SNAP4CITY

www.snap4city.org
www.snap4solutions.org

KM4CITY

www.km4city.org

Platform Architecture, Interoperability, Management and Deploy

October 2025, Course, Part 6

https://www.snap4city.org/944
https://www.snap4city.org/577

DIGITAL TWIN SOLUTIONS TO SETUP SUSTAINABLE DECISON SUPPORT SYSTEMS AND BUSINESS INTELLIGENCE

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

1

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

SNAP4CITY **KM4CITY**

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

www.snap4city.org

100% OPEN SOURCE

Powered by **FIWARE**

FREE TRIAL

PEN Test Passed

EU GDPR COMPLIANT

SNAP4 Appliances and Dockers **Installations**

EUROPEAN OPEN SCIENCE CLOUD

Node-RED

JS Foundation

E015 digital ecosystem

NVIDIA.

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

| HORIZONTAL AI PLATFORM | MOBILITY AND TRANSPORT | SMART ENERGY AND SMART BUILDING | ENVIRONMENT AND WASTE MANAGEMENT | CITY USER'S SERVICES AND TOURISM MANAGEMENT | SNAPADVISOR |

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

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

DASHBOARDS, WIDGETS TEMPLATES

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

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

SMART CITY LIVING LAB

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

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

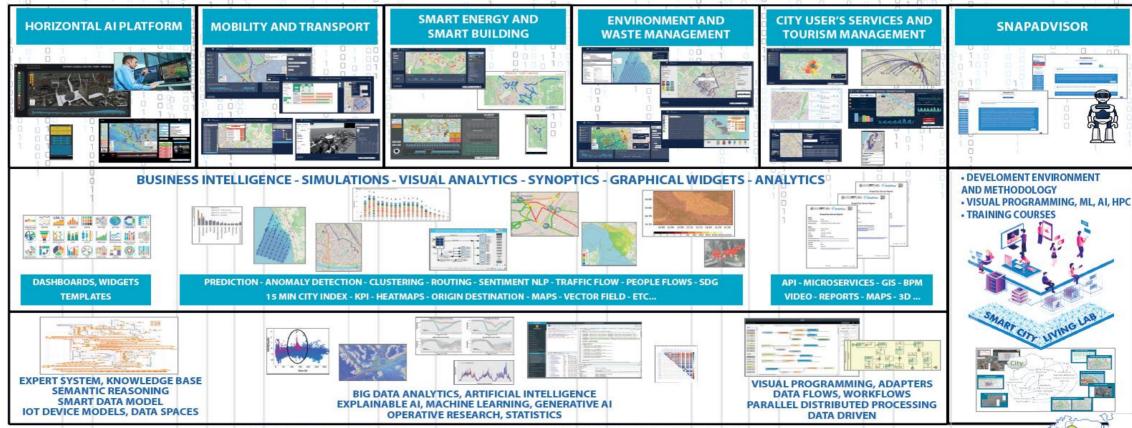**VISUAL PROGRAMMING, ADAPTERS DATA FLOWS, WORKFLOWS PARALLEL DISTRIBUTED PROCESSING DATA DRIVEN**

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

INDUSTRY4.0 SHARING PARKING LIGHT AGRICOLTURE ENVIRONMENT ENERGY SHOPPING MOBILE SECURITY CONTROL ROOM WASTE BUILDING SATELLITE TRANSPORT TOURISM

NATIVE AND EXTERNAL APPLICATIONS

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

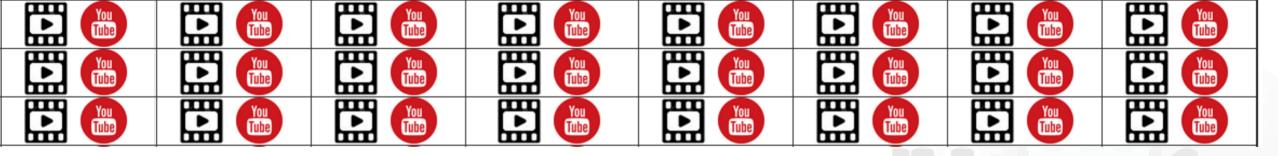# Technical Architecture

Visual Development Tools

2024/8

6

https://www.snap4city.org/944

On Line Training Material (free of charge)

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

Note on Training Material

- **Course 2023**: https://www.snap4city.org/944
  - Introductionary course to Snap4City technology

- **Course** https://www.snap4city.org/577
  - Full training course with much more details on mechanisms and a wider set of cases/solutions of the Snap4City Technology

- **Documentation** includes a deeper round of details
  - Snap4City Platform Overview:
    - https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf
  - Development Life Cycle:
    - https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf
  - Client Side Business Logic:
    - https://www.snap4city.org/download/video/ClientSideBusinessLogic-WidgetManual.pdf

- **On line cases and documentation**:
  - https://www.snap4city.org/108
  - https://www.snap4city.org/78
  - https://www.snap4city.org/426

Tech Overview

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

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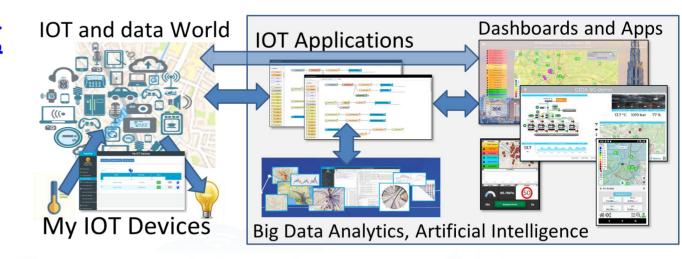
Free Trial

- Register on WWW.snap4city.org
  - 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

IF you need to go more in deep you can ask us to pass at the next Role becoming full AreaManager with full rights of development, also for Data Analytics, machine learning, etc.
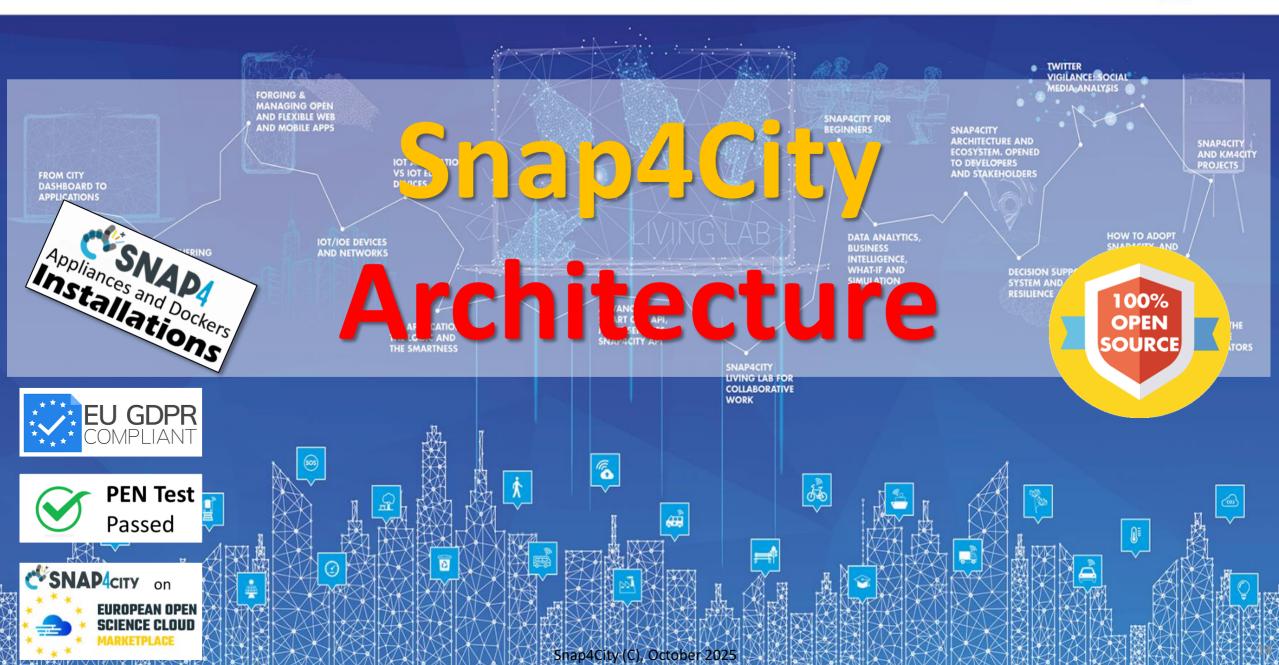
Agenda of Part 6

- Snap4City Architecture
- Interoperability of Snap4City Platform, and satellite data integration
- Interoperability with respect to Hardware staff
- Adding Features and Modules to Snap4City
- FIWARE and Snap4City
- Snap4City vs State of the Art Solutions
- Smart City planning with Snap4City Team Support
- The Role of the Living Lab Support
- Snap4City Platform: Administration Overview
- Snap4Tech: Smart Solutions as a Service
- Deploy Snap4Tech solutions: Docker Based
- Monitoring Snap4Tech Solutions/Platforms by Sentinel or other tools
- Training Material

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES

Snap4City
Architecture

Appliances and Dockers Installations

100% OPEN SOURCE

EU GDPR COMPLIANT

PEN Test Passed

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

We know the Problem

- **Systems are becoming complex CyberPhysical**
  - Delay in making decisions is a cost!
  - Missed early warning is a cost!
  - Lack of precision is a cost!
  - Lack of decisions & strategies and/or forecast is a cost!
  - KPI computation is a cost:
    - SDG, PUMS, SUMI, 15 Min City Index, etc.

- ***Making Decisions Process** is less effective when it is:*
  - not fully supported by data?
  - not performed in time?
  - not possible from remote?

- **Huge amount of data are or could be exploited to make the right decision in time.** The always listened reasons:
  - complexity, formats, integration, competence, licensing,
  - costs, processing, accessibility, discovery, production, ..
  - volume, velocity, value, update, …

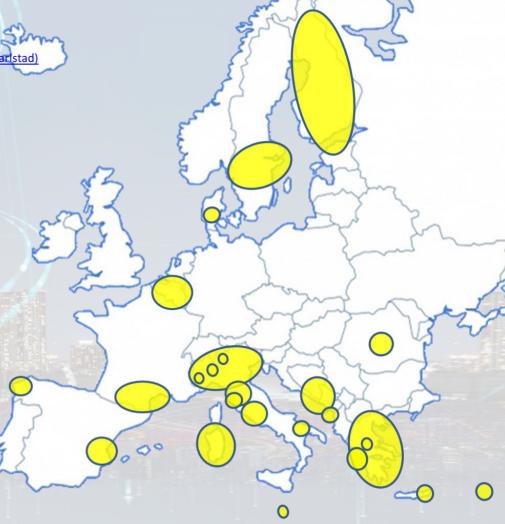# https://www.Snap4City.org

- 11 running installations in Europe
  - Snap4.city.org, Greece, Merano, Cuneo, …
  - Toscana, Pisa, Sweden, ISPRA, Snap4.eu,
  - Altair, Italmatic, Romania, ….

- 16 projects, 12 pilots on 10 Countries
  - >40 cities/area

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

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

THE POWER OF ARTIFICIAL INTELLIGENCE
AT THE SERVICE OF YOUR OPERATION AND PLAN
www.snap4city.org

SNAP4CITY · KM4CITY · UNIVERSITÀ DEGLI STUDI FIRENZE · DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE · DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

100% OPEN SOURCE

Powered by FIWARE

FREE TRIAL

PEN Test Passed

EU GDPR COMPLIANT

SNAP4 Appliances and Dockers Installations

EUROPEAN OPEN SCIENCE CLOUD

Node-RED

JS Foundation

E015 digital ecosystem

NVIDIA.

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

| HORIZONTAL AI PLATFORM | MOBILITY AND TRANSPORT | SMART ENERGY AND SMART BUILDING | ENVIRONMENT AND WASTE MANAGEMENT | CITY USER'S SERVICES AND TOURISM MANAGEMENT | SNAPADVISOR |

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

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

DASHBOARDS, WIDGETS TEMPLATES

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

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

SMART CITY LIVING LAB

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

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

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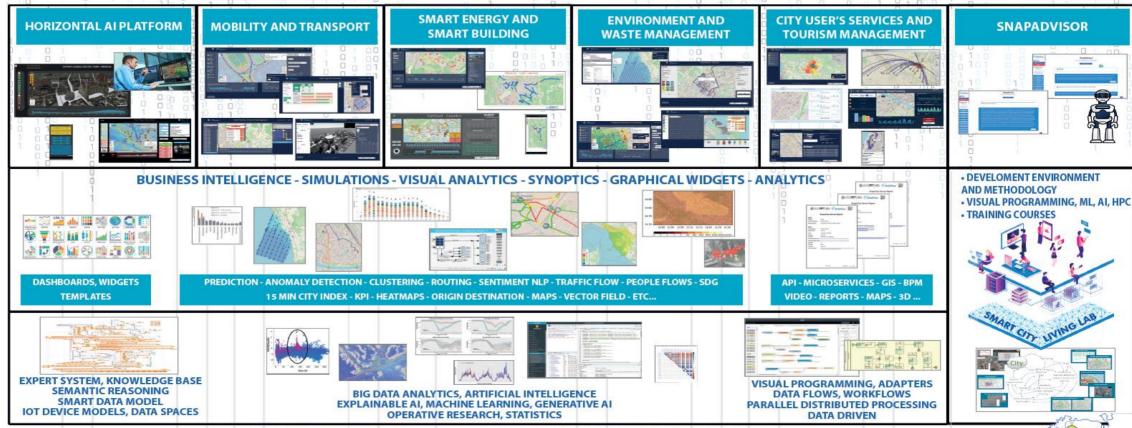DATA FLOWS, WORKFLOWS
PARALLEL DISTRIBUTED PROCESSING
DATA DRIVEN

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

NATIVE AND EXTERNAL APPLICATIONS

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

INDUSTRY 4.0 · SHARING · PARKING · LIGHT · ENVIRONMENT · AGRICOLTURE · ENERGY · SHOPPING · MOBILE · SECURITY · CONTROL ROOM · WASTE · BUILDING · SATELLITE · TRANSPORT · TOURISM

Digital Twin Development Platform

Technical Architecture

Snap4City architecture diagram with the following layers and components:

Presentation
- Dashboards, Business Intelligence, Visual Analytics, Smart Applications, Web & Mobile Apps
- Dashboard Themes, Dashboard Wizard, Compare, Measure, Custom Theme
- Dashboard Mng., Dashboard Builder, Widget Library, Scenario Editor, Synoptics, 3D Digital Twin, CSBL

Interoperability: Snap4City Node-RED Libraries, ASCAPI, API Mng, MQTT, FIWARE, kafka, WebSocket

Operations
- Operational Tools: BIMserver.center, openMAINT, Graphhopper, GeoServer; Routing, BIM Server, Workflow Mng, Notifications, Simulate, ckan, Node-RED, SUMO
- Artificial Intelligence, DA Tools: Statistics, KPI Computing, Predictions, Optimization, Early Warning, ……….
- MLOps, Dev. tools: python, R Studio, CLEARML, Node-RED, ML, AI,.. Libraries
- Visual Analytic processes: SSBL, JS, Node-RED, What-if, Business Intelligence

Internal Interoperability: API, MicroServices, WS — Snap4City Node-RED Libraries, ASCAPI, WebSocket, FIWARE

Persistence & Knowledge and Data Management
- Data Inspector, Service Map, LOGraph, DevDash
- SuperServiceMap, Data Management, HLT
- OpenSearch, virtuoso
- Ni-Fi (nifi)
- Linked Data triples

Aggregation Data Process
- Processes and Rules, Blockchain
- IoT/Entity Directory, Harvester
- Brokers, FIWARE, MQTT, Node-RED
- Any protocol and format

Connectivity: wired/wireless, IoT Edge, etc.
- Any protocol and format
- Node-RED

Left side: Platform Management:, Proc.Logic / IoT Applications Data Flow Logic (docker, Node-RED), docker, SNAP4CITY

Right side: Authentication and Authorization: GDPR compliant (KEYCLOAK, OpenLDAP, SNAP4CITY), Participatory and Living Lab Supports

Device Layer (icons)

External Third Party Services: GIS, BIM, OSM, Gateways, External Services, ERP, Social Media

Top: UNIVERSITÀ DEGLI STUDI FIRENZE — DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE — DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB, DISTRIBUTED DATA INTELLIGENCE AND TECHNOLOGIES LAB — SNAP4CITY legenda — SNAP4CITY KM4CITY

Requirements and Objectives

- Serve as a **City Dashboard**, **App User Interface**, etc.
  - Real time and historical data, any device, sensors and actuators
  - Sensors, KPI, maps, data trends, real time data, charts, etc.
  - Multi domain, smart city + industry 4.0 scenarious
- Referral / **historical data, and Open Data**:
  - shadow, access (API, storage, any protocol), production of OD, export
- **Data Driven Real Time communication &** processing:
  - IOT Applications, IOT edge, multiple operating systems, embedded systems, **MicroServices**
  - in/out data driven from/to the field into: applications, notifications, etc.
- **Data Analytics**: Machine Learning, statistics, reasoning, …
- **Serve as Living Lab**: open innovation, co-working; collaborative work; sharing: data, processes, dashboard, experiences, solutions, ….
- Experimented on **large scale cases**

Non functional requirements

- **Open Source** based 100%
  - Open **Standard** for communication and API for In/Out
- **Interoperability**: protocols, internal API, Smart City API, can integrate with legacy conditions in place, modular, reusable,...
  - Open to proprietary protocols as well, any protocol, any format
- **Data driven**, for reading and data analytic
- **Scalable, Robust, Distributed** and Decoupled, modular, Service Oriented, open to external services and data sets, big data
- **Heterogeneous**: any device, private and public, custom and..
- **Security** by Design: HTTPS, TLS, ... compliant with EC
- **User Centric** Design: privacy by Design (and **GDPR**), personalized, personal data management, ...

Security/Privacy Requirements

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

The secure stack

Sensors, actuators

Data Shadow

User Interface

IoT Devices

HTTPS

HTTPS — IoT Edge — HTTPS

IoT Firewall, IoT Context Broker

HTTPS

storage

HTTPS — IoT App — WSs

HTTPS

Mob / Web Apps

Dashboard Builder

HTTPS WSs

Aggregator and distributor: On premise computing

Via MicroServices: Cloud computing
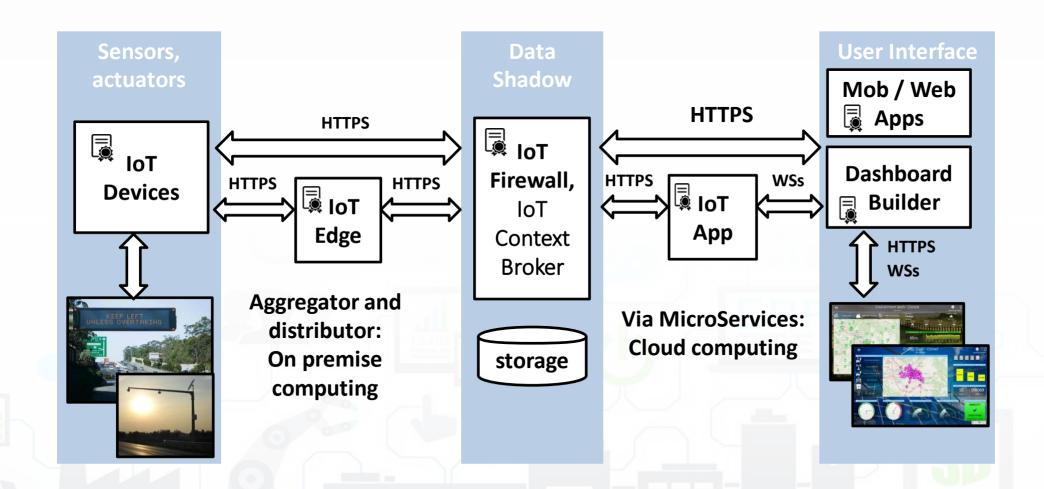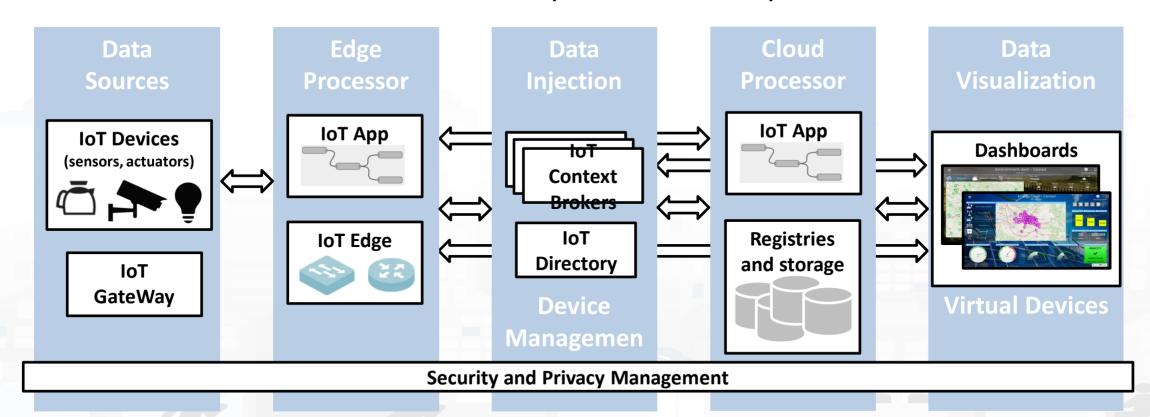
Complexity in Smart City IOT Platforms

End to End security

– From IOT Devices to Dashboard (user interface)

- H2M
- M2M

How to adopt Snap4City

Https://www.snap4city.org

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

On your premise

Download and deploy

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

Snap4City platforms

- **Public accessible and under our control:**
  - https://www.snap4city.org : by DISIT lab, on private Cloud
  - https://platform.snap4.eu : by Snap4 SRL, on ARUBA public cloud
  - https://www.snap4ai.org : Genova for OceanRace with AXIS on AWS public cloud

- **Other platform are presently under control of third parties:**
  - https://www.cityconn.cloud/ : Asymmetrica, on Public Cloud (by Snap4 setup)
  - Etc.

- **Many others are private and not accessible**
  - **On Public or private clouds**
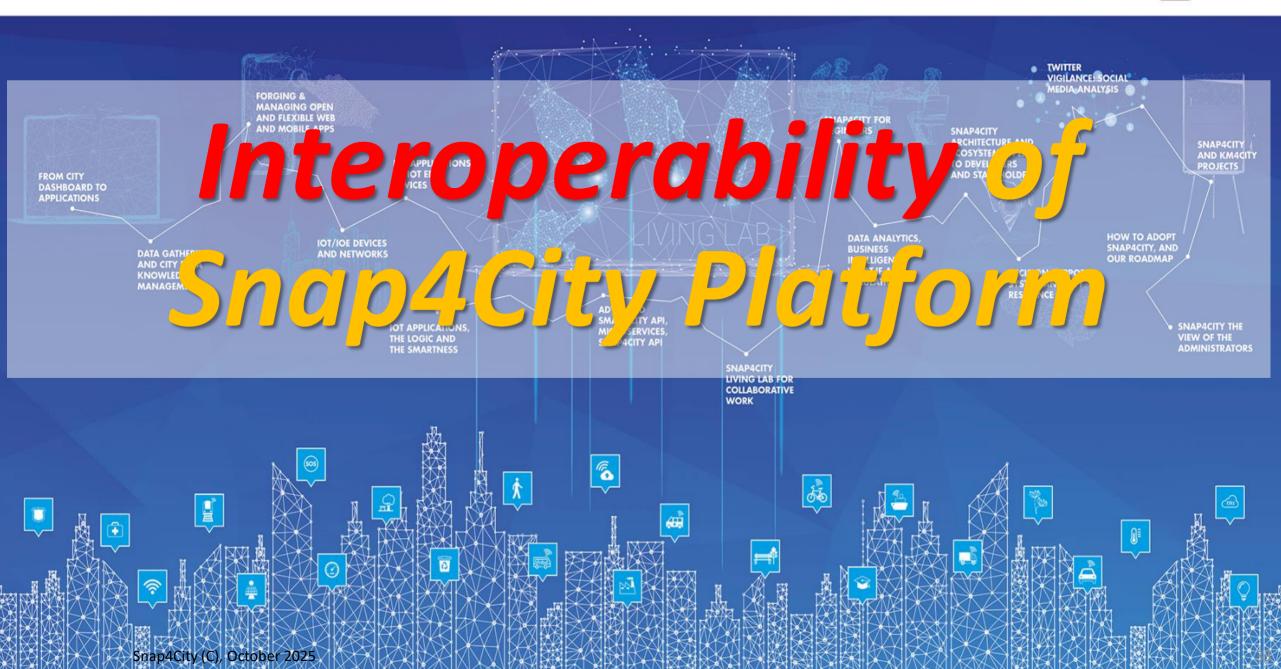
    List of published platforms: https://www.snap4city.org/661
      - Others are not listed for the presence of NDA

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES

Interoperability of Snap4City Platform

Standards and Interoperability

Compliant with:

- **IoT:** NGSI V2/LD, LoRa, LoRaWan, MQTT, AMQP, COAP, OneM2M, TheThingsNetwork, SigFOX, Libelium, IBIMET/IBE, Enocean, Zigbee, DALI, ISEMC, Alexa, Sonoff, HUE Philips, Tplink, BACnet, TALQ, Protocol Buffer, KNX, OBD2, Proximus, ..
- **IoT model:** FIWARE Smart Data Model, Snap4City IoT Device Models
- **General**: HTTP, HTTPS, TLS, Rest Call, SNMP, TCP, UDP, SOAP, WSDL, FTP, FTPS, WebSocket, WebSocket Secure, GML, WFS, WMS, WCS, RTSP, ONVIF, AXIS TVCam, CISCO Meraki, OSM, Copernicus, The Weather Channel, Open Weather, OLAP, VMS Milestone, TIM, HERE, ….
- **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.
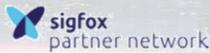
https://www.snap4city.org/65

Interoperability

Part 5

- Federation of Snap4City Smart City platforms

Part 6

- **Proc.Logic/IoT App working on multiple Snap4City Platforms**
- **Authentication Interoperability**
- **GIS Interoperability**
- **Ingestion of Public Transportation data:**
  - **GTFS, Transmodel, GTFS RT, NeTEx, etc.**
- **CKAN interoperability**
- **IOT Devices integration**
  - **MQTT, Libelium, LORA, AIRQINO, SIGFOX, AXIS Camera, OBD2, ..**
- **Satellite data Ingestion**

Part 3
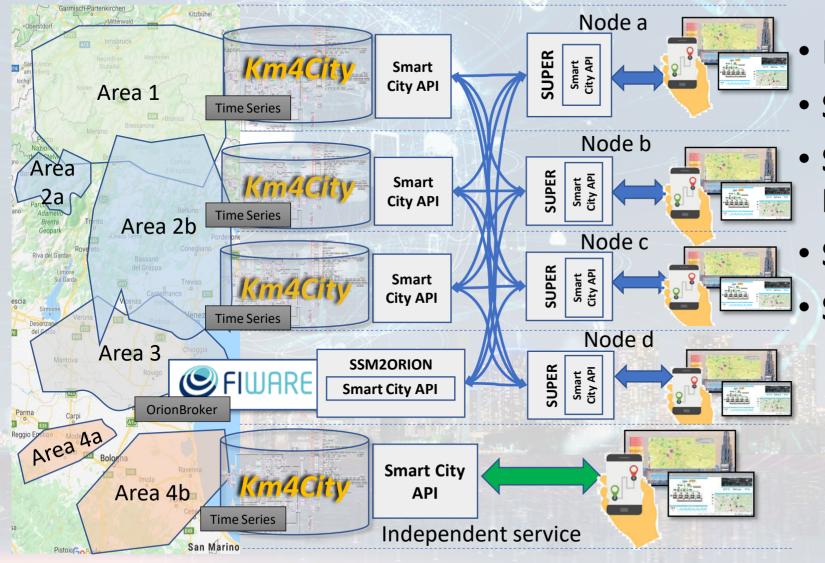
- *Open Maintenance Ticketing Interoperability*
- *Telegram Interoperability*
- *Social Media interoperability*

Federation of Smart City Services

Knowledge Base
Semantic Reasoners

- Km4City **Semantic Reasoner**

- **ServiceMap** interoperability

- **Seamless for multiple Mobile Apps**

- **Smart City API**

- **Super**:
  - distributed access and sharing services
  - Each city control its own data
  - Final user can pass from one city / area to another in seamless manner: without changing the mobile Apps

Proc.Logic/IoT App working on multiple Snap4City Platforms

Distributed Computing

- The Snap4City Libraries on Node-RED support the management of Multiple Snap4City Platforms Installations

- It is possible to:
  - Have in different Blocks/nodes, different registrations to different Snap4City Installations/platforms or Users
  - Get/Send data from/to a Snap4City Installations/Users and send/get to/from another
  - Have Multiple Brokers on multiple installations and users
  - Creating collaborative distributed processing that work and share data and processing in multiple platforms based on Snap4City or different.
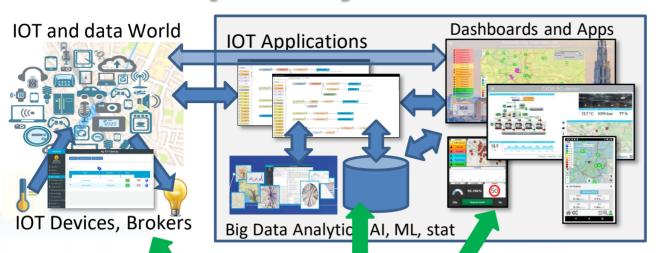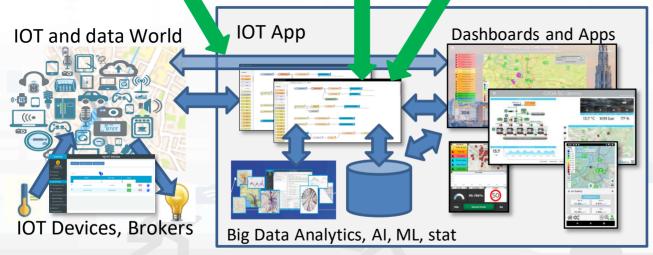
Snap4City Multidomain Applications

Any Snap4City Installation
Different domain
Different user
Different auth./authoriz. System
Etc..

Any Snap4City Installation
Different domain
Different user
Different auth./authoriz. System
Etc..
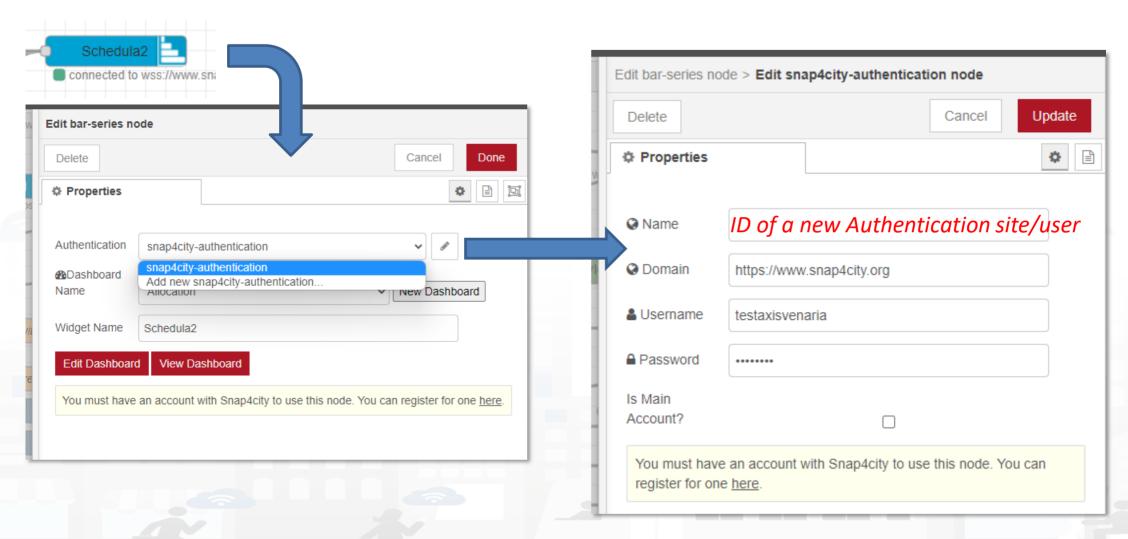
Example on Controlling Dashboards multiple domains

Snap4City Authentication Interoperability

Authentication and SSO

- **Authentication in Snap4Tech is based on KeyCloak which is based on SAML, https://auth0.com/blog/how-saml-authentication-works/**

- **Different Versions of interoperability Authentication and Single Sign On, SSO**, are available on demand, with

  - **Spid**, Public Digital Identity System, https://www.spid.gov.it/en/
  - **EIDAS** (electronic IDentification Authentication and Signature), http://www.agid.gov.it/en/platforms/eidas, https://digital-strategy.ec.europa.eu/en/policies/eidas-regulation
  - **CIE, Electronic Identity Card https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-digital-identity_en**
  - **RealMe** NZ, https://www.realme.govt.nz/

GIS Data Import and Export: WFS and WMS

https://www.snap4city.org/drupal/node/368

GIS vs Sna4City

GIS Server can be: ESRI ArcGSI Enterprise, QGIS, GeoServer, ..
GIS Player can be: ESRI ArcGIS Pro, ArcGIS Portal, Snap4City WFS player, ..

(EA)
GIS Player

(A)

GIS | WFS WMS

GIS | WFS WMS

(C) **(D)**

(B)
GIS Player
SNAP4CITY

(B)

SNAP4CITY
Dashboard System

(E)

Any External Service

(D)

Data Ingestion
SNAP4CITY

WMS/WFS APIs
Smart City APIs
Big Data and Semantic Storage
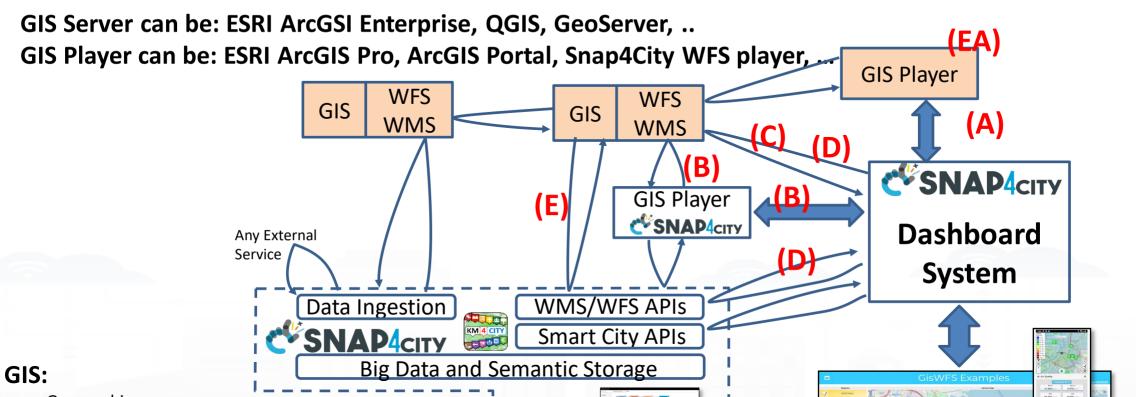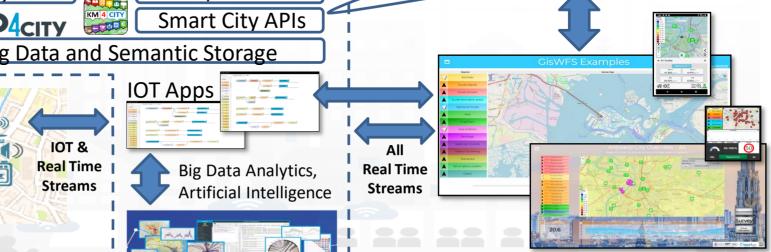
- **GIS:**
  - Geographic Information System
- **WMS:**
  - Web Map Service
- **WFS:**
  - Web Feature Services

IOT Apps

IOT & Real Time Streams

Big Data Analytics, Artificial Intelligence

All Real Time Streams

Dashboards and Apps
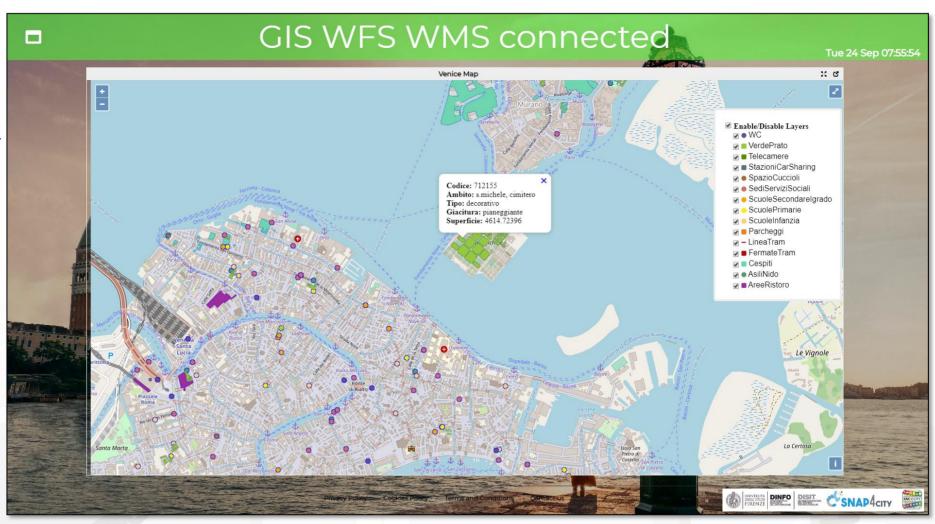
(B) GIS data on Dashboard via Snap4City GIS Player

- DISIT Lab has ESRI ArcGIS Enterprise 10.6 installed

- Snap4City has its WFS Player https://main.snap4city.org/widgets/venezia/index.php

- Snap4City Dashboard uses as External Service: Snap4City GIS viewer via WFS/WMS: https://main.snap4city.org/view/index.php?iddasboard=MTIxNg==
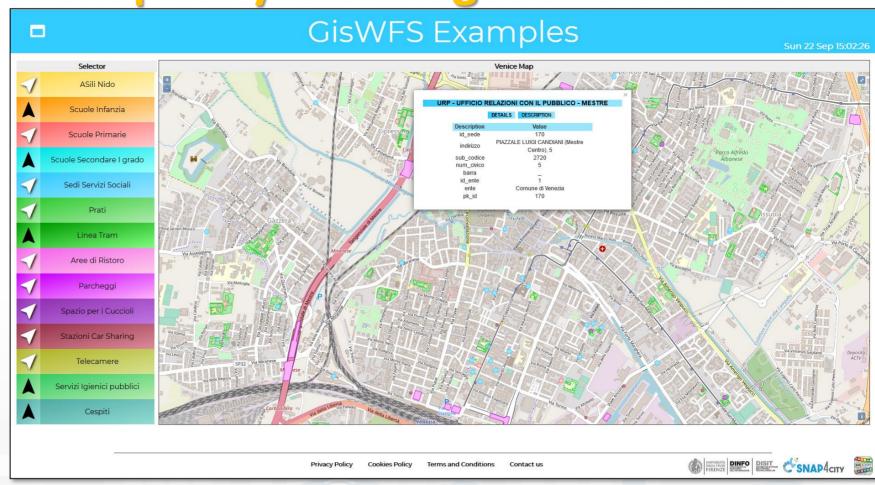
(C) Dash with Snap4City GIS widget and Selector

- DISIT Lab has ESRI ArcGIS Enterprise 10.6 installed

- Snap4City has its WFS / WMS widget / Player

- Snap4City Dashboard shows WFS/WMS data via Special GIS Widget Map:

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

- Snap4City can use **Selector** to select WFS / WMS sources to be shown from ESRI ArcGIS (as well as from any other WFS service) on Widget map

The Snap4City Widget Map allows to **mixt WFS GIS sources with Smart City API**
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTM5NA==

Snap4City vs GIS, WFS/WMS

- GIS data:
  - Ingested via WFS/WMS protocols, and then managed as the other data. Data ingestion from GIS server can be performed via ETL processes, or directly from Dashboards
  - Shown on Dashboards via third party GIS tools as External Services
  - Shown on Dashboards using Special GIS Widget Map which directly access to GIS data via WFS/WMS
  - Heatmaps and Maps are distributed via a GeoServer
- Snap4City can interact with ArcGIS Real Time Events via MQTT protocol as well
- **Snap4City vs GIS solutions and connections**

Ingesting Service
Transport Offers

Public Transport Information/file/streams

- **Other sources as ODM and POI: parking, sharing, etc.**
- **Models used for**: busses, train, ferry, metro, tramways, etc.
- **Include**:
  - Public Transport Lines, Rides with paths and timeline, stops, polylines for paths, etc.
  - real time data about the position of the vehicles: train, busses, etc.
  - Multi operator data
- **Information is modelled as**
  - **GTSF** format: multiple files in XML
  - **Transmodel** format
  - **Netex** format
- **GTSF files can be ingested on Snap4City via**
  - **Python** which takes GTFS files and convert them in triples «.n3» file for the Knowledge Base
    - https://github.com/disit/smart-city-etl/tree/master/TrasformazioneTPLBus_new_model/Triplification/Models
    - Former version: https://www.snap4city.org/download/snap4cityETL/TPL_bus_gtfs/
  - **GTFS RT can be ingested via IoT App and sent to the Broker**
  - **Chouette** and then
    - using a Python developed by **Snap4City to converter** to produce Triples for the Knowledge Base, service map
    - https://github.com/disit/snap4city/blob/master/Snap4CityGTFS/chouette-gtfs-n3.py
- **Transmodel (EN12896) or Neptune files can be ingested in Snap4City via**
  - **Chouette** and then, with a certain level of adaptation,
    - using a Python developed by **Snap4City to converter** to produce Triples for the Knowledge Base, service map
    - https://github.com/disit/snap4city/blob/master/Snap4CityGTFS/chouette-gtfs-n3.py

Chouette

- Interoperable with: GTFS, Transmodel, Neptune and «NeTEx»

http://www.chouette.mobi/en/
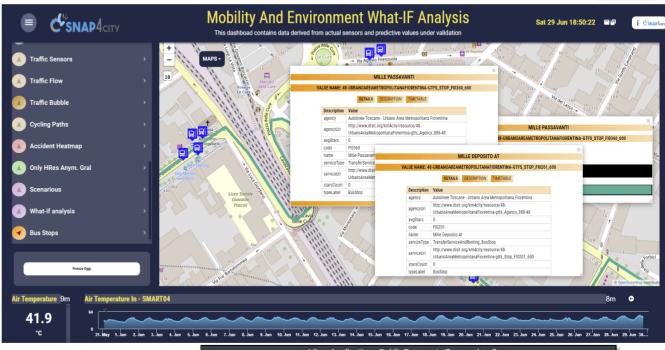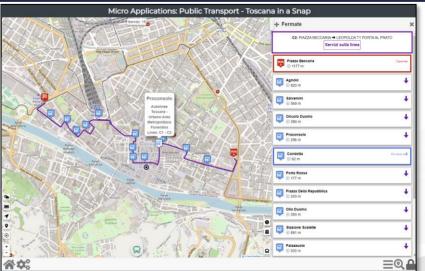
Public Transport Offer

- Via
  - Dashboards
  - MicroApplications
  - Mobile Apps
  - ServiceMap

Integration with CKAN Open Data Manager and Portal

Snap4City vs CKAN

Datagate

Snap4City Portal and Integrated tools

Advanced Snap4City APIs and MicroServices

Harvesting and Publishing
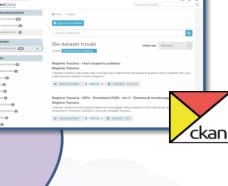
Open or Private External CKAN Data Portals
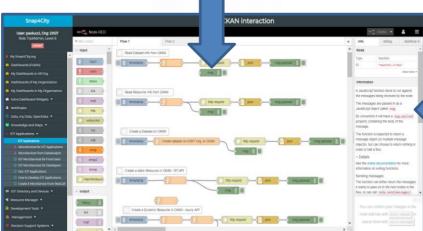
Automatize:
- Import data from CKAN to Snap4City
- Upload Public Data from Snap4City to CKAN
- Data Harvesting
- Dashboards and Mobile/Web Apps creation
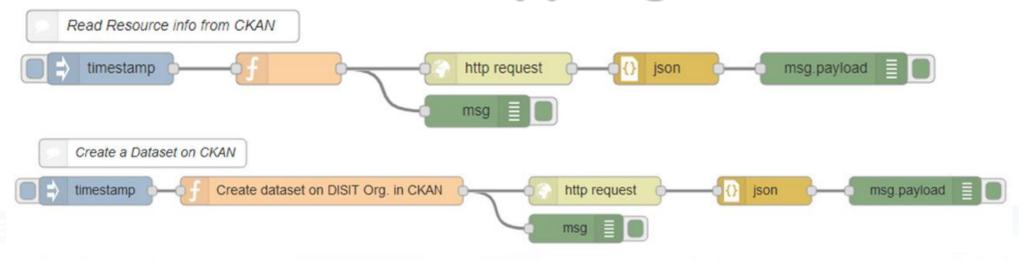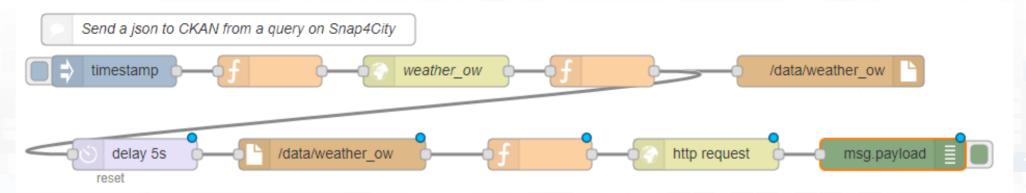
Some IOT App segements

Almost all the calls to CKAN are quite similar
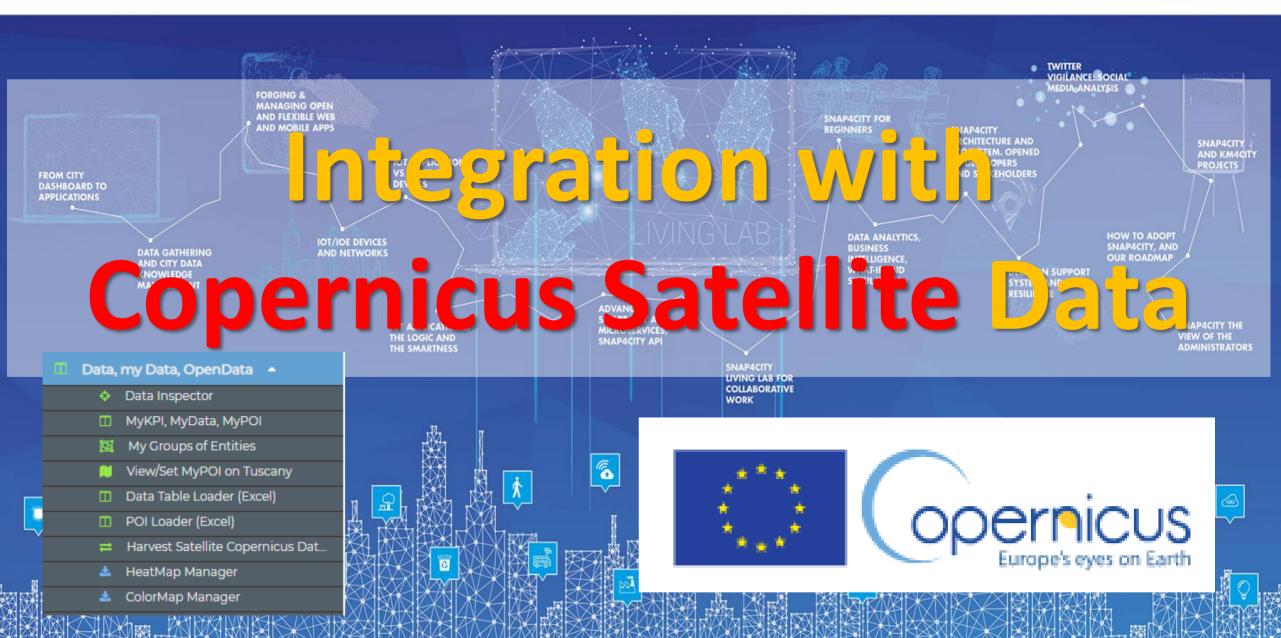
- **TC9.17 – CKAN vs Snap4City Integration and Interaction**
  - automating the *Read of a Dataset Info from CKAN*
  - automating the *Read of a Resource info from CKAN*
  - automating the *Creation of a Dataset on CKAN*
  - automating the *Creation of a static Resource in CKAN*
  - automating the *Creation of a dynamic Resource in CKAN*
  - automating the *Sending of a json to CKAN from a query to Snap4City to perform any other action on the Smart City*

- **Data Set Manager: Data Gate / CKAN federated**

Integration with Copernicus Satellite Data

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES

Needs
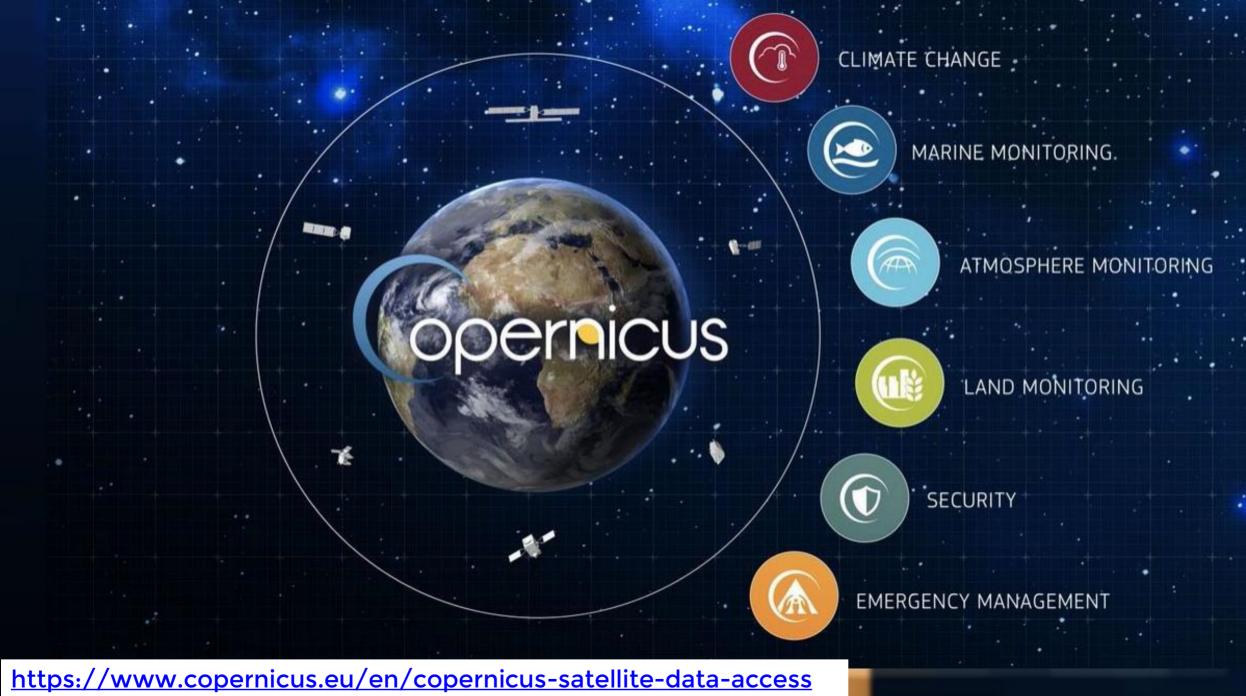
- In the Smart City context there is the needs of
  - **Accessible and affordable** data: spatially and temporally dense
  - **Reducing costs** for data gathering.
    - Sensors are good, but are scattered and very expensive
  - Reduce **costs for maintenance** of data gathering solutions
    - Sensors have high costs of maintenance: repairing, battery changes, calibrations, attacks, etc.
  - **Validation** of data.
- Satellite data may be a solution to some of those problems, while other have to be managed.

Smart City: Satellite Data vs Sensors Data

- **From Satellites, many sources, different resolutions, open/closed:**
  - Ozone, NO2, SO2, Aerosol, CO, etc.
  - Temperature, vegetation, land usage
    - Evolution of soil usage: with high seasonality, and weather impact
  - Air traffic derived data
  - Water traffic usage data
  - Many other technical measures….
  - Spatial and temporal resolution ???
- **From Sensors and other sources:**
  - Pollutant: PM10, PM2.5, NO2, NO, SO2, CO2, …
  - Weather: temperatures, humidity, wind, DEW, etc.
  - Other: Traffic flow sensors, people flow, parking, etc.
  - Air/lidar measures from flights: vegetation, land usage
  - Scattered data, specifically positioned, no dense data

https://www.copernicus.eu/en/copernicus-satellite-data-access
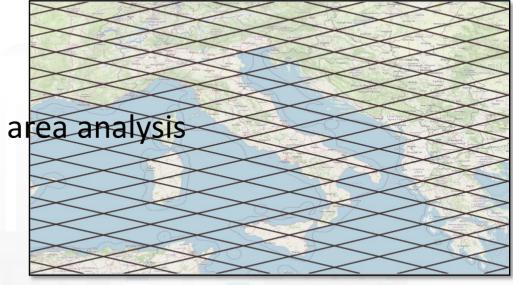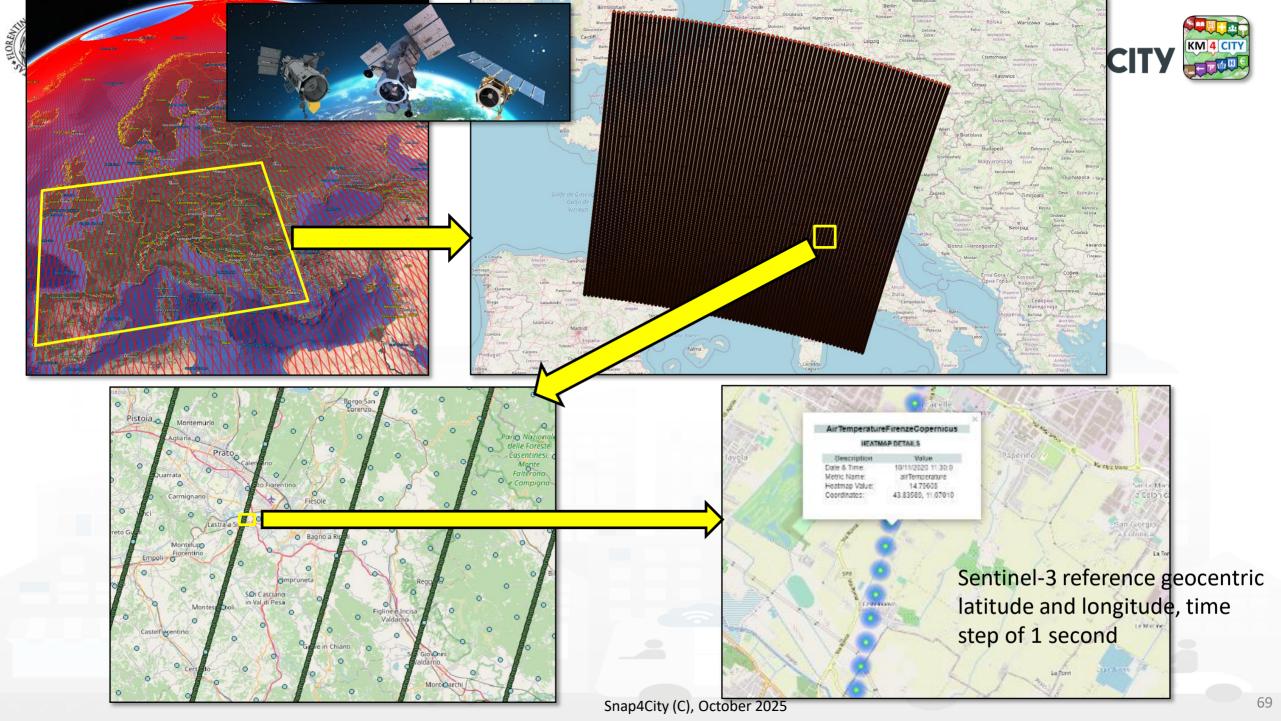
Satellite data

- **A large number of measures, not accessible from ground level sensors**

- **Complex data stream acquisition**
  - Data Transformation by knowing the satellite model is needed
  - Complex for small area since satellite products are typically large area

- **Temporal and spatial resolutions** (lat, lon)
  - They are not matrices actually
  - They are not always taken on the same places
  - Resolution may be not enough for specific city area analysis
  - No event driven data

- **View from the space:**
  - Affected by cloud and weather
  - Measures of the column of air and not at the ground level
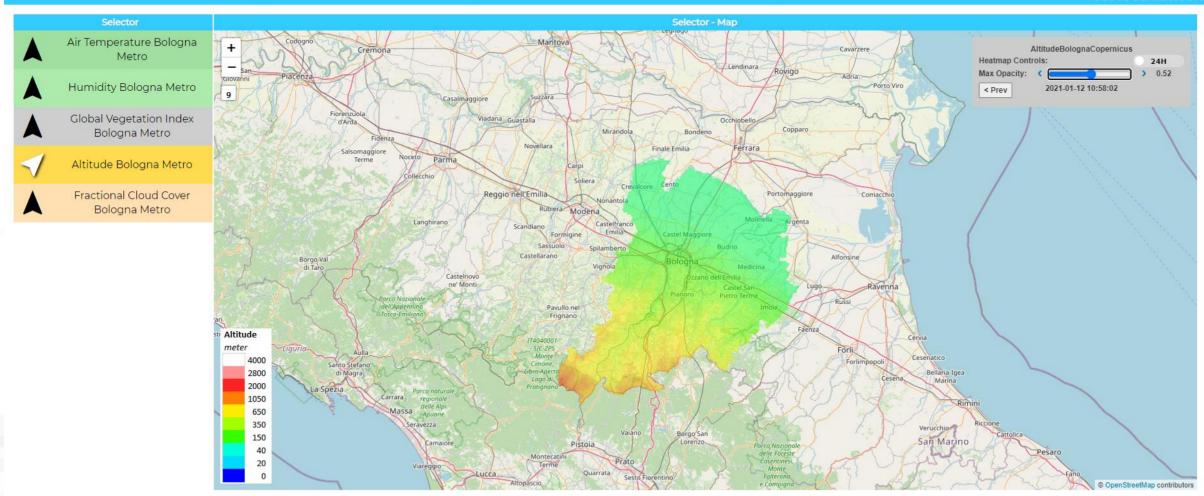
AirTemperatureFirenzeCopernicus

HEATMAP DETAILS

Description	Value
Date & Time:	10/11/2020 11:30:0
Metric Name:	airTemperature
Heatmap Value:	14.75608
Coordinates:	43.83589, 11.07010

Sentinel-3 reference geocentric latitude and longitude, time step of 1 second

Bologna Metro
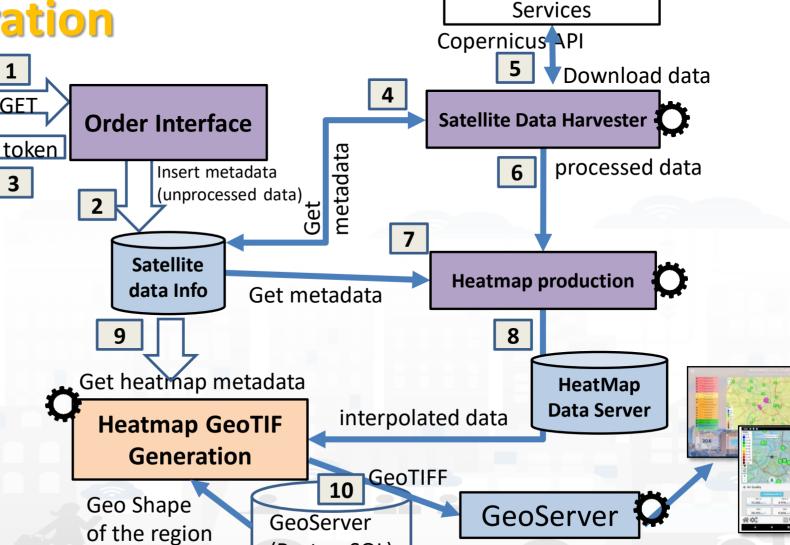
Satellite Data Harvesing and Preparation

Satellite Data Services

Copernicus API

Order Interface

1 GET

3 token

2 Insert metadata (unprocessed data)

Satellite data Info

4 Get metadata

5 Download data

Satellite Data Harvester

6 processed data

7 Get metadata

Heatmap production

8

HeatMap Data Server

9 Get heatmap metadata

Heatmap GeoTIF Generation

interpolated data

Geo Shape of the region

10 GeoServer (PostgreSQL)

GeoTIFF

GeoServer

Compernicus Data Request: Sci-Hub

https://www.snap4city.org/671

Harvest Satellite Copernicus Data form

- **Map name**: ……………….
- **Metric name**: AirTemperature, Humidity, Altitude, OLCI Global Vegetation Index, Cloud Fraction, etc.
- **Description**: a generic description;
- **Location**: select the level the data have to be taken and [heatmap](#) created. It is possible to specify one of the following: City, Country, State or Postal Code;
- **Location Name**: specify here the location: the name of a City or "Città Metropolitana di Firenze", or "Toscana" as State or "Italy" as Country, etc.;
- **Color Map**: color map visualization for example: airHumidity, ogvi, altitudeHQ, airTemperatureHQ, FractionalCloudCoverLQ, …. From those of Snap4City
- **Org**: specify the organization in Snap4City from the available list;
- **From Date - To Date**: use these to forms to specify the time period of the data to be downloaded. Please note that at least you have to specify at least 1 day period since satellite data are typically updated 1 times per day. If a longer period is specified, all data included in the period will be taken and, according to the available data, more date sets and [heatmaps](#) will be generated covering the time period;
- **Length**: specify here the dimension in meters of squared area, for example 700 for obtaining points values in a grid of 700x700 meters;
- **Write**: (1) to have data on piking and database, or (0) to do not have data thus obtaining only the heatmap
- You need to have a TOKEN to use the service ☺
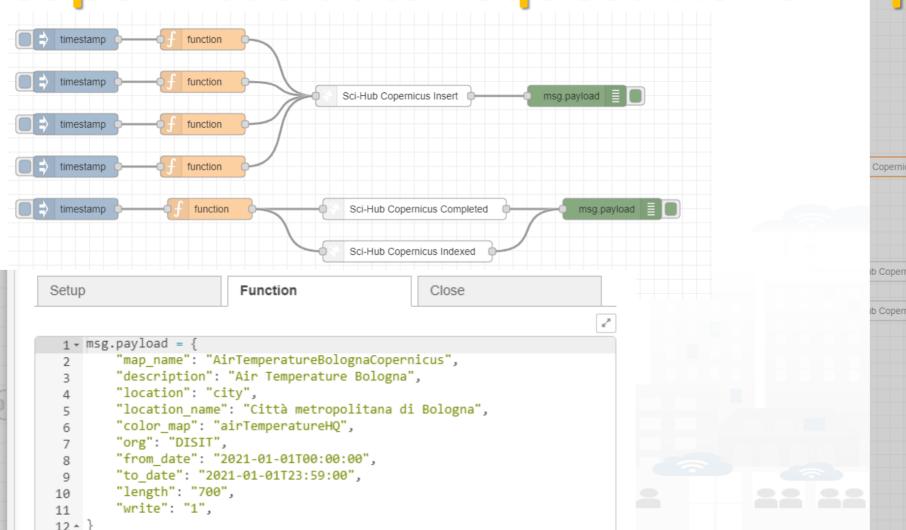
Copernicus data request via IoT Apps


```
1   msg.payload = {
2       "map_name": "AirTemperatureBolognaCopernicus",
3       "description": "Air Temperature Bologna",
4       "location": "city",
5       "location_name": "Città metropolitana di Bologna",
6       "color_map": "airTemperatureHQ",
7       "org": "DISIT",
8       "from_date": "2021-01-01T00:00:00",
9       "to_date": "2021-01-01T23:59:00",
10      "length": "700",
11      "write": "1",
12  }
13  return msg;
```
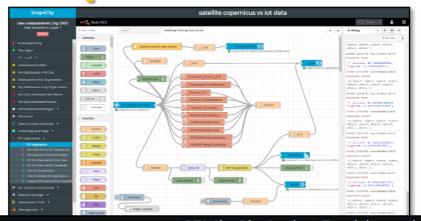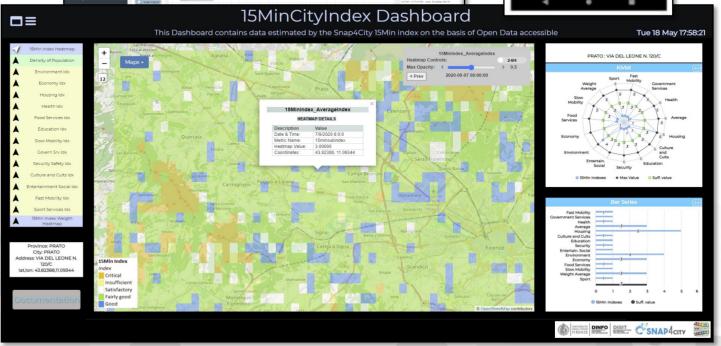
Once Generated can be exploited

- **Picking data on dense map and exploiting them on**
  - Assessing routing:
    - path of GPS points
  - Alerting specific users wrt specific locations.
    - One GPS position: park, garden, house, etc.
    - Alerting them
      - Via telegram
      - Email

- **Estimating city Indexes**
- **Comparison with sensors**

Heatmap production and used satellite and IOT data integrated

Snap4City (C), October 2025

77

Satellite (Copernicus) vs IOT Data

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

Interoperability with respect to Hardware staff
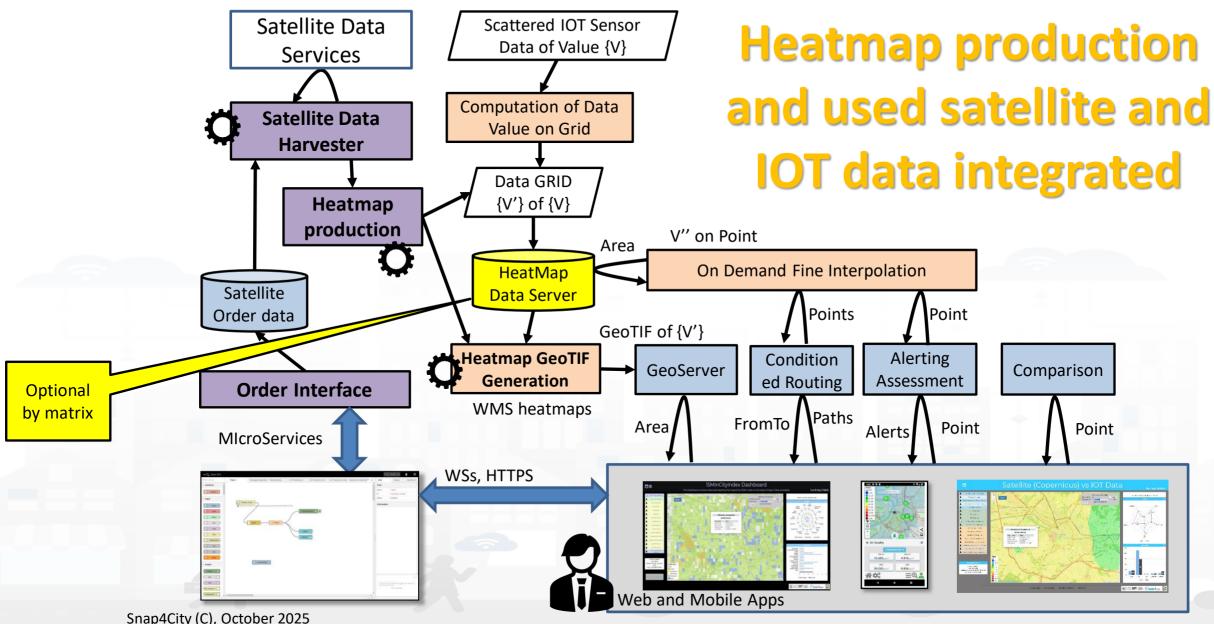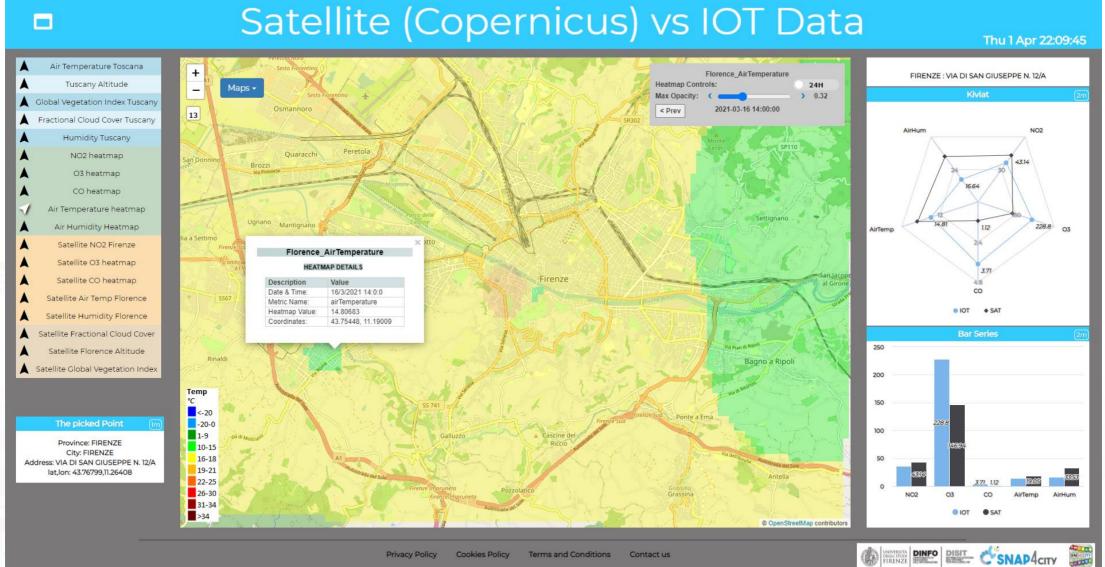
Some examples of Hardware Interoperability

- **Any Broker/Gateway** can be connected to Snap4City with any protocol:
  - For example: MQTT, COAP, SNMP, AMQP, OneM2M, LoraWAN, SigFox, etc..

- **Any Device** can be connected.
  - For example: Libelium, Arquino, Modbus, etc.

- **AXIS Cameras** can host
  - Snpa4City plugins and Proc.Logic/IoT Apps

- **Any TV Camera** can be conneced via VMS Milestone

MQTT Integration
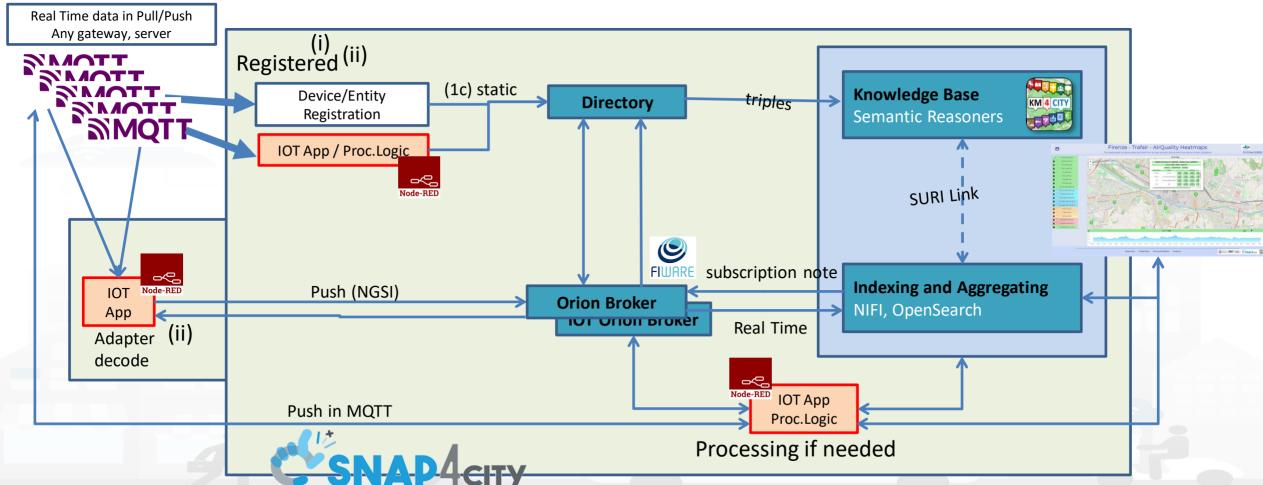
Can be connected from/to MQTT devices or gateways in push

Libelium devices
Smart Environment PRO

- PM10
- Temp
- Humidity
- Pm2.5
- NO
- NO2
- CO2
- Etc.

https://www.snap4city.org/659 how to set up on Snap4City
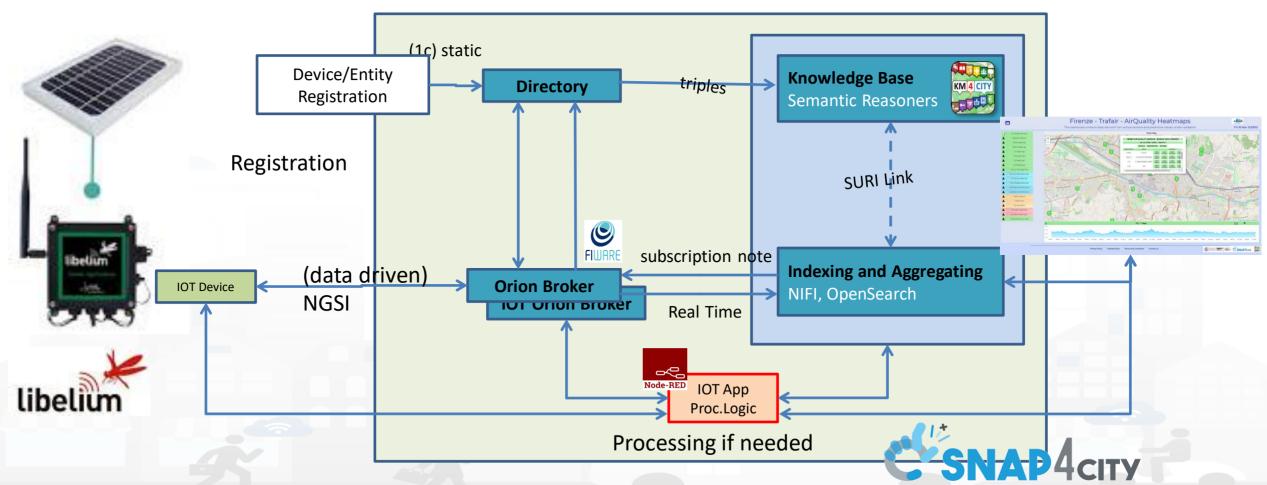
• Can be directly connected to Snap4City (data driven)

Lora IOT Gateway vs NGSI
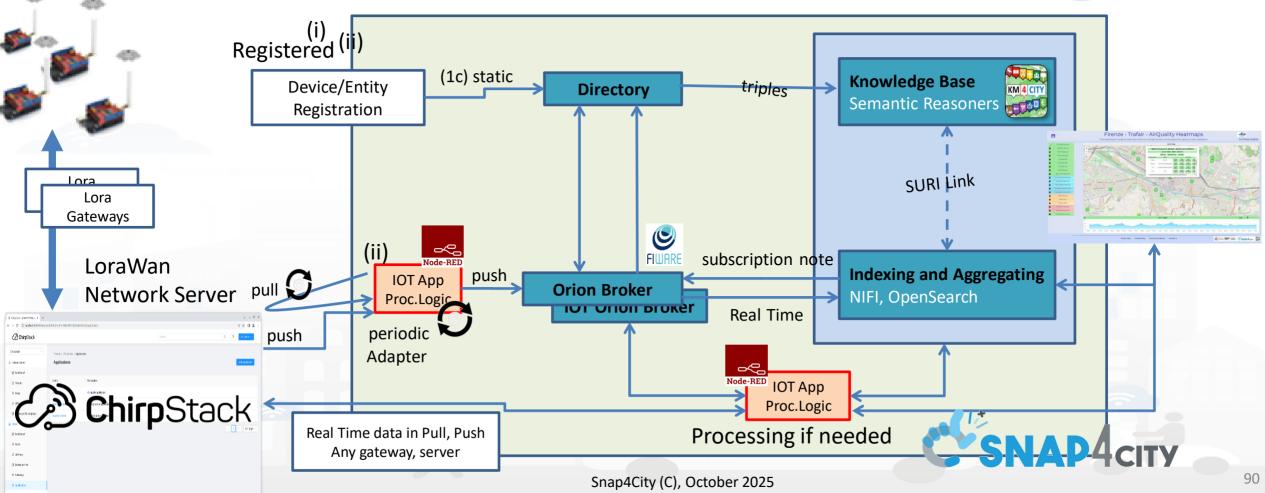
Management of Lora Devices Directly or via Lorawan Network Server with IoT App
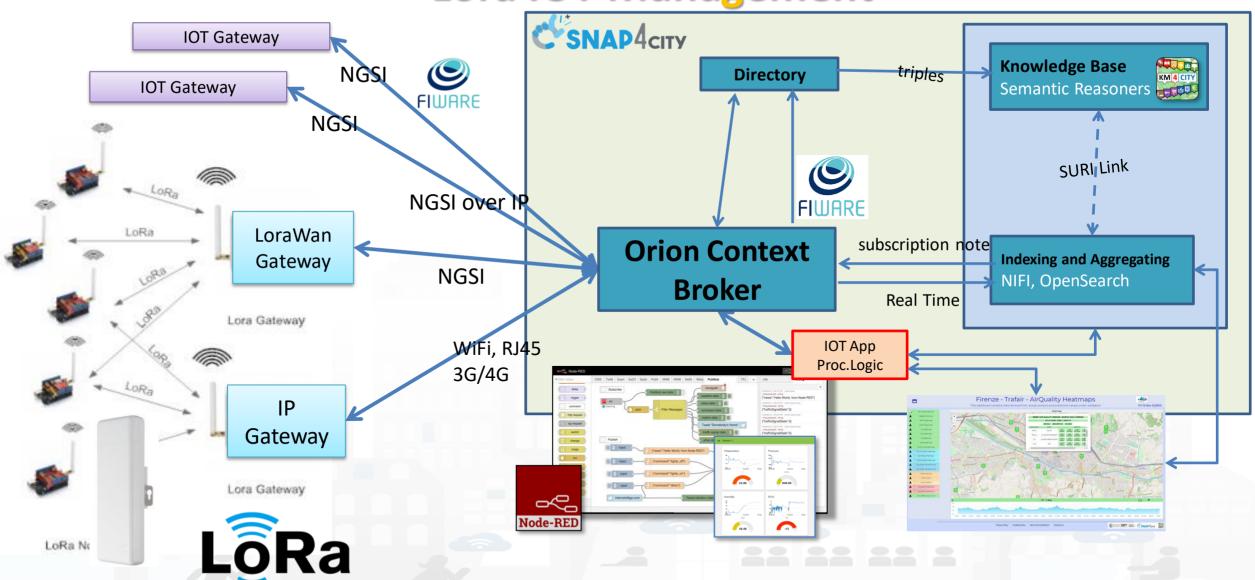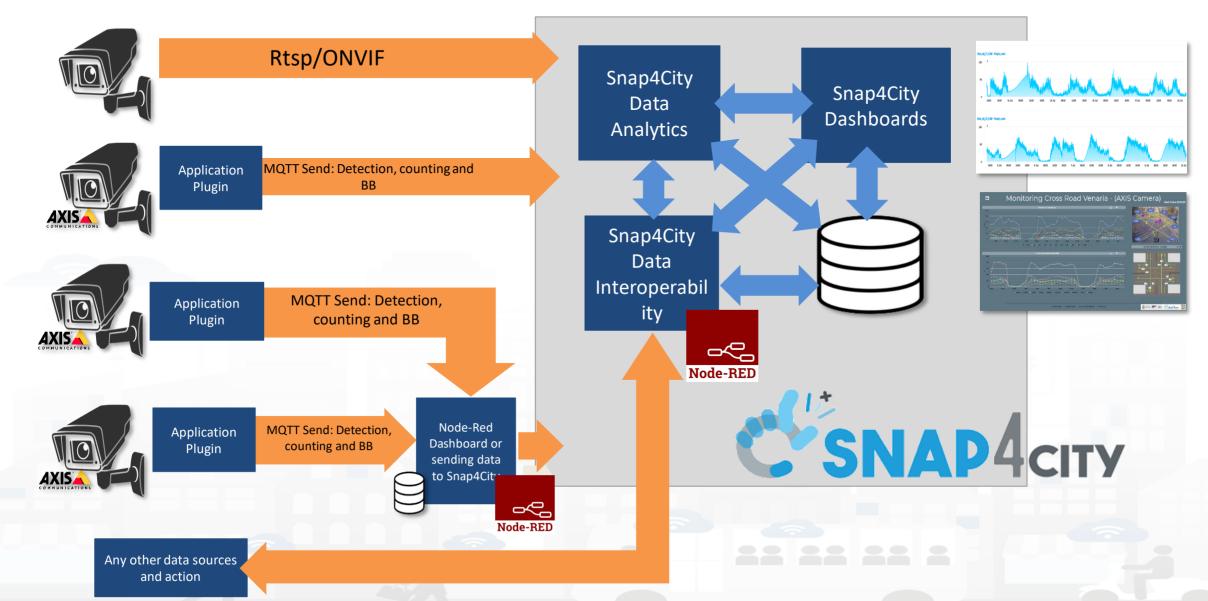
Lora IOT Management

Snap4City (C), October 2025

TV Cam AXIS on edge

Venaria Reale

- **AXIS cameras as IoT Edge (Node-RED)**
  - **Color, Thermal and Radar: security, transport, etc.**
  - Node-RED on board
  - Snap4City Library installed
  - Image processing for trajectories
  - Sending data stream on Snap4City.org
- **Snap4City infrastructure**
  - Collecting data in real time
  - Pre-processing, clustering in real time
  - **Counting in real time**: 12 trajectories, 8 in/out flows
  - Presenting data on dashboard
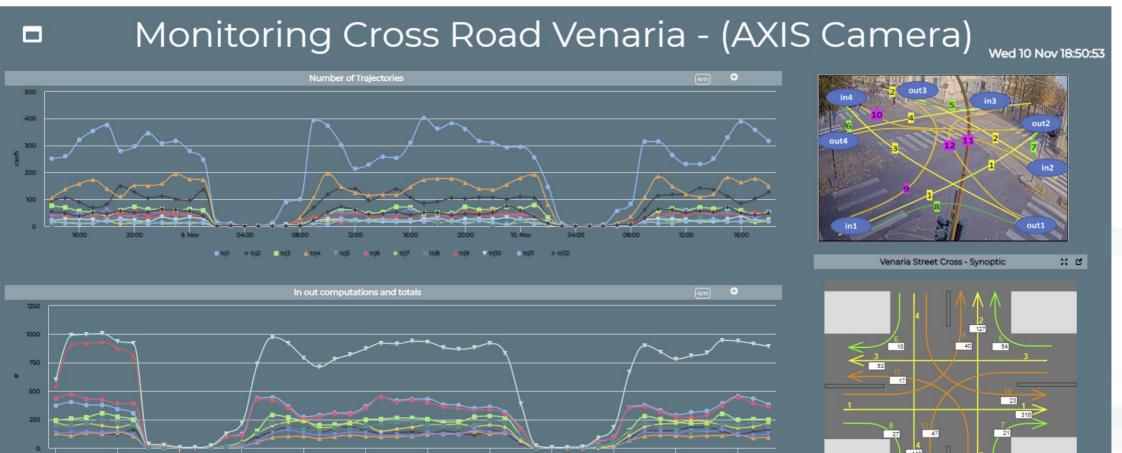
One Camera Many results

Venaria Reale

Monitoring Cross Road Venaria - (AXIS Camera)
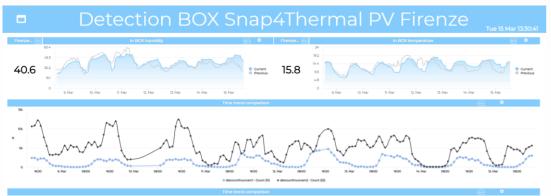
A view and data from the Thermal Camera
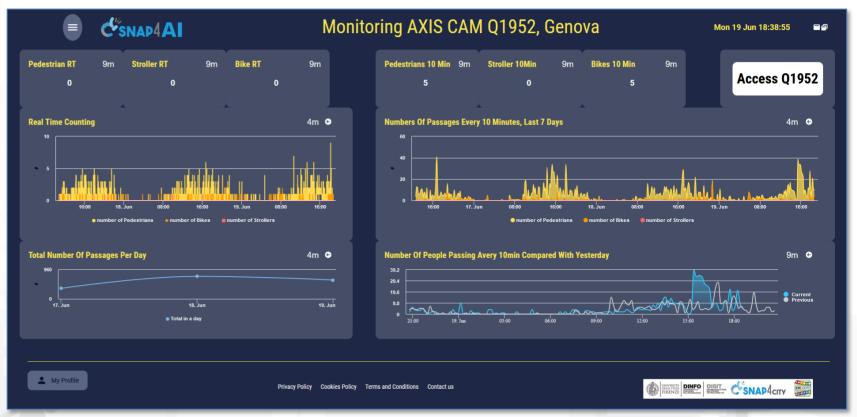
Monitoring Passages AXIS Q1952

- Genova: Ocean Race, 2023
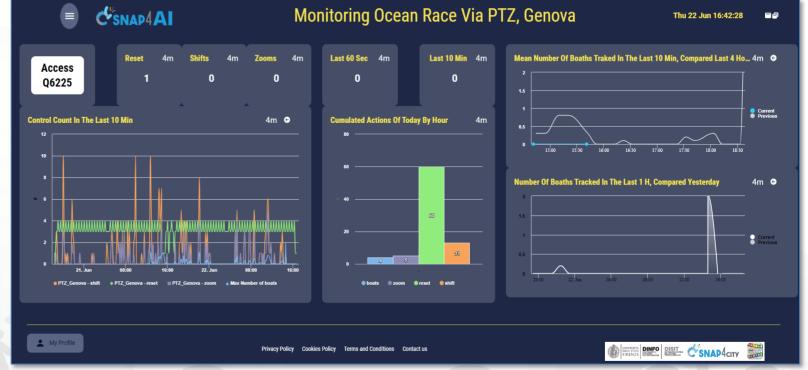
Monitoring Boats AXIS Q6225, PTZ

- Genova: Ocean Race, 2023

Integration with VMS milestone

Integration with MILESTONE XProtect Video Management
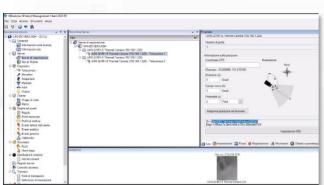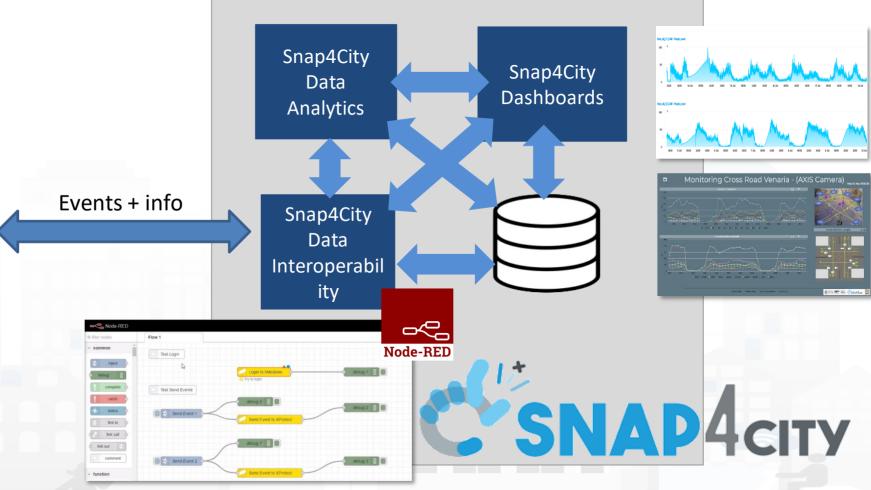
VMS vs Snap4City: sending and getting events, AI solutions

Events + info
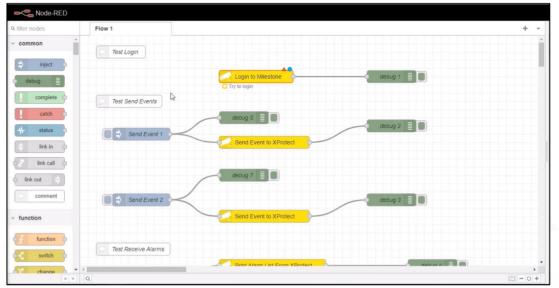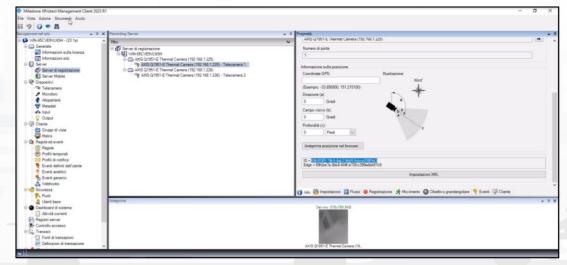
Snap4City ←→ Milestone Integration

- Snap4City VMS Library on Node-RED

- Functionalities:
  - Registering IoT App/Proc.Logic on VMS Milestone
  - Receving event of VMS into Snap4City platform via Node-RED, on cloud or on premise
  - Sending Snap4City Events into VMS Milestone

Event Management

sigfox **Integration**

SigFOX Server Side
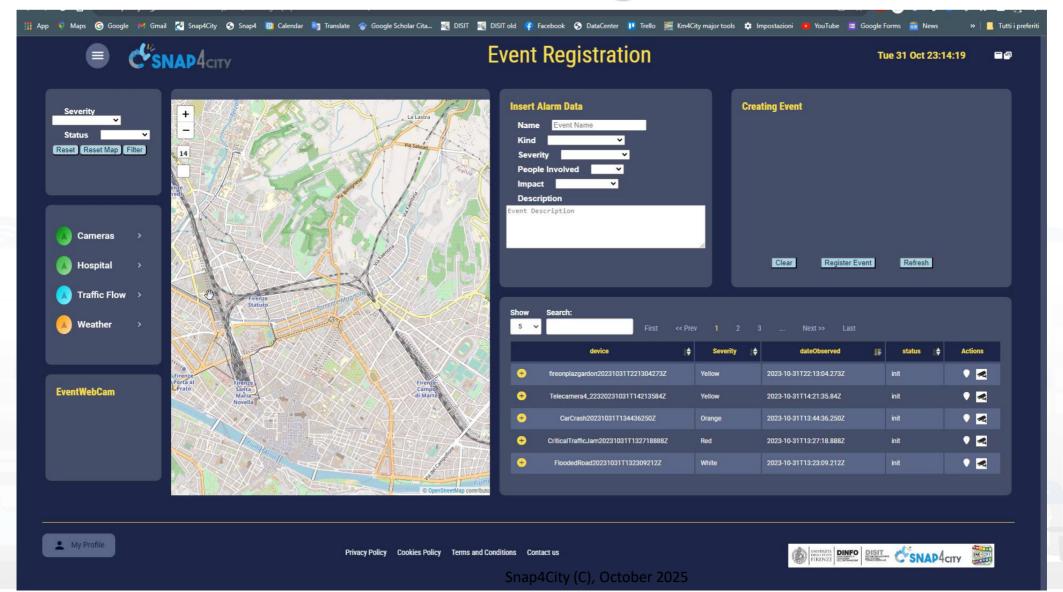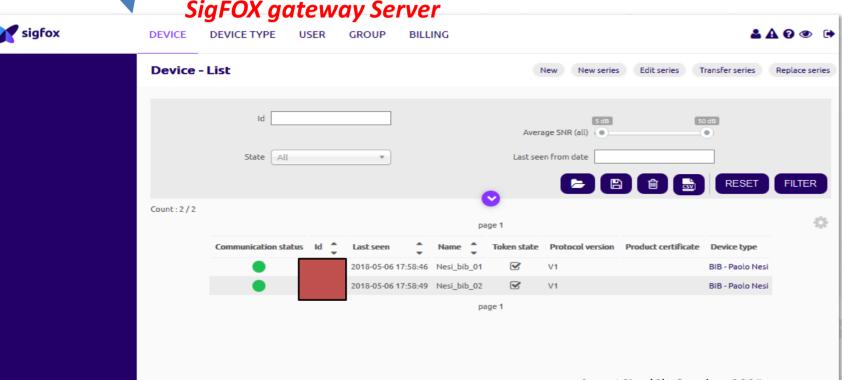
- Proprietary Protocol, freq similar to Lora
- Final users, consumers may buy SigFox devices and subscribe to network to register their devices
- 1 msg per every 10 minute, max num msg per day, per year…

Registered Managed

SigFOX gateway Server

SigFOX vs SNAP4CITY
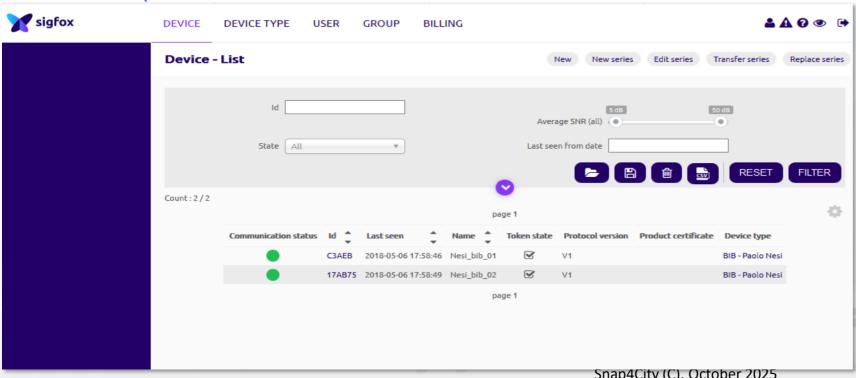
- Possible connection in PUSH and PULL
- Ingestion via IOT Application on Cloud or on IOT App on Edge
- Suggested connection in PULL

Registered Managed

SigFOX vs SNAP4CITY
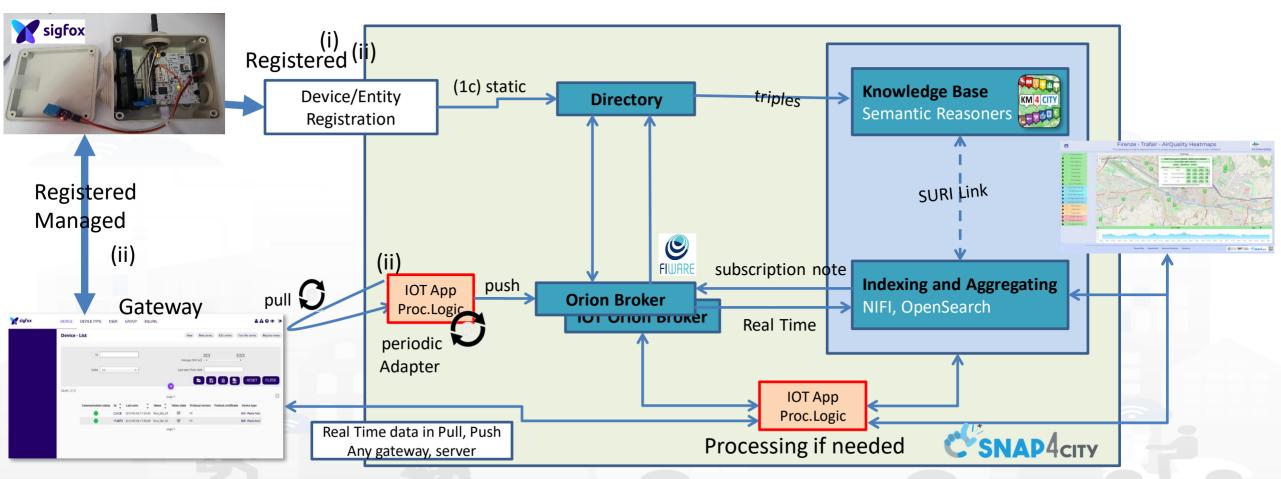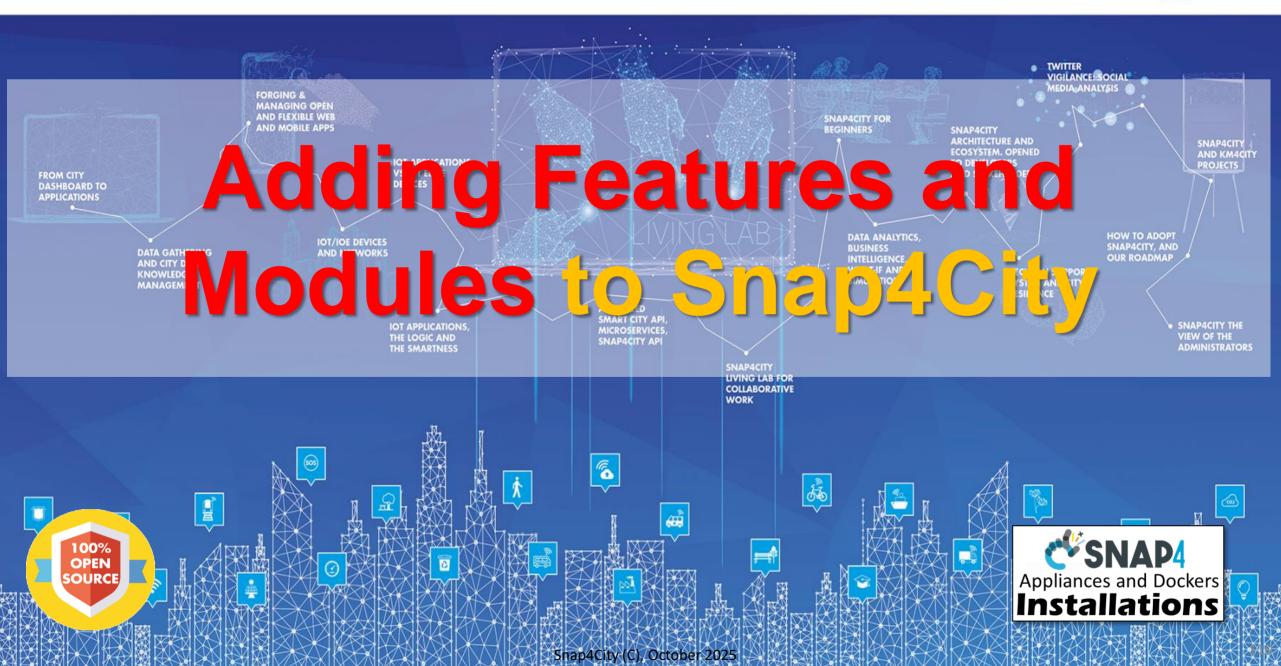
- Can be connected Indirectly via SigFox gateway (in push or pull), here represented in PULL

Adding Features and Modules to Snap4City

Technical Architecture

SNAP4CITY
KM4CITY

Any API

API Manager

Federation Smart City API

OpenSearch · virtuoso

storage

KB, graph

GeoServer

BIMserver.center

FIWARE

Brokers
MQTT Brokers
Brokers

Node-RED

Entity Directory:
Smart Data Models
IoT Data Models
Digital Twins

Entity Inspector

Data Manager

HLT Manager

Service Map

Simulators' tools:
SUMO, DORAM, TFR, ..

python R Studio

Artificial Intelligence tools:
pred., classif., optim., LLM, ...

Social Media
OSM, BIM, GIS, ITS
Gateways, satellite
External Services
Web Scraping
TV CAM streams

IoT App ProcLog.

On Edge
On Cloud

IoT App
ProcLogic

Event Driven

Front-End Facilities

Dashboard/View Builder & Mng.

Business Intelli-gence CSBL

Custom Themes

Synoptics & Widgets

2/3D Digital Twin

Tools

Routing, MulDyn

Heatmap Gen.

Prediction Gen.

Measure & Compare

Notification Mng.

KPI Support

Scenario, What-If

Applications

Traffic Optimiz.

Traffic Light Plan

Public Transport

Parking Mng.

Fines Mng.

Participation Mng.

Lighting Mng.

Building Mng.

Environment Mng.

Waste Mng.

Sharing/pool Mng.

Energy Mng.

Tourism Mng.

Mobile Apps

SnapAdvisor / Generative AI

A&A, RBAC, SSO, Blockchain, Resource Managers and Sharing

Sharing / Market Place

Third parties solutions

111

Adding new Features

- **Dashboard Theme/Style interface**
- **Dashboard Features** --> Custom Widgets, Widgets, Synoptics
- **Connectors, adapters, IoT protocols, data transformations,** etc. --> by creating new MicroServices, new flows or new IoT Apps ...
- **Applications, Modules** --> for management, for verticals, in the core by using
- **IoT Devices** --> for collecting new data kind or acting on the field
- **Processes** --> Data Analytic of any kind, also exploiting machine learning, GPU, etc.
- **Web and Mobile Apps** --> new end-users services
- **Dashboards**
- **IoT Applications / Proc.Logic**
- **Data ingestion process**, integration, etc.
- **External Services** to be exploited on Dashboards
- etc. etc.

Development Life Cycle Smart Solutions

Design
- Data Discovery Data Modeling
- Data Processes
- Data Analytic
- UserInterface + Business Logic

Development
- IoT App, Proc.Logic
- ML, AI, XAI Python, RStudio
- Special Tools
- UserInterface Dashboards

- Test — Deploy
- Test — Deploy
- Test — Deploy
- Test — Deploy

Analysis

Production

Validation
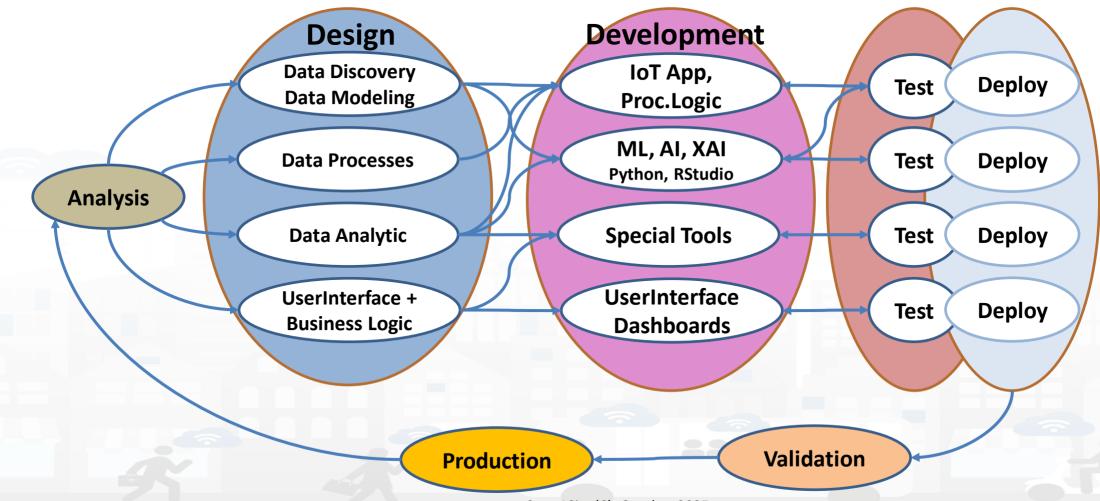
Adding new Features

- **Dashboard Features** --> Custom Widgets, Widgets
  - they can be created by using the Custom Widget SVG approach
    - TC1.22a: Create and configure a Snap4City SVG Custom Widget for real-time interaction
    - TC1.22b: Create and configure a Snap4City SVG Custom Widget for real-time interaction
    - Custom Widgets: Table explanation, as SVG
    - TC1.26: Use customised SVG pins in a map
    - TC9.19: Custom Widgets / Synoptics controlled by IOT Applications
  - they can be created by developing new elements programming in PHP, JavaScript, Angular, D3, etc..
    - Custom Synoptics and Widgets for Dashboards
- **connectors, adapters, IoT protocols, data transformations,** etc. --> by creating new MicroServices, new flows or new IoT Apps ...
  - https://www.snap4city.org/download/video/course/di/
  - HOW TO: Develop an IOT Application for Data Ingestion
  - they have to be in Node.JS, JavaScript according to Node-RED
    - Snap4City Supported Protocols, adding new protocols
    - how to create a flow and nodes in Node-red: https://nodered.org/docs/creating-nodes/first-node
  - They can be automatically created from API rest call
    - TC2.25. Registering external MicroService calling RestCall services, using it on IOT applications
  - business logic behind a dashboard
    - TC9.19: Custom Widgets / Synoptics controlled by IOT Applications

Adding new Features

- **Applications, Modules** --> for management, for verticals, in the core by using
  - any language you prefer, preferably exposing API for integration with other modules
    - https://www.km4city.org/swagger/external/index.html
    - https://www.km4city.org/swagger/internal/index.html
  - See Tutorial on how to transform any REST API in a MicroService
    - TC2.25. Registering external MicroService calling RestCall services, using it on IOT applications

- **IoT Devices** --> for collecting new data kind or acting on the field
  - HOW TO: add a device to the Platform
  - HOW TO: Manage IOT Network Components on Snap4City
  - you can add to the platform any kind of IoT Device, with any kind of IoT Protocol
  - You can exploit the open source for Android and raspberry for creating your safely connected IoT device with Snap4City using NGSI V1, V2 and exploiting our secure communication approach

https://www.snap4city.org/692

Adding new Features
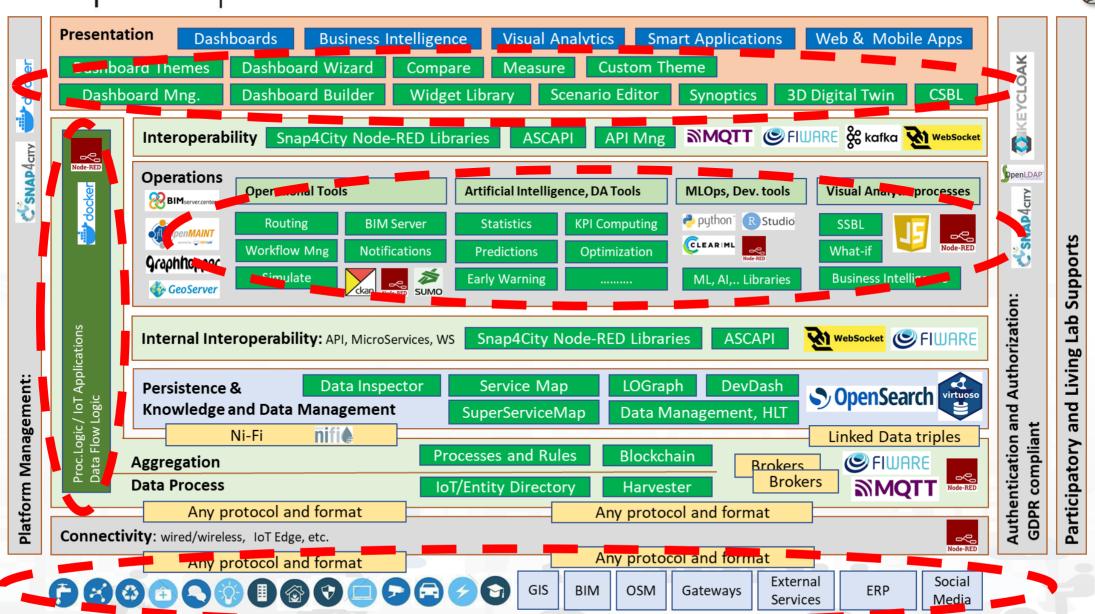
- **Processes --> Data Analytic** of any kind, also exploiting machine learning, gpu, etc.
  - see tutorial on Data Analytics
  - https://www.snap4city.org/download/video/course/da/
- **Web and Mobile Apps** --> new end-users services
  - https://www.snap4city.org/download/video/course/app/
- **Dashboards: Dashboard Builder and Kibana**
  - https://www.snap4city.org/download/video/course/das/
- **IoT Applications in Node-RED**
  - https://www.snap4city.org/download/video/course/iot/
- **data ingestion process, integration, etc.**
  - https://www.snap4city.org/download/video/course/di/
- **External Services to be exploited on Dashboard**s
  - by simply registering their URLs on the portal
  - https://www.snap4city.org/55
- **Workflows**: via OpenMaint
  - TC 1.24 – Integrated Ticketing and Facility Management system
- **BIM models** via Bim Editor for IFC production → Bim Server
  - HOW To: Manage BMP and BIM: main features of openMAINT, BMP, BIM
- etc. etc.

Constraints
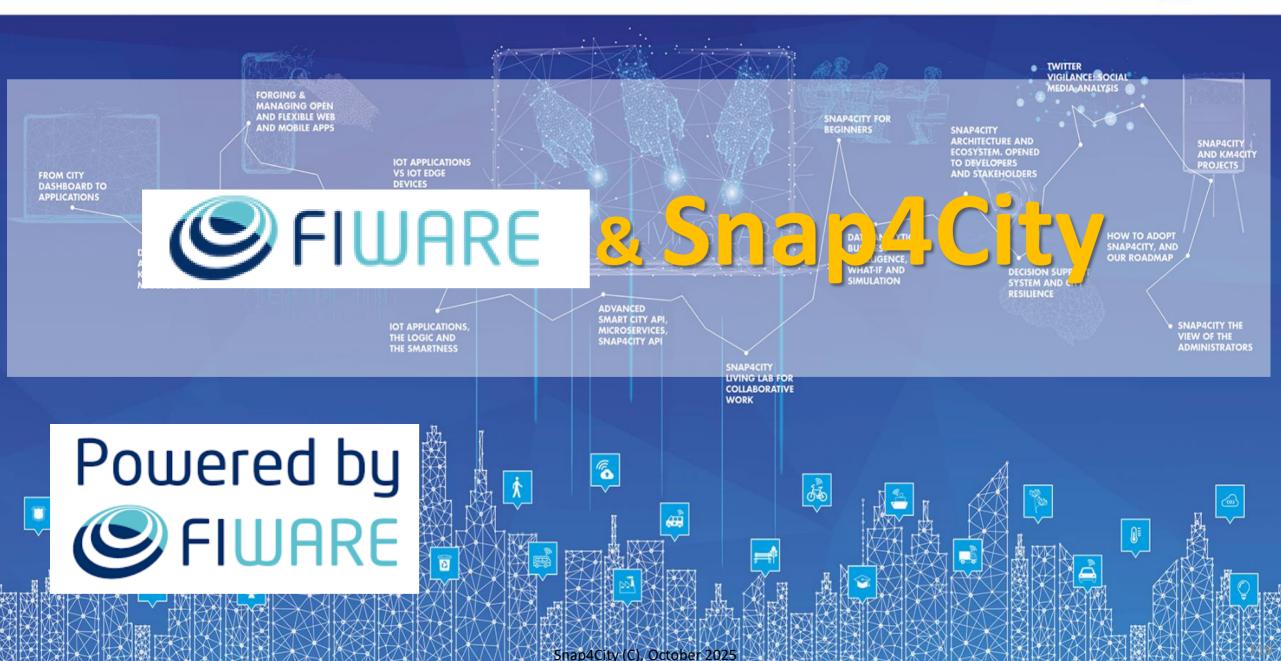
- **new version modules**
  - **to be integrated in the main version,** have to be tested and validated by DISIT Lab. They have to:
    - be in Affero GPL
    - do not affect the functionalities of other modules in negative manner
    - provide the needed quality, in terms of test cases, documentation, etc.
  - **If they are not part of the core**,
    - can be based on proprietary model, and exploit the Snap4City tools via APIs
      - **no constraints**
    - **but forked, they need to te** published version on Internet and linked to main according to **Affero GPL.**

- **Snap4City modules are mainly in Affero GPL**
  - **platform rebranding is not allowed**
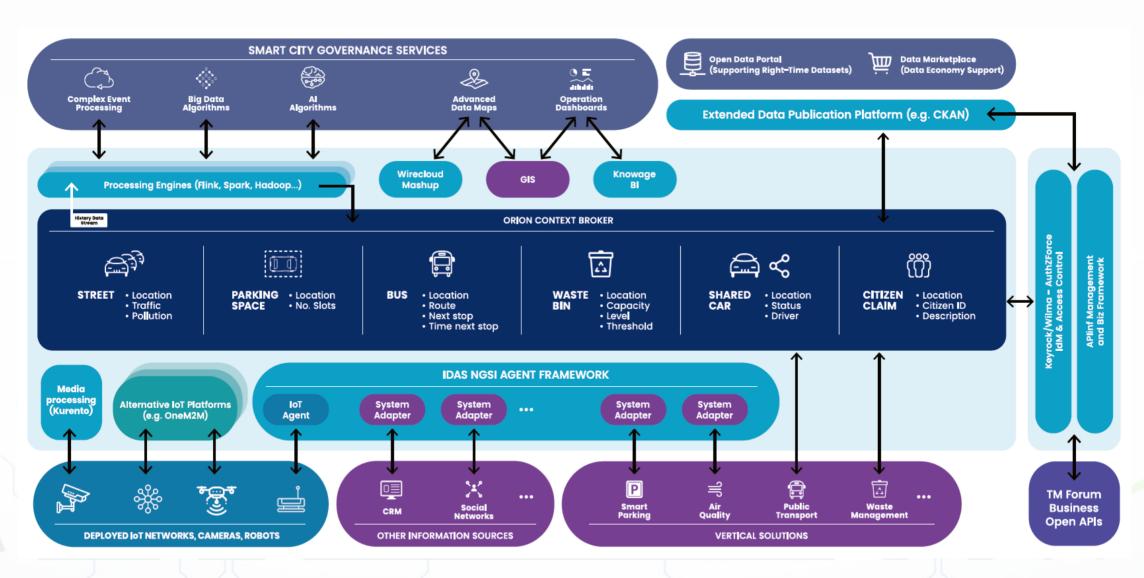
THE FIWARE SMART CITIES REFERENCE ARCHITECTURE

FI-WARE

Snap4City (C), October 2025

120

- Snap4City - Powered by FIWARE Solution & Platform:
  - https://www.fiware.org/marketplace/product-details/?category=powered&id=snap4city-snap4city
  - NGSI V1, V2 The IOT Orion Broker
  - IOT Orion Broker can connect JSON, MQTT, Lightweight M2M, LoraWAN, OPC, SigFOX, etc. see FiWare Https://www.fiware.org
- Snap4City - FIWARE Training Services:
  - https://marketplace.fiware.org/pages/solutions/03bccd83a0e1b0398ba7a0bf
- Snap4City - FIWARE Consultancy Services:
  - https://marketplace.fiware.org/pages/solutions/907f5ecc63927f643dd8421b
- **Snap4City is compatible** with all the above protocols
  - via IOT Orion Broker,
  - via IOT Applications.
  - via direct connection on ETL processes on their corresponding IOT brokers, and/or
- **Snap4City is also compatible** with many other protocols, see the table reported in page: https://www.snap4city.org/65

Overview

SMART CITIES AND SMART INDUSTRY

Snap4City: FIWARE powered smart app builder for sentient cities

- https://fiware-foundation.medium.com/snap4city-fiware-powered-smart-app-builder-for-sentient-cities-acfe24df49d5
- https://www.snap4city.org/drupal/sites/default/files/files/FF_ImpactStories_Snap4City.pdf

- In Snap4City you can chose to connect your devices at Snap4City Platform in different manners:
  - (a) directly to Snap4City with some Broker, or on IOT App, Brokers, MyKPI
  - (b) via an IOT Orion Broker (external IOT Broker or those provided by Snap4City), or
  - (c) via any third party IOT Brokers in any protocol you have.
- **Snap4City has**
  - **Improved IOT Orion Broker** with the so called Orion Broker Filter (Orion Broker Filter, NGSI Security Wrapper) which is a secure wrapper for NGSI V1 and V2 protocol for enforcing Mutual Authentication, Security, roles, etc.
  - **Produced open hardware and open software NGSI Compliant:** as
    - **IOT Devices** with mutual authentication and security based for NGSI on: Android, Arduino and ESP32, IOT Button, etc.
    - **IOT Edge** devices with mutual authentication and security based for NGSI on: Raspberry PI, Windows, Linux.
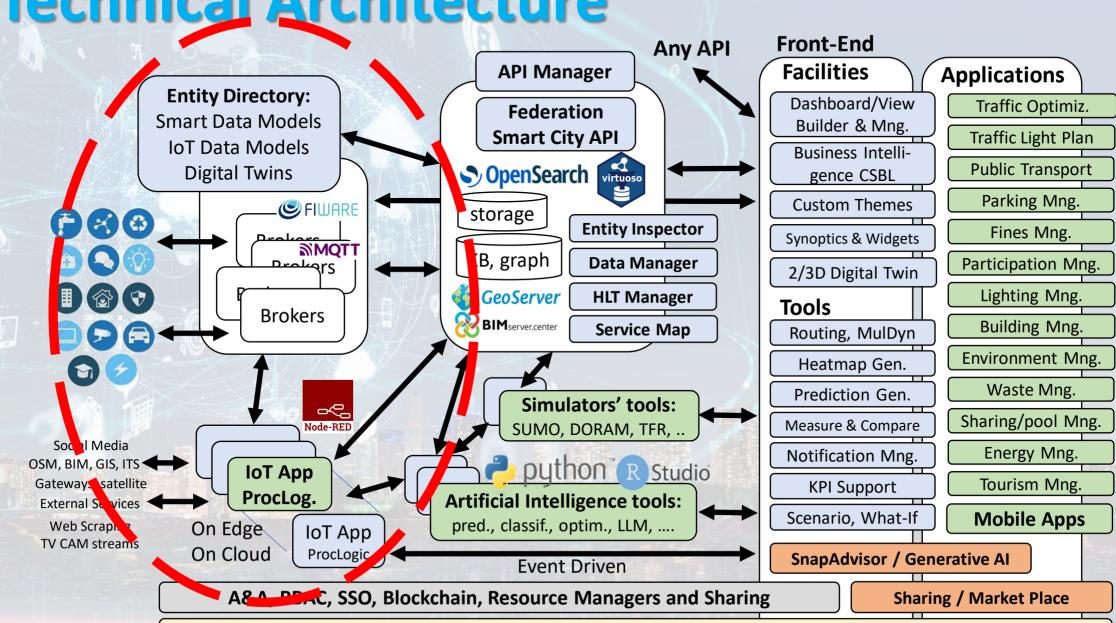
Technical Architecture
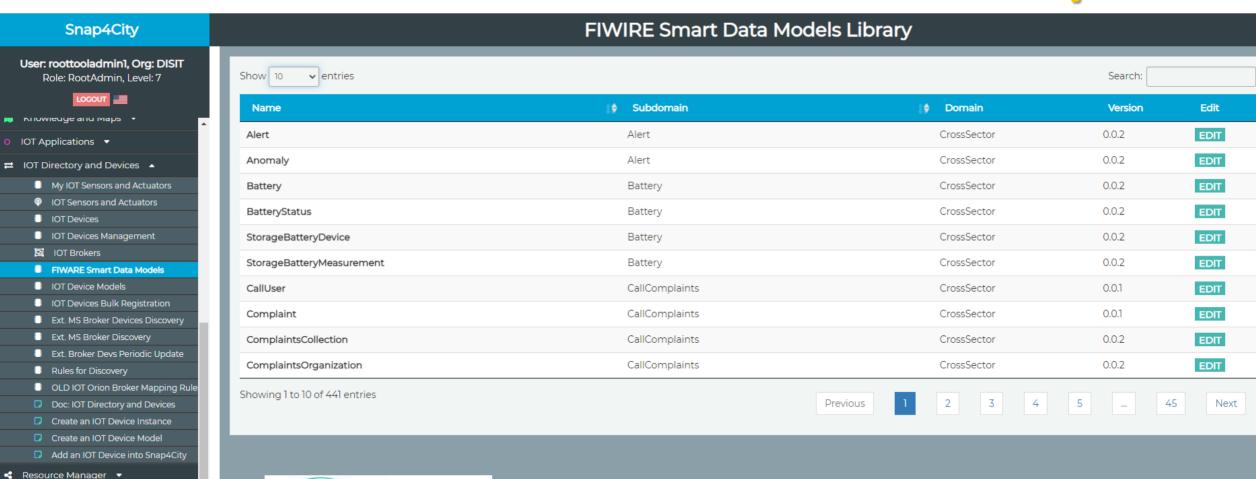
FIWARE Smart Data Models -- Library
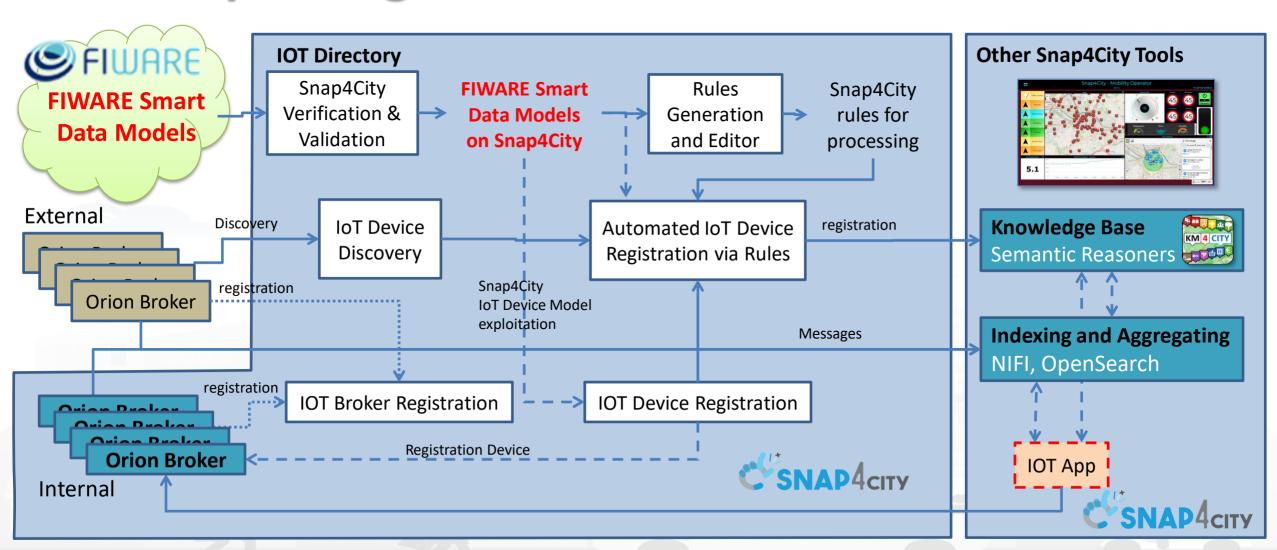
Exploiting FIWARE Smart Data Models

Snap4City and FiWare integration

- **A) Orion Broker as an External Broker** of a Snap4City platform
  - Devices are mainly managed by Orion Broker only
  - IoT Directory can harvest devices on Broker to registered them
- **B) Orion Broker is an Internal Broker** of a Snap4City platform
  - This implies that Snap4City facilities are exploited for:
    - IoT Devices registration, IoT discovery, Ontology, Bulk registration, optimization of stored data, adaptation, filtering crontrol, etc.
  - All the devices are registered into IoT Directory that performs the registration on both IoT Orion Broker and KB automatically
- **C) Federation of an Orion Broker** with storage by using SSM2ORION
  - Devices are managed by Orion Broker only
- **D) hybrid solutions** in which Web and Mobile App can exploit both Orion API and Snap4City services and API
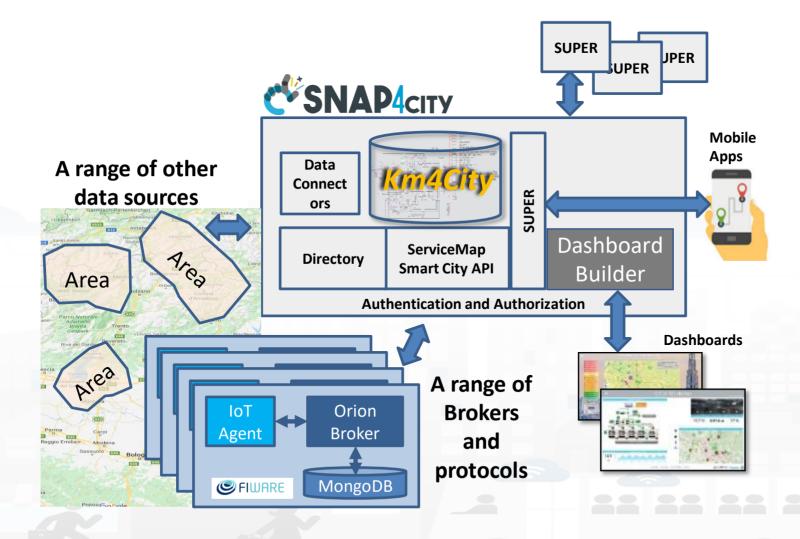
Snap4City IoT Registration and Access
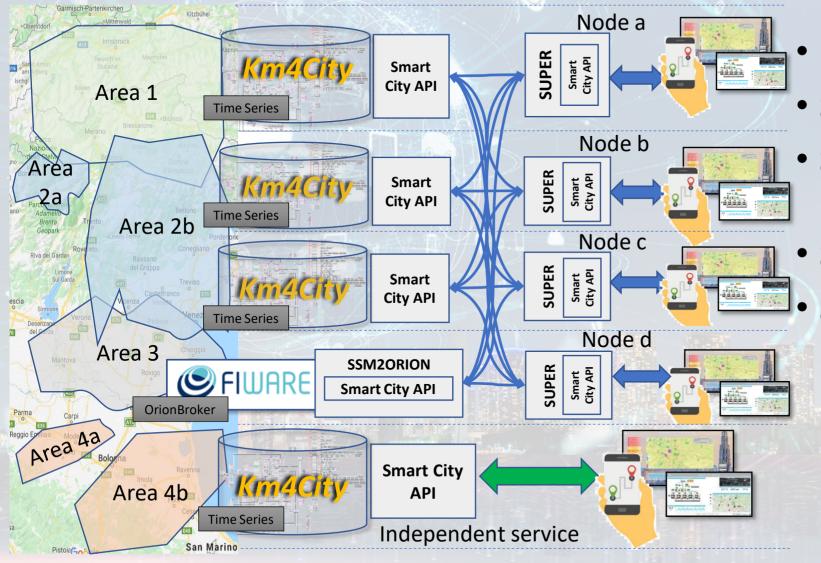
Snap4City (C), October 2025

Federation of Smart City Services

- Km4City **Semantic Reasoner**
- **ServiceMap** interoperability
- **Seamless for multiple Mobile Apps**
- **Smart City API**
- **Super**:
  - distributed access and sharing services
  - Each city control its own data
  - Final user can pass from one city / area to another in seamless manner: without changing the mobile Apps
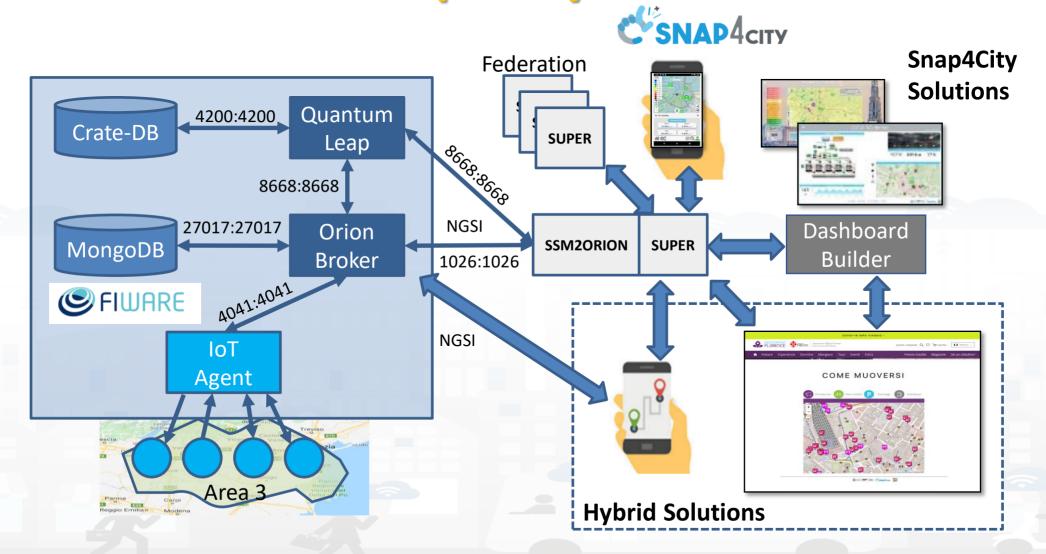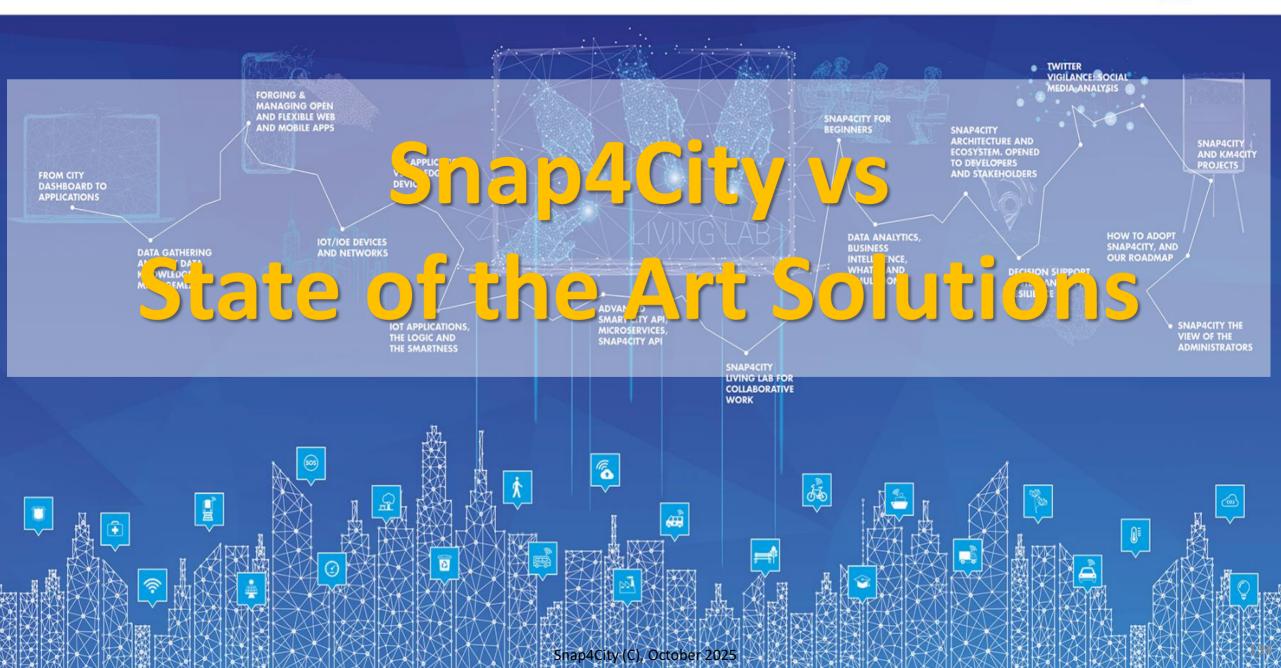
Federation of Snap4City vs ORION Broker

Snap4City vs State of the Art Solutions

Market Solutions

	Open Source end-to-end	Scalability IOT	Execution scalability	Visual Programming end-to-end applications	Advanced Smart City API,	MicroServices Multi Domain	Semantic Platform	External sevices via API	Standard based	Modules and IOT, Open Devices	Integrated Community manmagement Resoruce Sharing	Referral data management	Security end-2-end	Dashboard H24/7	Falxible and easy dashboard creation	Multi-protocol on IOT
SNAP4	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
KAA	Y	Y	Y	N	Y	N	Y	N/Y	Y	N	--	KAA	Y	Y	N	Y
AWS	N	Y	Y	N	N	N	Y	Y	N	Y	Y	AWS	Y	Y	(Y)	Limited
Azure IOT	N	Y	Y	(Y)	N	N	Y	Y	(Y)	Y	Y	Y	Y	Y	(Y)	Limited
IOT IGNITE	Y	Y	N	Y	N	N	Y	N	N	N	--	N	Y	Y	(Y)	MQTT
PTC ThingWorkx	N	Y	(Y)	Y	N	N	Y	Y	N	N	N	--	Y	Y	(Y)	Y
BEZIRK	Y	N	N	N	N	N	Y	--	Y	N	N	BEZIRK	N	N	N	Y
Bosch IoT Suite	N	Y	(Y)	Y	Y	N	Y	Y	N	N	N	Y	Y	Y	(Y)	Y
FIWARE ref SC arc.	Y	(Y)	N	N	Y	N	N	Y	N	N	N	FIWARE ref SC arc.	Y	N	N	Y
CISCO Jasper	N	Y	N	N	N	N	N	Y	N	--	--	Y	--	Y	--	N
IBM Watson IoT	(N)	Y	(Y)	Y	Y	Y	Y	Y	N	Y	(y)	IBM Watson IoT	Y	Y	Y	Y
Siemens MindSphere	N	Y	--	Y	N	N	N	Y	N	N	N	Y	N	Y	N	Y
Carriots	N	Y	--	N	N	N	N	Y	--	N	N	--	Carriots	Y	Y	MQTT
Thingsboard	Y	Y	N	N	N	N	N	N	N	N	N	--	Y	Y	Y	(MQTT, CoAP, http)
IOT eclipse.org	Y	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N	Y
Google IOT	N	Y	Y	N	N	N	Y	N	N	N	N	N	Y	N	N	MQTT, HTTTP

Requirements on Broker Interoperability

Requirement	Snap4City	Google IoT Cloud	Azure IoT	AWS Amazon	IBM Watson	Siemens Mindsphere
Manage different kinds of IoT entities	Y	N	Y	(Y)	Y	Y
Connect External and Internal Brokers	Y	Y	Y	Y	Y	(Y)
Use any Data Model with any data type	Y	Y	(Y)	(Y)	Y	(Y)
Verify the correctness of IoT Messages of IoT Devices	Y	(Y)	(Y)	(Y)	(Y)	(Y)
Semantic Interoperability	Y	Y	Y	Y	Y	(Y)
Automatics deploy of Internal IoT Brokers	Y	N	N	N	N	Y
Register External Brokers	Y	N	N	N	N	N
Discover IoT Devices on IoT Brokers	Y	N	(Y)	N	(Y)	N
Easy management graphic interface to list and test IoT entities	Y	(Y)	(Y)	(Y)	(Y)	(Y)
Manage IoT Device Model and Device Data Type ownership and access grant	Y	Y	(Y)	Y	Y	Y
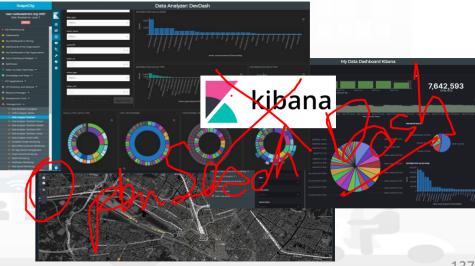
Two Main Lines for Dashboarding are present

- **Dashboard Builder of Snap4City**
  - For accessing and browsing data on: OpenDistro x ElasticSearch, Mongo, MySQL, Smart City API, Super and thus from federated Smart City API, etc.
  - Supports sensors/actuators: data driven data, maps in extended manner, data driven widgets, large collection of widgets, direct IoT Connections, custom widgets, animated PIN on maps, a large set of panel/widgets, etc.
  - Very simple to be used for control room, decision makers, situation rooms, operators, etc.
  - Very well integrated with IoT App, Custom widgets, animation, external services.
  - Very simple to be customized for non programmers since all the tools are visual.
  - Support for GDPR and deep control of access.
  - Can integrate Kibana/Grafana Views into a Widget
- **Kibana** (so called **DevDash**, **AMMA** and recently **My Dashboard (Dev) Kibana**), also accessible as Grafana
  - For accessing and browsing data on OpenDistro x ElasticSearch storage and other sources supported
  - No Support for real time event driven widgets/panels, actuators and synoptics, no sophisticated maps, etc.
  - Not simple for control room, decision makers, etc.
  - Not integrated with IoT App, Custom widgets, animation, external services.
  - Oriented to developers, complex production of custom views, etc.
  - Partial support of GDPR and deep control of access.

Snap4City Dashboard Builder (2023) vs Kibana/Grafana

Features	Snap4City Dashboard Builder	Kibana, Grafana
Large Collection of Widgets, also from D3 library	YES	Nothing
Custom Widgets SVG of any kind, full defined process for customization	YES	Nothing
Real time event driven widgets and data	YES	Nothing
Server/Client Side Business Logic for data transformation with visual programming: Node-RED	YES: visual/coding	coding
Maps with custom PIN, bubbles, animated and moving, etc.	YES	Nothing
Maps with paths, shapes, traffic flow, scenarios, routing, heatmaps, what-if, Origin Destination Matrix, …	YES	Nothing
Maps with Orthomaps from WFS, WMS, GIS connection, etc.	YES	Nothing
TV camera integration and selection	YES	Nothing
Widgets for business logic integration on real time: buttons, selector, switch, etc.	YES	Nothing
Kiviat, Spider net, Calendar (also any other D3 Widgets)	YES	Nothing
Typical Time Trends: day hours, month week, month days, …..	YES	Nothing
Time Trend Compare: day, week, month, year	YES	Nothing
Selectors/Menus: text, icons, etc., also in connection with IOT APP, Node-RED	YES	Nothing
Full control of graphic layout, font, colours, refresh per widget, etc.	YES	Nothing
Iframe integration of third party widgets and web pages, nesting dashboards, embedding Kibana	YES	Nothing
Connection among multiple Dashboards and Widgets	YES	Nothing
Synchronization with Video Wall, and Operators Views	YES	Nothing
Multiseries, bar lines, charts, pie, donut, simple selectors, trends, etc., also from business logic	YES	Limited
Single content, string, html, any data, etc.	YES	Limited
Special widgets: Weather forecast, civil protection, road plates, Twitter, SVG, etc…	YES	Nothing
Digital Twin Local (BIM) and Global (3D city representation) with 3D traffic, Heatmaps, Devices, …	YES	Nothing
Faceted search	YES: selectors, forms, buttons	YES

Functional: FIWARE ref arc wrt Snap4City solutions

	FIWARE ref arc smart city	Snap4City
Multiple Protocols: IoT, Databases, etc..	10 on IOT, Limited on databases, etc.	More than 200, very very wide
Large set of high level types: maps, trends, heatmaps, traffic, trajectories, scenarios,…	No	Yes:
Integration with workflows, BPM	Not Supported	Yes: bidirectional
Integration and Modeling Digital Twin BIM	Not Supported	Yes: bidirectional
Integration with GIS: WFS, WMS	Not fully supported	Yes: bidirectional
Integration with Heatmaps and Satellite	Partially, not calibrated	Yes: fully; calibrate and multiple versions, animations
Integration with Satellite	not supported	Yes: fully
Smart City API	no	Yes
Open Data Management	Partial with CKAN	Yes, Fully automated with CKAN
Federation of platforms	Partial on brokers	Full on Brokers and Knowledge base and API
Semantic model and queries	with NGSI-LD in the future	Yes since 2013
Multiple kinds of IoT Brokers	No, only agents	Yes: NGSI, COAP, AMQP, MQTT, SigFOX, etc.
Data Model	Smart Data Models	Smart Data Models, IoT Device Models
Complex data Model	Not supported	Heatmap, traffic flow, ODM, 3D models, TV Cam, etc.

Interoperability Openess

Functional: FIWARE refarc. wrt Snap4City solutions

	FIWARE ref arc smart city	Snap4City
Data Transformation	Coding	Yes: IOT App, Node.JS, Visual Programming, scalable
Data Analytics	No	Yes
on line development	No, limited	Yes: Rstudio, Python, Tensor Flow, MapReduce, etc.
Dashboard on data	Grafana no LDAP	Yes: Dashboard Builder, OS Dash with GDPR, LDA
Dashboard Widgets	Limited, no custom, coding needed	Yes: A wide range including custom widgets, secure compliant, animations, configuration, also open to new development
Real Time end-to-end from Dashboards to any other channel, event driven	No, very limited	Yes, fully supported
Multi Data Map	Limited with non OS	Very extensive, with multiple widgets and sync
MicroApplications	No	Yes
Auditing, Assessment, accounting	No, no, no	Yes, Yes, Yes
Multitenacy on data management	No only on broker	Yes: on Broker, on data management, on dashboards, etc..
Living Lab for creating/managing communities/groups	Not supported	Yes: provided in the open source
Report generation/management	No	Yes

Process
Graphics
Manag.

Smart City planning with Snap4City Team Support
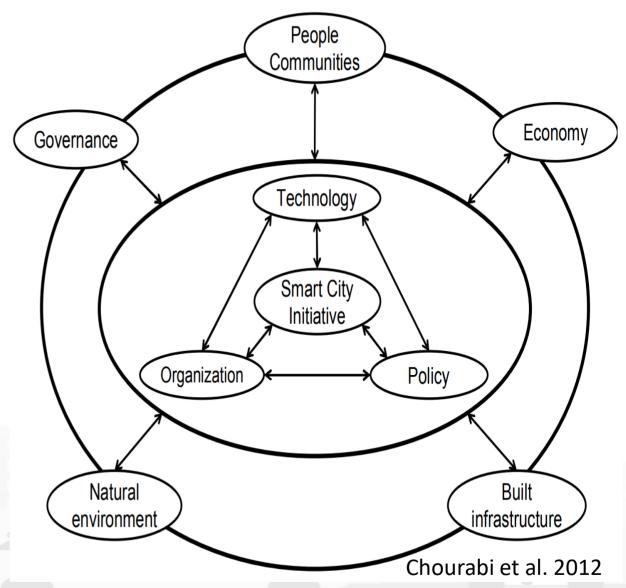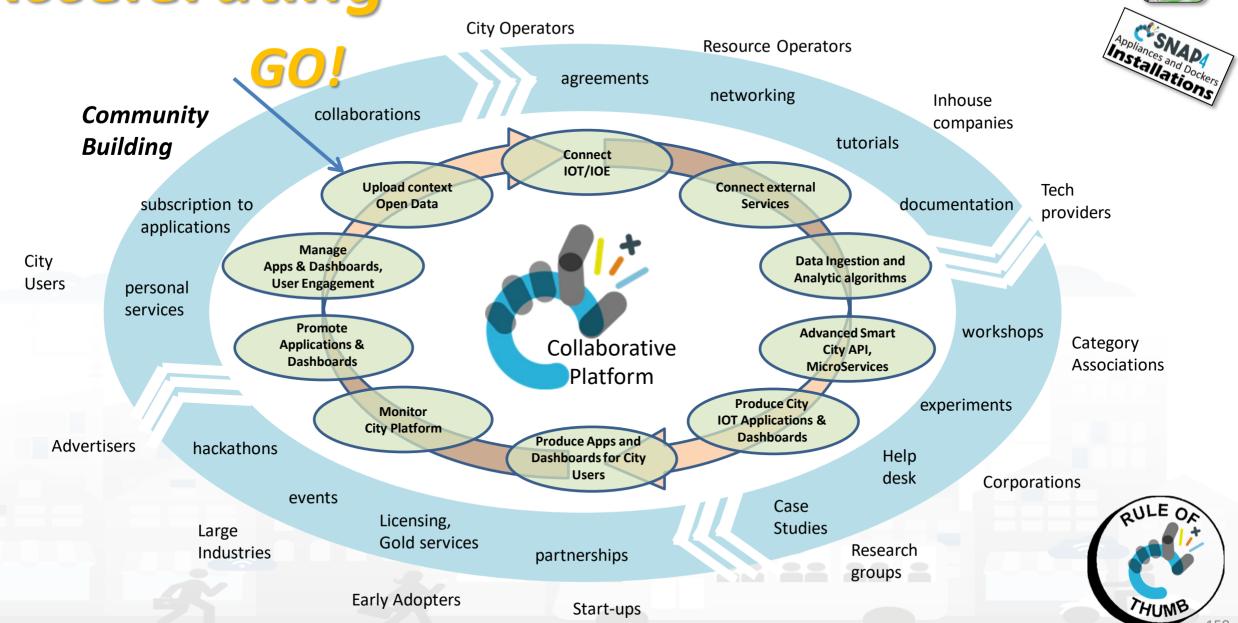
Smart City Process

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

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

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

Chourabi et al. 2012

Accelerating GO!

Community Building

Collaborative Platform

City Operators
Resource Operators
agreements
networking
collaborations
Inhouse companies
tutorials
subscription to applications
documentation
Tech providers
City Users
personal services
workshops
Category Associations
Advertisers
hackathons
experiments
events
Help desk
Large Industries
Licensing, Gold services
partnerships
Case Studies
Early Adopters
Start-ups
Research groups
Corporations

Connect IOT/IOE

Upload context Open Data

Connect external Services

Manage Apps & Dashboards, User Engagement

Data Ingestion and Analytic algorithms

Promote Applications & Dashboards

Advanced Smart City API, MicroServices

Monitor City Platform

Produce City IOT Applications & Dashboards

Produce Apps and Dashboards for City Users

SNAP4CITY
KM4CITY
SNAP4 Appliances and Dockers Installations
RULE OF THUMB

Smart City in a Snap Acceleration for Innovation

- **Organization/City analysis**
  - requirements analysis, identification of domains
  - Snap4City Innovation Process → Report of Scenarios vs Data
  - Data Analysis → Report as Data Table

- **Smart City Design for Innovation:**
  - Design of main Scenarios and Tools (Dashboard, SCCR, Apps, IOT Network, new data, etc.) → Report as Mock-up Design

- **Next phases**
  - Data Ingestion and Data Warehouse
  - Scenarios Implementation

Analysis and Design for Innovation (Co-Creation and Co-Working)

Analysis & Design for Innovation

- **Analysis**
  - The analysis starts with a number of meetings/interviews with stakeholders
  - The identification of the target stakeholders/actors/users (target Segments) and their definition/description
  - The meetings/workshops are focused on filling the **Snap4City Innovation Matrix** which is a evolution of the INNOVATRIX approach of IMEC
  - See the schema of the **Snap4City Innovation Matrix** reported in the next slide, on the basis of the kind of Meeting for example: (a) starting a smart city, (b) starting a smart city Living Lab

- **Data Discovery**
  - Production of the Data Table (Snap4City)
  - Data discovery is performed on analysis of the: (i) identified scenarios, (ii) data of the stakeholders, (iii) international sources, (iv) Snap4City experience, etc.
  - Performed by following the Snap4City guidelines on Data Search on web and world.

- **Design**
  - Focused on creating a large number of Use Cases and/or Scenarios for development
  - The design starts by taking into account the Snap4City development life cycles and tools. Thus shortening all the boring activities and following the typical Snap4City rapid prototyping described in these slides!!
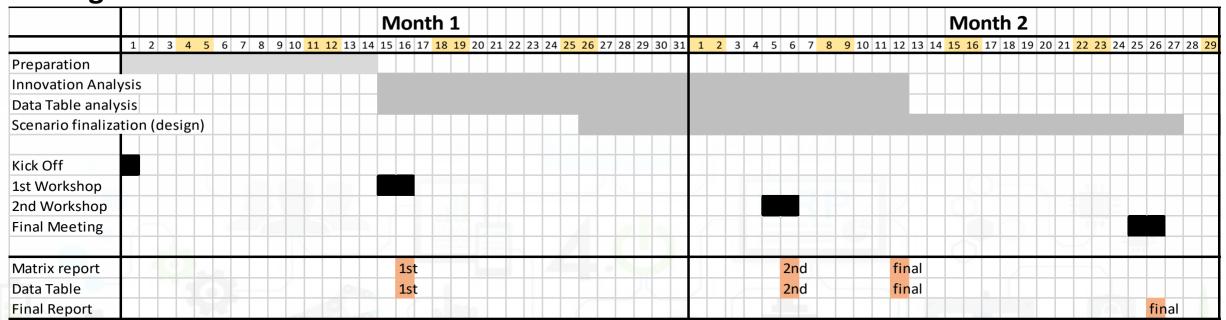
Snap4City Innovation Matrix and Process
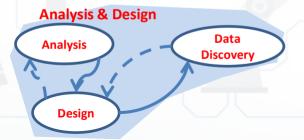
Realistic Timing for a small size example

Only for:

- **Analysis: innovation, data discovery, scenarios**
- **design of scenarios**

RULE OF THUMB

	Month 1	Month 2
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Preparation	▓▓	
Innovation Analysis	▓▓	▓▓
Data Table analysis	▓▓	▓▓
Scenario finalization (design)	▓▓	▓▓
Kick Off	■	
1st Workshop	■	
2nd Workshop		■
Final Meeting		■
Matrix report	1st	2nd final
Data Table	1st	2nd final
Final Report		final

Analysis & Design

- Analysis
- Data Discovery
- Design

Co-Create

Co-Design

Analysis for Innovation

Snap4City Analysis for Innovation

- **Analysis**
  - The analysis starts with a number of meetings/interviews with stakeholders
  - The identification of the target stakeholders/actors/users (target Segments) and their definition/description
  - The meetings/workshops are focused on filling the **Snap4City Innovation Matrix** which is an evolution of the INNOVATRIX approach of IMEC
  - The schema of the **Snap4City Innovation Matrix** is reported in the next slide,
    - It may be different depending on the kind of action: (a) starting a smart city, (b) starting a smart city Living Lab, (c) both actions at the same time.
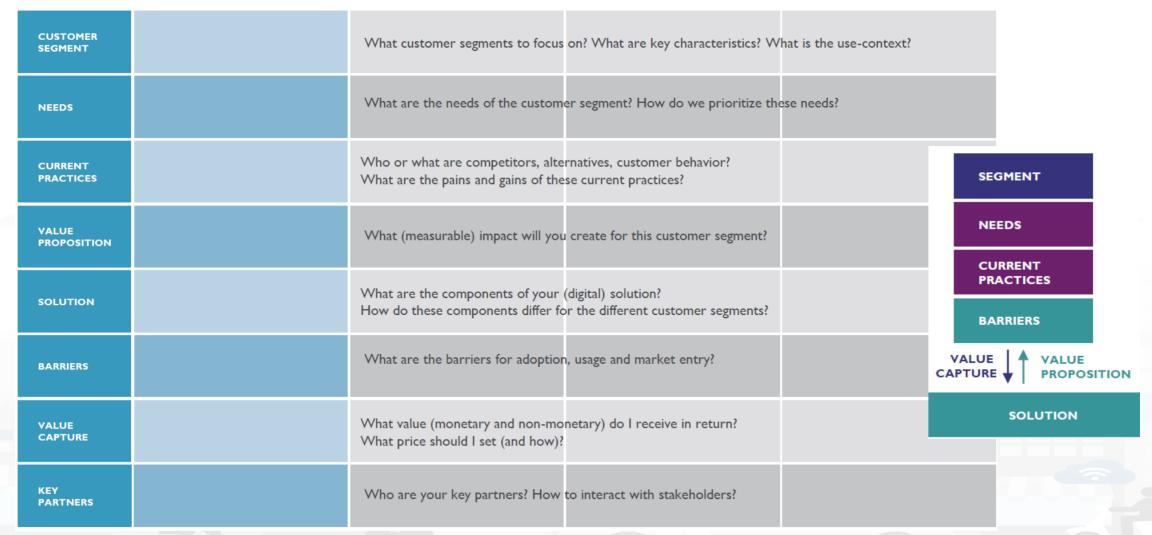- **Two main goals:**
  - Data Discovery (see later)
  - Identification of User Cases, Scenarios (see later)

Innovatrix

- Defined by IMEC for Living Lab according to ENOLL

CUSTOMER SEGMENT		What customer segments to focus on? What are key characteristics? What is the use-context?	
NEEDS		What are the needs of the customer segment? How do we prioritize these needs?	
CURRENT PRACTICES		Who or what are competitors, alternatives, customer behavior? What are the pains and gains of these current practices?	
VALUE PROPOSITION		What (measurable) impact will you create for this customer segment?	
SOLUTION		What are the components of your (digital) solution? How do these components differ for the different customer segments?	
BARRIERS		What are the barriers for adoption, usage and market entry?	
VALUE CAPTURE		What value (monetary and non-monetary) do I receive in return? What price should I set (and how)?	
KEY PARTNERS		Who are your key partners? How to interact with stakeholders?	

SEGMENT

NEEDS

CURRENT PRACTICES

BARRIERS

VALUE CAPTURE ↕ VALUE PROPOSITION

SOLUTION

Why Innovation Fail....

- https://hbr.org/2006/06/eager-sellers-and-stony-buyers-understanding-the-psychology-of-new-product-adoption

- Many innovate and good products failed on conquering the market/ deploy, due to the psychology of behaviour change.
  - To understand why may fail is the first step.

- One aspects is the **Psychological bias**:
  - Current users overvalue the benefits of what they are using
    - *endowed effect*, which is estimated to be of the 100%.
      The new should be at least twice better than the current to convince to change.
    - *status quo effect,* if the ownership of the current has been for long time (years) it may need a factor of 4 to change.
  - Developers overvalue the benefits of what they have developed, of a factor of 3

The Workshops for Innovation, Co-Creation

Pre-Conditions

- **Motivations identified**: domains/**thematic-areas**, actors/**segments**,
  - e.g.: Mobility and transport, energy, security, environment, etc.
- The customer **Segments** describe the position of the different *Actors Categories* with respect to the same needs, problem, action, scenario..
  - Two examples:
    - the **Citizens/Tourists** would like to have an overview of what is going on in the area, while the **City Officials** would be afraid to provide too much information since some information can be sensitive to security issues.
    - the **Mobile App users** would have this and that....., and the **City App Provider** would monitor their movements to provide ads, etc.

Schedule of Workshops and activities

- **1st Workshop** finalized to
  - definition of the first version of the **Snap4City Innovation Matrix (Report)**
  - Identification of the **Data Table**
- **Intermediate work on**
  - Knowing the **ICT** infrastructure and viable solutions
  - Refining **Data Table** details by email
  - Improving the **Report** with more descriptive scenarios
  - Presenting **Report** and TABLE 1 week in advance wrt the 2nd workshop (if it is possible)
- **2nd Workshop** finalized to
  - Discussing a reasoned version of the scenarios with problems pending
    - Solving pending aspects of the **Snap4City Innovation Matrix and Data Table**
  - **Identification of the main Scenarios to be developed and feasible according to feasibility and priority**
    - Corresponding consolidation of the development teams
- **Conclusive work on**
  - Refining Data Table details
  - Creating Final Report with Descriptive Scenarios
  - Designing of the Minimum Snap4City architecture to cope with scenarios, scenario feature table wrt to Snap4City modules
  - Development of mock-up for Dashboards with fake data to show the concept
- **Final Meeting**
  - Presentation of the final report with: 1 mock-up of a scenario, early design of the Snap4City solution vs modules according to the scenarios
  - further discussion on the next steps
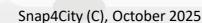
Snap4City Innovation Matrix ……………………………………

	Parameters	Commons	……..…	……..…	…………
Current State	Needs				
	Current Practices				
	Value proposition (current)				
Future State	Value proposition (Future)				
	Solution				
	Value Capture				
	Key Partners				
	Barriers				
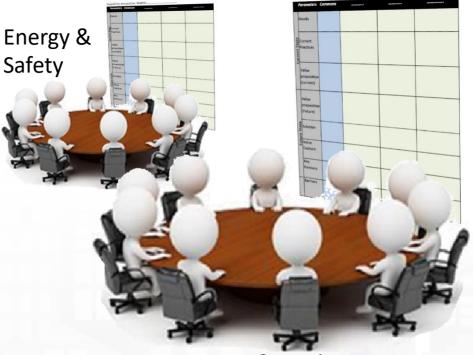
Meeting Organization

Energy & Safety

Mobility and Transport

Security & Resilience

For each table:

- Experts of the domain specific
- Experts of different customers segment
- Operative people
- ICT people
- Decision Makers
- Etc.

Recall to Smart City Development Life Cycle
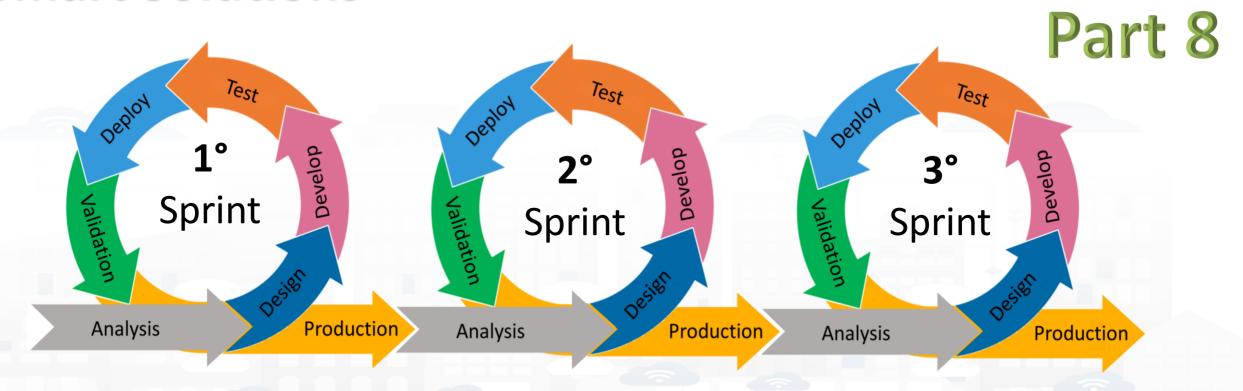
Agile Development Life Cycle by sprint Smart Solutions
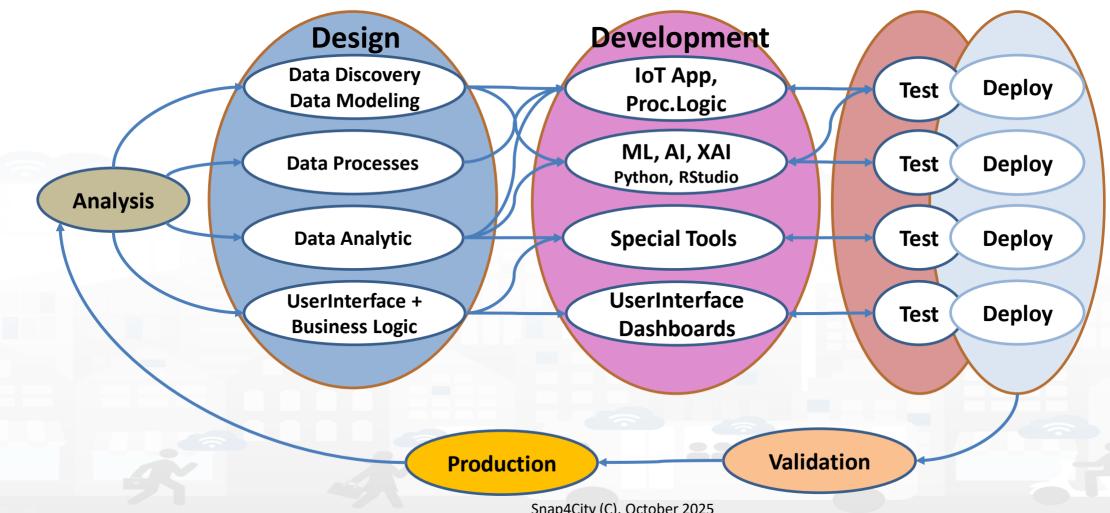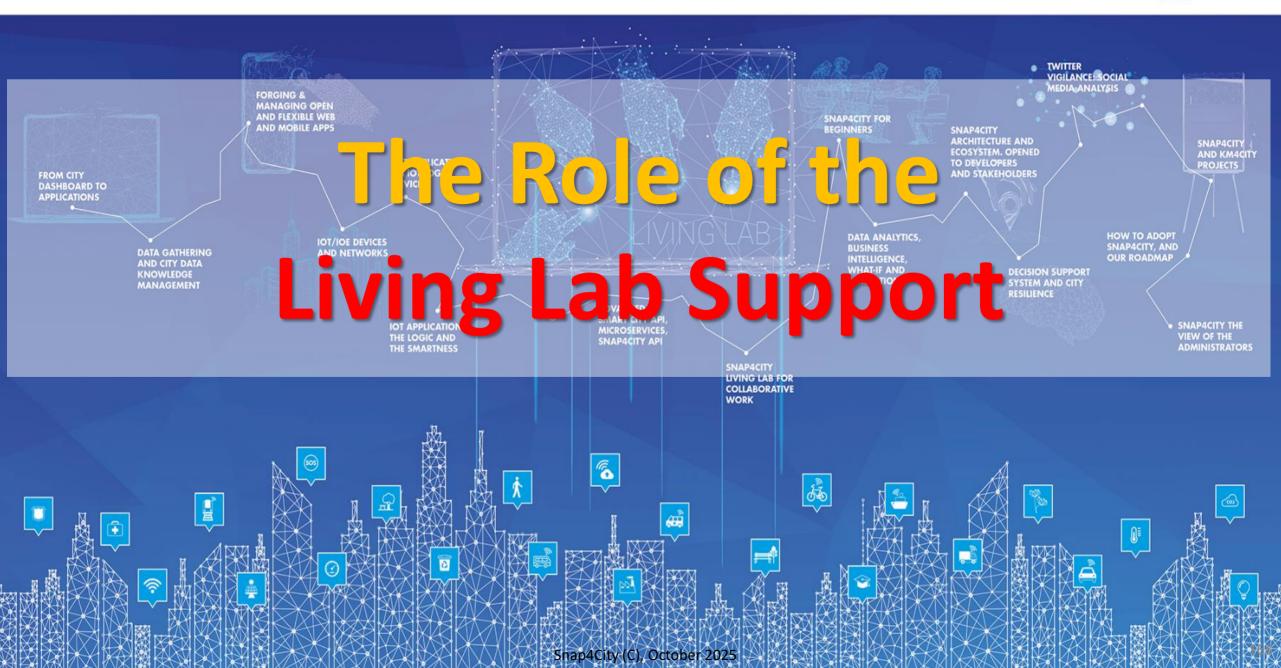
Part 8

Development Life Cycle Smart Solutions

Part 8

The Role of the Living Lab Support

Snap4City tools and Living lab Solution have been Created to satisfy requirements of international organizations as:

- **ENOLL**: https://www.openlivinglabs.eu/
  - European Network **of Living Labs**

- **EIP-SCC**: European Innovation Partnership on Smart Cities and Communities
  - https://eu-smartcities.eu/

- **Select4Cities**: Pre-Commercial Procurement Project to develop a data-driven, Internet-of-Everything (IoE) platform for large-scale urban co-creation
  - https://www.select4cities.eu/

SELECT
for Cities

CERTIFICATE OF ACHIEVEMENT

1° place award to

UNIVERSITY OF FLORENCE –
DEPARTMENT OF
INFORMATION ENGINEERING

for **SNAP4CITY**

for successfully completing the
SELECT for Cities PCP competition
19.11.2019

This project has received funding from the European
Union's Horizon 2020 research and innovation
programme under grant agreement No 688196

https://www.snap4city.org/558

DIGIPOLIS
FORUM VIRIUM HELSINKI
CITY OF COPENHAGEN
Buyers Group

172

Aspects of the Living Labs

- **Living lab capabilities and supports**
  - Organizations are supported in the user management and persecuting their goals
  - Projects can be launched and targeted with groups, hackathons, tools, etc.
  - Individual (user interaction), are supported by tools and training material
- **Instruments of the Living Lab**
  - **Real-life context**: data and solutions to be taken as examples, from devices to IOT Applications, and Dashboards. A large set of **real scenarios described**
  - **Multi-stakeholder:** mainly apply to organizational, a community from where anybody can take advantage
  - **Multimethod**: the same results can be obtained by using multiple methods
  - **Active user co-creation**: the platform cansupports: collaborative work, supervising by the teachers, sharing and delegation.
  - **Secure**: it is GDPR compliant and passed PENTest and Vulnerability Test

Living Lab Flexibility

Snap4City Satisfies all Requirements of ENOLL Select4Cities and EIP-SCC

- **Multiple modalities to perform the same activities**

- **Tuned for Beginners and Skilled people**

- **Visual interface and programming tools**

- **Resources and artefacts sharing for learn acceleration and co-working**

- **Open Living and co-working Portal**: https://www.Snap4City.org

Living Lab thematics

- **Typically devoted** to citizens (final users) services:
  - E.g.: mobility and transport, social, services, security, barriers, medical, open data, etc.

- **The aim**:
  - Finding new and innovative solutions for relevant social problems, starting from the field, user engagement

- The hypothesis is that taking the idea from the field the
  - reasons to change are confirmed,
  - acceptance gap is reduced, and
  - solutions are those required and shared since the beginning

Physical Location vs Virtual

- **Pros:**
  - Open every day for interaction and test of solutions
  - Suitable for co-creation
  - Suitable for IOT Devices development and test, attractive for device producers
  - Single local language
- **Cons:**
  - Animation has to be managed by presence
  - Hard to scale up
  - Hard to engage people that would spend time physically since it take time to go and work there, typically associated with co-working
  - Virtual area/portal is need any way
  - Higher costs

- **Pros:**
  - Lower costs, highly scalable
  - Attractive for young generation
  - accessible H24/7
  - Attractive for multi language and multicultural communities
  - Easy process for engagement since the people can dedicate to the Living Lab a portion of their time without spending time on traveling, etc.
- **Cons:**
  - Not very attractive for device producers
  - Not direct contact with people
  - Easy to scale up

Engagement

- **Finding the right participants to the Living Lab**
  - Campaigns tailored to the right audience according to the role: testing, developers, requirements collections, etc.
    - Finding specific profiles via stakeholders
    - And/OR: Web based recruitments, App Based, etc.
  - Motivation to participate, eventual incentives

- **Inform/educate the Participants about the project:**
  - after and before testing/validations, etc.

- **Protect the Participants privacy**, ask to NDA and provide the NDA, GDPR compliant

- **Support**: during the project, SPOC, Help-Desk, web portal, logistic
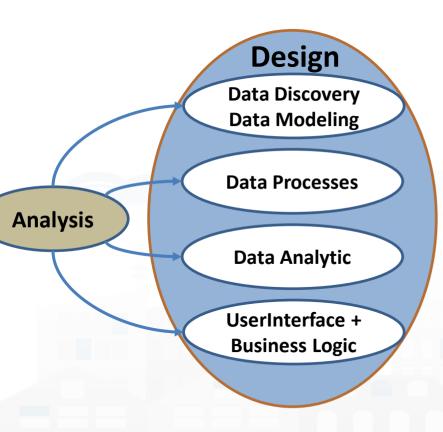
The Living Lab Snap4City Tools

Main Activities of Design

- **Data Discovery**: Ingestion, gathering, interoperability, discovery, modeling, aggregation, mapping → digital twin modeling

- **Data Processing**: transformation, interoperability; computing Indexes, KPIs and benchmarks, …

- **Data Analytic**: statistic, predictions, classification, anomaly detection, simulations, optimization, routing, ML, AI, XAI, HPC, …

- **User Interface:** dashboards, web pages, business intelligence, visual analytics, what-if analysis, business logic, mobile applications.

Phases' Coverage

| Data Identification | Data Gathering | Data Aggreg. Process. | Data Storage, semantic | Data search Retrieval | Data Analysis | Data Visualization | Visual Analytics |

what	Identification	Gathering	Complex data types	Aggregation	Storage (semantic)	Efficient Retrieval	Semantic Modeling, query	Data Analytics (micro, marco)	Scenarios context	Artificial Intelligence	Data rendering	Real Time Dashboard	Event Driven data rendering
GeoServer					(x)						(x)	(x)	
GIS			(x)					(micro)			x		
PowerBI						x		(x)			x	x	
Tableau					x	x		(x)			x	x	
....													
Snap4City	x	x	x	x	x	x	x	x	x	x	x	x	x

Snap4City: Living Lab supporting tools

- **All 100% Open Source**

- **Snap4City web portal**
  - **Scenarios** with ready to use solutions
  - **Organization/Groups** and co-working support
  - Developing tools and Documentation, training, tutorials, HOW TO...
  - Self Assessment tools to monitor your progresses to get suggestion
  - Assistants: to get training and problem solving
  - **Developing tools**
    - All of them are Web-Based developing tools (except for the Mobile App on Android and iOS)
  - **Resource Manager for Sharing:**
    - experiences, data warehouse tools, IOT Applications, Data Analytics, etc.
- **Hackathons**:
  - IOT Apps, Dashboards, Mobile Applications, Data Analytics, etc.

Welcome: how to start using Snap4City for beginners

MultiOrganization, Groups and Profiles

Organizations may have their distinct :

- menus and functionalities, GeoArea, Data, Dashboard, Groups of users, managers, Knowledge Base, repositories, etc.

Users may:

- Have personal IOT Devices/Models, Data, IOT brokers, Dashboards, IOT App,..
- Have access to multiple Groups of Multiple Org.
- Delegate them in usage or access
- Change ownership and Clone to pass a copy
- Assesses their usage and themselves, share

Level 1 Users: creating dashboards

Dashboard List → **Dashboard Model Selection** → **Wizard** →

See how Dashboards can be created using the wizard: dashboards with selectors, time trends, maps, etc.

- TC1.8.   Visual production of Dashboard via Wizard

- TC1.9.   Search on Wizard for any kind of data managed into the platform, from POI to sensors, KPI, social, etc.

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

- TC1.11.   IOT Discovery, on Dashboard Wizard

- TC1.13.   Dashboard Builder External Services and Widgets

User: paolonesi, Org: none
Role: Manager, Level: 0

- 🎛 Dashboards
- 🎛 My Dashboards
- 🔔 Notificator
- ⭕ IOT Applications
- ⇄ My IOT Devices
- 📗 Knowledge and Maps ▾
- 🚀 Micro Applications
- 🏛 External Services
- 🖨 Data Set Manager: Data Gate
- ⤜ Resource Manager
- 🚀 Help and Contacts ▾
- 🗋 Documentation and Articles ▾
- 🔴 My Profile ▾
- 🔗 Snap4City portal
- 🔗 Km4City portal
- 🔗 DISIT Lab portal

Home / TC1.8 - Visual production of Dashboard via Wizard

TC1.8 - Visual production of Dashboard via Wizard

Test Case Title	TC1.8 - Visual production of Dashboard via Wizard
Goal	As a any user I can • Create a Dashboard, composing it on the basis of data vs widgets, with large collection of data kind and corresponding graphics widgets, including: map, table, graphs, timetrend, weather, and many special widgets. • Modify an available Dashboard, editing general information and widgets, via Dashboard Builder
Prerequisites	The user is registered and logged in the system Using a PC or Mobile with a web browser. Access to the Dashboard Builder.
Expected successful result	See changes performed on the modified dashboard. Your user account into the Dashboard Builder has been endowed of a number of dashboard for using them, changing them without problem for the system. See the created dashboard and play with them.
Steps	

Example 1: Creating a City Dashboard

The creation of a dashboards has been strongly simplified with the im...
matching data vs graphics representation, thus arriving at creating au...

You can start testing this requirement by following the sequence of a...

1. Enter in the main application https://main.snap4city.org and log...
   - Main --> dashboards
2. On the left column main menu click on Dashboards ite... The preview of the dashboards available for the user will be shown.
3. The Dashboards page shows the preview of dash...ards...eated by the user (identified as "My own"), public dashboards accessible only in view, private dashboards that the user can...e...ce he has been delegated by the original dashboard owner, and also eventual dashboard someone that someone has de...you.

All Text on the Portal are Hypertext with Links for navigation among major concepts

Search

[Search field]

Recent comments

- 1 week 1 day ago

Recent content

Welcome: how to start using Snap4City for beginners drupaladmin

Snap4City - scalable Smart aNalytic APplication builder for sentient Cities
new
drupaladmin

Username: PaoloNesi

For the user: different levels of engagement

- **Manager: Final Users**
  - Level 1: create Dashboards
  - Level 2: create Dashboards that get and produce data, act on city
  - Level 3: add your own IOT Device, create Dashboards with them and city data
  - Level 4: create IOT Applications to make smarter your Dashboards, services, notifications, exploiting MicroServices

- **Area Manager: Developers, Researchers, Operators (Level 5):**
  - Developer of complex services exploiting: R Studio, ETL, External Services, …
  - Creating: MicroApplications, MicroServices, web and mobile application exploiting Advanced Smart City APIs, …

- https://www.snap4city.org/drupal/contact
- Bug Reporting
  - https://docs.google.com/forms/d/e/1FAIpQLSfDQtKqgLIIyycNXiazeYEh1SsRG1YL8Ze4ThD8nZoA5jsoXw/viewform
- For Service Level Agreement see:
  - Service Level Agreement
- Help Desk and Contact:
  - https://www.snap4city.org/3
- Availability rates:
  - https://www.snap4city.org/388

Contact us

Home / Contact us

Your name *

panesi

Your e-mail address *

info@disit.org

Subject *

Category *

Snap4City ContactUS

Message *

☐ Send yourself a copy.

Send message

Periodo di riferimento: 09 / 2019

Disponibilita' media: 99.91%

MTTR: 00G 00:10.00

MTBF: 04G 14:04.24

down tot. 4

max(t_down): 00G 00:10.01

Resource Manager: public and sharing

Living Lab
Snap4City Hackathons

LOGIN

- 🎡 Dashboards (Public)
- 📕 Knowledge and Maps ▼
- ✋ Micro Applications
- 🏛 External Services
- 🖨 Data Set Manager: Data Gate
- 📶 Resource Manager
- 📖 Development Tools ▲
  - 👥 Knowledge Base Graphs
  - 📶 Smart City API Docs: Swagger
  - 📑 Testing API by Postman
  - ☁ Source Code Access
- 🔧 Management ▲
  - 📈 Smart City API Monitoring
  - 📈 Web Server Monitoring
  - 📶 Smart Decision Support Sys
  - 📶 Resilience Decision Support Sys
- ✈ Help and Contacts ▲
  - ✈ Help Desk and contacts
  - ✈ Contact Us, Problem Reporting
  - ✈ FAQ
  - ✈ Help Us with Your Feedback!!!
- 📄 Documentation and Articles ▼
- ☐ Km4City portal
- ☐ DISIT Lab portal

KM 4 CITY

SNAP4CITY
HACKATHON
BUILD YOUR APP FOR A CONNECTED CITY

Open from
Jan 21 - Mar 15

CLICK HERE TO SEE THE HACKATHON WINNERS

see interim winner Fast Rabbit

Hackathon Organization

- OnLine Hackathon 2019
  - **Call** 2019. https://www.snap4city.org/370
  - **Multiple Categories** to avoid mixing companies with students, professionals with lovers, etc.
  - **Locations**: Helsinki, Antwerp and Tuscany at the same time
  - Multidisciplinary judges
  - Intermediated checkpoint(s) to help teams to improve and strive them toward the goals.
- **Support**: 100% online
  - All training already accessible
  - All online tools and support
- Several Teams have been engaged
  - Engagement via social network and on the area
- Multiple selections to refine the solutions, :
  - https://www.snap4city.org/416
- Awards and price of different kinds
  - https://www.snap4city.org/449
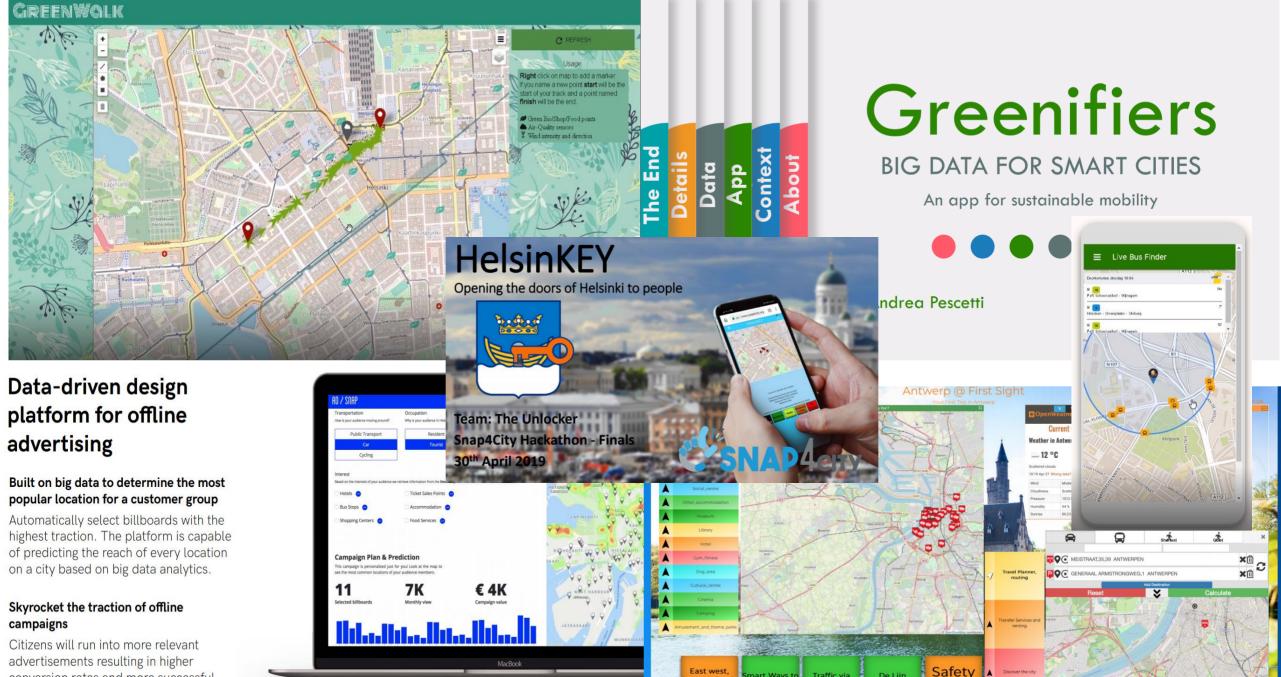
Validation with developers

- Helsinki and Antwerp, plus Florence Training, CINI Challenge, ..
- 65 performed operational activities:
  - dashboards, IOT Applications, registering IOT devices, etc.
  - More than the 80% created both Dashboards and IOT Applications, thus validating the solution and the process of engaging them in working on the platform

The 65 users	left on platform	Average per day over last 90 days	Total activity 90 days
Number of IOT Applications	117	81,6	7341
Number of private IOT devices	27	25,5	2296
Number of public dashboards	11	6,2	562
Number of private dashboards	173	135,1	12159
Number of accesses to dashboards	--	33,9	3048
Number of minutes	--	337,1	30337

GREENWALK

Usage:
Right click on map to add a marker.
If you name a new point **start** will be the start of your track and a point named **finish** will be the end.

🌿 Green Bio/Shop/Food points
🔵 Air-Quality sensors
🌀 Wind intensity and direction

⟳ REFRESH

The End | Details | Data | App | Context | About

Greenifiers
BIG DATA FOR SMART CITIES
An app for sustainable mobility

Andrea Pescetti

Live Bus Finder

HelsinKEY
Opening the doors of Helsinki to people

Team: The Unlocker
Snap4City Hackathon - Finals
30th April 2019

SNAP4CITY

Data-driven design platform for offline advertising

Built on big data to determine the most popular location for a customer group

Automatically select billboards with the highest traction. The platform is capable of predicting the reach of every location on a city based on big data analytics.

Skyrocket the traction of offline campaigns

Citizens will run into more relevant advertisements resulting in higher conversion rates and more successful campaigns.

AD / SNAP

Transportation
How is your audience moving around?
- Public Transport
- Car
- Cycling

Occupation
Why is your audience in Hel...?
- Resident
- Tourist

Interest
Based on the interests of your audience we retrieve information from the Sma...
- Hotels
- Bus Stops
- Shopping Centers
- Ticket Sales Points
- Accommodation
- Food Services

Campaign Plan & Prediction
This campaign is personalized just for you! Look at the map to see the most common locations of your audience members.

11 Selected billboards | **7K** Monthly view | **€ 4K** Campaign value

MacBook

Antwerp @ First Sight
Your First Trip in Antwerp

OpenWeather
Current
Weather in Antwerp
12 °C
Scattered clouds
Wind
Cloudiness
Pressure
Humidity   54 %
Sunrise

Social_centre
Other_accommodation
Museum
Library
Hotel
Gym_fitness
Dog_area
Cultural_centre
Cinema
Camping
Amusement_and_theme_parks

Travel Planner, routing
Transfer Services and renting
Discover the city

East west, DeWaterbus is best | Smart Ways to Antwerp | Traffic via Michelin | De Lijn routeplanner | Safety on Bike

Shortest | Quiet

MEISTRAAT,35,39 ANTWERPEN
GENERAAL ARMSTRONGWEG,1 ANTWERPEN

Add Destination
Reset | Calculate

Hackathon

6500 Euro di Premi

IEEE ITSS – Italian Chapter
&
DISIT LAB of Università di Firenze

present

IEEE Intelligent Transportation Systems Snap4City Hackathon
https://www.snap4city.org/757

Hackathon Data Focus

https://www.snap4city.org/755

Tuscany region which is a region with more than 3.5 M of inhabitants.
MicroService, API and services for routing and multimodal routing in Tuscany, etc.
regarding:

- Road model for the whole Tuscany, plus routing
- car parking status,
- public transport operators,
- bike sharing,
- Pollutant sensors,
- traffic flow sensors,
- Weather sensors,
- points of interests,
- Pollination sensor,
- Heatmaps of several kind
- picking from heatmaps,

- Tuscany: https://www.snap4city.org/760
- Florence: https://www.snap4city.org/747
- Pisa: https://www.snap4city.org/746
- Livorno: https://www.snap4city.org/751
- Siena: https://www.snap4city.org/759
- Prato: https://www.snap4city.org/758
- Pistoia: https://www.snap4city.org/761
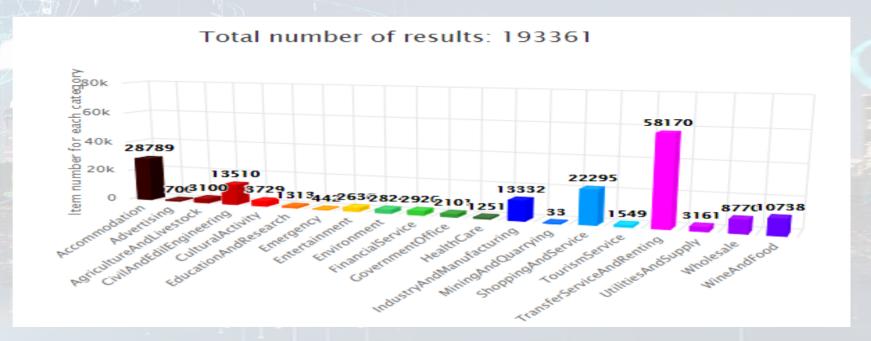
Total number of results: 193361

Challenges

- **full freedom** for creating new and innovative solutions
  - to improve the future of mobility and transportation systems in the cities in which we live.

- **For example**:
  - sustainable mobility and transport
  - services for ITS
  - addition of devices and data and t heir usage
  - interesting [data analytics](#) on accessible data
  - predictive models and solutions
  - services for the final users in city or rural areas
  - event driven solution and early warning
  - anomaly detections of critical conditions.
  - etc.

Snap4City Platform: Administration Overview

Roles in Snap4City/Industry solutions

- **RootAdmin**
  - The gods of the specific installation, access to all tools for all Organizations
- **ToolAdmin**
  - The administrators of an Organization with some capabilities on single tools
- **AreaManager**
  - Typical developer capabilities, access to development tools, access to a wider number of resources, IOT with both basic and advanced, IOT Models, etc.
- **Manager**
  - Final users, limited access to development, IOT App development with Basic library.

- **Users of any Role** have full control on their own resources: data, devices, dashboards, IOT App, etc., which may control according to GDPR rules,
  - providing access, revoking, etc.
- **All users start as Manager roles**
  - All users have also a Level (numeric). A score about what they have exploited in the platform. Higher scores correspond to wider exploitation of capabilities.
- **RootAdmin users may**
  - pass Users to higher roles. Ask to snap4city@disit.org to become an AreaManager for testing
  - Provide/grant specific authorizations to data access on Tool usage
- In the Installation onPremise, you become the RootAdmin of it, you decide ALL.
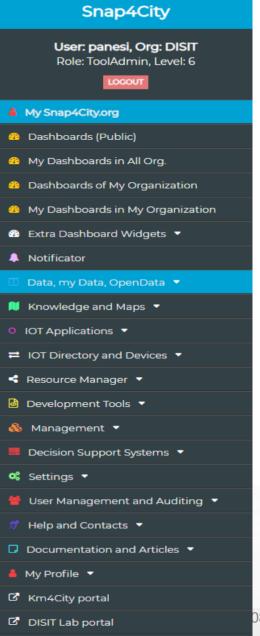
Management by Organization

- **Organizations/Tenants** may have
  - name, ID, GPS center, a number of Groups on Snap4City.org (living lab support Drupal)
  - users of different kinds and may impose early bounds on the resourced used by users (IOT Dev, IOT App, Dash)
  - on cloud user kinds up to level of Tool Administrator
  - One or more ServiceMap and boundaries for the federation

- **ToolAdmin** users (requested by Organizations) may
  - control processes, consumption of resources, healthiness, etc.
  - manage tools exploited in your configuration

- **24H/7D Help Desk and Assistance**

Snap4City

User: panesi, Org: DISIT
Role: ToolAdmin, Level: 6

LOGOUT

- My Snap4City.org
- Dashboards (Public)
- My Dashboards in All Org.
- Dashboards of My Organization
- My Dashboards in My Organization
- Extra Dashboard Widgets ▾
- Notificator
- Data, my Data, OpenData ▾
- Knowledge and Maps ▾
- IOT Applications ▾
- IOT Directory and Devices ▾
- Resource Manager ▾
- Development Tools ▾
- Management ▾
- Decision Support Systems ▾
- Settings ▾
- User Management and Auditing ▾
- Help and Contacts ▾
- Documentation and Articles ▾
- My Profile ▾
- Km4City portal
- DISIT Lab portal

RootAdmin

- RootAdmin on Snap4City.org has a very large set of tools
  - My Snap4City, ….Tour, etc.
  - Dashboards
  - **My Data Dashboard (Kibana)**
  - **Extra Dashboard Widgets**
  - Notificator (deprecated)
  - **Data, My Data, OpenData**
  - **Knowledge and Maps**
  - **IOT Applications**
  - **IOT Directory and Devices**
  - **Resource Manager**
  - **Development Tools**
  - **Management**
  - **Decision Support Systems**
  - **Settings**
  - **User Management and Auditing**
  - Help and Contacts
  - Documentation and Articles
  - …….

In this section of the slides, those market in bold are presented.

User: roottooladmin1, Org: DISIT
Role: RootAdmin, Level: 7

LOGOUT

- My Snap4City.org
- Tour Again
- ダッシュボード
- Dashboards (Public)
- My Dashboards in All Org.
- Dashboards of My Organization
- My Dashbards in My Organization
- My Data Dashboard Dev Kibana
- My Data Dashboard Kibana
- Extra Dashboard Widgets ▾
- Notificator
- Data, my Data, OpenData ▾
- Knowledge and Maps ▾
- IOT Applications ▾
- IOT Directory and Devices ▾
- Resource Manager ▾
- Development Tools ▾
- Management ▾
- Decision Support Systems ▾
- Settings ▾
- User Managment and Auditing ▾
- Help and Contacts
- Documentation and Articles
- My Profile ▾
- Km4City portal

Extra Dashboard Widgets

MicroApplic.

Extra Dashboard Widgets
- Micro Applications
- External Services, WebPages
- Register External Service, WebPage
- Custom Widgets / Synoptics
- My Data Selection for Synoptics
- Register Custom Widget Template
- Doc: MicroApplications
- Doc: External Services, WebPages
- Doc: Synoptics, Custom Widgets

External Services

Synoptics, Custom

Data My data

Data Management, HLT ▲

- Data Inspector
- MyKPI, MyData, MyPOI
- My Groups of Entities
- View/Set MyPOI on Tuscany
- Data Table Loader (Excel)
- POI Loader (Excel)
- Harvest Satellite Copernicus Dat…
- File Manager
- HeatMap Manager
- ColorMap Manager
- TrafficFlow Manager
- TVCam Manager
- OD Manager
- BIM Manager
- BIM Server old
- BIM Server New
- BIM Srv New: Add
- BIM Srv new: View
- OpenData Manager: Data Gate
- OpenData Manager: Data Gate
- OpenData Harvester: Data Gate…
- Add Data Sources into the Platfo…

- **Data Inspector**: to understant and see Digital Twin details of data
- **MyKPI, MyData, MyPOI**: to model and save your personal data
- **My Groups** of Entities: to create an aggegregation of Snap4City artects, entities to manage them in one shot
- **Data Table Loader**: fast load excel File as IOT Devices, IOT Device Model and instances
- **POI Loder**: fast load of Excel file with POI
- **Harvesting** satellite: to request data from Satellite services and make from them heatmaps
- **Heatmap Manager**: management of GeoTiff heatmaps as sequence of complex data
- **ODM Manager: ……..**
- **Traffic Flow Manager**: management of Traffic Flows as sequence of complex data
- **TV CAM manager**: ……….
- **Color Map**: to code rendering colors of other Managers
- **BIM manager and server**: support 3D for the Digital Twin Local
- **Open Data Manager, CKAN**: harvesting and publishing open data
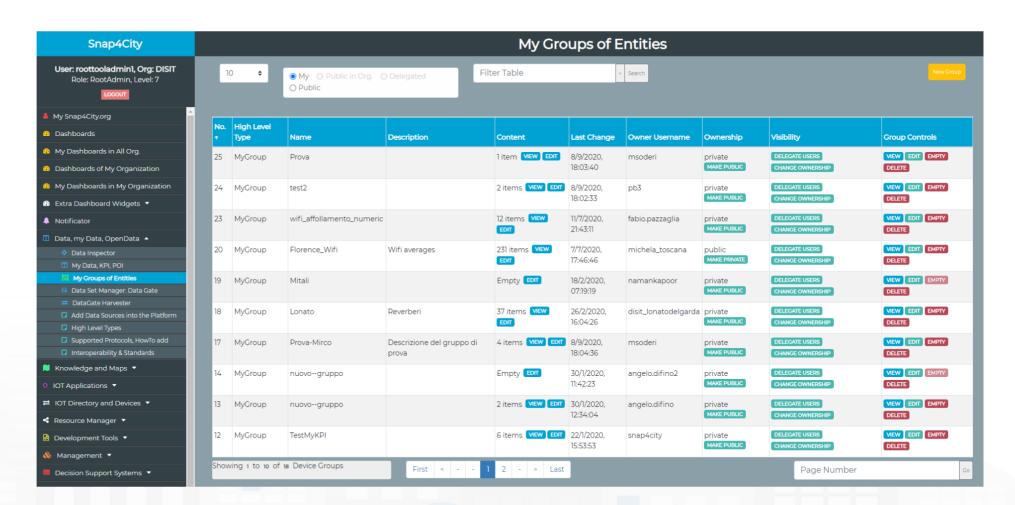
Managing Groups

- **My Groups of Entities**
  - **Licensing group of Entities in One Click**

- For non admin tools see other Training parts: https://www.snap4city.org/577
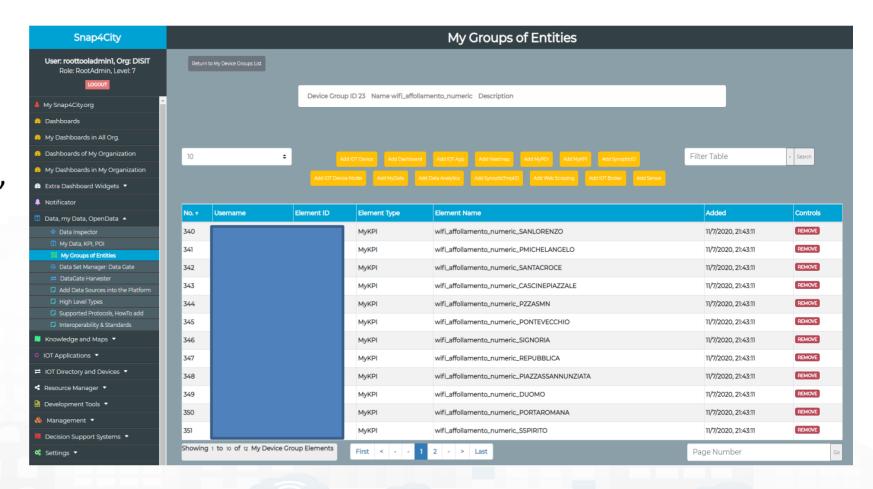
Group of entities

- A group may include a number of:
  - IOT Devices, Dashboards, MyPOI, MyKPI, Synoptics, IOT DeviceModels, MyData, Synoptics Templates, IOT Brokers, IOT Sensors/actuators,..

- Once the Group is created, the group owner can:
  - Produce a license to grant access at all the Group Entities in one click
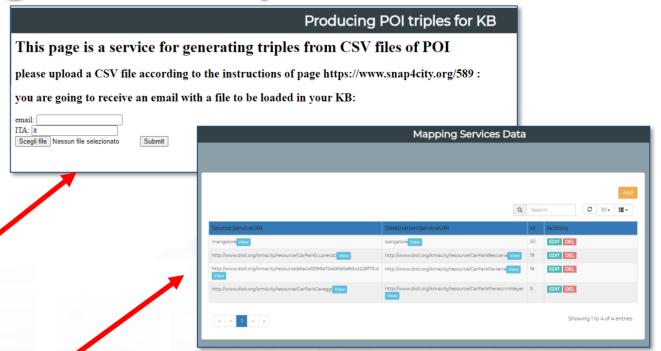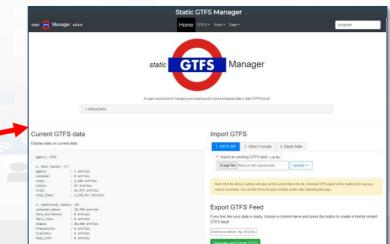
Knowledge and Maps

- A number of ServiceMaps, Knowledge bases, KB
- Tools for creating WKT, shapes
- Access to ServiceMap 3D, if any
- Service for Loading triples on KB
- My Annotations (deprecated)
- Mapping Tool (partial)
- GIS servers, if any
- Static GTFS editor and manager (if any)

Producing POI triples for KB

This page is a service for generating triples from CSV files of POI

please upload a CSV file according to the instructions of page https://www.snap4city.org/589 :

you are going to receive an email with a file to be loaded in your KB:

email: [   ]
ITA: [it]
Scegli file Nessun file selezionato   Submit

Mapping Services Data

Source:ServiceURI	Destination:ServiceURI	Id	Actions
mangalore View	bangalore View	20	EDIT DEL
http://www.disit.org/km4city/resource/CarParkS.Lorenzo View	http://www.disit.org/km4city/resource/CarParkBeccaria View	19	EDIT DEL
http://www.disit.org/km4city/resource/a9ac455916a724b61e5a8dcd228f7fcd View	http://www.disit.org/km4city/resource/CarParkParterre View	18	EDIT DEL
http://www.disit.org/km4city/resource/CarParkCareggi View	http://www.disit.org/km4city/resource/CarParkPieracciniMeyer View	11	EDIT DEL

Showing 1 to 4 of 4 entries

Static GTFS Manager

IOT Applications

- **IOT Applications**: a view to manage Containers / IOT Edge Apps: IOT Apps, Data Analytics (R and Python), WebScraping, IOT edge, etc.
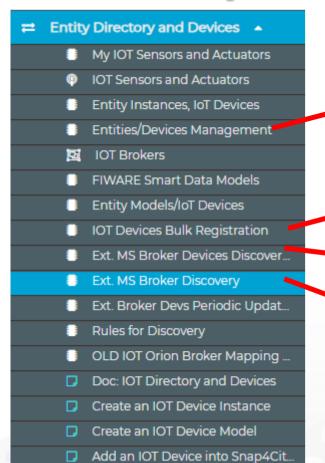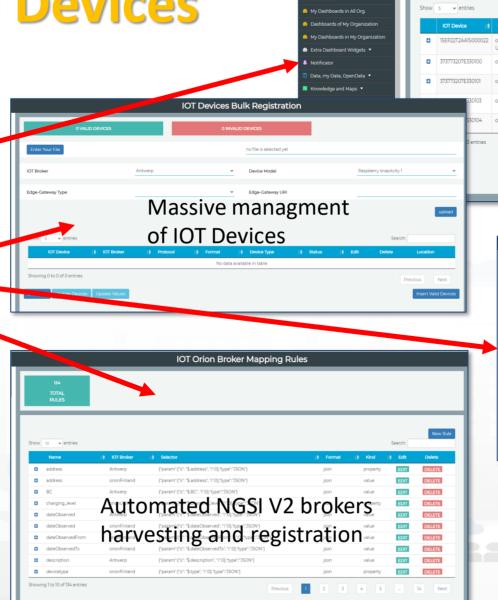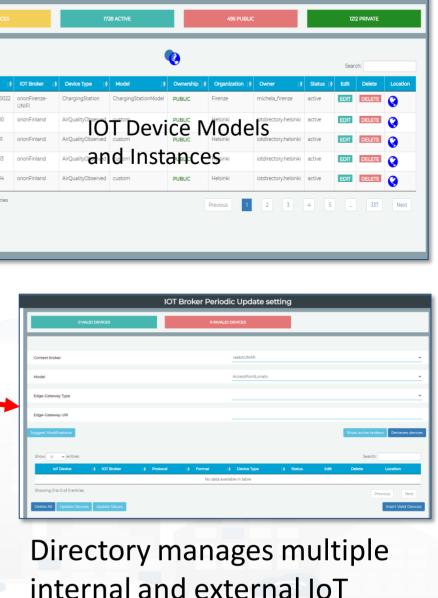
Managing also

- **MicroServices for IOT App exploiting REST Call**

- **MicroServices from DataAnalytics**

For non admin tools see Training parts 3 and 5:
https://www.snap4city.org/577

Directory and Devices

IOT Device Models and Instances

Massive managment of IOT Devices

Automated NGSI V2 brokers harvesting and registration

Directory manages multiple internal and external IoT Context Brokers
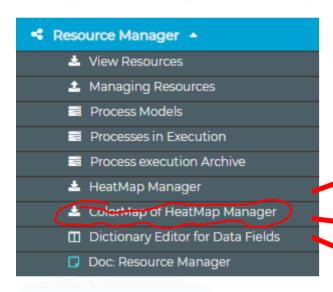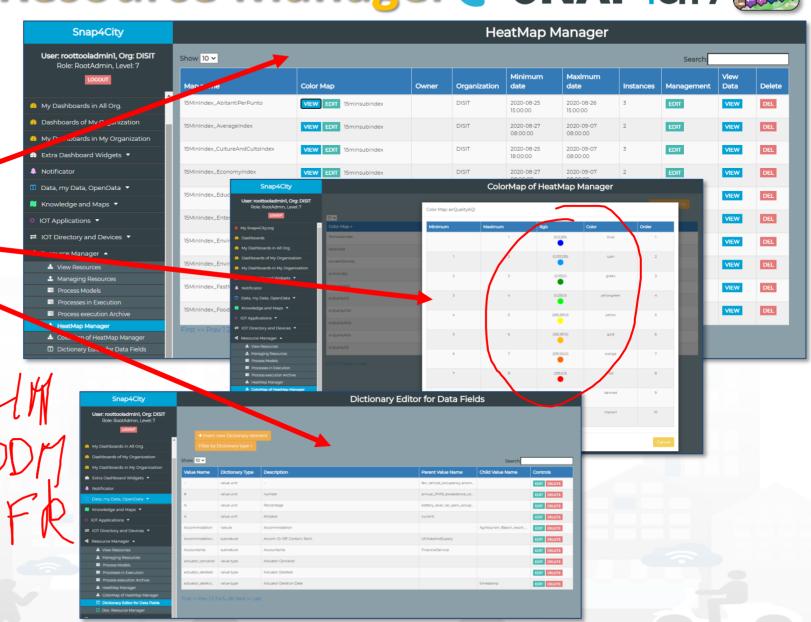
- For non admin tools see Training parts 3 and 5: https://www.snap4city.org/577

216

Resource Manager

- Tools for managing shared resources among Organizations and Users

- For non admin tools see Training parts: https://www.snap4city.org/577

Development Tools

Development Tools ▲
- Web Scraping Tool
- Jupyter Hub - Python
- Web Scraping Tool (0n)
- Web Scraping Tool (6l)
- R Studio Development
- R Studio Development 0.11
- R Studio Development 0.116
- R Studio Development TF
- R Studio Development GFF
- R Studio Development Gral
- ETL Development
- ETL Development 1
- ETL Development 2
- Knowledge Base Graphs
- Knowledge Base Queries
- Smart City API Docs: Swagger
- Internal API Docs: Swagger
- Testing API by Postman
- Source Code Access
- How to Develop Smart Applications

- *All these tools are well described into Training parts:* https://www.snap4city.org/577
- *The Administrators may*
  - *access to all instances of them*
  - *Grant access to them at specific AreaManager users*

- **API and Swagger documentation**
- **Model Knowledge Base Graphs (LOG.disit.org)**
- **Python online dev. Environment**
- **R Studio Online dev. Environment**
- WebScraping tool
- For KB: SPARQL Editor and tools (custom FLINT)
- ETL OnLine dev. Environment (deprecated)

Decision Support Systems

Decision Support Systems ▲
- Smart City Control Room
- Workflow Management Ticketing
- Altair Maintenance
- Altair Ticket Management
- Altair Ticket Close Event
- BIM Dashboard
- Workflow Management, Ticketing
- BIM Management and Dashboards
- DORAM Public Transport Analyzer
- Doc: DORAM Pub Transp. Analyzer
- Twitter Vigilance
- Twitter Vigilance Real Time
- Twitter Vigilance Antwerp
- Twitter Vigilance Helsinki
- Twitter Vigilance WestGreece
- Twitter Vigilance Valencia
- Twitter Vigilance Firenze HeritData
- Twitter Vigilance Pont Du Gard
- Twitter Vigilance Dubrovnik
- Twitter Vigilance Notes
- What-If Analysis
- Doc: What-If Analysis
- Origing Destination Matrices
- Traffic Flow Reconstruction
- High Res. Pollutant Predictions
- Resilience Decision Support Sys
- Smart Decision Support Sys
- Doc: Smart & Resilience DSS

- All these tools are well described into Training parts: https://www.snap4city.org/577

- Some of these tools need special VM / appliances, services to be activated

- Most of them are accessible to the public at least with guest account

- The Administrators may
  – access to all instances of them
  – Grant access to them at specific AreaManager users

219

Snap4City (C), October 2025

- **Menu Management**: for managing main menu and submenu, on web and mobile, and those of the Organizations on Dashboards

- A number of configurations for the Dashboard Manager (most of them are valid only for OnPremise solutions, and/or V1 infrastructure approach)

SuperSetting ▲
- Organization Manager
- Menu Management
- Translation Manager
- www.snap4solutions.org Login
- XML SiteMapGenerator
- Dashboard Config Files
- Dashboard Metrics
- Dashboard Widget Parameters...
- Dashboard Data Sources
- IOT Directory Setting
- Process: Test vs Production
- Setting Multiple DISCES

Multilingual Support and Translation Management

Settings
- Menu Management
- Translation Manager
- XML SiteMapGenerator

Multilingual Support, Any Language, UTF8

- Fully supported on CRM (drupal), Node-RED (IOT App)
  - See modules of those tools

- Partially developed for:
  - Dashboard Builder
  - Resource Manager
  - Other Tools..
  - Menu Manager
  - JavaScript Strings

to add a new language use POEDITOR (open version)
Ask for last file to
snap4city@disit.org
You can contribute on GitHub
https://poeditor.com/

to add a new language use Translation Manager as Administrator
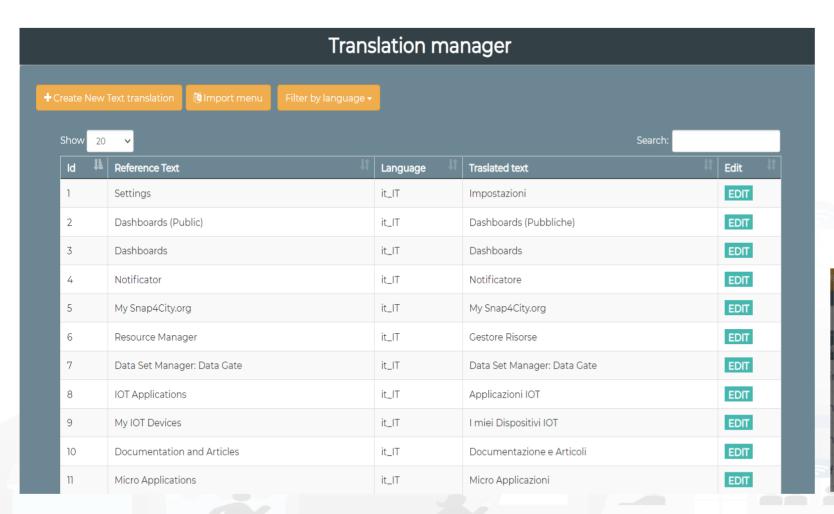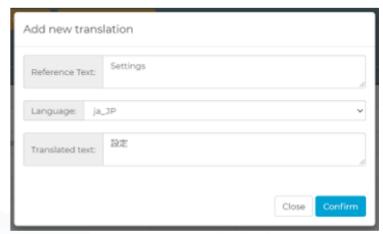
Translation Manager
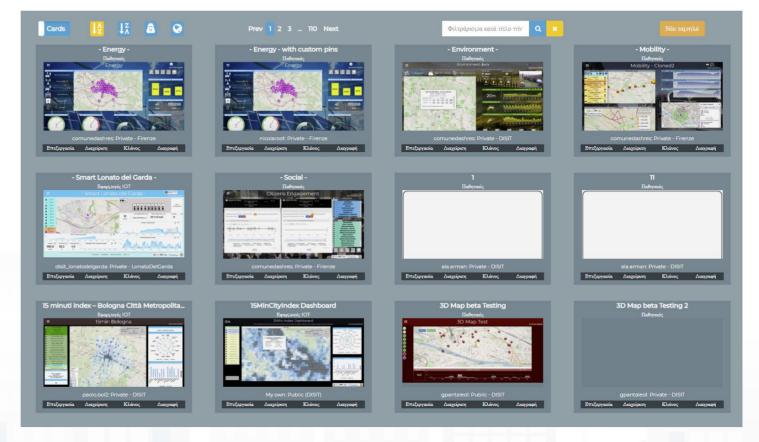
Resulting as

- Keyworks as Main Tools names should remain in English
- Names of the resources remain in the language in which they have been created/defined

User Management

User Management and Auditing

Sidebar menu:
- **User Management and Auditing** ▲
  - User Management
  - User Limits Management
  - User Engagement
  - User Engagement Dash
  - User Role Management via LDAP
  - Manage Resource Ownership
  - User Chats Management
  - Auditing Data Access Try-out
  - Auditing Elements vs Ownership
  - Auditing Personal Data
  - Auditing Accesses Authetication
  - Auditing User Activities
  - Auditing Activities on Queries
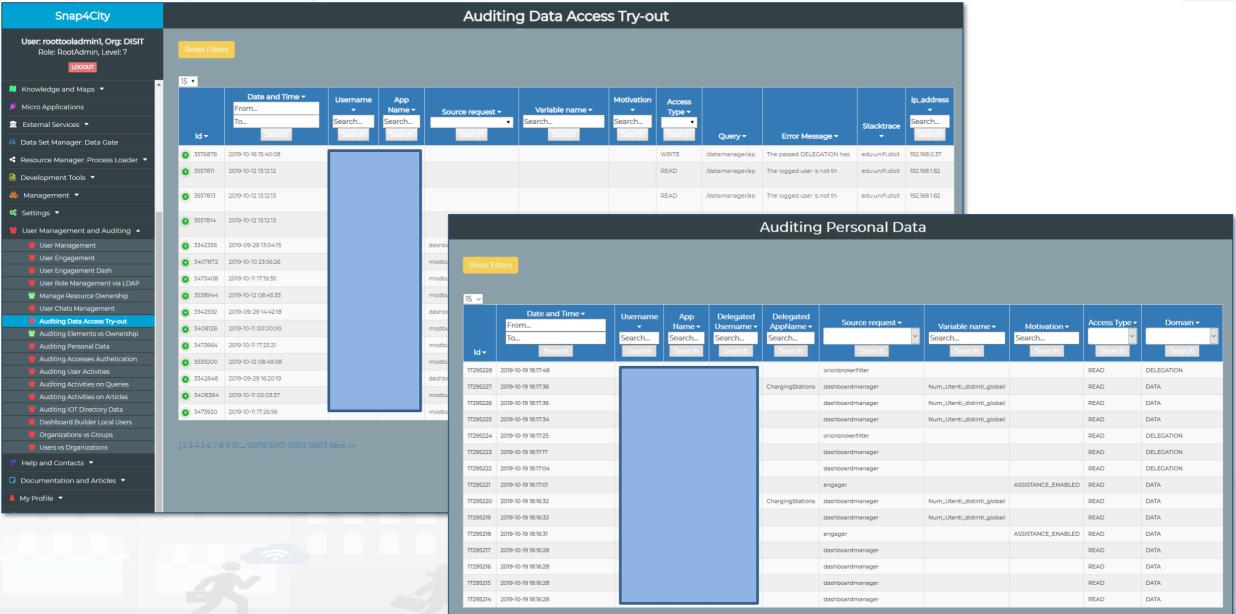 - Auditing Activities on Articles
  - Auditing IOT Directory Data
  - Dashboard Builder Local Users
  - Organizations vs Groups
  - Users vs Organizations

- All that the RootAdmin needs to manage:
  - **User Management: for managing**
    - accounts and profiles
    - limits of the users in exploiting resources
    - Accesses and providing special authorization
    - Organization vs Groups of users
    - Users vs Organizations
  - **Users vs Web and Mobile Applications**
    - Engaging and monitoring users on platform and devices
  - **Users on Chats room of Dashboards**
    - Managing Users on Chats of Dashboards
  - **Auditing of the data and resource accesses**
    - Auditing all the activities on the platform (see next section)
    - Personal auditing

User Management

- User Management via Drupal or Local Users Management without CRM.

- User Limits con controlling resource consumption

- User Engagement: see mobile App training part

- Roles and LDAP management

- Managing Resources vs Users' Ownerships and granted accesses to the resources

- Organizations and their Groups of users

- Users vs Organizations

- ..

- AND User Access Authentication via KeyCloak
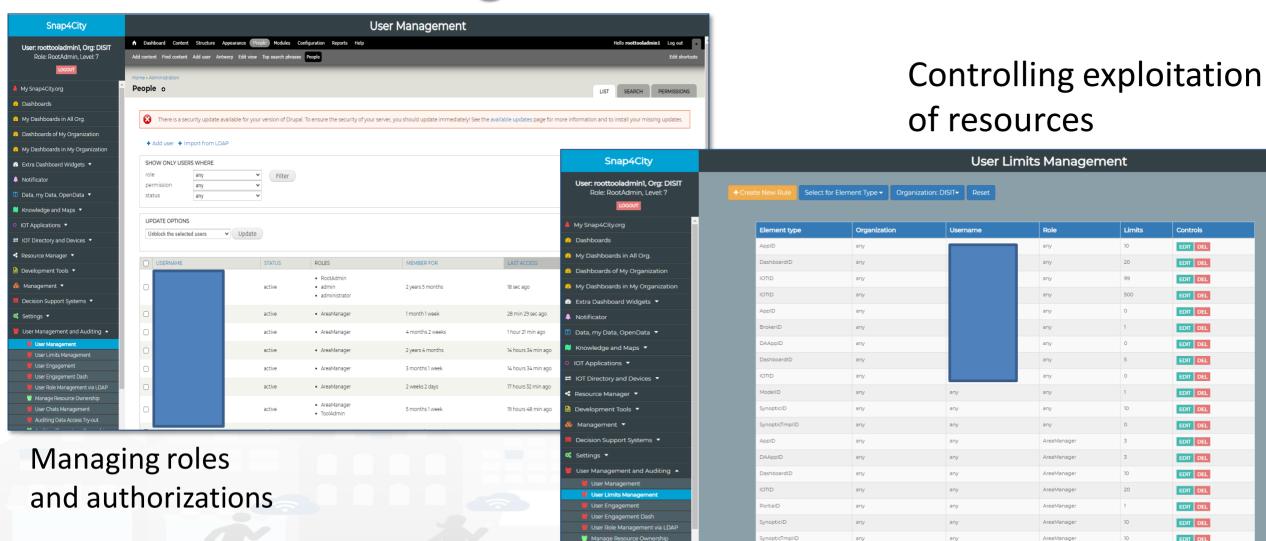
User Management and Users' Limits

Controlling exploitation of resources

Managing roles and authorizations

Controlling Exploitation of Resources and activities

- The exploitation of **Entities** is controlled by **Delegation** mechanisms managing for **Ownership** and Delegation (**Ownership Manager**) for:
    - DATA as read (access) or write (create) or read/write
    - IoT App only as Ownership
    - Dashboards as: read (access) or write (create/change)
    - etc.
- **User Limits** enforced the maximum number of resources can be exploited by a User in Creating
    - Entities, Model, Dashboards, IoT Applications, Heatmaps, etc.
- The **usage of Tools** (which can be Smart Applications as Dashboards and Views; Advisor Collection, etc.) is controlled by **ACL and RBAC** approach with ACL Profile
    - Also including limits on their usage as the max number of API calls, max number of simulations, etc.

Rule Based Access Conditions for Users

- **AC: Action Control**, eventually ACL, AC List
  - A Rule granting the Access to some Tool or functionality
    - AC name, ORG, Dash/Collection, max x day, max x month, max total
    - Examples of AC are: use CSBL, use JupiterHub, access to UserStats
- **ACL Profile** is a list of AC which can be granted to a User with a single grant:
  - E.g., a developer could have as ACL: CSBL, JupiterHub, UserStats
- **Grants to the users** can be provided with one or more ACs or ACL Profiles

Auditing Activities

- 👥 Auditing Data Access Try-out
- 👥 Auditing Elements vs Ownership
- 👥 Auditing Personal Data
- 👥 Auditing Accesses Authetication
- 👥 Auditing User Activities
- 👥 Auditing Activities on Queries
- 👥 Auditing Activities on Articles
- 👥 Auditing IOT Directory Data

User Stats

Platform Management

Management ▲

- Traffic Analyzer: AMMA
- Container Cluster Monitoring
- Container Cluster Intelligence
- Back Office Container Monitoring
- IOT App Version Management
- Smart City API Monitoring
- MyKPI Monitoring
- Notificator Monitoring
- Web Server Monitoring
- Back Office DWH Sched DISCES
- Back Office DA Sched DISCES
- Back Office DISCES monitor
- Mobile Application Monitoring
- Mng Anonym. Photos Comments
- Mng Photos Comments HelAnt
- Mng Online Helps
- Config ResDash
- Mesos view
- DISCES-EM
- DISCES-EM tail
- IOT App for Conf Clust Monitor

Management

Sidebar menu (Management):
- Management ▲
- Traffic Analyzer: AMMA
- Container Cluster Monitoring
- Container Cluster Intelligence
- Back Office Container Monitoring
- IOT App Version Management
- Smart City API Monitoring
- MyKPI Monitoring
- Notificator Monitoring
- Web Server Monitoring
- Back Office DWH Sched DISCES
- Back Office DA Sched DISCES
- Back Office DISCES monitor
- Mobile Application Monitoring
- Mng Anonym. Photos Comments
- Mng Photos Comments HelAnt
- Mng Online Helps
- Config ResDash
- Mesos view
- DISCES-EM
- DISCES-EM tail
- IOT App for Conf Clust Monitor

- **Tools for Platform Management.**
  - Most of them only accessible for RootAdmin and OnPremise
- Tools can be **grouped in the following families**
  - DataAnalyzer (DevDash): monitoring and browsing data ingested into OpenSearch (see on top as My Data ..))
  - Container Monitoring and Management
  - IoT App Version Management of Snap4City tools
  - Smart City API traffic monitoring
  - MyKPI Monitoring
  - Mobile Applications Monitoring
  - Management of Images and Comments from Smart City API, Mobile and Web Apps
  - Management of OnLine Helps (not active)
  - DISCES schedulers monitoring and management (V1 infrastructure versions) (deprecated)

- My Data Dashboard Dev Kibana
- My Data Dashboard Kibana

Customer Relationship Manager Integration and Living Lab basic

Living Lab vs DRUPAL

- **Based on Drupal 7 and only**
  - A Few Custom modules have been adapted and are distribution on GITHUB/DISIT
  - Full Customizable by adding Drupal modules as usual
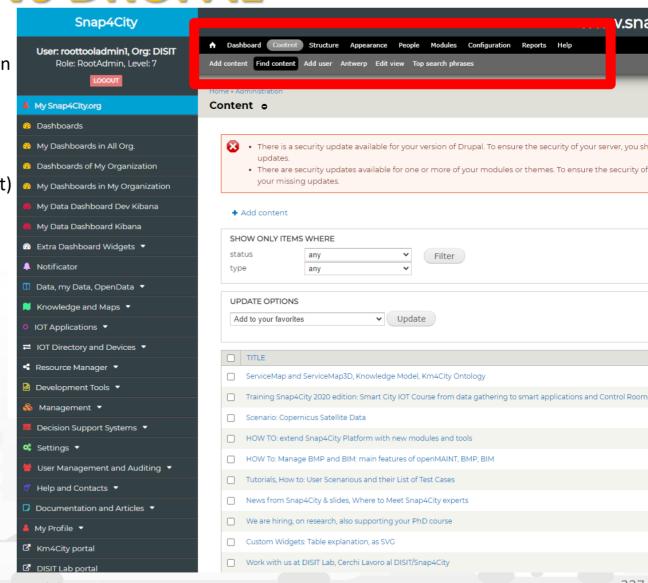
- **User Management registration and mailing**
  - LDAP connection for role management
  - KeyCloak connection for SS0 / Authentication (OpenID Connect)
  - Management of user profile
  - Authorization to access at the web pages..
  - User profile management for Role and Details + statistics

- **Content management for Organizations and Groups**
  - Indexing of all content and search
  - Content Distribution: web pages, newsletters, articles, comments, Video, technical notes, training
    - Statistics on their usage
  - Reports and views regarding living lab usage, and web pages
  - Organizations vs Users
  - Organizations vs Groups
  - Tracking and monitoring
  - Production and distribution of NewsLetters

- **Open to full contributions and comments**
  - Comments on web pages, …

- Etc.

Organizations
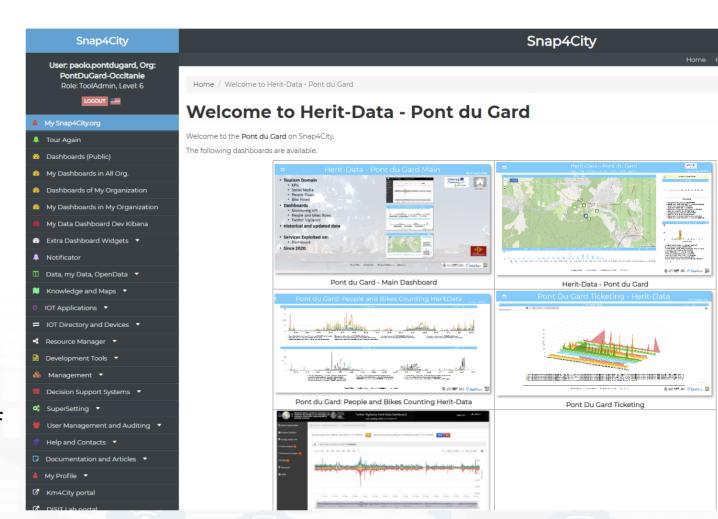
- Each Organization may have:
  - A number of groups to which the users can subscribe
  - A number of dashboards produced by the users
  - A number of IoT Devices, IoT Device Models,
  - A number of POI
  - Etc.
  - A dedicated Splash Page
    - It can be customized by an user of the Organization
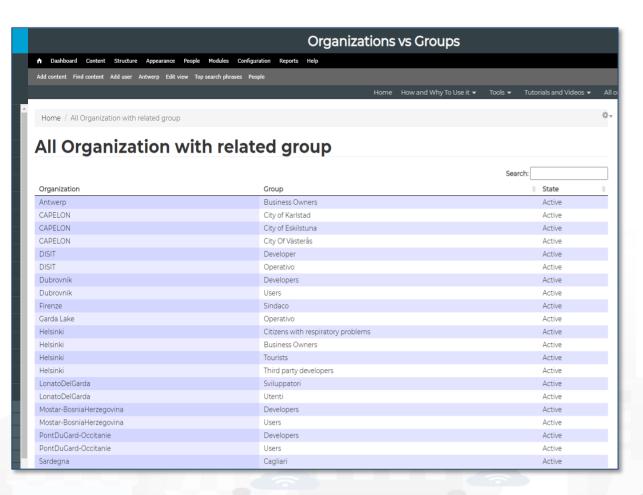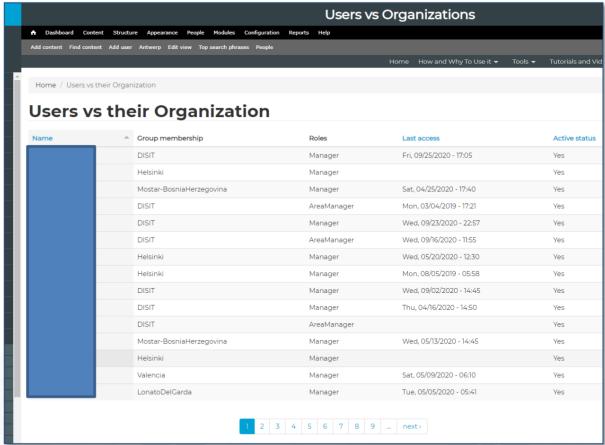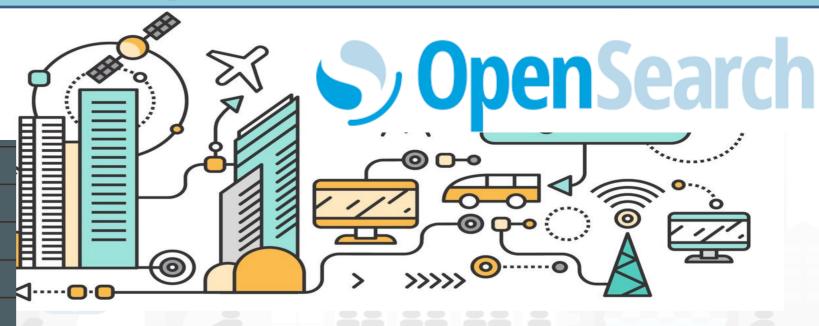   - Ask to activate one
  - Etc.

Organizations vs Groups vs Users

DataAnalyzer (DevDash): monitoring and browsing data ingested into OpenSearch with OpenSearch Dashboard

- Data Analyzer: DevDash
- Data Analyzer: DevDash Firenze
- Data Analyzer: DevDash Helsinki
- Data Analyzer: DevDash DISIT
- Data Analyzer: DevDash Lonato
- Data Analyzer: whole traffic

My Dev Dash (DevDash)

- For accessing and browsing data on Open Search storage and other sources supported
  - **Family of Grafana, Kibana, Banana**
- **No Support for real time event driven** widgets/panels, actuators and synoptics, no sophisticated maps, etc.
- **Not suitable for control room**, decision makers, etc.
- **Limited Business Intelligence,** Custom widgets, animation, external services.
- **Oriented to developers**, complex production of custom views, etc.
- **Partial support of GDPR** and deep control of access.
- Snap4City uses this technology only for monitoring data flow into the Storage with tools named: DevDash, or MyDevDash
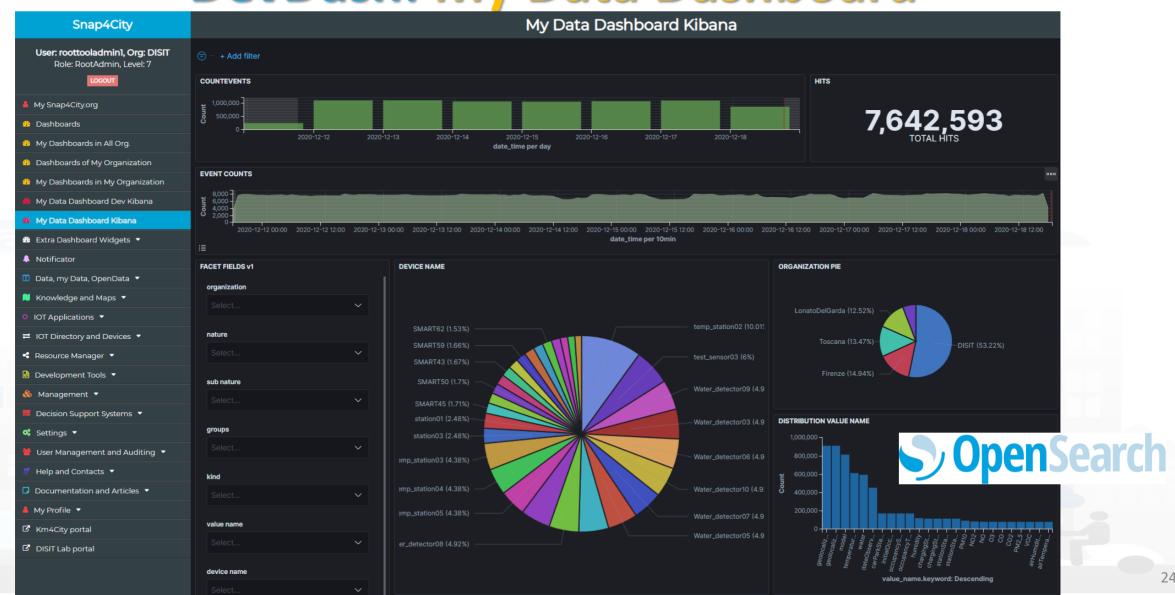
DevDash: My Data Dashboard

Business Analysis Dashboards
For all kind of users: DevDash

- Dynamic Filtering, Adaptable, …
- Full data details, drill down,…
- Synergic with **Data Inspector** which addresses data relationships, processing and information
- **Only Your Data for**
  - Manager and Area Managers
- **All Accessible Data for**
  - ToolAdmin and RootAdmin

Snap4City

User: roottooladmin1, Org: DISIT
Role: RootAdmin, Level: 7

LOGOUT

- 👤 My Snap4City.org
- 🎛️ Dashboards
- 🎛️ My Dashboards in All Org.
- 🎛️ Dashboards of My Organization
- 🎛️ My Dashboards in My Organization
- ⬛ Extra Dashboard Widgets ▾
- 🔔 Notificator
- ⬛ Data, my Data, OpenData ▾
- 📕 Knowledge and Maps ▾
- ⭕ IOT Applications ▾
- ⇄ IOT Directory and Devices ▾
- ⬛ Resource Manager ▾
- ⬛ Development Tools ▾
- 🎛️ Management ▴
  - 📈 Traffic Analyzer: AMMA
  - 📈 **Data Analyzer: DevDash**
  - 📈 Data Analyzer: DevDash Firenze
  - 📈 Data Analyzer: DevDash Helsinki
  - 📈 Data Analyzer: DevDash DISIT
  - 📈 Data Analyzer: DevDash Lonato
  - 📈 Data Analyzer: whole traffic
  - 📈 Container Cluster Monitoring
  - 📈 Back Office Container Monitoring
  - 📈 IOT App Version Management
  - 📈 Smart City API Monitoring
  - 📈 MyKPI Monitoring
  - 📈 Notificator Monitoring
  - 📈 Web Server Monitoring
  - 📄 Back Office DWH Sched DISCES
  - 📄 Back Office DA Sched DISCES
  - 📄 Back Office DISCES monitor
  - 📈 Mobile Application Monitoring

SMARTCITYMAP

Number of Sensors	4
Latitude	43.77896531461738
Longitude	11.2758450344471

Number of Sensors
- 🟡 1 – 4.333
- 🟠 4.333 – 7.667
- 🔴 7.667 – 11

© OpenStreetMap contributors , Elastic Maps Service

EVENTS

1–50 of 176.794

Time ▾	organization	deviceName	value	src	kind	latlon	value_name	value_type	data_type	serviceUri	value_unit	value_str
▸ October 11th 2020, 12:33:52.790		test_sensor03	9.215	IOT	sensor	43.7921,11.2495	geolocalization_lon	longitude	float	http://www.disit.org/km4city/resource/iot/orionUNIFI/test_sensor03	#	-
▸ October 11th 2020, 12:33:52.790		test_sensor03	24	IOT	sensor	43.7921,11.2495	temperature	temperature	float	http://www.disit.org/km4city/resource/iot/orionUNIFI/test_sensor03	°C	
▸ October 11th 2020, 12:33:52.790		test_sensor03	-	IOT	sensor	43.7921,11.2495	geolocalization_lat	latitude	float	http://www.disit.org/km4city/resource/iot/orionUNIFI/test_sensor03	#	NaN
▸ October 11th 2020, 12:33:52.492	DISIT	testxxx3	1,602,412,480,000	IOT	sensor	43.79737,11.3063	timestamp	timestamp	timestamp	http://www.disit.org/km4city/reso	#	

DevDash Case Study (2)

- Detect potential anomalies or disfunctions by inspecting the DevDash tool time trend

Back office Platform Scalability
Containers Management and Monitoring

- Container Cluster Monitoring
- Container Cluster Intelligence
- Back Office Container Monitoring
- Mesos view
- DISCES-EM
- DISCES-EM tail

Elastic Scaling: allocating / deallocating

- Allocation/ deallocation, Rebalancing vs compacting
  - Vertical of resources: Docker and/or VM: CPU, Mem
    - NodeJS multi-flow for each Docker, the user request data flows and IOT App, Snap4City allocates them dynamically on demand and perform workload optimization
    - VM: management of Mem, CPU; transparent and automatic in DRS VMware
  - Horizontal of resources of Dockers and/or VM and/or [Host]:
    - Docker: addition of containers, migrations/moving, balancing (per moving) of IOT App
    - VM: on/off
- Monitoring resources:
  - VM via VMware API,   Docker via Marathon and Mesos APIs
- Algorithm in Python for scaling, actions via APIs: VMware, Marathon,..

Container
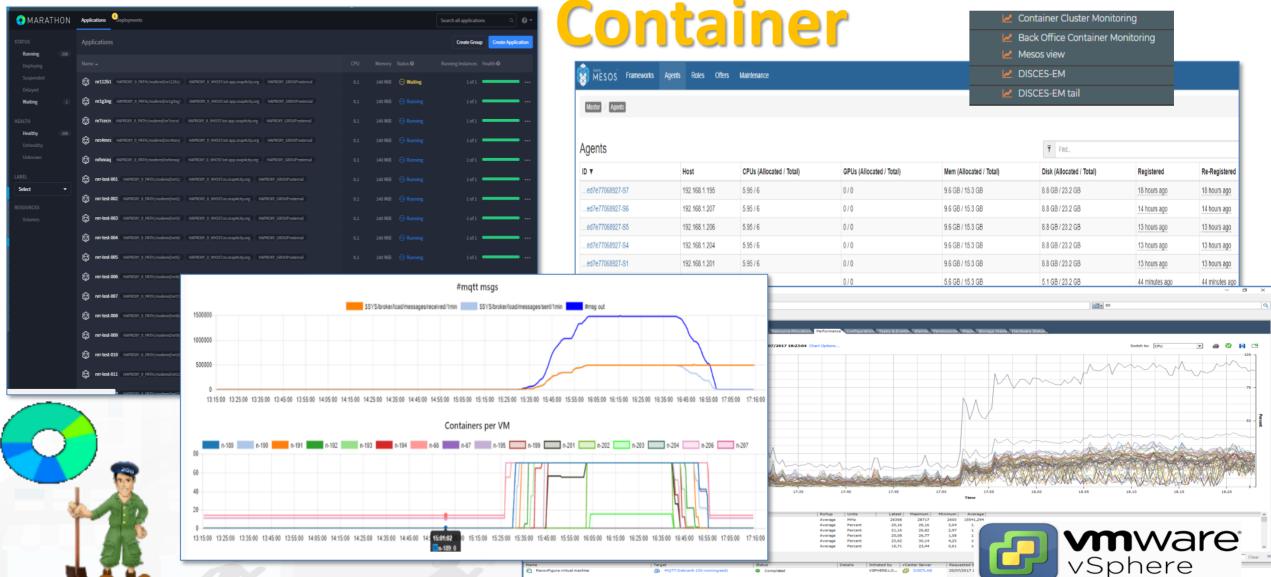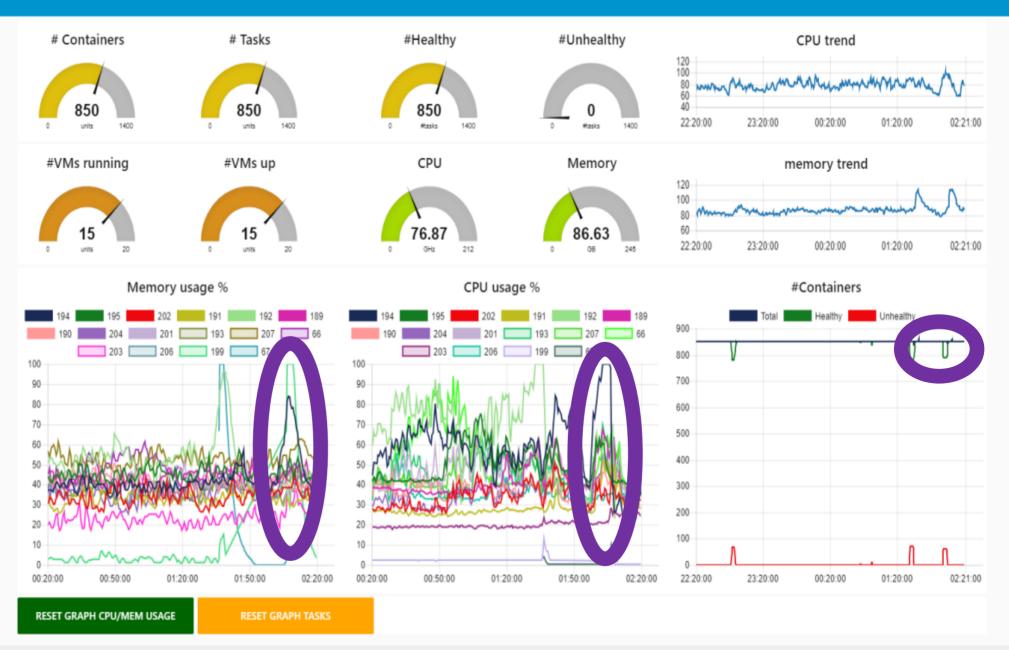
Snap4City
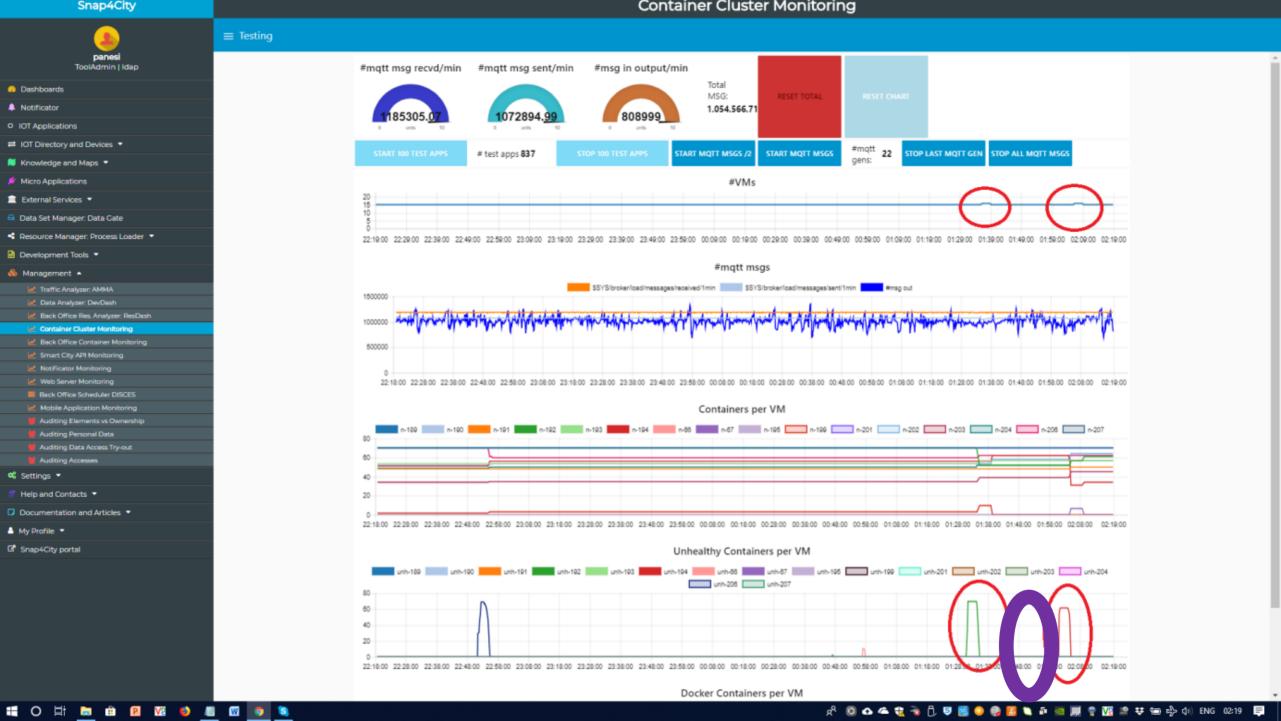
panesi
ToolAdmin | ldap

- Dashboards
- Notificator
- IOT Applications
- IOT Directory and Devices ▾
- Knowledge and Maps ▾
- Micro Applications
- External Services ▾
- Data Set Manager: Data Gate
- Resource Manager: Process Loader ▾
- Development Tools ▾
- Management ▴
  - Traffic Analyzer: AMMA
  - Data Analyzer: DevDash
  - Back Office Res. Analyzer: ResDash
  - **Container Cluster Monitoring**
  - Back Office Container Monitoring
  - Smart City API Monitoring
  - Notificator Monitoring
  - Web Server Monitoring
  - Back Office Scheduler DISCES
  - Mobile Application Monitoring
  - Auditing Elements vs Ownership
  - Auditing Personal Data
  - Auditing Data Access Try-out
  - Auditing Accesses
- Settings ▾
- Help and Contacts ▾
- Documentation and Articles ▾
- My Profile ▾
- Snap4City portal

≡ Testing

#mqtt msg recvd/min — 1185305.07

#mqtt msg sent/min — 1072894.99

#msg in output/min — 808999

Total MSG: 1.054.566.71

RESET TOTAL

RESET CHART

START 100 TEST APPS | # test apps 837 | STOP 100 TEST APPS | START MQTT MSGS /2 | START MQTT MSGS | #mqtt gens: 22 | STOP LAST MQTT GEN | STOP ALL MQTT MSGS

#VMs

#mqtt msgs

$SYS/broker/load/messages/received/1min $SYS/broker/load/messages/sent/1min   #msg out

Containers per VM

n-189 n-190 n-191 n-192 n-193 n-194 n-86 n-87 n-195 n-199 n-201 n-202 n-203 n-204 n-206 n-207

Unhealthy Containers per VM

unh-189 unh-190 unh-191 unh-192 unh-193 unh-194 unh-86 unh-87 unh-195 unh-199 unh-201 unh-202 unh-203 unh-204
unh-206 unh-207

Docker Containers per VM

Computational Capabilities of Snap4City

- **Managing:**
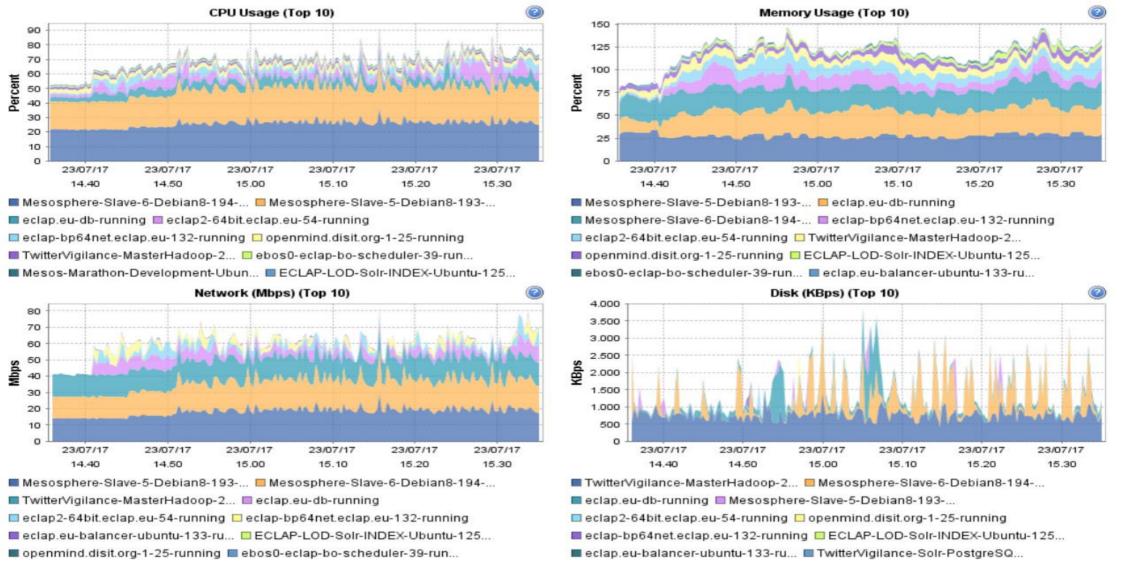
  - **Periodic Processes** → IoT App/Proc.Logic (Node-RED), Data Analytics (Python, Rstudio), even former ETL/ELT

  - **Asynchronous processes**, event driven, real time → Node-RED (SS Business Logic, IoT App / Proc.Logic

- **Scalability**

  - **Horizontal**: Increasing processes performing activities, demand on new processes for new users, for new applications, for new IoT App: VM, Hosts, clusters, Storage SAN

  - **Vertical**: Increasing resources on processes: CPU, MEM, Storage, Network

Monitoring on Cloud
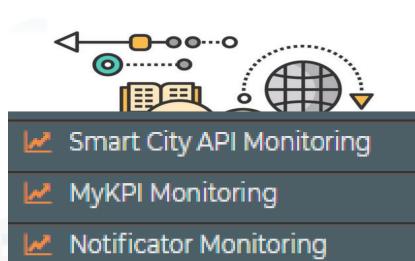
Monitoring Resources and API Traffic *(not control of API consumption which is in APIMAN)*
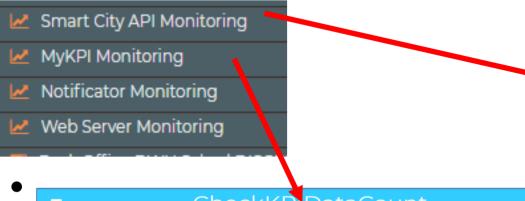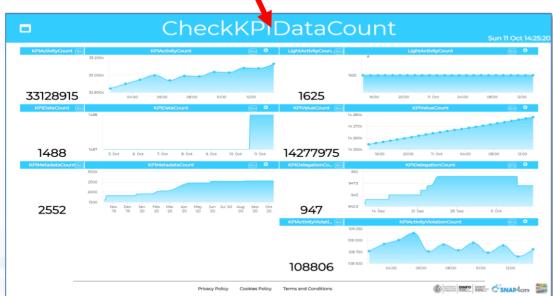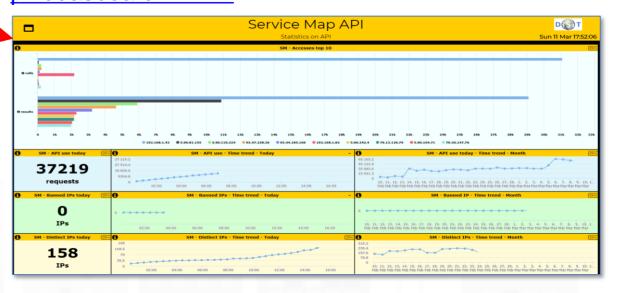
- Smart City API Monitoring
- MyKPI Monitoring
- Notificator Monitoring
- Web Server Monitoring

Monitoring Smart City API Usage

Smart City API Monitoring

MyKPI Monitoring

Notificator Monitoring

Web Server Monitoring

http://www.disit.org/dashboardSmartCity/view/index.php?iddasboard=MTkw

Block eventual IPs

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTY0NA==
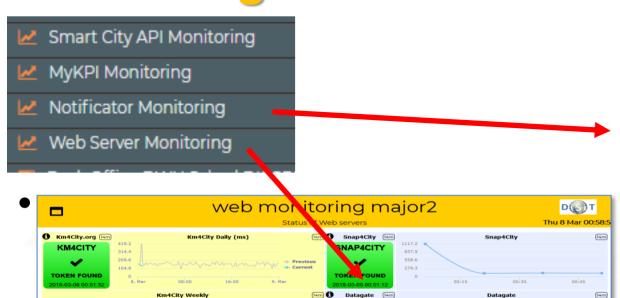
Monitoring Resources and Traffic

http://www.disit.org/dashboardSmartCity/view/index.php?iddasboard=MTQ4

http://www.disit.org/dashboardSmartCity/view/index.php?iddasboard=MjQ5

Report Generation and Management (admin tool)

Report Generation in Snap4City

- The reports can be produced in two different manners, by using:
  - 1) **Report Generator** which periodically can go on the data and KPI, computing the report and producing them for specific users
    - They are activated and scheduled by the Wizard on the single Entity/Device
    - They can be customized using Jasper-Report Jasper-Soft and programming for generating the report, performing queries and formatting graphics on the document:
      - limited graphics, report format will be predefined.
      - The User has no customization, no Business Intelligence results,
    - See next slides, while for details see web pages Snap4City.org, cited in the sequel
  - 2) **CSBL, as client side business logic** for creating a **custom Dashboard** programmed in JavaScript to generate a Business Intelligence Web page with graphs of any kind, which can be printed on PDF to create the report.
    - The PDF can be activated and saved manually from the dashboard.
    - The report can be focussed on specific aspects, may shoot a specific condition of the Business Intelligence results implemented in the Dashboard programmed.
    - See Part 8 for details.
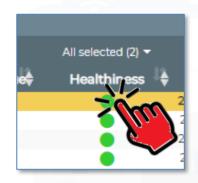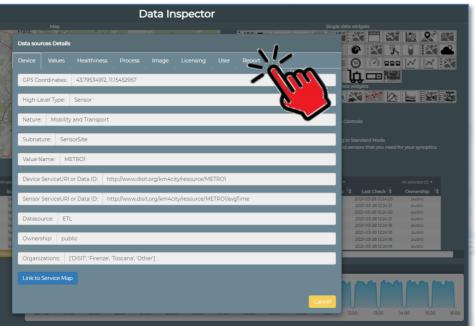
Report Generation and Management
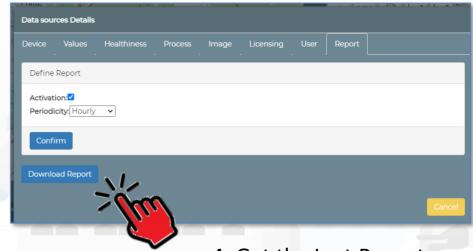
- **Device/data** owner may have their reports: **monthly or 3-monthly**
  - Ready to use reports are available for:
    - Single Device: ETL and IOT
  - Ask to your RootAdmin to activate the production of reports (and also **hourly** report **for testing only**).

1. Open data Inspector
2. Click on Device or sensor
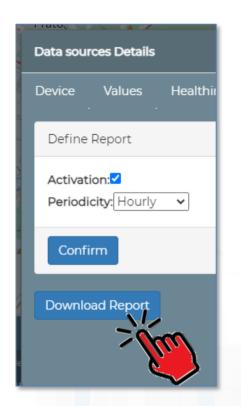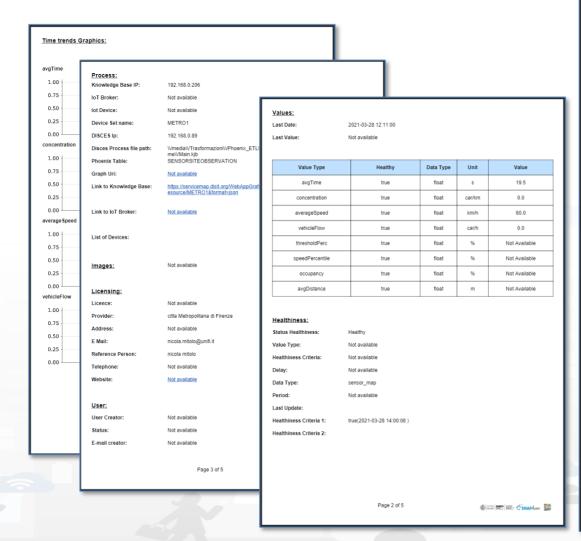
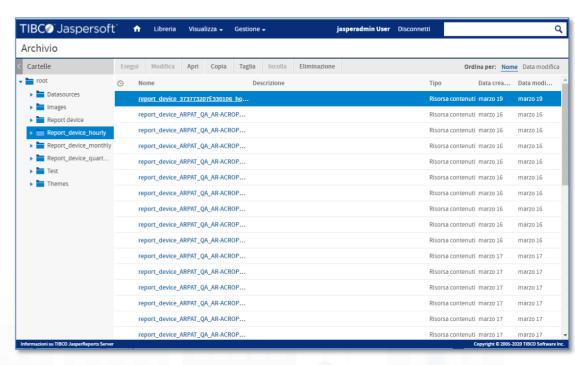3. Click on report

4. Get the Last Report

Take the last report

Report Generation and Management

- **Technically:**
  - Reports are produced on the basis of a Model
  - **Report Models** can be defined and customized in Jasper Studio, an open source standard
  - **Report Manager** is based on Jasper Server, an open source standard

- **Other kinds of reports** can be realized on demand for
  - Dashboards
  - Smart Applications
  - Organizations

Report user manuals:
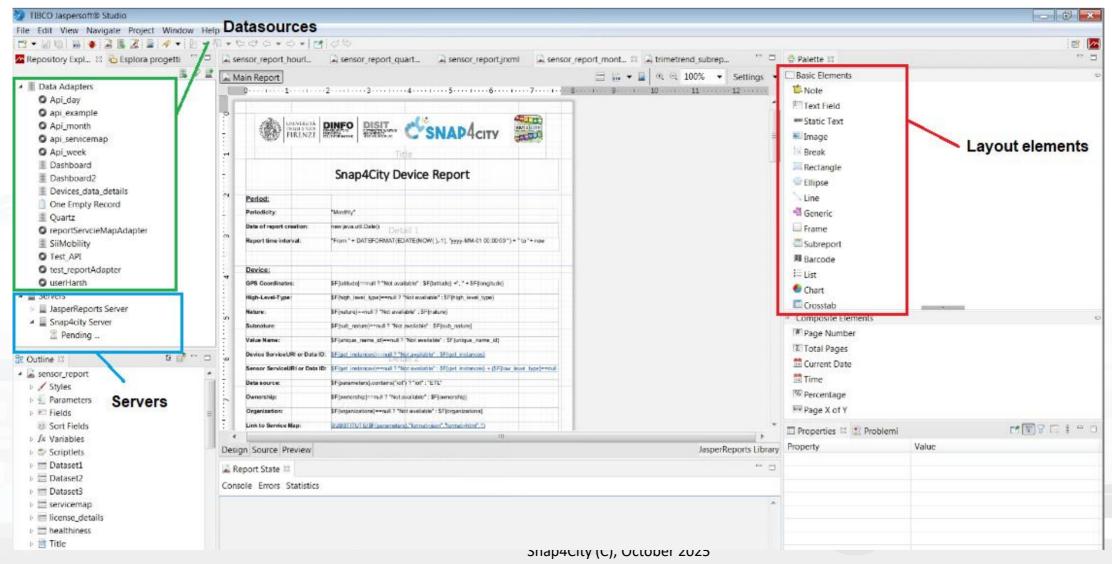https://www.snap4city.org/720
https://www.snap4city.org/721

How to Customize/Manage the Report Model

Snap4Tech:
Smart Solutions as a Service

Smart Solutions as a Service

- Snap4xxxx applications may exploit multiple paradigms as data driven, stream and batch processing, putting co-creation tools in the hands of:

    – **Smart Living Lab** users and developers a plethora of solutions to develop applications without vendor lock-in nor technology lock-in,

    – **final users** customizable / flexible mobile Apps and tools,

    – **city operators** and decision makers specialized / sophisticated city dashboards and IOT/IOE applications for city status monitoring, control and decision support. Open to Organizations

- Training and manuals: https://www.snap4city.org/108
- Help Desk: https://www.snap4city.org/3
- SLA: https://www.snap4city.org/497
- Terms of Use: https://www.snap4city.org/drupal/legal

Specialized Offer

Snap4xxxx as Smart Solution IOT as a Service for

- **Who would like to create** Living Labs as community exchanging experience with other cities as well;

- **Research Institutions, Departments** and **Projects** which would like to perform research and experiments in the area of Smart City and IOT, without the needs of setting up the infrastructure, exploiting open data, collaborating, accessing to Data Analysis on demands, etc. This is the spirit of **EOSC**, European Open Science Cloud Marketplace at which Snap4City is registered as DISIT Lab, see [**EOSC**].

- **Public Administrations**, as small cities that would like to offer smart services and does not have economic power to manage service on their premise from them self.
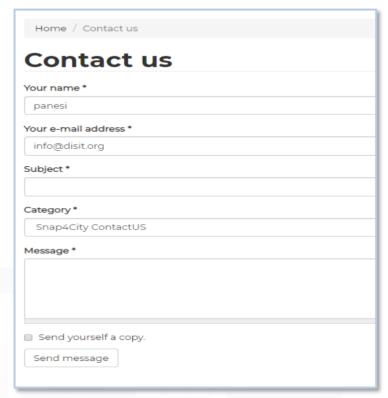
- https://www.snap4city.org/drupal/contact
- Bug Reporting
  - https://docs.google.com/forms/d/e/1FAIpQLSfDQtKqgLlIyycNXiazeYEh1SsRG1YL8Ze4ThD8nZoA5jsoXw/viewform
- For Service Level Agreement see:
  - Service Level Agreement
- Help Desk and Contact:
  - https://www.snap4city.org/3
- Availability rates:
  - https://www.snap4city.org/388

Contact us panel (right side):

Home / Contact us

Contact us

Your name *
panesi

Your e-mail address *
info@disit.org

Subject *

Category *
Snap4City ContactUS

Message *

☐ Send yourself a copy.

Send message

Availability data (bottom right):

Periodo di riferimento:	09 / 2019
Disponibilita' media:	99.91%
MTTR:	00G 00:10.00
MTBF:	04G 14:04.24
# down tot.	4
max(t_down):	00G 00:10.01
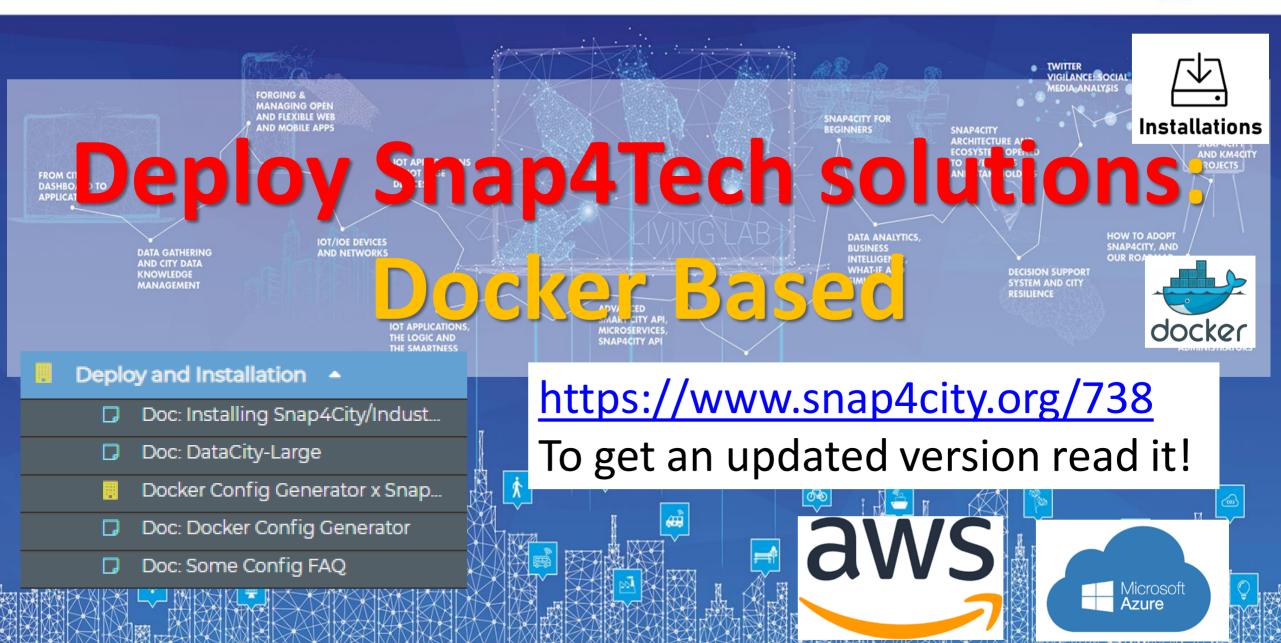
Providing consulting, customization, training, and developments

- Snap4City solution can be installed on premise and one cloud, private and public.
- **Snap4City (DISIT Lab and/or Snap4 SRL (INC.), or other companies as well), provide support, if needed, for design and/or Develop, set up:**
    - **Training and tutoring;**
    - **Snap4xxxx infrastructures and architectures**;
    - **data analytics,** that could be developed as proprietary solutions for the customer or as open source;
    - **data ingestion processes**, to enable them to have data into the platform;
    - **adaptor for some specific protocol or legacy/third part Tool**, that we prefer to release as open source, but if the connection is with some proprietary tool, the buyer could be interested to keep these solutions as private;
    - **IOT devices, full solutions, dashboards, specific dashboard widgets, etc.**

Tech Overview

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

How to adopt Snap4City

Https://www.snap4city.org

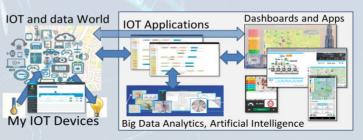## On your premise

Powered by SNAP4Tech

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

Installation on your premise
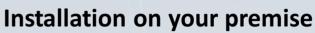- **Virtual Machines or Dockers**
- Different configurations
  - From small to scalable
  - Exploiting your legacy tools
  - Interoperable with any tool
- No vendor lock-in, No tech lock-in

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
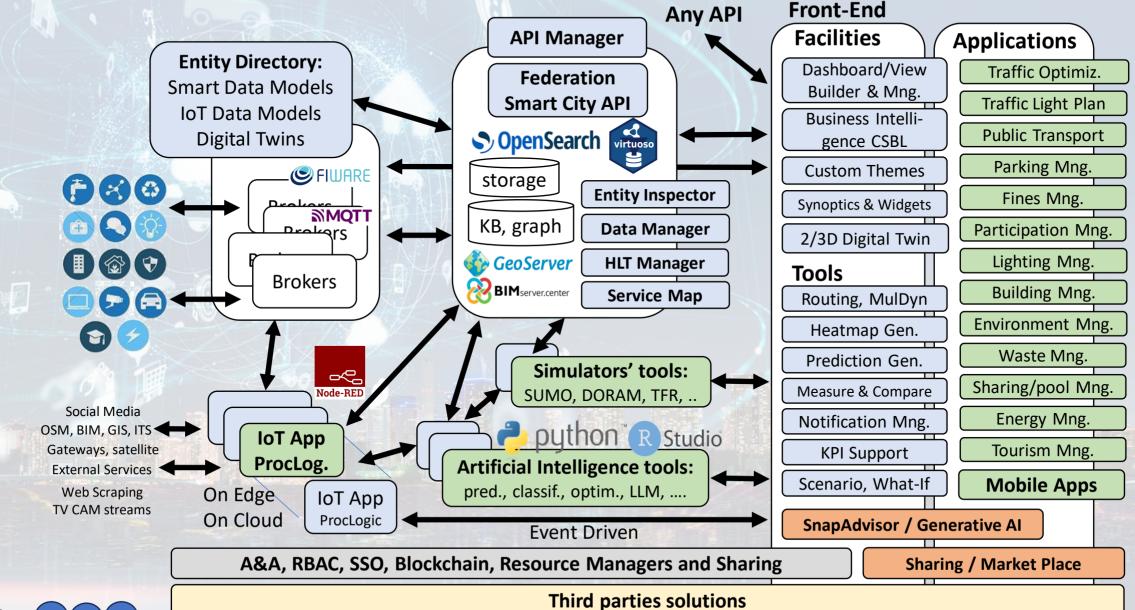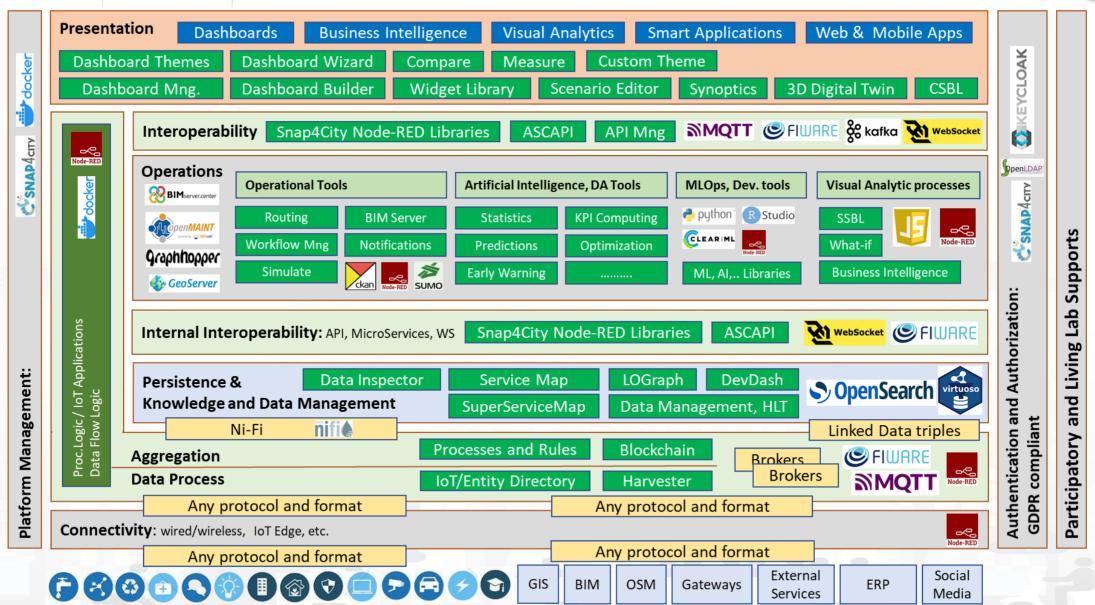 - Pass to install on premise what you need
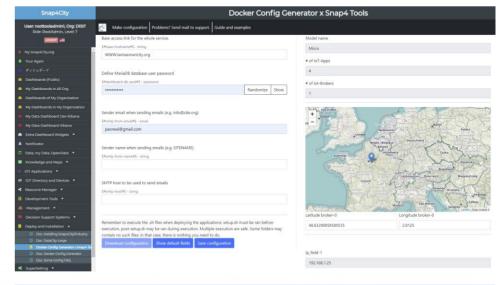
Technical Architecture

Installations, different models a TOOL to get them

- **Micro X:**
  - 1 VM of dockers
- **Normal X,Y:**
  - 2 VM of dockers
- **Small X,Y:** scalable
  - 4 VM of dockers
- **DataCitySmall X,Y,Z:** scalable
  - 6 VM of dockers
- **DataCityMid X,Y,Z,T:** scalable
  - # VM + X/70 VM + Y/3 VM + Z VM + T VM of dockers
- **DataCityLarge:** scalable
  - depending on your needs

https://www.snap4city.org/docker-generator/selecting_model

Config Generator Tools

https://www.snap4city.org/docker-generator/selecting_model

Micro 6 model

Micro 6 (technical)

Web Interface | proxy

Main

Synoptics (WS)	Dashboard Frontend	WSServer (node-red)	Resource Mng
PersonalData	DataBase	Kafka	MyLDAP, LDAP
Dashboard Cron	Dashboard BackEnd	ZooKeeper	KeyCloak
Smart Data Models	OD Manager	ExtBroker harvester	FIWARE IoT

Storage

NIFI | Open Search | Open Search Dashboard

ServiceMap (SCAPI) | Virtuoso

IOT Apps

IOT App 01

IOT App 02

IOT App 6

Broker

ORION | OrionFilter | Mongo

1Hour installation and ready to use

DataCitySmall X-2-2

Web Interfaces proxy

Main

- Synoptics (WS)
- Dashboard Frontend
- WSServer (node-red)
- PersonalData
- Config Mng.
- DataInspector
- Menu Mng
- MyKPI Mng
- Management Tools
- FIWARE Smart Data Models
- OD Manager
- GeoServer Heatmaps

Storage

- NIFI
- NIFI
- Open Search
- Open Search Dash
- Open Search
- Open Search

Brokers

- ORION1
- ORION2
- Mongo
- Mongo
- OrionFilter 01
- OrionFilter 02

Knowledge base

- ServiceMap1
- Virtuoso1
- ServiceMap2
- Virtuoso2

Computing

- IOT App 01
- IOT App 02
- IOT App X

- GeoServer
- Heatmap Mng
- Resource Mng

- Drupal CMS
- OpenMaint
- Report Generator
- Data Analytics

Computing

- Analytic 01
- Analytic 02
- Analytic N

Auth.Author

- LDAP
- MyLDAP
- KeyCloak

Legend:
- 1 or more VM
- 1 or more Containers

Container Based Installations, different models

- **Micro X:** configurations suitable for solutions for small verticals and industries, single **VM**, see in the following for the details.
  - it is more complete than the **Alone** configuration of **https://www.snap4city.org/471**

- **Normal X,Y:**
  - it is more complete than the **Basic** configuration of **https://www.snap4city.org/471**
  - **2 VM: X IOT App, Y Brokers**

- **Small X,Y:** solutions in which the storage is growing and can be managed into a separate VM, and may be clustered later on.
  - 4 VM: **VM1 MAIN:, VM2: authentication and authorization**: LDAP, KeyCloak, ….
  - **VM3 STORAGE**: NIFI, Open Search
  - **VM4 IOT APPs and Brokers**: X IoT Apps, Node-RED, MicroServices; and Y IoT Brokers.

Container Based Installations, different models

- **DataCitySmall X,Y,Z:** more powerful than the 2020 version based on VM
  - suitable for more scalable solutions in which the storage is growing and thus can be managed into a separate VM, also IoT App can be managed separately, such as the Brokers.
  - It is the perfect starting point for replicating VM for storage, Brokers and IoT according to the needs, and thus for starting point on large MultiTenant solutions.
  - 6 VM, but you can expand later cloning the same VM4-6 and manually configuring clusters
- **VM:**
  - **VM1 MAIN:, VM2: authentication and authorisation:** LDAP, KeyCloak,
  - **VM3 STORAGE:** NIFI, Open Search / Open Search Dashboard
  - **VM4:** X IoT Apps, Node-RED, MicroServices.
  - **VM5:** Y IoT Brokers, secure filter, etc.
  - **VM6:** Z KB, ServiceMap, one for each organization, they can be federated each other.
- **For wider and more complete configurations, see the solutions of the 2020**
  - https://www.snap4city.org/471

Providing ZIP files with Docker Compose

- Load on Server, one for each VM and follow the instruction for executing the docker compose

- You get the deployed version in fews minutes according to:
  - Your domain
  - Your password
  - Your preferred parameters

📁 dashboard-backend-conf	06/10/2021 16:21	
📁 dashboard-builder-conf	06/10/2021 16:21	
📁 dashboard-cron-conf	06/10/2021 16:21	
📁 database	06/10/2021 16:21	
📁 iotapp-001	06/10/2021 16:21	
📁 iotapp-002	06/10/2021 16:21	
📁 iotapp-003	06/10/2021 16:21	
📁 iot-directory-certificate	06/10/2021 16:21	
📁 iot-directory-conf	06/10/2021 16:21	
📁 ldap	06/10/2021 16:21	
📁 mariadb-conf	06/10/2021 16:21	
📁 nginx-proxy-conf	06/10/2021 16:21	
📁 nifi	06/10/2021 16:21	
📁 notificator-conf	06/10/2021 16:21	
📁 orionbrokerfilter-001-conf	29/06/2021 17:50	
📁 orionbrokerfilter-001-logs	29/06/2021 17:50	
📁 ownership-conf	06/10/2021 16:21	
📁 processloader-conf	06/10/2021 16:21	
📁 servicemap-conf	06/10/2021 16:21	
📁 servicemap-iot-conf	06/10/2021 16:21	
📁 servicemap-superservicemap-conf	06/10/2021 16:21	
📁 synoptics-conf	06/10/2021 16:21	
📄 apache-proxy.conf	06/10/2021 16:21	
📄 docker-compose.yml	06/10/2021 16:21	
📄 post-setup.sh	06/10/2021 16:21	
📄 setup.sh	06/10/2021 16:21	

Micro 3, all in!

- **FrontEnd:**
  - Creating 192168125_dashboard-builder_1   ... Done, 192168125_dashboarddb_1   ... done
  - Creating 192168125_dashboard-backend_1 ... Done, 192168125_dashboard-cron_1   ... Done
  - Creating 192168125_synoptics_1   ... Done
  - Creating 192168125_wsserver_1   ... done
  - Creating 192168125_kafka_1   ... Done
  - Creating 192168125_zookeeper_1   ... Done
- **Storage**
  - Creating 192168125_personaldata_1   ... Done
  - Creating 192168125_nifi_1   ... done
  - Creating 192168125_elasticsearch_1   ... Done, 192168125_kibana_1   ... Done
  - Creating 192168125_servicemap_1   ... Done, 192168125_virtuoso-kb_1   ... done
- **Authentication and Authorisation**
  - Creating 192168125_myldap_1   ... Done, 192168125_ldap-server_1   ... Done
  - Creating 192168125_proxy_1   ... Done
  - Creating 192168125_keycloak_1   ... Done
- **IOT**
  - Creating 192168125_orionbrokerfilter-001_1 ... done
  - Creating 192168125_orion-001_1   ... Done, 192168125_mongo-001_1   ... done
- **IOT APP**
  - Creating 192168125_iotapp-001_1   ... done
    Creating 192168125_iotapp-002_1   ... done
    Creating 192168125_iotapp-003_1   ... done

Platform Management and control ✓
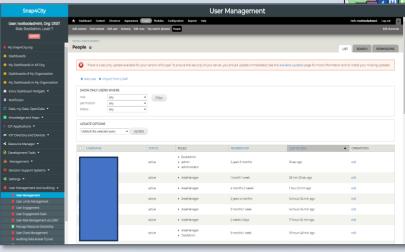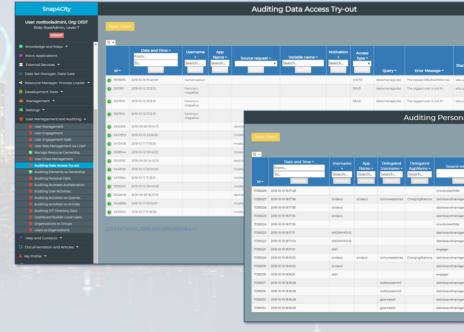
- **Platform Management** tools
  - Installation procedures
  - monitoring and control tools
  - Quality control
  - Help desk and SLA

- **User management tools**
  - **User profiling, limiting**
  - **Auditing** tools according to GDPR
  - **Menu profiling**
  - **CRM**

- **Training** and tutoring tools
  - Develop. Life Cycle
  - Develop. tools
  - Manual, courses, etc.
  - Community

- etc.

www.snap4city.org

HOW TO: Deploy/Install your Snap4City Solution on private or public Clouds, VM with Docker Containers

View   Edit   Track   Access control   Convert

Version 4.4 of 2024/04/22 of this web page

The Docker Config Generator x Snap4 Tools is presently accessible from the main menu under "Deploy and Installation".

Access to the **Docker Config Generator x Snap4 Tools**

Last release of the Generator is of the 2024-01-15 with AWS trial Kubernetes

The latest release introduce many features, such as:

- The api key for google 3d maps is now exposed in the generator; you might use your own key during your generation.
- Multiple tests which you can run to troubleshoot errors you might encounter.
- The checker app can be extended to support custom commands to automate or simplify any task
- Https for the main service, with an addition of a certbot container to generate your certificates
- Latest updates in the user interface
- Tools to backup and upgrade an old distribution to the newest one
- Tools to generate kubernetes distributions based on a Micro X installation; which can in turn be refined to work on an AWS cluster.

Snap4City & Snap4Industry Registered Instances Installations

for default Passwords of the VM and dockers see: https://www.snap4city.org/487, in docker based installations the passwords are also in the docker compose!

- TECHNICAL OVERVIEW: https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf
- Development Life Cycle: https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf
- Booklet Data Analytics, Snap4Solutions: https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf
- MicroX troubleshooting ENG: https://www.snap4city.org/download/video/TroubleShooting-MicroX-on-premise-en.pdf
- MicroX troubleshooting ITA: https://www.snap4city.org/download/video/TroubleShooting-MicroX-on-premise.pdf
- Monitoring Tool for MicroX: https://www.snap4city.org/download/video/MIcroX-monitoring-tool with images-v0-1.pdf
- How To add a Node to OpenSearch: https://www.snap4city.org/download/video/snap4city_elasticsearch_add_node.pdf
- Note on Kubernetes: if you decide to generate the version for Kubernetes, please download and follow the instructions into the single folders of the installation files provided
  - download the notes: https://www.snap4city.org/download/video/Snap4City-Generation-Kubernetes-V0-1.pdf

Former version of intallations based on VM at page https://www.snap4city.org/471

Registration
- **New Registration**
- Request a new password
- **Recover your registration**

Search

[Search] [🔍]

-Any-

Training on Tools and Platform

Powered by
www.km4city.org   KM4CITY

FIWARE   Node-RED

Sii-Mobility

Updates on Tools

HOW TO: Deploy/Install your Snap4City Solution on private or public Clouds, VM with Docker Containers
roottooladmin1

Notes

- **Micro X solutions** are provided according to the deploy contract or via the standard tool generator as described.
  - The list of functionalities is reported in the installation page. Some of the modules and features are optional as explained in the documentation.
- **Micro X solutions are provided** with a single organization. To add more organizations implies additional installations which can have to be manually performed acting on the current config and adding other tools such as other KB, Brokers, etc.
  - You can ask to Snap4City.org or certified partners to do it, and it may have a cost according your needs. Please consider that the extension of a platform may need to start from a certified / updated one.
    - https://www.snap4city.org/559

Costs

- ## The solution is 100% open source
  - Licensing cost is 0 (zero) euro

- ## Recurrent costs may be present for
  - ### HighCharts
    - Proprietary for commercial, Free of use for non-profit organizations.
    - Perpetual licence is about 5350Euro for 10 developer, then 171 euro for each developer for the successive hears.
  - ### Eventual SLA with us for https://www.snap4city.org/497
    - Corrective maintenance
    - Updates when performed by us
- ## Services: https://www.snap4city.org/559

Monitoring Snap4Tech Solutions/Platforms

For RootAdministrators and Platform Operators

Monitoring status

- Via **Sentinel** application provided

- Via an **IoT App** inside the composition of dockers (progressively deprecated)

- Via **dashboards** that can be installed and setup

- Via **Zabbix** or Nagios (optional)

Service	Status
ServiceMap	200 at: Wed, 27 Oct 2021 18:26:16 GMT Should be: 200
WSserver	400 at: Wed, 27 Oct 2021 18:26:19 GMT Should be: 400
Super Servicemap	400 at: Wed, 27 Oct 2021 18:26:22 GMT Should be: 400
Auth	200 at: Wed, 27 Oct 2021 18:26:25 GMT Should be: 200
Datamanager Pers.Data.	200 at: Wed, 27 Oct 2021 18:26:28 GMT Should be: 200
Kibana	200 at: Wed, 27 Oct 2021 18:26:31 GMT Should be: 200
Synoptic	200 at: Wed, 27 Oct 2021 18:26:34 GMT Should be: 200
IOT App 01	200 at: Wed, 27 Oct 2021 18:26:37 GMT Should be: 200
IOT App 02	200 at: Wed, 27 Oct 2021 18:26:40 GMT Should be: 200
IOT App 03	200 at: Wed, 27 Oct 2021 18:26:43 GMT Should be: 200
ZooKeeper	Error: socket hang up : http://zookeeper:2181/
Virtuoso	200 at: Wed, 27 Oct 2021 18:26:49 GMT Should be: 200
ElasticSearch	200 at: undefined Should be: 200
OrionBroker	400 at: Wed, 27 Oct 2021 18:26:58 GMT Should be: 400
OrionFilter	200 at: Wed, 27 Oct 2021 18:26:55 GMT Should be: 200
MyLDAP	200 at: Wed, 27 Oct 2021 18:27:04 GMT Should be: 200
Mongo	200 at: undefined Should be: 200
LDAP	Error: ESOCKETTIMEDOUT : http://ldap-server:389/
Kafka	Error: socket hang up : http://kafka:9092/
IOT Directory	200 at: Wed, 27 Oct 2021 18:26:46 GMT Should be: 200
dashboard front end	200 at: Wed, 27 Oct 2021 18:26:13 GMT Should be: 200

Control via SnapSentinel

- Sentinel is an application provided with the MicroX, which can
  - Show the status of the processes/dockers by section: A&A, Broker, Dash, Storage, HLT, KB, Process Logic, Real Time Dash, System, other/unknow
  - Monitor and reboot on demand all the Dockers, and most of the processes
  - Monitor and test on demand all the communications among platform components
  - Automatically send eventual alarms when a Monitoring process fails
  - Accept additional processes/dockers to be controlled in addition to those of Snap4tech platform
  - Provide different functionalities for Operator and Root
  - Should be maintained up and running on Operator Browser on control room
  - perform specific testing and unit testing (if prepared for the section)
  - Generate / give access to logs of processes/dockers
  - Grow with the platform, dynamically on dockers
  - Work with multiple VMs hosting multiple dockers/containers

https://www.snap4city.org/drupal/sites/default/files/files/Snap4Sentinel-Documentation-for-users-v0-7.pdf

Show administrative actions ▾   Show operational actions ▾

Authorization and Authentication ●■   Broker ●■   Dashboard ●■   Data Storage ●■   HLT ●■   Knowledge Base ●■   Process Logic ●■   Real Time Dash ●■   System ●■   Unknown ●■

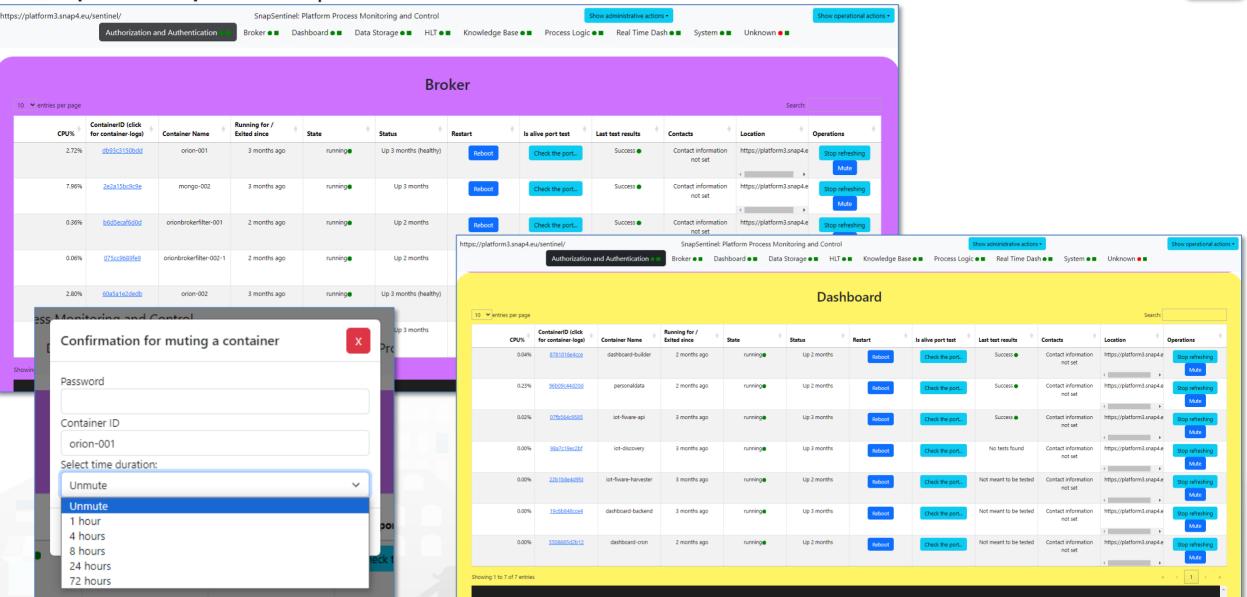# Authorization and Authentication

10 ⌄ entries per page   Search: _____

CPU%	ContainerID (click for container-logs)	Container Name	Running for / Exited since	State	Status	Restart	Is alive port test	Last test results	Contacts	Location	Operations
0.00%	b7c0da1f1d5d	ldap-server	3 months ago	running●	Up 3 months	Reboot	Check the port...	Success ●	Contact information not set	https://platform3.snap4.e	Stop refreshing / Mute
0.15%	1d1c81c0beac	keycloak	3 months ago	running●	Up 3 months	Reboot	Check the port...	Success ●	Contact information not set	https://platform3.snap4.e	Stop refreshing / Mute
0.00%	167920d92d96	myldap	3 months ago	running●	Up 3 months	Reboot	Check the port...	Success ●	Contact information not set	https://platform3.snap4.e	Stop refreshing / Mute

Showing 1 to 3 of 3 entries   « ‹ 1 › »

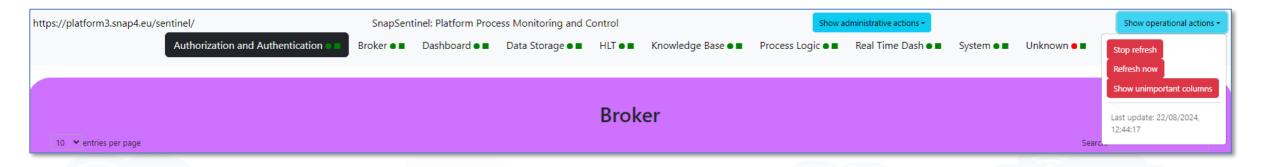| Add Device	No data yet...
Calls the test for adding a new device, then adds some test data	
Attempt new user registration	No data yet...
None	

Sentinel Operators / and Admin

- Can
  - Stop Refresh status
  - Force refresh status control
  - Show additional columns in the monitoring tables

What is missing here and you can get from former course

What is missing here and you can find in the former course

https://www.snap4city.org/577

- Data Streams from partecipatory, Mobile App

- Data streams from Mobile vehicles and smart phones Devices

- Data Ingestion via Web Scraping

- Data stream from TV Cameras, TV Cam Manager

- Social Media interoperability

- **Another Complete Example**
- **BlockChain models and devices in Snap4City (new feature)**
- **Orion Broker:**
  - **Services/SrvPath and Multitenant**
- **External and Internal Brokers,**
  - **External Broker harvesting**
- Managing Node-RED on edge from cloud
- More on: Security of Snap4City Stack from device to dashboards
- VM based installation of Snap4City
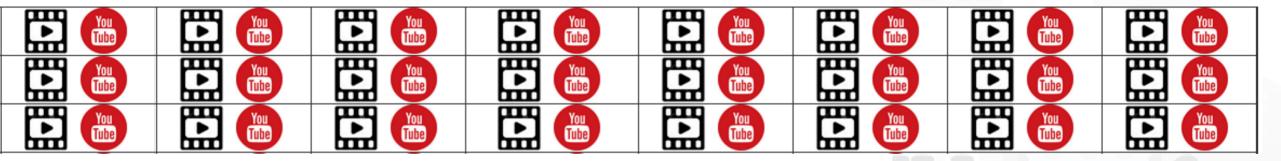- ETL: Penthao Kettle interoperability
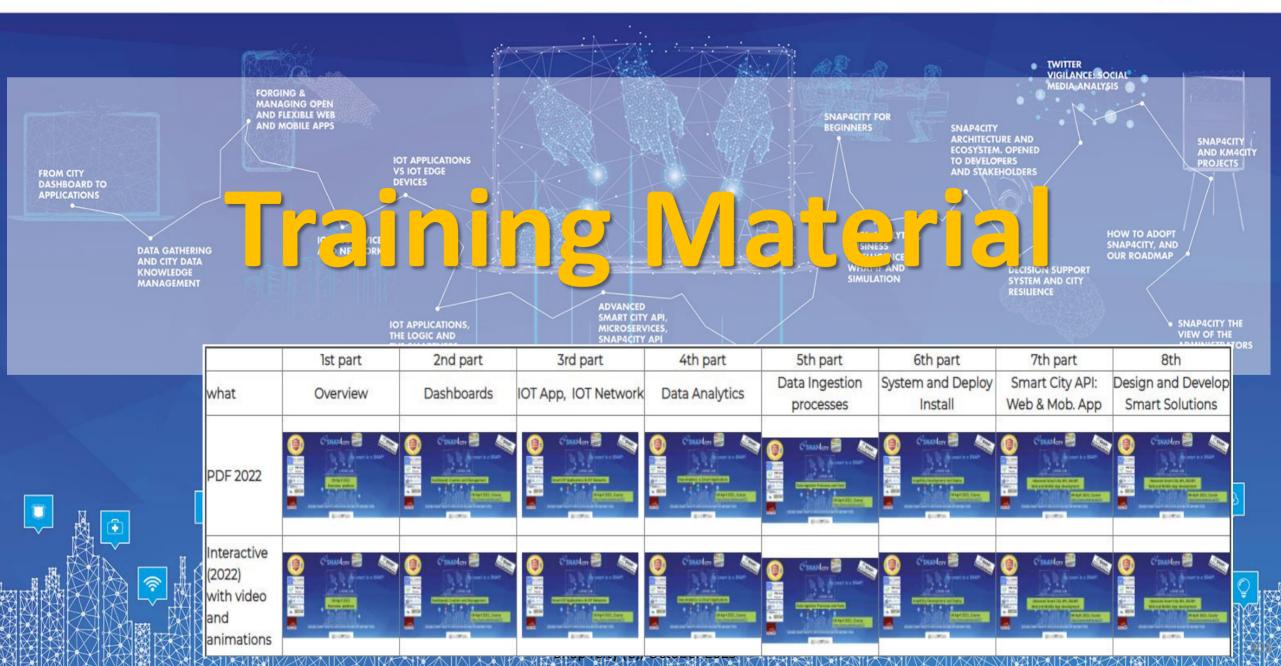
On Line Training Material (free of charge)

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

Training Material

what	1st part	2nd part	3rd part	4th part	5th part	6th part	7th part	8th
	Overview	Dashboards	IOT App, IOT Network	Data Analytics	Data Ingestion processes	System and Deploy Install	Smart City API: Web & Mob. App	Design and Develop Smart Solutions
PDF 2022								
Interactive (2022) with video and animations								

Note on Training Material

- **Course 2023**: https://www.snap4city.org/944
  - Introductionary course to Snap4City technology

- **Course** https://www.snap4city.org/577
  - Full training course with much more details on mechanisms and a wider set of cases/solutions of the Snap4City Technology

- **Documentation** includes a deeper round of details
  - Snap4City Platform Overview:
    - https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf
  - Development Life Cycle:
    - https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf
  - Client Side Business Logic:
    - https://www.snap4city.org/download/video/ClientSideBusinessLogic-WidgetManual.pdf

- **On line cases and documentation**:
  - https://www.snap4city.org/108
  - https://www.snap4city.org/78
  - https://www.snap4city.org/426

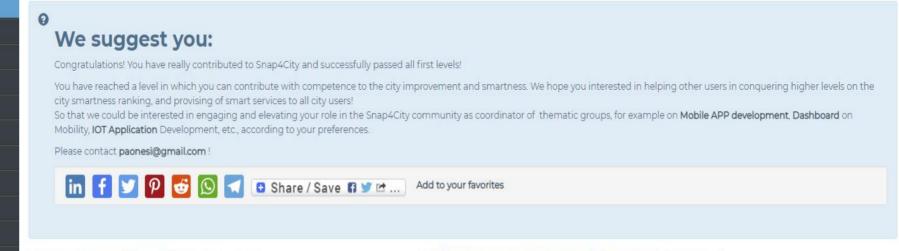# Snap4City

Switch To New Layout (Beta)

User: paolo.disit, Org: DISIT
Role: AreaManager, Level: 3

LOGOUT

- My Snap4City.org
- Tour Again
- www.snap4solutions.org
- Dashboards (Public)
- Dashboards of My Organization
- My Dashboards in My Organization
- My Data Dashboard Dev Kibana
- Extra Dashboard Widgets ▾
- Data Management, HLT ▾
- Knowledge and Maps ▾
- Processing Logics / IOT App ▾
- Entity Directory and Devices ▾
- Resource Manager ▾
- Development Tools ▾
- Management ▾
- Decision Support Systems ▾
- Deploy and Installation ▾
- Help and Contacts ▾
- Documentation and Articles ▾
- My Profile ▾
- Km4City portal
- DISIT Lab portal

Welcome: how to start using Snap4City for beginners

We suggest you:

Congratulations! You have really contributed to Snap4City and successfully passed all first levels!

You have reached a level in which you can contribute with competence to the city improvement and smartness. We hope you interested in helping other users in conquering higher levels on the city smartness ranking, and provising of smart services to all city users!

So that we could be interested in engaging and elevating your role in the Snap4City community as coordinator of thematic groups, for example on **Mobile APP development**, **Dashboard** on Mobility, **IOT Application** Development, etc., according to your preferences.

Please contact **paonesi@gmail.com** !

Share / Save   Add to your favorites

- TECHNICAL OVERVIEW: https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf
- Development Life Cycle: https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf
- Client-Side Business Logic Widget Manual: https://www.snap4city.org/download/video/ClientSideBusinessLogic-WidgetManual.pdf
- Booklet Data Analytics, Snap4Solutions: https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf

Please start a fully guided training cases:

- HOW TO: create a Dashboard in Snap4City
- HOW TO: add a device to the Snap4City Platform
- HOW TO: add data sources to the Snap4City Platform

Search

Search

-Any-

Training on Tools and Platform

Powered by
www.km4city.org

FIWARE   Node-RED

Sii-Mobility

Organization Groups

DISIT
- Developer
- Operativo

Updates on Tools

Training Course Snap4City - 2023 Edition new
drupaladmin

Snap4City Newsletter of April 2023 new
roottooladmin1

Dashboards (Public)

My Snap4City.org | Tour Again

- www.snap4solutions.org
- Dashboards of My Organization
- My Dashboards in My Organization
- My Data Dashboard Dev Kibana
- Extra Dashboard Widgets
- Data Management, HLT
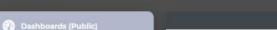- Knowledge and Maps
- Processing Logics / IOT App
- Entity Directory and Devices
- Resource Manager
- Development Tools
- Management
- Decision Support Systems
- Deploy and Installation
- Help and Contacts
- Documentation and Articles

Privacy Policy | Cookies Policy

UNIVERSITÀ DEGLI STUDI | DINFO | DISIT

Home | How and Why To Use it ▾ | Tools ▾ | Tutorials and Videos ▾

HOW ARE YOU GOING TO BUILD THE FUTURE?

Snap4City: a framework for rapid implementation of Decision Support Systems and Smart Applications.

Home / Snap4City: Smart aNalytic APp builder for sentient Cities and IOT

Snap4City: Smart aNalytic APp builder for sentient Cities and IOT

You can't delete this newsletter because it has not been sent to all its subscribers.   ✕

- TECHNICAL OVERVIEW: https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf
- Development Life Cycle: https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf
- Client-Side Business Logic Widget Manual: https://www.snap4city.org/download/video/ClientSideBusinessLogic-WidgetManual.pdf
- Booklet Data Analytics Snap4Solutions: https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf

Username: paolo.disit

Search

[Search]   🔍

-Any-

Training on Tools and Platform

Powered by www.km4city.org

FIWARE   Node-RED

Sii-Mobility

Organization Groups

DISIT
- Developer
- Operativo

booklets

- Smart City
- Industry
- Artificial Intelligence

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

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

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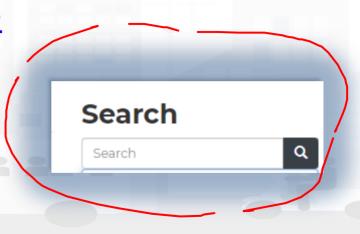
The Platform

- **Free Registration on Snap4City.org**
  - Please select DISIT ORG to be sure to access at the examples
  - Most of the cities / tenant are private and they do not left much visible
- **What you get** is probably the 10% of what is on the platform ☺
- **Training**: https://www.snap4city.org/944
- **Scenarious**: https://www.snap4city.org/4
- **Publications**: https://www.snap4city.org/426
- **WEB pages**: https://www.snap4city.org/78
- *SEARCH on the right side*

Search

Search

Tech. Overview

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

Development

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

CSBL
Client Side Business Logic

Client-Side Business Logic
Widget Manual

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

MLOperation

SMART CITIES AND SMART INDUSTRY

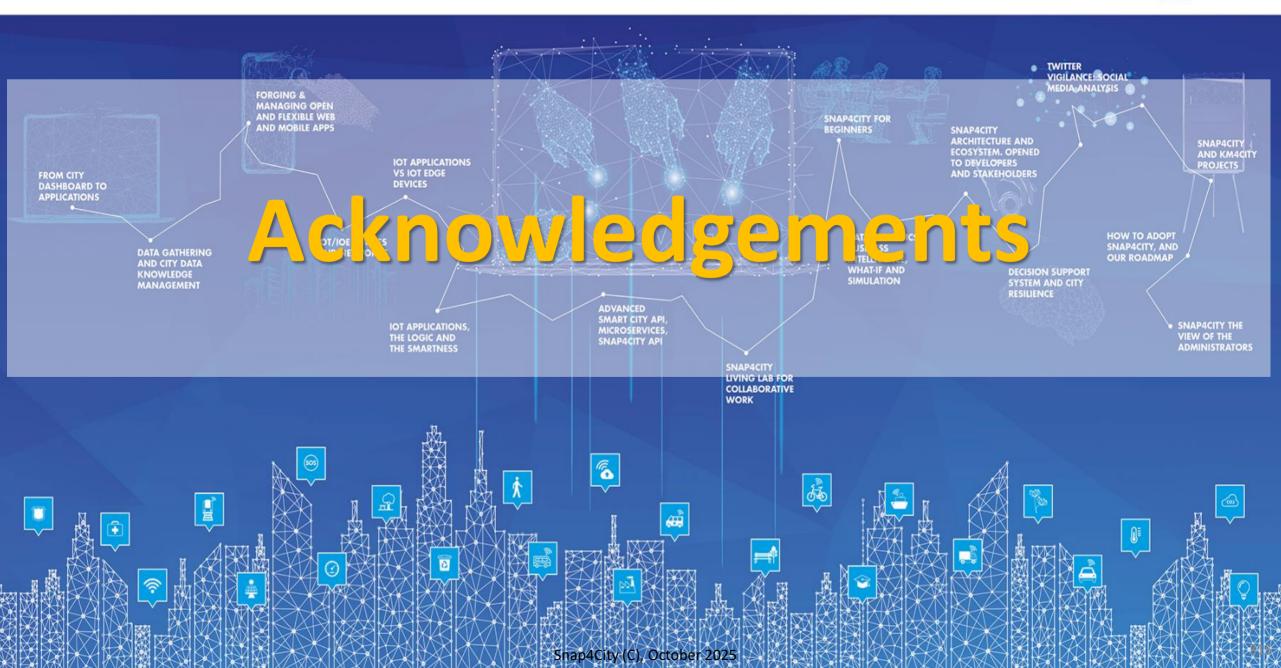**Snap4City: FIWARE powered smart app builder for sentient cities**

Commercial Overview
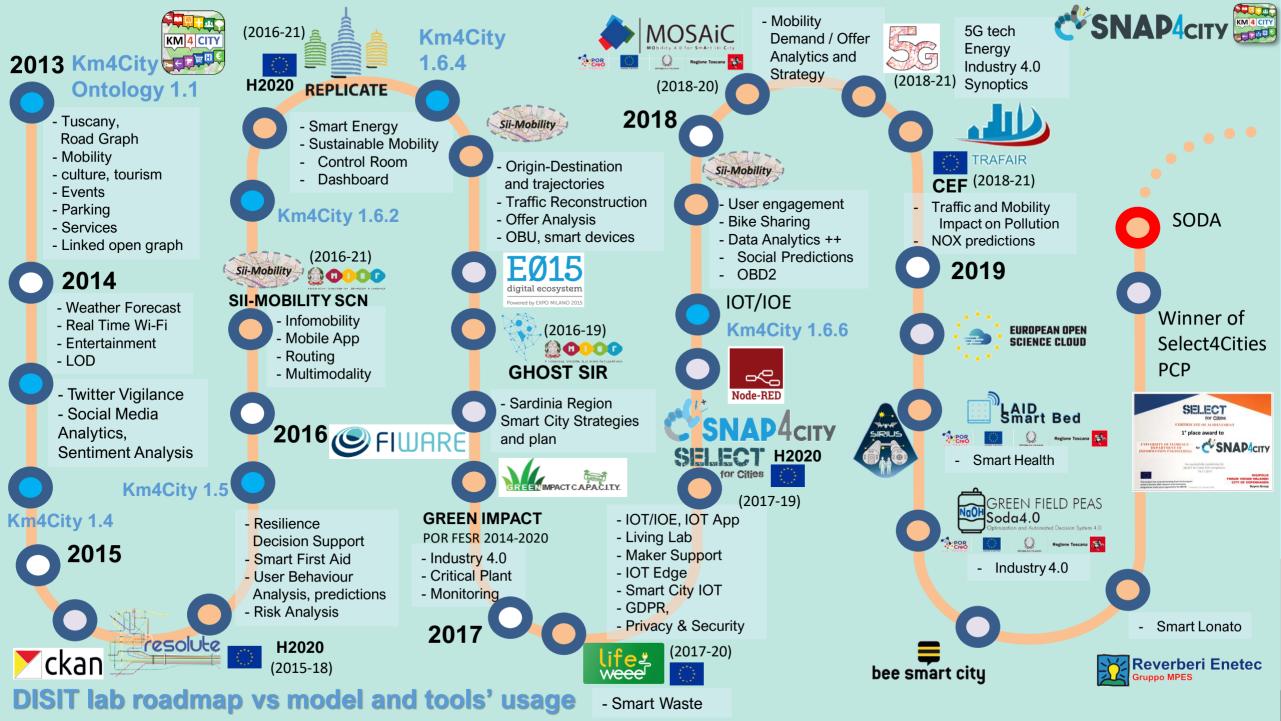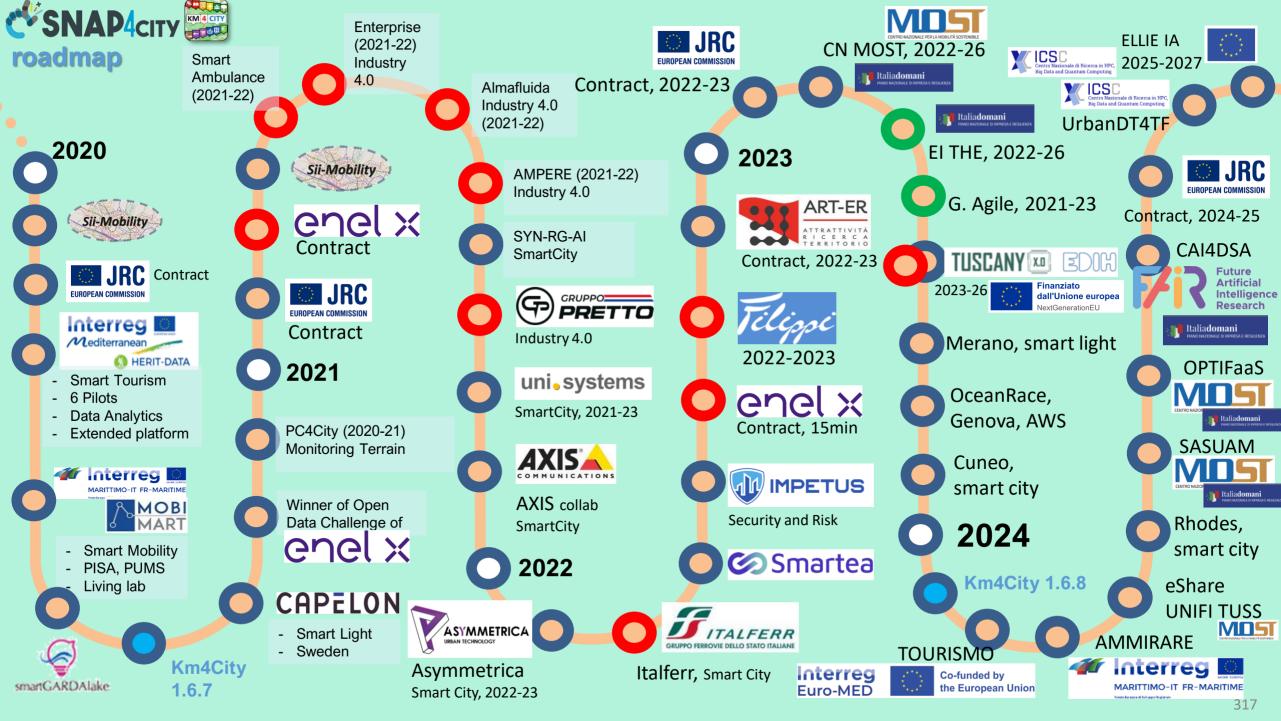
- https://fiware-foundation.medium.com/snap4city-fiware-powered-smart-app-builder-for-sentient-cities-acfe24df49d5

- https://www.snap4city.org/drupal/sites/default/files/files/FF_ImpactStories_Snap4City.pdf

Acknowledgements

DISIT lab roadmap vs model and tools' usage

SNAP4CITY roadmap

KM4CITY

2020
- Contract (JRC EUROPEAN COMMISSION)
- Interreg Mediterranean HERIT-DATA
  - Smart Tourism
  - 6 Pilots
  - Data Analytics
  - Extended platform
- Interreg MARITTIMO-IT FR-MARITIME / MOBIMART
  - Smart Mobility
  - PISA, PUMS
  - Living lab

smartGARDAlake

Km4City 1.6.7

Sii-Mobility

Smart Ambulance (2021-22)

Enterprise (2021-22) Industry 4.0

enel x Contract

Contract (JRC EUROPEAN COMMISSION)

2021

PC4City (2020-21) Monitoring Terrain

Winner of Open Data Challenge of enel x

CAPELON
- Smart Light
- Sweden

ASYMMETRICA URBAN TECHNOLOGY
Asymmetrica Smart City, 2022-23

Almafluida Industry 4.0 (2021-22)

AMPERE (2021-22) Industry 4.0

SYN-RG-AI SmartCity

GRUPPO PRETTO Industry 4.0

uni.systems SmartCity, 2021-23

AXIS COMMUNICATIONS
AXIS collab SmartCity

2022

ITALFERR GRUPPO FERROVIE DELLO STATO ITALIANE
Italferr, Smart City

Contract, 2022-23 (JRC EUROPEAN COMMISSION)

2023

ART-ER ATTRATTIVITÀ RICERCA TERRITORIO
Contract, 2022-23

Filippi 2022-2023

enel x Contract, 15min

IMPETUS Security and Risk

Smartea

CN MOST, 2022-26 (MOST CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE / Italiadomani)

ICSC Centro Nazionale di Ricerca in HPC, Big Data and Quantum Computing

ICSC Centro Nazionale di Ricerca in HPC, Big Data and Quantum Computing

EI THE, 2022-26 (Italiadomani)

G. Agile, 2021-23

TUSCANY X.0 EDIH 2023-26 / Finanziato dall'Unione europea NextGenerationEU

Merano, smart light

OceanRace, Genova, AWS

Cuneo, smart city

2024

Km4City 1.6.8

TOURISMO
Interreg Euro-MED Co-funded by the European Union

ELLIE IA 2025-2027

UrbanDT4TF

Contract, 2024-25 (JRC EUROPEAN COMMISSION)

CAI4DSA

FAIR Future Artificial Intelligence Research (Italiadomani)

OPTIFaaS (MOST CENTRO NAZIONALE / Italiadomani)

SASUAM (MOST CENTRO NAZIONALE / Italiadomani)

Rhodes, smart city

eShare UNIFI TUSS (MOST CENTRO NAZIONALE)

AMMIRARE
Interreg MARITTIMO-IT FR-MARITIME

317

Currently 2025

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

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