PTIFaaS

IL FUTURO DELLA MOBILITA'
INTELLIGENTE E SOSTENIBILE

Digital Twin & Intelligenza Artificiale.
Innovazione tecnologica "As a Service "
per la gestione operativa
e la pianificazione tattico-strategica
della mobilità urbana sostenibile e interconnessa

Start at 10:30

Firenze | Milano | Roma | Bari

Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
MOST CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE

Agenda

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IL FUTURO DELLA MOBILITA' INTELLIGENTE E SOSTENIBILE

Registrazione	10:00 - 10:30	Registrazione e Welcome Coffee
Avvio Lavori	10:30 - 10:40	Saluti - ***Prof. Paolo Nesi***, *UNIFI DISIT Lab/Snap4City* - ***Franco Prampolini***, Head of R&D and Innovative Industry Solutions Lutech Group
CN MOST SPOKE 8	10:40 - 11:00	Mobility-as-a-Service: tra integrazione e sostenibilità - ***Prof. Michele Ottomanelli***, *Politecnico di Bari*
Overview OPTIFaaS	11:00 - 11:20	Presentazione generale e obiettivi di **OPTIFaaS** - ***Mauro Starinieri***, Head of Smart City & Mobility Solutions CoE Lutech Group
Strumenti OPTIFaaS	11:20 - 11:50	Presentazione dell'infrastruttura - ***Prof. Paolo Nesi***, *UNIFI DISIT Lab/Snap4City*
Scenario OPTIFaaS	11:50 - 12:10	Ottimizzazione del Traffico - ***Ing. Alessio Tesone***, *Università degli Studi di Napoli*
Scenario OPTIFaaS	12:10 - 12:40	Ottimizzazione Semaforica e di Infrastruttura. Ottimizzazione del Trasporto Collettivo - ***Prof. Paolo Nesi***, *UNIFI DISIT Lab/Snap4City*
Q&A	12:40 - 13:00	Sessione aperta
Light Lunch (offered)	13:00 - 14:00	
Incontri 1:1	14:00 -	Incontri 1:1 con i referenti di Snap4City/**OPTIFaaS** (in presenza)

Agenda

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IL FUTURO DELLA MOBILITA'
INTELLIGENTE E SOSTENIBILE

Presentazione dell'infrastruttura

Prof. Paolo Nesi, UNIFI DISIT

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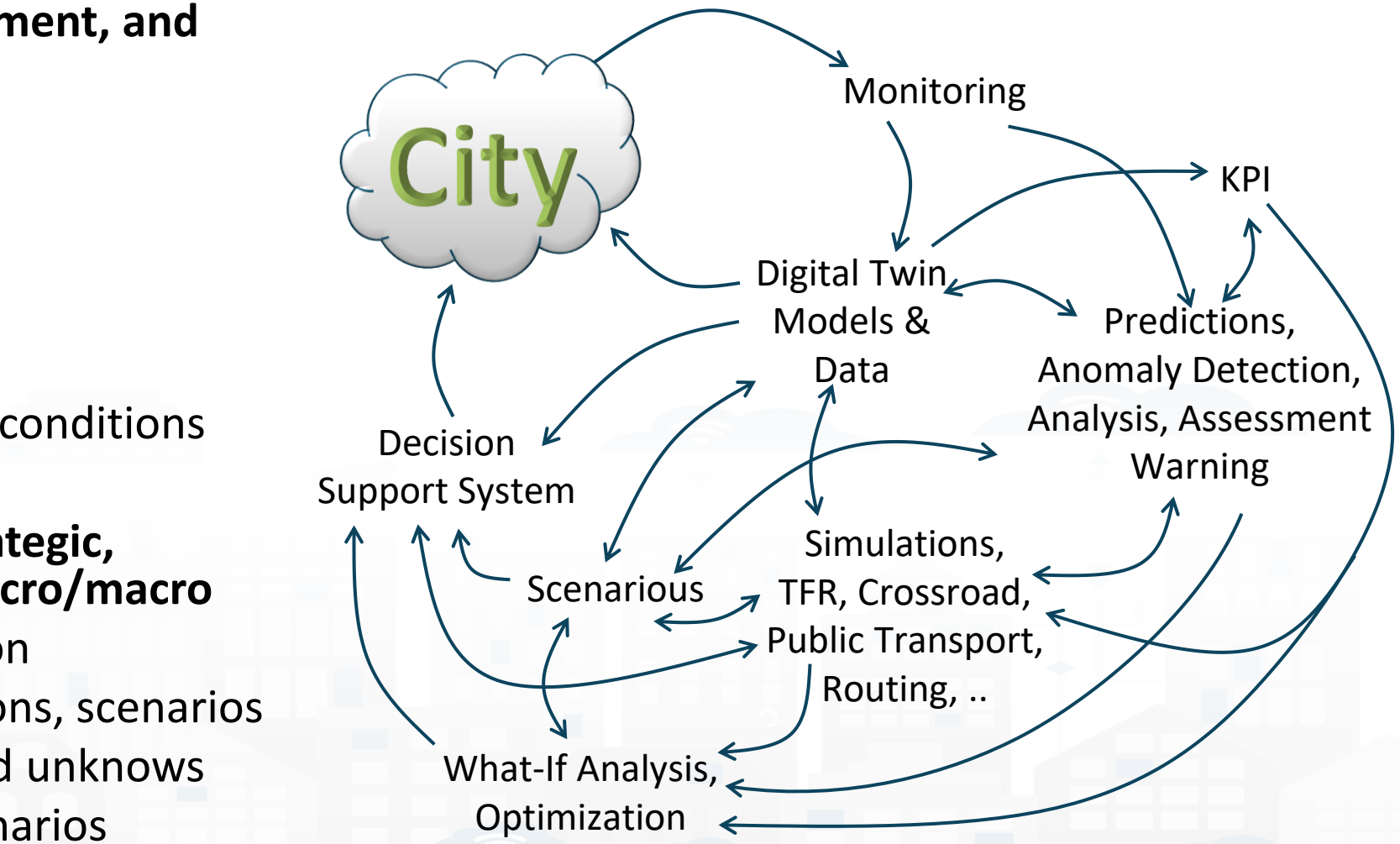
SNAP4CITY

Main tasks

- **Controlling Status: management, and operational**
  - Monitoring via KPI
  - Predictions vs KPI
  - Anomaly detection
  - Neuro-Symbolic analysis
  - Risk assessment
  - Early warning on critical conditions
  - Fast What-if analysis
- **Making plan: tactic and strategic, medium and long range, micro/macro**
  - Simulation & optimization
  - Generative AI Prescriptions, scenarios
  - Resilience to Unexpected unknows
  - What-if analysis wrt scenarios
  - Collaboration with stakeholders



THE POWER OF ARTIFICIAL INTELLIGENCE AT THE SERVICE OF YOUR OPERATION AND PLAN

www.snap4city.org

SNAP4CITY

KM4CITY

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100% OPEN SOURCE

Powered by FIWARE

FREE TRIAL

PEN Test Passed

EU GDPR COMPLIANT

SNAP4 Appliances and Dockers Installations

EUROPEAN OPEN SCIENCE CLOUD

Node-RED

JS Foundation

EØ15 digital ecosystem

NVIDIA

OPERATION AND PLAN - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - OPTIMIZATION - APPLICATIONS

HORIZONTAL AI PLATFORM

MOBILITY AND TRANSPORT

SMART ENERGY AND SMART BUILDING

ENVIRONMENT AND WASTE MANAGEMENT

CITY USER'S SERVICES AND TOURISM MANAGEMENT

SNAPADVISOR

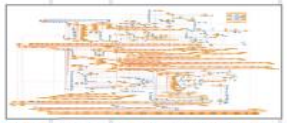
BUSINESS INTELLIGENCE - SIMULATIONS - VISUAL ANALYTICS - SYNOPTICS - GRAPHICAL WIDGETS - ANALYTICS

DASHBOARDS, WIDGETS
TEMPLATES

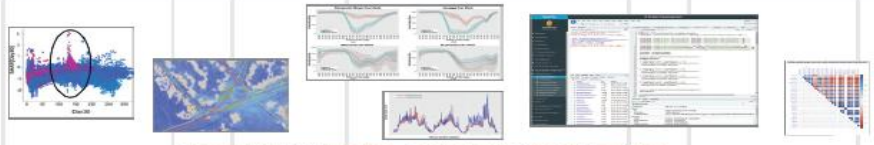
PREDICTION - ANOMALY DETECTION - CLUSTERING - ROUTING - SENTIMENT NLP - TRAFFIC FLOW - PEOPLE FLOWS - SDG
15 MIN CITY INDEX - KPI - HEATMAPS - ORIGIN DESTINATION - MAPS - VECTOR FIELD - ETC...

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

- DEVELOMENT ENVIRONMENT AND METHODOLOGY
- VISUAL PROGRAMMING, ML, AI, HPC
- TRAINING COURSES



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



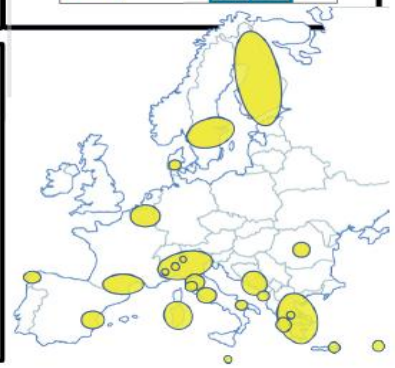
BIG DATA ANALYTICS, ARTIFICIAL INTELLIGENCE
EXPLAINABLE AI, MACHINE LEARNING, GENERATIVE AI
OPERATIVE RESEARCH, STATISTICS

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

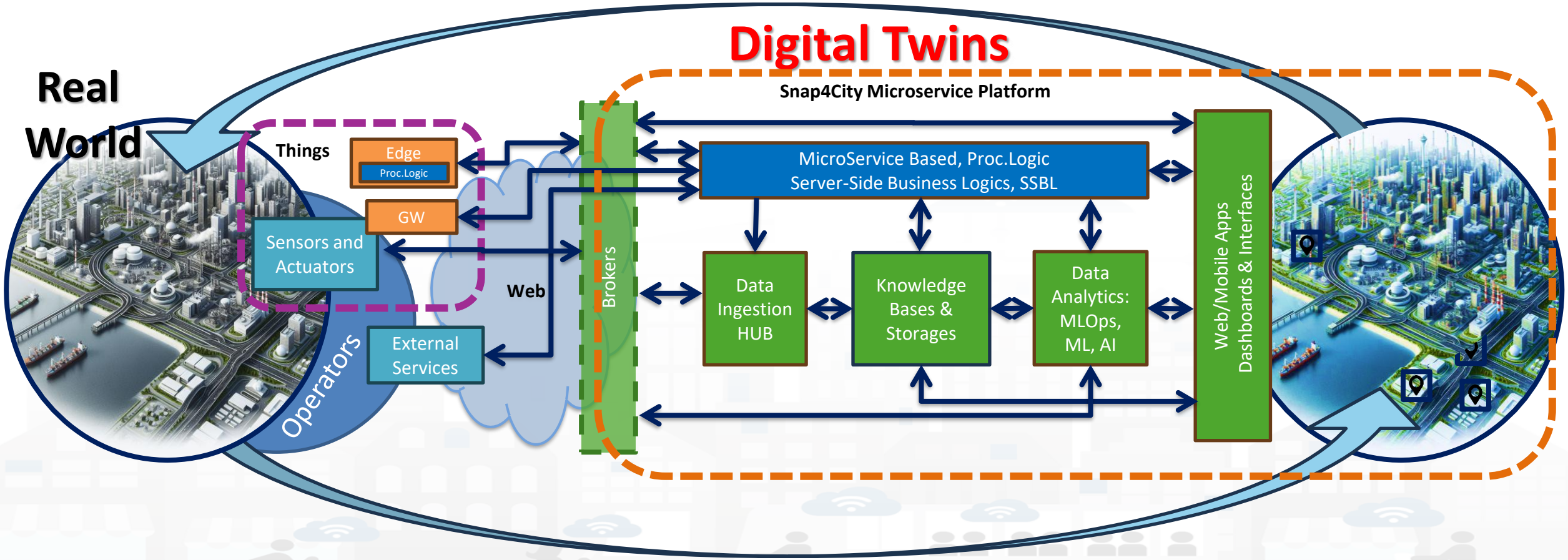
FULL INTEROPERABILITY, ANY: DATA, BROKERS, NETWORKS AND VERTICALS

NATIVE AND EXTERNAL APPLICATIONS

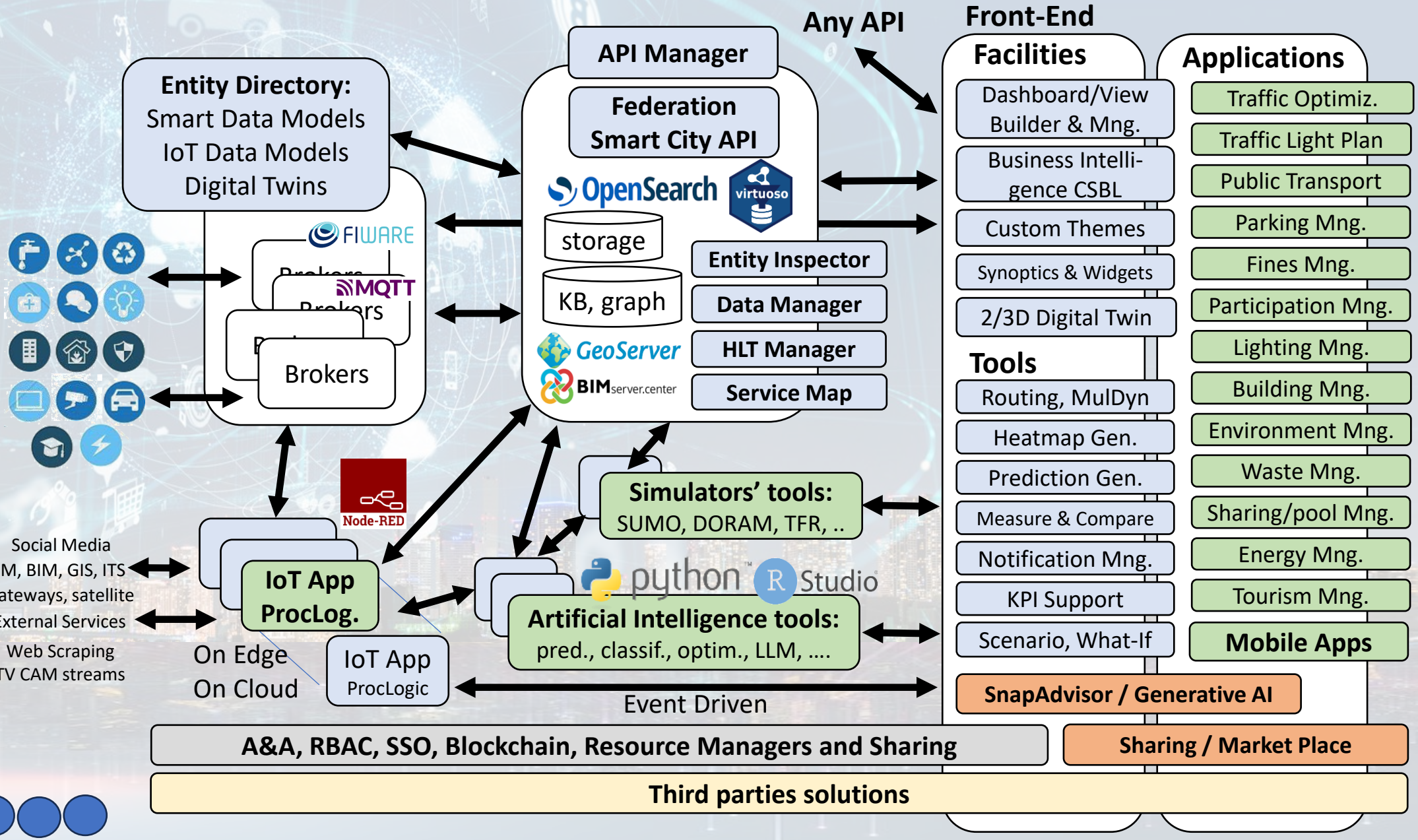
- Smart Parking
- Smart Light
- Smart Waste
- Smart Energy
- Smart Building
- Smart Tourism
- ...



Digital Twin Development Platform



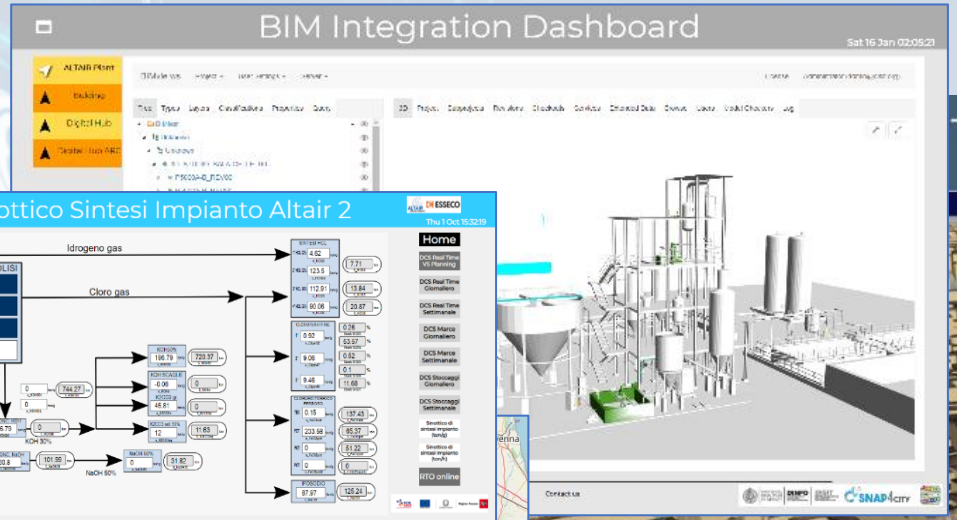
Technical Architecture

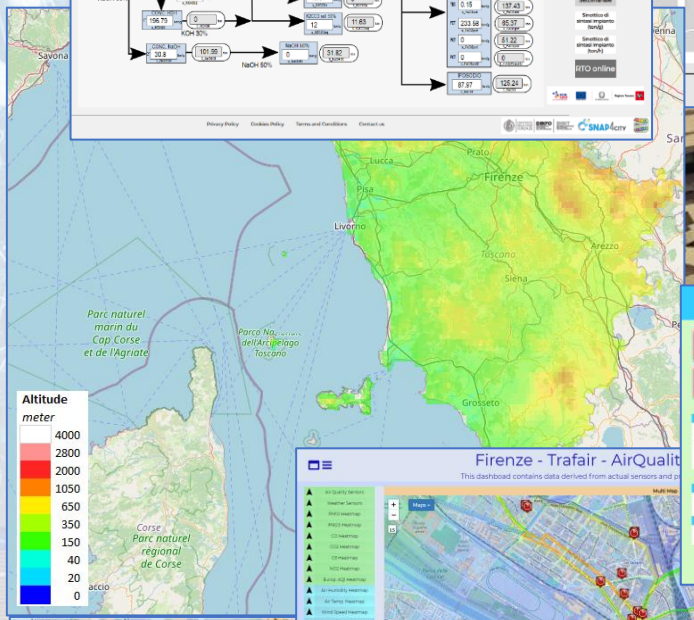


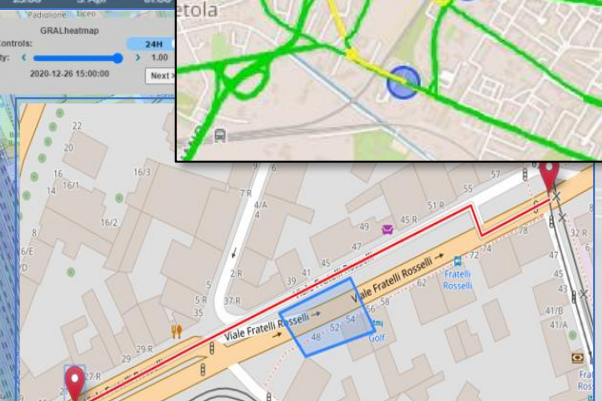
High Level Types

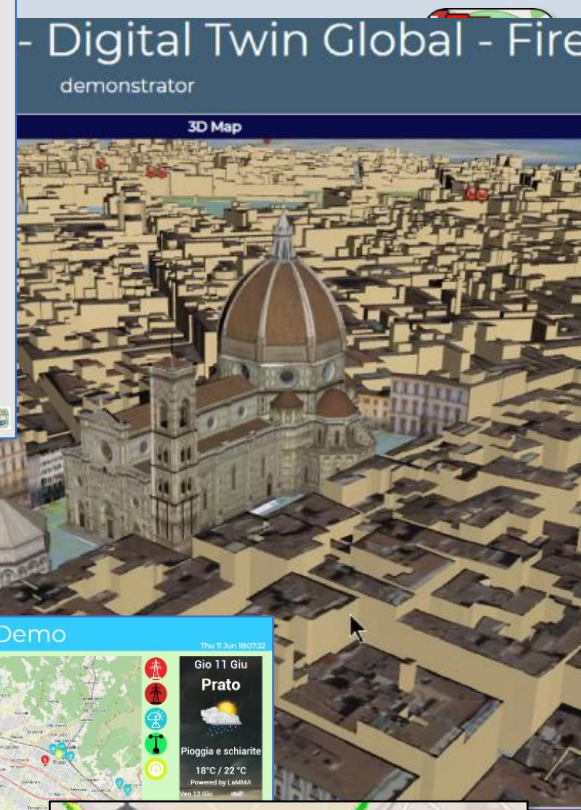
Snap4City (C), Sett. 2025

- POI, IOT Devices, shapes,..
  - FIWARE Smart Data Models,
  - IoT Device Models
- GIS, maps, orthomaps, WFS/WMS, GeoTiff, calibrated heatmaps, ..
- Satellite data, any kind..
- traffic flow, typical trends, ..
- Vector fields + heatmaps, ..
- trajectories, events, workflow, ..
- 3D Models, BIM, Digital Twins, ..
- OD Matrices of several kinds, ..
- Dynamic icons/pins, ..
- Synoptics, animations, ..
- KPI, personal KPI,..
- social media data, TV Stream,
- routing, multimodal, constraints, ..
- scenarios, ….
- etc.









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Standards and Interoperability

Compliant with:

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

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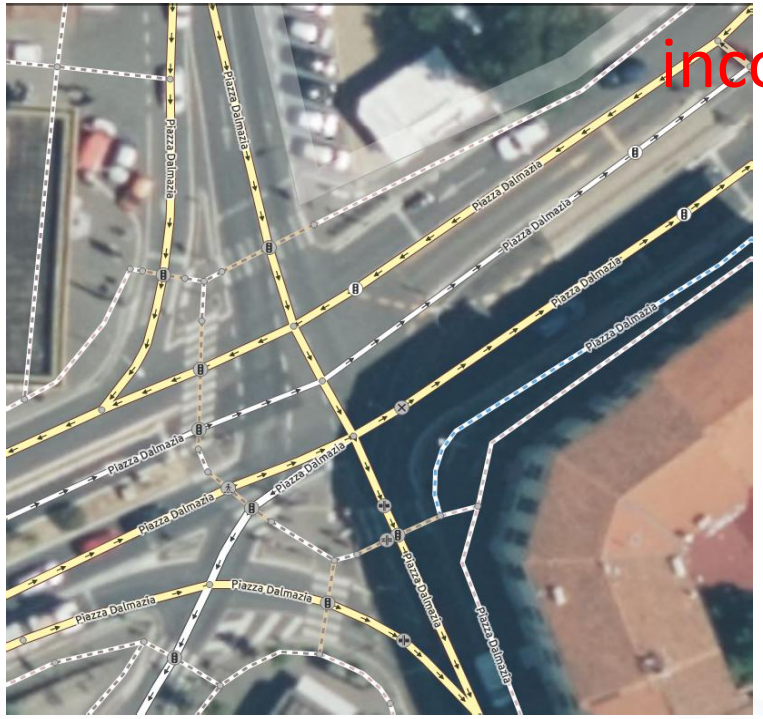
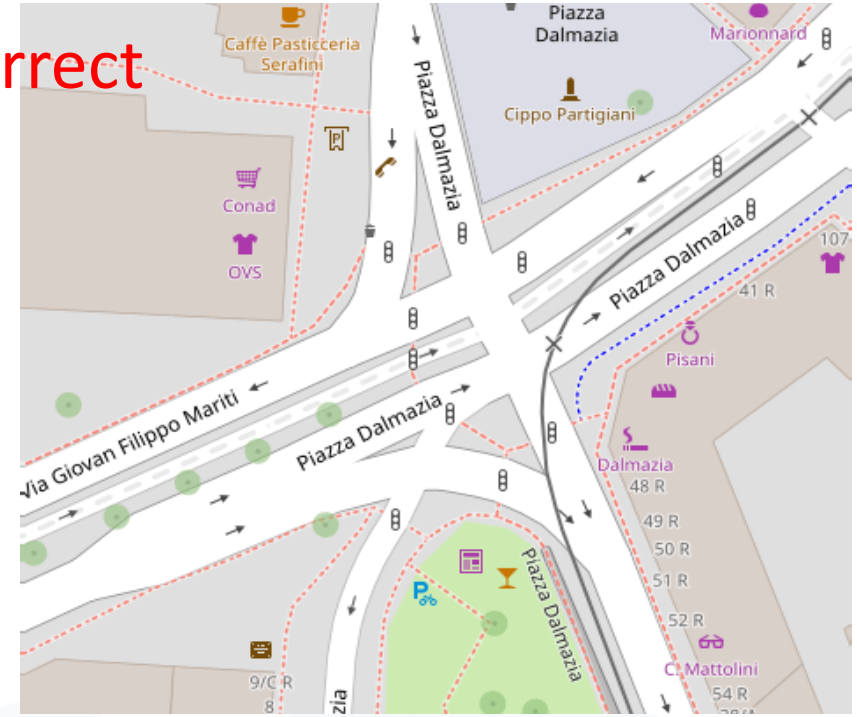
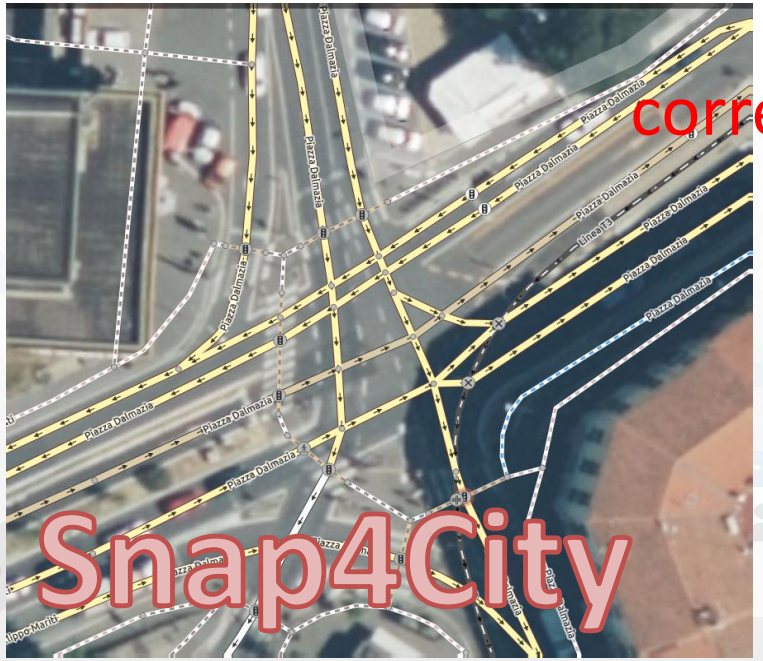
OSM data with non correct viability in Piazza Dalmazia, Firenze



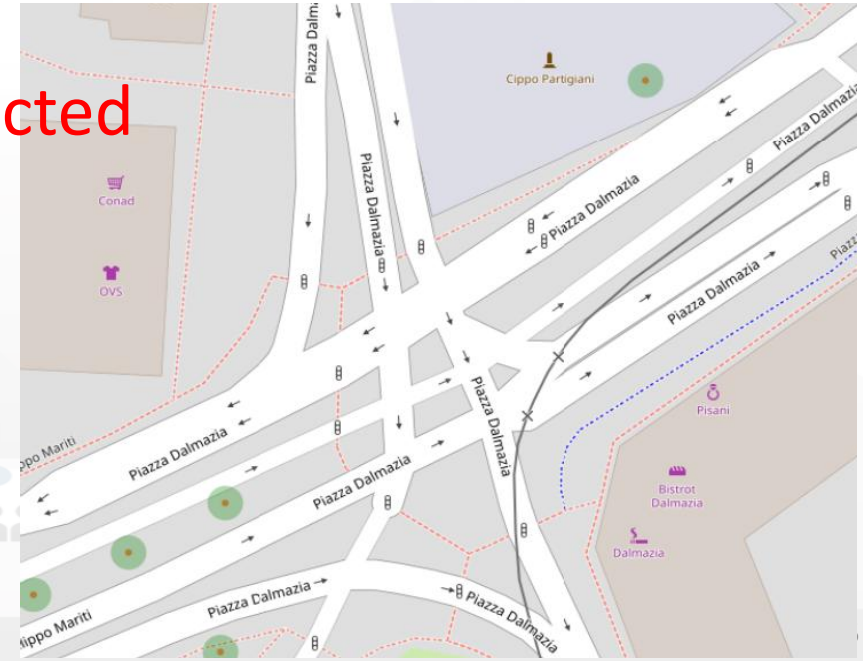
incorrect



After Correction of OSM data defining a correct viability of Piazza Dalmazia, Florence. Regeneration of the TILEs for the maps



corrected



From OSM to Snap4City

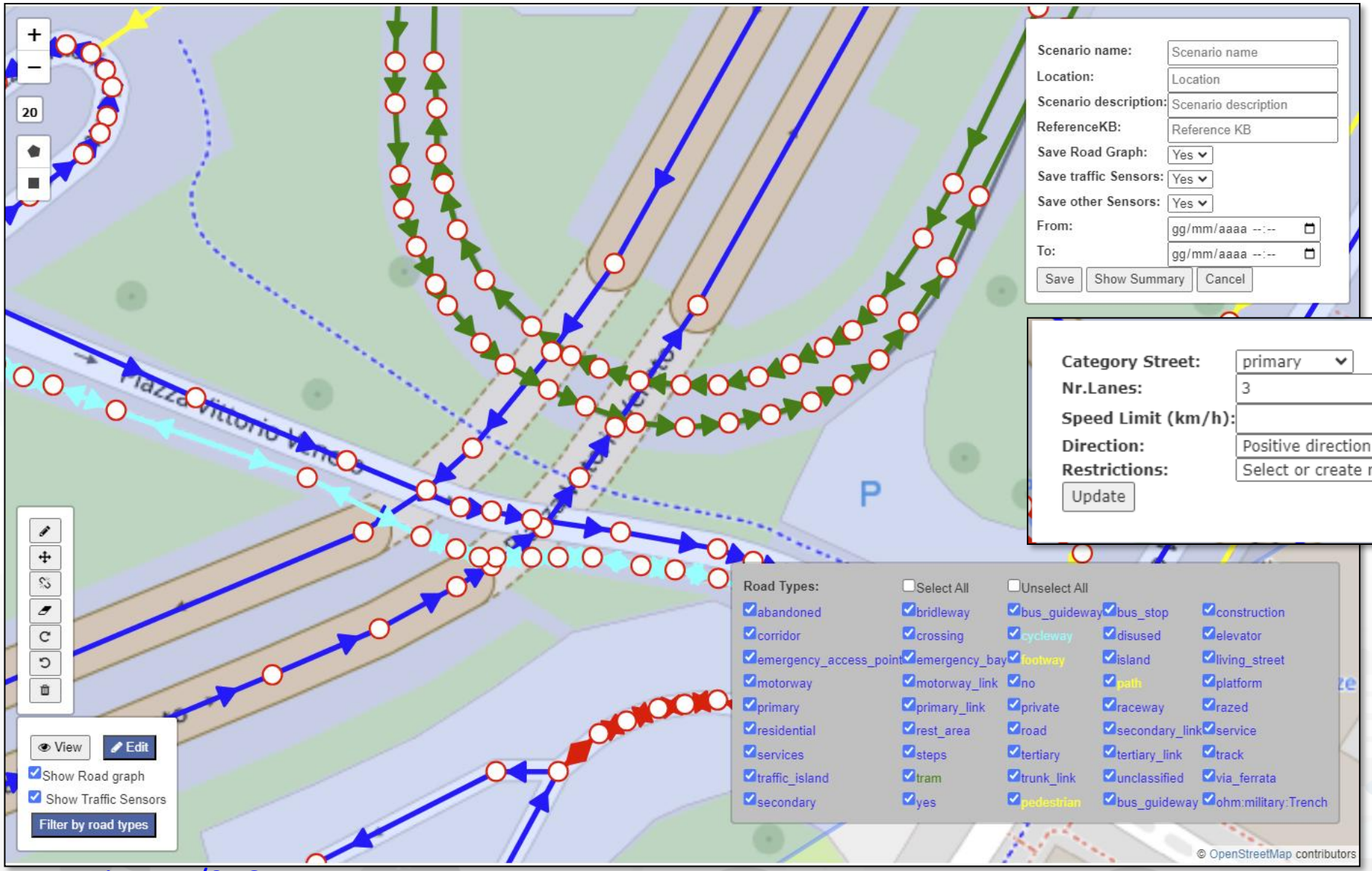
Scenario Editor

Select map

Zoom

New Scenario

Editing
Drag & drop
Split & Join
Delete
Do and Undo



Edit Road Segment

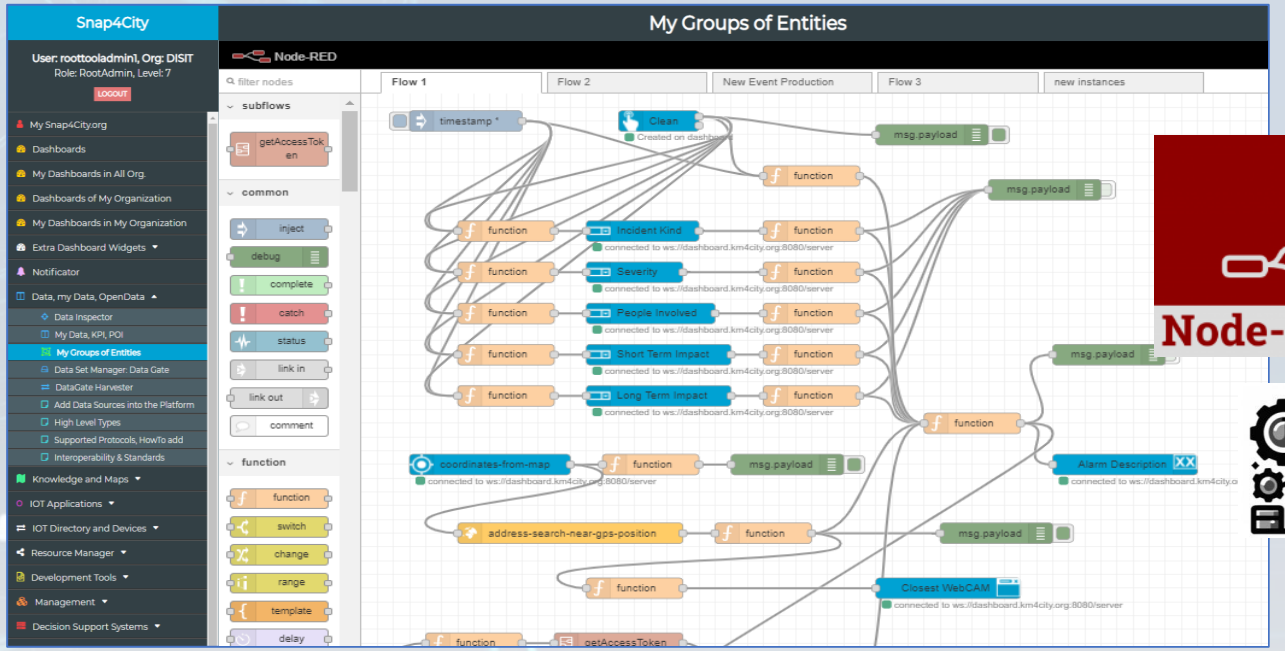
- identifier
- composition
- elemLocation
- elementClass
- elementType
- length
- operatingStatus
- speedLimit
- trafficDir
- width
- highwayType
- route

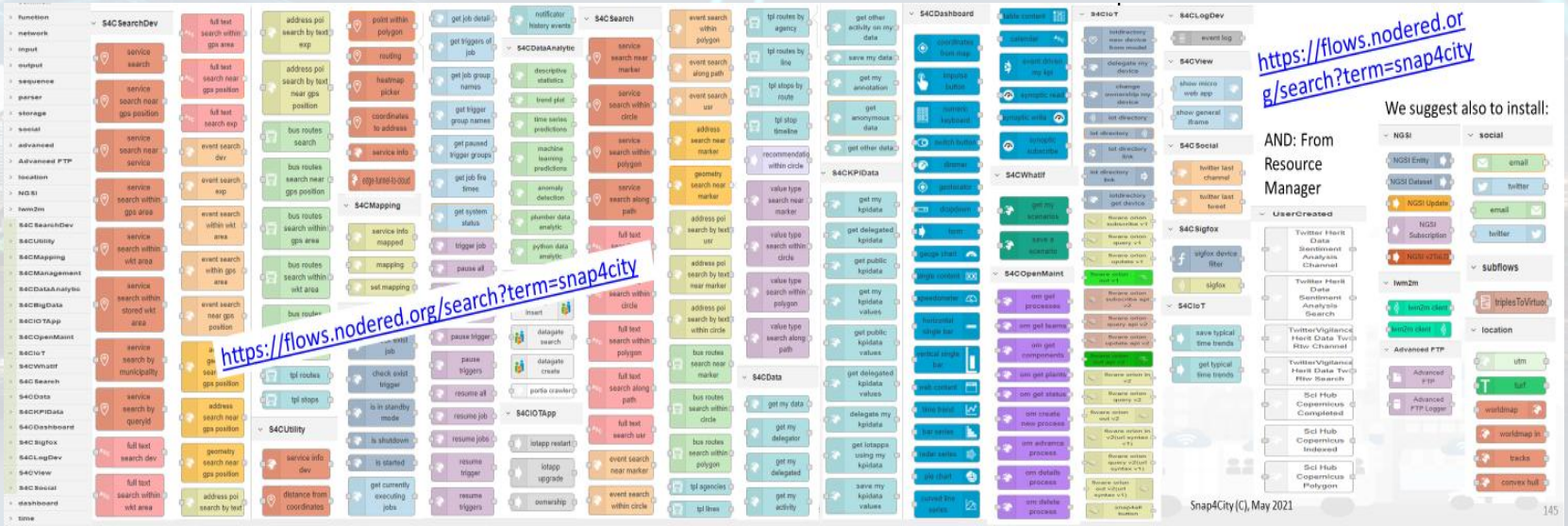
Properties of Road Elements

https://www.snap4city.org/976

Ingestion, aggreg. → exploitation

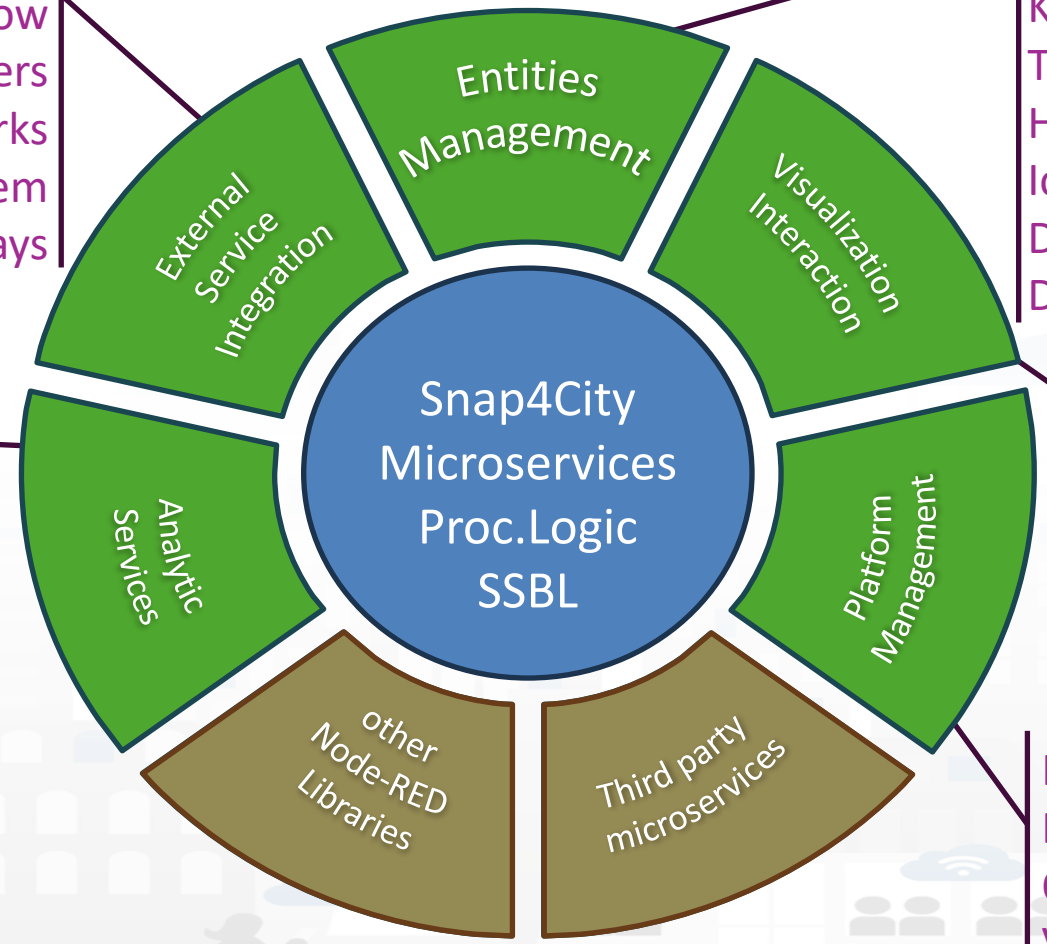
- **IoT App Visual Programming, no coding**
  - **Data transformation**
  - **Integration, Interoperab.**
  - **Scripting Data Analytics**
  - **Data ingestion**
  - **Business logic Server Side**
- **Edge and Cloud**
- **MicroServices** data event driven develop via visual language Node-RED





MicroServices Areas

> 60.000 downloads (up to 2024)



Open Data CKAN
Ticket Management, workflow
BIM Servers
Social Networks
Video Management system
Gateways

Data Load / Search / Retrieval
KPI, POI, GIS Data, Scenarios
Time Series, Public transport
High Level Types: heatmaps, ODM,…
IoT / Entity Discovery
Delegation Management
Data Mapping

Data Analytics
Statistic, Optimization
Simulation
Artificial Intelligence
What-if Analysis Support
Geo Utilities Support
Routing & Traffic Flow
MLOps support
Python support
R Studio Support

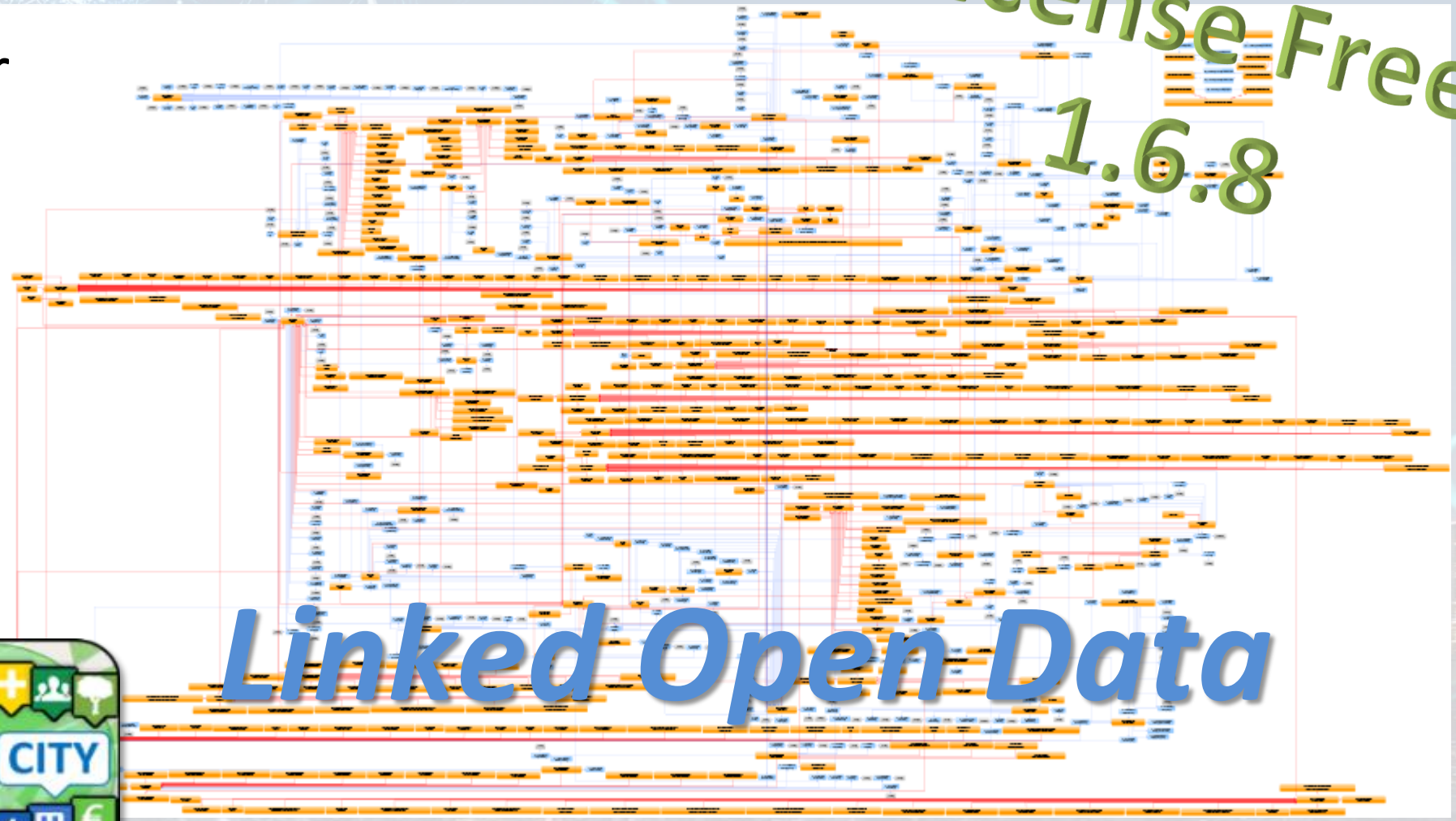
Dashboards
Widgets: Graphic Libraries
Interactive Widgets
Maps, 3D representations
Synoptics, External Content
Micro Web App

IoTApp Management
Data Logs, A&A, Security
Ownership Management
VPN remote access

Node-RED

Expert System semantic queries

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



https://www.snap4city.org/19

Available AI Solutions on Snap4City

https://www.snap4city.org/997

More than 80 Available Solutions & 300 AI applic.

- **Mobility and Transport**
- **Environment, Weather, Waste, Water**
- **City Users Behaviour and Social analysis**
- **Energy and Control**
- **Tourism and People**
- **Security and Safety**
- **High Level Decision Support Solutions**
  - **Asset management**
  - **Resilience and Risks Analysis**
- **Low level Techniques**

https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf

https://www.snap4city.org/download/video/course/p4/

SUSTAINABLE DEVELOPMENT GOALS

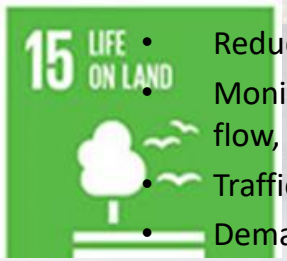
SNAP4CITY

KM 4 CITY

- ***15 Minute City Index:***
  - 13 subindexes: energy, slow mobility, fast mobility, housing, economy education, culture and cults, health, entertainment, gov, food, security…

- Optimization of car sharing/pooling
- Monitoring and Prediction of energy consumption
- Stimulating: Bike sharing, e-bikes, car charge, etc.
- Sizing energy plants, Community of energy

- Reduction of emissions, reduction of congestions
- Smart City infrastructure: monitoring and resilience, long terms predictions, optim. operation and plan
- Effective and Low cost smart solutions
- What-if analysis, Simulations, optimization
- Origin Destination matrices computation



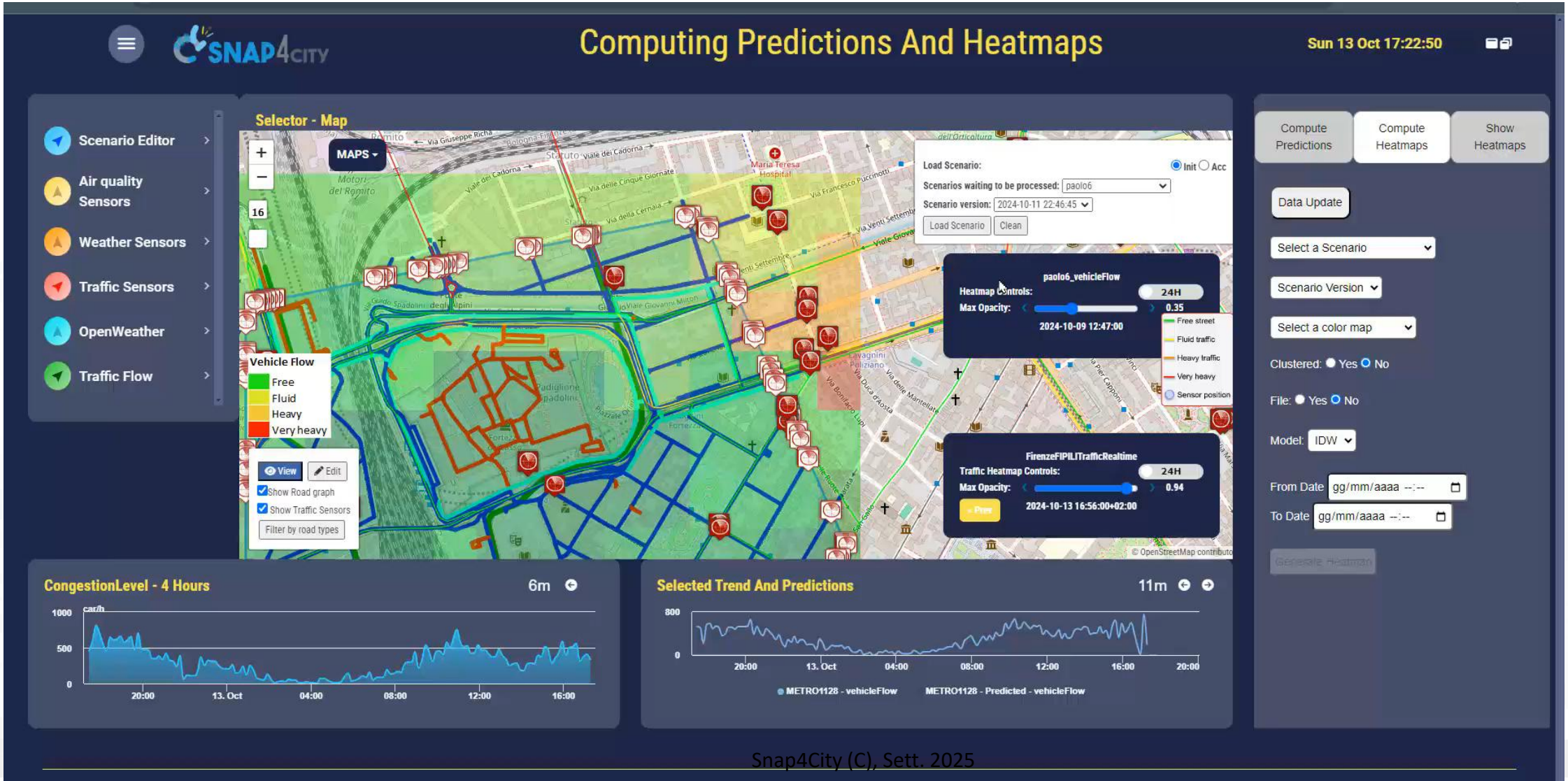
- Reduction of emissions, reduction of congestions
- Monitoring and Predicting: NO2, NOX, CO2, Traffic flow, pollutant, landslide, waste, etc.
- Traffic flow reconstruction, optimisation
- Demand vs Offer of Mobility analysis

- Predictive maintenance
- Decisions Support Systems
- Process optimization, control
- Industry 4.0 integrated solutions
- AI assistant for commercial activities

- Optimization of Waste Collection
- business intelligence tools for decision makers
- Reduction production costs
- Monitoring resource consumption
- Advisor for documentation, generative AI

- Shortening justice time
- Prediction of mediation proneness
- Assisting institution is taking legal decisions
- Anonymization and indexing legal docs.
- Ethical Explainable Artificial Intelligence
- Advisor for legal documentation, generative AI

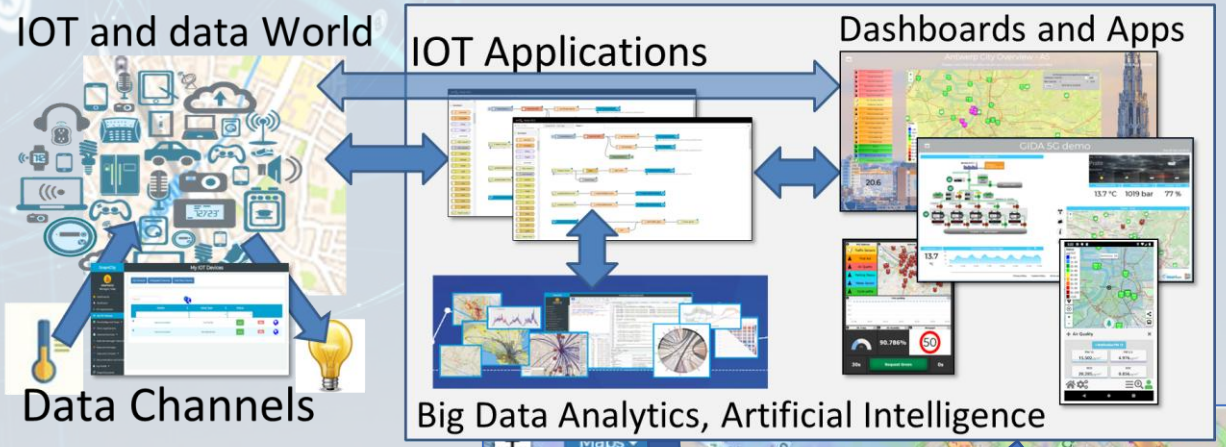
Predictions and Heatmaps in Real Time

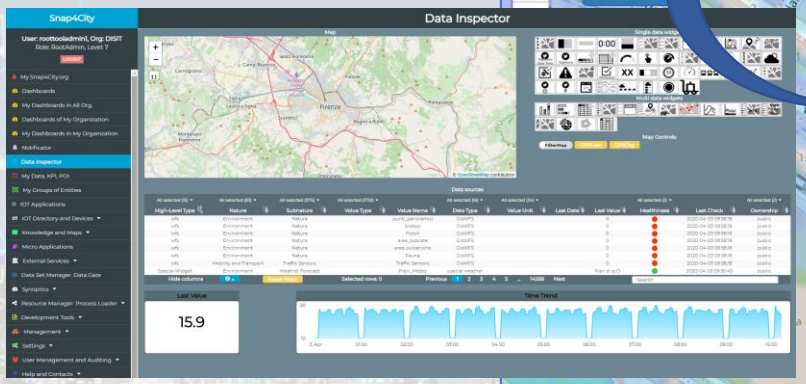


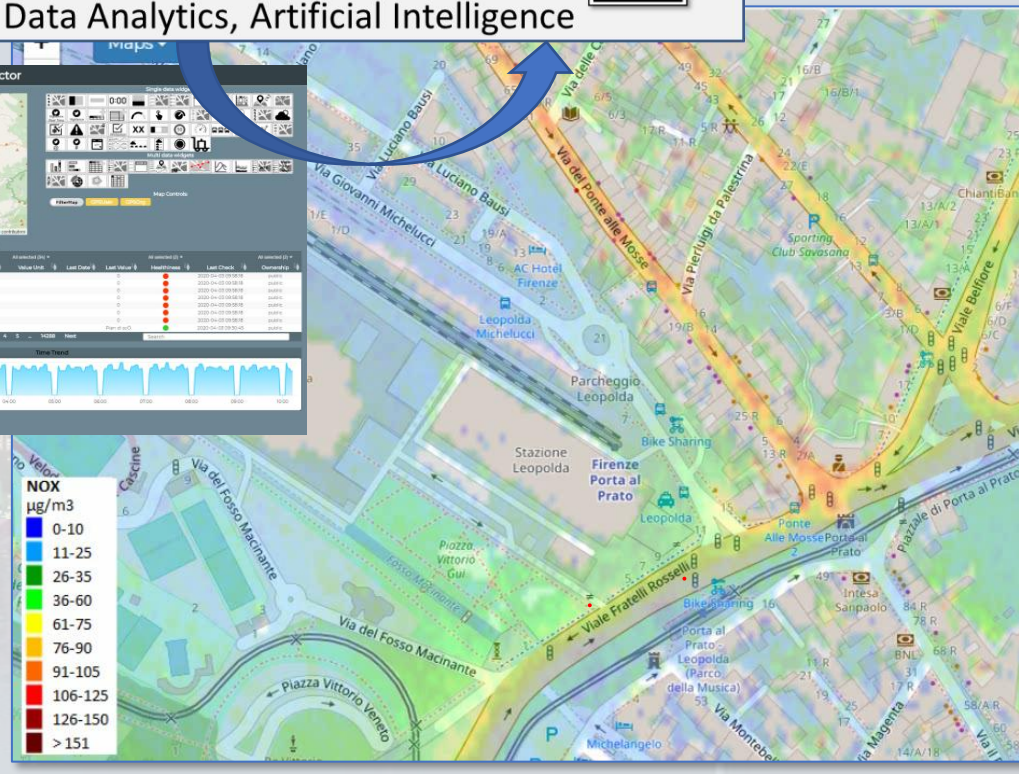
Solutions: reliable, secure and fast to realize

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

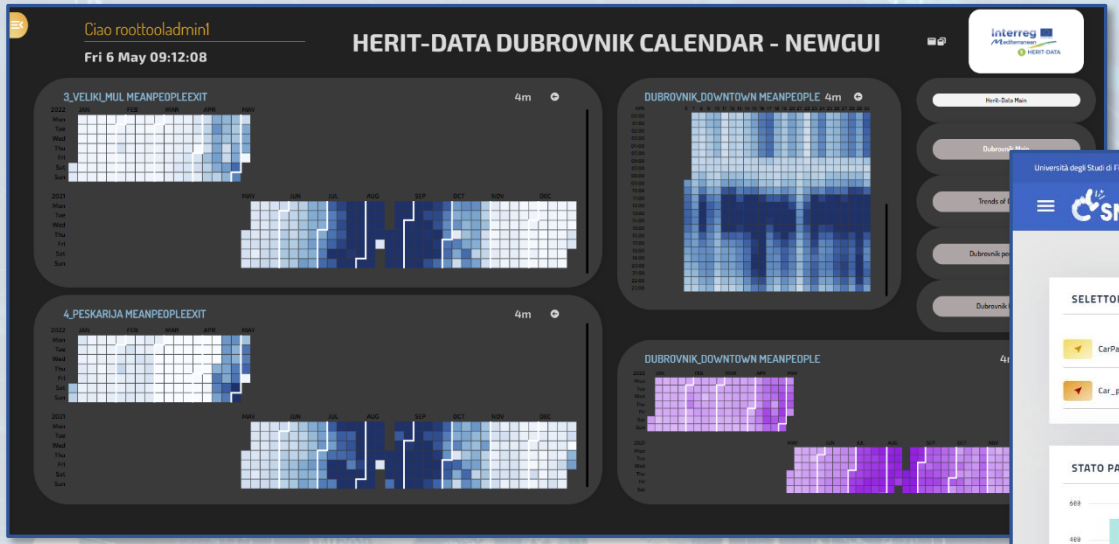
- **Smart Solutions results to be**
  - **Real time data drive**
  - **Secure end-to-end**
  - **GDPR compliant**
  - **Reliable, interoperable**
  - **Auditable, marketable**

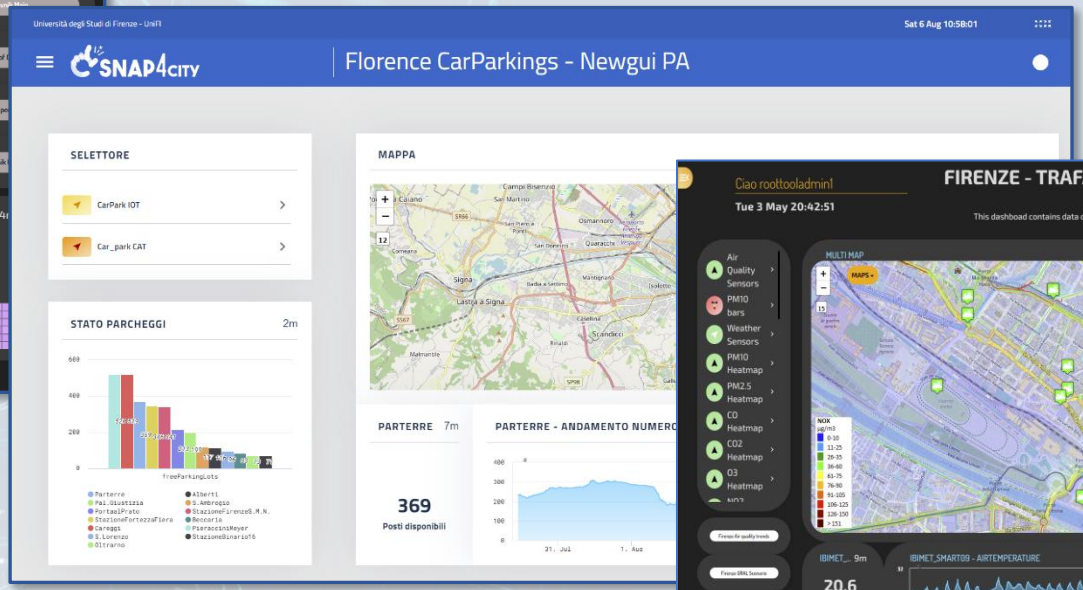


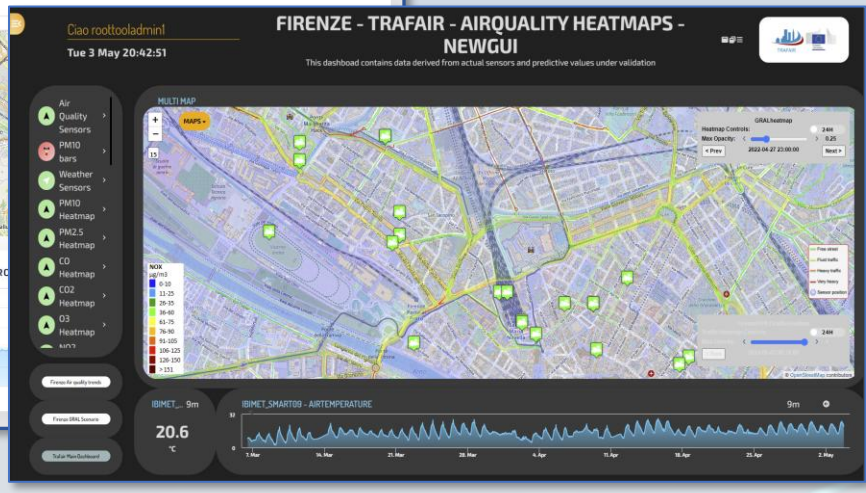


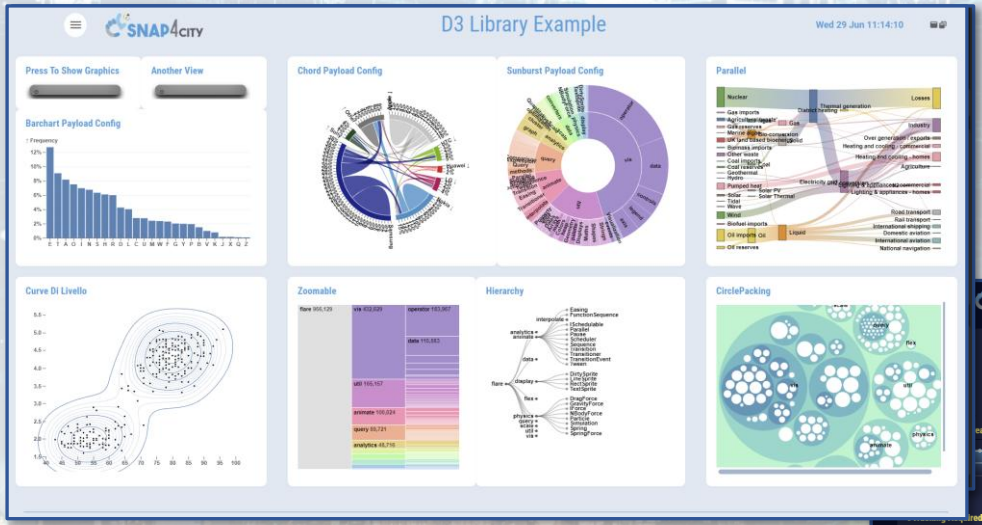


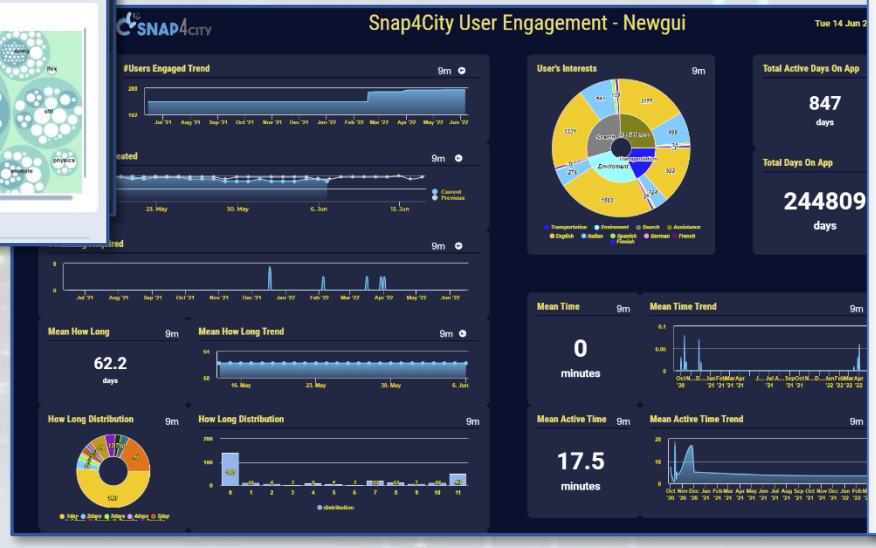
Different Themes

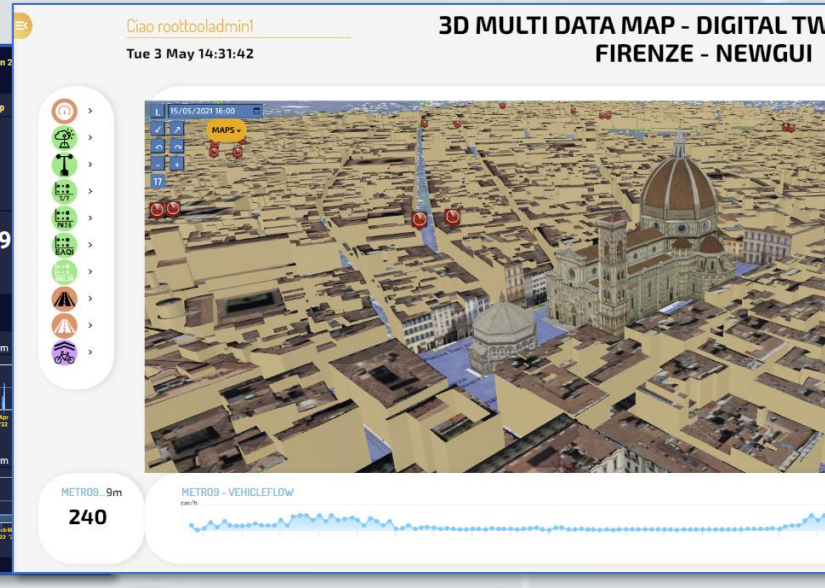








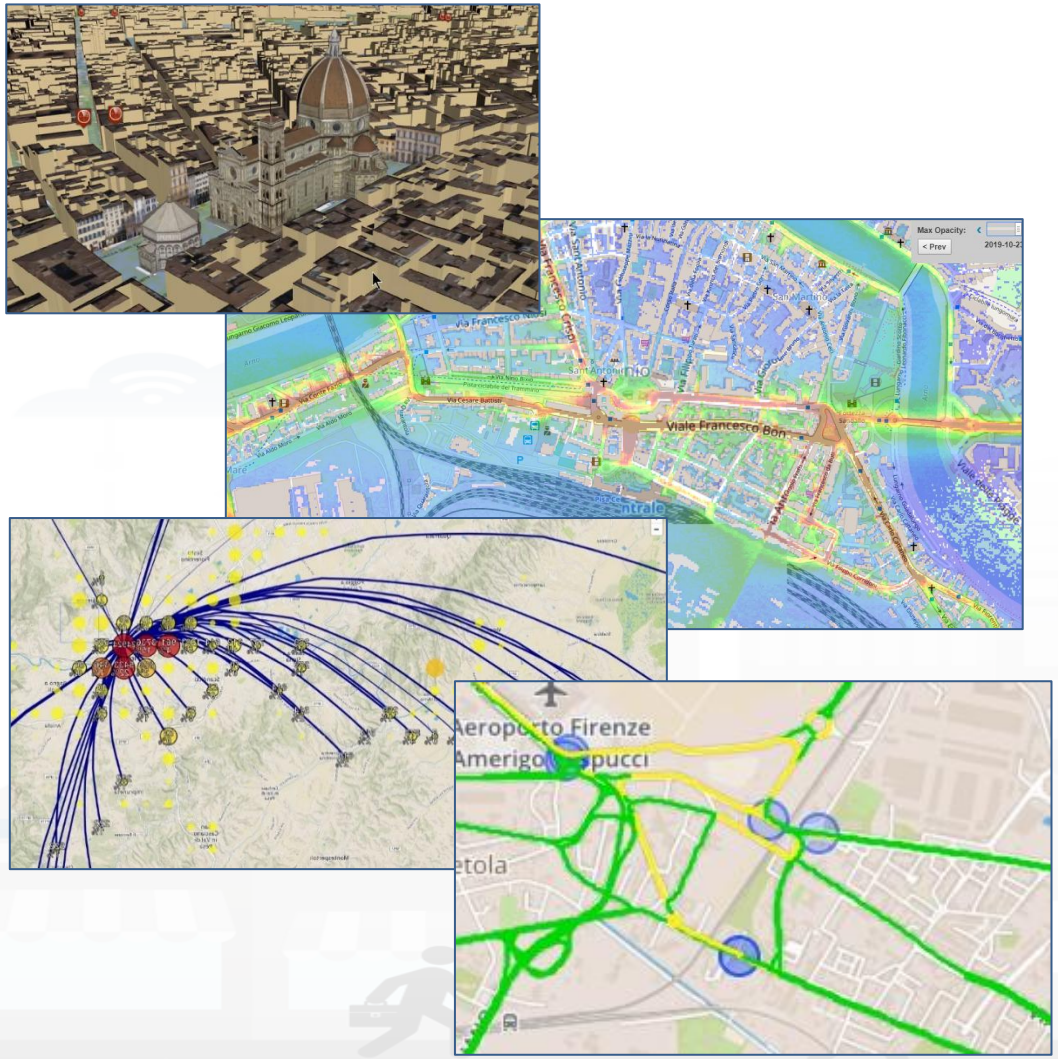




New styles/themes can be developed by specializing a few files from open source

https://www.snap4city.org/793

Smart City Digital Twin



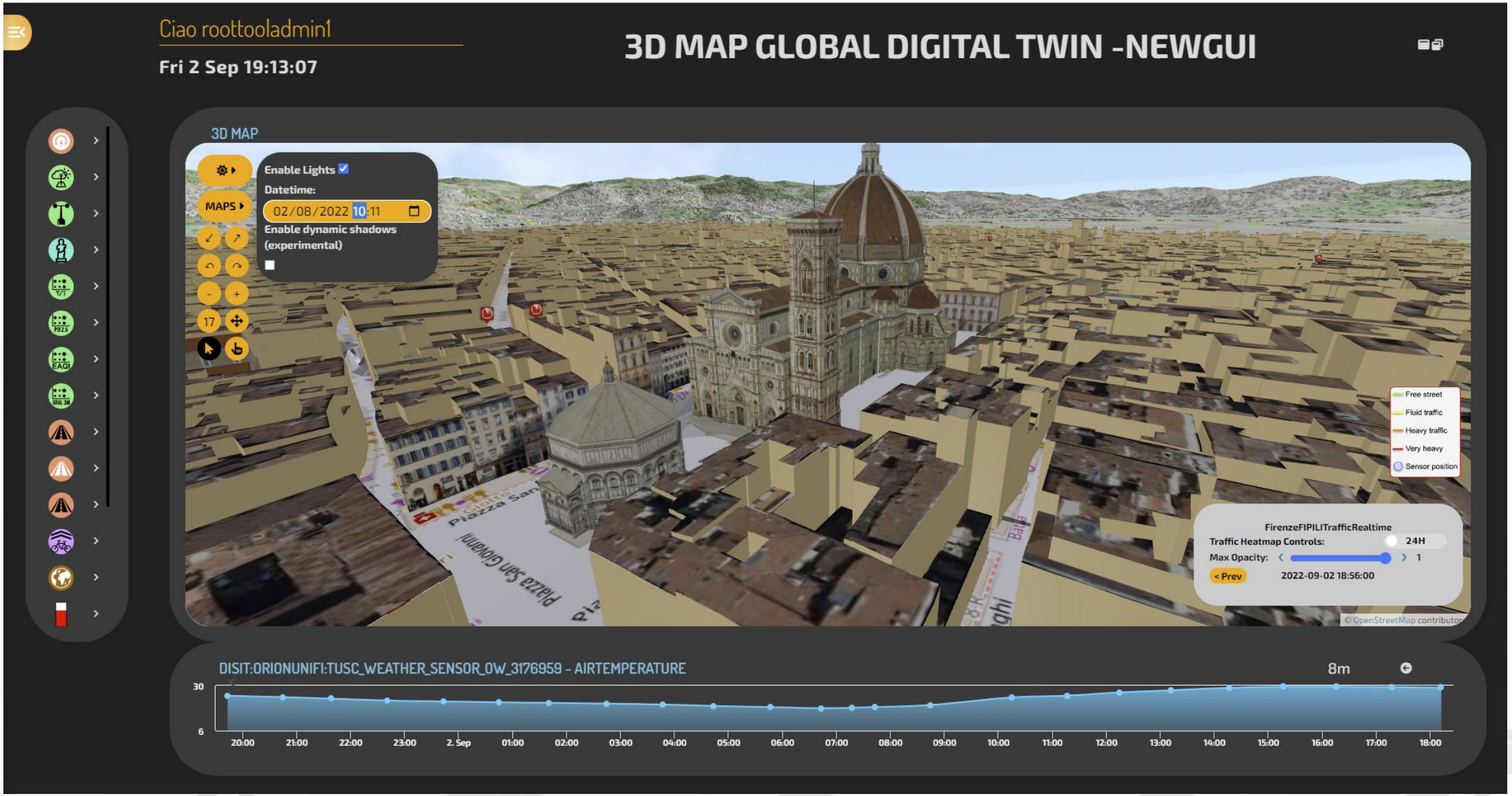
City Digital Model with…

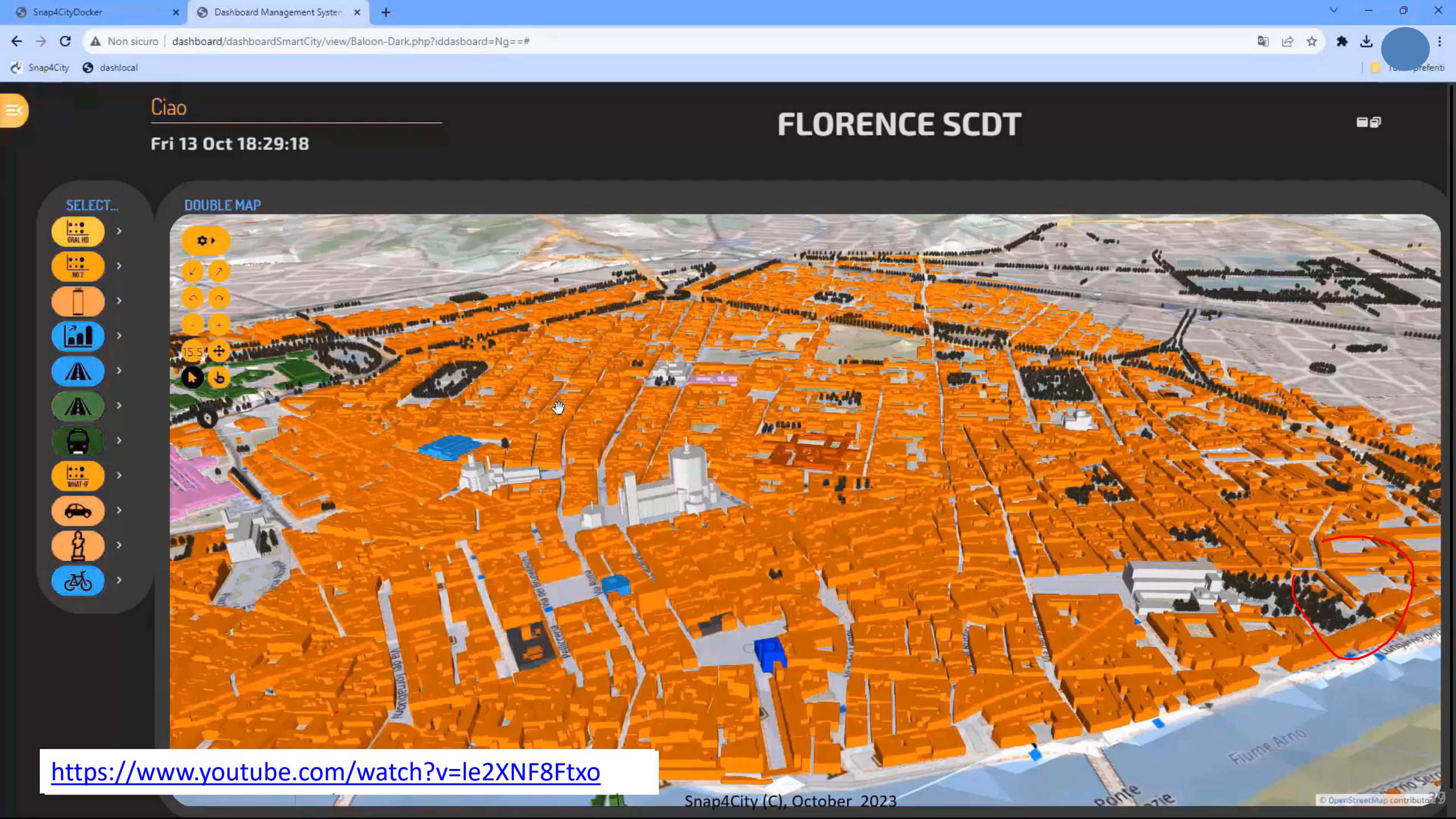
- Intuitive platform
- Any Data TYPE, any data source, any protocol
- Data storage seamless
- Data analytics → artificial intelligence, AI/XAI
- Data Ethics, AI Ethics, GDPR
- Interactive Data Representation, any kind
- Key Performance Indicators, any kind
- What-IF analysis – Simulation, prediction, 2D/3D
- Micro, Meso e macro scales
- Operation, planning tactic and strategic / optimization
- Collaborative and shared representation
- Sustainable, shared, open source 100%

Complex and heterogeneous information, interoperability

- GIS, ITS, AVM, IoT, BIM, CKAN, etc.
- Satellite services
- MaaS, last-mile delivery HUBs
- etc.

3D Digital Twin




Snap4CityDocker
Dashboard Management Syste
Non sicuro
dashboard/dashboardSmartCity/view/Baloon-Dark.php?iddasboard=Ng==#
Snap4City
dashlocal
Ciao
Fri 13 Oct 18:29:18
FLORENCE SCDT
SELECT...
DOUBLE MAP
GRAL HD
NO 2
WHAT-IF
Fiume Arno
Snap4City (C), October 2023
https://www.youtube.com/watch?v=le2XNF8Ftxo

Scenarious

Scenarious

- Snap4City at OSAKA with OPTIFaaS and CN MOST
- SMART3R-FLITS: SMART Transport for TRavellers and Freight Logistics Integration Towards Sustainability
- SOLUTION: Security, Smart City Asset Management for Cuneo, Italy PDF
- ENERGIA: R&S di autoclave a mandrini multipli nel curing di serbatoi in composito per storage di H2 mediante ottimizzazione energetica machine learning.
- UrbanDT4TF: Urban Digital Twin for Traffic Flow
- ELLIE: On the UsE of Internet of Senses for the CuLturaL HerItagE
- Snap4Rhodes: The "Single Smart City & Cyber Security Monitoring Platform" for the Municipality of Rhodes
- SADI-MIAC: Integrated Decision Support System with Digital Twin Models and Artificial Intelligence for Business
- SADI-MIAC: Sistema di Assistenza alle Decisioni Integrato con Modelli Digital Twin e Intelligenza Artificiale per le attività commerciali
- SCENARIO: City Users' Participation and Engagement with Snap4City, PDF
- OPTIFaaS: Operation and Plan, Transport Infrastructure and Facilities Support as a Service
- SOLUTION: 15MinCityIndex: understanding city areas by means of 13 different aspects, PDF
- **SOLUTION**: Energy Management and Control, PDF
- **SOLUTION: Environment Control, Predictions & Prescriptions,** PDF
- **SOLUTION**: Smart Light Control and Light Adaptive with Traffic Density PDF
- **SOLUTION**: Smart Tourism Management with Snap4City PDF
- **SOLUTION**: Traffic Infrastructure Optimisation: reducing travel time and emissions PDF
- **SOLUTION**: Traffic Light Plan Optimisation: reducing travel time, number of stops for vehicles and tramway lines: PDF
- **SOLUTION**: Snap4Building: monitoring, managing, controlling infrastructures PDF
- SOLUTION: Snap4City integration with Milestone X Protect, VMS, Video Management System PDF
- SOLUTION: Snap4City Digital Twin, PDF
- SOLUTION: eShare in a Snap - The innovative car sharing and car pooling service, PDF
- SOLUTION: Snap4City Smart Parking Manager and mobile App supports PDF
- SOLUTION: Exploit Snap4City in different Smart Waste use cases, waste manager, PDF
- eShare in a Snap - The innovative car sharing and car pooling service
- Digital Twin Cityverse FAQ to Snap4City
- AMMIRARE: make the beach system more resilient to climate change risks through the implementation of natural based solutions
- TOURISMO: TOURism Innovative and Sustainable Management of flOws
- CAI4DSA: Collaborative explainable neuro-symbolic AI for Decision Support Assistant
- SASUAM: Solutions for Safe, Sustainable and Accessible Urban Mobility
- SCENARIO: Exploit Snap4City in different Smart Waste use cases
- SCENARIO: Smart City Asset Management for Cuneo, Italy
- Deep Data Analytic Data Models Digital Twin (ITA)
- Smart Traffic Light Control Adaptive for Traffic Density (the actual case of Merano) PDF
- Key performance Indicator, KPI, per la mobilità e trasporti, MaaS, parcheggi, inquinamento (ITA)
- Snap4City integration with Milestone X Protect, VMS, Video Management System PDF
- SCENARIO: Smart Light Control, 2023, CAPELON, PDF
- Florence HeritData FactSheet: https://www.snap4city.org/drupal/sites/default/files/files/FACTSHEET%20FLORENCE.pdf
- SCENARIO: Smart City Living Lab in Romania, PDF
- Snap4PVenergy: Online Photovoltaic System Simulator
- SCENARIO: Fashion Retail Recommendation System via Multiple Clustering Approach
- SCENARIO: Energy Community, CER, SELFUSER
- SCENARIO: Supporting Decision Makers in Real Time about Quality Lab Analyses on the production process, PDF
- Herit-Data and Snap4City: to better manage tourism flows, PDF
- Digital Twin Local and Global, PDF
- Social Media Analysis: Twitter Vigilance, PDF
- GDPR Compliant People Detection and Counting using Thermal Cameras, PDF
- Artificial Intelligence Predicts Landslides in Florence Area, PDF
- Available Parking Slots Prediction, PDF
- Available Bikes and Free Slots Prediction On Bike Sharing Stations, PDF
- Long Term Prediction of NO2 KPI of European Commission reference values, PDF
- Inventory of transferable digital applications and solutions for the tourism ecosystem
- Scenario: AMPERE Operator Manual
- Scenario: IMPETUS Intelligent Management of Processes, Ethics and Technology for Urban Safety (Oslo and Padova)

https://www.snap4city.org/4

SNAP4CITY roadmap

2020

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

- Smart Mobility
- PISA, PUMS
- Living lab

Km4City 1.6.7

2021

Smart Ambulance (2021-22)

Enterprise (2021-22) Industry 4.0

Contract

Contract

PC4City (2020-21) Monitoring Terrain

Winner of Open Data Challenge of

- Smart Light
- Sweden

2022

Almafluida Industry 4.0 (2021-22)

AMPERE (2021-22) Industry 4.0

SYN-RG-AI SmartCity

Industry 4.0

SmartCity, 2021-23

AXIS collab SmartCity

Asymmetrica Smart City, 2022-23

Contract, 2022-23

2023

Contract, 2022-23

2022-2023

Contract, 15min

Security and Risk

Italferr, Smart City

CN MOST, 2022-26

EI THE, 2022-26

G. Agile, 2021-23

2023-26

Merano, smart light

OceanRace, Genova, AWS

Cuneo, smart city

2024

Km4City 1.6.8

TOURISMO

ELLIE IA 2025-2027

UrbanDT4TF

Contract, 2024-25

CAI4DSA

Future Artificial Intelligence Research

OPTIFaaS

SASUAM

Rhodes, smart city

eShare

UNIFI TUSS

AMMIRARE

Currently 2025

- **UrbanDT4TF**, CN HPC: Digital Twin mobility, https://www.snap4city.org/drupal/node/1057
- **DI-DTPlatform**, CN HPC: Digital Twin, mobility, environment, https://www.snap4city.org/drupal/node/1097
- **Sasuam**, CN MOST, PNRR: AI, mobility, https://www.snap4city.org/drupal/node/999
- **OPTIFaaS**, CN MOST, PNRR: AI, mobility, DSS, https://www.snap4city.org/drupal/node/1008
- **LeverageOPTIFaaS**, CN MOST: PNRR, mobility, https://www.snap4city.org/drupal/node/1064
- **TOURISMO**, Interreg, EC: Tourism, NLP, DSS, https://www.snap4city.org/drupal/node/1001
- **ELLIE**, Horizon Europe, EC: AI, VR, https://www.snap4city.org/drupal/node/1056
- **CN MOST**, PNRR: sustainable mobility, platform, https://www.snap4city.org/drupal/node/1050
- **ISPRA JRC contract**, EC: DSS, SOC, control room, energy, https://www.snap4city.org/drupal/node/970
- **AMMIRARE**, Interreg, EC: AI, environment, Big Data, https://www.snap4city.org/drupal/node/1002
- **CAI4DSA**, FAIR PE1, PNRR: AI, Neuro-Symbolic, PINN, NG-DSS, https://www.snap4city.org/drupal/node/1016
- **SADI-MIAC**, RT, partner: AI, Tourism, Retail, Computer Vision, https://www.snap4city.org/drupal/node/1055
- **SMART3R,** PRIN UNICagliari: mobility, DSS, https://www.snap4city.org/drupal/node/1087
- **Tuscany X.0, EDIH,** TestBeforeInvest, Training on AI, Big Data, Security, HPC: https://www.tuscanyx.eu/
- **Reg4IA**, AI for regional public administration, A project of presidency of national council
- **SmartCyprus**, a project of Cyprus Ministry of Digital Innovation and Policy
- **The IE**, PNRR: AI, NLP, LLM, Legal Aspects
- **BullVIT**, RT, conv: AI, NLP, LLM on commercial phases
- **Energia**, RT, conv: AI, PINN, DSS, on manufacturing
- **RFI contract**: mobility, AI, DSS
- **Salerno Port**: AI for container ID recognition and tracking
- **Talent Hub**, ECRF, conv: NLP, match demand vs offer

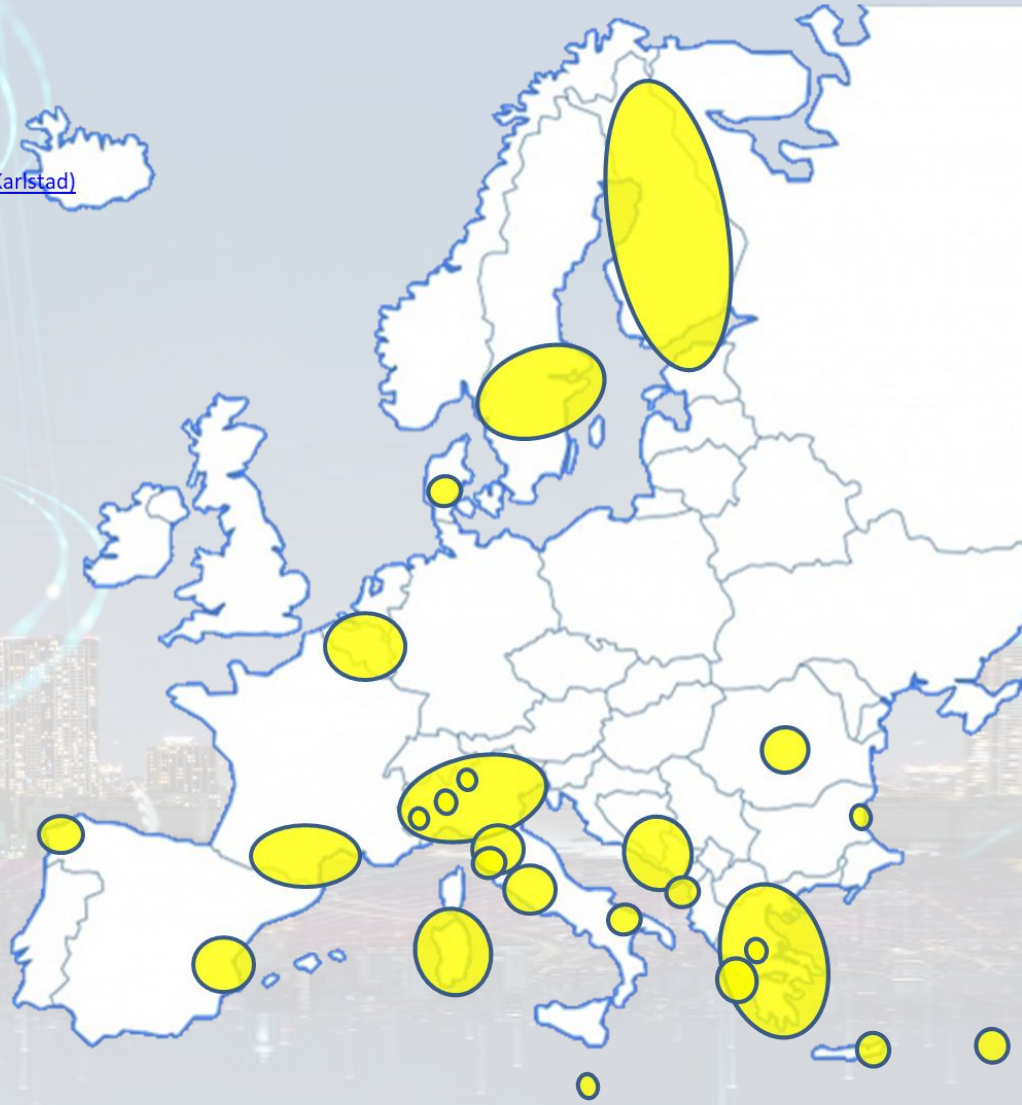
+ currently: Merano, Salerno, Cuneo, Rhodes, Reverberi, Florence, IDTS, ALTAIR, etc.

https://www.Snap4City.org

- 11 running installations in Europe
  - Snap4city.org, Greece, Merano, Cuneo, …
  - Toscana, Pisa, Sweden, ISPRA, Snap4.eu,
  - Altair, Italmatic, M4F, Romania, ….
- 20 projects, 12 pilots on 10 Countries
  - >40 cities/area
- **Widest MULTI-tenant deploy has**
  - 26 Organizations / tenant
  - > 8850 users on
  - > 1800 Dashboards
  - > 17 mobile Apps
  - **> 2.2 Million of structured data per day**
  - > 580 IoT Applications/node-RED
  - > 850 web pages with training
  - > 85 videos, training videos

Main Organizations/areas

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



- **+ Israel, Colombia, Brasile, Australia, India, China, etc.**

booklets

- Smart City

https://www.snap4city.org/download/video/DPL_SNAP4CITY.pdf

- Industry

https://www.snap4city.org/download/video/DPL_SNAP4INDUSTRY.pdf

- Artificial Intelligence

https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf


SNAP4CITY
Digital Twin Solutions for Sustainability
MOBILITY AND TRANSPORT
TRAFFIC INFRASTRUCTURE OPTIMIZATION
WHAT-IF ANALYSIS
PUBLIC TRANSPORT ANALYSIS
PARKING MANAGEMENT
SHARING AND POOLING MANAGEMENT
MOST
3D Global Digital Twin - 2023bl.
SMARTCITY
EXPO WORLD CONGRESS
THE EVENT FOR BETTER CITIES
ParkHelp

Control Planning Goals

Control

Management and Operational
(monitoring, KPI, anomaly detection, early warning)

Planning

Tactic and strategic, medium and long range, micro/macro
(simulations and predictions, what-if analysis)

THE POWER OF ARTIFICIAL INTELLIGENCE AT THE SERVICE OF YOUR OPERATION AND PLAN

www.snap4city.org

SNAP4CITY

KM4CITY

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

100% OPEN SOURCE

Powered by FIWARE

FREE TRIAL

PEN Test Passed

EU GDPR COMPLIANT

SNAP4 Appliances and Dockers Installations

EUROPEAN OPEN SCIENCE CLOUD

Node-RED

JS Foundation

EØ15 digital ecosystem

NVIDIA

OPERATION AND PLAN - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - OPTIMIZATION - APPLICATIONS

HORIZONTAL AI PLATFORM

MOBILITY AND TRANSPORT

SMART ENERGY AND SMART BUILDING

ENVIRONMENT AND WASTE MANAGEMENT

CITY USER'S SERVICES AND TOURISM MANAGEMENT

SNAPADVISOR

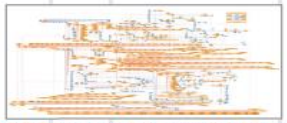
BUSINESS INTELLIGENCE - SIMULATIONS - VISUAL ANALYTICS - SYNOPTICS - GRAPHICAL WIDGETS - ANALYTICS

DASHBOARDS, WIDGETS
TEMPLATES

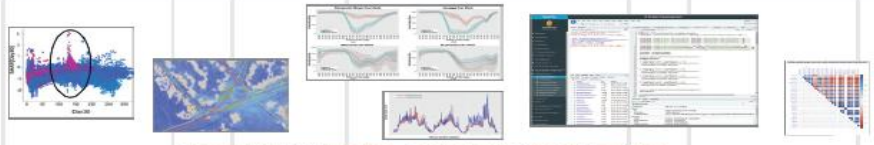
PREDICTION - ANOMALY DETECTION - CLUSTERING - ROUTING - SENTIMENT NLP - TRAFFIC FLOW - PEOPLE FLOWS - SDG
15 MIN CITY INDEX - KPI - HEATMAPS - ORIGIN DESTINATION - MAPS - VECTOR FIELD - ETC...

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

- DEVELOMENT ENVIRONMENT AND METHODOLOGY
- VISUAL PROGRAMMING, ML, AI, HPC
- TRAINING COURSES



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



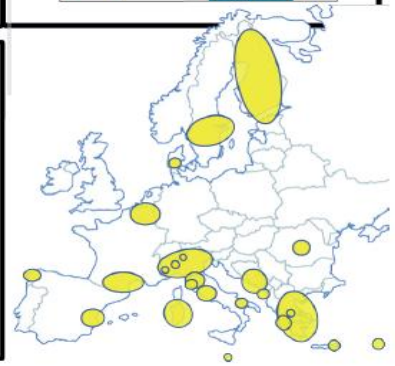
BIG DATA ANALYTICS, ARTIFICIAL INTELLIGENCE
EXPLAINABLE AI, MACHINE LEARNING, GENERATIVE AI
OPERATIVE RESEARCH, STATISTICS

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

FULL INTEROPERABILITY, ANY: DATA, BROKERS, NETWORKS AND VERTICALS

NATIVE AND EXTERNAL APPLICATIONS

- Smart Parking
- Smart Light
- Smart Waste
- Smart Energy
- Smart Building
- Smart Tourism
- ...



Key Performance Indicators, KPI

Air Quality Directive				WHO guidelines	
Pollutant	Averaging period	Objective and legal nature and concentration	Comments	Concentration	Comments
$PM_{2.5}$	One day			25 µg/m³ (*)	99th percentile (3 days/year)
$PM_{2.5}$	Calendar year	Target value, 25 µg/m³	The target value has become a limit value since 1 January 2015	10 µg/m³	
PM_{10}	One day	Limit value, 50 µg/m³	Not to be exceeded on more than 35 days per year.	50 µg/m³ (*)	99th percentile (3 days/year)
PM_{10}	Calendar year	Limit value, 40 µg/m³ (*)		20 µg/m³	
O_3	Maximum daily 8-hour mean	Target value, 120 µg/m³	Not to be exceeded on more than 25 days per year, averaged over three years	100 µg/m³	
NO_2	One hour	Limit value, 200 µg/m³ (*)	Not to be exceeded more than 18 times a calendar year	200 µg/m³ (*)	
NO_2	Calendar year	Limit value, 40 µg/m³		40 µg/m³	

- **United Nations Sustainable Development Goals, SDGs** (for which cities can do more to achieve some of the 17 SDGs, https://sdgs.un.org/goals);
- **15 minutes cities** (where primary services must be accessible within 15 minutes on foot);
- **objectives of the European Commission** in terms of pollutant emissions for: NO2, PM10, PM2.5 (https://environment.ec.europa.eu/topics/air_en);
- **SUMI: mobility and transport vs env**
  - **https://www.snap4city.org/951**
- **SUMP/PUMS: mobility and transport vs env.**
- **ISO indicators:** city smartness, digitization, tech level.
- **Low Level/Real Time:** global traffic, quality of service, betweenness, centrality, queue, time to travel, etc.

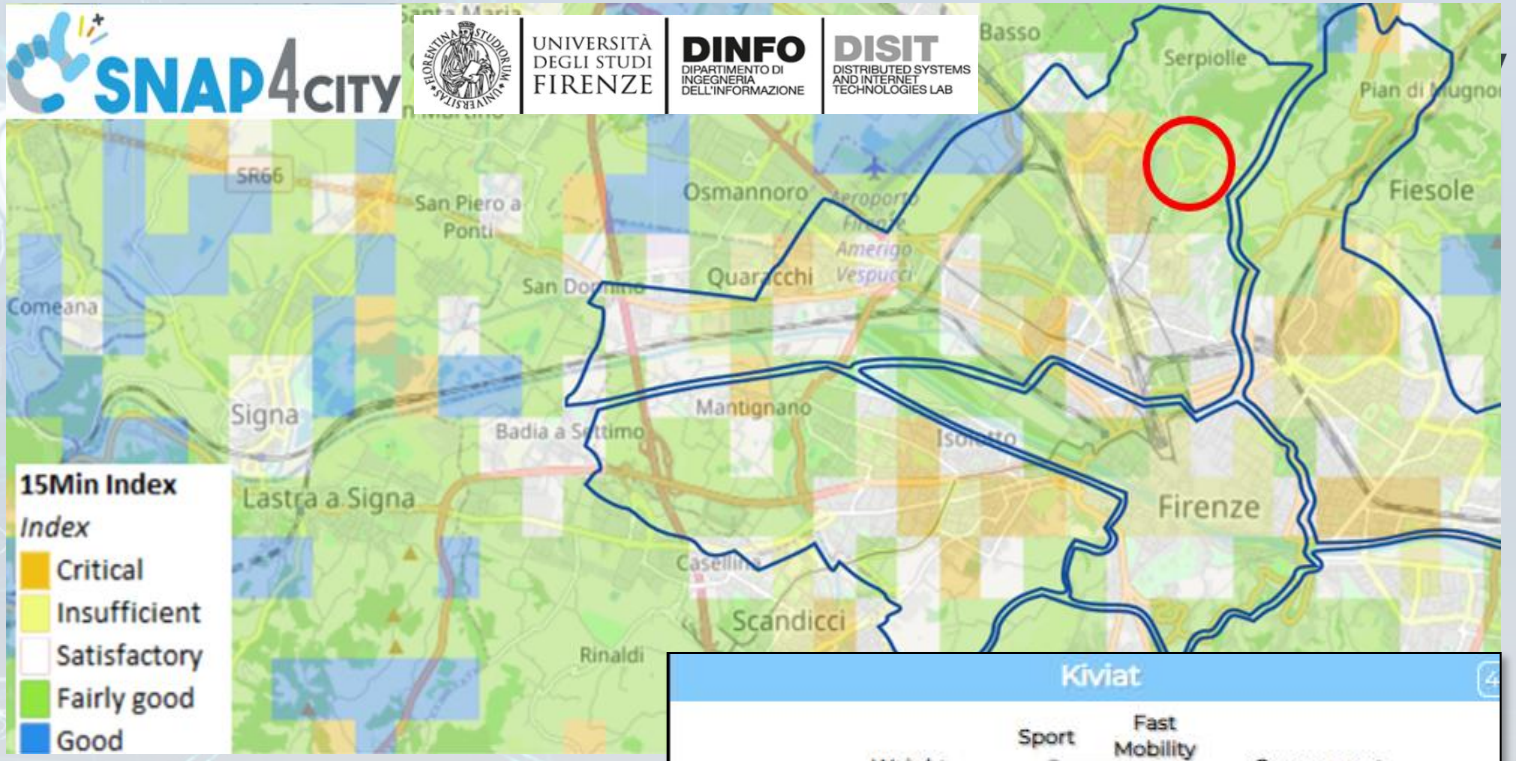
Global & Local

Periodic & Realtime

15MinCityIndex

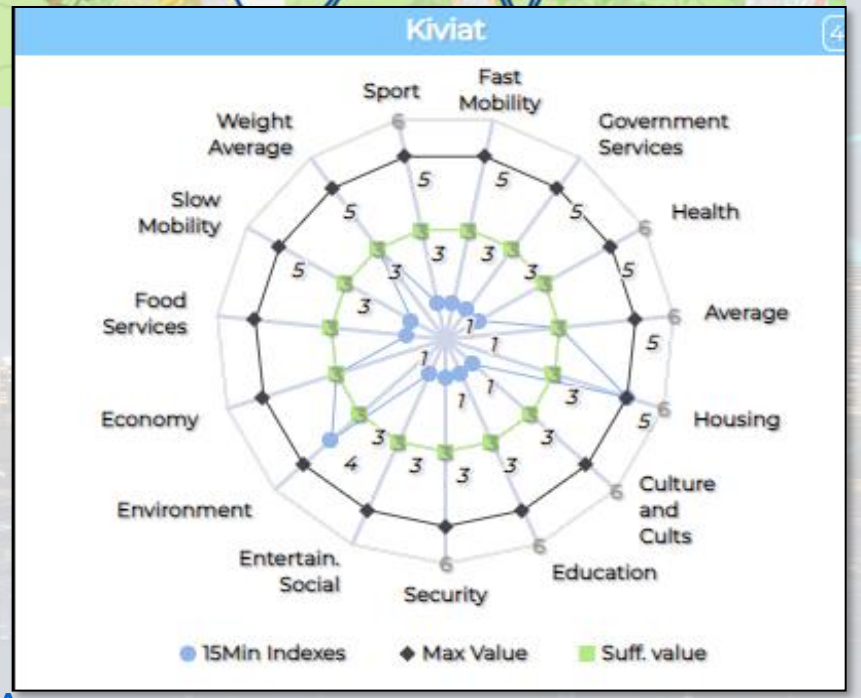
What would support my neighborhood to become a 15-Minute City?

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



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

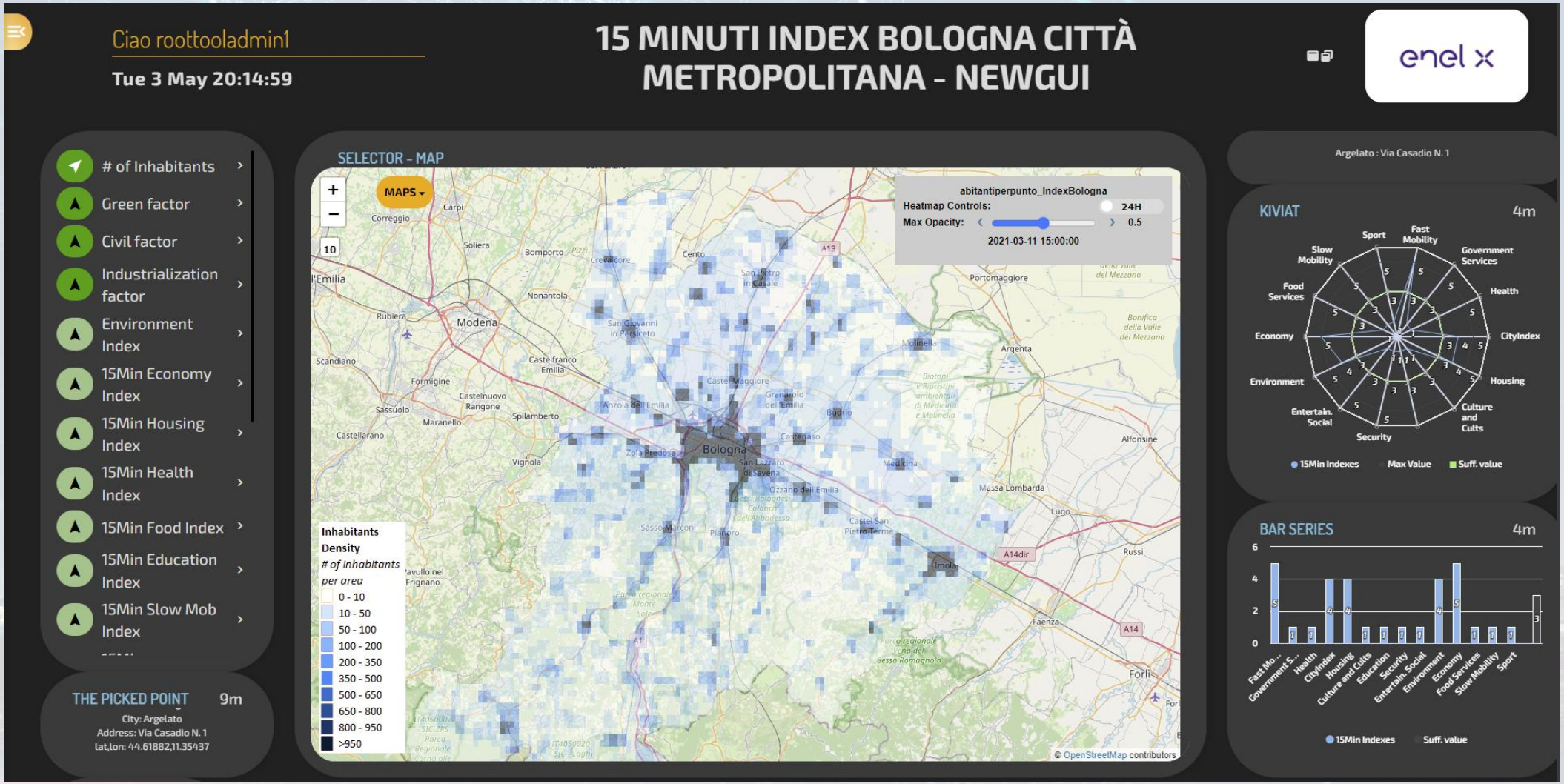
The tool supports the becoming of a 15-Minute city evaluating the service level in various domains.



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

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

15MinCityIndex on Bologna



1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
7 AFFORDABLE AND CLEAN ENERGY
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
15 LIFE ON LAND

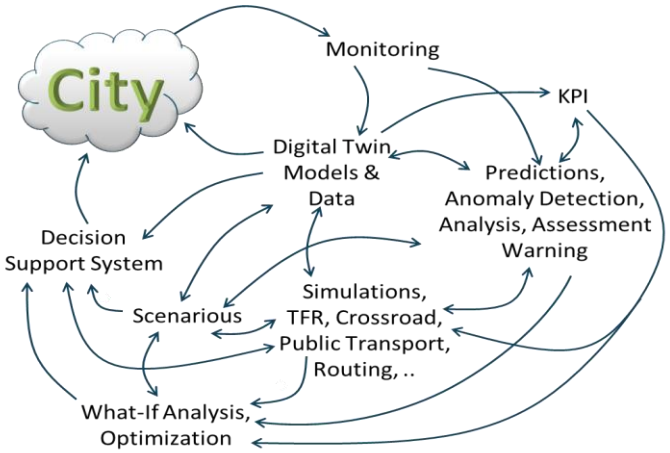
https://www.snap4city.org/dashboardSmartCity/view/Baloon-Dark.php?iddasboard=MzQxMg==

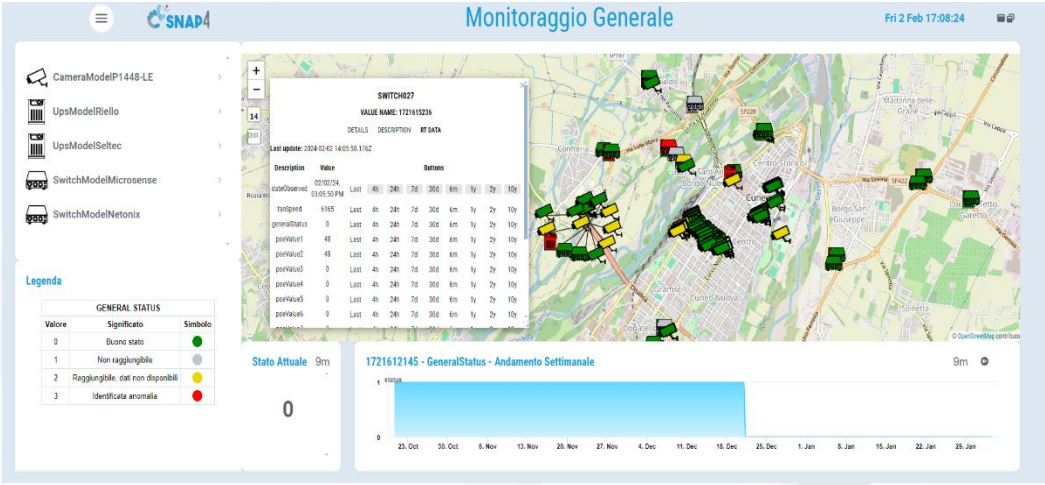
Control Room


SNAP4CITY
3D Global Digital Twin - 2023bt
KM4CITY
°C/°F
PM 2.5
EAQI
GRAL 3M
16.5
Free street
Fluid traffic
Heavy traffic
Very heavy
Sensor position
Air Quality FI-BASSI - NO2
New York
Paris
Rome
Tokyo

Assets Control Domain (2024/8)

- Goals:
  - Costs reduction, increase service availability, risk reduction
  - Quality Level
- Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)
  - Monitoring :
    - **Assets**: switches, Wi-Fi, servers, UPS, sensors, building, TV Cams, etc.
    - **Energy**: consumption, operative conditions, UPS continuity, etc.
    - **Production**: continuous serviceability analysis
    - Etc.
  - Early detection/warning, alarm, of critical conditions
    - **Multichannel** Event reporting, notifications: email, Telegram, mobile apps, SMS, etc.
  - Managing maintenance operation, predictive maintenance
  - Computing predictions of any kind
- Solutions for Planning (optimization and what-if analysis)
  - Reduction maintenance costs, reduction of critical SLA conditions, improve service level
- Algorithms and computational solutions, see next slide

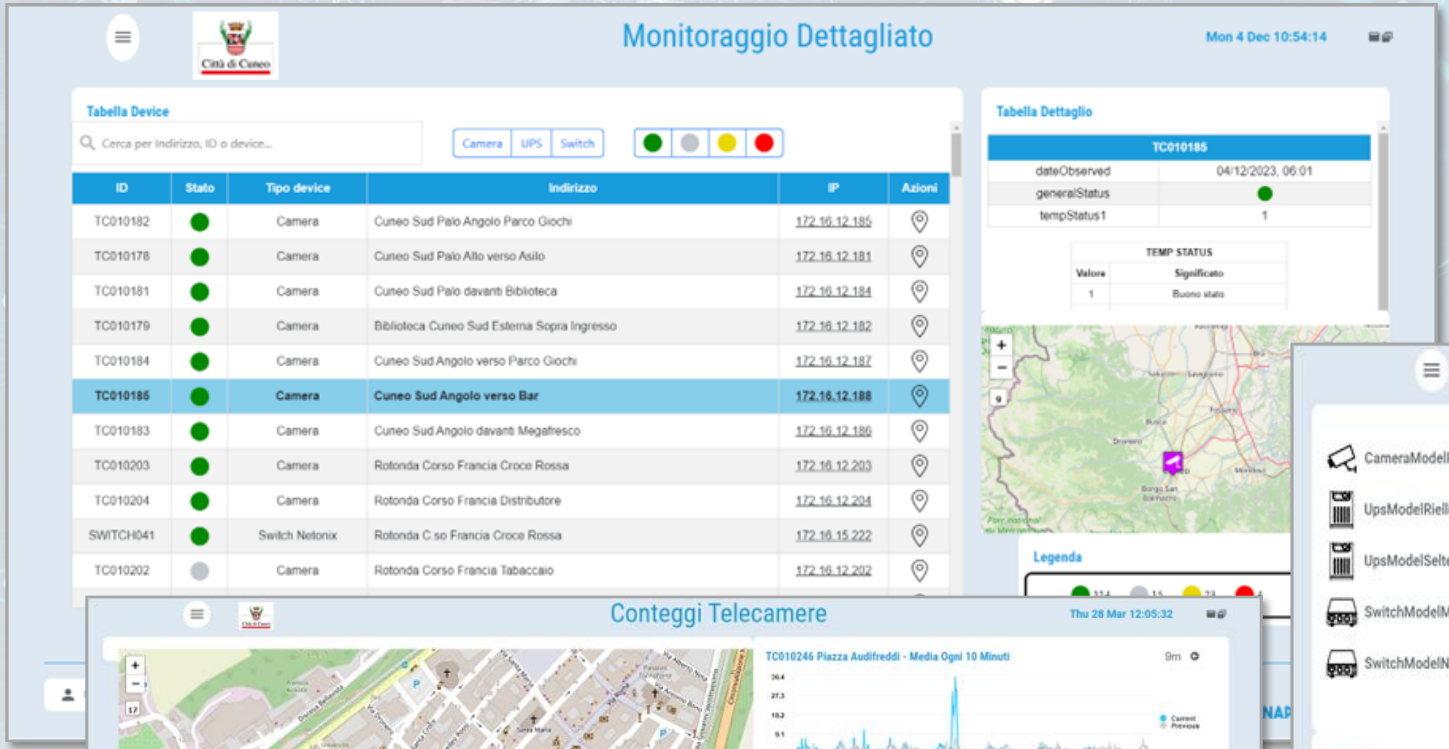


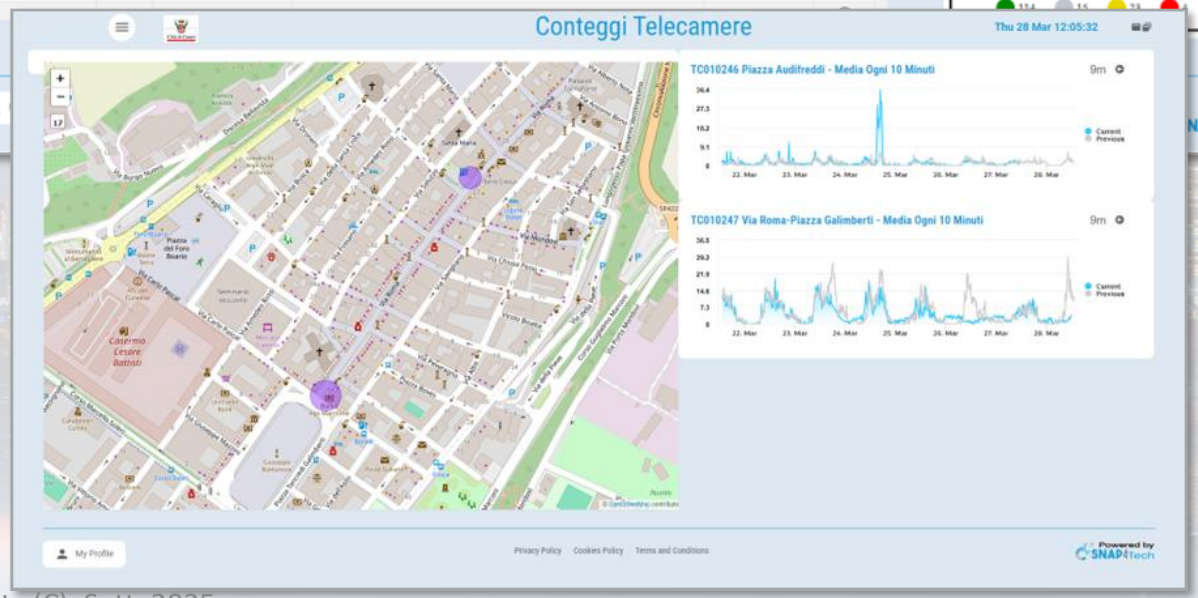


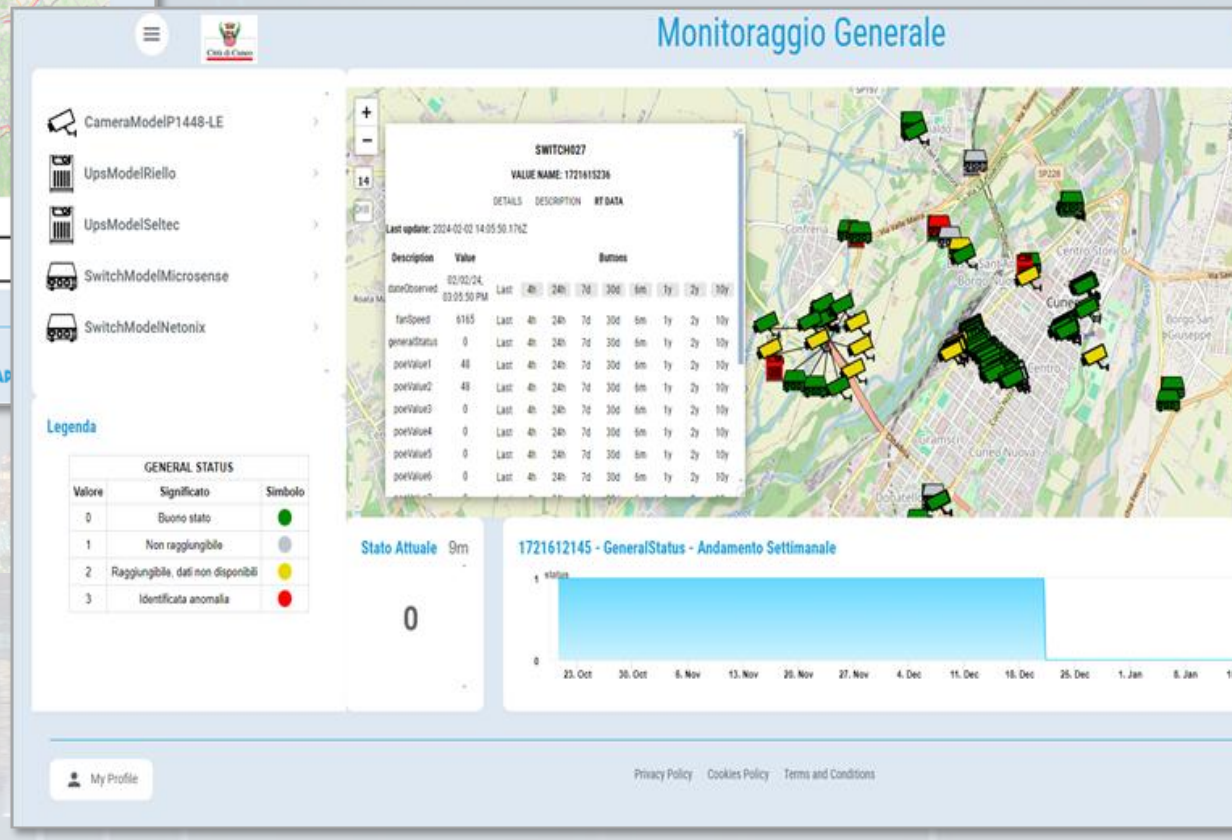
ICT Assets Control: CUNEO Municipality

- Cabinets, Switches, UPS
- TV Cameras, etc.

Manage the status, tickets, notifications

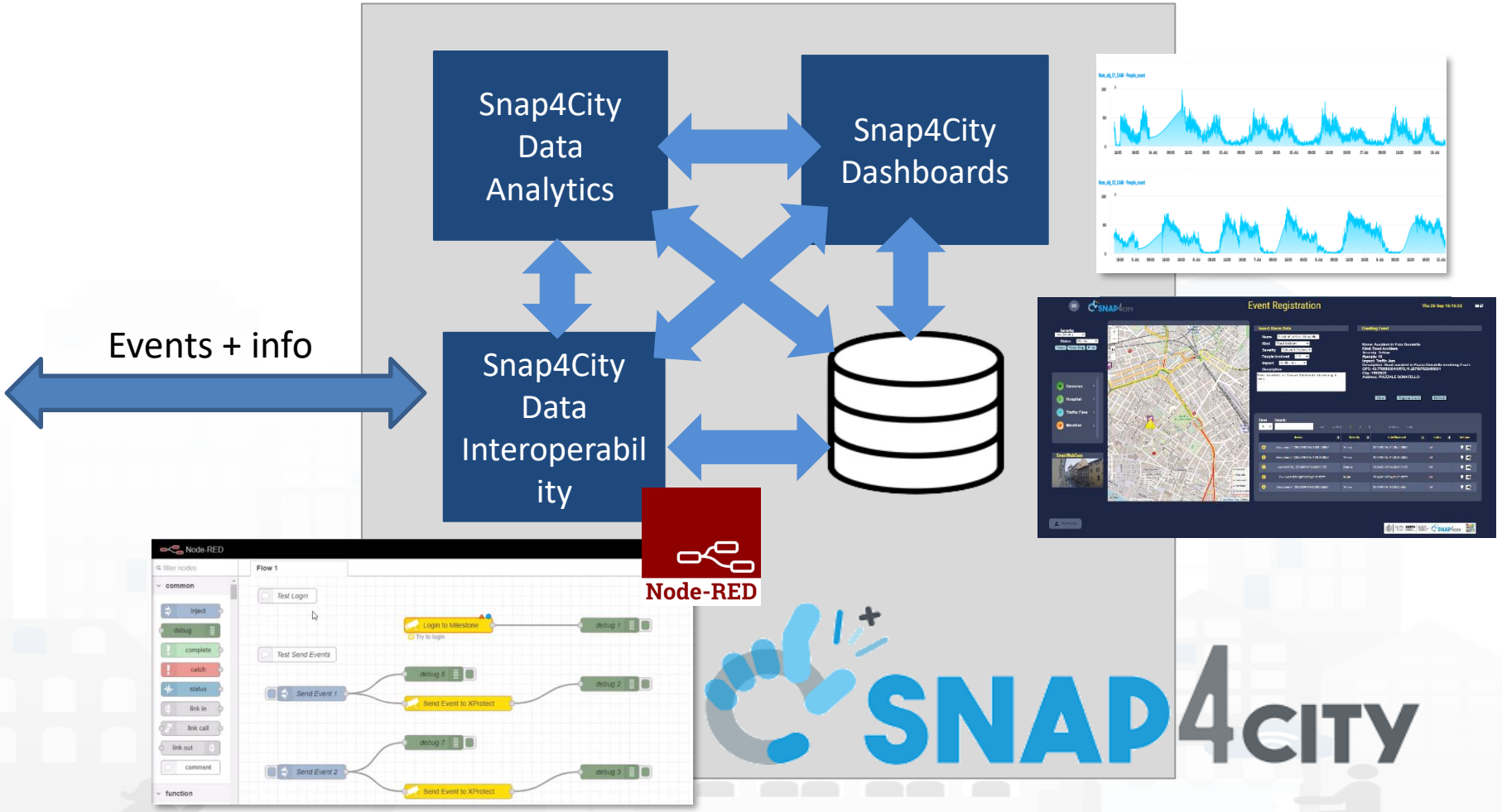


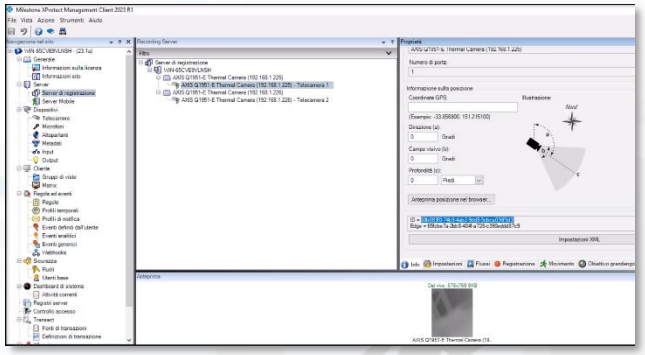




VMS vs Snap4City: sending and getting events, AI solutions

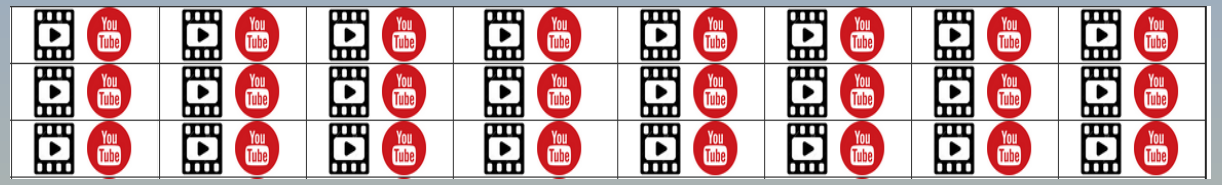
Events + info





Developing on Snap4City

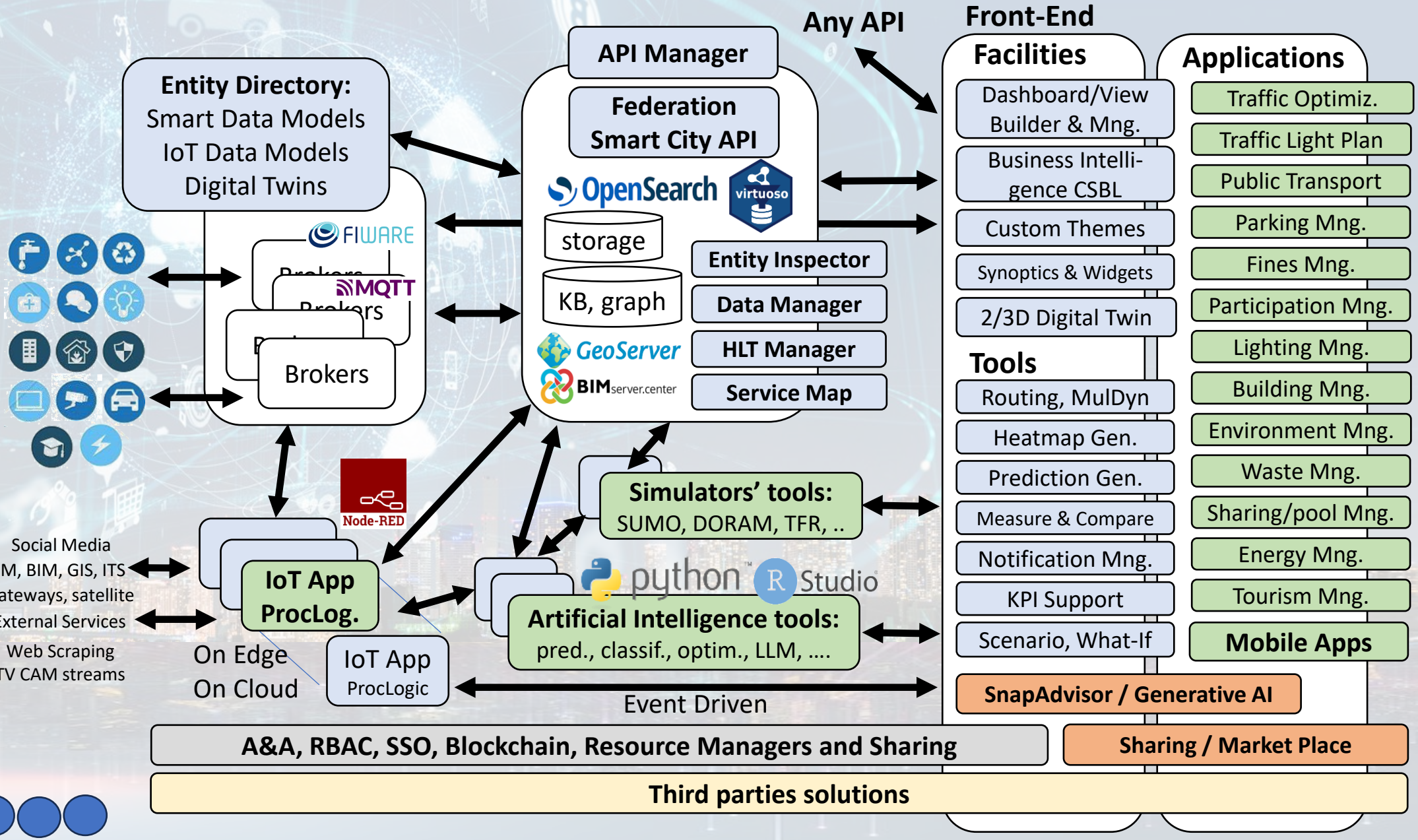
1st part	2nd part	3rd part	4th part	5th part	6th part	7th part	8th
Overview	Dashboards	IOT App, IOT Network	Data Analytics	Data Ingestion processes	System and Deploy Install	Smart City API: Web & Mob. App	Design and Develop Smart Solutions



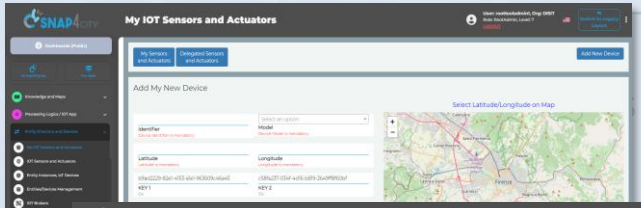
Why/How to Develop https://www.snap4city.org/1093

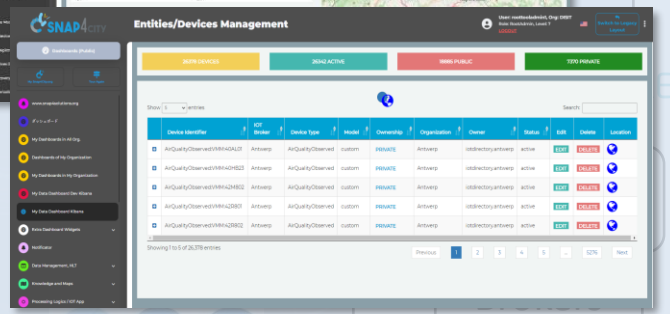
1. Data Integration Interoperability, standards
2. Advanced Analytics and AI Integration
3. Dashboard and Visualization Tools, custom graphics
4. Digital Twin Support
5. Scalability and Modularity, cloud usage
6. Compliance and Security
7. Real-World Applications, use cases
8. Applications development

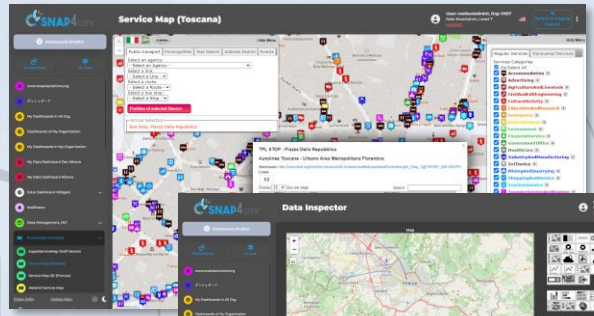
Technical Architecture

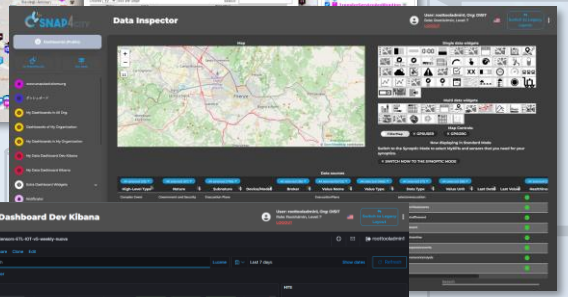


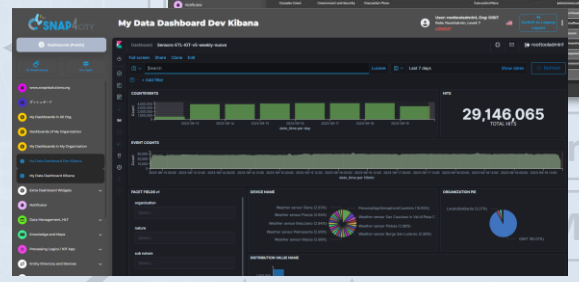
Visual Development Tools

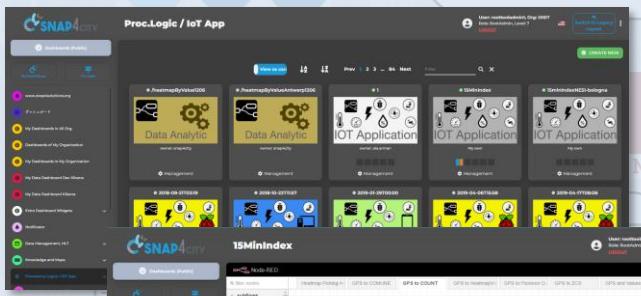


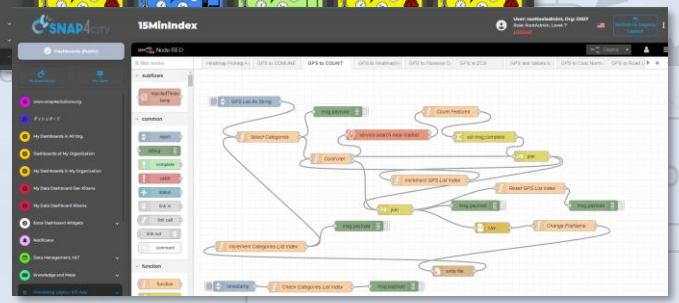


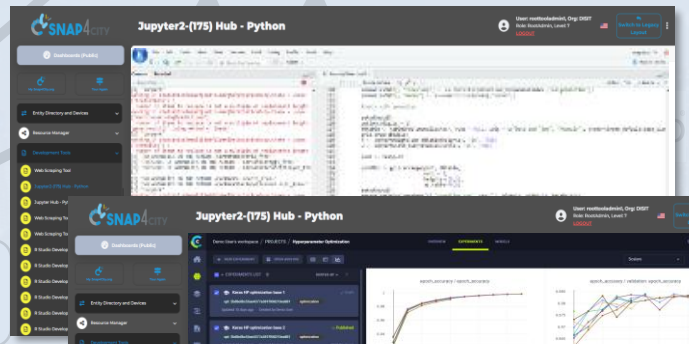


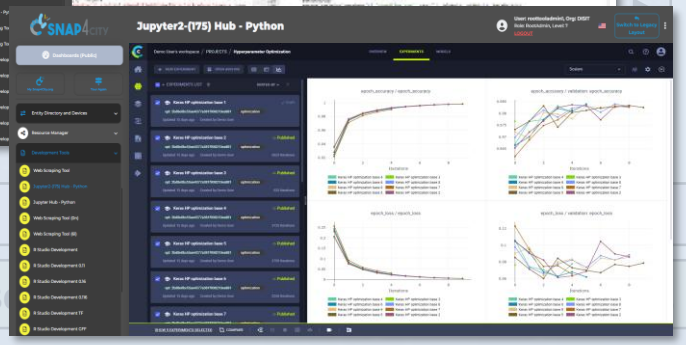


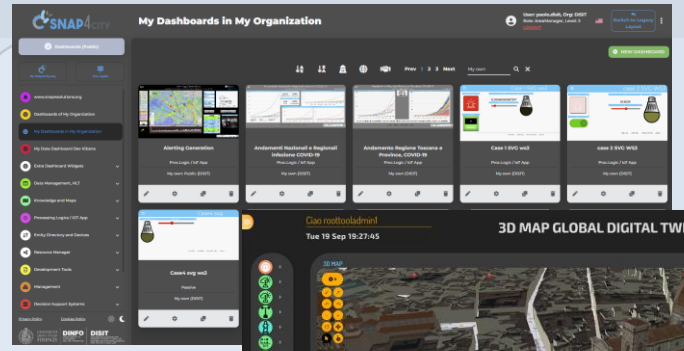


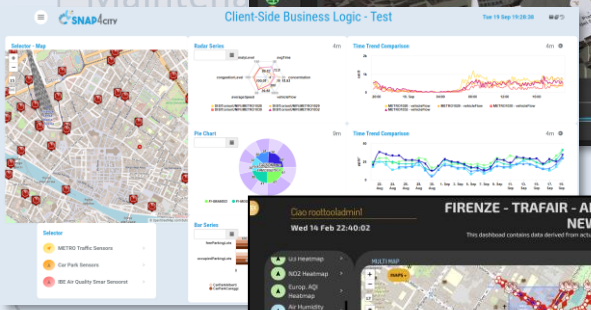


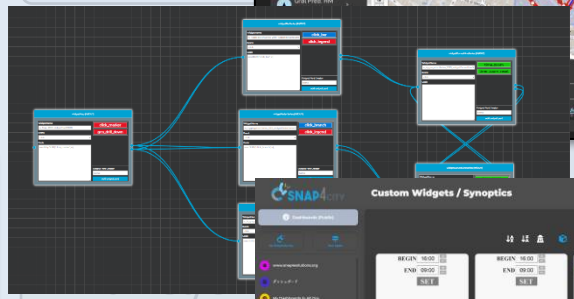




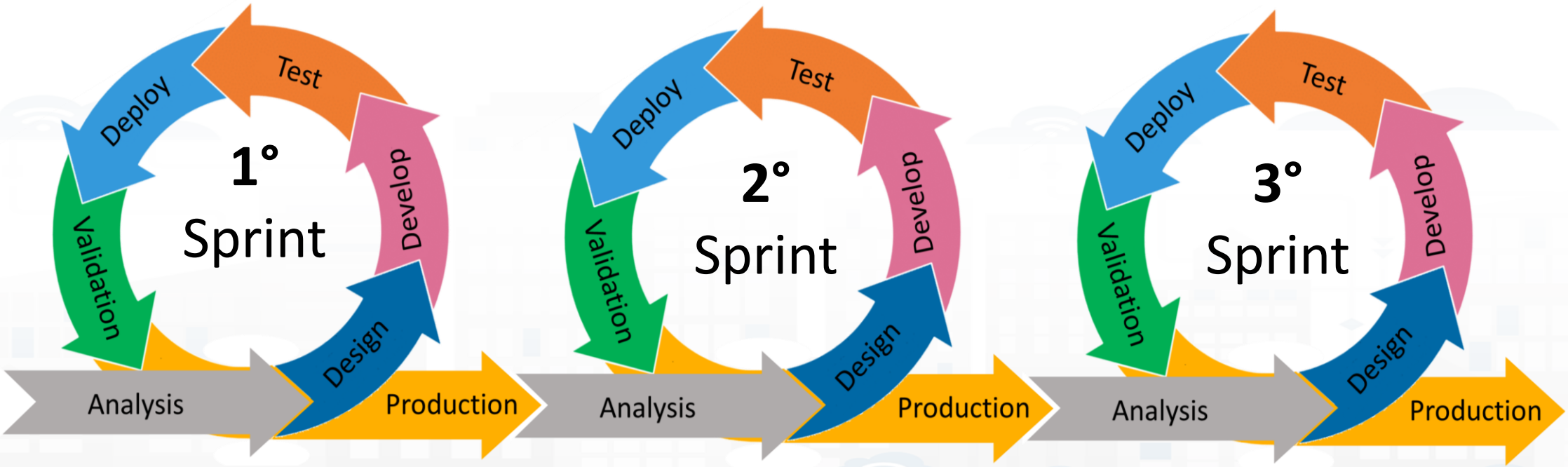








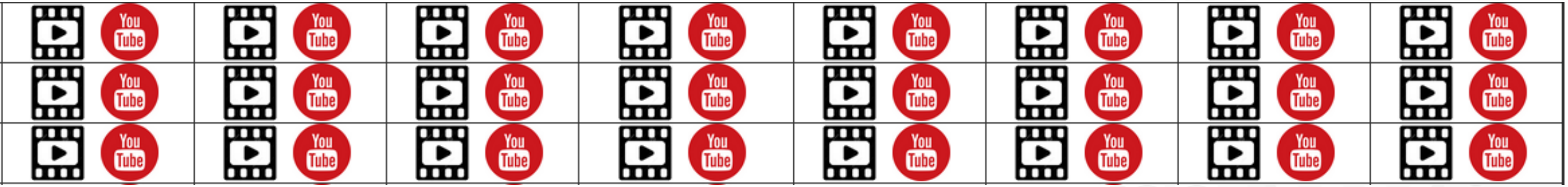
Agile Development Life Cycle by sprint Smart Solutions



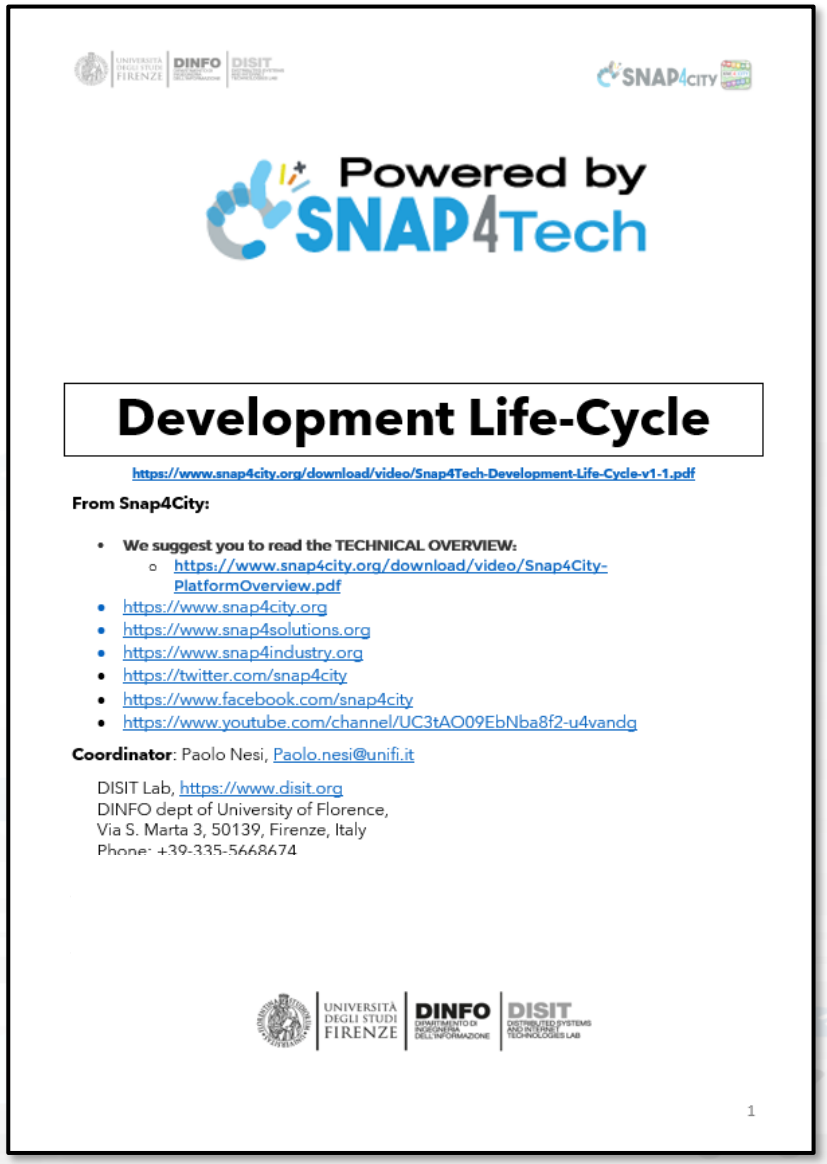
https://www.snap4city.org/944

On Line Training Material (free of charge)

1st part	2nd part	3rd part	4th part	5th part	6th part	7th part	8th
Overview	Dashboards	IOT App, IOT Network	Data Analytics	Data Ingestion processes	System and Deploy Install	Smart City API: Web & Mob. App	Design and Develop Smart Solutions
							
							



Development



Powered by SNAP4Tech

Development Life-Cycle

https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle-v1-1.pdf

From Snap4City:

- **We suggest you to read the TECHNICAL OVERVIEW:**
  - https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf
- https://www.snap4city.org
- https://www.snap4solutions.org
- https://www.snap4industry.org
- https://twitter.com/snap4city
- https://www.facebook.com/snap4city
- https://www.youtube.com/channel/UC3tAO09EbNba8f2-u4vandg

Coordinator: Paolo Nesi, Paolo.nesi@unifi.it

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Phone: +39-335-5668674

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1

https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf

Logged in as:
edoardo_tester

Your Profile

Logout

SnapAssistant model:

Llama3.3

New Chat

EdoChat1

EdoChat2

EdoChat3

EdoChat4

prova

chatNuova

chatTest1LLAMA

chatTest2LLAMA

testGianniLLAMA

testTastoInvioPreChanges

ChatTestPostPSWINVIO

SnapAdvisor

Current chat: debug0

Visualize references

Personal Advisor LLM

Come creo una dashboard?

Per creare una dashboard, puoi utilizzare la piattaforma Snap4City. La dashboard si compone di un insieme di widget grafici che possono essere impostati separatamente assegnando una serie di parametri, come origine dati, dimensioni, colori, forma, font, allarmi, relazioni con altri, ecc. (SOURCE: Snap4 City per la creazione di Smart City Control Room, SCCR). Inoltre, la piattaforma offre la possibilità di creare vere e proprie applicazioni interattive, multipagina/multidashboard, e non semplici storie monopagina da scrollare. Puoi anche condividere la dashboard con altri utenti anche fuori dalla Smart City Control Room tramite canali autenticati e protetti in HTTPS, in accordo al GDPR (SOURCE: Snap4 City per la creazione di Smart City Control Room, SCCR). Per vedere alcuni esempi di dashboard, puoi visitare il sito https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjU0Mg== (SOURCE: Snap4 City 1st Overview v4 8 annot). Tuttavia, non ho trovato informazioni dettagliate sulla procedura di creazione di una dashboard. Se hai bisogno di ulteriore assistenza, ti consiglio di contattare direttamente il team di supporto di Snap4City. Non so dirti altro in merito.

Write a message...

Part 2: Dashboard production and management

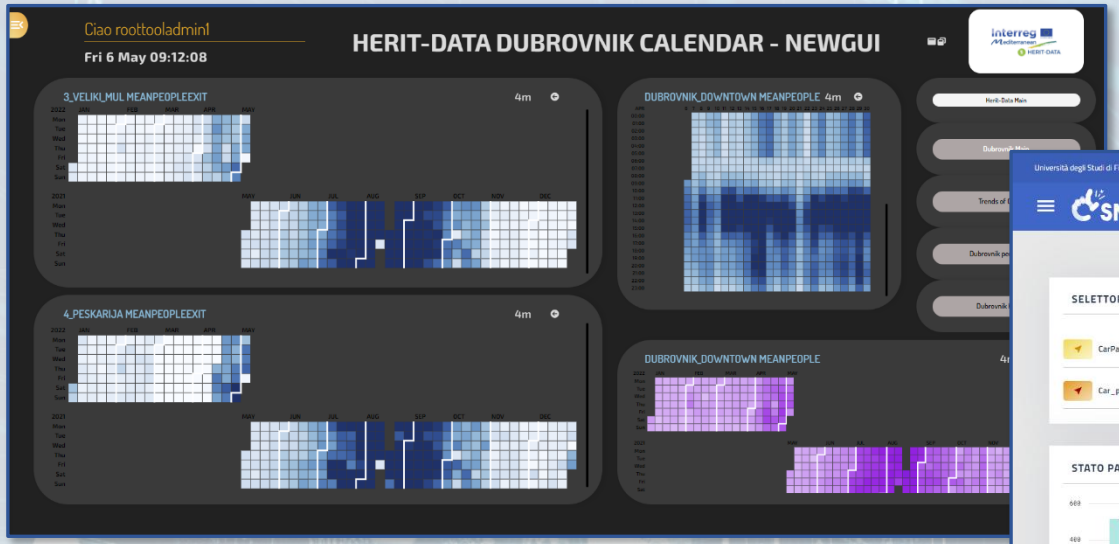
Part 2: Dashboards production and management

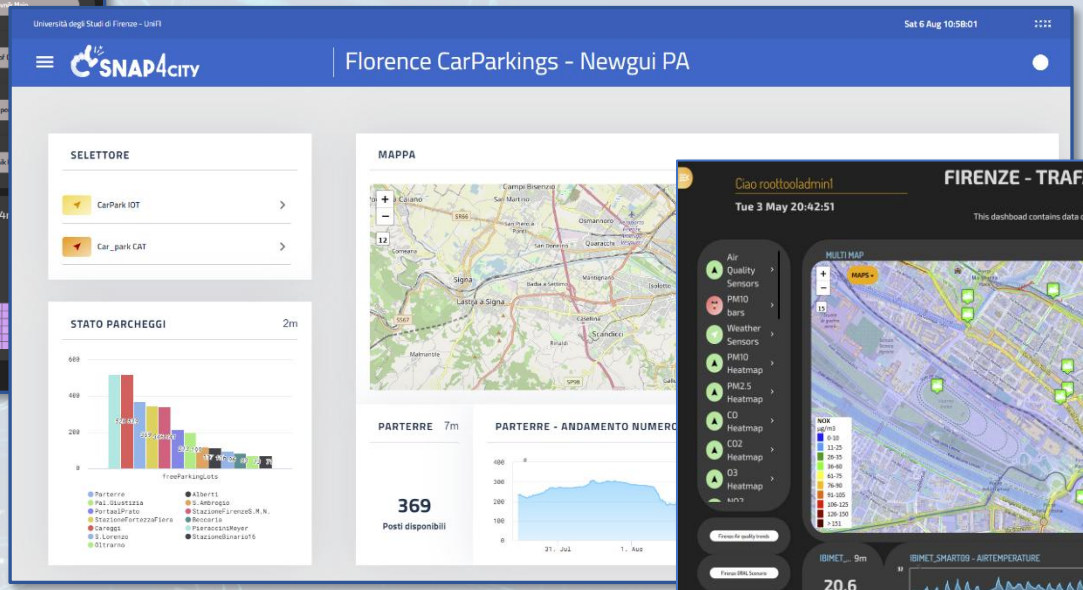
SLIDES

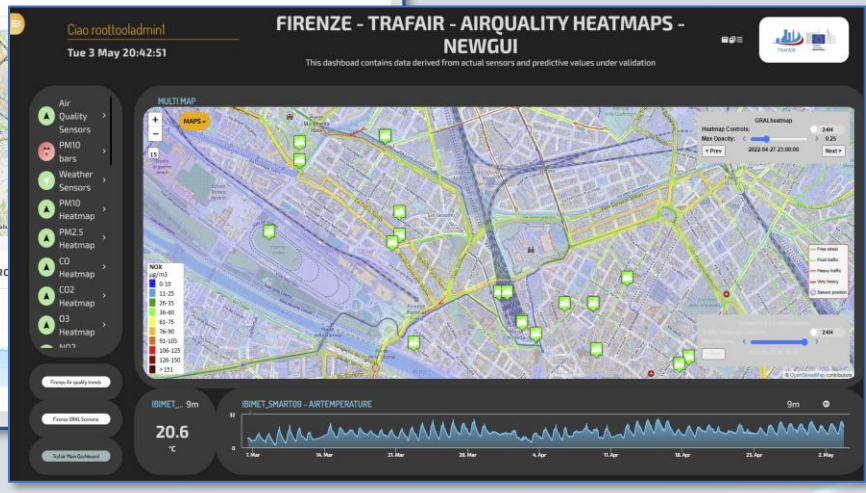
Interactive Slides

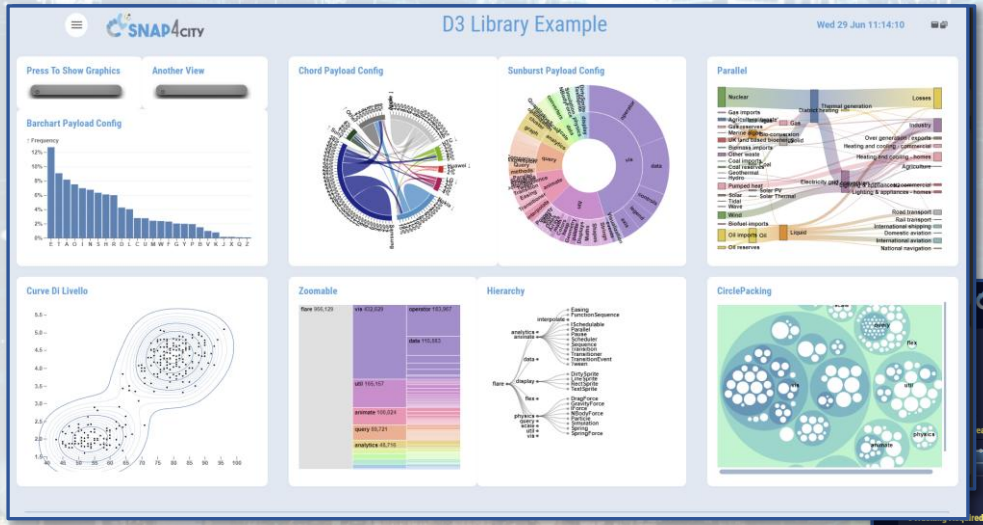
- Recall on Snap4City Architecture
- Dashboards Purposes and Uses
- Main Data Kinds: data vs representations
- Dashboards Main Concepts and simple Widgets
- Creating a Snap4City Dashboard, wizard
- Multi Data Map Widget
- High Level Types, video, external services, synoptics
- Selector for the Multi Data Map Widget
- Data Inspector vs Data Processes Details
- Dashboard Management

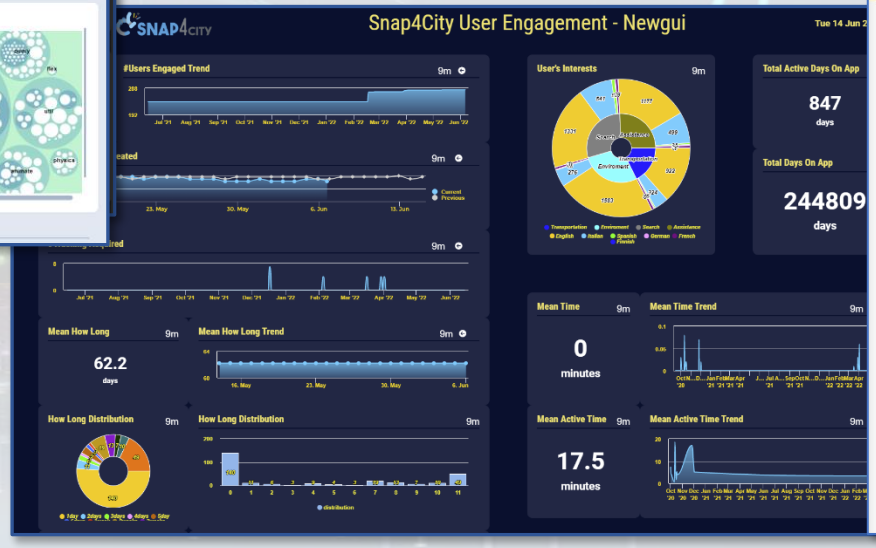
Different Themes

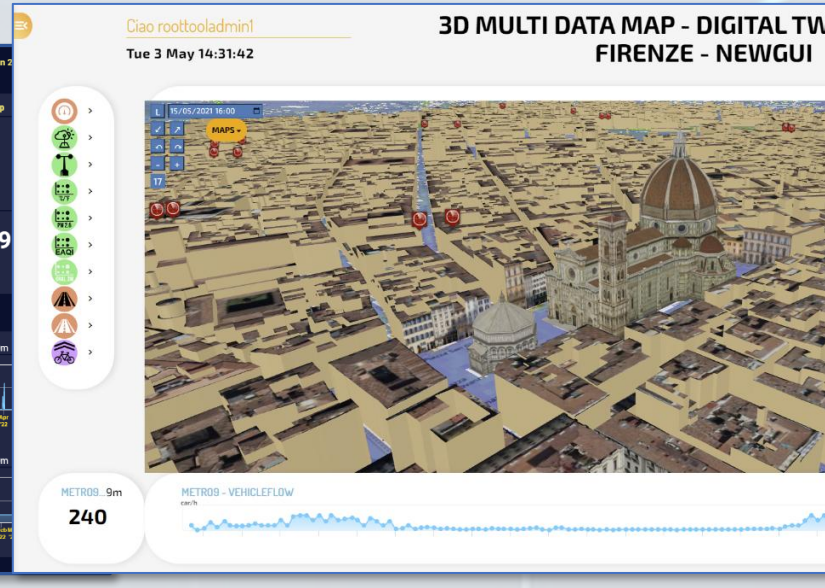










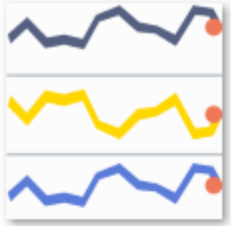


New styles/themes can be developed by specializing a few files from open source

https://www.snap4city.org/793

Visual Representations


Sliderwith-multiple-steps-for-KPI


sparklines

kpi


histogram


heatmap


flow-maps


geo-maps

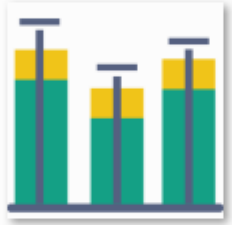

donut-chart

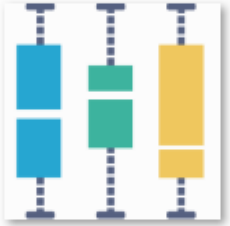

Data-grid


chord


Cone


Bubble-matrix-chart


Bullet


Box-plot


staked-area


Stacked-line-chart


Stacked-combinational-Chart


spider-maps


Sequence-Sunbur


Pivot


pie-chart-1


Pareto-chart


radar


Bubble-maps

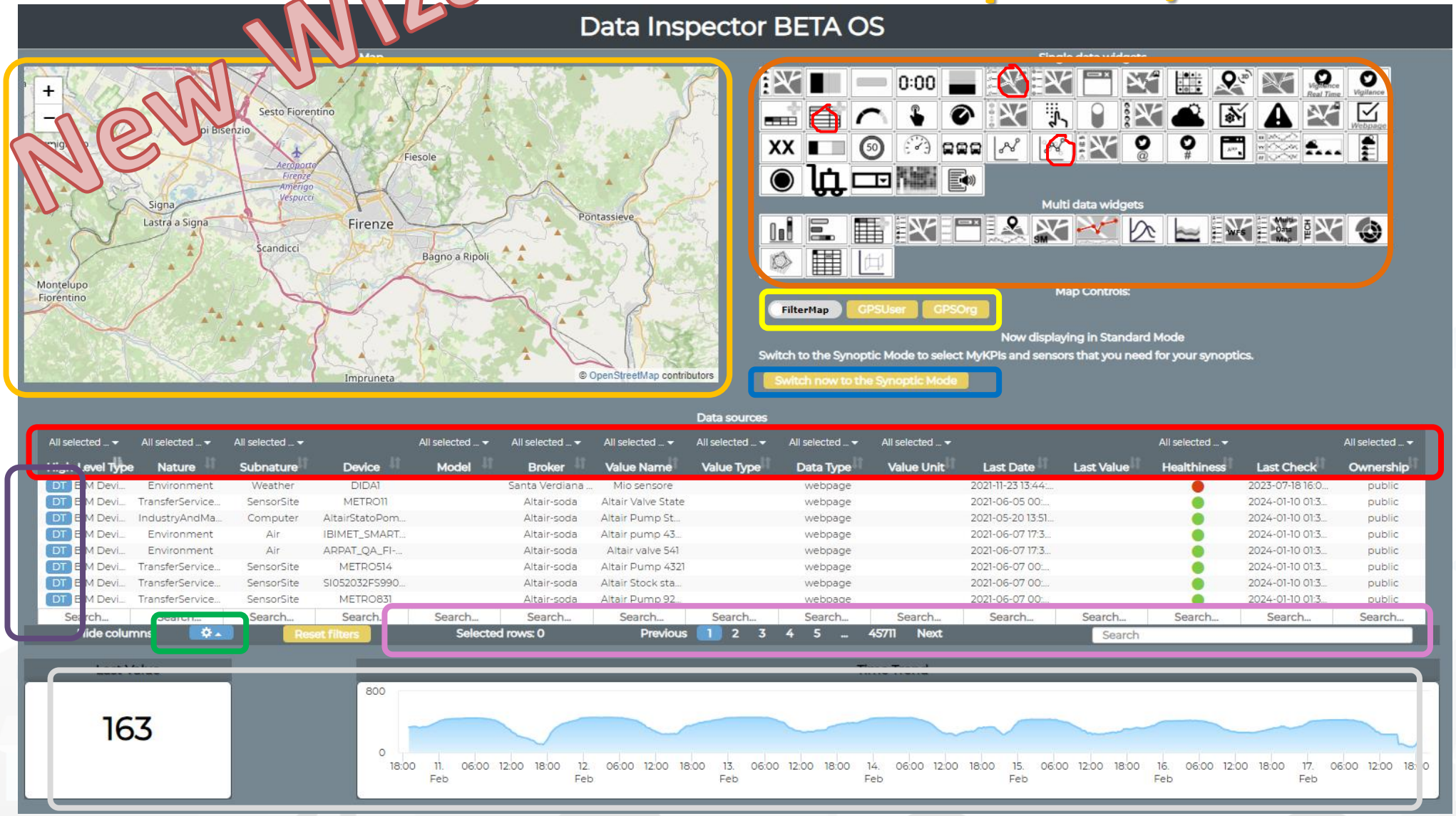

waterfall


Sunburst


Sankey

New Data Inspector/Wizard

New Wizard



Filtering/Searching for individual fields (even for some fields not displayed as geographic coordinates)

Geographic Filtering

Text Search on all fields

Menu for choosing the fields to display in the table

View on Map(via PREVIEW)

Data and Trend visualization

Opening Digital Twin

Pass to Synoptic mode

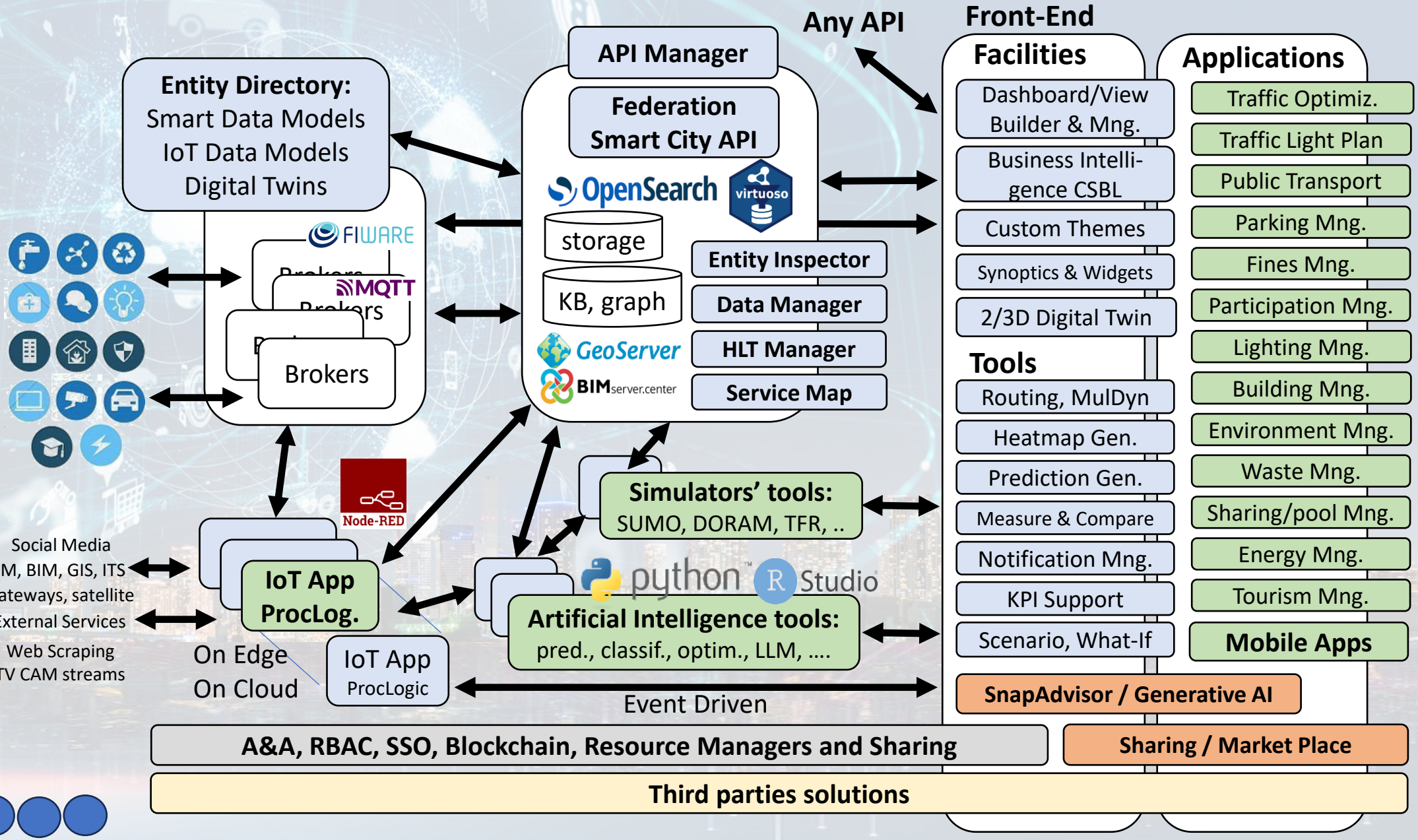
Select the graph representation

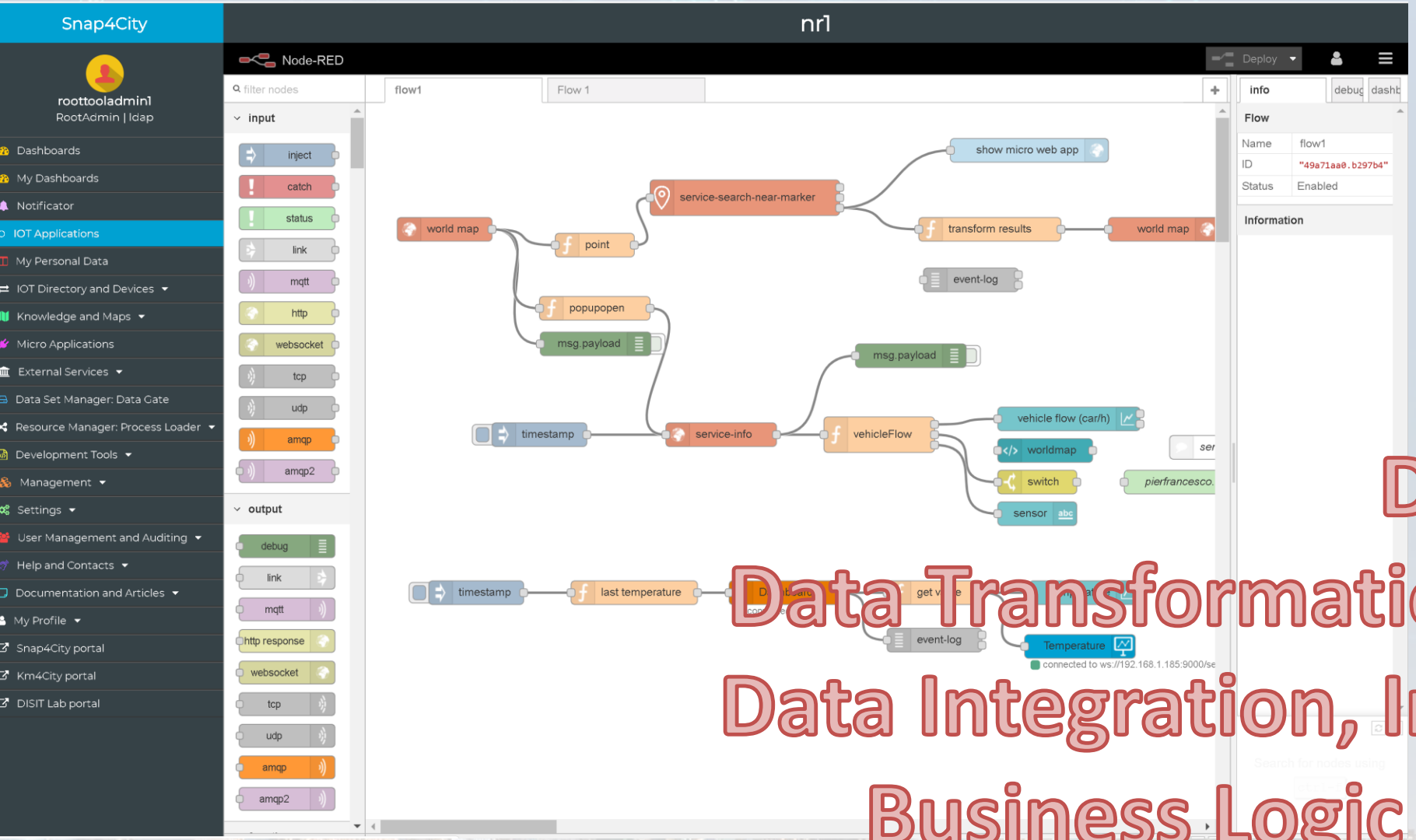
Part 3: IoT App, process logic, server side BL

Part 3: IOT App, Process Logic, Server Side Business Logic SLIDES Interactive Slides	

- Recall on Snap4City Architecture
- Node-RED
- IOT App = Node-RED + Snap4City
  - IoT App === Proc.Logic
- Examples of IOT App for Smartening Solutions
- Exploiting/Generating data by using: IoT App/Proc.Logic
- External Service <-> IoT App/Proc.Logic
- Dashboards <-> IoT App/Proc.Logic
  - Server Side Business Logic
- training material

Technical Architecture



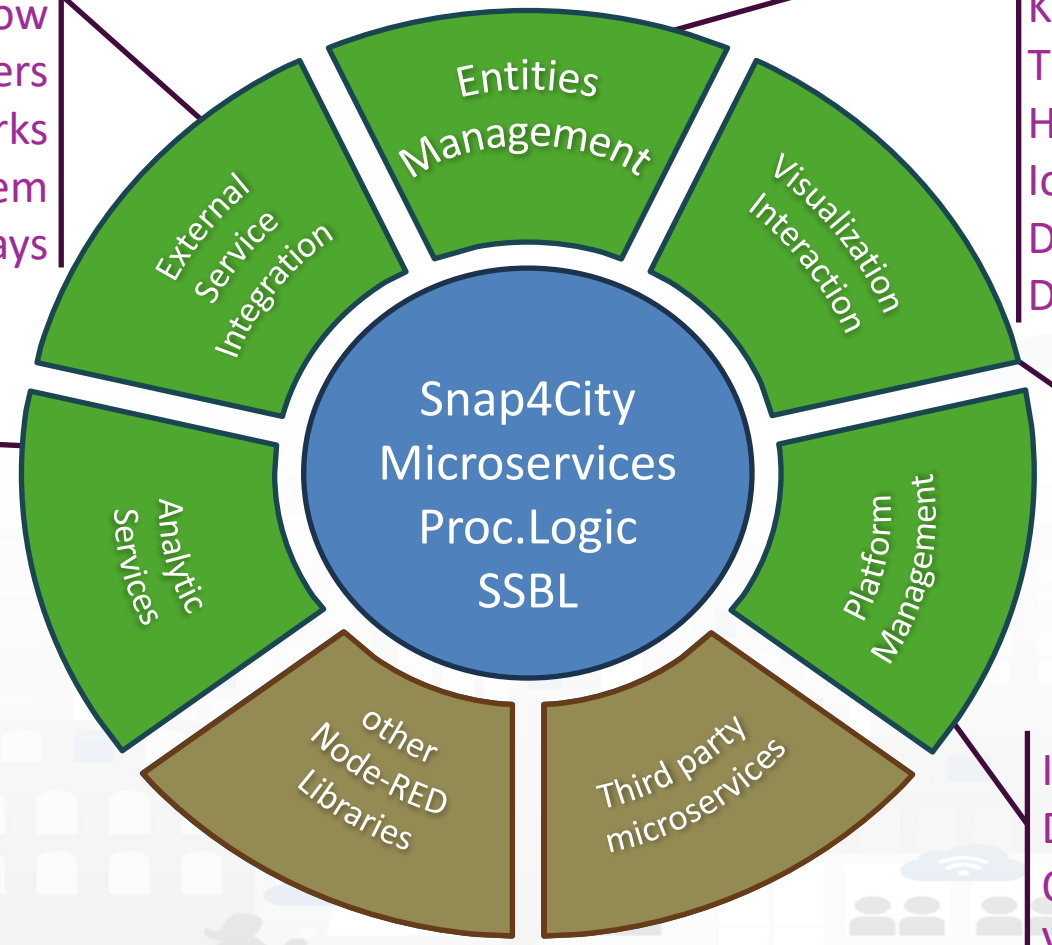


Data Adapation
Data Transformation, Conversion
Data Integration, Interoperability
Business Logic vs Dashboards
Data Analytics control
Everywhere: Cloud, on IoT Edge Devices

diting IOT Applications

MicroServices Areas

> 60.000 downloads (up to 2024)



Open Data CKAN
Ticket Management, workflow
BIM Servers
Social Networks
Video Management system
Gateways

Data Load / Search / Retrieval
KPI, POI, GIS Data, Scenarios
Time Series, Public transport
High Level Types: heatmaps, ODM,…
IoT / Entity Discovery
Delegation Management
Data Mapping

Data Analytics
Statistic, Optimization
Simulation
Artificial Intelligence
What-if Analysis Support
Geo Utilities Support
Routing & Traffic Flow
MLOps support
Python support
R Studio Support

Dashboards
Widgets: Graphic Libraries
Interactive Widgets
Maps, 3D representations
Synoptics, External Content
Micro Web App

IoTApp Management
Data Logs, A&A, Security
Ownership Management
VPN remote access

Node-RED

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DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB DISTRIBUTED DATA INTELLIGENCE AND TECHNOLOGIES LAB

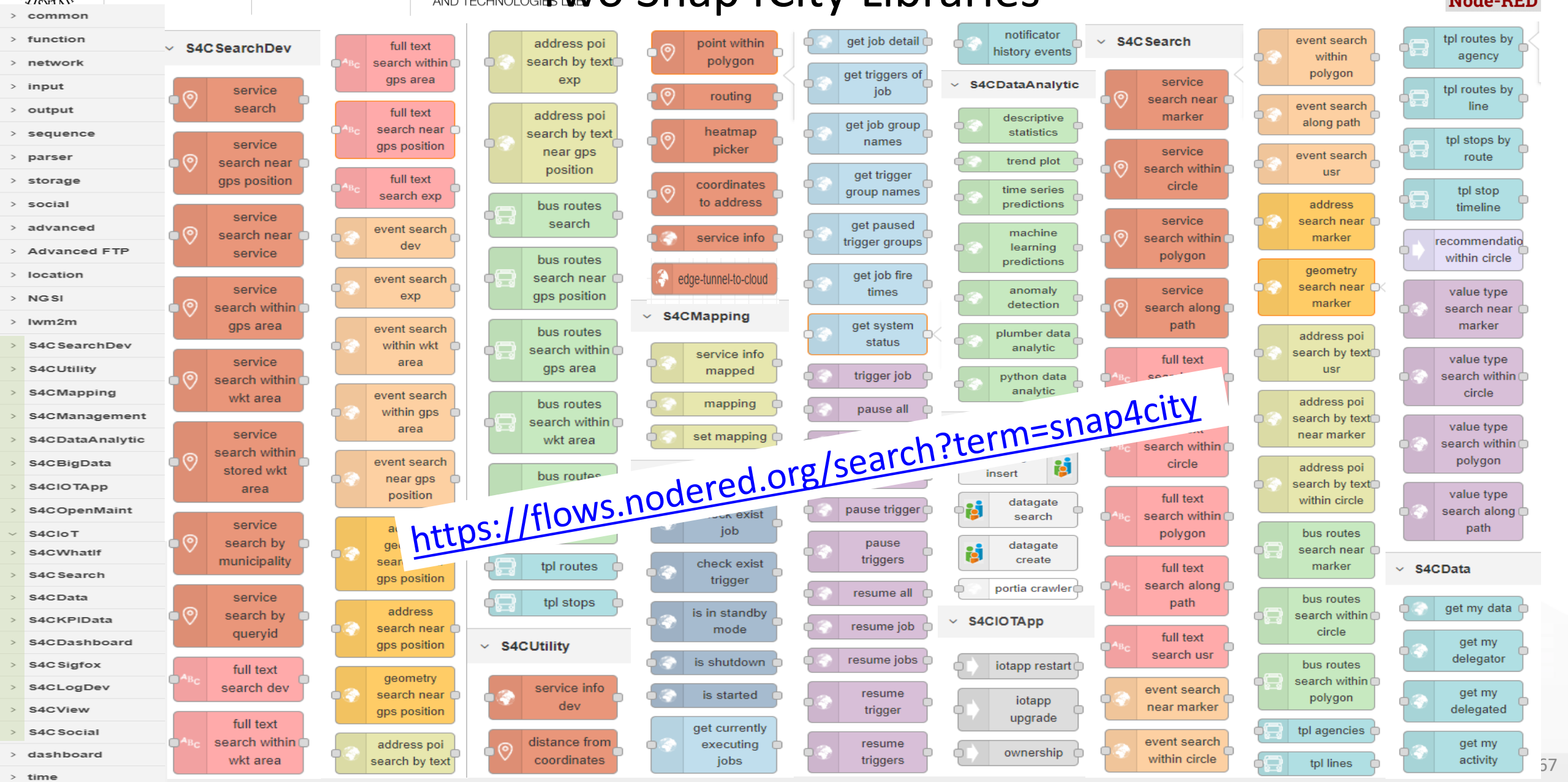
Sept 2024 collection

Two Snap4City Libraries

SNAP4CITY

Node-RED

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

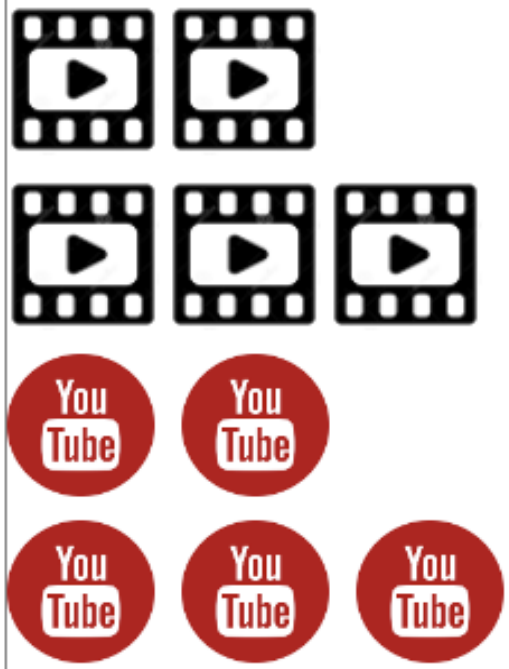


Part 5: Data Ingestion and Interoperability

Part 5: Data Ingestion and Interoperability

SLIDES

Interactive Slides

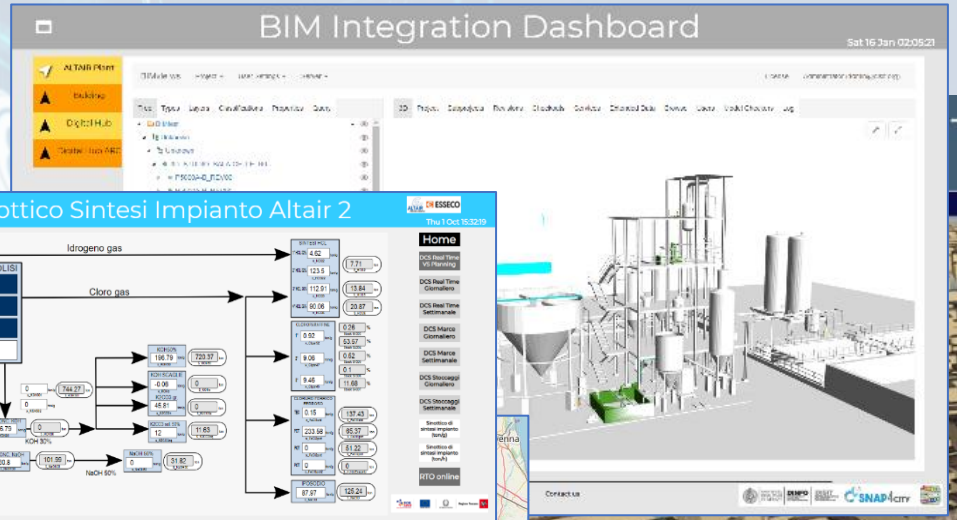


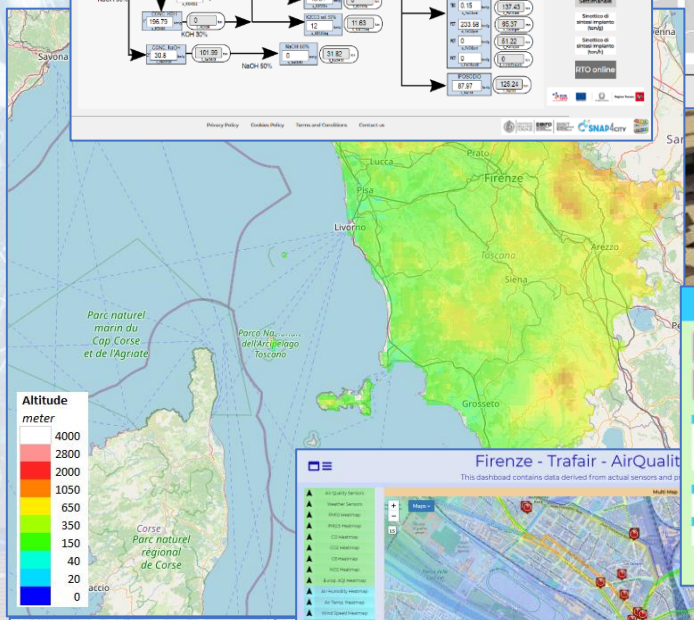
- When Solutions and tools for Data Ingestion and Interoperability are needed
- Overview of Snap4City Data Storage and Stack
- Knowledge Base: Modelling and Setting Up
- High Level Types vs Ingestion Process
- Data Ingestion Strategy and Orientation
- Ingestion of Points of Interest with POI Loader
- Models vs Devices/Entities and Registration
- Verification of Data Ingestion
  - Digital Twin Data Inspector vs Data Processes Details
  - My Data Dashboard Dev to assess data on Open Search Storage
- An Integrated Example for Time Series
- Entities Ingestion with Data Table Loader
- High Performance Ingestion via Python
- FIWARE Smart Data Models on Snap4City
- Ingestion of MyKPI with Proc.Logic / IoT App

High Level Types

Snap4City (C), Sett. 2025

- POI, IOT Devices, shapes,..
  - FIWARE Smart Data Models,
  - IoT Device Models
- GIS, maps, orthomaps, WFS/WMS, GeoTiff, calibrated heatmaps, ..
- Satellite data, any kind..
- traffic flow, typical trends, ..
- Vector fields + heatmaps, ..
- trajectories, events, workflow, ..
- 3D Models, BIM, Digital Twins, ..
- OD Matrices of several kinds, ..
- Dynamic icons/pins, ..
- Synoptics, animations, ..
- KPI, personal KPI,..
- social media data, TV Stream,
- routing, multimodal, constraints, ..
- scenarios, ….
- etc.





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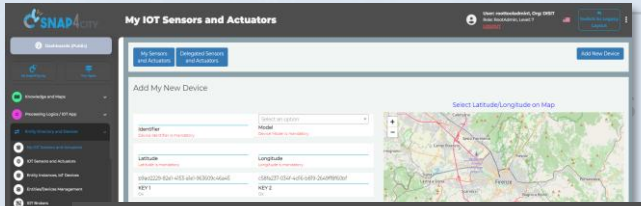
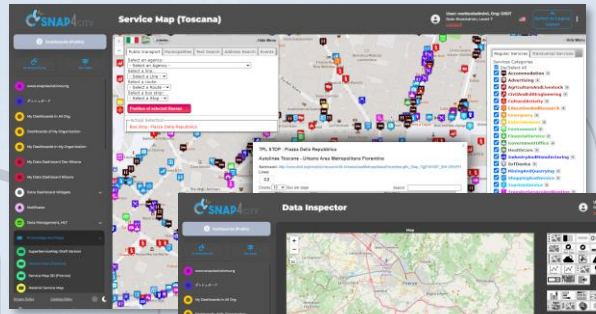
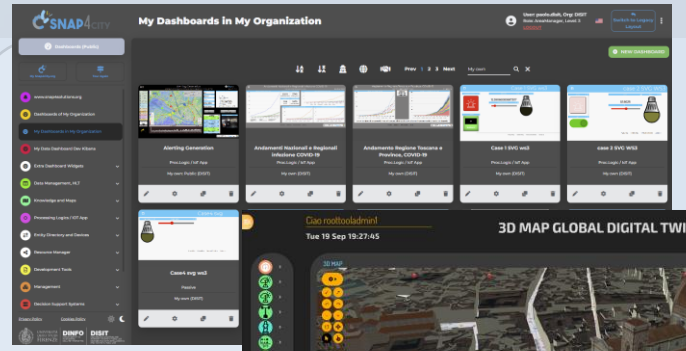
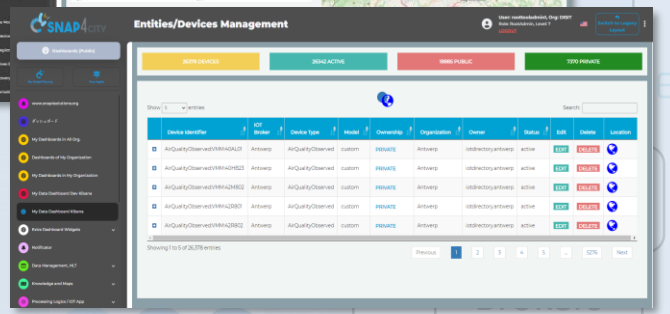
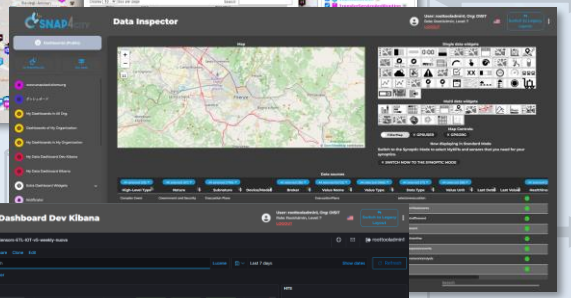
Visual Development Tools

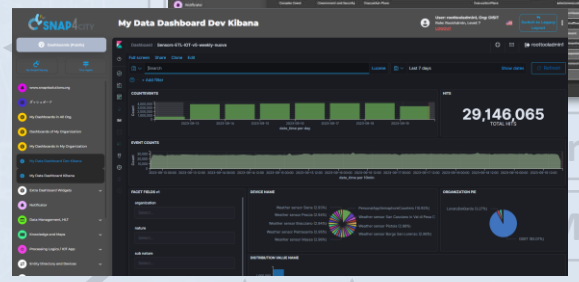


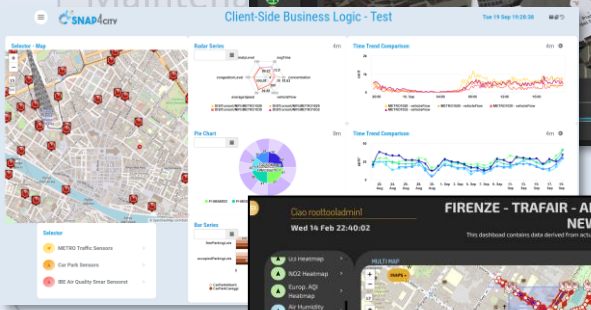


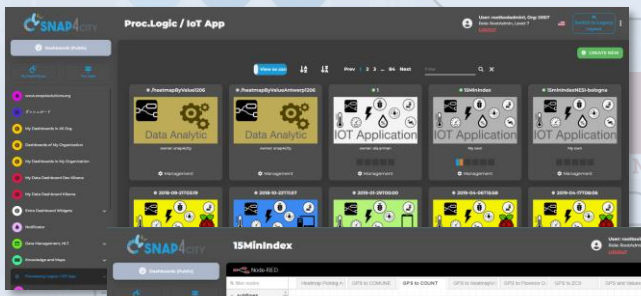


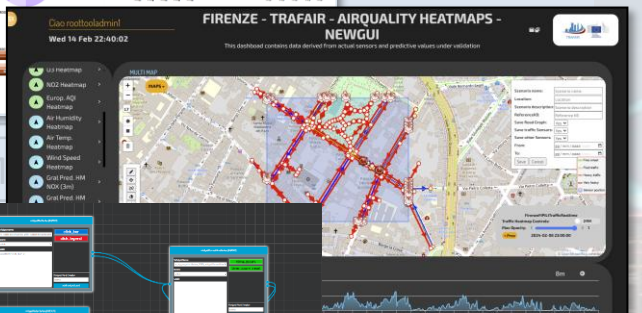


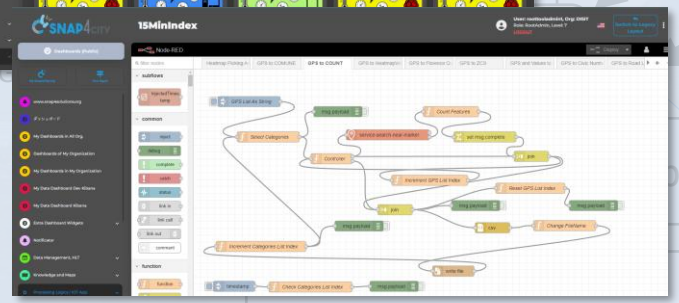


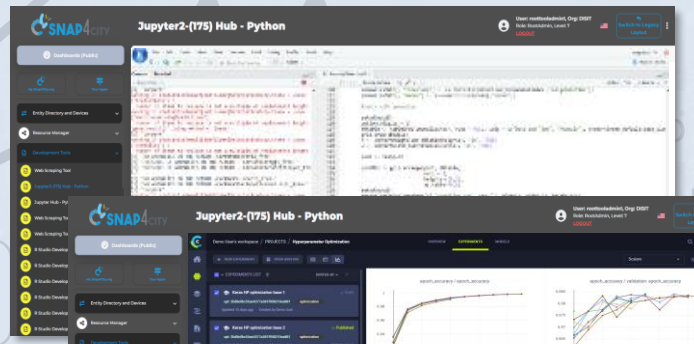


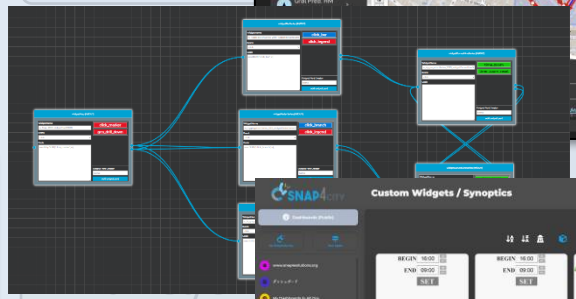


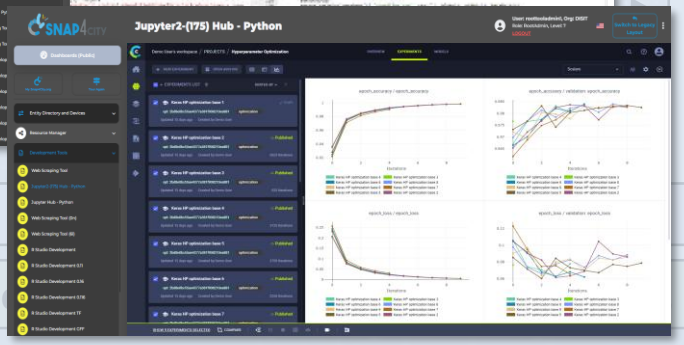




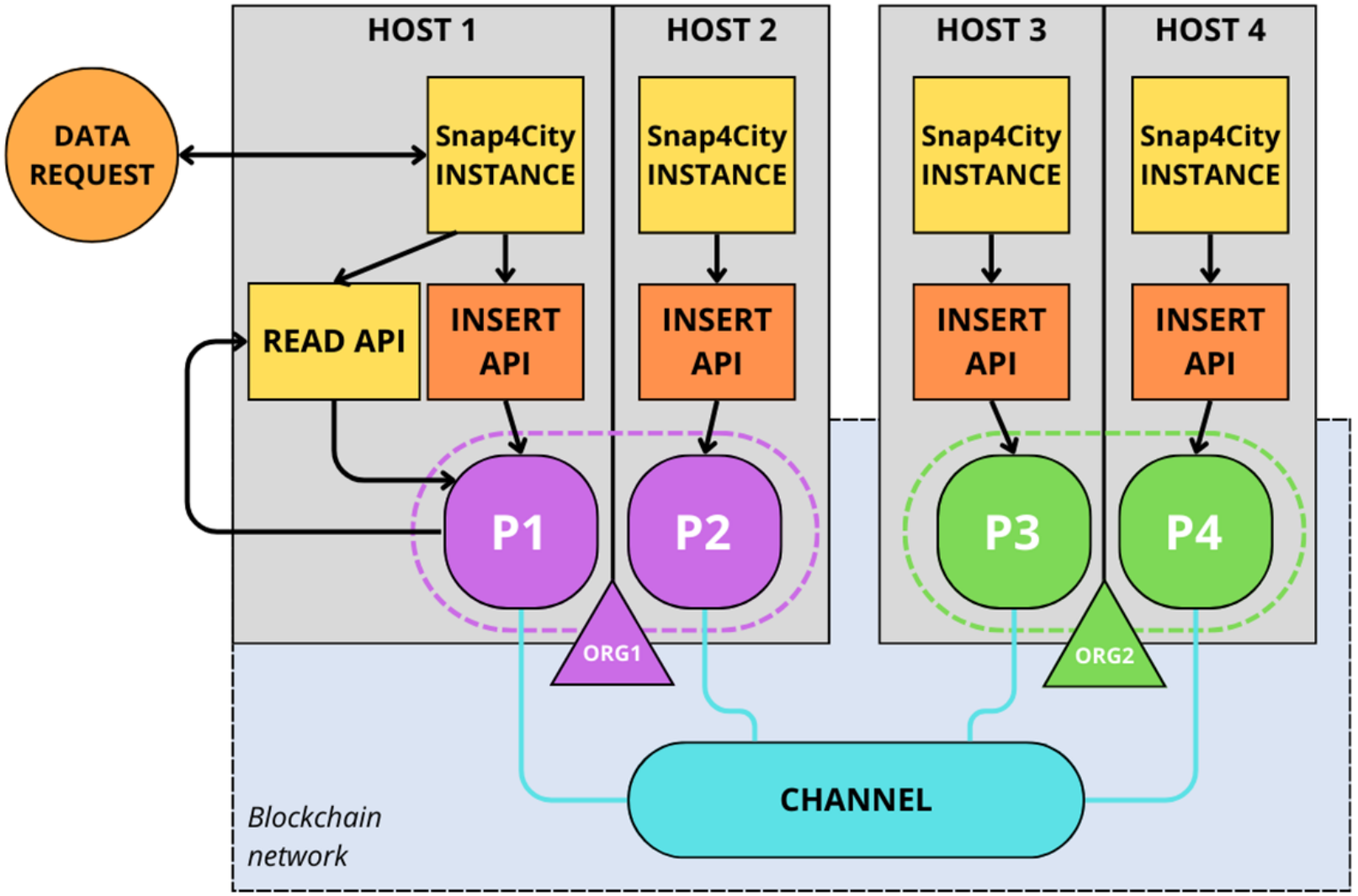








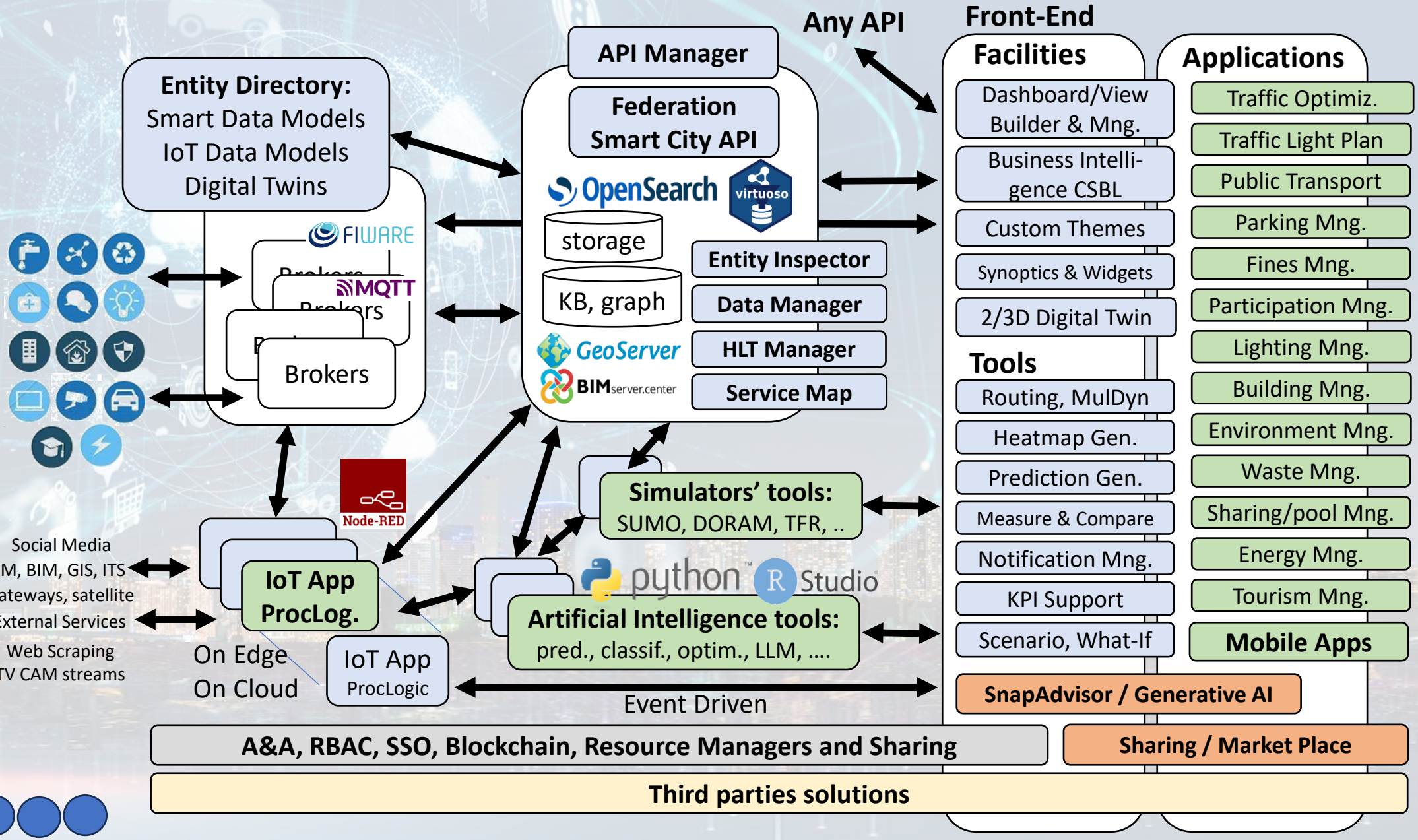
Snap4City with Blockchain



Part 4: Data Analytics

- Why and Where use DA, AI and XAI -> General Life Cycle, scenario editor, monitoring and control
- Data Processing: KPI, traffic, emissions, public transport quality, ..
- From Data Analytics, DA to Artificial Intelligence, AI
- List of the most relevant available DA and AI Solutions
- Predictions and Anomaly detections: parking, biking, NOx, landslide, people
- Computing: Higher Level Types Data and their representations: traffic, heatmaps, 3D
- Human Behavior, Engagement, Typical Time trends, WIFI sniffing
- Using AI in main domains: Mobility and transport, traffic optimization, Smart Energy, Smart Building,
- How AI/XAI, and Life Cycle, AI/ML requirements, XAI,
- Using DA, AI/XAI in Snap4City infrastructures
  - Data Analytics <-> IoT App / Proc.Logic
  - MLOps, ClearML, exploiting clusters of GPU/CPU
- Decision Support Systems and What-If Analysis, transport offer, DORAM tool
- Routing, Multimodal Routing, Dynamic Routing
- Predictive Maintenance
- Training Material

Technical Architecture

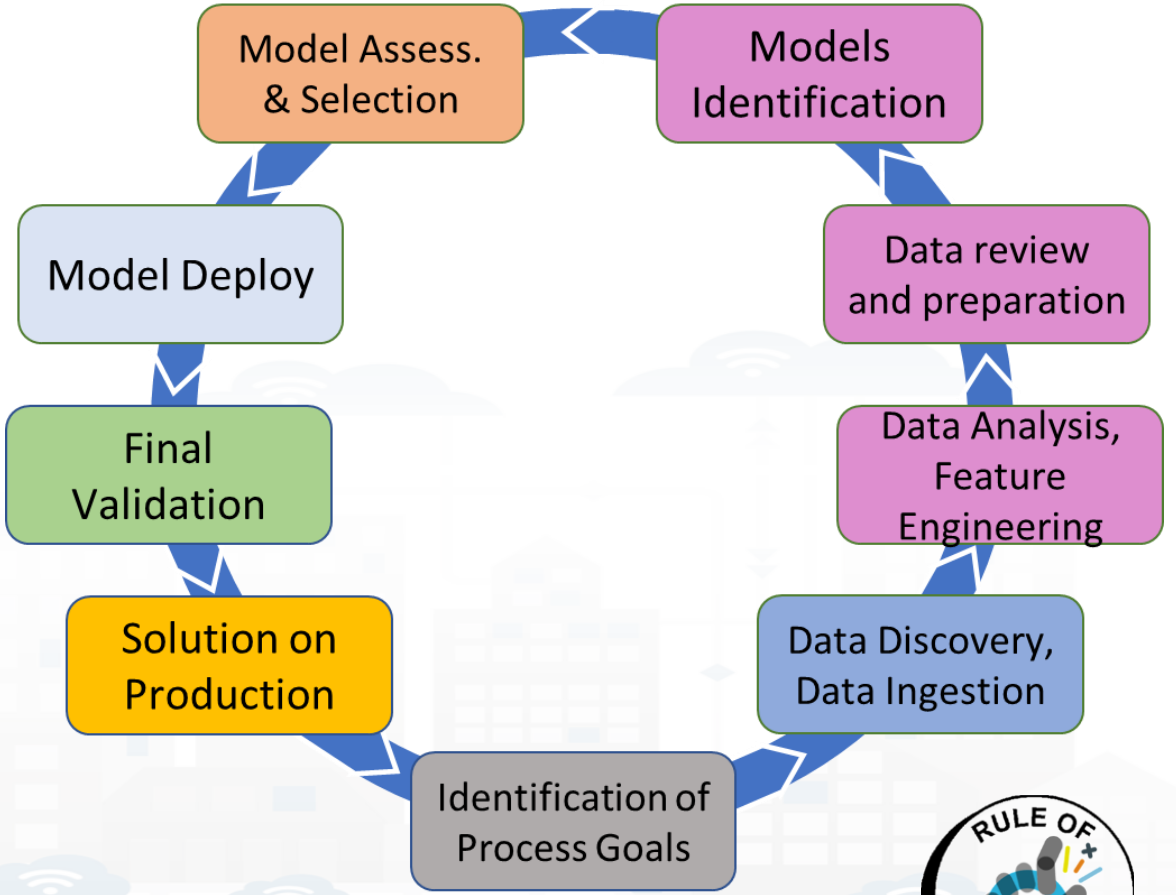


Main Functionalities of DA, ML, AI Support

- **High Interoperability**, HLT management, any format/protocol
  - Users and data support GDPR compliant
- **Integrated MLOps, agile CI/CD Orchestration on CPU/GPU, HPC** clusters, Kubernetes (DISIT Lab, HPC Lutech, CN MOST, etc.)
  - Develop, optimization, tracking experiments, etc.
  - Online and Offline development
  - Stable and one demand execution (deploy)
  - Automated transformation of AI,ML,DA processes on MicroServices
  - Node-RED visual programming
- **Monitoring, Accounting** and Billing → Market Place
  - AI Control and Plan as a Service

Model/Technique Development/testing

- **Identification of Process goals and Planning (problem definition)**
  - Which goals
  - How to compute, which language
  - Which environment, which libraries
- **Data Discovery and Ingestion (from the general life cycle)**
  - Data Collection, Data Preprocessing if needed
- **Data Analysis: feature engineering, feature selection**
  - Data ethics assessment
- **Data review and preparation for the model, splitting, encoding**
- **Model Identification and building: ML, AI, etc….**
  - Model Training
  - Tuning hyperparameters when possible
- **Model Assessment and Selection (Evaluation)**
  - Validation in testing
  - Assessment on a set of metrics depending on the goals: global relevant and feature assessment
  - Assessing computational costs
  - Impact Assessment, Ethic Assessment and incidental findings
  - Global and Local Explanation via Explainable AI techniques
- **Model Deploy and Final Validation**
  - Optimisation of computation cost for features, if needed reiterate
  - Solution on Production (security, scalability, etc.)
- **Monitoring and Maintenance on production**
- **Documentation, incremental documentation**



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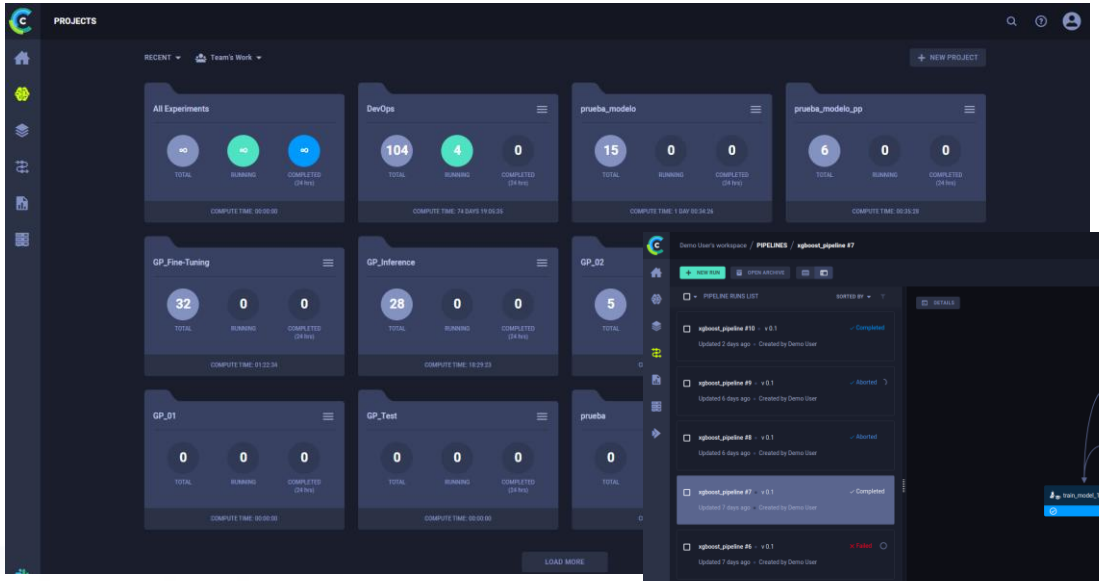
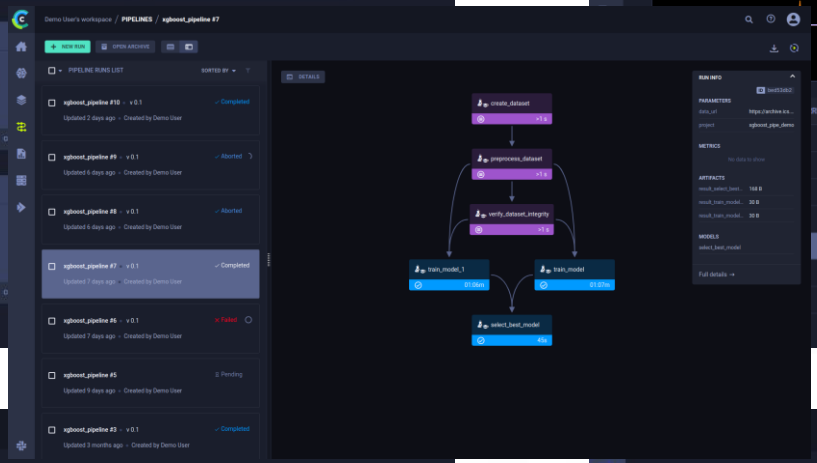
DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

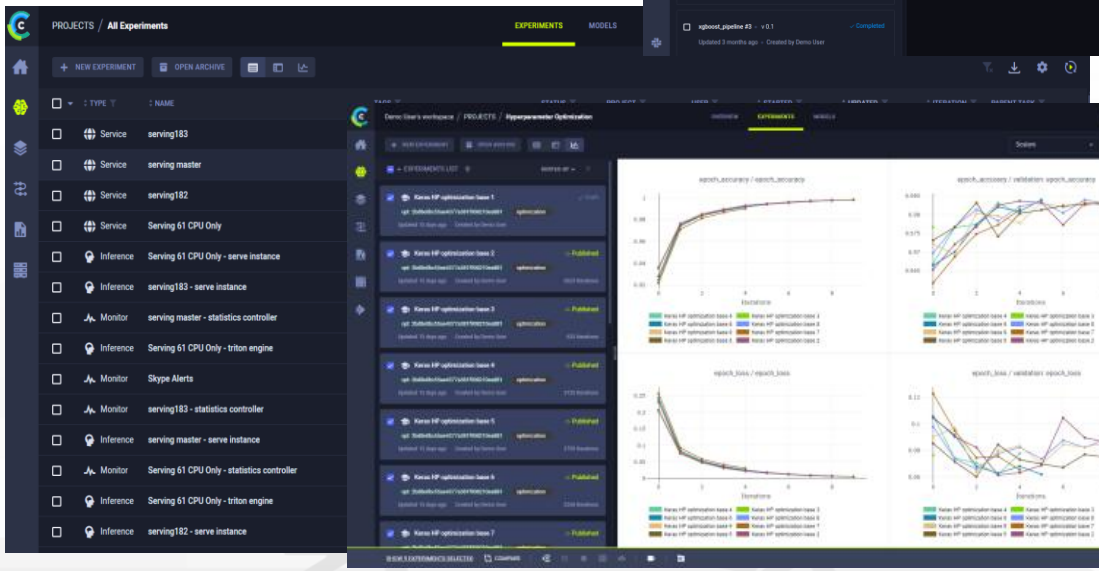
DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB
DISTRIBUTED DATA INTELLIGENCE AND TECHNOLOGIES LAB

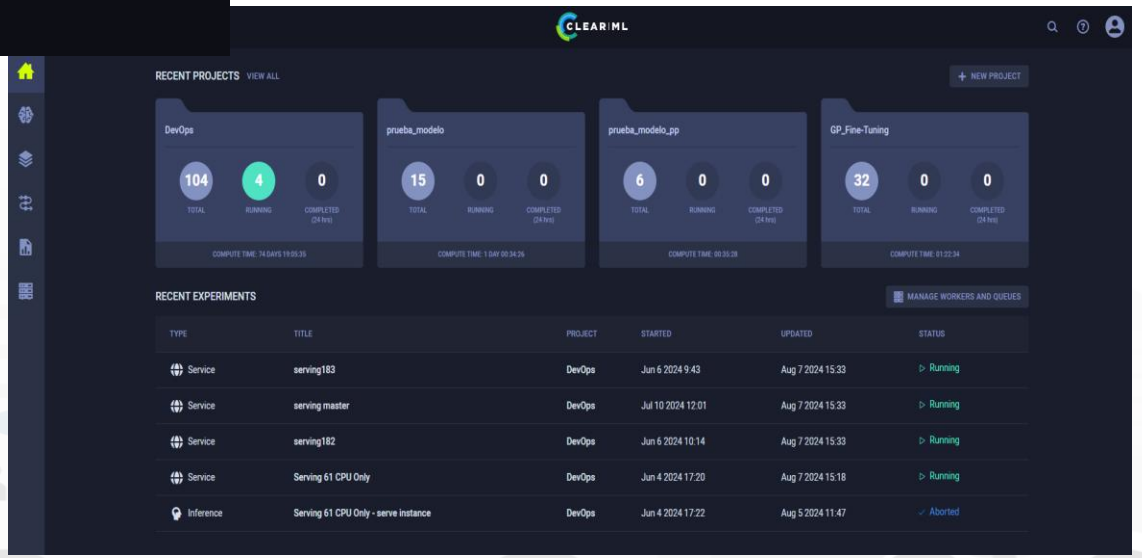
MLOps

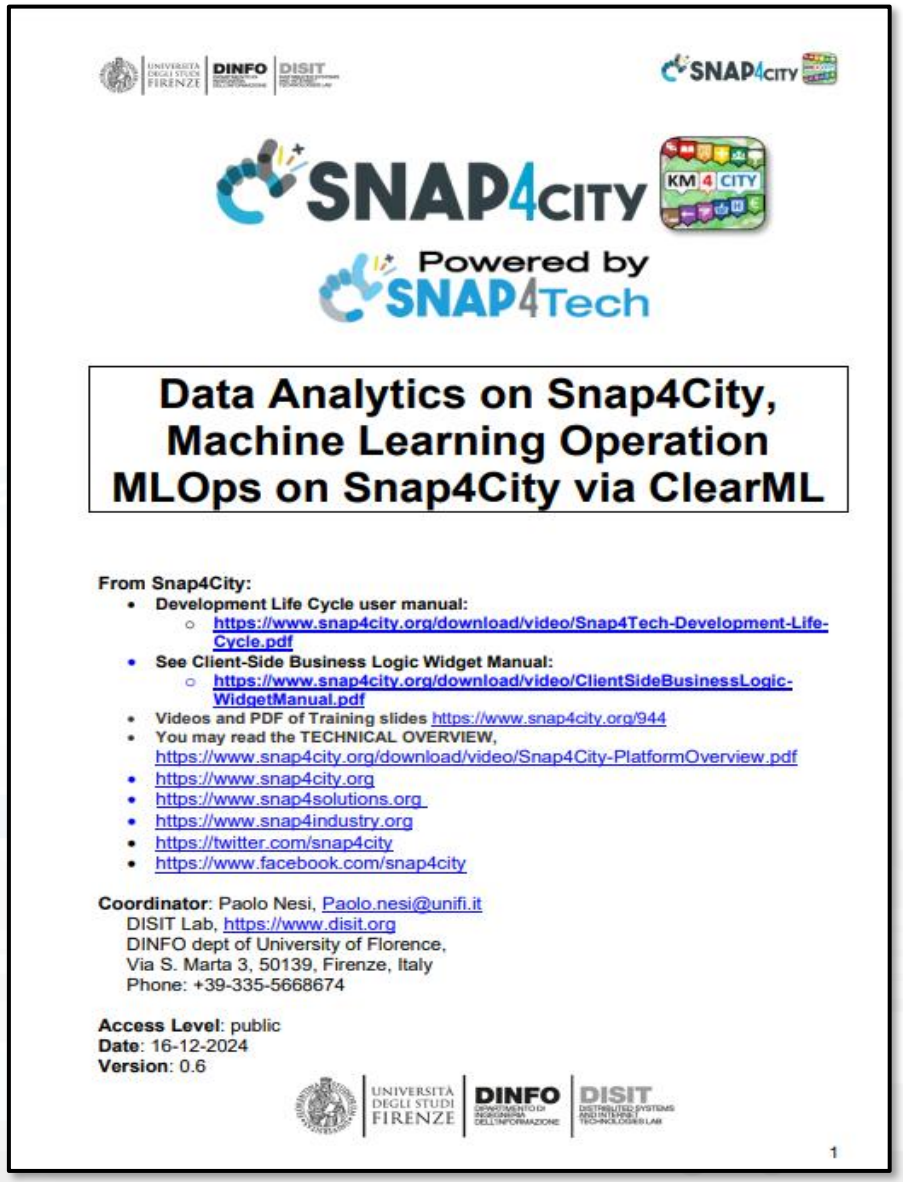
SNAP4CITY KM4CITY











SNAP4CITY

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Data Analytics on Snap4City, Machine Learning Operation MLOps on Snap4City via ClearML

From Snap4City:

- **Development Life Cycle user manual:**
  - https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf
- **See Client-Side Business Logic Widget Manual:**
  - https://www.snap4city.org/download/video/ClientSideBusinessLogic-WidgetManual.pdf
- **Videos and PDF of Training slides** https://www.snap4city.org/944
- **You may read the TECHNICAL OVERVIEW,** https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf
- https://www.snap4city.org
- https://www.snap4solutions.org
- https://www.snap4industry.org
- https://twitter.com/snap4city
- https://www.facebook.com/snap4city

Coordinator: Paolo Nesi, Paolo.nesi@unifi.it
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Access Level: public
Date: 16-12-2024
Version: 0.6

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MLOperation

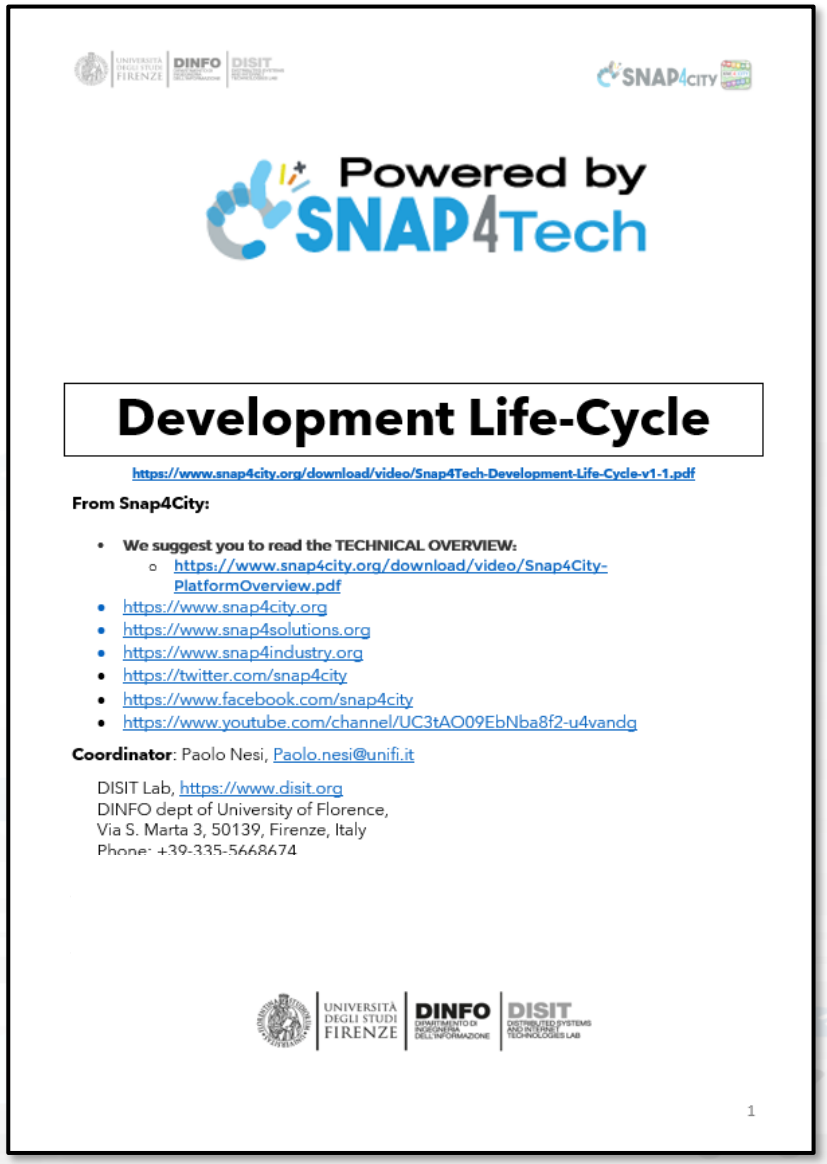
https://www.snap4city.org/download/video/Snap4City-MLOps-Manual.pdf

Parts 7 & 8: API, Mobile, Business Intelligence

Part 7: Exploiting Snap4City API, and Web/Mobile Applications SDK SLIDES Interactive Slides	
Part 8: Developing Smart Applications & Business Intelligence Solutions SLIDES Interactive Slides	

- Smart City API: Internal and External
- Concepts and tools for using Knowledge Base, ServiceMap, API
- Federated Knowledge Bases and Smart City APIs
- Advanced Smart City API
- Access to Protected data
- Forging and managing: Mobile and Web Apps, MicroApplications
- Web and Mobile App Development Kit
- ----------
- Developing in the smart city IoT/WoT context
- Smart Solutions Development Life Cycle
- Analysis for Innovation (Co-Creation and Co-Working)
- Design: Data, Data Models, Data Relationships
- Design & Develop: Data Processes Proc.Logic / IoT App
- Design & Develop of Data Analytics
- Design & Develop: user interfaces, visual tools
- Visual Analytic vs Data Analytics: Client Side Business Logic Intelligence
- Design and Control of Smart Applications
- What is missing here and you can get from former course

Development



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Development Life-Cycle

https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle-v1-1.pdf

From Snap4City:

- **We suggest you to read the TECHNICAL OVERVIEW:**
  - https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf
- https://www.snap4city.org
- https://www.snap4solutions.org
- https://www.snap4industry.org
- https://twitter.com/snap4city
- https://www.facebook.com/snap4city
- https://www.youtube.com/channel/UC3tAO09EbNba8f2-u4vandg

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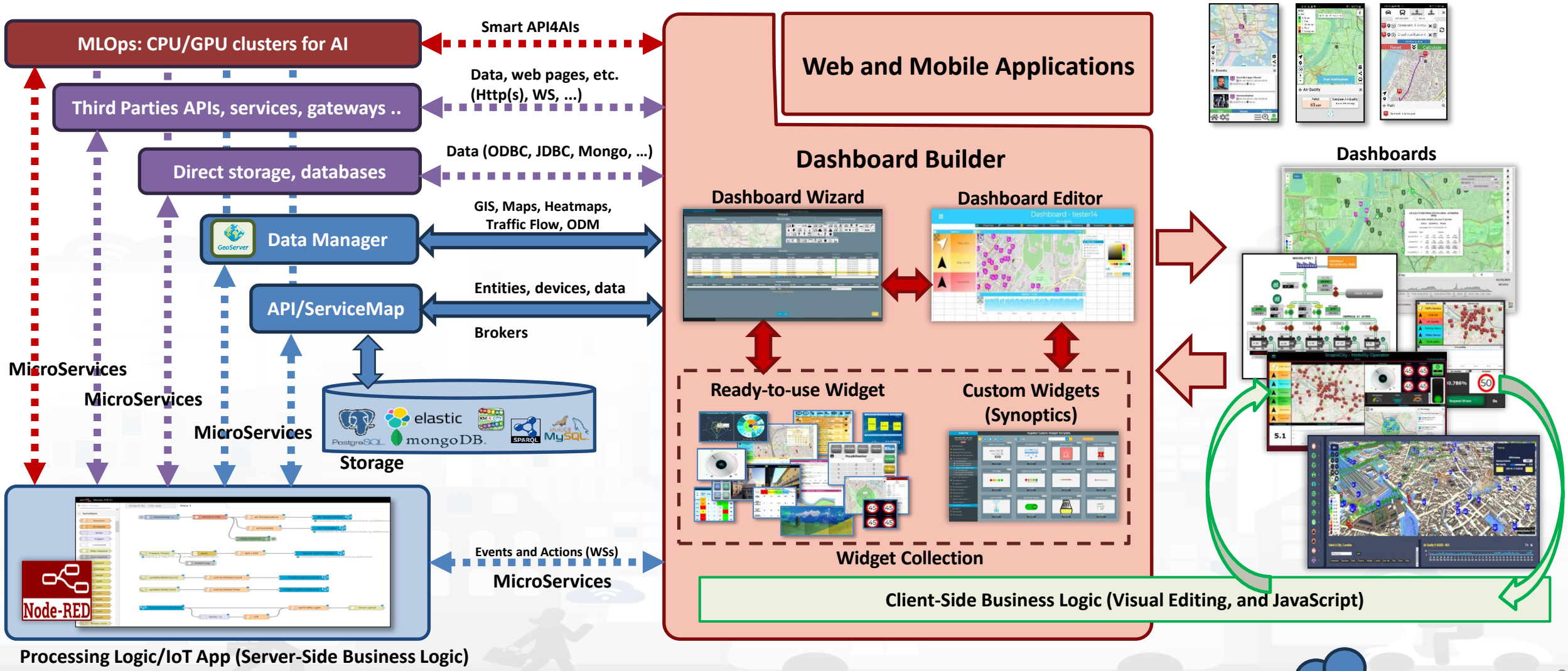
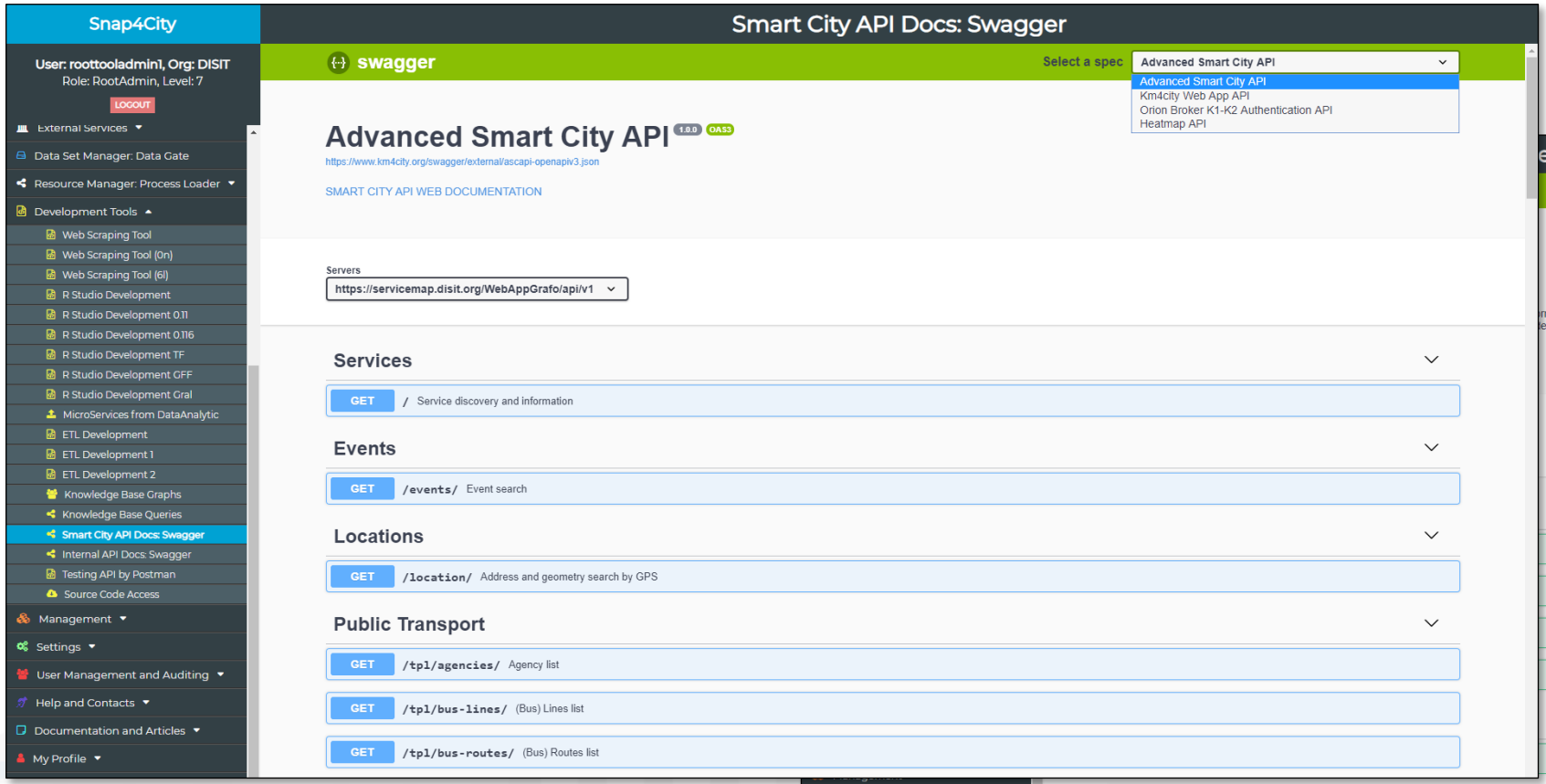
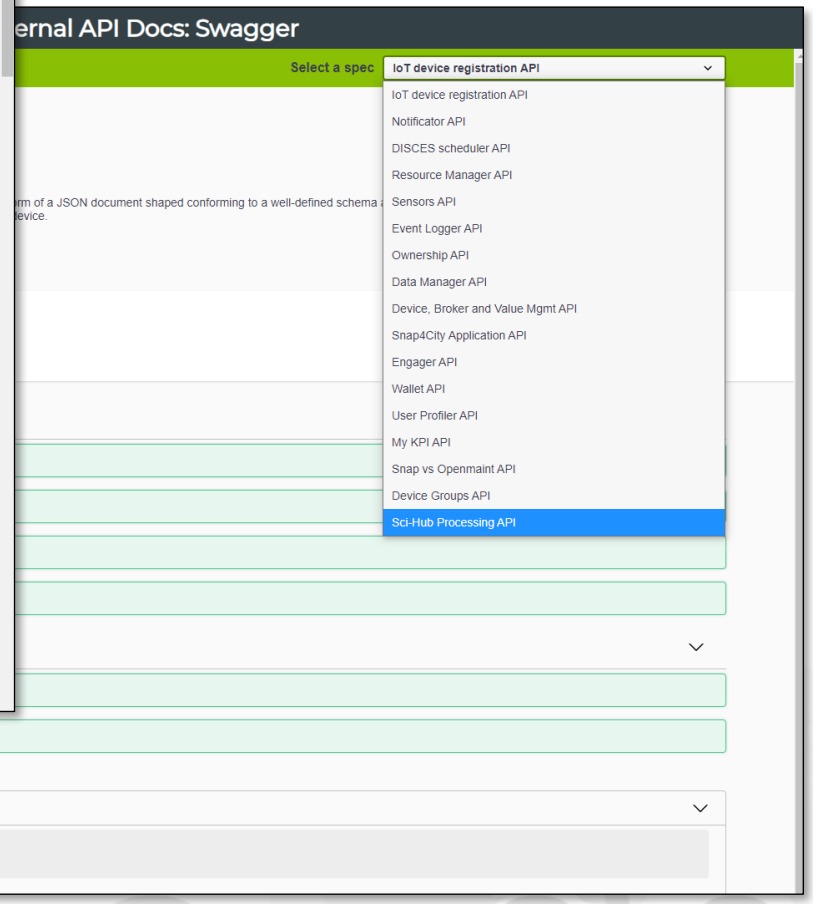
https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf

How the Dashboards / Apps Exchange data (2024/8)



Internal and External Smart City API



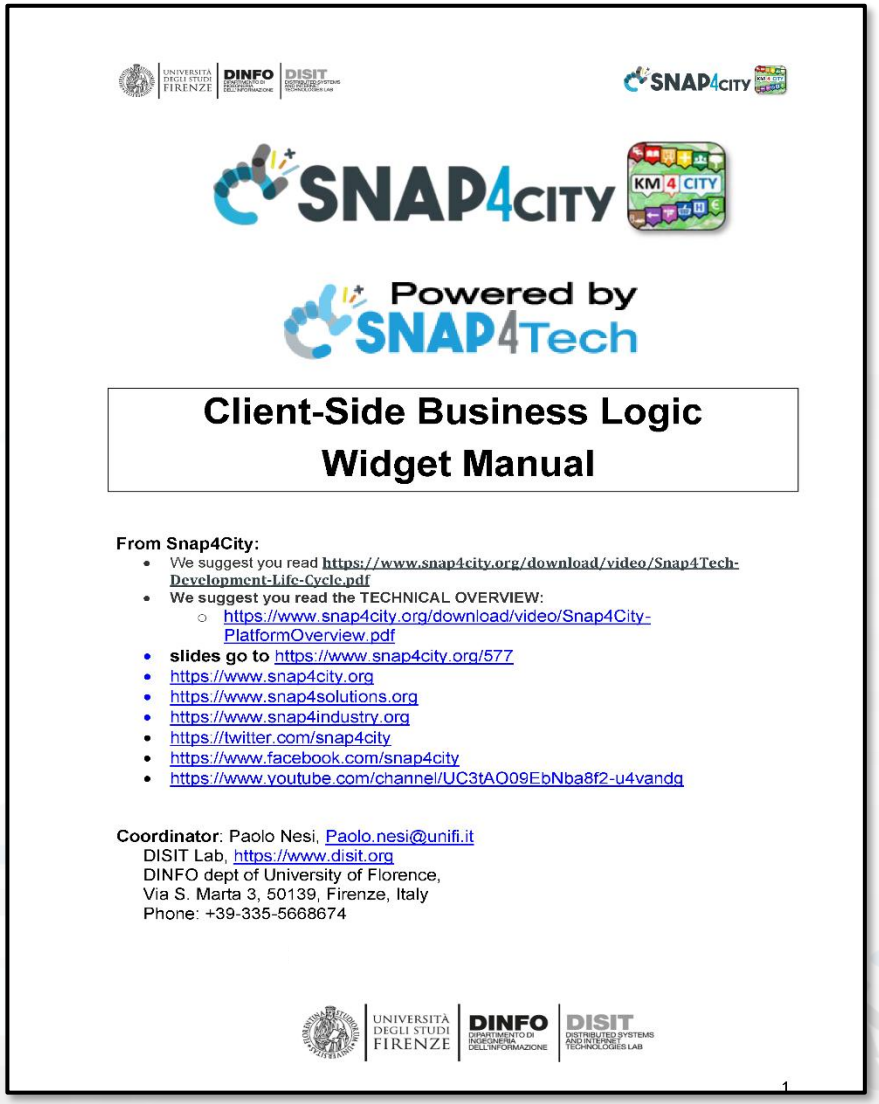


https://www.km4city.org/swagger/external/index.html

https://www.km4city.org/swagger/internal/index.html

CSBL

Client Side Business Logic



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Client-Side Business Logic
Widget Manual

From Snap4City:

- We suggest you read **https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf**
- **We suggest you read the TECHNICAL OVERVIEW:**
  - https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf
- **slides go to** https://www.snap4city.org/577
- https://www.snap4city.org
- https://www.snap4solutions.org
- https://www.snap4industry.org
- https://twitter.com/snap4city
- https://www.facebook.com/snap4city
- https://www.youtube.com/channel/UC3tAO09EbNba8f2-u4vandg

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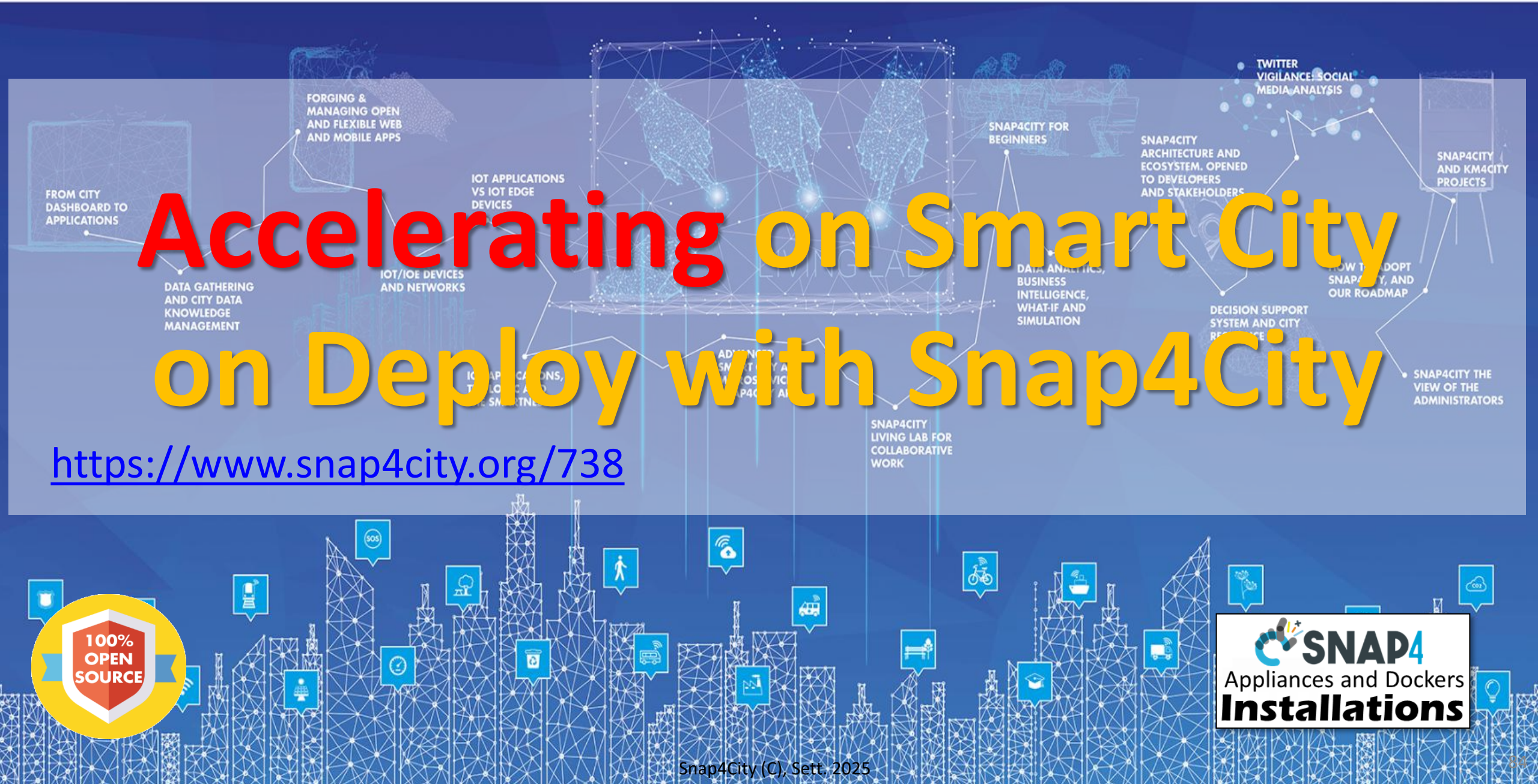
https://www.snap4city.org/download/video/ClientSideBusinessLogic-WidgetManual.pdf



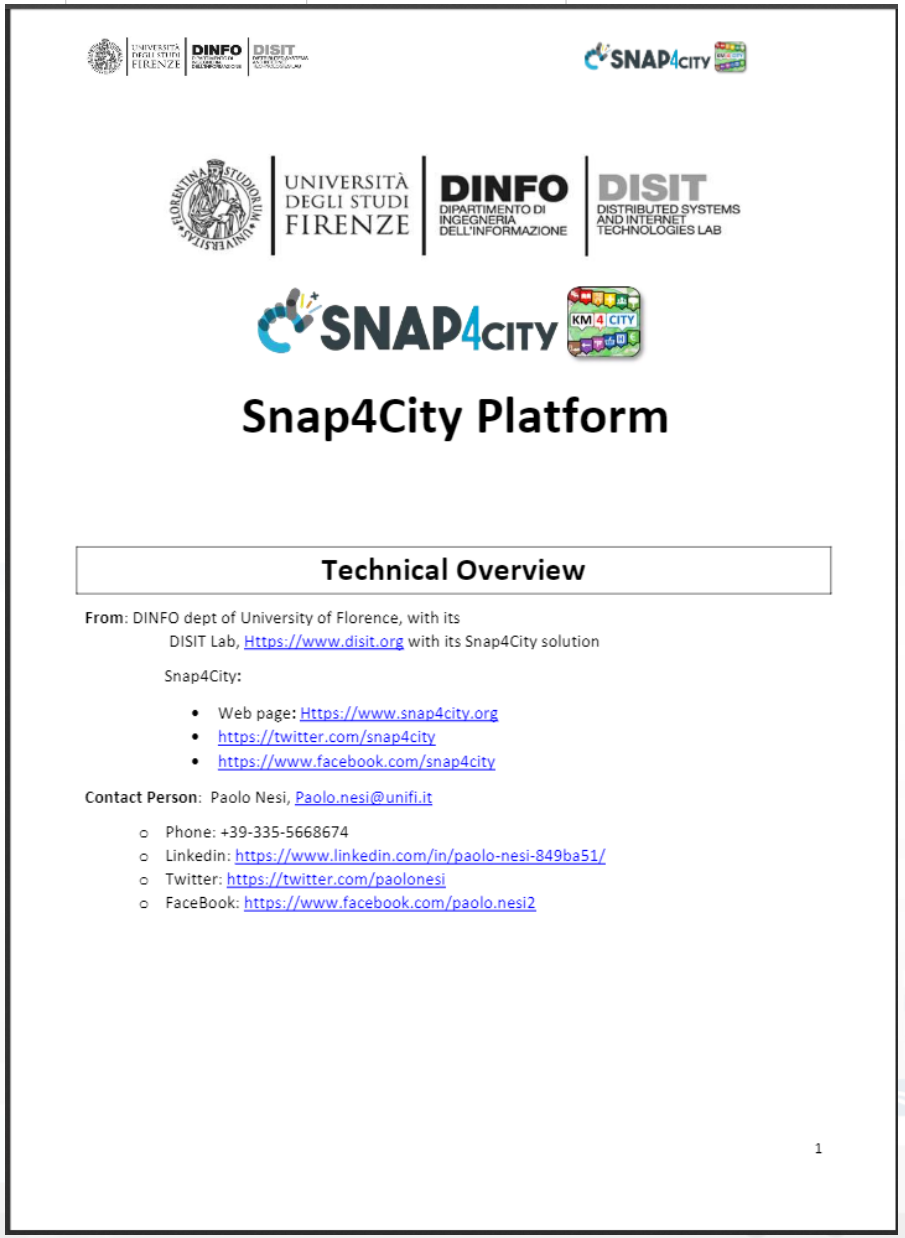
Accelerating on Smart City

on Deploy with Snap4City

https://www.snap4city.org/738

100% OPEN SOURCE

SNAP4 Appliances and Dockers **Installations**



Snap4City Platform

Technical Overview

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

Snap4City:

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

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- Twitter: https://twitter.com/paolonesi
- FaceBook: https://www.facebook.com/paolo.nesi2

1

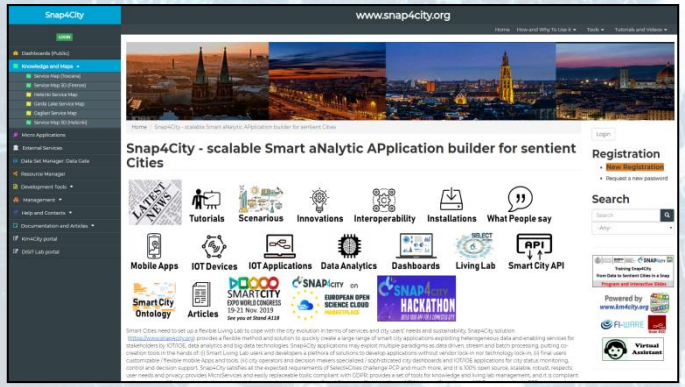
Tech Overview

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

How to adopt Snap4City

SNAP4CITY

Https://www.snap4city.org



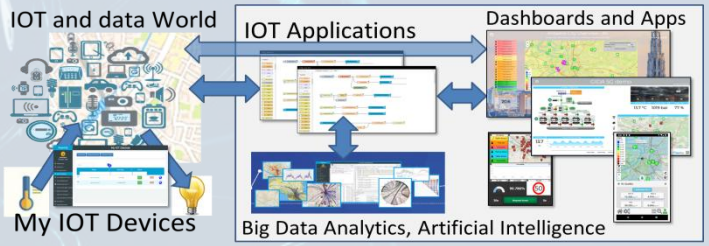
Smart City as a Service

- Supporting Org
- 100% Open Source Platform: Github
- Further developments
- Publishing Appliances and Dockers
- Training courses, docs
- Consulting
- Forums
- Etc.

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

Download and deploy

On your premise



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Installation on your premise

- **Dockers / Kubernetes, VM**
- Different configurations
  - From small to scalable
  - Exploiting your legacy tools
  - Interoperable with any tool
- No vendor lock-in, No tech lock-in

Mixed solutions! For example:

- Start on Cloud as Smart City as a Service
  - Migrate on premise on the fly
- Start on Cloud into a sand box
  - Pass to install on premise what you need

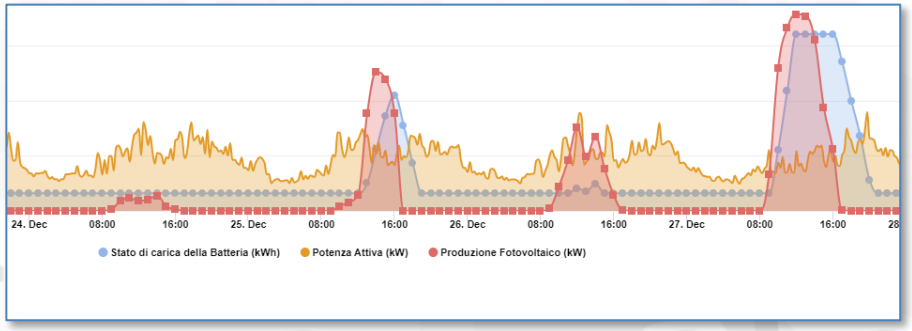
Smart Energy and Smart Building

Goals

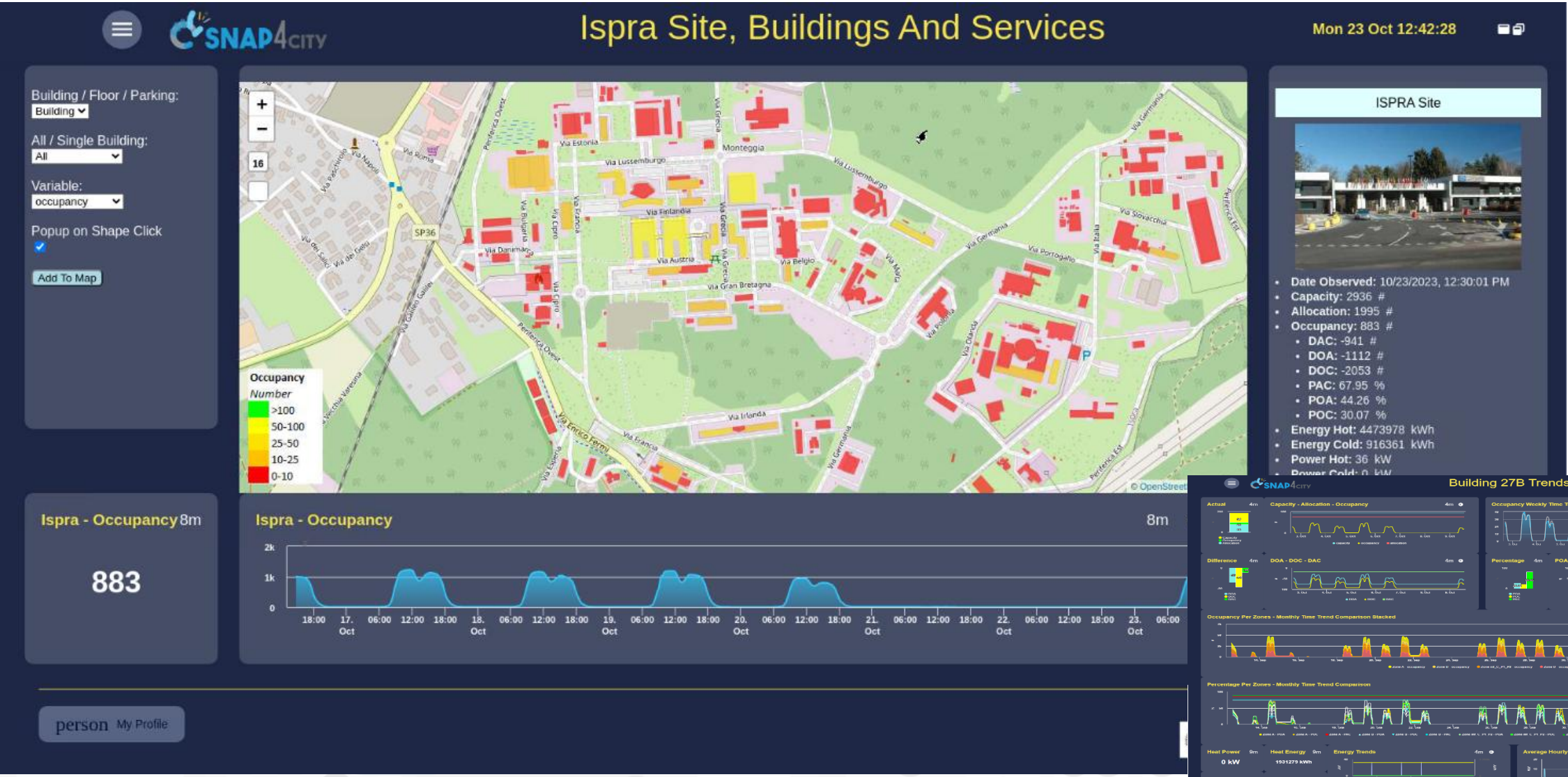
Cost Reduction

City Energy and Buildings

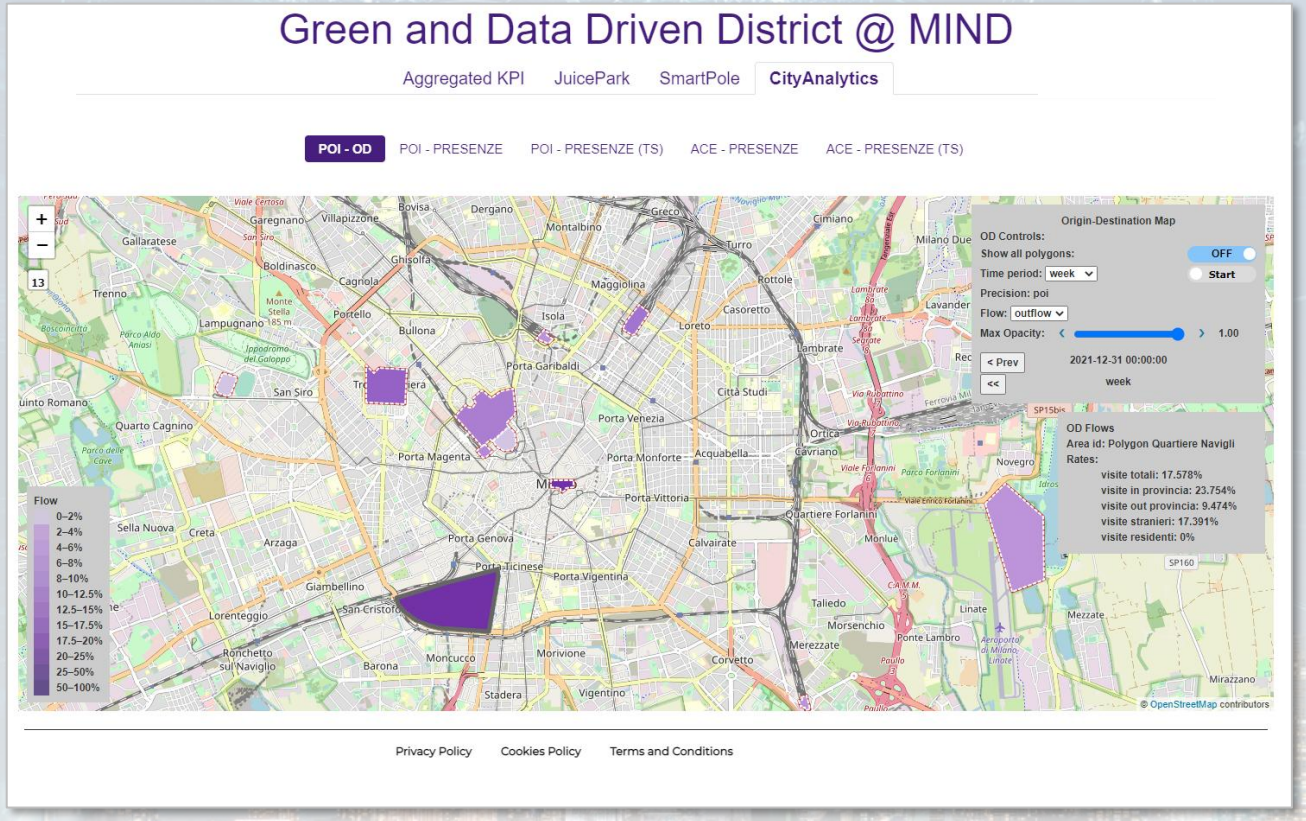
- **Goals:**
  - Energy consumption reduction, increment of efficiency,
  - Areas and building sustainability
  - Improve accessibility to services, security and safety
- **Energy Monitoring:** Building, floors, rooms, recharging poles, cabinets, Community of Energy, Data centers, Energy for Hot / cold, air condition, energy vs temperature and usage, etc.
- **Energy Management:** Predictions, early warning, identification of critical conditions
- **Smart Light Management**: LED/mixt, cabinets, lights vs traffic, lights vs security, energy saving, luminaries profiling, group management.
- **Smart Building Management:** consumption, number of people, etc.
  - Communities of Energy, Photovoltaic plants, sustainability
  - What-if analysis, optimisation tools
- **KPI: Energy consumption, efficiency, pros/cons**
  - Light profiling and adaptation
  - Autoclave industrial plants simulation, Photovoltaic plant simulation
  - consumption / usage, energy vs temperature
- **Mobile App:** monitoring, info-recharge, eSharing, booking, ..
- **Participatory**: problem reporting, ticketing, etc.
- **Integration of any kind**

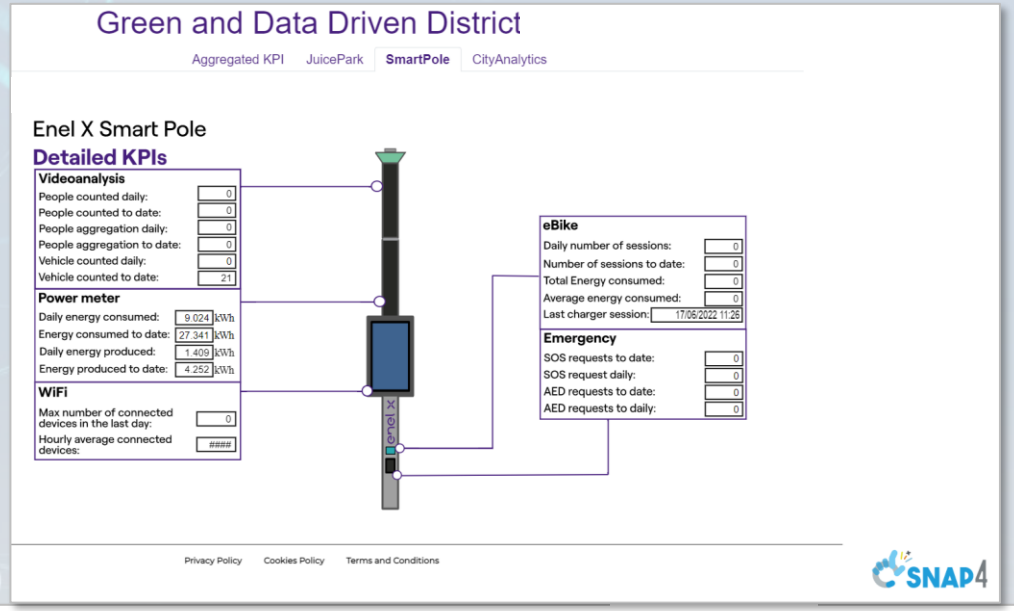


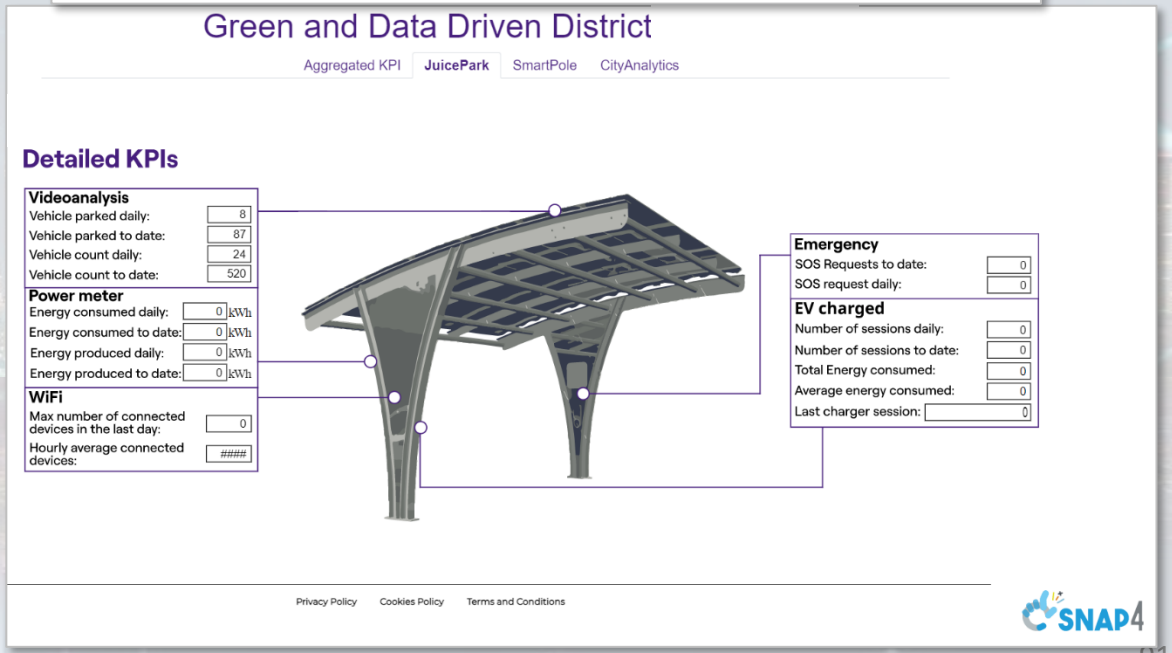
ISPRA JRC Site



Energy monitoring and business intelligence

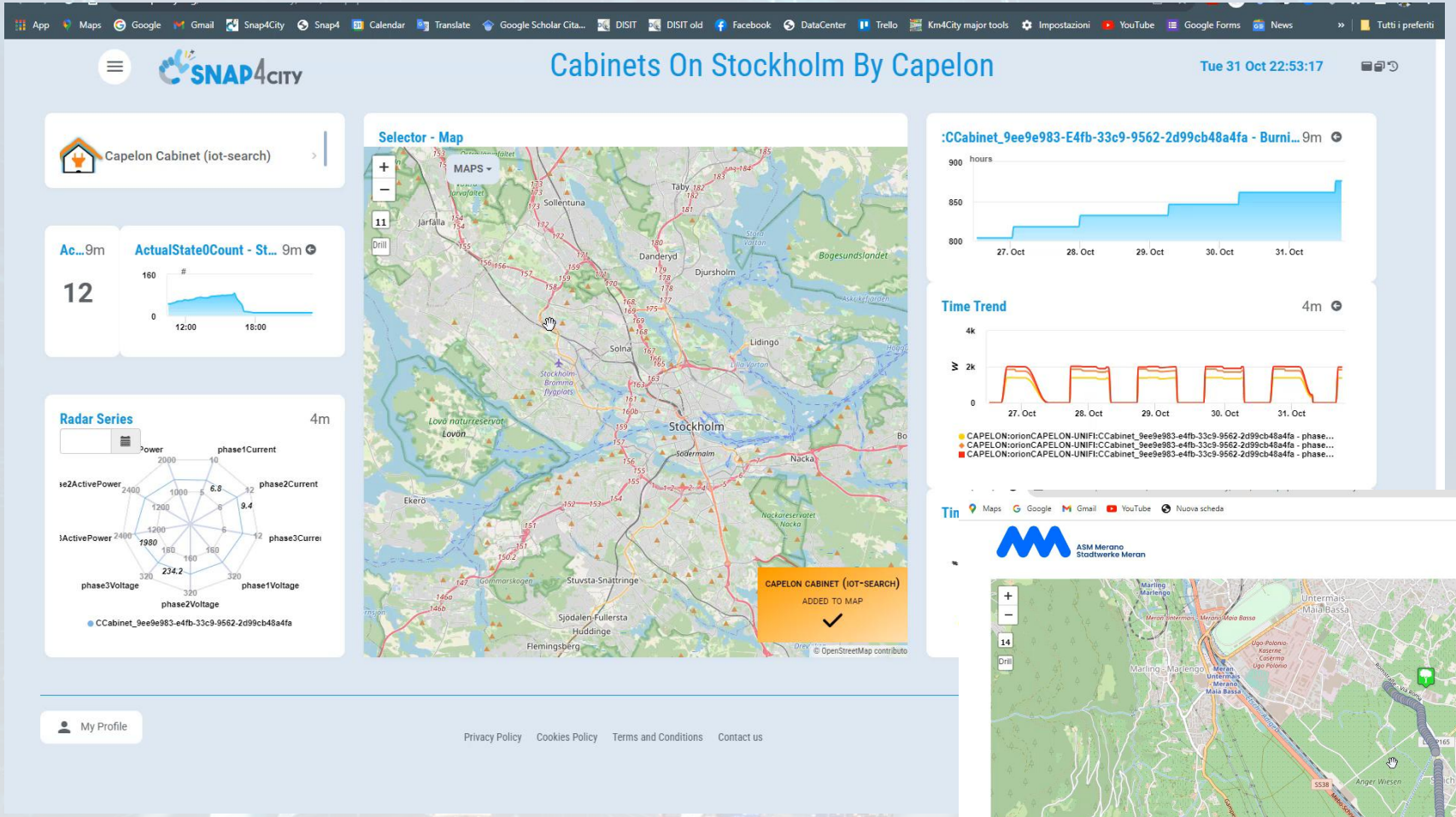


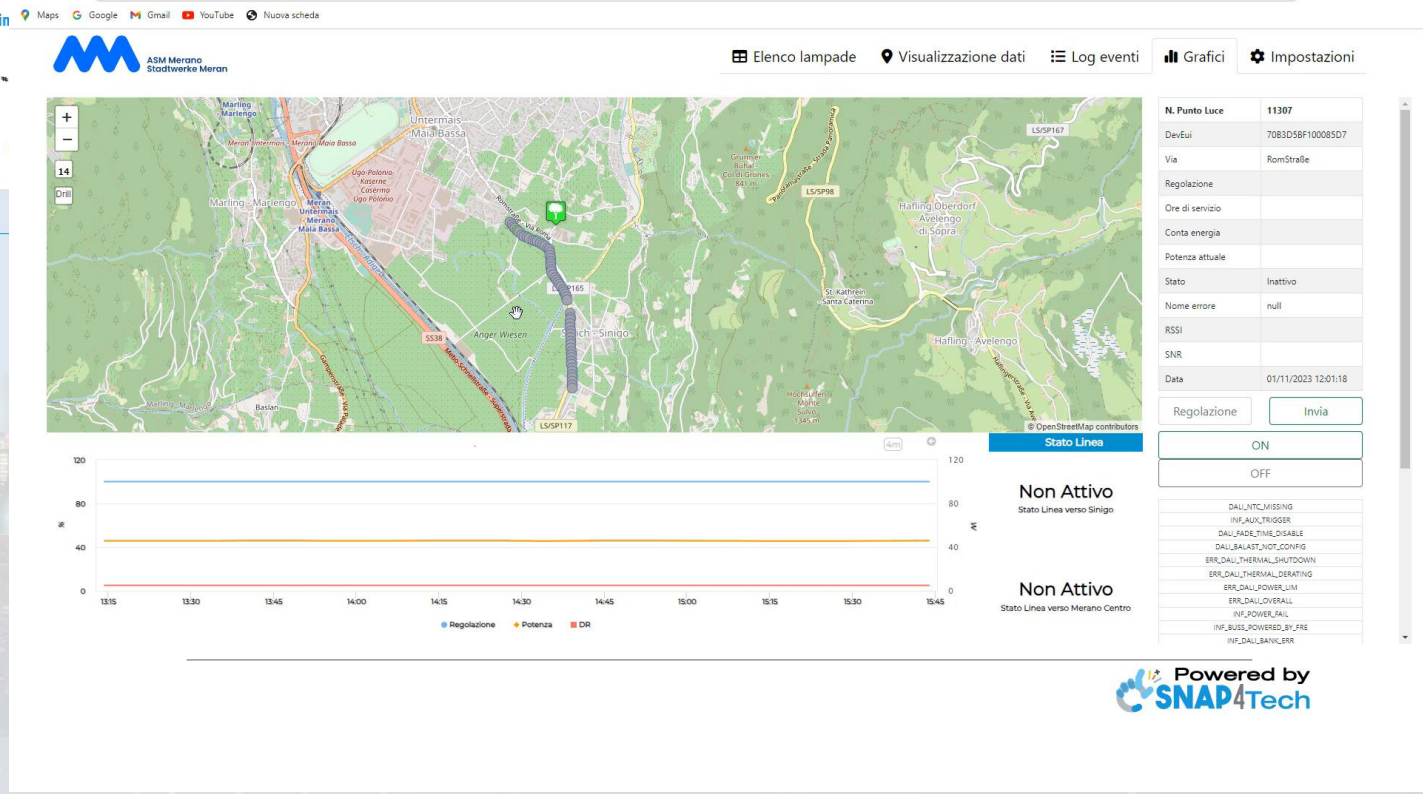




7 AFFORDABLE AND CLEAN ENERGY

11 SUSTAINABLE CITIES AND COMMUNITIES





Smart Light Management

Environment and Waste Management

Goals

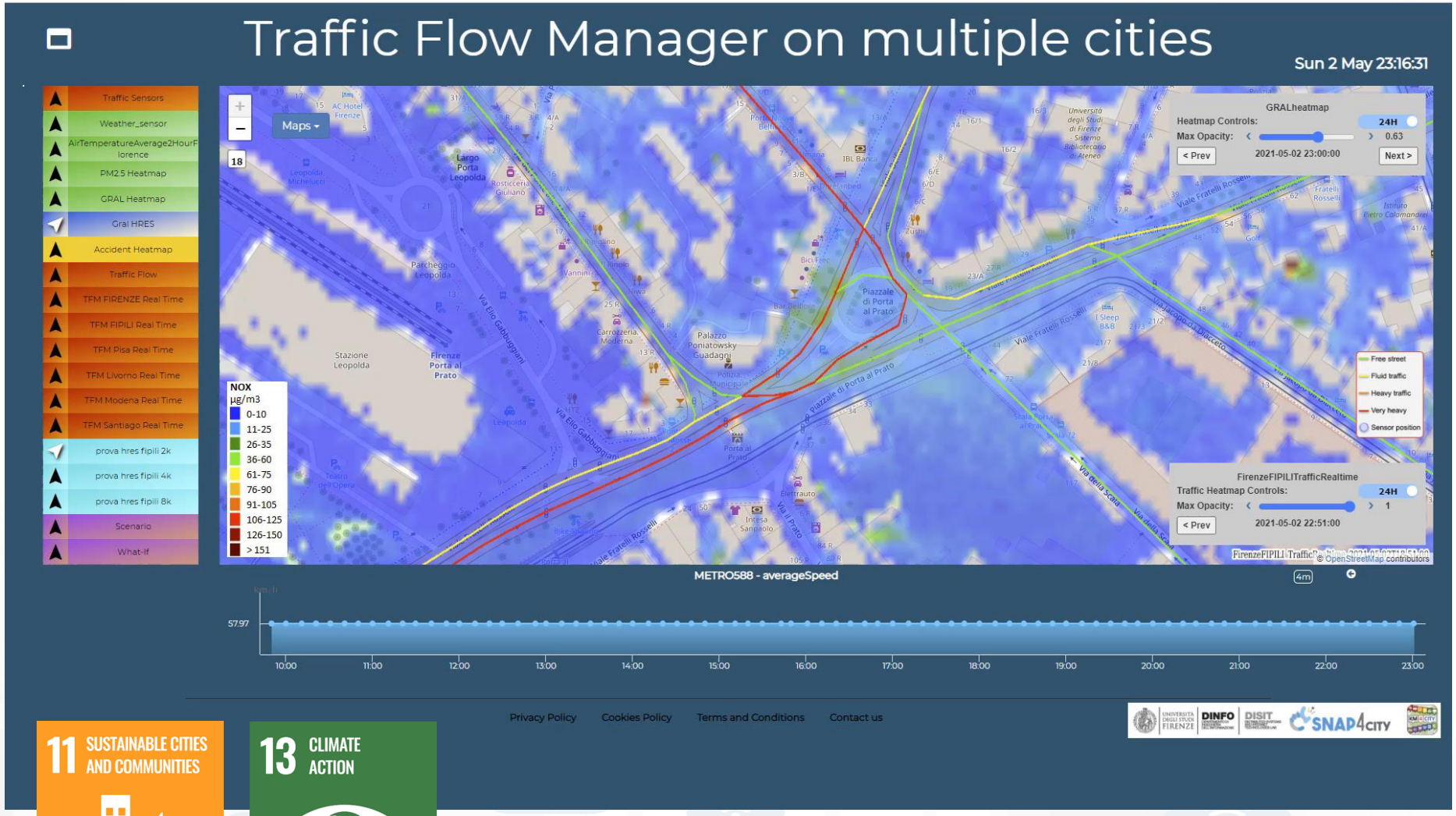
Control of emissions
Reduction of emissions
Early warning
Meet the EC targets
Reduction of EC taxation

Environment and Waste

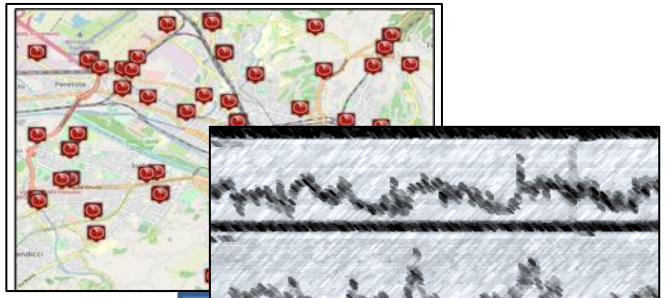
- **Goals:**
  - Reduction of emissions and EC taxations
  - Cost reduction for waste collection,
  - reduction of waste collection impact on mobility
- **AIR quality (Indexes) monitoring and warning**
- **Environment Management & producing prescriptions:**
  - Monitoring, long and short-term predictions, warning for:
    - GHG, emissions, pollutants, aerosol, chemical plants analysis
  - Traffic Flow impact emissions, predictions
  - Sea conditions, UV conditions, etc.
- **Land slide prediction warning**
- **Coastal erosion monitoring and analysis**
- **Smart Waste Management and Optimisation:**
  - costs reduction, optimal routing production, pay as you throw,
  - avoiding out of bins, predictions of waste production on bins, alarms
- **KPI:** SDG, 15MinCityIndex, QOS, costs, Km, colleting time, EC KPI, emissions
- **Mobile App**: final users services/informing and operators
  - Info Waste for operators, participation, optimal routing, RAEE Collection, ..
- **Participatory**: problem reporting, ticketing, etc.
- **Integration of any kind: env/weather, mobility, ticketing, presences, POI, ..**

Environment

- **Prediction**
  - **NOX Pollutant** diffusion on the basis of Traffic Flow (prediction), weather and 3D structure
  - **NO2 progressive average** (Long term)
- **Project:**
  - **Trafair** CEF EC
  - Mixed solutions of Fluidinamics modeling and AI



Estimating City Local CO2 from Traffic Flow Data



Computing Traffic Flow into CO2 sensor area

Traffic Flow data

- Traffic Flow is one the main source of CO2 **(ton of CO2 x Km x Vehicle)**
  - **K1: Fluid Flow**
  - **K2: Stop and Go**
- **Dense estimation of CO2 into the city** is very useful to know to target EC's KPIs

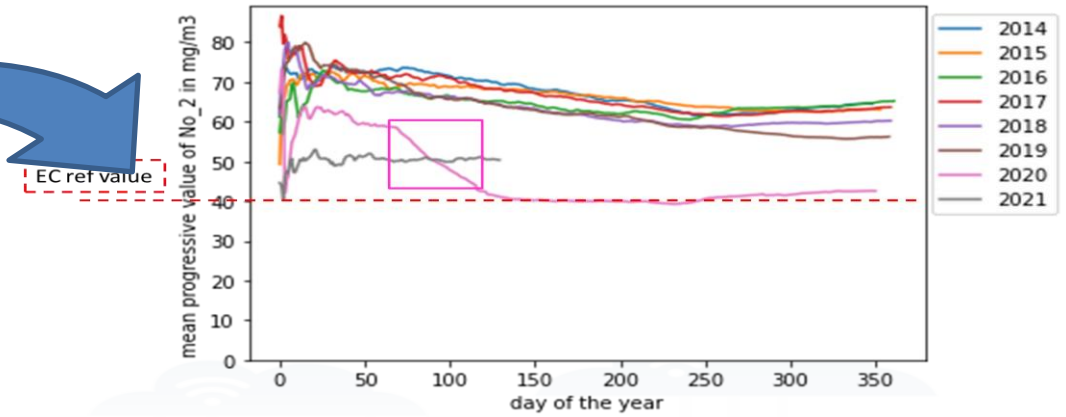
Computing CO2 on the basis of traffic flow data

CO2 estimation

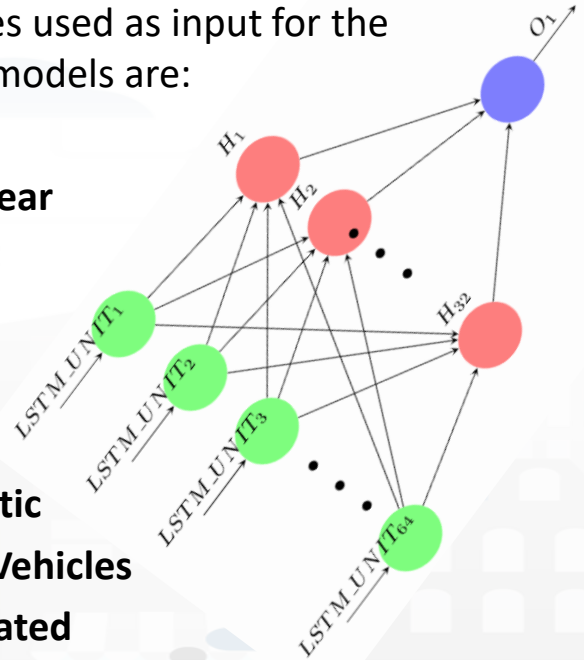
S. Bilotta, P. Nesi, "Estimating CO2 Emissions from IoT Traffic Flow Sensors and Reconstruction", Sensors, MDPI, 2022. https://www.mdpi.com/1424-8220/22/9/3382/

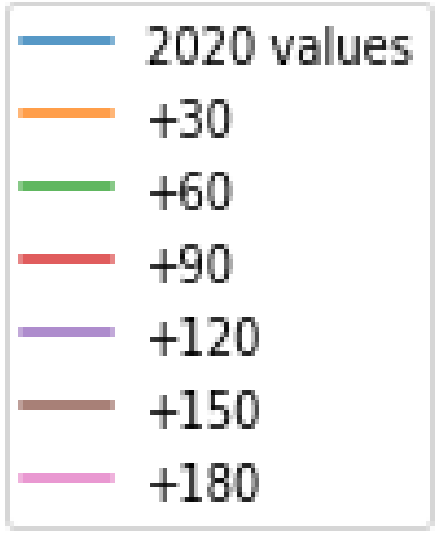
Predicting EC's KPI on NO2 months in advance

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



- The features used as input for the predictive models are:
- **Month**
- **dayOfTheYear**
- **NO2**
- **Tmean**
- **Humidity**
- **windMean**
- **NoxDomestic**
- **numberOfVehicles**
- **NO2cumulated**
- **NO2progresseveMean**
- **numberOfVehiclesCumulated**





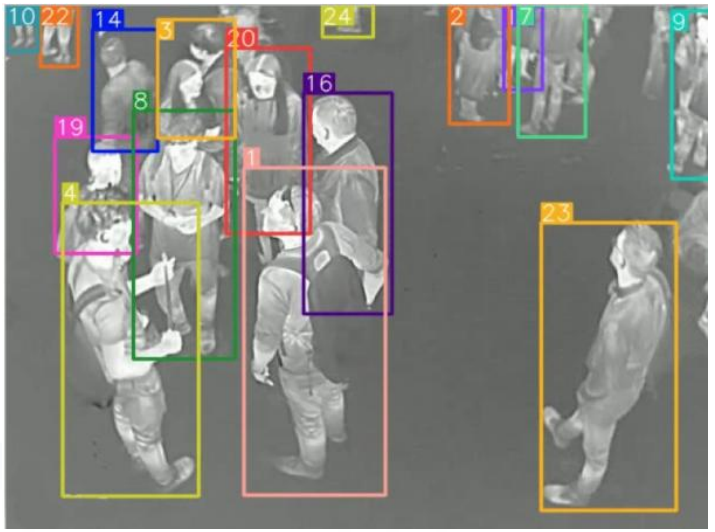
		Air Quality Directive		WHO guidelines	
Pollutant	Averaging period	Objective and legal nature and concentration	Comments	Concentration	Comments
$PM_{2.5}$	One day			25 µg/m³ (*)	99th percentile (3 days/year)
$PM_{2.5}$	Calendar year	Target value, 25 µg/m³	The target value has become a limit value since 1 January 2015	10 µg/m³	
PM_{10}	One day	Limit value, 50 µg/m³	Not to be exceeded on more than 35 days per year.	50 µg/m³ (*)	99th percentile (3 days/year)
PM_{10}	Calendar year	Limit value, 40 µg/m³ (*)		20 µg/m³	
O_3	Maximum daily 8-hour mean	Target value, 120 µg/m³	Not to be exceeded on more than 25 days per year, averaged over three years	100 µg/m³	
NO_2	One hour	Limit value, 200 µg/m³ (*)	Not to be exceeded more than 18 times a calendar year	200 µg/m³ (*)	
NO_2	Calendar year	Limit value, 40 µg/m³		40 µg/m³	

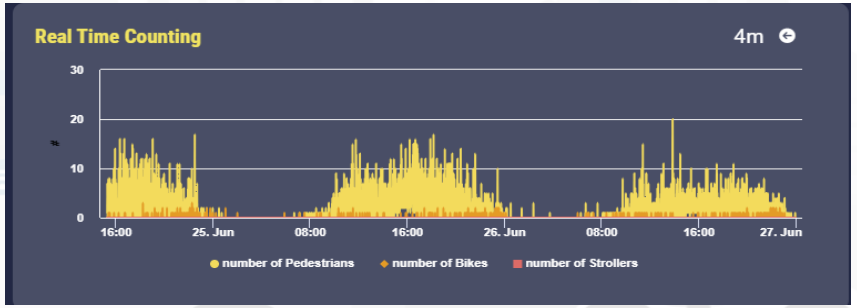
City Users' Services and Tourism Management

Goals

City User Behaviour/services, Tourism and Safety

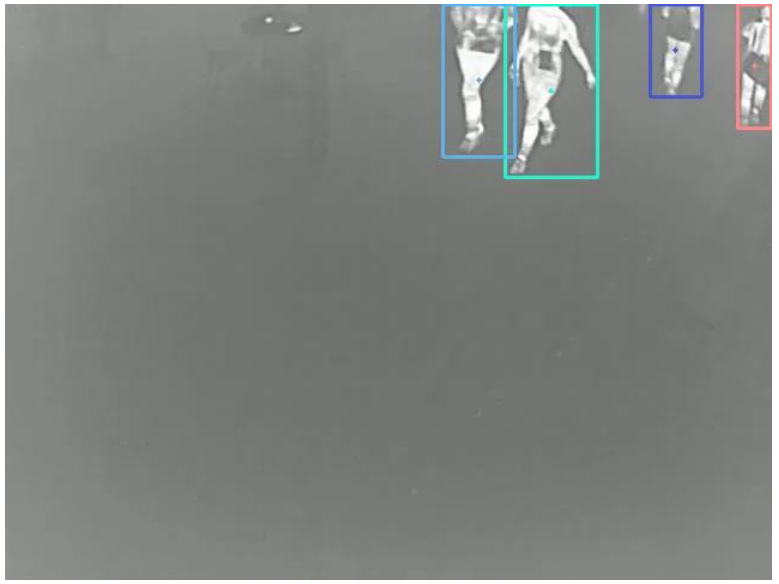
- **Goals:**
  - Improve Quality of Life and quality of services,
  - Over tourism mitigation, sustainability
  - Costs reduction of services
  - Improve accessibility to services: citizens, Tourists, commuters, etc.
  - Improve Security/Safety of city users
- **People Flow Analysis / Management:** in/out-door, retail, attractions
  - Counting, tracking, Flows, ODM, sentiment, recency/frequency, etc.,
  - multiple sources: thermal & TV cameras, radar sensors, PAX sniffers, mobile data, …
  - Data and/or **OD matrices** from: Wi-Fi, traffic data, mobile phone data
  - **Suggestions**: info Tourism, digital signages, engagement, ..
- **Tourists Flows & Retail Management**: predictions of presences, services' reputations, suggestions on second offer, over-tourism, notifications, early warning,
- **KPI**: 15 MinCityIndex, energy vs people, over-tourism, accepted suggestions, precision
- **Mobile App**: final users services/informing and operators
  - Info Tourism, people flows, info mobility, sharing, …
  - Participation, engagement, ..
- **Participatory**: problem reporting, ticketing, etc.
- **Integration of any kind: env/weather, mobility, ticketing, presences, POI, ..**

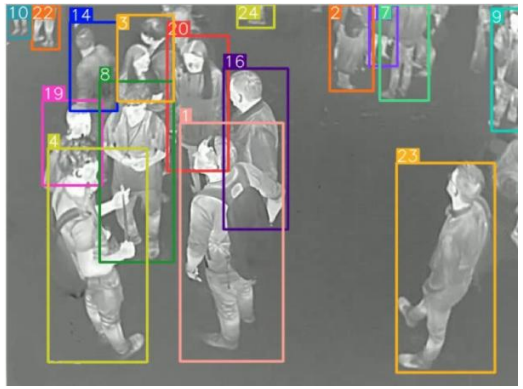


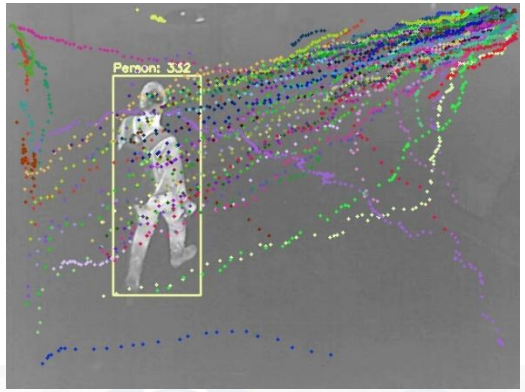


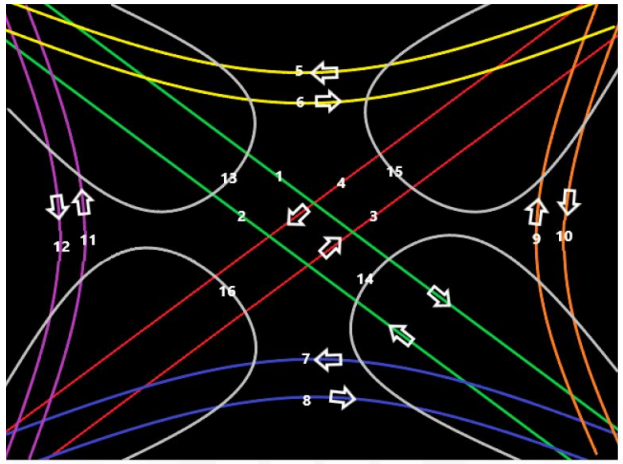
User Behaviour: People Counting, Tracking, etc.

- **Behavior analysis in open or closed spaces**
  - HUB, metro, stations, production lines, parking lots, critical areas in cities,
  - shopping centers, retail, etc.
- **Thermal Cameras**
  - GDPR compliant
- **AI injection**
  - classification and counting
  - Identification of critical situations
  - Early warning
  - Integration with PAX counters, and with ODM data from operators
- **Real-time estimation**
  - Directly on the camera
  - High precision and reliability
  - Used by: Cuneo, Florence, Genoa, etc









Mobility and Transport goals

Decongestion

Safety

Accessibility

Cost Reduction

Decarbonization

THE POWER OF ARTIFICIAL INTELLIGENCE AT THE SERVICE OF YOUR OPERATION AND PLAN

www.snap4city.org

SNAP4CITY

KM4CITY

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100% OPEN SOURCE

Powered by FIWARE

FREE TRIAL

PEN Test Passed

EU GDPR COMPLIANT

SNAP4 Appliances and Dockers Installations

EUROPEAN OPEN SCIENCE CLOUD

Node-RED

JS Foundation

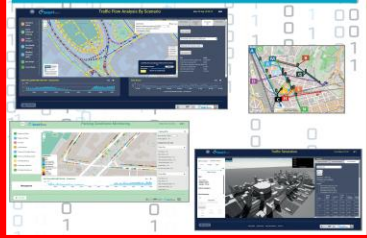
EØ15 digital ecosystem

NVIDIA

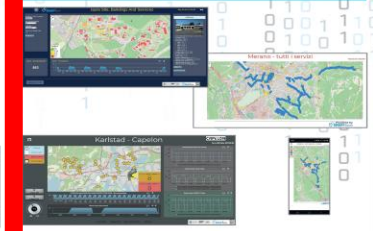
OPERATION AND PLAN - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - OPTIMIZATION - APPLICATIONS

HORIZONTAL AI PLATFORM

MOBILITY AND TRANSPORT



SMART ENERGY AND SMART BUILDING



ENVIRONMENT AND WASTE MANAGEMENT

CITY USER'S SERVICES AND TOURISM MANAGEMENT

- DEVELOMENT ENVIRONMENT AND METHODOLOGY
- VISUAL PROGRAMMING, ML, AI, HPC
- TRAINING COURSES
- LLM ADVISOR

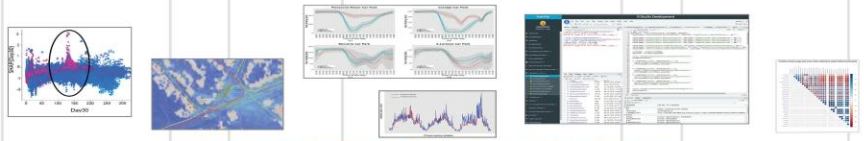
BUSINESS INTELLIGENCE - SIMULATIONS - VISUAL ANALYTICS - SYNOPTICS - GRAPHICAL WIDGETS - ANALYTICS

DASHBOARDS, WIDGETS TEMPLATES

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

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

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



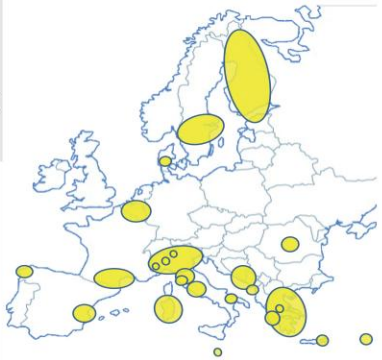
BIG DATA ANALYTICS, ARTIFICIAL INTELLIGENCE
EXPLAINABLE AI, MACHINE LEARNING, GENERATIVE AI
OPERATIVE RESEARCH, STATISTICS

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

FULL INTEROPERABILITY, ANY: DATA, BROKERS, NETWORKS AND VERTICALS

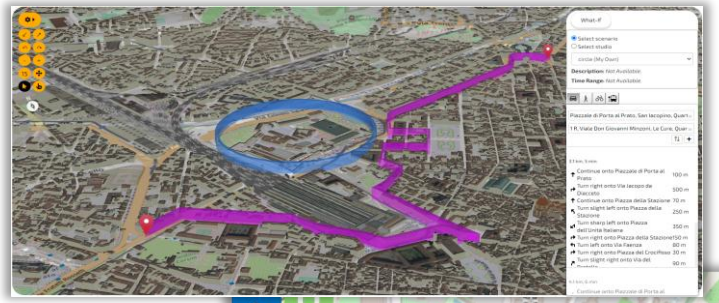
NATIVE AND EXTERNAL APPLICATIONS

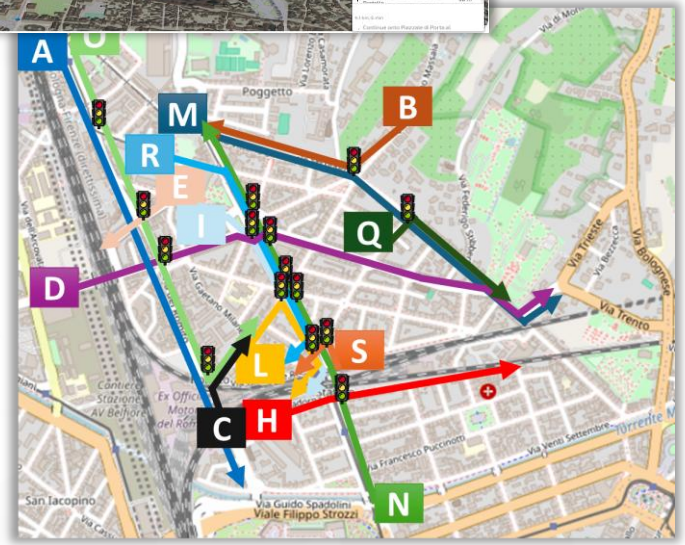
- Smart Parking
- Smart Light
- Smart Waste
- Smart Energy
- Smart Building
- Smart Tourism
- ...



Mobility & Transport

- **Goals:**
  - Decongestion, Decarbonization, costs reductions
  - Improve Accessibility to services
  - Improve Security/Safety of city users
- **Operation and Plan**:
  - Traffic monitoring, prediction, reconstruction, identification of critical conditions (early warning), fleet management, dynamic routing, multimodal routing, city user behaviour analysis
- **Optimization and what-if analysis traffic light, infrastructure**
  - **Reduction**: travel time, waiting time, stops, CO2 emissions, consume fuel, travel time for tramways
- **Public Transport**: analysis of Mobility Demand vs Offer of Transportation
- **Parking Management:** monitoring, prediction, any payments, on/off-road
- **Sharing / Pooling Management**: eShare and mobile app, bikesharing, smart bike, fleet management
- **KPI:** SUMI/SUMP, travel time, emissions, traffic status, accessibility, ..
- **Mobile App**: final users and operators
  - Info Mobility, traffic reconstruction, charging, participation,
  - Parking, payments, overparking, fine reporting, ..
- **Participatory**: problem reporting, ticketing, etc.
- **Data Integration of any kind: env, weather. Tickets, presences, POI, sat, etc.**





OPTIFaaS

AI-Powered Digital Twin Platform for Mobility & Transport Operation and Plan

Urban Challenges & OPTIFaaS Objectives

From data to action : Tailored Mobility Services

The Core

Snap4City / OPTIFaaS delivers mobility solutions for operational management and strategic-tactical planning through an integrated Digital Twin and various AI models, enabling what-if analysis, simulation, and optimization

Objectives

Decongestion

Safety

Accessibility

Cost Reduction

Decarbonization

OPTIFaaS ⟩ Scalable, flexible, customized mobility solutions

Supports various urban contexts from small communities to large metropolises

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SNAP4CITY
www.snap4city.org

OPTIFaaS

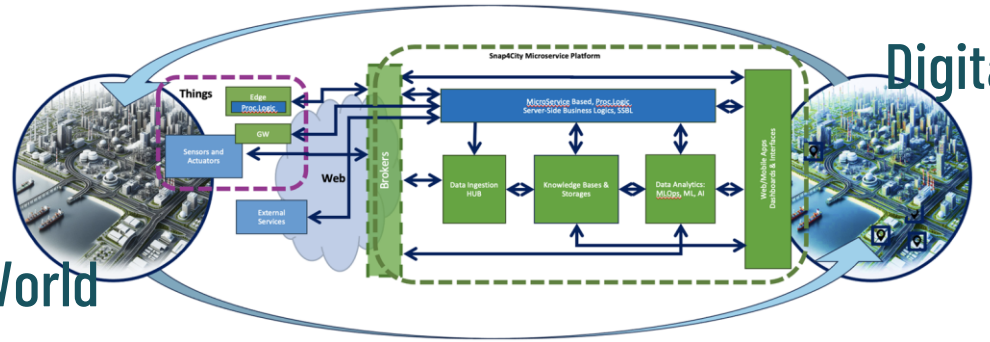
MOST
CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE

AI-Powered Digital Twin Platform for Mobility & Transport Operation and Plan

Smart & Sustainable Mobility with Snap4City / OPTIFaaS

Empowering Cities with AI based Digital Twin

Integrated Digital Twin + Artificial Intelligence platform for real-time urban mobility monitoring and optimization



AI Technologies

- Deep Learning
- Reinforcement Learning
- Generative AI
- GNN-DRL and similar

Designed for Tactic and Strategic Planning

- What-if scenarios
- Simulations
- Optimizations

Supports Operational Management

- Traffic monitoring, forecasting, and reconstruction
- Infrastructure evaluation
- Traffic light plan generation
- Early warning systems
- Dynamic/multimodal routing
- Analysis of city users' behavior

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LUTECH BRAIN MOBILITY 4 FUTURE

Operation

OPTIFaaS

indietro log-out

- Home
- Traffic Monitoring
- Smart Parking
- 15 minuti index
- Urban Security

Road Monitoring

Media congestioni	Nr. congestioni	Picco congestioni	Riduzione Co2 ZTL	Emissioni medie CO2	Emissioni totali CO2
28.4 %	17 -	18:27 -	-5.2 %	282 ppm	846 ppm

Traffico in ingresso

Tot. veicoli in ingresso: 12105 Veicoli

Velocità media: 27 km/h

Traffico in uscita

Tot. veicoli in uscita: 11703 Veicoli

Veicoli totali: 7825 -

Pannello Rischi Meteo

MINIMO | BASSO | MEDIO | ALTO

Rischio Idraulico	MINIMO	Rischio Idrogeologico	MINIMO
Rischio Temporali	MINIMO	Rischio Neve	MINIMO
Rischio Ghiaccio	MINIMO	Rischio Vento	MINIMO

Viabilità

INCIDENTI	3
Chiusura Traffico	2
Chiusura Lavori	0
Limitazioni Traffico	4
Limitazioni Lavori	0
SEGNALAZIONI	7

Trasporto Pubblico

Tempo medio di attesa: 5.9 sec

Ritardo autobus: 0 %

Attesa Media Fermate

Linea 50	12 sec
Linea 11	10 sec
Linea 33	6 sec
Linea 02/	5 sec
Linea E	5 sec
Linea 19	4 sec

Sensori

15 Semafori	3
22 Videocamere	0
4 Sensori	1

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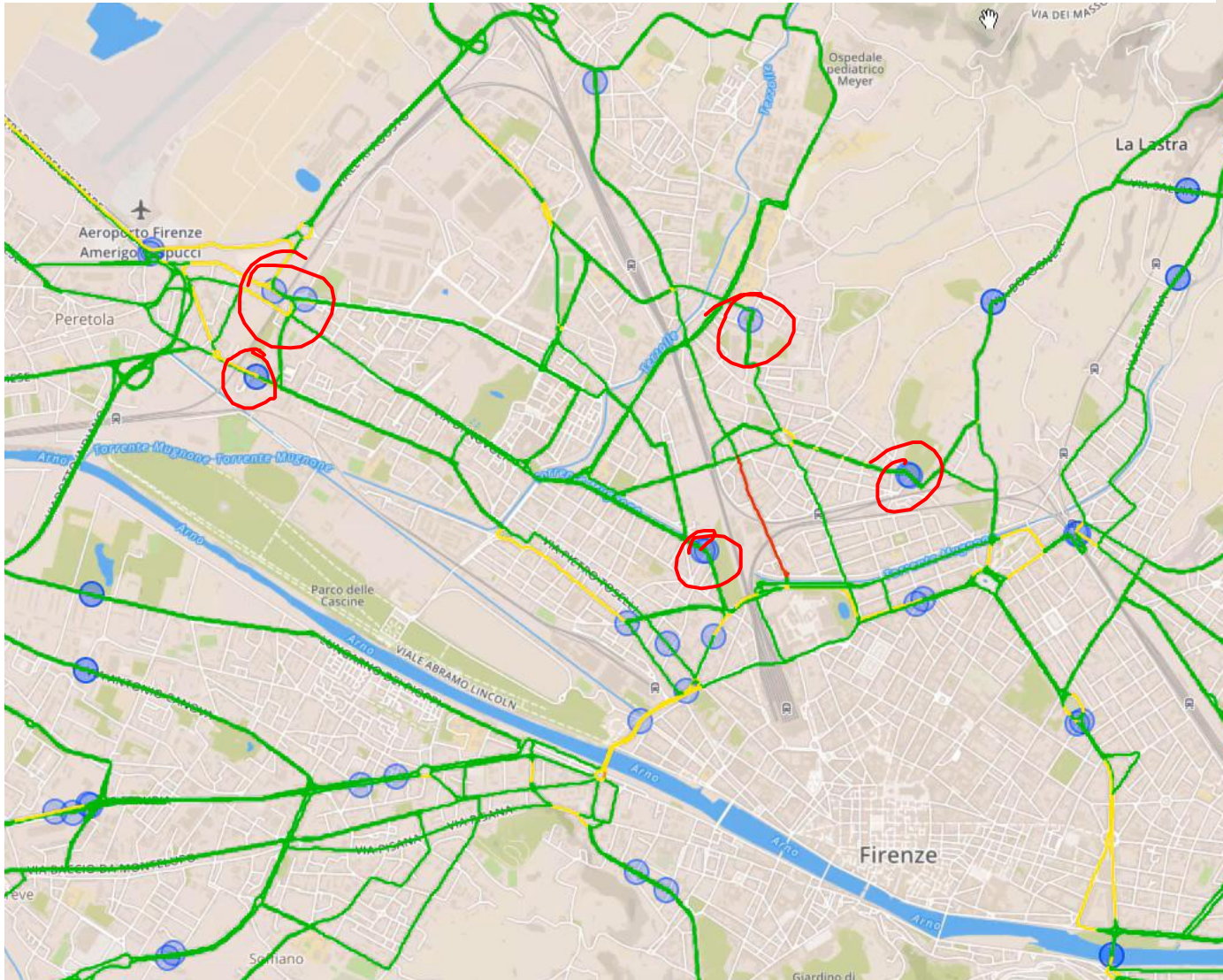
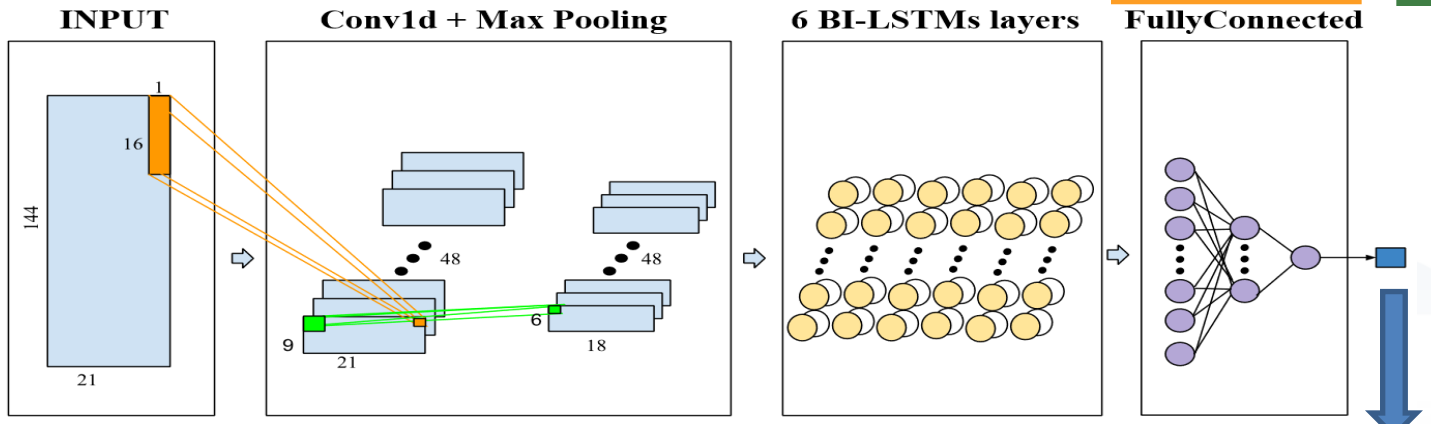
Powered by SNAP4Tech

Dense Traffic Flow Reconstruction ?

- Making decision on mobility and transport solutions → what if analysis
- Controlling pollution
- Dynamic Routing for Firebrigade, Ambulances, general public
- Planning Public Transportation routing



Short-Term Prediction of City Traffic Flow via Convolutional Deep Learning

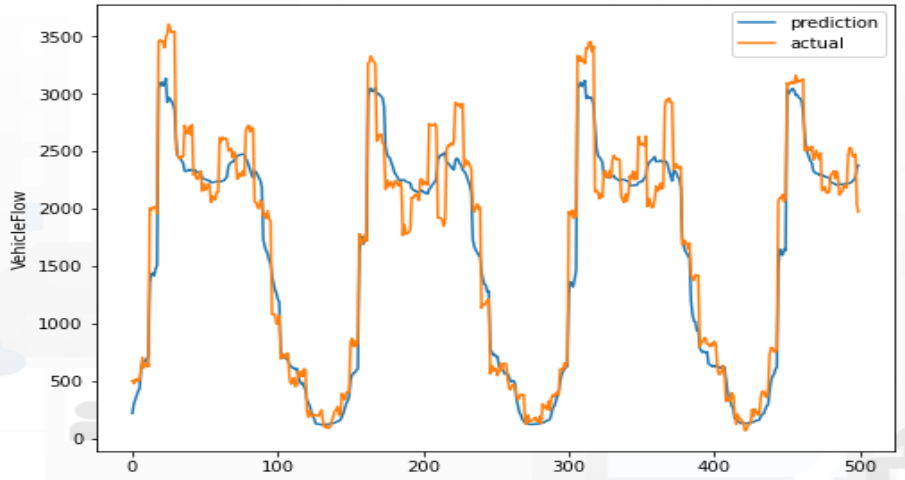


Urban data:

- Date-time
- Traffic
- Temporal
- Seasonality
- Pollution
- Weather

RF
XGBOOST
DNN
LSTM
BI-LSTM
Autoencoder BI-LSTM
Attention CONV-LSTM
CONV-BI-LSTM

CONV-BI-LSTM



OPTIFaaS

AI-Powered Digital Twin Platform for Mobility & Transport Operation and Plan

Platform Value & Business Model

Scalable Solutions for Smart City Growth

Snap4City

Is an **open platform** designed to support cities and organizations in enhancing urban mobility through the integration of **heterogeneous data sources** and **AI**

OPTIFaaS

Adopts a **service-based business model tailored to the needs of small and medium-sized cities and mobility operators**. It emphasizes cost-effectiveness, offering flexible and scalable solutions for urban mobility and sustainability

Open

open source, interoperable, modular, microservices

Optimizing Transportation Systems

improving efficiency, sustainability, quality of life

Scalable

with city size and complexity

Business Intelligence Tools

available for decision makers, operators, control rooms

AI-powered platform

data-driven platform for mobility innovation

Minimal Set up Costs

maximum flexibility, visual programming, no-code platform

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LUTECH BRAIN
MOBILITY 4 FUTURE

indietro log-out

- Home
- Traffic Monitoring
- Smart Parking
- 15 minuti index
- Urban Security

Road Monitoring

Media congestioni	Nr. congestioni	Picco congestioni	Riduzione Co2 ZTL	Emissioni medie CO2	Emissioni totali CO2
28.4 %	17 -	18:27 -	-5.2 %	282 ppm	846 ppm

Traffico in ingresso

Tot. veicoli in ingresso: 7152 Veicoli

Velocità media: 27 km/h

Traffico in uscita

Tot. veicoli in uscita: 6988 Veicoli

Veicoli totali: 7825 -

Pannello Rischi Meteo

MINIMO | BASSO | MEDIO | ALTO

Rischio Idraulico	MINIMO	Rischio Idrogeologico	MINIMO
Rischio Temporali	MINIMO	Rischio Neve	MINIMO
Rischio Ghiaccio	MINIMO	Rischio Vento	MINIMO

Viabilità

INCIDENTI	3
Chiusura Traffico	2
Chiusura Lavori	1
Limitazioni Traffico	7
Limitazioni Lavori	0
SEGNALAZIONI	9

Trasporto Pubblico

Tempo medio di attesa
11.6 min

Ritardo autobus
11.1 %

Attesa Media Fermate

Linea 22	21.1 min
Linea 02/	10 min
Linea 09	10 min
Linea 27	8.3 min
Linea 06	8.3 min
Linea 01	7.2 min

Sensori

15 Semafori	3
22 Videocamere	0
4 Sensori	1

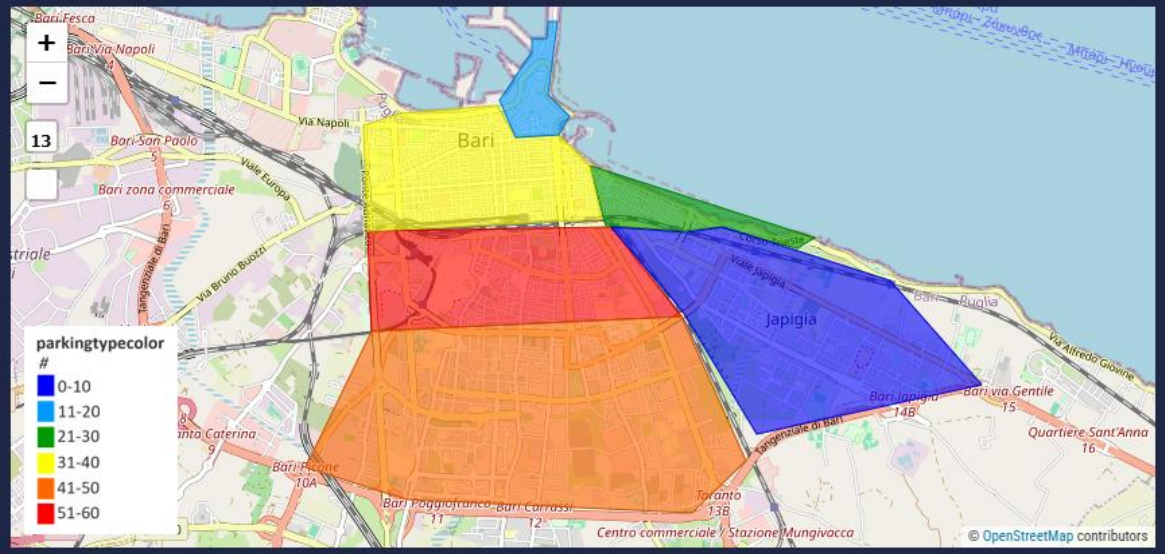
LUTECH BRAIN MOBILITY 4 FUTURE

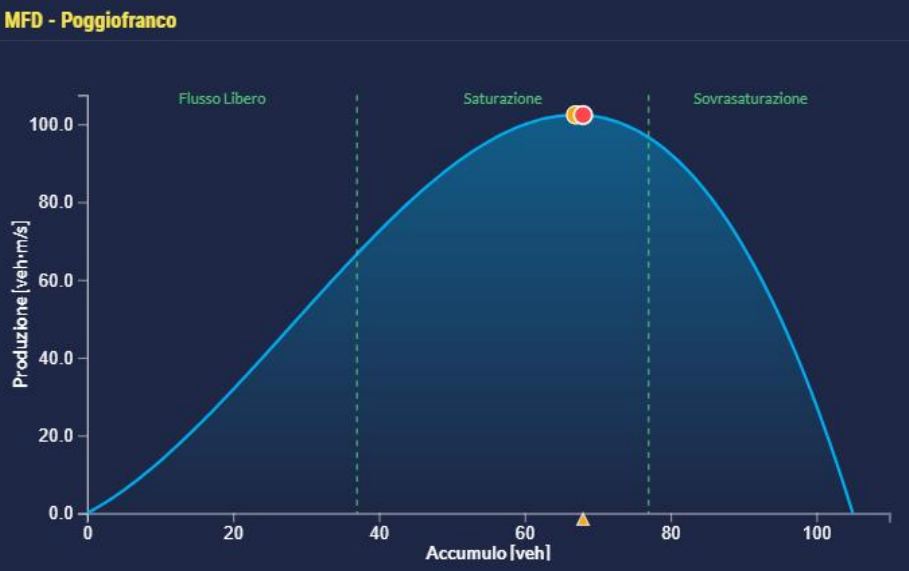
Traffic Analysis

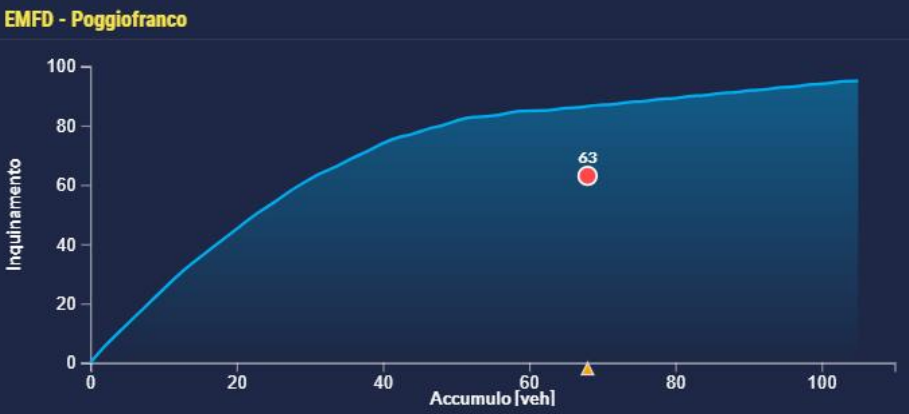
OPTIFaaS

indietro log-out

- Home
- Traffic Monitoring
- Smart Parking
- 15 minuti index
- Urban Security







OPTIFaaS

AI-Powered Digital Twin Platform for Mobility & Transport Operation and Plan

Sustainability & Social Benefits

Driving the Future: Smarter. Greener. Together.

> Snap4City / OPTIFaaS promotes efficient and safe urban mobility, contributing to an improved quality of life and the sustainable growth of the community

Social Impact

Reduced travel times and emissions

Accessibility and inclusivity

Road safety

Sustainability Features

Traffic optimization

Multimodal transport integration

Data-driven simulation and what-if analysis

Fuel consumption reduction

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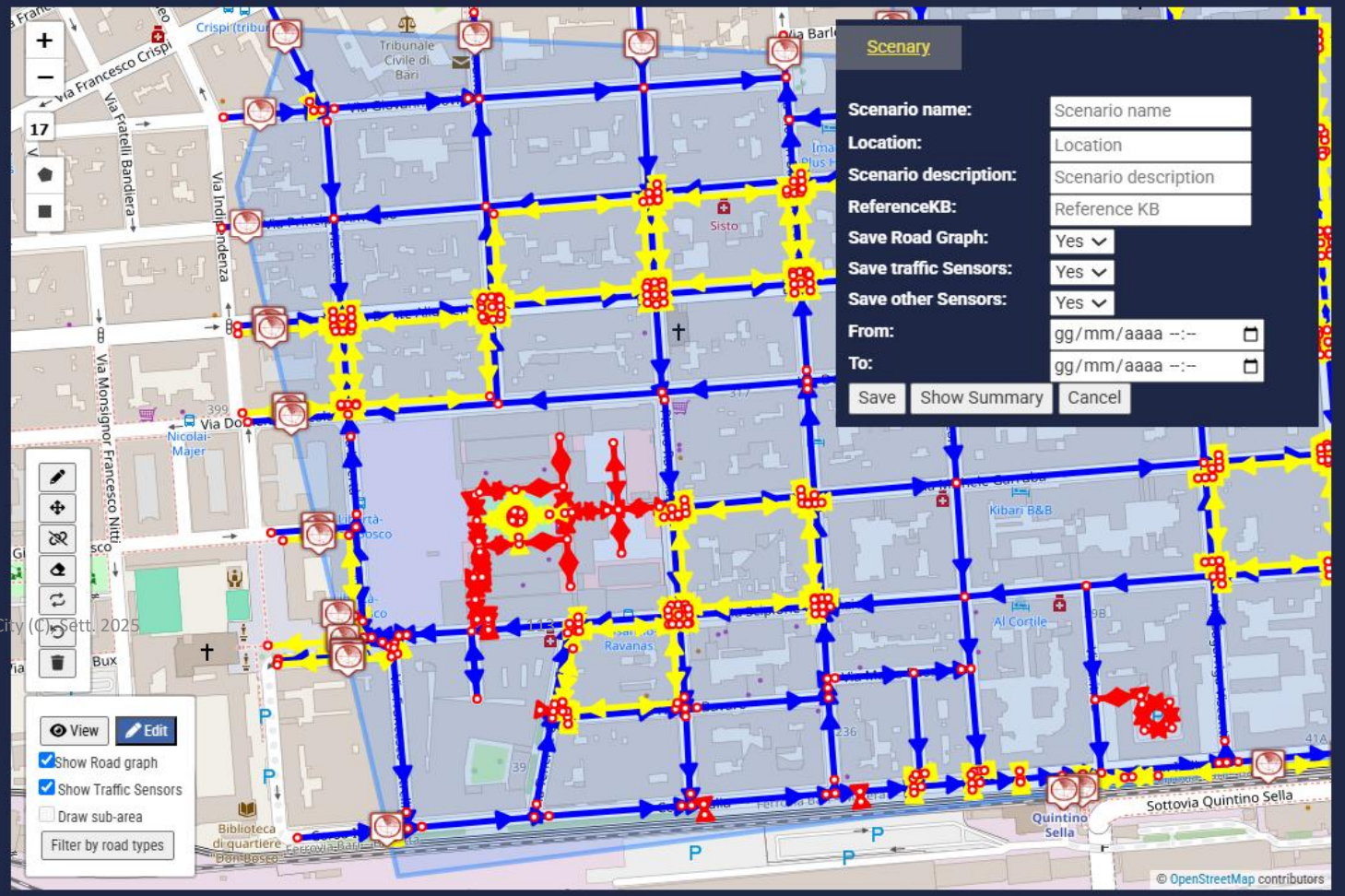
LUTECH BRAIN MOBILITY 4 FUTURE

Analysis and Simulation

indietro log-out

- Home
- Traffic Monitoring
- Smart Parking
- 15 minuti index
- Urban Security

Scenario



INIT to ACC | Compute TFRS | Compute KPI | Show TFR

Data Update

HeatmapScenarioTest

2025-04-01 11:29:35

Execution

OPTIFaaS

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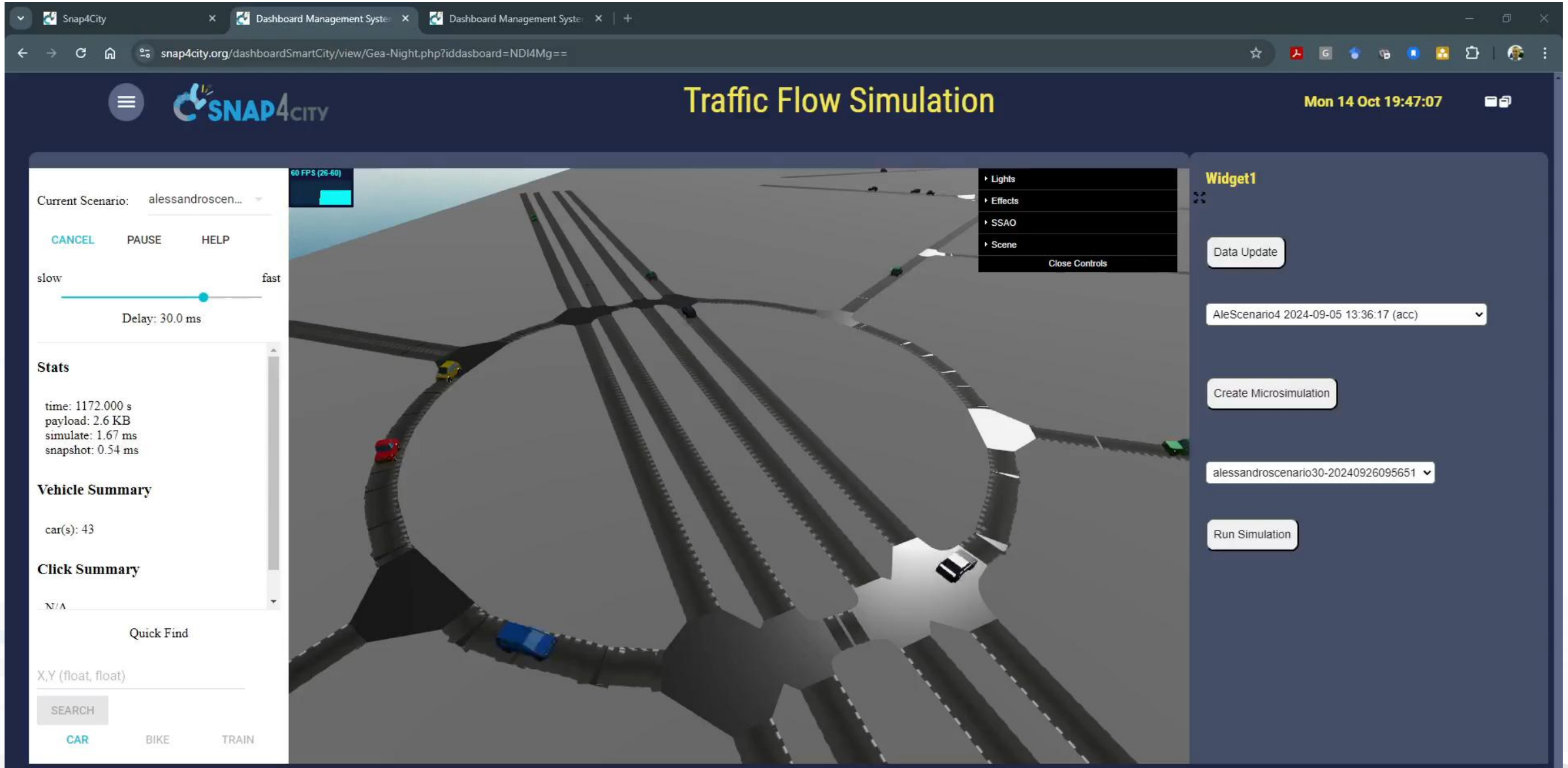
Snap4City
Dashboard Management Syste
Dashboard Management Syste
snap4city.org/dashboardSmartCity/view/Gea-Night.php?iddasboard=NDI4Mg==
SNAP4CITY
Traffic Flow Simulation
Mon 14 Oct 19:47:07
Current Scenario:
alessandroscen...
CANCEL
PAUSE
HELP
slow
fast
Delay: 30.0 ms
Stats
time: 1172.000 s
payload: 2.6 KB
simulate: 1.67 ms
snapshot: 0.54 ms
Vehicle Summary
car(s): 43
Click Summary
N/A
Quick Find
X,Y (float, float)
SEARCH
CAR
BIKE
TRAIN
60 FPS (26-60)
Lights
Effects
SSAO
Scene
Close Controls
Widget1
Data Update
AleScenario4 2024-09-05 13:36:17 (acc)
Create Microsimulation
alessandroscenario30-20240926095651
Run Simulation

Agenda

PTIFaaS
IL FUTURO DELLA MOBILITA' INTELLIGENTE E SOSTENIBILE

Registrazione	10:00 - 10:30	Registrazione e Welcome Coffee
Avvio Lavori	10:30 - 10:40	Saluti - ***Prof. Paolo Nesi***, *UNIFI DISIT Lab/Snap4City* - ***Franco Prampolini***, Head of R&D and Innovative Industry Solutions Lutech Group
CN MOST SPOKE 8	10:40 - 11:00	Mobility-as-a-Service: tra integrazione e sostenibilità - ***Prof. Mario Marinelli***, *Politecnico di Bari*
Overview OPTIFaaS	11:00 - 11:20	Presentazione generale e obiettivi di **OPTIFaaS** - ***Mauro Starinieri***, Head of Smart City & Mobility Solutions CoE Lutech Group
Strumenti OPTIFaaS	11:20 - 11:50	Presentazione dell'infrastruttura - ***Prof. Paolo Nesi***, *UNIFI DISIT Lab/Snap4City*
Scenario OPTIFaaS	11:50 - 12:10	Ottimizzazione del Traffico - ***Prof. Luigi Pariota***, *Università degli Studi di Napoli*
Scenario OPTIFaaS	12:10 - 12:40	Ottimizzazione Semaforica e di Infrastruttura. Ottimizzazione del Trasporto Collettivo - ***Prof. Paolo Nesi***, *UNIFI DISIT Lab/Snap4City*
Q&A	12:40 - 13:00	Sessione aperta
Light Lunch (offered)	13:00 - 14:00	
Incontri 1:1	14:00 -	Incontri 1:1 con i referenti di Snap4City/**OPTIFaaS** (in presenza)

OPTIFaaS

IL FUTURO DELLA MOBILITA'
INTELLIGENTE E SOSTENIBILE

Digital Twin & Intelligenza Artificiale.
Innovazione tecnologica "As a Service "
per la gestione operativa
e la pianificazione tattico-strategica
della mobilità urbana sostenibile e interconnessa

Firenze | Milano | Roma | Bari

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MOST CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE