Herit-Data:
collection of integrated data in 6 pilot sites

This document reflects only the author's view and that the Programme authorities are not liable for any use that may be made of the information contained therein.

From: DINFO dept of University of Florence, with its
      DISIT Lab, Https://www.disit.org with its Snap4City solution
      Snap4City on social**:**
      1.   Web page**:** Https://www.snap4city.org
      2.   https://twitter.com/snap4city
      3.   https://www.facebook.com/snap4city
Contact Person: Paolo Nesi, Paolo.nesi@unifi.it
      1.   Phone: +39-335-5668674
      2.   Linkedin: https://www.linkedin.com/in/paolo-nesi-849ba51/
      3.   Twitter: https://twitter.com/paolonesi
      4.   FaceBook: https://www.facebook.com/paolo.nesi2
Access Level: Public.
Date: 10-02-2020
Version: 0.4

Table of Contents

The present report is intended to describe the progress made towards the collection of integrated data in 6 sites (deliverable 4.1.1)

1 - Executive Summary

DISIT lab entered into Herit-Data project with the Snap4City solution in order to set up a customized infrastructure for a number of Pilots.

DISIT lab has used the Snap4City tools to realize a Herit Data project platform and a number of data services and data analytics, in particular for: Dubrovnik, Florence, Pont Du Gard, Mostar, Valencia and West Greece. The activities performed, as described in the following has been:

1. Setup of the Pilot Organization accessible as a separate Tenant/host for each pilot
2. Setup of the knowledge base, RDF store for each pilot
3. Set up of a specific IoT Broker for data ingestion for each pilot
4. Set up of IoT Applications for data ingestion for each pilot
5. Set up of the big data Storage for each pilot
6. Set up of the MyKPI storage for each pilot
7. Set up of dedicated listening channel on Twitter Vigilance platform for each pilot
8. Collection of Twitters and social media analysis for each pilot
9. Develop for some data analysis on the social media for each pilot
10. Set up specific cases for collecting data on people counting
11. Set up and develop specific dashboard for data analysis in real time.
12. Computing correlation analysis of twitter data vs lockdown period of Covid-19 in the different areas
13. Dashboard and view for specific mobile apps.
14. Etc.

In addition, DISIT lab provided and will keep providing support for training the partners in the usage of the platform at different levels:

1. Final users and decision makers
2. ICT officers and data experts.

2 – Herit-Data Pilots

DISIT lab entered into Herit-Data project with the Snap4City solution in order to set up a customized infrastructure for a number of Pilots.

Please note that Herit-Data aims at:

1. improving cooperation, joint and integrated planning of conflicting interests to improve the management & policies towards cultural tourism destinations as old towns, and cultural heritage or archaeological interest locations for visitors. To reach this objective and address this issue, our approach plans to take advantage of technology and innovation in management tools (Smart Cities), as well as other policy and social measures.

2. collecting of existing and generation of complementary data (Big & Open Data, IoT, data from sensors, local systems & cameras, etc.), one of the key objectives is to develop, test and deploy the HERIT-DATA Tourist Flow Management Platform: an autonomous system leveraged by AI and Big Data techniques aiming to proactively protect the destinations.

3. setting up and testing an ICT tool to help public authorities and policy makers in the decision-making process with respect to tourism management. The tool (i.e. project platform) has to be capable of analysing the Big Data and convert them in Smart Data, i.e., pieces of valid information, such as: values of sustainability indicators, tourist behaviour trends, seasonality data, etc. The ICT tool has to be a general module to be adapted to each specific destination.

The project platform has to support the 6 pilots with collected aggregated data, stored and analysed to obtain high value data to be used by decision-making algorithms in order to manage crowd flows. The platform has to provide with several modules to facilitate the usage of MAPE-K approach (monitor, analyse, plan, execute and knowledge) in order to react on time against appearing crowds in areas close to heritage sites. The resulting Smart Data will be the basis to calculate the values for sustainability indicators and evaluate their dependence with tourist flows.

The front end of the HERIT-DATA platform should provide:

1. Mobile App views, for final users and operators
2. Dashboards for decision makers: tourism companies or managers, such as hotels, heritage site managers, travel enterprises, tour operators, etc.

2.1 – Herit-Data Activities

In this section the summary of activity performed and the present status are reported.

KPI,	KB ready	Streets	Civic Numbers	IOT App ready	Big data store ready	MyKPI ready	Dashboards ready	Active loaded data
Dubrovnik	✔	✔	✖	✔	✔	✔	3 + 1 on Twitter Vigilance	Twitter Vigilance, TV Cameras
Florence	✔	✔	✔	✔	✔	✔	1 + 1 on Twitter Vigilance	Twitter Vigilance, WiFi people, traffic, POI, some Apps, parking, etc.
Pont Du Gard	✔	✔	✖	✔	✔	✔	1 on Twitter Vigilance	Twitter Vigilance
Mostar	✔	✔	✔	✔	✔	✔	1 on Twitter Vigilance	Twitter Vigilance
Valencia	✔	✔	✔	✔	✔	✔	2 + 1 on Twitter Vigilance	Twitter Vigilance, Pax Counters
WestGreece	✔	✔	✔	✔	✔	✔	1 on Twitter Vigilance	Twitter Vigilance

Datasets status

STATUS	Data Table	Data Availability	Data Description (source)	Data ingestion in Snap4City
Dubrovnik	✓	✓	• Camera position • #people every minute Licence: **Attribution-NonCommercial-NoDerivatives 4.0 International**	**Work Finalised:** • Camera Position • Average #people every 15 minutes ✓
Florence	✓ (partial)	✓	• Camera position • Many other data in place NOW !!! **Licence: Open data ONLY on position, no RT data**	**Work Finalised:** • Wifi position ✓ • Average #people every 15 minutes ✗
Pont Du Gard	✗	✗	Received an email with details on data Next days: we will help pont du gard to define the dataset and fill the datatable ✓	✗
Mostar	✗	✗	✗	✗
Valencia	✓	Not yet ✗	• Pax counters position • Number of persons in transit between two points • Average time spent in sensor location (no RT data yet) ✗ **Licence: private data**	✗
WestGreece	✓	Not yet ✗	Building/Site Capacity - Static + dynamic Data **Licence: Public as CC: to be decided the specific ones**	✗

28 Sept.

# Twitter Vigilance Herit-Data: *Some Numbers*

Channel Name	Total Number of Collected TW+RTW	Number of Collected Tweets	Number of Collected Retweets	Twitter Volume Processing Time Range	NLP & Sentiment Analysis Processing Time Range	NLP & Sentiment Analysis Languages
Spain	100.3 Millions	36.3 Millions	64 Millions	From 30-01-2020 to current datetime	From 01-02-2020 to current datetime	English
France	24.5 Millions	6.1 Millions	18.4 Millions	From 30-01-2020 to current datetime	From 01-02-2020 to current datetime	Italian, English, testing French
Greece	10.4 Millions	3.3 Millions	7.1 Millions	From 30-01-2020 to current datetime	From 01-02-2020 to current datetime	English
Italy	1.4 Millions	506 Thousands	894 Thousands	From 30-01-2020 to current datetime	From 01-02-2020 to current datetime	Italian, English
Croatia	19.9 Thousands	8 Thousands	11.9 Thousands	From 30-01-2020 to current datetime	From 01-02-2020 to current datetime	English

- For Spain: 87 million of TW taken for too generic keys
- For France: 8.2 Million of TW taken for too generic keys

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjc3NQ==
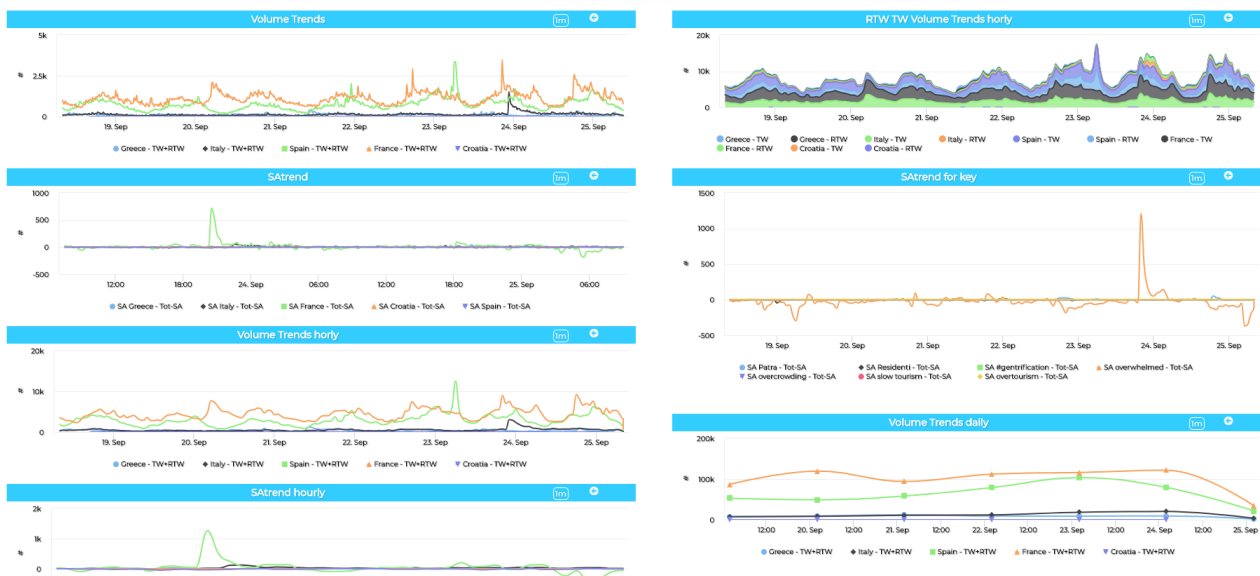
In the following subsections the activity performed on project platform and data by DISIT lab is reported.

2.2 – Dubrovnik, Croatia

In this section the structural activity performed for this pilot of Herit-Data:

1.	Setup of the Pilot Organization accessible as a separate host on Https://www.snap4city.org
2.	Setup of the knowledge base, RDF store for the city area
3.	Set up of a specific IoT Broker for data ingestion
4.	Set up of IoT Applications for data ingestion
5.	Set up of the big data Storage
6.	Set up of the MyKPI storage
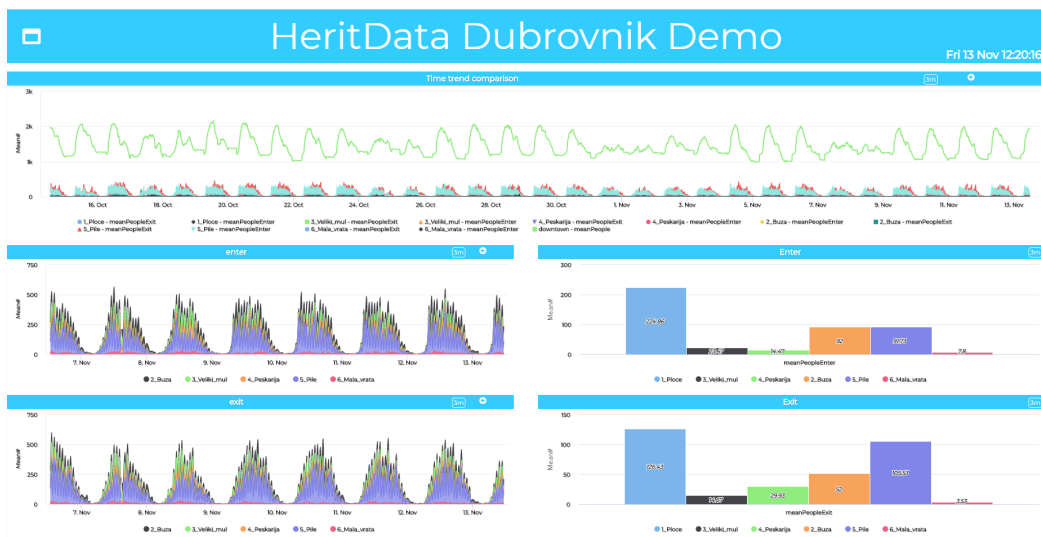7.	Set up of dedicated listening channel on Twitter Vigilance platform

In this section the activity performed on Data for this pilot of Herit-Data:

8.	Infrastructure:
	1.	Ingestion of the Open Street Map, OSM, data for the Pilot Area
	2.	Reporting the OSM on Knowledge base, Service Map
	3.	Civic Numbers have been missing in this case
	4.	https://dubrovnik.snap4city.org/
9.	Social media
	1.	Set up of the Twitter Vigilance Platform to collect tweets with the specific keywords, hashtags and citations of this pilot
	2.	Collection of Twitter Vigilance data with the numbers reported above
	3.	Creation of Twitter vigilance dashboards analysing a large number of keys, hashtags and citations related to cultural and tourisms aspects of the city.
	4.	https://rttvhd.snap4city.org/index.php?p=chart_singlechannel&dashboard=false&canale=Croatia
10.	Covid-19 vs Social Media
	1.	Logistic Correlation analysis of social media data with lockdown period
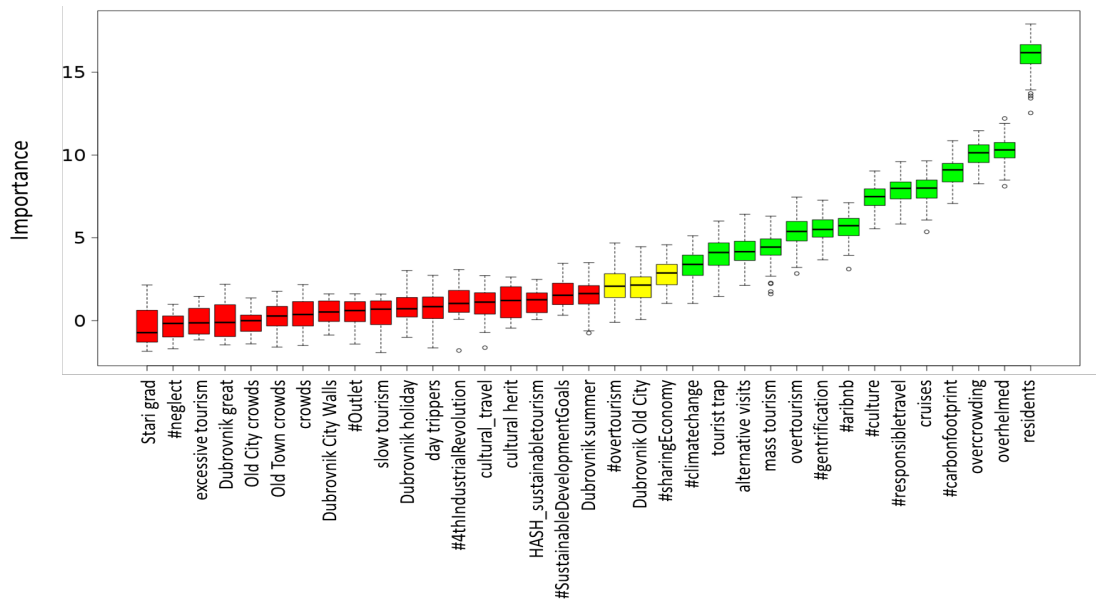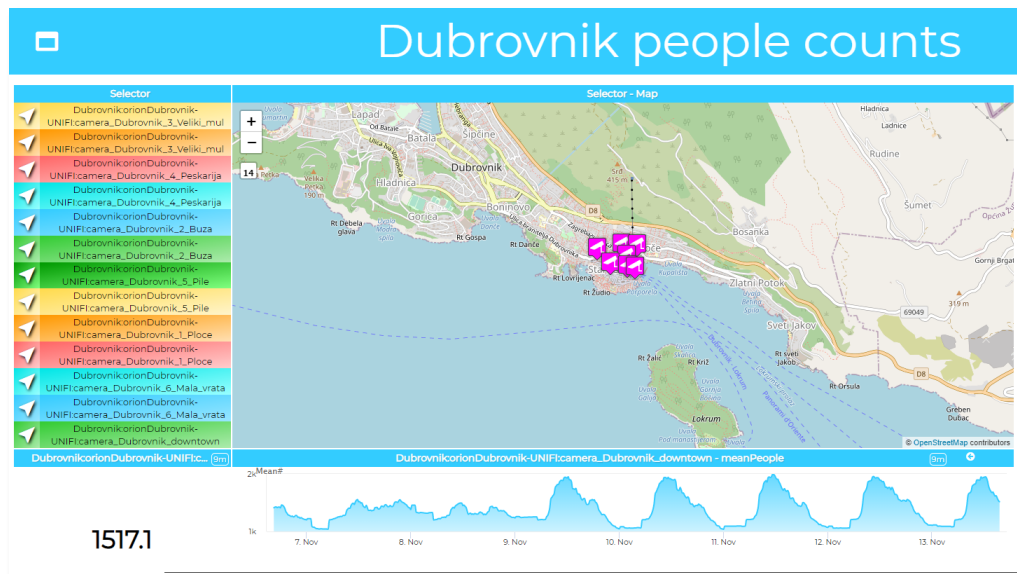
11. People flow
    1. Collection of data from counting people, 6 TV cameras for Static data, Historical data, Real time data. To this end, a number of IoT App processes have been developed and are still running for continuous real time data ingestion.
    2. Creation of Dashboards for analysing and rendering data regarding people in/out of the city.
    3. https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjg5Mw==

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

12. KPI Data:

    1. The city provided a number of possible data. Corresponding data have to be received and ingested

2.3 – Florence, Italy

In this section the structural activity performed for this pilot of Herit-Data:

1. Setup of the Pilot Organization accessible as a separate host on Https://www.snap4city.org
2. Setup of the knowledge base, RDF store for the city area
3. Set up of a specific IoT Broker for data ingestion
4. Set up of IoT Applications for data ingestion
5. Set up of the big data Storage
6. Set up of the MyKPI storage
7. Set up of dedicated listening channel on Twitter Vigilance platform

In this section the activity performed on Data for this pilot of Herit-Data:

8. Infrastructure:

    1. Open Street Map, OSM, data for the Pilot Area (already in place, thus exploited)

    2. Reporting the OSM on Knowledge base, Service Map (already in place, thus exploited)

    3. Civic Numbers have been already present in this case (already in place, thus exploited)

    4. https://servicemap.snap4city.org/

9. Social media

1. Set up of the Twitter Vigilance Platform to collect tweets with the specific keywords, hashtags and citations of this pilot
2. Collection of Twitter Vigilance data with the numbers reported above
3. Creation of Twitter vigilance dashboards analysing a large number of keys, hashtags and citations related to cultural and tourisms aspects of the city.
4. https://rttvhd.snap4city.org/index.php?p=chart_singlechannel&dashboard=false&canale=Italy
5. Analysis of the impact of events on people flows. For example the critical case of the manifestation of 30th October 2020.
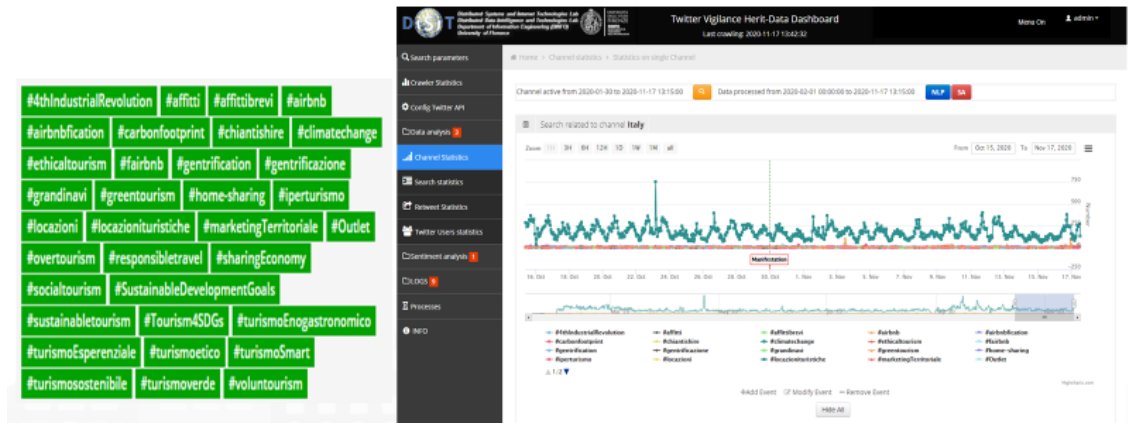
10. Covid-19 vs Social Media
    1. Logistic Correlation analysis of social media data with lockdown period

11. Effects of COVID-19 on traffic, parking, and pollutant
    1. Collection of data specific for COVID-19
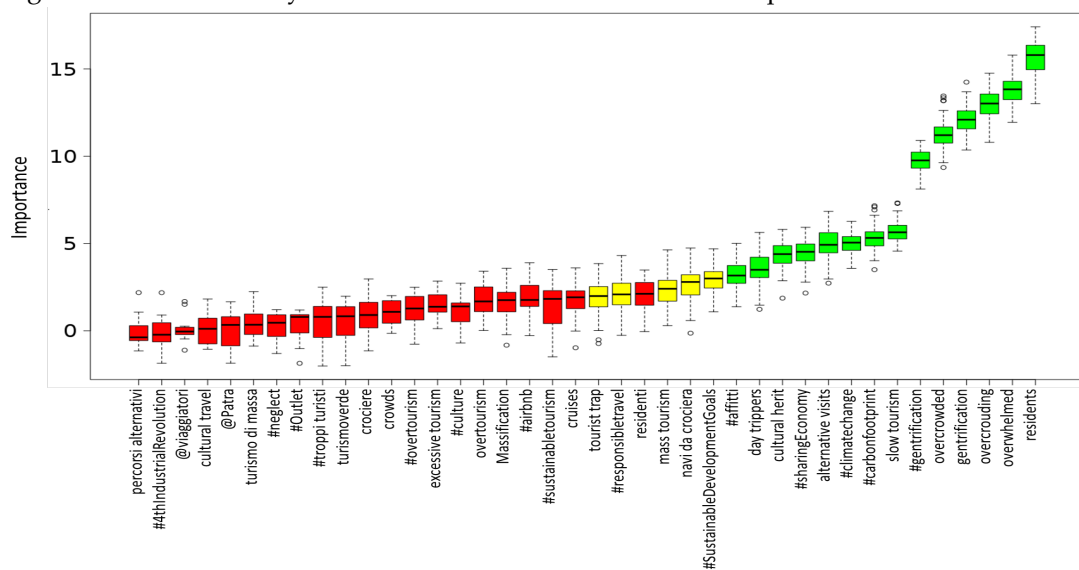   2. Assessment of the impact of COVID-19 on: Traffic, parking, pollutant, and cross aspects as reported in the paper published. C. Badii, P. Bellini, S. Bilotta, D. Bologna, D. Cenni, A. Difino, A. Ipsaro Palesi, N. Mitolo, P. Nesi, G. Pantaleo, I. Paoli, M. Paolucci, M. Soderi, "How COVID-19 Lockdown Impacted on Mobility and Environmental data", Bollettino della Società Geografica Italiana, FuPress, June 2020, https://drive.google.com/file/d/1hN4dFuEXLMLq4rMY8u88iIZnrVk3HPIl/view?u..., DOI: 10.13128//bsgi.v2i2.932 https://drive.google.com/file/d/1hN4dFuEXLMLq4rMY8u88iIZnrVk3HPIl/view
    3. Production of a number of Dashboards for the above mentioned analysis and making them available on Feel Florence App, an independent app sponsored and built by the Municipality of

Florence and on which Herit-Data has a dedicated area. Specifically, the contributions are the following:

1.   traffic flow entering/exiting to/from Florence
2.   Hot Parking
3.   Environmental data
4.   https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzAwNA==
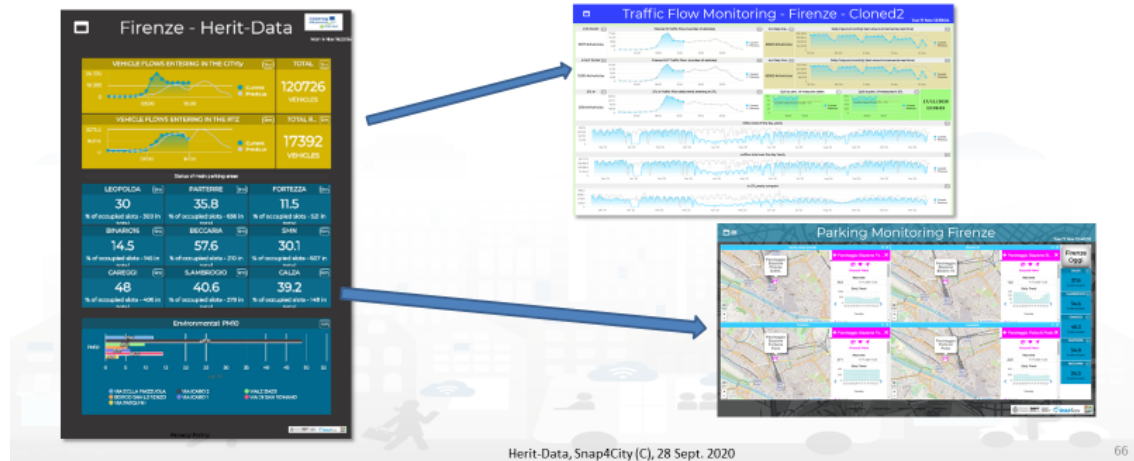
12.   KPI Data:
   1.   The city provided a number of possible data. Corresponding data have to be received and ingested.

2.4 – Pont du Gard, Occitanie, France

In this section the structural activity performed for this pilot of Herit-Data:

1.   Setup of the Pilot Organization accessible as a separate host on Https://www.snap4city.org
2.   Setup of the knowledge base, RDF store for the city area
3.   Set up of a specific IoT Broker for data ingestion
4.   Set up of IoT Applications for data ingestion
5.   Set up of the big data Storage
6.   Set up of the MyKPI storage
7.   Set up of dedicated listening channel on Twitter Vigilance platform

In this section the activity performed on Data for this pilot of Herit-Data:

8.   Infrastructure:
   1.   Ingestion of the Open Street Map, OSM, data for the Pilot Area
   2.   Reporting the OSM on Knowledge base, Service Map
   3.   Civic Numbers have been missing in this case
   4.   https://pontdugard-occitanie.snap4city.org/
9.   Social media
   1.   Set up of the Twitter Vigilance Platform to collect tweets with the specific keywords, hashtags and citations of this pilot
   2.   Collection of Twitter Vigilance data with the numbers reported above
   3.   Creation of Twitter vigilance dashboards analysing a large number of keys, hashtags and citations related to cultural and tourisms aspects of the city.
   4.   https://rttvhd.snap4city.org/index.php?p=chart_singlechannel&dashboard=false&canale=France

10. Covid-19 vs Social Media
     1. Logistic Correlation analysis of social media data with lockdown period

11. KPI Data:
     1. The city provided a number of possible data. Corresponding data have to be received and ingested.

2.5 – Mostar, Bosnia-Herzegovina

In this section the structural activity performed for this pilot of Herit-Data:

1. Setup of the Pilot Organization accessible as a separate host on Https://www.snap4city.org
2. Setup of the knowledge base, RDF store for the city area
3. Set up of a specific IoT Broker for data ingestion
4. Set up of IoT Applications for data ingestion
5. Set up of the big data Storage
6. Set up of the MyKPI storage
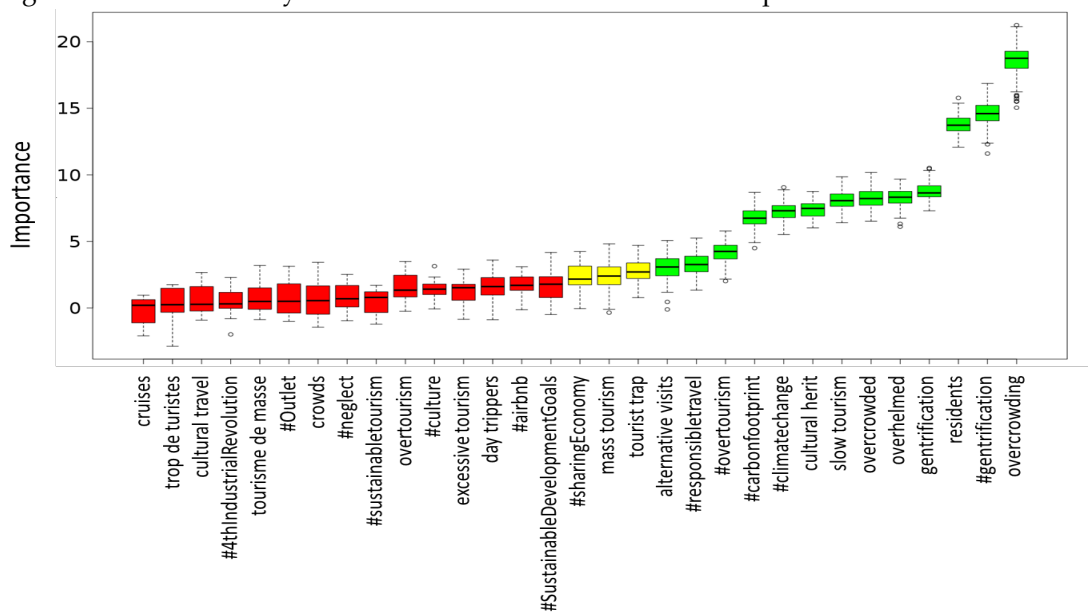7. Set up of dedicated listening channel on Twitter Vigilance platform

In this section the activity performed on Data for this pilot of Herit-Data:

8. Infrastructure:
    1. Ingestion of the Open Street Map, OSM, data for the Pilot Area
    2. Reporting the OSM on Knowledge base, Service Map
    3. Civic Numbers have been found and ingested in this case
    4. https://mostar-bosniaherzegovina.snap4city.org/

9. Covid-19 vs Social Media
   1. Logistic Correlation analysis of social media data with lockdown period
10. KPI Data:
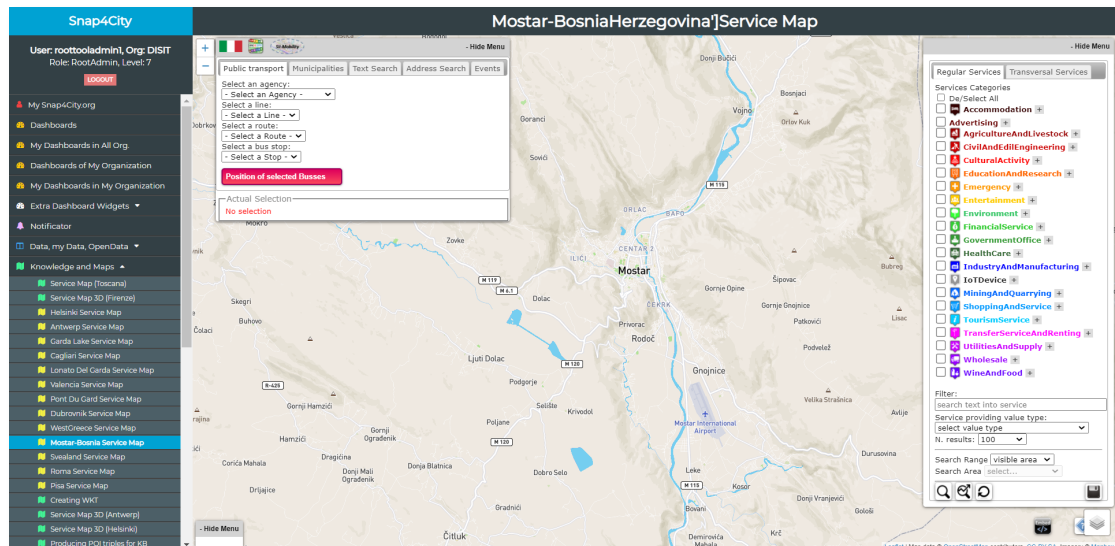   1. The city of Mostar provided a number of indicators. Corresponding data have to be received and ingested.

2.6 – Valencia, Spain

In this section the structural activity performed for this pilot of Herit-Data:

1. Setup of the Pilot Organization accessible as a separate host on Https://www.snap4city.org
2. Setup of the knowledge base, RDF store for the city area
3. Set up of a specific IoT Broker for data ingestion
4. Set up of IoT Applications for data ingestion
5. Set up of the big data Storage
6. Set up of the MyKPI storage
7. Set up of dedicated listening channel on Twitter Vigilance platform

In this section the activity performed on Data for this pilot of Herit-Data:

8. Infrastructure:
   1. Ingestion of the Open Street Map, OSM, data for the Pilot Area
   2. Reporting the OSM on Knowledge base, Service Map
   3. Civic Numbers have been found and ingested in this case
   4. https://valencia.snap4city.org/
9. Social media
   1. Set up of the Twitter Vigilance Platform to collect tweets with the specific keywords, hashtags and citations of this pilot
   2. Collection of Twitter Vigilance data with the numbers reported above
   3. Creation of Twitter vigilance dashboards analysing a large number of keys, hashtags and citations related to cultural and tourisms aspects of the city.
   4. https://rttvhd.snap4city.org/index.php?p=chart_singlechannel&dashboard=false&canale=Spain

10. Covid-19 vs Social Media

    1. Logistic Correlation analysis of social media data with lockdown period
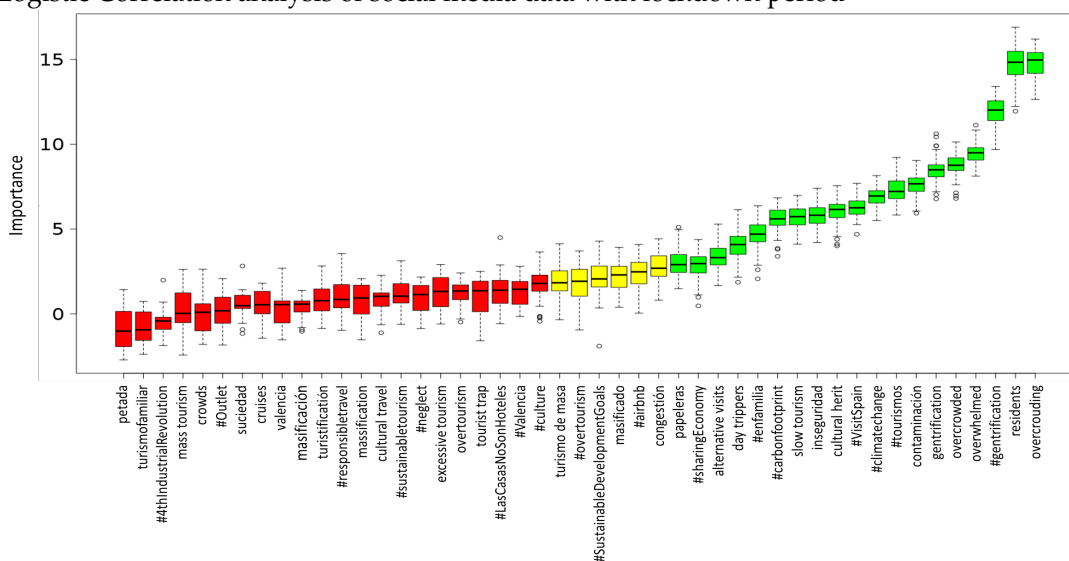
11. People flow

    1. Valencia provided and connected devices for PAX Counting. The data flow has been integrated into the platform and the data are collected in real time. To this end, a number of IoT App processes have been developed and are still running for continuous real time data ingestion.

    2. Development of specific dashboard for monitoring people flows.

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

    4.

Valencia IOT edge for data collection by Joan

12. KPI Data:
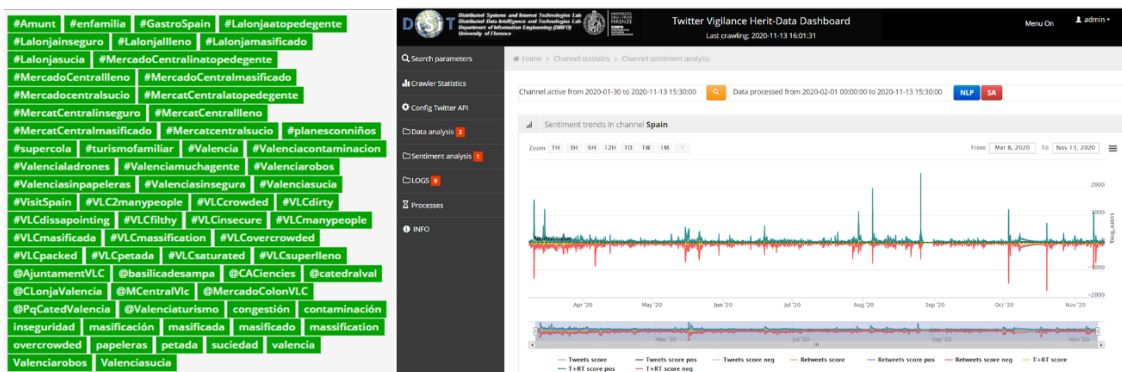   1. The city provided a number of possible data. Corresponding data have to be received and ingested.

2.7 – West Greece

In this section the structural activity performed for this pilot of Herit-Data:

1. Setup of the Pilot Organization accessible as a separate host on Https://www.snap4city.org
2. Setup of the knowledge base, RDF store for the city area
3. Set up of a specific IoT Broker for data ingestion
1. Set up of IoT Applications for data ingestion
2. Set up of the big data Storage
3. Set up of the MyKPI storage
4. Set up of dedicated listening channel on Twitter Vigilance platform

In this section the activity performed on Data for this pilot of Herit-Data:

5. Infrastructure:
    1. Ingestion of the Open Street Map, OSM, data for the Pilot Area
    2. Reporting the OSM on Knowledge base, Service Map
    3. Civic Numbers have been found and ingested in this case
    4. https://westgreece.snap4city.org/
6. Social media
    1. Set up of the Twitter Vigilance Platform to collect tweets with the specific keywords, hashtags and citations of this pilot
    2. Collection of Twitter Vigilance data with the numbers reported above
    3. Creation of Twitter vigilance dashboards analysing a large number of keys, hashtags and citations related to cultural and tourisms aspects of the city.
    4. https://rttvhd.snap4city.org/index.php?p=chart_singlechannel&dashboard=false&canale=Greece

7. Covid-19 vs Social Media
   1. Logistic Correlation analysis of social media data with lockdown period
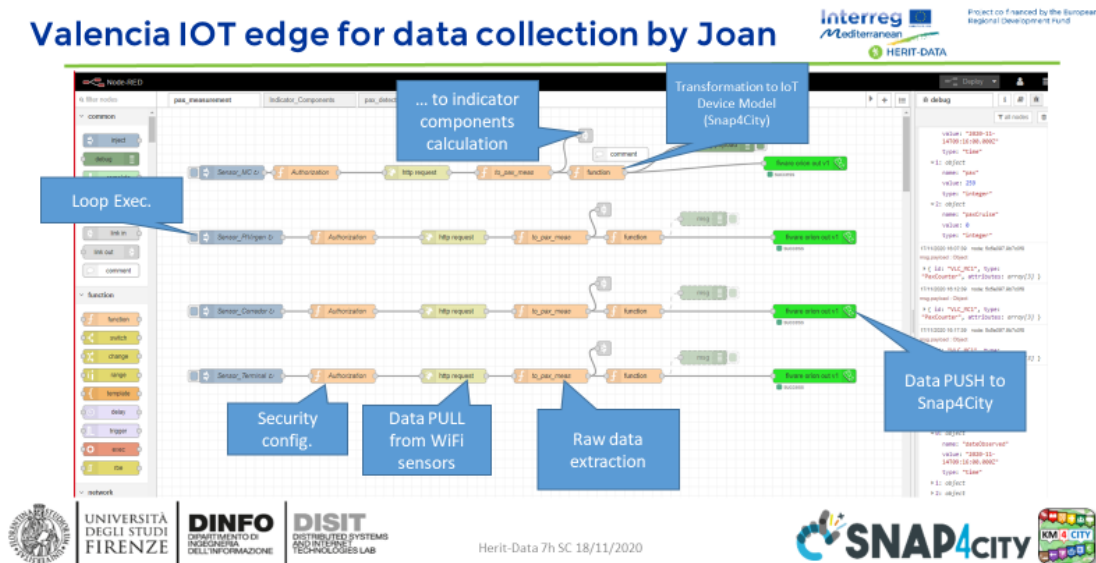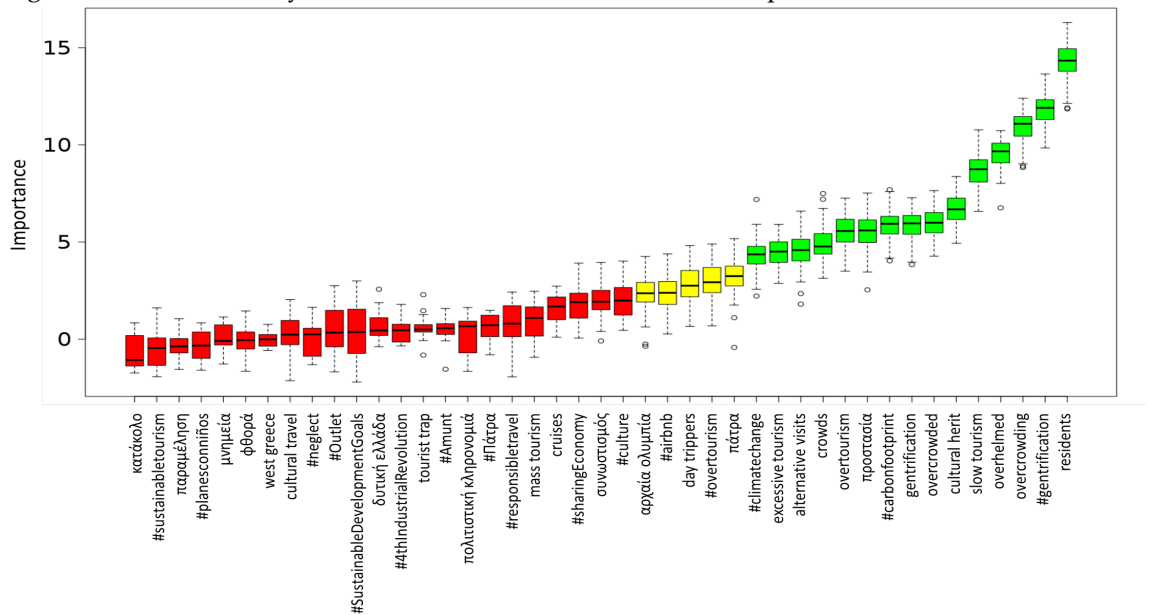

8. KPI Data:
   1. The city provided a number of possible data. Corresponding data have to be received and ingested.

3 – Terms and Acronyms of Snap4City

Term	Description
Access Token	An access token is an object encapsulating the security identity of a process or thread or of a user. In Snap4City is used for the M2M authentication. For example when a process needs to access a smart city API via data analytics https://www.snap4city.org/650 or when your IoT App needs to access your devices.
AMMA	Application and MicroService Monitor and Analyzer. A Snap4City tool to perform the analysis of data flows among IoT Apps and the several MicroServices. See more on https://www.snap4city.org/198, https://www.snap4city.org/43 In alternative, standard tools may be used.
API	Snap4City API are classified in Internal and External. They are all API Rest and are documented in Swagger: https://www.km4city.org/swagger/external/index.html https://www.km4city.org/swagger/internal/index.html
ArcGIS	Is a commercial GIS solution, which has to provide WFS and WMS modules if not installed. https://www.arcgis.com/index.html ArcGIS is produced by ESRI that has a joined lab with **University of Florence LabGeo** and has been in collaboration with **University of Florence DISIT Lab since long time on Snap4City solution**.
BI	Business Intelligence. In Snap4City, the tool for BI is composed by Dashboard Builder, Wizard, IoT App, and for direct Dashboards with Kibana.
BIM	Business Information Modelling. In Snap4City, the tool for BIM is performed by OpenMAINT (https://www.openMAINT.org/en/home) and its integration with the BIMServer. https://github.com/opensourceBIM/BIMserver OpenMaint can be controlled by IoT Apps.
BPM	Business Process Management. In Snap4City this activity of defining business processworkflows is modelled and performed by means of OpenMAINT tool. See OpenMAINT definition.
Calibrated Heatmap	Calibrated heatmaps are heatmap with stable colors based on a color map not depending on the zoom level or on the different view colors are represented. In Snap4City, both calibrated and gaussian heatmap can be produced and distributed. Calibrated Heatmap are distributed via a GIS with WMS (for example as ArcGIS or GeoServer) and may have billions of points. https://www.snap4city.org/457
City Map Command and Control Center	See Smart City Control Room
CKAN	CKAN is an open source solution for Open Data management and distribution https://ckan.org/ In Snap4City is integrated with **DataGate** module and goes with SSO with the rest of tools. CKAN/DataGate can be controlled by IoT Apps.
Connectors	Connectors can be found/implemented in the Snap4City services by means of different approaches, by using: 1. IoT App, since a large number of connectors with several protocols and formats are accessible on the Node-RED community. A large number is ready to use in the Snap4City IoT App on cloud and on IoT Edge as well. https://flows.nodered.org/ 2. IoT Agents of IoT Orion Broker of FIWARE, when they are present, they convert the format into NGSI. https://www.FIWARE.org/developers/catalogue/ For Snap4City, IoT App possibility is more flexible, since it permits to map and filter models and transform them, as well, when needed. The IoT App can be put in execution on Cloud and on IoT Edge as well, but all controlled with a visual environment from the main Snap4City interface.
Containers	In Snap4City Container are implemented as Dockers. They are used for Snap4City tools as described in https://www.snap4city.org/471 as well as for managing IoT App, Data Analytics in RStudio, Data Analytic in Python, and WebScraping processes.
Copernicus	Satellite data: pollution, weather, land, climate, atmosphere, security, emergency, etc. https://www.copernicus.eu/en
Custom Widget	In Snap4City, widgets are the components of the Dashboard to visualize views on data (with animation, graphics, synoptics, etc.) and also to collect interaction from the users (buttons, faces to be clicked, sliders, keypad, text pad, etc.). see HOW to create custom widgets in SVG, and examples: https://www.snap4city.org/651 https://www.snap4city.org/595 https://www.snap4city.org/644 https://www.snap4city.org/663 How to create widgets by programming: https://www.snap4city.org/153

D3	A library for JavaScript graphic representation: https://d3js.org/ This library may have some costs according to the licensing and usage.
Dashboard	is substantially a Decision Support System tool, since it provides evidence of critical conditions, and may offer solutions. On this regard, it may integrate/exploit artificial intelligence algorithms, for example, reporting prediction, identifying anomalies, manifesting early warning, providing relationships among entities exploiting inference geospatial reasoning about what is located in the city: resources, structure, people, areas, critical infrastructures, etc. See details on dashboard in section 3.10 of this document and from the training course part 2: https://www.snap4city.org/download/video/course2020/das/Snap4City-2nd-slot-dashboard-building-v5-4.pdf
Dashboard Builder	In Snap4city, it is the main tool for creating Dashboards and connect them with IoT Apps, and other dashboards and custom widgets. See details on dashboard in section 3.10 of this document and from the training course part 2: https://www.snap4city.org/download/video/course2020/das/Snap4City-2nd-slot-dashboard-building-v5-4.pdf
Data Analytic	For Data Analytic we intend all deep data transformation on data that produce a new data kind: prediction, heatmap, anomaly detection alarm, traffic flow reconstruction, origin destination matrices, etc. In Snap4City, in the several installations, a large number of them have been developed in Rstudio, Python, Java, JavaScript, etc. In most cases, they exploit statistic, machine learning, data mining, artificial intelligence, semantic computing, etc. See for more info section 3.9 of this document and training course part 4: https://www.snap4city.org/download/video/course2020/da/Snap4City-4th-slot-Data-Analytic-v3-4.pdf
Data Dictionary	A Snap4City tool which allows to define Value_Type, Value_Unit and their relationship; and Nature and Subnature in their relationships. Snap4City is also provided with a set of more than 200 different attribute models into the Dictionary.
Data Inspector	In Snap4City, the Data Inspector is the main tool for the browsing of the information about a data stream entering into the platform. It is directly accessible from the main menu and give access to the Digital Twin representation of data, devices, and all **High Level Types** of the platform. See more details on part 5 of the training course: https://www.snap4city.org/download/video/course2020/di/Snap4City-5th-slot-data-ingestion-v4-4.pdf
Data Shadow	A term adopted to describe the historical data of and IoT Device (sensors and actuators). In most of the platforms (for example: MS Azure, AWS), this feature is optional (please note that most of the Brokers provide only the last values of the IoT Devices). In Snap4City, it is a main feature to save all data messages of devices, and it is implemented saving data into Elastic Search cluster. See training part 3 https://www.snap4city.org/download/video/course2020/iot/Snap4City-3rd-slot-IOT-Applications-v5-8.pdf
Data_Type	Each Attribute/variable in Snap4City platform is defined in term of Value_Type, Value_Unit and Data_Type (e.g., Energy Power, Kw/h, Float).
DataGate, Data Gate	Module of Snap4City to integrate the solution with CKAN Open Data management and network of services
DevDash	A Snap4City tool for monitoring the global flow of data entering into the platform and reaching the Elastic Search. https://www.snap4city.org/198 https://www.snap4city.org/152 https://www.snap4city.org/145
Digital Twin	See Data Inspector which is the main tool for navigating into the information associated at each Digital Twin.
DISCES	Distributed scheduler for Smart City by Snap4City. It is used for scheduling Java processes in a distributed set of Nodes. It is part of the additional Suite for managing ETL processes. https://www.snap4city.org/236
DISCES-EM	Distributed scheduler for elastic management for Smart City by Snap4City. This tool is used for the elastic management of Container on the Marathon/Mesos cluster of containers. Read more on section 3.14 and on https://www.snap4city.org/232
Docker	Specific kind of Containers adopted by Snap4City, https://www.docker.com/
DockerHub	Socker Hub for Snap4City tools via DISIT lab https://cloud.docker.com/u/disitlab ,
Drupal CMS	A CMS, Content Management System, for Living Lab. See for its usage Https://www.snap4city.org and part 6 of the training course since it is the main support for the Living Lab: https://www.snap4city.org/download/video/course2020/sys/Snap4City-6th-slot-system-deploy-v4-6.pdf
End-2-End	Solution that allows to connect devices to the dashboards full stack. Snap4City can create end-2-end solutions, full stack, and secure with TSL, HTTPS, and Web Socket secure from devices to Dashboards.

EOSC	Snap4City is an official solution of EOSC (European Open Science Cloud) marketplace of the European Commission. https://marketplace.docker-fid.grid.cyf-kr.edu.pl/services/snap4city
ERP	Enterprise Resource Planning. Typically, the ERP may include BPM functionalities. Snap4City is integrated with openMAINT BPM which in turn is integrated with several ERP. Also IoT App are integrated with several ERP among them: https://flows.nodered.org/search?term=erp
ESB	Enterprise Service Bus, a modality for exchanging information among services. It has been replaced in most cases with MicroServices.
ExternalServices, External Services	Snap4City external services can be any external services reachable with some protocol to get data and services. REST Call can be automatically transformed in MicroServices for the IoT App. The other can be called from the IOT Ap directly using a large range of protocols: https://www.snap4city.org/65
Federated Knowledge Base	A set of Snap4City knowledge Basis connected each other via the so-called SuperServiceMap API. This allows the creation of mobile applications that may move from multiple cities and area accessing data and making queries transparently. This solution is presently in place among the **Knowledge Bases**: Antwerp/Helsinki, Tuscany/Firenze, Sardegna, etc. The resulting Service is called **SuperServiceMap** and it is integrated in the Smart City API. See **Section 3.8**. **Km4City ontology** data model https://www.snap4city.org/download/video/DISIT-km4city-City-Ontology-ita-v5-1.pdf
Federated Smart Cities	See Federated Knowledge Base
GDPR	General Data Protection Regulation of the European Commission. https://ec.europa.eu/info/law/law-topic/data-protection/reform/what-does-general-data-protection-regulation-gdpr-govern_en Snap4City is compliant with this directive and passed the assessment with a number of cities https://www.snap4city.org/670
GeoServer	GeoServer is an open source solution/tool for GIS data distribution. http://geoserver.org/ In Snap4City, the Geo Server is used into the HeatMap Server for distributing Heatmaps in GeoTiFF format according to tiled. https://www.snap4city.org/536 https://www.snap4city.org/507 GeoTiFF are used for distributing Orthomaps, Map and Heatmaps in form of images / tiles.
GIS	Geographic Information Server/service. A tool for modelling geo information. In Snap4City this role is covered by ServiceMap, and by the HeatMap Manager which includes a connection to a GIS (ArcGIS of GeoServer) or directly the GeoServer if needed. See https://www.snap4city.org/368 to see all relationships from GIS and Snap4City including interoperability.
Group	A Snap4City Group of User is a community into an Organization. Grant authorizations to resource access can be provided at level of single user, Group and/or Organization.
GTFS	General Transit Feed Specification, https://developers.google.com/transit/gtfs It is a standard file format by used to formalize the public transport information, trips, paths, busstops, time schedule, etc. Snap4City is compliant and can ingest GTFS files using ETL processes, the corresponding information is feed into Knowledge Base.
Heatmap	Are maps of points into Heatmap server, and/or directly images representing data in regular and non regular matrices. When they are in images are distributed via a GIS in WMS protocol as tiles (for example via ArcGIS or GeoServer). See https://www.snap4city.org/457 and https://www.snap4city.org/641 see Calibrated Heatmaps
HeatMap Server, Heatmap Manager	HeatMap Server exposes API for (i) colleting data regarding Heatmaps, (ii) providing information about the value of the map in any GPS point included, the so called heatmap picking, (iii) automated generation of Heatmaps in GeoTiFF format according to tiled which are distributed by a GIS via WMS protocol (they can be ArcGIS or GeoServer). https://www.snap4city.org/536 https://www.snap4city.org/507
High Level Types, HLT	They are the main data entity type managed by Snap4City. They are: sensor, sensor actuator, virtual sensors, external services, MicroApplications, synoptics, MyKPI, personal data, WFS, Complex event, heatmaps, traffic flow, etc. see https://www.snap4city.org/583
HighCharts	A library for JavaScript graphic representation: https://www.highcharts.com/ This graphic library may have according to the usage some licensing conditions.
HLT	See High Level Types
IAM	Identity and Access Management. In Snap4City, this function is solved by KeyClock and LDAP open source tools, and it also provide SSO.

Innovatrix	A methodology for innovation at the ground of Snap4City Innovation model: https://www.imec-int.com/en/innovation/innovatrix
integrations	The instrument to implement inegrations is what is called in Snap4City terminology the IoT App, IoT Applications. SEE IoT App, see section 3.6 in this document. See training part 3 https://www.snap4city.org/download/video/course2020/iot/Snap4City-3rd-slot-IOT-Applications-v5-8.pdf
IoT Adapter	A term adopted in IOT to indicate a remote converter of protocol located from the IoT Device and the IoT Broker. See training part 3 https://www.snap4city.org/download/video/course2020/iot/Snap4City-3rd-slot-IOT-Applications-v5-8.pdf
IoT Agent	A term adopted in IOT to indicate a remote converter of protocol located from the IoT Device and the IoT Broker. See training part 3 https://www.snap4city.org/download/video/course2020/iot/Snap4City-3rd-slot-IOT-Applications-v5-8.pdf
IoT App, IoT Application	Node-RED process + Snap4City Library of MicroServices SEE IoT App, see section 3.6 in this document. See training part 3 https://www.snap4city.org/download/video/course2020/iot/Snap4City-3rd-slot-IOT-Applications-v5-8.pdf
IoT Application, IoT App	Node-RED process + Snap4City Library of MicroServices SEE IoT App, see section 3.6 in this document. See training part 3 https://www.snap4city.org/download/video/course2020/iot/Snap4City-3rd-slot-IOT-Applications-v5-8.pdf
IoT Broker	An IoT Broker which may support one or more protocols, typically only one. It can support IoT Adapter, it can implement solution for MultiTenant and paths, such as IoT Orion Broker. Other IoT Broker can be: Mosquitto, HiveMQ, etc. https://en.wikipedia.org/wiki/Message_broker There are several brokers that may implement the same protocol such as https://en.wikipedia.org/wiki/Comparison_of_MQTT_implementations Snap4City is almost agnostic about the brokers and accept a number of brokers and protocols registered on IoT Directory of Brokers and Devices. See training part 3 https://www.snap4city.org/download/video/course2020/iot/Snap4City-3rd-slot-IOT-Applications-v5-8.pdf
IoT Connector	A component to connect to a service using a protocol. In Snap4City, a large number of connectors and protocols are supported into the IoT App microservices. See Section 3.7, and interoperability web compliant page Https://www.snap4city.org/65
IoT Device	An IoT Device with sensors and/or actuators. In Snap4City, an IoT Device can be registered on IoT Broker before sending data on the platform. If the Broker is internal, the IoT Device can be registered on IoT Directory that perform all what is needed to register on IoT Broker and also on Knowledge Base and NIFI to automatically perform the Data Shadow of all the data produces by the device. This is possible since NIFI is automatically subscribed to all Devices of the Internal Brokers. See training part 3 https://www.snap4city.org/download/video/course2020/iot/Snap4City-3rd-slot-IOT-Applications-v5-8.pdf
IoT Device Model	A model for an IoT Device, Virtual IoT Device, etc. In Snap4City, an IoT Device Model can be registered once and shared and used many times for instantiating one or many devices with the same model in short time. For example, 40.000 lights of a smart light system. Please note that the Model is a template, and once used can be modified without any impact of the produced instances. See training part 3 https://www.snap4city.org/download/video/course2020/iot/Snap4City-3rd-slot-IOT-Applications-v5-8.pdf
IoT Directory	Snap4City tool for registering IoT Broker and Devices. Snap4City is almost agnostic about the brokers and accept a number of brokers and protocols registered on IoT Directory of Brokers and Devices. The IoT Directory is capable to browse on internal and external brokers to discover IoT Devices and register them on Knowledge Base. https://www.snap4city.org/115 The IoT Directory is also the tool that manage all the network information about the devices deployed and connected. It is capable to exploit NGSI V1 and V2 protocol aspects to inspecting and managing IoT Orion Brokers of FIWARE, so that to manage a large number of them and automatically performing registration of devices in bulk on Knowledge base. See https://www.snap4city.org/76 https://www.snap4city.org/562, https://www.snap4city.org/647 See training part 3 https://www.snap4city.org/download/video/course2020/iot/Snap4City-3rd-slot-IOT-Applications-v5-8.pdf
IoT Discovery	It is a function of Snap4City IoT Directory and Knowledge base which allow to discover the IoT Devices by a number of filters: geospatial, by type, by value name, by unit, by nature and subnature, etc- https://www.snap4city.org/109 The same Feature is provided in IoT App, IoT Directory, ServiceMap, Data Inspector and Dashboard Builder. See training part 3 https://www.snap4city.org/download/video/course2020/iot/Snap4City-3rd-slot-IOT-Applications-v5-8.pdf

IoT Edge Device	An IoT Device capable to execute processes. In Snap4City terminology are typically endowed of Node-RED process which also has installed Snap4City Libraries of MicroServices. See section 3.5, and also 1. https://www.snap4city.org/646 for the remote control of IoT Edges 2. Edges on Linux https://www.snap4city.org/298 3. Android https://www.snap4city.org/278 4. raspberry pi. https://www.snap4city.org/279 5. Snap4Home: https://www.snap4city.org/617 6. Snap4industry: https://www.snap4city.org/369 7. See training part 3 https://www.snap4city.org/download/video/course2020/iot/Snap4City-3rd-slot-IOT-Applications-v5-8.pdf
IoT Orion Broker	FIWARE component: https://FIWARE-orion.readthedocs.io/en/master/ The IoT Orion Broker support natively the NGSI V1, V2 and LD. It usually provides only the last values of the IoT Devices and not the historical data (data shadow). In order to have the Data Shadow, and thus to perform queries on time series, the IoT Orion Broker has to be connected to a storage. In Snap4City, the storage provided is Elastic Search which provides high capabilities for insert, search and retrieval and scalability. See training part 3 https://www.snap4city.org/download/video/course2020/iot/Snap4City-3rd-slot-IOT-Applications-v5-8.pdf
ISEMC for Video Wall	ISEMC for Video Wall management integrated with IoT App. (https://www.snap4city.org/621)
KB	See Knowledge Base
KeyCloak	For identify and access management, authentication and SAML, and SSO. https://www.keycloak.org/
Km4City Ontology	Km4City means Knowledge Model for the City. It is an Ontological model for the smart city and IoT Applications in smart city and many other domains. It is the core model adopted in Snap4City to design and implement the Knowledge Base, ServiceMap and the federation of **ServiceMaps** and smart city APIs. https://www.snap4city.org/19 https://www.snap4city.org/download/video/DISIT-km4city-City-Ontology-eng-v5-1.pdf
Knowledge Base, KB,	**Km4City Ontology** at the basis of the RDF Store. It is an expert system on the city data and entities in which smart city API can perform queries with spatial, temporal and relational reasoners. https://www.snap4city.org/19 https://www.snap4city.org/download/video/DISIT-km4city-City-Ontology-eng-v5-1.pdf
KPI	Key Performance Indicator, see MyKPI
LD	See LOD
LDAP	Lightweight Directory Access Protocol, for user registration role management https://en.wikipedia.org/wiki/Lightweight_Directory_Access_Protocol
Living Lab	Snap4City Living lab Support and Methodology, see Section 3.2. https://www.snap4city.org/206 https://www.snap4city.org/82
LOD, LD	Linked Open Data, Linked Data, see LOG.DISIT, LOG.DISIT.ORG tool for their reading https://en.wikipedia.org/wiki/Linked_data https://lod-cloud.net/
Log, LOGS	In Snap4City (as in many professional solutions and operating systems), LOGS/logs are produced reporting errors with different level of severity (e.g., warning, severe, etc.), they are produced in standard format as **SYSlog**. Those logs can be browsed, queried with tools, for example: standard **LogStash** which is based on Elastic Search, and Snap4City AMMA also based on Elastic Search.
LOG.DISIT, Log.disit.org	Linked Open Graph tool (noting to do with Logs). LOG.DISIT is a tool for accessing and browsing Linked Open Data in the world and in the local Knowledge base, KB. https://log.disit.org/service/
LogStash	See Log, https://www.elastic.co/logstash an open source tool for inspecting logs
Marathon	A Tool Open Source, standard for the management of containers https://mesosphere.github.io/marathon/
Market Place	Resource Manager of Snap4City https://www.snap4city.org/205
MESOS	A Tool Open Source, standard for the management of containers http://mesos.apache.org/

MicroApplications	A snap4City set of views implemented in HTML5 JavaScript for realizing specific functionalities. They are substantially views of Web and/or Mobile Apps which can be called independently and placed into Dashboard external content Widget as well as into Totems. https://www.snap4city.org/dashboardSmartCity/management/microApplications.php https://www.snap4city.org/54 https://www.snap4city.org/99
MicroServices	Snap4City tool is based on MicroServices. They are realized on the basis of the API (both internal and external). In Snap4City, the term MicroService is a synonym of Node in the Node-RED terminology. Each Snap4City node in the Snap4city Libraries for Node-RED is a MicroService of the solution. Other MicroServices can be easily added for customization and mapping of REST CALL APIs internal or of third party or of additional services, or from Container with Data Analytics. https://www.snap4city.org/22 https://www.snap4city.org/106 https://www.snap4city.org/129 For the recent list of MicroServices you have to see the documentation into the Library: https://flows.nodered.org/node/node-red-contrib-snap4city-user https://flows.nodered.org/node/node-red-contrib-snap4city-developer
MultiTenant	is a reference to the mode of operation of software where multiple organizations with their applications operate in a shared environment. The instances (tenants) are logically isolated, but physically integrated.
MyKPI, MyPOI	Snap4City tool for collecting and managing personal KPI, POI. A MyKPI is a variable with may change over time determining a TimeSeries with variable GPS position at each time instant. https://www.snap4city.org/396 https://www.snap4city.org/414
MyPOI	See MyKPI
NIFI Apache	Apache NIFI supports powerful and scalable directed graphs of data routing, transformation, and system mediation logic. https://nifi.apache.org/
Node-RED	A visual Editor for Node.JS processes from JS Foundation. https://nodered.org/ https://flows.nodered.org/
OpenMAINT	Workflow Management System, Incident Management, Business process Management, BIM and GIS integrated with Snap4City. The tool is capable to define workflow integrating activities of humans and machines with the main focus on maintenance and ticketing. It is presently integrated with IoT App of Snap4City. https://www.openMAINT.org/en/home
Organization	Snap4City Organizations inside the platform represent a tenant partitioning of maps and data and users. Typically, the users may belong to a single Organization with their email address and nickname. An Organization may have multiple Groups. A user may belong to multiple Groups. Grant authorizations to resource access can be provided at level of single user, Group and/or Organization.
Out of the Box	Component ready to be used without development, already in use in Snap4City applications and/or solutions.
Platform Management	See Quality Assessment and User Management and Control. **See Section 3.16.**
POI	Point of Interest, services on map, with some GPS location and service classification
Portia	A Tool for Web Scraping, extracting data from web pages. Processes of Portia in Snap4City are converted in MicroServices executed on containers. https://portia.readthedocs.io/en/latest/index.html
Python Server	Snap4City Python server for developing Python processes for machine learning, AI and statistical purpose on data. It can access to data via Smart City API and the Python processes can be transformed into Containers. They can exploit Tensor Flow and Keras and CUDA provided that specific NVIDIA boards are present on the servers, and VM can exploit them with some VGPU of the virtualization environment.
Quadruple Helix	describes university-industry-government-public-environment interactions within a knowledge economy. In innovation helix framework theory, first developed by Henry Etzkowitz and Loet Leydesdorff and used in innovation economics and theories of knowledge, such as the knowledge society and the knowledge economy, each sector is represented by a circle (helix), with overlapping showing interactions. https://en.wikipedia.org/wiki/Quadruple_and_quintuple_innovation_helix_framework
Quality Assessment	A process of quality control regarding several aspects of the platform. A quality control is also performed when the Reports are produced according to specific KPI. See **Section 3.16.** They are default KPI and Dashboards for quality control on Snap4City solution with the views on: 8. API reachability / availability performed by E015 external service: https://www.snap4city.org/388

	9. Smart City API performance:
	        https://dashboard.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTkw
	 10. DISCES performance:
	        https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjE3Mw==
	 11. MyKPI monitoring:
	        https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTY0NA==
	 12. Traffic Analyzer: see **AMMA**
	 13. Data Flow Global analyzer: see **DevDash**
	 14. Container Cluster healthiness: see section 3.14, only internally accessible
	 15. Mobile App monitoring: only internally accessible
	 16. WEB Server Performance and monitoring: only internally accessible
	 17. Marathon and Mesos Monitoring: only internally accessible
	 18. Cloud Services Monitoring and control: from VMware, only internally accessible
	 19. NIFI Monitoring: an IoT App which uses NIFI API to monitor critical conditions and send alerts
	 20. IoT Orion Broker Monitoring: the broker provides some statistics on notifications and logs.
	        https://FIWARE-orion.readthedocs.io/en/master/admin/perf_tuning/index.html
	 21. HTTP server tuning + Notification modes and performance

Quality Assessment of IOT Data and services	A process of quality control regarding IOT data. Snap4City platform performs a control on the healthiness of the IoT Devices automatically on the basis of criteria set up on the IoT Directory. In this case, the control is performed at level of ServiceMap. An additional quality control may be performed in parallel to a dedicated process quality assessment. It is based on Machine Learning. This latter solution is optional for the large amount of resources needed to adopt it. A quality control can be also performed when the Reports are produced according to specific KPI which has to be defined and computed. **See Section 3.16.**
Reports	In Snap4City, the report generator can create consumptive views on the platform status on specific programmable aspects for users and administrators, for example at level of IoT Devices, Dashboards. Specific Reports can be created to produce quality assessment aspects.
ResilienceDS	Resilience and sustained adaptability in urban transport systems (UTS) Today, enhancing resilience in Urban Transport Systems is considered imperative for two main reasons: a) such systems provide critical support to every socio-economic activity and are currently themselves one of the most important economic sectors in Europe; b) the paths that convey people, goods and information, are the same through which risks are propagated. ResilienceDS (https://www.snap4city.org/520).
Resource Manager	Is a Market Place of Snap4City artefacts: IoT App, Flows/subflows, data analytics, ETL, Kibana Dashboards, etc. They can be searched, shared and promoted via a web portal. https://www.snap4city.org/27 https://www.snap4city.org/205 https://www.snap4city.org/188 https://www.snap4city.org/134
Roles	Snap4City users are classified in Roles. Typical Roles are RootAdmin, ToolAdmin, AreaManager and Manager. Other Roles can be defined as well.
Routing, Travel plans	A detailed set of travel segments to start from Point A and reach Point B in the map at the certain time and day. It may be done by car, bus, and multimodal. A specific tool is needed to compute the travel plan, and detailed data are needed on the Knowledge Base to take decision about the planning. Some of the data can be recovered from OSM, Open Street Map, and their availability may depend on the geo zone.
Rstudio Server	Snap4City RStudio server (open source tool) for developing RStudio processes for machine learning, AI and statistical purpose on data. It can access to data via Smart City API and the RStudio processes can be transformed into Containers. They can exploit Tensor Flow and Keras and CUDA. https://rstudio.com/
SDK Mobile App	Software Development Kit for the production of Mobile Apps, exploiting the smart City API of Snap4City. Also this kit is provided in Open Source.
ServiceMap	Visual map interface to make Smart City API query on RDF store and test queries, and request samples of queries via email https://www.snap4city.org/19 https://www.snap4city.org/184 https://www.snap4city.org/155 https://www.snap4city.org/180

ServiceURI	In Snap4City terminology the service URI is the unique identifier of the Service and it is in substance an URI in the Linked Data model and Km4City Ontology and Expert system. It allows to identify univocally any entity of the city.
Smart City API	In Snap4City, a large collection of services to: exploit queries and reasoning on the storage and Knowledge Base, access/control IoT Network, exploit Data Analytic results, exploit IoT Apps, etc. All the data and services are accessible via the Smart City API which are used by Front End Tools such as Dashboards, Web and Mobile Apps, MicroApplications. Details regarding Smart City API are reported in: https://www.snap4city.org/download/video/course2020/app/Snap4City-7th-day-Mobile-Applications-v2-7.pdf
Smart City Control Room	A solution for centralized control of the smart city via a set of view wall and operator console of 3-4 monitors. See Florence Control Room https://www.snap4city.org/531 ISEMC for Video Wall management integrated with IoT App. (https://www.snap4city.org/621)
Smart City Control Rooms	See the following example of the Smart City Control Room, SCCR, of Florence Metropolitan City which has more than 1.5 million of inhabitants. The figure reports the main dashboard used by the Mayor (namely: Dario Nardella) and the second level dashboards. Please note that a third and a fourth level are present as well. https://www.snap4city.org/525 control room with video wall: https://www.snap4city.org/621
SmartDS	The **SmartDS** (Smart Decision System) of DISIT is an Advanced System Thinking solution for Decision Support System, DSS, on smart city problems and data. SmartDS is a tool presently in trial that allows you to model decision processes by using an Advances System Thinking formalism defining weights on branches and value of the Italian Flags probabilities on processes, etc. (the application of verification and validation algorithms on data are also provided). http://smartds.km4city.org/dss/ see (https://www.snap4city.org/520).
Snap4City Innovation Matrix.	The methodology for innovation of Smart City derived from the **Innovatrix** method and it has been adopted for the leveraging the Innovation into the European Commission JRC ISPRA in the 2019, in Pisa 2020, and other locations. A few details about its implementation and processes are reported in section 3.2 regarding the Living Lab in which the Methodology is largely used. See training course 2020 part 6. https://www.snap4city.org/download/video/course2020/sys/Snap4City-6th-slot-system-deploy-v4-6.pdf
Snap4Home	22. Snap4Home: https://www.snap4city.org/617
Snap4Home	A subset of the Snap4City solution which is suitable for smart home control and automation. It may include, Snap4City IoT App also installed at home, in some IoT Edge Device hosting Node-RED. See the list of supported protocols and those in Node-RED https://www.snap4city.org/65
Snap4industry	23. Snap4industry: https://www.snap4city.org/369
Snap4Industry	A subset of the Snap4City solution which is suitable for smart industry/industry4.0 control and automation. It may include, Snap4City IoT App also installed in the factor or into the retail shops, and in particular in IoT Edge Device hosting Node-RED. They can be: raspberry Pi, Linux, windows, etc. See the list of supported protocols and those in Node-RED https://www.snap4city.org/65
Snp4City IoT App	See IoT App, IoT Application Node-RED process + Snap4City Library of MicroServices
SSM2ORION	SSM2ORION a module for connecting an IoT Orion Broker with its Data Shadow implemented by using Quantum Leap with the Federation of Knowledge Base. This solution allows to connect at the Smart City also other already in place FIWARE solutions which may have local storage. The queries performed on Snap4City Smart City API provide seamlessly the results also providing the geo data which are stored into that Orion Broker without the need to register the IoT Devices of that IoT Orion Broker into the Knowledge Base. Some limitations are present on the security aspects.
SSO	Single Sign On, In Snap4City, this function is performed by LDAP and KeyCloak at which all tool are referring to exploiting OpenID Connect.
SUMO	Simulation of Urban Mobility, open source tool, which can be integrated with the solution provided. https://www.eclipse.org/sumo/ https://sumo.dlr.de/docs/

	https://en.wikipedia.org/wiki/Simulation_of_Urban_Mobility
SuperServiceMap	See **Federated Knowledge Base**. A tool on top of Smart City API, which is the API interface of ServiceMap, **Knowledge Base**
Swagger	Standard API documentation and design tool https://swagger.io/
Synoptics	See **Custom Widgets**
SYSLog	Standard format for Logs: https://en.wikipedia.org/wiki/Syslog
Time Series	Is a series of data values over time associated to a variable, sensor, actuator. A Time Serie may have change GPS location of measure, and in that case is a Moving Object Time Series. In Snap4City, all the variable of IoT Devices, area HTL Sensors/Actuator and may be Time Series; also MyKPI variable may be Moving Object Rime Series.
Tracker	A Specific Widget for tracking moving devices, which can be located into Snap4City Dashboards.
Traffic Flow Reconstruction	Algorithm and Tool for computing the traffic flow in ay point of the city on the basis of the data collected from a limited number of sensors located on roads and scattered in the city.
Typical Time Trends	A typical trend of the data, highlighting one or more seasonality aspects of the data. They can be daily, weekly, weekly on day, monthly, etc.
User Management and control	24. User vs registration: LDAP and KeyCloak 25. User Limits management 26. User vs consumption of resources 27. Content vs publication 28. Auditing data access try-out, Elements and Ownerships, personal data, accesses authentications, user activities, queries, articles, web pages, dashboards, IoT Directory, etc- 29. Org vs Groups, user vs orgs 30. Chat management **See Section 3.16.**
Value_type	Each Attribute/variable in Snap4City is defined in term of Value_Type, Value_Unit and Data_Type (e.g., Energy Power, Kw/h, Float). They can be defined with the Data Dictionary.
Value_Unit	Each Attribute/variable in Snap4City is defined in term of Value_Type, Value_Unit and Data_Type (e.g., Energy Power, Kw/h, Float). They can be defined with the Data Dictionary.
Virtual IoT Devices	An IoT Device which has not a physical counterpart. It can be a just defined in the IoT Broker for passing data from one service to another. Virtual IoT Devices having sensors and actuators can be also the Widgets on Dashboards by which a user can see value and act on them to send values.
VM	Virtual Machine
Web Socket Secure, WSs	A TLS version of the WS. In Snap4City it is used for communicating from Client Dashboards, Custom widgets, event driven widgets, etc., to the platform on which IoT App and MyKPI/storage are connected in real time.
Web Socket Variable	A single Variable connected via WSs
Web Socket. WS	A communication protocol for real time connection. In Snap4City is only used in its TLS version Web Socket Secure.
What-IF analysis	The What-IF analysis is a modality of work recently included in the Snap4City suite which aim to exploit in a multicontextual environment most of the former tools as dashboards and Data Analytic with IoT App intelligence. See Section 3.9.2
WS	See Web Socket
WS Secure	See Web Socket Secure, WSs