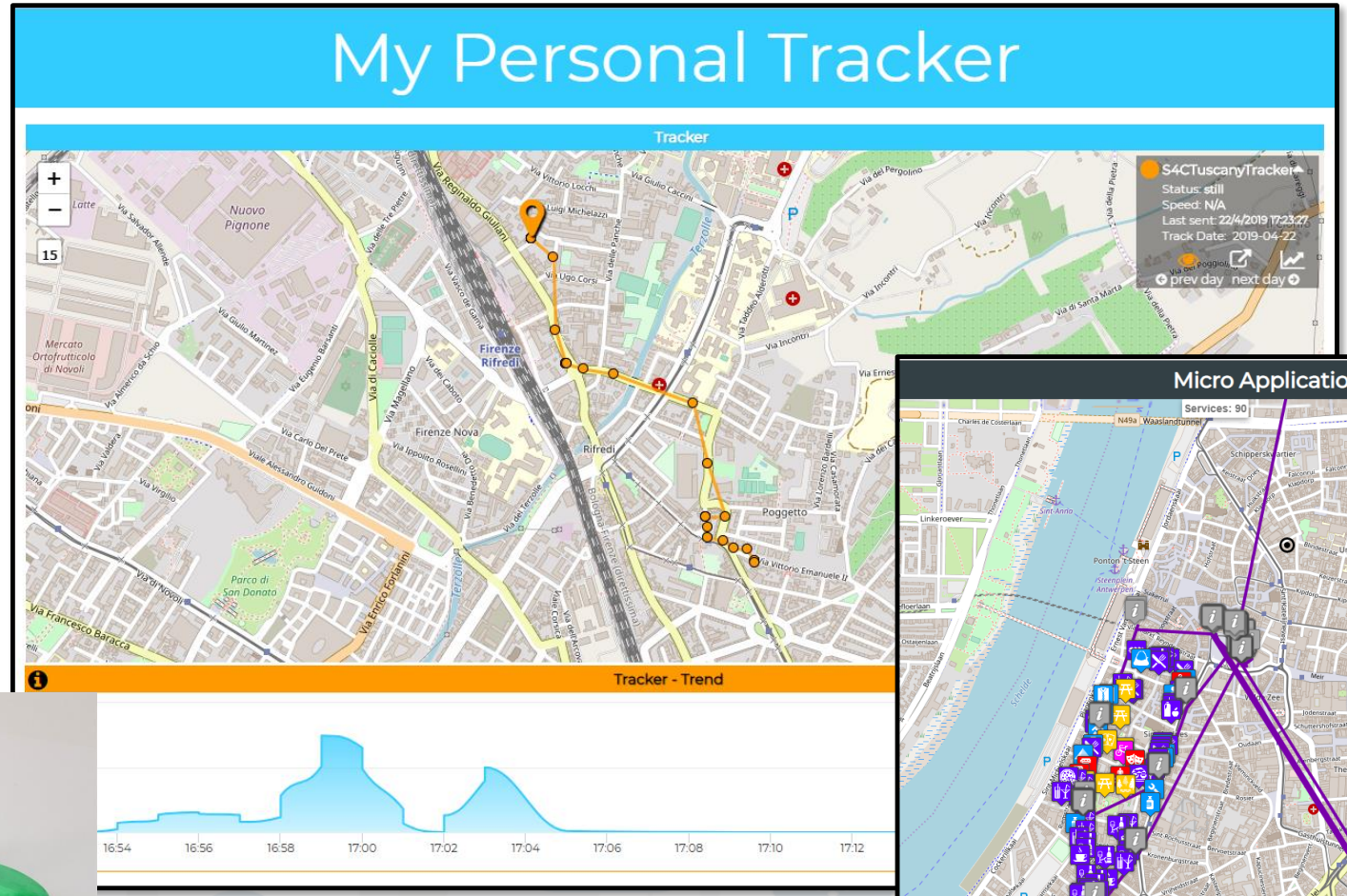
https://main.snap4city.org/view/index.php?iddasboard=MTAw

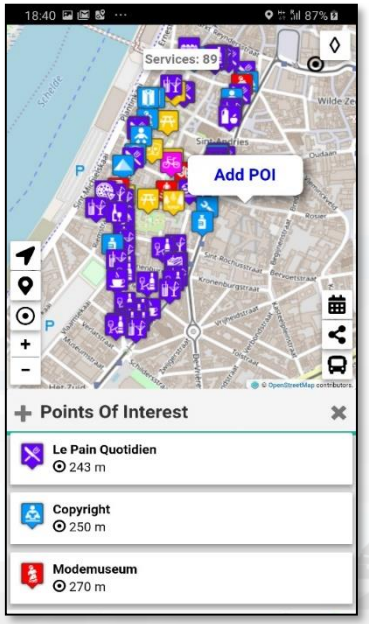


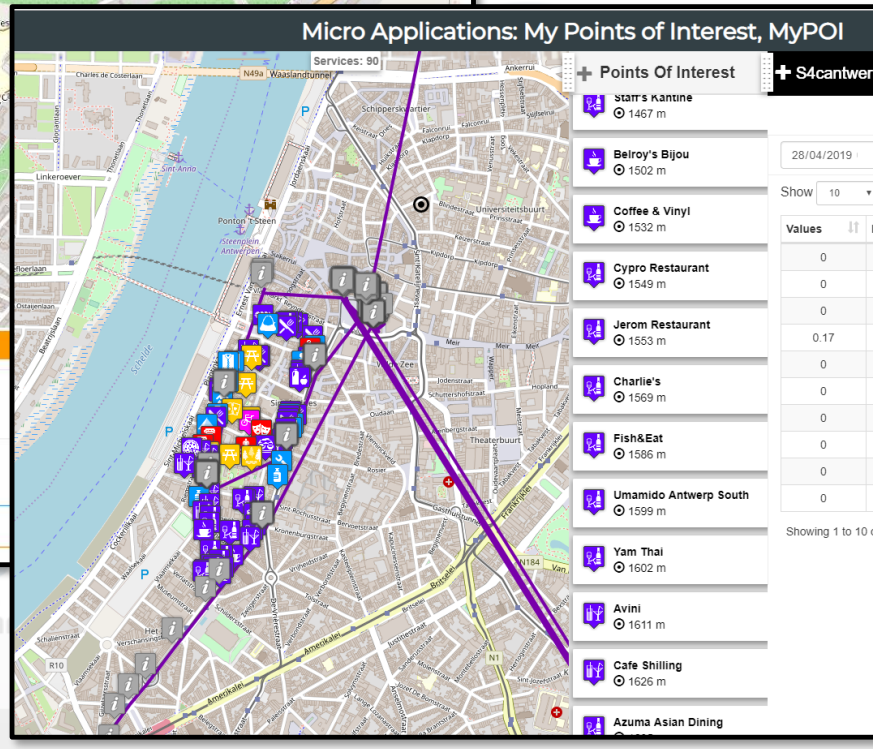
https://main.snap4city.org/view/index.php?iddasboard=ODM=

Tracking of Devices and Mobiles

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







Real Time Tracking

From mobile app:

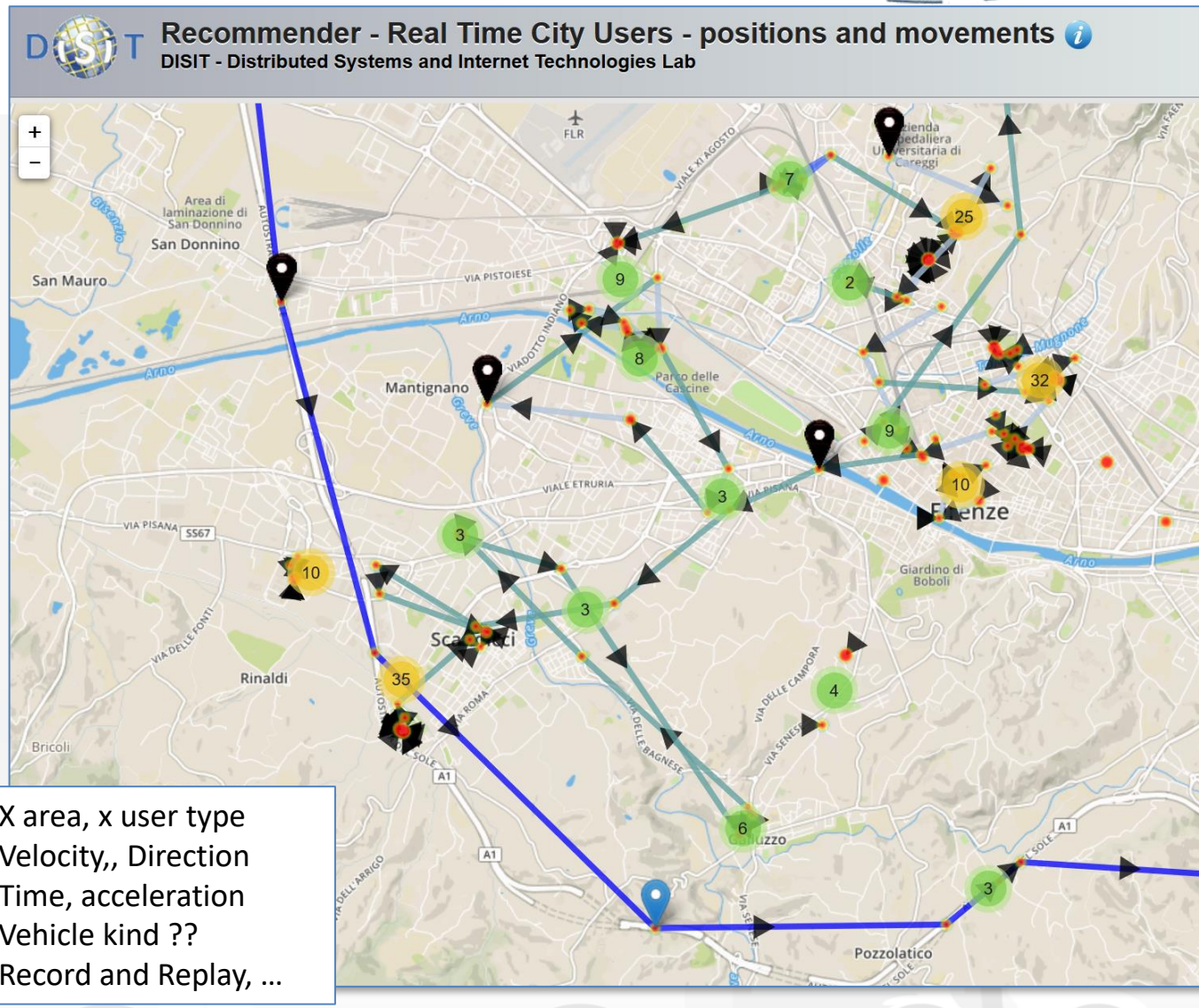
- Resolving GPS location: GPS, cells, wifi-network, … mixt
- Noisy, different kind of devices, …
- Smart algorithm on devices for location acquisition
- Anonymized data, terms of use on mobile

Filtering:

- GPS Accuracy, kind of measure (GPS, mixt)
- Jump in time, space, velocity
- General noise (diff. devices)
- Knowledge of precision map

Clustering:

- time, space, user kind, etc.



- X area, x user type
- Velocity,, Direction
- Time, acceleration
- Vehicle kind ??
- Record and Replay, …

Dashboards Production

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INDEX

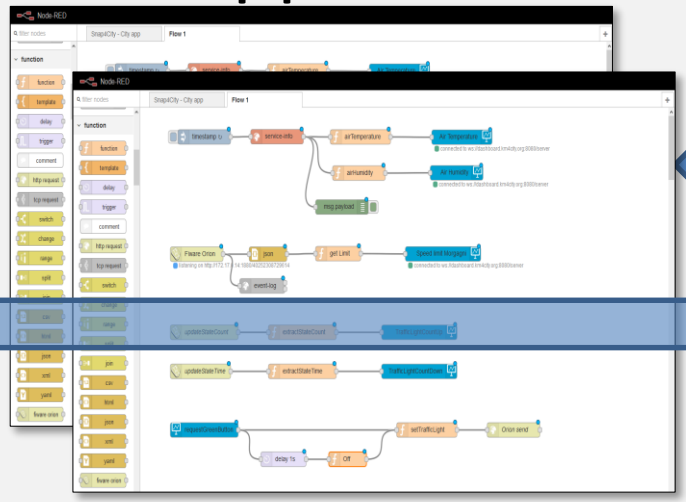
Dashboard with intelligence App

Dashboards with IOT Applications for enforcing data driven smart and intelligence into them

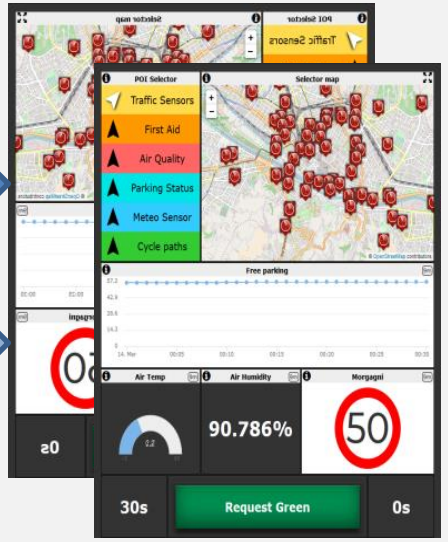
Dashboard-IOT App

IOT and City data World

IOT Applications

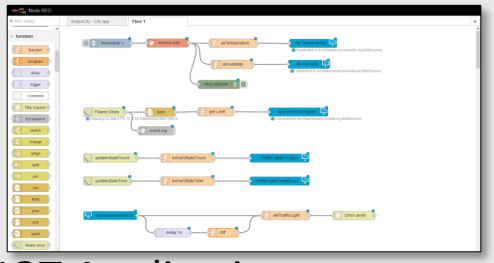


Dashboards



Applications

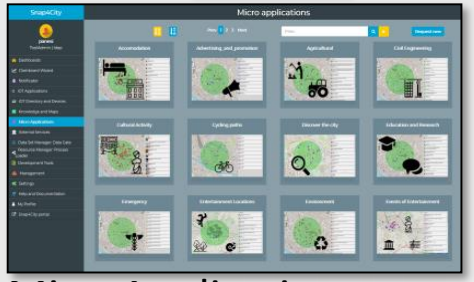
Dashboard Development



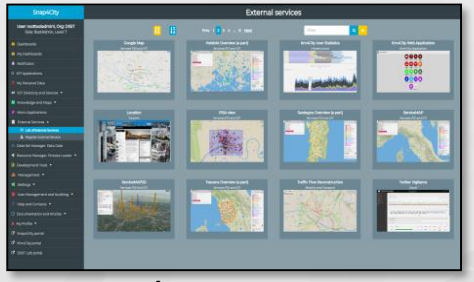
IOT Applications

Knowledge and Storage
Data from the Field and
City

Widget Collection

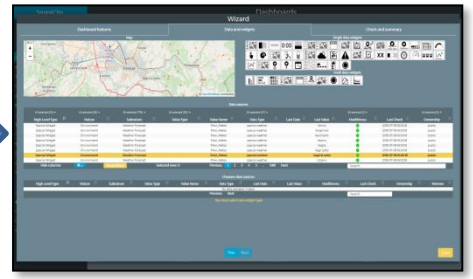


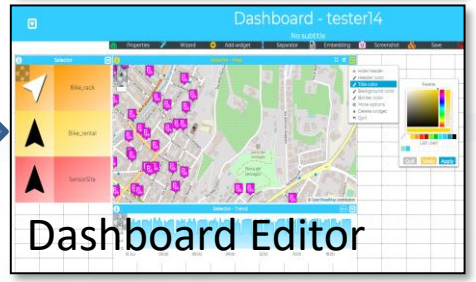
MicroApplications



External Services

Dashboard Wizard





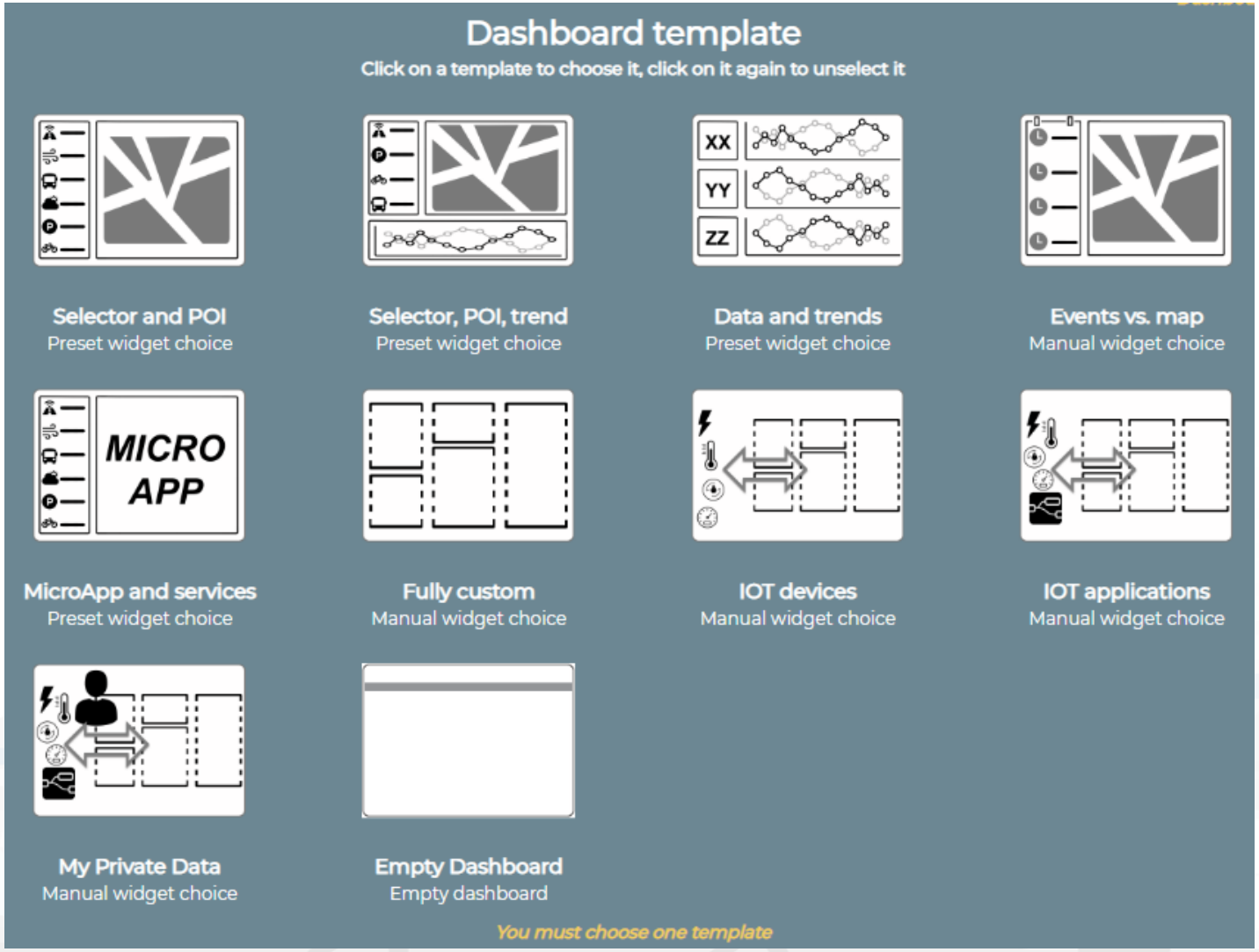
Dashboard Editor

Create, save, load,
delegate, grant access

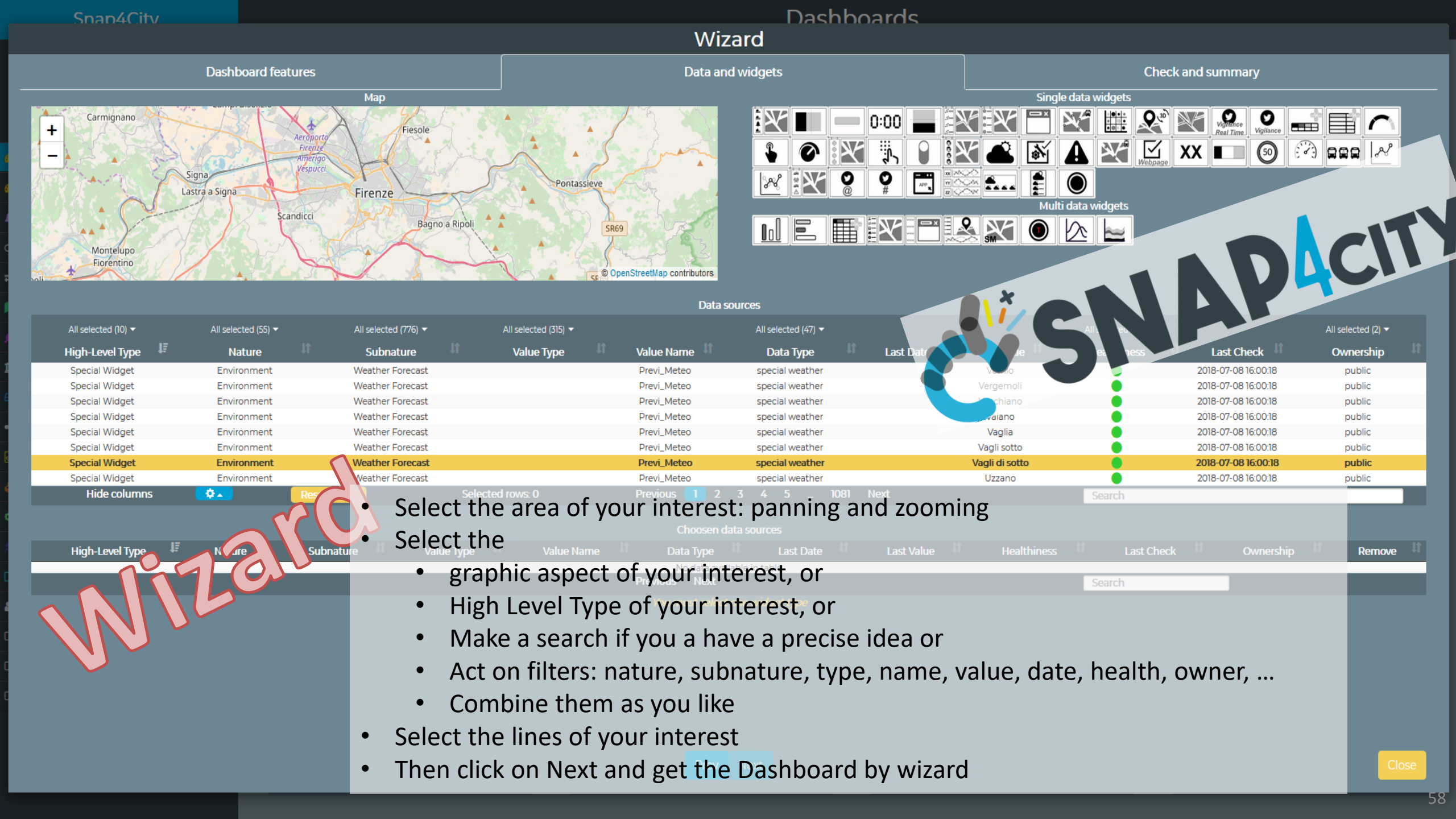
Public
Dashboard
Collection

My Own Dash/App

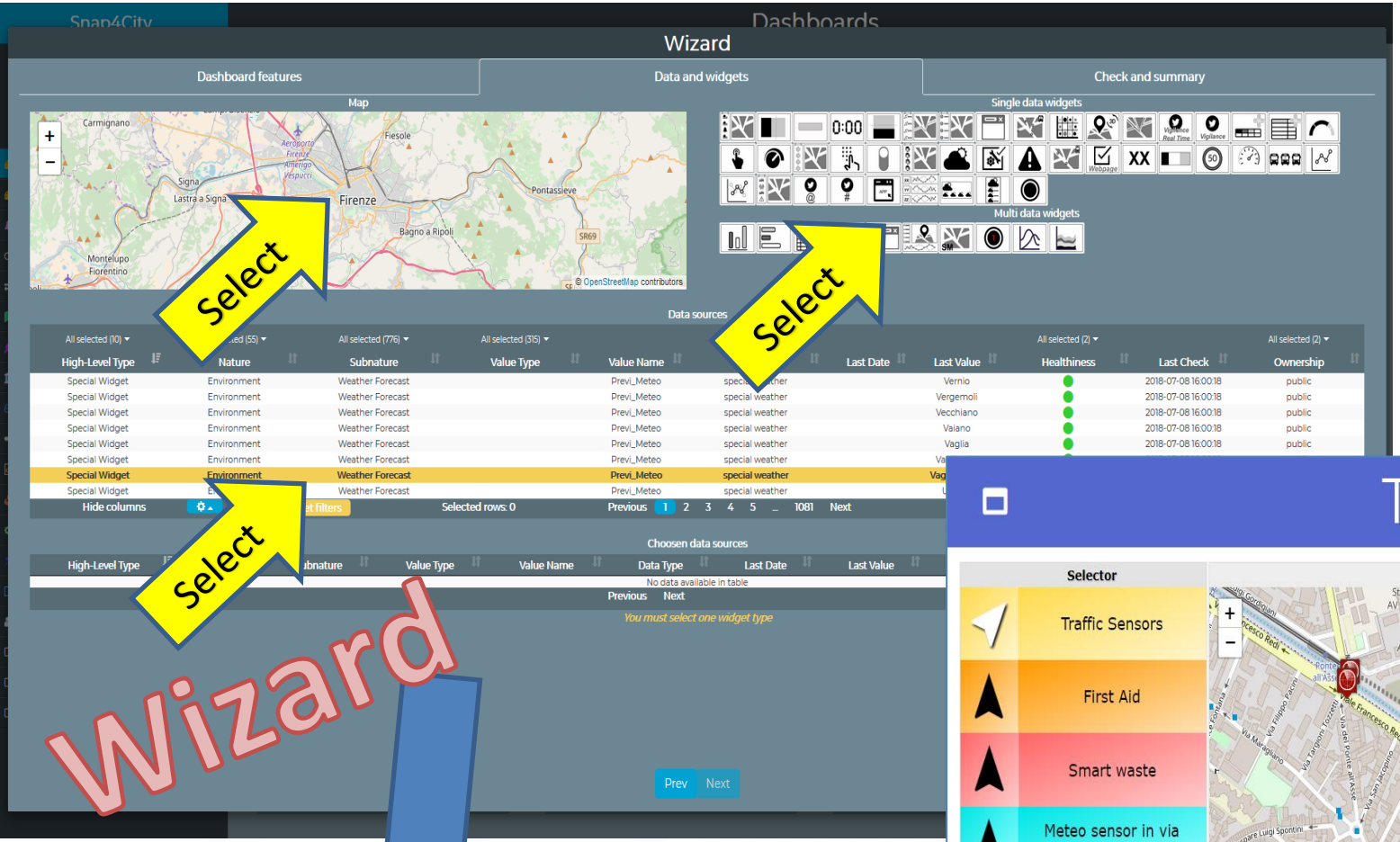
From Templates to Wizard and Dashboards

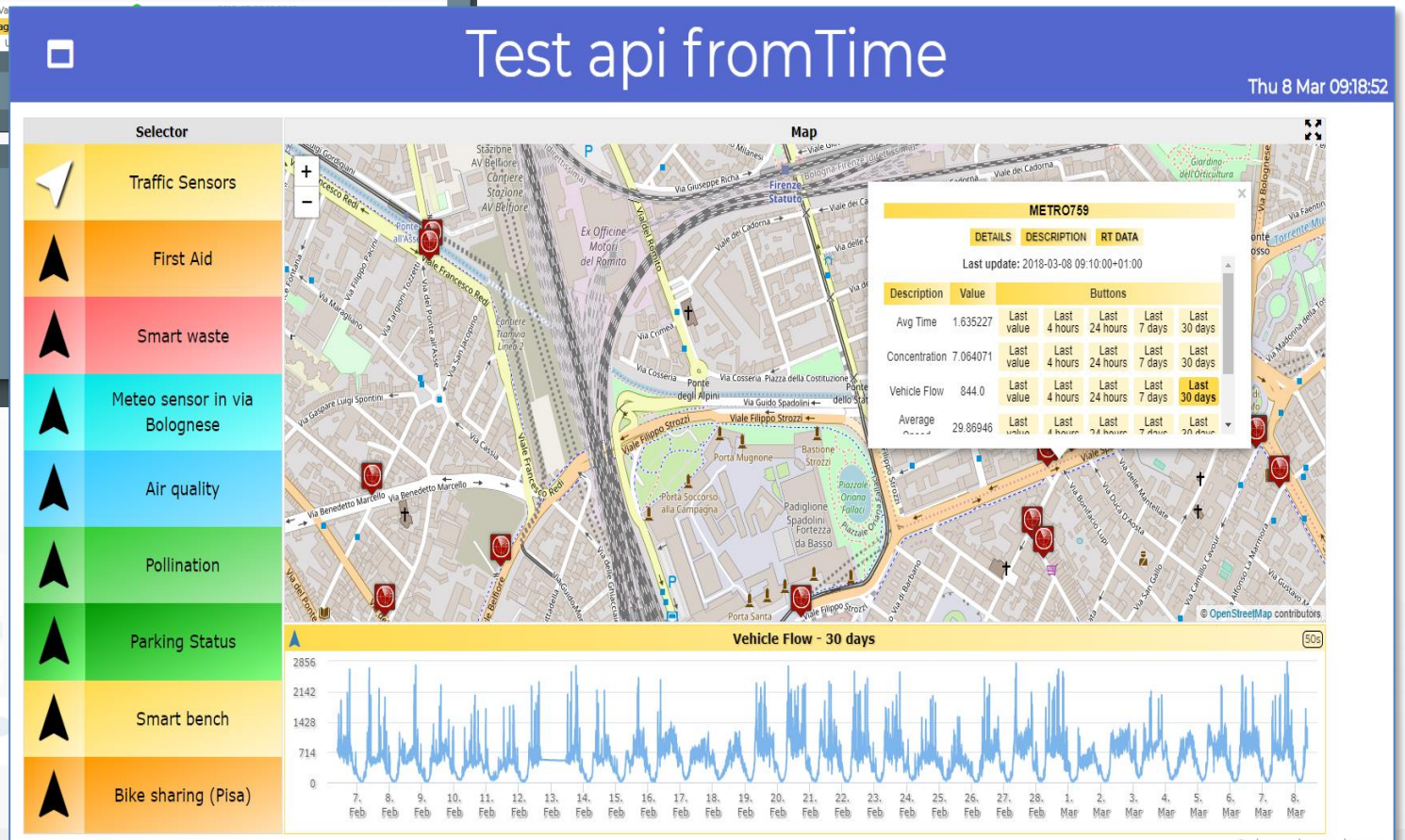


- to create a new Dashboard
- to add widgets and/or groups of them on any Dashboard


Wizard
Dashboard features
Data and widgets
Check and summary
Map
Single data widgets
Multi data widgets
Data sources
Wizard
Select the area of your interest: panning and zooming
Select the
graphic aspect of your interest, or
High Level Type of your interest, or
Make a search if you a have a precise idea or
Act on filters: nature, subnature, type, name, value, date, health, owner, …
Combine them as you like
Select the lines of your interest
Then click on Next and get the Dashboard by wizard
Close

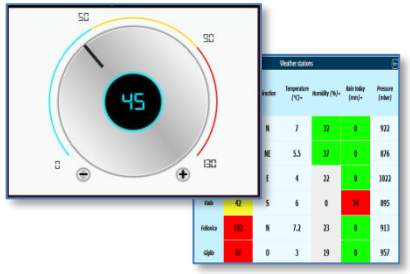
Dashboard Wizard

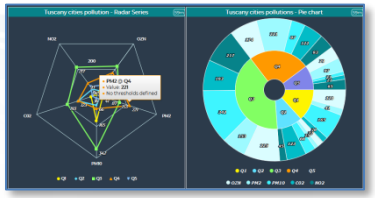


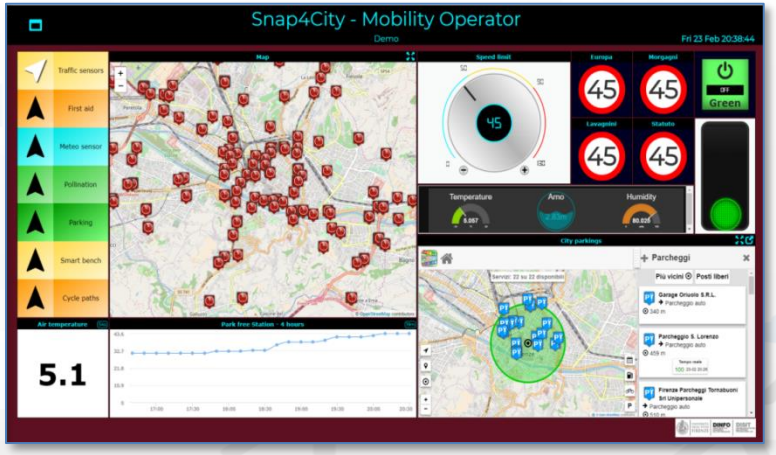


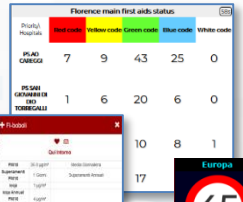
The Wizard help you in selecting only possible combination of data vs graphic representation

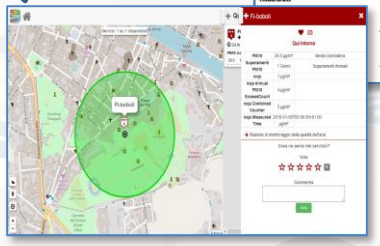
Dashboard List and Editor

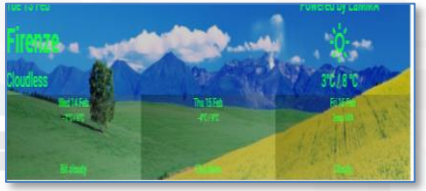


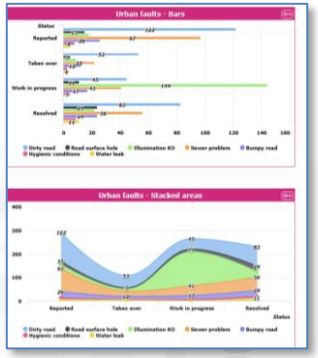






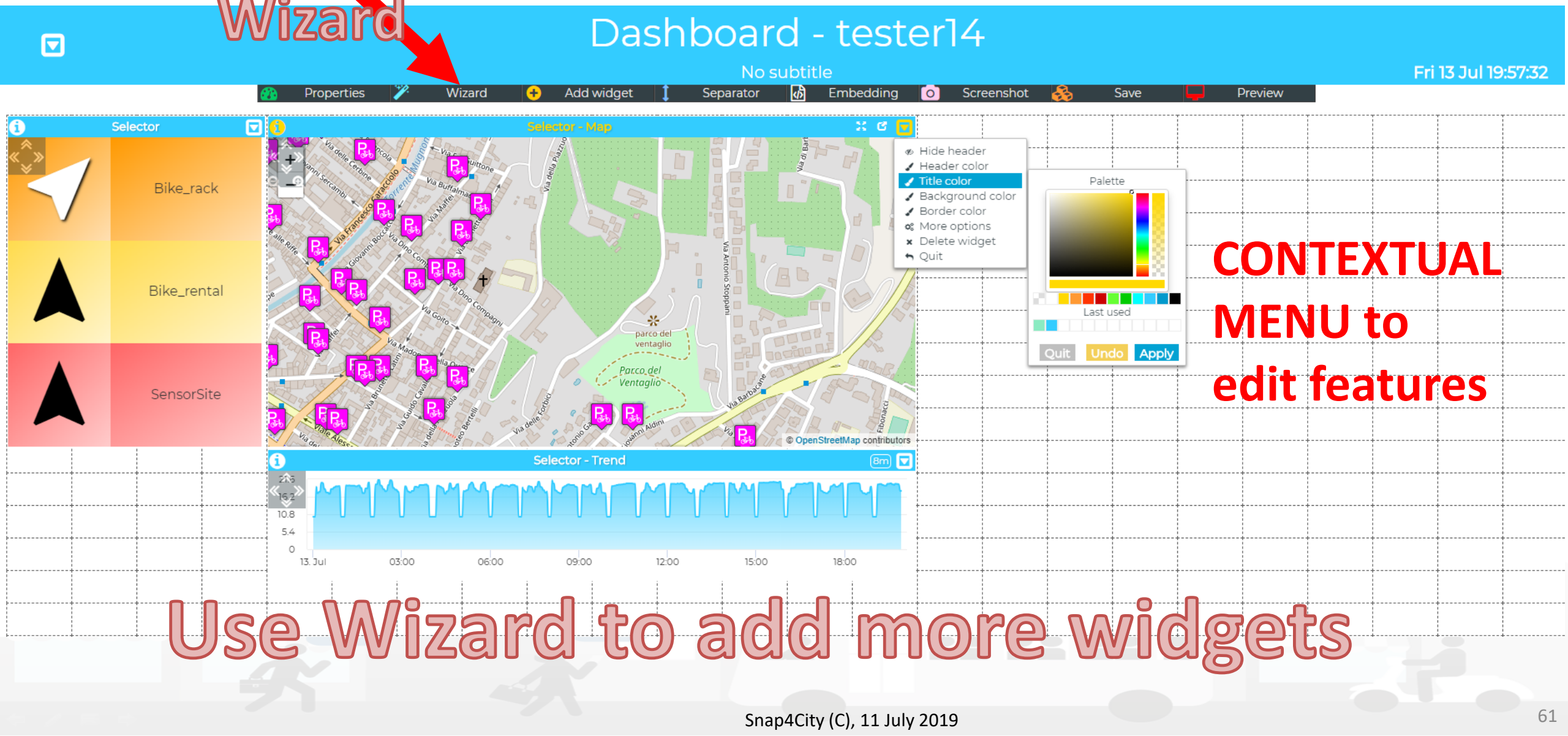






edit mode

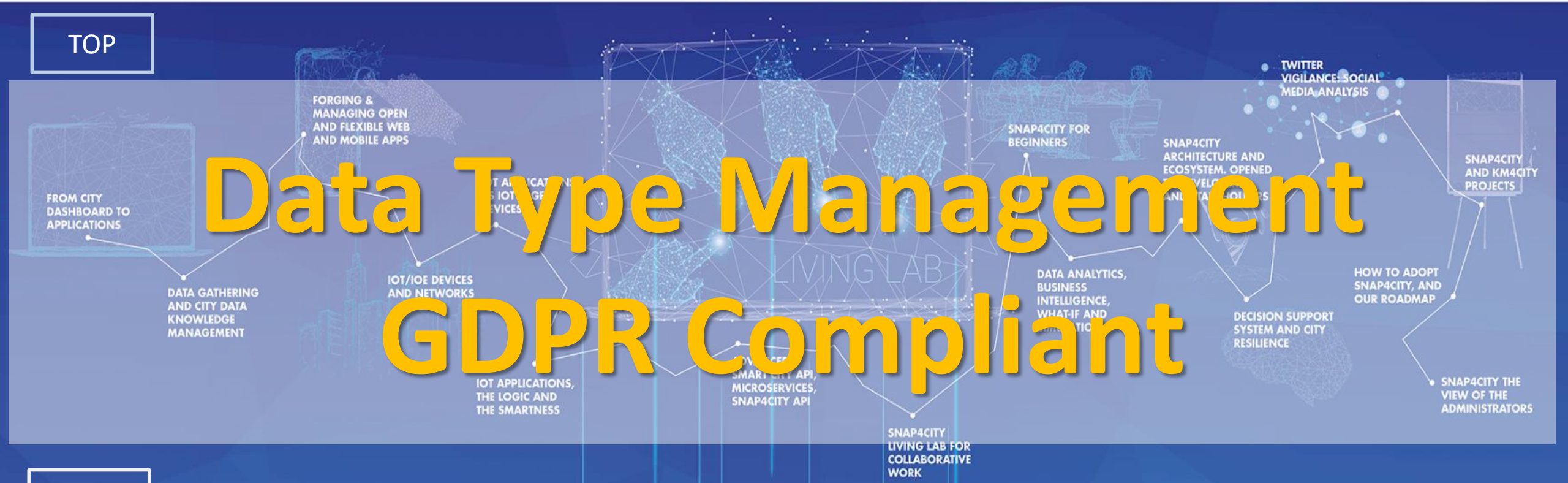
Wizard



CONTEXTUAL MENU to edit features

Use Wizard to add more widgets

TOP



Data Type Management GDPR Compliant

ARC
INDEX

GDPR: General Data Protection Regulation

Users may decide to:

- provide access to who, for do what, until when consented
- accept terms of use by **signed** consent **for** data management **service**

From each service, the user is capable to:

- **See** what we collect in terms of Data Type: traces, logs, paths, profiles, accesses, IOT devices, sensors, maps, etc.
- **Download**, **delete**, **inspect** Data
- **Auditing** and **Revoke access** or **grant** access right to each **single Data**
- **Delete all Data in single shot** or singularly (**forget all about me**)

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

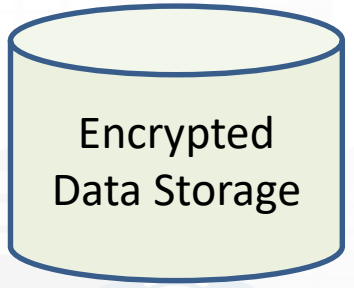
GDPR: General Data Protection Regulation

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

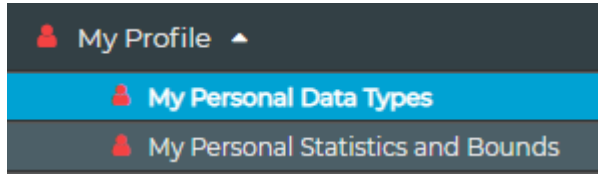
- the data are **released anonymously**,
  → also in this case they can be **revoked at any time**:

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

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



GDPR Compliant



My Personal Data Types

View | Edit | Track | Access control | Convert

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

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

Manage Profile and MyPersonalData

For each Data Type:

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

Details for Main Data Kinds

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

DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT

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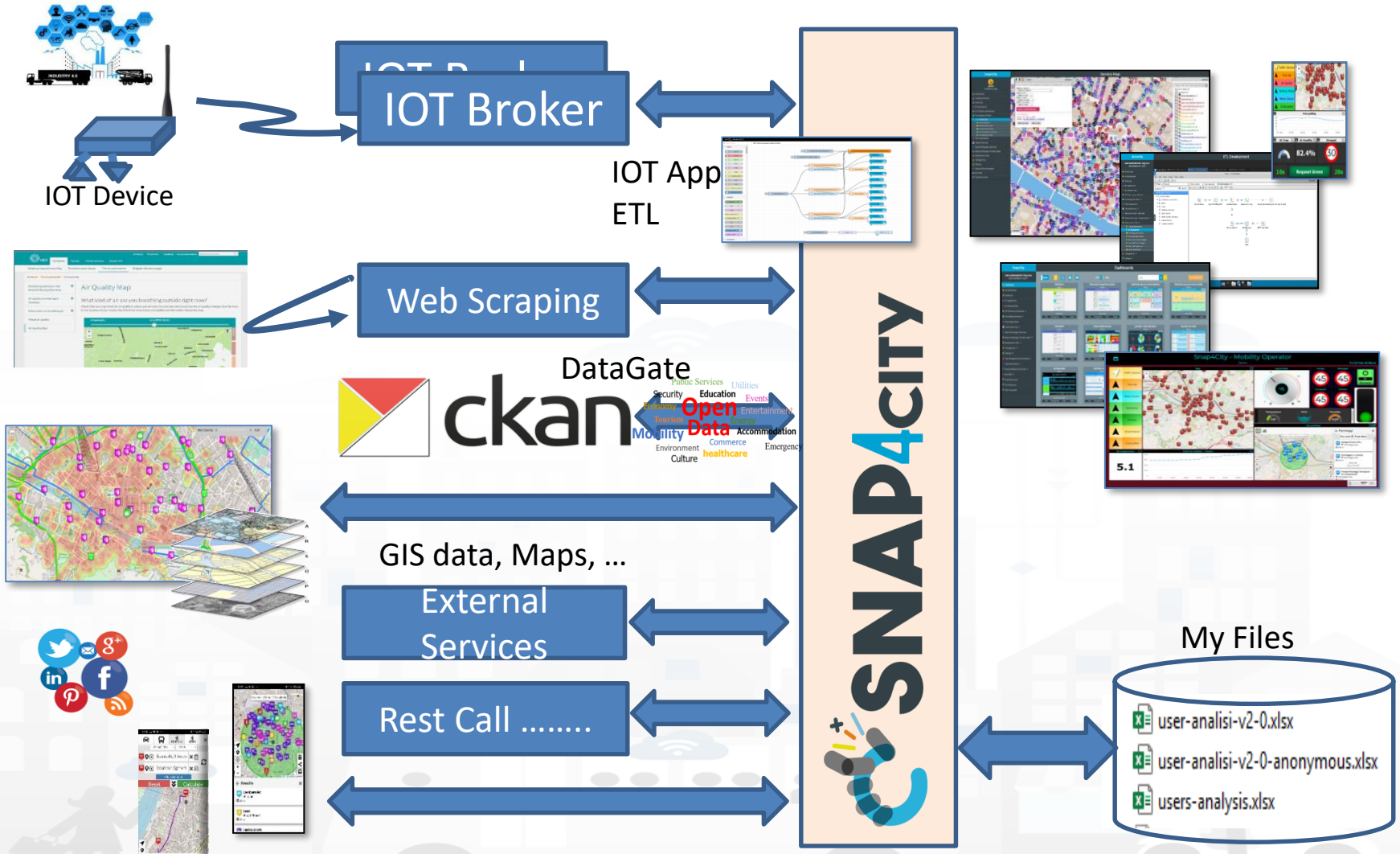
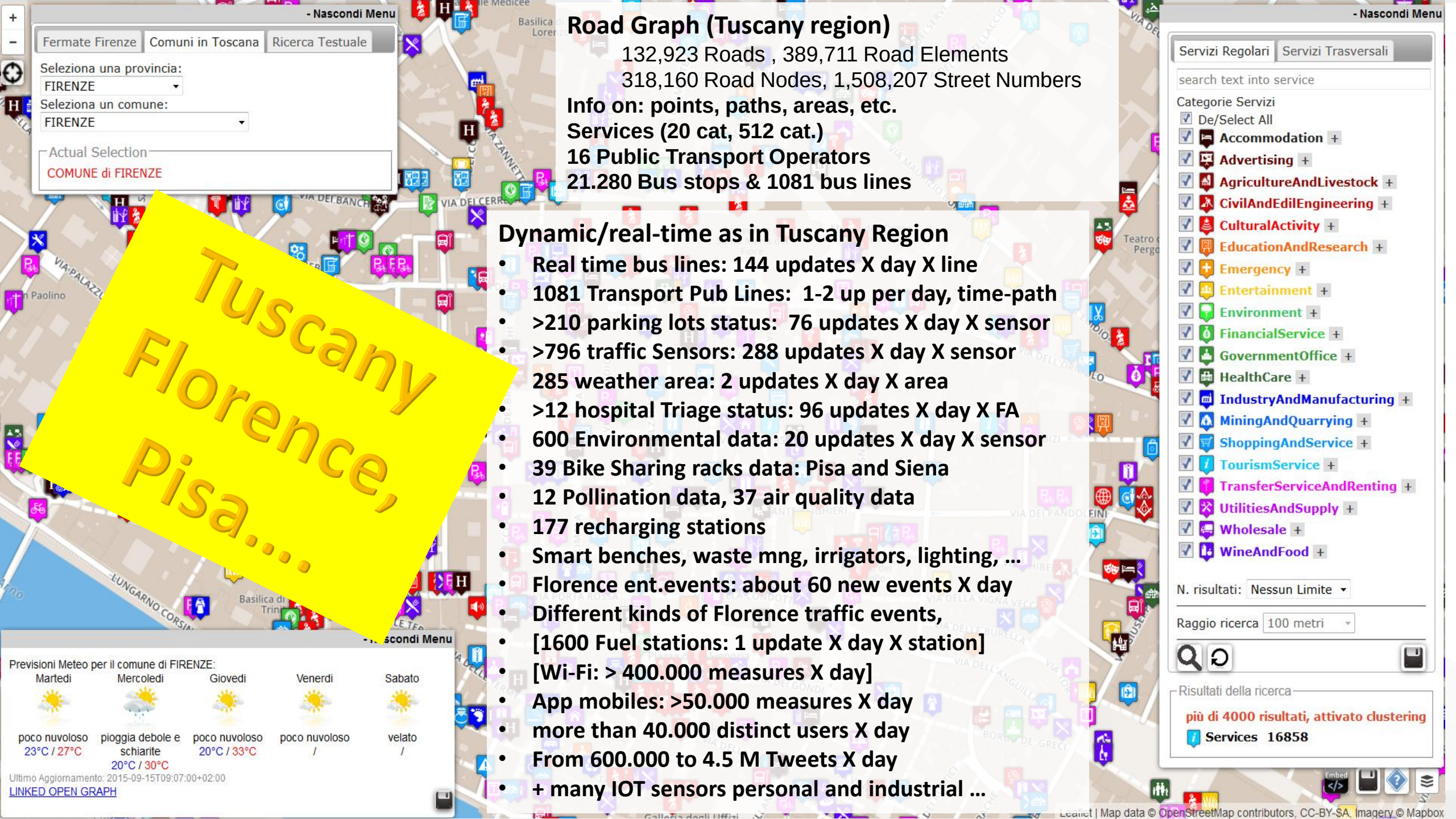
INDEX

Data Gathering/ingestion

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




- 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

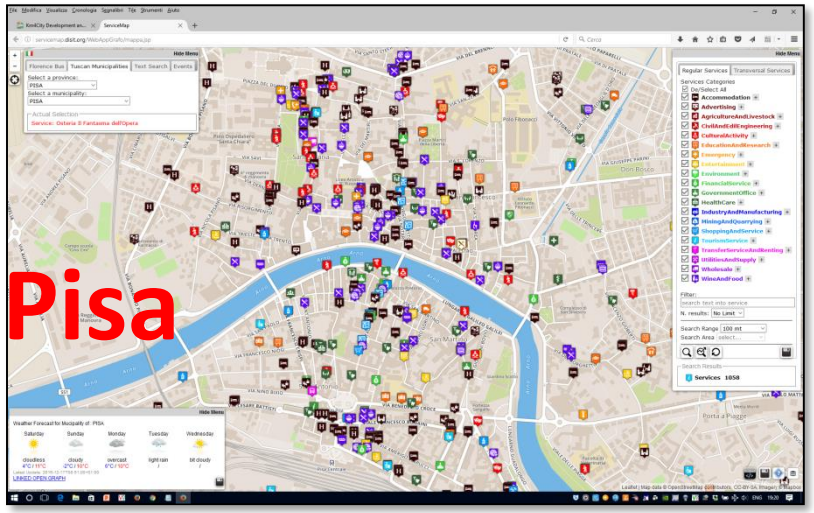
UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

Km4City in …

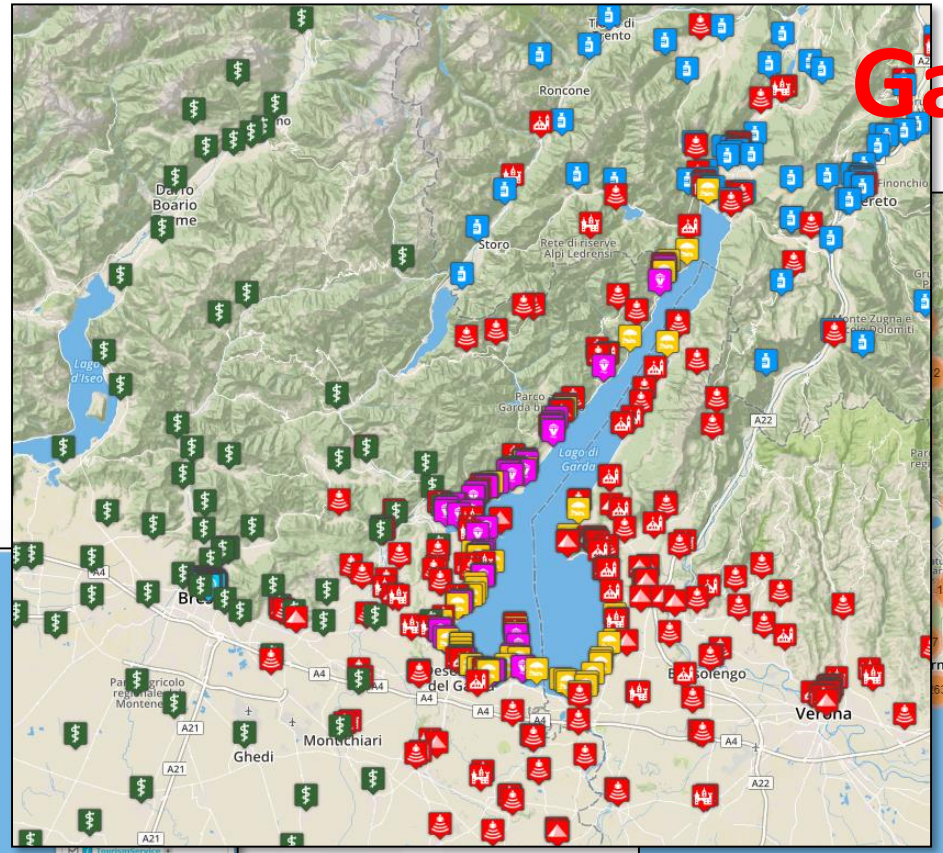
KM 4 CITY

Sii-Mobility

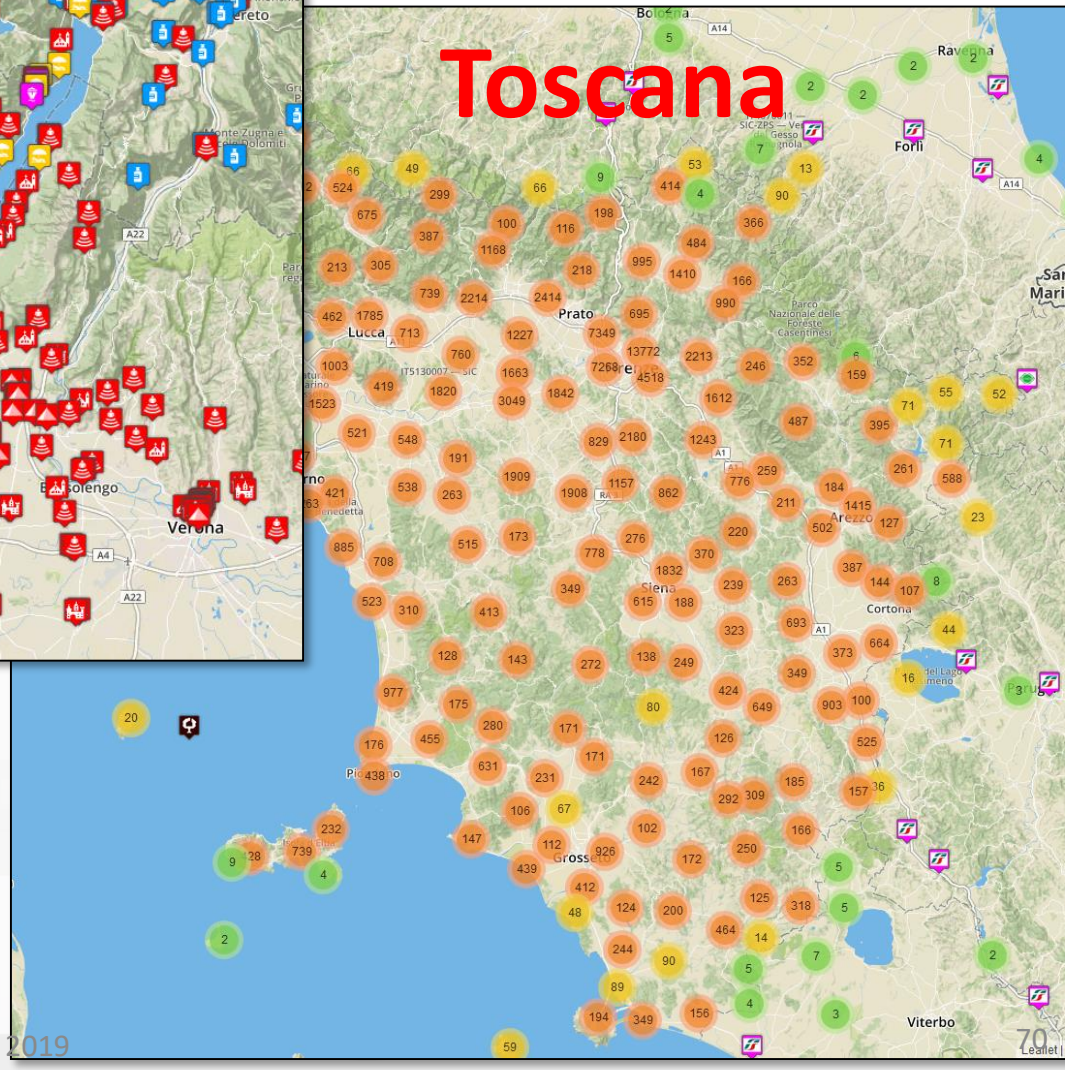
Pisa



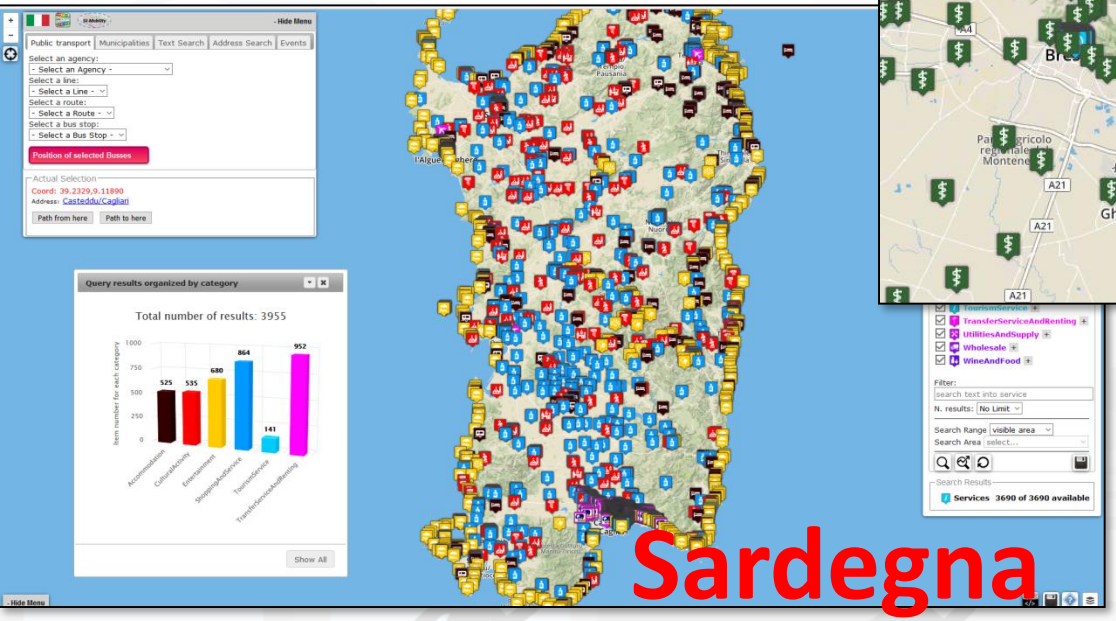
Garda Lake



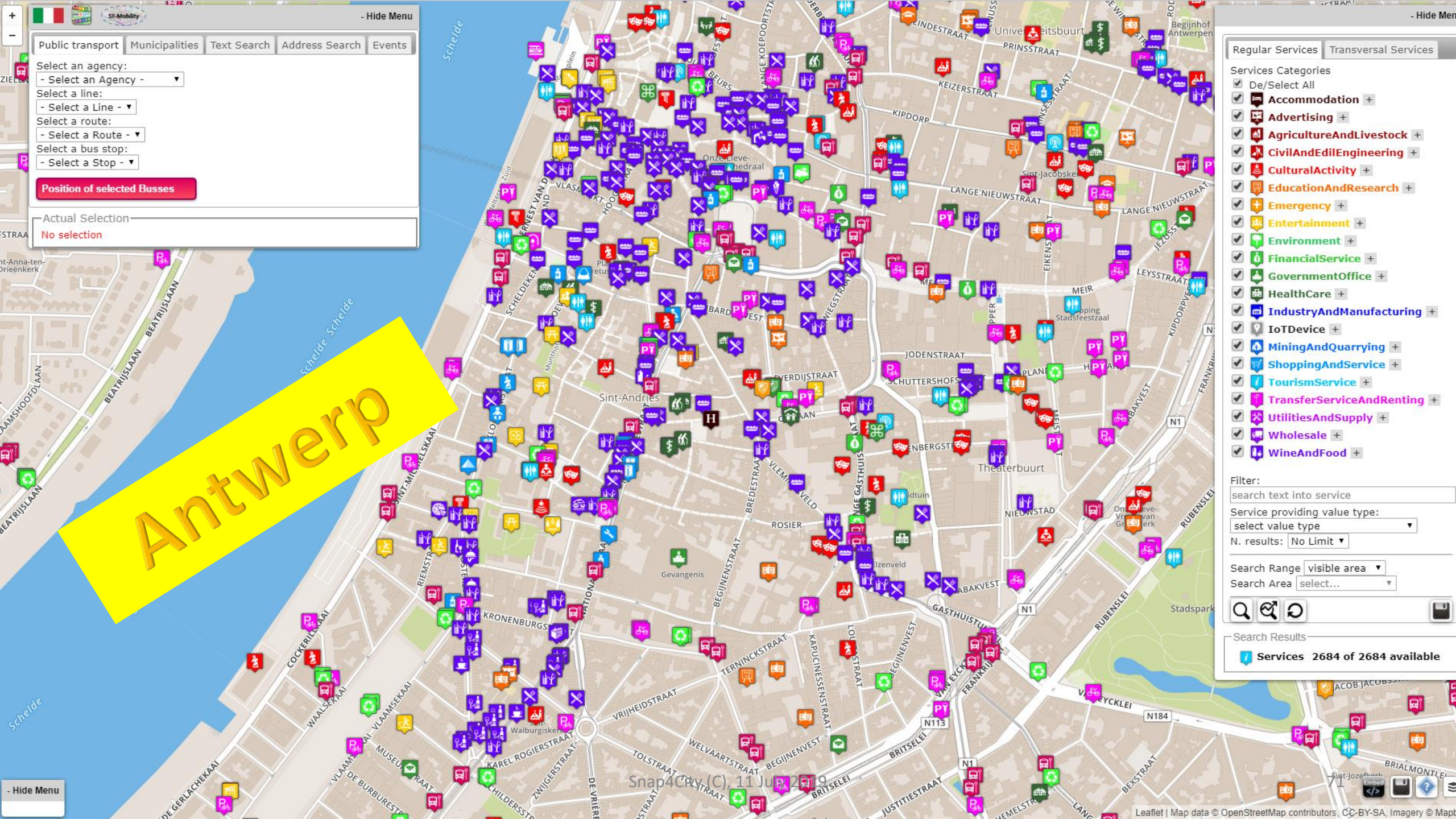
Toscana



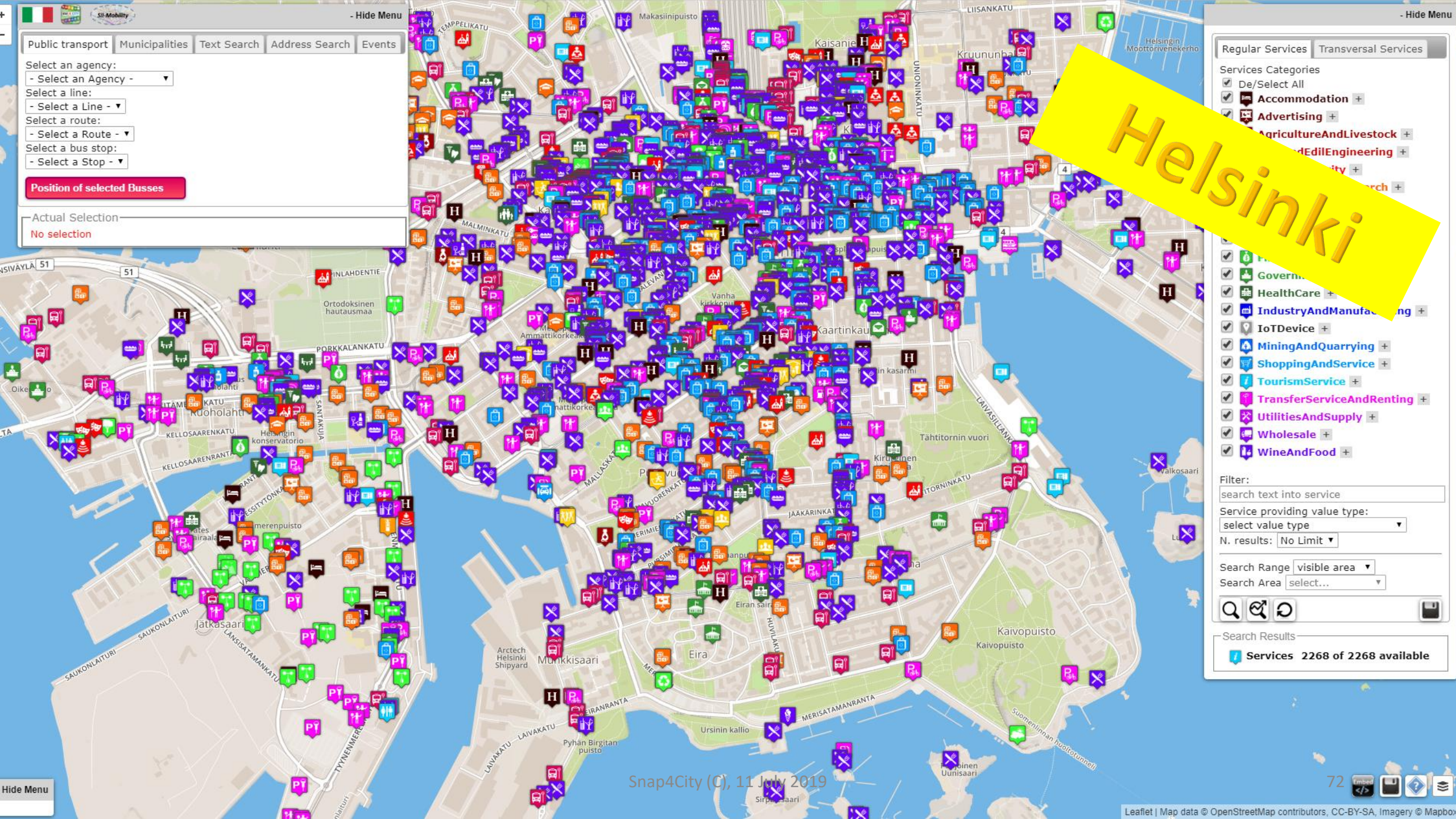
Sardegna



Search all services in the area



Snap4City (C), 11 Jul 2019


- Hide Menu
Public transport
Municipalities
Text Search
Address Search
Events
Select an agency:
- Select an Agency -
Select a line:
- Select a Line -
Select a route:
- Select a Route -
Select a bus stop:
- Select a Stop -
Position of selected Busses
Actual Selection
No selection
Helsinki
- Hide Menu
Regular Services
Transversal Services
Services Categories
De/Select All
Accommodation
Advertising
HealthCare
IoTDevice
MiningAndQuarrying
ShoppingAndService
TourismService
TransferServiceAndRenting
UtilitiesAndSupply
Wholesale
WineAndFood
Filter:
search text into service
Service providing value type:
select value type
N. results:
No Limit
Search Range
visible area
Search Area
select...
Search Results
Services 2268 of 2268 available
Hide Menu
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

Data vs Smart Services enabling on Snap4City

- **Public Transportation and mobility activated services in some where with Snap4City**
  - **Smart parking** (parking locations and real time parking data) … predictions
  - **Smart Fuel pricing** (fuel station locations and real time prices)
  - **Routing** (detailed GIS information, text indexing of streets, POI, etc.)
    - **Quite routing, perfect shopping, etc. etc**. (more data in needed….)
  - **multimodal routing** (detailed GIS information, Public transport time schedule)
  - **Info traffic** (traffic flow sensors, real time Traffic events, their localization, etc.)
  - **Dense info traffic** (traffic flow sensors and traffic flow reconstruction algorithm)
  - **Car/Bike/Scooter Sharing** (position and availability of Cars/Bikes, Scooters) … predictions
  - **Smart Biking** (cycling paths, environmental data) … predictions on bike racks
  - **E-vehicles** (position, status of recharging stations,. …) … predictions vs booking
  - **Smart river crossing** (position and status of Underpass, Ferry) … prediction
  - **Quality of Public Transport** (actual time of arrival at the bus stops, wrt planned time schedule**)**
  - **Early Warning vs Resilience** (combination of several data including mobility, events, Social to perform early warning…)

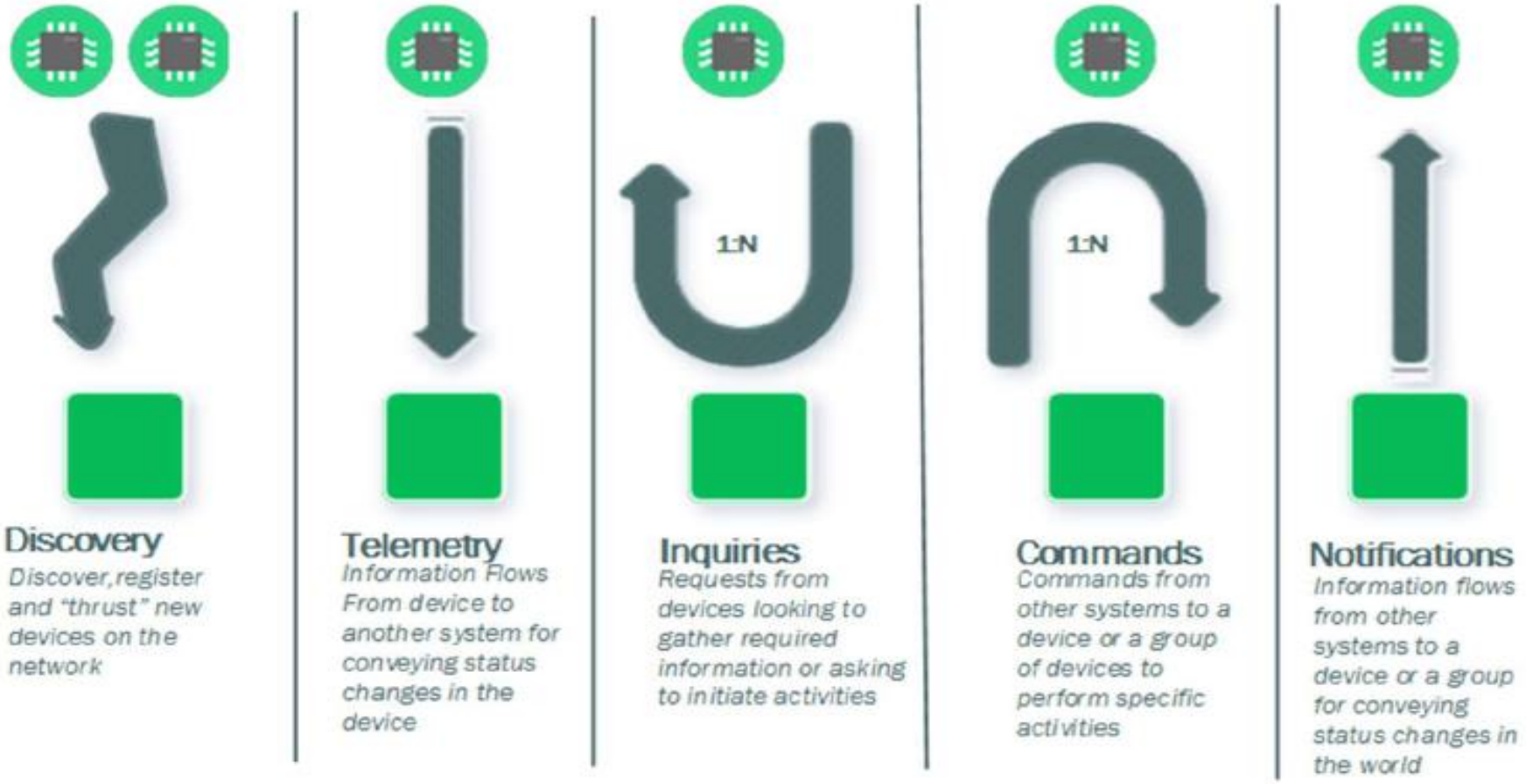
Data vs Smart Services enabling on Snap4City

- **Social and Users Behaviour**
  - **Smart First Aid** (Location of First AID, real time status of triage)
  - **search for POI and public transport services** (POI geolocalized, spatial queries, along paths)
  - **Social Media Monitoring and acting** (Identif. of dysfunction, quality of service perceived)
  - **Information to Tourists** (Entertainment Events)
  - **Early Warning, prediction of audience** (Twitter data, social media)
  - **Improvement of services for Tourists** (people flow, usage of services)
    (Origin Destination Matrices, trajectories, heatmaps)
    (People Monitoring, via App, Wifi, PAX Counter)
    (Twitter Data, social mea,….)
- **Weather and environment, quality of life**
  - **Weather forecast/condition** (Weather forecast)
  - **Air quality Pollution** (pollution sensors, PM10, PM2.5, NOX, etc.)
  - **Pollination** (Pollination sensors)
  - **Alerting on Air quality for multiple parameters** (Prediction of parameters time slots, notification)
  - **Information Heatmaps for weather and air quality** (air quality sensors, heatmaps, prediction)
  - **Air quality indexes, and forecast** (…….

Protocols vs Data

IOT/IOE Protocols

Communication Patterns



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

Interoperability

Powered by FIWARE

http://marketplace.fiware.org/pages/solutions/b8905e91973b420189cce972

https://partners.sigfox.com/companies/disit-lab-university-of-florence

https://partners.sigfox.com/products/snap4city

Node-RED

https://flows.nodered.org/?num_pages=1

https://flows.nodered.org/?term=snap4city&num_pages=1

E015 digital ecosystem Official API

http://www.e015.regione.lombardia.it/

Compliant
Federated

Compliant with: AMQP, COAP, MQTT, OneM2M, HTTP, HTTPS, Rest Call, SMTP, TCP, UDP, NGSI, 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, RS485, WFS, WMS, ODBC, JDBC, Elastic Search, Phoenix, JSON, XML, GeoJSON, Enfuser FMI, Android, Raspberry, Local File System, etc.

Snap4City vs Formats

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

Snap4City vs protocols/formats

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

Data Gathering Processes

Modalities and Strategies for data ingestion

- **Road Graphs**: from GIS, and/or OSM (see Snap4City tool for that), …
- **Data** of any format via any protocol
- **Structured and non-structured** data (tables and free text, mixt)
- **Static data** and metadata descriptions:
  - typically ingested with DataGate for automated ingestion and you find it on the menu on left of Snap4City environment.
    - DataGate is a module of CKAN, it can be installed on any CKAN also.
  - ingested producing a process visually: ETL, Node-RED, NIFI, etc.
- **Real Time data** can be ingested by using:
  - Node-RED, NIFI, ETL, WebScraping, etc.
- **Event Driven** → Node-RED, NodeJS

Developers of ETL, Data Manager

kettle™ pentaho data integration

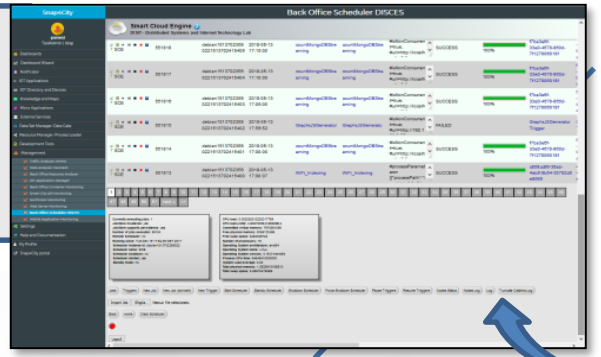
Distributed Back Office

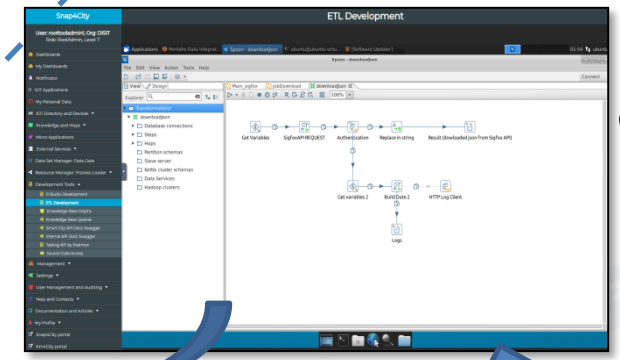
DISCES scheduler production

ETL Development Environment

Data sources

ETL Process



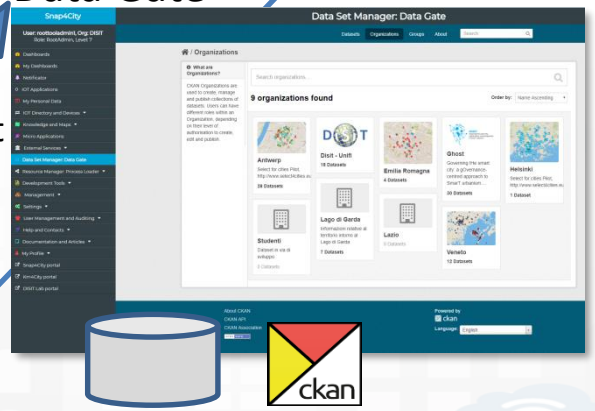


Data Gate

Knowledge Base, Km4City

Knowledge and Storage Data from the Field and City

Data Set Saving / Sharing



Data Set Loading/ Downloading

Saving / Sharing reusing

Resource Manager

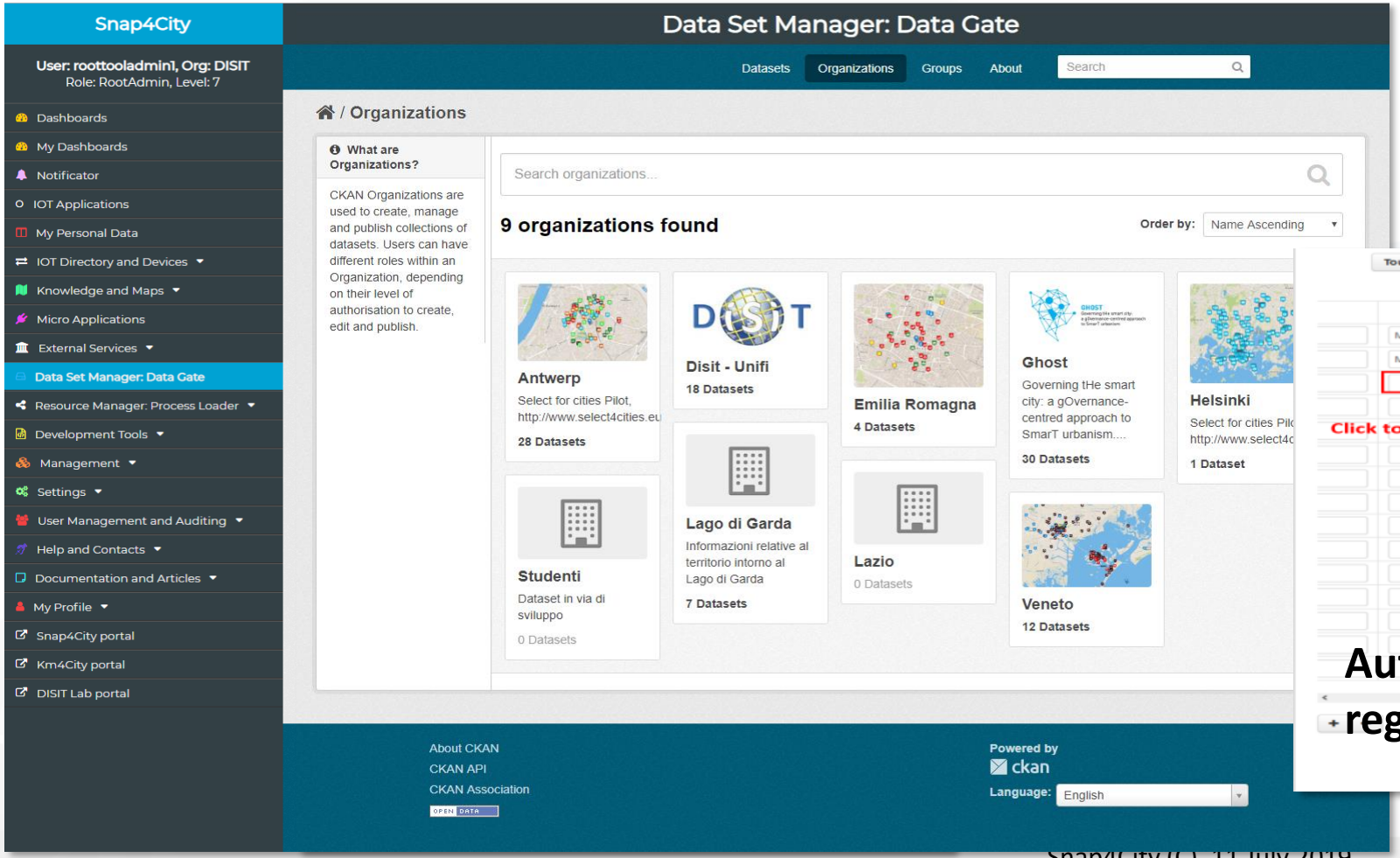
Schedule Execute

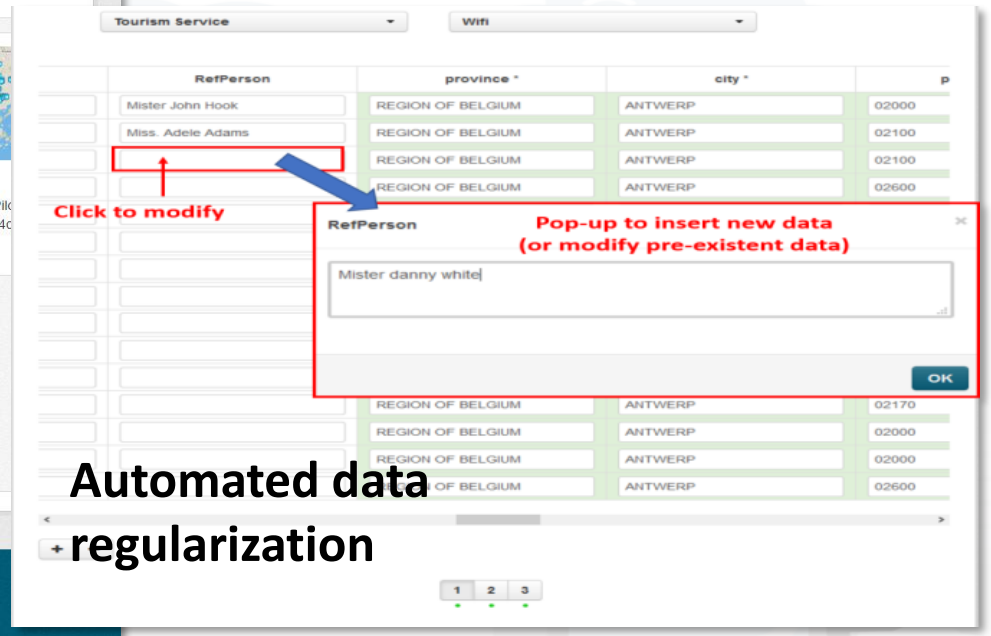
Load data or prepare for data ingestion

Integrated DataGate/CKAN
Static open data ingestion

Federated Crawling
Federated Distribution

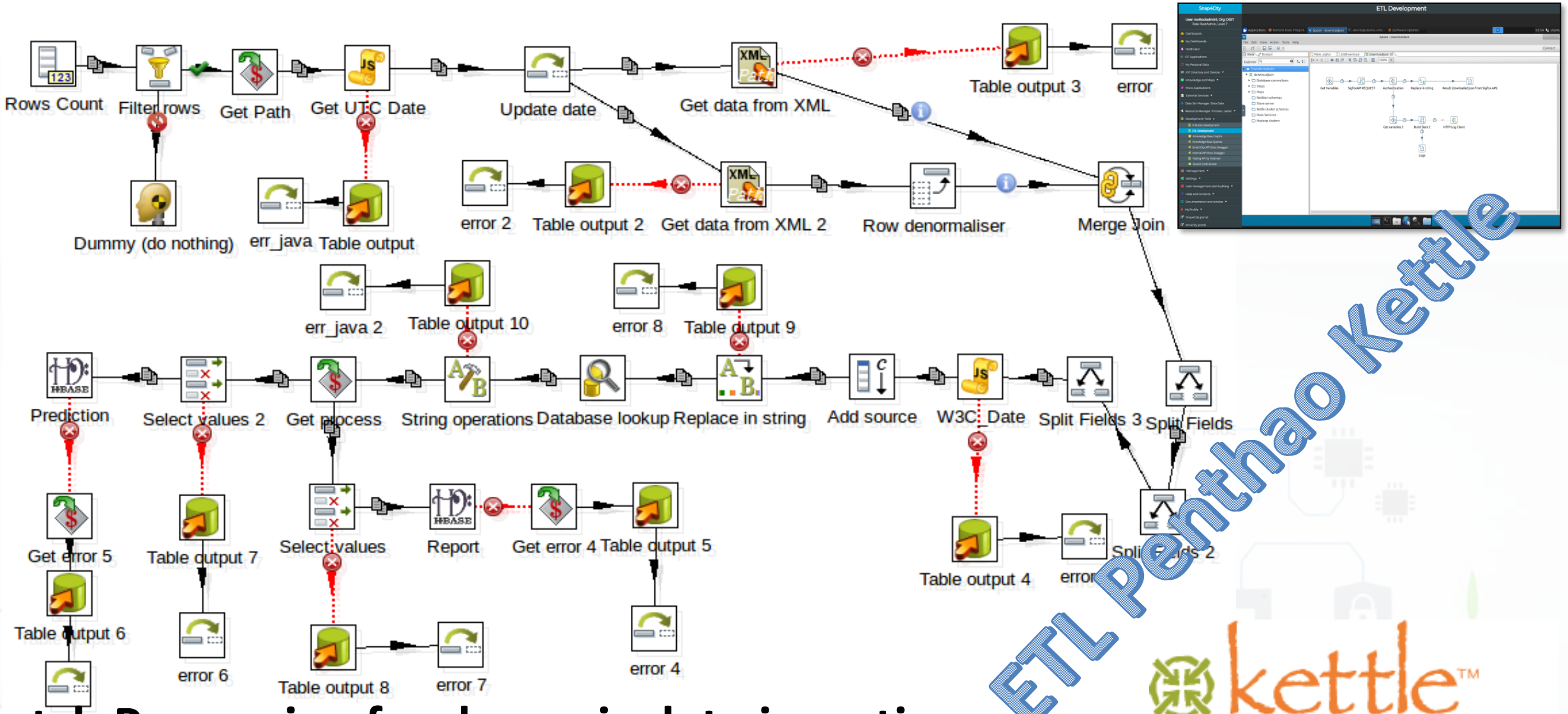
Data Set:
- Search
- Loading
- Download
- Share
- Publish
- Also automated





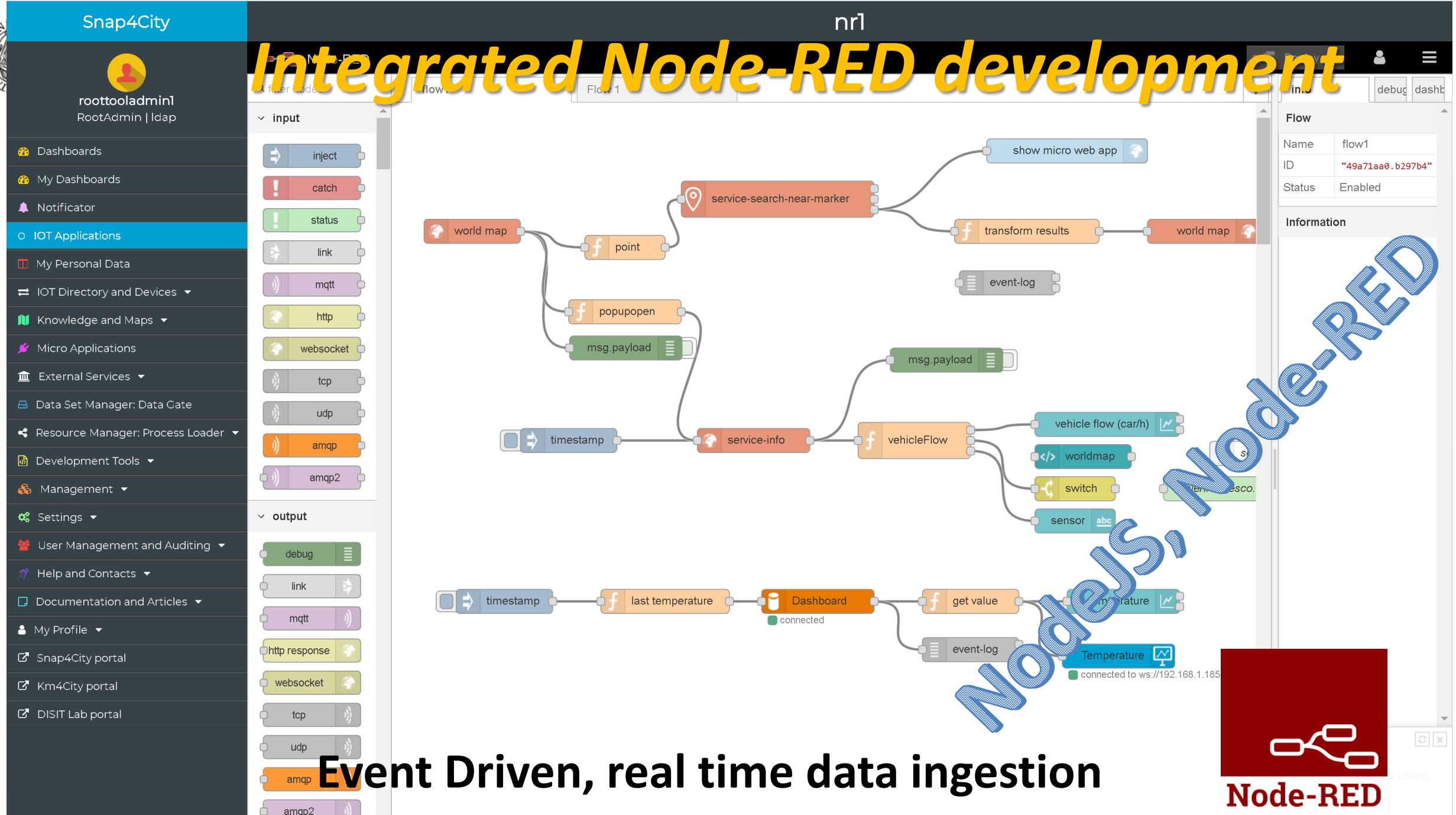
Automated data regularization

Integrated ETL development



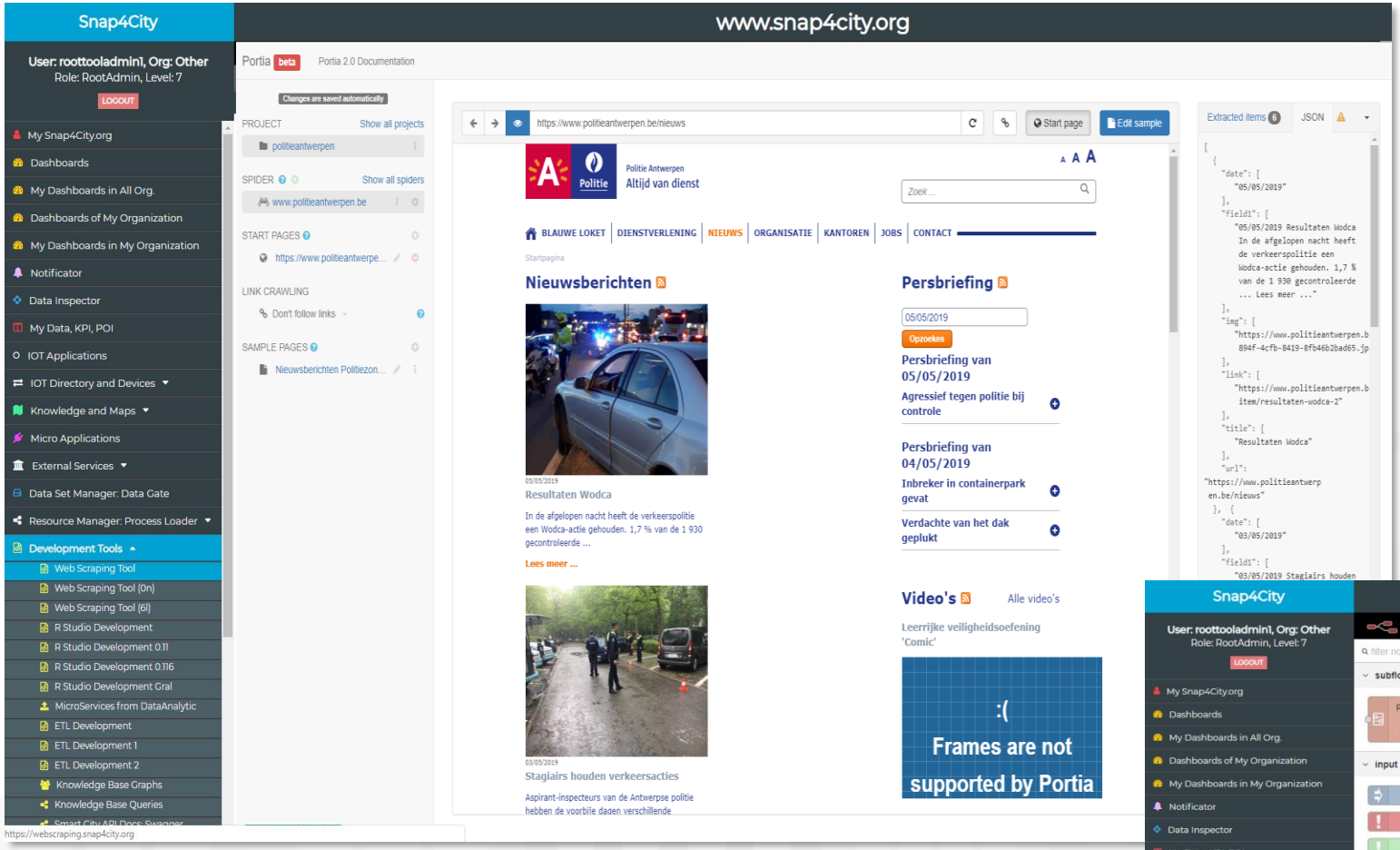
Batch Processing for dynamic data ingestion

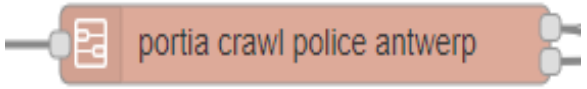
Integrated Node-RED development

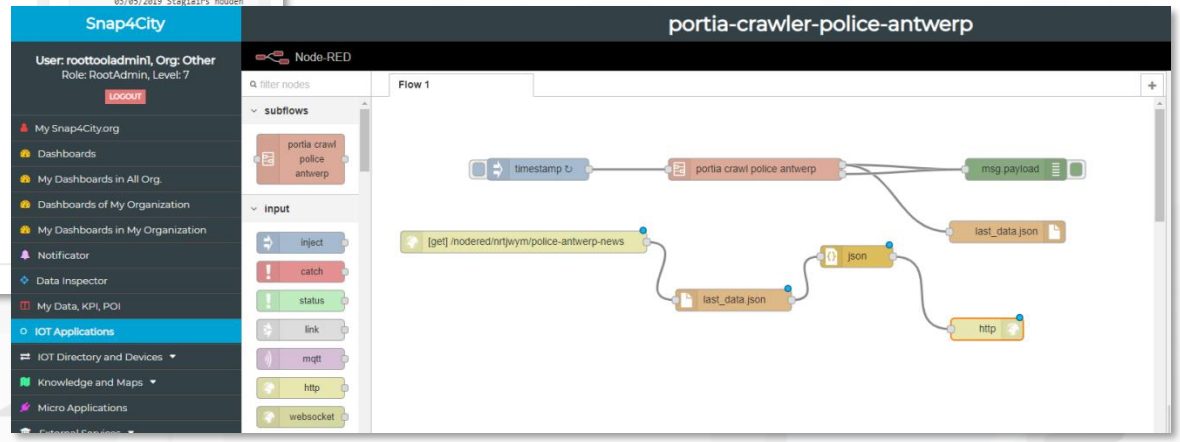


Event Driven, real time data ingestion

Web Scraping







Data Gathering and Knowledge Management

- Data ingestion can be performed by using multiple tools:
  - ETL processes, IOT Applications, Data Gate, WebScraping. We suggest:
    - ETL for static / periodic data in PULL
    - IOT App for real time data and flow, from IOT Brokers/Devices
    - DataGate for Static Data, upload them as files, or collected from other CKAN
    - WebScraper for scraping data from Web Pages, when authorized!
- See how to test cases:
  - **HOW TO: add data sources to the Snap4City Platform**
  - **HOW TO: define privacy rules for personal data, produced by the end-users own device**
  - **US6. Developing and using processes for data transformation**
  - **TC6.1 - Managing DataSets via DataGate: ingest, search, download, upload, annotate, share**
  - **TC6.3 - Creating ETL processes for automated data ingestion and data transformation**
  - **TC6.5 - Managing Heterogeneous File Ingestion via ETL processes**
  - **TC6.9 - ETL processes for multiprotocol and format data ingestion, see on GITHUB for library**
  - **TC9.2 - Managing heterogeneous File Ingestion, protocols, formats via IOT applications, and open standards**

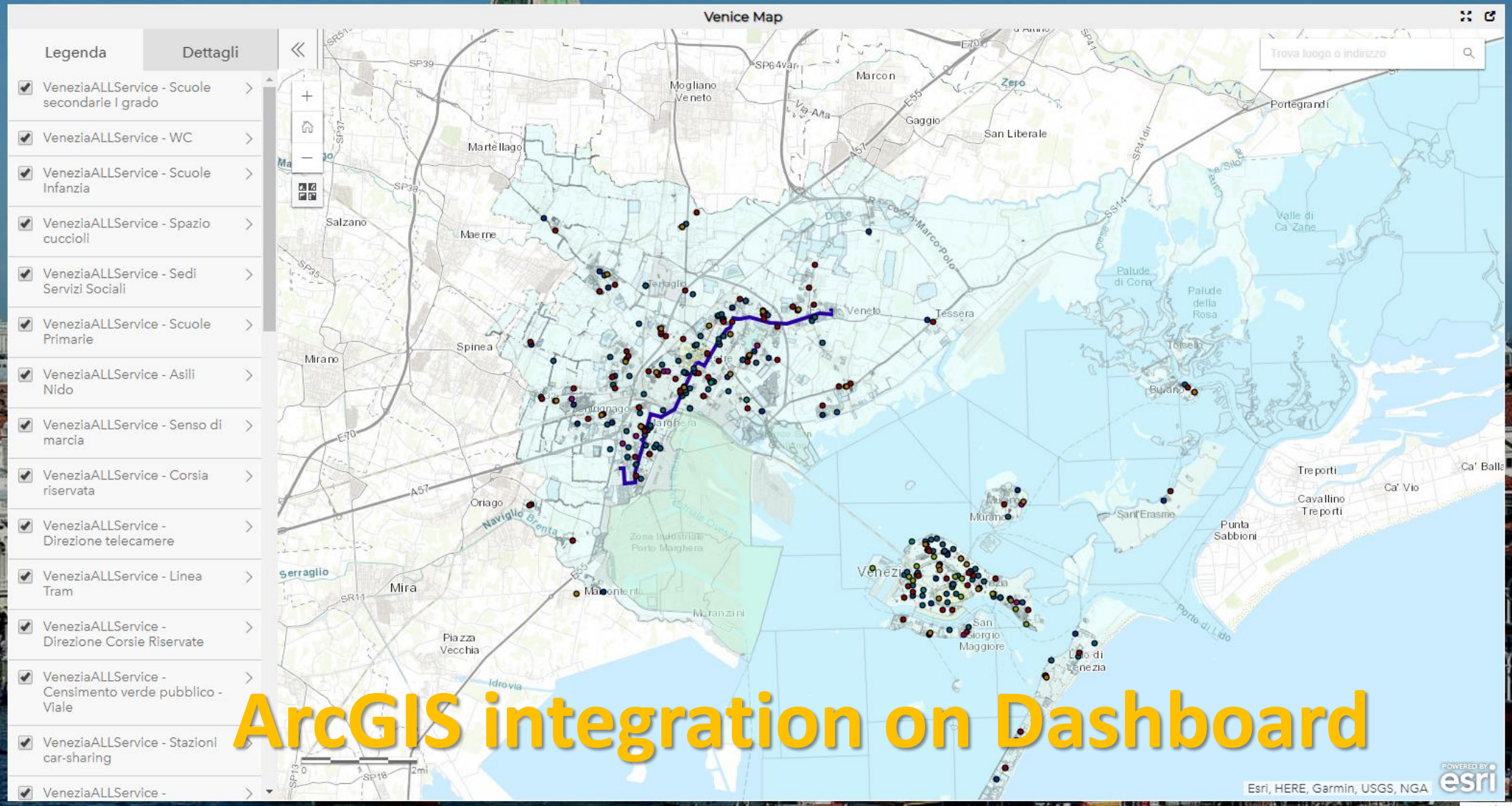
GIS Data Gathering/Connection

ARC

INDEX

ArcGIS Integration

Sat 10 Nov 16:58:32

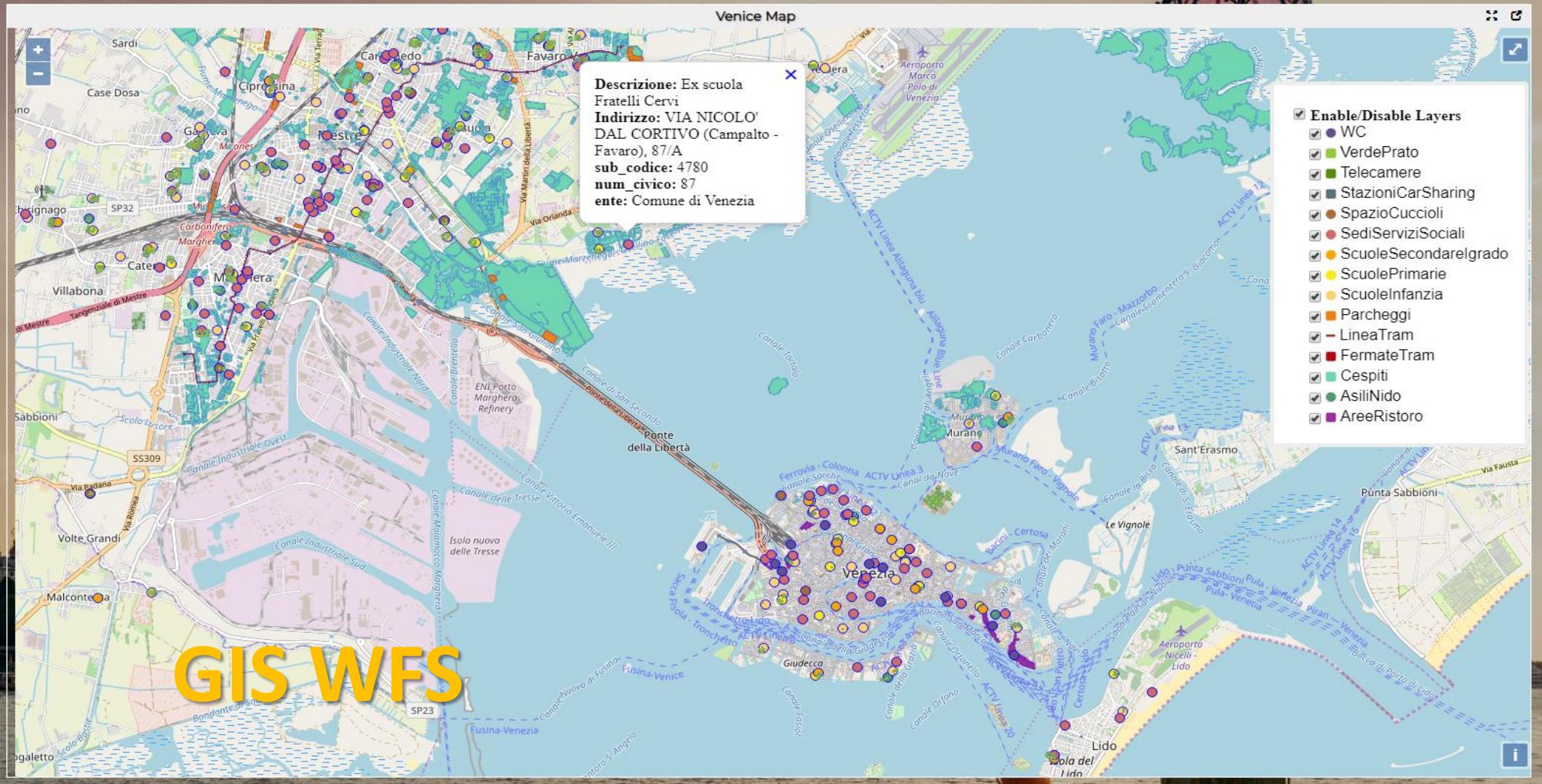


ArcGIS integration on Dashboard

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

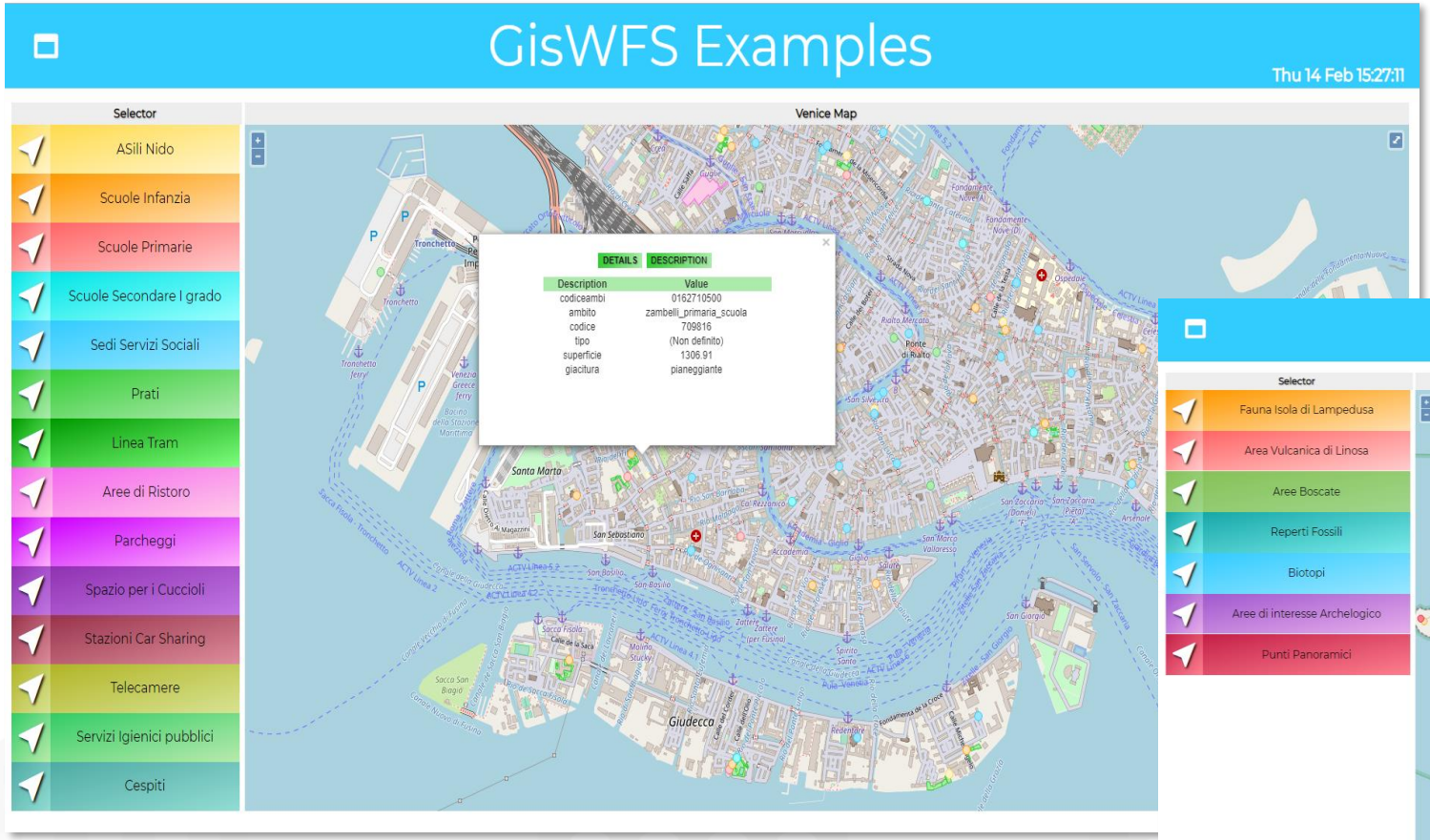
GIS WFS WMS connected

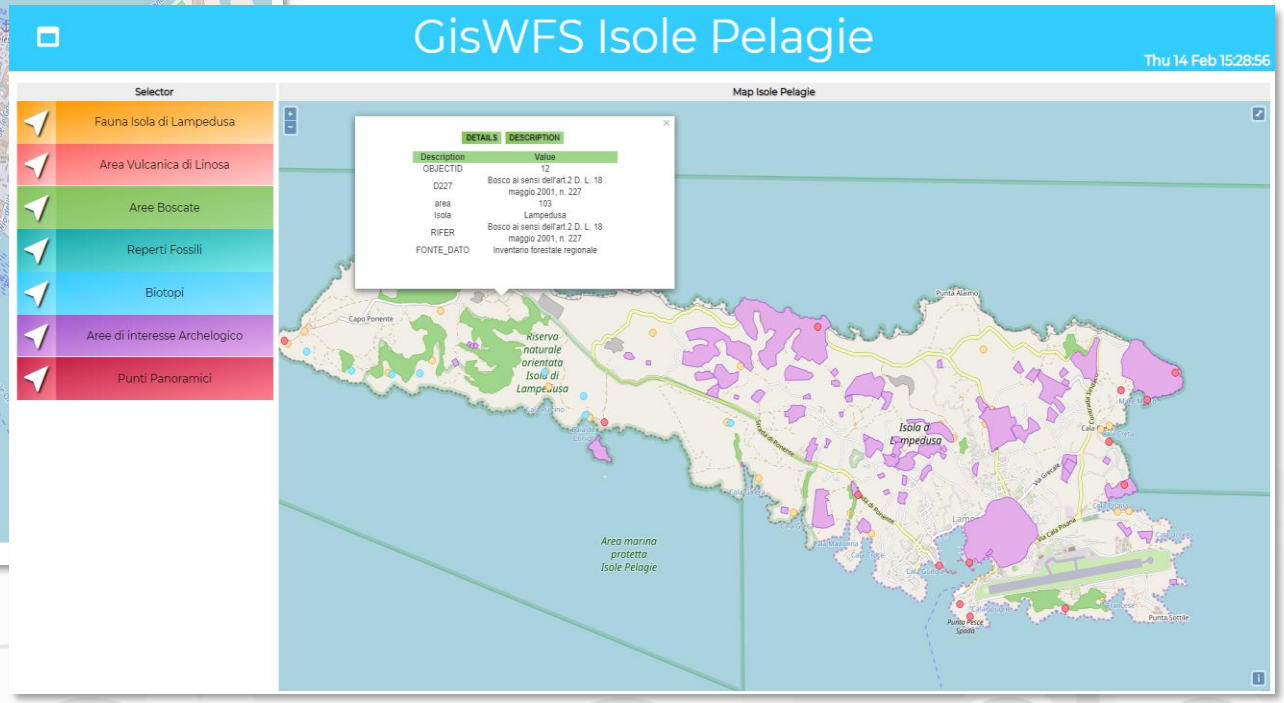
Sun 11 Nov 00:27:54



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

GIS data connection exploiting WFS/WMS map





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

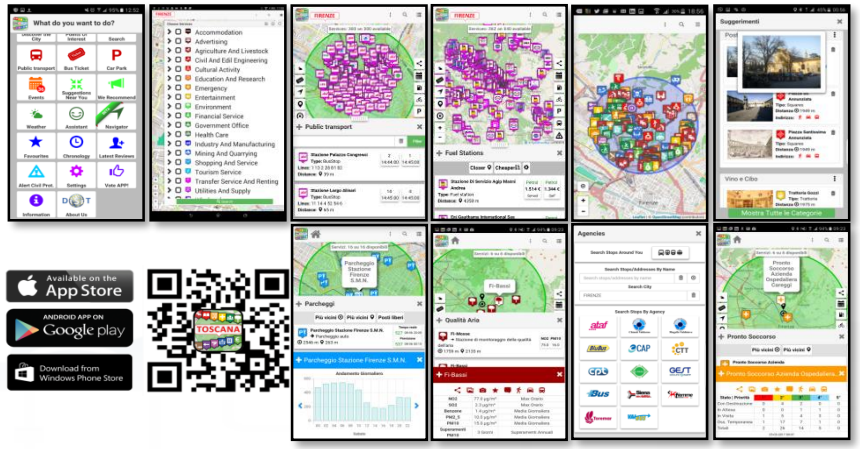
TOP

FORGING & MANAGING FLEXIBLE MOBILE APPS, Web Apps and MicroApplications

ARC
INDEX

Web and Mobile App Developers, to generate

Mobile Apps

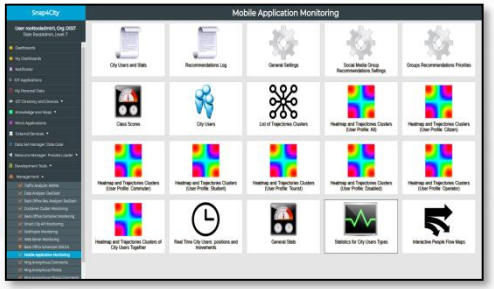


Web App HTML5

Embed into Web pages

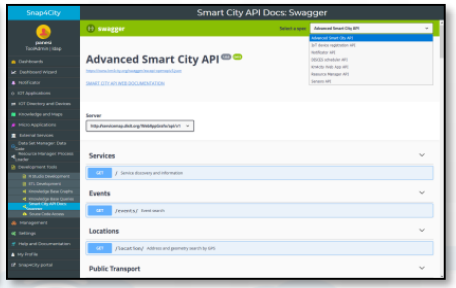
City User

Advanced Smart City API

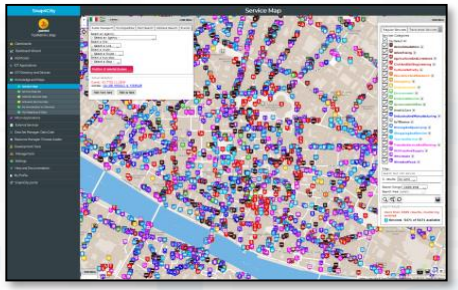


Mobile Application Monitoring Administrator

Km4City Open Source examples dev. tool kit



Swagger



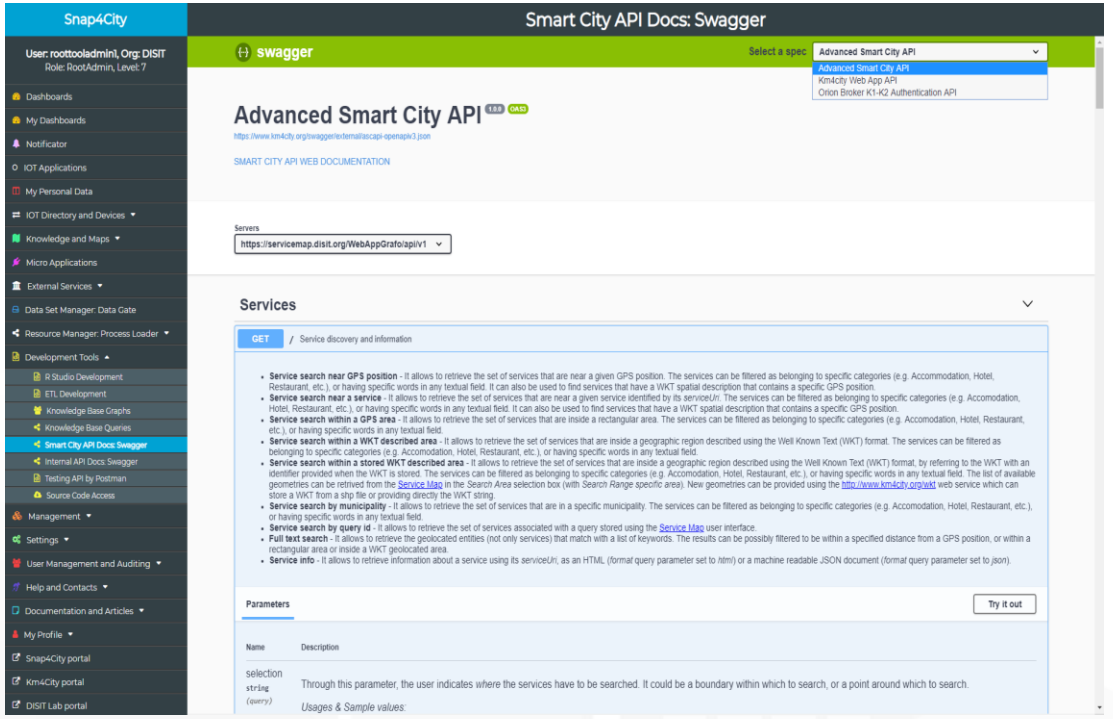
ServiceMap

Developer

Advanced SmartCity API

- Search data: by text, near, along, etc.
  - Resolving text to GPS and formal city nodes model
- Empowering city users: contributions, suggestions, forum discussions, etc.
- Events: Entertainment, critical and mobility
- Public and Private Mobility & Transport, and predictions
- POIs, Cultural and Touristic info
- Health services and predictions
- Environmental information, heatmaps; values
- Profiled Suggestions to City Users
- Traffic flow reconstruction
- Personal Assistant: PAVAL
- User Engagement: goal experiences, and assessment
- *Sharing knowledge among cities → see Knowledge base Management*

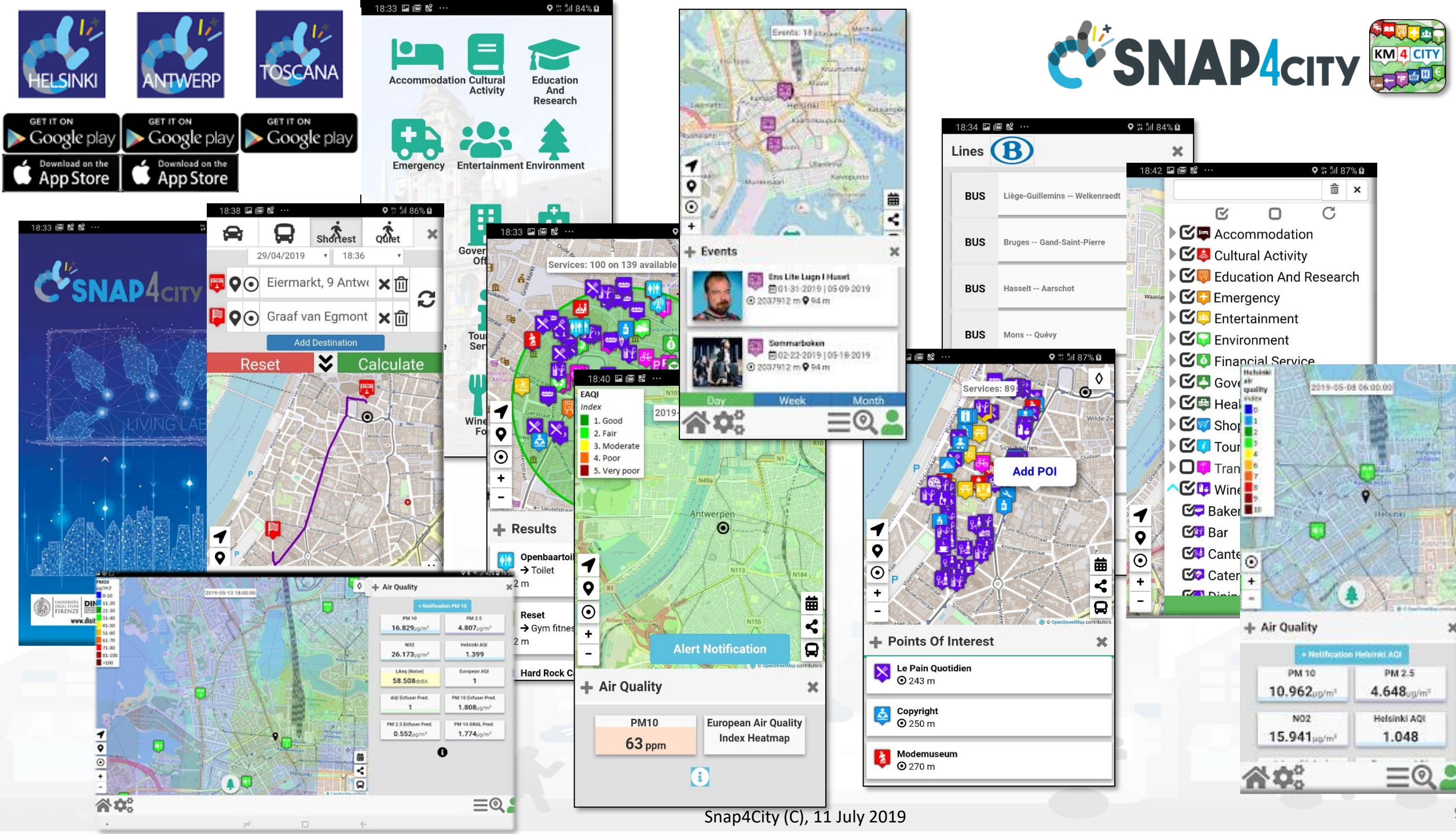
Swagger



Web and Mobile App with Open Development Kit

ARC

INDEX


HELSINKI
ANTWERP
TOSCANA
GET IT ON Google play
Download on the App Store
SNAP4CITY
KM 4 CITY
Accommodation
Cultural Activity
Education And Research
Emergency
Entertainment
Environment
Shortest
Quiet
Add Destination
Reset
Calculate
Events
Day
Week
Month
Services: 100 on 139 available
EAQI
Index
1. Good
2. Fair
3. Moderate
4. Poor
5. Very poor
Results
Antwerpen
Alert Notification
Air Quality
PM10
63 ppm
European Air Quality Index Heatmap
Lines
BUS
Liège-Guillemins -- Welkenraedt
Bruges -- Gand-Saint-Pierre
Hasselt -- Aarschot
Mons -- Quévy
Add POI
Points Of Interest
Le Pain Quotidien
243 m
Copyright
250 m
Modemuseum
270 m
Financial Service
Bar
Air Quality
PM 10
10.962
PM 2.5
4.648
NO2
15.941
Helsinki AQI
1.048

Mobile App Features

- **Discovery** POI/services
- **Search**: POI, streets, suggestions
- **Mobility and transport**: Pub/priv, routing, car position, time table, park, sharing, tickets, etc.
- **Environment and Weather**: values, sensors, heatmaps, notifications
- **Assistant, Forum, Developer Assistant**
- **Goal Experiences** (Engagement)
- **Personal** data, activities, POI, tracking, IOT App, Dashboards, etc.
- **Events**: entertainment, critical
- **Sharing** position and trajectories with friends
- **Monitoring** city and personal Dashboards
- **Personalized for Operators and Developers full control of their applications on cloud**

Understanding how City Users are using the City Services

ARC

INDEX

The App is a Bidirectional Device

- GPS Positions
- Selections on menus
- Views of POI
- Access to Dashboards
- searched information
- Routing
- Ranks, votes
- Comments
- Images
- Subscriptions to notifications
- ….

Produced information

- Accepted ?
- Performed ?
- …

Users

Derived information

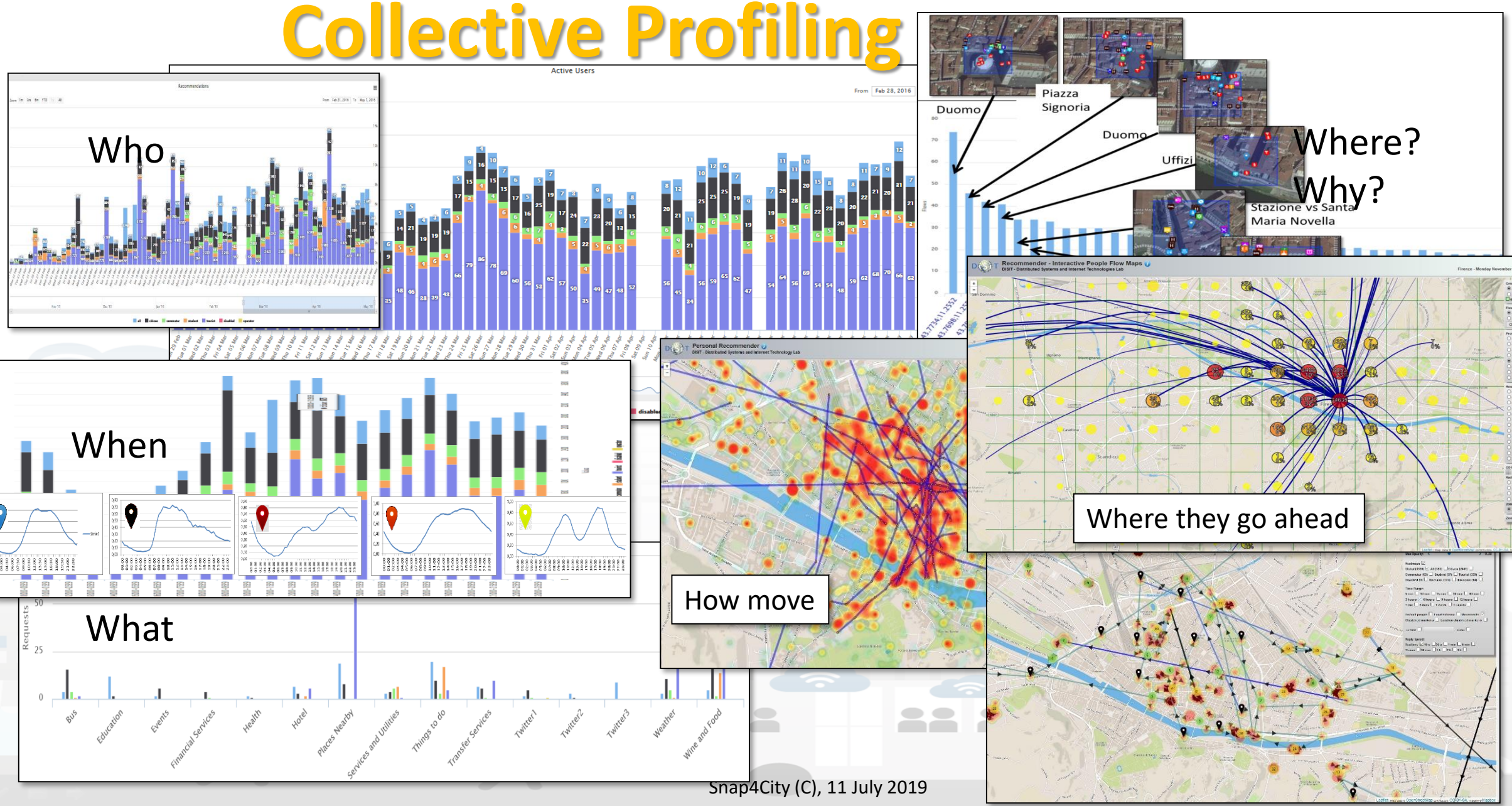
- Trajectories
- Hot Places by click and by move
- Origin destination matrices
- Most interested topics
- Most interested POI
- Delegation and relationships
- Accesses to Dashboards
- Requested information
- Routing performed
- …..

Produced information

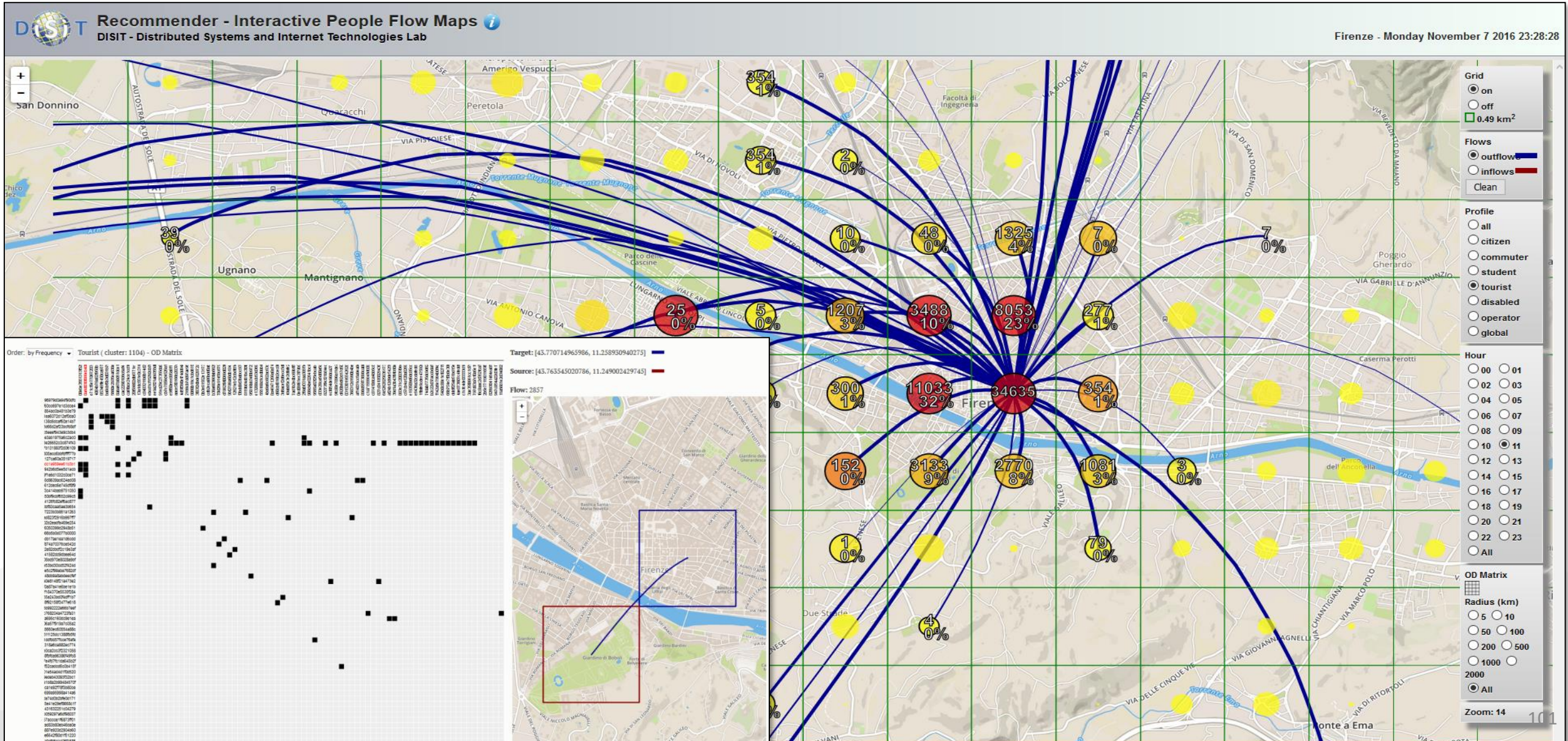
- Suggestions
- Engagements
- Notifications
- …

System

User Behavior Analyser for Collective Profiling

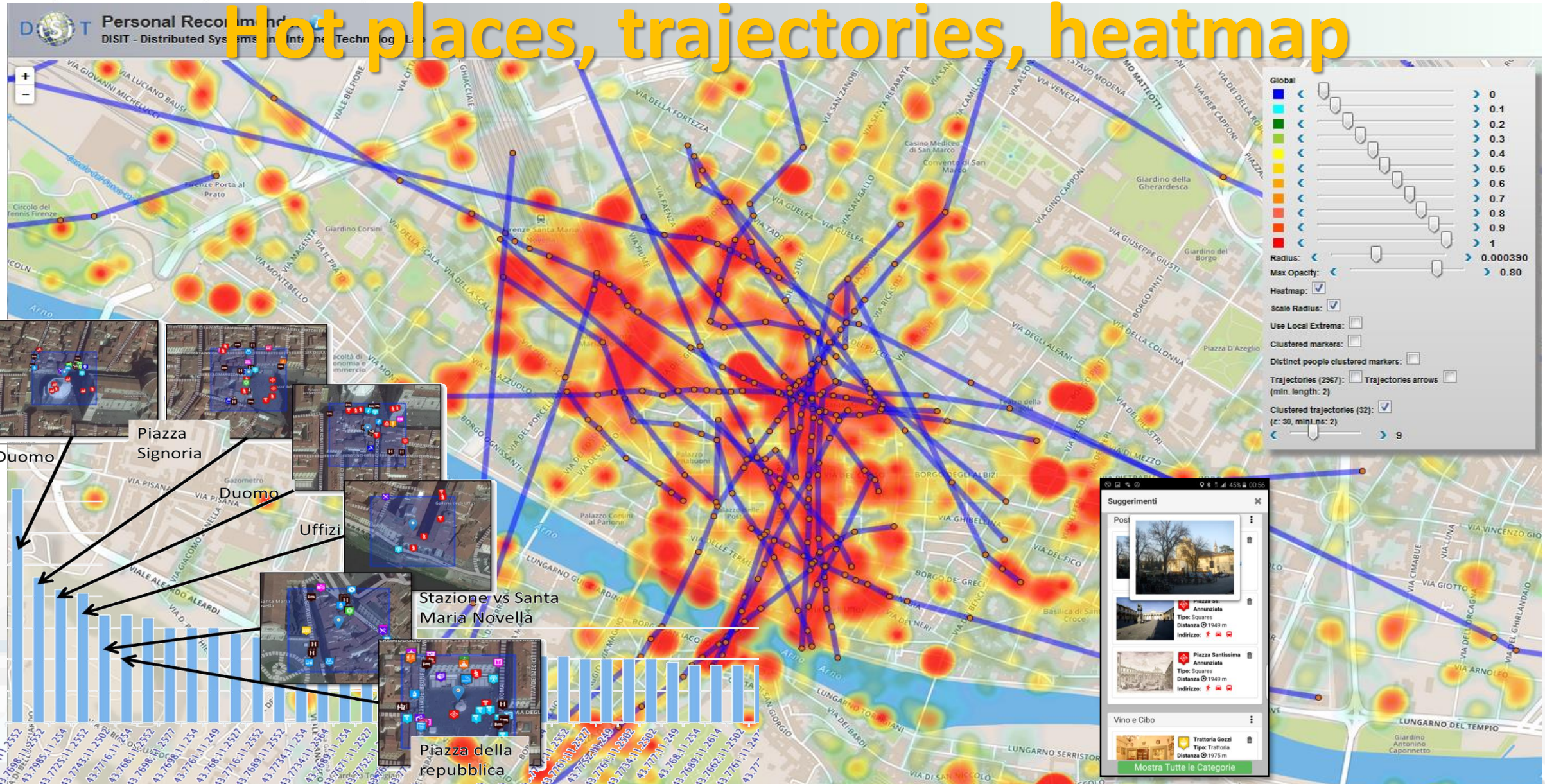


Scalable OD Matrix



User Behaviour Analyser

Hot places, trajectories, heatmap



Engaging City Users Towards Virtuous Behaviours (real time)

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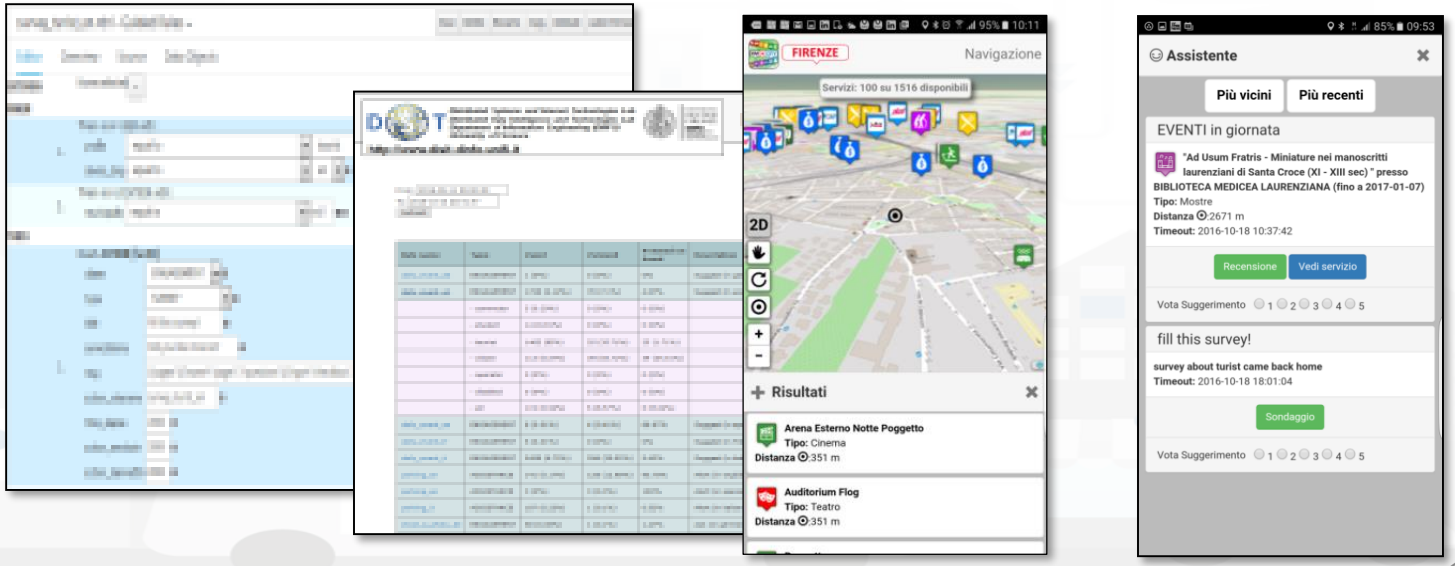
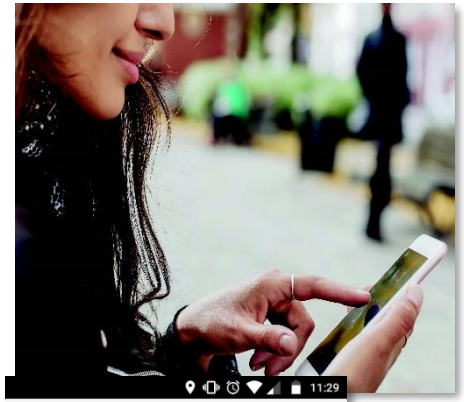
INDEX

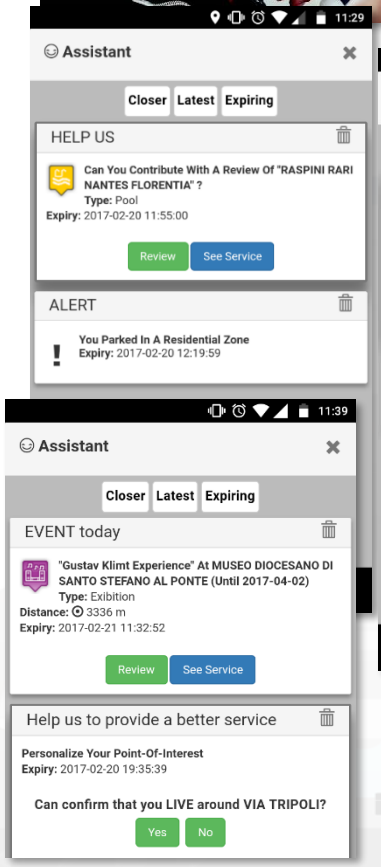
Profiled Engagements to City Users

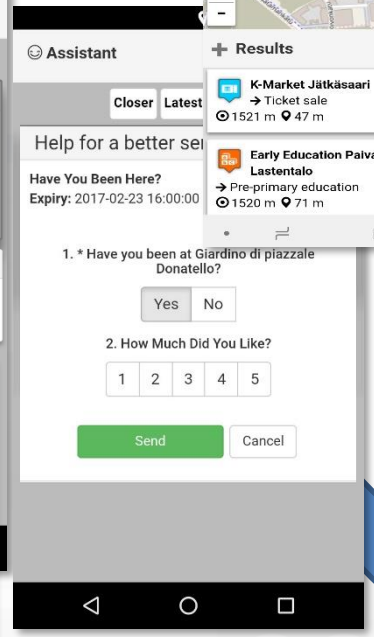
- The users are profiled to learn habits:
  - Personal POI, paths, Mobility habits
- Information and engagements sent to the users are programmed according to the context and user behavior to:
  - Stimulate virtuous habits
  - More sustainable habits
  - More healthy habits, etc.
  - Get feedbacks
  - Provide bonus and prices, …..
  - Send alerts, ….

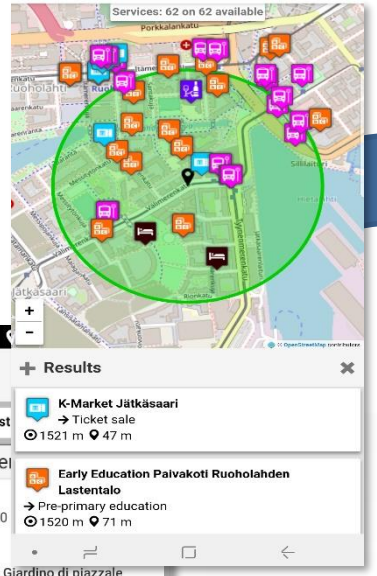


Users' Engagement

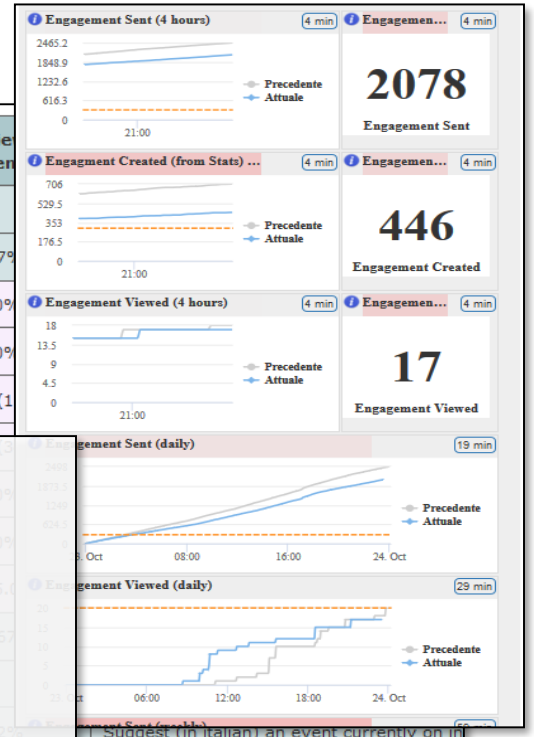








Rule name	Type	#sent	#viewed	#vie #sen
daily_event_de	ENGAGEMENT	1 (0%)	0 (0%)	0%
daily_event_en	ENGAGEMENT	1720 (2.12%)	70 (7.1%)	4.07%
	- commuter	5 (0.29%)	0 (0%)	0 (0%
	- student	14 (0.81%)	0 (0%)	0 (0%
	- tourist	1462 (85%)	25 (35.71%)	25 (1



Inform
- Air Quality forecast is not very nice
- You have parked out of your residential parking zone
- The Road cleaning is this night
- The waste in S.Andreas Road is full

Engage
- Provide a comment, a score, etc.

Stimulate / recommend
- Events in the city, services you may be interested, etc..

Provide Bonus, rewards if needed
- you get a bonus since you parked here
- We suggest: leave the car out of the city, this bonus can be used to by a bus ticket

Suggest (in italian) an event currently on in
Alert (in english) if the user parked in a res
Alert (in spanish) if the user parked in a res
Alert (in italian) if the user parked in a resid
Ask (in german) a contribution for a nearby

User context

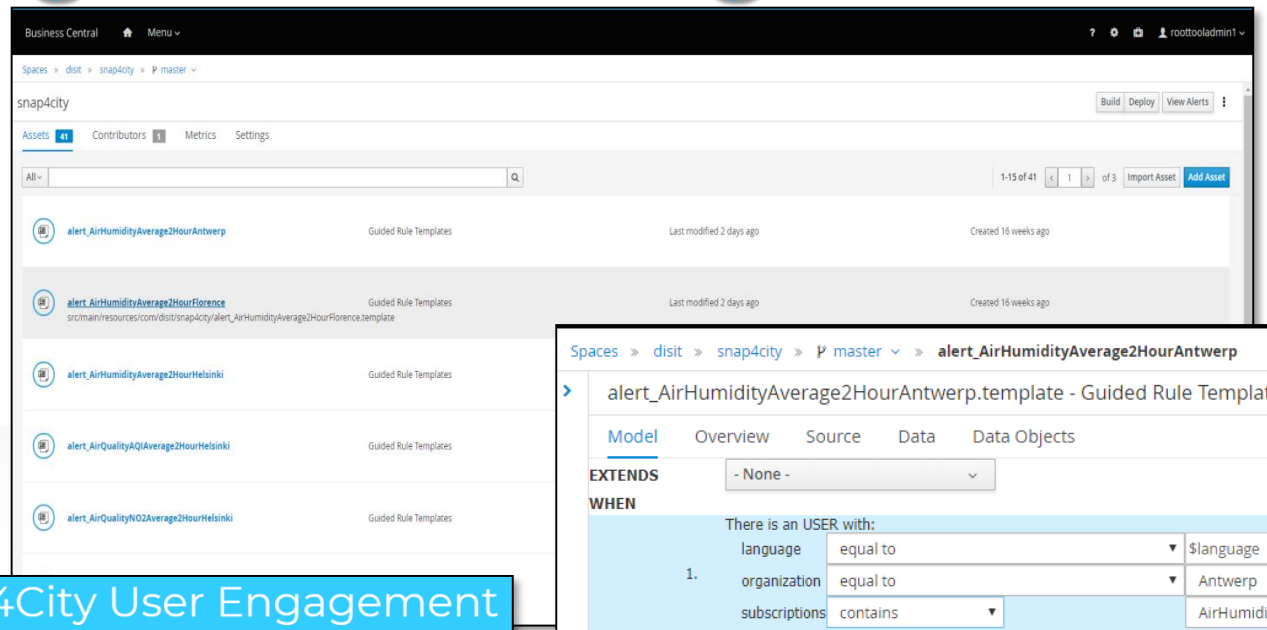
Rules

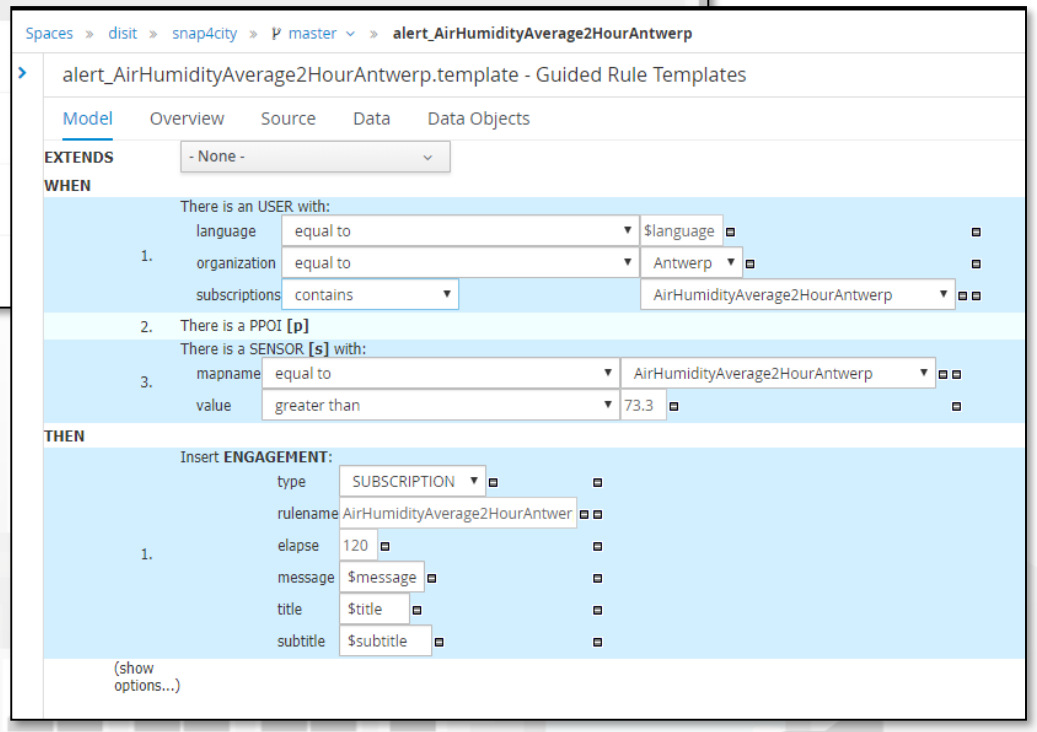
City context

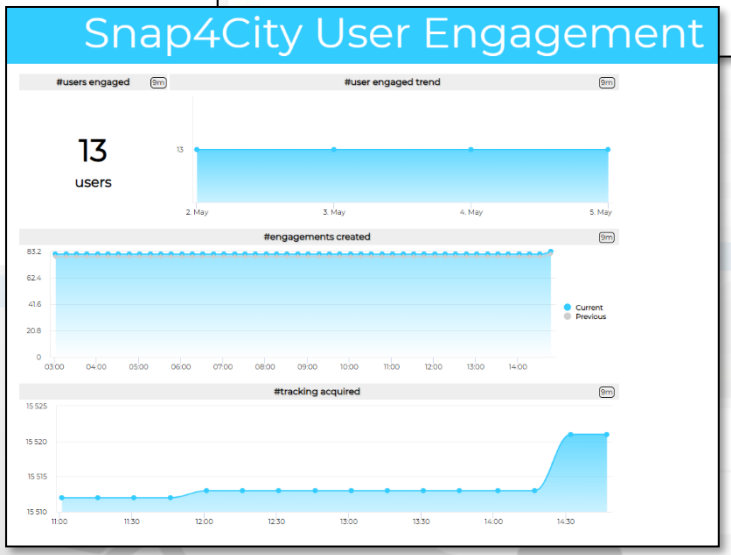
Campaing on Sustainable Mobility

Engagement Manager

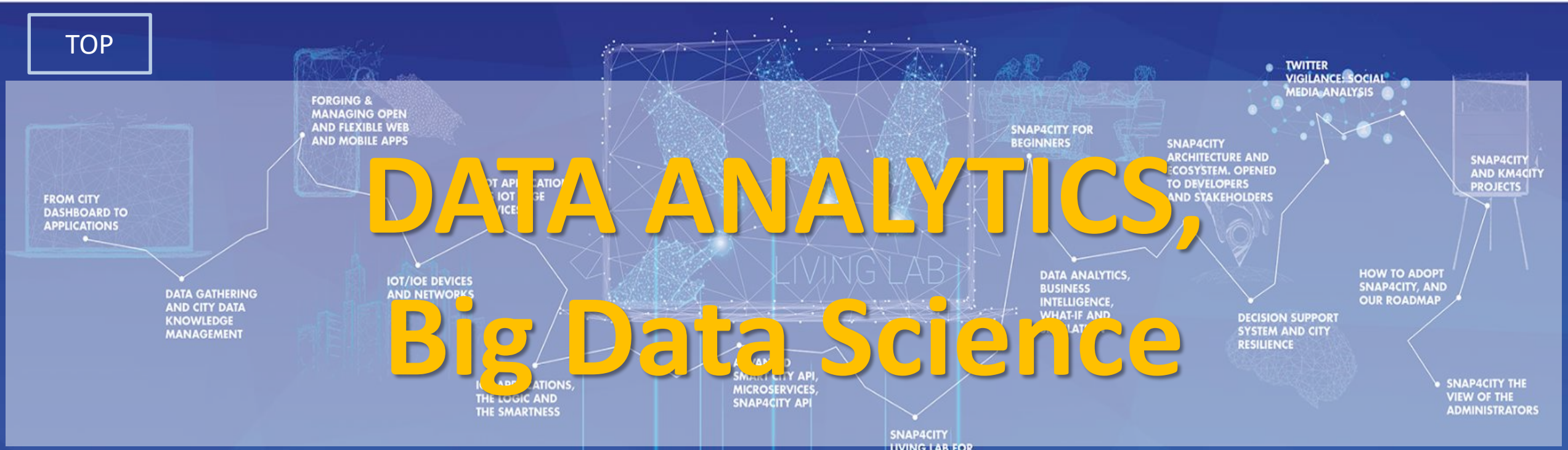
- Definition of Rules for campaigns
- Monitoring and follow-up for each City
- Segmented for user kind and interest







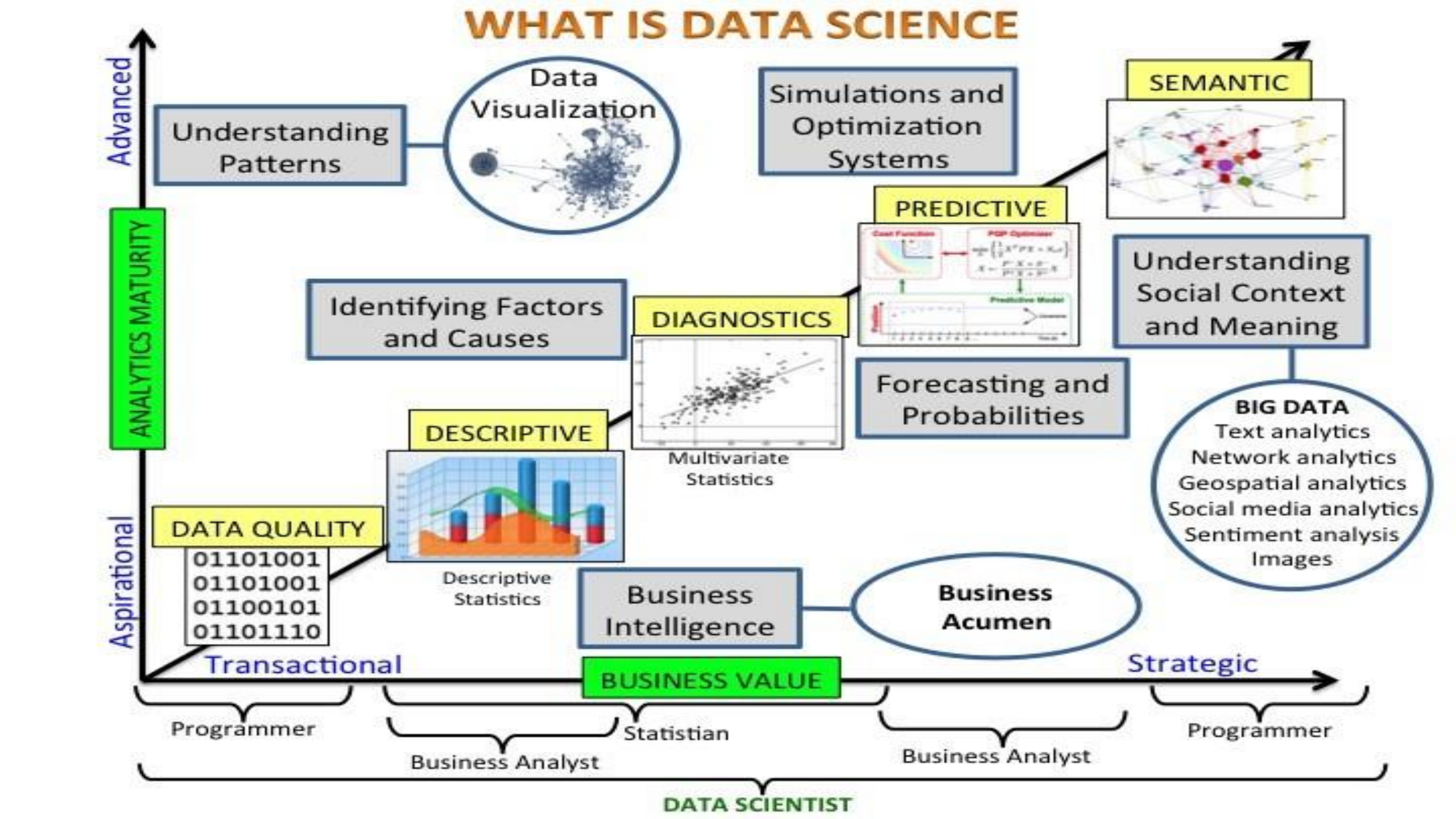
TOP



DATA ANALYTICS, Big Data Science

ARC
INDEX

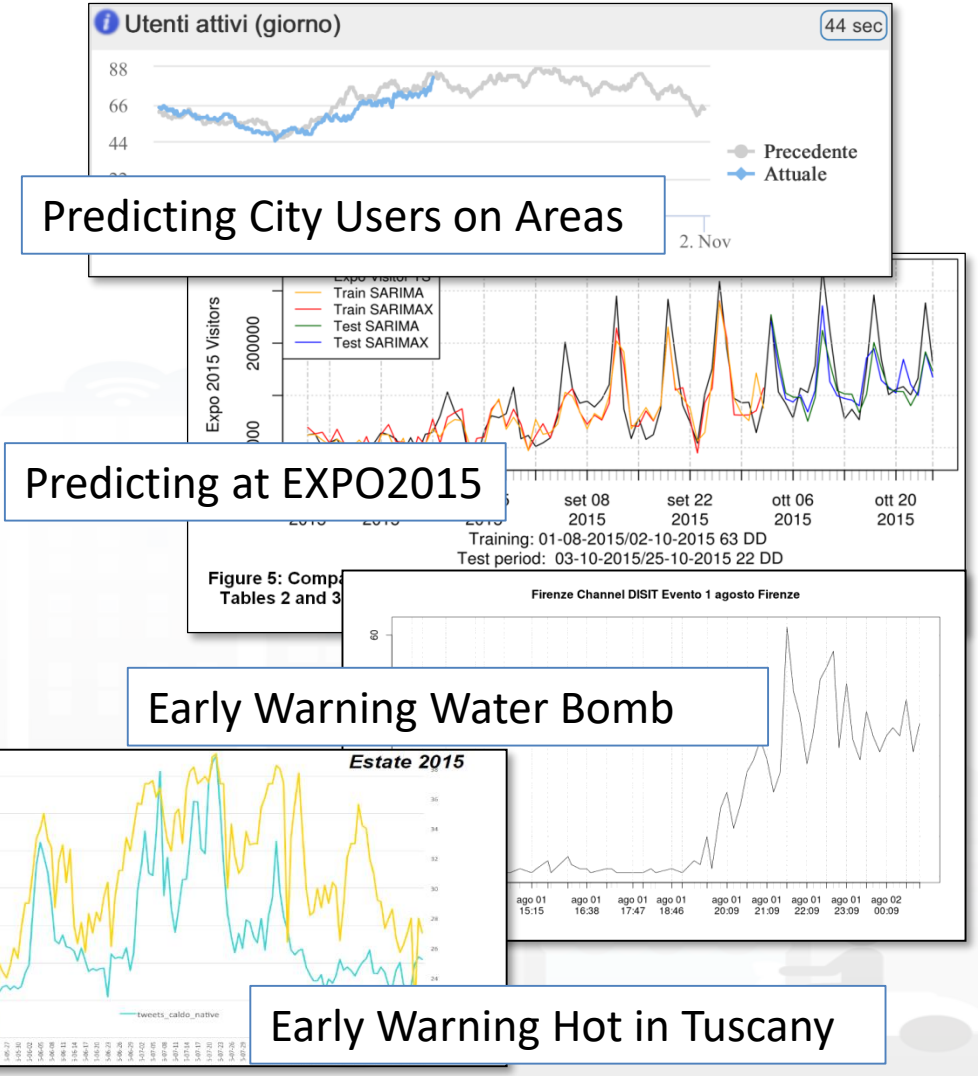
WHAT IS DATA SCIENCE



Data Analytics: Predictions

Predicting Models for Administrators & City Users

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



Smart Parking: predictions

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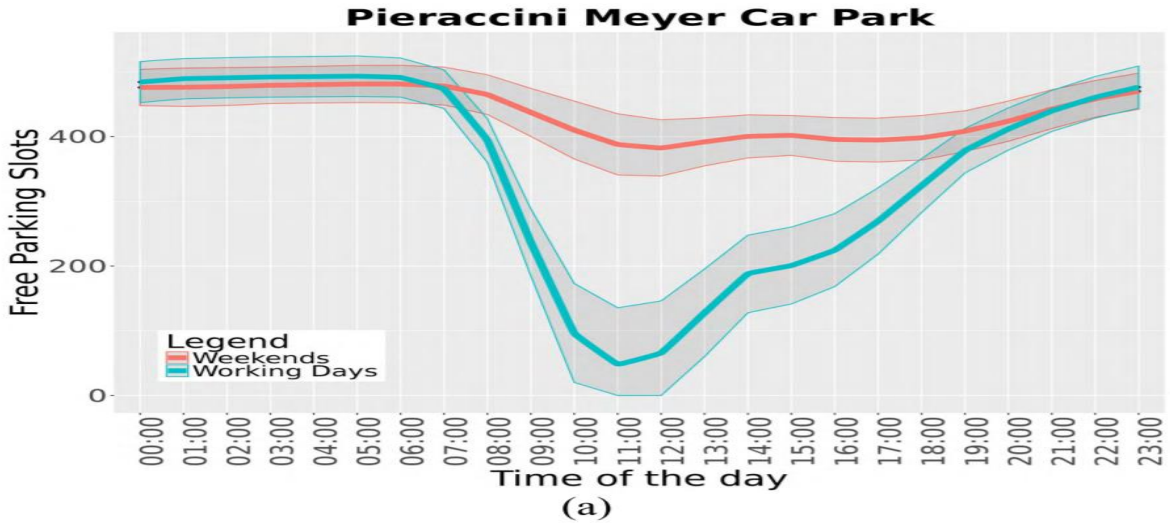
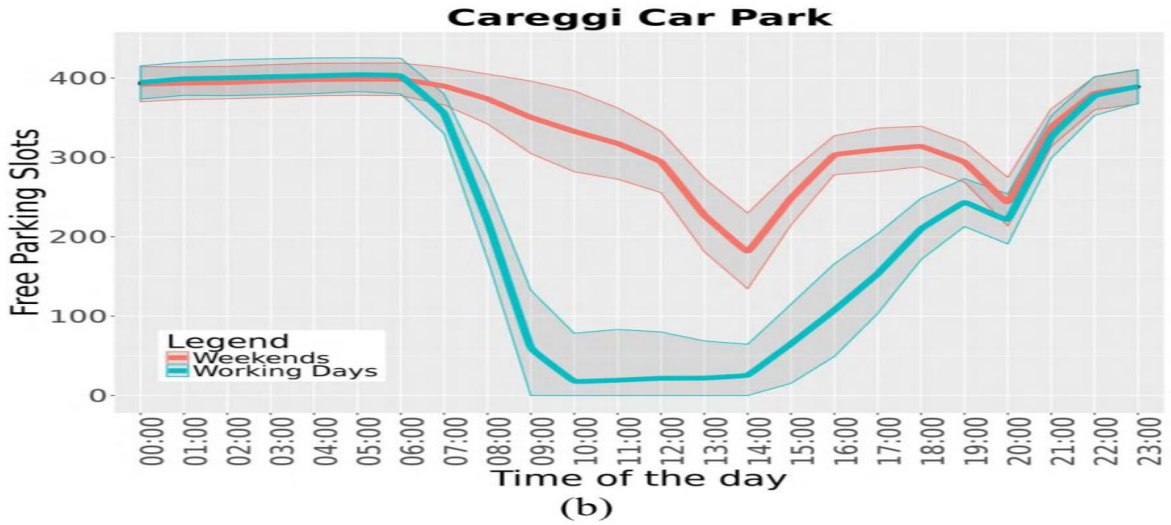
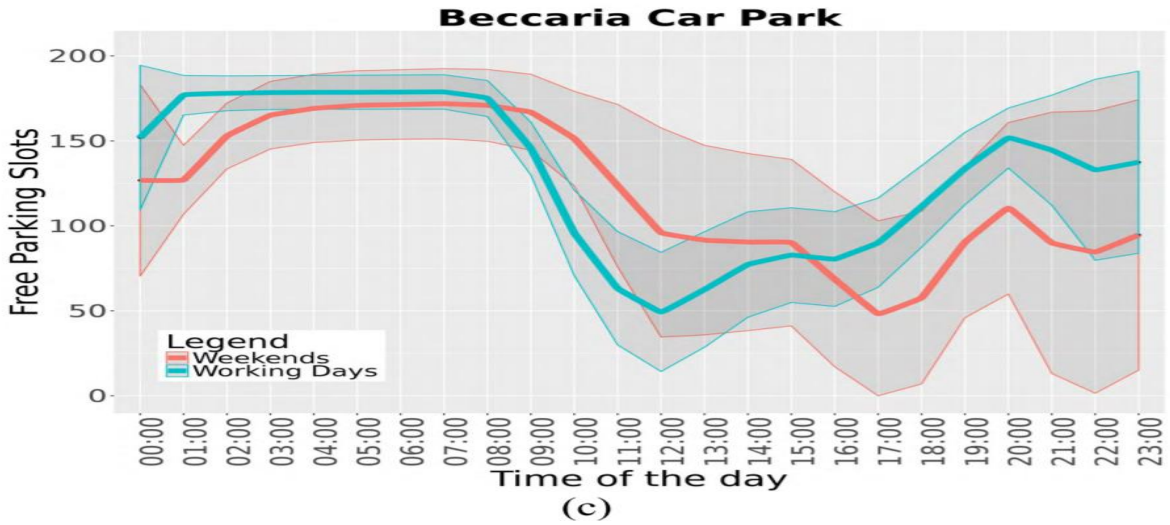
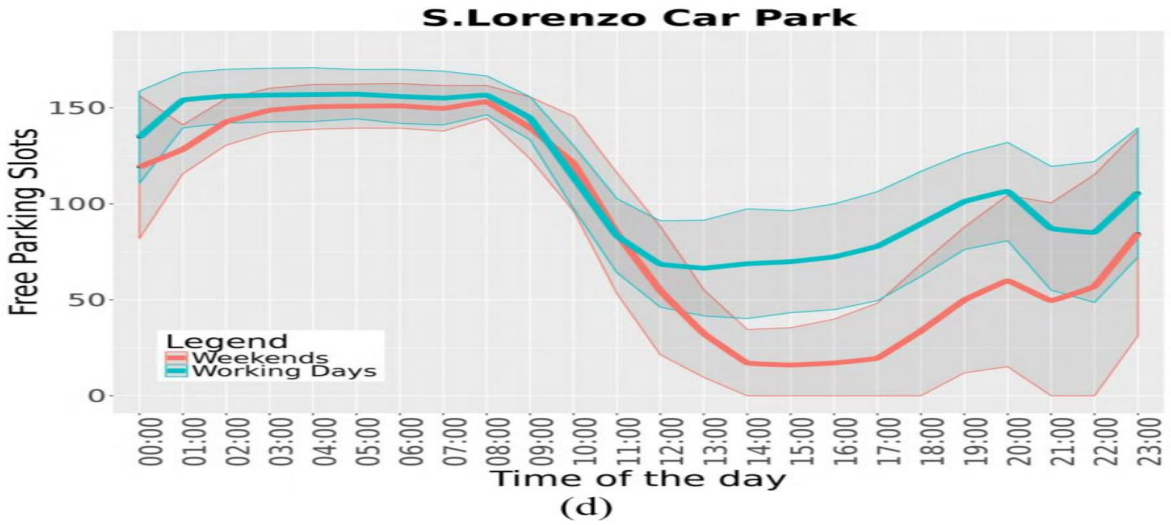
INDEX

Free Parking space trends









12 parking areas in Florence

Free Parking Predictions

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

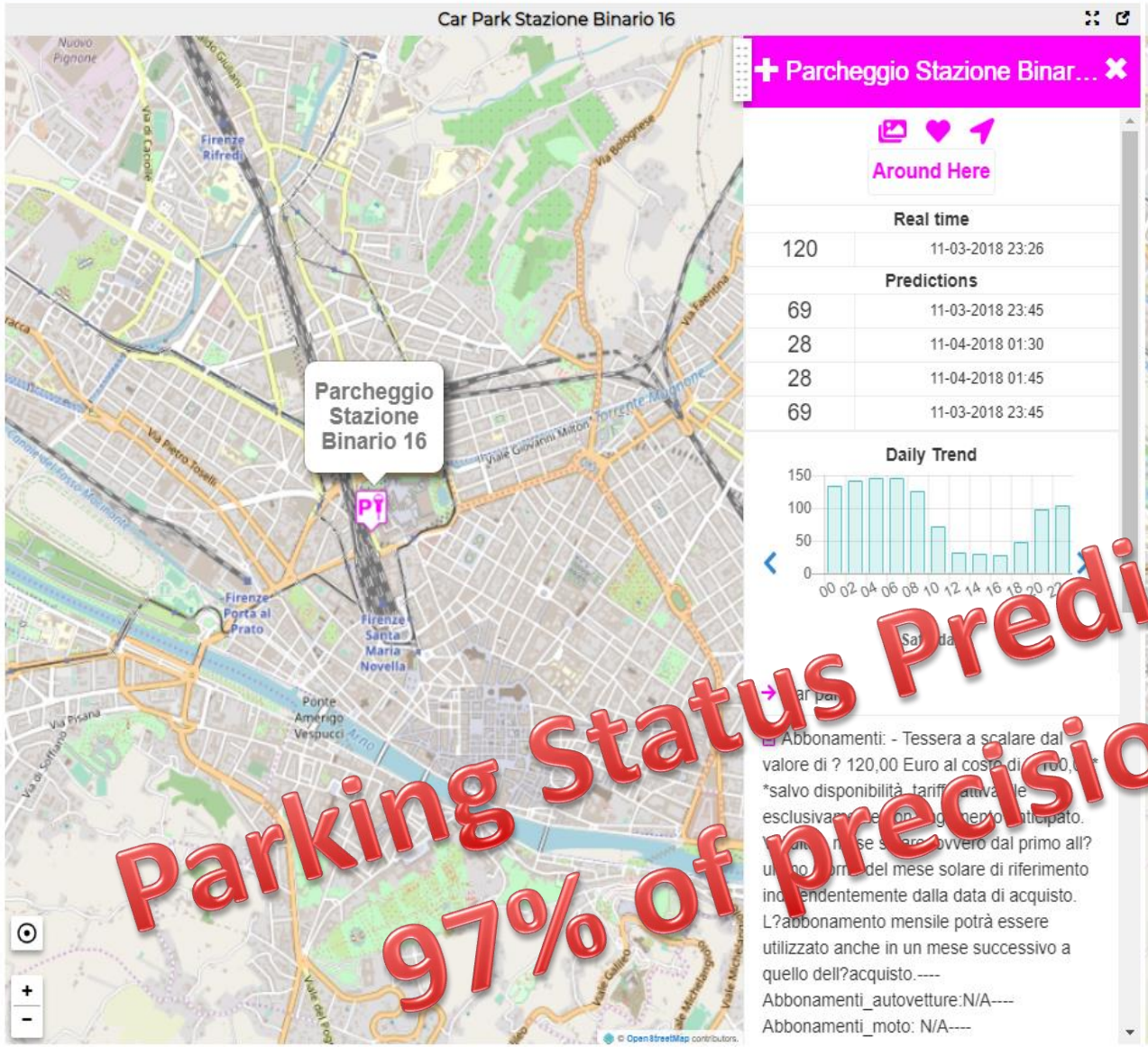
Active on Mobile Apps as:

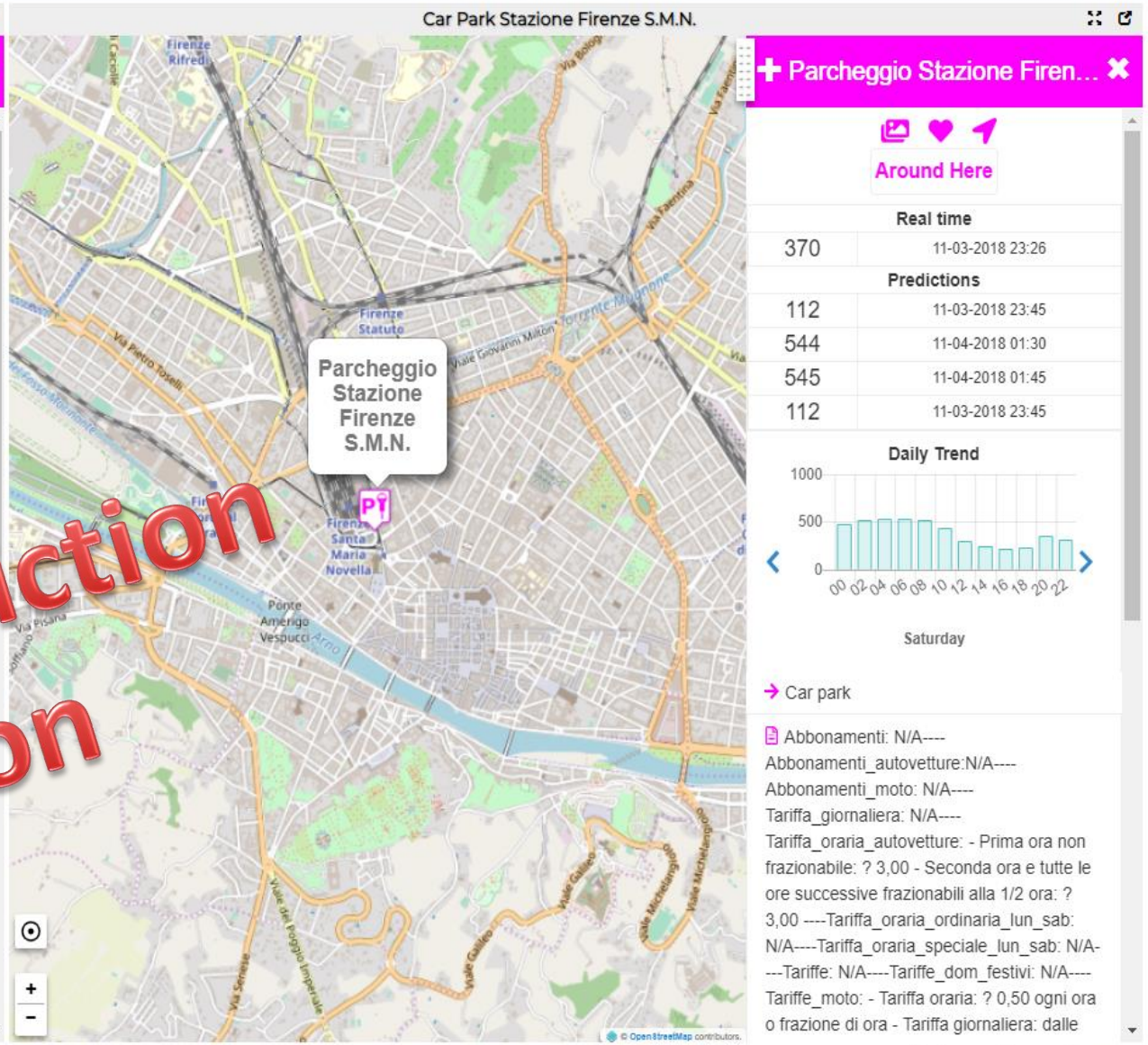
- «Firenze dove cosa»
- «Toscana dove cosa»

Precision: 97,5%

Monitoring Station for Parking

Sat 3 Nov 23:39:55





Parking Status Prediction 97% of precision

https://www.disit.org/dashboardSmartCity/view/index.php?iddasboard=MjQ2

User Behaviour Analysis via Wi-Fi, OD Matrices, Trajectories

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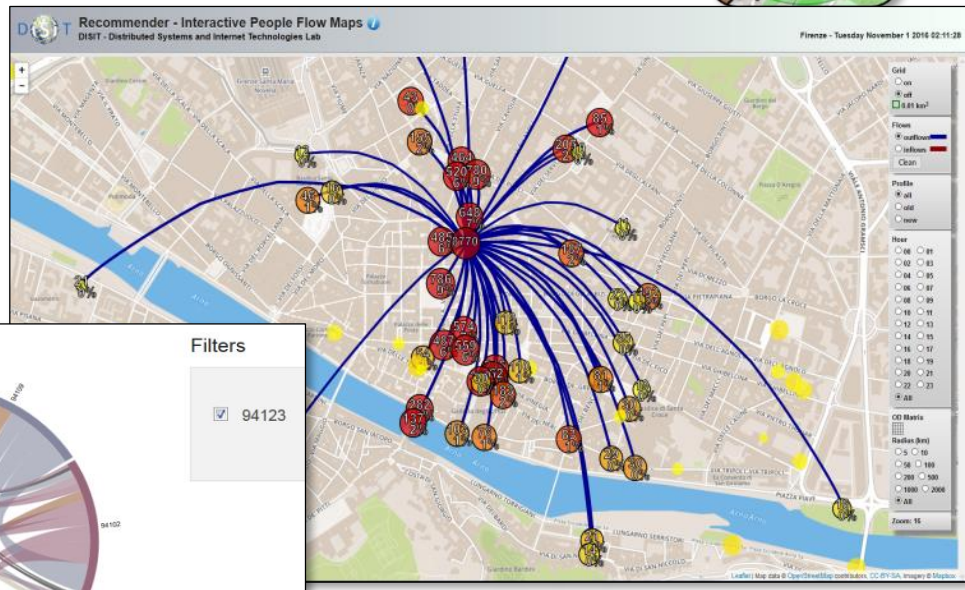
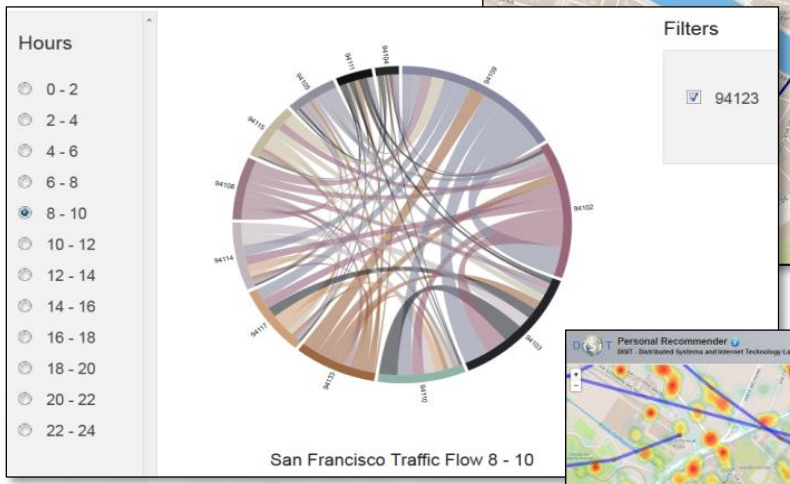
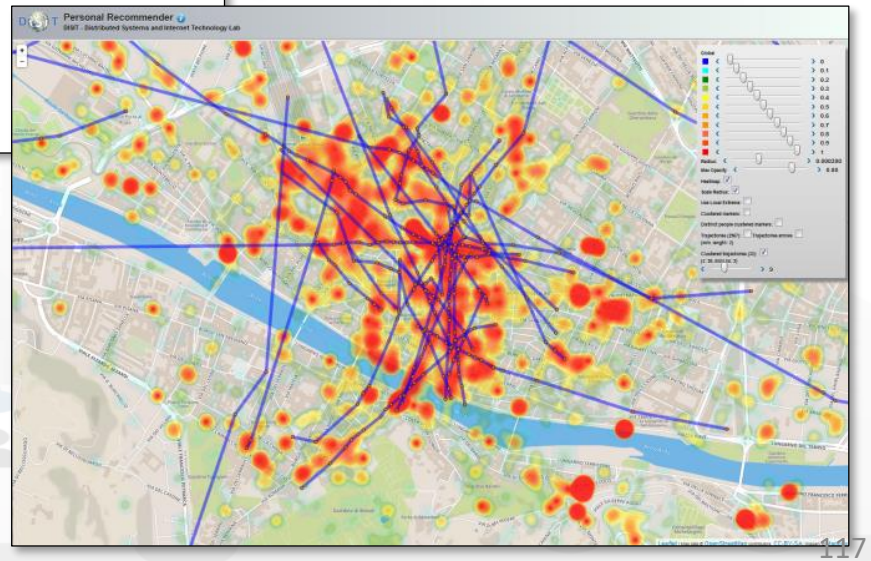
INDEX

User Behaviour Analysis

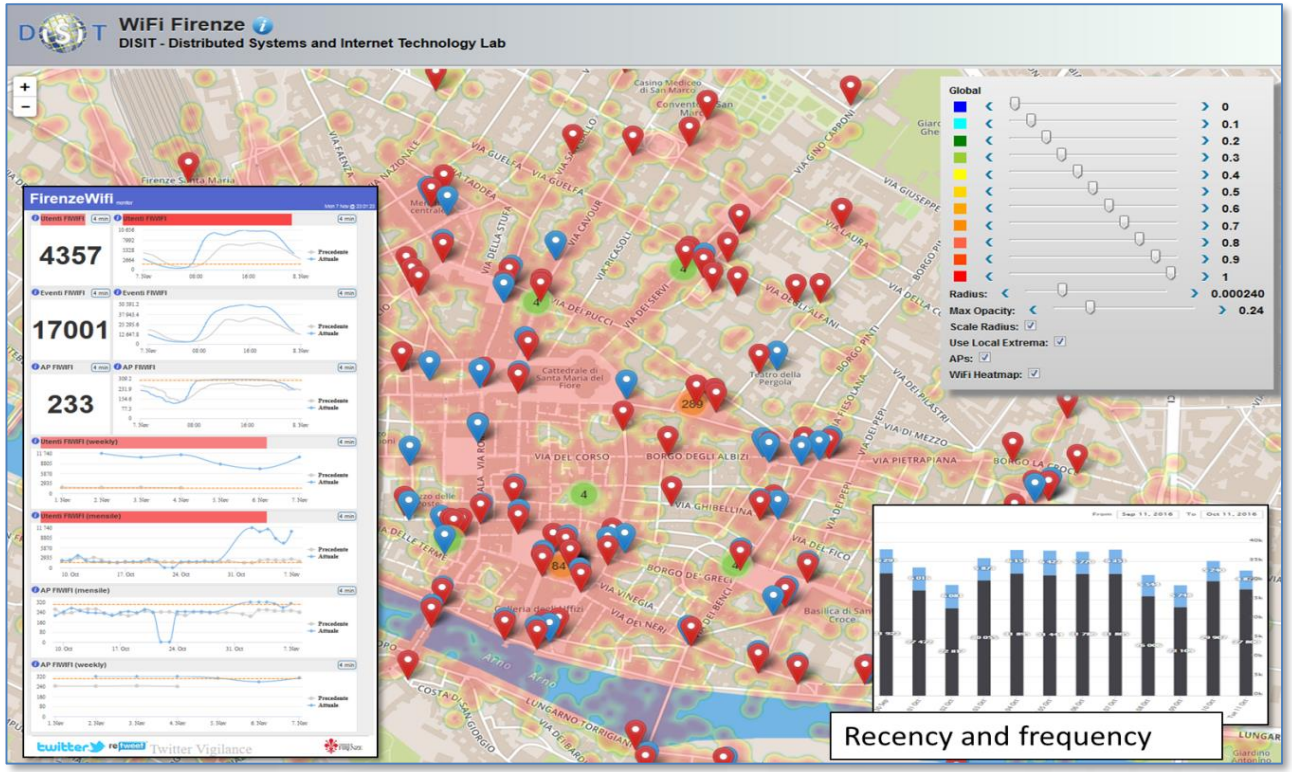
- **Monitoring movements by traffic flow sensors**
  - Spires and virtual spires
- **Monitoring movements from Mobile Cells**
  - Unsuitable for precise tracking and OD production
- **Monitoring movements from Wi-Fi**
- **Monitoring movements** and much more from mobile Apps

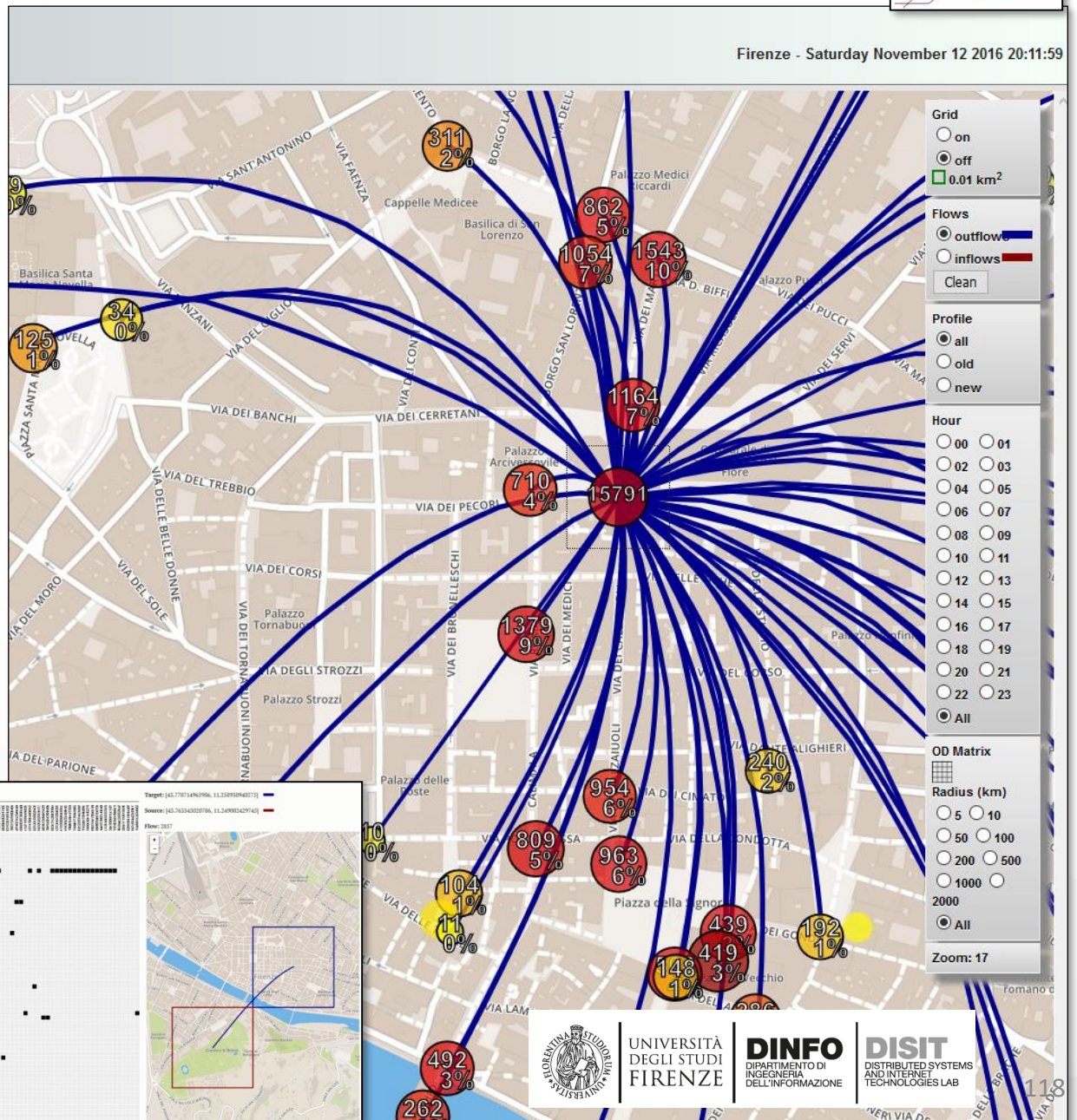




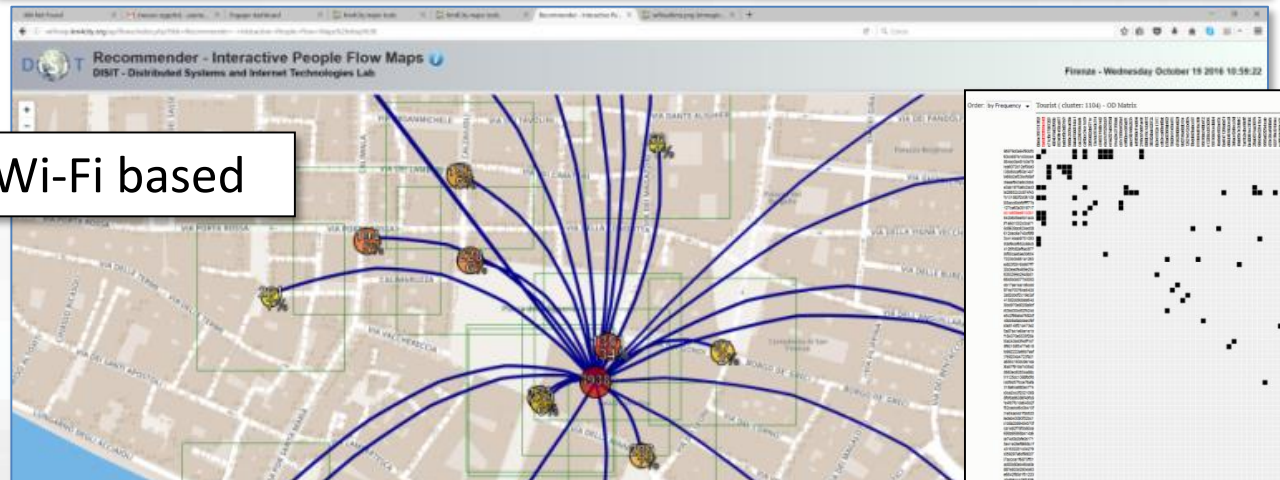


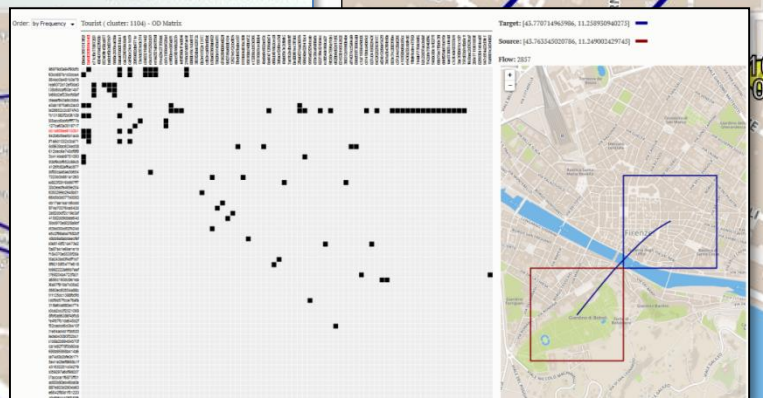
Origin Destination Matrix Estimation





Wi-Fi based





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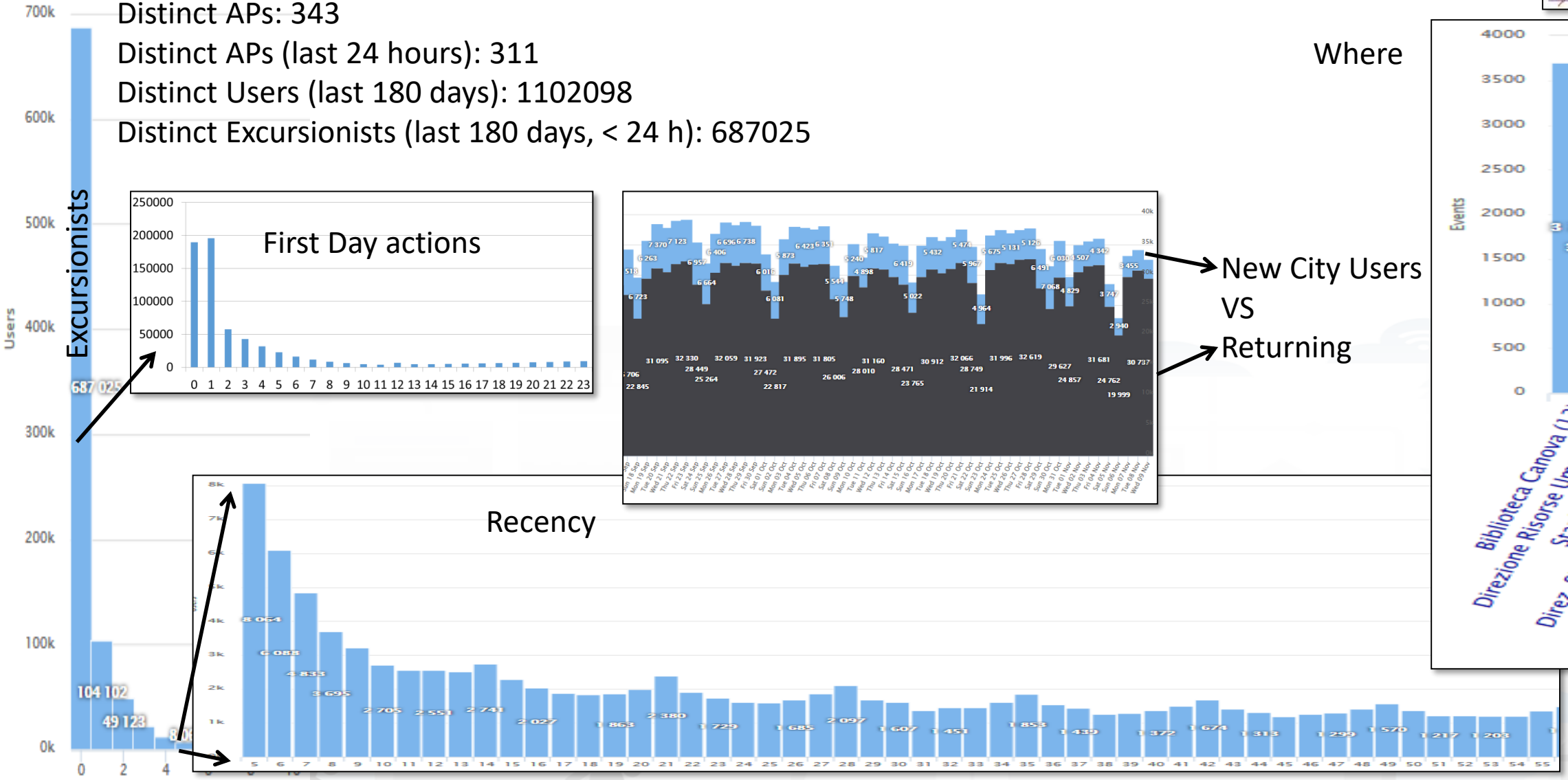
User Behaviour Analysis

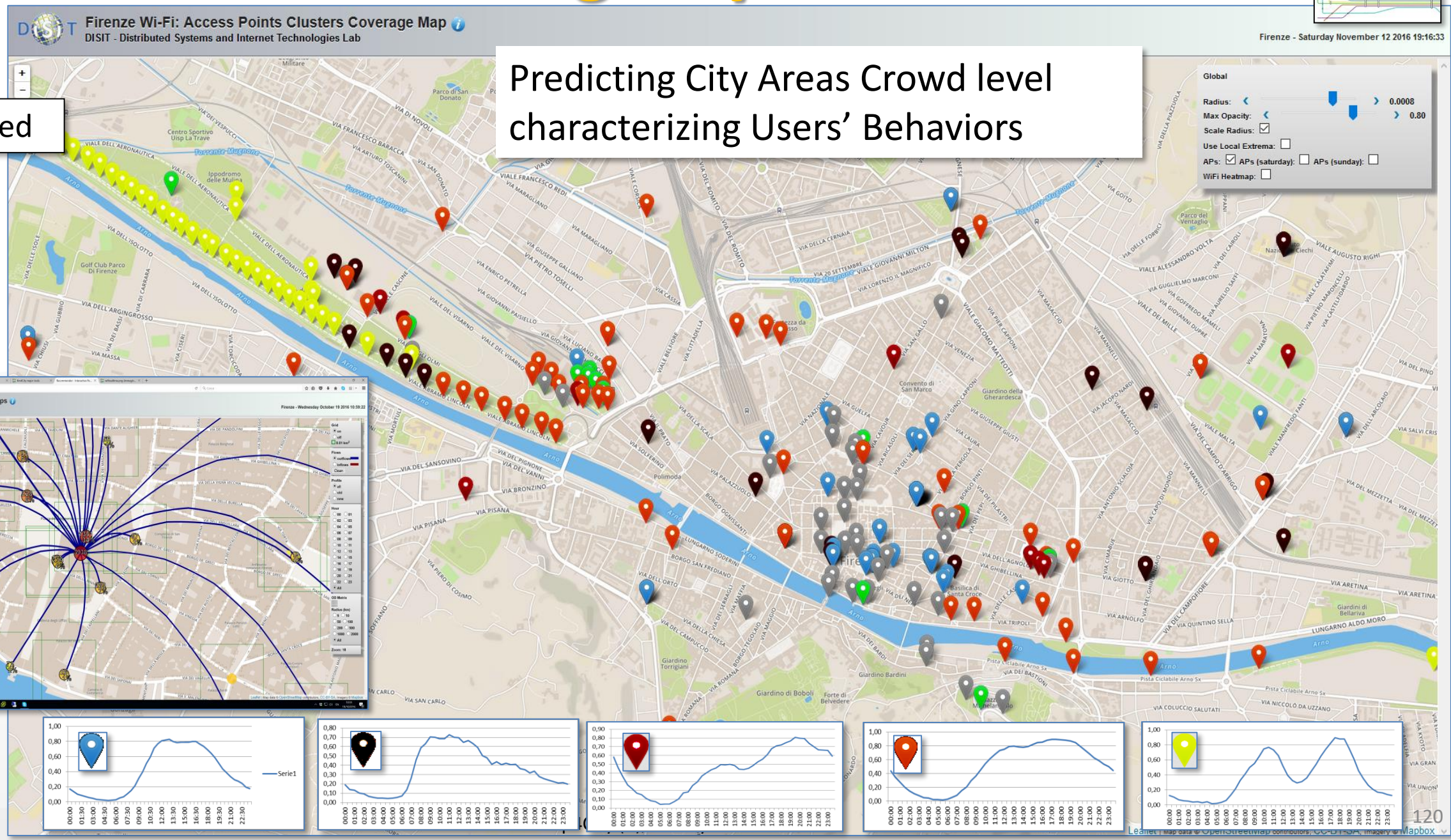
Distinct APs: 343
Distinct APs (last 24 hours): 311
Distinct Users (last 180 days): 1102098
Distinct Excursionists (last 180 days, < 24 h): 687025



Characterizing City Areas

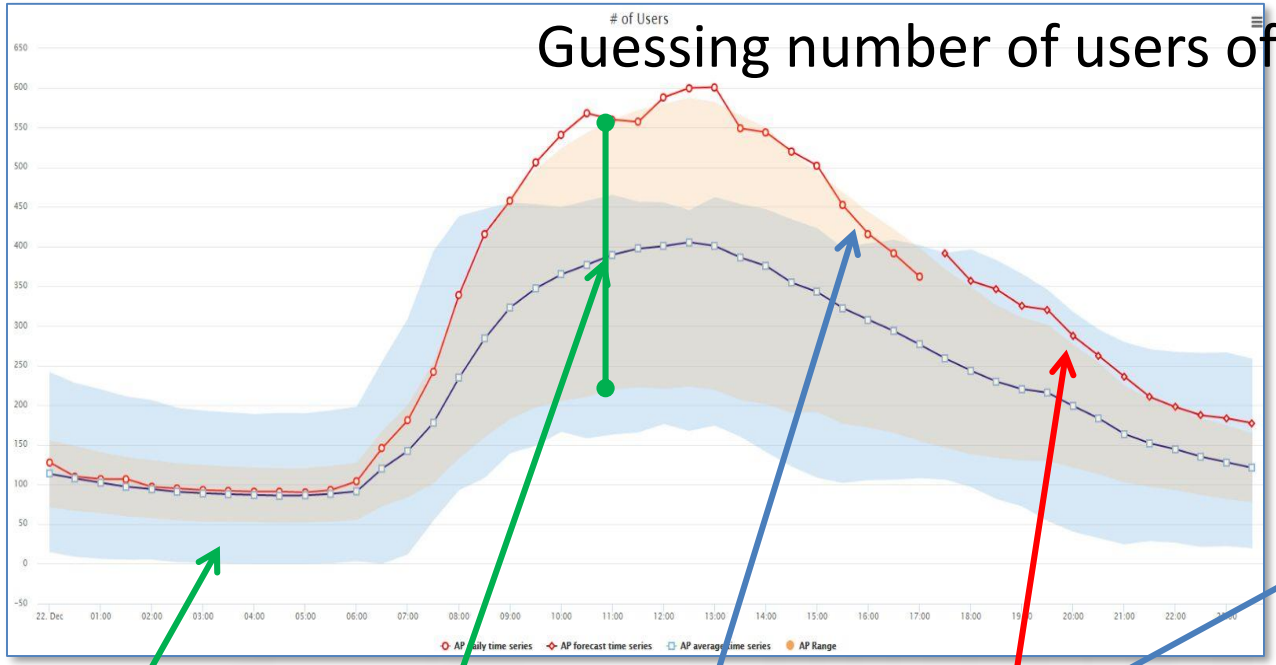
Wi-Fi based

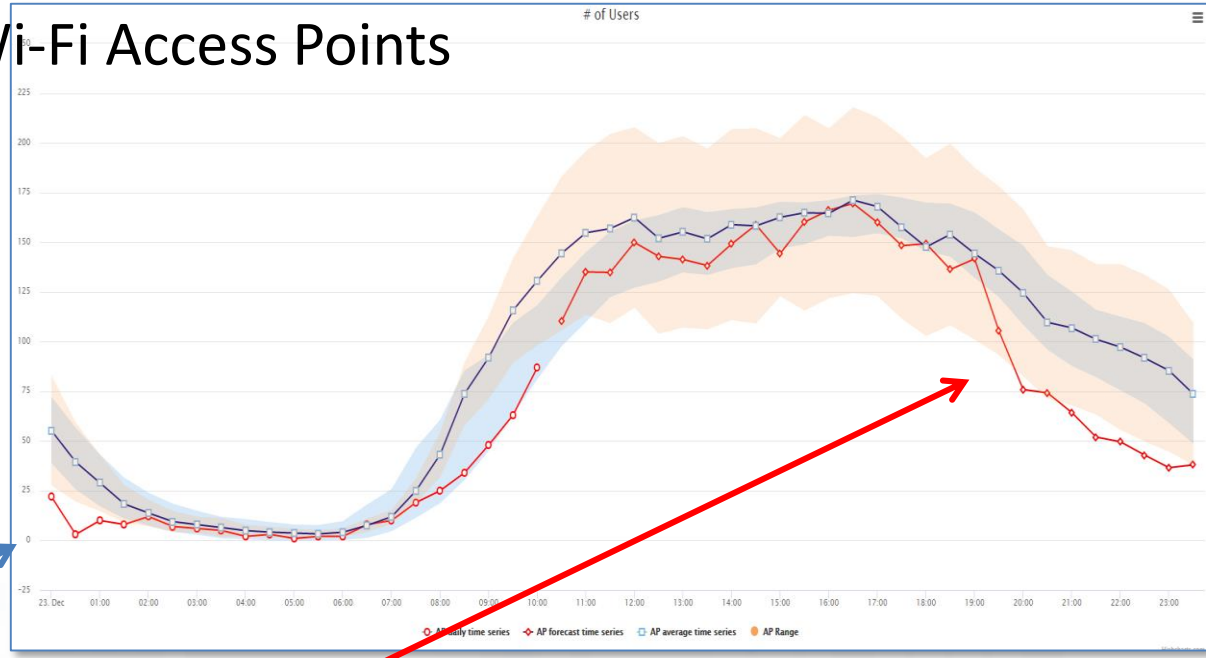
Predicting City Areas Crowd level characterizing Users' Behaviors



Prediction and Identification of Anomalies

Guessing number of users of Wi-Fi Access Points





Cluster confidence

AP average and confidence

Actual AP trend for today

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

Predictive precision of the 95%

Quality of Public Transport

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INDEX

Qualità Trasporto Pubblico - Cloned

Firenze - 6 linee

Sat 22 Jun 07:45:48

Linea 13

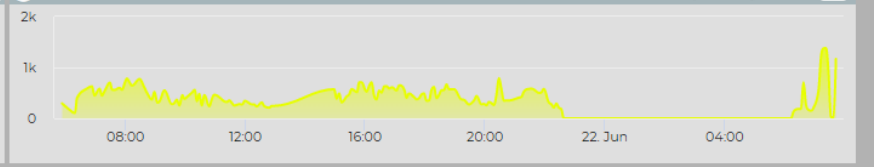
825

Ritardo medio corse attive nei 5min in sec

Linea 31

1166

Ritardo medio corse attive nei 5min in sec



Linea 17

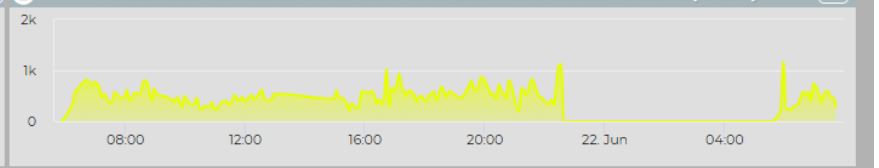
222

Ritardo medio corse attive nei 5min in sec

Linea 36

289

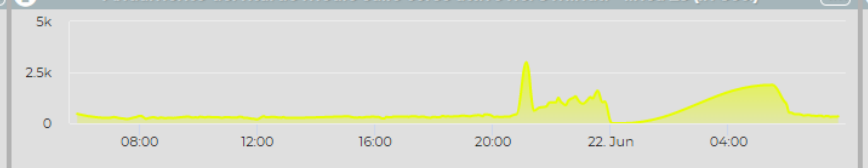
Ritardo medio corse attive nei 5min in sec



Linea 23

337

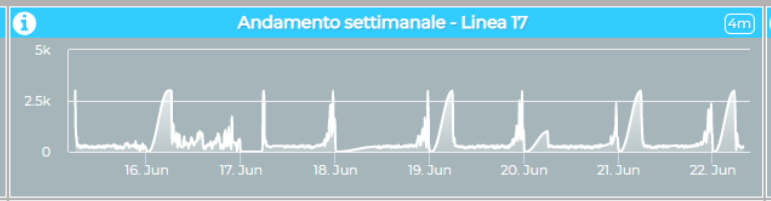
Ritardo medio corse attive nei 5min in sec

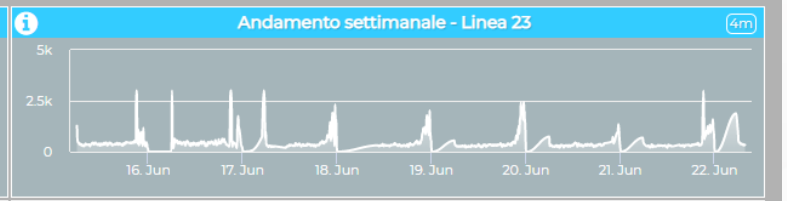


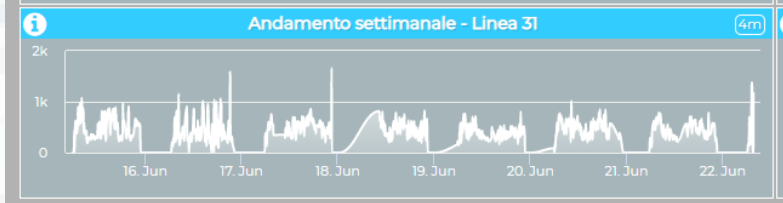
Linea 6

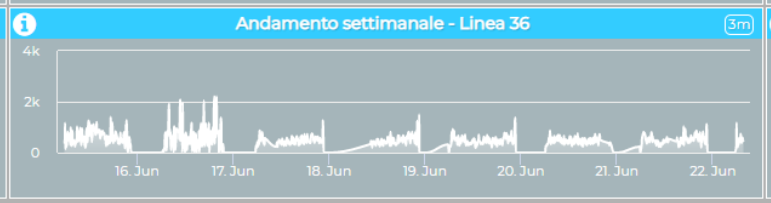
411

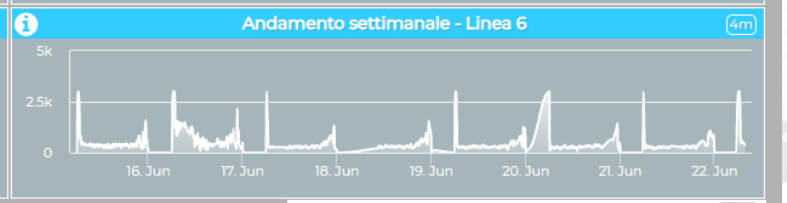
Ritardo medio corse attive nei 5min in sec









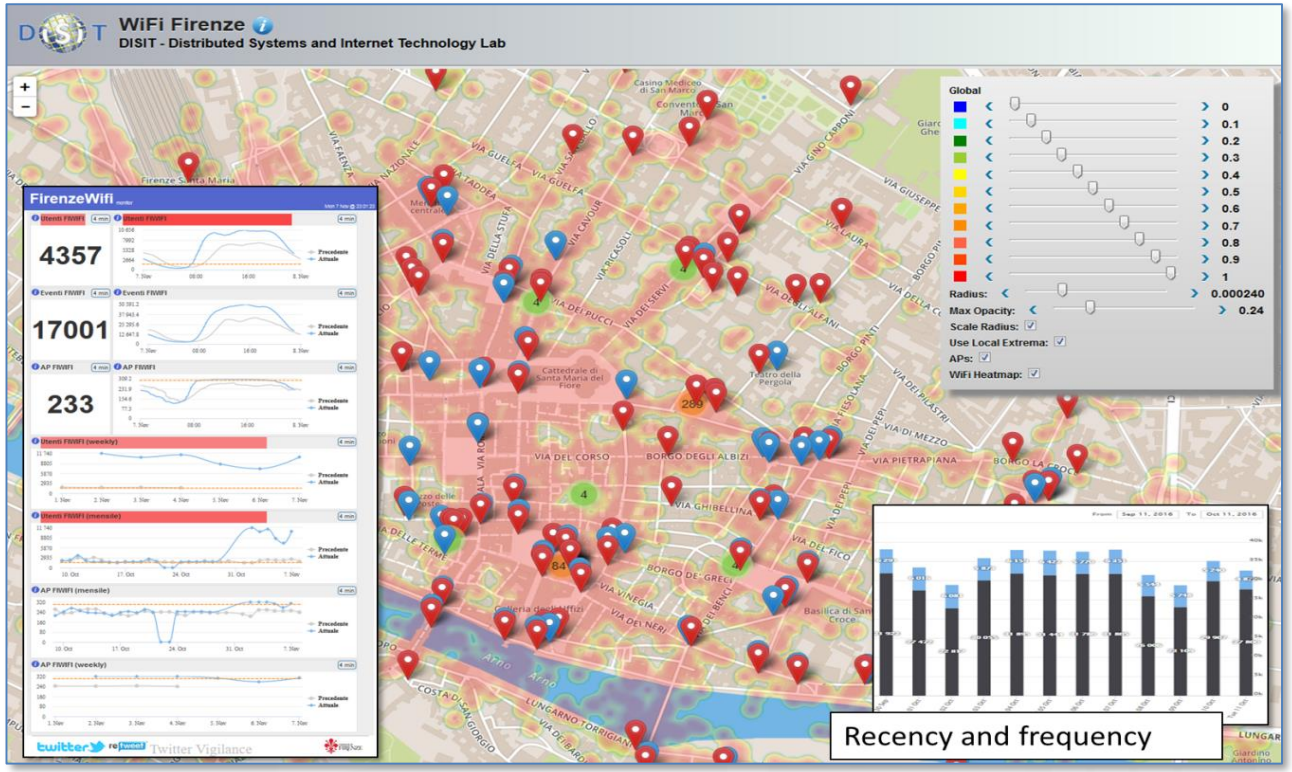


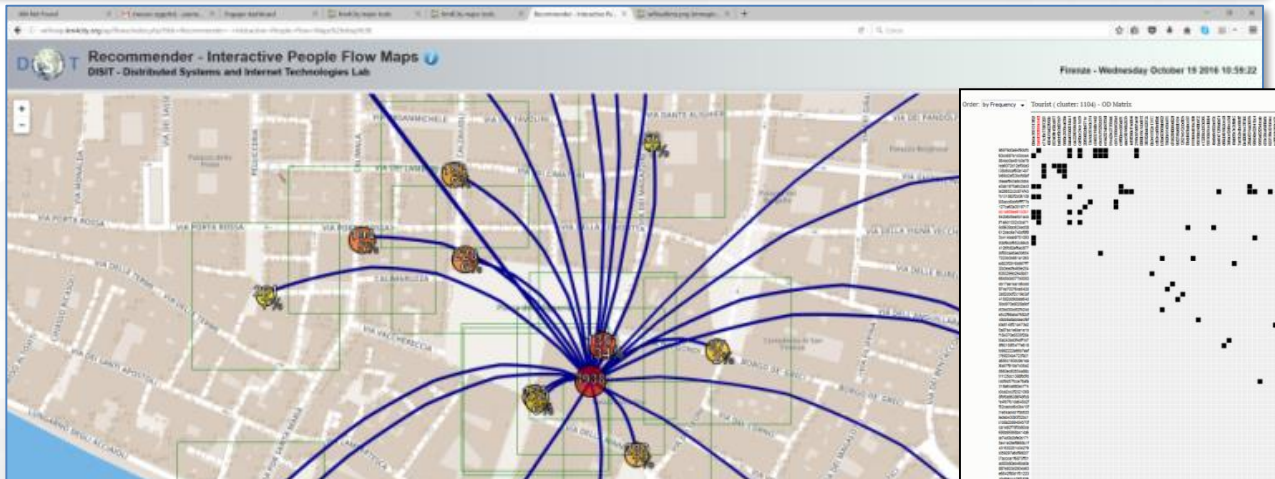
Origin Destination Matrices

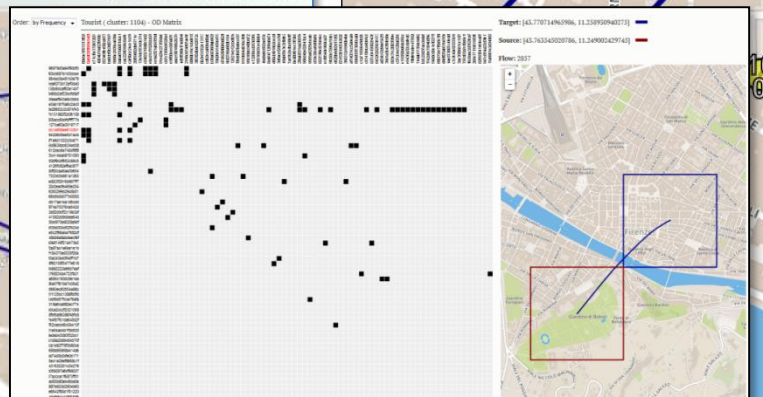
ARC
INDEX

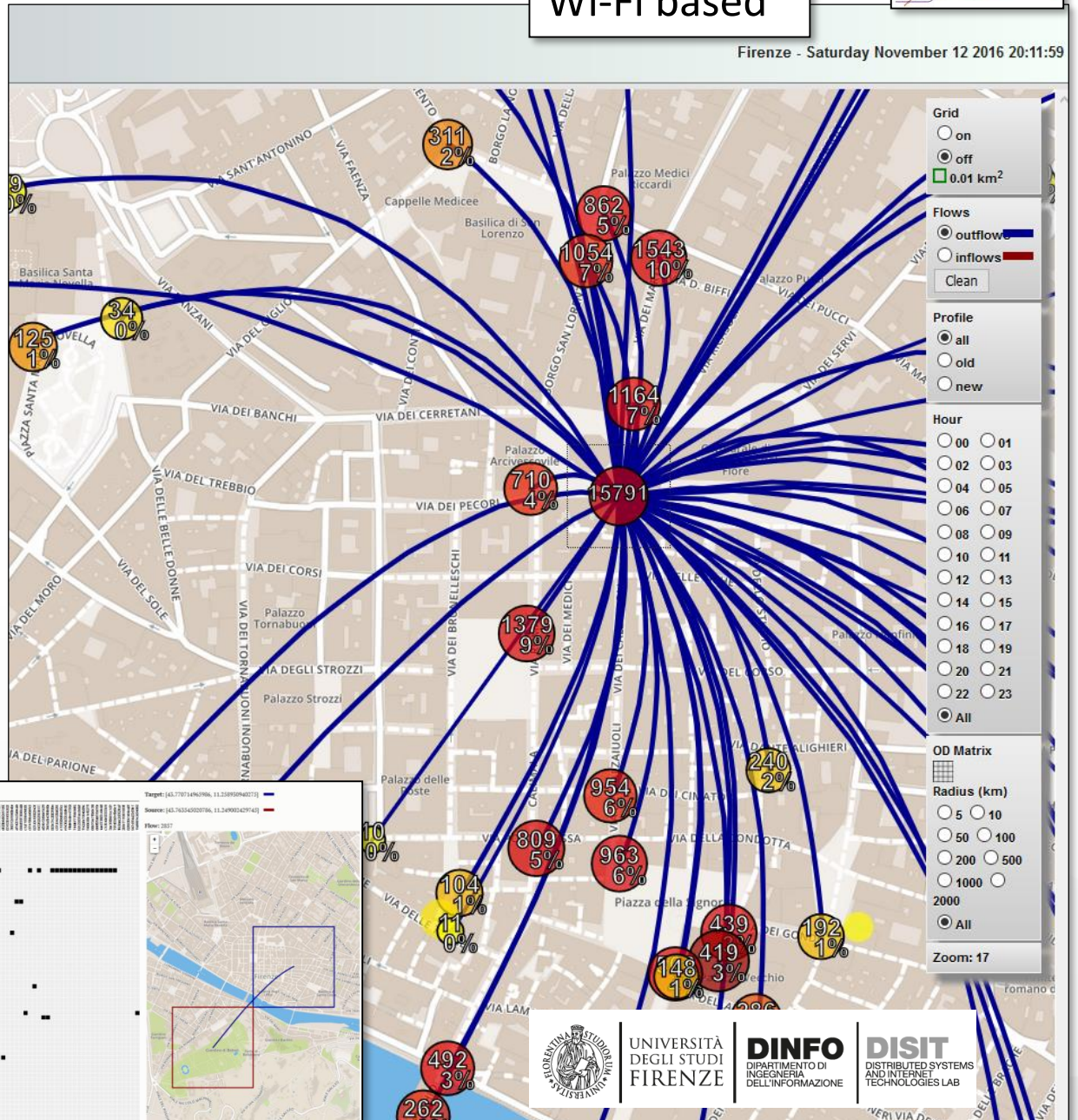
Origin Destination Matrix Estimation

Wi-Fi based









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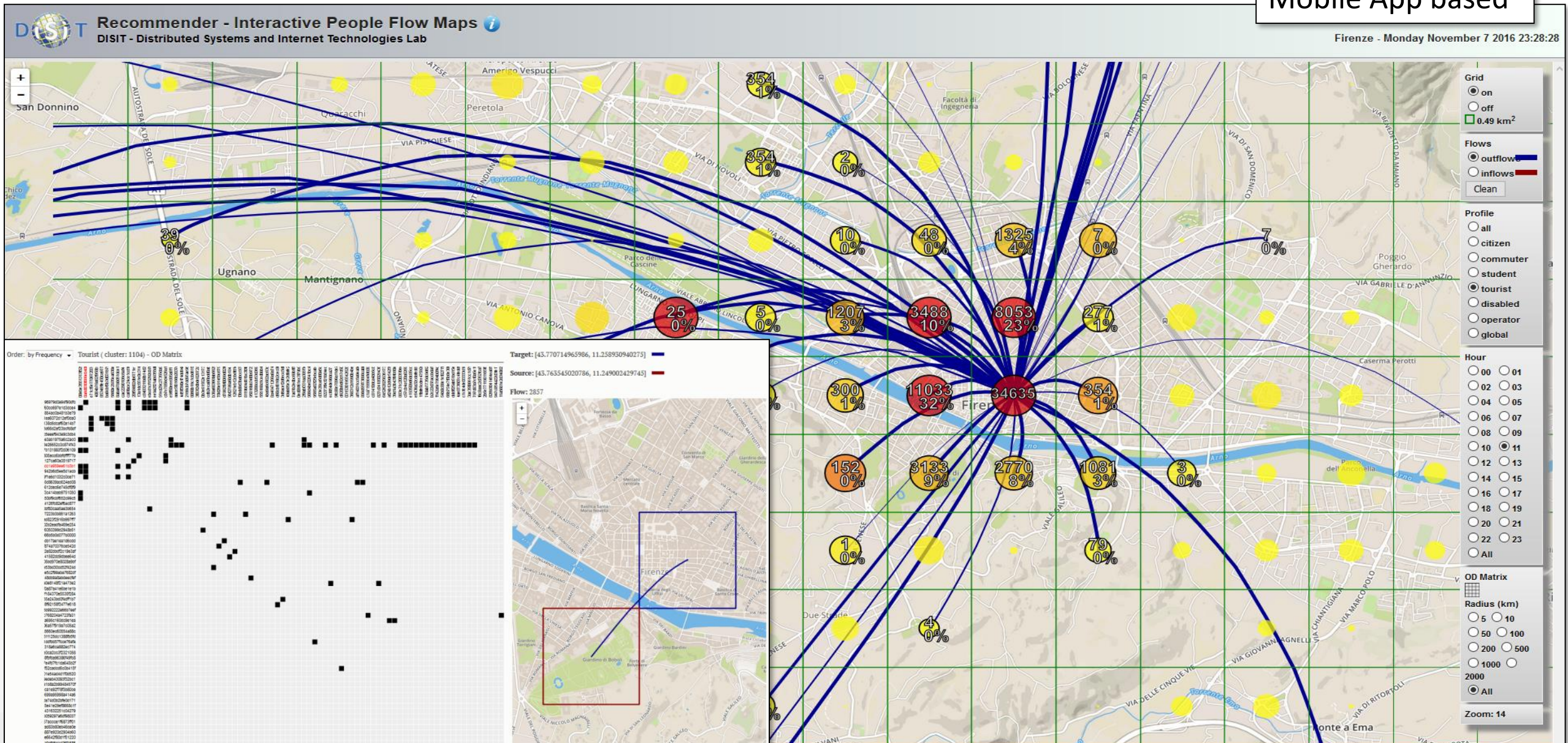
Scalable multiresolution OD matrix

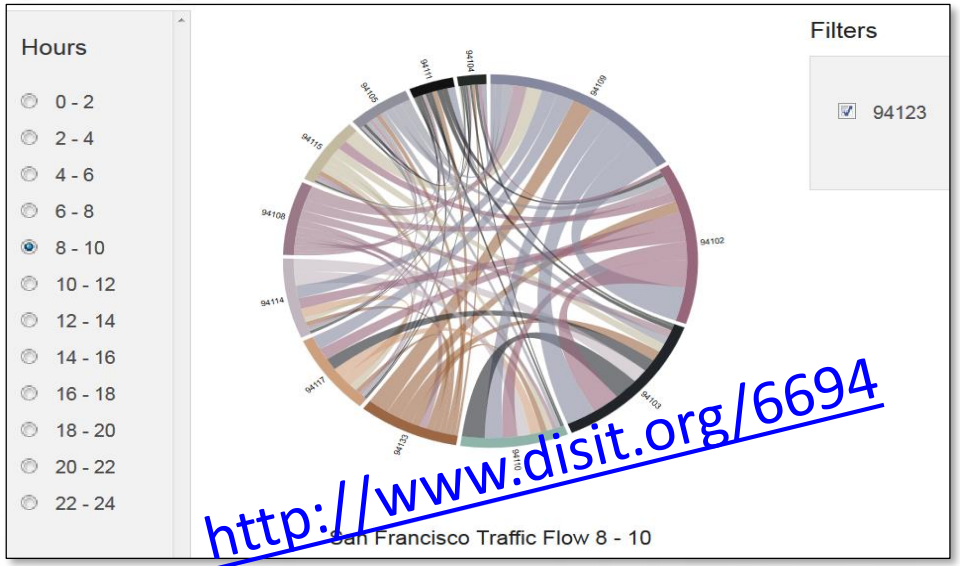
Sii-Mobility

Mobile App based

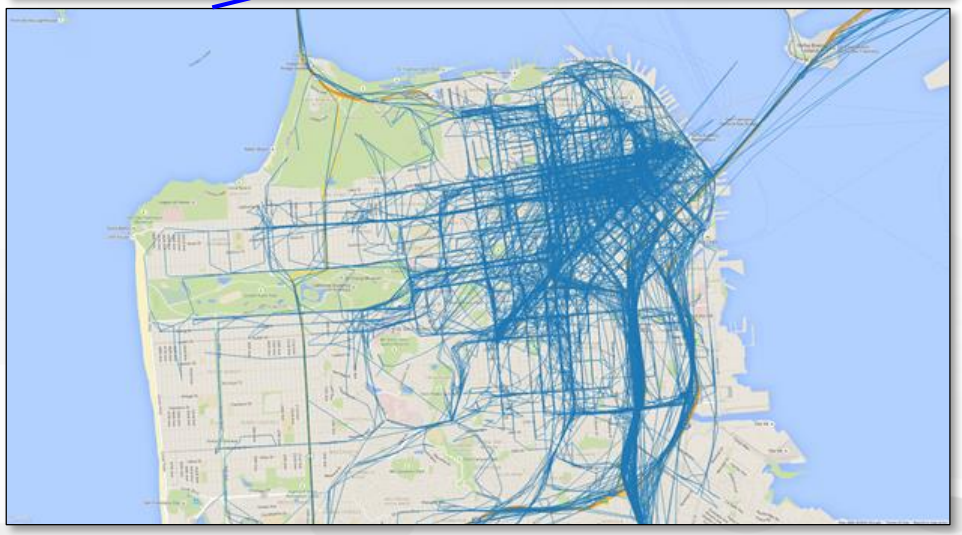


Traffic and People Flow Assessment

- **Origin Destination Matrix**
  - Specific Sensors, vehicle Kits, mobile App, Wi-Fi Access Points, etc.
  - Data from Taxi in San Francisco
- **Assess people and traffic flows to**
  - improve services
  - predict critical conditions on Crit. Infra.
  - take real time decisions and sending messages in push to population
  - Increase city resilience
  - optimize traffic flow
  - take decision of routing



http://www.disit.org/6694

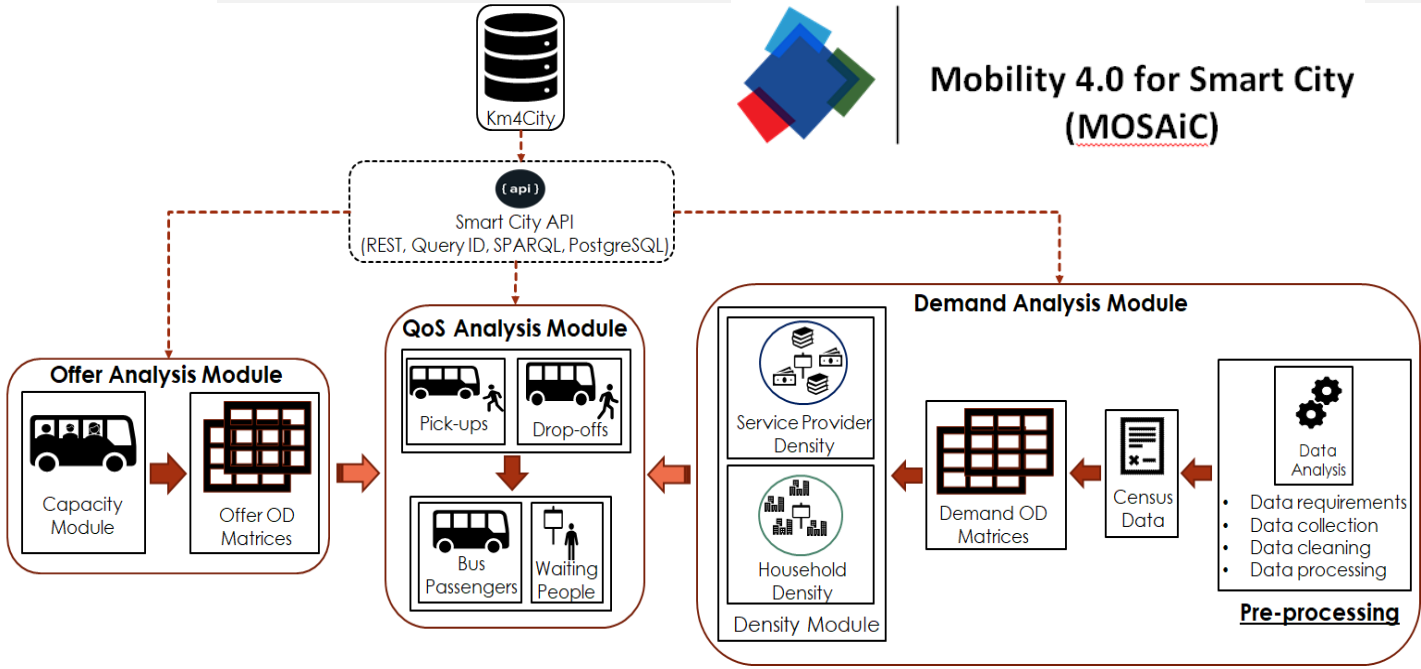


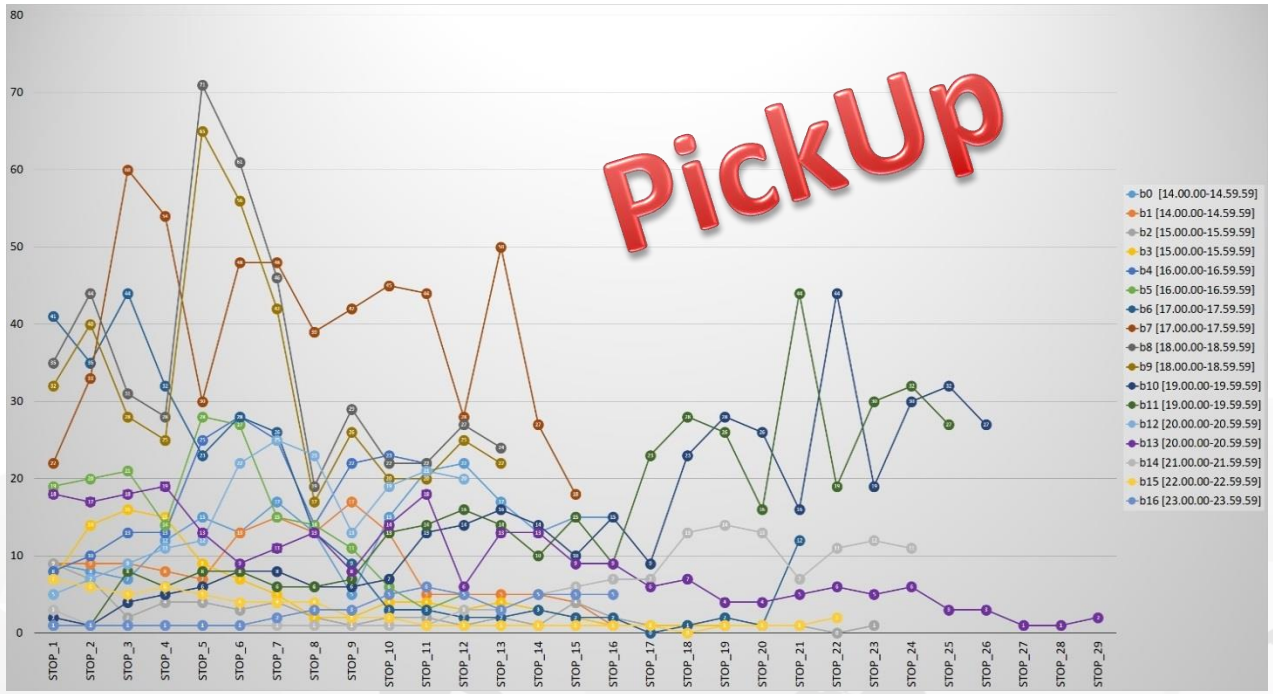
Demand of Mobility vs Offer of Transportation

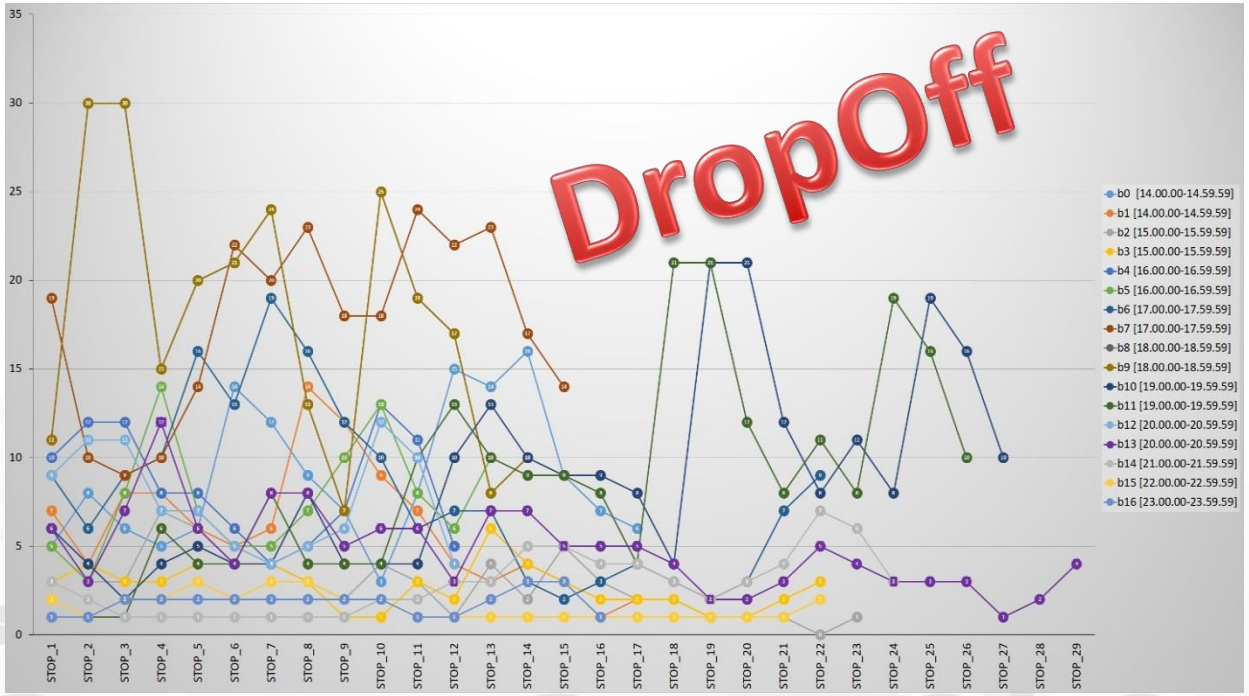
ARC

INDEX

Demand vs Offer of Mobility Analysis



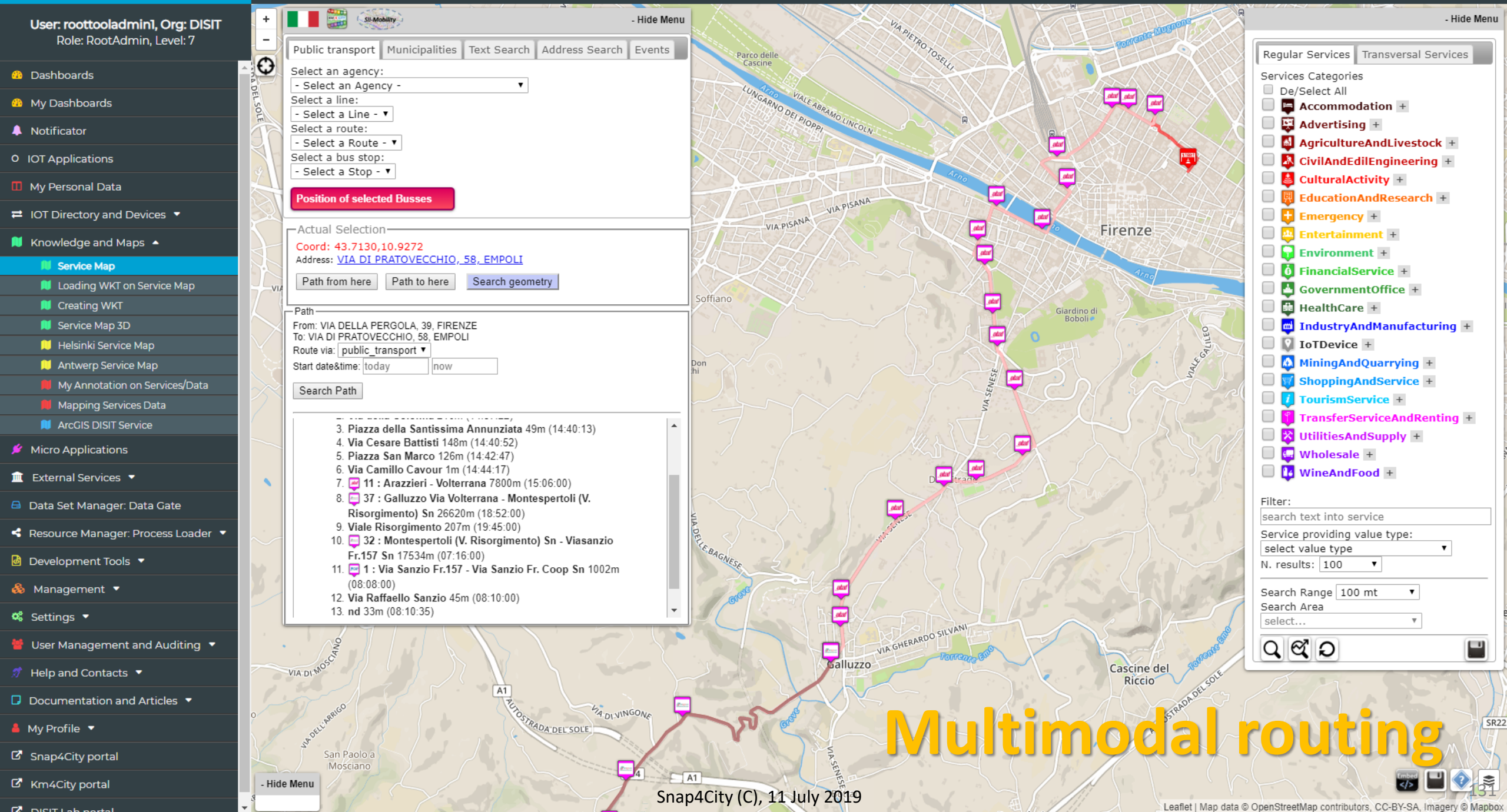




Modal & Multimodal Routing for Navigation and Travel Planning

ARC

INDEX


User: roottooladmin1, Org: DISIT
Role: RootAdmin, Level: 7
Dashboards
My Dashboards
Notificator
IOT Applications
My Personal Data
IOT Directory and Devices
Knowledge and Maps
Service Map
Loading WKT on Service Map
Creating WKT
Service Map 3D
Helsinki Service Map
Antwerp Service Map
My Annotation on Services/Data
Mapping Services Data
ArcGIS DISIT Service
Micro Applications
External Services
Data Set Manager: Data Gate
Resource Manager: Process Loader
Development Tools
Management
Settings
User Management and Auditing
Help and Contacts
Documentation and Articles
My Profile
Snap4City portal
Km4City portal
- Hide Menu
Public transport
Municipalities
Text Search
Address Search
Events
Select an agency:
- Select an Agency -
Select a line:
- Select a Line -
Select a route:
- Select a Route -
Select a bus stop:
- Select a Stop -
Position of selected Busses
Actual Selection
Coord: 43.7130,10.9272
Address: VIA DI PRATOVECCHIO, 58, EMPOLI
Path from here
Path to here
Search geometry
Path
From: VIA DELLA PERGOLA, 39, FIRENZE
To: VIA DI PRATOVECCHIO, 58, EMPOLI
Route via: public_transport
Start date&time: today now
Search Path
3. Piazza della Santissima Annunziata 49m (14:40:13)
4. Via Cesare Battisti 148m (14:40:52)
5. Piazza San Marco 126m (14:42:47)
6. Via Camillo Cavour 1m (14:44:17)
7. 11 : Arazzieri - Volterrana 7800m (15:06:00)
8. 37 : Galluzzo Via Volterrana - Montespertoli (V. Risorgimento) Sn 26620m (18:52:00)
9. Viale Risorgimento 207m (19:45:00)
10. 32 : Montespertoli (V. Risorgimento) Sn - Viasanzio Fr.157 Sn 17534m (07:16:00)
11. 1 : Via Sanzio Fr.157 - Via Sanzio Fr. Coop Sn 1002m (08:08:00)
12. Via Raffaello Sanzio 45m (08:10:00)
13. nd 33m (08:10:35)
- Hide Menu
Regular Services
Transversal Services
Services Categories
De/Select All
Accommodation
Advertising
AgricultureAndLivestock
CivilAndEdilEngineering
CulturalActivity
EducationAndResearch
Emergency
Entertainment
Environment
FinancialService
GovernmentOffice
HealthCare
IndustryAndManufacturing
IoTDevice
MiningAndQuarrying
ShoppingAndService
TourismService
TransferServiceAndRenting
UtilitiesAndSupply
Wholesale
WineAndFood
Filter:
search text into service
Service providing value type:
select value type
N. results: 100
Search Range 100 mt
Search Area
select...
Firenze
Galluzzo
Cascine del Riccio
Soffiano
Giardino di Boboli
Parco delle Cascine
San Paolo a Mosciano
Multimodal routing
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

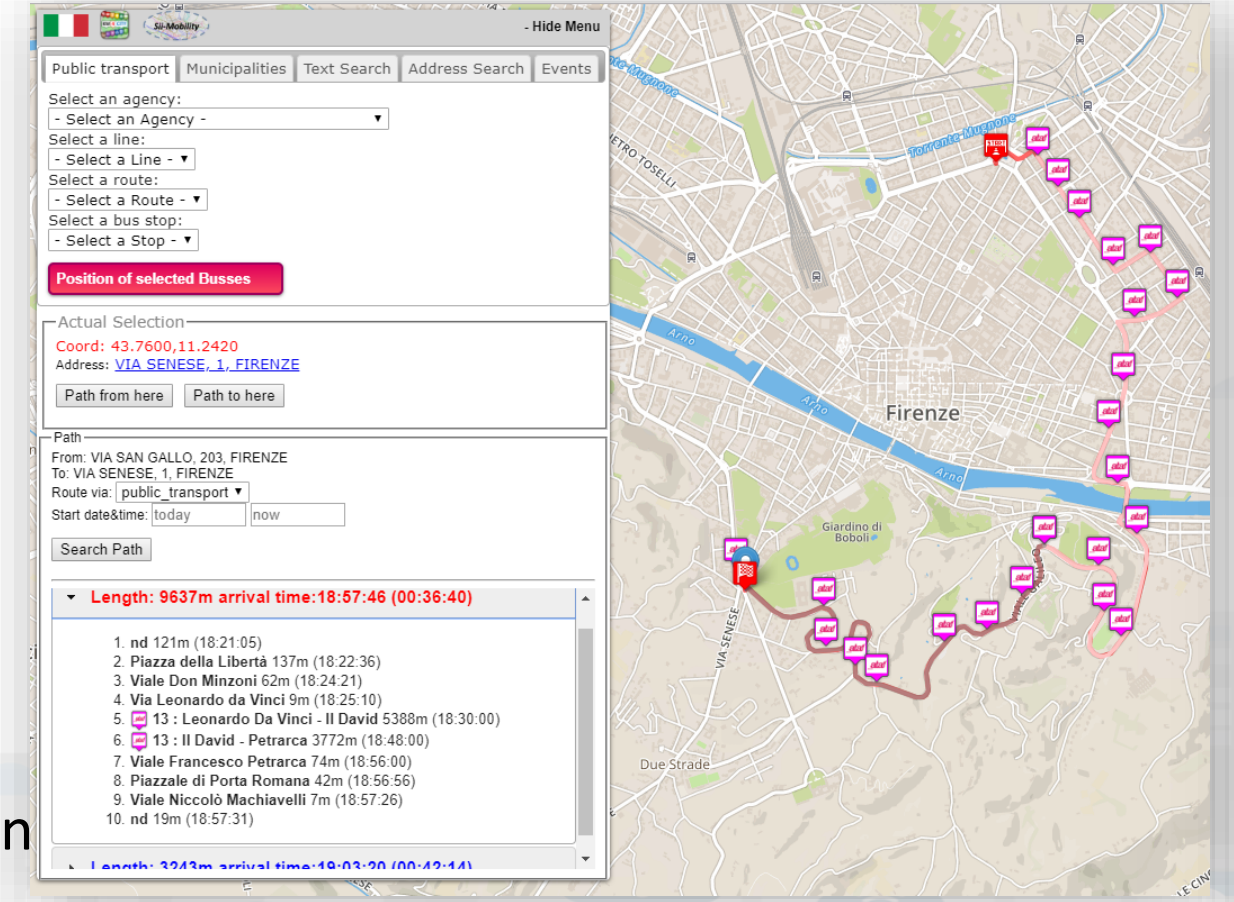
Routing and Multimodal Routing

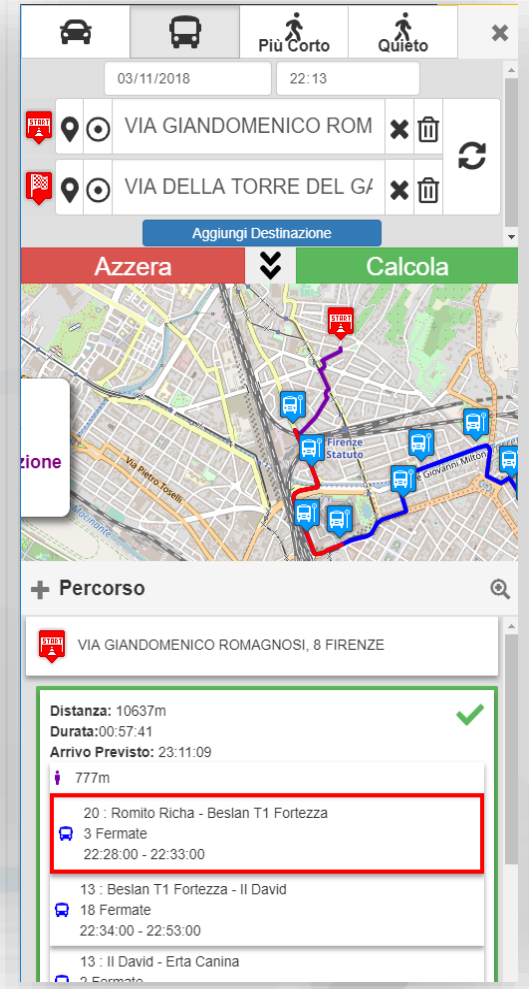
Modes:

- Pedonal, Vehicles
- Public Multimodal
- Multi Point for Delivering
- Constrained: quite, blocked, etc.

Test it on our:

- Mobile Apps
- MicroApplication
- Dashboard
- ServiceMap service on Tuscany in Snap4City

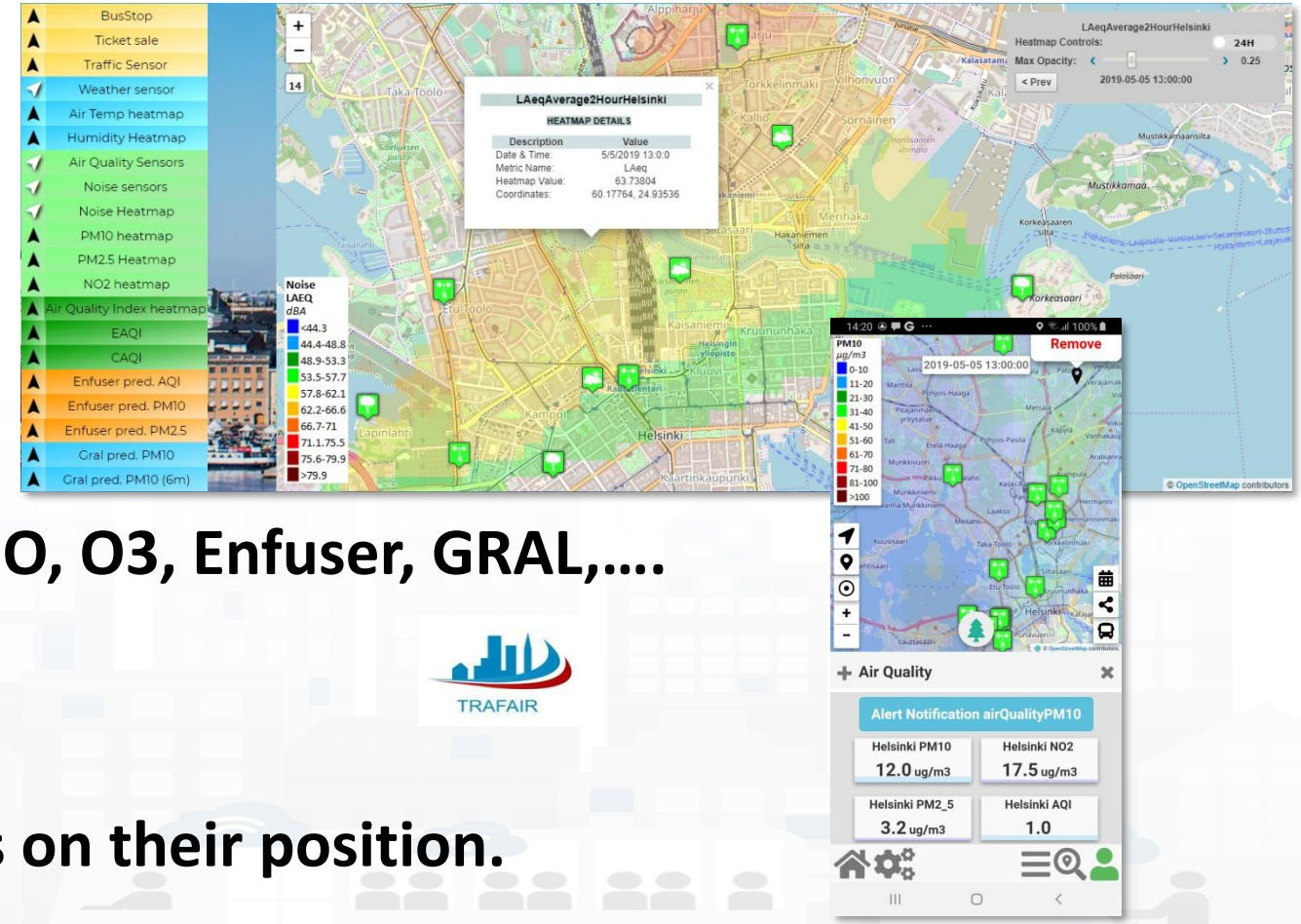




Environmental Data Predictions

Data Analytics: Heatmaps

- Over the Gaussian Heatmaps
- Calibrated heatmaps on the basis of Interpolated data for:
  - From 200x200 to 4x4 mt
  - PM10, PM2.5, SO2, NO2, Noise, NO, O3, Enfuser, GRAL,….
  - Any programmed Color map
  - Animations over H24
  - Picking values in any place, values on their position.
  - On Web and Mobile App



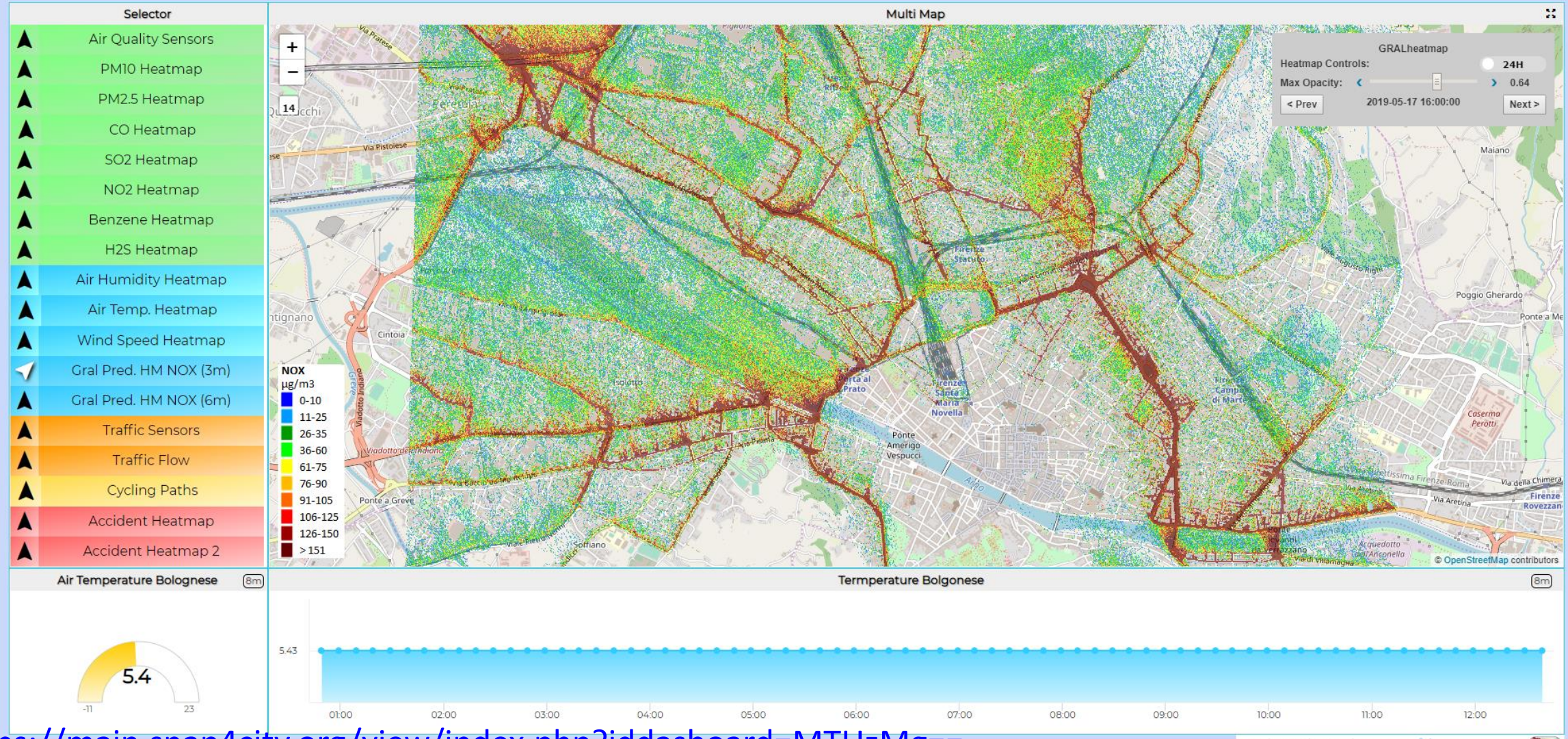
Environmental Data Predictions: GRAL

- **GRAL predictions: PM10, NOX, ….**
  - **Comparison wrt real time values in actual value of Sensors**
  - Graz Lagrangian Model.
- GRAL model takes into account:
  - pollution sources (for example the vehicles, their distribution on the streets, the about of pollution they produce according to their distribution over time and space, etc.),
  - structure of the city (streets and shape 3D of the buildings),
  - weather forecast (wind intensity and direction), etc.
- GRAL can be applied on NOX, PM10, PM2.5, … or any other particles

Heatmap Firenze - trafair

different data

Fri 17 May 12:49:34



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

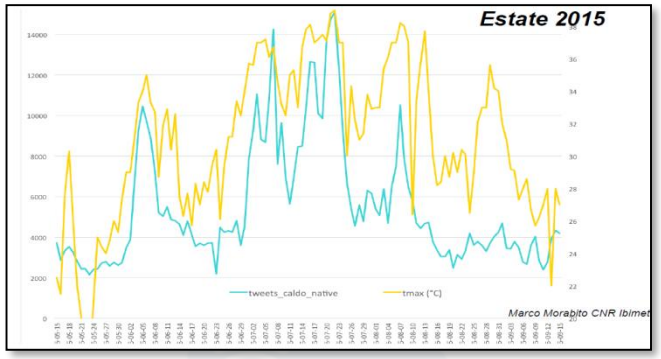
Social Media Analysis

ARC

INDEX

Prediction/Assessment

- Football game results as related to the volume of Tweets
- Number of votes on political elections, via sentiment analysis, SA
- Size and inception of contagious diseases
- marketability of consumer goods
- public health seasonal flu
- box-office revenues for movies
- places to be visited, most visited
- number of people in locations like airports
- audience of TV programmes, political TV shows
- weather forecast information
- Appreciation of services



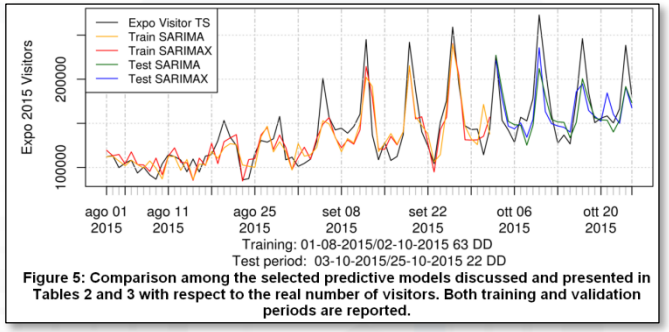
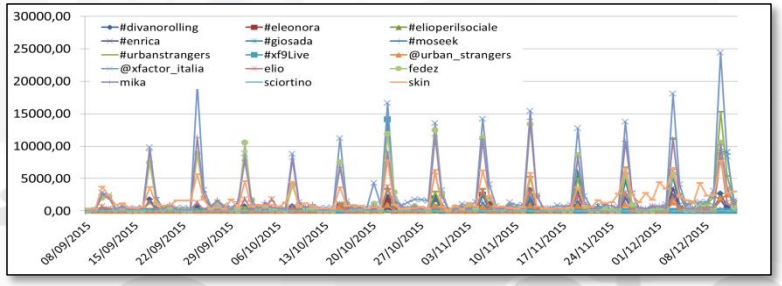
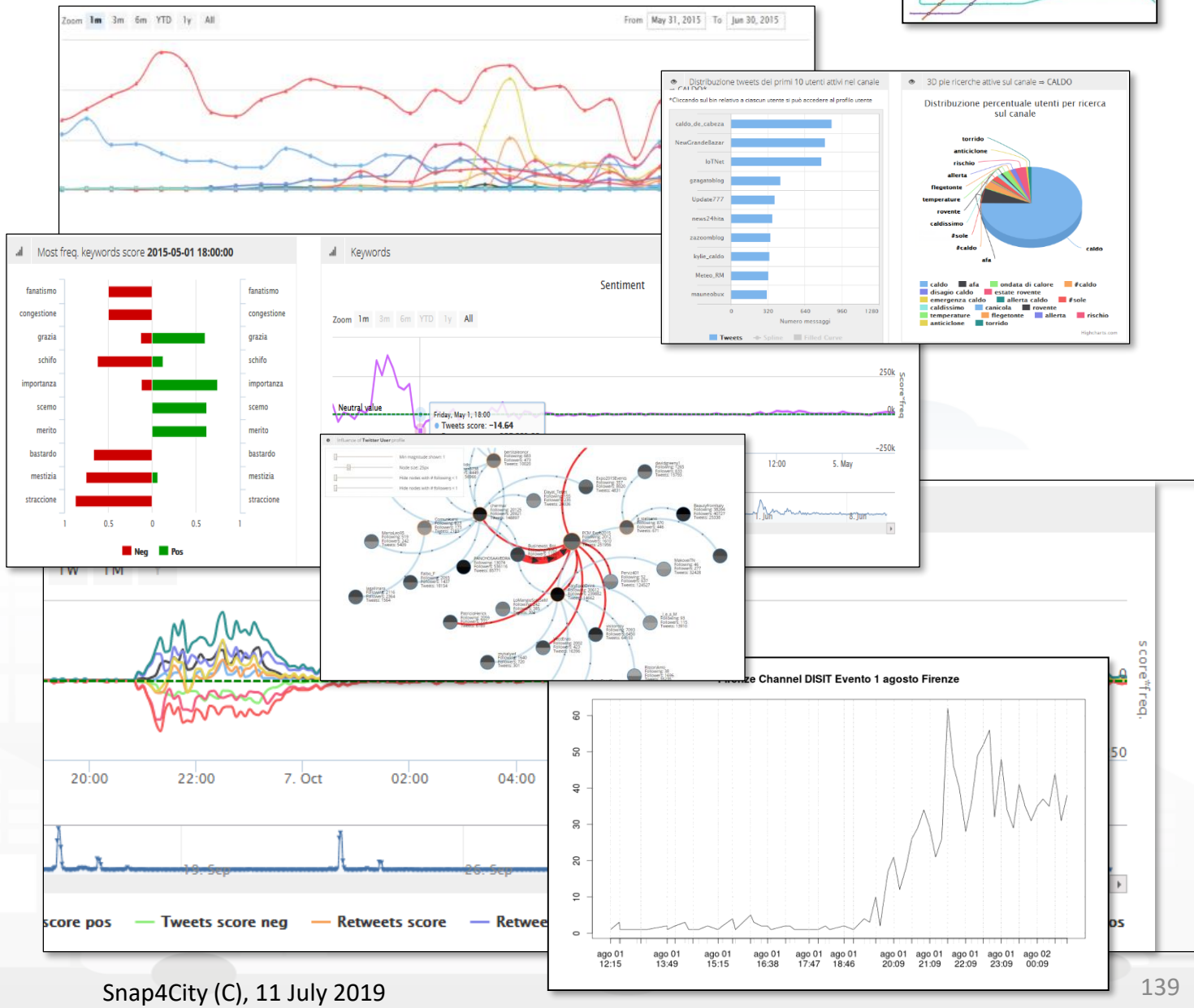


Figure 5: Comparison among the selected predictive models discussed and presented in Tables 2 and 3 with respect to the real number of visitors. Both training and validation periods are reported.

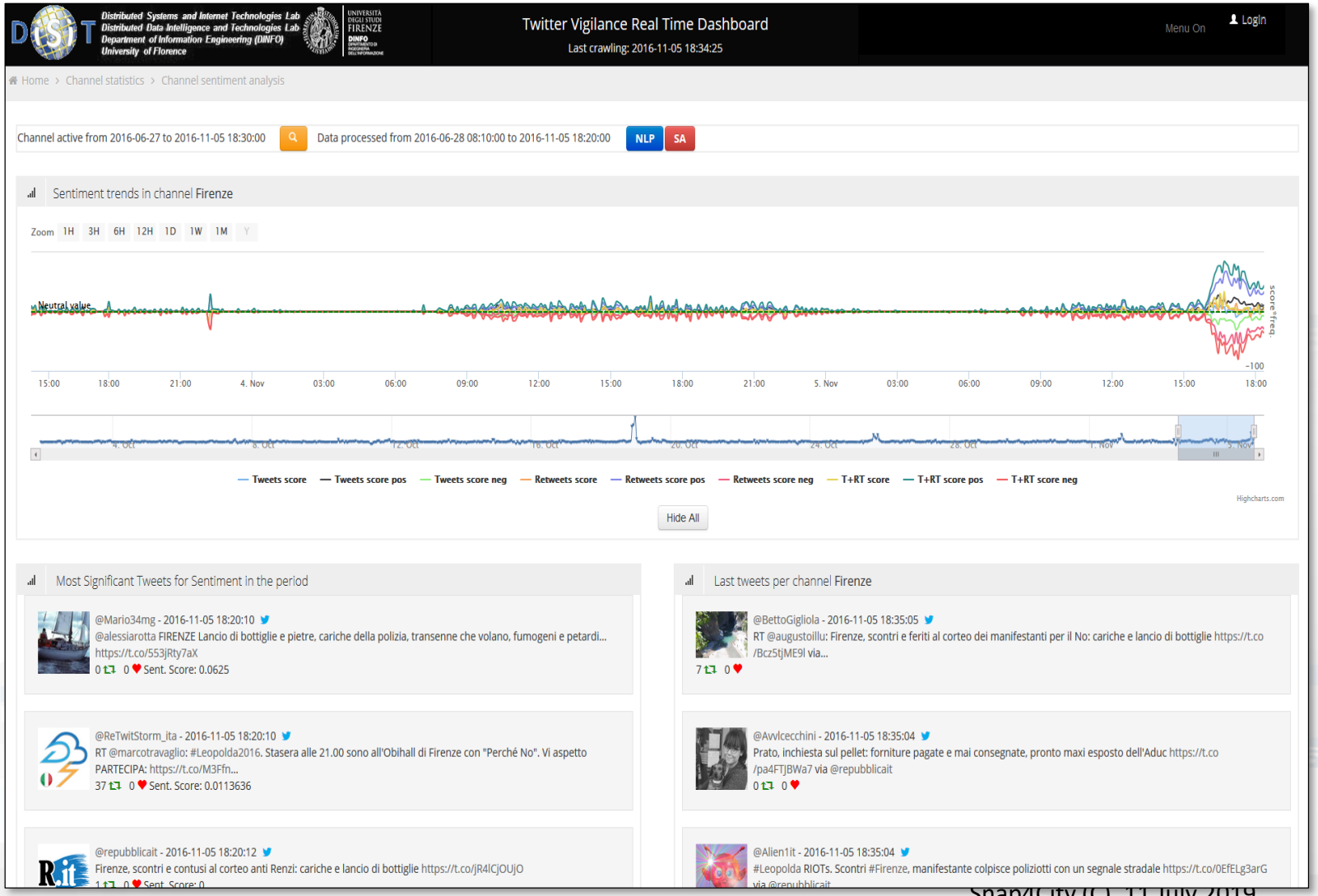


Twitter Vigilance

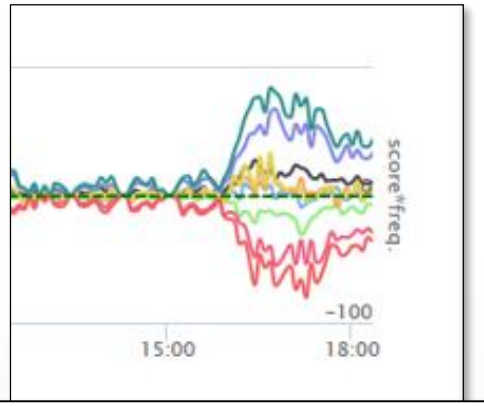
- http://www.disit.org/tv
- http://www.disit.org/rttv
- Citizens as sensors to
  - Assess sentiment on services, events, …
  - Response of consumers wrt, …
  - Early detection of critical conditions
  - Information channel
  - Opinion leaders
  - Communities
  - Formation
  - Predicting volume of visitors for tuning the services

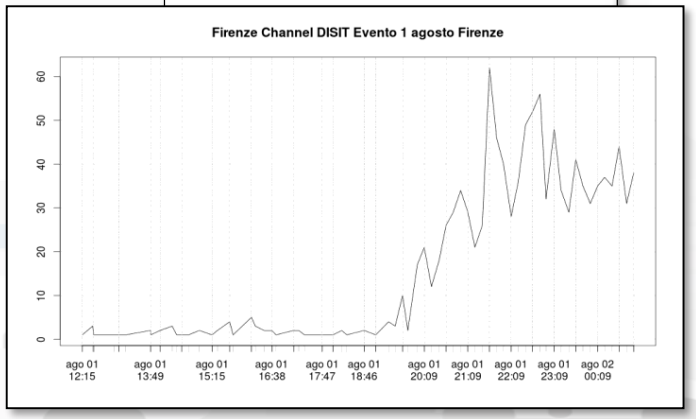


Twitter Vigilance RT: sentiment analysis



Real time
Early Warning





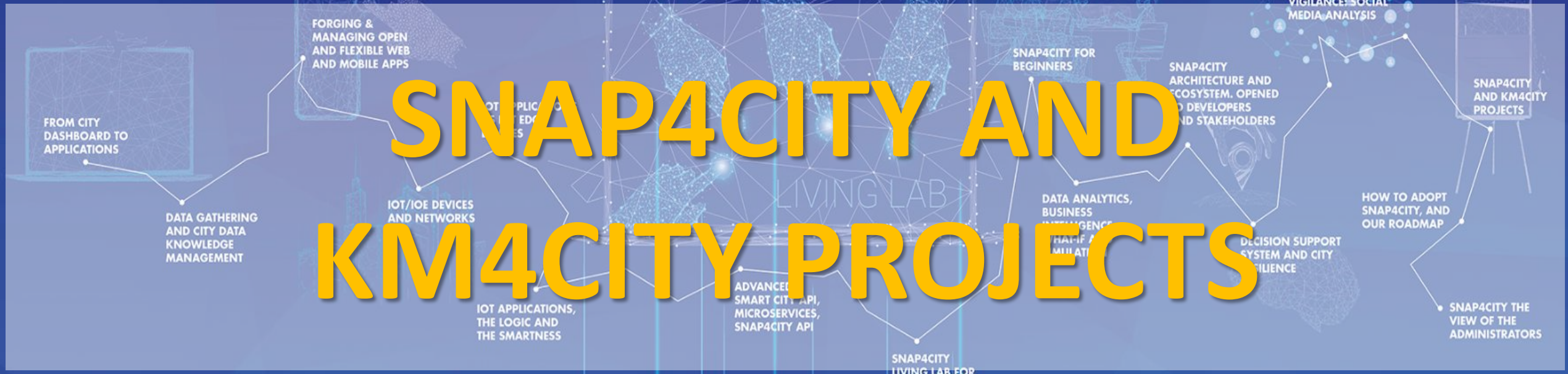
Riuso per la PA

Snap4City vs Linee Guida per il riuso

- DISIT Lab ha sviluppato tutto internamente ed è il Maintainer
  - 100% open source, ma anche le librerie e i tool di terzi usati sono Open Source
- Pubblicato su GITHUB/DISIT https://github.com/disit
  - Pagina di riferimento: https://www.snap4city.org/drupal/node/7
  - Licenze AGPL, Affero GPL
- Pubblicato anche come Appliance:
  - https://www.snap4city.org/drupal/node/471
- Bug Solving (ticketing) e richieste nuove funzionalità:
  - https://www.snap4city.org/drupal/contact
- Informazioni e Supporto, Help Desk:
  - https://www.snap4city.org/drupal/node/3
- Service Level Agreement:
  - https://www.snap4city.org/drupal/node/497

Nuove Funzionalità

- Ricezione contributi via GITHUB, vengono valutati e incorporati
  - Le versioni sono accessibili on GITHUB
  - Possono essere integrate, vengono valutate
  - Possibile fare dei Fork anche su GITHUB
- Snap4City è modulare,
  - ogni tool è definito come modulo e con delle API REST CALL.
  - Ogni tool ha una sua configurazione e si presta a varie configurazioni
- Molte delle funzioni sono MicroServizi e in Smart City API



SNAP4CITY AND KM4CITY PROJECTS

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

Main running projects

Projects

- Snap4City → The platform!
- Sii-Mobility → DISIT (mobility and transport)
- REPLICATE → DISIT (ICT, Energy, IOT)
- RESOLUTE → DISIT (Resilience, ICT, Big Data)
- GHOST → UNICA, UNIFI (strategies, smart city)
- TRAFAIR → UNIMORE, DISIT (environ. & transport)
- MOSAIC → DISIT (mobility and transport)
- WEEE Life → DISIT (waste, environment)
- Smart Garda Lake → Castelnuovo del Garda
- 5G → DISIT (Industry 4.0 vs SmartCity)
- Green Impact → DISIT (Industry 4.0, Chemical)
- PISA Agreement → data aggregation

Green Impact

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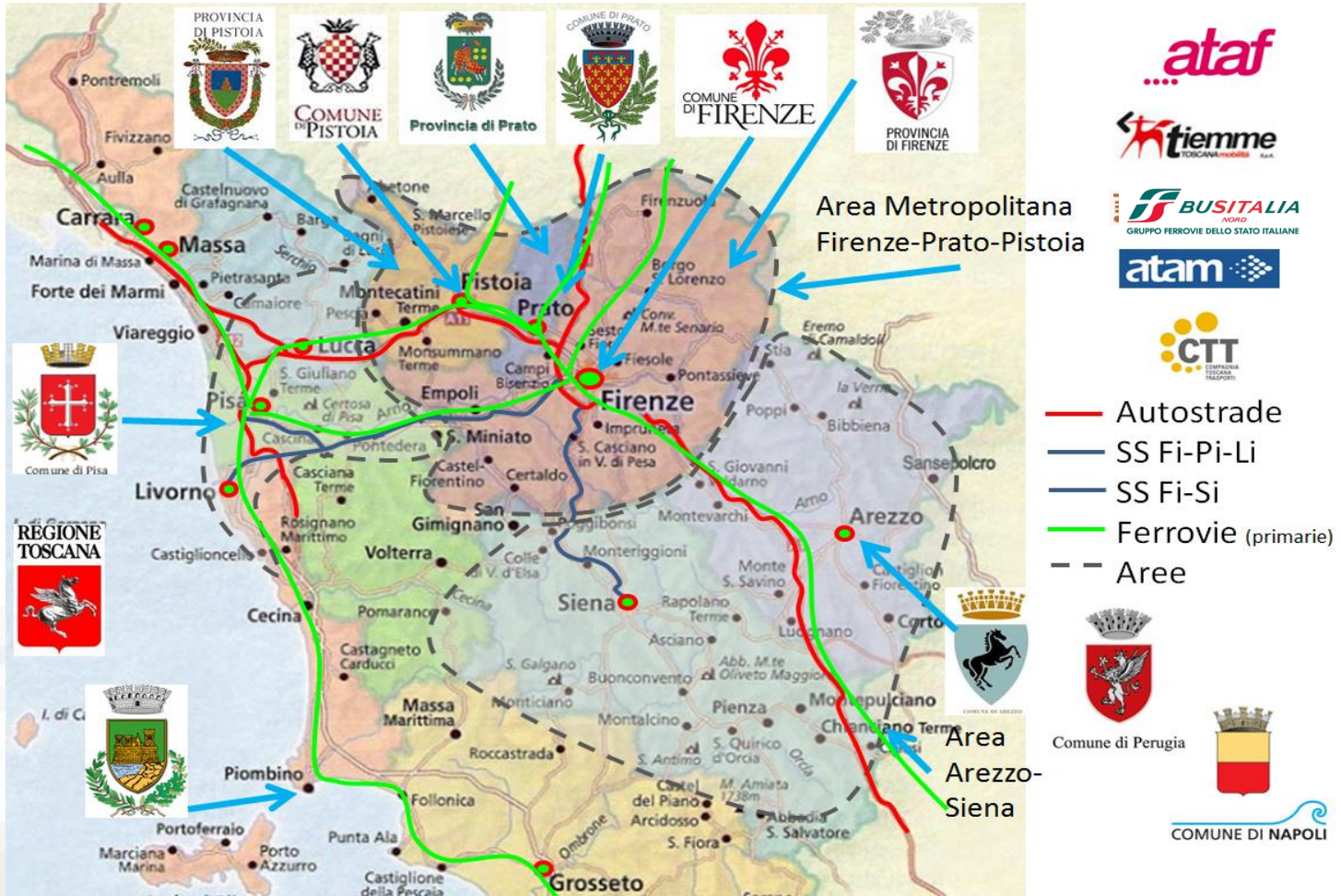
Sii-Mobility

http://www.Sii-Mobility.org

- *Experimentations and validation in Tuscany*
- *Integration with present central station and subsystems*
- *DISIT lab, Università di Firenze, is the tech-scientific coordinator*


Area Metropolitana
Firenze-Prato-Pistoia
Area
Arezzo-
Siena
Autostrade
SS Fi-Pi-Li
SS Fi-Si
Ferrovie (primarie)
Aree
Comune di Perugia
COMUNE DI NAPOLI
Pontremoli
Fivizzano
Aulla
Carrara
Massa
Marina di Massa
Forte dei Marmi
Viareggio
Lucca
Pistoia
Prato
Firenze
Pisa
Livorno
Empoli
Arezzo
Siena
Grosseto
Piombino
Portoferraio
Volterra
Cecina
Castiglioncello
Rosignano Marittimo
Castelnuovo di Garfagnana
Montecatini Terme
Monsummano Terme
S. Giuliano Terme
Pontedera
Casciana Terme
Castel-Fiorentino
Certaldo
San Gimignano
S. Miniato
Sansepolcro
Montevarchi
Monteriggioni
Pomarance
Castagneto Carducci
Massa Marittima
Roccastrada
Follonica
Punta Ala
Marciana Marina
Porto Azzurro
Castiglione della Pescaia
Montalcino
Pienza
Chianciano Terme
Montepulciano
Asciano
Rapolano Terme
Buonconvento
Monticiano
Castel del Piano
Arcidosso
S. Fiora
Abbadia S. Salvatore
Ombrone
Bibbiena
Poppi
Impruneta
Pontassieve
Fiesole
Campi Bisenzio
Barberino di Mugello
Vicchio
Borgo S. Lorenzo
Firenzuola
Scarperia
Dicomano
Reggello
Figline Valdarno
Incisa in V. d'Arno
Cavriglia
Loro Ciuffenna
Castelfranco di Sopra
Terranuova Bracciolini
Monte S. Savino
Foiano della Chiana
Lucignano
Cortona
Sinalunga
Torrita di Siena
Abbadia S. Salvatore
Radicofani
Sarteano
Cetona
Chiusi
Città della Pieve
Castiglione del Lago
Panicale
Passignano sul Trasimeno
Magione
Tavarnelle Val di Pesa
Barberino Val d'Elsa
Poggibonsi
Colle di V. d'Elsa
Castellina in Chianti
Radda in Chianti
Gaiole in Chianti
Greve in Chianti
Bagno a Ripoli
Rignano sull'Arno
Pelago
Pontassieve
Rufina
Londa
Pratovecchio
Stia
Castel Focognano
Subbiano
Capolona
Arezzo
Civitella in Val di Chiana
Foiano della Chiana
Lucignano
Marciana
Portoferraio
Rio nell'Elba
Capoliveri
Porto Azzurro
Campo nell'Elba
Piombino
Suvereto
Sassetta
Monteverdi Marittimo
Castagneto Carducci
Bolgheri
Donoratico
Sassetta
Scarlino
Follonica
Gavorrano
Massa Marittima
Monterotondo Marittimo
Roccastrada
Paganico
Sassofortino
Civitella Paganico
Arcidosso
Castel del Piano
Seggiano
Pitigliano
Sorano
Manciano
Semproniano
Roccalbegna
Santa Fiora
Abbadia S. Salvatore
Castiglione d'Orcia
Pienza
Montepulciano
Chianciano Terme
Sarteano
Cetona
Chiusi
Città della Pieve
Piancastagnaio
Abbadia S. Salvatore
Radicofani

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Sii-Mobility

MIUR MINISTERO DELL'ISTRUZIONE DELL'UNIVERSITÀ E DELLA RICERCA

KM 4 CITY

http://www.Sii-Mobility.org

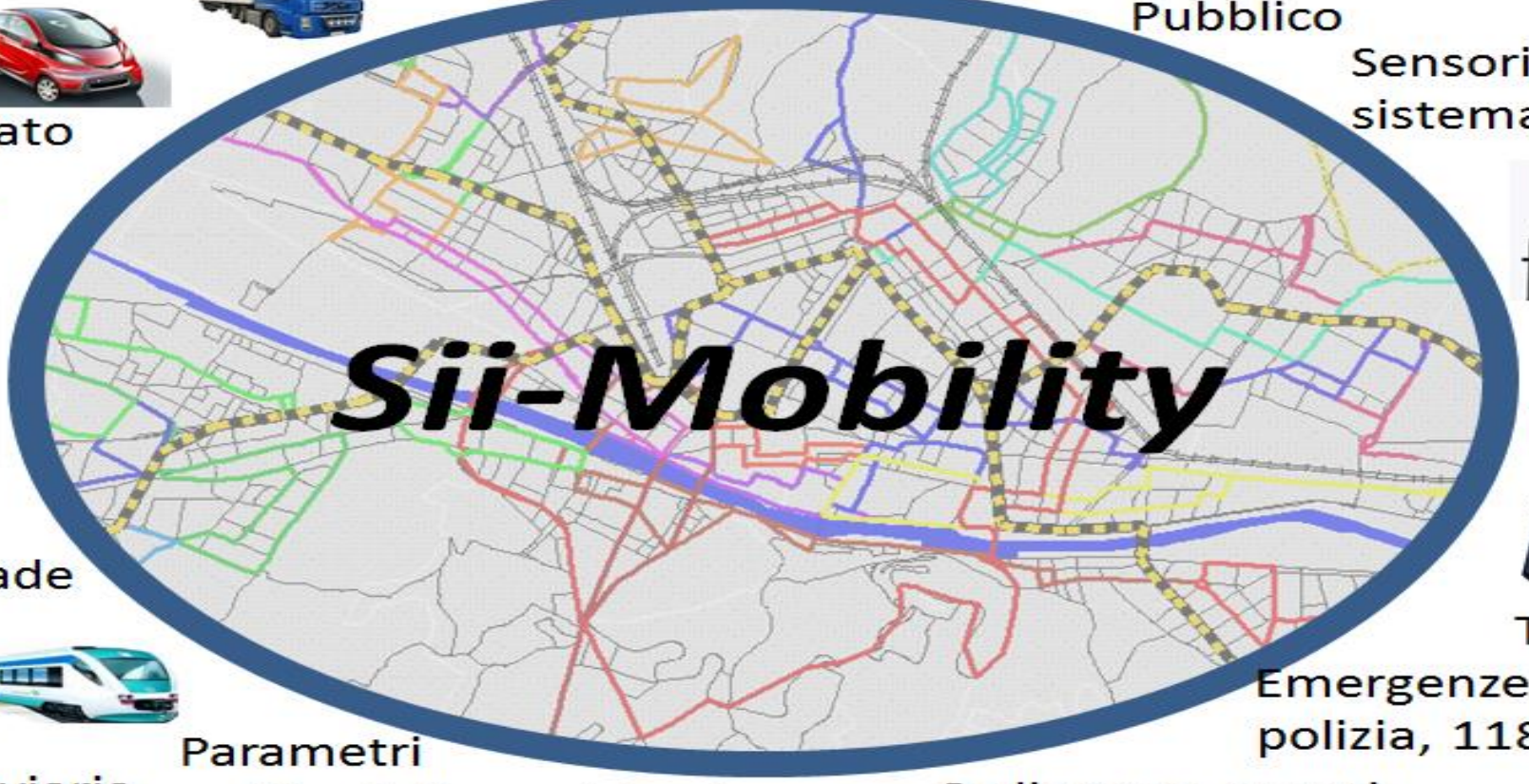
Commenti dei cittadini, Social Media

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

General Objectives

http://www.Sii-Mobility.org

- Reduce the social costs of mobility
  - minor inconvenience,
  - greater efficiency,
  - greater sensitivity to the needs of the citizen,
  - lower emissions,
  - better environmental conditions;
  - info-training programs to help city user in getting virtuous habits;
  - reduce transportation costs and travel times for users, for operators and administrations,
  - optimization solutions.
- **simplify the use of mobility systems**
  - innovative sensors for AVM and private transport on the territory
  - integrated systems for payment and identification
  - driving / offline routing solutions
  - connect the drive, smart drive or walk
  - Integration of data from operators and different type sources
  - advanced management of resources measurement of flows realization of sensors, actuators
- **Testing on municipalities and provinces of Tuscany**
- **Contribute to the improvement of national and international standards**

REPLICATE

Horizon 2020
European Union Funding
for Research & Innovation

REnaissance of PLaces
with Innovative Citizenship
And TEchnology

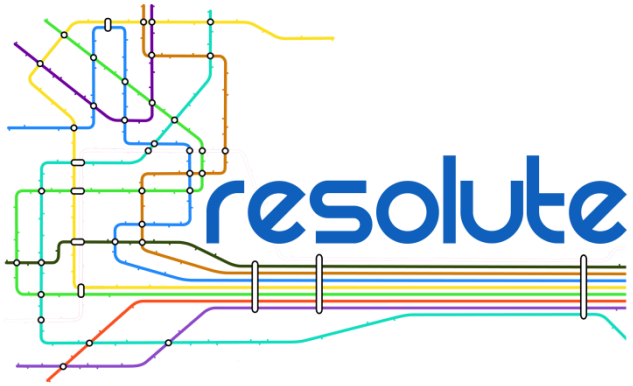
Replicate project

http://replicate-project.eu/

- Demonstrate Smart City technologies in energy, transport and ICT in districts in:
  - San Sebastian, Florence and Bristol,
  - follower cities of Essen, Nilufer and Lausanne
- Cities are the customer: considering local specificities
- Solutions must be replicable, interoperable and scalable:
  - Integrated Infrastructure: deployment of ICT architecture, from internet of things to applications
  - Low energy districts
  - Urban mobility: sustainable and smart urban services

KM 4 CITY

1 (coordinator) FOMENTO DE SAN SEBASTIAN FSS SPAIN
2 AYUNTAMIENTO DE SAN SEBASTIAN SAN SEBASTIAN SPAIN
3 COMUNE DI FLORENCE FLORENCE ITALY
4 BRISTOL COUNCIL BRISTOL UNITED KINGDOM
5 STADT ESSEN ESSEN GERMANY
6 NILUFER BELEDIYESI NILUFER TURKEY
7 VILLE DE LAUSANNE LAUSANNE SWITZERLAND
8 IKUSI ANGEL IGLESIAS, S.A. IKUSI SPAIN
9 ENDESA ENERGÍA, S.A. ENDESA SPAIN
10 EUROHELP CONSULTING, S.L. EUROHELP SPAIN
11 ILUMINACION INTELIGENTE LUIX, S.L. LUIX SPAIN
12 FUNDACION TECNALIA RESEARCH & INNOVATION TECNALIA SPAIN
13 EUSKALTEL, S.A. EUSKALTEL SPAIN
14 COMPAÑÍA DEL TRANVÍA DE SAN SEBASTIÁN DBUS SPAIN
15 CONSIGLIO NAZIONALE DELLE RICERCHE CNR ITALY
16 ENEL DISTRIBUZIONE, SPA ENEL ITALY
17 MATHEMA, SRL MATHEMA ITALY
18 SPES CONSULTING SPES ITALY
19 TELECOM ITALIA, SPA TELECOM ITALY
20 UNIVERSITA DEGLI STUDI DI FLORENCE UNIFI ITALY: DINFO.DISIT Lab and DIEF
21 THALES ITALIA, SPA THALES ITALY
22 ZABALA INNOVATION CONSULTING ZABALA SPAIN
23 TECHNOMAR TECHNOMAR GERMANY
24 UNIVERSITY OF BRISTOL UOB UNITED KINGDOM
25 UNIVERSITY OF OXFORD UOXF UNITED KINGDOM
26 BRISTOL IS OPEN, LTD BIO UNITED KINGDOM
27 ZEETTA NETWORKS ZEETTA UNITED KINGDOM
28 KNOWLE WEST MEDIA CENTRE, LGB KWMC UNITED KINGDOM
29 TOSHIBA RESEARCH EUROPE, LTD TREL UNITED KINGDOM
30 ROUTE MONKEY, LTD ROUTE MONKEY UNITED KINGDOM
31 ESOTERIX SYSTMES, LTD ESOTERIX UNITED KINGDOM
32 NEC LABORATORIES EUROPE, LTD NEC UNITED KINGDOM
33 COMMONWHEELS CAR CLUB CIC CO-WHEELS UNITED KINGDOM
34 UNIVERSITY OF THE WEST OF ENGLAND UWE UNITED KINGDOM
35 ESADE BUSINESS SCHOOL ESADE SPAIN
36 SISTELEC SOLUCIONES DE TELECOMUNICACION, S.L. SISTELEC SPAIN



Horizon 2020
European Union Funding
for Research & Innovation

http://www.resolute-eu.org

- **Develop European Resilience Management Guidelines (ERMG)**
  - Develop a conceptual framework for creating/ maintaining Urban Transport Systems
- **Enhance resilience** through improved support of human decision making processes, particularly by training professionals and civil users on the ERMG and the RESOLUTE system
- **Operationalize and validate the ERMG** by implementing the RESOLUTE Collaborative Resilience Assessment and Management Support Systems (CRAMSS) for Urban Transport Systems addressing Road and Urban Rail Infrastructures
  - Pilots in **Florence and Athens**
- Adoption of the ERMG at EU and Associated Countries level

University of Florence: DISIT lab DINFO (Proj coordinator), DISIA and DST	UNIFI	IT
THALES	THALES	IT
ATTIKOMetro	ATTIKO	GR
Comune di Firenze	CDF	IT
Centre for Research and Technology Hellas	CERTH	GR
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.	FHG	DE
HUMANIST	HUMANIST	FR
SWARCO Mizar	SWMIZ	IT
Associação para o Desenvolvimento da Investigação no Instituto Superior de Gestão	ADI-ISG	PT
Consorzio Milano Ricerche	CMR	IT

GHOST: Governing tHe smart city: a gOvernance-centred approach to SmarT urbanism

General Objectives

- Offer a **comprehensive framework** for measuring and reassessing urban smart development and related rankings
- **Critical assessment** of Smart City ranking index existence
- Definition of an **enabling technology** supporting the action plans for strengthening multi-level place-based governance, applied in the tourism context
- Definition of **strategies for good smart governance**, with the purpose of providing recommendations to start or implement an institutional and development process leading towards smart city governance.

Partners:

University of Cagliari (Coordinator) DICAAR and DMI

University of Florence SAGAS and DISIT

University of Turin ESOMAS

University of Sassari DADU

Under the patronage of the Municipality of Cagliari

COMUNE DI CAGLIARI

Duration: 23/09/2015 - 23/09/2018

http://sites.unica.it/ghost

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

http://trafair.eu/

TRAFAIR

Understanding Traffic Flows to Improve Air quality

- **Objective:**
  - to develop a service that **combines traffic data on air quality**, weather conditions, and traffic flows in order to allow citizens and municipalities to estimate the level of pollution resulting from varying traffic flow conditions.
- **Where:**
  - **Zaragoza, Florence, Modena, Livorno, Santiago de Compostela, and Pisa**

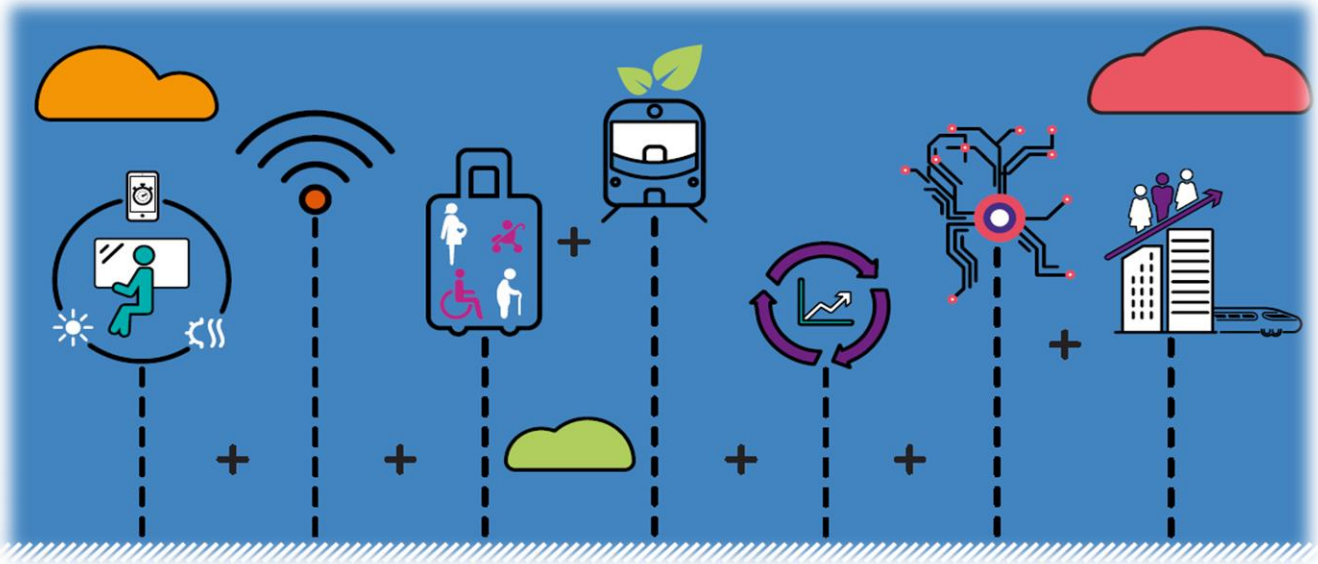
- Università degli studi di Modena e Reggio Emilia (UNIMORE) -- Italy
- **Università degli Studi di Firenze – DISIT DINFO -- Italy**
- Universidade de Santiago de Compostela (USC) - Spain
- Comune di Modena (CMO) - Italy
- Regione Toscana (TR) - Italy
- Concello de Santiago de Compostela (CSC) - Spain
- Fundación Pública Gallega Centro Tecnológico de Supercomputación de Galicia (Fundacion CESGA) - Spain
- Universidad de Zaragoza (UNIZAR) - Spain
- Lepida S.p.A. (LP) - Italy

MObility 4.0 for SmArt (i) City

Tools for Mobility operators

- Demand Analysis
- Prediction on Parking
- Connected Drive
- Offer Analysis
- Simulation of Mobility
- Etc.

Where: in Tuscany



WEEE: Waste from Electrical and Electronic Equipment

- **maximize the collection of WEEE** in Tuscany through a new governance model based on the involvement of SMEs and awareness raising activities towards citizens and its **replication in Andalucía**.
- Actions:
  - Improve the regional governance
  - Support municipalities in capacity building of public officials and improving services to citizens.
  - Develop a system of **services and incentives for SMEs**
  - Develop IT tools for companies and citizens: a **software** and **guidelines** for the simplification of administrative and bureaucratic activities and an **App** to easily locate collection sites.
  - Develop an awareness raising **information campaign** to increase public attention on the topic.
  - Test the **replicability and transferability** of project results through the implementation of actions in the Region of Andalucía.

http://www.regione.toscana.it/-/life-weee

smartGARDAlake

www.smartgardalake.it

1

INTELLIGENT
PUBLIC LIGHTING

SMART
NETWORK

SENSORS

INFRASTRUCTURE

2

OPEN DATA, IoT, SOCIAL

SNAP4CITY

3

APP E SERVIZI ON DEMAND
SMART CITY & SMART TOURISM

4

CONTROL ROOM FOR SMART
GOVERNCANCE

Experimenting 5G

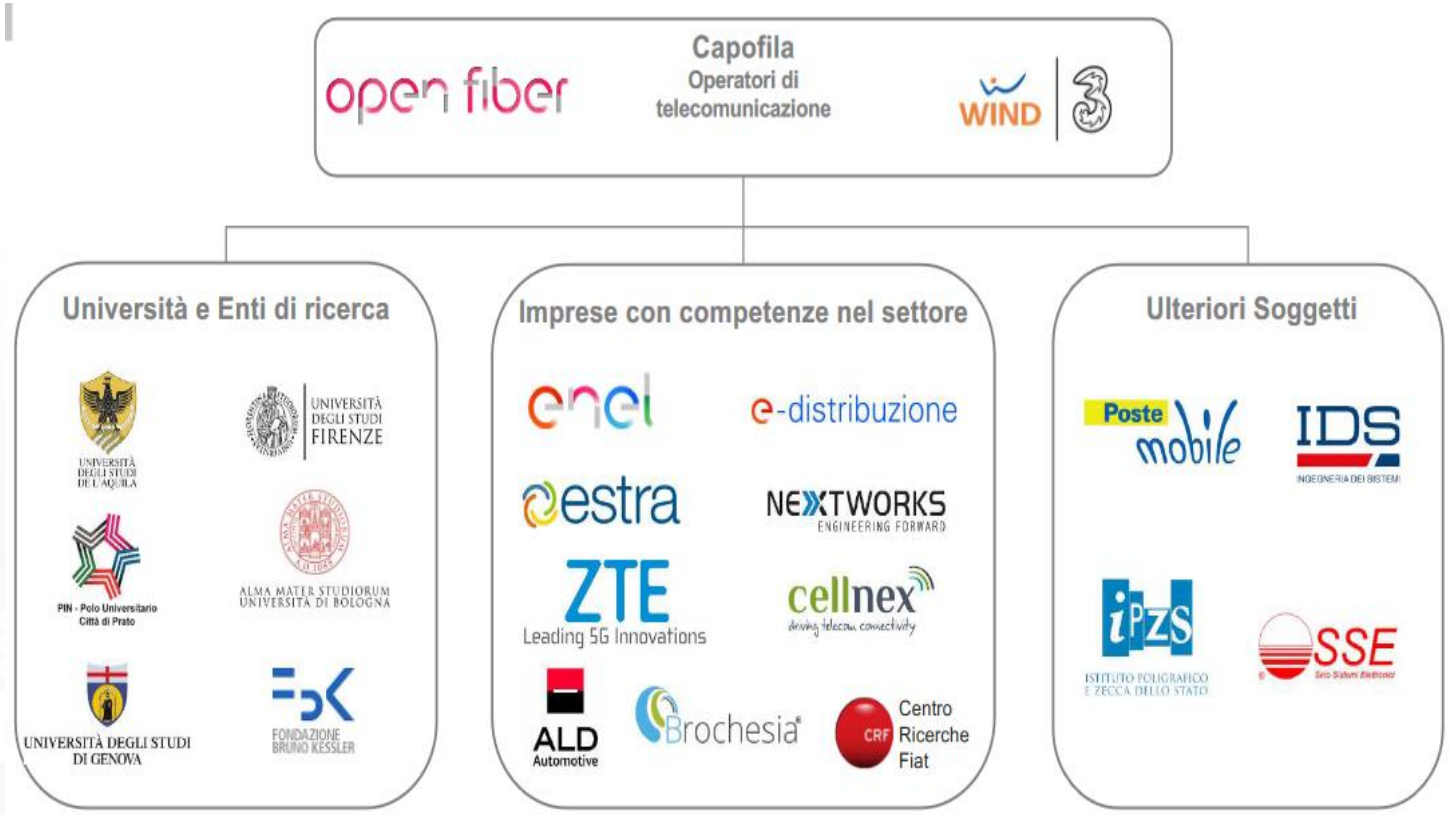
Fields:

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

Where in Italy:

- Prato and L'Aquila

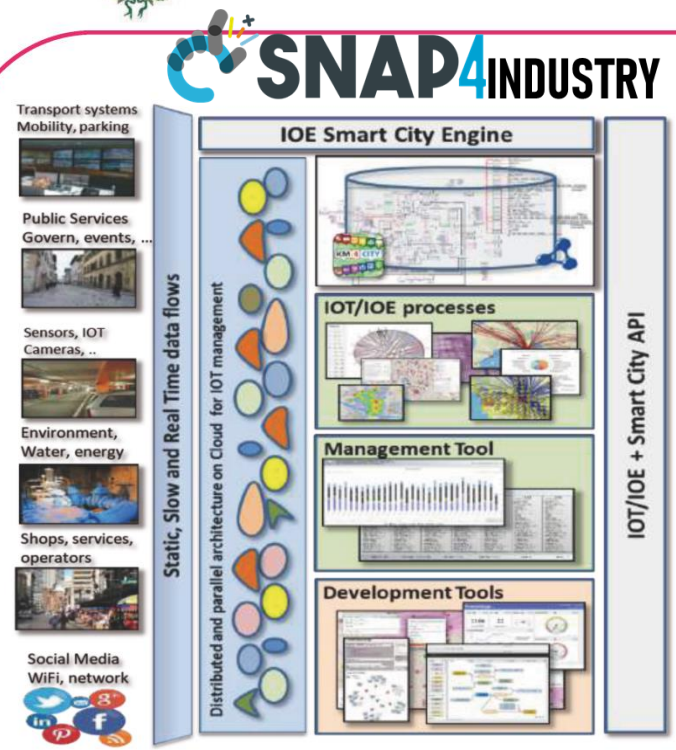
Partners:

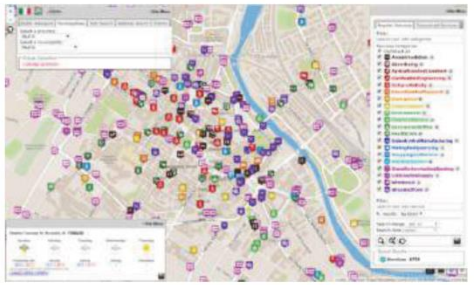


SENSORI E IOT - PRATO

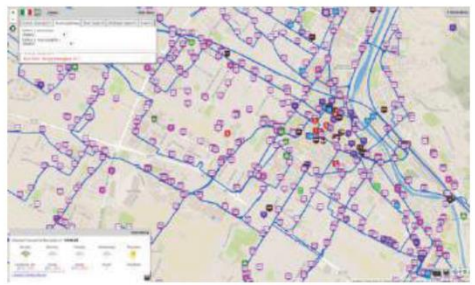
Piattaforma IoT/IoE abilitata dal 5G per applicazioni di:

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





Punti di interesse e servizi su Prato



Use Case LEADER estra

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

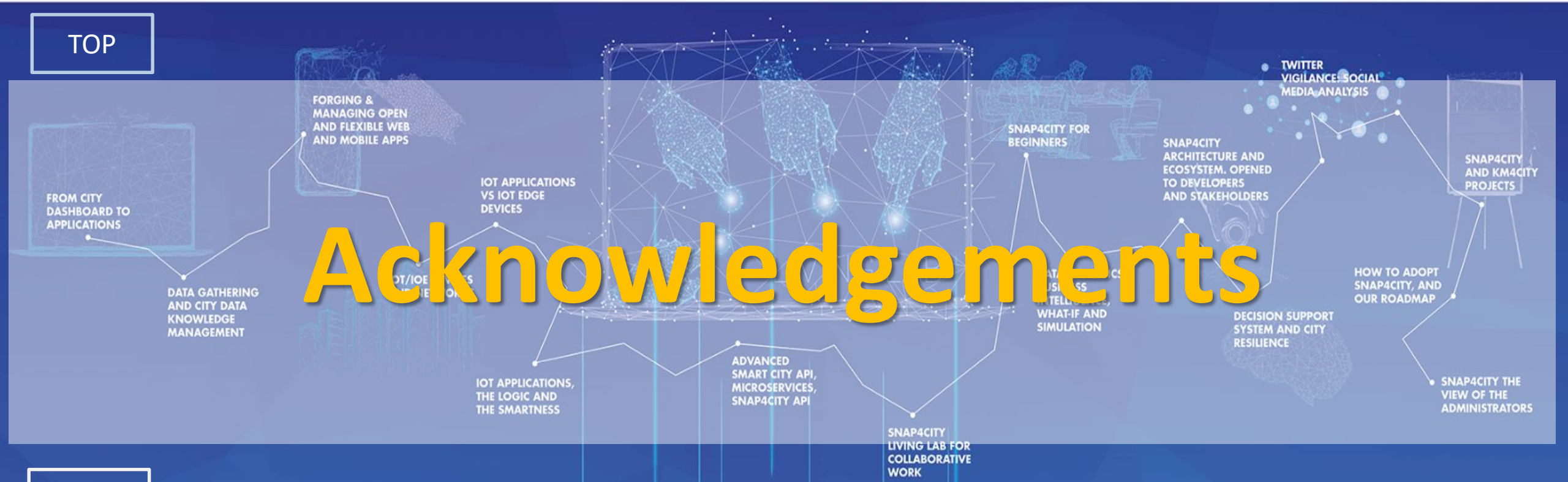
Aziende/Enti Coinvolti Qualcomm, Interporto della Toscana Centrale, Unione Industriale Pratese Confindustria Prato, Publiacqua, GIDA, Programma Ambiente, centria Reti Gas

Green Impact Capacity (GIC)

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

TOP

Acknowledgements



ARC
INDEX

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- **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.*

TOP

SNAP4CITY

KM 4 CITY

Be smart in a SNAP!

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INDEX

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