

Be smart in a SNAP!



SMARTCITY
EXPO WORLD CONGRESS
7-9 November 2023, Barcelona, Spain
Visit Snap4City in Hall 1

Data Ingestion and Interoperability



Sept. 2023, Course, Part 5
<https://www.snap4city.org/944>
<https://www.snap4city.org/577>

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES



UNIVERSITÀ
DEGLI STUDI
FIRENZE

DINFO
DIPARTIMENTO DI
INGEGNERIA
DELL'INFORMAZIONE

DISIT
DISTRIBUTED SYSTEMS
AND INTERNET
TECHNOLOGIES LAB



SNAP4CITY



Powered by

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

<https://www.Snap4City.org>

Data Ingestion and Interoperability

100%
OPEN
SOURCE

Sept. 2023, Course, Part 5

<https://www.snap4city.org/944>

<https://www.snap4city.org/577>

Paolo Nesi, paolo.nesi@unifi.it

<https://www.Km4City.org>

<https://www.disit.org>





SMART SOLUTIONS AND DECISION SUPPORT SYSTEMS

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



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



DASHBOARDS, WIDGETS
TEMPLATES

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

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

ANY: DATA, BROKER, NETWORK AND VERTICAL

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

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

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

- Native and External Applications**
- Smart Parking
 - Smart Light
 - Smart Waste
 - Smart Energy
 - Social Media Analysis
 - ...



METHODOLOGIES
LIVING LABS
COURSES AND COMMUNITY
DEVELOPMENT TOOLS



Powered by
FIWARE

FREE
TRIAL

PEN Test
Passed

EU GDPR
COMPLIANT

SNAP4
Appliances and Dockers
Installations

EUROPEAN OPEN
SCIENCE CLOUD

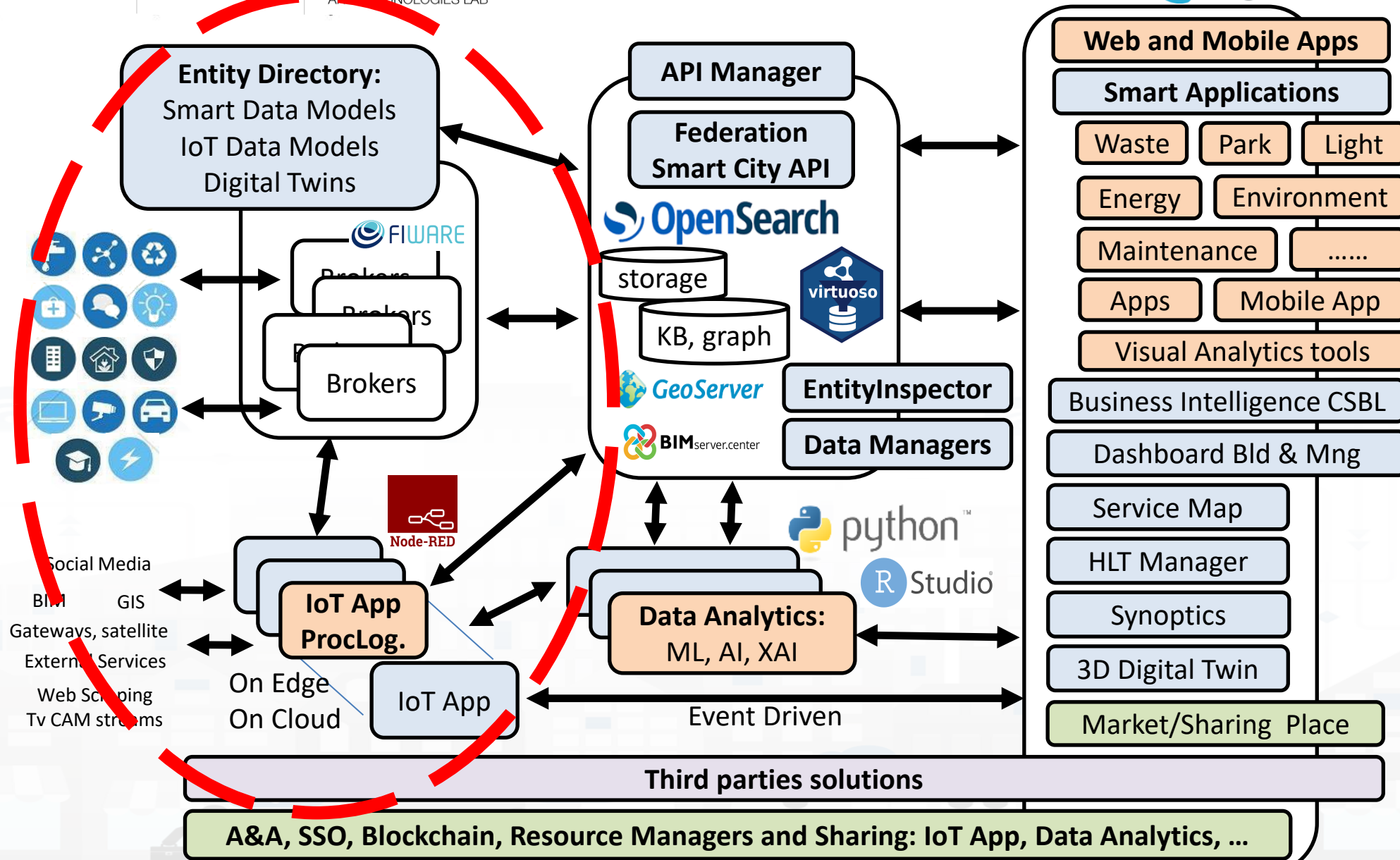
Node-RED

JS Foundation

E015
digital ecosystem

NVIDIA

Tech Arch



<https://www.snap4city.org/577>



On Line Training Material (free of charge)

<https://www.snap4city.org/944>

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

Video1								
Video2								
Video3								
Video4				none		none	none	none

Note on Training Material

- **Course 2023:** <https://www.snap4city.org/944>
 - Introductionary course to Snap4City technology
- **Course** <https://www.snap4city.org/577>
 - Full training course with much more details on mechanisms and a wider set of cases/solutions of the Snap4City Technology
- **Documentation** includes a deeper round of details
 - Snap4City Platform Overview:
 - <https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf>
 - Development Life Cycle:
 - <https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf>
 - Client Side Business Logic:
 - <https://www.snap4city.org/download/video/ClientSideBusinessLogic-WidgetManual.pdf>
- **On line cases and documentation:**
 - <https://www.snap4city.org/108>
 - <https://www.snap4city.org/78>
 - <https://www.snap4city.org/426>

Tech Overview

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



Technical Overview

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

Snap4City:

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

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

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

Development

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



Development Life-Cycle

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

From Snap4City:

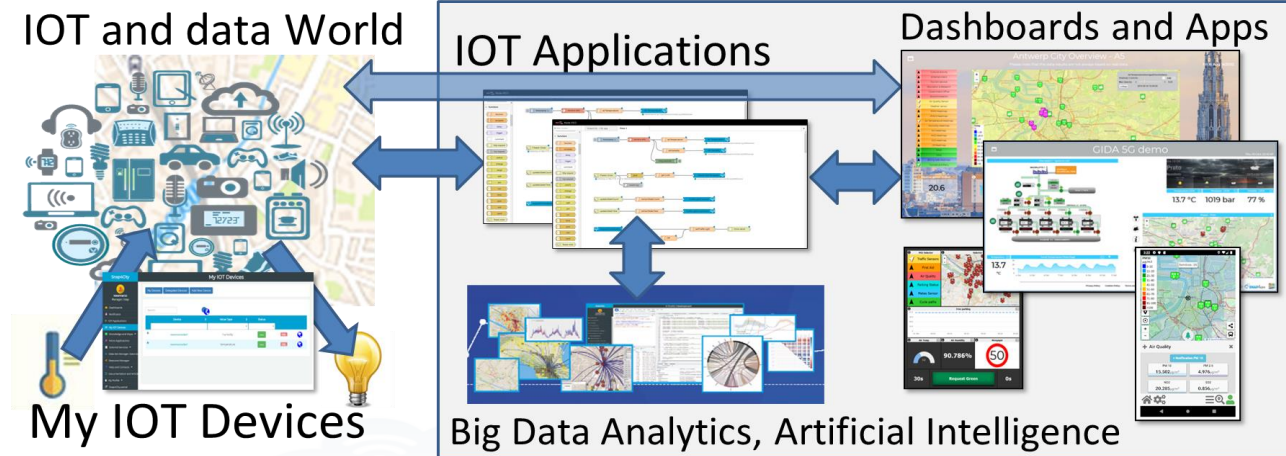
- We suggest you to read the **TECHNICAL OVERVIEW**:
 - <https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf>
- <https://www.snap4city.org>
- <https://www.snap4solutions.org>
- <https://www.snap4industry.org>
- <https://twitter.com/snap4city>
- <https://www.facebook.com/snap4city>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

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

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

Free Trial

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



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

Agenda of Part 5

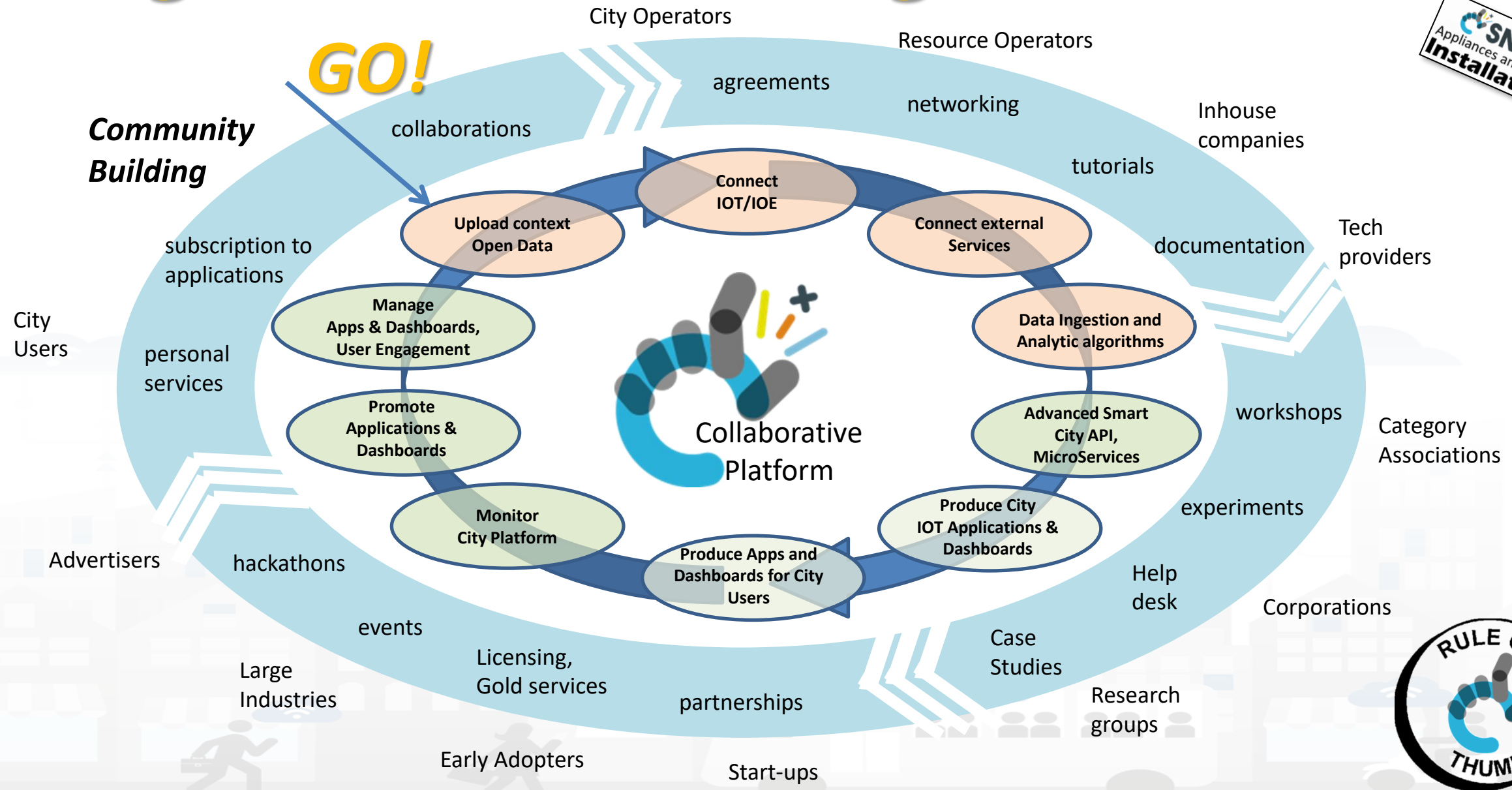
- When Solutions and tools for Data Ingestion and Interoperability are needed
- Overview of Snap4City Data Storage and Stack
- Knowledge Base: Modelling and Setting Up
- High Level Types vs Ingestion Process
- Data Ingestion Strategy and Orientation
- Ingestion of Points of Interest with POI Loader
- Models vs Devices/Entities and Registration
- Verification of Data Ingestion
 - Digital Twin Data Inspector vs Data Processes Details
 - My Data Dashboard Dev to assess data on Open Search Storage
- An Integrated Example for Time Series
- Entities Ingestion with Data Table Loader
- High Performance Ingestion via Python
- FIWARE Smart Data Models on Snap4City
- Ingestion of MyKPI with Proc.Logic / IoT App
- Training Material

TOP

When Solutions and tools for Data Ingestion and Interoperability are needed

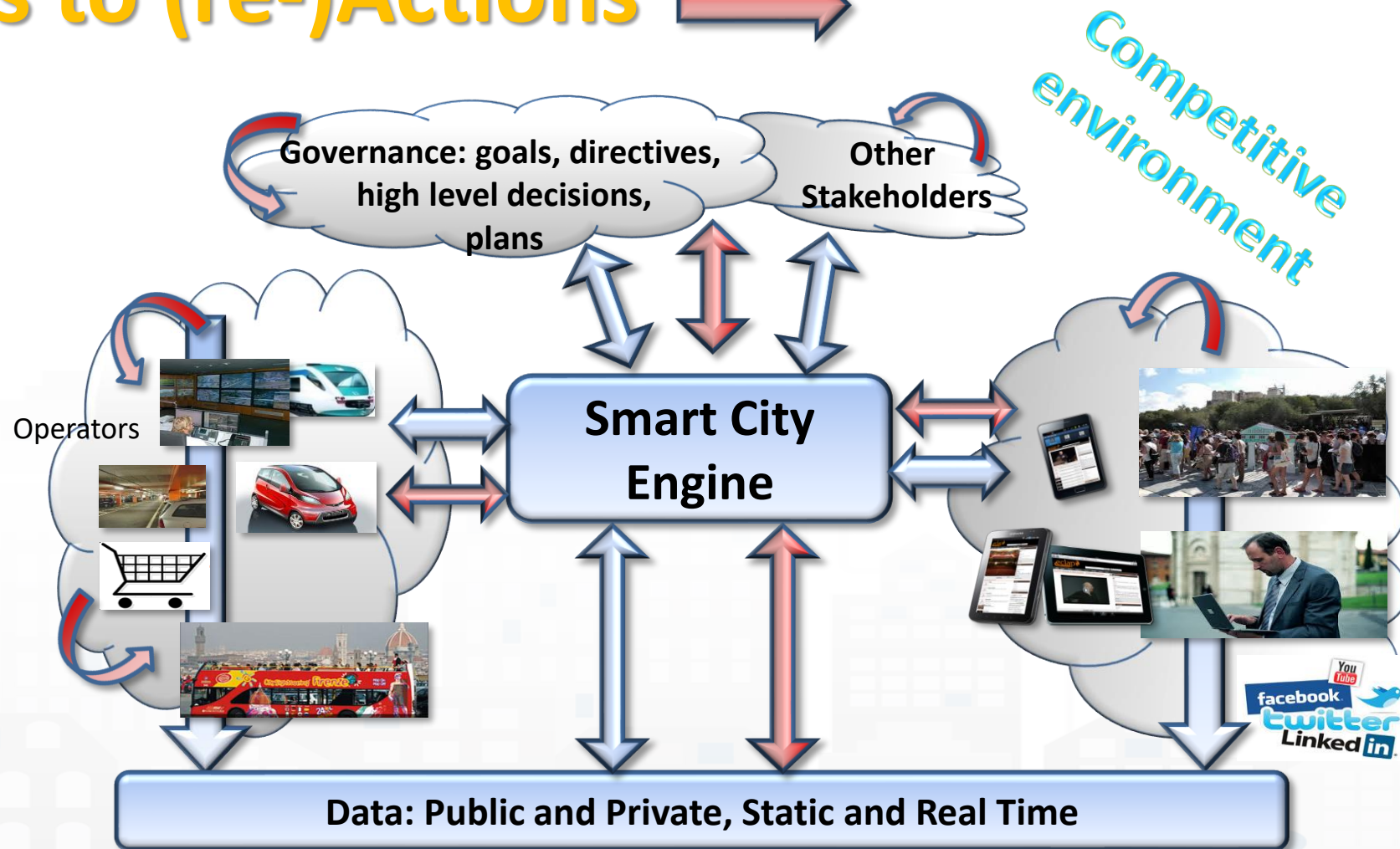


Living Lab Accelerating



From Strategies to (re-)Actions

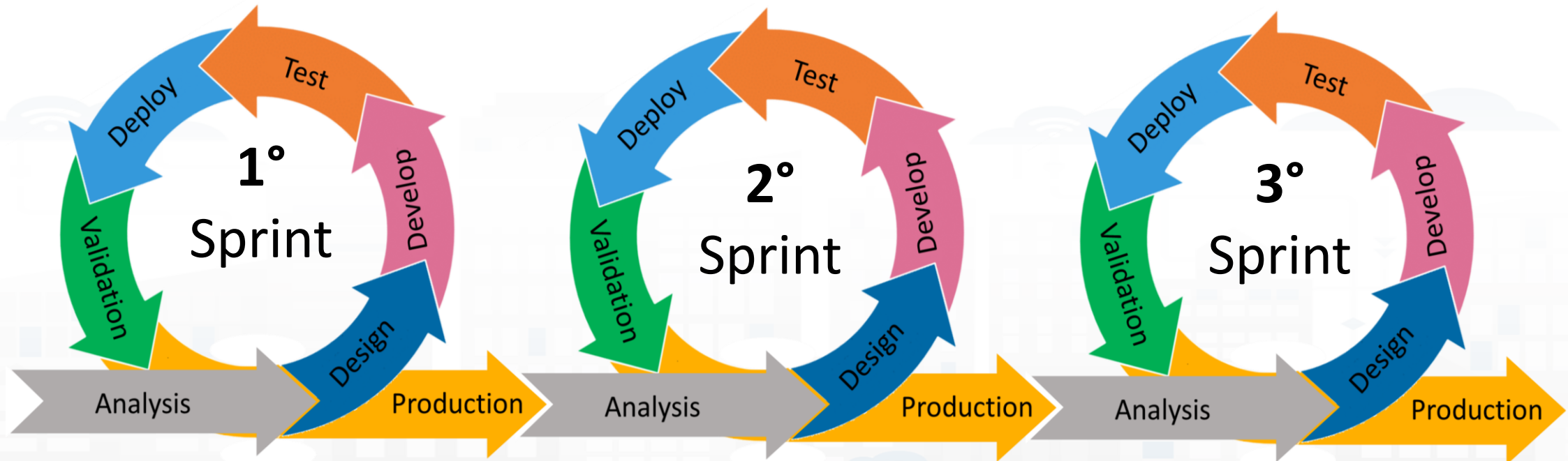
- Analyze
- Alerting, Early Warning
- Support Decision makers
- Plans
- Prescriptions
- Inform
- Suggest
- Engage
- Research



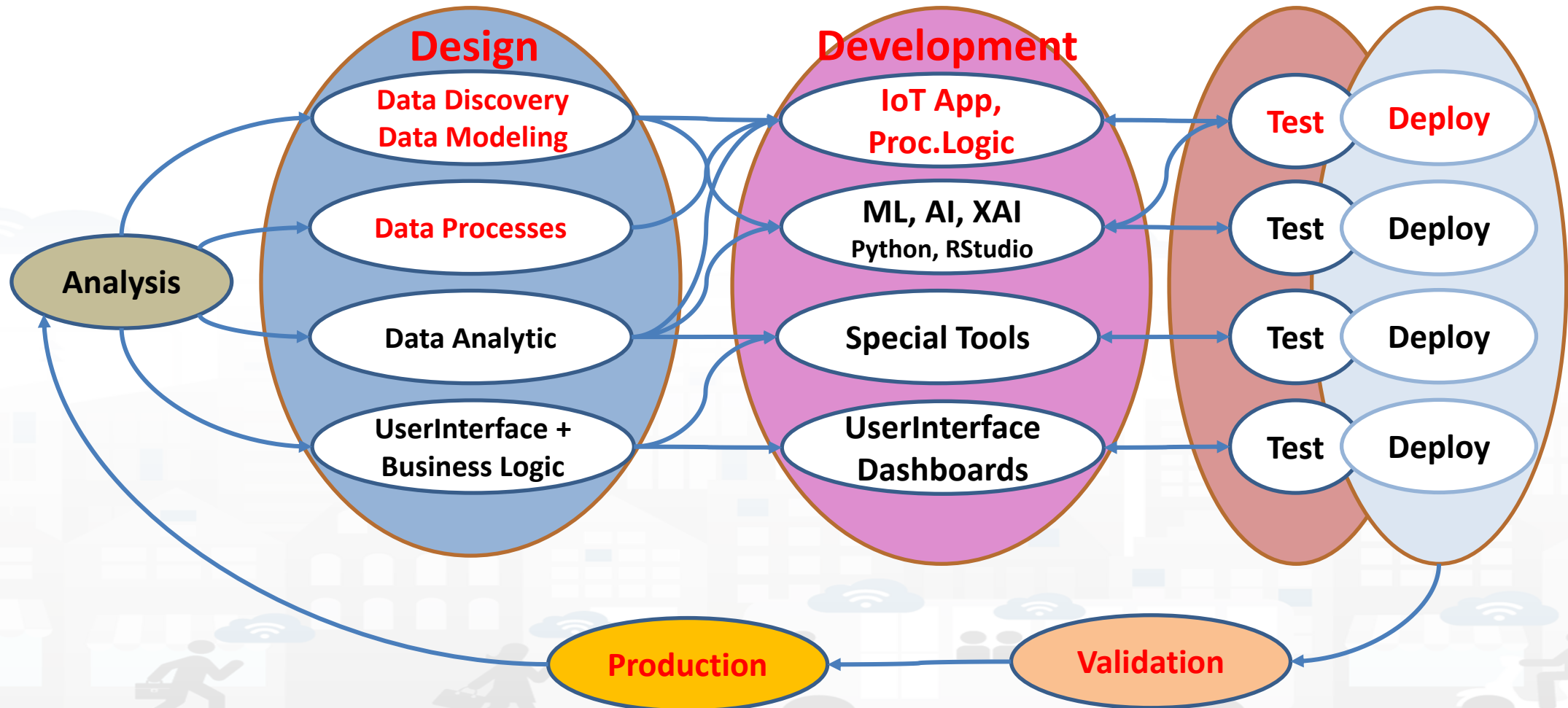


Agile Development Life Cycle by sprint

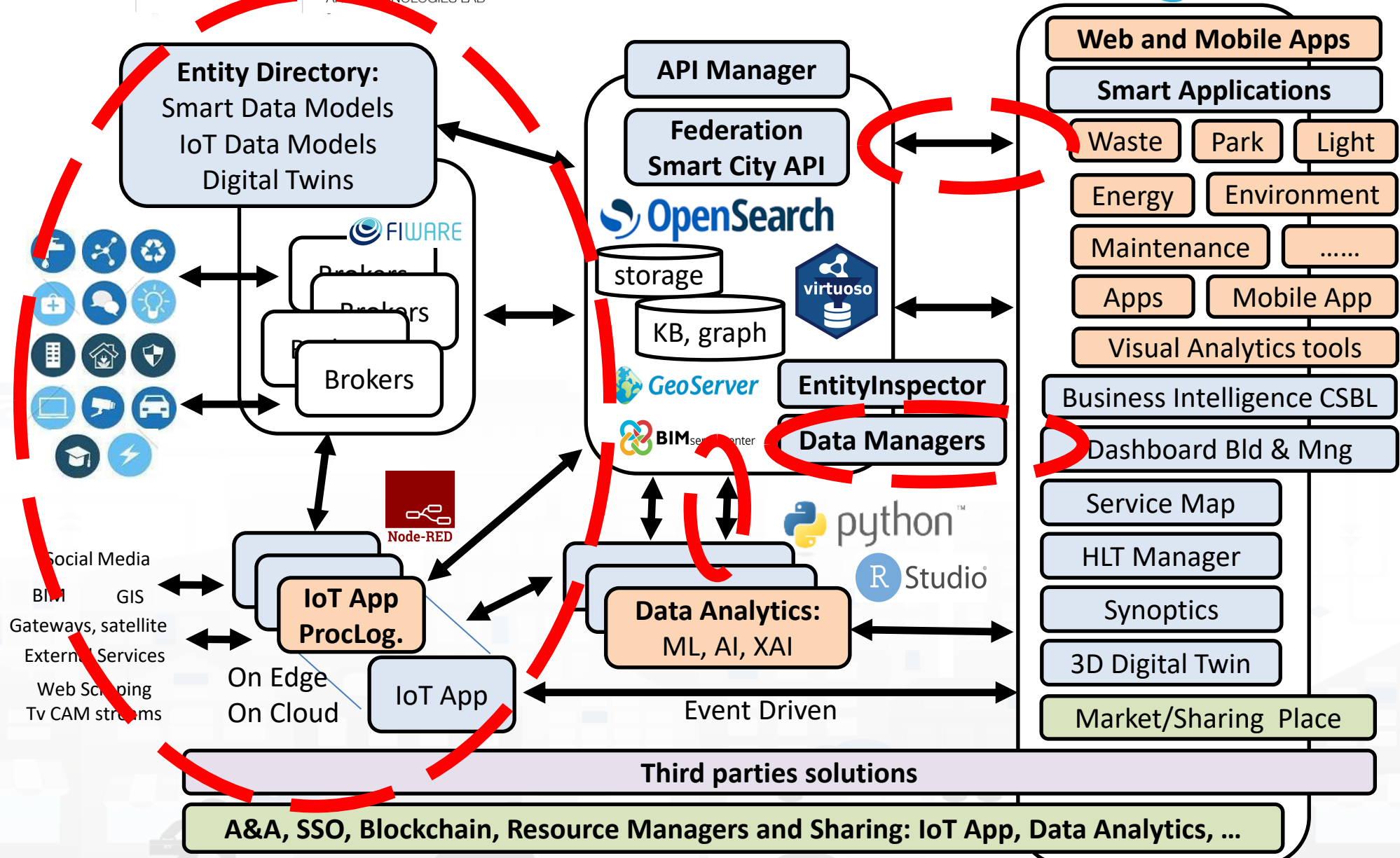
Smart Solutions



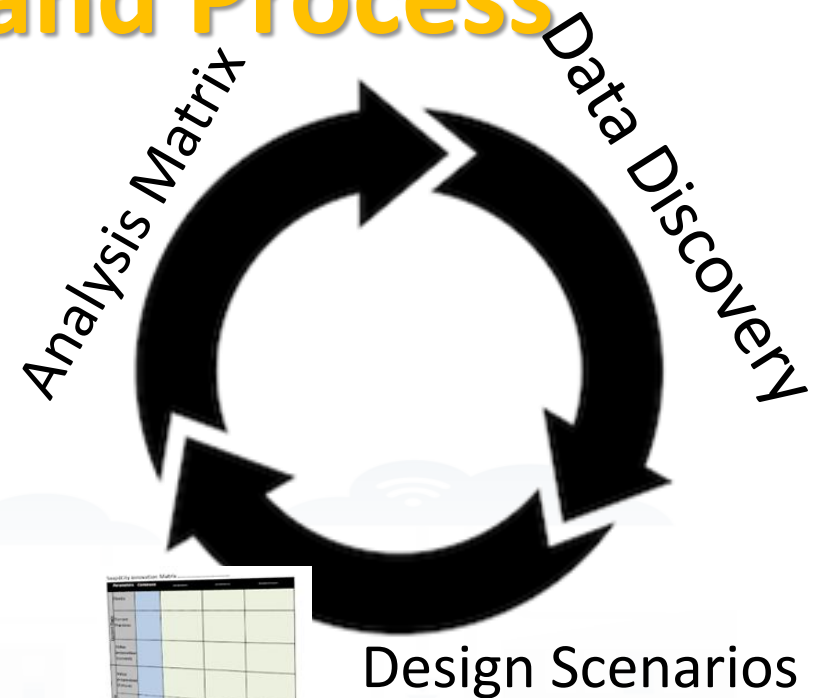
Development Life Cycle Smart Solutions



Tech Arch



Snap4City Innovation Matrix and Process



Snap4City Innovation Matrix

	Parameters	Commons	Operators	SBFF	Visitors
Current State	Needs	[Sticky notes]	[Sticky notes]	[Sticky notes]	[Sticky notes]
	Current Practices	[Sticky notes]	[Sticky notes]	[Sticky notes]	[Sticky notes]
	Value proposition (Current)	[Sticky notes]	[Sticky notes]	[Sticky notes]	[Sticky notes]
Future State	Value proposition (Future)	[Sticky notes]	[Sticky notes]	[Sticky notes]	[Sticky notes]
	Solution	[Sticky notes]	[Sticky notes]	[Sticky notes]	[Sticky notes]
	Value Capture	[Sticky notes]	[Sticky notes]	[Sticky notes]	[Sticky notes]
	Key Partners	[Sticky notes]	[Sticky notes]	[Sticky notes]	[Sticky notes]
	Barriers	[Sticky notes]	[Sticky notes]	[Sticky notes]	[Sticky notes]

Snap4City Innovation Matrix

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



see Course Part 6

Data vs Smart Services enabling on Snap4City

- **Public Transportation and mobility activated services in some where with Snap4City**
 - **Smart parking** (parking locations, real time parking data, traffic, meteo) → predictions
 - **Smart Fuel pricing** (fuel station locations and real time prices)
 - **Routing** (detailed GIS information, text indexing of streets, POI, etc.)
 - **Quite routing, perfect shopping, etc. etc.** (more data in needed....)
 - **multimodal routing** (detailed GIS information, Public transport time schedule)
 - **Info traffic** (traffic flow sensors, real time Traffic events, their localization, etc.)
 - **Dense info traffic** (traffic flow sensors and traffic flow reconstruction algorithm)
 - **Car/Bike/Scooter Sharing** (position and availability of Cars/Bikes, Scooters) ... predictions
 - **Smart Biking** (cycling paths, environmental data) → predictions
 - **E-vehicles** (position, status of recharging stations,) ... predictions vs booking
 - **Smart river crossing** (position and status of Underpass, Ferry) ... prediction
 - **Quality of Public Transport** (actual time of arrival at the bus stops, wrt planned time schedule)
 - **Early Warning vs Resilience** (combination of several data including mobility, events, Social to perform early warning...)

Data vs Smart Services enabling on Snap4City

- **Social and Users Behaviour**

- **Smart First Aid** (Location of First AID, real time status of triage)
- **search for POI and public transport services** (POI geolocalized, spatial queries, along paths)
- **Social Media Monitoring and acting** (Identification of dysfunction, quality of service perceived)
- **Information to Tourists** (Entertainment Events)
- **Early Warning, prediction of audience** (Twitter data, social media)
- **Improvement of services for Tourists** (people flow, usage of services)

- **Weather and environment, quality of life**

- **Weather forecast/condition** (Weather forecast)
- **Air quality Pollution** (pollution sensors, PM10, PM2.5, NOX, etc.)
- **Pollination** (Pollination sensors)
- **Alerting on Air quality for multiple parameters** (Prediction of parameters time slots, notification)
- **Information Heatmaps for weather and air quality** (air quality sensors, heatmaps, prediction)
- **Air quality indexes, and forecast** (.....)

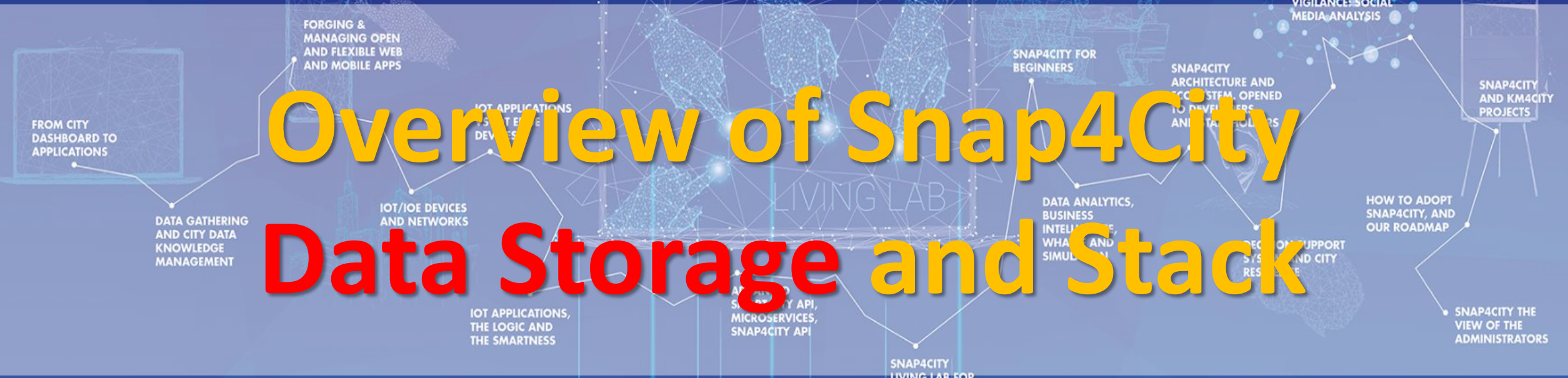
Kind of Data Sources/channels

- **IoT Networks and/or devices** which
 - provide data in PUSH: Brokers, devices, etc.
 - receive data in PUSH to act on devices, via brokers, gateways, etc.
- **Gateways and Services** which provide data access from some API or other protocols in PULL
 - GIS, governmental servers, legacy servers, admin servers, ...
 - Satellite, open data CKAN networks, ...
 - third party services: Here, Vodafone, ...
 - some devices may be ready to provide data in PULL
- **Mobile Apps** which
 - get data in PULL from the smart city servers and
 - provide data in PUSH to the smart city servers
- **ETC.....**

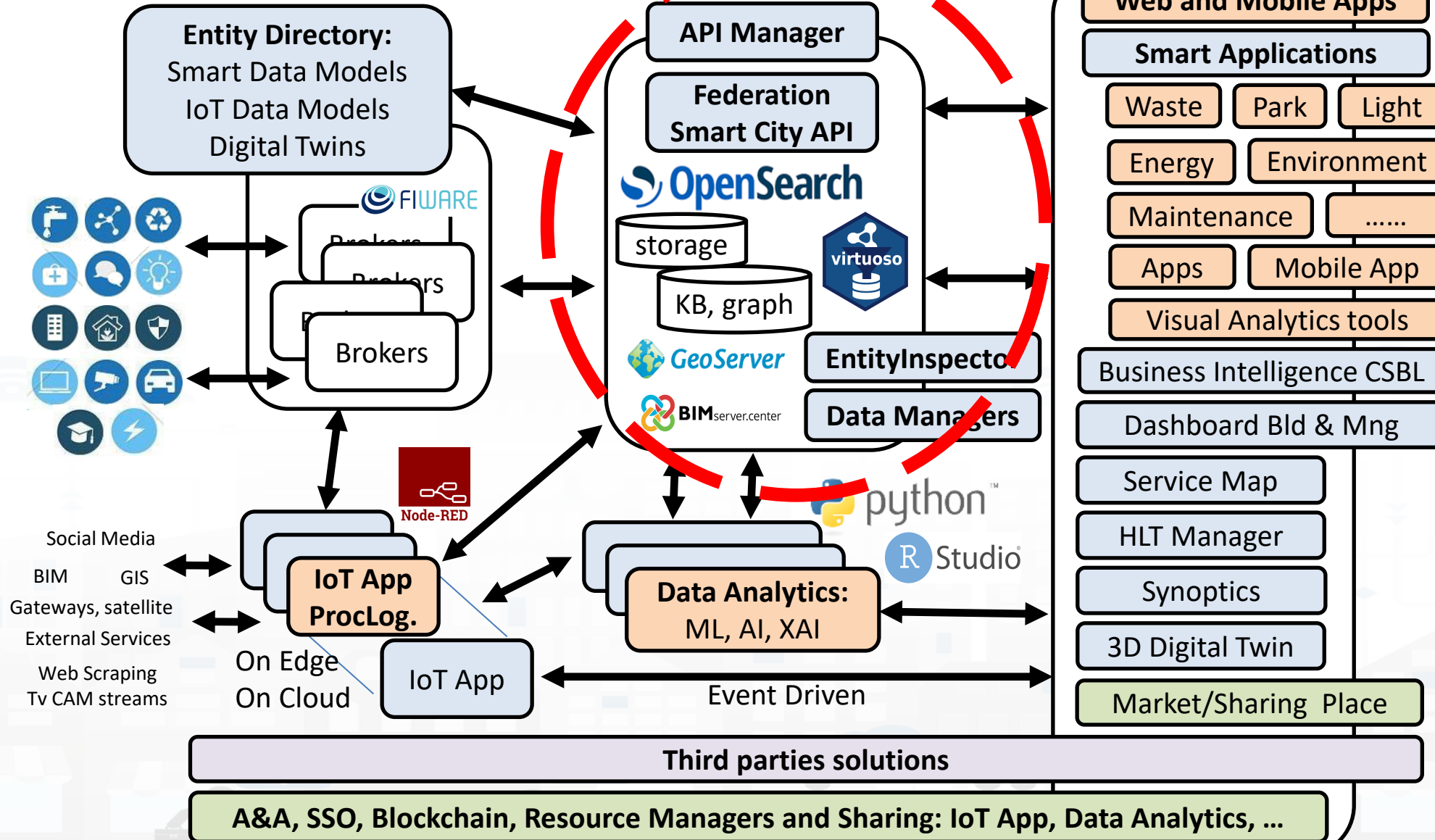
TOP

Overview of Snap4City

Data Storage and Stack



Tech Arch



Snap4city Data Ingestion Diagram

storage

Manual or automated
Registration
of Entities/Devices

**Entity/IoT
Directory**

registration
triples

NGSI



Orion Broker

IoT Orion Broker

IoT Orion Broker

IoT Orion Broker

IoT Orion Broker

Brokers

subscription note

NGSI

Real Time

Knowledge Base

Semantic Reasoners

Semantic Reasoners

Semantic Reasoners

SURI Link

Indexing and Aggregating
NIFI, OpenSearch

Data Managers

Data Managers

Entity Inspector



A number of KB
federated



Federation
Smart City API, ASCAPI

API Manager

Cluster of **OpenSearch**
for storage with in
front a cluster of
NIFI

Platform Automation:

IoT Apps, Proc.Logics,
Python, ...



Data Analytics: ML, AI, XAI

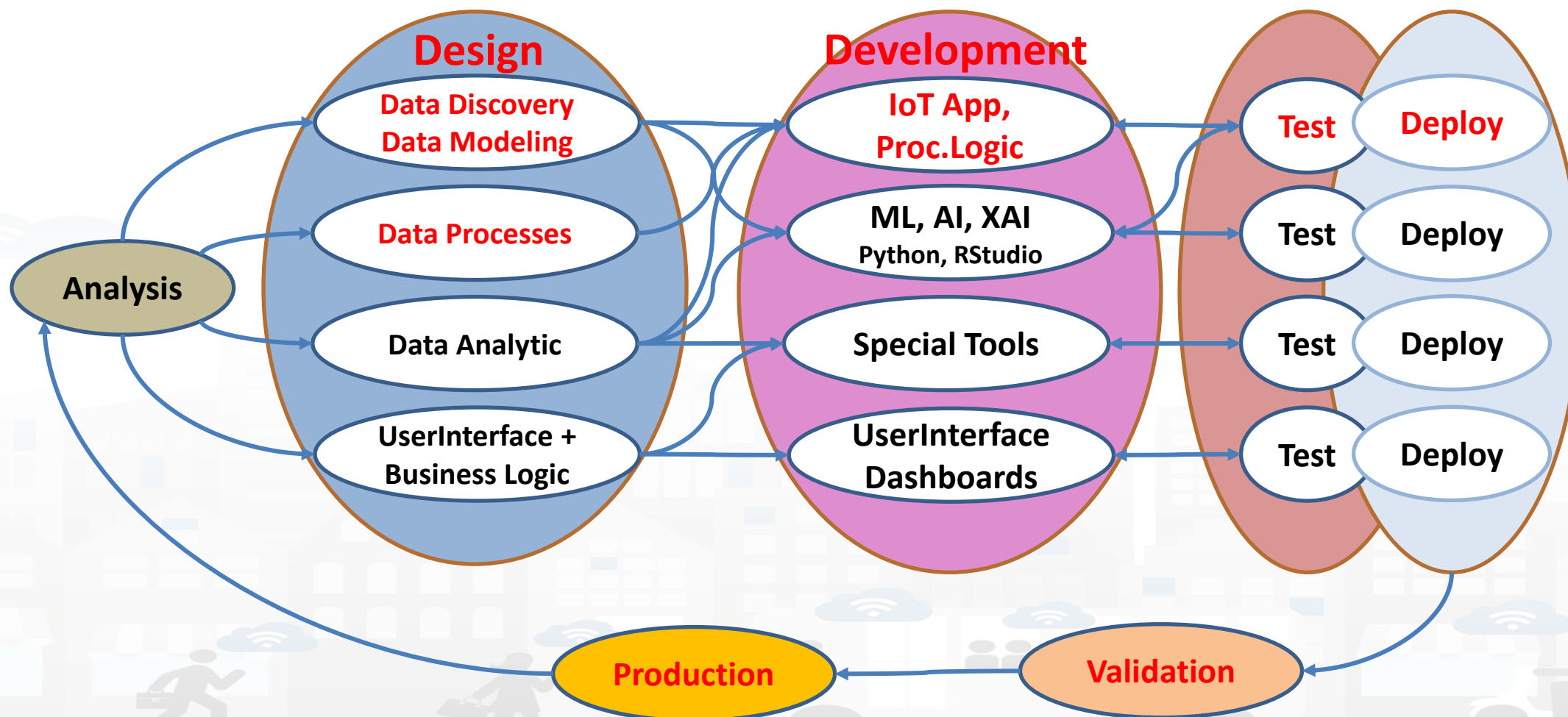


Platform Control and Management

Massive data flow
entering

Massive data flow
exiting

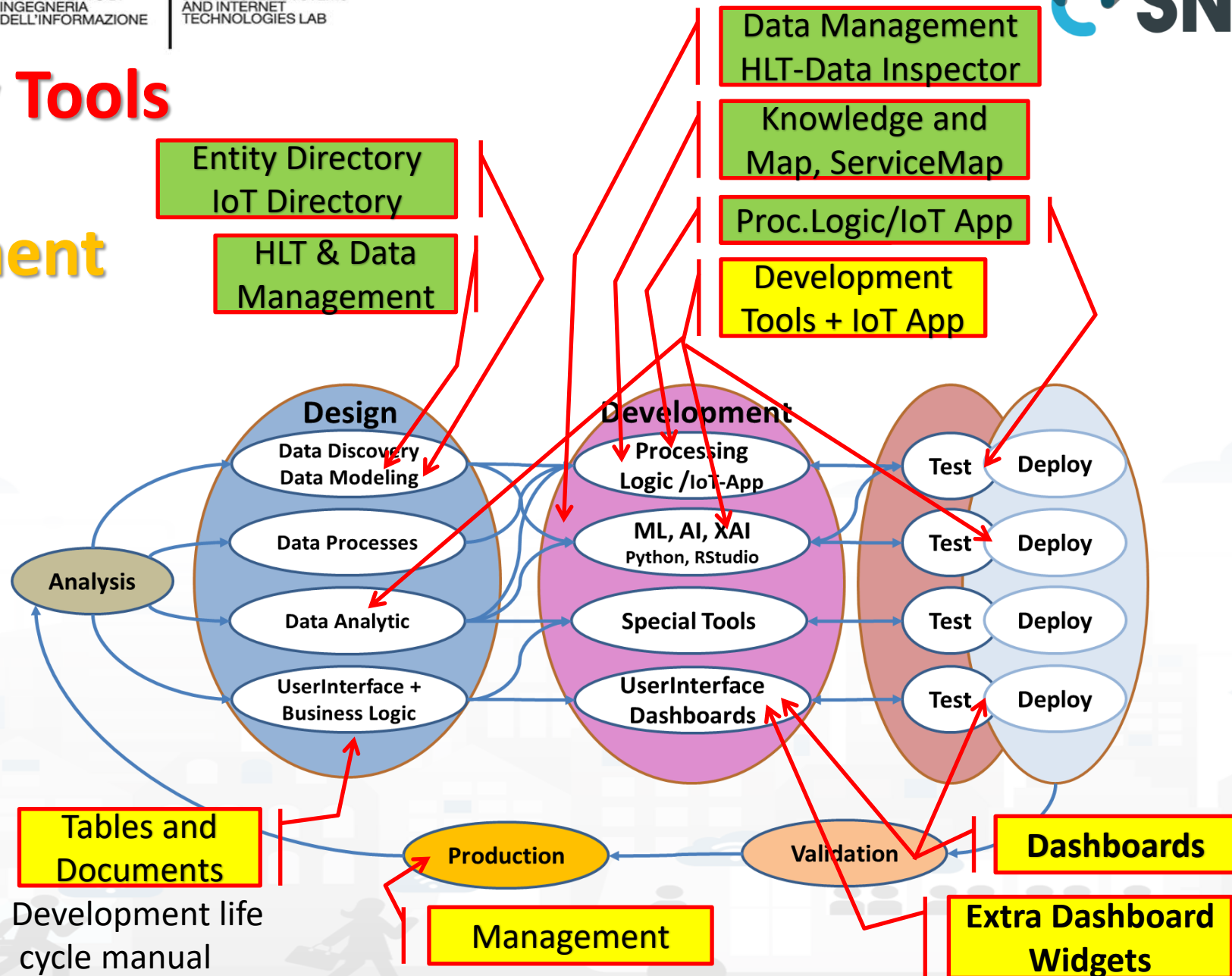
Development Life Cycle Smart Solutions



Snap4City Tools

vs

Development Life Cycle



TOP

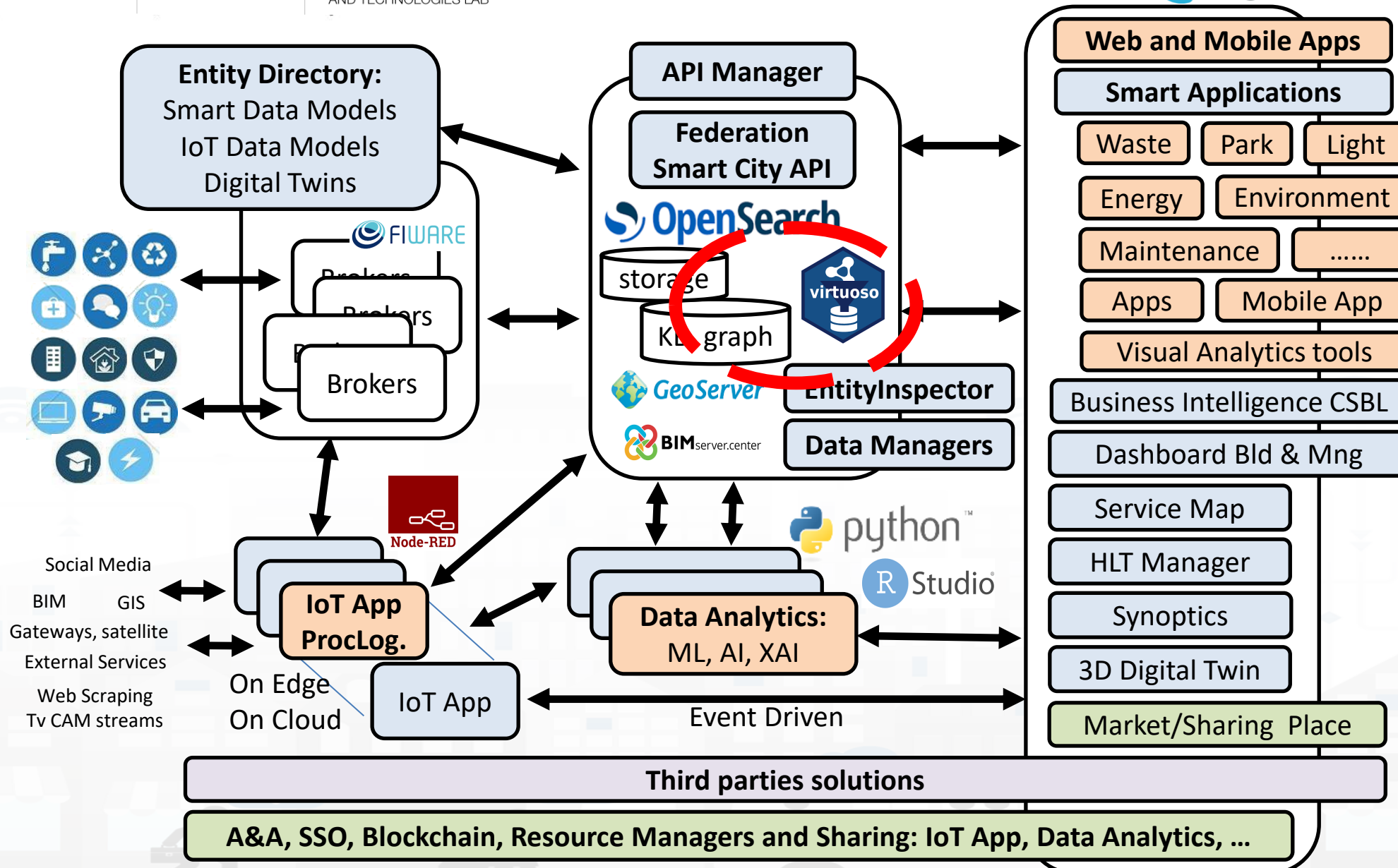


Knowledge Base:

Modelling and Setting Up



Tech Arch



Knowledge Base city structure

- Needs of the KB city Structure:
 - For many trivial applications of Smart City the KB does not need to be initialized with some road graph, for example taken from OSM
 - For example, if you need only to position devices on map to some GPS coordinates you do not need to set up the KB
- The KB Set up is needed only when is needed to have:
 - Geoserver functionality
 - Routing based on KB
 - Some spatial reasoning queries
 - Etc.



TOP

Usage of the ServiceMap and Knowledge Base Browsing

- 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
- Greece Service Map
- Valencia Service Map
- Pont Du Gard Service Map
- Dubrovnik Service Map
- WestGreece Service Map
- Mostar-Bosnia Service Map
- Svealand Service Map
- Bologna Service Map
- Roma Service Map
- Pisa Service Map



Snap4city Data Ingestion Diagram

storage

Manual or automated
Registration
of Entities/Devices

**Entity/IoT
Directory**

registration
triples

NGSI



Orion Broker

IoT Orion Broker

IoT Orion Broker

IoT Orion Broker

IoT Orion Broker

Brokers

subscription note

NGSI

Real Time

Knowledge Base

Semantic Reasoners

Semantic Reasoners

SURI Link

Indexing and Aggregating
NIFI, OpenSearch

Data Managers

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A number of KB
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Federation
Smart City API, ASCAPI

API Manager

Cluster of **OpenSearch**
for storage with in
front a cluster of
NIFI

Platform Automation:
IoT Apps, Proc.Logics,
Python, ...



Data Analytics: ML, AI, XAI



Platform Control and Management

Massive data flow
entering

Massive data flow
exiting

Snap4City

User: rootooladmin1, Org: DISIT
Role: RootAdmin, Level: 7

LOGOUT

Notificator

Data, my Data, OpenData

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
- 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
- IOT Applications
- IOT Directory and Devices

Service Map (Toscana)

Public transport | Municipalities | Text Search | Address Search | Events

Select an agency:
- Select an Agency -

Select a line:
- Select a Line -

Select a route:
- Select a Route -

Select a bus stop:
- Select a Stop -

Position of selected Busses

Actual Selection:
Bus Stop: Salvemini

Regular Services | Transversal Services

Services Categories

- De/Select All
- Accommodation +
- Advertising +
- AgricultureAndLivestock +
- CivilAndEdilEngineering +
- CulturalActivity +
- EducationAndResearch +
- Emergency +
- Entertainment +
- Environment +
- FinancialService +
- GovernmentOffice +
- HealthCare +
- IndustryAndManufacturing +
- IoTDevice +
- MiningAndQuarrying +
- ShoppingAndService +
- TourismService +
- TransferServiceAndRenting +
- UtilitiesAndSupply +
- Wholesale +
- WineAndFood +

Filter:
search text into service

Service providing value type:
select value type

N. results: 100

Search Range: visible area

Search Area: select...

Search Results:
Services 100 of 60336 available

TPL STOP : Salvemini

ATAF&LINEA

Serviceuri: http://www.disit.org/km4city/resource/Bus_ataflinea_Stop_FM0612_500 GRAPH

Lines:

14 23 C1 C2

Display 10 Bus per page Search:

Time	Line	Direction
09:31:00 2020-10-07	C1	Parterre
09:33:00 2020-10-07	23	T2 Guidoni
09:36:00 2020-10-07	14	Santa Maria Maggiore
09:38:00 2020-10-07	C2	Leopolda T1 Porta Al Prato
09:39:00 2020-10-07	23	T2 Guidoni
09:40:00 2020-10-07	C1	Parterre

Showing page 1 of 45

Real-time data currently not available

Knowledge Base
Semantic Reasoners



- **KB is based on the Km4City ontology, It allows to:**
 - keep connected city entities each other:
 - Semantic Index, reticular
 - Perform spatial, geo graphic, and temporal reasoning
 - Discover city entities and their relationships via Proc.Logic / IoT App and Smart City API:
 - Entities / devices, sensors, city elements, roads, services, Brokers, etc. etc.
 - Provide access via Advanced Smart City API
 - Federate other Smart Cities / Knowledge Bases, the approach allows to scale geographically and create redundancies, improving performances

Views of the Knowledge Base

Knowledge Base
Semantic Reasoners



Helsinki KB Service Map

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

Public transport Municipalities Text Search Address Search Events

Select an agency:
- Select an Agency -
Select a line:
- Select a Line -
Select a route:
- Select a Route -
Select a bus stop:
- Select a Stop -

Position of selected Buses

Actual Selection
Service: 373773207E330127

LINKED OPEN GRAPH
Name: lot/orion/Finland/Helsinki/373773207E330127
Nature: Environment
Subnature: Air_quality_monitoring_station

Property	Type	Value
PM10	3	
PM2.5	2	
dateObserved	2019-10-22T00:59:42.939000+00:00	
reliability	0.5	
source	https://vth...	
airQualityPM10Gral	0.2405	@2019-10-22T00:00+01:00
airQualityPM10Emfuser	2.6207	@2019-10-22T00:00+01:00
RealTimeDeltaAQI	-0.1793	@2019-10-22T00:00+01:00
airQualityPM10RealTimeDeltaGral	2.2595	@2019-10-22T00:00+01:00
EmfuserAQI	1.1793	@2019-10-22T00:00+01:00
airQualityPM2_5Emfuser	0.7096	@2019-10-22T00:00+01:00
airQualityPM10RealTimeDelta	-0.1207	@2019-10-22T00:00+01:00
airQualityPM10AverageLastHour	2.5	@2019-10-22T00:00+01:00
RealTimeAQI	1	@2019-10-22T00:00+01:00
airQualityPM2_5AverageLastHour	1.9	@2019-10-22T00:00+01:00
airQualityPM2_5RealTimeDelta	1.1914	@2019-10-22T00:00+01:00

Linked Open Graph

Select a SPARQL endpoint:
Snap4City SmartCity Ontology (by DISIT)
http://www.disit.org/km4city/resource/lot/orion/Finland/Helsinki/373773207E330127

Your data
Select all Deselect all Invert Hide all inverse
exposedBy hasAttribute hasSystemCapability observes implements owl:sameAs owl:seeAlso rdf:type

Linked Open Graph

Identifier:
http://www.disit.org/km4city/resource/lot/orion/Finland/Helsinki/373773207E330127

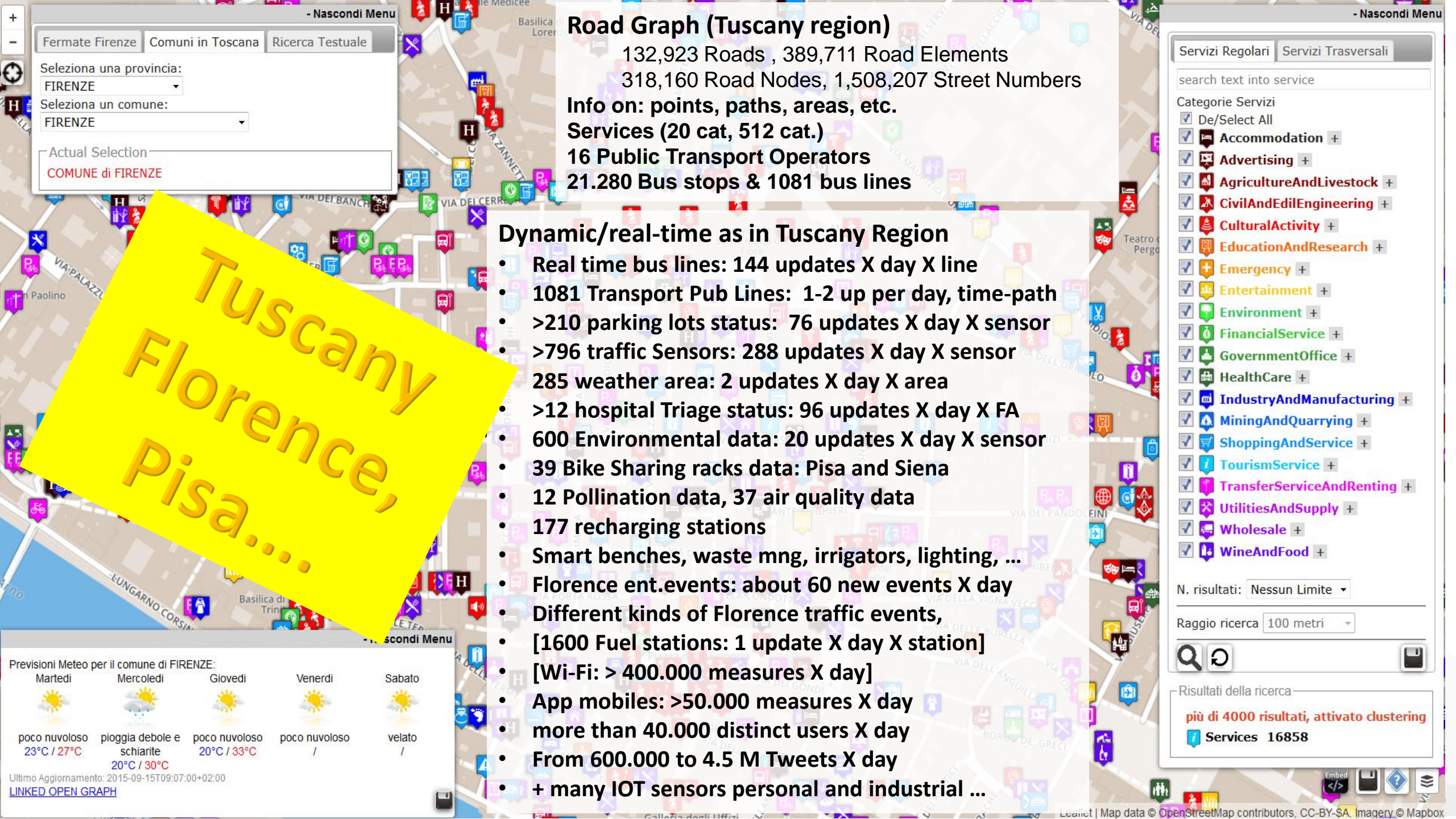
Image:

Info:

- http://www.w3.org/2003/01/geo/wgs84_pos#lat: 60.15858
- http://www.w3.org/2003/01/geo/wgs84_pos#long: 24.921349
- http://schema.org/name: 373773207E330127
- http://www.disit.org/km4city/schema#format: json
- http://www.disit.org/km4city/schema#macaddress: ...

Network graph showing relationships between concepts like AirQualityObject, hasAttribute, exposedBy, hasSystemCapability, observes, implements, owl:sameAs, owl:seeAlso, rdf:type, and Sensor.

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



- Nascondi Menu

Fermate Firenze Comuni in Toscana Ricerca Testuale

Seleziona una provincia:
FIRENZE

Seleziona un comune:
FIRENZE

Actual Selection
COMUNE di FIRENZE

Road Graph (Tuscany region)

132,923 Roads , 389,711 Road Elements
318,160 Road Nodes, 1,508,207 Street Numbers

Info on: points, paths, areas, etc.

Services (20 cat, 512 cat.)

16 Public Transport Operators

21.280 Bus stops & 1081 bus lines

**Tuscany
Florence,
Pisa....**

Dynamic/real-time as in Tuscany Region

- Real time bus lines: 144 updates X day X line
- 1081 Transport Pub Lines: 1-2 up per day, time-path
- >210 parking lots status: 76 updates X day X sensor
- >796 traffic Sensors: 288 updates X day X sensor
- 285 weather area: 2 updates X day X area
- >12 hospital Triage status: 96 updates X day X FA
- 600 Environmental data: 20 updates X day X sensor
- 39 Bike Sharing racks data: Pisa and Siena
- 12 Pollination data, 37 air quality data
- 177 recharging stations
- Smart benches, waste mng, irrigators, lighting, ...
- Florence ent.events: about 60 new events X day
- Different kinds of Florence traffic events,
- [1600 Fuel stations: 1 update X day X station]
- [Wi-Fi: > 400.000 measures X day]
- App mobiles: >50.000 measures X day
- more than 40.000 distinct users X day
- From 600.000 to 4.5 M Tweets X day
- + many IOT sensors personal and industrial ...

Servizi Regolari Servizi Trasversali

search text into service

- Categorie Servizi
- De/Select All
 - Accommodation +
 - Advertising +
 - AgricultureAndLivestock +
 - CivilAndEdilEngineering +
 - CulturalActivity +
 - EducationAndResearch +
 - Emergency +
 - Entertainment +
 - Environment +
 - FinancialService +
 - GovernmentOffice +
 - HealthCare +
 - IndustryAndManufacturing +
 - MiningAndQuarrying +
 - ShoppingAndService +
 - TourismService +
 - TransferServiceAndRenting +
 - UtilitiesAndSupply +
 - Wholesale +
 - WineAndFood +

N. risultati: Nessun Limite

Raggio ricerca 100 metri

🔍 ↻ 📄

Risultati della ricerca

più di 4000 risultati, attivato clustering
Services 16858

Previsioni Meteo per il comune di FIRENZE:

Martedì	Mercoledì	Giovedì	Venerdì	Sabato
poco nuvoloso 23°C / 27°C	pioggia debole e schiarite 20°C / 30°C	poco nuvoloso 20°C / 33°C	poco nuvoloso /	velato /

Ultimo Aggiornamento: 2015-09-15T09:07:00+02:00
[LINKED OPEN GRAPH](#)

Discovery



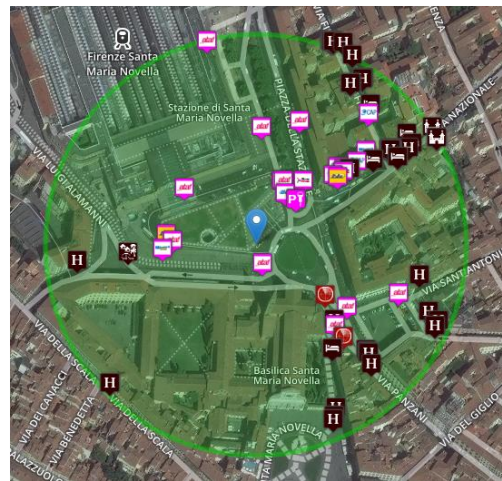
Around a point or POI

Search by Shape and Distance

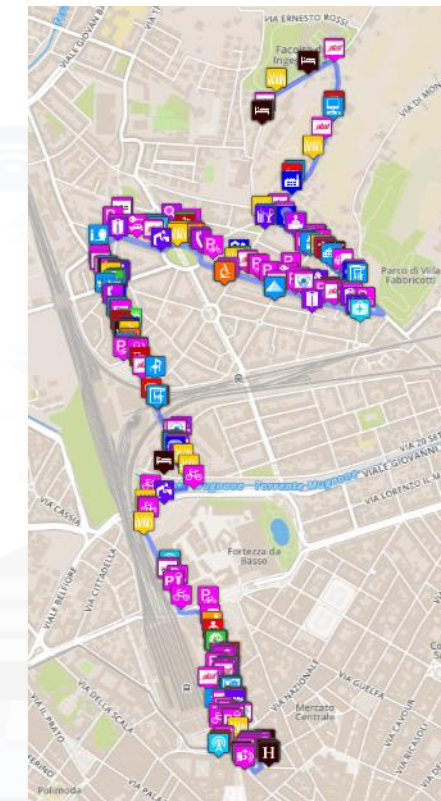
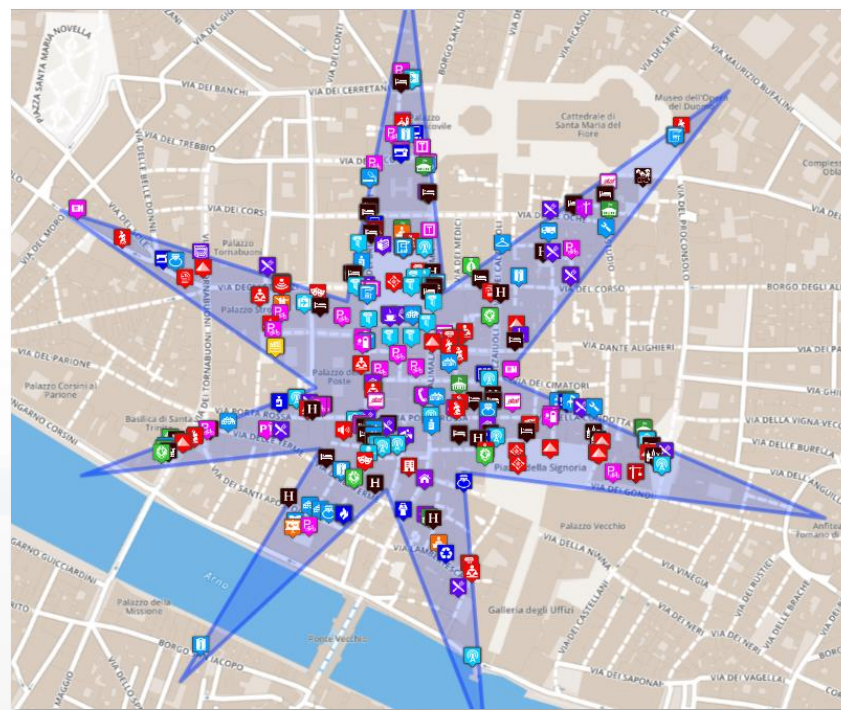
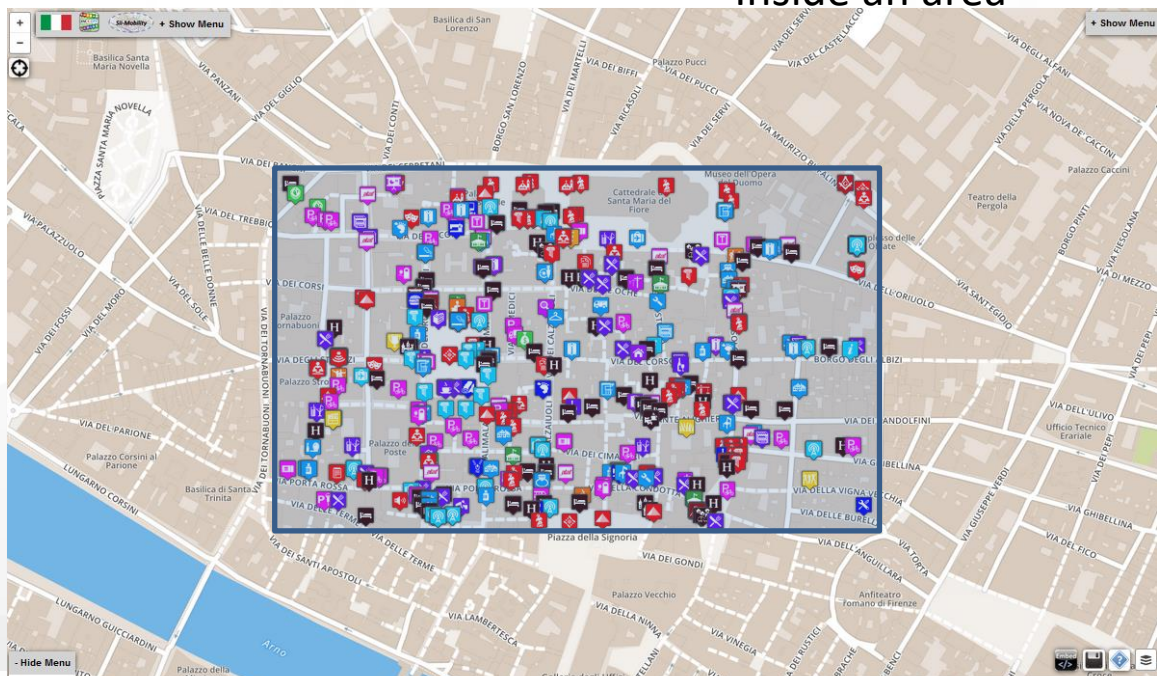
Each request or search in the Km4City model can be referred to a point and a ray, to an area, to a polyline

Inside a closed polyline

Along a polyline



Inside an area



Knowledge Base
Semantic Reasoners

Cycling Paths

The screenshot displays the ServiceMap web application interface. On the left, a sidebar menu allows users to select a line, route, bus stop, and view the position of selected buses. The main map area shows a network of red cycling paths overlaid on a street map of Florence, with various icons representing different services like bus stops and digital locations. On the right, a control panel offers options for regular and transversal services, including filters for areas, digital locations, and paths. Below the map, two mobile app preview windows show the service map on a smartphone, displaying search results for cycling paths and other services.



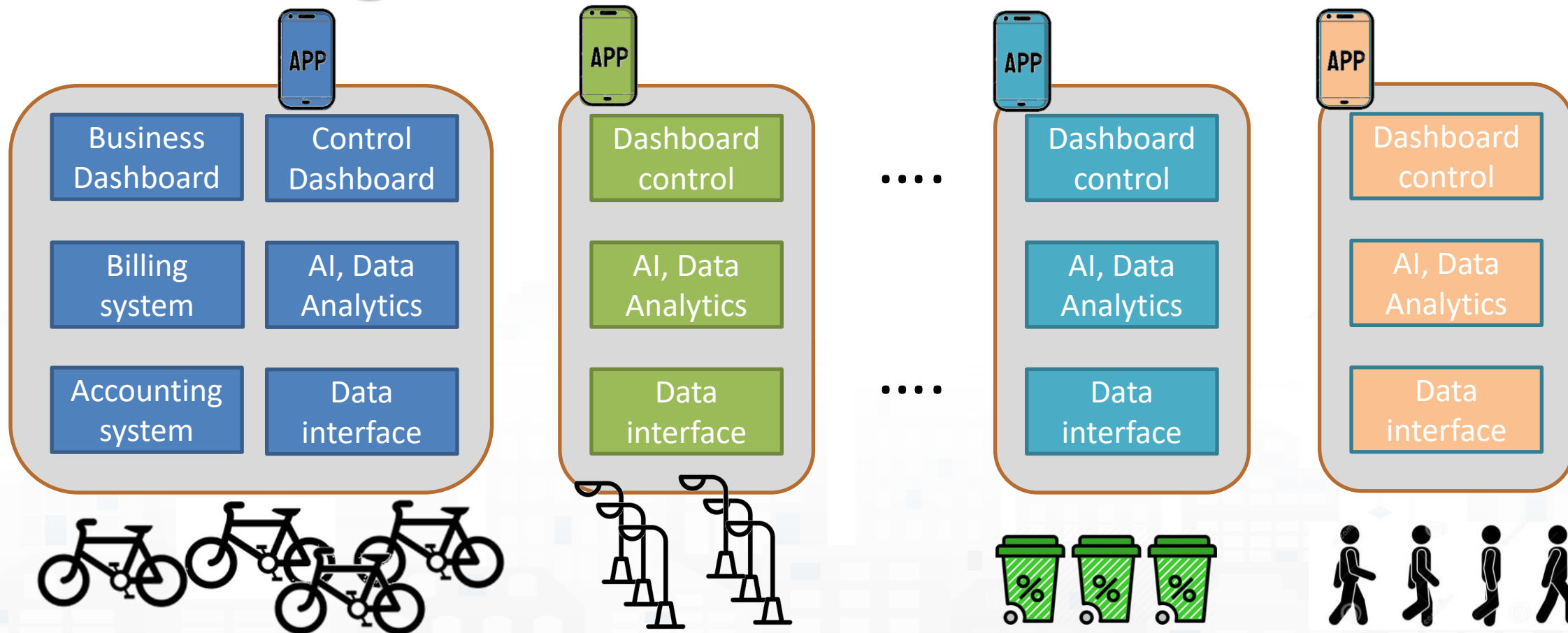
Knowledge Base
Semantic Reasoners

ServiceMap: <https://servicemap.km4city.org>

*Set up of the **Knowledge Base** performed with an open source tool*



Avoiding to have a collection of verticals



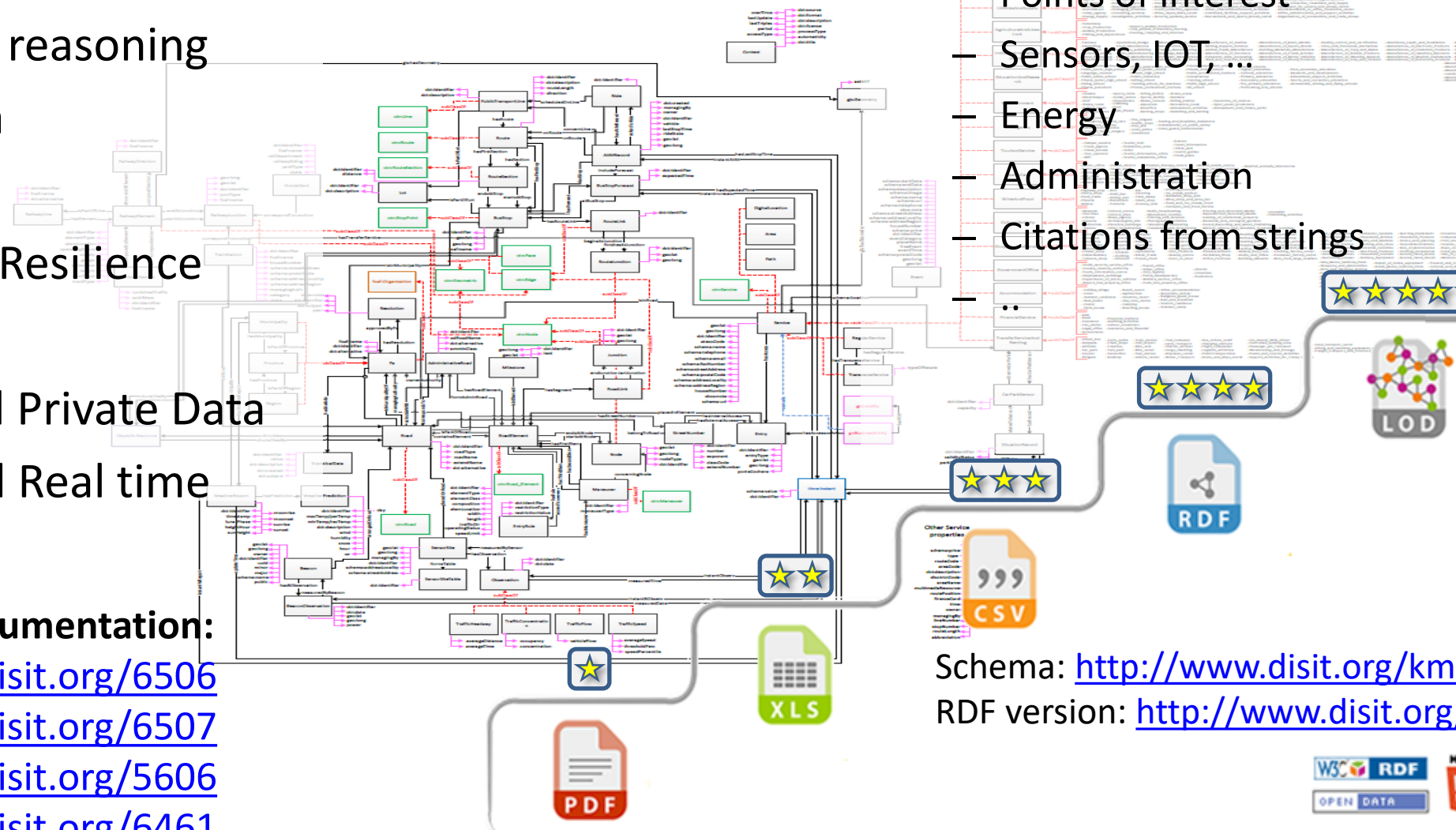
Simplifying the development and integration of verticals

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

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



Big Data Tools



LOD and reasoners



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



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

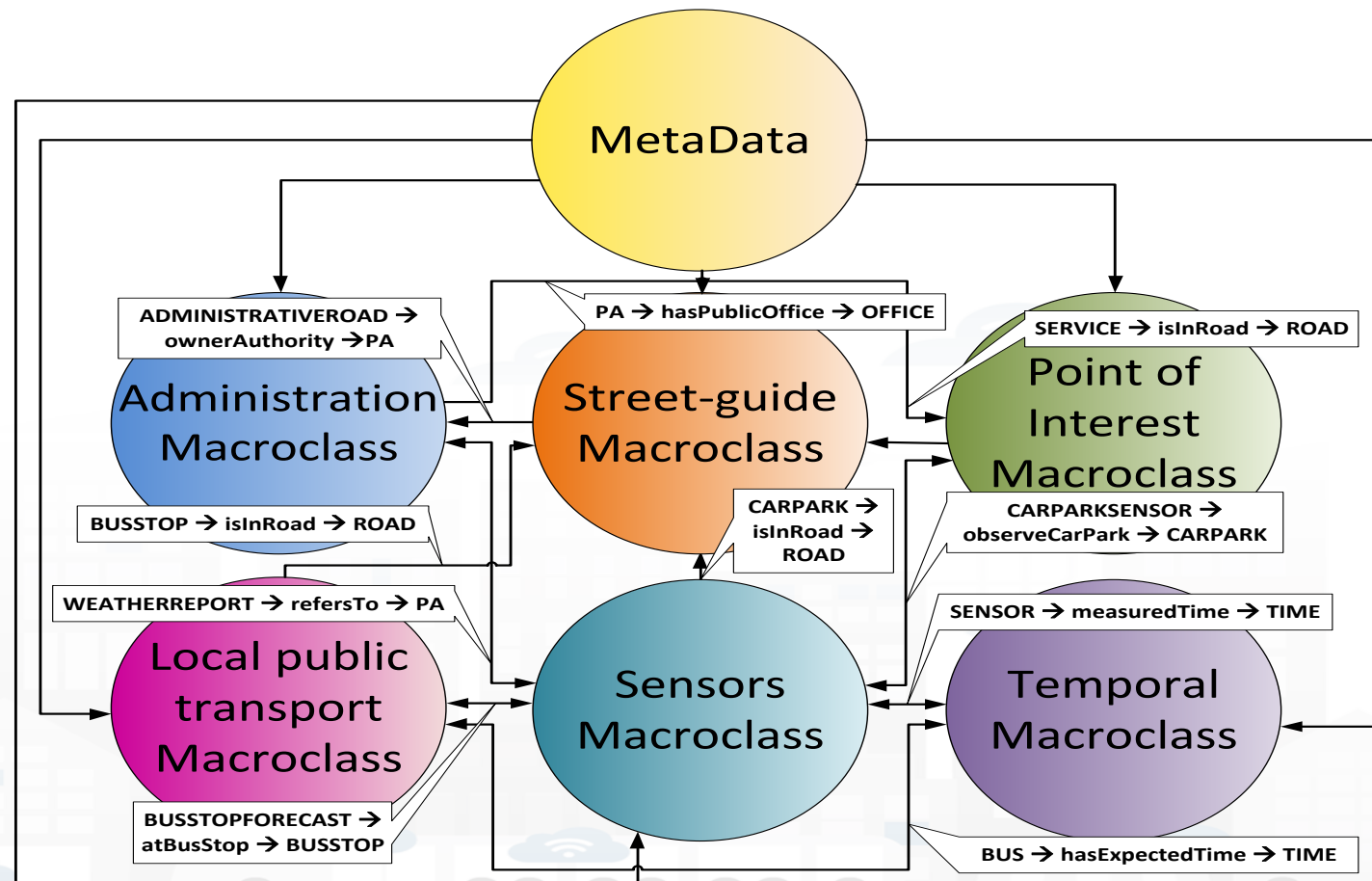


- **Km4City is the reference ontology for Snap4City**, It allows to:
 - keep connected city entities each other:
 - Semantic Index, reticular
 - Perform spatial, geo graphic, and temporal reasoning
 - Provide access via Advanced Smart City API
 - Discover city entities and their relationships via Proc.Logic / IoT App and Smart City API:
 - Entities / devices, sensors, city elements, roads, services, Brokers, etc. etc.
 - Federate other Km4City Knowledge Bases, the approach allows to scale geographically and create redundancies, improving performances
- Documentation
 - [TC5.15 - Snap4City Smart City API Collection and overview, real time](#)
 - [ServiceMap and ServiceMap3D, Knowledge Model, Km4City Ontology](#)
 - [Knowledge Base Graphs and Queries: browsing and queries into the KB](#)

Smart-city Ontology: 1.6

- covers different aspects:

- Administration
- Street-guide
- Points of interest
- Local public transport
- Sensors
- Temporal aspects
- Metadata on the data
- Industry 4.0 structures



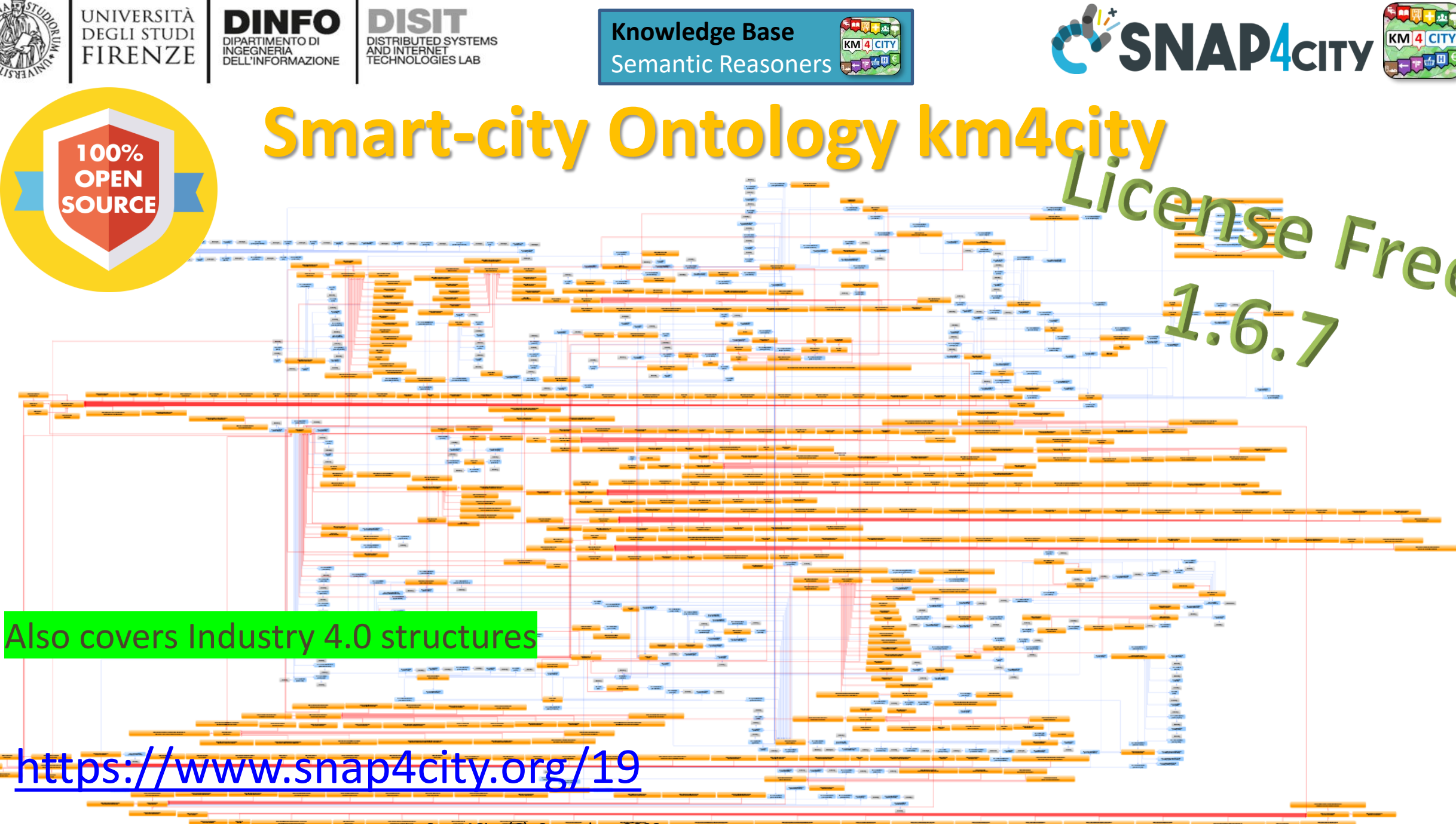
Km4City Ontology elements 1.6.7

- **Km4C:** Km4City 1.6.7
- Using
 - **DCTERMS:** for metadata Dublin Core Metadata Initiative
 - **FOAF:** friends of a friends
 - **Good Relation:** entities relationships
 - **iot-lite:** IOT Vocabulary
 - **OTN:** Ontology of Transportation Networks
 - **OWL-Time:** time reasoning
 - **SAREF** Smart Appliances REference extension for building devices available at <https://saref.etsi.org/saref4bldg/>
 - **Schema.org** for people and organizations
 - **SSN:** Semantic Sensor Network Ontology (see <https://www.w3.org/TR/vocab-ssn/>)
 - **WGS84** Datum of Geo-Objects
 - **GTFS**, General Transit Feed Specification, and **Transmodel**, for public transport infrastructures: lines/rides time schedules, real-time records, paths, etc.;



Smart-city Ontology km4city

License Free
1.6.7



Also covers Industry 4.0 structures

<https://www.snap4city.org/19>

Set up of the Knowledge Base, KB

- The **KB starts with the ontology and empty in terms of instances**, it should to be **initialized** with the Road Graph(s) of interest, but may be not needed in some cases.
- **Road Graphs** can be obtained from:
 - GIS of the municipalities, regional govern, etc.
 - Open Street Map, OSM
 - Etc.
- See this note on KM vs OSM: <https://www.snap4city.org/397>
- Snap4City provides a tool for **feeding the KB with OSM**
 - [TC5.10- Open Street Map ingestion process](#)
 - [From the Open Street Map to the Km4City street graph](#)
 - <https://www.snap4city.org/download/video/From%20the%20Open%20Street%20Map%20to%20the%20Km4City%20street%20graph.pdf>
 - **OSM2KM4C** tool is included into KBSM, VM and Docker <https://www.snap4city.org/471>
 - Tool: <https://github.com/disit/osm2km4c>
- The load of a city of 1 Million of inhabitants can be done in few hours.

Knowledge Base
Semantic Reasoners



Which are the mechanisms to send data into the Knowledge Base?

The KB is feed with new concepts and entities, and they are produced by the solution and feed into the KB:

- (i) automatically by the Entity/Device Directory about all the new registered Entities / Devices which are registered on some IoT broker which have been already registered on Directory
- (ii) automatically from an Proc.Logic / IoT App it is possible to generate triples in somehow and poste them in N3 formats into the specific KB you targeted, according to the ORG you have
- (iii) automatically from POI Loader tool that takes Excel file in input and generate triples for a specific your organization
- (iii) manually producing triples and send them to RootAdming for feeding KB, or using an IOT App for feeding KB
- (iv) converting OSM in triples about road graph details by using a tool called
 - From the Open Street Map to the Km4City street graph, OSM2SM, OSMOSIS
 - <https://www.snap4city.org/download/video/From%20the%20Open%20Street%20Map%20to%20the%20Km4City%20street%20graph.pdf>

Linked Open Graph

LOG: <https://log.disit.org>

Linked Open Graph

SiiMobility (by DISIT)

Examples:

- VIA GIACOMO MATTEOTTI
- Bagno a ripoli
- Florence

Choose a class:

Search for keyword

keyword:

uri: Request

Your data

sparql endpoint: (optional)

uri: Request

Status

Requests:

Remove Clear

Type of relations

Select all Deselect all Invert Hide all inverse

- belongTo
- contains
- ends
- has
- hasExternalAccess
- hasProvince
- hasStreetNumber
- isIn
- isPartOfProvince
- managingAuthority
- placedIn
- seeAlso
- coincideWith
- depiction
- forming
- hasAccess
- hasMunicipality
- hasRule
- inMunicipalityOf
- isPartOf
- isPartOfRegion
- ownerAuthority
- sameAs
- starts

Linked Open Graph

more 5 hasProvince...
Entities: 16
Relations: 32

museo ferragamo

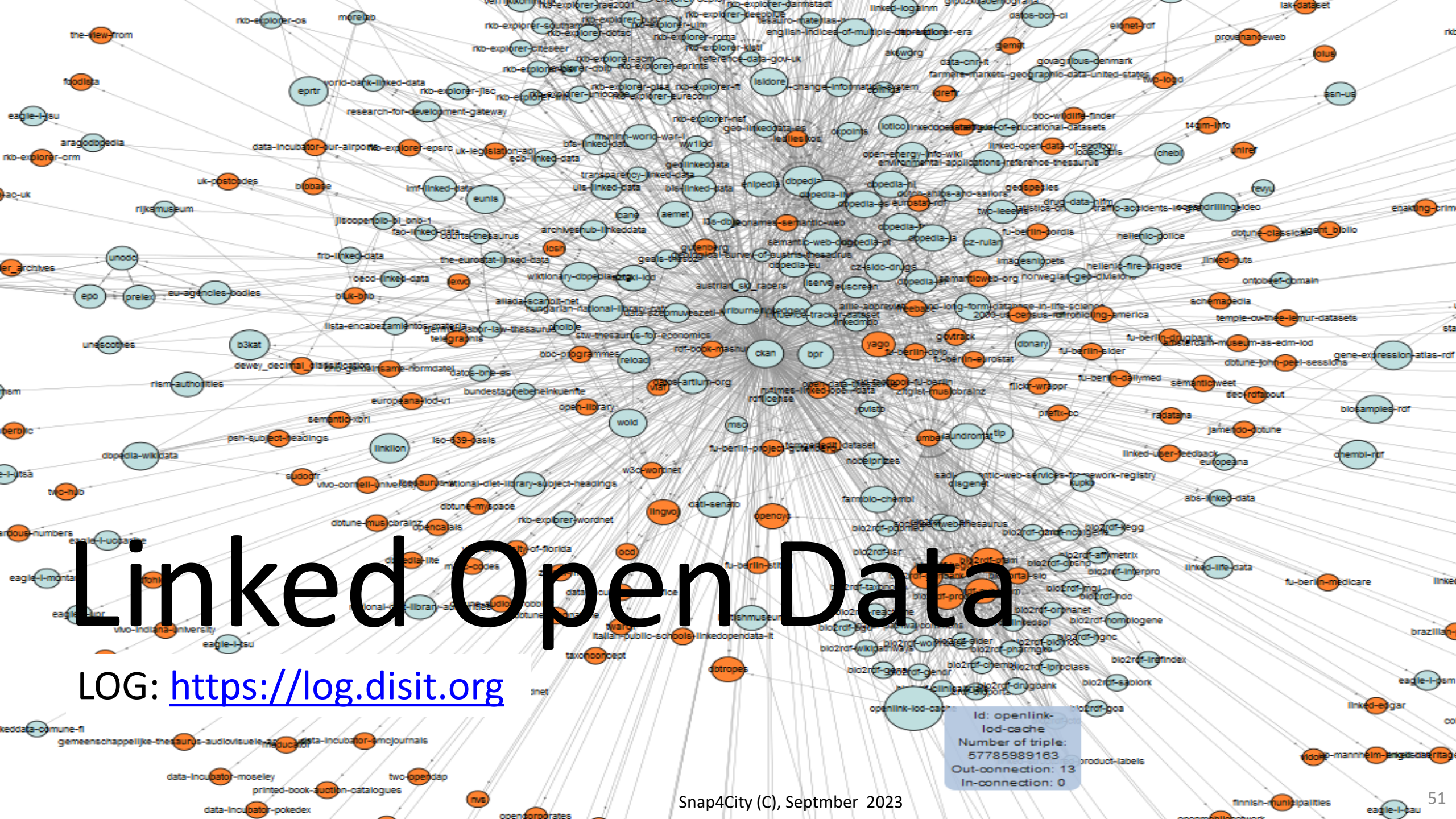
DESCRIPTION

Relations of Museo Ferragamo with the road graph

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

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

50



Linked Open Data

LOG: <https://log.disit.org>

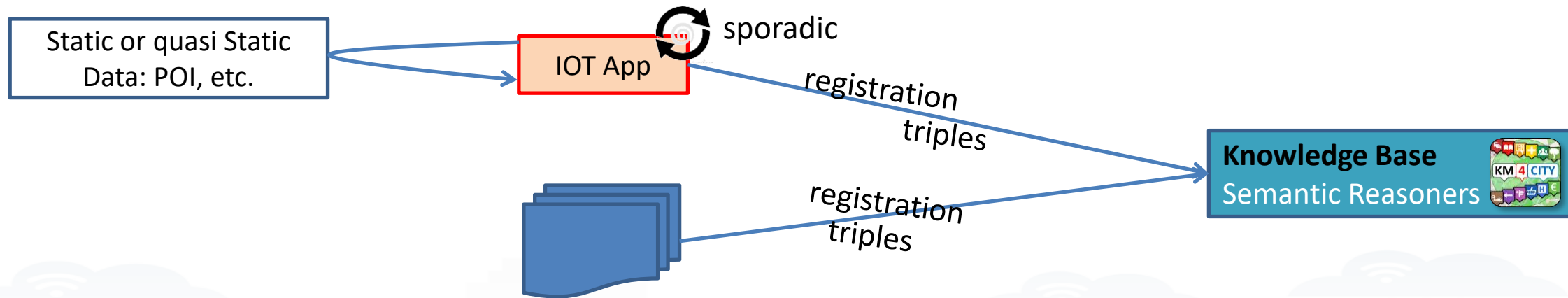
Id: openlink-lod-cache
Number of triple:
57785989163
Out-connection: 13
In-connection: 0

How to load triples into the KB

(Admin and on-premise)



Loading Static Data into KB



- The loading is performed via
 - Proc.Logic / IoT App, with a specific flow exploiting a **MicroService/API of ServiceMap, KB**
 - **files of triples** on a shared folder of the ServiceMap, KB, for massing loading of Triples. For batch loading of triples

Load Triples in KB

Pre-requirements:

- Available only for your Proc.Logic / App on premise and for administrators

Load Static Data on Snap4City KB:

- Register Static Data on Snap4City KB (point 1 and 2 on the right)
- Connect the additional blocks present in the IOT App and save ('Deploy' button)
- Upload your csv

<https://www.snap4city.org/596>

Register Static Data on Snap4City KB:

1. 'Regularize' your data (csv)
2. Create your IoTApp
3. Upload your csv

The screenshot displays the Snap4City user interface. On the left, a sidebar shows the user profile (User: paolucci, Org: DISIT, Role: ToolAdmin, Level: 6) and a list of dashboards and IOT Applications. The main area shows a Node-RED flow titled 'Flow 2' with the following steps: 1. 'csv' block (labeled '1.2') with a 'Static data generation' tooltip. 2. 'produce triples' block. 3. 'Email adapting' block. 4. 'send email from xxxxxxxx' block (with a 'send failed' indicator). 5. 'html' block. 6. 'http' block. 7. 'prepare DELETE graph' block. 8. 'tripleToVirtuoso (3)' block. 9. 'prepare POST' block. 10. 'tripleToVirtuoso (3)' block. A 'Deploy' button is visible in the top right corner. A blue arrow points from the 'prepare DELETE graph' block to the 'prepare POST' block.

Load Triples in KB

- Additional Option Only for ONPREMISE Snap4City versions and for administrators
- In case you need to upload ONLY on the Knowledge Base a set of data containing static data and dynamic data all together:
 - Example: Cultural Events or weather predictions
- Use a predefined IoT App available here <https://www.snap4city.org/594> (with the copy and past method, you can create your Mobile App)
- Add:
 - Inject block
 - Function block
 - Debug block
- The function block must contain ...
- Now you can see the triples to be updated in the Knowledge Base in the Debug Tab

The screenshot shows the Snap4City Node-RED interface. On the left, there is a sidebar with user information (User: paolucci, Org: DISIT, Role: ToolAdmin, Level: 6) and a list of dashboards. The main workspace shows a flow with four blocks: 'timestamp', 'function', 'triplesToVirtuoso', and 'msg.payload'. The 'triplesToVirtuoso' block is highlighted, and its configuration is visible in the right-hand pane. The configuration includes fields for Name, Type, and ID.

The input message to be provided to *triplesToVirtuoso* has to have the following properties:

msg.user="dba" // the user of virtuoso to be used to access to virtuoso

msg.passw="dba" //the password

msg.method="POST" //the http method: GET, POST, DELETE, PUT

msg.url="http://virtuoso-kb:8890/sparql-graph-crud-auth?graph-uri=urn:graph:POIs"

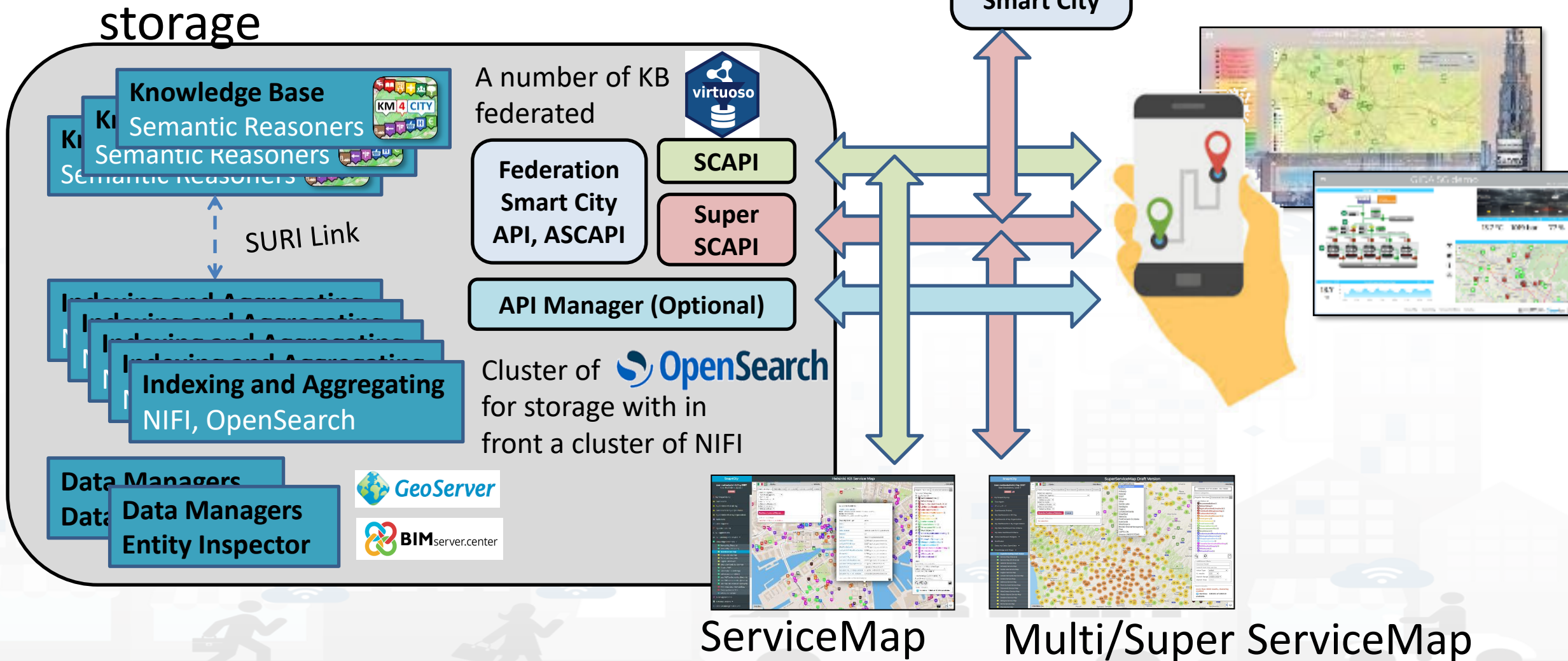
msg.triples= "..."

TOP

The role of Knowledge base and ServiceMaps



Accessing to Snap4City Services





- ServiceMap is the **main Tool** to:
 - monitor the status of the Knowledge Base
 - test queries and produce query and SmartCity API testing calls for developers
 - Any kind of search (semantic, full text, etc.), routing,
 - Access at the specific Graph Data base via LOG.disit.org
- **ServiceMap is showing:**
 - only **public data**. Private data are not shown via ServiceMap but can be accessed via DataInspector
 - data regarding a **single Knowledge Base** of the federated network of KBs. Each KB may contain multiple Organizations.
 - technical views for developers
- **Super ServiceMap** shows to you your private data and data which have been delegated in Access to you.
- In most cases we refer as ServiceMap to intend both Super and basic
- In the installations on Cloud, the Super is the Default used by Dashboards, on premise the basic ASCAPI are the default

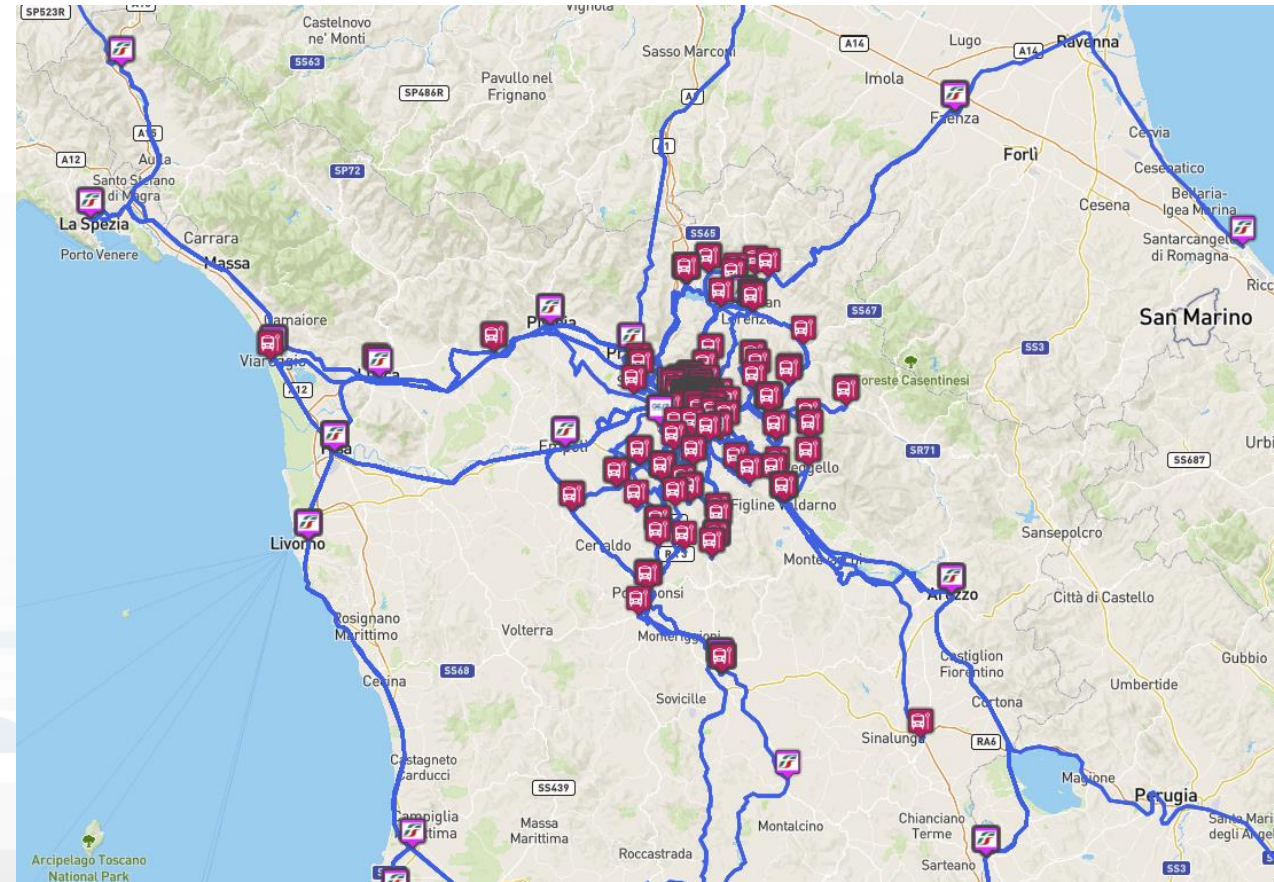
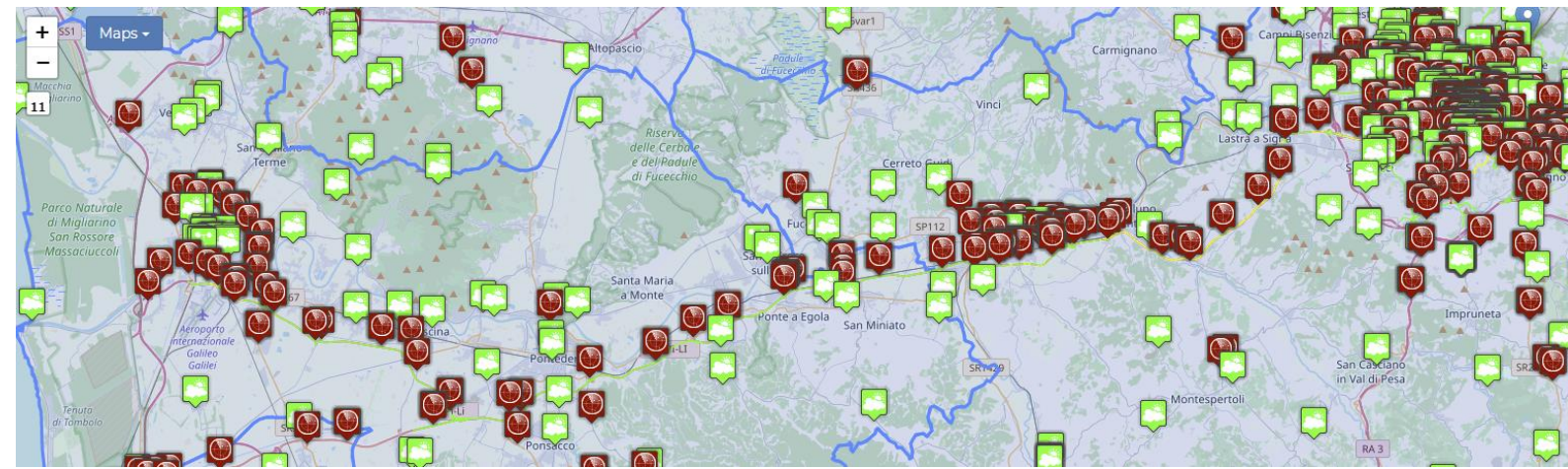
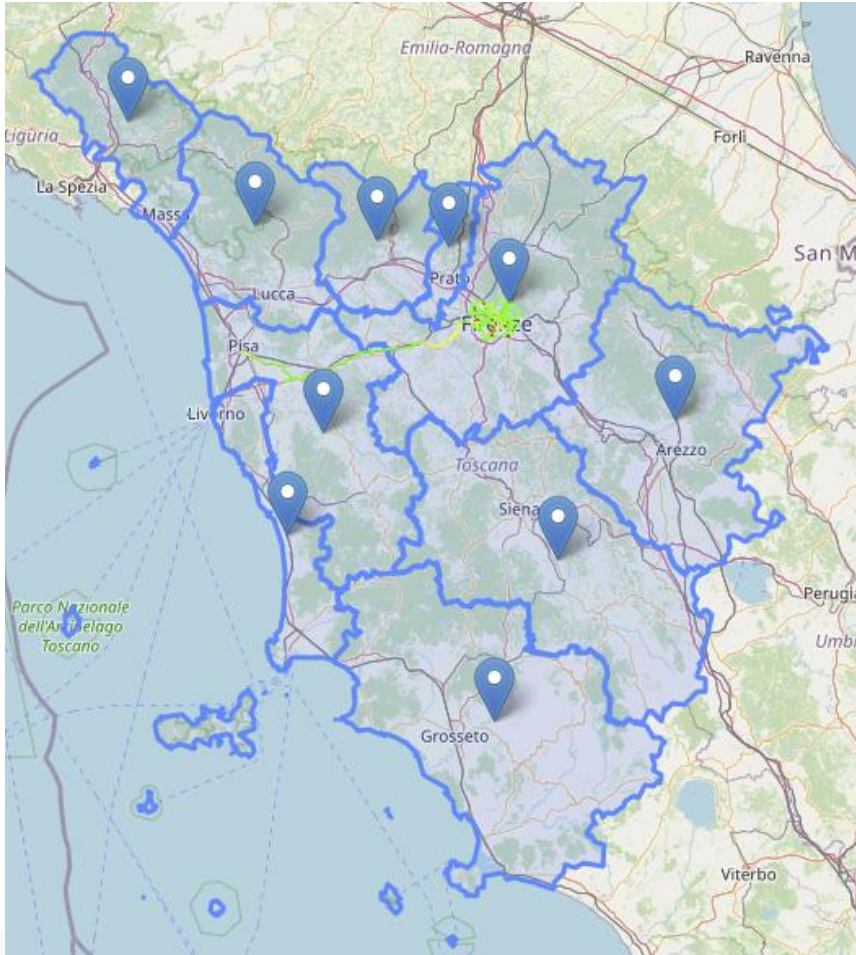


TOP

Federation of: Service Maps, Knowledge Bases, Smart City APIs

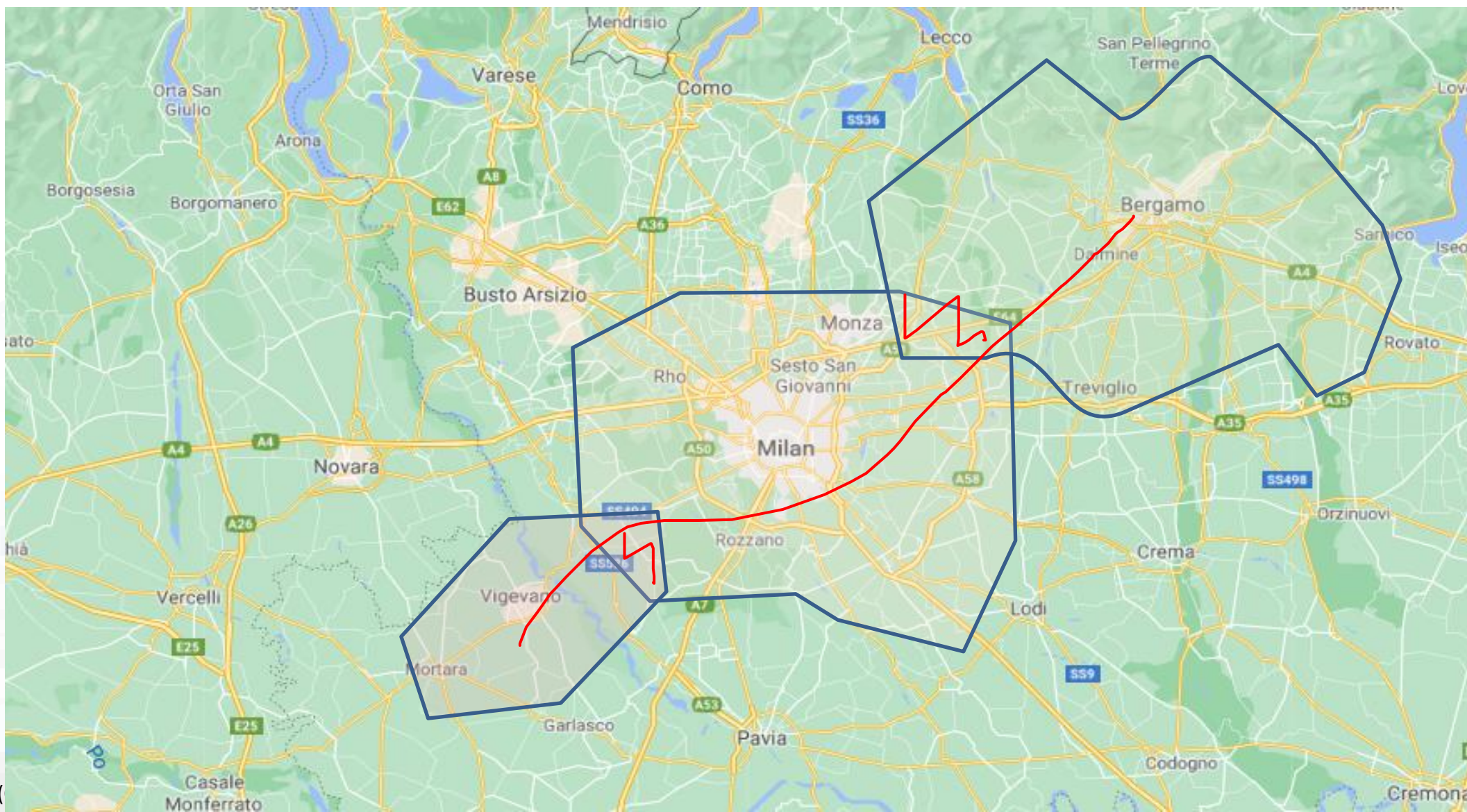
- Knowledge and Maps
 - Service Map (Toscana)
 - Service Map 3D (Firenze)
 - Helsinki Service Map
 - Antwerp Service Map
 - Garda Lake Service Map
 - Cagliari Service Map
 - Lonato Del Garda Service Map
 - Greece Service Map
 - Valencia Service Map
 - Pont Du Gard Service Map
 - Dubrovnik Service Map
 - WestGreece Service Map
 - Mostar-Bosnia Service Map
 - Svealand Service Map
 - Bologna Service Map
 - Roma Service Map
 - Pisa Service Map





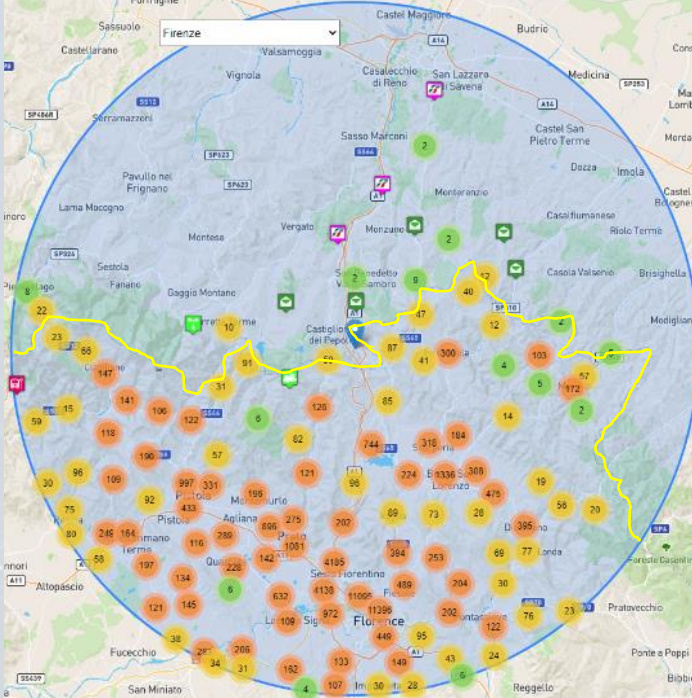
Admin Models & limitations

One Snap4City Platform may serve Multiple Cities





Knowledge Base Semantic Reasoners



Hide Menu

LOGIN

Username: - Org: -

Search Categories:

Regular Services Transversal Services

Services Categories

- De/Select All
- Accommodation
- Advertising
- AgricultureAndLivestock
- CivilAndEdilEngineering
- CulturalActivity
- EducationAndResearch
- Emergency
- Entertainment
- Environment
- FinancialService
- GovernmentOffice
- HealthCare
- IndustryAndManufacturing
- MiningAndQuarrying
- ShoppingAndService
- TourismService
- TransferServiceAndRenting
- UtilitiesAndSupply
- Wholesale
- WineAndFood

Model:

Service Model

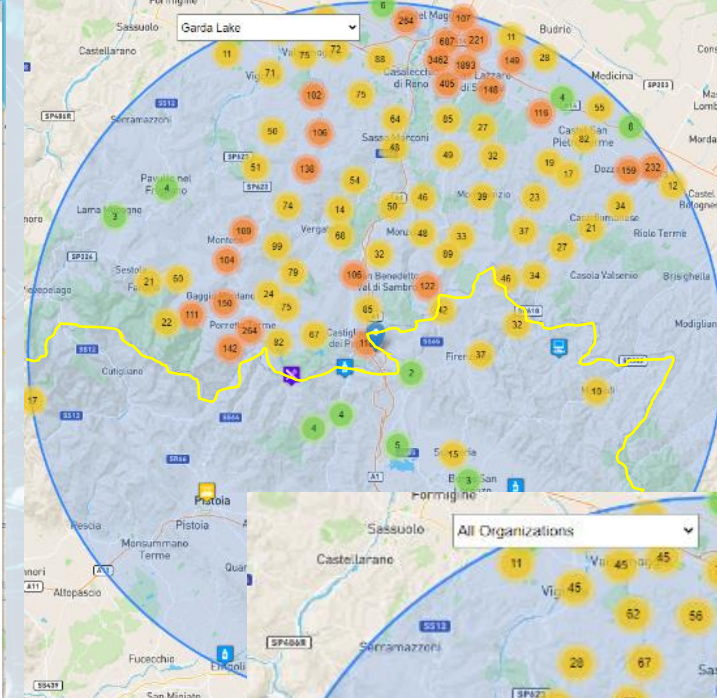
Filter:

search text into service

Service providing value type: select value type

N. results: (No Limit)

Search range: 50 km



Hide Menu

LOGIN

Username: - Org: -

Search Categories:

Regular Services Transversal Services

Services Categories

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- MiningAndQuarrying
- ShoppingAndService
- TourismService
- TransferServiceAndRenting
- UtilitiesAndSupply
- Wholesale

Model:

Service Model

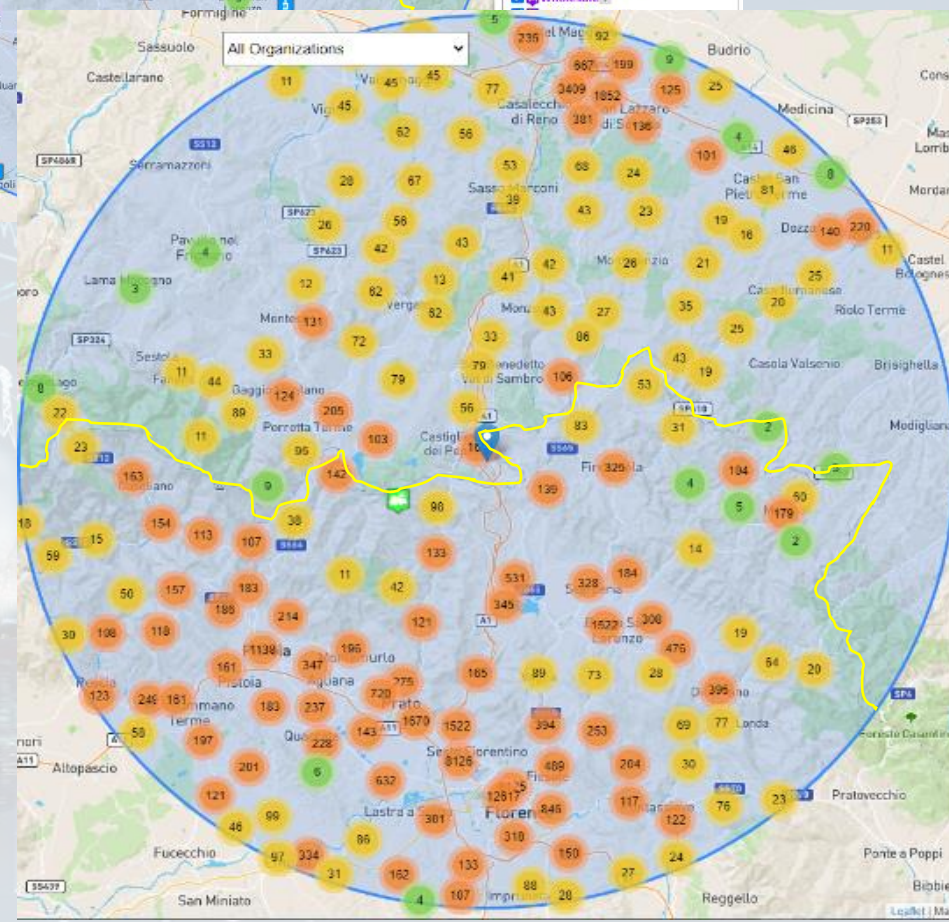
Filter:

search text into service

Service providing value type: select value type

N. results: (No Limit)

Search range: 50 km



Hide Menu

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Username: - Org: -

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- MiningAndQuarrying
- ShoppingAndService
- TourismService
- TransferServiceAndRenting
- UtilitiesAndSupply
- Wholesale
- WineAndFood

Model:

Service Model

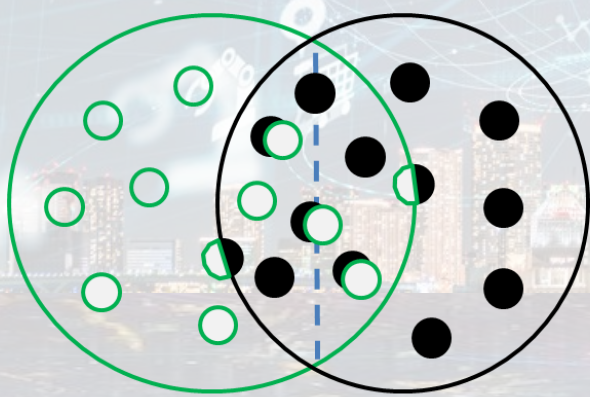
Filter:

search text into service

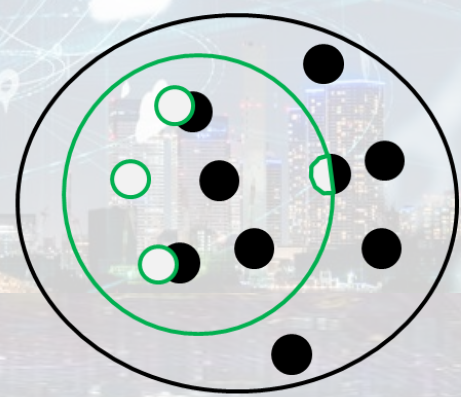
Service providing value type: select value type

N. results: (No Limit)

Search range: 50 km



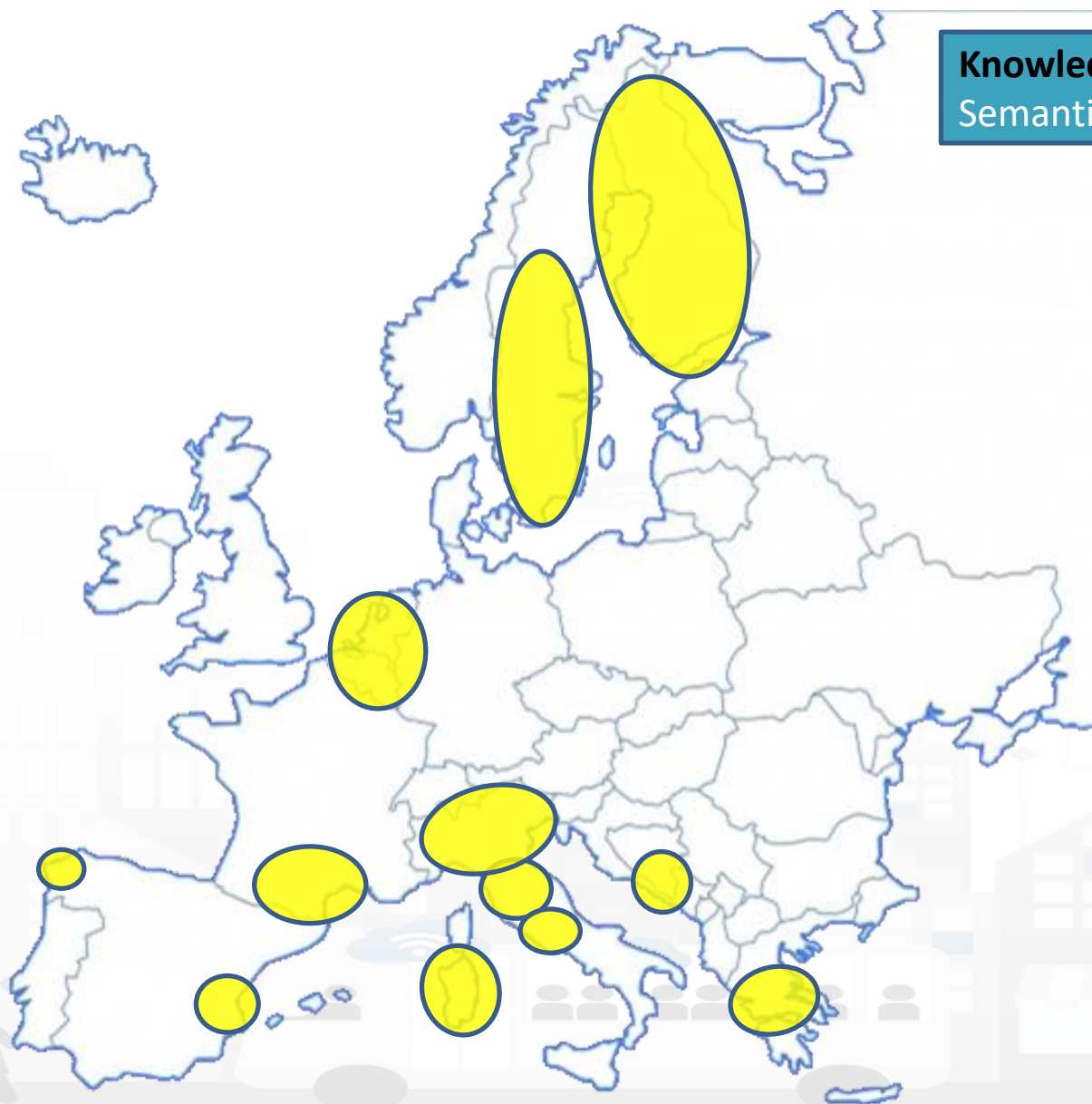
a) Overlap



b) Inclusion

Main Organizations/areas

- [Antwerp area \(Be\)](#)
- Capelon (Sweden)
- [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 \(Gr\)](#)



Knowledge Base
Semantic Reasoners



Federated ServiceMap and Smart City API

To improve scalability, fault tolerance and federation among cities:

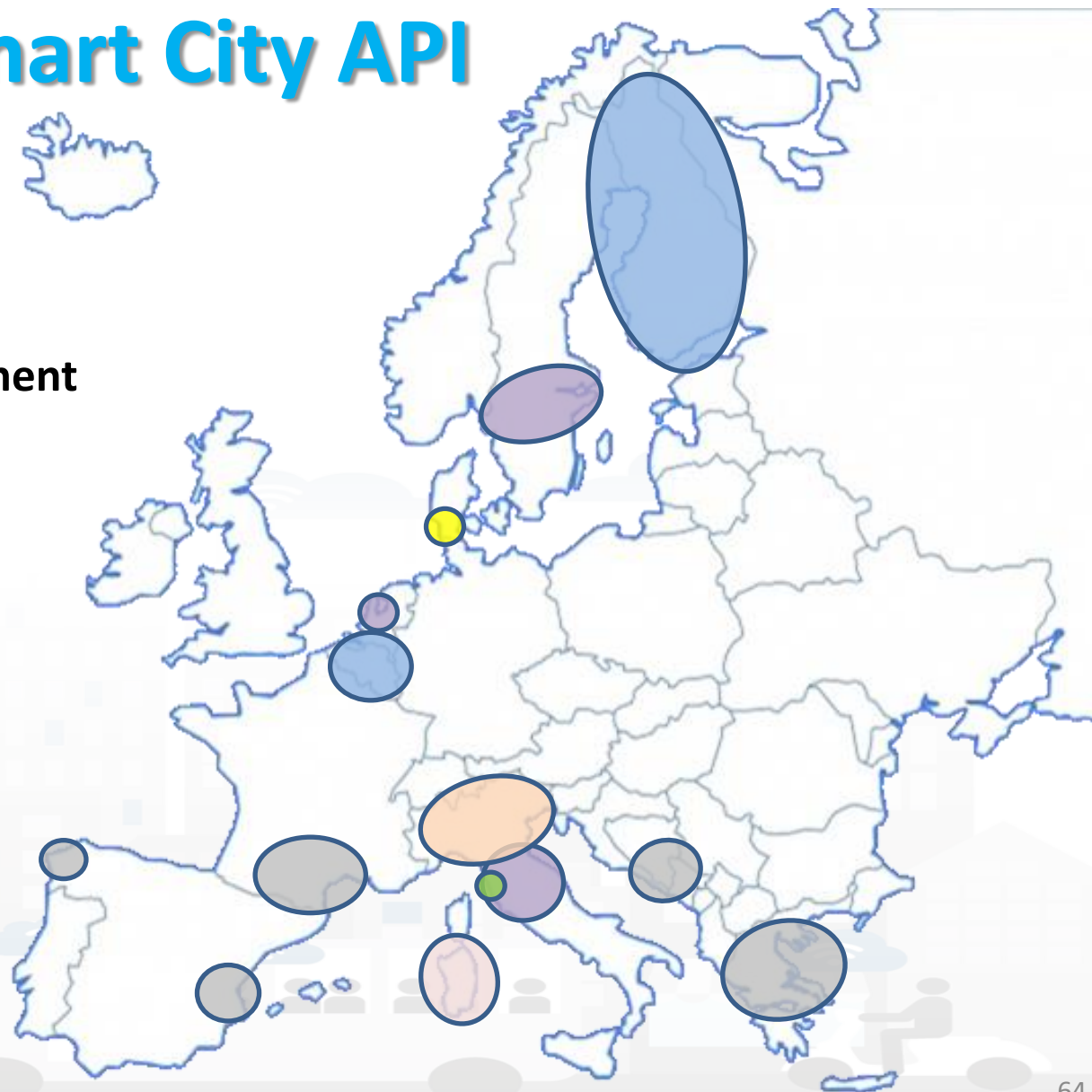
- One entry point Smart City API for all zones
- Multiple Knowledge base See performance assessment

At different levels:

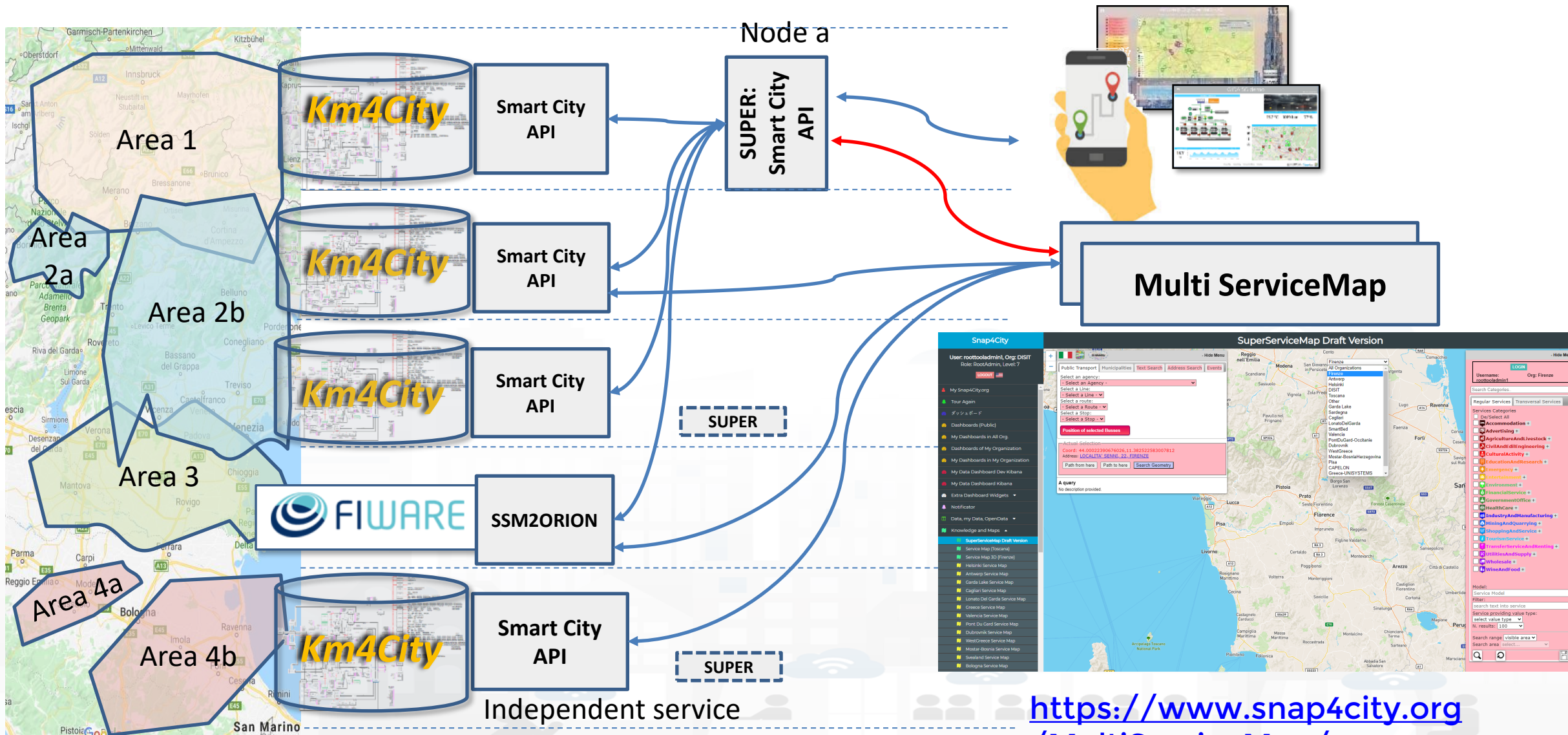
- Among cities/regions
- Among data providers, Operators

By Means of:

- Smart City API → Apps
- Smart City Ontology
- Dashboards/data analytics
- Organization independent



MultiServiceMap



<https://www.snap4city.org/MultiServiceMap/>

Snap4City
SuperServiceMap Draft Version

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
- SuperServiceMap Draft Version
- 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
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- Valencia Service Map
- Pont Du Gard Service Map
- Dubrovnik Service Map
- WestGreece Service Map
- Mostar-Bosnia Service Map
- Svealand Service Map
- Bologna Service Map
- Roma Service Map
- Pisa Service Map

Public transport Municipalities Text Search Address Search Events

Select an agency:
- Select an Agency -

Select a line:
- Select a Line -

Select a route:
- Select a Route -

Select a bus stop:
- Select a Stop -

Show the Position of Vehicles Cancel

Actual Selection
No selection

All Organizations

- All Organizations
- Firenze
- Antwerp
- Helsinki
- DISIT
- Toscana
- Other
- Garda Lake
- Sardegna
- Cagliari
- LonatoDelGarda
- SmartBed
- Valencia
- PontDuGard-Occitanie
- Dubrovnik
- WestGreece
- Mostar-BosniaHerzegovina
- Pisa
- CAPELON
- Greece-UNISYSTEMS

USERNAME: ROOTTOOLADMIN1, ORG: FIRENZE

Search Categories...

Regular Services Transversal Services

De/Select All

- Accommodation +
- Advertising +
- AgricultureAndLivestock +
- CivilAndEdilEngineering +
- CulturalActivity +
- EducationAndResearch +
- Emergency +
- Entertainment +
- Environment +
- FinancialService +
- GovernmentOffice +
- HealthCare +
- IndustryAndManufacturing +
- MiningAndQuarrying +
- ShoppingAndService +
- TourismService +
- TransferServiceAndRenting +
- UtilitiesAndSupply +
- Wholesale +
- WineAndFood +

Additional Filters

Service Model

search text into service

Value Type

N. results

Search Range

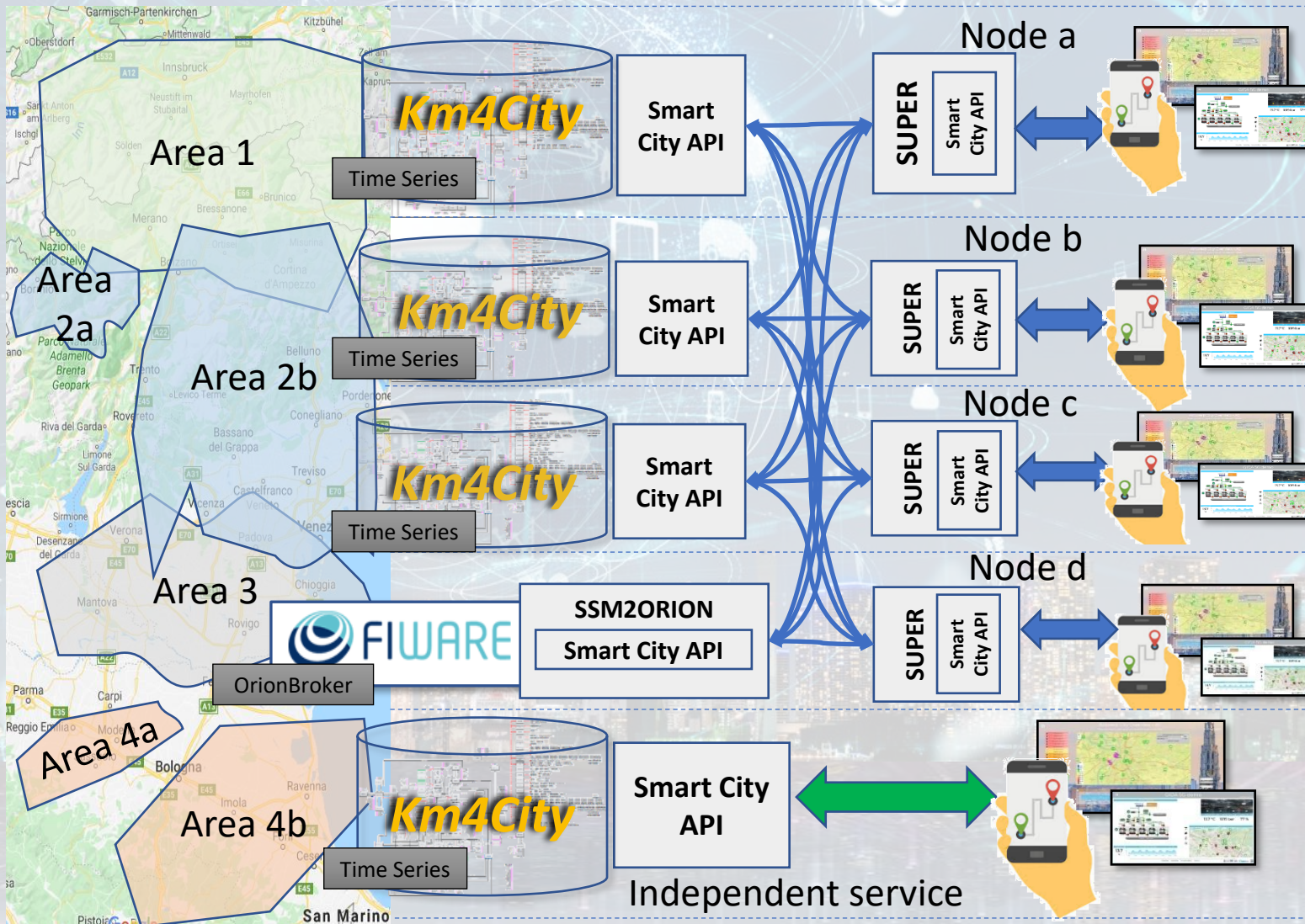
Search Area

Search Results

more than 4000 results, clustering enabled

Services 108102 of 108310 available

Federation of Smart City Services



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

- Super, Nodes and SSM2ORION presents the same Smart City APIs.
- The **network of Super** can be reconfigured dynamically
 - Multiple networks of Super can be realized as well
 - Distributed Searches via the Federation of Super are performed with $o(1)$ complexity
 - Results from an API rest calls are provided in real time also when the size of the network is large
 - Dashboard widgets and Mobile Apps are enabled to use the Super
 - Clients can pass from one Super to another transparently: moving devices
- Nodes
 - do not need to permanently share data
 - data can be of any size, the data shared is typically public since users of different KB are different and not refer to the same LDAP/KeyCloak authentication/authorization service.
 - may have different number of services
 - Services can be based on KB as well as on Brokers
 - Services managed as HLT of: Sensors, Sensor-Actuators, POI.
 - Data of other HLTs are managed independently from the other SmartCity API such as: MyKPI, External Services, WFS GIS, Heatmaps, special tools, etc. etc.
- The solution support disjointed nodes, federation and independent services



COFFEE BREAK

TOP

High Level Types vs Ingestion Process



High Level Types

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

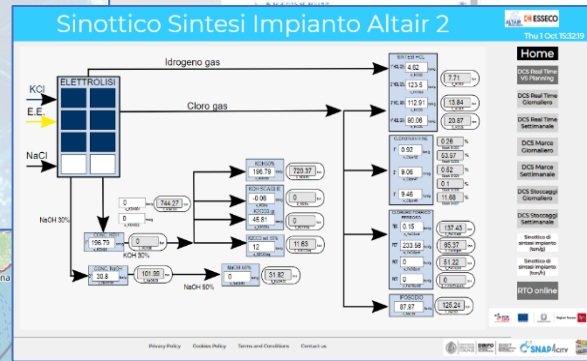
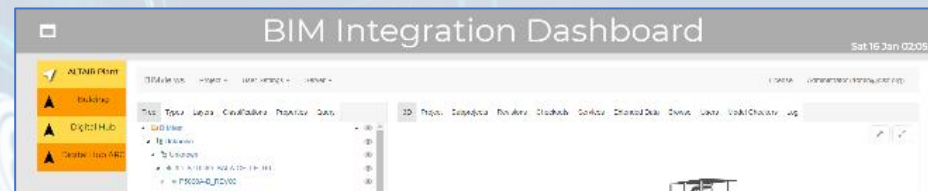


UNIVERSITÀ
DEGLI STUDI
FIRENZE

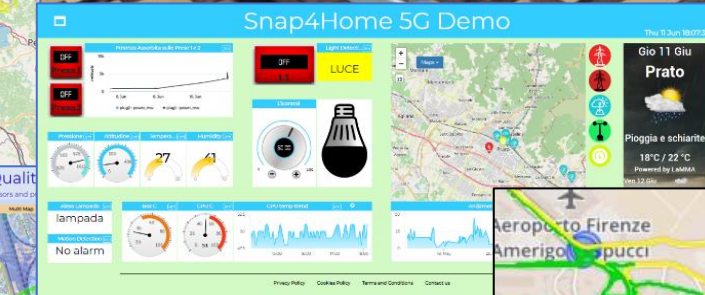
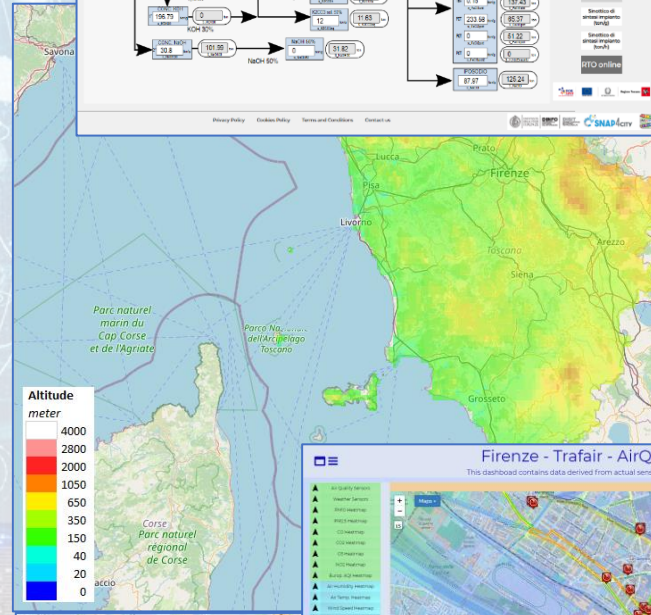
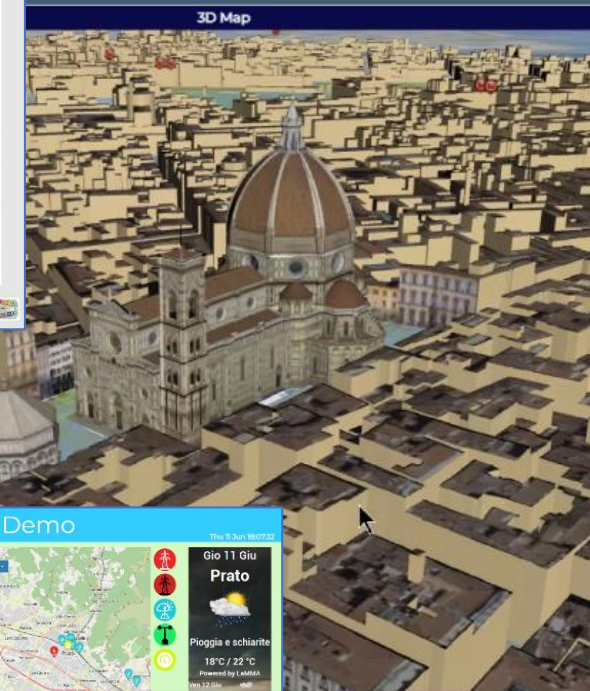
DINFO
DIPARTIMENTO DI
INGEGNERIA
DELL'INFORMAZIONE

DISIT
DISTRIBUTED SYSTEMS
AND INTERNET
TECHNOLOGIES LAB

Snap4City (C), September 2023



SNAP4CITY
- Digital Twin Global - Fire
demonstrator



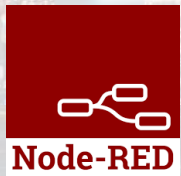
Standards and Interoperability (6/2023)



Compliant with:

- **IoT:** NGSII V2/LD, LoRa, LoRaWan, MQTT, AMQP, COAP, OneM2M, TheThingsNetwork, SigFOX, Libelium, IBIMET/IBE, Enocean, Zigbee, DALI, ISEMC, Alexa, Sonoff, HUE Philips, Tplink, BACnet, TALQ, Protocol Buffer, KNX, OBD2, Proximus, ..
- **IoT model:** FIWARE Smart Data Model, Snap4City IoT Device Models
- **General:** HTTP, HTTPS, TLS, Rest Call, SNMP, TCP, UDP, SOAP, WSDL, FTP, FTPS, WebSocket, WebSocket Secure, GML, WFS, WMS, RTSP, ONVIF, AXIS TVCam, CISCO Meraki, OSM, Copernicus, The Weather Channel, Open Weather, OLAP, VMS Milestone,
- **Formats:** JSON, GeoJSON, XML, CSV, GeoTIFF, OWL, WKT, KML, SHP, db, XLS, XLSX, TXT, HTML, CSS, SVG, IFC, XPD, OSM, Enfuser FMI, Lidar, gITF, GLB, DTM, GDAL, Satellite, D3 JSON, ...
- **Database:** Open Search, MySQL, Mongo, HBASE, SOLR, SPARQL, ODBC, JDBC, Elastic Search, Phoenix, PostGres, MS Azure, ..
- **Industry:** OPC/OPC-UA, OLAP, ModBUS, RS485, RS232,..
- **Mobility:** DATEX, GTFS, Transmodel, ETSI, NeTEx, ..
- **Social:** Twitter, FaceBook, Telegram, ..
- **Events:** SMS, EMAIL, CAP, RSS Feed, ..
- **OS:** Linux, Windows, Android, Raspberry Pi, Local File System, AXIS, ESP32, etc.

<https://www.snap4city.org/65>



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
- My Data Dashboard Dev Kibana
- My Data Dashboard Kibana
- Extra Dashboard Widgets
- Notificator
- Data, my Data, OpenData
- 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)

Service Map (Toscana)

Public transport | Municipalities | Text Search | Address Search | Events

Select an agency:
- Select an Agency -

Select a line:
- Select a Line -

Select a route:
- Select a Route -

Select a bus stop:
- Select a Bus Stop -

Position of selected Buses

Actual Selection
Service: METRO758

Serviceuri: <http://www.disit.org/km4city/resource/METRO758>

Name: METRO758
Nature: TransferServiceAndRenting
Subnature: SensorSite
Address: Lavagnini dir. Viale Strozzi (38)
DBpedia: "Spartaco_Lavagnini"

Property/Value Type	Value
avgDistance	Not Available
avgTime	14.291604
occupancy	Not Available
concentration	8.25
vehicleFlow	1344.0
averageSpeed	29.613344
thresholdPerc	Not Available
speedPercentile	Not Available
congestionLevel	119.0967
anomalyLevel	101.56058

Latest Update: 2021-01-18T13:...

Regular Services | Transversal Services

De/Select All

- Accommodation +
- Advertising +
- AgricultureAndLivestock +
- CivilAndEdilEngineering +
- CulturalActivity +
- EducationAndResearch +
- Emergency -
- Carabinieri
- Civil_protection
- Coast_guard
- Economic_safety
- Corps_of_forest_rangers
- Emergency_medical_care
- Emergency_services
- Fire_brigade
- First_aid
- Italian_finance_police
- Entertainment +
- Environment +
- Fire_service +
- GovernmentOffice +
- HealthCare +
- IoTDevice +
- MiningAndQuarrying +
- ShoppingAndService +
- TourismService +
- TransportServiceAndRenting +
- UtilitiesAndSupply +
- Wholesale +
- WineAndFood +

Filter:
search text into service

Select value type
N. results: 500

Search Range: 2 km
Search Area: select...

Weather Forecast for Mucipality of : FIRENZE

Saturday	Sunday	Monday	Tuesday	Wednesday
bit cloudy -2°C / 7°C	overcast -2°C / 6°C	cloudless -3°C / 7°C	cloudy -3°C / 6°C	overcast 5°C / 10°C

Latest Update: 2021-01-18T07:57:00+01:00
<http://www.disit.org/km4city/resource/Firenze1610780220000>

Dev, Entity

Geometry of a POI or Dev

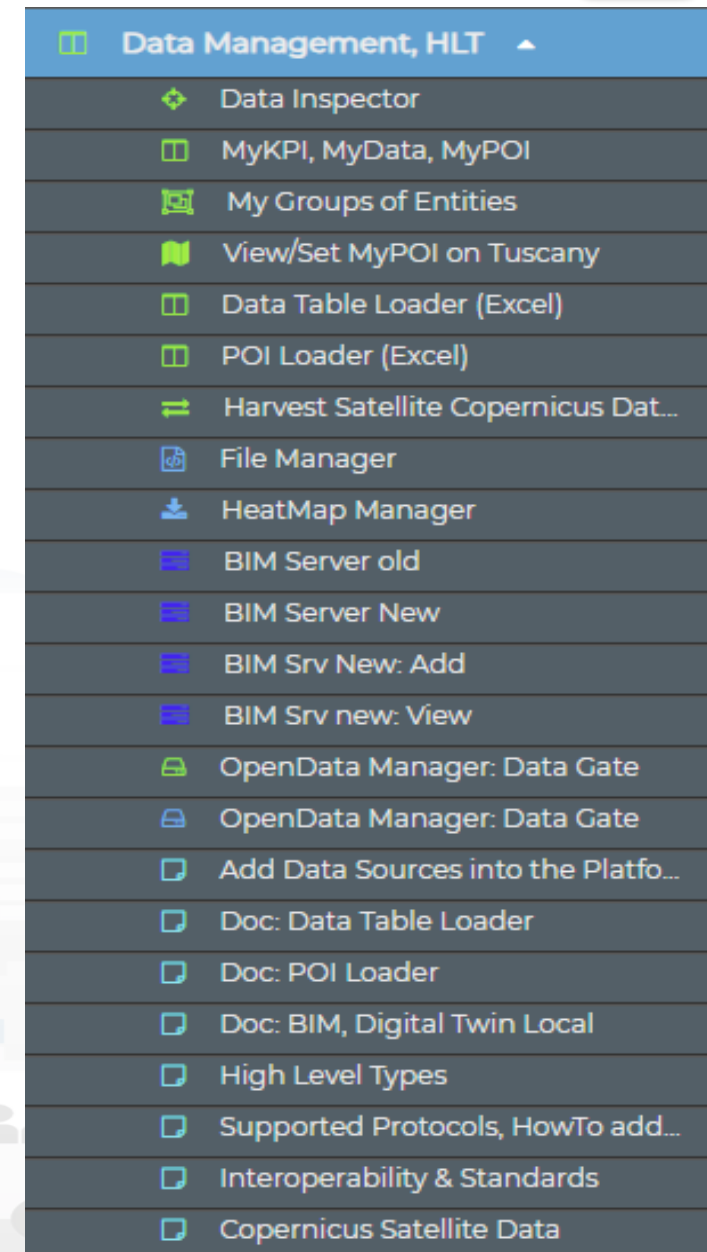
POI

Dev, Entity

Map: Struct. Information

Snap4City vs Formats

- **Snap4City is capable to ingest** and work with **any format**:
 - Data **exchange**: JSON, GeoJSON, XML, HTML, HTML5, DATEX, GTFS, binary, etc.
 - **GIS formats**: WMF, WFS, heatmaps,
 - **Table**: CSV, XLSX, XLS, database, ...
 - **Road graphs**: OSM, triples, geoJSON, etc.
 - **graphics**: IFC, Shape, WKT, SVG, ...
 - **archive** file formats: zip, rar, 7z, tgz, pdf, ...
 - **image** formats: png, gif, tiff, geoTiff, ico, jpg, ...
 - **ODM**: JSON and other formats
 - **Traffic Flow**: JSON and other formats
 - **Heatmaps**: GeoTIFF, JSON, etc.
 - **video** formats: mp4, avi, mov, RTSP, ...
 - **3D elements**: GLB, DWG, IFC, etc.
- Search the format you need to cope on the search box of Snap4City portal!: [Snap4City Supported Protocols, adding new protocols](#)



The screenshot shows a web interface for 'Data Management, HLT'. It features a list of various data management tools and services, each with a small icon and a text label. The list includes:

Icon	Label
🔍	Data Inspector
📄	MyKPI, MyData, MyPOI
🗺️	My Groups of Entities
📖	View/Set MyPOI on Tuscany
📄	Data Table Loader (Excel)
📄	POI Loader (Excel)
📡	Harvest Satellite Copernicus Dat...
📁	File Manager
📡	HeatMap Manager
📡	BIM Server old
📡	BIM Server New
📡	BIM Srv New: Add
📡	BIM Srv new: View
📡	OpenData Manager: Data Gate
📡	OpenData Manager: Data Gate
📄	Add Data Sources into the Platfo...
📄	Doc: Data Table Loader
📄	Doc: POI Loader
📄	Doc: BIM, Digital Twin Local
📄	High Level Types
📄	Supported Protocols, HowTo add...
📄	Interoperability & Standards
📄	Copernicus Satellite Data

How to ingest with most relevant HLT

main High Level Types	1st option	2nd option
POI, Point of Interest	IOT App/Proc.Logic or POI Loader (from EXCEL files)	Create an Entity Model, Entity Registration , ingest via IoT App
IoT Devices, KPI multivariable, WoT, Entities Instances	Create an Entity Model, Entity Registration , ingest via broker (e.g., Time Series) or IoT App/proc.Logic	Data Table Loader (from EXCEL files)
GIS data	Use GIS API from IoT App/Proc.Logic, Create an Entity Model, Entity Registration , ingest via IoT App/Proc.Logic	Load them on GeoServer
Satellite Data	Use Snap4City tool to download satellite data and push them into the Heatmap Manager/GeoServer , via API	<i>(seen in Course Part 3)</i>
Traffic Flow	Compute the traffic flow and/or load them into the TrafficFlow Manager , via API	<i>(seen in Course Part 3)</i>
Heatmaps	Compute them and/or push them into the Heatmap Manager/GeoServer , via API	<i>(seen in Course Part 3)</i>
OD Matrices	Compute the ODM and/or push them into the OD Manager , via API	<i>(seen in Course Part 3)</i>
BIM Models	Produce them on some BIM editor, convert into IFC and load them on BIM Manager and server	<i>(seen in Course Part 3)</i>
MyKPI (single var)	Create them on MyKPI Manager , save/load by using IoT App / Proc.Logic and/or API	<i>(seen in Course Part 2)</i>

Data Inspector

Snap4City

Switch To New Layout (Beta)

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

LOGOUT

- My Snap4City.org
- Tour Again
- www.snap4solutions.org
- Dashboards (Public)
- Dashboards of My Organization
- My Dashboards in My Organization
- My Data Dashboard Dev Kibana
- Extra Dashboard Widgets
- Data Management, HLT**
 - Data Inspector**
 - MyKPI, MyData, MyPOI
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 - View/Set MyPOI on Tuscany
 - Data Table Loader (Excel)
 - POI Loader (Excel)
 - Harvest Satellite Copernicus Data
 - File Manager
 - HeatMap Manager
 - BIM Server old
 - BIM Server New
 - BIM Srv New: Add
 - BIM Srv new: View
 - OpenData Manager: Data Gate
 - OpenData Manager: Data Gate

Data Inspector

METRO729

VALUE NAME: METRO729

DESCRIPTION	DESCRIPTION	RT DATA
congestionLevel	109.37501	Last value Last 4 hours Last 24 hours Last 7 days
dateObserved	2023-07-08T17:15:00.000Z	Last value Last 4 hours Last 24 hours Last 7 days
vehicleFlow	1138.9792	Last value Last 4 hours Last 24 hours Last 7 days

Keep data on target widget(s) after popup close:

Single data widgets
Multi data widgets

Map Controls:

FilterMap | GPSUser | GPSOrg

Now displaying in Standard Mode
Switch to the Synoptic Mode to select MyKPIs and sensors that you need for your synoptics.

Switch now to the Synoptic Mode

Data sources

High-Level Type	Nature	Subnature	Device/Model	Broker	Value Name	Value Type	Data Type	Value Unit	Last Date	Last Value	Healthiness	Last
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO792	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO791	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO793	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO713	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO729	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO7	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO760	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO799	orionUNIFI			sensor_map		2023-07-08 13:55:00		●	2023-07-08 13:55:00

Hide column | Reset filters | Selected rows: 1 | Previous | 1 | 2 | 3 | 4 | 5 | ... | 262 | Next

vehicleFlow

1139

vehicleFlow - Day

Snap4City (C), September 2023

91

HLT wrt to Time Series, GPS and Geometry

High Level Types	Evolution over time ?	May have GPS/Geom
POI, Point of Interest	Sporadically, for versioning	Yes/Yes
IoT Devices, KPI multivariable, WoT Entities	A set of values for each time instant of observation (dateObserved)	Yes/Yes
GIS data	Sporadically, for versioning	Yes/Yes
Satellite Data	An image for each time instant of observation (dateObserved)	Yes/Yes
Traffic Flow	A Traffic Flow network for each time instant of observation (dateObserved)	Yes/Yes
Heatmaps	An Heatmap for each time instant of observation (dateObserved)	Yes/Yes
OD Matrices	An ODM for each time instant of observation (dateObserved)	Yes/Yes
BIM Models	Sporadically, for versioning	Yes/Yes
MyKPI (single variable)	A value for each time instant of observation (dateObserved)	Yes/no
3D model data	Sporadically, for versioning or for model kind for example	Yes/Yes
<i>Messages exchanged with Dashboards</i>	<i>A set of values for each time instant of observation (dateObserved)</i>	<i>No/No</i>
<i>Messages exchanged with Synoptics</i>	<i>A set of values for each time instant of observation (dateObserved)</i>	<i>No/No</i>

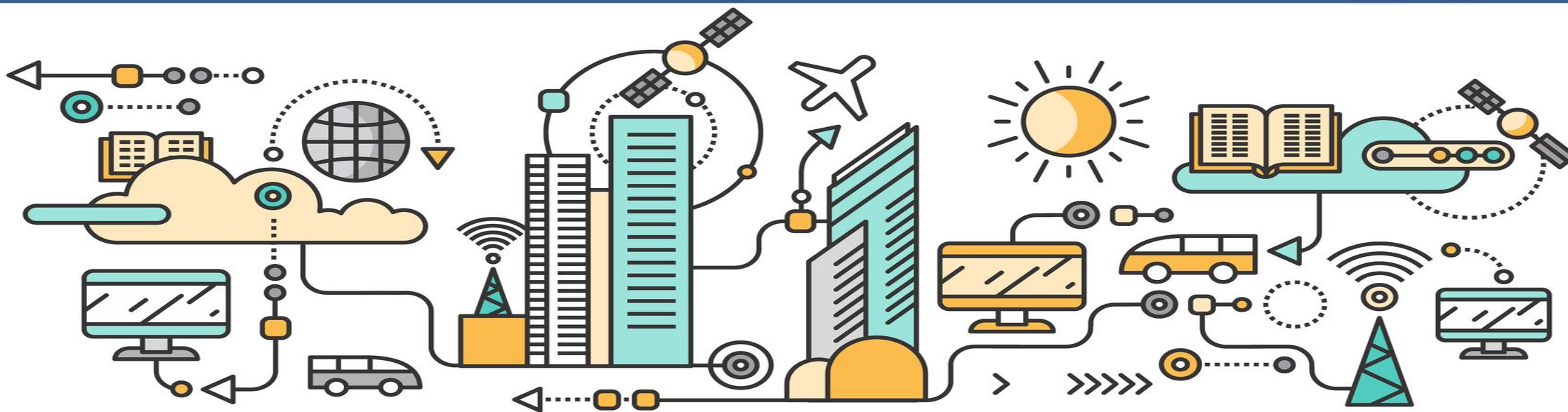
SubStantially

- **Entities** are used to model Digital Twins and thus:
 - POI, MyPOI, KPI, MyKPI, IoT Devices, etc.
 - **including: metadata info, time series, GPS position, geometries, hyper Links, and Actions which are links to tools/functions/processes to Act on them**
- **Complex Data** such as used to model spec. aspects as Traffic Flow, Heatmaps, ODM, BIM, TV cameras, 3D elements, .. :
 - Are placed on map as an Entity plus **additional information** into a dedicated <data> Manager
 - **Entity includes: metadata info, time series, GPS posizione, geometries, iper Links, and Actions which are links to tools/functions/processes to Act on them**

TOP

Classification by Nature/SubNature

Semantic Classification



Data Inspector

Snap4City

Switch To New Layout (Beta)

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

LOGOUT

- My Snap4City.org
- Tour Again
- www.snap4solutions.org
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- Dashboards of My Organization
- My Dashboards in My Organization
- My Data Dashboard Dev Kibana
- Extra Dashboard Widgets
- Data Management, HLT
 - Data Inspector**
 - MyKPI, MyData, MyPOI
 - My Groups of Entities
 - View/Set MyPOI on Tuscany
 - Data Table Loader (Excel)
 - POI Loader (Excel)
 - Harvest Satellite Copernicus Data
 - File Manager
 - HeatMap Manager
 - BIM Server old
 - BIM Server New
 - BIM Srv New: Add
 - BIM Srv new: View
 - OpenData Manager: Data Gate
 - OpenData Manager: Data Gate

Data Inspector

Map

Single data widgets
Multi data widgets

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FilterMap GPSUser GPSOrg

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IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO793	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
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IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO7	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO760	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO799	orionUNIFI			sensor_map		2023-07-08 13:55:00		●	2023-07-08 13:55:00

Hide columns Reset filters Selected rows: 1 Previous 1 2 3 4 5 ... 262 Next metro7

vehicleFlow

1139

vehicleFlow - Day

Any Entity has a Semantic Classification

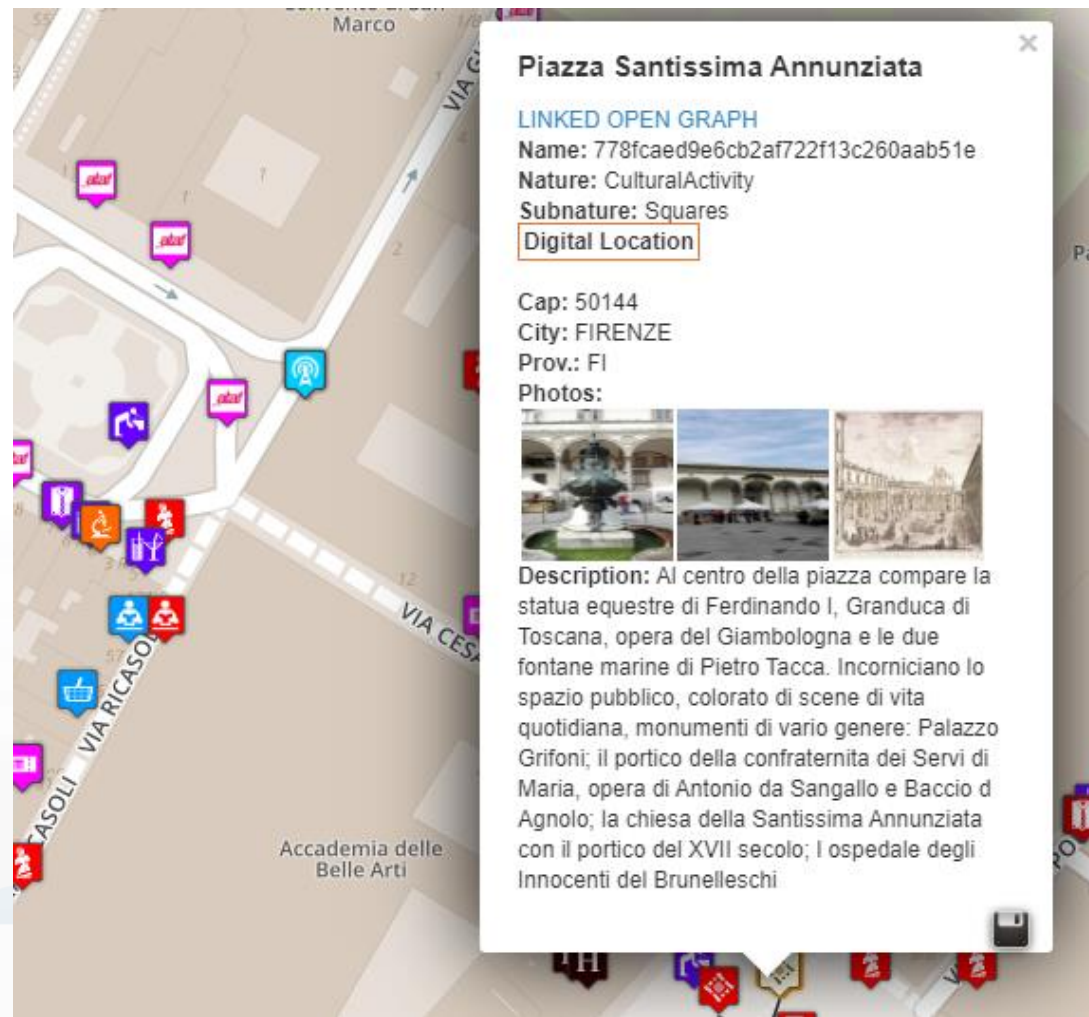
Nature

- Accommodation +
- Advertising +
- AgricultureAndLivestock +
- CivilAndEdilEngineering +
- CulturalActivity +
- EducationAndResearch +
- Emergency +
- Entertainment +
- Environment +
- FinancialService +
- GovernmentOffice +
- HealthCare +
- IndustryAndManufacturing +
- IoTDevice +
- MiningAndQuarrying +
- ShoppingAndService +
- TourismService +
- TransferServiceAndRenting +
- UtilitiesAndSupply +
- Wholesale +
- WineAndFood +

SubNature

- EducationAndResearch -
 - Educational_support_activities
 - Higher_education
 - Language_courses
 - Performing_arts_schools
 - Post_secondary_education
 - Pre_primary_education
 - Primary_education
 - Private_high_school
 - Private_infant_school
 - Private_junior_high_school

SKOS



TOP

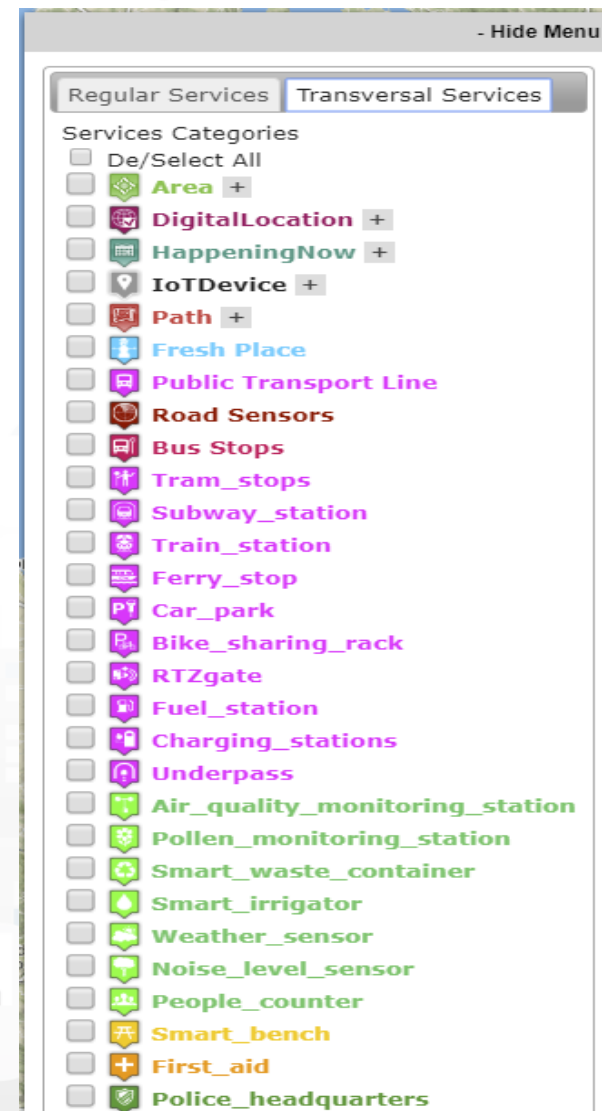
Point of Interests, POI

mainly static data



Access to Point of Interest information, POI

- **POI:** point of interest
- **type:** macro (nature) and subcategories (subnature)
- **Position:** GPS, address, telephone, fax, email, URL, ...
- **Description:** textual, multilingual, with images, ...
- **Link to dbPedia, Linked Open Data**
- **Links to other services**
 - **Not Real time data if any, please use Entities / devices connected:** sensors data, timeline, events, prices, opening time, rules of access, status of services, status of queue, etc..
- *See transversal services on ServiceMap*
 - *Regular and in test platform*



POI, Point of Interest

- They are
 - classified in terms of nature/subnature
 - relevant services with codified **metadata** to simplify the massive management of huge amount of POIs
 - mapped on Knowledge Base on **specific GPS location**
 - Do not move over time
 - represented as PIN
- **Do not have Time Series** for variable over time
- May sporadically change over time

Piazza Santissima Annunziata

LINKED OPEN GRAPH
Name: 778fcaed9e6cb2af722f13c260aab51e
Nature: CulturalActivity
Subnature: Squares
Digital Location

Cap: 50144
City: FIRENZE
Prov.: FI
Photos:

Description: Al centro della piazza compare la statua equestre di Ferdinando I, Granduca di Toscana, opera del Giambologna e le due fontane marine di Pietro Tacca. Incorniciano lo spazio pubblico, colorato di scene di vita quotidiana, monumenti di vario genere: Palazzo Grifoni; il portico della confraternita dei Servi di Maria, opera di Antonio da Sangallo e Baccio d Agnolo; la chiesa della Santissima Annunziata con il portico del XVII secolo; l'ospedale degli Innocenti del Brunelleschi

- Accommodation +
- Advertising +
- AgricultureAndLivestock +
- CivilAndEdilEngineering +
- CulturalActivity +
- EducationAndResearch +
 - EducationAndResearch
 - Educational_support_activities
 - Higher_education
 - Language_courses
 - Performing_arts_schools
 - Post_secondary_education
 - Pre_primary_education
 - Primary_education
 - Private_high_school
 - Private_infant_school
 - Private_junior_high_school
- Emergency +
- Entertainment +
- Environment +
- FinancialService +
- GovernmentOffice +
- HealthCare +
- IndustryAndManufacturing +
- IoTDevice +
- MiningAndQuarrying +
- ShoppingAndService +
- TourismService +
- TransferServiceAndRenting +
- UtilitiesAndSupply +
- Wholesale +
- WineAndFood +

TOP

Time Series can be: IoT Devices, MyKPI, Entities, etc.



What About a Time Series

IOT Device



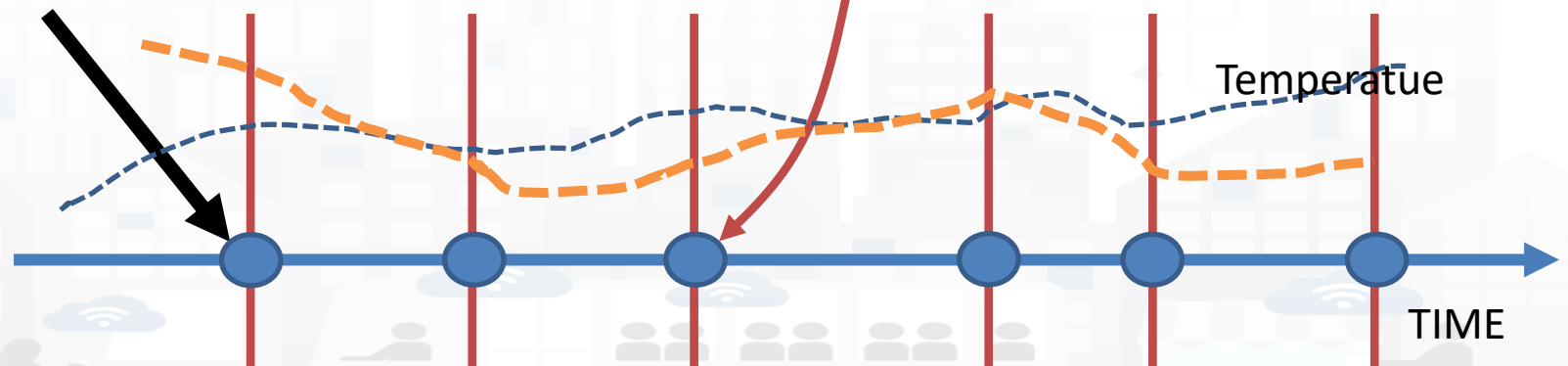
Entity: IOT
Device

Sends a
message

Message (
timestamp: 02-04-2020 at 10:30,
Temperature: 29.34,
Humidity: 35
)

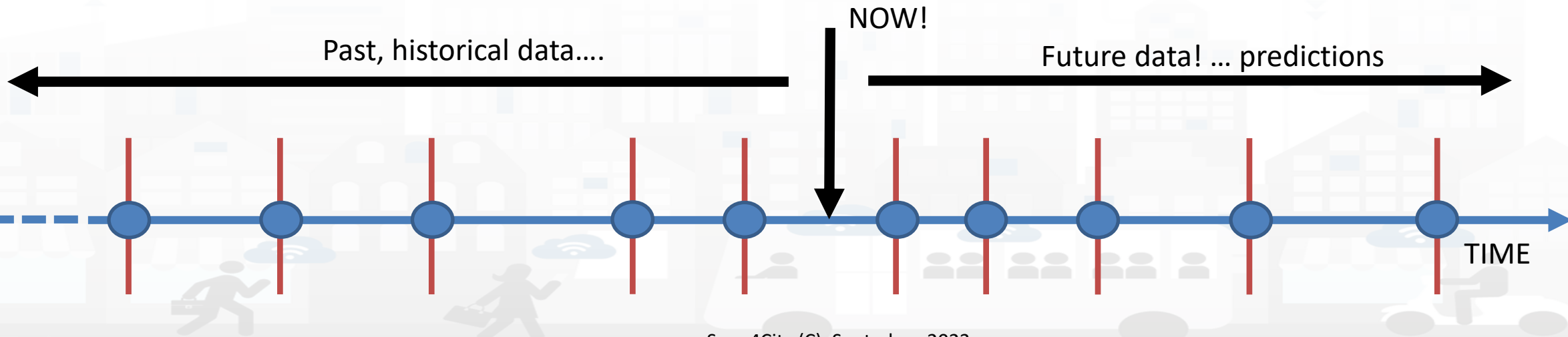
- A set of data coming from an IoT Device with multiple sensor become a time series of values for devices.
 - For example: taking a new measure every 10 minutes (**Red Lines**)
 - Non regular rates can be valid data as well.
- Each new measure in Snap4City is conventionally time located in «**dateObserved**», which has to be **Unique**.
 - **Only one message per dateObserved is allowed**

dateObserved	Temp	Humidity
02-04-2020 10:30	34.5	23
02-04-2020 10:40	36.5	24
02-04-2020 10:50	36.0	22.5



Time Series: they are data streams

- As soon as you have a variable changing over time → time series
 - You are ready to get Future data, may be arriving in PUSH
 - Recall and store historical data as well, but they have to be
 - recalled in PULL with some IoT App/Proc.Logic
 - Loaded in PULL with some File or Data Table Loader



A time series

The messages posted on Entity Instances / IoT Devices can produce different effects on time series.

Omitting the message would allow the broker to reuse the last data to fill it, as for V5, which appear

- valid in all messages on graphs
- With holes in tables

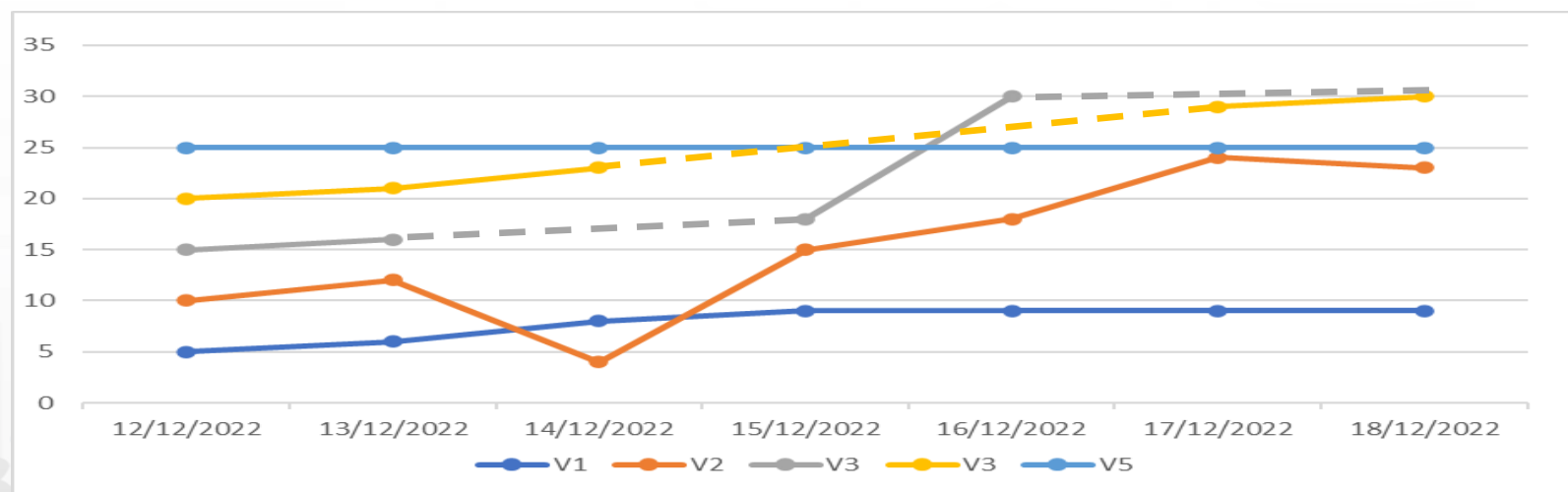
Putting null values (as in V3) would produce a missing data and thus would lead to create:

- interpolate line on graphs: dashed are actually continuous lines in Dashboards
- Empty values in the tables

device42 Entity Messages over time

12-12-2022	13-12-22	14-12-22	15-12-22	16-12-22	17-12-22	18-12-22
V1: 5	5	6	8	9	9	9
V2: 10	10	12	4	15	18	24
V3: 16	15	16	null	18	30	null
V4: 20	20	21	23	null	null	29
V5: 25	25	25	25	25	25	25

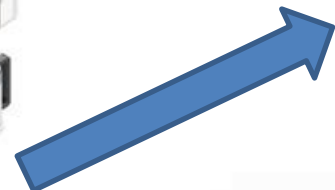
Color for missed



IoT Devices, Entities Instances, WoT



IoT Device Models



IoT Device

- Name: CM23
- Model: Lavazza
- Position:

IoT Device Variables

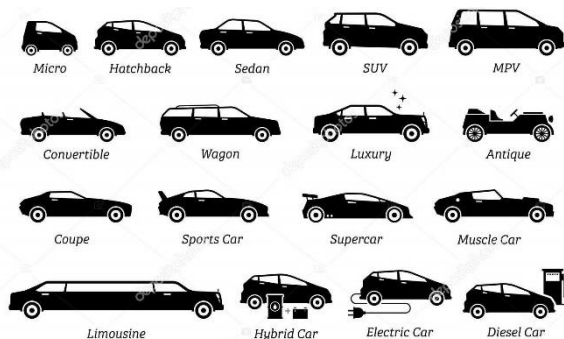
- **dateObserved:**
- ID: CM23
- Status: ready
- Temperature: 70°
- WaterLevel: 35%
- UsedCapsBox: 30%
- Power: OK
-

- Conceptually are Devices with sensors/actuators, IN/IN-OUT
- They are classified in terms of nature/subnature
- For Searching and showing on maps and dashboards
HLT of Devices/Entities can be:

- **(IoT Device) Entity Models**, for example: «personal coffee machine»
- **Entity name**, for example: «mycoffemachine1», «CM23»
- **Entity Variable**, for example: «Temperature»



Mobile Devices/Entities



Mobile Device Models



Mobile Device

- Name: BMWJD7356HD
- Model: BMW 318
- Spec:...

Mobile Entity/device Variables

- ID: BMWJD7356HD
- **dateObserved:**
- Status: ready
- Temperature: 70%
- Gasoline: 35%
- Velocity: 231,3 Km/h
- **Position: 44.3223, 11.3432**
-

- They are a special case of devices/entities
 - they are managed as Devices/Entities in the system
- They are classified in terms of nature/subnature
- For Searching and showing on maps and dashboards, they are different

HLT of Mobile Devices/entities can be:

 - **Mobile Entity Model**, for example: «sedan»
 - **Mobile Entity Instance** name, for example: «BMW JD7356HD», «Ford KO786KK»
 - **Mobile Entity Variable**, for example: «velocity»



Sensor/Sensor-Actuator

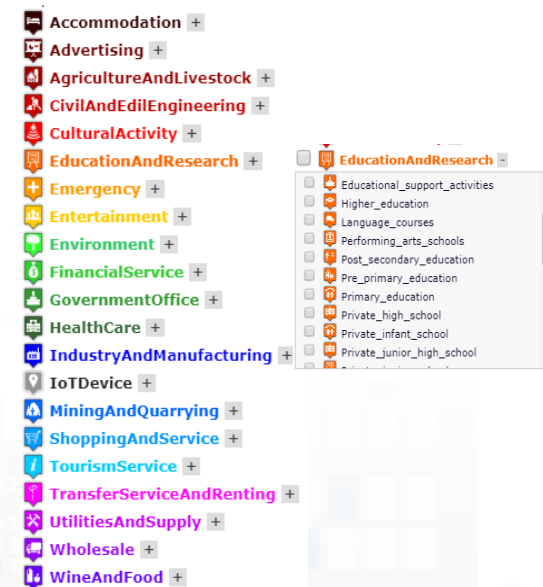


IoT Device

- Name: CM23
- Model: Lavazza
- Position:

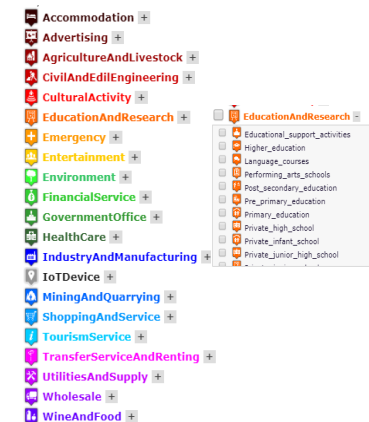
Sensors

- **dateObserved:**
- ID: CM23
- Status: ready
- Temperature: 60°
- WaterLevel: 35%
- UsedCapsBox: 30%
- Power: OK
-



- They are classified in terms of nature/subnature
- For Searching and showing on maps and dashboards
HLT of Sensors/Sensor-Actuator can be:
 - **Sensor Device** name, for example: «mycoffemachine1», «CM23»
 - **Sensor/sensor-actuator** is a variable of a Sensor Device, for example: «Temperature»
- They do not have a model, while, in KB, have a reference process from which their real time data are collected from the field, from gateways, etc..

KPIs, Key Performance Indicators



- They are classified in terms of nature/subnature
- Typically associated with
 - City or infrastructure, so that the GPS can be city center
 - Some date: 2019, march 2019, etc.
- For example:
 - Number of Arrivals from France in March 2019
 - Average price for **** hotels in 2019, downtown
 - Net income of the region
 - CO2 saved in the April 2020
 - Total number of vehicles sold in 2020
 - Stock option value of Airport
- Note that in most cases:
 - They are time series, change over time, by year
 - they can be managed as *Virtual IoT Devices*

Data from INSETE

Basic Sizes of Incoming Tourism

Basic Sizes of Incoming Tourism of the Region of Western Greece 2019							
Regions	Countries Origin	Visits (in thousands)	Receipts (in € million)	Nights (in thousands)	Expenditure / Visit (in €)	Cost / Night (in €)	Average Length of Stay
West Hellas	Albania	132.9	26.5	225.8	199.7	117.5	1.7
	United Kingdom	47.7	17.9	345.8	375.2	51.8	7.2
	Germany	70.3	36.4	672.4	517.9	54.1	9.6
	France	55.4	16.5	321.6	298.1	51.4	5.8
	Other	510.7	160.0	2,964.9	313.3	54.0	5.8
	Total	817.0	257.4	4,530.4	315.0	56.8	5.5
	% of the total	2.2%	1.5%	1.9%			

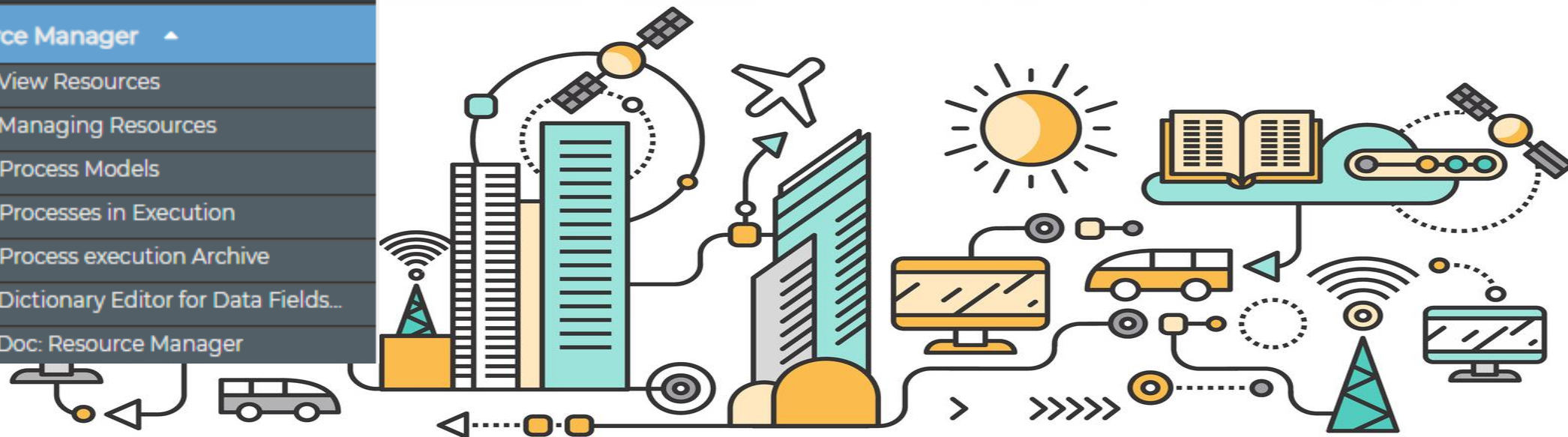
Source: BoG Border Research, INSETE Intelligence Editing

Basic Sizes of Incoming Tourism of the Region of Western Greece 2018							
Regions	Countries of Origin	Visits (in thousands)	Receipts (in € million)	Nights (in thousands)	Expenditure / Visit (in €)	Cost / Night (in €)	Average Length of Stay
West Greece	Albania	138.7	29.0	222.9	209.2	130.1	1.6
	United Kingdom	42.6	13.5	180.6	317.6	74.9	4.2
	Germany	71.3	26.0	466.5	365.1	55.8	6.5
	France	44.2	13.5	262.9	304.7	51.2	6.0
	Other	402.5	129.8	2,050.7	322.4	63.3	5.1
	Total	699.2	211.8	3,183.5	302.9	66.5	4.6
	% of the total	2.0%	1.4%	1.4%			

TOP

Classification of Variables of Devices, Entities, Sensors, etc. Data Dictionary

Resource Manager
View Resources
Managing Resources
Process Models
Processes in Execution
Process execution Archive
Dictionary Editor for Data Fields...
Doc: Resource Manager



Data Inspector

Snap4City
Data Inspector

Switch To New Layout (Beta)

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

LOGOUT

- My Snap4City.org
- Tour Again
- www.snap4solutions.org
- Dashboards (Public)
- Dashboards of My Organization
- My Dashboards in My Organization
- My Data Dashboard Dev Kibana
- Extra Dashboard Widgets
- Data Management, HLT
- Data Inspector**
- MyKPI, MyData, MyPOI
- My Groups of Entities
- View/Set MyPOI on Tuscany
- Data Table Loader (Excel)
- POI Loader (Excel)
- Harvest Satellite Copernicus Data
- File Manager
- HeatMap Manager
- BIM Server old
- BIM Server New
- BIM Srv New: Add
- BIM Srv new: View
- OpenData Manager: Data Gate
- OpenData Manager: Data Gate

METRO729

VALUE NAME: METRO729

DESCRIPTION	DESCRIPTION	RT DATA
congestionLevel	109.37501	Last value Last 4 hours Last 24 hours Last 7 days
dateObserved	2023-07-08T17:15:00.000Z	Last value Last 4 hours Last 24 hours Last 7 days
vehicleFlow	1138.9792	Last value Last 4 hours Last 24 hours Last 7 days

Keep data on target widget(s) after popup close:

Single data widgets
Multi data widgets

Map Controls:

FilterMap GPSUser GPSOrg

Now displaying in Standard Mode
Switch to the Synoptic Mode to select MyKPIs and sensors that you need for your synoptics.

Switch now to the Synoptic Mode

Data sources

High-Level Type	Nature	Subnature	Device/Model	Broker	Value Name	Value Type	Data Type	Value Unit	Last Date	Last Value	Healthiness	Last
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO792	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO791	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO793	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO713	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO729	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO7	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
IoT Device	TransferServiceAndRenting	Traffic_sensor	METRO760	orionUNIFI			sensor_map		2023-07-08 14:05:00		●	2023-07-08 14:05:00
Device	TransferServiceAndRenting	Traffic_sensor	METRO799	orionUNIFI			sensor_map		2023-07-08 13:55:00		●	2023-07-08 13:55:00

Hide columns Reset filters Selected rows: 1 Previous 1 2 3 4 5 ... 262 Next metro7

vehicleFlow

1139

vehicleFlow - Day

HLT: Unified Classification for Data and Services

IoT Device Variable, Sensor Device	All selected (15)	All selected (48)	All selected (27)		All selected (1499)	All selected (159)	All selected (15)	All selected (63)	Last Date	Last Value	All selected (2)		All selected (2)
High-Level Type	Nature	Subnature	Device/Model	Broker	Value Name	Value Type	Data Type	Value Unit			Healthiness	Last Check	Ownership
IoT Device Variable	IoTDevice	IoTSensor	devicetest1	orionUNIFI	temperature	temperature	float	°C			●	2021-10-15 10:01:02	private (My Own)
IoT Device Variable	IoTDevice	IoTSensor	devicetest1	orionUNIFI	humidity	humidity	float	#			●	2021-10-15 10:01:02	private (My Own)
IoT Device Variable	IoTDevice	IoTSensor	MyThermometer_001	orionUNIFI	temperature	temperature	float	°C			●	2021-10-15 10:01:01	private
IoT Device Variable	IoTDevice	IoTSensor	MyThermometer_001	orionUNIFI	humidity	humidity	float	#			●	2021-10-15 10:01:01	private
IoT Device Variable	IoTDevice	IoTSensor	adminTest1	orionUNIFI	temperature	temperature	string	°C	2018-05-31 19:16:05		●	2021-10-15 10:01:00	private (My Own)
IoT Device Variable	IoTDevice	IoTSensor	adminTest1	orionUNIFI	humidity	humidity	string	%	2018-05-31 19:16:05		●	2021-10-15 10:01:00	private (My Own)
IoT Device Variable	IoTDevice	IoTSensor	newmarcodev1	orionUNIFI	temperature	temperature	float	°C			●	2021-10-15 10:00:59	private
IoT Device Variable	IoTDevice	IoTSensor	newmarcodev1	orionUNIFI	humidity	humidity	float	%			●	2021-10-15 10:00:59	private

High Level Types

Nature

**Semantic
Classific.**

SubNature

Dev/Model name

**Technical
Source**

Broker name

Value Name

Variables, names

Value Type

Data Type

Value Unit

Last Date/Time

**Real
Time**

Last Value

Healthiness

Status

Last Check

**Ownership
Organization**

**For
Admin**

• HLT: MyKPI

• **Nature:** Industry and manufacturing

• **Subnature:** Chemical

• **Value Name:** CloroParaffine

• **Value Type:** Density percentage

• **Value Unit:** %

• **Data Type:** float mykpi

• **Last Date:** 2019-02-25 «*DateTime*»

• **Last Value:** 87.0

• **Healthiness:**

• **Last Check:** 2020-04-03 10:28:12

• **Ownership:** private for xyz...

• **Organization:** Firenze

Single Variable for MyKPI

• HLT: IoT Device, Sensor Device, Data Tab Device

• **Nature:** Industry and manufacturing

• **Subnature:** Chemical

• **Value Name:** Irrigator fioriera Gag

• **Value Type:** Battery Level

• **Value Unit:** V

• **Data Type:** float

• **Last Date:** 2020-04-01 12:59:00 «*dateObserved*»

• **Last Value:** 5.18

• **Healthiness:**

• **Last Check:** 2020-04-03 03:28:12

• **Ownership:** public/private

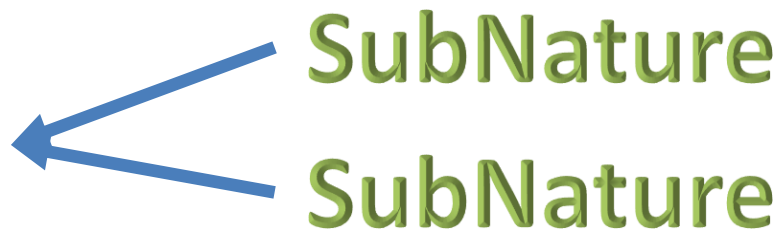
• **Organization:** Firenze

an IoT Device may have multiple Sensors/variables

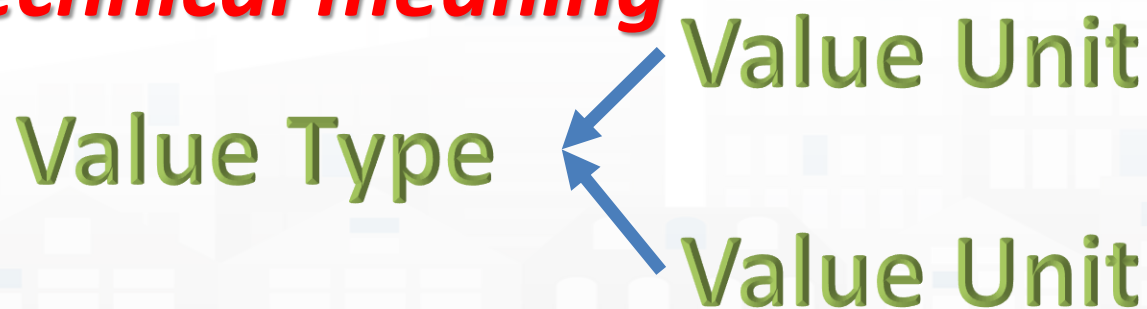
This Section
is repeated
for each
variable

Unified Data and Services Model/Classification

**Semantic
Nature**



Technical meaning



- Exists a Dictionary for the 4 categories
- They are related each other and not all values are possible
- **Right setting** leads to right rendering on graphs / dash
- **automated** combinations and processing
- The Dictionary is used by many tools

Technical meaning

^{Power}
Value Type

Value Unit

mW

Value Unit

KW

Data Type

Integer

Data Type

Float

Link to Friend Sensor as ServiceURI: Value Type

Value Unit

URL

Value Unit

KW

Data Type

String, URL

Data Type

Float

Example of Energy and its Value Units

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
- 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
 - View Resources
 - Managing Resources
 - Process Models
 - Processes in Execution
 - Process execution Archive
 - Dictionary Editor for Data Fields**
 - Doc. Resource Manager

Dictionary Editor for Data Fields

+ Insert new Dictionary element

Filter by Dictionary type

Show 10

Search:

Value Name	Dictionary Type	Description	Data Types	Parent Value Name	Child Value Name	Controls
Boats_and_shi...	subnature	Boats And Ships Rental		TransferServiceAndRenti...		EDIT DELETE
Bollard	subnature	Bollard		TransferServiceAndRenti...		EDIT DELETE
Bookshop	subnature	Bookshop		ShoppingAndService		EDIT DELETE
bool	value unit	boolean		dali_com_error, dali_dim...		EDIT DELETE
Botanical_and...	subnature	Botanical & Zoolog. Gardens		CulturalActivity		EDIT DELETE
Boxoffice	subnature	Boxoffice		Entertainment		EDIT DELETE
bpm	value unit	Beat per minute		average_heart_rate, avera...		EDIT DELETE
brightness_flag	value type	Brightness Flag	string		#	EDIT DELETE
broken_bikes	value type	Broken Bikes	integer		#	EDIT DELETE
Building_and_...	subnature	Build. & Indust. Clean. Activ.		Environment		EDIT DELETE

First << Prev 1...9 10 11...89 Next >> Last

Value Type: Energy

Value Units:

- Watt per hour
- KiloWatt per hour
- MegaWatt per hour

Snap4City (C), September 2023

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Please note on: **Data Type**

- Value Types have only a few number of **Data Types** because they represent how the data area treated into the system
- Therefore: main Data Types are:
 - **Float**: numbers with decimals large as you like, etc.
 - **Integer**: numbers, booleans (0/1), etc.
 - **String**: url, links, names, id, descriptions, status code, etc.
 - **Json**: structured data, vector, matrices, etc.
 -

IoT Device Model and Devices Data

Dictionary: updated at 11/2022

<https://www.snap4city.org/818>

IoT Device Model and Devices Data Dictionary: updated at 11/2022

View Edit Track Access control Convert

Any update and addition to the dictionary of snap4city.org has to be requested to snap4city@disit.org

if you have your own instance of the platform you can define your own dictionary and request a copy of the snap4city.org dictionary

The dictionary is used into the IoT Device Model definition, in mapping smart data models, and in creating full custom devices.

https://www.snap4city.org/drupal/sites/default/files/image_from_word/fil...

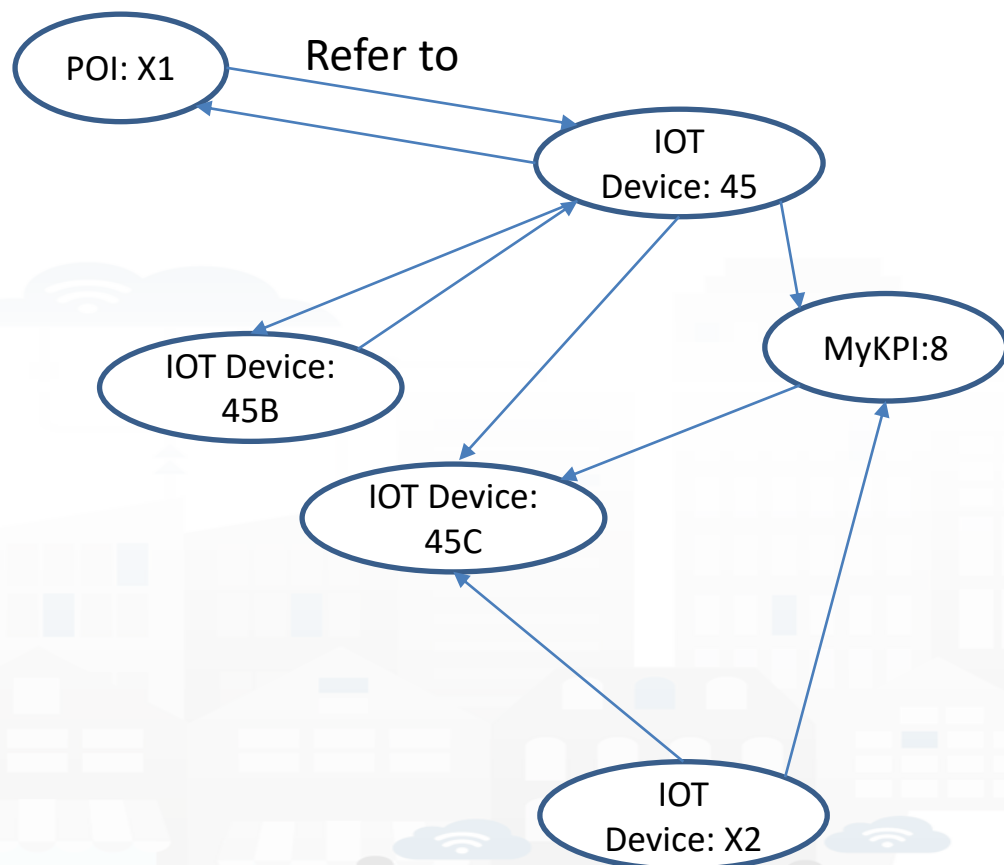
value type	Description	possible value Units	Possible Data Types
actuator_canceller	Actuator Canceller		string
actuator_deleted	Actuator Deleted		integer
actuator_deletion_date	Actuator Deletion Date	timestamp	string
air_quality_index	Air quality index		float
altitude	Altitude	m	float, integer
angle	angle	deg	float
annual_C6H6_average	annual_C6H6_average	ppm, mg/m ³ , µg/m ³	float
annual_C6H6_exceedance_count	annual_C6H6_exceedance_count	#	integer, float
annual_CO_average	annual_CO_average	ppm, mg/m ³ , µg/m ³	float
annual_CO_exceedance_count	annual_CO_exceedance_count	#	integer, float
annual_NO2_average	annual_NO2_average	ppm, mg/m ³ , µg/m ³	float
annual_NO2_exceedance_count	annual_NO2_exceedance_count	#	integer, float
annual_O3_average	annual_O3_average	ppm, mg/m ³ , µg/m ³	float

TOP

References/Links to Entities Instances / IoT Devices



Relationships among Devices/Entities, POI and MyKPI



- **Devices and POI** may refer to:
 - IoT Devices/Entities, POI, MyKPI, Heatmaps, etc.
 - The Links may change over time
- **MultiDataMap** can be used for navigation:
 - Among: IoT Devices, POI, MyKPI
 - Automated focus
 - Accessing Time Trends

IoT device with References to other and MyKPI

```
{  
  "id": "ThermalBOX1",  
  "type": "thermalbox",  
  "dateObserved": {"type": "string", "value": "2022-02-24T17:15:34.609Z"},  
  "latitude": {"type": "float", "value": "43.76965"},  
  "longitude": {"type": "float", "value": "11.25570"},  
  "SHTdevice": {"type": "string",  
    "value": "http://www.disit.org/km4city/resource/iot/orion/Firenze2/Firenze/SHT20lab_new"},  
  "cam51count": {"type": "string", "value": "datamanager/vapi/v1/poidata/17058000"},  
  "cam52count": {"type": "string", "value": "datamanager/vapi/v1/poidata/17058001"},  
  ...  
}
```

Value Type: Identifier

Value Unit: ServiceURI

Data Type: String

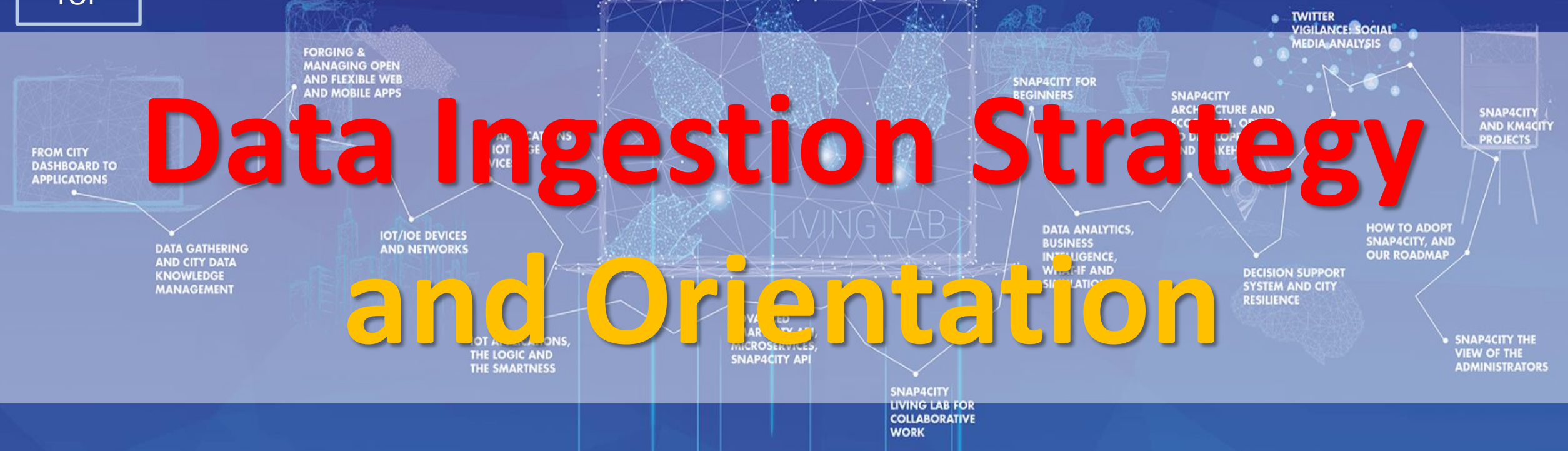
//any query: such as those of the Selector



COFFEE BREAK

TOP

Data Ingestion Strategy and Orientation



The main High Level Types

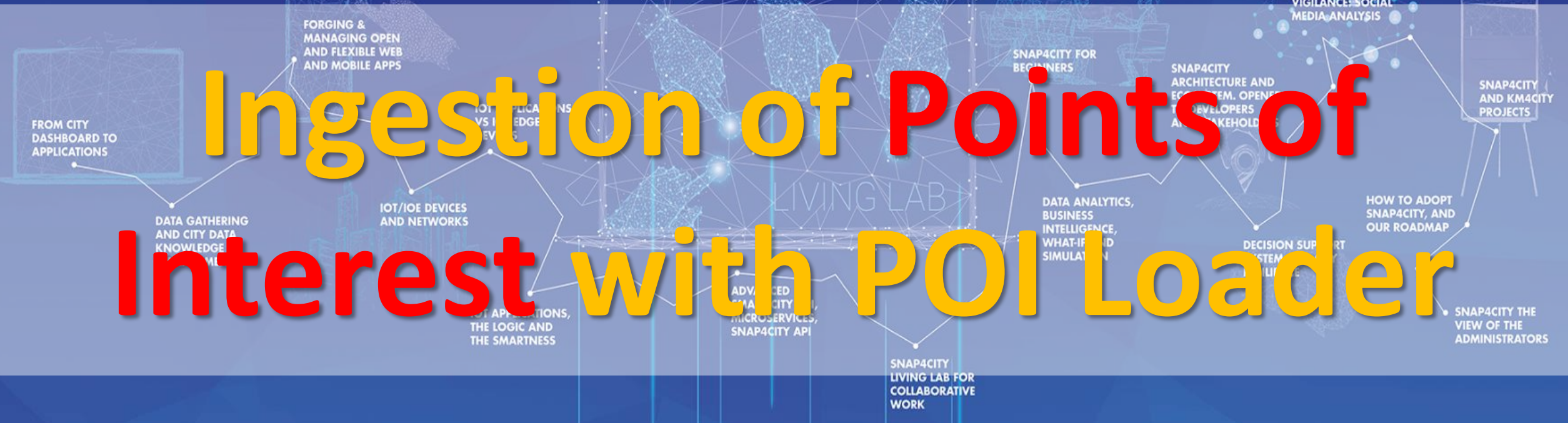
- **POI**: codified metadata, static GPS, + info, no time series
- **Entity Instance / IoT Device**: static GPS, Info, variable data, Time Series
 - Sensors and actuators
 - **Entity Mobile / IoT Device Mobile**: if dynamic GPS
- **MyKPI**: dynamic GPS, - info, single variable, Time Series
- **Heatmaps**: *matrices on some area, Time Series*
- **Traffic Flow**: *road segments with flow density, Time Series*
- **OD matrix**: *different parameters, Time Series*
- ...

How to ingest with most relevant HLT

main High Level Types	1st option	2nd option
POI, Point of Interest	IOT App/Proc.Logic or POI Loader (from EXCEL files)	Create an Entity Model, Entity Registration , ingest via IoT App
IoT Devices, KPI multivariable, WoT, Entities Instances	Create an Entity Model, Entity Registration , ingest via broker (e.g., Time Series) or IoT App/proc.Logic	Data Table Loader (from EXCEL files)
GIS data	Use GIS API from IoT App/Proc.Logic, Create an Entity Model, Entity Registration , ingest via IoT App/Proc.Logic	Load them on GeoServer
Satellite Data	Use Snap4City tool to download satellite data and push them into the Heatmap Manager/GeoServer , via API	<i>(seen in Course Part 3)</i>
Traffic Flow	Compute the traffic flow and/or load them into the TrafficFlow Manager , via API	<i>(seen in Course Part 3)</i>
Heatmaps	Compute them and/or push them into the Heatmap Manager/GeoServer , via API	<i>(seen in Course Part 3)</i>
OD Matrices	Compute the ODM and/or push them into the OD Manager , via API	<i>(seen in Course Part 3)</i>
BIM Models	Produce them on some BIM editor, convert into IFC and load them on BIM Manager and server	<i>(seen in Course Part 3)</i>
MyKPI (single var)	Create them on MyKPI Manager , save/load by using IoT App / Proc.Logic and/or API	<i>(seen in Course Part 2)</i>

TOP

Ingestion of Points of Interest with POI Loader



How to ingest POI

main High Level Types	1st option	2nd option
POI, Point of Interest	IoT App or POI Loader (from EXCEL files)	Create an Entity Model, Entity Registration , ingest via IoT App
IoT Devices, KPI multivariable, WoT, Entities Instances	Create an Entity Model, Entity Registration , ingest via broker (e.g., Time Series) or IoT App	Data Table Loader
GIS data	Pose query from IoT App, Create an Entity Model, Entity Registration , ingest via IoT App	Load them on GeoServer

Ingestion of POI

- Their structure has been described previously
 - They do not change over time → they do not have dateObserved
- **Open Data** referring to services on the territory can be regarded as POI
- **POI Loader** to perform the automated loading of new POI
- There is also a **MicroApplication** which allows to load MyPOI one by one, and a procedure to pass from MyPOI to POI can be activated by the RootAdmin
- **POI may be modelled as Entity Instances / IoT Devices**

TOP

POI Loader, from Excel Files

(for authorized AreaManagers)

- Data, my Data, OpenData ▲
- Data Inspector
- MyKPI, MyData, MyPOI
- My Groups of Entities
- View/Set MyPOI on Tuscany
- Data Table Loader (Excel)
- POI Loader (Excel)



<https://www.snap4city.org/731>

POI, Point of Interest

- They are
 - classified in terms of nature/subnature
 - relevant services with codified **metadata** to simplify the massive management of huge amount of POIs
 - mapped on Knowledge Base on **specific GPS location**
 - Do not move over time
 - represented as PIN
- **Do not have Time Series** for variable over time
- May sporadically change over time

Piazza Santissima Annunziata

[LINKED OPEN GRAPH](#)

Name: 778fcaed9e6cb2af722f13c260aab51e
 Nature: CulturalActivity
 Subnature: Squares
Digital Location

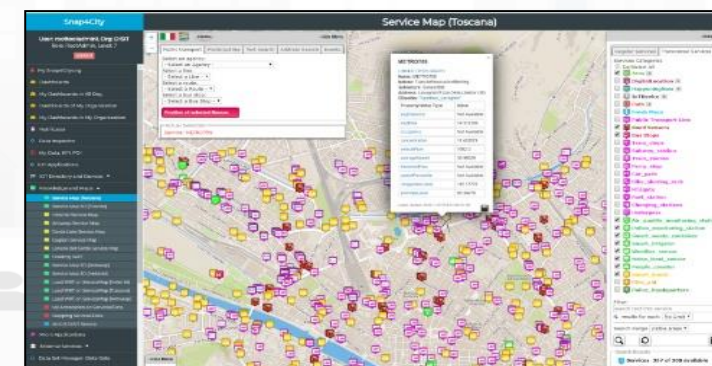
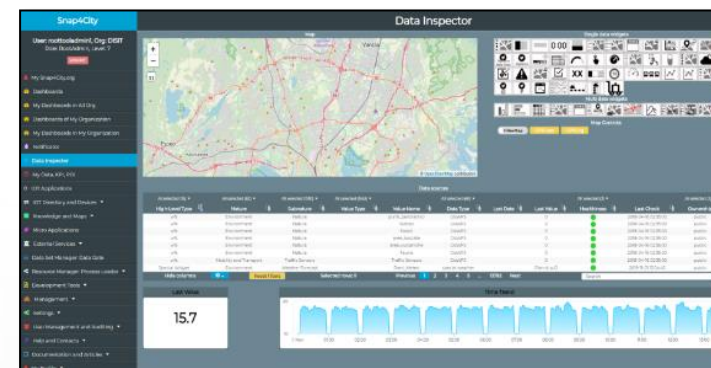
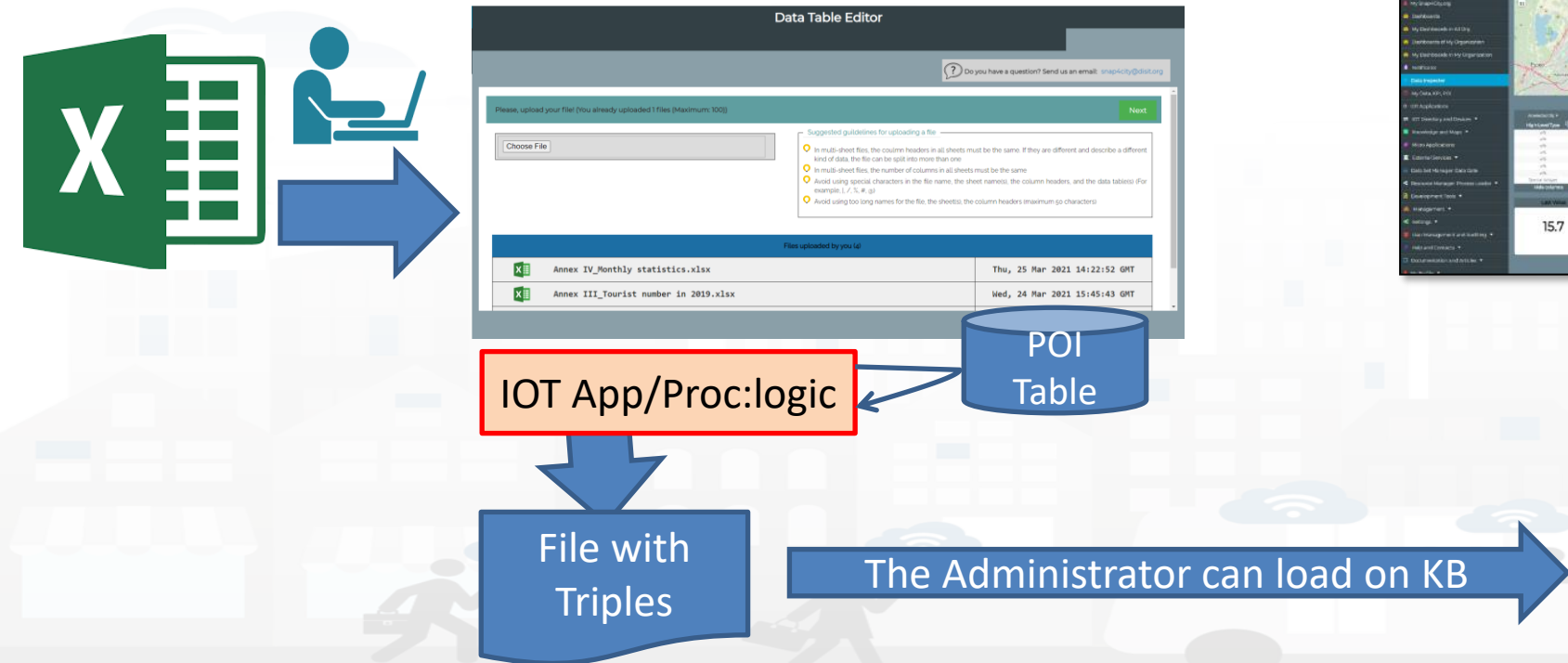
Cap: 50144
 City: FIRENZE
 Prov.: FI
 Photos:

Description: Al centro della piazza compare la statua equestre di Ferdinando I, Granduca di Toscana, opera del Giambologna e le due fontane marine di Pietro Tacca. Incorniciano lo spazio pubblico, colorato di scene di vita quotidiana, monumenti di vario genere: Palazzo Grifoni; il portico della confraternita dei Servi di Maria, opera di Antonio da Sangallo e Baccio d Agnolo; la chiesa della Santissima Annunziata con il portico del XVII secolo; l'ospedale degli Innocenti del Brunelleschi

- Accommodation +
- Advertising +
- AgricultureAndLivestock +
- CivilAndEdilEngineering +
- CulturalActivity +
- EducationAndResearch +
 - EducationAndResearch
 - Educational_support_activities
 - Higher_education
 - Language_courses
 - Performing_arts_schools
 - Post_secondary_education
 - Pre_primary_education
 - Primary_education
 - Private_high_school
 - Private_infant_school
 - Private_junior_high_school
- Emergency +
- Entertainment +
- Environment +
- FinancialService +
- GovernmentOffice +
- HealthCare +
- IndustryAndManufacturing +
- IoTDevice +
- MiningAndQuarrying +
- ShoppingAndService +
- TourismService +
- TransferServiceAndRenting +
- UtilitiesAndSupply +
- Wholesale +
- WineAndFood +

POI Loader

- To help you to upload POI data in short/zero time <https://www.snap4city.org/731>
 - Start from Excel Files, they should be formatted some how or well formatted according to our guidelines (model provided)
 - https://www.snap4city.org/drupal/system/files/private/POI_loader_template.zip
 - Custom upload for each Organization is possible on the provided IOT App/Proc.Logic
- To enable you to
 - create dashboards from them according to different views and nature



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
- My Data Dashboard Dev Kibana
- My Data Dashboard Kibana
- Extra Dashboard Widgets
- Notificator
- Data, my Data, OpenData
 - Data Inspector
 - MyKPI, MyData, MyPOI
 - My Groups of Entities
 - View/Set MyPOI on Tuscany
 - Data Table Loader (Excel)
 - POI Loader (Excel)**
 - Harvest Satellite Copernicus Data
 - HeatMap Manager
 - ColorMap Manager
 - TrafficFlow Manager
 - BIM Server old

POI Loader (Excel)

Do you have a question? Send us an email: snap4city@disit.org

Please, upload your file, following the [Reference Template!](#) (You have uploaded 0 files (Maximum: 100))

Next

Scegli file

General Guidelines

- Use "Previous" and "Next/Save" (not browser navigation) buttons to move to previous and next pages
- Avoid using special characters in cells (For example,|,?)
- Avoid using special characters in file name (For example,|,/#,@,%,"',;")
- Avoid using special characters in sheet name(s) and column headers (For example, blank space,|,/#,@,%,"',;")
- Avoid using too long names for file name, sheet name(s), and column headers (maximum 50 characters)
- Avoid using line breaks in column headers

Uploaded Files (9)								
	Organization	File Name	Triple Status	RDF File	Upload Date & Time			
	Greece-UNISYSTEMS	ergaPOI2.xlsx	Created	ergaPOI2.n3	Tue, 29 Jun 2021 13:28:24 GMT	VIEW DETAILS	CHANGE STATUS	DELETE
	DISIT	Fresh_places.xlsx	Not Created	-	Fri, 11 Jun 2021 14:28:40 GMT	VIEW DETAILS	CHANGE STATUS	DELETE
	Greece-UNISYSTEMS	POI_citycare.xlsx	Created	POI_citycare.n3	Fri, 11 Jun 2021 12:28:48 GMT	VIEW DETAILS	CHANGE STATUS	DELETE

POI Structure, EXCEL

- nameENG, abbreviationENG, descriptionShortENG, descriptionLongENG
- Phone, Fax,
- url (web page), email
- refPerson
- secondPhone, secondFax, secondEmail, secondCivicNumber, secondStreetAddress
- notes
- timetable
- photo
- Other1, other2, other3
- Postalcode, Province, city
- streetAddress, civicNumber
- Latitude, longitude

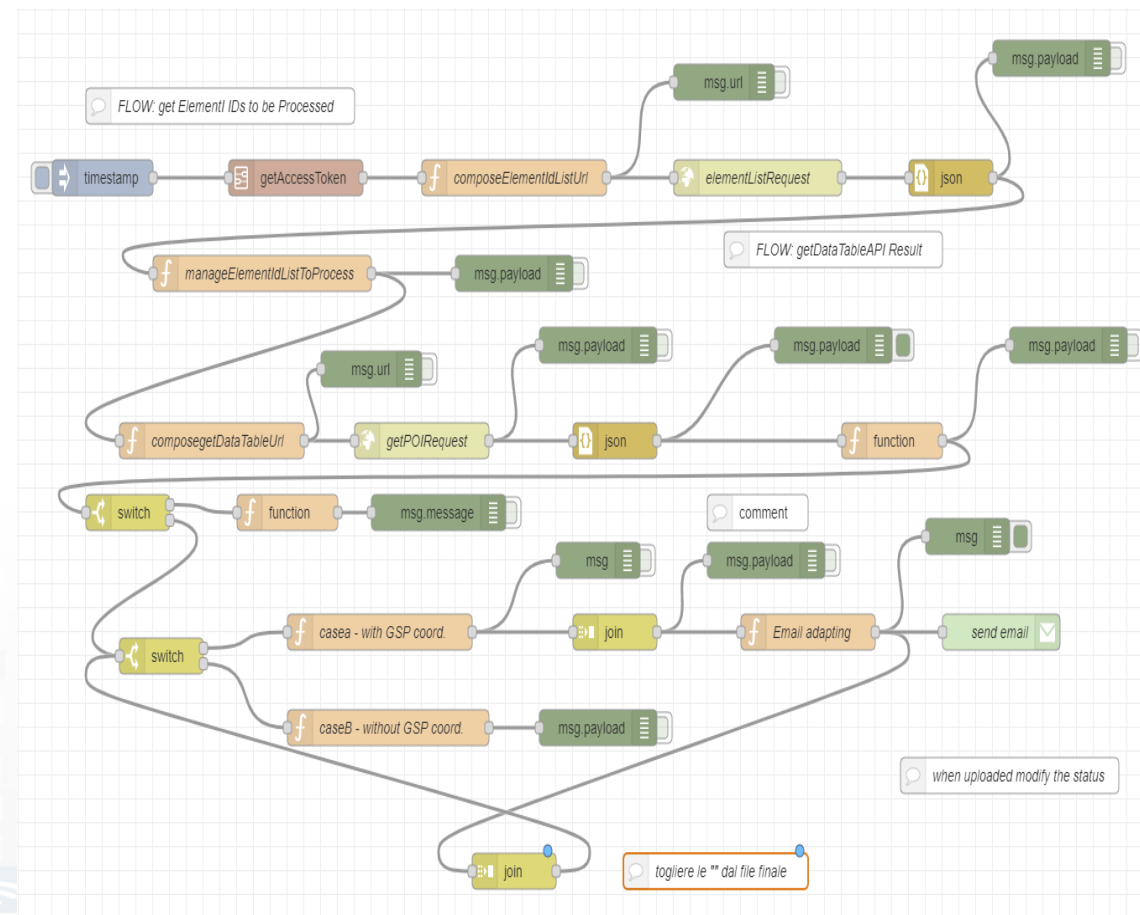
<https://www.snap4city.org/731> Manual

id	name	abbr	desc_s	desc_l	type	lat	lon	url	email	phone	second_phone	second_fax	second_email	second_civic	second_street	notes	photo	other1	other2	other3	postal	province	city	street	civic	lat	lon	status	date	author	page
1	
2	
3	
4	
5	
6	
7	
8	
9	

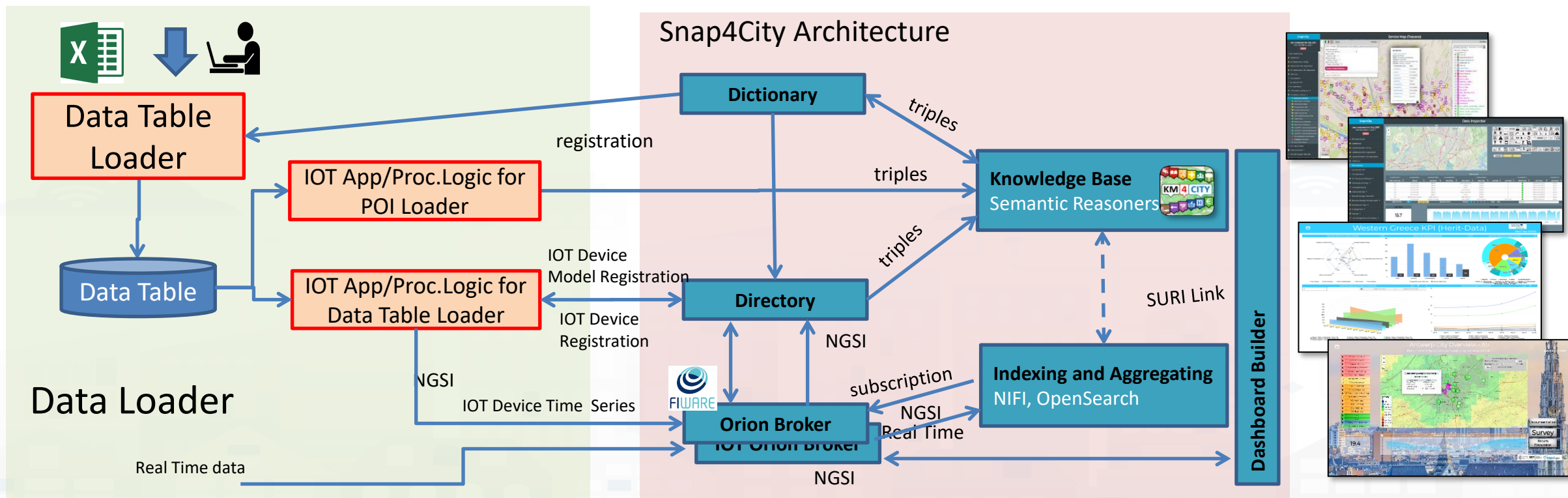
https://www.snap4city.org/drupal/system/files/private/POI_loader_template.zip

Note on POI Loader

- The structure of Excel File is fixed
- UTF8 characters can be used into the values and not in the device name neither on field names
- Follow the guidelines in the first page and the instruction during the upload
- POI Loading is performed via an IoT App which produces triples
 - They are verified and loaded by some administrator
- Any AreaManager can upload POI data sets but only specific dedicated responsible for data upload can actually load being owners and responsible of the IOT App process, which can be customized also.



Short cut Data Ingestion from Excel file

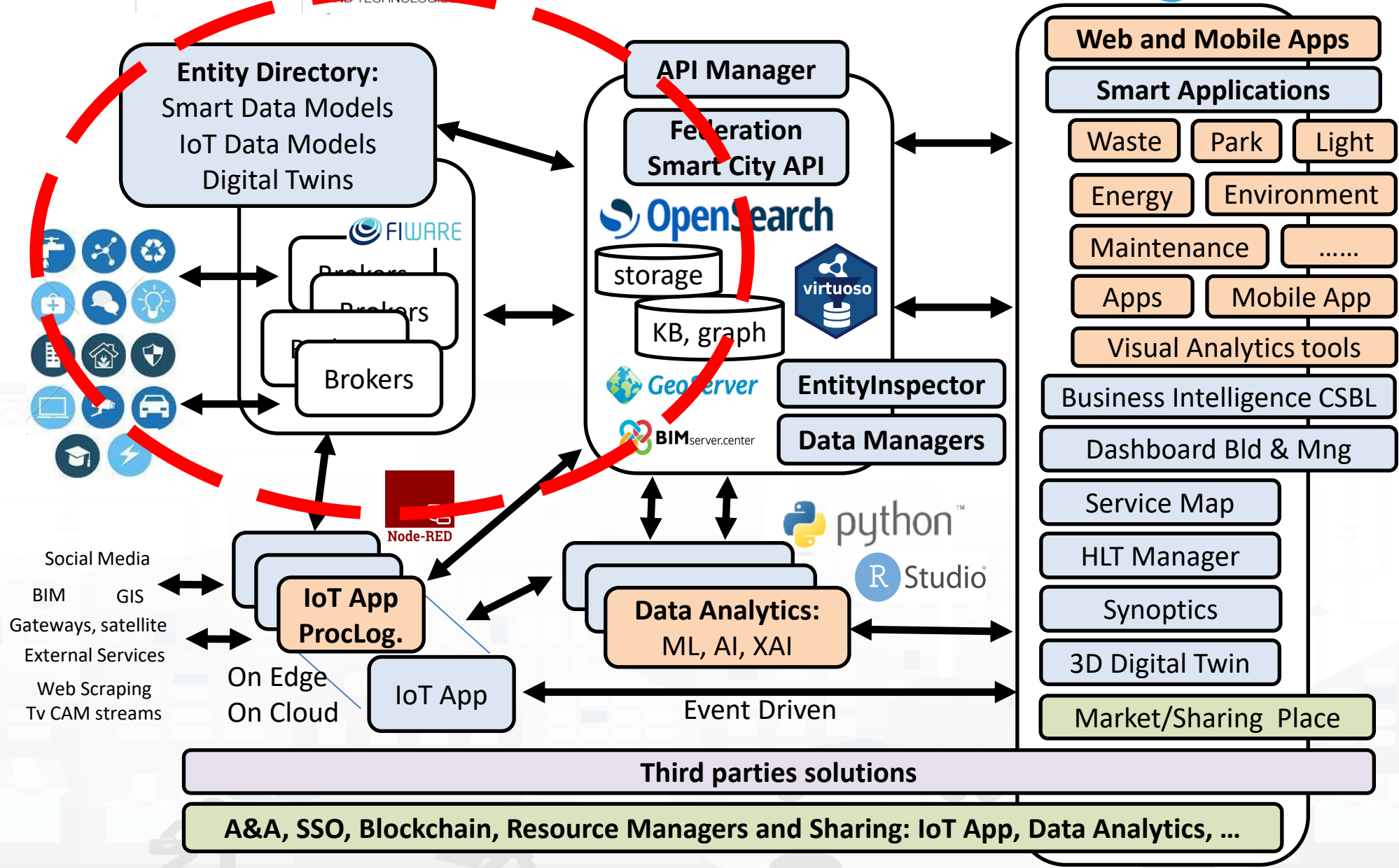


TOP

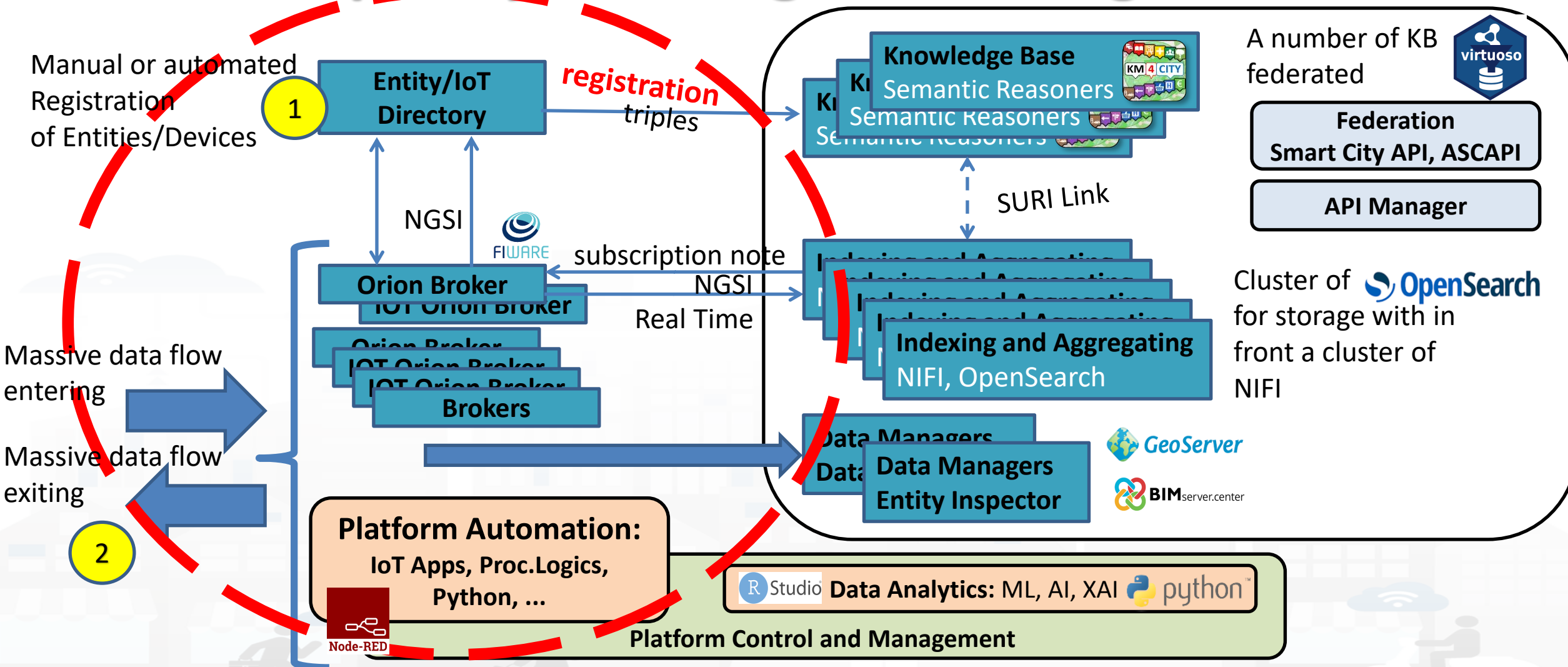
Models vs Devices/Entities and Registration



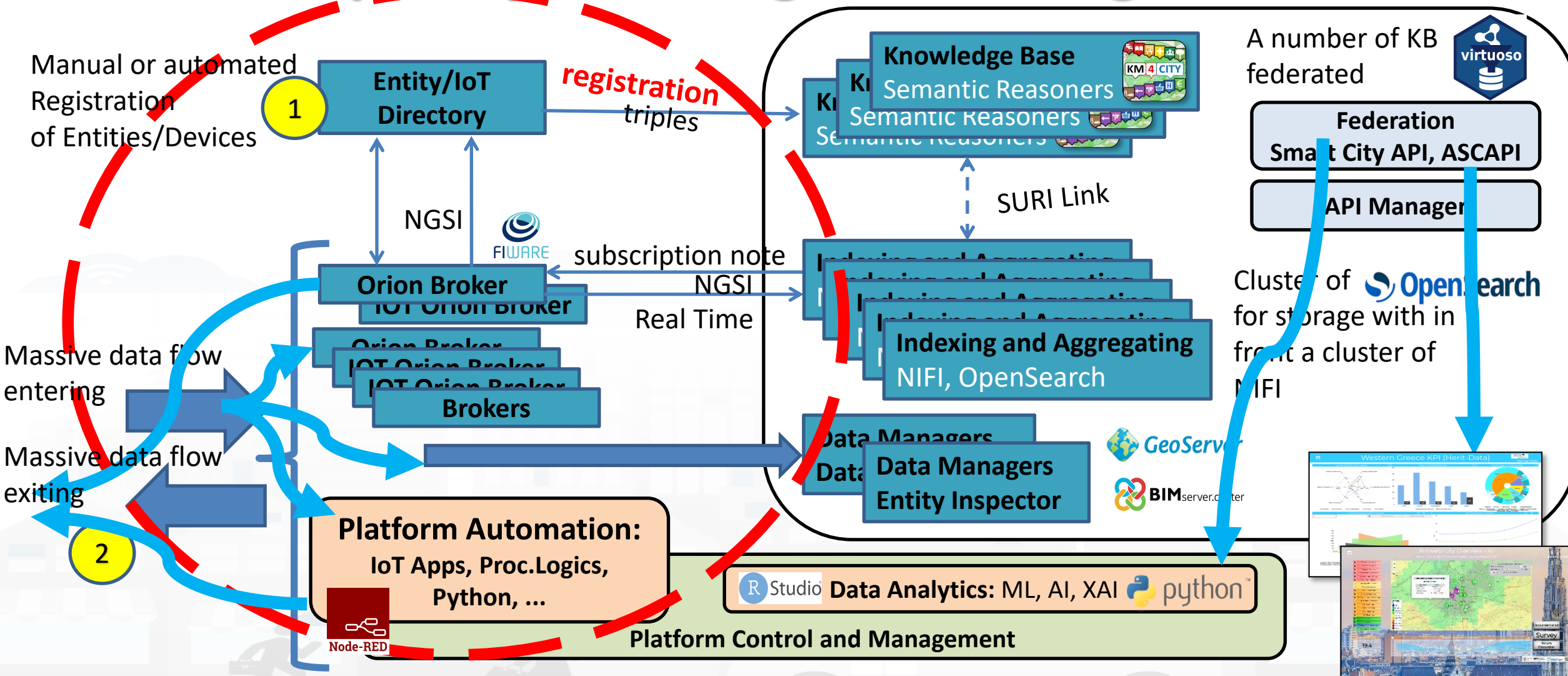
Tech Arch



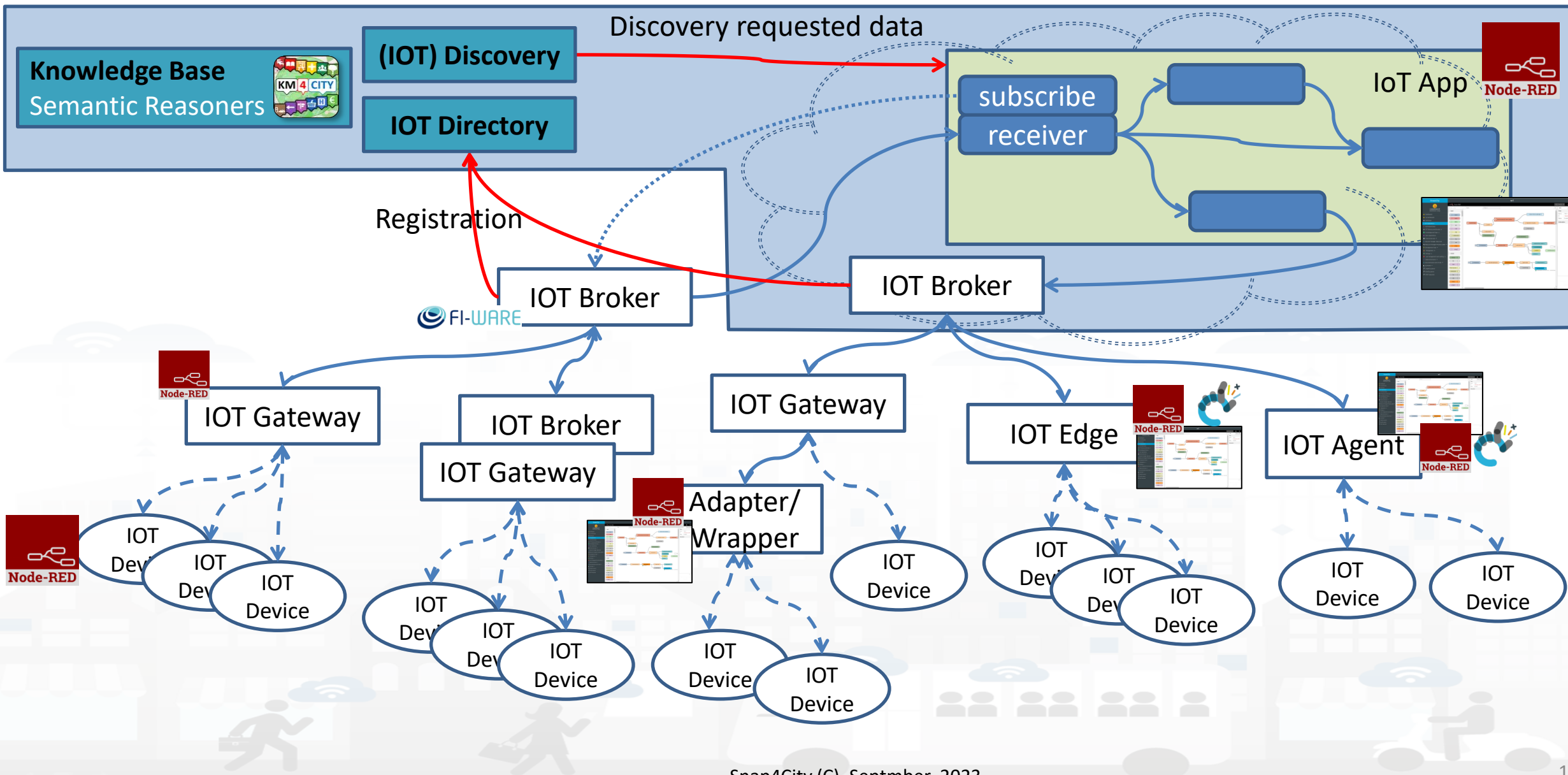
Snap4city Data Ingestion Diagram



Snap4city Data Ingestion Diagram



IoT Network



Directory Features vs Users Roles (07/23)

Entities	what	By using IOT Directory and:	Manager	AreaManager	ToolAdmin/ RootAdmin	Proc.Logic/IOT App microservices
Sensor/Actuator	Browse, use	Several Tools	X	X	X	Yes
	Delegate	API, ..	X	X	X	
	Discovery	KB, API, ..	X	X	X	Yes
Devices/Entities	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
Models (S4C, Fiware)	Browse, Use		X	X	X	(Yes)
	Create, change, delete		X	X	X	(Yes)
	delegate, change ownership		X	X	X	
Brokers	Browse, use		use	Browse, use	X	Yes (use)
	Register/change/Delete				X	
	Deploy Orion Broker				ToolAdmin	
	Delegate				X	
	Periodic Update				X	

Discovery on Proc.Logic/IoT App Node-RED

Node-RED interface showing a flow for processing temperature data. The flow includes nodes for timestamp, Celsius temperature, Fahrenheit temperature, JSON, http request, temp3010, Fiware Orion Query, aggregator, and convert temp. The debug console shows incoming MQTT messages with temperature data.

Device-based search interface showing a map of Florence and a list of aggregated devices. The list includes device names and types such as ARDUINO_ST_4203, ARDUINO_ST_4204, ARDUINO_ST_4205, ARDUINO_ST_4207, ARDUINO_ST_4212, ARDUINO_ST_4213, Light, Motion_Detection, Sound_LV, Presence_Detection_E, Power_Meter_M, and Power_Meter_S.

Node-RED interface showing the 'Edit device-registration node' dialog. The dialog includes a map of Florence and fields for Device Name, Model, and two keys. The keys are: Key 1: 3568dcdf-3167-4ee7-ac05-91d3a9668cb8, Key 2: 5e26b980-402e-4853-9edc-664e025254c8. A 'Check!' button is visible at the bottom.

TOP

Entity/Device Registration

many possibilities

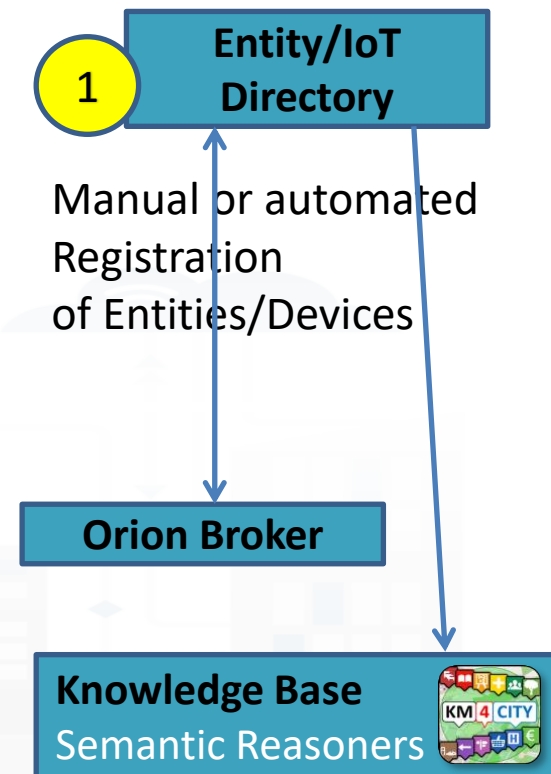
IOT Directory and Devices

- My IOT Sensors and Actuators
- IOT Sensors and Actuators
- IOT Devices
- IOT Devices Management
- IOT Device Discovery
- IOT Brokers
- IOT Device Models
- IOT Devices Bulk Registration
- IOT Broker Periodic Update setti...
- IOT Orion Broker Mapping Rules...
- Doc: IOT Directory and Devices
- Create an IOT Device Instance
- Create an IOT Device Model
- Add an IOT Device into Snap4Cit...



Benefits of Registration on Directory

- **The registration implies the automated production of the Digital Twin Device into the Knowledge Base**
 - Registration of the Entity on Brokers and KB
 - Activation of the Storage “DataShadow” for historical data access
 - Activation of all the relationships
 - Activation of Discovery mechanisms via Entity Directory, KB and SCAPI, etc.
 - Activation of Dashboard Wizard (after a few minutes), and Data Inspector



Activities for Registration on Directory

- **Manual Registration**

- From scratch Single Device / Entity Registration
→ **Entity Directory / IoT Directory**
- From a template (the templates are called Models)

- **Automated Registration for bulk/massive registration: N Entities / Devices**

- From IoT App/Proc.Logic on the basis of some **Models** from IoT App
- From IoT App/Proc.Logic **loading a CSV** (with or without a reference IoT/Entity Model)
- Programming from scratch or from a **Model**
- On the basis of some EXCEL file with data by using the **Data Table Loader, which create model, devices and data**
- Etc.

1

Entity/IoT
Directory

Manual or automated
Registration
of Entities/Devices

Snap4City

Switch To New Layout (Beta)

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

LOGOUT

- My Snap4City.org
- Tour Again
- www.snap4solutions.org
- Dashboards (Public)
- Dashboards of My Organization
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- Entity Directory and Devices
 - My IOT Sensors and Actuators
 - IOT Sensors and Actuators
 - Entity Instances, IoT Devices**
 - IOT Brokers
 - FIWARE Smart Data Models
 - Entity Models/IoT Devices
 - IOT Devices Bulk Registration
 - Doc: IOT Directory and Devices
 - Create an IOT Device Instance
 - Create an IOT Device Model

Entity Instances, IoT Devices

Show entries

	Device Identifier	IOT Broker	Device Type	Model	Ownership	Status	Edit	Delete	Location	View
	1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	orionUNIFI	File	fileModel	MYOWNPUBLIC	active	EDIT	DELETE		VIEW
	alert_1610543238306	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
	alert_1610548534047	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
	alert_1610613189703	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
	alert_1610629197473	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
	...	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
	...	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
	...	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
	...	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
	...	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
	...	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
	...	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW

Search Device Location on Map

Leaflet | © OpenStreetMap contributors

Cancel

What you can do ?

- List and browse your devices and those received in delegation
- Change ownership, control the delegation
- Edit, Change, delete all parameters
- View on map and view all data
- See details

Entity/IoT
Directory

	alert_1610548534047	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
Broker URI: https://broker1.snap4city.org		Broker Port: 8080								
Kind: sensor		Visibility: MyOwnPrivate								
Device Type: event		Format: json								
Protocol: ngsi		MAC:								
Model: AlertGeneric		Producer: disit								
Longitude: 11.241117		Latitude: 43.776703								
Device Uri: http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/alert_1610548534047		VIEW IN SERVICE MAP								
Organization: DISIT		NEW DATA IN alert_1610548534047								
Owner: undefined										
PAYLOAD NGSI v1		PAYLOAD NGSI v2								
K1: 44eca781-af56-490f-a6c6-36d88b1bcd9c		K2: 6a620551-e4e5-4c0d-8777-d0721175cfb0								
Created on: 2021-01-13 15:35:41										

Add New Device

Add a new device

Info | IOT Broker | Position | Static Attributes | Values

Device Identifier Device Identifier is mandatory

Device Type

Edge-Gateway Type

Producer

Private

Ownership

KEY1

Add a new device

Info | IOT Broker | Position | Static Attributes | Values

Latitude

Longitude

Add a new device

Info | IOT Broker | Position | Static Attributes | Values

ContextBroker Context broker is mandatory

Protocol Device protocol is mandatory

Service/Tenant only ngsi w/MultiService supports Service/Tenant selection

Kind

Format Device format is mandatory

ServicePath only ngsi w/MultiService supports ServicePath

Add a new device

Info | IOT Broker | Position | Static Attributes | Values

Value Name <input type="text" value="Value name is mandatory"/>	-- select an option -- <input type="text" value="Value type is mandatory"/>	Value Unit <input type="text" value="Ok"/>	Data Type <input type="text" value="Ok"/>
Refresh rate <input type="text" value="300"/>	Healthiness Criteria <input type="text" value="Ok"/>	<input type="button" value="Remove Value"/>	

Value Name <input type="text" value="Value name is mandatory"/>	-- select an option -- <input type="text" value="Value type is mandatory"/>	Value Unit <input type="text" value="Ok"/>	Data Type <input type="text" value="Ok"/>
Refresh rate <input type="text" value="300"/>	Healthiness Criteria <input type="text" value="Ok"/>	<input type="button" value="Remove Value"/>	

Value Name <input type="text" value="Value name is mandatory"/>	-- select an option -- <input type="text" value="Value type is mandatory"/>	Value Unit <input type="text" value="Ok"/>	Data Type <input type="text" value="Ok"/>
Refresh rate <input type="text" value="300"/>	Healthiness Criteria <input type="text" value="Ok"/>	<input type="button" value="Remove Value"/>	

Entity / Device: Attributes

Where	IOT Device	AT 23-12-2019T20:13:12...	AT 23-12-2019T22:13:12...
IOT Broker	Broker: OrionUNIFI	--	
IOT Broker	Protocol: NGSI	--	
Info	ID: "park45"	park45	park45
Position	GSP Position: 43.12, 11.34	GSP Position: 44.12, 11.12	GSP Position: 44.14, 11.13
Static attribute	Description: "parking massaia"	--	
Static attribute	Location: "Via Massaia"	--	
Static attribute	Civic Number: 3	--	
Static attribute	MaxCapacity: 456	--	
Values	dateObserved: Timestamp	23-12-2019T20:13:12...	23-12-2019T22:13:12...
Values	FreeSlots: Integer, #	345	356
Values	Humidity: float, %	25,5	25,5
Values	Temperature: float, celsius	34	

IoT Device Management for All, Developers

Snap4City

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

[LOGOUT](#)

- My Snap4City.org
- Tour Again
- Dashboards (Public)
- Dashboards of My Organization
- My Dashboards in My Organization
- My Data Dashboard Dev Kibana
- Extra Dashboard Widgets
- Data, my Data, OpenData
- Knowledge and Maps
- IOT Applications
- IOT Directory and Devices
 - My IOT Sensors and Actuators
 - IOT Sensors and Actuators
 - IOT Devices**
 - IOT Brokers
 - IOT Device Models
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 - Create an IOT Device Model
 - Add an IOT Device into Snap4City
- Resource Manager
- Development Tools

IOT Devices

Show entries

[Add new device](#)

Search:

	Device Identifier	IOT Broker	Device Type	Model	Ownership	Status	Edit	Delete	Location	View
+	alert_1610543238306	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610548534047	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610613189703	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610629197473	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610714974380	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610715864347	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610715997465	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610717002089	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610717247691	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610717428876	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW

Showing 1 to 10 of 108 entries

Previous

1 2 3 4 5 ... 11 Next



Developers can

- Manage their own Devices
 - Edit/Modify, Delete, view, send messages, etc.
 - Pass the ownership of a Device to another user
 - Delegate in
 - READ_ACCESS the IoT Device to other users
 - READ_WRITE the IoT Device to other users
 - MODIFY the IoT Device to other users
 - See and change the Delegations
- See Delegated IoT Devices, ...
- See Public IoT Devices, ...



MYOWNPRIVATE

Device - alert_1610543238306

Ownership Visibility **Delegations** Group Delegations

Add new delegation

Delegated username

Confirm

Delegated username can't be empty

READ_ACCESS
READ_ACCESS
READ_WRITE
MODIFY

Current delegations

Delegated user	Kind	Remove
----------------	------	--------

Close

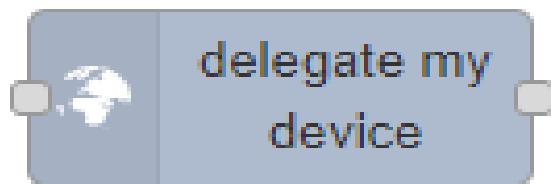
What they mean ?

Supposing that User User45 has the Device D34 !

THUS: User45 can delegate Device D34 at User DD12 for

- **READ_ACCESS**. This means that User DD12 can read the values/data of Device D34, real time and historical
- **READ_WRITE**. This means that User DD12 can
 - read the values/data of Device D34, real time and historical
 - Send messages to the broker to add them for device DD12
- **MODIFY**. This means that User DD12 can Modify structure of Device D34, for example: changing the name of variables, etc.

Delegate Management from IoT App



To delegate a certain device to some other user

Edit delegate-my-device node

Delete Cancel Done

Properties

Authentication: envdatacollection

Select Device: A_DeviceDiProva1

Kind: READ_ACCESS (dropdown menu open showing READ_ACCESS, READ_WRITE, MODIFY)

User Delegated: [text input]

Group Delegated: Group Delegated

You must have an account with Snap4city to use this node. You can register for one [here](#)

Simplified Device Management

Snap4City

Switch To New Layout (Beta)

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

LOGOUT

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 - FIWARE Smart Data Models
 - Entity Models/IoT Devices
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 - Add an IOT Device into Snap4City
- Resource Manager

My IOT Sensors and Actuators

My Sensors and Actuators | Delegated Sensors and Actuators | Add New Device

Show 10 entries

	Device Identifier	Value Type	Device Type	Ownership	Status	Location
+	1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	timestamp	File	MYOWNPUBLIC	active	
+	1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	entity_desc	File	MYOWNPUBLIC	active	
+	1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	entity_desc	File	MYOWNPUBLIC	active	
+	1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	entity_desc	File	MYOWNPUBLIC	active	
+	1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	description	File	MYOWNPUBLIC	active	
+	1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	description	File	MYOWNPUBLIC	active	
+	1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	description	File	MYOWNPUBLIC	active	
+	alert_1610543238306	status	event	MYOWNPRIVATE	active	
+	alert_1610543238306	timestamp	event	MYOWNPRIVATE	active	
+	alert_1610543238306	timestamp	event	MYOWNPRIVATE	active	

Showing 1 to 10 of 1,045 entries

Previous 1 2 3 4 5 ... 105 Next

Simplified Add Device: only from Model

Snap4City

Switch To New Layout (Beta)

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

LOGOUT

- My Snap4City.org
- Tour Again
- www.snap4solutions.org
- Dashboards (Public)
- Dashboards of My Organization
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- My Data Dashboard Dev Kibana
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- IOT Sensors and Actuators
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- IOT Brokers
- FIWARE Smart Data Models
- Entity Models/IoT Devices
- IOT Devices Bulk Registration
- Doc: IOT Directory and Devices

My IOT Sensors and Actuators

My Sensors and Actuators | Delegated Sensors and Actuators | Add New Device

Add My New Device

Select an option

Identifier
Device Identifier is mandatory

Model
Device Model is mandatory

Latitude
Latitude is mandatory

Longitude
Longitude is mandatory

3c4bab66-c273-4599-a1ed-1db1a35d15fe
KEY 1
Ok

1743d0d5-01d6-42a4-a443-1c09c3834ae7
KEY 2
Ok

ContextBroker | Protocol

Format

Submit Device

Select Latitude/Longitude on Map

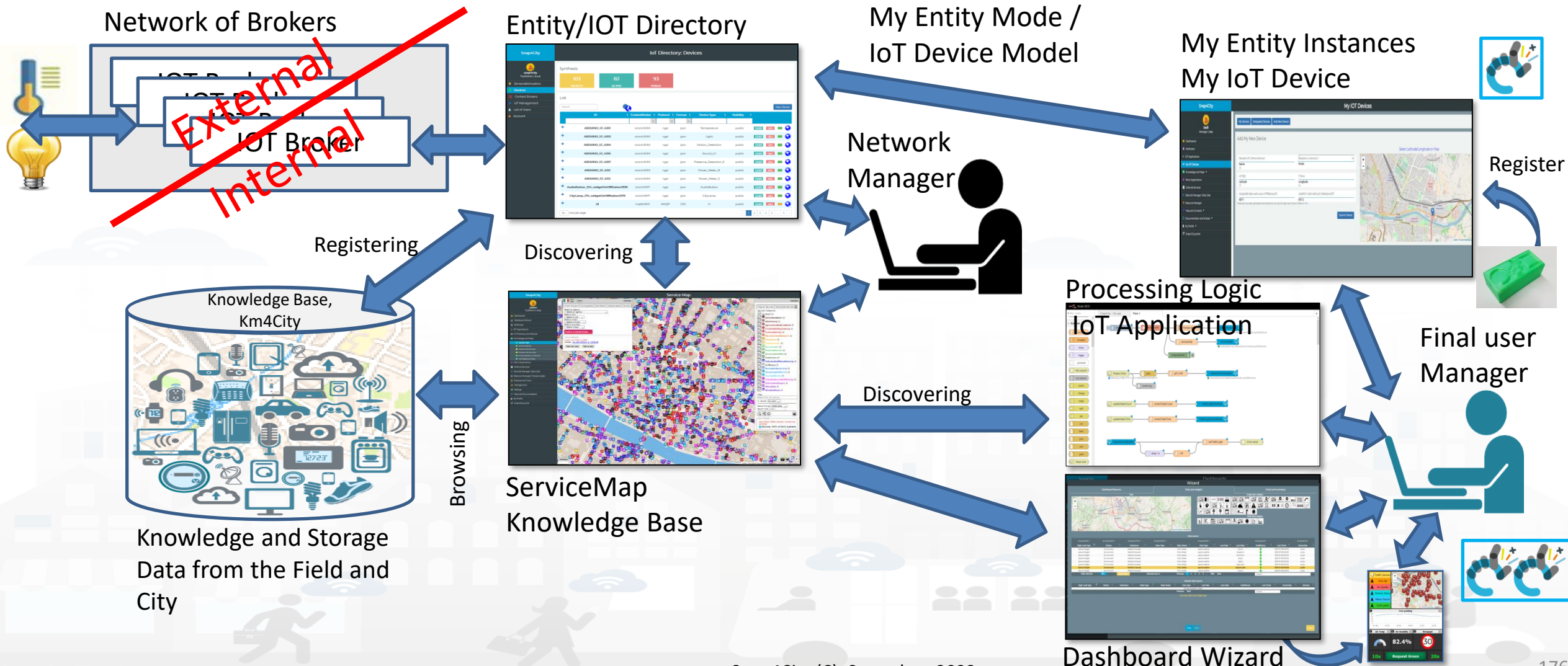
Leaflet | © OpenStreetMap contributors

TOP

*Design: from **Data Modelling** to **Data Ingestion***



IoT/Entity Network Manager vs Final User



Using the Entity/Device Model notes!!!

- Once performed the Entity/Device Model, a number of Entities/Devices can be produce **using the model as a Template**
 - **NOTE:** the produced Entities/Devices are not going to change if the Entity/Device Model is modified.
 - *Your biscuit is not changing if the template is modified after the printout*



The Data Models can be simply instantiated from

- a) **FIWARE Smart Data Models**, versioning, and harvesting the standard repository
- b) **Entity Model / IoT Device Model** which are accessible into the Snap4City environment
- c) **Excel files by using Data Table tool**, which extracts the model from the excel table and automatically creates **Entity Model / IoT Device Model**, Entity Instances / IoT Devices and data attached to them
- d) Creating a **custom Entity Model / IoT Device Model** in standard Snap4City format via **Entity Directory / IoT Directory**



FIWARE Smart Data Models -- Library

Snap4City

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

[LOGOUT](#)

- 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
 - FIWARE Smart Data Models**
 - IOT Device Models
 - IOT Devices Bulk Registration
 - Ext. MS Broker Devices Discovery
 - Ext. MS Broker Discovery
 - Ext. Broker Devs Periodic Update
 - Rules for Discovery
 - OLD IOT Orion Broker Mapping Rule
 - Doc: IOT Directory and Devices
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FIWIRE Smart Data Models Library

Show entries Search:

Name	Subdomain	Domain	Version	Edit
Alert	Alert	CrossSector	0.0.2	EDIT
Anomaly	Alert	CrossSector	0.0.2	EDIT
Battery	Battery	CrossSector	0.0.2	EDIT
BatteryStatus	Battery	CrossSector	0.0.2	EDIT
StorageBatteryDevice	Battery	CrossSector	0.0.2	EDIT
StorageBatteryMeasurement	Battery	CrossSector	0.0.2	EDIT
CallUser	CallComplaints	CrossSector	0.0.1	EDIT
Complaint	CallComplaints	CrossSector	0.0.1	EDIT
ComplaintsCollection	CallComplaints	CrossSector	0.0.2	EDIT
ComplaintsOrganization	CallComplaints	CrossSector	0.0.2	EDIT

Showing 1 to 10 of 441 entries

[Previous](#)
1
2
3
4
5
...
45
[Next](#)



Connections among Entities

Where	Entity Model (IOT Device Model)	Entity Instance (IOT Device)	Entity Message at 23-12-2019T20:15:00	Entity Message at 23-12-2019T20:30:12
Broker	Broker: OrionUNIFI			
Broker	Protocol: NGSI			
Info	ID: string	ID: "park45"	park45	park45
Position	GPS: lat, long	GSP: 43.12, 11.34	GSP: 44.1256, 11.1234	GSP: 44.1259, 11.1233
Static attribute	Description: string	Description: "parking massaia"		
Static attribute	MyAddInfoSURI: string	MyAddInfoSURI: "http://...../InfoPersonal"		
Values	dateObserved: Timestamp		23-12-2019T20:15:00	23-12-2019T20:30:12
Values	FreeSlots: Integer, #		FreeSlots: 345	FreeSlots: 234
Values	TodayCarSURI: string		TodayCarSURI: "http://...../CarNF126GD"	TodayCarSURI: "http://...../CarGF789KK"
Values	Temperature: float, celsius		34	34

Model meaning

- **ID:** is the unique identifier for reconnecting Temporal Instances with registered Entity / Devices
- **Static Attributes:**
 - Are typically associated with instances of the IOT Device.
E.g.:, You have a set of parking areas, each of them is located in a specific street, and has its one name, etc.
 - Different kinds of attributes can be set for each SubNature. Their definition has to be prepared into the Knowledge Base 😊 for automated indexing.
- **Values:** they are time varying variables (temporal values/instances)
 - They change over time, the timestamp of the time series is conventionally «dateObserved» in Snap4City
 - In new *SensorMobile* HLT, also GPS can be changing over time as in the MyKPI
- **NOTE for:**
 - **names/IDs:** Spaces or strange characters are not allowed in the. Please use simple alphanumeric strings, it is a limitation of many solutions including Orion Broker and increase interoperability of your data.
 - **Values of attributes and variables:** can be UTF8, but similarly, they do not accept: () <> “ ‘ ; = into values
 - https://fiware-orion.readthedocs.io/en/master/user/forbidden_characters/index.html



Entity / Device Model (1)



- IOT Broker
 - Name of the Brokers: among those registered
 - Protocol: NGSI, AMQP, MQTT, etc..
 - Format: CSV, JSON, XML.
 - Service/Tenant:.....
 - ServicePath:.....

- Info
 - Name (Identifier)
 - Model: Custom or Model ID
 - DeviceType: ..a string..
 - MAC address: ...optional...
 - Edge-GW: Raspberry, Android, ...
 - Edge-GW: URI
 - Producer
 - Owner
 - Freq: Sec
 - Keys: K1, K2

Add new device

IOT Broker | Info | Position | Static Attributes | Values

ContextBroker Context broker is mandatory

Protocol Device protocol is mandatory

Service/Tenant only ngsi w/MultiService supports Service/Tenant selection

Kind Ok

Format Device format is mandatory

ServicePath only ngsi w/MultiService supports ServicePath

Cancel Confirm

Add new device

IOT Broker | Info | Position | Static Attributes | Values

Name Device name is mandatory

Device Type Device Type is mandatory

Edge-Gateway Type

Producer

Private Ownership

KEY1

custom

Model Ok

Mac Address

Edge-Gateway URI

600 sec

Frequency Ok

Generate Keys

KEY 2

Cancel Confirm

Entity / Device Data Model (2)

Add new device

IOT Broker Info **Position** Static Attributes Values

Latitude Latitude is mandatory Longitude Longitude is mandatory

Cancel Confirm

Edit Model - ChargingStationModel

General Info	IoT Broker	Static Attributes	Values
chargingStateValue Value Name: Ok	charging_state (Chargin Value Type: Ok	some coded status (sta Value Unit: Ok	string Data Type
Refresh rate: 900	Healthiness Criteria	Remove Value	
stationStateValue Value Name: Ok	charging_station_state Value Type: Ok	some coded status (sta Value Unit: Ok	string Data Type
Refresh rate: 900	Healthiness Criteria	Remove Value	
dateObserved Value Name: Ok	timestamp (Timestamp Value Type: Ok	timestamp in millisecon Value Unit: Ok	string Data Type
Refresh rate: 900	Healthiness Criteria	Remove Value	
chargingState Value Name: Ok	charging_state (Chargin Value Type: Ok	some coded status (sta Value Unit: Ok	string Data Type
Refresh rate: 900	Healthiness Criteria	Remove Value	
stationState Value Name: Ok	charging_station_state Value Type: Ok	some coded status (sta Value Unit: Ok	string Data Type
Refresh rate: 900	Healthiness Criteria	Remove Value	

Add Value Cancel Confirm



SURI Connections

From a

- *Static* Attribute of an Entity Instance to another Entity Instance, as highlighted in green in previous table.
- *Dynamic Value/Variable* of an Entity Message of an Entity Instance to another Entity Instance, as highlighted in green in previous table.
- *the example reports a*
 - *static connection and*
 - *dynamic connection to change the car at a given timestamp, note also change of position and other parameters, if needed*



p	o
http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/ns/sosa/Sensor
http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.disit.org/km4city/schema#Traffic_sensor
http://www.w3.org/ns/ssn/implements	http://www.disit.org/km4city/resource/iot/traffic
http://www.disit.org/km4city/schema#hasAttribute	http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO759/avgDistance
http://www.disit.org/km4city/schema#hasAttribute	http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO759/occupancy
http://www.disit.org/km4city/schema#hasAttribute	http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO759/thresholdPerc
http://www.disit.org/km4city/schema#hasAttribute	http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO759/speedPercentile
http://www.disit.org/km4city/schema#hasAttribute	http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO759/dateObserved
http://www.disit.org/km4city/schema#hasAttribute	http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO759/avgTime
http://www.disit.org/km4city/schema#hasAttribute	http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO759/concentration
http://www.disit.org/km4city/schema#hasAttribute	http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO759/vehicleFlow
http://www.disit.org/km4city/schema#hasAttribute	http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO759/averageSpeed
http://www.disit.org/km4city/schema#hasAttribute	http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO759/congestionLevel
http://www.disit.org/km4city/schema#hasAttribute	http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO759/anomalyLevel
http://www.w3.org/ns/sosa/observes	http://www.disit.org/km4city/resource/value_type/average_vehicle_distance
http://www.w3.org/ns/sosa/observes	http://www.disit.org/km4city/resource/value_type/average_vehicle_speed
http://www.w3.org/ns/sosa/observes	http://www.disit.org/km4city/resource/value_type/average_vehicle_time
http://www.w3.org/ns/sosa/observes	http://www.disit.org/km4city/resource/value_type/vehicle_concentration
http://www.w3.org/ns/sosa/observes	http://www.disit.org/km4city/resource/value_type/vehicle_speed_percentile
http://www.w3.org/ns/sosa/observes	http://www.disit.org/km4city/resource/value_type/vehicle_threshold_perc
http://www.w3.org/ns/sosa/observes	http://www.disit.org/km4city/resource/value_type/vehicle_flow
http://www.w3.org/ns/sosa/observes	http://www.disit.org/km4city/resource/value_type/timestamp
http://www.w3.org/ns/sosa/observes	http://www.disit.org/km4city/resource/value_type/anomaly_level
http://www.w3.org/ns/sosa/observes	http://www.disit.org/km4city/resource/value_type/traffic_congestion
http://www.w3.org/ns/ssn/hasSystemCapability	http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO759/systemCapability
http://purl.oclc.org/NET/UNIS/fiware/iot-lite#exposedBy	http://www.disit.org/km4city/resource/iot/orionUNIFI
http://www.disit.org/km4city/schema#protocol	"ngsi"
http://www.disit.org/km4city/schema#format	"json"
http://www.w3.org/2003/01/geo/wgs84_pos#long	11.25673
http://schema.org/addressLocality	"FIRENZE"
http://schema.org/name	"METRO759"
http://schema.org/streetAddress	"Lavagnini P.zza Della Liberta' (38)"
http://www.w3.org/2003/01/geo/wgs84_pos#lat	43.78278
http://www.disit.org/km4city/schema#isInRoad	http://www.disit.org/km4city/resource/RT04801703772TO
http://www.w3.org/2003/01/geo/wgs84_pos#geometry	"POINT(11.256730079651 43.782779693604)""^
http://www.disit.org/km4city/schema#model	"metrotrafficsensor"
http://www.disit.org/km4city/schema#producer	"metro"
www.disit.org/km4city/resource/iot/traffic	www.disit.org/km4city/resource/iot/traffic
www.disit.org/km4city/resource/iot/traffic	"DISIT"



TOP

Entity / Device Registration from Model

IOT Directory and Devices

- My IOT Sensors and Actuators
- IOT Sensors and Actuators
- IOT Devices
- IOT Devices Management
- IOT Device Discovery
- IOT Brokers
- IOT Device Models
- IOT Devices Bulk Registration
- IOT Broker Periodic Update setti...
- IOT Orion Broker Mapping Rules...
- Doc: IOT Directory and Devices
- Create an IOT Device Instance
- Create an IOT Device Model
- Add an IOT Device into Snap4Cit...



Many IoT Devices?

IOT Device Model!!!

Example: ChargingStationModel

- **Prerequisites:** only for AreaManager users
- If you have a set of sensors with the same features,
 - you can create a model and then a set of instances (IoT Devices) in compliance with the model (not time consuming and avoiding errors)
- IoT Directory and Devices > IoT Device Models > 'New Model' button

Edit Model - ChargingStationModel

General Info | IoT Broker | Values

ChargingStationModel

Name
Ok

Modello per stazioni di ricarica elettrica

Description
Ok

ChargingStation

Device Type
Ok

Sensor

Kind

Comune di Firenze

Producer
Ok

600

Frequency

Healthiness Criteria

Healthiness Value

Automatically generated

Key Generation

Edge-Gateway Type

Edit Model - ChargingStationModel

General Info | IoT Broker | Values

orionFirenze-UNIFI

ContextBroker

ngsi

Protocol

json

Format

Cancel Confirm

Edit Model - ChargingStationModel

General Info | IoT Broker | Static Attributes | Values

Value Name	Value Type	Value Unit	Data Type
chargingStateValue	charging_state (Chargii	some coded status (sta	string
Refresh rate	900	Remove Value	
Healthiness Criteria	Healthiness Value		
stationStateValue	charging_station_state	some coded status (sta	string
Value Name	Value Type	Value Unit	Data Type
Refresh rate	900	Remove Value	
Healthiness Criteria	Healthiness Value		
dateObserved	timestamp (Timestamp	timestamp in milliseco	string
Value Name	Value Type	Value Unit	Data Type
Refresh rate	900	Remove Value	
Healthiness Criteria	Healthiness Value		
chargingState	charging_state (Chargii	some coded status (sta	string
Value Name	Value Type	Value Unit	Data Type
Refresh rate	900	Remove Value	
Healthiness Criteria	Healthiness Value		
stationState	charging_station_state	some coded status (sta	string
Value Name	Value Type	Value Unit	Data Type
Refresh rate	900	Remove Value	
Healthiness Criteria	Healthiness Value		

Add Value

Cancel Confirm

Add Entity / Devices, exploiting a Model

My IOT Sensors and Actuators

My Sensors and Actuators | Delegated Sensors and Actuators | **Add New Device**

Show 10 entries | Search:

Device Identifier	Value Type	Device Type	Ownership	Status	Location
1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	timestamp	File	MYOWNPUBLIC	active	
1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	entity_desc	File	MYOWNPUBLIC	active	
1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	entity_desc	File	MYOWNPUBLIC	active	
1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	entity_desc	File	MYOWNPUBLIC	active	
1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	description	File	MYOWNPUBLIC	active	
1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	description	File	MYOWNPUBLIC	active	
1dd79caa95f6771afad4fd38e699c8542022-12-05T18:54:13.000Z	description	File	MYOWNPUBLIC	active	
alert_1610543238306	status	event	MYOWNPRIVATE		
alert_1610543238306	timestamp	event	MYOWNPRIVATE		
alert_1610543238306	timestamp	event	MYOWNPRIVATE		

Showing 1 to 10 of 1,045 entries

My IOT Sensors and Actuators

User: rootooladmin1, Org: DISIT
Role: RootAdmin, Level: 7

Add My New Device

My Devices | Delegated Devices | **Add New Device**

Identifier: Dubrovnik Total Average Person
Model: OK

Latitude: 16d71349-2eb6-454e-84f1-ae54fd3617ce
Longitude: 4e7abd20-77ea-4412-8aed-9e352d055093

KEY1: These keys have been generated automatically for your device. Keep track of them. Details on info

KEY2:

Monitoring Camera: (TransferServiceAndRem: ▾)

Subnature: Locality | Dubrovnik | Value | Remove

Add Attribute | Submit Device

Select Latitude/Longitude on Map

Add Entity / Devices, exploiting a Model

Just Buy an IOT Device and register: SigFOX, MQTT, NGSi (FiWare), ...

- Attach them by
 - Models
- A range of protocols, formats, approaches

Create your own devices:

- Arduino,
- Raspberry,
- Android,
- LoraWAN + Arduino,
- etc.

The screenshot displays the Snap4City web interface for adding a new IoT device. The sidebar on the left shows the user is logged in as 'rootooladmin' from the 'DISIT' organization. The main panel, titled 'My IOT Sensors and Actuators', contains a form for 'Add My New Device'. The form includes fields for 'Identifier' (with a dropdown menu showing 'Dubrovnik Total Average Person'), 'Latitude', 'Longitude', 'KEY1', 'KEY2', and 'Subnature'. A map on the right side of the form allows the user to 'Select Latitude/Longitude on Map'. The 'Subnature' field is currently set to 'Dubrovnik' and has a 'Remove' button next to it. A 'Submit Device' button is located at the bottom right of the form.

**Secure Communication: HTTPS,
TLS (K1, K2), Certificates**

Add Entity / Devices, exploiting a Model

Addition of Static
Attributes of the
Entity Instance /
IoT Device

Only if you
enabled from
model

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
Notifier
Data, my Data, OpenData
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

My IOT Sensors and Actuators
My Devices | Delegated Devices | Add New Device

Add My New Device

Identifier: Dubrovnik Total Average Person
Model: Ok
Latitude: 16d71349-2eb6-454e-84f1-ae54fd3617ce
Longitude: 4e7dbd20-77ea-4412-8aed-8e352d055093
KEY1: KEY2
These keys have been generated automatically for your device. Keep track of them. Details on info

Monitoring Camera (TransferServiceAndRen...
Subnature
Locality: Dubrovnik
Value: [Redacted]
Remove
Add Attribute

Submit Device

Select Latitude/Longitude on Map

Map showing location near Firenze, Italy.

TOP

Entity / Device Registration from IOT App/Proc.Logic (automation)

IOT Directory and Devices

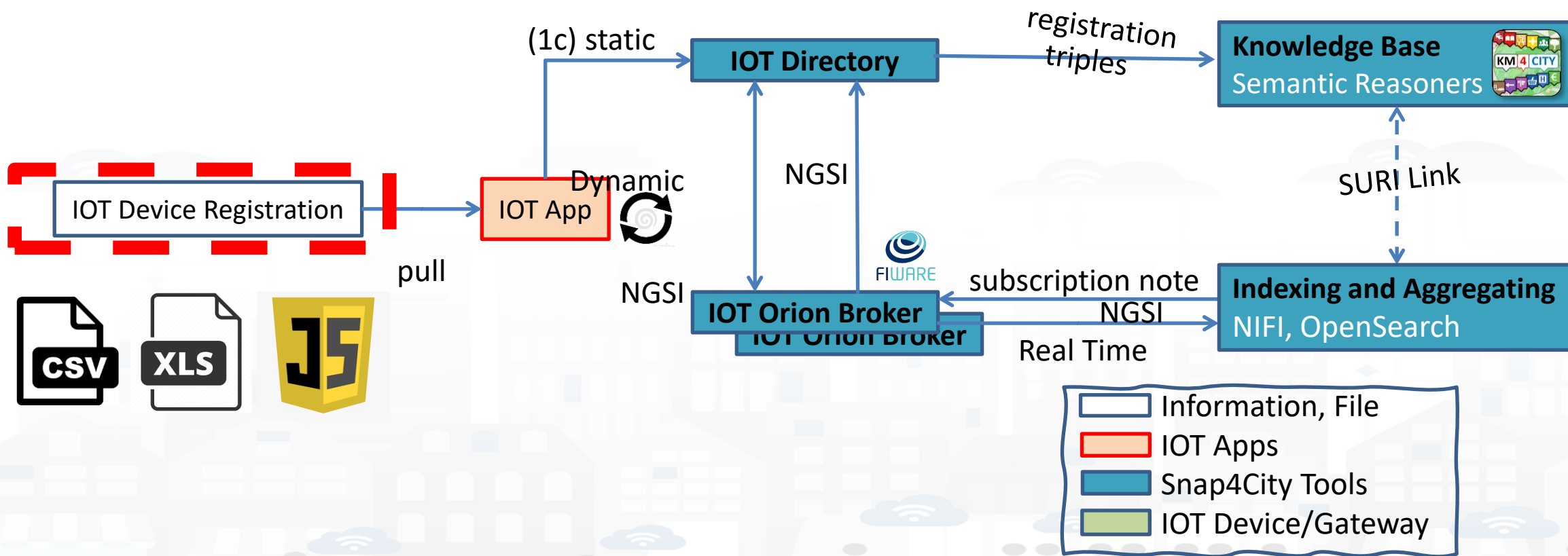
- My IOT Sensors and Actuators
- IOT Sensors and Actuators
- IOT Devices
- IOT Devices Management
- IOT Device Discovery
- IOT Brokers
- IOT Device Models
- IOT Devices Bulk Registration
- IOT Broker Periodic Update setti...
- IOT Orion Broker Mapping Rules...
- Doc: IOT Directory and Devices
- Create an IOT Device Instance
- Create an IOT Device Model
- Add an IOT Device into Snap4Cit...



IOT Applications

- IOT Applications
- MicroServices for IOT Applicatio...
- MicroServices from DataAnalyti...
- IOT MicroServices for Final Users...
- IOT MicroServices for Developers...
- Doc: IOT Applications
- How to Develop IOT Application...
- Create A MicroService from Rest...

Snap4city Data Ingestion Flow Diagram



1) Model creation

IOT Device Models

Edit Model - Florence wifi average person

General Info	IoT Broker	Static Attributes	Values
Florence wifi average person			
Name Ok	Average Number of person for each wifi point in Florence		
Description Ok	Sensor		
wifiSensor	Kind		
Device Type Ok	900		
Comune Di Firenze	Frequency		
Producer Ok	Healthiness Value		
Healthiness Criteria	Edge-Gateway Type		
Automatically generates Key Generation			

Cancel Confirm

Model name: Florence wifi average person

Edit Model - Florence wifi average person

General Info	IoT Broker	Static Attributes	Values
orionToscana-UNIFI ContextBroker		ngsi Protocol	
json Format			
Service/Tenant only ngsi v2/MultiService supports		ServicePath	

Edit Model - Florence wifi average person

General Info	IoT Broker	Static Attributes	Values
Wifi (TourismService)			
Subnature			
Locality	FIRENZE	Remove	Value
Region	FI	Remove	Value

Add Attribute

Edit Model - Florence wifi average person

General Info	IoT Broker	Static Attributes	Values
meanPeople	people_count (People C	Mean number of peopl	integer
Value Name Ok	Value Type	Value Unit	Data Type
Refresh rate	900	Remove Value	
Healthiness Criteria	Healthiness Value		
dateObserved	timestamp (Timestamp	timestamp in millisecor	string
Value Name Ok	Value Type	Value Unit	Data Type
Refresh rate	900	Remove Value	
Healthiness Criteria	Healthiness Value		

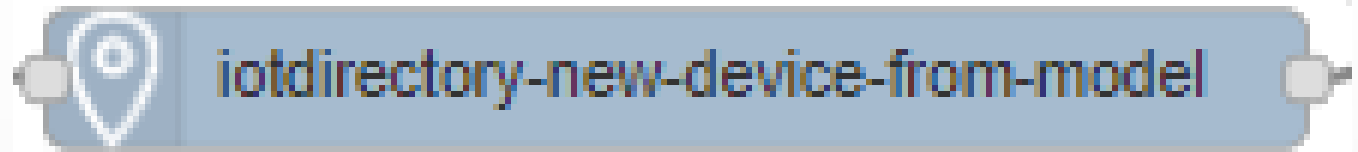
Add Value

Cancel Confirm

The screenshot displays the Node-RED interface within the Snap4City application. The main workspace shows a static flow named 'Flow 1' with the following nodes: 'timestamp', 'split', 'every device', 'iotdirectory-new-device-from-model' (highlighted with a red box), 'delay 5s', and 'json'. The 'iotdirectory-new-device-from-model' node is connected to the 'split' node and outputs a message. The right-hand panel shows the message content as a JSON object:

```
msg: Object
  object:
    topic: ""
    payload: null
    _msgid: "800b6958.c0fc68"
  wifi: array[231]
  statusCode: 201
  headers: object
    responseUrl: "https://wifi-aaa.comune.fi.it/resolute/dettaglio_stato_rete/"
  parts: object
    id_number: "186"
    id_name: "ParcoMusica"
  id: array[309]
  last_date: "2020-07-13T13:46:00.000Z"
  send_averages: false
  date_avg: 0
  passo: 0
  avg: "non la calcolo ancora"
  minuti_last: 46
  minuti_now: 55
```

2) IoT Devices Creation from IOT APP



BLOCK: 'IoTDirectory-new-device-from-model'
Model name: Florence wifi average person

Snap4City

User: michela_toscana, Org: Toscana
Role: ToolAdmin, Level: 3

[Logout](#)

- My Snap4City.org
- Dashboards (Public)
- My Dashboards in All Org.
- Dashboards of My Organization
- My Dashboards in My Organization
- Extra Dashboard Widgets
- Notifier
- Data, my Data, OpenData
- Knowledge and Maps
- IOT Applications
 - MicroServices for IOT Applications
 - MicroServices from DataAnalytic
 - IOT MicroServices for Final Users
 - IOT MicroServices for Developers
 - Doc: IOT Applications
 - How to Develop IOT Applications
 - Create A MicroService from RestCall

Florence_wifi

Node-RED Static flow

Florence_wifi

Edit iotdirectory-new-device-from-model node

node properties:

- devicename: devicename
- latitude: Latitude
- longitude: Longitude

Map view showing location in Florence, Italy.

Inputs:

- k1: 42a688f6-6114-4c0b-84fb-21238e789ef7
- k2: 564cd1f4-3bd4-4acc-be2d-9ea940c24ea1
- Model: Florence wifi average person

Information:

It allows to create a device from model

A JSON with these parameters:

- devicename: The name of the device you want to create (string)
- latitude: latitude of a GPS position (number)
- longitude: longitude of a GPS position (number)
- k1: K1 and K2 are the keys necessary to read and write access to the device. They must be different from each other. (UUID v4 format)
- k2: K1 and K2 are the keys necessary to read and write access to the device. They must be different from each other. (UUID v4 format)
- model: The name of the model (string)

Outputs: Returns the k1 and k2 of device created

3) Group Creation (more than 200 devices) -> put all the devices in the group and put them as 'public' (or they remain private)

My Groups of Entities

Return to My Device Groups List

Device Group ID 20 Name Florence_Wifi Description Wifi averages

No. +	Username	Element ID	Element Type	Element Name	Added
104	michela_toscana	Toscana.orionToscana-UNIFI-wifi_2_Parcheggio_Porta_aLPrato_Leopolda	IOT Device	wifi_2_Parcheggio_Porta_aLPrato_Leopolda	6/7/2020, 18:36:17
105	michela_toscana	Toscana.orionToscana-UNIFI-wifi_6_Parcheggio_Santa_Maria_Novella	IOT Device	wifi_6_Parcheggio_Santa_Maria_Novella	6/7/2020, 18:36:17
106	michela_toscana	Toscana.orionToscana-UNIFI-wifi_5_Parcheggio_Beccaria	IOT Device	wifi_5_Parcheggio_Beccaria	6/7/2020, 18:36:17
107	michela_toscana	Toscana.orionToscana-UNIFI-wifi_9_Ospedale_Pediatrico_Meyer	IOT Device	wifi_9_Ospedale_Pediatrico_Meyer	6/7/2020, 18:36:17
108	michela_toscana	Toscana.orionToscana-UNIFI-wifi_0_Parcheggio_Europa	IOT Device	wifi_0_Parcheggio_Europa	6/7/2020, 18:36:17
109	michela_toscana	Toscana.orionToscana-UNIFI-wifi_4_Parcheggio_San_Lorenzo_Mercato_Centrale	IOT Device	wifi_4_Parcheggio_San_Lorenzo_Mercato_Centrale	6/7/2020, 18:36:17
110	michela_toscana	Toscana.orionToscana-UNIFI-wifi_7_Parcheggio_S_Ambrogio	IOT Device	wifi_7_Parcheggio_S_Ambrogio	6/7/2020, 18:36:17

1) IoTModel

2) Static Flow to create IoTDevices

3) Add the license and Make Public the IoTDevices (according to the license)

IoT Device	IoT Broker	Device Type	Model	Ownership	Status	Edit	Delete	Location
camera_Dubrovnik_1_Ploce	orionDubrovnik-UNIFI	cameraSensor	Dubrovnik Camera Average Person	MYOWNPUBLIC	active	EDIT	DELETE	
camera_Dubrovnik_1_Buza	orionDubrovnik-UNIFI	cameraSensor	Dubrovnik Camera Average Person	MYOWNPUBLIC	active	EDIT	DELETE	
camera_Dubrovnik_1_Milki_mai	orionDubrovnik-UNIFI	cameraSensor	Dubrovnik Camera Average Person	MYOWNPUBLIC	active	EDIT	DELETE	
camera_Dubrovnik_1_Peskarja	orionDubrovnik-UNIFI	cameraSensor	Dubrovnik Camera Average Person	MYOWNPUBLIC	active	EDIT	DELETE	
camera_Dubrovnik_1_Pile	orionDubrovnik-UNIFI	cameraSensor	Dubrovnik Camera Average Person	MYOWNPUBLIC	active	EDIT	DELETE	
camera_Dubrovnik_1_Mala_urata	orionDubrovnik-UNIFI	cameraSensor	Dubrovnik Camera Average Person	MYOWNPUBLIC	active	EDIT	DELETE	

4) Search for the Cameras on Map

5) Working on Dynamic Flow to save Average #people every 15 minutes for each IoTDevice

Node-RED interface for Florence_wifi application. The flow includes nodes for provider, timestamp, http request, json, split, Save on Array for each wifi sensor, send data on Broker, delay 5s, and send. A red box highlights the 'fiware orion out v1' node with the text "Set the lotBroker".

Snap4City API

```

JSON  Dati non elaborati  Header
Salva  Copia  Comprimi tutto  Espandi tutto  Filtra JSON
▼ Service:
  type: "FeatureCollection"
  features: [...]
  ▼ realtime:
    ▼ head:
      ▼ vars:
        0: "measuredTime"
        1: "dateObserved"
        2: "meanPeople"
    ▼ results:
      ▼ bindings:
        ▼ 0:
          ▼ measuredTime:
            value: "2020-07-13T19:49:26.780+02:00"
          ▼ dateObserved:
            value: "2020-07-13T17:45:00Z"
          ▼ meanPeople:
            value: "0"
        ▼ 1:
          ▼ measuredTime:
            value: "2020-07-13T19:40:43.168+02:00"
          ▼ dateObserved:
            value: "2020-07-13T17:30:00Z"
          ▼ meanPeople:
            value: "0"
        ▼ 2:
          ▼ measuredTime:
            value: "2020-07-13T19:20:31.181+02:00"
          ▼ dateObserved:
            value: "2020-07-13T17:15:00Z"
          ▼ meanPeople:
            value: "0"
        ▼ 3:
          ▼ measuredTime:
            value: "2020-07-13T19:01:21.564+02:00"
          ▼ dateObserved:
            value: "2020-07-13T17:00:00Z"
          ▼ meanPeople:
            value: "0"
        ▼ 4:
  
```

- 5) Send RT data to the IoTDevices
- 6) Verify RT Data via Snap4City API or via ServiceMap

ServiceMap interface showing a map of Florence with bus stop locations. A popup window displays details for "wifi_57_Loggia_Lanzi_Uffizi" including service URL, name, nature, city, and observed data.

ServiceMap



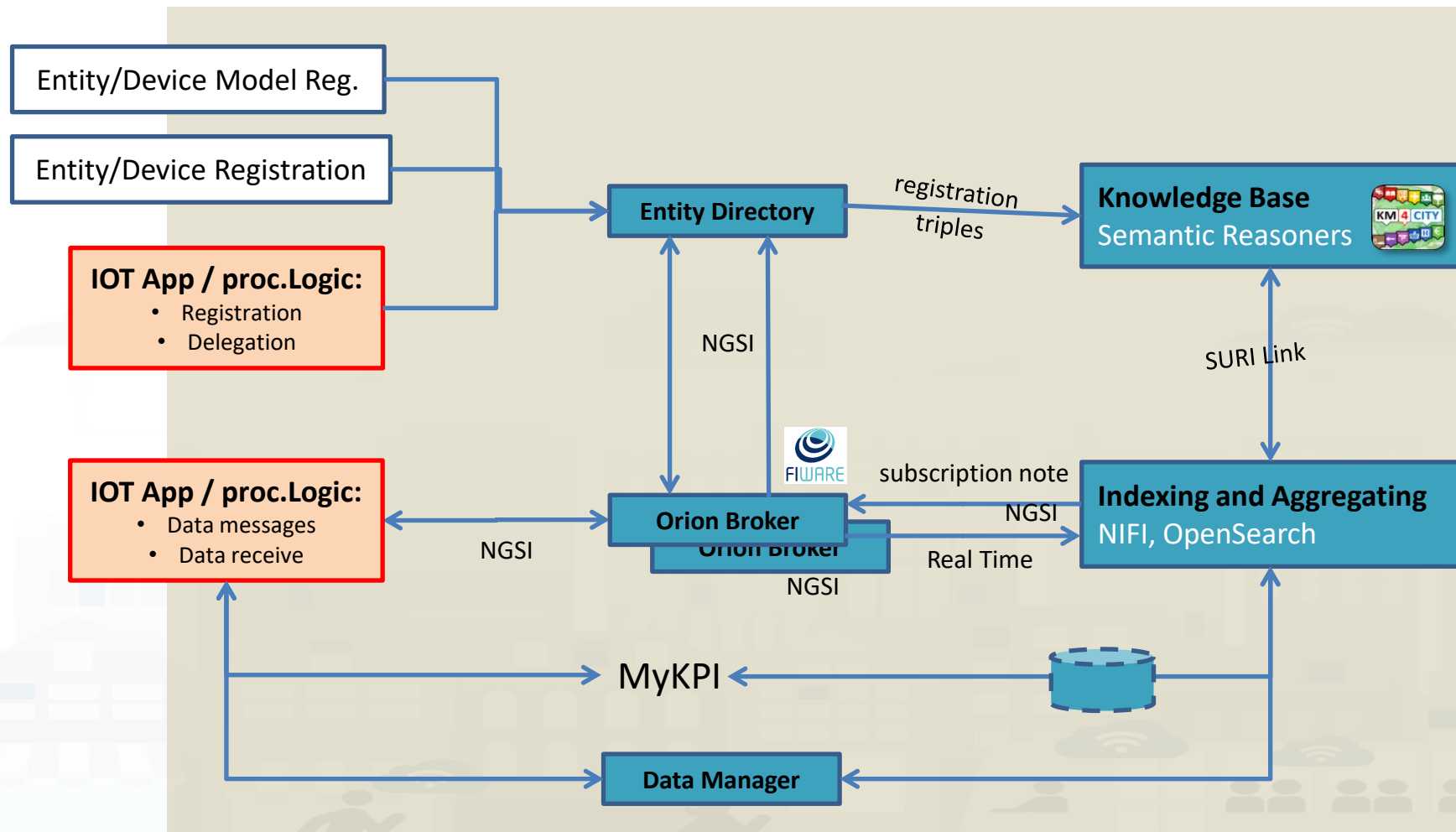
COFFEE BREAK

TOP

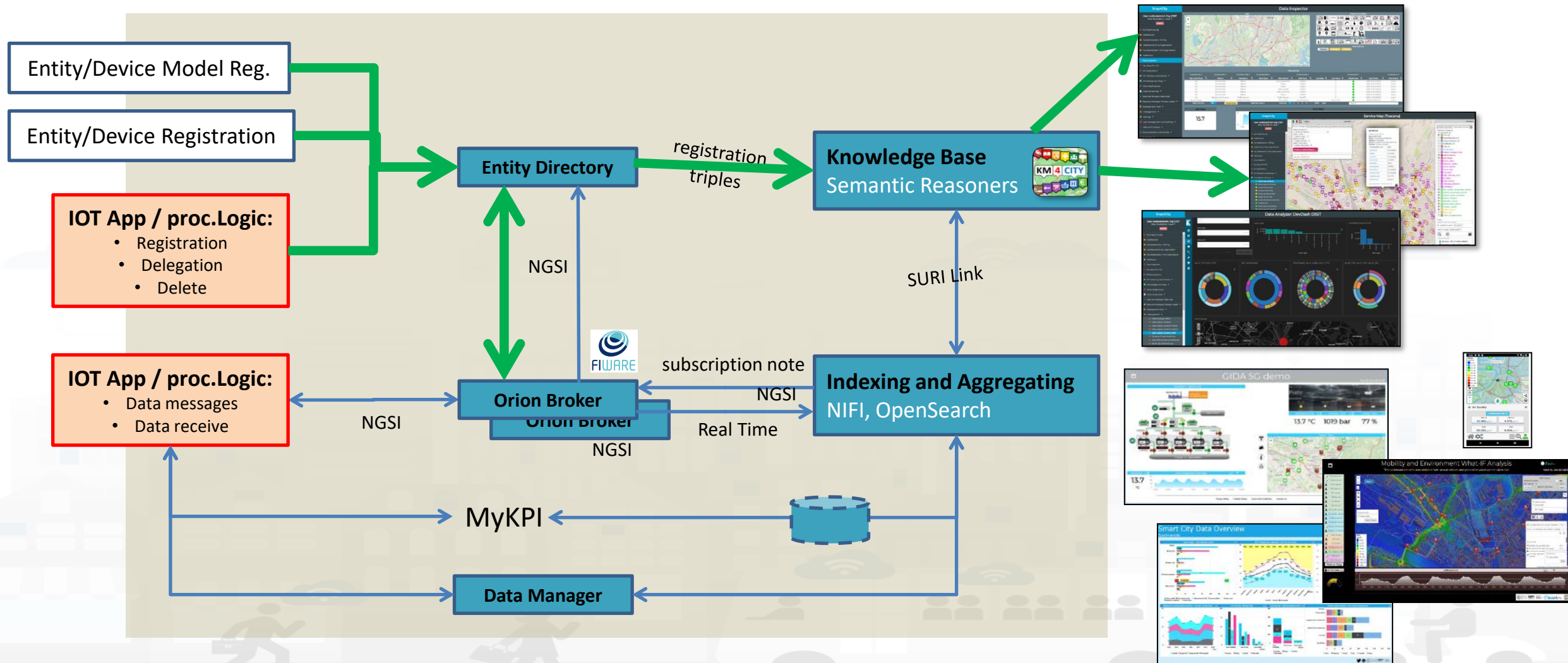
Verification of Data Ingestion



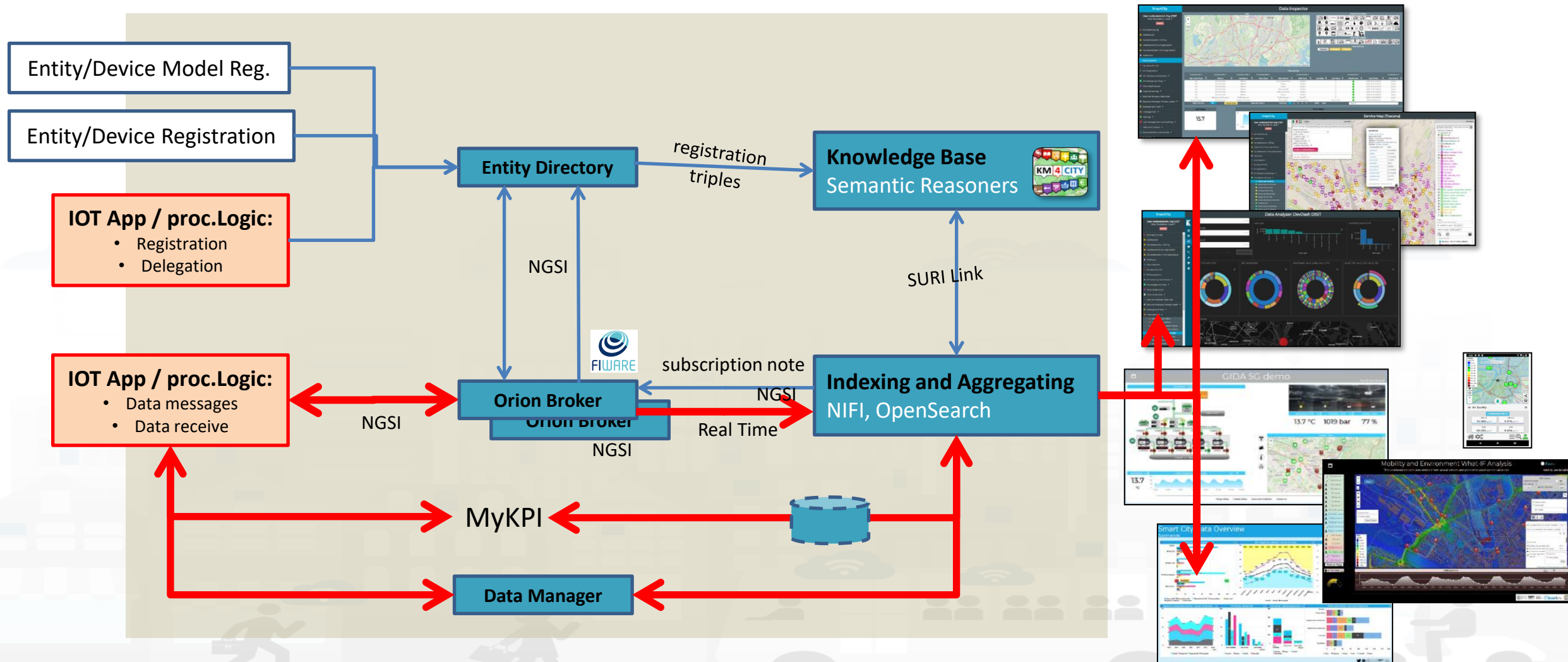
Main Data In/Out flows



Main Data In/Out flows



Main Data In/Out flows



Checking data/Entity ingestion results

Knowledge base Semantic reasoners



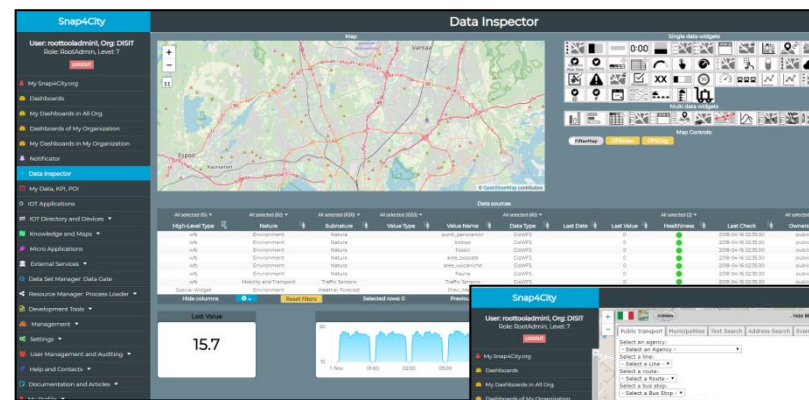
- All searches
- Metata
- Structure
- Last values of IoT Dev
- GTFS
- Only public IoT Dev

Indexing and aggregating NIFI, OpenSearch

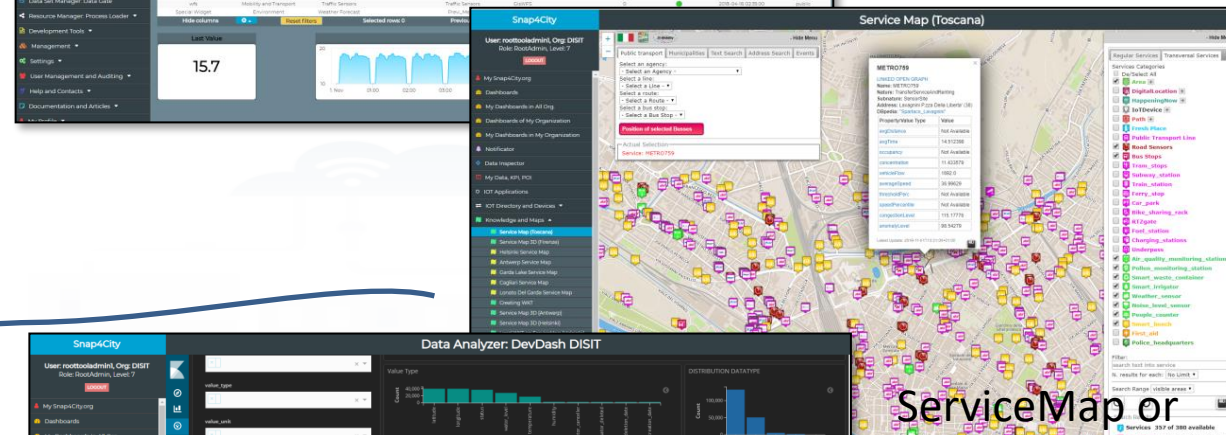
- Faceted search
- Geo search
- Time Series
- Private and Public

- **Data Inspector**
- **ServiceMap, SCAPI**
 - LOG / LOD viewer
 - Super Service Map
- **IoT/Entity Directory**
- **SCAPI: Swagger**
- **IoT Brokers**

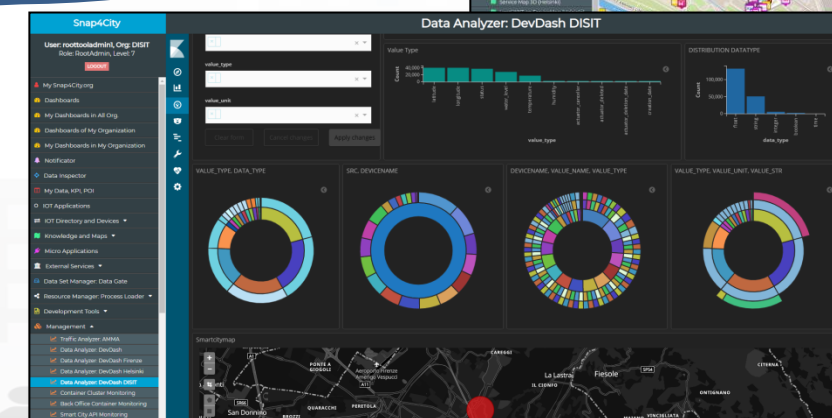
- **Data Inspector**
- **ServiceMap, SCAPI**
- **My Data Dashboard, OpenSearchDash**
- **OpenSearch**



Data Inspector
Digital Twin view



ServiceMap or
Super ServiceMap



My Data Dashboard
DevDash

Verification of Data Ingestion Process

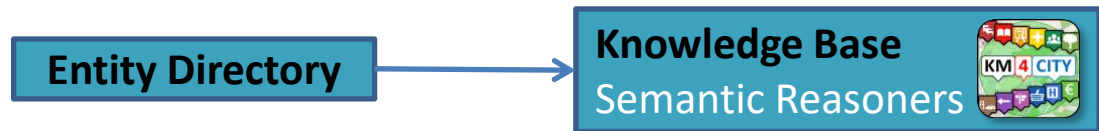
- **Verify that**

- **Entity/Device Creation** see it on

- Entity/IoT Directory, Entities/Devices list
- Service Map if the device is Public
- Data Inspector if the device is public and/or private
 - You can see the trend to see the time series and last value from the pin on map of the Data Inspector
- Dashboards..... you can create a specific one using the Dashboard Wizard

- **Entities/Device Data (time series)** see them on

- Broker, via A dedicated services is coming....
- Service Map if the device is Public
- Data Inspector, this means that the data are on Storage
 - You can see the trend to see the time series and last value from the pin on map of the Data Inspector
- Dashboards..... you can create a specific one using the Dashboard Wizard



Verify on IoT Directory

1. Verify the presence of the IoT Device you created
2. Verify the structure of the device by edit tool
3. See the **NGSI V2 JSON** format to be used on sending data msgs
4. Call the IoT Broker to see the last data on it (some user name and Pwd can be needed)
 - Get the Broker Name from the device profile
5. See next slide

Device Identifier	IOT Broker	Device Type	Model	Ownership	Organization	Owner	Status	Location
basilicaDesamparados_new2	orionValencia-UNIFI	building	buildingval	PUBLIC	Valencia	jogarcia	active	valencia
basilicaDesamparados_new2_gases	orionValencia-UNIFI	heritageNode	heritageNode	PUBLIC	Valencia	jogarcia	active	valencia
criptaSanVicente_new	orionValencia-UNIFI	building	buildingval	PUBLIC	Valencia	jogarcia	active	valencia
criptaSanVicente_new_conteo	orionValencia-UNIFI	heritageNode	heritageNode	PUBLIC	Valencia	jogarcia	active	valencia
criptaSanVicente_new_gases	orionValencia-UNIFI	heritageNode	heritageNode	PUBLIC	Valencia	jogarcia	active	valencia

Broker service URL such as

-- <https://www.snap4city.org/brokrname/v2/entities>

-- <http://brokrname.snap4city.org/v2/entities/>

IOT Broker	Access Link	Access Port	Kind	Protocol	Ownership	Organization	Owner	Created	Edit	Delete
orionValencia-UNIFI	valencia-broker.snap4city.org	443	internal	ngsi	DELEGATED	Valencia	iotdirectory.valencia	2020-08-10 10:16:50	EDIT	DELETE

Verify on Knowledge Base

5. Click on ServiceURI (device URI) to Open in a new TAB the data sent on the KB

6. If your device is Public and you have sent data → the list of the last data from OpenSearch querying from KB will appear as:

Service
URI
LOD

Verify data ingestion on KB via ServiceMap

- **7)** Verify on ServiceMa by Search on data location or by text name of the device
- **8)** click on ServiceURI to jump on **9)** LOG.DISIT.ORG to see semantic structure in terms of Linked Open Data, LOD

The screenshot shows the Snap4City interface. On the left is a sidebar with a menu for 'Valencia Service Map'. The main area is a map with a search bar containing 'basilicaDesamparados'. A search result pop-up shows details for 'basilicaDesamparados_new2', including its ServiceURI: http://www.disit.org/km4city/resource/ot/orionValencia-UNIFI/Valencia/basilicaDesamparados_new2. A blue arrow points from this URI to a 'Linked Open Graph' window at the bottom, which displays a network of semantic relationships between various entities like 'building', 'sensor', and 'historical building'.

Service
URI
LOD

Every data on OpenSearch

- Verify on OpenSearch Dash which monitor Open Search: My data Dash

Snap4City

User: roottoadmin, Org: DISIT
Role: RootAdmin, Level: 7
[Logout](#)

- My Snap4City.org
- Tour Again
- ダッシュボード
- Dashboards
- My Dashboards in All Org
- Dashboards of My Organization
- My Dashboards in My Organization
- My Data Dashboard Dev Kibana

Extra Dashboard Widgets

Notifier

Data, my Data, OpenData

Knowledge and Maps

IOT Applications

IOT Directory and Devices

Resource Manager

Personalization Tools

My Data Dashboard Kibana

deviceName.keyword: basilicaDesamparados_new2 × + Add filter

COUNTEVENTS

HITS
690
TOTAL HITS

EVENT COUNTS

FACET FIELDS v1

- groups: Select...
- kind: Select...
- value name: Select...
- device name: basilicaDesamparados_new2 ×
- src: Select...
- value type: Select...
- kpi id: Select...
- sensor id: Select...

[Apply changes](#) [Cancel changes](#) [Clear form](#)

DEVICE NAME

ORGANIZATION PIE

DISTRIBUTION VALUE NAME

DISTRIBUTION VALUE TYPE

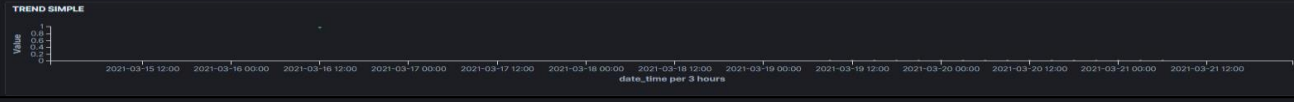
DISTRIBUTION DATA TYPE

VALUE_TYPE, DATA_TYPE

SRC, DEVICENAME

DEVICENAME, VALUE_NAME, VALUE_TYPE

VALUE_TYPE, VALUE_UNIT, VALUE_STR

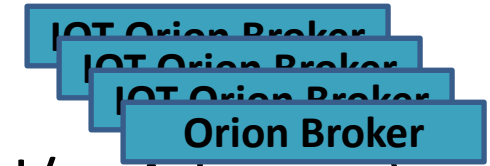


EVENTS 1-50 of 690

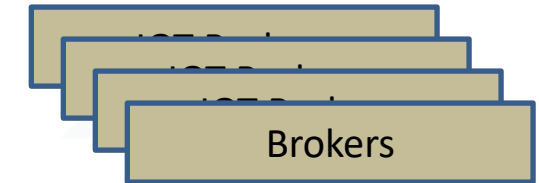
Time	organization	deviceName	value	src	kind	latlon	value_name	value_type	data_type	serviceUrl	value_unit	value_str	sensorID
> Mar 21, 2021 @ 06:23:00.000	Valencia	basilicaDesamparados_new2	-	IOT	sensor	39.47627-0.374804	dateObserved	timestamp	time	http://www.disit.org/km4city/resource/lorionValencia-UNIFI/Valencia/basilicaDesamparados_new2	timestamp	2021-03-21T05:23:00.000Z	basilicaDesamparados_new2
> Mar 21, 2021 @ 06:23:00.000	Valencia	basilicaDesamparados_new2	0	IOT	sensor	39.47627-0.374804	conservationStatus	status	integer	http://www.disit.org/km4city/resource/lorionValencia-UNIFI/Valencia/basilicaDesamparados_new2	status	-	basilicaDesamparados_new2
> Mar 21, 2021 @ 05:53:00.000	Valencia	basilicaDesamparados_new2	0	IOT	sensor	39.47627-0.374804	conservationStatus	status	integer	http://www.disit.org/km4city/resource/lorionValencia-UNIFI/Valencia/basilicaDesamparados_new2	status	-	basilicaDesamparados_new2
> Mar 21, 2021 @ 05:53:00.000	Valencia	basilicaDesamparados_new2	-	IOT	sensor	39.47627-0.374804	dateObserved	timestamp	time	http://www.disit.org/km4city/resource/lorionValencia-UNIFI/Valencia/basilicaDesamparados_new2	timestamp	2021-03-21T05:53:00.000Z	basilicaDesamparados_new2


Additional Notes

- The **Orion Brokers** can be feed by means of
 - **IoT App/Proc.Logic** of Snap4City (to implement Agents and/or Adapters)
 - **IoT Agents** and/or **NGSI Adapters** by FiWare for different protocols
 - **Brokers** of any kind, different protocols and producers, also as Gateways, and they can be located on premise and/or on any cloud

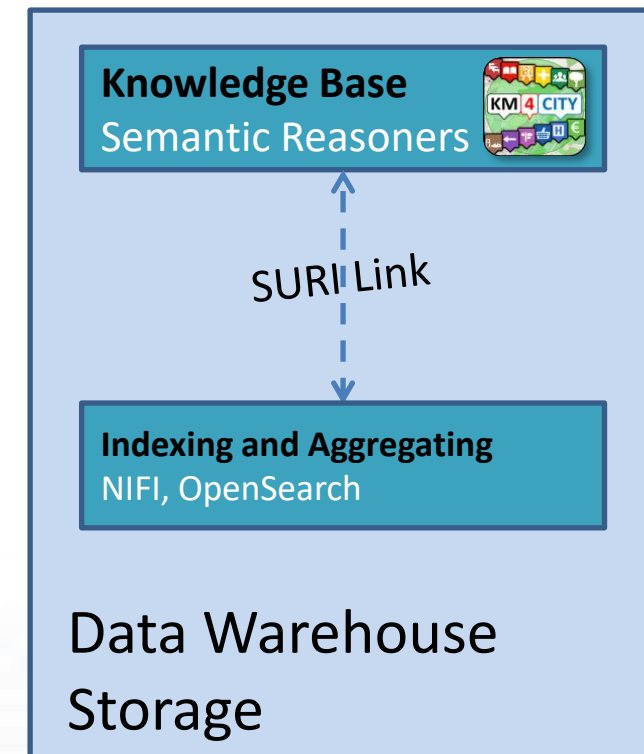


- **Proc.Logic/IoT App, IoT Agents, Adapters** can
 - be on IoT Edge
 - be implemented as IoT App/Proc.Logic of Snap4City
 - be on other clouds and services
 - work on a large range of different protocols and kinds
 - have or not Snap4City libraries installed



- The **Internal Orion Brokers** at Snap4City  are used as a gate for data ingestion and actuations. Since they are
 - connected with the Directory and discovery of the Knowledge Base to make easy the production of Dashboards by wizard, Data Inspector;
 - Synchronized automatically with NIFI/OpenSearch for the Automated Data Shadow and Indexing
 - Ready to be used by Proc.Logic/IoT App to subscribe for creating even driven Proc.Logic/IoT Apps, on Edge and Cloud, etc...
 - Compatible and harmonized with FiWare networks

- **Direct Data Ingestion is also possible:**
 - From data sources to Data Warehouse Storage of Snap4City, Snap4Industry
- **Data Warehouse Storage includes:** KB, and I&A, reported on right side can be acted via API REST Call
 - for direct feeding data into store and retrieval,
 - which can be exploited by:
 - IOT App/Proc.Logic
 - applications in Python, R Studio, Java



Notation Terminology

WHERE	Are synonymous at level of service which can be IoT device or entity with data and references to	Are synonymous at level of the single attribute of the entity , device, service, etc.
IoT Directory, Entity Directory	IoT Device, Entity Instance, Device URI	Sensor, Actuator, Attributes, Values (value name)
Knowledge Base, ServiceMap, SmartCity API, ASCAPI	Service, ServiceURI, SURI	Attribute, Metric, SURI with metric
DataInspector, Wizard, Dashboard	Value Name (Model name, Category)	Sensor, Sensor Actuator, ValueType
IoT App., Proc.Logic, Node-RED	ServiceURI, SURI	SURI and its real time results of the objects into the data structure

ServiceURI, SURI of a sensor device:

- <http://www.disit.org/km4city/resource/METRO759>
- <http://www.disit.org/km4city/resource/iot/orionCAPELON-UNIFI/CAPELON/Streetlight%3A90FD9FFFFE5A7F>

ServiceURI, SURI extended with attribute/variable/value:

- <http://www.disit.org/km4city/resource/METRO759&metric=vehicleFlow>
- <http%3A%2F%2Fwww.disit.org%2Fkm4city%2Fresource%2FMETRO759&metric=vehicleFlow>
- In some cases
 - <http://www.disit.org/km4city/resource/METRO759/vehicleFlow>

TOP

Digital Twin Data Inspector vs Data Processes Details

- Data, my Data, OpenData ▾
- Data Inspector
- MyKPI, MyData, MyPOI
- My Groups of Entities



*Some functionalities are
limited to certain roles*

- It is showing data:
 - Listed by High Level Types, and classified as in the **Dashboard WIZARD: see Tutorial Part 2 for details.**
 - of your Organization only, that are public of the organization, your private or those that have been delegated to you some how.

Data Inspector

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
Notificator
Data Inspector
My Data, KPI, POI
My Groups of Entities
IOT Applications
IOT Directory and Devices
Knowledge and Maps
Micro Applications
External Services
Data Set Manager: Data Gate
Synoptics
Resource Manager: Process Loader
Development Tools
Management
Settings
User Management and Auditing
Help and Contacts

Map

Single data widgets
Multi data widgets
Map Controls: FilterMap GPSUser GPSOrg

High-Level Type	Nature	Subnature	Value Type	Value Name	Data Type	Value Unit	Last Date	Last Value	Healthiness	Last Check	Ownership
wfs	Environment	Natura		punti_panoramici	GisWFS			0	●	2020-04-03 09:58:18	public
wfs	Environment	Natura		biotopi	GisWFS			0	●	2020-04-03 09:58:18	public
wfs	Environment	Natura		Fossili	GisWFS			0	●	2020-04-03 09:58:18	public
wfs	Environment	Natura		aree_boscate	GisWFS			0	●	2020-04-03 09:58:18	public
wfs	Environment	Natura		aree_vulcaniche	GisWFS			0	●	2020-04-03 09:58:18	public
wfs	Environment	Natura		Fauna	GisWFS			0	●	2020-04-03 09:58:18	public
wfs	Mobility and Transport	Traffic Sensors		Traffic Sensors	GisWFS			0	●	2020-04-03 09:58:18	public
Special Widget	Environment	Weather Forecast		PrevLMeteo	special weather				●	2020-04-03 09:30:45	public

Hide columns Reset filters Selected rows: 0 Previous 1 2 3 4 5 ... 14288 Next Search

Last Value: 15.9

Time Trend: 3 Apr 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00

Data Inspector (open on your left side menu)

- **Cross Filtering on the basis of:**
 - **MAP:** pan and zoom → lock , center on GPS coordinates of the user
 - **Data Source Classification:**
 - faceted filtering
 - full text search
 - **Click on data source** to see it on map, and see the graphics representation, just to learn how widgeting it.
 - **Full Text Search** if you remember some desc...

- **Selecting a Data Source on Map:** on its Pin you can see:
 - Real time data
 - Time trend: 4 hours, 12 hours, 1 day, 1 week, 30 days.
 - Full status and description (only for Administrators)

High-Level Type	Nature	Subnature	Value Type	Value Name	Data Type	Last Date	Last Value	Healthiness	Last Check	Ownership
Sensor	From IOT Device to KB	IoTSensor	humidity	DISIT:orionUNIFI:Termometro	float	2019-07-02 08:36:32		●	2019-07-02 08:36:32	private
Sensor	From IOT Device to KB	IoTSensor	temperature	DISIT:orionUNIFI:Termometro	float	2019-07-02 08:36:32		●	2019-07-02 08:36:32	private
Sensor	From IOT Device to KB	IoTSensor	humidity	DISIT:orionUNIFI:Termometro00	float	2019-07-02 08:36:49		●	2019-07-02 08:36:49	private
Sensor	From IOT Device to KB	IoTSensor	temperature	DISIT:orionUNIFI:Termometro00	float	2019-07-02 08:36:49		●	2019-07-02 08:36:49	private
Sensor	From IOT Device to KB	IoTSensor	humidity	DISIT:orionUNIFI:Termometro00	float	2019-07-02 08:36:49		●	2019-07-02 08:36:49	private
Sensor	TransferServiceAndRenting	SensorSite	vehicleFlow	METRO487	float	2019-06-25 22:40:00	0.0	●	2019-06-25 22:49:14	public
Sensor	TransferServiceAndRenting	SensorSite	avgDistance	METRO487	float	2019-06-25 22:40:00	Not Available	●	2019-06-25 22:49:14	public



Snap4City

User: roottooladmin, 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
- Notificator
- Data Inspector**
- My Data, KPI, POI
- 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
- Settings
- User Management and Auditing
- Help and Contacts
- Documentation and Articles

Data Inspector

Map

Single data widgets
Multi data widgets

Map Controls:
FilterMap GPSUser GPSOrg

Data sources

Sensor	All selected (7)
High-Level Type	Nature
Sensor	Environment
Sensor	Environment
Sensor	Environment
Sensor	Environment
Sensor	Environment
Sensor	Environment
Sensor	Environment

Last Value: 14.9

Data sources Details

Device	Values	Healthiness	Process	Image	Licensing	User
GPS Coordinates:	42.642033, 18.1122					
High-Level Type:	Sensor					
Nature:	From IOT Device to KB					
Subnature:	IoTSensor					
Value Name:	DubrovnikorionDubrovnik-UNIFI:camera_Dubrovnik_1_Ploce					
Device ServiceURI or Data ID:	http://www.disit.org/km4city/resource/iot/orionDubrovnik-UNIFI/Dubrovnik/camera_Du					
Sensor ServiceURI or Data ID:	http://www.disit.org/km4city/resource/iot/orionDubrovnik-UNIFI/Dubrovnik/camera_Du					
Datasource:	IoT					
Ownership:	private					
Organizations:	Dubrovnik					

[Link to Service Map](#) [Link to IoT Device](#)

Healthiness table:

Healthiness	Last Check	Ownership
●	2019-08-13 07:18:30	public
●	2019-08-13 07:18:30	public
●	2019-08-13 07:18:30	public
●	2019-08-13 07:18:30	public
●	2019-08-13 07:18:30	public
●	2019-08-13 07:18:30	public
●	2019-08-13 07:18:30	public



- Click with the mouse on it

HLT: Sensor

Knowledge Base view

IOT Devices

IOT Device	IOT Broker	Device Type	Model	Ownership	Status	EDIT	DELETE	Location
AccessPoint1_FemiaSuperstore	orionLonatoDeCarda-UNIFI	AccessPointSensor	AccessPointLonato	DELEGATED	active	EDIT	DELETE	📍
AccessPoint2_ITIS	orionLonatoDeCarda-UNIFI	AccessPointSensor	AccessPointLonato	DELEGATED	active	EDIT	DELETE	📍
AccessPoint3_DataSport	orionLonatoDeCarda-UNIFI	AccessPointSensor	AccessPointLonato	DELEGATED	active	EDIT	DELETE	📍
adminDev1	orionUNIFI	Ambiental		MYOWNPRIVATE	active	EDIT	DELETE	📍
AdminDevice001	orionUNIFI	Ambiental		MYOWNPRIVATE	active	EDIT	DELETE	📍
AdminDevice002	orionUNIFI	Ambiental		MYOWNPRIVATE	active	EDIT	DELETE	📍
AdminDevice004	orionUNIFI	Ambiental		MYOWNPRIVATE	active	EDIT	DELETE	📍
AdminDevice005	orionUNIFI	Ambiental		MYOWNPRIVATE	active	EDIT	DELETE	📍
AdminTest005	orionUNIFI	Ambiental		MYOWNPRIVATE	active	EDIT	DELETE	📍

Showing 1 to 10 of 370 entries

Some functionalities are limited to certain roles

Details regarding the IOT Ingestion process

Data sources Details

Device	Values	Healthiness	Process	Image	Licensing	User
Knowledge Base IP:	192.168.0.206					
IoT Broker:	orionFinland					
lot Device:	373773207E330105					
Device Set name:						

Link to Knowledge Base Link to IoT Broker

Cancel

- For IOT Device data
- IOT Broker details

The screenshot shows the Snap4City interface with a sidebar menu and a main table of IOT Brokers. The table has columns for IOT Broker, Access Link, Access Port, Protocol, Ownership, Organization, Owner, Created, Edit, and Delete.

IOT Broker	Access Link	Access Port	Protocol	Ownership	Organization	Owner	Created	Edit	Delete
Antwerp	https://antwerp-belgium-police/kommu/1/entities		ngsi	DELEGATED	Antwerp	iotdirectory.antwerp	2019-03-13 14:57:17	EDIT	DELETE
Antwerp2	https://antwerp-belgium-police/kommu/1/entities		ngsi	DELEGATED	Antwerp	iotdirectory.antwerp	2019-07-01 00:00:00	EDIT	DELETE
CB-test-multi	192.168.1.47	8444	ngsi	DELEGATED	DISIT	angelodifino	2020-05-20 15:42:39	EDIT	DELETE
iotobf-smartbed	192.168.1.47	8443	ngsi	DELEGATED	SmartBed	angelodifino	2019-11-29 15:31:51	EDIT	DELETE
mqttUNIFI	192.168.1.10	1883	mqtt	DELEGATED	DISIT	iotdirectory.dist	2018-02-07 15:14:39	EDIT	DELETE
mqttUNIMI	159.149.129.184	1884	mqtt	DELEGATED	DISIT	iotdirectory.dist	2018-04-30 16:49:05	EDIT	DELETE
orionAntwerp-UNIFI	broker3.snap4city.org	8080	ngsi	PUBLIC	Antwerp	iotdirectory.antwerp	2019-06-03 14:25:16	EDIT	DELETE
orionDubrovnik-UNIFI	192.168.1.47	8446	ngsi	DELEGATED	Dubrovnik	iotdirectory.dubrovnik	2020-07-09 11:06:49	EDIT	DELETE
orionFinland	https://ngsi.fv.fi		ngsi	PUBLIC	Helsinki	iotdirectory.helsinki	2018-11-21 16:05:24	EDIT	DELETE
orionFirenze-UNIFI	192.168.1.17	8443	ngsi	PRIVATE	Firenze	iotdirectory.firenze	2019-10-28 10:01:53	EDIT	DELETE

Some functionalities are limited to certain roles

HLT: Sensor

- Specific values of selected
- Information of the values of the other sensors on the same device
- View Trends, marking problems, healthiness by point according to a Fuzzy model
- Marking problems for future machine learning processes (separate tool)

Data sources Details

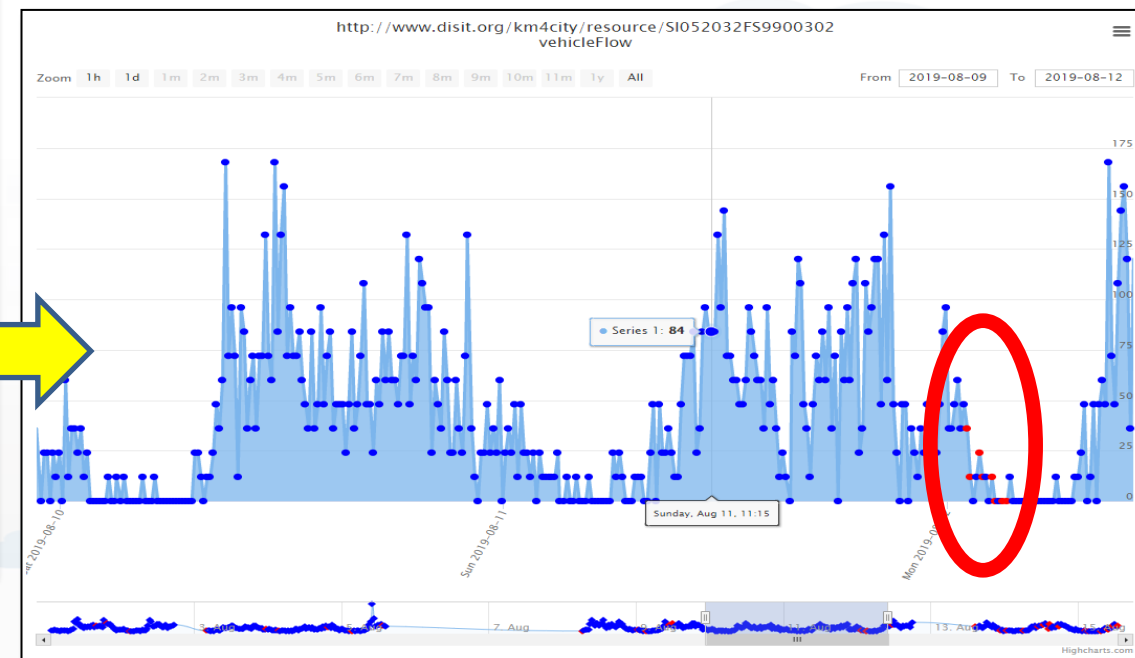
Device Values Healthiness Process Image Licensing User

Last Date: 2020-07-21 19:00:00

Last Value:

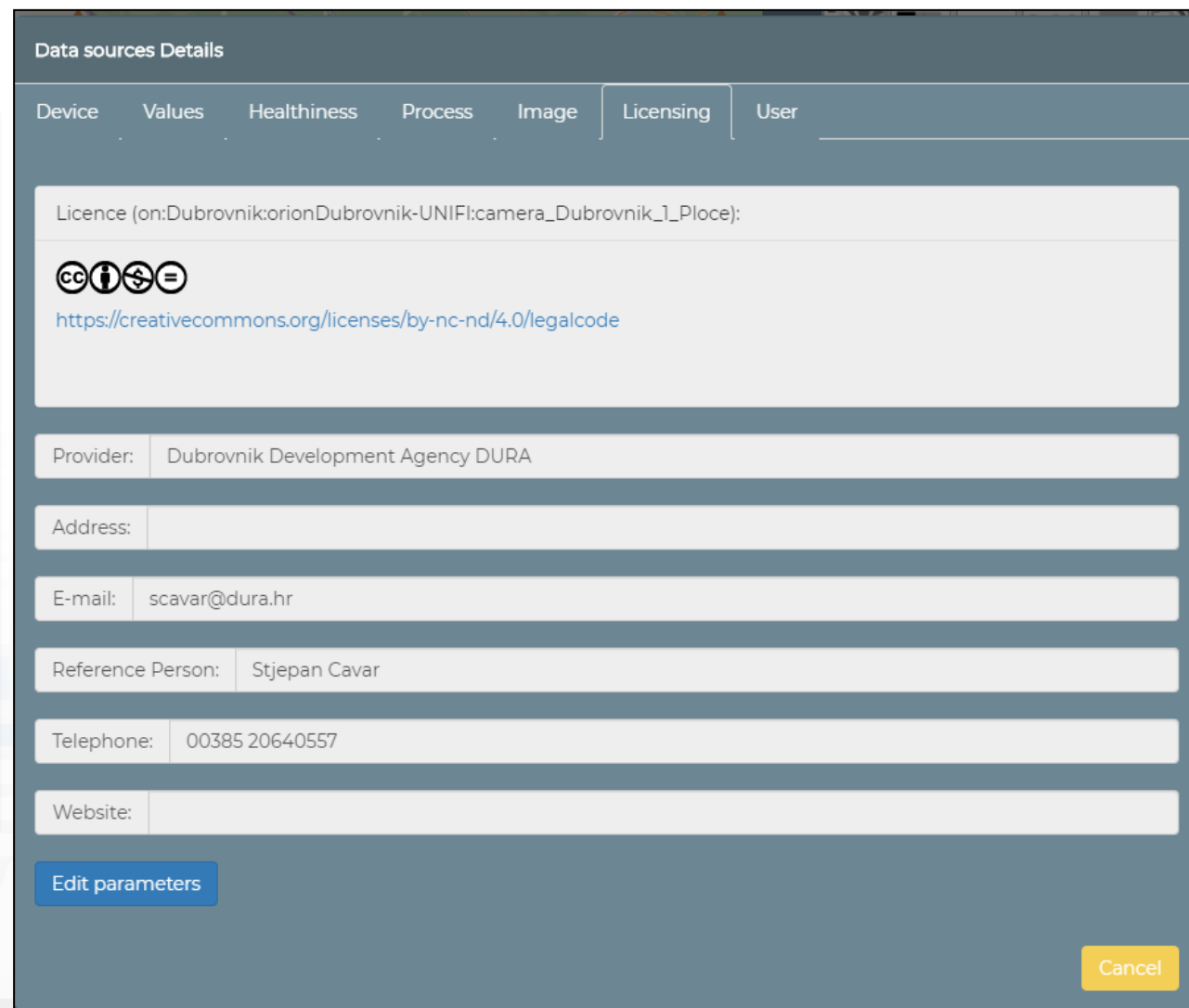
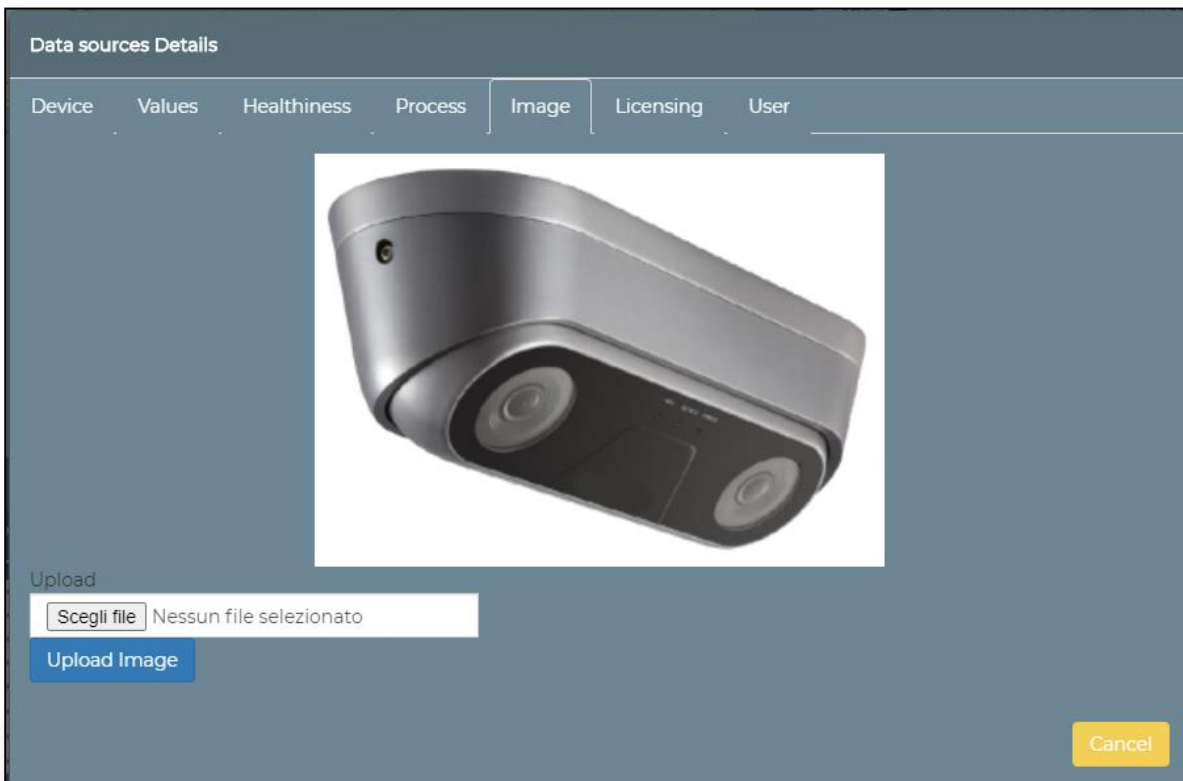
Value Type	Healthy	Delay (s)	Reason	Healthiness Criteria	Refresh Rate (s)	Data type	Unit	Value	Time Trend
dateObserved	●	61890	undefined	undefined	300	time	timestamp	2020-07-21T17:00:00.000Z	VIEW
deceduti	●	61890	undefined	undefined	300	integer	#	16797	VIEW
dimessi_guariti	●	61890	undefined	undefined	300	integer	#	71775	VIEW
isolamento_domiciliare	●	61890	undefined	undefined	300	integer	#	6838	VIEW
nuovi_attualmente_positivi	●	61890	undefined	undefined	300	integer	#	-131	VIEW
ricoverati_con_sintomi	●	61890	undefined	undefined	300	integer	#	151	VIEW
stato	●	61890	undefined	undefined	300	string	#	ITA	VIEW
tamponi	●	61890	undefined	undefined	300	integer	#	1212468	VIEW
terapia_intensiva	●	61890	undefined	undefined	300	integer	#	21	VIEW
totale_attualmente_positivi	●	61890	undefined	undefined	300	integer	#	7010	VIEW
totale_casi	●	61890	undefined	undefined	300	integer	#	95582	VIEW
totale_ospedalizzati	●	61890	undefined	undefined	300	integer	#	172	VIEW
codice_regione	●	61890	missing value	undefined	300	integer	status		VIEW
denominazione_regione	●	61890	missing value	undefined	300	string	status		VIEW

Cancel



Some functionalities are limited to certain roles

Image of the Devices and Licensing



Some functionalities are limited to certain roles

HLT: From Dashboard to IOT APP

- Click with the mouse on it

Data Inspector

Data sources Details

Device	Values	Healthiness	Image	Licensing	User
GPS Coordinates:					
High-Level Type:	Dashboard-IOT App				
Nature:	From Dashboard to IOT App				
Subnature:	Mobile PAXCounter 01 in Antwerp				
Value Name:	nr8a0bv				
Device ServiceURI or Data ID:					
Sensor ServiceURI or Data ID:					
Datasource:	From Dashboard to IOT App				
Ownership:	private (My Own)				
Organizations:	Other				

Link to lot App
List of Dashboard

Link to dashboard "Mobile PAXCounter 01 in Antwerp"
Link to dashboard "PaxMobAnt05"
Link to dashboard "Mobile PAXCounter 03 in Antwerp"

Mobile PAXCounter 01 in Antwerp

Begin: 19:00
Finish: 19:00
Activate

CUMULATIVE MODE: OFF
Device in Cumulative Mode: OFF

- Click with the mouse on it

No.	Value	Latitude	Longitude	Data Time	Insert Time	Controls
42290	ok	42.27846	4.422778	20/02/2019 19:04:38	20/02/2019 19:04:38	<input type="checkbox"/>
42291	ok	42.27831	4.422754	20/02/2019 19:04:37	20/02/2019 19:04:38	<input type="checkbox"/>

Link to MyKPI
List of lotApp

List of lotApp
Link to lotApp nrqolob

HLT: External Service

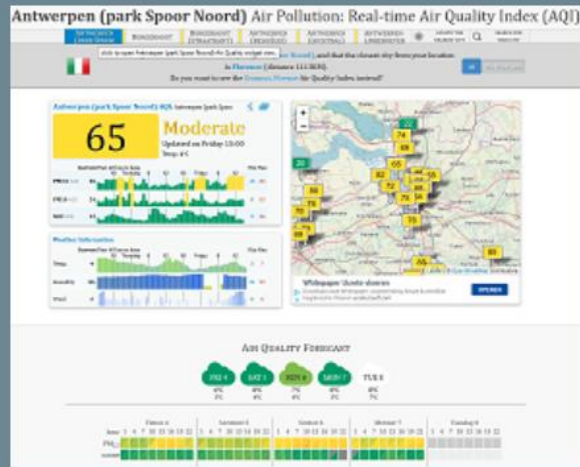
Data sources Details

Device	Values	Image	Ownership
GPS Coordinates:	51.222744, 4.405380		
High-Level Type:	External Service		
Nature:	Environment		
Subnature:	Antwerpen (park Spoor Noord) Air Pollution		
Value Name:	ExternalContent		
Datasource:	Special Process		
Ownership:	public		
Organizations:	['DISIT', 'Antwerp', 'Other']		
Link to External Service			

Data sources Details

Device	Values	Image	Ownership	
Value Type:				
Data Type:	webpage			
Last Date:				
Last Value:	Antwerp			
Value Type	Healthy	Delay (s)	Reason	Health

Data sources Details

Device	Values	Image	Ownership
			

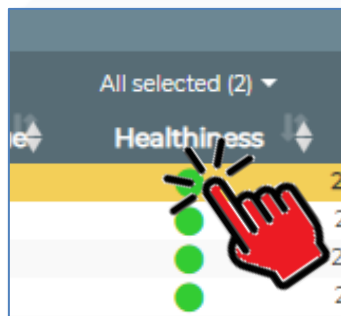
Data sources Details

Device	Values	Healthiness	Process	Image	Licensing	User
User Creator:	angelo.difino.dubrovnik					
Status:						
E-mail creator:						
Cancel						

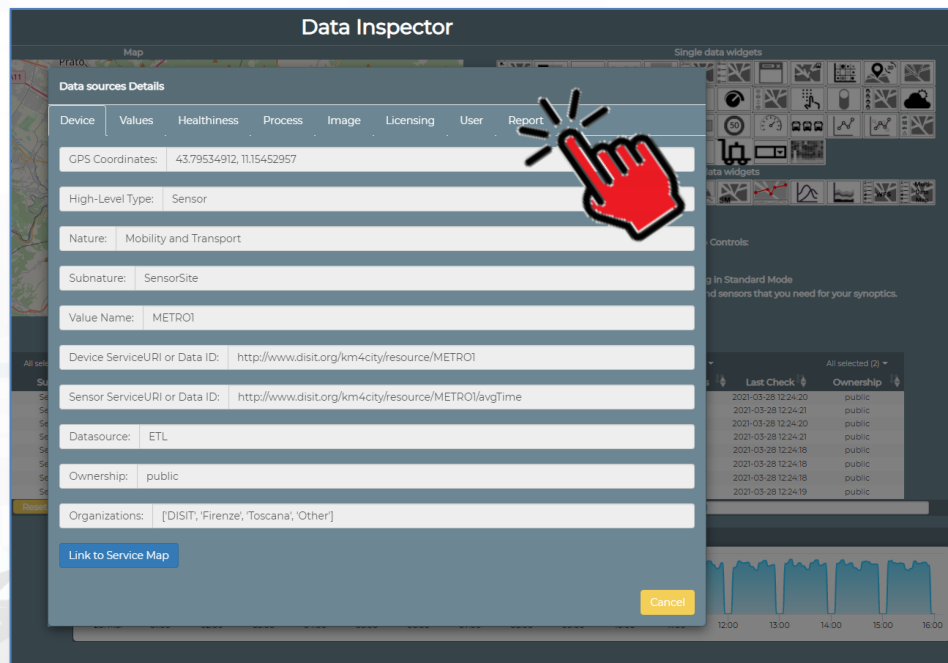
The fields shown may be present or not depending on the HLT and on the information received

Report Generation and Access

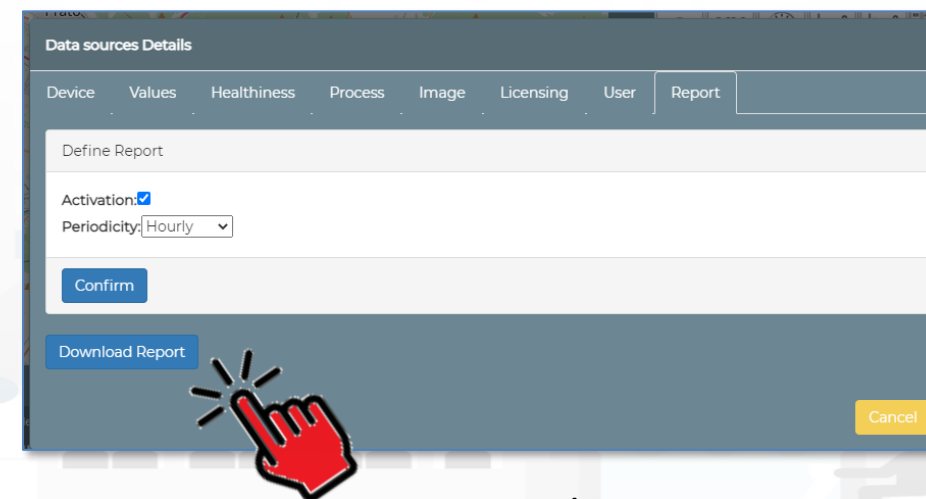
- **Device/data** owner may have their reports: **monthly or 3-monthly**
 - Ready to use reports are available for:
 - Single Device: ETL and IOT
 - Ask to your RootAdmin to activate the production of reports (and also **hourly report for testing only**).



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



3. Click on report



4. Get the Last Report

TOP

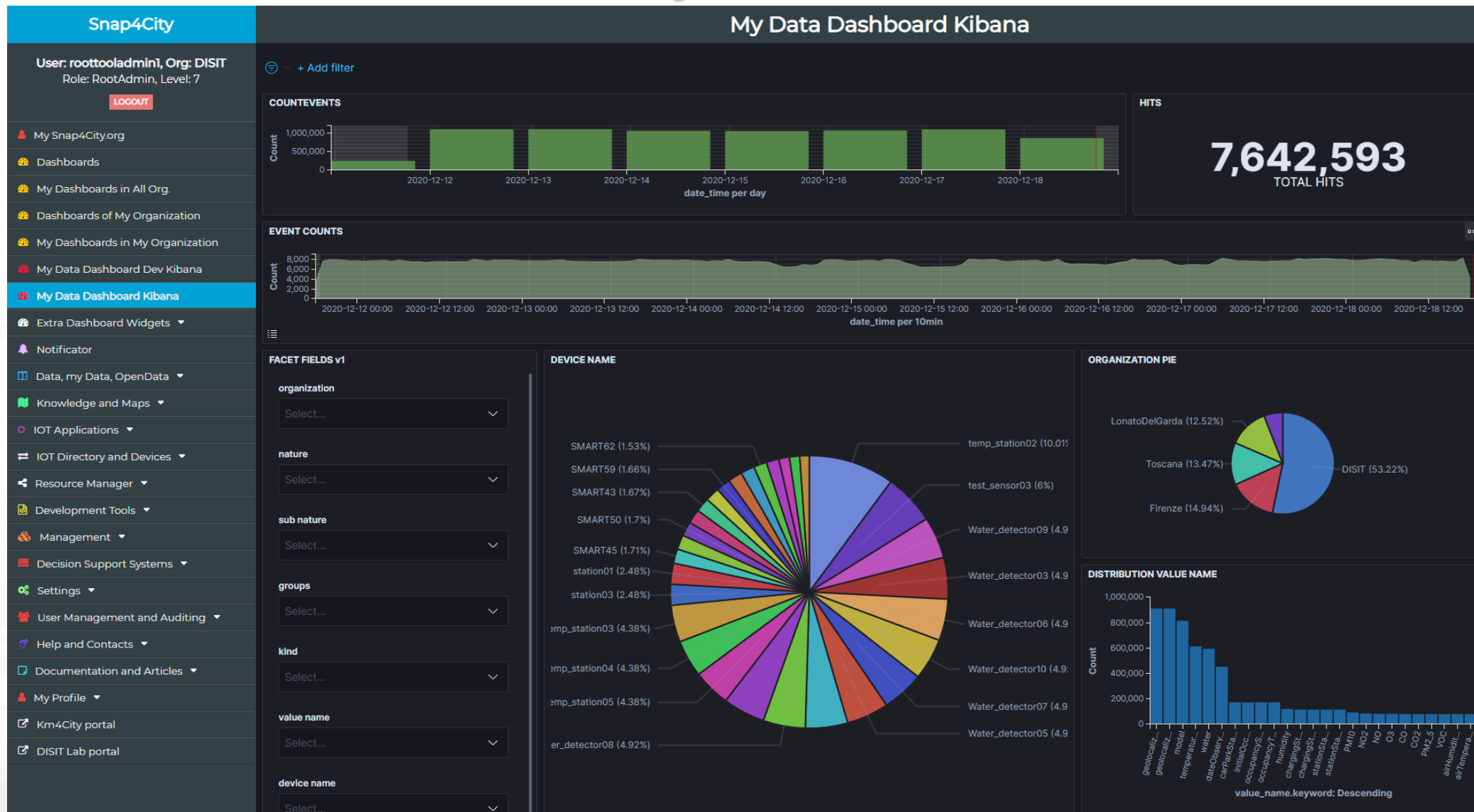
My Data Dashboard Dev to assess data on Open Search Storage

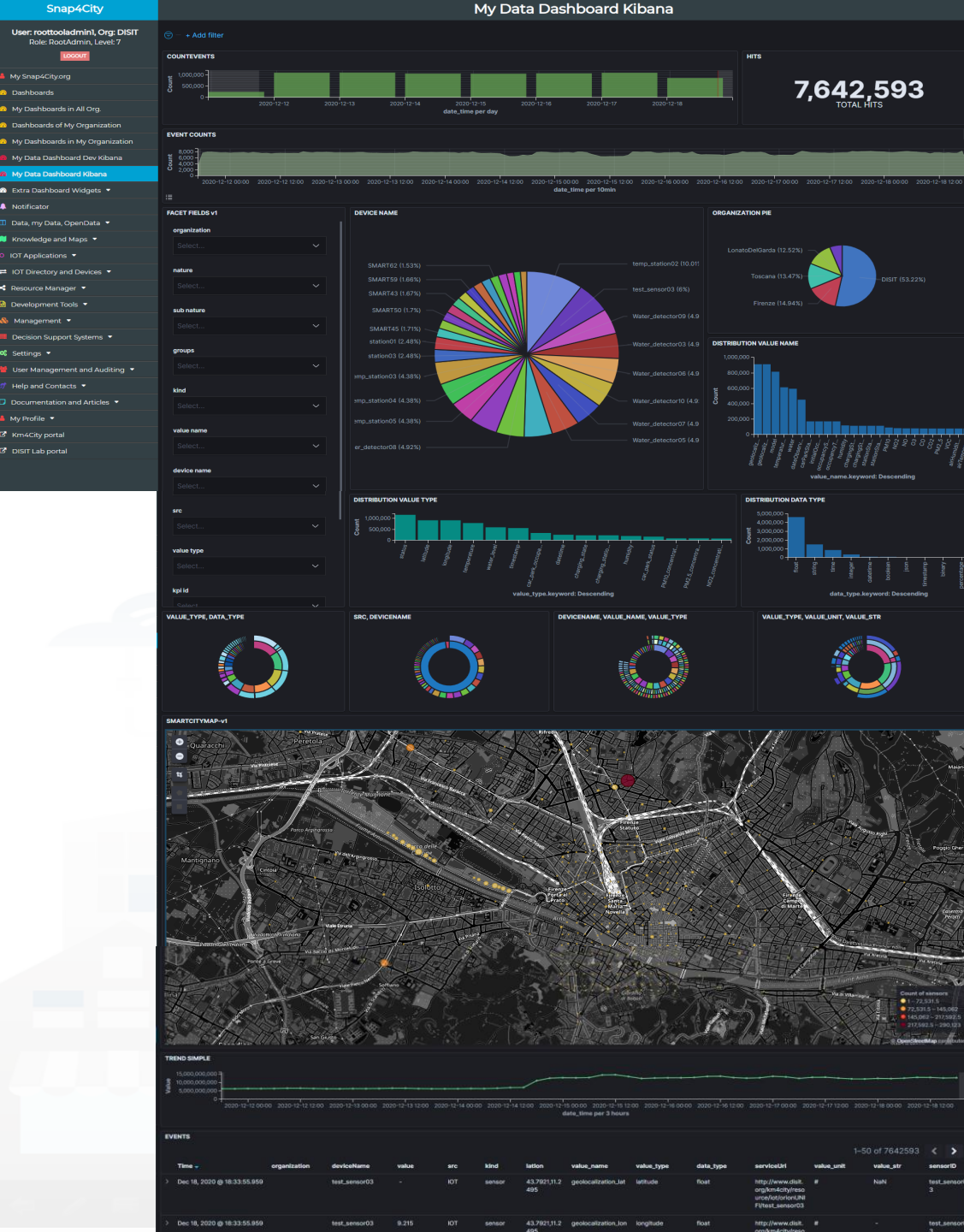
- My Data Dashboard Dev Kibana
- My Data Dashboard Kibana



Some functionalities are limited to certain roles

DevDash: My Data Dashboard





Business Analysis Dashboards For all kind of users: DevDash

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



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



- Respect Privacy and GDPR



VALUE_TYPE, DATA_TYPE

SRC, DEVICENAME

DEVICENAME, VALUE_NAME, VALUE_TYPE

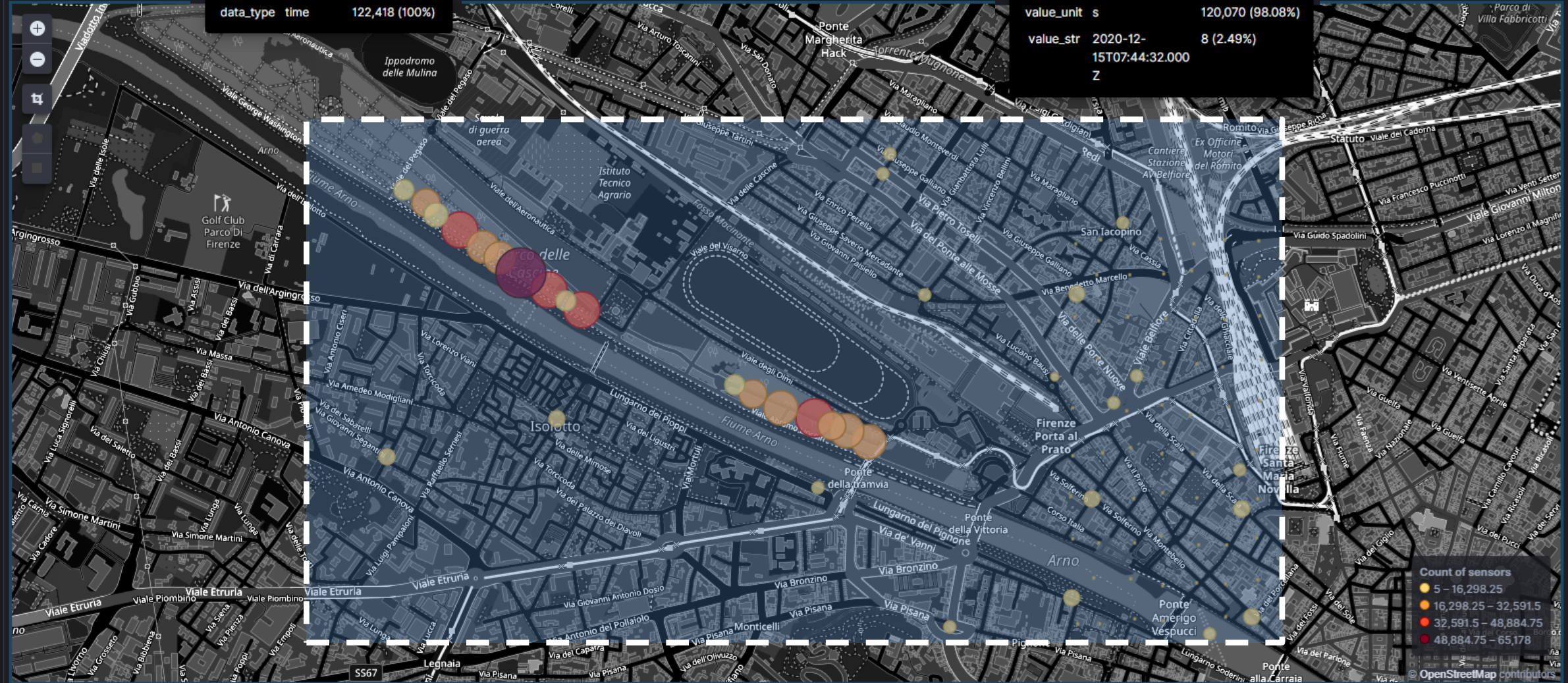
VALUE_TYPE, VALUE_UNIT, VALUE_STR



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

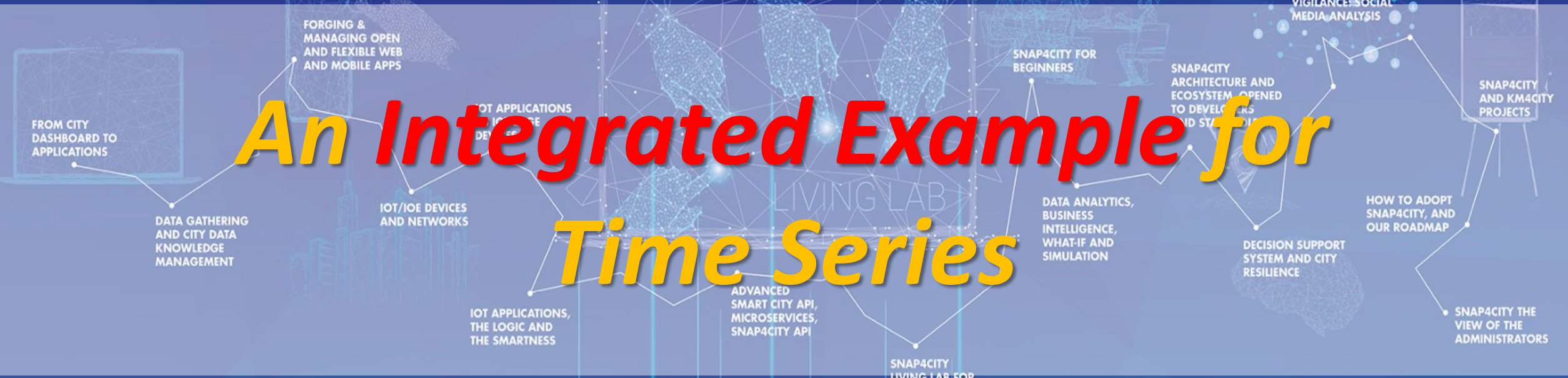


Count of sensors

5 - 16,298.25
16,298.25 - 32,591.5
32,591.5 - 48,884.75
48,884.75 - 65,178

TOP

An Integrated Example for Time Series



Activities for Registration on Directory

- **Manual Registration**

- From scratch Single Device / Entity Registration
→ **Entity Directory / IoT Directory**
- From a template (the templates are called Models)

- **Automated Registration for bulk/massive registration: N Entities / Devices**

- From IoT App on the basis of some **Models** from IoT App
- From IoT App **loading a CSV** (with or without a reference IOT Model)
- Programming from scratch or from a **Model**
- On the basis of some EXCEL file with data by using the **Data Table Loader, which create model, devices and data**
- Etc.

1

**Entity/IoT
Directory**

Manual or automated
Registration
of Entities/Devices

created a Model as:

Edit Model - statuscorregione

General Info	IoT Broker	Static Attributes	Values
statuscorregione		statuscorregione	
Name Ok		Description Ok	
misura		Sensor	▼
Device Type Ok		Kind	
protezione civile		600	
Producer Ok		Frequency	
Healthiness Criteria		Healthiness Value	
Automatically generated			▼
Key Generation		Edge-Gateway Type	

Cancel Confirm

Edit Model - statuscorregione

General Info	IoT Broker	Static Attributes	Values
orionUNIFI		ngsi	▼
ContextBroker		Protocol	
json			
Format			
Service/Tenant <small>only ngsi w/MultiService supports Service/Tenant selection</small>		ServicePath <small>only ngsi w/MultiService supports ServicePath</small>	

Cancel Confirm

Edit Model - statuscorregione

General Info	IoT Broker	Static Attributes	Values
Select an option			
Subnature			
Add Attribute			

Cancel Confirm

Edit Model - statuscorregione

General Info	IoT Broker	Static Attributes	Values
dateObserved Value Name Ok	timestamp (Timestamp) ✓ Value Type Ok	timestamp in milliseco ✓ Value Unit Ok	string Data Type
Refresh rate ✓	300	Remove Value	
Healthiness Criteria	Healthiness Value		
deceduti Value Name Ok	people_count (People C) ✓ Value Type Ok	number (#) ✓ Value Unit Ok	integer Data Type
Refresh rate ✓	300	Remove Value	
Healthiness Criteria	Healthiness Value		
dimessi_guariti Value Name Ok	people_count (People C) ✓ Value Type Ok	number (#) ✓ Value Unit Ok	integer Data Type
Refresh rate ✓	300	Remove Value	
Healthiness Criteria	Healthiness Value		
isolamento_domiciliare Value Name Ok	people_count (People C) ✓ Value Type Ok	number (#) ✓ Value Unit Ok	integer Data Type
Refresh rate ✓	300	Remove Value	
Healthiness Criteria	Healthiness Value		
nuovi_attualmente_positiv Value Name Ok	people_count (People C) ✓ Value Type Ok	number (#) ✓ Value Unit Ok	integer Data Type
Refresh rate ✓	300	Remove Value	
Healthiness Criteria	Healthiness Value		

For Time Series

- **ValueName:**
dateObserved
- **ValueType:**
timestamp
- **ValueUnit:**
timestamp in millisecond
- **DataType:**
string
- **E.g.: ISO string of the date-time**

terapia_intensiva Value Name Ok	people_count (People) ✓ Value Type Ok	number (#) ✓ Value Unit Ok	integer Data Type
Refresh rate ✓	300	Remove Value	
Healthiness Criteria	Healthiness Value		
totale_attualmente_positiv Value Name Ok	people_count (People) ✓ Value Type Ok	number (#) ✓ Value Unit Ok	integer Data Type
Refresh rate ✓	300	Remove Value	
Healthiness Criteria	Healthiness Value		
totale_casi Value Name Ok	people_count (People) ✓ Value Type Ok	number (#) ✓ Value Unit Ok	integer Data Type
Refresh rate ✓	300	Remove Value	
Healthiness Criteria	Healthiness Value		
totale_ospedalizzati Value Name Ok	people_count (People) ✓ Value Type Ok	number (#) ✓ Value Unit Ok	integer Data Type
Refresh rate ✓	300	Remove Value	
Healthiness Criteria	Healthiness Value		
codice_regione Value Name Ok	status (Status) ✓ Value Type Ok	some coded status (stz) ✓ Value Unit Ok	string Data Type
Refresh rate ✓	300	Remove Value	
Healthiness Criteria	Healthiness Value		
denominazione_regione Value Name Ok	status (Status) ✓ Value Type Ok	some coded status (stz) ✓ Value Unit Ok	string Data Type
Refresh rate ✓	300	Remove Value	
Healthiness Criteria	Healthiness Value		

Add Value Cancel Confirm

Please note for Time Series of IoT Devices

- Snap4City engine recognizes as time basis for the TimeSerie only 1 Variable with
 - ValueType as TimeStamp (in milliseconds)
- **If you need more than one timestamp** in milliseconds use:
 - ValueType as ***DateTime*** (in milliseconds)

Startingtime	datetime (Datetime) ▼	timestamp in millisecond ▼	string ▼
Value Name	Value Type	Value Unit	Data Type
Ok	Ok	Ok	
Refresh rate ▼	300	Remove Value	
Healthiness Criteria	Healthiness Value		

From Model, you can create instances of Entities / Devices

Snap4City

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

[LOGOUT](#)

- My Snap4City.org
- Tour Again
- Dashboards (Public)
- Dashboards of My Organization
- My Dashboards in My Organization
- My Data Dashboard Dev Kibana
- Extra Dashboard Widgets
- Data, my Data, OpenData
- Knowledge and Maps
- IOT Applications
- IOT Directory and Devices
 - My IOT Sensors and Actuators
 - IOT Sensors and Actuators
 - IOT Devices**
 - IOT Brokers
 - IOT Device Models
 - IOT Devices Bulk Registration
 - Doc: IOT Directory and Devices
 - Create an IOT Device Instance
 - Create an IOT Device Model
 - Add an IOT Device into Snap4City
- Resource Manager
- Development Tools
- Management
- Decision Support Systems

IOT Devices

Show entries

[Add new device](#)

Search:

	Device Identifier	IOT Broker	Device Type	Model	Ownership	Status	Edit	Delete	Location	View
+	adminDev1	orionUNIFI	Ambiental		PUBLIC	active				VIEW
+	alert_1610543238306	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610548534047	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610613189703	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610629197473	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610714974380	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610715864347	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610715997465	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610717002089	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610717247691	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW

Showing 1 to 10 of 217 entries

Previous **1** 2 3 4 5 ... 22 Next

They have been created by «Add new Device»

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
 - 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

My IOT Sensors and Actuators

[My Devices](#) [Delegated Devices](#) [Add New Device](#)

Add My New Device

<input type="text" value="Dubrovnik Total Average Person"/> <small>Device Identifier is mandatory</small>	<input type="text" value="Dubrovnik Total Average Person"/> <small>Model</small>
<input type="text" value="16d71349-2eb6-454e-84f1-ae54fd3617ce"/> <small>Latitude is mandatory</small>	<input type="text" value="4e7dbd20-77ea-4412-8aed-8e352d055093"/> <small>Longitude is mandatory</small>
<input type="text" value="KEY1"/>	<input type="text" value="KEY2"/> <small>These keys have been generated automatically for your device. Keep track of them. Details on info</small>
<input type="text" value="Monitoring Camera (TransferServiceAndRen:"/>	
<input type="text" value="Subnature"/>	
<input type="text" value="Dubrovnik"/> <small>Locality</small>	<input type="text" value="Value"/> <small>Value</small>

[Add Attribute](#) [Remove](#) [Submit Device](#)

Select Latitude/Longitude on Map

Leaflet | © OpenStreetMap contributors

Device from Model by Providing:

- **NAME** (it has to be unique)
- Select the IoT/Entity Model: «**statuscorregione**»
 - Thus the K1, K2 appears since the model is associated to an Orion Broker that needs to have them, the tool generate them for you but you can impose if you like
 - See in previous slide the ID name of the IOT Broker used
- **Lat** and **Lon**, GPS coordinates you can:
 - pick on the map
 - Write the coordinates manually and see the pin on map

Once Created, I may send a new data to it

Snap4City

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

LOGOUT

My Snap4City.org

Tour Again

Dashboards (Public)

Dashboards of My Organization

My Dashboards in My Organization

My Data Dashboard Dev Kibana

Extra Dashboard Widgets

Data, my Data, OpenData

Knowledge and Maps

IOT Applications

IOT Directory and Devices

- My IOT Sensors and Actuators
- IOT Sensors and Actuators
- IOT Devices**
- IOT Brokers
- IOT Device Models
- IOT Devices Bulk Registration
- Doc: IOT Directory and Devices

IOT Devices

Show entries

Search:

Add new device

	Device Identifier	IOT Broker	Device Type	Model	Ownership	Status	Edit	Delete	Location	View
+	adminDev1	orionUNIFI	Ambiental		PUBLIC	active				VIEW
-	alert_1610543238306	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW

Broker URI: https://broker1.snap4city.org
Kind: sensor
Device Type: event
Protocol: ngsi
Model: AlertGeneric
Longitude: 11.215839
Device Uri: http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/alert_1610543238306
Organization: DISIT
Created on: 2021-01-13 14:07:21

Broker Port: 8080
Visibility: MyOwnPrivate
Format: json
MAC:
Producer: disit
Latitude: 43.766755

PAYLOAD NGSI v1
K1: 44eca781-af56-490f-a6c6-36d88b1bcd9c

PAYLOAD NGSI v2
K2: 6a620551-e4e5-4c0d-8777-d0721175cfb0

VIEW IN SERVICE MAP

NEW DATA IN alert_1610543238306

+	alert_1610548534047	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610613189703	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW
+	alert_1610629197473	orionUNIFI	event	AlertGeneric	MYOWNPRIVATE	active	EDIT	DELETE		VIEW

Get/See last message
from Broker

Generate a New Message
towards the Device, Storage

View IoT Device on
map and its last value

The screenshot shows the Snap4City IOT Devices Management interface. A modal window is open for editing a message. The modal contains several fields for configuration:

Value Name	Value Type	Value Unit	Data Type	Send value
peopleinvolved	people_count (People)	number (#)	integer	<input checked="" type="checkbox"/>
responsible	Identifier (Identifier)	symbolic identifier (ID)	string	<input checked="" type="checkbox"/>
severity	status (Status)	some coded status (sta)	string	<input checked="" type="checkbox"/>
shorttermimpact	status (Status)	some coded status (sta)	string	<input checked="" type="checkbox"/>
ticketID	Identifier (Identifier)	symbolic identifier (ID)	string	<input checked="" type="checkbox"/>

At the bottom of the modal, there are buttons for "Get Time stamp", "Close", and "Confirm".

Impose current date time on dateObserved

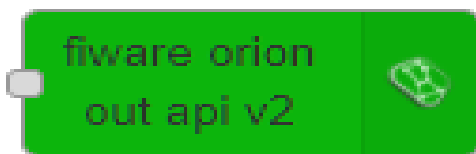
Send the Message to the Device, Storage

Once created the Device you may send data on it



- You may create a Proc.Logic / IOT App, where:
 - Function: is preparing the JSON package
 - Block «FIWARE Orion OUT V2» is sending the data to the Orion Broker. Namely: «OrionUNIFI»
 - Please note that several version of ORION Brokers and protocols exists:
 - So that you have to know which protocols you need to use for your broker

Settings ?



- Certificates are automatically loaded at the first authentication
- Done!!

Edit fiware orion out v1 node

Delete Cancel Done

Properties

Service: Orion Service

Certificates: Add new tls-config...

Device Type: []

Device Identifier: []

key 1: [REDACTED]

key 2: [REDACTED]

Service/Tenant: []

Service Path: []

apikey: []

auth: []

Name: node-red-contrib-snap4city-user/fiware-orion:com1

fiware orion out v1 > Edit orion-service node

Delete Cancel Update

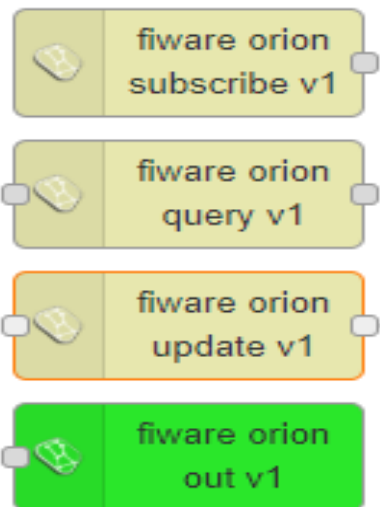
Broker URL: 192.168.1.9

port: 8443

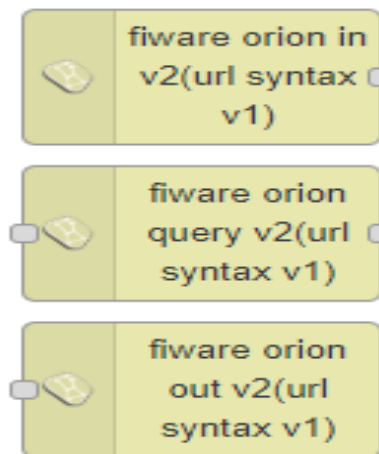
Name: Name

- IP if the Broker is in cloud (internal)
 - List of brokers is automatically provides
 - The K1, K2 is automatically provided if you are authenticated
- Symbolic address of Broker can be taken from Directory

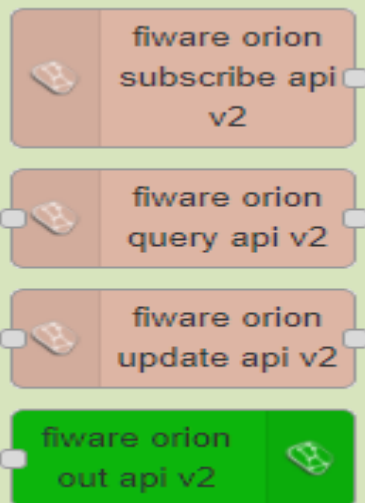
NGSI versions



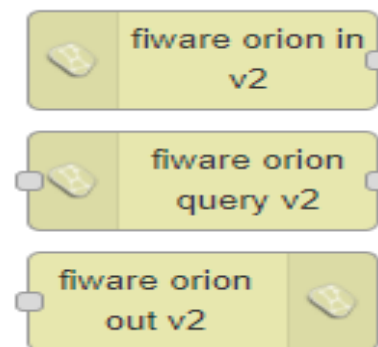
- Orion Broker of V1 with **NGSI syntax of V1** + Secure Filter of Snap4city (deprecated)



- Orion Broker of V2 with NGSI syntax of V1 (deprecated)



- Orion Broker of V2 with **NGSI syntax of V2** + Secure Filter of Snap4city



- Orion Broker of V2 with NGSI syntax of V2 (deprecated)

examples

	To generate injection messages into a flow, scheduled or on demand by click
	A java script function, from a JSON input to one or more JSON outputs
	To send a message of and Entity Instance into the storage. The Device has to be registered and you have to be the owner or to be delegated in READ-WRITE to send messages to it.
	To subscribe an IoT App to receive event-driven notification about messages and changes on specific devices. You can subscribe to many and then to get all of them from it.
	Query call to Smart City API to get any information about a SURI, ServiceURI. There are many other Nodes which can be used to pose Smart City API queries in very simple manner
	Send email, you can even send Telegram, SMS, etc.
	To send a REST CALL (get, post, etc.). Please USE THIS ONLY for the external API not for the Snap4City API for which a lot of MicroService accessible as NODEs/Blocks in the IoT App are simpler and ready to use.
	A block which is printing on debug view the data JSON passed in input.
	To create a device instance from a model prepared on IoT Directory
	To change the ownership of a device.
	To delegate a certain device to some other user
	To show something on Snap4City dashboard with a simple widget.

- A Json from the IOT App
 - **NGSI V1**
- **ID:** The Name of the IOT Device: «corveneto»
- **Type** as that define in the IOT Device when you created
- **The Time stamp:** “dateObserved” to have a time series data
 - “str” is a string with the date and time in standard ISO, such as ,
 - “2020-08-04T04:00:00+02:00”,
 - “2020-08-03T00:00:00.000Z”
- And the **vector** of “attributes”

```
msg = { payload : {
```

```
  "id": "corveneto",
```

```
  "type": "misura",
```

```
  "attributes":[
```

```
    { "name": "dateObserved", "value": str, "type": "timestamp" },
```

```
    { "name": "stato", "value": "active", "type": "string" },
```

```
    { "name": "ricoverati_con_sintomi", "value": 12, "type": "integer" },
```

```
    { "name": "terapia_intensiva", "value": 34, "type": "integer" },
```

```
    { "name": "totale_ospedalizzati", "value": 34, "type": "integer" },
```

```
    { "name": "isolamento_domiciliare", "value": 334, "type": "integer" },
```

```
    { "name": "totale_attualmente_positivi", "value": 12, "type": "integer" },
```

```
    { "name": "nuovi_attualmente_positivi", "value": 33, "type": "integer" },
```

```
    { "name": "dimessi_guariti", "value": 22222, "type": "integer" },
```

```
    { "name": "deceduti", "value": 2, "type": "integer" },
```

```
    { "name": "totale_casi", "value": 2222, "type": "integer" },
```

```
    { "name": "tamponi", "value": 222222344, "type": "integer" }
```

```
  ]
```

```
 }
```

```
 }
```

```
return msg;
```

```
{  
  "id": "corveneto",  
  "type": "misura",  
  "codice_regione": {"type": "integer", "value": ""},  
  "dateObserved": {"type": "time", "value": "2021-01-18T17:00:00.000Z"},  
  "deceduti": {"type": "integer", "value": "8025"},  
  "denominazione_regione": {"type": "string", "value": ""},  
  "dimessi_guariti": {"type": "integer", "value": "222062"},  
  "isolamento_domiciliare": {"type": "integer", "value": "66514"},  
  "latitude": {"type": "float", "value": "45.43490"},  
  "longitude": {"type": "float", "value": "12.33845"},  
  "nuovi_attualmente_positivi": {"type": "integer", "value": "-1557"},  
  "ricoverati_con_sintomi": {"type": "integer", "value": "2233"},  
  "stato": {"type": "string", "value": "ITA"},  
  "tamponi": {"type": "integer", "value": "3663538"},  
  "terapia_intensiva": {"type": "integer", "value": "336"},  
  "totale_attualmente_positivi": {"type": "integer", "value": "69083"},  
  "totale_casi": {"type": "integer", "value": "299170"},  
  "totale_ospedalizzati": {"type": "integer", "value": "2569"}  
}
```

The differences are mainly on how the variable are provided:

```
{  
  "id": "MyMobileDeviceTest",  
  "type": "misura",  
  "dateObserved": {"type": "timestamp", "value": "2021-06-11T16:17:23.425Z"},  
  "status": {"type": "float", "value": 25}  
  "mydescription": {"type": "string", "value": "see below the note for the forbidden  
characters" }  
}
```

- **NOTE for:**

- **names/IDs:** Spaces or strange characters are not allowed in the. Please use simple alphanumeric strings, it is a limitation of many solutions including Orion Broker and increase interoperability of your data.
- **Values of attributes and variables:** can be UTF8, but similarly, they do not accept: () <> “ ‘ ; = into values
- https://fiware-orion.readthedocs.io/en/master/user/forbidden_characters/index.html

DateObserved

- The **Timestamp**: “dateObserved” to have a time series data
 - “str” is a string with the date and time in standard ISO, such as ,
 - “2020-08-04T04:00:00+02:00”,
 - “2020-08-03T00:00:00.000Z”
- In JavaScript you can obtain by using:
 - `Var str = new Date().toISOString();`
 - **Str** has to be the ISO date string of today-now (at the current time).

From date to ISOString with fuse aligned time

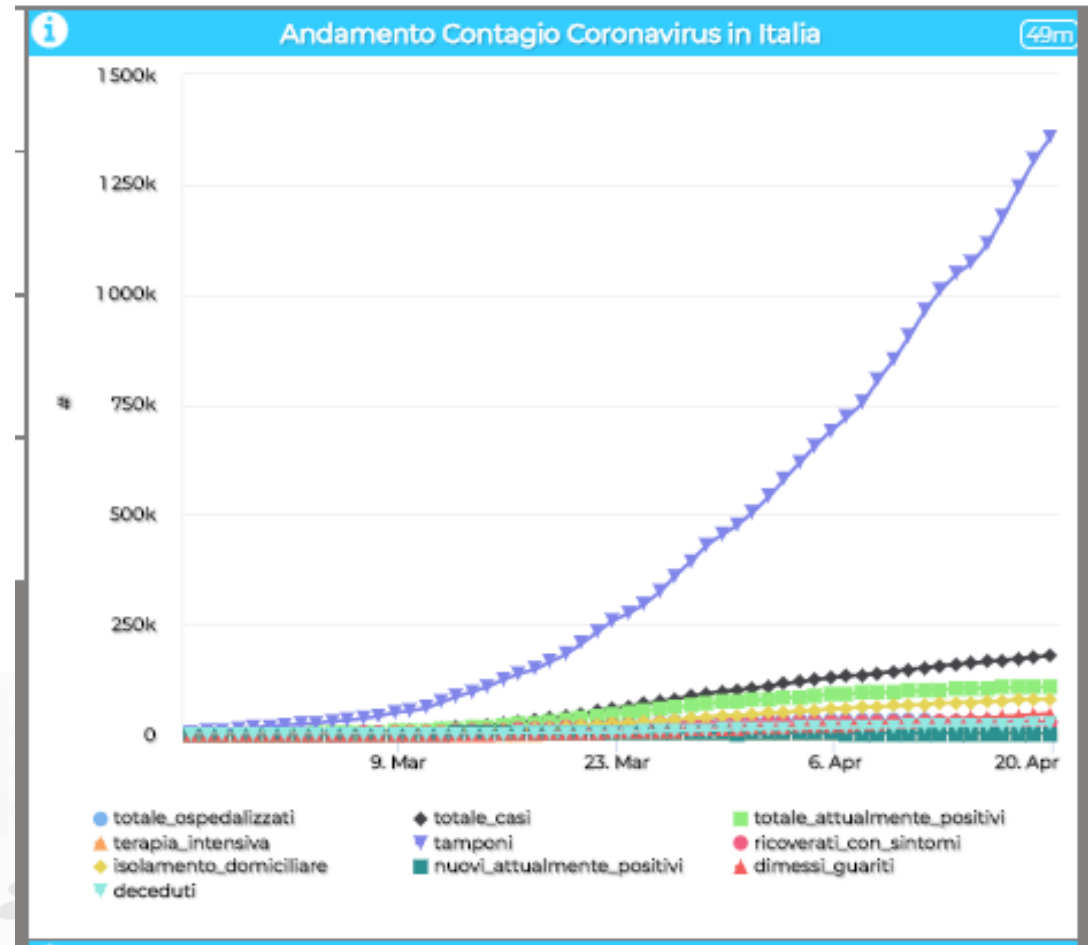
```
var todaynow = new Date();  
dateCET2Z(todaynow).toISOString();
```

```
function dateCET2Z(date) {  
    d = new Date(date).toLocaleString('nl-BE', {timeZone: 'Europe/Brussels'});  
    offset = new Date(d).getTime() - new Date(date).getTime();  
    return new Date(new Date(date).getTime() - offset);  
}
```

Multi Series Widget coming from the same IOT Device

- Over on the serie label to highlight
- Click on the serie label to on/ok
- Over on the graph to see the values

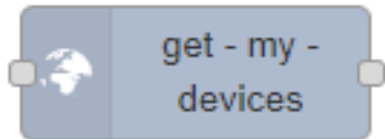
[https://www.snap4city.org/dashboardSmartCity/vi
ew/index.php?iddashboard=MjU2OQ==](https://www.snap4city.org/dashboardSmartCity/vi
ew/index.php?iddashboard=MjU2OQ==)



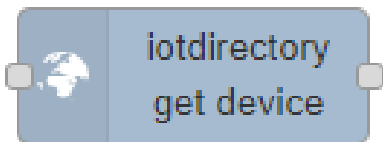
JSON for Authentication as well

```
msg.auth= {  
  "k1": "1ef0e5e8-yyyy-xxxx-9462-0aa4cfcf5e19",  
  "k2": "b2b34425-yyyy-xxxx-818d-2d6cac2314a6",  
  "apikey": "apikey",  
  "basicAuth": "basicAuthKey"  
};
```


You may use other functions from Directory



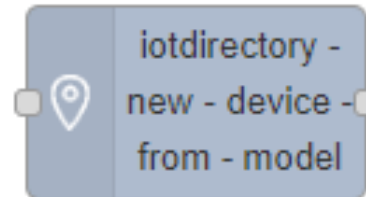
- Discovery in an area
- Query on Directory



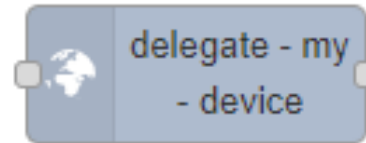
- Get Device Info



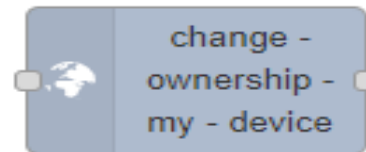
- Delete a Device
(max rate 1 per minute)



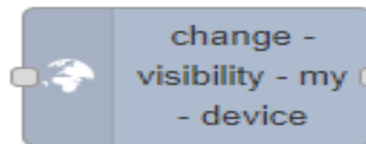
- Registering an Device from model



- Delegate an Device

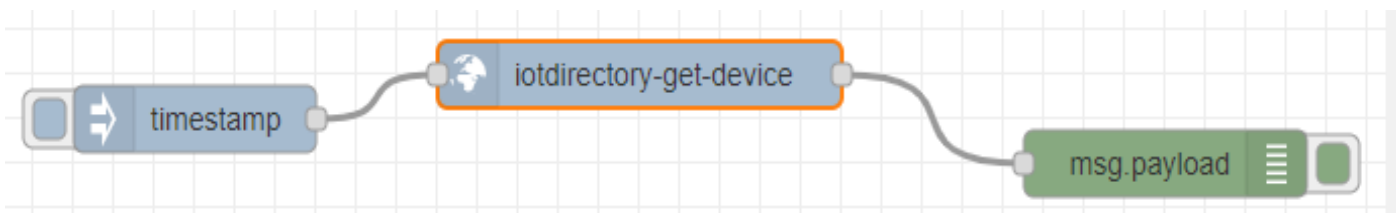


- Change Ownership of an Device



- Change Visibility, Publish

Get IOT Device Info



- You can create smart Proc.Logic / IoT App that on the basis of the list of Devices would request all what you need to load data into **YOUR OWN** Devices including:
 - Service URI
 - K1, K2
 - Authentication

msg.payload : Object

▼ object

status: "ok"

▼ content: object

uri:

"http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/corarezzo"

devicetype: "misura"

kind: "sensor"

status1: "active"

macaddress: ""

model: "statuscorregione"

producer: "protezione civile"

longitude: "11.88228"

latitude: "43.46642"

protocol: "ngsi"

format: "json"

visibility: "public"

frequency: "600"

created: "2020-03-21 18:34:32"

privatekey: ""

certificate: ""

organization: "DISIT"

accesslink: "https://broker1.snap4city.org"

accessport: "8080"

sha: "C61E32DBFAE7F14C0810177F2D2300843C41C550"

subnature: null

static_attributes: null

k1: "bf739214-f6b4-45fe-85f7-97cd09fe8e57"

k2: "c19e0b6f-8f98-4130-b135-e7a1dfae9273"

error_msg: ""

TOP



Entities Ingestion with Data Table Loader

(for Authorized AreaManagers)

- Data, my Data, OpenData
- Data Inspector
- MyKPI, MyData, MyPOI
- My Groups of Entities
- View/Set MyPOI on Tuscany
- Data Table Loader (Excel)

<https://www.snap4city.org/729>

How to ingest Devices/Entities in automatic

main High Level Types	1st option	2nd option
POI, Point of Interest	IoT App or POI Loader (from EXCEL files)	Create an Entity Model, Entity Registration , ingest via IoT App
IoT Devices, KPI multivariable, WoT, Entities Instances	Create an Entity Model, Entity Registration , ingest via broker (e.g., Time Series) or IoT App	Data Table Loader
GIS data	Pose query from IoT App, Create an Entity Model, Entity Registration , ingest via IoT App	Load them on GeoServer

Ingestion of Entities

-



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
- My Data Dashboard Dev Kibana
- My Data Dashboard Kibana
- Extra Dashboard Widgets
- Notificator
- Data, my Data, OpenData
 - Data Inspector
 - MyKPI, MyData, MyPOI
 - My Groups of Entities
 - View/Set MyPOI on Tuscany
 - Data Table Loader (Excel)**
 - POI Loader (Excel)
 - Harvest Satellite Copernicus Data
 - HeatMap Manager
 - ColorMap Manager
 - TrafficFlow Manager
 - BIM Server old
 - BIM Server New

Data Table Loader (Excel)

Do you have a question? Send us an email: snap4city@disit.org

Please, upload your file! (You have uploaded 0 files (Maximum: 100)) [Next](#)

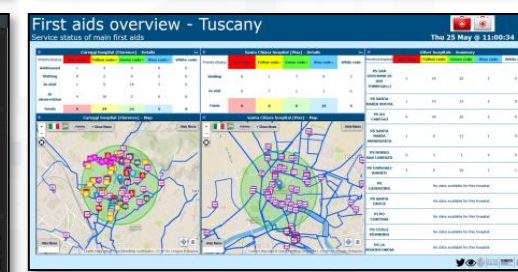
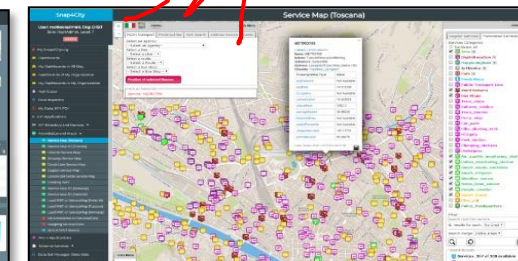
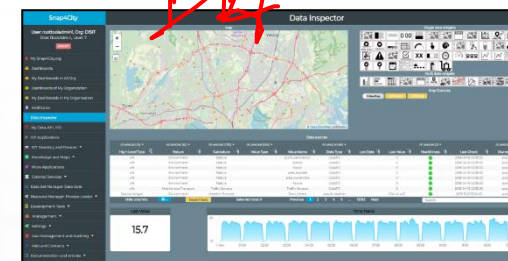
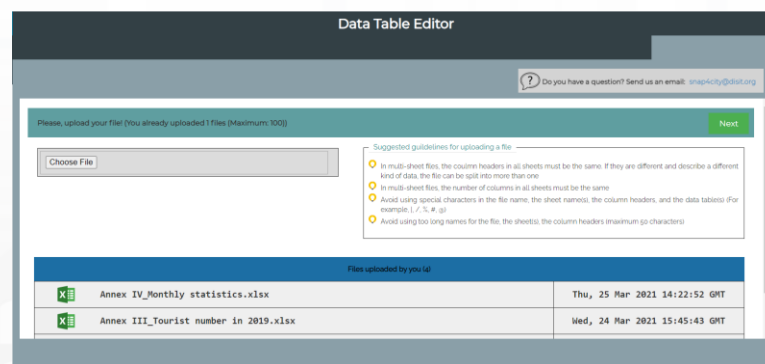
Scegli file

- General guidelines**
- Use "Previous" and "Next/Save" (not browser navigation) buttons to move to previous and next pages
 - In multi-sheet files, coulumn headers in all sheets must be the same. If they are different and describe a different kind of data, the file can be split into more than one
 - In multi-sheet files, the number of columns in all sheets must be the same
 - Avoid using special characters in file name (For example,/,#,@,%,,[,])
 - Avoid using non-UTF-8 (e.g., non-English) letters in the file name and column headers (For example,И,Ž,ć)

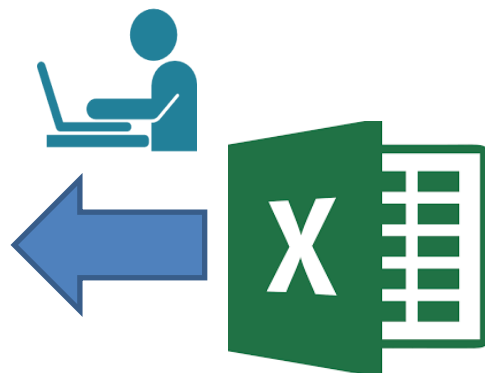
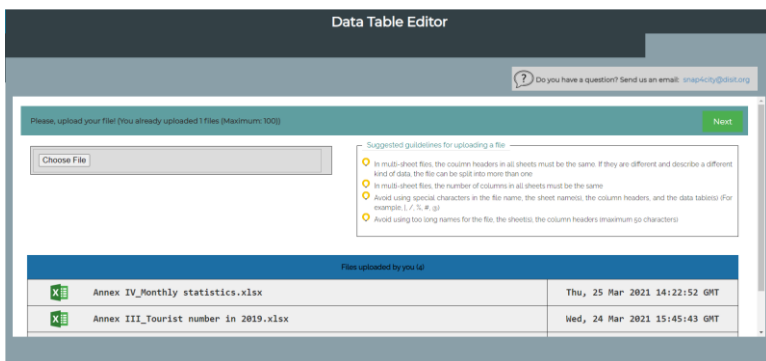
Uploaded Files (18)					
	Organization	File Name	Status	Upload Date & Time	
	Greece-UNISYSTEMS	KOK2021_877019342_SAMPLE_demo.xlsx	Model: Created Device(s): Created Instance(s): Not Created	Tue, 08 Jun 2021 08:41:41 GMT	VIEW DETAILS DELETE
	WestGreece	Rooms for rent 2017-2019.xlsx	Model: Created Device(s): Created Instance(s): Created	Tue, 11 May 2021 08:56:05 GMT	VIEW DETAILS DELETE
	WestGreece	Arrivals_Departures of Air Transport_Montly_2010-2019.xlsx	Model: Created Device(s): Created Instance(s): Created	Mon, 10 May 2021 15:04:21 GMT	VIEW DETAILS DELETE

Data Table Loader

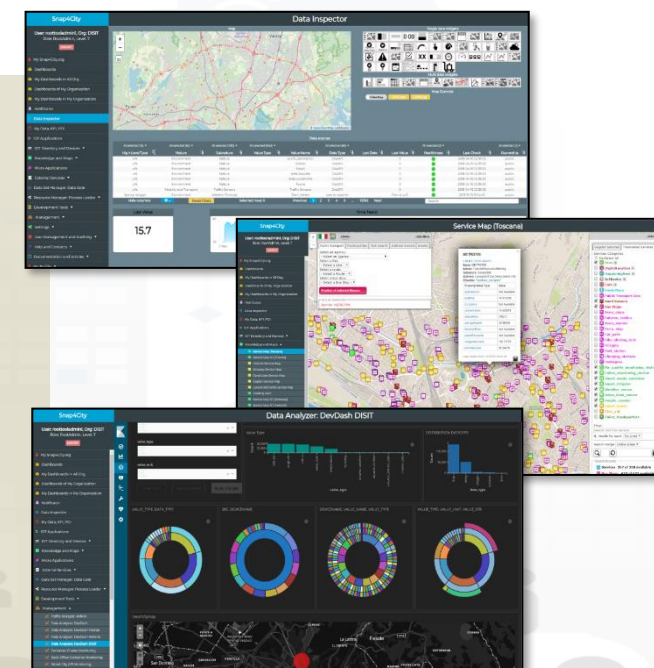
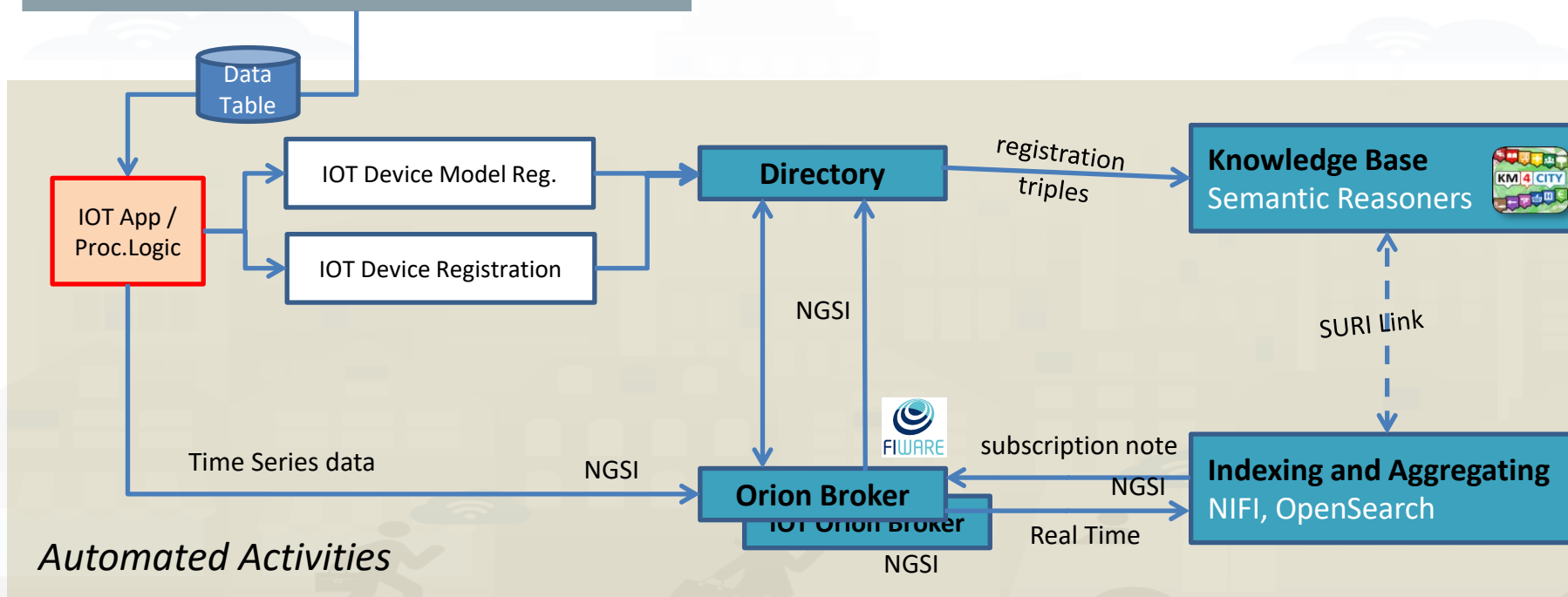
- For: IoT Devices, KPI as devices, OD as devices, time Series ...
- To help you to **upload data in short/zero time**
 - **Start from Excel Files, they should be formatted some how or well formatted according to our guidelines (models are provided)**
 - Custom upload for each Organization is possible
- To **enable you to**
 - create dashboards from them according to different views and nature



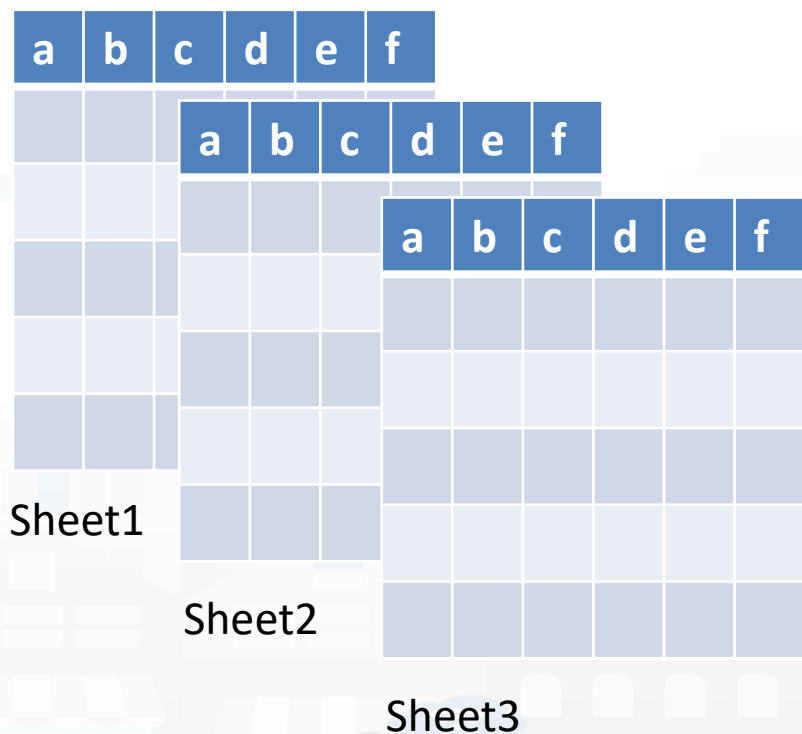
Short cut Data Ingestion from Excel file



- 1) Upload the file on **Data Table Loader**
- 2) Follows the instructions and guidelines
 - the dirty work will be done in a Snap
 - wait! --
- 3) See data on your Data Inspector 😊
- 4) Use Data Into Dashboards 😊



Assuming an Excel file with 1 or more Sheets all of them with the same structure

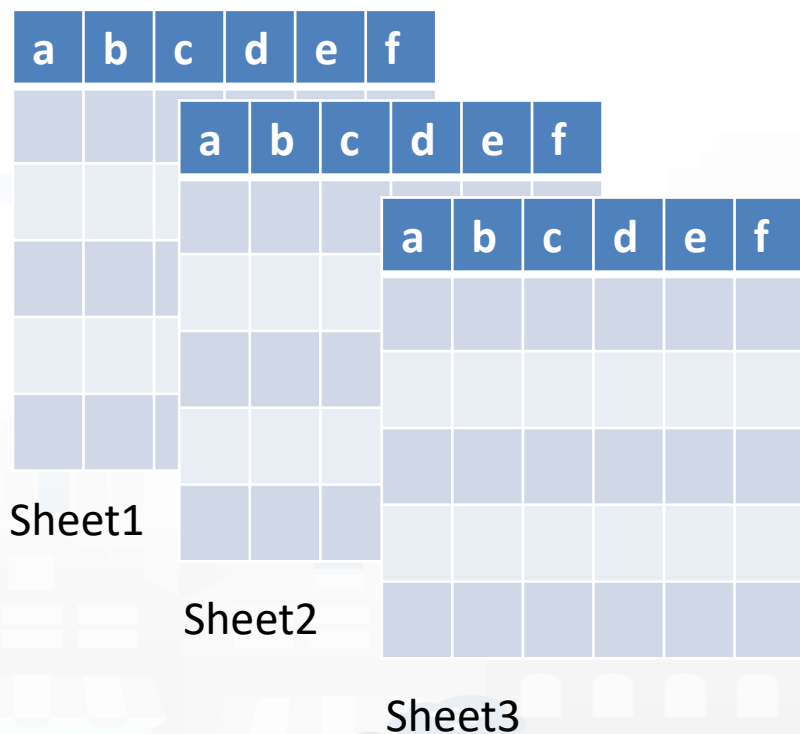


If this is not the case!

- Columns in the sheets are different AND it is not possible to regularize them (by editing: adding empty columns, change names, etc.)

→ split the excel file in multiple files

Assuming an Excel file with 1 or more Sheets all of them with the same structure



If this is the case!

- 1) The Schema of the sheets is becoming an IoT Device Model
- 2) Each single Sheet is becoming a single IoT Device
- 3) The row in the single Sheet are becoming instances of the corresponding IoT Device

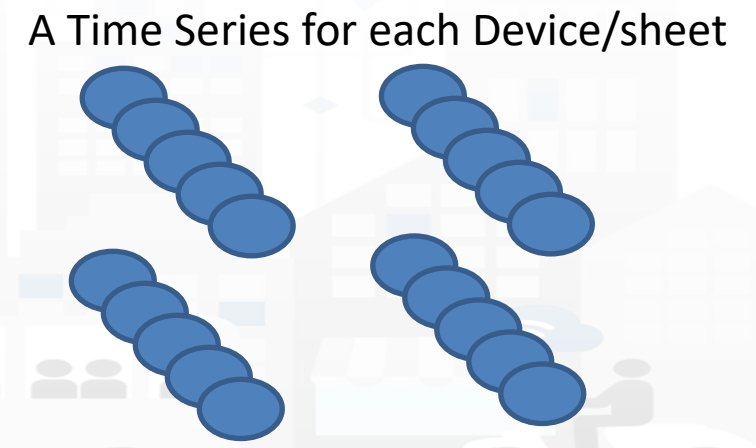
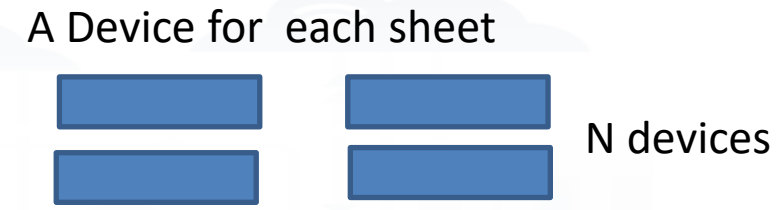
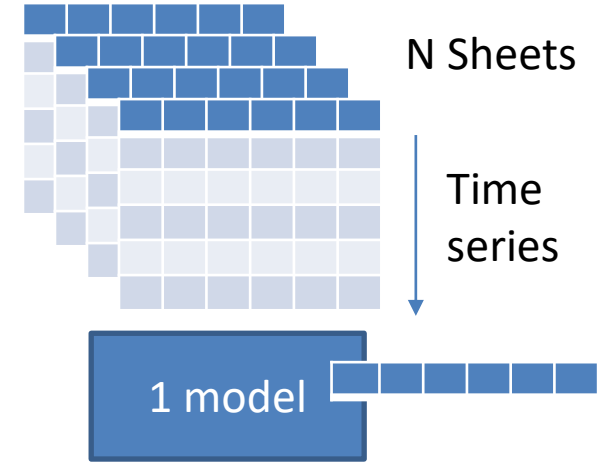
Row Case

- One **dateObserved for each Row of each Sheet**, multiple sheets with the same structure
 - An **IoT Device/Entity Model** is created for the structure of the sheet
 - a number of **variables are produced**
 - Including dateObserved variable which is a column
 - For each Sheet an **IoT Device/Entity** is produced from the model
 - The device name is the combination: sheet+..... as defined by the user
 - Sheet name is part of the IOT Device Name and may also become a variable
 - Sheets may have a different number of rows
 - For each Row of each Sheet an **IoT Device/entity Time Instance** is created
 - Each row has a specific dateObserved
 - Each row has ... other attributes as well

1 model

iotdirectory-new-device-from-model

fware orion out api v2



delegate-my-device

Example

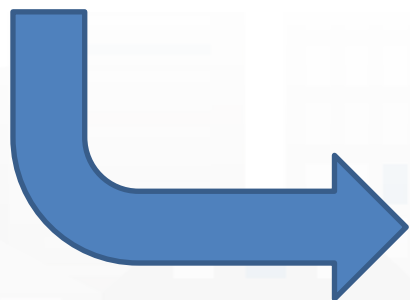
Data from INSETE
Basic Sizes of Incoming Tourism

Basic Sizes of Incoming Tourism of the Region of Western Greece 2019							
Regions	Countries Origin	Visits (in thousands)	Receipts (in € million)	Nights (in thousands)	Expenditure / Visit (in €)	Cost / Night (in €)	Average Length of Stay
West Hellas	Albania	132.9	26.5	225.8	199.7	117.5	1.7
	United Kingdom	47.7	17.9	345.8	375.2	51.8	7.2
	Germany	70.3	36.4	672.4	517.9	54.1	9.6
	France	55.4	16.5	321.6	298.1	51.4	5.8
	Other	510.7	160.0	2,964.9	313.3	54.0	5.8
	Total	817.0	257.4	4,530.4	315.0	56.8	5.5
	% of the total	2.2%	1.5%	1.9%			

Source: BoG Border Research, INSETE Intelligence Editing

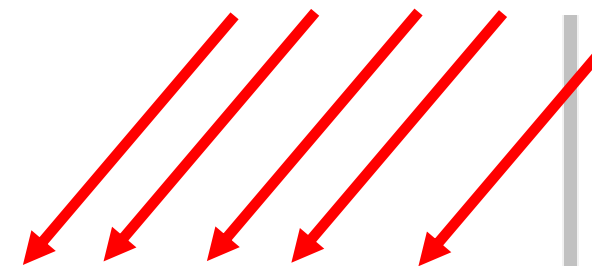
Basic Sizes of Incoming Tourism of the Region of Western Greece 2018							
Regions	Countries of Origin	Visits (in thousands)	Receipts (in € million)	Nights (in thousands)	Expenditure / Visit (in €)	Cost / Night (in €)	Average Length of Stay
West Greece	Albania	138.7	29.0	222.9	209.2	130.1	1.6
	United Kingdom	42.6	13.5	180.6	317.6	74.9	4.2
	Germany	71.3	26.0	466.5	365.1	55.8	6.5
	France	44.2	13.5	262.9	304.7	51.2	6.0
	Other	402.5	129.8	2,050.7	322.4	63.3	5.1
	Total	699.2	211.8	3,183.5	302.9	66.5	4.6
	% of the total	2.0%	1.4%	1.4%			

Region	Visits_in_Thousands	receipts_in_Millions_Euro	Nights_in_Thousands	Expenditure_per_Visit_Euro	Cost_per_Night_Euro	Average_Length_of_Stay	dateObserved
West Greece	77,5	12,8	165,6	165,3	77,4	2,1	2016-12-31T23:00:00+0000
West Greece	131,3	18,8	183,3	142,9	102,3	1,4	2017-12-31T23:00:00+0000
West Greece	138,7	29	222,9	209,2	130,1	1,6	2018-12-31T23:00:00+0000
West Greece	132,9	26,5	225,8	199,7	117,5	1,7	2019-12-31T23:00:00+0000



Resulted Data Table Loaded by Row Model

Value Type							
geolocation	Count	price	Count	price	price	duration	timestamp
Value Unit							
text	K#	Meuro	K#	euro	euro	day	timestamp
Data Type							
string	float	float	float	float	float	float	time



Device Name	Sheet Name	Region	Visits_in_Thousands	receipts_in_Millions_Euro	Nights_in_Thousands	Expenditure_per_Visit_Euro	Cost_per_Night_Euro	Average_Length_of_Stay	dateObserved	Latitude	Longitude	Nature	Sub-Nature	Context Broker
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__Albania	Albania	West Greece	77.5	12.8	165.6	165.3	77.4	2.1	2016-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__Albania	Albania	West Greece	131.3	18.8	183.3	142.9	102.3	1.4	2017-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__Albania	Albania	West Greece	138.7	29	222.9	209.2	130.1	1.6	2018-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__Albania	Albania	West Greece	132.9	26.5	225.8	199.7	117.5	1.7	2019-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__UnitedKingdom	United Kingdom	West Greece	48.1	17.4	373.1	362.6	46.8	7.8	2016-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__UnitedKingdom	United Kingdom	West Greece	49.7	20	290.5	402.5	68.8	5.8	2017-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__UnitedKingdom	United Kingdom	West Greece	42.6	13.5	180.6	317.6	74.9	4.2	2018-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__UnitedKingdom	United Kingdom	West Greece	47.7	17.9	345.8	375.2	51.8	7.2	2019-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__Germany	Germany	West Greece	42.5	13.6	237.9	319.2	57	5.6	2016-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__Germany	Germany	West Greece	46.5	15	320.3	323.6	47	6.9	2017-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__Germany	Germany	West Greece	71.3	26	466.5	365.1	55.8	6.5	2018-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__Germany	Germany	West Greece	70.3	36.4	672.4	517.9	54.1	9.6	2019-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__France	France	West Greece	36.3	12.1	173.3	334.7	70.1	4.8	2016-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__France	France	West Greece	34.7	14.7	213.7	424.8	69	6.2	2017-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__France	France	West Greece	44.2	13.5	262.9	304.7	51.2	6	2018-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__France	France	West Greece	55.4	16.5	321.6	298.1	51.4	5.8	2019-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__Other	Other	West Greece	308.9	89.5	1791.9	289.8	50	5.8	2016-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__Other	Other	West Greece	301.3	90.3	1810.8	299.7	49.9	6	2017-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__Other	Other	West Greece	402.5	129.8	2050.7	322.4	63.3	5.1	2018-12-31T12:00:00.000+02:00	38.2384	21.7385	TourismService	TravelInformation	orionWestGreece-UNIFI

Requested information if not provided

GeoLocation to assign at the city or area

- Latitude
- Longitude

Classification to simplify the search

- Nature
- Subnature

Broker is assigned automatically on the basis of Organization / tenant

Latitude	Longitude	Nature	Sub-Nature	Context Broker
38.2384	21.7385	TourismService	Travel_information	orionWestGreece-UNIFI
38.2384	21.7385	TourismService	Travel_information	orionWestGreece-UNIFI
38.2384	21.7385	TourismService	Travel_information	orionWestGreece-UNIFI
38.2384	21.7385	TourismService	Travel_information	orionWestGreece-UNIFI
38.2384	21.7385	TourismService	Travel_information	orionWestGreece-UNIFI
38.2384	21.7385	TourismService	Travel_information	orionWestGreece-UNIFI
38.2384	21.7385	TourismService	Travel_information	orionWestGreece-UNIFI
38.2384	21.7385	TourismService	Travel_information	orionWestGreece-UNIFI

Variables of the Device

- dateObserved for Time Series, UNIQUE!
- Variables have to be assigned to:
 - Value Type, Value Unit, Data Type
- For example for Device
BasicSizesofIncomingTourismoftheRegionofWesternGreece.xlsx__UnitedKingdom

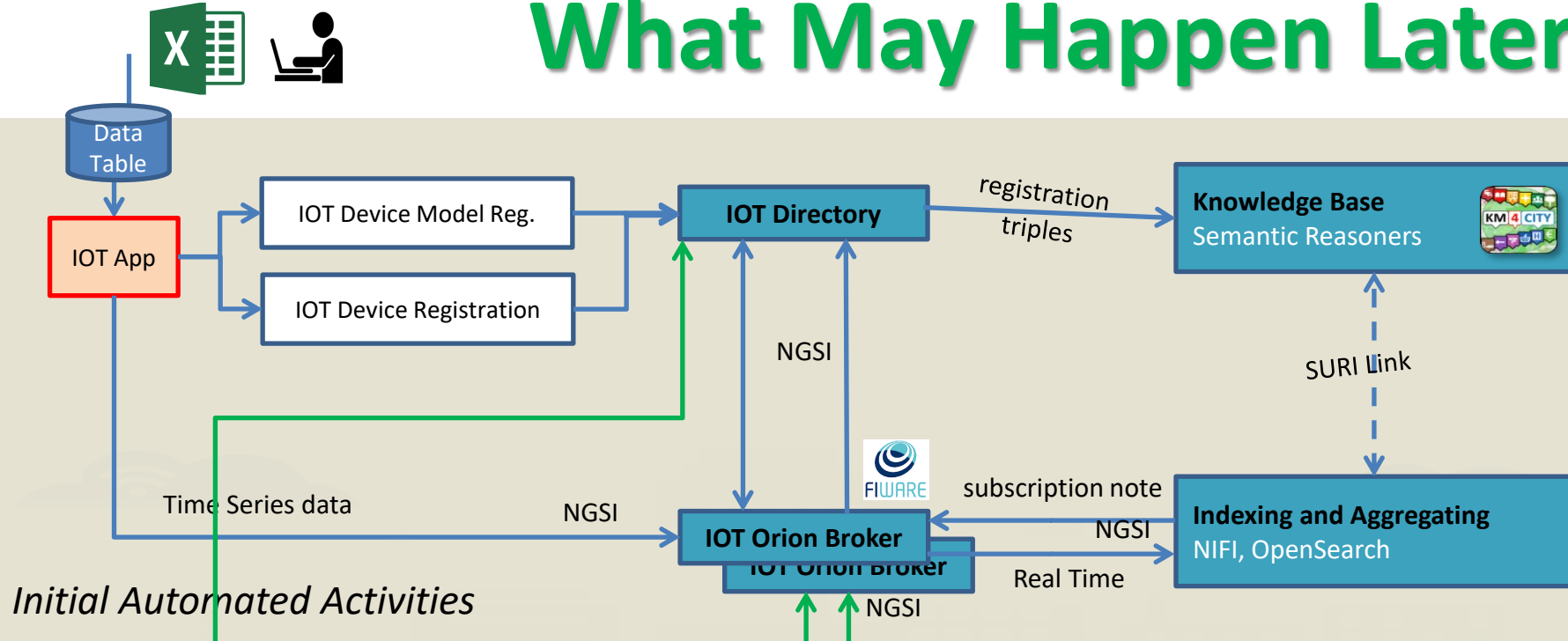
Value Type							
geolocation	Count	price	Count	price	price	duration	timestamp
Value Unit							
text	K#	Meuro	K#	euro	euro	day	timestamp
Data Type							
string	float	float	float	float	float	float	time
Region	Visits_in_Thousands	receipts_in_Millions_Euro	Nights_in_Thousands	Expenditure_per_Visit_Euro	Cost_per_Night_Euro	Average_Length_of_Stay	dateObserved
West Greece	775	12.8	165.6	165.3	77.4	21	2016-12-31T12:00:00.000+02:00
	131.3	18.8	183.3	142.9	102.3	1.4	2017-12-31T12:00:00.000+02:00
	138.7	29	222.9	209.2	130.1	1.6	2018-12-31T12:00:00.000+02:00
	132.9	26.5	225.8	199.7	117.5	1.7	2019-12-31T12:00:00.000+02:00
	48.1	17.4	373.1	362.6	46.8	7.8	2016-12-31T12:00:00.000+02:00
	49.7	20	290.5	402.5	68.8	5.8	2017-12-31T12:00:00.000+02:00
	42.6	13.5	180.6	317.6	74.9	4.2	2018-12-31T12:00:00.000+02:00
	47.7	17.9	345.8	375.2	51.8	7.2	2019-12-31T12:00:00.000+02:00
	42.5	13.6	237.9	319.2	57	5.6	2016-12-31T12:00:00.000+02:00

IoT Broker Info Position Static Attributes Values Status

Average_Length_of_Stay	float	Duration	duration in days (day)
Value Name	Data Type	Value Type	Value Unit
Ok		Ok	Ok
false		Refresh rate	100
Editable		Healthiness Criteria	Healthiness_Value
Remove Value			
Cost_per_Night_Euro	float	price	Euro (euro)
Value Name	Data Type	Value Type	Value Unit
Ok		Ok	Ok
false		Refresh rate	100
Editable		Healthiness Criteria	Healthiness_Value
Remove Value			
dateObserved	time	Timestamp	timestamp in millisecc

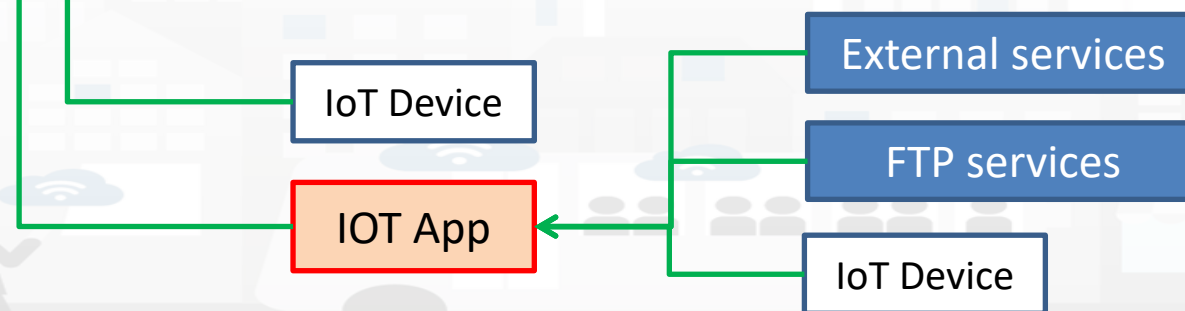


What May Happen Later



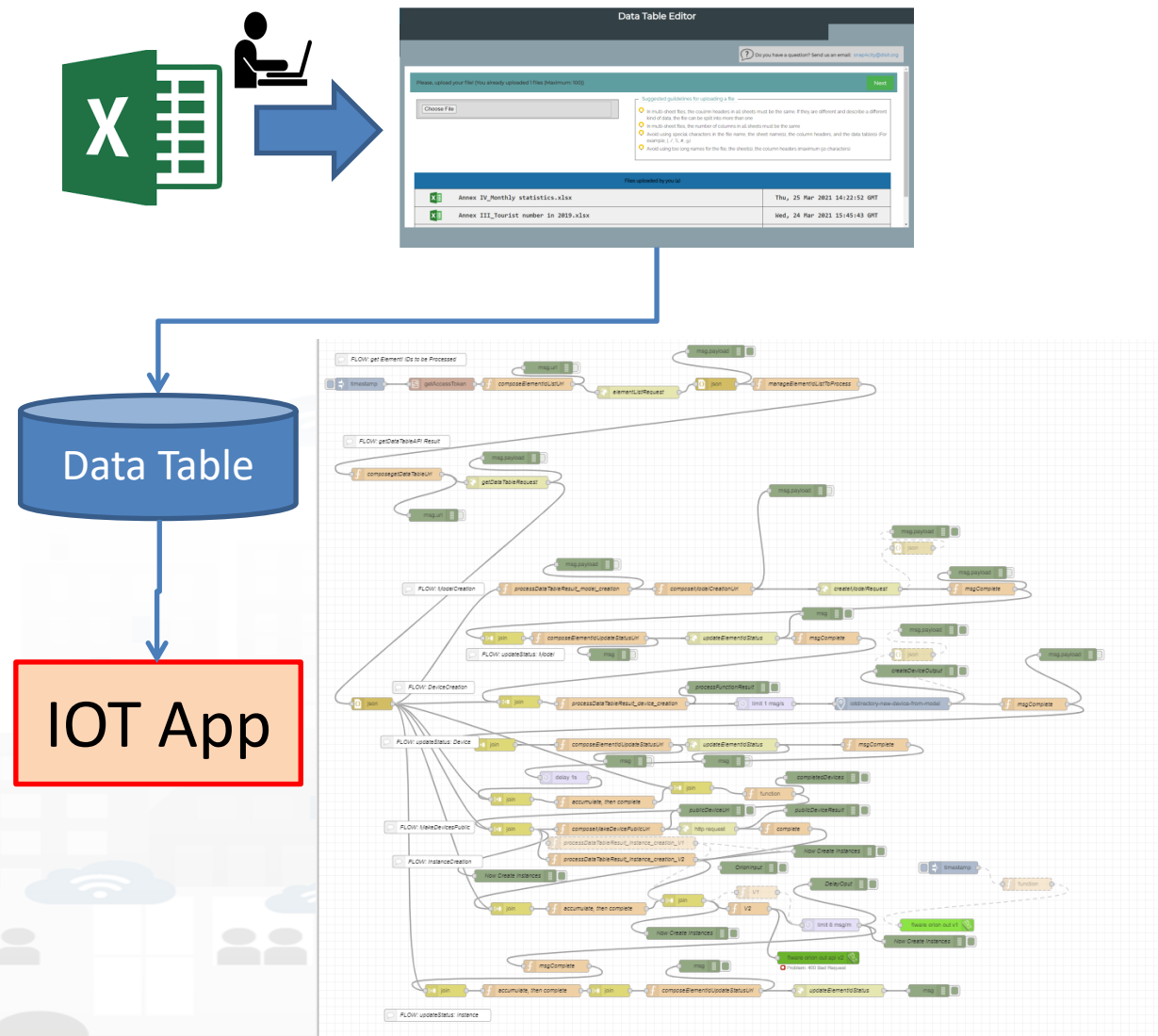
Initial Automated Activities

- A) User may Add data on IoT Directory Tool (time series)
- B) IoT Device may send additional data (time Series) on Broker
- C) Other IoT Apps may get / produce and load additional Data (time Series)



Notes on the implementation

- The Data Table Loader has been developed in PHP to interact with the user to regularize data in ingestion, request missing information, etc., and finally to save this information on a **DataTable** in MySQL
 - A Status for data ingestion is defined, managed, evolved
- The IoT App** gets the data and when possible and needed: creates the IoT Device Modes, IoT Devices, and IoT Device Instances (time series)
- Any AreaManager can upload DataTable sets but only specific dedicated responsible users for data upload can actually load. We suggest one.
 - Each of them is becoming the owner and responsible of the IOT App process, which can be customized also, and of the IoT Device Model, IoT Device.



TOP

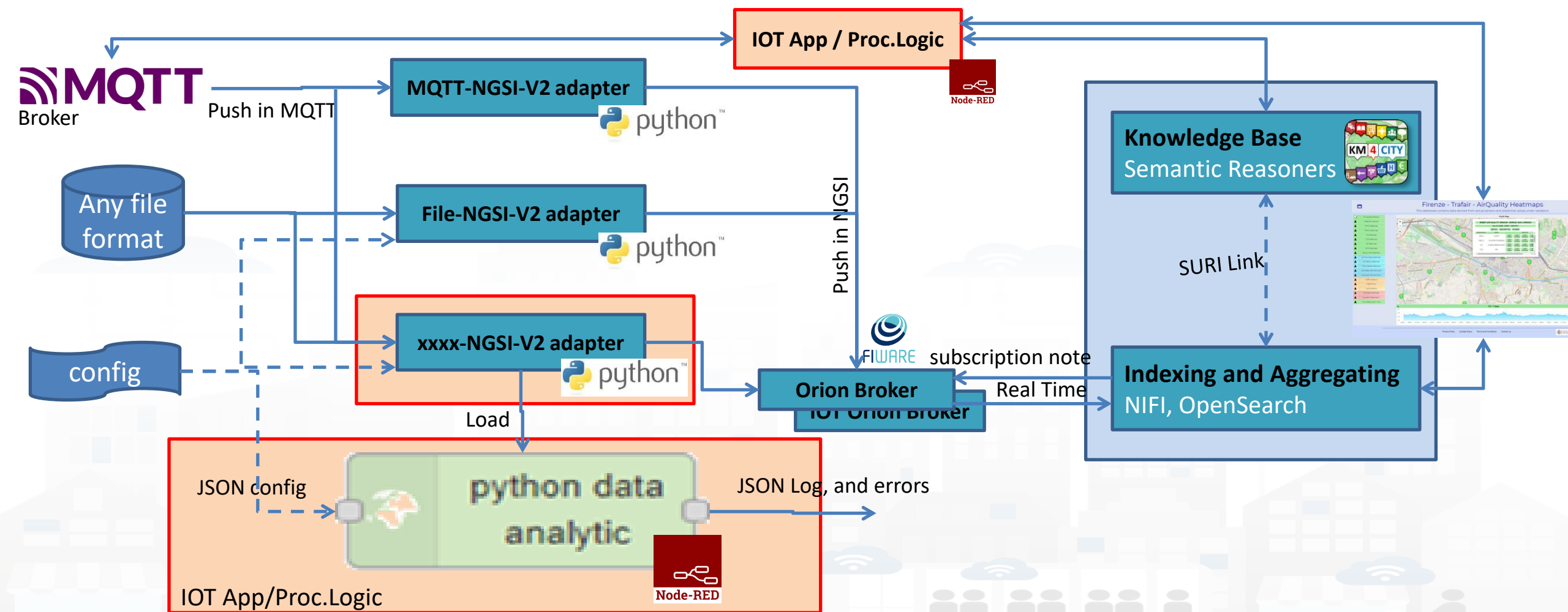
High Performance Ingestion via Python (FastDataLoader)

<https://www.snap4city.org/831>

Fast and Massive Data Ingestion

- The ingestion processes passes data to some Orion Broker when the device is registered on Directory.
 - The ingestion in this case consists in posting each single message on the broker and the broker posts them on NIFI which performs regularization exploiting KB and passes them on Open Search
 - The process can be performed by IoT App, thus in Node-RED with high flexibility (95% of cases is ok) but with some limitation on throughput
- **Faster approaches** can be to **write a Python process** to get data and:
 - **Case A)** post each single message on one of the Orion Brokers
 - Case B) post each single message directly on Ni-Fi cluster (not suggested but viable)
 - For Both: *you have to register the IoT devices/Entities on Directory*

High Performance Solutions on Snap4City Framework



TOP



Smart Data Models on Snap4City

FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS

SNAP4CITY FOR BEGINNERS

SNAP4CITY ARCHITECTURE AND ECOSYSTEM. OPENED TO DEVELOPERS AND PARTNERS

TWITTER VIGILANCE: SOCIAL MEDIA ANALYSIS

SNAP4CITY AND KM4CITY PROJECTS

FROM CITY DASHBOARD APPLICATIONS

DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT

IOT/IOE DEVICES AND NETWORKS

DATA ANALYTICS, BUSINESS INTELLIGENCE, WHAT-IF AND PREDICTION

HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP

DECISION SUPPORT SYSTEM AND CITY RESILIENCE

SNAP4CITY THE VIEW OF THE ADMINISTRATORS

IOT APPLICATIONS, THE LOGIC AND THE SMARTNESS

ADVANCED SMART CITY API, MICROSERVICES, SNAP4CITY API

SNAP4CITY LIVING LAB FOR COLLABORATIVE INNOVATION

- IOT Directory and Devices
- My IOT Sensors and Actuators
- IOT Sensors and Actuators
- IOT Devices
- IOT Devices Management
- IOT Brokers
- FIWARE Smart Data Models**
- IOT Device Models
- IOT Devices Bulk Registration
- Ext. MS Broker Devices Discovery
- Ext. MS Broker Discovery
- Ext. Broker Devs Periodic Update
- Rules for Discovery
- OLD IOT Orion Broker Mapping Rule
- Doc: IOT Directory and Devices
- Create an IOT Device Instance
- Create an IOT Device Model
- Add an IOT Device into Snap4City

<https://www.snap4city.org/800>

FIWARE Smart Data Model



- Include
 - JSON Schema (for verification and validation) and Specs
 - Examples in: NGSI V2, NGSI LD
- Domains



<https://www.fiware.org/smart-data-models/>



FIWARE Smart Data Models -- Library

Snap4City

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

[LOGOUT](#)

- 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
 - FIWARE Smart Data Models**
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 - Doc: IOT Directory and Devices
 - Create an IOT Device Instance
 - Create an IOT Device Model
 - Add an IOT Device into Snap4City
- Resource Manager
- Development Tools

FIWARE Smart Data Models Library

Show entries Search:

Name	Subdomain	Domain	Version	Edit
Alert	Alert	CrossSector	0.0.2	EDIT
Anomaly	Alert	CrossSector	0.0.2	EDIT
Battery	Battery	CrossSector	0.0.2	EDIT
BatteryStatus	Battery	CrossSector	0.0.2	EDIT
StorageBatteryDevice	Battery	CrossSector	0.0.2	EDIT
StorageBatteryMeasurement	Battery	CrossSector	0.0.2	EDIT
CallUser	CallComplaints	CrossSector	0.0.1	EDIT
Complaint	CallComplaints	CrossSector	0.0.1	EDIT
ComplaintsCollection	CallComplaints	CrossSector	0.0.2	EDIT
ComplaintsOrganization	CallComplaints	CrossSector	0.0.2	EDIT

Showing 1 to 10 of 441 entries

[Previous](#)
1
2
3
4
5
...
45
[Next](#)



Exploiting FIWARE Smart Data Models

- **Smart Data Models** can be used into Snap4City:
 - as initial IoT Data Model without precise Variable Definitions
 - Attach automated rules to each specific Smart Data Model of a Broker for directly registration and management of IoT Device Messages
- **Exploitation** to simplify IoT Device Registration from Orion Brokers, for
 - **External Brokers**: automating Device Registration while Device Discovery
 - **Internal Brokers**: exploiting the Smart Data Model as a Template for Device Registration

Get a New Orion Broker

automated deploy of Orion Brokers

IOT Directory and Devices

- My IOT Sensors and Actuators
- IOT Sensors and Actuators
- IOT Devices
- IOT Devices Management
- IOT Device Discovery
- IOT Brokers
- IOT Device Models
- IOT Devices Bulk Registration
- IOT Broker Periodic Update setti...
- IOT Orion Broker Mapping Rules...
- Doc: IOT Directory and Devices
- Create an IOT Device Instance
- Create an IOT Device Model
- Add an IOT Device into Snap4Cit...



Automated Deploy of Orion Brokers

ToolAdmin user access to the button for the automated Deploy of Orion Brokers.

This feature can be provided to large Organizations and on demand to medium and small

Snap4City
User: iotdirectory.disit, Org: DISIT
Role: ToolAdmin, Level: 6
LOGOUT

IOT Brokers
30 TOTAL

Register new IOT Broker | Deploy new orion broker

Show 10 entries

IOT Broker	Access Link	Access Port	Kind	Protocol	Ownership	Organization	Created	Edit	Delete	Go to	Util
Antwerp	https://ext-api-gw-p.antwerpen.be/digipolis/aovmma/v1/entities		external	ngsi	PRIVATE	Antwerp	2019-03-13 14:57:17			Go	TEST VIEW
Antwerp2	https://ext-api-gw-p.antwerpen.be/imec/smartzone/v1		external	ngsi	PRIVATE	Antwerp	2019-01-01 00:00:00			Go	TEST VIEW
CB-test-multi	192.168.1.47	8444	internal	ngsi w/MultiService		DISIT	2020-05-20 15:42:39			Go	TEST VIEW
iotobsf-smartbed	192.168.1.47	8443	internal	ngsi	PRIVATE	SmartBed	2019-11-29 15:31:51			Go	TEST VIEW
mqttUNIFI	192.168.1.10	1883		mqtt	MYOWNPRIVATE	DISIT	2018-02-07 15:14:39	EDIT	DELETE		VIEW
mqttUNIMI	159.149.129.184	1884		mqtt	MYOWNPRIVATE	DISIT	2018-04-30 16:49:05	EDIT	DELETE		VIEW
orion-DISIT-external	192.168.1.47	1034	external	ngsi w/MultiService	PRIVATE	Firenze	2021-04-20 10:03:34			Go	TEST VIEW
orion-test1	https://iot-app.snap4city.org/orionfilter/orion-test1	443	internal	ngsi	MYOWNPRIVATE	DISIT	2021-10-01 17:11:49	EDIT	DELETE	GoDyn	TEST VIEW
orionAntwerp-UNIFI	broker3.snap4city.org	8080	internal	ngsi	PUBLIC	Antwerp	2019-06-03 14:25:16			Go	TEST VIEW
orionCAPELON-Tampere	https://context.tampere.fiware.cityvision.cloud		external	ngsi w/MultiService		CAPELON	2021-05-17 18:29:27			Go	TEST VIEW

Showing 1 to 10 of 30 entries

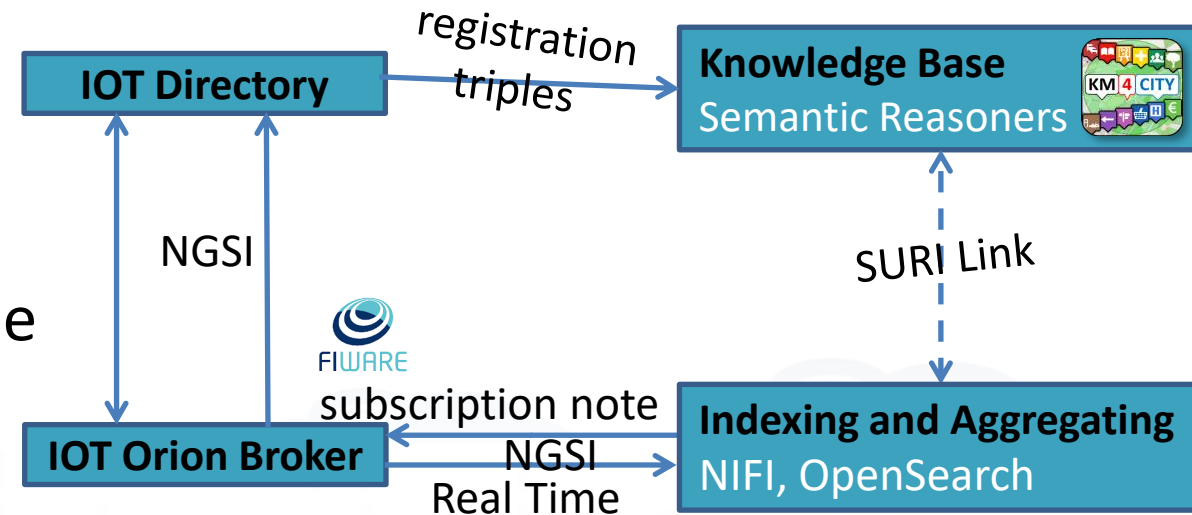
Previous | 1 | 2 | 3 | Next

Automated Deploy of Orion Brokers

- **You can define**
 - Name/nickname
 - GPS position
 - Accessible from inside and/or outside

- **→ Automatically....**

- an Orion Broker is deployed in
- Container for your organization
- Proxy are set up
- Registration on data shadow is established (OpenDistro ES)
- New IoT Device Model and IoT Devices can be registered, etc. (NIFI)



Deployed Orion Brokers

orion-test1	https://iot-app.snap4city.org/orionfilter/orion-test1	ngsi	MYOWNPRIVATE	DISIT	2021-10-01 17:11:49	EDIT	DELETE	GoDyn	TEST	VIEW
Broker URI: https://iot-app.snap4city.org/orionfilter/orion-test1	Broker Port: 443									
Latitude: 43.80381	Longitude: 11.20262									
Login:	Password:									
SHA:	Version: v2									
Orion version: 3.1.0-next	Orion status: upgraded 2021-10-04 15:10:01									

- You can:

- Delete: undeploy the broker from the cloud
- Change ownership, delegate access
- See/View/Edit of config parameters
- Access: public / private
- External access test
- Test on internal registration
- Update to upgrade the Broker at the last Docker version from FIWARE

The broker answers at the link:
<http://192.168.1.47:2032/v2/entities>

TOP

IOT Broker Registration

*(for External/Internal Orion Brokers
or other Brokers)*

IOT Directory and Devices

- My IOT Sensors and Actuators
- IOT Sensors and Actuators
- IOT Devices
- IOT Devices Management
- IOT Device Discovery
- IOT Brokers
- IOT Device Models
- IOT Devices Bulk Registration
- IOT Broker Periodic Update setti...
- IOT Orion Broker Mapping Rules...
- Doc: IOT Directory and Devices
- Create an IOT Device Instance
- Create an IOT Device Model
- Add an IOT Device into Snap4Cit...



Snap4City

User: iotdirectory.disit, Org: DISIT
Role: ToolAdmin, Level: 6

LOGOUT

- My Snap4City.org
- Tour Again
- Dashboards (Public)
- My Dashboards in All Org.
- Dashboards of My Organization
- My Dashboards in My Organization
- My Data Dashboard Dev Kibana
- Extra Dashboard Widgets
- Notificator
- Data, my Data, OpenData
- 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
 - Ext. MS Broker Devices Discovery
 - Ext. Broker Devs Periodic Update
 - IOT Orion Broker Mapping Rules
 - Doc: IOT Directory and Devices
 - Create an IOT Device Instance
 - Create an IOT Device Model
 - Add an IOT Device into Snap4City
- Resource Manager
- Development Tools
- Management
- Decision Support Systems
- Deploy and Installation

IOT Brokers

30

Register new IOT Broker Deploy new orion broker

Show 10 entries

Search:

	IOT Broker	Access Link	Access Port	Kind	Protocol	Ownership	Organization	Created	Edit	Delete	Go to	Utility
+	orionPisa-UNIFI	192.168.1.47	8447	internal	ngsi	PRIVATE	Pisa	2020-08-03 12:55:52			Go	TEST VIEW
+	orionPontDuGard-UNIFI	192.168.1.47	8454	internal	ngsi	PRIVATE	PontDuGard-Occitanie	2021-06-15 11:00:54			Go	TEST VIEW
Broker URI: 192.168.1.47						Broker Port: 8454						
Latitude: 43.96910						Longitude: 4.52808						
Login:						Password:						
SHA:						Version: v2						
+	orionToscana-UNIFI	192.168.1.47	8445	internal	ngsi	PRIVATE	Toscana	2020-05-19 10:00:30			Go	TEST VIEW
+	orionUNIFI	https://broker1.snap4city.org	8080	internal	ngsi	MYOWNPRIVATE	DISIT	2018-02-07 15:14:39	EDIT	DELETE	Go	TEST VIEW
+	orionUNIFIProxyHelsinki	https://www.snap4city.org/iot_ingestion/		internal	ngsi	PRIVATE	Helsinki	2019-04-05 14:31:21			Go	TEST VIEW
+	orionUNIMI	159.149.129.184	1026		ngsi	MYOWNPRIVATE	DISIT	2018-03-12 15:17:11	EDIT	DELETE	Go	TEST VIEW
+	orionValencia-UNIFI	valencia-broker.snap4city.org	443	internal	ngsi	PRIVATE	Valencia	2020-08-10 10:16:50			Go	TEST VIEW
+	orionWestGreece-UNIFI	192.168.1.47	8451	internal	ngsi	PRIVATE	WestGreece	2021-03-23 16:41:55			Go	TEST VIEW
+	rabbitUNIMI	159.149.129.184	5672		amqp	MYOWNPRIVATE	DISIT	2018-02-07 15:14:39	EDIT	DELETE		VIEW
+	sigfox	213.186.33.69	0		sigfox	MYOWNPRIVATE	DISIT	2018-05-28 00:31:53	EDIT	DELETE		VIEW

Showing 21 to 30 of 30 entries

Previous 1 2 **3** Next

Register a New IOT Broker

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
- Notificator
- Data Inspector
- My Data, KPI, POI
- IOT Applications
- IOT Directory and Devices
 - My IOT Devices
 - 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
- Knowledge and Maps
- Micro Applications
- External Services
- Data Set Manager: Data Gate
- Resource Manager: Process Loader
- Development Tools

IOT Brokers

Show 10 entries

IOT Broker	Access Link	Owner	Created	Edit	Delete
+ Antwerp	https://ext-api-gw-p.antwerpen.be/digipolis/aov	iotdirectory.antwerp	2019-03-13 14:57:17	EDIT	DELETE
+ Antwerp2	https://ext-api-gw-p.antwerpen.be/imec/smart	iotd			
+ mqttUNIFI	192.168.1.10	iotd			
+ mqttUNIMI	159.149.129.184	iotd			
+ orionAntwerp-UNIFI	broker3.snap4city.org	iotd			
+ orionFinland	https://ngsi.fvh.fi	iotd			
+ orionHelsinki-UNIFI	broker2.snap4city.org	iotd			
+ orionUNIFI	https://broker1.snap4city.org	iotd			
+ orionUNIFIProxyHelsinki	https://www.snap4city.org/iot_ingestion/	ngsi	PRIVATE	Helsinki	
+ orionUNIMI	159.149.129.184	1026	ngsi	DELEGATED	DISIT

Showing 1 to 10 of 12 entries

Add new context broker

Info | Geo-Position | Security

Kind:

Name: Context Broker name is mandatory

IP: IP is mandatory

Port: Port is mandatory

Protocol:

Version:

Access Link:

Access Port:

Private:

Ownership:

Cancel Confirm

Add new context broker

Info | Geo-Position | Security

Latitude: Latitude is mandatory

Longitude: Longitude is mandatory

Cancel Confirm

Snap4city Data Ingestion Diagram

storage

Manual or automated
Registration
of Entities/Devices

**Entity/IoT
Directory**

registration
triples

NGSI



Orion Broker

subscription note

NGSI

Real Time

Orion Broker
IoT Orion Broker
IoT Orion Broker
Brokers

Knowledge Base
Semantic Reasoners
Semantic Reasoners

SURI Link

Indexing and Aggregating
Indexing and Aggregating
Indexing and Aggregating
Indexing and Aggregating
NIFI, OpenSearch

Data Managers
Data Managers
Entity Inspector

A number of KB
federated



Federation
Smart City API, ASCAPI

API Manager

Cluster of **OpenSearch**
for storage with in
front a cluster of
NIFI

Massive data flow
entering

Massive data flow
exiting

Platform Automation:
IoT Apps, Proc.Logics,
Python, ...

Data Analytics: ML, AI, XAI

Platform Control and Management

Snap4 technology is broker Agnostic. Most of the features are only accessible for FIWARE Orion Brokers

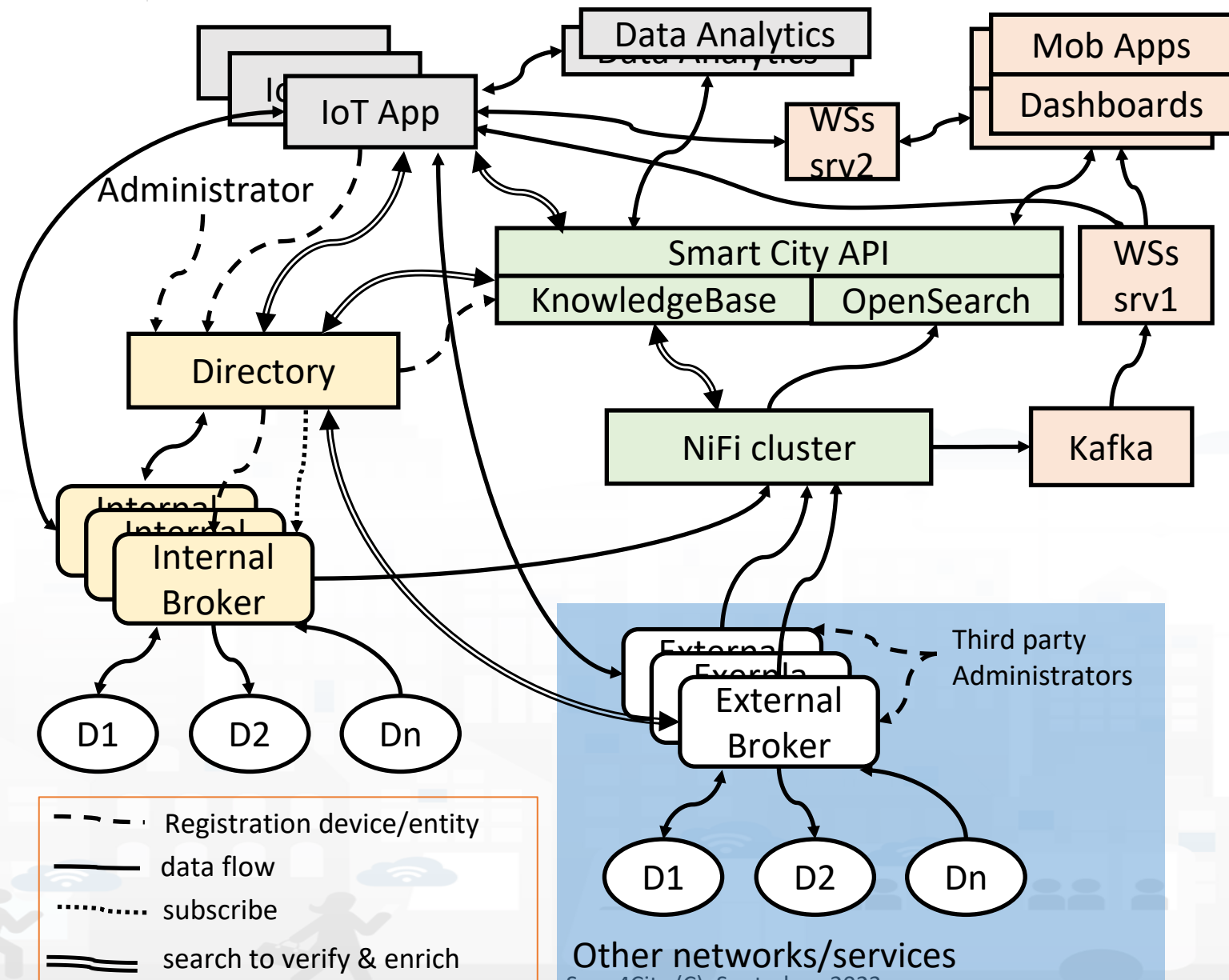
• IOT Brokers

- You can test, view, and register, and also automatically deploy Orion Brokers
- are associated with an Organization
 - Each **Organization** has a **Knowledge Base** of reference (KB, ServiceMap)
 - Each **KB** may host multiple **Organizations** and addresses multiple **Geographic areas**
- can be compliant with
 - **NGSI version**: V1, V2-1, V2, etc...
 - with Snap4City Security or regular NGSI FiWare
 - other protocols as well such as: MQTT, COAP, AMQP, etc.
- can
 - expose different **authentication methods**: K1/K2, Certificate, etc.
 - be accessible from IOT Devices and IOT App **in Cloud only**
 - be accessible **from Internet to post data from outside, etc.**

IOT Orion Broker Network: NGSI V1 and V2

- **IOT Broker can be Internal (on Snap4City Cloud)**
 - Registration of IOT Devices can be performed by the IOT Directory
 - Authentication is automatic, K1 and K2 are not needed since the security is performed via Access Token, M2M secure communication, on the basis of IOT App ownership
 - The **NIFI Cluster** automatically subscribes to all the entities on the Broker, to post data into the Data Shadow enriched with data of the KB
- **IOT Broker can be External (managed by third party)**
 - Registration of IOT Devices is managed by third parties
 - The registered IOT Devices can be collected and queried from the IOT Directory as well
 - The NIFI Cluster **may** automatically subscribes to all the entities on the Broker, to post data into the Data Shadow enriched with data of the KB
- **IOT Brokers can be networked**
 - Services, Service paths: for managing the IOT Broker network
 - Multi-tenant: more than one user/org on the same IOT Broker

Req.	Snap4 City	Azure IoT	Aws IOT	IBM Watson	Mind sphere
R1	Y	N	(y)	(y)	(y)
R2	Y	N	(y)	N	(y)
R3	Y	N	N	(y)	N
R4	Y	Y	Y	Y	Y
R5	Y	Y	Y	Y	N
R6	Y	N	(y)	N	(y)
R7	Y	N	N	N	N
R8	Y	Y	(y)	N	N
R9	Y	N	N	N	N
R10	Y	(y)	(y)	(y)	(y)
R11	Y	(y)	Y	Y	Y



Conclusions

- (i) Internal and External brokers,
- (ii) automated registration of devices/entities managed into External Brokers' single- or multi-tenant services,
- (iii) automated registration by harvesting and reasoning of data models/entities compliant with standard models such as FIWARE SDM, and any custom Data Model in Snap4City IoT Device Model providing a formal semantic definition of device attributes,
- (iv) fast data ingestion for ingesting / migrating historical data from legacy platforms and services to a new established uplevel platform,
- (v) sustained data usage from query demand and for data driven show changes in real time.

TOP

Ingestion of MyKPI with Proc.Logic / IoT App

FROM CITY DASHBOARD TO APPLICATIONS

FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS

IOT APPLICATIONS / SMART DEVICES

SNAP4CITY FOR BEGINNERS

SNAP4CITY ARCHITECTURE AND ECOSYSTEM OPENED TO DEVELOPERS AND PARTNERS

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SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK

SNAP4CITY THE VIEW OF THE ADMINISTRATORS

Data, my Data, OpenData

Data Inspector

MyKPI, MyData, MyPOI

IOT Applications

IOT Applications

MicroServices for IOT Applicatio...

MicroServices from DataAnalyti...

IOT MicroServices for Final Users...

IOT MicroServices for Developers...

Doc: IOT Applications

How to Develop IOT Application...

Create A MicroService from Rest...

- be time series + metadata
- be POI with full metadata decryption, MyPOI
- be passed in ownership to other users,
- be delegated in access to other users
- model daily trajectories from: Mobile Phone Apps, CANBUS data and GPS location from mobiles, PAX Counter Mobile, mobile IOT Devices, etc.
- be saved and retrieved from IOT Apps
- create events at their changes towards IOT Apps
- be saved into: MySQL and/or OpenSearch (default saving modality can be different for solutions on cloud and on premise)
 - The access from smart city API is in any way transparent, while only when they are saved into the OpenSearch they are accessible from the so called

– “My Data Dashboard”

No. +	High Level Type	Nature	Sub Nature	Value Name	Value Type	Value Unit	DB of Values	Data Type	Last Date	Last Value	Ownership	Username	Organization
17057849	MyKPI	Emergency	Emergency_services	WebServers	status	status	ElasticSearch	string	19/2/2021, 07:11:24	ServiceMap;2021-02-19T06:11:24.721Z;code:ESOCKETTIMEDOUT;From:undefined;https://servicemap.snap4city.org/VM206	private	roottooladmin1	Firenze

Create your MyKPIs

- My Data, KPI, POI > 'Add My KPI' button
- Verify the KPI existence in My Data, KPI, POI
- Create your IoT App/Proc.Logic sending data to your KPIs
- Example: Lonato Car Park:
 - NumFreeSlots
 - MaxDuration
 - MaxDurationSlotId

My KPI Details ✕

Nature *

Subnature *

Value Name *

Value Type *

Value Unit *


Data Type *

Description

Info

Latitude

Longitude



Close SAVE

Snap4City
My Data, KPI, POI

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
- 🔔 Notificator
- 🔍 Data Inspector
- 📄 My Data, KPI, POI

10 Add My KPI Add My POI Add My Data

My
 Public in Org.
 Delegated
 Public

No. +	High Level Type	Nature	Sub Nature	Value Name	Value Type	Value Unit	Data Type	Last Date	Last Value	Ownership	Username	Controls	Data	Visibility
17057184	MyKPI	TransferServiceAndRenting	Car_park	NumFreeSlots	Slots	#	integer	8/4/2020, 19:37:14	7	private MAKE PUBLIC	disit_lonatodelgarda	VIEW EDIT DELETE	VALUES METADATA	DELEGATE USERS CHANGE OWNERSHIP

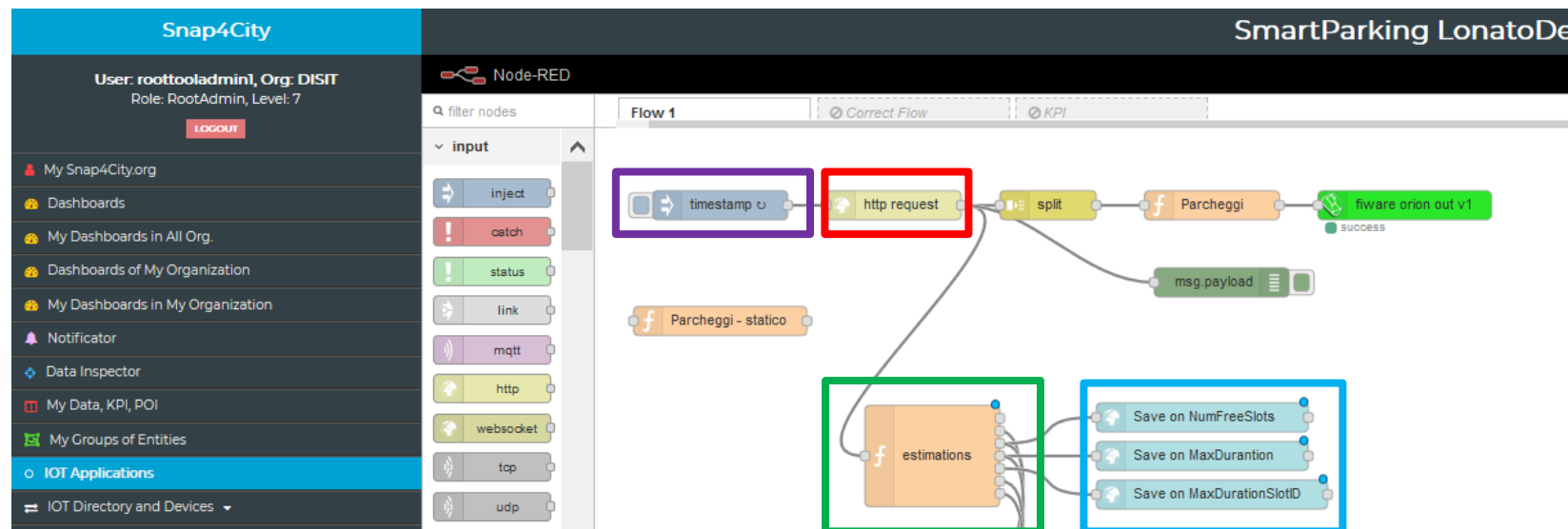
Showing 1 to 1 of My KPI Data Page Number

First < - - 1 - - > Last

IoT App sending data to your KPIs

- Create your IoT App (ex: 'SmartParking LonatoDelGarda')

1. Use an **inject** block to choose the frequency of update
2. Use **http** block to download data (e.g.)
3. Use a **function** of blocks to convert data in a specific json sending data to each KPI
4. Use a **save-my-kpidata-values** block



Edit function node

node properties

Name: estimations

```

Function
124
125
126 var msg3 = { payload : {
127   "datetime":msg.payload[0].attributes[0].value.received,
128   "value": msg.payload.length-10-numbusyslot
129 } };
130
131 var msg4 = { payload : {
132   "datetime":msg.payload[0].attributes[0].value.received,
133   "value" : sectostring(maxduration)
134 } };
135
136 var msg5 = { payload : {
137   "datetime":msg.payload[0].attributes[0].value.received,
138   "value":maxdurationslot
139 } };
140
141

```

Edit save-my-kpidata-values node

node properties

Select KPI: 17057184-NumFreeSlots

- 17057183-NumBusySlots
- 17057184-NumFreeSlots
- 17057185-MaxDuration
- 17057186-MaxDurationSlotID
- 17057257-AccessPoint3_Palaspport
- 17057258- AccessPoint2_ITIS
- 17057259-AccessPoint1_FamilaSuperstore



What is missing here and you can get from former course

DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT

FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS

IOT APPLICATIONS VS. IT LOGIC DEVICES

IOT/IOE DEVICES AND NETWORKS

IOT APPLICATIONS, THE LOGIC AND THE SMARTNESS

ADVANCED SMART CITY API, MICROSERVICES, SNAP4CITY API

SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK

SNAP4CITY FOR BEGINNERS

SNAP4CITY ARCHITECTURE AND ECOSYSTEM. OPENED TO DEVELOPERS AND MAKERS

DATA ANALYTICS, BUSINESS INTELLIGENCE, WHAT IS AND IS NOT SMART

TWITTER VIGILANCE: SOCIAL MEDIA ANALYSIS

HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP

SNAP4CITY AND KM4CITY PROJECTS

SNAP4CITY THE VIEW OF THE ADMINISTRATORS

What is missing here and you can find in the former course or other parts of this

- GIS Interoperability
- Ingestion of Public Transportation data:
 - GTFS, Transmodel, GTFS RT, NeTEx, etc.
- CKAN interoperability
- Satellite data Ingestion
- IOT Devices integration
 - AIRQINO, Libelium, SIGFOX,
 - LORA, MQTT, OBD2, AXIS Cameras
- Snap4City vs FIWARE
- Data Streams from participatory, Mobile App
- Data streams from Mobile vehicles and smart phones Devices
- Data Ingestion via Web Scraping
- Data stream from TV Cameras, TV Cam Manager

Part 6

- Social Media interoperability
- Open Maintenance Ticketing Interoperability
- Telegram Interoperability
- **Another Complete Example**
- **BlockChain models and devices in Snap4City (new feature)**
- **Orion Broker:**
 - **Services/SrvPath and Multitenant**
- **External and Internal Brokers,**
 - **External Broker harvesting**
- Managing Node-RED on edge from cloud
- More on Security of Snap4City Stack from device to dashboards
- <https://www.snap4city.org/577>

<https://www.snap4city.org/577>



On Line Training Material (free of charge)

<https://www.snap4city.org/944>

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

Video1								
Video2								
Video3								
Video4				none		none	none	none



Training Material




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



Note on Training Material

- **Course 2023:** <https://www.snap4city.org/944>
 - Introductionary course to Snap4City technology
- **Course** <https://www.snap4city.org/577>
 - Full training course with much more details on mechanisms and a wider set of cases/solutions of the Snap4City Technology
- **Documentation** includes a deeper round of details
 - Snap4City Platform Overview:
 - <https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf>
 - Development Life Cycle:
 - <https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf>
 - Client Side Business Logic:
 - <https://www.snap4city.org/download/video/ClientSideBusinessLogic-WidgetManual.pdf>
- **On line cases and documentation:**
 - <https://www.snap4city.org/108>
 - <https://www.snap4city.org/78>
 - <https://www.snap4city.org/426>

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Welcome: how to start using Snap4City for beginners






We suggest you:

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

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

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

Please contact paonesi@gmail.com !

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Innovations



Interoperability



Installations



What People say



Mobile Apps



IOT Devices



IOT Applications



Data Analytics



Dashboards



Living Lab



Smart City API



Smart City Ontology



Work with Us



Articles



SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE



SNAP4CITY HACKATHON



INDUSTRY 4.0 Snap4Industry



Snap4Home

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

Please start a fully guided training cases:

- [HOW TO: create a Dashboard in Snap4City](#)
- [HOW TO: add a device to the Snap4City Platform](#)
- [HOW TO: add data sources to the Snap4City Platform](#)

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**Training on Tools and Platform**Powered by www.km4city.org  

Organization Groups

DISIT

- Developer
- Operativo

Updates on Tools

Training Course Snap4City - 2023 Edition [new](#)
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roottooladmin1[My Snap4City.org](#)[Tour Again](#)[www.snap4solutions.org](#)[Dashboards \(Public\)](#)[Dashboards of My Organization](#)[My Dashboards in My Organization](#)[My Data Dashboard Dev Kibana](#)[Extra Dashboard Widgets](#)[Data Management, HLT](#)[Knowledge and Maps](#)[Processing Logics / IOT App](#)[Entity Directory and Devices](#)[Resource Manager](#)[Development Tools](#)[Management](#)[Decision Support Systems](#)[Deploy and Installation](#)[Help and Contacts](#)[Documentation and Articles](#)[My Profile](#)[Km4City portal](#)[DISIT Lab portal](#)



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

Snap4City: Smart aNalytic APp builder for sentient Cities and IOT

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WHAT IS Snap4City

SMARTCITY EXPO WORLD CONGRESS
15 - 17 NOVEMBER 2022
BARCELONA & ONLINE [GET YOUR PASS](#)

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HOLD YOUR APP FOR A CONNECTED CITY

INDUSTRY 4.0
Snap4Industry

SMART
Snap4Home

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Node-RED

Sii-Mobility

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- Development Life Cycle: <https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf>
- Client-Side Business Logic Widget Manual: <https://www.snap4city.org/download/video/ClientSideBusinessLogic-WidgetManual.pdf>
- Booklet Data Analytics, Snap4Solutions: https://www.snap4city.org/download/video/DBL_SNAP4SOLL.pdf

Updates on

2022 booklets



- Snap4City



https://www.snap4city.org/download/video/DPL_SNAP4CITY_2022-v02.pdf

- Snap4Industry



https://www.snap4city.org/download/video/DPL_SNAP4INDUSTRY_2022-v03.pdf

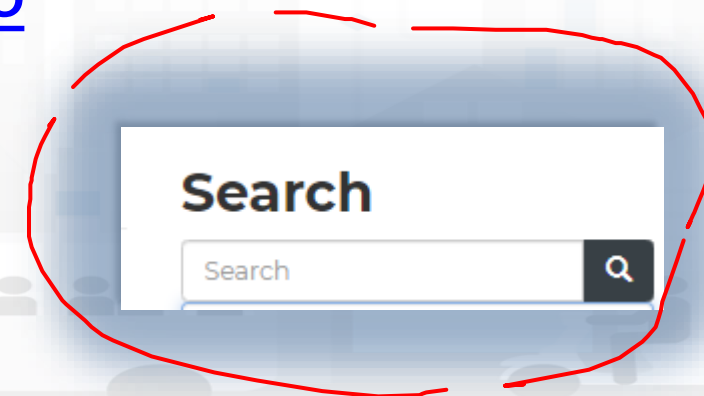
- Solutions
- Data Analytics



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

The Platform

- **Free Registration on Snap4City.org**
 - Please select DISIT ORG to be sure to access at the examples
 - Most of the cities / tenant are private and they do not left much visible
- **What you get** is probably the 10% of what is on the platform 😊
- **Training:** <https://www.snap4city.org/577>
- **Scenariious:** <https://www.snap4city.org/4>
- **Publications:** <https://www.snap4city.org/426>
- **WEB pages:** <https://www.snap4city.org/78>
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Snap4City Platform

Technical Overview

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

Snap4City:

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

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

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

Tech. Overview

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



Development

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



Development Life-Cycle

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

From Snap4City:

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

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

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DINFO dept of University of Florence,
Via S. Marta 3, 50139, Firenze, Italy
Phone: +39-335-5668674

Client Side Business Logic

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



Client-Side Business Logic Widget Manual

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- <https://www.snap4city.org>
- <https://www.snap4solutions.org>
- <https://www.snap4industry.org>
- <https://twitter.com/snap4city>
- <https://www.facebook.com/snap4city>
- <https://www.youtube.com/channel/UC3tAQ09EbNba8f2-u4vandu>

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

Commercial Overview



- <https://fiware-foundation.medium.com/snap4-city-fiware-powered-smart-app-builder-for-sentient-cities-acfe24df49d5>
- https://www.snap4city.org/drupal/sites/default/files/files/FF_ImpactStories_Snap4City.pdf



SMART CITIES AND SMART INDUSTRY

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

With the contribution of



TOP

FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS

FROM CITY DASHBOARD TO APPLICATIONS

DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT

IOT APPLICATIONS VS IOT EDGE DEVICES

Acknowledgements

IOT APPLICATIONS, THE LOGIC AND THE SMARTNESS

ADVANCED SMART CITY API, MICROSERVICES, SNAP4CITY API

SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK

SNAP4CITY FOR BEGINNERS

SNAP4CITY ARCHITECTURE AND ECOSYSTEM. OPENED TO DEVELOPERS AND STAKEHOLDERS

TWITTER VIGILANCE, SOCIAL MEDIA ANALYSIS

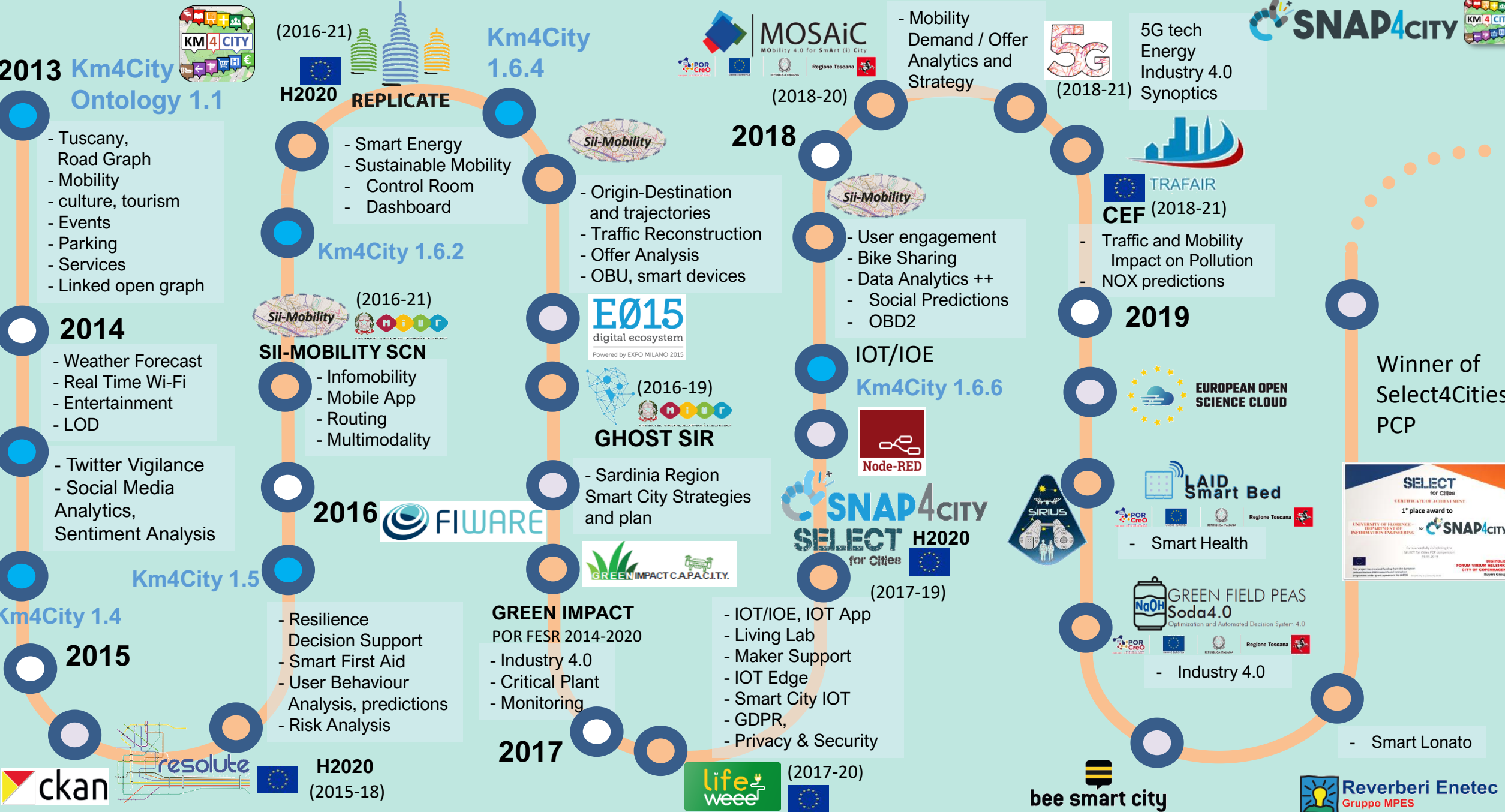
HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP

SNAP4CITY AND KM4CITY PROJECTS

DECISION SUPPORT SYSTEM AND CITY RESILIENCE

SNAP4CITY THE VIEW OF THE ADMINISTRATORS





2013 Km4City Ontology 1.1

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

2014

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

- Twitter Vigilance
- Social Media Analytics, Sentiment Analysis

Km4City 1.4

2015

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



(2016-21) H2020 REPLICATE

- Smart Energy
- Sustainable Mobility
- Control Room
- Dashboard

Km4City 1.6.2

(2016-21) SII-MOBILITY SCN

- Infomobility
- Mobile App
- Routing
- Multimodality

2016 FIWARE

Km4City 1.5

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

Km4City 1.6.4

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

E015 digital ecosystem

Powered by EXPO MILANO 2015

(2016-19) GHOST SIR

- Sardinia Region Smart City Strategies and plan

GREEN IMPACT CAPACITY

- GREEN IMPACT POR FESR 2014-2020**
- Industry 4.0
 - Critical Plant
 - Monitoring

2017

(2017-20) life weee

- Smart Waste

MOSAiC Mobility 4.0 for Smart (II) City

- 2018**
- User engagement
 - Bike Sharing
 - Data Analytics ++
 - Social Predictions
 - OBD2
-

IOT/IOE Km4City 1.6.6

Node-RED

SNAP4CITY SELECT for Cities H2020

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

(2017-20) bee smart city

- Smart Waste

5G tech Energy Industry 4.0 Synoptics

- 2019**
- Traffic and Mobility Impact on Pollution
 - NOX predictions
-

EUROPEAN OPEN SCIENCE CLOUD

LAID Smart Bed

GREEN FIELD PEAS Soda4.0

Optimization and Automated Decision System 4.0

- Industry 4.0

bee smart city

- Smart Lonato

SNAP4CITY

Winner of Select4Cities PCP

SELECT for Cities

CERTIFICATE OF ACHIEVEMENT

1st place award to

UNIVERSITY OF FERUGINE - DEPARTMENT OF INFORMATION ENGINEERING

for **SNAP4CITY**

Reverberi Enetec Gruppo MPES

DISIT lab roadmap vs model and tools' usage



SODA

Smart Ambulance (2021-22)

Enterprise (2021-22)
Industry 4.0

Almafluida Industry 4.0 (2021-22)

JRC
EUROPEAN COMMISSION
Contract, 2022-23

2020

JRC
EUROPEAN COMMISSION

enel x
Contract

AMPERE (2021-22)
Industry 4.0

ART-ER
ATTRATTIVITÀ
R I C E R C A
T E R R I T O R I O
Contract, 2022-23

CN MOST, 2022-26

EI THE, 2022-26

G. Agile, 2021-23

Interreg
Mediterranean
HERIT-DATA

2021

PC4City (2020-21)
Monitoring Terrain

SYN-RG-AI
SmartCity

GRUPPO PRETTO
Industry 4.0

Filippi
2022-2023

TUSCANY X.D **EDIH**
2023-26

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

Interreg
MARITTIMO-IT FR-MARITIME
MOBI MART

Winner of Open Data Challenge of
enel x

uni.systems
SmartCity, 2021-23

enel x
Contract

Merano, smart light

OceanRace, Genova, AWS

Cuneo, smart city

- Smart Mobility
- PISA, PUMS
- Living lab

AXIS COMMUNICATIONS

AXIS collab
SmartCity

IMPETUS
Security and Risk

2022

CAPÉLON

- Smart Light
- Sweden

ASYMMETRICA
URBAN TECHNOLOGY

Asymmetrica
Smart City, 2022-23

Smartea

ITALFERR
GRUPPO FERROVIE DELLO STATO ITALIANE

Italferr, Smart City



Km4City
1.6.7

TOP



Be smart in a SNAP!



SMARTCITY

EXPO WORLD CONGRESS

7-9 November 2023, Barcelona, Spain

Visit Snap4City in Hall 1

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Università degli Studi di Firenze - School of Engineering

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