



Control and Plan an Horizontal **AI** Platform Digital Twin for all

DIGITAL TWIN SOLUTIONS TO SETUP SUSTAINABLE DECISON SUPPORT S







Optimization









FREE TRIAL















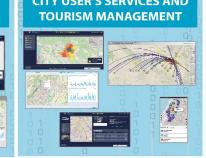




Digital Twin Solutions for Sustainability

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







DEVELOMENT ENVIRONMENT

VISUAL PROGRAMMING, ML, AI, HPC

FULL APPLICATIONS, DASHBOARDS

AND METHODOLOGY

TRAINING COURSES

• LIVING LABS GUI CUSTOM STYLES

AND VIEWS

MOBILE APPS









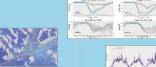
SEMANTIC REASONING

SMART DATA MODEL

IOT DEVICE MODELS, STORAGE













EXPLAINABLE AI, MACHINE LEARNING, GENERATIVE AI OPERATIVE RESEARCH, STATISTICS FULL INTEROPERABILITY, ANY: DATA, BROKERS, NETWORKS AND VERTICALS

BIG DATA ANALYTICS, ARTIFICIAL INTELLIGENCE



Domains (2024/8)

- Smart City, control room
- **Mobility and transport**
- Energy, light, recharge
- **Buildings and Assets**
- Tourism and People
- **Environment, pollutant**
- **Waste Optimisation**
- Security and Safety
- **Risk and Resilience**
- Social Media
- Big Data, AI/XAI
- **Public and private data**











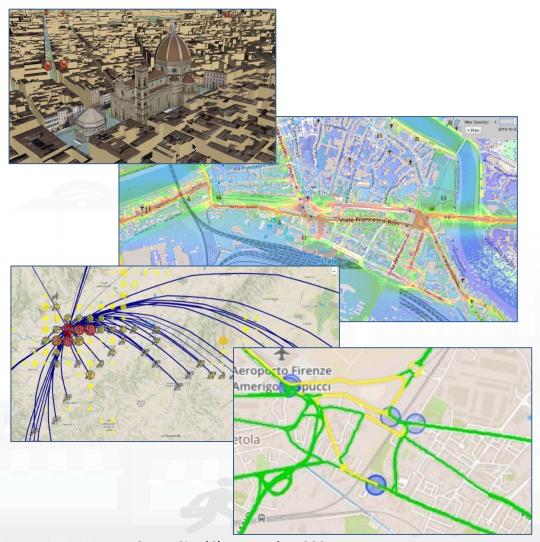








Smart City Digital Twin



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

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







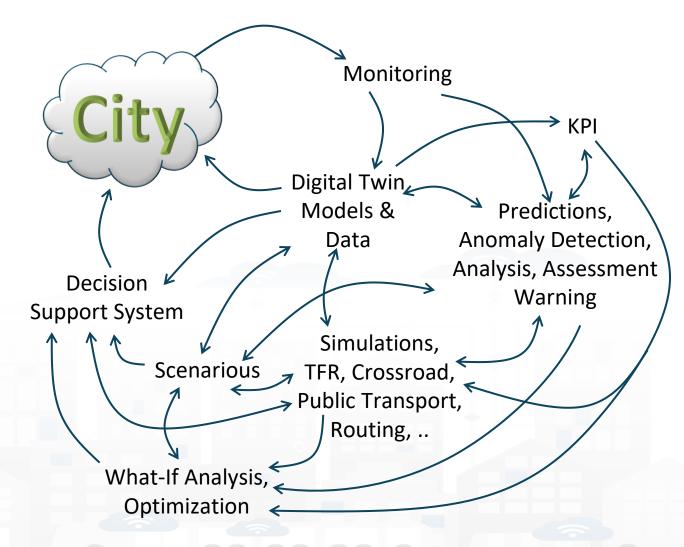




Main tasks



- 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 Al Prescriptions, scenarios
 - Resilience to Unexpected unknows
 - What-if analysis wrt scenarios
 - Collaboration with stakeholders











Horizontal Al Platform/Control

Goals:

- Increasing quality of Life, quality of services,
- Decongestion, Decarbonization, Sustainability
- increase efficiency and production optimization
- Improve accessibility to services: citizens, Tourists, commuters, etc.
- Improve security/Safety of city users, risk reduction
- Costs reduction of services, energy consumption reduction
- Reduction of emissions and EC taxations

Horizontal homogeneous platform Uniform Technology for

- Any Vertical operation/plan: mobility, energy, environment, security, tourism, infrastructure and assets control, buildings, etc.
- Al Solutions: early warning, predictions, simulations, what-if, optimization; Deep Learning, ML, BERT, LLM, XAI (Shap/Lime),
- Development Environment for any vertical, Digital Twin: City Global and Local, IoT, VR, Visual Programming, business intelligence, CSBL, SSBL, etc.
- **Interoperability**: any format, any protocol, any video management system, any sensor, any device, etc.
- KPI: multidomain KPI, general management, early warning, early detection of critical conditions, 15 Min City Index, SDG
- Mobile App: modular applications, operators' modules, multiple cities, etc.
- **Participatory**: problem reporting, ticketing, etc.
- Integration of any kind







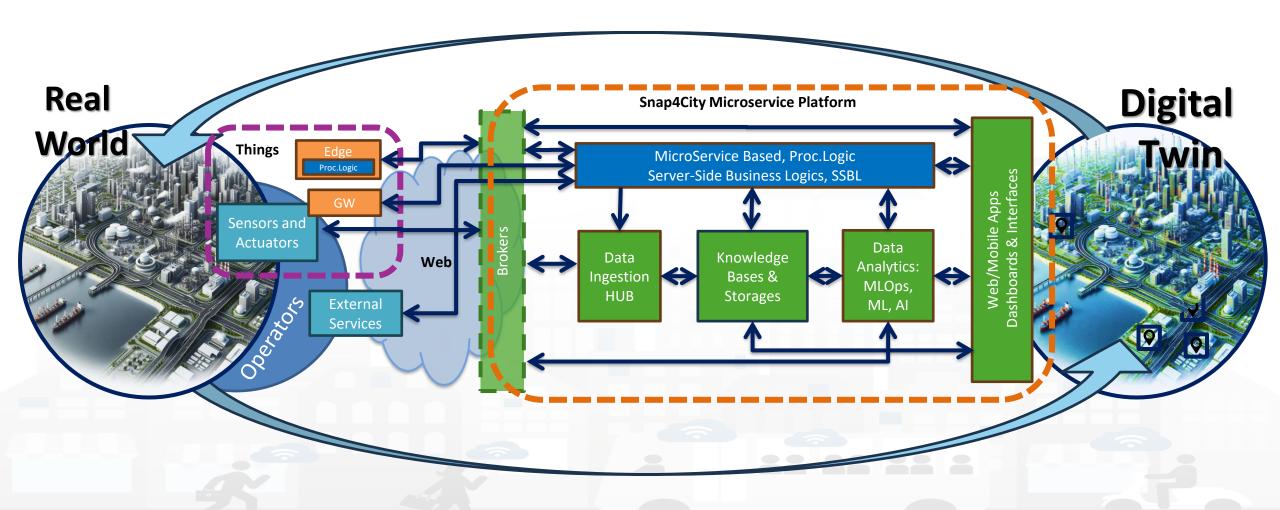








Digital Twin Development Platform



Standards and Interoperability (10/2024)

SNAP4city

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, RTSP, ONVIF, AXIS TVCam, CISCO Meraki, OSM, Copernicus, The Weather Channel, Open Weather, OLAP, VMS Milestone, TIM, HERE,
- 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

Snap4City (C), November 2024

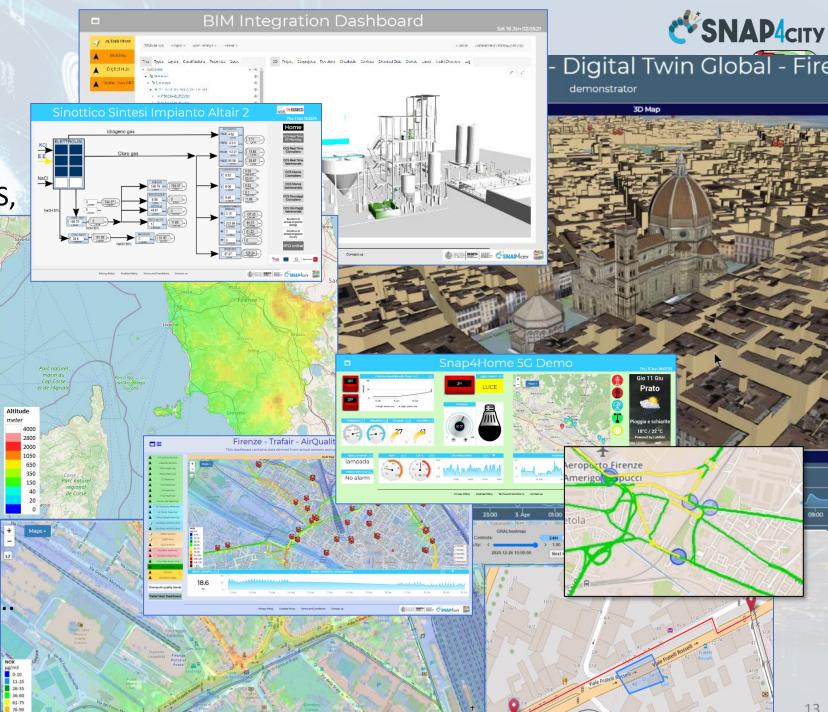
- POI, IOT Devices, shapes,...
 - FIWARE Smart Data Models,
 - IoT Device Models
- GIS, maps, orthomaps, WFS/WMS, GeoTiff, calibrated heatmaps, ..
- Satellite data, ...
- traffic flow, typical trends, ...
- trajectories, events, Workflow, ...
- 3D Models, BIM, Digital Twins, ...
- OD Matrices of several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











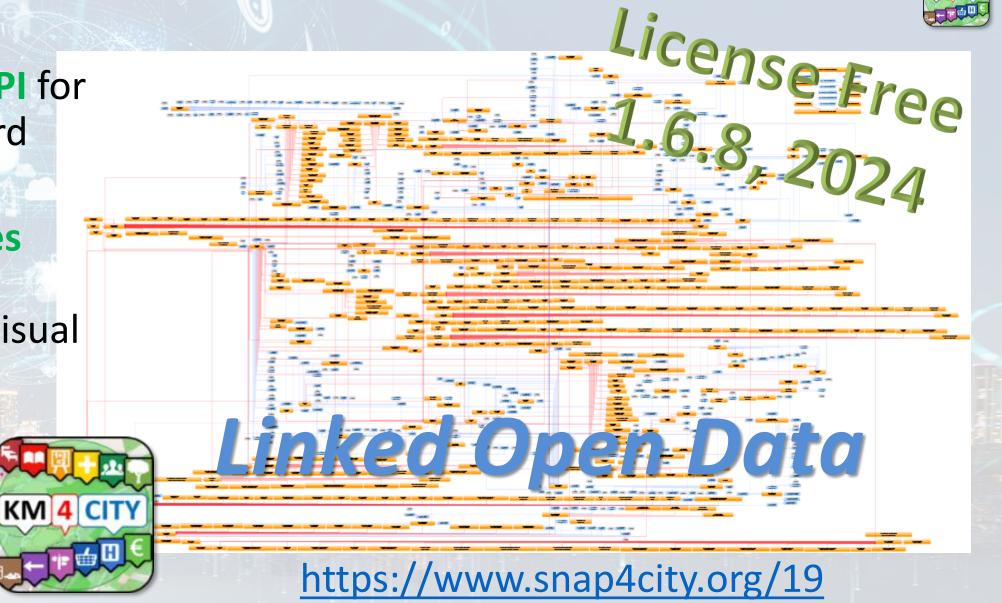
Expert System semantic queries



• via:

 Smart City API for Apps and third party

MicroServices
 data driven
 develop via visual
 language
 Node-RED



Snap4City (C), November 2024

Ingestion, aggreg. > exploitation

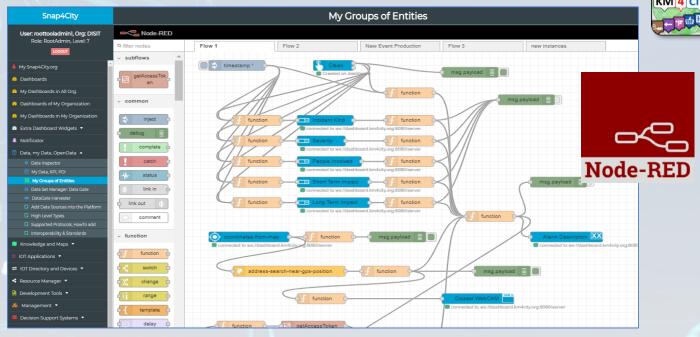


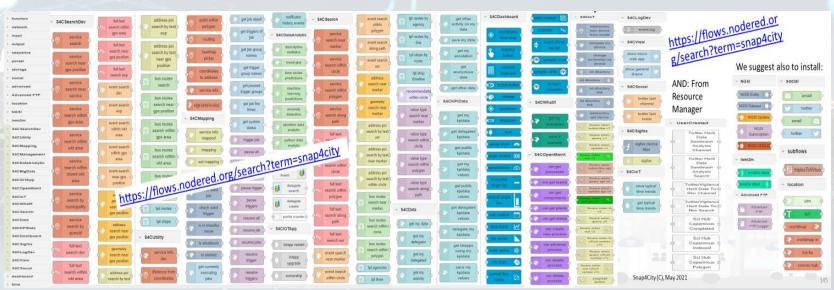






- IoT App Visual Programming, no coding
 - Data transformation
 - Integration, Interoperab.
 - Scripting Data Analytics
 - Data ingestion
 - Business logic
- Edge and Cloud
- MicroServices data driven develop via visual language Node-RED









Areas





> 60.000 downloads

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

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

Entities Nanagemenx Visualitation service **Snap4City** Microservices *M_{ana}g*ement Analytic Services Platform Proc.Logic **SSBL** other Node-RED Third part

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**

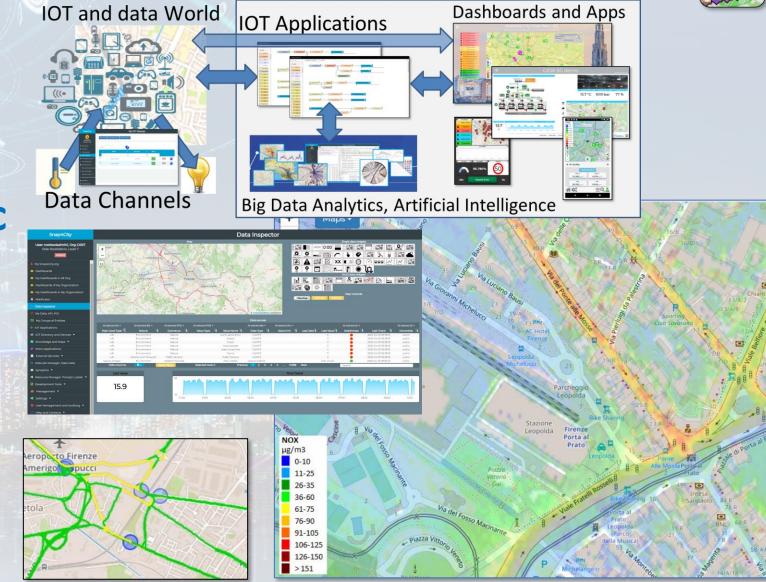
> Dashboards Widgets: Graphic Libraries **Interactive Widgets** Maps, 3D representations Synoptics, External Content Micro Web App

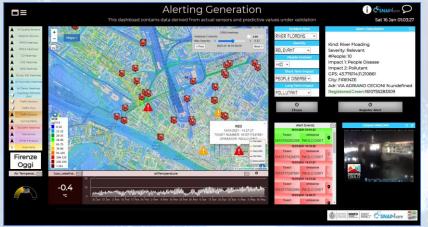
IoTApp Management Data Logs, A&A, Security Ownership Management **VPN** remote access

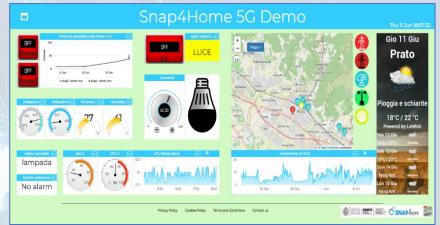
Solutions: reliable, secure and fast to realize

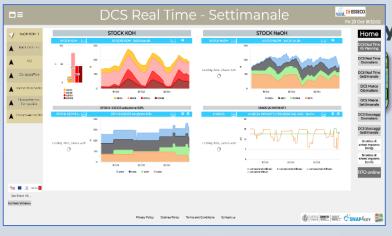
SNAP4CITY KM/4 CITY

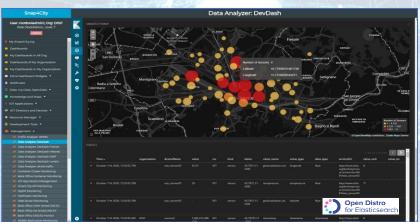
- Via Snap4City tools
 - Dashboard Wizard
 - Dashboard Builder
 - Data/Visual Analytic
- Smart Solutions results to be
 - Real time data drive
 - Secure end-to-end
 - GDPR compliant
 - Reliable, interoperable
 - Auditable, marketable



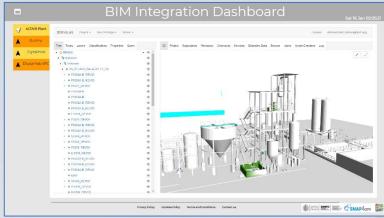




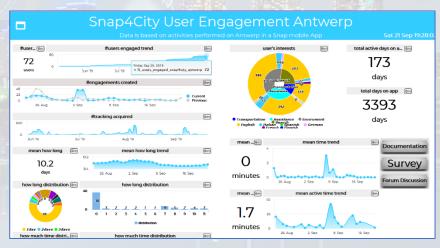


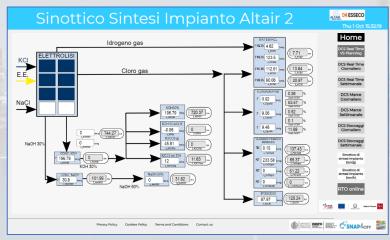


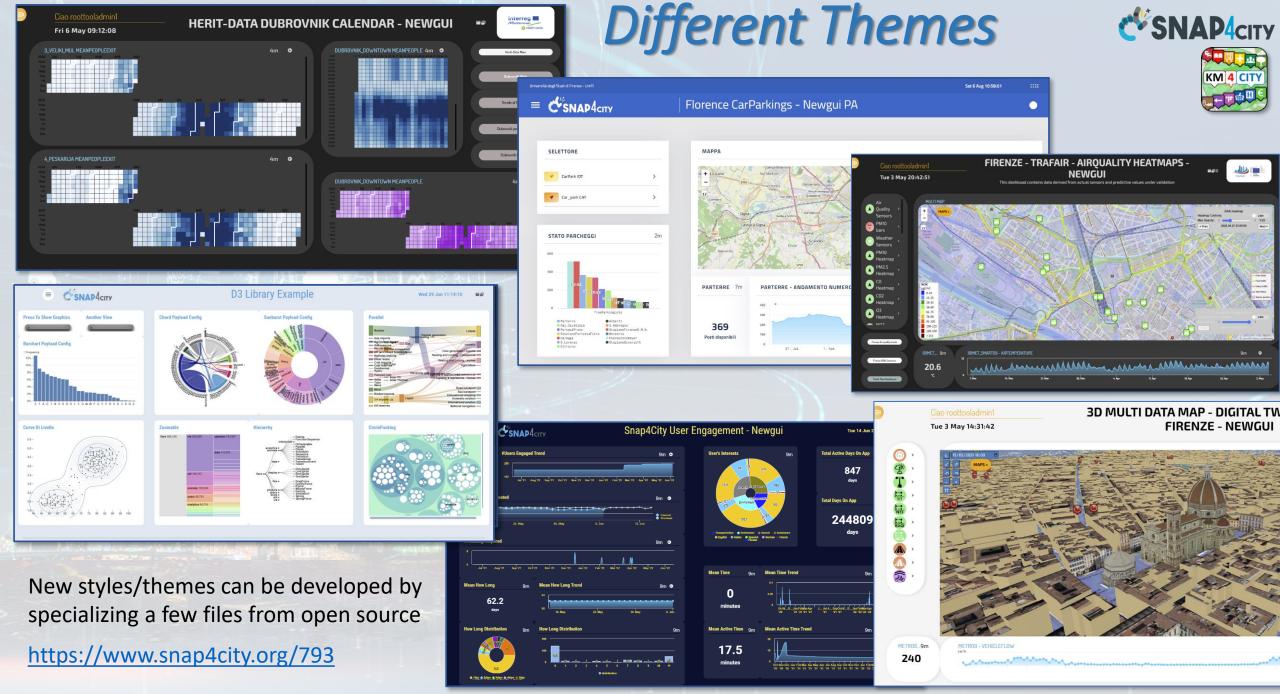










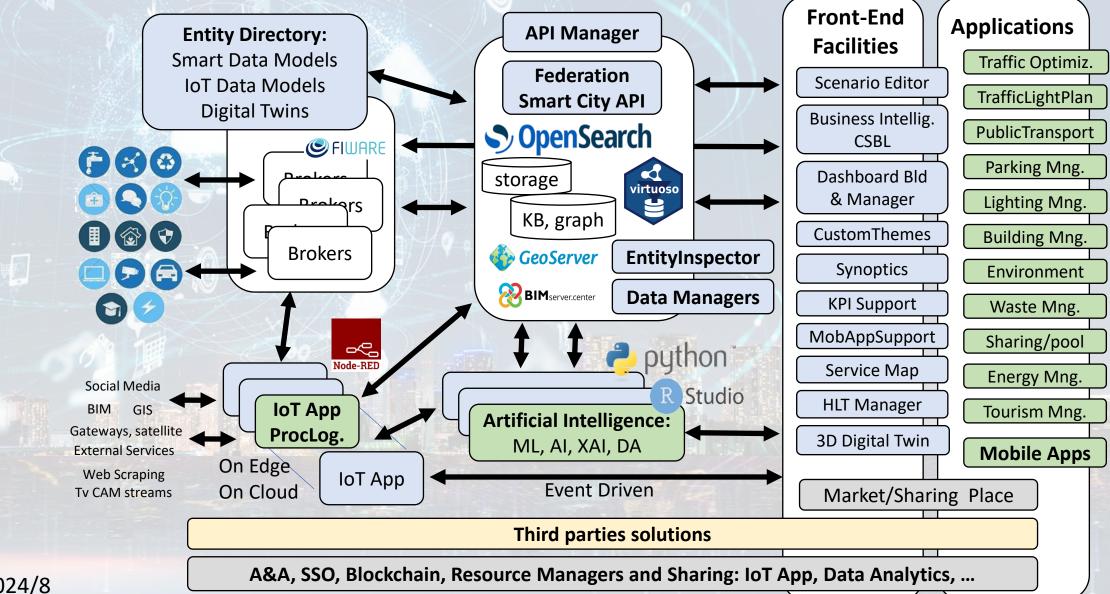


Snap4City (C), November 2024

Technical Architecture



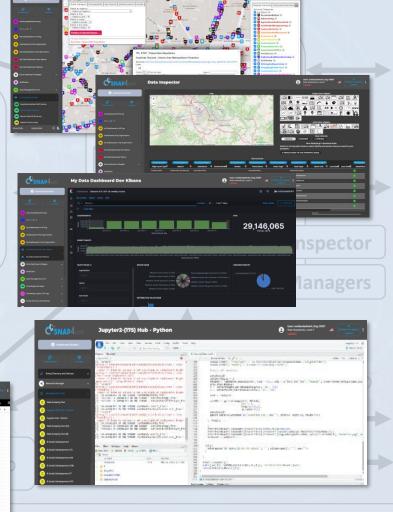




Visual Development Tools

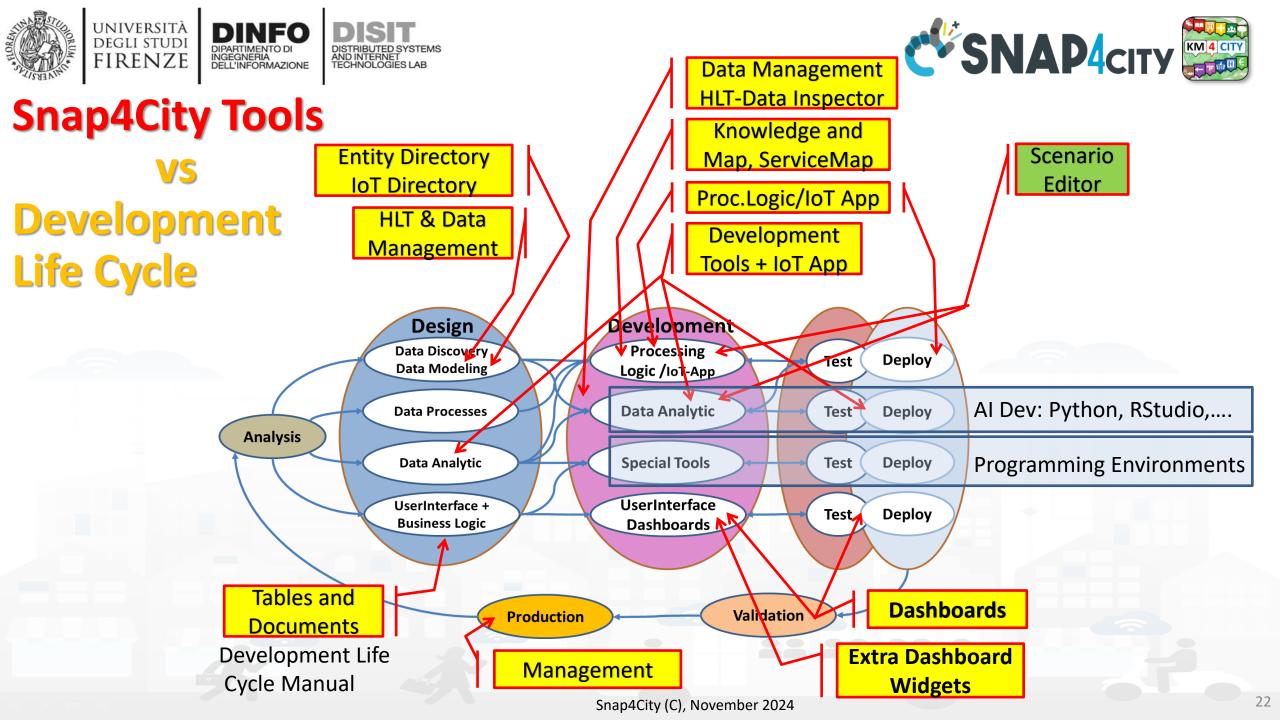






Third parties solutions

A&A, SSO, Blockchain, Resource Managers and Sharing: IoT App, Data Analytics





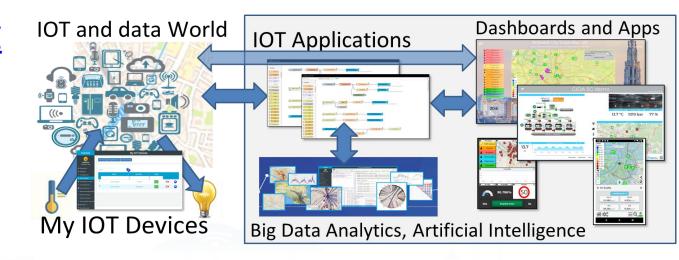








- Register on <u>WWW.snap4city.org</u>
 - Subscribe on **DISIT Organization**
- You can:
 - Access on basic Tools
 - Access to a large volume of Data
 - Create Dashboards
 - Create IOT Applications
 - Connect your IOT Devices
 - Exploit Tutorials and Demonstrations



License Free Installation scripts for: Pub cloud & on premises

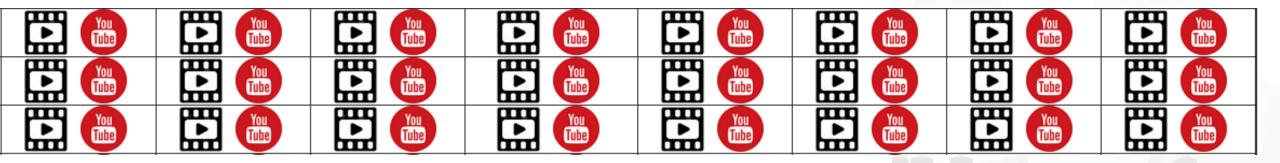
https://www.snap4city.org/944

On Line Training Material (free of charge)





			<u> </u>			
2nd part	3rd part	4th part	5th part	6th part	7th part	8th
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
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	Dashboards CSNAMORT CONTROL OF THE PARTY OF	Dashboards IOT App, IOT Network SNAMOR STANDARD STANDAR	Dashboards IOT App, IOT Network Data Analytics Canapage Can	Dashboards IOT App, IOT Network Data Analytics Data Ingestion processes Data Ingestion processes Data Ingestion processes	2nd part Dashboards IOT App, IOT Network Data Analytics Data Ingestion processes System and Deploy Install Install Data Ingestion processes System and Deploy Install Data Ingestion processes System and Deploy Install Data Ingestion processes Data Ingestion processes System and Deploy Install Data Ingestion processes Data Ingestion processe	2nd part Dashboards IOT App, IOT Network Data Analytics Data Ingestion processes System and Deploy Install Web & Mob. App Charter











Development

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









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.snap4citv.org/download/video/Snap4Citv-
- https://www.snap4city.org

- https://www.snap4industrv.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







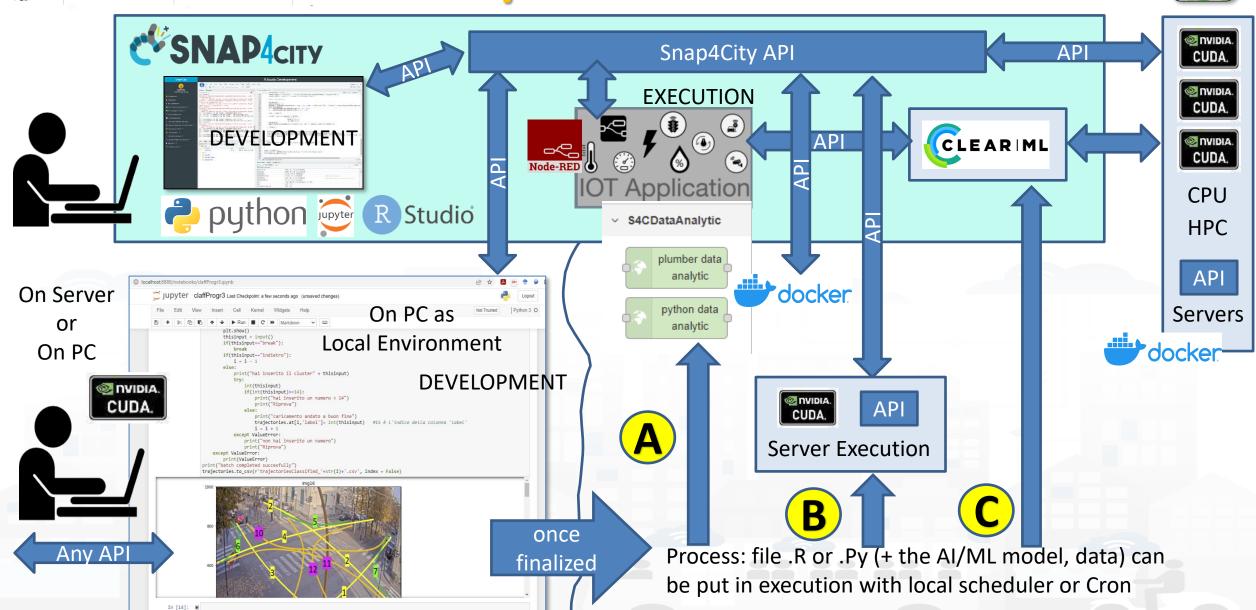




DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB DISTRIBUTED DATA INTELLIGENCAL / ML Infrastruct. C'SNAP4city AND TECHNOLOGIES LAB WM 4 CITY ENTERNET TECHNOLOGIES LAB AND TECHNOLOGIES LAB







https://www.Snap4City.org













12 running installations in Europe

- Snap4.city.org, Greece, Merano, Cuneo, .:.
- Toscana, Pisa, Sweden, ISPRA, Snap4.eu,
- Altair, Italmatic, Romania, Rhodes,
- 16 projects, 12 pilots on 10 Countries
 - >40 cities/area

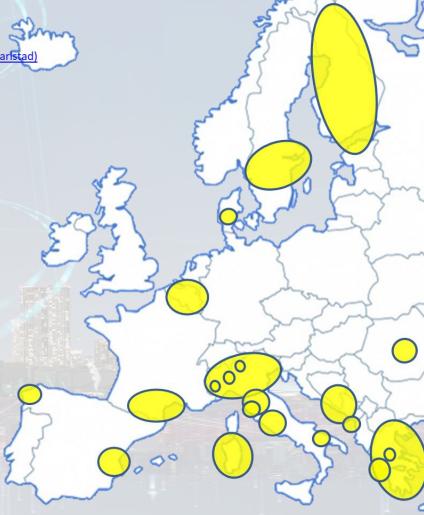
Update: 29-10-2024

Widest MULTI-tenant deploy has

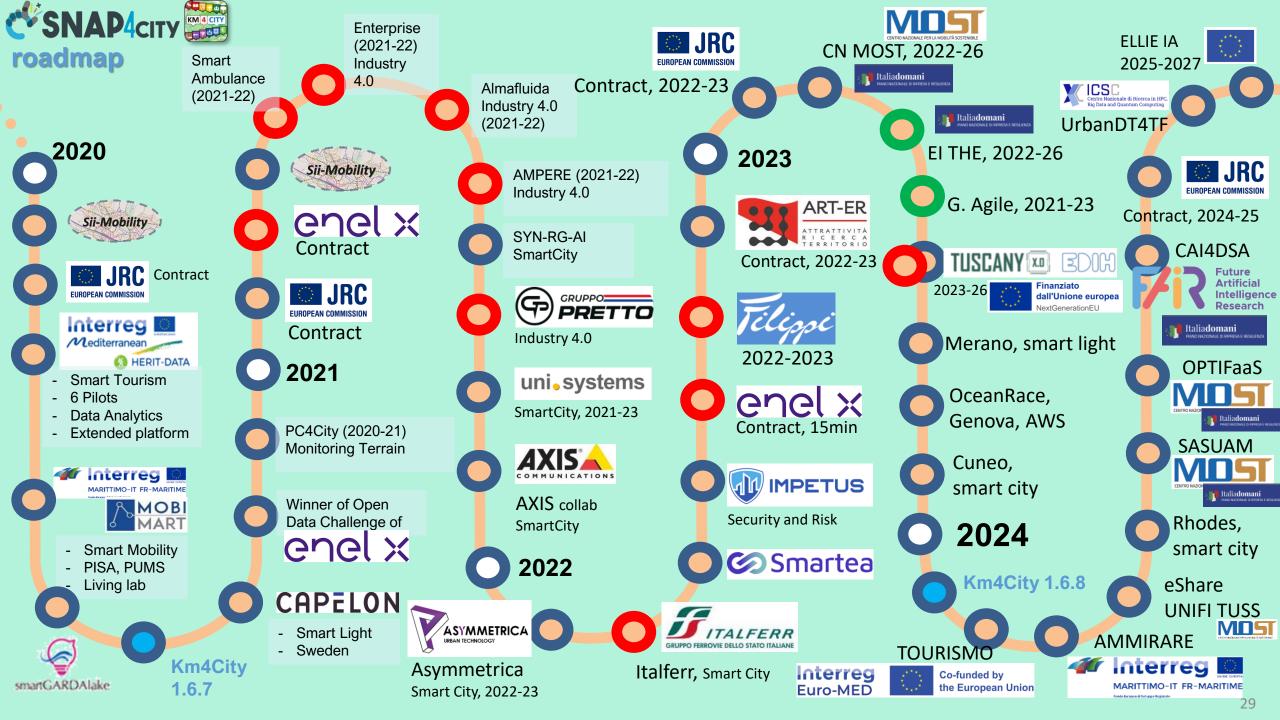
- 24 Organizations / tenant
- > 8850 users on
- > 1800 Dashboards
- > 17 mobile Apps
- > 2.2 Million of structured data per day
- > 580 IoT Applications/node-RED
- > 750 web pages with training
- > 75 videos, training videos

Main Organizations/areas

- Antwerp area (Be)
- Bisevo, Croatia
- Bologna (I)
- Brasov (Ro), by ICEBERG
- Capelon (Sweden: Västerås, Eskilstuna, Karlsta
- 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)









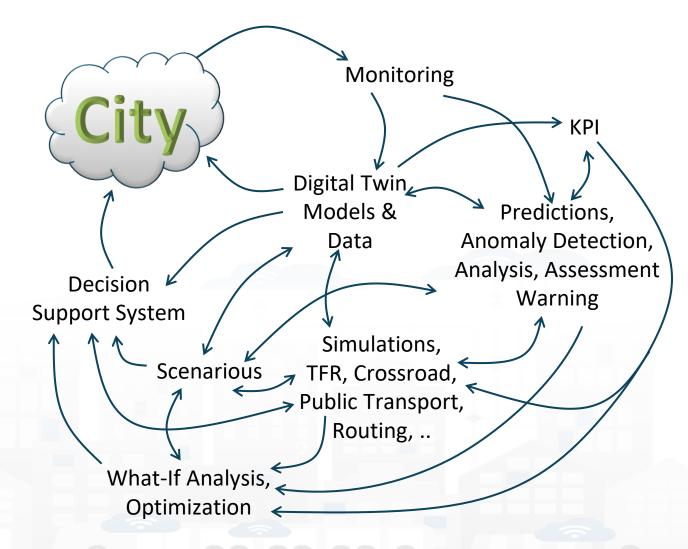




Main tasks



- 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 Al Prescriptions, scenarios
 - Resilience to Unexpected unknows
 - What-if analysis wrt scenarios
 - Collaboration with stakeholders



SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES







Monitoring





- Monitoring via KPI
- Computing predictions and KPI
- Anomaly detection, Early warning
- Control Rooms, situation rooms
- Early warning on critical conditions

Reacting: Computing in real time

- Changing semaphore maps
- Changing Dynamic signage
- Real time Info Mobility
- User engagement via Mobile Apps
- What-if analysis
- o etc.,



















City Resilience CSNAP4city





Early Warning, Detection

Issue:

- Detection of critical condition
- Not easily detected with other means

Impact:

- Early warning, faster reaction
- Increased resilience

Prepare

Absorb

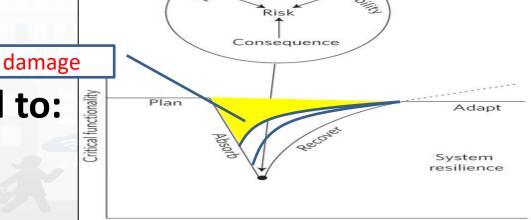
Recover

Adapt



Several metrics related to:

- Volume of retweets
- Sentiment analysis



Time

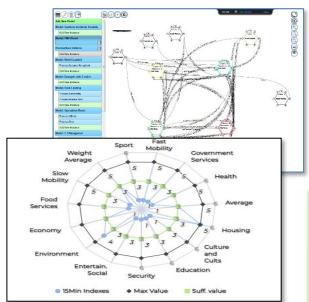


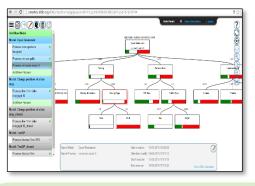






ERMG: European Resilience Management Guide









MONITORING

CRAMSS Collaborative Resilience **Assessment and Management** Support System

RESPONDING



ANTICIPATING





- · European Resilience Management Guidelines
- · Game Based Training



- · IoT/IoE/Open Data
- · Real Time Dashboard · Resilience Control Room
- · Data Analytics
- · Early Warnings
- · Urban Traffic Manager Data Exchenge



·Smart Decision Support Systems (DSS)



- · Human Behavior Analysis · Predictive Analytics
 - Urban Transport System Dynamic
 - · Resilience Quantification
 - Network Analysis







KM 4 CITY

- · Evacuation Decision Support ·Smart Intelligent Transport Systems
 - · Emergency Support Smart App
 - · Resilience DSS







Smart City Control Room Florence Metropolitan City



- Thousands of Open/Private data, POI, IOT, etc.
- mobility and transport: accidents, public transport, parking, traffic flow, Traffic Reconstruction, KPI, ...
- **AND**: environment, civil protection, gov KPI, covid-19, social & social media, people flow, tourism, energy, culture, ...

Multiple dash/tool Levels & Decision Makers

Real Time monitoring, Alerting, quality assess.

Predictions, KPI, DSS, what-if analysis

Historical and Real Time data

Billions of Data

Services Exploited on:

• Multiple Levels, Mobile Apps, API

Since 2017















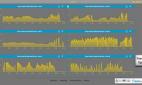












Key Performance Indicators, KPI







15Min

SIMPRE



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



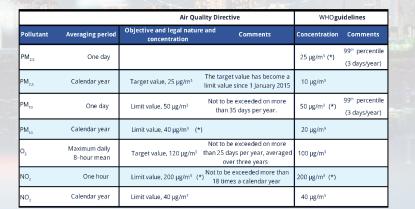
• 15 minutes cities (where primary services must be accessible within 15 minutes on foot);



 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.





8

Realtime

15MinCityIndex

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

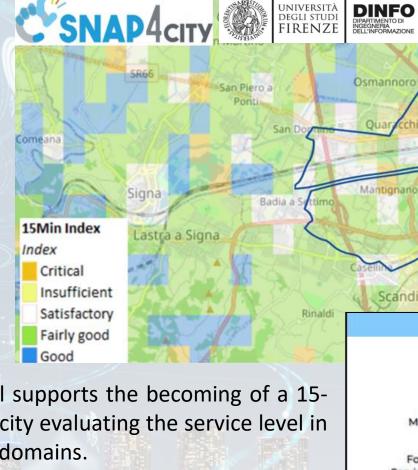
Using the Open Data:

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.

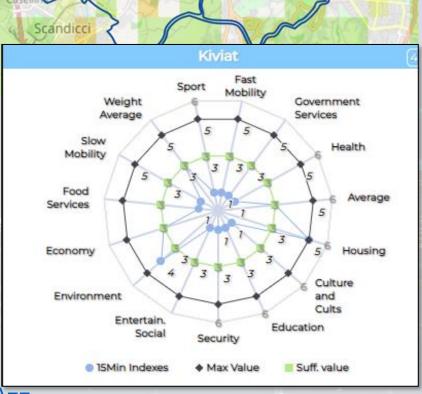


Careggi/Rifredi is a relevant district in Florence because of hosting the main Florence/Tuscany hospitals Careggi and Meyer, but also university headquarters and many other workplaces.



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





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

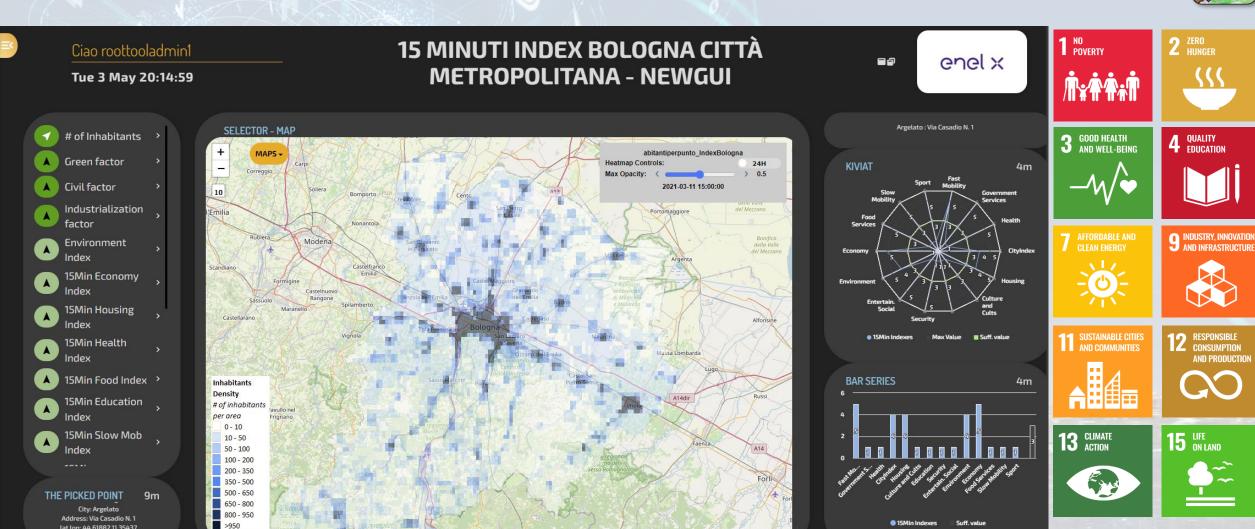
Snap4City (C), November 2024

15MinCityIndex on Bologna









lat.lon: 44.61882.11.35437

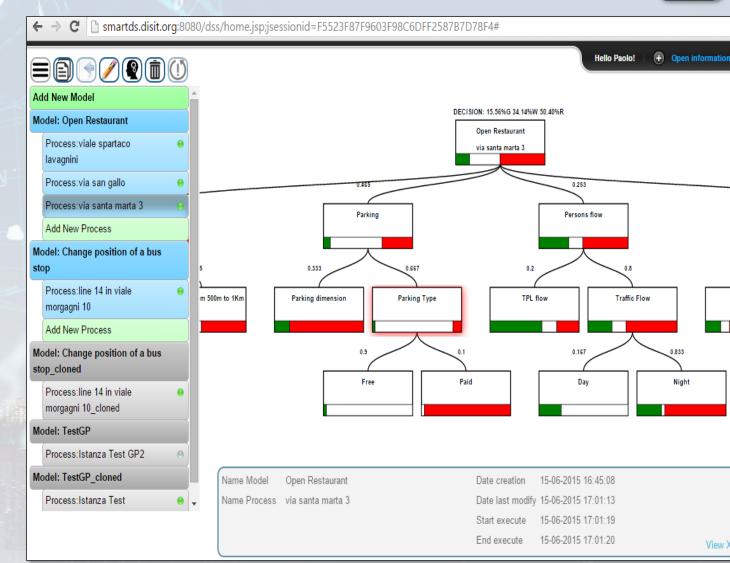








- Smart Decision Support System based on System Thinking plus
- Actions to city reaction, resilience, smartness, ...
- Enforcing Mathematical model for propagation of decision confidence..
- Collaborative work, ...
- Processes connected to city data: DB, RDF Store, Twitter, etc.
- Production of alerts/alarms
- Data analytics process
- Twitter Processes
- reuse, copy past, ...



Snap4City (C), November 2024

Decision Support System:

Immediate response and Tactiens in Classical Architecture and Architecture

DASHBOARD TO APPLICATIONS

Plans, via What-if Analysis takeholders







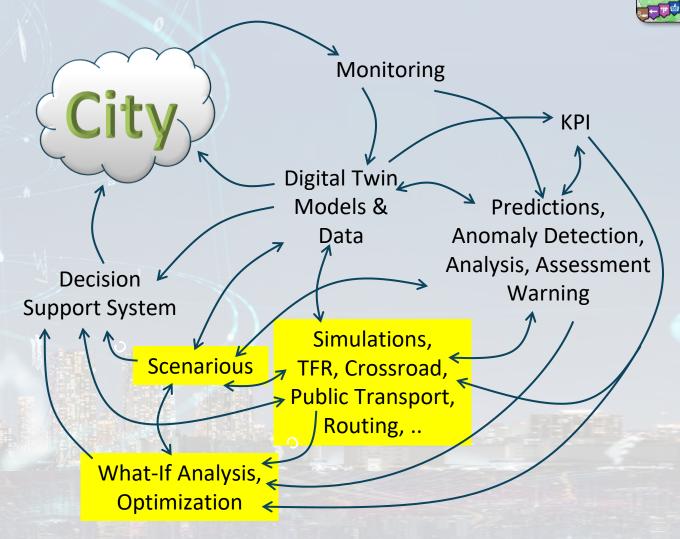


From What-If to Decision Support System

SNAP4CITY

KM 4 CITY

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 - What-if analysis wrt scenarios
 - Collaboration with stakeholders

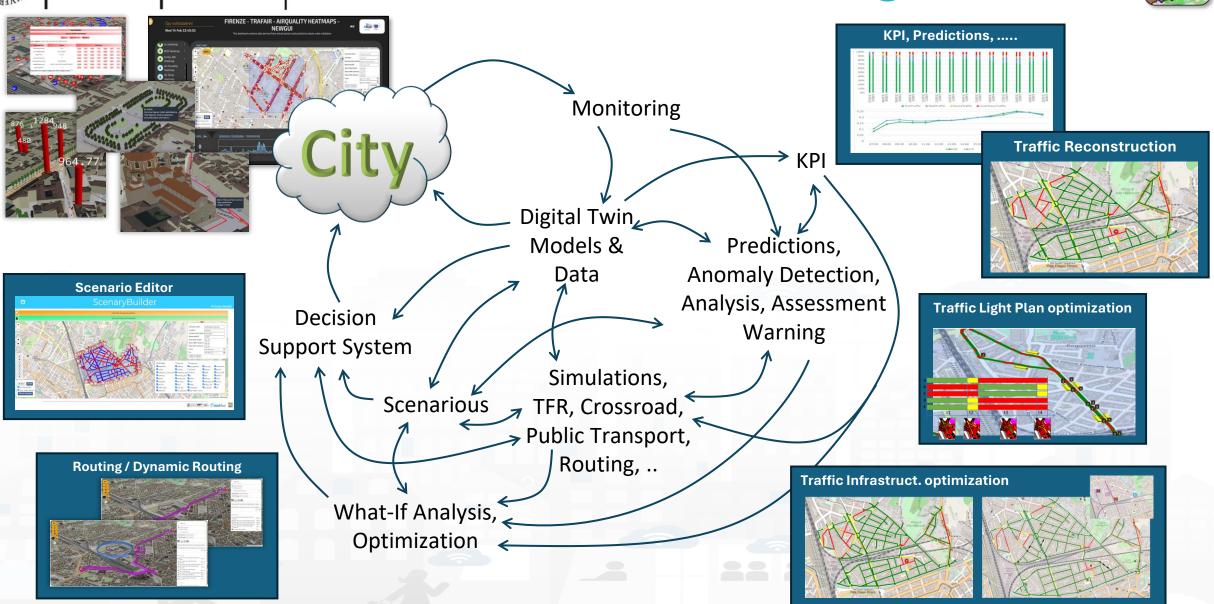












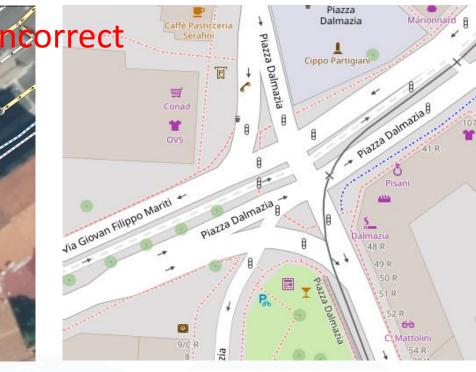




DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

OSM data with non correct viability in Piazza Dalmazia, Firenze





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





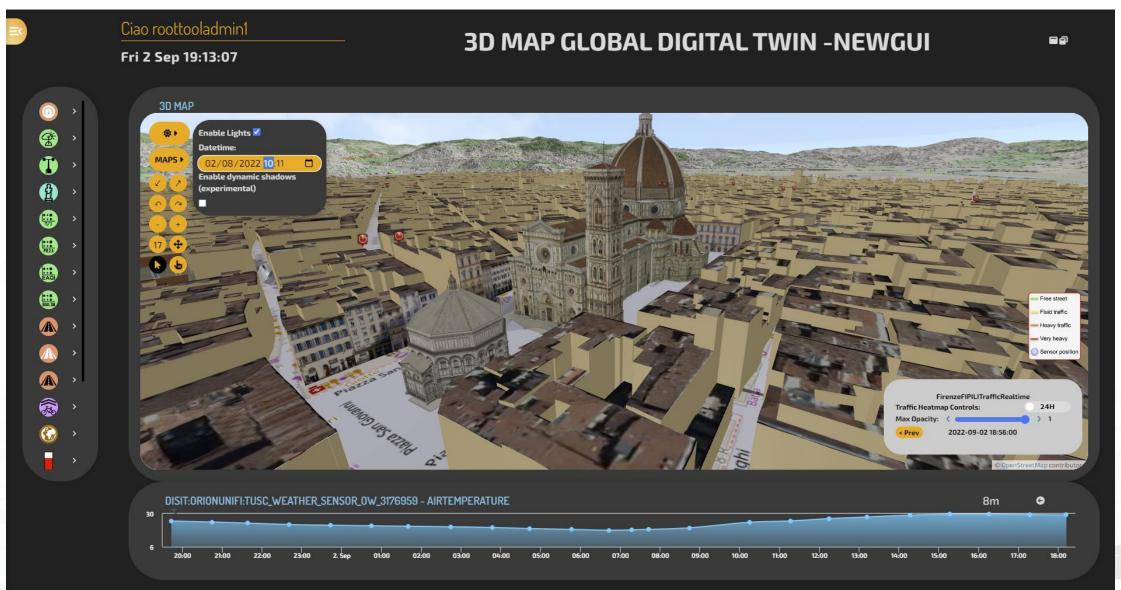


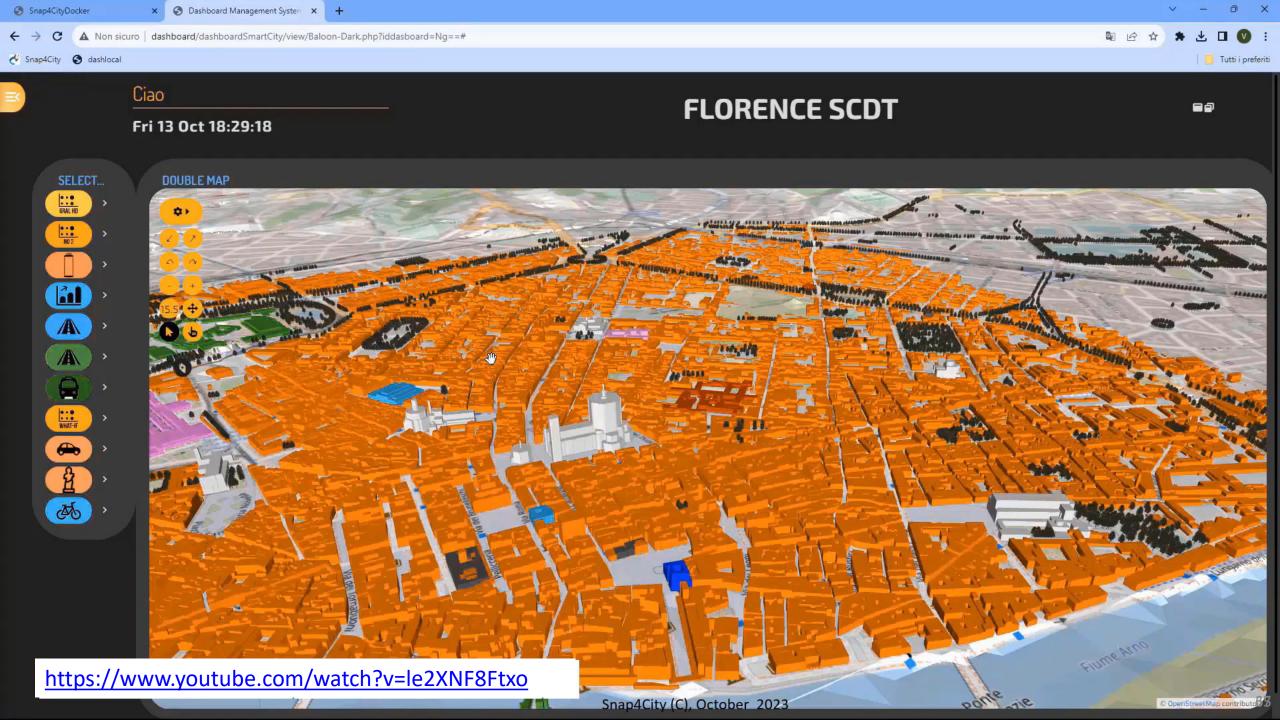














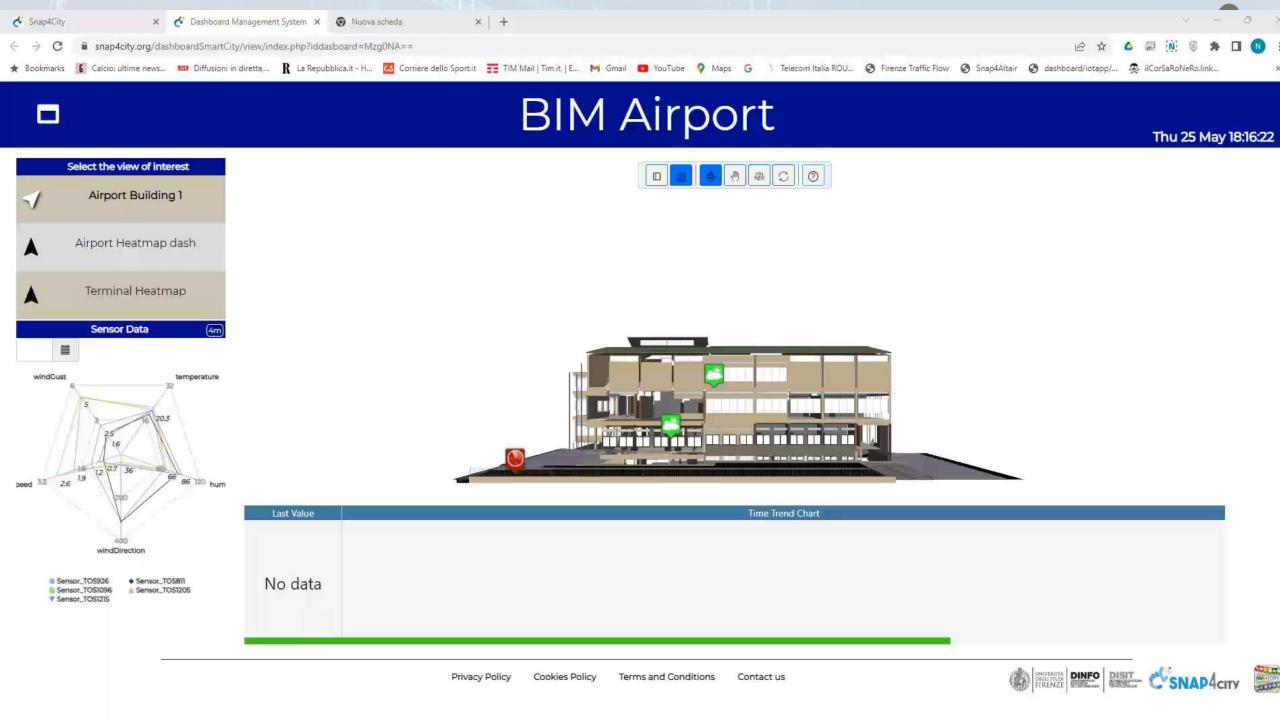






Local Digital Twin vs BIM





Simulators in What-If analysis and Optimisations



- Mobility and Transport: infrastructure, data, TLP, by Scenario or Wall
 - Traffic flow reconstruction: from sensors to full traffic flows (Meso, Macro) (Snap4City)
 - Multimodal Traffic: cars, tram, busses, pedestrian (SUMO micro-meso + Snap4City meso-macro)
 - Public Transport: match demand vs offer (Snap4City:DORAM1, DORAM2 beta + SUMO: micro-meso-macro)
 - Routing, dynamic routing: micro, meso, macro scales (GraphHopper + Snap4City)
 - Multimodal routing: micro, meso, macro scales (GraphHopper + Snap4City)
 - Road Parking simulator and management system (Snap4City)
 - KPI: travel time, emissions, waiting time, etc. (Snap4City, SUMO)

Environment

- Impact on NO2, CO2 by traffic flow, heating emissions, wind, weather, etc. (Snap4City)
- Waste Collection Simulator and Management system (Snap4City)

Energy

- Photovoltaic plant: home level, area data (Snap4City)
- Computing roof orientations and patterns from LIDAR data, positioning of PV panels (Snap4City)
- Smart Light management systems (by Snap4 srl, on top of Snap4City

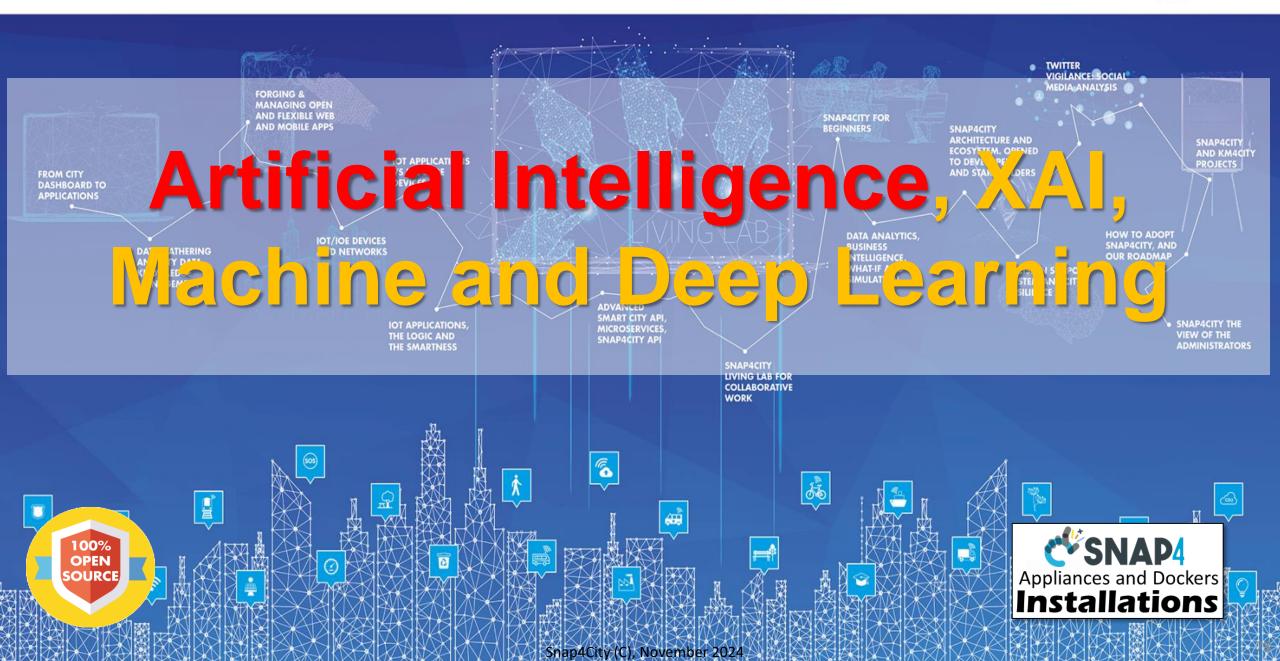
Other:

- 15 Min City Index: 13 subindexes, (Snap4City)
- SUMI indexes, partial; SUMP indexes, partial; SDG...; etc. (Snap4City)
- 3D Tiles from plant shape extrusions and patterning, Google 3D Tiles, working on other formats (Snap4City)

Snap4City (C), November 2024

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES





Available AI Solutions on Snap4City

SNAP4city

https://www.snap4city.org/997

More than 80 Available Solutions & 300 Al 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/course/p4/





https://www.snap4city.o rg/download/video/DPL SNAP4SOLU.pdf









Predictions and Heatmaps in Real Time

















• 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



- Reduction of emission, reduction of congestion
- Smart City infrastructure: monitoring and resilience, long terms predictions
- Effective and Low cost smart solutions
- What-if analysis, Simulations
- Origin Destination matrices computation





Reduction of emission, reduction of congestion Monitoring and Predicting: NO2, NOX, CO2, Traffic flow, pollutant, landslide, waste, etc.

Traffic flow reconstruction

Demand vs Offer of Mobility analysis



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



- Optimization of Waste Collection
- business intelligence tools for decision makers
- Reduction production costs
- Monitoring resource consumption



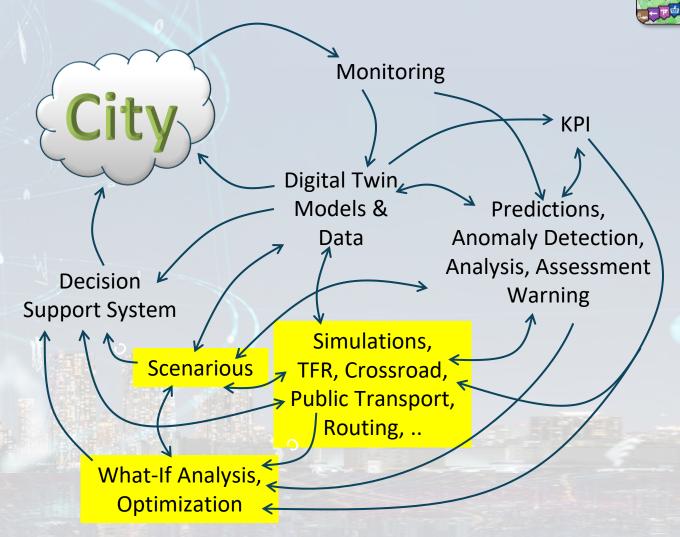
- Shortening justice time
- Prediction of mediation proneness
- Assisting institution is taking legal decisions
- Anonymization and indexing legal docs.
- Ethical Explainable Artificial Intelligence

Snap4City (C), November 2024 (10/2024)

From What-If to Decision Support System

C SNAP4CITY

- 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 Al Prescriptions, scenarios
 - Resilience to Unexpected unknows
 - What-if analysis wrt scenarios
 - Collaboration with stakeholders

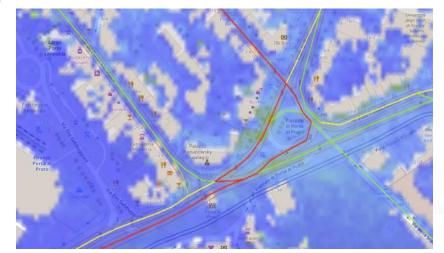


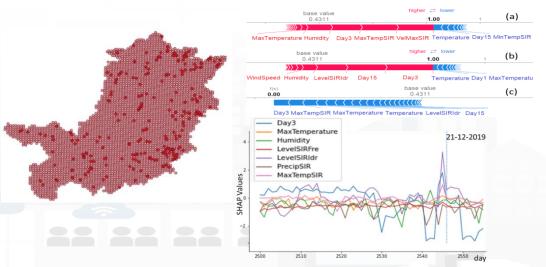




The difference is on computational models

- Simulation models,
- statistics and operations research techniques
- Machine Learning and Artificial Intelligence techniques
 - o exploitation of heterogeneous data, **BIG DATA**
 - o Predictions, Early Warning, Anomaly Detection, ...
 - What-If Analysis integrating predictive models and simulations
 - Explainable AI, XAI, providing to the decision-maker
 - detailed explanations on the motivations behind the suggestions provided, so that the decision maker can understand the process and the motivations
 - evidence of compliance with ethical aspects with confidence
 - To be able to use the systems as a trusted expert system.





SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES



















- 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.













Mobility and Transport Domain (2024/8)

- Goals:
 - Decongestion
 - Decarbonization
 - Accessibility to services
 - Security/Safety of city users
- Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)
 - Monitoring traffic, parking, people flow, services, boats, ports, beaches, etc.
 - Early detection/warning of critical conditions: traffic, congestion, security/safety
 - Managing Smart Parking, transportation services, fines, etc.
 - Managing fleets: personal, sharing, waste collection, maintenance, etc.
 - Managing E-sharing, pooling services, MaaS, etc.
 - Managing entrances in city areas: restricted areas, touristic busses, etc.
 - Production of suggestions, recommendations, nudging
 - Computing predictions of any kind
- Solutions for Planning (optimization and what-if analysis)
 - · Reduction of traffic congestion, via optimization: traffic light plans, viability, routing
 - Reduction of Pollutant Emissions, via optimization: traffic light plans, viability
 - Optimization of transportation offers wrt multimodal mobility demand
- Algorithms and computational solutions, see next slide



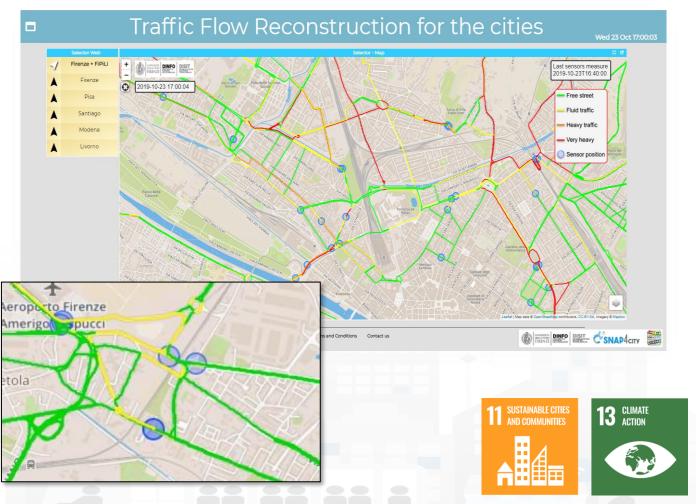




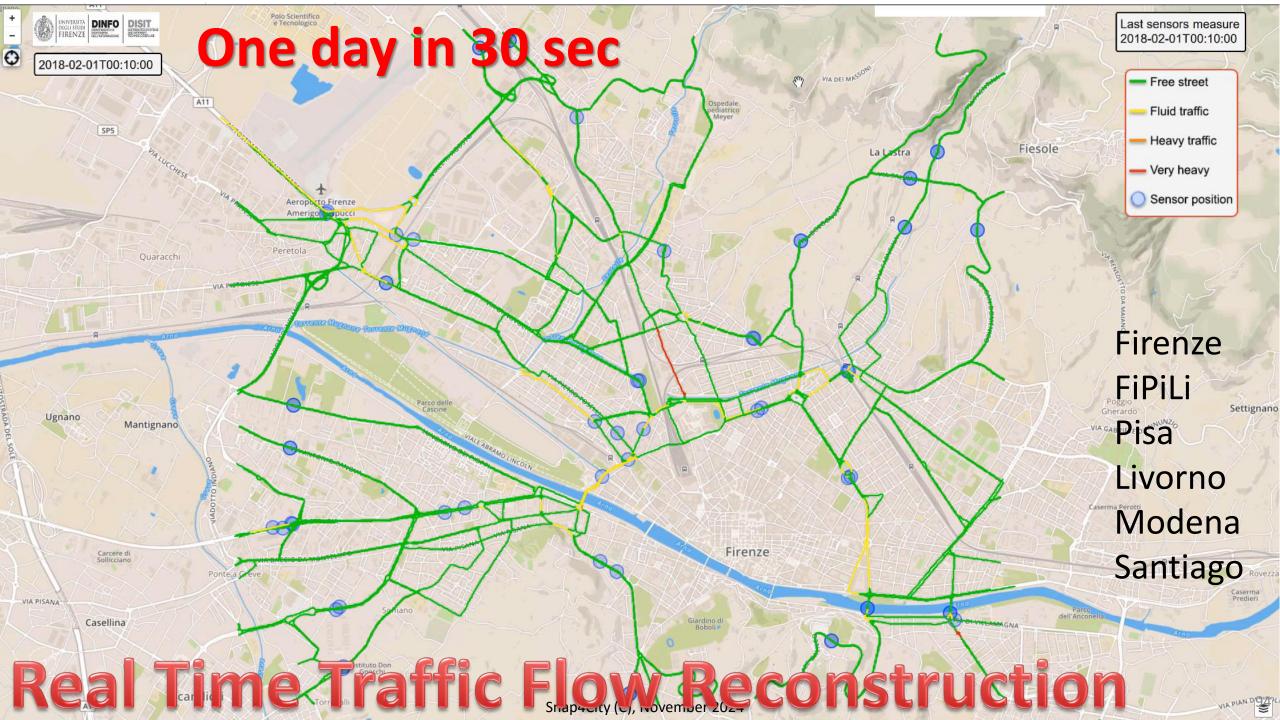


Why Dense Traffic Flow Reconstruction?

- Controlling pollution
- Dynamic Routing for Firebrigade, Ambulances, general public
- Planning Public
 Transportation routing



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc5NQ==













Decision Support Systems, What-if

Snap4City (C), November

Event planning, via what-if analysis

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

Immediate reaction to natural events or not

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

Digital Twin

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











Select map Zoom

Scenario name: Scenario name Location: Scenario description: Scenario description ReferenceKB: Reference KB Save Road Graph: Yes 🕶 Save traffic Sensors: Yes v Save other Sensors: Yes ∨ From: gg/mm/aaaa **Edit Road** gg/mm/aaaa --:--Show Summary | Cancel Segment Category Street: primary Nr.Lanes: Speed Limit (km/h): Direction: Positive direction > Restrictions: Select or create restriction Update identifier + composition S elemLocation Select All Unselect All **☑**bridleway ☑bus_guideway☑bus_stop elementClass construction Corridor ✓ disused **⊠**elevator C elementType ✓emergency_access_point emergency_bay ✓ island ☑living street c length ✓ motorway **☑**platform ☑motorway link ☑no operatingStatus **primary** primary_link razed ✓ private speedLimit residential ☑rest area secondary linkservice View **e** Edit **I**tertiary services ✓ steps ☑ tertiary link ☑ track trafficDir Show Road graph tram ☑unclassified ☑via ferrata ✓ traffic island urunk link width Show Traffic Sensors ■bus_guideway Ohm:military:Trench secondary highwayType Filter by road types route

New Scenario

Editing Drag & drop Split & Join Delete Do and Undo



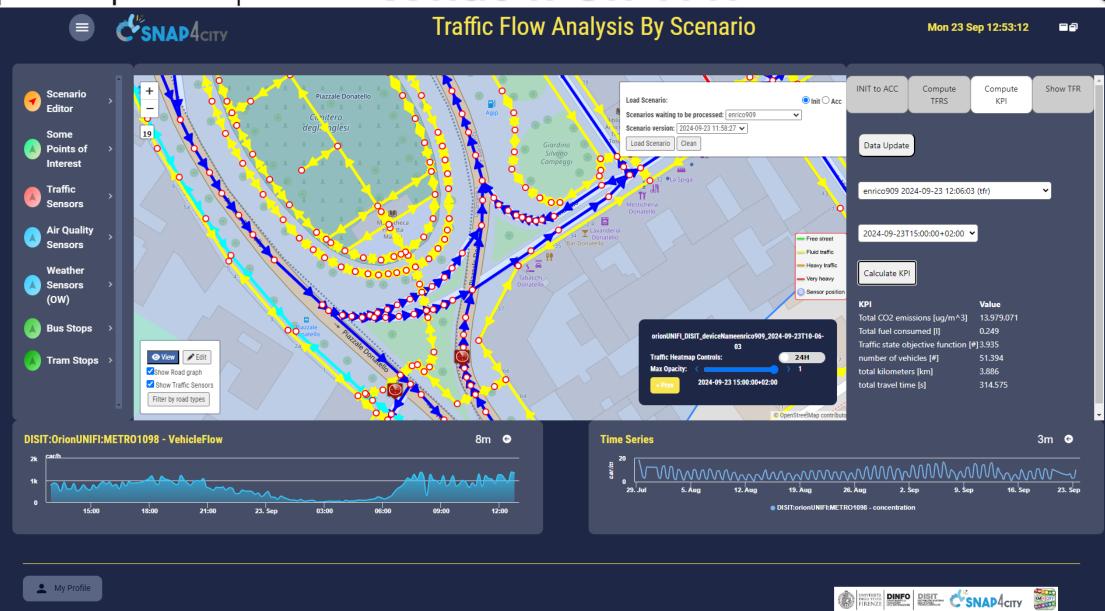
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What-if on TFR









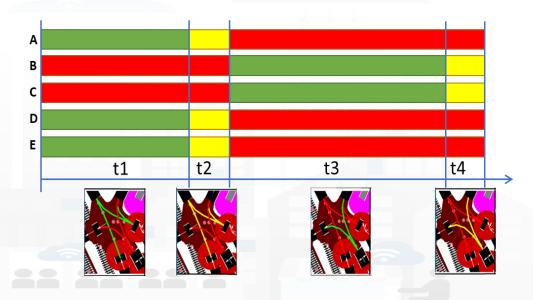




Traffic Light Plan Optimisation, Digital Twin

- Match Multiple Objectives and Synchronization:
 - public and private traffic, tramway priority
 - Micro and Macro Scales
 - Al: Genetic Algorithms, Reinforced Learning
 - Fixed and Actuated Cycles
 - Adjusted on Demand
- Validation/integ. with SUMO simulation
 - Travel Time, waiting time, waiting count
 - Specific travel time on directions
 - CO2 emissions, etc.
- Reductions from 5% to 15%





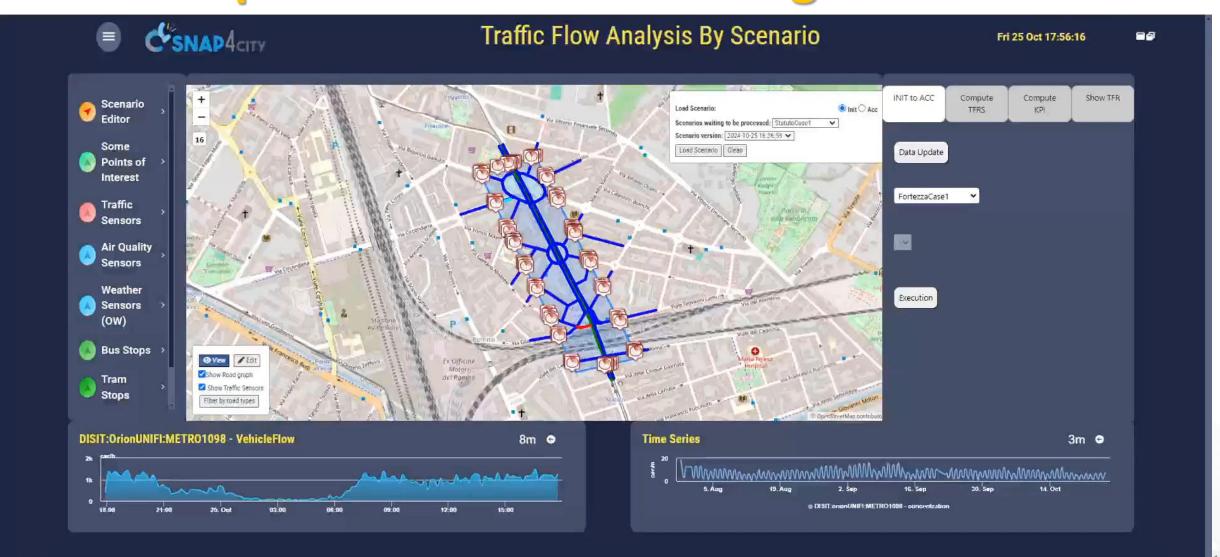








Optimization of Traffic Light Plan







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













Mean Travel Time

	Traffic Load	MTTall	MTT dir_N	MTT dir_M	MTT dir_A	MTT TW Careggi	MTT TW Costanza
4TW-NTNS-MWD-P	1.5	3542.50	198.90	242.14	197.64	436.00	427.00
4TW-NTNS-MWD-A	1.5	3242.71	178.33	243.28	195.79	436.00	427.00
4TW-NTNS-MWD-P-A	1.5	3242.71	178.33	243.28	195.79	436.00	427.00
2TW-NTNS-MWD-P	1.5	4538.02	207.40	456.14	615.00	436.00	427.00
2TW-NTNS-MWD-A	1.5	3940.07	179.30	428.67	481.53	436.00	429.75
2TW-NTNS-MWD-P-A	1.5	4380.63	182.05	456.59	654.21	436.00	427.00
SUMO Actuated	1.5	3409.13	280.09	515.34	200.66	497.54	499.81
Webster	1.5	6474.95	465.45	441.93	210.50	1379.25	493.87
WebsterAdjusted	1.5	4035.08	195.82	441.09	205.66	463.87	447.06
		-5%	-8%	-45%	-3%	-6%	-4.5%

Reductions of Travel time of 3-45% and elimination of the #stops for the tramways

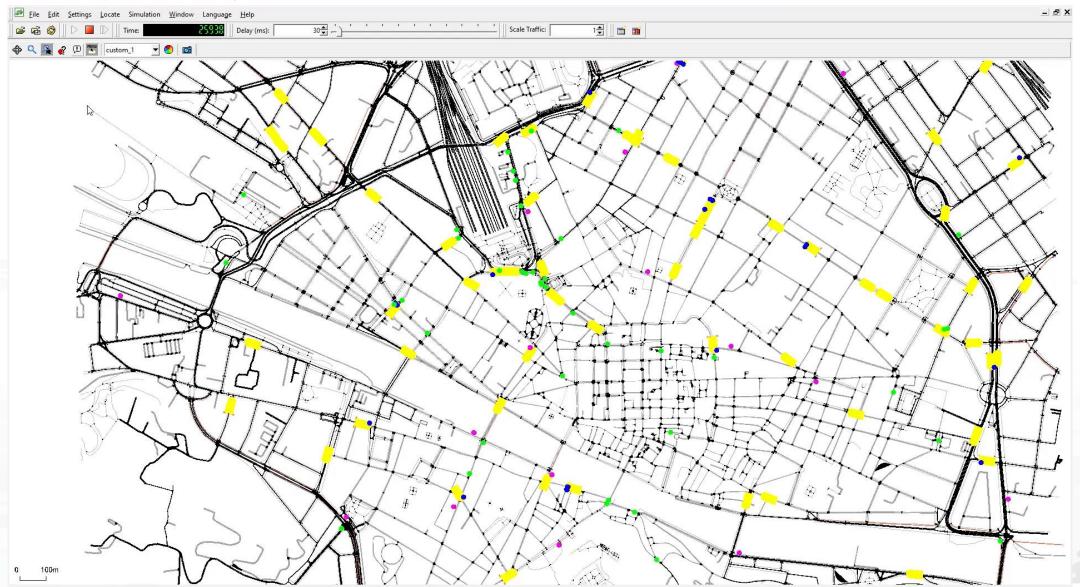
4TWD-NTNS-MWD-P-A: optimization by prioritizing traffic **directions**, the normalized number of **vehicles stops**, *NTNS*, **the mean waiting delay** *MWD*, for all traffic lights, and post synchronization, with Penalty and Adjust dynamically performed



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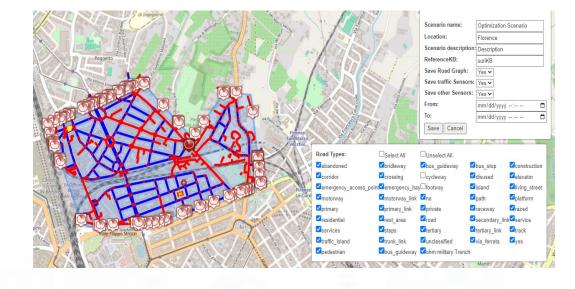






Traffic Infrastructure Optimisation, Digital Twin

- Identification of Scenario (Scenario Editor), any changes
 - Definition of traffic loads by flows
- What-if or Automated Optimisation
- Automated Optimisation:
 - Stochastic Relaxation, Simulated Annealing, Traffic Flow Reconstruction
 - Multiple objectives targeting
 - Travel time, emissions, fuel consumption, traffic status
 - Limiting the number of changes





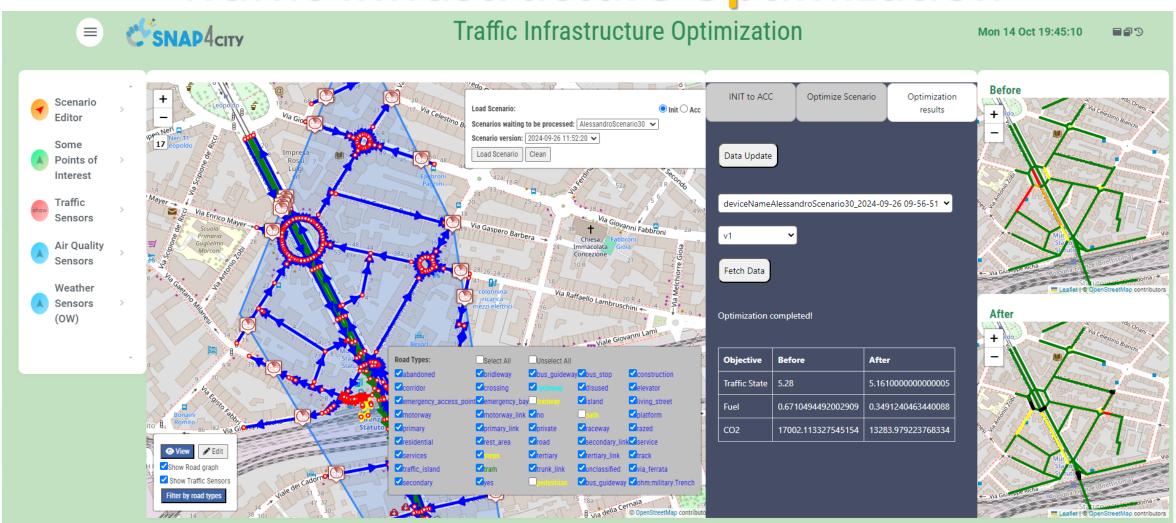








Traffic Infrastructure Optimization











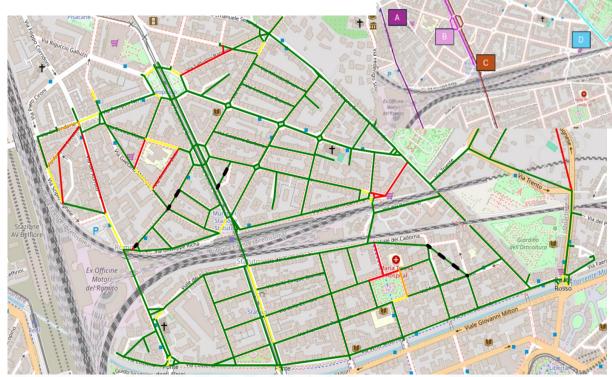




Optimization Results



Case max 4 changes	KPI estimation on the best solution				
Optimization Target	Traffic State	Fuel	CO2		
Optim 4 Traffic State	91.341- 21 %	17.964	128536		
Optim 5 Fuel	91.514	16.633 -35	% 128227		
Optim 6 CO2	92.859	19.192	127876 - 23		
Original	115.475	25.680	165822		



Travel Time [s]	Path A	Path B	Path C	Path D	Total Time
Original Scenario	183.2	59.6	80.9	132.5	456.4
Optim 4 Traffic State	93.2	60.0	63.7	96.0	313.1
Optim 5 Fuel	89.6	51.2	59.7	96.4	296.9
Optim 6 CO2	89.5	53.2	58.4	100.1	301.3

-28%



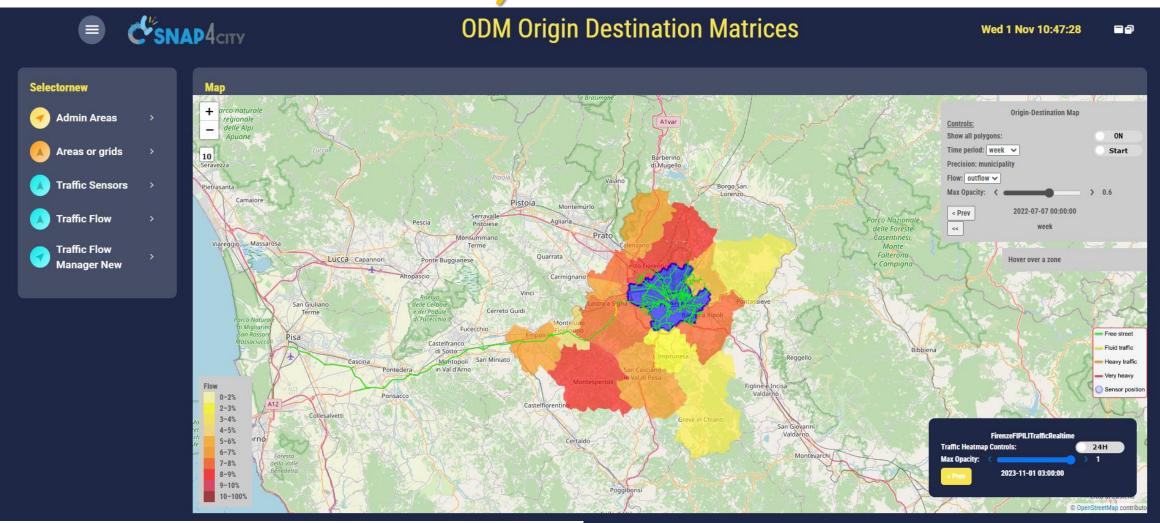








ODM, Traffic Flow



https://www.snap4city.org/dashboardSmartCity/view/Gea-Night.php?iddasboard=Mzk3Nw==





What-if Analysis on Pub Transport







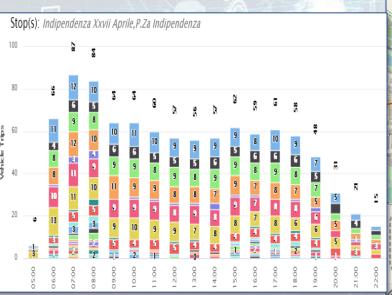


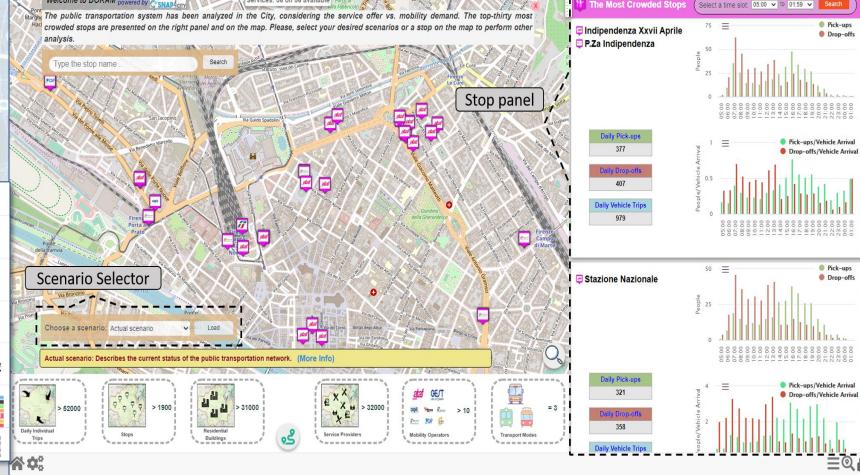


- Definition of scenarious impact on
 - Traffic, Pollutant, parking, public transport, private flows, etc.

KPI analysis

Public Services





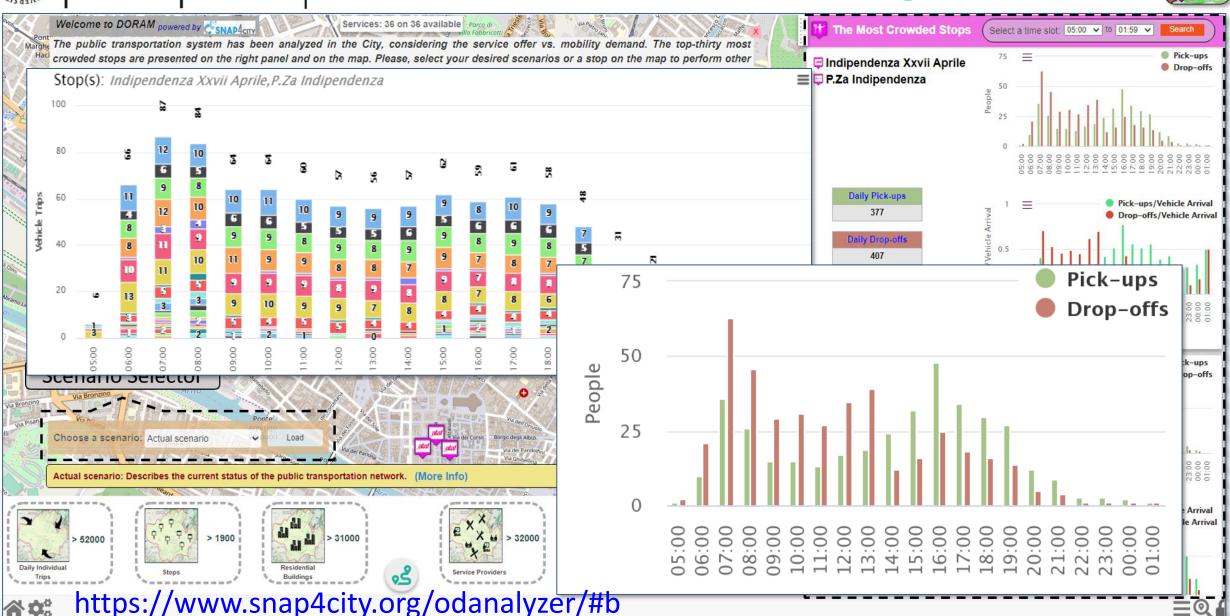


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DORAM









Road Parking

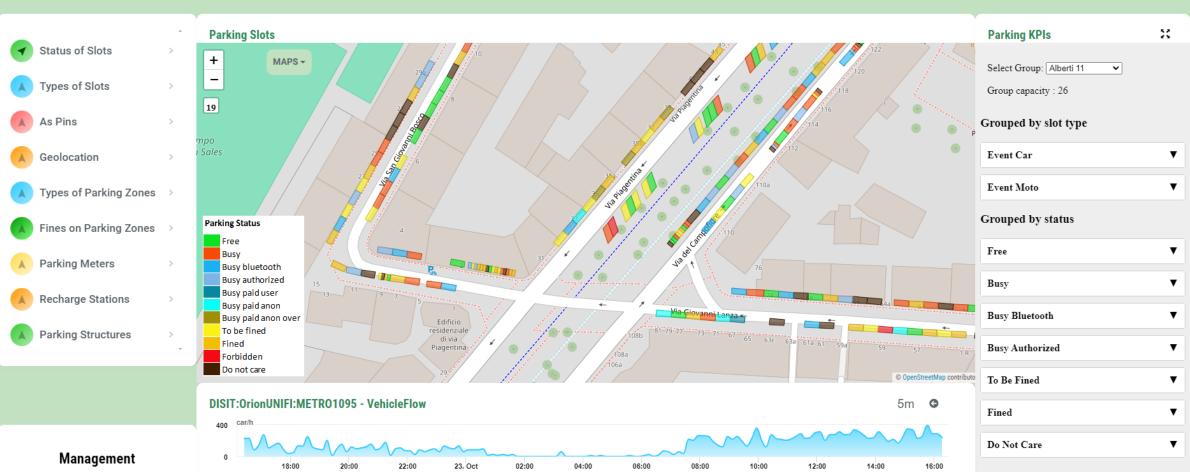




Parking Conditions Monitoring

Wed 23 Oct 16:30:45







My Profile











Road Parking

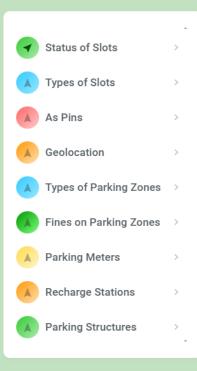


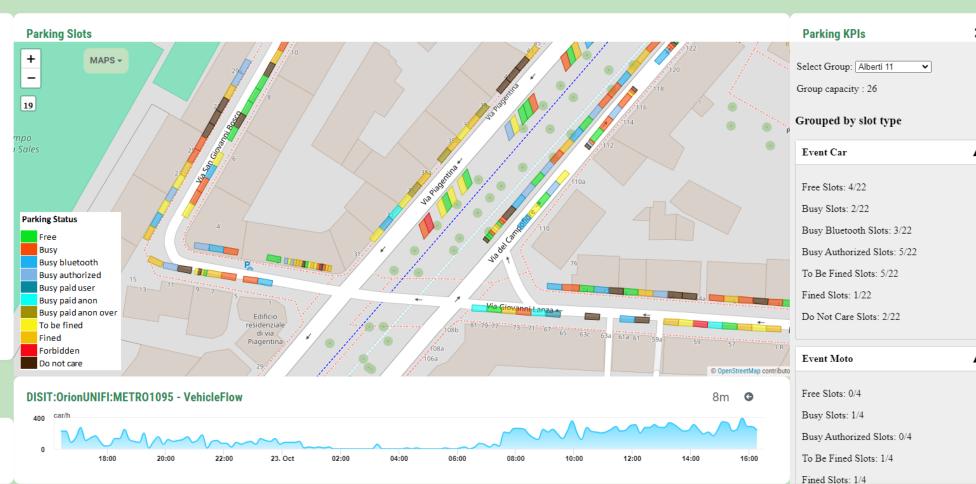


Parking Conditions Monitoring

Wed 23 Oct 16:24:41







Management

















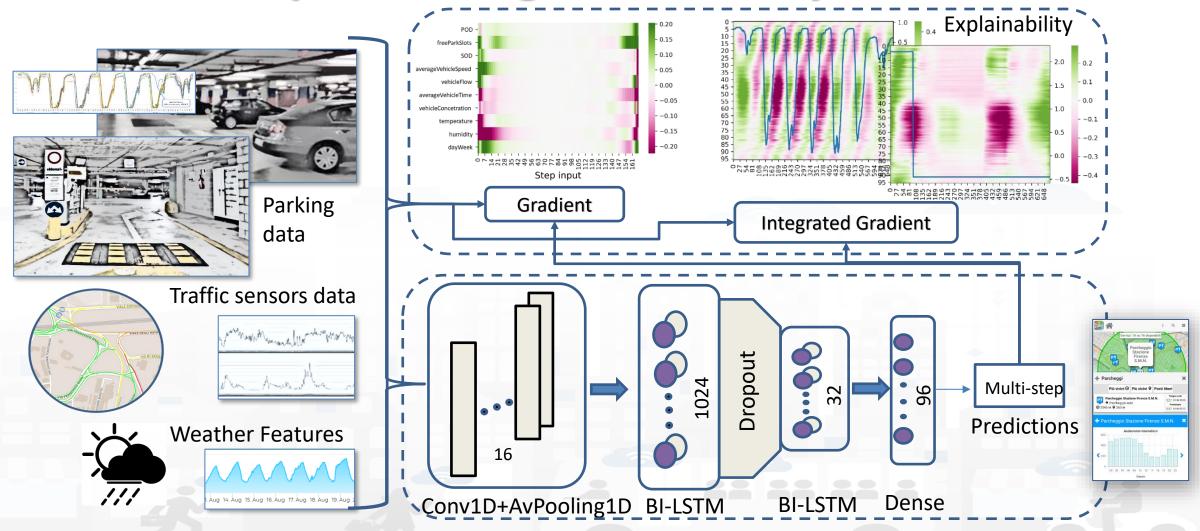








Deep Learning AI to surely Park!

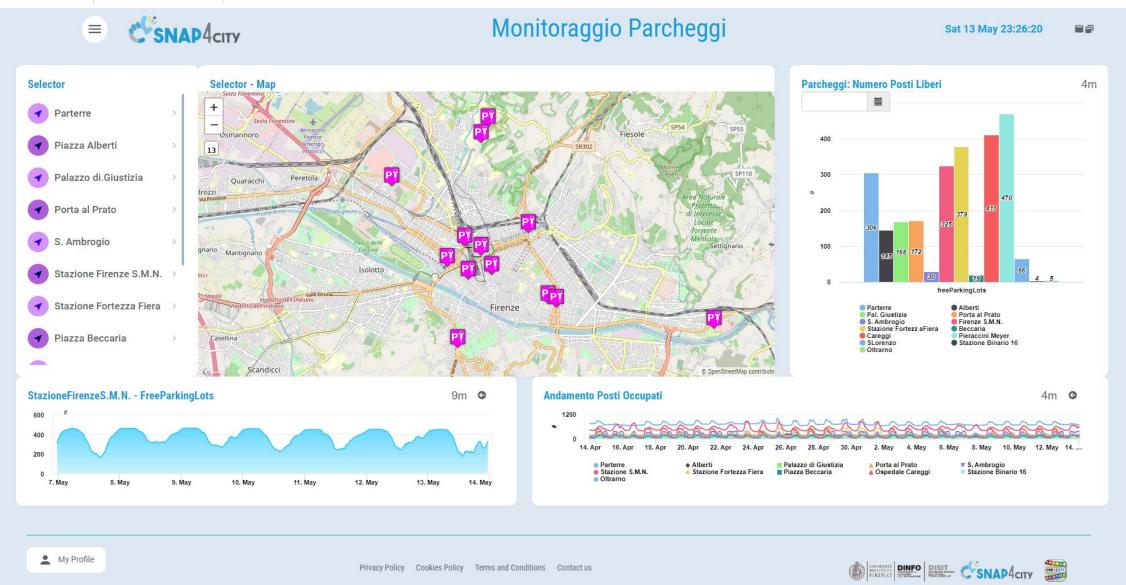












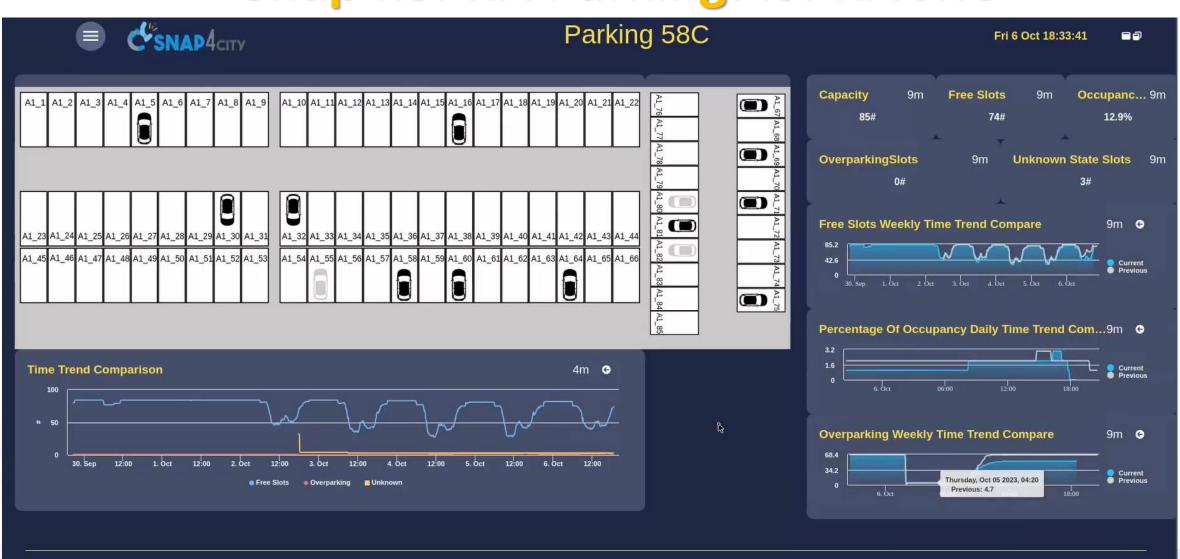








Snap4ISPRA Parking: ISPRA JRC





DASHBOARD TO

APPLICATIONS



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SNAP4CITY AND KM4CITY PROJECTS

SNAP4CITY THE VIEW OF THE **ADMINISTRATORS**

Application: esharing and Powling



eShare in a Snap, by Snap4

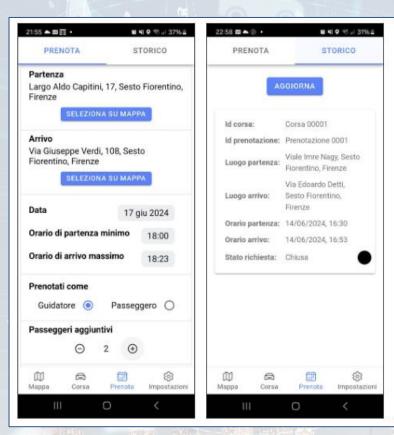


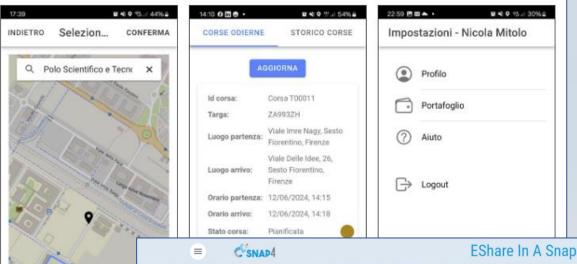
Sun 16 Jun 23:17:54

Gestione

Prenotazioni







Gestione

Utenti

ng ZA-991ZHO

Gestione

Veicoli

Gestione

Corse

Integrated car sharing and pooling
Multiple drivers on the same means
Dynamic pooling and e-sharing

Snap4City (C), November 2024









Humang & Behavior analysis & security for and flexible web and mobile apps

FROM CITY DASHBOARD TO APPLICATIONS



SNAP4CITY THE VIEW OF THE ADMINISTRATORS

AND KM4CITY PROJECTS





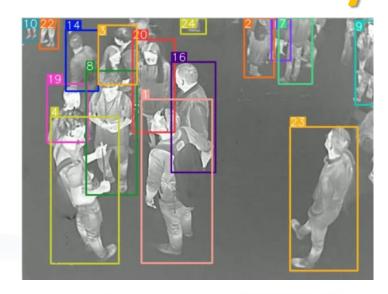


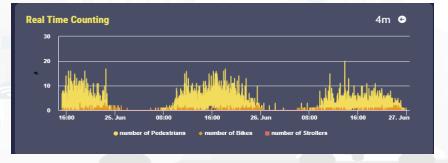






- Improve Quality of Life and quality of services,
- Over tourism mitigation, sustainability
- Costs reduction of services
- Improve accessibility to services: citizens, Tourists, commuters, etc.
- Improve Security/Safety of city users
- **People Flow Analysis / Management:** in/out-door, retail, attractions
 - Counting, tracking, Flows, ODM, sentiment, 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 suggetions, 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, ...













• Goals:

City User Behaviour/services, Tourism and Safety (2024/8)

- Quality of Life, quality of services, over tourism mitigation, sustainability
- Costs reduction of services
- Accessibility to services: citizens, Tourists, commuters, etc.
- Security/Safety of city users
- Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)
 - Monitoring services: tickets, reputation, usages, areas, etc.
 - Monitoring user behaviour (counting, trajectories): indoor/outdoor, hot places/services, ports, beaches,
 - Computing: origin destination, trajectories, travel means, etc.
 - Early detection/warning of critical conditions, connection with Video Management Systems
 - Managing entrances in city areas: restricted areas, touristic busses, etc.
 - Production of info-toursim, recommendations, nudging to city users and operators, second offer promotion
 - Providing Virtual Assistants for City Services, Tourist Offices, etc.
 - Monitoring reputation of services via: social media, blogs, etc.
 - Collecting complains, requests, participations from City users via mobile apps
 - Computing predictions of any kind
- Solutions for Planning (optimization and what-if analysis)
 - Reduction of Pollutant Emissions, via optimization
 - Optimization plan to distribution of workload on multiple touristic offers/services, area cleaning, etc.
 - Predicting reputation of services, touristic and operative
- Algorithms and computational solutions, see next slide









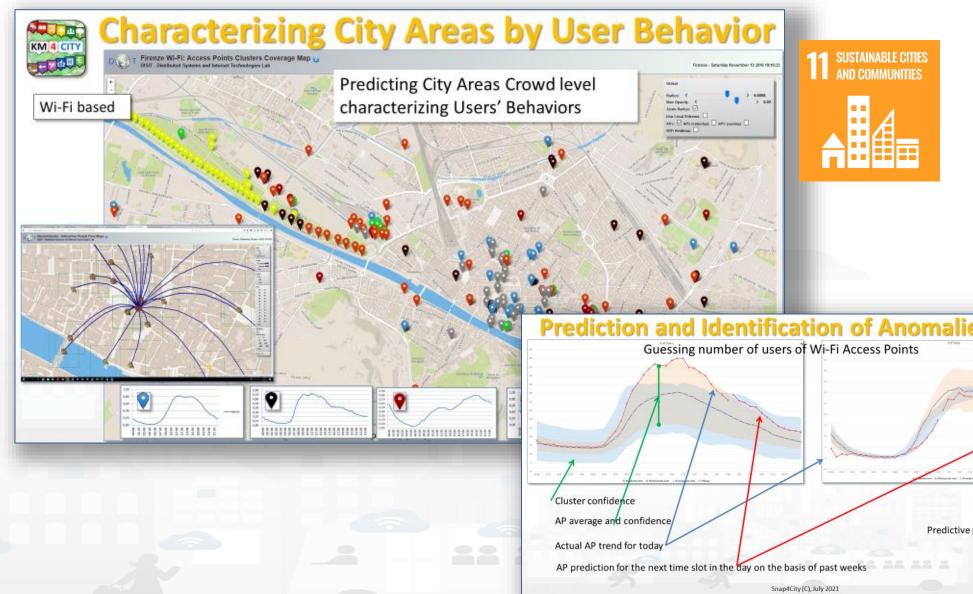


Snap4City (C), November 2024



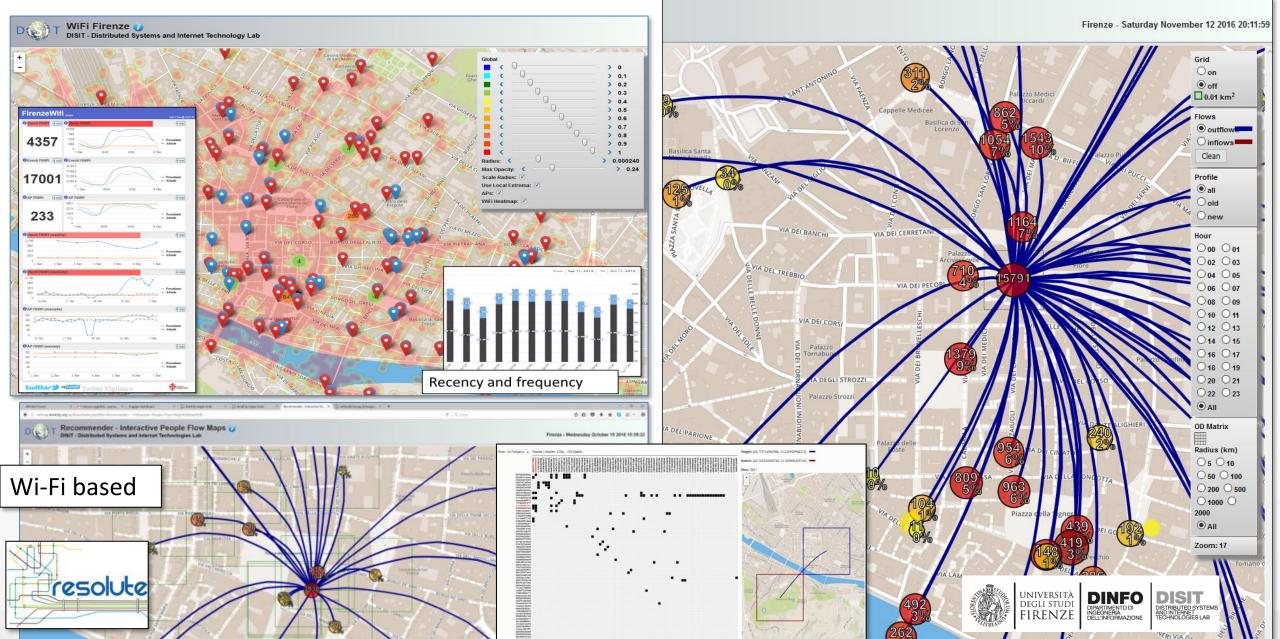
130

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



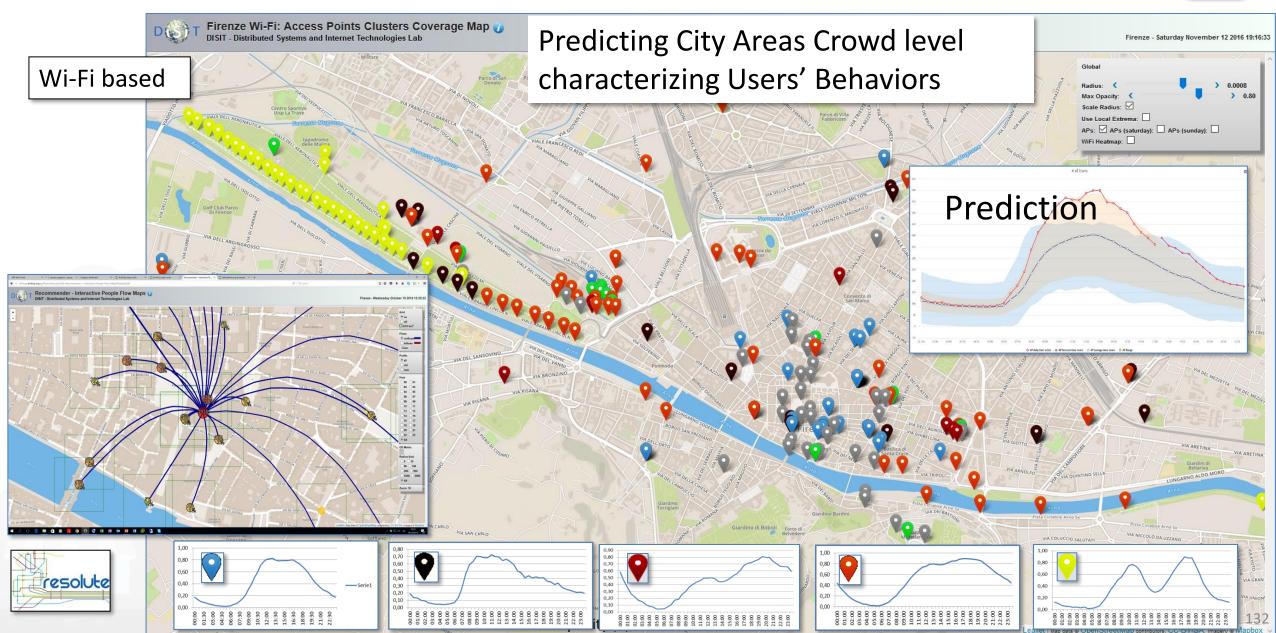
Origin Destination Matrix Estimation





Characterizing City Areas











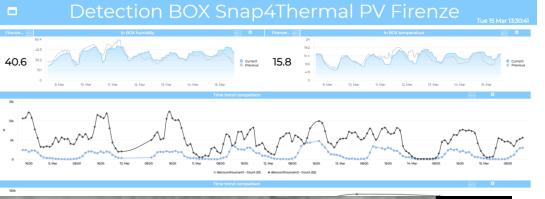








A view and data from the Thermal Camera













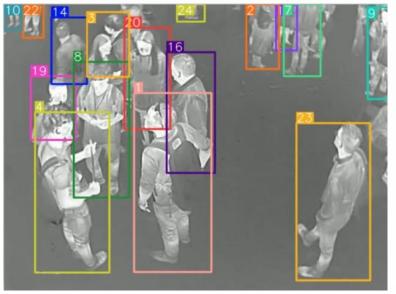


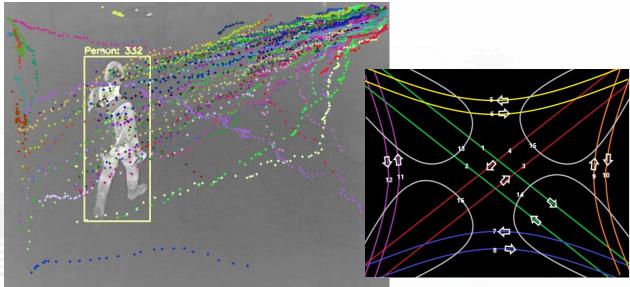




People Counting and Tracking











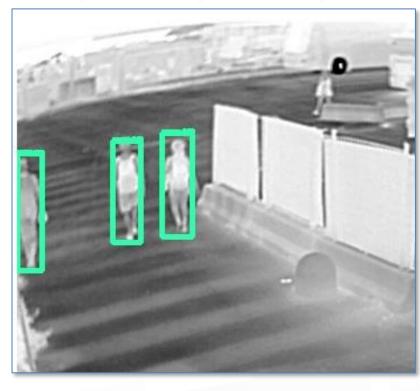










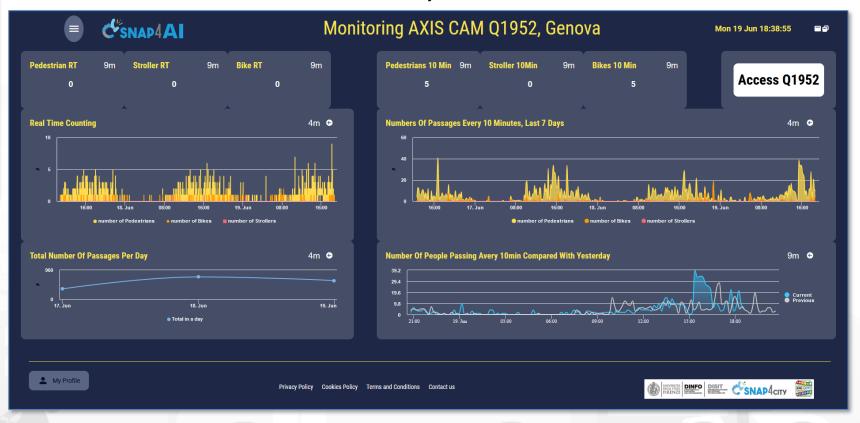


SUSTAINABLE CITIES AND COMMUNITIES

Monitoring Passages AXIS Q1952



Genova: Ocean Race, 2023







Tourism management, over-tourism

Operation:

- Monitoring: counting, tracking, flows, ODM, etc.
 - Differentiating: tourists, commuters, resident, students, etc.
 - Differentiating on Restricted zone: permissions
- Early warning detection, predictions, etc.
- Collecting participation, complains, etc.
- Producing suggestions towards second offers, diversification
- Informing of crowed conditions

Management

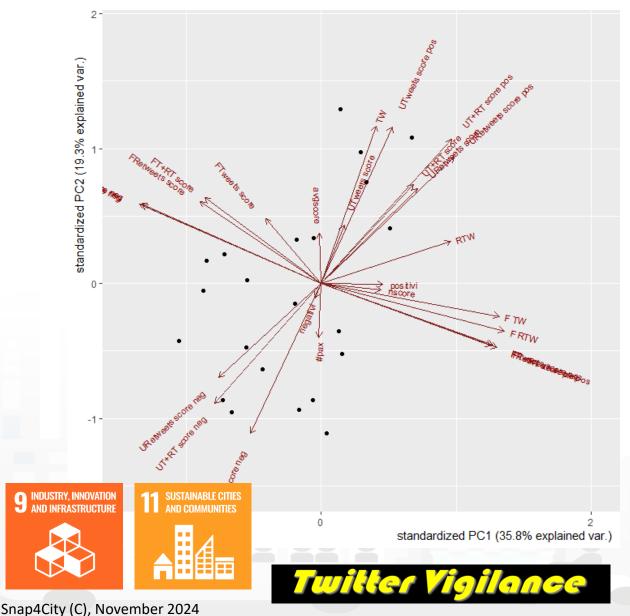
- Promoting best moments for visiting, pushing event organizers
- Simulation and plan, improve services: transportation, sharing
- Assessing and predicting reputation



Reputation



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







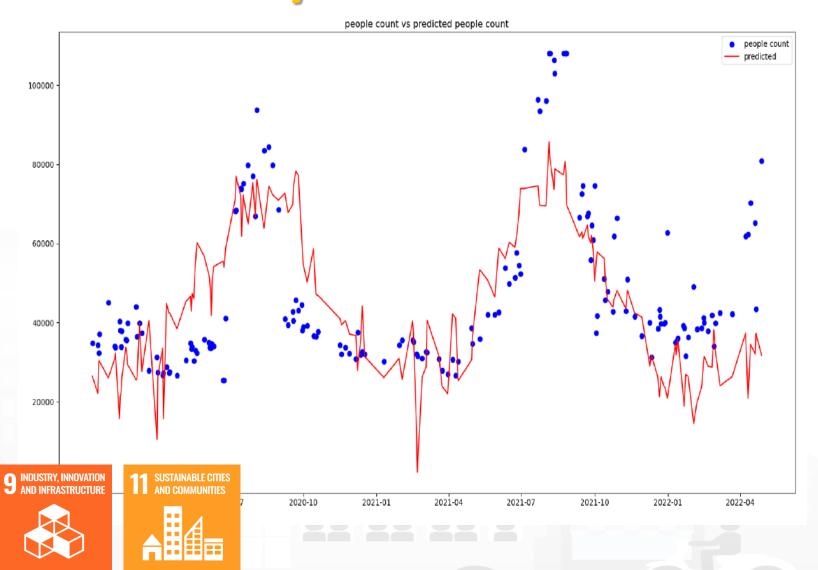




rovnik: Data Analytics

 Assessing impact of advertising

- Prediction of presences on the basis of
 - Social Media Twitter Vigilance
 - weather conditions
 - Historical data







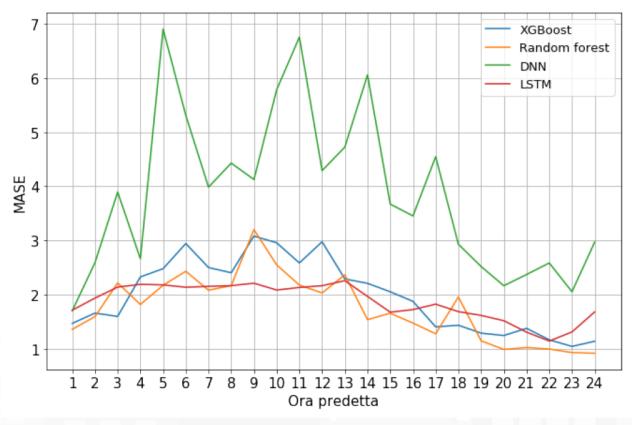


Pont du Gard: data analytics

 Prediction of the number of sold tickets
 24 hours in advance

- Using:
 - Historical data
 - Weather conditions
 - Social Media









SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES







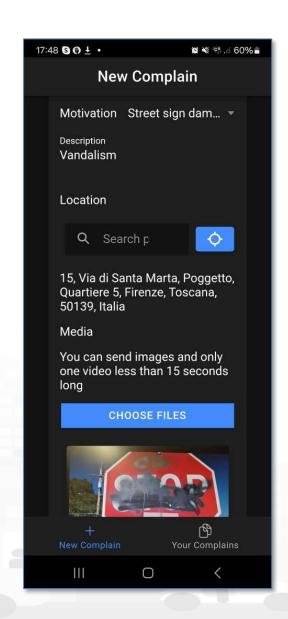






Event Managements

- Bidirectional events: from VMS to Snap4City and viceversa
 - From/to Snap4City to any service...
- Snap4City collects and manages events from:
 - Video Management System
 - Mobile Apps, city user complaints, operators, etc.
 - Web Apps, city users and operators
 - Early warning detected from Snap4City, etc.
 - Maintenance management tools, ...
 - Other channels, ...





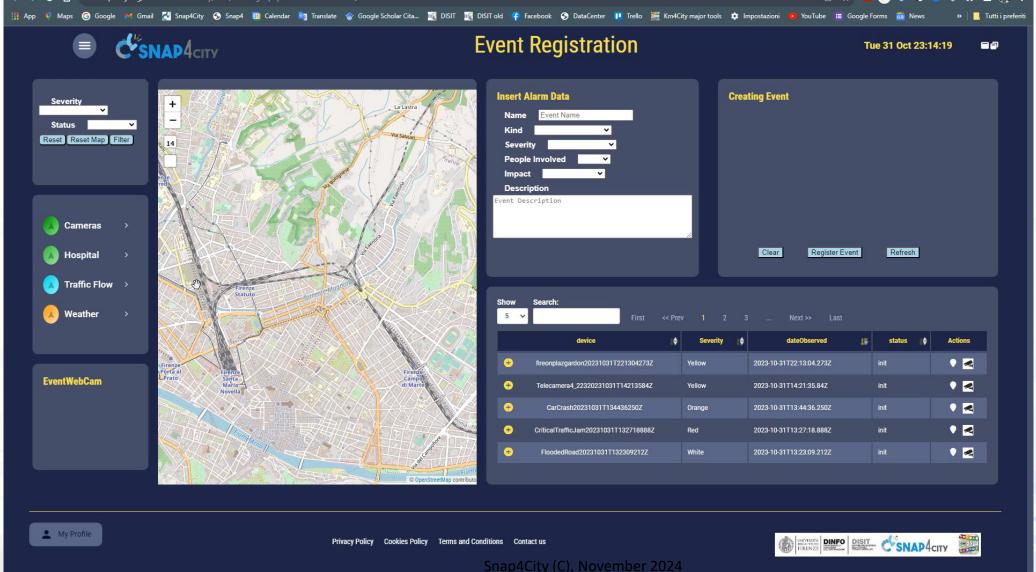








Event Management





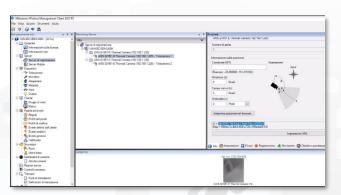


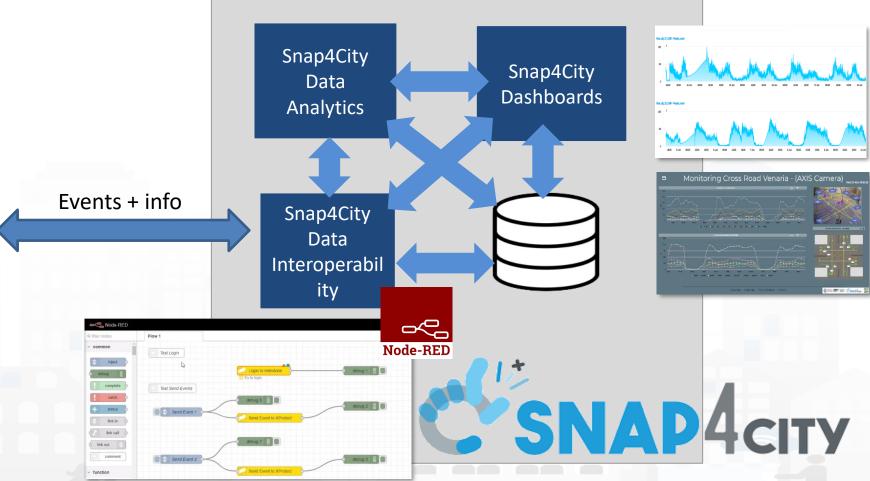




VMS vs Snap4City: sending and getting events, AI solutions







SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES









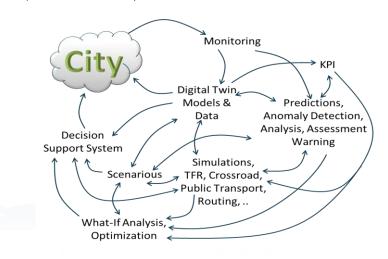


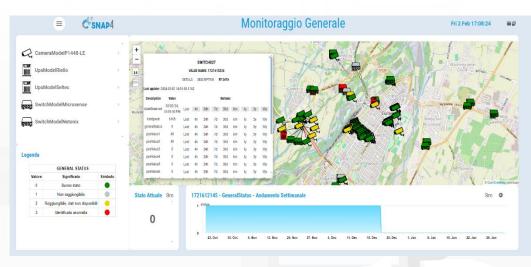


Goals:

Assets Control Domain (2024/8)

- 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
 - Ftc
 - 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





Cuneo Assets' Monitoring, Safety





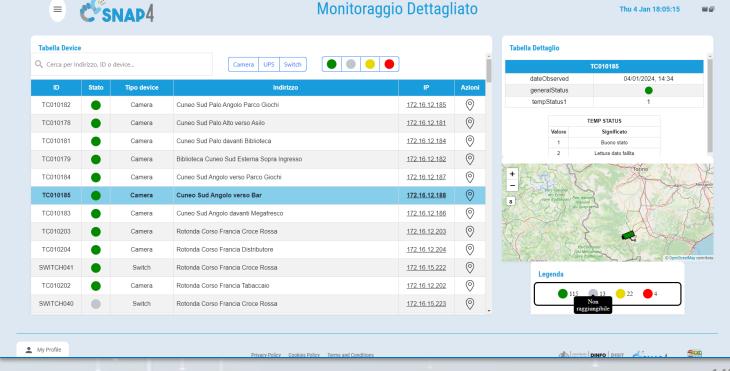
More than
 400 devices



- 49

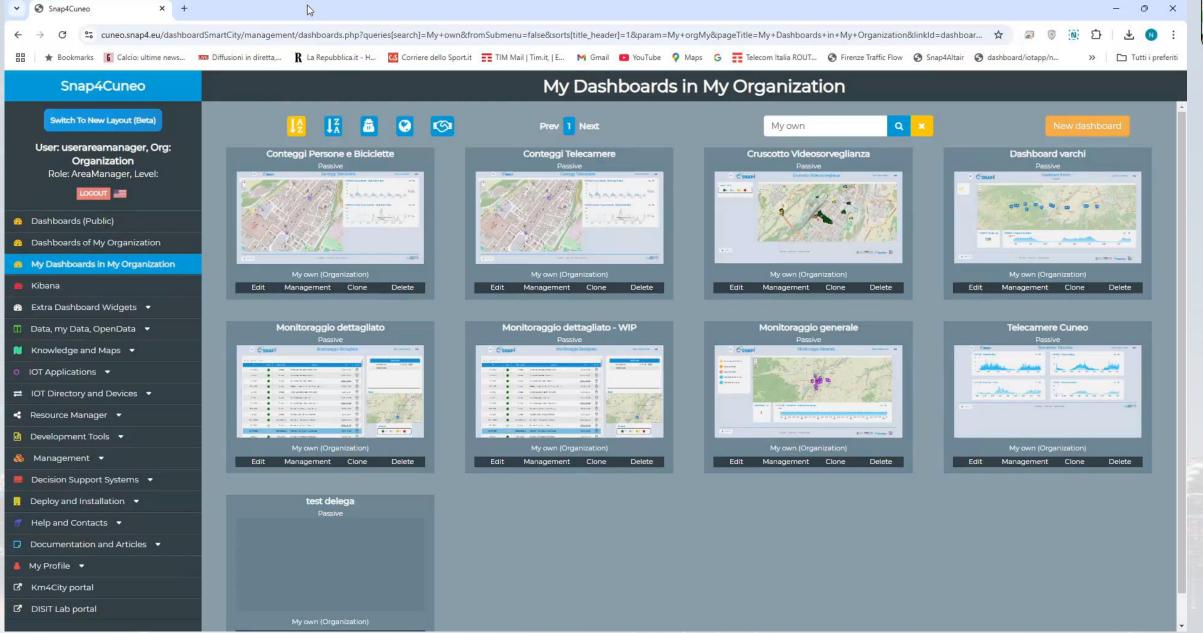
 29. 06:00 12:00 18:00 30. 06:00 12:00 18:00 31. 06:00 12:00 18

 Privacy Policy Cookies Policy Terms and Conditions
- TV Cams: color, Thermal
- Traffic Gates
- Switches
- UPS



Cuneo Assets' Monitoring, Safety







DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB DISTRIBUTED DATA INTELLIGENCE



SNAP4CITY AND KM4CITY PROJECTS

SNAP4CITY THE VIEW OF THE

ADMINISTRATORS

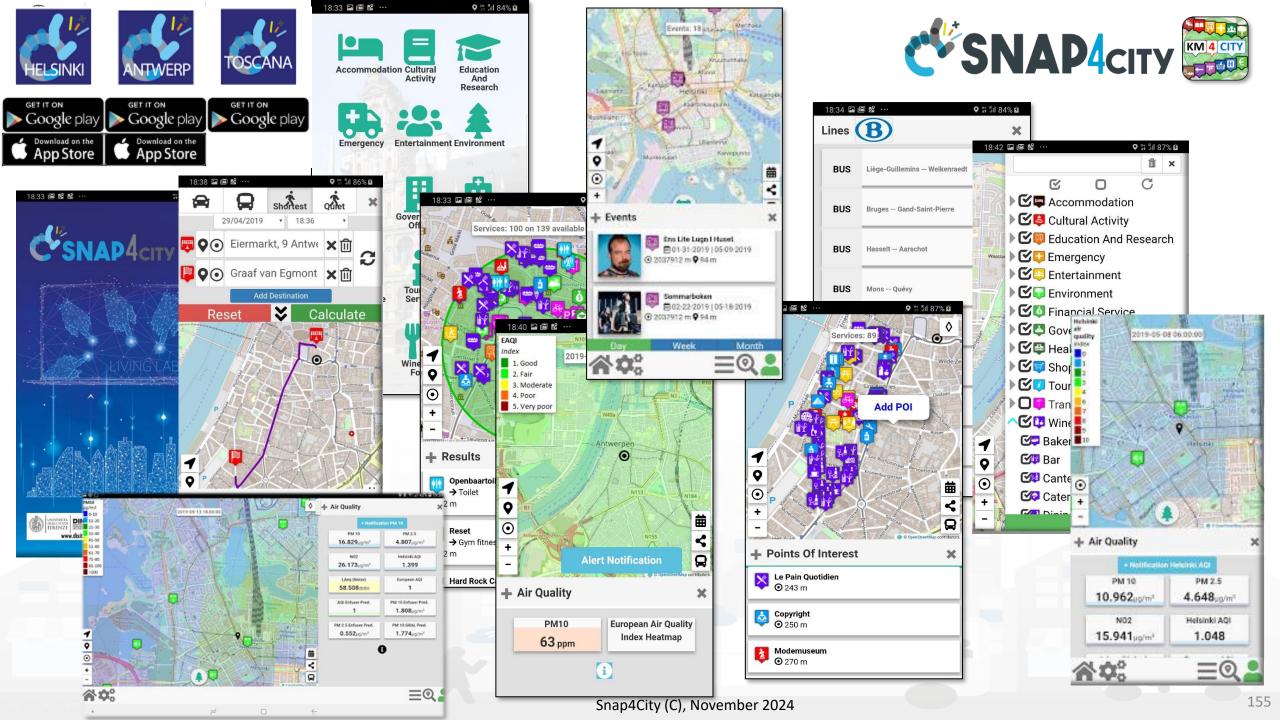


FROM CITY
DASHBOARD TO
APPLICATIONS

DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT







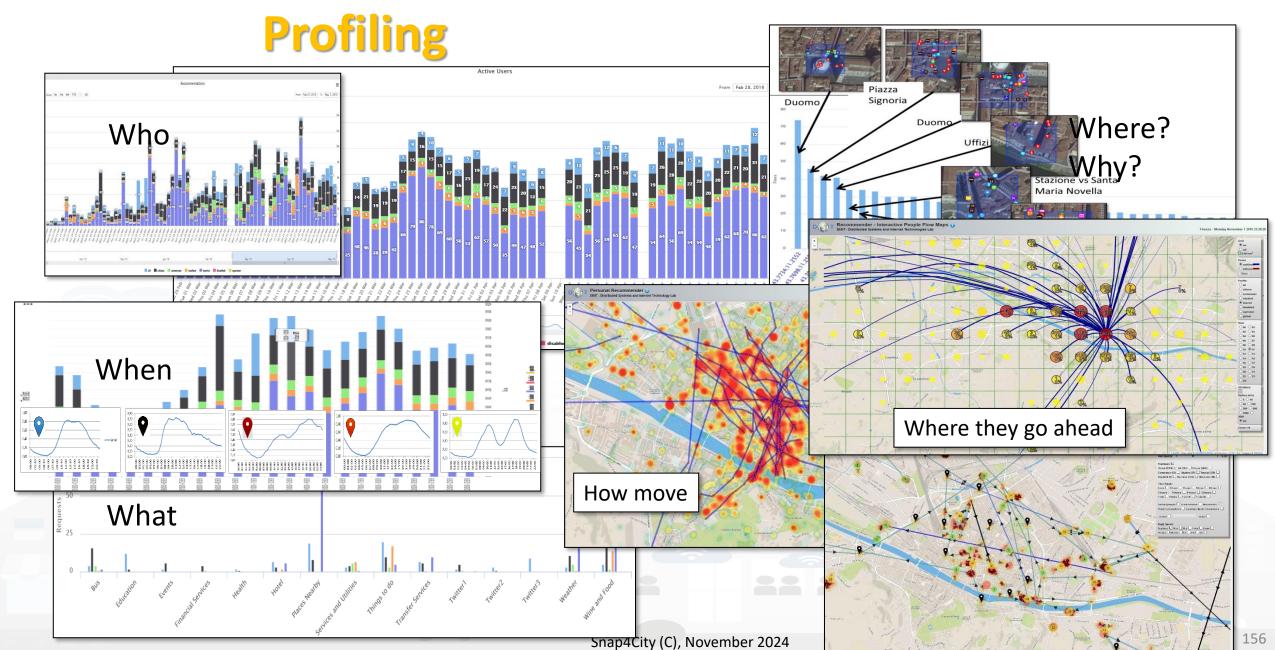






User Behavior Analyser for Collective









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













Environment and Waste

- Goals:
 - Reduction of emissions and EC taxations
 - Cost reduction for waste collection,
 - reduction of waste collection impact on mobility
- Environment Management producing predictions/prescriptions:
 - Monitoring and long and short-term predictions, warning for:
 - GHG, emissions, pollutants, aerosol, chemical plants analysis
 - land slide, coastal erosion (blue economy)
 - Traffic Flow impact emissions, predictions
 - What-if analysis, optimisation tools
- 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, ...





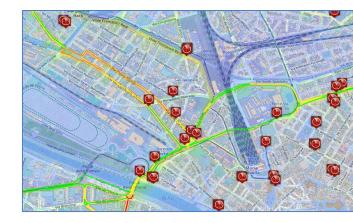






Environment, waste, land, etc., domain (2024/8)

- Goals:
 - Reduction of emissions and EC taxations
 - Cost Reduction for waste collection, reduction of waste collection impact on mobility
- Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)
 - Monitoring emissions, weather, waste, water, etc.: sensors, traffic, flows,
 - Early detection/warning of critical conditions on *emissions, weather, waste, water, fire, animals, ...*
 - Early detection/warning of critical conditions for landslides, water flooding, beach
 - Smart Waste Management: bins/lockers, waste collection daily plan, pay as you throw, PAYT, etc.
 - Short terms prediction of emissions: CO2, NO2, etc.
 - Production of suggestions, nudging
 - Computing and predicting of long terms KPI indicators of the European Commission
- Solutions for Planning (optimization and what-if analysis)
 - Identification of main CO2/NO2 emissions locations in the city, total production from traffic
 - Reduction of Pollutant Emissions, via optimization: semaphore cycles, viability
- Algorithms and computational solutions, see next slide





Environment and Quality of Life

Air Quality Predictions

Multiple Domain Data

- Traffic Flow data, Pollutant: NOX, CO2, PM10, PM2.5, O3,
- 3D City structure, weather, ...

Multiple Decision Makers

- Pollutant Predictions: NOX, NO2, ...
- City officers, energy industries
- Dashboards, What-IF analysis
- Traffic Flow Reconstruction

Historical and Real Time data

- Billions of Data
- Services Exploited on:
 - Dashboards, Mobile App
- Since 2020

















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 Al









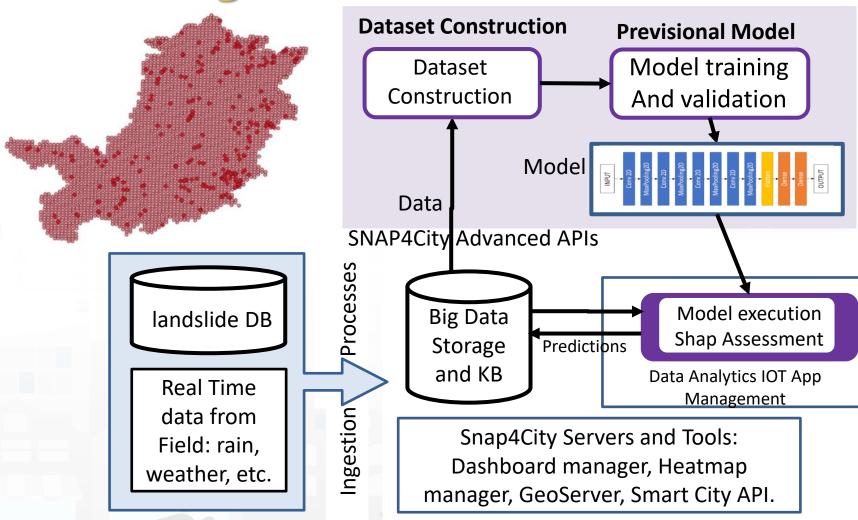


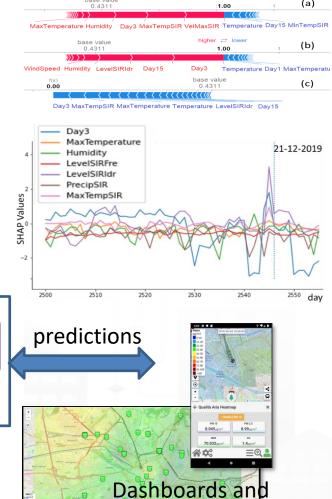






Predicting Land slides





Mobile Apps

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

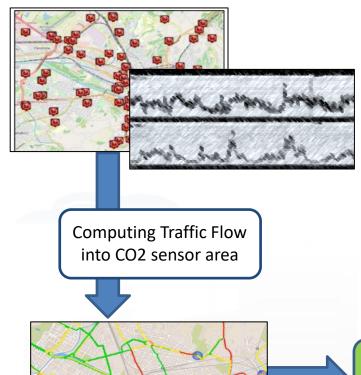








Estimating City Local CO2 from Traffic Flow Data



Traffic Flow is one the main source of CO2 (ton of CO2 x Km x Vehicle)



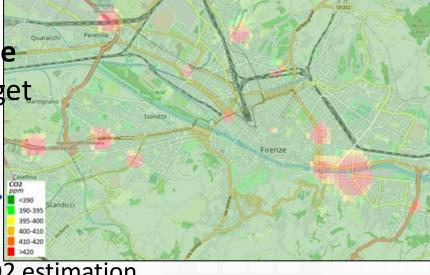


K2: Stop and Go

K1: Fluid Flow

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

Traffic Flow data

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/





INTERNET TECHNOLOGIES LAB DISTRIBUTED DATA INTELLIGENCE AND TECHNOLOGIES LAB

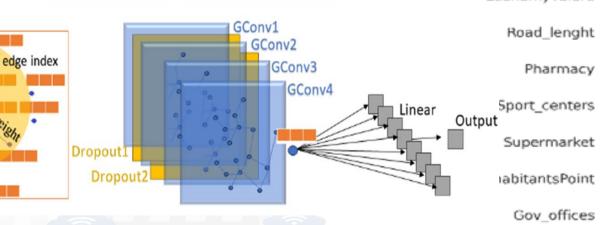


Number of inhabitants

Number of inhabitants
Number of green areas
Surface area of green areas
Number of Taxpayers
Average taxable income
Cost of house per square meter
Number of Supermarket
Number of bicycle paths
Length of bicycle paths
Length of Roads
Number of Churches
Number of Churches
Number of Charging station
Number of bus stops
Number of bus lines
Number of Fuel stations
etc. Etc.

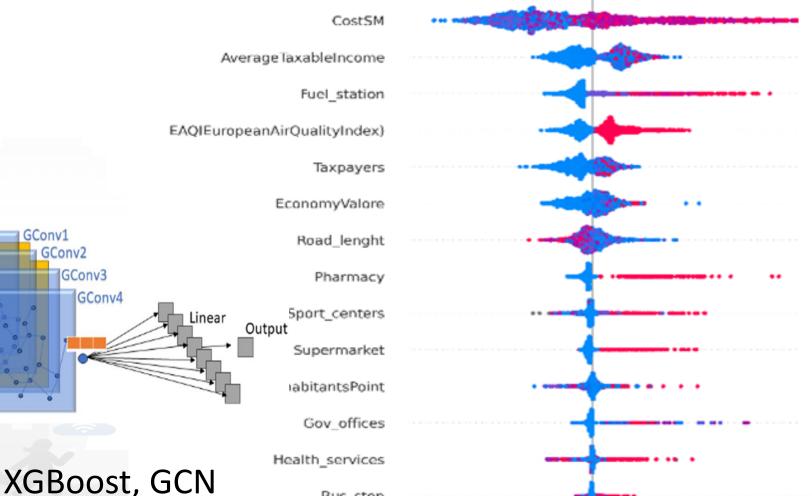
etc. Etc.

Input



CO2 estimation from Open Data via by explainable Al

Bus_stop











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 🦃

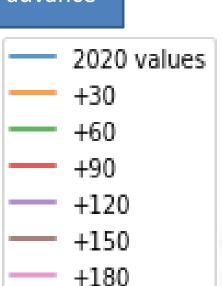
NoxDomestic

numberOfVehicles

NO2cumulated

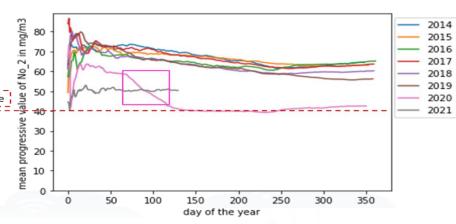
- NO2progresseveMean

numberOfVehiclesCumulated









	Air Quality Directive			WHOguidelines	
Pollutant	Averaging period	Objective and legal nature ar concentration	nd Comments	Concentration	Comments
PM _{z,5}	One day			25 μg/m³ (*)	99 th percentile (3 days/year)
PM _{2.5}	Calendar year	Target value 25 ug/m³	he target value has become a nit 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 (*)	99 th percentile (3 days/year)
PM ₁₀	Calendar year	Limit value, 40 μg/m³ (*)		20 μg/m³	
O ₃	Maximum daily 8–hour mean		Not to be exceeded on more an 25 days per year, averaged over three years	100 μg/m³	
NO ₂	One hour	Limit value, 200 µg/m³ (*)	ot 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	

Smart Waste – Map view



- Reduction of costs for waste collection
 - Optimization of waste collection for the next day, forecast
 - Production of rides and paths for the drivers on waste collection
- Operator:
 - · Refine a search by using the filters on the left side
 - Click on a waste bin pin on the map:
 - A popup with real time data is shown
 - The fullness status of the selected group of bins is shown in the synoptic below the map
 - Specific fullness weekly trends are shown below the map
 - Chick on the «Table view» button to access the other dashboard





Search bins on map by filtering per:

- **Kind** (All, generic, plastic, paper, glass, metal, organic)
- Status (Active, Not Active)
- Fullness (Full, Half-full, Empty)
- Address
- Group of bins (by GroupID)





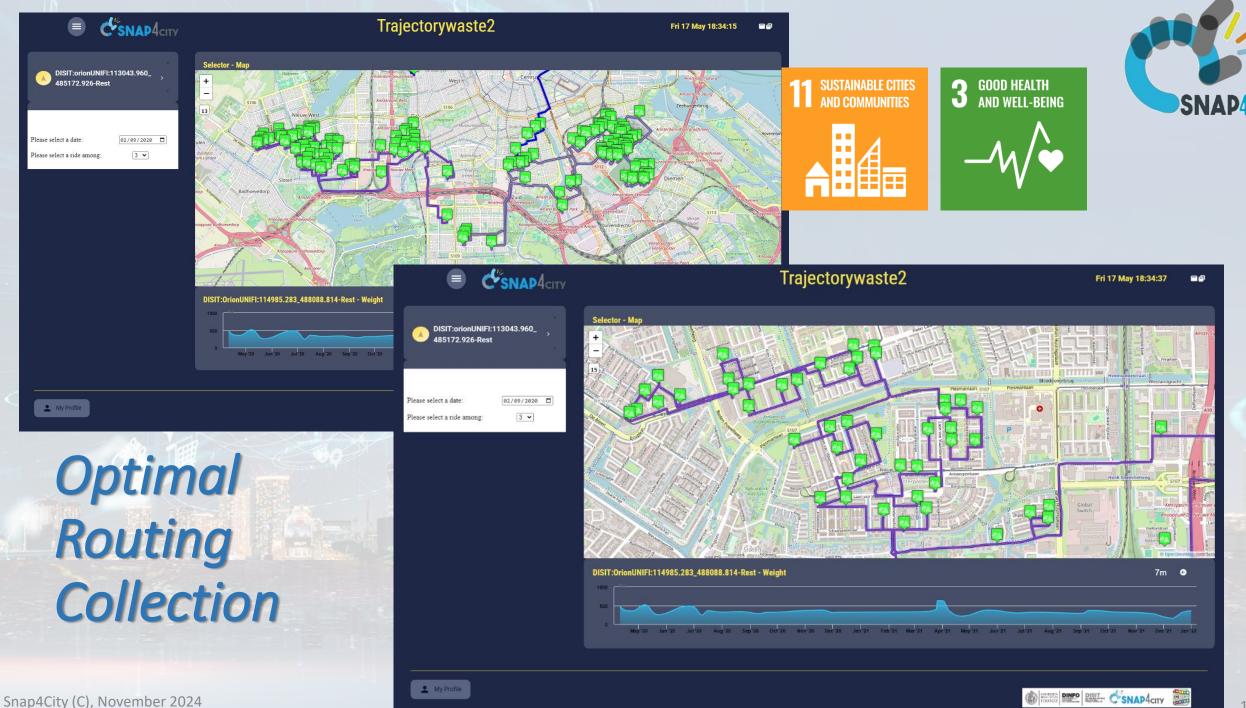










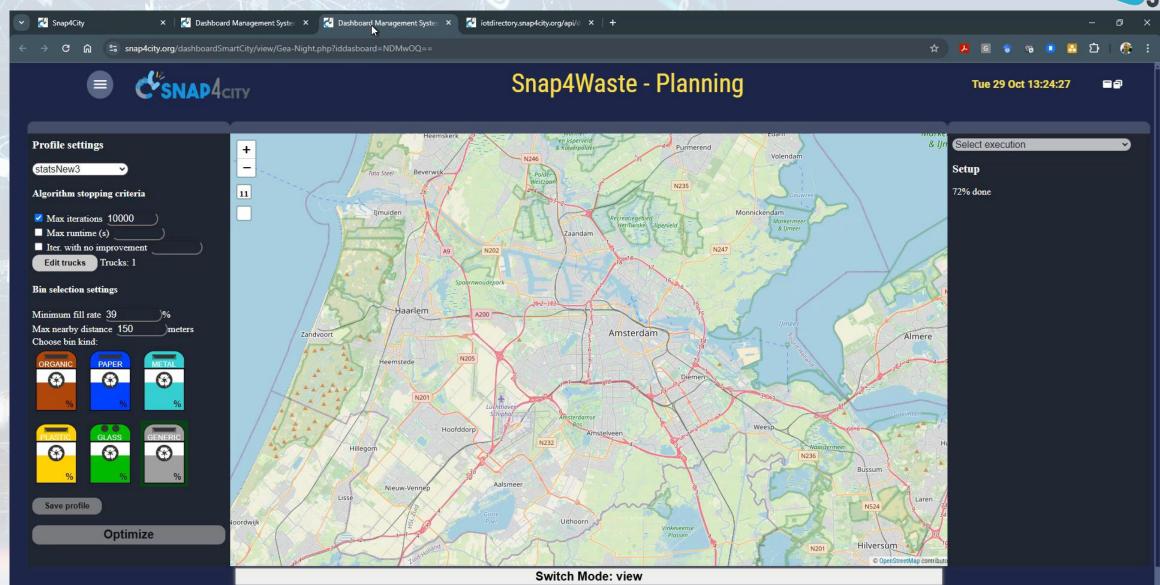


Waste Collection Optimization









Smart Energy

TWITTER
VIGILANCE SOCIAL
MEDIA ANALYSIS





















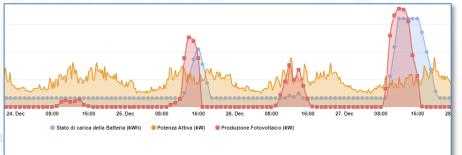
SNAP4city

Energy and Buildings

- 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









Smart Light Control of CAPELON

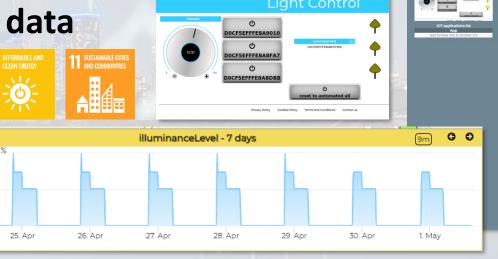




- Energy Domain
 - Smart Light, MQTT,
 - IoT Orion Broker FIWARE
- Dashboards
 - Map coverage on Sweden
 - Monitoring and real time control
 - Energy control, analytics
 - Direct control
- Historical and Real Time data
- Services Exploited on:
 - Multiple Levels, API
 - Dashboards
- Since 2020

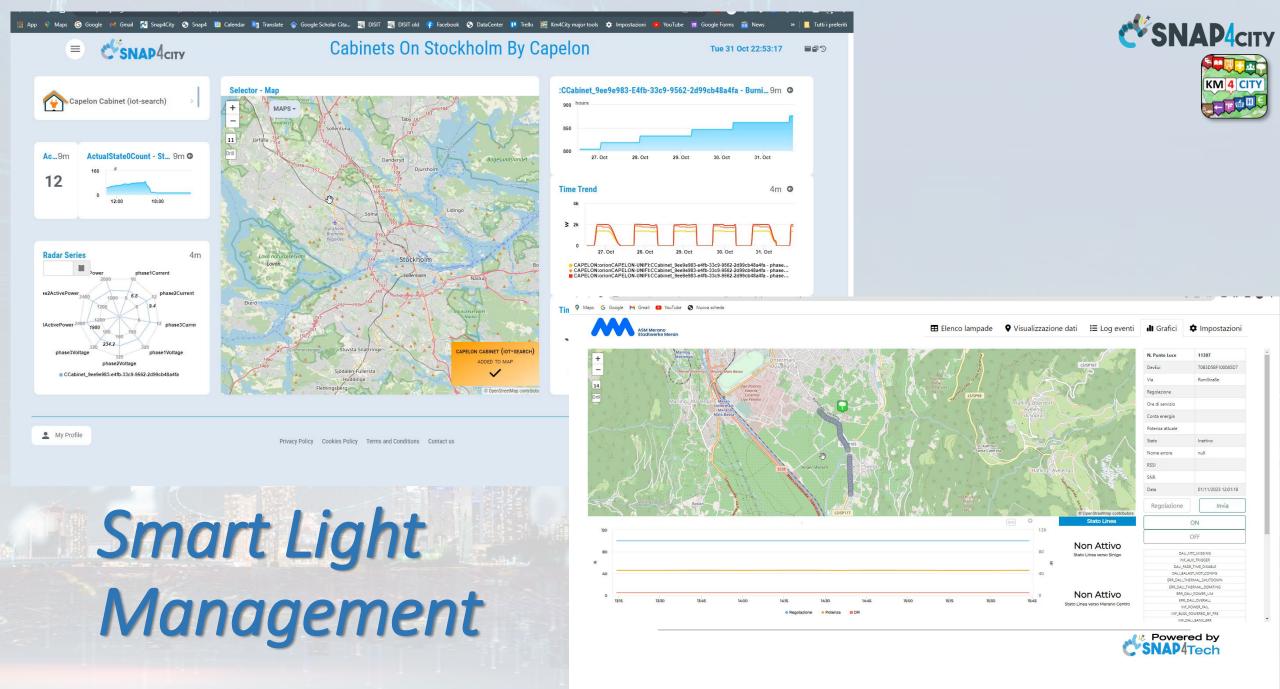






April May 1 Plant 1 Plant 1 Plant 1 Plant 1 Plant 2 Q Arterior in translations

| Surface | Plant 1 | Plant 1 | Plant 1 | Plant 1 | Plant 2 | Q Arterior in translations
| Surface | Plant 1 | Plant 2 | Q Arterior in translations
| Surface | Plant 2 | Q Arterior in translations
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Snap4City (C), November 2024

Smart Light in Merano











Merano - tutti i servizi

Wed 13 Dec 15:34:57







Snap4City (C), November 2024

Karlstad Street Lights CAPELON













▲ - PV + battery 10kWh

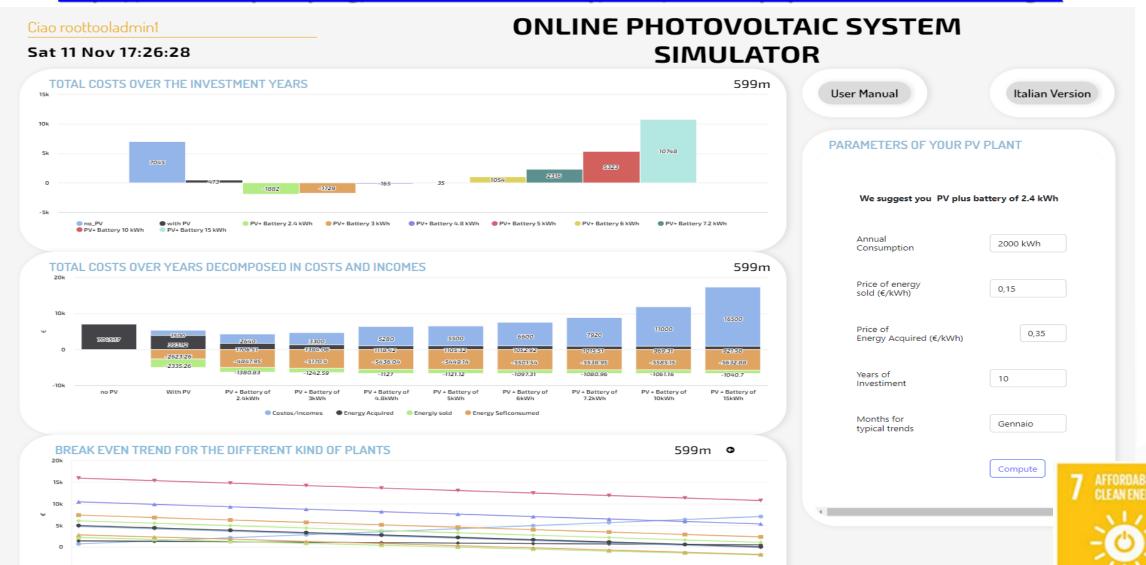
PV + battery 15kWh







https://www.snap4city.org/dashboardSmartCity/view/Baloon.php?iddasboard=MzczNg==



2032







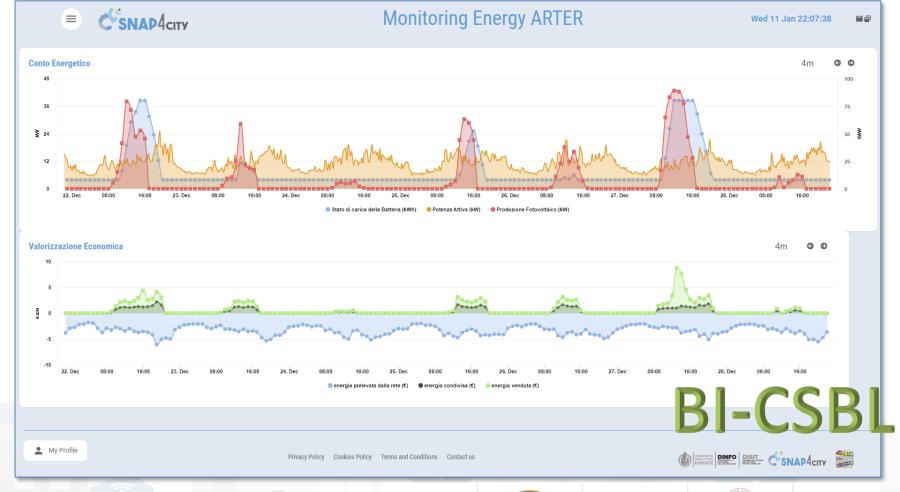








- Field-tested energy community: the selfconsumer condominium
- The Self User project creates in the pilot condominium, through the collection and analysis of data, a model for calculating and enhancing the impact of an energy community on a community of people, with a view to actions to combat energy poverty









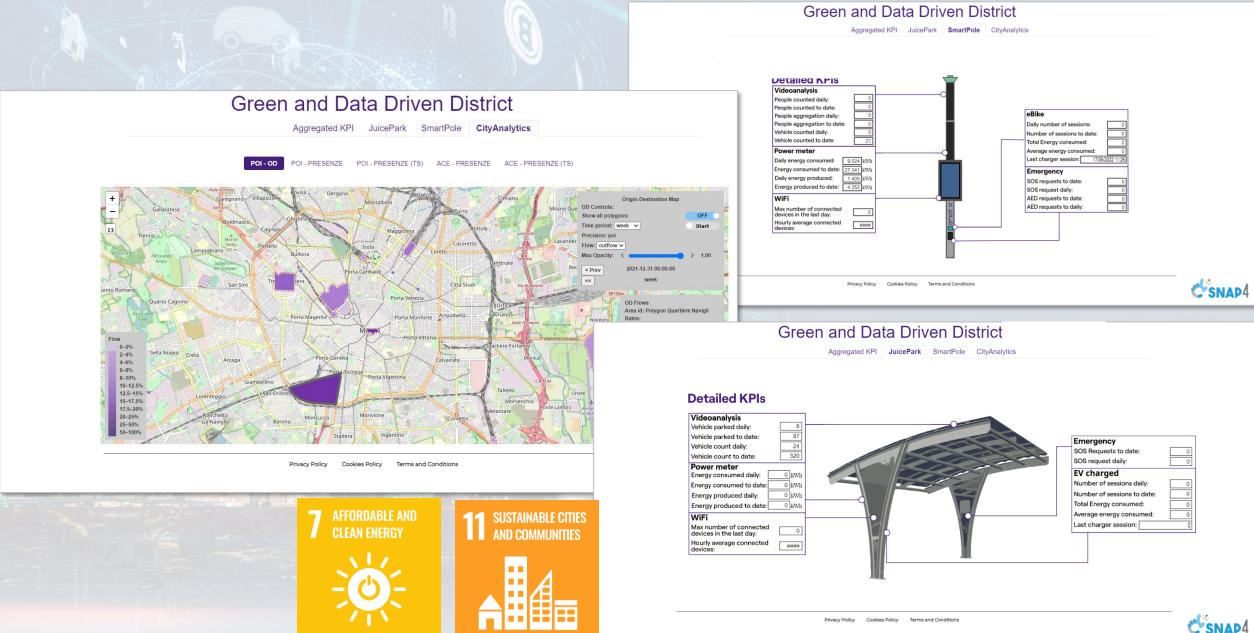




enel x

Energy monitoring and business intelligence



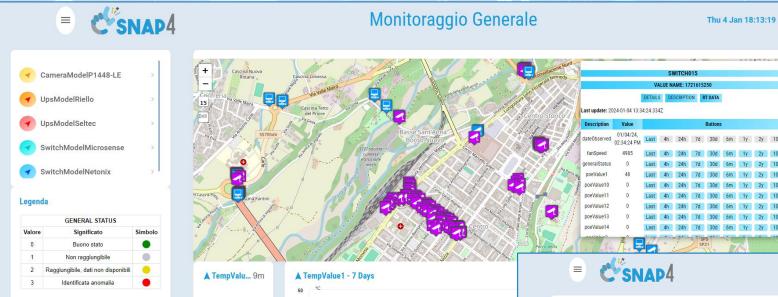


Cuneo Assets' Monitoring, Safety

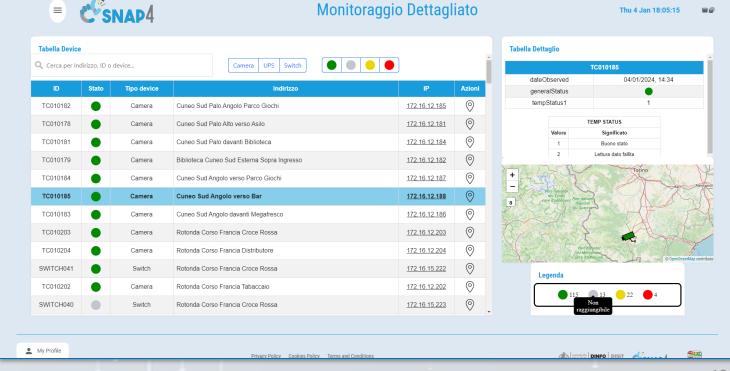




More than
 400 devices



- 49 29. 06:00 12:00 16:00 00:00 12:00 16:00 00:00 12:00 16:00 00:00 12:00 16:00 16:00 12:00 16:0
- Traffic Gates
- Switches
- UPS



SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES















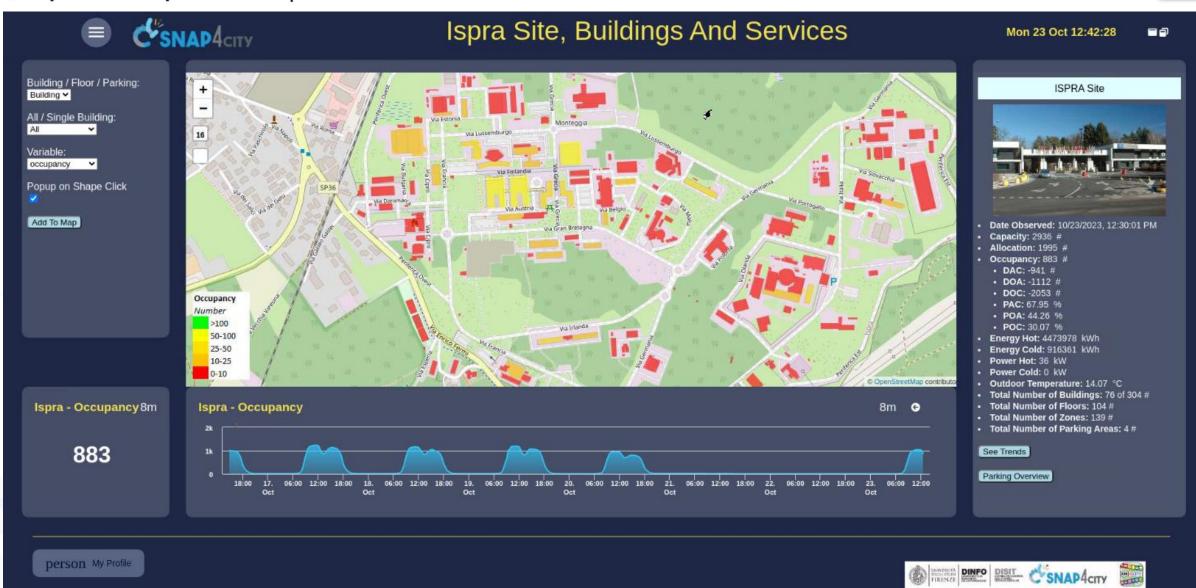






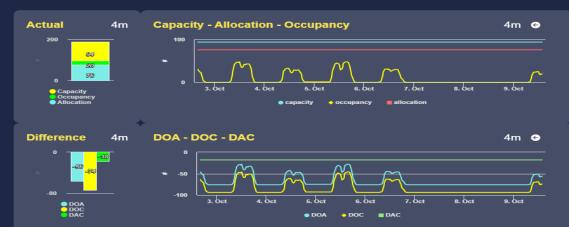




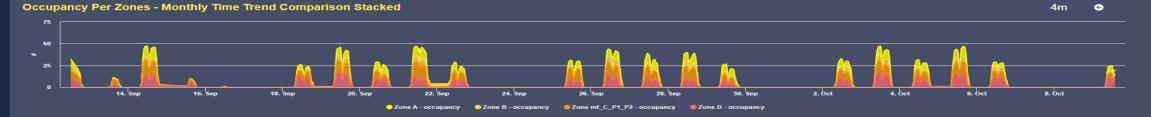








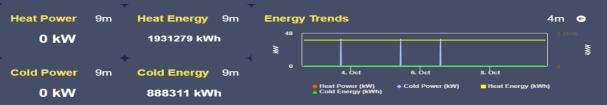


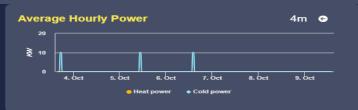


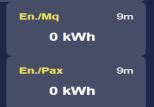
Building 27B Trends

POA POC PAC















Floor Details







INGEGNERIA DELL'INFORMAZIONE

DISTT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB DISTRIBUTED DATA INTELLIGENCE AND TECHNOLOGIES LAB OUT BUILDING STRIBUTED SYSTEMS AND INTERNET TECH





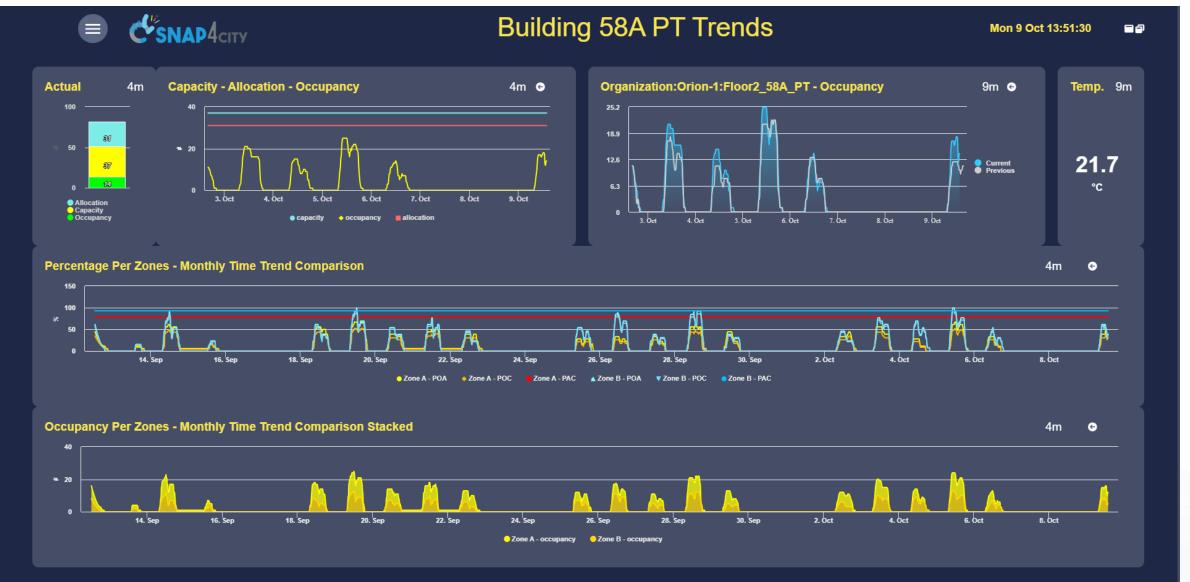






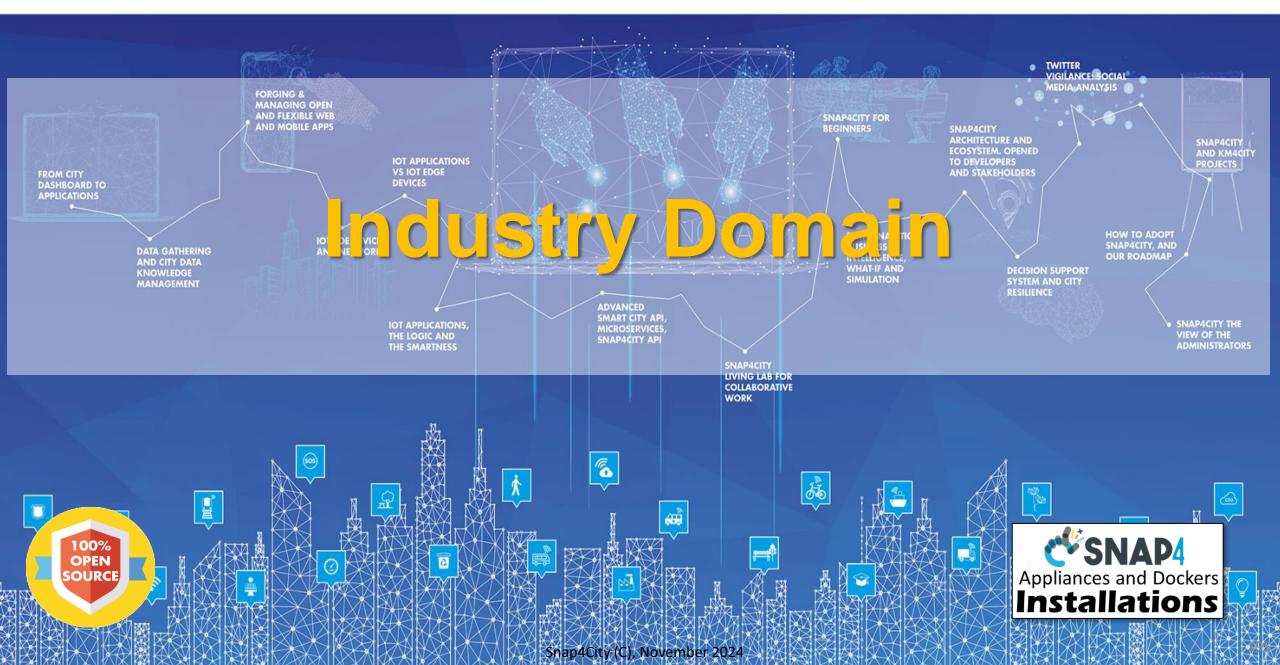






SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES







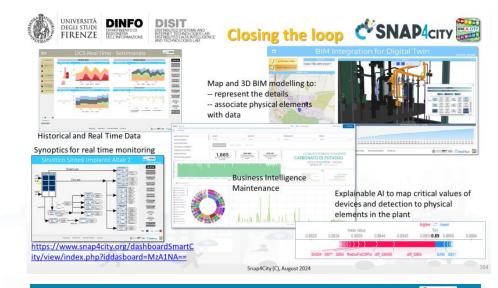


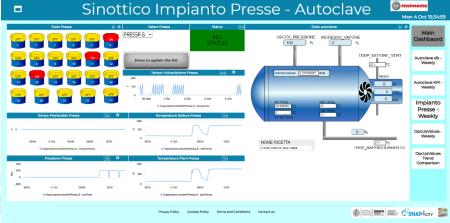




Industry production Domain (2024/8)

- Goals:
 - Cost reduction, increase control on production
 - Production optimisation
 - Quality Level
- Solutions for Operation (monitoring, managing, mobile apps, digital signages, control rooms)
 - Monitoring KPI: administration, production, commercial, faults, etc.
 - Early detection/warning, alarm, of critical conditions
 - Multichannel Event reporting: email, Telegram, mobile apps, SMS, etc.
 - Managing maintenance operation
 - Computing predictions on KPI
 - Computing predictive maintenance
- Solutions for Planning (optimization and what-if analysis)
 - Generative AI and predictive AI for production plan optimisation
 - Reduction maintenance costs, reduction of critical SLA conditions, improving quality level
- Algorithms and computational solutions, see next slide





Snap4Altair Decision Support supervision and control, Industry 4.0





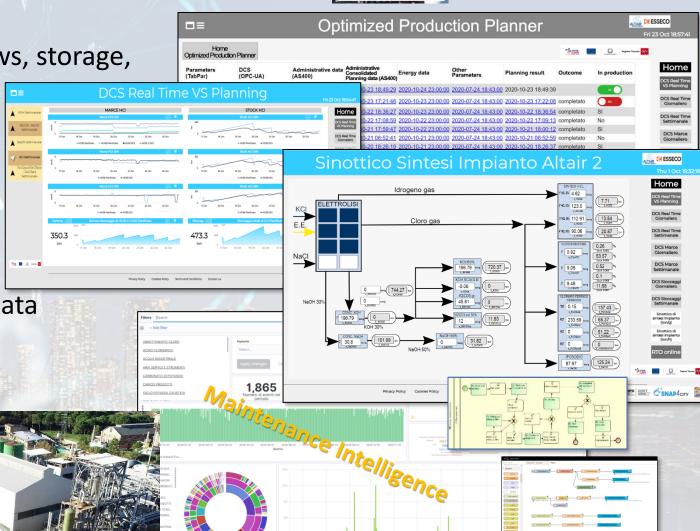


Multiple Domain Data

• Distributed Control System: energy, flows, storage,

chemical data, settings, ...

- Cost of energy, Orders,
- Production Parameters
- Maintenance data
- Multiple Levels & Decision Makers
 - Optimized planning on chemical model
 - Business Intelligence on Maintenance data
- Historical and Real Time data
 - Billions of Data
- Services Exploited on:
 - Multiple Levels, Mobile Apps, API
- Since 2020



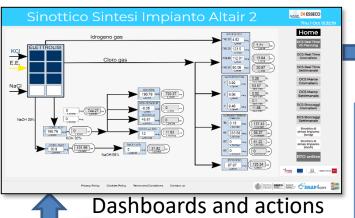




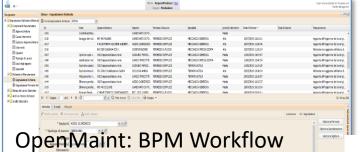
DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB DISTRIBUTED DATA INTELLIGENCE AND TECHNOLOGIES LAB



Workflow for Ticket management







management, team assignement,

Events/actions



S4COpenMaint

on get

process

on get status

on on extent

new process

on advance

process

on deale

process

on deale

process

on deale

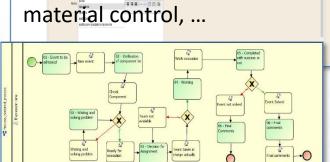
process

process

on deale

process

IOT App, Data event firing, event detection and firing Critical event management





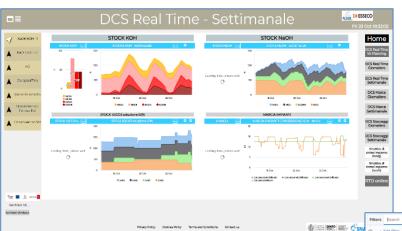






Closing the loop





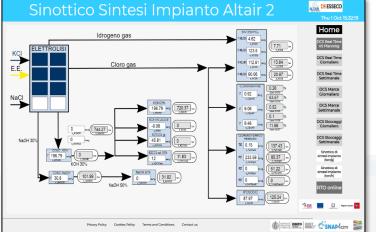
Map and 3D BIM modelling to:

- -- represent the details
- -- associate physical elements

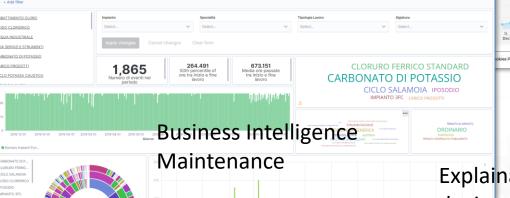
with data

Historical and Real Time Data

Synoptics for real time monitoring



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzA1NA==



Explainable AI to map critical values of devices and detection to physical elements in the plant



SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES













BlockChain vs Snap4City

- A feature optionally installed and optimally used to certify locally or in federation with other installations.
- Blockchain technology on Snap4City can be used for:
 - Certification of Data Messages →
 - Time Series, NFT with history of transactions, cold chains, transactions chains
 - MaaS, Waste collection Pay as you Throw (PAYT), etc.
 - Certification of Devices/Entities →
 - Contracts, transaction, micro-transactions
 - Certification of IoT Devices/Entities Models
 - Usage of Standard models and templates

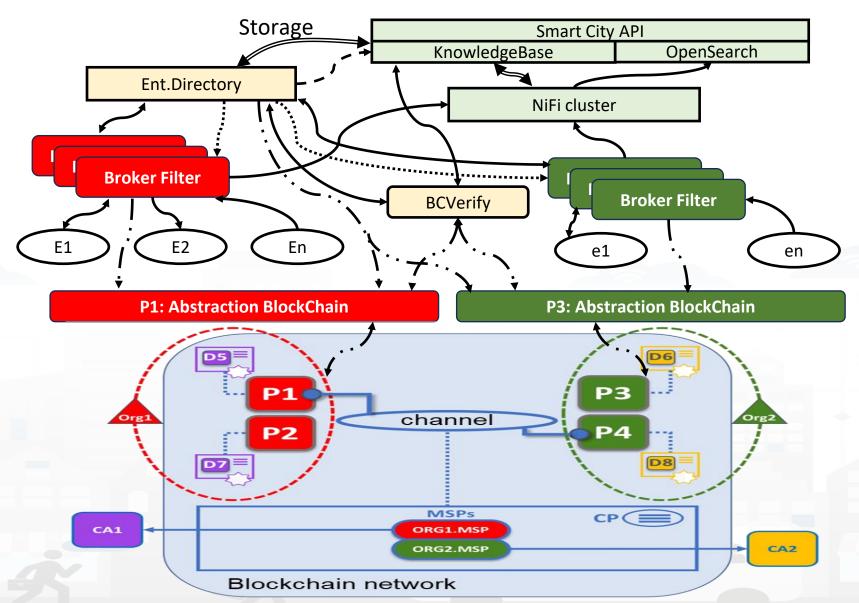






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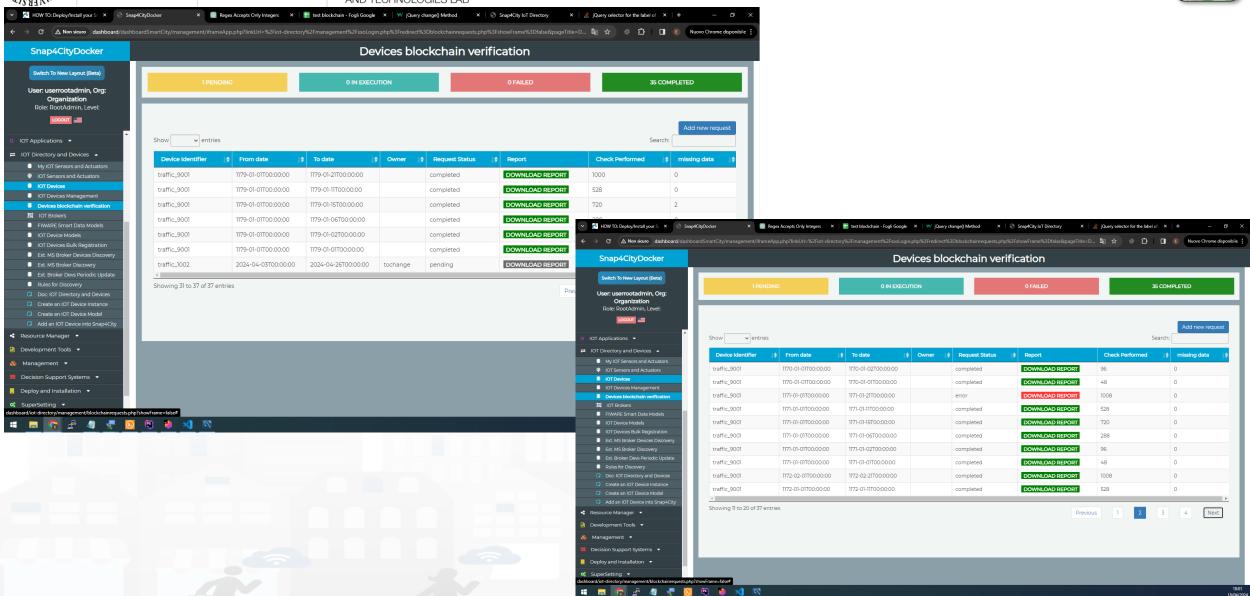






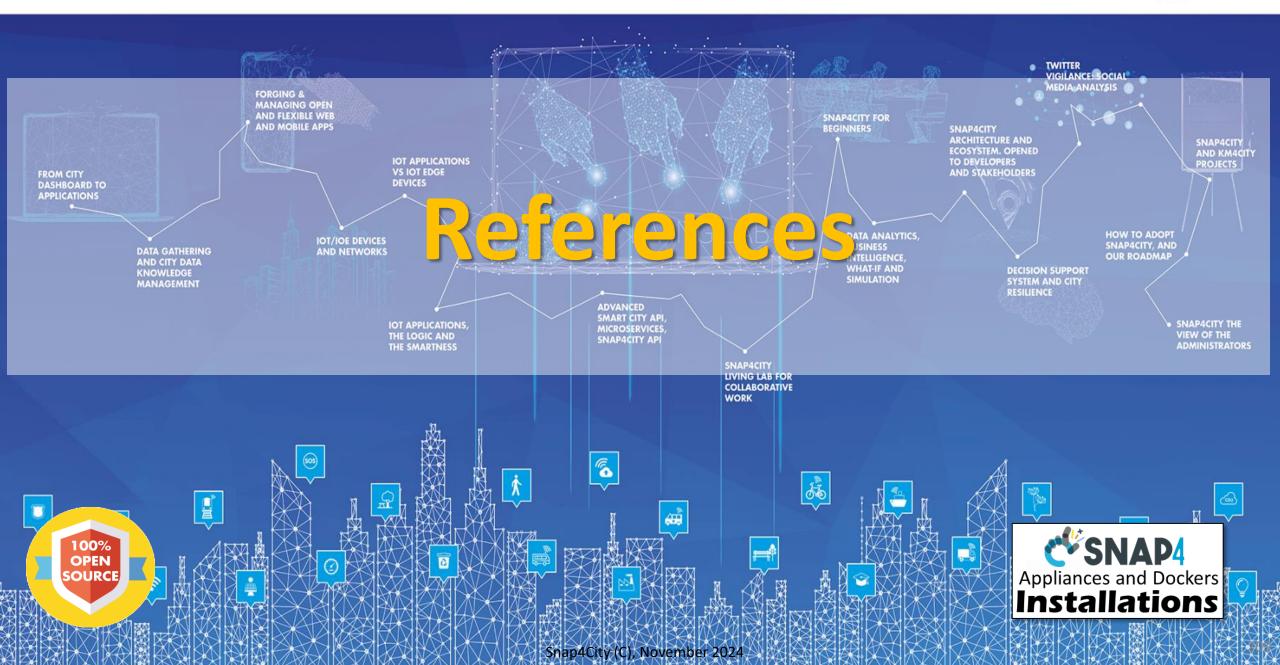
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SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES





booklets

Smart City





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Artificial Intelligence





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