

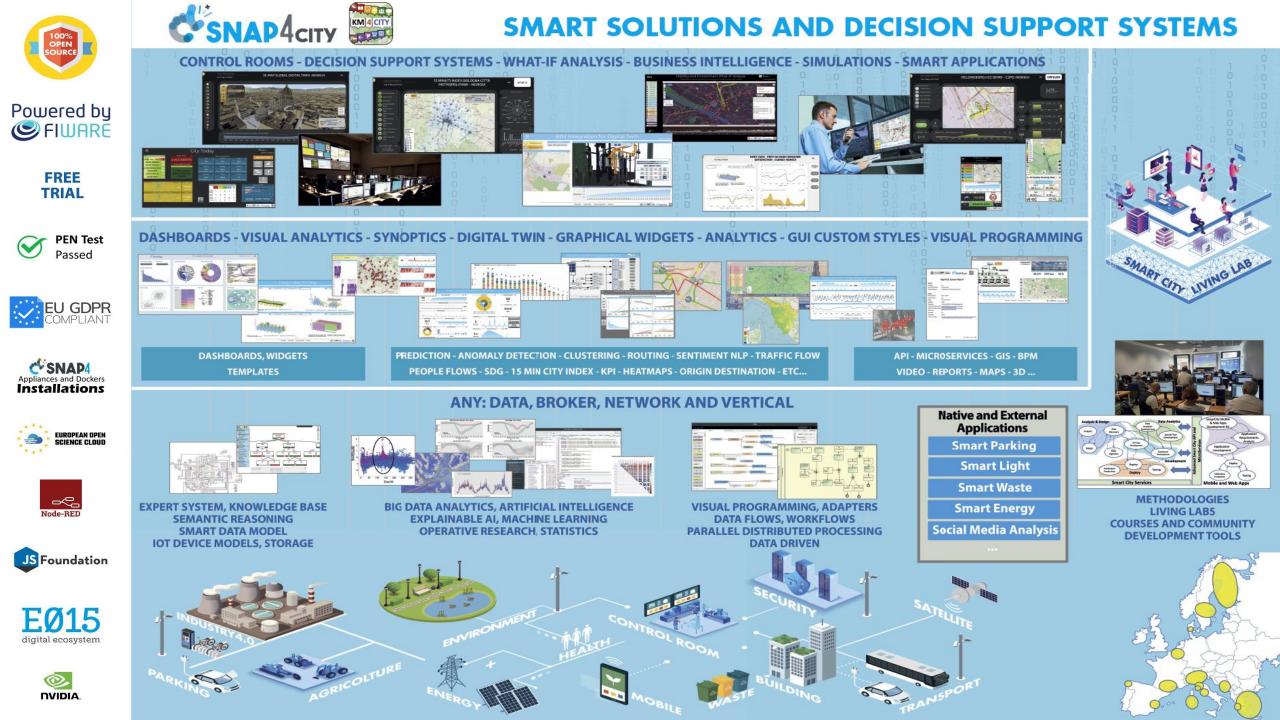


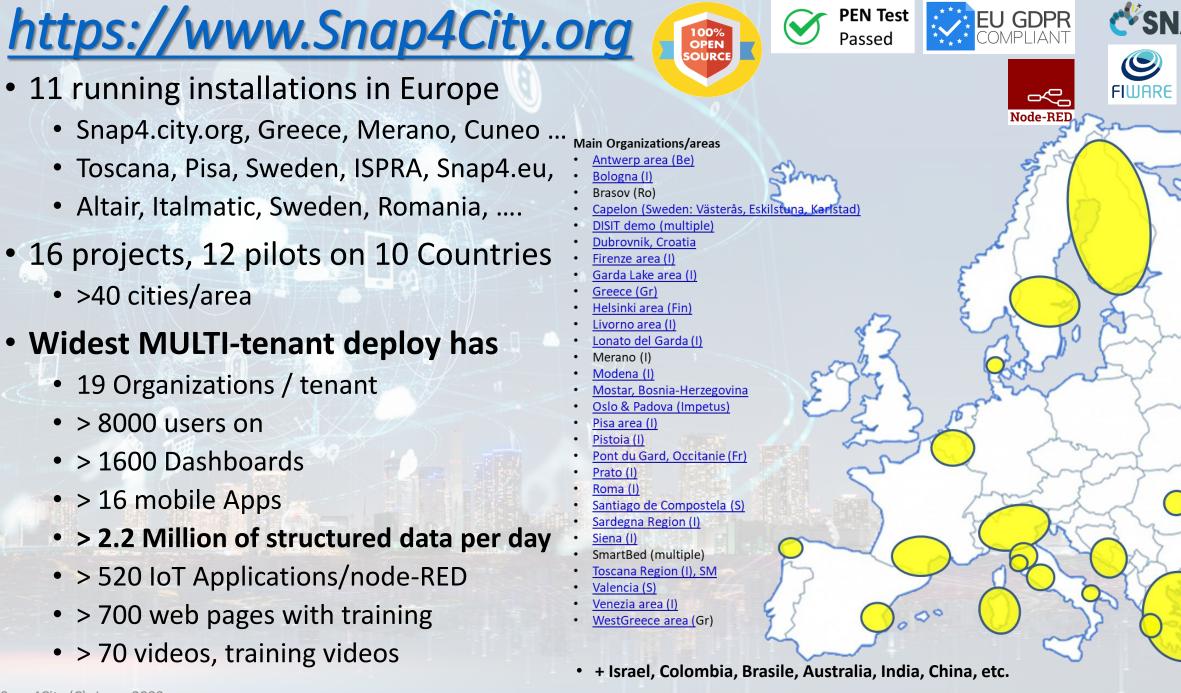




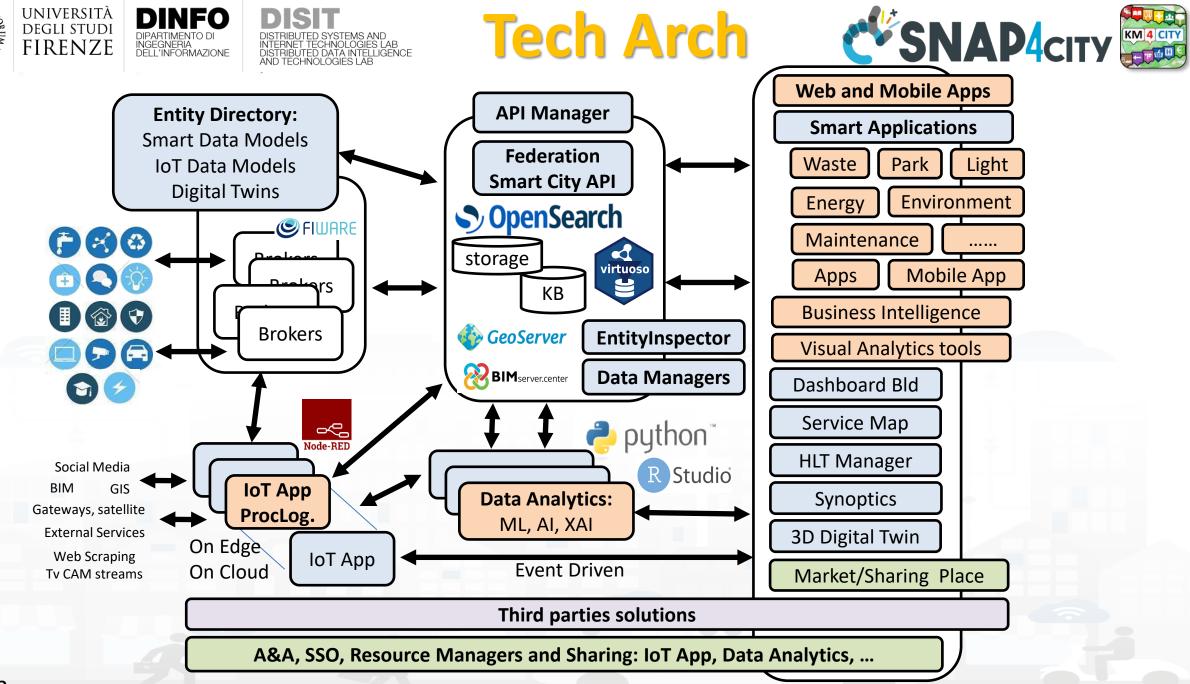
### Snap4City multi domain multitenant platform, from event driven to global and local 3D digital twins







Snap4City (C), June 2023





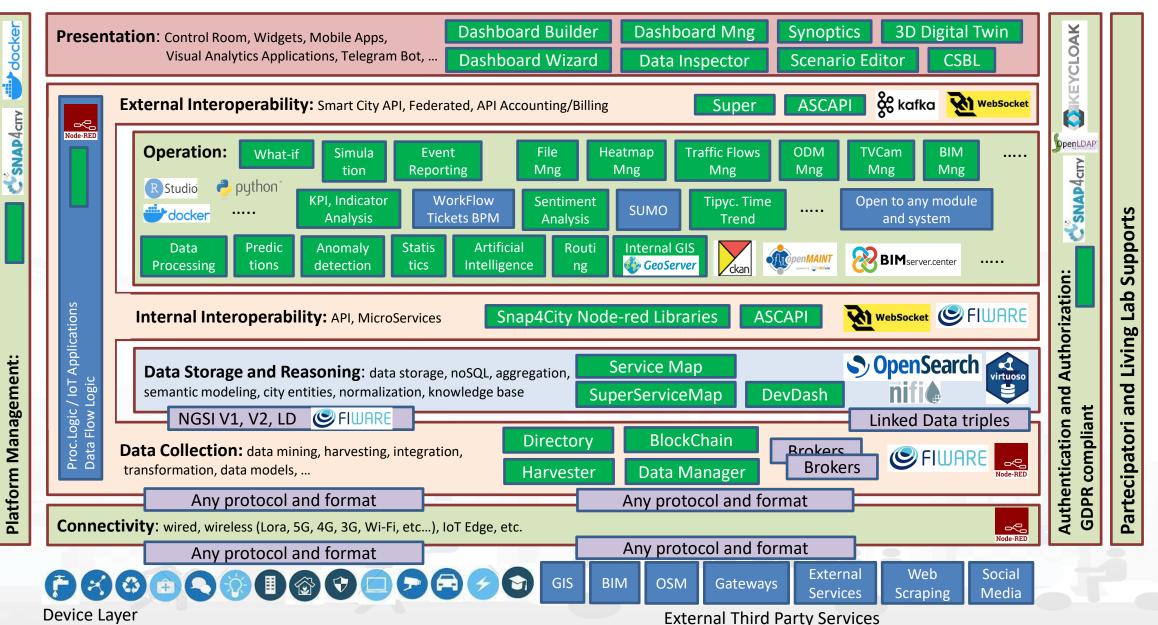












## Domains

- Smart City, control room
- Mobility and transport
- Environment, pollutant, waste, water, ..
- Green Deal, smart light, ..
- Energy , Industry
- Tourism and People
- Security & Safety
- Big Data

DEGLI STUDI

FIRENZE

Artificial Intelligence

DINFO

DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

Public and private data



## Standards and Interoperability (6/2023)

Snap4City (C), June 2023

**Compliant with:** 

- IoT: NGSI V2/LD, LoRa, LoRaWan, MQTT, AMQP, COAP, OneM2M, TheThingsNetwork, SigFOX, Libelium, IBIMET/IBE, Enocean, Zigbee, DALI, ISEMC, Alexa, Sonoff, HUE Philips, Tplink, BACnet, TALQ, Protocol Buffer, KNX, OBD2, Proximus, ..
- IoT model: FIWARE Smart Data Model, Snap4City IoT Device Models
- **General**: HTTP, HTTPS, TLS, Rest Call, SMTP, TCP, UDP, SOAP, WSDL, FTP, FTPS, WebSocket, WebSocket Secure, GML, WFS, WMS, RTSP, ONVIF, AXIS TVCam, CISCO Meraki, OSM, Copernicus, The Weather Channel, Open Weather, OLAP, VMS, ....
- 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.





https://www.snap4city.org/65

### **High Level Types**

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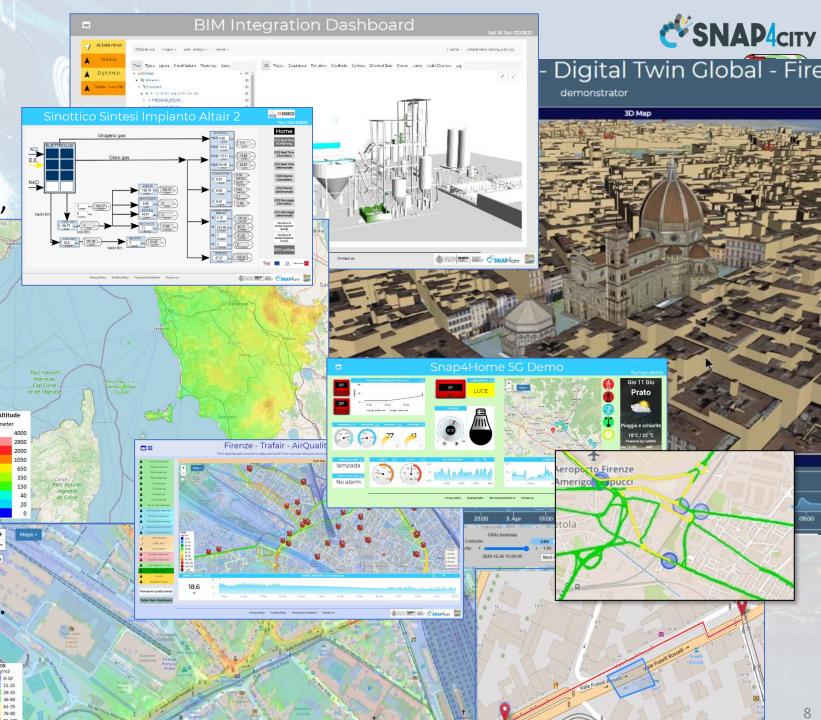
- POI, IOT Devices, shapes,..
  - FIWARE Smart Data Models,
  - IoT Device Models
- GIS, maps, orthomaps, WFS/WMS, GeoTiff, calibrated heatmaps, ...
- Satellite data, ..
- traffic flow, typical trends, ..
- trajectories, events, Workflow, ..
- 3D Models, BIM, Digital Twins, ..
- OD Matrices of several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

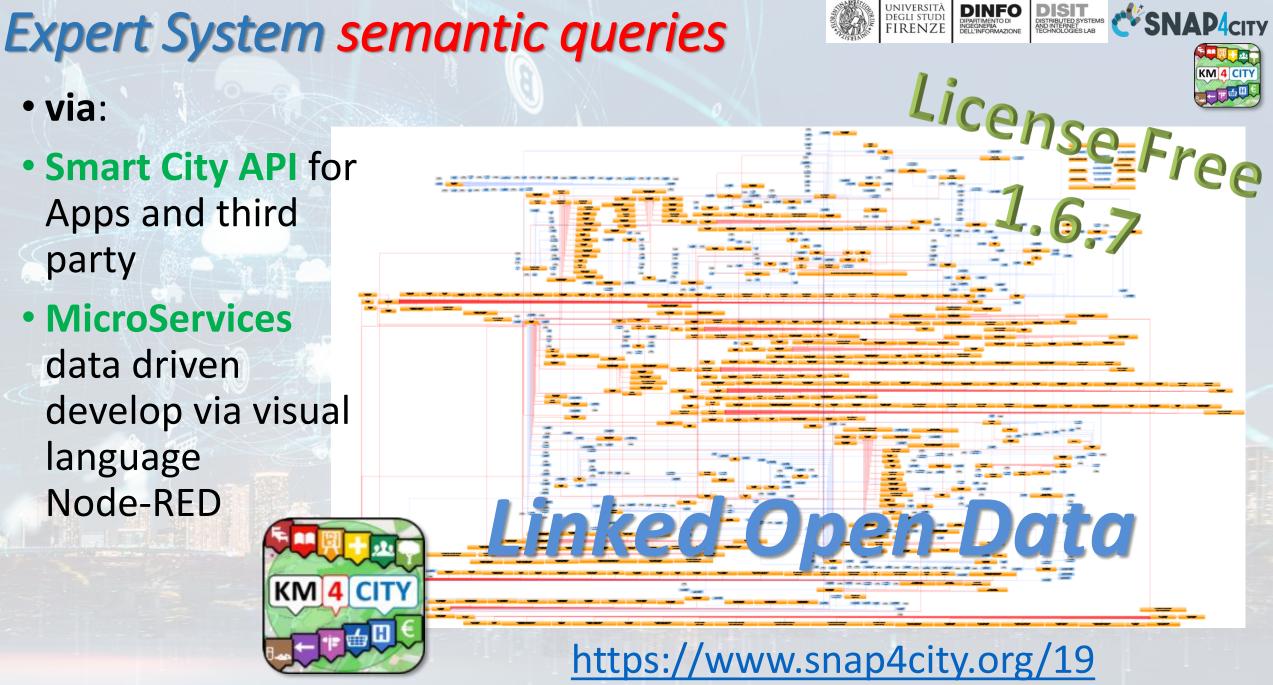
IRENZE

• decision scenarios, ....

etc.

10/22

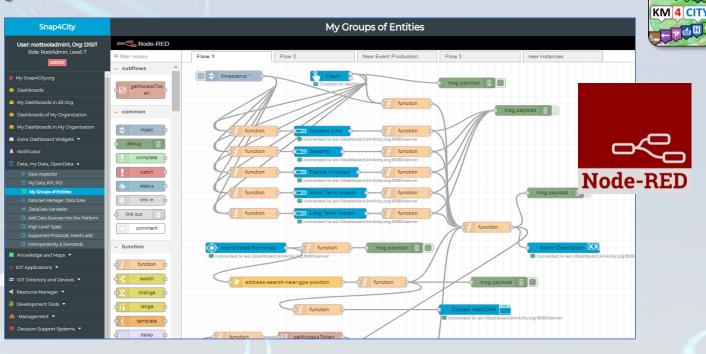




### Ingestion, aggreg. -> exploitation

### • IoT App Visual Programming, no coding

- Data transformation
- Integration, Interoperab.
- Scripting Data Analytics
- Data ingestion
- Business logic
- Edge and Cloud
- MicroServices data driven develop via visual language Node-RED



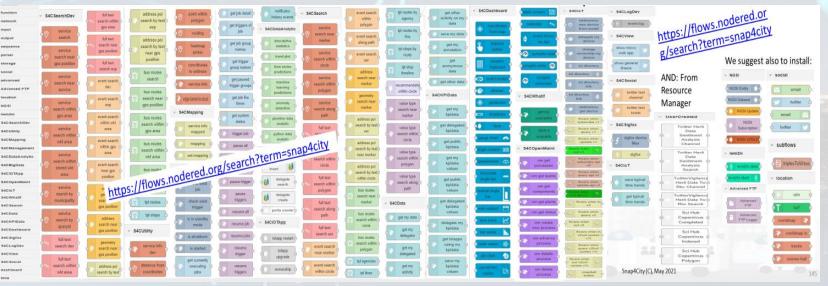
DEGLI STUDI

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DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

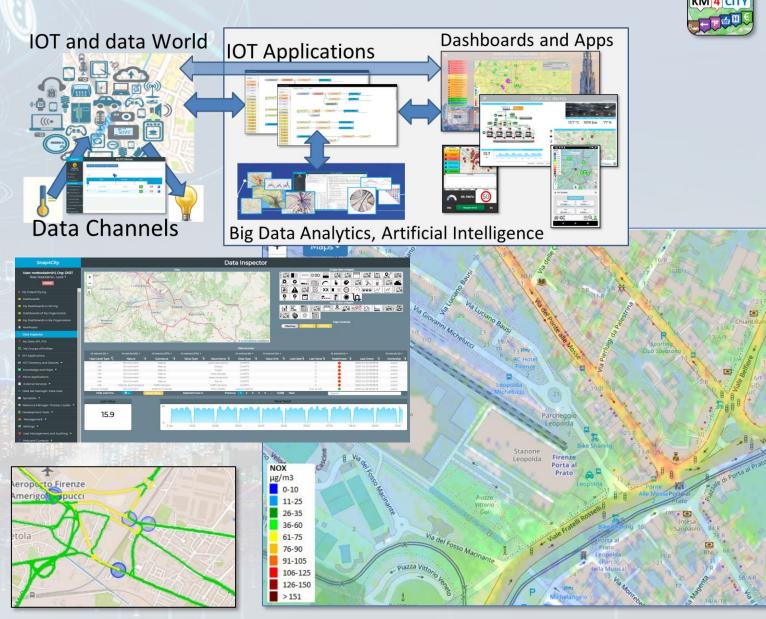
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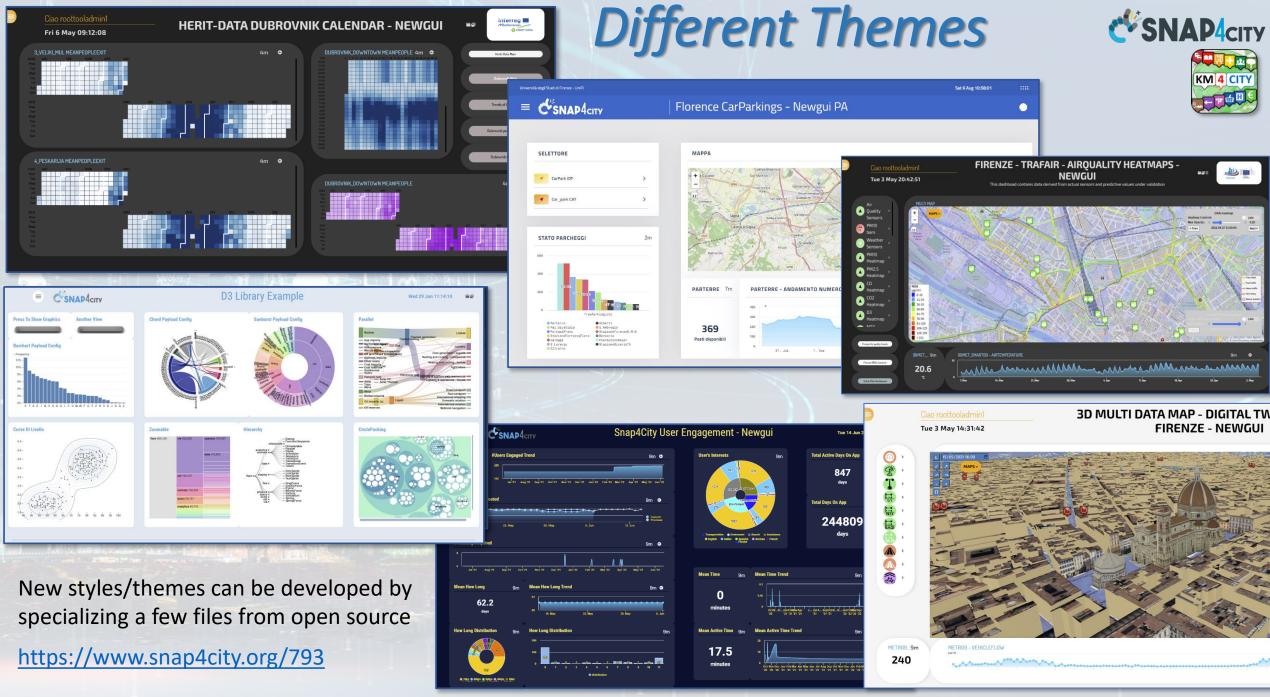
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### Solutions: reliable, secure and fast to realize

- 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

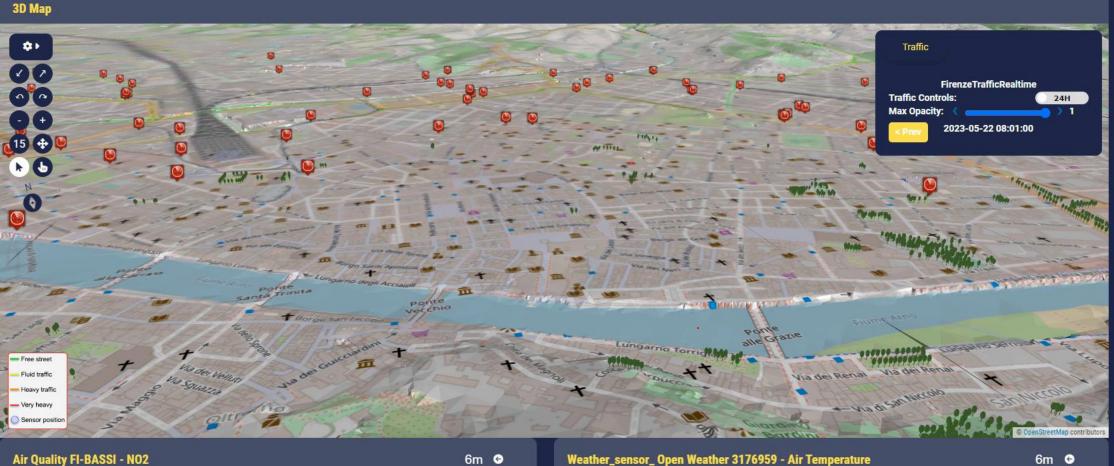








#### 3D Map Global Digital Twin -Newgui2







#### https://youtu.be/JLzT9k3Xbc0

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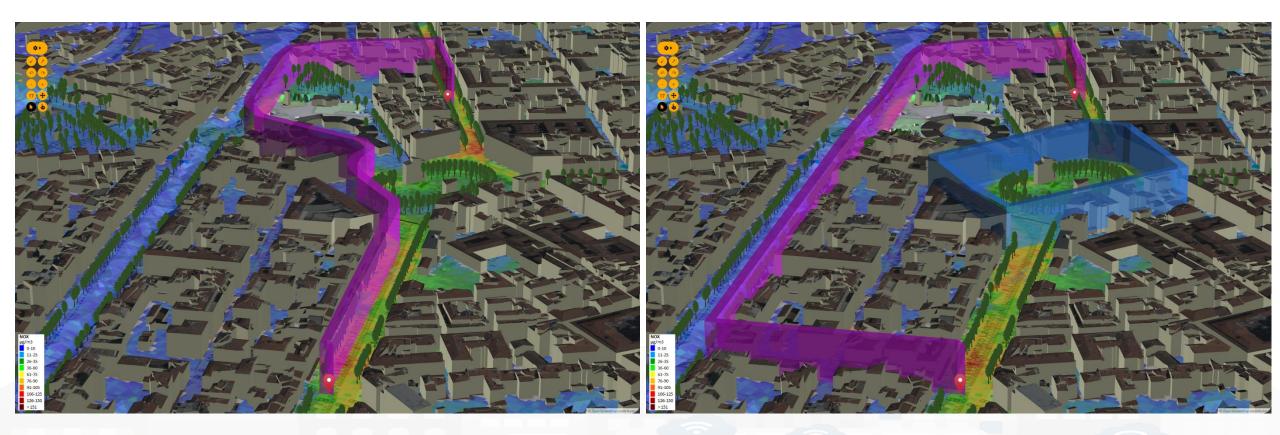




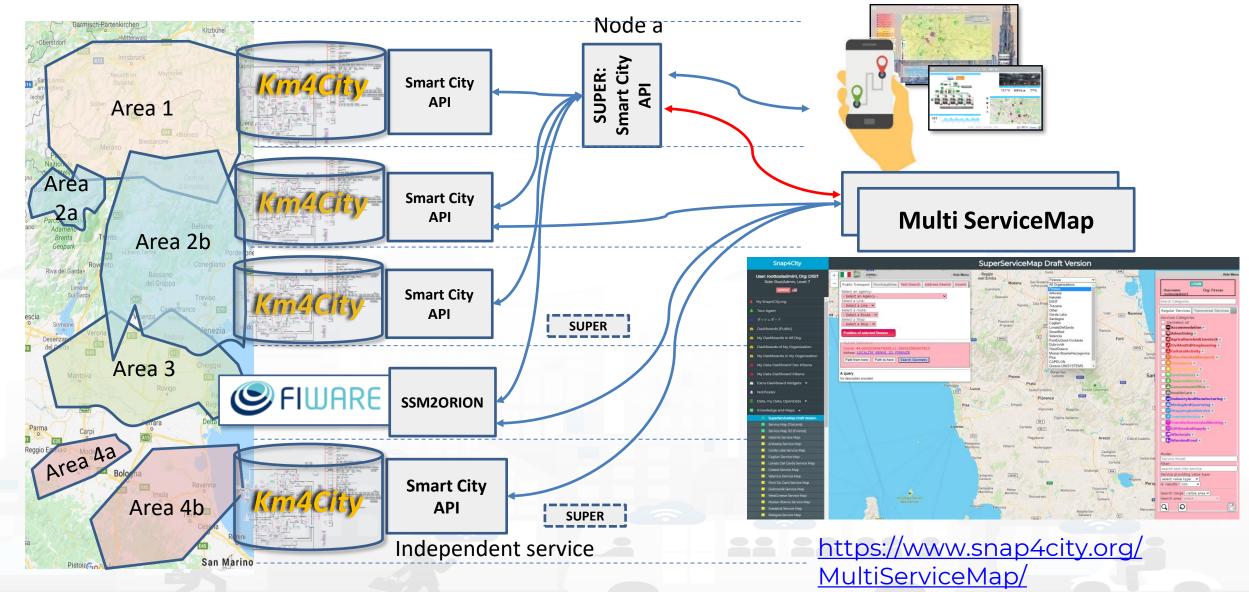




### **Dyamic Routing in 3D space**



#### UNIVERSITÀ DEGLI STUDI FIRENZE DISTRIGUES AB DISIT DISTRIUTE DISTRICTO DI INFORMAZIONE INFORMAZIONE DI INF



Snap4City (C), July 2023



#### **SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES**









INGEGNERIA

DELL'INFORMAZIONE

DISTRIBUTED DATA INTELLIGENCE

# 

 United Nations Sustainable Development Goals, SDGs (for which cities can do more to achieve some of the 17 SDGs, <u>https://sdgs.un.org/goals</u>);

indicators

- **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/topic s/air\_en);

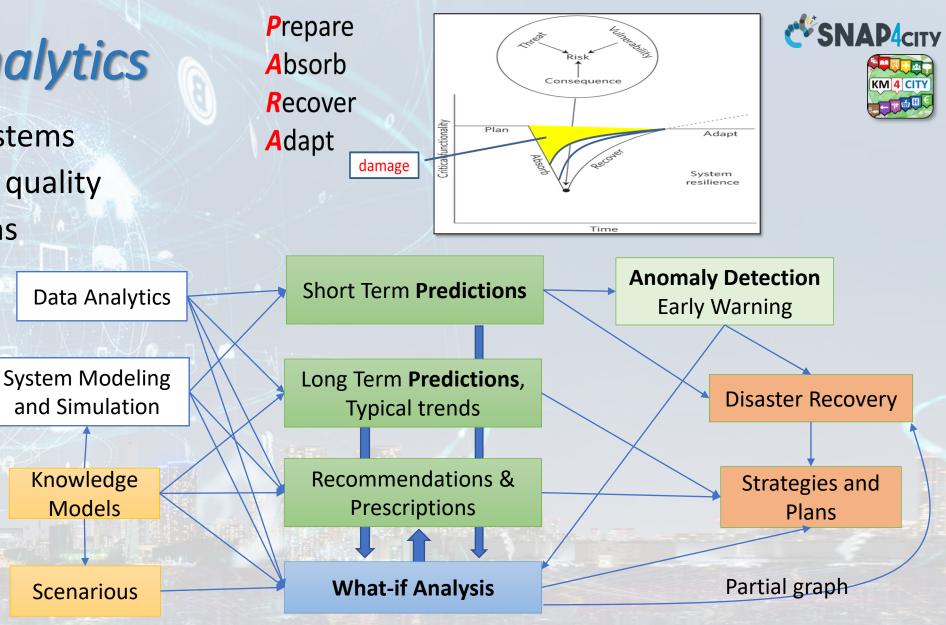
Global

- o2, **Local**
- PUMS: mobility and transport vs wnv
- SUMI: mobility and transport vs env
- ISO indicators: city smartness, digitization. Tech level

Snap4City (C), June 2023

### **Snap4City Analytics**

- Decision support systems
- Improvement of life quality
- Sustainable Solutions
- Reduction of costs
- Risk Assessment
- Resilience



#### **Decision Support System** targeting Indicators: Quality of Life, PUMS, SUMI, KPI, SDG, 15MinIndex,...





## **Mobility and Transport**

- Public Transportation: Ingestion and modelling of GTFS, Transmodel, etc. (DP)
  - Analysis of the **demand mobility vs offer transport** of according to public transportation and multiple data sources (Simulation)
  - Assessing quality of public transportation (analysis)
- Accidents heatmaps, anomaly detection (analysis, ML)
- Predictions for: traffic flow, smart parking, smart bike sharing, people flows, etc. (ML, DL)
- What if analysis: routing, traffic flow, demand vs offer, pollutant, etc. (Simulation + ML)
- Traffic flow reconstruction from sensors and other sources (simulation + ML)
- Tracking fleets, people, via devices: OBU, OBD2, mobile apps, etc. (DP)
- Routing and multimodal routing (multistop travel planning), constrained routing, dynamic routing (DA)
- Computing Origin Destination Matrices from different kind of data (analysis, DP, DP)
- Computing typical trajectories on the basis of tracks (analysis, ML)
- Computing Messages for Connected drive (DP)
- Slow and Fast Mobility 15 Minute City Indexes (analysis, DP, ...ML)
- Computing and comparing traffic flow on devices and at the city border (analysis)
- Typical time trends for traffic flow and IoT Time series. (analysis, ML)
- Impact of COVID-19 on mobility and transport
- Computing SUMI, PUMS, etc. (mainly DP)
- Etc.





## **City Users Behavior and Social Analysis**

- People detection and classification: persona, strollers, bikes, etc. (ML, DL)
- people counting and tracking, head counting (via thermal cameras, ML, DL)
- People flows prediction and reconstruction, (ML, DL)
  - Wi-Fi data, mobile apps data, Mobile Data, etc.
- User's behaviour analysis, People flow analysis from PAX Counters and heterogenous data sources (ML, AI)
  - origin destination matrices, hot places, time schedule,
  - Recency and frequency, permanence, typical trajectory, etc.
- Computing User engagement and suggestions for sustainable mobility (Rule Based, ML)
- Social media analysis on specific channel, specific keywords: see Twitter Vigilance,
  - Reputation, service assessment: MultiLingual NLP and Sentiment Analysis, SA
  - Tweet proneness, retweet-ability of tweets, impact guessing
  - Audience predictions on TV channels and physical events, locations
  - Prediction of attendance of events and on attractions
- Virtual Assistant construction, LLM, NLP, Sentiment Analysis (DL, NLP)
- 15 Minute City Index , etc. (modeling and computability)
- Computing SDG, etc., (DP)
- Etc.



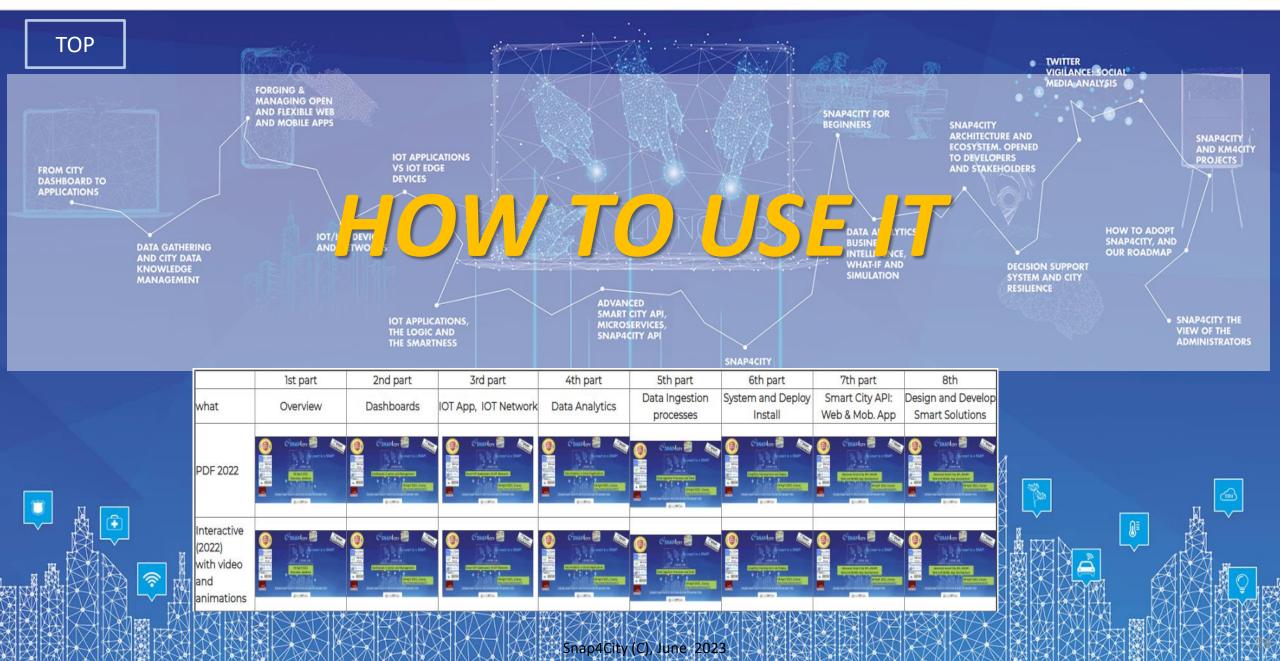


## **Environment and Weather**

- Pollutant Predictions: short, long and very long term European Commission KPIs
  - NOX, PM10 pollution on the basis of traffic flow, 48 hours (ML, AI, DL)
  - Cumulated NO2 average value over the year, ...... (ML, AI, DL)
- Computation of CO2 on the basis of traffic flows (DP), computing emission factor (DA)
  - each road for each time slot of the day
- Prediction of MicroClimate conditions for diffusion (ML, AI)
  - NO2, PM10, PM2.5, etc.
- Prediction of landslides, 24 hours in advance (AI, DL)
- Heatmaps production, dense data interpolation (DP) for
  - Weather conditions: temperature, humidity, wind, DEW
  - Pollutants and Aerosol: NO, NO2, CO2, PM10, PM2.5, etc.
- Impact of COVID-19 on Environmental aspects (DP)
- Optimisation of waste collection schedule and paths (DP, ML)
- Computing SDG, SUMI, PUMS, .. (mainly DP)
- Etc.

#### **SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES**





### https://www.snap4city.org/577





#### On Line Training Material (free of charge)

	1st part	2nd part	3rd part	4th part	5th part	6th part	7th part	8th
what	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
PDF 2022		CONDUCTOR OF A CONTRACT OF A C				Calabidar Calabidar		CEREMAN CONTRACTOR
Interactive (2022) with video and animations								

Videol				
Video2				
Video3				
Video4		none	none	none





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#### UNIVERSITÀ DIGUI STUDI FIRENZE DINFO DISIT SNAP4city 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 DISIT Lab, https://www.disit.org DINFO dept of University of Florence, Via S. Marta 3, 50139, Firenze, Italy Phone: +39-335-5668674 Access Level: public Date: 21-10-2022 Version: 1.4

Development https://www.snap4city.org/d ownload/video/Snap4Tech-**Development-Life-Cycle.pdf** 









**BI-CSBL** 





## **Client Side Business Logic**

Snap4City (C), June 2023

https://www.snap4city.org/d

ownload/video/ClientSideBus

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**Client-Side Business Logic** Widget Manual

From Snap4City:

- We suggest you read <u>https://www.snap4city.org/download/video/Snap4Tech-</u> 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
- tps://www.snap4industry.org
- /twitter.com/snap4city
- tps://www.facebook.com/snap4city
- ttps://www.youtube.com/channel/UC3tAO09EbNba8f2-u4vandg

Coordinator: Paolo Nesi, Paolo.nesi@unifi.it DISIT Lab, https://www.disit.org DINFO dept of University of Florence, Via S. Marta 3, 50139, Firenze, Italy Phone: +39-335-5668674



### How to adopt Snap4City



#### **Smart City as a Service**

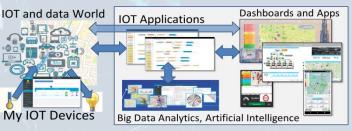
- Supporting Org
- 100% Open Source Platform: Github
- Further developments
- Publishing Appliances and Dockers
- Training courses, docs
- Consulting
- Forums
- Etc.



Download

and deploy

#### **On your premise**





#### Installation on your premise

- Virtual Machines or Dockers
- 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



Powered by

**SNAP**4Tech







### **Be smart in a SNAP!**



7-9 November 2023, Barcelona, Spain

**SMARTCITY EXPO WORLD CONGRESS** 

Visit Snap4City in Hall 1



#### CONTACT

TOP

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