SNAP4CITY

www.snap4city.org
www.snap4solutions.org

KM4CITY

www.km4city.org

Platform Architecture, Interoperability, Management and Deploy

June 2025, Course, Part 6

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

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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

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

SNAP4CITY

KM4CITY

SNAP4 Appliances and Dockers Installations

100% OPEN SOURCE

EU GDPR COMPLIANT

PEN Test Passed

Powered by FIWARE

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

Node-RED

Be smart in a SNAP!

SMARTCITY EXPO WORLD CONGRESS

Platform Architecture, Interoperability, Management and Deploy

Data Analytic

June 2025, Course, Part 6
https://www.snap4city.org/944
https://www.snap4city.org/577

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES

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Smart Solutions and Decision Support Systems

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FREE TRIAL

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SNAP4 Appliances and Dockers Installations

EUROPEAN OPEN SCIENCE CLOUD

Node-RED

JS Foundation

E015 digital ecosystem

NVIDIA

CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - BUSINESS INTELLIGENCE - SIMULATIONS - SMART APPLICATIONS

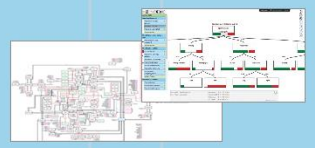
DASHBOARDS - VISUAL ANALYTICS - SYNOPTICS - DIGITAL TWIN - GRAPHICAL WIDGETS - ANALYTICS - GUI CUSTOM STYLES - VISUAL PROGRAMMING

DASHBOARDS, WIDGETS
TEMPLATES

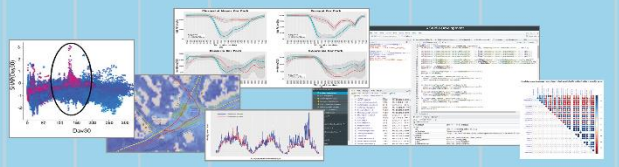
PREDICTION - ANOMALY DETECTION - CLUSTERING - ROUTING - SENTIMENT NLP - TRAFFIC FLOW
PEOPLE FLOWS - SDG - 15 MIN CITY INDEX - KPI - HEATMAPS - ORIGIN DESTINATION - ETC...

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

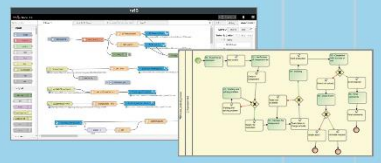
ANY: DATA, BROKER, NETWORK AND VERTICAL



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



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

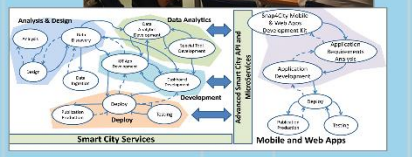


VISUAL PROGRAMMING, ADAPTERS
DATA FLOWS, WORKFLOWS
PARALLEL DISTRIBUTED PROCESSING
DATA DRIVEN

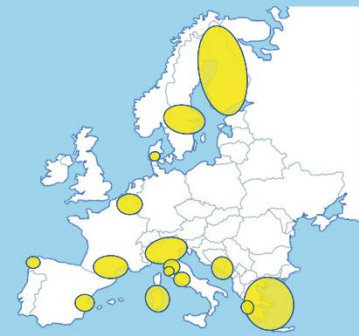
Native and External Applications

- Smart Parking
- Smart Light
- Smart Waste
- Smart Energy
- Smart Building
- Smart Tourism
- Social Media Analysis

...



METHODOLOGIES
LIVING LABS
COURSES AND COMMUNITY
DEVELOPMENT TOOLS



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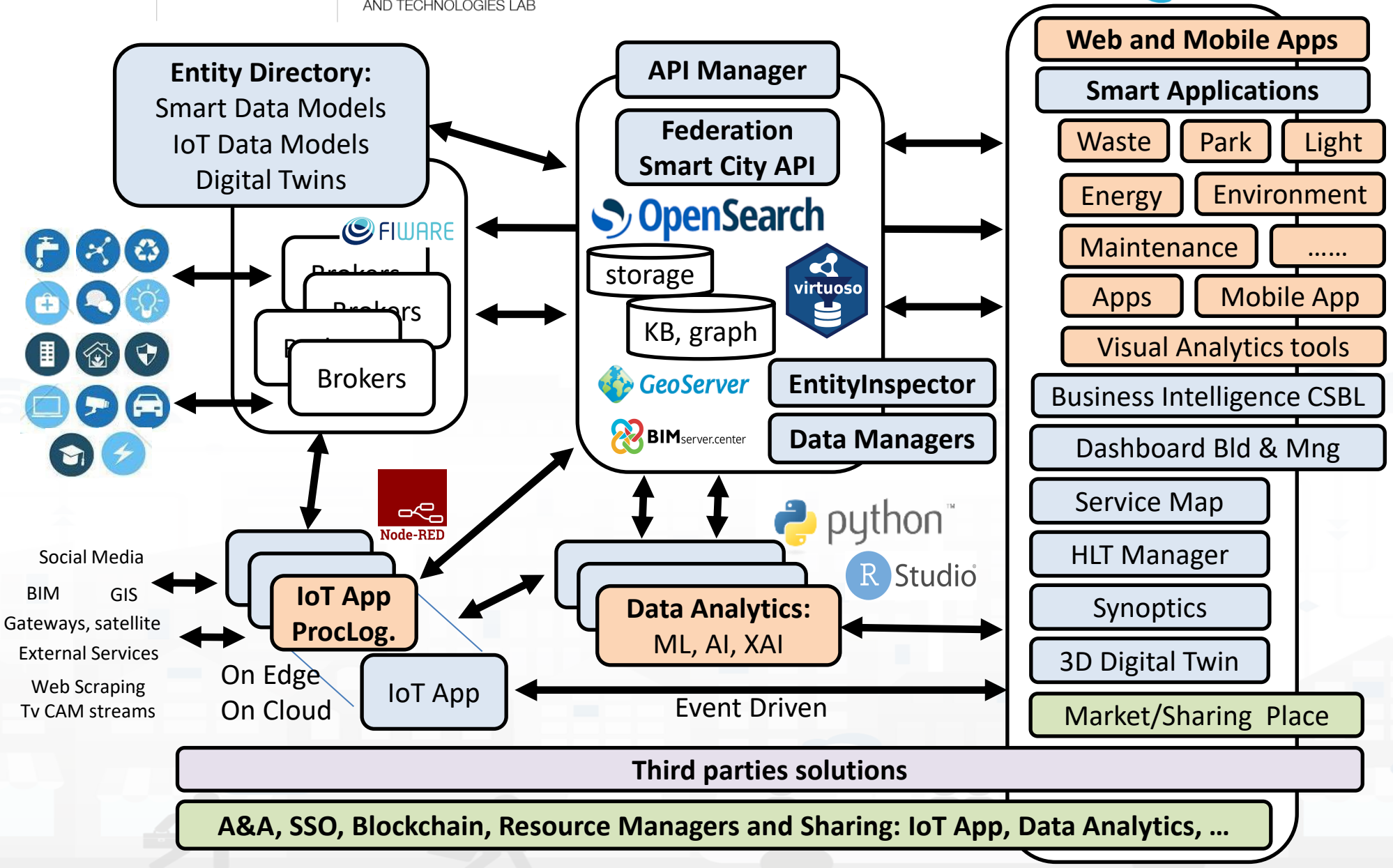
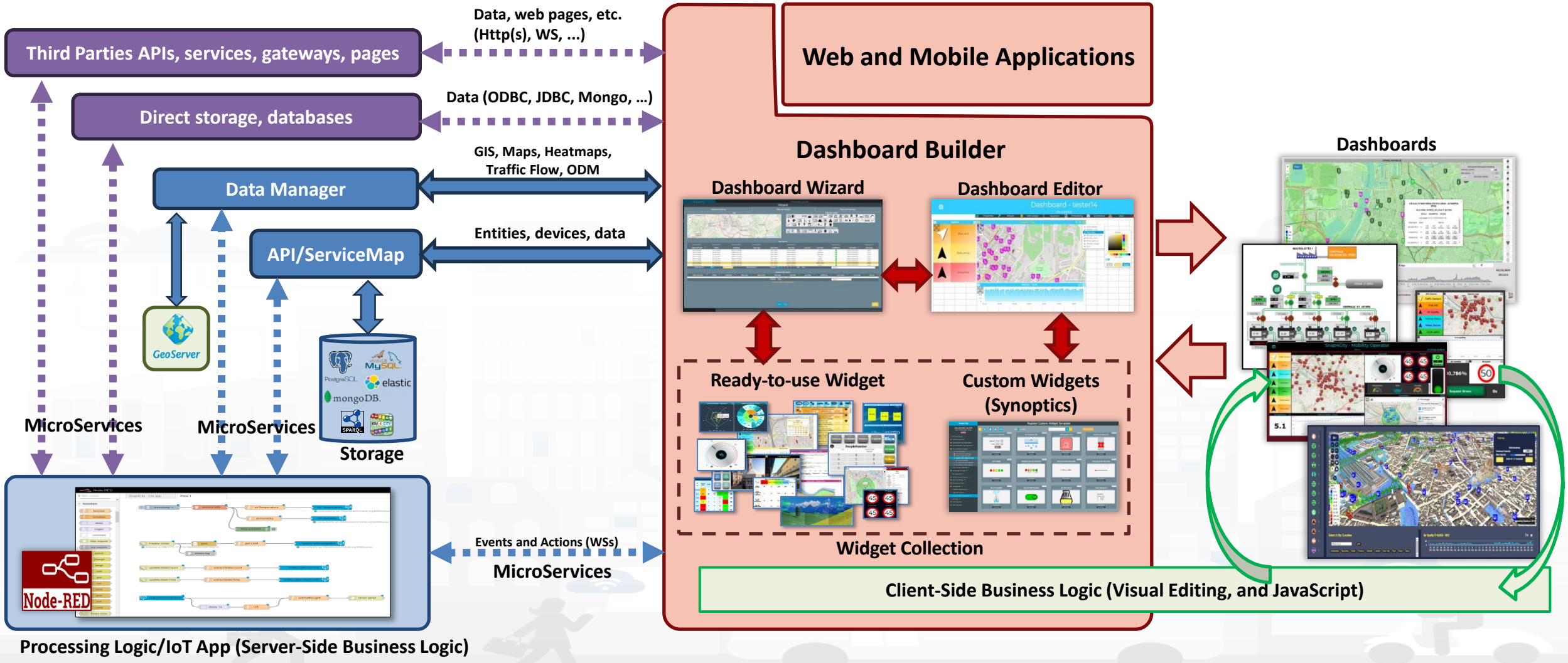
Tech Arch

SNAP4CITY KM4CITY



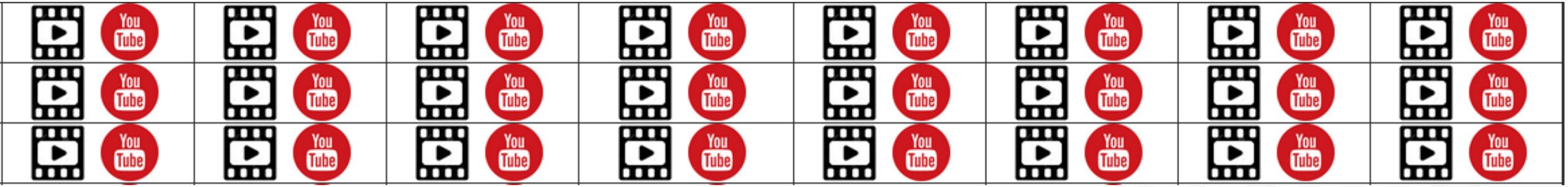
How the Dashboards / Apps exchange data



https://www.snap4city.org/944

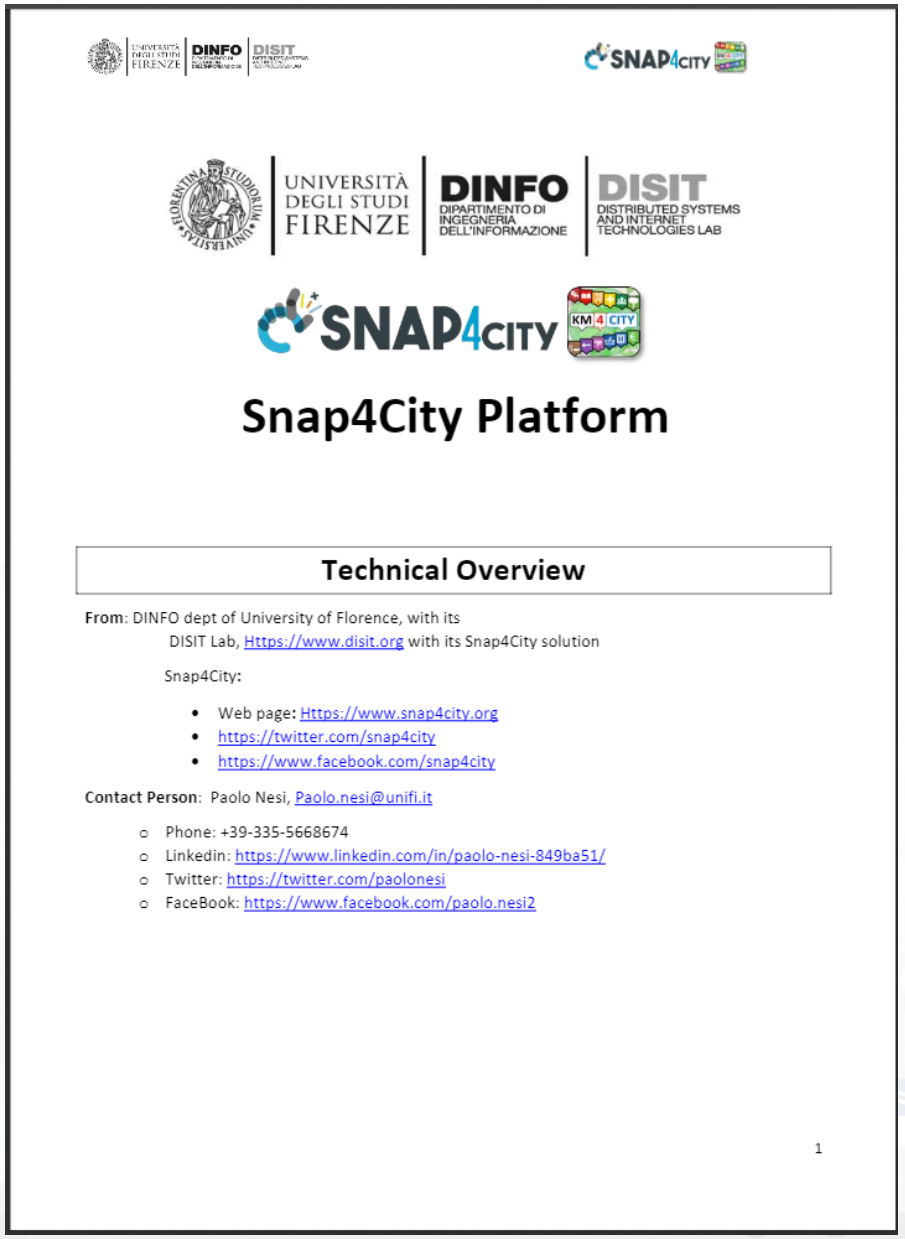
On Line Training Material (free of charge)

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



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Snap4City Platform

Technical Overview

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

Snap4City:

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

Contact Person: Paolo Nesi, Paolo.nesi@unifi.it

- Phone: +39-335-5668674
- Linkedin: https://www.linkedin.com/in/paolo-nesi-849ba51/
- Twitter: https://twitter.com/paolonesi
- FaceBook: https://www.facebook.com/paolo.nesi2

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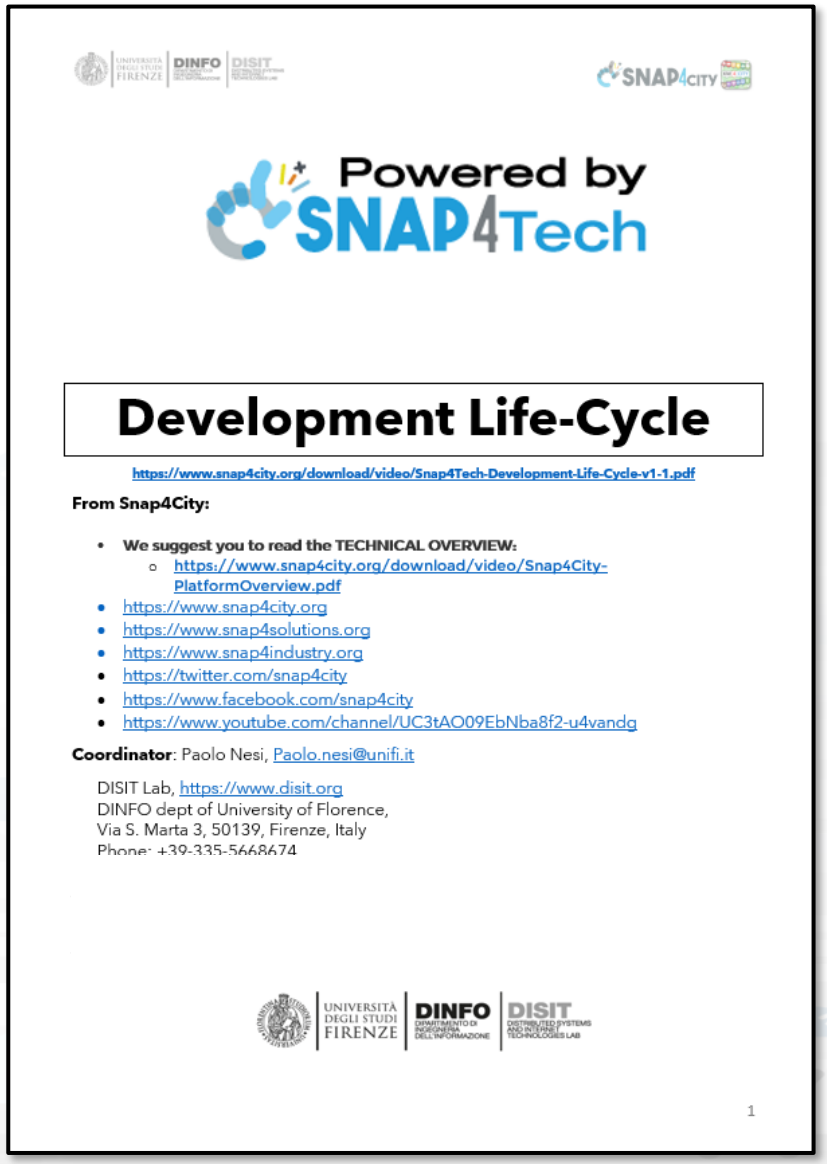
Tech Overview

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

Development



Powered by SNAP4Tech

Development Life-Cycle

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

From Snap4City:

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

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

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

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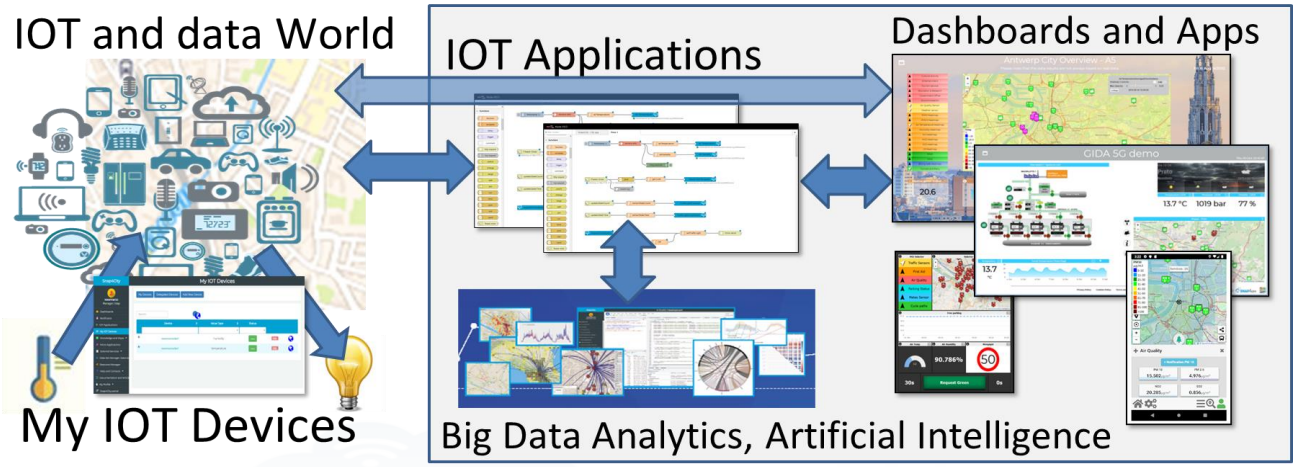
https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf

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
- Training Material

TOP

Snap4City Architecture

SNAP4 Appliances and Dockers Installations

100% OPEN SOURCE

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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?

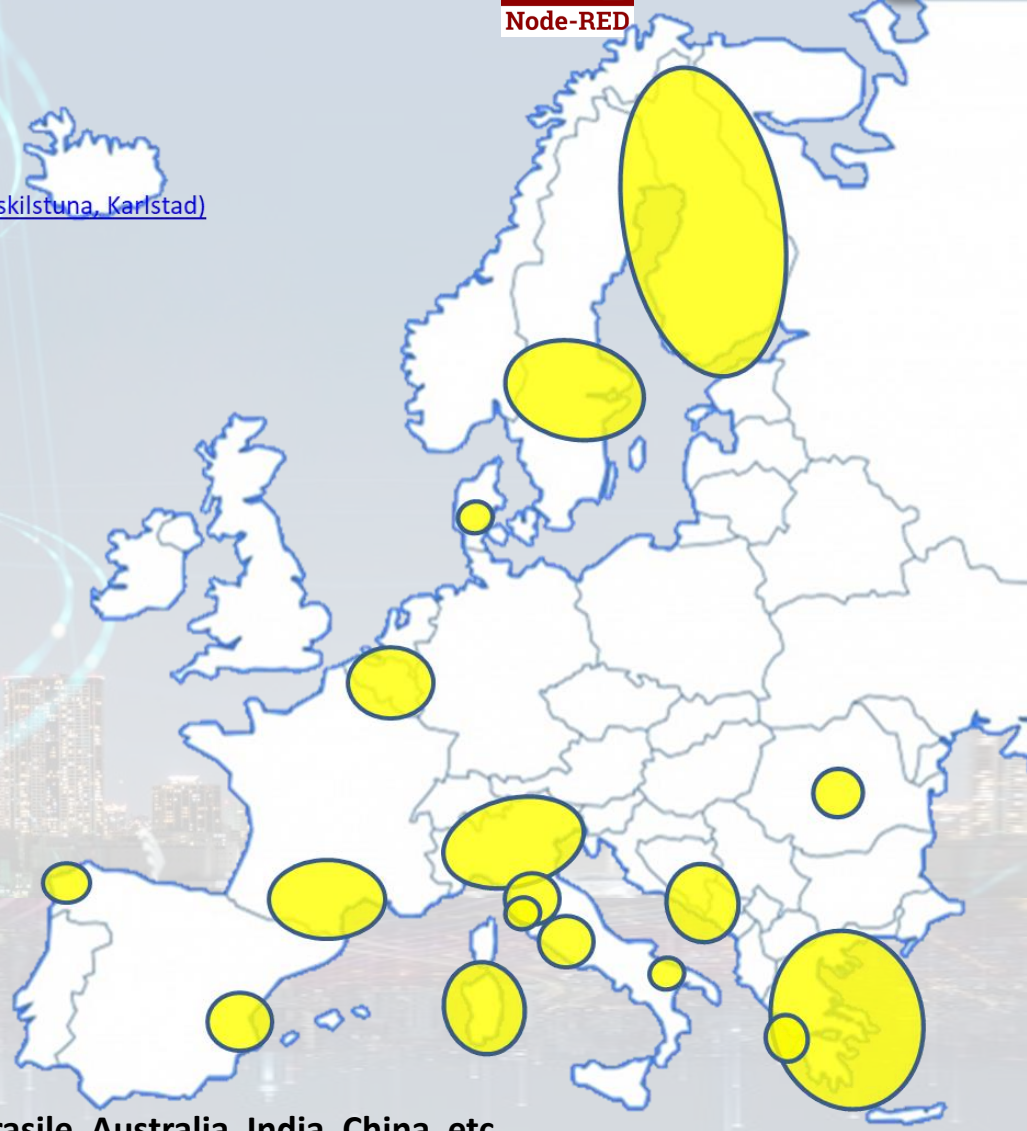
- **Huge amount of data are or could be exploited to make the right decision in time.** The always listened reasons:
  - complexity, formats, integration, competence, licensing,
  - costs, processing, accessibility, discovery, production, ..
  - volume, velocity, value, update, ...

https://www.Snap4City.org

- 11 running installations in Europe
  - Snap4.city.org, Greece, Merano, …
  - Toscana, Pisa, Sweden, ISPRA, Snap4.eu,
  - Altair, Italmatic, Sweden, Romania, ….
- 16 projects, 12 pilots on 10 Countries
  - >40 cities/area
- **Widest MULTI-tenant deploy has**
  - 19 Organizations / tenant
  - > 8000 users on
  - > 1600 Dashboards
  - > 16 mobile Apps
  - **> 2.2 Million of structured data per day**
  - > 520 IoT Applications/node-RED
  - > 700 web pages with training
  - > 70 videos, training videos

Main Organizations/areas

- Antwerp area (Be)
- Bologna (I)
- Brasov (Ro)
- Capelon (Sweden: Västerås, Eskilstuna, Karlstad)
- DISIT demo (multiple)
- Dubrovnik, Croatia
- Firenze area (I)
- Garda Lake area (I)
- Greece (Gr)
- Helsinki area (Fin)
- Livorno area (I)
- Lonato del Garda (I)
- Merano (I)
- Modena (I)
- Mostar, Bosnia-Herzegovina
- Oslo & Padova (Impetus)
- Pisa area (I)
- Pistoia (I)
- Pont du Gard, Occitanie (Fr)
- Prato (I)
- 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.**

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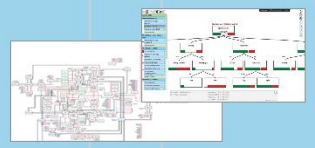

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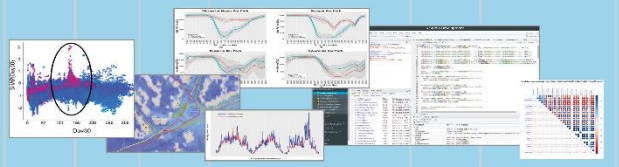

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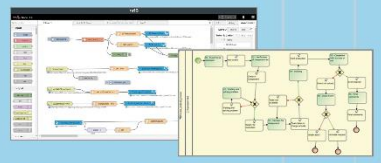

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- Smart Light
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- Smart Energy
- Smart Building
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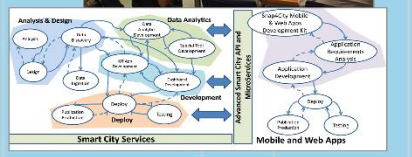

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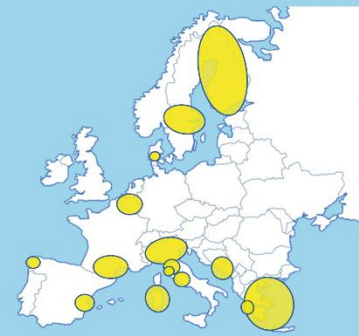
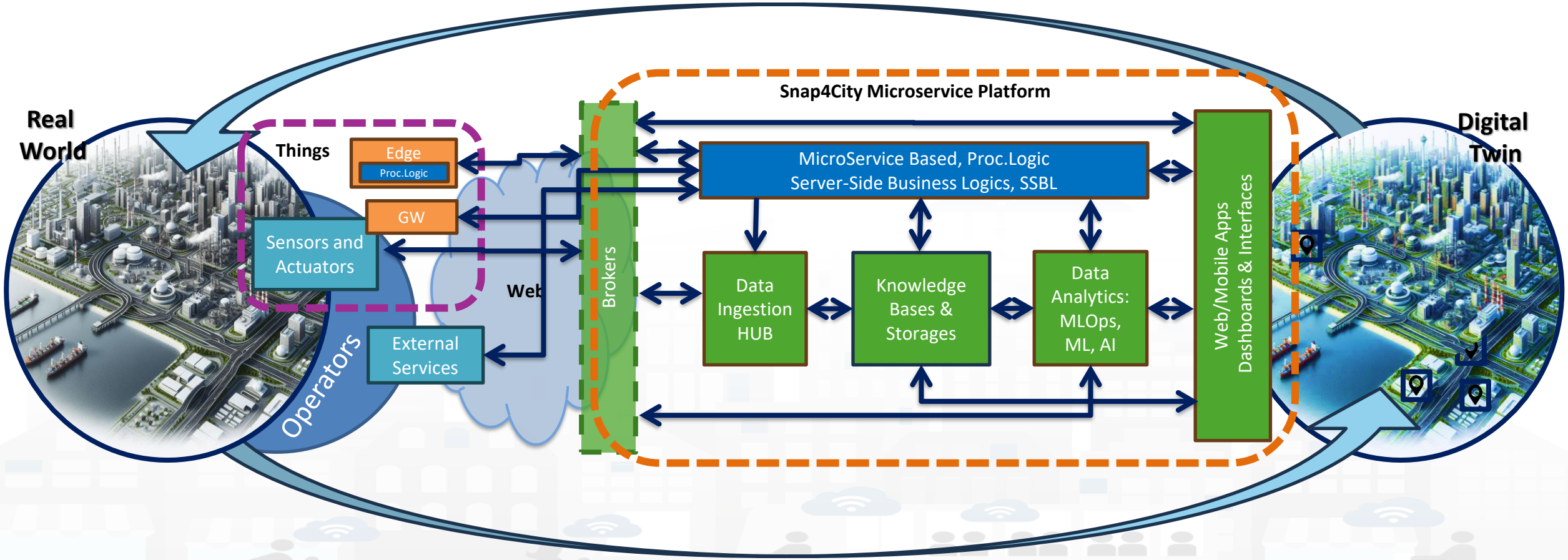


Digital Twin Development Platform



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Tech Arch

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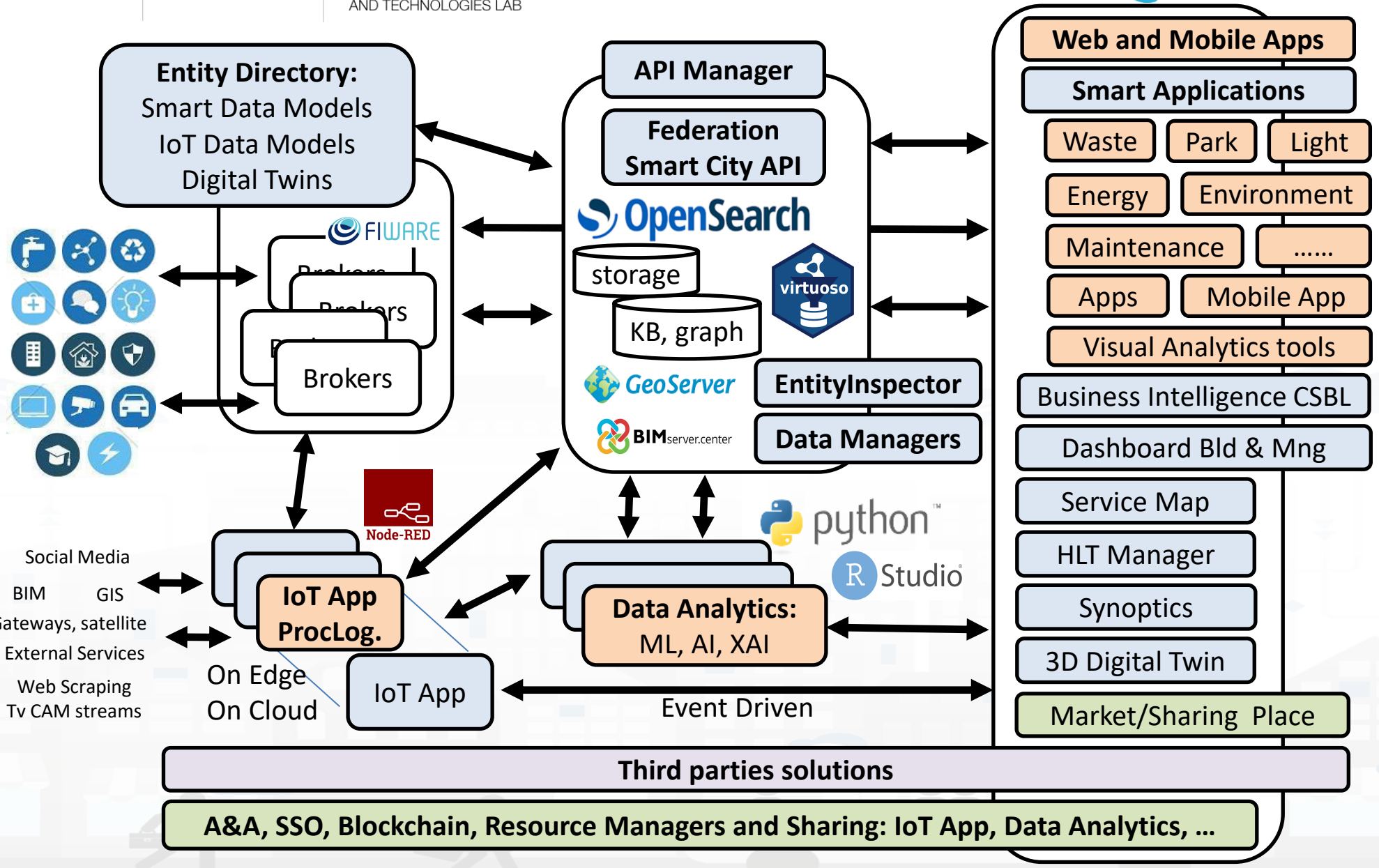

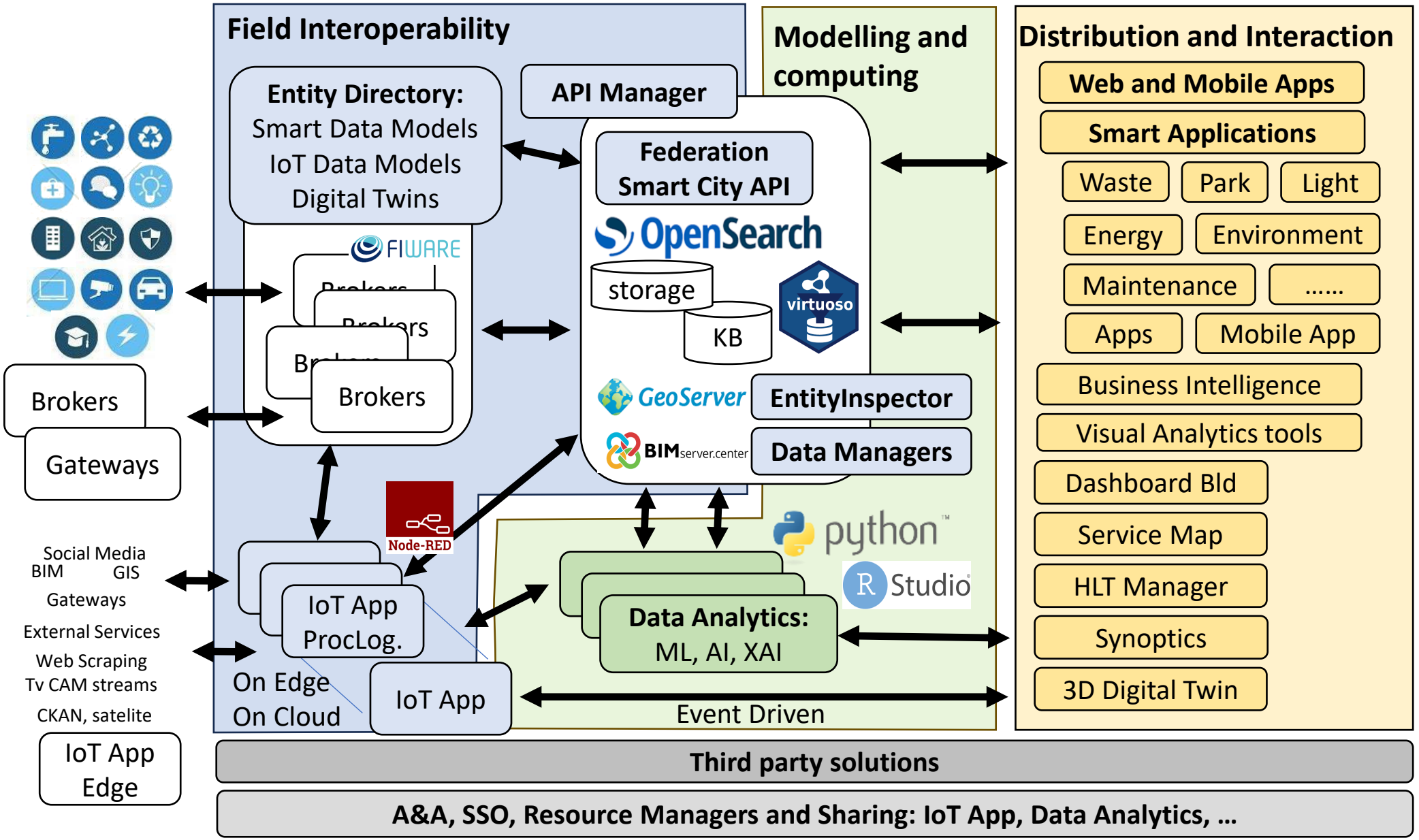
Field Interoperability
Modelling and computing
Distribution and Interaction
Entity Directory:
Smart Data Models
IoT Data Models
Digital Twins
API Manager
Federation
Smart City API
OpenSearch
storage
KB
virtuoso
FIWARE
Brokers
Brokers
Brokers
GeoServer
EntityInspector
BIMserver.center
Data Managers
Node-RED
python
RStudio
Web and Mobile Apps
Smart Applications
Waste
Park
Light
Energy
Environment
Maintenance
……
Apps
Mobile App
Business Intelligence
Visual Analytics tools
Dashboard Bld
Service Map
HLT Manager
Synoptics
3D Digital Twin
Brokers
Gateways
Social Media
BIM
GIS
Gateways
External Services
Web Scraping
Tv CAM streams
CKAN, satelite
IoT App
ProcLog.
On Edge
On Cloud
IoT App
Data Analytics:
ML, AI, XAI
Event Driven
IoT App
Edge
Third party solutions
A&A, SSO, Resource Managers and Sharing: IoT App, Data Analytics, …

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legenda

SNAP4CITY | KM 4 CITY

Platform Management: docker, SNAP4CITY

Presentation: Control Room, Widgets, Mobile Apps, Visual Analytics Applications, Telegram Bot, …
- Dashboard Builder
- Dashboard Mng
- Synoptics
- 3D Digital Twin
- Dashboard Wizard
- Data Inspector
- Scenario Editor
- CSBL

External Interoperability: Smart City API, Federated, API Accounting/Billing
- Super
- ASCAPI
- kafka
- WebSocket

Node-RED

Proc.Logic / IoT Applications Data Flow Logic

Operation:
- What-if
- Simulation
- Event Reporting
- File Mng
- Heatmap Mng
- Traffic Flows Mng
- ODM Mng
- TVCam Mng
- BIM Mng
- .....
- R Studio
- python
- docker
- .....
- KPI, Indicator Analysis
- WorkFlow Tickets BPM
- Sentiment Analysis
- SUMO
- Tipyc. Time Trend
- .....
- Open to any module and system
- Data Processing
- Predictions
- Anomaly detection
- Statistics
- Artificial Intelligence
- Routing
- Internal GIS GeoServer
- ckan
- openMAINT
- BIMserver.center
- .....

Internal Interoperability: API, MicroServices
- Snap4City Node-red Libraries
- ASCAPI
- WebSocket
- FIWARE

Data Storage and Reasoning: data storage, noSQL, aggregation, semantic modeling, city entities, normalization, knowledge base
- Service Map
- LOGraph
- SuperServiceMap
- DevDash
- OpenSearch
- nifi
- virtuoso
- NGSI V1, V2, LD
- FIWARE
- Linked Data triples

Data Collection: data mining, harvesting, integration, transformation, data models, …
- Directory
- Blockchain
- Harvester
- Data Manager
- Brokers
- Brokers
- FIWARE
- Node-RED

Any protocol and format | Any protocol and format

Connectivity: wired, wireless (Lora, 5G, 4G, 3G, Wi-Fi, etc…), IoT Edge, etc.
- Node-RED

Any protocol and format | Any protocol and format

Authentication and Authorization: KEYCLOAK, OpenLDAP, SNAP4CITY
GDPR compliant

Partecipatori and Living Lab Supports

Device Layer

External Third Party Services
- GIS
- BIM
- OSM
- Gateways
- External Services
- Web Scraping
- Social Media

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**

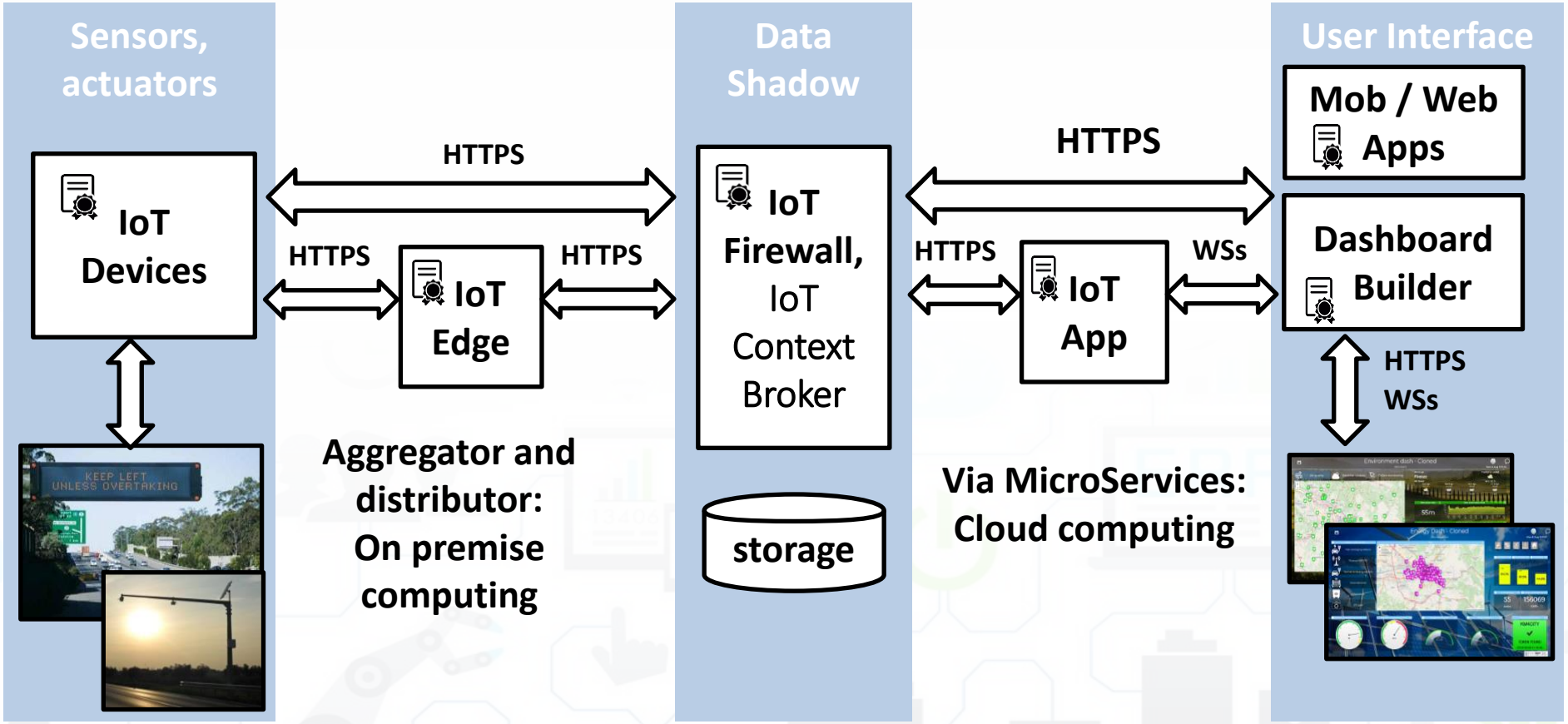
Non functional requirements

- **Open Source** based 100%
  - Open **Standard** for communication and API for In/Out
- **Interoperability**: protocols, internal API, Smart City API, ca , 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

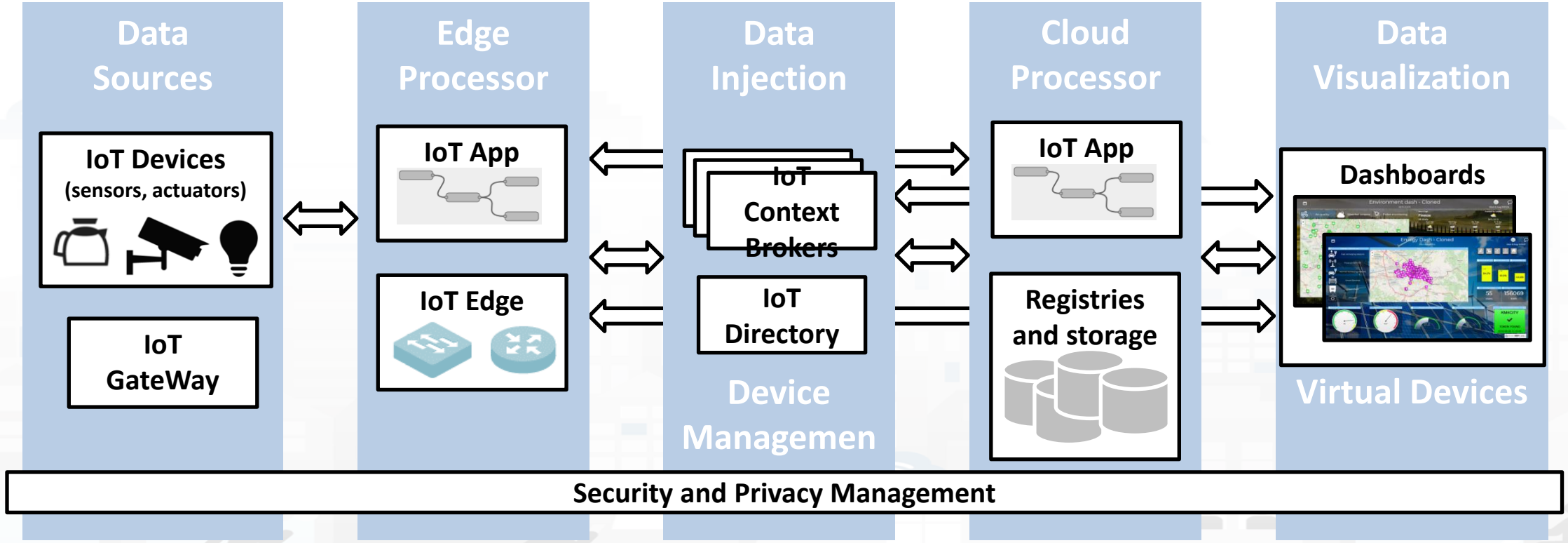


Complexity in Smart City IOT Platforms

End to End security

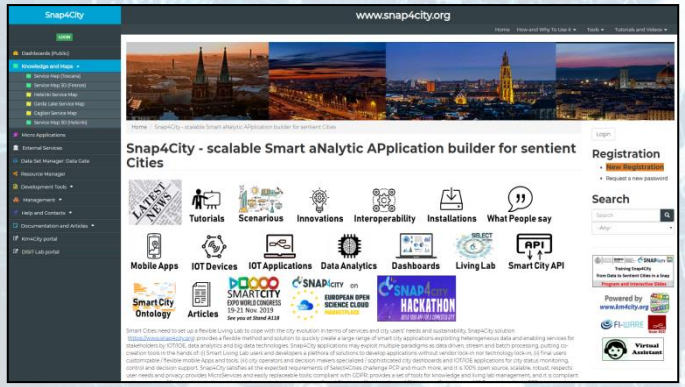
– From IOT Devices to Dashboard (user interface)

- H2M
- M2M

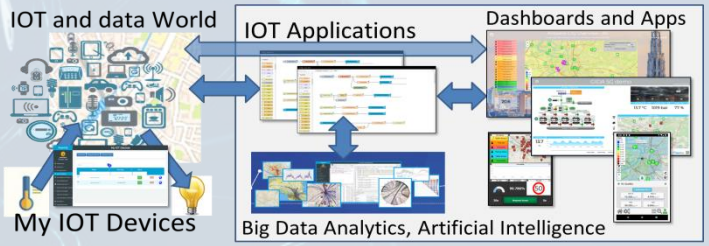


How to adopt Snap4City

Https://www.snap4city.org



On your premise



Smart City as a Service

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

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

Download and deploy

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

TOP

Interoperability of Snap4City Platform

Standards and Interoperability (6/2023)

Compliant with:

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

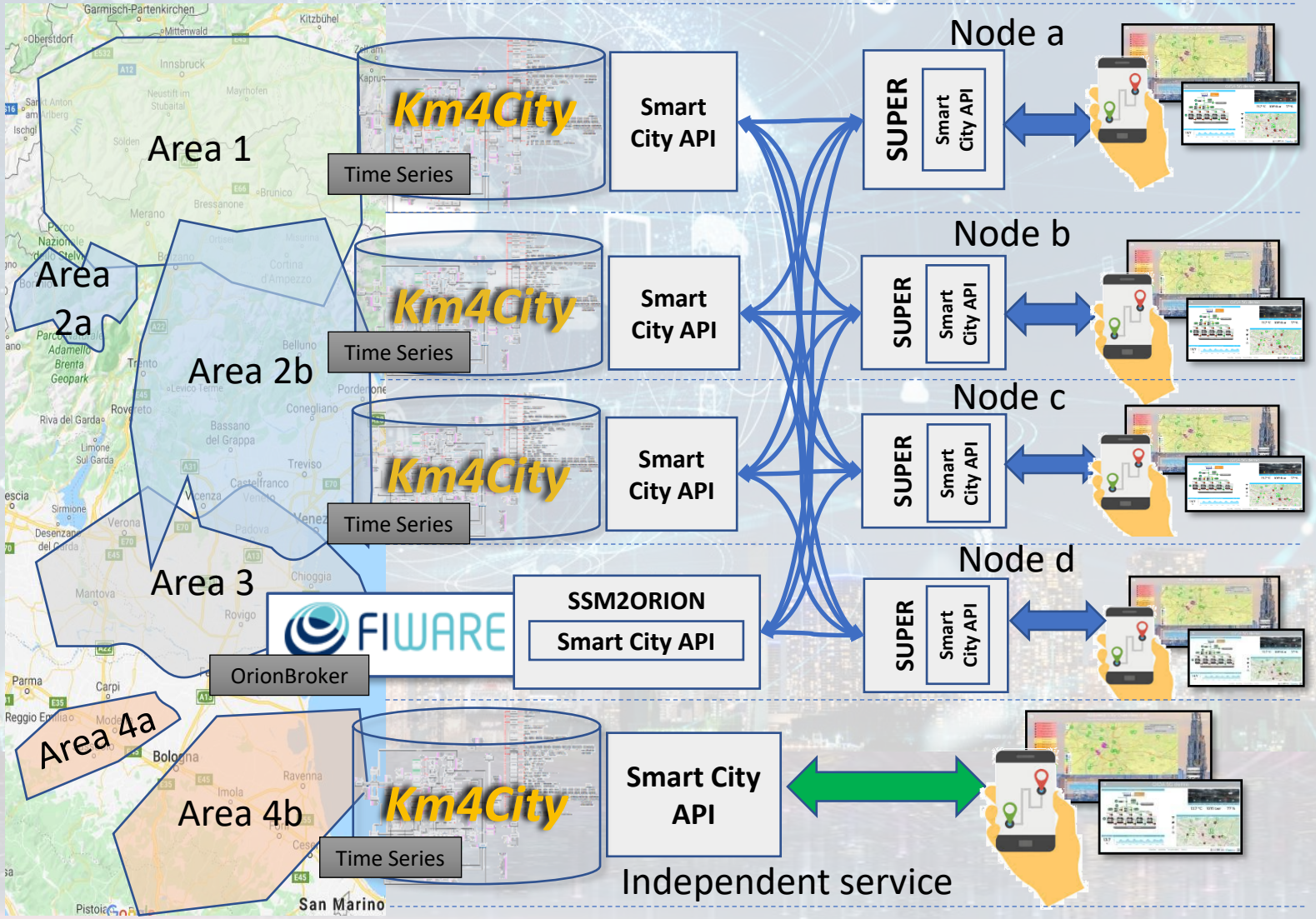
- **Proc.Logic/IoT App working on multiple Snap4City Platforms**
- **Authentication Interoperability**
- **GIS Interoperability**
- **Ingestion of Public Transportation data:**
  - **GTFS, Transmodel, GTFS RT, NeTEx, etc.**
- **CKAN interoperability**
- **IOT Devices integration**
  - **MQTT, Libelium,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



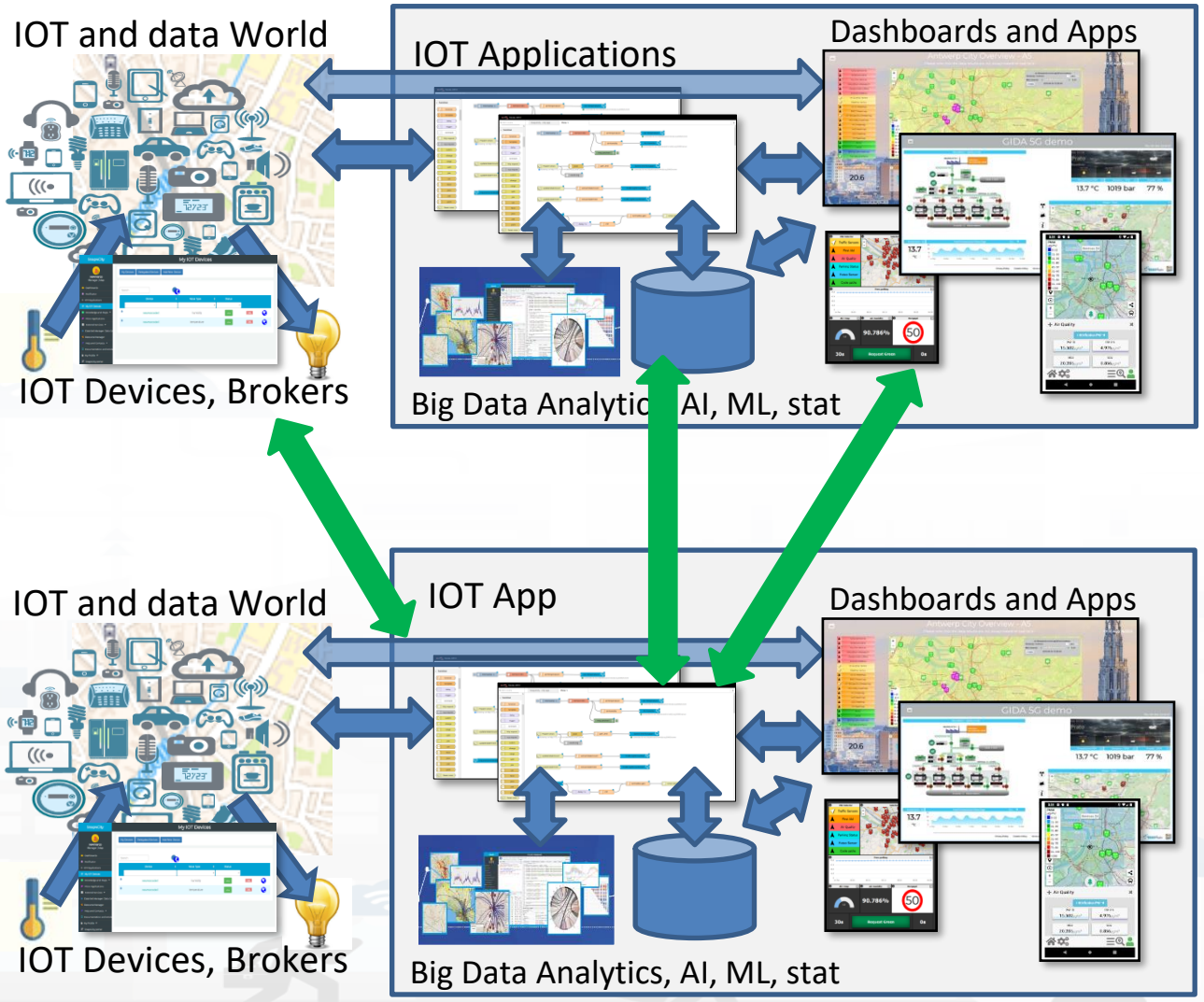
- Km4City **Semantic Reasoner**
- **ServiceMap** interoperability
- **Seamless for multiple Mobile Apps**
- **Smart City API**
- **Super**:
  - distributed access and sharing services
  - Each city control its own data
  - Final user can pass from one city / area to another in seamless manner: without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

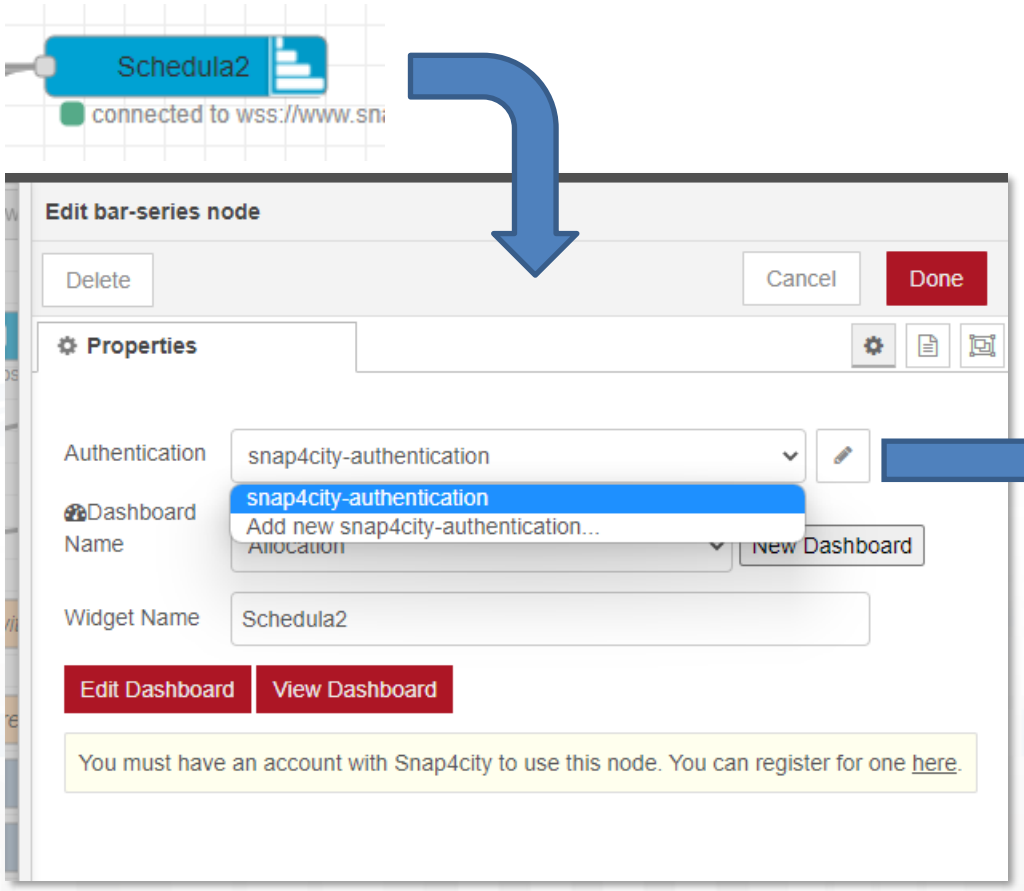
Snap4City Multidomain Applications

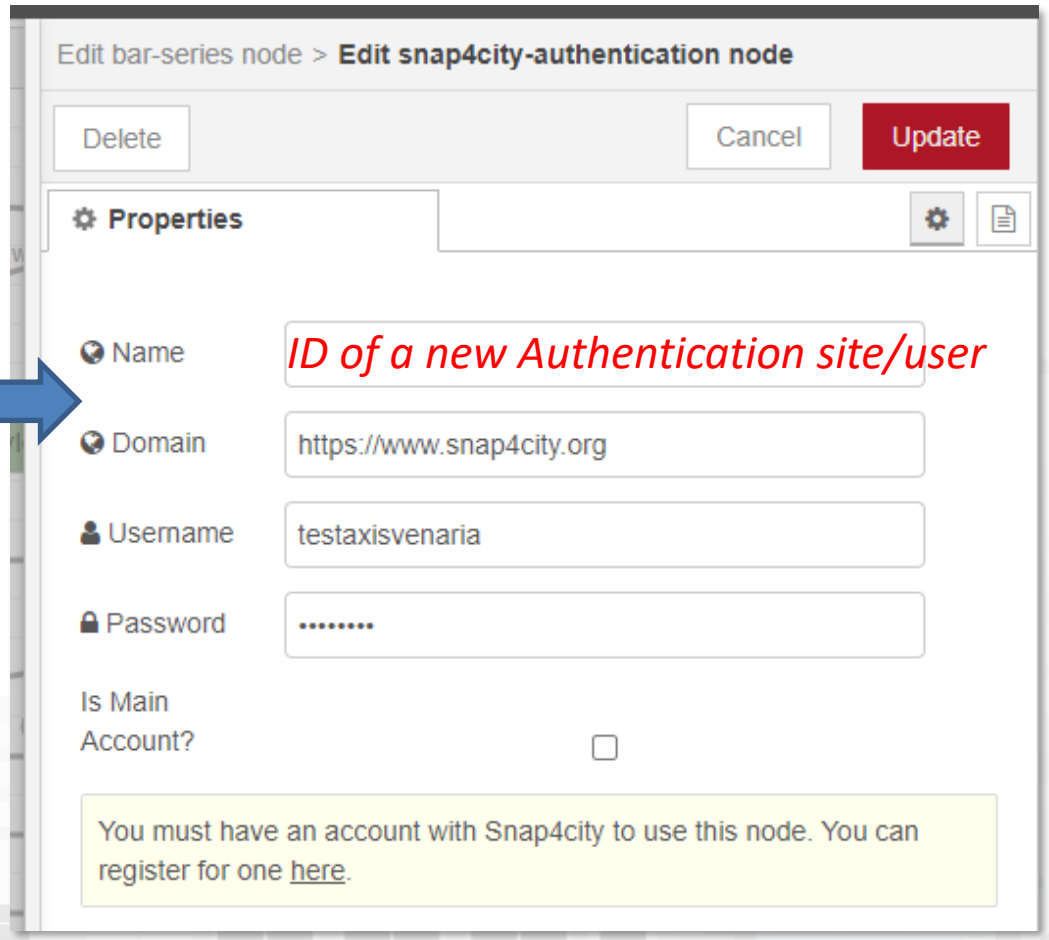


Any Snap4City Installation
Different domain
Different user
Different auth./authoriz. System
Etc..

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

Example on Controlling Dashboards multiple domains





Snap4City
Authentication Interoperability

Authentication and SSO

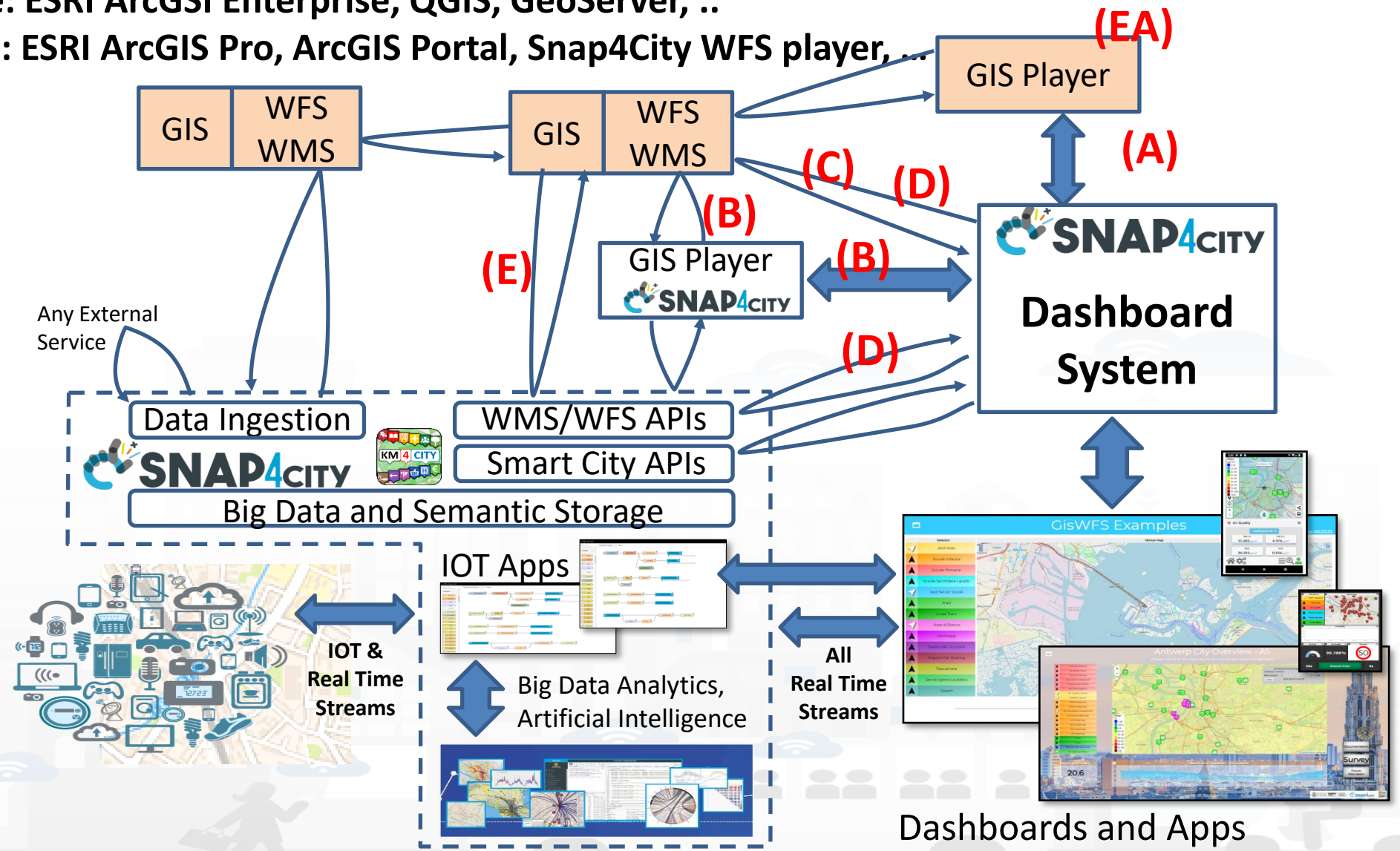
- **Authentication in Snap4Tech is based on KeyCloak which is based on SAML, https://auth0.com/blog/how-saml-authentication-works/**
- **Different Versions of interoperability Authentication and Single Sign On, SSO**, are available on demand, with
  - **Spid**, Public Digital Identity System, https://www.spid.gov.it/en/
  - **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

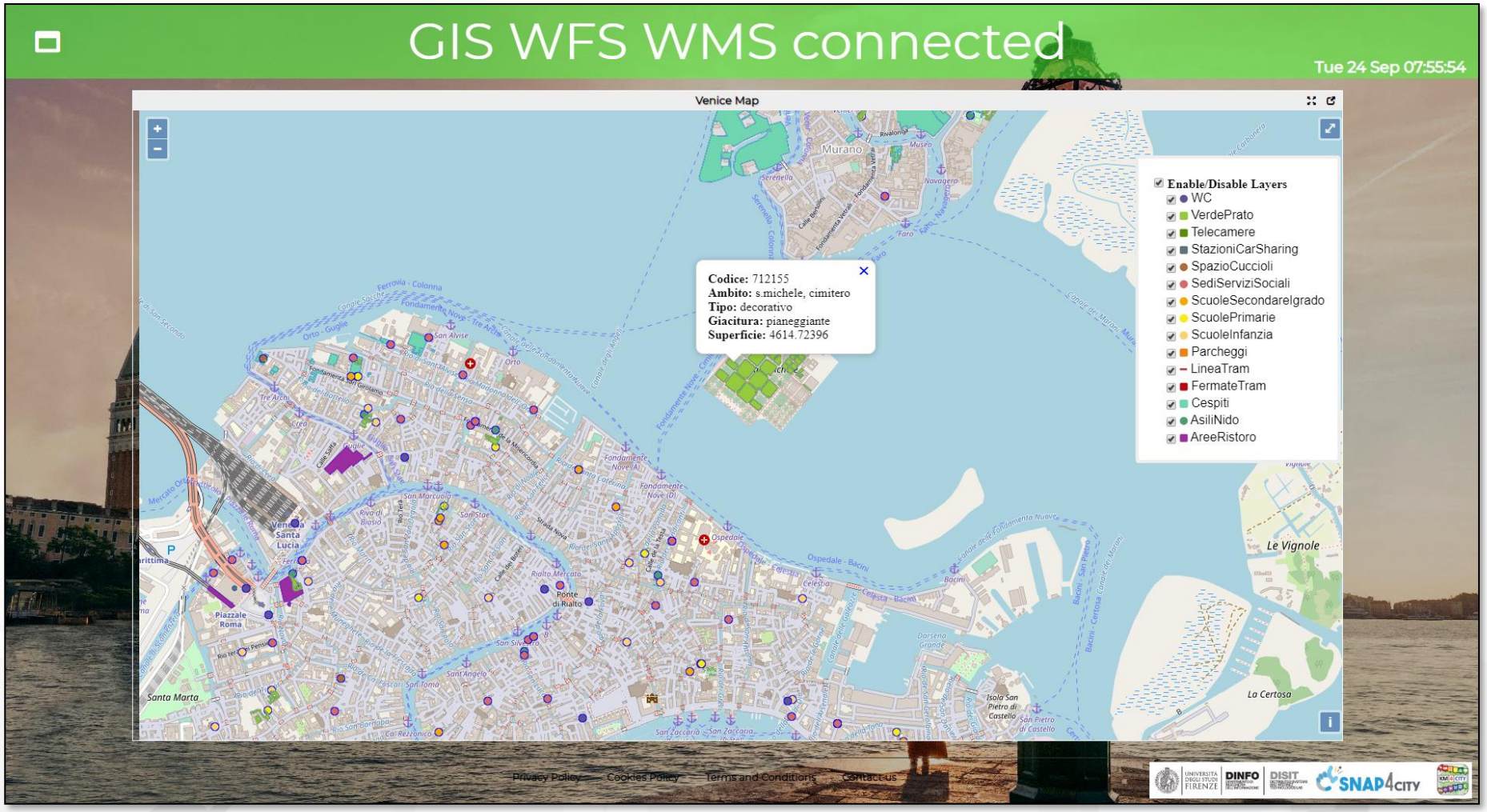
GIS Server can be: ESRI ArcGSI Enterprise, QGIS, GeoServer, ..
GIS Player can be: ESRI ArcGIS Pro, ArcGIS Portal, Snap4City WFS player, ...



- **GIS:**
  - Geographic Information System
- **WMS:**
  - Web Map Service
- **WFS:**
  - Web Feature Services

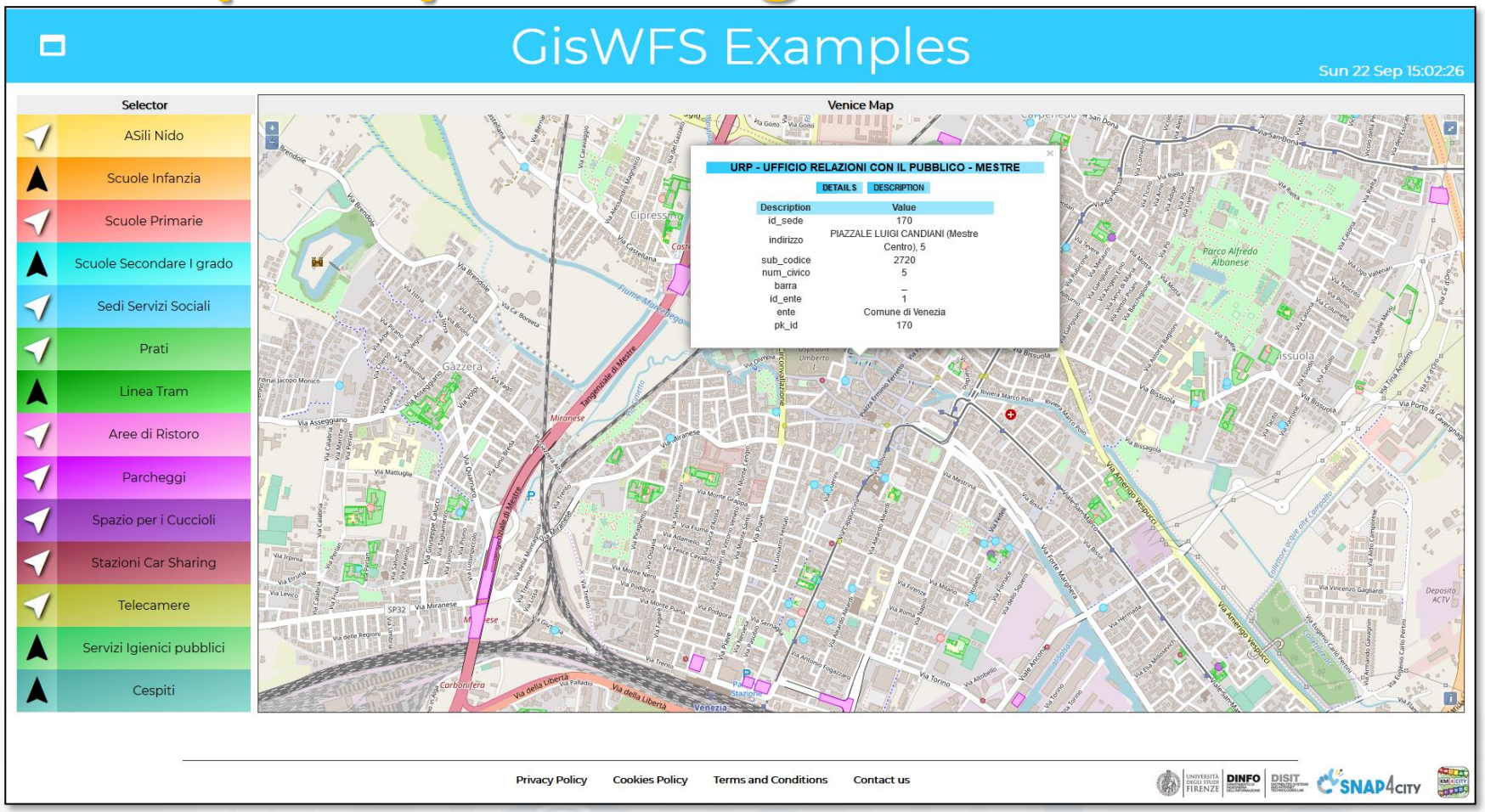
(B) GIS data on Dashboard via Snap4City GIS Player

- 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 Public Transport Information

Public Transport Information/file/streams

- **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»

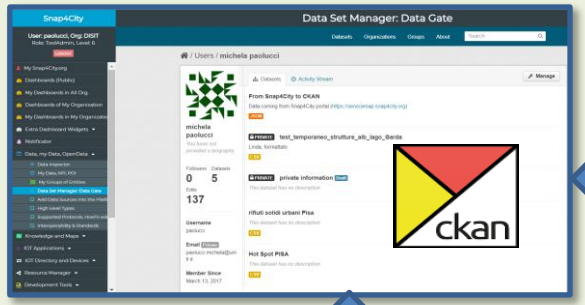
http://www.chouette.mobi/en/

Integration with CKAN Open Data Manager and Portal

Snap4City vs CKAN

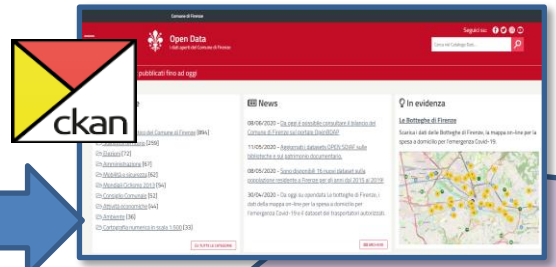
Snap4City Portal and Integrated tools

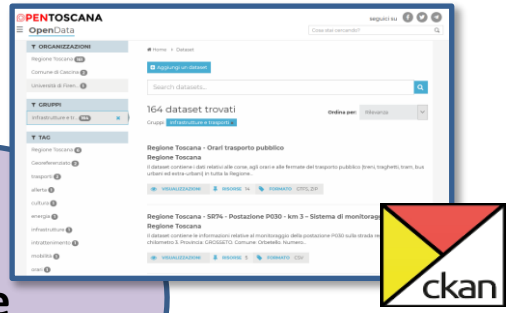
Datagate



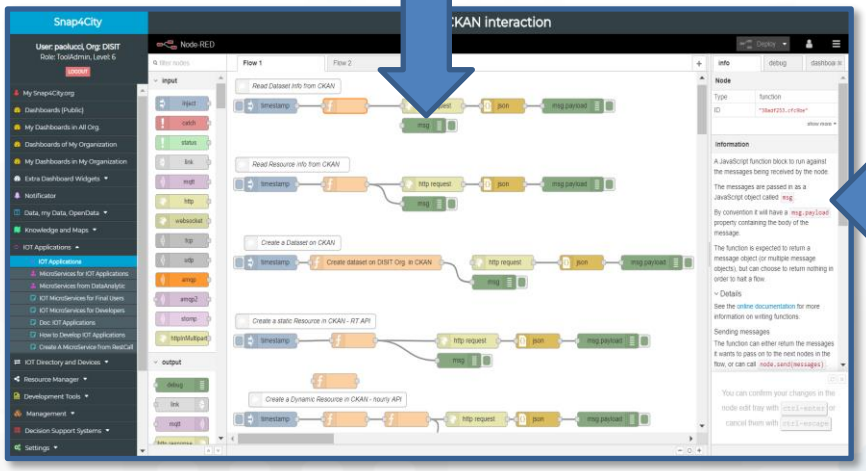
Advanced Snap4City APIs and Micro Services

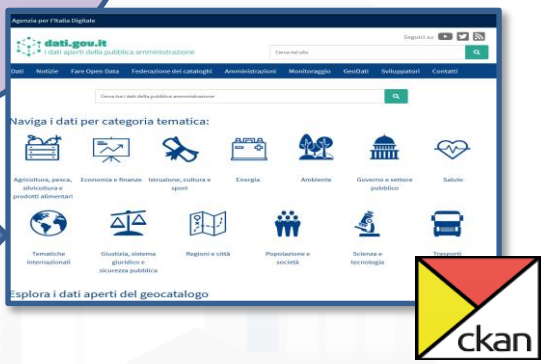
Harvesting and Publishing





Open or Private External CKAN Data Portals

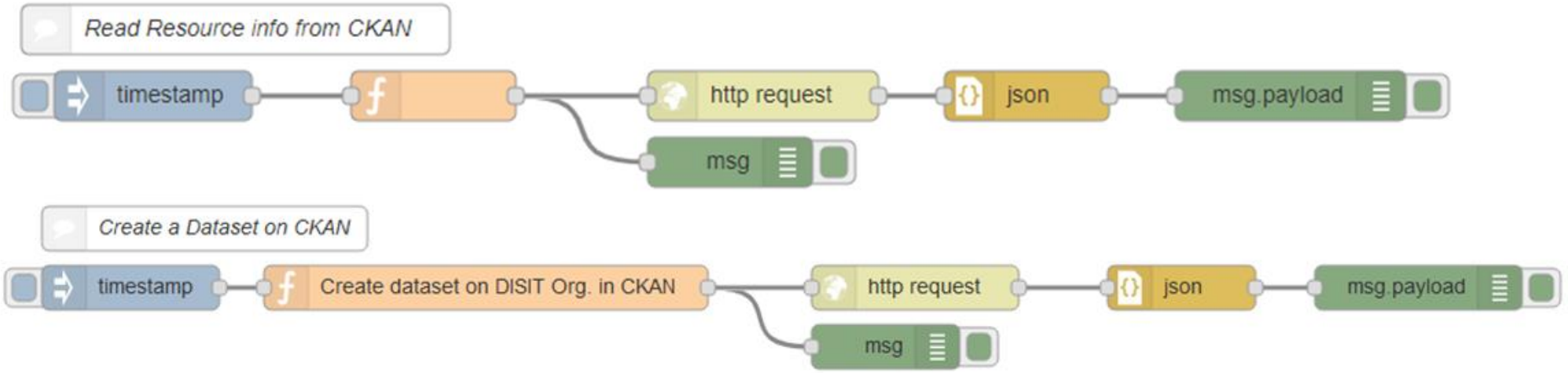




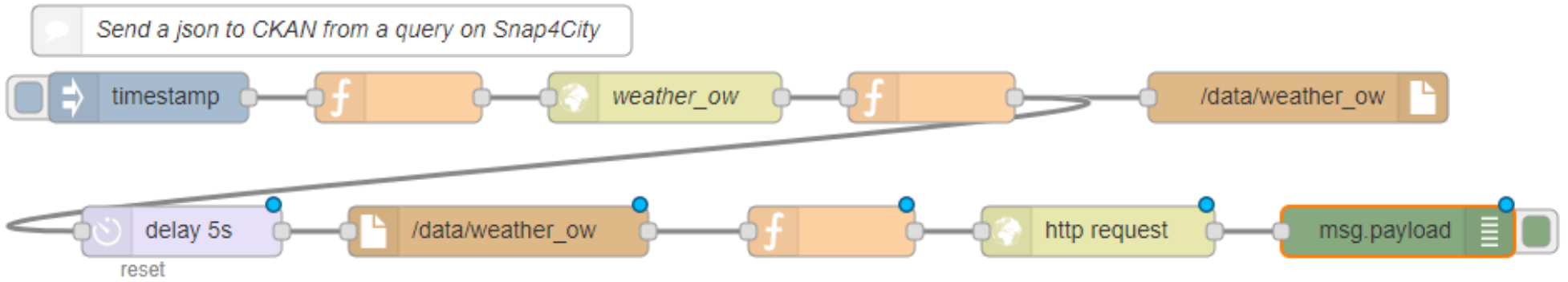
Automatize:

- 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

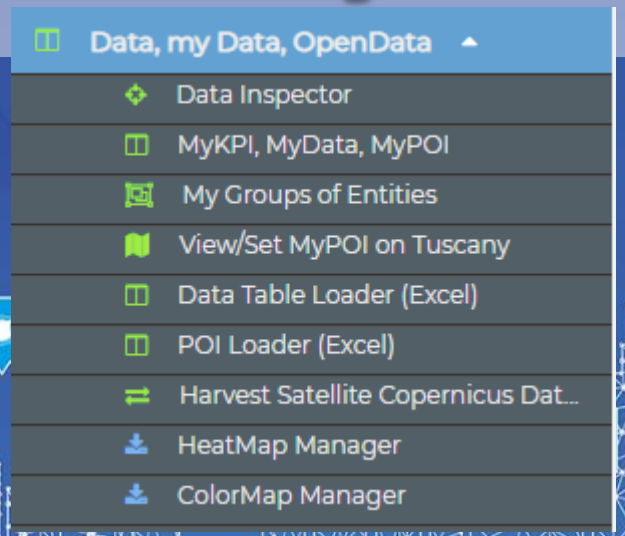


Read more on

- **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**

TOP

Integration with Copernicus Satellite Data



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.

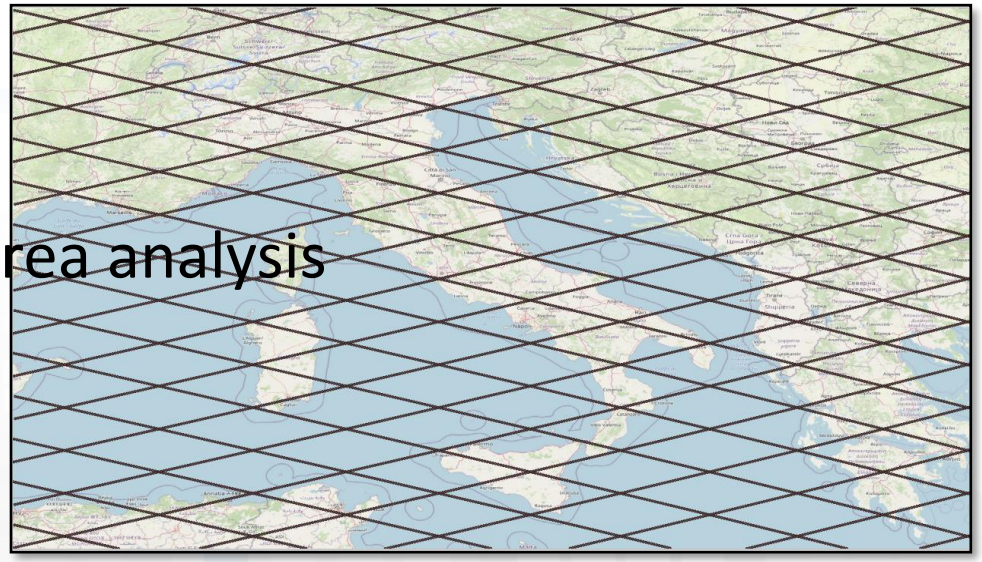
Smart City: Satellite Data vs Sensors Data

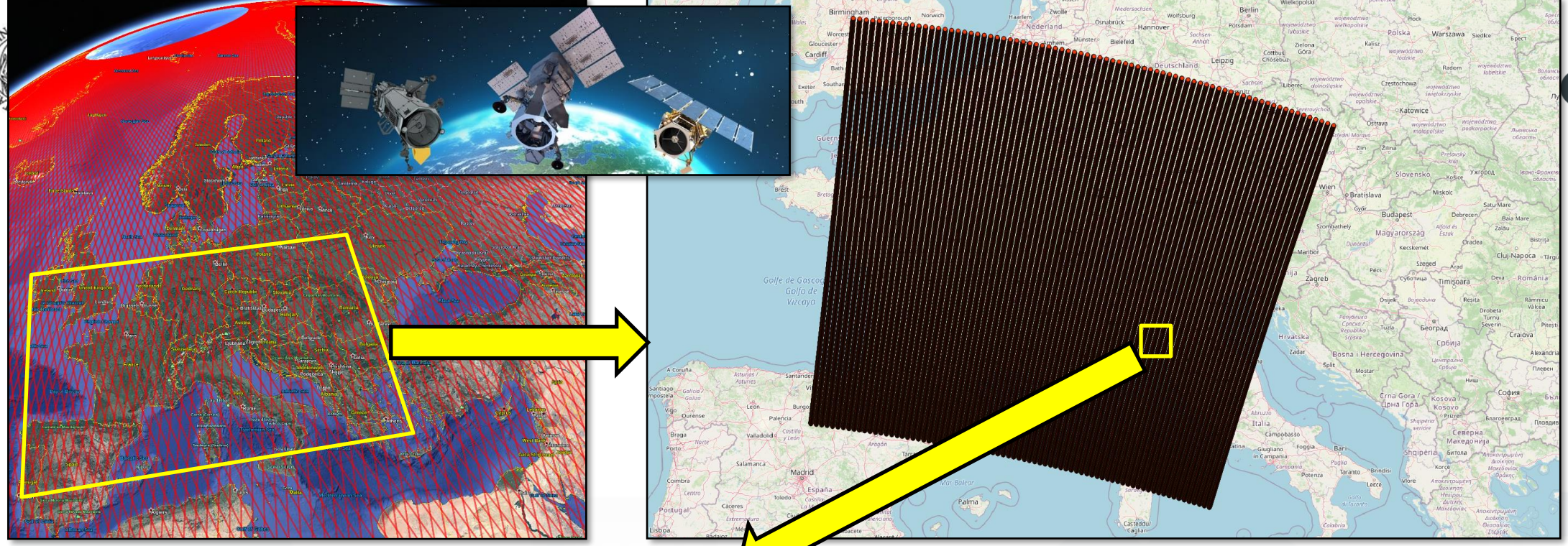
- **From Satellites, many sources, different resolutions, open/closed:**
  - Ozone, NO2, SO2, Aerosol, CO, etc.
  - Temperature, vegetation, land usage
    - Evolution of soil usage: with high seasonality, and weather impact
  - Air traffic derived data
  - Water traffic usage data
  - Many other technical 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

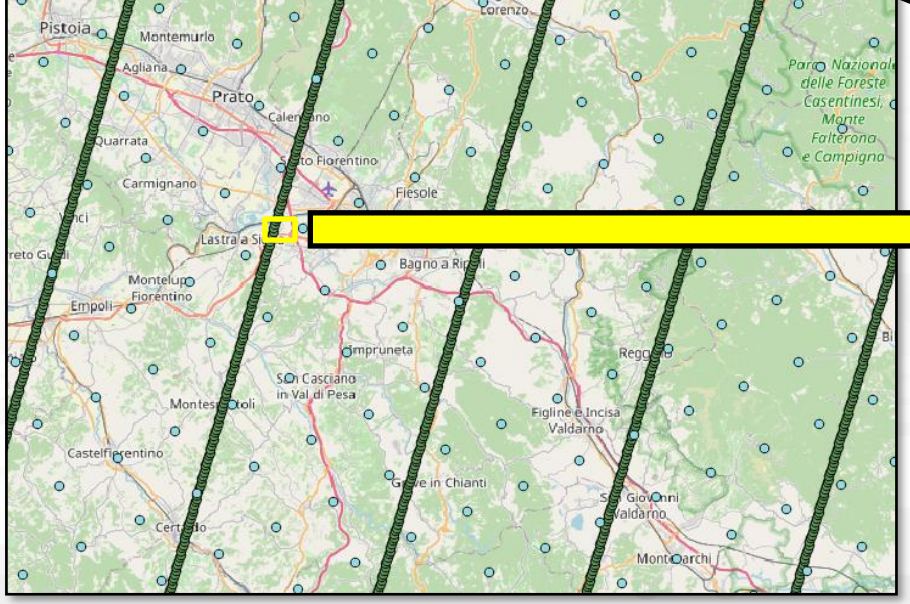
https://www.copernicus.eu/en/copernicus-satellite-data-access

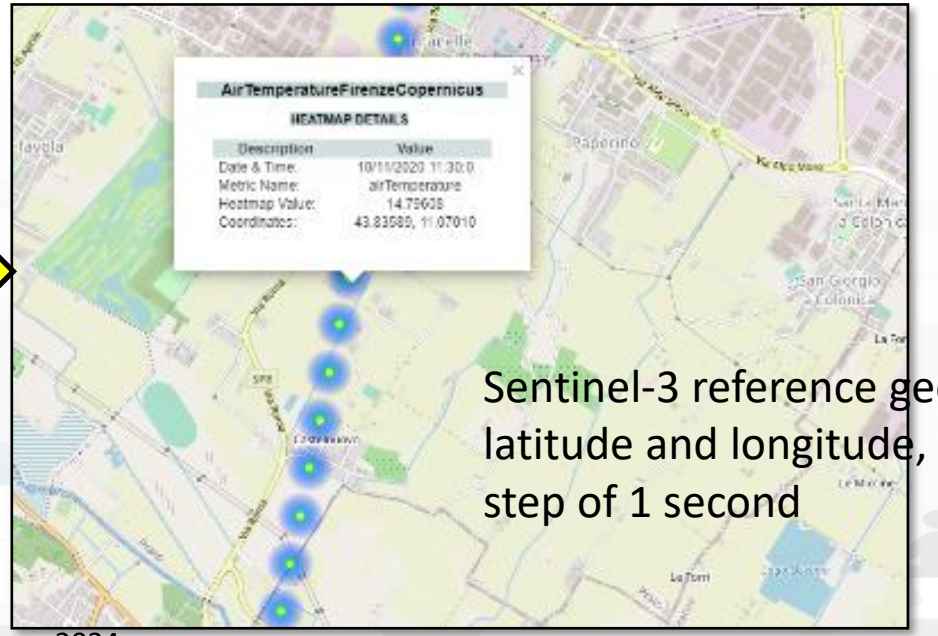
Satellite data

- **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







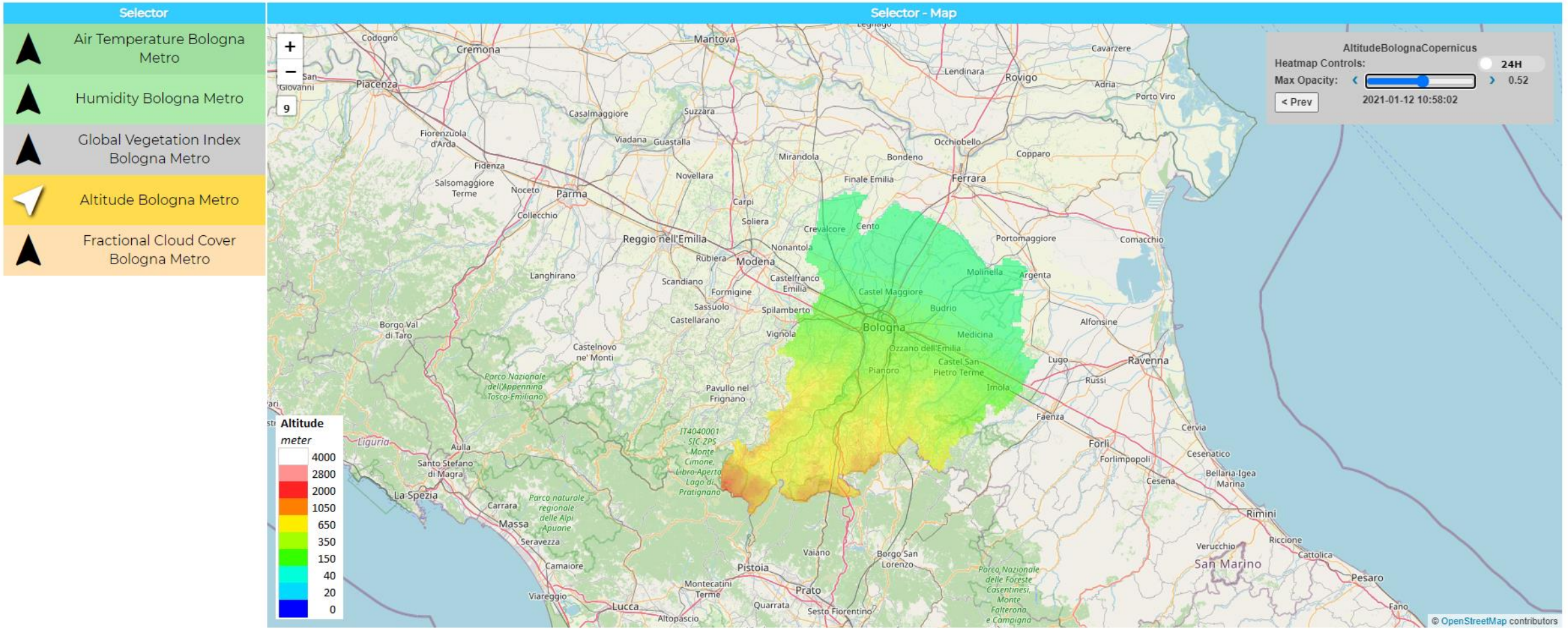


Sentinel-3 reference geocentric latitude and longitude, time step of 1 second

Bologna Metro

Bologna Metropolian Area Copernicus Data

Sat 16 Jan 20:08:03



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

Satellite Data Harvesing and Preparation

1 GET

token 3

Order Interface

2 Insert metadata (unprocessed data)

Satellite Data Services

Copernicus API

5 Download data

4 Get metadata

Satellite Data Harvester

6 processed data

Satellite data Info

7 Get metadata

Heatmap production

8

HeatMap Data Server

9 Get heatmap metadata

Heatmap GeoTIF Generation

interpolated data

10 GeoTIFF

Geo Shape of the region

GeoServer (PostgreSQL)

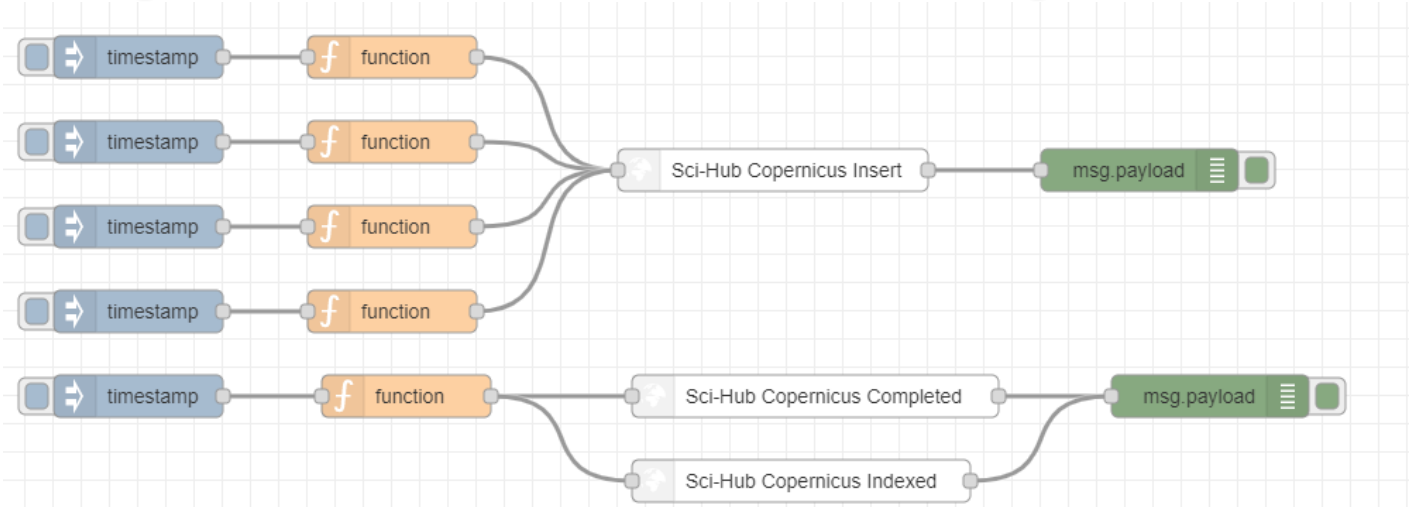
GeoServer

Compernicus Data Request: Sci-Hub

https://www.snap4city.org/671

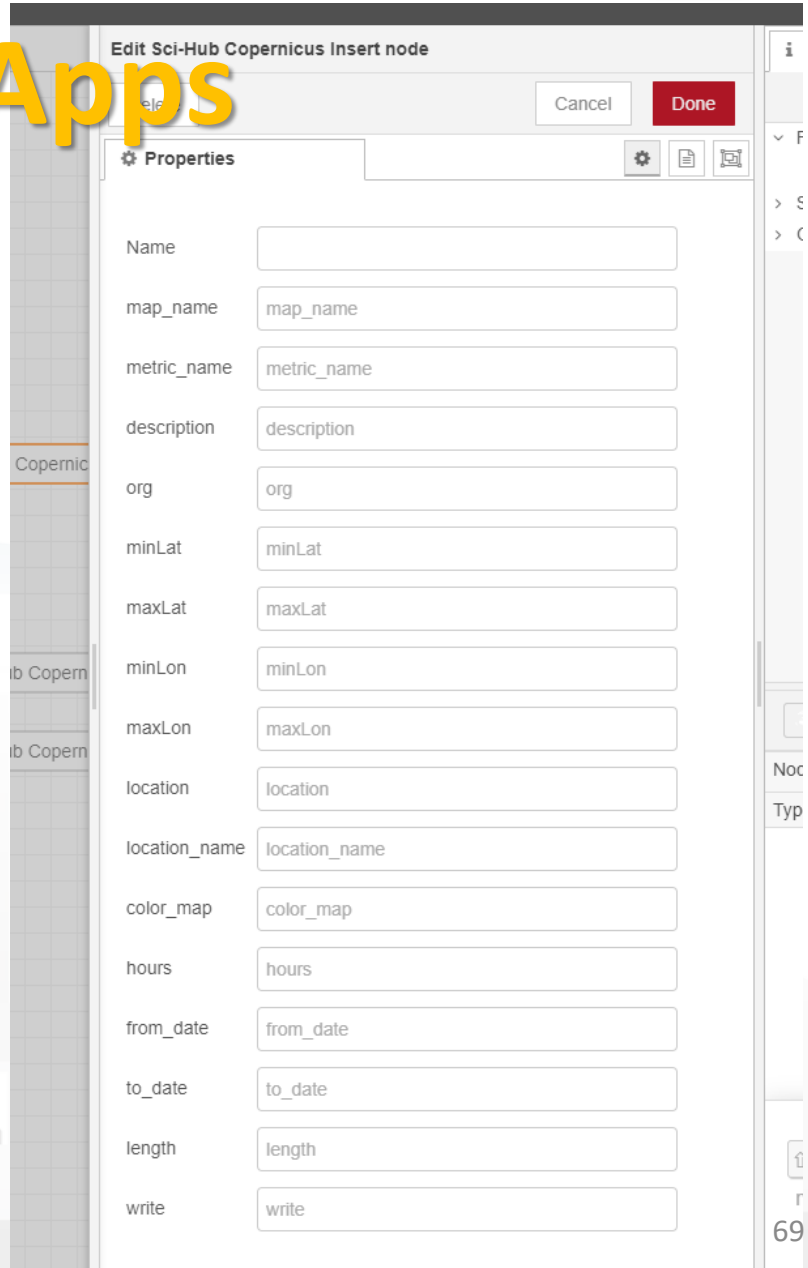
- **Map name**: ……..
- **Metric name**: AirTemperature, Humidity, Altitude, OLCI Global Vegetation Index, Cloud Fraction, etc.
- **Description**: a generic description;
- **Location**: select the level the data have to be taken and heatmap created. It is possible to specify one of the following: City, 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



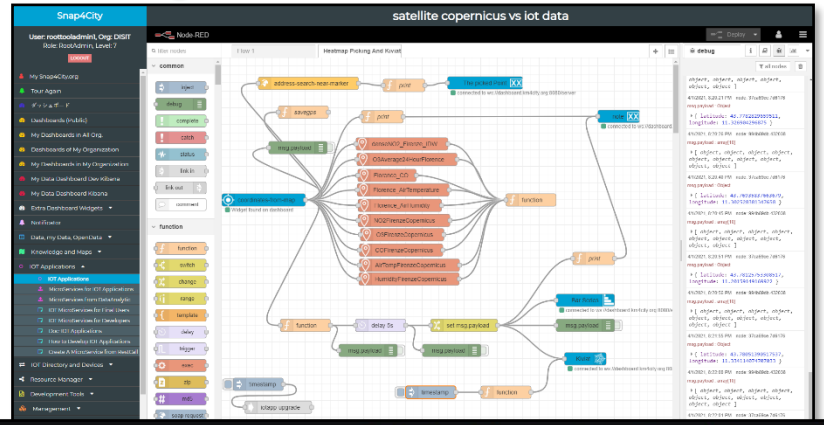
Setup | **Function** | Close

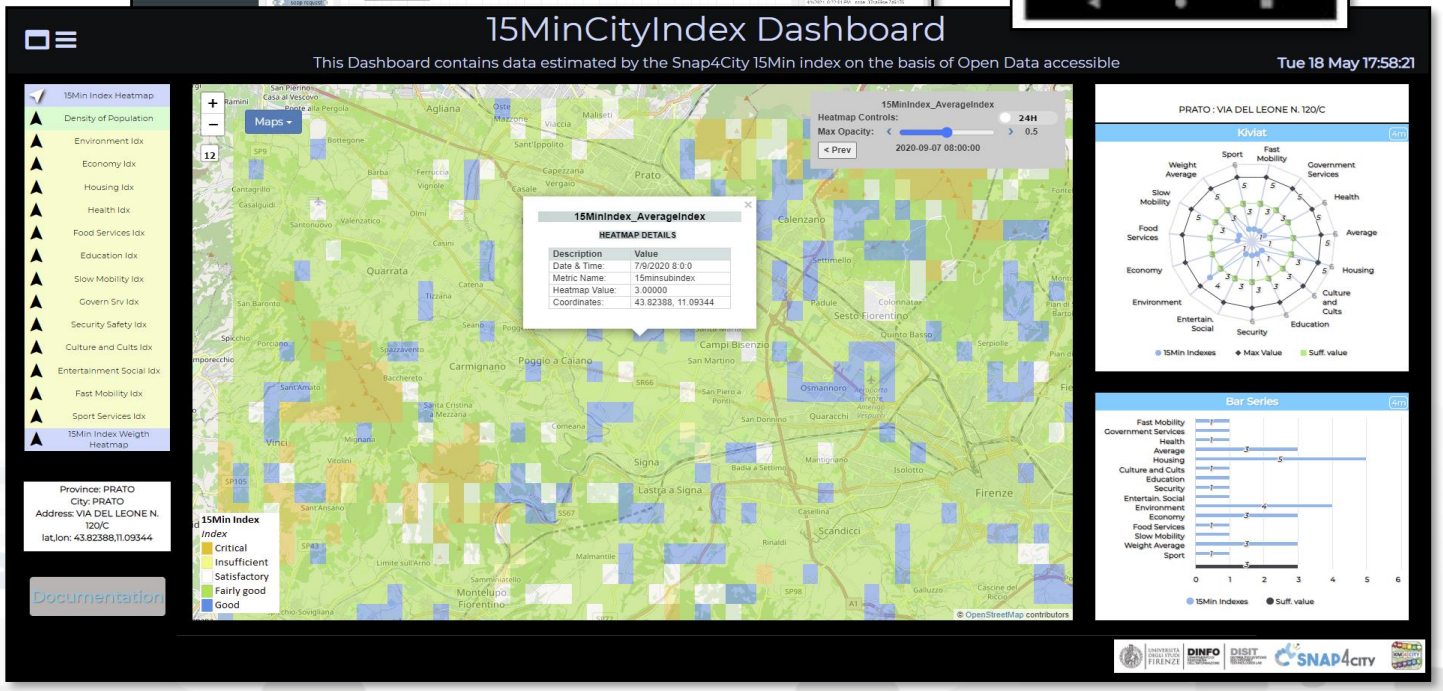
```
msg.payload = {
    "map_name": "AirTemperatureBolognaCopernicus",
    "description": "Air Temperature Bologna",
    "location": "city",
    "location_name": "Città metropolitana di Bologna",
    "color_map": "airTemperatureHQ",
    "org": "DISIT",
    "from_date": "2021-01-01T00:00:00",
    "to_date": "2021-01-01T23:59:00",
    "length": "700",
    "write": "1",
}
return msg;
```



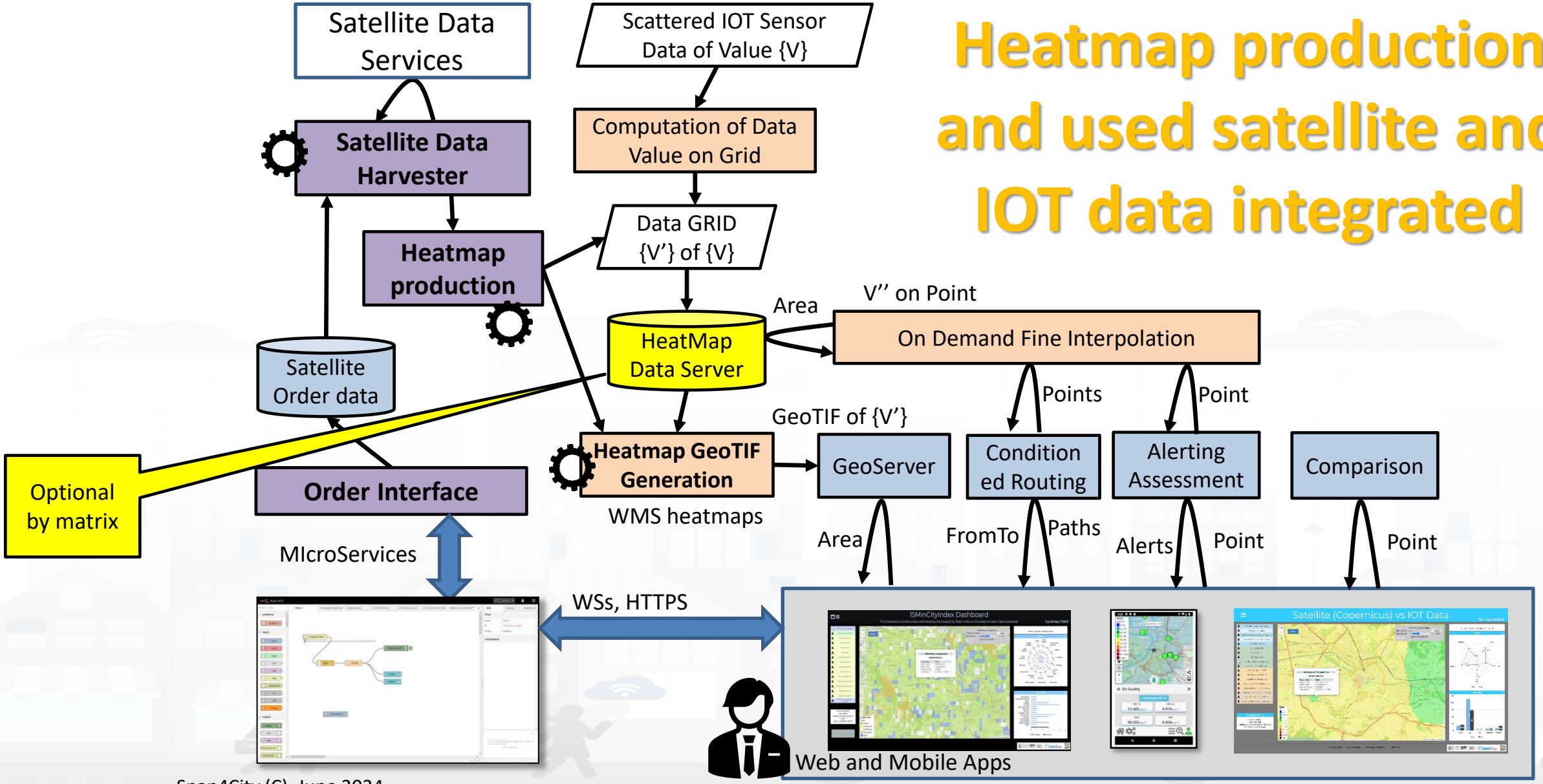
Once Generated can be exploited

- **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**

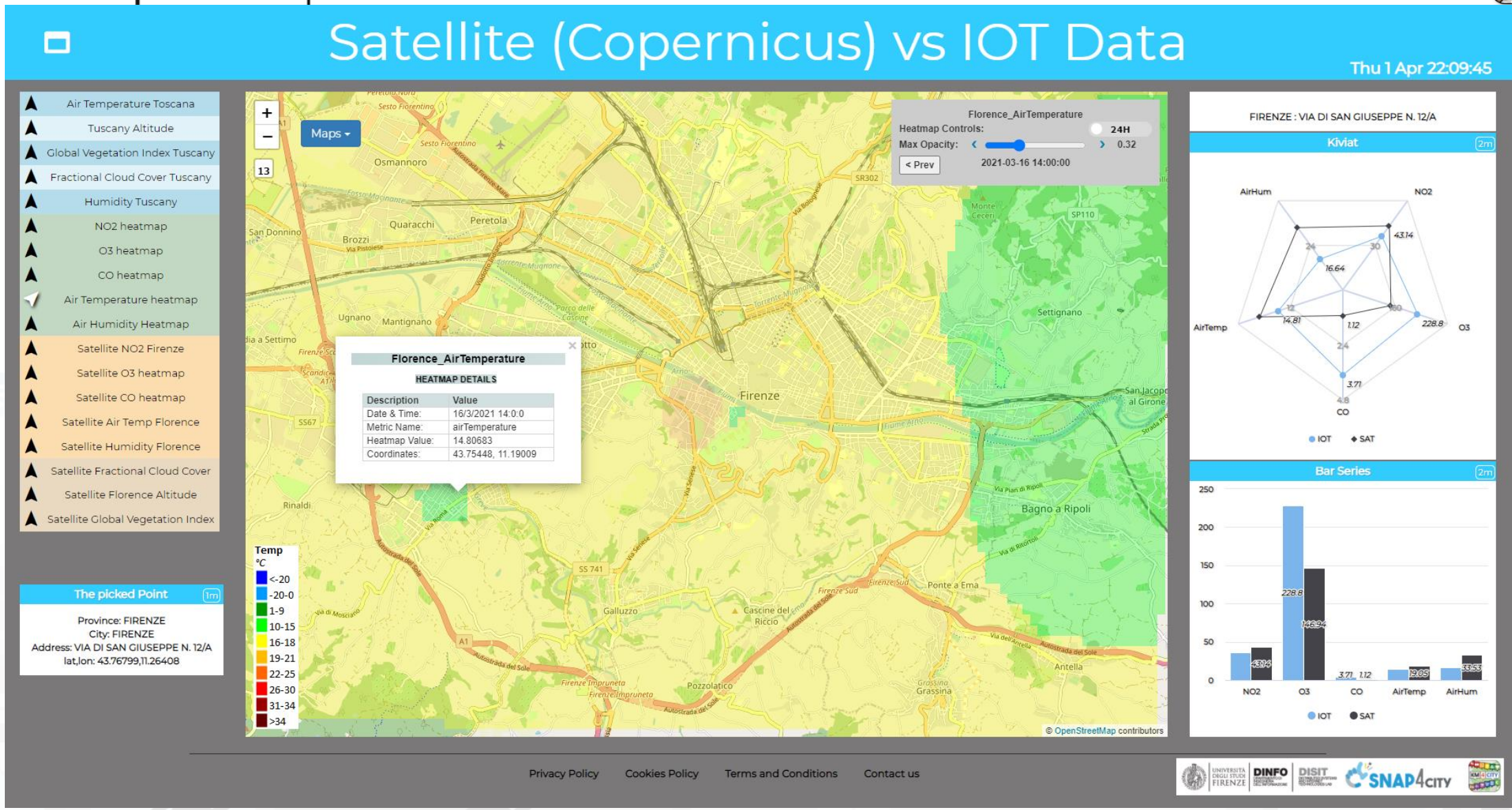




Heatmap production and used satellite and IOT data integrated



Satellite (Copernicus) vs IOT Data



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

TOP

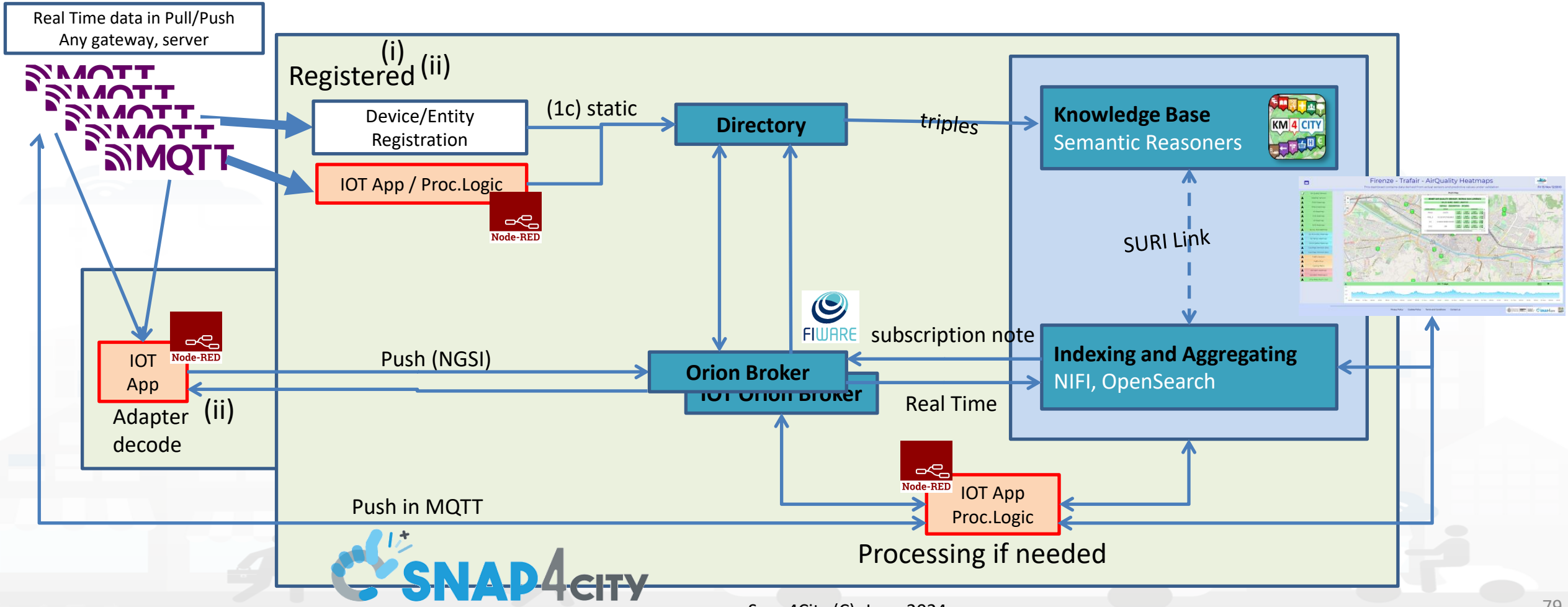
Interoperability with respect to Hardware staff

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

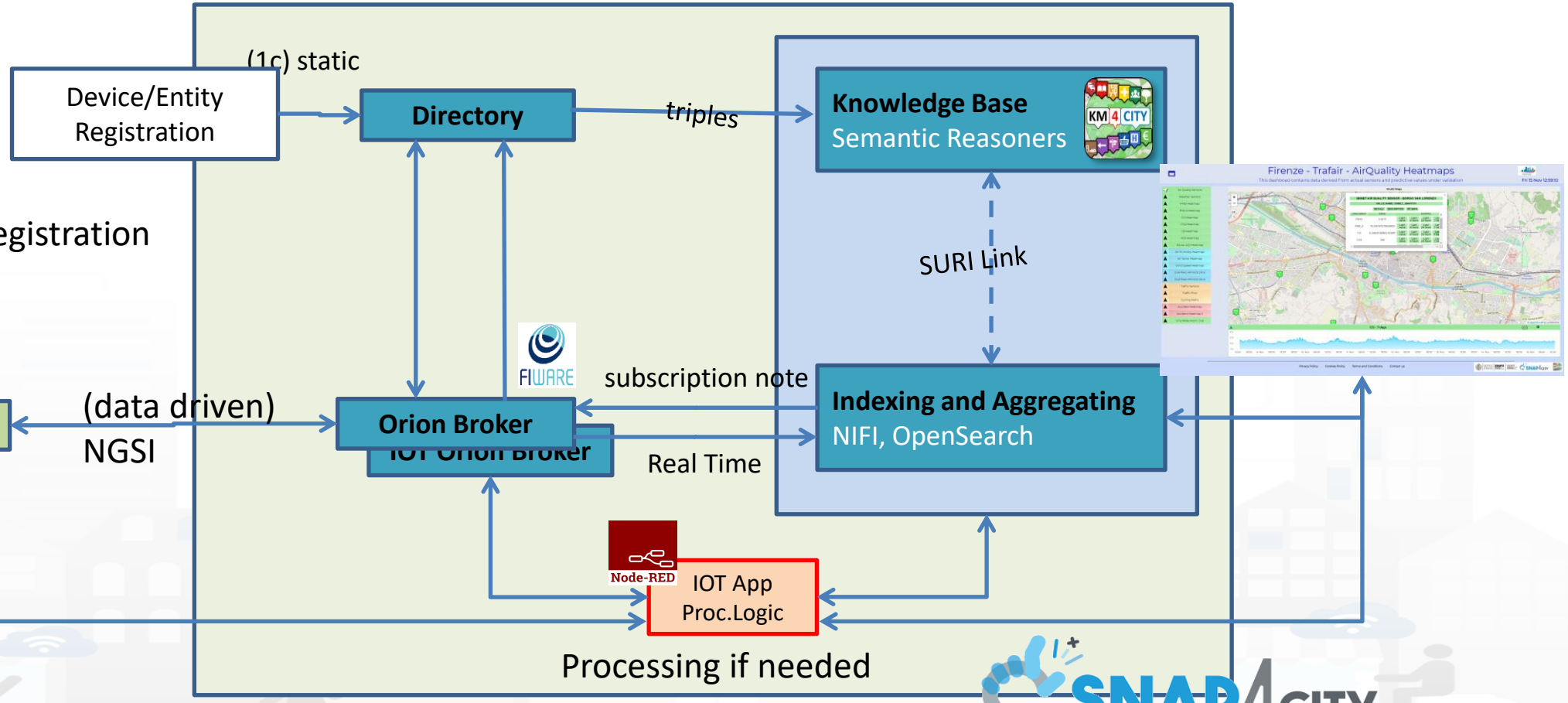
Smart Environment PRO

libelium

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

https://www.snap4city.org/659 how to set up on Snap4City

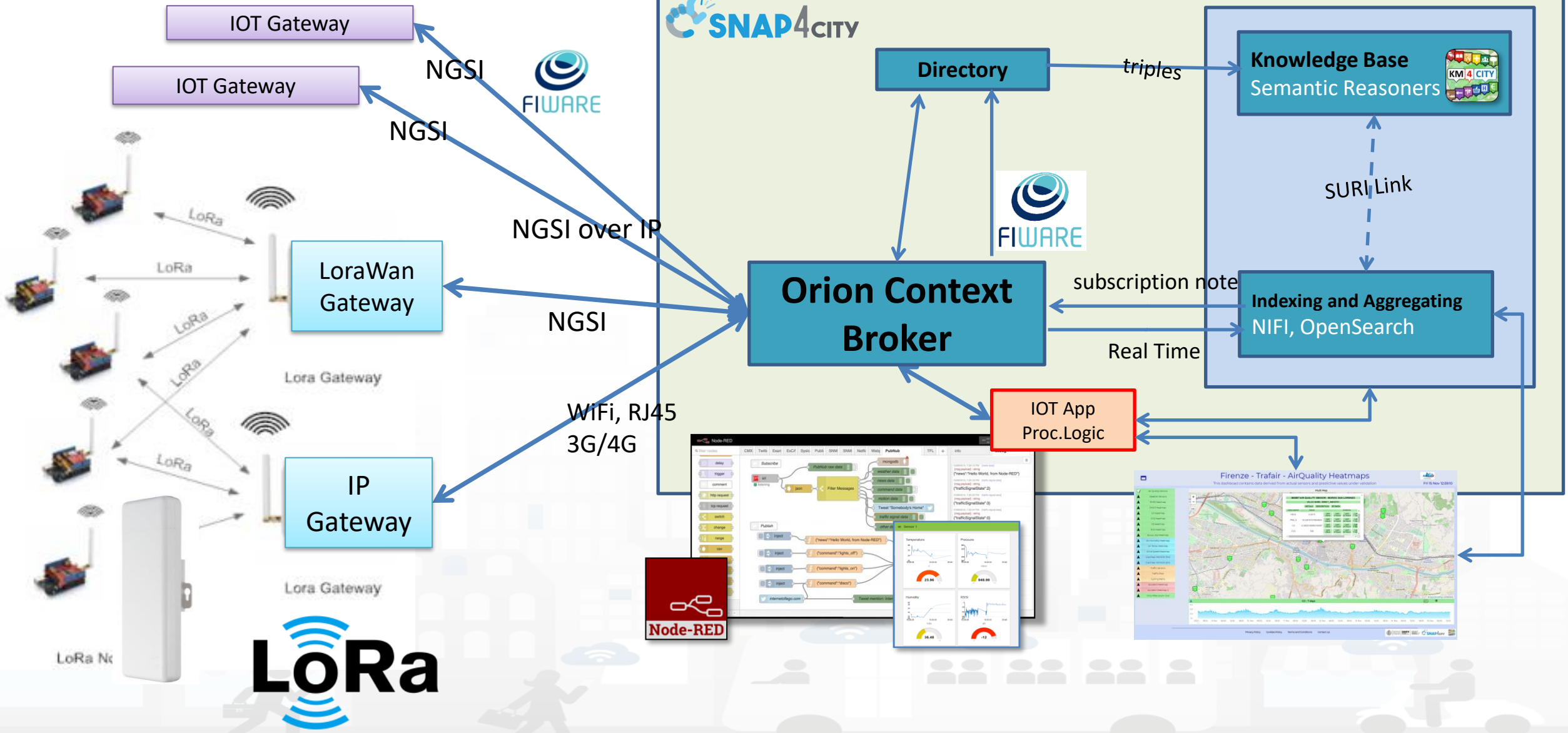
- Can be directly connected to Snap4City (data driven)



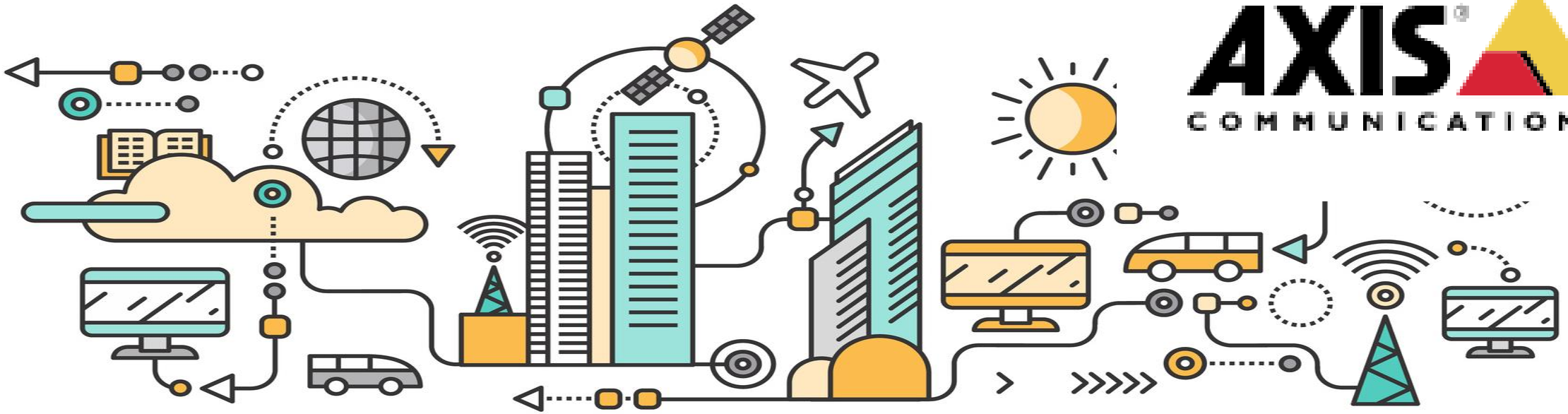
LoRa Lora IOT Gateway vs NGSI

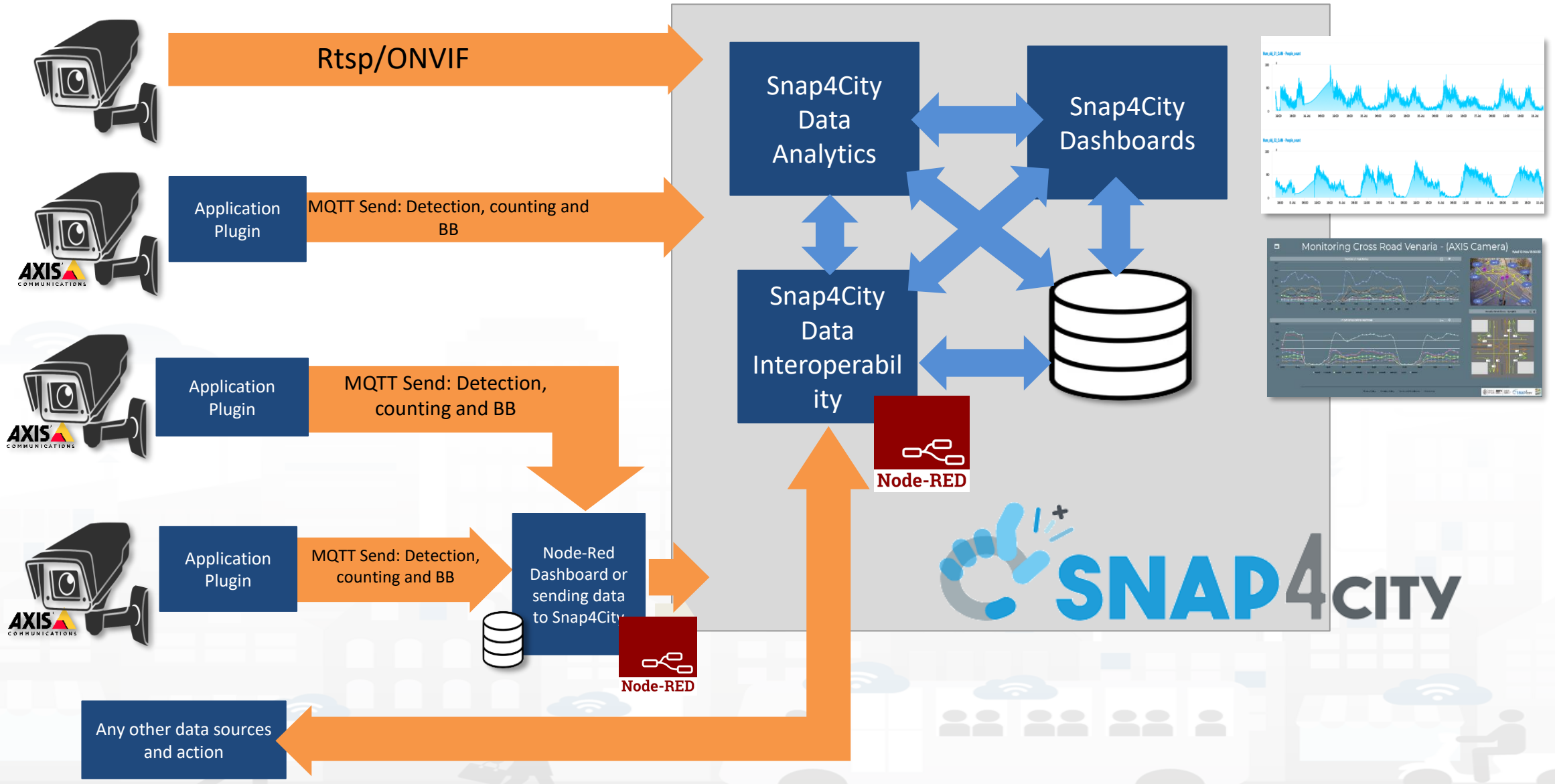
- Management of Lora Devices Directly or via Lorawan Network Server with IoT App

Lora IOT Management



TV Cam AXIS on edge




Rtsp/ONVIF
Application Plugin
MQTT Send: Detection, counting and BB
Application Plugin
MQTT Send: Detection, counting and BB
Application Plugin
MQTT Send: Detection, counting and BB
Node-Red Dashboard or sending data to Snap4City
Node-RED
Any other data sources and action
Snap4City Data Analytics
Snap4City Dashboards
Snap4City Data Interoperability
Node-RED
Monitoring Cross Road Venaria - (AXIS Camera)
SNAP4CITY

Venaria Reale

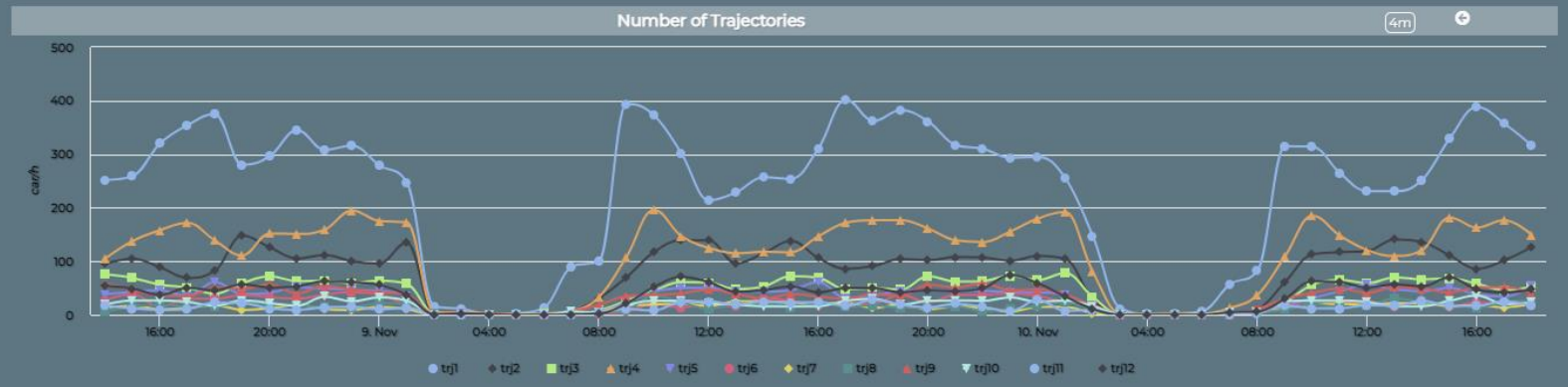
- **AXIS cameras as IoT Edge (Node-RED)**
  - **Color, Thermal and Radar: security, transport, etc.**
  - Node-RED on board
  - Snap4City Library installed
  - Image processing for trajectories
  - Sending data stream on Snap4City.org
- **Snap4City infrastructure**
  - Collecting data in real time
 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

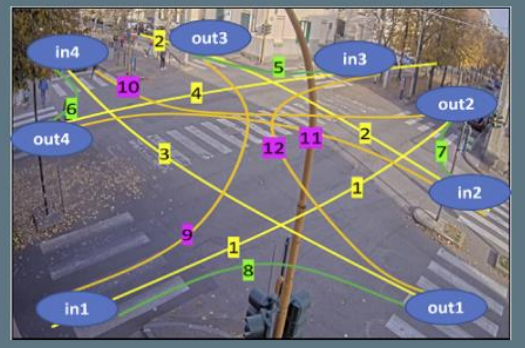
One Camera
Many results

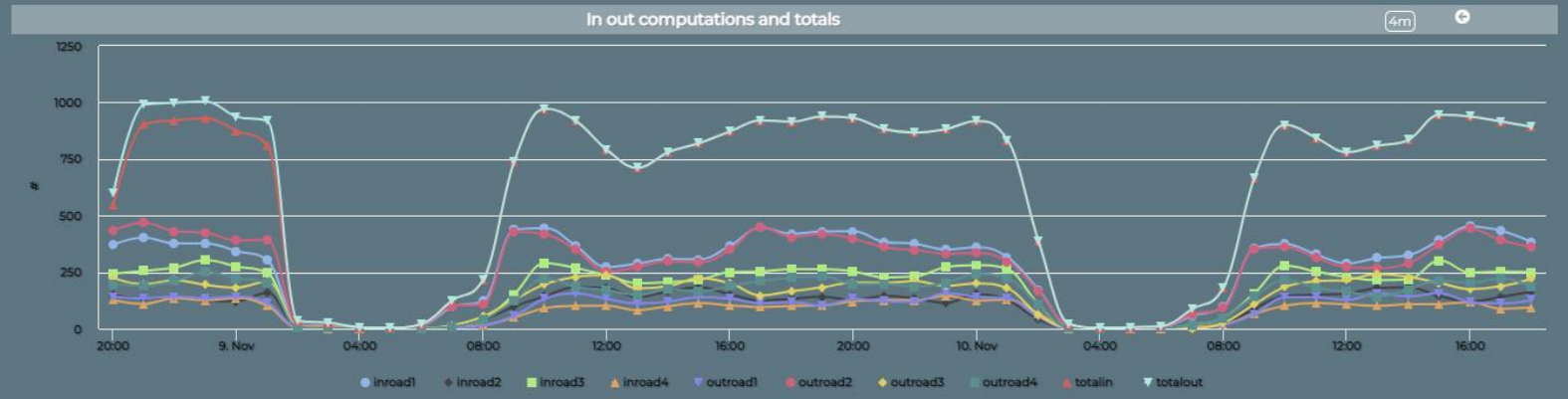
Venaria Reale

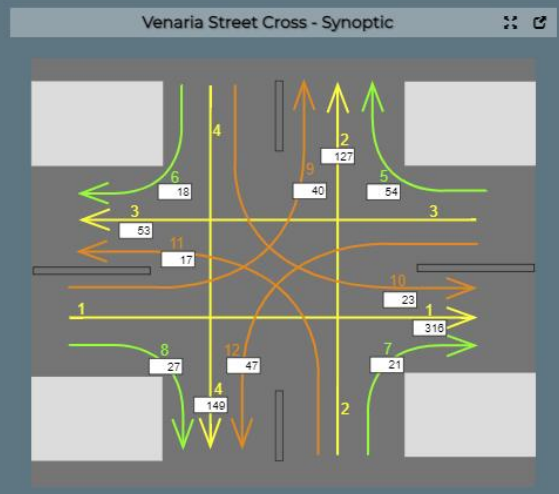
Monitoring Cross Road Venaria - (AXIS Camera)

Wed 10 Nov 18:50:53









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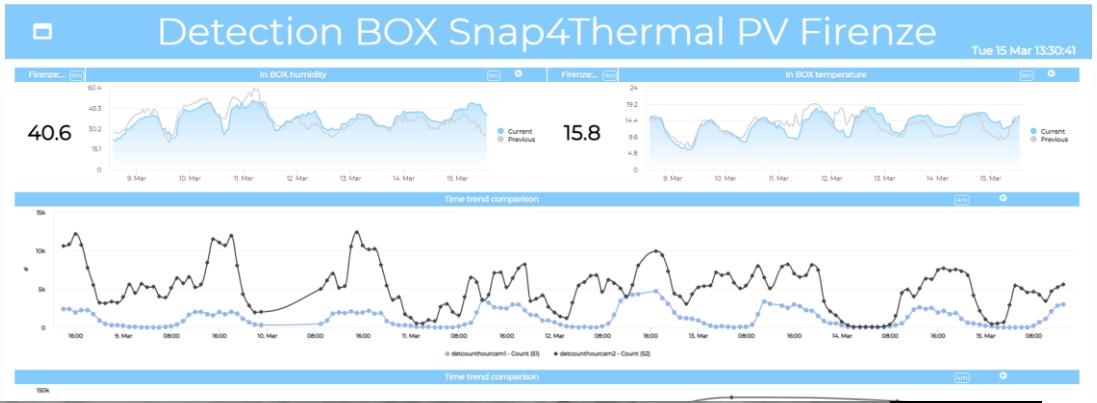
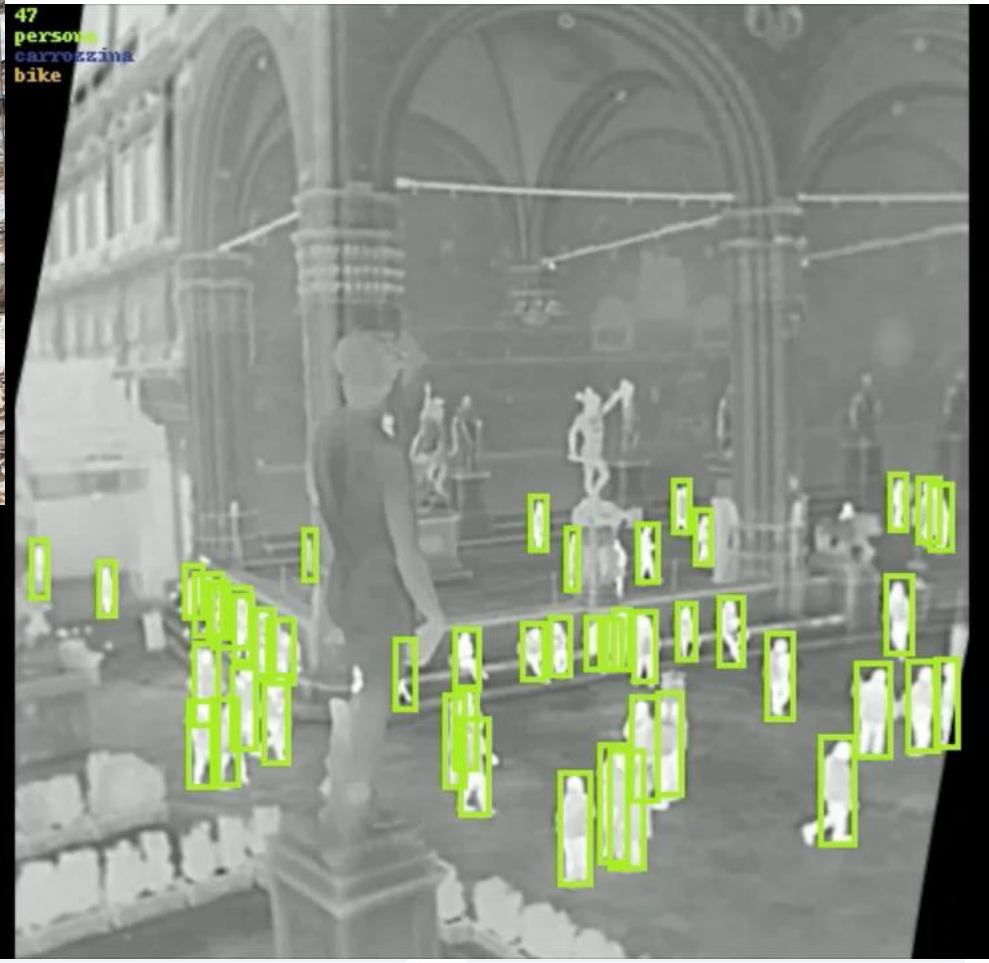
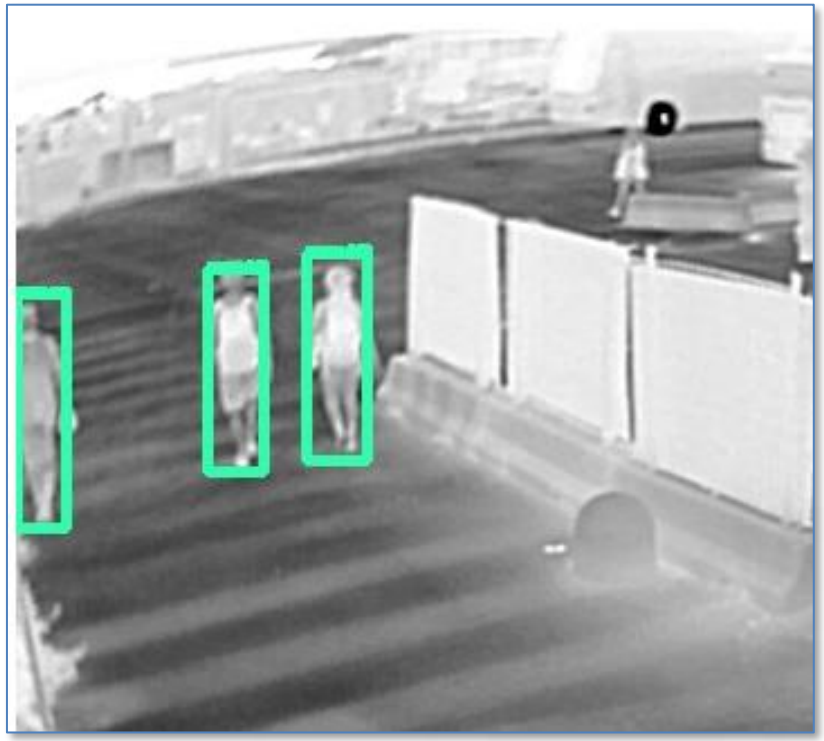
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzI5Ng==

A view and data from the Thermal Camera

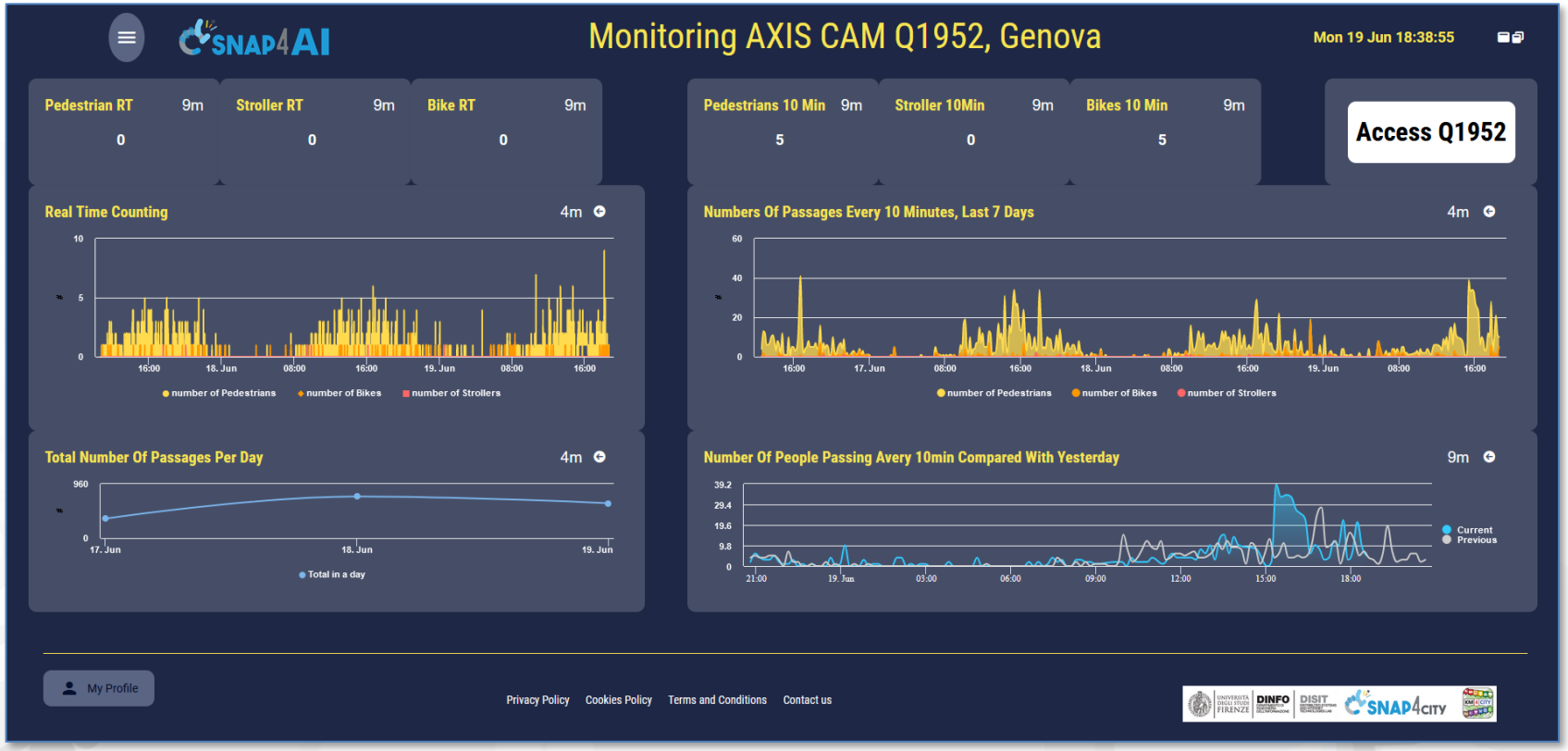






Monitoring Passages AXIS Q1952

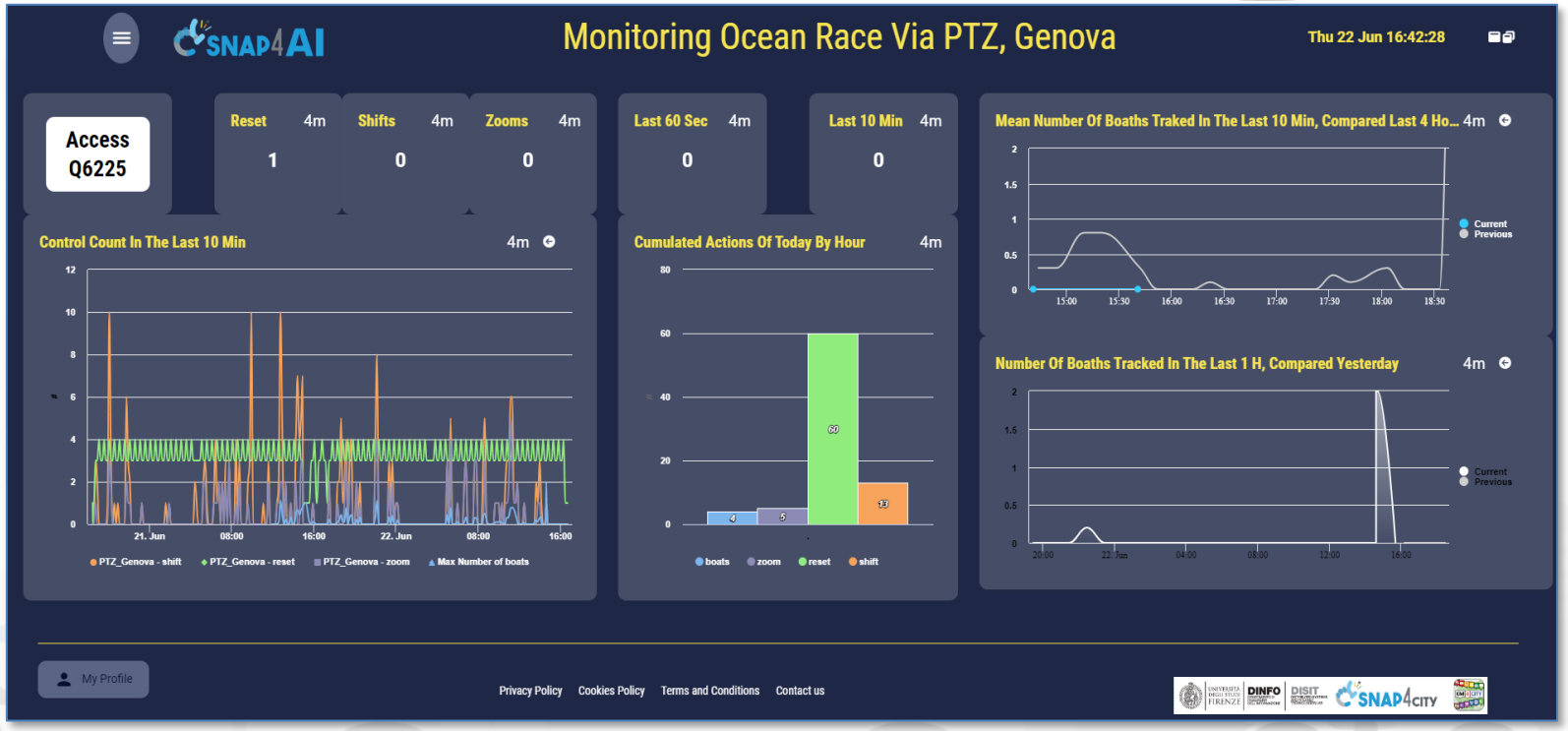
- Genova: Ocean Race, 2023



11 SUSTAINABLE CITIES AND COMMUNITIES

Monitoring Boats
AXIS Q6225, PTZ

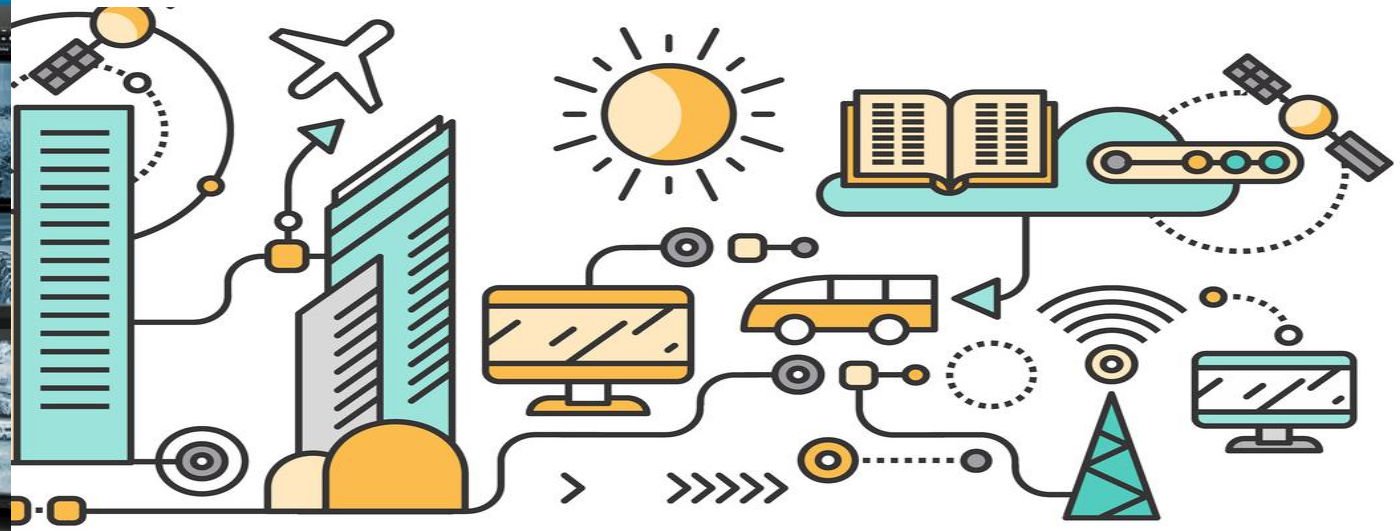
- Genova: Ocean Race, 2023



11 SUSTAINABLE CITIES AND COMMUNITIES

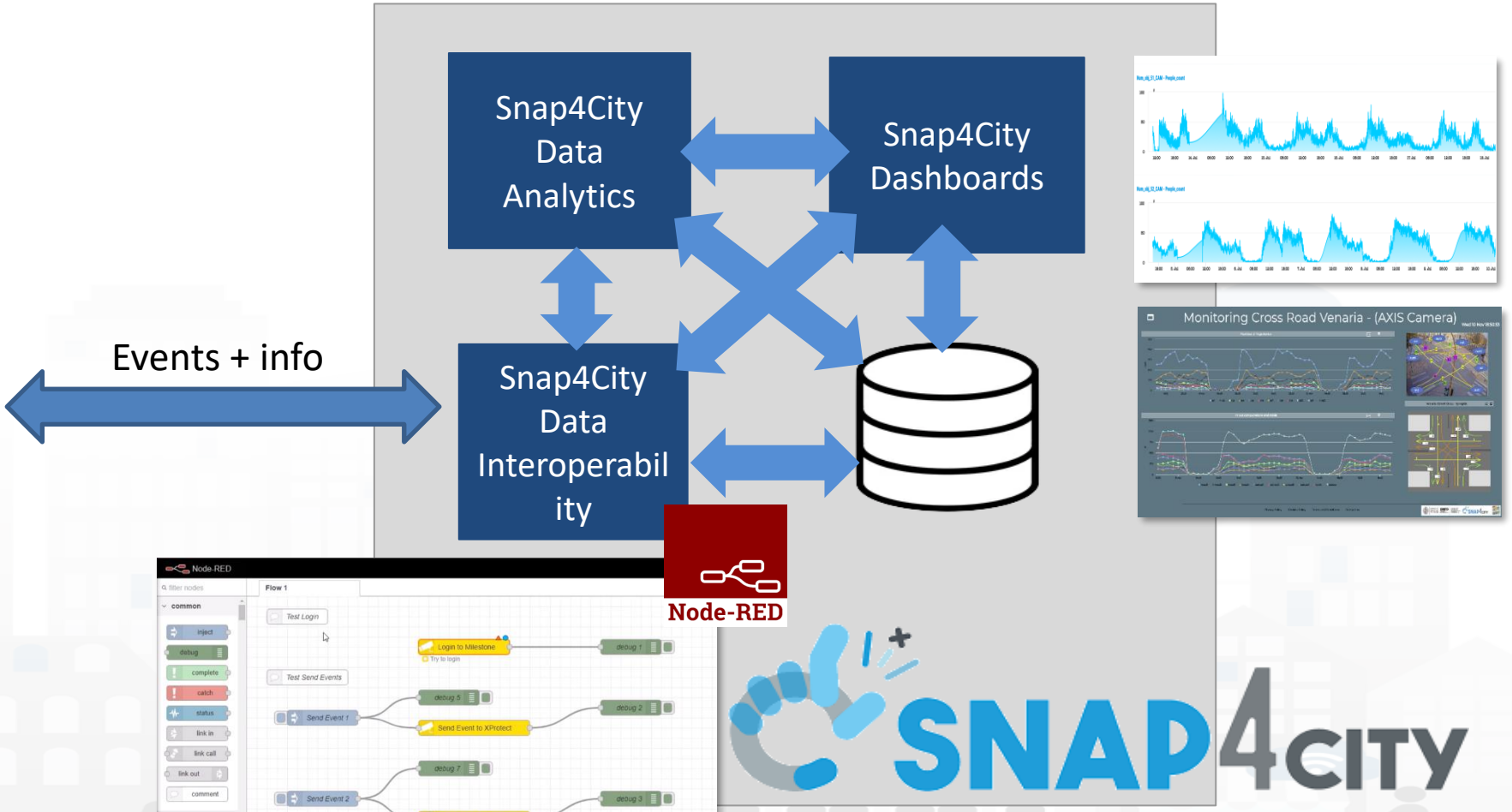
Integration with VMS

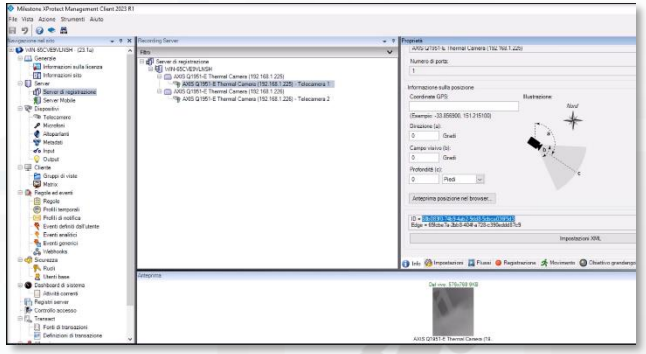
milestone



VMS vs Snap4City: sending and getting events, AI solutions

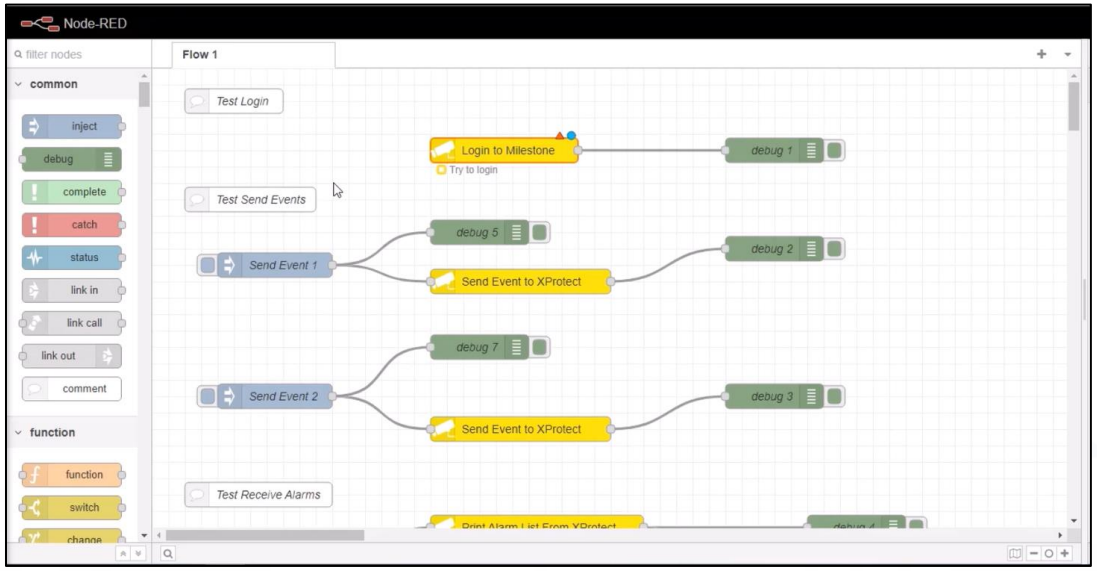
Events + info

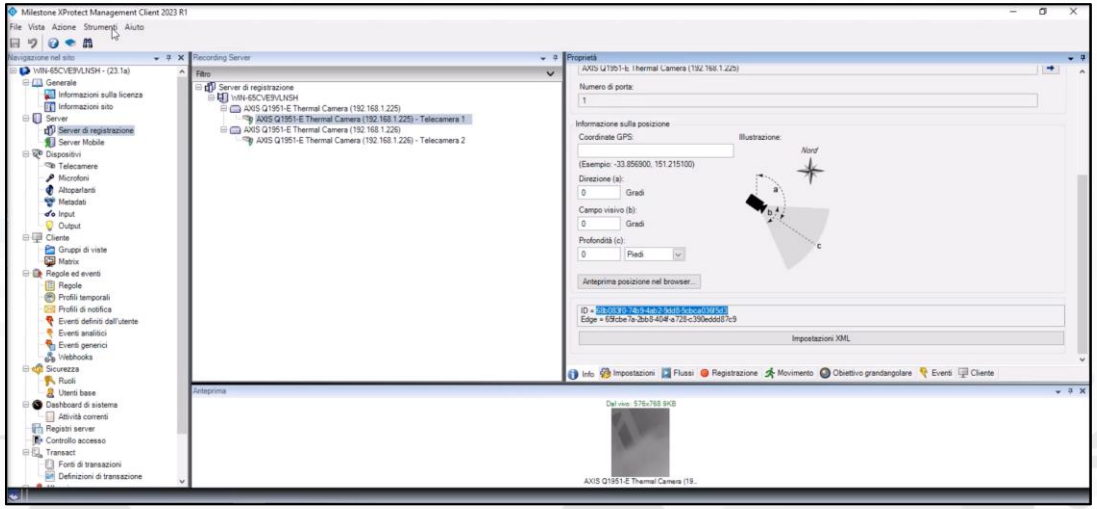




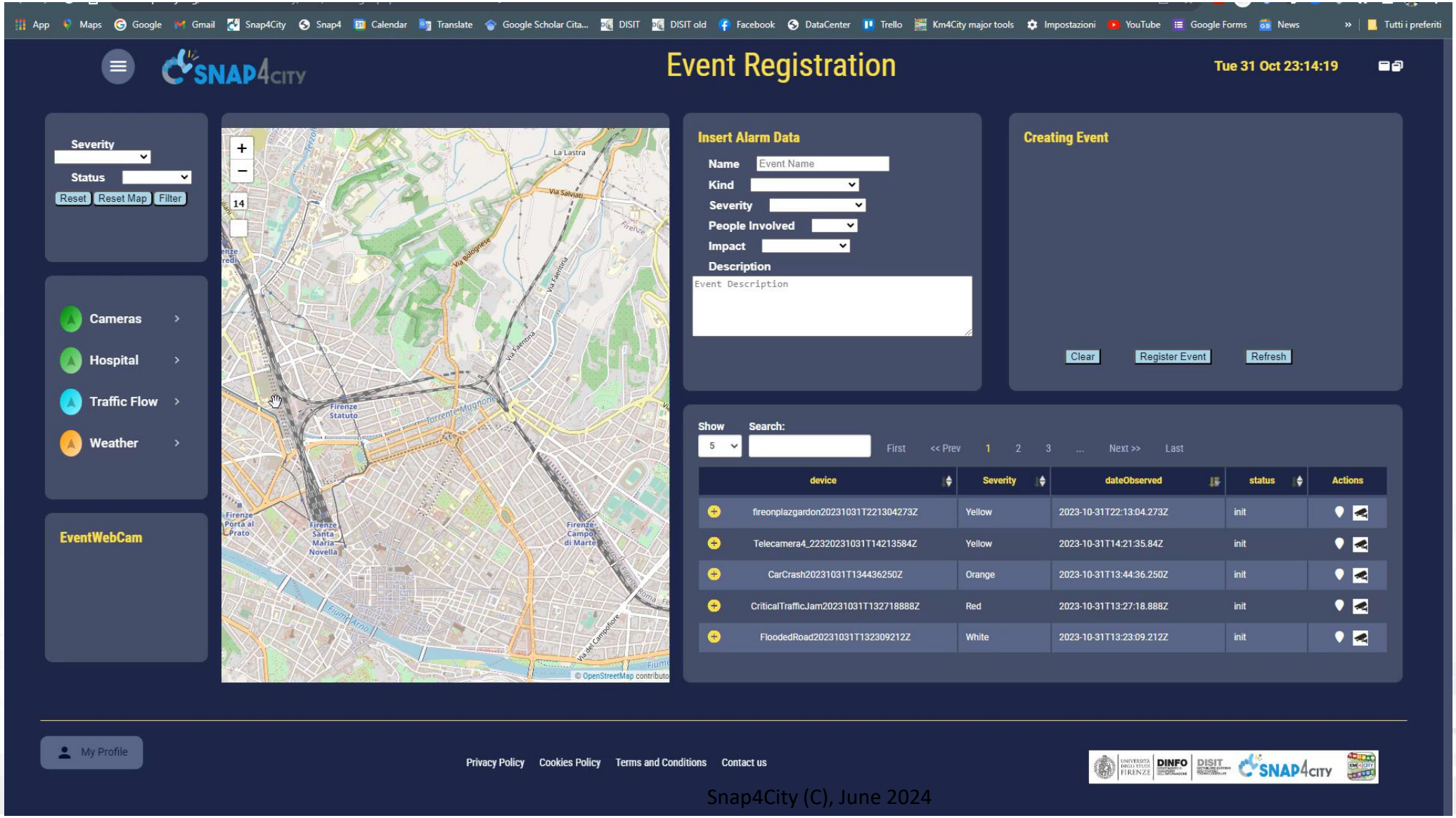
Snap4City ←→ Milestone Integration

- 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



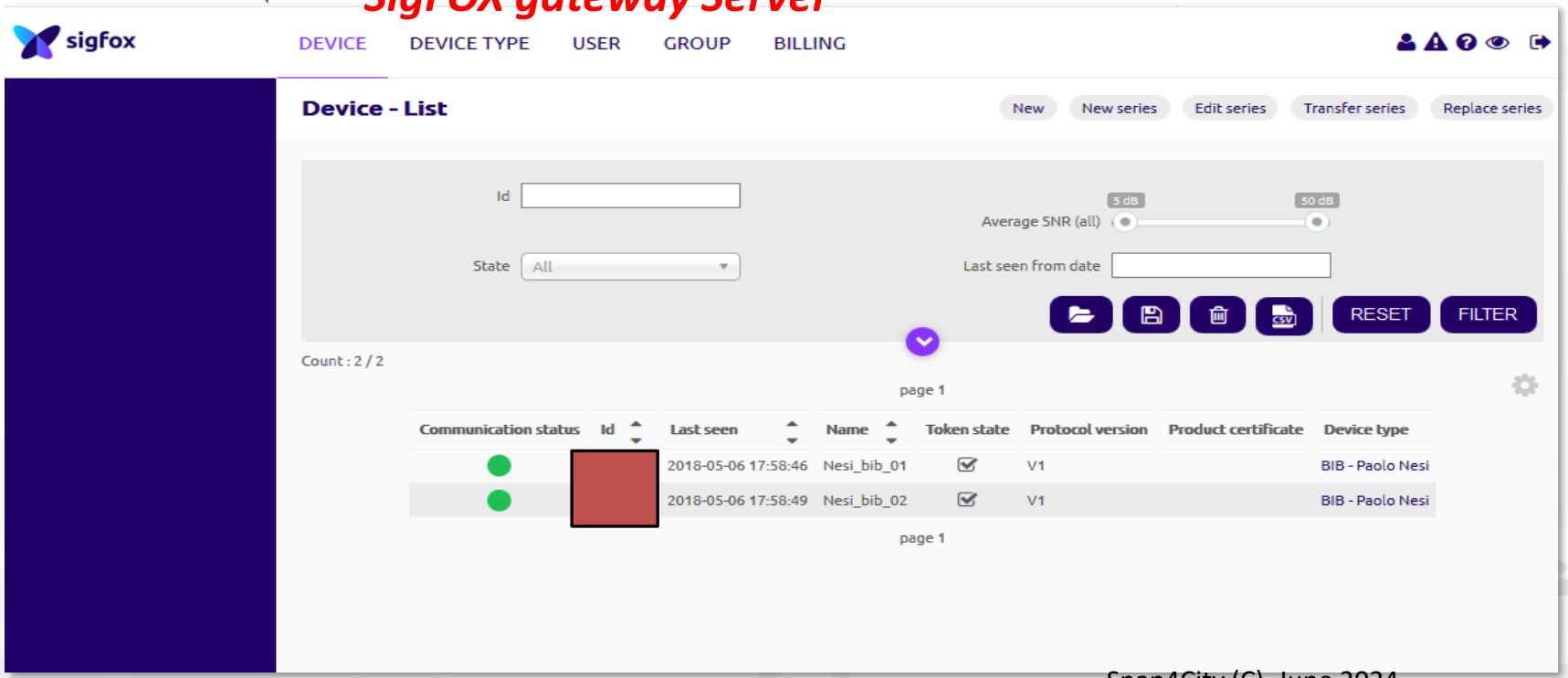
sigfox Integration

SigFOX Server Side

Registered
Managed

- 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…

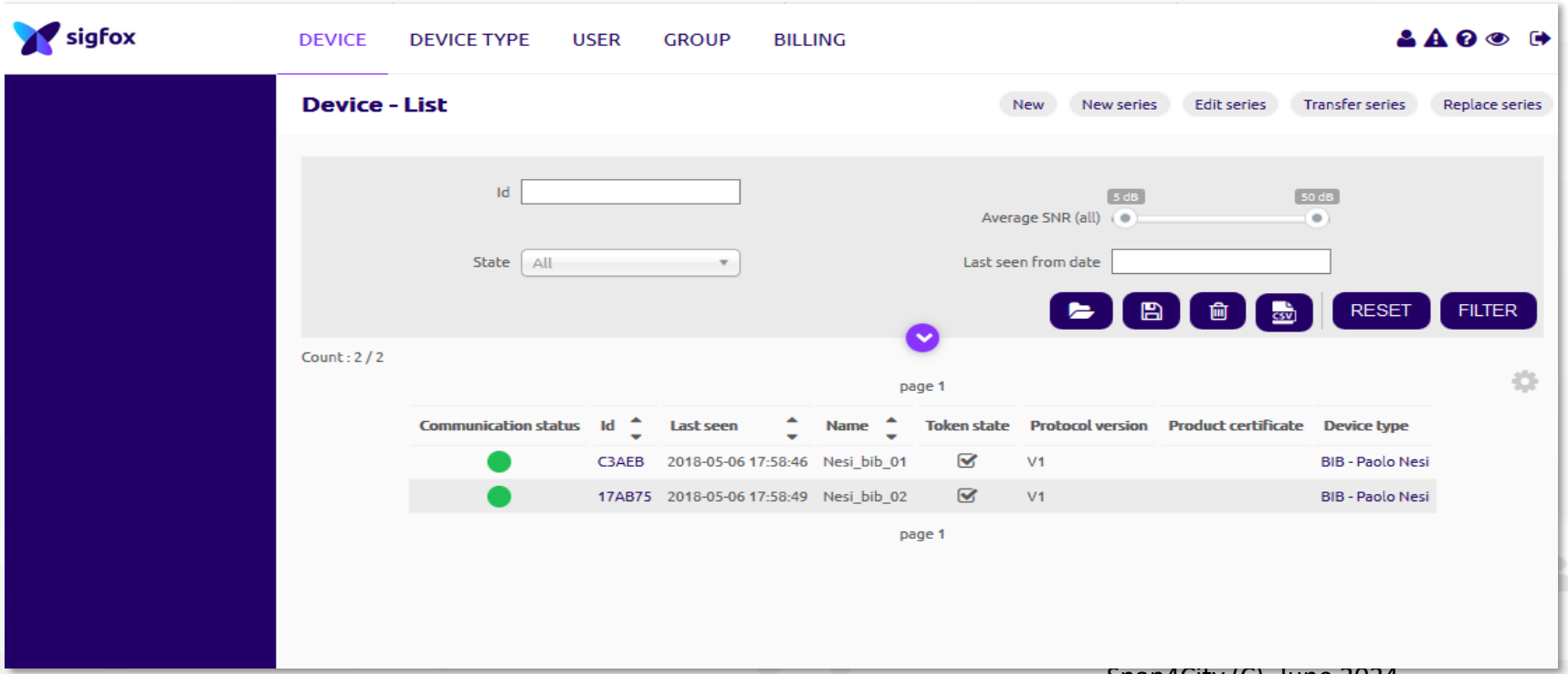
SigFOX gateway Server



SigFOX vs SNAP4CITY

Registered
Managed

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



SigFOX vs SNAP4CITY

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

(i) Registered (ii)

Device/Entity Registration

(1c) static

Directory

triples

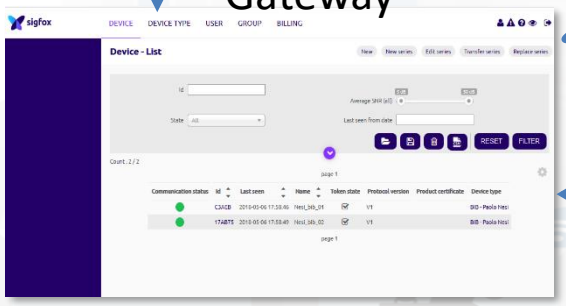
Knowledge Base
Semantic Reasoners

SURI Link

Registered
Managed

(ii)

Gateway



pull

(ii)

IOT App Proc.Logic

push

Orion Broker

IOT Orion Broker

FIWARE

subscription note

Real Time

Indexing and Aggregating
NIFI, OpenSearch

periodic Adapter

IOT App Proc.Logic

Real Time data in Pull, Push
Any gateway, server

Processing if needed

SNAP4CITY

TOP

Adding Features and Modules to Snap4City

100% OPEN SOURCE

SNAP4 Appliances and Dockers **Installations**

UNIVERSITÀ DEGLI STUDI FIRENZE
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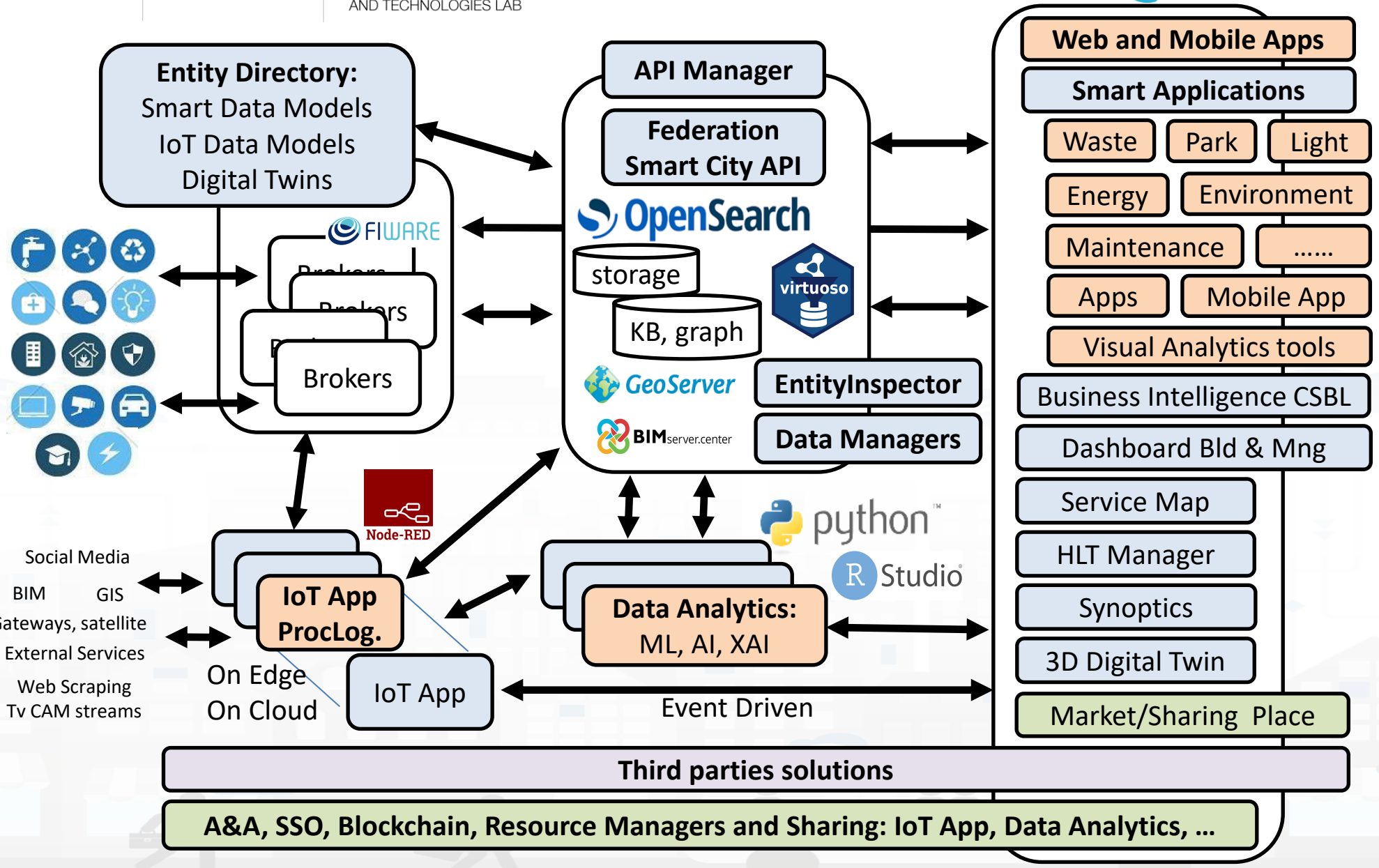
DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB DISTRIBUTED DATA INTELLIGENCE AND TECHNOLOGIES LAB

Tech Arch

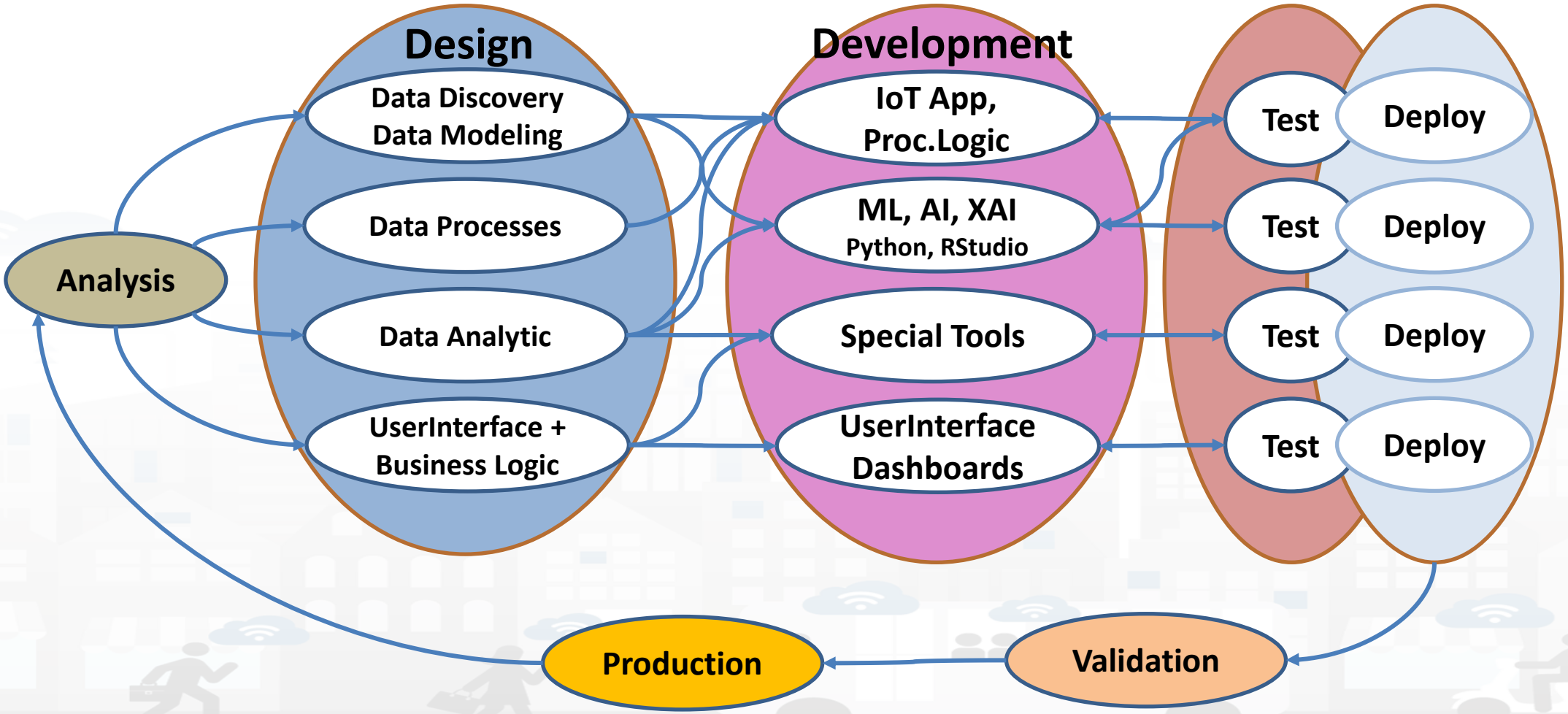
SNAP4CITY KM4CITY



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



Adding new Features

https://www.snap4city.org/692

- **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

https://www.snap4city.org/692

- **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.

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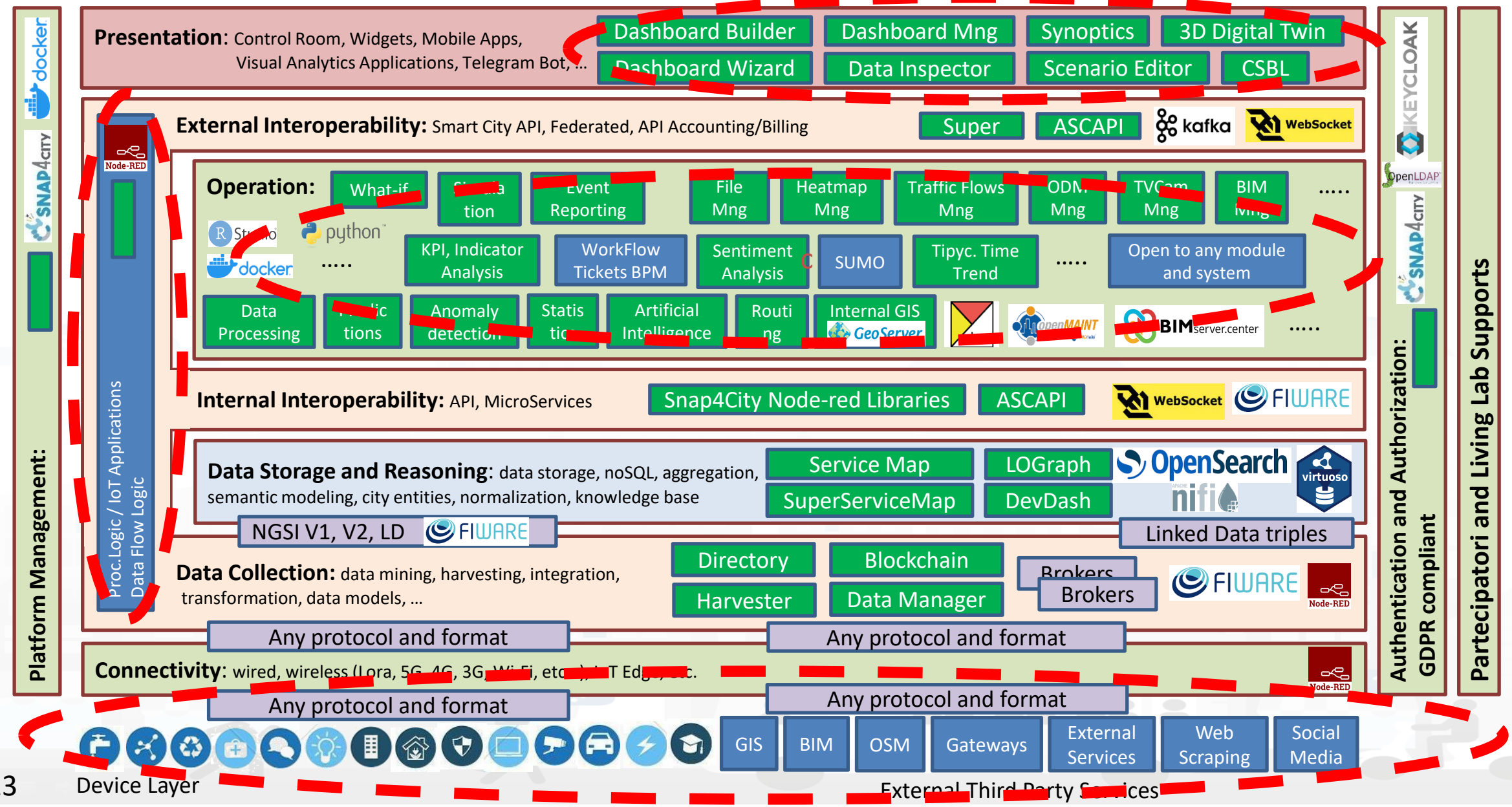
legenda

SNAP4CITY | KM 4 CITY



Constraints

https://www.snap4city.org/692

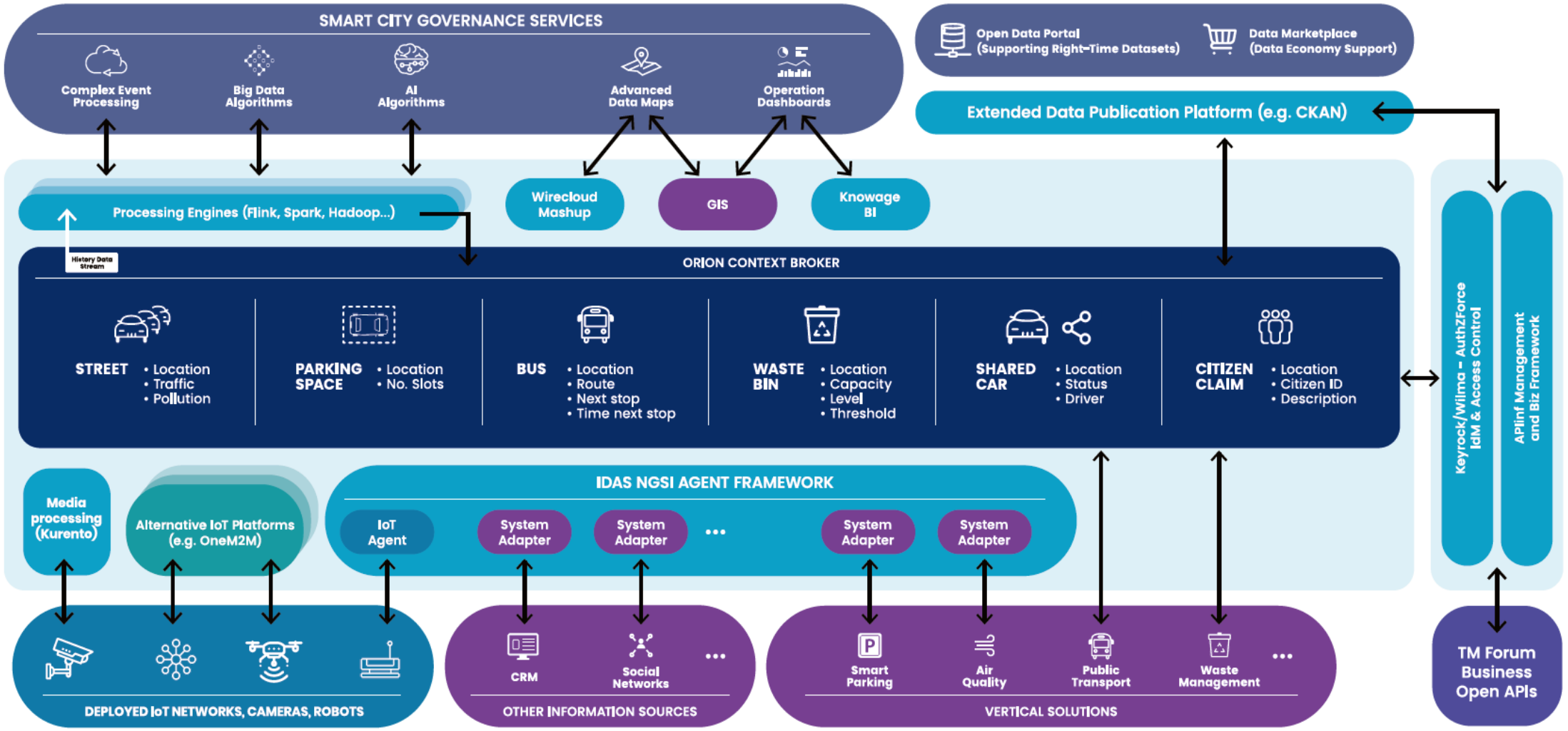
- **new version modules**
  - **to be integrated in the main version,** have to be tested and validated by DISIT Lab. They have to:
    - be in Affero GPL
    - do not affect the functionalities of other modules in negative manner
    - provide the needed quality, in terms of test cases, documentation, 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**

TOP

FIWARE & Snap4City

Powered by FIWARE

THE FIWARE SMART CITIES REFERENCE ARCHITECTURE



- 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

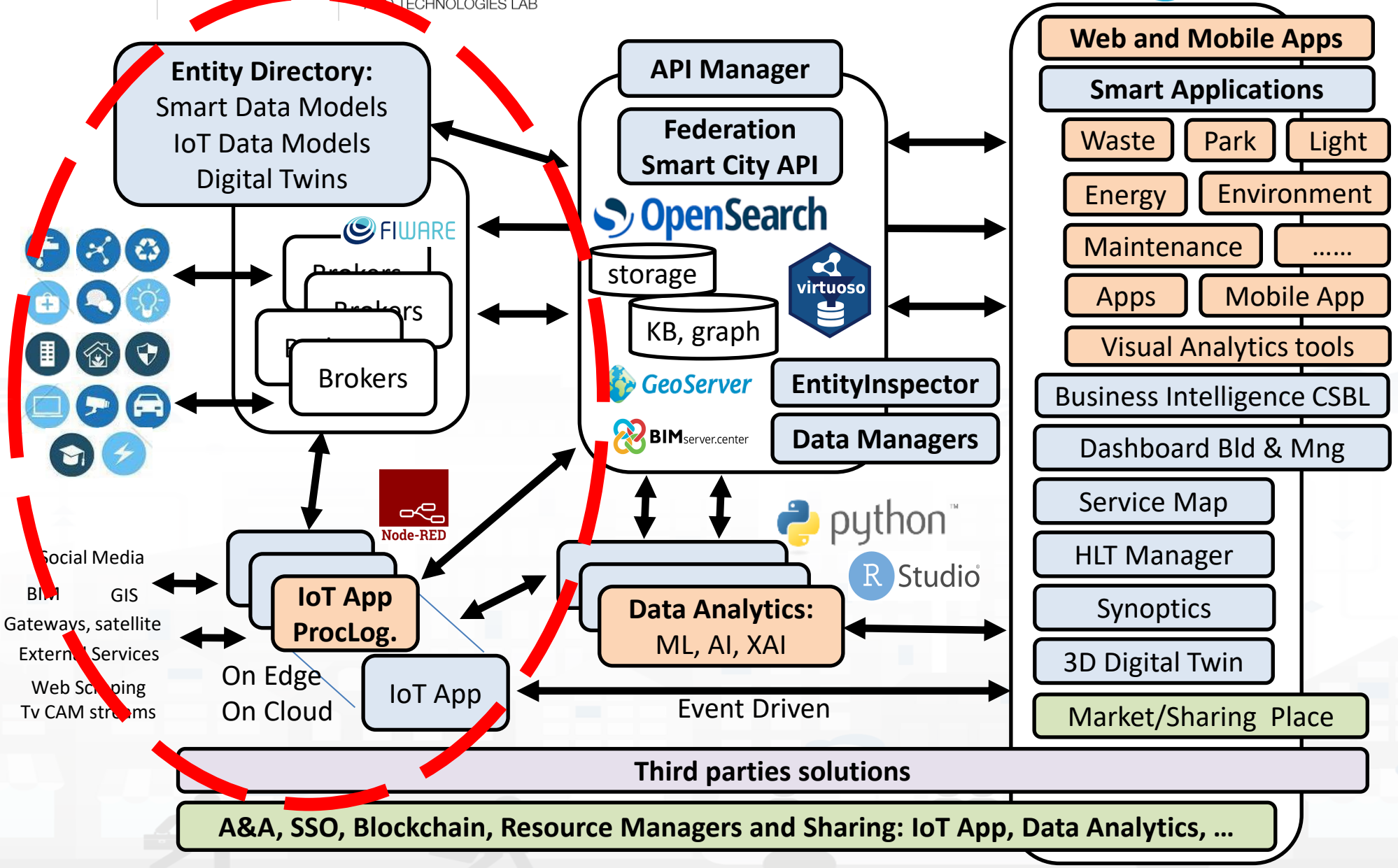
Powered by FIWARE

Overview

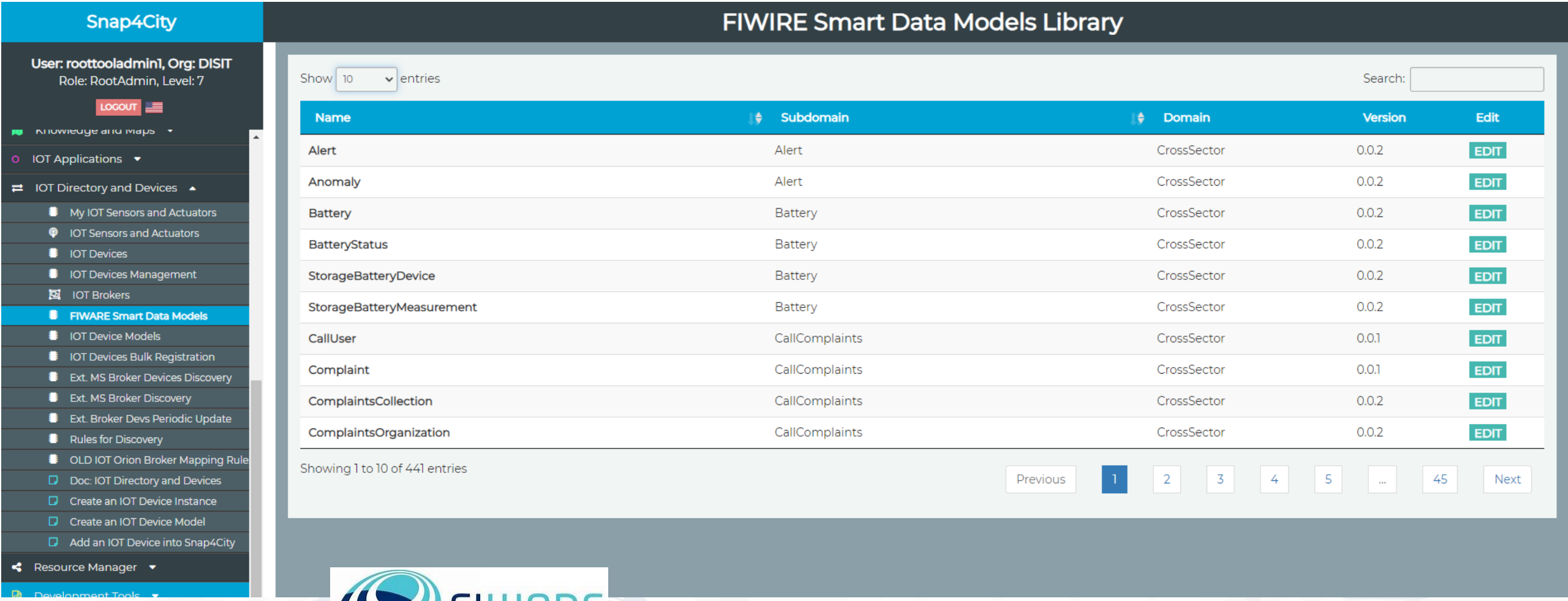
- https://fiware-foundation.medium.com/snap4city-fiware-powered-smart-app-builder-for-sentient-cities-acfe24df49d5
- https://www.snap4city.org/drupal/sites/default/files/files/FF_ImpactStories_Snap4City.pdf

- 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.

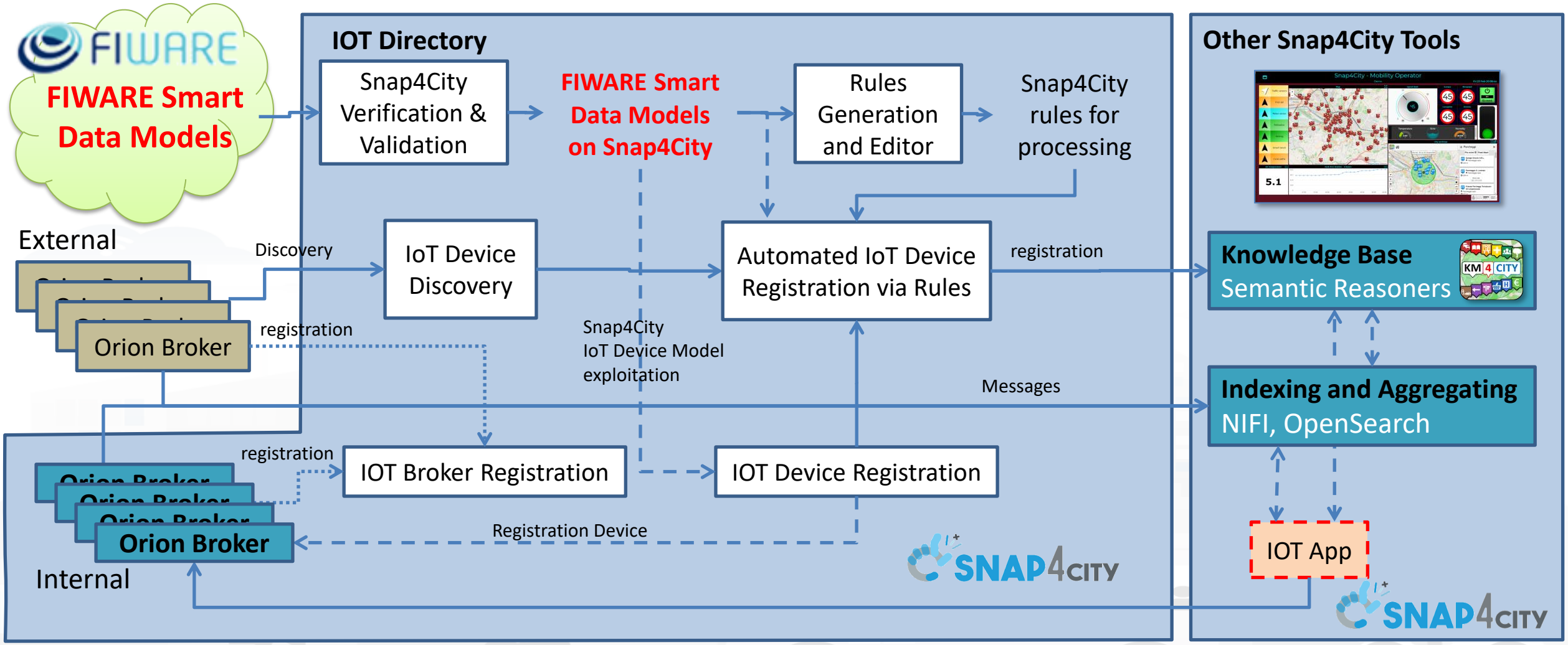
Tech Arch


Entity Directory:
Smart Data Models
IoT Data Models
Digital Twins
FIWARE
Brokers
Brokers
Brokers
API Manager
Federation
Smart City API
OpenSearch
storage
KB, graph
virtuoso
GeoServer
EntityInspector
BIMserver.center
Data Managers
Node-RED
python
RStudio
Social Media
BIM
GIS
Gateways, satellite
External Services
Web Scraping
Tv CAM streams
IoT App
ProcLog.
On Edge
On Cloud
IoT App
Data Analytics:
ML, AI, XAI
Event Driven
Web and Mobile Apps
Smart Applications
Waste
Park
Light
Energy
Environment
Maintenance
……
Apps
Mobile App
Visual Analytics tools
Business Intelligence CSBL
Dashboard Bld & Mng
Service Map
HLT Manager
Synoptics
3D Digital Twin
Market/Sharing Place
Third parties solutions
A&A, SSO, Blockchain, Resource Managers and Sharing: IoT App, Data Analytics, …

FIWARE Smart Data Models -- Library



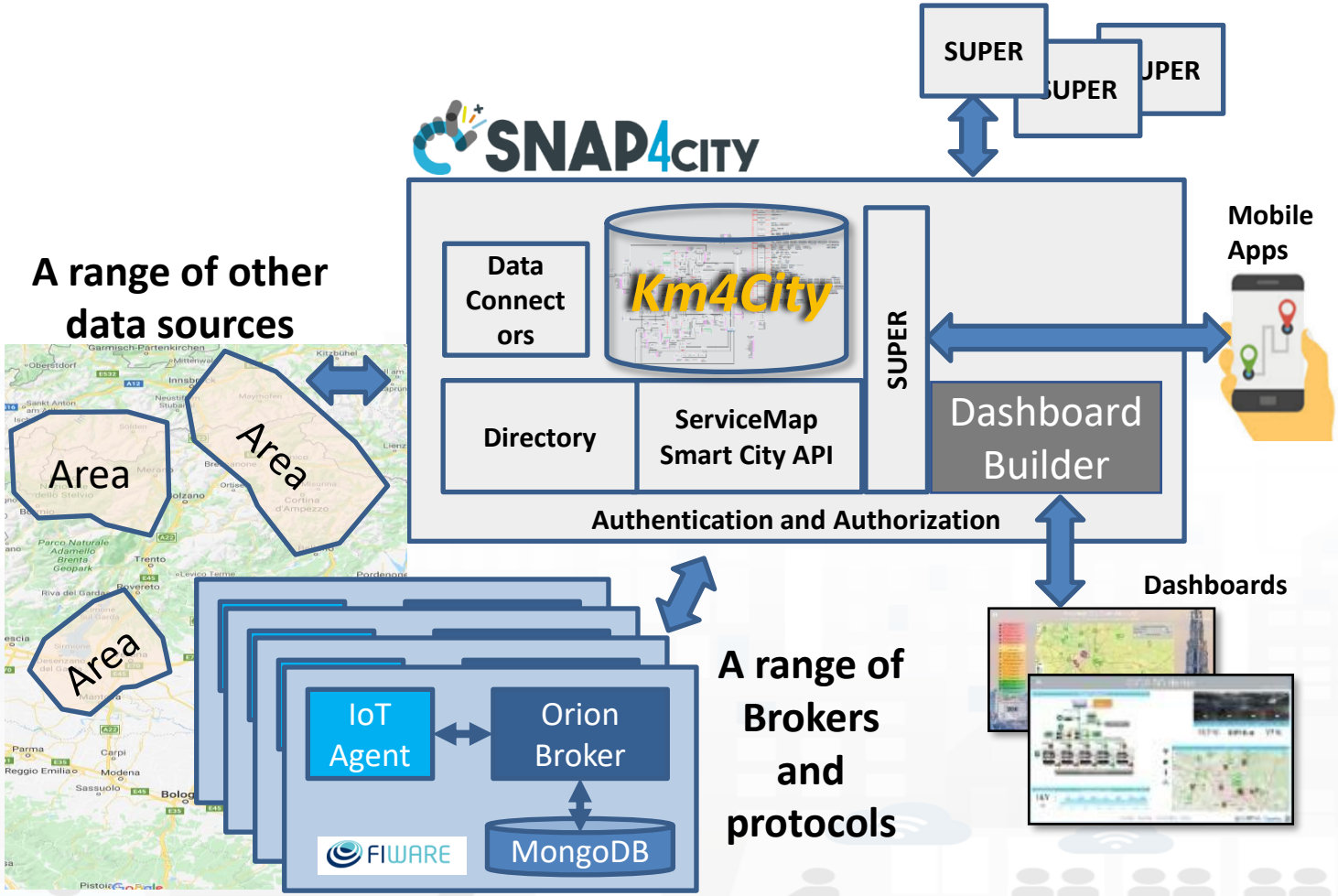
Exploiting FIWARE Smart Data Models



Snap4City and FiWare integration

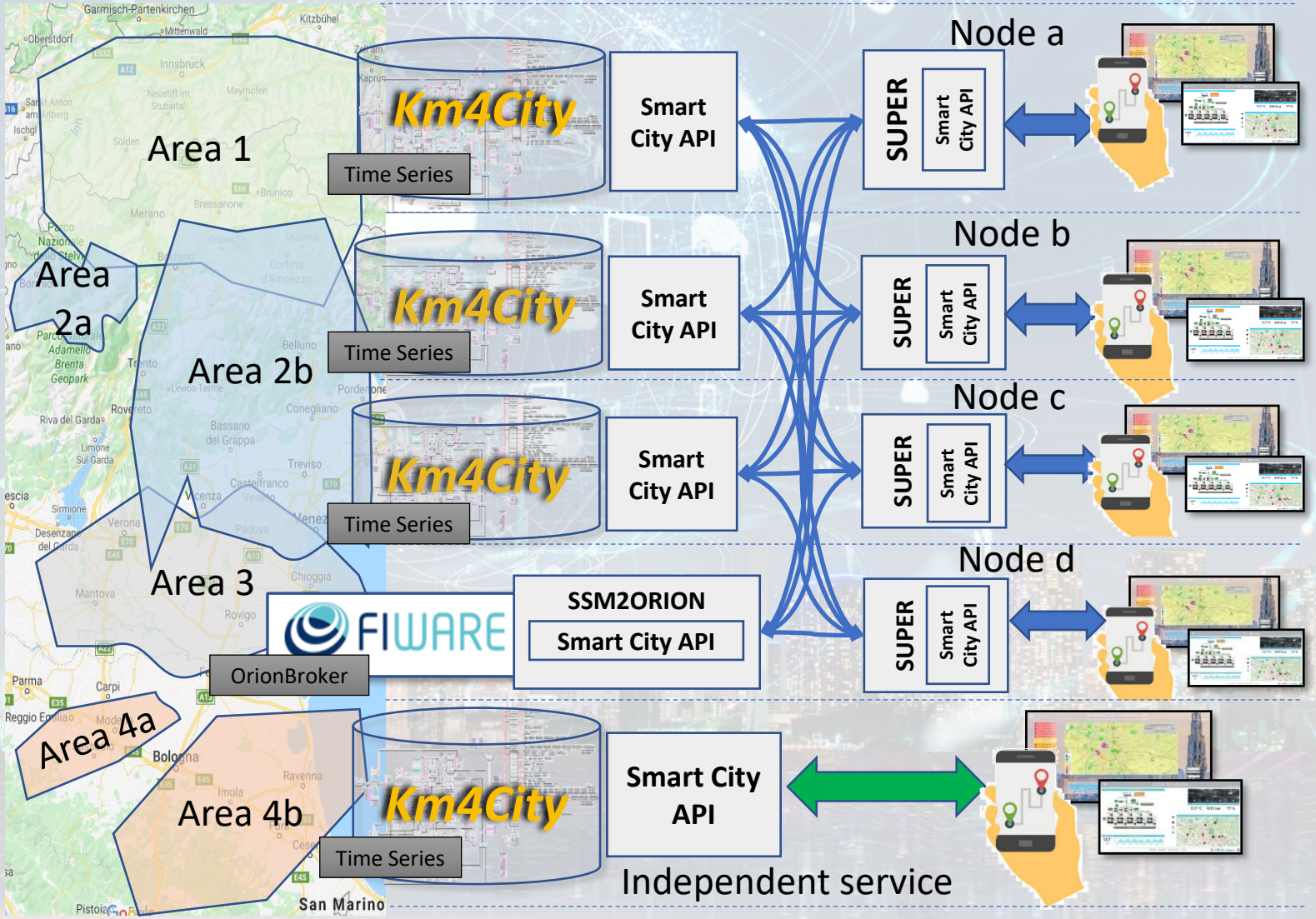
- **A) Orion Broker as an External Broker** of a Snap4City platform
  - Devices are mainly managed by Orion Broker only
  - IoT Directory can harvest devices on Broker to registered them
- **B) Orion Broker is an Internal Broker** of a Snap4City platform
  - This implies that Snap4City facilities are 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



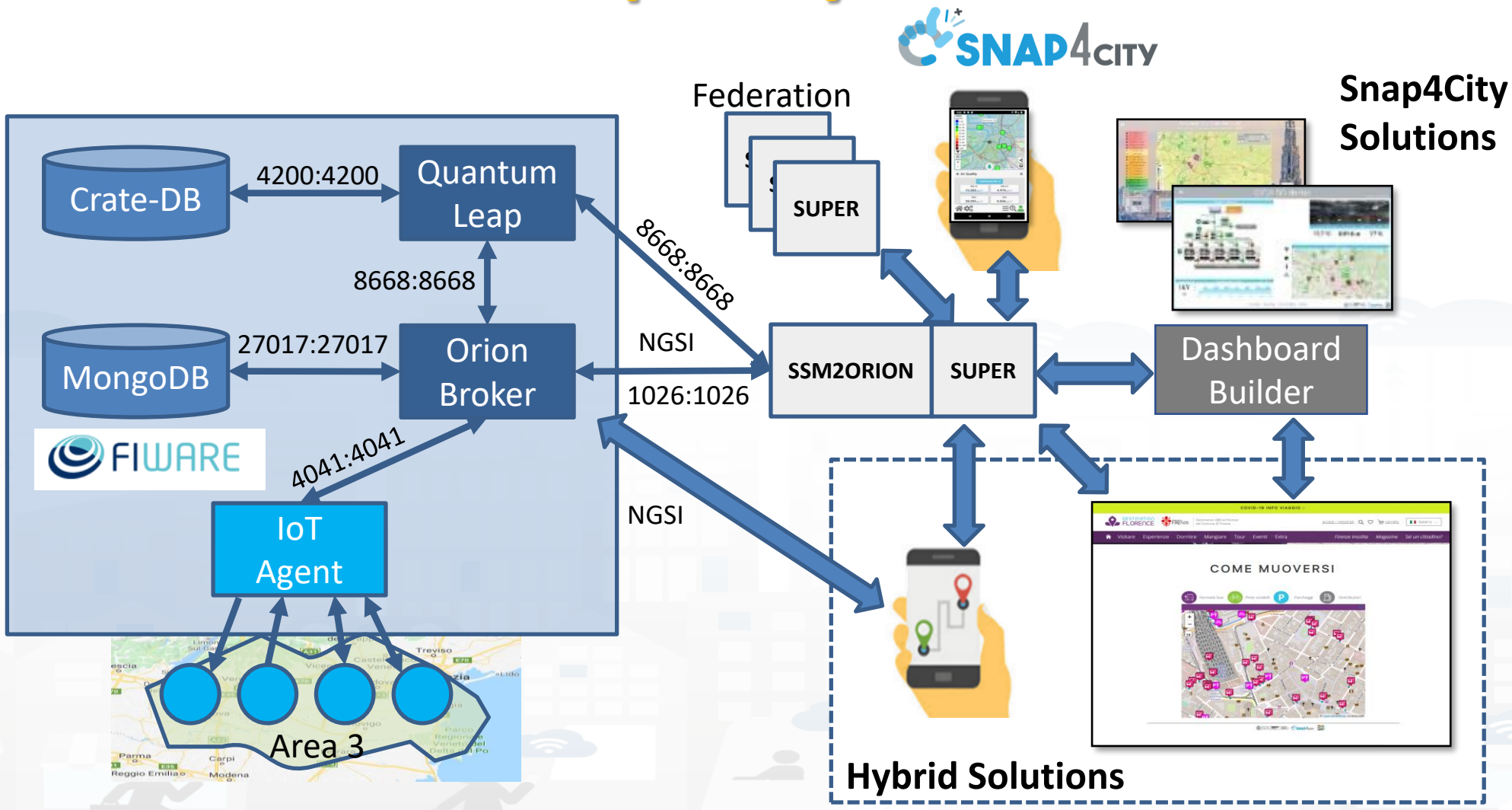
Federation of Smart City Services

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

Federation of Snap4City vs ORION Broker



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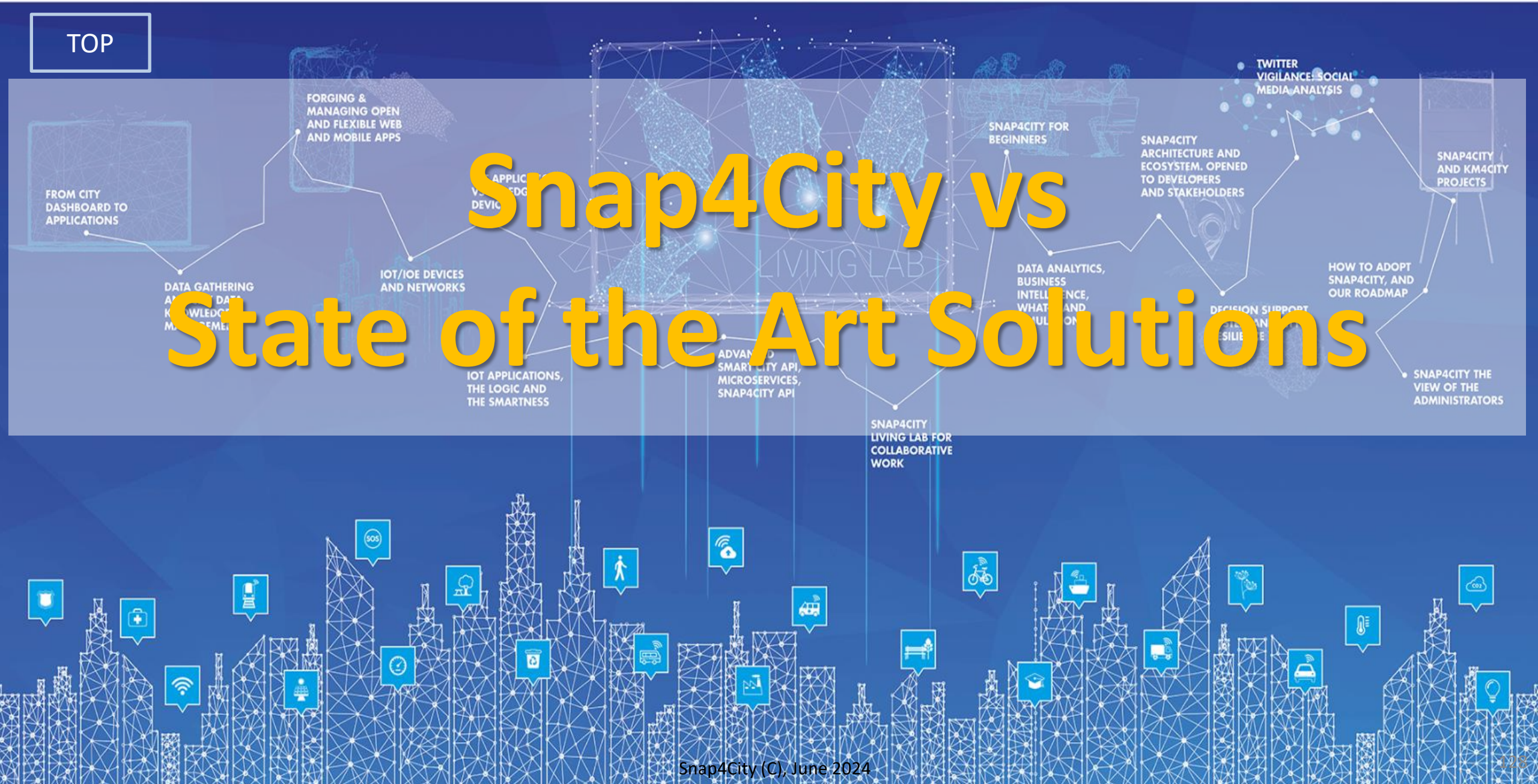
Snap4City vs State of the Art Solutions



Market Solutions

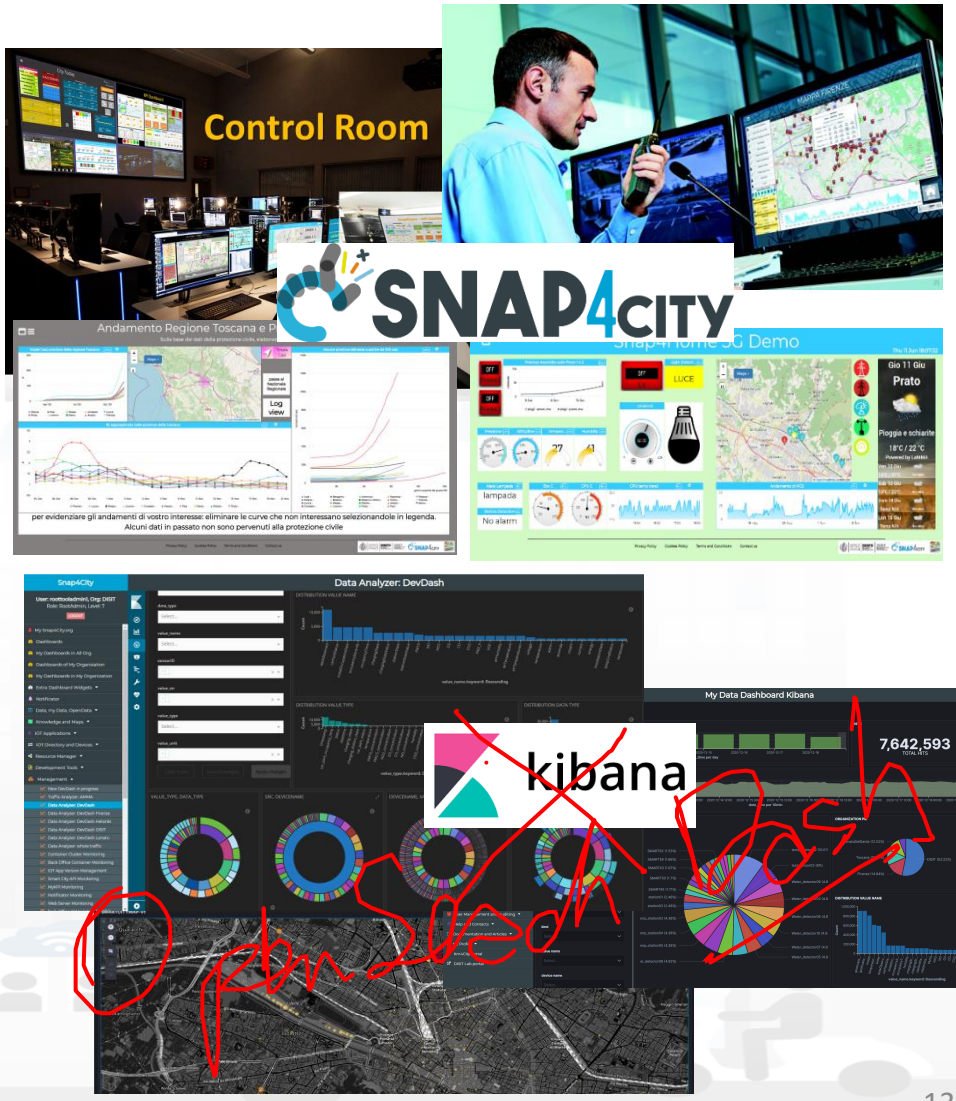
	Open Source end-to-end	Scalability IOT	Execution scalability	Visual Programming end-to-end applications	Advanced Smart City API, MicroServices Multi Domain Semantic Platform	External sevices via API	Standard based Modules and IOT, Open Devices Integrated	Community manmagement Resoruce Sharing	Referral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

TOP

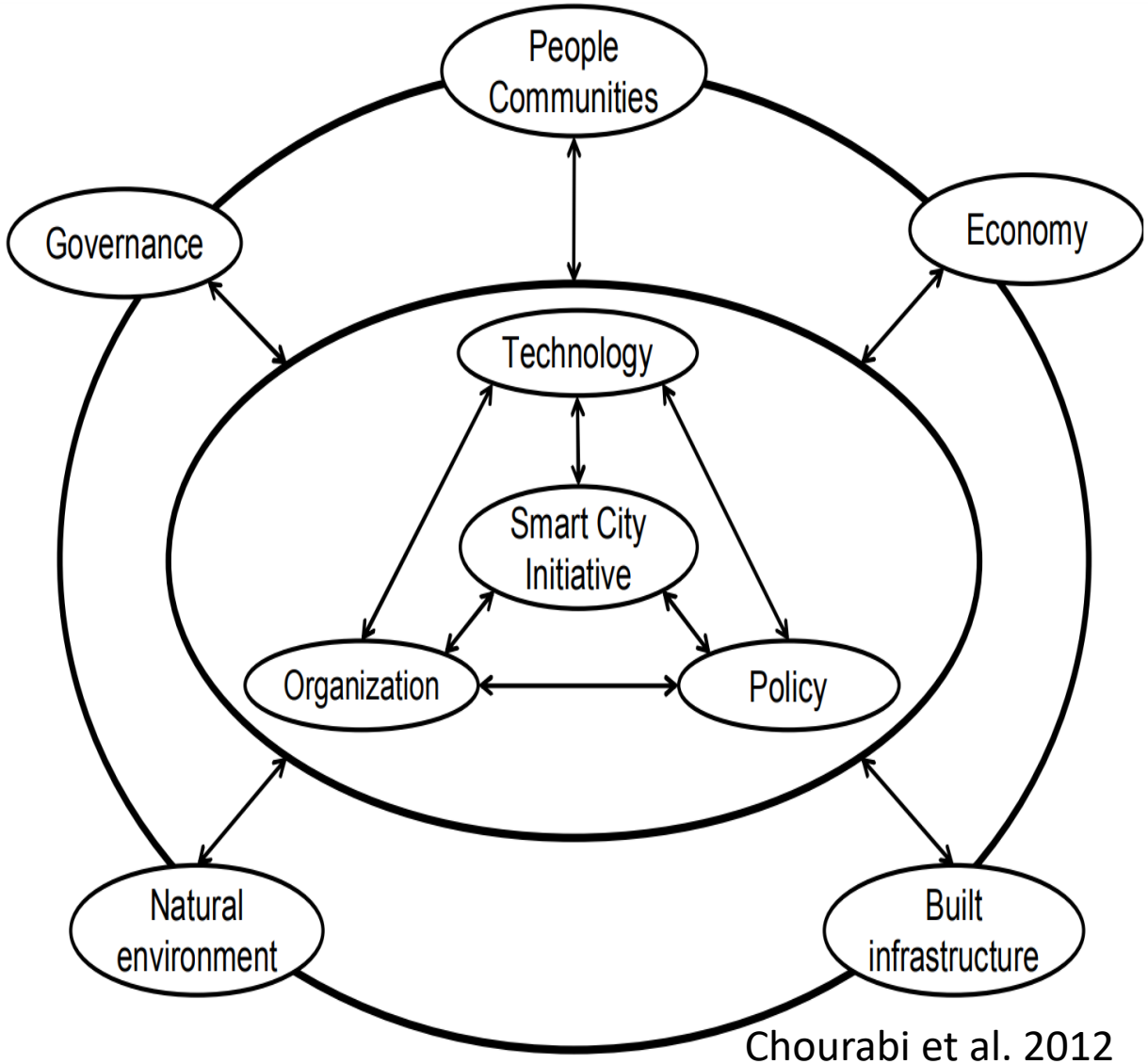
Smart City planning with Snap4City Team Support

Smart City Process

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

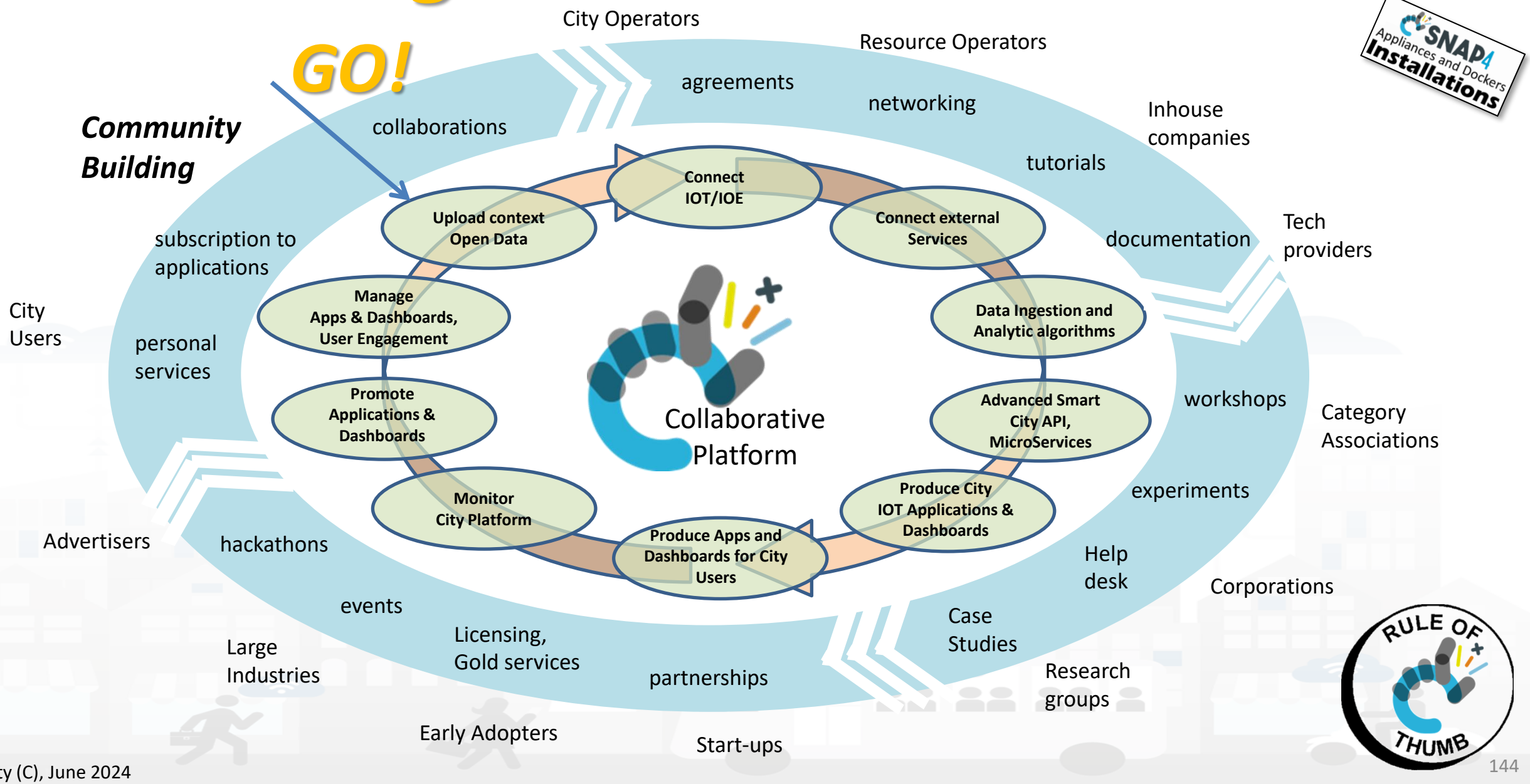
- → *The influence of each of them depends on context, attitude of the institutions, internal structure, etc.*
  - *Parallel actions can conflict, compete …*
  - *Spreading of efforts may distance the goals*
  - *……*

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



Chourabi et al. 2012

Accelerating GO!



Smart City in a Snap Acceleration for Innovation

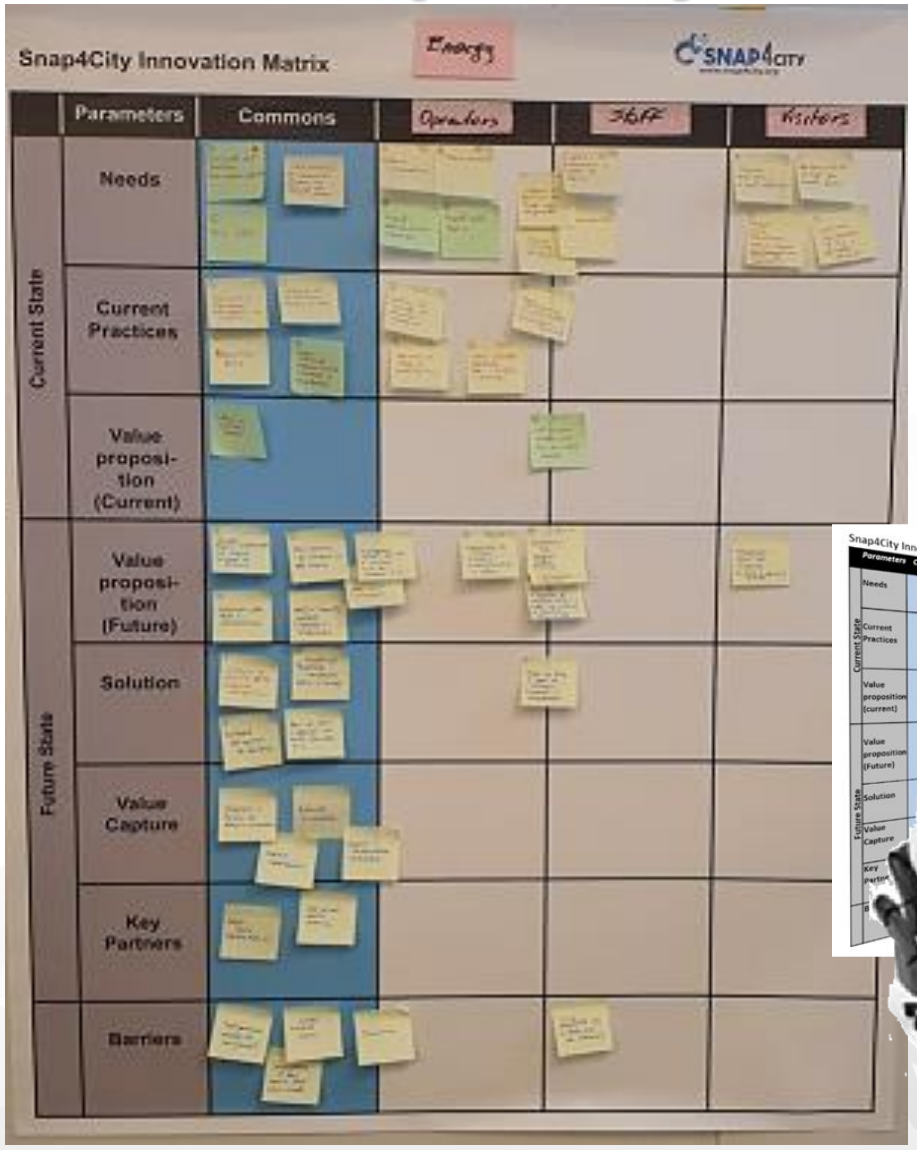
- **Organization/City analysis**
  - requirements analysis, identification of domains
  - Snap4City Innovation Process → Report of Scenarios vs Data
  - Data Analysis → Report as Data Table
- **Smart City Design for Innovation:**
  - Design of main Scenarios and Tools (Dashboard, SCCR, Apps, IOT Network, new data, etc.) → Report as Mock-up Design
- **Next phases**
  - Data Ingestion and Data Warehouse
  - Scenarios Implementation

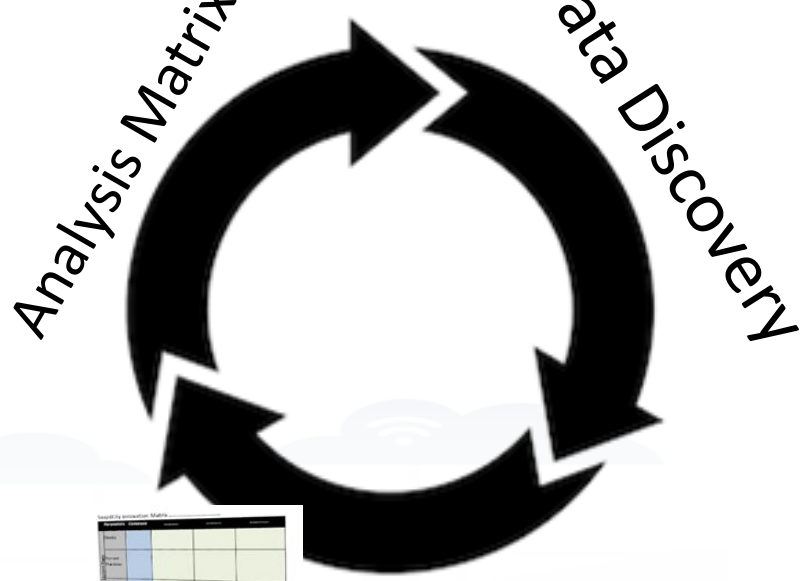
Analysis and Design for Innovation (Co-Creation and Co-Working)

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

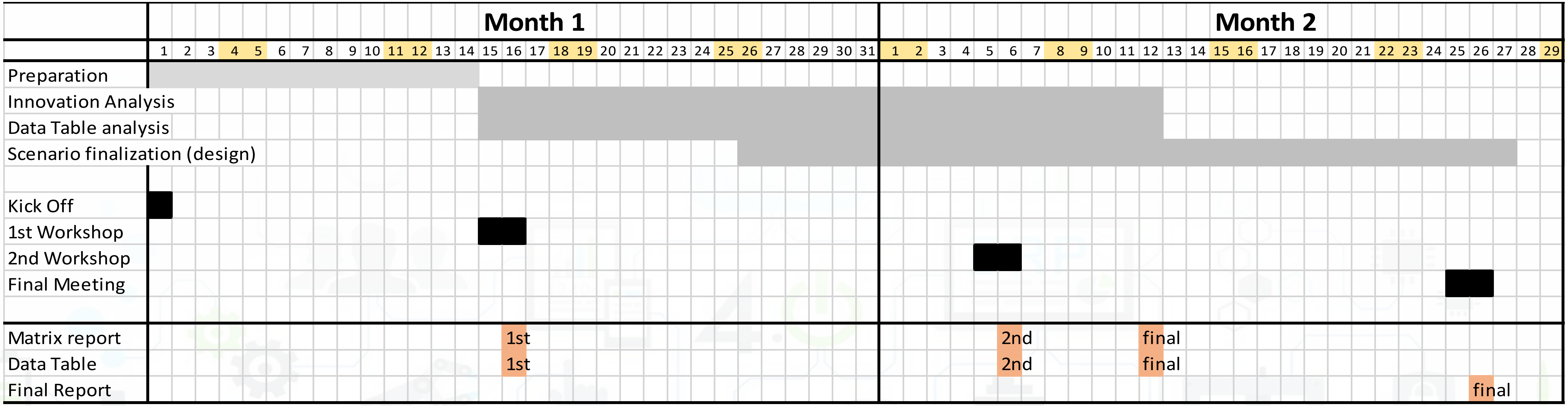


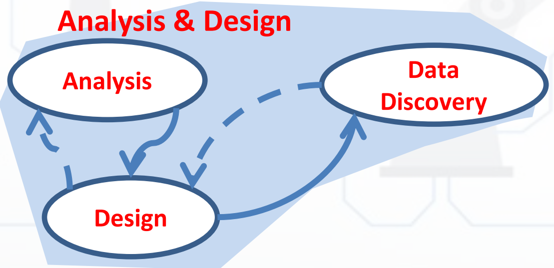


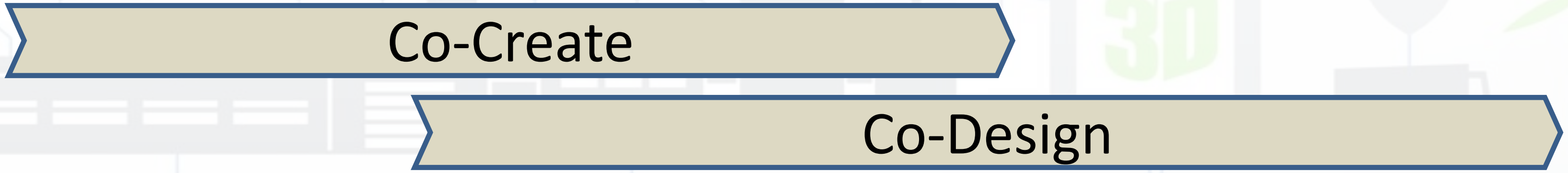
Realistic Timing for a small size example

Only for:

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







Analysis for Innovation

Snap4City Analysis for Innovation

- **Analysis**
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  - 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)

- 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?		

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

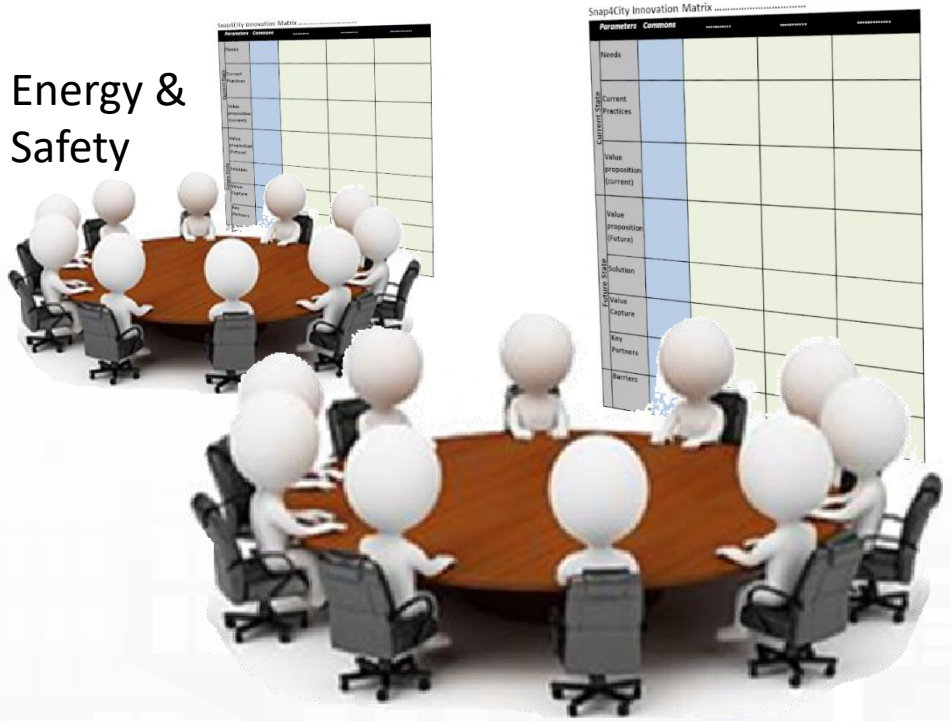
Snap4City Innovation Matrix .....

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

Meeting Organization

Mobility and Transport

Energy & Safety



Security & Resilience

For each table:

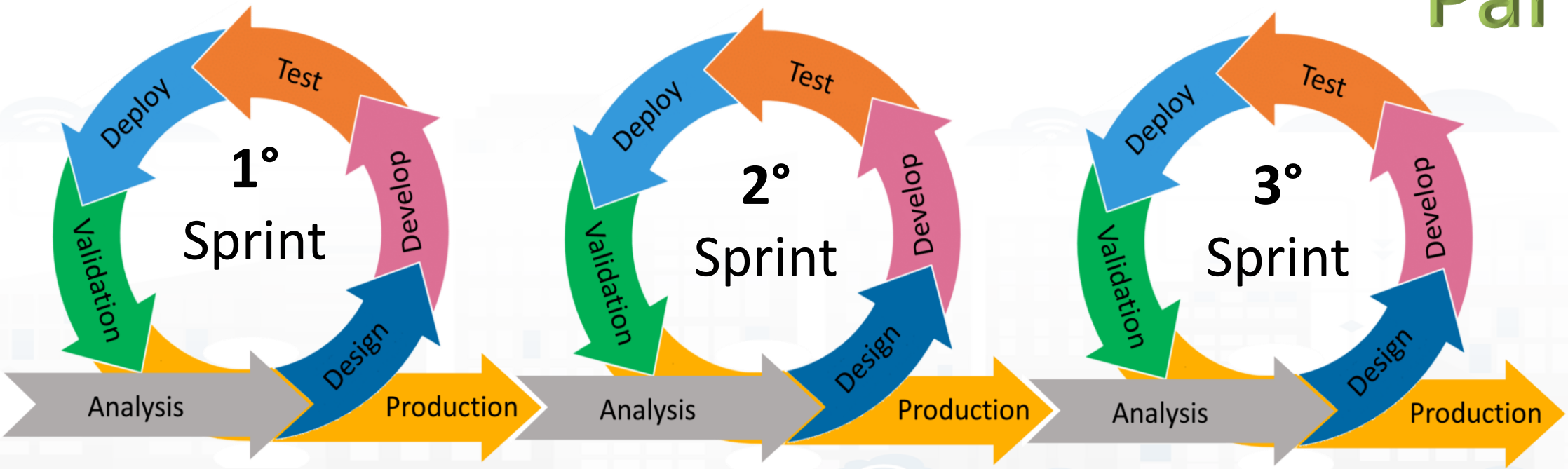
- Experts of the domain specific
- Experts of different customers segment
- Operative people
- ICT people
- Decision Makers
- Etc.

Recall to Smart City
Development Life Cycle

Agile Development Life Cycle by sprint Smart Solutions

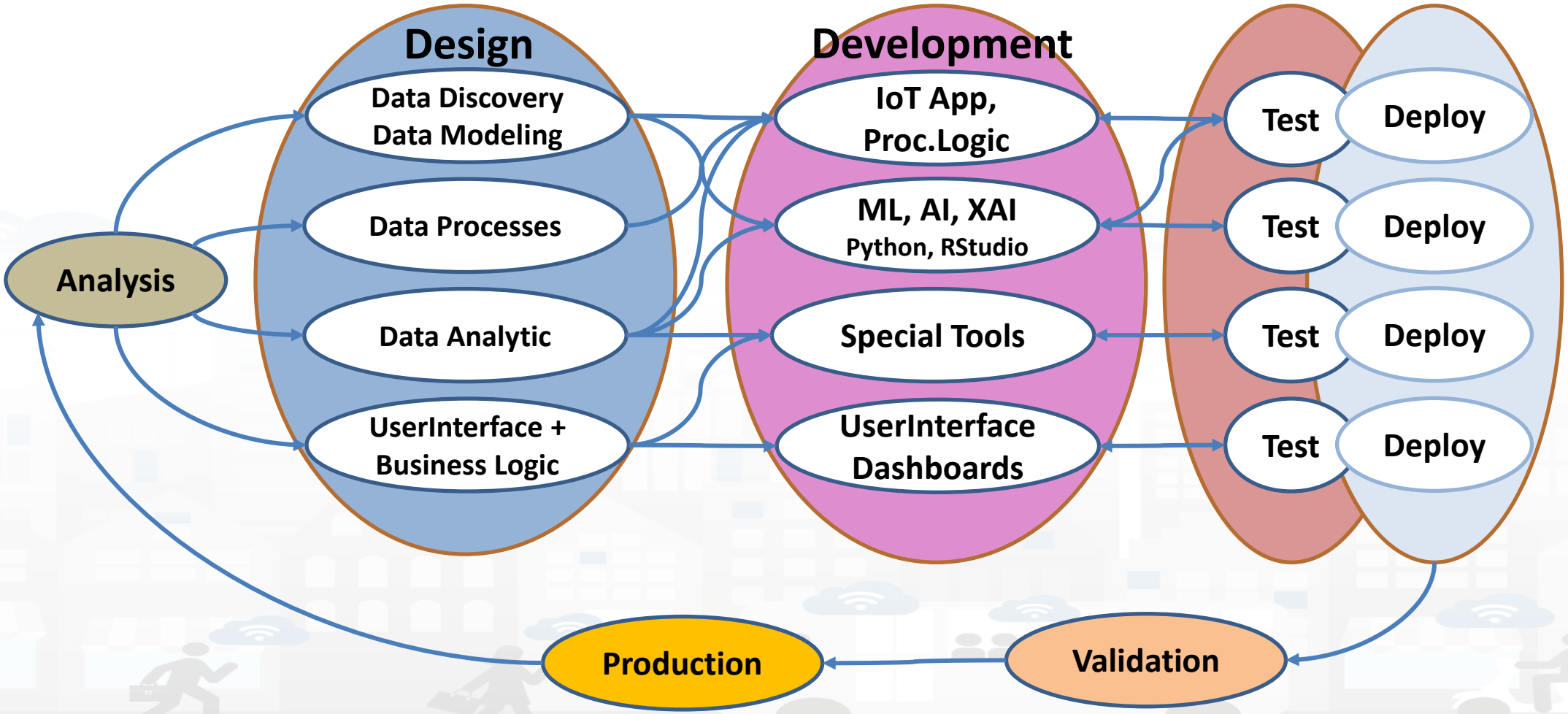
RULE OF THUMB

Part 8



Development Life Cycle Smart Solutions

Part 8



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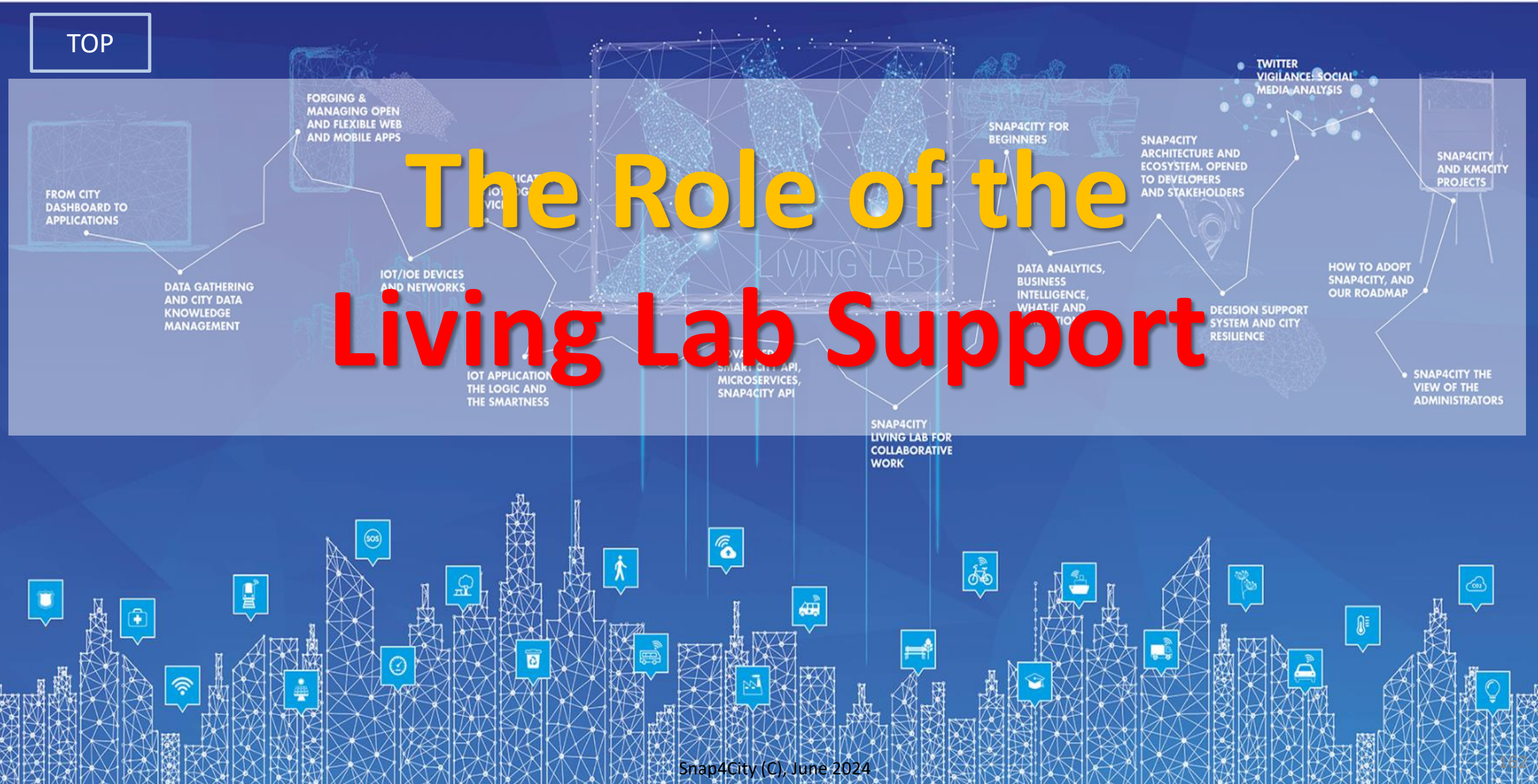
The Role of the Living Lab Support



Context and Life Cycle and 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/

https://www.snap4city.org/558

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

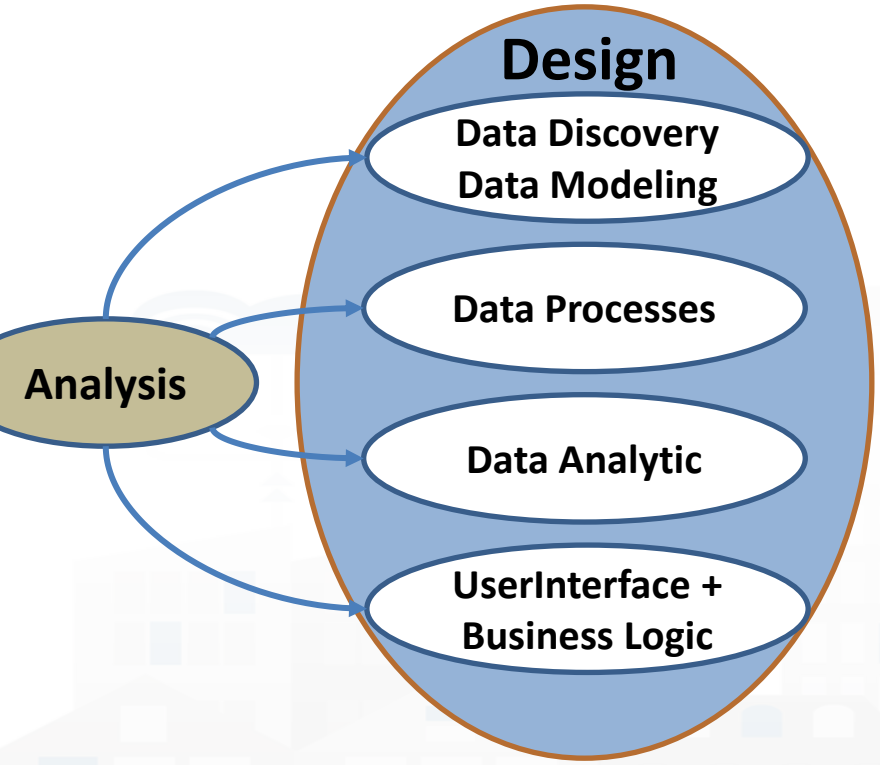
- **Pros:**
  - Lower costs, highly scalable
  - Attractive for young generation
  - accessible H24/7
  - Attractive for multi language and multicultural communities
  - Easy process for engagement since the people can dedicate to the Living Lab a portion of their time without spending time on traveling, 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.

Your Level

All Tools

Welcome: how to start using Snap4City for beginners

Personalized Suggestions

Snap4City developers suggest you reading:

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

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

See this ... case for development ... of the above possibilities:

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

Exercises

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

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

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

SLIDES

Flyer

News

VIDEOS

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

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

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

Your Org

Organization Groups

DISIT
- Operativo

Last Art.

Recent comments

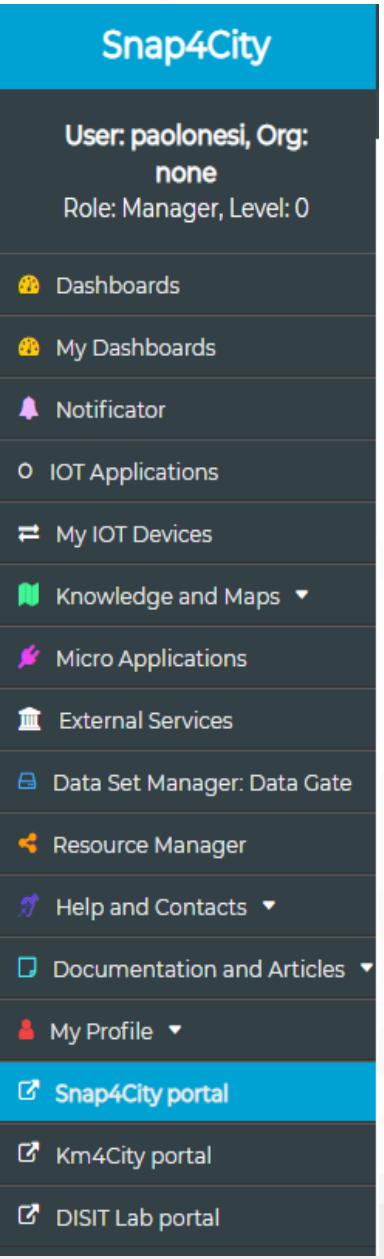
- 1 month 6 days ago

Recent content

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

Benvenuto al nostro Sindaco ed al suo Team
new
roottooladmin1

We suggest Antwerp Developers: How to manange my Dashboards



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 ac

1. Enter in the main application https://main.snap4city.org and log
   - Main --> dashboards
2. On the left column main menu click on Dashboards item. The preview of the dashboards available for the user will be shown.
3. The Dashboards page shows the preview of dash ards created by the user (identified as "My own"), public dashboards accessible only in view, private dashboards that the user can 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

Username: PaoloNesi

Powered by www.km4city.org

Search

Search

Recent comments

- 1 week 1 day ago

Recent content

Welcome: how to start using Snap4City for beginners
drupaladmin

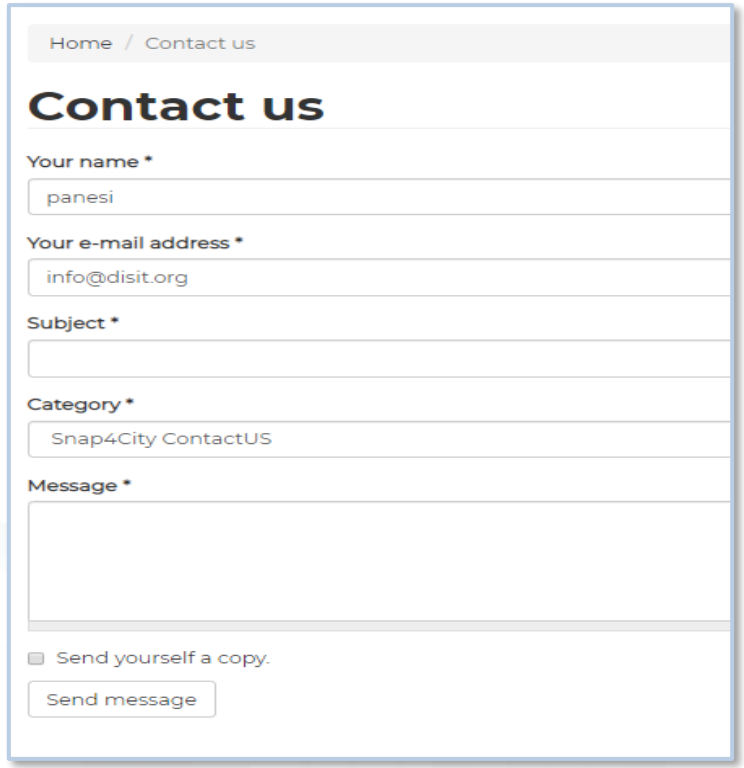
Snap4City - scalable Smart aNalytic APplication builder for sentient Cities
new
drupaladmin

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, …

Help Desk and SLA

- https://www.snap4city.org/drupal/contact
- Bug Reporting
  - https://docs.google.com/forms/d/e/1FAIpQLSfDQtKqgLIlyycNXiazeYEh1SsRG1YL8Ze4ThD8nZoA5jsoXw/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



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

Snap4City

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

- Dashboards
- My Dashboards
- Notificator
- IOT Applications
- My Personal Data
- IOT Directory and Devices
- Knowledge and Maps
- Micro Applications
- External Services
- Data Set Manager: Data Gate
- Resource Manager: Process Loader
  - View Resources
  - Managing Resources
  - MicroServices for IOT Applications
  - Process Models
  - Processes in Execution
  - Process execution Archive
- Development Tools
- Management
- Settings
- User Management and Auditing
- Help and Contacts
- Documentation and Articles
- My Profile
- Snap4City portal

View Resources

Pages: Prev 1 2 3 ... 12 Next

dev

Reset | Username | Nature | Sub_nature | License | Resource_type | Format

- IoTApp (118)
- ETL (53)
- MicroService (8)
- AMMA (4)
- R (3)
- DevDash (2)
- IoTBlocks (2)

Florence_Pharmacies_CSV.zip
developer1: Public
Username: developer1
Resource type: ETL
Nature: geolocated
Description: Florence Pharmacies o...
View Edit Unpublish Owner

S...
developer1: Public
Username: developer1
Resource type: ETL
Nature: sensors
Description: Smart bench
View Edit Unpublish Owner

DeveloperDash-V3-1523555417880
snap4city: Private
Username: snap4city
Resource type: DevDash
Nature: data category (ie: geolocat...
Description: Snap4city Developer D...
View Edit Publish Owner

node-red-contrib-snap4city-developer.rar
snap4city: Private
Username: snap4city
Resource type: IoTBlocks
Nature: data category (ie: geolocat...
Description: Snap4city NodeRed Li...
View Edit Publish Owner

PaoloApplication.json
developer1: Private
Username: developer1
Resource type: IoTApp
Nature: data category (ie: geolocat...
Description: NodeRed Flow Shared ...
View Edit Publish Owner

AMMADashSnap4City-30minview-v2-152...
developer1: Private
Username: developer1
Resource type: AMMA
Nature: ToBeDefined
Description: AMMA snap4city dash...
View Edit Publish Owner

Developer Dashboard New-1526308876256
developer1: Private
Username: developer1
Resource type: DevDash
Nature: ToBeDefined
Description: Developer Dashboard ...
View Edit Publish Owner

ResDash Docker-1526308998809
developer1: Private
Username: developer1
Resource type: ResDash
Nature: ToBeDefined
Description: Resource Dashboard: ...
View Edit Publish Owner

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

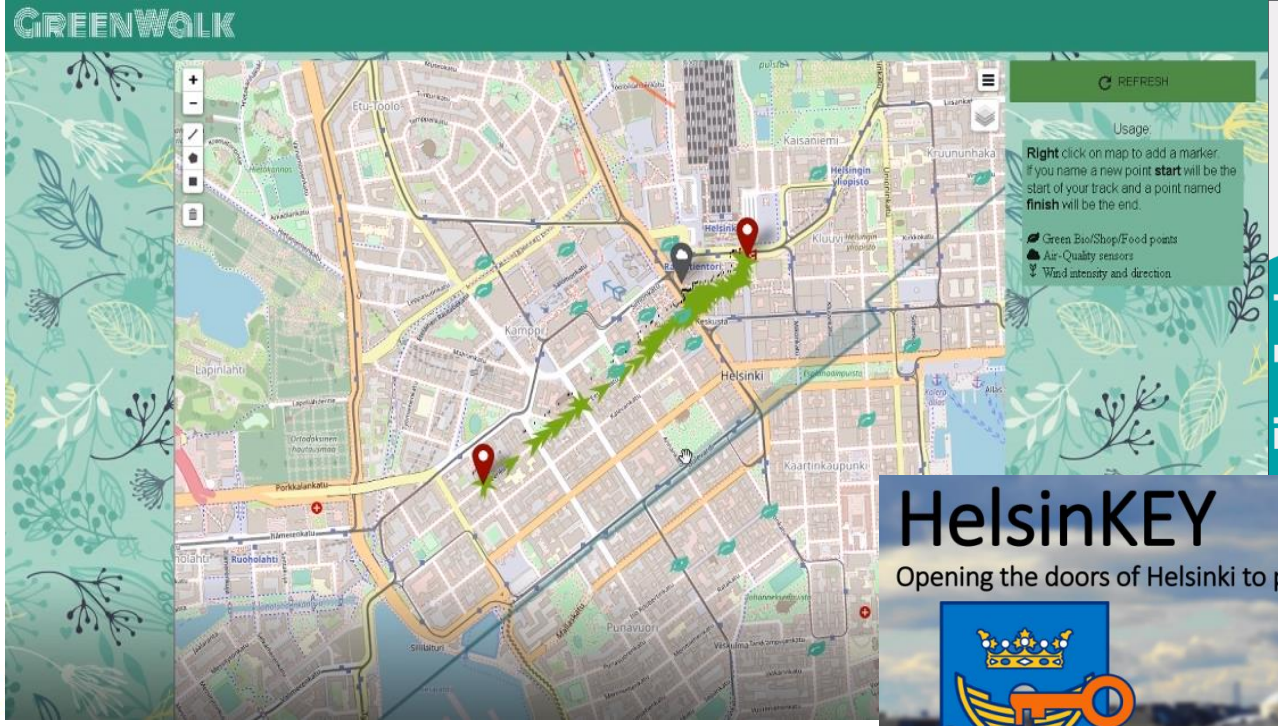
Hackathon Organization

- 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



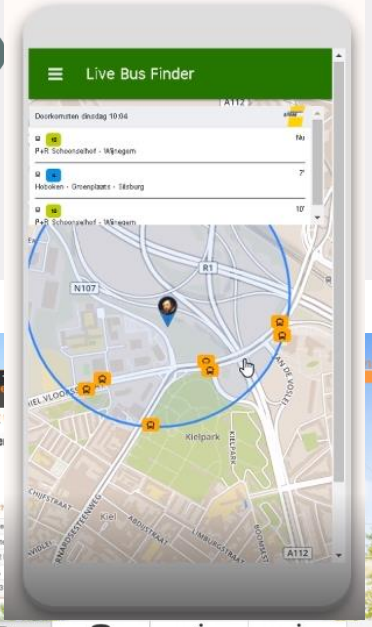
The End
Details
Data
App
Context
About

Greenifiers

BIG DATA FOR SMART CITIES

An app for sustainable mobility

ndrea Pescetti



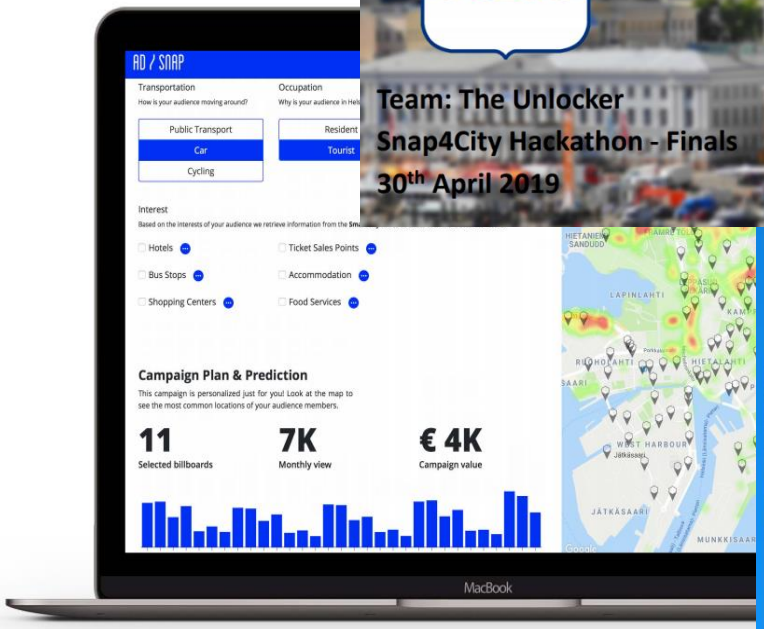
Data-driven design platform for offline advertising

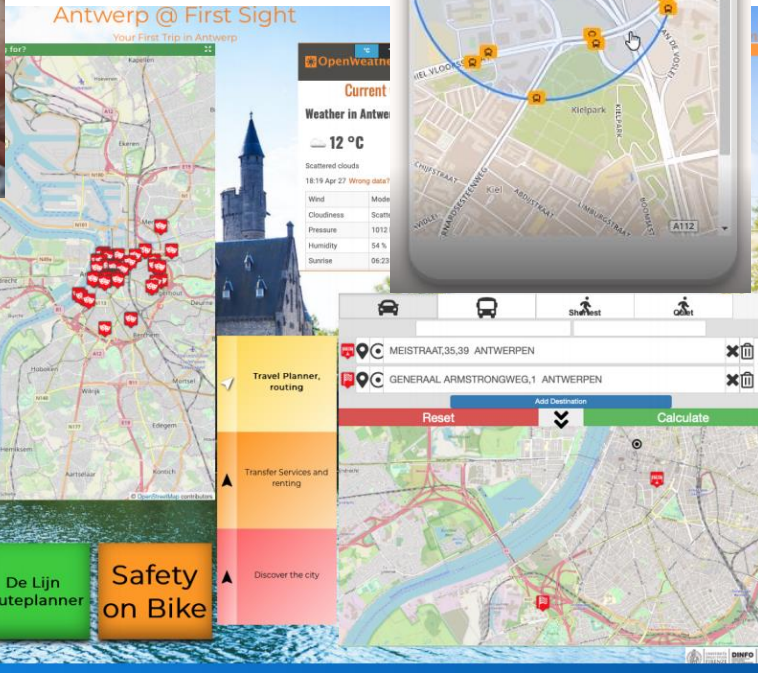
Built on big data to determine the most popular location for a customer group

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.





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

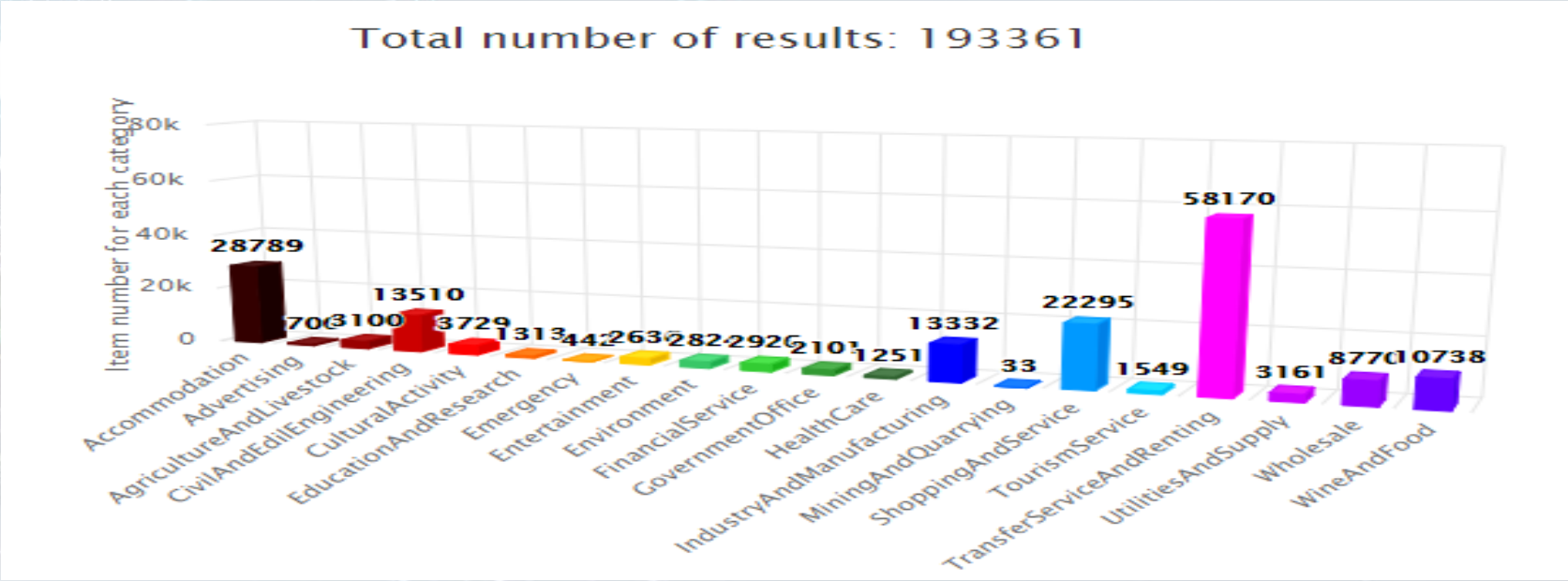
Hackathon Data Focus

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



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.

TOP

Snap4City Platform: Administration Overview

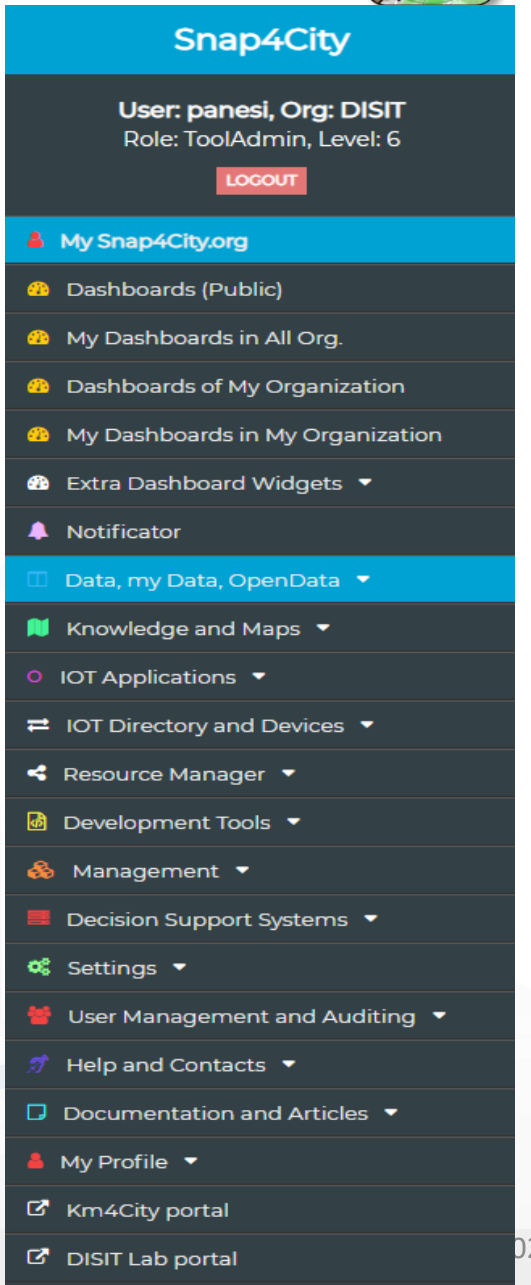
Roles in Snap4City/Industry solutions

- **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

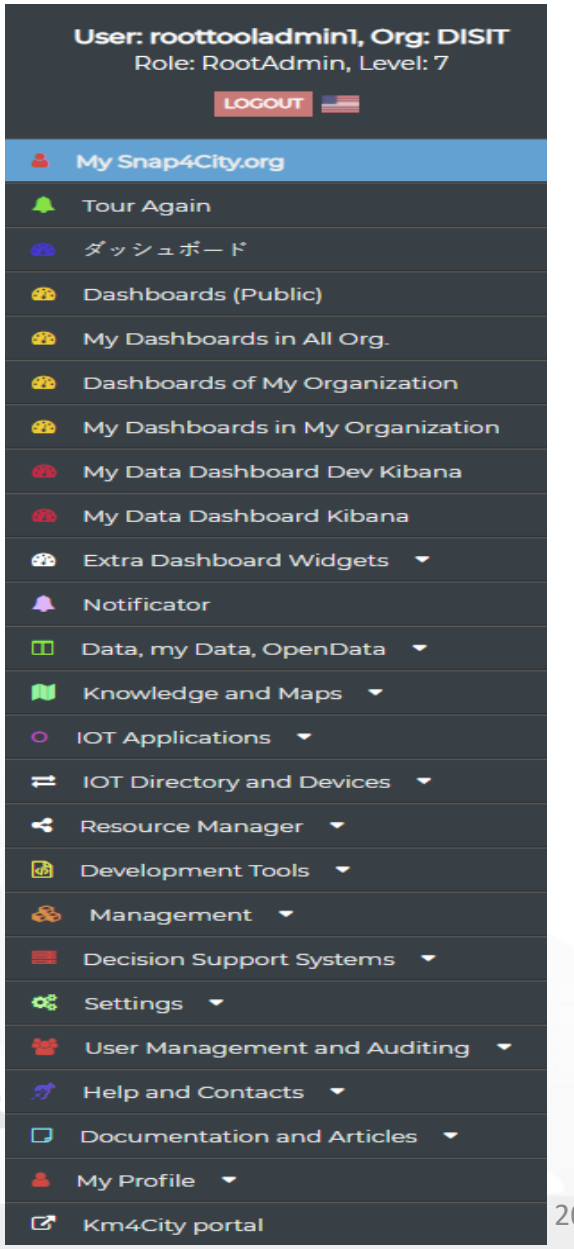
- **Organizations/Tenants** may have
  - name, ID, GPS center, a number of Groups on Snap4City.org (living lab support Drupal)
  - users of different kinds and may impose early bounds on the resourced used by users (IOT Dev, IOT App, Dash)
  - on cloud user kinds up to level of Tool Administrator
  -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



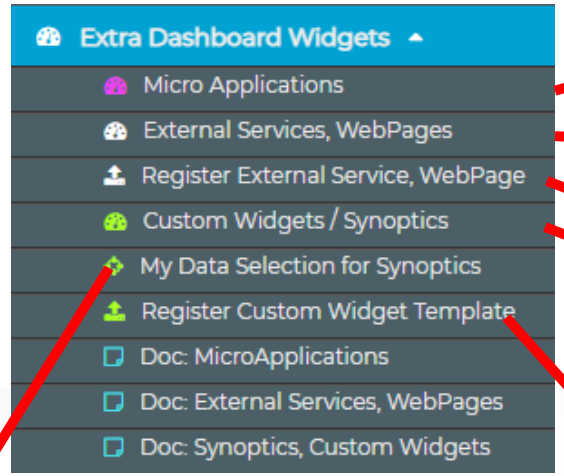
RootAdmin

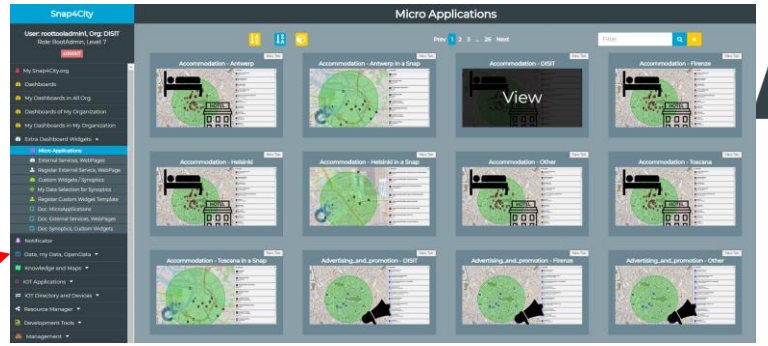
- RootAdmin on Snap4City.org has a very large set of tools
  - My Snap4City, ….Tour, etc.
  - Dashboards
  - **My Data Dashboard (Kibana)**
  - **Extra Dashboard Widgets**
  - Notificator (deprecated)
  - **Data, My Data, OpenData**
  - **Knowledge and Maps**
  - **IOT Applications**
  - **IOT Directory 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.

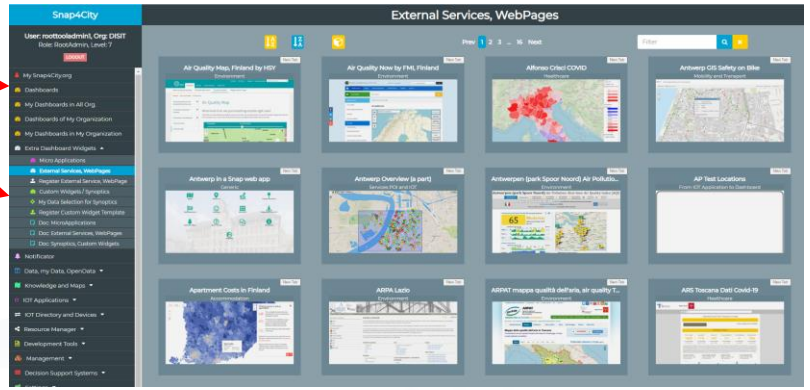


Extra Dashboard Widgets

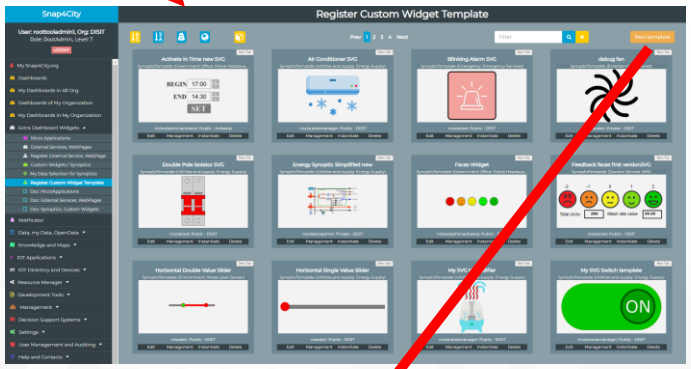


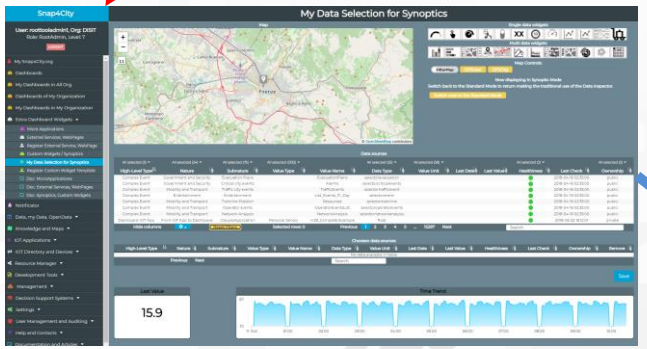


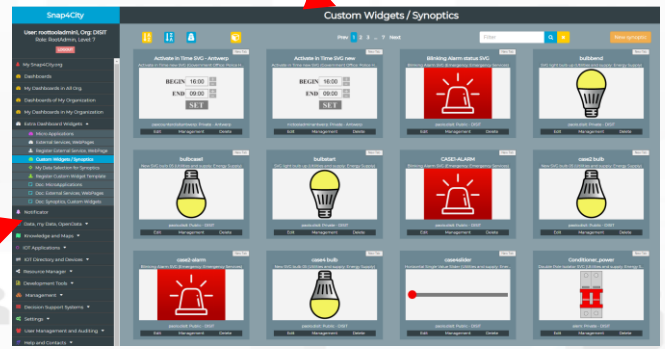
MicroApplic.



External Services

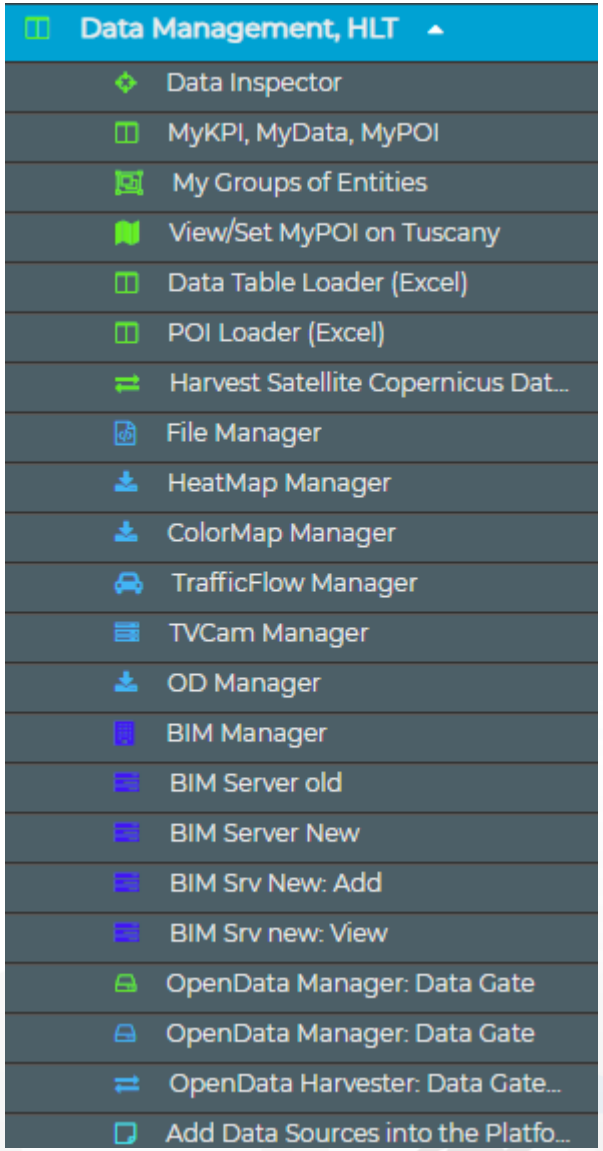






Synoptics, Custom

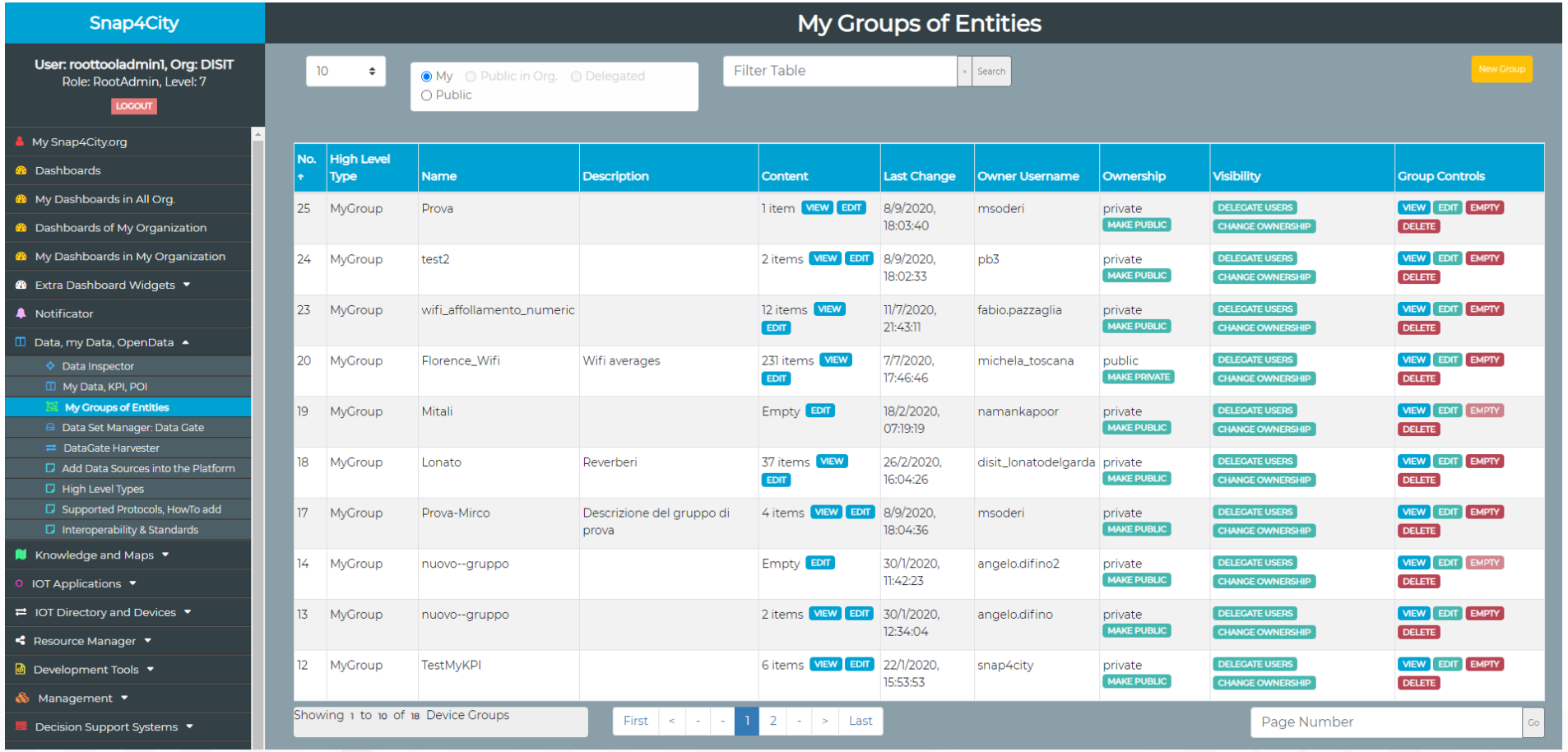
Data My data



- **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

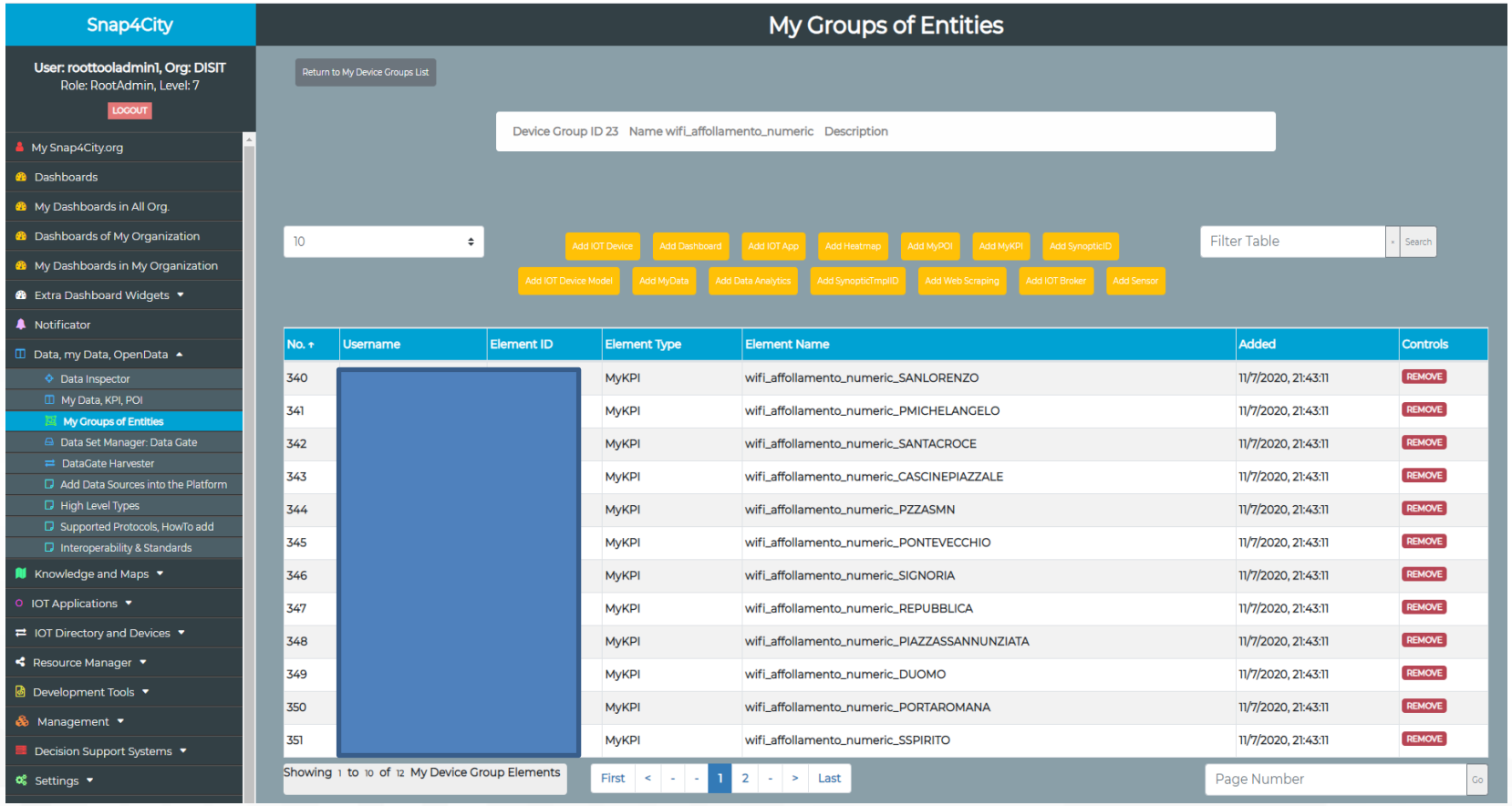
- **My Groups of Entities**
  - **Licensing group of Entities in One Click**



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

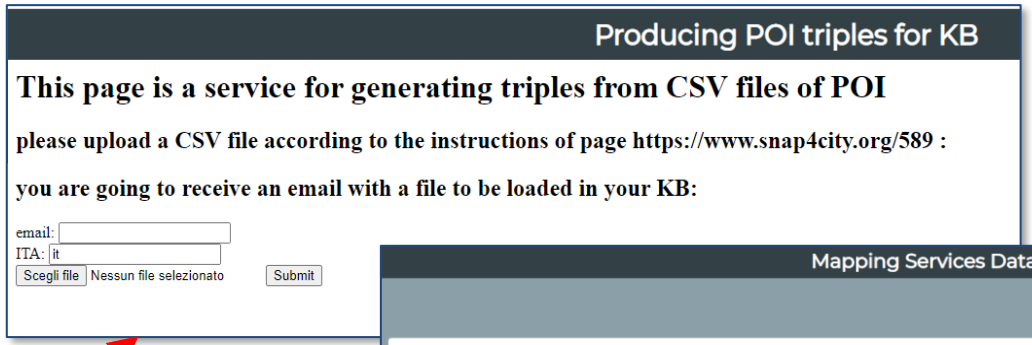
Group of entities

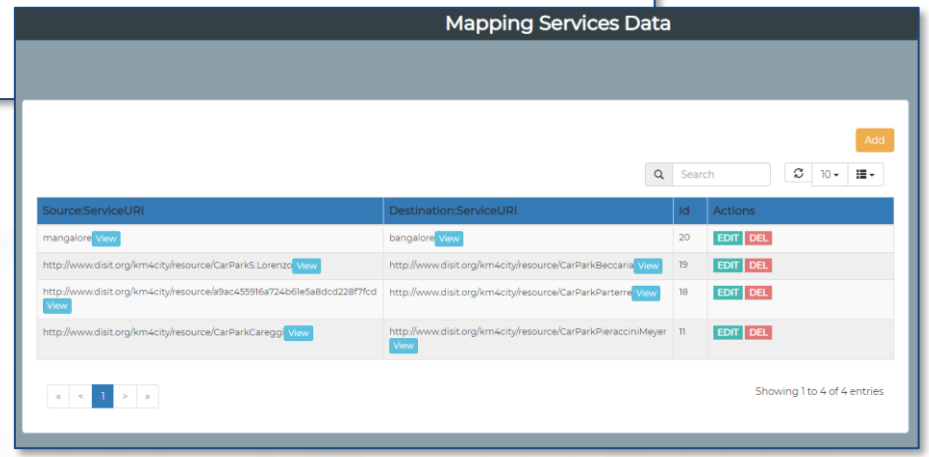
- A group may include a number of:
  - IOT Devices, Dashboards, MyPOI, MyKPI, Synoptics, IOT DeviceModels, MyData, Synoptics Templates, IOT Brokers, IOT Sensors/actuators,..
- Once the Group is created, the group owner can:
  - Produce a license to grant access at all the Group Entities in one click

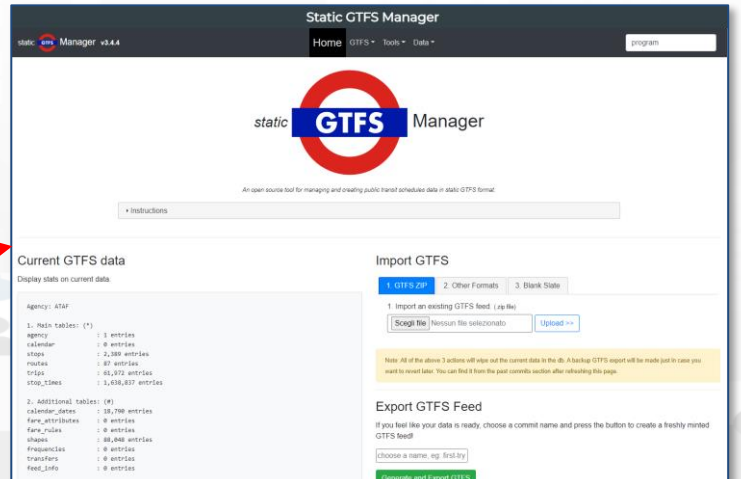


Knowledge and Maps

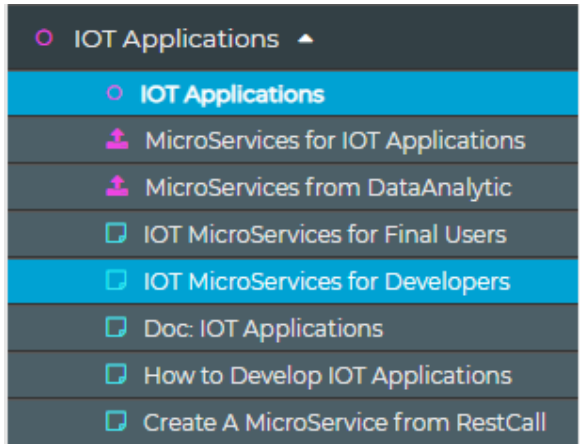
- A number of ServiceMaps, Knowledge bases, KB
- Tools for creating WKT, shapes
- Access to ServiceMap 3D, if any
- Service for Loading triples on KB
- My Annotations (deprecated)
- Mapping Tool (partial)
- GIS servers, if any
- Static GTFS editor and manager (if any)

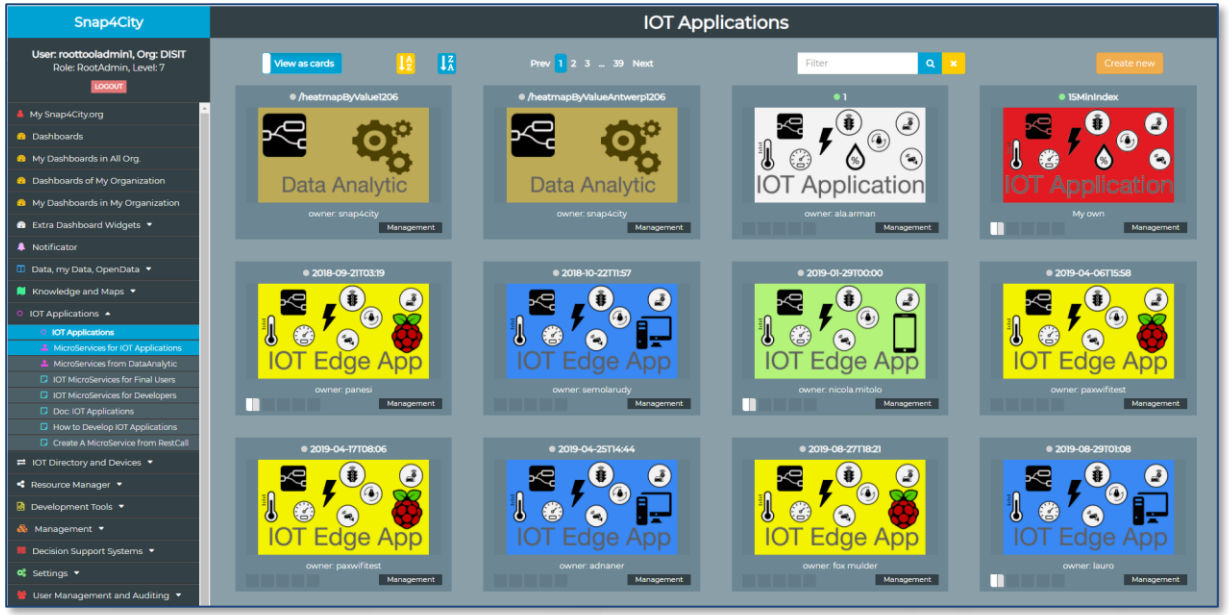






IOT Applications

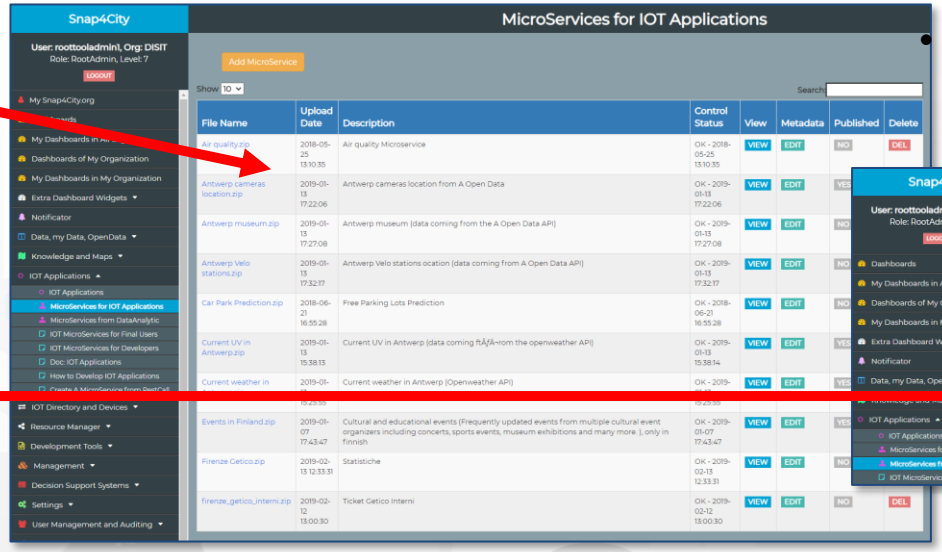


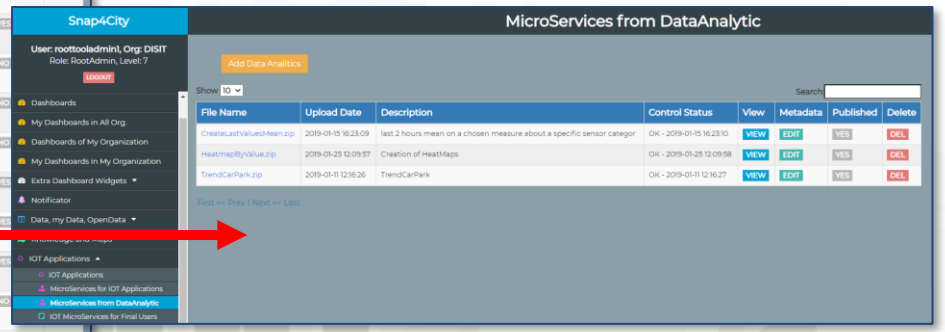


- **IOT Applications**: a view to manage Containers / IOT Edge Apps: IOT Apps, Data Analytics (R and Python), WebScraping, IOT edge, etc.

Managing also

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

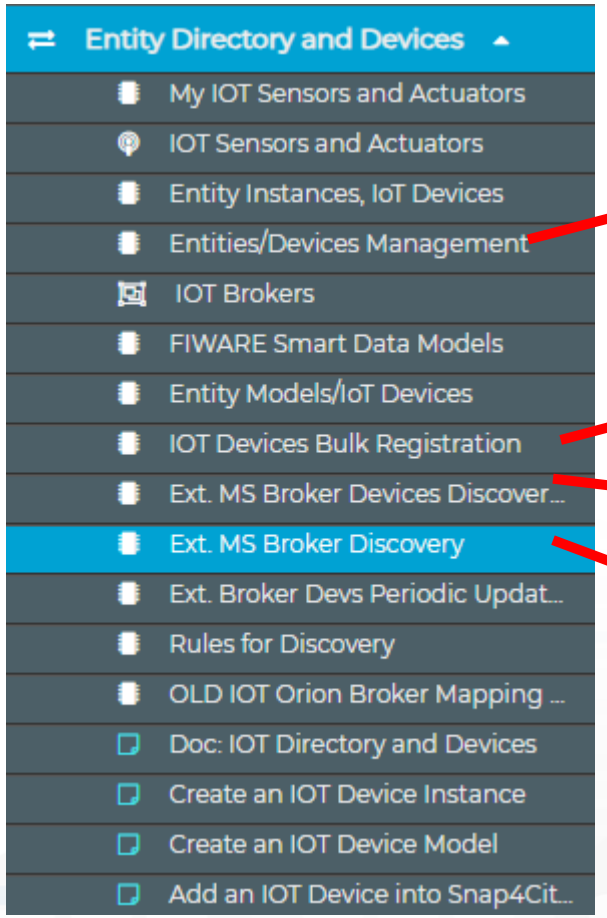


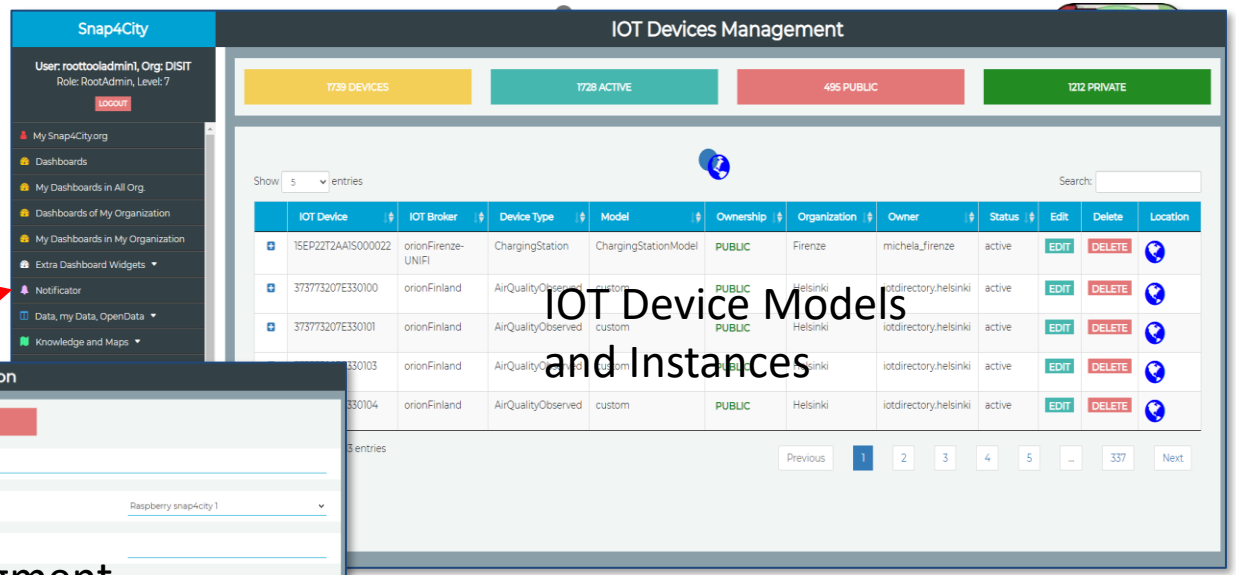


For non admin tools see Training parts 3 and 5: https://www.snap4city.org/577

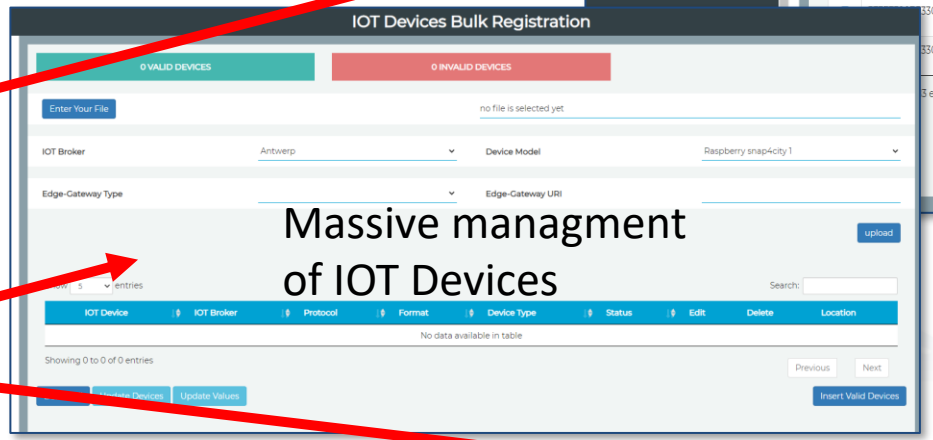
UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

Directory and Devices

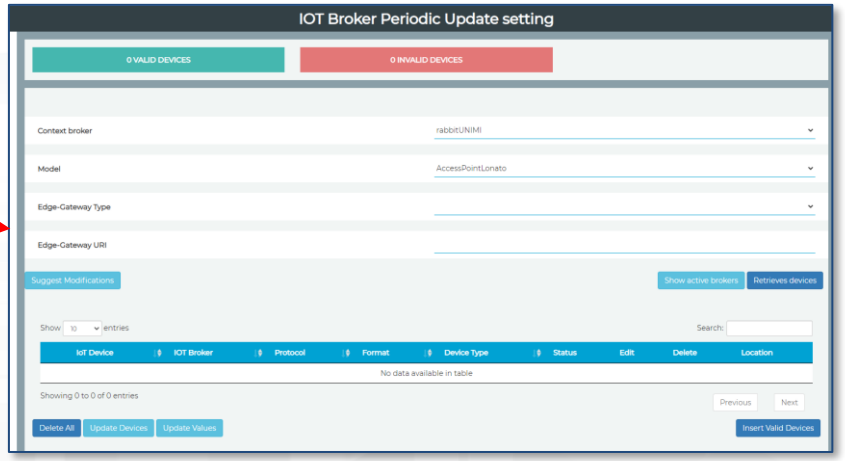


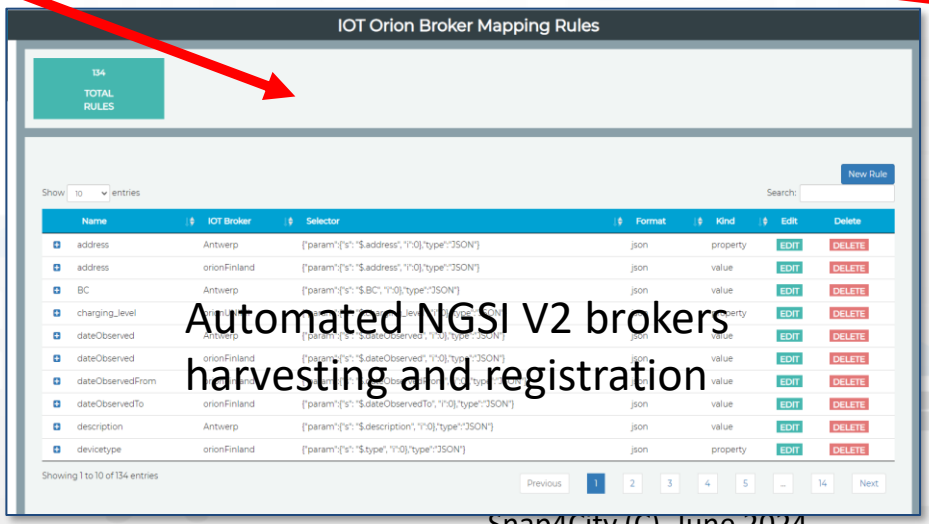


IOT Device Models and Instances



Massive managment of IOT Devices



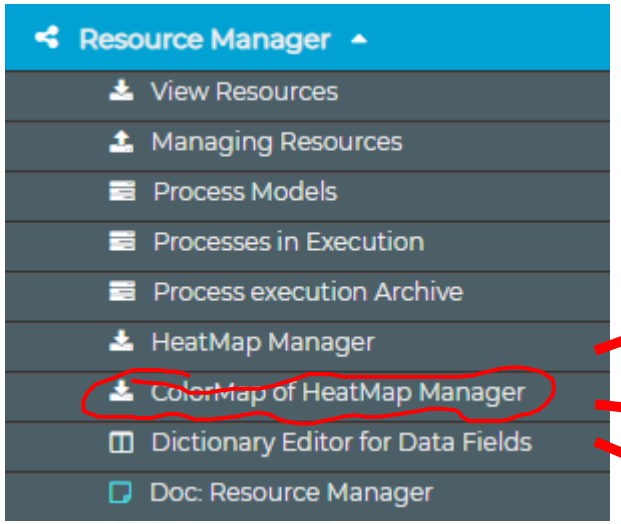


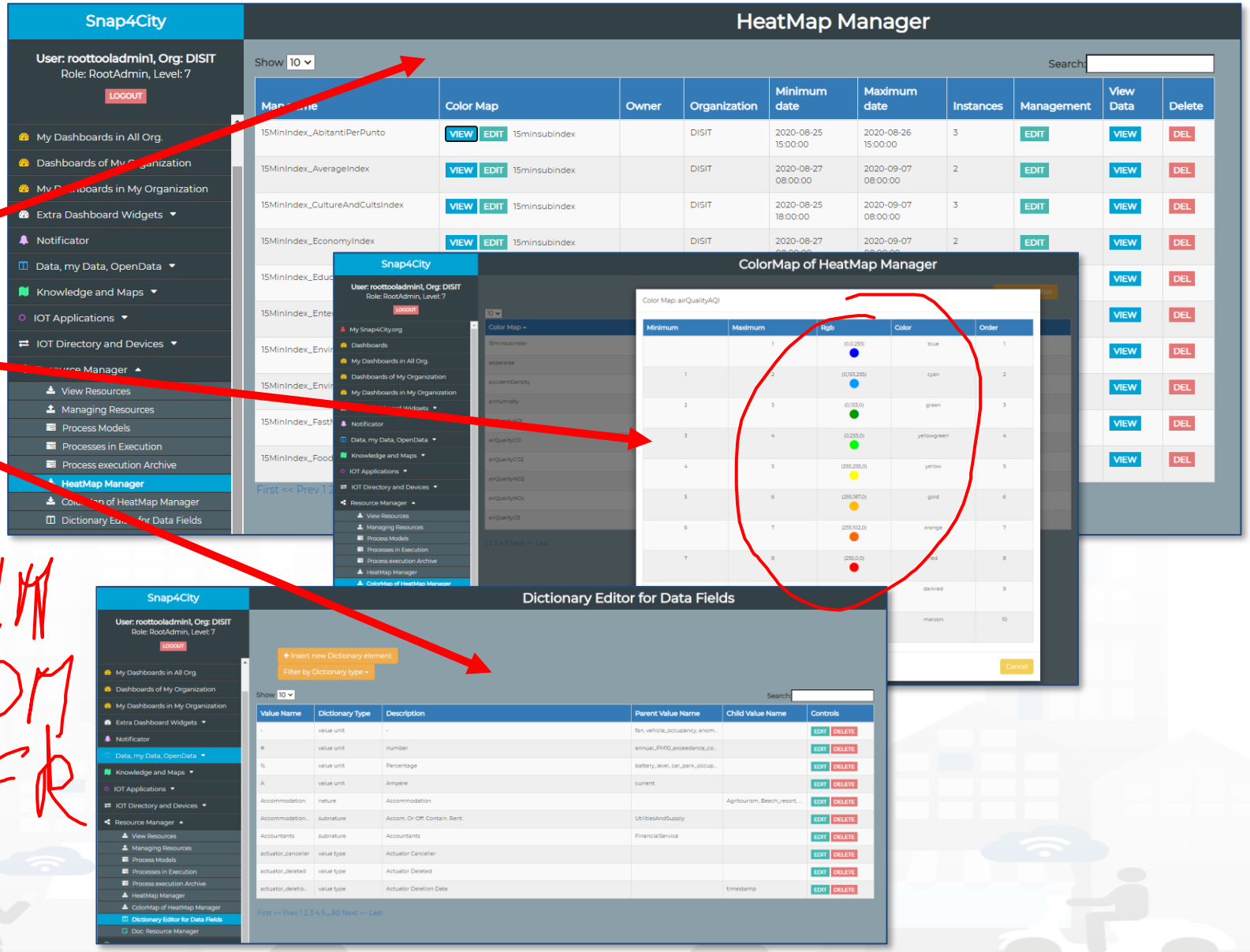
Automated NGSI V2 brokers harvesting and registration

Directory manages multiple internal and external IoT Context Brokers

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

Resource Manager

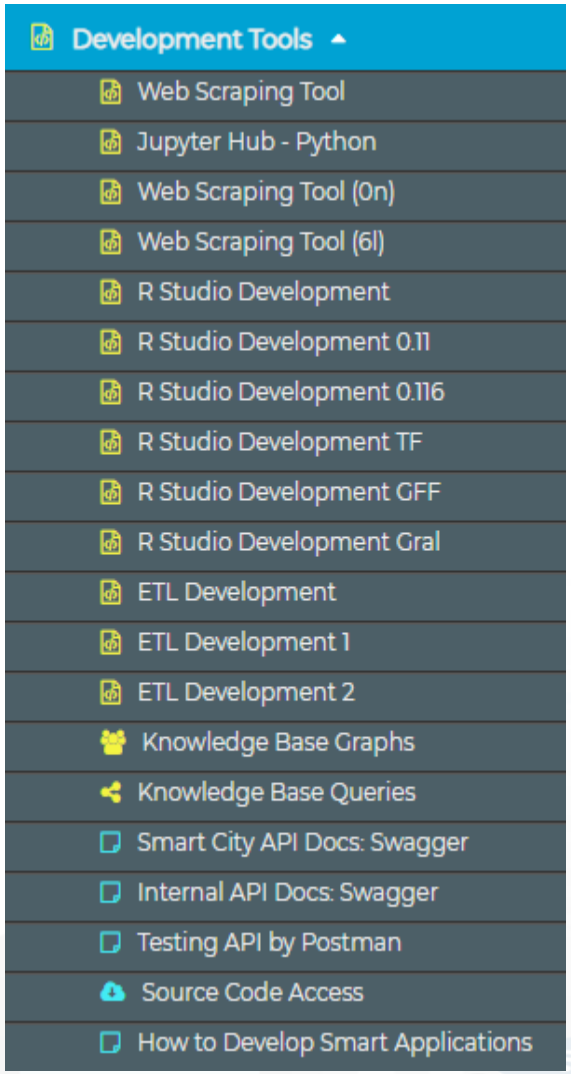




- Tools for managing shared resources among Organizations and Users

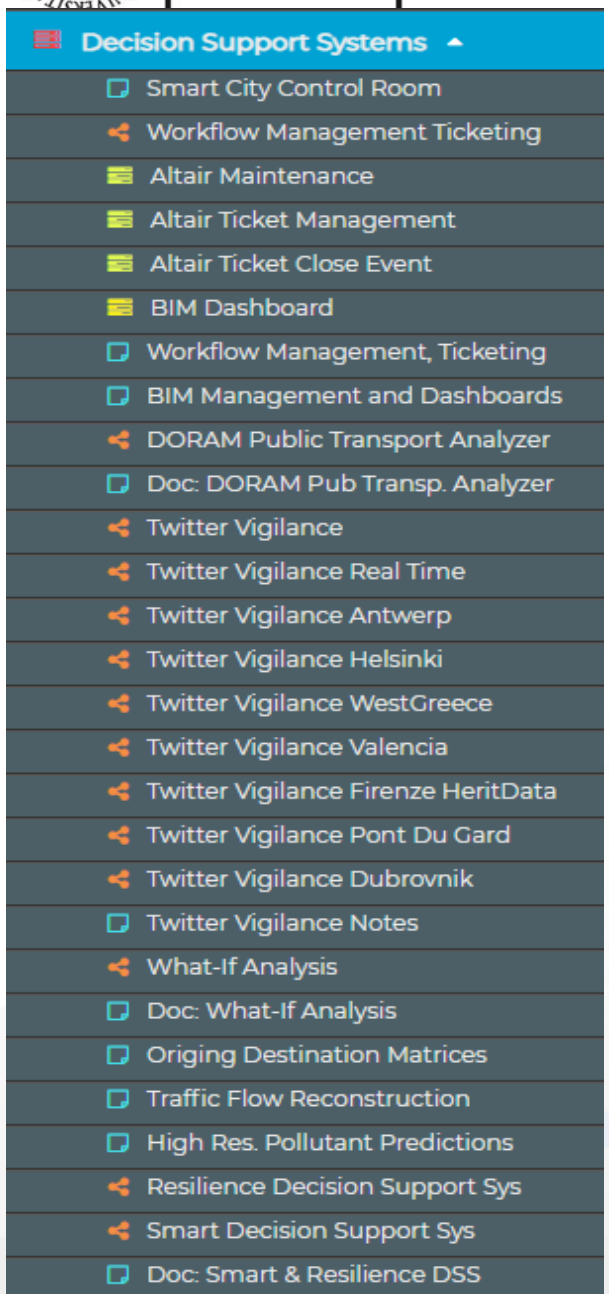
- For non admin tools see Training parts: https://www.snap4city.org/577

Development Tools



- *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*

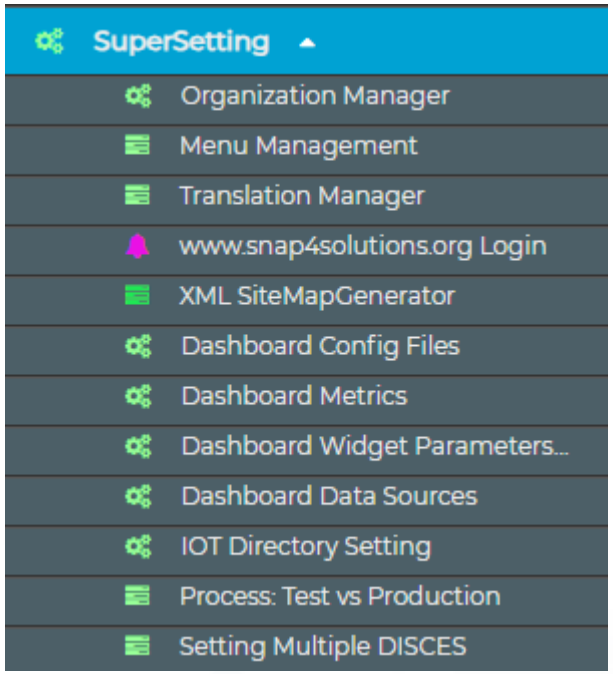
- **API and Swagger documentation**
- **Model Knowledge Base Graphs (LOG.disit.org)**
- **Python online dev. Environment**
- **R Studio Online dev. Environment**
- WebScraping tool
- For KB: SPARQL Editor and tools (custom FLINT)
- ETL OnLine dev. Environment (deprecated)



Decision Support Systems

- 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

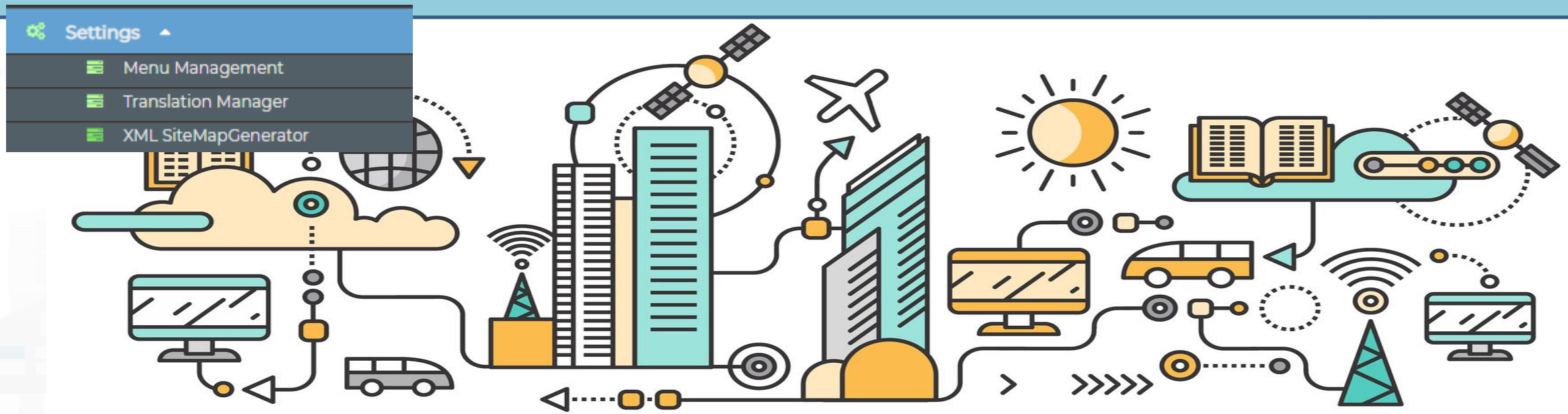
Settings



- **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)

Multilingual Support and Translation Management



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

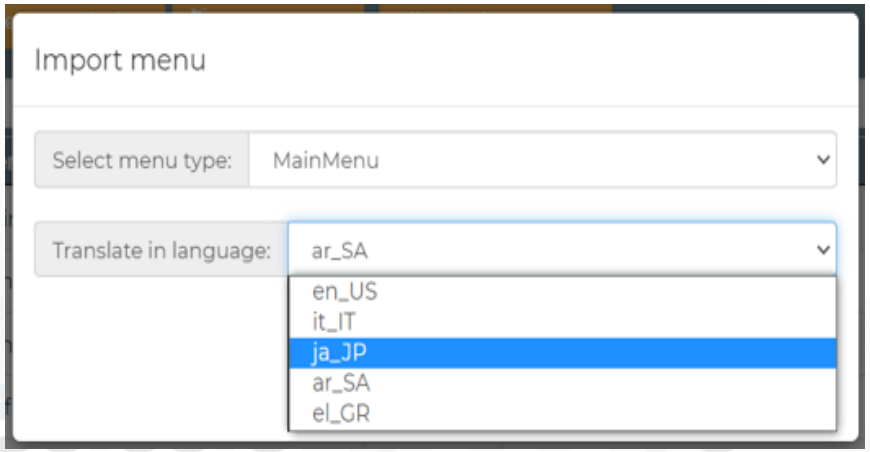
Translation Manager

Translation manager

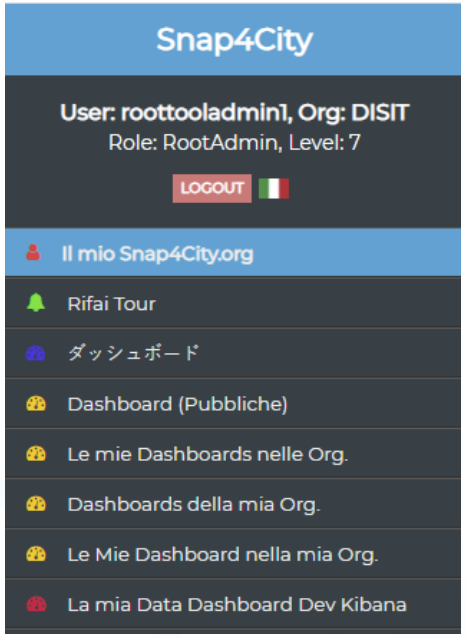
+ Create New Text translation | Import menu | Filter by language

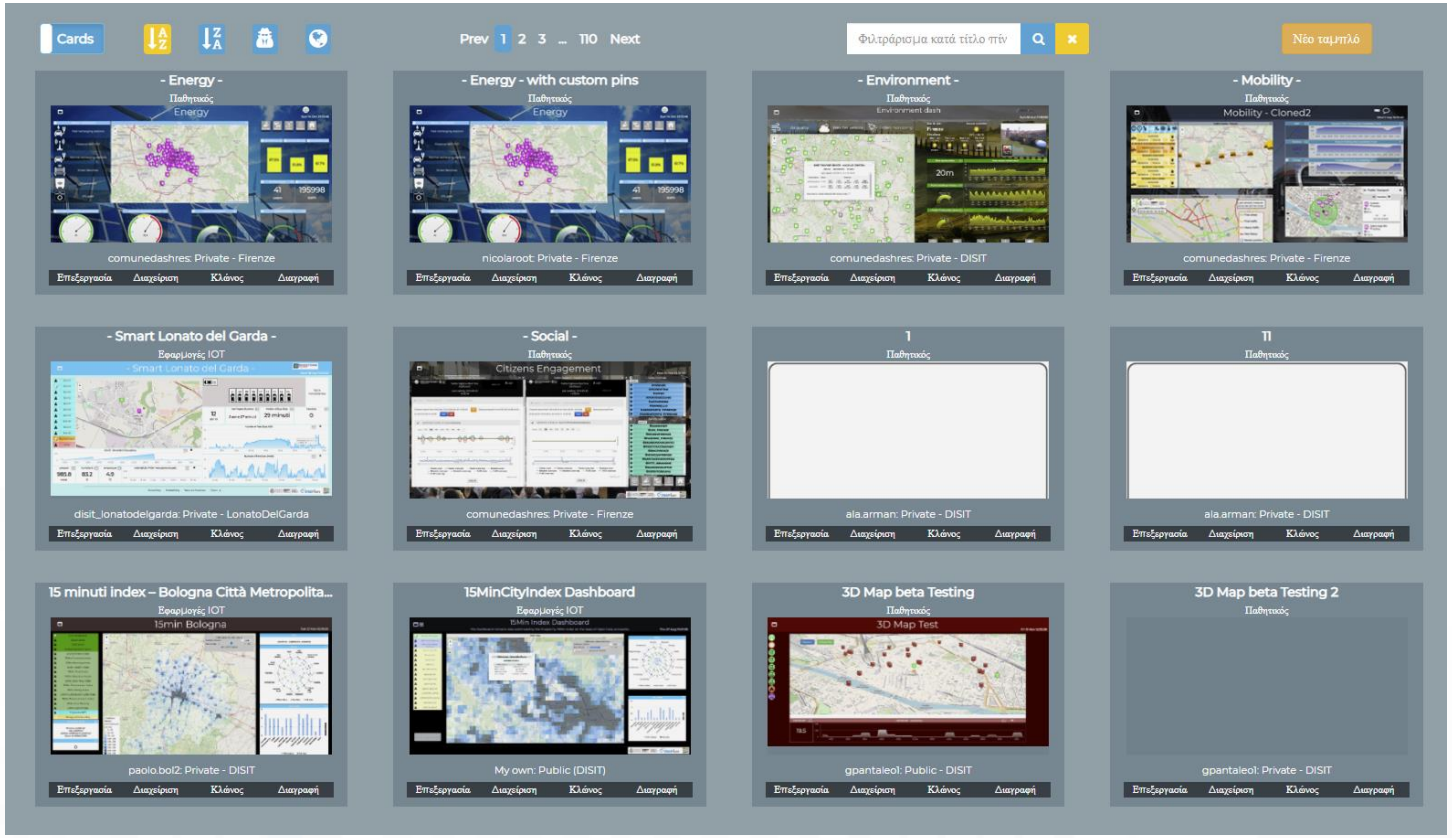
Show 20 | Search:

Id	Reference Text	Language	Traslated text	Edit
1	Settings	it_IT	Impostazioni	EDIT
2	Dashboards (Public)	it_IT	Dashboards (Pubbliche)	EDIT
3	Dashboards	it_IT	Dashboards	EDIT
4	Notificator	it_IT	Notificatore	EDIT
5	My Snap4City.org	it_IT	My Snap4City.org	EDIT
6	Resource Manager	it_IT	Gestore Risorse	EDIT
7	Data Set Manager: Data Gate	it_IT	Data Set Manager: Data Gate	EDIT
8	IOT Applications	it_IT	Applicazioni IOT	EDIT
9	My IOT Devices	it_IT	I miei Dispositivi IOT	EDIT
10	Documentation and Articles	it_IT	Documentazione e Articoli	EDIT
11	Micro Applications	it_IT	Micro Applicazioni	EDIT



Resulting as

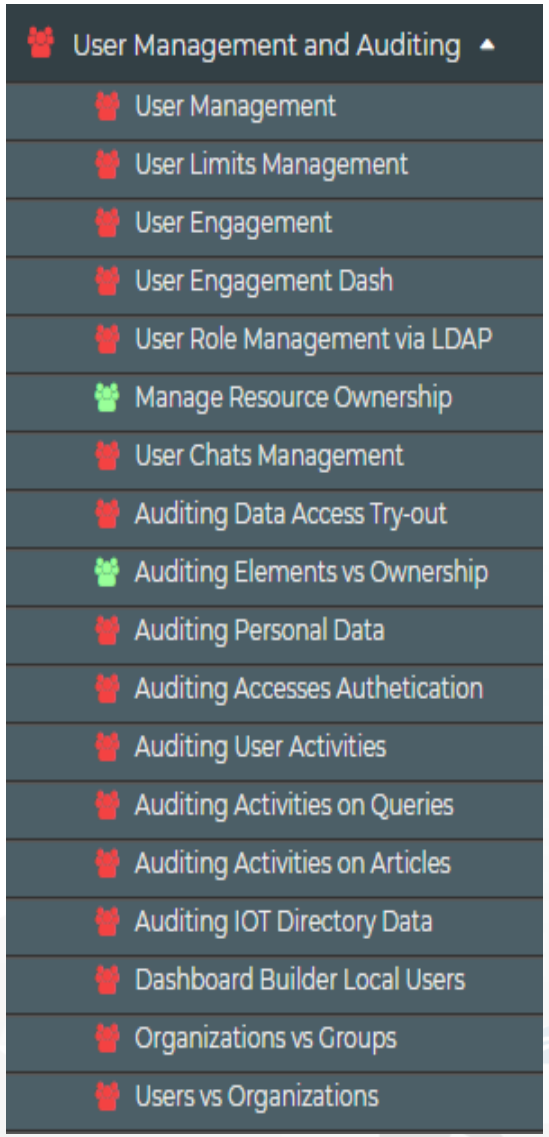




- Keyworks as Main Tools names should remain in English
- Names of the resources remain in the language in which they have been created/defined

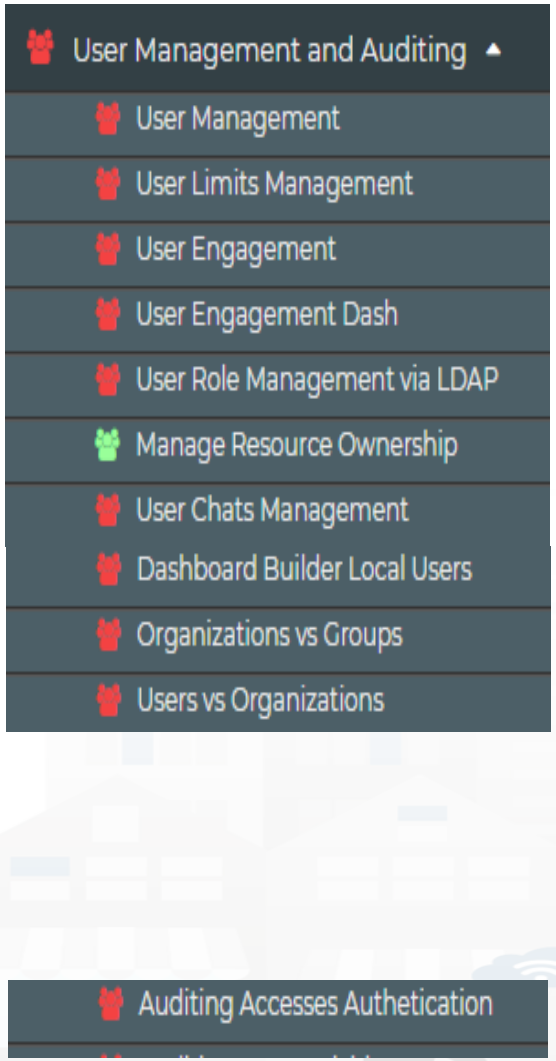
User Management

User Management and Auditing



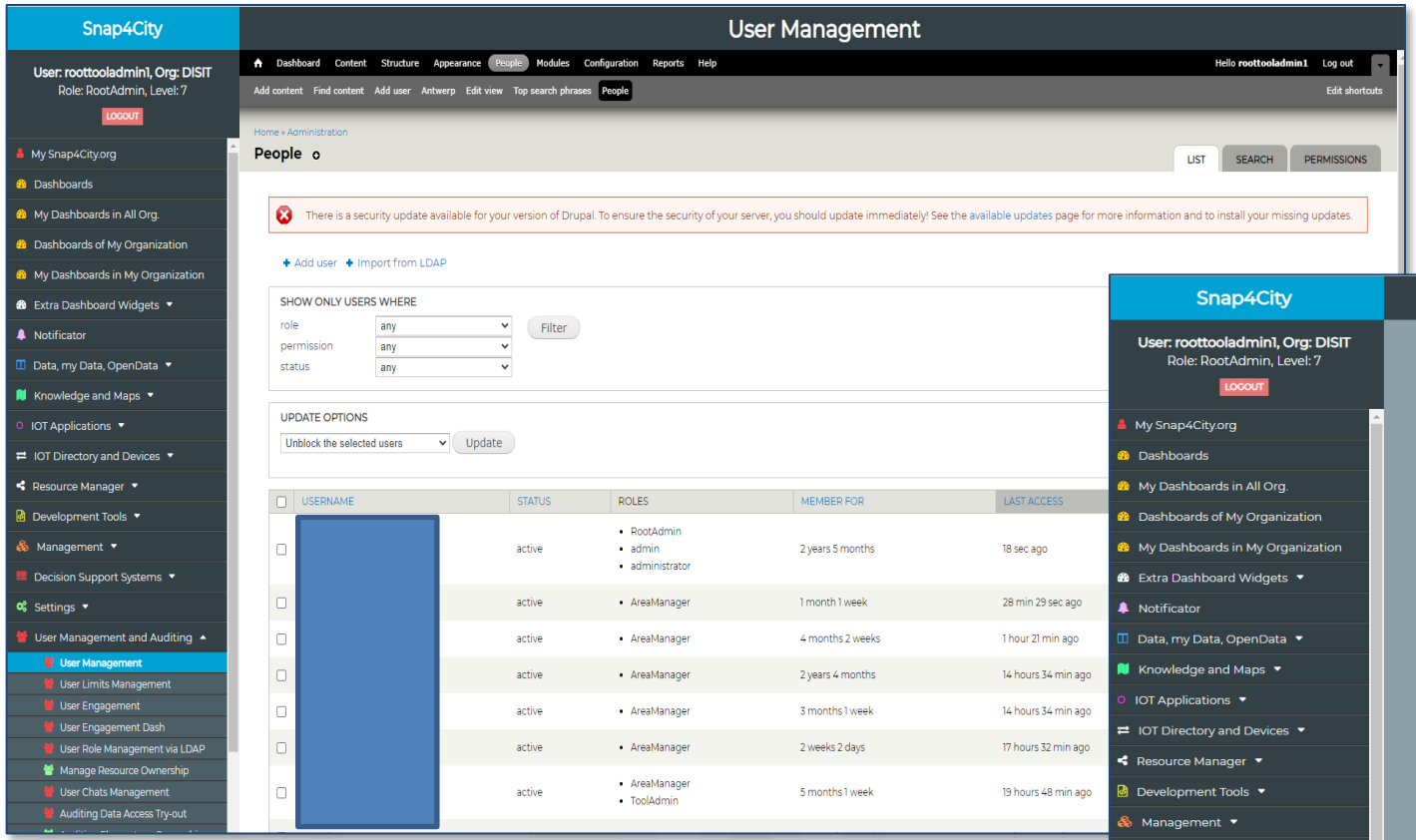
- All that the RootAdmin needs to manage:
  - **User Management: for managing**
    - accounts and profiles
    - limits of the users in exploiting resources
    - Accesses and providing special authorization
    - Organization vs Groups of users
    - Users vs Organizations
  - **Users vs Web and Mobile 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



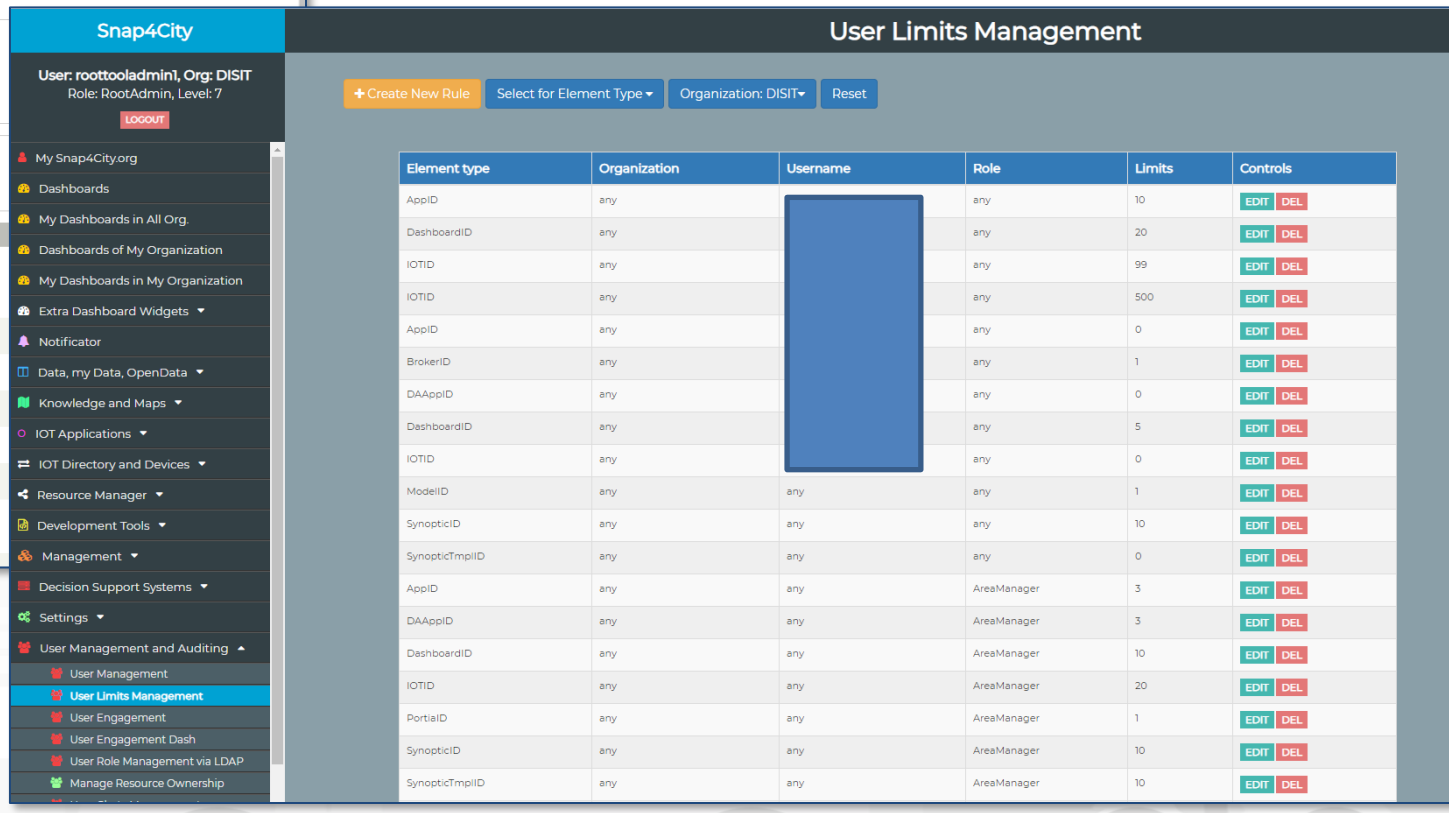
- User Management via Drupal or Local Users Management without CRM.
- User Limits con controlling resource consumption
- User Engagement: see mobile App training part
- Roles and LDAP management
- Managing Resources vs Users' Ownerships and granted accesses to the resources
- Organizations and their Groups of users
- Users vs Organizations
- ..
- AND User Access Authentication via KeyCloak

User Management and Users' Limits



Managing roles and authorizations

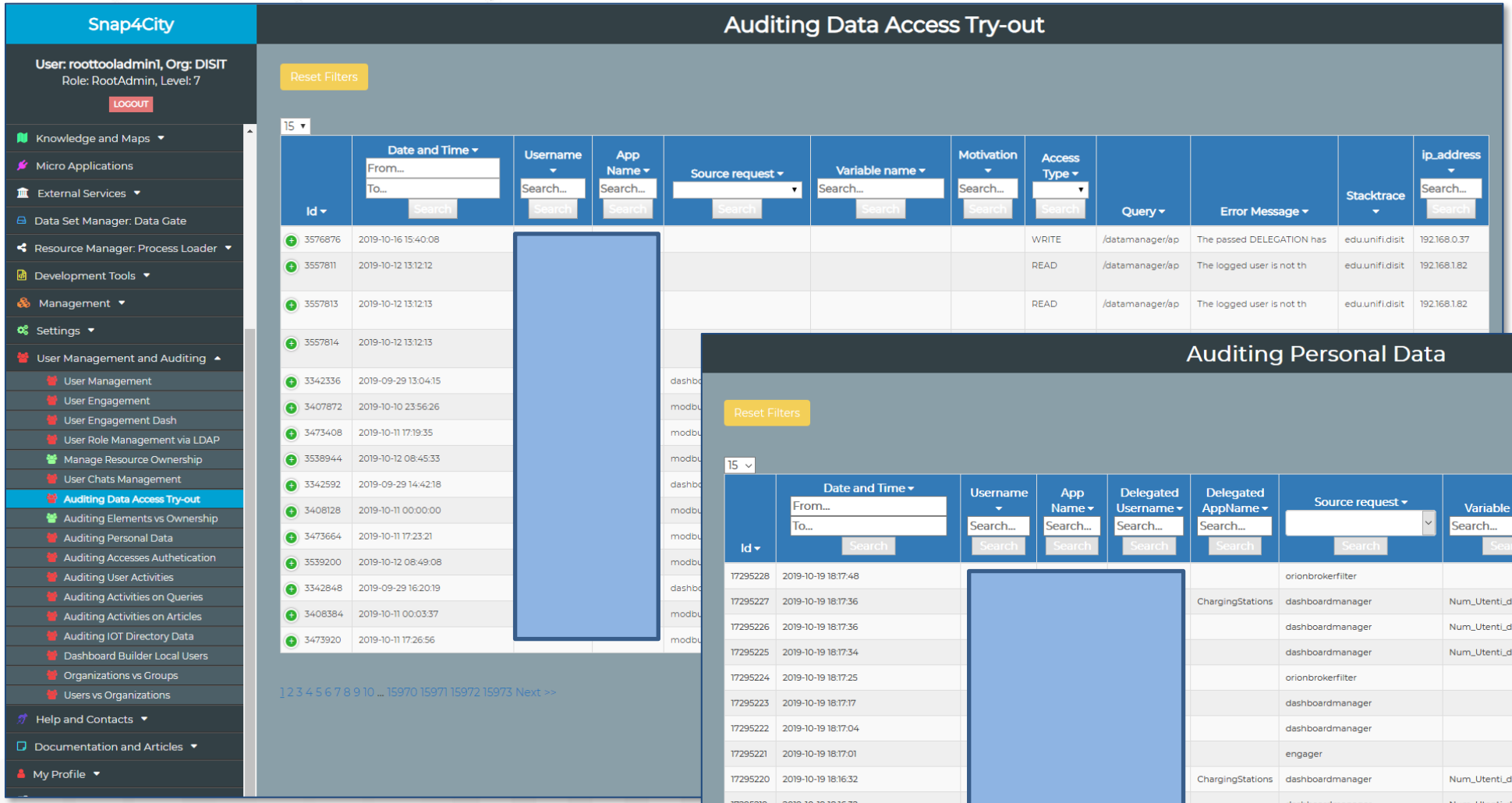
Controlling exploitation of resources



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

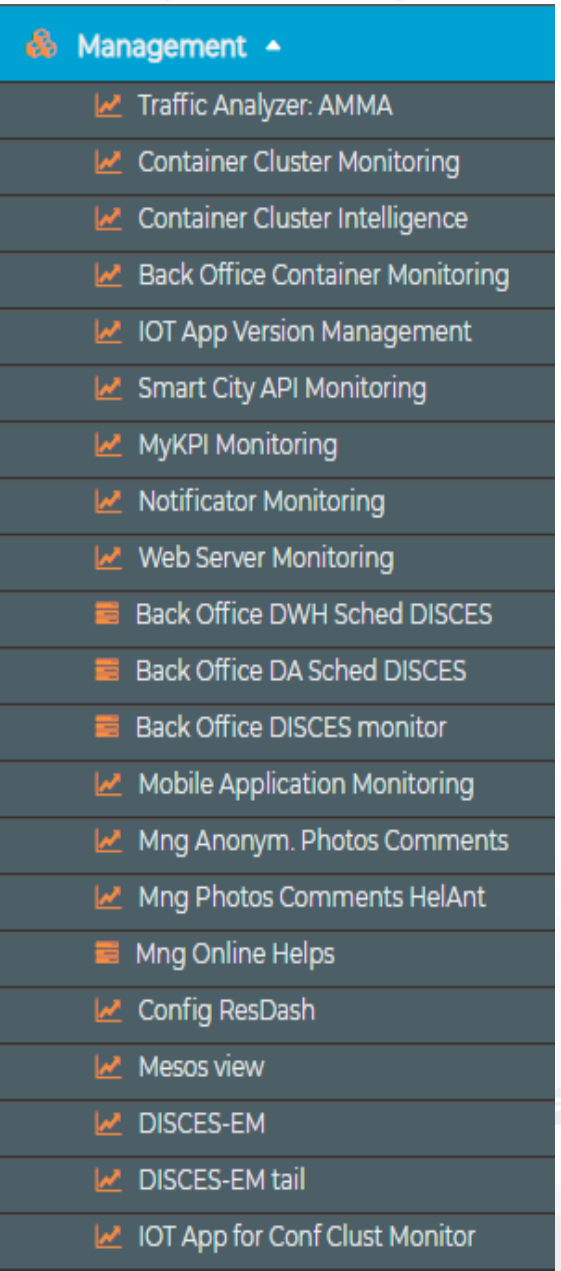
Auditing Activities



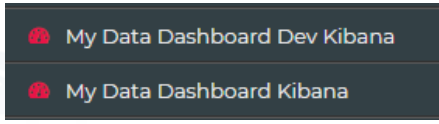
- Management
  - Traffic Analyzer: AMMA
  - Container Cluster Monitoring
  - Container Cluster Intelligence
  - Back Office Container Monitoring
  - IOT App Version Management
  - Smart City API Monitoring
  - MyKPI Monitoring
  - Notificator Monitoring
  - Web Server Monitoring
  - Back Office DWH Sched 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

Platform Management

Management



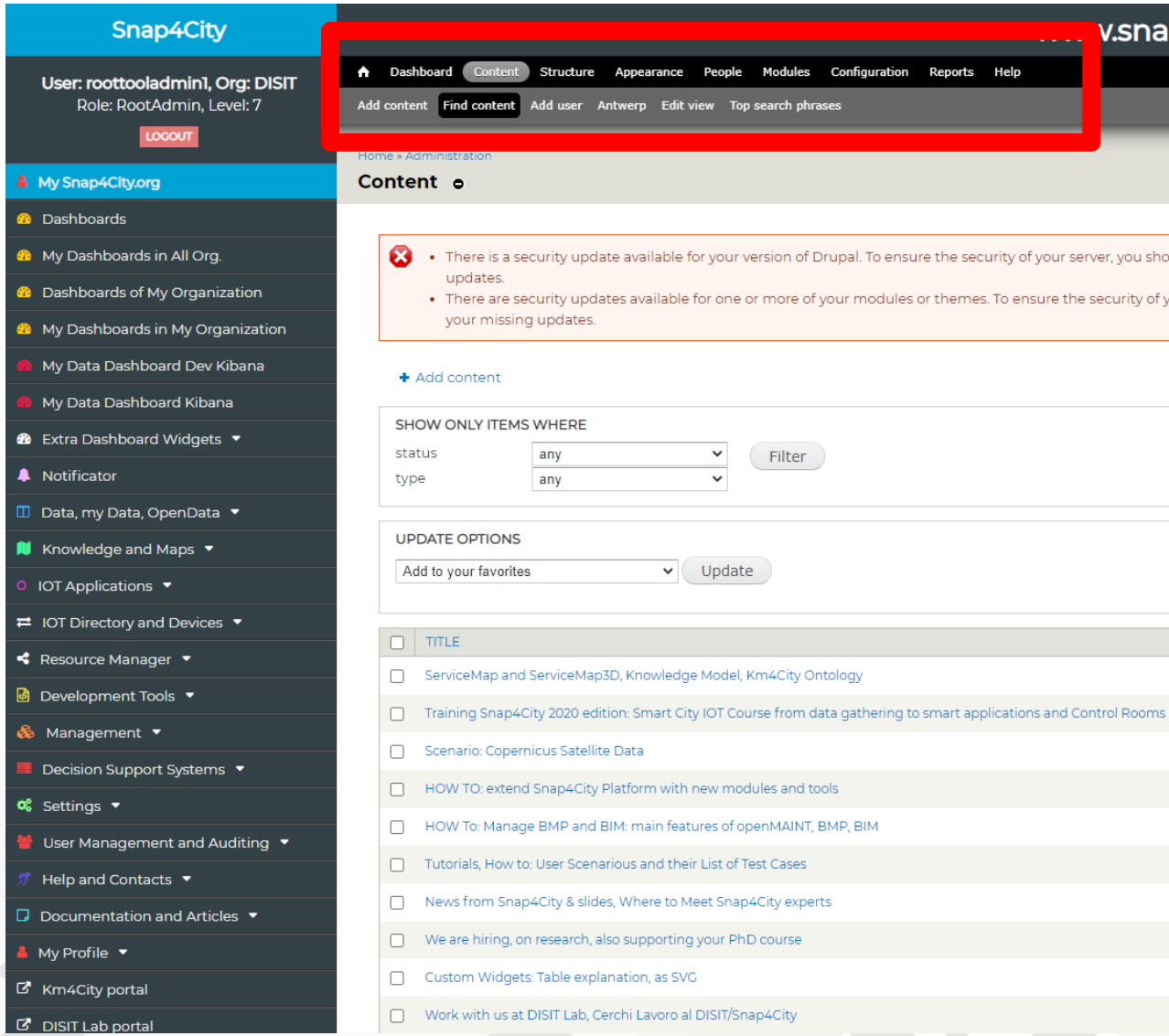
- **Tools for Platform Management.**
  - Most of them only accessible for RootAdmin and OnPremise
- Tools can be **grouped in the following families**
  - DataAnalyzer (DevDash): monitoring and browsing data ingested into OpenSearch (see on top as My Data ..))
  - Container Monitoring and Management
  - 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)



Customer Relationship Manager Integration and Living Lab basic

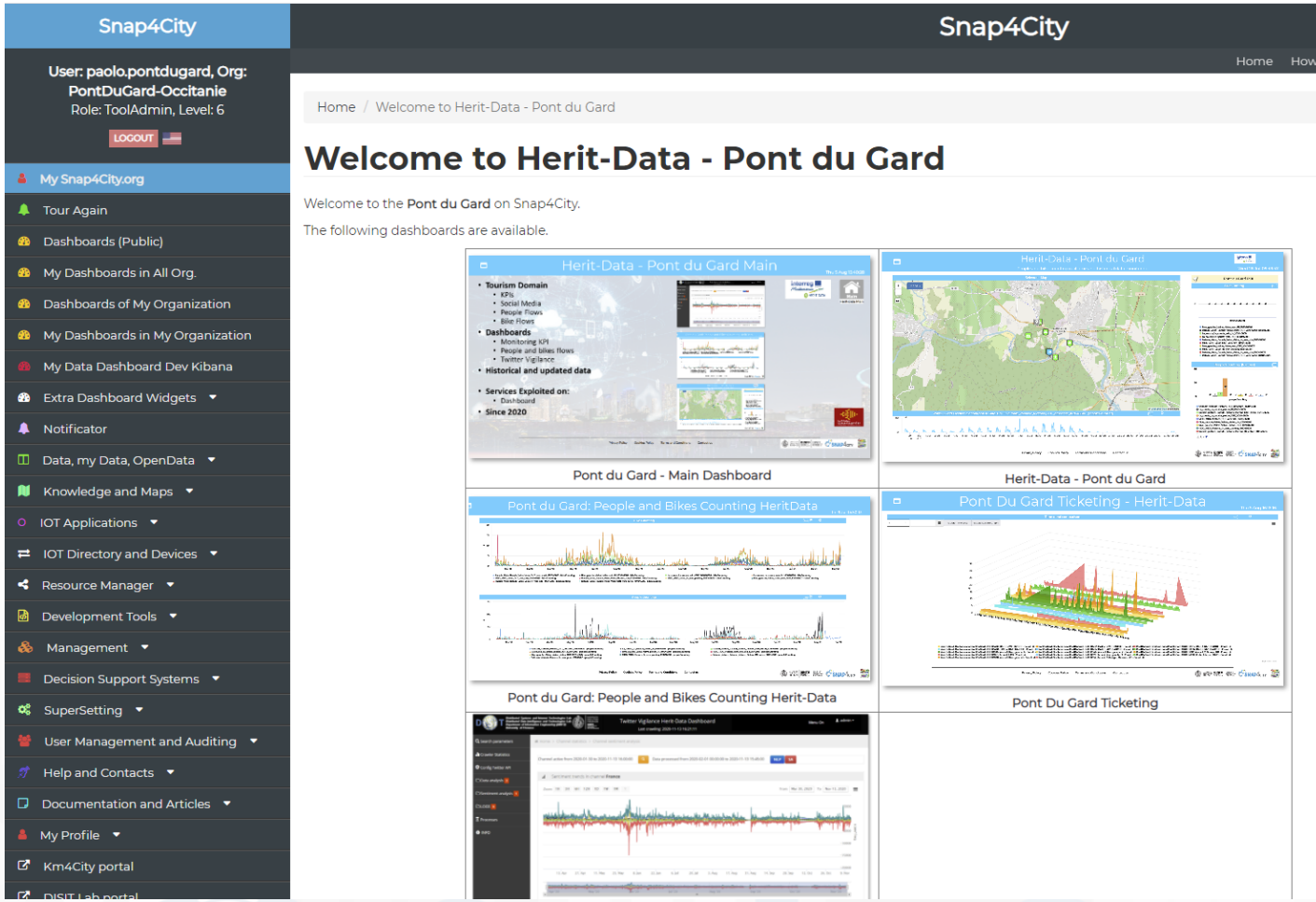
Living Lab vs DRUPAL

- **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 r**egistration 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.

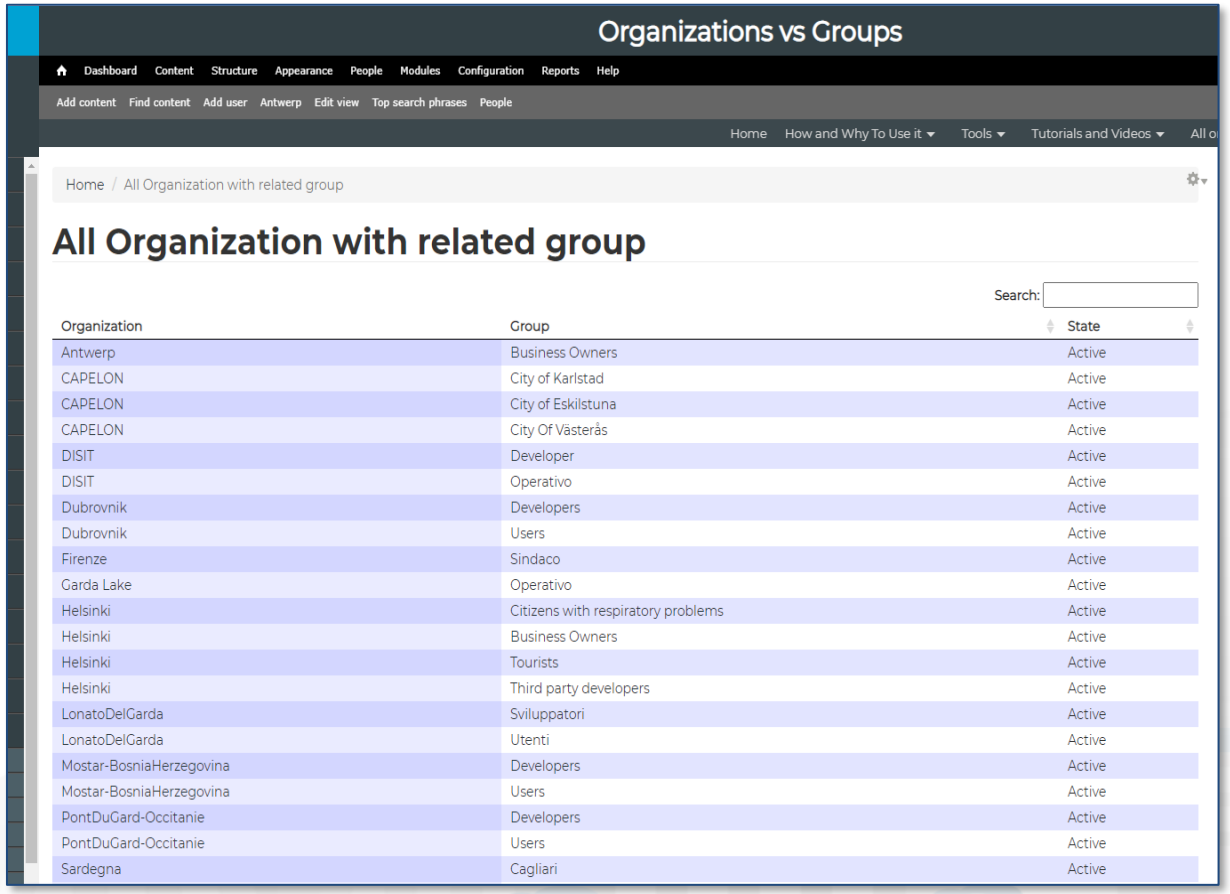


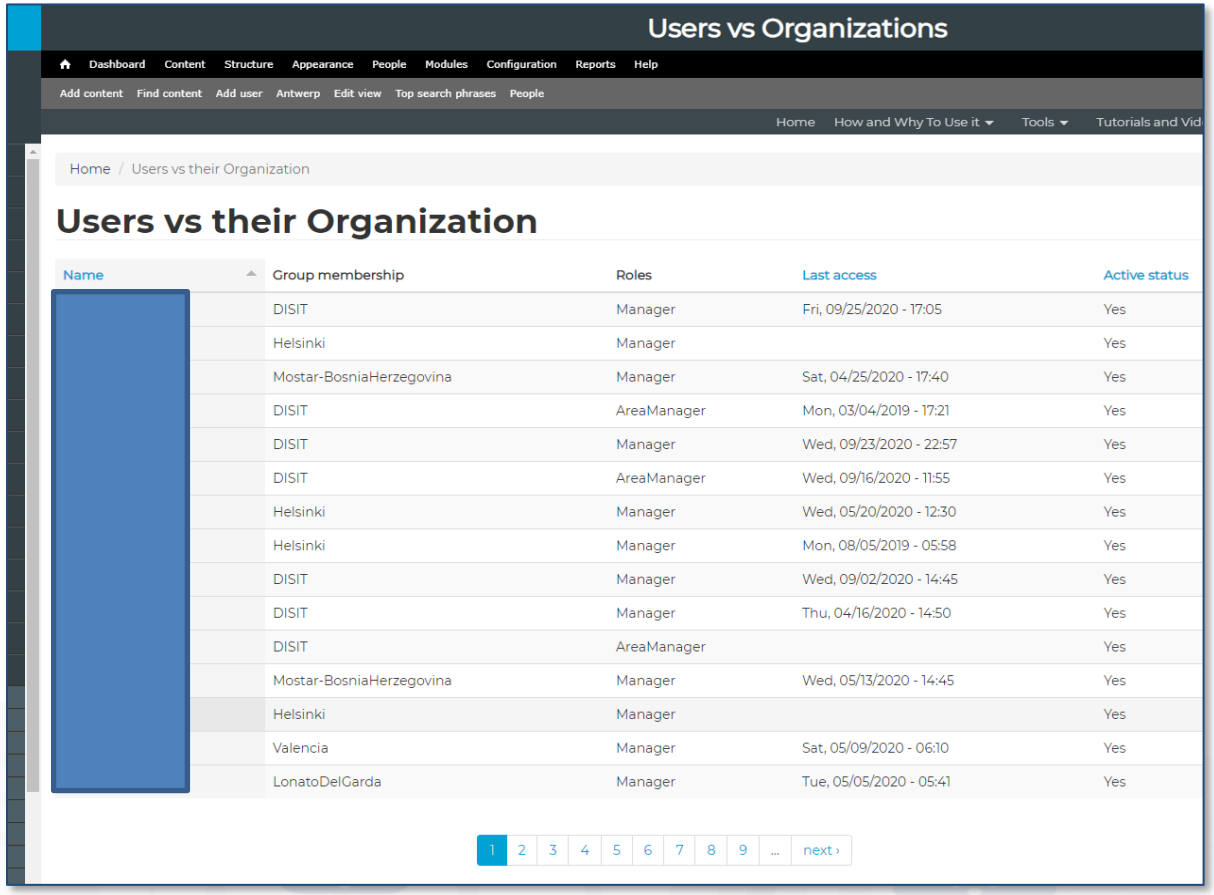
Organizations

- 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.

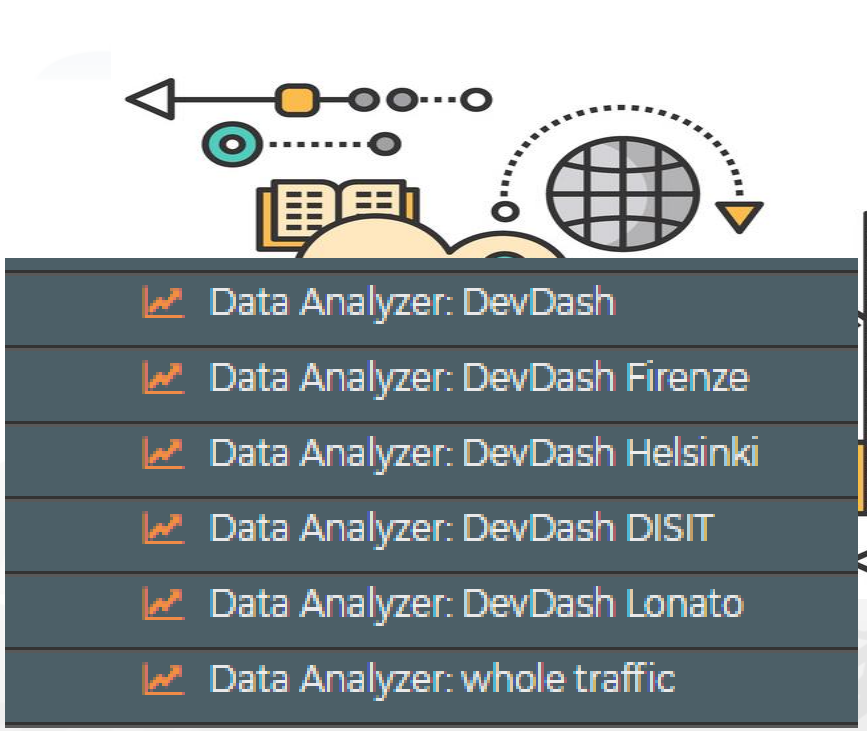


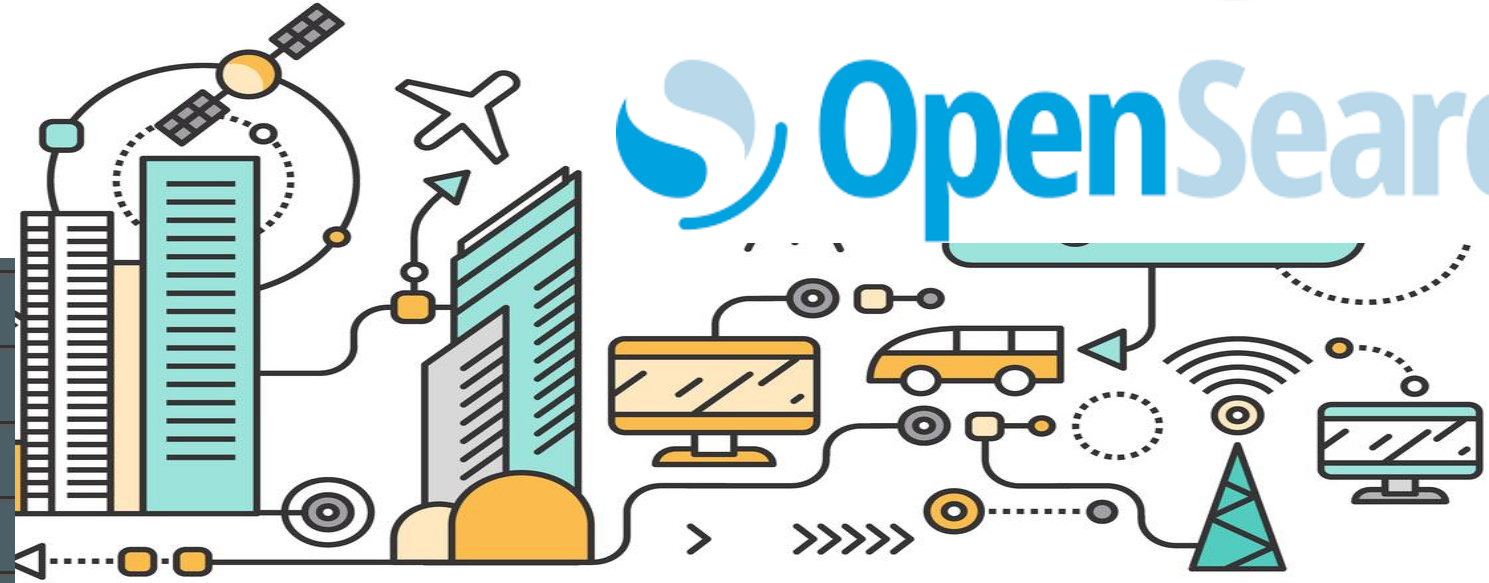
Organizations vs Groups vs Users





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



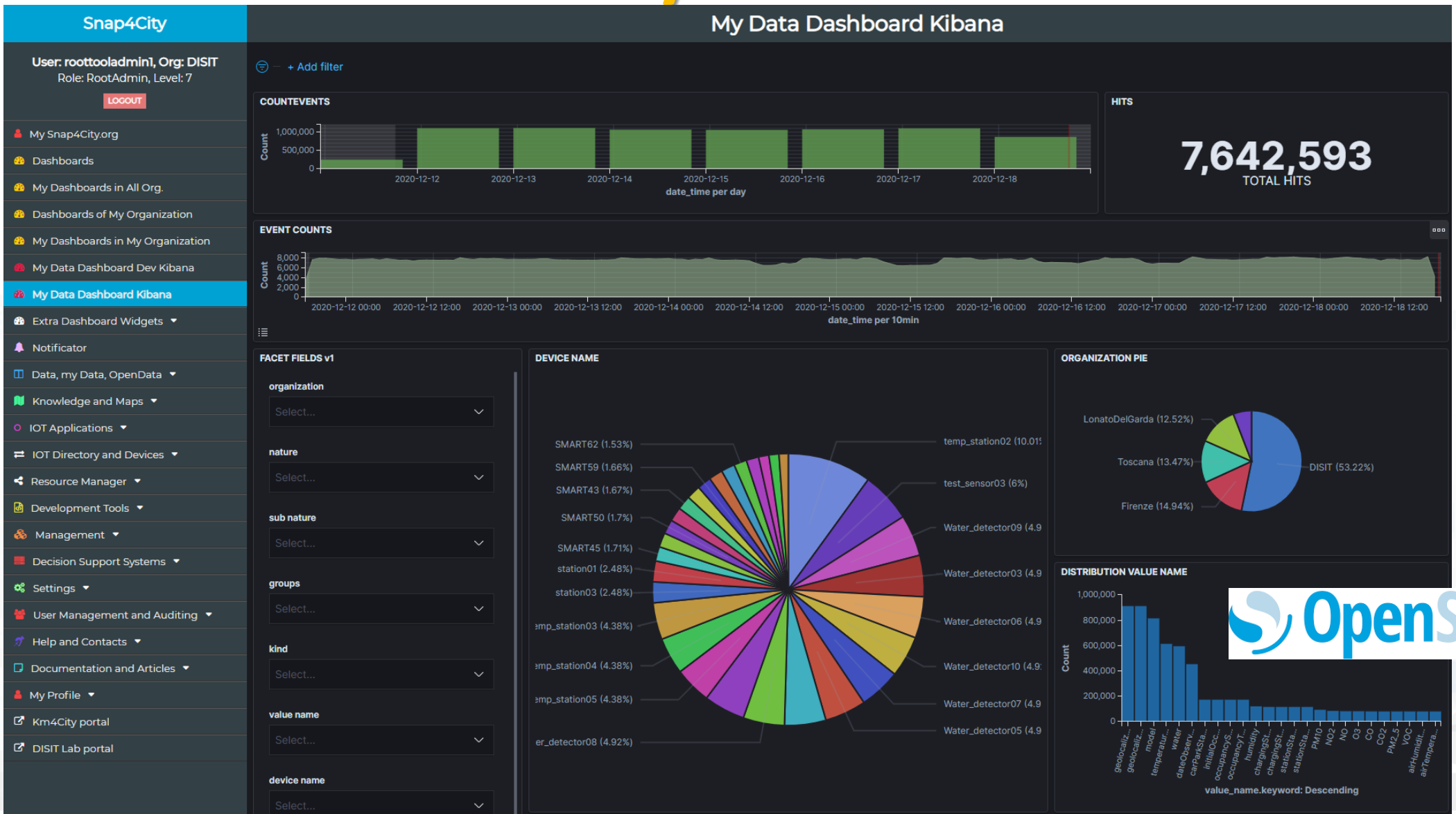


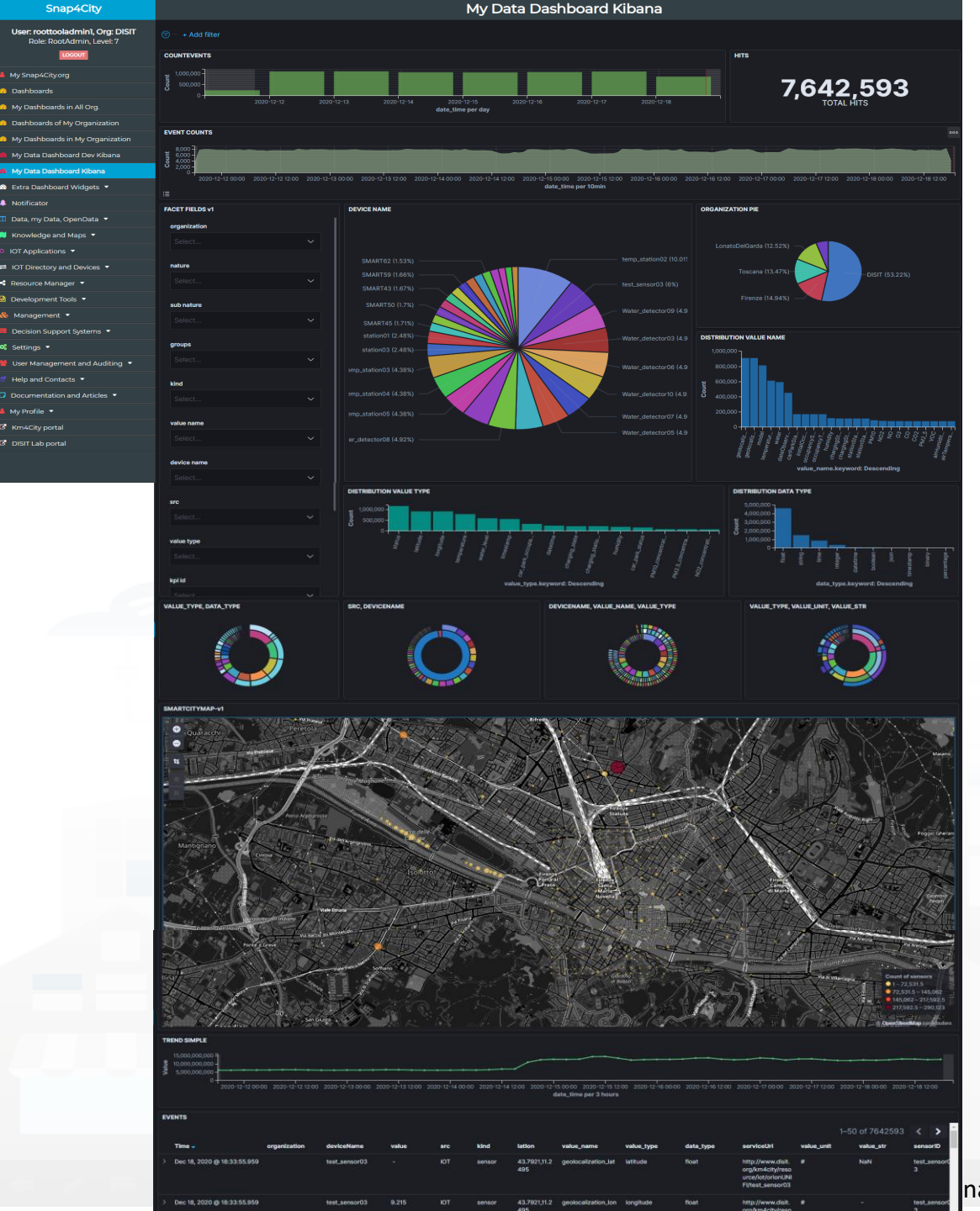
My Dev Dash (DevDash)

OpenSearch

- 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





OpenSearch SNAP4CITY KM4CITY

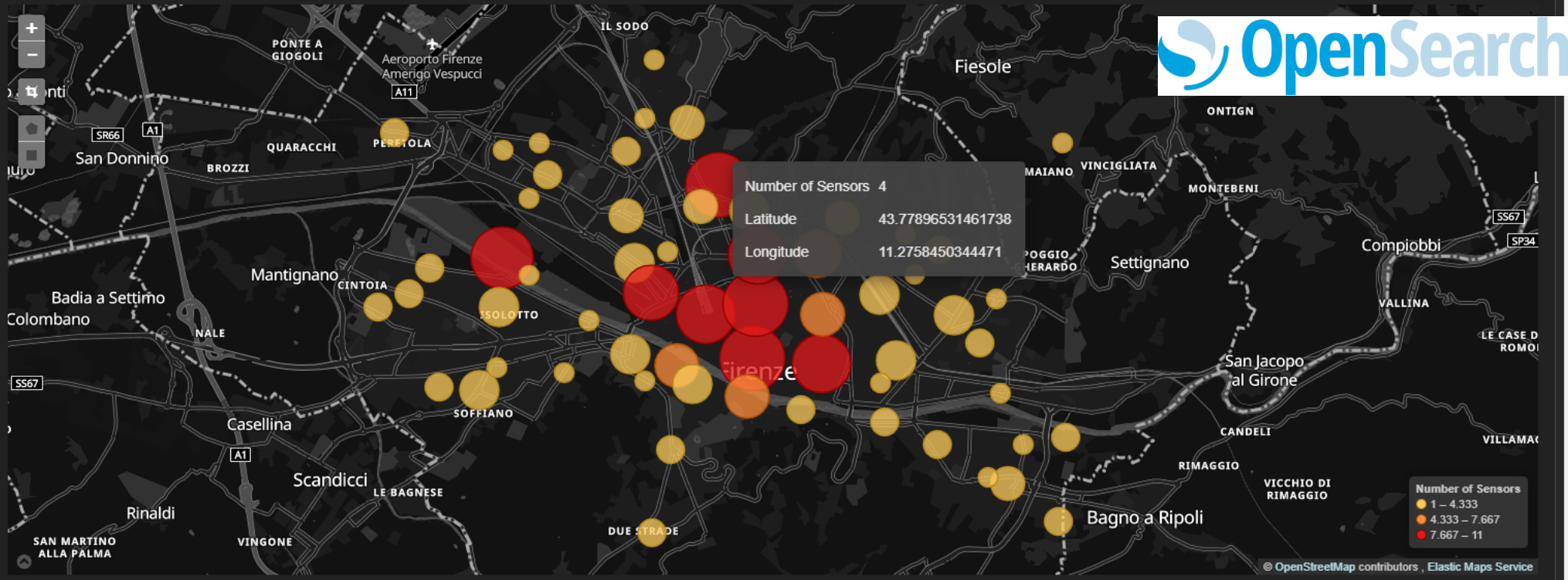
Business Analysis Dashboards For all kind of users: DevDash

- 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

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

LOGOUT

SMARTCITYMAP



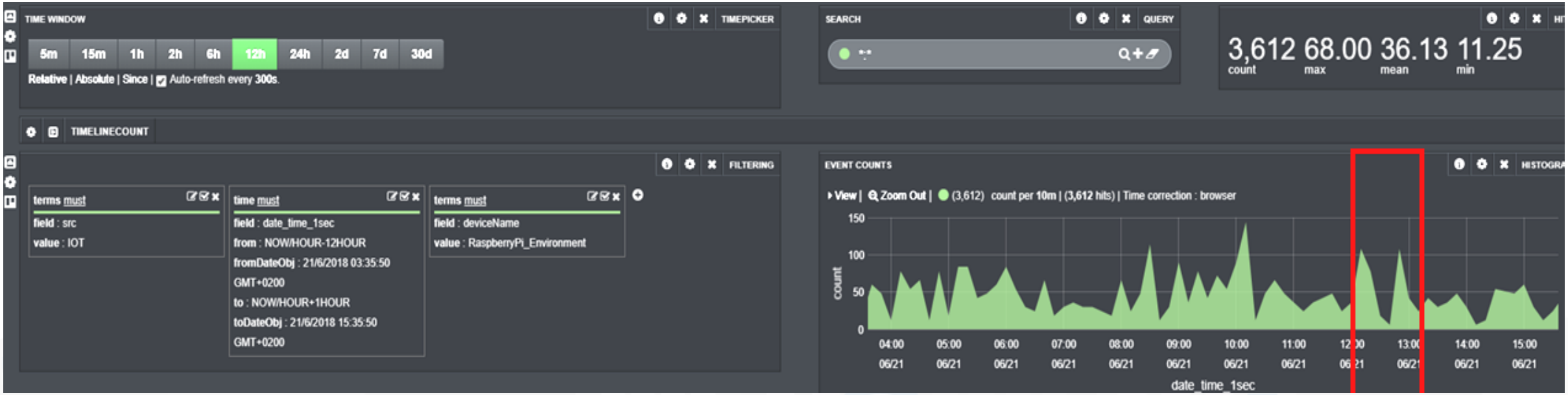
EVENTS

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,..

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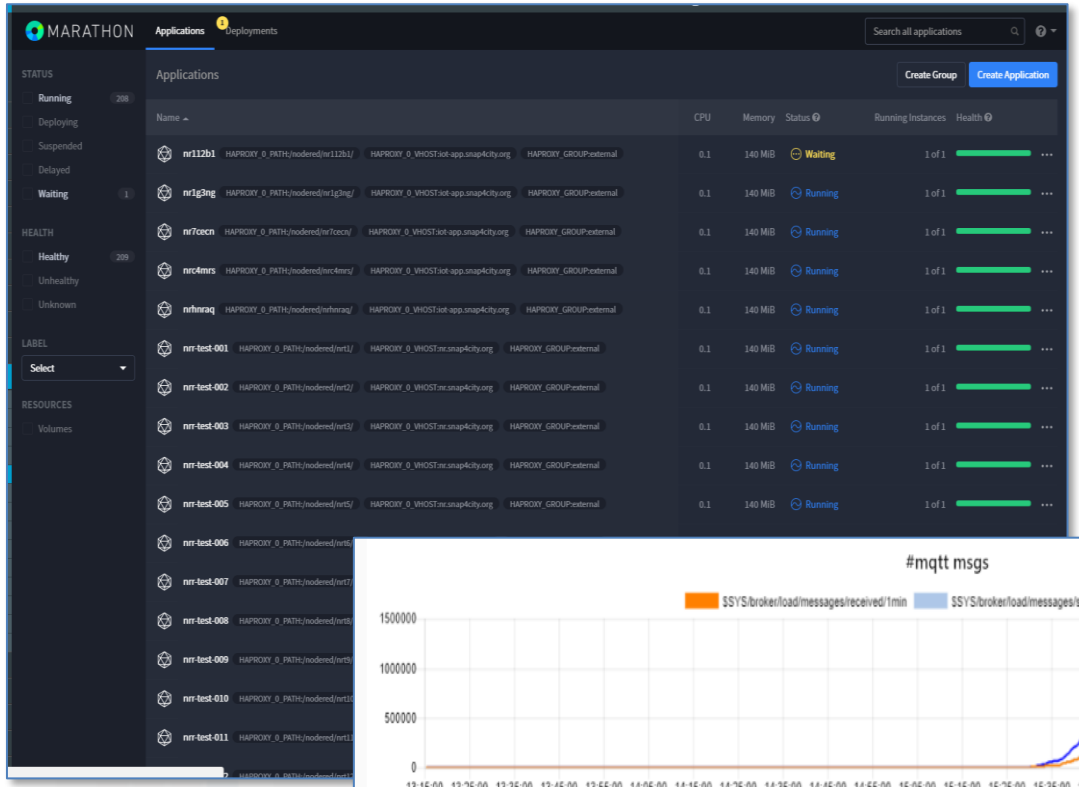
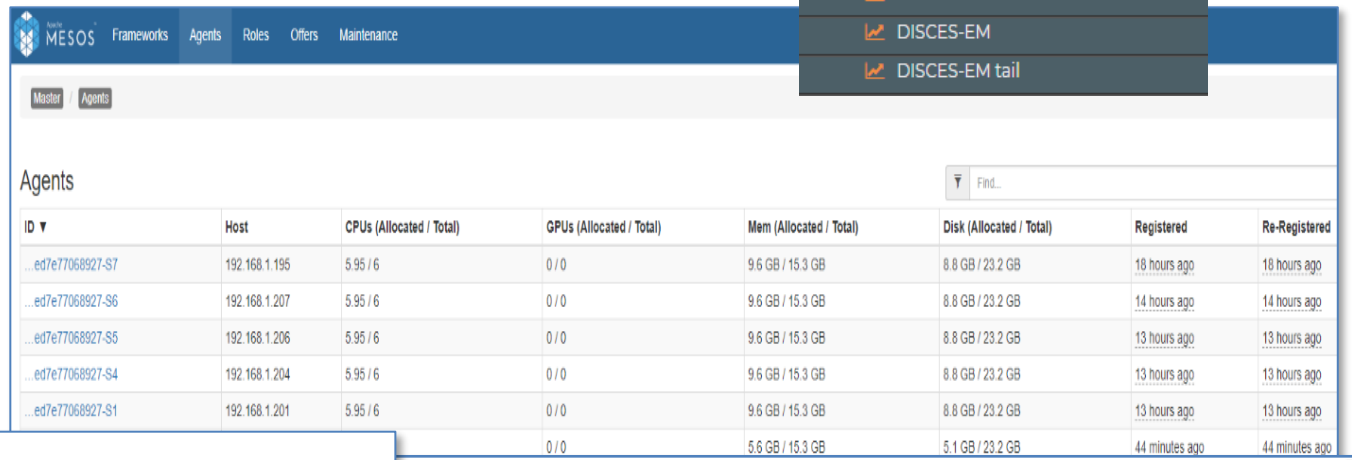
SNAP4CITY KM4CITY

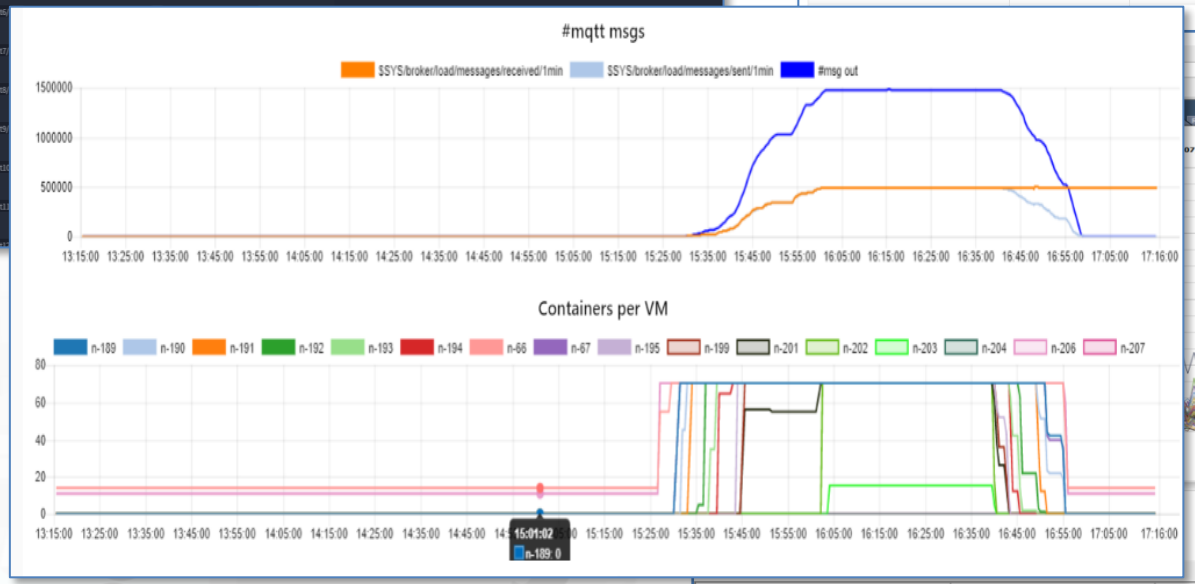
Container

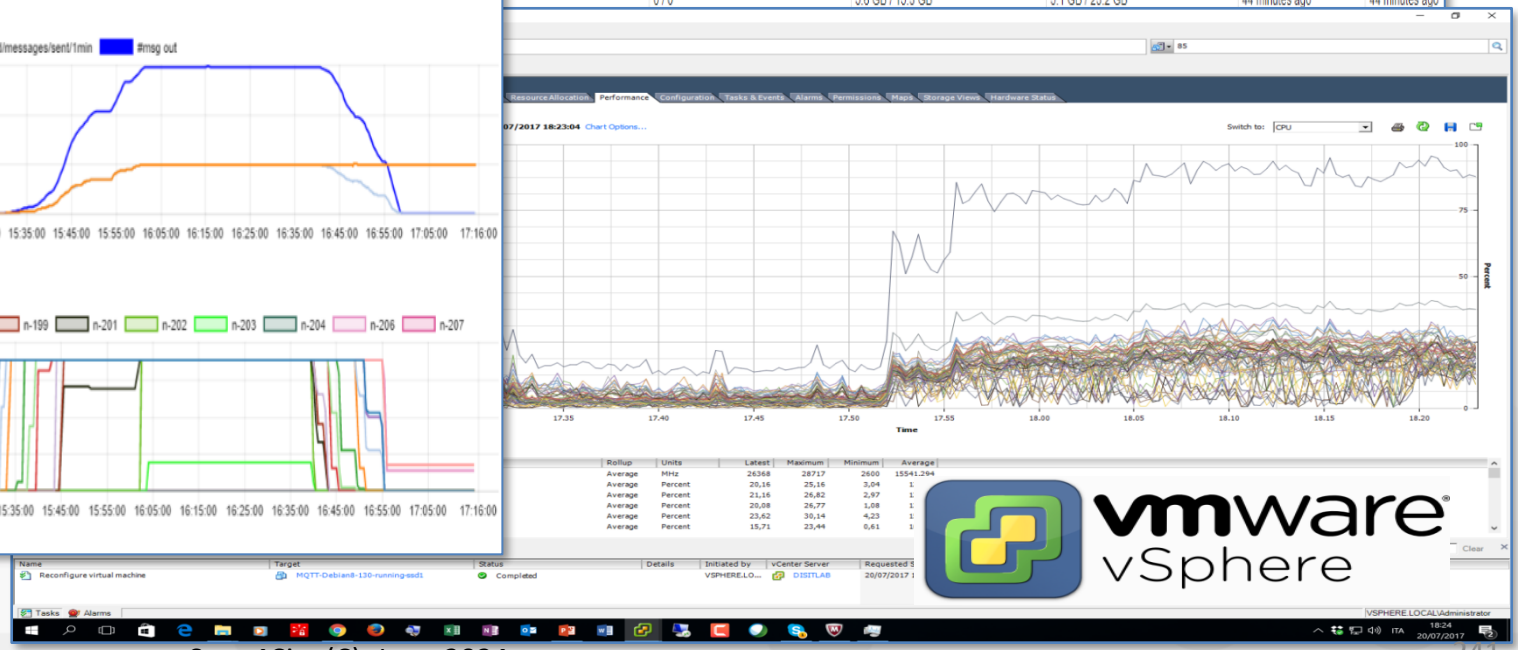
- Container Cluster Monitoring
- Back Office Container Monitoring
- Mesos view
- DISCES-EM
- DISCES-EM tail





ID	Host	CPUs (Allocated / Total)	GPUs (Allocated / Total)	Mem (Allocated / Total)	Disk (Allocated / Total)	Registered	Re-Registered
...ed7e77068927-S7	192.168.1.195	5.95 / 6	0 / 0	9.6 GB / 15.3 GB	8.8 GB / 23.2 GB	18 hours ago	18 hours ago
...ed7e77068927-S6	192.168.1.207	5.95 / 6	0 / 0	9.6 GB / 15.3 GB	8.8 GB / 23.2 GB	14 hours ago	14 hours ago
...ed7e77068927-S5	192.168.1.206	5.95 / 6	0 / 0	9.6 GB / 15.3 GB	8.8 GB / 23.2 GB	13 hours ago	13 hours ago
...ed7e77068927-S4	192.168.1.204	5.95 / 6	0 / 0	9.6 GB / 15.3 GB	8.8 GB / 23.2 GB	13 hours ago	13 hours ago
...ed7e77068927-S1	192.168.1.201	5.95 / 6	0 / 0	9.6 GB / 15.3 GB	8.8 GB / 23.2 GB	13 hours ago	13 hours ago
			0 / 0	5.6 GB / 15.3 GB	5.1 GB / 23.2 GB	44 minutes ago	44 minutes ago





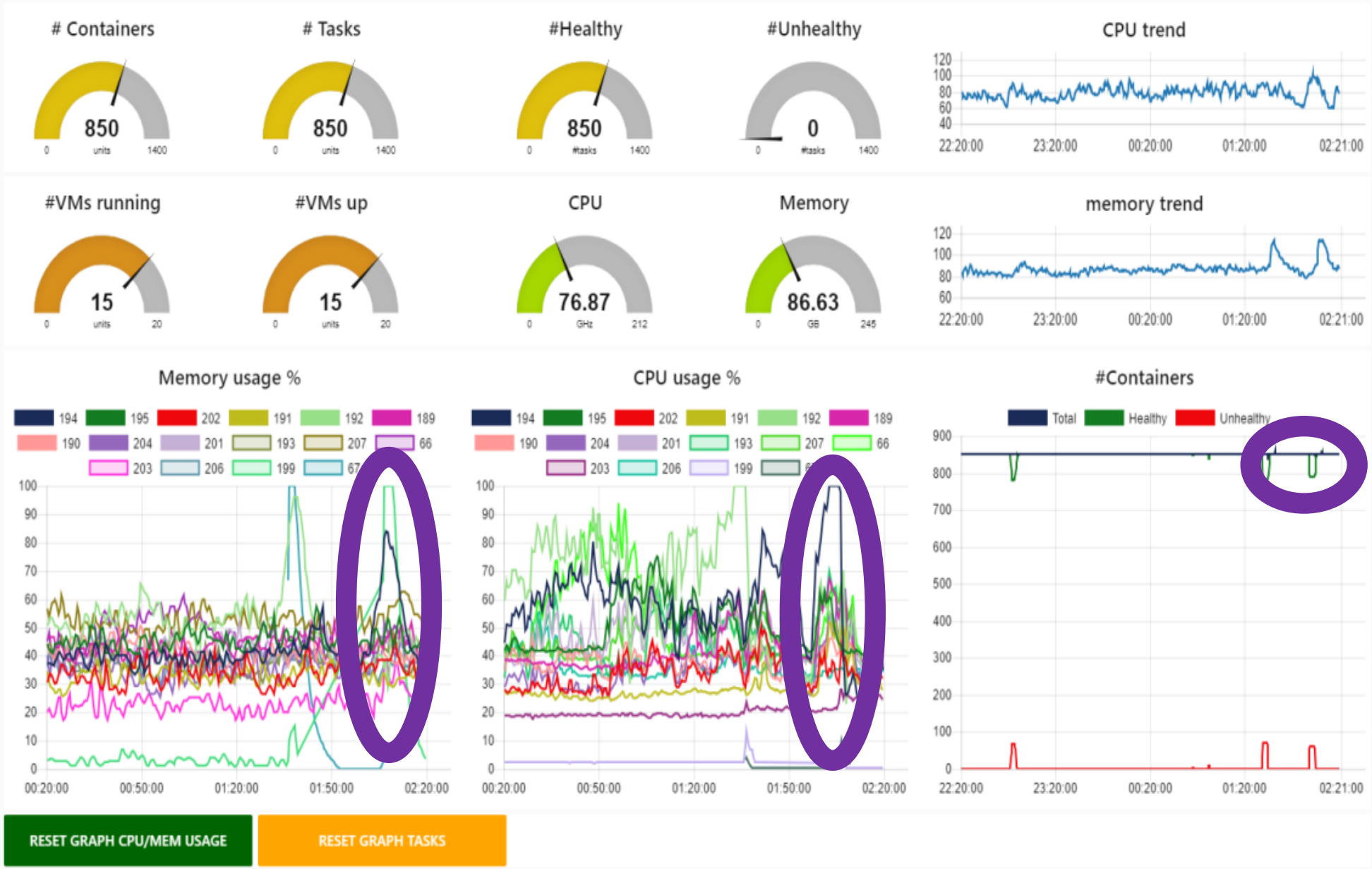
Snap4City

Container Cluster Monitoring

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

Cluster status




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
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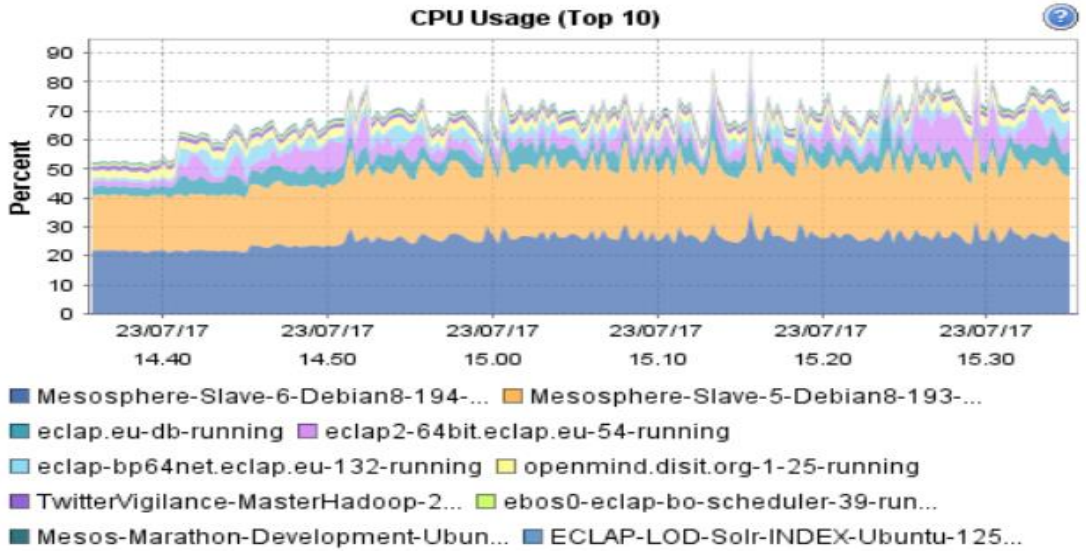
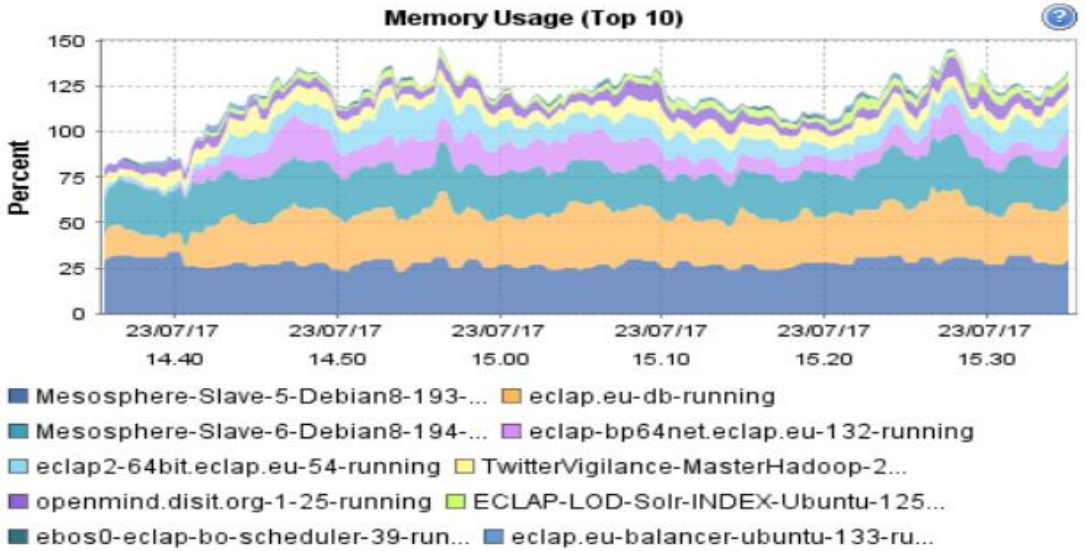
Container Cluster Monitoring
Back Office Container Monitoring
Smart City API Monitoring
Notificator Monitoring
Web Server Monitoring
Back Office Scheduler DISCES
Mobile Application Monitoring
Auditing Elements vs Ownership
Auditing Personal Data
Auditing Data Access Try-out
Auditing Accesses
Settings
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
Unhealthy Containers per VM
Docker Containers per VM

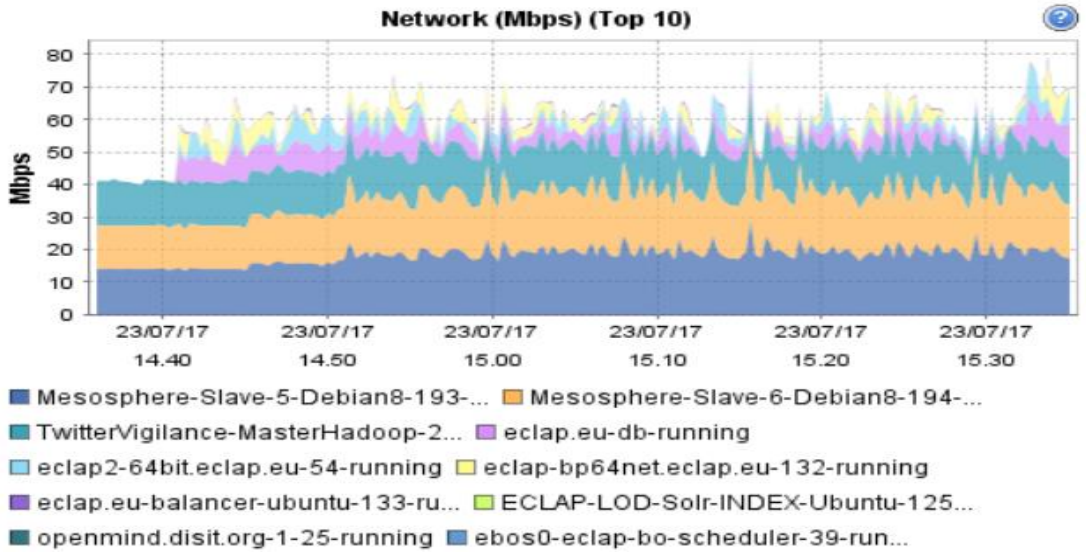
Computational Capabilities of Snap4City

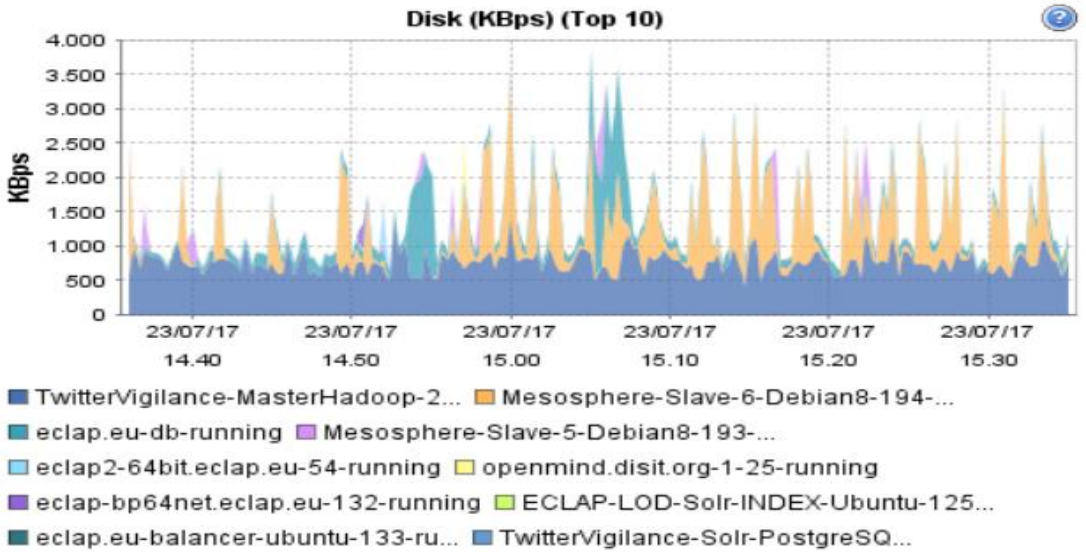
- **Managing:**
  - **Periodic Processes** → IoT App/Proc.Logic (Node-RED), Data Analytics (Python, Rstudio), even former ETL/ELT
  - **Asynchronous processes**, event driven, real time → Node-RED (SS Business Logic, IoT App / Proc.Logic
- **Scalability**
  - **Horizontal**: Increasing processes performing 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



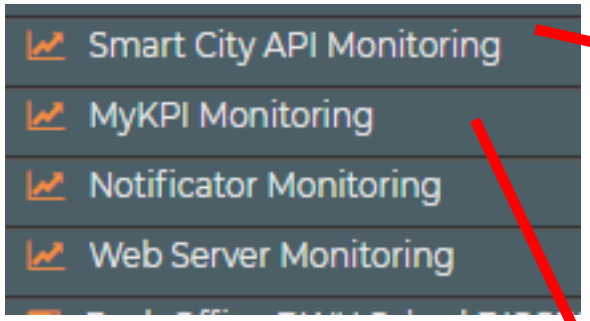




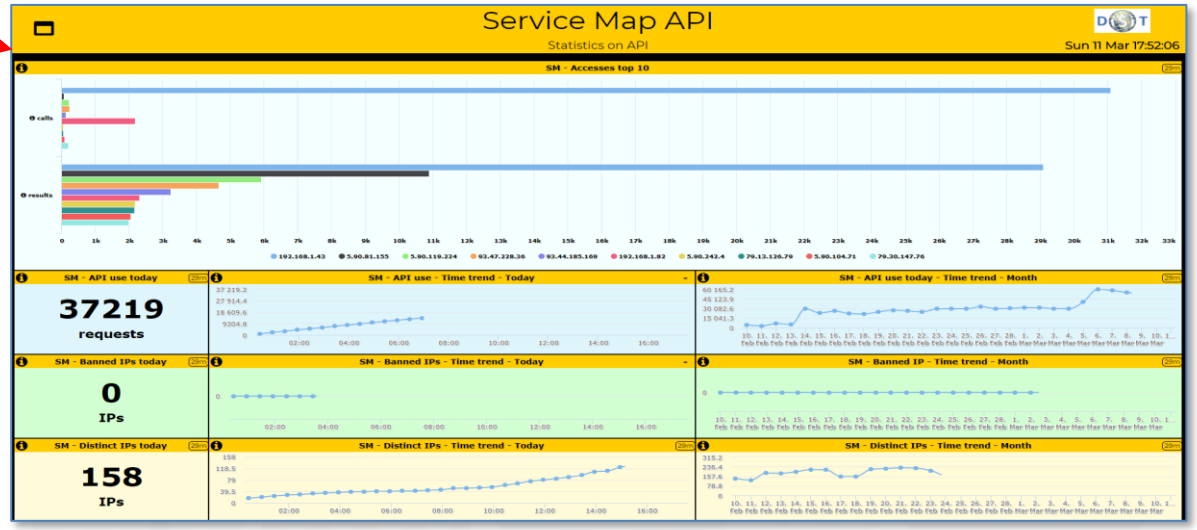


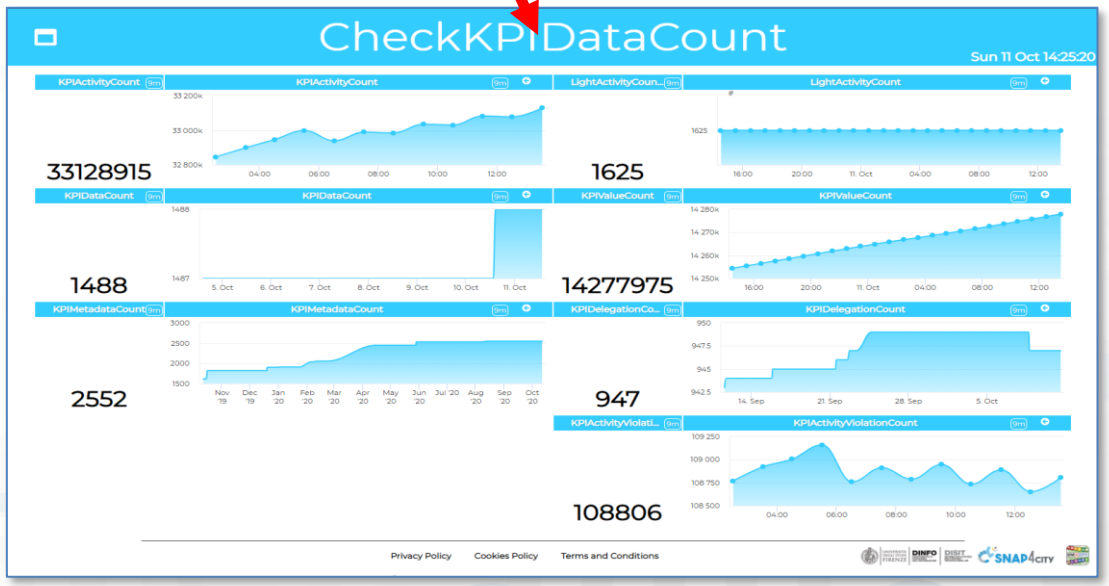
Monitoring Resources and API Traffic (not control of API consumption which is in APIMAN)

Monitoring Smart City API Usage



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

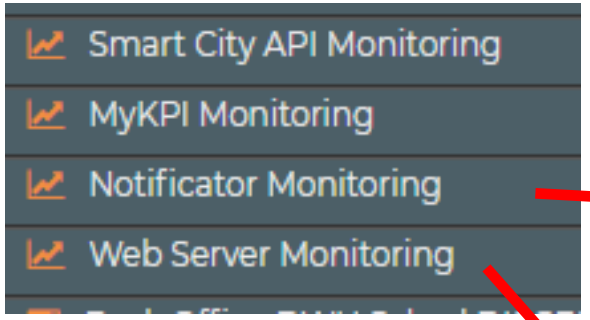


- 

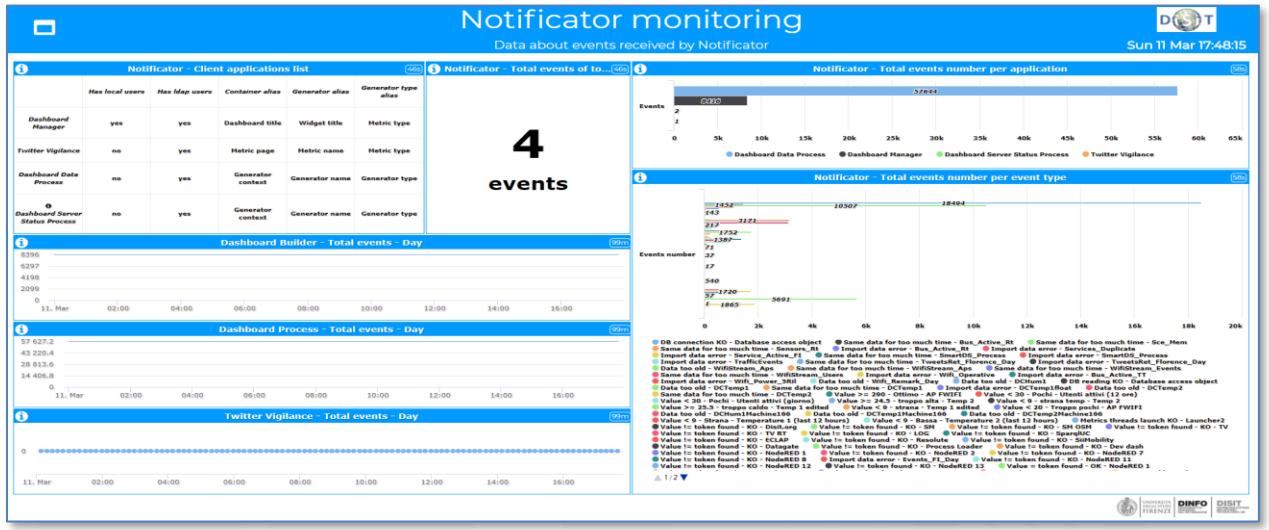
Block eventual IPs

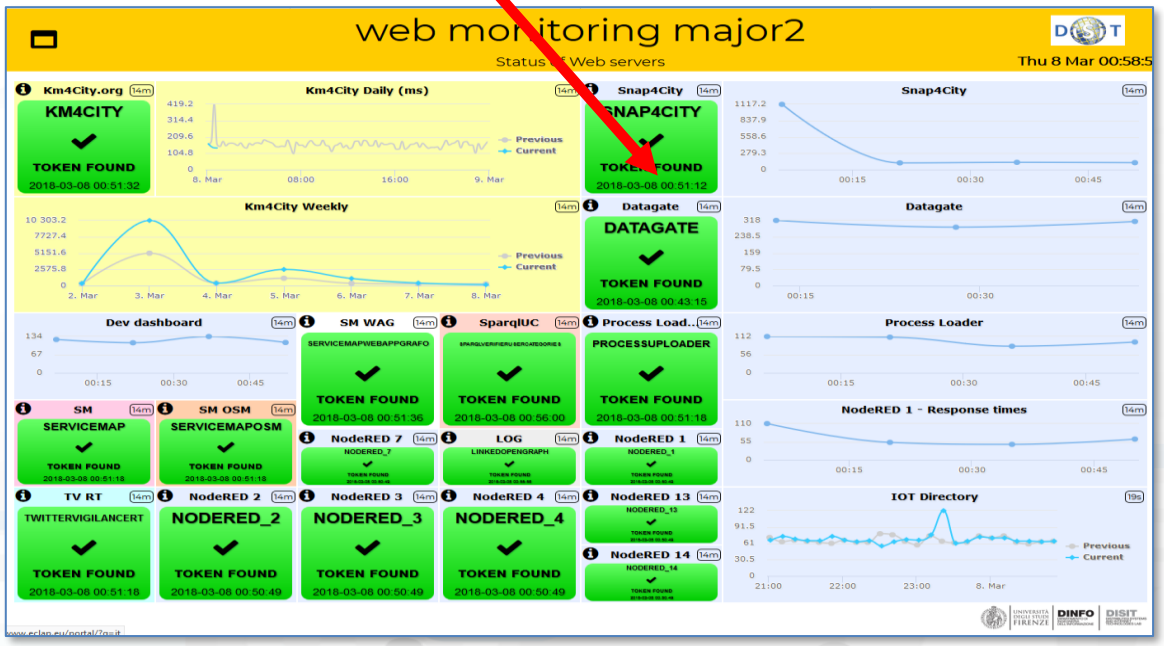
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTY0NA==

Monitoring Resources and Traffic



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



- 

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

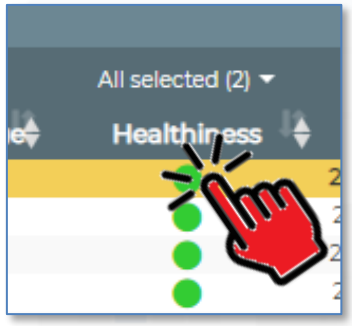
Report Generation and Management (admin tool)

Report Generation in Snap4City

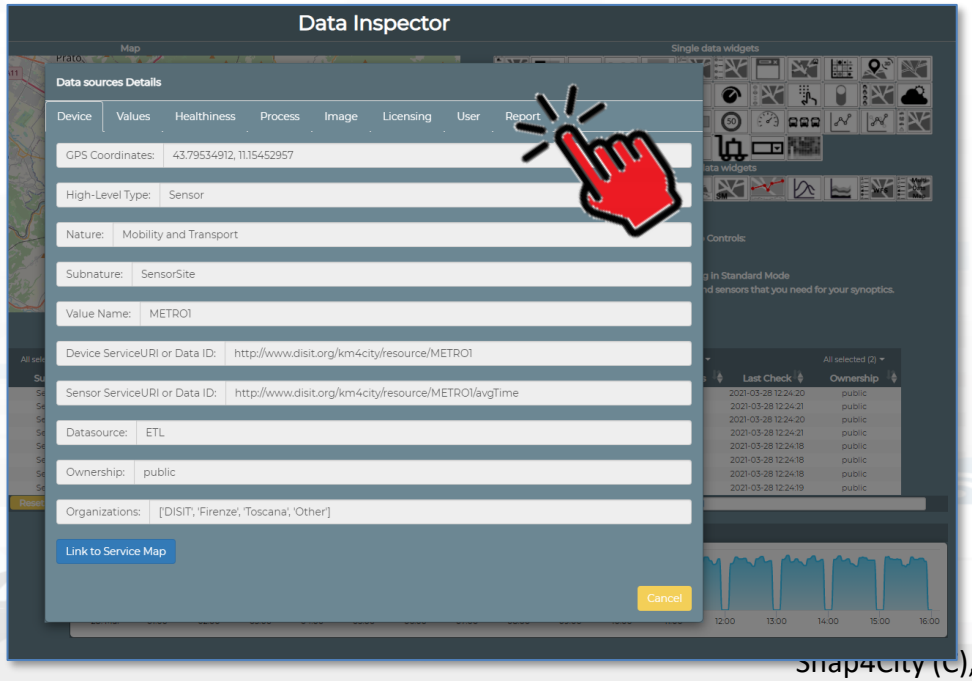
- The reports can be produced in two different manners, by using:
  - 1) **Report Generator** which periodically can go on the data and KPI, computing the report and producing them for specific users
    - They are activated and scheduled by the Wizard on the single Entity/Device
    - They can be customized 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

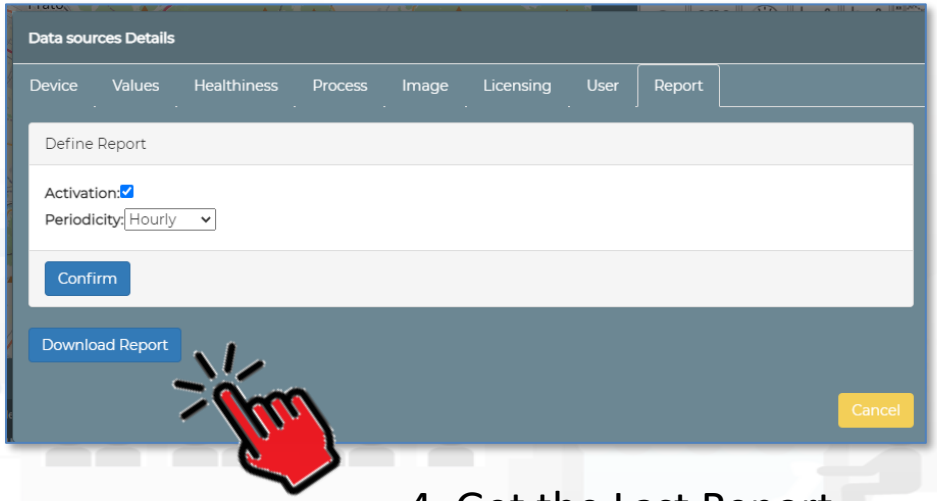
- **Device/data** owner may have their reports: **monthly or 3-monthly**
  - Ready to use reports are available for:
    - Single Device: ETL and IOT
  - Ask to your RootAdmin to activate the production of reports (and also **hourly** report **for testing only**).



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

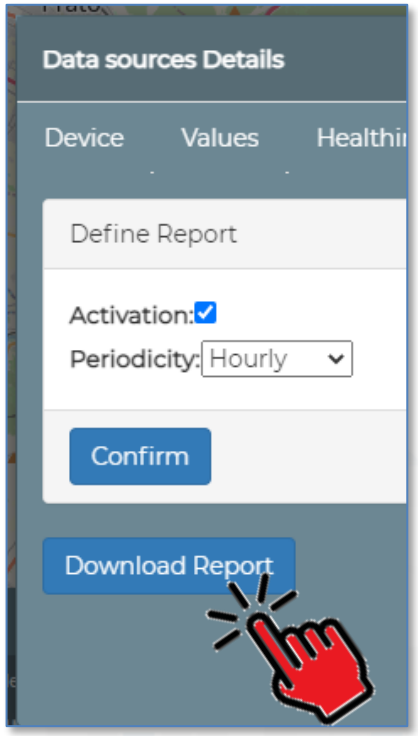


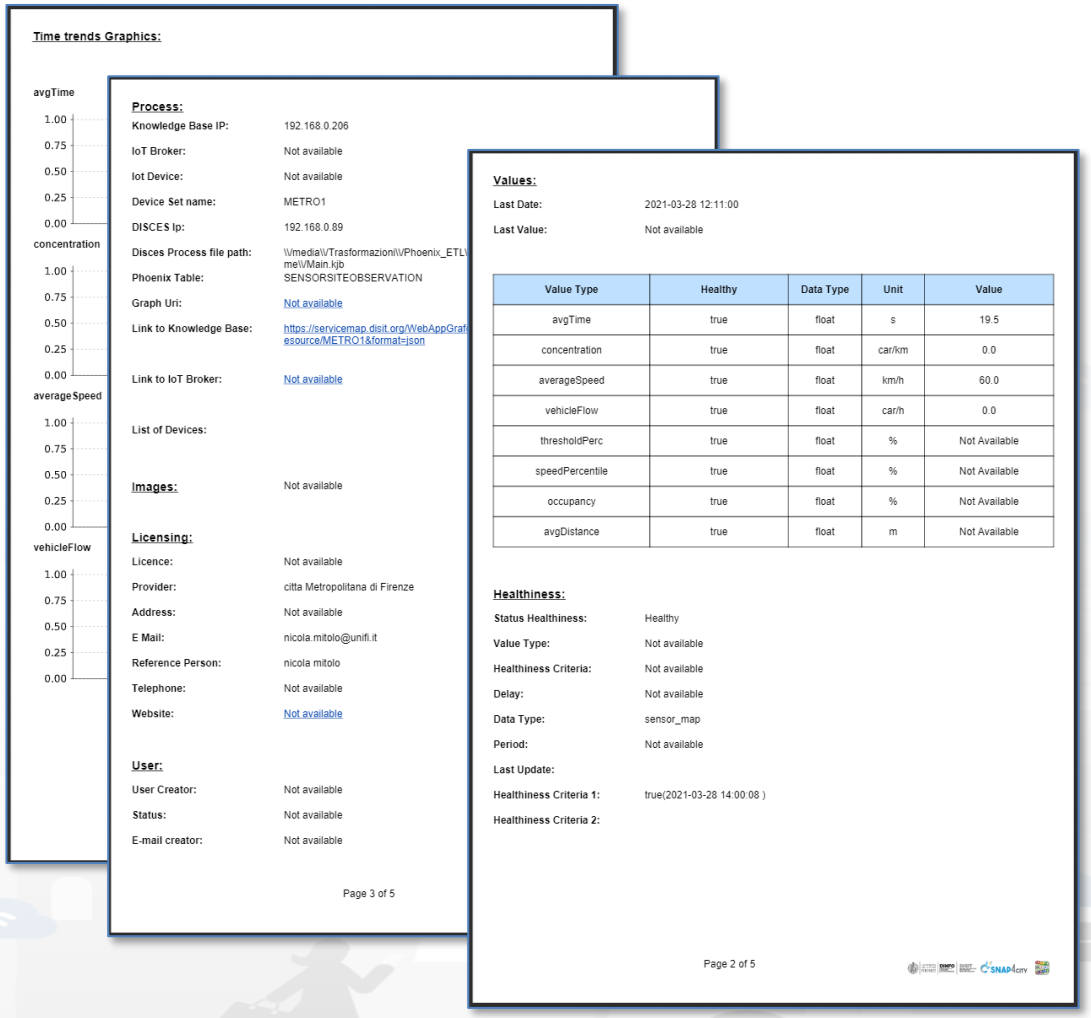
3. Click on report

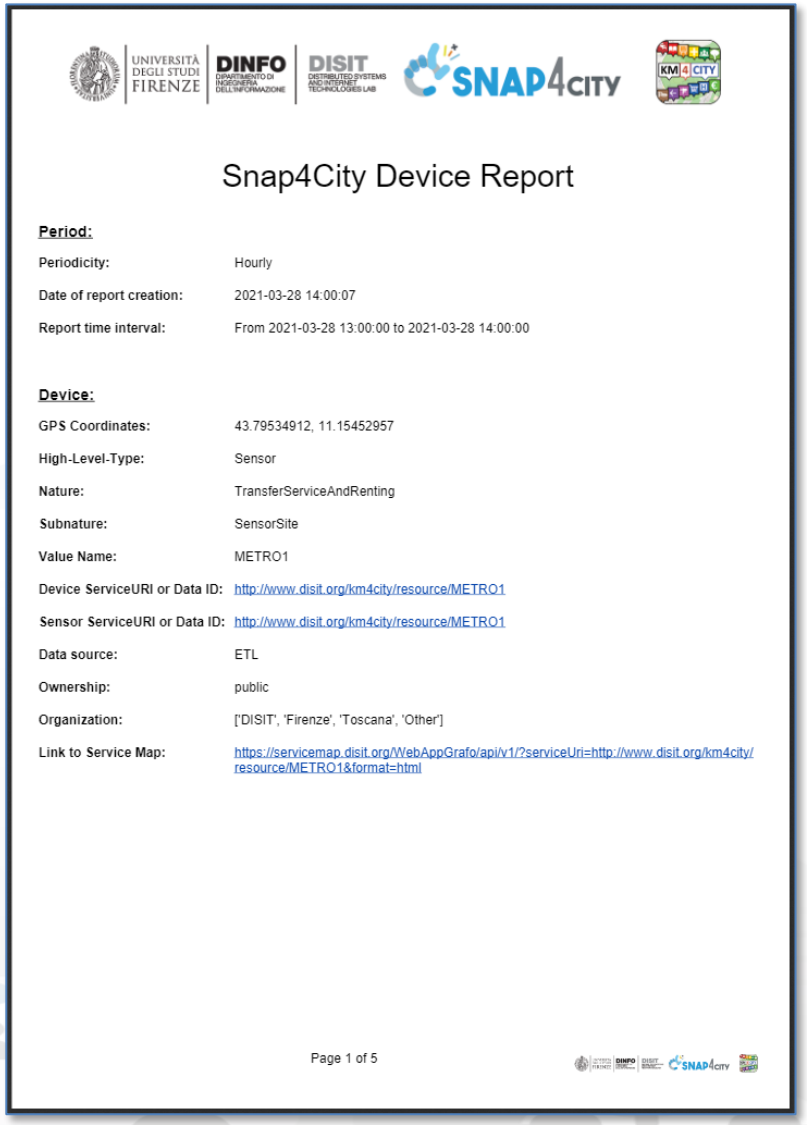


4. Get the Last Report

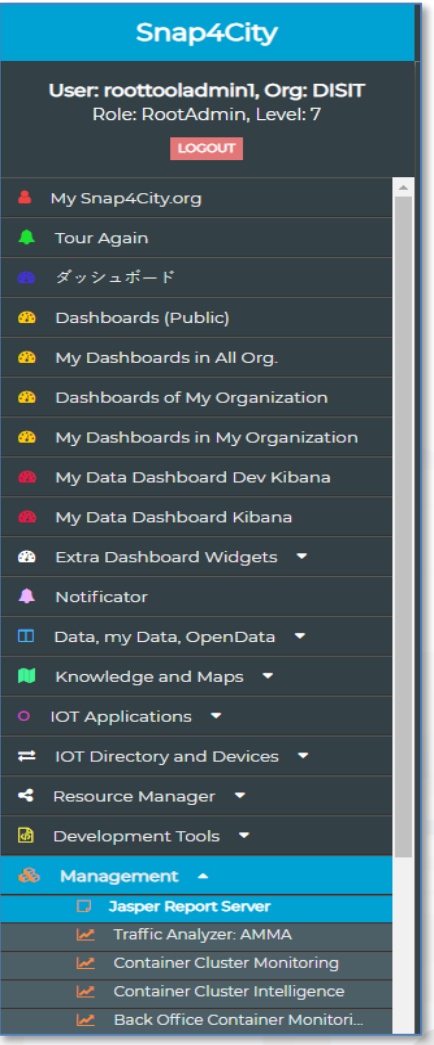
Take the last report



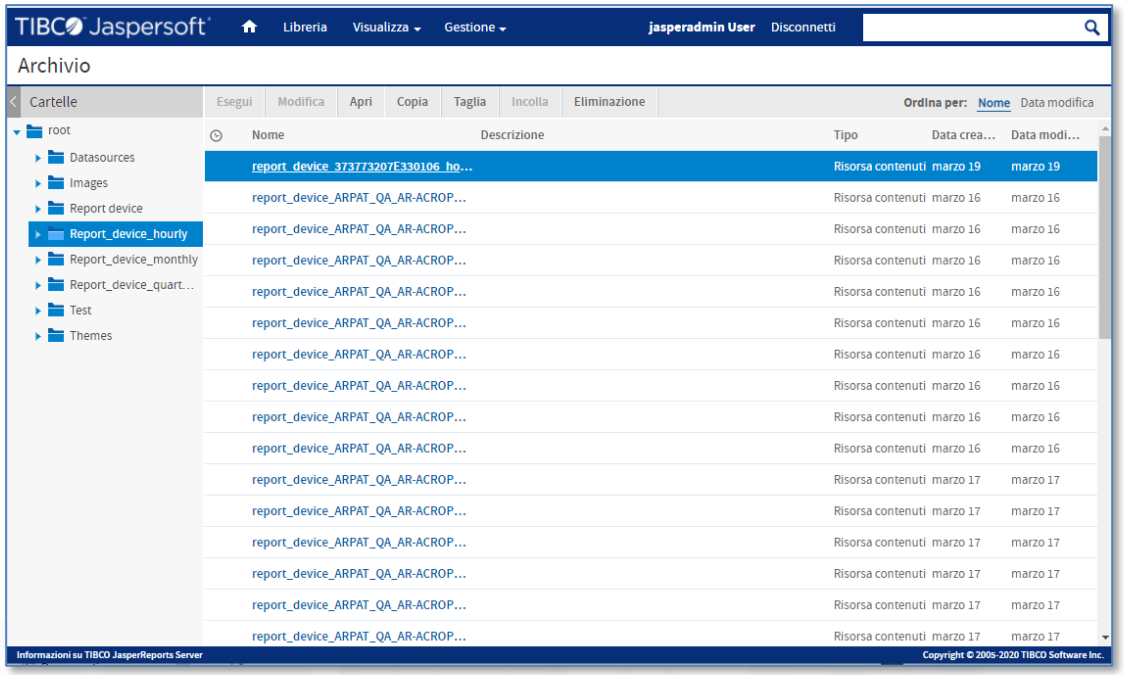




Report Generation and Management



- **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

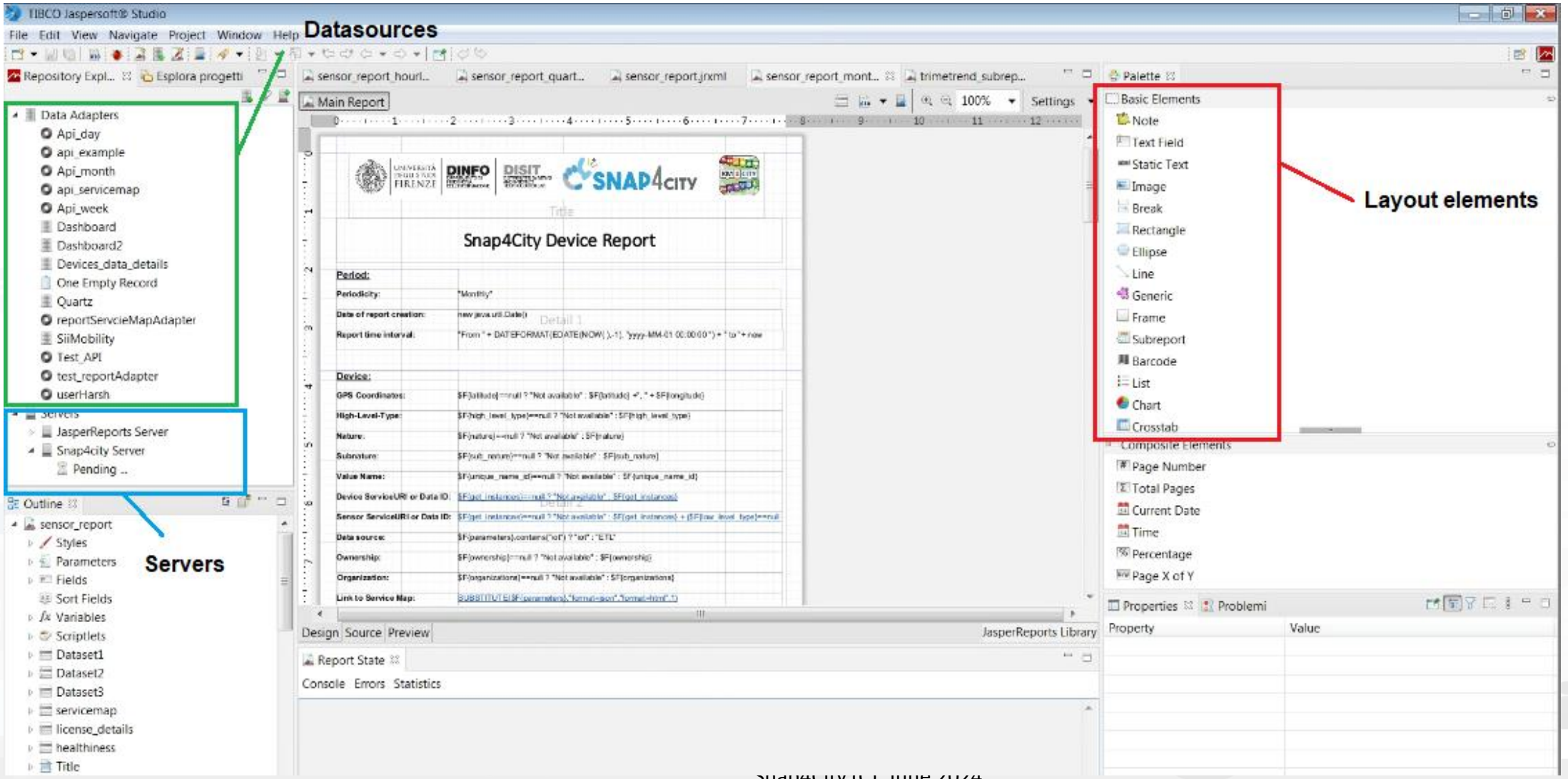


Report user manuals:

https://www.snap4city.org/720

https://www.snap4city.org/721

How to Customize/Manage the Report Model



TOP

Snap4Tech:

Smart Solutions as a Service

https://marketplace.docker-fid.grid.cyf-kr.edu.pl/services/snap4city

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

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

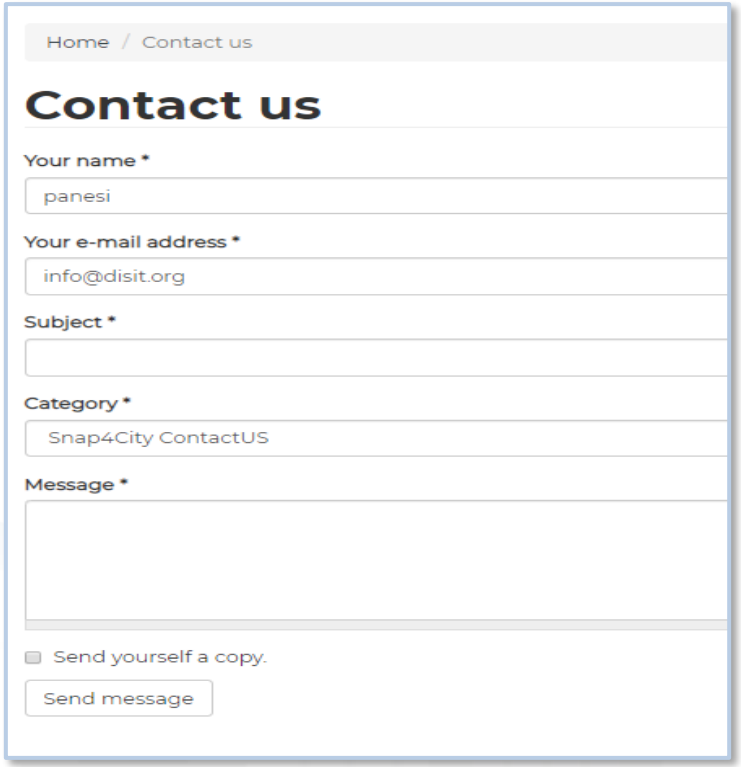
Specialized Offer

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 t heir premise from them self.

Help Desk and SLA

- https://www.snap4city.org/drupal/contact
- Bug Reporting
  - https://docs.google.com/forms/d/e/1FAIpQLSfDQtKqgLIlyycNXiazeYEh1SsRG1YL8Ze4ThD8nZoA5jsoXw/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



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.**

TOP

Deploy Snap4Tech solutions:

Docker Based

Installations

docker

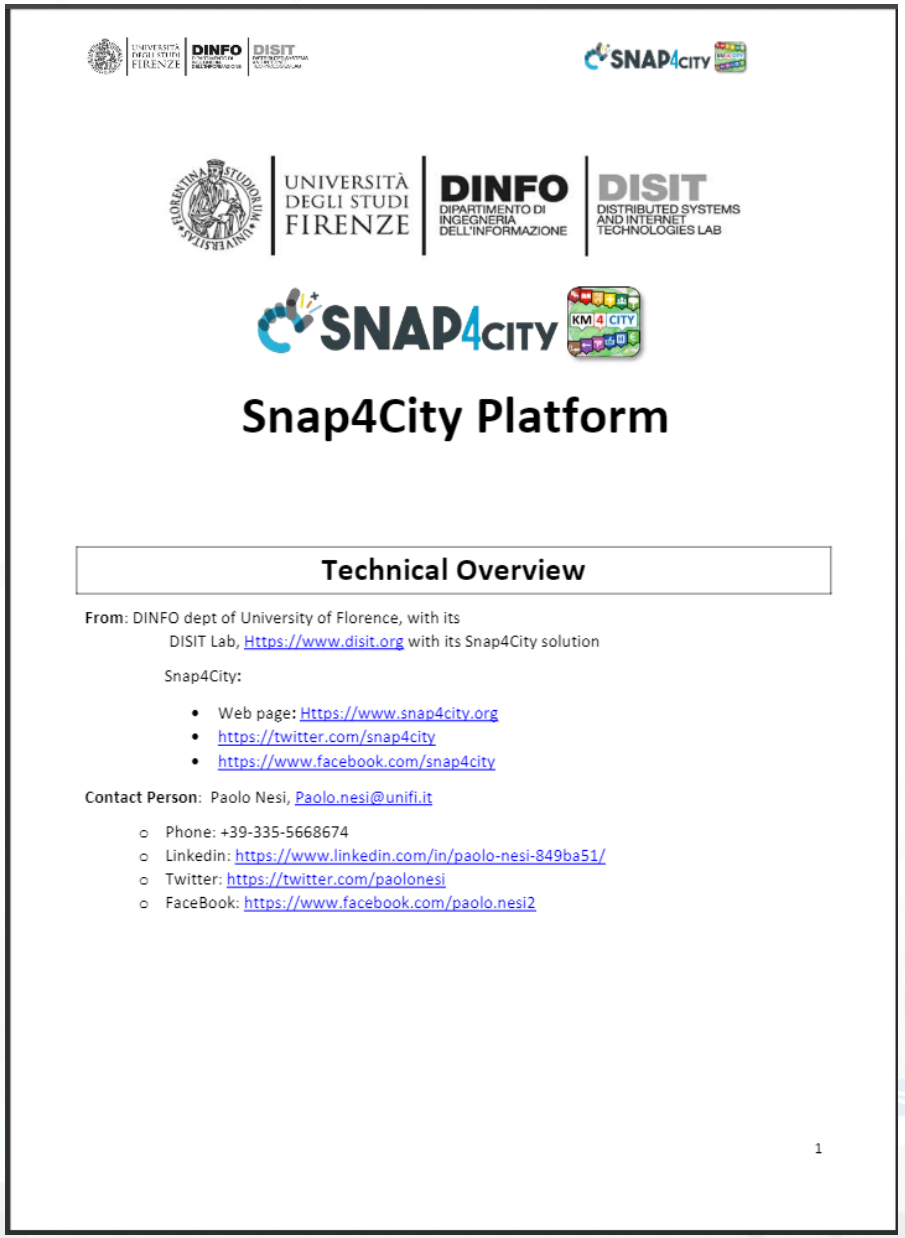
https://www.snap4city.org/738

To get an updated version read it!

- Deploy and Installation
  - Doc: Installing Snap4City/Indust...
  - Doc: DataCity-Large
  - Docker Config Generator x Snap...
  - Doc: Docker Config Generator
  - Doc: Some Config FAQ

aws

Microsoft Azure



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SNAP4CITY

Snap4City Platform

Technical Overview

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

Snap4City:

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

Contact Person: Paolo Nesi, Paolo.nesi@unifi.it

- Phone: +39-335-5668674
- Linkedin: https://www.linkedin.com/in/paolo-nesi-849ba51/
- Twitter: https://twitter.com/paolonesi
- FaceBook: https://www.facebook.com/paolo.nesi2

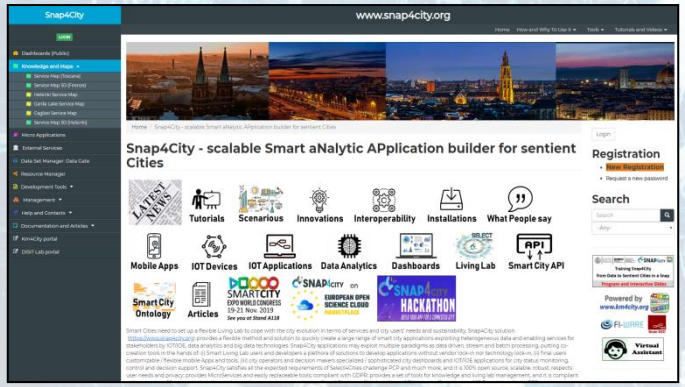
1

Tech Overview

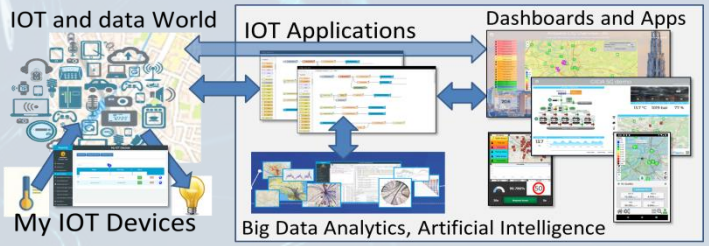
- https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf

How to adopt Snap4City

Https://www.snap4city.org



On your premise



Smart City as a Service

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

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

Download and deploy

Installation on your premise

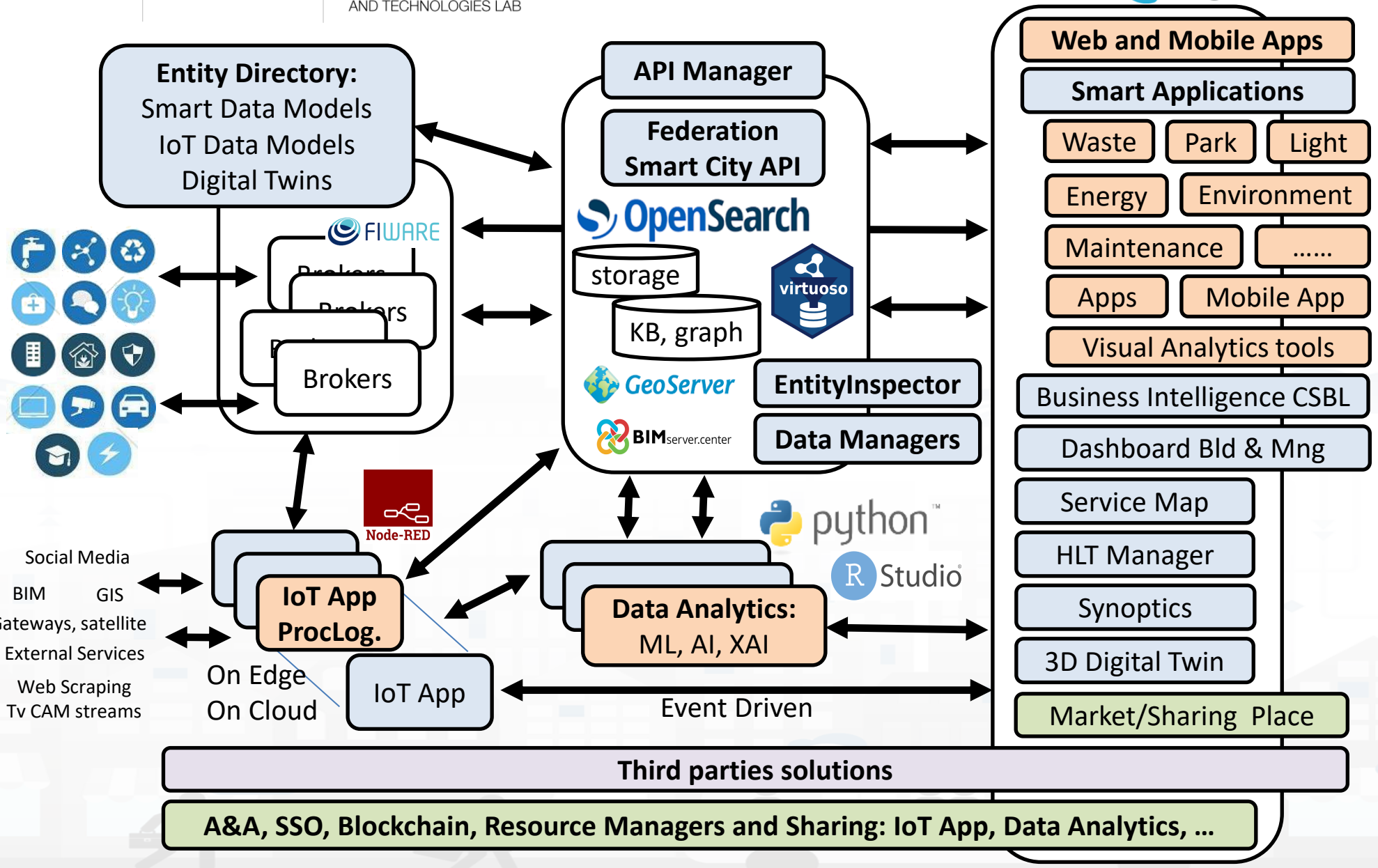
- **Virtual Machines or Dockers**
- Different configurations
  - From small to scalable
  - Exploiting your legacy tools
  - Interoperable with any tool
- No vendor lock-in, No tech lock-in

Mixed solutions! For example:

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

Powered by SNAP4Tech

Tech Arch


Entity Directory:
Smart Data Models
IoT Data Models
Digital Twins
FIWARE
Brokers
Brokers
Brokers
API Manager
Federation
Smart City API
OpenSearch
storage
KB, graph
virtuoso
GeoServer
EntityInspector
BIMserver.center
Data Managers
Node-RED
python
RStudio
Social Media
BIM
GIS
Gateways, satellite
External Services
Web Scraping
Tv CAM streams
IoT App
ProcLog.
On Edge
On Cloud
IoT App
Data Analytics:
ML, AI, XAI
Event Driven
Web and Mobile Apps
Smart Applications
Waste
Park
Light
Energy
Environment
Maintenance
……
Apps
Mobile App
Visual Analytics tools
Business Intelligence CSBL
Dashboard Bld & Mng
Service Map
HLT Manager
Synoptics
3D Digital Twin
Market/Sharing Place
Third parties solutions
A&A, SSO, Blockchain, Resource Managers and Sharing: IoT App, Data Analytics, …

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legenda

SNAP4CITY | KM 4 CITY

Platform Management: docker, SNAP4CITY

Presentation: Control Room, Widgets, Mobile Apps, Visual Analytics Applications, Telegram Bot, …
- Dashboard Builder
- Dashboard Mng
- Synoptics
- 3D Digital Twin
- Dashboard Wizard
- Data Inspector
- Scenario Editor
- CSBL

External Interoperability: Smart City API, Federated, API Accounting/Billing
- Super
- ASCAPI
- kafka
- WebSocket

Node-RED

Proc.Logic / IoT Applications Data Flow Logic

Operation:
- What-if
- Simulation
- Event Reporting
- File Mng
- Heatmap Mng
- Traffic Flows Mng
- ODM Mng
- TVCam Mng
- BIM Mng
- .....
- R Studio
- python
- docker
- .....
- KPI, Indicator Analysis
- WorkFlow Tickets BPM
- Sentiment Analysis
- SUMO
- Tipyc. Time Trend
- .....
- Open to any module and system
- Data Processing
- Predictions
- Anomaly detection
- Statistics
- Artificial Intelligence
- Routing
- Internal GIS GeoServer
- ckan
- openMAINT
- BIMserver.center
- .....

Internal Interoperability: API, MicroServices
- Snap4City Node-red Libraries
- ASCAPI
- WebSocket
- FIWARE

Data Storage and Reasoning: data storage, noSQL, aggregation, semantic modeling, city entities, normalization, knowledge base
- Service Map
- SuperServiceMap
- DevDash
- OpenSearch
- nifi
- virtuoso
- NGSI V1, V2, LD — FIWARE
- Linked Data triples

Data Collection: data mining, harvesting, integration, transformation, data models, …
- Directory
- Blockchain
- Harvester
- Data Manager
- Brokers
- Brokers
- FIWARE
- Node-RED

Any protocol and format | Any protocol and format

Connectivity: wired, wireless (Lora, 5G, 4G, 3G, Wi-Fi, etc…), IoT Edge, etc.
- Node-RED

Any protocol and format | Any protocol and format

Authentication and Authorization: KEYCLOAK, OpenLDAP, SNAP4CITY — **GDPR compliant**

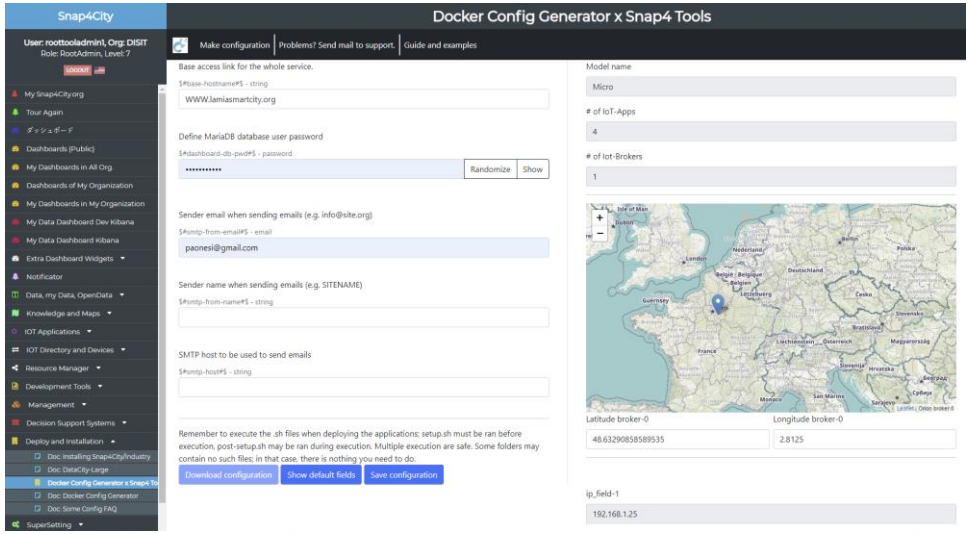
Partecipatori and Living Lab Supports

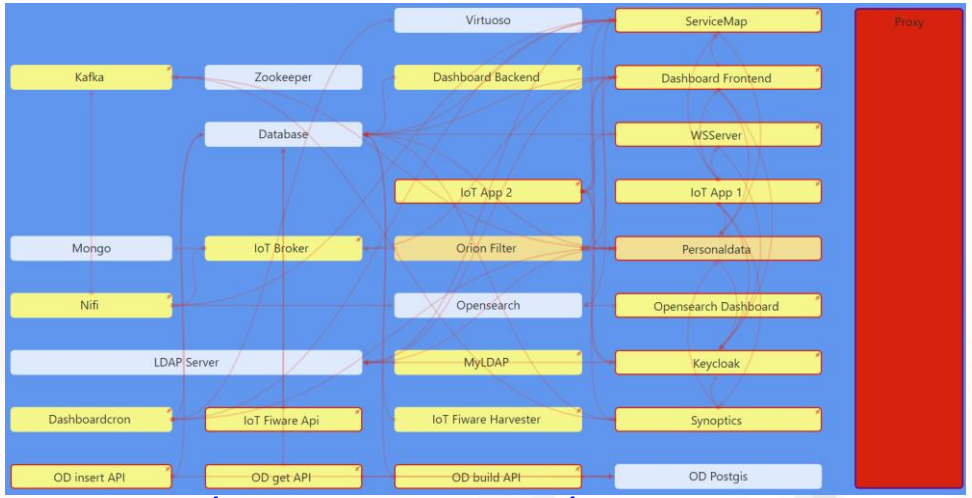
Device Layer

External Third Party Services
- GIS
- BIM
- OSM
- Gateways
- External Services
- Web Scraping
- Social Media

Installations, different models a TOOL to get them

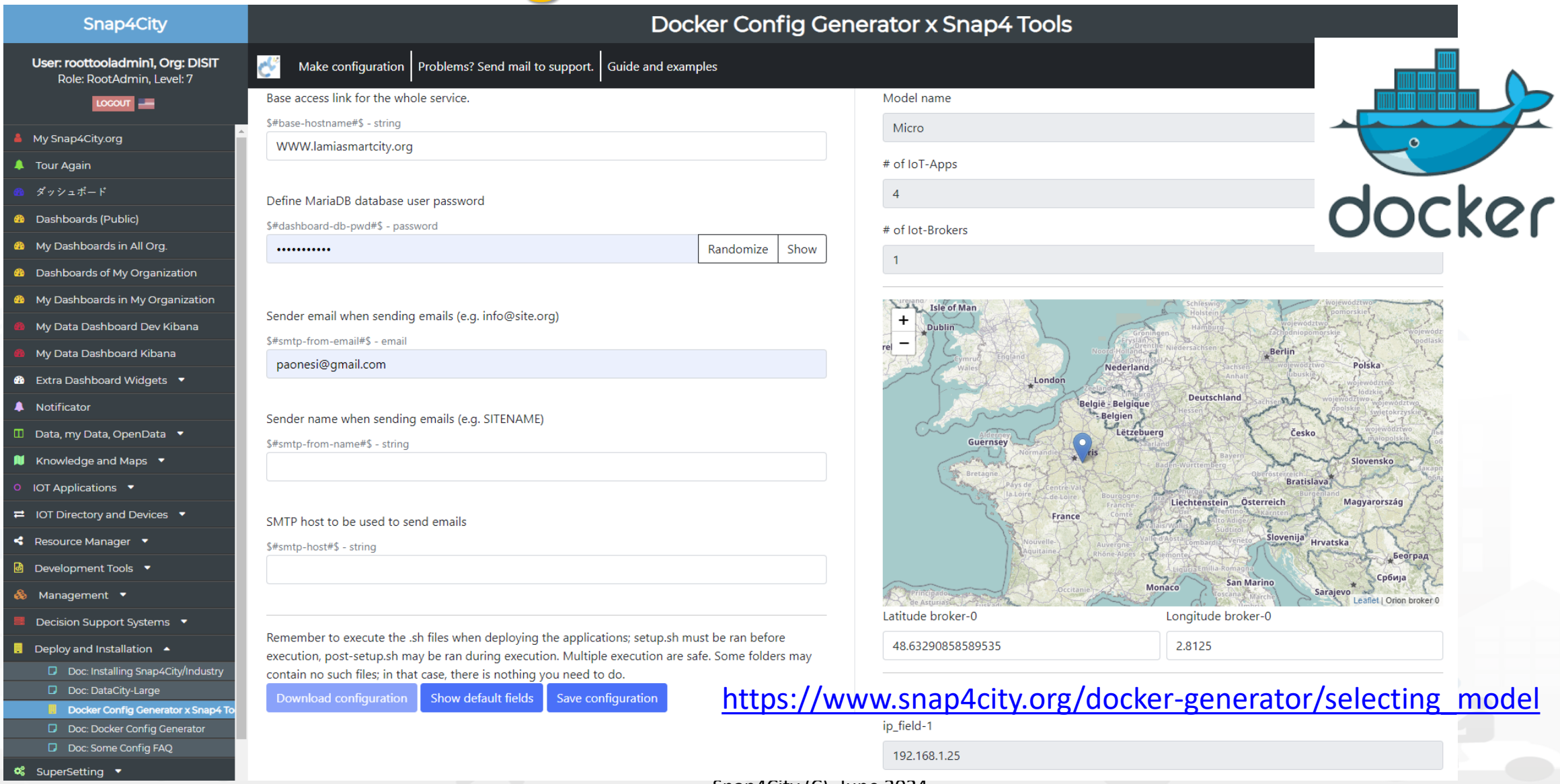
- **Micro X:**
  - 1 VM of dockers
- **Normal X,Y:**
  - 2 VM of dockers
- **Small X,Y:** scalable
  - 4 VM of dockers
- **DataCitySmall X,Y,Z:** scalable
  - 6 VM of dockers
- **DataCityMid X,Y,Z,T:** scalable
  - # VM + X/70 VM + Y/3 VM + Z VM + T VM of dockers
- **DataCityLarge:** scalable
  - depending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



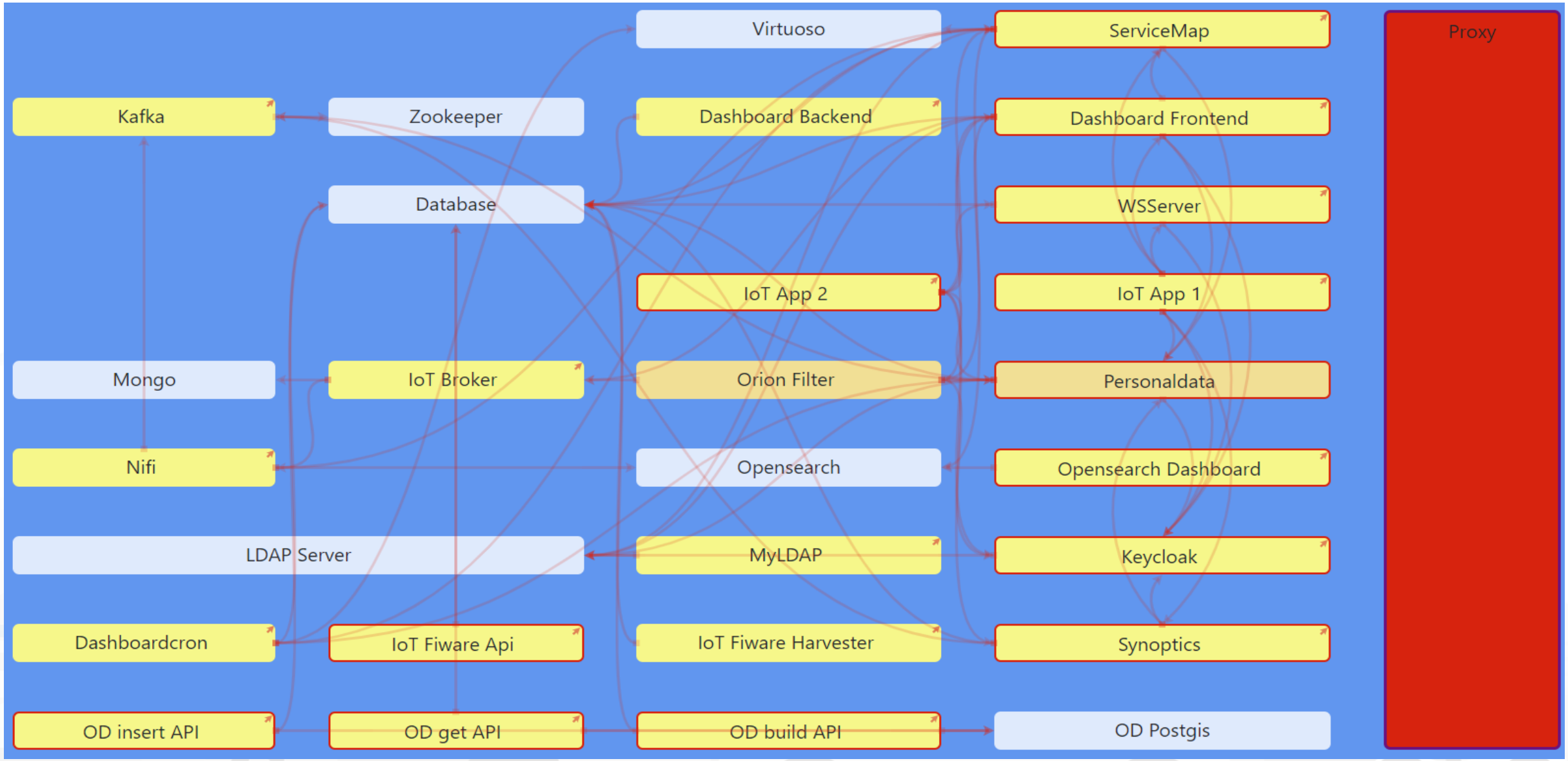


https://www.snap4city.org/docker-generator/selecting_model

Config Generator Tools

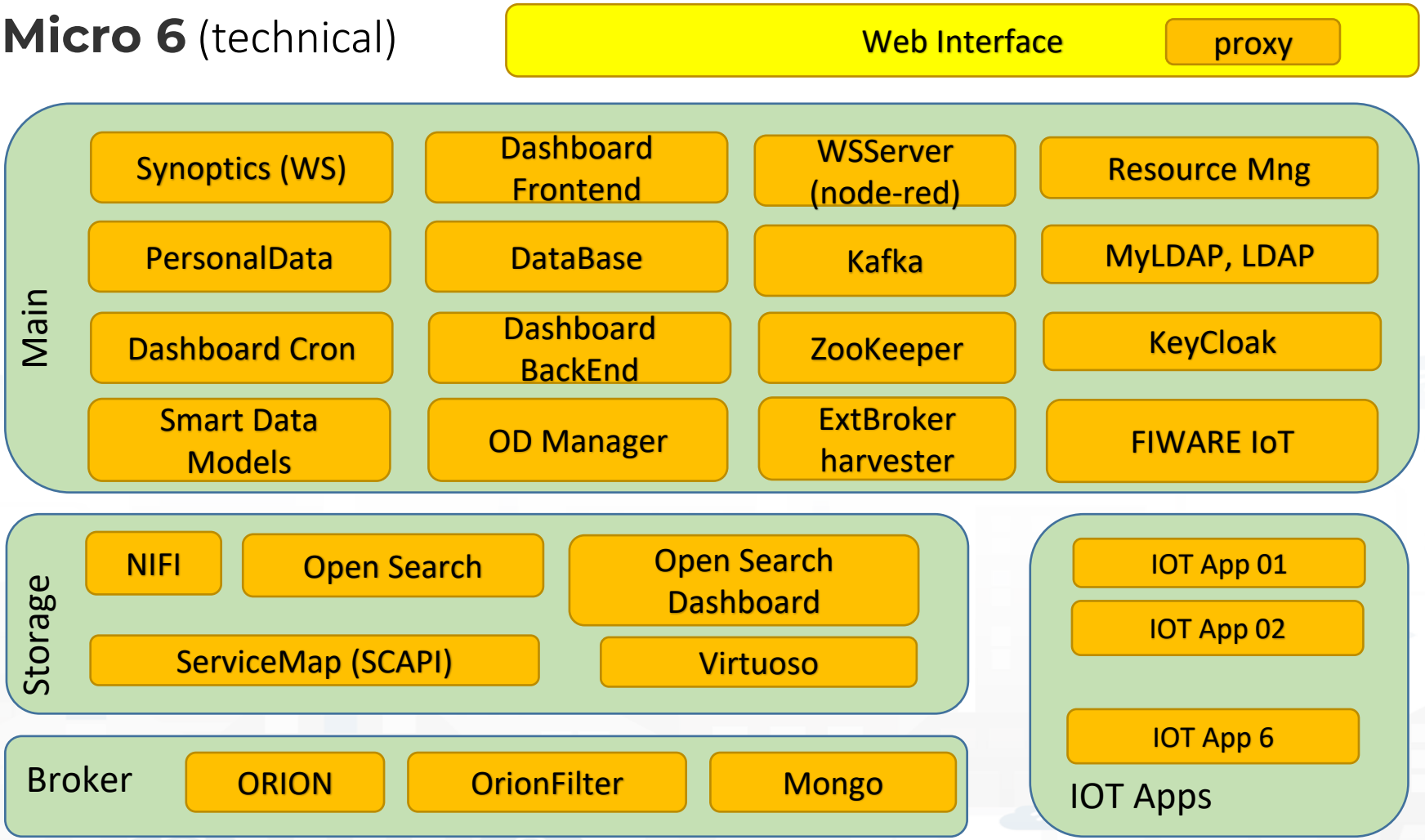


https://www.snap4city.org/docker-generator/selecting_model


Virtuoso
ServiceMap
Proxy
Kafka
Zookeeper
Dashboard Backend
Dashboard Frontend
Database
WSServer
IoT App 2
IoT App 1
Mongo
IoT Broker
Orion Filter
Personaldata
Nifi
Opensearch
Opensearch Dashboard
LDAP Server
MyLDAP
Keycloak
Dashboardcron
IoT Fiware Api
IoT Fiware Harvester
Synoptics
OD insert API
OD get API
OD build API
OD Postgis

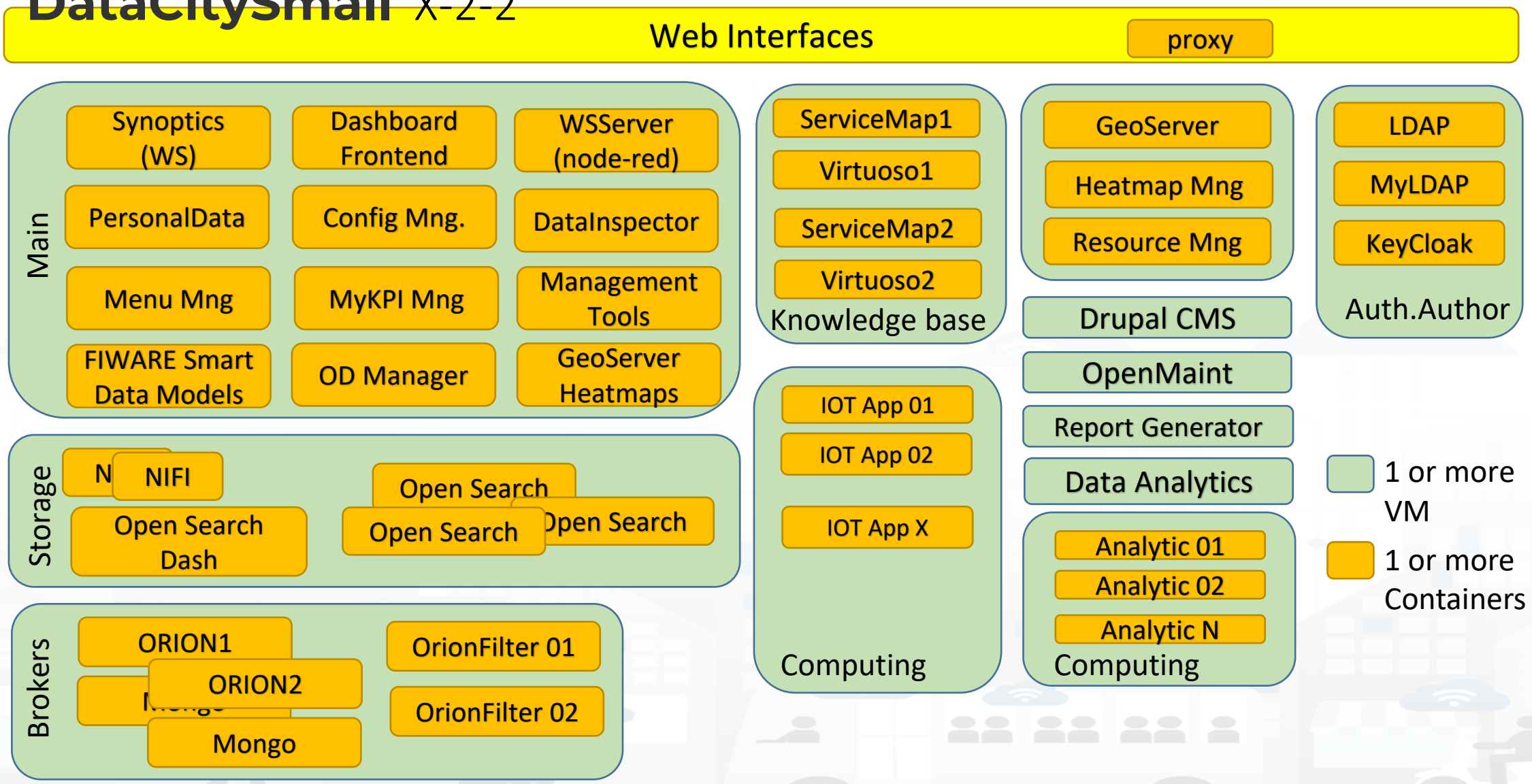
Micro 6 model

Micro 6 (technical)



1Hour installation and ready to use

DataCitySmall X-2-2

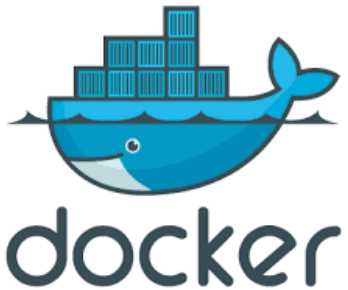


Container Based Installations, different models

- **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.

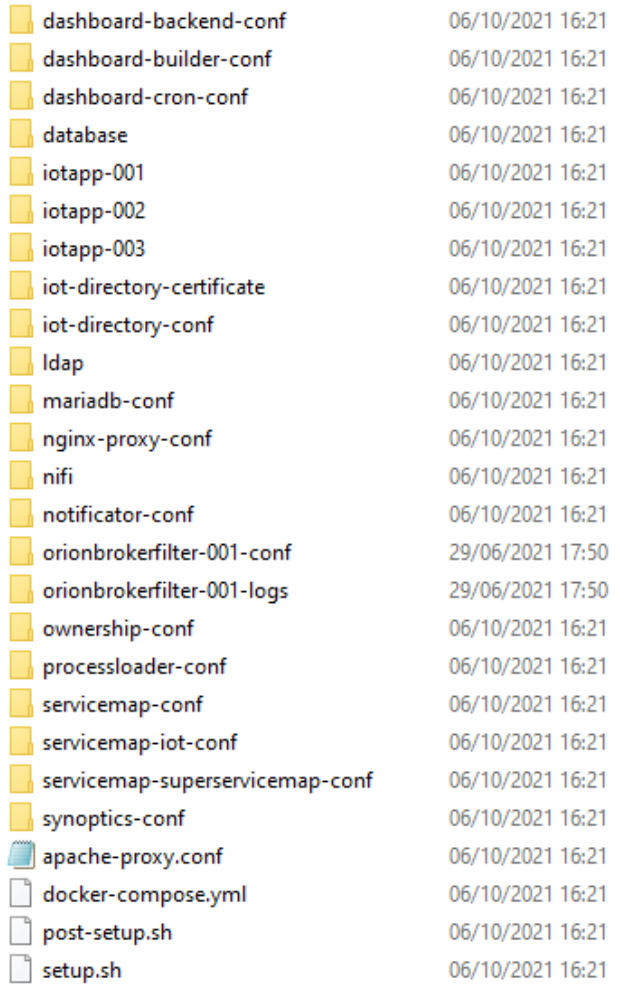
Container Based Installations, different models

- **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



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

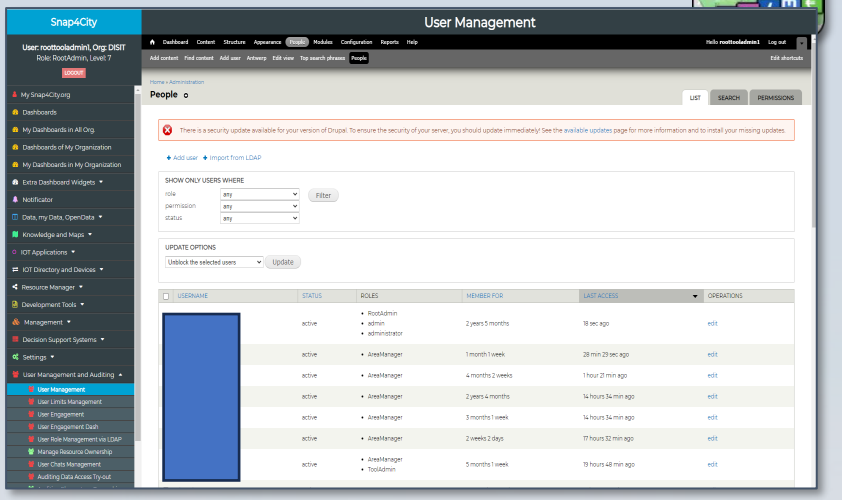
Monitoring status

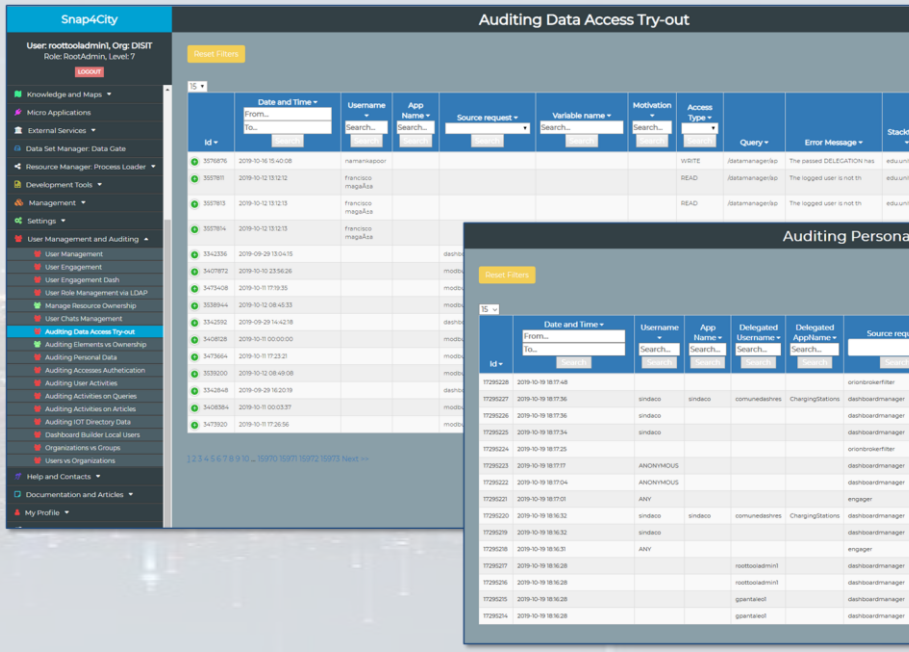
- EARLY: Via an IOT App inside the composition of dockers
- Via specific applications provided
- Via dashboards that can be installed and setup
- Also via Zabbix or Nagios (optional)

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

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.





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

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

Version 3.7 of 26/07/2023 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 25-05-2023 with AWS trial Kubernetes

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

This web page aims to prepare you entering into the Docker Config Generator Tool, and to provide you the minimal suggested info of the VMs involved in the installation.
This page is describing a tool for generating installation files for a number of different configuration models each of which with a set of parameters.
The main idea of the Snap4 Configuration Tool is to:

- allow you to select a configuration on the basis of the purpose
- provide you a wizard that is going to ask you information such as: IP, names, IDs, number of features interested
- generate for you a set of installation files to perform an almost automated configuration based on Containers on your VMs on any cloud/servers
- save the installation files to be reused by you in other installations, also modifying some parameters.

The installation files are generated for a number of proposed configurations with a number of scalable parameters.
Depending on the configuration a different number of VMs will be suggested and the configurations will be provided for each VM.

- We suggest you to use Debian distribution for the VM. You can get the ISO from https://www.debian.org We also suggest to execute your VM on cloud environment as Vmware or similar.
- in each VM, the docker and docker-compose have to be installed, please verify their correct installation.
- each VM should have at least 10 Gbyte of RAM, more than 50 Gbyte of HD, but this is going to depend on the data you would like to have, and 8 cores or virtual cores. The precise size of the VM (in terms of Memory, CPU, Storage) can be computed only at the end of the Docker Config Generator process when all needed information for their computation will be provided by you to the tool, and when the number of VM are also known.
- The VM have to provide a network connection with the IP that you have to provide in the file generation process. If you execute the VM into VMWare player, the VM network

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

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

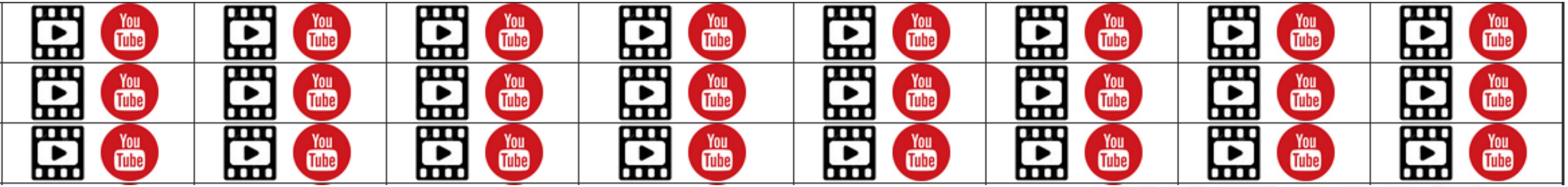
- Data Streams from partecipatory, Mobile App
- Data streams from Mobile vehicles and smart phones Devices
- Data Ingestion via Web Scraping
- Data stream from TV Cameras, TV Cam Manager
- Social Media interoperability

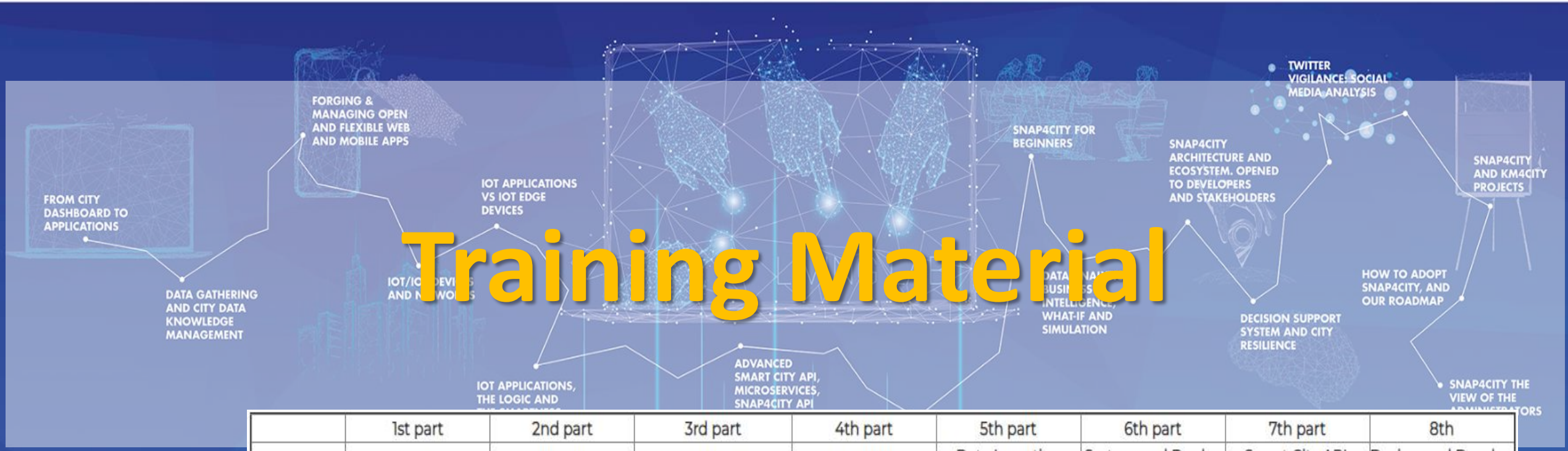
- **Another Complete Example**
- **BlockChain models and devices in Snap4City (new feature)**
- **Orion Broker:**
  - **Services/SrvPath and Multitenant**
- **External and Internal Brokers,**
  - **External Broker harvesting**
- Managing Node-RED on edge from cloud
- More on: Security of Snap4City Stack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

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
							
							





Training Material

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

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** !


- 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

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

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

Snap4City: Smart aNalytic APp builder for sentient Cities and IOT

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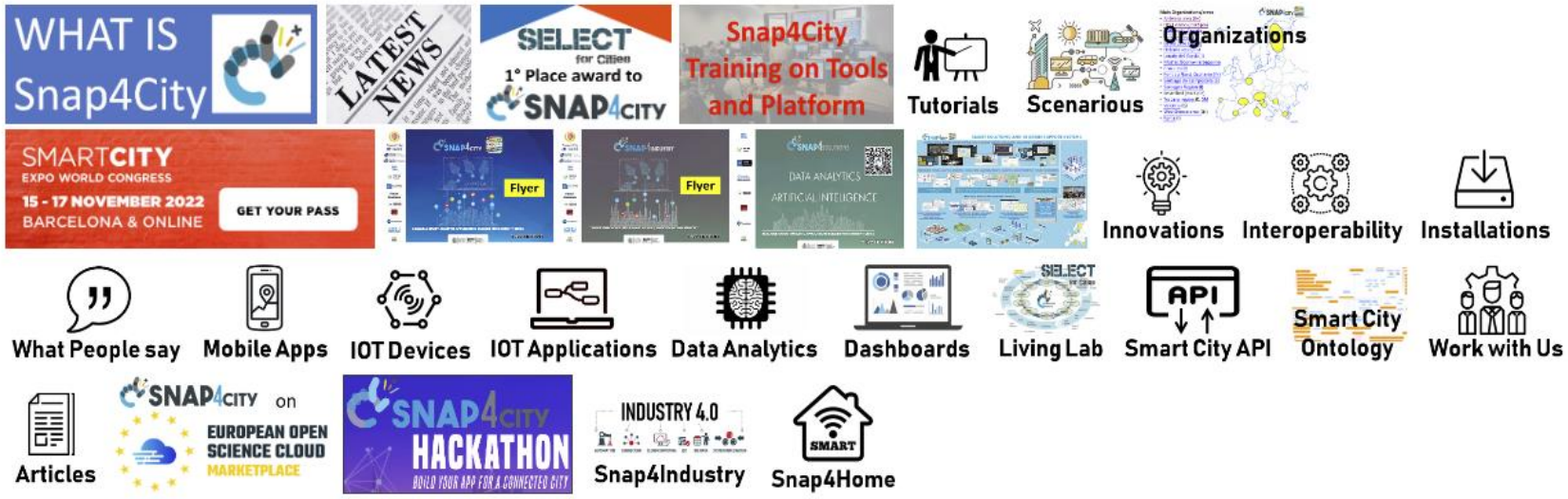

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- Client-Side Business Logic Widget Manual: https://www.snap4city.org/download/video/ClientSideBusinessLogic-WidgetManual.pdf
- Booklet Data Analytics Snap4Solutions: https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf

Username: paolo.disit

Search

Search
-Any-

Training on Tools and Platform
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FIWARE
Node-RED
Sii-Mobility

Organization Groups

DISIT
- Developer
- Operativo

Updates on

2023 booklets

- Smart City

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

- Industry

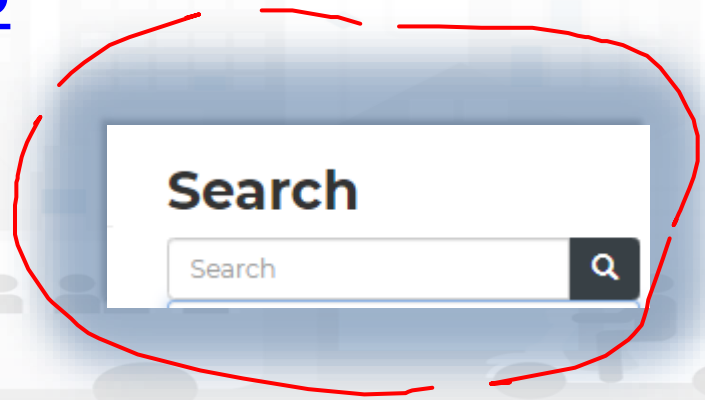
https://www.snap4city.org/download/video/DPL_SNAP4INDUSTRY.pdf

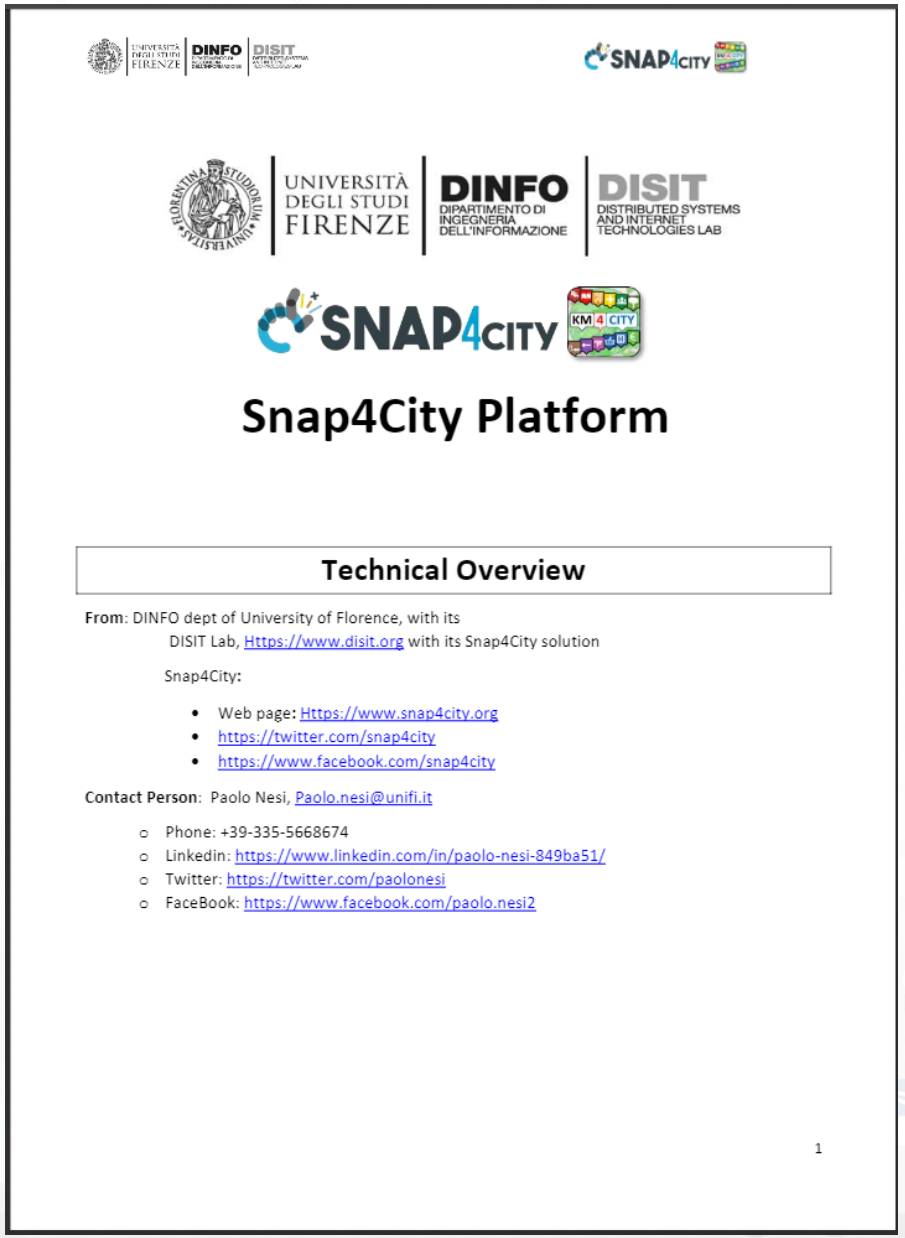
- Artificial Intelligence

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

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/577
- **Scenarious**: https://www.snap4city.org/4
- **Publications**: https://www.snap4city.org/426
- **WEB pages**: https://www.snap4city.org/78
- ***SEARCH on the right side***





Snap4City Platform

Technical Overview

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

Snap4City:

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

Contact Person: Paolo Nesi, Paolo.nesi@unifi.it

- Phone: +39-335-5668674
- Linkedin: https://www.linkedin.com/in/paolo-nesi-849ba51/
- Twitter: https://twitter.com/paolonesi
- FaceBook: https://www.facebook.com/paolo.nesi2

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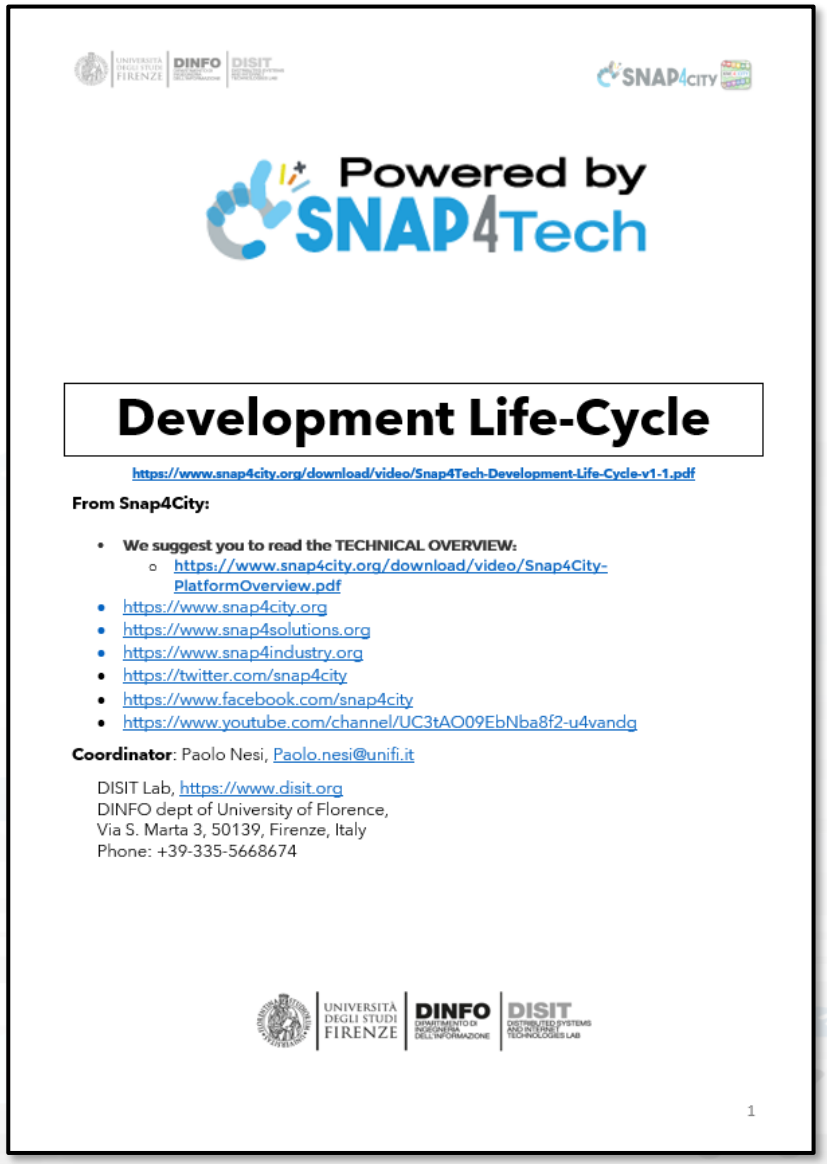
Tech. Overview

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

Development



Powered by SNAP4Tech

Development Life-Cycle

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

From Snap4City:

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

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

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

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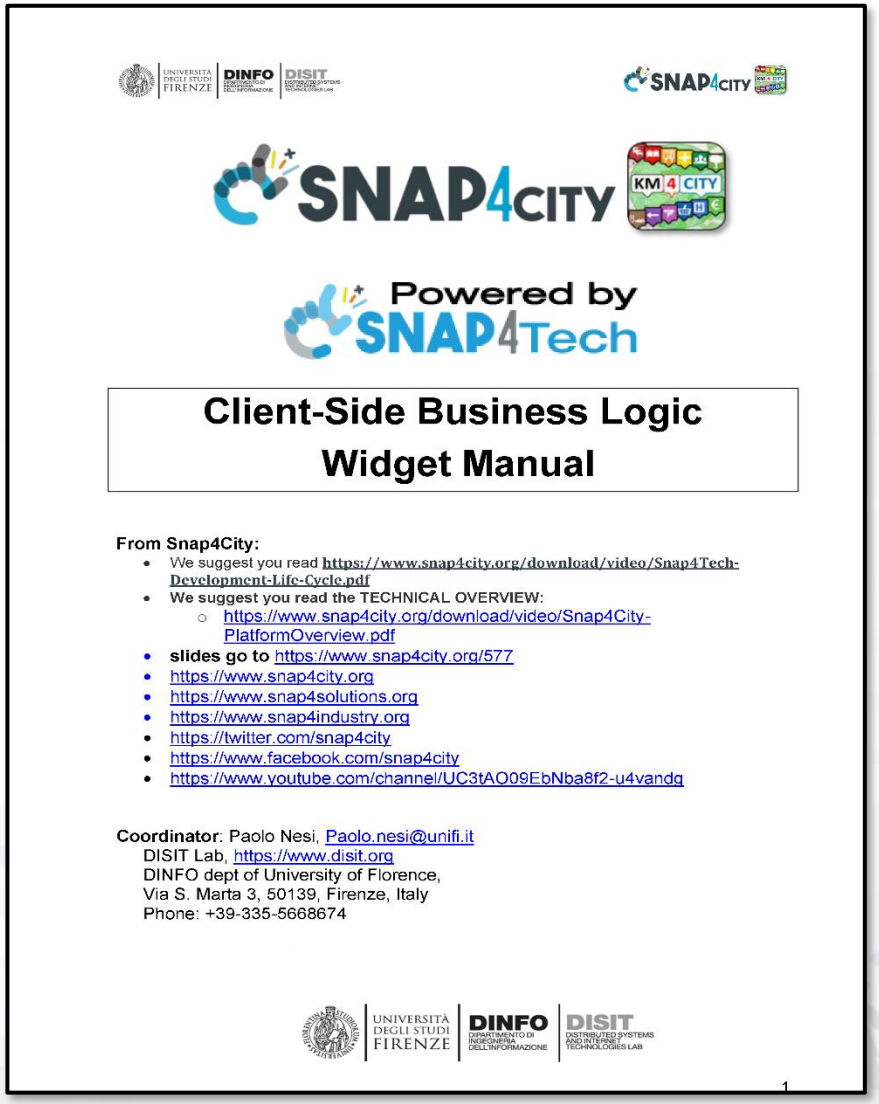
https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf

CSBL

Client Side Business Logic



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Client-Side Business Logic Widget Manual

From Snap4City:

- We suggest you read **https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf**
- **We suggest you read the TECHNICAL OVERVIEW:**
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- **slides go to** https://www.snap4city.org/577
- https://www.snap4city.org
- https://www.snap4solutions.org
- https://www.snap4industry.org
- https://twitter.com/snap4city
- https://www.facebook.com/snap4city
- https://www.youtube.com/channel/UC3tAQ09EbNba8f2-u4vandg

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

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

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

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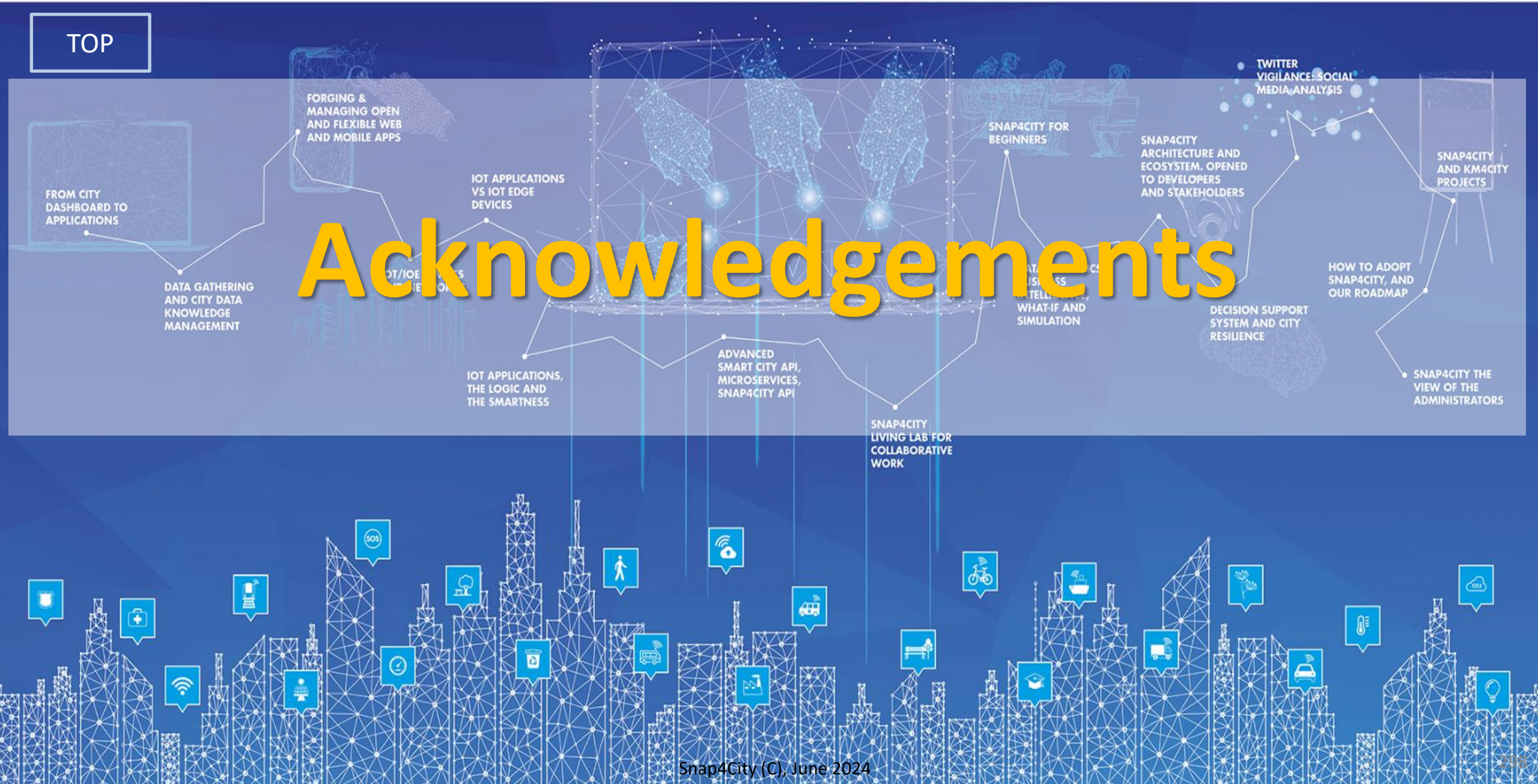
Acknowledgements



DISIT lab roadmap vs model and tools' usage

2013
Km4City Ontology 1.1

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

2014
- Weather Forecast
- Real Time Wi-Fi
- Entertainment
- LOD

- Twitter Vigilance
- Social Media Analytics, Sentiment Analysis

Km4City 1.4

2015
Km4City 1.5

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

ckan, resolute

H2020 (2015-18)

2016
(2016-21) H2020 REPLICATE

Km4City 1.6.4

- Smart Energy
- Sustainable Mobility
- Control Room
- Dashboard

Km4City 1.6.2

Sii-Mobility (2016-21) MIUR

SII-MOBILITY SCN

- Infomobility
- Mobile App
- Routing
- Multimodality

FIWARE

Km4City 1.5

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

2017
Sii-Mobility

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

E015 digital ecosystem (Powered by EXPO MILANO 2015)

(2016-19) MIUR GHOST SIR

- Sardinia Region Smart City Strategies and plan

GREEN IMPACT C.A.P.A.C.I.T.Y.

GREEN IMPACT
POR FESR 2014-2020

- Industry 4.0
- Critical Plant
- Monitoring

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

life weee (2017-20)

- Smart Waste

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

- Mobility Demand / Offer Analytics and Strategy

Sii-Mobility

- User engagement
- Bike Sharing
- Data Analytics ++
- Social Predictions
- OBD2

IOT/IOE

Km4City 1.6.6

Node-RED

SNAP4CITY SELECT for Cities H2020 (2017-19)

2019
5G (2018-21)

- 5G tech
- Energy
- Industry 4.0
- Synoptics

TRAFAIR CEF (2018-21)

- Traffic and Mobility Impact on Pollution
- NOX predictions

EUROPEAN OPEN SCIENCE CLOUD

SIRIUS

LAID Smart Bed

- Smart Health

GREEN FIELD PEAS Soda4.0 Optimization and Automated Decision System 4.0

- Industry 4.0

bee smart city

- Smart Lonato

Reverberi Enetec Gruppo MPES

SNAP4CITY

Winner of Select4Cities PCP

SNAP4CITY roadmap

2020

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

- Smart Mobility
- PISA, PUMS
- Living lab

Km4City 1.6.7

2021

Smart Ambulance (2021-22)

Sii-Mobility

Contract

Contract

PC4City (2020-21) Monitoring Terrain

Winner of Open Data Challenge of

- Smart Light
- Sweden

2022

Enterprise (2021-22) Industry 4.0

Almafluida Industry 4.0 (2021-22)

AMPERE (2021-22) Industry 4.0

SYN-RG-AI SmartCity

Industry 4.0

SmartCity, 2021-23

AXIS collab SmartCity

Asymmetrica Smart City, 2022-23

2023

Contract, 2022-23

Contract, 2022-23

2022-2023

Contract, 15min

Security and Risk

Italferr, Smart City

2024

Contract, 2024-25

CN MOST, 2022-26

EI THE, 2022-26

G. Agile, 2021-23

2023-26

Merano, smart light

OceanRace, Genova, AWS

Cuneo, smart city

TOURISMO

ELLIE IA 2024-2027

SASUAM

CAI4DSA

Rhodes, smart city

eShare UNIFI TUSS

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CONTACT

DISIT Lab, DINFO: Department of Information Engineering
Università degli Studi di Firenze - School of Engineering

Via S. Marta, 3 - 50139 Firenze, ITALY
https://www.disit.org

www.snap4city.org

Email: snap4city@disit.org

Office: +39-055-2758-515 / 517
Cell: +39-335-566-86-74
Fax.: +39-055-2758570

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