100% OPEN SOURCE

EU GDPR COMPLIANT

PEN Test Passed

Powered by FIWARE

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

Node-RED

SNAP4CITY

KM4CITY

SNAP4 Appliances and Dockers Installations

Be smart in a SNAP!

LIVING LAB

Snap4City Development and Deploy

18 July 2021, Course
https://www.snap4city.org/577

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES

UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO | DISIT

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

SNAP4CITY

Powered by KM4CITY

scalable Smart aNalytic APplication builder for sentient Cities: for Living Lab and co-working with Stakeholders

https://www.Snap4City.org

18 July 2021, Course
https://www.snap4city.org/577

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

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SNAP4CITY

www.snap4city.org

KM4CITY

100% OPEN SOURCE

FREE TRIAL

SNAP4 Appliances and Dockers Installations

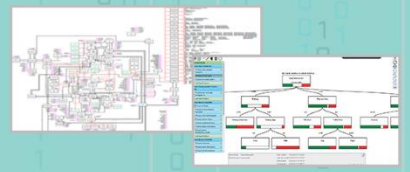
PEN Test Passed

EU GDPR COMPLIANT

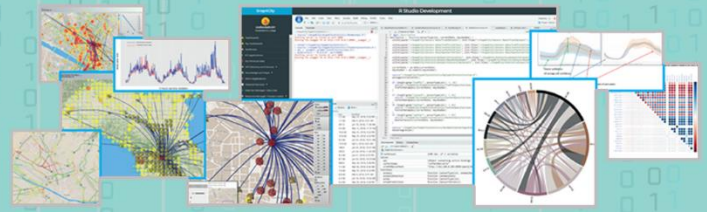
Powered by FIWARE

EUROPEAN OPEN SCIENCE CLOUD

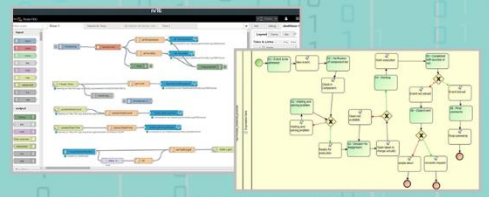
DASHBOARDS AND APPS - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS



EXPERT SYSTEM
KNOWLEDGE BASE
STORAGE

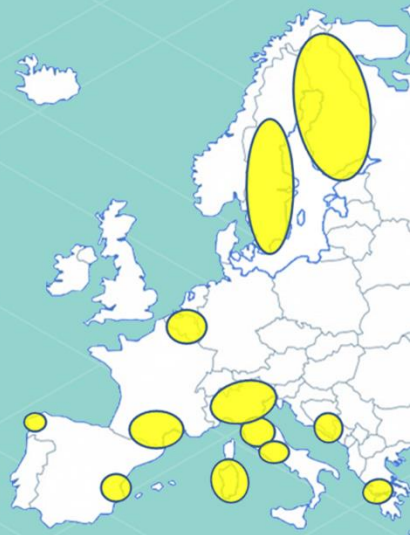


BIG DATA ANALYTICS
ARTIFICIAL INTELLIGENCE
BUSINESS INTELLIGENCE
MACHINE LEARNING



DATA FLOWS, WORKFLOWS
MICROSERVICES
MANAGEMENT

METHODOLOGIES
COURSES AND COMMUNITY
LIVING LABS
DEVELOPMENT TOOLS



Snap4City/Industry structure

- The **Snap4xxxx** solution is released in Open Source, VM and Docker with fully support of MultiTenant/multiple-Organizations
  - Each Organization may be configured for a separate environment with a set of Maps, Menus, Users, Data, Dashboards, IOT Apps, MicroApplications, Custom Widgets, Models, resources, open data, etc.
- **Https://www.Snap4City.ORG** is the main instance of Snap4xxxx solution managed by DISIT Lab. The main documentation is located and updated on Snap4City.org, GitHUB, dockerHub and Node-Red Library. Snap4City.org is where the last tools are tested and news published.
  - Organizations on Snap4City.org have been created with contracts as for *Platform as a Service*, for testing and for providing *SmartCity as a Service* as well as *Industry 4.0 as a Service*

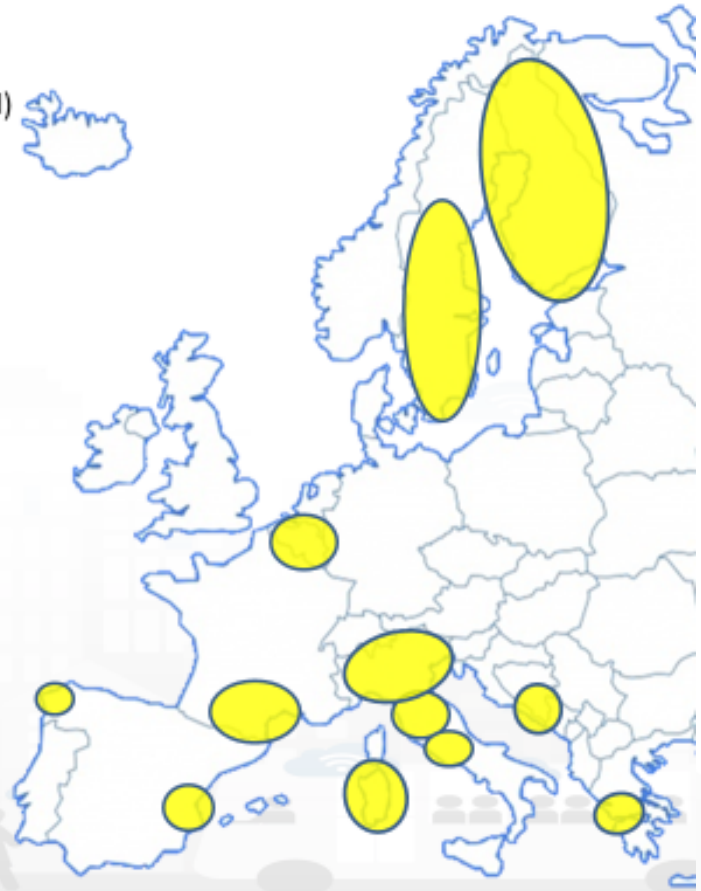
Snap4City/Industry Community

- Most of Organizations on Snap4City.org also correspond to companies or institutions that have an installation of Snap4City tools on their Premise,
  - such as: Pisa, SmartGarda Lake, Snap4, ALTAIR, etc.
- This double way allows them to:
  - test the news,
  - share experiences with other groups,
  - get visibility,
  - work in the collaborative environment, and
  - be better supported by Snap4City.org and DISIT Lab personnel.
- Each instance of Snap4xxxx solution ***can decide to join the federation*** of SmartCity API to exploit shared data.
  - This allows to exploit regional data for city installations applications (web, mobile, dashboards, etc.) without reloading them for example.

Main Organizations/areas

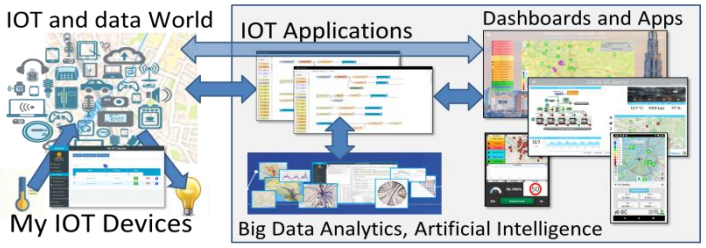
- Antwerp area (Be)
- Capelon (Sweden: Västerås, Eskilstuna, Karlstad)
- DISIT demo (multiple)
- Dubrovnik, Croatia
- Firenze area (I)
- Garda Lake area (I)
- Helsinki area (Fin)
- Livorno area (I)
- Lonato del Garda (I)
- Modena (I)
- Mostar, Bosnia-Herzegovina
- Pisa area (I)
- Pont du Gard, Occitanie (Fr)
- Roma (I)
- Santiago de Compostela (S)
- Sardegna Region (I)
- SmartBed (multiple)
- Toscana Region (I), SM
- Valencia (S)
- Venezia area (I)
- WestGreece area (Gr)

Snap4City (C), October 2020

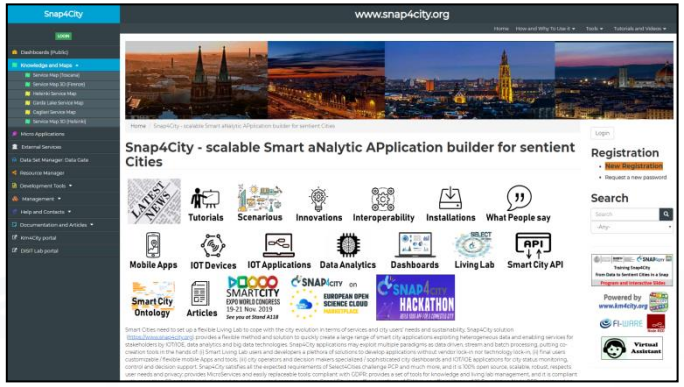


How to adopt Snap4City

On your premise



Https://www.snap4city.org



Smart City as a Service

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

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

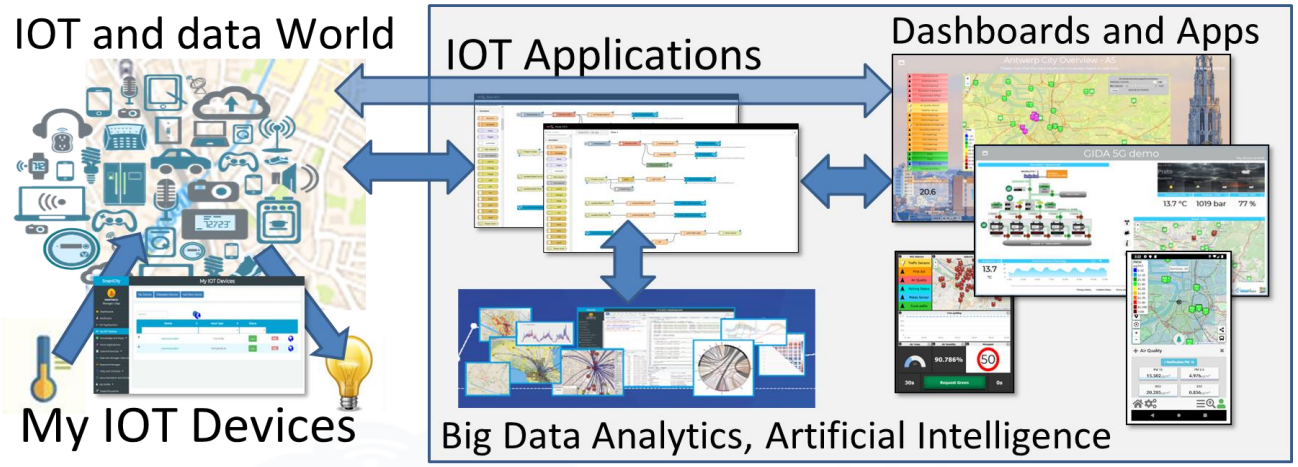
https://www.snap4city.org/577

On Line Training Material (free of charge)

	1st part (*)	2nd part (*)	3rd part (*)	4th part (*)	5th part (*)	6th part (*)	7th part (*)
what	General	Dashboards	IOT App, IOT Network	Data Analytics	Data Ingestion processes	System and Deploy Install	Smart City API: Web & Mob. App
PDF							
Inter active							
Video1							
Video2							
Video3							
Video4				none		none	none
duration	2:55	3:16	3:41	2:00	2:48	2:35	1:47

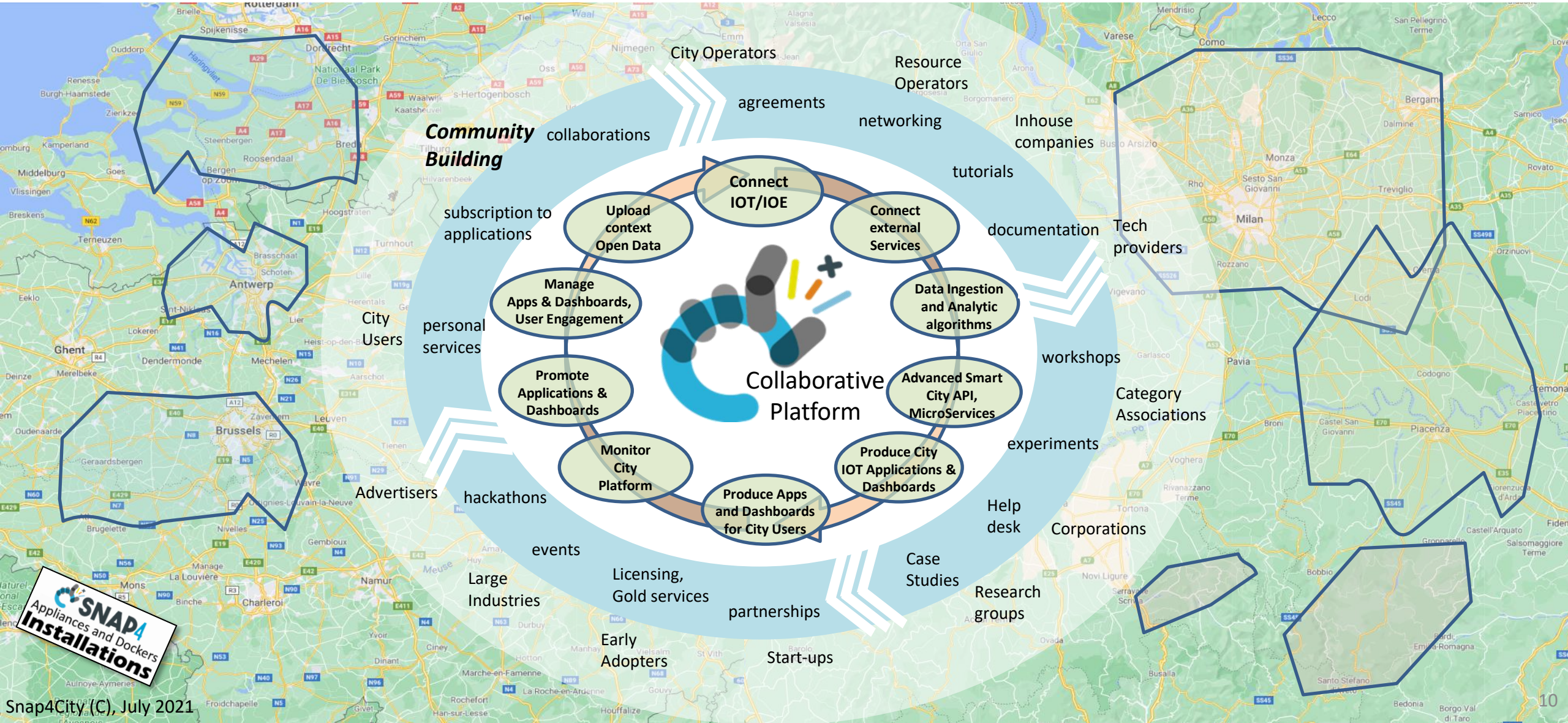
Free Trial

- 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

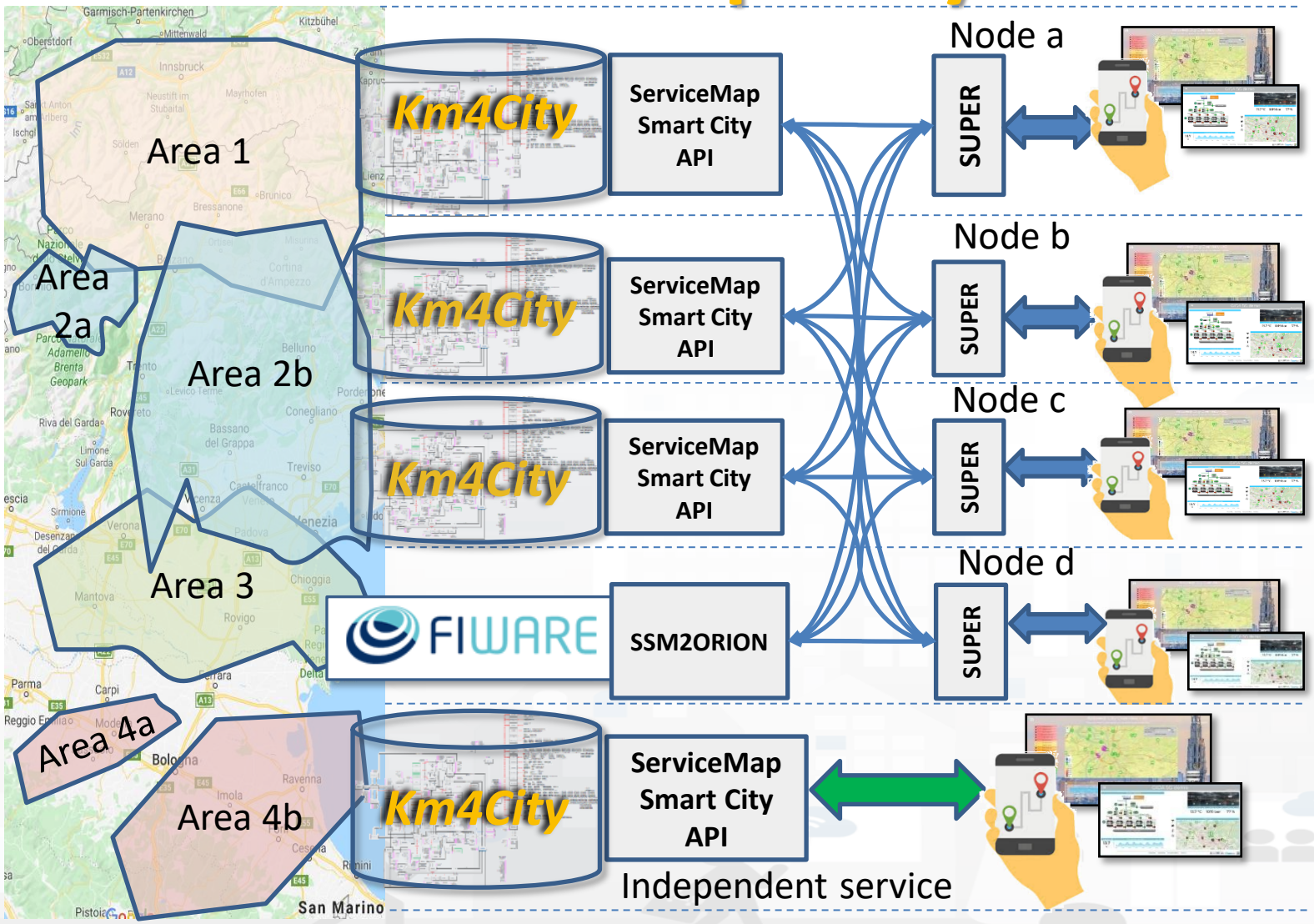


IF you need to go more in deep you can ask us to pass at the next Role becoming full AreaManager with full rights of development, also for Data Analytics, machine learning, etc.

One Snap4City Platform may serve Multiple Cities



Federation of Snap4City Services



- A Mobile App may refer to one Smart City API Server (for Area 1) via SUPER and receive data from the Federated SUPERS (Area 2) if navigation, queries, etc. are leading to discover out of the addressed KB.
  - SUPER can be used for creating redundant and/or balanced distributed solutions for Federated KB. See Area 2, the two KB in the front.
  - Federated SUPER can have overlapped KB even totally.
  - A Mobile App can be developed to support multiple Smart City API servers, for balancing and
- The usage of Super is not mandatory so that separate services can be produced as well
- Super and Nodes presents the same Smart City APIs.

General Overview of the full Course 2021

- ***1st part:*** *General Overview*
- ***2nd part:*** *Dashboards Creation and Management*
- ***3rd part:*** *IOT Applications development, IOT Devices, IOT Networks*
- ***4th part:*** *Data Analytics, in R Studio, in Python, how to Exploit and Manage Data Analytics in IOT Applications*
- ***5th part:*** *Data Ingestion, Data Warehouse, Data Gate, IOT Device Data ingestion, IOT App for Data Ingestion, Interoperability, etc.*
- ***6th part:*** *Snap4City Development, Extension, Administration, and Installation*
- ***7th part****: Smart city API (internal and external) Web and Mobile App development tool kit*

A number of the training sections include exercitations

Updated versions on: https://www.snap4city.org/577

See also courses in ITALIANO: https://www.snap4city.org/485

6th part Agenda

- GO • **Snap4City/Industry Architecture**
- GO • **Snap4City technology for Industry 4.0 → Snap4Industry**
- GO • **Snap4City & Fi-Ware**
- GO • **Snap4City vs State of the Art Solutions**
- GO • **Smart City in a Snap, How to become smart**
  - GO – **Smart City Development Life Cycle**
  - GO – **Analysis and Design for Innovation (Co-Creation and Co-Working)**
  - GO – **Analysis for Innovation, the workshops for innovation, co-creation; Data Discovery**
- GO • **Snap4City: Overview of Development Tools**
  - **IOT Network Interoperability**
  - **Integration via IoT Apps and processes**
  - **Integration via IoT Apps on IoT Edge**
  - **Integration with GIS and ArcGIS**
  - **API, and Federation of Smart Cities via API**
  - **Linked Open Data**
- GO • **Platform How to Add new features capability and constraints**
- GO • **Snap4City/Industry: Smart Solution IOT as a Service vs Consulting and Developing**
- GO • **Snap4City Living Lab For Collaborative Work**
- GO • **The view of the Administrator**
  - Main menu, User Management, Auditing, Platform Management, Customer Relationship Management and Living Lab
  - AMMA traffic Analyzer, Data Analyzer, Back Office Platform Scalability
  - Monitoring Resources and API Traffic; DISCES; reports
  - Mng. Photos and comments, Mobile App Monitoring, IoT App management, Data-City small example, ..
- GO • **Installing Snap4City**
- GO • **Acknowledgement**

LOGIN

Dashboards (Public)

Knowledge and Maps

- Service Map (Toscana)
- Service Map 3D (Firenze)
- Helsinki Service Map
- Garda Lake Service Map
- Cagliari Service Map
- Service Map 3D (Helsinki)

Micro Applications

External Services

Data Set Manager: Data Gate

Resource Manager

Development Tools

Management

Help and Contacts

Documentation and Articles

Km4City portal

DISIT Lab portal

Home / Snap4City - scalable Smart aNalytic APplication builder for sentient Cities

Snap4City - scalable Smart aNalytic APplication builder for sentient Cities

Tutorials | Scenarious | Innovations | Interoperability | Installations | What People say

Mobile Apps | IOT Devices | IOT Applications | Data Analytics | Dashboards | Living Lab | Smart City API

Smart City Ontology | Articles

SMARTCITY EXPO WORLD CONGRESS 19-21 Nov. 2019 *See you at Stand A118*

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

SNAP4CITY HACKATHON BUILD YOUR APP FOR A CONNECTED CITY

Smart Cities need to set up a flexible Living Lab to cope with the city evolution in terms of services and city users' needs and sustainability. Snap4City solution (https://www.snap4city.org) provides a flexible method and solution to quickly create a large range of smart city applications exploiting heterogeneous data and enabling services for stakeholders by IOT/IOE, data analytics and big data technologies. Snap4City applications may exploit multiple paradigms as data driven, stream and batch processing, putting co-creation tools in the hands of: (i) Smart Living Lab users and developers a plethora of solutions to develop applications without vendor lock-in nor technology lock-in, (ii) final users customizable / flexible mobile Apps and tools, (iii) city operators and decision makers specialized / sophisticated city dashboards and IOT/IOE applications for city status monitoring, control and decision support. Snap4City satisfies all the expected requirements of Select4Cities challenge PCP and much more, and it is 100% open source, scalable, robust, respects user needs and privacy; provides MicroServices and easily replaceable tools; compliant with GDPR; provides a set of tools for knowledge and living lab management, and it is compliant

Login

Registration

- New Registration
- Request a new password

Search

Search

-Any-

Training Snap4City from Data to Sentient Cities in a Snap

Program and Interactive Slides

Powered by www.km4city.org

FI-WARE Node-RED

Virtual Assistant

TOP

Snap4City/Industry: Architecture

SNAP4 Appliances and Dockers Installations

100% OPEN SOURCE

EU GDPR COMPLIANT

PEN Test Passed

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

URBAN PLATFORM: SMART CITY IOT AS A SERVICE AND ON PREMISE

100% OPEN SOURCE

APPLIANCES CONTAINERS

- LOCAL GOVERN
- STAKEHOLDERS
- CITY USERS
- IN-HOUSE
- ENERGY OPERATORS
- MOBILITY OPERATORS
- COMMERCIAL OPERATORS
- SECURITY OPERATORS
- INDUSTRIES
- RESEARCHERS
- START-UPS
- ASSOCIATIONS

- GDPR
- SECURITY
- PRIVACY
- ASSESSMENT
- AUDITING
- PENTESTED

- OPEN IOT DEVICES
- IOT EDGE
- IOT GATEWAY
- PAX COUNTERS
- IOT BUTTONS

- TEST CASES, SCENARIOUS, VIDEOS, HACKATHONS
- OPEN SOURCES, COMMUNITY OF CITIES
- TRAINING TUTORIALS, COMMUNITY MANAGEMENT

IOT APPLICATIONS - INSTANT APPS

DATA DRIVEN APPLICATIONS • REAL TIME PROCESSING • BATCH PROCESSING • ANY PROTOCOL & FORMAT

DASHBOARDS & APPLICATIONS

CONTROL ROOM • SITUATION ROOM • OPERATOR DASHBORDS • BUSINESS INTELLIGENCE • WHAT-IF ANALYSIS • DECISION SUPPORT • SIMULATIONS • RISK ANALYSIS • RESILIENCE ANALYSIS

MOBILE & WEB APPLICATIONS

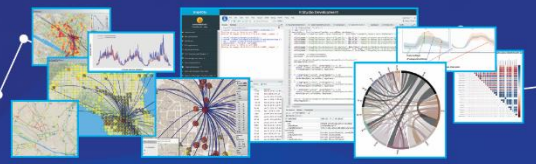
DEVELOPMENT KIT • SUGGESTIONS • MOBILE APPS • MONITORING PANELS • PLATFORM UTILITIES • READY TO USE SMART APPLICATIONS

MICROSERVICES & ADVANCED SMART CITY API

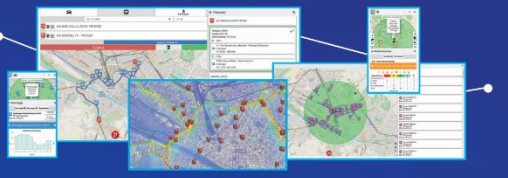
LIVING LAB - DEV TOOLS - COWORKING

IOT DIRECTORY • SERVICE MAP • RESOURCE MANAGER • DATA GATE • R STUDIO • ETL

BIG DATA - DATA ANALYTICS



DATA ANALYTICS TOOLS - MICRO-APPLICATIONS



PREDICTIONS • ANOMALY DETECTION • WHAT-IF ANALYSIS • TRAFFIC FLOW RECONSTRUCTION • ORIGIN-DESTINATION MATRICES • SOCIAL MEDIA ANALYSIS • OFFER VS DEMAND ANALYSIS • ENVIRONMENTAL DATA ANALYSIS AND PREDICTIONS • REAL TIME HEATMAPS • ROUTING • ALERTING • EARLY WARNING • PERSONAL AND VIRTUAL ASSISSTANTS • SMART SOLUTIONS • SMART SHARING • PARTECIPATORY

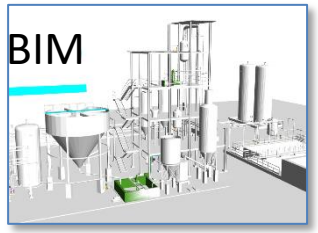
KM4CITY DATA AGGREGAT KNOWLEDGE BASE - EXPERT SYSTEM OF THE CITY – BIG DATA STORE

IOT MNG - DATA MNG - DATA INSPECTOR – PROCESS MNG – USER ENGAGEMENT – GDPR MNG ...

GIS	CITY UTILITIES	OPEN DATA	LEGACY & EXTERNAL SERVICES	PERSONAL DATA	IOT / IOE	BROKERS	KPI	INDUSTRY 4.0	SOCIAL MEDIA

Concept

BIM

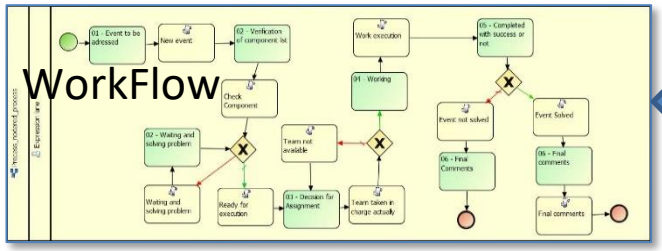


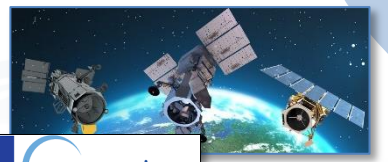
KPI, POI, MyKPI, …

API, External Services

Web Scraping

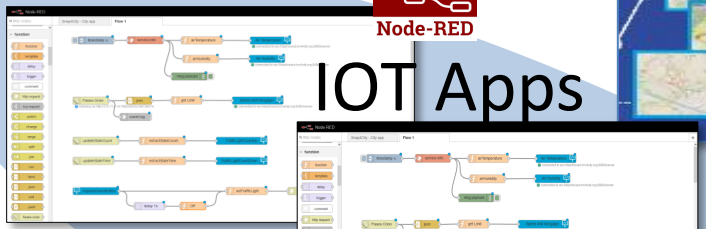
WorkFlow



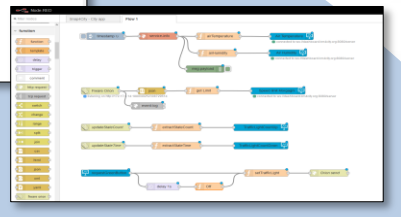


Node-RED

IOT Apps



Data Analytics,
Artificial Intelligence



IOT Brokers

IOT Broker

IOT Broker

FIWARE

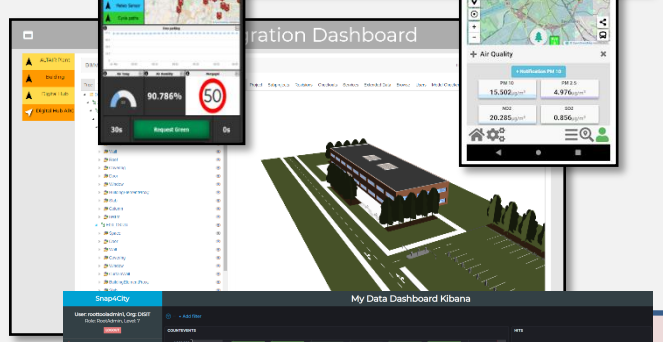
ckan

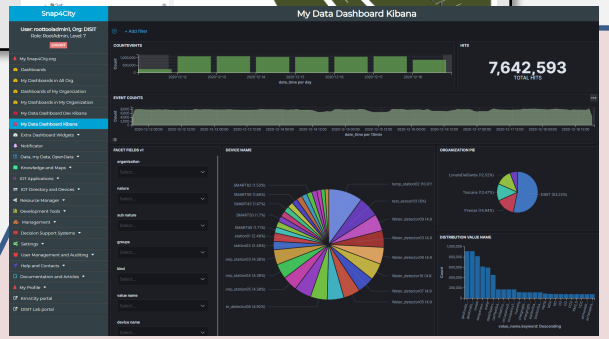
GIS

Big Data

KB

LD, LOD

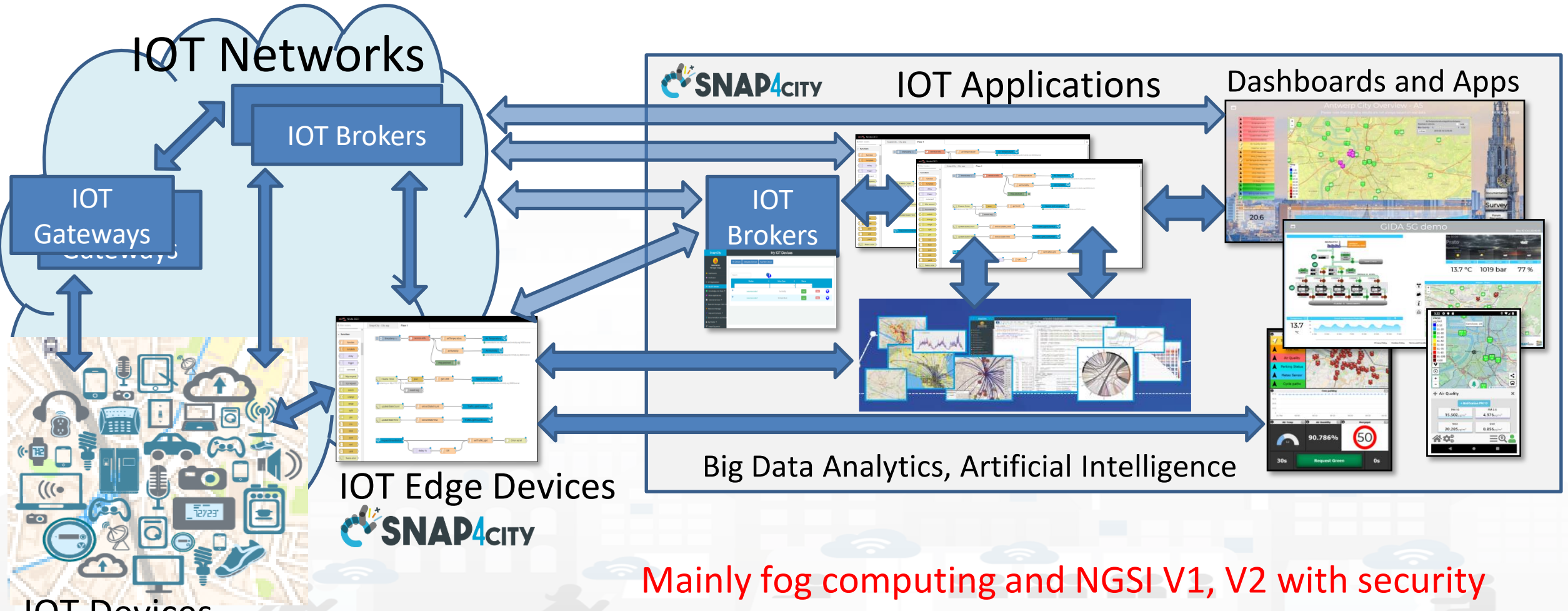




Dashboards and Apps

FI-WARE

Snap4City Services also on IOT Edge!!!

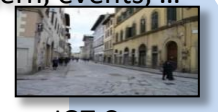


Mainly fog computing and NGSI V1, V2 with security

Smart City Functional Architecture

Transport systems
Mobility, parking

Public Services,
Govern, events, …



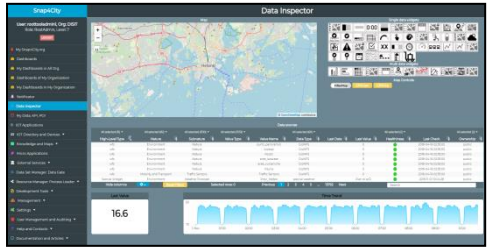
Sensors, IOT Cameras,
Wi-Fi

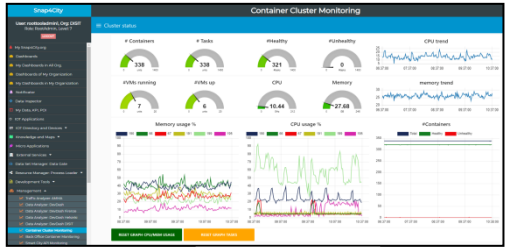
Environment, Water,
energy

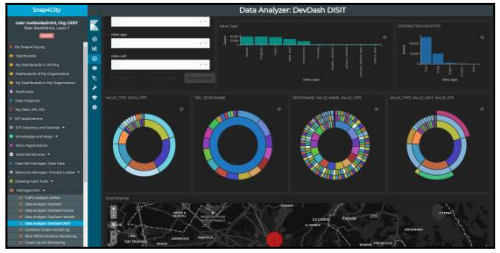
Shops, services,
operators

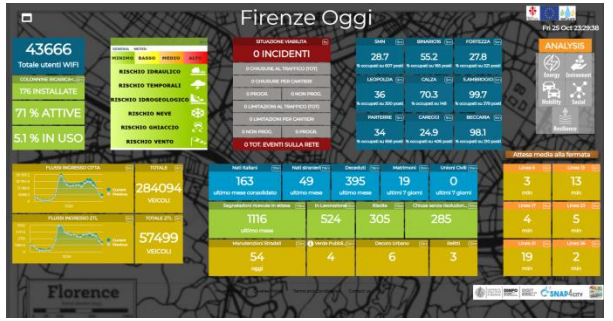
Social Media

Social Media Crawler and Manager









Back-End ⟷ Front-End

Data Sources, External Services *PULL Data*

Data Sources, Brokers, External Services *Data Driven, Real Time*

Data Ingestion, aggregation, regularization, reconcile: IOT Directory, NIFI, special tools

Knowledge base
Semantic Reasoners

Indexing and aggregating
Elastic Search

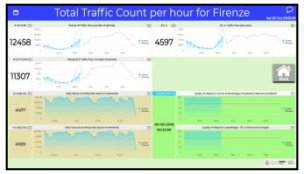
Federation

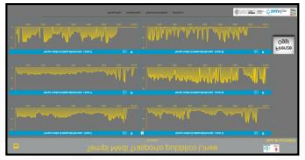
Search and Query, Smart City API, Web Socket Server, GIS, Facet, semantic

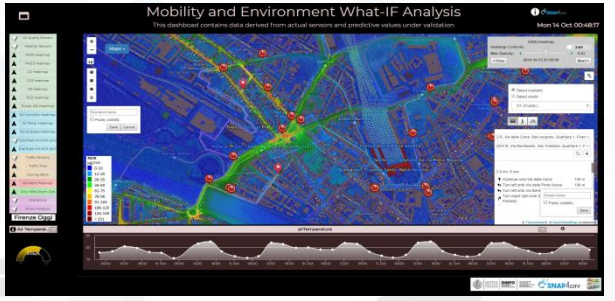
Data Analytics, Simulations, Special Tools
R Studio, Tensor Flow, Python, ….

IOT Applications, Business Logic
Node-RED + Snap4City MicroServices

Rendering Acting, Widgets, Synoptics, MicroApps
User interface, Drill down, maps, heatmaps







Inform, announce, Act!, warning, alarms, What-IF, ..

Authentication, Authorization, Platform & Processes Management, Data Inspector, Digital Twin, …

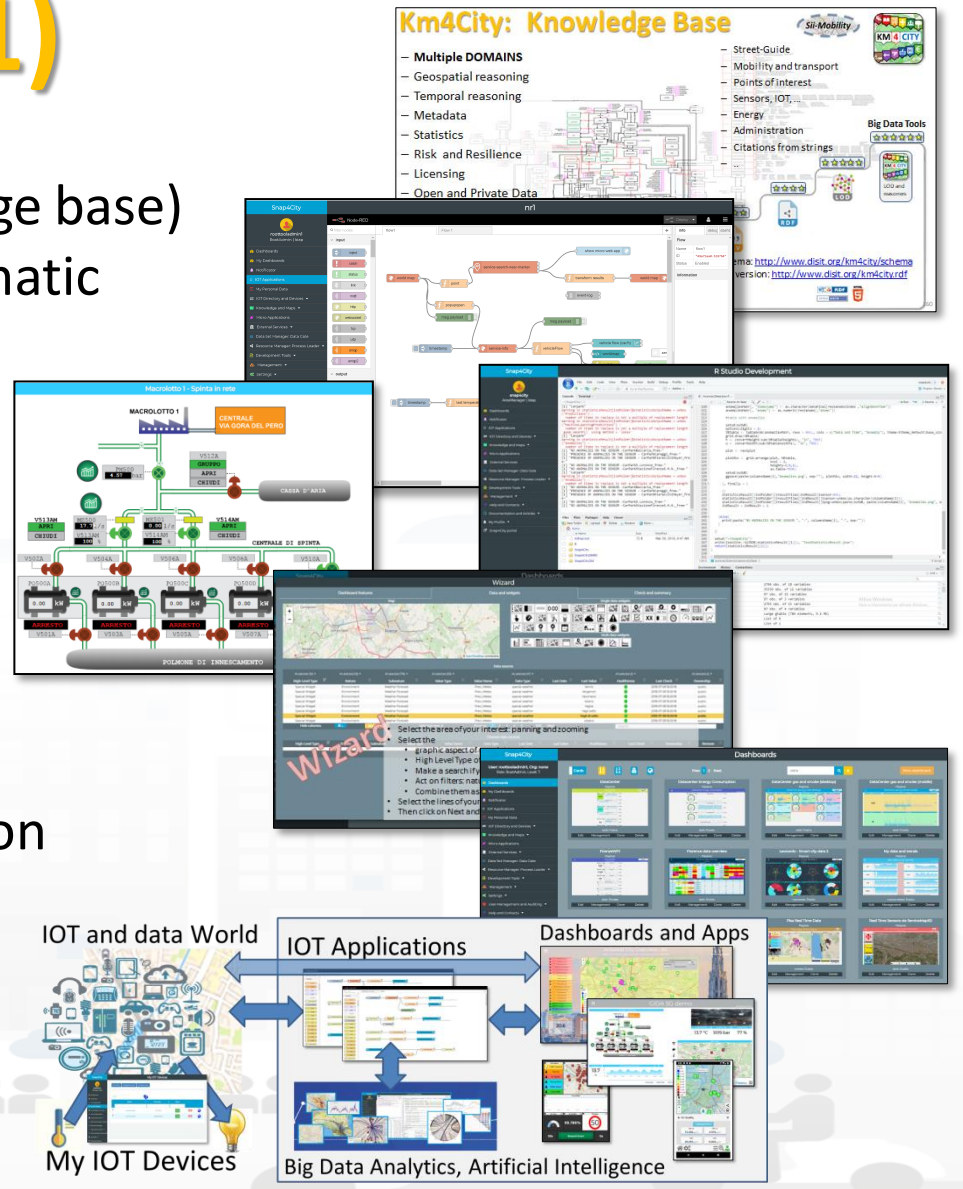
https://www.snap4city.org/65

Standards and Interoperability (2021)

Compliant with: AMQP, COAP, MQTT, OneM2M, HTTP, HTTPS, TLS, Rest Call, SMTP, TCP, UDP, NGSI, LoRa, LoRaWan, TheThingsNetwork, SigFOX, DATEX II, SOAP, WSDL, Twitter, FaceBook, Telegram, SMS, OLAP, MySQL, Mongo, HBASE, SOLR, SPARQL, EMAIL, FTP, FTPS, WebSocket, WebSocket Secure, ModBUS, OPC/OPC-UA, GML, RS485, RS232, WFS, WMS, ODBC, JDBC, Elastic Search, Phoenix, XML, JSON, CSV, GeoTIFF, OWL, WKT, KML, SHP, db, GeoJSON, Enfuser FMI, Android, Raspberry Pi, Local File System, ESP32, Libelium, IBIMET/IBE, OBD2, SVG, XLS, XLSX, TXT, HTML, CSS, KNX, Enocean, Zigbee, DALI, ISEMC, Alexa, Sonoff, HUE Philips, Tplink, BACnet, TALQ, Copernicus, Protocol Buffer, IFC, XPDL,

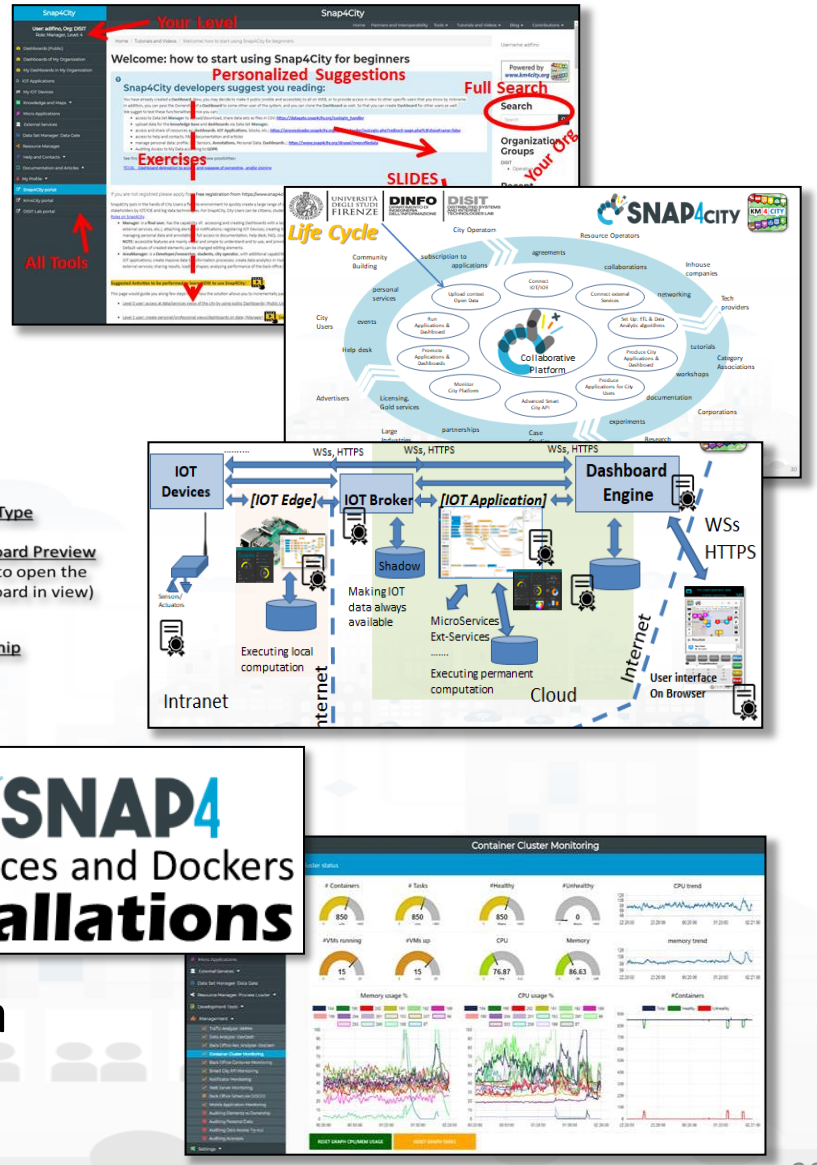
Unique of Snap4City Platform (1)

- Data ingestion and model
  - **Unified data model** (exploited in the Wizard and Knowledge base)
  - **Semantic Reasoner** modelling city entities, supporting sematic search, expert system, digital Twin, etc.
  - **IOT Directory abstracting complexity of IOT Devices, Edge, Brokers**, protocols and data formats
- Data Analytics and Data Processes
  - **Flexible and extensible IOT Applications**
  - **Data Analytic:** multiple programming languages,
- Visual Analytics, dashboarding, Apps
  - **Wizard: expert system** for immediate dashboard production matching data vs graphics representation
  - **Dashboards specialized** multidomain for Smart Cities
  - **Custom Widgets and Synoptics**
  - **Ready to use Mobile App, instant App, MicroApplication**
  - **Strategies** formalization supports

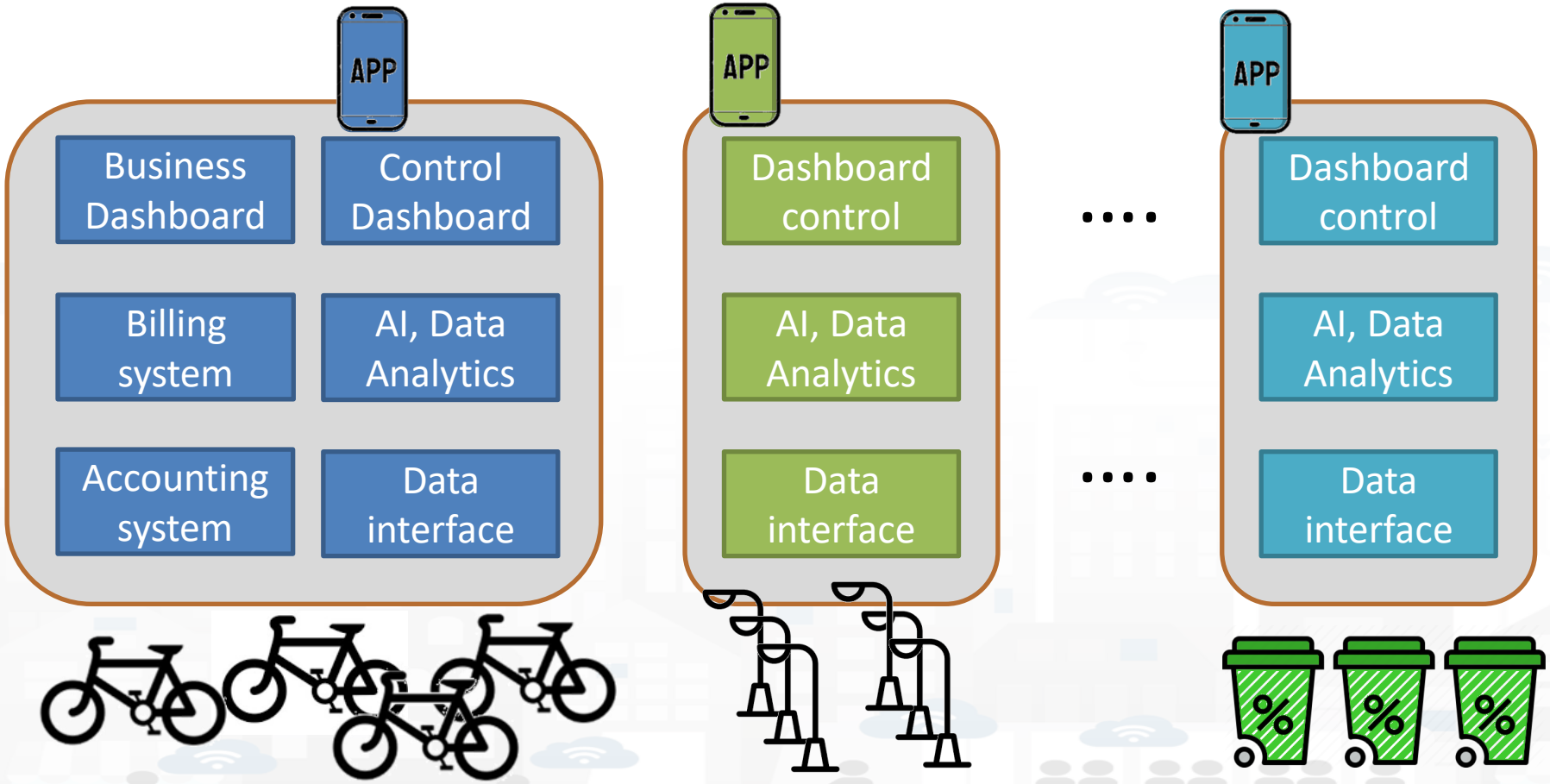


Unique of Snap4City Platform (2)

- Openness to any developers
  - **Living Lab support for coworking, sharing, and delegating**
  - **Advanced Smart City APIs and MicroServices**
  - **100% Open Source, Open hardware**
- Security and Privacy
  - **End-2-end encrypted communication**, on devices, platform, ... dashboards
  - **GDPR compliant** privacy/security
- Non functional
  - **on cloud and on premise,** your private installation
  - **On IOT edge and on cloud/premise**
  - **Multitenacy, multiple organization**
  - **Multiple smart solution on a single platform**
  - **Ready to use Appliance** Virtual Machines and/or Containers for a modules and tools, IOT edge, OpenSource code on GITHUB.
  - **Flexible, Modular, Elastic, scalable and robust**



Avoiding to have a collection of verticals



Platform Management: docker, SNAP4CITY

Presentation: Control Room, Dashboards, Synoptics, Wizards, Widgets, Visual Analytics Applications, Mobile Apps Telegram, Bot, ...
SNAP4CITY, Open Distro for Elasticsearch

External Interoperability: Smart City API, general API and accounting
SNAP4CITY, ASCAPI, WebSocket

Node-RED
IoT Applications Data Flow Logic

Operation:
Reporting | Simulation | Heatmapping | Traffic Flows | Tip. Time Trend | .....
R Studio, python, docker, GeoServer, ...
Analysis | WorkFlow Tickets BPM | .....
Open to any module and system
Data Analytics | Predictions | Anomaly detection | Statistics | Artificial Intelligence | Routing | Sentiment Analysis
ckan, openMAINT, BIMserver.center, ...

Internal Interoperability: API, MicroServices
SNAP4CITY, ASCAPI, WebSocket, FIWARE

Data Management: data modeling, data storage, noSQL, semantic modeling, city entities, aggregation, normalization, knowledge base
nifi, Open Distro for Elasticsearch, virtuoso
NGSI V1, V2 (FIWARE)
Linked Data triples

Data Collection: data mining, harvesting, integration, transformation, data models,
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: GDPR compliant
KEYCLOAK, OpenLDAP, SNAP4CITY

Device Layer

External Third Party Services: GIS | BIM | Gateways | External Services | Web Scraping | Social Media

TOP

SNAP4INDUSTRY

SNAP4 Appliances and Dockers Installations

Snap4City tech. for Industry 4.0

https://www.snap4city.org

Snap4Industry

- See **more** on https://www.snap4city.org/369
- Snap4City technology can be exploited on Industy and IOT solutions:
  - **Snap4Industry: Snap4City for Industry 4.0 (SLIDES)**
  - **Scenario: 5G Enabled Water Cleaning Control**
  - **Scenario: High Level Control of Industrial Plant**
  - **Custom Synoptics and Widgets for Dashboards**
  - **The integration between data and devices: the Snap4City solution**
  -

External Services

Fleet management

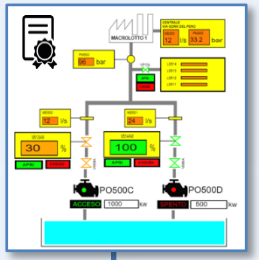
IoT Devices/Edge

IoT Broker

Internet

SECURE

Admin



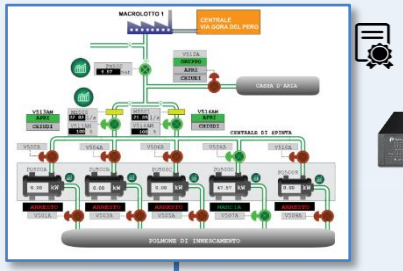
DCS

IoT Broker

PLC

IoT Devices/Edge

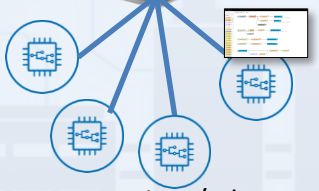
Industry Plant1.....



SCADA

IoT Broker

PLC/ RTU

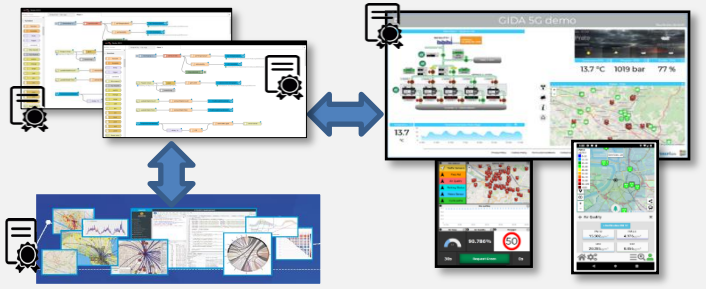


IoT Devices/Edge

Industry Plant2.....

IOT Applications

Dashboards and Apps

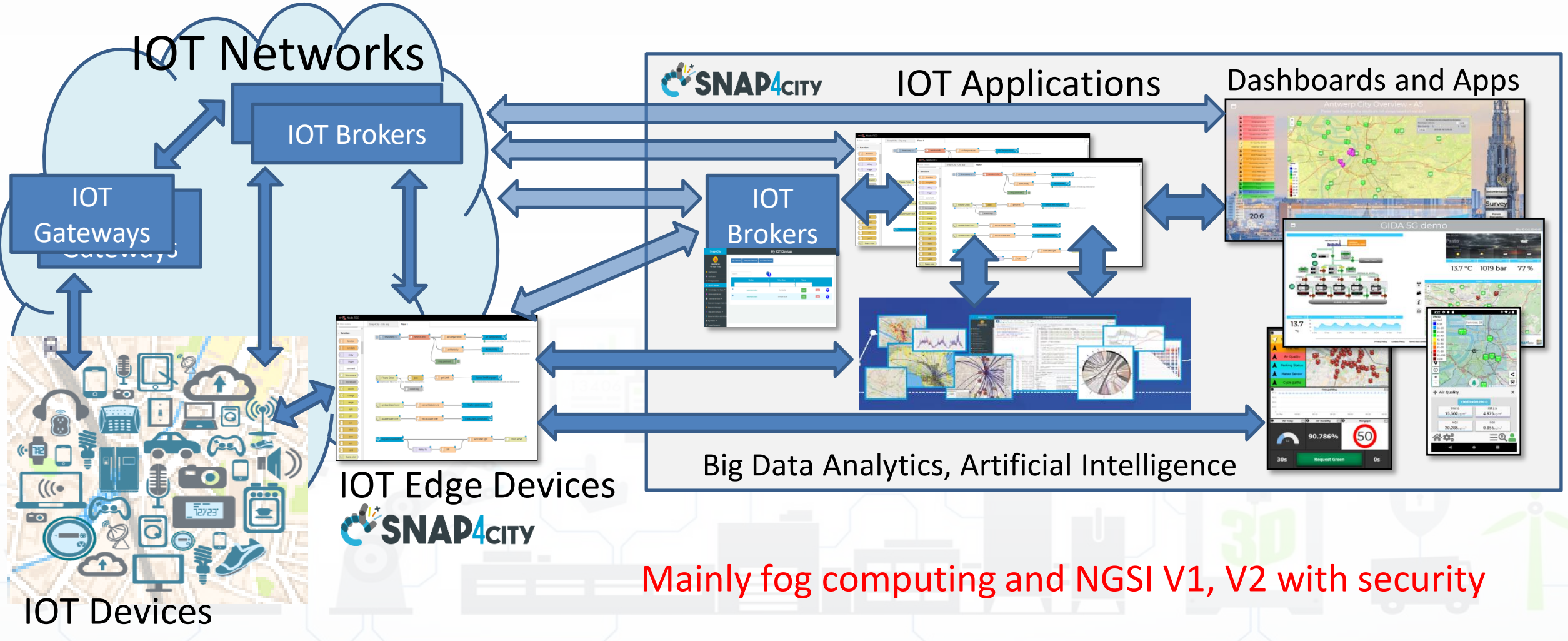


Big Data Analytics, Artificial Intelligence

Control and Supervision on Multiple Supply Chains

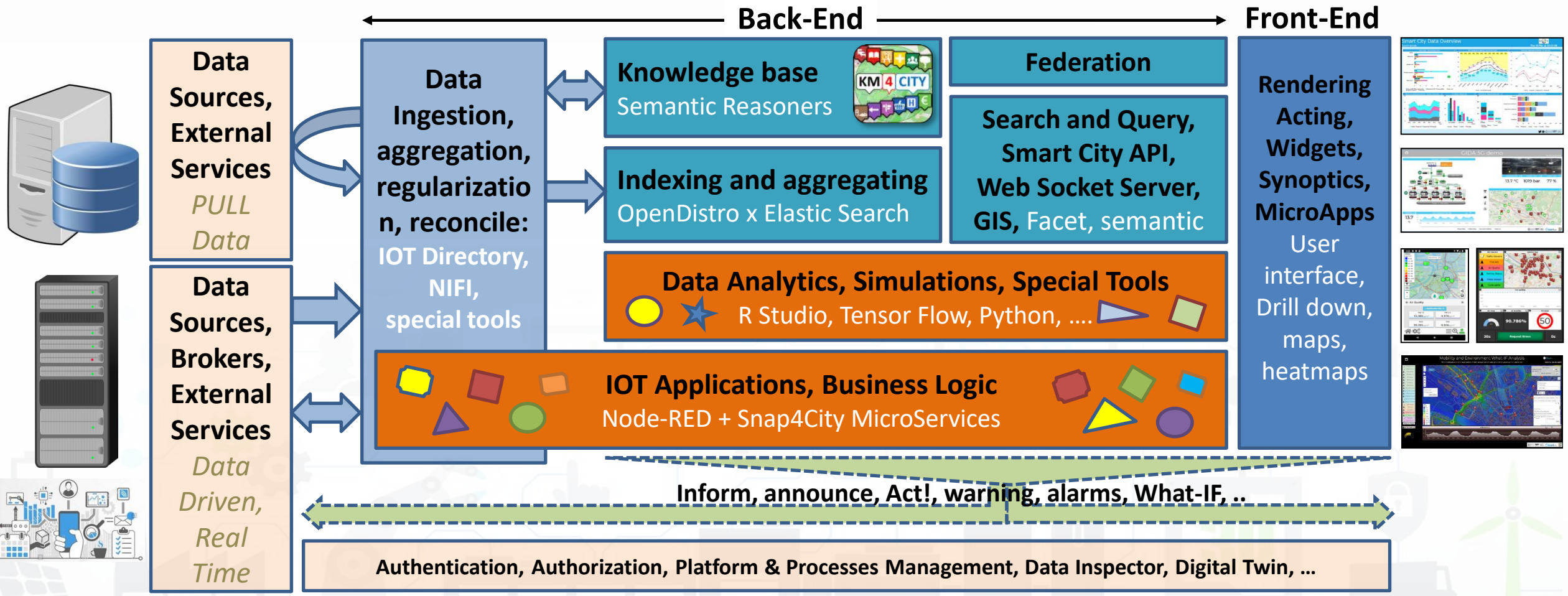
Industry 4.0 as a Service

Snap4City Services also on IOT Edge!!!

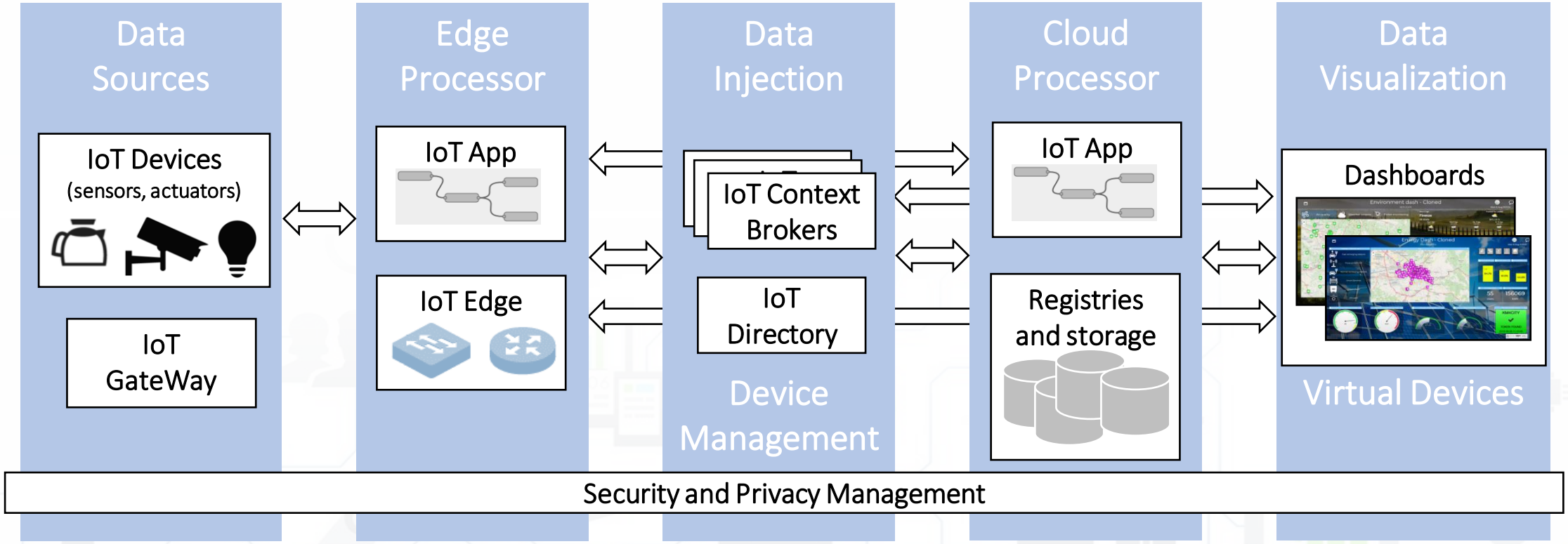


Mainly fog computing and NGSI V1, V2 with security

Snap4City, Snap4Industry Architecture, V2

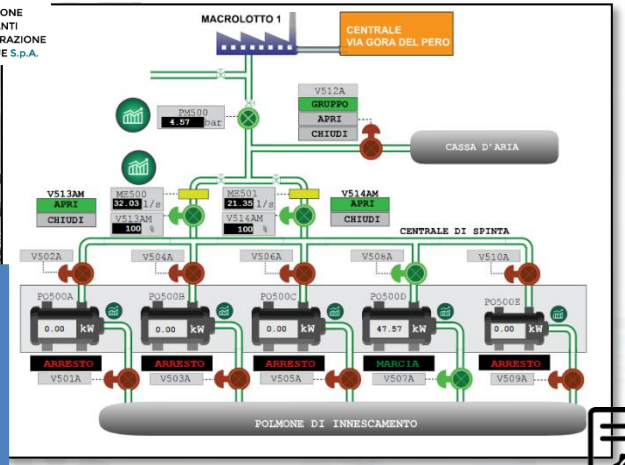


Security Architecture at a glance



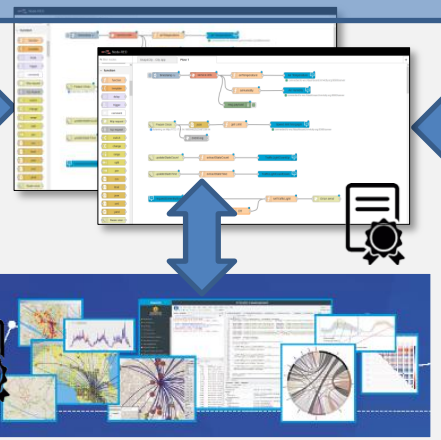
GIDA set up

Smart City data from many sources

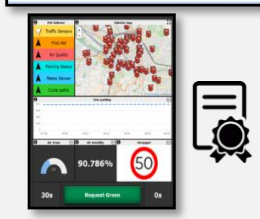


IOT Data Shadow Snap4City

IOT Applications



Dashboards and Apps



Big Data Analytics, Artificial Intelligence

Modbus

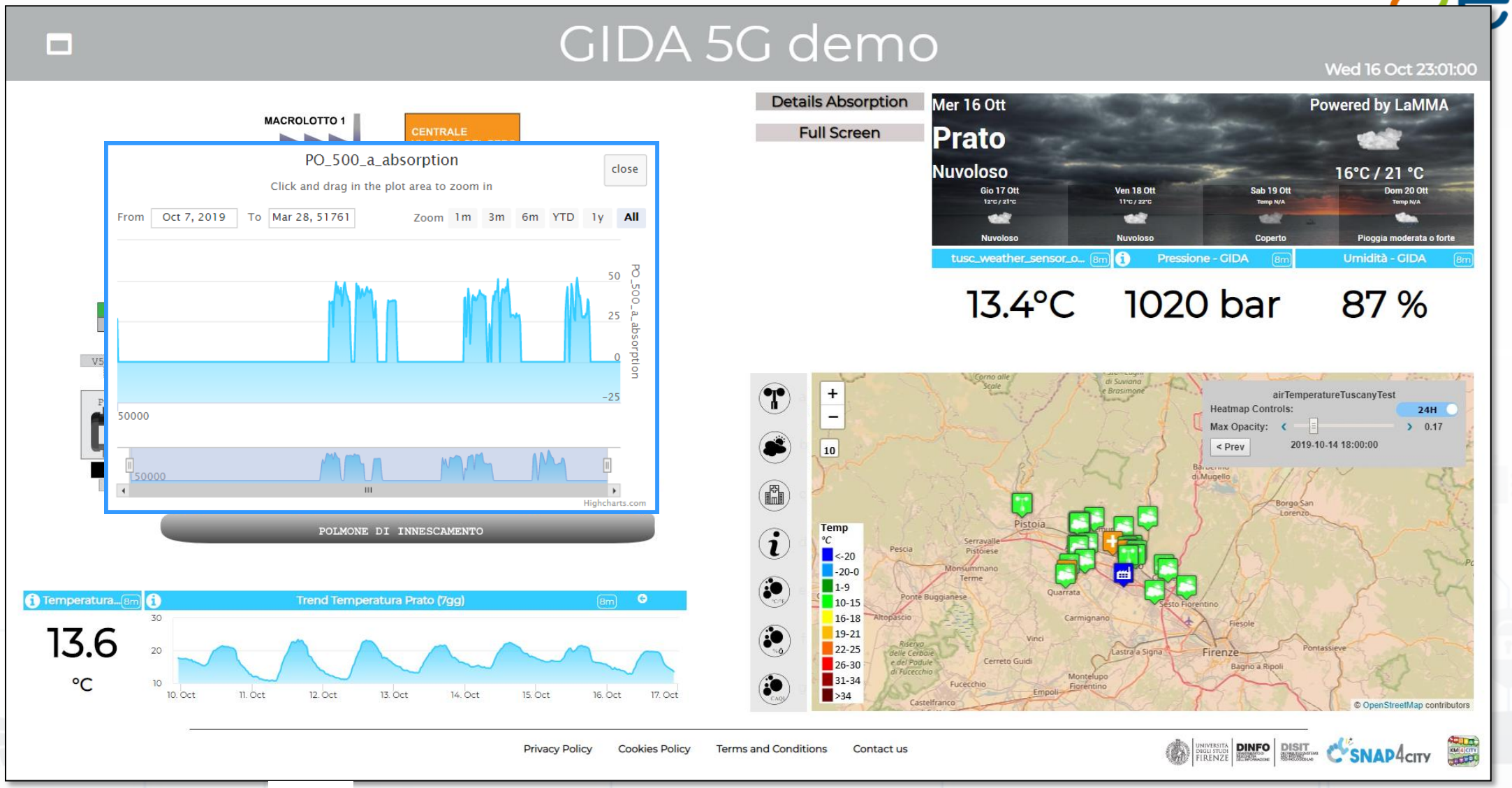
ModBus to Snap4City Gateway Edge

5G network devices

ZTE

Telemonitoring
Telecontrol

Demo UC5 GIDA



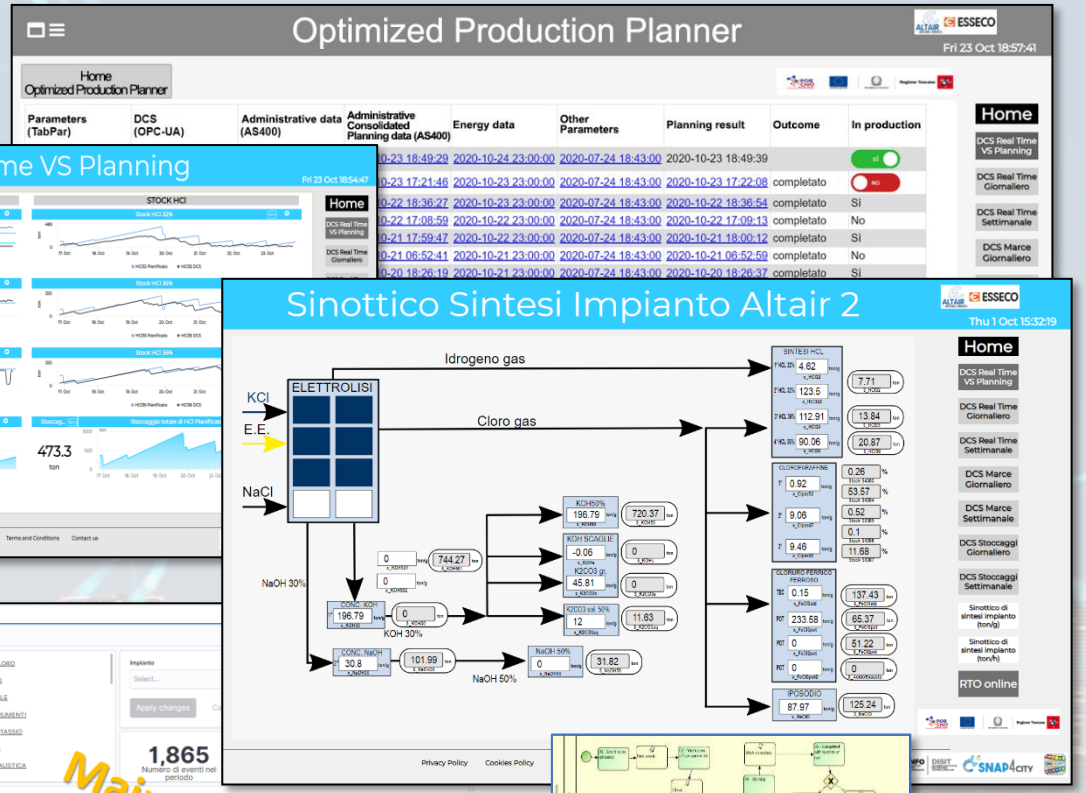
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjIyNg==

Altair Chemical (I)

Snap4Altair Decision Support supervision and control, Industry 4.0

reference

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



Industry Plant Supervision and Maintenance

Aims

- **Control Room**: Higher level supervision and monitoring (since 2020)
  - Management of Production Plan *Optimization*
  - Control of Perimeter with drone and sensors
- **Maintenance ticketing** (since 2017)
  - *predictive* (in development)
  - 3D Digital Twin (in development)

MicroService Architecture

Energy Service

Data Connections and Transformation

IoT App/DA: Real Time & Stream Processing

Predictive Maintenance

Prod. Plan Optimization

API/MicroServices

Maintenance Intelligence

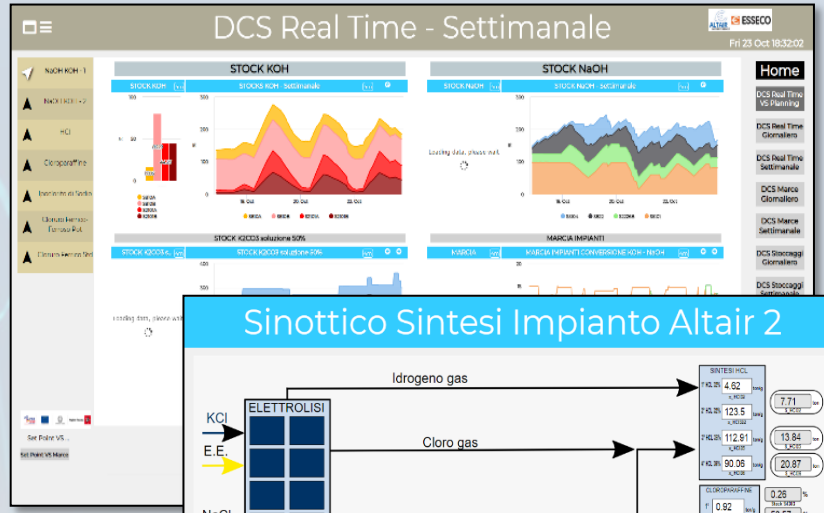
Digital Twin Local / BIM

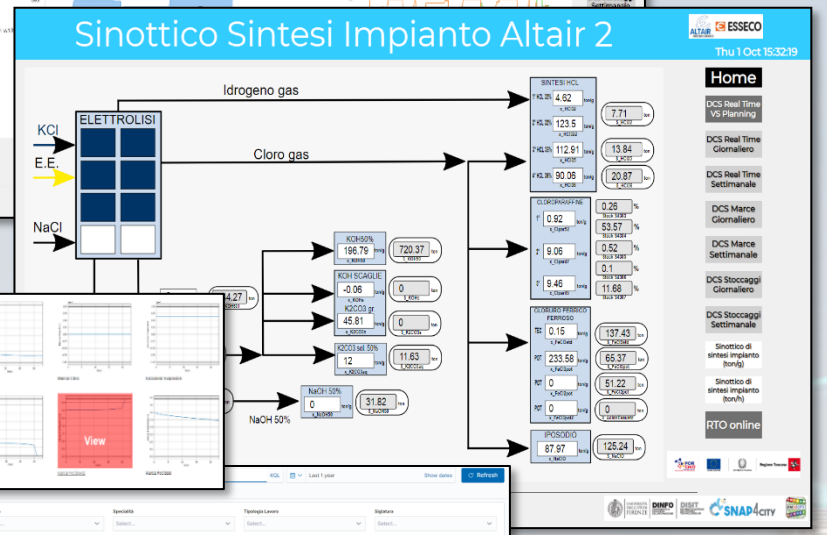
.....

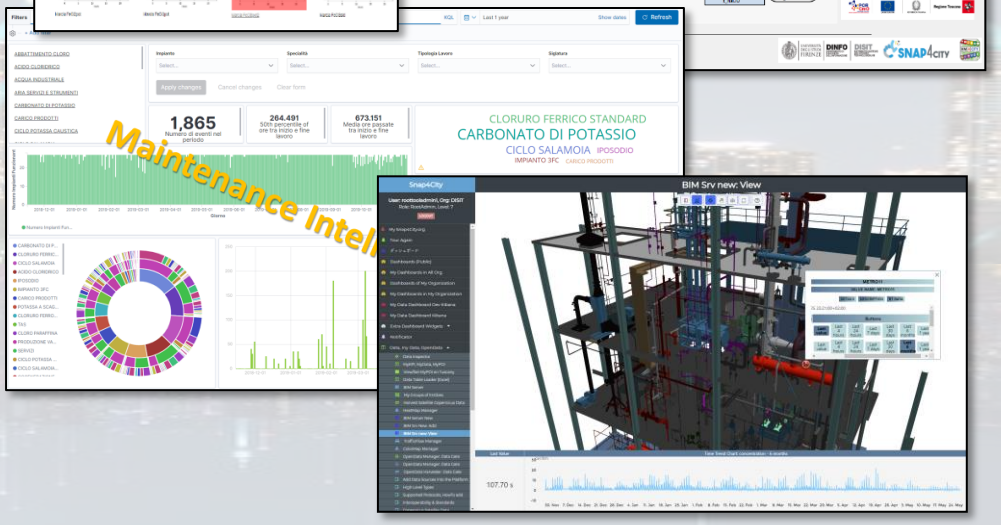
Data Storage

Management, Auth./Autoriz.

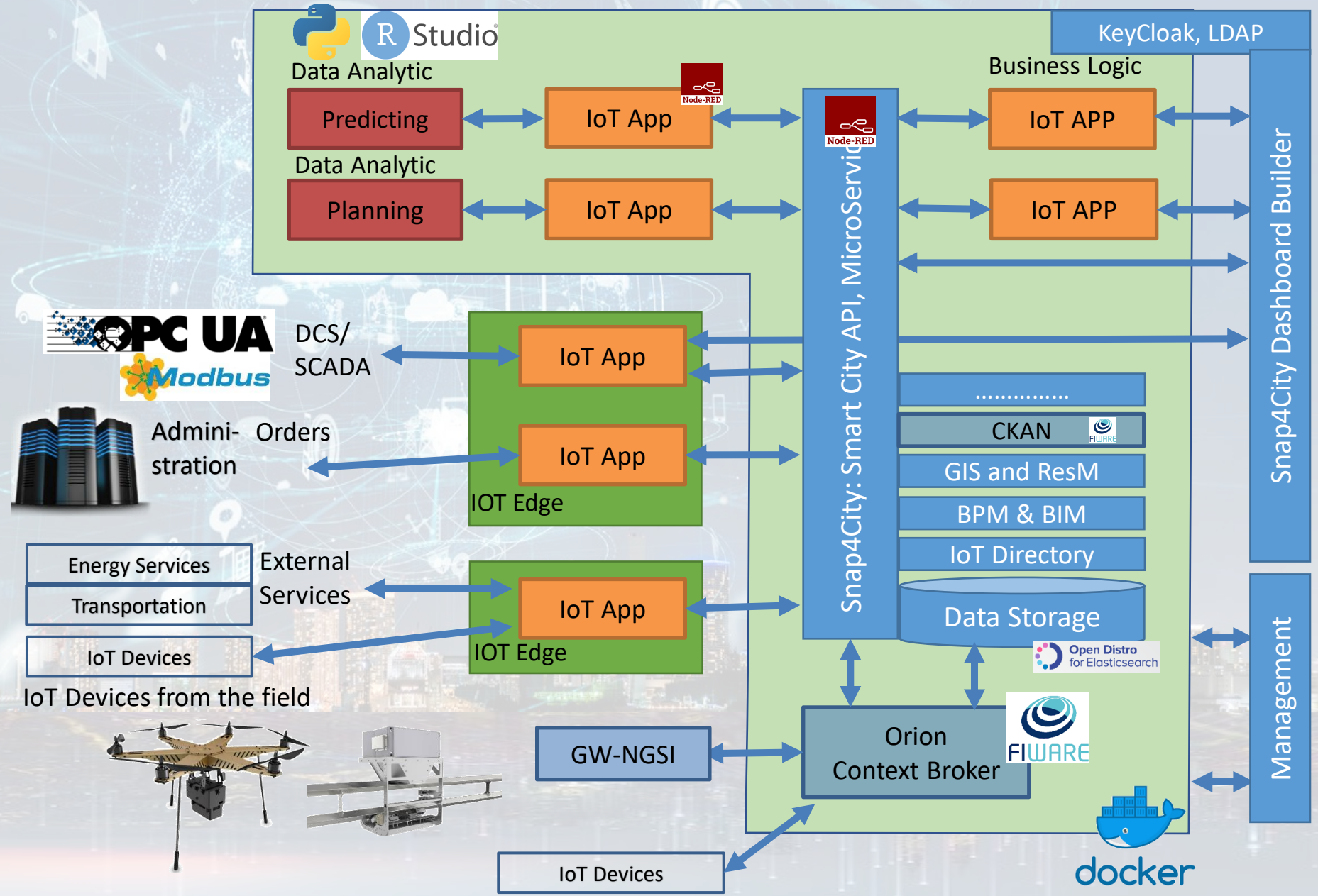
Snap4City Dashboard Builder





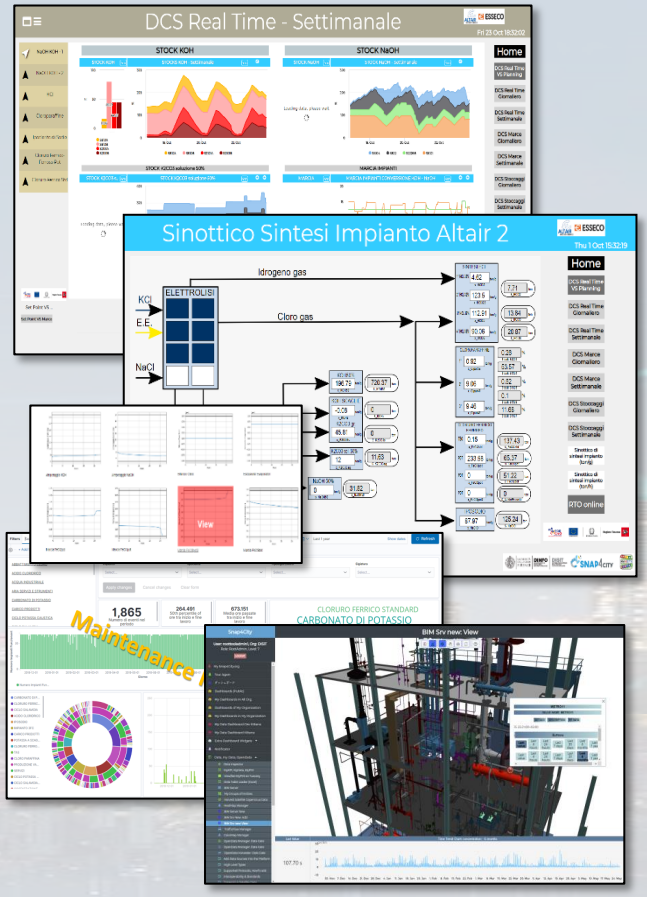


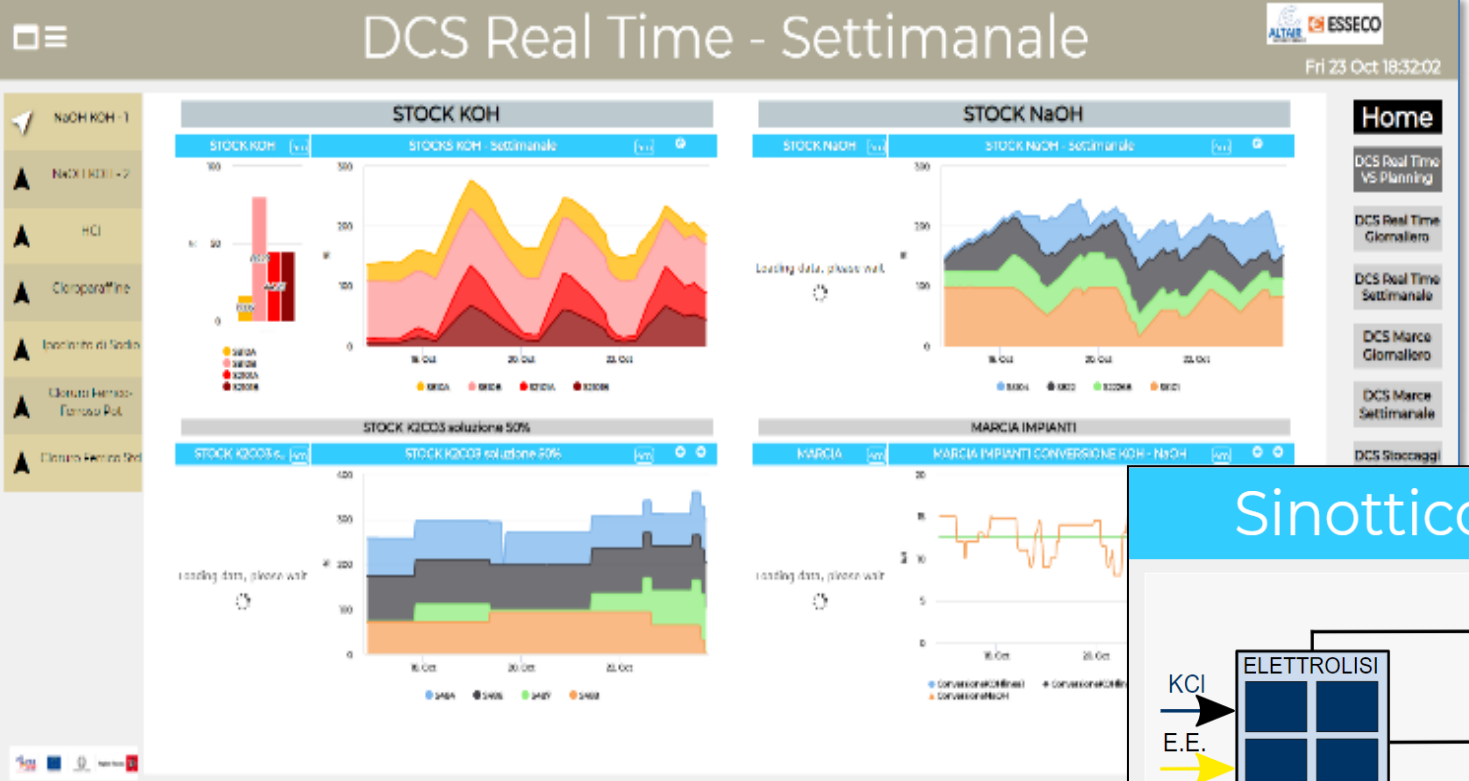
Snap4City/Industry Detailed Architecture

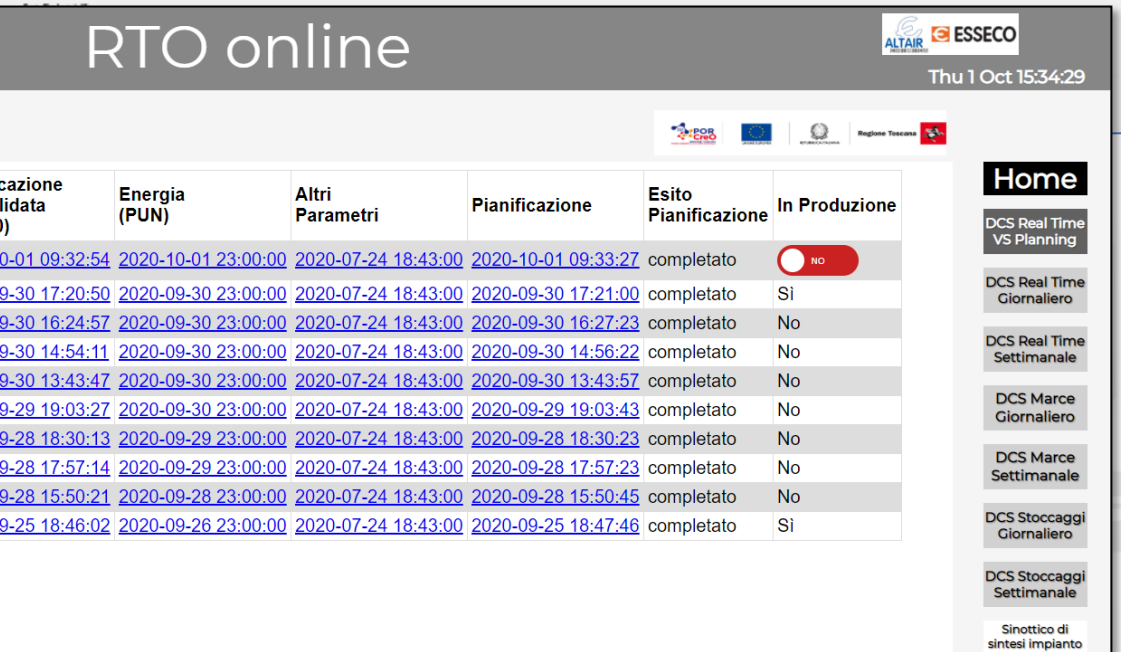


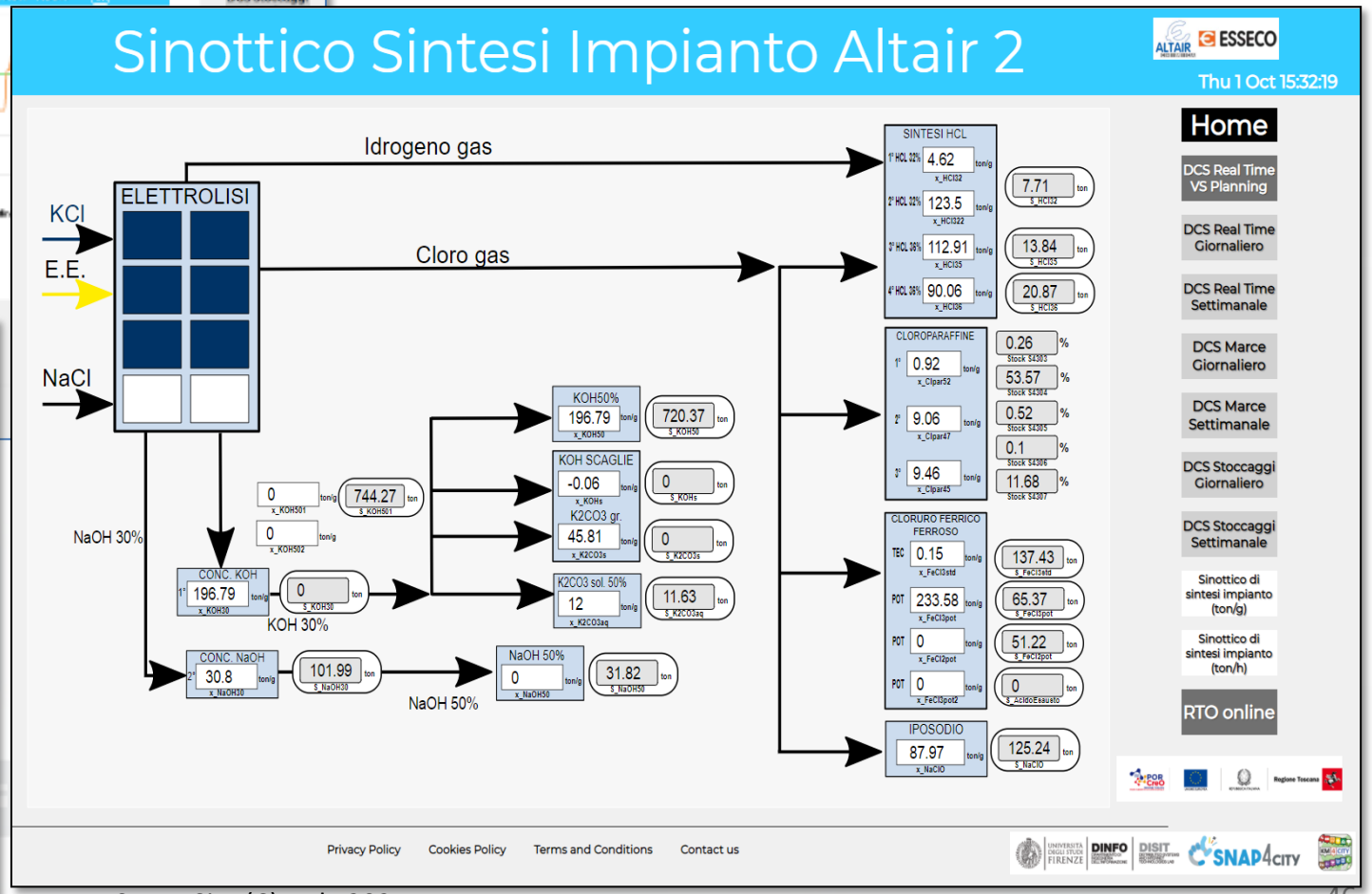
Production Parameters

Dashboards, Visual Analytics, Synoptics, 3D, Maps




DCS Real Time - Settimanale
Fri 23 Oct 18:32:02
STOCK KOH
STOCK NaOH
STOCK K2CO3 soluzione 50%
MARCIA IMPIANTI
Home
DCS Real Time VS Planning
DCS Real Time Giornaliero
DCS Real Time Settimanale
DCS Marce Giornaliero
DCS Marce Settimanale
DCS Stoccaggi


RTO online
Thu 1 Oct 15:34:29
Energia (PUN)
Altri Parametri
Pianificazione
Esito Pianificazione
In Produzione
2020-10-01 23:00:00
2020-07-24 18:43:00
completato
NO
2020-09-30 23:00:00
Sì
No
2020-09-29 23:00:00
2020-09-28 23:00:00
2020-09-26 23:00:00
Home
DCS Real Time VS Planning
DCS Real Time Giornaliero
DCS Real Time Settimanale
DCS Marce Giornaliero
DCS Marce Settimanale
DCS Stoccaggi Giornaliero
DCS Stoccaggi Settimanale


Sinottico Sintesi Impianto Altair 2
Thu 1 Oct 15:32:19
Idrogeno gas
Cloro gas
KCl
E.E.
NaCl
ELETTROLISI
NaOH 30%
KOH 30%
NaOH 50%
SINTESI HCL
CLOROPARAFFINE
CLORURO FERRICO FERROSO
IPOSODIO
Home
DCS Real Time VS Planning
DCS Real Time Giornaliero
DCS Real Time Settimanale
DCS Marce Giornaliero
DCS Marce Settimanale
DCS Stoccaggi Giornaliero
DCS Stoccaggi Settimanale
Sinottico di sintesi impianto (ton/g)
Sinottico di sintesi impianto (ton/h)
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Optimized Production Planner

ESSECO ALTAIR

Fri 23 Oct 18:57:41

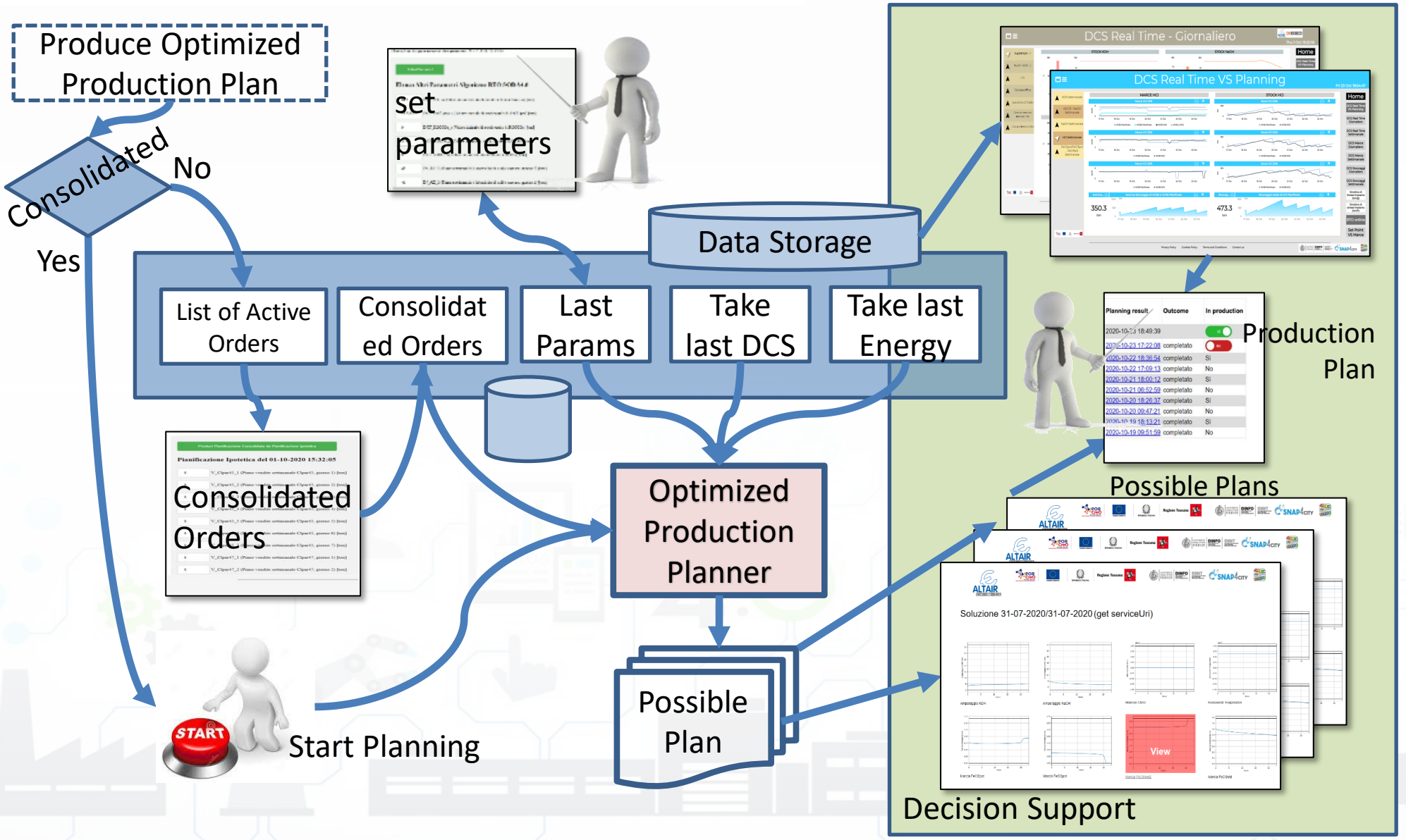
Home
Optimized Production Planner

Parameters (TabPar)	DCS (OPC-UA)	Administrative data (AS400)	Administrative Consolidated Planning data (AS400)	Energy data	Other Parameters	Planning result	Outcome	In production
2020-09-25 18:47:36	2020-10-23 18:49:02	2020-10-23 18:49:29	2020-10-23 18:49:29	2020-10-24 23:00:00	2020-07-24 18:43:00	2020-10-23 18:49:39		SI
2020-09-25 18:47:36	2020-10-23 17:22:03	2020-10-23 17:21:46	2020-10-23 17:21:46	2020-10-23 23:00:00	2020-07-24 18:43:00	2020-10-23 17:22:08	completato	NO
2020-09-25 18:47:36	2020-10-22 18:36:02	2020-10-22 18:36:27	2020-10-22 18:36:27	2020-10-23 23:00:00	2020-07-24 18:43:00	2020-10-22 18:36:54	completato	Si
2020-09-25 18:47:36	2020-10-22 17:09:02	2020-10-22 17:08:59	2020-10-22 17:08:59	2020-10-22 23:00:00	2020-07-24 18:43:00	2020-10-22 17:09:13	completato	No
2020-09-25 18:47:36	2020-10-21 18:00:02	2020-10-21 17:59:47	2020-10-21 17:59:47	2020-10-22 23:00:00	2020-07-24 18:43:00	2020-10-21 18:00:12	completato	Si
2020-09-25 18:47:36	2020-10-21 06:52:02	2020-10-21 06:52:41	2020-10-21 06:52:41	2020-10-21 23:00:00	2020-07-24 18:43:00	2020-10-21 06:52:59	completato	No
2020-09-25 18:47:36	2020-10-20 18:26:02	2020-10-20 18:26:19	2020-10-20 18:26:19	2020-10-21 23:00:00	2020-07-24 18:43:00	2020-10-20 18:26:37	completato	Si
2020-09-25 18:47:36	2020-10-20 09:47:03	2020-10-20 09:47:05	2020-10-20 09:47:05	2020-10-20 23:00:00	2020-07-24 18:43:00	2020-10-20 09:47:21	completato	No
2020-09-25 18:47:36	2020-10-19 18:13:02	2020-10-19 18:13:09	2020-10-19 18:13:09	2020-10-20 23:00:00	2020-07-24 18:43:00	2020-10-19 18:13:21	completato	Si
2020-09-25 18:47:36	2020-10-19 09:51:02	2020-10-19 09:51:08	2020-10-19 09:51:08	2020-10-19 23:00:00	2020-07-24 18:43:00	2020-10-19 09:51:59	completato	No

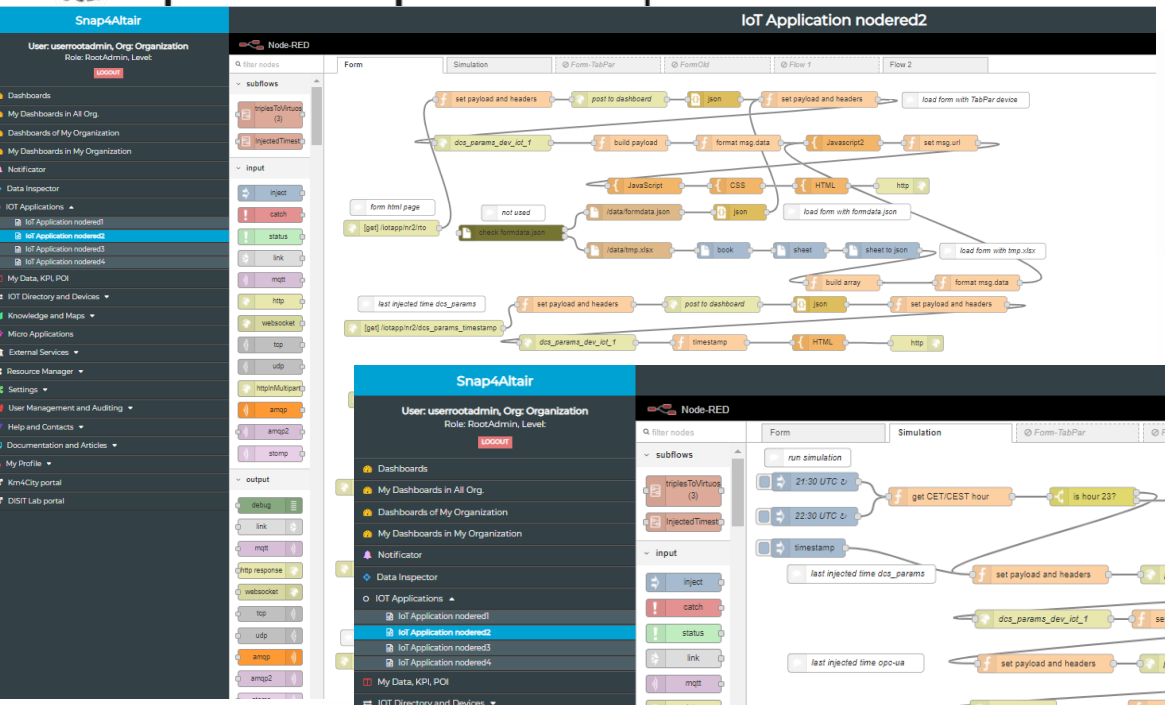
<< 1 2 3 4 5 6 7 8 9 10 11 12 13 14 >>

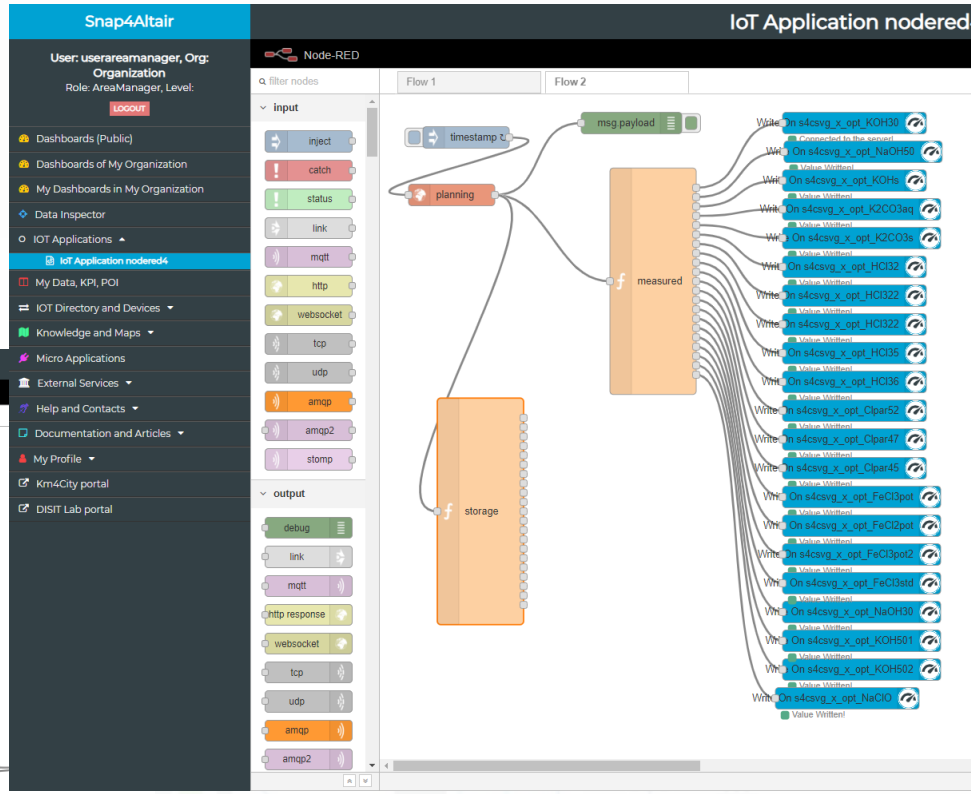
Home
DCS Real Time VS Planning
DCS Real Time Giornaliero
DCS Real Time Settimanale
DCS Marce Giornaliero
DCS Marce Settimanale
DCS Stoccaggi Giornaliero
DCS Stoccaggi Settimanale

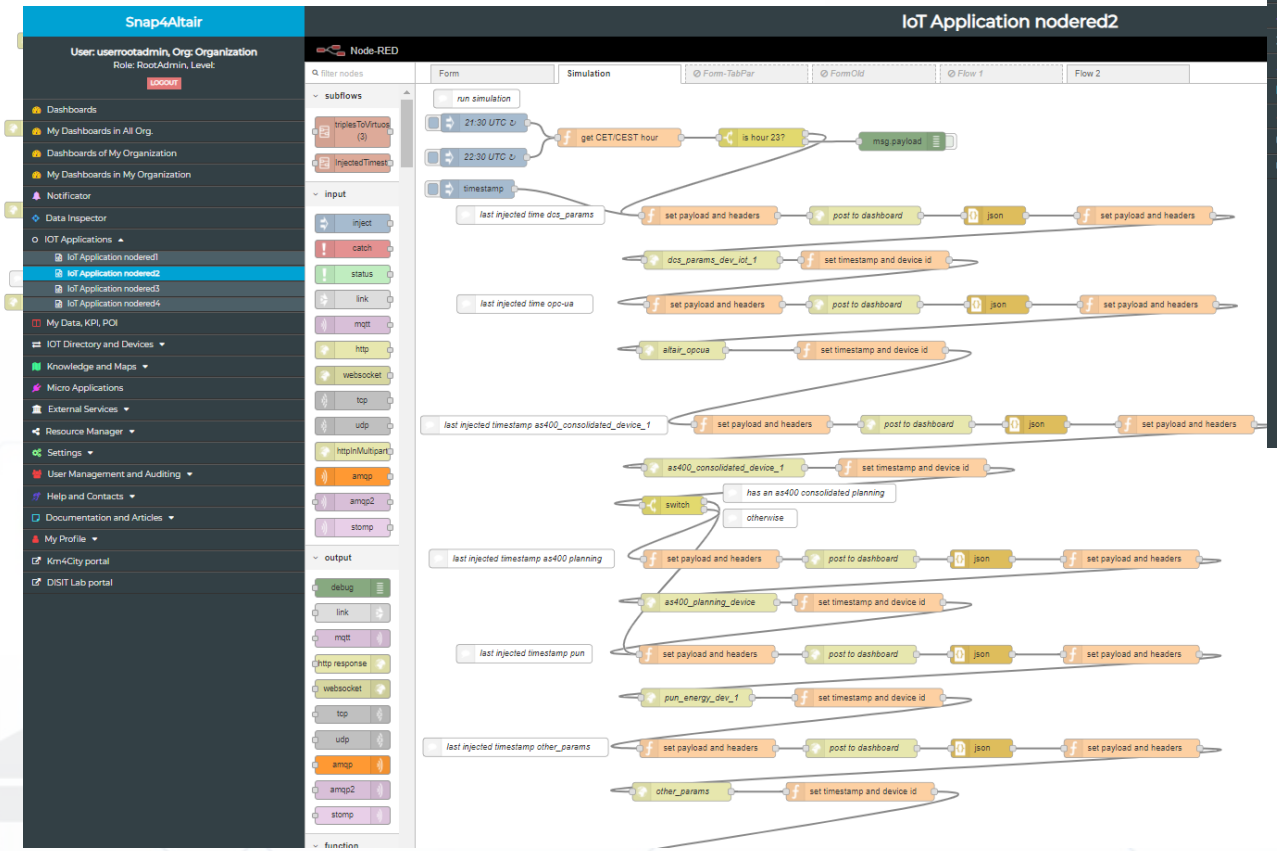
Business Logic



Some Flows


Snap4Altair
IoT Application nodered2
Node-RED

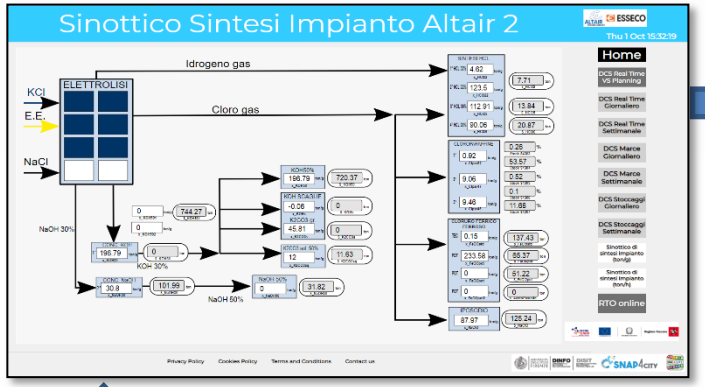

Snap4Altair
IoT Application nodered
Node-RED
timestamp
planning
msg.payload
measured
storage


Snap4Altair
IoT Application nodered2
Node-RED
Simulation

Green Impact Capacity (GIC)

Altair Control room

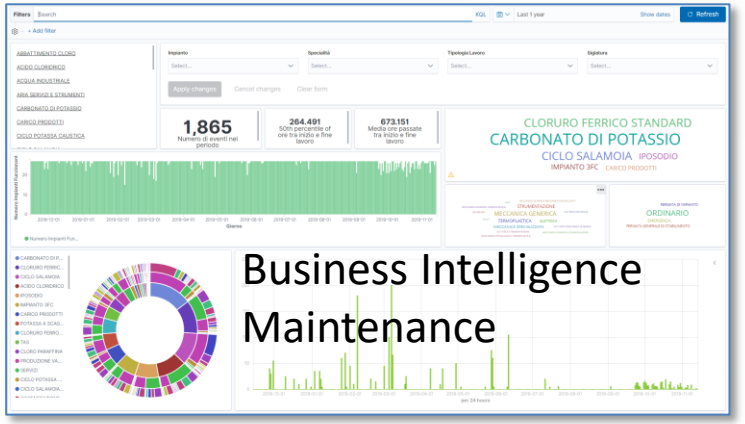
Workflow for Ticket management

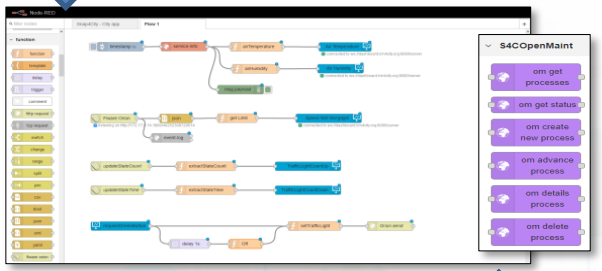


Dashboards and actions

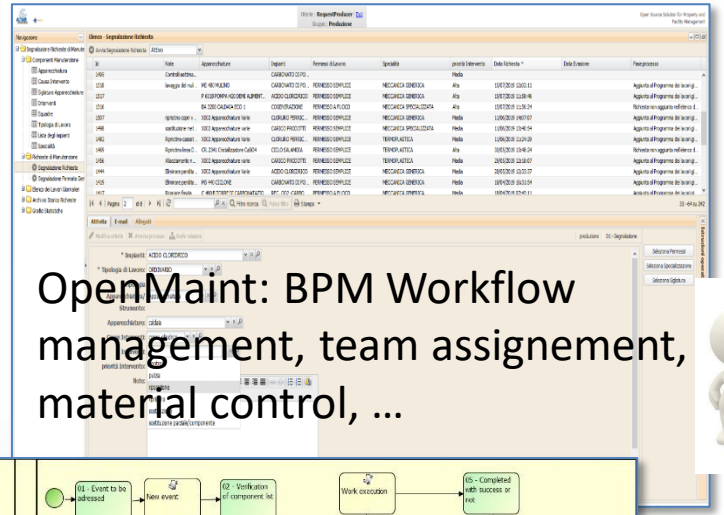
Consumptions/productions

Events/actions

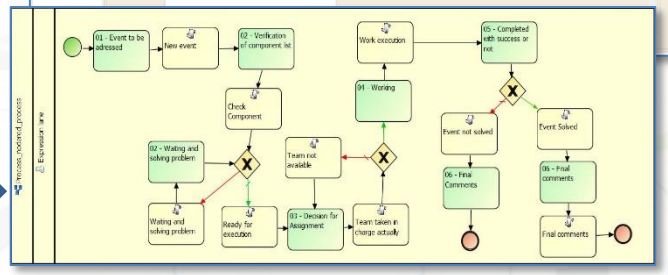


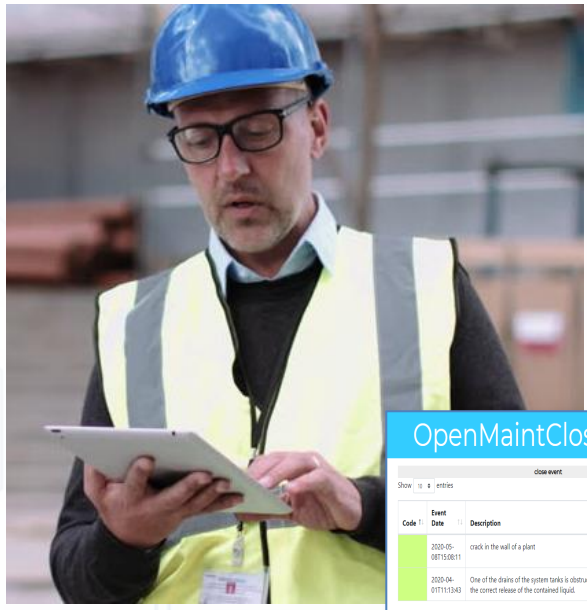


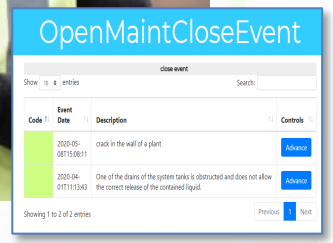
IOT App, Data event firing, event detection and firing Critical event management



OpenMaint: BPM Workflow management, team assignement, material control, …

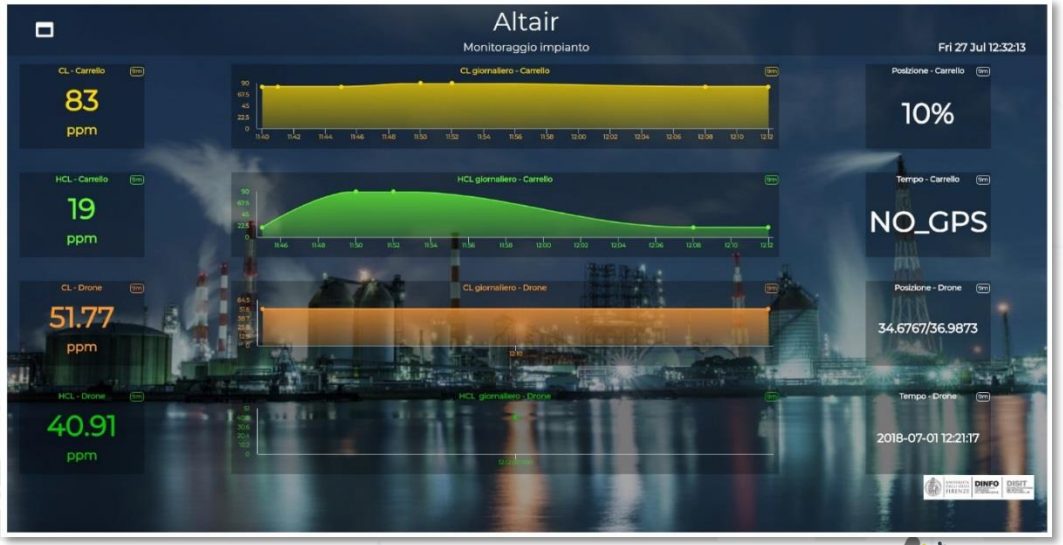






Green Impact Capacity (GIC)

- Improve productivity of chemical plant
- Keep GREEN the environmental impact
- Exploiting innovative technologies
- Diversify the production
- Monitoring environmental conditions

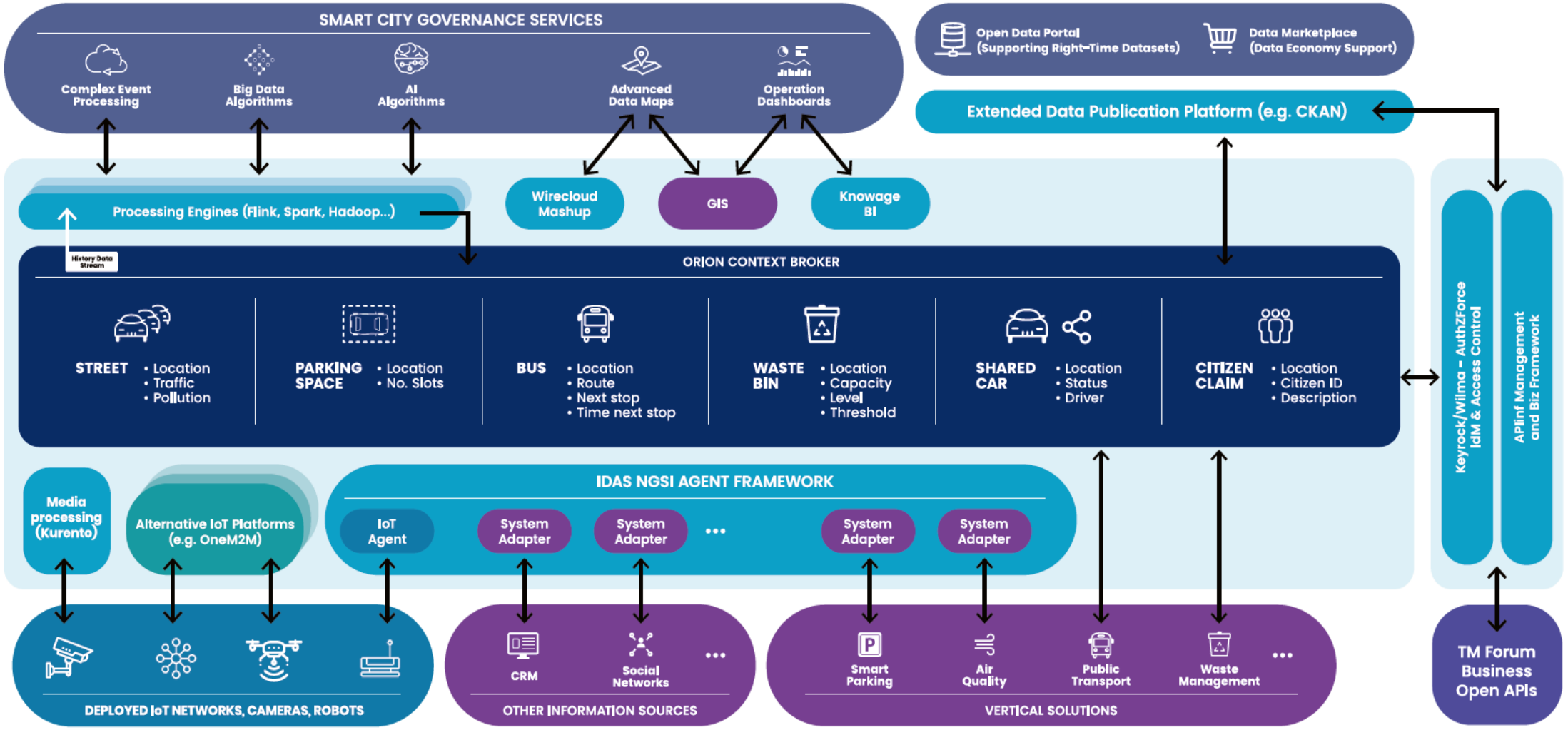


TOP

FIWARE & Snap4City

Powered by FIWARE

THE FIWARE SMART CITIES REFERENCE ARCHITECTURE



- Snap4City - Powered by FIWARE Solution:
  - https://marketplace.fiware.org/pages/solutions/b8905e91973b420189cce972
  - 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.

URBAN PLATFORM: SMART CITY IOT AS A SERVICE AND ON PREMISE

100% OPEN SOURCE

APPLIANCES CONTAINERS

- LOCAL GOVERN
- STAKEHOLDERS
- CITY USERS
- IN-HOUSE
- ENERGY OPERATORS
- MOBILITY OPERATORS
- COMMERCIAL OPERATORS
- SECURITY OPERATORS
- INDUSTRIES
- RESEARCHERS
- START-UPS
- ASSOCIATIONS

- GDPR
- SECURITY
- PRIVACY
- ASSESSMENT
- AUDITING
- PENTESTED

- OPEN IOT DEVICES
- IOT EDGE
- IOT GATEWAY
- PAX COUNTERS
- IOT BUTTONS

- TEST CASES, SCENARIOUS, VIDEOS, HACKATHONS
- OPEN SOURCES, COMMUNITY OF CITIES
- TRAINING TUTORIALS, COMMUNITY MANAGEMENT

IOT APPLICATIONS - INSTANT APPS

DATA DRIVEN APPLICATIONS • REAL TIME PROCESSING • BATCH PROCESSING • ANY PROTOCOL & FORMAT

DASHBOARDS & APPLICATIONS

CONTROL ROOM • SITUATION ROOM • OPERATOR DASHBORDS • BUSINESS INTELLIGENCE • WHAT-IF ANALYSIS • DECISION SUPPORT • SIMULATIONS • RISK ANALYSIS • RESILIENCE ANALYSIS

MOBILE & WEB APPLICATIONS

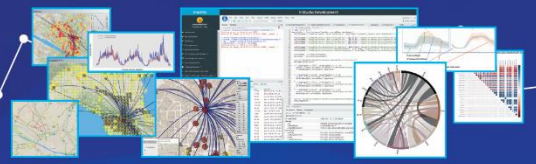
DEVELOPMENT KIT • SUGGESTIONS • MOBILE APPS • MONITORING PANELS • PLATFORM UTILITIES • READY TO USE SMART APPLICATIONS

MICROSERVICES & ADVANCED SMART CITY API

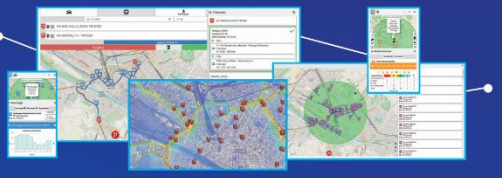
LIVING LAB - DEV TOOLS - COWORKING

IOT DIRECTORY • SERVICE MAP • RESOURCE MANAGER • DATA GATE • R STUDIO • ETL

BIG DATA - DATA ANALYTICS



DATA ANALYTICS TOOLS - MICRO-APPLICATIONS



PREDICTIONS • ANOMALY DETECTION • WHAT-IF ANALYSIS • TRAFFIC FLOW RECONSTRUCTION • ORIGIN-DESTINATION MATRICES • SOCIAL MEDIA ANALYSIS • OFFER VS DEMAND ANALYSIS • ENVIRONMENTAL DATA ANALYSIS AND PREDICTIONS • REAL TIME HEATMAPS • ROUTING • ALERTING • EARLY WARNING • PERSONAL AND VIRTUAL ASSISSTANTS • SMART SOLUTIONS • SMART SHARING • PARTECIPATORY

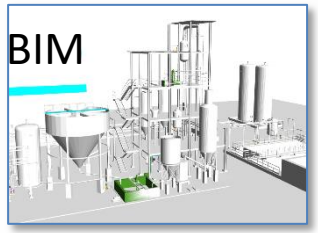
KM4CITY DATA AGGREGAT KNOWLEDGE BASE - EXPERT SYSTEM OF THE CITY – BIG DATA STORE

IOT MNG - DATA MNG - DATA INSPECTOR – PROCESS MNG – USER ENGAGEMENT – GDPR MNG ...

GIS	CITY UTILITIES	OPEN DATA	LEGACY & EXTERNAL SERVICES	PERSONAL DATA	IOT / IOE	BROKERS	KPI	INDUSTRY 4.0	SOCIAL MEDIA

Concept

BIM

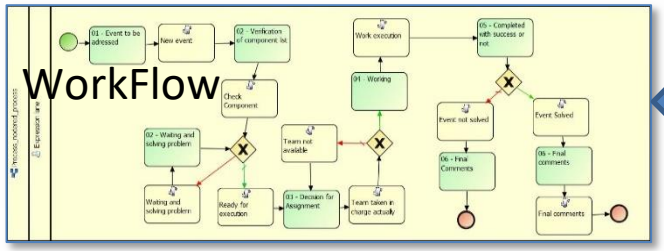


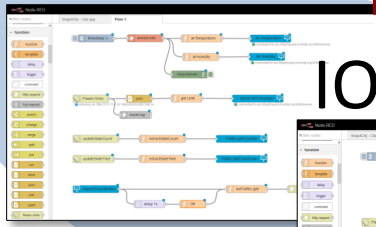
KPI, POI, MyKPI, …

API, External Services

Web Scraping

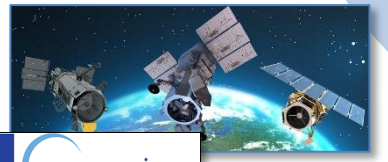
WorkFlow



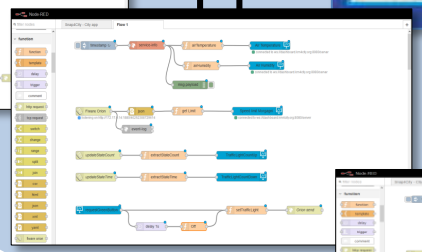


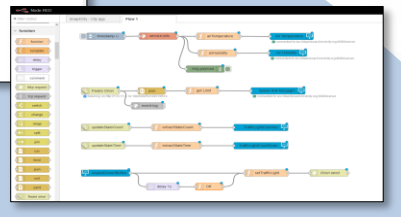
Node-RED

IOT Apps



opernicus
Europe's eyes on Earth





Data Analytics,
Artificial Intelligence

IOT Brokers

IOT Broker

IOT Broker

FIWARE

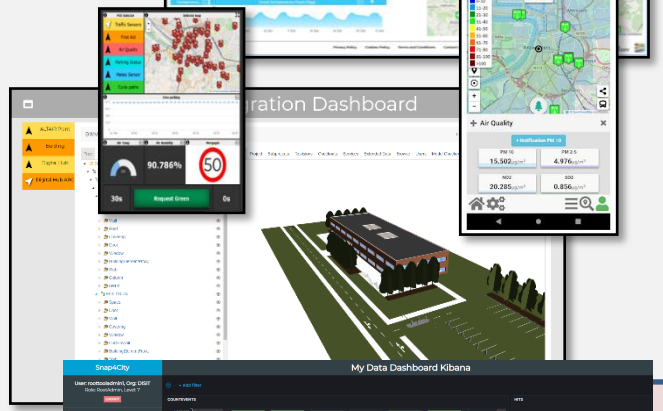
GIS

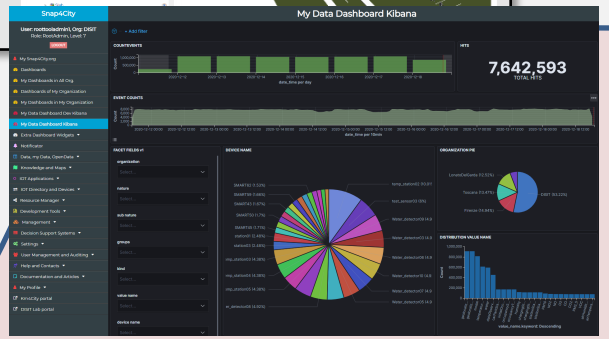
Big Data

KB

LD, LOD

ckan





Dashboards and Apps

FI-WARE

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 caòibrated	Yes: fully; calibarate 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	No, probably with NGSI-LD in the future	Yes since 2013
Multiple kinds of IoT Brokers	No, only agents	Yes: NGSI, COAP, AMQP, MQTT, SigFOX, etc.

Interoperability
Openess

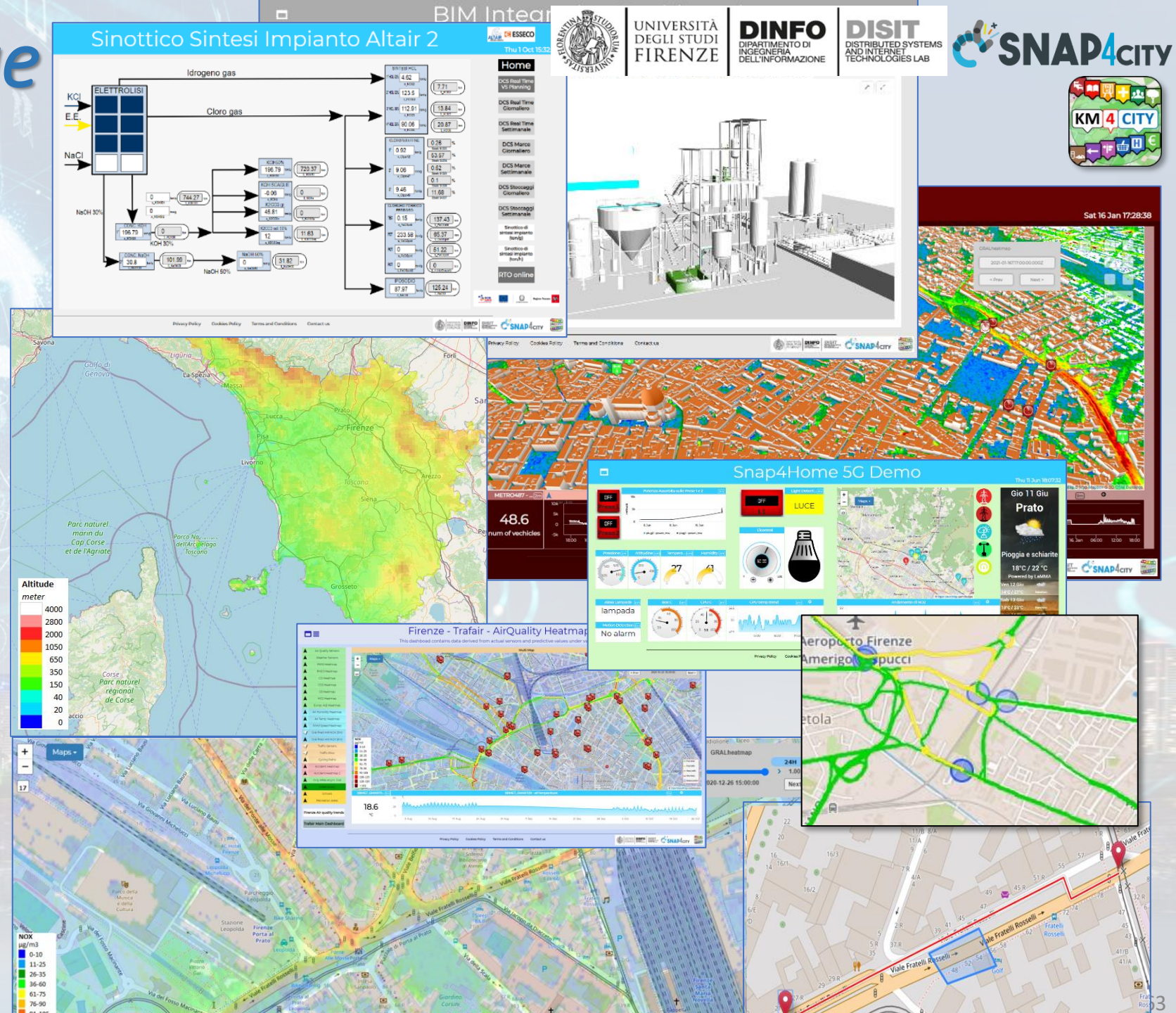
Functional: FIWARE refarc wrt Snap4City solutions

	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, Kibana with GDPR, LDA (Open Distro)
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.

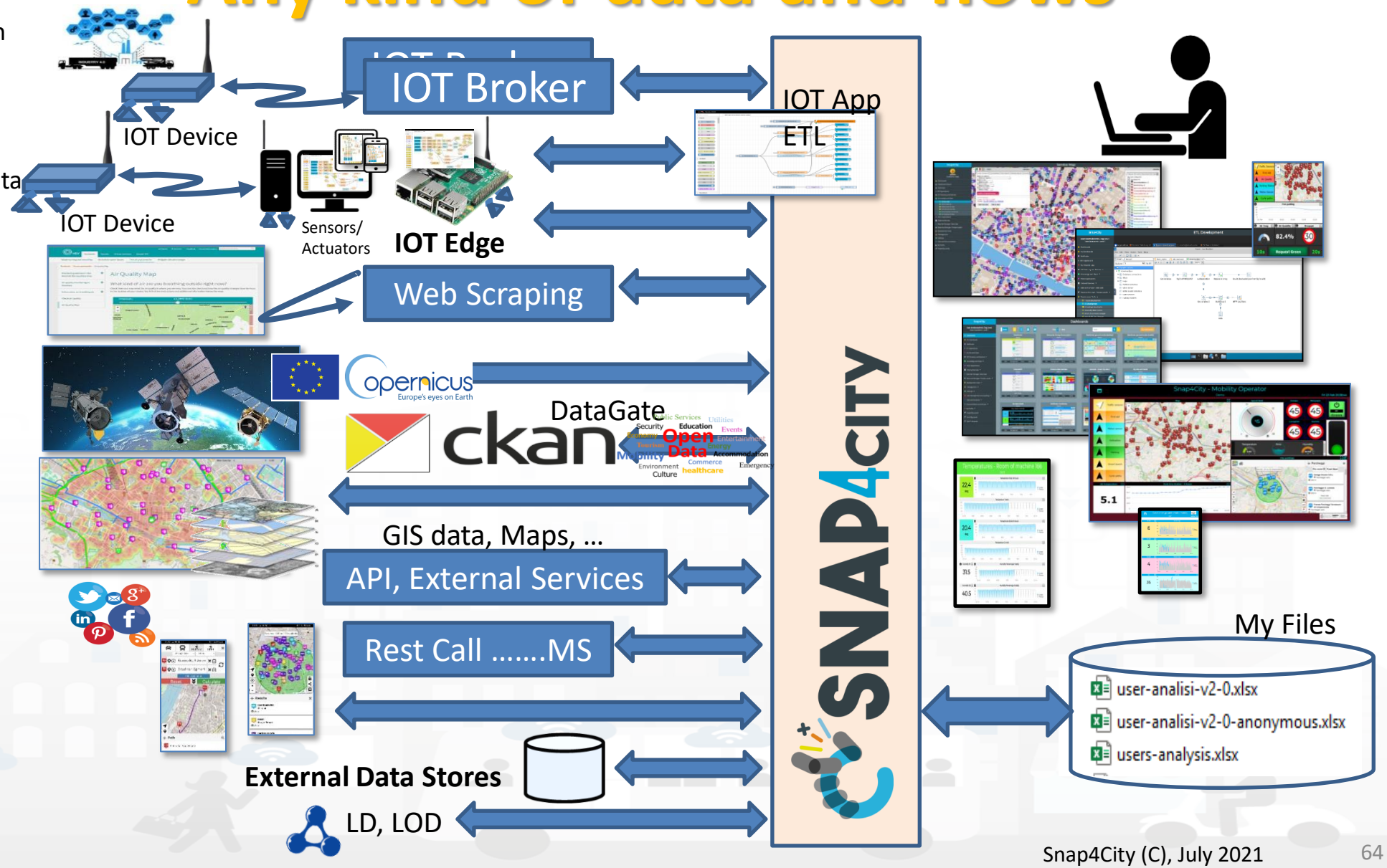
Data Type Coverage

- POI, IOT, shapes,..
- maps, orthomaps, GTFS, GIS WFS/WMS, GeoTiff, ..
- calibrated heatmaps, ..
- traffic flow, typical trends, ..
- trajectories, events, ..
- 3D, BIM, Workflow, ..
- Dynamic icons/pins, ..
- OD Matrices, scenarios, ..
- prediction models, ...
- decision support, ...
- Synoptics, animations, ..
- social media, Routing, ..
- Satellite data, ..
- KPI, personal KPI,..
- etc.



Any kind of data and flows

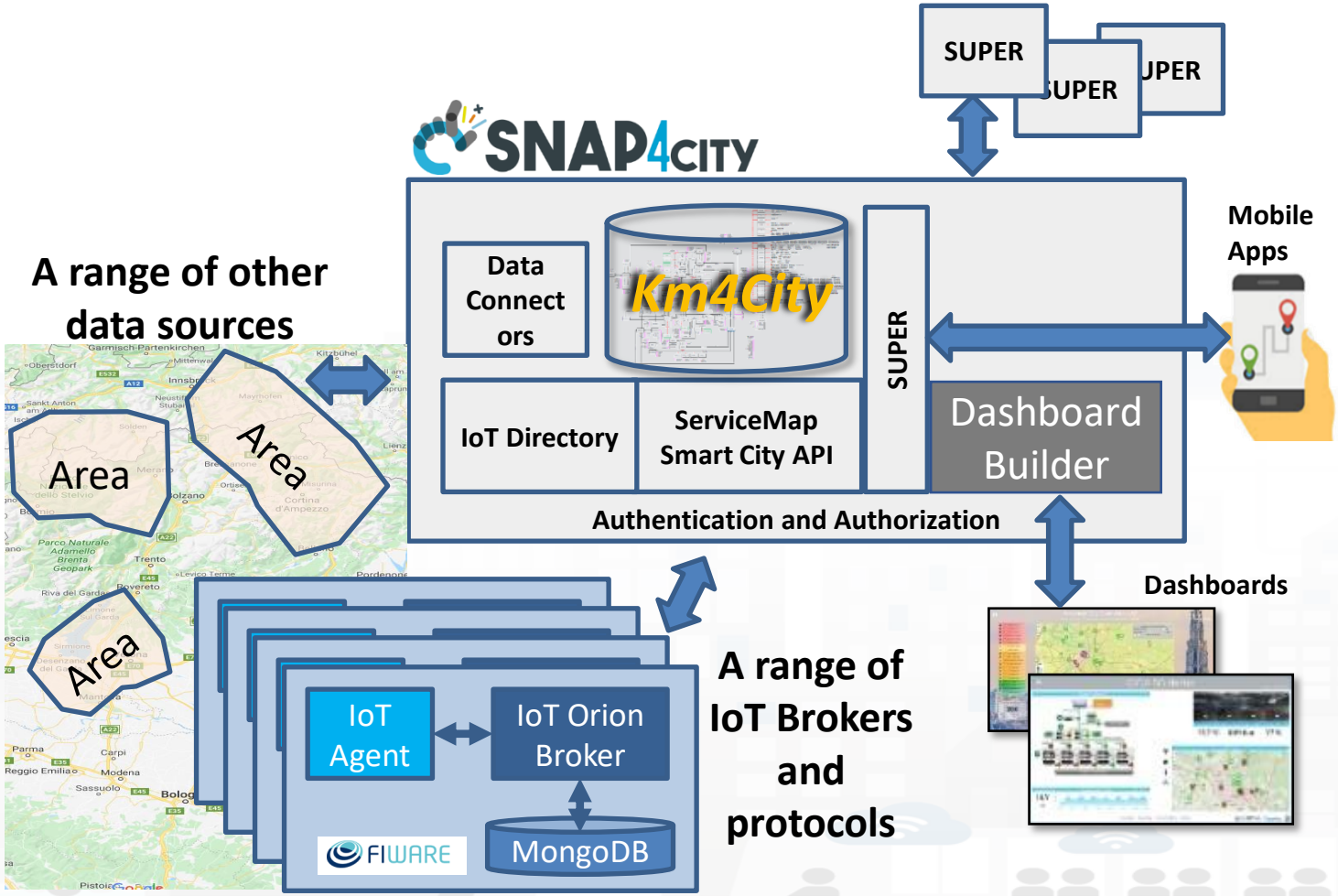
- **Open Data:**
  - Data gate, federation of Open Data Portals
  - IOT App, ETL proc(PULL)
- **IOT Networks:**
  - IOT Application processes, data driven or PULL
  - IOT Brokers (Push) → IOT Shadow
- **Web Pages:**
  - Web scraping, crawling processes
- **Satellite data**
- **Social media: Twitter, Facebook,..**
  - Twitter Vigilance, IOT App
- **Mobile Apps**
  - Smart City API
- **Files upload: CSV, Excel, etc.**
  - IOT Applications, ETL
- **REST API, WS, FTP, LD, LOD, etc.**
  - IOT Applications, ETL
- **Data base accesses**
  - GIS: WFS, WMS
  - ETL, IOT Application



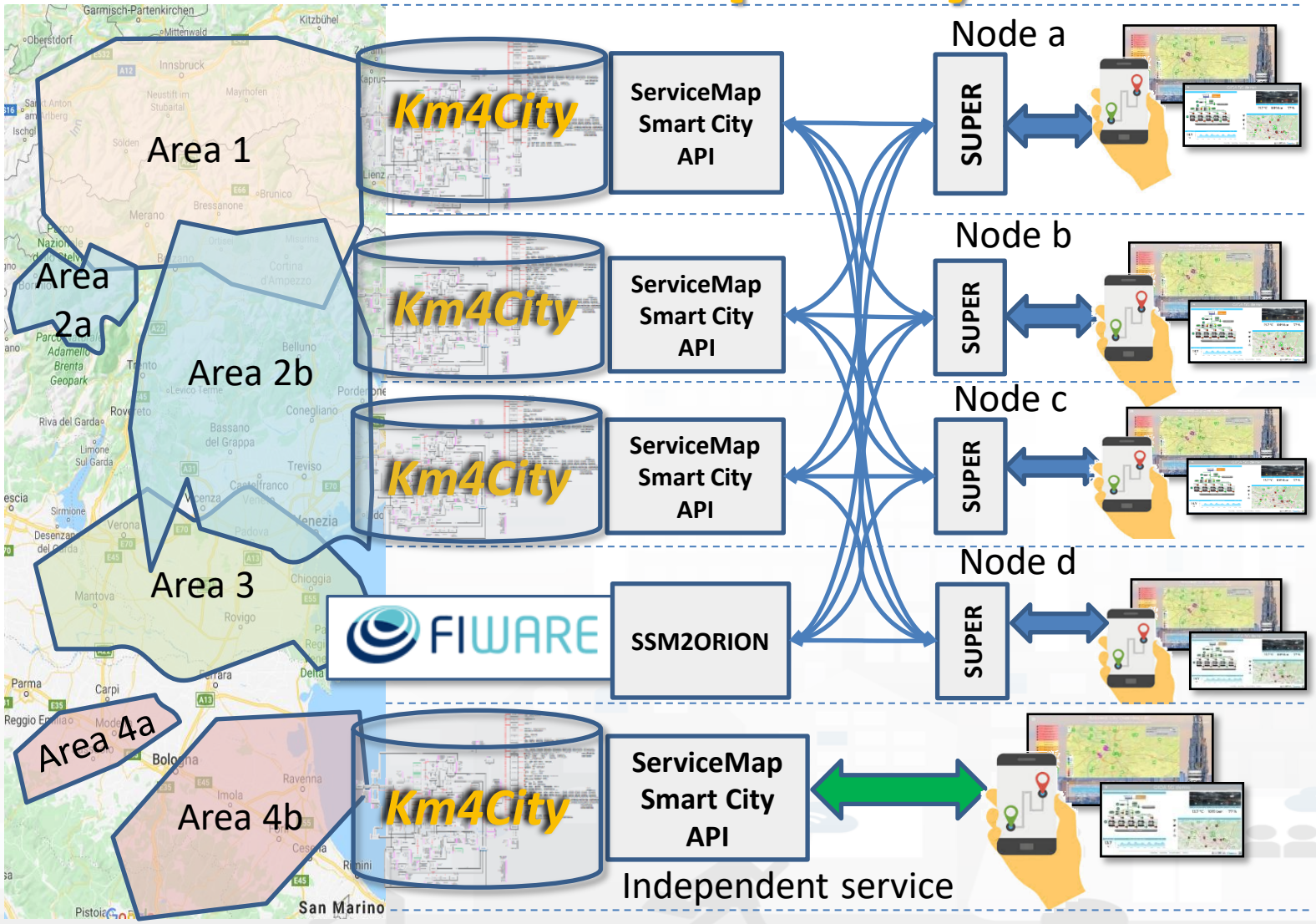
Snap4City and FiWare integration

- **A) IoT 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) IoT 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 IoT 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

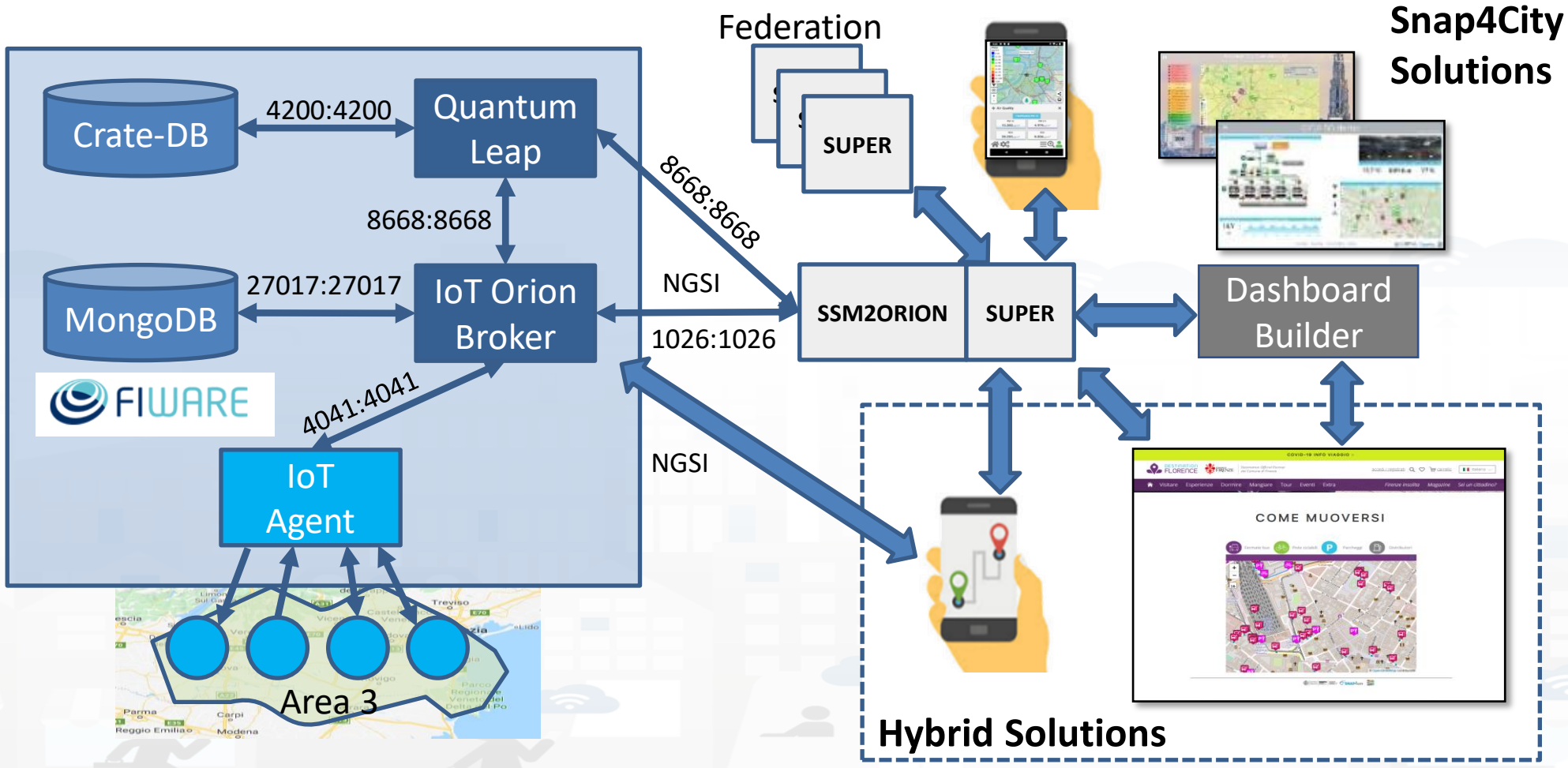


Federation of Snap4City Services



- A Mobile App may refer to one Smart City API Server (for Area 1) via SUPER and receive data from the Federated SUPERS (Area 2) if navigation, queries, etc. are leading to discover out of the addressed KB.
  - SUPER can be used for creating redundant and/or balanced distributed solutions for Federated KB. See Area 2, the two KB in the front.
  - Federated SUPER can have overlapped KB even totally.
  - A Mobile App can be developed to support multiple Smart City API servers, for balancing and
- The usage of Super is not mandatory so that separate services can be produced as well
- Super and Nodes presents the same Smart City APIs.

Federation of Snap4City vs IOT ORION Broker



Non Functional

FiWare OS Solutions wrt Snap4City solutions

	FiWare	Snap4City
Security	TLS	Yes: End to end, TSL and dashboards, event driven, mutual authentication, Access Token, OpenID Connect
Privacy	Not on all data	Yes: GDPR compliant full stack
Access Control, authorization	To be done, Partial	Yes: User Roles, and management tools
Scalability	Limited on data No on processes	Yes
Full stack Open Source	No (proprietary applicative levels)	Yes: open source also application level
Full Modular	Not all modules are Open Source	Yes
Interoperable	Partial, see previous table	Yes at all levels, in all modules, 100% open source
Full training course	Partial	Yes
Examples and code shared	Partial	Yes

Two Main Lines for Dashboarding are present

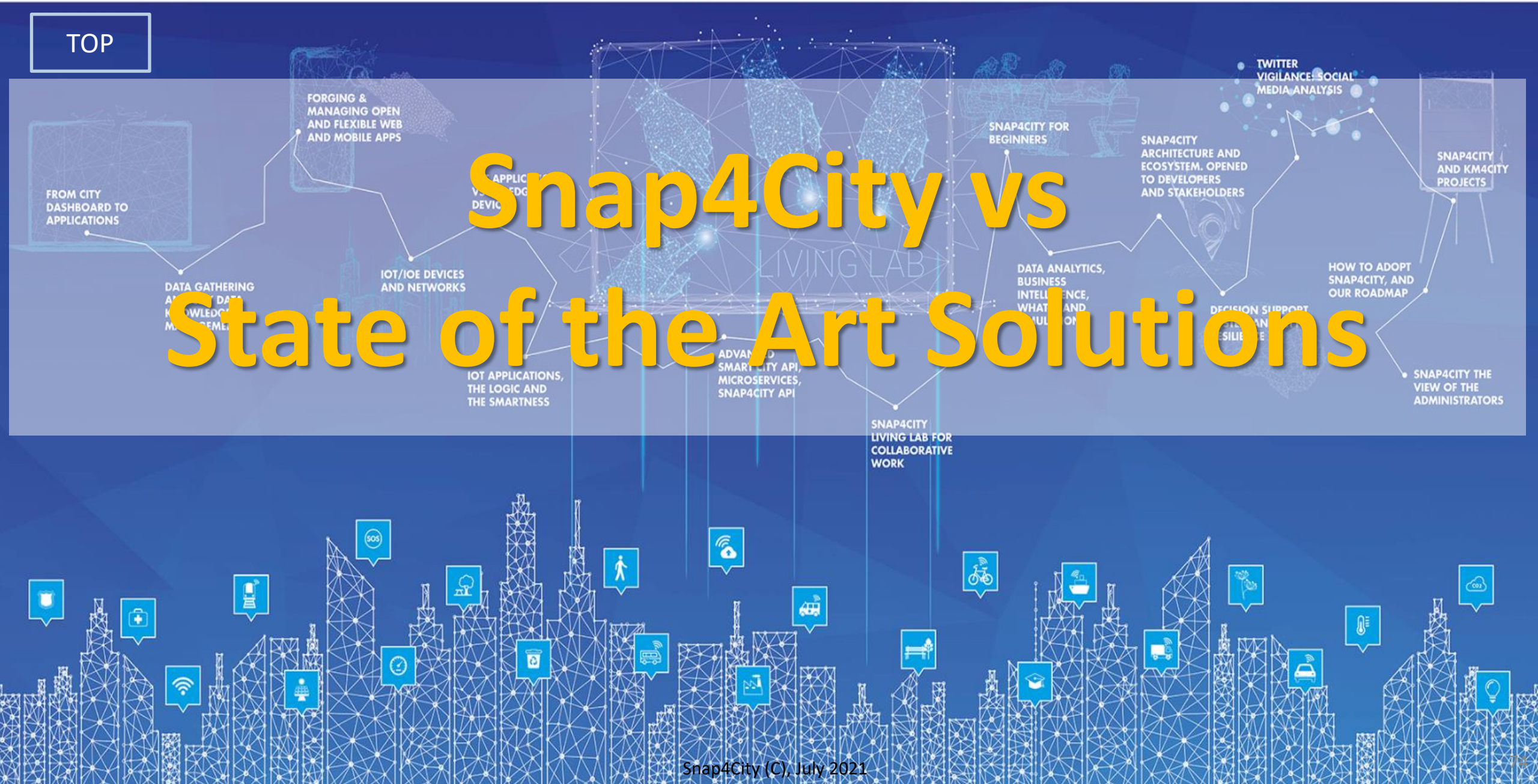
- **Dashboard Builder of Snap4City**
  - For accessing and browsing data on: OpenDistro x ElasticSearch, Mongo, MySQL, Smart City API, Super and thus from federated Smart City API, etc.
  - Supports sensors/actuators: data driven data, maps in extended manner, data driven widgets, large collection of 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 vs Kibana

Features	Snap4City Dashboard Builder	Kibana, Grafana
Large Collection of Widgets	YES	Nothing
Custom Widgets SVG of any kind, full defined process for customization	YES	Nothing
Real time event driven widgets and data	YES	Nothing
Business Logic for data transformation with visual programming: Node-RED	YES	Some coding
Maps with custom PIN, bubbles, animated and moving, etc.	YES	Nothing
Maps with paths, shapes, traffic flow, scenarios, routing, heatmaps, what-if, …	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	YES	Nothing
Typical Time Trends: day hours, month week, month days, …..	YES	Nothing
Time Trend Compare: day, eek, 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, etc…	YES	Nothing
Faceted search	possible with selectors	YES

TOP

Snap4City vs State of the Art Solutions

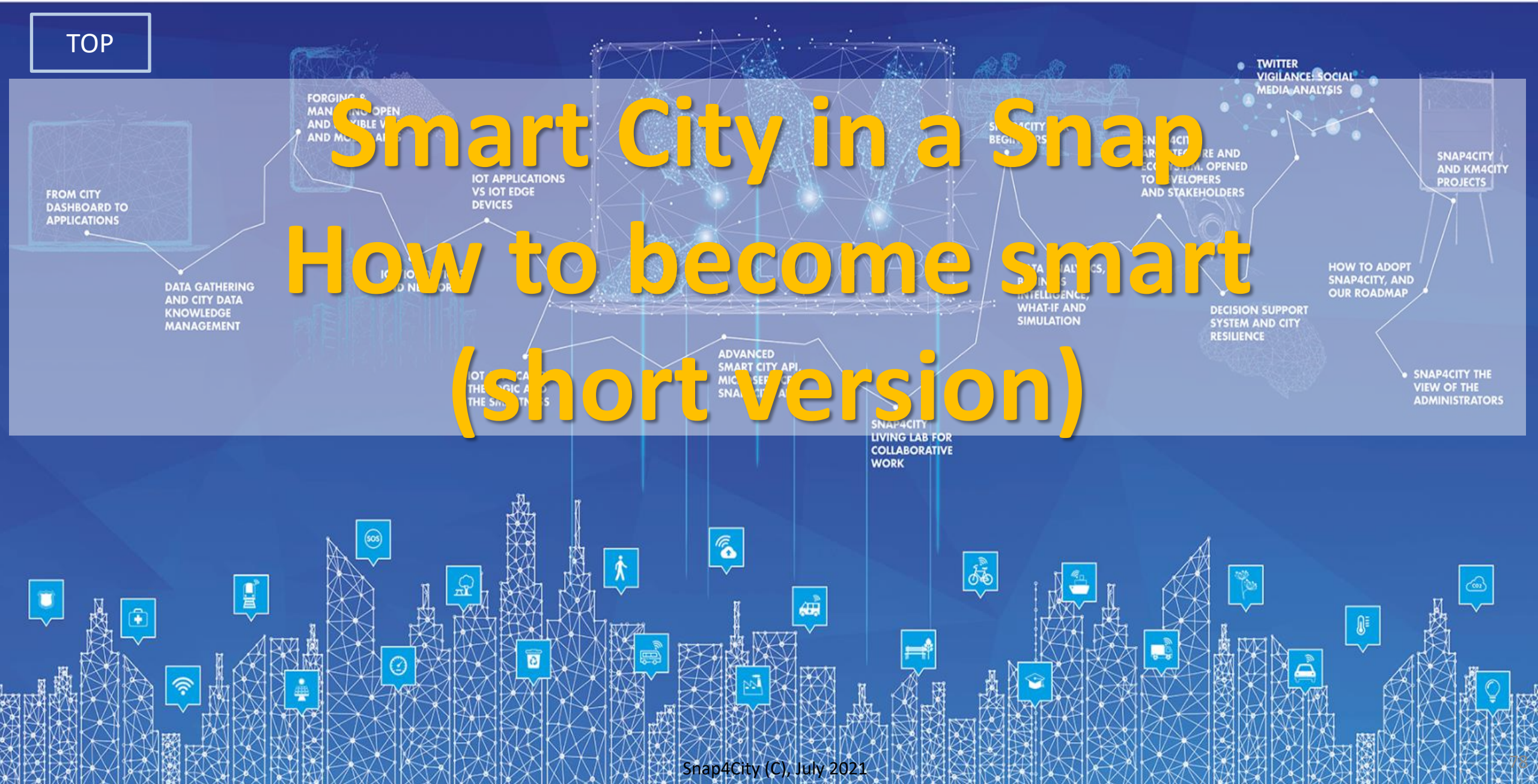


Market Solutions

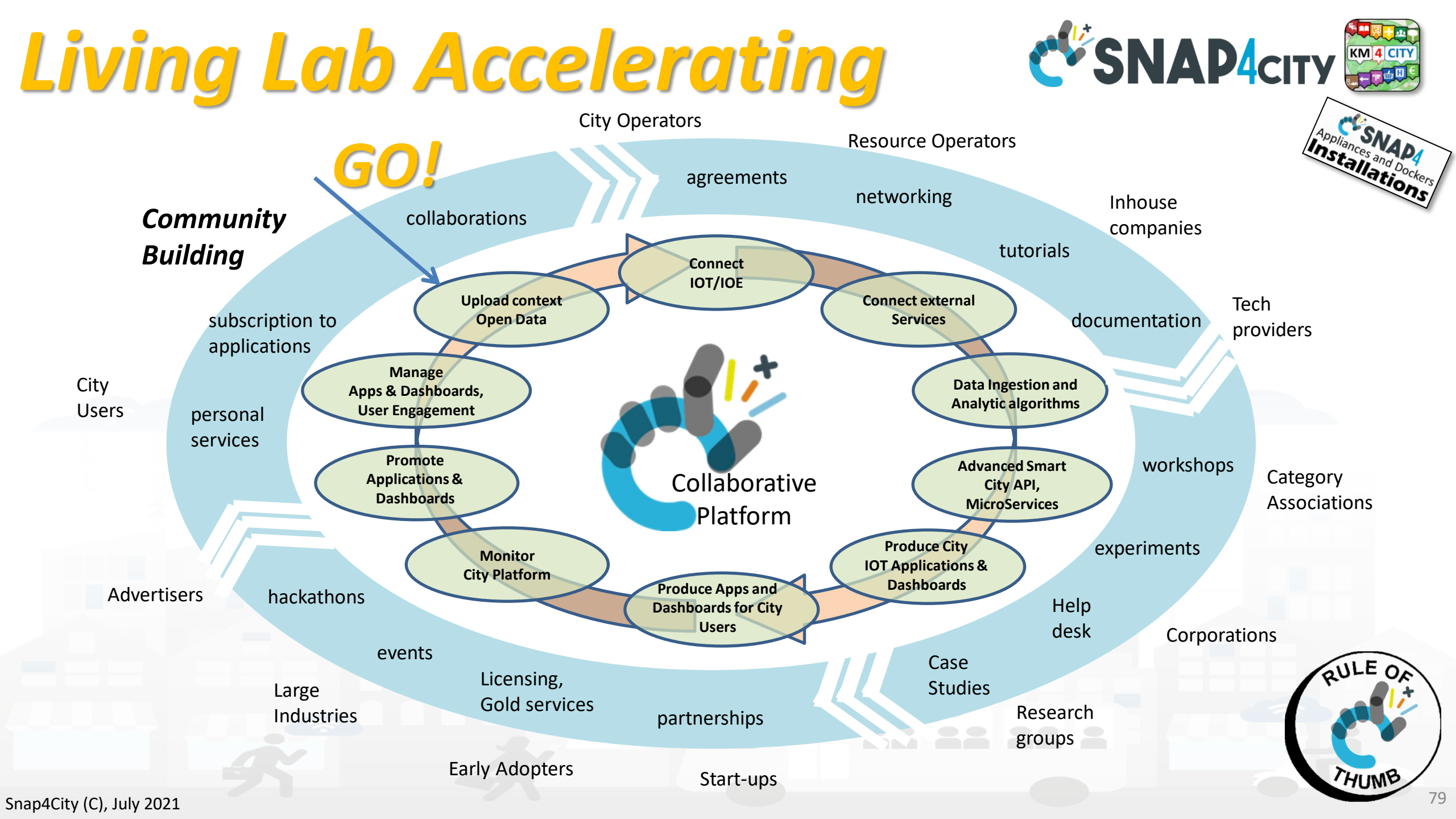
	IOT Discovery Abstraction	Authentication, Authorization	Security end-2-end, secure on IOT and Dashboards	Open HW and Open SW	Integrated Community management	Data Types: IOT Devices, IOT App, Dashboard, Data	Data Type: Publish/share, Delegation, Consent and change	Data Type: Download and Delete	Auditing on Data Type Access	Open Source end-to-end	Scalability IOT	Visual Programming end-to-end applications	Advanced Smart City API, MicroServices	Multi Domain Semantic Platform	Standard based Modules and IOT, Open Devices	Resource Sharing	Data Analytics integrated	Dashboard H24/7, protected connection	Multi-protocol on IOT
		G				G	G	G	G										
Snap4City	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
KAA [53]	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	N	(Y)	N	N	Y	Y
Thingsboard [55]	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	N	N	N	N	N	Y	MQTT,coap, http
IOT eclipse.org [56]	N	N	N	(Y)	N	Y	N	N	N	Y	Y	N	N	N	Y	N	N	N	Y
IOT IGNITE [57]	N	Y	N	Y	N	Y	N	Y	Y	Y	Y	Y	N	N	N	N	N	Y	MQTT
FIWARE [47]	N	Y	N	Y	N	N	N	Y	N	Y	(Y)	(N)	Y	N	Y	N	N	Y	Y
ARM mbed IoT [48]	Y	Y	Y	Y	Y	N	(N)	N	Y	Y	Y	N	N	N	Y	N	N	Y	Limited
Airvantage [51]	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	N	N	N	N	N	Y	MQTT, HTTP
AWS [43]	Y	Y	Y	Y	N	Y	(N)	Y	Y	N	Y	N	N	N	Y	Y	(Y)	Y	Limited
Azure IOT [44]	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	N	Y	Y	(Y)	Y	Limited
PTC ThingWorkx [59]	N	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	N	N	Y	N	N	Y	Y
Bosch IoT Suite [58]	Y	Y	Y	Y	Y	(Y)	(N)	Y	Y	N	Y	Y	Y	N	Y	N	Y	Y	Y
CISCO Jasper [55]	Y	Y	Y	Y	N	(Y)	(N)	N	Y	N	Y	N	N	N	N	--	(Y)	Y	N
Siemens MindSphere [60]	Y	Y	Y	(Y)	N	Y	(N)	Y	Y	N	Y	Y	N	N	Y	N	Y	Y	Y
Carriots [54]	Y	Y	Y	(Y)	N	Y	N	N	Y	N	Y	N	N	N	--	N	N	Y	MQTT
Google IOT [45]	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	N	N	N	N	(Y)	(Y)	MQTT, HTTP
Homekit Apple [50]	Y	Y	Y	Y	N	Y	N	N	Y	N	(Y)	N	N	N	N	Y	N	Y	Limited
Smarthing Samsung [52]	Y	Y	Y	Y	Y	Y	(Y)	Y	Y	N	(Y)	N	N	N	N	N	N	Y	Limited

TOP

Smart City in a Snap
How to become smart (short version)



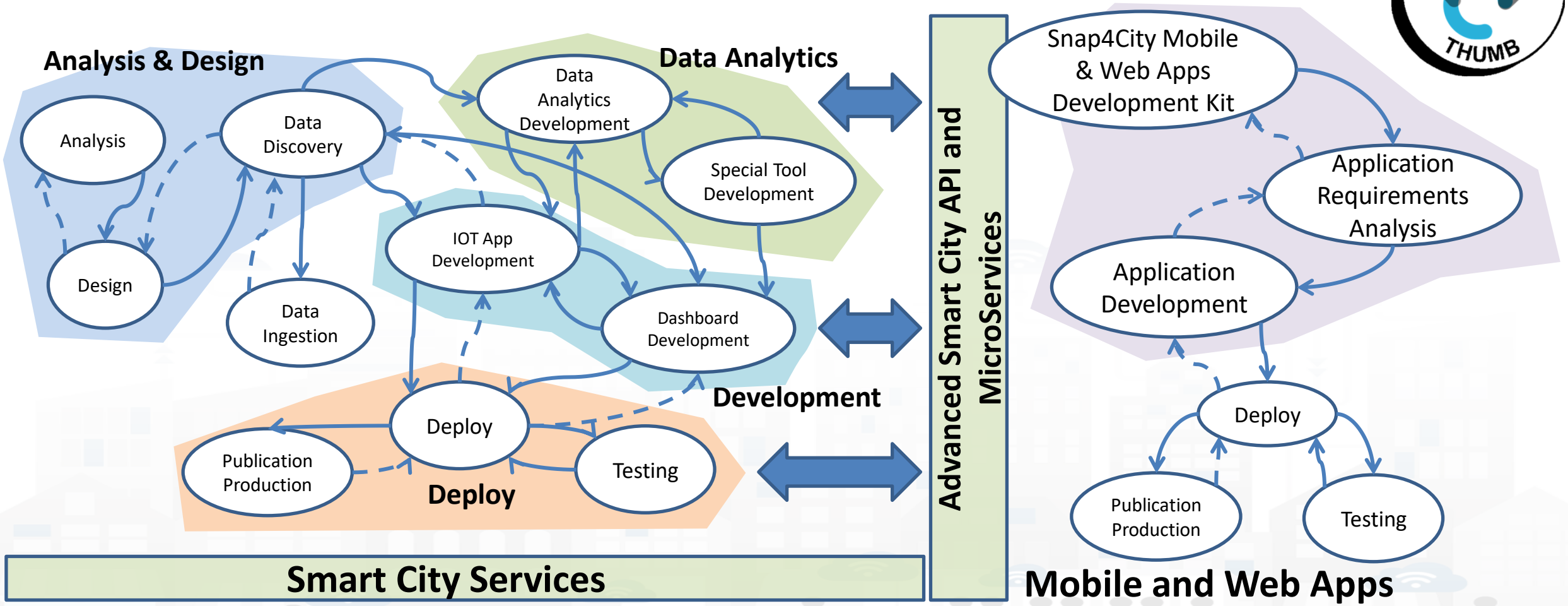
Living Lab Accelerating



Smart City in a Snap Acceleration for Innovation

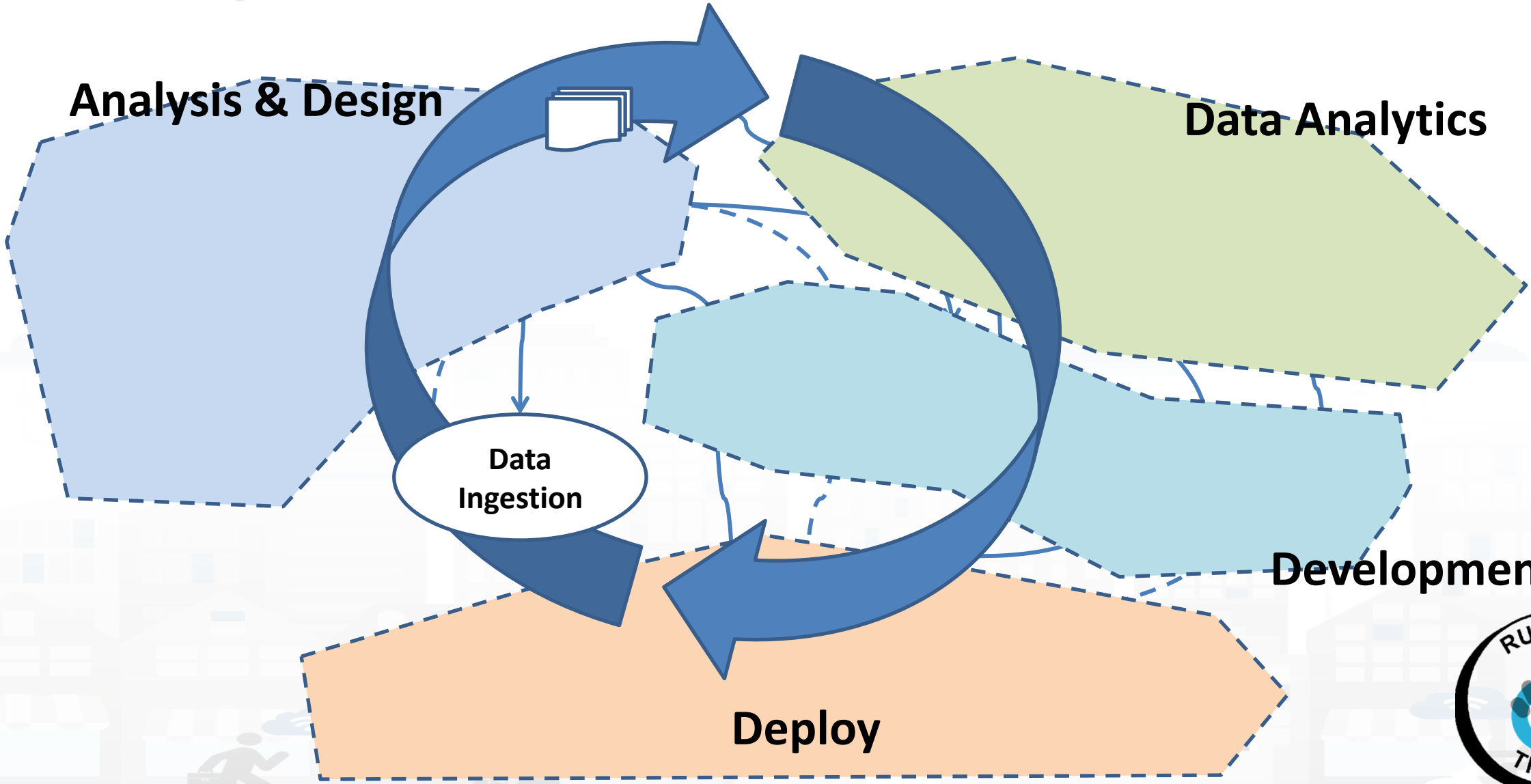
- **Organization/City analysis**
  - requirements analysis, identification of domains
  - Snap4City Innovation Process → Report of Scenarios vs Data
  - Data Analysis → Report as Data Table
- **Smart City Design for Innovation:**
  - Design of main Scenarios and Tools (Dashboard, SCCR, Apps, IOT Network,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

Develop Mobile & Web Applications Exploiting Snap4City Smart City Services

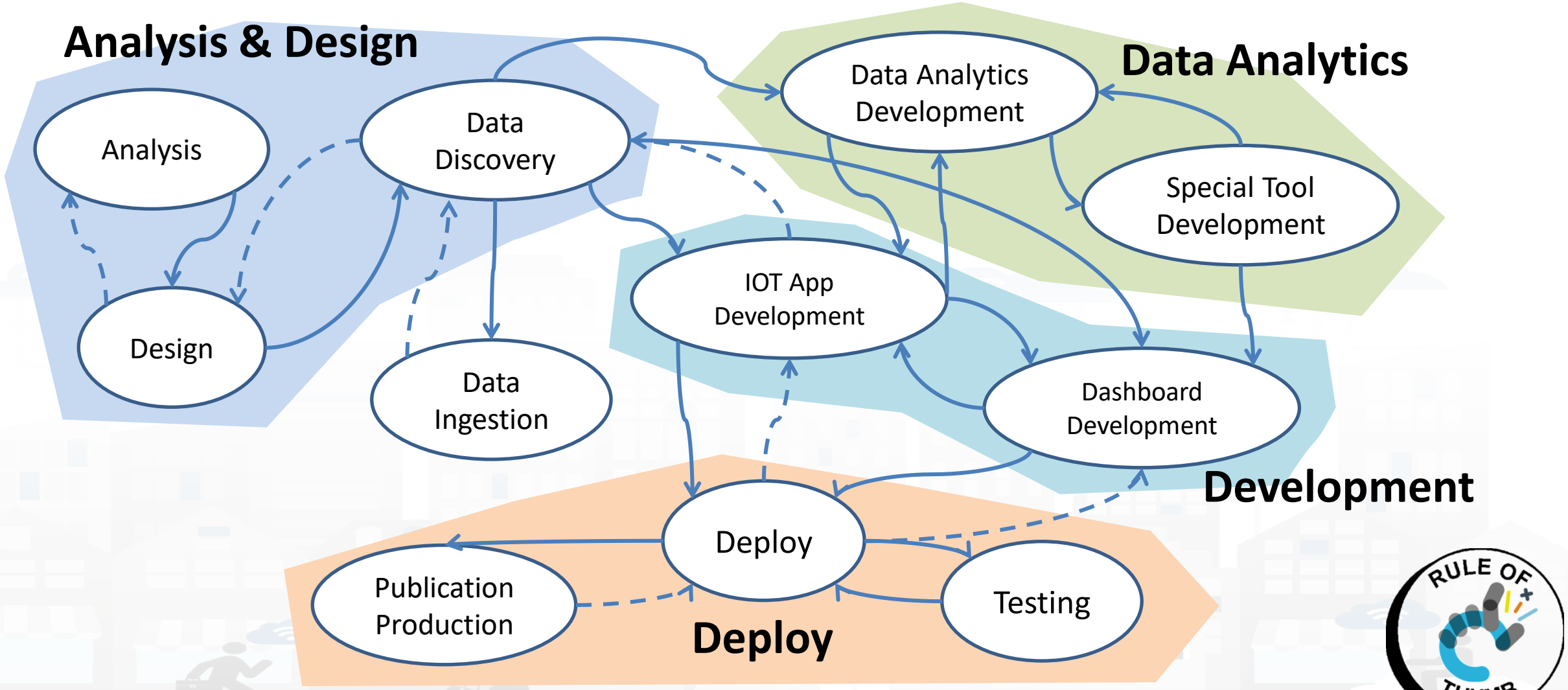


Smart City Development Life Cycle

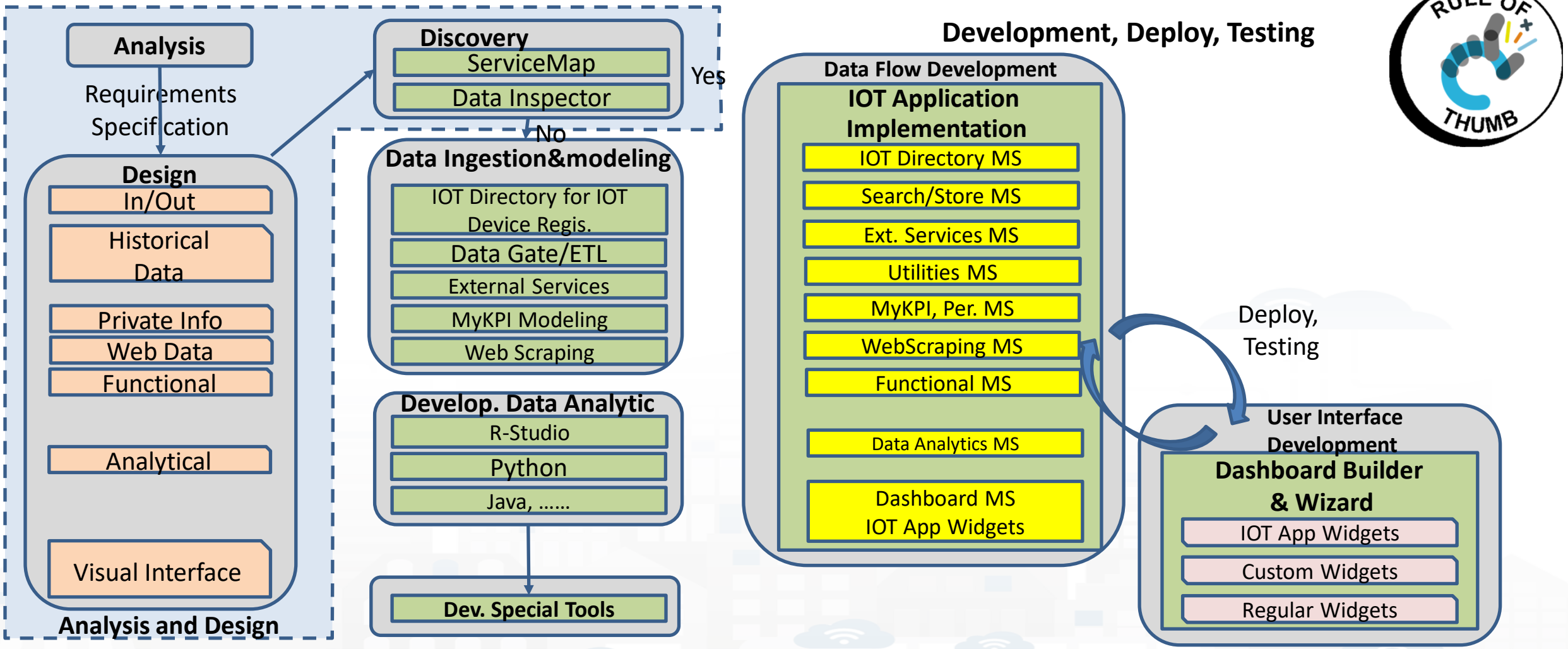
Development Life Cycle Smart City Services



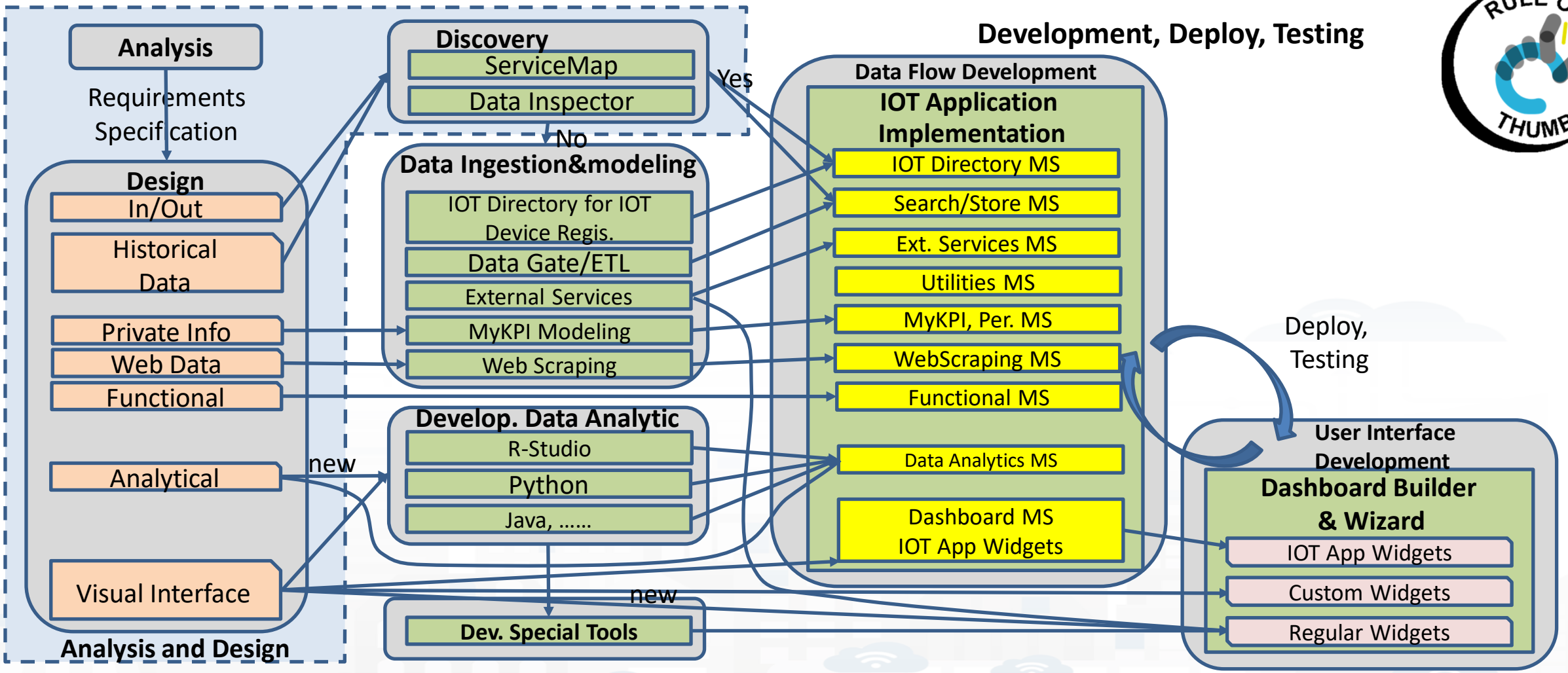
Development Life Cycle Smart City Services



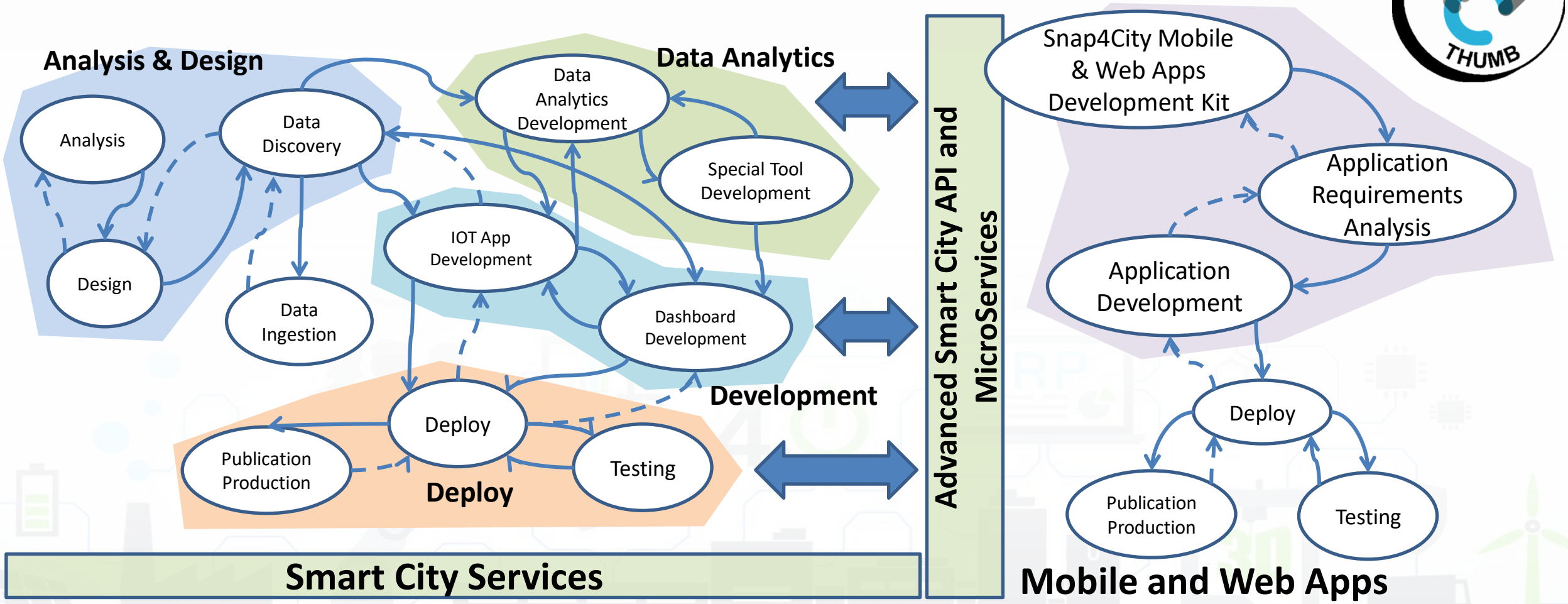
Development Life Cycle Smart City Services



Development Life Cycle Smart City Services

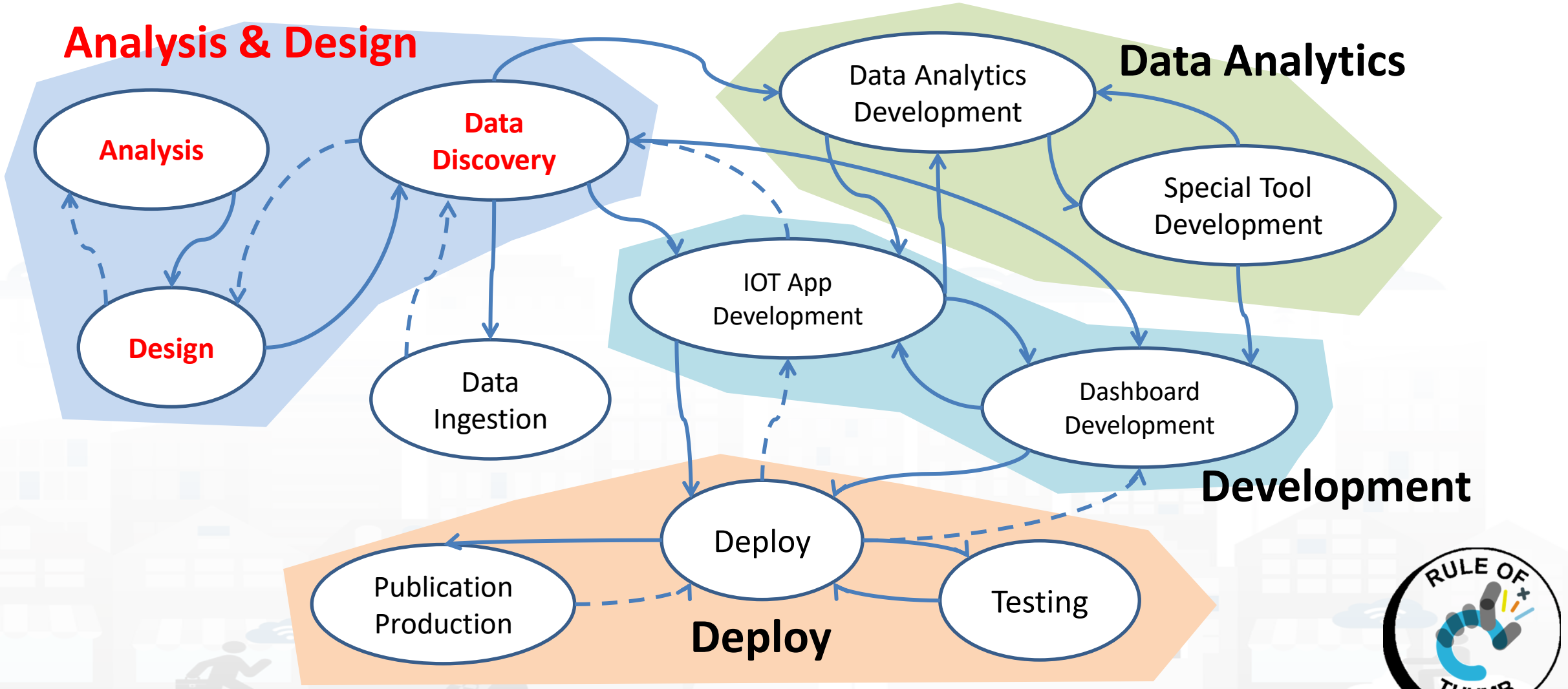


Develop Mobile & Web Applications Exploiting Snap4City Smart City Services



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

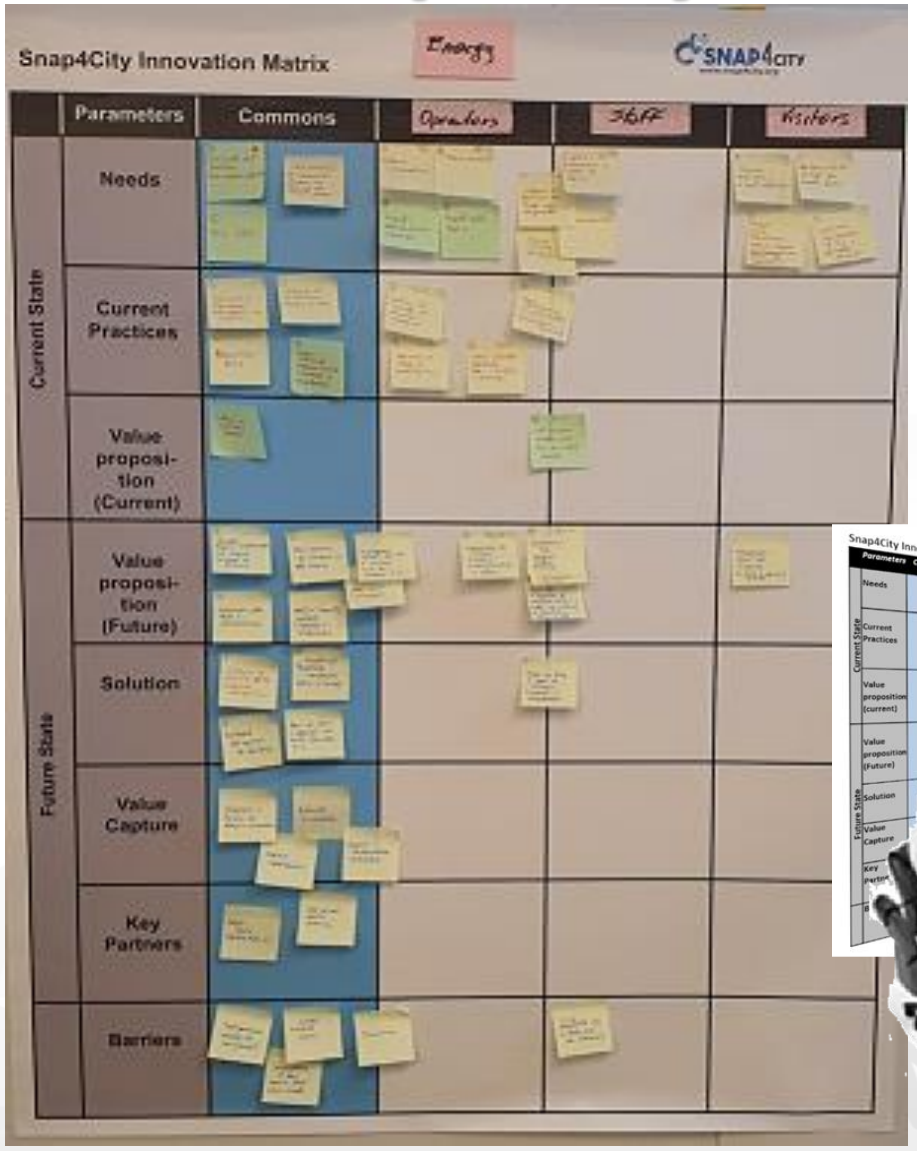
Development Life Cycle Smart City Services

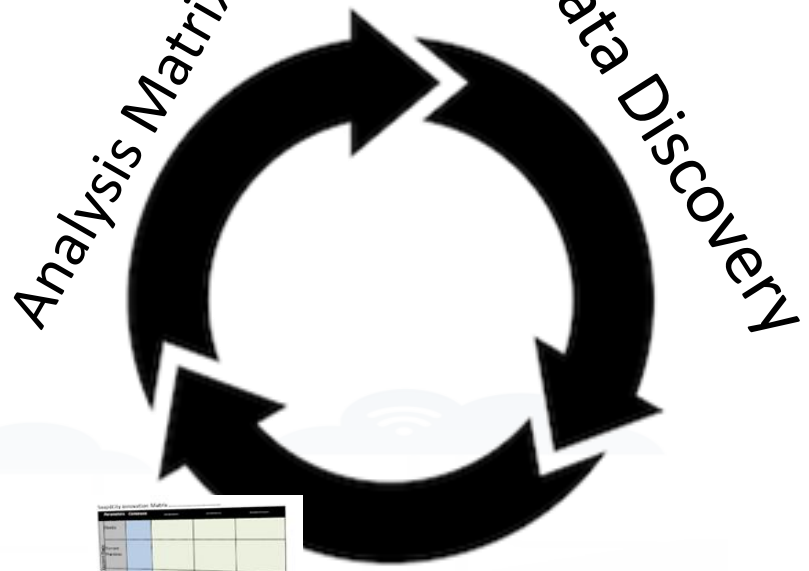


Analysis & Design for Innovation

- **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





Design Scenarios

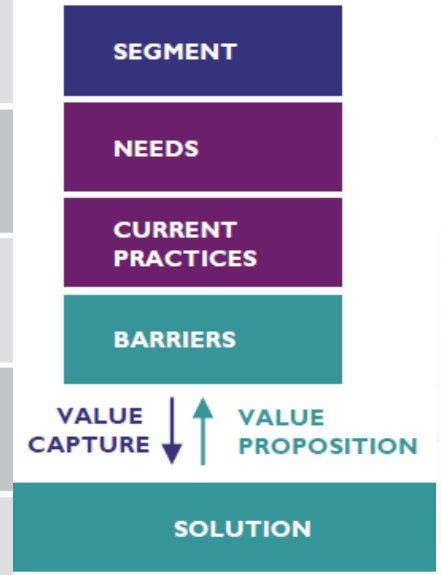
Analysis for Innovation

Snap4City Analysis for Innovation

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

- 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….

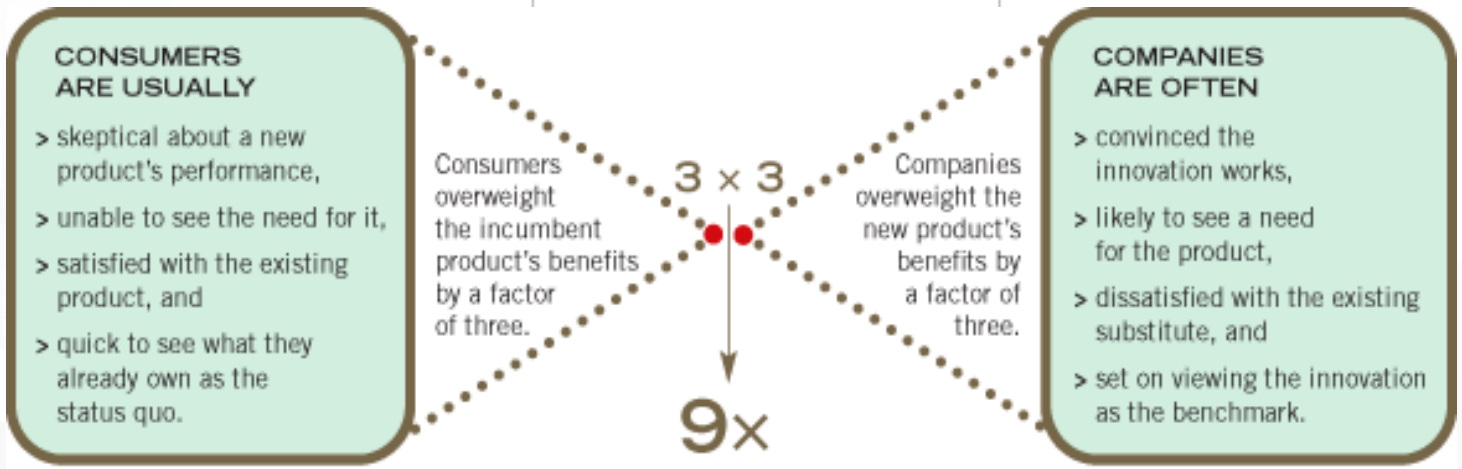
- https://hbr.org/2006/06/eager-sellers-and-stony-buyers-understanding-the-psychology-of-new-product-adoption
- Many innovate and good products failed on conquering the market/ deploy, due to the psychology of behaviour change.
  - To understand why may fail is the first step.
- One aspects is the ***Psychological 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

Reasons to remain vs change

- Attractiveness of the product
  - Is subjective as perceived value
- They compare the new with respect to what they know
  - Any improvement is a Gain, any lack is seen as a Loss
  - Where losses have a larger appearance of gains
- Cost to change product in:
  - Learning, Time and Money
- Rational vs Irrational impulse to change/buy
- *→ Is a Recipes for a disaster*

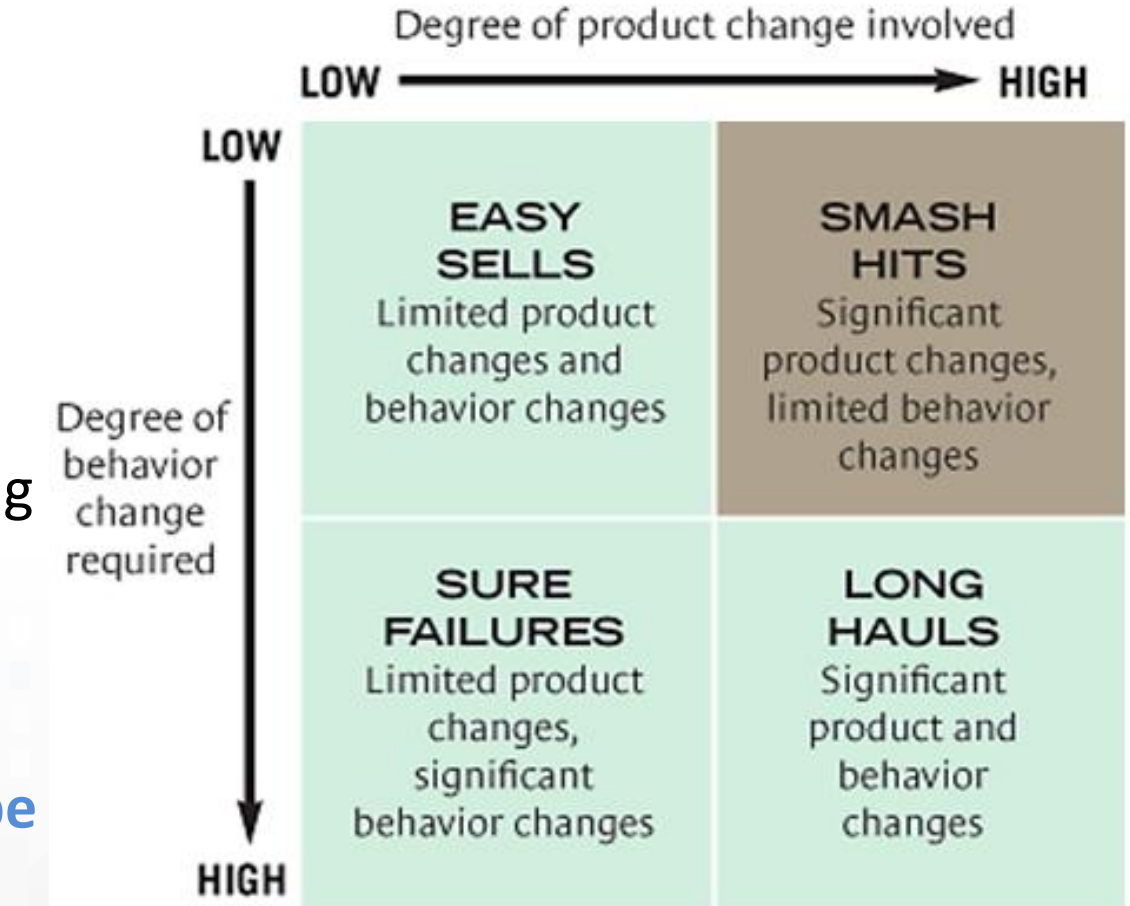
THE TRADE-OFFS INNOVATIONS DEMAND

Innovation	What Consumers Gain by Buying	What Consumers Lose by Buying
Electric cars	Clean environment	Easy refueling
Digital video recorders	Easy recording	Ability to play rented movies
DVD rentals by mail	Broad selection	Spontaneity
E-books	Easy portability	Durability
Online grocery shopping	Home delivery	Ability to select freshest products
Satellite radio	Broad selection	Free music
Screw-top wine caps	Less spoilage	Elegance of the experience
Segway scooter	Mobility	Health benefits of walking
Wind turbines	Nonpolluting energy	Unobstructed views



The 4 Categories

- **Easy Sells/Accept**
  - Acceptance high but new benefits low
- **Sure Failures**
  - Limited benefits and high changes, hard to be accepted
- **Long hauls, a marathon**
  - May be great new value, but associated with big changes. Consumer resistance is high. It may take time to go (e.g., Linux, mobile phones).
- **Smash hits**
  - **Are those that have the major probability to be accepted in short or long term.**
  - High benefits and innovations, with limited changes in behaviour



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

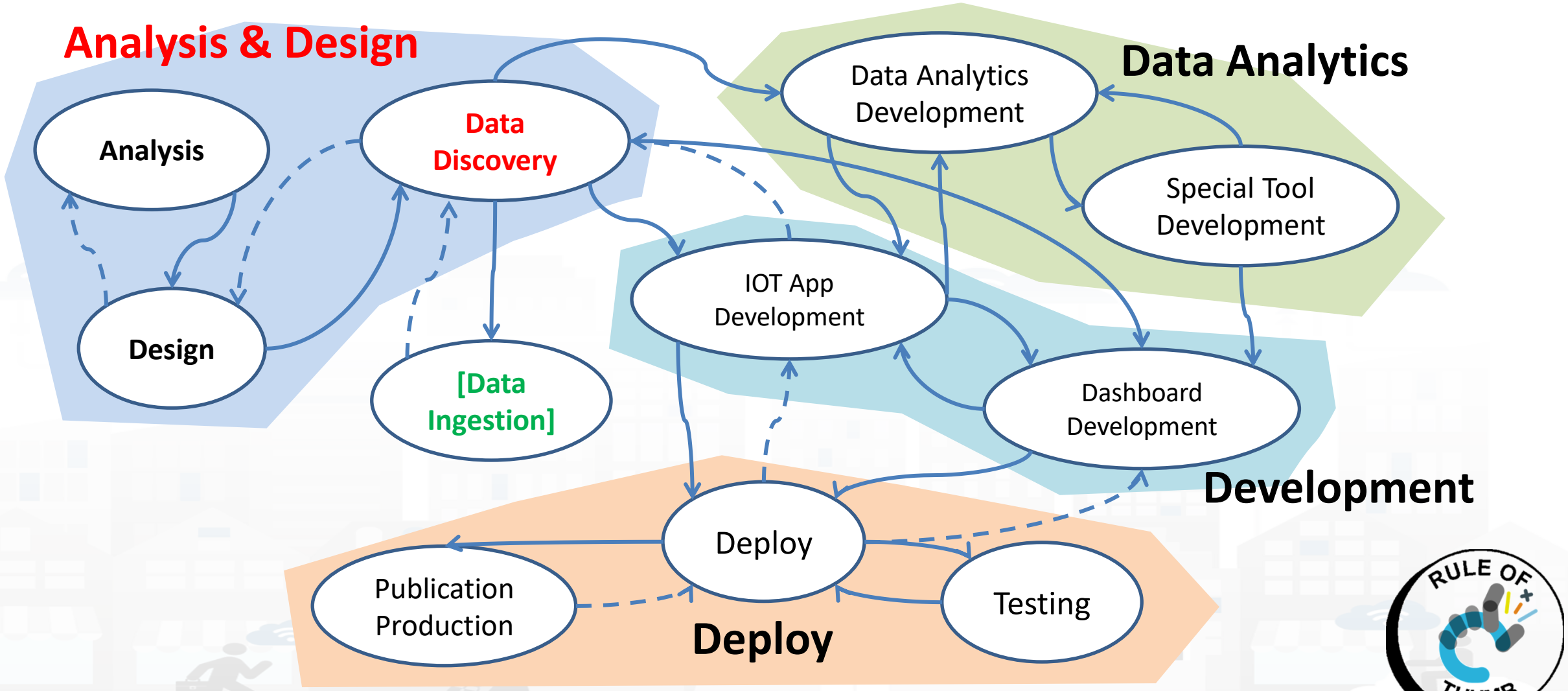
Security & Resilience

For each table:

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

Data Discovery and Analysis

Development Life Cycle Smart City Services

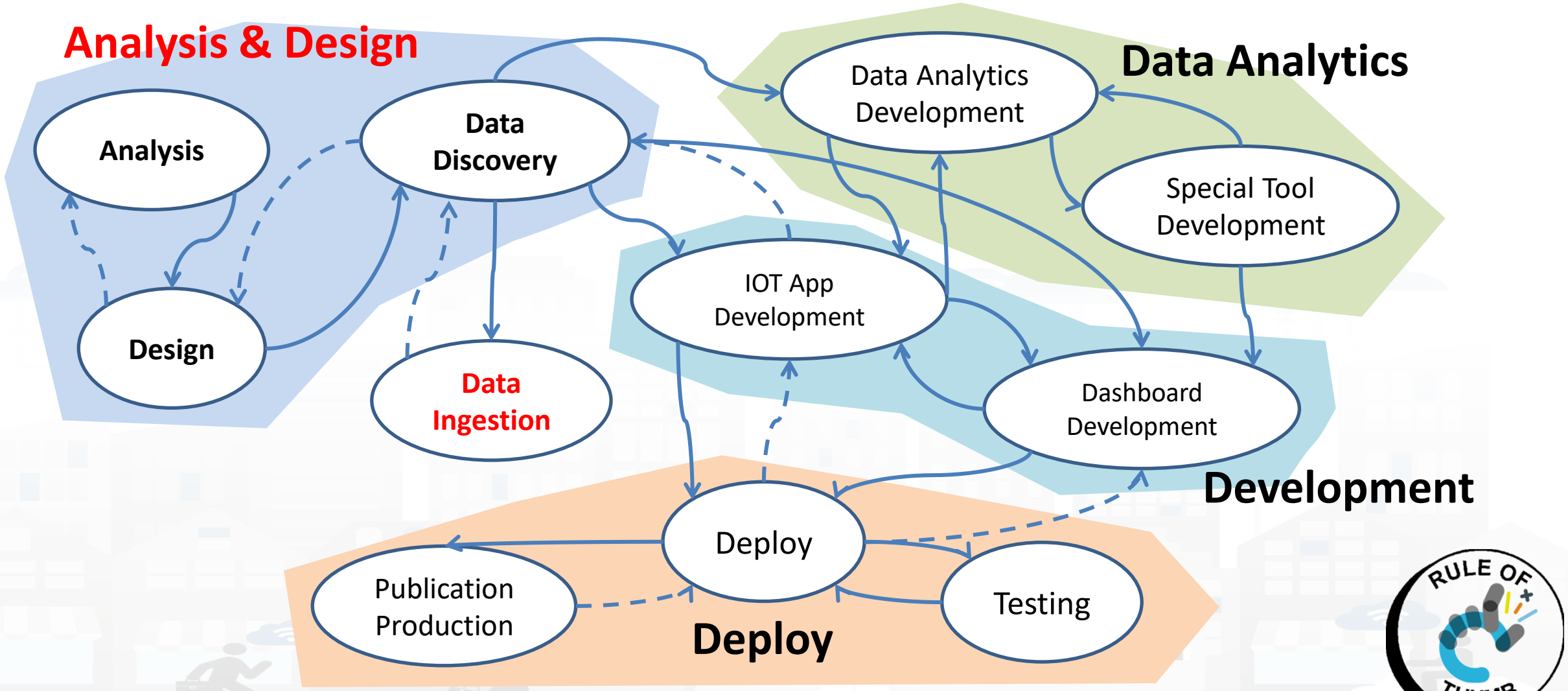


Data Discovery

- Performed by analyzing data from:
  I. identified scenarios from the **Snap4City Innovation Matrix**
  II. main organizations (via interviews)
  III. other stakeholders (via interview and web pages)
  IV. regional, national and international sources:
    I. open data portals, weather sources,
    II. IOT networks, etc. via web pages and sites
  V. Mobile Applications (via Snap4City API)
  VI. Snap4City portal Https://www.snap4city.org
  VII. etc.

- Exploiting Snap4City experience, data and tools
- By following the Snap4City guidelines on Data Search on web and world reported in the training course and on Snap4City.org portal.

Development Life Cycle Smart City Services



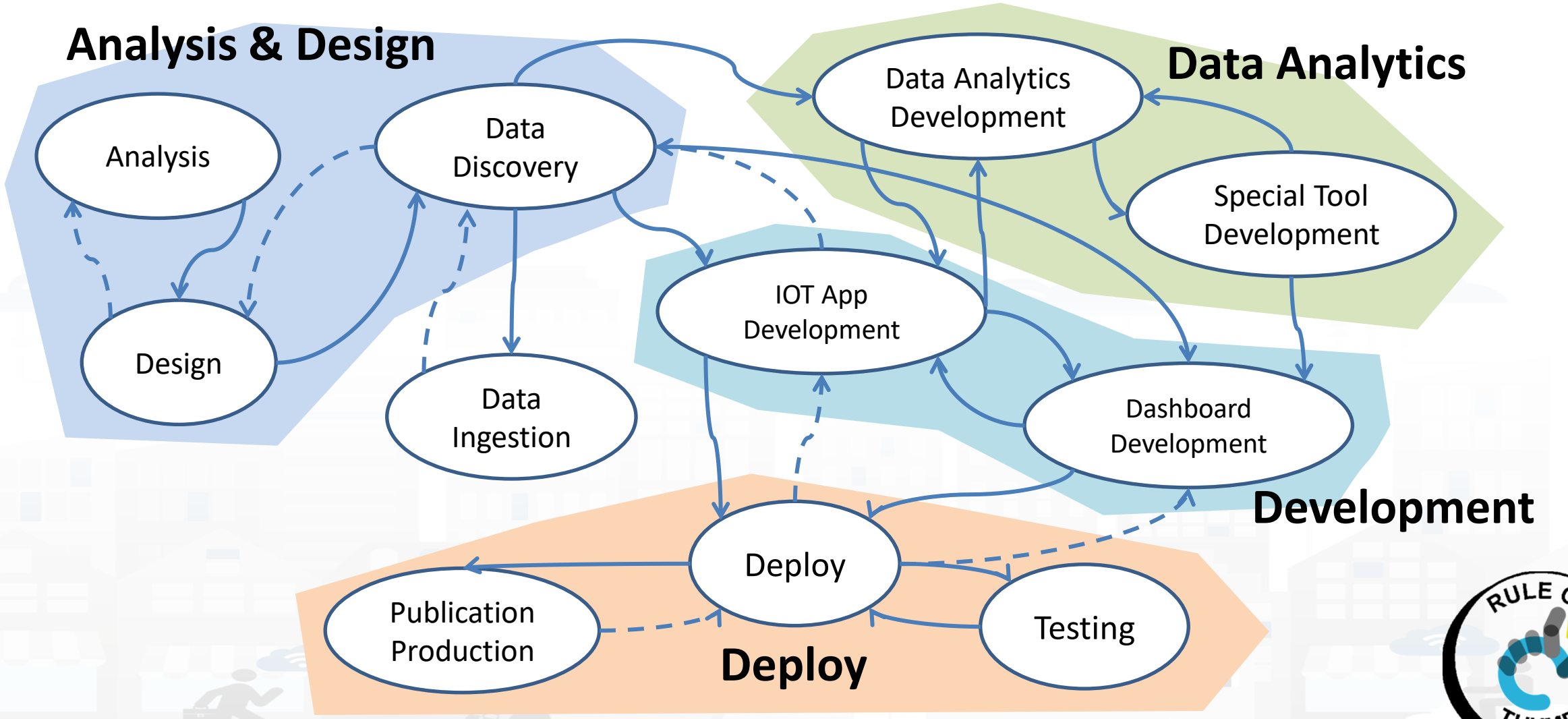
Data Ingestion

- For Data Warehouse mechanisms (IOT App, IOT Brokers, ETL, DataGate, etc.) and related tools please see slides of the 5th PART of the Snap4City course.

TOP

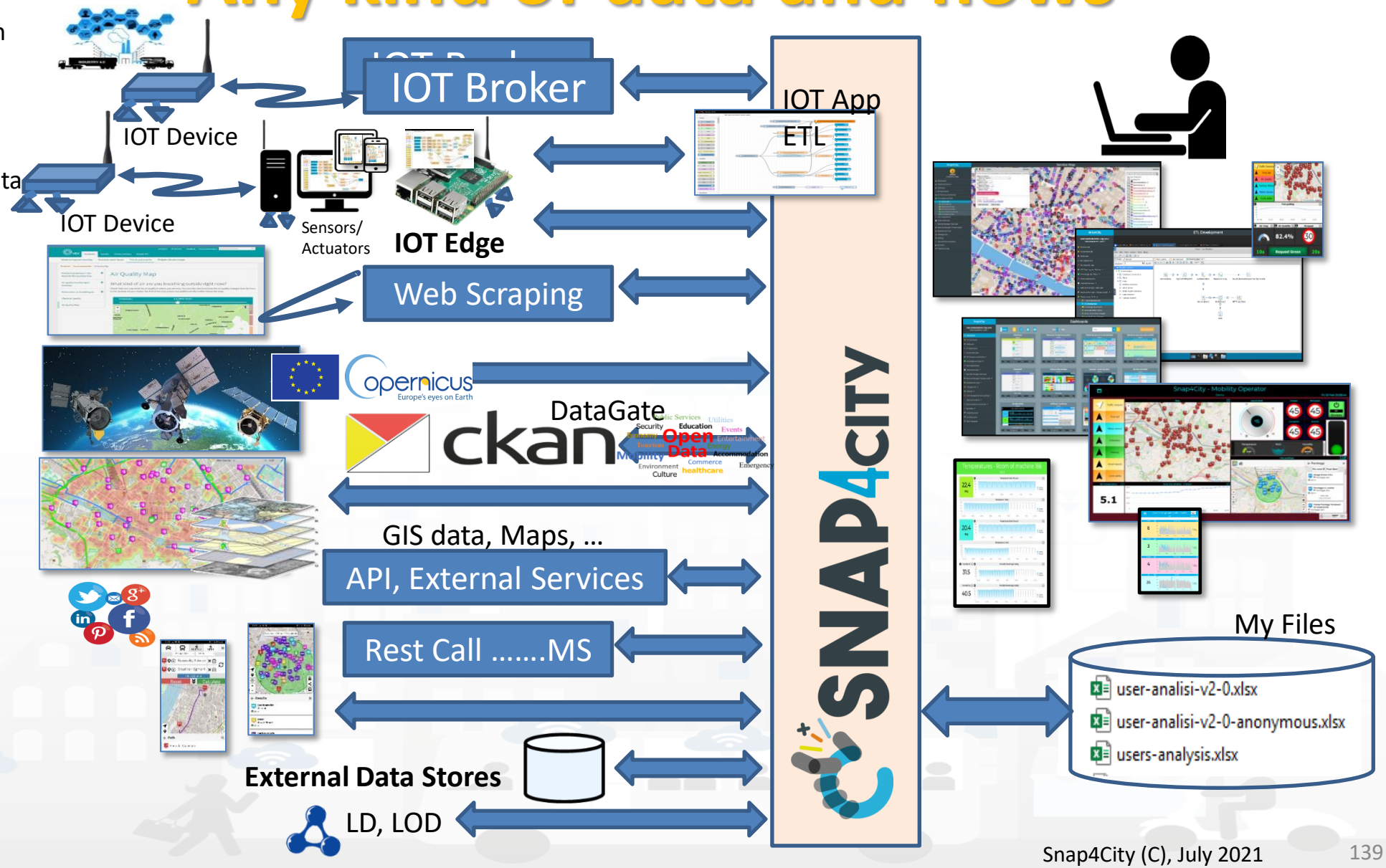
Snap4City Overview of Development Tools

Development Life Cycle Smart City Services



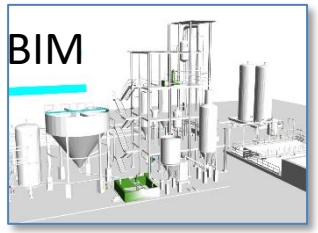
Any kind of data and flows

- **Open Data:**
  - Data gate, federation of Open Data Portals
  - IOT App, ETL proc(PULL)
- **IOT Networks:**
  - IOT Application processes, data driven or PULL
  - IOT Brokers (Push) → IOT Shadow
- **Web Pages:**
  - Web scraping, crawling processes
- **Satellite data**
- **Social media: Twitter, Facebook,..**
  - Twitter Vigilance, IOT App
- **Mobile Apps**
  - Smart City API
- **Files upload: CSV, Excel, etc.**
  - IOT Applications, ETL
- **REST API, WS, FTP, LD, LOD, etc.**
  - IOT Applications, ETL
- **Data base accesses**
  - GIS: WFS, WMS
  - ETL, IOT Application



Concept

BIM

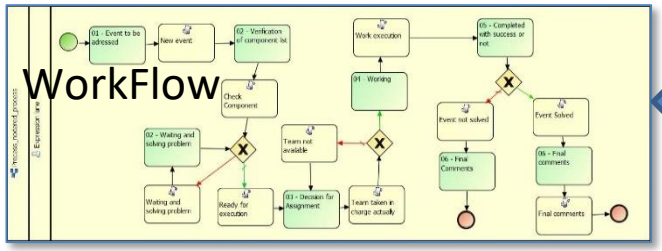


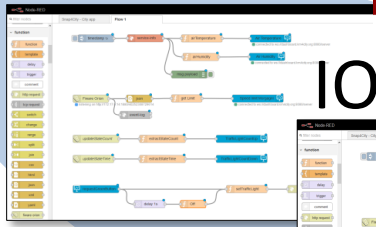
KPI, POI, MyKPI, …

API, External Services

Web Scraping

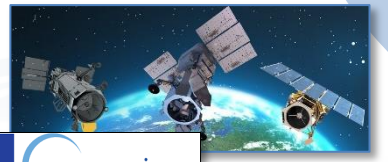
WorkFlow



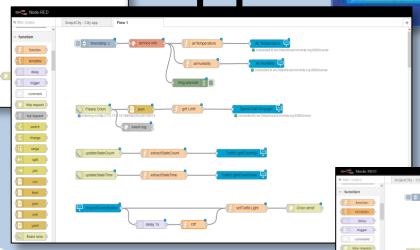


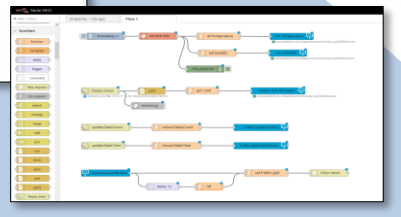
Node-RED

IOT Apps



Data Analytics,
Artificial Intelligence





IOT Brokers

IOT Broker

IOT Broker

FIWARE

GIS

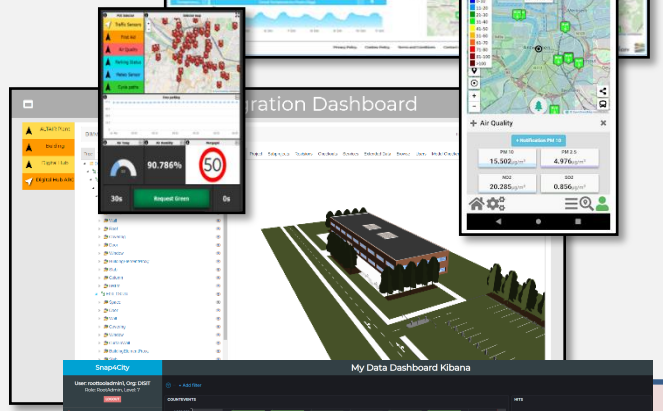
Big Data

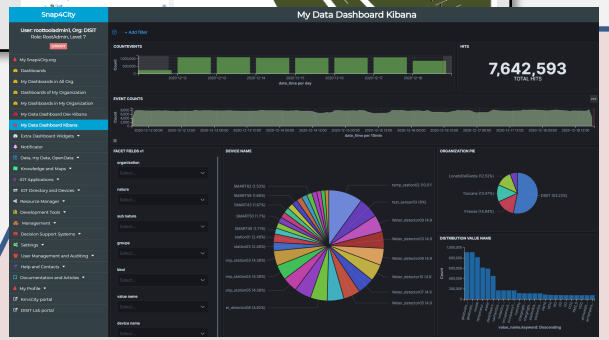
KB

LD, LOD

ckan

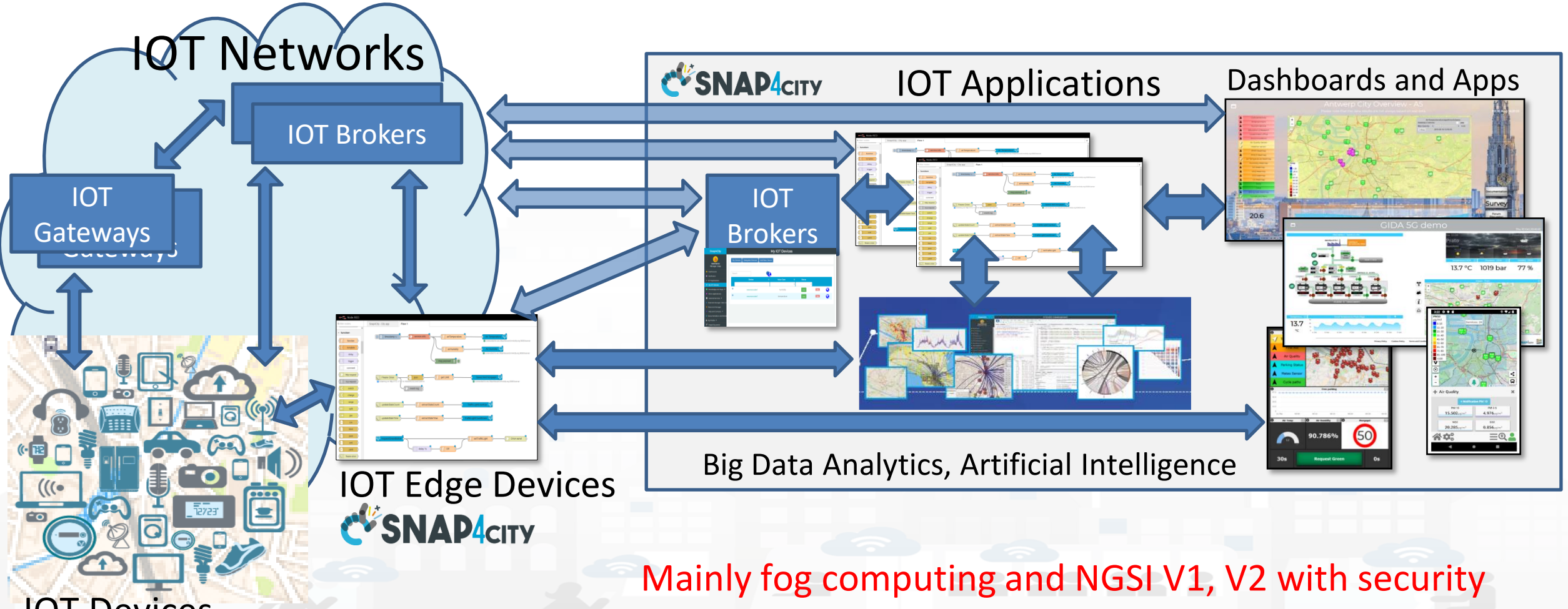
FI-WARE





Dashboards and Apps

Snap4City Services also on IOT Edge!!!



Mainly fog computing and NGSI V1, V2 with security

IOT Network Manager vs Final User

Network of IOT Brokers

IOT Broker

External

Internal

IOT Directory

IOT Network Manager

My IOT Device

Register

Registering

Discovering

Knowledge Base, Km4City

Knowledge and Storage Data from the Field and City

Browsing

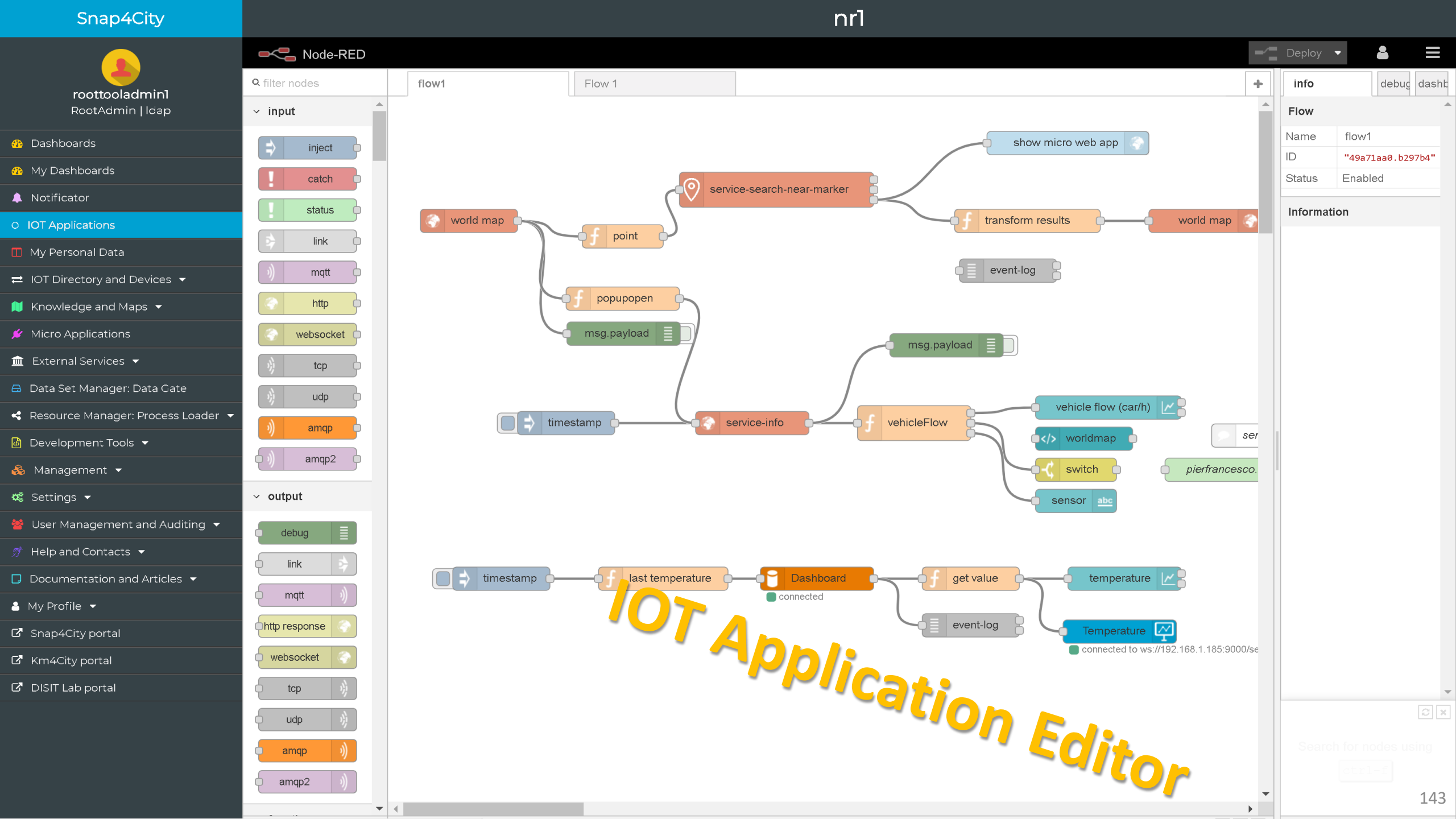
ServiceMap Knowledge Base

Discovering

IOT Application

Final user Manager

Dashboard Wizard


Snap4City
nr1
roottooladmin1
RootAdmin | ldap
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
Development Tools
Management
Settings
User Management and Auditing
Help and Contacts
Documentation and Articles
My Profile
Snap4City portal
Km4City portal
DISIT Lab portal
Node-RED
Deploy
filter nodes
input
inject
catch
status
link
mqtt
http
websocket
tcp
udp
amqp
amqp2
output
debug
link
mqtt
http response
websocket
tcp
udp
amqp
amqp2
flow1
Flow 1
world map
point
service-search-near-marker
show micro web app
transform results
world map
event-log
popupopen
msg.payload
msg.payload
timestamp
service-info
vehicleFlow
vehicle flow (car/h)
worldmap
switch
sensor
timestamp
last temperature
Dashboard
connected
get value
temperature
event-log
Temperature
connected to ws://192.168.1.185:9000/se
IOT Application Editor
info
debug
dashb
Flow
Name
flow1
ID
"49a71aa0.b297b4"
Status
Enabled
Information
Search for nodes using
143

IOT Applications

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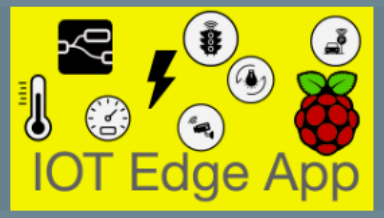

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Management

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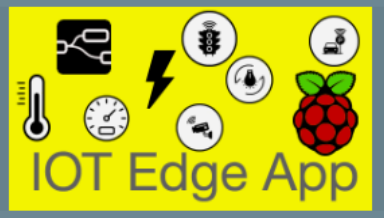

owner: panesi
Management

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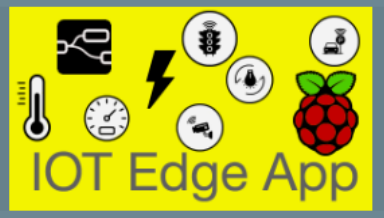

owner: pb3
Management

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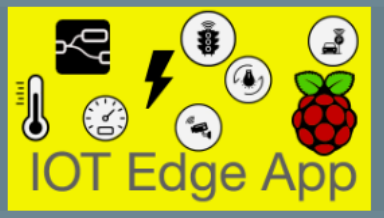

owner: pb3
Management

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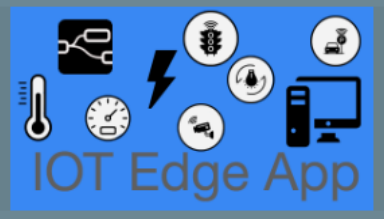


owner: semolarudy
Management

application

owner: tester5
Management

Bib APP

owner: semolarudy
Management

ChargingStations

owner: comunedashres
Management

Deprecated - SiiMobilityControlRoom

owner: badii
Management

SamsungGalaxyS4BarCode

owner: badii
Management

esercitazione

owner: tester2
Management

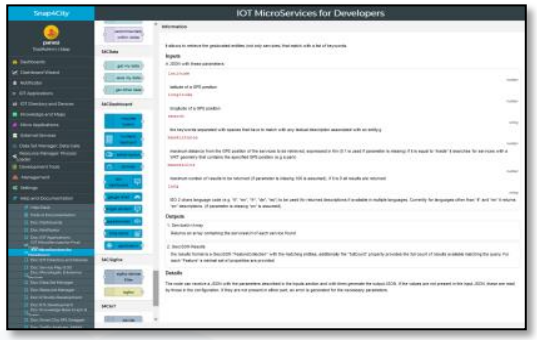
Iot-App

owner: tester14
Management

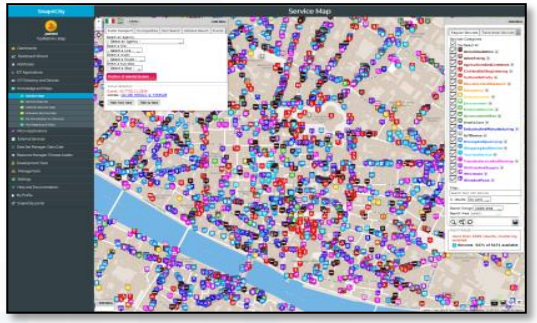
Developing IOT Applications

IOT Discovering

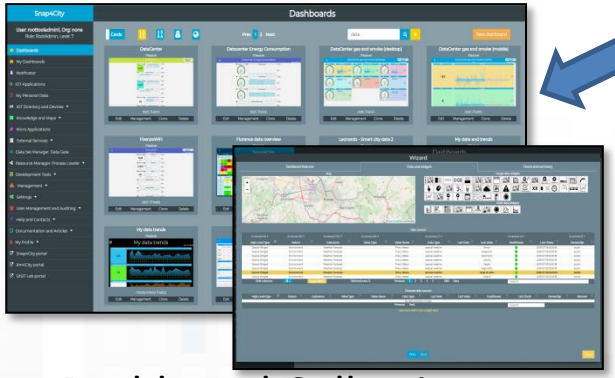
MicroServices collections



My IOT Applications



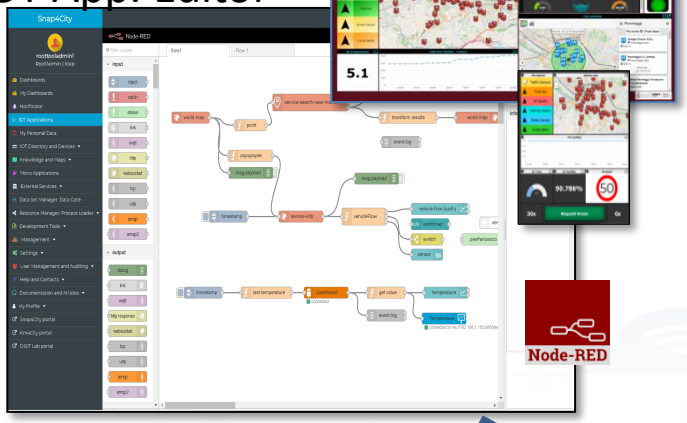
ServiceMap Discovery



Dashboard Collection, Editor and Wizard

Knowledge Base, Km4City

IOT App. Editor



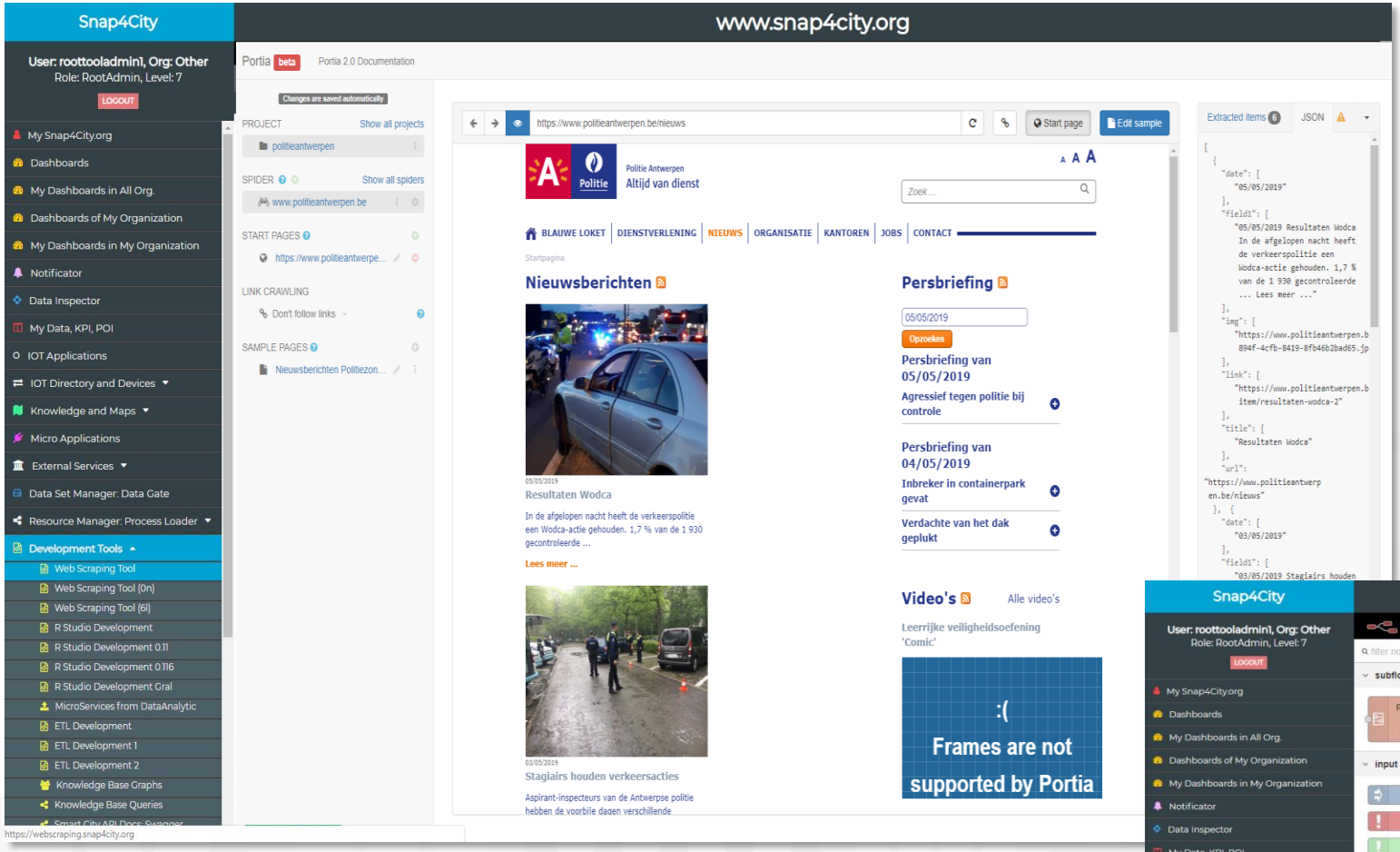
Generating IOT App With Dashboard

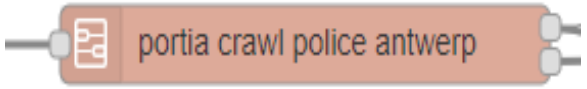
Sharing/saving reusing IOT App

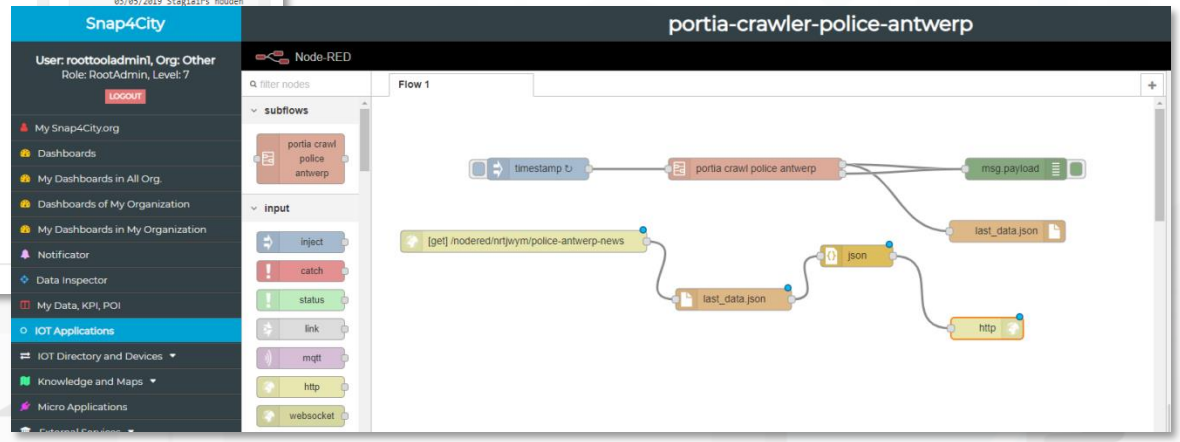
Resource Manager

GitHub

Web Scraping

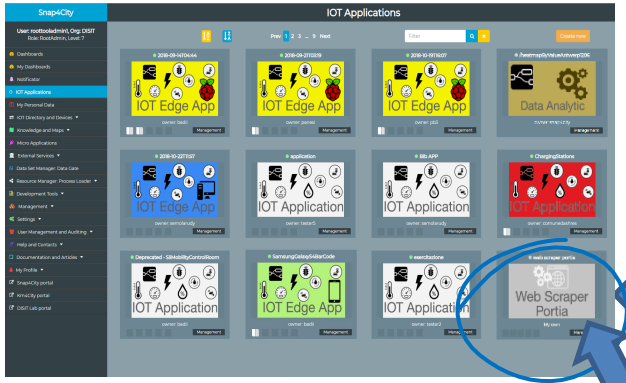




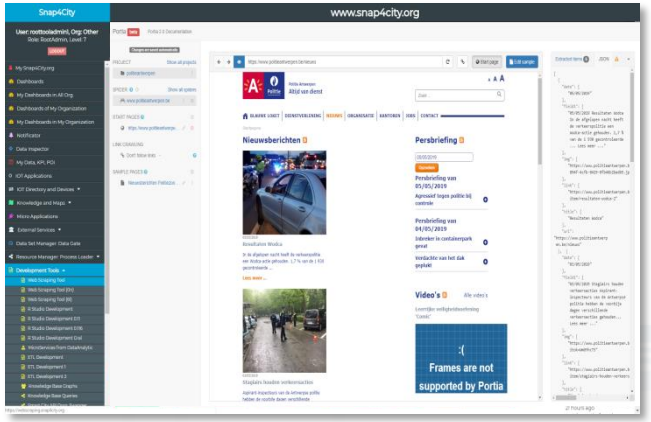


Web Scraping

My Scraping processes

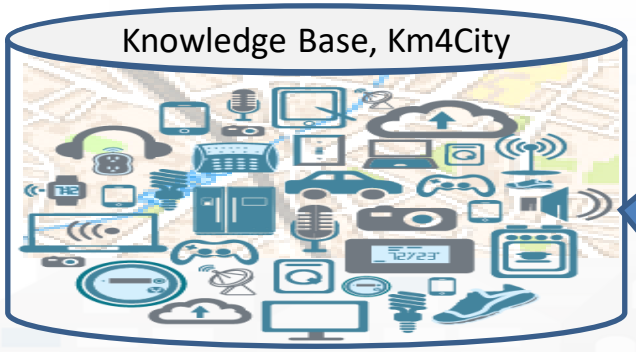


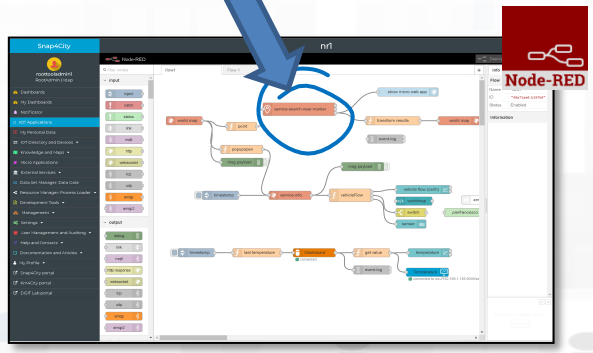
Web Scraper PORTIA



Generating WEB Scraping

Knowledge Base, Km4City





IOT App. Editor

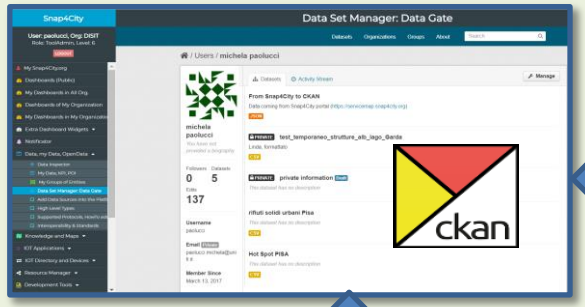
Sharing/saving reusing Scraping

Resource Manager

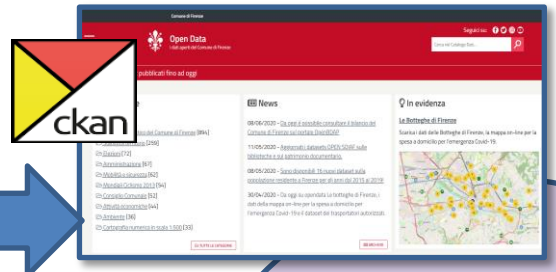
Snap4City vs CKAN

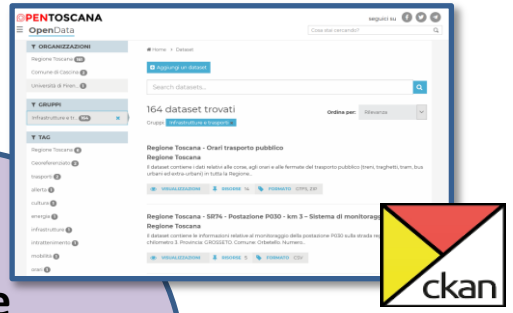
Snap4City Portal and Integrated tools

Datagate



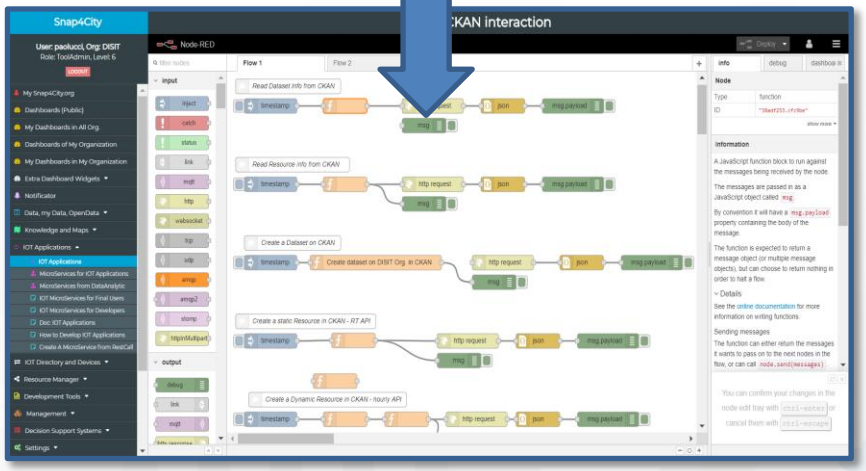
Harvesting and Publishing

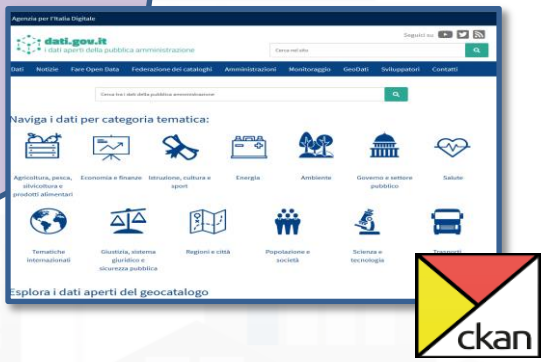




Open or Private External CKAN Data Portals

Advanced Snap4City APIs and Micro Services





Automatize:

- Import data from CKAN to Snap4City
- Upload Public Data from Snap4City to CKAN
- Data Harvesting
- Dashboards and Mobile/Web Apps creation

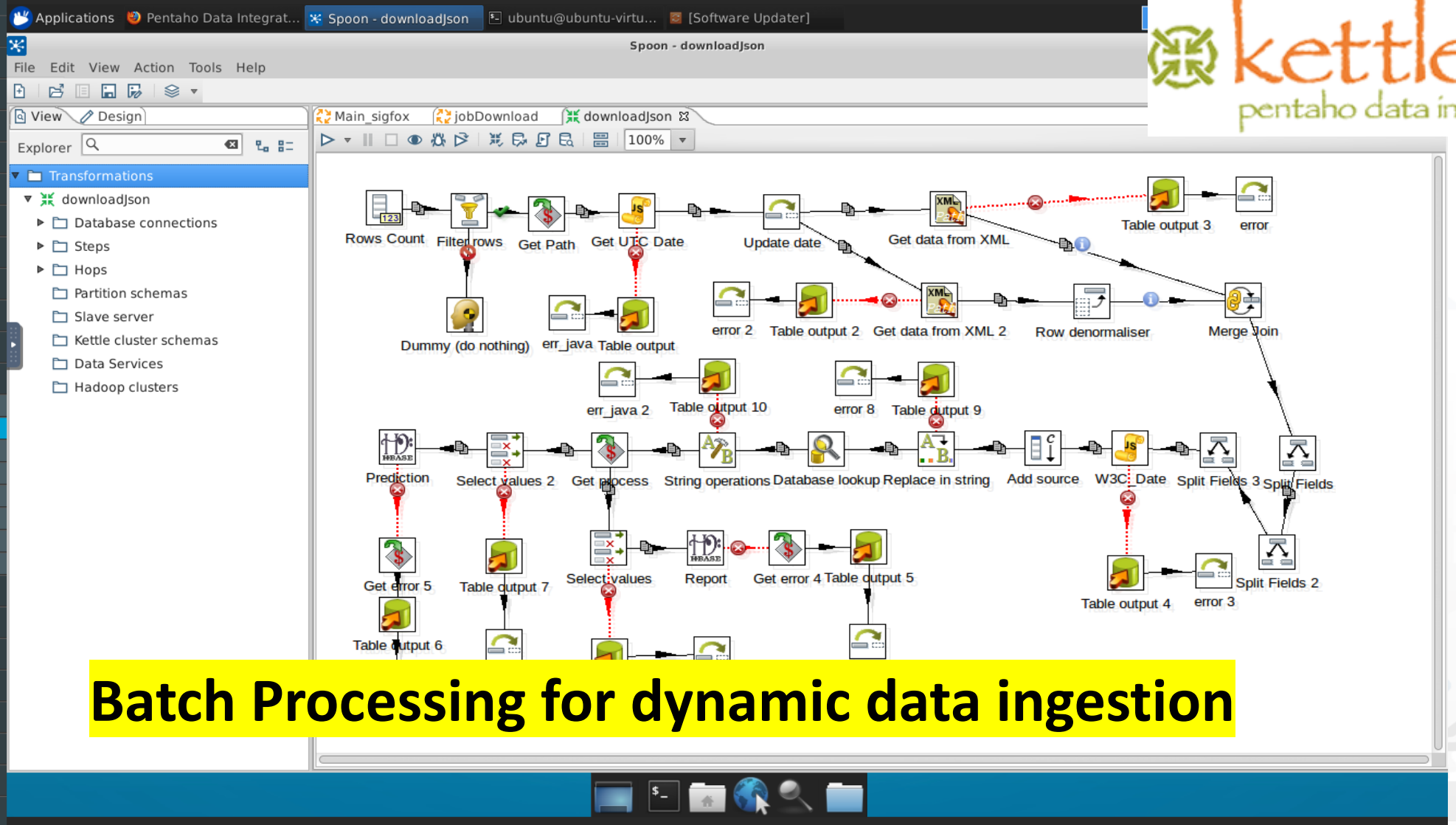
In Yellow alternative & legacy solutions

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
- Development Tools
  - R Studio Development
  - ETL Development
  - Knowledge Base Graphs
  - Knowledge Base Queries
  - Smart City API Docs: Swagger
  - Internal API Docs: Swagger
  - Testing API by Postman
  - Source Code Access
- Management
- Settings
- User Management and Auditing
- Help and Contacts
- Documentation and Articles
- My Profile
- Snap4City portal
- Km4City portal

ETL Development



kettle™ pentaho data integration

Batch Processing for dynamic data ingestion

Developing ETL, Data Manager

In Yellow alternative & legacy solutions

kettle™ pentaho data integration

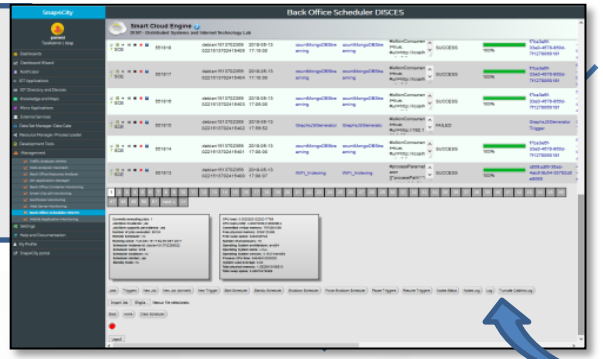
Distributed Back Office

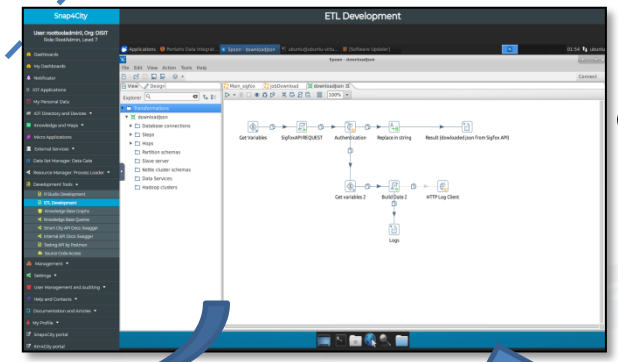
DISCES scheduler production

ETL Development Environment

Data sources

ETL Process

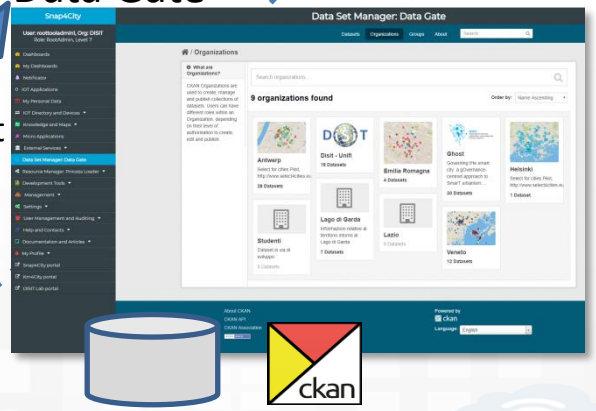




Knowledge Base, Km4City

Knowledge and Storage Data from the Field and City

Data Gate



Data Set Saving / Sharing

Data Set Loading/ Downloading

Saving / Sharing reusing

Resource Manager

Schedule Execute

Load data or prepare for data ingestion

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

Resource_type:
- 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

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

DeveloperDash-V3-1523555417880
Dev Dashboard
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
IOT Application
developer1: Private
Username: developer1
Resource type: IoTApp
Nature: data category (ie: geolocat...
Description: NodeRed Flow Shared ...
View Edit Publish Owner

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

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

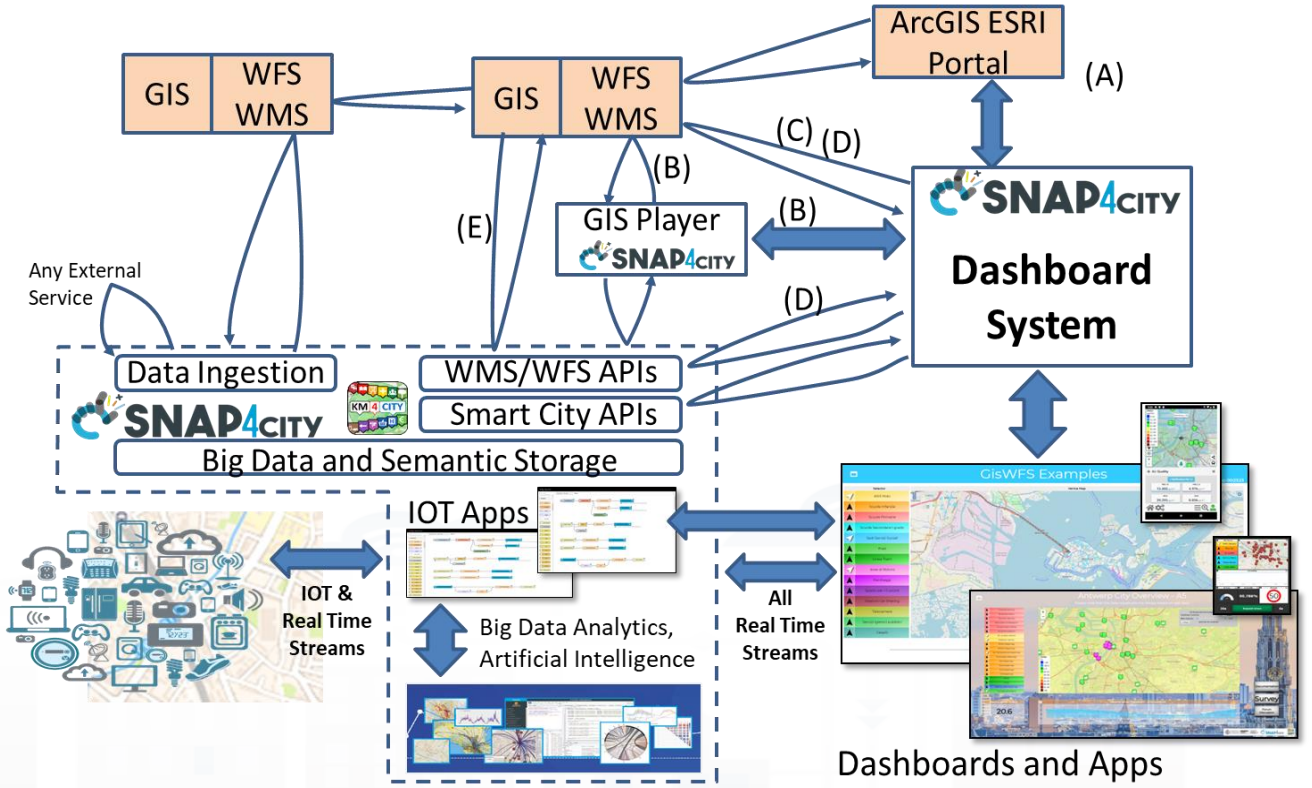
ResDash Docker-1526308998809
Res Dashboard
developer1: Private
Username: developer1
Resource type: ResDash
Nature: ToBeDefined
Description: Resource Dashboard: ...
View Edit Publish Owner

Data Gathering and Knowledge Management

- Data ingestion can be performed by using multiple tools:
  - ETL processes, IOT Applications, Data Gate, WebScraping. We suggest:
    - ETL for static / periodic data in PULL
    - IOT App for real time data and flow, from IOT Brokers/Devices
    - DataGate for Static Data, upload them as files, or collected from other CKAN
    - WebScraper for scraping data from Web Pages, when authorized!
- See how to test cases:
  - **HOW TO: add data sources to the Snap4City Platform**
  - **HOW TO: define privacy rules for personal data, produced by the end-users own device**
  - **US6. Developing and using processes for data transformation**
  - **TC6.1 - Managing DataSets via DataGate: ingest, search, download, upload, annotate, share**
  - **TC6.3 - Creating ETL processes for automated data ingestion and data transformation**
  - **TC6.5 - Managing Heterogeneous File Ingestion via ETL processes**
  - **TC6.9 - ETL processes for multiprotocol and format data ingestion, see on GITHUB for library**
  - **TC9.2 - Managing heterogeneous File Ingestion, protocols, formats via IOT applications, and open standards**

Interoperability ESRI

- **Snap4City is interoperable with**
  - ESRI ArcGIS Enterprise, Portal, Pro/MAP, ...
  - other GIS tools supporting WFS, WMS, GeoJSON, GML
- **Snap4City is interoperable since:**
  - **Provides** info/data in WFS, WMS
  - **Exploits** data/info from WFS, WMS
  - **Import** data/info from WFS/WMS

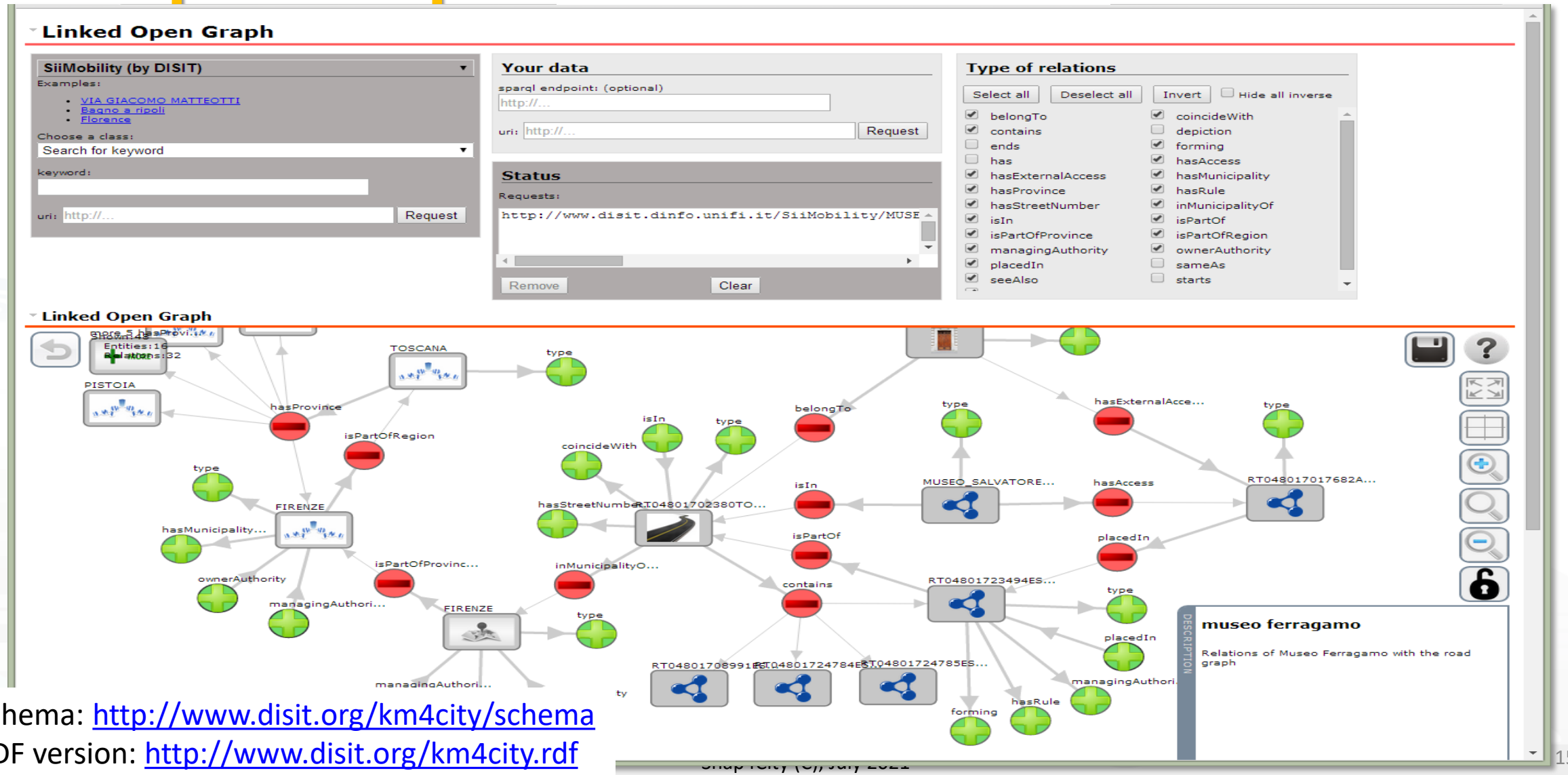


- The Snap4City platform can be installed on premise using **Snap4City Appliance** https://www.snap4city.org/471
  - **StartSNAP4CITYVM** includes the Dashboard Builder that is capable to work with WFS WMS protocols for the integration with GIS platforms as ESRI ArcGIS, QGIS, directly or using **Snap4City GIS player**.
  - **KBSSMVM** includes the Smart City API and WFS API which can be used to data harvest from any GIS servers and GIS desktop tool

Linked Open Data

Linked Open Graph

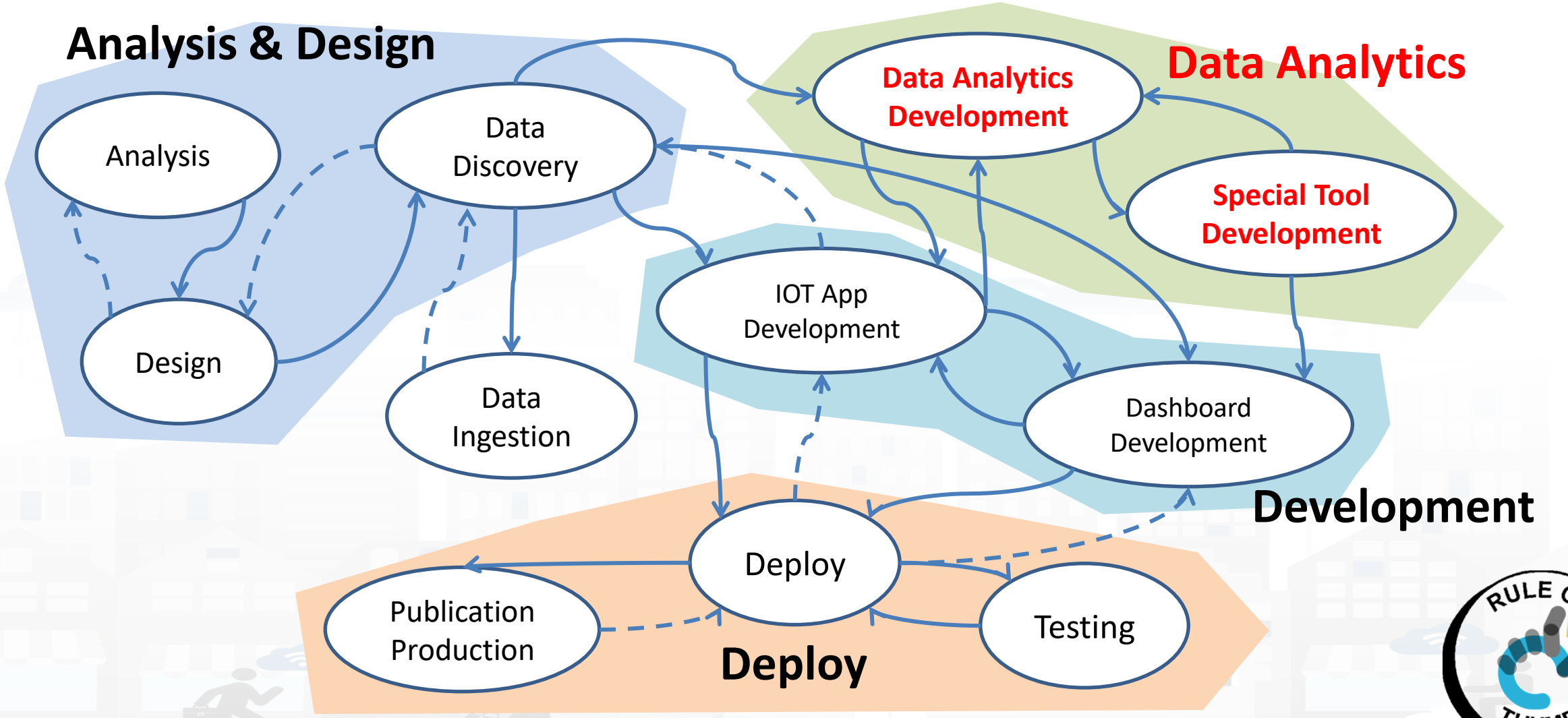
LOG: https://log.disit.org



Schema: http://www.disit.org/km4city/schema

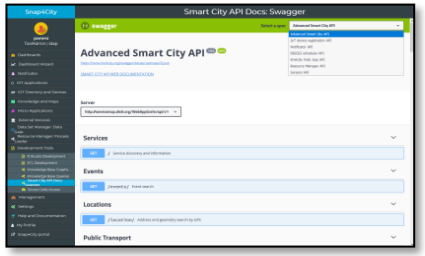
RDF version: http://www.disit.org/km4city.rdf

Development Life Cycle Smart City Services

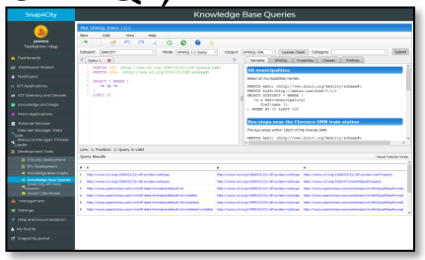


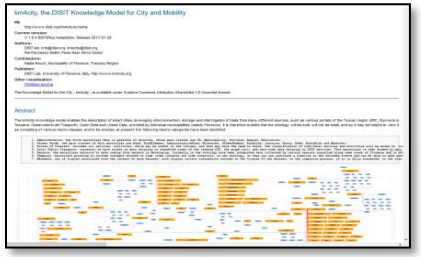
Data Analytics Dev. in R Studio and/or Tensor Flow

Swagger



SPARQL, FLINT





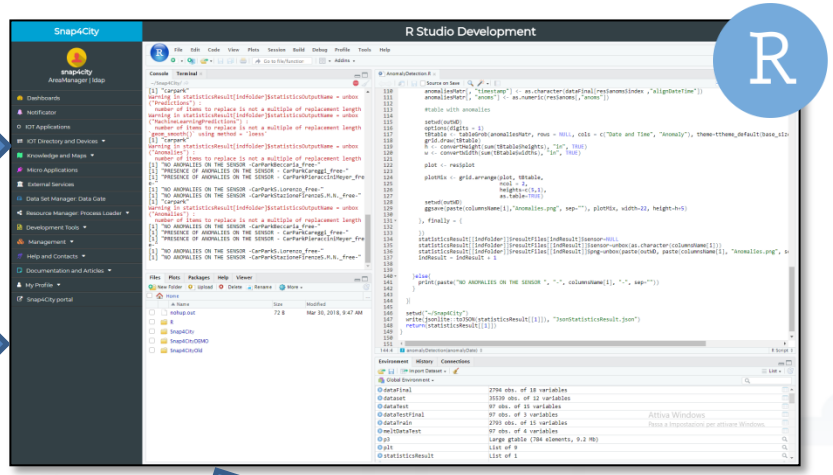
Ontology Schema

LOG.disit.org

Knowledge Base, Km4City

Big Data Store Facility

Smart City API from Knowledge Base and other tools



Creating MicroServices

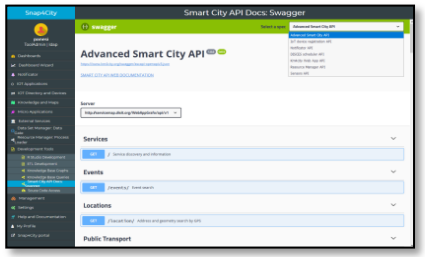
Using them into IOT Applications

Saving / Sharing reusing

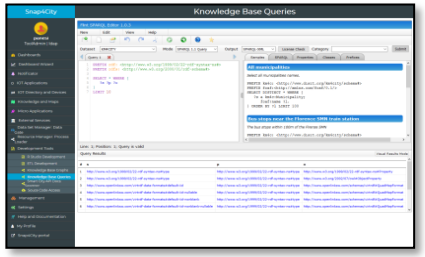
Resource Manager

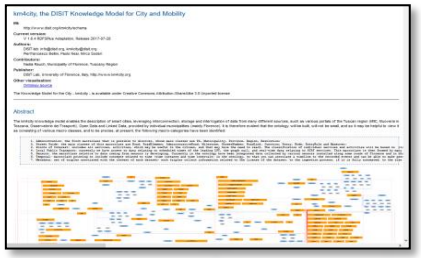
Data Analytics Development in Python,

Swagger



SPARQL, FLINT





Ontology Schema

LOG.disit.org

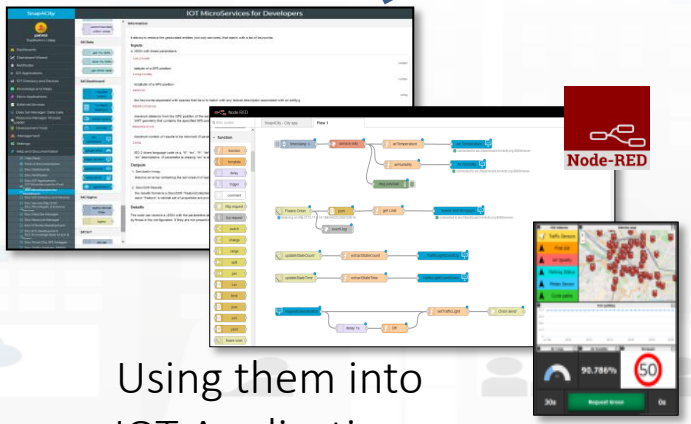
Knowledge Base, Km4City

Big Data Store Facility

Smart City API from Knowledge Base and other tools

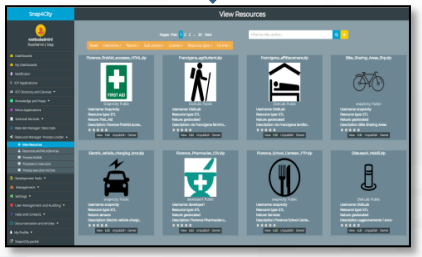
Coding
Testing

Creating
Micro Services



Using them into
IOT Applications

Saving
Sharing
Reusing

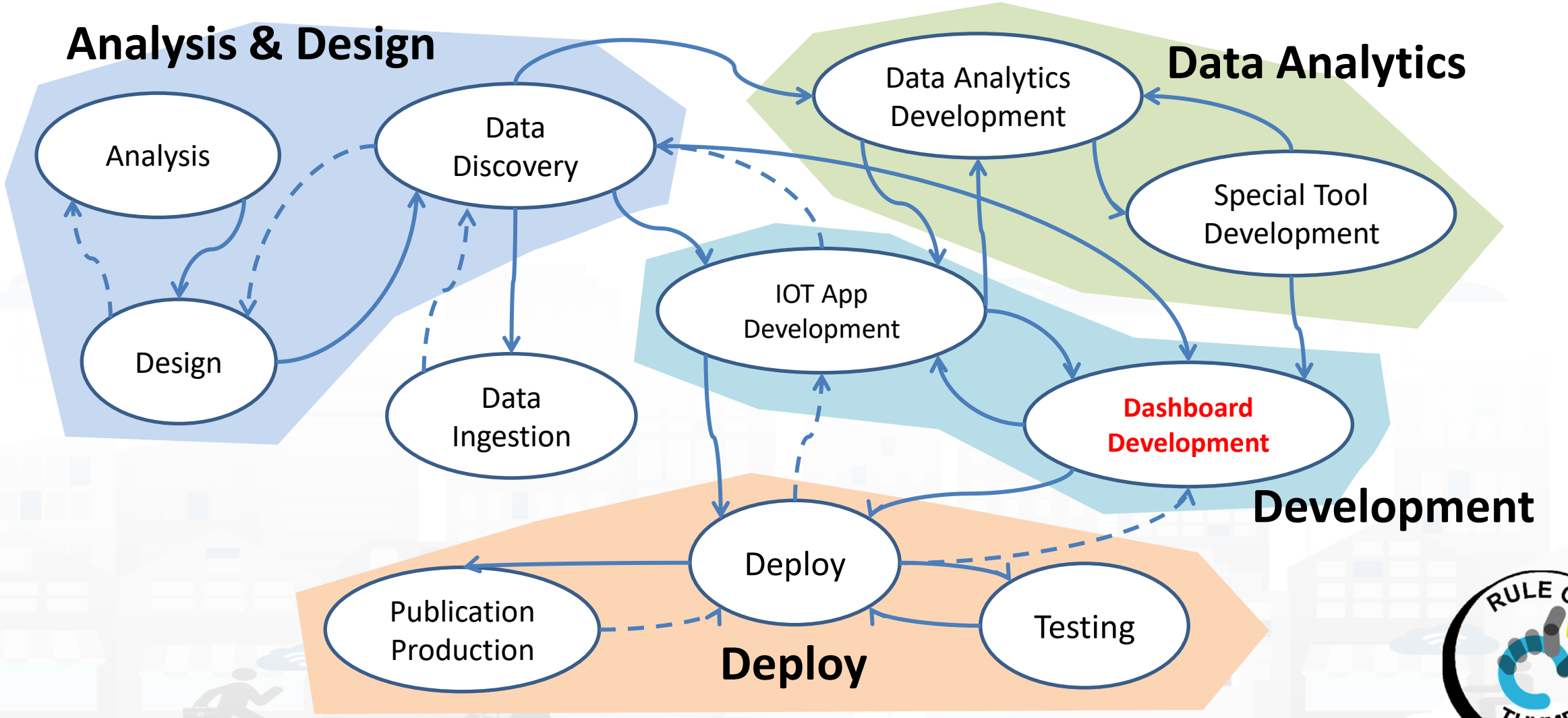


Resource Manager

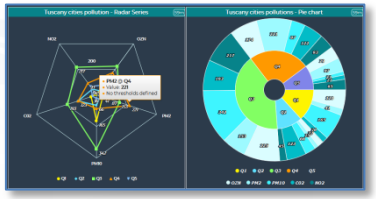
Loading new Node-RED nodes/microservices from external Palet

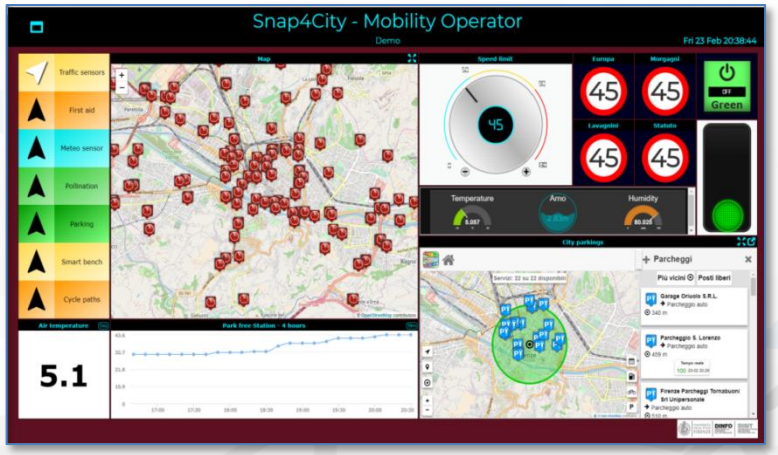
- Ask to RootAdministrator to have your custom Node-RED nodes/modules added to your IOT Applications
  - https://www.snap4city.org/drupal/contact
- A validation of requested Node-RED nodes will be performed to avoid violation of security and privacy for all
- Administrators may load custom Node-RED nodes/modules
- This limitation is not present in your on premise installations of Snap4City

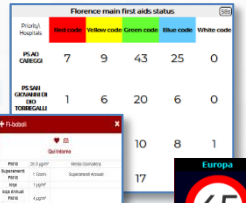
Development Life Cycle Smart City Services

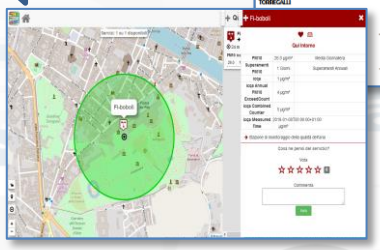


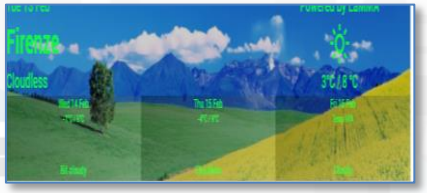
Dashboard List and Editor

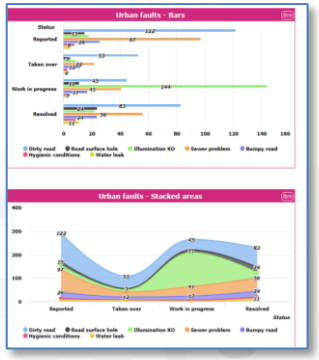




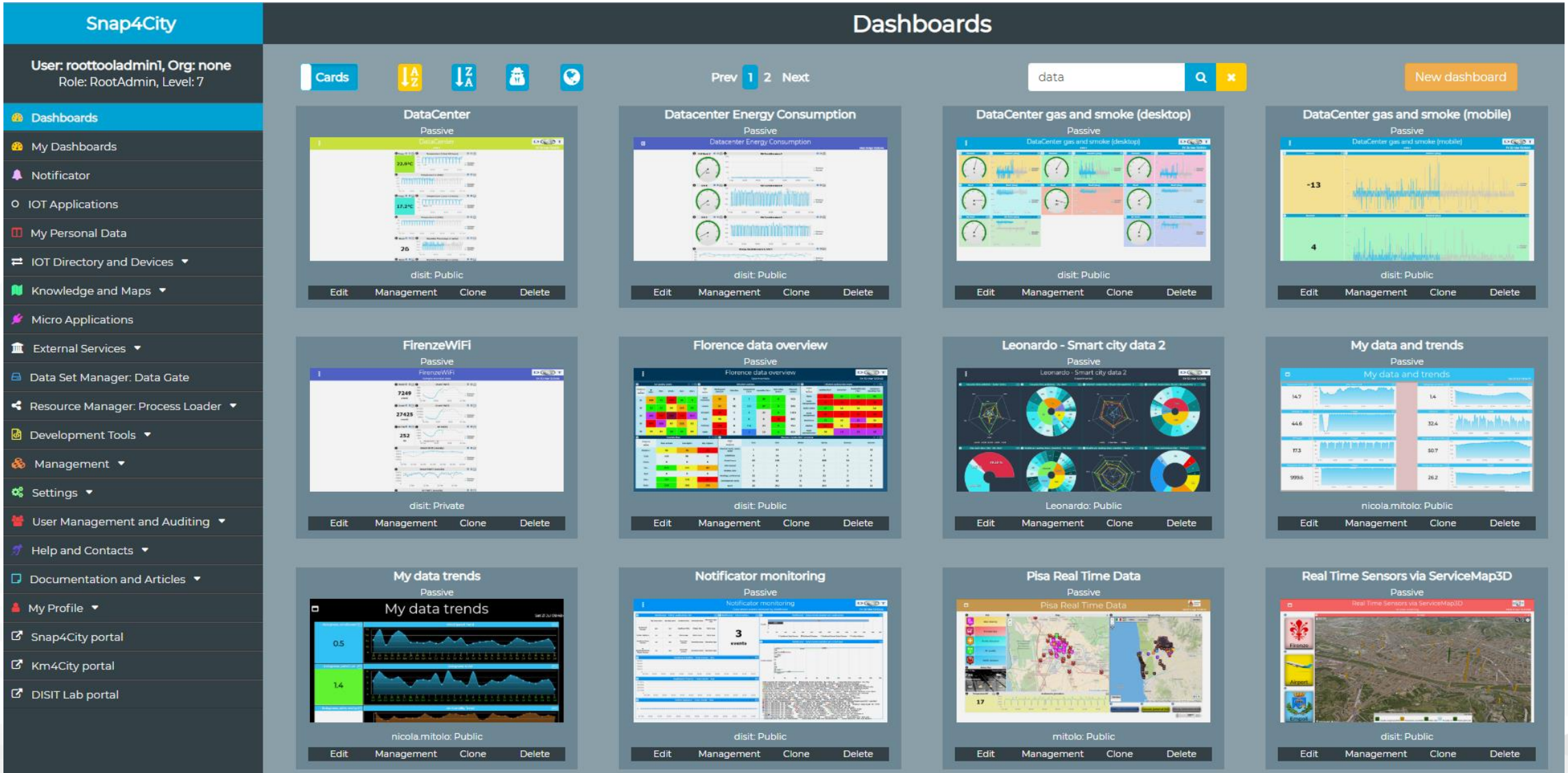








Dashboard List and Editor



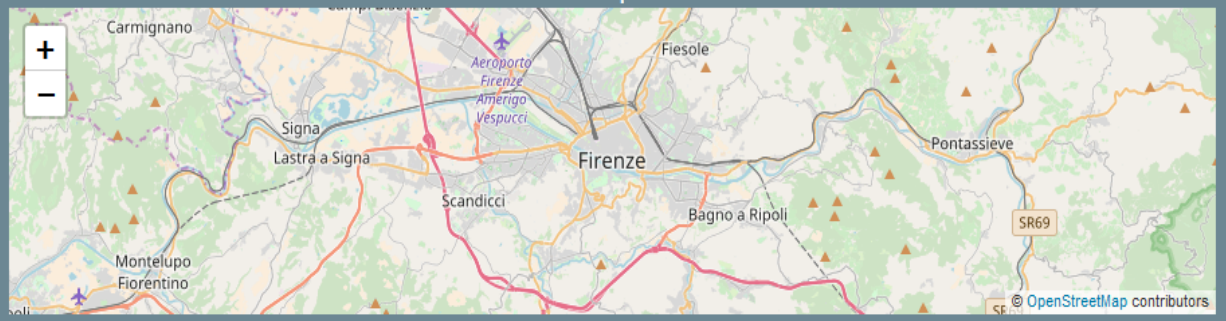
Snap4City

Dashboards

Wizard

Dashboard features | Data and widgets | Check and summary

Map



Single data widgets

Multi data widgets

Data sources

All selected (10)	All selected (55)	All selected (776)	All selected (315)		All selected (47)				All selected (2)
High-Level Type	Nature	Subnature	Value Type	Value Name	Data Type	Last Dat		Last Check	Ownership
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather			2018-07-08 16:00:18	public
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather		Vergemoli	2018-07-08 16:00:18	public
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather		chiano	2018-07-08 16:00:18	public
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather		aiano	2018-07-08 16:00:18	public
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather		Vaglia	2018-07-08 16:00:18	public
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather		Vagli sotto	2018-07-08 16:00:18	public
Special Widget	**Environment**	**Weather Forecast**		**Previ_Meteo**	**special weather**		**Vagli di sotto**	**2018-07-08 16:00:18**	**public**
Special Widget	Environment	Weather Forecast		Previ_Meteo	special weather		Uzzano	2018-07-08 16:00:18	public

Hide columns | Res | Selected rows: 0 | Previous 1 2 3 4 5 ... 1081 Next | Search

Choosen data sources

High-Level Type	Nature	Subnature	Value Type	Value Name	Data Type	Last Date	Last Value	Healthiness	Last Check	Ownership	Remove

Previous Next | Search

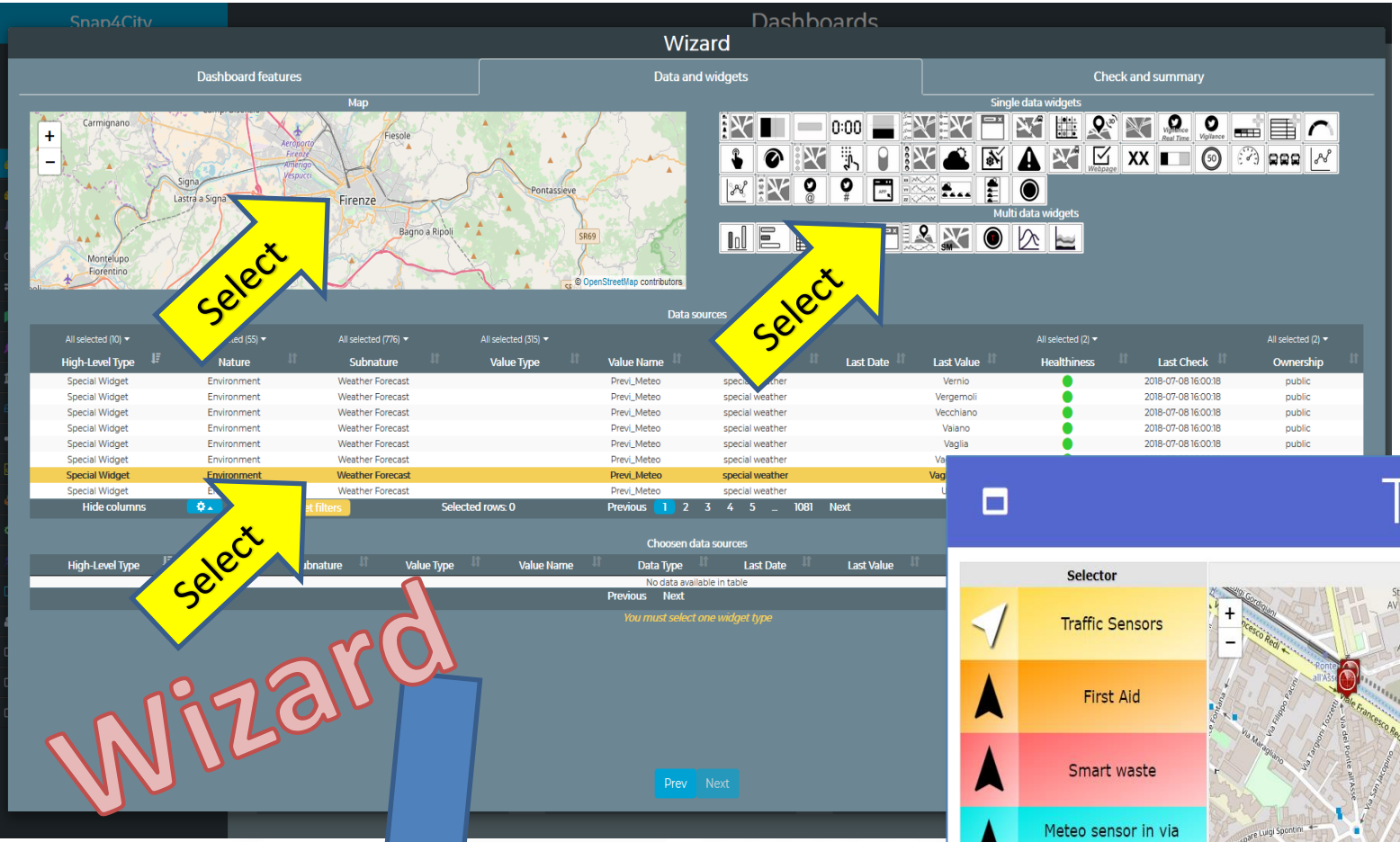
Close

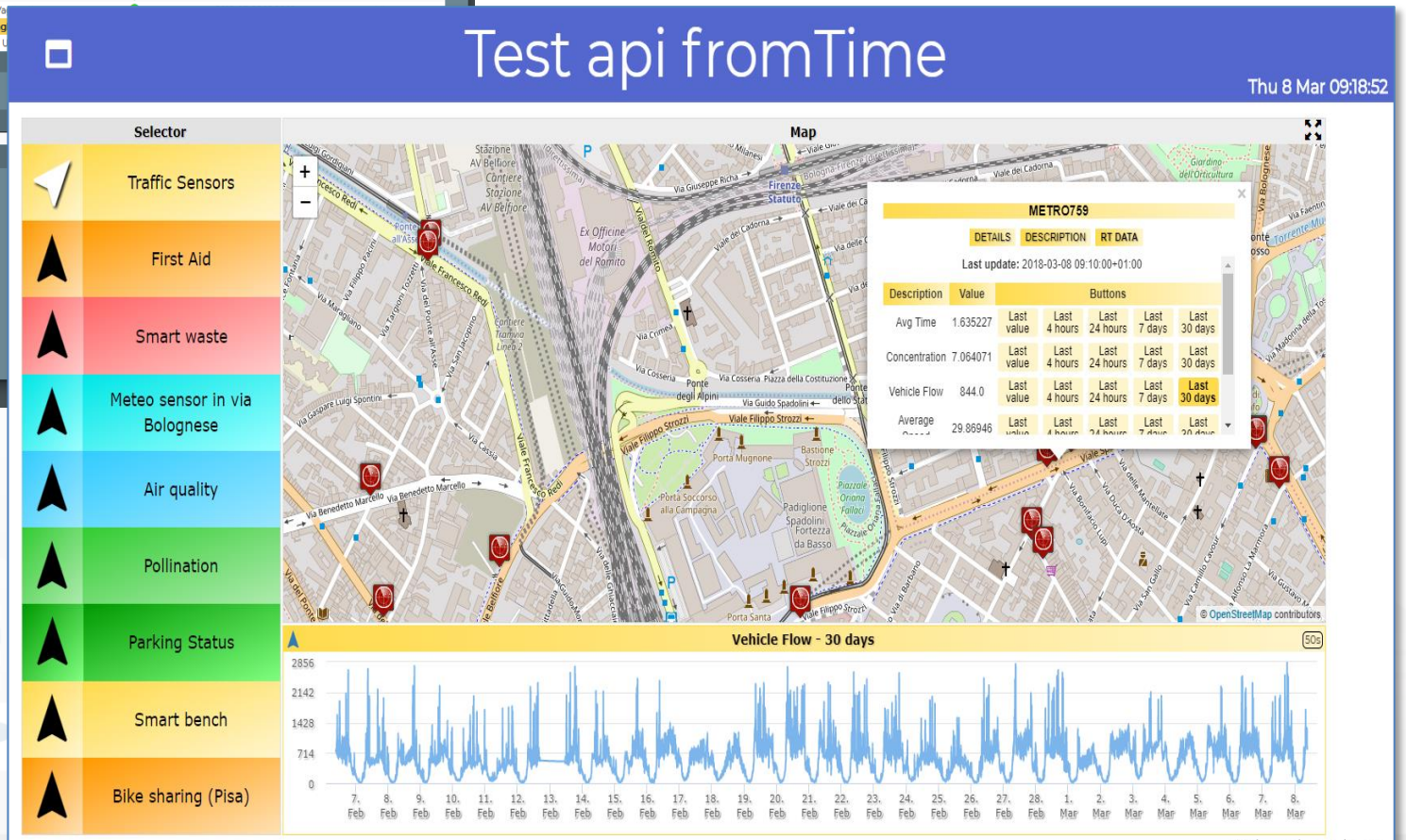
SNAP4CITY

Wizard

- Select the area of your interest: panning and zooming
- Select the
  - graphic aspect of your interest, or
  - High Level Type of your interest, or
  - Make a search if you a have a precise idea or
  - Act on filters: nature, subnature, type, name, value, date, health, owner, …
  - Combine them as you like
- Select the lines of your interest
- Then click on Next and get the Dashboard by wizard

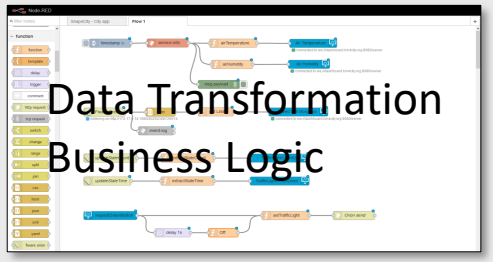
Dashboard Wizard





The Wizard help you in selecting only possible combination of data vs graphic representation

Dashboard Builder: Development



Data Transformation
Business Logic

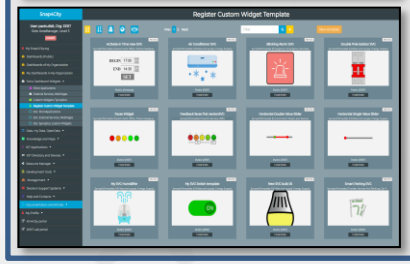
IOT Applications

Knowledge and Storage
Data from the Field and
City + MyKPI ++

Widget Collection

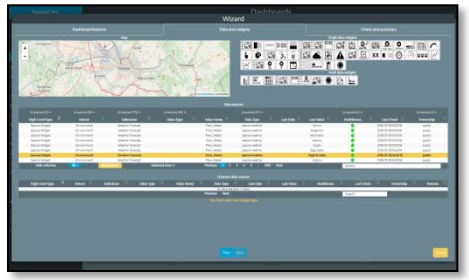
Micro
Applicat
ions

External
Services

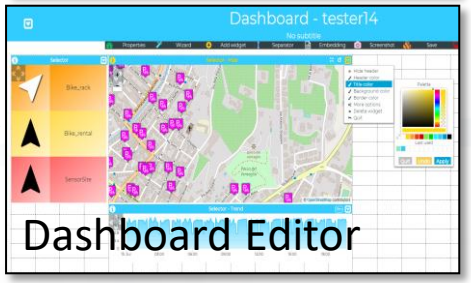


Custom
Widgets/
Synoptics

Dashboard Wizard

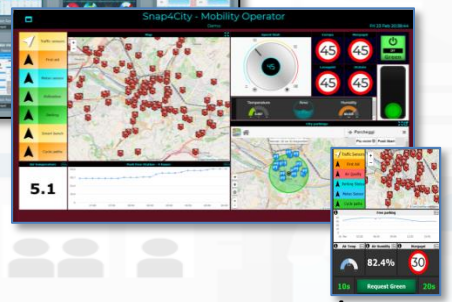


Create, save, load,
delegate, grant access,
change ownership



Dashboard Editor

Public
Dashboard
Collection

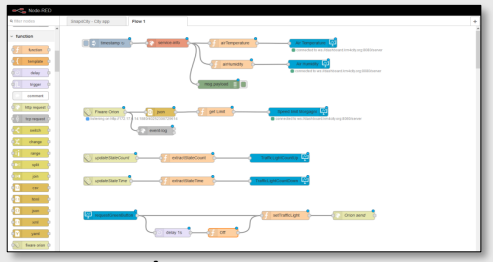


My Own Dash/App

Developing new Dashboard Graphic Widget

- The development of new Widget is feasible for programmers
  - in PHP, JavaScript and CSS
    - The starting point is the Core Snap4City Virtual Machine Appliance StartSNAP4CITYVM: https://www.snap4city.org/471
    - While the source code is also accessible on GitHub/DISIT
    - see TC3.11 - New graphics widget can be easily created, Dashboard Widget Creation
  - creating a new Graphic widget via SVG and programming: Custom Synoptics and Widgets for Dashboards https://www.snap4city.org/504

Custom Widget / Synoptic / PIN Development

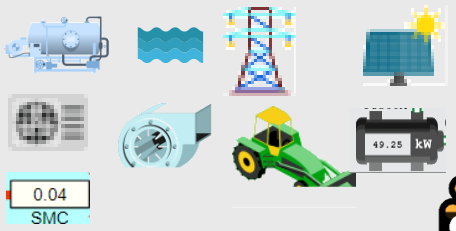


IOT Applications

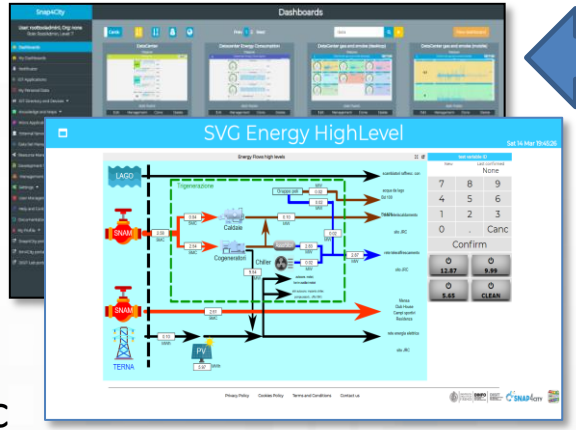
Knowledge Base,
Km4City

Knowledge and Storage
Data from the Field and
City

SVG Symbols Collection

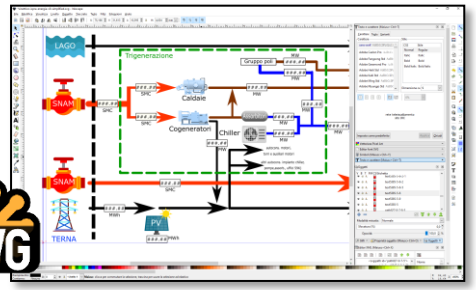


Public
Dashboard
Collection

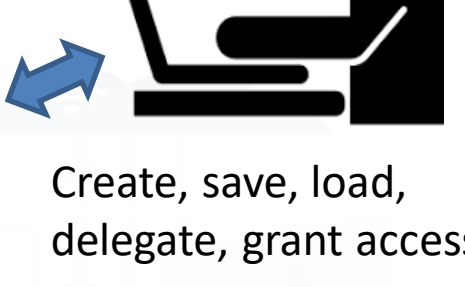


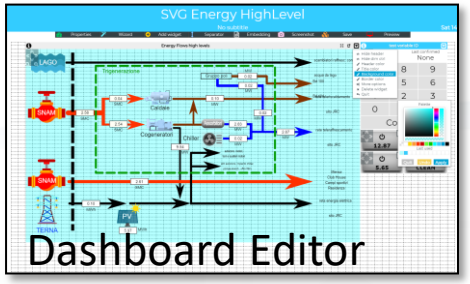
My Own Dash/App

Inkscape editor on your computer



Create, save a Custom
Widget in SVG



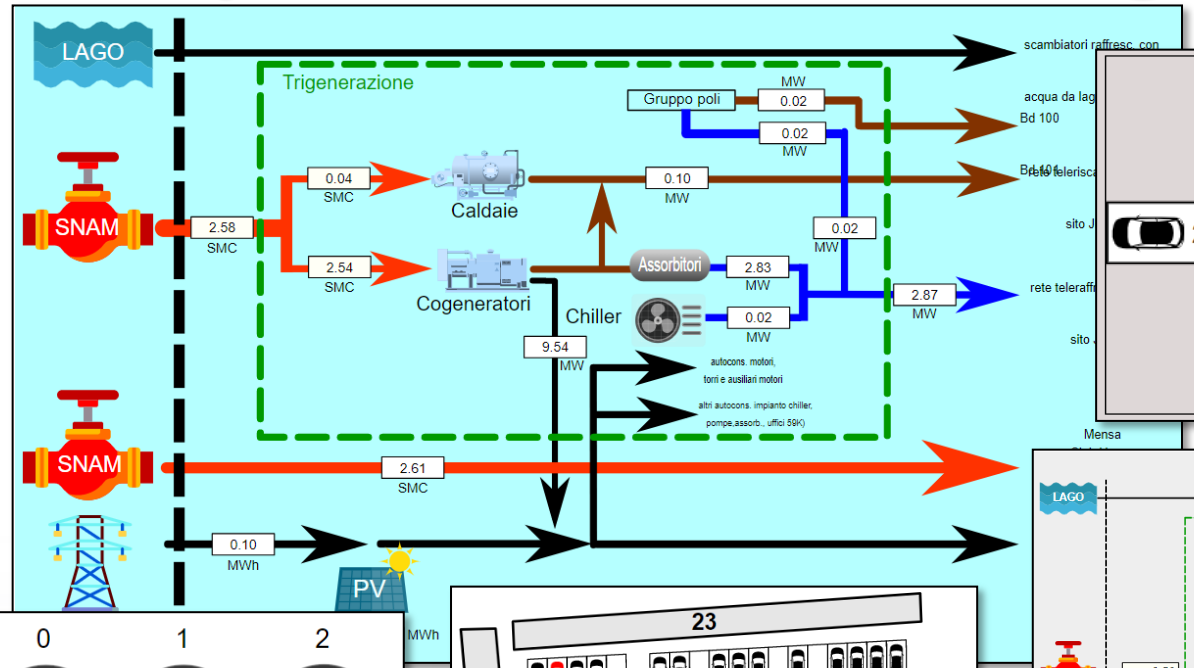


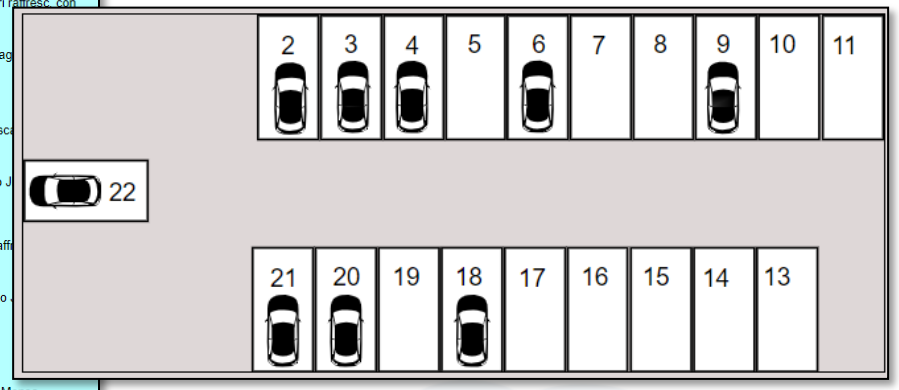
Create, save, load,
delegate, grant access

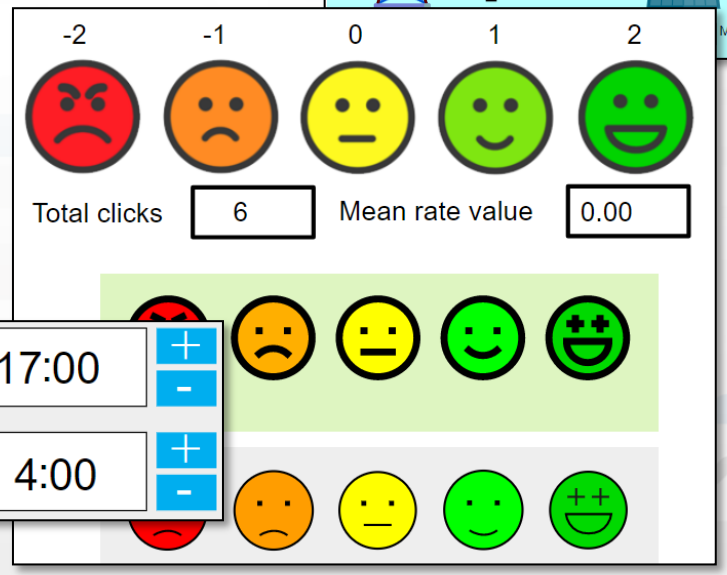
1. Create and Load a Custom SVG
2. Select/Reuse an SVG
3. Make and Instance of Synoptic by Associate Variables with MyKPI
4. Create on Dashboard a Widget based on Synoptic HLT such as Ext. Srv.:
   - https://www.snap4city.org/synoptic/v2/synoptic.html?id=xxxx

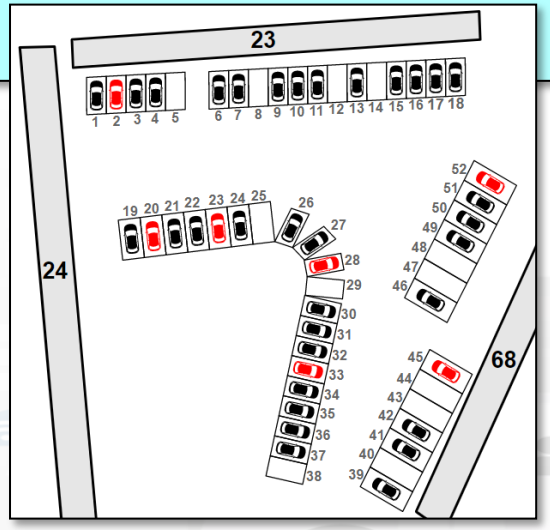
Special Custom Widgets

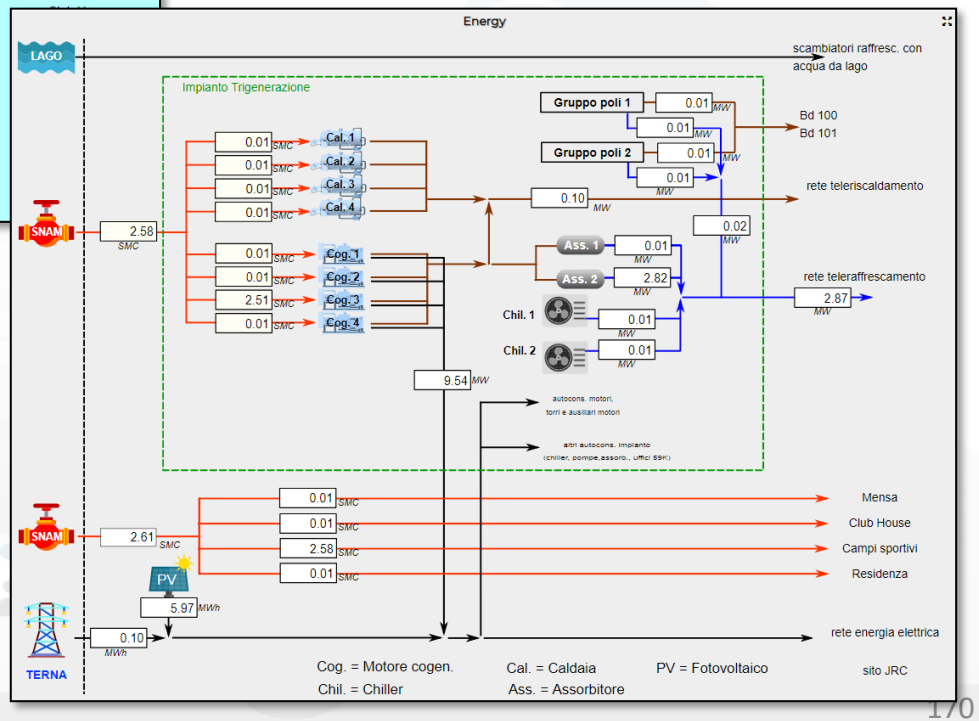
- Smart parking
- Smart Energy
- Smart Light
- Smart ….
- Energy View
- Custom Controls



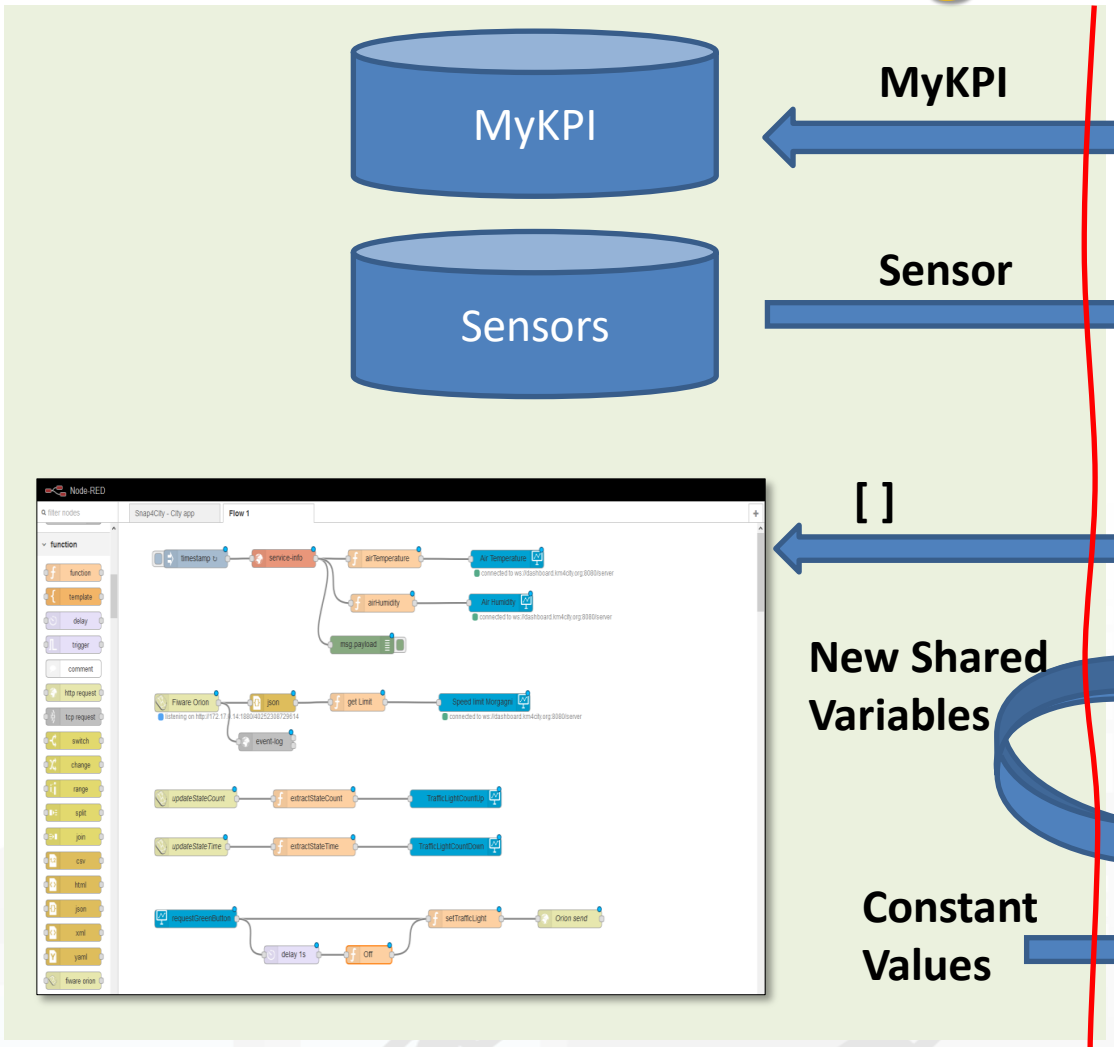


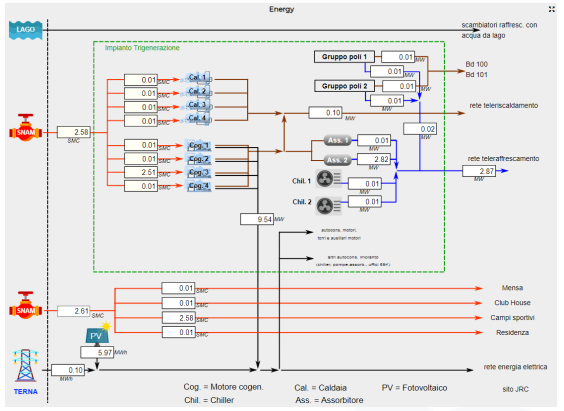


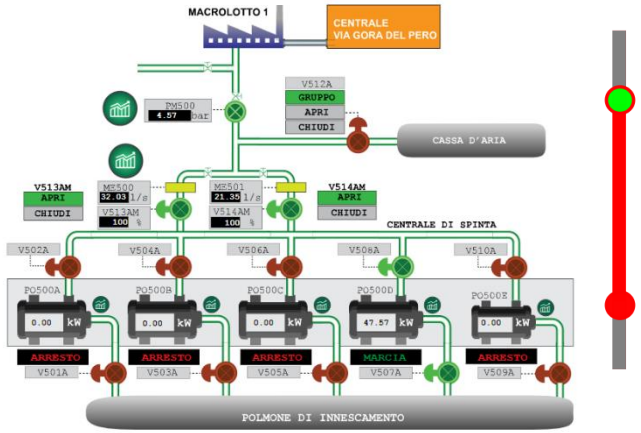


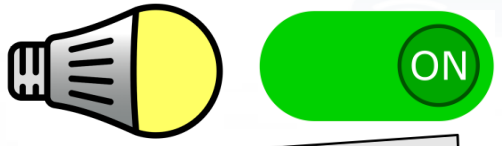


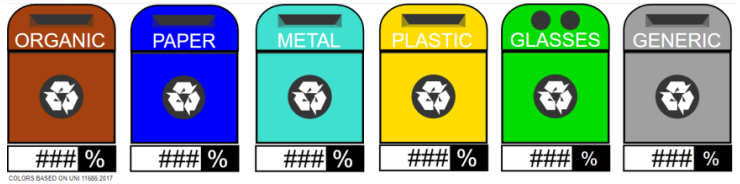
From-To Custom Widgets / Synoptics to Storage in WS

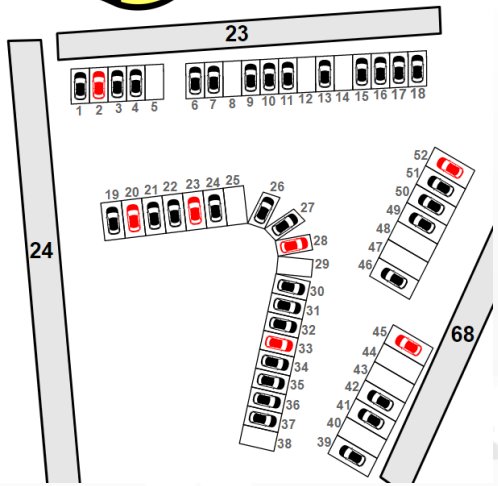


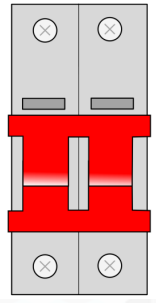


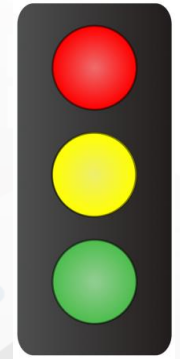










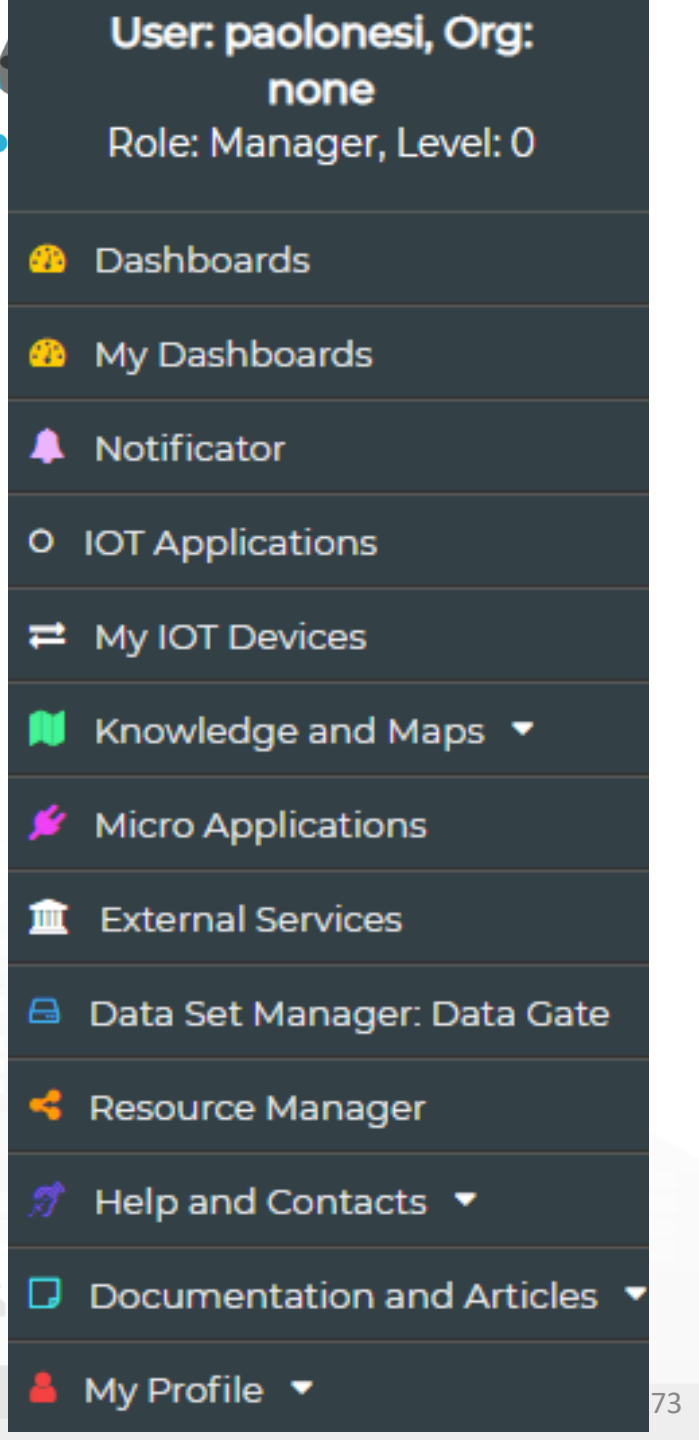


Dashboards

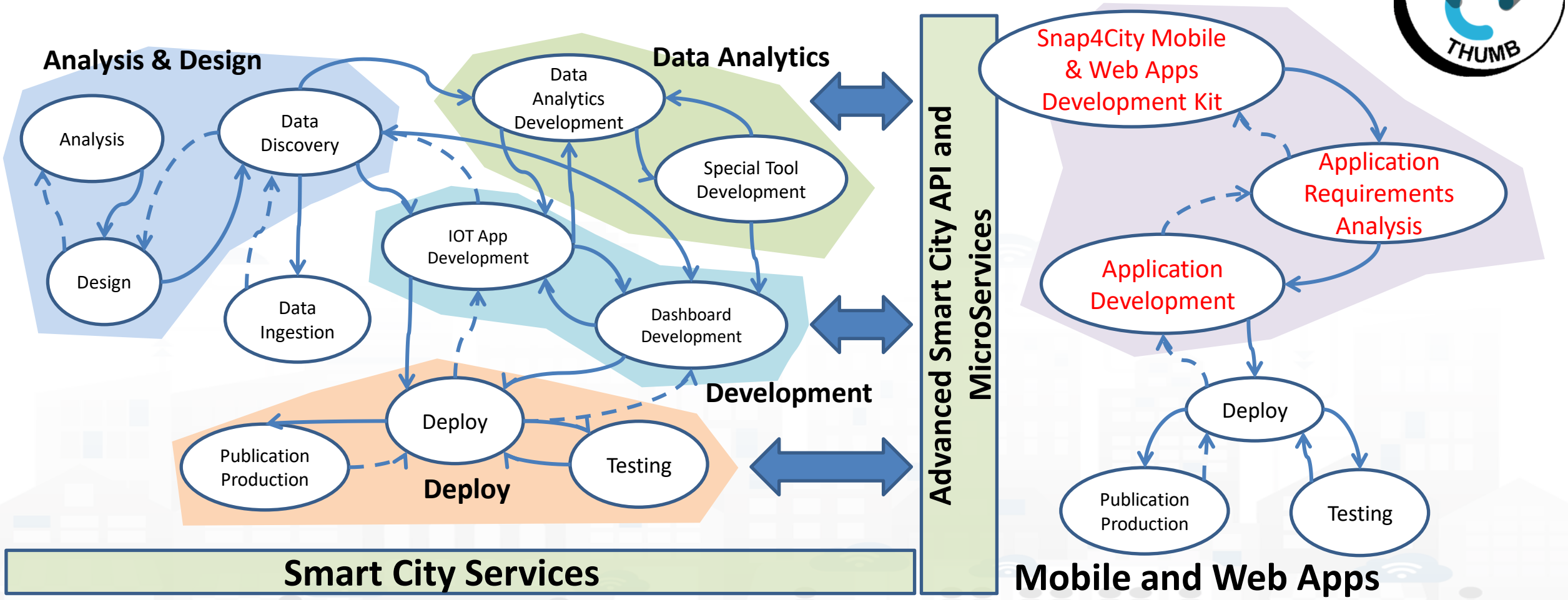
- **Suitable** as: City Dashboard, App interface, and Control Room Dashboards, Situation Room Dashboard, Operator Dashboard
- **Created** visually compounding graphic Widgets
  - Each widget has an autonomous update
  - Each metric/data-source may have associated with an alarm: blinking and sending events to people and machines in different manners
- **Can be**: public or private, private dash can be delegated or passed in ownership
- See https://main.snap4city.org/management/dashboards.php?linkId=dashboardsLink&fromSubmenu=false&sorts[title_header]=1
- See the following tutorials
  - **HOW TO: create a Dashboard in Snap4City**
  - **US1. Using City Dashboards**
  - **US2. Using and Creating Snap4City Applications with Dashboards**
  - **US4. Creating City Dashboards and related Event Monitoring and Actions**

Level 1 Users: using dashboards

- TC1.3. Accessing and using Dashboards with any device
- TC1.4. Dashboards Showing Data Real Time and Historical/trends, comparison
- TC1.5. Dashboards showing a range of different High Level Types: KPI, POI, IOT dev, MicroApp, Maps using different kind of Graphics Widget. Monitor city status with Dashboards
- TC1.6. Dashboards using different kind of graphics Widgets matching with High Level Types, Monitor city status with Dashboards
- TC1.12. Dashboard with MicroApplications
- TC4.1. Dashboard and Notificator
- TC4.6. Dashboard with city events, ESB, police, traffic, etc.

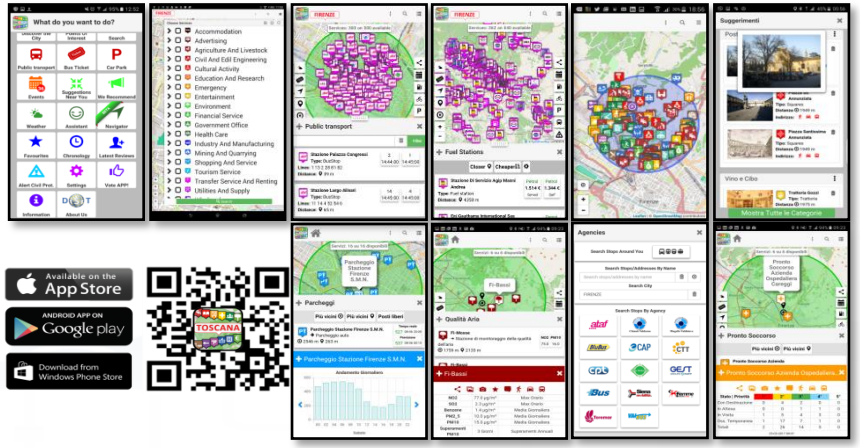


Develop Mobile & Web Applications Exploiting Snap4City Smart City Services

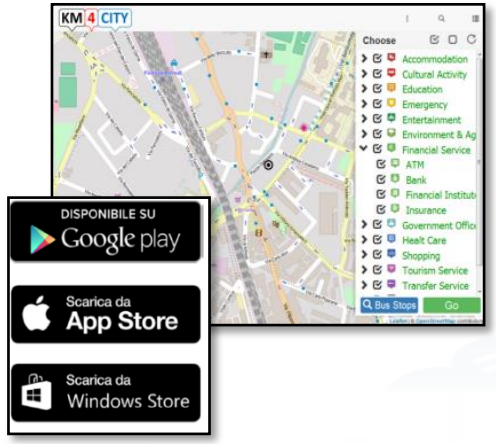


Developing Web and Mobile Apps, MicroApps,..

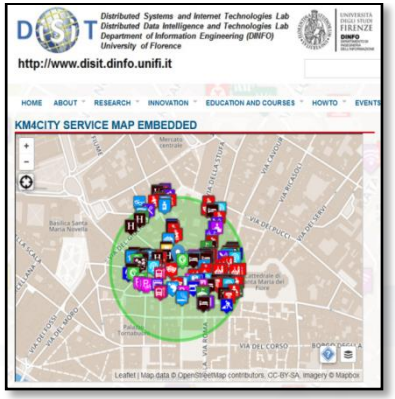
Mobile Apps



Web App HTML5, MicroApplications

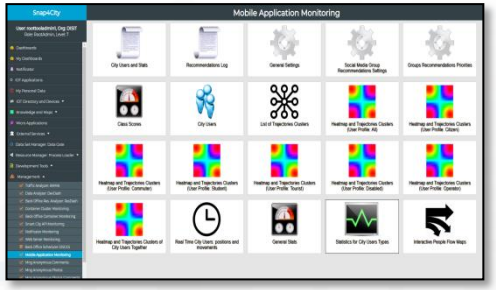


Embed into Web pages



City User

Advanced Smart City API

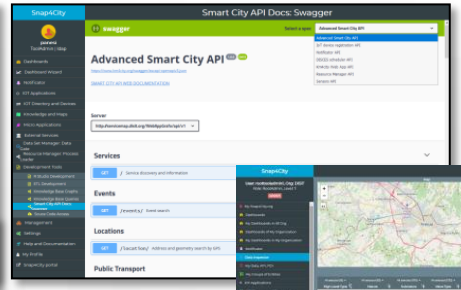


Mobile Application Monitoring Administrator

Knowledge Base, Km4City

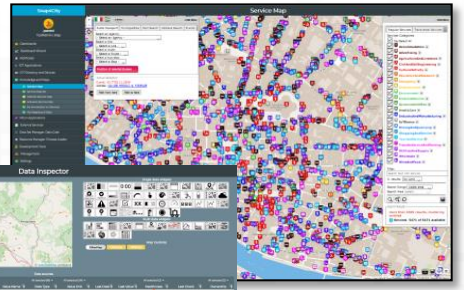
GitHub

Snap/Km4City Open Source development tool kit



Swagger

DataInspector

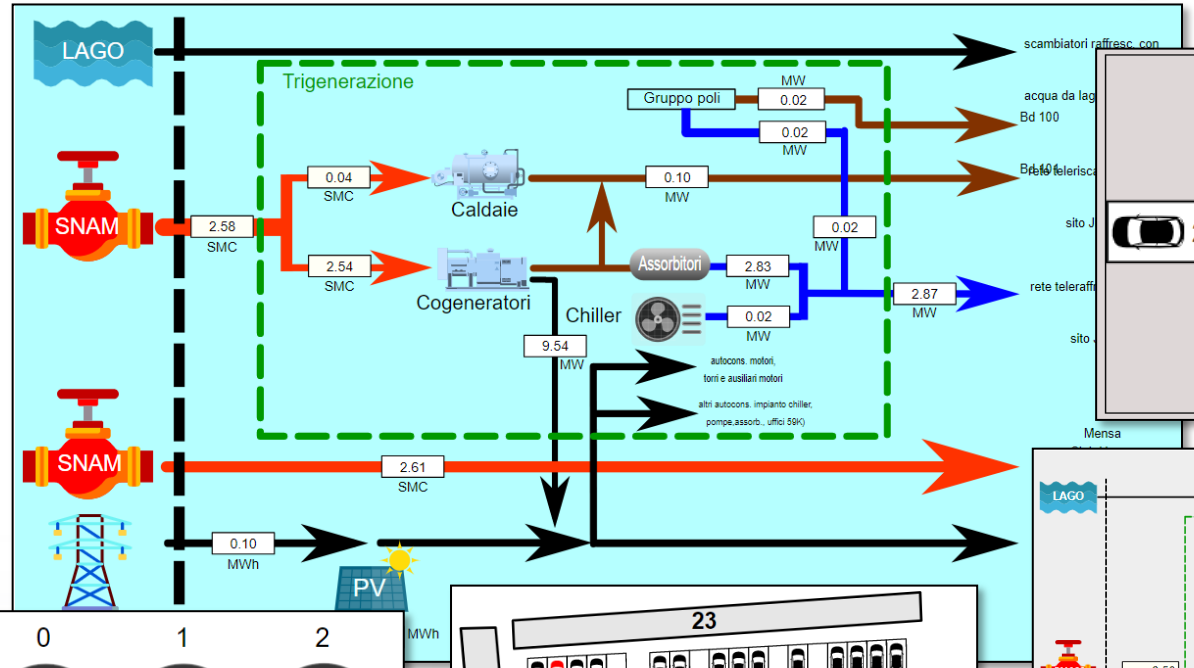


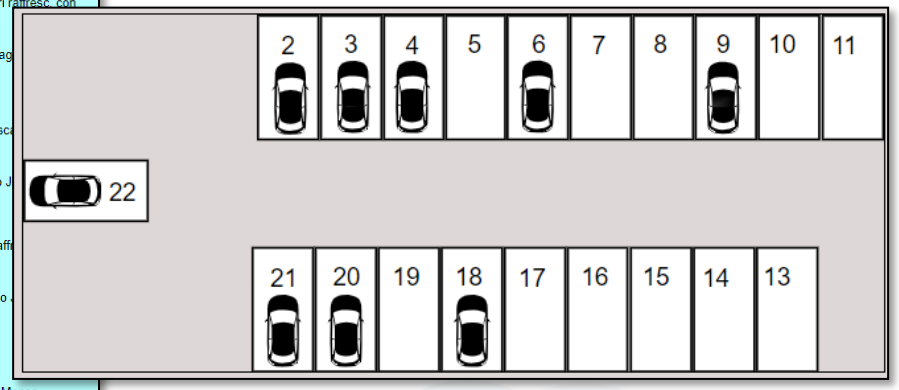
ServiceMap

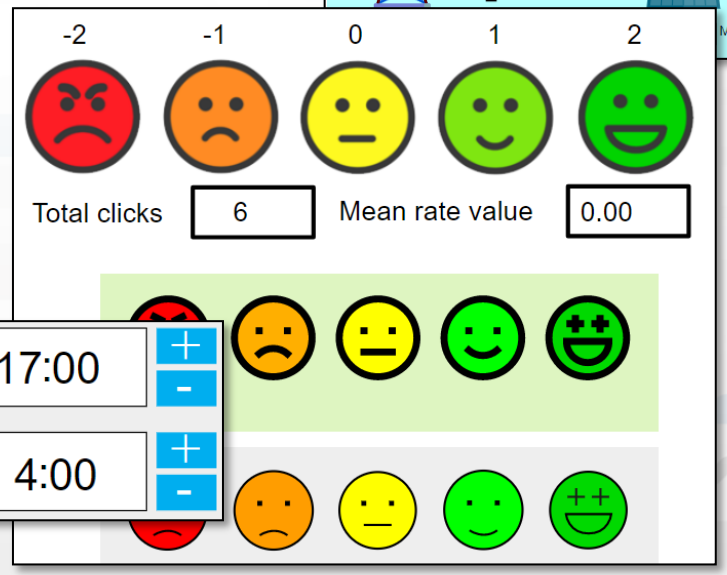
Developer

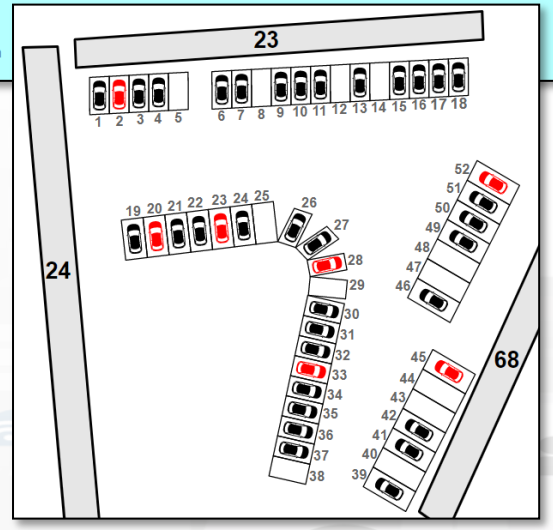
Special Custom Widgets

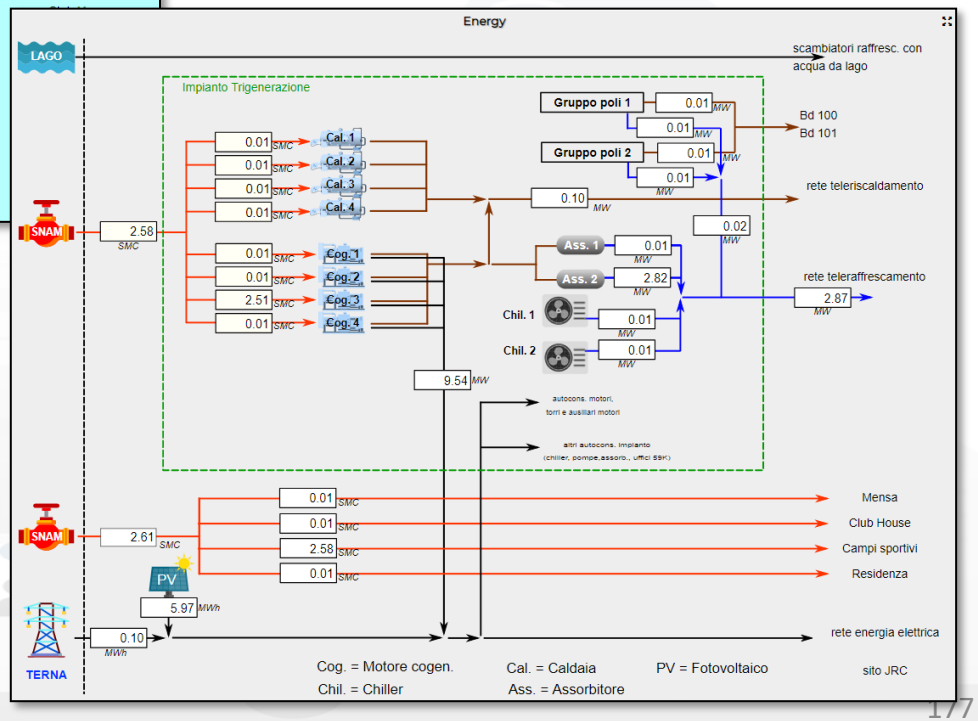
- Smart parking
- Smart Energy
- Smart Light
- Smart ….
- Energy View
- Custom Controls



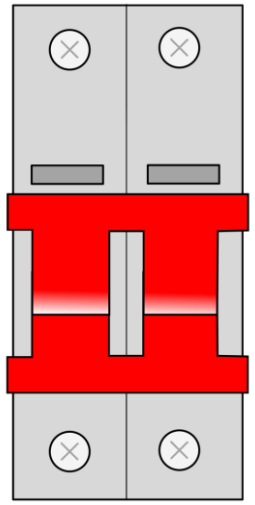




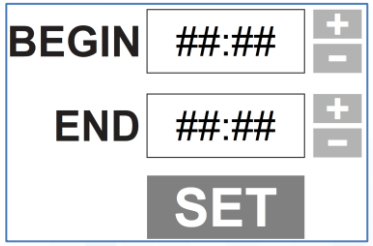


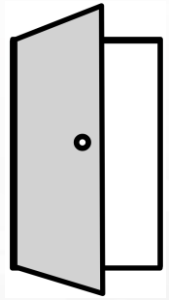


Other examples

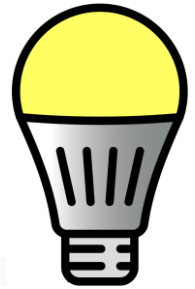


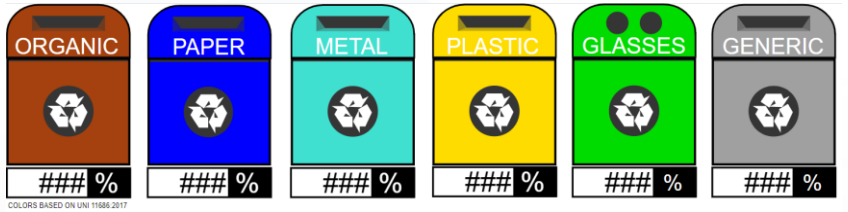
- **Virtual Actuators (sensor-actuator)**
  - From: Dashboard
  - To: IOT App, MyKPI, other Synoptics

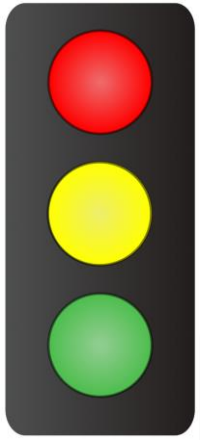


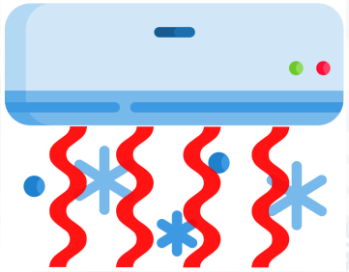


- **Virtual Sensors**
  - From: MyKPI, Sensors, IOT App, other Synoptics
  - To: Dashboards









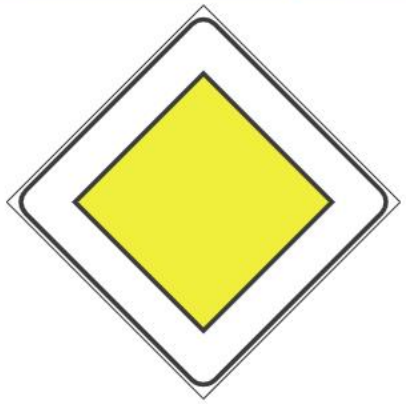
######.##

https://www.snap4city.org/663

SVG Custom Widgets Examples

Sat 16 Jan 01:07:39

Precedence Italians Road signals

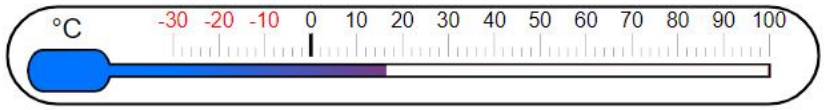


Select a code from 0 to 11 to change the road sign

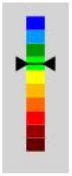
New		Last confirmed: None
7	8	9
4	5	6
1	2	3
0	.	Canc
Confirm		

s... | Smart Light Luminosity

Air Temperature in Florence



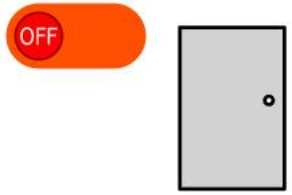
PM10 level - Bologna



fan | Fan velocity

Symbols Legenda

open/... | M...



Dynamic Prohibition...

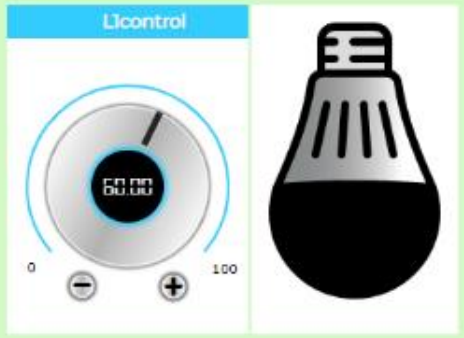
Prohibition Traffic Signs Co...

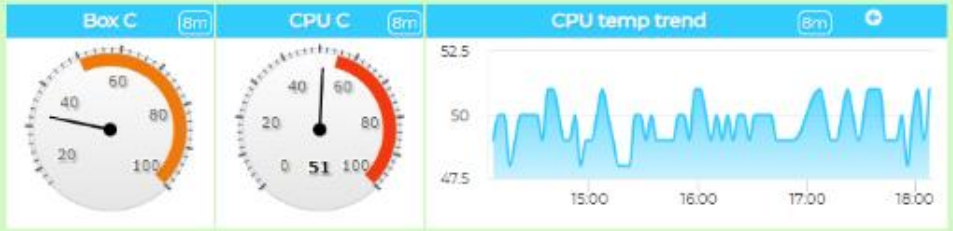
New		Last confirmed: None
7	8	9
4	5	6
1	2	3
0	.	Canc
Confirm		

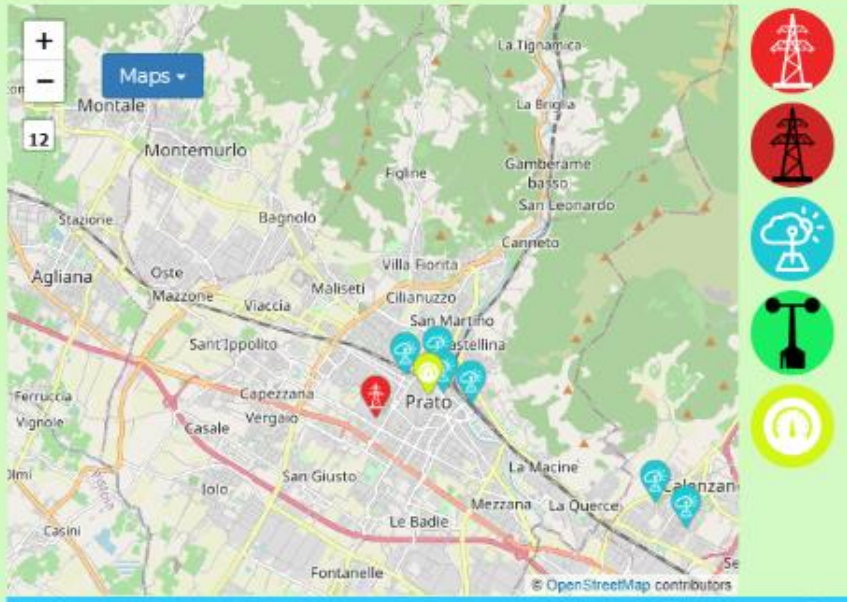
Prohibition Traffic Signs Legenda

Snap4Home 5G Demo

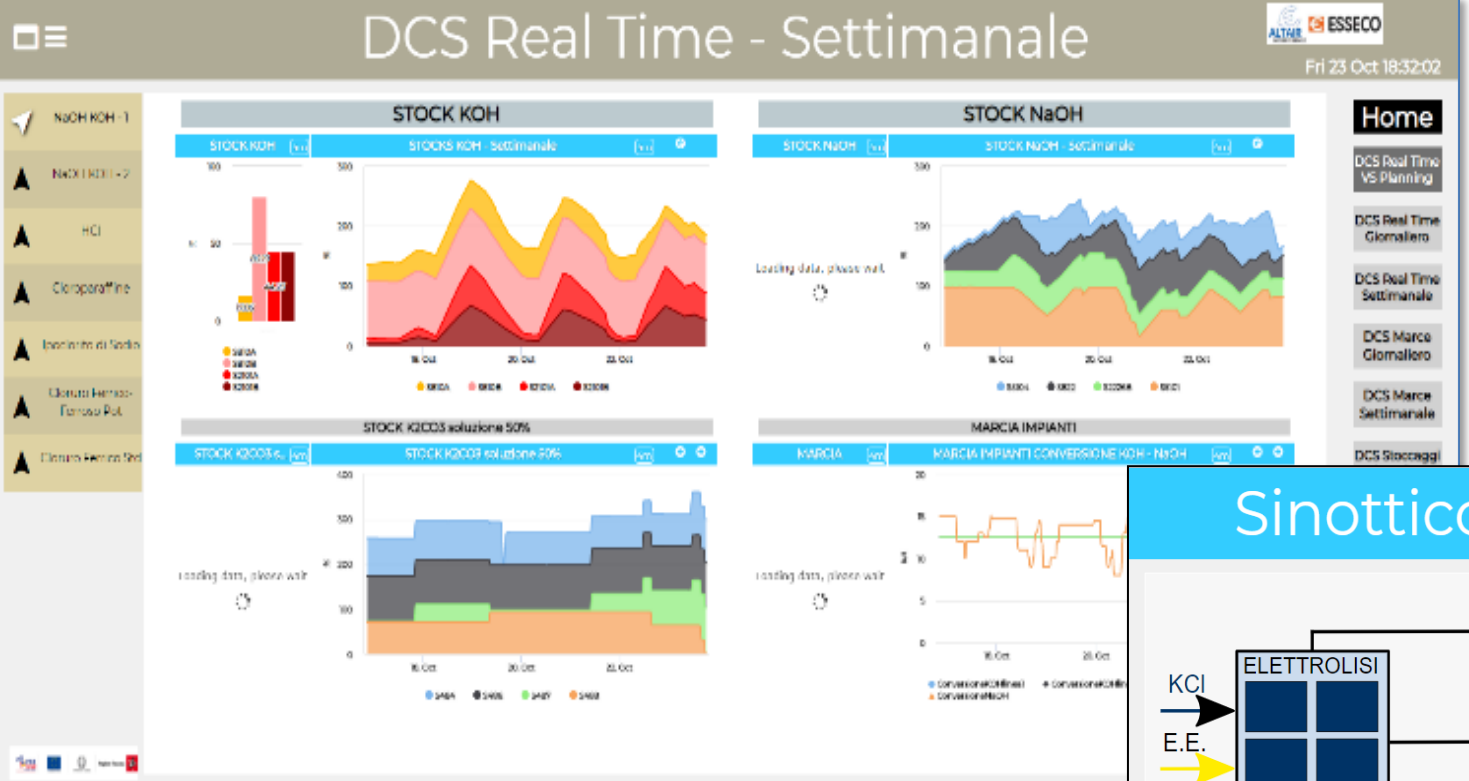
Thu 11 Jun 18:07:32

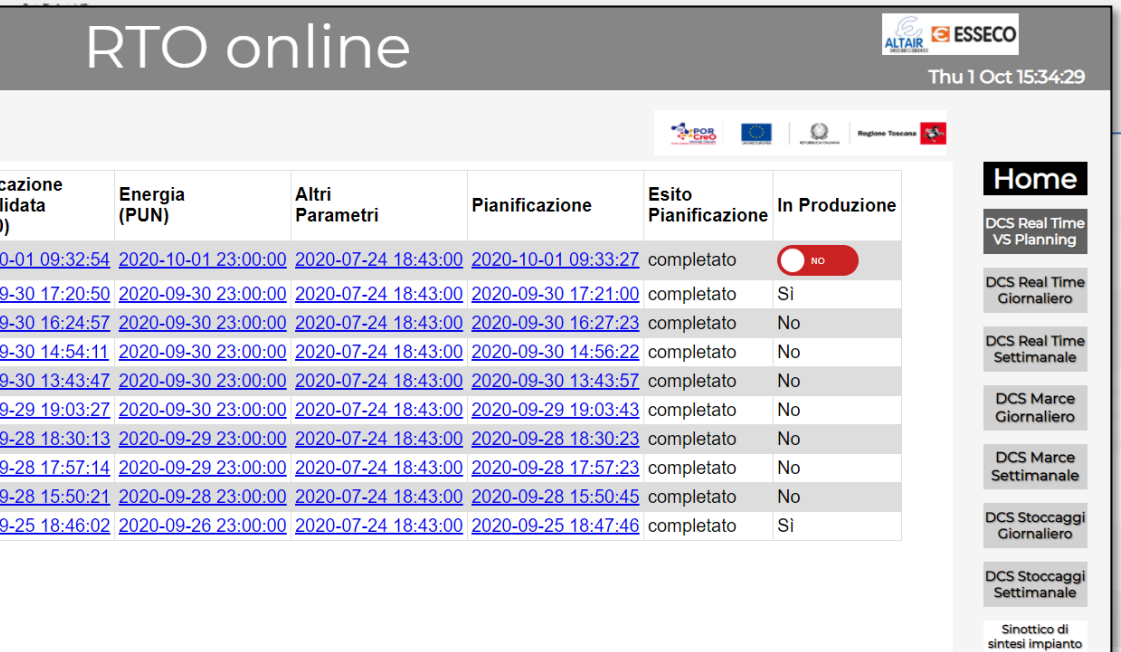




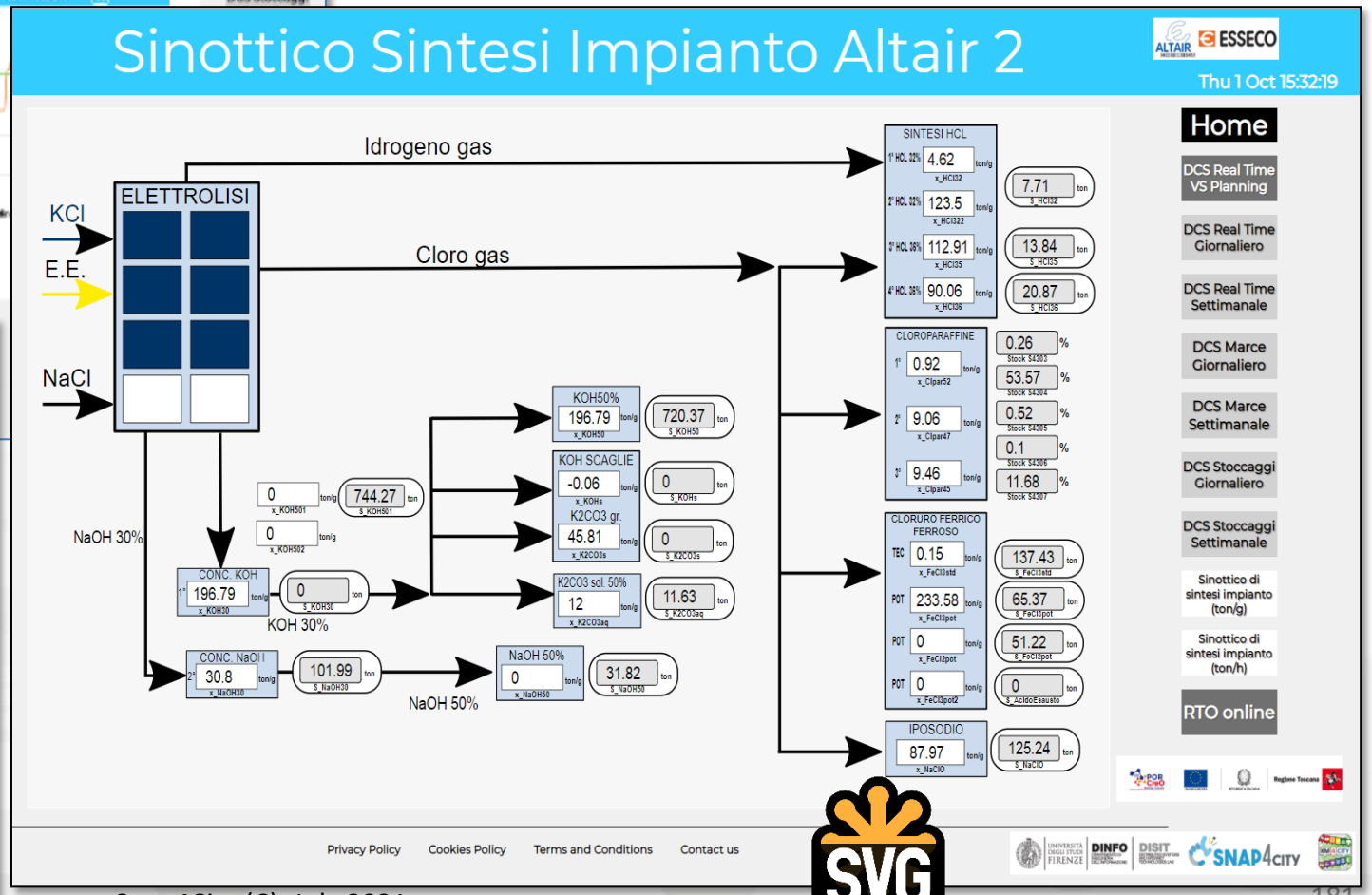


open fiber WIND 3 ZTE estra

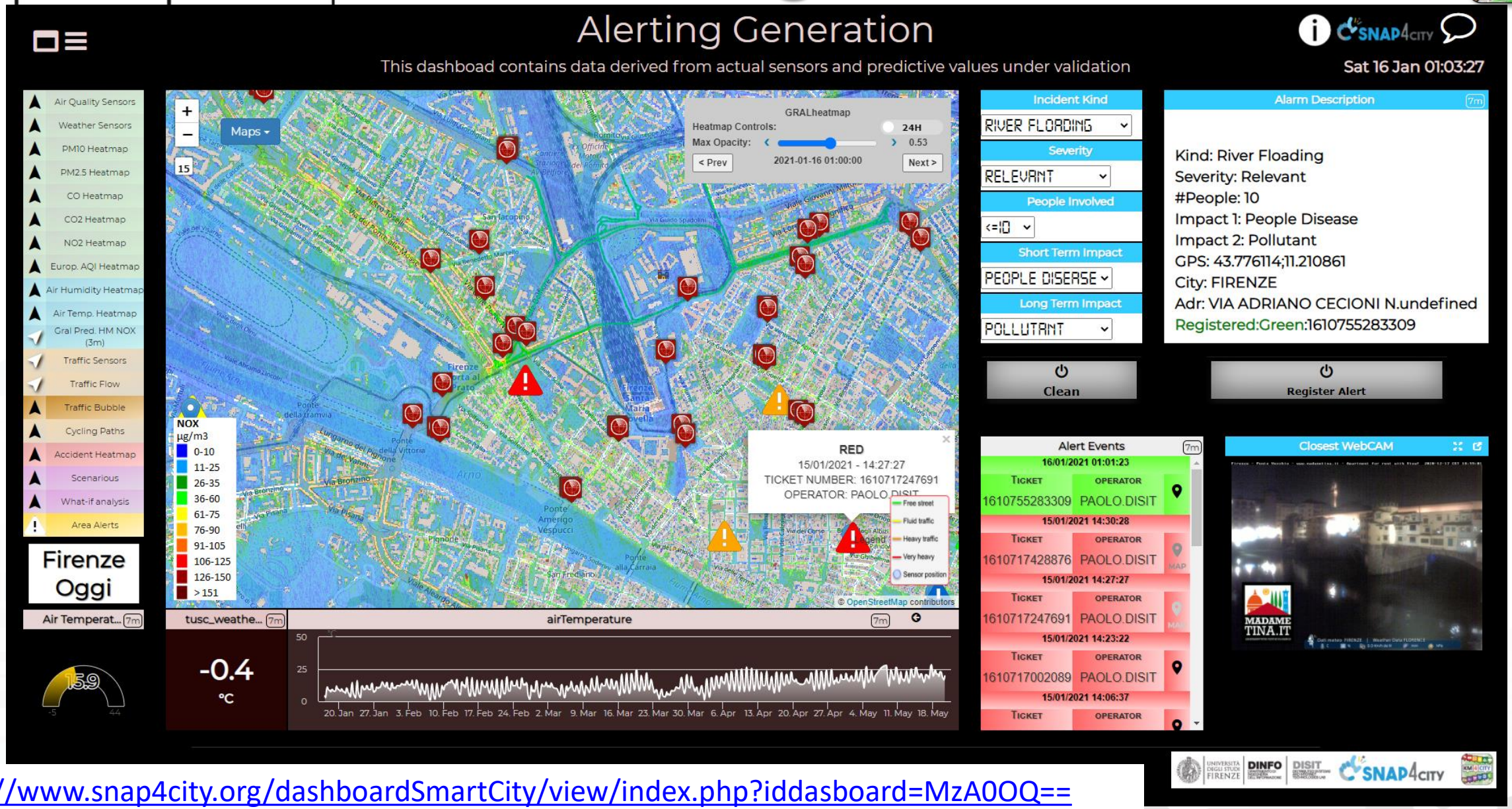




cazione lidata)	Energia (PUN)	Altri Parametri	Pianificazione	Esito Pianificazione	In Produzione
0-01 09:32:54	2020-10-01 23:00:00	2020-07-24 18:43:00	2020-10-01 09:33:27	completato	NO
9-30 17:20:50	2020-09-30 23:00:00	2020-07-24 18:43:00	2020-09-30 17:21:00	completato	Sì
9-30 16:24:57	2020-09-30 23:00:00	2020-07-24 18:43:00	2020-09-30 16:27:23	completato	No
9-30 14:54:11	2020-09-30 23:00:00	2020-07-24 18:43:00	2020-09-30 14:56:22	completato	No
9-30 13:43:47	2020-09-30 23:00:00	2020-07-24 18:43:00	2020-09-30 13:43:57	completato	No
9-29 19:03:27	2020-09-30 23:00:00	2020-07-24 18:43:00	2020-09-29 19:03:43	completato	No
9-28 18:30:13	2020-09-29 23:00:00	2020-07-24 18:43:00	2020-09-28 18:30:23	completato	No
9-28 17:57:14	2020-09-29 23:00:00	2020-07-24 18:43:00	2020-09-28 17:57:23	completato	No
9-28 15:50:21	2020-09-28 23:00:00	2020-07-24 18:43:00	2020-09-28 15:50:45	completato	No
9-25 18:46:02	2020-09-26 23:00:00	2020-07-24 18:43:00	2020-09-25 18:47:46	completato	Sì



Alert Registration



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzA0OQ==

How the Dashboards exchange data

Snap4City BigData Storage and KB

IOT Broker Orion Quantum Leap

ServiceMap Super ServiceMap

- Req. ServiceURI

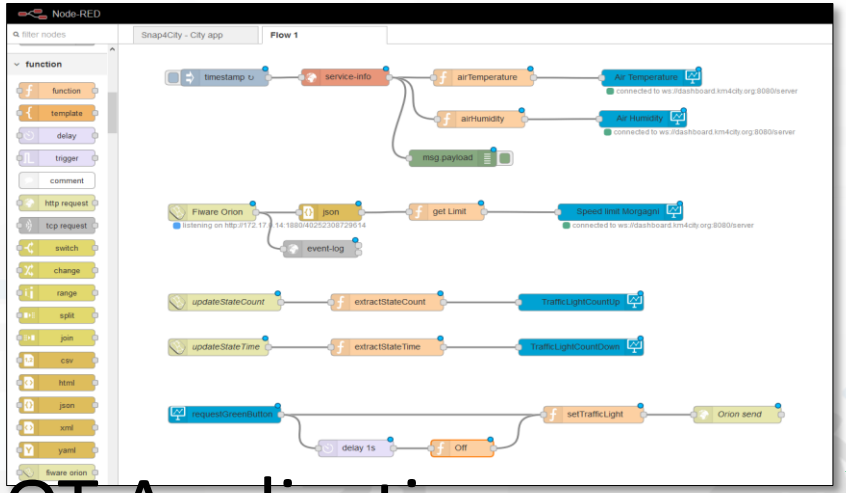
Metric, KPI

MyKPI, MyPOI, …

- Req. KPI, Metric ID
- Req. MyKPI ID

API, External Services, MicroApp

- Traffic Flow, MAPS, Heatmaps
- GIS, HTTPs URLs

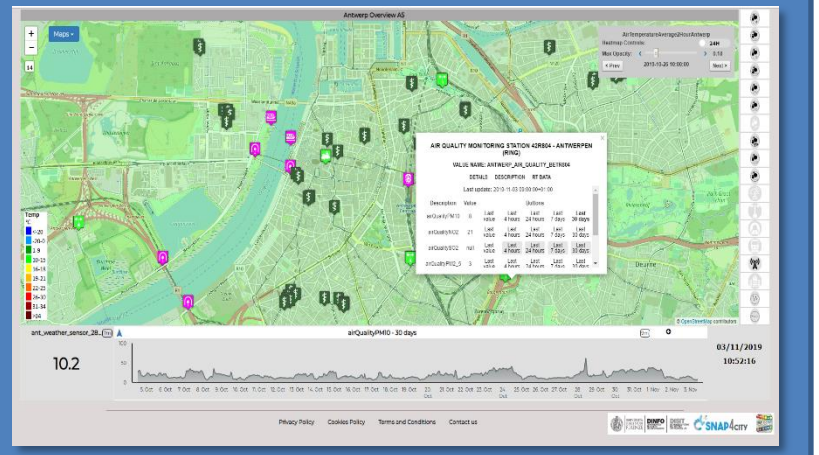


IOT Application

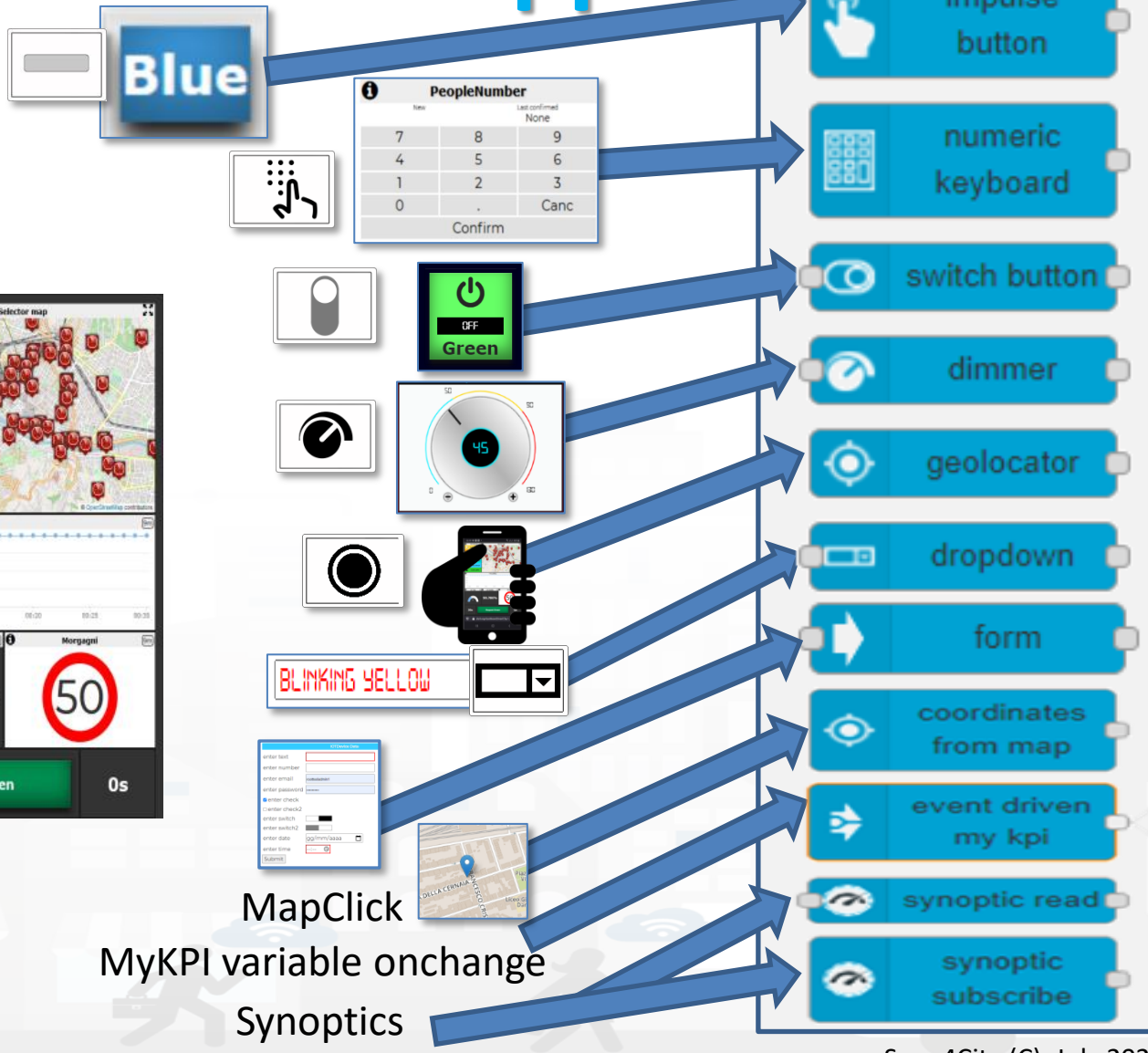
- ServiceURI (ID)
- MyKPI, Metric (ID)
- Dynamic Data, computed into IOT Application

- Rx. Dynamic Data
- Event Driven Synoptics
- Actions, Show

Dashboards



Dashboard-IOT App

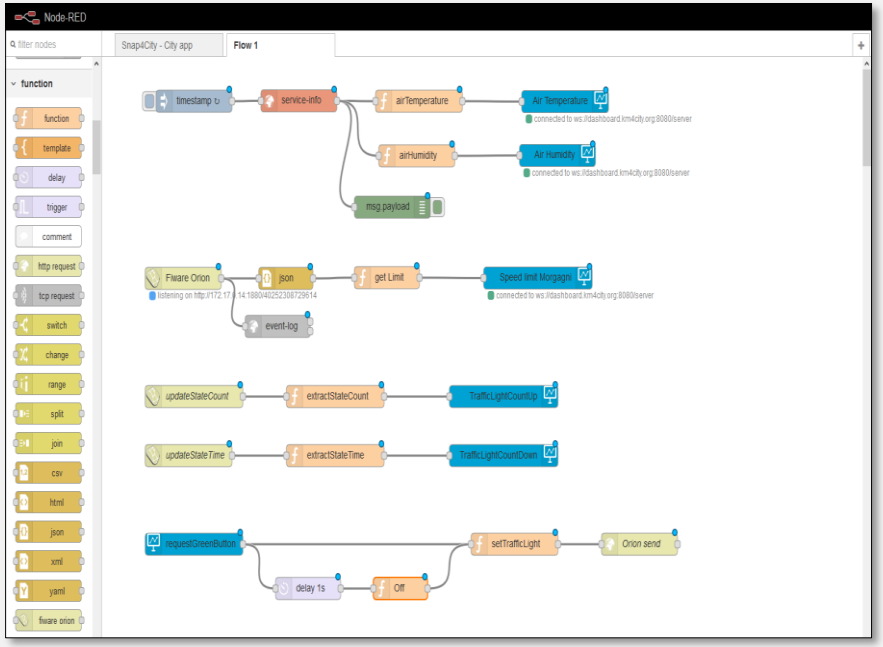


MapClick

MyKPI variable onchange

Synoptics

From Dashboard to IOT App

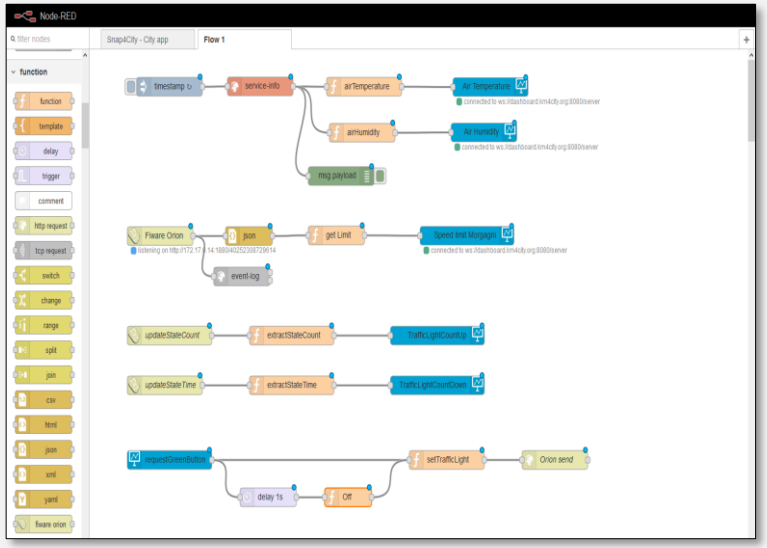


IOT Application

Nature

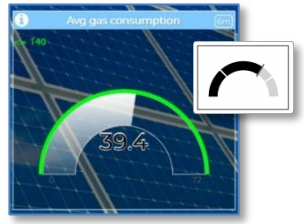
Dashboard-IOT App

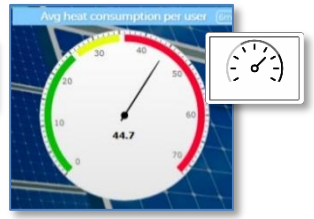
From IOT App to Dashboard

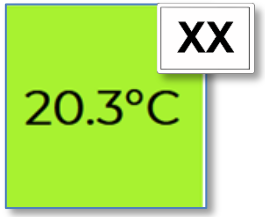


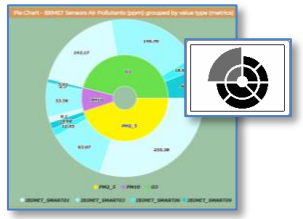
IOT Application

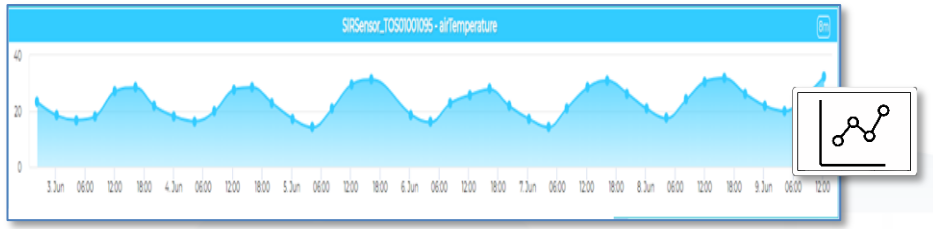
- gauge chart
- single content
- speedometer
- horizontal single bar
- vertical single bar
- web content
- time trend
- bar series
- radar series
- pie chart
- curved line series
- table content
- synoptic write
- calendar

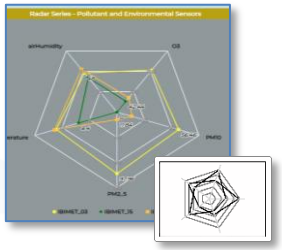


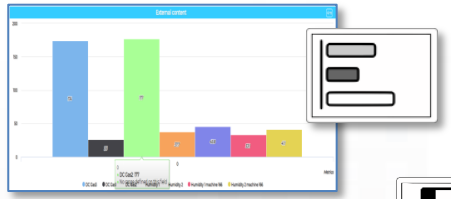


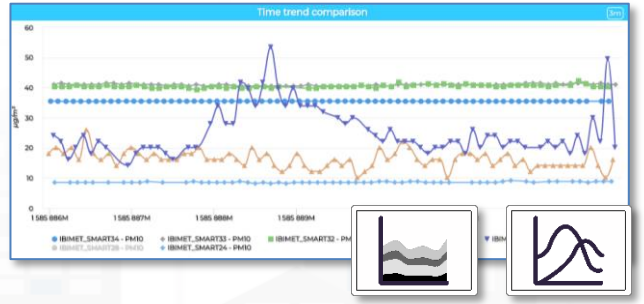


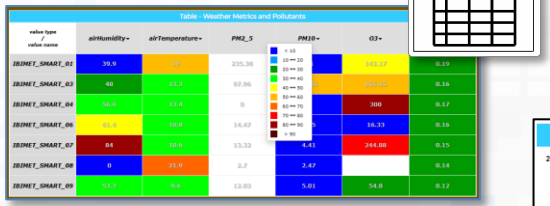


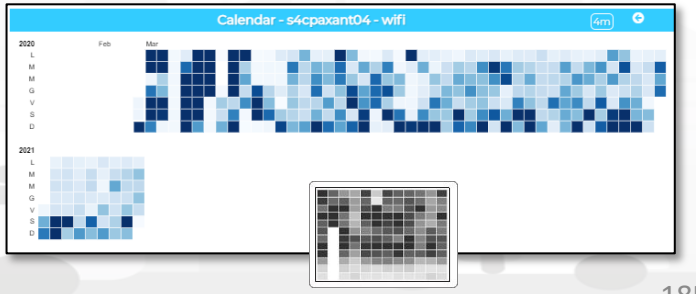




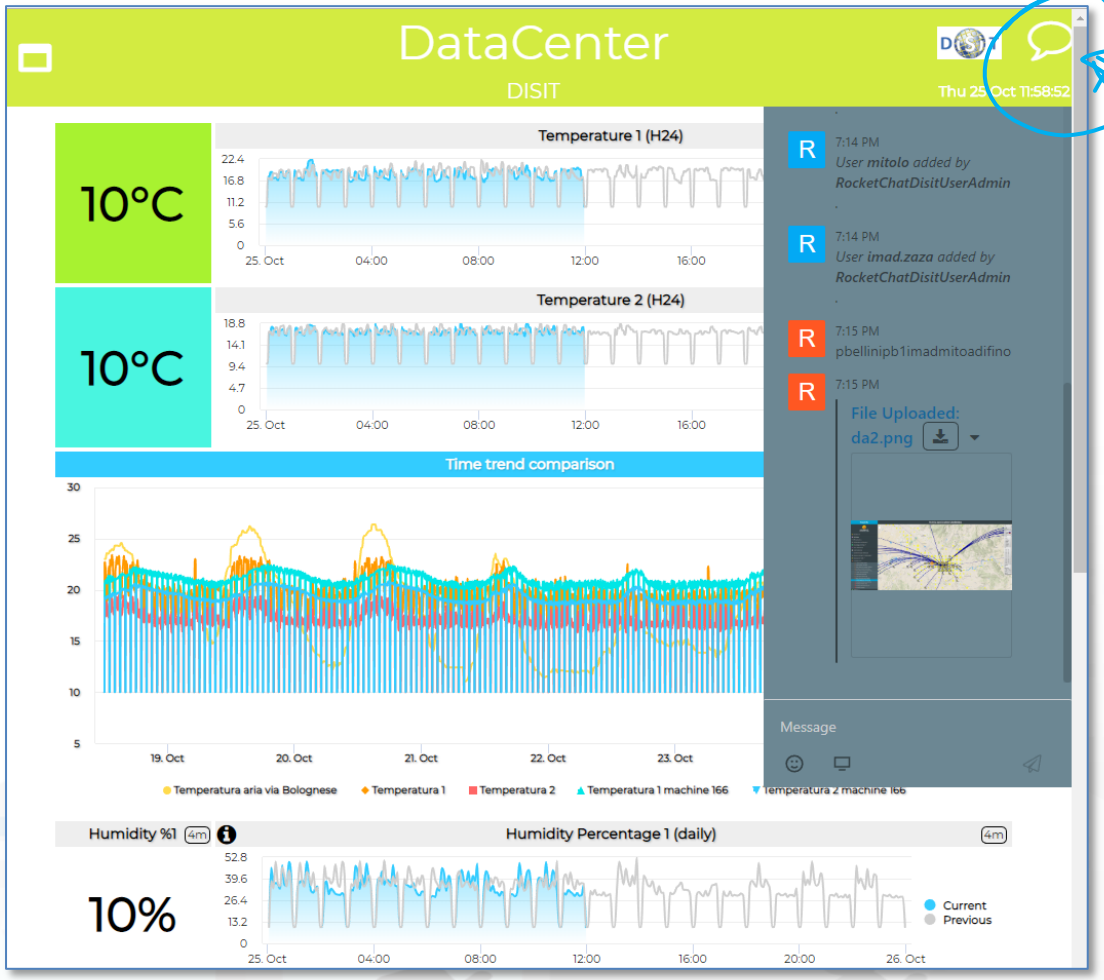




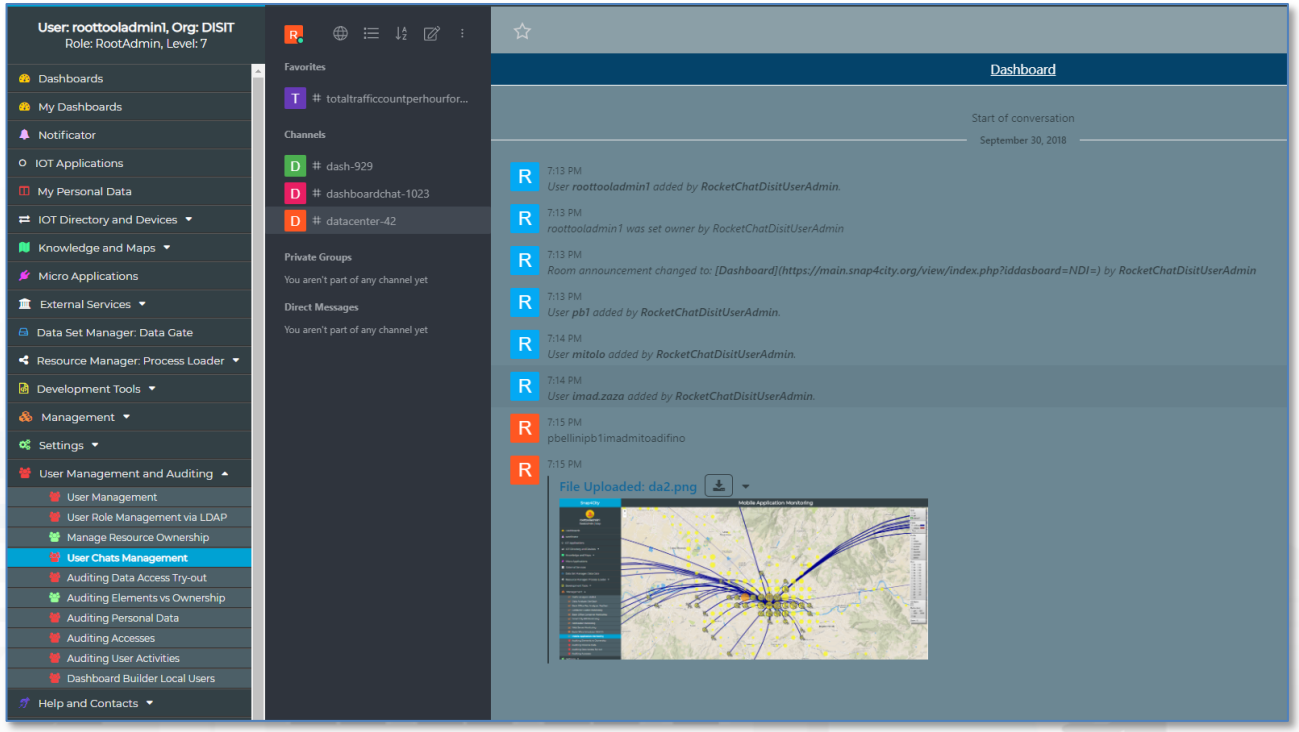




Private ChatRoom per Dashboard



Chat Management



IOT Network Interoperability

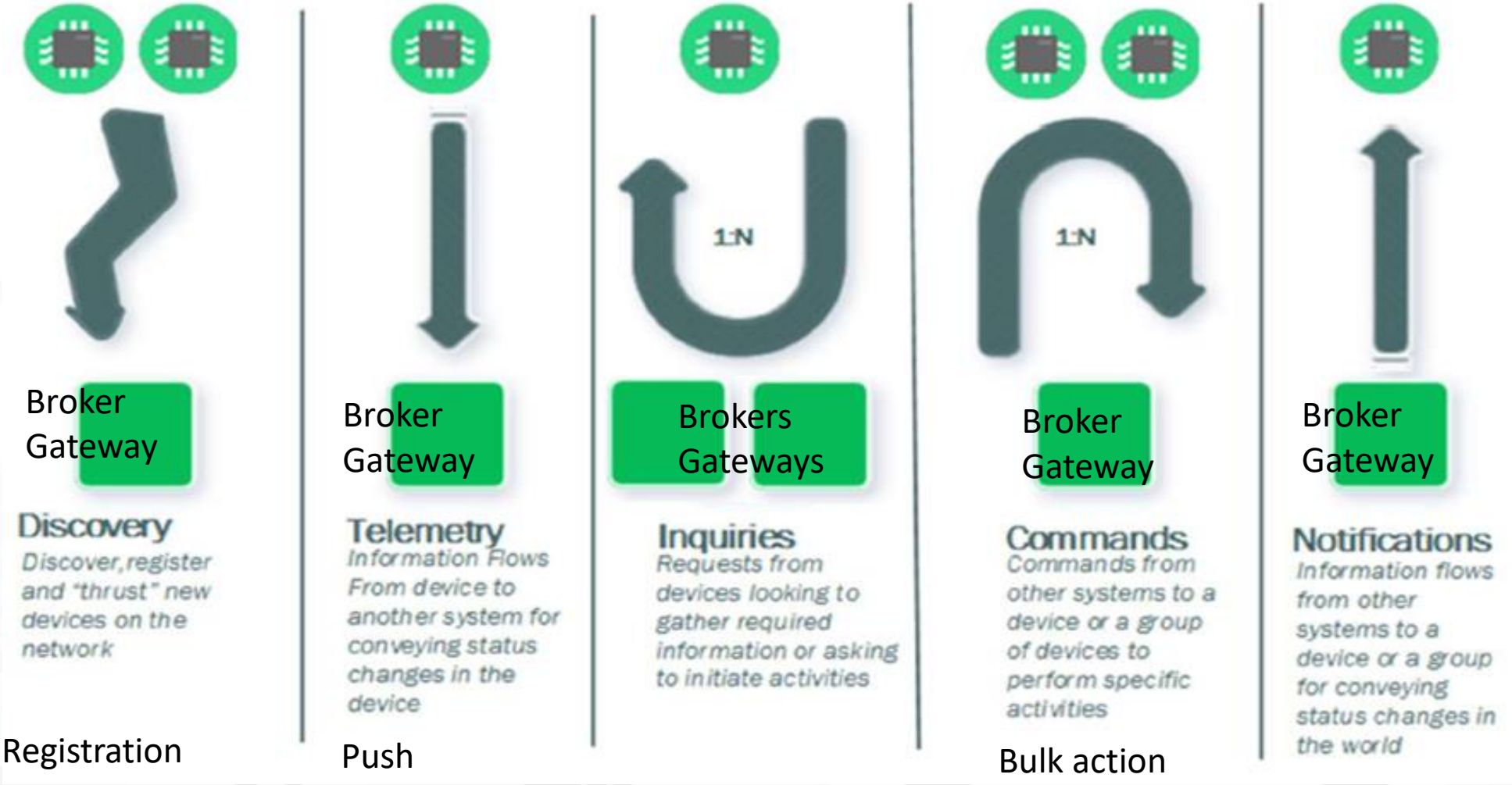
IOT Interoperability

Compliant with: AMQP, COAP, MQTT, OneM2M, HTTP, HTTPS, TLS, Rest Call, SMTP, TCP, UDP, NGSI, LoRa, LoRaWan, TheThingsNetwork, SigFOX, DATEX II, Telegram, SMS, WebSocket, WebSocket Secure, ModBUS, OPC, GML, RS485, RS232, XML, JSON, CSV, GeoJSON, ESP32, Libelium, IBIMET/IBE, OBD2, XLS, XLSX, KNX, Enocean, Zigbee, DALI, ISEMC, Alexa, Sonoff, HUE Philips, Tplink, BACnet, TALQ, Protocol Buffer, etc.

Node-RED
JS Foundation
FIWARE Open APIs for Open Minds
E015 digital ecosystem
bee smart city
sigfox partner network
ckan
GJL
LABGEO
esri Italia THE SCIENCE OF WHERE
EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

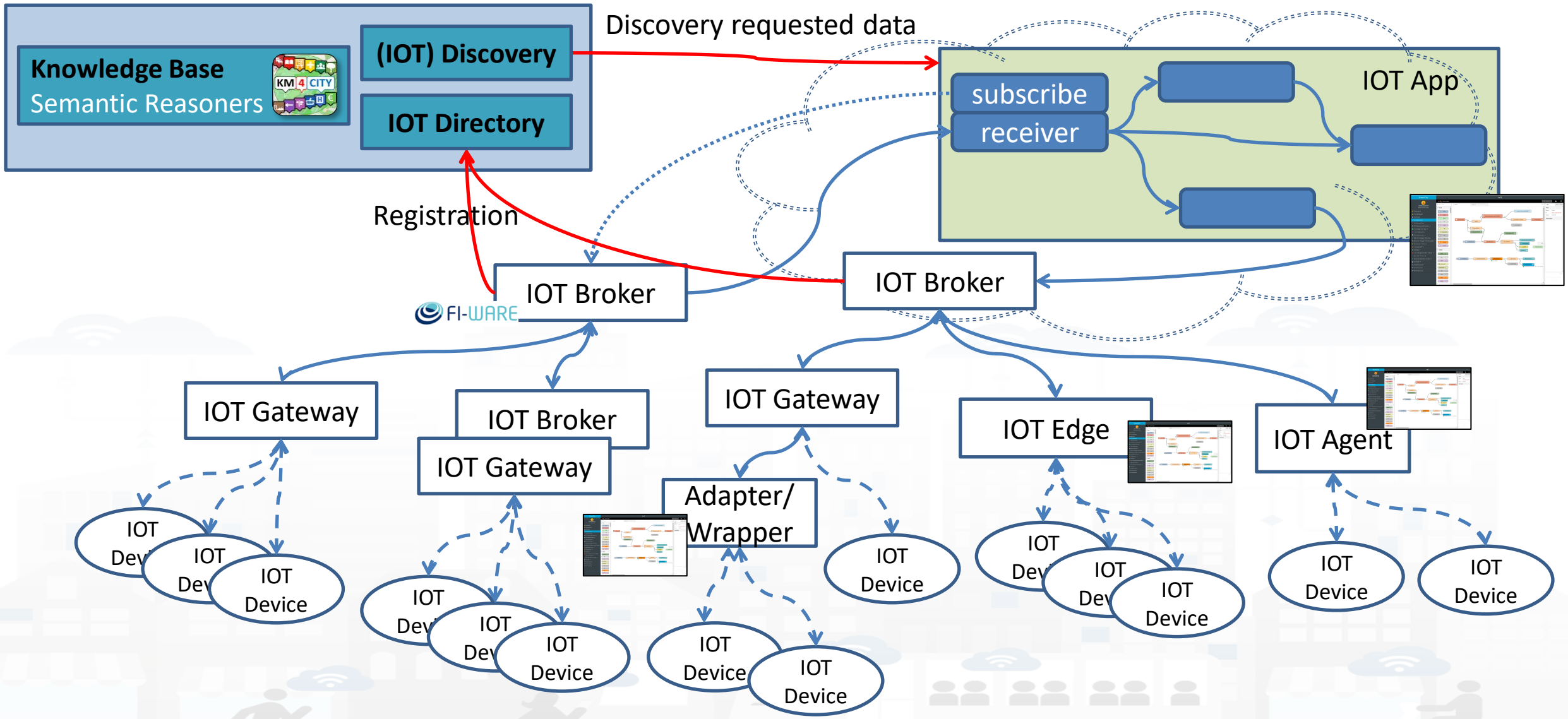
IOT/IOE Protocols

Communication Patterns



- MQTT
- HTTP(s)
- AMQP
- COAP
- NGSI
- OneM2M
- WebSockets
- ……..
- Etc.

IoT Network


Knowledge Base
Semantic Reasoners
(IOT) Discovery
IOT Directory
Discovery requested data
Registration
subscribe
receiver
IOT App
FI-WARE
IOT Broker
IOT Broker
IOT Gateway
IOT Broker
IOT Gateway
IOT Gateway
Adapter/
Wrapper
IOT Edge
IOT Agent
IOT Device

IOT Network Manager vs Final User

Network of IOT Brokers

IOT Broker

External

Internal

IOT Directory

IOT Network Manager

My IOT Device

Register

Registering

Discovering

Knowledge Base, Km4City

Knowledge and Storage Data from the Field and City

Browsing

ServiceMap Knowledge Base

Discovering

IOT Application

Final user Manager

Dashboard Wizard

Prepare

Deep Manage

Exploit

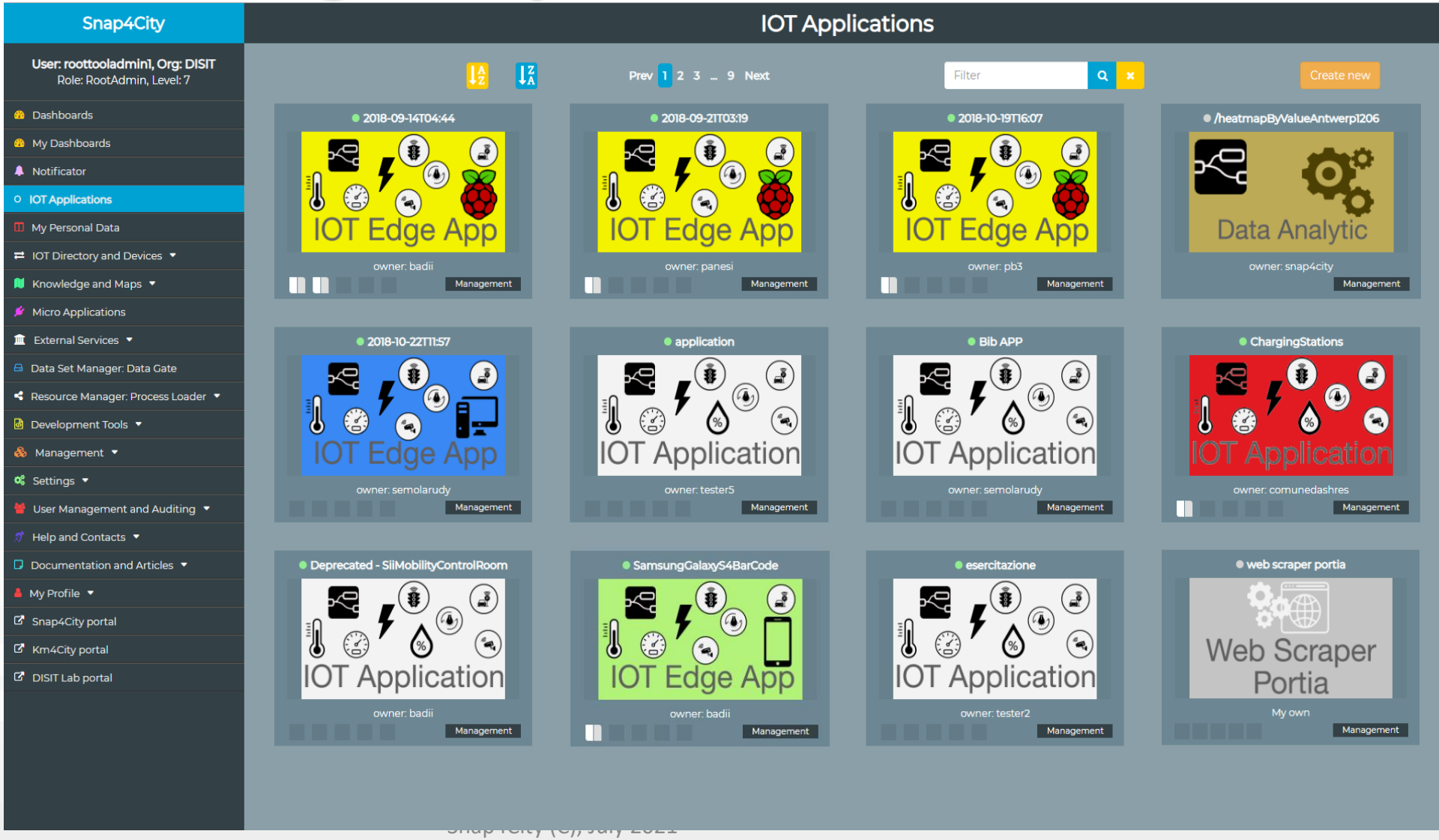
IOT Directory Features vs Users Roles

Entities	what	By using IOT Directory and:	Manager	AreaManager	ToolAdmin/ RootAdmin	IOT App microservices
IOT Sensor/Actuator	Browse, use	Several Tools	X	X	X	Yes
	Delegate	API, ..	X	X	X	
	Discovery	KB, API, ..	X	X	X	Yes
IOT Devices	Browse, use	Several Tools	X	X	X	Yes (use)
	Create, change, delete	API, ..	X	X	X	Yes
	Register in Bulk	API, ..		X	X	Yes
	Delegate, Change Owner	API, ..	X	X	X	Yes
	Discovery	KB, API, ..	X	X	X	Yes
IOT Device Model	Browse, Use		X	X	X	
	Create, change, delete			X	X	
	delegate, change ownership			X	X	
IOT Broker	Browse, use		use	Browse, use	X	Yes (use)
	Register/change/Delete				X	
	Delegate				X	
	Periodic Update				X	

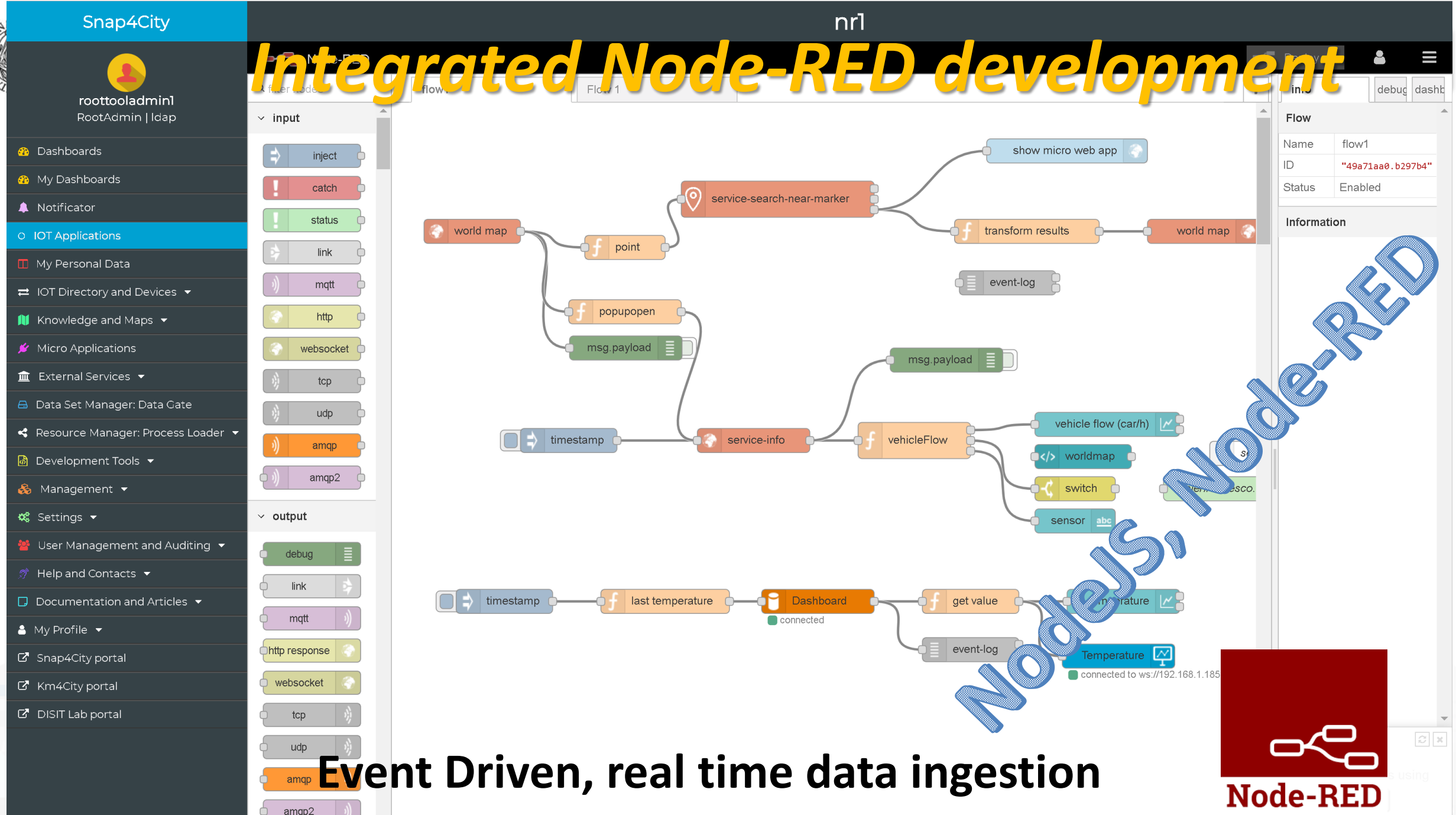
Integration via IoT Apps and processes

IOT Application Listing, they can be

- Basic (white)
- Advanced (red)
- IOT Edge
  - Raspberry Pi
  - Android
  - Win/Linux
- Data Analytic (Plumber)
- Web Scraper (Portia)



Integrated Node-RED development



Event Driven, real time data ingestion

IoT Applications

- **Data ingestion**: more than 70 protocols IOT and Industry 4.0, web Scraping, external services, any protocol database, etc.
- **Data access**: save/retrieve data, query search on expert system, georeverse solution, search on expert system Km4City ontology, etc.
- **Data Transformation/transcoding:** binary, hexadecimal, XML, JSON, String, any format
- **Integration**: CKAN, Web Scraping, FTP, Copernicus satellite, Twitter Vigilance, Workflow OpenMaint, Digital Twin BIMServer, any external service REST Call, etc.
- **Manipulation of complex data**: heatmaps, scenarios, typical time trend, multi series, calendar, maps, etc.
- **Access to Smart City Entities and exploitation of Smart City Services**: transport, parking, POI, KPI, personal data, scenarios, etc.
- **Data Analytic**: managing Python native, calling and scheduling Python/Rstudio containers as snap4city microservices (predictions, anomaly detection, statistics, etc.)
- **User interaction on Dashboard**: get data and message from the user interface, providing messages to the user (form, buttons, switches, animations, selector, maps, etc.)
- **Custom Widgets**: SVG, synoptics, animations, dynamic pins on maps, etc
- **Event management**: Telegram, Twitter, Facebook, SMS, WhatsApp, CAP, etc.
- **Hardware Specific Devices**: Raspberry Pi, Android, Philips, video wall management, etc.

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Two Snap4City Libraries

SNAP4CITY | Node-RED

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

- common
- function
- network
- input
- output
- sequence
- parser
- storage
- social
- advanced
- Advanced FTP
- location
- NGSI
- lwm2m
- S4C SearchDev
- S4CUtility
- S4CMapping
- S4CManagement
- S4CDataAnalytic
- S4CBigData
- S4CIOTApp
- S4COpenMaint
- S4CIoT
- S4CWhatIf
- S4C Search
- S4CData
- S4CKPIData
- S4CDashboard
- S4C Sigfox
- S4CLogDev
- S4CView
- S4C Social
- dashboard
- time

S4C SearchDev

service search
service search near gps position
service search near service
service search within gps area
service search within wkt area
service search within stored wkt area
service search by municipality
service search by queryid
full text search dev
full text search within wkt area
full text search within gps area
full text search near gps position
full text search exp
event search dev
event search exp
event search within wkt area
event search within gps area
event search near gps position
address search near gps position
geometry search near gps position
address poi search by text
address poi search by text exp
address poi search by text near gps position
bus routes search
bus routes search near gps position
bus routes search within gps area
bus routes search within wkt area
tpl routes
tpl stops

S4CUtility

service info dev
distance from coordinates

point within polygon
routing
heatmap picker
coordinates to address
service info
edge-tunnel-to-cloud

S4CMapping

service info mapped
mapping
set mapping
check exist job
check exist trigger
is in standby mode
is shutdown
is started
get currently executing jobs

get job detail
get triggers of job
get job group names
get trigger group names
get paused trigger groups
get job fire times
get system status
trigger job
pause all
pause trigger
pause triggers
resume all
resume job
resume jobs
resume trigger
resume triggers

notificator history events

S4CDataAnalytic

descriptive statistics
trend plot
time series predictions
machine learning predictions
anomaly detection
plumber data analytic
python data analytic

insert
datagate search
datagate create
portia crawler

S4CIOTApp

iotapp restart
iotapp upgrade
ownership

S4C Search

service search near marker
service search within circle
service search within polygon
service search along path
full text search within circle
full text search within polygon
full text search along path
full text search usr
event search near marker
event search within circle
event search within polygon
event search along path
event search usr
address search near marker
geometry search near marker
address poi search by text usr
address poi search by text near marker
address poi search by text within circle
bus routes search near marker
bus routes search within circle
bus routes search within polygon
tpl agencies
tpl lines

tpl routes by agency
tpl routes by line
tpl stops by route
tpl stop timeline
recommendatio within circle
value type search near marker
value type search within circle
value type search within polygon
value type search along path

S4CData

get my data
get my delegator
get my delegated
get my activity

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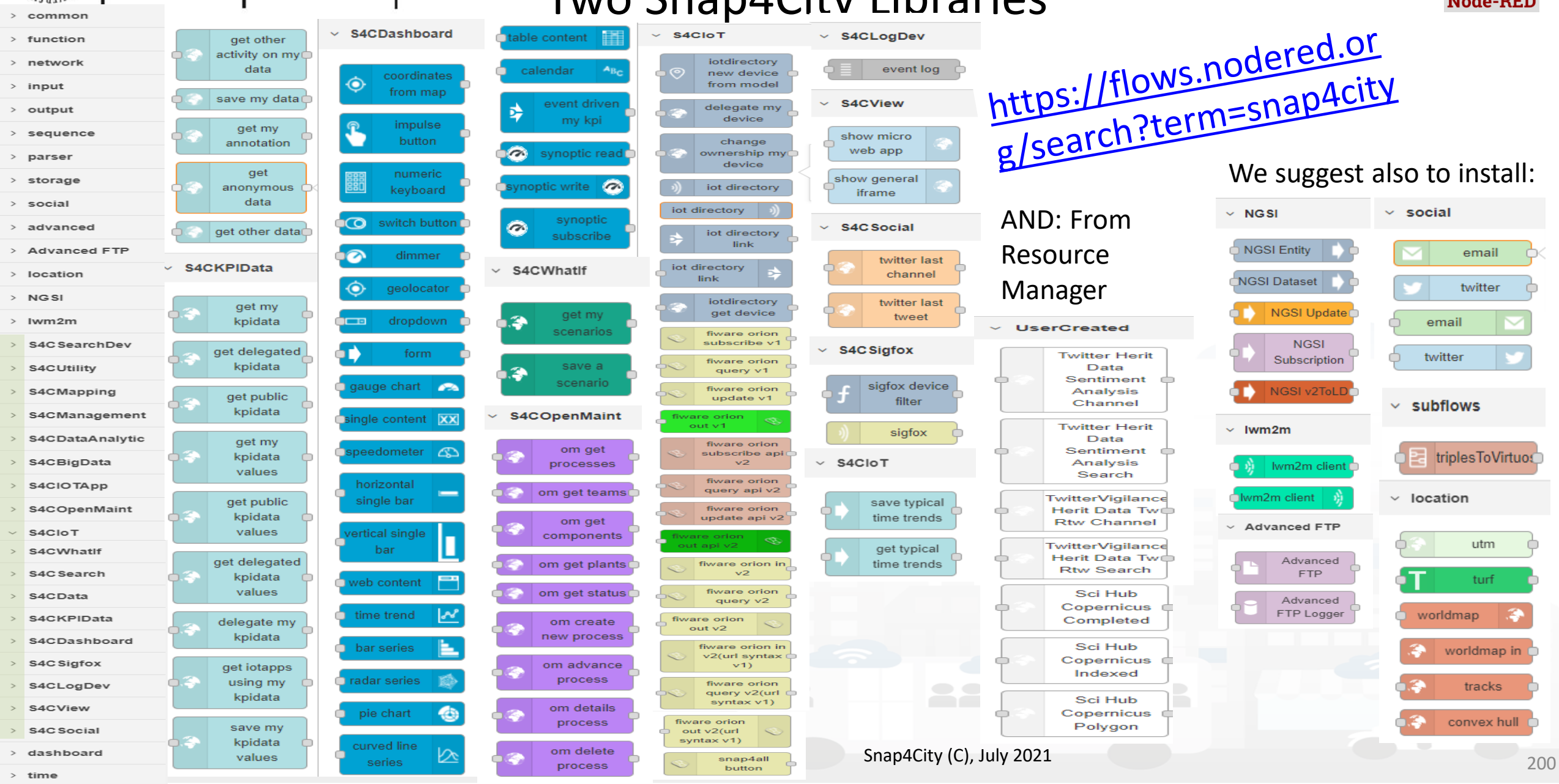
Two Snap4City Libraries

SNAP4CITY | Node-RED

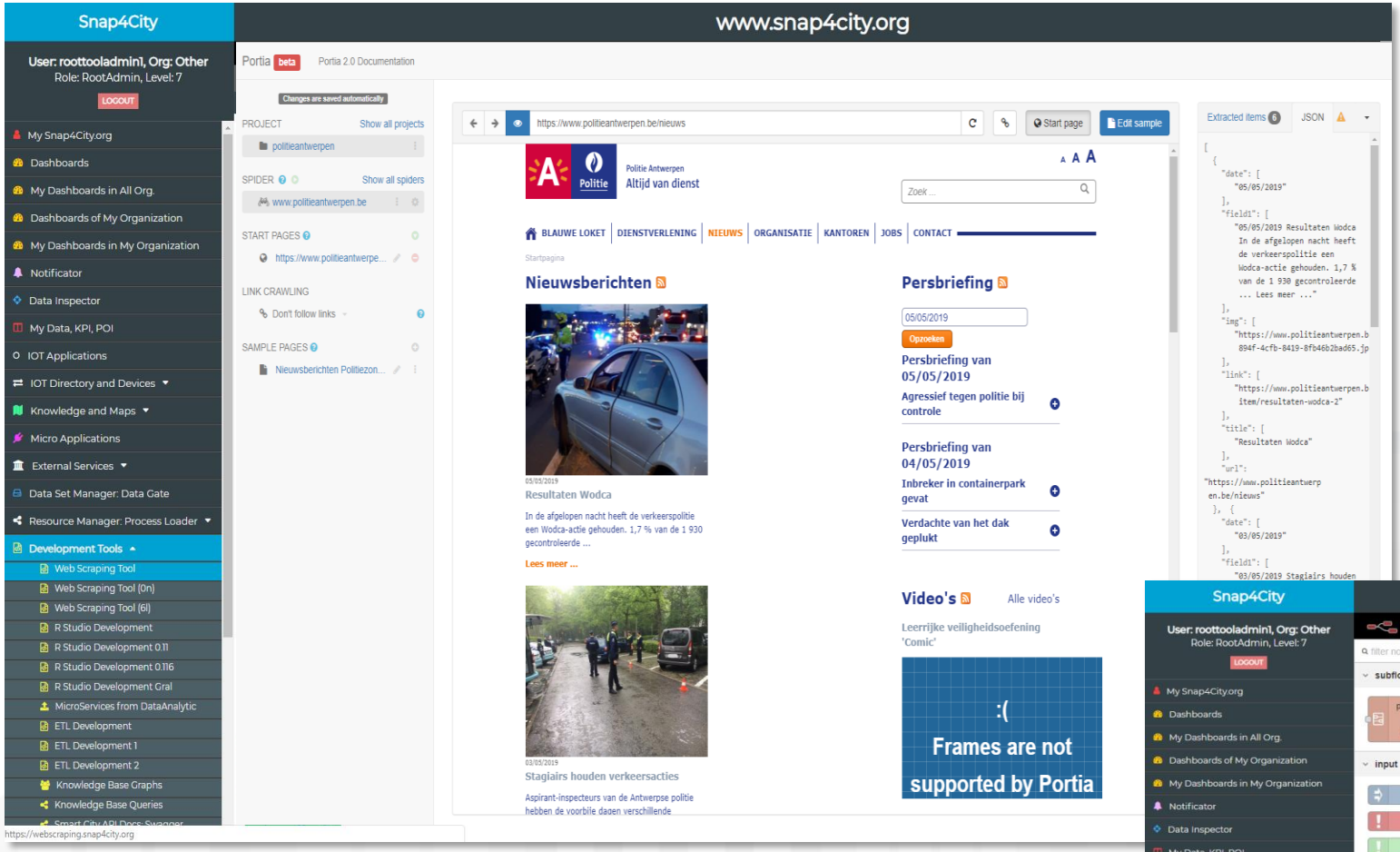
https://flows.nodered.org/search?term=snap4city

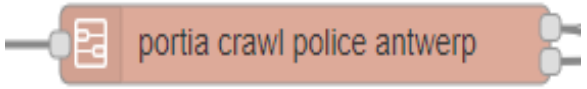
We suggest also to install:

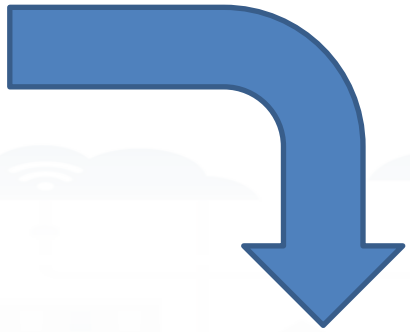
AND: From Resource Manager

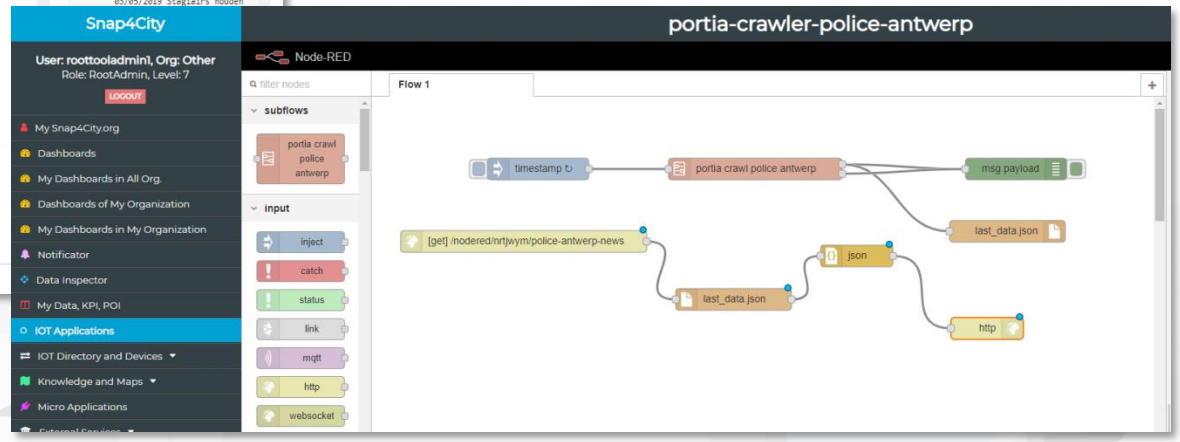


Web Scraping





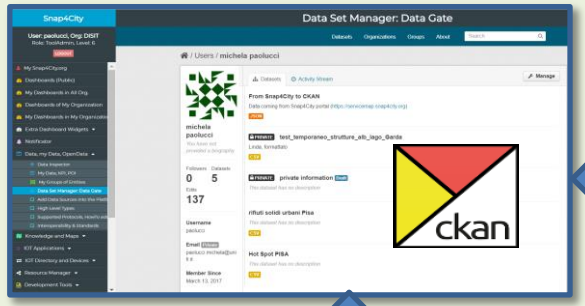




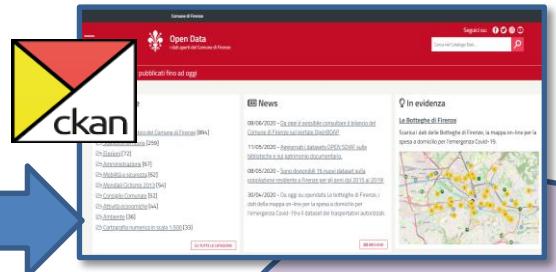
Snap4City vs CKAN

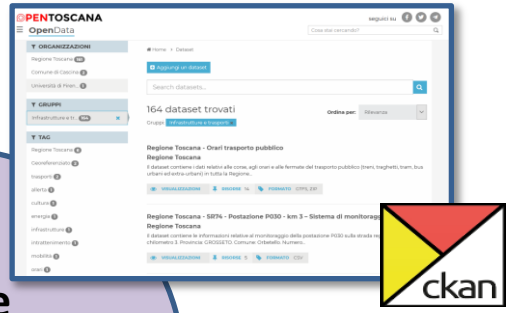
Snap4City Portal and Integrated tools

Datagate



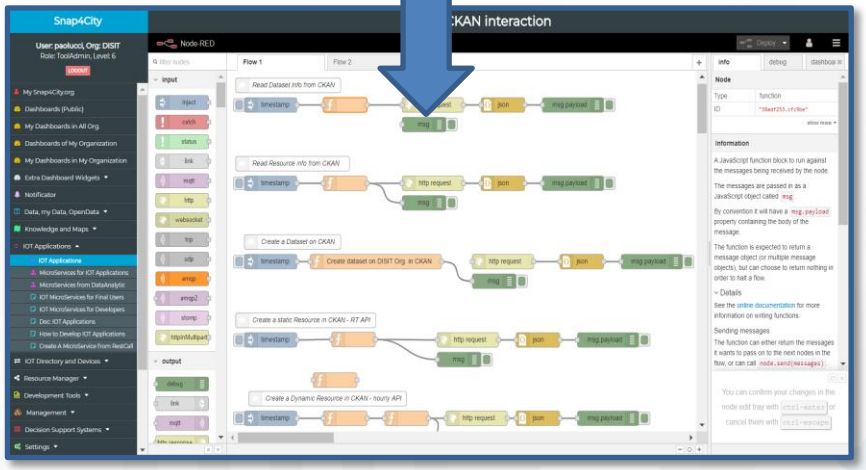
Harvesting and Publishing

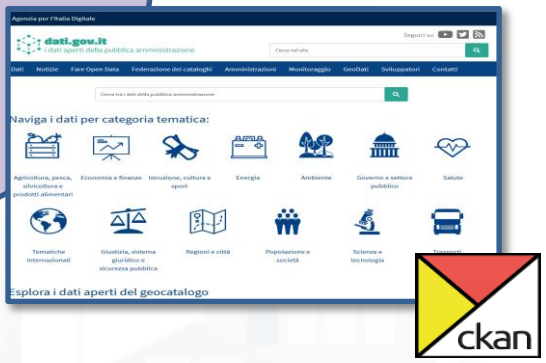




Open or Private External CKAN Data Portals

Advanced Snap4City APIs and Micro Services

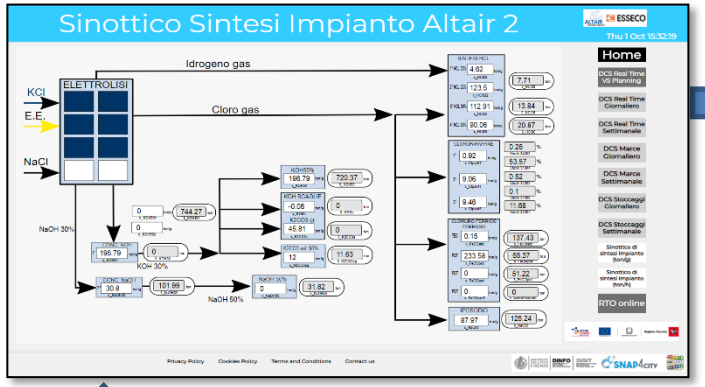




Automatize:

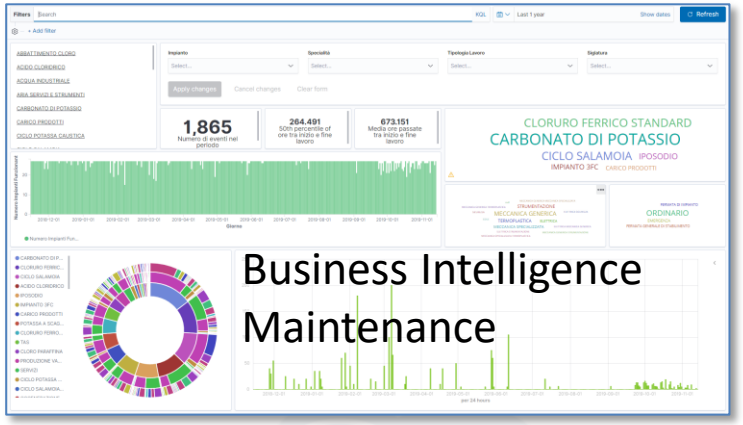
- Import data from CKAN to Snap4City
- Upload Public Data from Snap4City to CKAN
- Data Harvesting
- Dashboards and Mobile/Web Apps creation

Example of Integrated workflow

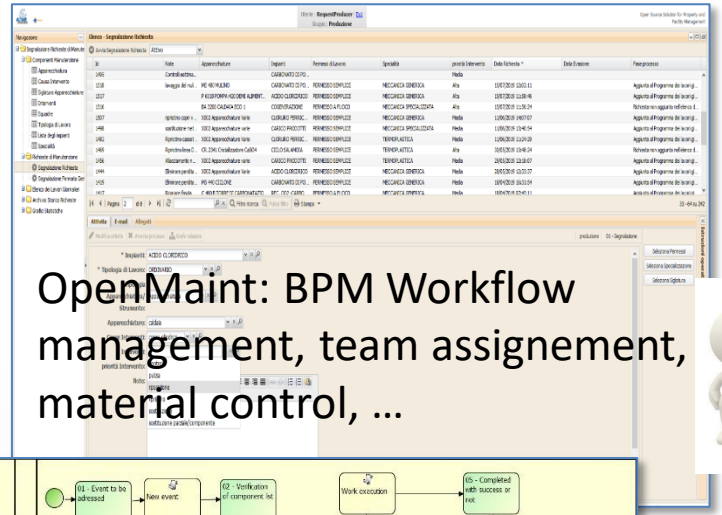


Dashboards and actions

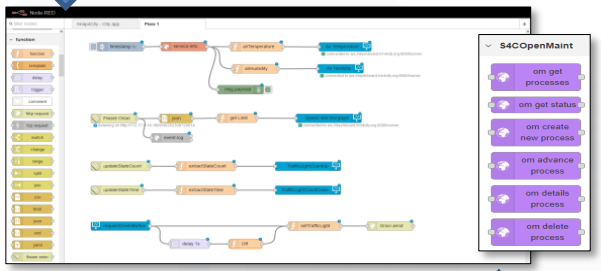
Consumptions/productions



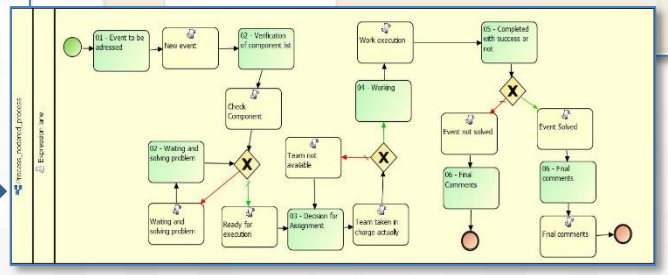
Events/actions

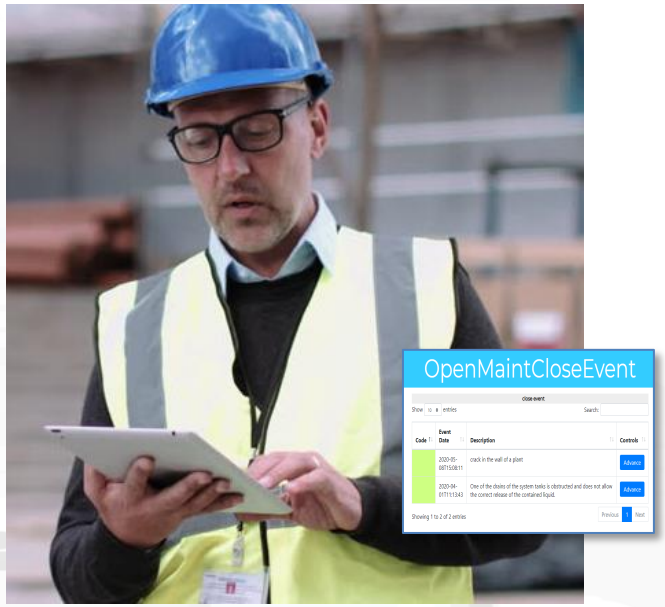


OpenMaint: BPM Workflow management, team assignement, material control, …

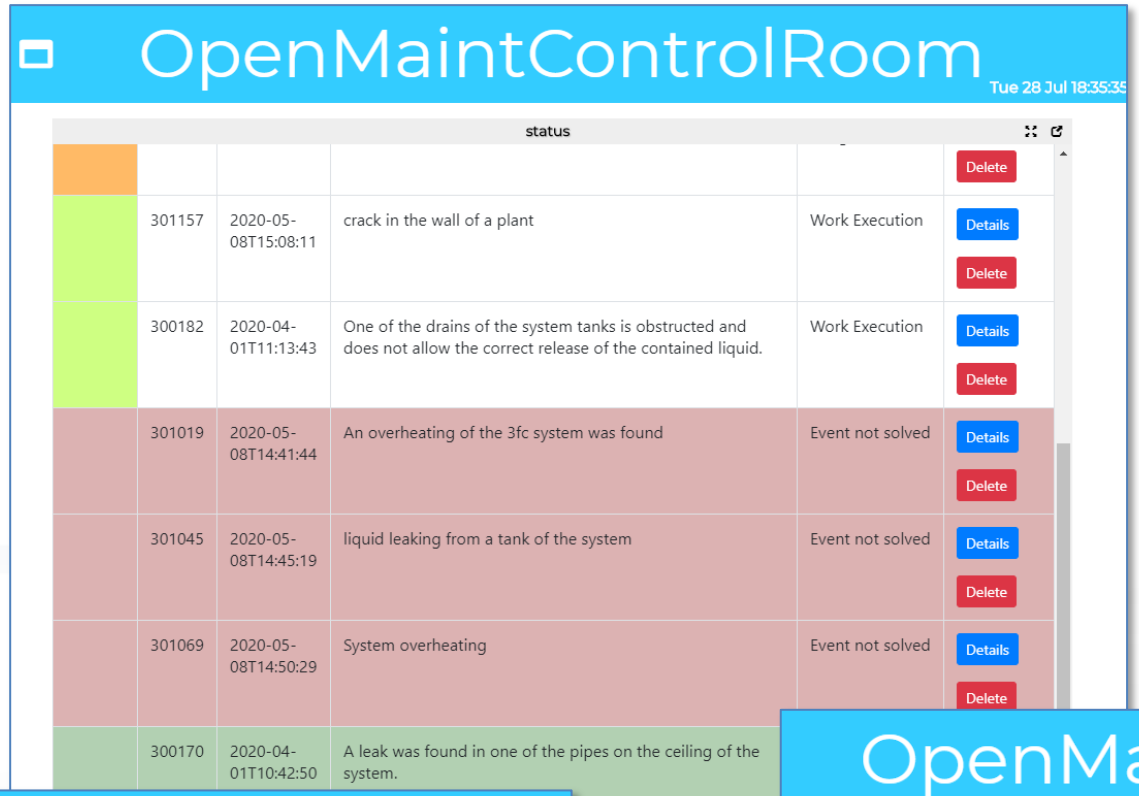


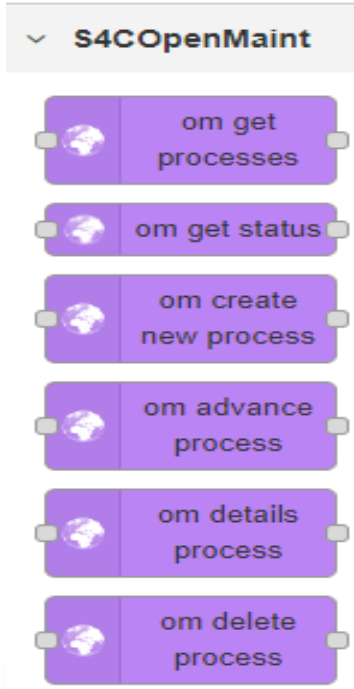
IOT App, Data event firing, event detection and firing Critical event management

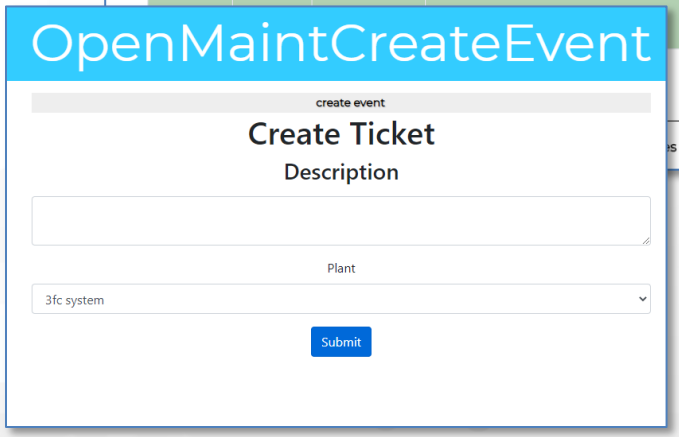


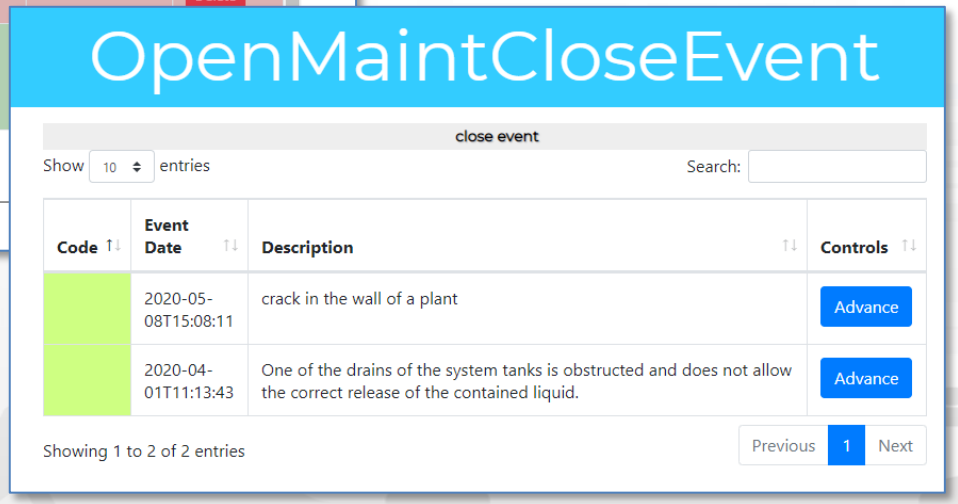


Dashboards



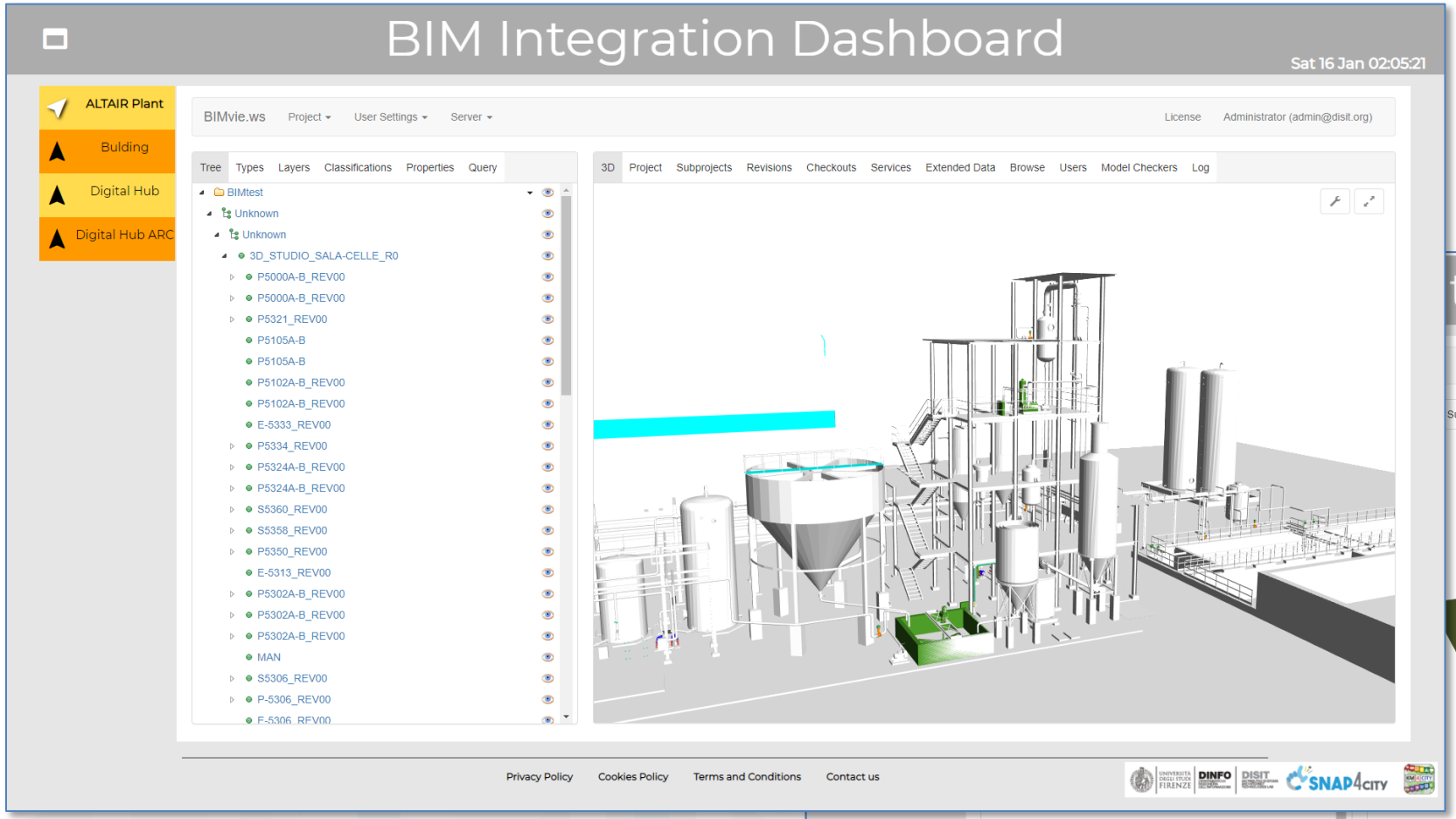


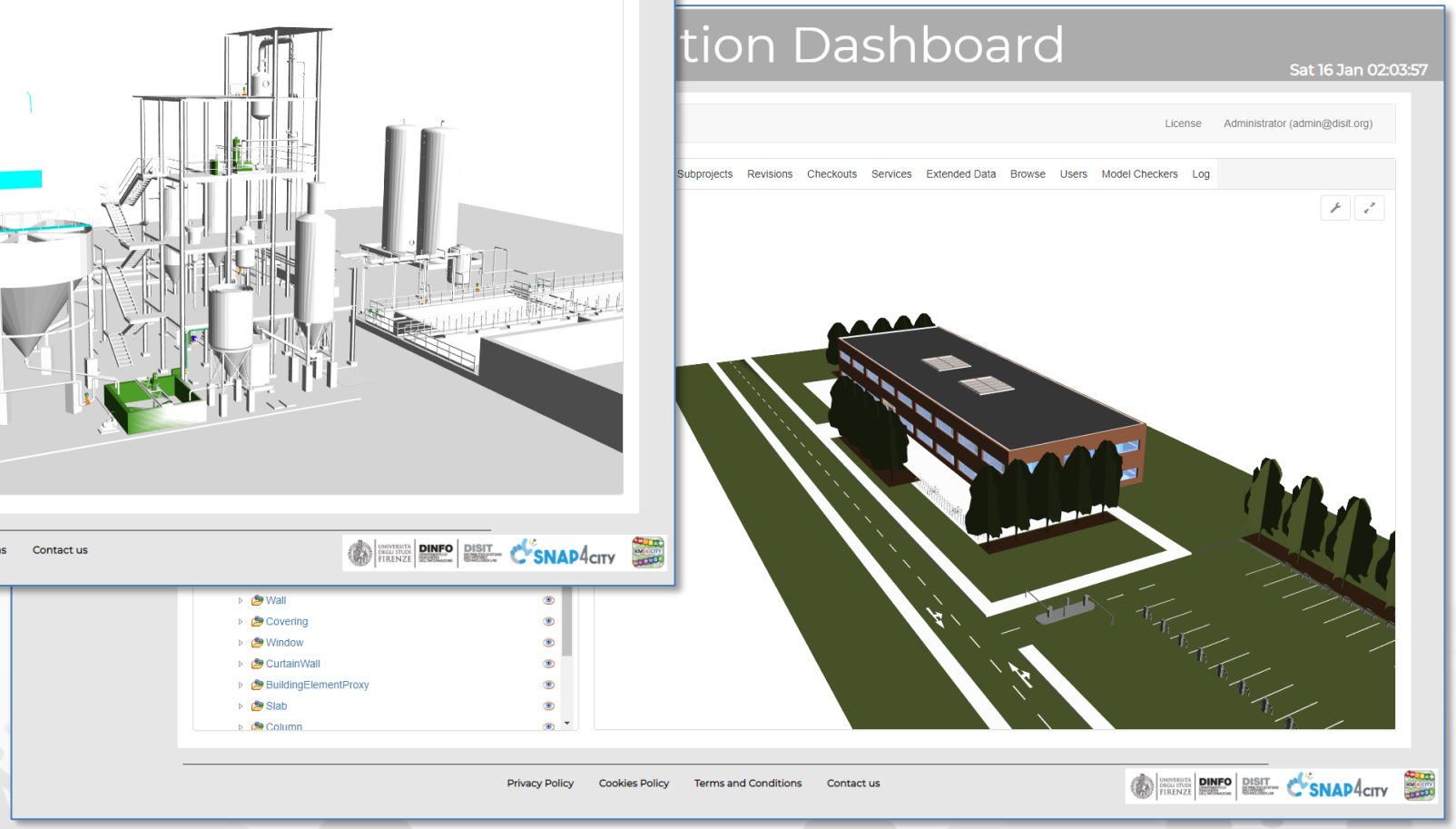




- **Snap4City can**
  - Create new tickets
  - Manage steps, workflow
  - Collecting feedbacks and results from teams
  - Manage all phases of the workflow on the fields via IOT Apps and logics
  - The integration if via API and MicroServices into IOT App.

BIM Server

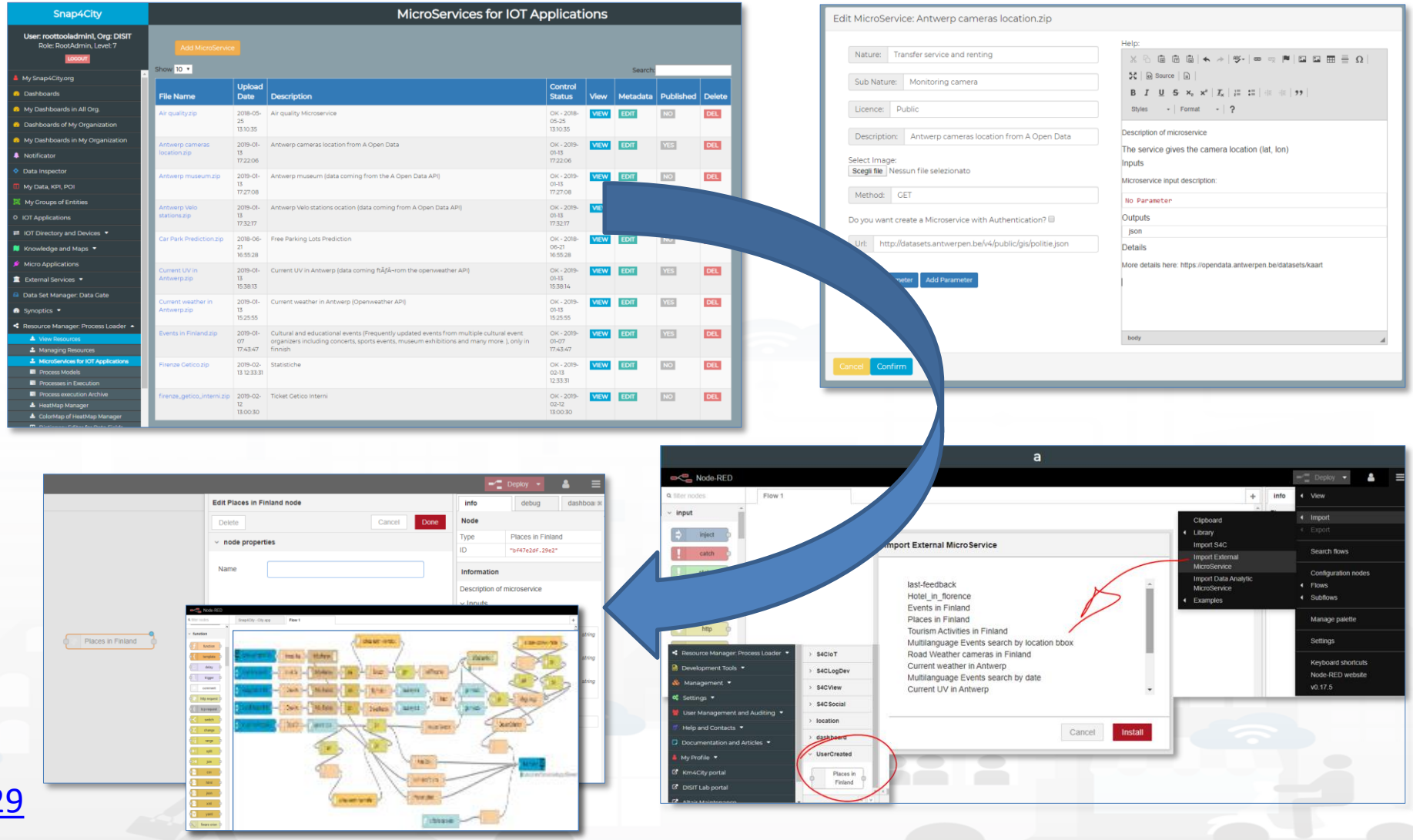




https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzA1NA==

External REST Call API vs MicroServices

- Each Rest Call API can be automaticaly transformed into e MicroService for the IOT Applications



https://www.snap4city.org/129

Integration via IoT Apps on IoT Edge

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https://www.snap4city.org/369

SNAP4CITY KM4CITY

Measuring any kind of sensors values

Controlling Energy Power

Measuring
Energy Consumption

Any kind of notification channel

IOT Edge:
Node-RED
+
Snap4City

Local Control

Modbus

SCADA

OPC UA

DCS

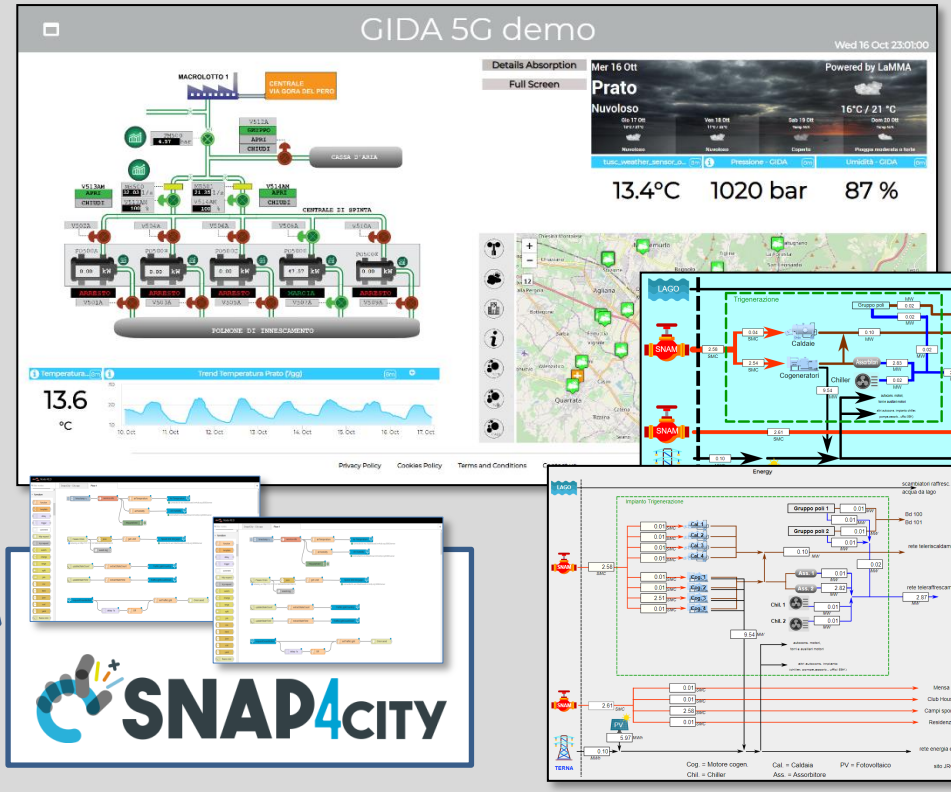
PLC

ODBC

Administrative Servers

Alexa: Voice Commands

Contextual (smart city/home) data, Data Analytics
Historical Data, Remote Control, Mobile App



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Snap4Home

SNAP4CITY | KM 4 CITY

Sonoff: Controlling Energy Power

Philips Hue: Controlling Lights

Hue: Motion Control / Alarm

Measuring Energy Consumption

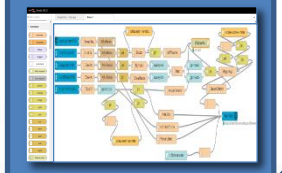
TP Link: Controlling / Measuring Energy Plugs

Alexa: Voice Control

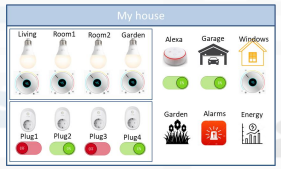
WiFi

IOT Edge:

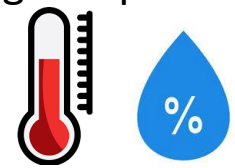
Raspberry pi: Node-RED + Snap4City



Local Control



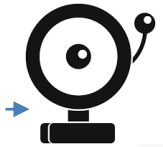
Measuring Temperature and Humidity



Garage Door

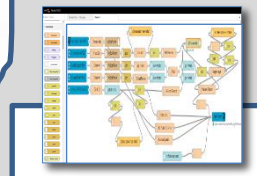
Window Roller Shutters

Controlling Motors

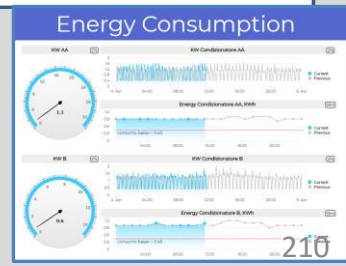


Alarm sound and light

Controlling Irrigators



SNAP4CITY



Environmental Contextual data from the city
Historical Data, Remote Control, Mobile App

https://www.snap4city.org/620

IOT Edge Device

Other Local Connections

IOT Brokers

IOT Brokers

HTTPS

HTTPS

Search and Query, Smart City API
Facet, semantic search

Knowledge base
Semantic reasoners

Indexing and aggregating
Elastic search

WiFi

Modbus

OPC UA

IOT Edge:
Node-RED + Snap4City

edge-tunnel-to-cloud

WSs

Firewall
Gateway
Towards internet

HTTPS

IOT Devices

Access to IoT Edge Maintenance

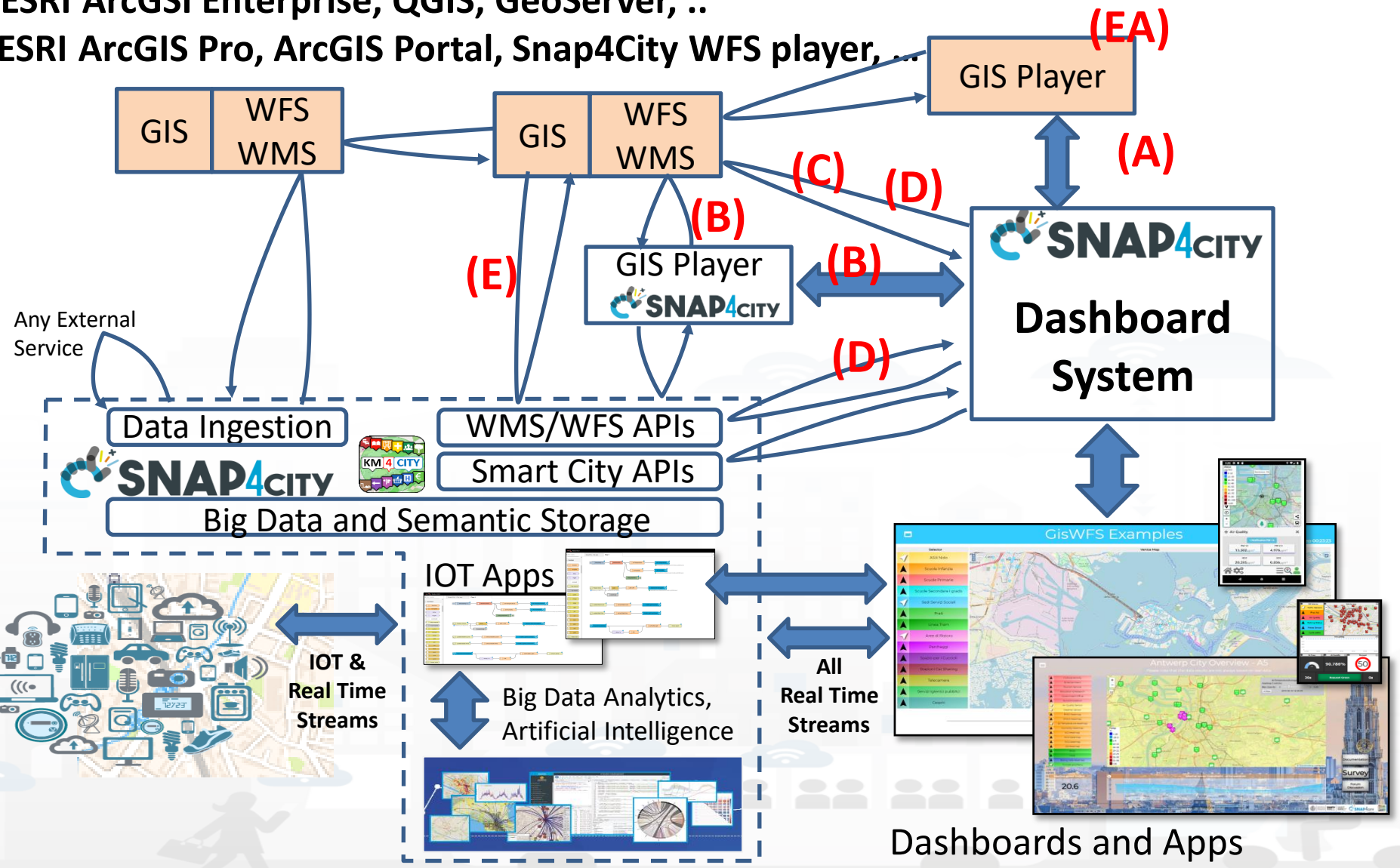
Remote Access/Control/program to your IOT Applications via secure connection

Integration with GIS and ArcGIS

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

GIS vs Sna4City

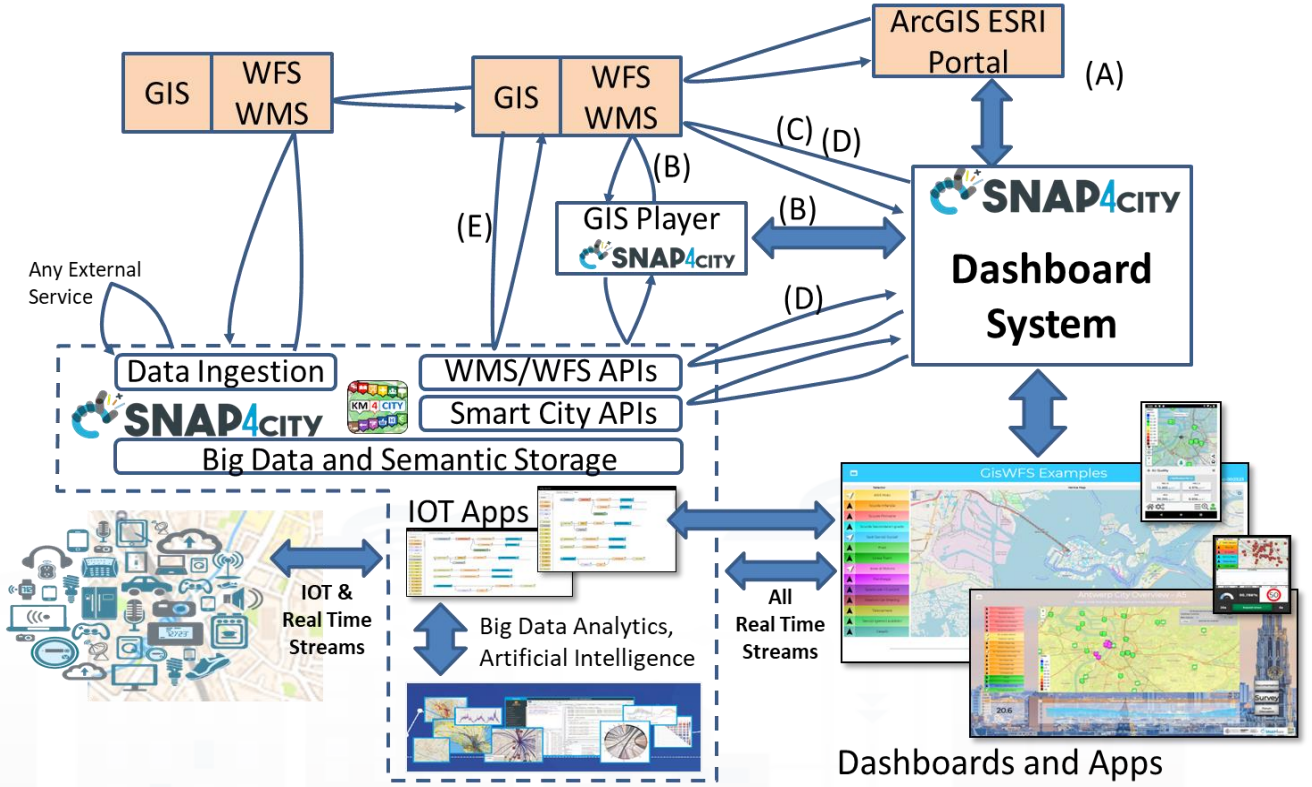
GIS Server can be: ESRI ArcGSI Enterprise, QGIS, GeoServer, ..
GIS Player can be: ESRI ArcGIS Pro, ArcGIS Portal, Snap4City WFS player, ...



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

Interoperability ESRI

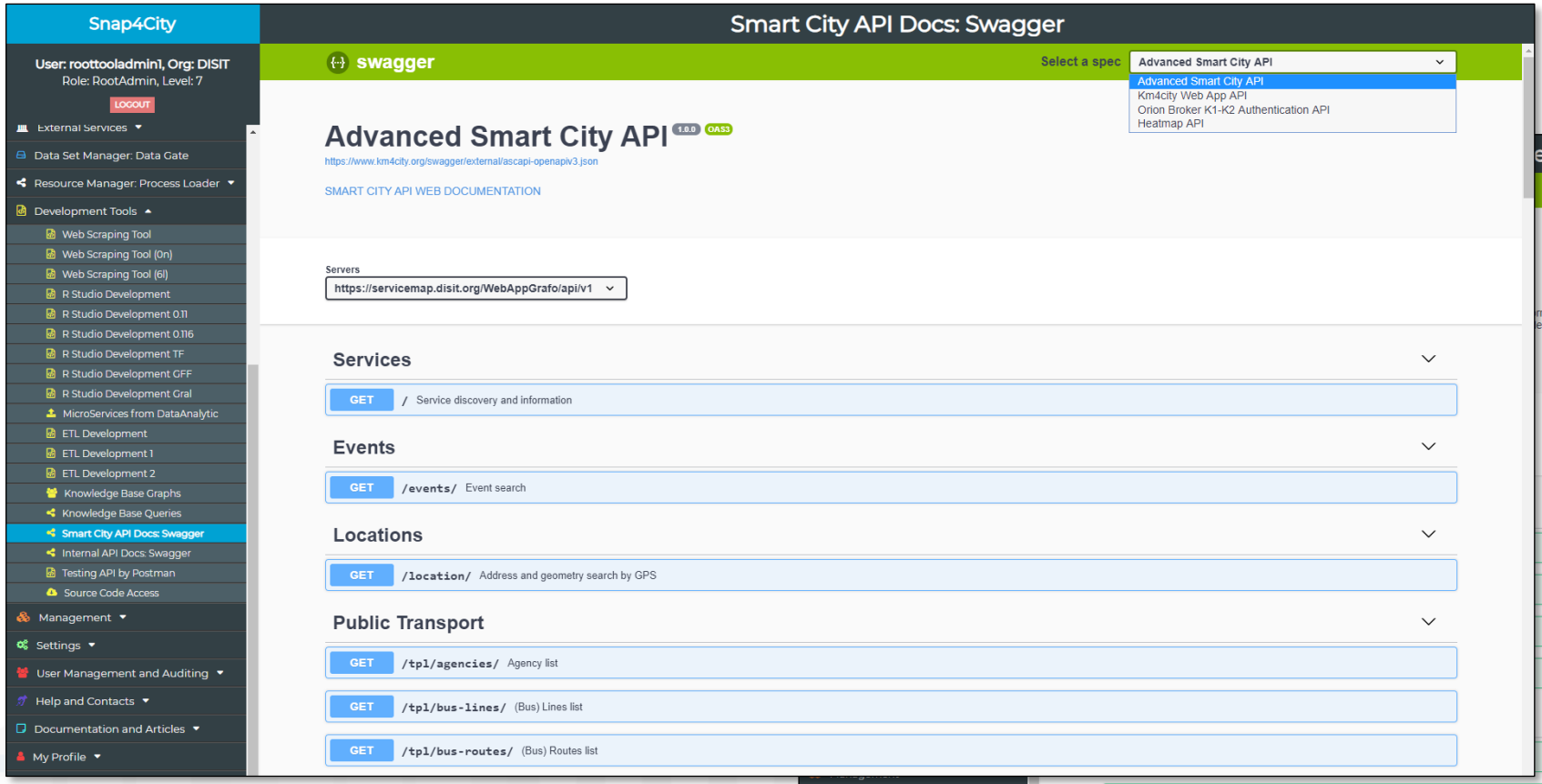
- **Snap4City is interoperable with**
  - ESRI ArcGIS Enterprise, Portal, Pro/MAP, ...
  - other GIS tools supporting WFS, WMS, GeoJSON, GML
- **Snap4City is interoperable since:**
  - **Provides** info/data in WFS, WMS
  - **Exploits** data/info from WFS, WMS
  - **Import** data/info from WFS/WMS

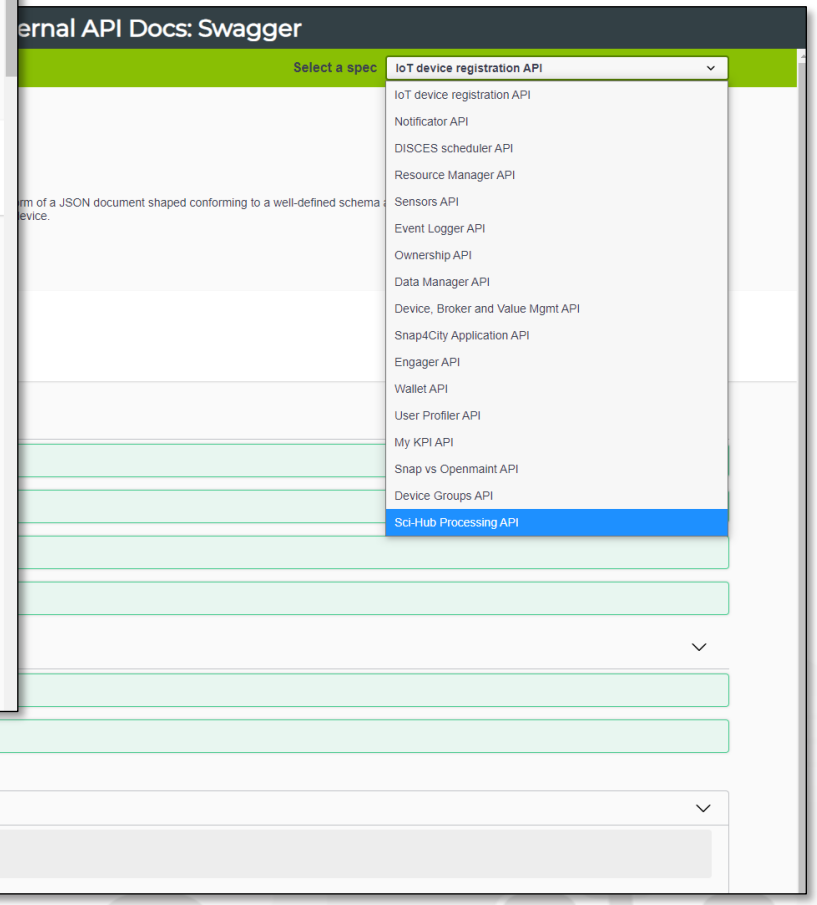


- The Snap4City platform can be installed on premise using **Snap4City Appliance** https://www.snap4city.org/drupal/node/471
  - **StartSNAP4CITYVM** includes the Dashboard Builder that is capable to work with WFS WMS protocols for the integration with GIS platforms as ESRI ArcGIS, QGIS, directly or using **Snap4City GIS player**.
  - **KBSSMVM** includes the Smart City API and WFS API which can be used to data harvest from any GIS servers and GIS desktop tool

API, and Federation of Smart Cities via API

Internal and External Smart City API

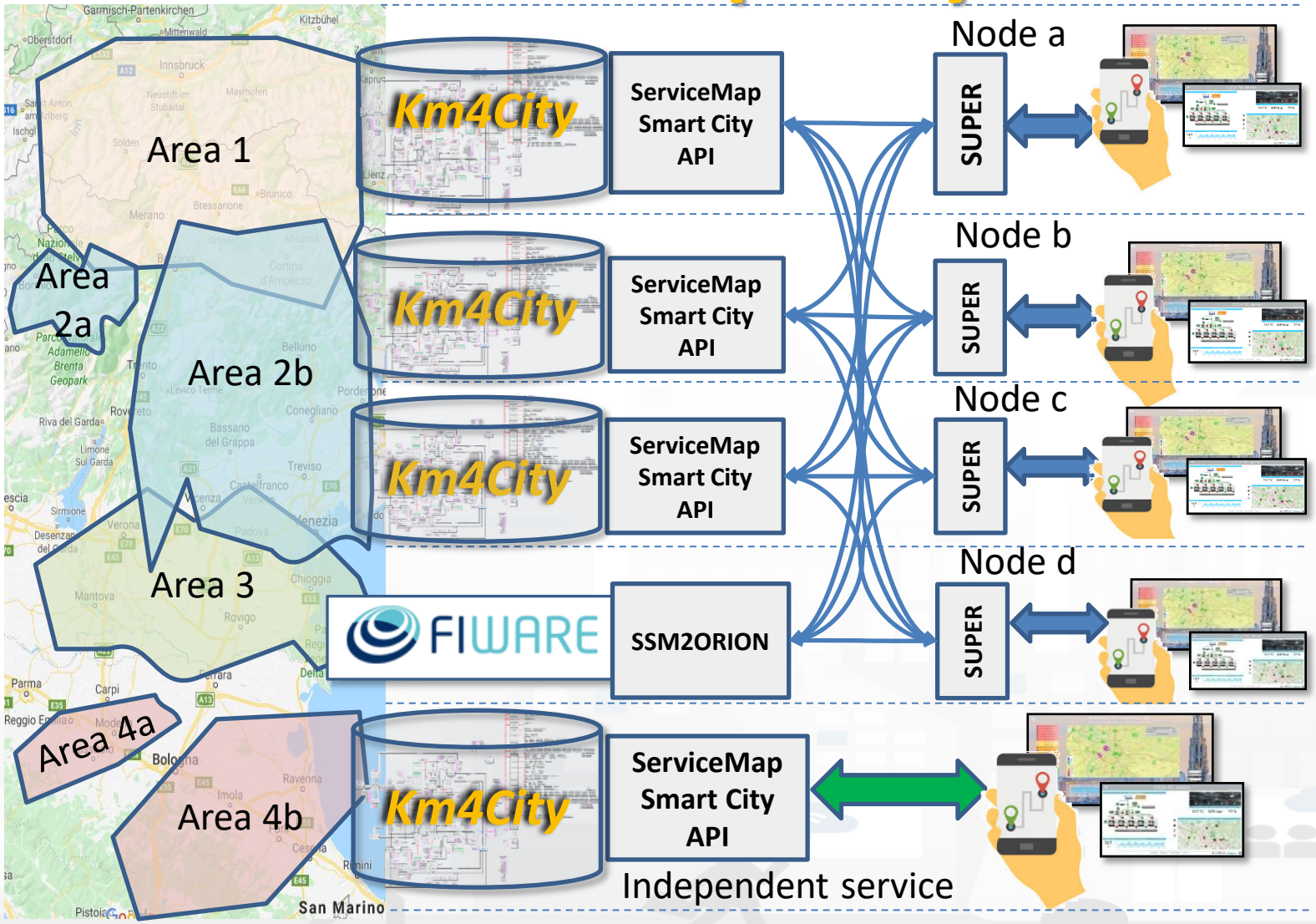




https://www.km4city.org/swagger/external/index.html

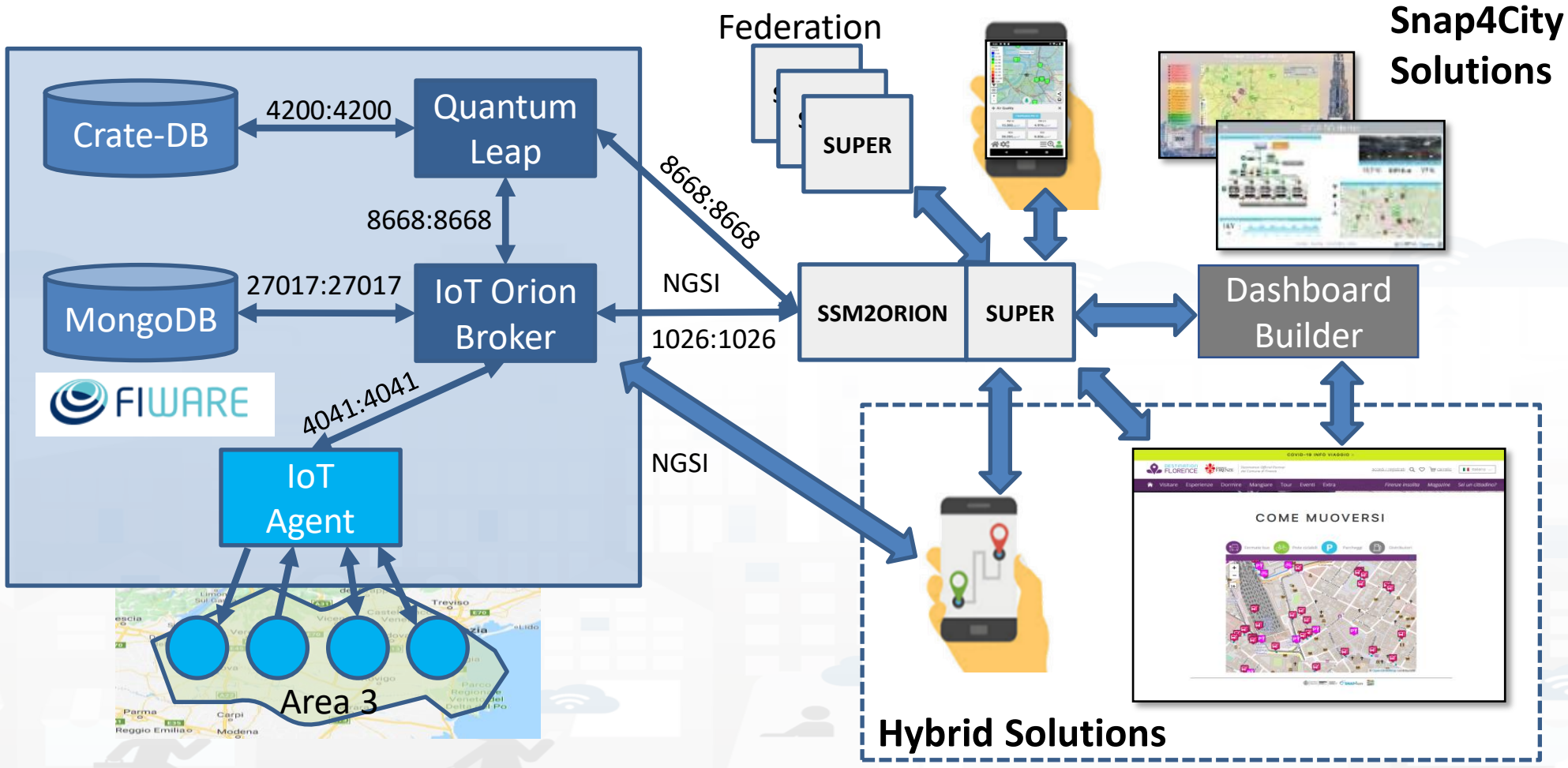
https://www.km4city.org/swagger/internal/index.html

Federation of Snap4City Services

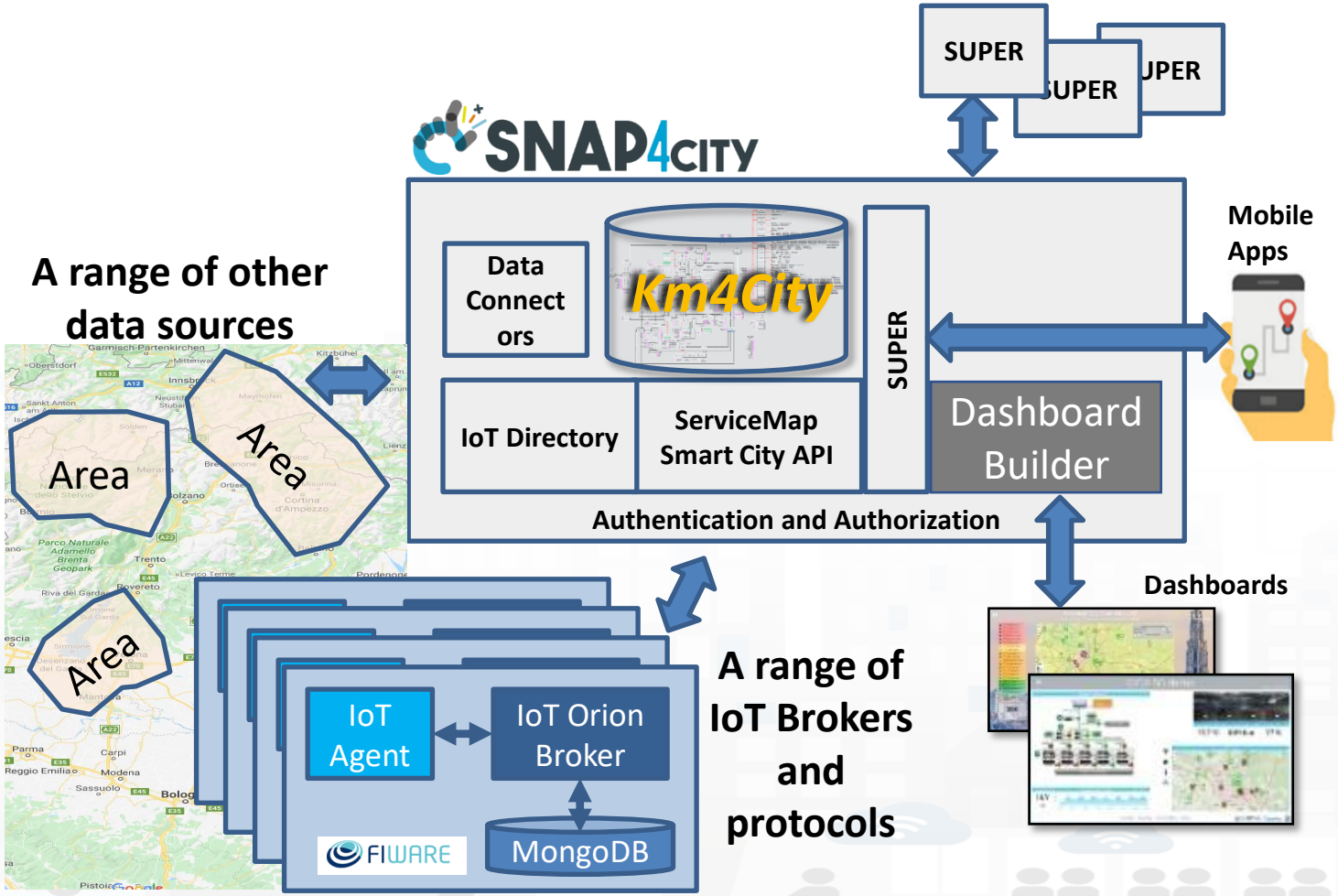


- A Mobile App may refer to one Smart City API Server (for Area 1) via SUPER and receive data from the Federated SUPERS (Area 2) if navigation, queries, etc. are leading to discover out of the addressed KB.
  - SUPER can be used for creating redundant and/or balanced distributed solutions for Federated KB. See Area 2, the two KB in the front.
  - Federated SUPER can have overlapped KB even totally.
  - A Mobile App can be developed to support multiple Smart City API servers, for balancing and
- The usage of Super is not mandatory so that separate services can be produced as well
- Super and Nodes presents the same Smart City APIs.

Federation of Snap4City vs IOT ORION Broker



Snap4City IoT Registration and Access



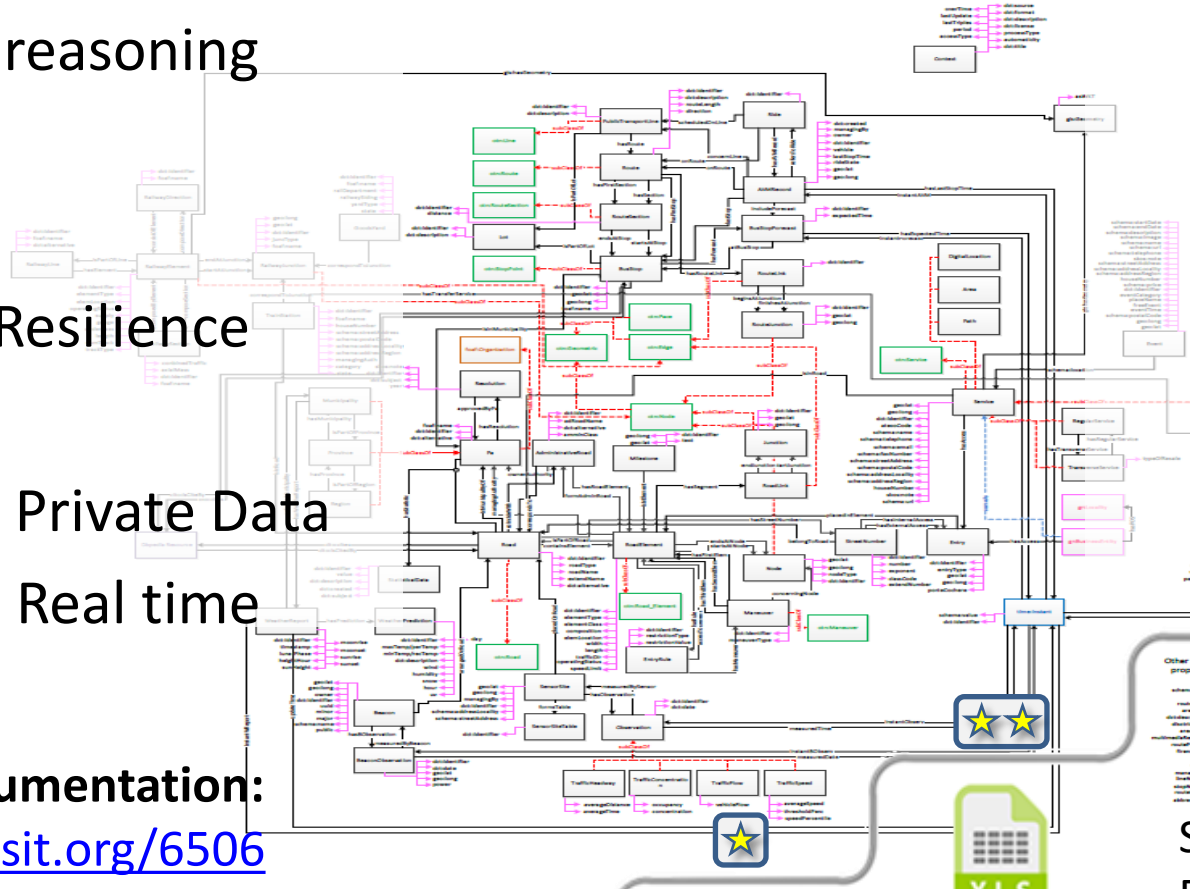
Linked Open Data

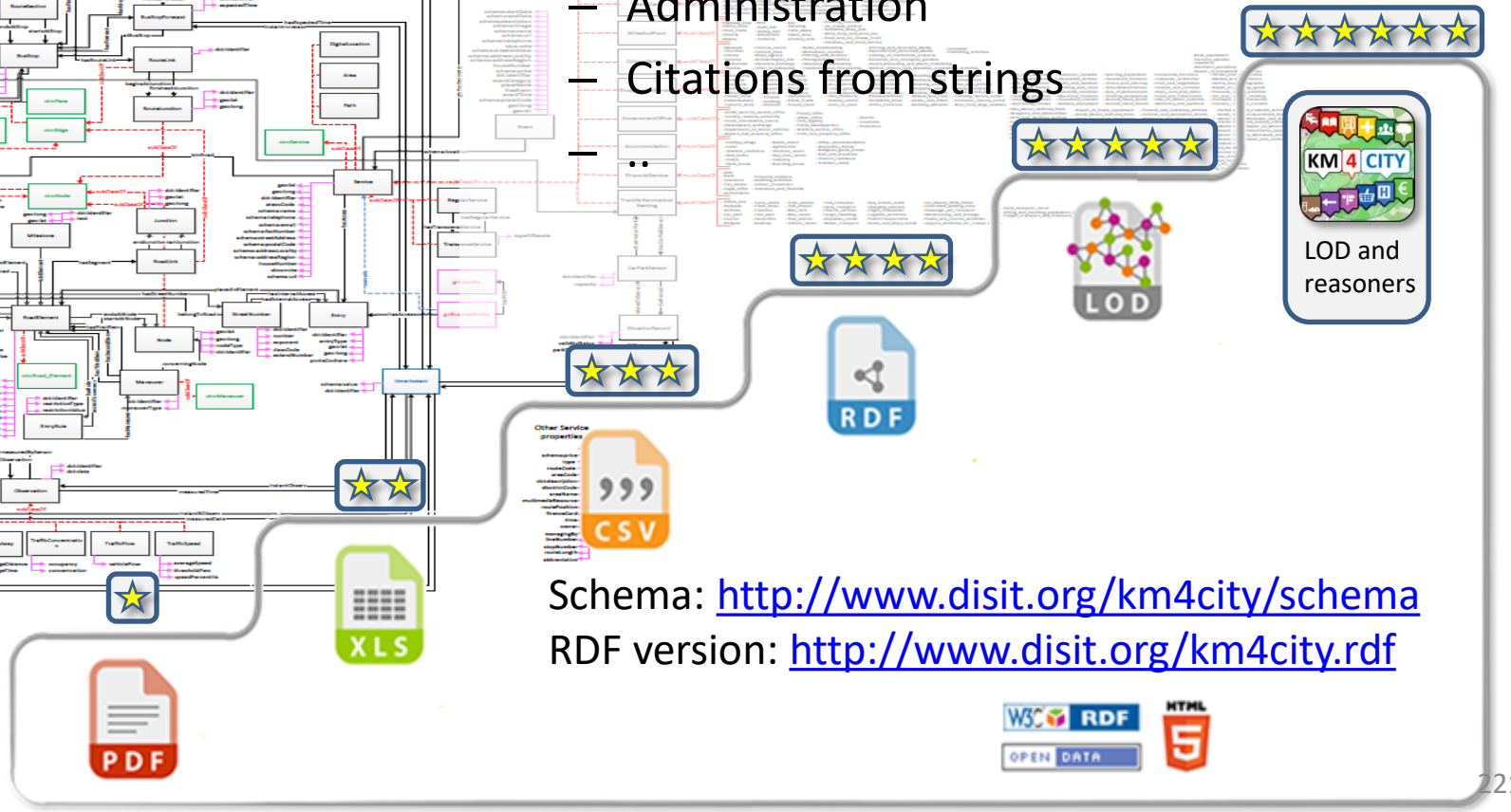
Km4City: Knowledge Base

- **Multiple DOMAINS**
- Geospatial reasoning
- Temporal reasoning
- Metadata
- Statistics
- Risk and Resilience
- Licensing
- Open and Private Data
- Static and Real time
- IOT/IOE

Ontology Documentation:
http://www.disit.org/6506
http://www.disit.org/6507
http://www.disit.org/5606
http://www.disit.org/6461

- Street-Guide
- Mobility and transport
- Points of interest
- Sensors, IOT, …
- Energy
- Administration
- Citations from strings
- ..





Schema: http://www.disit.org/km4city/schema
RDF version: http://www.disit.org/km4city.rdf

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Knowledge Base
Semantic Reasoners

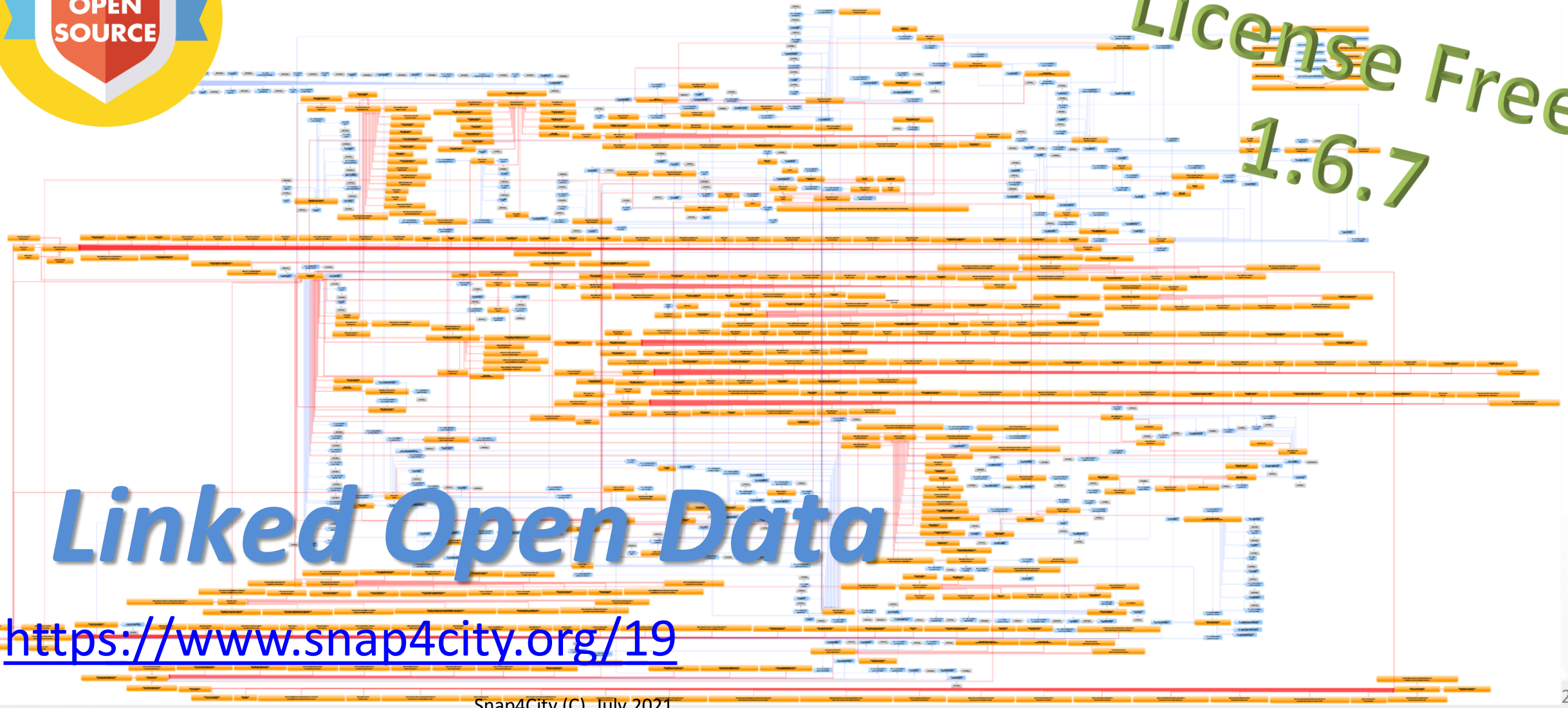
SNAP4CITY

100% OPEN SOURCE

Smart-city Ontology km4city

License Free

1.6.7

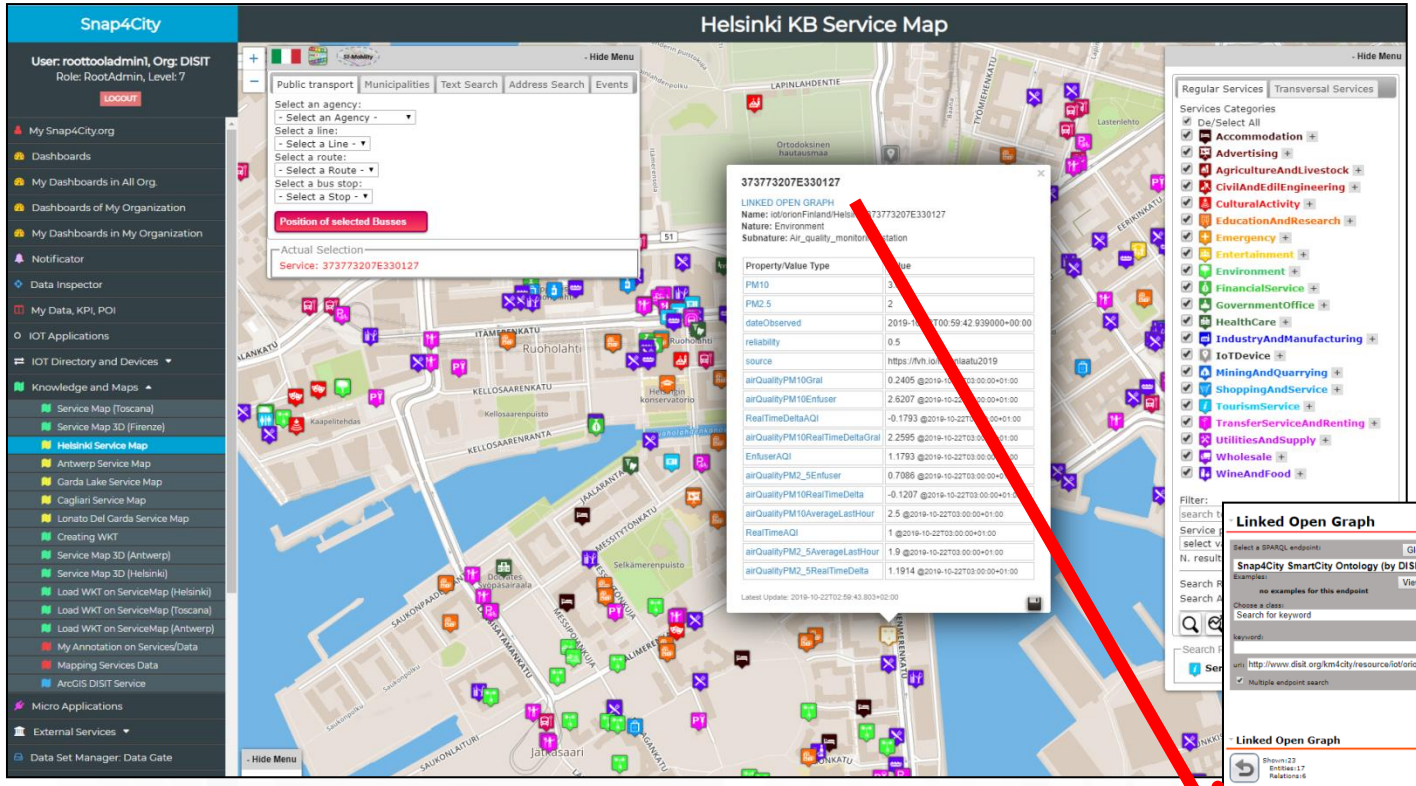


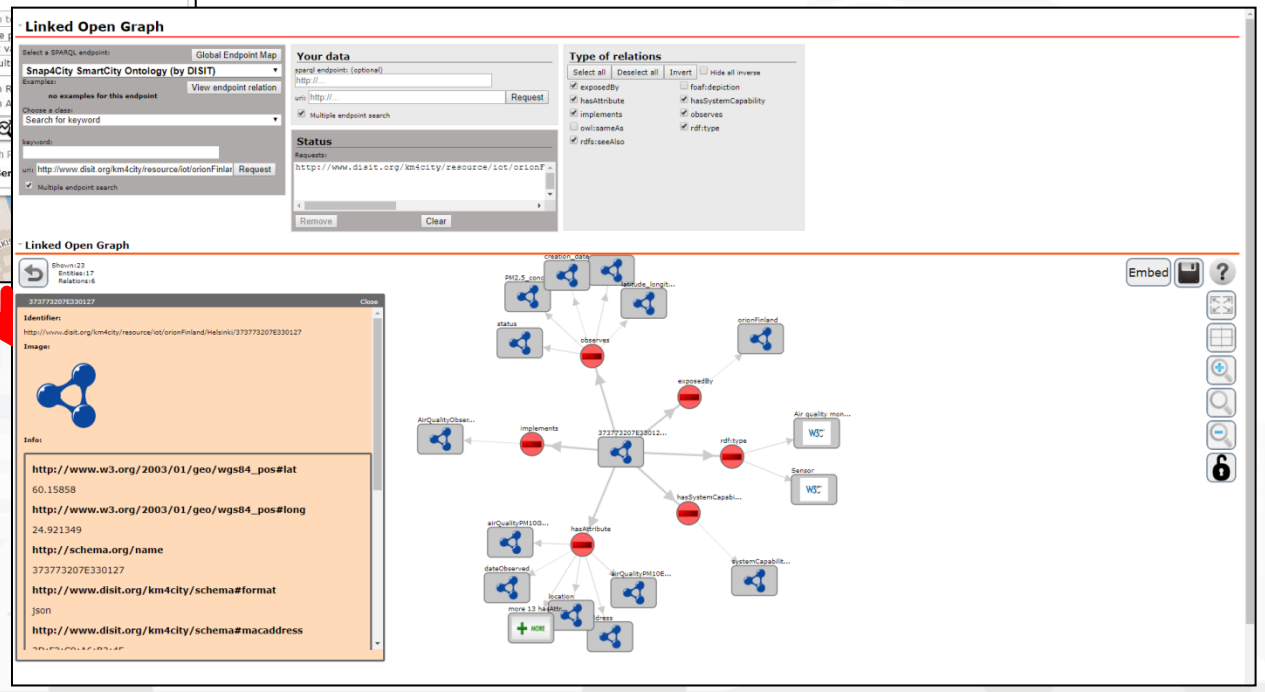
Linked Open Data

https://www.snap4city.org/19

Views of the Knowledge Base

Knowledge Base
Semantic Reasoners

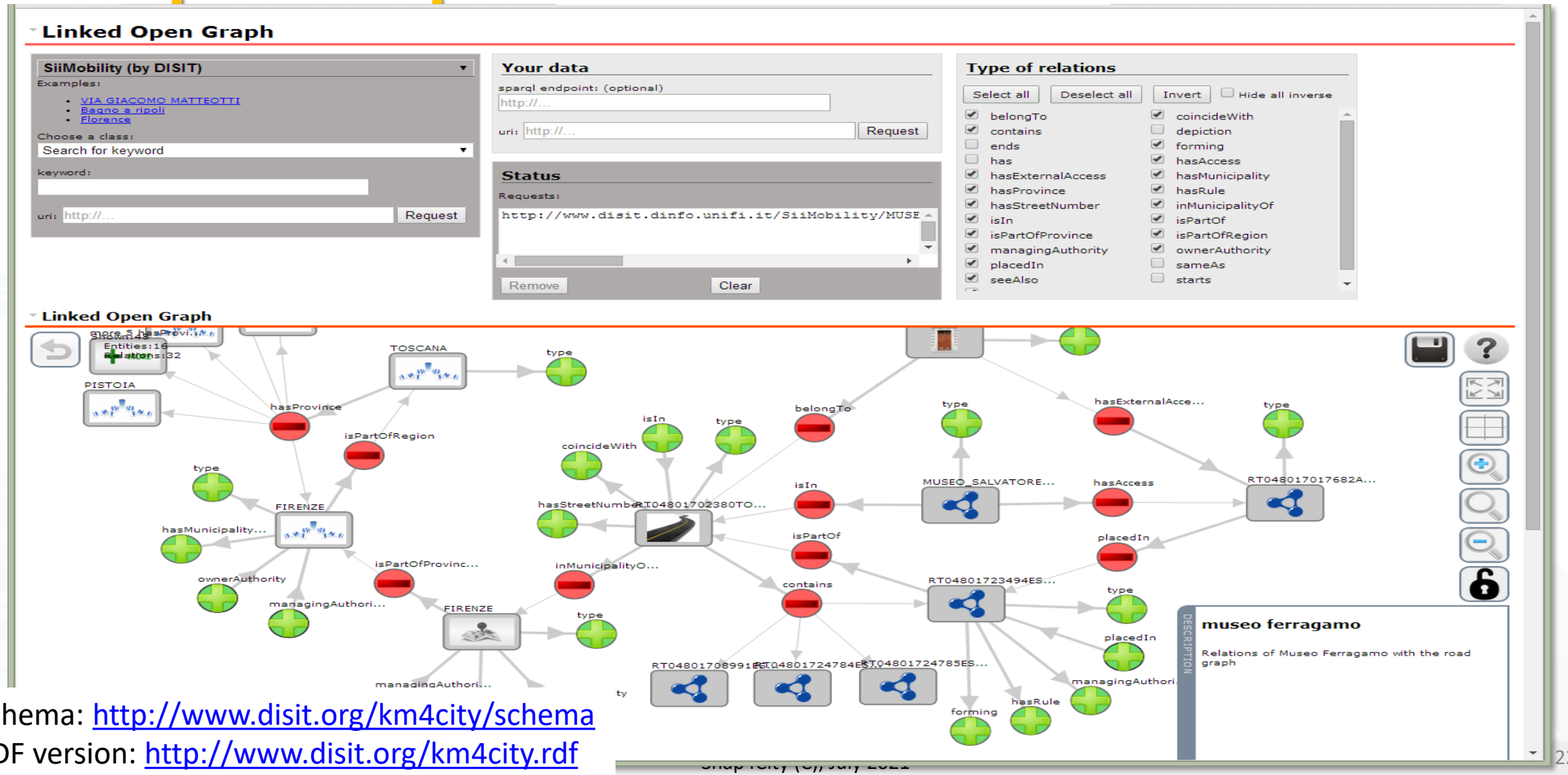




- How pass from ServiceMap to Linked Open Graph, Linket Data view tool

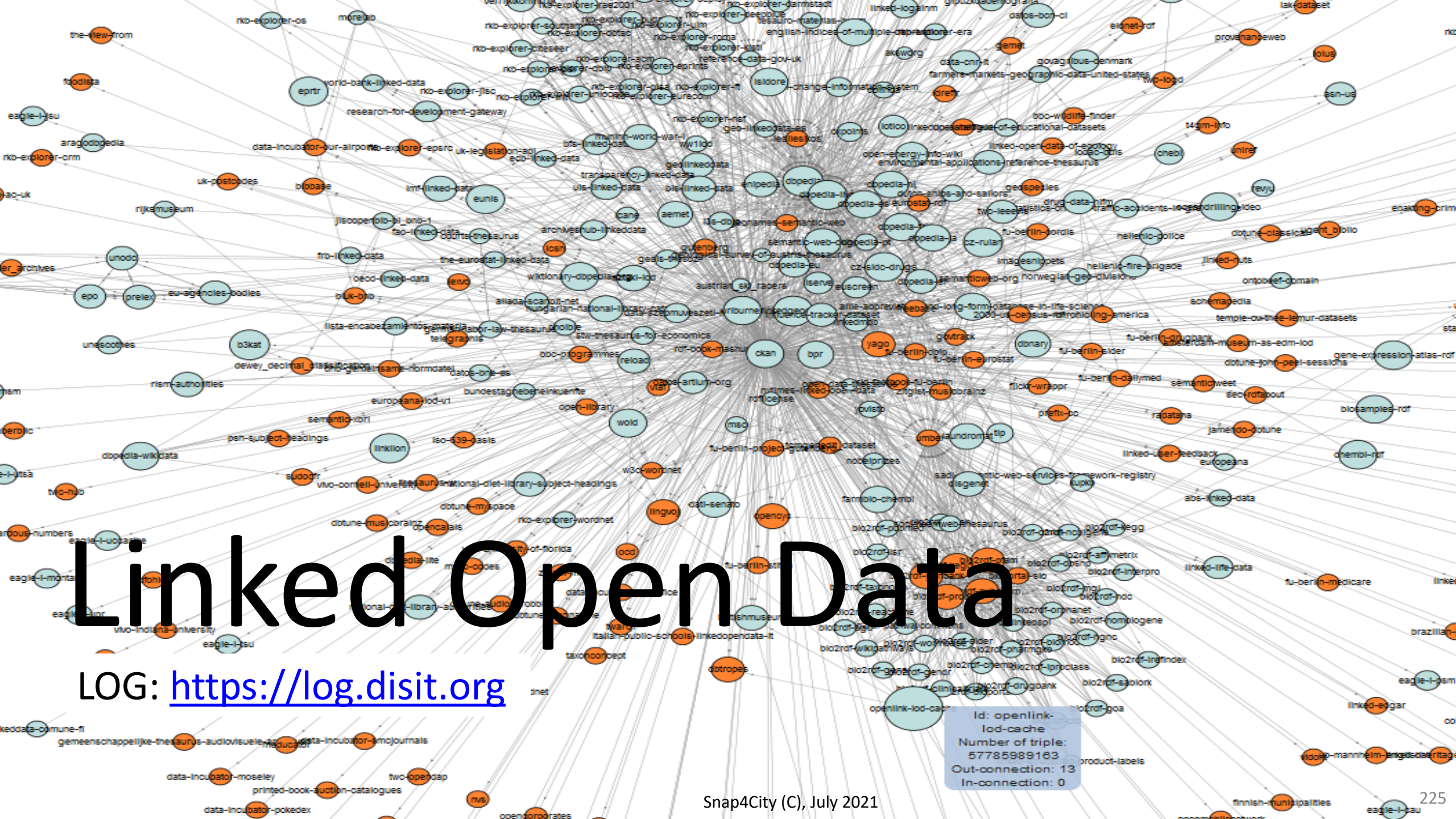
Linked Open Graph

LOG: https://log.disit.org



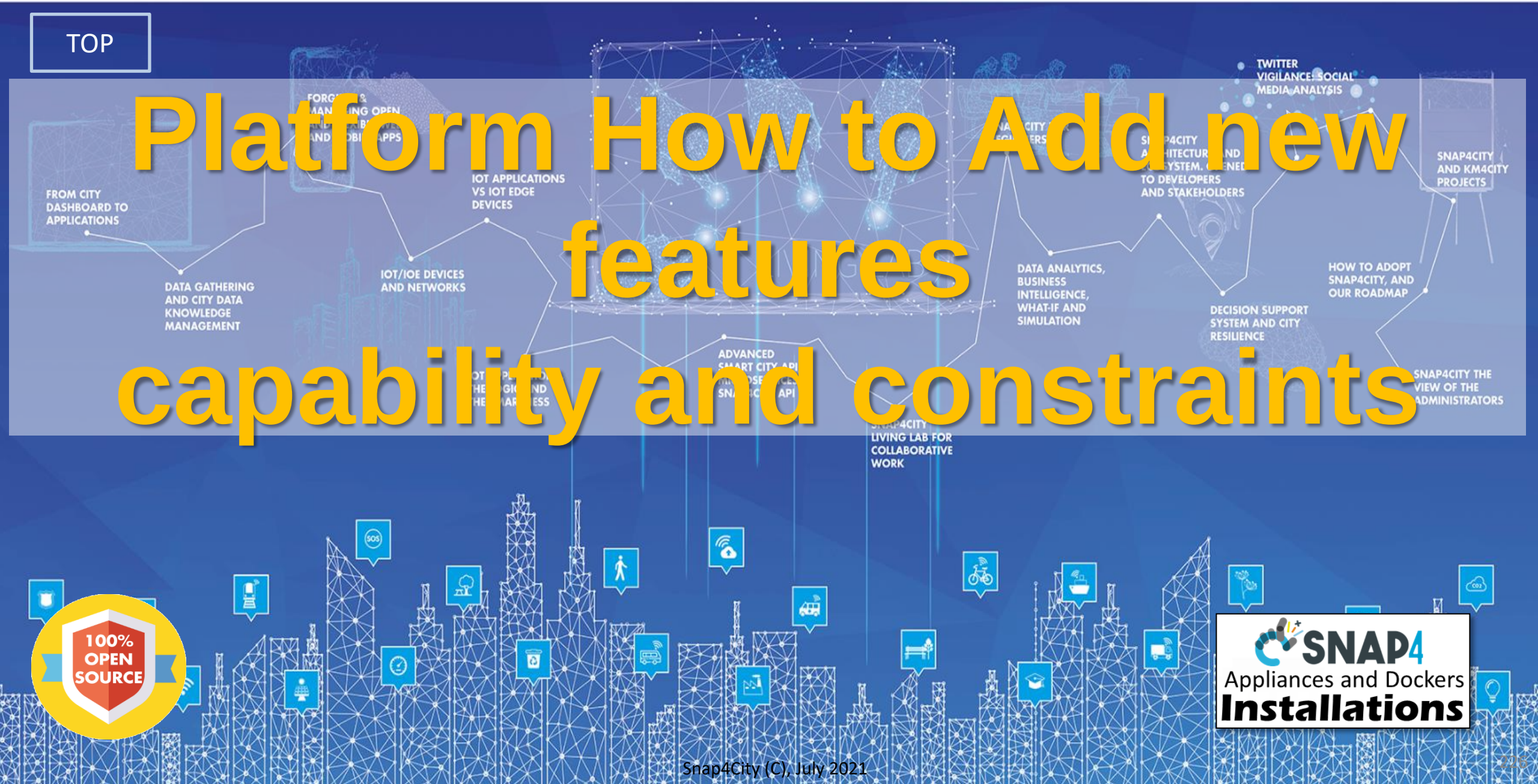
Schema: http://www.disit.org/km4city/schema

RDF version: http://www.disit.org/km4city.rdf

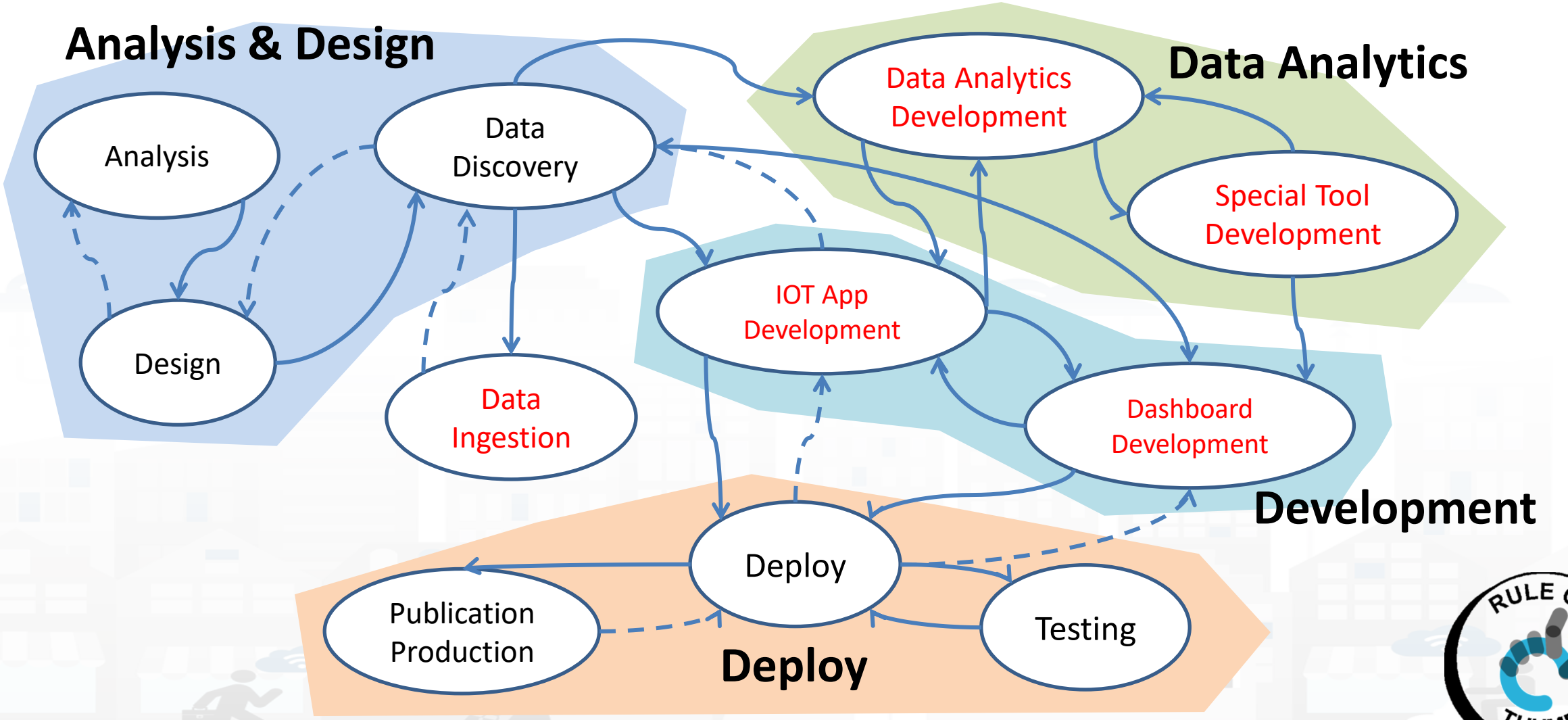

Linked Open Data
LOG: https://log.disit.org
Id: openlink-lod-cache
Number of triple: 57785989163
Out-connection: 13
In-connection: 0

TOP

Platform How to Add new features capability and constraints



Development Life Cycle Smart City Services



Adding new Features

- **Dashboard Features** --> Custom Widgets, Widgets
- **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**
- **Data ingestion process**, integration, etc.
- **External Services** to be exploited on Dashboards
- etc. etc.

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/course2020/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

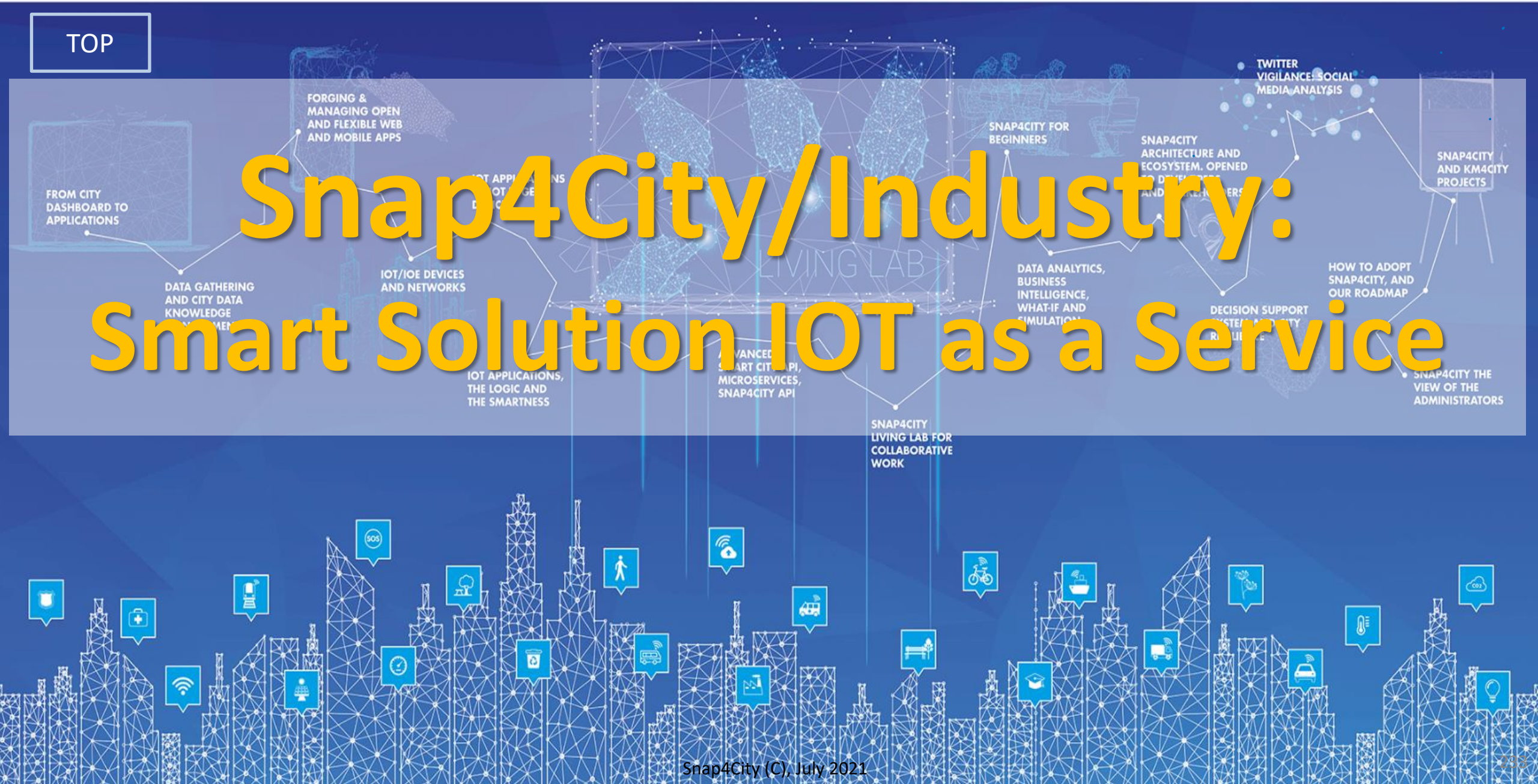
- **Processes --> Data Analytic** of any kind, also exploiting machine learning, gpu, etc.
  - see tutorial on Data Analytics
  - https://www.snap4city.org/download/video/course2020/da/
- **Web and Mobile Apps** --> new end-users services
  - https://www.snap4city.org/download/video/course2020/app/
- **Dashboards: Dashboard Builder and Kibana**
  - https://www.snap4city.org/download/video/course2020/das/
- **IoT Applications in Node-RED**
  - https://www.snap4city.org/download/video/course2020/iot/
- **data ingestion process, integration, etc.**
  - https://www.snap4city.org/download/video/course2020/di/
- **External Services to be exploited on Dashboard**s
  - by simply registering their URLs on the portal
  - https://www.snap4city.org/55
- **Workflows**: via OpenMaint
  - TC 1.24 – Integrated Ticketing and Facility Management system
- **BIM models** via Bim Editor for IFC production → Bim Server
  - HOW To: Manage BMP and BIM: main features of openMAINT, BMP, BIM
- etc. etc.

Constraints

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



Snap4City/Industry: Smart Solution IOT as a Service

Smart Solution IOT 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

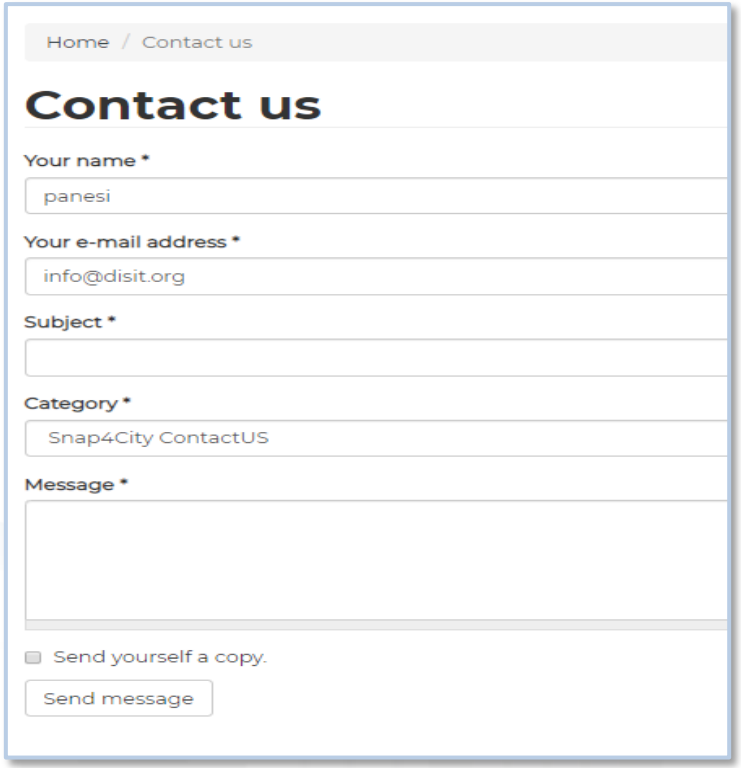
Specialized Offer

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

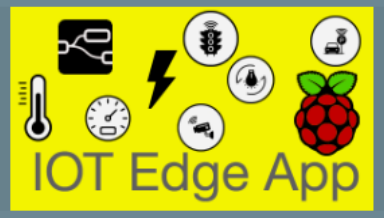


Periodo di riferimento: 09 / 2019	
Disponibilita' media:	99.91%
MTTR:	00G 00:10.00
MTBF:	04G 14:04.24
# down tot.	4
max(t_down):	00G 00:10.01

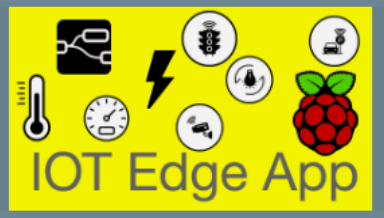
Providing consulting, customization, training, and developments

- 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.**

IOT Applications

2018-09-14T04:44


owner: badii
Management

2018-09-21T03:19


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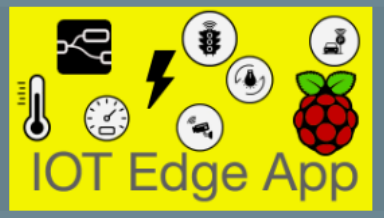
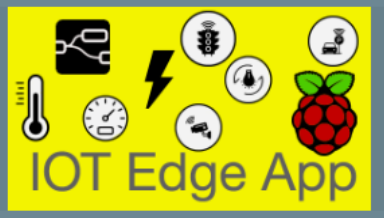
Management

2018-10-19T16:07


owner: pb3
Management

2018-10-19T17:17


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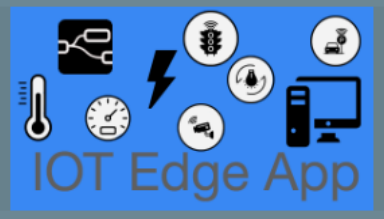


owner: semolarudy
Management

application

owner: tester5
Management

Bib APP

owner: semolarudy
Management

ChargingStations

owner: comunedashres
Management

Deprecated - SiiMobilityControlRoom

owner: badii
Management

SamsungGalaxyS4BarCode

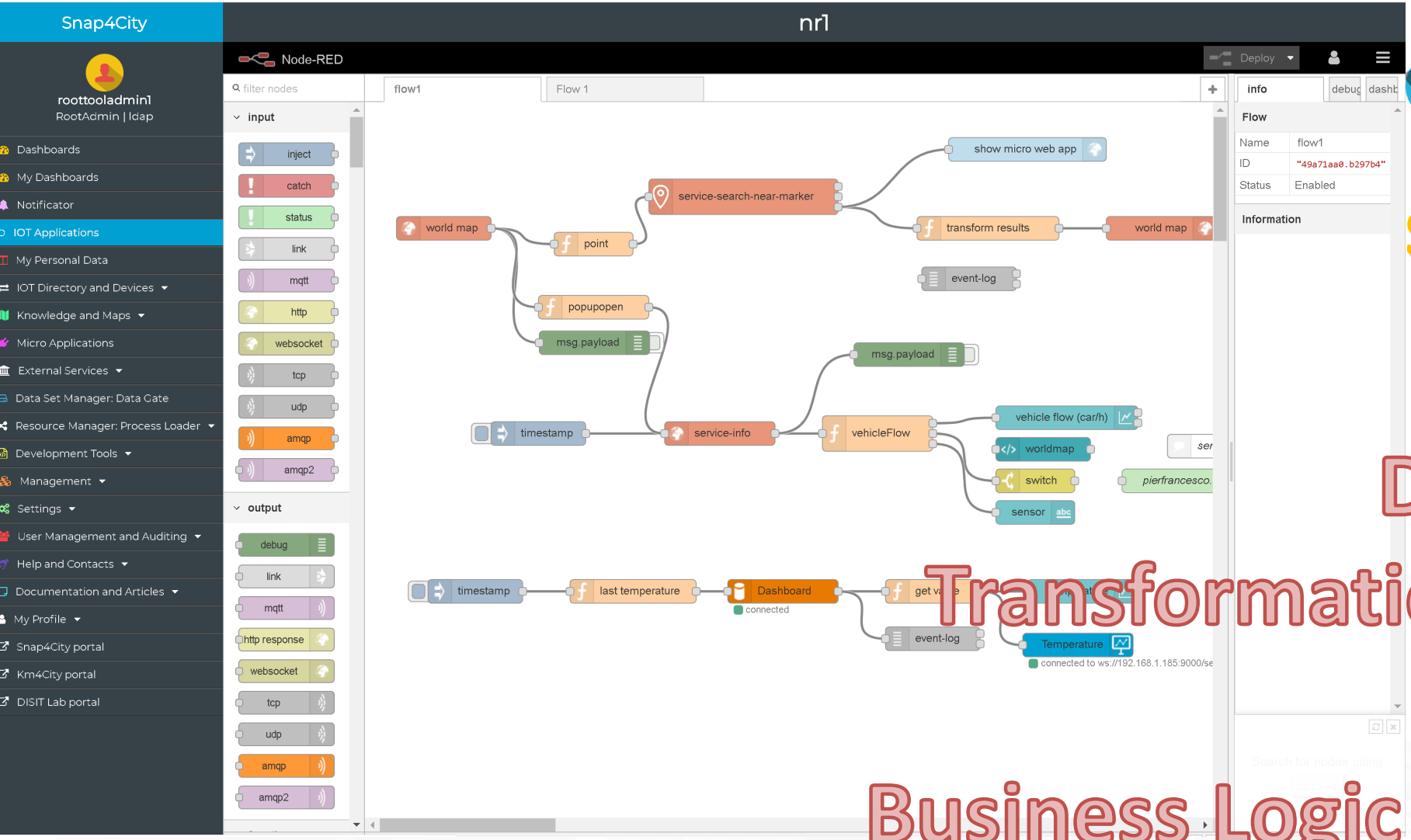
owner: badii
Management

esercitazione

owner: tester2
Management

Iot-App

owner: tester14
Management



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

IoT Applications

- **Data ingestion**: more than 70 protocols IOT and Industry 4.0, web Scraping, external services, any protocol database, etc.
- **Data access**: save/retrieve data, query search on expert system, georeverse solution, search on expert system Km4City ontology, etc.
- **Data Transformation/transcoding:** binary, hexadecimal, XML, JSON, String, any format
- **Integration**: CKAN, Web Scraping, FTP, Copernicus satellite, Twitter Vigilance, Workflow OpenMaint, Digital Twin BIMServer, any external service REST Call, etc.
- **Manipulation of complex data**: heatmaps, scenarios, typical time trend, multi series, calendar, maps, etc.
- **Access to Smart City Entities and exploitation of Smart City Services**: transport, parking, POI, KPI, personal data, scenarios, etc.
- **Data Analytic**: managing Python native, calling and scheduling Python/Rstudio containers as snap4city microservices (predictions, anomaly detection, statistics, etc.)
- **User interaction on Dashboard**: get data and message from the user interface, providing messages to the user (form, buttons, switches, animations, selector, maps, etc.)
- **Custom Widgets**: SVG, synoptics, animations, dynamic pins on maps, etc
- **Event management**: Telegram, Twitter, Facebook, SMS, WhatsApp, CAP, etc.
- **Hardware Specific Devices**: Raspberry Pi, Android, Philips, video wall management, etc.

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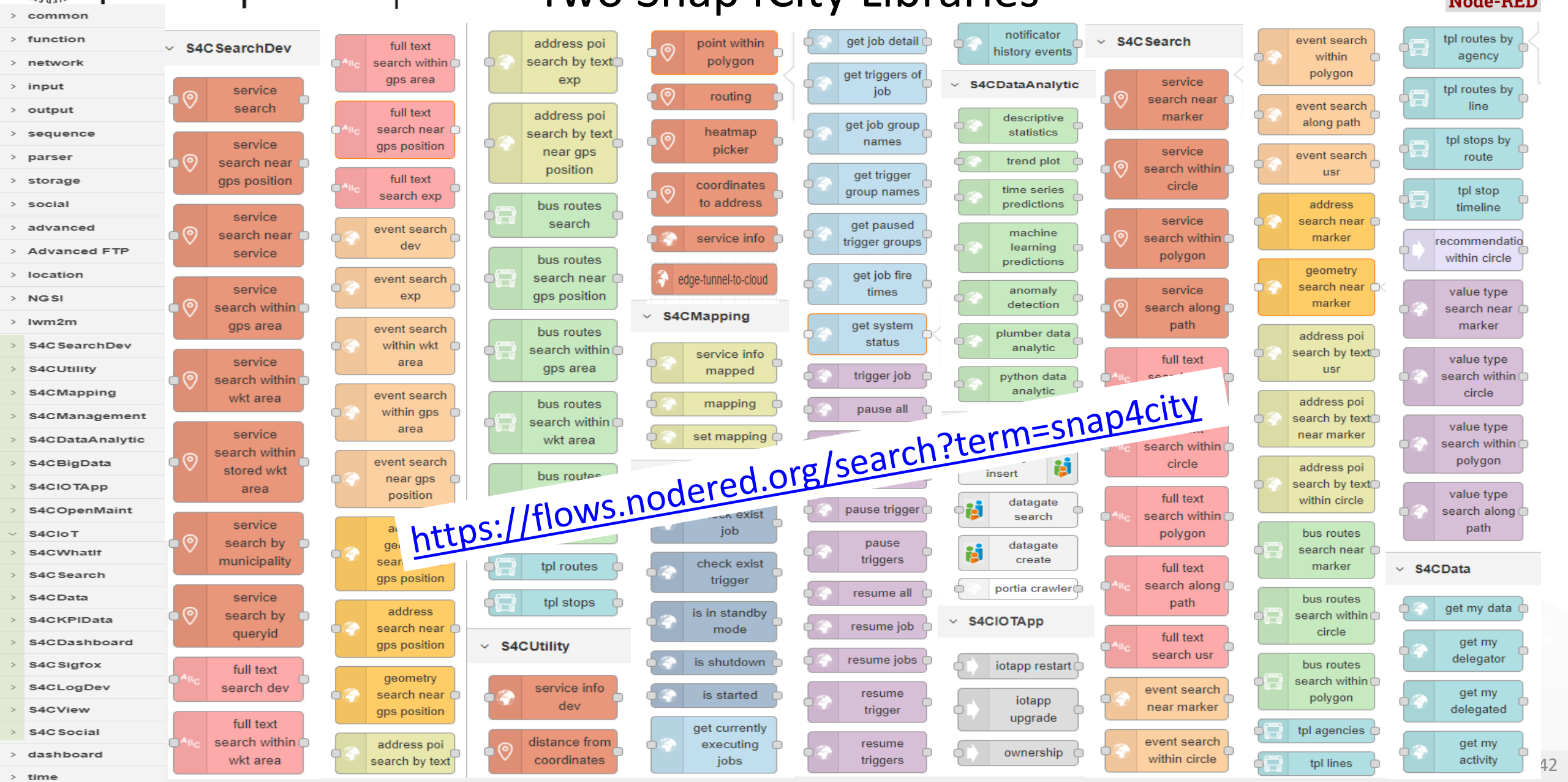
April 2021 collection

Two Snap4City Libraries

SNAP4CITY | Node-RED



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

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April 2021 collection

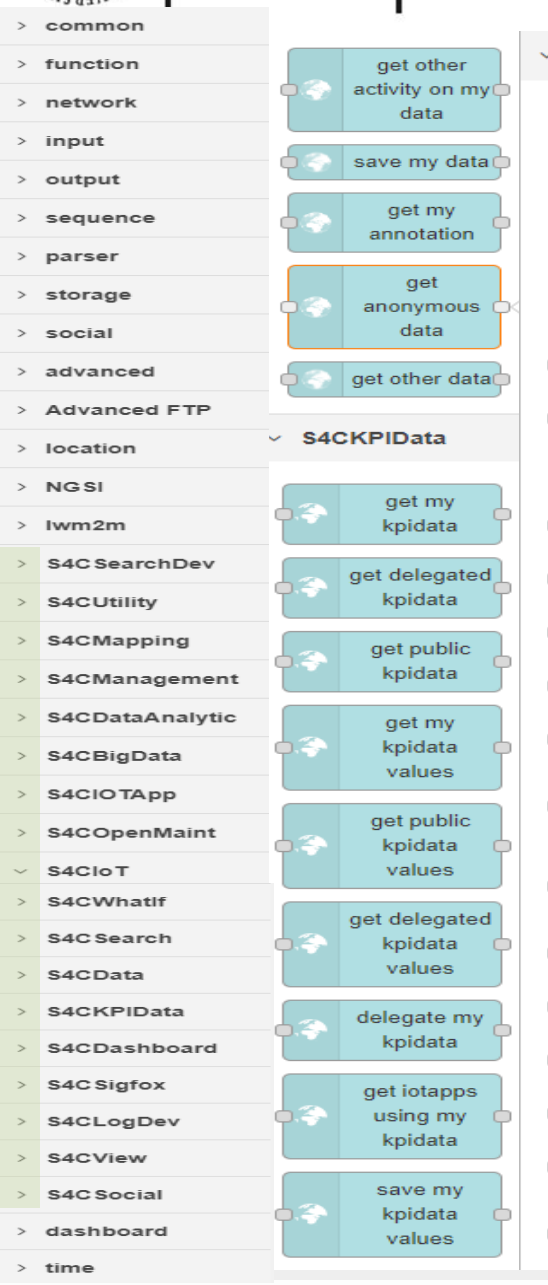
Two Snap4City Libraries

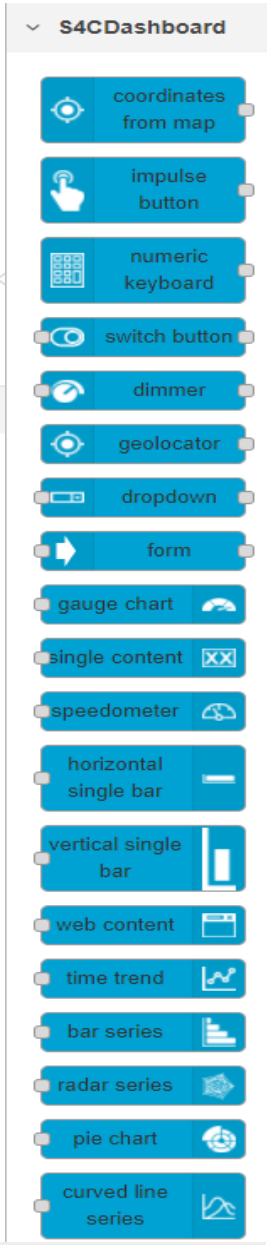
SNAP4CITY | Node-RED

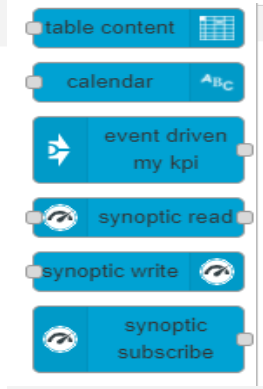
https://flows.nodered.org/search?term=snap4city

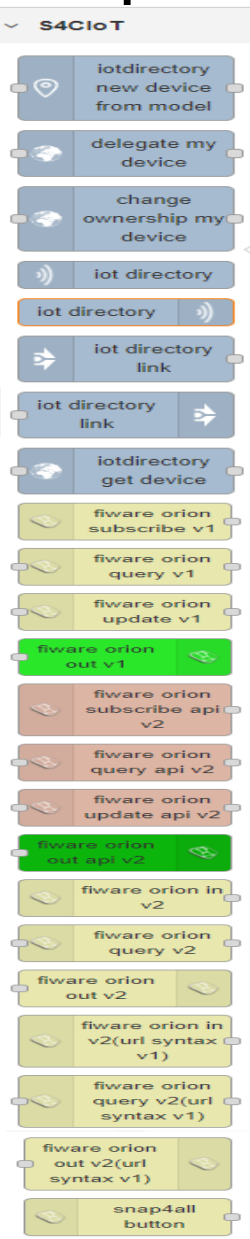
We suggest also to install:

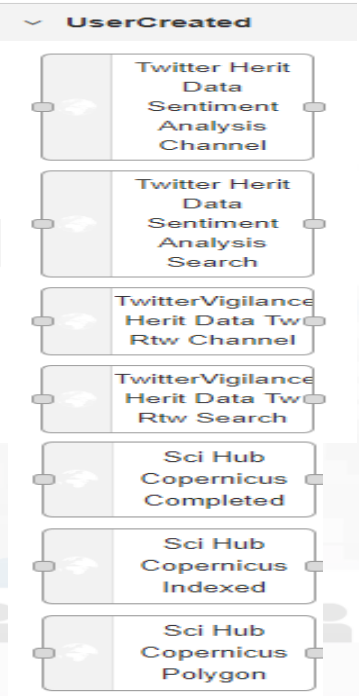
AND: From Resource Manager

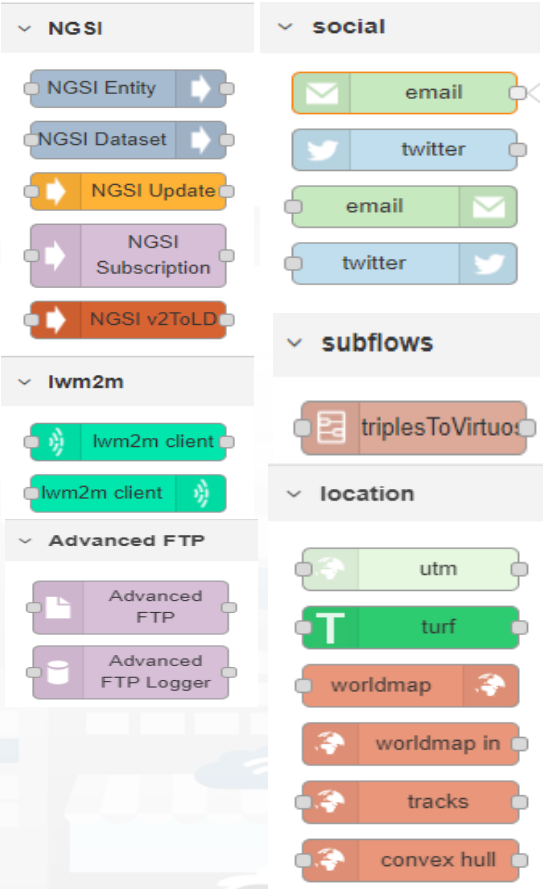








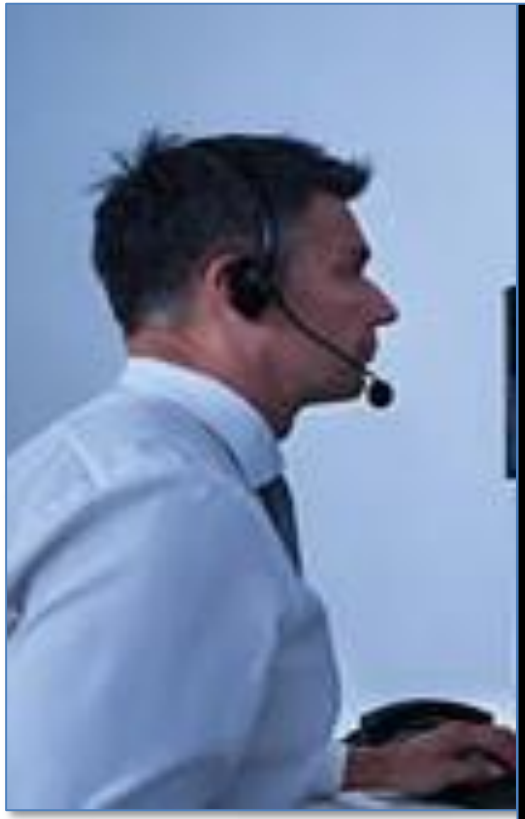


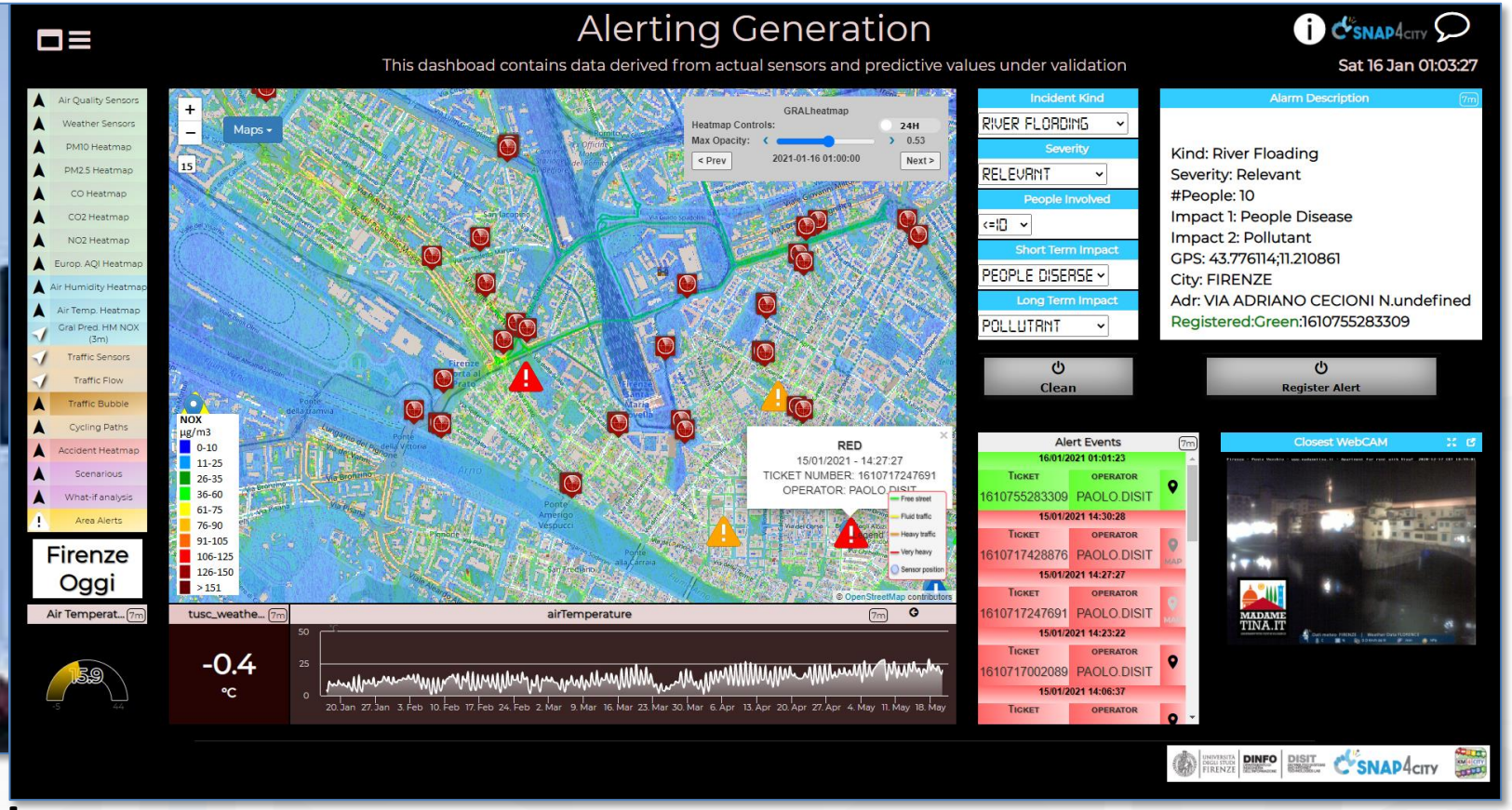


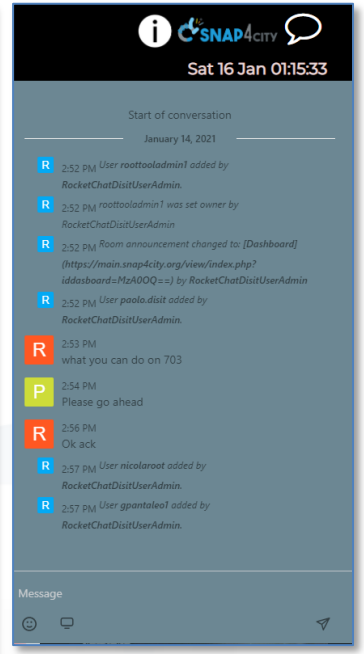
Nov. 2020 collection
Two Snap4City Libraries

- Search and management of Services, POI, Parking, Public Transport, etc.
- Event management, ticket management
- Routing, Data Analytic, Open Data processing
- IOT adaptation, network management
- Dashboard management
- Personal data management, KPI, etc.
- ….

Registering Alerting events





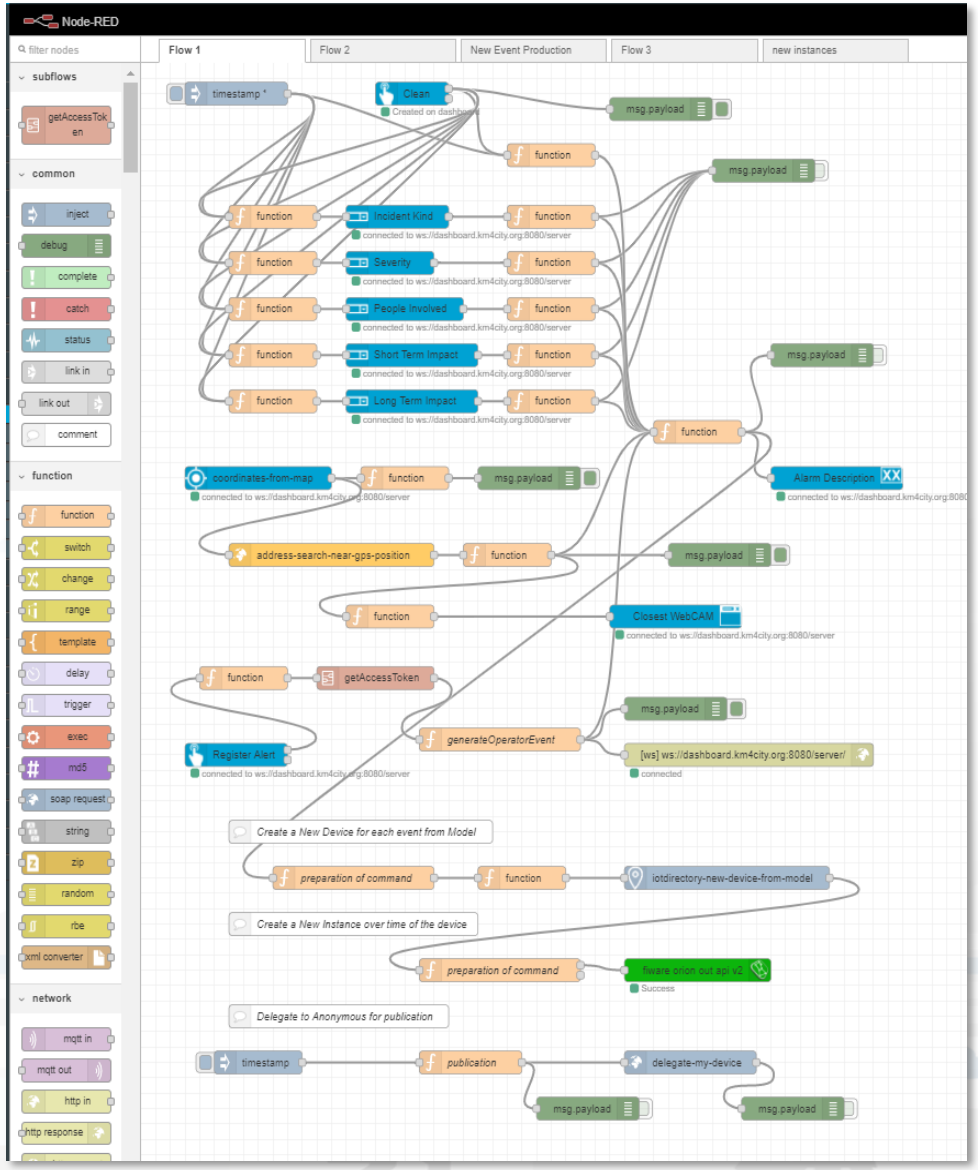


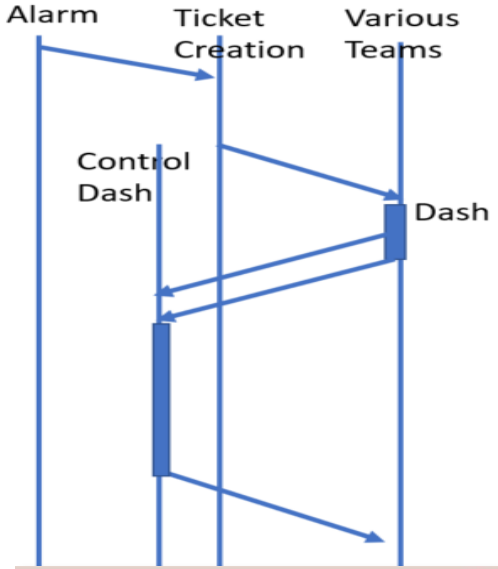
Control Room Operator

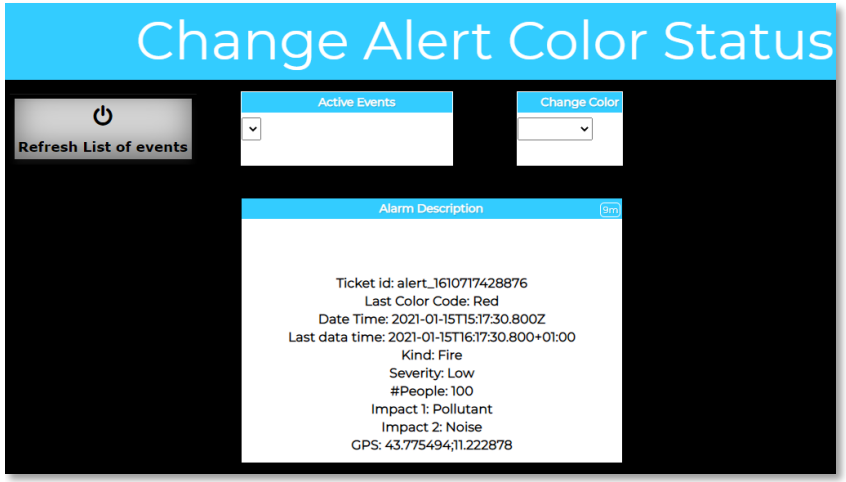
- **Monitor** traffic flow, Environment, Car parking, Cycling, First aid, temp., …
- **Registering Events: classification**
- **Changing status**
- **Acting**

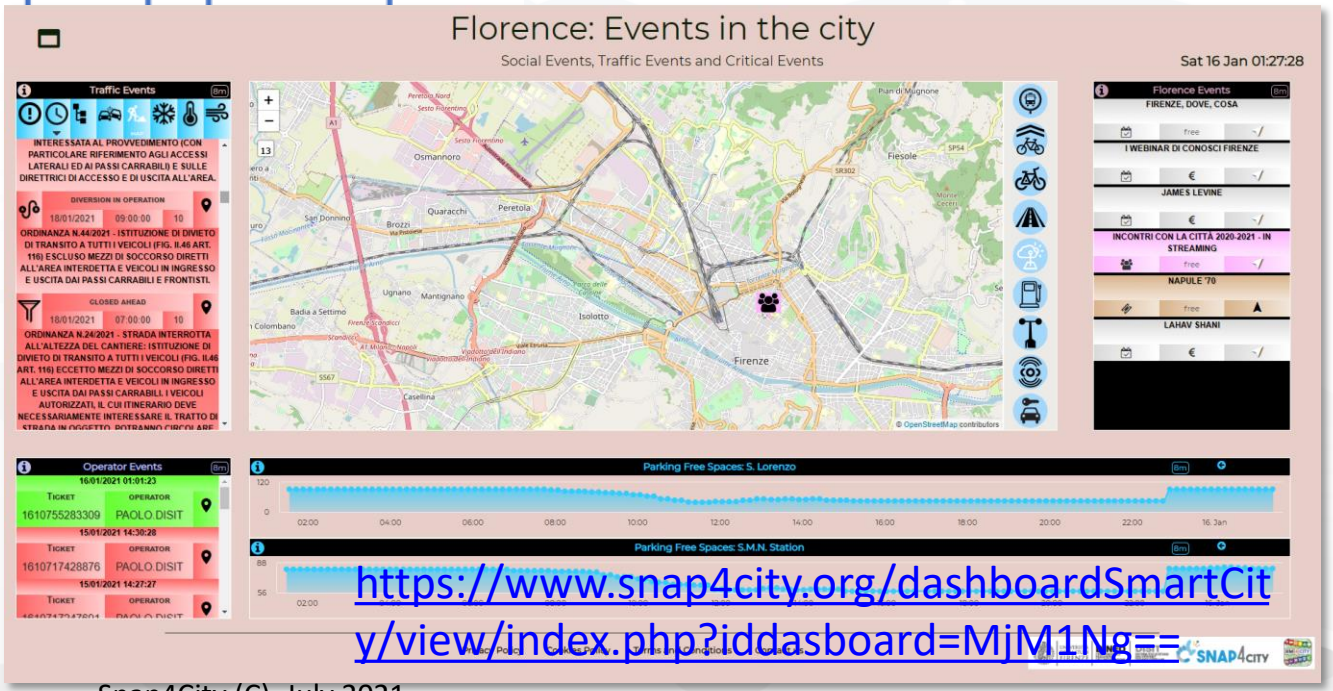
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzA0OQ==

Flow Mng



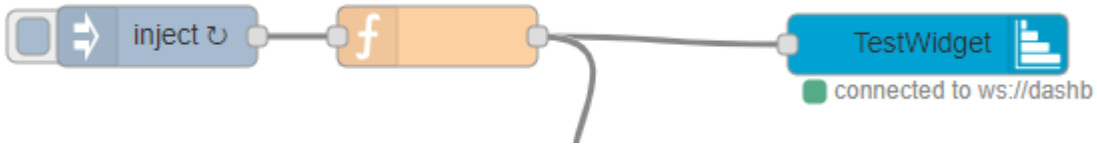




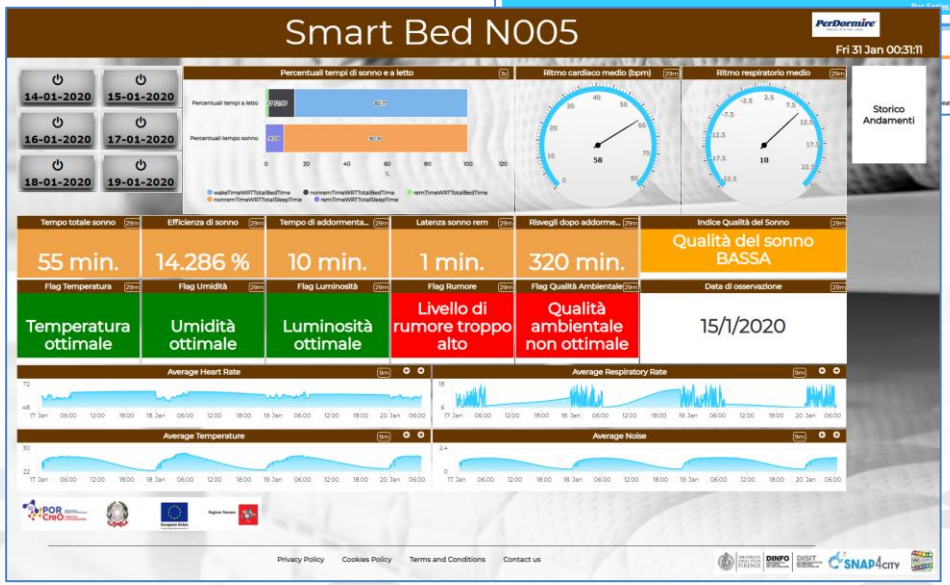


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjM1Ng==

Dynamic Dashboards: changing from IOT App

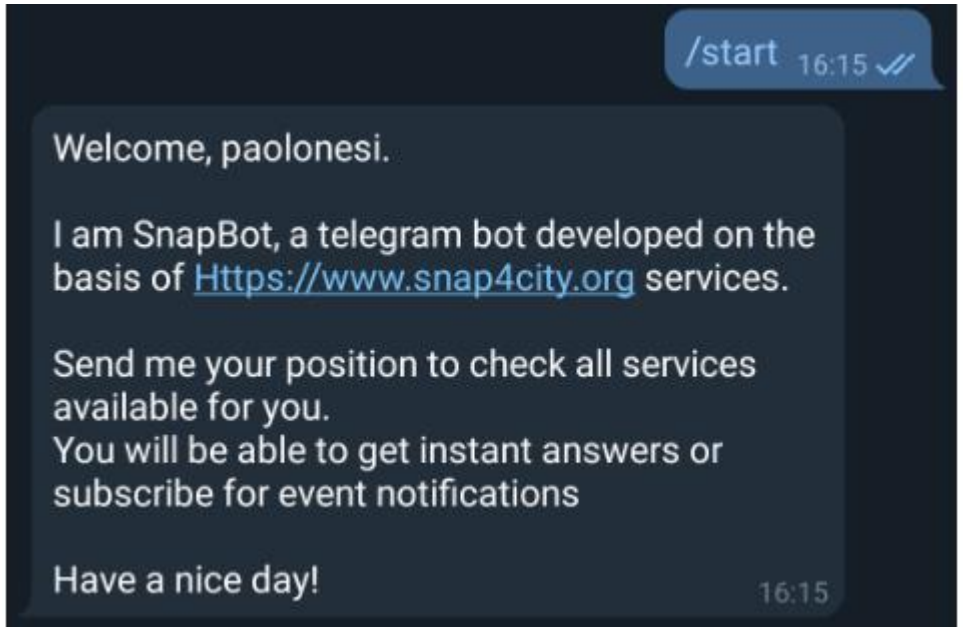


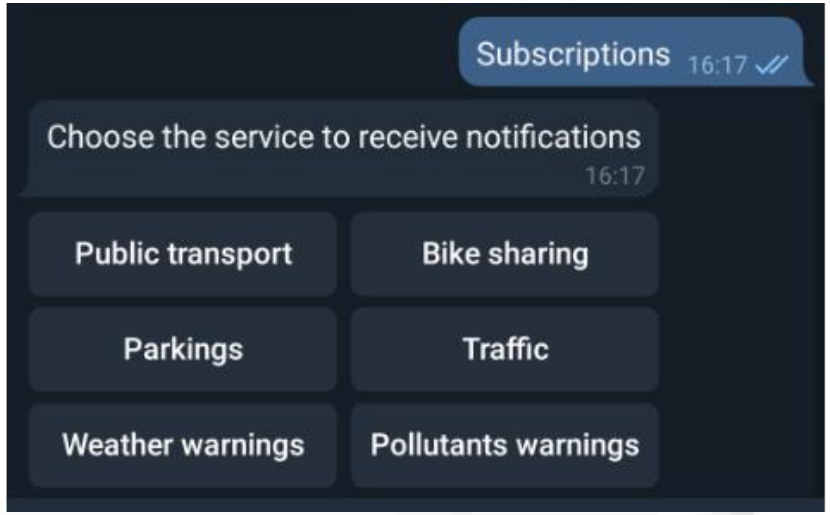
- Dynamic Creation of Widget Content: BarSeries, trends, maps, single content, etc.
- Temporary data pushed on Dashboards



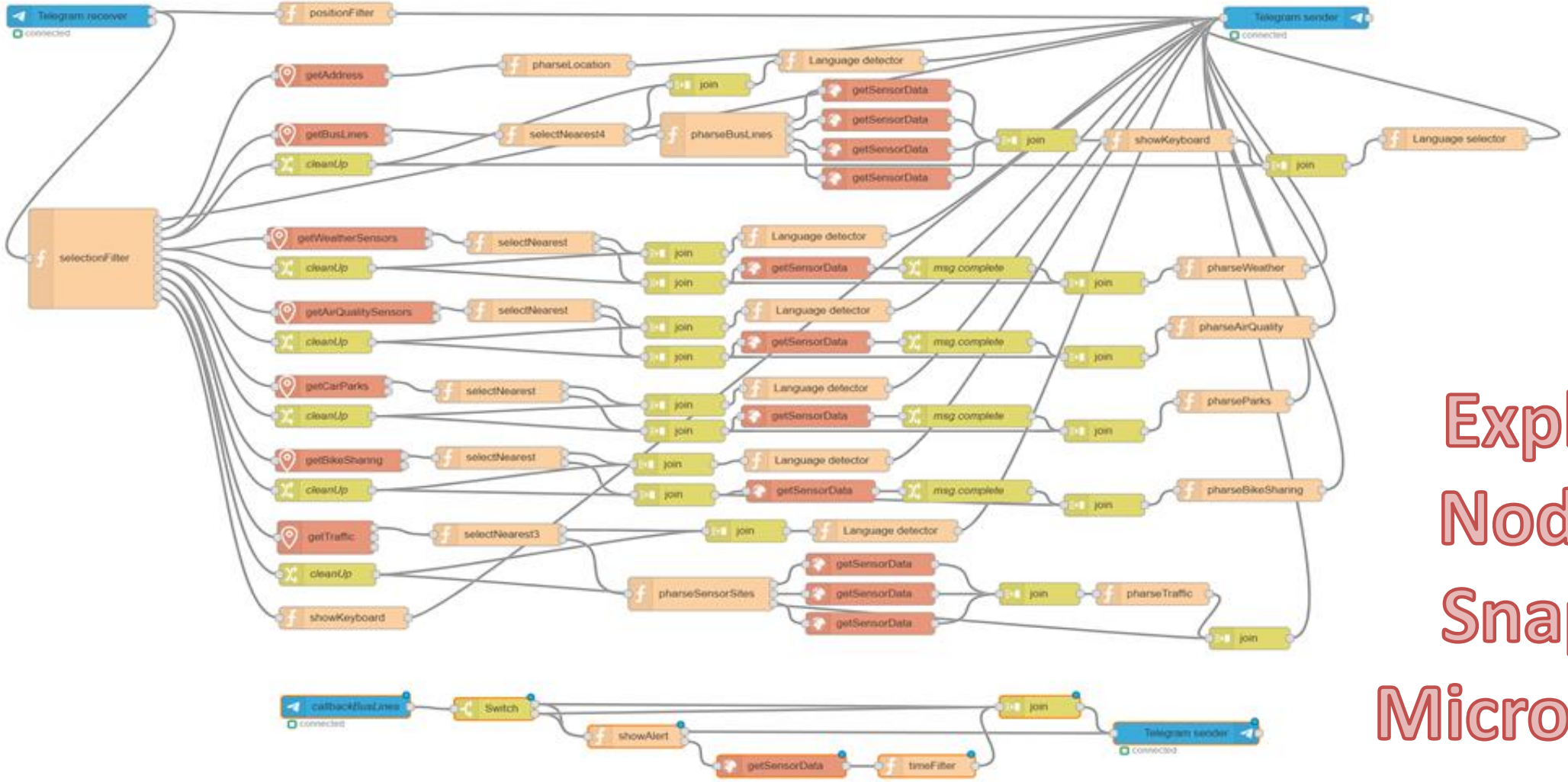
SnapBot

- provides real time smart city services to Telegram users, geolocalized, when you like, what you like
- active on Tuscany in all provinces and cities according to the data accessible on Https://www.snap4city.org
- Services on
  - Public Transport (more than 10 different operators),
  - bike sharing, parking lots,
  - traffic flow, weather warnings,
  - Air quality, pollutant,
  - find your location, etc.





IOT App of SnapBot: OneShot Services



Exploiting Node-RED Snap4City MicroServices

TOP

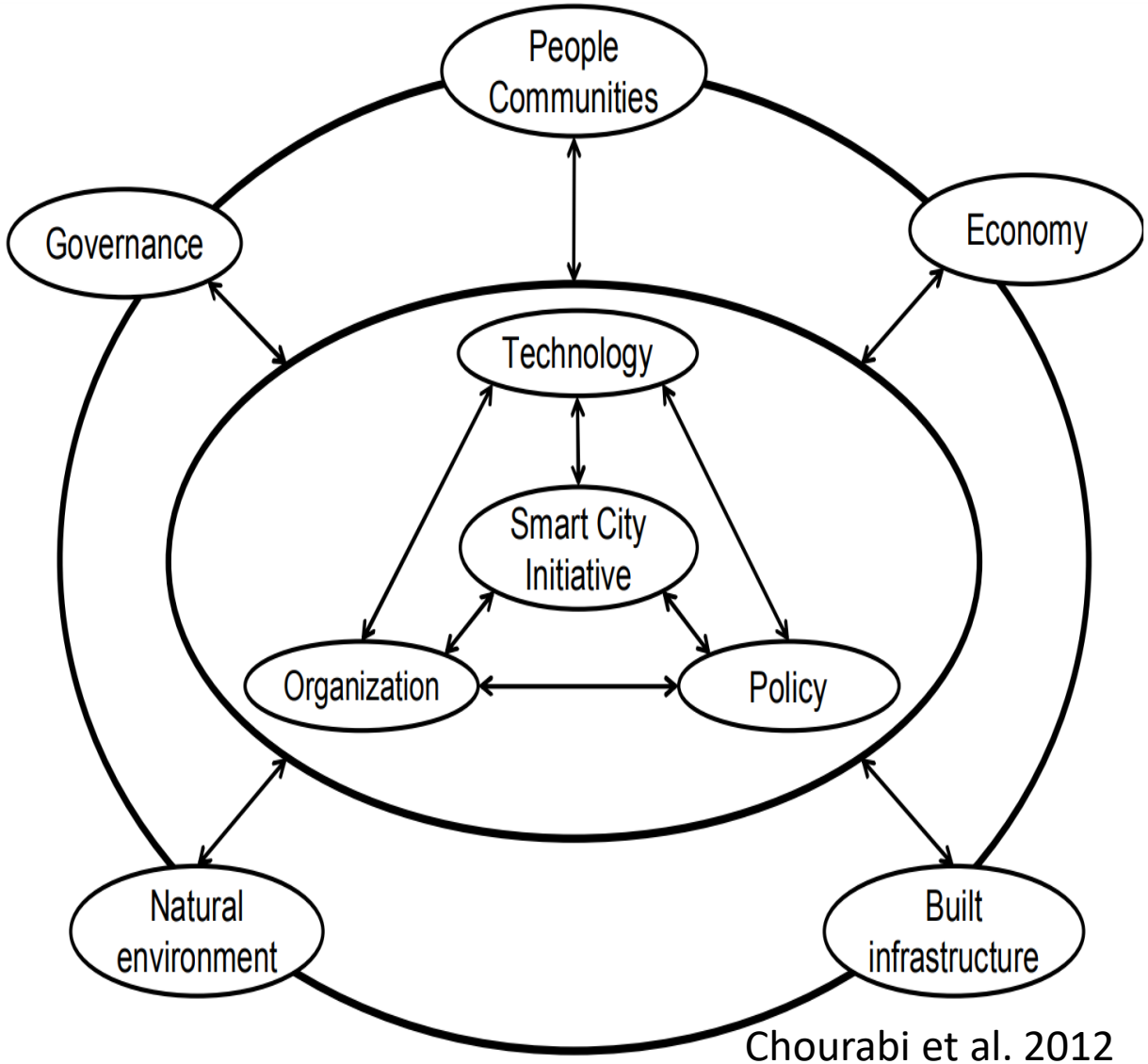
SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK

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

The Living Lab
Concepts and Organization

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

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.

Aspects of the Living Labs

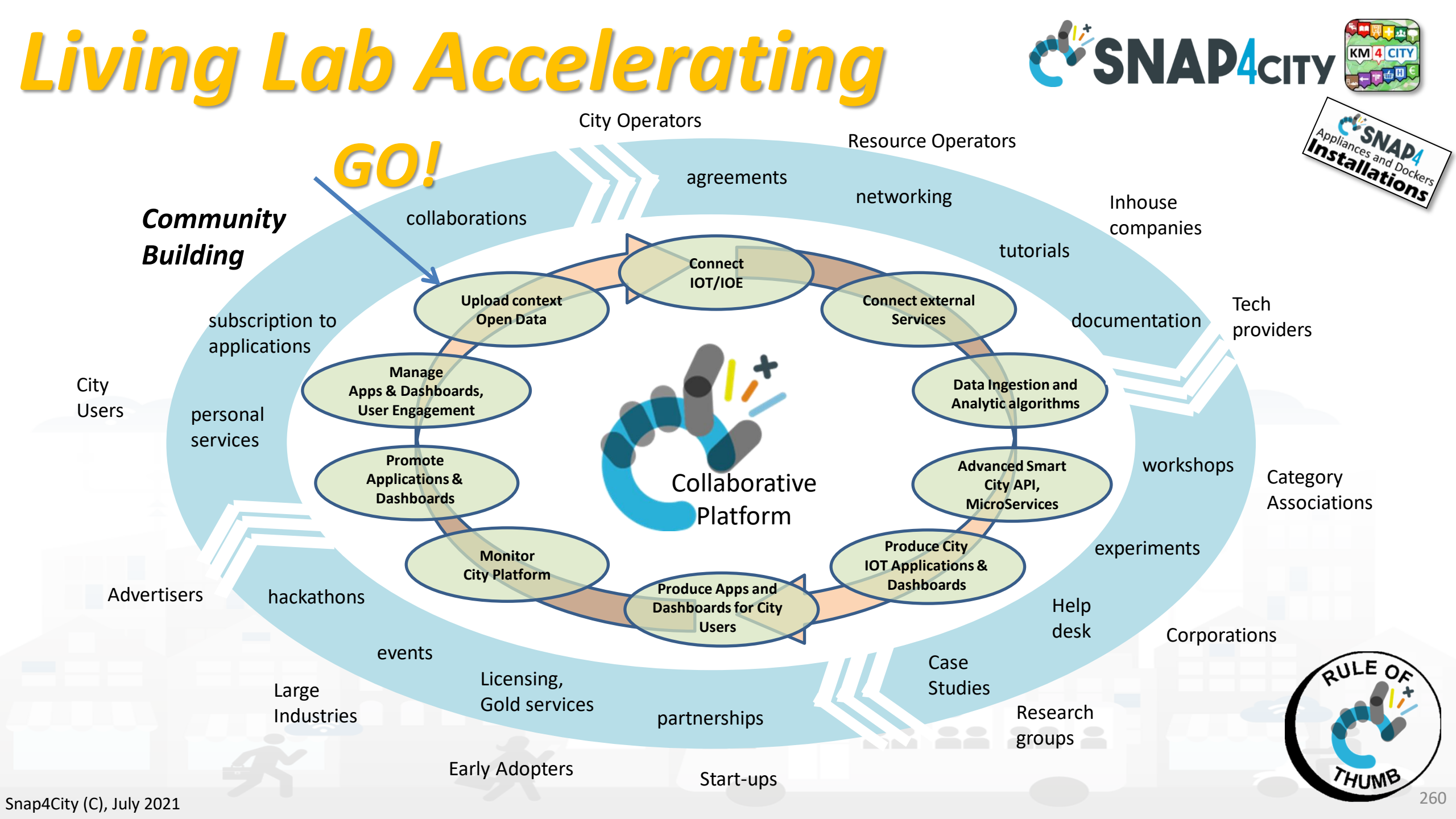
- **Living lab capabilities and supports**
  - Organizations are supported in the user management and persecuting their goals
  - Projects can be launched and targeted with groups, hackathons, tools, etc.
  - Individual (user interaction), are supported by tools and training material
- **Instruments 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

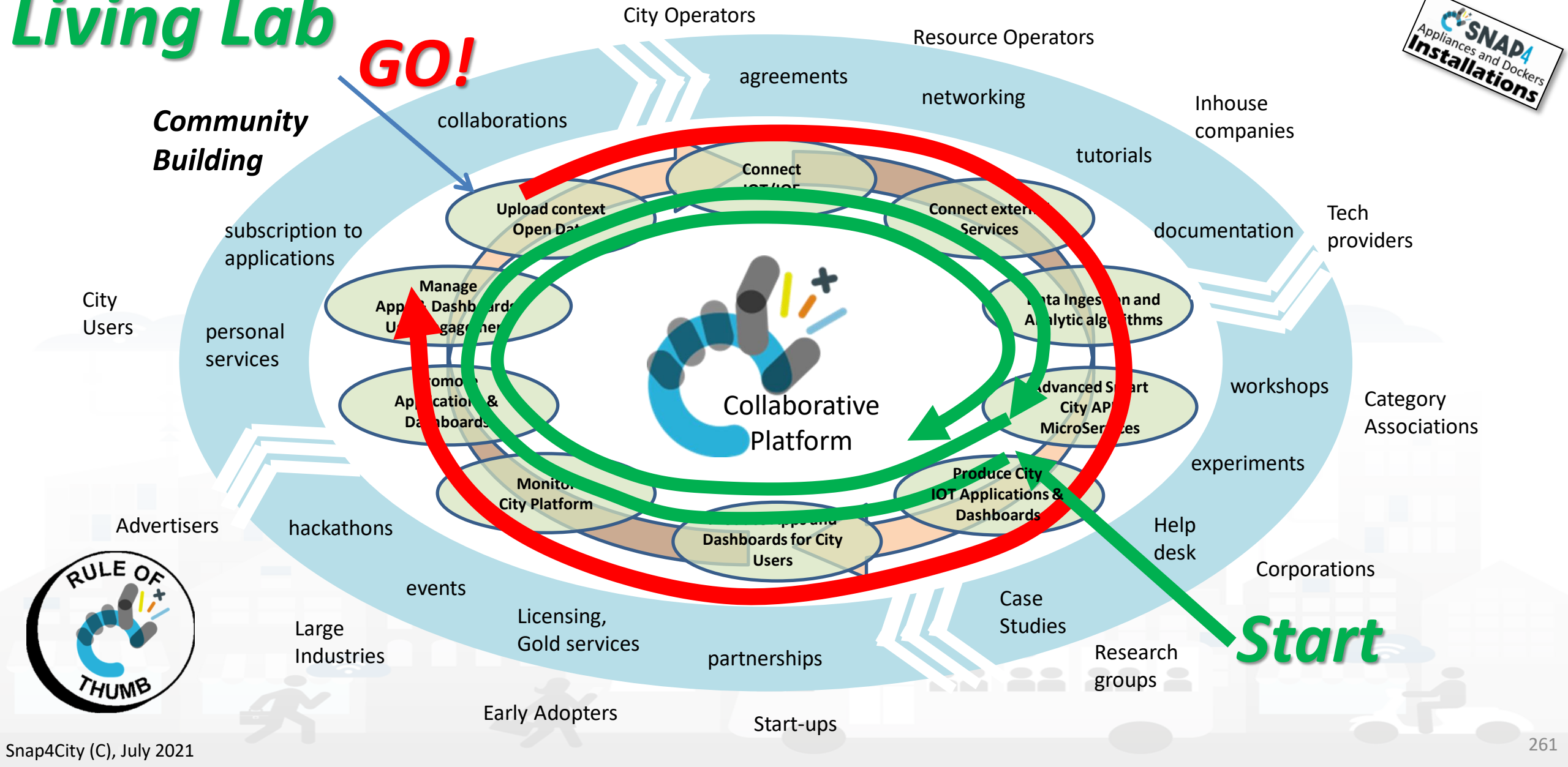
- **Multiple modalities to perform the same activities**
- **Tuned for Beginners and Skilled people**
- **Visual interface and programming tools**
- **Resources and artefacts sharing for learn acceleration and co-working**
- **Open Living and co-working Portal**: https://www.Snap4City.org

Living Lab Accelerating



Smart City Start Up vs Living Lab

GO!



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

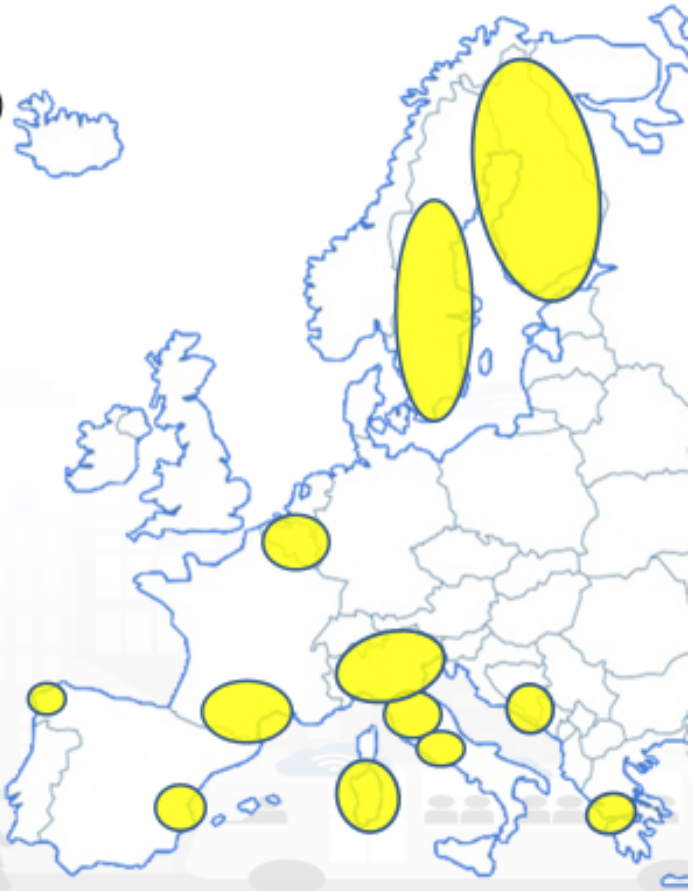
Snap4City/Industry Community

- Most of Organizations on Snap4City.org also correspond to companies or institutions that have an installation of Snap4City tools on their Premise,
  - such as: Pisa, SmartGarda Lake, Snap4, ALTAIR, etc.
- This double way allows them to:
  - test the news,
  - share experiences with other groups,
  - get visibility,
  - work in the collaborative environment, and
  - be better supported by Snap4City.org and DISIT Lab personnel.
- Each instance of Snap4xxxx solution ***can decide to join the federation*** of SmartCity API to exploit shared data.
  - This allows to exploit regional data for city installations applications (web, mobile, dashboards, etc.) without reloading them for example.

Main Organizations/areas

- Antwerp area (Be)
- Capelon (Sweden: Västerås, Eskilstuna, Karlstad)
- DISIT demo (multiple)
- Dubrovnik, Croatia
- Firenze area (I)
- Garda Lake area (I)
- Helsinki area (Fin)
- Livorno area (I)
- Lonato del Garda (I)
- Modena (I)
- Mostar, Bosnia-Herzegovina
- Pisa area (I)
- Pont du Gard, Occitanie (Fr)
- Roma (I)
- Santiago de Compostela (S)
- Sardegna Region (I)
- SmartBed (multiple)
- Toscana Region (I), SM
- Valencia (S)
- Venezia area (I)
- WestGreece area (Gr)

Snap4City (C), October 2020



Who is using the Living Lab of Snap4City today

- **Snap4City.org**: multiple Organizations
  - **DISIT**: Univ. Milano, Univ. Firenze, Univ. Cagliari, etc.
  - **Firenze**: City Firenze, and inhouse companies
  - Multiple Organizations for **HeritData pilots**:
    - Firenze, Valencia, Dubrovnik, Mostar, WestGreece, Pont Du Gard
  - **CAPELON**: Capelon Sweden
  - **…Antwerp, Helsinki, …**
- **Snap4Pisa** on MOBIMART: AEDIT, Pisa, PISAMO, ….
- **SmartGardaLake:** SmartEA, Univ. Brescia

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.

Snap4City

User: adifino, Org: DISIT
Role: Manager, Level: 4

Your Level

- Dashboards (Public)
- Dashboards of My Organization
- My Dashboards in My Organization
- 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

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 the implementation 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

News

Flyer

VIDEOS

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

This page would guide you along few steps to show 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)**

Full Search

Username: adifino

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Search

Search

Your Org

Organization Groups

DISIT
- Operativo

Last Art.

Recent comments

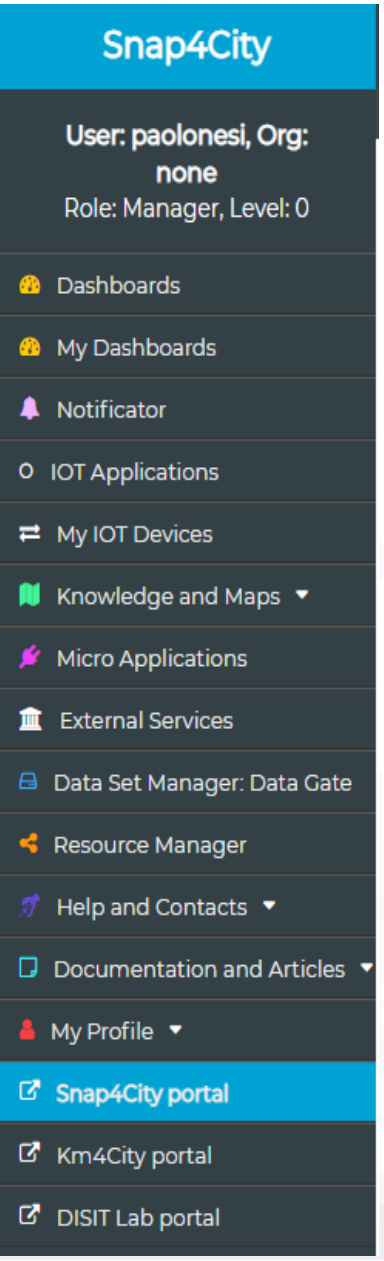
- 1 month 6 days ago

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 to 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

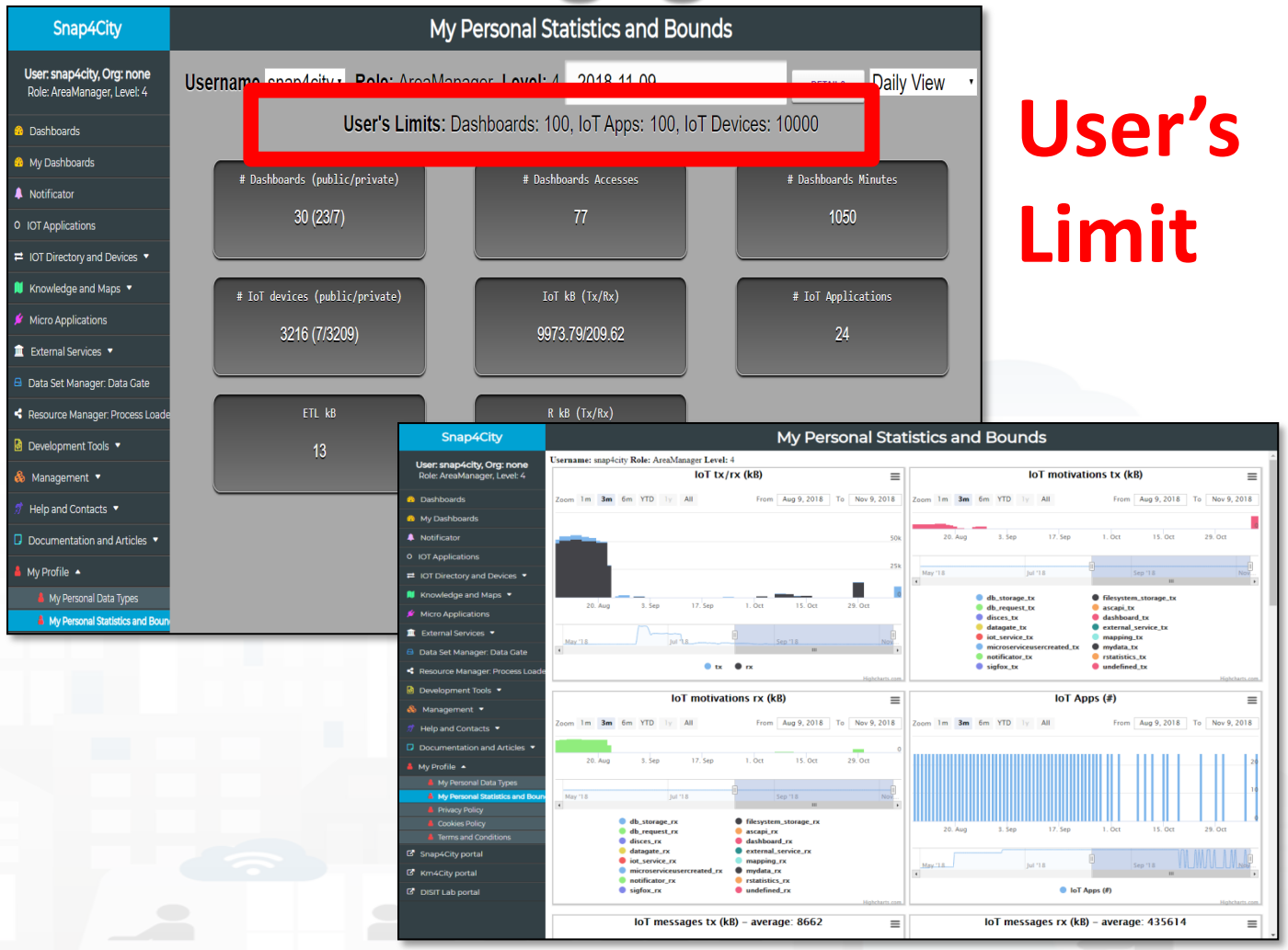
Snap4City - scalable Smart aNalytic APplication builder for sentient Cities
new
drupaladmin

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, …

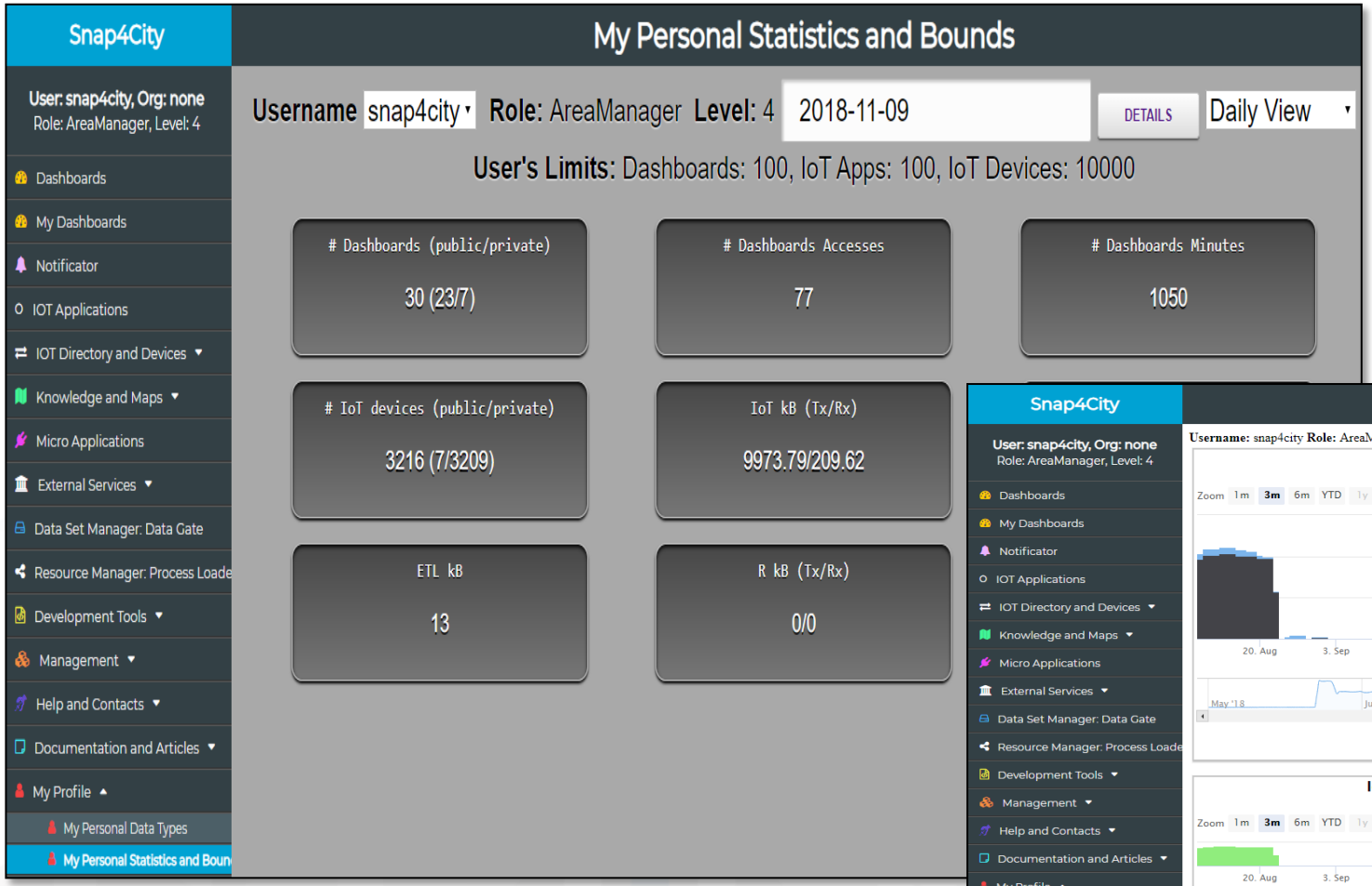
For the user: different levels of engagement

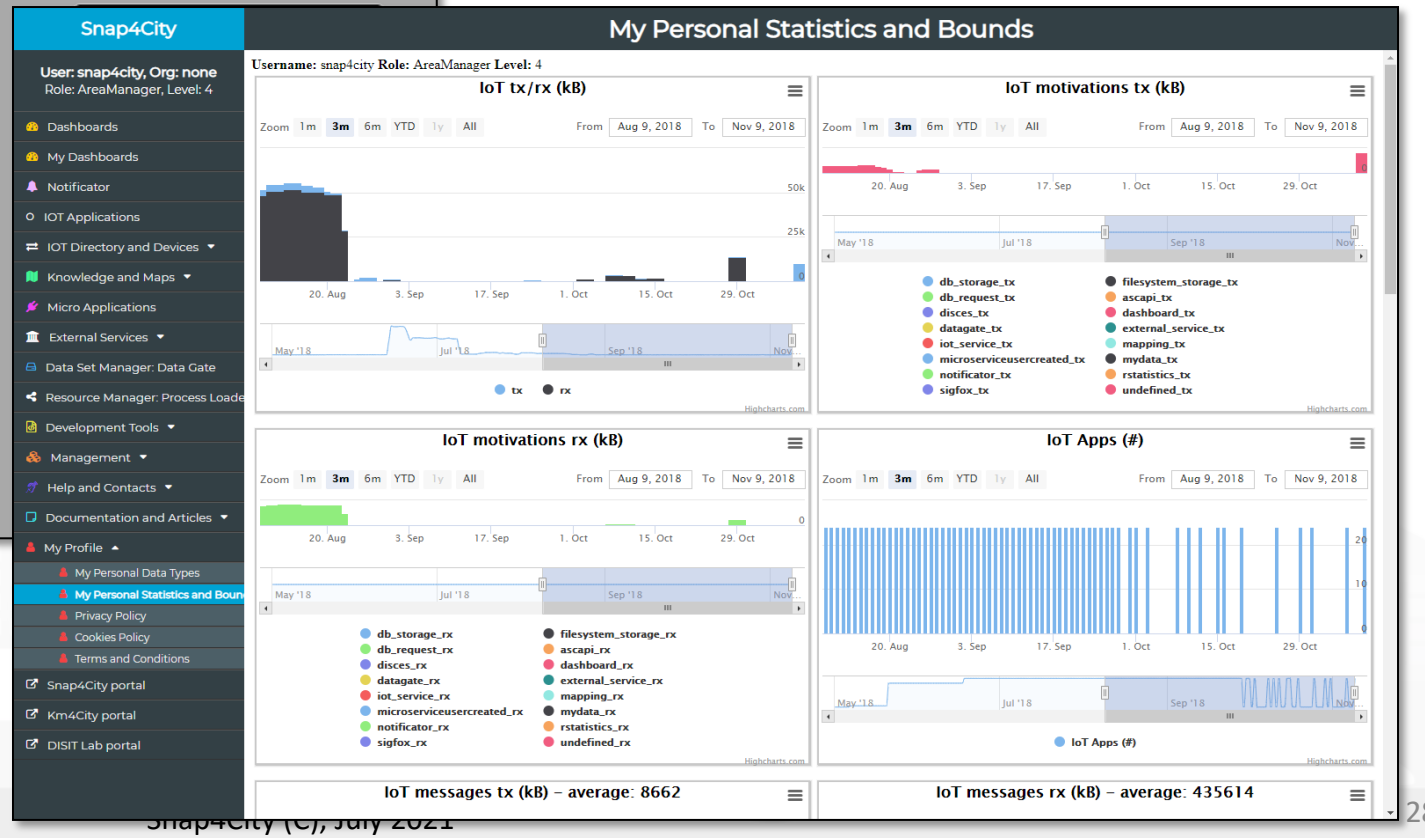
- **Multiple Organizations**
- **Roles:**
  - Managers
  - AreaManagers (developers): special access to computing resources
- **Levels for self-assessment**
  - **Suggestions on next steps to learn on the basis of personal progresses**



User's Limit

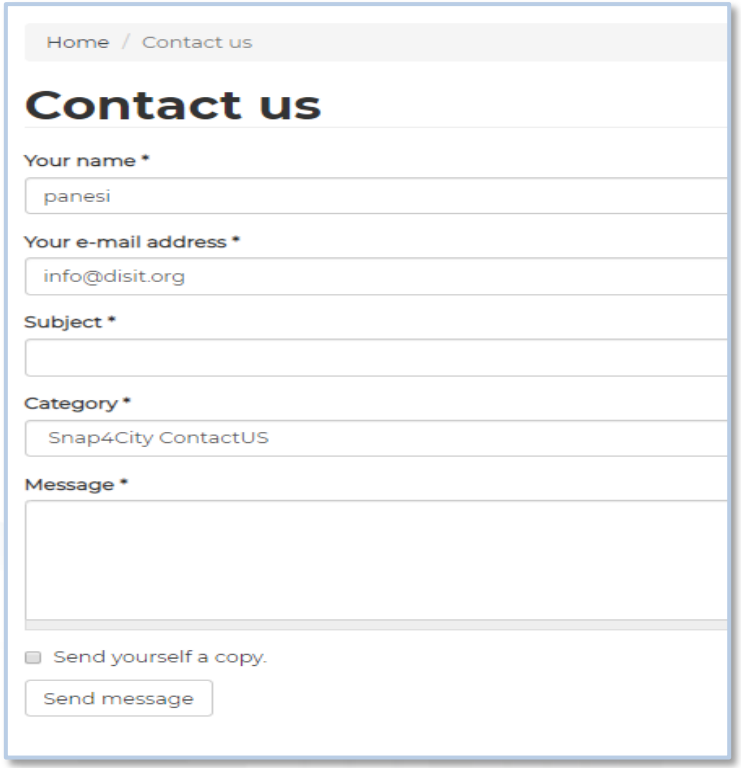
Self Assessment





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

Resource_type:
- 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

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

DeveloperDash-V3-1523555417880
Dev Dashboard
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
IOT Application
developer1: Private
Username: developer1
Resource type: IoTApp
Nature: data category (ie: geolocat...
Description: NodeRed Flow Shared ...
View Edit Publish Owner

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

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

ResDash Docker-1526308998809
Res Dashboard
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

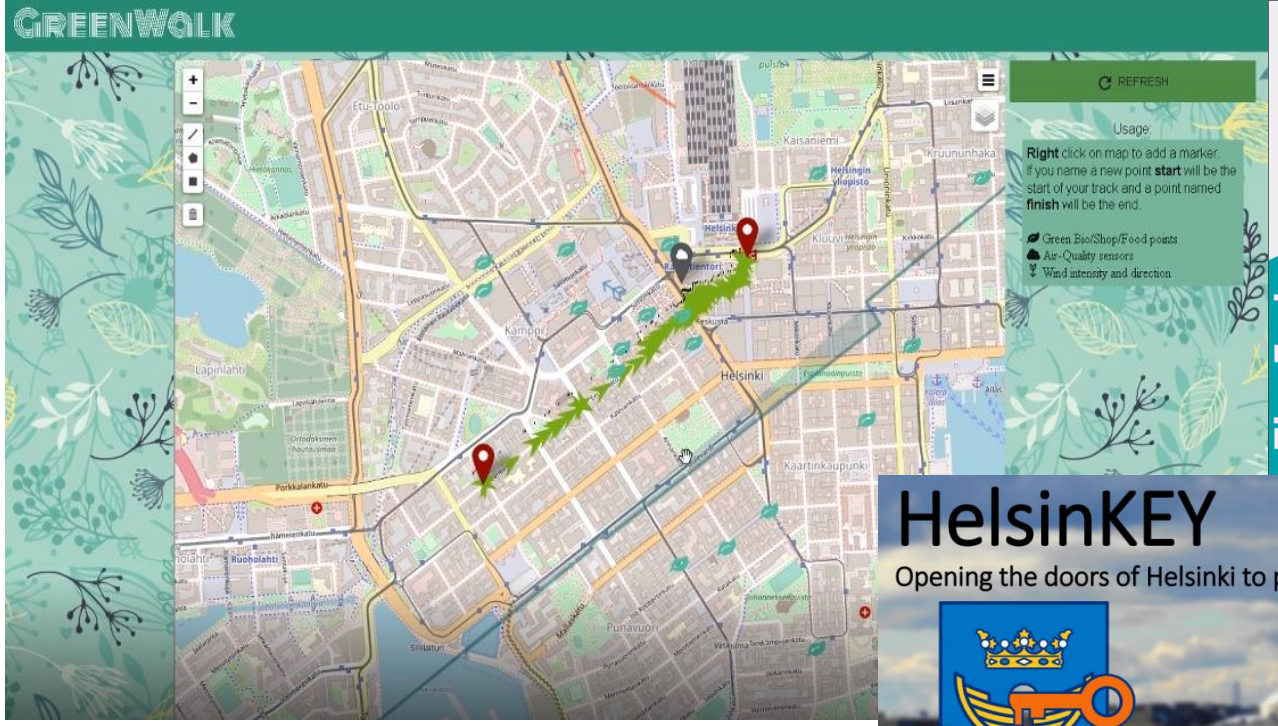
Hackathon Organization

- 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

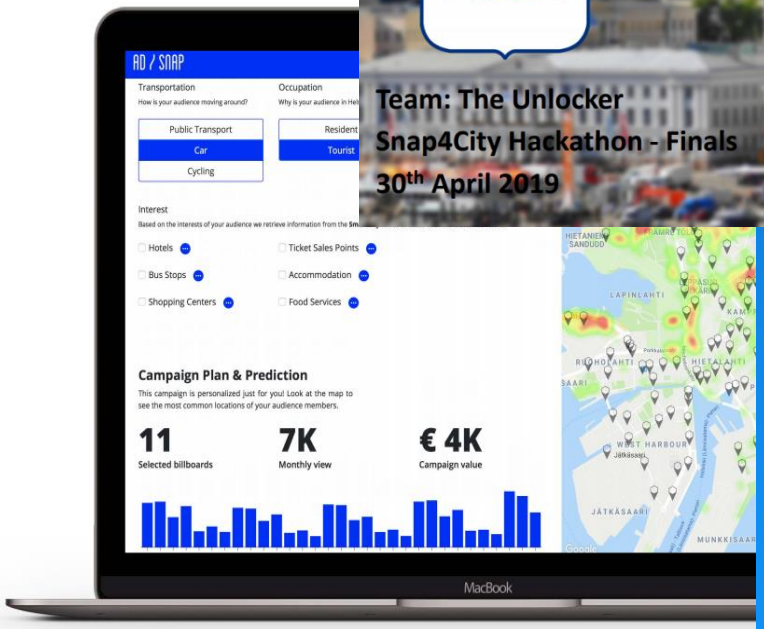
Data-driven design platform for offline advertising

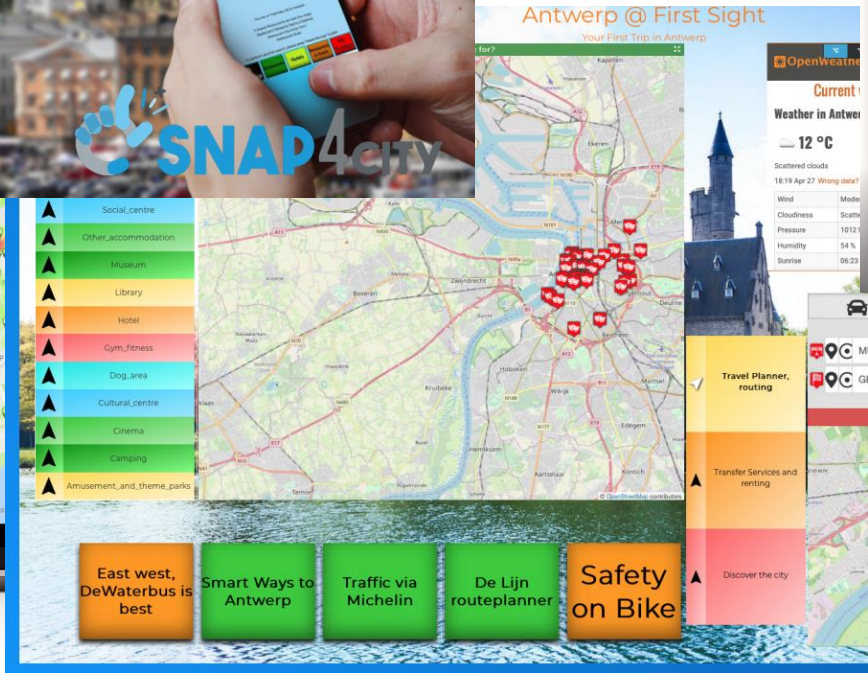
Built on big data to determine the most popular location for a customer group

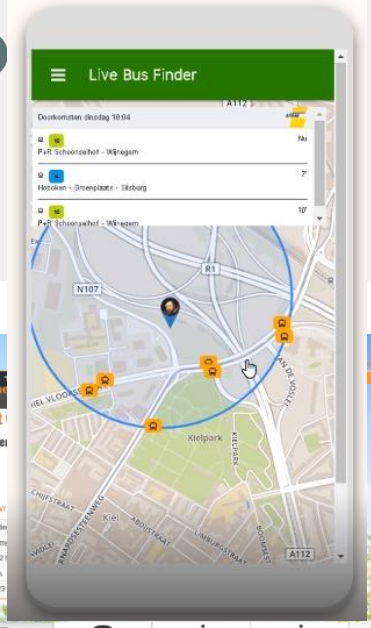
Automatically select billboards with the highest traction. The platform is capable of predicting the reach of every location on a city based on big data analytics.

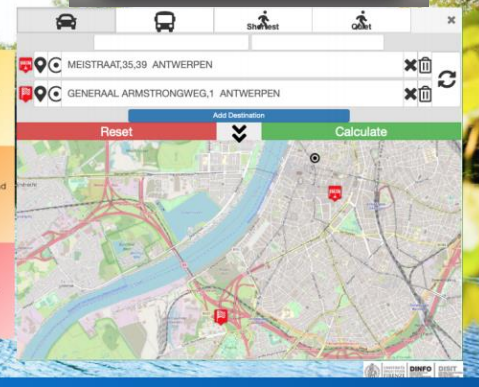
Skyrocket the traction of offline campaigns

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



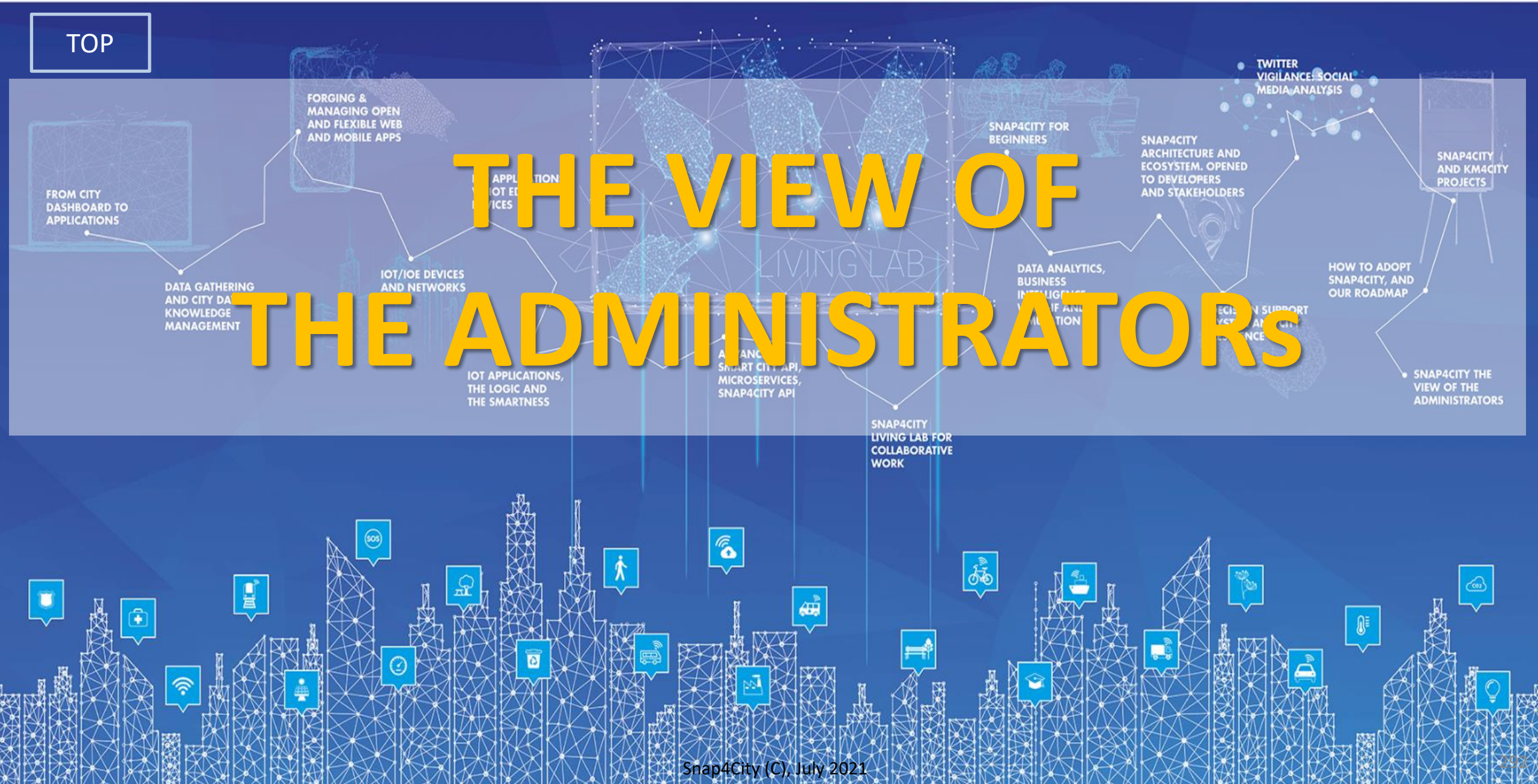






TOP

THE VIEW OF THE ADMINISTRATORs



Snap4City/Industry Architecture, V1/V2

Data Sources, External Services
PULL Data

Data Sources, Brokers, External Services
Data Driven, Real Time

Data Ingestion, aggregation, regularization, reconcile
- NIFI
- Tools, [ETL], DISCES,
- IOT Apps

Big Data Cluster
HDFS, Hbase, Phoenix

Knowledge base
Semantic reasoners

Indexing and aggregating
OpenDistro x Elastic search

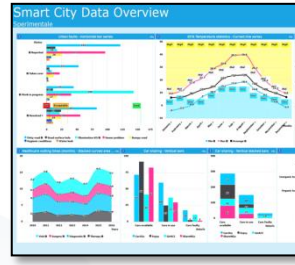
Search and Query, Smart City API
Facet, semantic search

Data Analytics
R, Tensor Flow, Python, MapReduce, …

Visual Analytics

IOT Applications
Node-RED + Snap4City MicroServices

Rendering Acting, Widgets, MicroApps
User interface, Interactive Dashboard, Drill down, maps, heatmaps



Inform, announce, Act!, warning, alarms, What-IF, ..

In Yellow Alternaive Snap4City V1

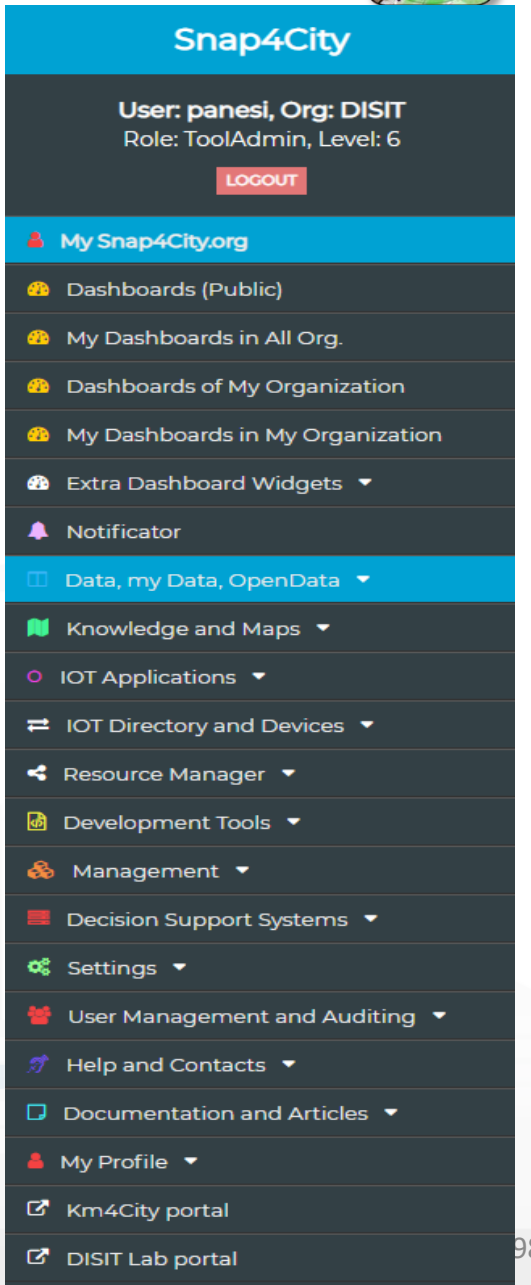
Roles in Snap4City/Industry solutions

- **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

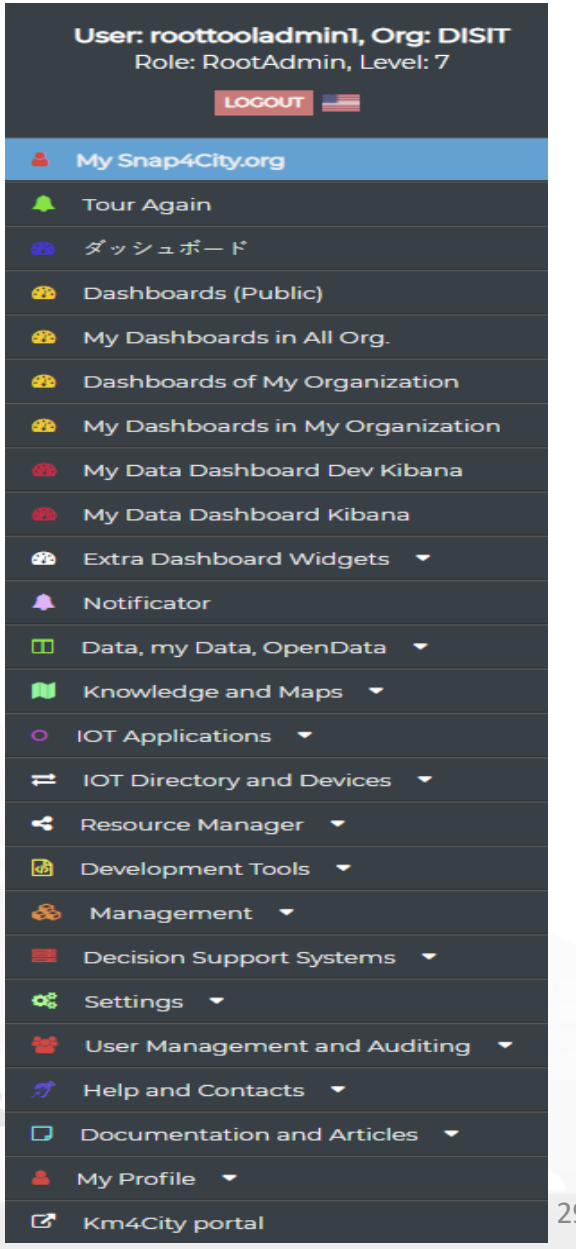
- **Organizations** may have
  - name, ID, GPS center, a number of Groups on Snap4City.org (living lab support Drupal)
  - users of different kinds and may impose early bounds on the resourced used by users (IOT Dev, IOT App, Dash)
  - on cloud user kinds up to level of Tool Administrator
  - One or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



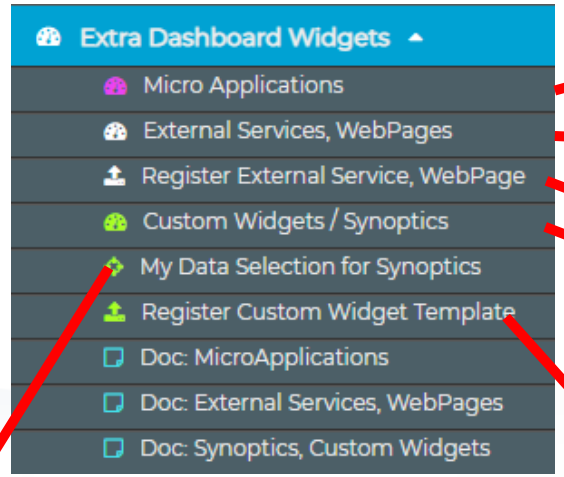
RootAdmin

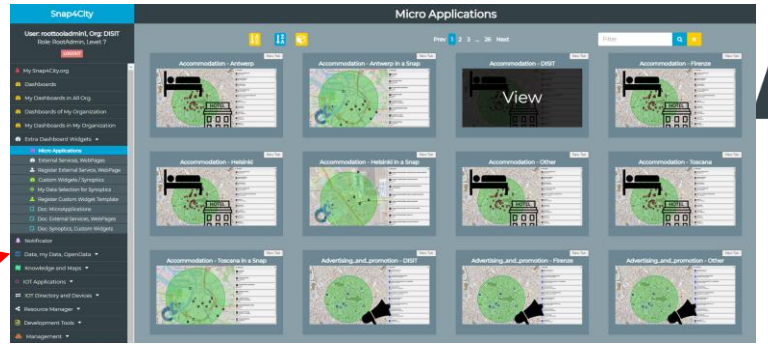
- RootAdmin on Snap4City.org has a very large set of tools
  - My Snap4City, ….Tour, etc.
  - Dashboards
  - **My Data Dashboard (Kibana)**
  - **Extra Dashboard Widgets**
  - Notificator
  - **Data, My Data, OpenData**
  - **Knowledge and Maps**
  - **IOT Applications**
  - **IOT Directory and Devices**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

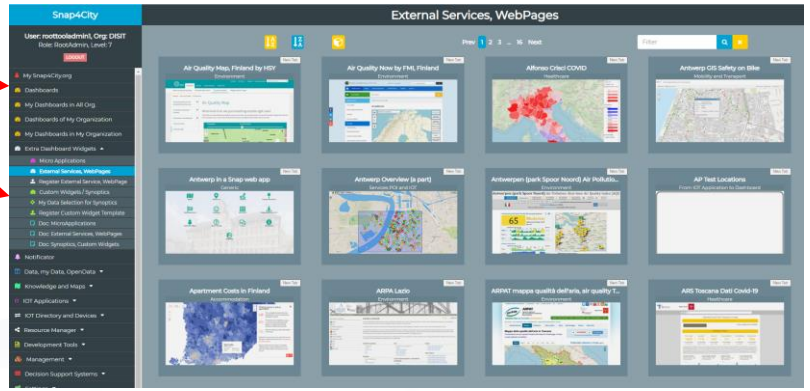


Extra Dashboard Widgets

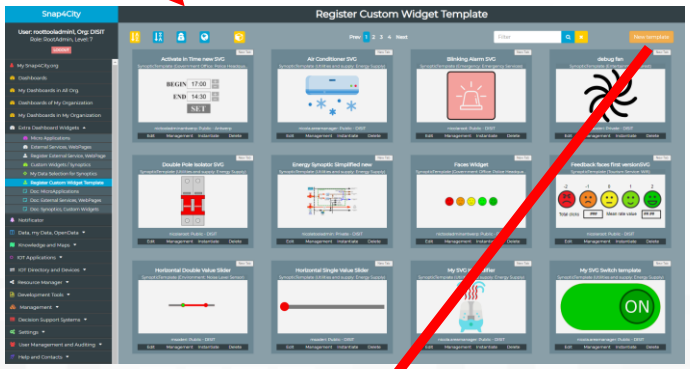


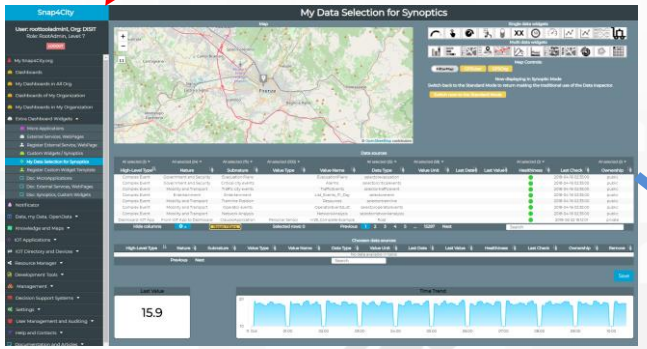


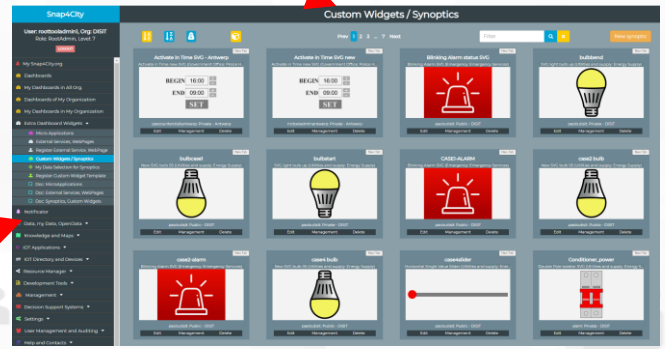
MicroApplic.



External Services

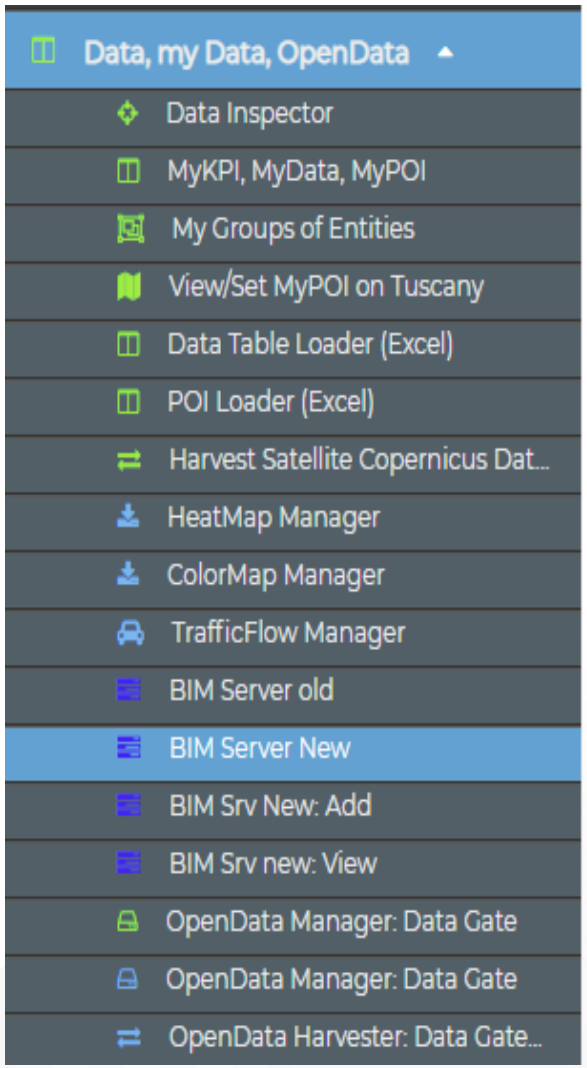






Synoptics, Custom

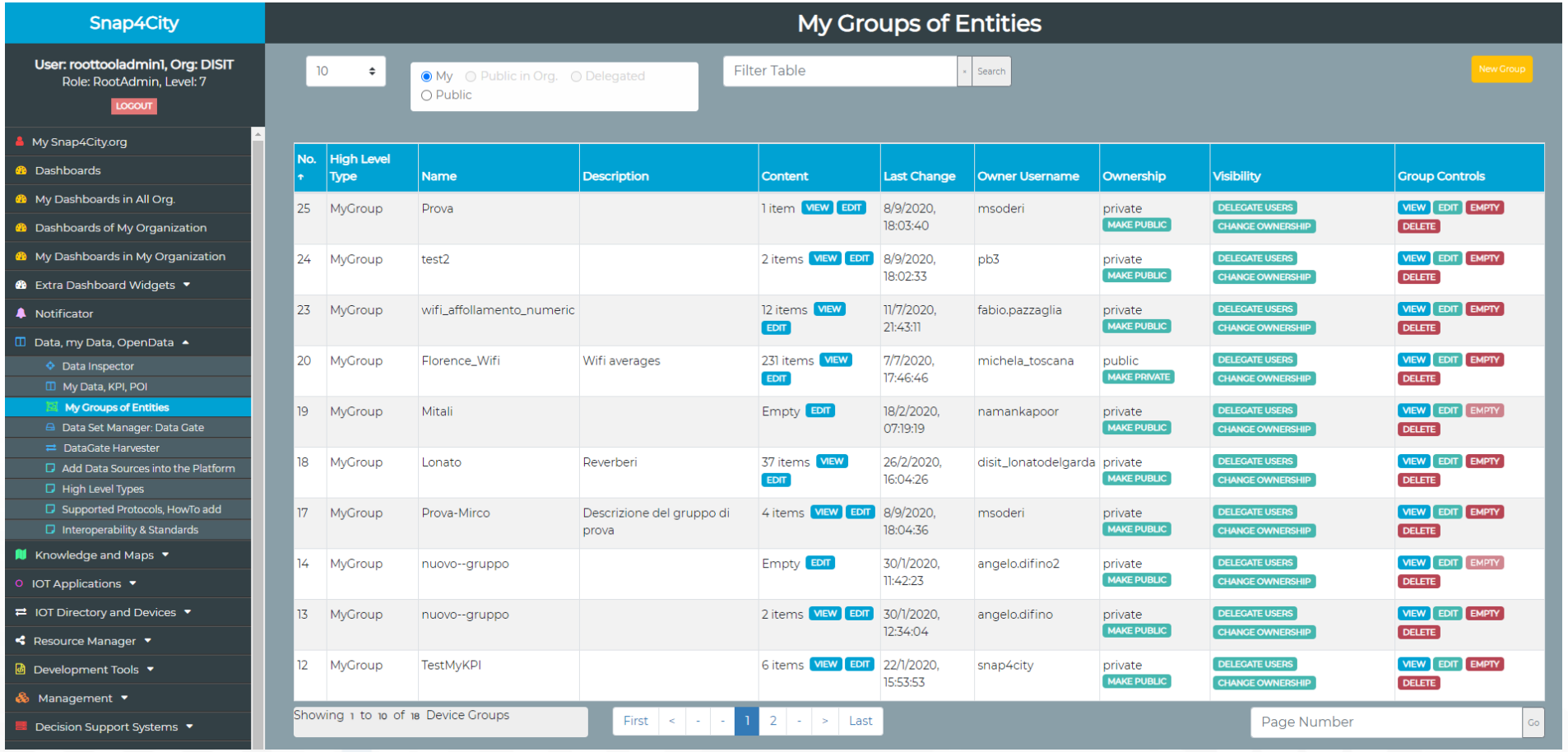
Data My data



- **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
- **Traffic Flow Manager**: management of Traffic Flows as sequence of complex data
- **Color Map**: to code rendering colors of other Managers
- **BIM**: support 3D for the Digital Twin Local
- **Open Data, CKAN**: harvesting and publishing open data

Managing Groups

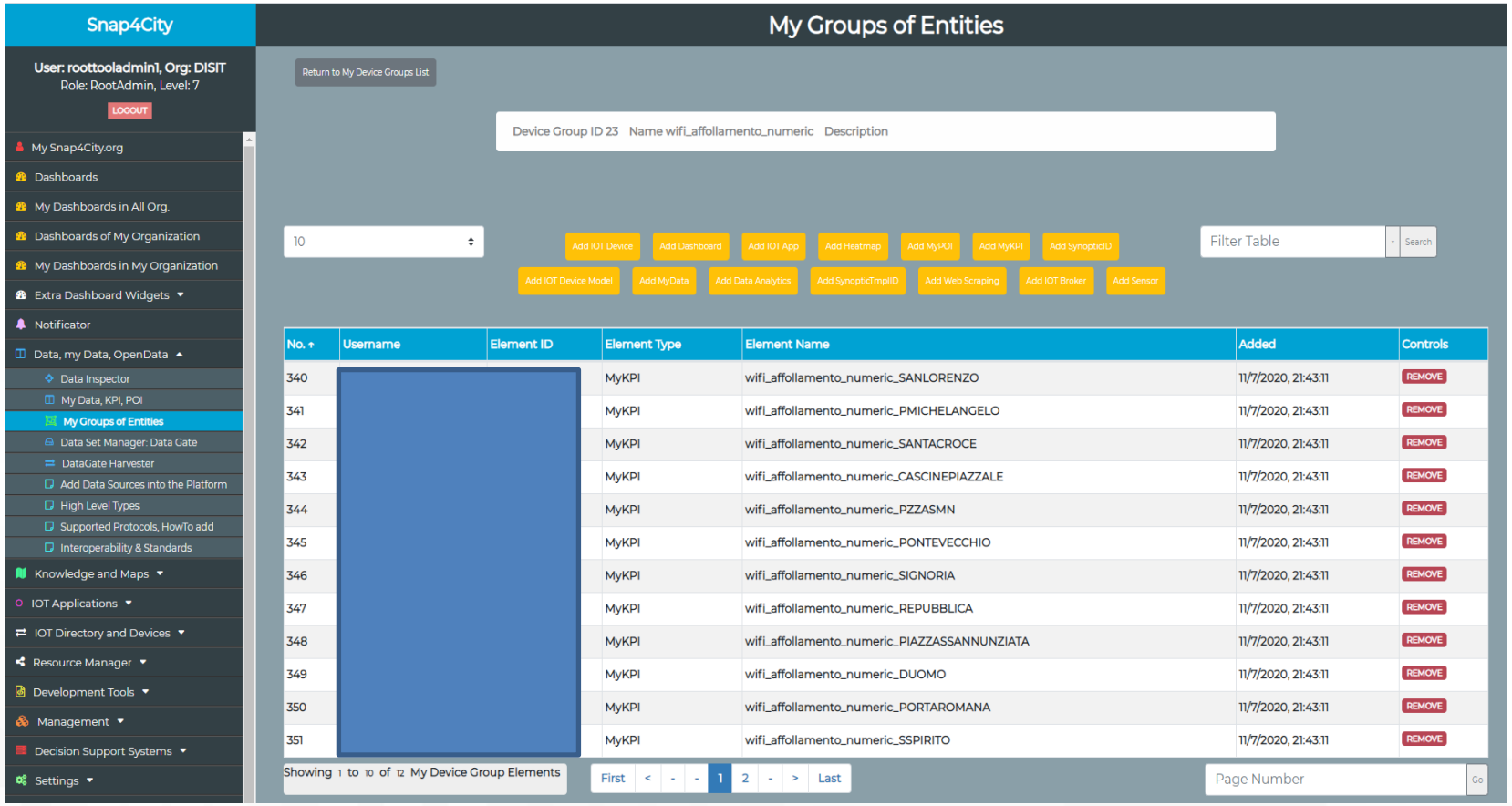
- **My Groups of Entities**
  - **Licensing group of Entities in One Click**



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

Group of entities

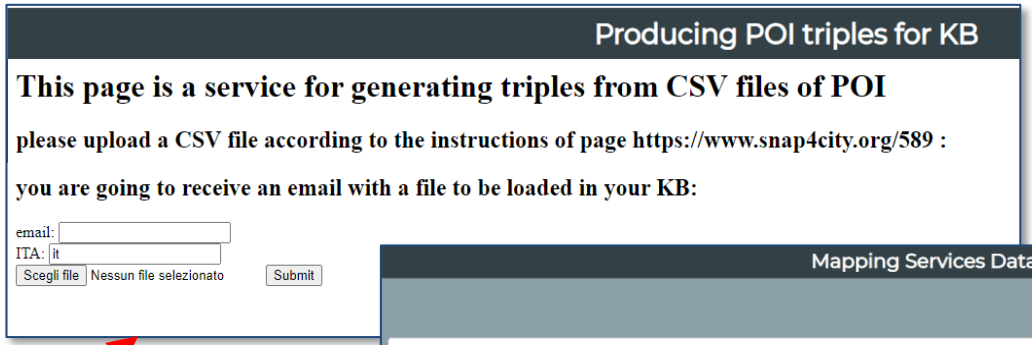
- A group may include a number of:
  - IOT Devices, Dashboards, MyPOI, MyKPI, Synoptics, IOT DeviceModels, MyData, Synoptics Templates, IOT Brokers, IOT Sensors/actuators,..
- Once the Group is created, the group owner can:
  - Produce a license to grant access at all the Group Entities in one click

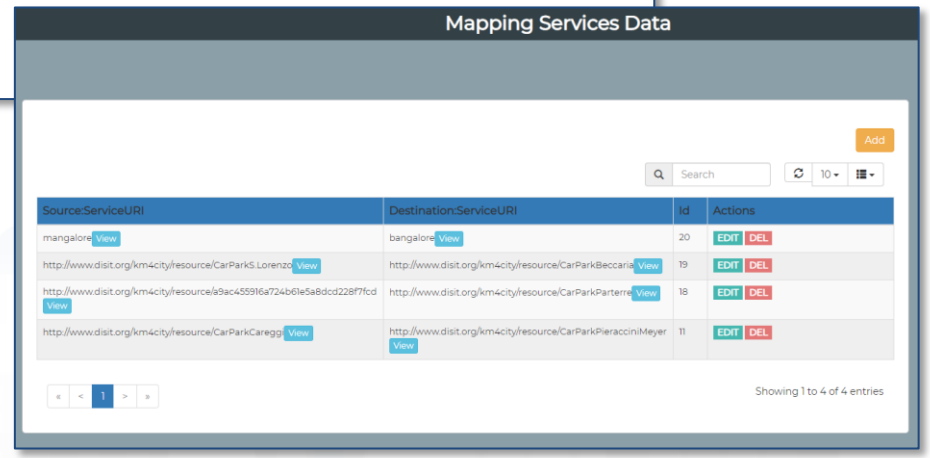


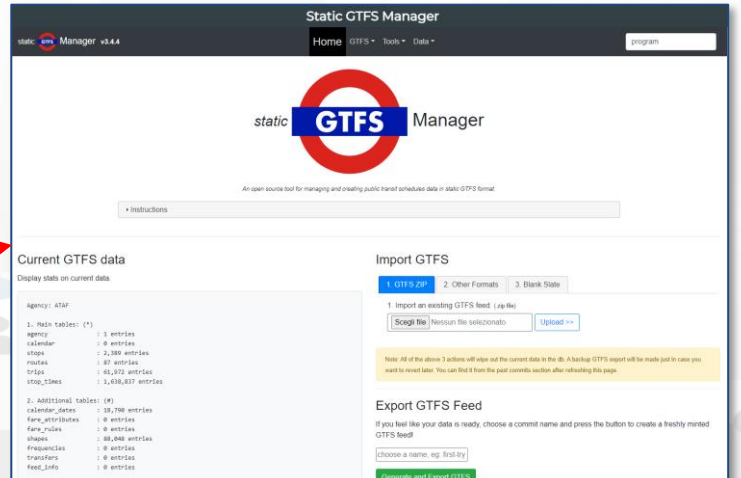
Knowledge and Maps

- Knowledge and Maps
  - Service Map (Toscana)
  - Service Map 3D (Firenze)
  - Helsinki Service Map
  - Antwerp Service Map
  - Garda Lake Service Map
  - Cagliari Service Map
  - Lonato Del Garda Service Map
  - Valencia Service Map
  - Pont Du Gard Service Map
  - Dubrovnik Service Map
  - WestGreece Service Map
  - Mostar-Bosnia Service Map
  - Svealand Service Map
  - Roma Service Map
  - Pisa Service Map
  - Creating WKT
  - Service Map 3D (Antwerp)
  - Service Map 3D (Helsinki)
  - Producing POI triples for KB
  - Load WKT on ServiceMap (Helsinki)
  - Load WKT on ServiceMap (Toscana)
  - Load WKT on ServiceMap (Antwerp)
  - My Annotation on Services/Data
  - Mapping Services Data
  - ArcGIS DISIT Service
  - Static GTFS Manager

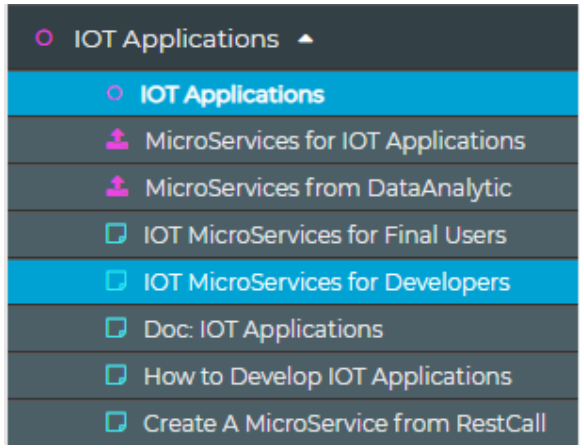
- A number of ServiceMaps, Knowledge bases, KB
- Tools for creating WKT, shapes
- Access to ServiceMap 3D, if any
- Service for Loading triples on KB
- My Annotations (deprecated)
- Mapping Tool (partial)
- GIS servers, if any
- Static GTFS editor and manager (if any)

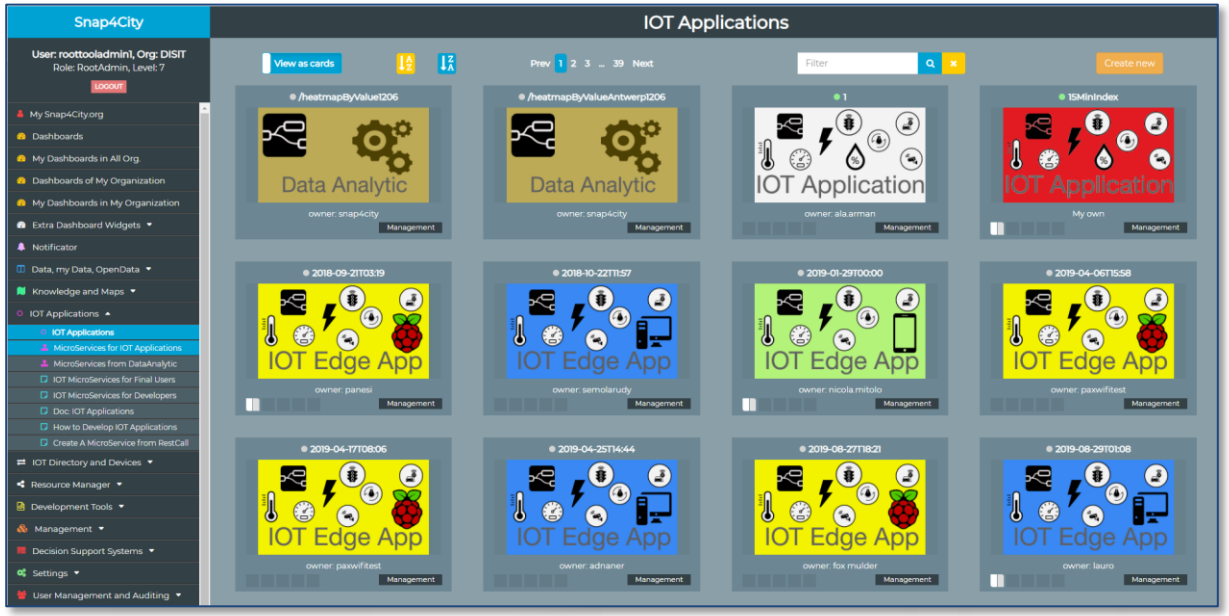






IOT Applications

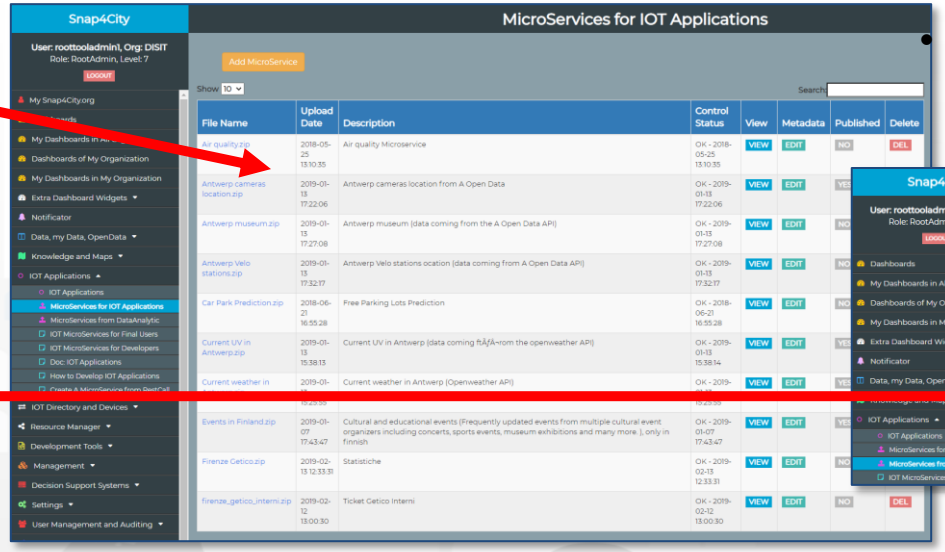


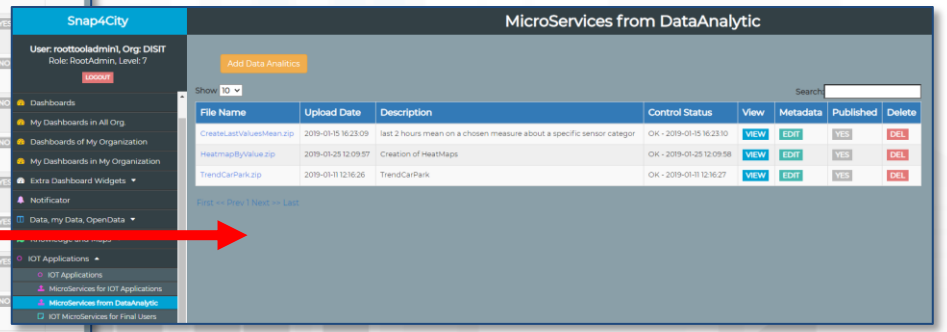


- **IOT Applications**: a view to manage Containers / IOT Edge Apps: IOT Apps, Data Analytics (R and Python), WebScraping, IOT edge, etc.

Managing also

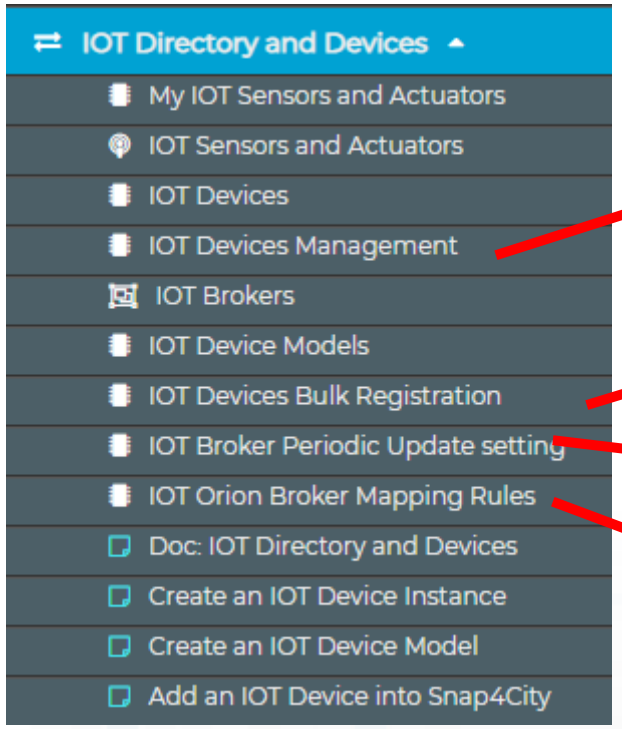
- **MicroServices for IOT App exploiting REST Call**
- **MicroServices from DataAnalytics**

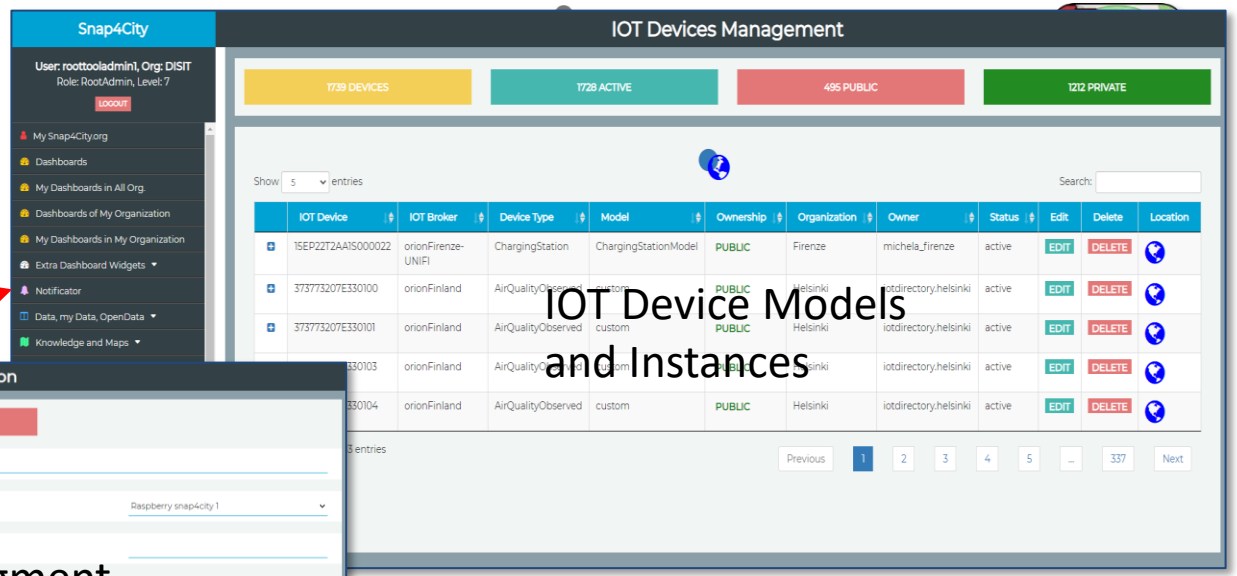




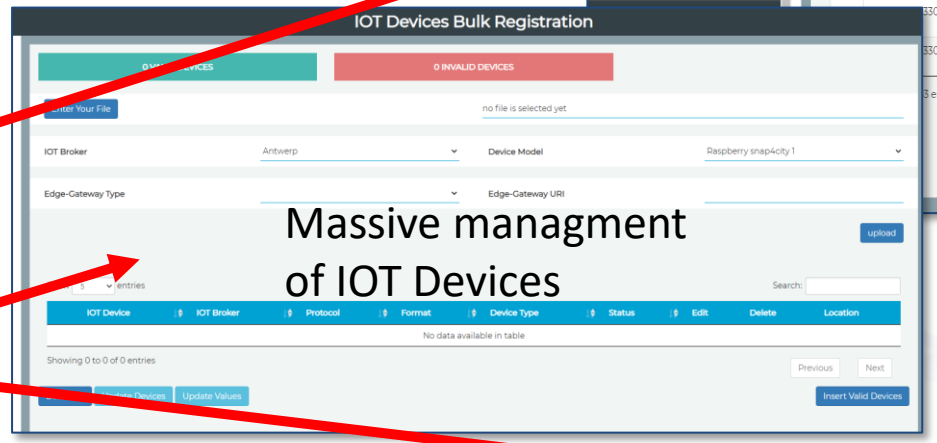
For non admin tools see Training parts 3 and 5: https://www.snap4city.org/577

IOT Directory and Devices

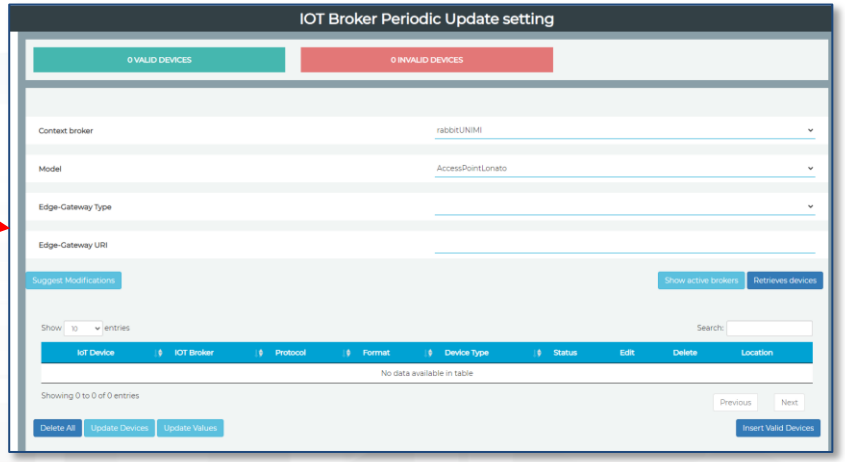


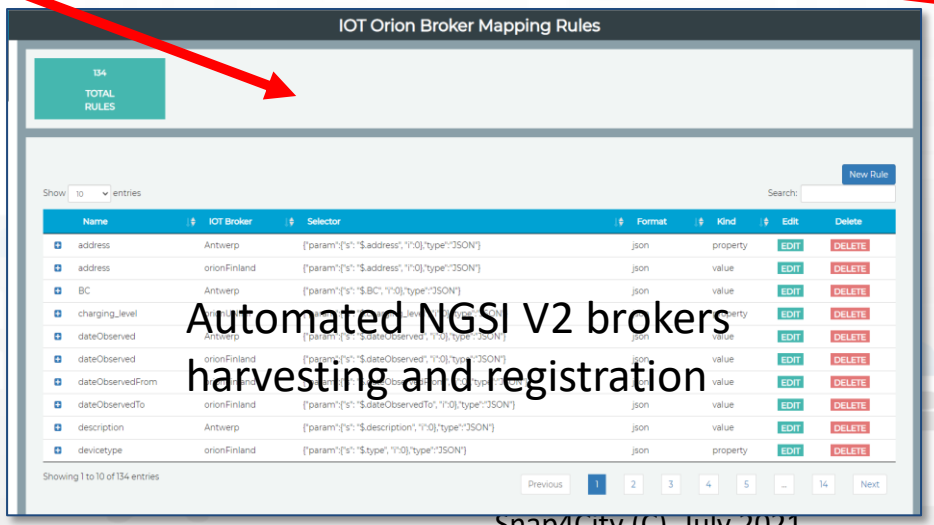


IOT Device Models and Instances



Massive managment of IOT Devices



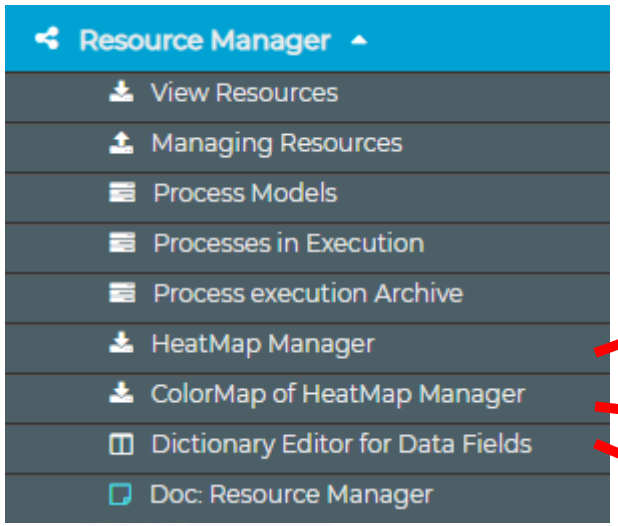


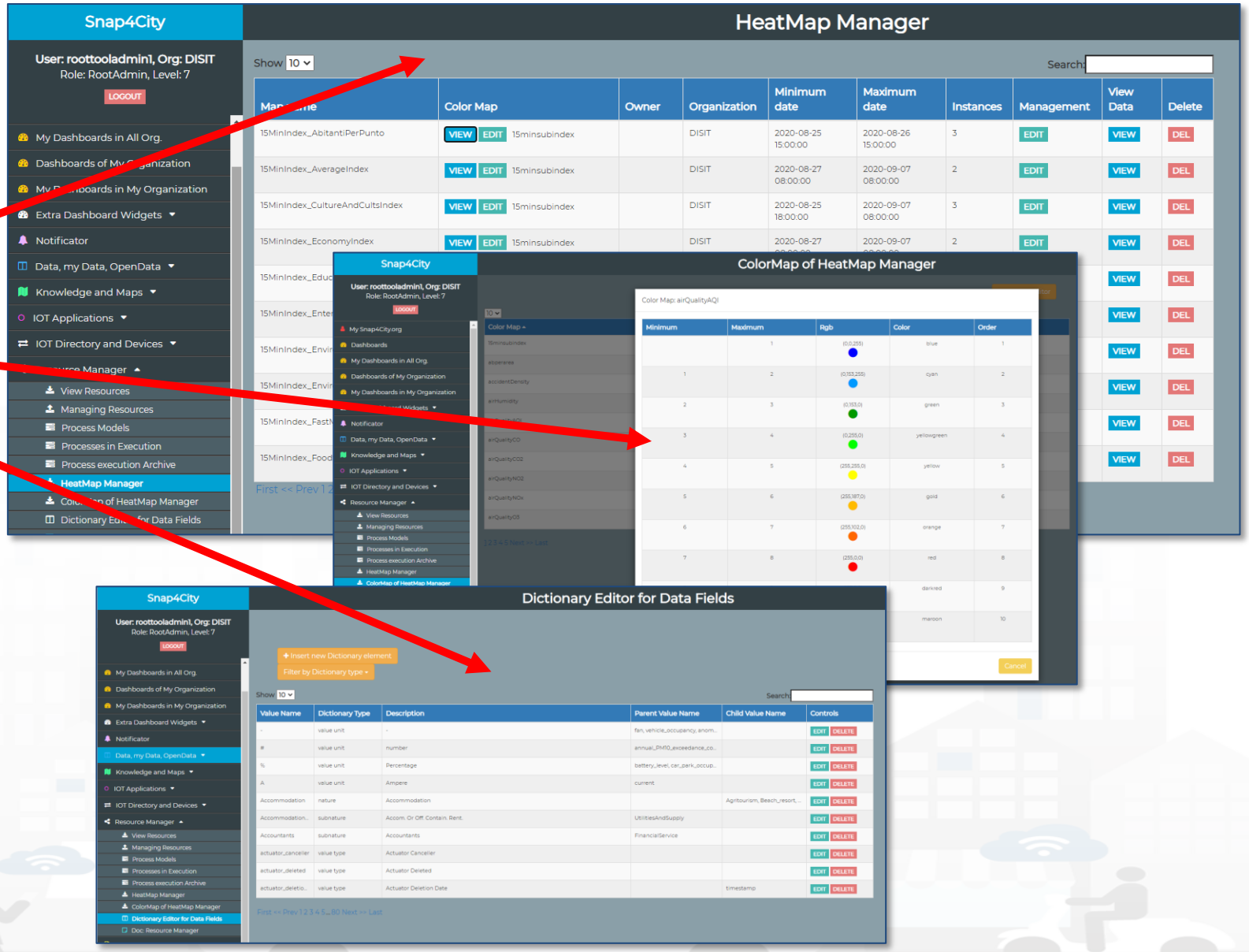
Automated NGSI V2 brokers harvesting and registration

IOT 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*

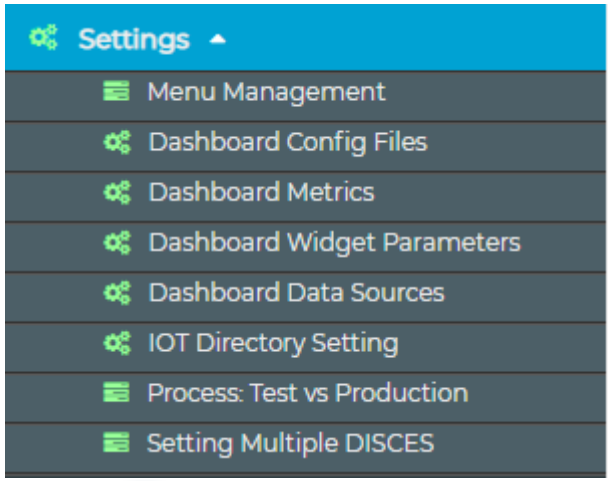
- **API and Swagger documentation**
- **Model Knowledge Base Graphs (LOG.disit.org)**
- **Python online dev. Environment**
- **R Studio Online dev. Environment**
- WebScraping tool
- SPARQL Editor and tools (custom FLINT)
- ETL OnLine dev. Environment (deprecated)

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

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

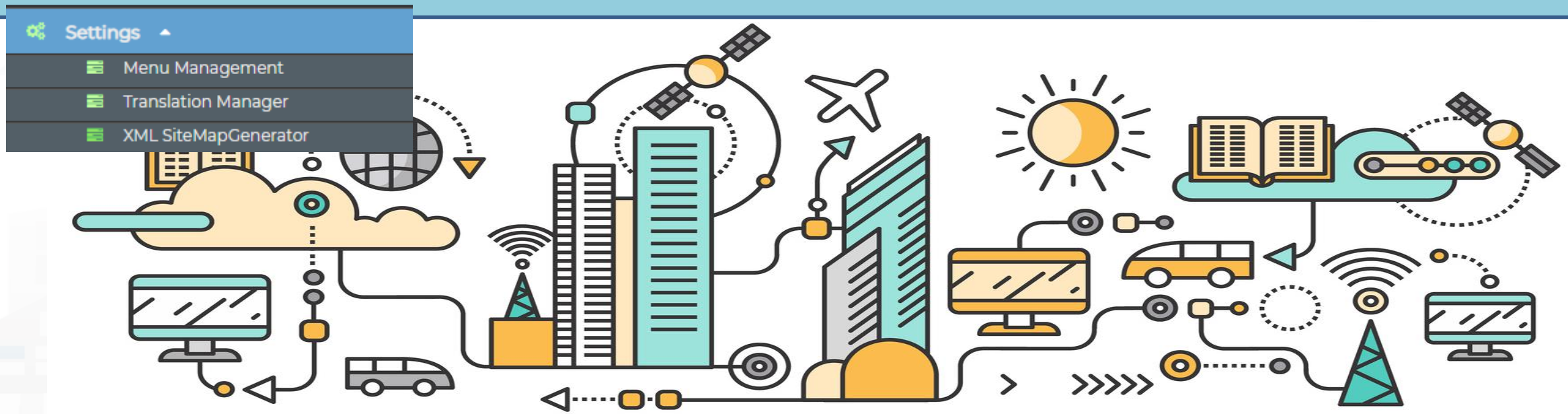
Settings



- **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

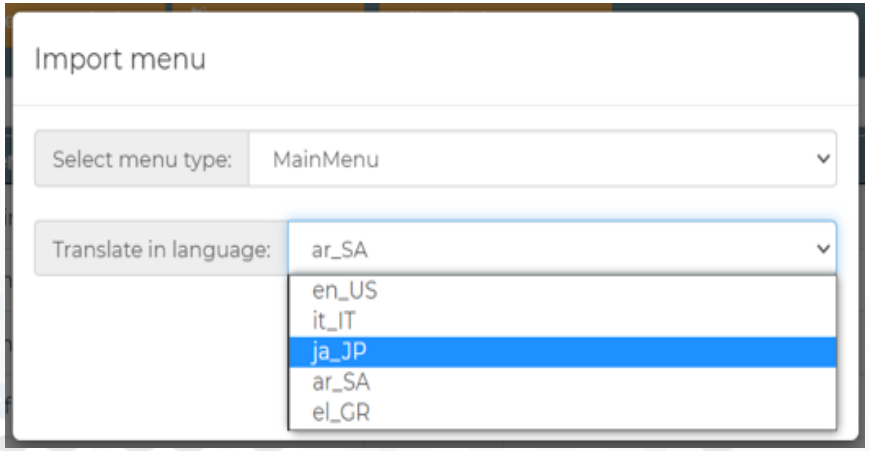
Translation Manager

Translation manager

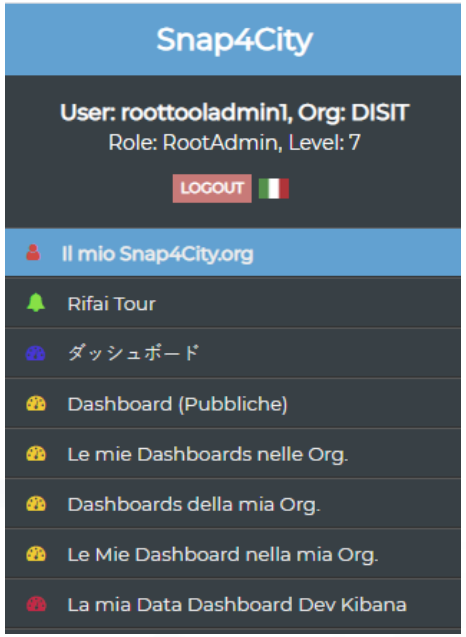
+ Create New Text translation | Import menu | Filter by language

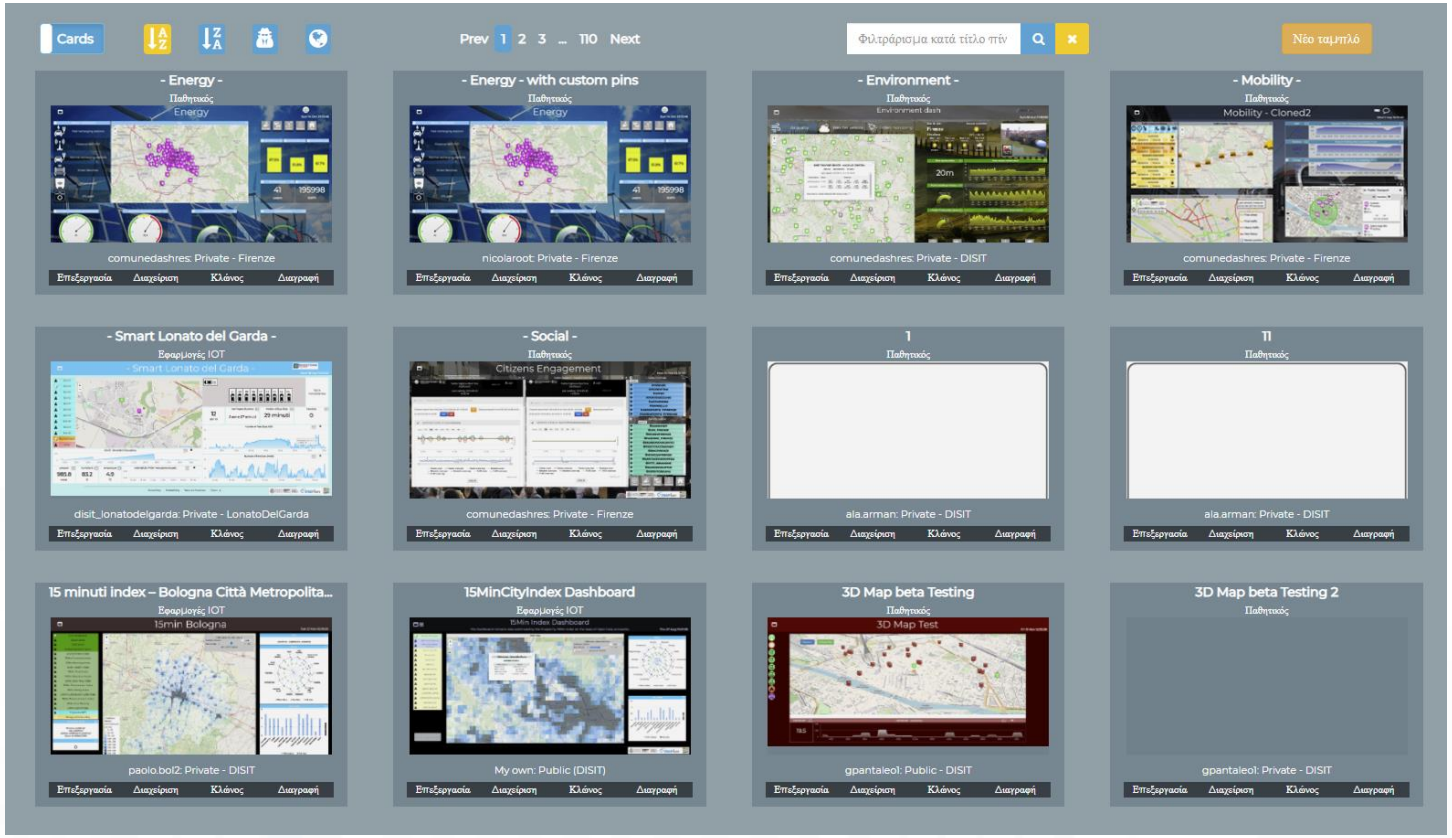
Show 20 | Search:

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

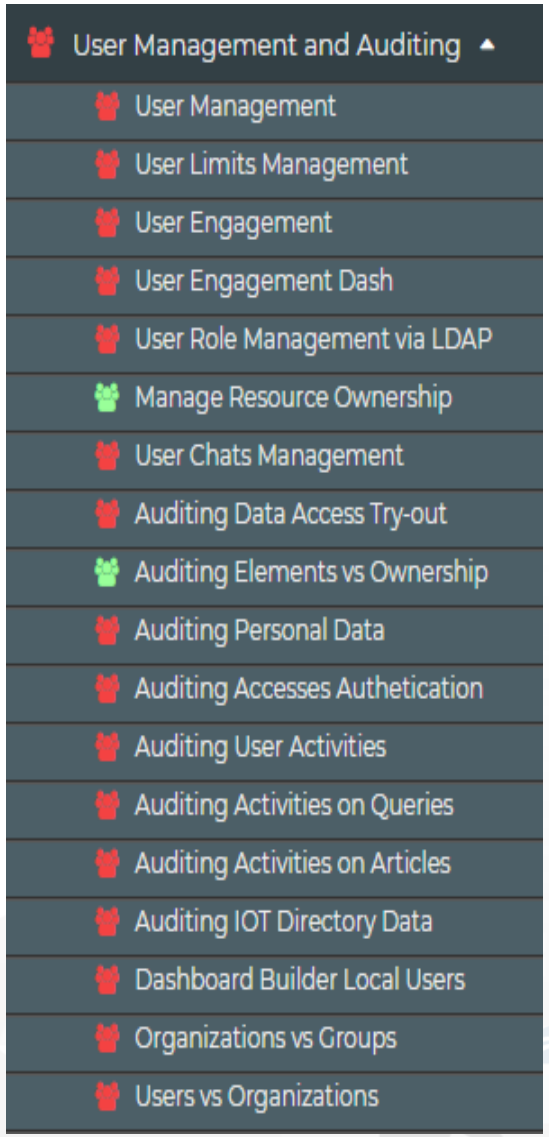




- Keyworks as Main Tools names should remain in English
- Names of the resources remain in the language in which they have been created/defined

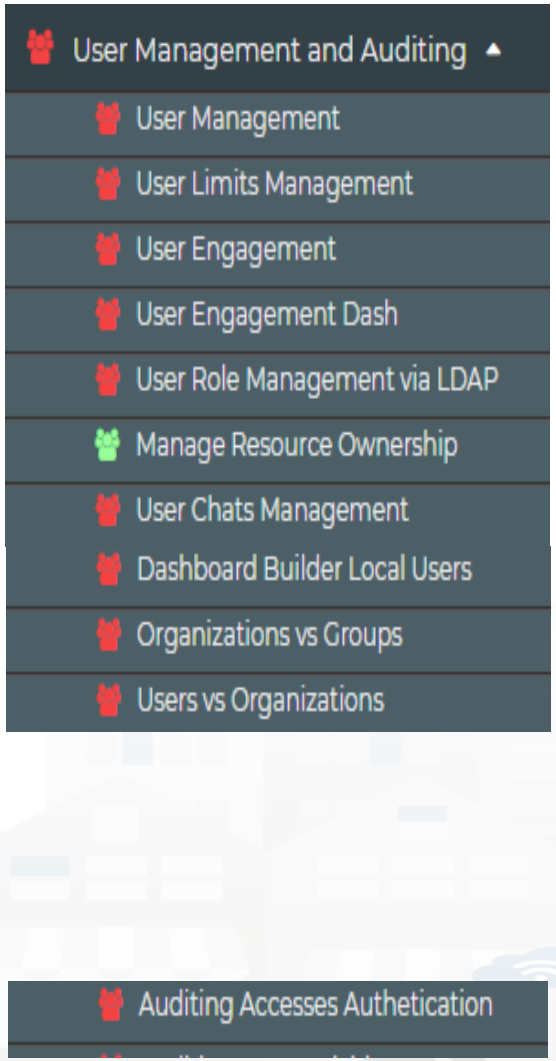
User Management

User Management and Auditing



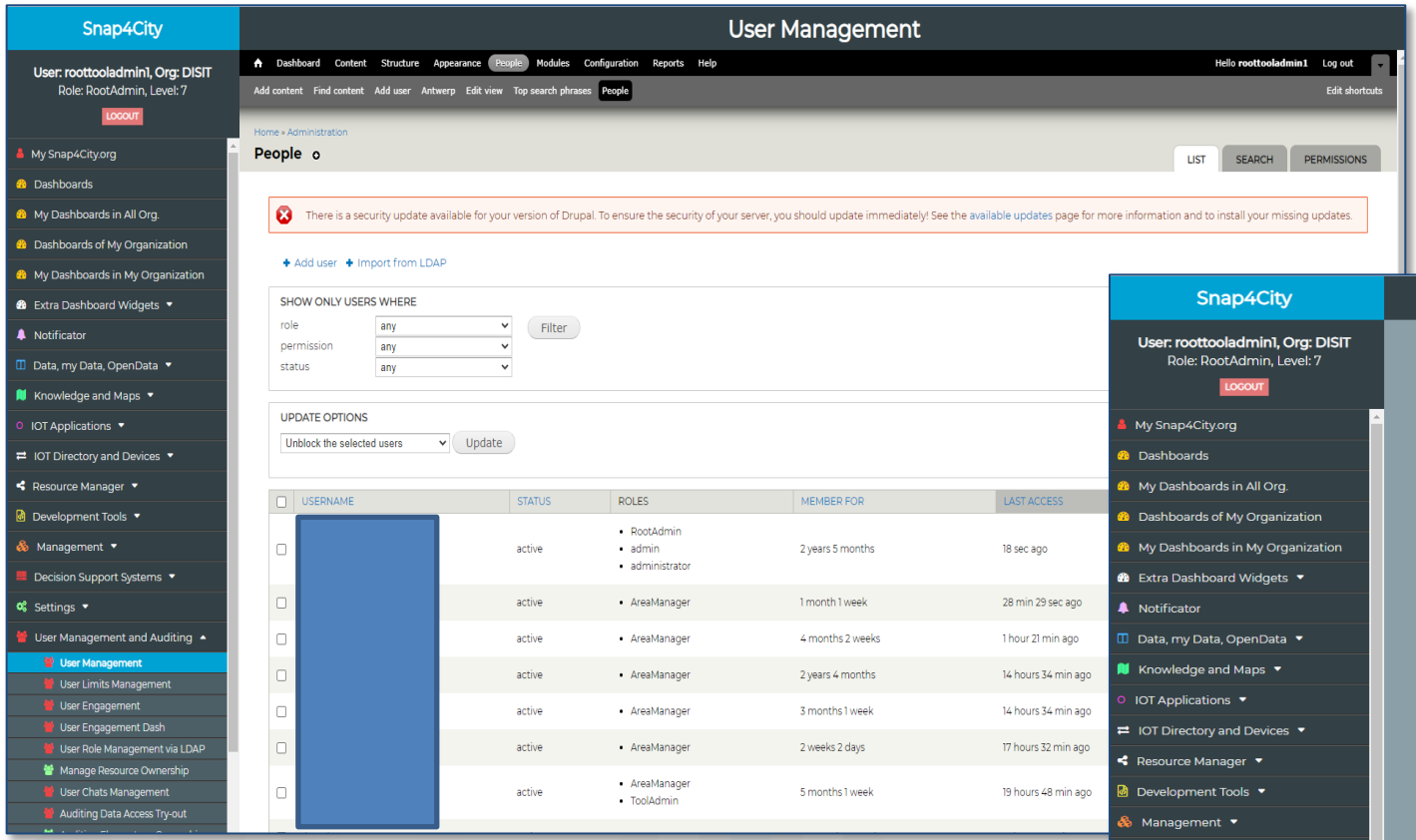
- All that the RootAdmin needs to manage:
  - **User Management: for managing**
    - accounts and profiles
    - limits of the users in exploiting resources
    - Accesses and providing special authorization
    - Organization vs Groups of users
    - Users vs Organizations
  - **Users vs Web and Mobile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



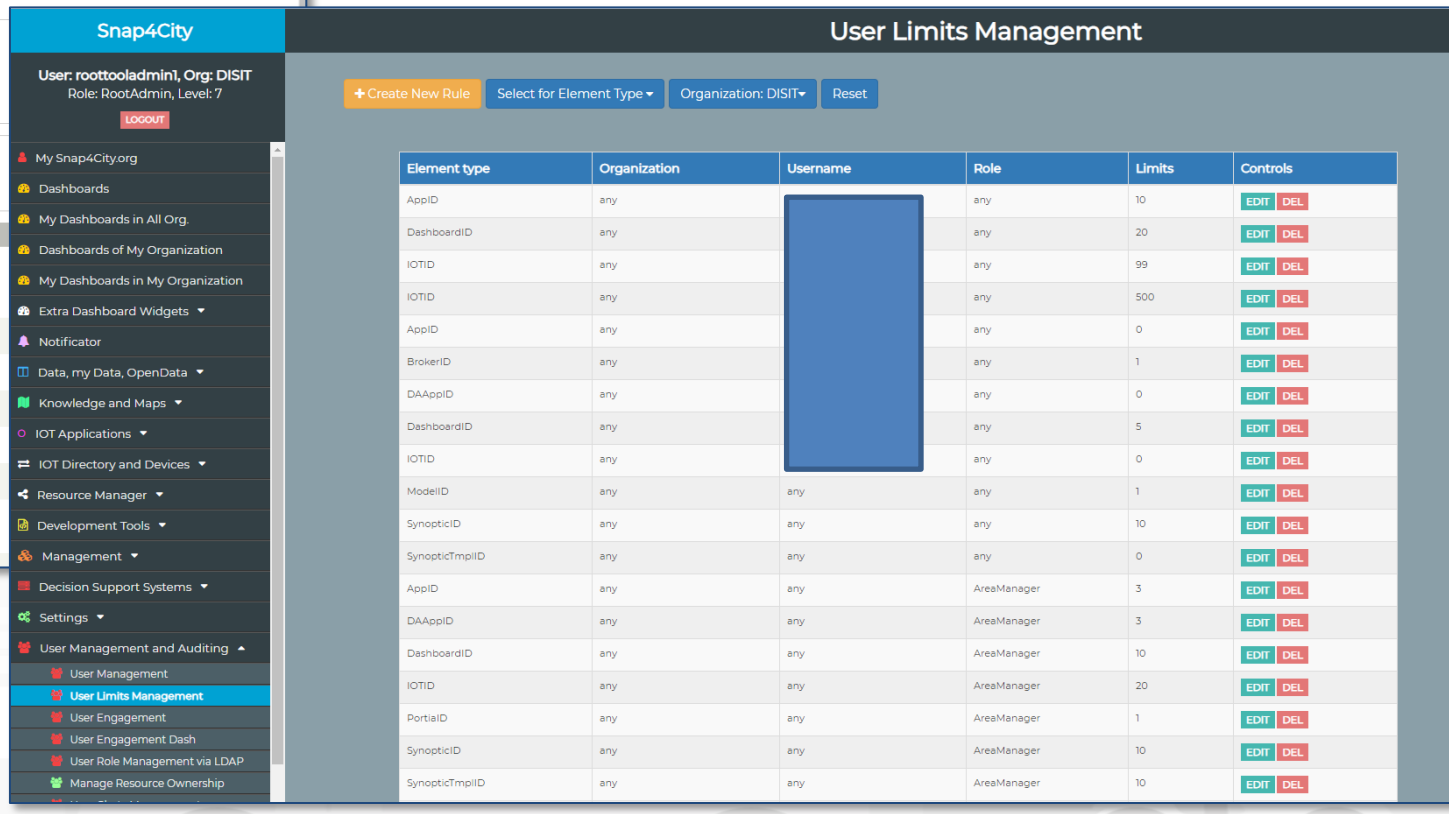
- User Management via Drupal or Local Users Management without CRM.
- User Limits con controlling resource consumption
- User Engagement: see mobile App training part
- Roles and LDAP management
- Managing Resources vs Users' Ownerships and granted accesses to the resources
- Organizations and their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

User Management and Users' Limits



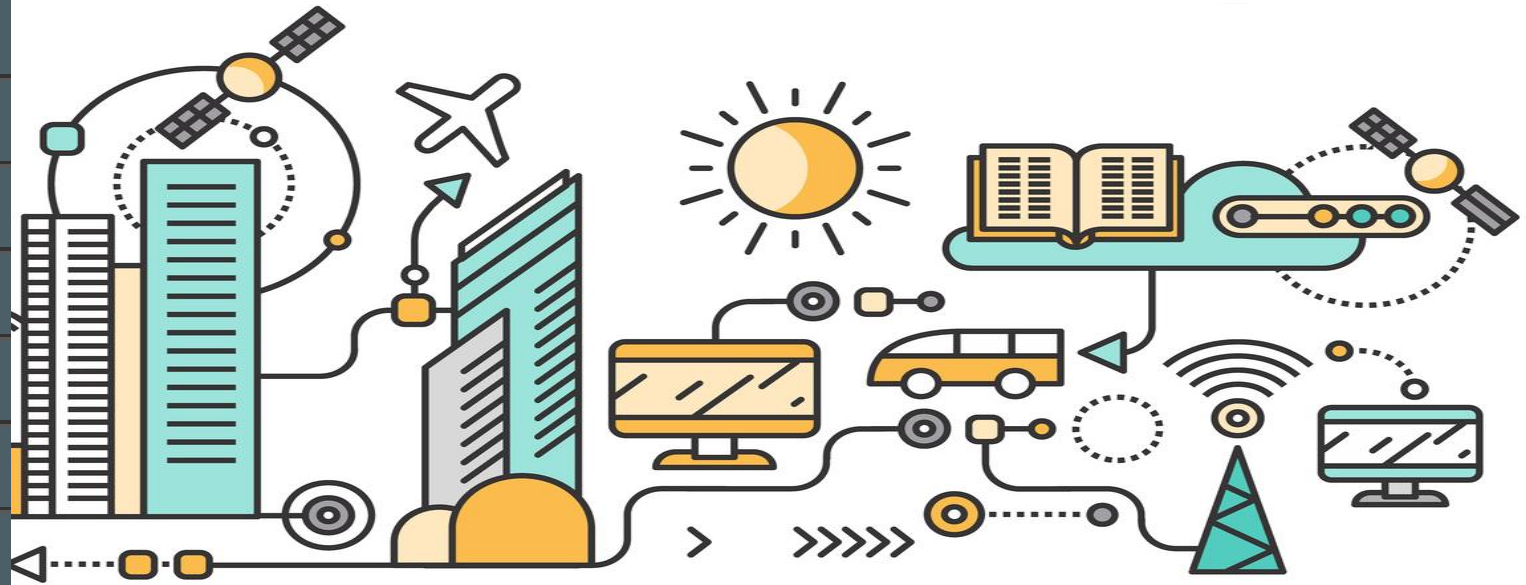
Managing roles and authorizations

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

Auditing Data Access Try-out

Snap4City

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

- Knowledge and Maps
- Micro Applications
- External Services
- Data Set Manager: Data Gate
- Resource Manager: Process Loader
- Development Tools
- Management
- Settings
- User Management and Auditing
  - User Management
  - User Engagement
  - User Engagement Dash
  - User Role Management via LDAP
  - Manage Resource Ownership
  - User Chats Management
  - Auditing Data Access Try-out
  - Auditing Elements vs Ownership
  - Auditing Personal Data
  - Auditing Accesses Authetication
  - Auditing User Activities
  - Auditing Activities on Queries
  - Auditing Activities on Articles
  - Auditing IOT Directory Data
  - Dashboard Builder Local Users
  - Organizations vs Groups
  - Users vs Organizations
- Help and Contacts
- Documentation and Articles
- My Profile

Reset Filters

15

Id	Date and Time (From... / To... / Search)	Username (Search... / Search)	App Name (Search... / Search)	Source request (Search)	Variable name (Search... / Search)	Motivation (Search... / Search)	Access Type (Search)	Query	Error Message	Stacktrace	ip_address (Search... / Search)
3576876	2019-10-16 15:40:08						WRITE	/datamanager/ap	The passed DELEGATION has	edu.unifi.disit	192.168.0.37
3557811	2019-10-12 13:12:12						READ	/datamanager/ap	The logged user is not th	edu.unifi.disit	192.168.1.82
3557813	2019-10-12 13:12:13						READ	/datamanager/ap	The logged user is not th	edu.unifi.disit	192.168.1.82
3557814	2019-10-12 13:12:13										
3342336	2019-09-29 13:04:15			dashbo							
3407872	2019-10-10 23:56:26			modbu							
3473408	2019-10-11 17:19:35			modbu							
3538944	2019-10-12 08:45:33			modbu							
3342592	2019-09-29 14:42:18			dashbo							
3408128	2019-10-11 00:00:00			modbu							
3473664	2019-10-11 17:23:21			modbu							
3539200	2019-10-12 08:49:08			modbu							
3342848	2019-09-29 16:20:19			dashbo							
3408384	2019-10-11 00:03:37			modbu							
3473920	2019-10-11 17:26:56			modbu							

1 2 3 4 5 6 7 8 9 10 ... 15970 15971 15972 15973 Next >>

Auditing Personal Data

Reset Filters

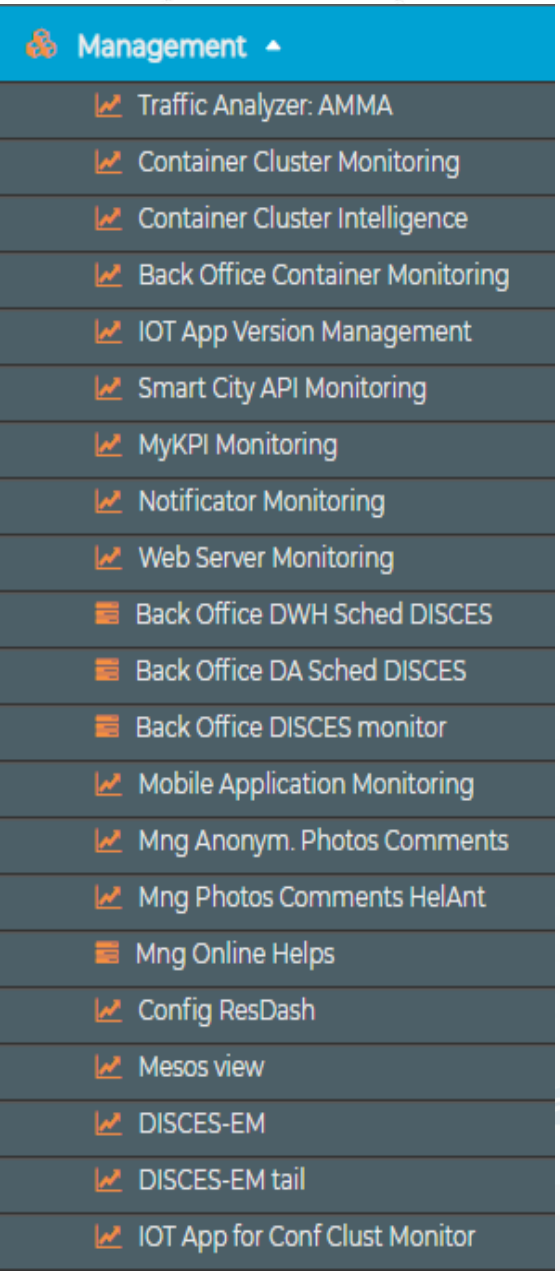
15

Id	Date and Time (From... / To... / Search)	Username (Search... / Search)	App Name (Search... / Search)	Delegated Username (Search... / Search)	Delegated AppName (Search... / Search)	Source request (Search)	Variable name (Search... / Search)	Motivation (Search... / Search)	Access Type (Search)	Domain (Search)
17295228	2019-10-19 18:17:48					orionbrokerfilter			READ	DELEGATION
17295227	2019-10-19 18:17:36				ChargingStations	dashboardmanager	Num_Utenti_distinti_globali		READ	DATA
17295226	2019-10-19 18:17:36					dashboardmanager	Num_Utenti_distinti_globali		READ	DATA
17295225	2019-10-19 18:17:34					dashboardmanager	Num_Utenti_distinti_globali		READ	DATA
17295224	2019-10-19 18:17:25					orionbrokerfilter			READ	DELEGATION
17295223	2019-10-19 18:17:17					dashboardmanager			READ	DELEGATION
17295222	2019-10-19 18:17:04					dashboardmanager			READ	DELEGATION
17295221	2019-10-19 18:17:01					engager		ASSISTANCE_ENABLED	READ	DATA
17295220	2019-10-19 18:16:32				ChargingStations	dashboardmanager	Num_Utenti_distinti_globali		READ	DATA
17295219	2019-10-19 18:16:32					dashboardmanager	Num_Utenti_distinti_globali		READ	DATA
17295218	2019-10-19 18:16:31					engager		ASSISTANCE_ENABLED	READ	DATA
17295217	2019-10-19 18:16:28					dashboardmanager			READ	DATA
17295216	2019-10-19 18:16:28					dashboardmanager			READ	DATA
17295215	2019-10-19 18:16:28					dashboardmanager			READ	DATA
17295214	2019-10-19 18:16:28					dashboardmanager			READ	DATA

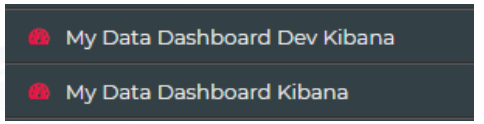
- Management
  - Traffic Analyzer: AMMA
  - Container Cluster Monitoring
  - Container Cluster Intelligence
  - Back Office Container Monitoring
  - IOT App Version Management
  - Smart City API Monitoring
  - MyKPI Monitoring
  - Notificator Monitoring
  - Web Server Monitoring
  - Back Office DWH Sched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



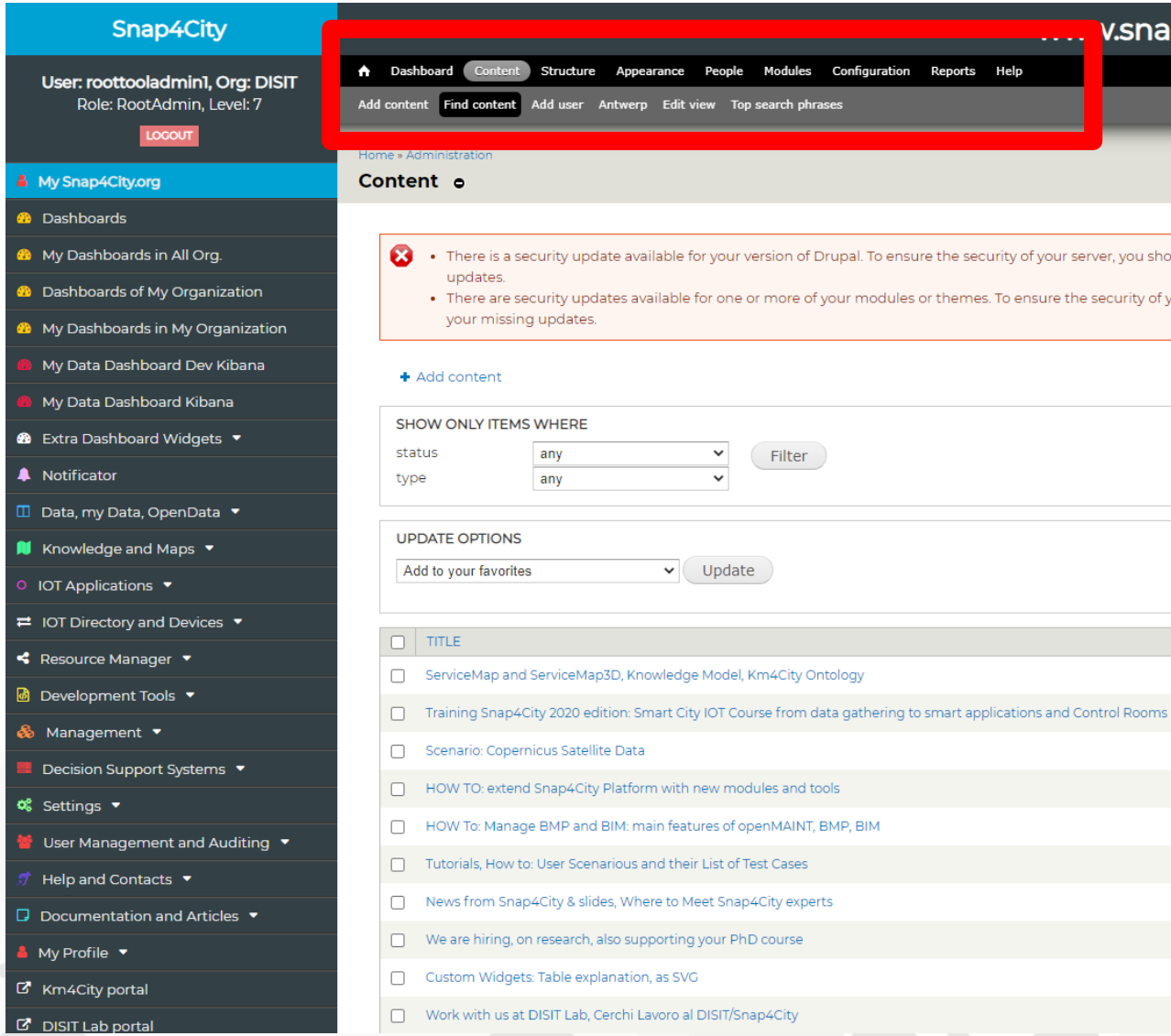
- **Tools for Platform Management.**
  - Most of them only accessible for RootAdmin and OnPremise
- Tools can be **grouped in the following families**
  - AMMA Traffic Analyzer as OpenDistro(Elastic Search, Kibana)
  - DataAnalyzer (DevDash): monitoring and browsing data ingested into OpenDistro (ElasticSearch,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



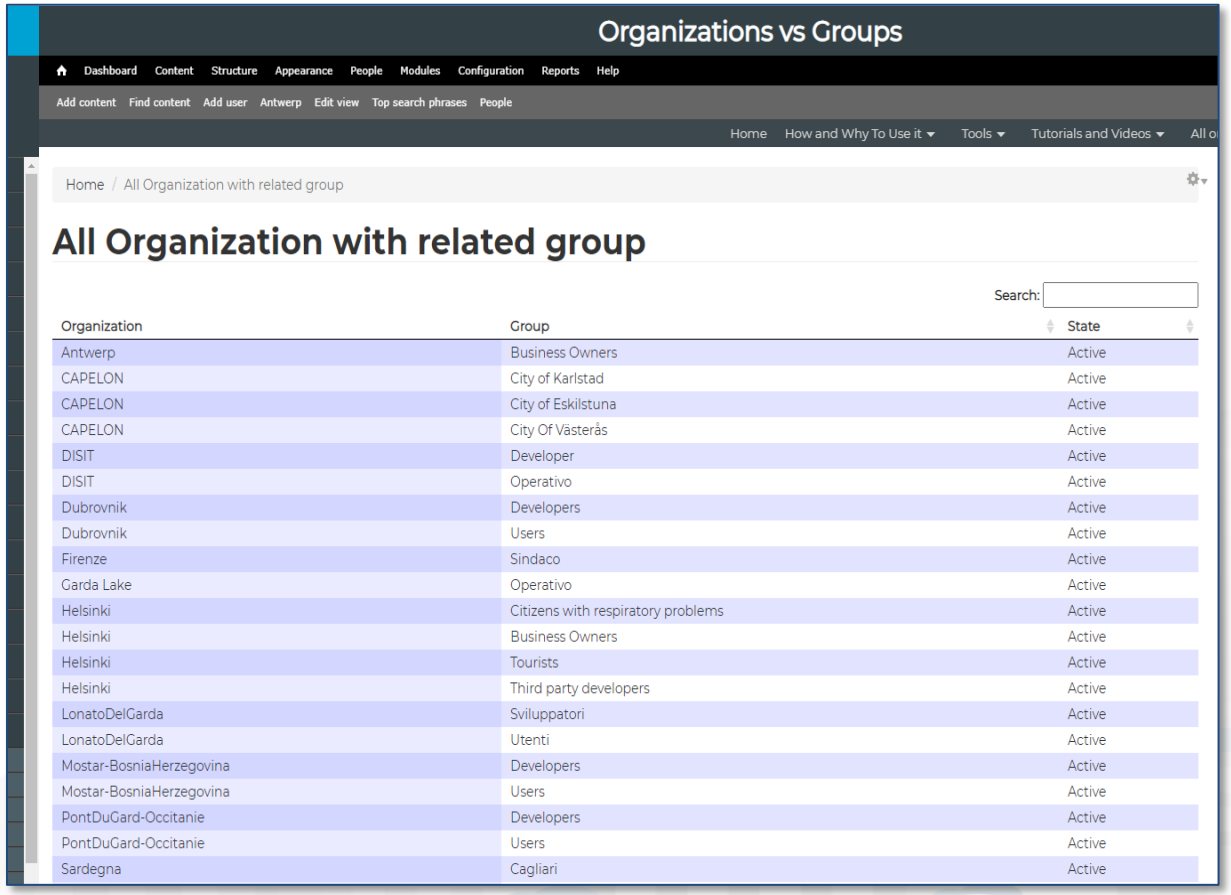
Customer Relationship Manager Integration and Living Lab basic

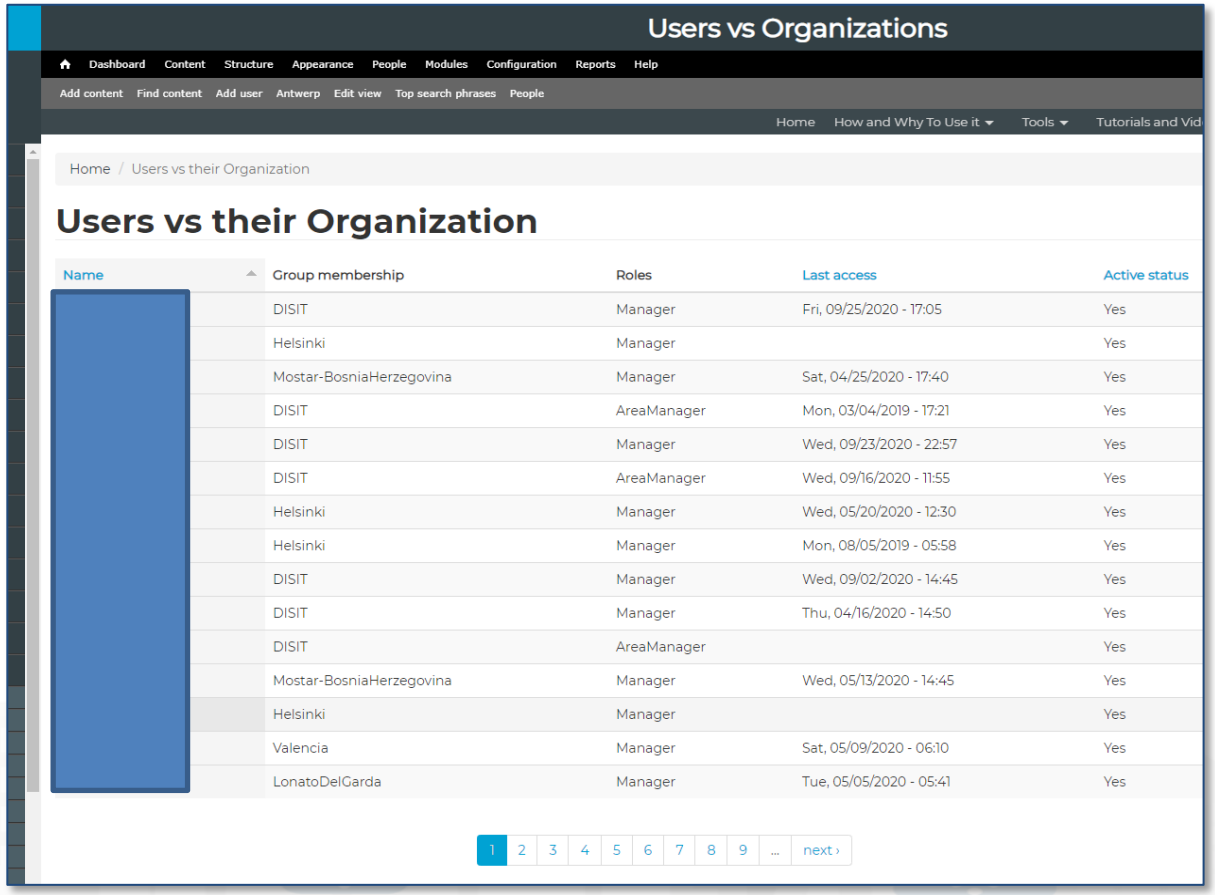
Living Lab vs DRUPAL

- **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.



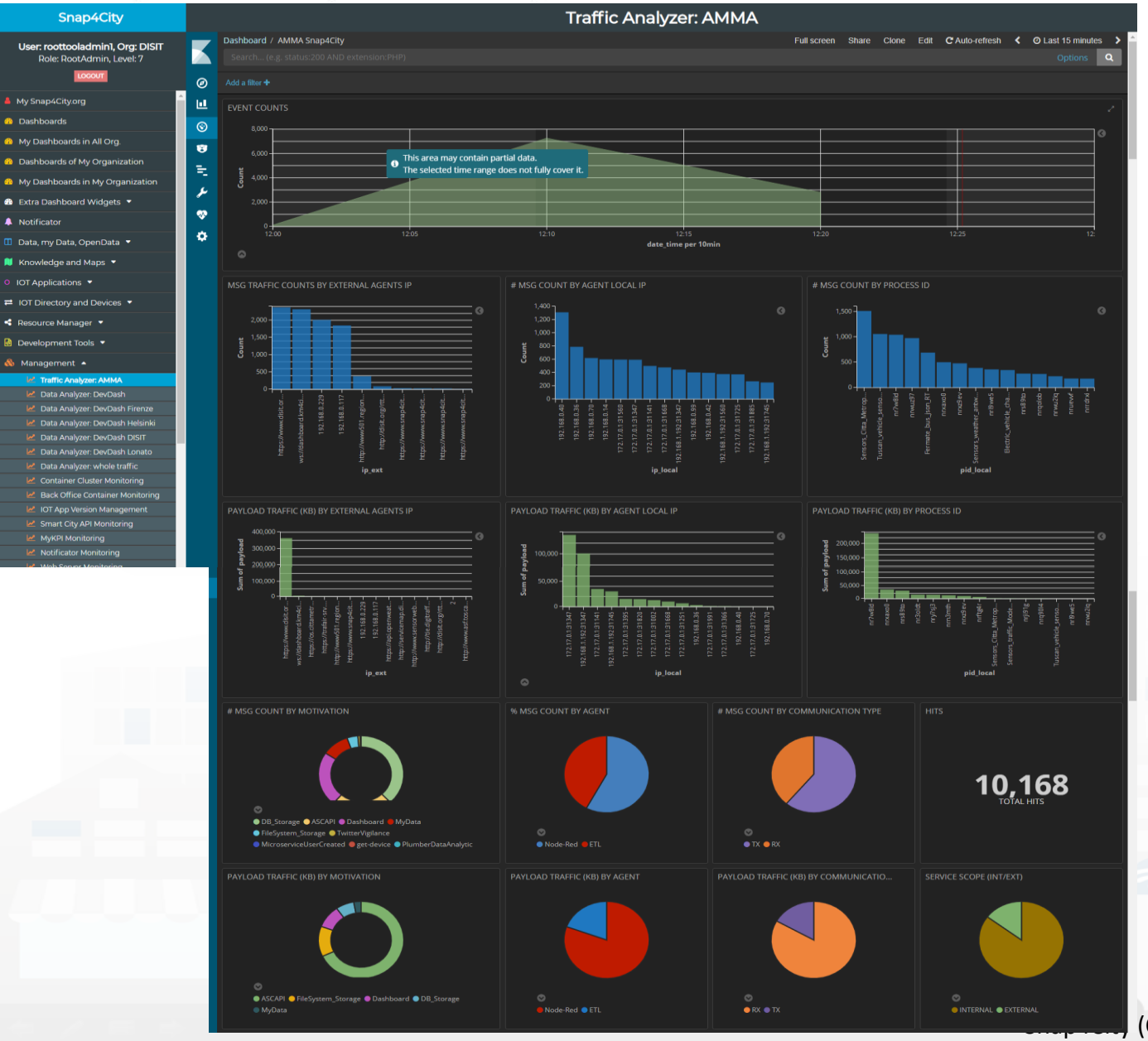
Organizations vs Groups vs Users





AMMA Traffic Analyzer OpenDistro(Elastic Search, Kibana)

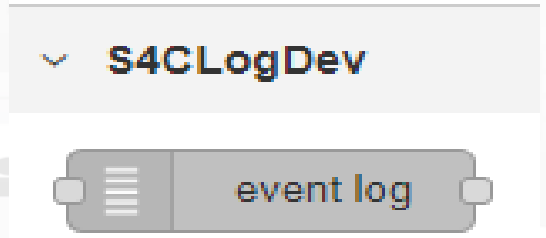
AMMA



- ***Managing and Monitoring Data-Traffic in the BackOffice***
- Data Traffic Analyzer
  - Business intelligence
  - Faceted searches
  - Drill down on time
- Several different views and details on data traffic among the main entities in the platform:
  - IOT APP
  - Storage
  - Data sources,
  - ….

Event Logger

- There are API for Event Logger, REST API
  - They are automatically used by most of the Snap4City MicroServices
  - They log in standard Rsyslog API
    - https://www.snap4city.org/56
- The Logs regarding messages passed and usage are logged and accessed with the AMMA tools that is based on OpenDistro per Elastic Search and Kibana.
  - Former version was made in Hbase and SOLR, and Banana
- Additional Logs events can be logged by using a dedicated MicroService in Node-RED, IOT Apps



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

LOGOUT

Micro Applications
External Services
Data Set Manager: Data Gate
Resource Manager: Process Loader
Development Tools
Management
Traffic Analyzer: AMMA
Data Analyzer: DevDash
Container Cluster Monitoring
Back Office Container Monitoring
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 Anonymous Photos Comments
Mng Photos Comments HelAnt
Mng Online Helps
Config ResDash
Mesos view
DISCES-EM
DISCES-EM tail
IOT App for Conf Clust Monitor
Smart Decision Support Sys
Resilience Decision Support Sys
DataGate Harvester
Settings
User Management and Auditing
Help and Contacts
Documentation and Articles
My Profile
Km4City portal
DISIT Lab portal

MSG COUNT BY MOTIVATION

DB_Storage ASCAPI Dashboard FileSystem_Storage MyData
PlumberDataAnalytic MicroserviceUserCreated

% MSG COUNT BY AGENT

ETL Node-Red

MSG COUNT BY COMMUNICATION TYPE

TX RX

HITS

1,922,214
TOTAL HITS

PAYLOAD TRAFFIC (KB) BY MOTIVATION

ASCAPI FileSystem_Storage Dashboard DB_Storage MyData

PAYLOAD TRAFFIC (KB) BY AGENT

Node-Red ETL

PAYLOAD TRAFFIC (KB) BY COMMUNICATION TYPE

RX TX

SERVICE SCOPE (INT/EXT)

INTERNAL EXTERNAL

FACET FIELDS

motivation
Select...

agent
Select...

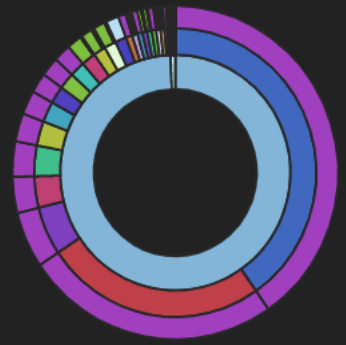
service_scope
Select...

ip_ext
Select...

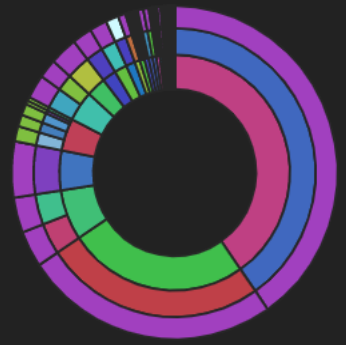
lang

ip_local
Select...

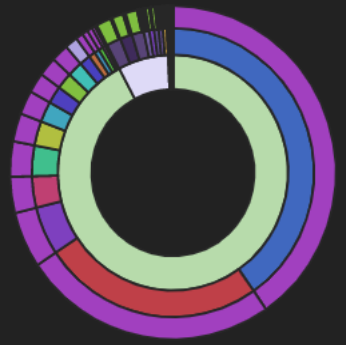
IP TRAFFIC (KB) BY COMMUNICATION MODE



IP TRAFFIC (KB) BY PID_LOCAL



IP TRAFFIC (KB) BY MOTIVATION



IP TRAFFIC (COUNTS) BY COMMUNICATION MODE

IP TRAFFIC (COUNTS) BY PID_LOCAL

IP TRAFFIC (COUNTS) BY MOTIVATION

Snap4City

Traffic Analyzer: AMMA

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

LOGOUT

My Snap4City.org
Dashboards
My Dashboards in All Org.
Dashboards of My Organization
My Dashboards in My Organization
Extra Dashboard Widgets
Notificator
Data, my Data, OpenData
Knowledge and Maps
IOT Applications
IOT Directory and Devices
Resource Manager
Development Tools
Management
Traffic Analyzer: AMMA
Data Analyzer: DevDash
Data Analyzer: DevDash Firenze
Data Analyzer: DevDash Helsinki
Data Analyzer: DevDash DISIT
Data Analyzer: DevDash Lonato
Data Analyzer: whole traffic
Container Cluster Monitoring
Back Office Container Monitoring
IOT App Version Management
Smart City API Monitoring
MyKPI Monitoring
Notificator Monitoring
Web Server Monitoring

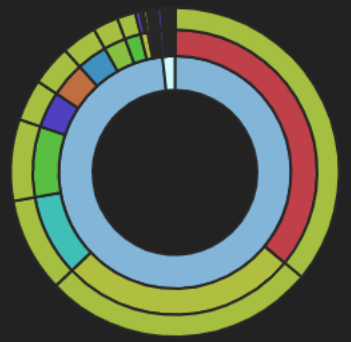
MyData
Node-Red ETL
RX TX
INTERNAL EXTERNAL

FACET FIELDS

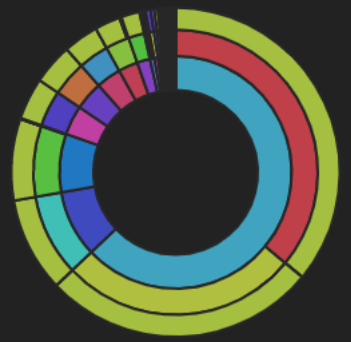
motivation: Select...
agent: Select...
service_scope: Select...
ip_ext: Select...
lang:
ip_local: Select...
pid_local: Select...
com_mode: Select...
service_uri:

Clear form | Cancel changes | Apply changes

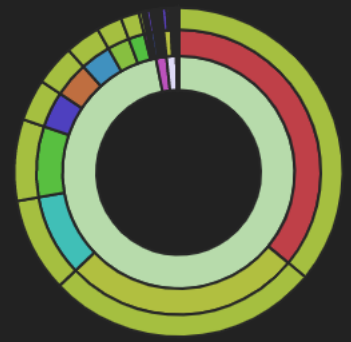
IP TRAFFIC (KB) BY COMMUNICATION MODE



IP TRAFFIC (KB) BY PID_LOCAL

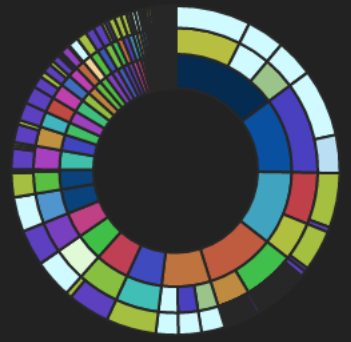


IP TRAFFIC (KB) BY MOTIVATION



IP TRAFFIC (COUNTS) BY COMMUNICATION ...

IP TRAFFIC (COUNTS) BY PID_LOCAL



IP TRAFFIC (COUNTS) BY MOTIVATION

Geo mapped

Snap4City

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

LOGOUT

- My Snap4City.org
- Dashboards
- My Dashboards in All Org.
- Dashboards of My Organization
- My Dashboards in My Organization
- Extra Dashboard Widgets
- Notificator
- Data, my Data, OpenData
- Knowledge and Maps
- IOT Applications
- IOT Directory and Devices
- Resource Manager
- Development Tools
- Management
  - Traffic Analyzer: AMMA
  - Data Analyzer: DevDash
  - Data Analyzer: DevDash Firenze
  - Data Analyzer: DevDash Helsinki
  - Data Analyzer: DevDash DISIT
  - Data Analyzer: DevDash Lonato
  - Data Analyzer: whole traffic
  - Container Cluster Monitoring
  - Back Office Container Monitoring
  - IOT App Version Management
  - Smart City API Monitoring
  - MyKPI Monitoring
  - Notificator Monitoring
  - Web Server Monitoring
  - Back Office DWH Sched DISCES
  - Back Office DA Sched DISCES

Traffic Analyzer: AMMA

SMARTCITY MAP

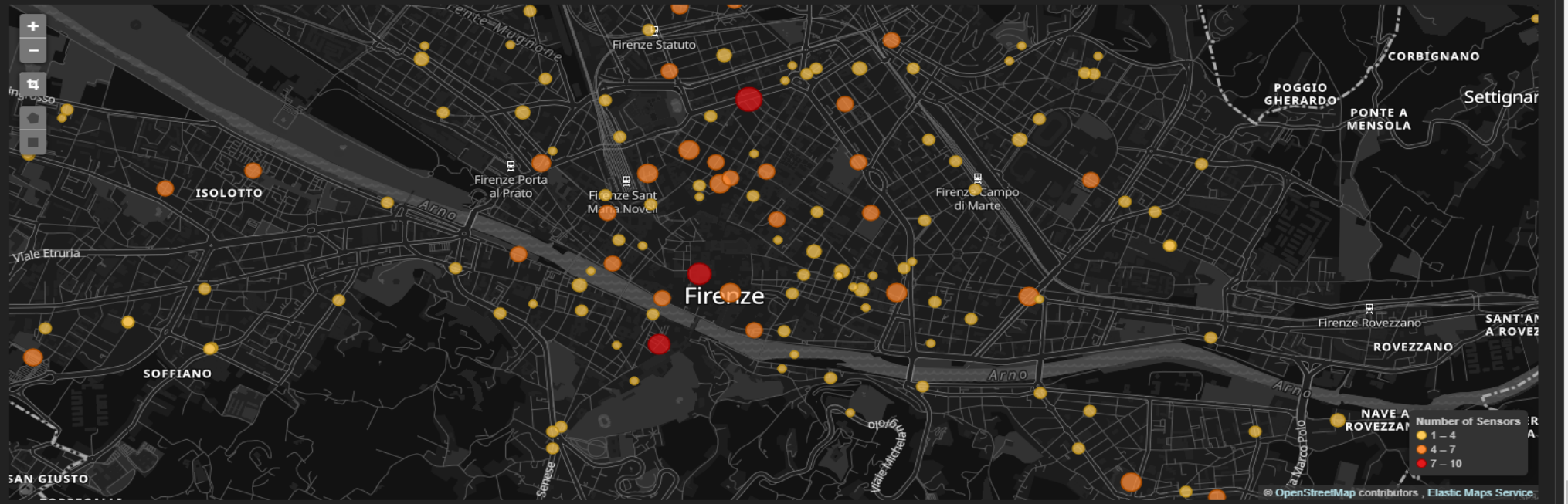
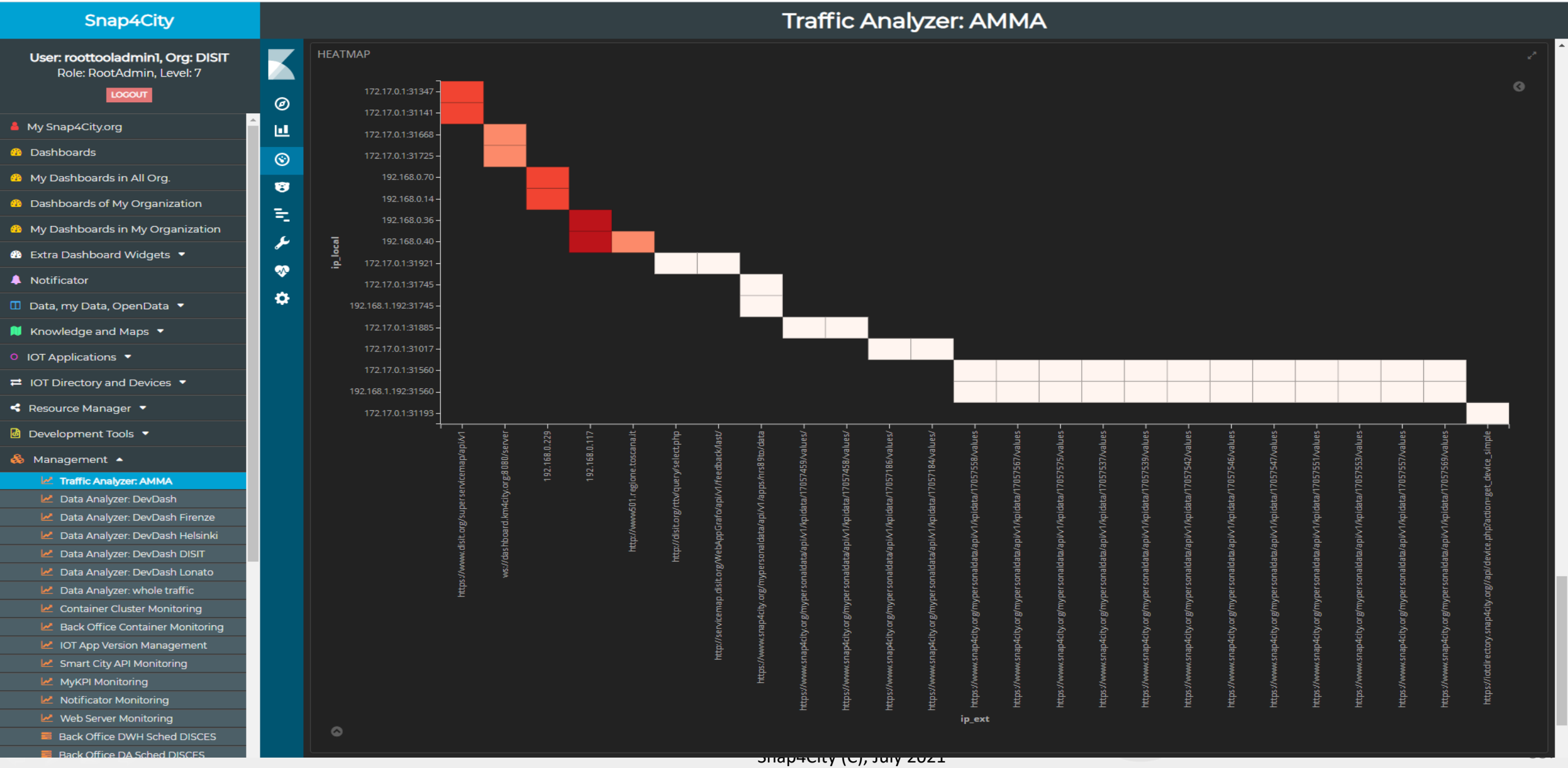


TABLE PANEL

1–50 of 10.167

Time	agent	com_mode	ip_ext	ip_local	lang	lat	lon	message	motivation	payload	service_uri	pid_local
October 11th 2020, 12:24:31.128	Node-Red	RX	https://www.disit.org/superservicemap/api/v1	172.17.0.1:31809		43.799	11.254	undefined	ASCAPI		undefined	nr82yu8
October 11th 2020, 12:24:30.595	Node-Red	TX	ws://dashboard.km4city.org:8080/server	172.17.0.1:31668	undefined	43.799	11.254	undefined	Dashboard	1.775	undefined	nrxz9ev
October 11th 2020, 12:24:30.413	Node-Red	TX	ws://dashboard.km4city.org:8080/server	172.17.0.1:31668	undefined	43.799	11.254	undefined	Dashboard	1.795	undefined	nrxz9ev
October 11th 2020, 12:24:30.234	Node-Red	TX	ws://dashboard.km4city.org:8080/server	172.17.0.1:31668	undefined	43.799	11.254	undefined	Dashboard	1.776	undefined	nrxz9ev
October 11th 2020, 12:24:30.226	Node-Red	TX	ws://dashboard.km4city.org:8080/server	172.17.0.1:31725	undefined	43.799	11.254	undefined	Dashboard	1.764	undefined	nrl9we5

OD matrix


Snap4City
User: roottooladmin1, Org: DISIT
Role: RootAdmin, Level: 7
LOGOUT
My Snap4City.org
Dashboards
My Dashboards in All Org.
Dashboards of My Organization
My Dashboards in My Organization
Extra Dashboard Widgets
Notificator
Data, my Data, OpenData
Knowledge and Maps
IOT Applications
IOT Directory and Devices
Resource Manager
Development Tools
Management
Traffic Analyzer: AMMA
Data Analyzer: DevDash
Data Analyzer: DevDash Firenze
Data Analyzer: DevDash Helsinki
Data Analyzer: DevDash DISIT
Data Analyzer: DevDash Lonato
Data Analyzer: whole traffic
Container Cluster Monitoring
Back Office Container Monitoring
IOT App Version Management
Smart City API Monitoring
MyKPI Monitoring
Notificator Monitoring
Web Server Monitoring
Back Office DWH Sched DISCES
Back Office DA Sched DISCES
Traffic Analyzer: AMMA
HEATMAP
ip_local
172.17.0.1:31347
172.17.0.1:31141
172.17.0.1:31668
172.17.0.1:31725
192.168.0.70
192.168.0.14
192.168.0.36
192.168.0.40
172.17.0.1:31921
172.17.0.1:31745
192.168.1.192:31745
172.17.0.1:31885
172.17.0.1:31017
172.17.0.1:31560
192.168.1.192:31560
172.17.0.1:31193
ip_ext
https://www.disit.org/superservicemap/api/v1
ws://dashboard.km4city.org:8080/server
192.168.0.229
192.168.0.117
http://www501.regione.toscana.it
http://disit.org/ttv/query/select.php
http://servicemap.disit.org/WebAppGrafo/api/v1/feedback/last/
https://www.snap4city.org/mypersonaldata/api/v1/apps/mrs85to/data
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057459/values/
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057458/values/
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057186/values/
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057184/values/
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057558/values
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057567/values
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057575/values
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057537/values
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057539/values
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057542/values
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057546/values
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057547/values
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057551/values
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057553/values
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057557/values
https://www.snap4city.org/mypersonaldata/api/v1/kpidata/17057569/values
https://iotdirectory.snap4city.org/api/device.php?action=get_device_simple

AMMA (1)

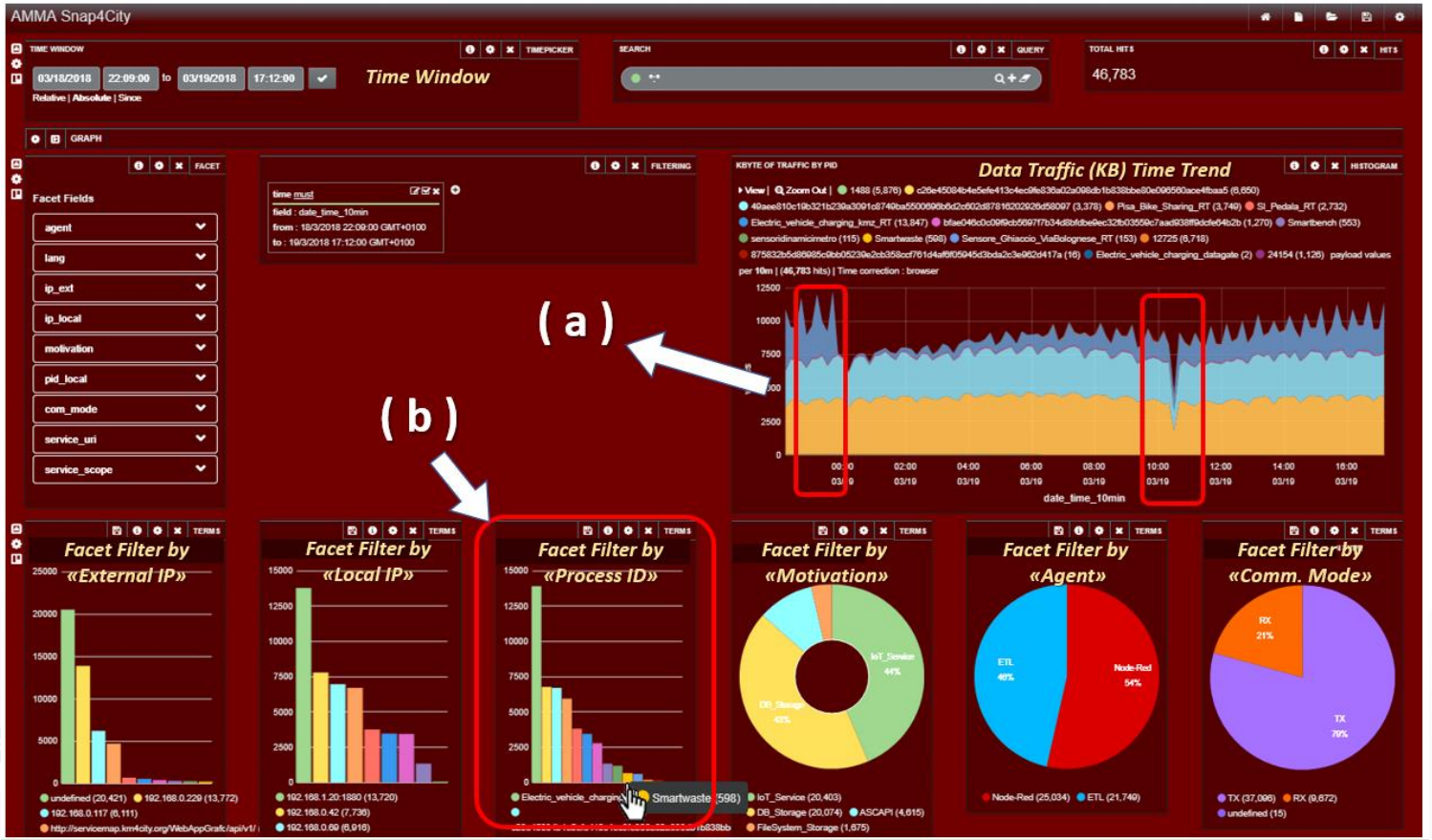
Monitor data traffic flows among IoT devices, services, applications etc. and detect potential anomalies

quantitatively monitoring data/message traffic and flows

Unexpected behaviors can be revealed by inspecting the data flow time trend:

a) detecting peaks or valleys in the trend

b) drill-down on data to identify single/more malfunctioning devices and/or services



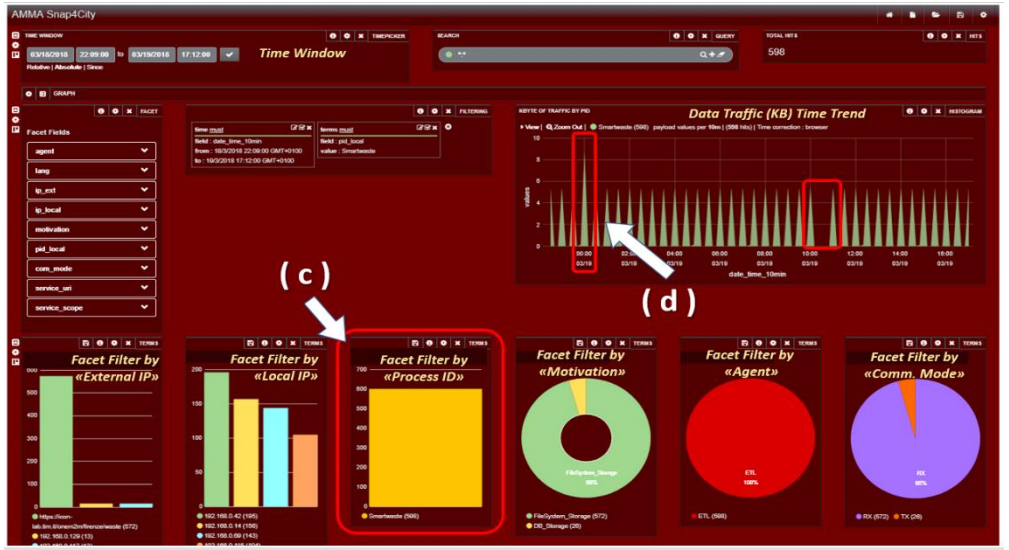
AMMA (2)

Make drill-down activities on data related to a single Process ID and check for unexpected behavior in the Time Trend panel:

c) Filtering data by the Process ID (e.g. for example those related to a SmartWaste container)

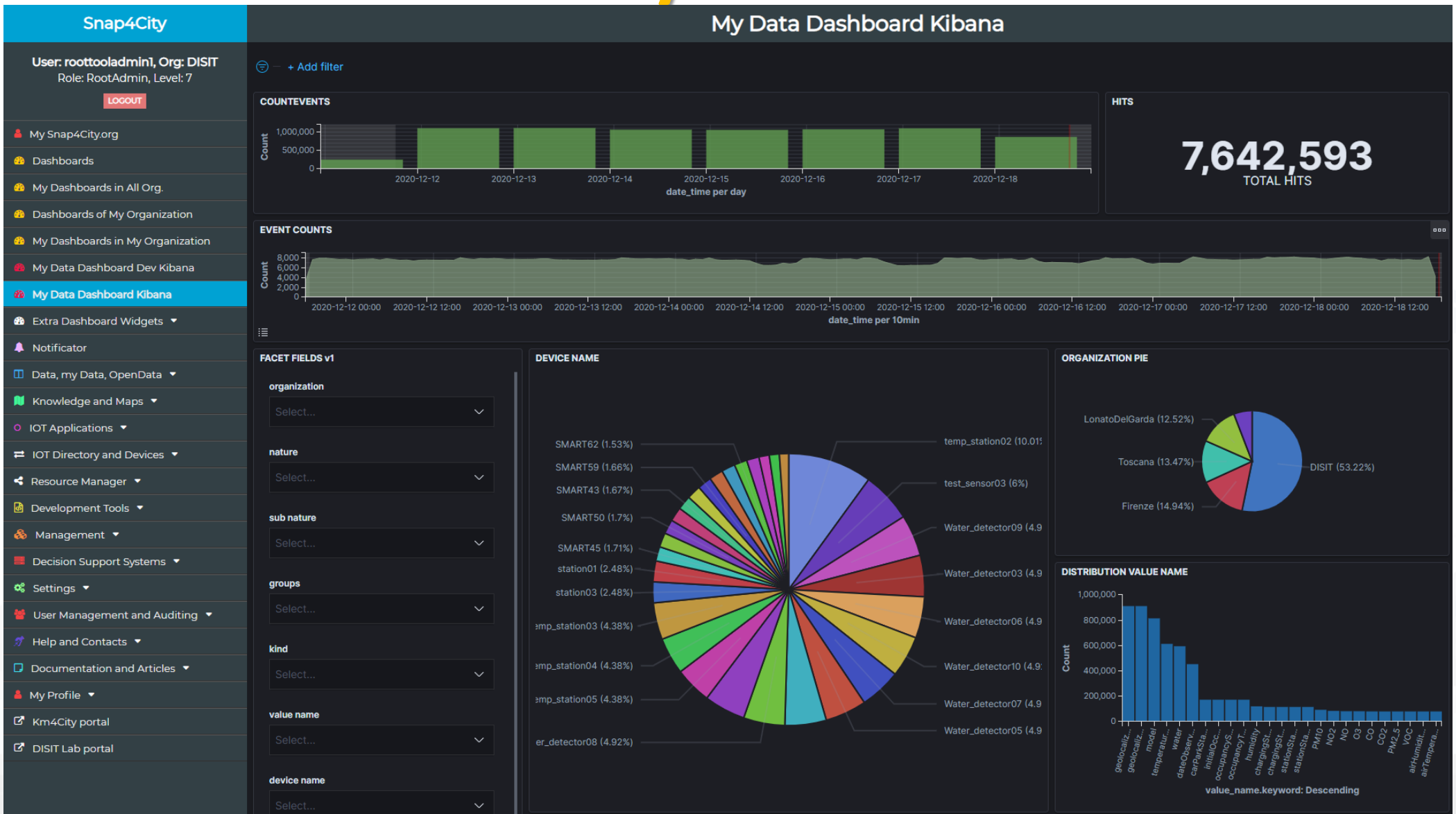
d) Detect a peak with more data traffic than expected during its scheduled activity, by properly filtering on time, the single data portion corresponding to the unexpected data flow can be viewed

e) Locate on map the single involved device or service



DataAnalyzer (DevDash): monitoring and browsing data ingested into OpenDistro per Elastic Search, via Kibana

DevDash: My Data Dashboard Kibana

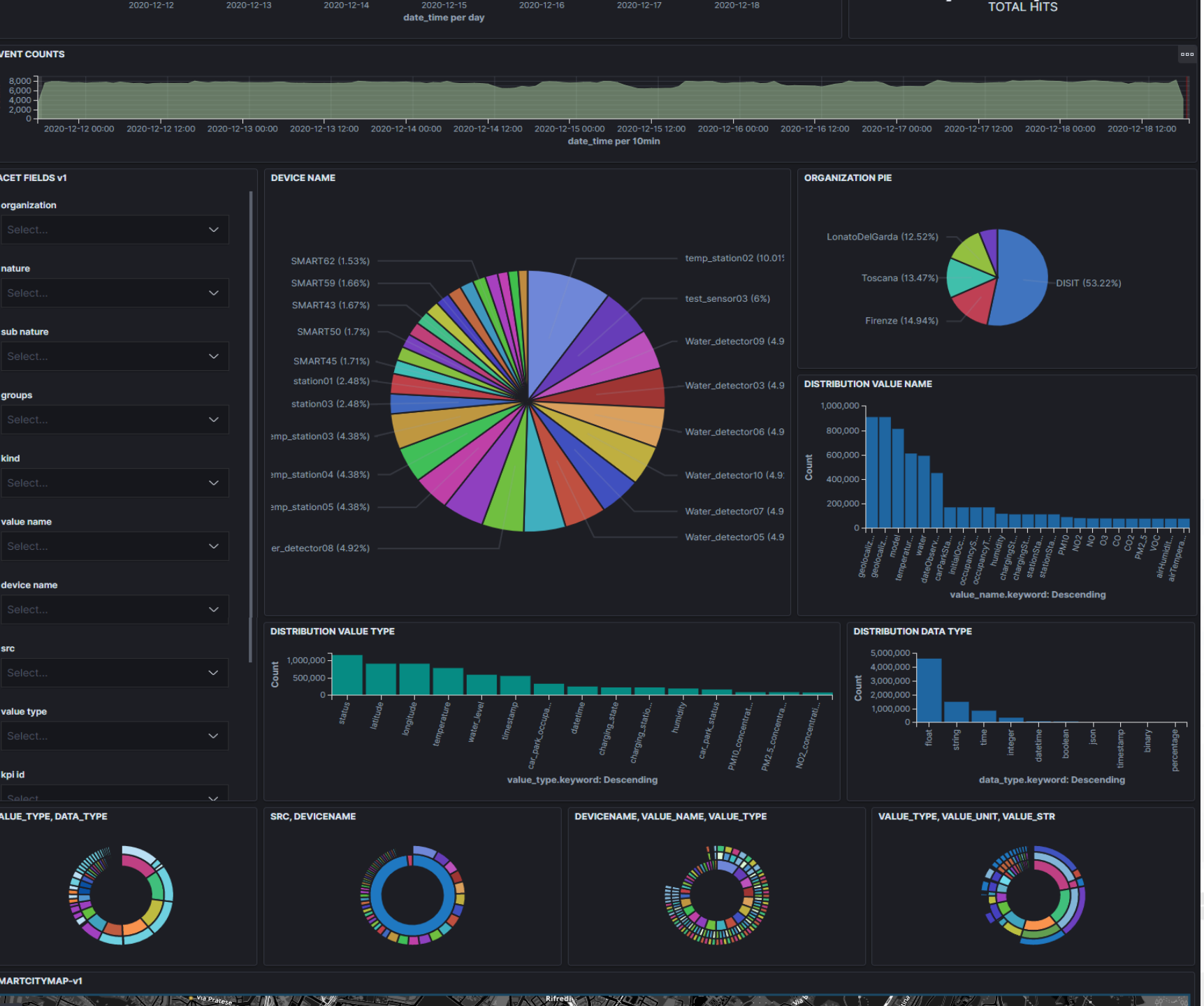


kibana

SNAP4CITY

Business Analysis Dashboards For all kind of users: DevDash

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



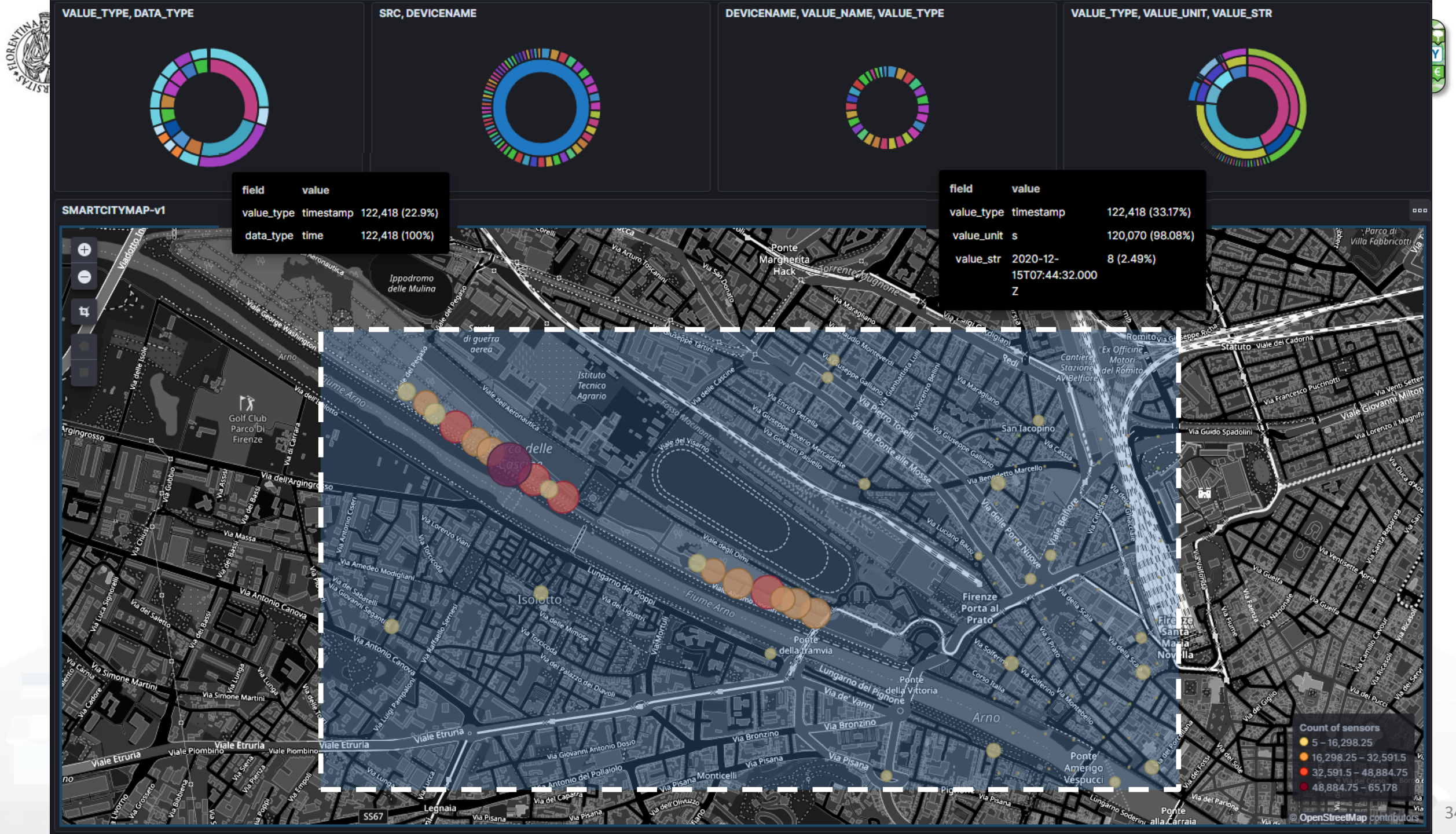
SNAP4CITY

KM4CITY

- Multi faceted Search by
  - Devices
  - Organization
  - Drill on Time
  - Drill on Map
  - Value Types
  - Data Type
  - Value name
  - Data table
  - Etc.

kibana

- Respect Privacy and GDPR


VALUE_TYPE, DATA_TYPE
SRC, DEVICENAME
DEVICENAME, VALUE_NAME, VALUE_TYPE
VALUE_TYPE, VALUE_UNIT, VALUE_STR
field value
value_type timestamp 122,418 (22.9%)
data_type time 122,418 (100%)
field value
value_type timestamp 122,418 (33.17%)
value_unit s 120,070 (98.08%)
value_str 2020-12-15T07:44:32.000Z 8 (2.49%)
SMARTCITYMAP-v1
Count of sensors
5 – 16,298.25
16,298.25 – 32,591.5
32,591.5 – 48,884.75
48,884.75 – 65,178
© OpenStreetMap contributors

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

LOGOUT

My Snap4City.org
Dashboards
My Dashboards in All Org.
Dashboards of My Organization
My Dashboards in My Organization
Extra Dashboard Widgets
Notificator
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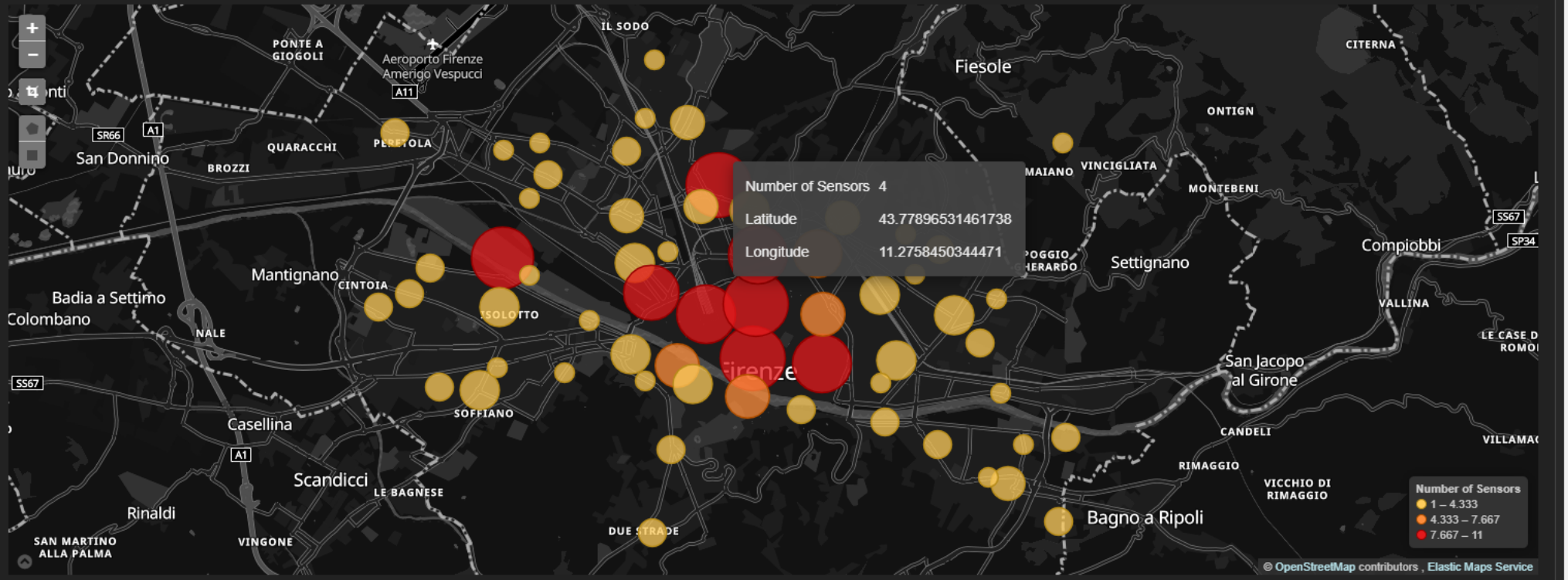
Back Office DWH Sched DISCES
Back Office DA Sched DISCES
Back Office DISCES monitor
Mobile Application Monitoring

SMARTCITYMAP



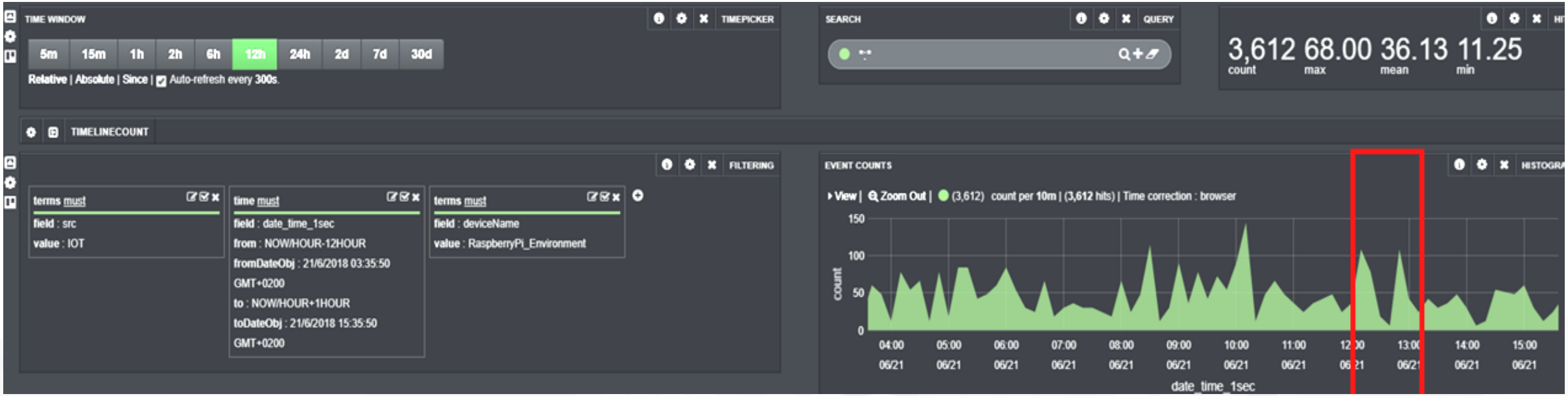
EVENTS

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	#	-

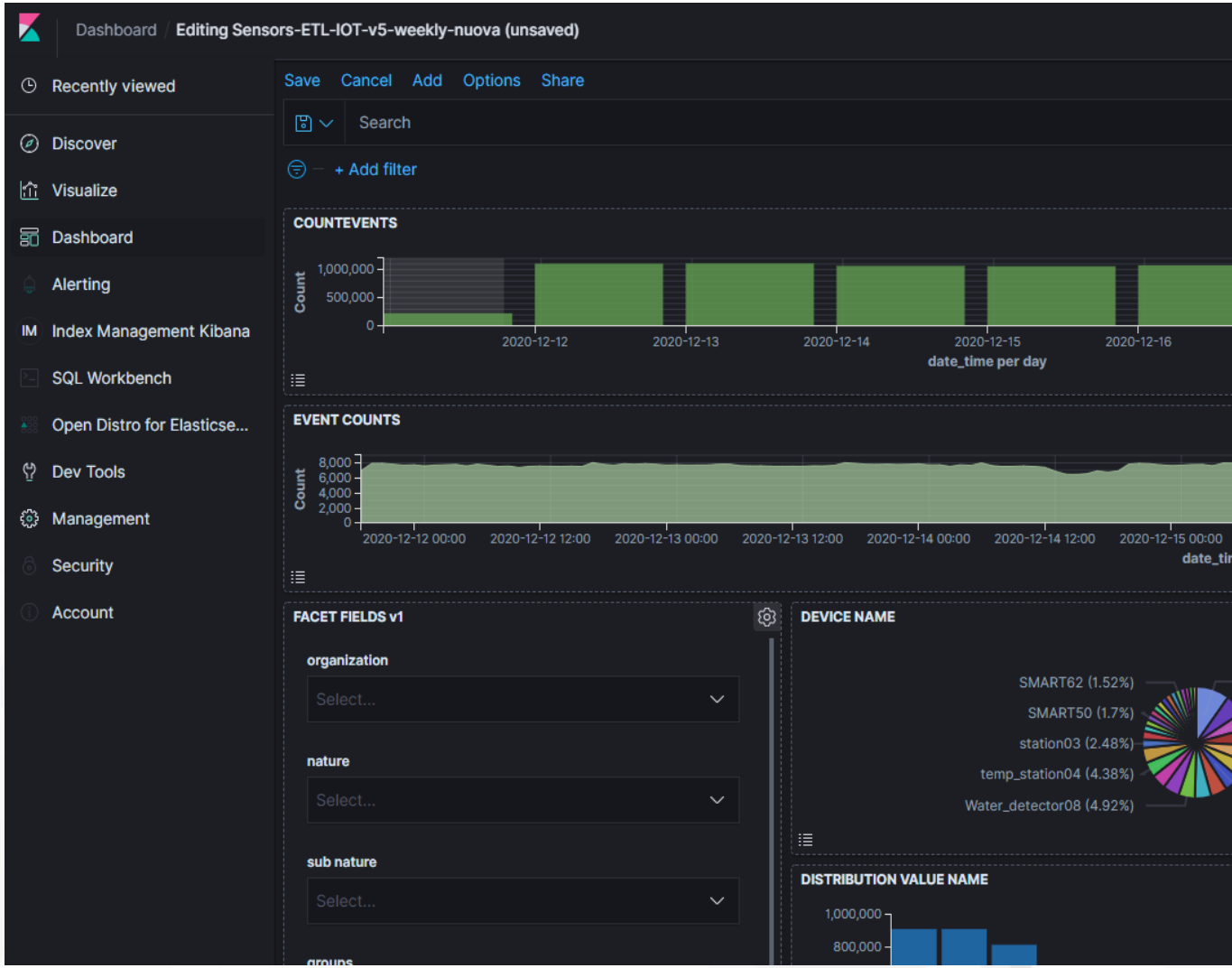
DevDash Case Study (2)

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



My Data Dashboard Customization

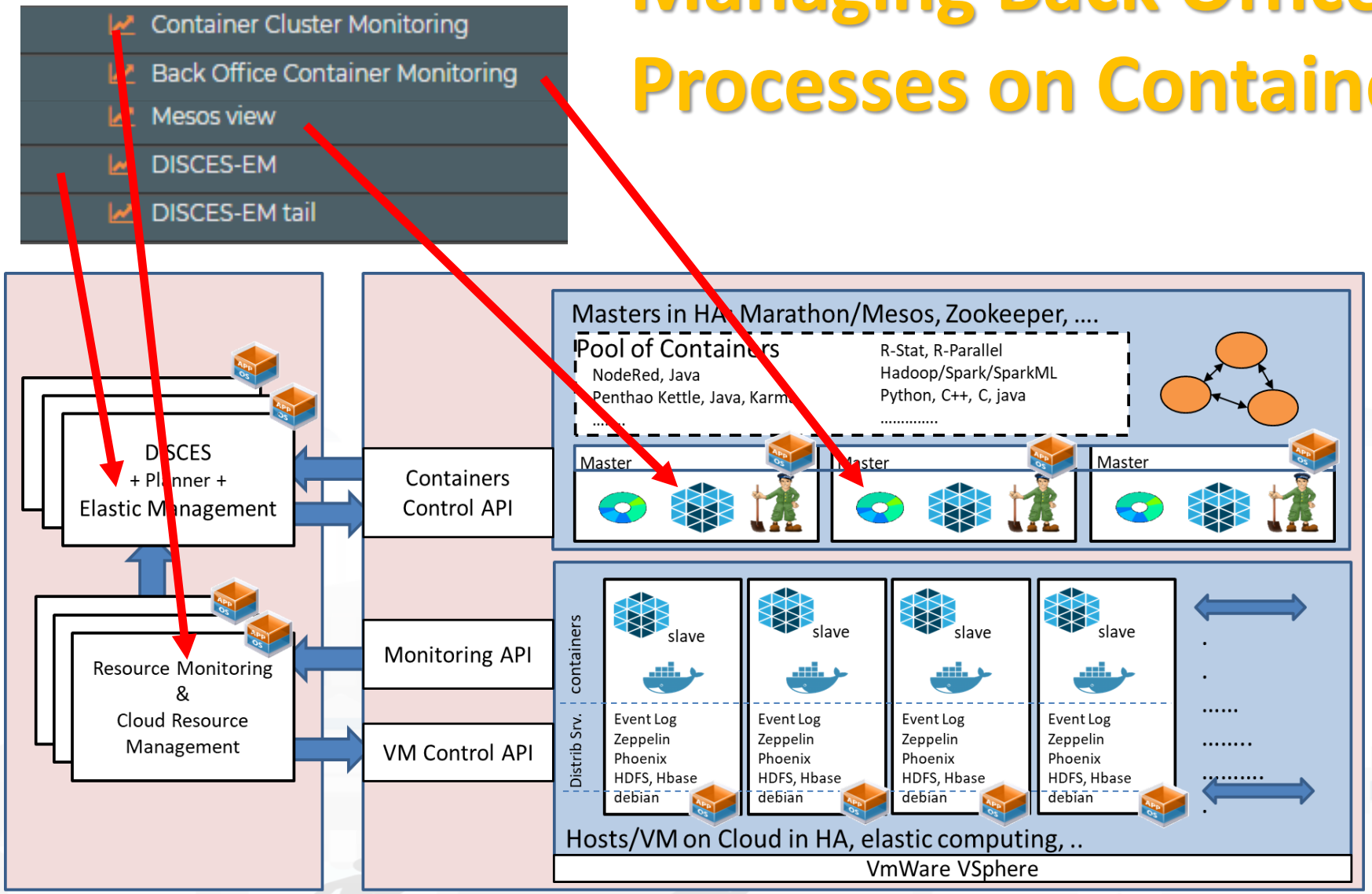
- My Data Dashboards (for Developers and for Managers) can be customized by RootAdmin.
  - Authority for Customizzation can be also extended to other role on Premise solutions
- Customizations is based on Full editing Capabilities of Kibana OpenDiostro per Elastic Search 7.1, and with multiple indexes of Snap4City



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

Managing Back Office Processes on Containers



- Containers:
  - IOT App,
  - Web Crawling,
  - (ETL processes),
  - Data Analyics in R Studio,
  - Data Analytics in Python
- Elastic management
- Management via
  - Marathon
  - Mesos
  - DISCES EM
- Possible on Kubernetes

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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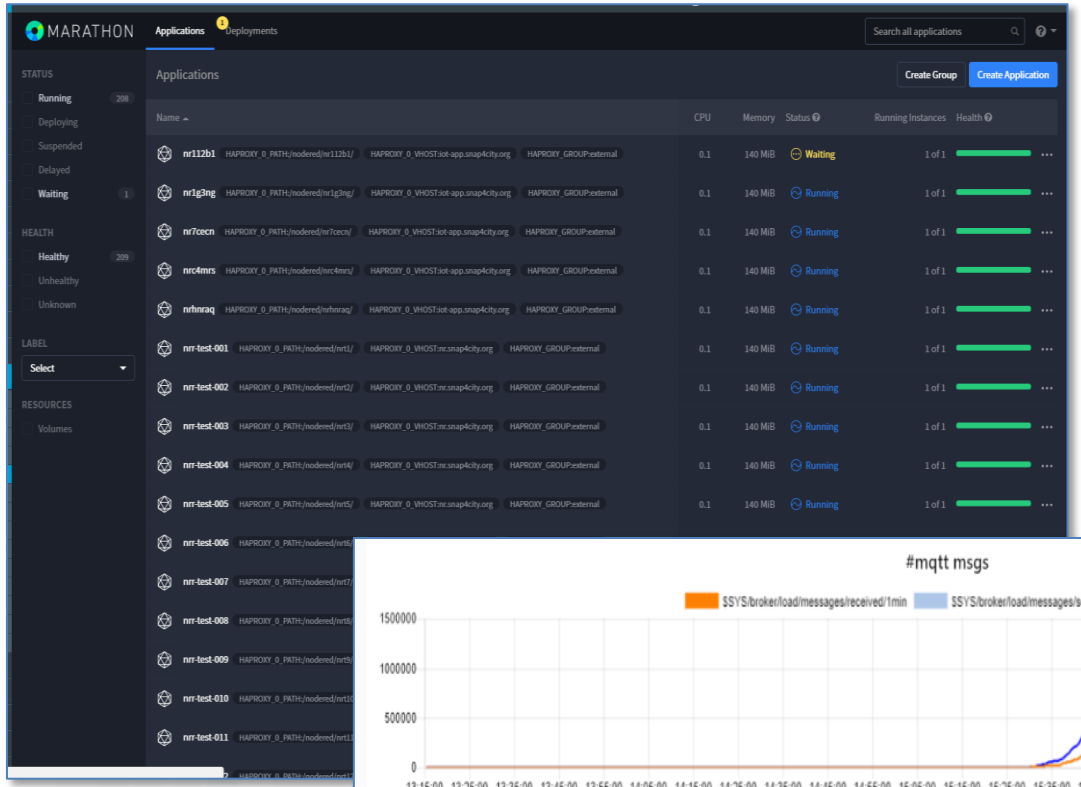
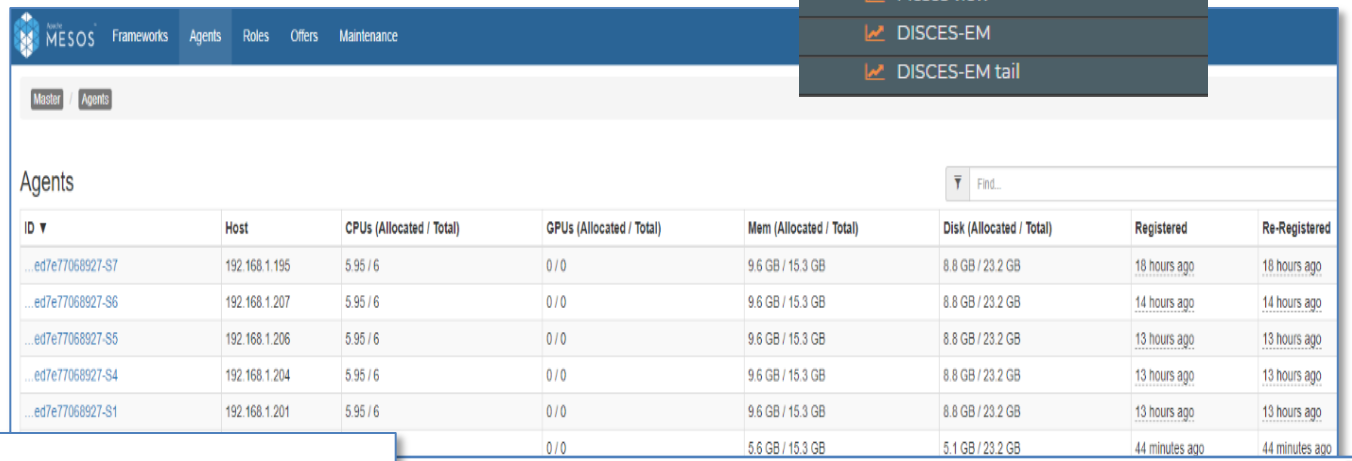
Container

SNAP4CITY KM4CITY





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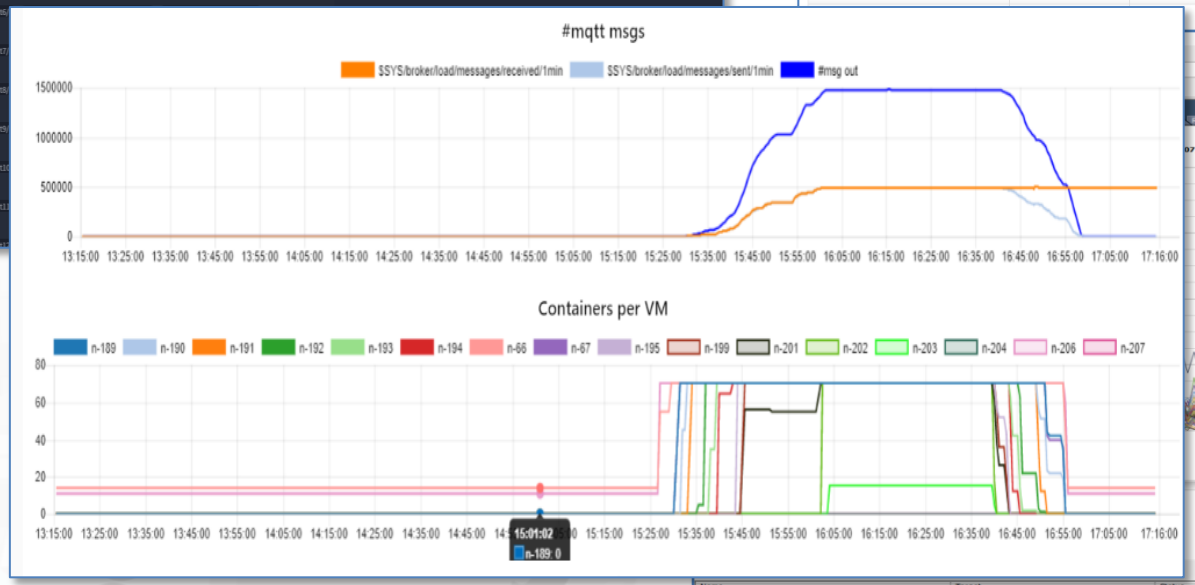
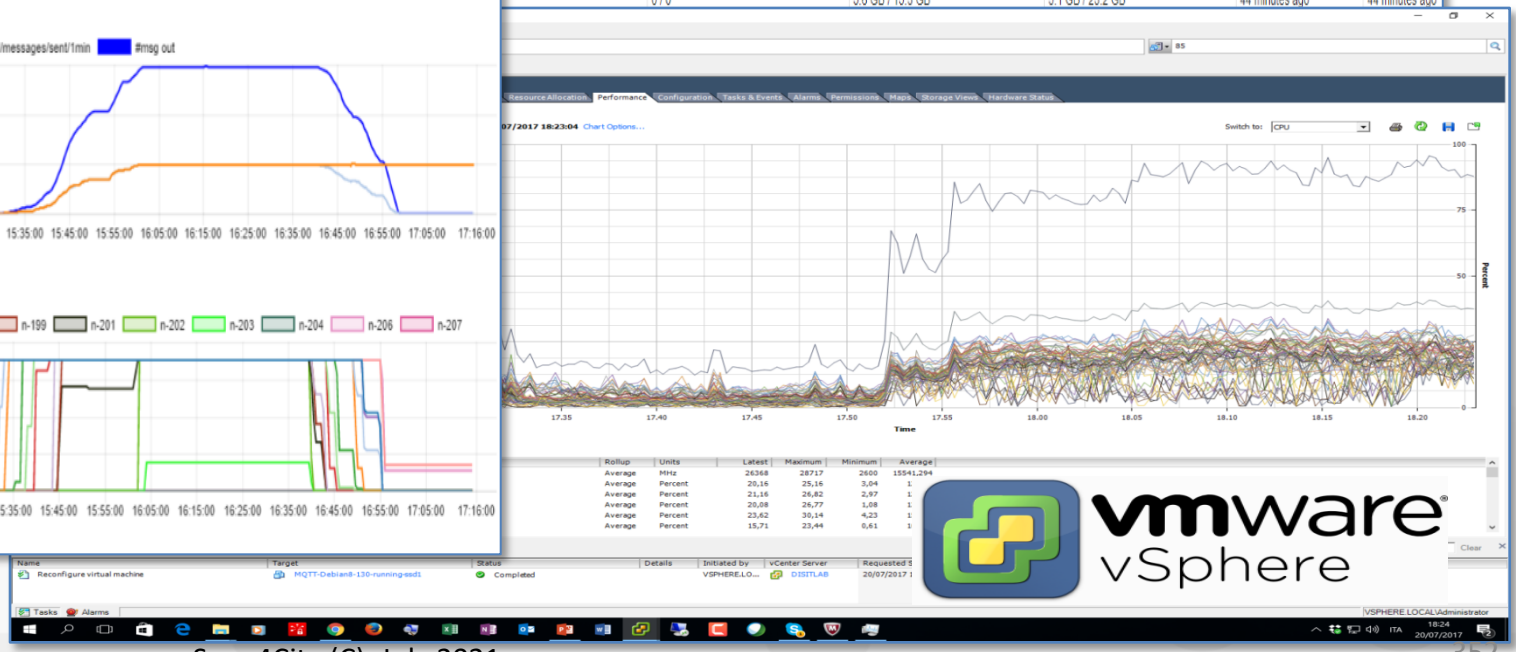
- DISCES-EM tail





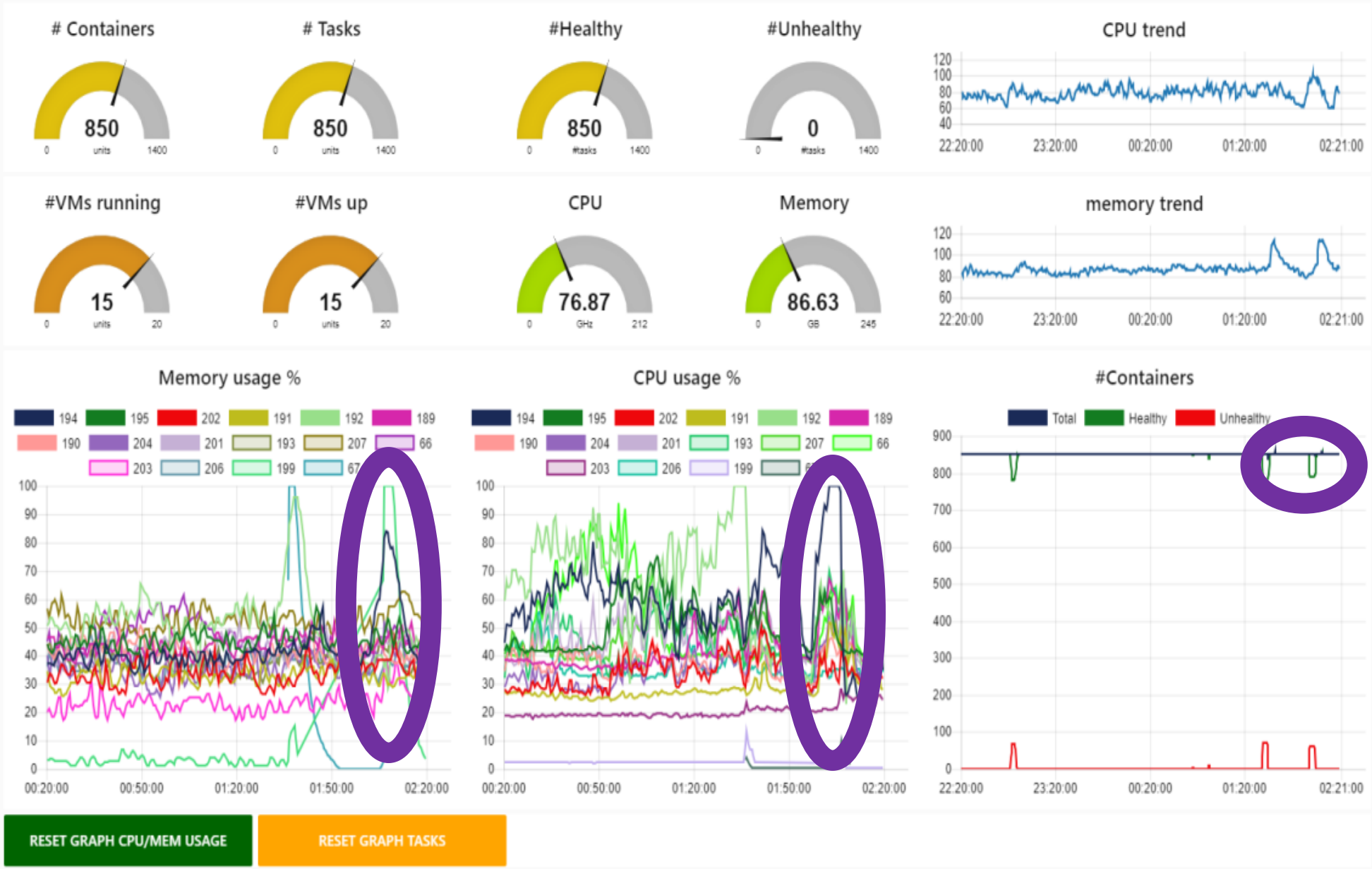
Snap4City

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



Snap4City

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ToolAdmin | ldap

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  - 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

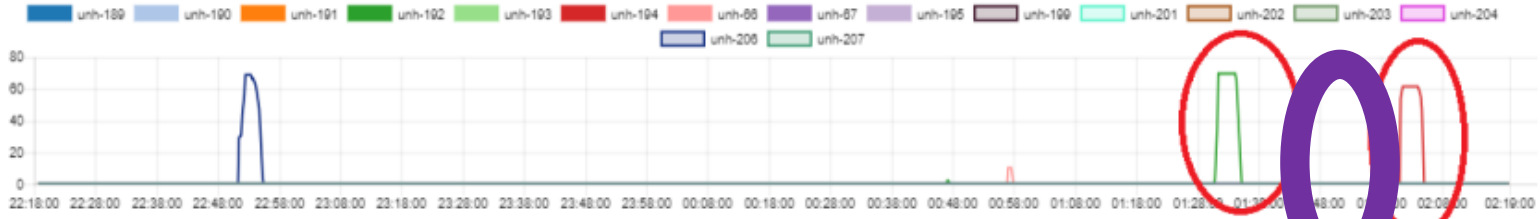
STOP ALL MQTT MSGS

#VMs

#mqtt msgs

Containers per VM

Unhealthy Containers per VM

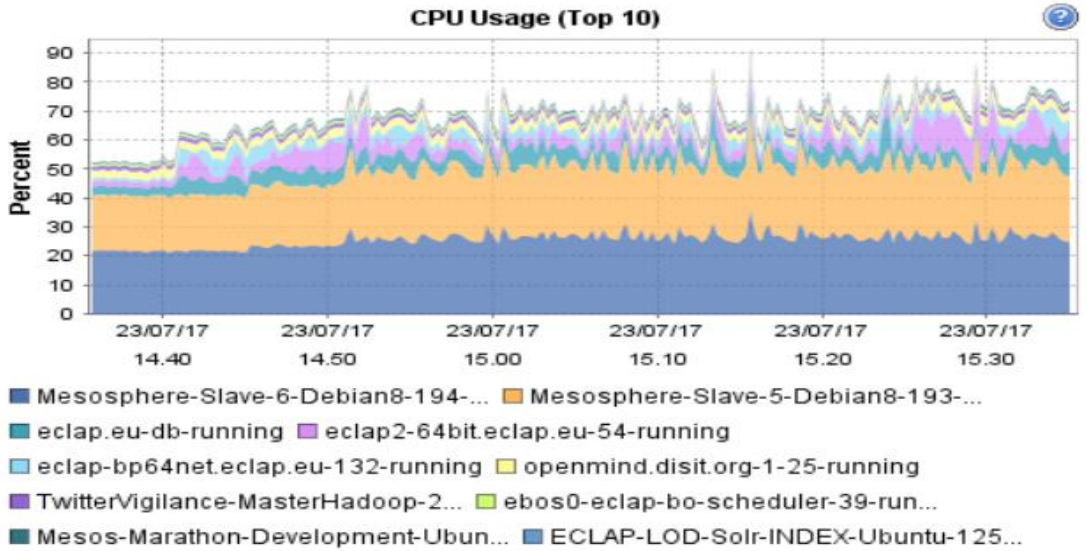


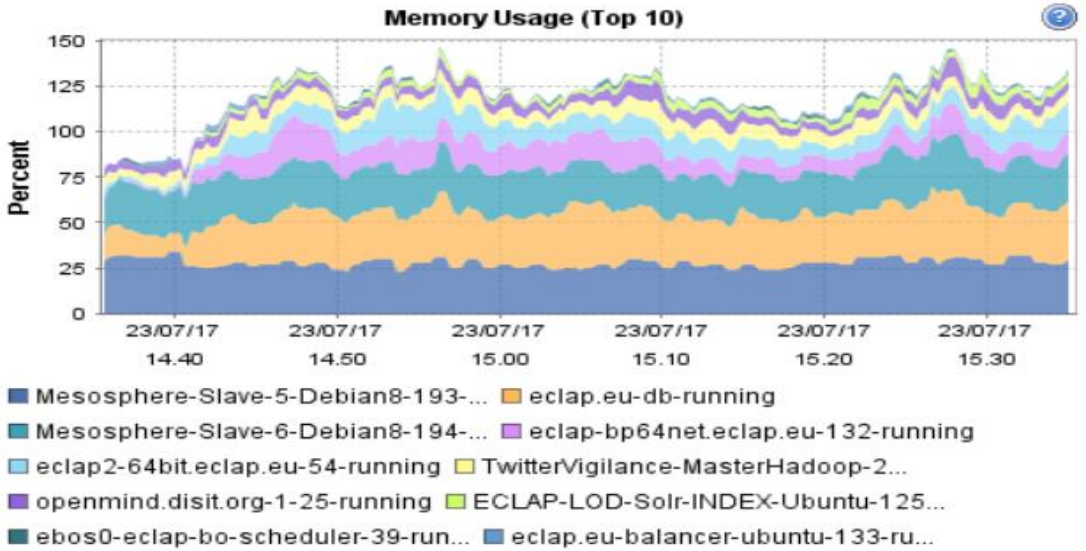
Docker Containers per VM

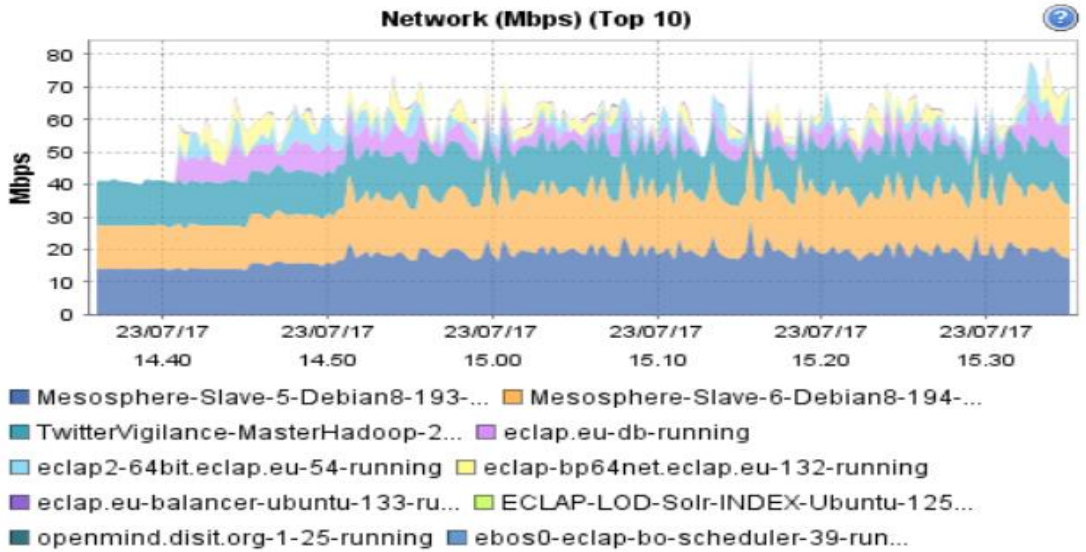
Computational Capabilities of Snap4City

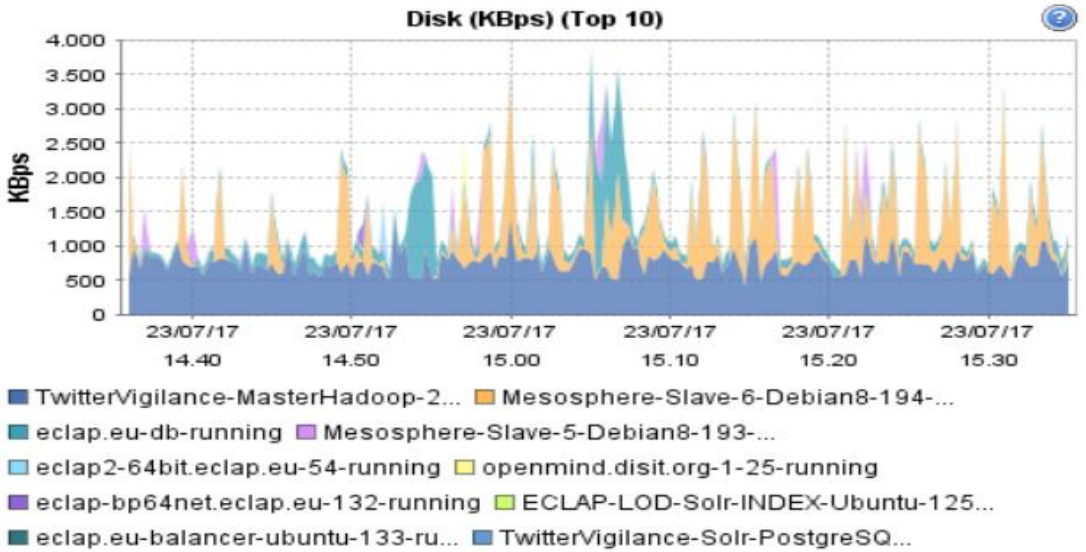
- **Managing:**
  - **Periodic Processes** → ETL, IOT App (Node-RED)
  - **Asynchronous processes**, data driven, real time → Node-RED, IOT Applications
- **Scalability**
  - **Horizontal**: Increasing processes performing activities, demand on new processes for new users, for new applications, for new IOT applications: VM, Hosts, clusters, Storage SAN
  - **Vertical**: Increasing resources on processes: CPU, MEM, Storage, Network

Monitoring on Cloud





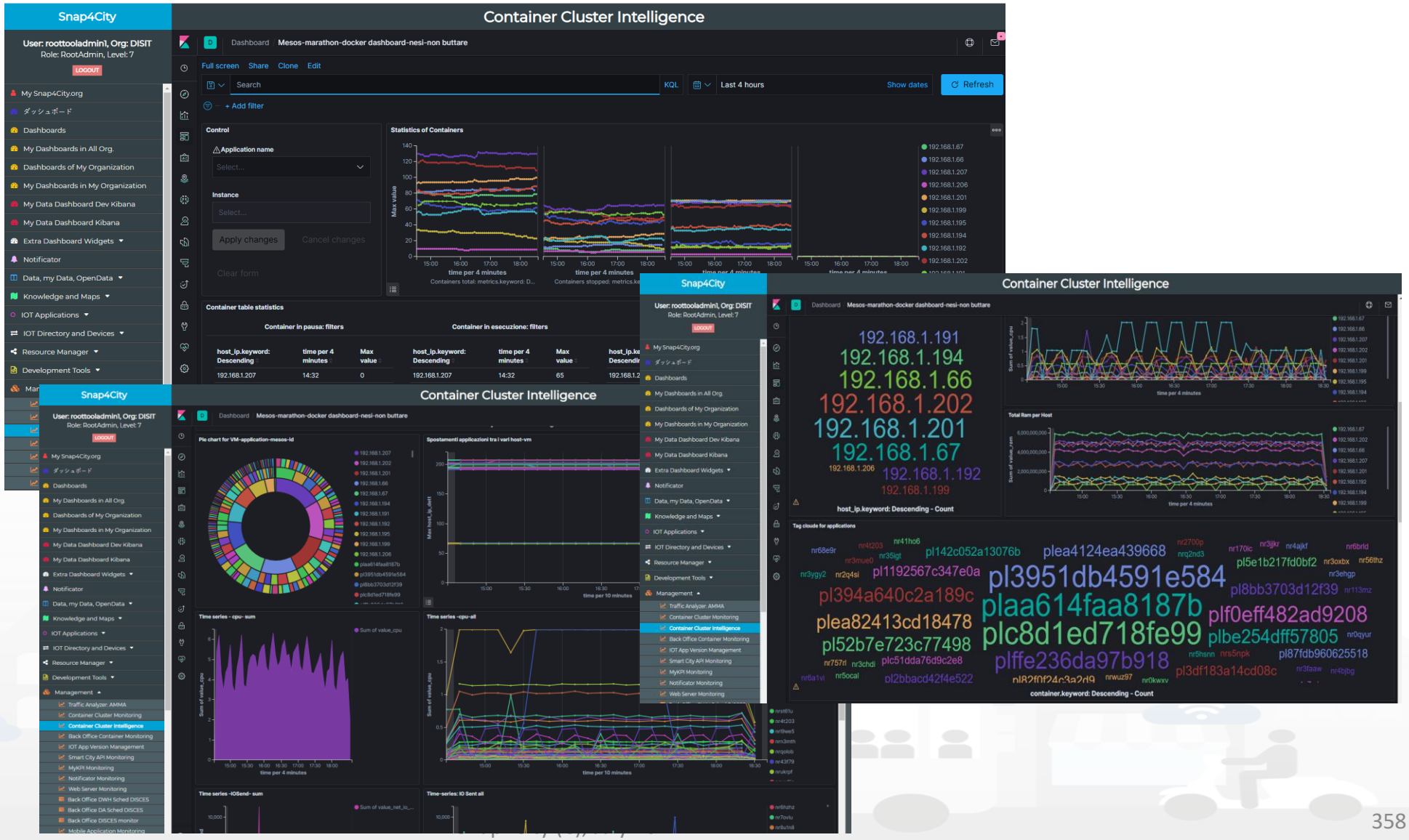




Container Cluster Intelligence via Zabbix → → Kibana

Container Cluster Intelligence via Zabbix

- Via ZABBIX
  - OpenDistro
    - Elastic Search
    - Kibana
- By VM/Host
- By Container
- By CPU, MEM, I/O
- Over time



Container Cluster Intelligence

Snap4City

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

- My Snap4City.org
- Tour Again
- ダッシュボード
- Dashboards (Public)
- My Dashboards in All Org.
- Dashboards of My Organization
- My Dashboards in My Organization
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- My Data Dashboard Kibana
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  - **Container Cluster Intelligence**
  - Back Office Container Monitoring
  - IOT App Version Management

Dashboard / Mesos-marathon-docker dashboard-nesi-non buttare

Full screen Share Clone Edit

Search KQL Last 4 hours Show dates Refresh

+ Add filter

Control

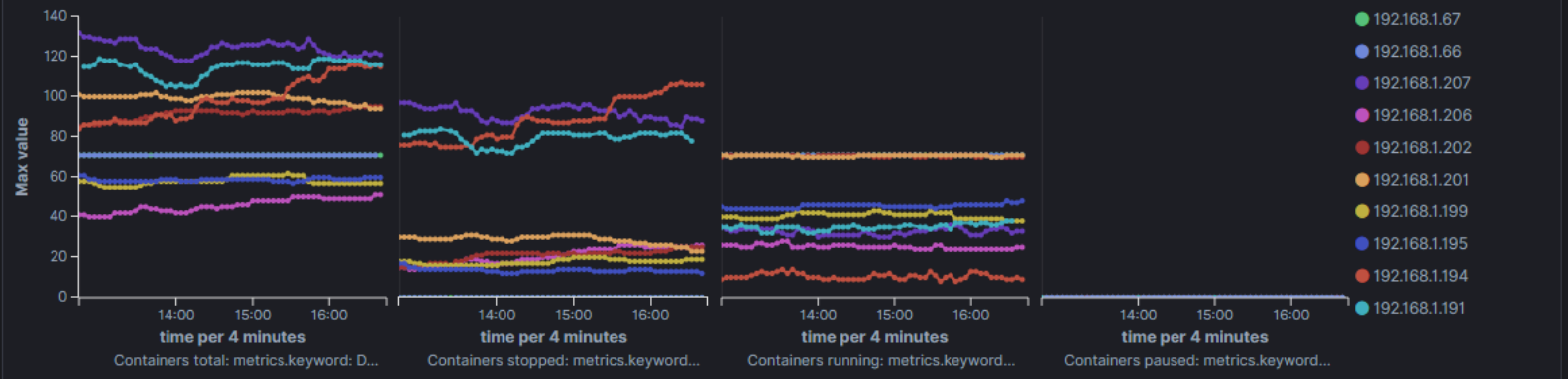
⚠Application name
Select...

Instance
Select...

Apply changes Cancel changes

Clear form

Statistics of Containers



Container table statistics

Container in pausa: filters			Container in esecuzione: filters			Container in totale: filters			Container stoppati: filters		
host_ip.keyword: Descending	time per 4 minutes	Max value	host_ip.keyword: Descending	time per 4 minutes	Max value	host_ip.keyword: Descending	time per 4 minutes	Max value	host_ip.keyword: Descending	time per 4 minutes	Max value
192.168.1.207	12:44	0	192.168.1.207	12:44	35	192.168.1.207	12:44	132	192.168.1.207	12:44	97
192.168.1.207	12:48	0	192.168.1.207	12:48	34	192.168.1.207	12:48	130	192.168.1.207	12:48	97
192.168.1.207	12:52	0	192.168.1.207	12:52	33	192.168.1.207	12:52	130	192.168.1.207	12:52	97
192.168.1.207	12:56	0	192.168.1.207	12:56	33	192.168.1.207	12:56	129	192.168.1.207	12:56	96
192.168.1.207	13:00	0	192.168.1.207	13:00	34	192.168.1.207	13:00	129	192.168.1.207	13:00	95
192.168.1.207	13:04	0	192.168.1.207	13:04	34	192.168.1.207	13:04	128	192.168.1.207	13:04	94
192.168.1.207	13:08	0	192.168.1.207	13:08	34	192.168.1.207	13:08	128	192.168.1.207	13:08	94
192.168.1.207	13:12	0	192.168.1.207	13:12	34	192.168.1.207	13:12	127	192.168.1.207	13:12	94

Container Cluster Intelligence

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  - Web Server Monitoring

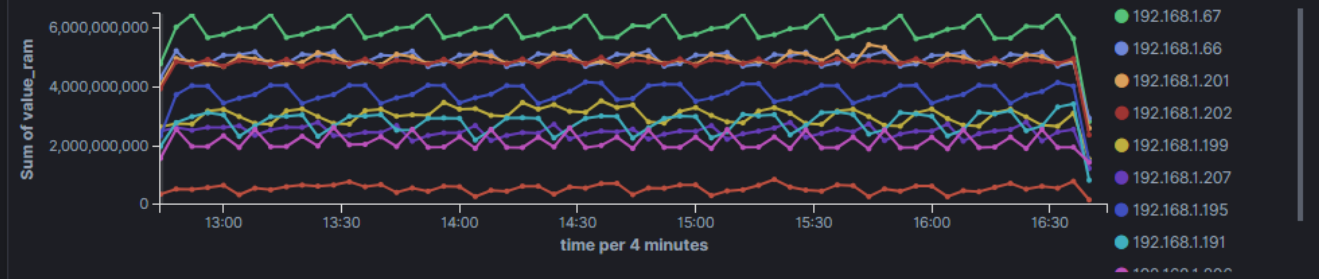
Dashboard / Mesos-marathon-docker dashboard-nesi-non buttare

Tag cloude for VM ip

host_ip.keyword: Descending - Count

CPU usage per hosts

Total Ram per Host



Tag cloude for applications

container.keyword: Descending - Count

Container Cluster Intelligence

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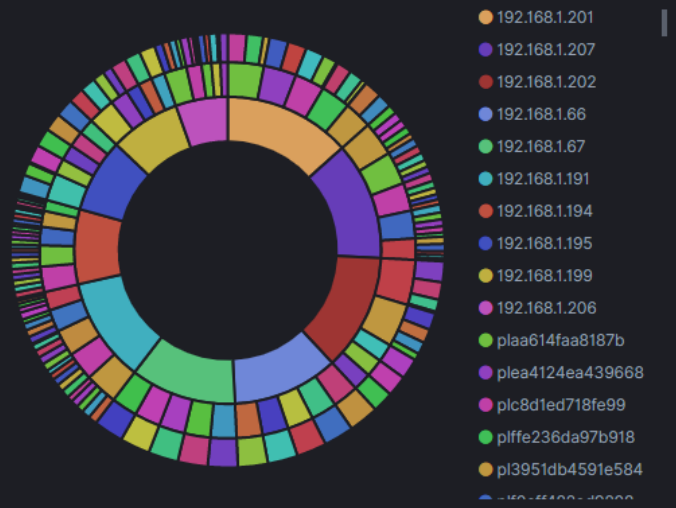
- Notificator
- Data, my Data, OpenData
- Knowledge and Maps
- IOT Applications
- IOT Directory and Devices
- Resource Manager
- Development Tools
- Management
  - Jasper Report Server
  - Traffic Analyzer: AMMA
  - Container Cluster Monitoring
  - Container Cluster Intelligence
  - Back Office Container Monitoring
  - IOT App Version Management

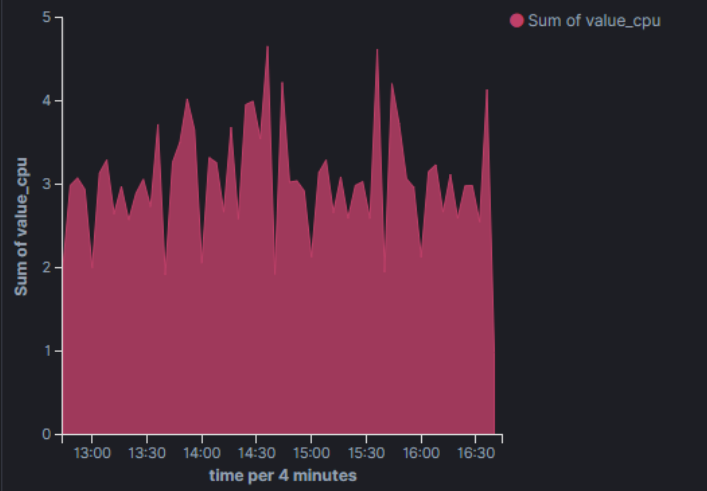
Dashboard / Mesos-marathon-docker dashboard-nesi-non buttare

Pie chart for VM-application-mesos-id

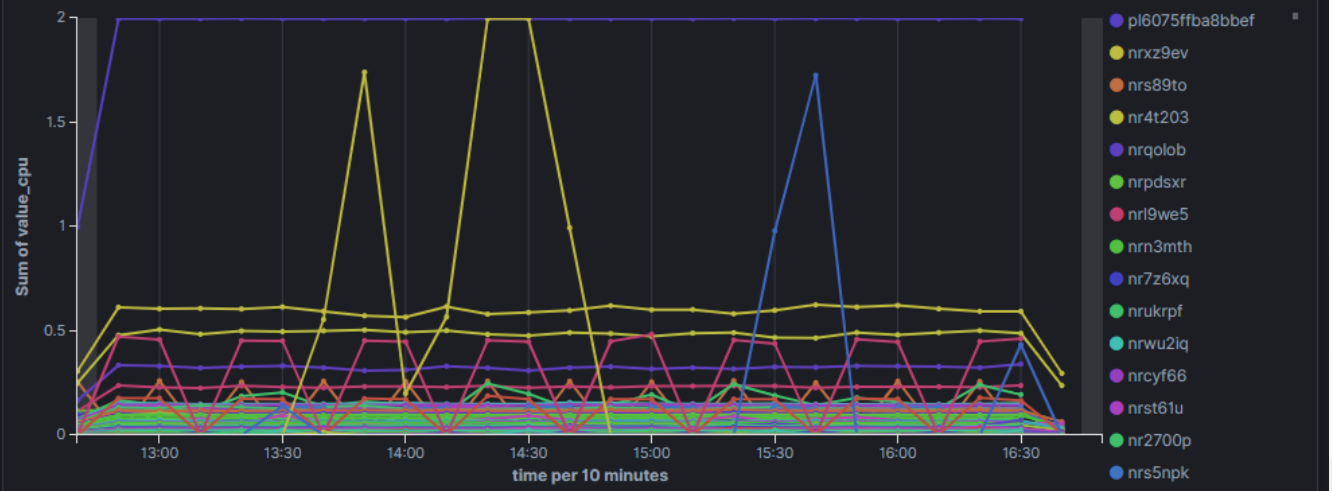


Spostamenti applicazioni tra i vari host-vm

Time series - cpu- sum



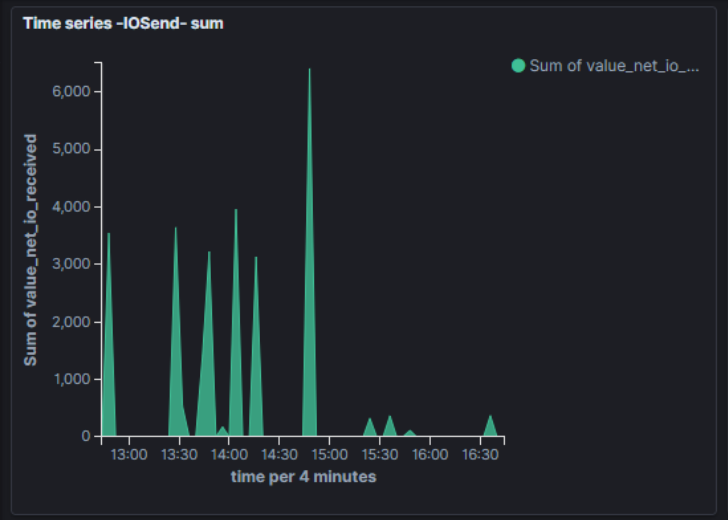
Time series -cpu-all

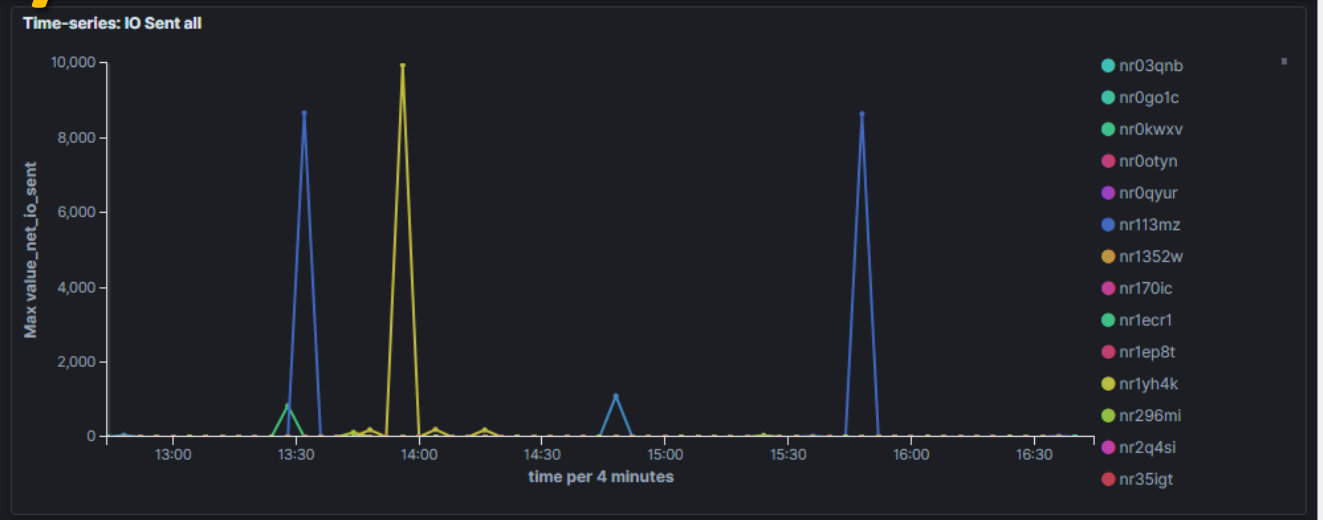


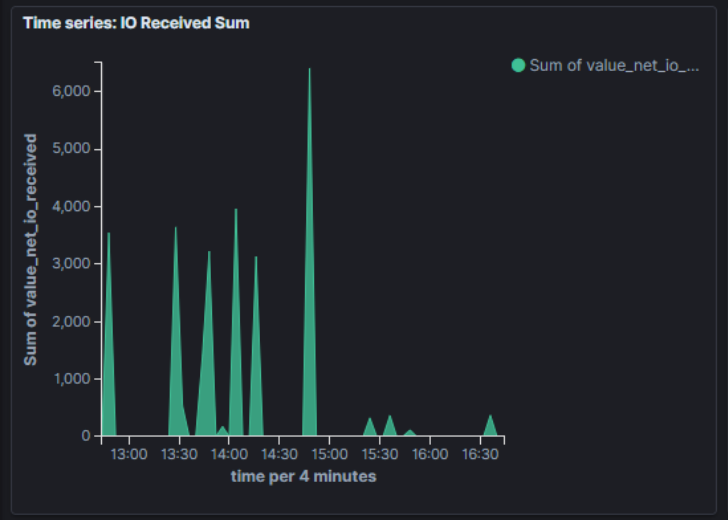
User: roottooladmin1, Org: DISIT
Role: RootAdmin, Level: 7

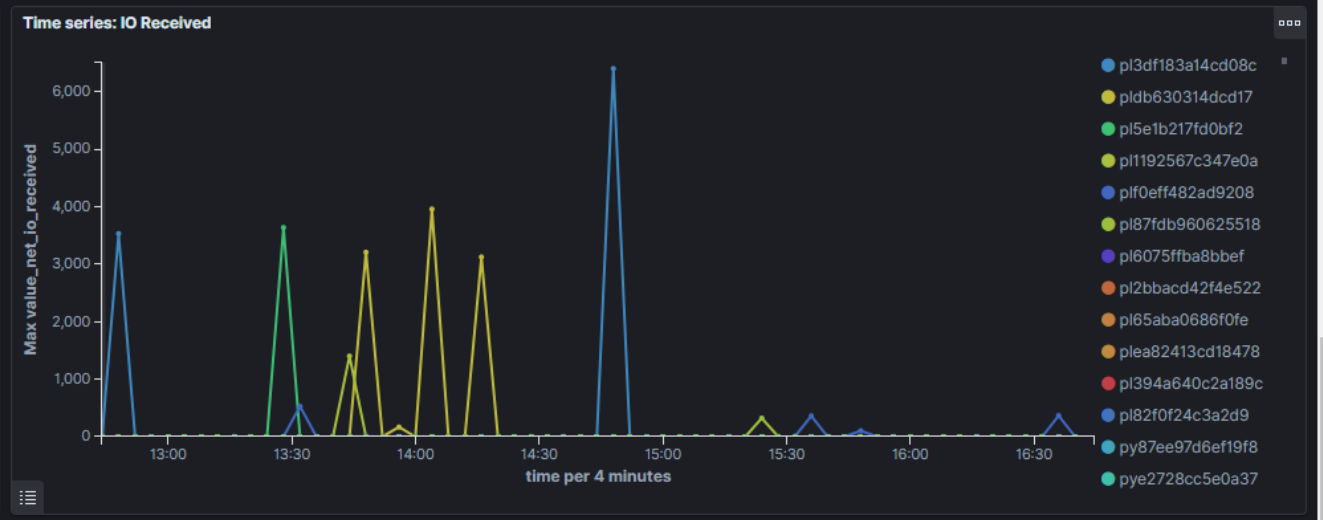
LOGOUT

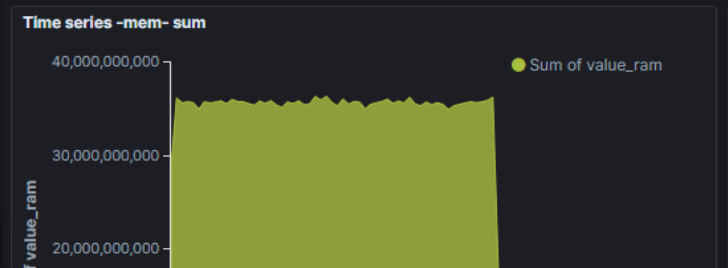
My Snap4City.org
Tour Again
ダッシュボード
Dashboards (Public)
My Dashboards in All Org.
Dashboards of My Organization
My Dashboards in My Organization
My Data Dashboard Dev Kibana
My Data Dashboard Kibana
Extra Dashboard Widgets
Notificator
Data, my Data, OpenData
Knowledge and Maps
IOT Applications
IOT Directory and Devices
Resource Manager
Development Tools
Management
Jasper Report Server
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

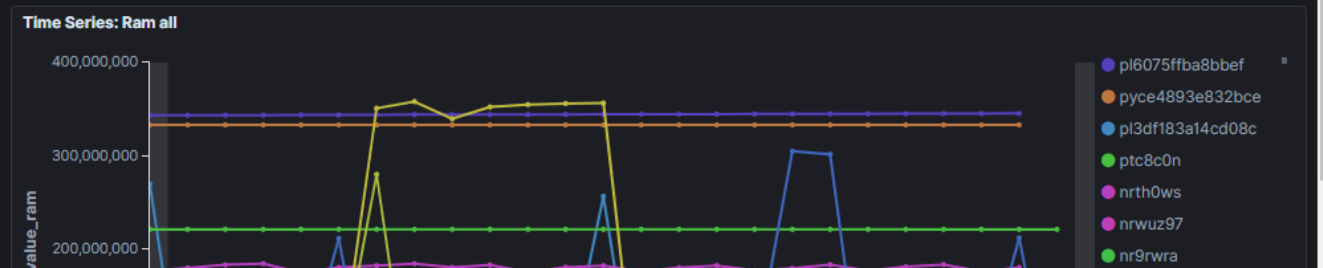






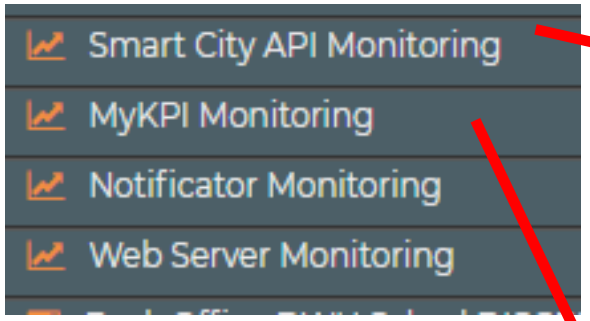




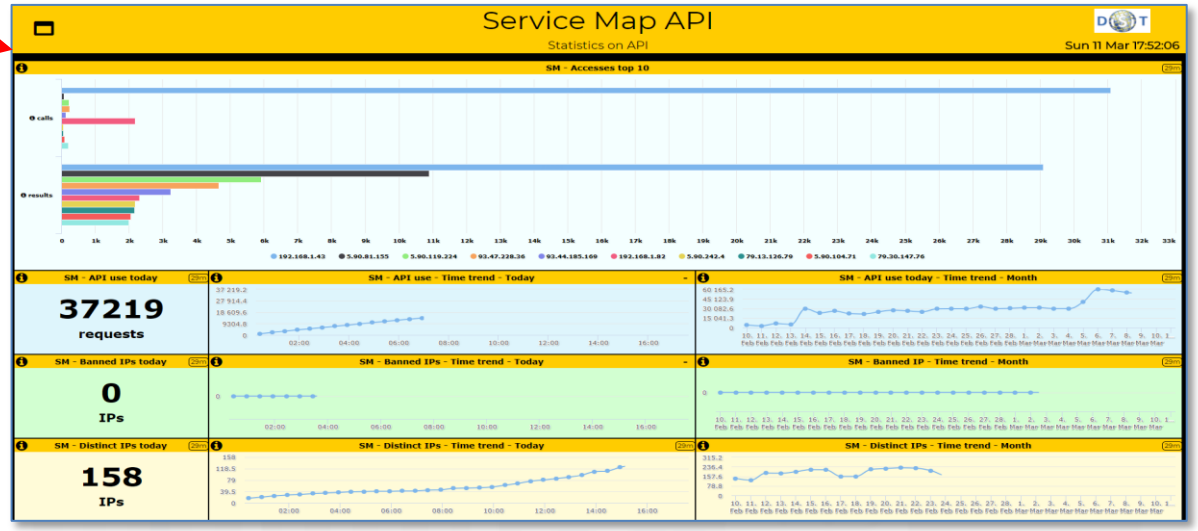


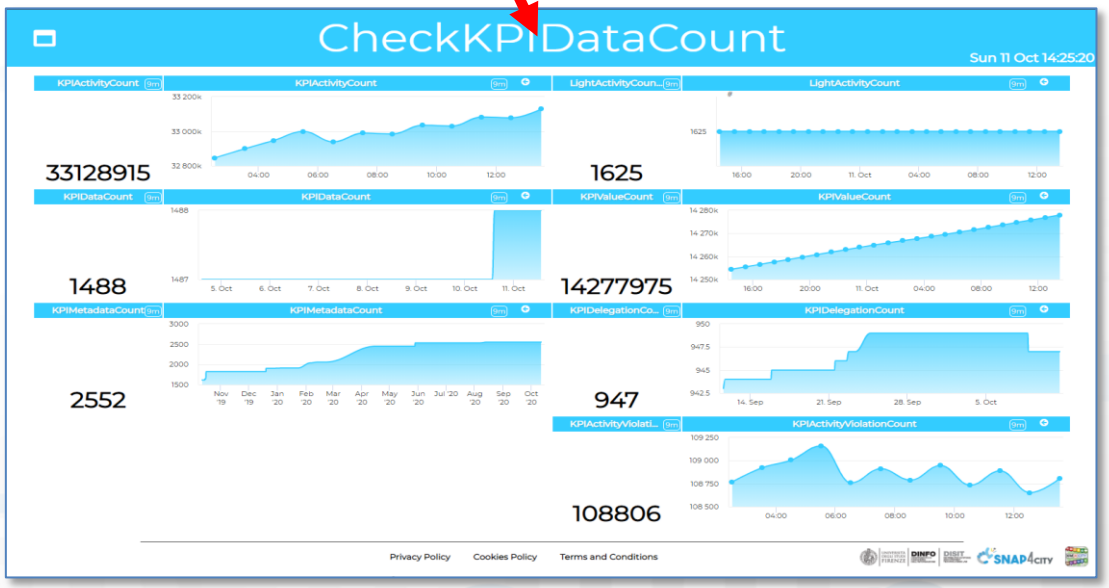
Monitoring Resources and API Traffic

Monitoring Smart City API Usage



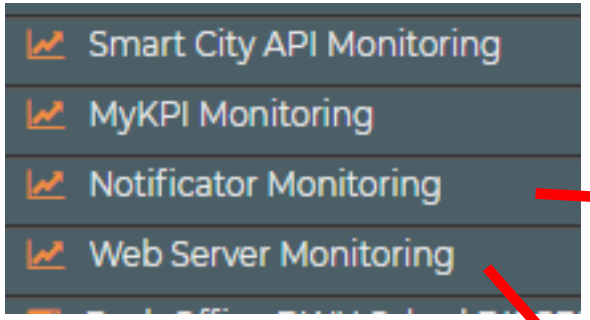
http://www.disit.org/dashboardSmartCity/view/index.php?iddasboard=MTkw



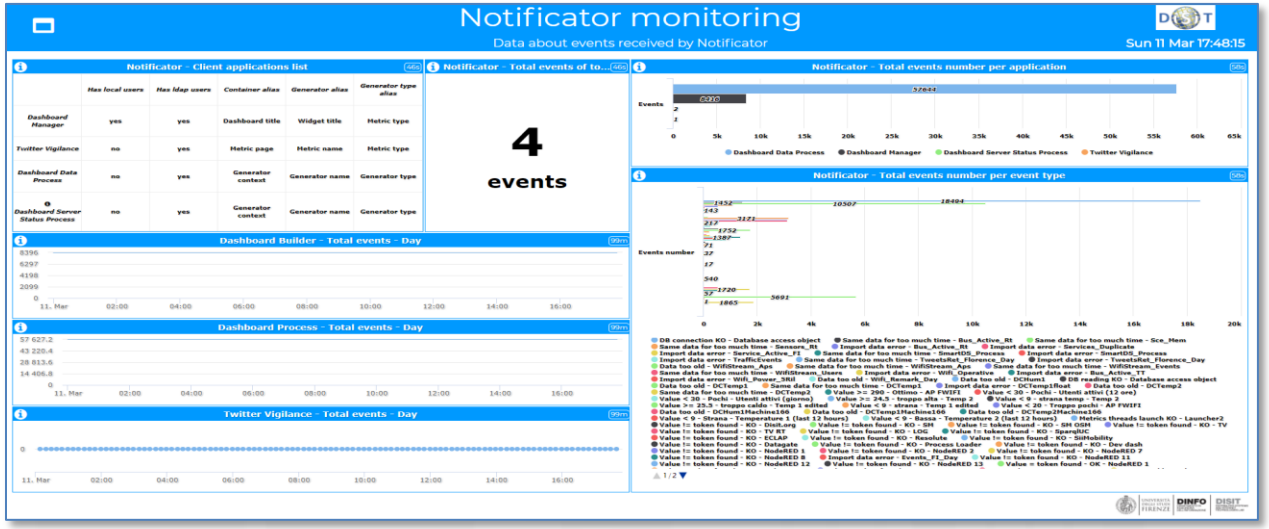
- 

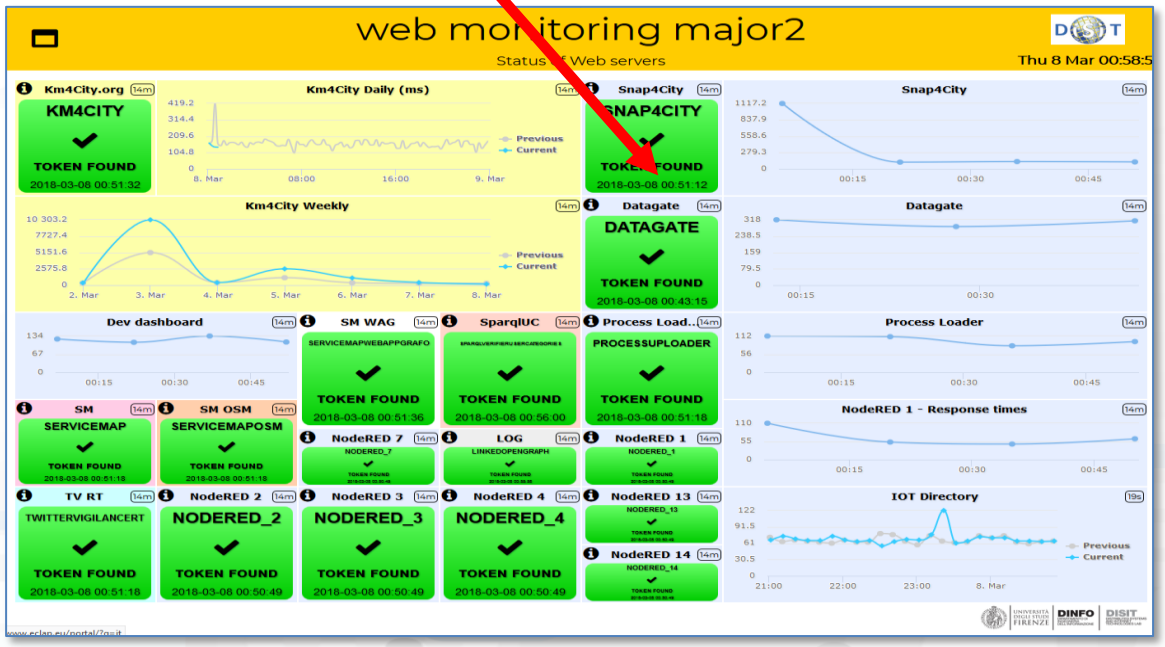
https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTY0NA==

Monitoring Resources and Traffic



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



- 

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

Monitoring Schedulers via DISCES Processes and ETL tasks

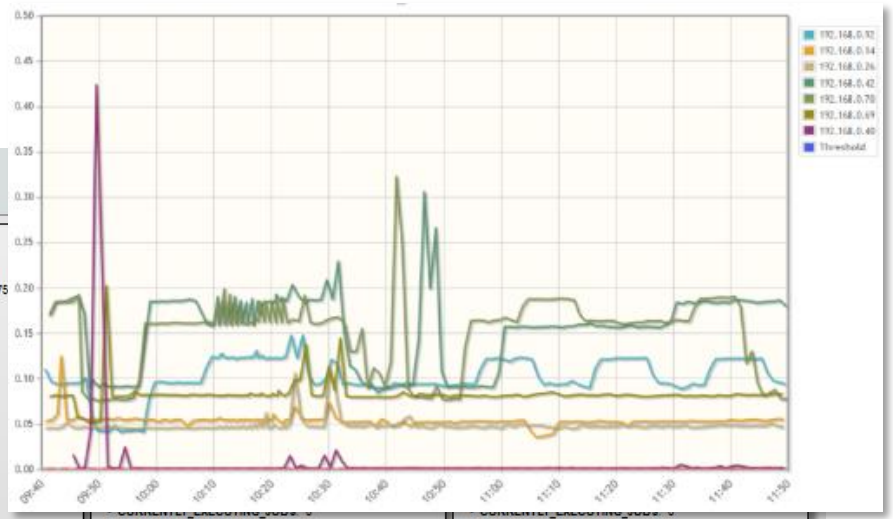
In Yellow alternative & legacy solutions

DISCES: Distributed SCE Scheduler

Sii-Mobility

Smart Cloud Engine
DISIT - Distributed Systems and Internet Technology Lab

SCHEDULER NAME	ID	FIRE INSTANCE ID	DATE	JOB NAME	JOB GROUP	JOB DATA	STATUS
SCE	297230	hadoopnode01d14183077042351418307705019	2014-12-15 15:25:33	sensori47_A	sensori47	#processParameters=[{"processPath":"/ho	RUNNING
SCE	297229	hadoopnode06c14183076279641418307629359	2014-12-15 15:25:33	sensori44_A	sensori44	#processParameters=[{"processPath":"/ho	RUNNING
SCE	297228	hadoopnode02141830838738214183083917 58	2014-12-15 15:22:39	ZTL_notturna_shp_I	ZTL_notturna_shp	#processParameters=null;#isNonConcurrent=t	SUCCESS
SCE	297227	hadoopnode02141830838738214183083917 57	2014-12-15 15:22:39	ZTL_notturna_kmz_I	ZTL_notturna_kmz	#processParameters=null;#isNonConcurrent=t	SUCCESS
SCE	297226	hadoopnode01c14183085186101418308520365	2014-12-15 15:21:49	sensori45_A	sensori45	#processParameters=[{"processPath":"/ho	RUNNING
SCE	297225	hadoopnode06141830832370214183083258 68	2014-12-15 15:21:49	sensori40_A	sensori40	#processParameters=[{"processPath":"/ho	RUNNING
SCE	297224	hadoopnode01b14183075646221418307566749	2014-12-15 15:21:49	sensori46_A	sensori46	#processParameters=[{"processPath":"/ho	RUNNING
SCE	297223	hadoopnode02141830838738214183083917 56	2014-12-15 15:21:37	ZTL_notturna_kmz_I	ZTL_notturna_kmz	#processParameters=null;#isNonConcurrent=t	SUCCESS
SCE	297222	hadoopnode02141830838738214183083917 55	2014-12-15 15:21:00	sensori31_C	sensori31	#processParameters=[{"processPath":"/ho	SUCCESS
SCE	297221	hadoopnode06c14183076279641418307629358	2014-12-15 15:21:00	sensori30_C	sensori30	#processParameters=[{"processPath":"/ho	SUCCESS
SCE	297220	hadoopnode02141830838738214183083917 54	2014-12-15 15:18:58	ZTL_notturna_shp_I	ZTL_notturna_shp	#processParameters=null;#isNonConcurrent=t	SUCCESS
		hadoopnode01c14183				#processParameter	

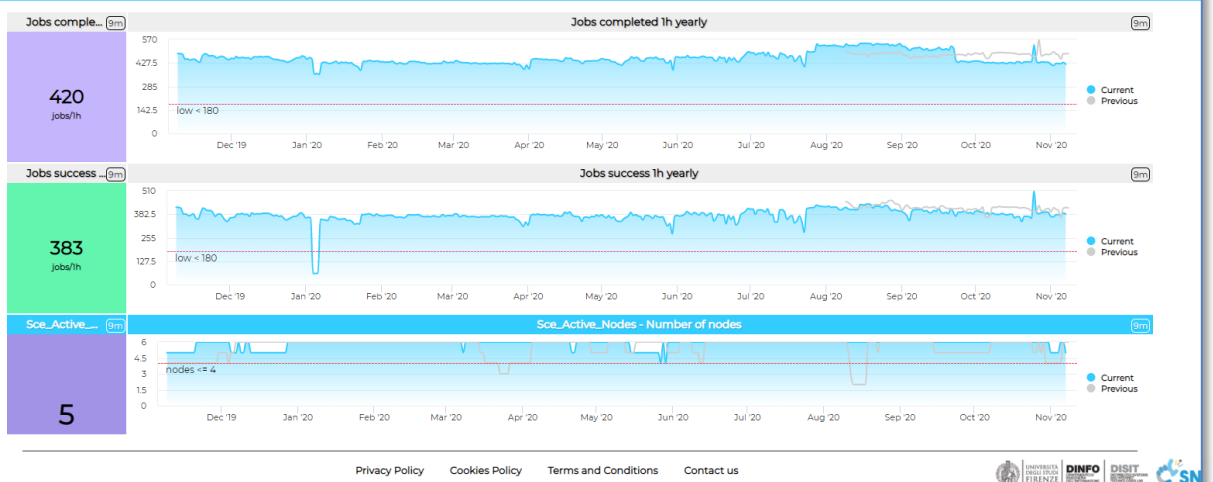


192.168.0.69
- LAST_CHECK: 2016-10-26 19:14:18
- $CHEDULER_IN$TANCE_ID: hadoopnode021475
- CPU_LOAD: 3.77%
- FREE_PHYSICAL_MEMORY: 4.45 GB
- JOB$_EXECUTED: 14770
- $CHEDULER_NAME: SCE
- CURRENT_TIME: 2016-10-26 19:14:36
- JOB$/h: 31.89
- RUNNING_$INCE: 2016-10-07 12:04:15
- CLU$TERED: 1
- PERITENCE: 1
- REMOTE_$CHEDULER: 0
- CURRENTLY_EXECUTING_JOB$: 1
- CPU_LOAD_JVM: 0.01%
- YTEM_LOAD_AVERAGE: 0.58
- OPERATING_YTEM_VER$ION: 3.13.0-24-generic
- COMMITTED_VIRTUAL_MEMORY: 8.38 GB
- OPERATING_YTEM_NAME: Linux
- FREE_$WAP_$PACE: 11.98 GB
- PROCE$$_CPU_TIME: 10180410000000
- TOTAL_PHY$ICAL_MEMORY: 11.73 GB
- NUMBER_OF_PROCE$$ORS: 16
- OPERATING_YTEM_ARCHITECTURE: amd64
- TOTAL_$WAP_$PACE: 12 GB
- I$_$CHEDULER_$TANDBY: 0
- I$_$CHEDULER_$HUTDOWN: 0
- I$_$CHEDULER_$TARTED: 1
- TOTAL_DI$K_$PACE: 2.11 TB
- UNALLOCATED_DI$K_$PACE: 1004.16 GB
- U$ABLE_DI$K_$PACE: 894.89 GB
- PREV_FIRE_TIME: 2016-10-26 19:14:04
- CPU: Intel(R) Xeon(R) CPU E5-2650 v3 @ 2.30GHz

CPU	CPU Load	Mem Total	Mem Free	Cores	Jobs/h	Jobs Executed	Jobs Failed/Success (24 h)	Jobs Failed/Success (7 days)
244.07 GHz	5.41 GHz (2.22%)	70.41 GB	20.36 GB	84	203.56	94283	221 (4.45%) 4742 (95.55%)	2879 (8.41%) 31356 (91.59%)

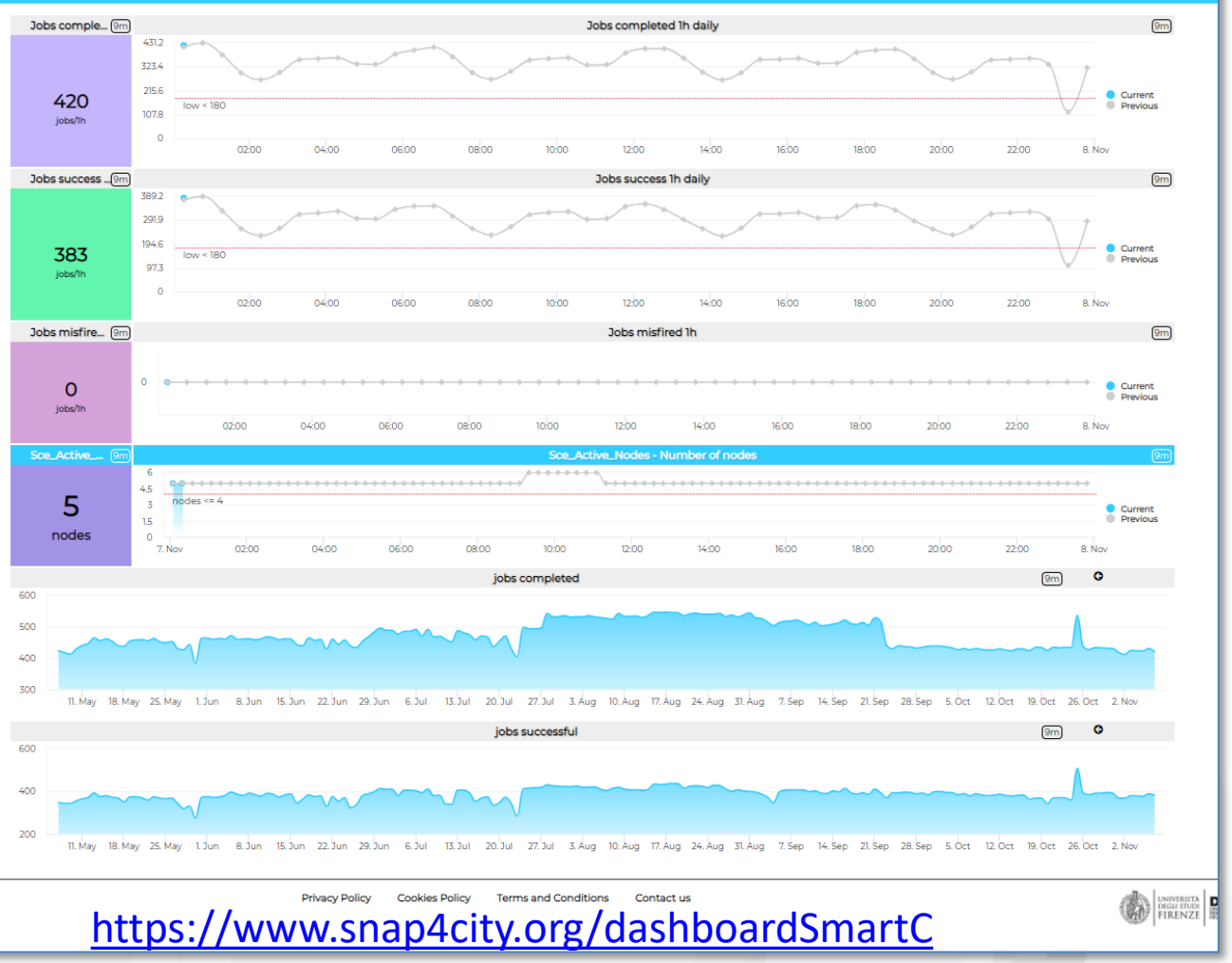
DISCES monitoring

DISCES Monitoring - Annuale



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjM5Mw==

DISCES Monitoring

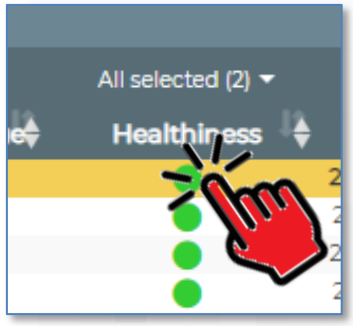


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjE3Mw==

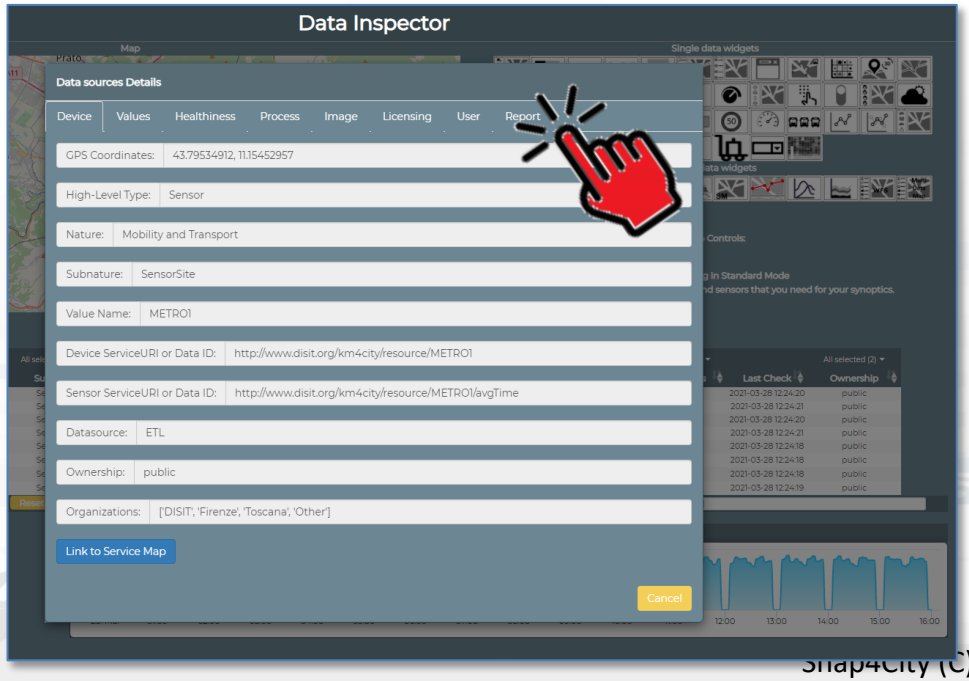
Report Generation and Management (admin tool)

Report Generation and Management

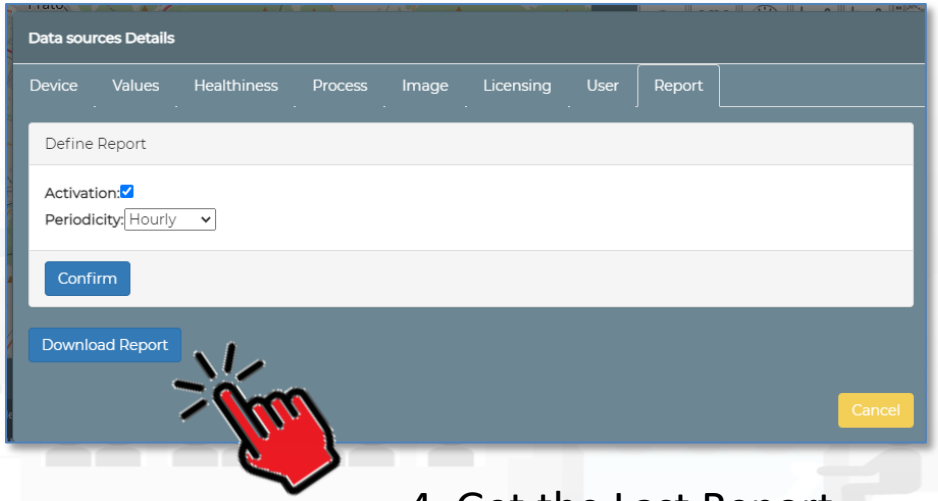
- **Device/data** owner may have their reports: **monthly or 3-monthly**
  - Ready to use reports are available for:
    - Single Device: ETL and IOT
  - Ask to your RootAdmin to activate the production of reports (and also **hourly** report **for testing only**).



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

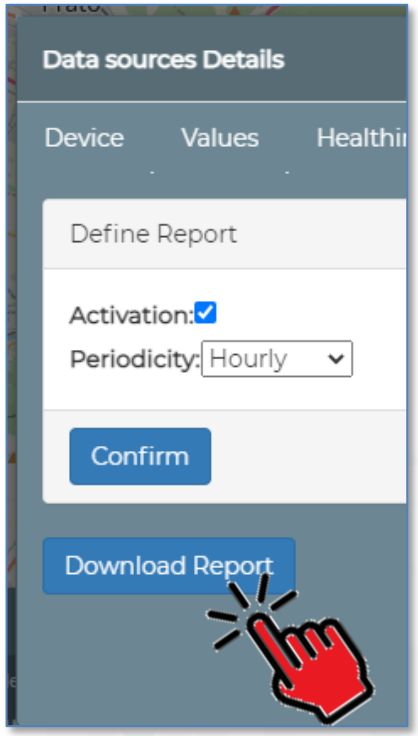


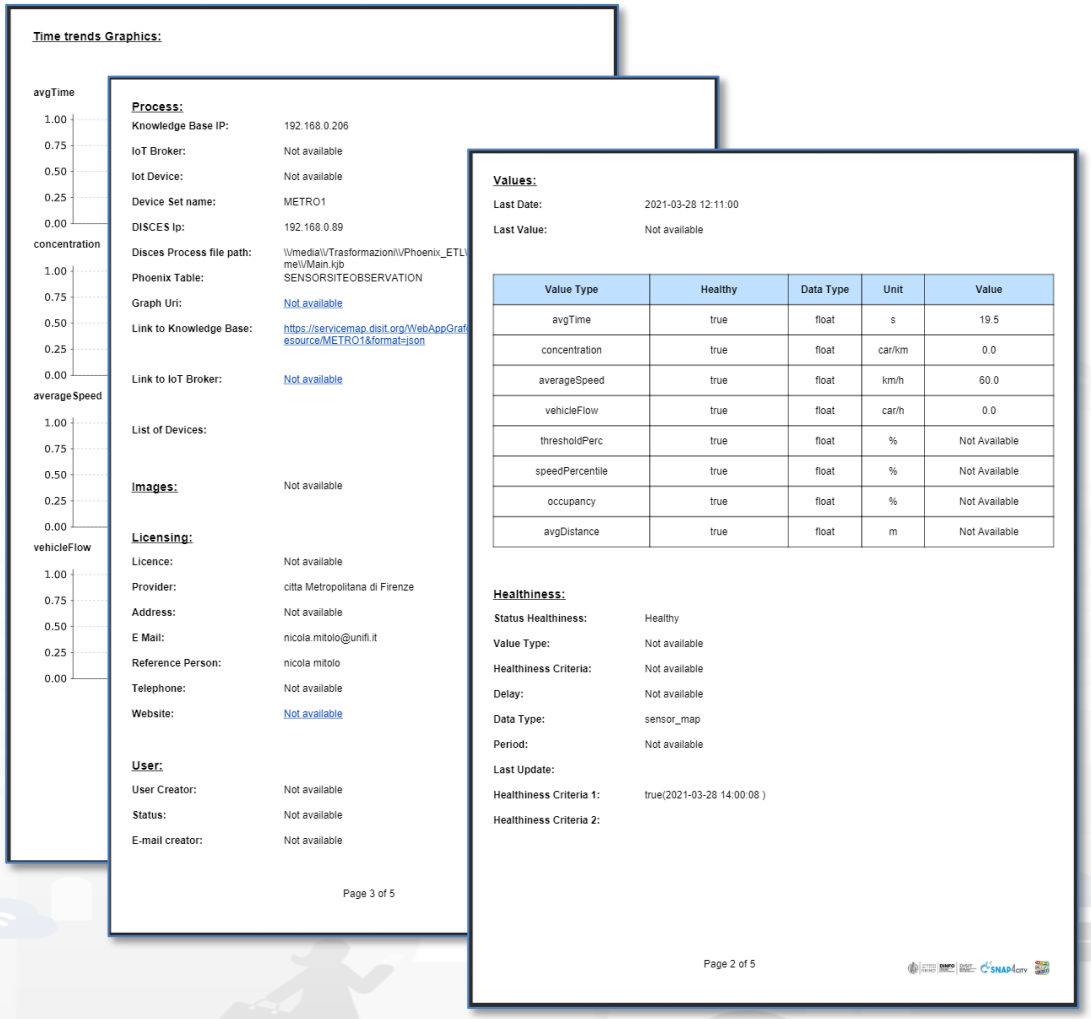
3. Click on report

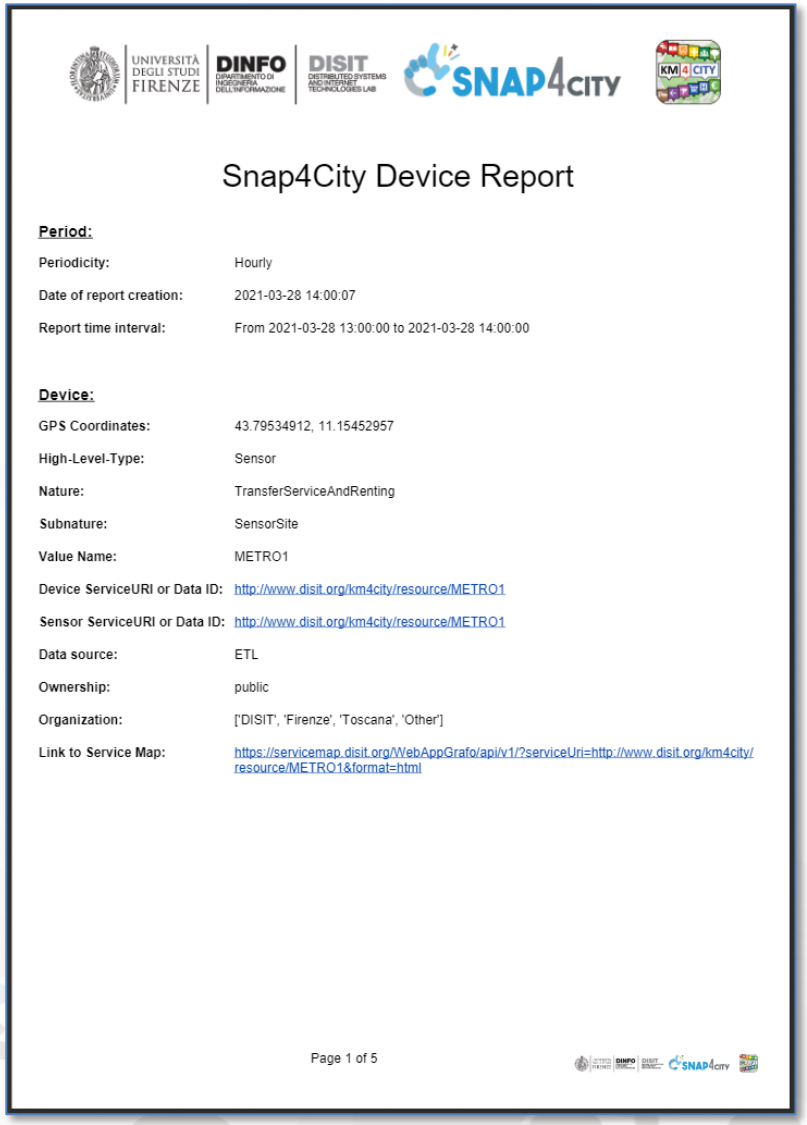


4. Get the Last Report

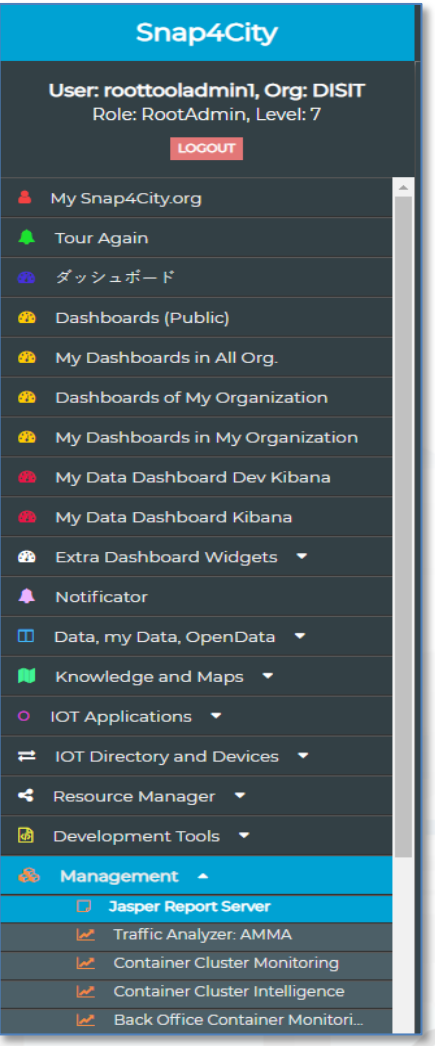
Take the last report



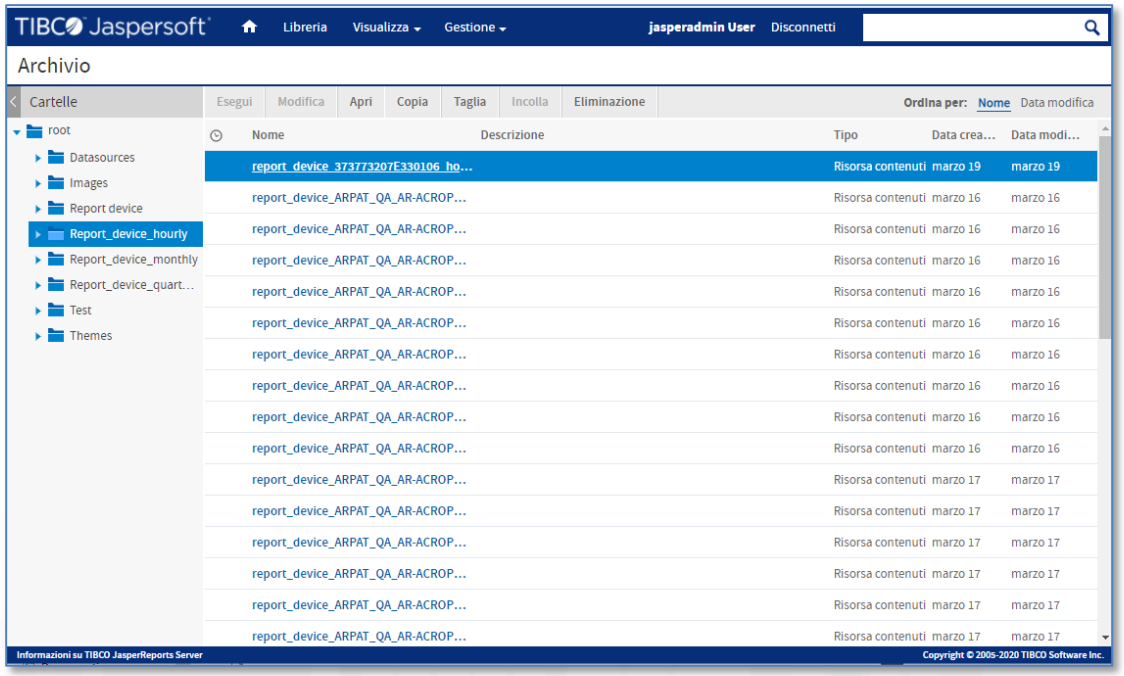




Report Generation and Management



- **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

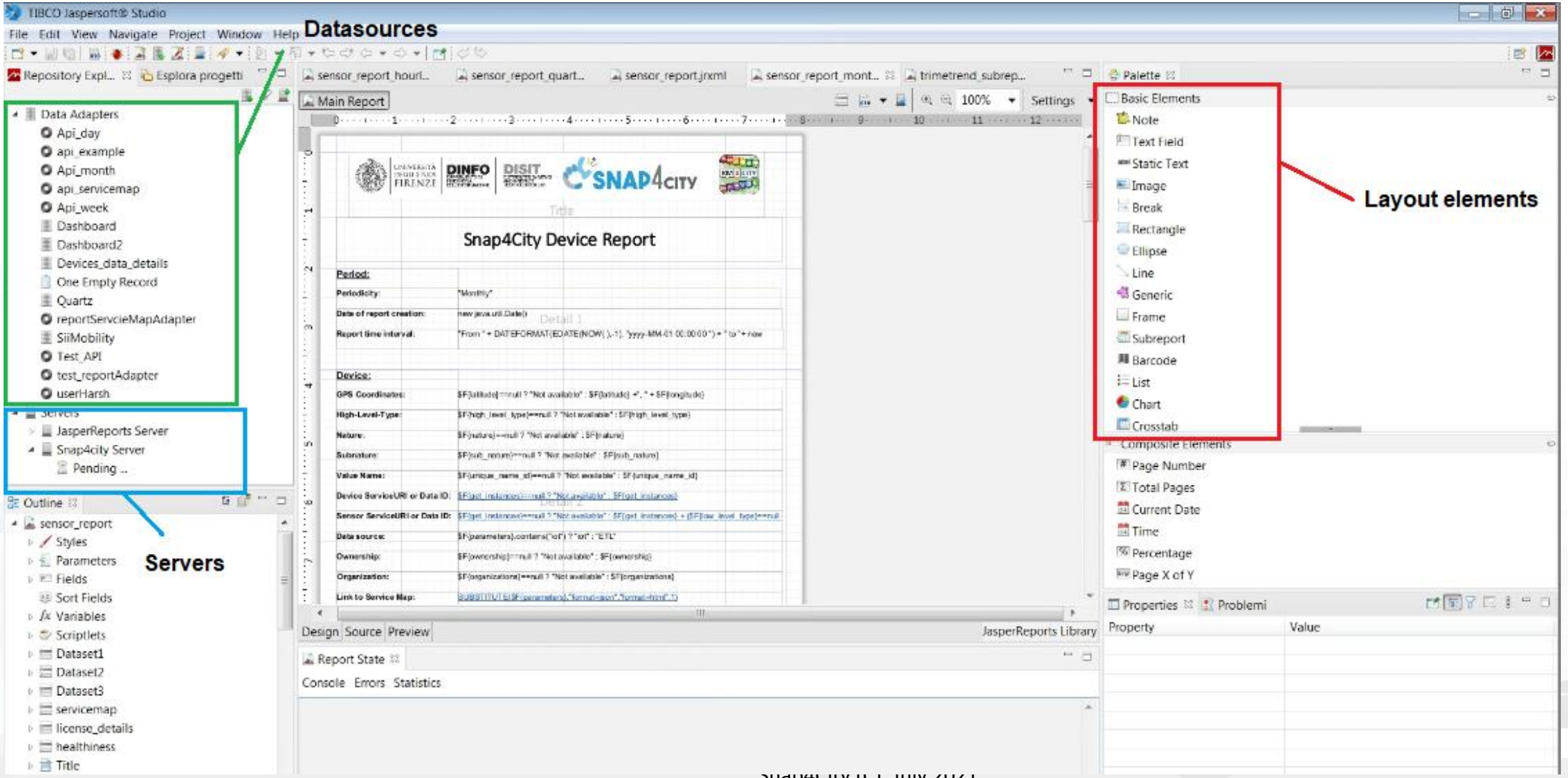


Report user manuals:

https://www.snap4city.org/720

https://www.snap4city.org/721

How to Customize/Manage the Report Model



Managing Photos and Comments from Web and Mobile Apps

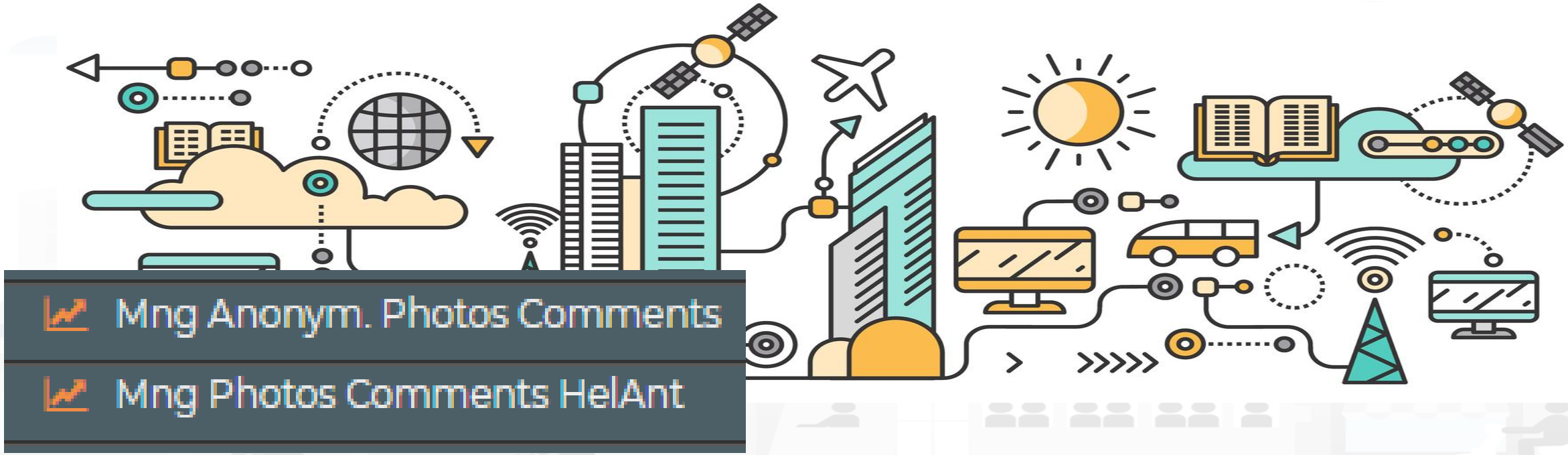
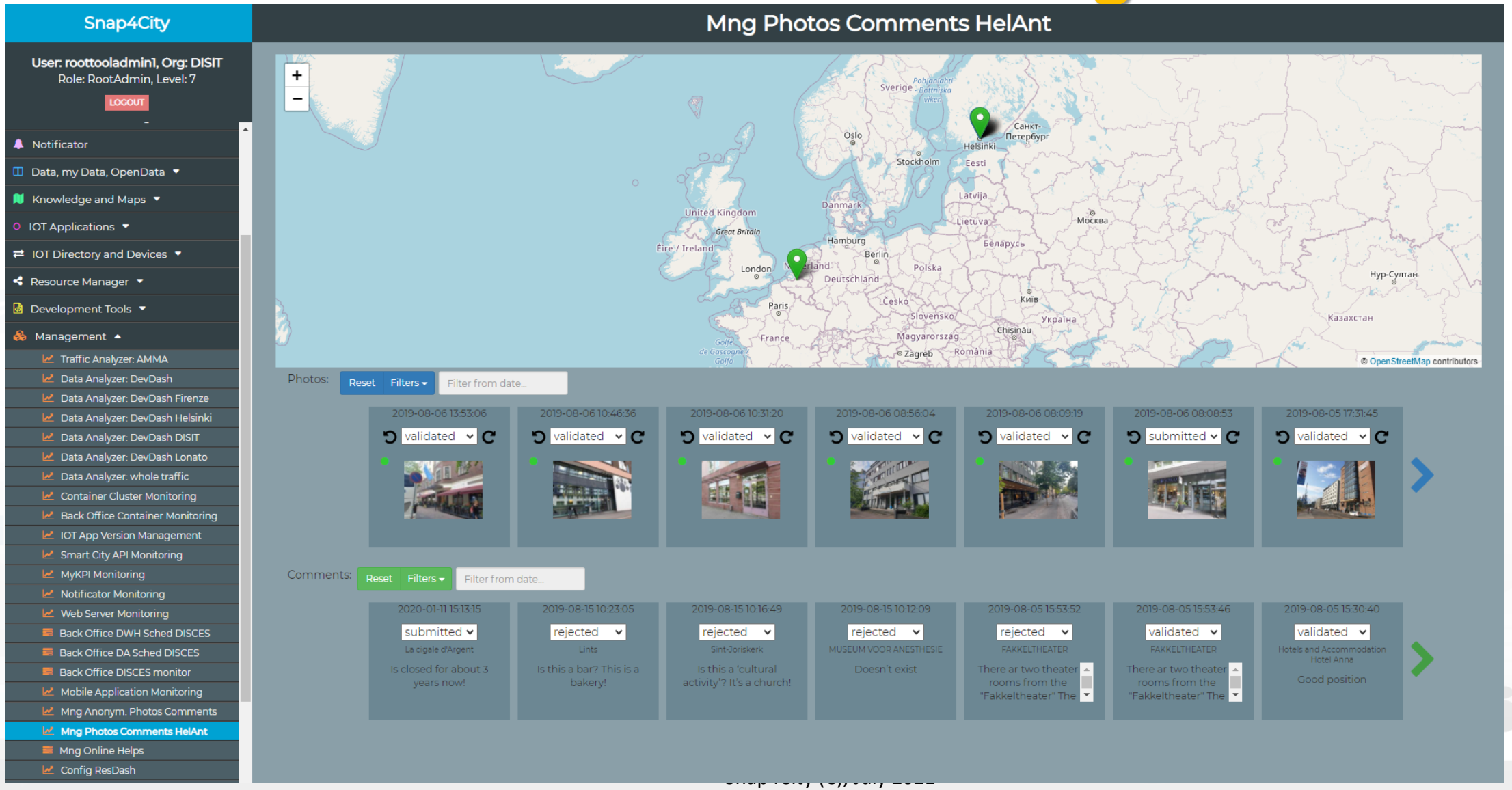
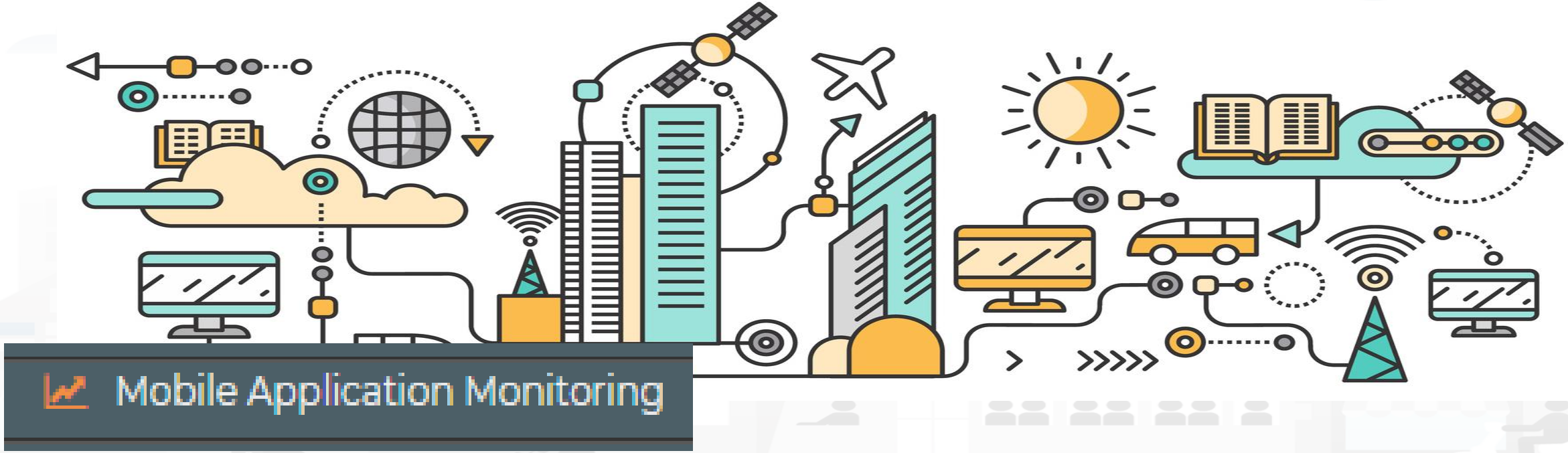


Photo and Comments Management



Mobile App Monitoring and Management



Mobile App Monitoring and Management

Snap4City

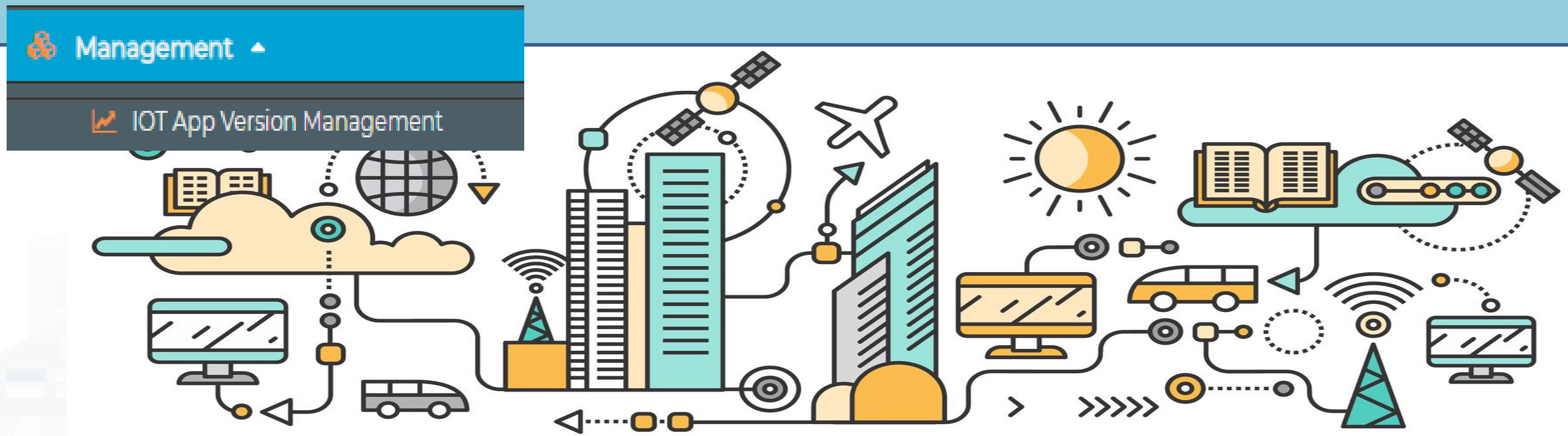
User: roottooladmin1, Org: DISIT
Role: RootAdmin, Level: 7
LOGOUT

- IOT Applications
- IOT Directory and Devices
- Resource Manager
- Development Tools
- Management
  - Traffic Analyzer: AMMA
  - Data Analyzer: DevDash
  - Data Analyzer: DevDash Firenze
  - Data Analyzer: DevDash Helsinki
  - Data Analyzer: DevDash DISIT
  - Data Analyzer: DevDash Lonato
  - Data Analyzer: whole traffic
  - Container Cluster Monitoring
  - Back Office Container Monitoring
  - IOT App Version Management
  - Smart City API Monitoring
  - MyKPI Monitoring
  - Notificator Monitoring
  - Web Server Monitoring
  - Back Office DWH Sched DISCES
  - Back Office DA Sched DISCES
  - Back Office DISCES monitor
  - **Mobile Application Monitoring**
  - Mng Anonym. Photos Comments
  - Mng Photos Comments HelAnt
  - Mng Online Helps
  - Config ResDash

Mobile Application Monitoring

- City Users and Stats
- Recommendations Log
- General Settings
- Social Media Group Recommendations Settings
- Groups Recommendations Priorities
- Class Scores
- City Users
- List of Trajectories Clusters
- Heatmap and Trajectories Clusters (User Profile: All)
- Heatmap and Trajectories Clusters (User Profile: Citizen)
- Heatmap and Trajectories Clusters (User Profile: Commuter)
- Heatmap and Trajectories Clusters (User Profile: Student)
- Heatmap and Trajectories Clusters (User Profile: Tourist)
- Heatmap and Trajectories Clusters (User Profile: Disabled)
- Heatmap and Trajectories Clusters (User Profile: Operator)
- Heatmap and Trajectories Clusters of City Users Together
- Real Time City Users: positions and movements
- General Stats
- Statistics for City Users Types
- Interactive People Flow Maps

IOT Apps Version Management



IOT App Versions Monitor and Upgrade

IotAppControlRoom

Sat 14 Nov 16:56:20

IotAppControlRoom

Show 10 entries

Search:

ElementID	ElementName	ElementType	Username	Type	Image	Controls
fa777	[redacted]	AppID	[redacted]			
node		AppID		advanced	snap4city-nodered-v1.1.3-adv:v4	Update
node		AppID		basic	snap4city-nodered-v1.1.3-basic:v4	Update
nr03c		AppID		basic	snap4city-nodered-basic:v90	Update
nr0kv		AppID		basic	snap4city-nodered-basic:v90	Update
nr0nz		AppID		basic	snap4city-nodered-basic:v90	Update
nr0ot		AppID		basic	snap4city-nodered-basic:v90	Update
nr0qy		AppID		basic	snap4city-nodered-basic:v90	Update
nr113		AppID		basic	snap4city-nodered-basic:v90	Update
nr11c		AppID		basic	snap4city-nodered-basic:v90	Update

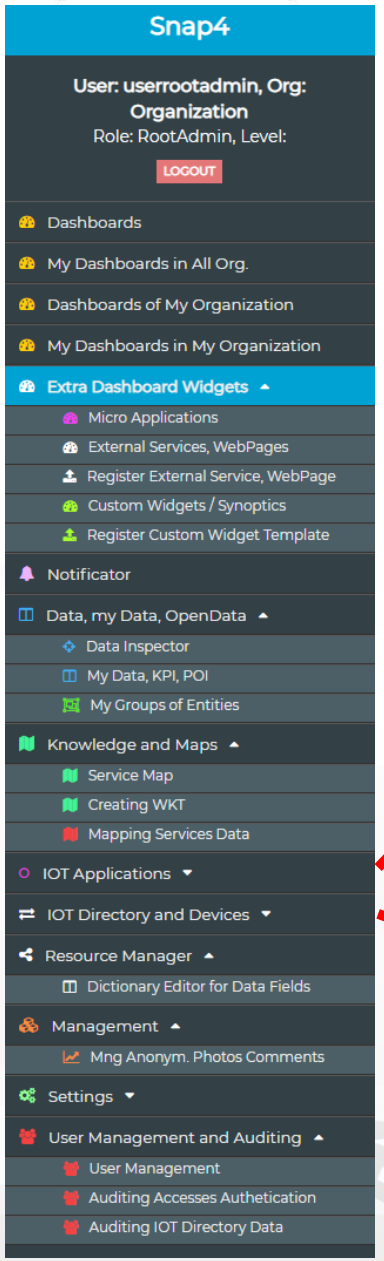
Showing 71 to 80 of 445 entries

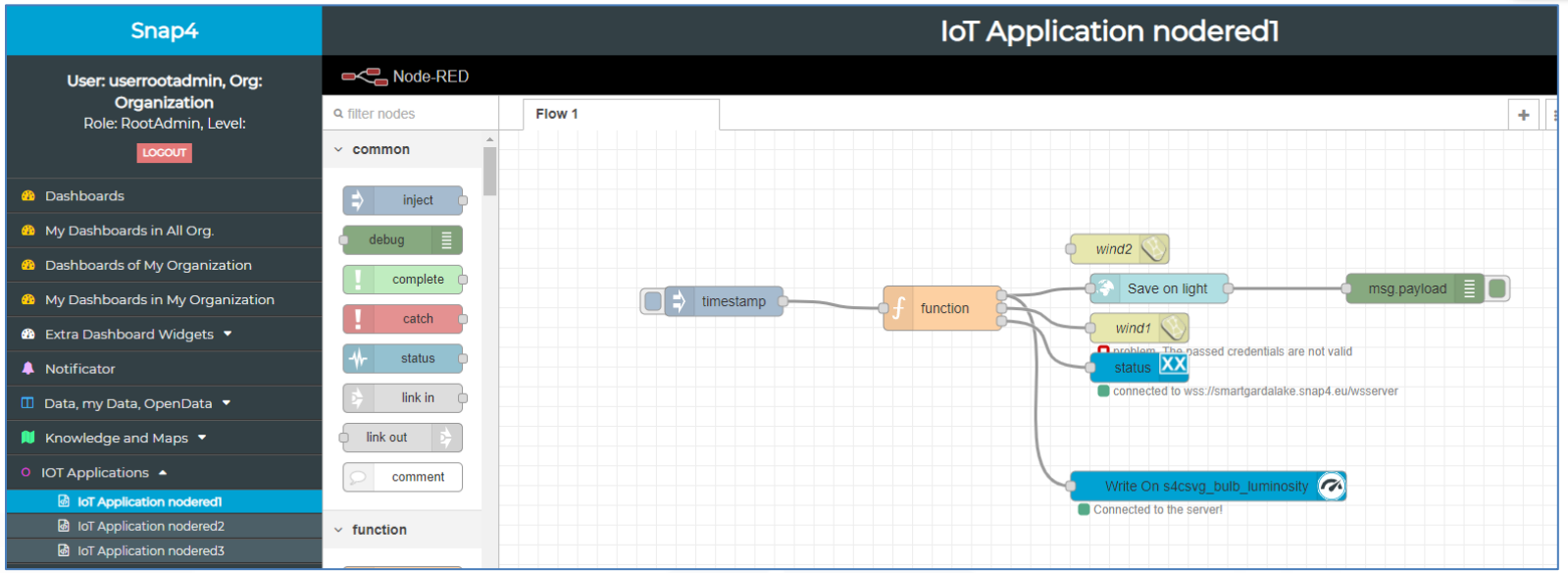
Previous 1 ... 7 8 9 ... 45 Next

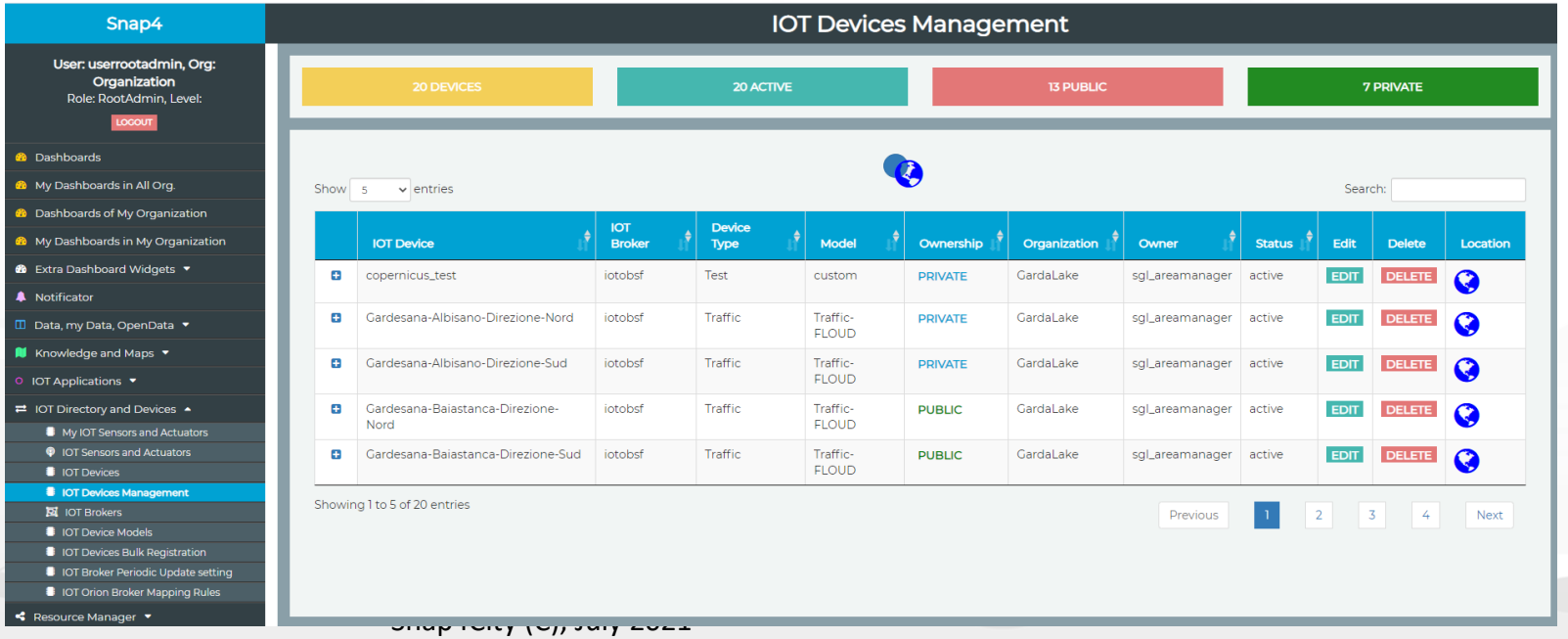
adv-v90	adv:v56	adv:v66	adv:v71	adv:v76	adv:v90	basic-v90	basic:v90	v1.1.3-adv:v4	v1.1.3-adv:v5	v1.1.3-adv:v6
1	1	2	1	3	70	1	270	1	1	2

v1.1.3-adv:v8	v1.1.3-basic:v11	v1.1.3-basic:v4	v1.1.3-basic:v5	v1.1.3-basic:v7	v1.1.3-basic:v8	undefined
3	3	6	7	1	1	46

Data-City Small example


Snap4
User: userrootadmin, Org: Organization
Role: RootAdmin, Level:
LOGOUT
Dashboards
My Dashboards in All Org.
Dashboards of My Organization
My Dashboards in My Organization
Extra Dashboard Widgets
Micro Applications
External Services, WebPages
Register External Service, WebPage
Custom Widgets / Synoptics
Register Custom Widget Template
Notificator
Data, my Data, OpenData
Data Inspector
My Data, KPI, POI
My Groups of Entities
Knowledge and Maps
Service Map
Creating WKT
Mapping Services Data
IOT Applications
IOT Directory and Devices
Resource Manager
Dictionary Editor for Data Fields
Management
Mng Anonym. Photos Comments
Settings
User Management and Auditing
User Management
Auditing Accesses Authetication
Auditing IOT Directory Data


Snap4
User: userrootadmin, Org: Organization
Role: RootAdmin, Level:
LOGOUT
Dashboards
My Dashboards in All Org.
Dashboards of My Organization
My Dashboards in My Organization
Extra Dashboard Widgets
Notificator
Data, my Data, OpenData
Knowledge and Maps
IOT Applications
IoT Application nodered1
IoT Application nodered2
IoT Application nodered3
IoT Application nodered1
Node-RED
filter nodes
Flow 1
common
inject
debug
complete
catch
status
link in
link out
comment
function
timestamp
function
wind2
Save on light
msg.payload
wind1
problem: The passed credentials are not valid
status
connected to wss://smartgardalake.snap4.eu/wsserver
Write On s4csvg_bulb_luminosity
Connected to the server!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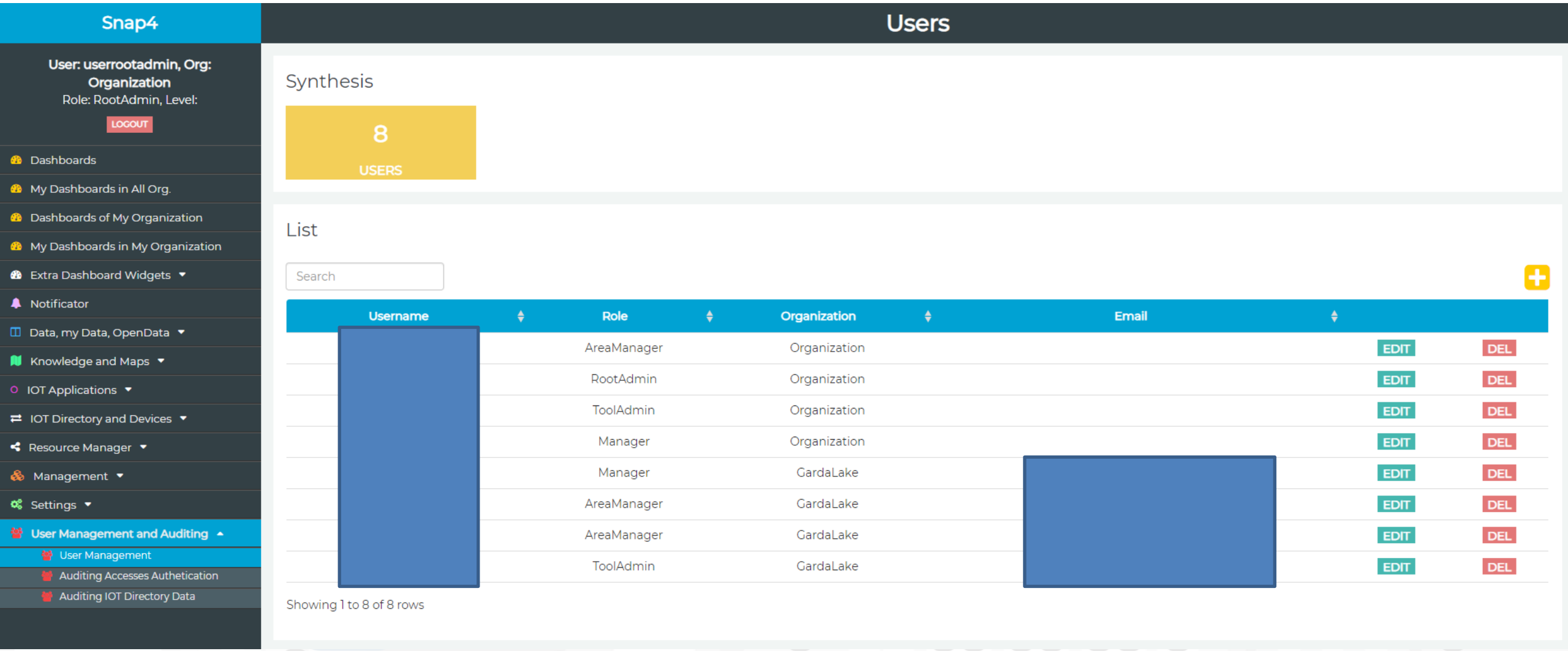
Knowledge and Maps
IOT Applications
IOT Directory and Devices
My IOT Sensors and Actuators
IOT Sensors and Actuators
IOT Devices
IOT Devices Management
IOT Brokers
IOT Device Models
IOT Devices Bulk Registration
IOT Broker Periodic Update setting
IOT Orion Broker Mapping Rules
Resource Manager
IOT Devices Management
20 DEVICES
20 ACTIVE
13 PUBLIC
7 PRIVATE
Show 5 entries
Search:
IOT Device
IOT Broker
Device Type
Model
Ownership
Organization
Owner
Status
Edit
Delete
Location
copernicus_test iotobsf Test custom PRIVATE GardaLake sgl_areamanager active EDIT DELETE
Gardesana-Albisano-Direzione-Nord iotobsf Traffic Traffic-FLOUD PRIVATE GardaLake sgl_areamanager active EDIT DELETE
Gardesana-Albisano-Direzione-Sud iotobsf Traffic Traffic-FLOUD PRIVATE GardaLake sgl_areamanager active EDIT DELETE
Gardesana-Baiastanca-Direzione-Nord iotobsf Traffic Traffic-FLOUD PUBLIC GardaLake sgl_areamanager active EDIT DELETE
Gardesana-Baiastanca-Direzione-Sud iotobsf Traffic Traffic-FLOUD PUBLIC GardaLake sgl_areamanager active EDIT DELETE
Showing 1 to 5 of 20 entries
Previous 1 2 3 4 Next

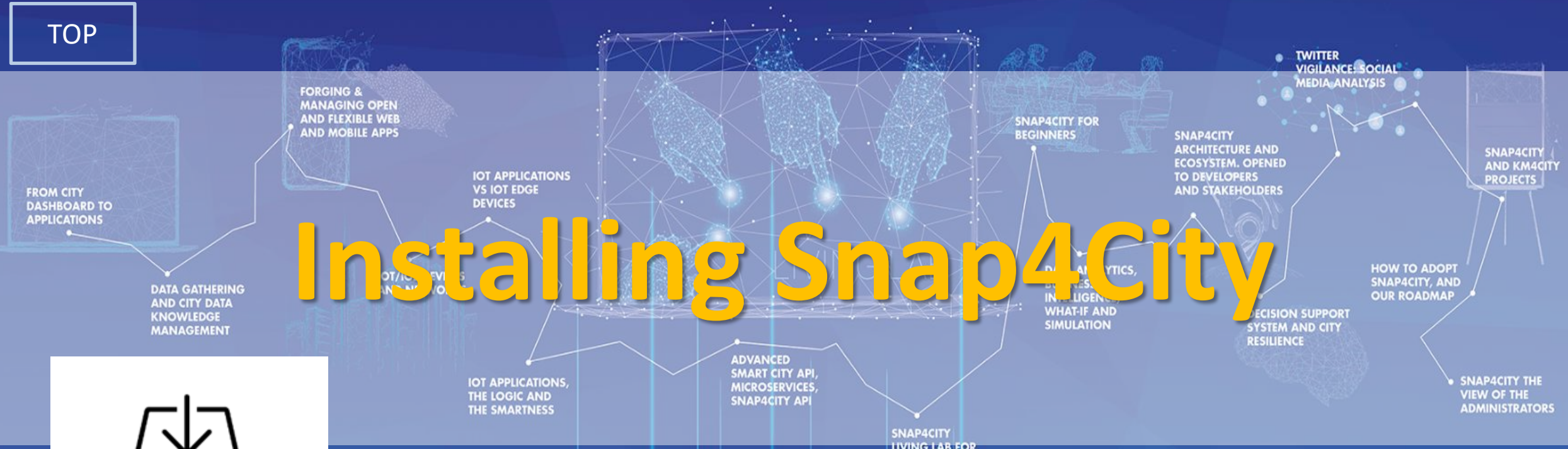
User Registration for DataCity-Small without Living Lab

User registration



TOP

Installing Snap4City



Installations

https://www.snap4city.org/471

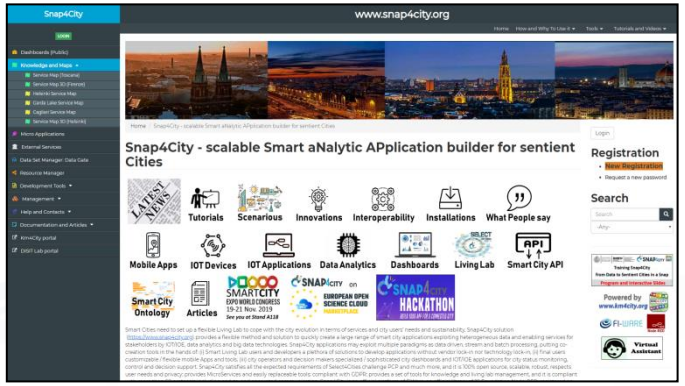
To get an updated version read it!

What we suggest since October 2020

- Exploit trial on Snap4City.org of your early solutions and concept, also exploiting the full support of Snap4 experts and community, on DISIT Organization or Multiple Org as you prefer
  - Please note that each Organization need a distinct email address and registration, and applies their own restriction to data and dashboards. So that maximum access to demonstrations is on DISIT Organization into Snap4city.org portal
- Ask/book for an Organization if you would like to test in a separate environment
- Once tested and convinced, start deploy your version on your premise by using «DataCity-Small» on Docker or VM

How to adopt Snap4City

Https://www.snap4city.org



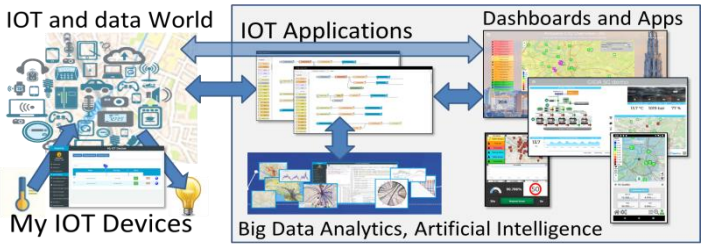
Smart City as a Service

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

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

Download and deploy

On your premise



Installation on your premise

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

Mixed solutions! For example:

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

Snap4City/Industry Architecture, V1, V2

Data Sources, External Services
PULL Data

Data Sources, Brokers, External Services
Data Driven, Real Time

Data Ingestion, aggregation, regularization, reconcile
- NIFI
- Tools, [ETL], DISCES,
- IOT Apps

Big Data Cluster
HDFS, Hbase, Phoenix

Knowledge base
Semantic reasoners

Indexing and aggregating
OpenDistro x Elastic search

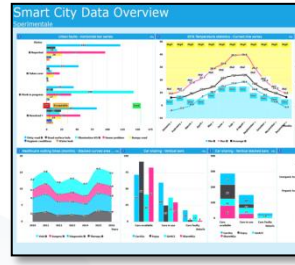
Data Analytics
R, Tensor Flow, Python, MapReduce, …

Visual Analytics

IOT Applications
Node-RED + Snap4City MicroServices

Search and Query, Smart City API
Facet, semantic search

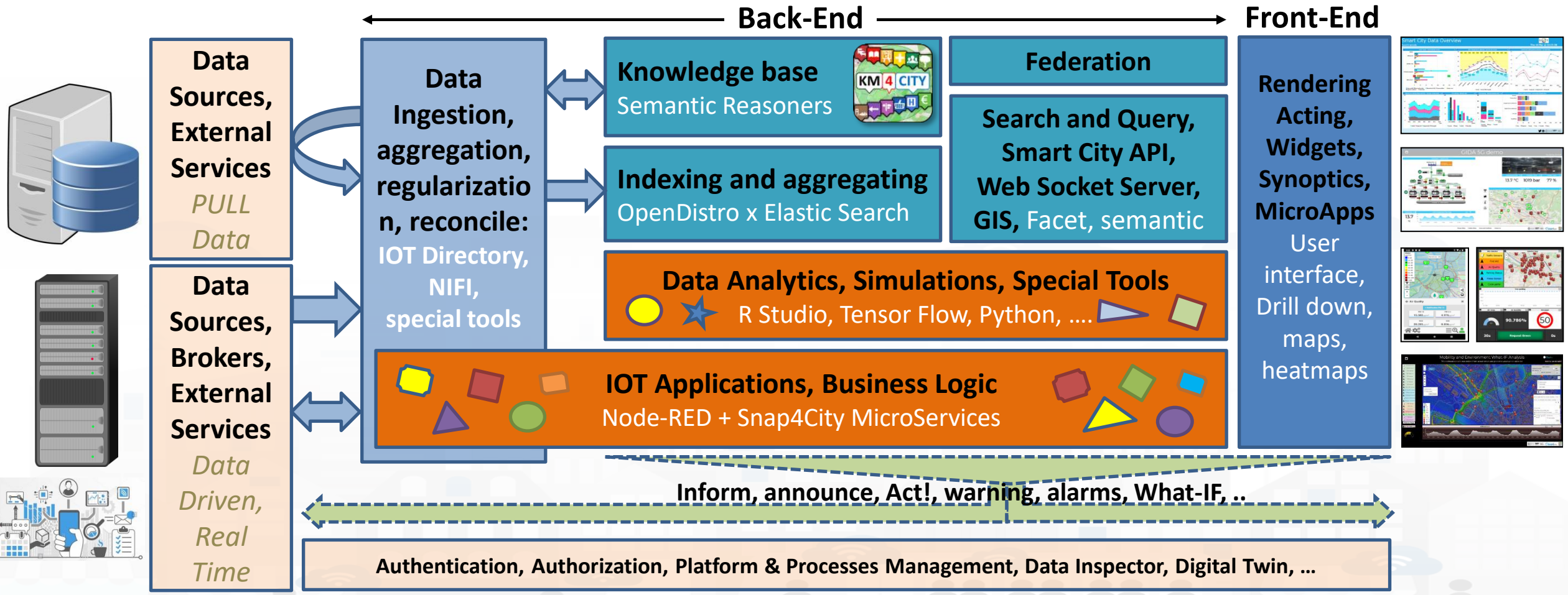
Rendering Acting, Widgets, MicroApps
User interface, Interactive Dashboard, Drill down, maps, heatmaps



Inform, announce, Act!, warning, alarms, What-IF, ..

In Yellow alternative & legacy solutions: snap4city V1

Snap4City, Snap4Industry Architecture, V2



Presentation: Control Room, Dashboards, Synoptics, Wizards, Widgets, Visual Analytics Applications, Mobile Apps Telegram, Bot, …

External Interoperability: Smart City API, general API and accounting

Operation:

Reporting | Simulation | Heatmapping | Traffic Flows | Tip. Time Trend | …..

R Studio | python | docker | GeoServer | ….. | Analysis | WorkFlow Tickets BPM | ….. | Open to any module and system

Data Analytics | Predictions | Anomaly detection | Statistics | Artificial Intelligence | Routing | Sentiment Analysis | ckan | openMAINT | BIMserver.center | …

Internal Interoperability: API, MicroServices

Data Management: data modeling, data storage, noSQL, semantic modeling, city entities, aggregation, normalization, knowledge base

NGSI V1, V2 | Linked Data triples

Data Collection: data mining, harvesting, integration, transformation, data models,

Any protocol and format | Any protocol and format

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

Any protocol and format | Any protocol and format

Node-RED | IoT Applications Data Flow Logic

Platform Management: docker | SNAP4CITY

Authentication and Authorization: GDPR compliant — KEYCLOAK | OpenLDAP | SNAP4CITY

Device Layer

External Third Party Services: GIS | BIM | Gateways | External Services | Web Scraping | Social Media

Overview of Snap4City platform, for Buyers, for all

Other Services And Servers

Cluster for Smart Processes container: ingestion, analytics, scraping, etc.

Cluster for big data storage: static and real time, Indexing and search

IOT brokers

IOT Networks | Social Media | CRM | ….. | GIS

Legacy Platform

Back End

Snap4City MAIN
Dashboard, User Management, etc.

Knowledge base, semantic Store

HeatMaps and Maps

Living Lab Portal

Front End

Mobile Apps, Dashboards

Overview of Snap4City platform, for Buyers, for all

Services
- CKAN DataGate
- Routing Server
- Chat Manager
- R Studio Server
- ETLSDK Server
- Engager Server
- ……. Server

Container Cluster
MCLSCont, NCLSCont
Marathon, Mesos, Zookeeper, Disces-EM, Executing in Container: IOT App, Web Scraping, R-Studio, Python, Java, ETL, …

[DataCluster]
ETL-VM
Phoenix HBASE, HDFS DISCES, ETL support

IOTOBSFs
- IOTBrokers, secure

Data Shadow Cluster
IOTDSES
NIFI, OpenDistro, DevDash, Amma

IOT Networks | Social Media | CRM | ….. | GIS

Legacy Platform

Back End

Snap4City MAIN
Dashboard Builder, Data Inspector, User Stats, ExternalSrv, Res Manager, MyKPI, MyPOI, Synoptic, IOT Device Manager, Micro Applications, Authorization/ Authentication, Roles, …

KBSSM
KB/ServiceMap, .. SmartCity API, WFS, ServiceMap3D, LOG/FLINT, SuperServiceMap, Virtuoso

GISGeoServer
Heatmap Manager, WFS, WMS

Living Lab Portal
Drupal support CRM, ..

Front End

Mobile Apps, Dashboards

What is included in the Buyers / Full Platform

- **IOTOBSF**
  - IOT Orion Broker Fi-Ware
  - Secure Filter (Snap4City)
- **IOT Edge support**
  - Linux Ubuntu
  - Windows
  - Raspberry Pi
  - Android
- **IOT Devices support**
  - ESP32
  - Arduino
- **IOT Application**
  - Node-RED
  - Snap4City Library of nodes

- **Other Services**
  - Routing Server
  - DataGate CKAN
  - Chat as Rocket
  - ETL SDK VM
  - Engager ..
  - …..
- **Data Analytics**
  - Heatmap production MS Rstudio
  - OD production
  - Predictions MS RStudio
  - Anomaly detection MS RStudio
  - ETL Collection
  - ….

- **MCLSCount, NCLSCount Container[Cluster]**
  - Containers models
  - DISCES-EM
  - Monitoring App
- **ETL Server Data[Cluster]**
  - DISCES
  - Phoenix Drivers
  - Hbase Model
  - ETL processes
- **IOTDSES DataShadow[Cluster]**
  - NIFI process, Squid
  - OpenDistro
    - Elastic Search Model
    - Kibana
  - AMMA data flow
  - DevDash data store

- **KBSSM**
  - Knowledge Base Km4City
  - ServiceMap
  - ServiceMap3D
  - SuperServiceMap
  - LOG/Flint
  - OSM2Km4City
  - Smart City API
  - WFS API
- **GIS GeoServer**
  - GeoServer
  - Heatmap Manager
- **Living Lab Portal**
  - CRM Drupal
  - LDAP Snap4City
  - Registration mng
  - Etc. etc.

- **Snap4City MAIN**
  - Dashboard Builder, Wizard
  - Dashboard Engine
  - Data Inspector, Notificator
  - External Srv manager
  - Menu Manager
  - Ownership Manager
  - Authentication and Authorisation
  - WS server
  - Resource Manager
  - User Stats
  - JavaScript Web App in a Snap, MicroApplications
  - Synoptics, custom Widgets
  - IOT device manager: IOT Directory
  - Snap4City MicroServices on IOT Applications: basic and advanced
  - Snap4City GIS Player
  - What-IF tools

All in source code, and most of components in Appliances/VMs

Platform Maintenance, K3.14

- **Snap4City modules** are released on GITHUB/DISIT and can be updated from:
  - GITHUB/DISIT into VM Appliance or Servers in which they are installed
    - https://github.com/disit
  - Node-RED tool, using official Library regarding: Snap4City Libraries
  - Drupal for the Living-Lab Portal aspects
  - Other tools from their corresponding providers
- **Maintenance** would not be a problem, all users should be capable to perform the updates autonomously
- Updates on new versions will be provided by Snap4City periodically, Notification will be provided on NEWS and GitHUB

Keeping Platform at the State of The Art

- **Updates** will be provided by Snap4City periodically and released on GITHUB, and other portals.
- **Snap4City team** is involved in contracts since now, so that this will guarantee that the solution will be evolved to anticipate the state of the art as we have done in Iteration 3, in which we released a number of developments.
  - See also the activity of dissemination and updated roadmap
  - See the presence of Snap4City on EOSC, BeeSmartCity, EO15, etc.
  - See the list of concreate developments
  - See the list of supporters on the Stand with respect to those of the 2018
  - See the planned new developments

Set-up of Open Source version from Scratch

- **Guidelines reported on:**
  - https://www.snap4city.org/471
- **How to proceed:**
  - We have presented 7 Configurations models from **A:Alone** to **F:FullPlatform+LivingLab, but they can be customized as you like.**
  - **By follow the Configurations** the Customers are guided to identify the most suitable according to their needs;
  - Once the most suitable Configuration has been identified, they are supported into the:
    i. Download and deploy of the Appliances provided as Virtual Machines or Containers, or
    ii. Download and install modules from GITHUB according to the recipes for VM/Container and the user manual of the single tools, or
    iii. Mixt of the above (i) and (ii) approaches.
  - **IOT Edge** can created by (1) installing Node-RED, (2) adding Snap4City library of Nodes from the Palette Manager of Node-RED, (3) registering on Snap4City: https://nodered.org/docs/user-guide/editor/palette/manager

Note that some of the material we are presenting has not been published on the portal yet, for the competition.

Snap4City Scalable Platform with your business

Configuration Kind	Min #VM	Dockers	IOT Broker int	IOT Broker Ext	MAP	KBSM	IOT APP, MicroServices	Storage & IOT Data Shadow	SSO, Roles	IOT Security	Dash + Wizard	GIS in	GIS out	Heatmap	Mob. App	ASCAPI	Living Lab Sup.	Options supported by the configuration
A: Alone	1	6		X	X		1 mf		X	X	X	X				(x)		ETL, DG, CM
B: Basic	2	7	X	X	X		1 mf	Small	X	X	X	X				(x)		ETL, DG, CM
C: CityStart	3-4	8-9	X	X	X	X	1 mf	Small	X	X	X	X	X	X	X	X		ETL, DG, R, CM, Eng
D: DataCity	5-6	Ask	X	X	X	X	70	Medium	X	X	X	X	X	X	X	X		ETL, DG, R, CM, Eng, LL
E: ExtensiveCity	6-8+	Ask	X	X	X	X	70	Scalable	X	X	X	X	X	X	X	X		ETL, DG, R, CM, Eng, LL
F: FullPlatform	12-14+	Ask	X	X	X	X	Scalable	Scalable	X	X	X	X	X	X	X	X		ETL, DG, R, RS, CM, Eng, LL
F: FullPlatform + LivingLab	13-15+	Ask	X	X	X	X	Scalable	Scalable	X	X	X	X	X	X	X	X	X	ETL, DG, R, RS, CM, Eng

mf: multiple flows for each IOT App

Read next slide for the other notes and legenda

Legenda and Notes on the previous table

- **In all configurations you:**
  - **have**: Multiple IOT Brokers; unlimited number of data sources; interoperability support; KB
  - **may have**: HA, DRS, FT, Balancing, cloning and configuring additional VM;
  - **may pass** at the next configuration without reinstalling the VM;
  - **may add** one or more Optional Services as VM/Containers: ETL, DataGate, Routing, Engager, Data Analytics, etc. etc.
- **From Config. E:ExtensiveCity and upper the number of VMs depends on the volume of DataStorage and the volume of Data Stream in input.**
  - These two aspects are managed by two independent clusters of VMs and scale independently each other. This allows to satisfy any different combination of volumes in streams and data storage.
- **We suggest** using Living Lab support only on FullPlatform, while it can be installed on Smaller Configurations with some limitations in terms of features

Optional Services

- **DG: DataGate CKAN**
- **R: Routing**
- **ETL: ETL SDK VM**
- **RS: R Studio Server**
- **Eng: Engager**
- **CM: Chat Manager**
- **LL: Living Lab**
- **..**
- **..**

Computational and Storage Costs

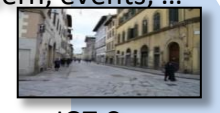
- **The VM** is considered (appliances are provided) as 16/24 cores 2.2 Ghz, 16-24 GB Ram, 500 GB HD in thin provisioning, with 25-40 GB HD used at the start, in most cases Debian.
  - to estimate the needed CPU, RAM, Storage for each configuration it is easy from the #of VM in the configuration.
  - Please note that configurations A and B can be executed on 4 cores, 4 GB Ram, ..
- **In solutions**, with a very large number of users on the Front End: Smart City API (mobile App users, Dashboard users, a frontend balancer and more FrontEnd servers would be needed). Please note that the Smart City API are also used by DataAnalytics processes and by MicroServices in the IOT Applications.
  - Typically a thousand of simultaneous users on the front end can be sustained for each VM
  - More precise estimations can be performed by knowing the actual workload

Ds) DataCity-small Configuration and its evolution in DataCity-Large

Smart City Functional Architecture

Transport systems Mobility, parking

Public Services, Govern, events, …



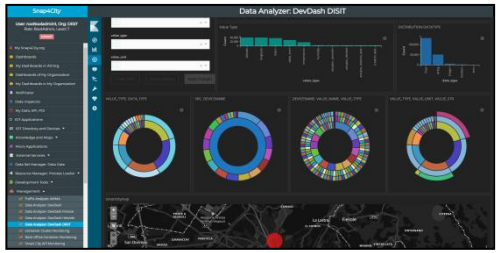
Sensors, IOT Cameras, Wi-Fi

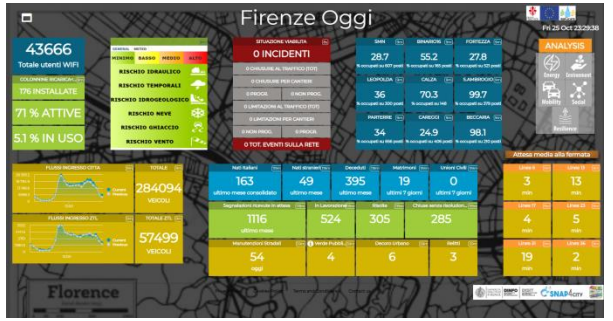
Environment, Water, energy

Shops, services, operators

Social Media

Social Media Crawler and Manager





Back-End ← → Front-End

Data Sources, External Services *PULL Data*

Data Sources, Brokers, External Services *Data Driven, Real Time*

Data Ingestion, aggregation, regularization, reconcile: IOT Directory, NIFI, special tools

Knowledge base Semantic Reasoners

Indexing and aggregating Elastic Search

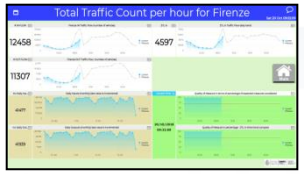
Federation

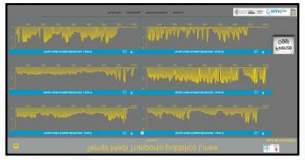
Search and Query, Smart City API, Web Socket Server, GIS, Facet, semantic

Data Analytics, Simulations, Special Tools R Studio, Tensor Flow, Python, ….

IOT Applications, Business Logic Node-RED + Snap4City MicroServices

Rendering Acting, Widgets, Synoptics, MicroApps User interface, Drill down, maps, heatmaps

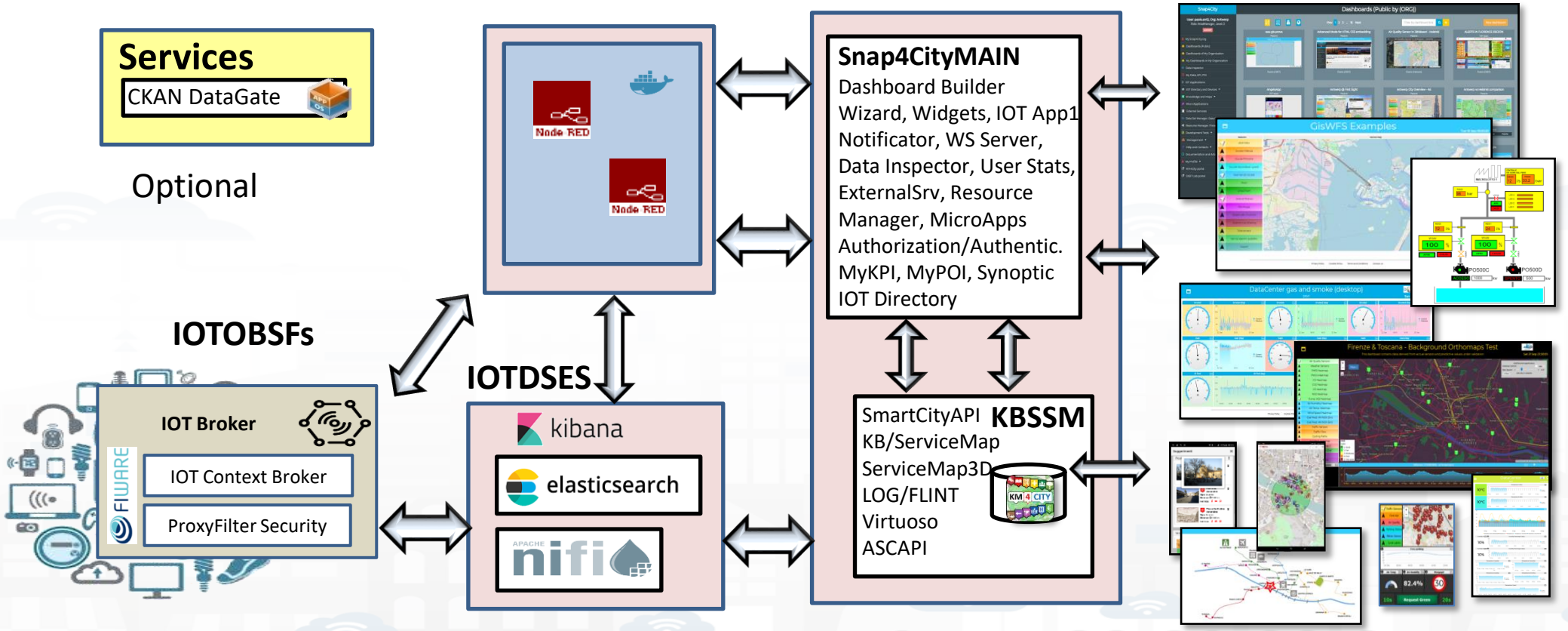




Inform, announce, Act!, warning, alarms, What-IF, ..

Authentication, Authorization, Platform & Processes Management, Data Inspector, Digital Twin, …

D: DataCity-Small) A small size Smart City with a 4 smart applications on cloud and 2 of IOT brokers, limited volume of data entering into the cloud.



D: DataCity) A medium/large size Smart City with a number of smart applications on cloud and a number of IOT brokers, relevant volume of data entering into the cloud.

For Managing

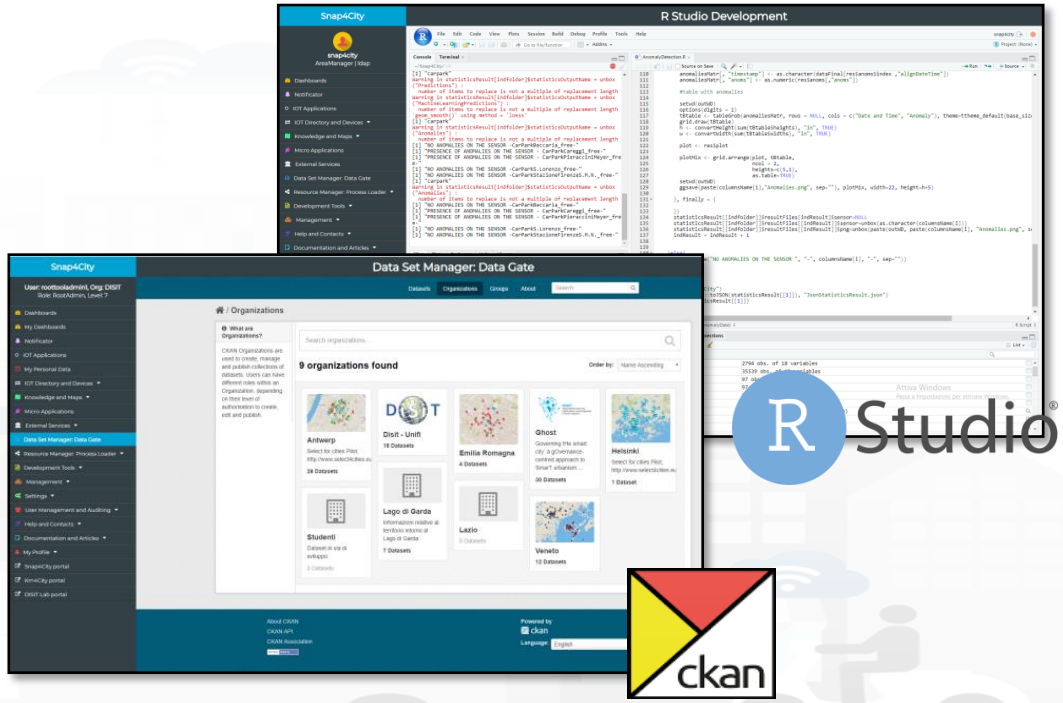
Beyond C:CityStart Configuration

- **IOTDSES DataShadow[Cluster]**
  - NIFI process
  - Elastic Search Model
  - AMMA and DevDash

+ A limited number of IOT Applications for data transformation and Analytics
+ A small sized Data Shadow for IOT data management

Optionally:

- Data Gate CKAN for Open Data



DCL: DataCity-Large (2020 edition)

Opt. Services

- Chat Manager
- Routing Server
- Engager Server
- …… Server
- ……. Server

External Services

Energy
Mobility
GIS
Waste
…

Digital Signage
Security
Environment
Weather

Servers

- R Studio Server
- Python Server
- OpenMaint
- CKAN DataGate

MCLSCont

IOTOBSFs

IOT Broker

IOT Orion Broker

IOT Context Broker

ProxyFilter Security

IOTDSES

Balancer

ESSTORE

kibana

elasticsearch

Other Brokers

FIWARE

IOT ORION Broker

Quantum Leap

SSM2ORION

Snap4CityMAIN

Dashboard Builder, Wizard, Widgets, IOT App1 Notificator, WS Server, Data Inspector, User Stats, ExternalSrv, Resource Manager, MicroApps, Authorization/Authentic, MyKPI, MyPOI, Synoptic, IOT Directory

SuperServiceMap, ASCAPI
KB/ServiceMap
LOG/FLINT
Virtuoso

KBSSM

HeatMap Server
Manager [GeoServer]

Living Lab support
Drupal, CRM

Balancers

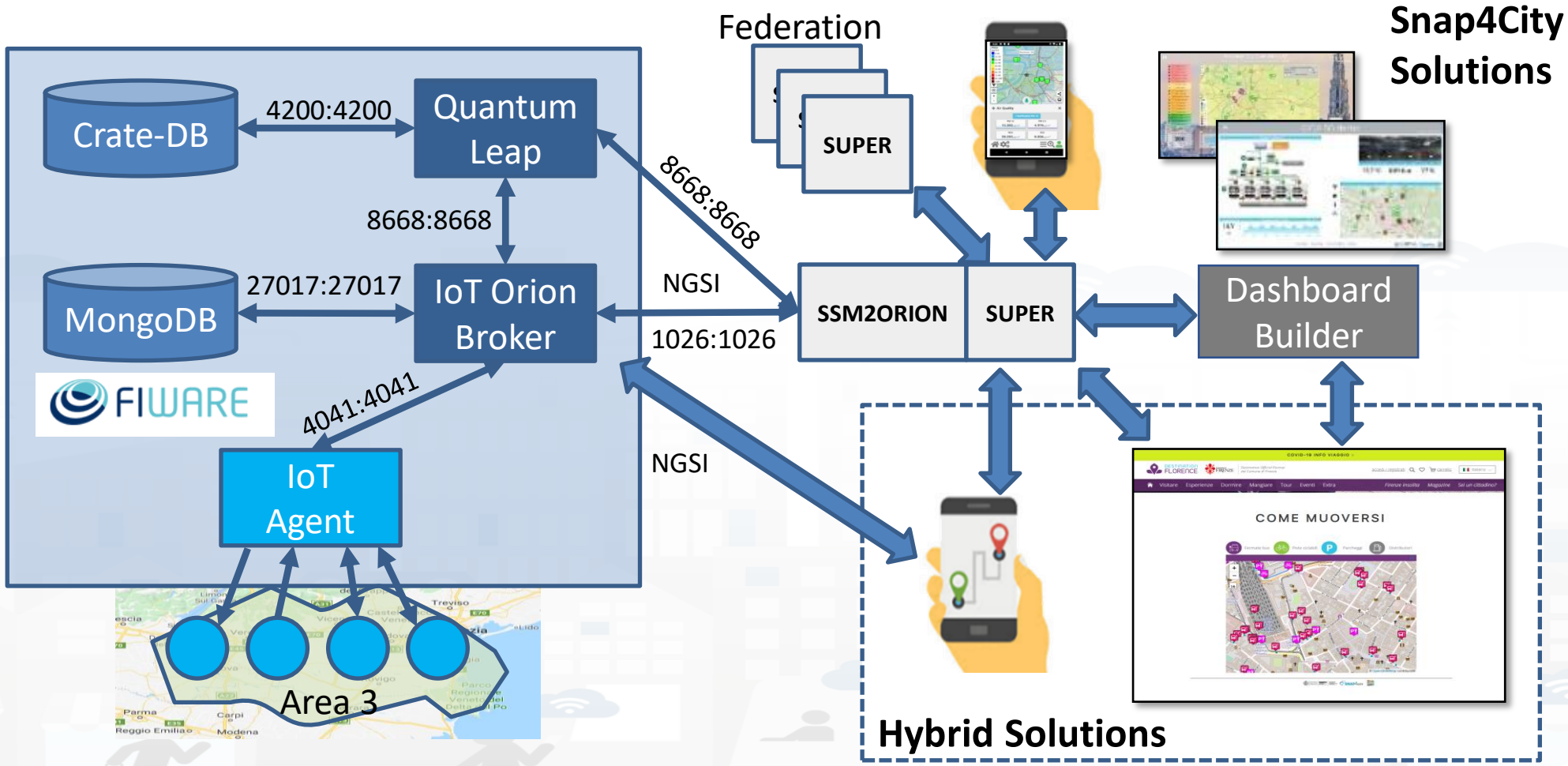
Example of Deploy in different configurations

	Cores	Gbyte	Gbyte	Production				Staging/Support				System Integration				User Acceptance Test				Development			
	CPU	MEM	HD	Redun	CPU	MEM	HD	Redu	CPU	MEM	HD	Red	CPU	MEM	HD	Red	CPU	MEM	HD	Red	CPU	MEM	HD
Snap4City Main	12	24	250	2	24	48	500	1	12	24	250	1	8	18	250	1	12	24	250	1	12	24	250
KBSSM	12	40	250	2	24	80	500	1	12	40	250	1	8	24	250	1	12	40	250	1	12	40	250
HeatMap Server	4	24	200	2	8	48	400	1	4	24	200	1	4	12	200	1	4	24	200	1	4	24	200
Living Lab Support	4	24	200	2 FT	8	48	200	1	4	24	200	1	4	12	200	1	4	24	200	1	4	24	200
OpenMaint	4	16	400	2 FT	8	32	400	1	4	16	400	1	4	12	400	1	4	16	400	1	4	16	200
IOTOBSF	8	16	200	2	16	32	400	1	8	16	200	1	4	12	200	1	8	16	200	1	8	16	200
IOTDSES	8	12	200	2	16	24	400	1	8	12	200	1	8	12	200					1	8	12	200
ESSTORE	12	24	500	8	96	192	4000	3	36	72	1500	3	36	72	1500					3	36	72	1500
MCLSCount	12	24	200	6	72	144	1200	3	36	72	600	3	36	72	600					3	36	72	600
Rstudio Server	12	24	200					1	12	24	200	1	4	12	100					2	24	48	400
Python Server	12	24	200					1	12	24	200	1	4	12	100					2	24	48	400
CKAN DataGate	4	12	200	2 FT	8	24	200	1	4	12	200	1	4	12	100					1	4	24	400
User profile Mng	12	24	1000	2	24	48	2000	1	12	24	1000	1	4	12	300	2	4	12	300	1	12	24	250
				32	304	720	10200	17	164	384	5400	17	128	294	4400	8	48	156	1800	19	188	444	5050

legenda

- CPU are reported in number of Cores at xxx GHz min
- MEM is in GByte
- HD are in GByte are high speed HD or SSD for Production while medium speed for the other configurations
- Red: is the level of redundancy, number of VMs. They can be launched in FT or not
- IOTOBSF could be dockers
- MCLSCount is a cluster with dockers. If the solution has no access to orchestrator VMware, then a VM with Nagios/Zabbix has to installed to control the On/Off of VM from DISCES_EM. The alternative could be to manage the small cluster with always one VM.
- IOTDSES a cluster of federated NIFI on Dockers and their balancer
- ESSTORE VM a cluster of OpenDistro per ElasticSearch and Kibana VMs. The number of VM depends on the size of the global storage which can increase elastically with the need along the operation.

Federation of Snap4City vs IOT ORION Broker

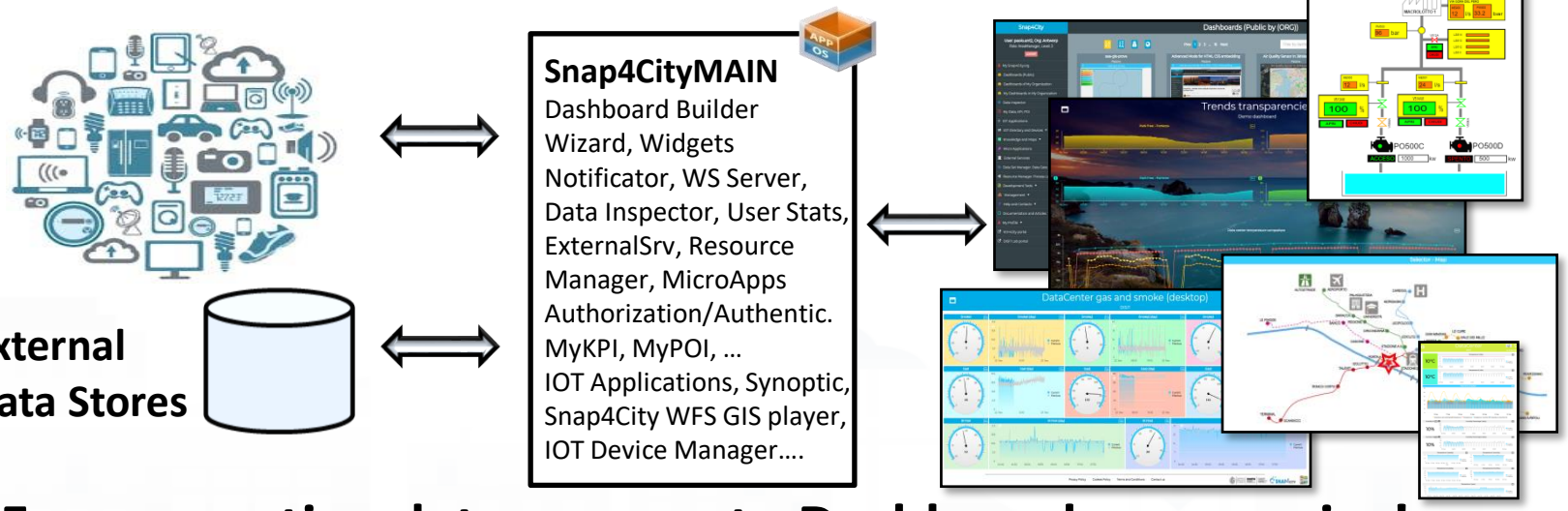


A) Alone Configuration

A: Alone) For Small Size Business, for example an industry 4.0 application you can need to install only one VM: Snap4CityMAINVM

- **Snap4City MAIN VM**
  - Dashboard Builder, Wizard
  - Dashboard Engine
  - Data Inspector, Notificator
  - External Srv manager
  - Menu Manager
  - Ownership Manager
  - Authentication and Authorisation
  - WS secure server
  - Resource Manager
  - User Stats
  - JavaScript Web App in a Snap, MicroApplications
  - Synoptics, custom Widgets
  - IOT device manager: IOT Directory
  - Snap4City MicroServices on IOT Applications: basic and advanced
  - Snap4City WFS player
  - What-IF tools

Node-RED



- **For connecting data sources to Dashboards onpremise!**
  - *Data driven solution, no large data store*
  - *Industry 4.0*
  - *Small Smart City business, no knowledge basse, no servicemap*
  - *Start with Snap4City platform as seeding element*
  - *Storage: ODBC, JDBC, Mongo, SPARQL, MySQL, etc.*

Snap4CityMAIN: Alone Configuration

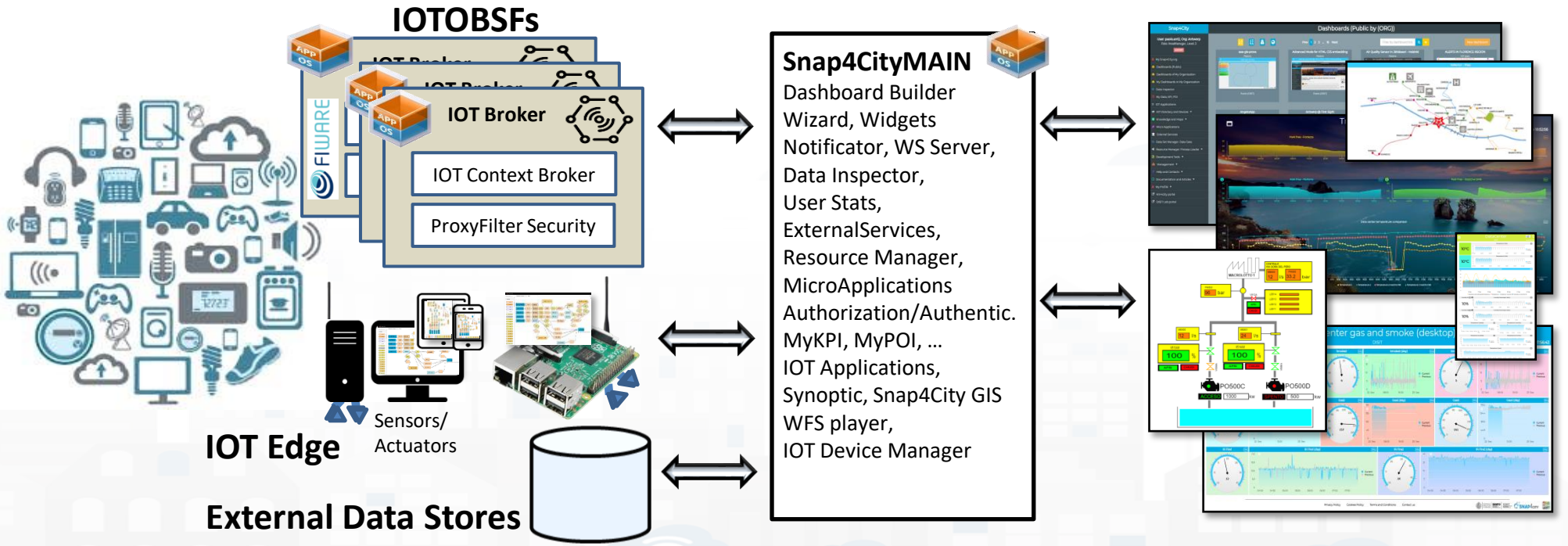
- **As Virtual Machine:**
  - HOW TO: configure/install StartSNAP4CITYVM: starting appliance of Snap4City
  - https://www.snap4city.org/487
- **As Container Composer:**
  - HOW TO: configure/install StartSNAP4CITYVM: starting appliance of Snap4City
  - https://github.com/disit/snap4city-docker/tree/master/Alone

B) Basic Configuration

B: Basic) Addressing a relevant number of IOT devices/ IOT brokers in your smart city or industry 4.0, a few smart Applications with multiple flows

For managing
beyond A:Alone Configuration

+ large number of IOT devices and brokers, any protocol, format
+ IOT Devices
+ IOT Edge
+ Etc.



B: Basic) Addressing a relevant number of IOT devices/ IOT brokers, a few smart Applications

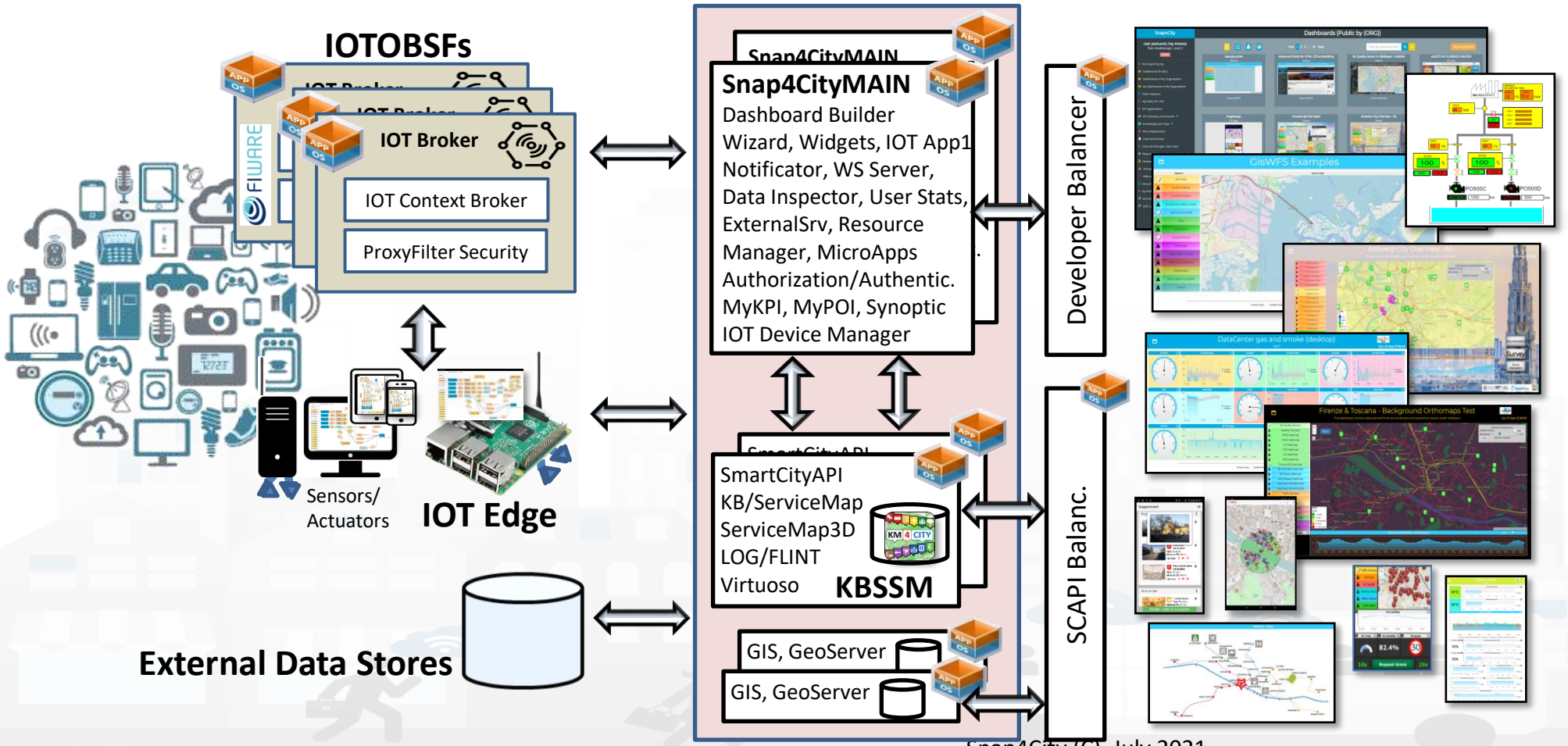
- **IOTOBSF VM**
  - IOT Orion Broker Fi-Ware
  - Secure Filter (Snap4City)
- **IOT Edge support**
  - Linux Ubuntu
  - Windows
  - Raspberry
  - Android
  - Snap4City Library of nodes
- **IOT Devices support**
  - ESP32
  - Arduino
- **IOT Application**
  - Node-RED
  - Snap4City Library of nodes

- **IOT Edge:** local intelligence, processes and Applications located on the field, on premise. Those autonomous smart tools can be implemented by IOT Applications working on IOT Edge:
  - **Linux Ubuntu Appliance VM**: https://www.snap4city.org/drupal/node/298
  - **Android as IOT Edge** https://www.snap4city.org/drupal/node/278 and
  - **Raspberry Pi as IOT Edge**: https://www.snap4city.org/drupal/node/77 You can install Snap4City library in any Node-RED from the official Node-RED library

- **IOT Applications = Node-RED + Snap4City libs of Nodes/MicroService**s,
  - Available in **Snap4CityMAIN VM**, so that in any installation
  - any installation of Node-RED add Snap4City Library from the official Library of Node-RED, add new Nodes into the Palette as
    - https://nodered.org/docs/user-guide/editor/palette/manager
  - Snap4City MicroService collection from the JS foundation with full documentation inside https://flows.nodered.org/?term=snap4city
    - **BASIC: suitable for Final User**
    - **ADVANCED: DEVELOPER** (you have to install both libraries: basic and advanced)

C) CityStart Configuration

C: CityStart) Addressing a relevant number of GeoLocated Points of Interest, PIN on maps, and eventually heatmaps, a Small Smart City with a few smart IOT applications on cloud and many on edge



For managing

Beyond B:Basic Configuration

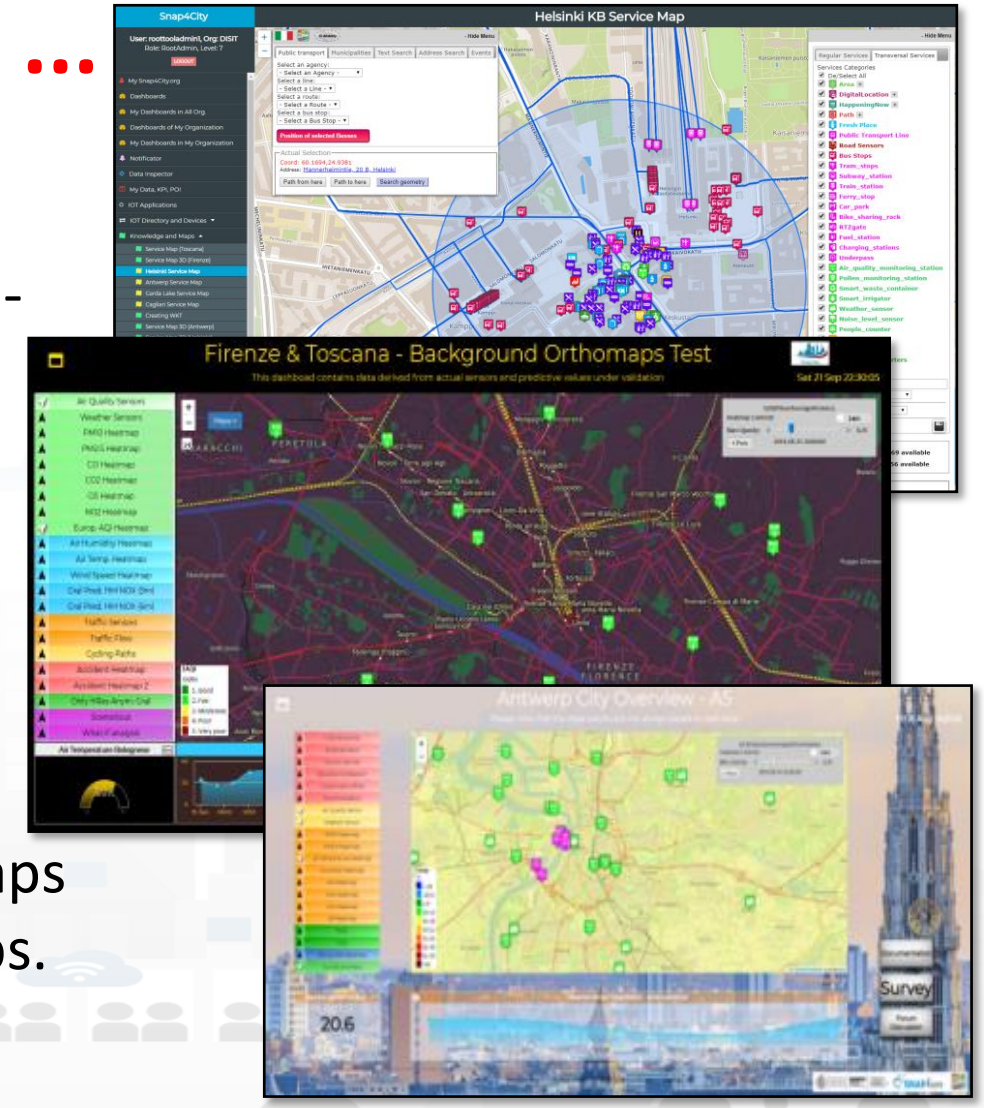
+ Large number of GEO elements on maps
+ Heatmaps
+ Geo shapes
+ GIS, ….

C: CityStart) Addressing a relevant number of GeoLocated Points, heatmaps, ...

- **KBSSM VM**
  - Knowledge Base Km4City
  - ServiceMap
  - ServiceMap3D
  - SuperServiceMap
  - LOG/Flint
  - OSM2Km4City
  - Smart City API
  - WFS API

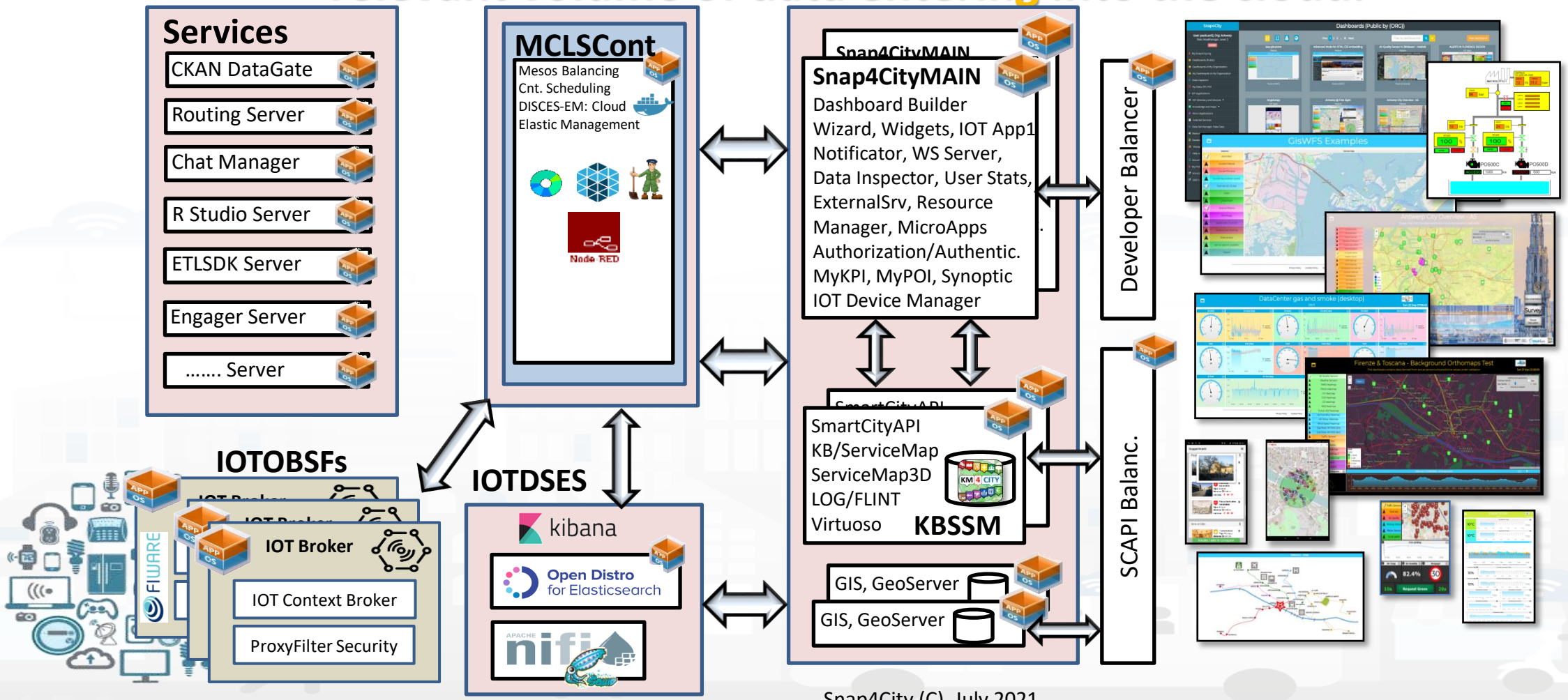
- **GIS GeoServer VM**
  - GeoServer
  - Heatmap Manager

- **KMSSM VM:**
  - knowledge base, KB, positioning elements on maps, enabling geo-spatial and temporal reasoning
  - Ingestion OSM to load on KB, ServiceMap and reasoning on it
  - GeoReverse data, from street to data and vice versa
  - WFS export and import
- **GIS GeoServer VM:**
  - Producing and providing heatmaps
  - Managing Heatmaps colour maps.
  - WMS, WFS export, distribution



D) DataCity Configuration

D: DataCity) A medium/large size Smart City with a number of smart applications on cloud and a number of IOT brokers, relevant volume of data entering into the cloud.



D: DataCity) A medium/large size Smart City with a number of smart applications on cloud and a number of IOT brokers, relevant volume of data entering into the cloud.

- **MCLSCount Container[Cluster]**
  - Containers models
  - DISCES-EM
  - Monitoring App

- **ETL Server Data[Cluster]**
  - DISCES
  - Phoenix Drivers
  - Hbase Model
  - ETL processes

- **IOTDSES DataShadow[Cluster]**
  - NIFI process
  - OpenDistro
    - Elastic Search Model
  - AMMA and DevDash

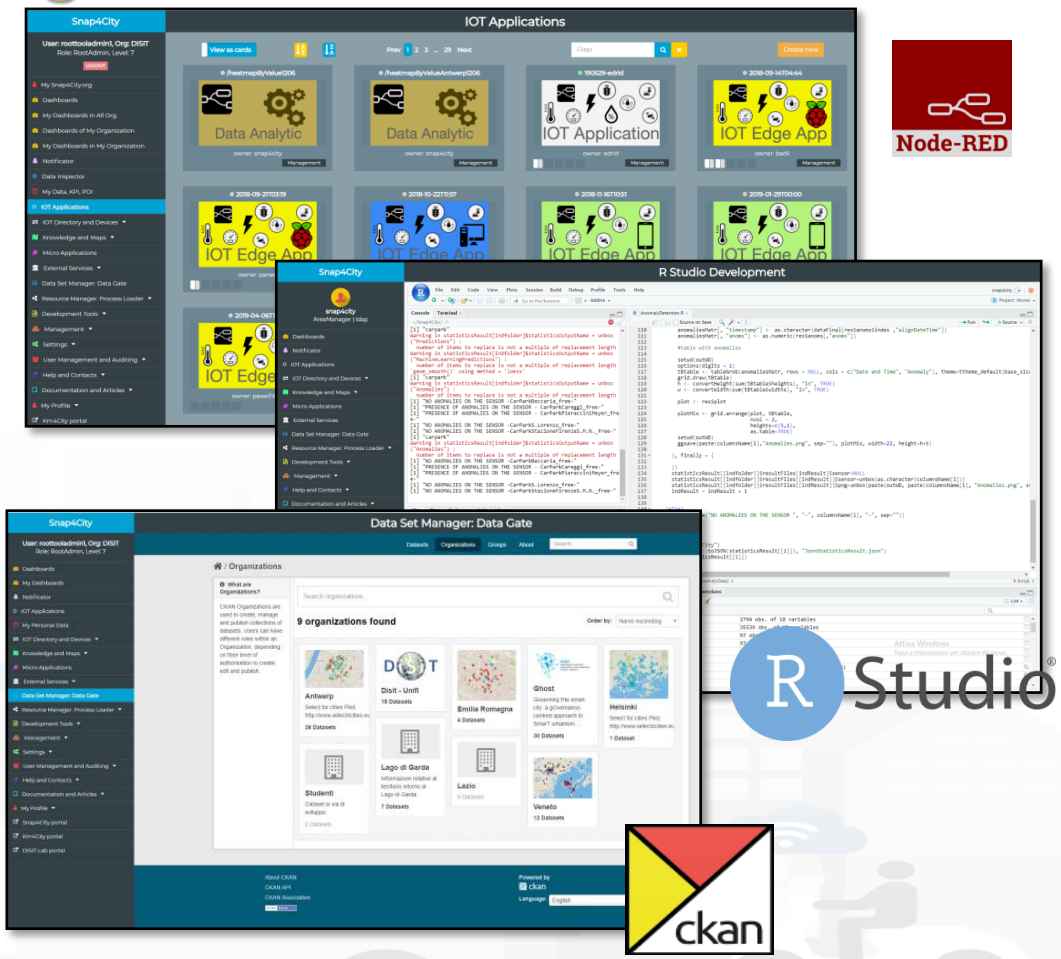
For Managing

Beyond C:CityStart Configuration

+ A relevant number of IOT Applications for data transformation and Analytics
+ A small sized Data Shadow for IOT data management

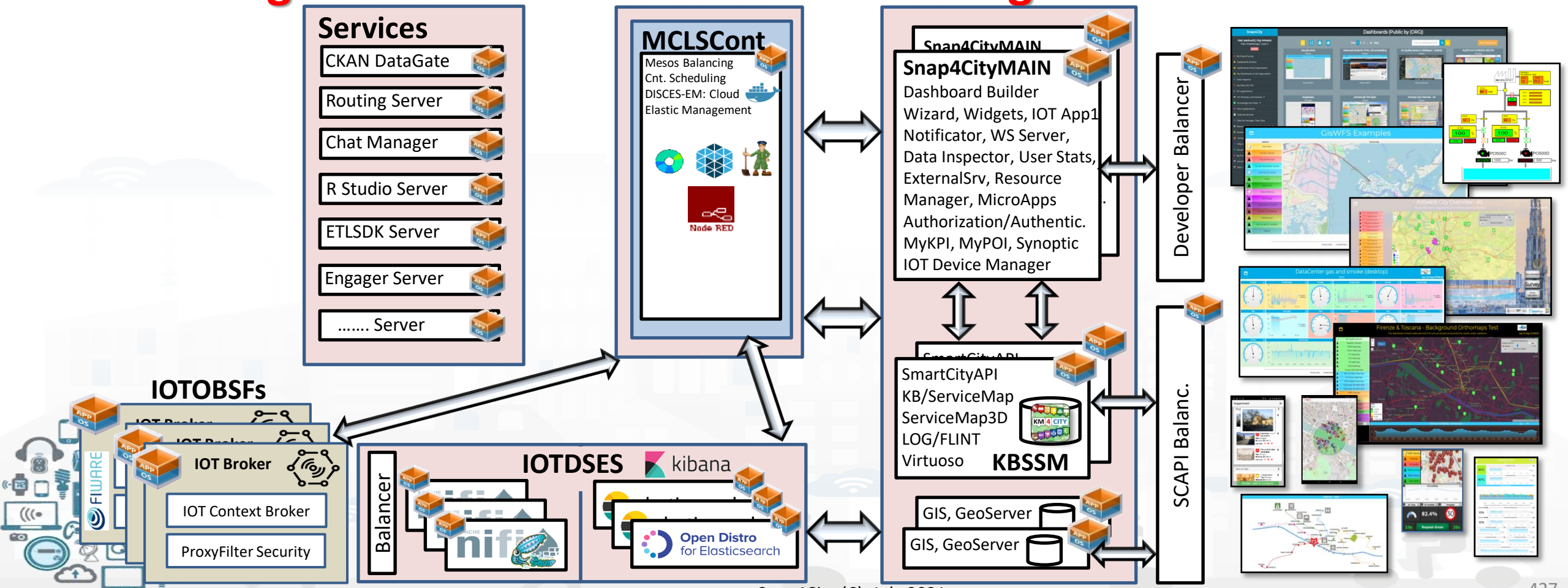
Optionally:

- Data Analytics in R Studio, Tensor Flow (NVIDIA)
- Hbase / Phoenix Big Data Store
- Data Gate CKAN for Open Data
- Chat Manager on Dashboard
- Routing Solutions



E) ExtensiveCity Configuration

E: ExtensiveCity) A Large size Smart City with smart applications on cloud and a number of IOT brokers, large volume of data streams entering in the cloud



E: ExtensiveCity) A Large size Smart City with smart applications on cloud and a number of IOT brokers, large volume of data streams entering in the cloud

- **IOTDSES DataShadow Cluster**
  - NIFI process
  - Squid cache on SCAPI
  - OpenDistro
    - Elastic Search Model extended API
    - Kibana
  - AMMA data flow
  - DevDash data monitor
  - …

For Managing

Beyond D:DataCity Configuration

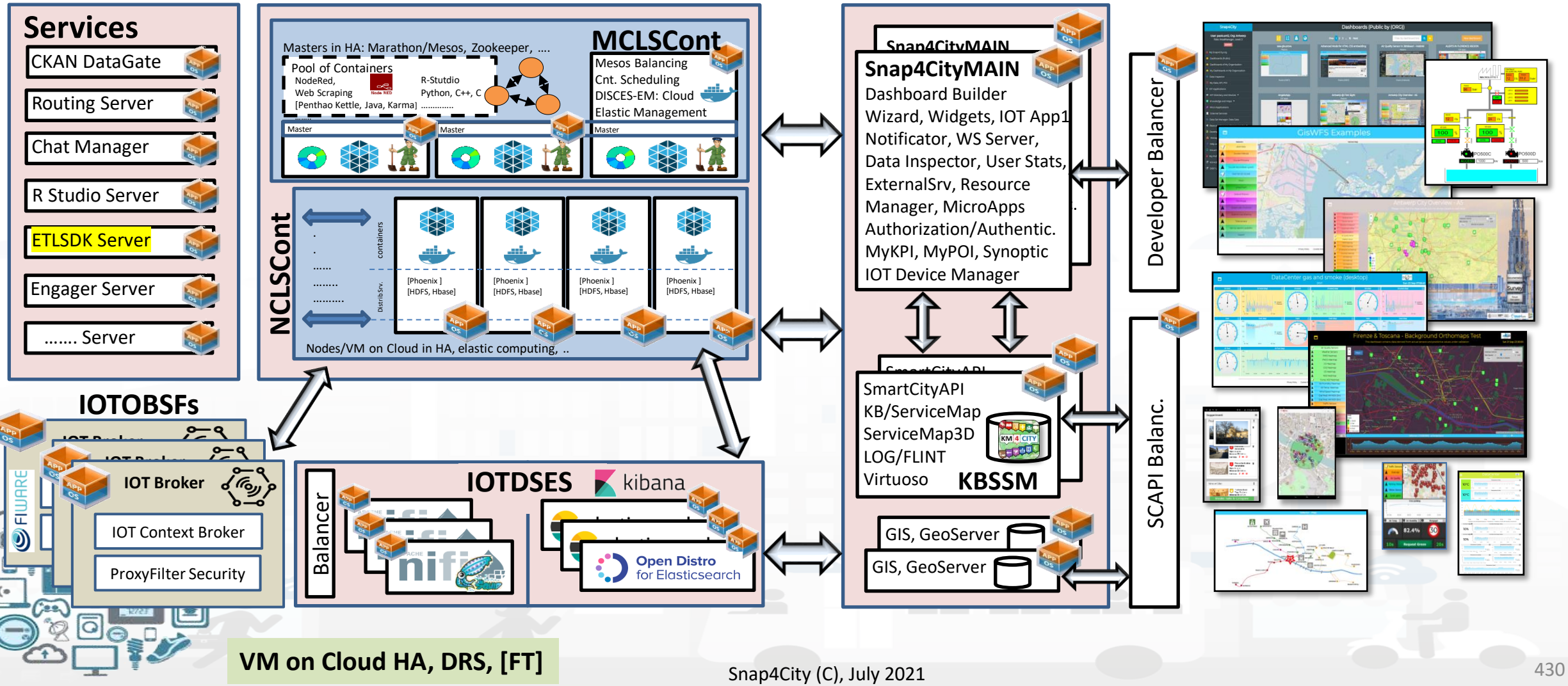
+ A relevant number of data streams entering in the platform
+ A scalable Data Shadow for IOT data management

Optionally:

- Data Analytics in R Studio, Tensor Flow (NVIDIA)
- Hbase / Phoenix Big Data Store
- Data Gate CKAN for Open Data
- Chat Manager on Dashboard
- Routing Solutions

F) FullPlatform Configuration

F: FullPlatform) For Huge scale Smart City with a Huge number of smart applications and processes on cloud (thousands), any number of IOT brokers



F: FullPlatform) For Huge scale Smart City with a Huge number of smart applications and processes on cloud (thousands), any number of IOT brokers

- **MCLSCount**
- **NCLSCount**

Container[Cluster]

- Marathon, Mesos Cluster
- Containers models
  - IOT App
  - Web Scraping
  - Data Analytics
  - ETL
  - Python
  - ..
- DISCES-EM
  - Elastic management of containers
- Monitoring App

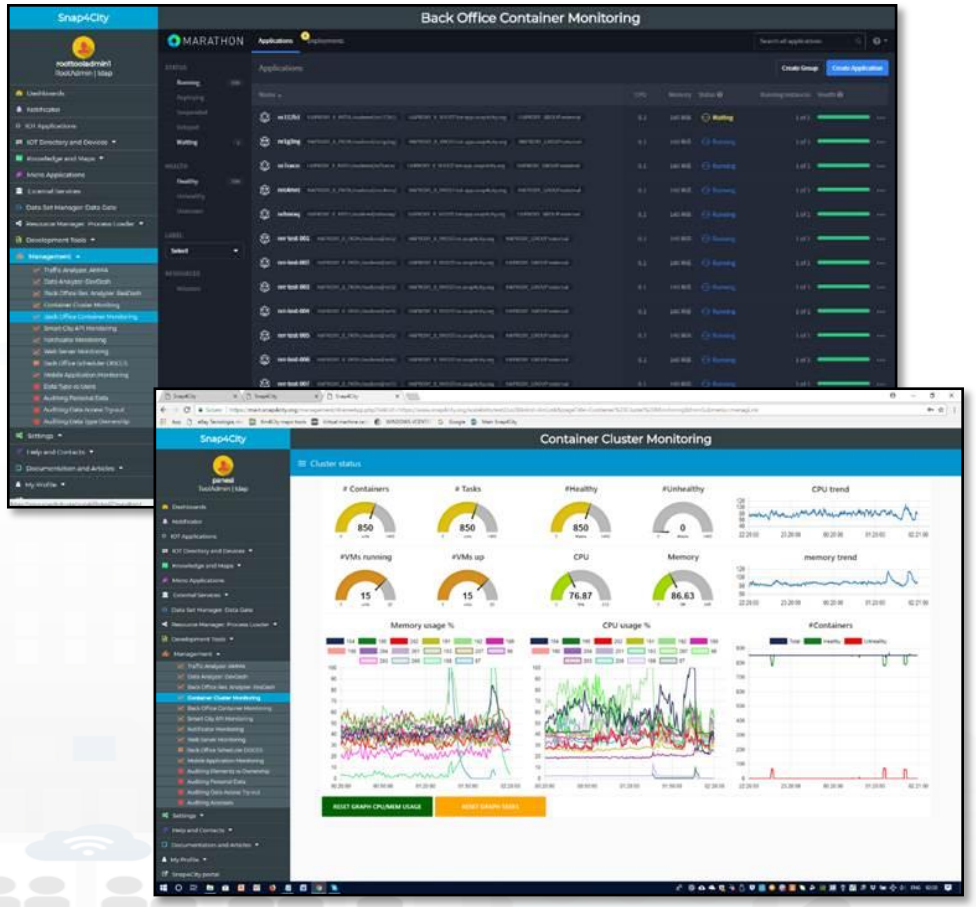
For Managing

Beyond E:ExtendedCity Configuration

+ A scalable huge number of Containers including different kind of processes: IOT, ETL, data analytics, scraping
+ A scalable Data Shadow for IOT data management

Optionally:

- Data Analytics in R Studio, Python, Tensor Flow (NVIDIA), etc.
- Hbase / Phoenix Big Data Store
- Data Gate CKAN for Open Data
- Chat Manager on Dashboard
- Routing Solutions



F+) LivingLab Configuration

F-LivingLab: FullPlatform + LivingLab) For Huge scale Smart City as Full Platform plus Living lab Support

Services
- CKAN DataGate
- Routing Server
- Chat Manager
- R Studio Server
- ETLSDK Server
- Engager Server
- ……. Server

IOTOBSFs
- IOTBrokers, secure

Container Cluster
MCLSCont, NCLSCont
Marathon, Mesos, Zookeeper, Disces-EM, Executing in Container: IOT App, Web Scraping, R-Studio, Python, Java, ETL, …

[DataCluster]
ETL-VM
Phoenix HBASE, HDFS
DISCES, ETL support

Data Shadow Cluster
IOTDSES
NIFI, OpenDistro, DevDash, Amma

IOT Networks | Social Media | CRM | ….. | GIS
Legacy Platforms

Snap4City MAIN
Dashboard Builder, Data Inspector, User Stats, ExternalSrv, Res Manager, MyKPI, MyPOI, Synoptic, IOT Device Manager, Micro Applications, Authorization/ Authentication, Roles

KBSSM
KB/ServiceMap, SmartCity API, WFS, ServiceMap3D, LOG/FLINT, SuperServiceMap, Virtuoso

GISGeoServer
Heatmap Manager, WFS, WMS

Living Lab Portal
Drupal support CRM

Mobile Apps, Dashboards

In Yellow alternative & legacy solutions including ETL

F-LivingLab: FullPlatform + LivingLab) For Huge scale Smart City as Full Platform plus Living lab Support

- **Living Lab Portal**
  - CRM Drupal
  - LDAP Snap4City
  - Blogs, Articles, comments, etc.
  - Multiple Organization
  - Multiple Groups
  - SSO with Snap4City tools
  - Automated Registration management
  - SOLR indexing on content
  - Monitoring activity
  - Reporting and statistics

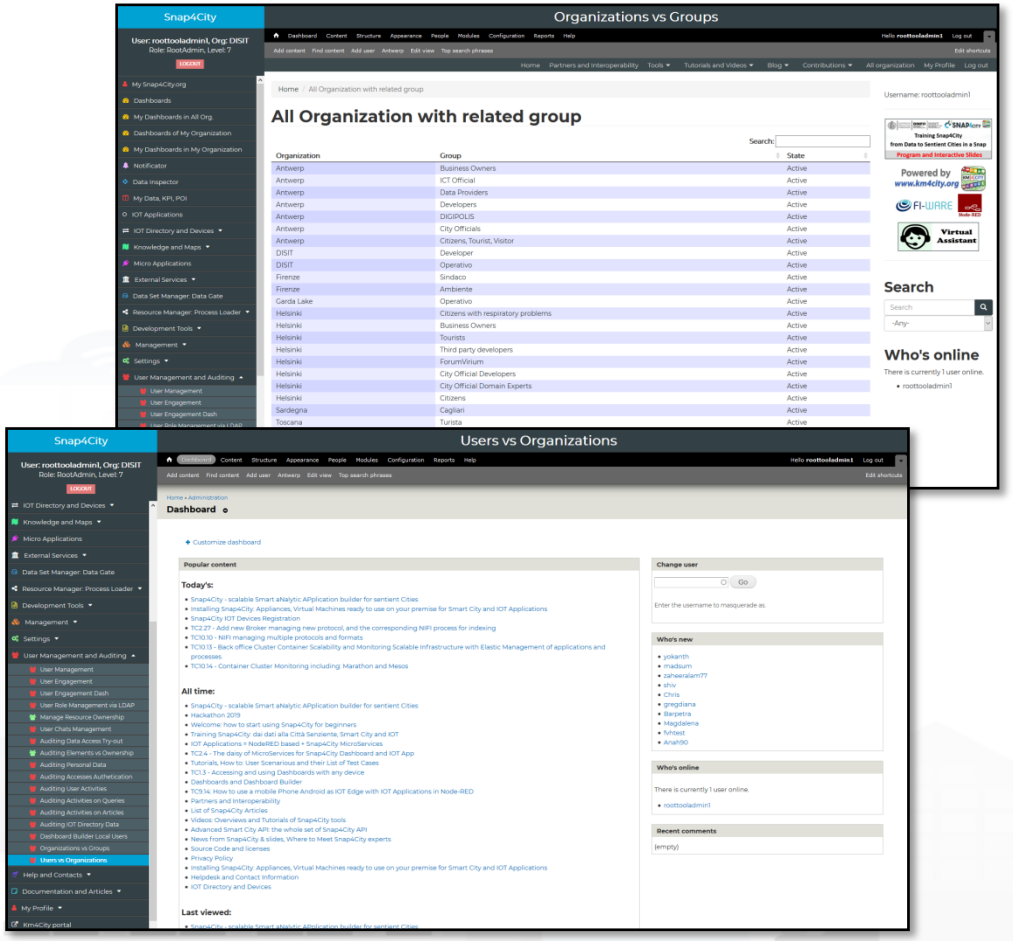
For Managing

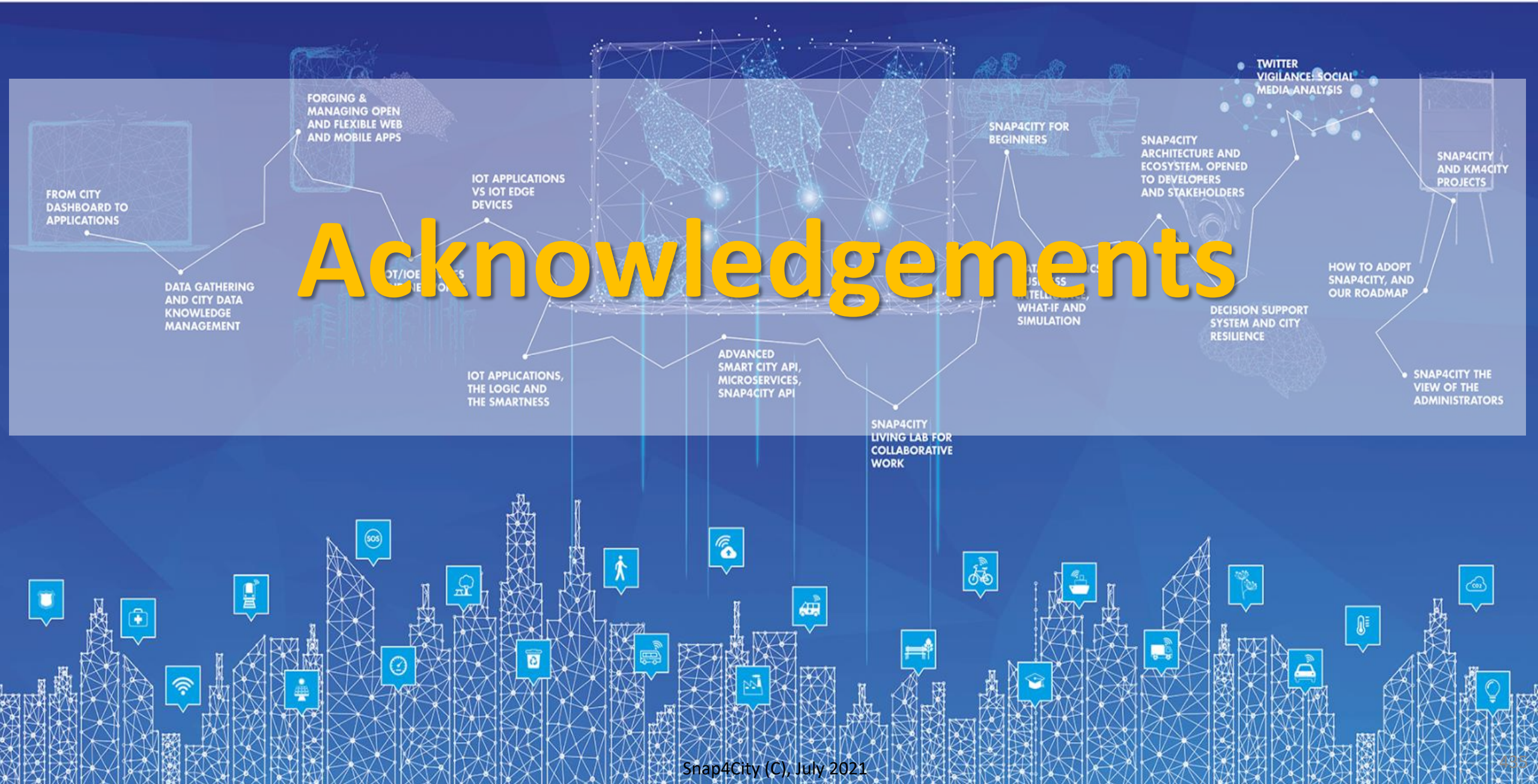
Beyond F:FullPlatform Configuration

+ Providing Living Lab Support, a full CRM for stakeholder, co-working, collaborative work, discussion environment, chart, forum, etc.

Strongly suggested:

- Data Analytics in R Studio, Python, Tensor Flow (NVIDIA), etc.
- Hbase / Phoenix Big Data Store
- Data Gate CKAN for Open Data
- Chat Manager on Dashboard
- ETL SDK servers
- User Engagement Server
- Routing Solutions





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
- 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

- 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

2017
Km4City 1.6.4

Sii-Mobility

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

E0l5 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 (POR CreO, Regione Toscana) (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 (POR CreO, Regione Toscana)

- Smart Health

GREEN FIELD PEAS Soda4.0 Optimization and Automated Decision System 4.0 (POR CreO, Regione Toscana)

- Industry 4.0

bee smart city

- Smart Lonato

Reverberi Enetec Gruppo MPES

- PCP Award

SNAP4CITY KM4CITY

SNAP4CITY roadmap

2019

- EUROPEAN OPEN SCIENCE CLOUD
- LAID Smart Bed
  - Smart Health
- GREEN FIELD PEAS Soda4.0
  - Industry 4.0
- bee smart city
- Smart Lonato del Garda
- Reverberi Enetec Gruppo MPES

2020

- CAPELON
  - Smart Light
  - Sweden
- Km4City 1.6.7
- smartGARDAlake
- Interreg MARITTIMO-IT FR-MARITIME MOBI MART
  - Smart Mobility
  - PISA, PUMS
  - Living lab
- Interreg Mediterranean HERIT-DATA
  - Smart Tourism
  - 6 Pilots
  - Data Analytics
  - Extended platform
- JRC EUROPEAN COMMISSION
- Winner of Select4Cities PCP

2021

- Winner of Open Data Challenge of enel x
- PC4City (2020-21)
  Monitoring Terrain
- JRC EUROPEAN COMMISSION
- enel x
  Contract
- Smart Ambulance (2021-22)
- Enterprise (2021-22)
  Industry 4.0
- Almafluida
  Industry 4.0
  (2021-22)

2022

- UNI.SYSTEMS
  SmartCity
- PRETTO
  Industry 4.0
- SYN-RG-AI
  SmartCity
- AMPERE (2021-22)
  Industry 4.0

Main running instances

- Sii-Mobility → mobility and transport, sustainability
- REPLICATE → ICT, smart City Control room, Energy, IOT
- RESOLUTE → Resilience, ICT, Big Data
- GHOST → Strategies, smart city
- TRAFAIR → Environment & transport
- MOSAIC → mobility and transport
- WEEE Life → Smart waste, environment
- Smart Garda Lake → Castelnuovo del Garda, SMARTEA
- 5G → Industry 4.0 vs SmartCity
- Green Impact → Industry 4.0, Chemical Plant
- SmartBed (Laid) → smart health
- Green Field Peas (Soda) → Industry 4.0, Chemical plant
- MobiMart and PISA Agreement → data aggregation, mobility and transport, Living Lab
- Lonato del Garda → smart parking, environment
- Herit Data → tourism, culture and management
- ISPRA JRC → site management and services
- Capelon (Sweden) → smart light solutions

Acknowledgements

- Thanks to the European Commission for founding. All slides reporting logo of **Snap4City** https://www.snap4city.org **of Select4Cities H2020** are representing tools and research founded by European Commission for the **Select4Cities** project. **Select4Cities** has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation Programme (grant agreement n° 688196)
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- Thanks to the MIUR for co-founding and to the University of Florence and companies involved. All slides reporting logo of **Sii-Mobility** are representing tools and research founded by MIUR for the Sii-Mobility SCN MIUR project.
- **Km4City** *is an open technology and research line of DISIT Lab exploited by a number of projects. Some of the innovative solutions and research issues developed into projects are also compliant and contributing to the Km4City approach and thus are released as open sources and are interoperable, scalable, modular, standard compliant, etc.*

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DISIT thanks to

Herit Data: Tourism and Mng. https://herit-data.interreg-med.eu/
Snap4City: IOT/IOE smart city www.snap4city.org
Trafair: CEF project with several Cities http://trafair.eu/
Mosaic: Mobility and transport model
Km4City: http://www.km4city.org
REPLICATE H2020, SCC1, EC flagship
http://replicate-project.eu/
Sii-Mobility SCN MIUR: http://www.sii-mobility.org
Feedback: retail and GDO Big Data analytics
5G with 3G-Wind, Open Fiber, Estra
Coll@bora Social Innovation, MIUR:
http://www.disit.org/5479
RESOLUTE H2020, EC:
http://www.resolute-eu.org
TRACE-IT, RAISSS, TESYSRAIL, …
Mobile Emergency:
http://www.disit.org/5404

SNAP4CITY

REPLICATE

resolute

Sii-Mobility

TRAFAIR

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

LAID Smart Bed

GREEN FIELD PEAS Soda4.0

5G

MOSAiC

Coll@bora

TESYS RAIL

feedback

Trace-IT

RAISSS

Smart COMMUNITIES Tech Italian Technology Cluster for Smart Communities

Regione Toscana

MIUR

Horizon 2020 European Union Funding for Research & Innovation

Further readings

https://www.snap4city.org/108

- 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
- HOW TO: define privacy rules for personal data, produced by the end-users own device
- HOW TO: Develop Smart Applications, Snap4City development Life Cycle
- HOW TO: HLT vs Ingestion, and HLT vs Widgets
- HOW TO: Develop an IOT Application for Data Ingestion
- HOW TO: Upload data into Knowledge Base, ServiceMap (triple upload)
- HOW TO: Create as set of Devices with BulkProcessing
- HOW TO: Create an IOT Device Model
- HOW TO: Create an IOT Device Instance from IOT Directory tool

TOP

SNAP4CITY

KM 4 CITY

Be smart in a SNAP!

100% OPEN SOURCE

SNAP4 Appliances and Dockers **Installations**

CONTACT

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