



www.snap4city.org
www.snap4solutions.org



www.km4city.org

Exploiting Snap4City API, and Web/Mobile Applications SDK

Sept. 2024, Course, Part 7

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

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

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



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DISIT
DISTRIBUTED SYSTEMS
AND INTERNET
TECHNOLOGIES LAB



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



Be smart in a SNAP!



Exploiting Snap4City API,
and Web/Mobile Applications SDK

Sept. 2024, Course, Part 7
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<https://www.snap4city.org/577>

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES



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Snap4City





Digital Twin Solutions for Sustainability

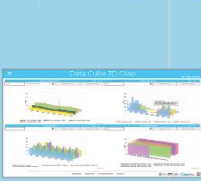
OPERATION AND PLAN - CONTROL ROOMS - DECISION SUPPORT SYSTEMS - WHAT-IF ANALYSIS - OPTIMIZATION - APPLICATIONS



- DEVELOPMENT ENVIRONMENT AND METHODOLOGY
- VISUAL PROGRAMMING, ML, AI, HPC
- TRAINING COURSES
- LIVING LABS
- GUI CUSTOM STYLES
- FULL APPLICATIONS, DASHBOARDS AND VIEWS
- MOBILE APPS



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



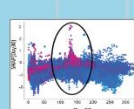
DASHBOARDS, WIDGETS TEMPLATES

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 ...



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

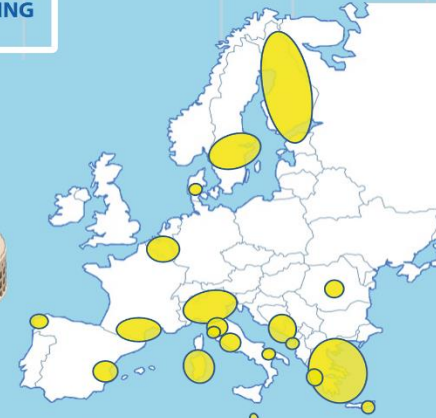


BIG DATA ANALYTICS, ARTIFICIAL INTELLIGENCE
EXPLAINABLE AI, MACHINE LEARNING, GENERATIVE AI
OPERATIVE RESEARCH, STATISTICS



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

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



Powered by FIWARE

FREE TRIAL

PEN Test Passed

EU GDPR COMPLIANT

SNAP4 Appliances and Dockers Installations

EUROPEAN OPEN SCIENCE CLOUD

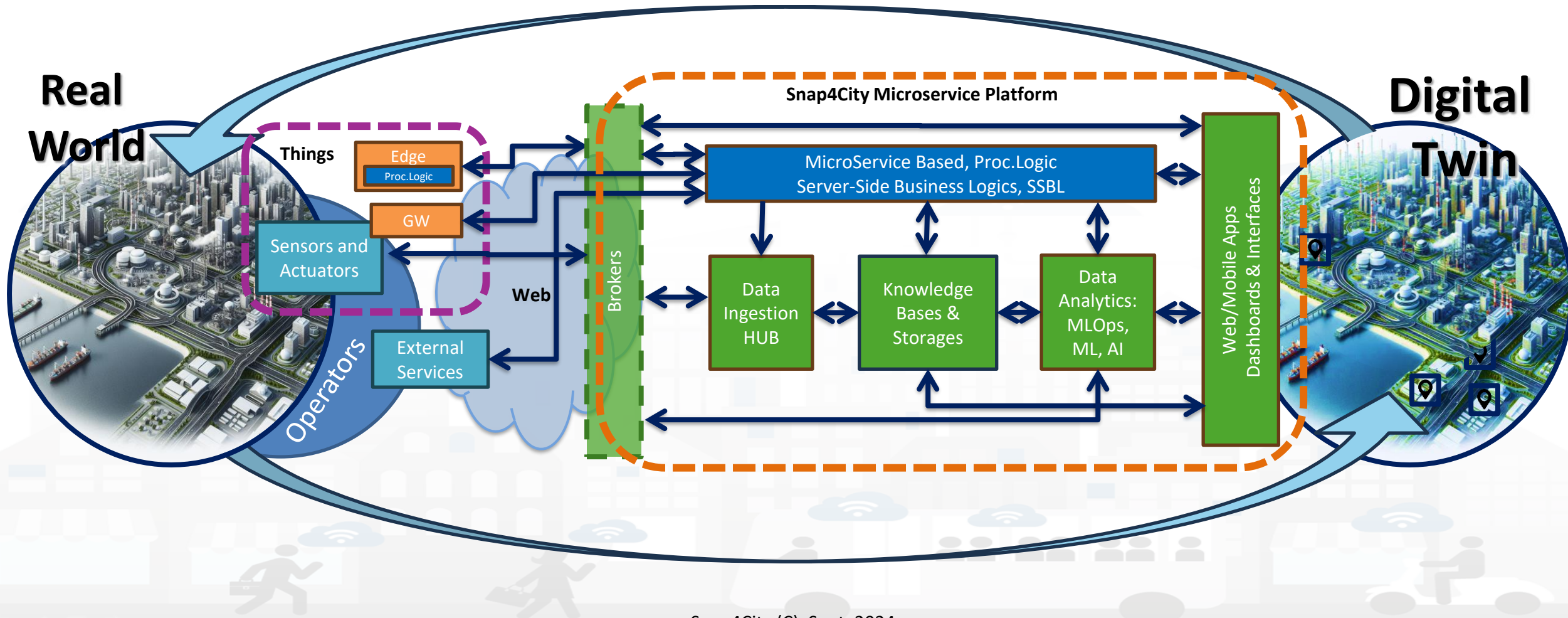
Node-RED

JS Foundation

E015 digital ecosystem

NVIDIA

Digital Twin Development Platform



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

On Line Training Material (free of charge)



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



Note on Training Material


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



Tech Overview

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



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AND INTERNET
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 **SNAP4CITY** 

Snap4City Platform

Technical Overview

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

Snap4City:

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

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

- 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>

1

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:

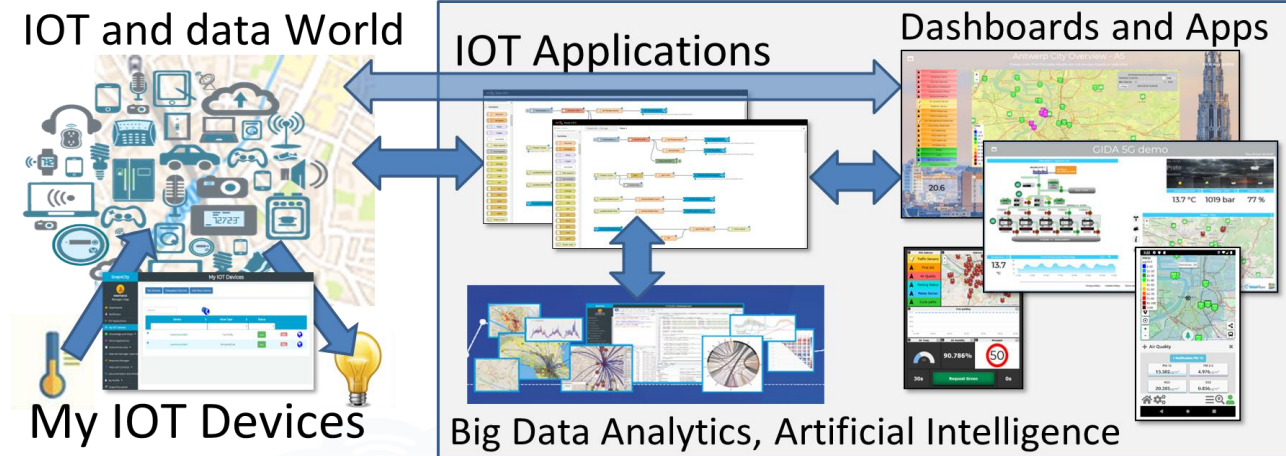
- We suggest you to read the **TECHNICAL OVERVIEW**:
 - <https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf>
- <https://www.snap4city.org>
- <https://www.snap4solutions.org>
- <https://www.snap4industry.org>
- <https://twitter.com/snap4city>
- <https://www.facebook.com/snap4city>
- <https://www.youtube.com/channel/UC3tAO09EbNba8f2-u4vandq>

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

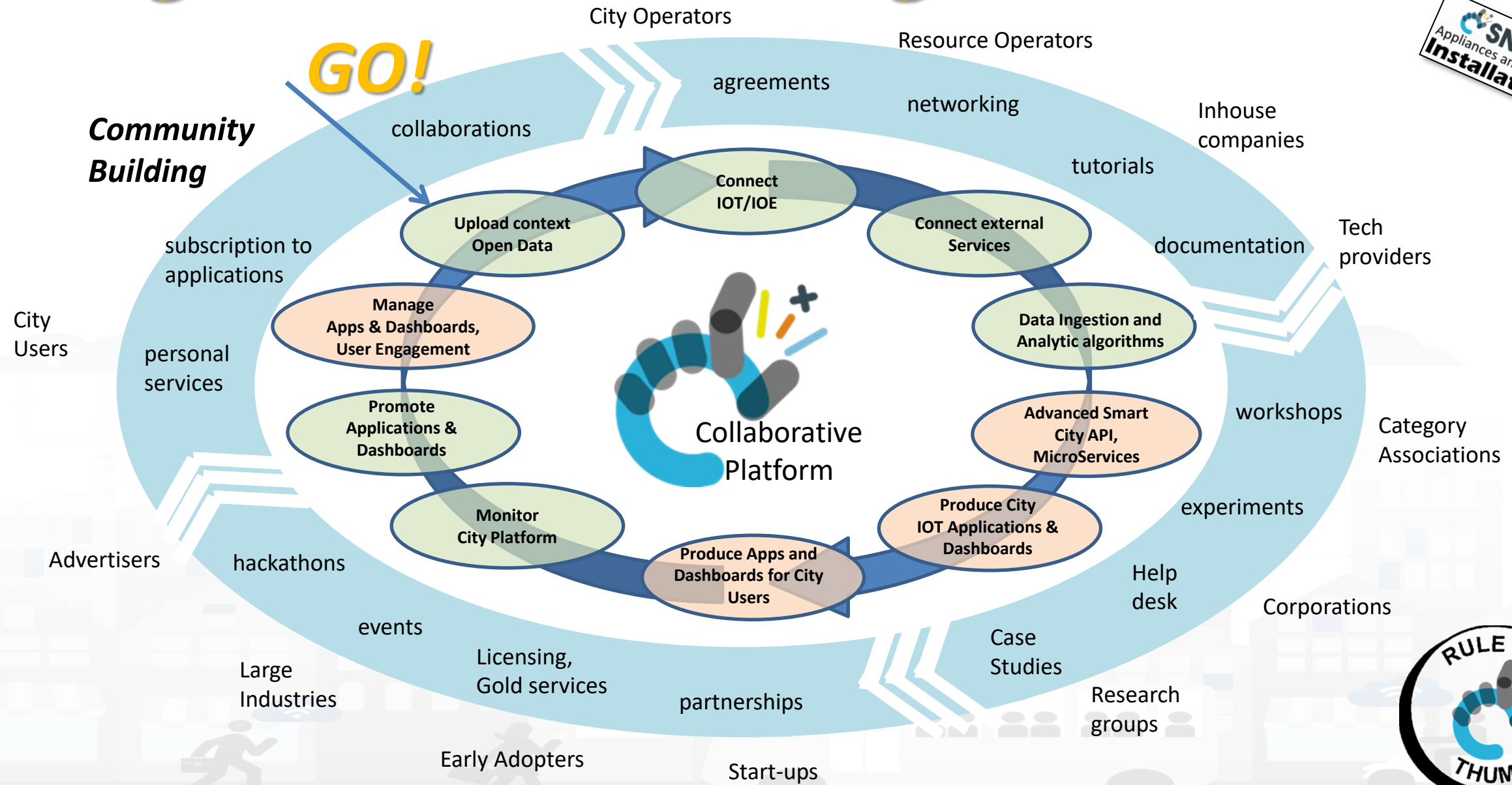


IF you need to go more in deep you can ask us to pass at the next Role becoming full AreaManager with full rights of development, also for Data Analytics, machine learning, etc.

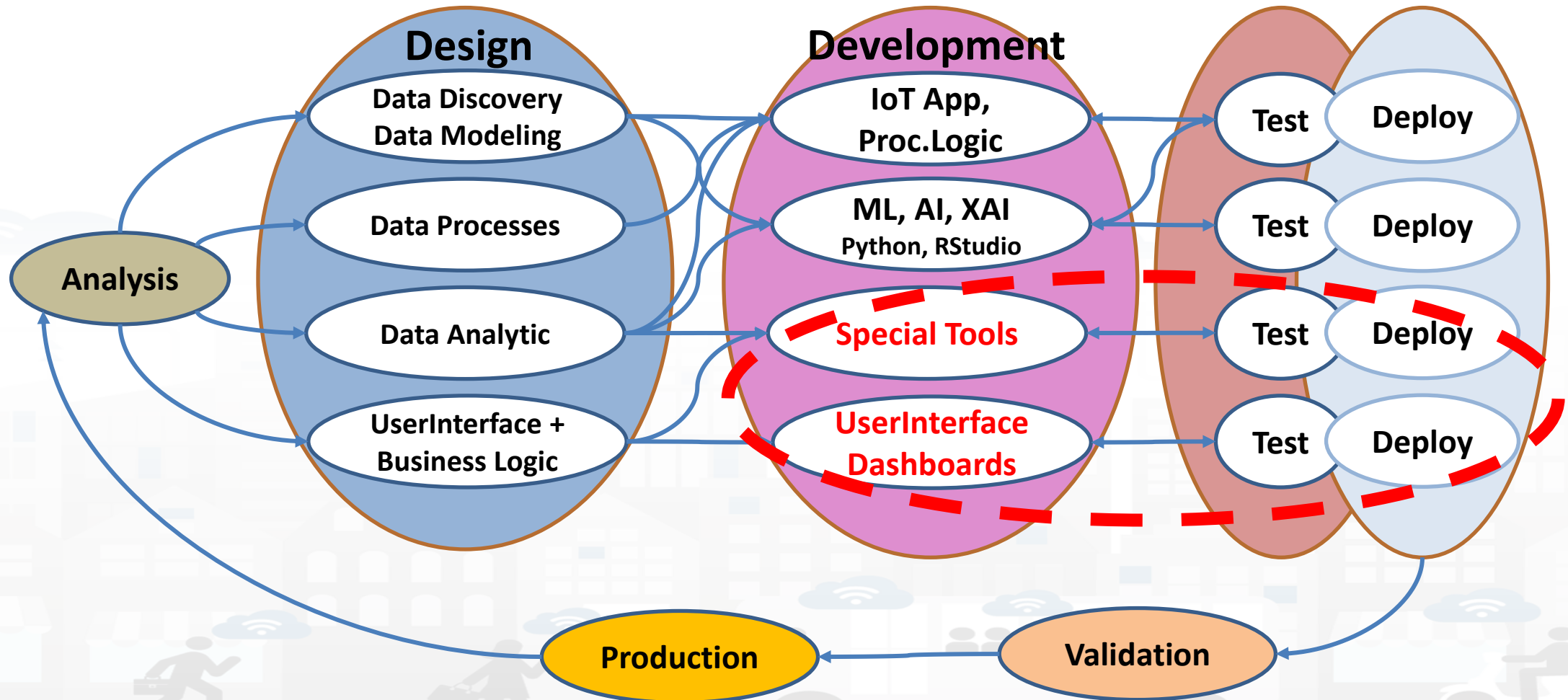
Agenda of Part 7

- Smart City API: Internal and External
- Concepts and tools for using Knowledge Base, ServiceMap, API
- Federated Knowledge Bases and Smart City APIs
- Advanced Smart City API
- Access to Protected data
- Forging and managing: Mobile and Web Apps, MicroApplications
- Web and Mobile App Development Kit
- Training Material

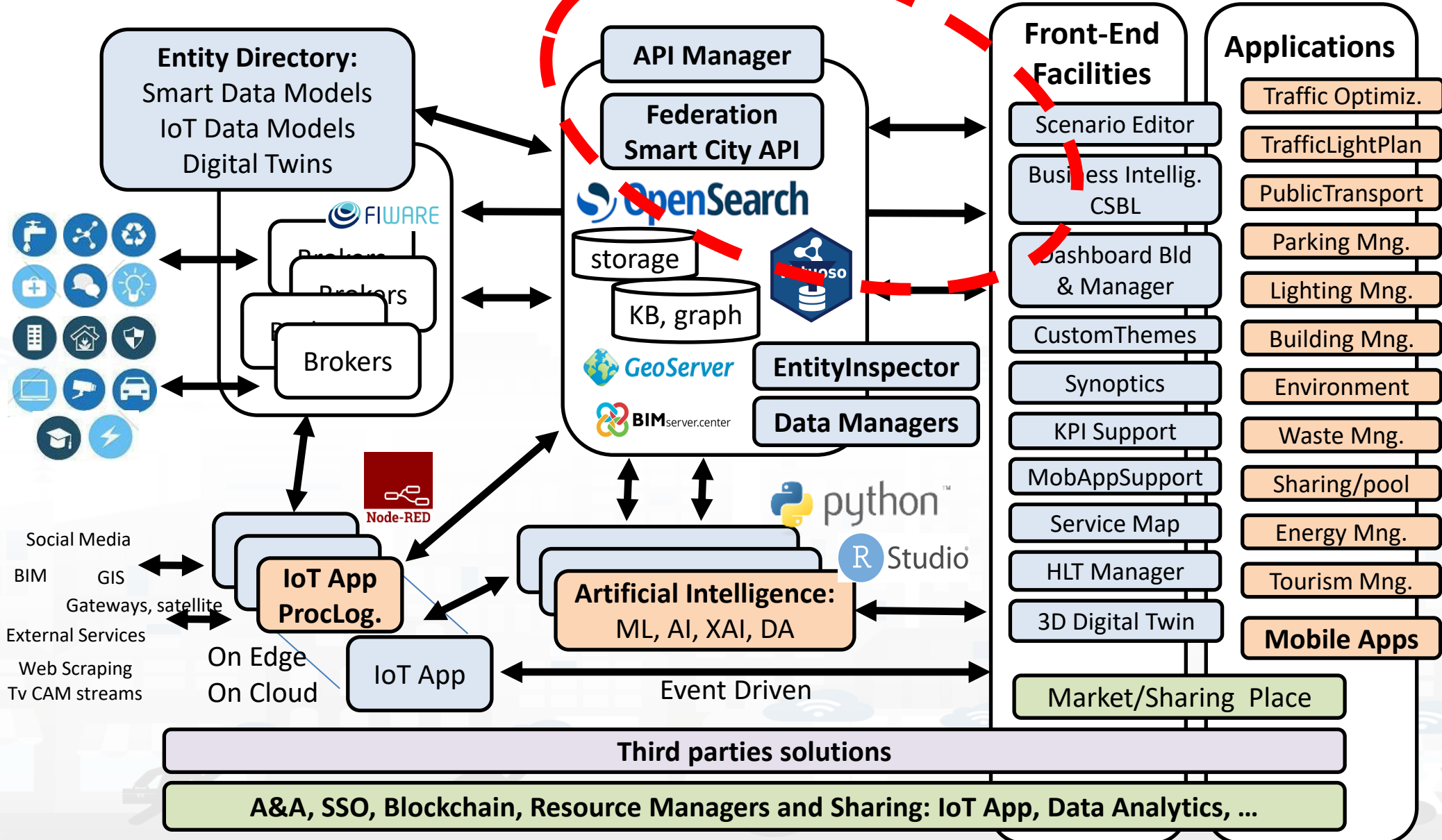
Living Lab Accelerating



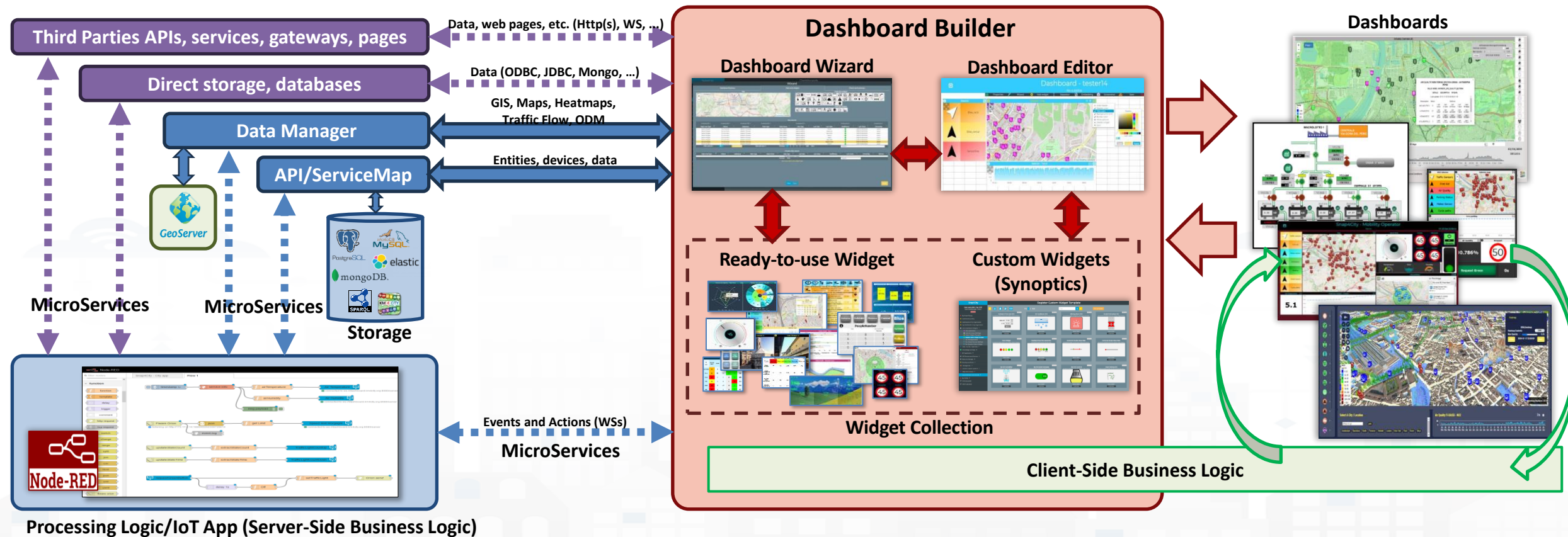
Development Life Cycle Smart Solutions

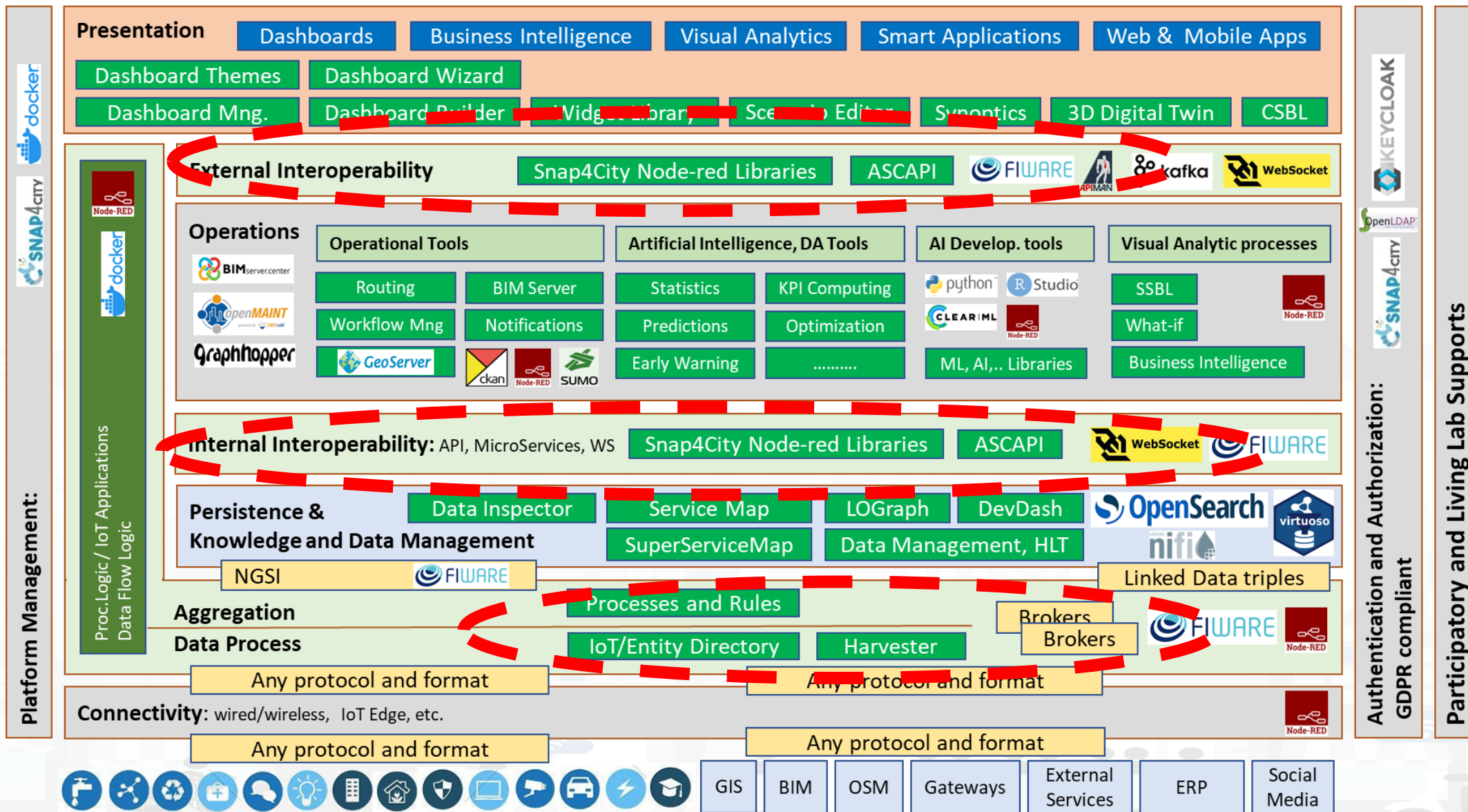


Tech Arch



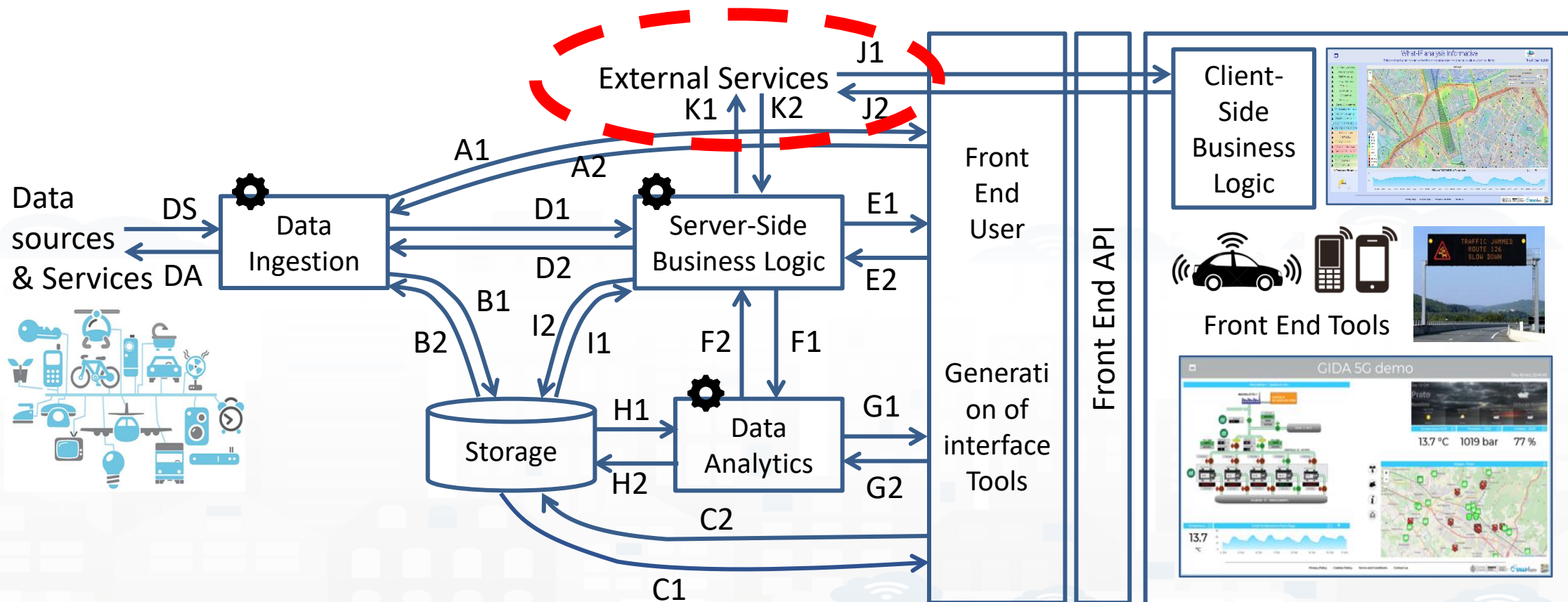
How the Dashboards exchange data





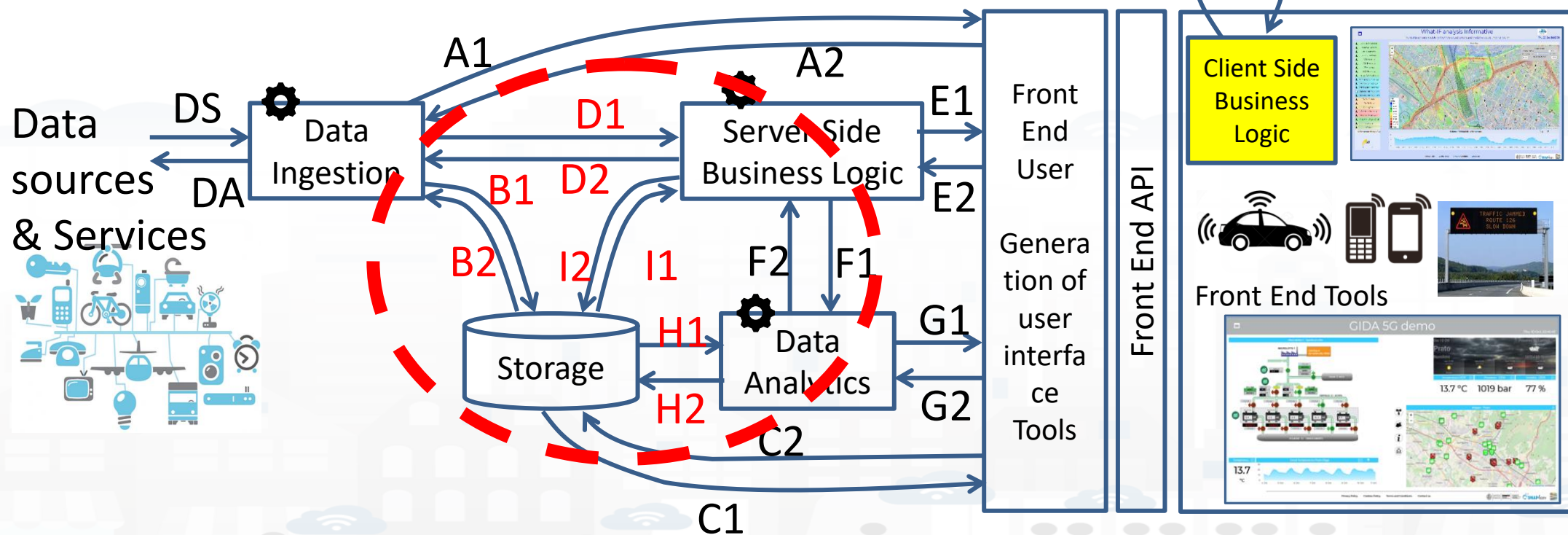
- **Smart Applications can be easily developed exploiting the cloud infrastructure by producing only:**
 - **Processing Logic / IoT App** with almost no coding activities
 - **Data Analytics** in Python or Rstudio
 - **Dashboards** with almost no coding activities.
- **→ Orange parts of the previous figure slide are those usually developed,**
 - all the rest, is part of the provided microservices and infrastructure.
- **Third party applications can dialog with the solutions via**
 - **Smart City API**, Swagger: <https://www.km4city.org/swagger/external/>
 - **Brokers/IoT Brokers**, for example for NGSI Orion Broker:
<https://www.km4city.org/swagger/external/?urls.primaryName=Orion%20Broker%20K1-K2%20Authentication%20API>
 - **Processing Logic / IoT App** any protocols: <https://www.snap4city.org/65> They can also expose some specific API, custom made

Communications vs External Services



Internal API

Part 8



Internal and External Smart City API

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

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

Internal Snap4City API

The screenshot displays the Swagger UI for the Internal API Docs. The left sidebar shows a navigation menu with categories like Knowledge and Maps, IOT Applications, IOT Directory and Devices, Resource Manager, and Development Tools. The main content area is titled "Internal API Docs: Swagger" and shows the "IoT Device Registration API" (version 2.0.0 OAS3). The API description states: "The API accepts in input a description of an IoT device with its broker and attributes in the form of a JSON document shaped conforming to a well-defined schema operations on a graph database, also returning the URI of the inserted, updated or deleted device." Below the description, there is a "Servers" dropdown menu set to "http://www.disit.org/ServiceMap/api/v1/iot". The "Registry" section lists several POST endpoints: `/insert` (For registering or updating a device in the graph database), `/delete` (For deleting a device from the graph database), `/make-private` (For marking a device as a private device), and `/make-public` (For marking a device as a public device). The "Device Attributes" section lists two POST endpoints: `/disable` (For disabling a device attribute) and `/enable` (For enabling a device attribute that had been disabled). The "Models" section shows a "device" model.

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

Internal Smart City API

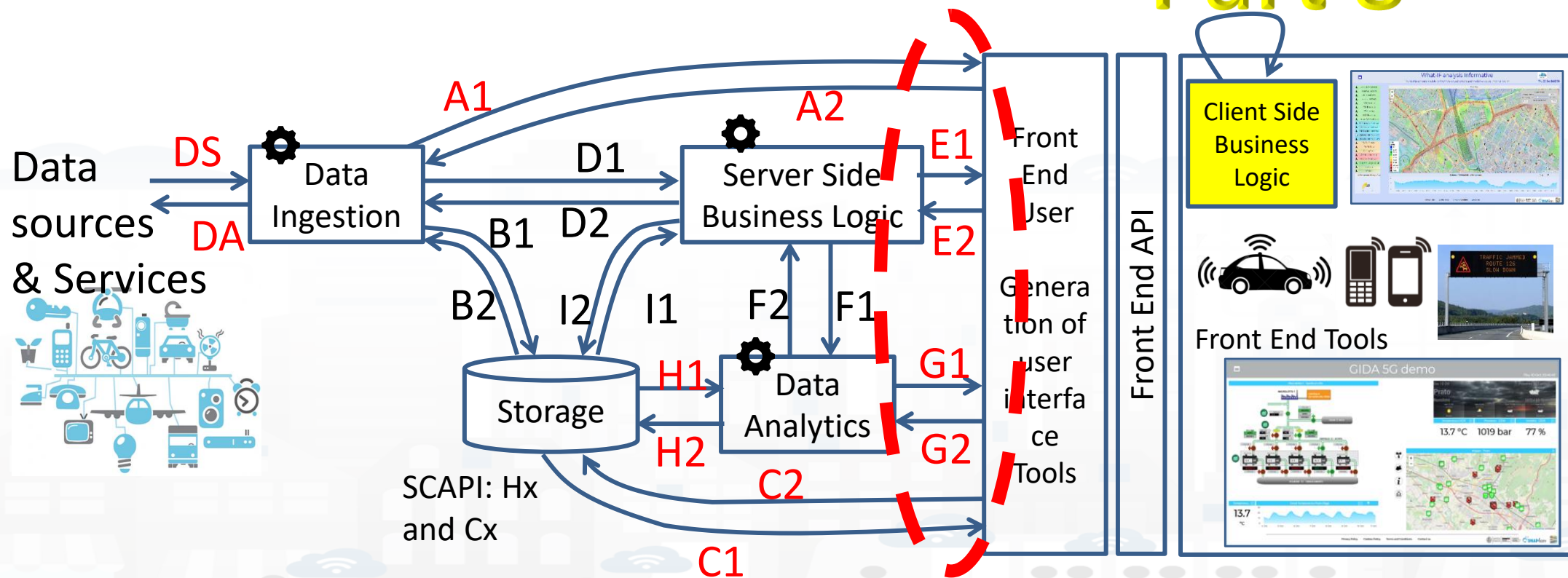
- **IOT devices / Entities and tools API:**
 - **IoT device /entity registration API**
 - API of the IoT / Entity Directory
 - **Sensors API**
 - API of the IoT / Entity Directory
 - **Device, Broker and Value Mgmt API**
 - API of the IoT / Entity Directory
- **Mobile App management**
 - **User Profiler API**
 - To manage the user profile for the Engager on Mobile Apps
 - **Engager API**
 - From the Engager to prepare engagements to the Mobile Apps
 - **Wallet API**
 - From the Engager to Wallet of the users of Mobile Apps and in general
 - **Snap4City Application API**

Internal Smart City API

- **Resources and entities (Partially usable also as External API)**
 - **Snap4City Application API**
 - To manage IOT Apps, Proc.Logic
 - **My KPI API**
 - To manage MyKPI, MyPOI, POI, etc.
 - **Data Manager API**
 - **Resource Manager API**
 - To manage resources on the market place
 - **Ownership API**
 - To manage ownerships and delegations
 - **Device Groups API**
 - To manage ownerships and delegations
- **Notificator API**
- **DISCES scheduler API (deprecated)**
- **Event Logger API (partially deprecated)**
- **Snap vs OpenMaint API**
 - Integration with the workflow management and ticketing
- **SCI-HUB Processing API**
 - To activate data download and heatmap production from Copernicus satellite services

Snap4City External API

Part 8



Snap4City API families

- **C1-C2 / H1-H2:** ASCAPI, Advanced Smart City API + Data Managers
 - Mainly to access at data, pose query, etc.
- **A1-A2:** broker connections
 - Mainly access to send data, get data here is without storage !!!!
- **E1-E2:** Server Side Business Logic, Proc.Logic/IoT App, Node-red
 - Event Driven data INPUT/OUTPUT, via WS
- **G1-G2:** Dedicated Connections with Data Analytics, Custom communications
- **Internal API:**
 - All the others

External Smart City API

The screenshot displays the Swagger UI for the Snap4City Smart City API. The interface is divided into a sidebar on the left and a main content area on the right. The sidebar contains navigation options such as 'External Services', 'Data Set Manager', 'Resource Manager', 'Development Tools', 'Management', 'Settings', 'User Management and Auditing', 'Help and Contacts', 'Documentation and Articles', and 'My Profile'. The main content area shows the 'Advanced Smart City API' documentation, including a dropdown menu for selecting a specification, a 'Servers' dropdown, and a list of services with their respective endpoints and methods.

Smart City API Docs: Swagger

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

External Services

Data Set Manager: Data Gate

Resource Manager: Process Loader

Development Tools

- Web Scraping Tool
- Web Scraping Tool (0n)
- Web Scraping Tool (6l)
- R Studio Development
- R Studio Development 0.11
- R Studio Development 0.116
- R Studio Development TF
- R Studio Development GFF
- R Studio Development Gral
- MicroServices from DataAnalytic
- ETL Development
- ETL Development 1
- ETL Development 2
- Knowledge Base Graphs
- Knowledge Base Queries
- Smart City API Docs: Swagger**
- Internal API Docs: Swagger
- Testing API by Postman
- Source Code Access

Management

Settings

User Management and Auditing

Help and Contacts

Documentation and Articles

My Profile

swagger Select a spec: Advanced Smart City API

Advanced Smart City API ^{1.0.0} ^{OAS3}
<https://www.km4city.org/swagger/external/ascapi-openapi3.json>
SMART CITY API WEB DOCUMENTATION

Servers

Services

- GET / Service discovery and information

Events

- GET /events/ Event search

Locations

- GET /location/ Address and geometry search by GPS

Public Transport

- GET /tp1/agencies/ Agency list
- GET /tp1/bus-lines/ (Bus) Lines list
- GET /tp1/bus-routes/ (Bus) Routes list

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

External Smart City API

- **Advanced Smart City API, normal or Super**
 - To access the Service Map resources and query
- **Orion Broker K1-K2 Authentication, etc., SSO**
 - To communicate with IOT Orion Brokers exploiting the Secure Filter of Snap4City.
- **Heatmap**
 - To save and access to HeatMaps of the Heatmap server
- **Other: ODM, Traffic Flow, etc.**
- **Km4city Web App API**
 - To exploit MicroApplications created as tools for Dashboards, totem, web Apps, etc.

The screenshot shows the Postman interface for the KM4City API. The left sidebar contains a navigation menu with items like 'Service Discovery', 'Event, POI, Address Discovery', 'Service Details', 'Public Transport', 'User Feedbacks', 'Recommender', 'DISCES', 'Web App', and 'Control Room'. The main content area is titled 'KM4City API' and includes an introduction, a 'Service Discovery' section with sample calls, and a 'GET Search by category in a radius' section with a URL and a table of parameters. The right sidebar shows an 'Example Request' in cURL format and an 'Example Response' showing a 200 OK status and a JSON response structure.

SCAPI

KM4City API

An exhaustive set of read-only APIs that have been developed in the context of the [KM4City Project](#) can be found below here.

Service Discovery

Sample calls to APIs that allow to discover the available services, and retrieve some minimal information about each of them, including the Service URI, that can be leveraged for requesting further details through calls like those that can be found in the *Details about services* section (see below).

GET Search by category in a radius

```
https://servicemap.km4city.org/WebAppGrafo/api/v1/?selection=43.7909;11.2280&maxDists=0.5&categories=Accommodation&lang=en
```

Search for an accommodation in a radius of 500 m from a given position, using English names & labels.

See also par. 4.2 of the [Smart City API Guidelines](#).

PARAMS	
selection	43.7909;11.2280 WGS84 latitude and longitude, that could come from a GPS device, but also could be somewhat entered by the user for gathering information about a remote location.
maxDists	0.5 Maximum distance from the given position of the services to be retrieved, expressed in kilometres. It defaults to 100 metres. If it is set to the special value "inside", services are returned whose WKT boundary contains the given position (it could be the case of a park).
categories	Accommodation The list of categories of the services to be retrieved separated by a semicolon. If omitted, all kinds of services are returned. It can contain macro categories or categories. If a macro category is specified, services are returned that belong to any of the categories in the macro category. The complete list of categories and macro categories can be retrieved on the Service Map that can be reached at https://servicemap.disit.org .

Example Request

Search by category in a radius

```
curl --location --request GET "https://servicemap.km4city.org/WebAppGrafo/api/v1/?selection=43.7909;11.2280&maxDists=0.5&categories=Accommodation&lang=en"
```

Example Response

200 - OK

```
{
  "Services": {
    "fullCount": 16,
    "type": "FeatureCollection",
    "features": [
      {
        "geometry": {
          "type": "Point",
          "coordinates": [
            11.22766494750977,
            43.7909
          ]
        }
      }
    ]
  }
}
```

<https://documenter.getpostman.com/view/4177198/km4city-api/RW83QsX5?version=latest>

- **Advanced Smart City API** which can be confined into a single Smart City installation or Federated as well as for Super Service Map
 - <https://www.km4city.org/swagger/external/index.html>
- **Federated Multiple Snap4City Knowledge Bases.** 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 of: Antwerp/Helsinki, Tuscany/Firenze, Sardegna, etc. The resulting Service is called Super Service Map and it is integrated in the Smart City API. For example, via:
 - <https://www.disit.org/superservicemap/api/v1>
- **Federated Open Data Portals** via DataGate/CKAN that presently presents now more than 13800 data sets linked for the cities of Helsinki and Antwerp.
 - <https://datagate.snap4city.org/organization>
 - Federation, Harvesting interface is: <https://datagate.snap4city.org/harvest>
- **WFS service of Snap4City** on top of Federated Smart City API or simple Smart City API of a single ServiceMap (smart City installation). This solution permits to GIS applications and platforms (such as ArcGIS OnLine ESRI, ArcGIS Enterprise ESRI, ArcGIS Map/pro Desktop, QGIS, GeoServer, etc.) to access at Snap4City data. For Example, via:
 - <https://www.disit.org/superservicemap/api/v1/wfs>
 - <https://www.disit.org/superservicemap/api/v1/wfs?service=WFS&request=GetCapabilities&version=2.0.0>
- **WMS service of Snap4City** for publishing **maps and heatmaps**, provided by an installed GeoServer third party open source tool. For example, via:
 - <https://wmserver.snap4city.org/geoserver/Snap4City/wms>
 - <https://www.km4city.org/swagger/external/index.html?urls.primaryName=Heatmap%20API>

Test the API

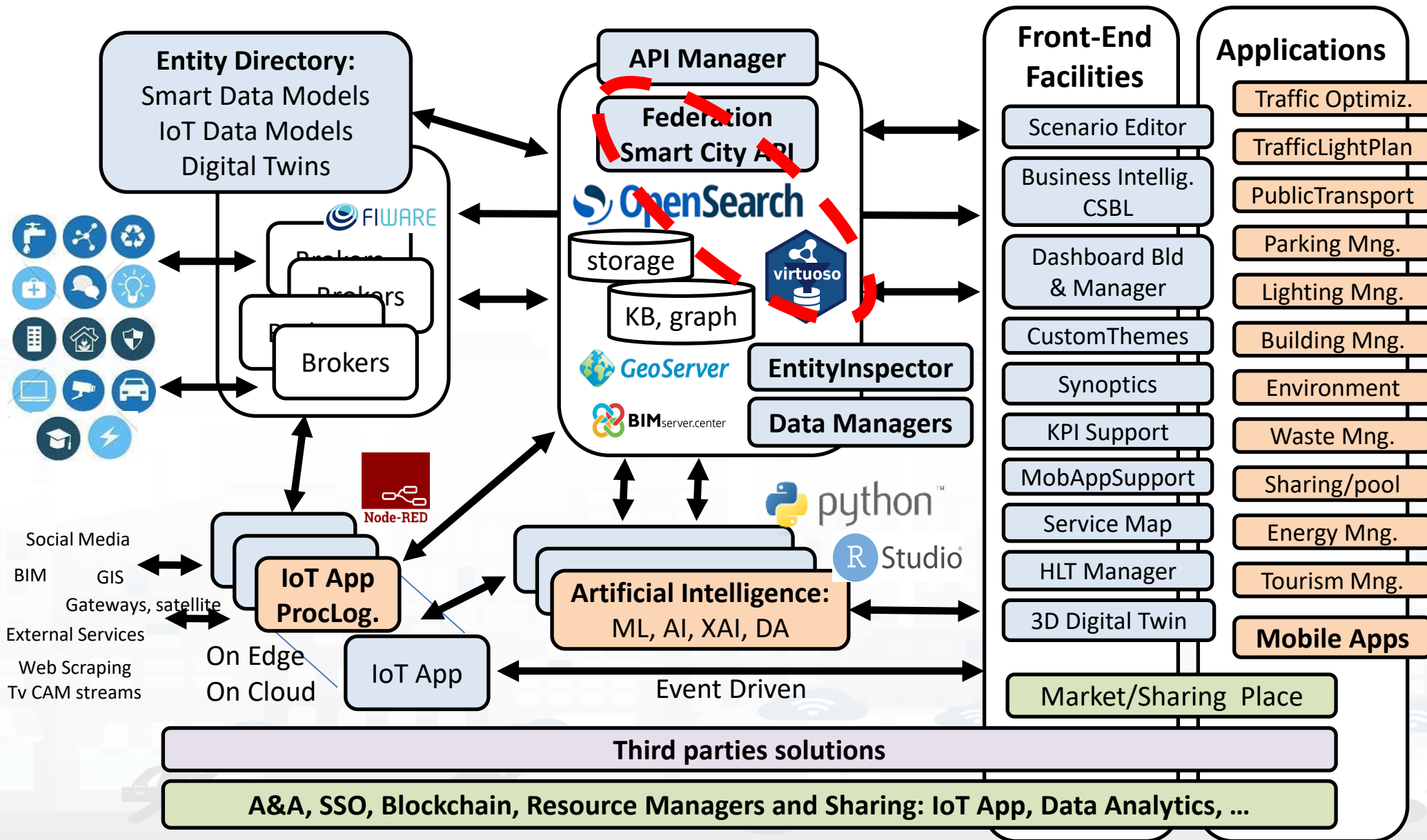


KEY	VALUE	DESCRIPTION	...	Bulk Edit
<input checked="" type="checkbox"/> serviceUri	http://www.disit.org/km4city/resource/iot/o...			
<input checked="" type="checkbox"/> format	json			
<input checked="" type="checkbox"/> fromTime	2022-10-01T00:00:00			
<input checked="" type="checkbox"/> toTime	2022-11-01T00:00:00			
Key	Value	Description		

Body Cookies (1) Headers (11) Test Results 200 OK 411 ms 107.13 KB Save Response

```
1  
2 "Service": {  
3   "type": "FeatureCollection",  
4   "features": [  
5     {  
6       "geometry": {  
7         "type": "Point",
```

http://servicemap.disit.org/WebAppGrafo/api/v1/?serviceUri=http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/ARPAT_QA_FI-GRAMSCI&format=json&fromTime=2022-10-01T00:00:00&toTime=2022-11-01T00:00:00

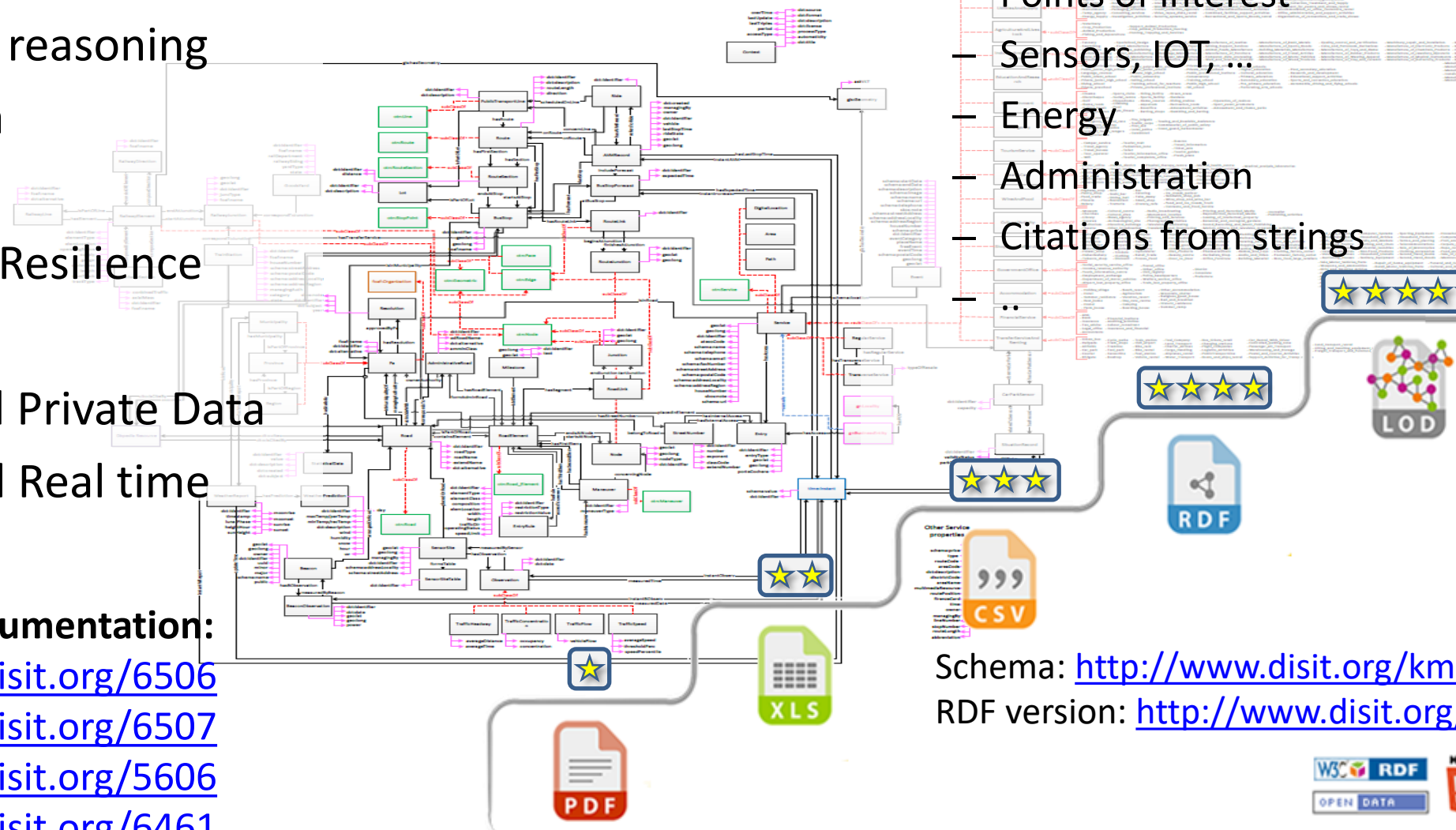


Km4City: Knowledge Base



- 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>



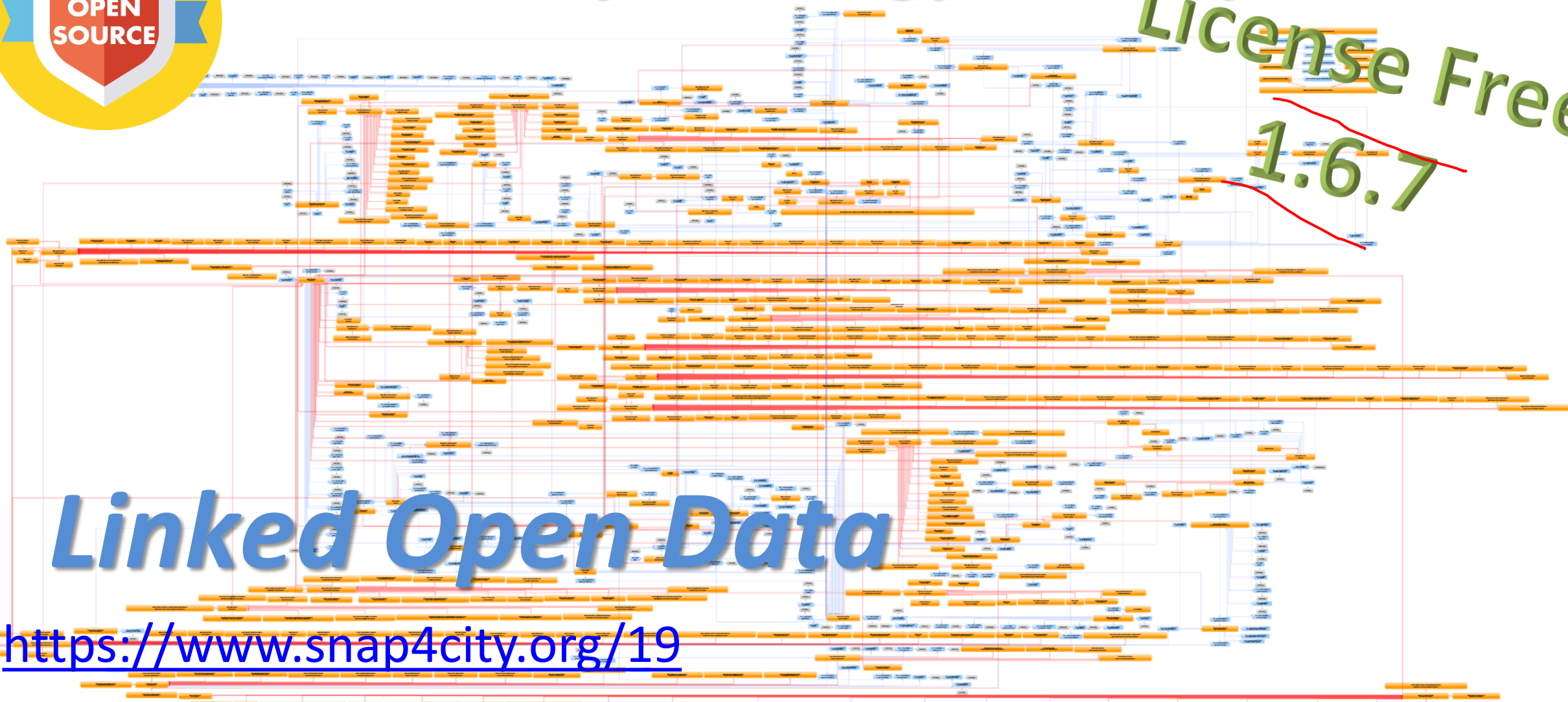
Ontology Documentation:

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



Smart-city Ontology km4city

License Free
1.6.7



Linked Open Data

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

Views of the Knowledge Base

Knowledge Base
Semantic Reasoners



Helsinki KB Service Map

Public transport Municipalities Text Search Address Search Events

Select an agency:
Select a line:
Select a route:
Select a Route:
Select a bus stop:
Select a Stop:

Position of selected Buses

Actual Selection
Service: 373773207E330127

373773207E330127

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

Property/Value Type	Value
PM10	3
PM2.5	2
dateObserved	2019-10-22T07:59:42.939000+00:00
reliability	0.5
source	https://vth.io/.../saatu2019
airQualityPM10Gral	0.2405 @2019-10-22T07:59:42.939000+01:00
airQualityPM10Enfuser	2.8207 @2019-10-22T07:59:42.939000+01:00
RealTimeDeltaAQI	-0.1793 @2019-10-22T07:59:42.939000+01:00
airQualityPM10RealTimeDeltaGral	2.2595 @2019-10-22T07:59:42.939000+01:00
EnfuserAQI	1.1793 @2019-10-22T07:59:42.939000+01:00
airQualityPM2_5Enfuser	0.7086 @2019-10-22T07:59:42.939000+01:00
airQualityPM10RealTimeDelta	-0.1207 @2019-10-22T07:59:42.939000+01:00
airQualityPM10AverageLastHour	2.5 @2019-10-22T07:59:42.939000+01:00
RealTimeAQI	1 @2019-10-22T07:59:42.939000+01:00
airQualityPM2_5AverageLastHour	1.9 @2019-10-22T07:59:42.939000+01:00
airQualityPM2_5RealTimeDelta	1.1914 @2019-10-22T07:59:42.939000+01:00

Linked Open Graph

Select a SPARQL endpoint:
Snap4City SmartCity Ontology (by DISIT)

Your data
Select all: Deselect all
exposedBy
hasAttribute
implements
owl:sameAs
rdfs:seeAlso

Type of relations
Invert
Hide all inverse

LOGraph

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

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: ...

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

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

TOSCANA

PISTOIA

FIRENZE

FIRENZE

MUSEO_SALVATORE...

MUSEO_FERRAGAMO...

RT04801702380TO...

RT048017223494ES...

RT04801708991ES...

RT04801724784ES...

RT04801724785ES...

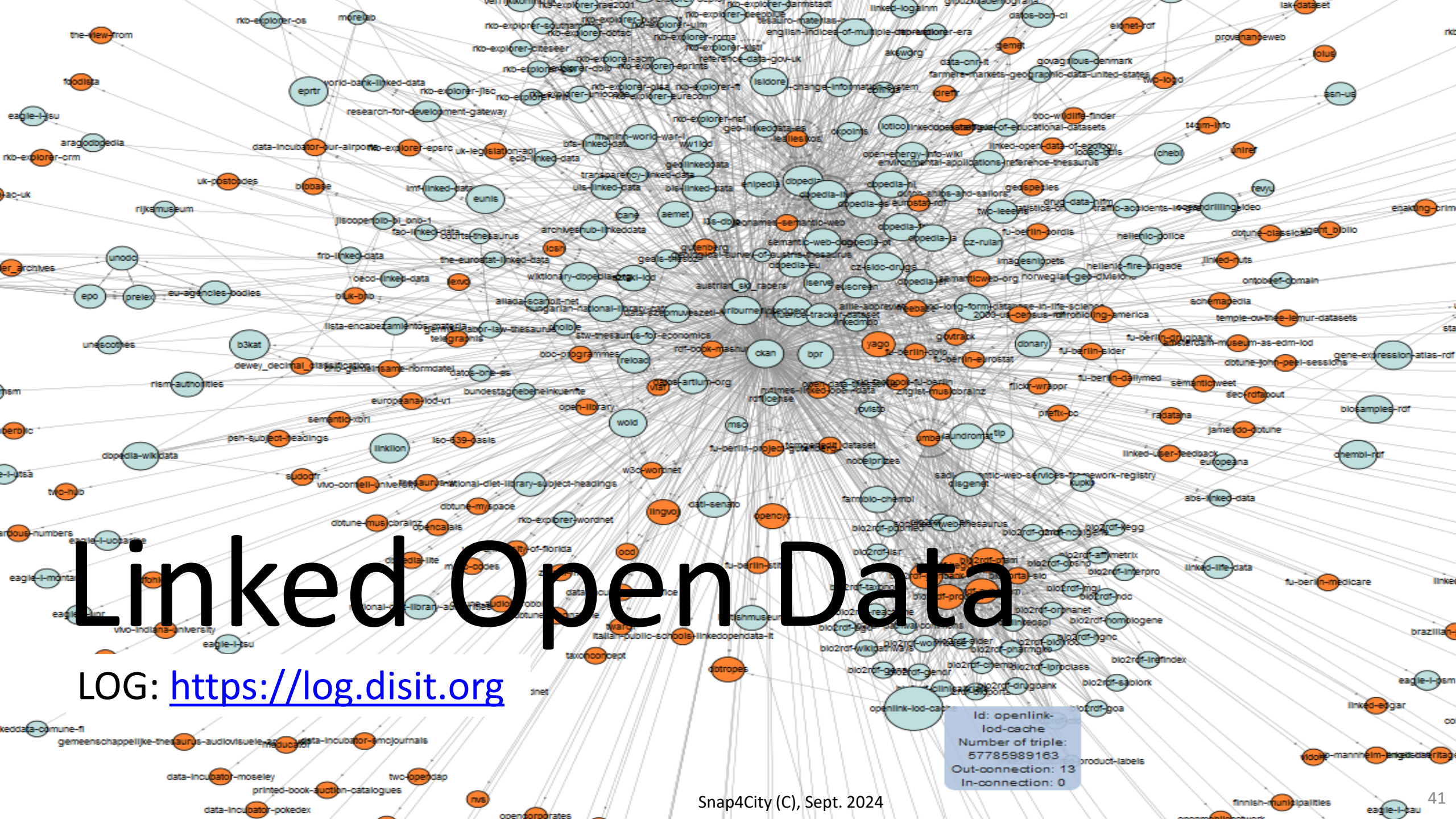
DESCRIPTION

museo ferragamo

Relations of Museo Ferragamo with the road graph

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

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



Linked Open Data

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

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



Some structures from Km4City model

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

The screenshot displays the ServiceMap web application interface. The main map shows a street grid in Florence with various service icons overlaid, including bus stops (red), bike lanes (green), and tram lines (blue). Several information panels are visible:

- Top Left Panel:** Search and filter options for "Fermate Firenze" and "Comuni in Toscana". It includes dropdown menus for "Seleziona una provincia:" (FIRENZE) and "Seleziona un comune:" (FIRENZE). The "Actual Selection" shows "Servizio: PERGOLA".
- Top Center Panel (Giardino di piazza dell'Indipendenza):** Provides details for a specific location, including "Tipologia: Entertainment - Green_areas", "Digital Location", "Indirizzo: PIAZZA DELLA INDIPENDENZA, 15", "Cap: 50129", "City: FIRENZE", "Prov.: FI", and "Note: areeverdi238". It includes a "Rimuovi dalla Mappa" button.
- Center Panel (FERMATA : T1 ALAMANNI):** Lists bus lines: 2, 28, 52, 54. It notes "Dati Real Time al momento non disponibili".
- Center Panel (FERMATA : PERGOLA):** Lists bus lines: 14, 19, 23, 31, 6. It includes a route table:

Linea	Percorso
6 A	NOVELLI → OSPEDALE TORRE GALLI
6 B	NOVELLI → OSPEDALE TORRE GALLI
6 A	OSPEDALE TORRE GALLI → NOVELLI
6 B	OSPEDALE TORRE GALLI → NOVELLI

It also notes "Dati Real Time al momento non disponibili".
- Right Panel (Servizi Regolari / Servizi Trasversali):** A search and filter interface. It includes a search text input, "Categorie Servizi" (De/Select All), and a list of service categories with checkboxes: DigitalLocation, Consulate, Controlled_parking_zone, Cycle_paths, Gardens, Green_areas, Historical_buildings, Library, Literary_cafe, Local_health_authority, Monument_location, Museum, Fresh Place, Road Sensors, and Bus Stops. It also shows "N. risultati for each: Nessun Limite" and "Raggio ricerca: area visibile".
- Bottom Left Panel (Previsioni Meteo):** Shows weather forecasts for the week of Monday to Saturday for the comune of FIRENZE. It includes icons for sun, clouds, and rain, along with temperature ranges (e.g., 23°C / 27°C for Tuesday).
- Bottom Right Panel (Risultati della ricerca):** Shows search results for "Bus Stops: 21 - Linea Bus: 25" and "Direction: LA PIRA → PIAN DI SAN BARTOLO".

The map also features a weather forecast for the week of Monday to Saturday for the comune of FIRENZE, and a search results panel showing "Bus Stops: 21 - Linea Bus: 25" and "Direction: LA PIRA → PIAN DI SAN BARTOLO".

Areas, Bus lines, bike lanes, tram, RTZ, etc.



UNIVERSITÀ
DEGLI STUDI
FIRENZE

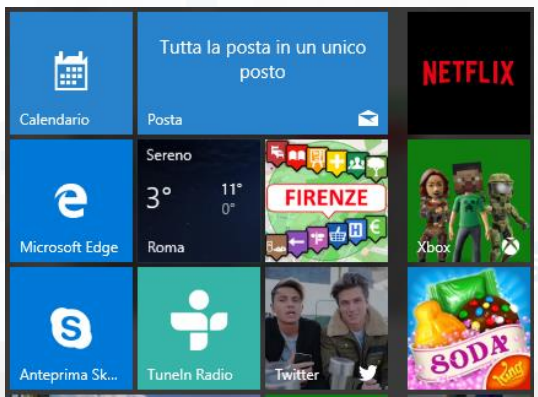
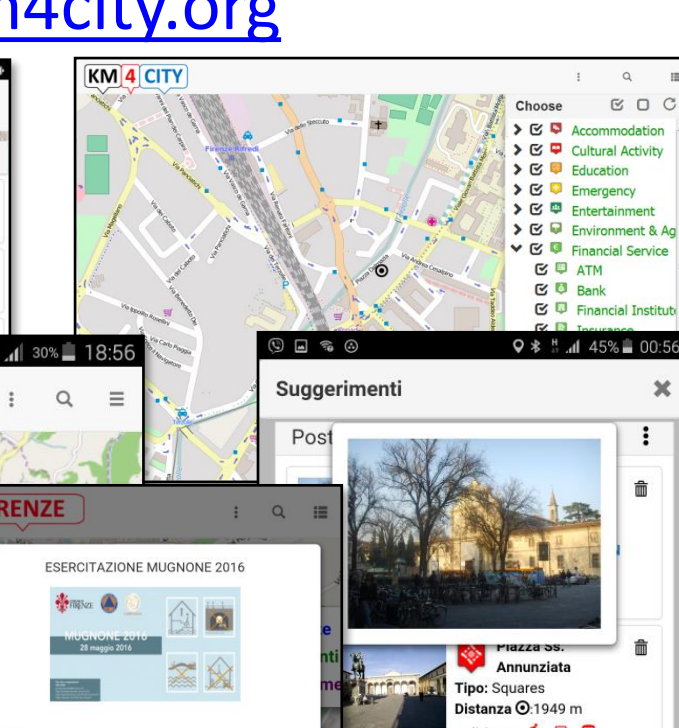
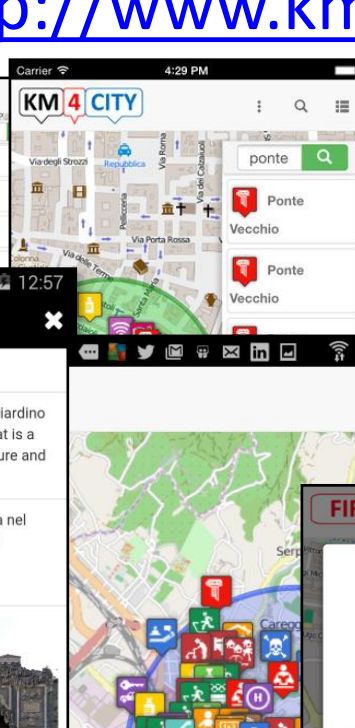
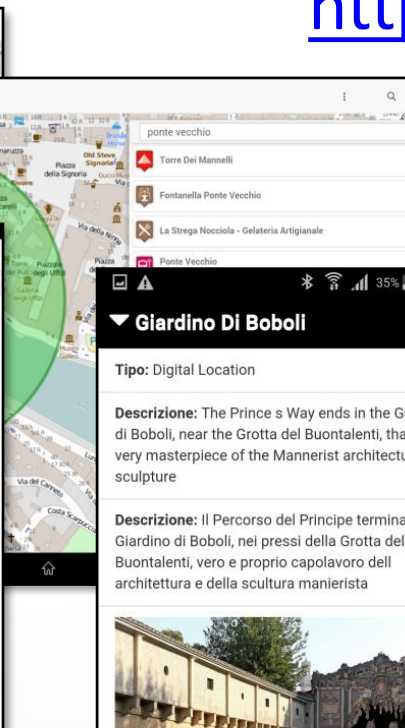
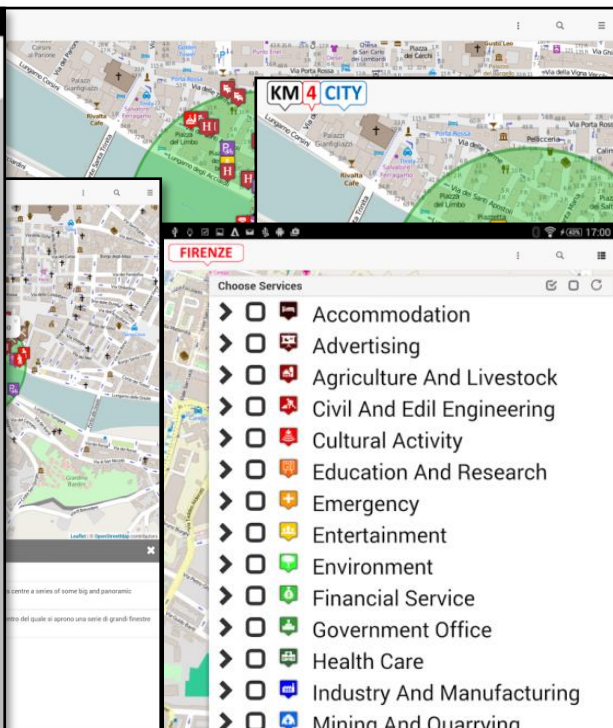
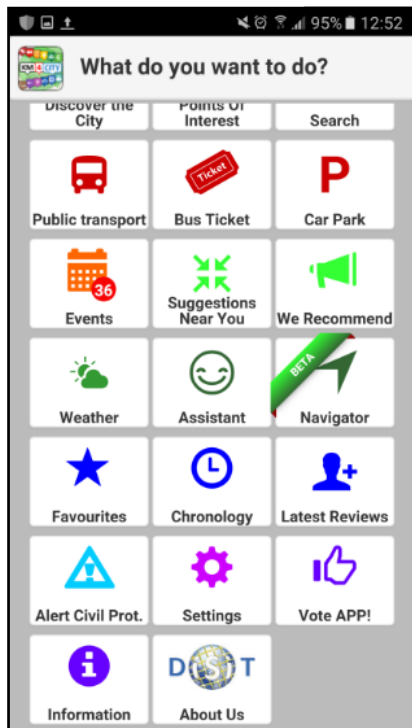
DINFO
DIPARTIMENTO DI
INGEGNERIA
DELL'INFORMAZIONE

DISIT
DISTRIBUTED SYSTEMS
AND INTERNET
TECHNOLOGIES LAB

Km4City Mobile App



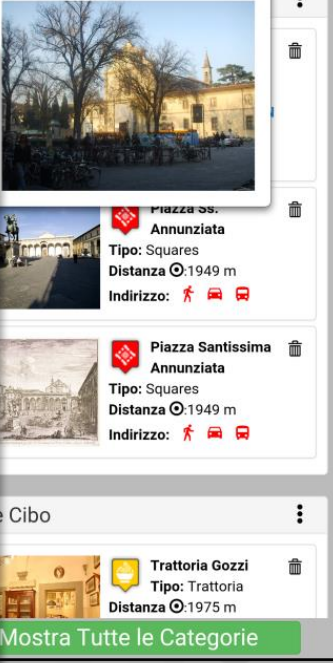
<http://www.km4city.org>



ESERCITAZIONE MUGNONE 2016

prevede: Firenze (FI) (ZONA: A3)

RISCHIO	TEMPI	ALLERTA
IDROGEOLOGICO IDRAULICO RETICOLO MINORE	Dalle ore 13.00 di Venerdì 27 maggio 2016 alle ore 18.00 di Venerdì 27 maggio 2016	GIALLO
IDROGEOLOGICO IDRAULICO RETICOLO MINORE	Dalle ore 18.00 di Venerdì 27 maggio 2016 alle ore 12.00 di Venerdì 27 maggio 2016	ARANCIONE



MicroApplications

Snap4City Micro Applications

User: root@localhost: Org: DISIT Role: RootAdmin, Level: 7

Micro Applications shown include: Advertising and promotion - Toscana, Agriculture And Livestock - DISIT, Air Quality - Antwerp in a Snap, Air Quality - Helsinki in a Snap, Air Quality - Toscana in a Snap, Air Quality Zeebosch - Helsinki in a Snap, and many others.

Micro Applications: Public Transport - Helsinki in a Snap

Map showing bus routes and stations in Helsinki. A sidebar lists bus lines like 'Ruskeasuon Varkko' and 'Hesperon Piste'.

Public Transport

Micro Applications: Travel Planning - Toscana in a Snap

Travel planning interface showing a route between 'VIA MONTEBELLO, 35 FIRENZE' and 'VIA DEL CAMPOFIORE, 106/A FIRENZE'. It includes a map with a highlighted path and a list of stops.

Modal and Multimodal Routing

Micro Applications: Car Parks - Toscana in a Snap

Map showing various parking locations in Toscana. A sidebar lists specific parking areas like 'Firenze Parcheggio Tornaboni' and 'Garage Lungano S.A.S. Di Be'.

Smart Parking

Micro Applications: Environment & Weather

Heatmap and data table for environmental metrics.

PM10	4.911 µg/m³	PM 2.5	2.766 µg/m³
NO2	23.817 µg/m³	Helsinki AQI	1
LAeq (Noise)	52.593 dBA	European AQI	1.078
AQI Enfuser Pred.	1	PM 10 Enfuser Pred.	5.4 µg/m³
PM 2.5 Enfuser Pred.	4 µg/m³	PM 10 GRAL Pred.	0.314 µg/m³

Environment & weather

Advanced Devevelopment Kit features

- **Exploiting Km4City Advanced Smart City API**
 - Open Source: GitHub
 - Multiplatform: exploiting Apache Cordova Framework
 - Active since 2015
 - Adopted by a community of several Projects, Cities and SME
- **Respecting user privacy:**
 - Anonymous usage vs Authenticated usage (OAuth, email, ...)
- **Modular & Dynamic:**
 - Loading new modules from the WEB, and/or creating App by modular approach
- **Personalization and Profiling:**
 - Personalized menu, proposed POI for search
- **Reaching City Users:**
 - Alerting and notifications by location, by user behaviour

Advanced SmartCity API

Swagger

- Search data: by text, near, along, etc.
 - Resolving text to GPS and formal city nodes model
- Empowering city users: contributions, suggestions, forum discussions, etc.
- Events: Entertainment, critical and mobility
- Public and Private Mobility & Transport, and predictions
- POIs, Cultural and Touristic info
- Health services and predictions
- Environmental information, heatmaps; values
- Profiled Suggestions to City Users
- Traffic flow reconstruction
- Personal Assistant: PAVAL
- User Engagement: goal experiences, and assessment
- *Sharing knowledge among cities → see Knowledge base Management*

The screenshot shows the Swagger UI for the Snap4City API. The left sidebar contains a navigation menu with items like 'Dashboards', 'My Dashboards', 'Notifier', 'IOT Applications', 'My Personal Data', 'IOT Directory and Devices', 'Knowledge and Maps', 'Micro Applications', 'External Services', 'Data Set Manager: Data Gate', 'Resource Manager: Process Loader', 'Development Tools', 'R Studio Development', 'ETL Development', 'Knowledge Base Graphs', 'Knowledge Base Queries', 'Smart City API Docs: Swagger', 'Internal API Docs: Swagger', 'Testing API by Postman', 'Source Code Access', 'Management', 'Settings', 'User Management and Auditing', 'Help and Contacts', 'Documentation and Articles', 'My Profile', 'Snap4City portal', 'Km4City portal', and 'DISIT Lab portal'. The main content area is titled 'Smart City API Docs: Swagger' and shows the 'Advanced Smart City API' documentation. It includes a 'Services' section with a list of endpoints and their descriptions, and a 'Parameters' section with a table of parameters.

Name	Description
selection	Through this parameter, the user indicates where the services have to be searched. It could be a boundary within which to search, or a point around which to search.
string	
(empty)	Usages & Sample values:



Snap4City
Smart City API Docs: Swagger

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

- 🏠 Dashboards
- 🏠 My Dashboards
- 🔔 Notificator
- 📁 IOT Applications
- 📁 My Personal Data
- 📁 IOT Directory and Devices
- 📁 Knowledge and Maps
- 📁 Micro Applications
- 📁 External Services
- 📁 Data Set Manager: Data Gate
- 📁 Resource Manager: Process Loader
- 📁 Development Tools
 - 📁 R Studio Development
 - 📁 ETL Development
 - 📁 Knowledge Base Graphs
 - 📁 Knowledge Base Queries
 - 📁 **Smart City API Docs: Swagger**
 - 📁 Internal API Docs: Swagger
 - 📁 Testing API by Postman
 - 📁 Source Code Access
- 📁 Management
- 📁 Settings
- 📁 User Management and Auditing
- 📁 Help and Contacts
- 📁 Documentation and Articles
- 📁 My Profile
- 📁 Snap4City portal
- 📁 Km4City portal
- 📁 DISIT Lab portal

swagger
Select a spec

Advanced Smart City API
Advanced Smart City API
Km4city Web App API
Orion Broker K1-K2 Authentication API

Advanced Smart City API 1.0.0 OAS3

https://www.km4city.org/swagger/external/ascapi-openapi3.json

SMART CITY API WEB DOCUMENTATION

Servers

https://servicemap.disit.org/WebAppGrafo/api/v1

Services ▼

GET / Service discovery and information

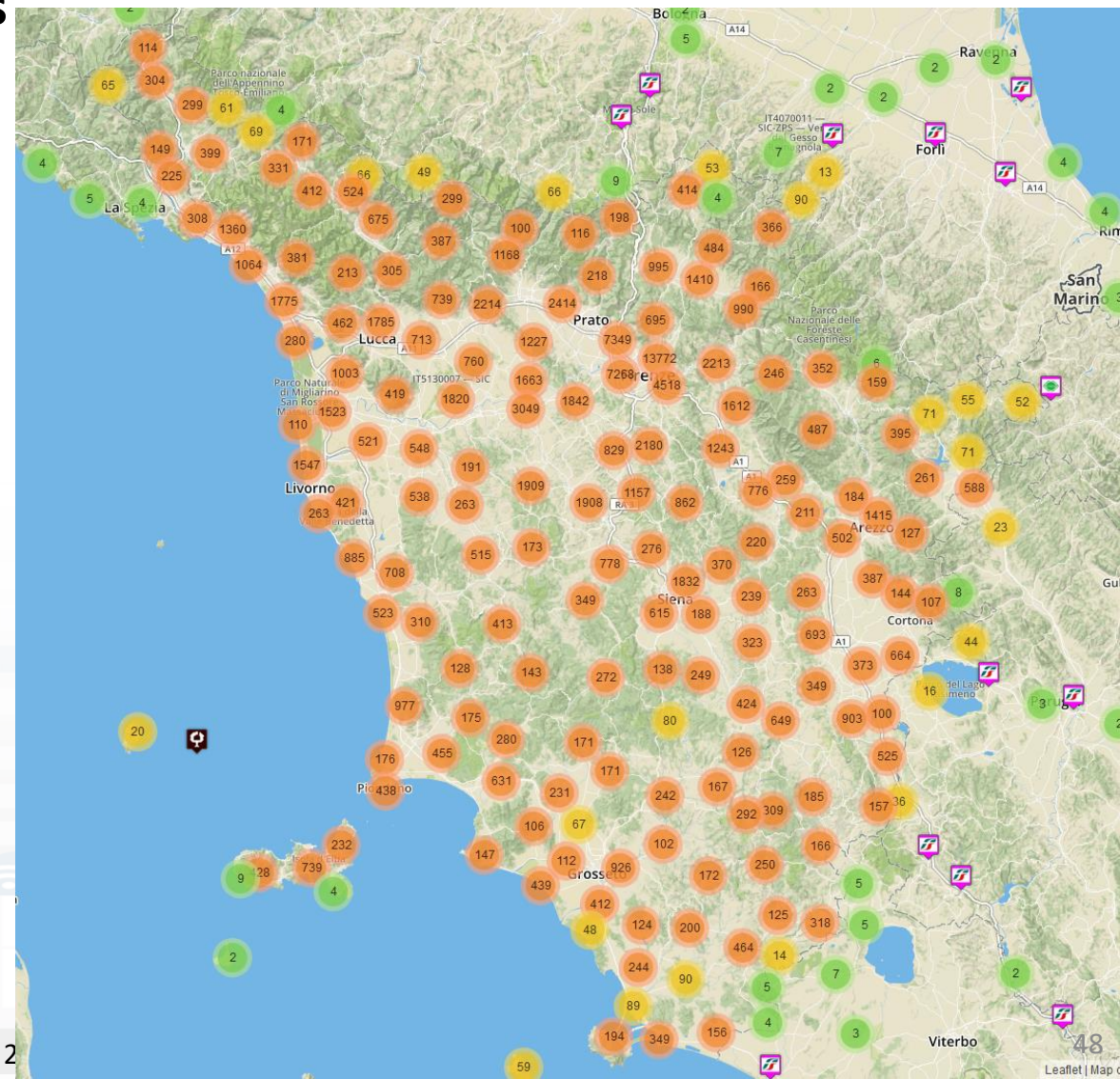
- Service search near GPS position** - It allows to retrieve the set of services that are near a given GPS position. The services can be filtered as belonging to specific categories (e.g. Accommodation, Hotel, Restaurant, etc.), or having specific words in any textual field. It can also be used to find services that have a WKT spatial description that contains a specific GPS position.
- Service search near a service** - It allows to retrieve the set of services that are near a given service identified by its *serviceUri*. The services can be filtered as belonging to specific categories (e.g. Accommodation, Hotel, Restaurant, etc.), or having specific words in any textual field. It can also be used to find services that have a WKT spatial description that contains a specific GPS position.
- Service search within a GPS area** - It allows to retrieve the set of services that are inside a rectangular area. The services can be filtered as belonging to specific categories (e.g. Accommodation, Hotel, Restaurant, etc.), or having specific words in any textual field.
- Service search within a WKT described area** - It allows to retrieve the set of services that are inside a geographic region described using the Well Known Text (WKT) format. The services can be filtered as belonging to specific categories (e.g. Accommodation, Hotel, Restaurant, etc.), or having specific words in any textual field.
- Service search within a stored WKT described area** - It allows to retrieve the set of services that are inside a geographic region described using the Well Known Text (WKT) format, by referring to the WKT with an identifier provided when the WKT is stored. The services can be filtered as belonging to specific categories (e.g. Accommodation, Hotel, Restaurant, etc.), or having specific words in any textual field. The list of available geometries can be retrieved from the [Service Map](#) in the *Search Area* selection box (with *Search Range specific area*). New geometries can be provided using the <http://www.km4city.org/wkt> web service which can store a WKT from a shp file or providing directly the WKT string.
- Service search by municipality** - It allows to retrieve the set of services that are in a specific municipality. The services can be filtered as belonging to specific categories (e.g. Accommodation, Hotel, Restaurant, etc.), or having specific words in any textual field.
- Service search by query id** - It allows to retrieve the set of services associated with a query stored using the [Service Map](#) user interface.
- Full text search** - It allows to retrieve the geolocated entities (not only services) that match with a list of keywords. The results can be possibly filtered to be within a specified distance from a GPS position, or within a rectangular area or inside a WKT geolocated area.
- Service info** - It allows to retrieve information about a service using its *serviceUri*, as an HTML (*format* query parameter set to *html*) or a machine readable JSON document (*format* query parameter set to *json*).

Parameters Try it out

Name	Description
selection string <i>(query)</i>	Through this parameter, the user indicates <i>where</i> the services have to be searched. It could be a boundary within which to search, or a point around which to search.
<i>Usages & Sample values:</i>	

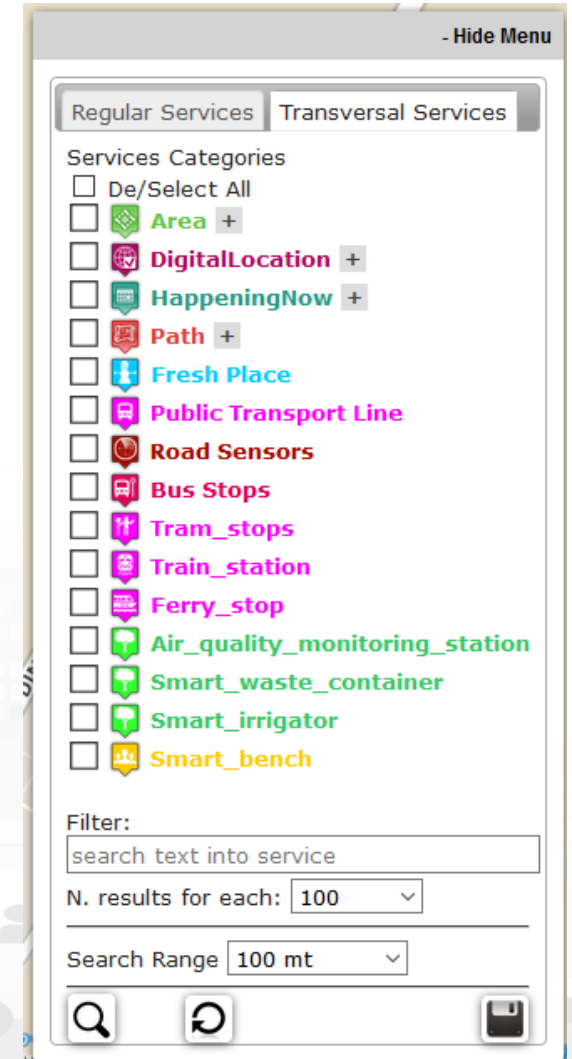
Thematic Data Domain Tuscany

- **Street and geoinformation of the territory and details for routing, navigation, ...**
- **GeoResolution, Environmental data**
- **Mobility and Transport:** public and private, public transport, parking status, fuel stations prices, traffic sensors, etc.
- **Culture and Tourism:** POI, churches, museum, schools, university, theatres, events in Florence
- **Environmental:** pollution real time, weather forecast, etc.
 - Environmental data geo resolution
- **Social Media:** twitter data
- **Health:** hospital, pharmacies, status of the first aid triage in major hospitals, ...
- **Alarms:** civil protection alerts, hot areas, ...



Access to Point of Interest information, POI

- **POI:** point of interest
- **type:** macro and subcategories
- **Position:** GPS, address, telephone, fax, email, URL, ...
- **Description:** textual, multilingual, with images, ...
- **Link to dbPedia, Linked Open Data**
- **Links to other services**
- **Real time data if any:** 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



Concepts of Services: Macro and subcategory

A SKOS area into the Km4City Ontology and Knowledge base for modeling POI and any element on map

Regular Services | Transversal Services

Services Categories

- De/Select All
- Accommodation** +
- Advertising** +
- AgricutureAndLivestock** +
- CivilAndEditEngineering** -
- Architectural_consulting
- Building_construction
- Cartographers
- Civil_engineering
- Engineering_consulting
- Other_specialized_construction
- Specialized_construction
- Surveyor
- Technical_consultants
- CulturalActivity** +
- EducationAndResearch** +
- Emergency** +
- Entertainment** +
- Environment** +
- FinancialService** +
- GovernmentOffice** +
- HealthCare** +
- IndustryAndManufacturing** +
- MiningAndQuarrying** +
- ShoppingAndService** +
- TourismService** +
- TransferServiceAndRenting** +
- UtilitiesAndSupply** +
- Wholesale** +
- WineAndFood** +

20 Service Macro Classes (nature)

Service subClasses, (subnature)

Accommodation -

- Agritourism
- Beach_resort
- Bed_and_breakfast
- Boarding_house
- Camping
- Day_care_centre
- Farm_house
- Historic_residence

Service Information: different kinds of services

AURORA
LINKED OPEN GRAPH
Typology: Accommodation - Hotel
Email: info@hotelaurora.info
Website: www.hotelaurora.info
Phone: 055210283
Address: VIA L. ALAMANNI, 5
Cap: 50100
City: FIRENZE
Prov.: FI

TPL STOP : Piazza Stazione (Fr. Cc)
Vaibus
LINKED OPEN GRAPH
Lines:
FI-LU **FI-VG**
No available routes
Display Bus per page
Search:

Time	Line	Direction
08:48:00	2017-03-20	FI-LU Piazzale Verdi
08:16:00	2017-03-20	FI-LU Piazzale Verdi
10:09:00	2017-03-20	FI-LU Piazzale Verdi
	2017-03-20	FI-LU Piazzale Verdi
	2017-03-20	FI-LU Piazzale Verdi
	2017-03-20	FI-LU Piazzale Verdi

Page 1 of 1
Data currently not available

Loggia San Paolo
LINKED OPEN GRAPH
Typology: CulturalActivity - Monument_location
Digital Location
Address: VIA DELLA SCALA, 3
Cap: 50123
City: FIRENZE
Prov.: FI
Photos:

Description: The rounded arches, the stone skeleton and the glazed terracotta medallions recall the model of the Loggiato degli Innocenti. The medallions in glazed terracotta by Andrea della Robbia and his sons Marco and Luca contain seven polychrome figures of Santi Francescani and two works of mercy Cristo conforta un Giovane and Cristo conforta un Anziano. Beneath the portico can be admired the expressive embrace between San Domenico Guzman and San Francesco d Assisi by Andrea della Robbia

Giardino di piazza dell'Indipendenza
LINKED OPEN GRAPH
Typology: Entertainment - Green_areas
Digital Location
Address: PIAZZA DELLA INDIPENDENZA, 15
Cap: 50129
City: FIRENZE
Prov.: FI
Note: areeverdi238
Remove from map

ZCS_1_D
LINKED OPEN GRAPH
Typology: TransferServiceAndRenting - Controlled_parking_zone
Digital Location
Address: VIA GUSCIANA
Cap: 50124
City: FIRENZE
Prov.: FI
Remove from map

General Text Search Features

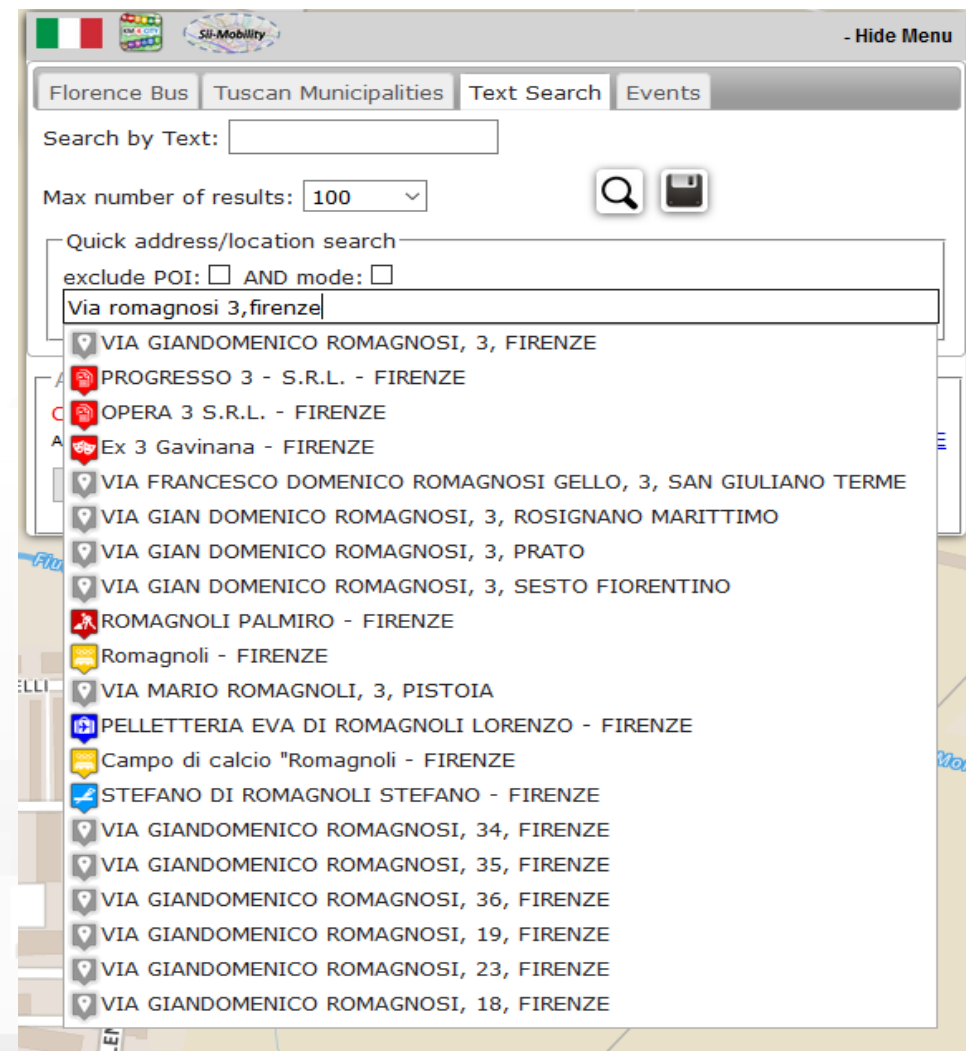
Search by text for POIs via:

- Full text: description, title, macro and category name
- Filtering by macro-cat and subcategory
- Filtering on distance and geometric shape

Search by text with assisted suggestion to get:

- Streets and civic numbers, or POI, locations

Geo resolution, from point to street; from civic to GPS, etc.



Search by Shape (WKT) or Distance

Around a point or POI

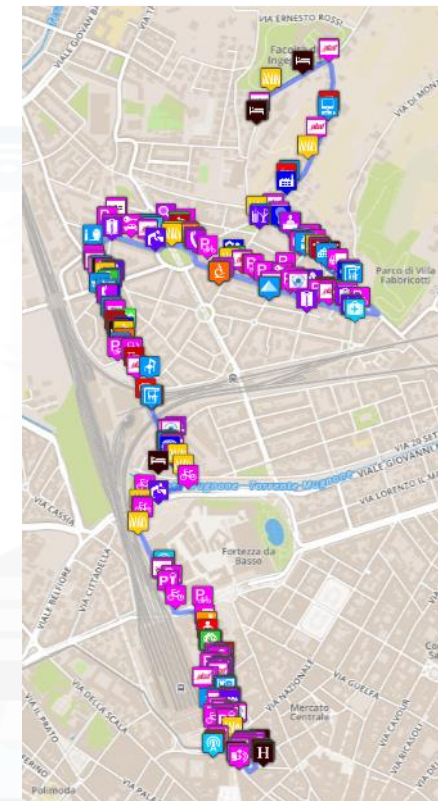
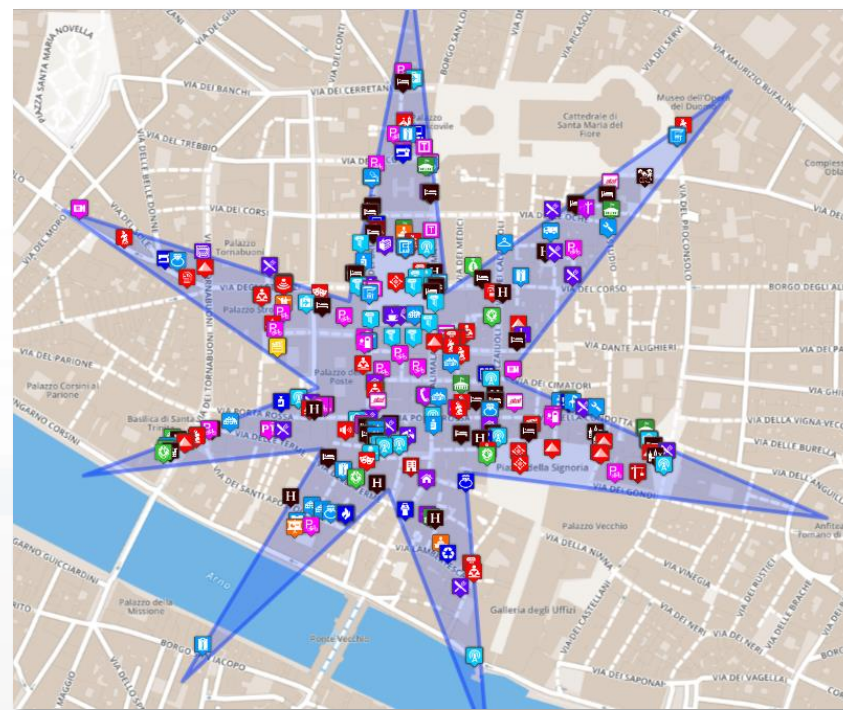
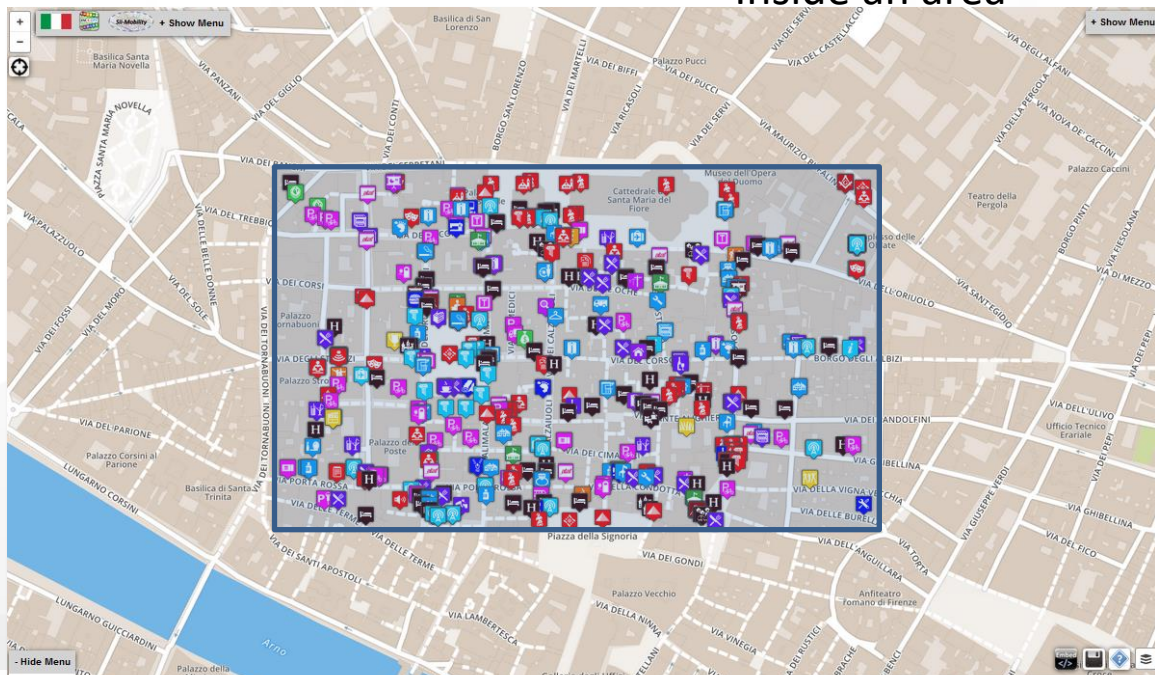


Each request or search in the Km4City model can be referred to a point and a ray, to an area, to a polyline

Inside a closed polyline

Along a polyline

Inside an area





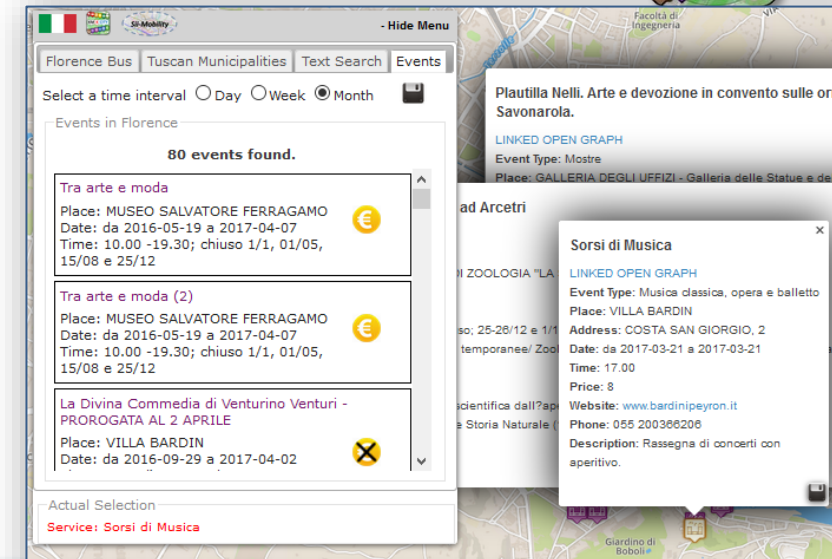
Empowering City Users

- Allow city users to
 - provide comments, images and scores associated with a certain Service (or place, via GPS), discussions on forums, etc.
 - Get list of last contributions of the same kind provided by other users
 - Save favorites
 - Share trajectories,
 - Save and Manage their own data, IOT data, etc.
- Contributions can be:
 - used as feedbacks
 - moderated by a back-office personnel
 - ...
- Connection with powerful servers based on 311 standard it also possible



Access to Event information

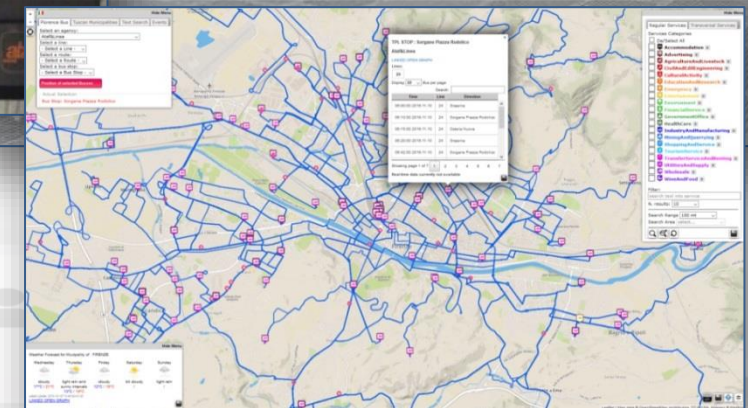
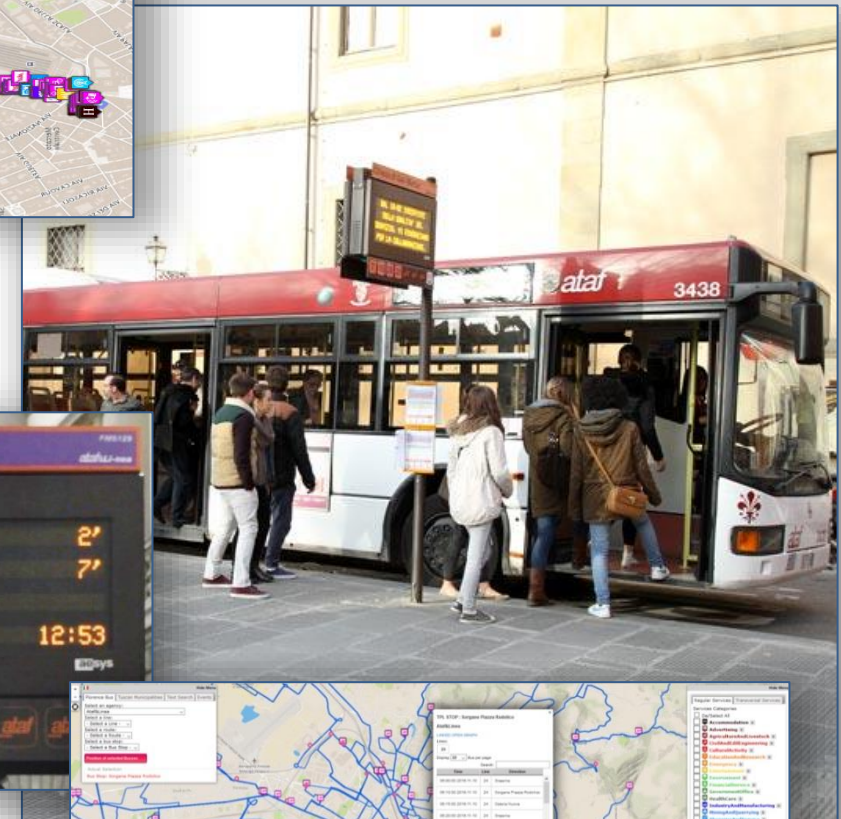
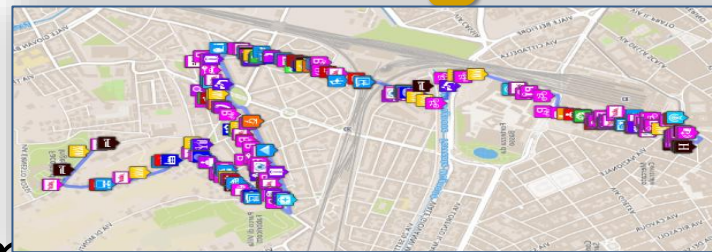
- Getting Traffic Events: ESB, etc.
- Getting Critical Events: CAP standard
- Getting Police events
- Getting Entertainment Events in the city
 - Theater, museum, show, sport, etc.
 - Getting Event details
 - Event kind, and thus ordering
 - in the day, week, and month
 - Location, and thus ordering, or selecting events per area, per residence
 - General information
 - Opening and cost (if any)
 - Etc.



Supporting City Users in using Public Mobility

Public Transportation, PT

- Getting tickets
- Getting bus stops, lines, and timetables for bus, train and tramline (GTFS, ETL, ...)
- Getting Tunnel and Ferry Status
- Searching Services along a Pub. Transport line or closer to a stop
- Searching the closest bus stops
- searching for BUS stops via name
- real time delays of busses
- Modal/multimodal routing for Pub. Transport
- Tracking fleets, trajectories, etc.
- Get connected drive data

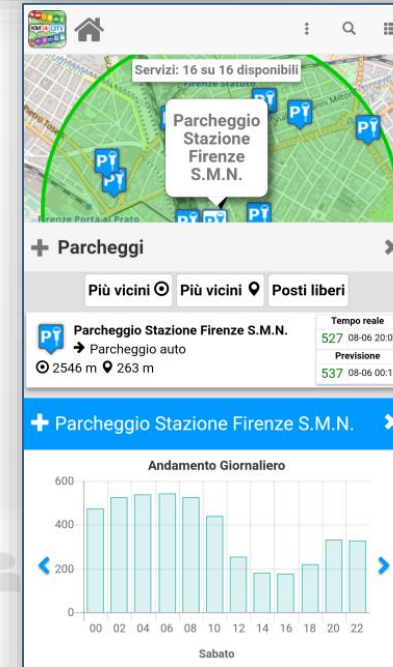
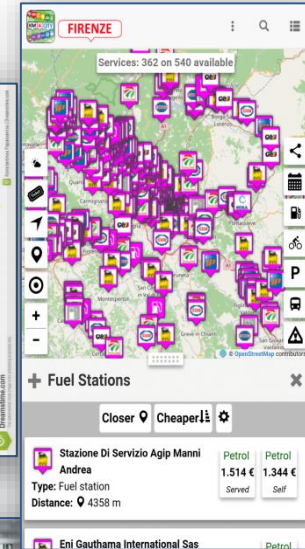




Supporting City Users using Private Mobility

Private Transport

- Parking status (DATEX II, ...)
- Saving car park
- Getting closer parking
- **OBD2 data from your engine or fleet**
- **Getting parking forecast: short and long term**
- Getting closer free space on parking
- Getting **fuel stations** location and fuel product prices
- Getting bike sharing rack status
- Searching Services along a **path** or closer to a point or Service as Hotel, Restaurants, square, etc.
- Getting closer **cycling paths**
- Recharging stations: location and status
- Getting traffic information
- Heatmap where is safer to bike



Private Mobility: routing and navigation paths

To get the path from two points/POIs:

- Shortest for pedestrian
- Quietest for pedestrian
- Shortest for private vehicles
- Multimodal with Public Transportation
- Constrained routing

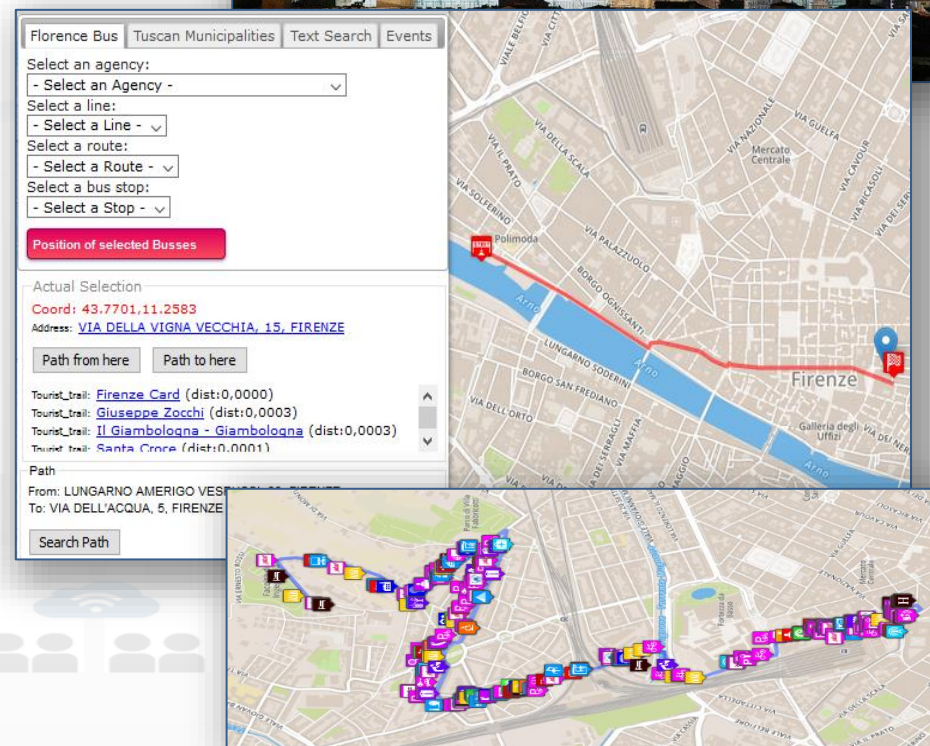
Search for POIs along the identified Path!

<http://www.disit.org/ServiceMap>



New Experience to access at Cultural and Touristic info

- Getting location and description of Point of Interests, POIs: culture and tourism first
 - Location, images, phone, URL, etc.
 - Get image, video, audio, ...
- Search for POIs in areas and closer
- Get routing to reach location or POI by walking downtown
 - searching Services along the path
- Search for location, full text assisted
- Leave a score, take a picture, etc.



New way to access at health services

- Searching for pharmacies and hospitals
- Getting the closest hospital first aid locations and status
- Getting real time updated information about the first aid status of major hospitals (triage)



Servizi: 2 su 2 disponibili

corso
enda
daliera
reggi

Soccorso

Più vicini

Soccorso Azienda Ospedaliera Careggi

on to soccorso

Distanza: 1268 m

Triage

5	23	22	3	0
---	----	----	---	---

+ Pronto Soccorso Azienda Ospedaliera...

Stato Priorità	1°	2°	3°	4°	5°
Con Destinazione	0	1	0	0	0
In Attesa	0	1	1	0	0
In Visita	3	10	11	2	0
Oss. Temporanea	2	11	10	1	0
Totali	5	23	22	3	0

20-03-2017 00:37

I CODICI DEL PRONTO SOCCORSO

CODICE ROSSO EMERGENZA accesso immediato	Casi con pericolo di vita Il trattamento di questi pazienti avviene immediatamente in via prioritaria
CODICE GIALLO URGENZA accesso rapido	Casi con lesioni gravi ed eventuale alterazione di una o più funzioni vitali L'assistenza viene assicurata nel minor tempo possibile
CODICE VERDE URGENZA differibile	Casi in condizioni critiche, ma non in pericolo di vita L'assistenza viene assicurata dopo i casi più urgenti
CODICE AZZURRO NON URGENZA	Casi in condizioni non gravi La prestazione sanitaria è differibile
CODICE BIANCO	Casi con problematiche risolvibili dal medico curante, dalla guardia medica o da ambulatori specialistici Tempi di attesa molto lunghi

Access at Environmental information

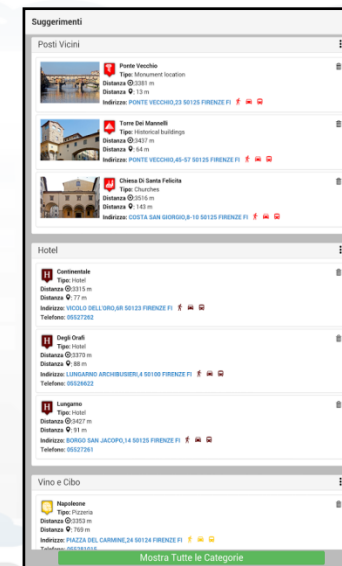
- Getting weather forecast for the next hours and days
- Getting alert information from Civil protection
- Getting air quality status
- Getting Air quality via heatmaps, heatmap animation
- Computing Air quality indexes
- Computing Air quality predictions
- Getting pollination status
- getting actual weather status: temperature, humidity, pressure, rain level, etc.



Profiled Suggestions to City Users

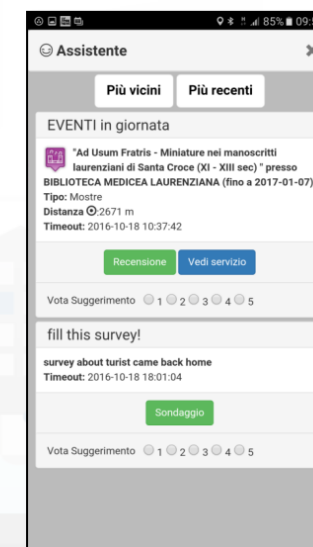
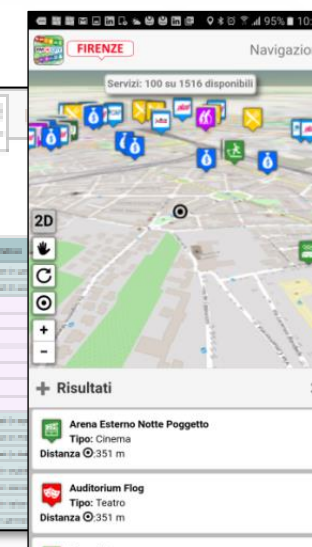
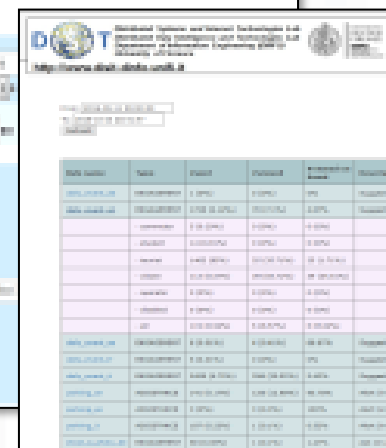
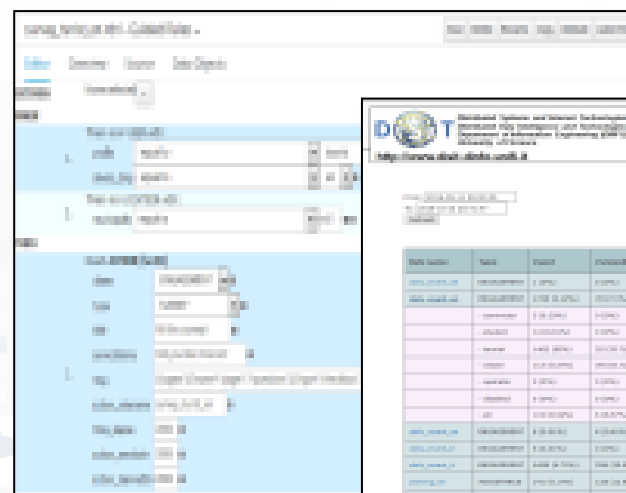
Personalized suggestions

- The server provide suggestions in the user context (location and time) arranged in a number of categories
 - Culture, mobility, food and drink, etc.
 - Alerts: civil protection, city council, twitter data, etc.
- The city user may reject some of them, thus the suggestion engine learns about preferred topics and category



Profiled Engagements to City Users

- The user are profiled to learn habits:
 - Personal POI and paths
 - Mobility habits
- Information and engagements sent to the city users are programmed according to the user evolution to:
 - Stimulate virtuous habits
 - More sustainable habits
 - More healthy habits, etc.
 - Get feedbacks
 - Provide bonus and prices, ...
 - Send alerts, ...

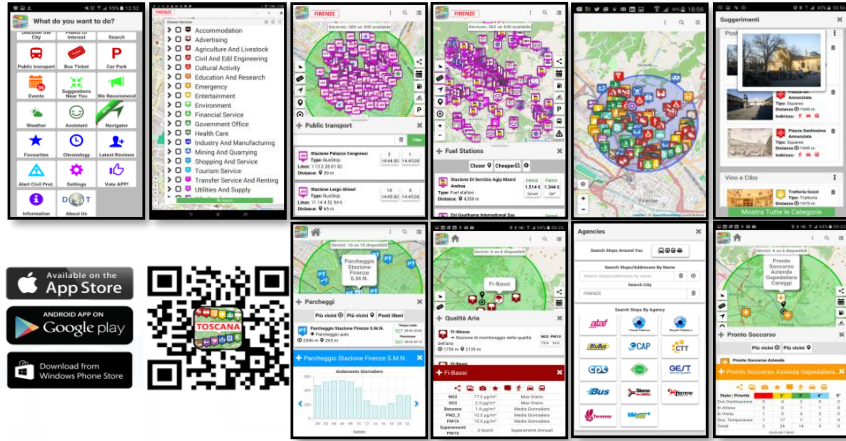


Developing Web and Mobile Apps, MicroApps,..

Mobile Apps

Web App HTML5, MicroApplications

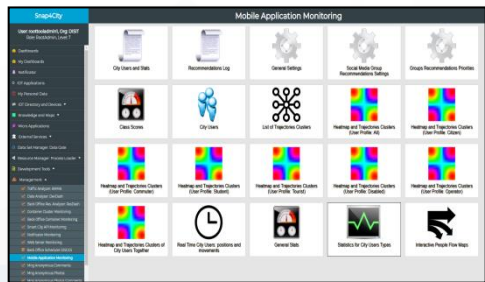
Embed into Web pages



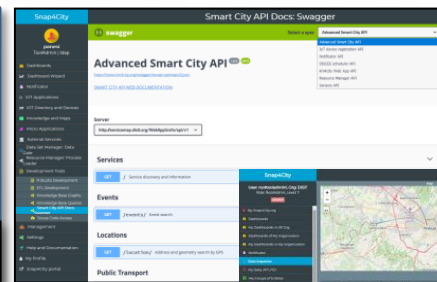
City User



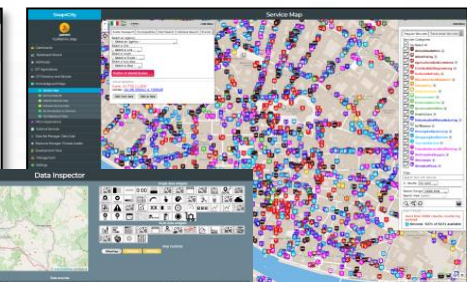
Advanced Smart City API



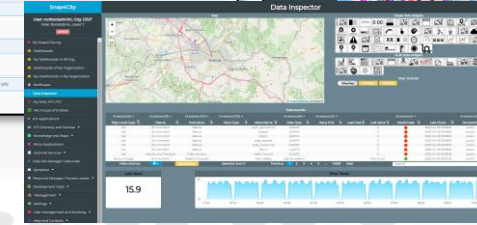
Snap/Km4City
Open Source
development
tool kit



Swagger



ServiceMap



DataInspector

Developer



Mobile Application
Monitoring
Administrator

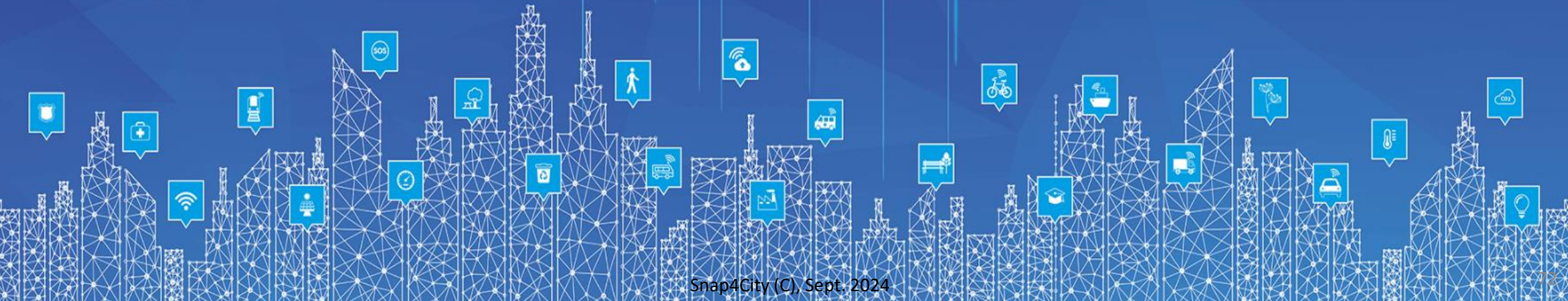
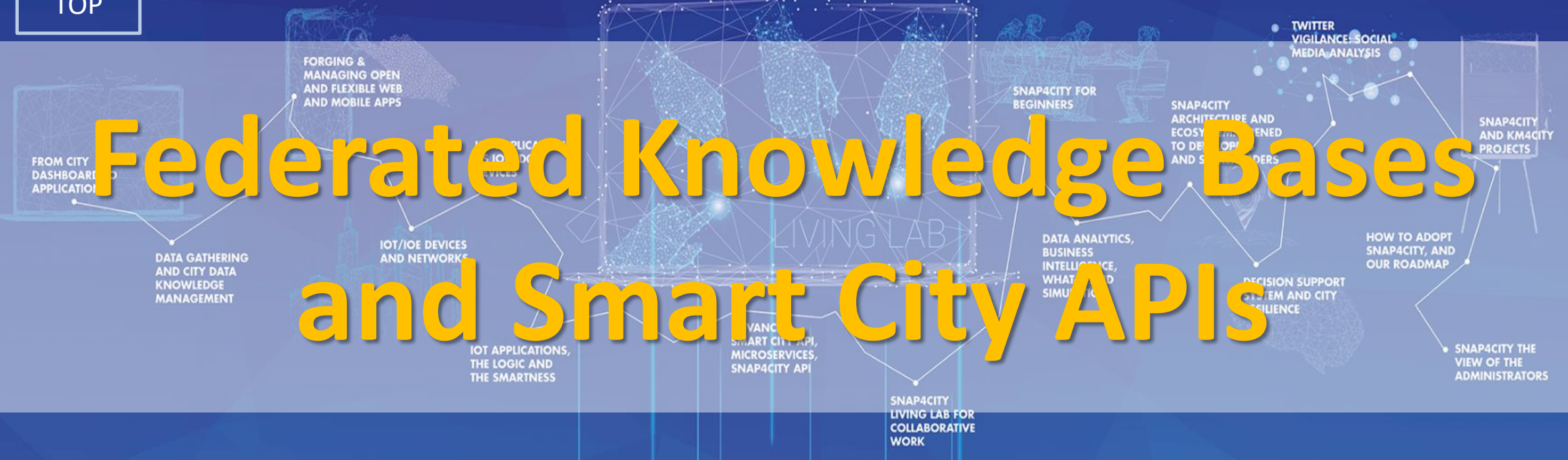


Smart City API

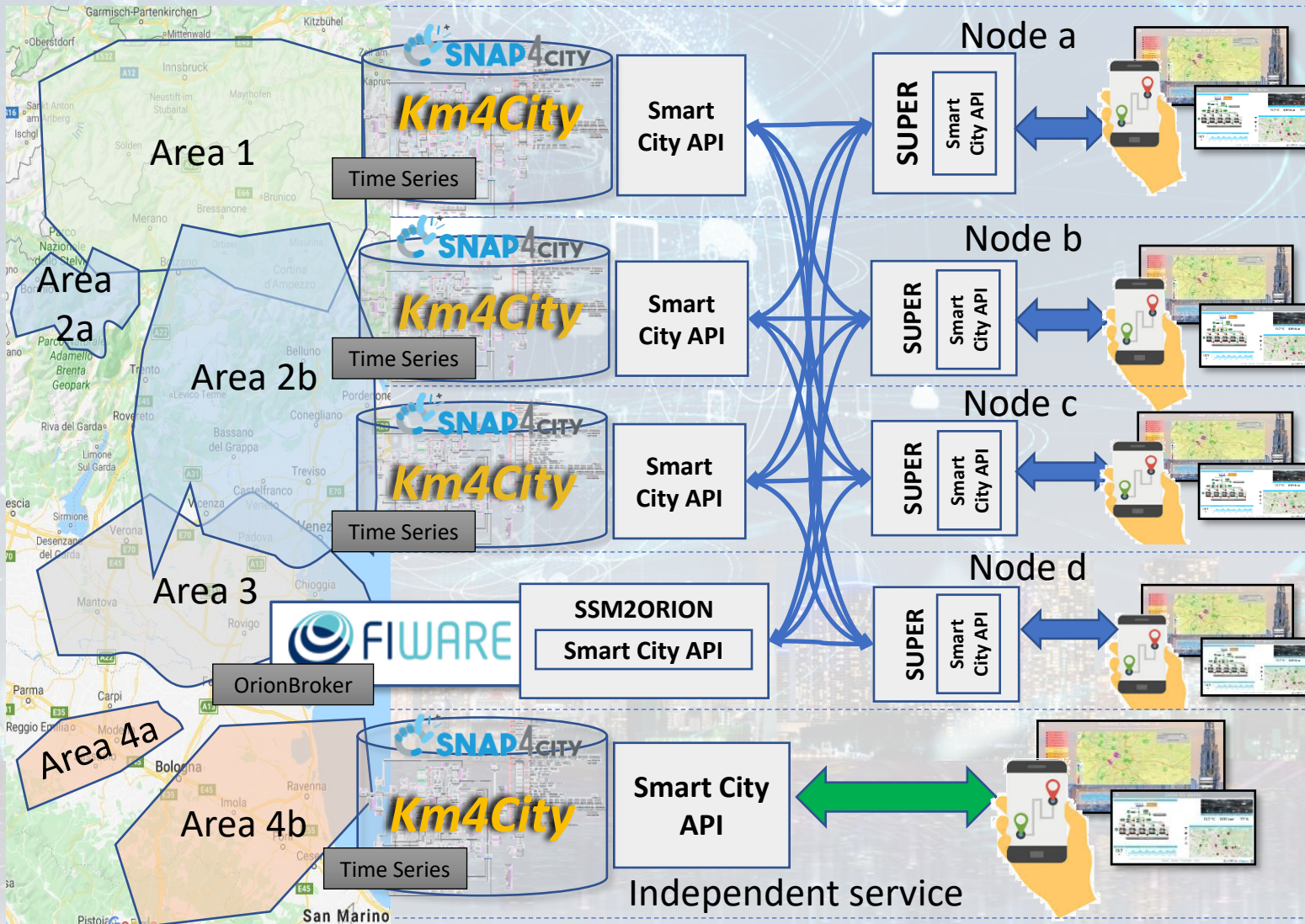
- based on Km4City engine on the back
- documented: <https://www.snap4city.org/404>
- **ServiceMap** tool to generate visually calls to exploit the Smart City API in web and mobile applications
- **Documentation and examples:**
 - [TC5.15 - Snap4City Smart City API Collection and overview, real time](#)
 - [ServiceMap and ServiceMap3D, Knowledge Model, Km4City Ontology](#)
 - [Knowledge Base Graphs and Queries: browsing and queries into the KB](#)
- **The Alternatives:**
 - just Dashboards directly exploiting data on graphics and/or
 - IOT Applications via Node-RED exploiting MicroServices also using the Smart City APIs

TOP

Federated Knowledge Bases and Smart City APIs

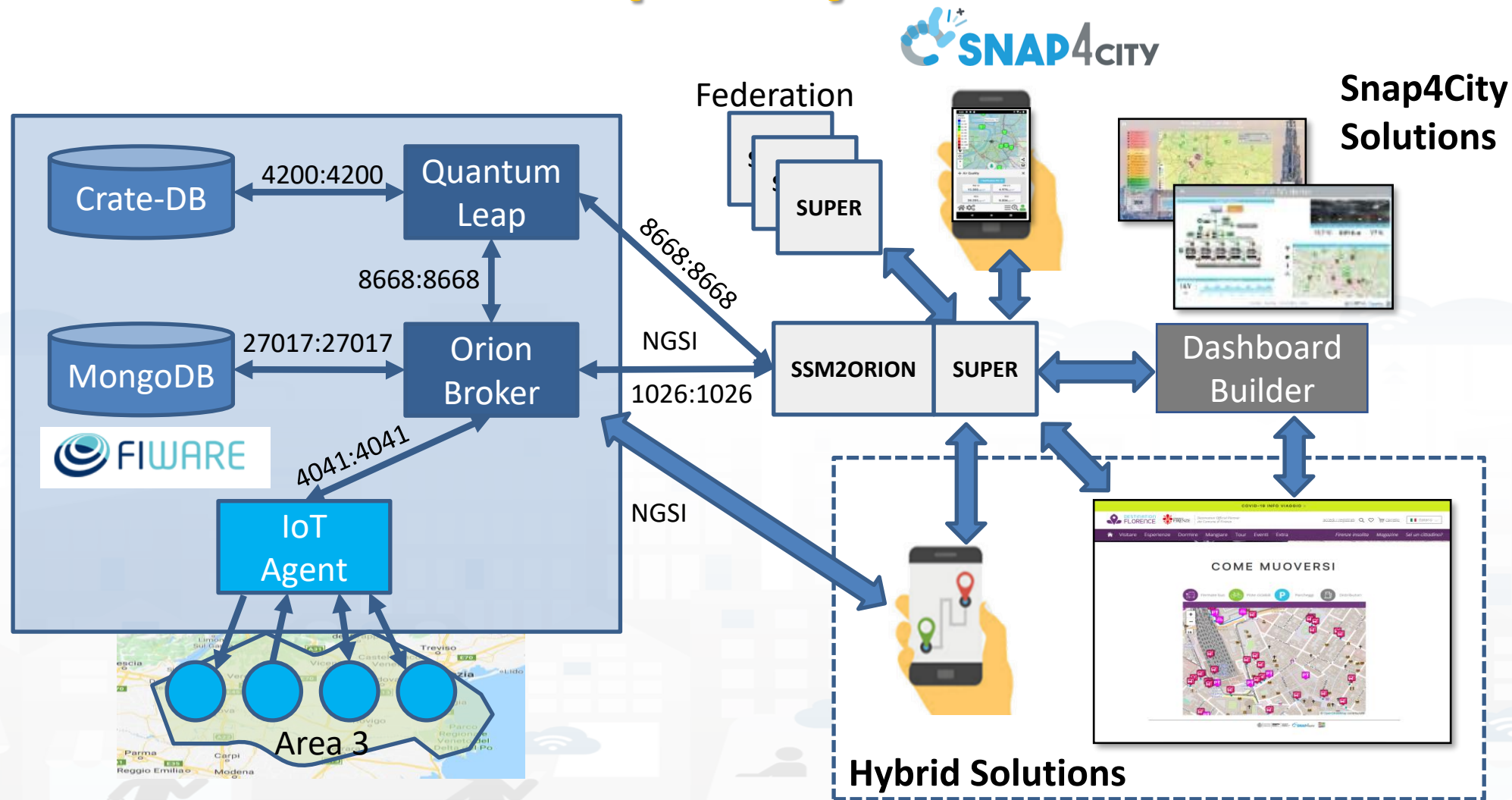


Federation of Smart City Services



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

Federation of Snap4City vs ORION Broker



- 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

Federated ServiceMap and Smart City API

To improve scalability, fault tolerance and federation among cities:

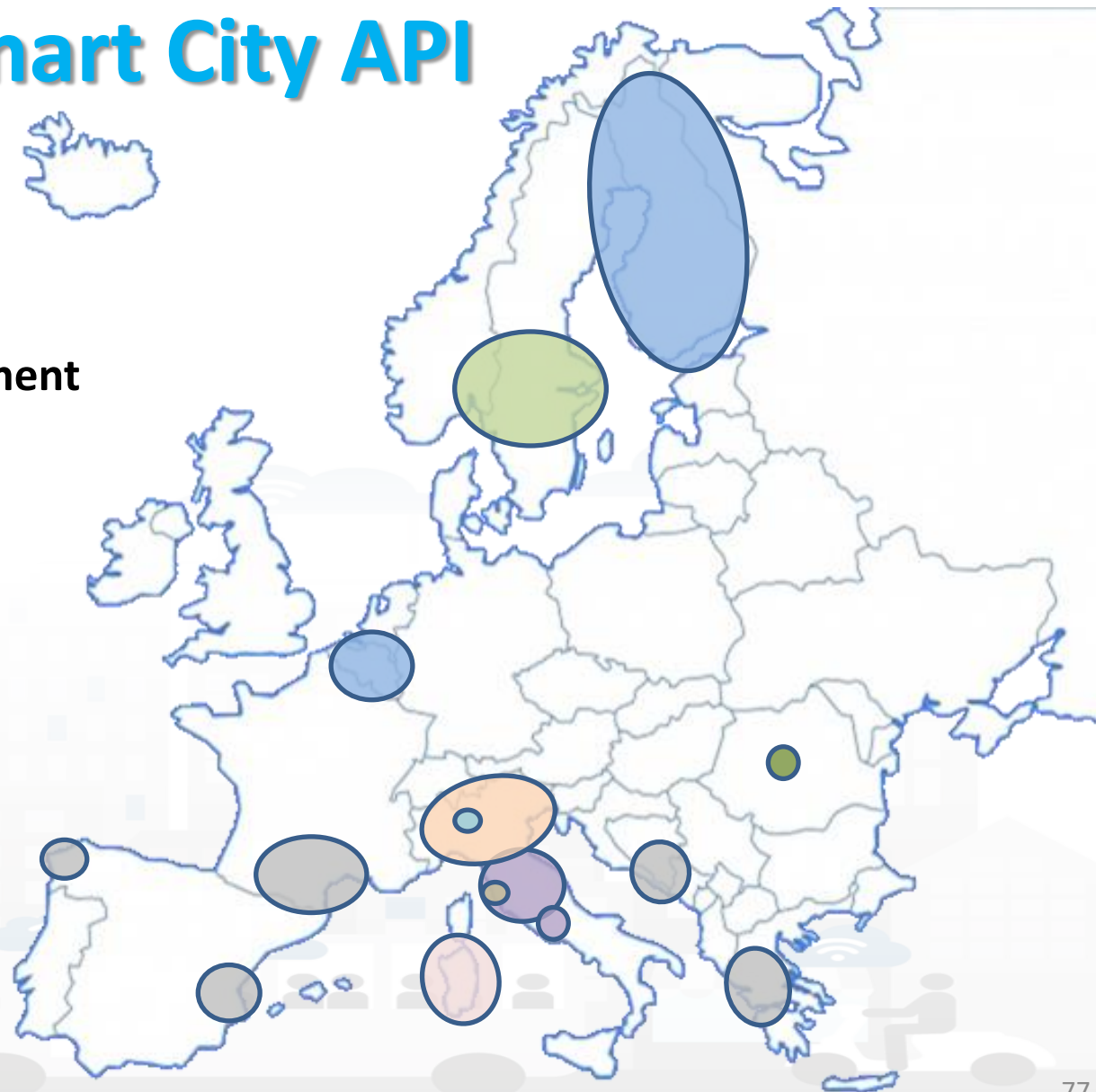
- One entry point Smart City API for all zones
- Multiple Knowledge base See performance assessment

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
- CKAN via harvesting



TOP

Advanced Smart City API

FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS

FROM CITY DASHBOARD TO APPLICATIONS

IOT APPLICATIONS VS IOT EDGE DEVICES

SNAP4CITY FOR BEGINNERS

SNAP4CITY ARCHITECTURE AND ECOSYSTEM. OPENED TO DEVELOPERS AND STAKEHOLDERS

TWITTER VIGILANCE SOCIAL MEDIA ANALYSIS

SNAP4CITY AND KM4CITY PROJECTS

KNOWLEDGE MANAGEMENT

ANALYTICS BUSINESS INTELLIGENCE WHAT-IF AND SIMULATION

DECISION SUPPORT SYSTEM AND CITY RESILIENCE

IOT APPLICATIONS, THE LOGIC AND THE SMARTNESS

ADVANCED SMART CITY API, MICROSERVICES, SNAP4CITY API

SNAP4CITY THE VIEW OF THE ADMINISTRATORS

SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK



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:

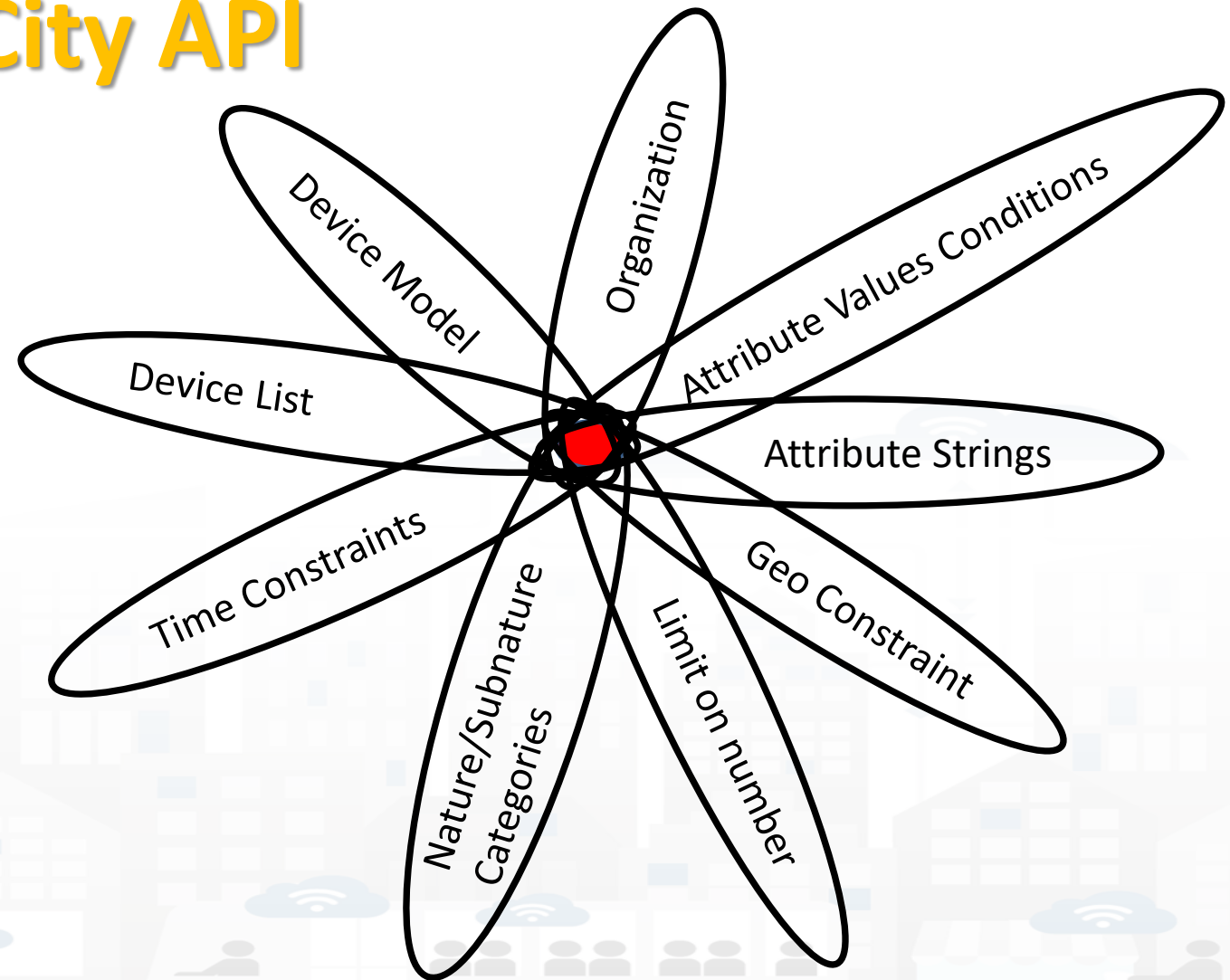
- We suggest you to read the **TECHNICAL OVERVIEW**:
 - <https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf>
- <https://www.snap4city.org>
- <https://www.snap4solutions.org>
- <https://www.snap4industry.org>
- <https://twitter.com/snap4city>
- <https://www.facebook.com/snap4city>
- <https://www.youtube.com/channel/UC3tAO09EbNba8f2-u4vandq>

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

Selection on Smart City API

- Combining different filters for selecting entities from Smart City APIs
- **Be care:** filtering too much may lead to empty set 😊



How to Get the «Query» used in More Options (2a)

- **REST CALL by category → JSON (Options in RED), they are REST ASCAPI calls**
 - **Requesting a category, so that to see all Services of the same category (subNature)**
 - http://svealand.snap4city.org/ServiceMap/api/v1/?selection=59.581458578537955;16.71183586120606;59.62875017053684;16.875171661376957&categories=Street_light&maxResults=100&format=json
 - Please note that in the MoreOption dashboard the GPS area is neglected
 - https://servicemap.disit.org/WebAppGrafo/api/v1/?selection=43.64471;11.005751;43.89471;11.505751&categories=Green_areas&maxResults=200&format=json
 - Please note that in the MoreOption dashboard the GPS area is neglected
 - Custom PINS note: “selection” coordinates are used for collecting attributes in custom PINS. Other options such as “maxDists” cannot be used in custom PIN. All parameters can be used in other cases.
 - Different KB links are identified by their ASCAPI links: svealand.snap4city.org, servicemap.disit.org,
 - **Requests to SuperServiceMap for the network of Federated KBs by using /api/.....**

Without prefixed KB to obtain merged results from more KBs. For example as:

 - /api/v1/?categories=Air_quality_monitoring_station&format=json
 - Please note that the direct links to the superservicemap can be of the form:
 - <https://www.disit.org/superservicemap/api/v1/?>

How to Get the «Query» used in More Options (2b)

- **REST CALL by ServiceURI → JSON (ServiceURI in RED), they are ASCAPI calls**
 - Requesting **single Service**
 - https://servicemap.disit.org/WebAppGrafo/api/v1/?serviceUri=http://www.disit.org/km4city/resource/ARPAT_QA_FI-BOBOLI&format=json
 - https://servicemap.disit.org/WebAppGrafo/api/v1/?serviceUri=http://www.disit.org/km4city/resource/ARPAT_QA_FI-MOSSE_SV&format=json
 - Different KBs links are identified by their ASCAPI links: svealand.snap4city.org, servicemap.disit.org,
 - Requesting all IoT Devices that have been produced by the same **Model**
 - <https://www.disit.org/superservicemap/api/v1?selection=59.36535064975547;13.457822799682619;59.39031474260852;13.566999435424806&model=SmartLightCapelon&format=json>
 - Please note that in this case the call is performed on the superservicemap, you can change to go directly on the right KB
 - You can specific both category and model to be more precise and focused.
 - https://www.disit.org/superservicemap/api/v1/?selection=36.8092847020594;12.216796875000002;42.71473218539458;32.03613281250001&categories=Travel_information&format=json&fullCount=false&maxResults=500&model=DOMESTIC_MOVEMENTS2013-2018_1620304406
 - In this case, we have a double filtering for model and for categories, plus other constraints
 - Please note that in the MoreOption dashboard the GPS area is neglected

How to Get the «Query» used in More Options (2c)

- Requesting get data single device (view on map, if format HTML and not JSON)

Request to see the single device:

- <https://svealand.snap4city.org/ServiceMap/api/v1/?serviceUri=http://www.disit.org/km4city/resource/iot/orionCAPELON-UNIFI/CAPELON/5C0272FFFE894AF7&format=json&fromTime=3-day>
- With ServerURI: <http://www.disit.org/km4city/resource/iot/orionCAPELON-UNIFI/CAPELON/5C0272FFFE894AF7>
- From KB: <https://svealand.snap4city.org>

<https://svealand.snap4city.org/ServiceMap/api/v1/?serviceUri=http://www.disit.org/km4city/resource/iot/orionCAPELON-UNIFI/CAPELON/5C0272FFFE894AF7&format=json&fromTime=3-day>

```
{ "Service":  
  {"type": "FeatureCollection",  
   "features": [  
     {  
       "geometry": { "type": "Point", "coordinates": [ 13.46701, 59.37458 ] },  
       "type": "Feature",  
       "properties": { "serviceUri": "http://www.disit.org/km4city/resource/iot/orionCAPELON-UNIFI/CAPELON/5C0272FFFE894AF7",  
                     "serviceType": "Environment_Smart_street_light",  
                     "name": "5C0272FFFE894AF7",  
                     "typeLabel": "Smart street light",  
                     "protocol": "ngsi",  
                     "format": "json",  
                     "model": "SmartLightCapelon2",  
                     "producer": "Capelon",  
                     "macaddress": "",  
                     "brokerName": "orionCAPELON-UNIFI",  
                     "ownership": "public",  
                     "organization": "CAPELON",  
                     "description": "",  
                     "website": "",  
                     "maintenanceUrl": "",  
                     "maxCapacity": "",  
                     "minCapacity": "",  
                     "isMobile": "",  
                     "nature": "Environment",  
                     ....  
                     ....  
                   }  
     }  
   ]  
}
```


Query by value

Queries can be complex *by geo-area, by category, by IoT Device Model, a list of ServiceURI (all the same kind), with filters by value on specific Variables (numeric, and textual in AND), QUERY:*

- <https://www.snap4city.org/superservicemap/api/v1/iot-search/?selection=43.77;11.2&maxDists=700.2&model=CarPark>
- <https://www.snap4city.org/superservicemap/api/v1/iot-search/?selection=42.014990;10.217347;43.7768;11.2515&model=metrotrafficsensor&valueFilters=vehicleFlow>0.5;vehicleFlow<300>
- <https://www.snap4city.org/superservicemap/api/v1/iot-search/?selection=43.77;11.2&maxDists=200.2&model=metrotrafficsensor&valueFilters=vehicleFlow>10;vehicleFlow<400&serviceUri=http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO1;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO10;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO11;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO13;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO14;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO15;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO16;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO17;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO18;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO19;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO2;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO20;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO21;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO22;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO23;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO24;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO25;http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/METRO26>

How to Get the «Query» used in More Options (3)

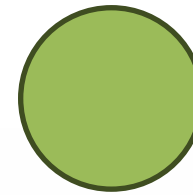
- **ServiceMap (specific KB) and Query service**
 - The Query performed is saved and can be recalled with a QueryID, valid for that specific KB, and not accessible via SuperServiceMap / Federated KB
 - The QueryID is communicated via email
 - Specific REST Call with HTML is also provided to change the Query in server associated with the QueryID received
- **Query ID (only Read and Read/Write of the query)**
 - <https://servicemap.disit.org/WebAppGrafo/api/v1/?queryId=1c8111893d40a2bb07a2078ffe299ced&format=json>
 - Cannot be used for Custom PINs.
 - **Cannot be used to get data via ServiceMap since the Query ID is KB based**

Special Commands in «Query» of More Options (4)

- **Commands for Special Tool:**
 - **Traffic Flow** tool: <https://firenzetraffic.km4city.org/trafficRTDetails/roads/read.php>
 - **Scenario** tool: </scenario/>
 - **Whatif** tool: </whatif/>
- **Heatmaps**, see Data Analytic part of the training for the several versions which can be used:
 - https://wmsserver.snap4city.org/geoserver/Snap4City/wms?service=WMS&layers=PM2_5Average24HourFlorence
 - https://wmsserver.snap4city.org/geoserver/Snap4City/wms?service=WMS&layers=denseNO2_Firenze_IDW
 - WMSServer that is a GeoServer may be different for different installations of Snap4City

Time Series Data Access

- Time Series are attached to Devices which are identified by ServiceURI
- To **Access at the Time Series** (also called real time data) you can:
 1. From IoT App use the block «service info dev» In this case, you automatically access to your private and delegated data. You do not need to perform the authentication since it is performed directly from the microservice IoT App context, both on cloud and on edge
 2. From Python/Rstudio, Web and Mobile App, you can call Smart City API, see in this section and in **Part 7 of the course**.
 3. Retrieve data from IoT App and pass them to Python/Rstudio as presented in other sections. This approach is viable for small amount of data, such as some thousands. For larger amount of data or to be more efficient we suggest to use case (2) which is a direct access to the Smart City API.



IoT Search API (Search Entities)

- These API allows to find «IoT devices» matching a specific query on the dynamic data
 - On the last values
 - On a temporal range
- For example:
 - Find all weather sensors with a last temperature value greater than 35
 - Find all weather sensors that last week had a temperature greater than 38
- The API over a temporal range can return the list of matching devices or a list of dynamic data records matching the query
 - the list of times when temperature was greater than 38
- These APIs for performance reason query only the OpenSearch index and have some limitations

IOTSearch APIs

- The base url is <https://www.snap4city.org/superservicemap/api/v1/iot-search/?...>
- Query params are similar to other apis:
 - **selection=...**
 - A GPS point <latitude>;<longitude>
 - A GPS rectangular area <lat1>;<long1>;<lat2>;<long2>
 - A service uri (uses its lat;lon position)
 - More complex geographic filters are not supported
 - **maxDists=..**
 - Maximum distance in km from the GPS point (default 0.1 km)
 - **categories=...**
 - A list of categories as nature and subnature separated by ";
 - **model=...**
 - Search for devices of a specific model (only one allowed)
 - **serviceUri=<suri1>;<suri2>...**
 - Filters on specific service uris
 - **text=...**
 - Filters using keywords and phrases to be searched in any string value of the device (phrases are delimited by "...")
 - **valueFilters=<cond1>;<cond2>;...**
 - A set of conditions in AND on specific values (the verification of equal condition is «=» or «:» depending on the data type)
 - **<value name>:<string>** (ex. Status:Active)
 - **<value name>{=|<|<=|>|=|>}<number>** (ex. temperature>38)

- **Other query params:**

- **fromResult=...**

- Start from a result at a given position (starting from 0)

- **maxResults=...**

- Maximum number of results returned (default 100)

- **values=...**

- Report data of only specific fields, separated by «;» (e.g. temperature;humidity) if omitted all fields are reported

- **sortOnValues=...**

- Allow to sort results on a specific field, if omitted are sorted by distance from the GPS point, adding «:asc» or «:desc» sort direction can be provided (e.g. temperature:asc)

- **notHealthy=true**

- Reports only sensors that are now considered unhealthy as have not provided data in the expected next time

- **For more details see the documentation:**

https://www.km4city.org/swagger/external/#/IOT_Search/get_iot_search

IoTSearch Example

- Find all **weather sensors** with last values of **temperature** in [25,30] and **humidity** greater than 50
- **GET** https://www.snap4city.org/superservicemap/api/v1/iot-search/?categories=Weather_sensor&valueFilters=temperature>=25;temperature<=30;humidity>50
- Only GeoJSON response
- https://www.snap4city.org/superservicemap/api/v1/iot-search/?categories=Weather_sensor&valueFilters=temperature>=25;temperature<=30;humidity>50


```
snap4city.org/superservicemap/ x +
snap4city.org/superservicemap/api/v1/iot-search/?categories=Weather_sensor&valueFilters=temperature...
App Maps Google Gmail Snap4City Snap4 Calendar Translate Google Scholar Cita... DISIT DISIT

{
  "features": [
    {
      "geometry": {
        "coordinates": [
          10.5224,
          43.794
        ],
        "type": "Point"
      },
      "properties": {
        "date_time": "2023-07-27T08:30:00.000Z",
        "deviceModel": "SirSensors",
        "deviceName": "SIRSensor_TOS11000512",
        "expected_next_date_time": "2023-07-27T08:45Z",
        "nature": "Environment",
        "organization": "DISIT",
        "serviceUri": "http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/SIRSensor_TOS11000512",
        "subnature": "Weather_sensor",
        "values": {
          "dateObserved": "2023-07-27T08:30:00.000Z",
          "humidity": 57,
          "rainDelta15": 0,
          "temperature": 28.6,
          "windDirection": 346,
          "windGust": 3.4,
          "windSpeed": 1.8
        }
      },
      "type": "Feature"
    },
    {
      "geometry": {
```

Results

```
{  
  "fullCount": 49,  
  "type": "FeatureCollection"  
  "features": [ {  
    "type": "Feature"  
    "geometry": { "type": "Point", "coordinates": [10.5224,43.794] },  
    "properties": {  
      "date_time": "2023-07-26T07:00:00.000Z",  
      "deviceModel": "SirSensors",  
      "deviceName": "SIRSensor_TOS11000512",  
      "expected_next_date_time": "2023-07-26T07:15Z",  
      "nature": "Environment",  
      "organization": "DISIT",  
      "serviceUri": "http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/SIRSensor_TOS11000512",  
      "subnature": "Weather_sensor",  
      "values": {  
        "dateObserved": "2023-07-26T07:00:00.000Z",  
        "humidity": 59,  
        "rainDelta15": 0,  
        "temperature": 27,  
        "windDirection": 340,  
        "windGust": 2.2,  
        "windSpeed": 1.3  
      }  
    }  
  }  
},
```


Results pagination

- Results can be paginated using
 - fromResult=... (first result to be returned starting with 0)
 - maxResults=... (page size)
- The total results is reported in the fullCount field of the results.
- To get page p (1..n) of results (with page size 50)
 - ...?...&fromResult=($p-1$)*50&maxResults=50

IoTSearch over time Example

- Find all instants where a **weather sensor** has **temperature** in [25,30] and **humidity** greater than 50 in the last 7 days
- GET https://www.snap4city.org/superservicemap/api/v1/iot-search/time-range/?fromTime=7-day&categories=Weather_sensor&valueFilters=temperature>=25;temperature<=30;humidity>50
- Only GeoJSON response
- https://www.snap4city.org/superservicemap/api/v1/iot-search/time-range/?fromTime=7-day&categories=Weather_sensor&valueFilters=temperature%3E=25;temperature%3C=30;humidity%3E50

Results

```
{  
  "fullCount": 122339,  
  "type": "FeatureCollection"  
  "features": [ {  
    "type": "Feature",  
    "geometry": { "coordinates": [ 9.23375, 45.47745 ], "type": "Point" },  
    "properties": {  
      "deviceModel": "Arduino Uno",  
      "deviceName": "station01",  
      "nature": "Environment",  
      "organization": "DISIT",  
      "serviceUri": "http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/station01",  
      "subnature": "Weather_sensor",  
      "values": {  
        "date_time": "2023-07-26T08:44:56.791Z",  
        "expected_next_date_time": "2023-07-26T08:45:06.791Z",  
        "humidity": 86,  
        "temperature": 30  
      }  
    }  
  },  
  ],  
}
```

IoTSearch over time Example

- Find all **weather sensor** with at least one time with **temperature in [25,30]** and **humidity greater than 50 in the last 7 days**
- GET https://www.snap4city.org/superservicemap/api/v1/iot-search/time-range/?fromTime=7-day&aggregate=true&categories=Weather_sensor&valueFilters=temperature>=25;temperature<=30;humidity>50
- Only GeoJSON response


```
{  
  "sumOtherDocs": 10771,  
  "type": "FeatureCollection"  
  "features": [  
    {  
      "geometry": { "coordinates": [9.23375, 45.47745], "type": "Point"},  
      "properties": {  
        "aggregationCount": 44870,  
        "deviceModel": "Arduino Uno",  
        "deviceName": "station03",  
        "nature": "Environment",  
        "organization": "DISIT",  
        "serviceUri": "http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/station03",  
        "subnature": "Weather_sensor"  
      },  
      "type": "Feature"  
    },  
    ...  
  ]  
}
```

- Returns the first 100 devices matching the request, «sumOtherDocs» is the number of matching records that are left out in the aggregation process, meaning that there are more than 100 device, adding **maxResults=200** in the request the sumOtherDocs become 0 meaning that all matching data is aggregated in the results.
- No pagination is possible for aggregated results.

IoTSearch Limitations

- Report only limited static data of matching devices (model, nature, subnature, geographic position)
- Limited geographic queries (no polygon or line search)
- In case of private data, the owner and the delegated users can access the data but if the owner or the delegations change these applies only to newly submitted data (old data can be accessed only by old owner or old delegations)

Legenda on REST Call 1/2

- the **black continuous line** (push) will be used to send some data on the platform broker with a REST call which has to be Authenticated and Authorized according to the OpenId Connect as explained later, and would be in the form of:
 - <https://<platformdomain>:8443/orionbrokerfilter/v1/updateContext>
 - Or in the form for non TSL protected interaction:
 - <http://iot-app.snap4city.org:80/orion-broker/v1/updateContext?elementid=ELEMENTID&k1=K1&k2=K2>
- the **black dashed line** (pull) will be used to request some data from the platform by using a REST call to smart city API (Authenticated and Authorized according to the OpenId Connect as explained later), in the forms:
 - via regular Smart city API by category, etc.
 - http://svealand.snap4city.org/ServiceMap/api/v1/?selection=59.581458578537955;16.71183586120606;59.62875017053684;16.875171661376957&categories=Street_light&maxResults=100&format=json
 - Via Super
 - <https://www.disit.org/superservicemap/api/v1/?.....>
 - Via Super by values
 - <https://www.snap4city.org/superservicemap/api/v1/iot-search/?selection=43.77;11.2&maxDists=700.2&model=CarPark>
 - <https://www.snap4city.org/superservicemap/api/v1/iot-search/?selection=42.014990;10.217347;43.7768;11.2515&model=metrotrafficsensor&valueFilters=vehicleFlow>0.5;vehicleFlow<300>

Legenda on REST Call 2/2

- the **red dashed line** (push) will be used to send some data from the platform (from an Orion broker) to some stable IP client or other machine for machine-to-machine communication
 - As a first step the client has to subscribe to some entity on the Orion Broker passing its IP where the broker will have to send the data in push
 - The POST will be in the form of [/v1/subscribeContext](#) passing as parameters: elementid (the device ID, and K1, K2) or TSL approach
 - ```
curl -X POST "https://broker1.snap4city.org:8080/v1/subscribeContext?elementid=myspersonaldatatester-device&k1=4e0924a8-fdd6-49cf-8d4a-f49cb5710d8b&k2=240567da-64a4-43b3-8ac9-1265178f3cbe" -H "accept: application/json" -H "Content-Type: application/json" -d '{"entities":{"type":"Ambiental","isPattern":false,"id":"myspersonaldatatester-device"},"attributes":{"temperature"},"reference":"http://prova/","duration":"P1M"},"notifyConditions":{"type":"ONCHANGE","condValues":{"temperature"},"throttling":"PT10S"}'
```
    - Then the broker will send the messages to the subscribed client
    - it could be possible to have this kind of push also by using Kafka and/or WebSocket, but this is possible with simple and direct exposed API to all Snap4City platforms.
- **The external APIs of Snap4City are documented in Swagger**
  - <https://www.km4city.org/swagger/external/index.html>

TOP

# Access to Protected data





TOP

# *Why and How to use Delegations to READ/WRITE*





# Delegations Rules

- Each entity in Snap4City is created as private and can be only visible/editable only for its owner, the so-called Creator.
  - The Owner/creator can pass the ownership to some other user of the same Organization.
  - Each entity in Snap4City provide a specific graphic user interface to change the ownership for: IoT Device Models, Dashboards, IoT Apps, etc.
- Once the Ownerships is passed, the former Owner/creator loses the possibility of editing and view the entity.
- The Owner of an IoT Device/Entity Instance can provide grant rights
- to other users.
  - **READ\_ACCESSS**: means to be capable to read data messages of a device/Entity Instance even if you are not the Owner. This grant allows you to create devices/entities which can read from one or several users.
  - **READ\_WRITE**: means to be capable to send new messages on that device/Entity, and also to read the data provided. This grant allows you to create devices/entities which can receive messages / data from one or several users.
  - **MODIFY**: means to have the right to modify the device/entity structure. This grant is quite strong and should be carefully used and in general the Owner should be conceptually the only one authorized to change the device / entity structure.

## Example of Delegation Patterns

- A user **A creates a device**, and post data for it, and it is interested to communicate the data to many users at which the user A provide READ\_ACCESS.
  - To this end, A has to know the UserName of the platform to create the delegations.
- A user **A creates a device to receive messages notifications** from many users. A sort of mailbox for receiving some event notifications.
  - To this end, user A provide READ\_WRITE grant to each of them. They are going to write their messages on the same mailbox, with the hope to avoid them to send messages at the same time stamp.
  - A can read the message notification and can overwrite them to confirm their reception.
- If all the IoT Devices/EntityInstances produce by **a given Device Model are for instance userprofiles of some application**, they can be searched and listed by all users having at least the READ\_ACCESS to those devices.
  - The platform provides a Search block in IoT App / Proc.Logic, as well as Smart City API as query by model.
  - In both cases, the user performing the query will receive back only the device he/she created and those that have been delegated to him.

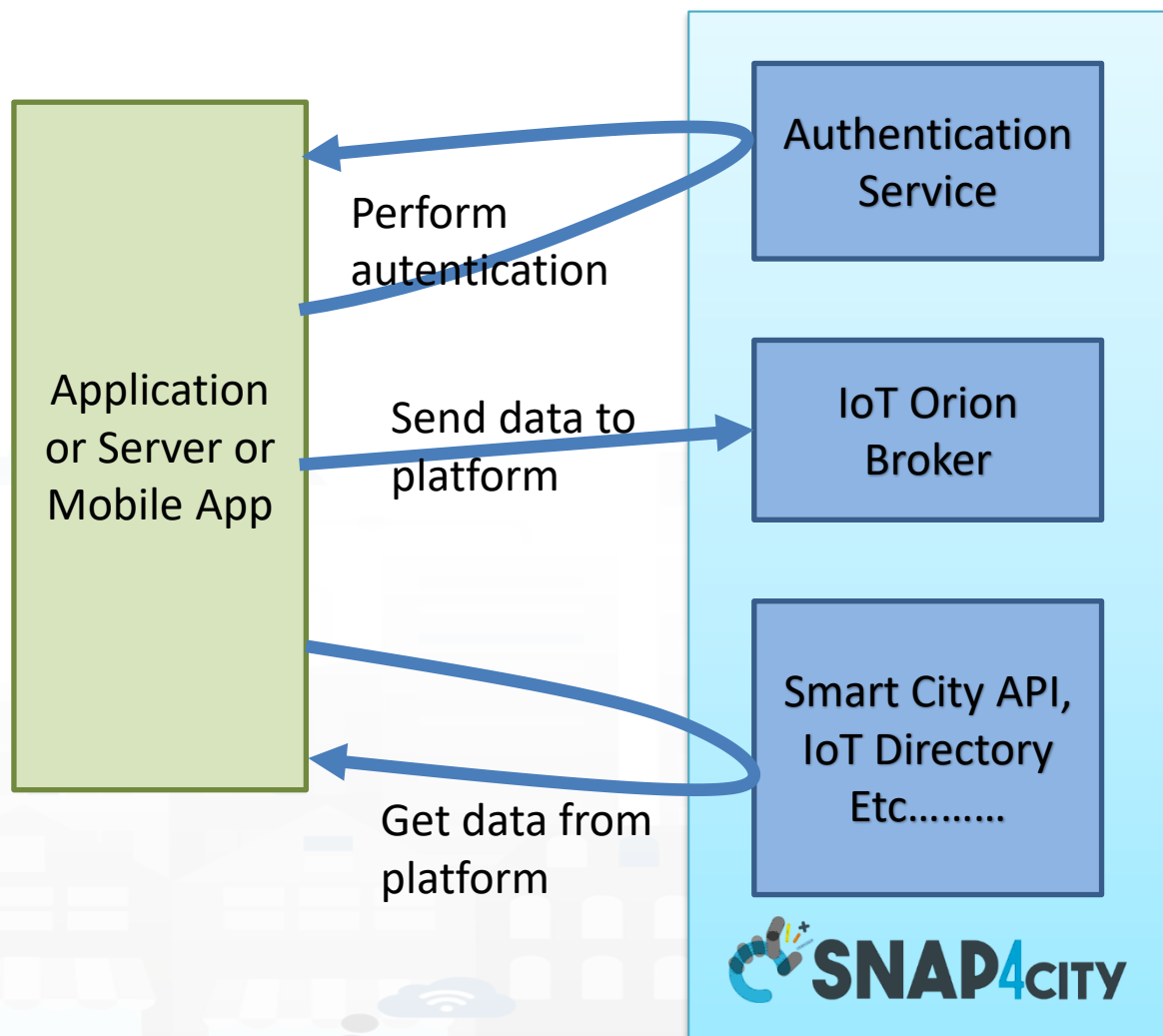
TOP

# *Develop: Provide Data and Access to Protected Data*

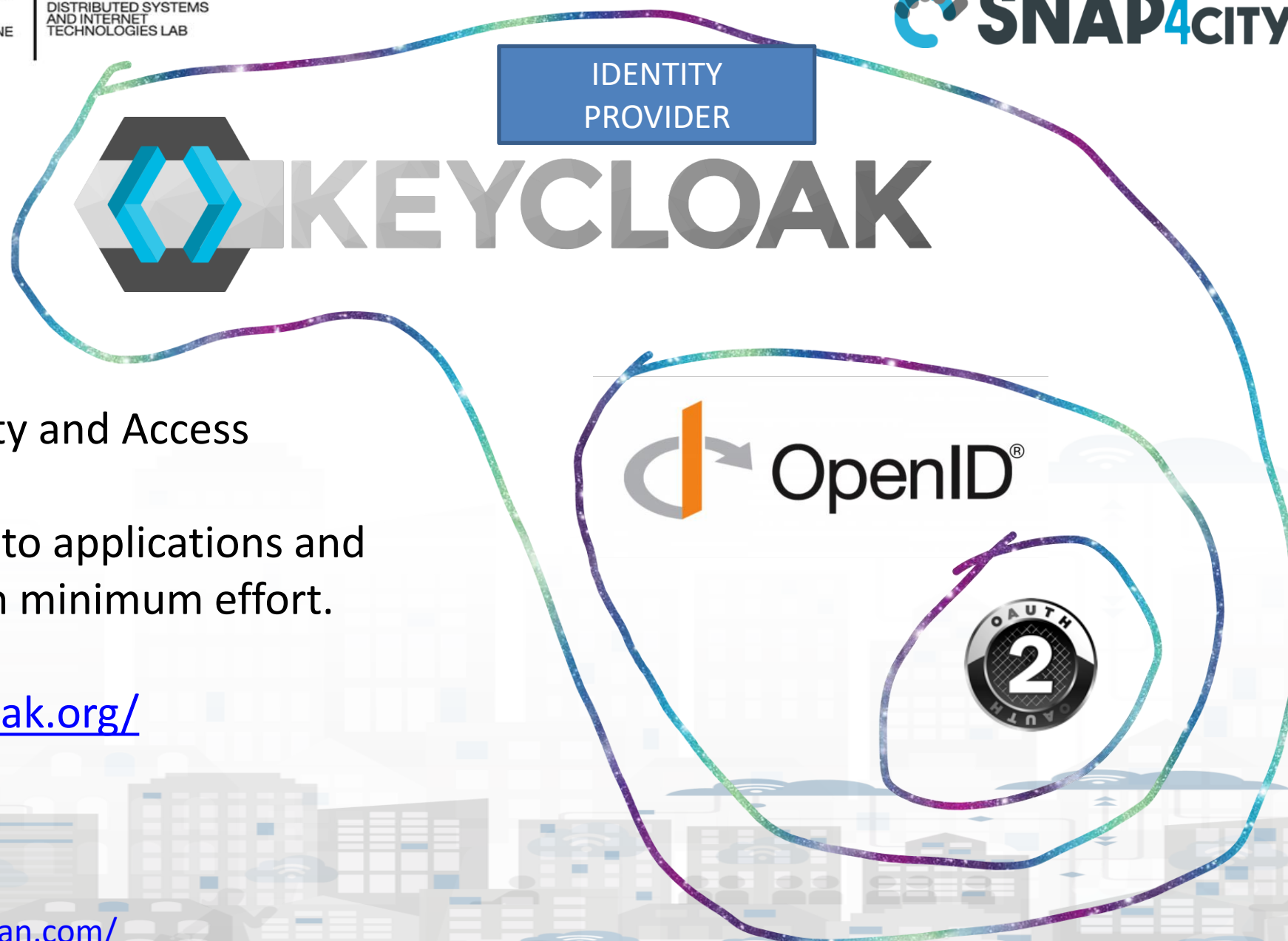




# Approaches



- **First**
  - authenticate
- **Second**
  - use the services to provide and/or get data



Open Source Identity and Access  
Management

Add authentication to applications and  
secure services with minimum effort.

<https://www.keycloak.org/>



<https://www.postman.com/>

# Two Possible Approaches for Authentication

## Authentication Code Flow Protocol (confidential application)

- For Web Application with Server Side functionalities or native applications, including services towards mobile applications

## Single Page App

- For Web Application without Server Side functionalities

## Implicit Flow Protocol referred to as Direct Grant with username/password (public applications)

- Less secure: It's not recommended to use this flow unless you absolutely need to
- For Front-End Web Application that do not have Server Side functionalities.
- JavaScript can do only this kind of applications



# Authentication Flow Protocol (confidential application, Web Server Application)

**Step1** The Web Server Application provides a way to securely store information, and provide service to your users via HTML pages

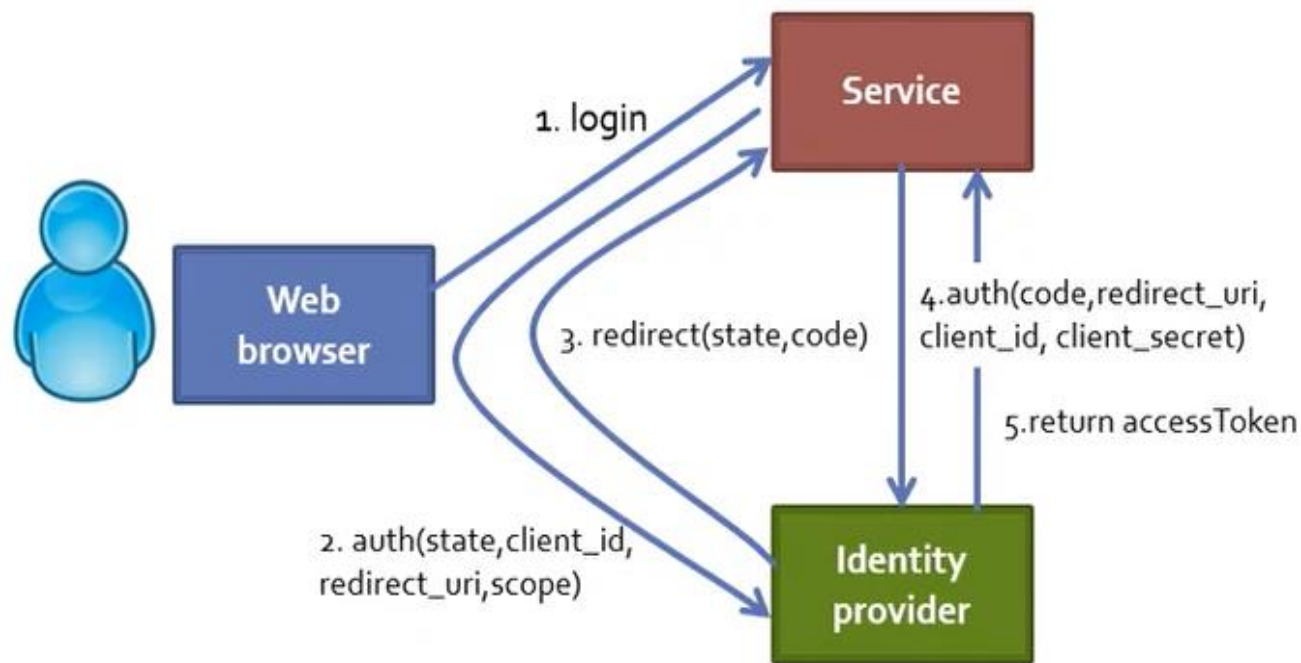
- In particular: **client\_id** and **client\_secret** are secured on the WSA
  - **They** have to be requested to the snap4City platform organization
  - Snap4City has to know the **redirect uri** of your Application Server to complete the round and provide back the information
- This approach is valid for application servers which provide html pages to your users, while this information is saved into the Applications Server which also interact with the Snap4City Platform
  - It in practice the same approach used by the Dashboard manager to provide access to the dashboard at the users.

# Client\_id

- The HOW TO manual for RootAdministrators to create a client\_id can be recovered from: <https://www.snap4city.org/1029>



# Authentication Flow Protocol, step 2



## Step2

- the user login is redirected to the identity provider
- 2) Given the **client\_id** of the application and the **client\_secret** (in the diagram called code)
- 5) The Service get the AccessToken
- Then the Service can pose any API rest call to get data for the User

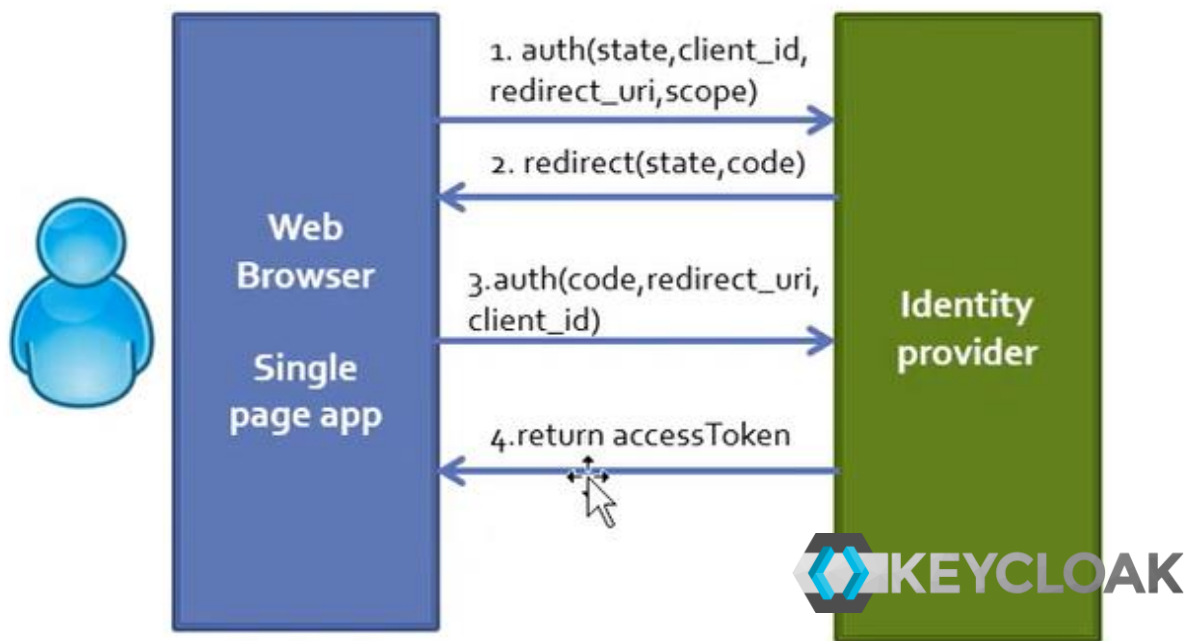






# Single Page App

- The Single Page has no secure way to store information on client side
- All the secret information is maintained on the Identity Provider side

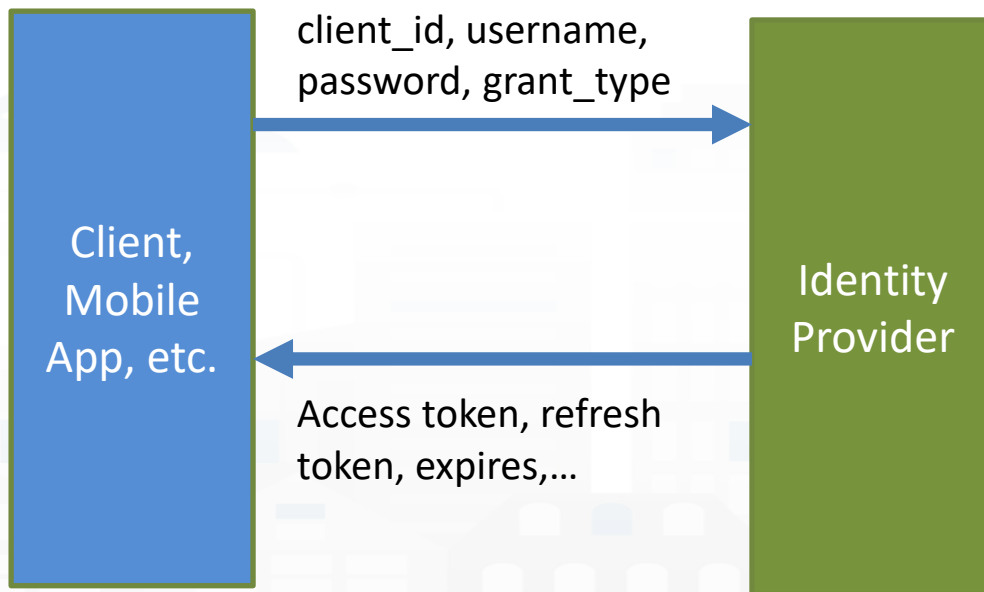


- The Single Page has to bring the login on the Identify Provider, which redirect on the applications
- The process follow the above presented approach
- Given the **client\_id** of the application, the users can get the `accessToken` to make requests.

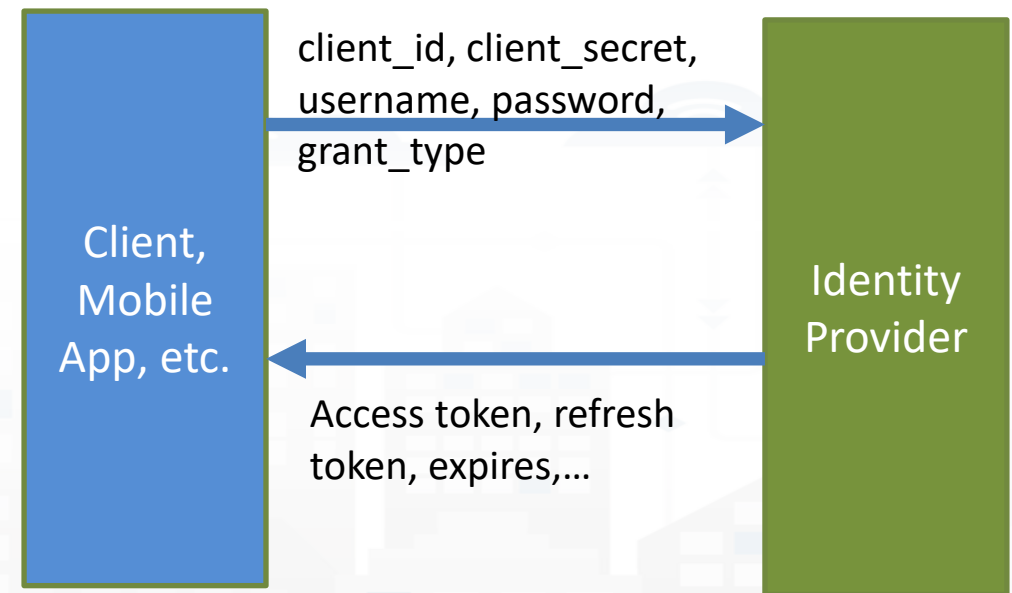


# Two Simpler Cases

- Public Applications



- Implicit Flow Protocol









# Access Token & Refresh Token

- Access tokens have typically of short duration
  - Once the access token is expired,
  - The refresh token can be used to request another fresh access token and this can be done at the endpoint
- <https://www.snap4city.org/auth/realms/master/protocol/openid-connect/token/>
- With the parameters reported in the next slide



POST ▼ <https://www.snap4city.org/auth/realms/master/protocol/openid-connect/token/> Send ▼

Params Authorization Headers (8) **Body** ● Pre-request Script Tests Settings Cookies

none  form-data  x-www-form-urlencoded  raw  binary  GraphQL

|                                     | KEY           | VALUE                                                                                                                                                                                                                                                                          | DESCRIPTION | ... | Bulk Edit |
|-------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----|-----------|
| <input checked="" type="checkbox"/> | client_id     | <del>XXXXXXXXXX</del>                                                                                                                                                                                                                                                          |             |     |           |
| <input checked="" type="checkbox"/> | grant_type    | refresh_token                                                                                                                                                                                                                                                                  |             |     |           |
| <input checked="" type="checkbox"/> | scope         | openid profile                                                                                                                                                                                                                                                                 |             |     |           |
| <input checked="" type="checkbox"/> | refresh_token | eyJhbGciOiJSUzI1NiIsInR5cCI6IkpzZW50L3R5cyJ9.eyJ1b2wudm9udG9udGR1Z2FyZCI6ImN1YiI6ImQzZmYmNmI3LWQ1MTktNGJmYy04OGExLWU1OWMwNDRmNjcxNCIsInR5cCI6IkpzZW50L3R5cyJ9.eyJ1b2wudm9udG9udGR1Z2FyZCI6ImN1YiI6ImQzZmYmNmI3LWQ1MTktNGJmYy04OGExLWU1OWMwNDRmNjcxNCIsInR5cCI6IkpzZW50L3R5cyJ9 |             |     |           |
|                                     | Key           | Value                                                                                                                                                                                                                                                                          | Description |     |           |

Body Cookies Headers (5) Test Results Status: 200 OK Time: 11 ms Size: 2.75 KB Save Response ▼

Pretty Raw Preview Visualize **JSON** ▼ 🔍

```

1
2 "access_token": "eyJhbGciOiJSUzI1NiIsInR5cCI6IkpzZW50L3R5cyJ9.eyJ1b2wudm9udG9udGR1Z2FyZCI6ImN1YiI6ImQzZmYmNmI3LWQ1MTktNGJmYy04OGExLWU1OWMwNDRmNjcxNCIsInR5cCI6IkpzZW50L3R5cyJ9.eyJ1b2wudm9udG9udGR1Z2FyZCI6ImN1YiI6ImQzZmYmNmI3LWQ1MTktNGJmYy04OGExLWU1OWMwNDRmNjcxNCIsInR5cCI6IkpzZW50L3R5cyJ9",
3 "expires_in": 1500,
4 "refresh_expires_in": 2073589,
5 "refresh_token": "eyJhbGciOiJSUzI1NiIsInR5cCI6IkpzZW50L3R5cyJ9.eyJ1b2wudm9udG9udGR1Z2FyZCI6ImN1YiI6ImQzZmYmNmI3LWQ1MTktNGJmYy04OGExLWU1OWMwNDRmNjcxNCIsInR5cCI6IkpzZW50L3R5cyJ9"

```



POSTMAN





## Private Device Data Retrieval

- We'll use the cloud installation of jupyterhub
- <https://www.snap4city.org/650>



Not All The Device in Snap4City are public...

for some you'll need an access token to the private **IoT Device** of that authenticated user 🔑

so let's get the username and password

```
[1]: ### in the config.py file that i've created are stored the user and password for the snap4city authentication
snap4cityauth = dict(
user = 'user name of snap4city',
psw = 'the password of the user',
clid= '<client id depending on the App kind>' has to be obtained from Snap4City organization by sending an email to snap4city@disit.org.
)
import config
utente = config.snap4cityauth['user']
password = config.snap4cityauth['psw']
client_id = config.snap4cityauth['clid']
```

# Private Device Data Retrieval

next let's get the auth token ¶

```
2]: import requests
import json
url = "https://www.snap4city.org/auth/realms/master/protocol/openid-connect/token/"
data = {"client_id": client_id, "grant_type": "password", "username": utente, "password": password}
r=requests.post(url, data)
print(r.status_code, r.reason)
responseToken=json.loads(r.text)
refreshToken = responseToken["refresh_token"]
print("access_token : {}... expires in {}s, token_type: {}".format(responseToken['access_token'][:20],responseToken['expires_in'],responseToken['token_type']))

#to update the token using the refresh_token
url = "https://www.snap4city.org/auth/realms/master/protocol/openid-connect/token/"
data = {"client_id": client_id, "grant_type": "refresh_token", "scope": "openid profile", "refresh_token":refreshToken}
r=requests.post(url, data)
print("updating token using the refresh token ",r.status_code, r.reason)
responseToken=json.loads(r.text)
```

200 OK

access\_token : eyJhbGciOiJIUzI1NiIs... expires in 1500s, token\_type: bearer

updating token using the refresh token 200 OK

# Private Device Data Retrieval

so now you can access the private iot device data...

```
] auth_token=responseToken['access_token']
hed = {'Authorization': 'Bearer ' + auth_token}

url = "https://www.snap4city.org/superservicemap/api/v1?serviceUri=http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/118907.682_485819.390-Plastic&accessToker"

response = requests.get(url, headers=hed)
if response.status_code == 200: # ok
 print(json.loads(response.text))
```

```
{'Service': {'features': [{'geometry': {'coordinates': [4.857379, 52.359085], 'type': 'Point'}, 'properties': {'address': '', 'avgStars': 0, 'brokerName': 'orionUNIFI', 'cap': '', 'city': '', 'civic': '', 'comments': [], 'description': 'Plastic', 'email': '', 'fax': '', 'format': 'json', 'frequencySec': '600', 'isMobile': '', 'linkDBpedia': [], 'macaddress': '', 'maintenanceUrl': '', 'maxCapacity': '5', 'minCapacity': '', 'model': 'AmsterdamPlasticContainer', 'multimedia': '', 'name': '118907.682_485819.390-Plastic', 'nature': 'Environment', 'organization': 'DISIT', 'ownership': '', 'phone': '', 'photoOrigins': [], 'photoThumbs': [], 'photos': [], 'producer': 'Amsterdam city', 'protocol': 'ngsi', 'province': '', 'realtimeAttributes': {'dateObserved': {'attr_type': 'DeviceAttribute', 'data_type': 'string', 'different_values': '0', 'value_bounds': 'unspecified', 'value_refresh_rate': '300', 'value_type': 'timestamp', 'value_unit': 'timestamp'}, 'weight': {'attr_type': 'DeviceAttribute', 'data_type': 'float', 'different_values': '0', 'value_bounds': 'unspecified', 'value_refresh_rate': '300', 'value_type': 'weight', 'value_unit': 'Kg'}}, 'serviceType': 'Environment_Waste_container', 'serviceUri': 'http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/118907.682_485819.390-Plastic', 'starsCount': 0, 'subnature': 'Waste_container', 'typeLabel': 'Waste container', 'website': '', 'wktGeometry': ''}, 'type': 'Feature'}], 'type': 'FeatureCollection'}, 'realtime': {'head': {'vars': ['measuredTime', 'dateObserved', 'weight']}, 'results': {'bindings': [{'dateObserved': {'value': '2022-01-14T09:52:09.000Z'}, 'measuredTime': {'value': '2022-01-14T10:52:09.000+01:00'}, 'weight': {'value': '120'}}]}}}
```



TOP

# Forging and managing: Mobile and Web Apps, MicroApplications



Basic version for MaaS mobile App: missing payments: a small version is on GITHUB, a wider version will be Published soon



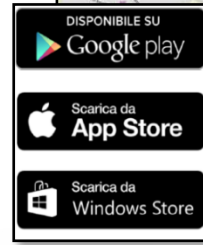
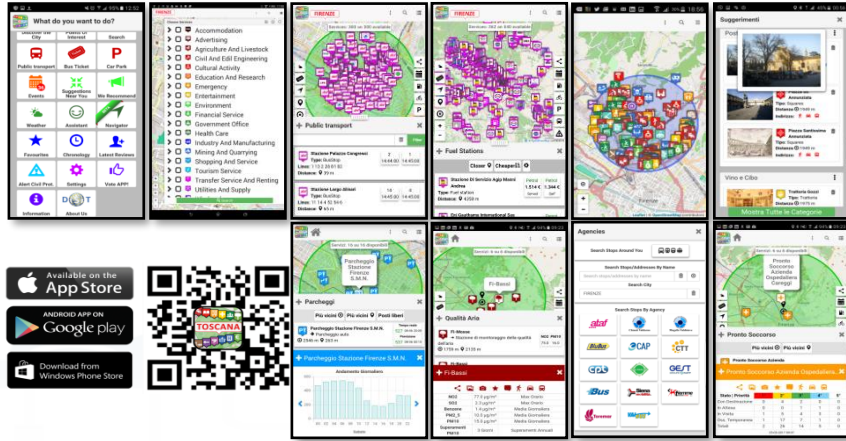


# Developing Web and Mobile Apps, MicroApps,..

Mobile Apps

Web App HTML5, MicroApplications

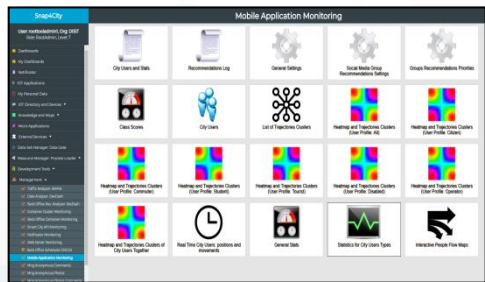
Embed into Web pages



City User



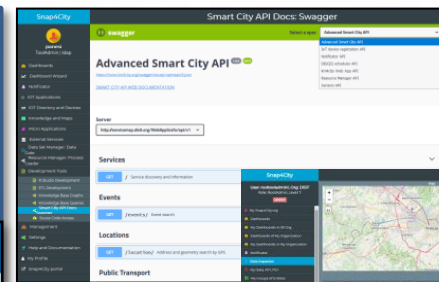
## Advanced Smart City API



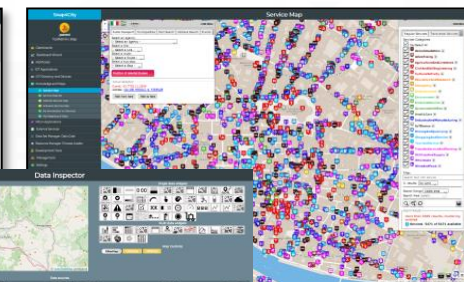
Mobile Application  
Monitoring  
Administrator



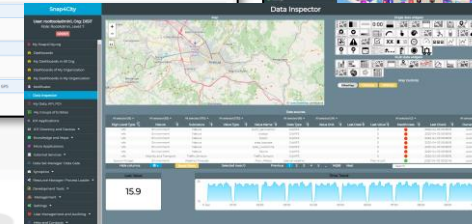
Snap/Km4City  
Open Source  
development  
tool kit



Swagger



ServiceMap



DataInspector

Developer



# Advanced SmartCity API

## Swagger

- Search data: by text, near, along, etc.
  - Resolving text to GPS and formal city nodes model
- Empowering city users: contributions, suggestions, forum discussions, etc.
- Events: Entertainment, critical and mobility
- Public and Private Mobility & Transport, and predictions
- POIs, Cultural and Touristic info
- Health services and predictions
- Environmental information, heatmaps; values
- Profiled Suggestions to City Users
- Traffic flow reconstruction
- Personal Assistant: PAVAL
- User Engagement: goal experiences, and assessment
- *Sharing knowledge among cities → see Knowledge base Management*

The screenshot shows the Swagger UI for the Snap4City API. The left sidebar contains a navigation menu with items such as 'Dashboards', 'My Dashboards', 'Notifier', 'IOT Applications', 'My Personal Data', 'IOT Directory and Devices', 'Knowledge and Maps', 'Micro Applications', 'External Services', 'Data Set Manager: Data Gate', 'Resource Manager: Process Loader', 'Development Tools', 'R Studio Development', 'ETL Development', 'Knowledge Base Graphs', 'Knowledge Base Queries', 'Smart City API Docs: Swagger', 'Internal API Docs: Swagger', 'Testing API by Postman', 'Source Code Access', 'Management', 'Settings', 'User Management and Auditing', 'Help and Contacts', 'Documentation and Articles', 'My Profile', 'Snap4City portal', 'Km4City portal', and 'DISIT Lab portal'. The main content area is titled 'Smart City API Docs: Swagger' and features a search bar with a dropdown menu showing 'Advanced Smart City API', 'Km4City Web App API', and 'Orion Broker K1-K2 Authentication API'. Below the search bar, the 'Advanced Smart City API' documentation is displayed, including a 'Services' section with a list of endpoints and their descriptions, and a 'Parameters' section with a table of parameters.

| Name      | Description                                                                                                                                                          |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| selection | Through this parameter, the user indicates where the services have to be searched. It could be a boundary within which to search, or a point around which to search. |
| string    |                                                                                                                                                                      |
| (query)   | Usages & Sample values                                                                                                                                               |



# Mobile Apps exploiting our tech/Smart City API

- **Firenze Dove Cosa, Km4City:**

- Android: <https://play.google.com/store/apps/details?id=org.disit.siiMobile&hl=en&gl=US>
- Apple iOS: <https://apps.apple.com/it/app/firenze-dove-cosa-km4city/id1028356115>

- **Toscana dove cosa, Km4City**

- Android: <https://play.google.com/store/apps/details?id=org.disit.toscana&hl=en&gl=US>
- Apple iOS: <https://apps.apple.com/it/app/toscana-dove-cosa-km4city/id1064554200>

- **Antwerp in a Snap**

- Android: <https://play.google.com/store/apps/details?id=org.disit.snap4city.mobileApp.antwerp&hl=en&gl=US>
- Apple iOS: <https://apps.apple.com/it/app/antwerp-in-a-snap/id1467737363>

- **Helsinki in a Snap**

- Android: <https://play.google.com/store/apps/details?id=org.disit.snap4city.mobileApp.helsinki&hl=en&gl=US>
- Apple iOS: <https://apps.apple.com/it/app/helsinki-in-a-snap/id1466970280>

- **Tuscany in a Snap**

- Android: <https://play.google.com/store/apps/details?id=org.disit.snap4city.mobileApp.tuscany&hl=en&gl=US>
- Apple iOS: <https://apps.apple.com/us/app/toscana-in-a-snap/id1471094480>

- **Snap4Pisa: Pisa in a Snap:**

- Android: <https://snap4city.aedit.it/drupal//sites/default/files/snap.apk>

- **Wee Life Mobile App:**

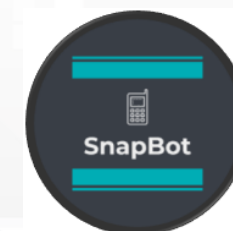
- Android: <https://play.google.com/store/apps/details?id=org.disit.lifeweee&hl=en&gl=US>
- Apple iOS: <https://apps.apple.com/it/app/life-weee/id1470224854>

- **Comune Facile Android:**

- Android: <https://www.e015.regione.lombardia.it/site/app-detail?id=131>
- Comune Facile IOS: <https://www.e015.regione.lombardia.it/site/app-detail?id=130>

- **POS by EPSON:** <https://www.e015.regione.lombardia.it/site/app-detail?id=58>

- **SnapBot:** <https://www.snap4city.org/684>





TOP

# Web and Mobile App with Open Development Kit







UNIVERSITÀ  
DEGLI STUDI  
FIRENZE

**DINFO**  
DIPARTIMENTO DI  
INGEGNERIA  
DELL'INFORMAZIONE

**DISIT**  
DISTRIBUTED SYSTEMS  
AND INTERNET  
TECHNOLOGIES LAB

# Mobile Apps

# SNAP4CITY



What do you want to do?

|                   |                      |                |
|-------------------|----------------------|----------------|
| Discover the City | Points Of Interest   | Search         |
| Public transport  | Bus Ticket           | Car Park       |
| Events            | Suggestions Near You | We Recommend   |
| Weather           | Assistant            | Navigator      |
| Favourites        | Chronology           | Latest Reviews |
| Alert Civil Prot. | Settings             | Vote APP!      |
| Information       | About Us             |                |

**Choose Services**

- Accommodation
- Advertising
- Agriculture And Livestock
- Civil And Edil Engineering
- Cultural Activity
- Education And Research
- Emergency
- Entertainment
- Environment
- Financial Service
- Government Office
- Health Care
- Industry And Manufacturing

Suggerimenti

Post

**Piazza San Annunziata**  
Tipo: Squares  
Distanza: 1949 m  
Indirizzo: ...

**Piazza Santissima Annunziata**  
Tipo: Squares  
Distanza: 1949 m  
Indirizzo: ...

Vino e Cibo

**Trattoria Gozzi**  
Tipo: Trattoria  
Distanza: 1975 m

Mostra Tutte le Categorie

**Giardino di Boboli**

Tipo: Digital Location

Descrizione: The Boboli Gardens, near the very masterpiece sculpture

Descrizione: Il Palazzo di Boboli, nei pressi della Grotta del Buontalenti, vero e proprio capolavoro dell'architettura e della scultura manierista

VIALE DELLA MERIDIANA, 50125

**HELSENKI**

Helsinki in a Snap

DISIT Lab, paolo nesi Viaggi e info locali

★★★★★ 2

PEGI 3

Aggiungi alla lista desideri

Installa

**ANTWERP**

Antwerp in a Snap

DISIT Lab, paolo nesi Travel & Local

PEGI 3

This app is compatible with some of your devices.

App Store

App Store > Utility > Università Degli Studi Di Firenze

**Helsinki in a Snap**

Università Degli Studi Di Firenze

Dettagli Valutazioni e recensioni Correlati

Istantanee

iPhone iPad

Carrier 11:38 AM

Carrier 11:40 AM

Carrier 11:40 AM



Giardino di Boboli

Leaflet | OpenStreetMap contributors

Air Quality

PM10: 15.502 µg/m³

PM2.5: 4.976 µg/m³

NO2: 20.285 µg/m³

SO2: 0.856 µg/m³

Map

Around you

Transport

Assistant

Goal Experiences

Suggestions Near You

Environment and Weather

Forum

Information

Help and Contacts

My Activity

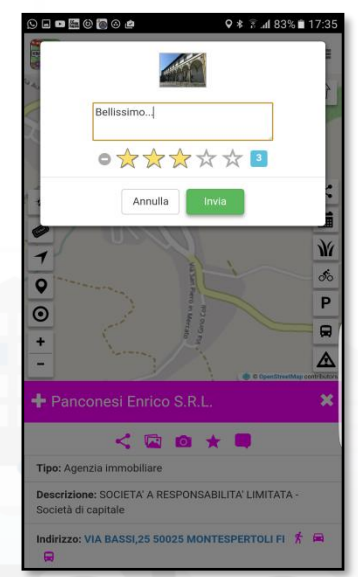
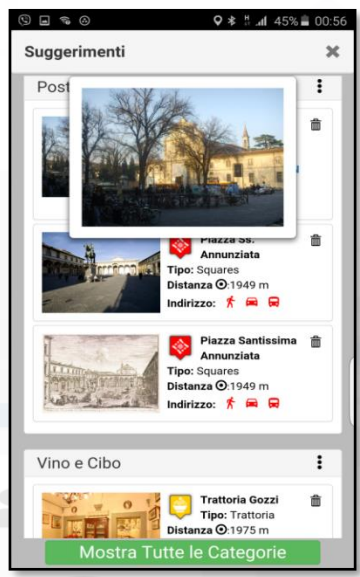
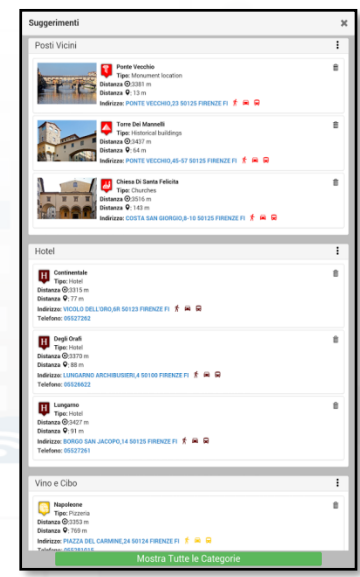
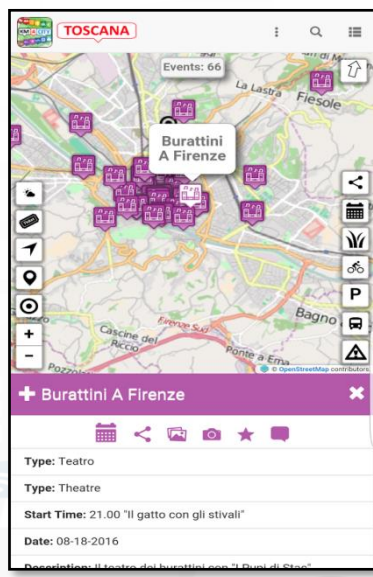
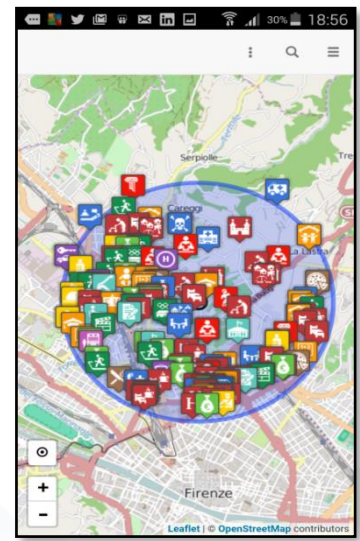
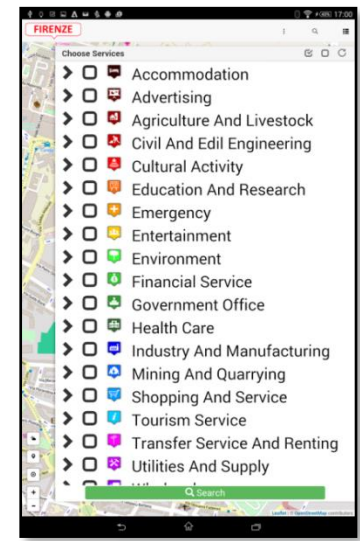
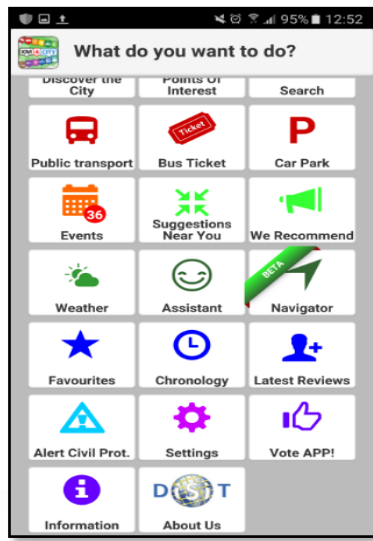
SNAP4CITY



# Km4City APP, features



- **5 languages:** IT, EN, SP, DE, FR
- **Profiles city users:** citizens, commuter, student, tourist, operator, etc.
- **Profiled Menu per POI**
  - adaptive
- **Main Menu:** dynamic, and personalized
- **Search Text**
- **Search per POI**
  - Near to you, near to a point, a line, ...
- **Other search**
  - Close to you, events green areas, public transport, tickets, Cycling, parking, ...
  - Etc.
- **POI**
  - Preferred, Social icon
  - Ranking, Comments, Images

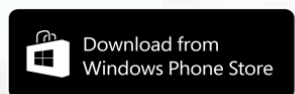
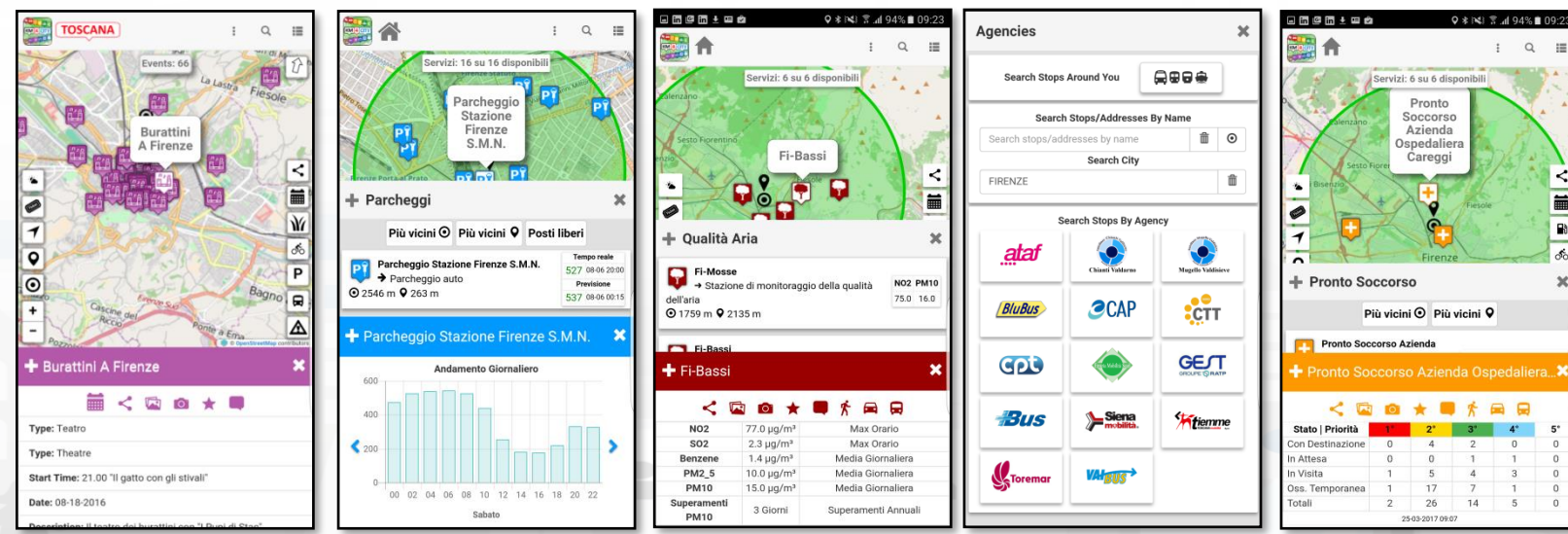
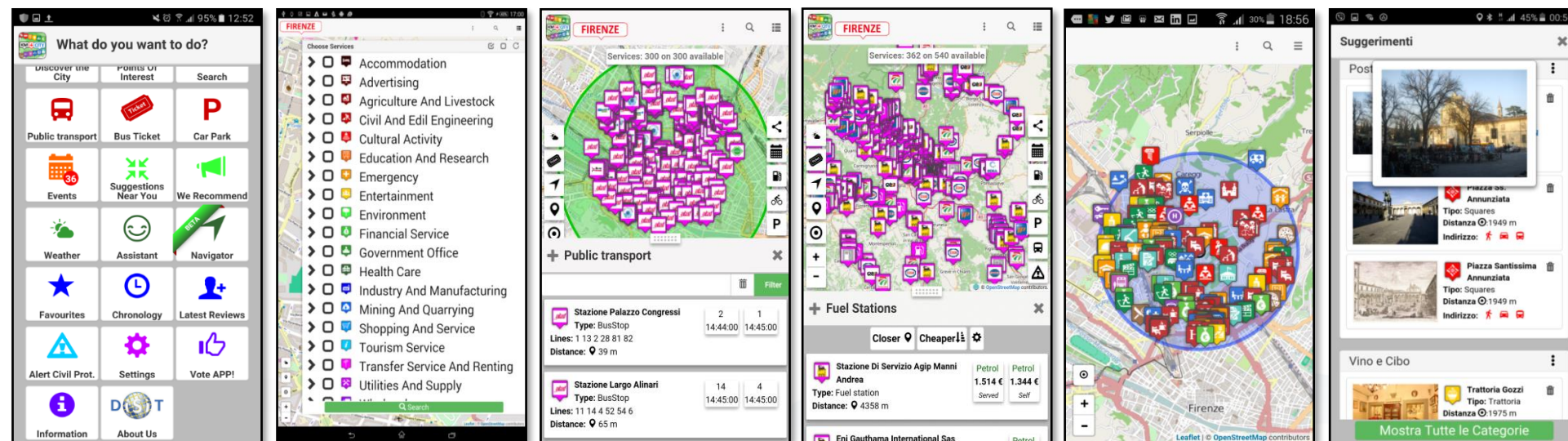




# Km4City APP



- Smart Parking, in Tuscany
- Smart First Aid in Tuscany
- Smart Public Transportation in Tuscany
- Smart Fuel pricing in Tuscany
- Bike Sharing in Pisa
- Weather condition in Tuscany
- Environmental data
- Pollution and Pollination in Tuscany
- Traffic Sensors in Tuscany
- Smart Routing in Tuscany
- Smart Transportation in Florence
  - Events, traffic, ...
- Entertainment Events in Florence

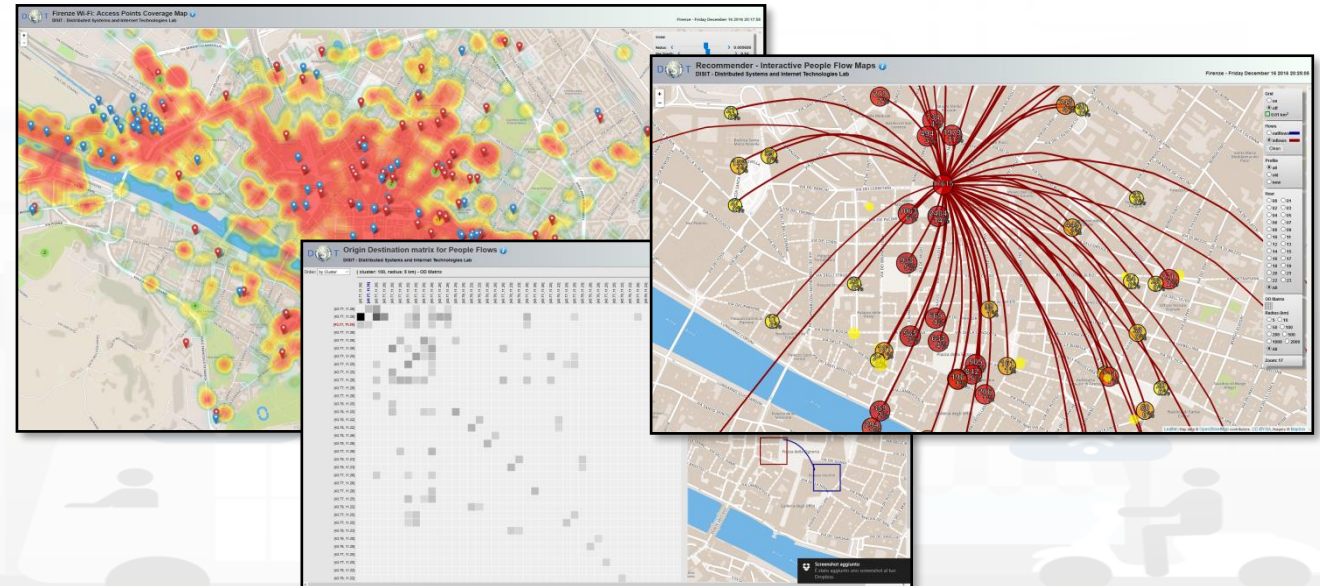
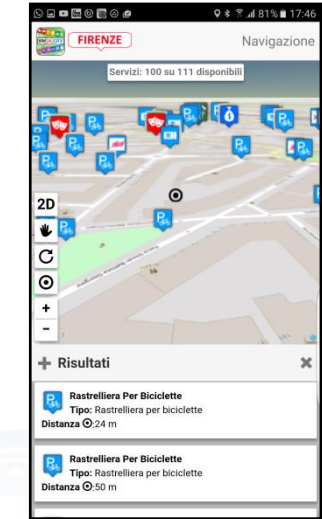
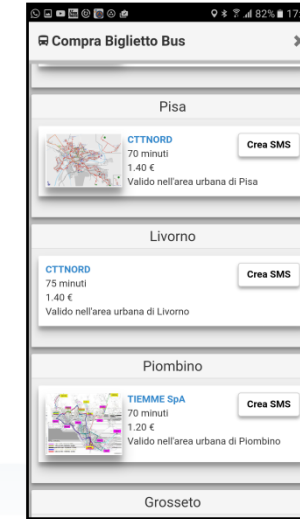
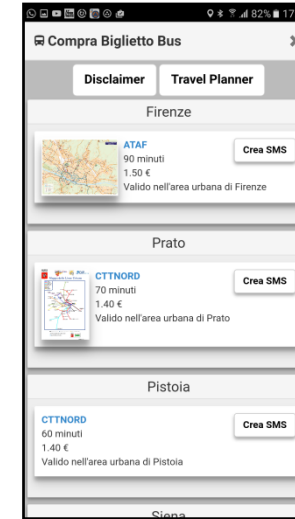




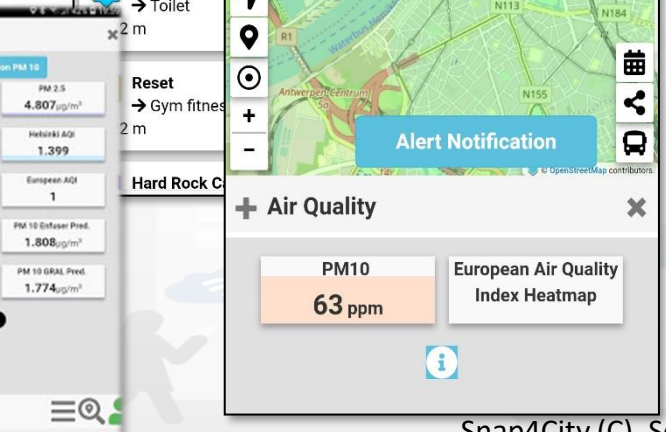
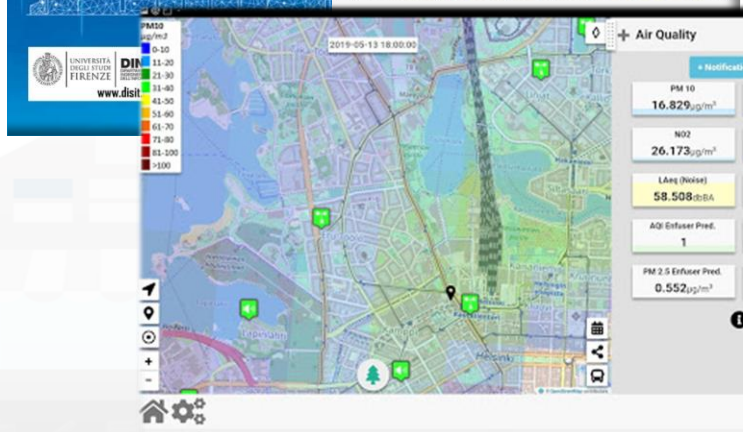
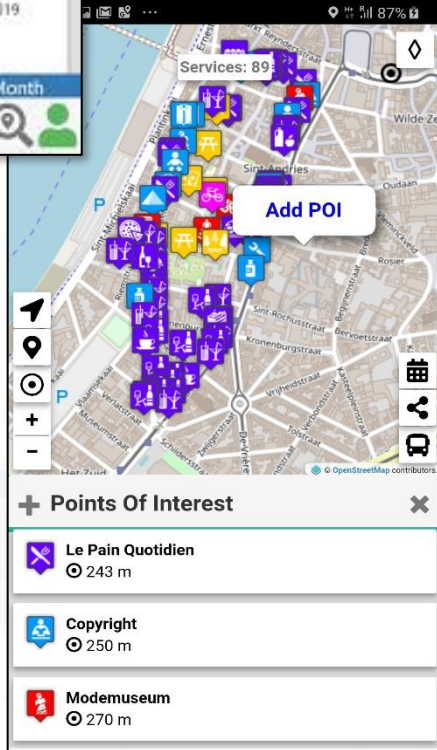
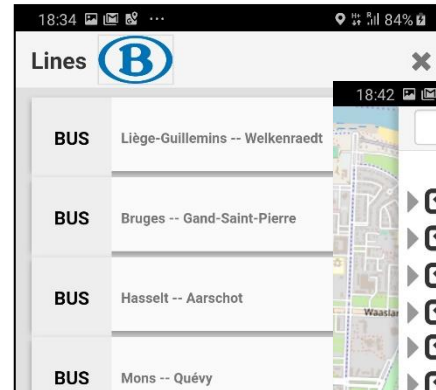
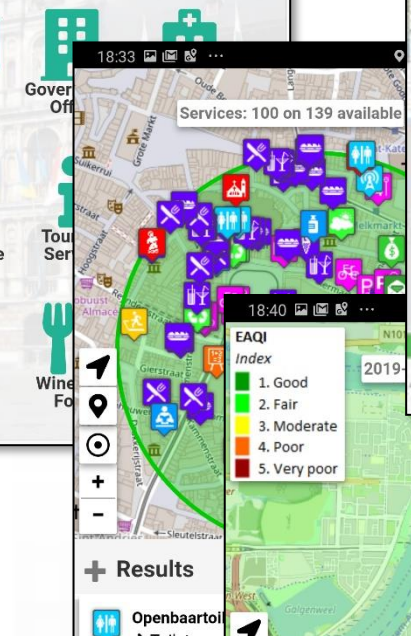
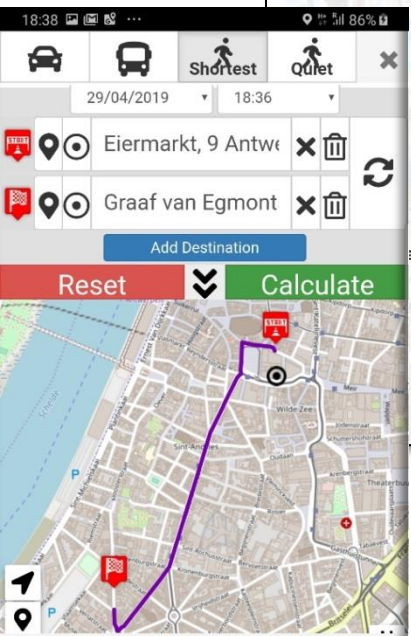
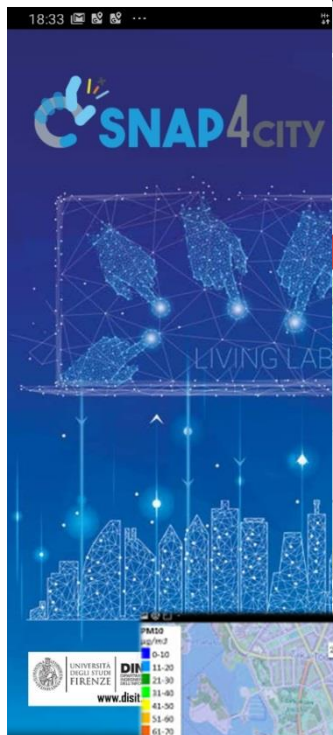
# Km4City APP, features 3/3



- Navigation 3D
- Ticketing for busses
- App used as a tool for city assessment
  - Wi-Fi status
  - iBeacon status
  - User behavior analysis
    - GPS movements kinds
    - OD matrix
    - International flows









# Mobile App Features



- **Discovery** POI/services
- **Search:** POI, streets, suggestions
- **Mobility and transport:** Pub/priv, routing, car position, time table, park, sharing, tickets, etc.
- **Environment and Weather:** values, sensors, heatmaps, notifications
- **Assistant, Forum, Developer Assistant**
- **Goal Experiences** (Engagement)
- **Personal** data, activities, POI, tracking, IOT App, Dashboards, etc.
- **Events:** entertainment, critical
- **Sharing** position and trajectories with friends
- **Monitoring** city and personal Dashboards
- **Personalized for Operators and Developers full control of their applications on cloud**



# MicroApplications

## Snap4City

- [LOGIN](#)
- [Dashboards \(Public\)](#)
- [Knowledge and Maps](#)
- [Micro Applications](#)**
- [External Services](#)
- [Data Set Manager: Data Gate](#)
- [Resource Manager](#)
- [Development Tools](#)
- [Management](#)
- [Help and Contacts](#)
- [Documentation and Articles](#)
- [Km4City portal](#)
- [DISIT Lab portal](#)

## Micro Applications

Prev 1 2 3 ... 11 Next

snap

Accommodation - Antwerp in a Snap

Accommodation - Helsinki in a Snap

Accommodation - Toscana in a Snap

Advertising\_and\_promotion - Toscana in a ...

Agriculture And Livestock - Helsinki in a Sn...

Agriculture And Livestock - Toscana in a Sn...

Air Quality - Antwerp in a Snap

|      |        |              |        |
|------|--------|--------------|--------|
| PM10 | 63.02  | PM10         | 56.665 |
| NO2  | 33.585 | NO2          | 1.863  |
| CO   | 36.672 | Benzeno (µg) | 4.948  |

Air Quality - Helsinki in a Snap

|                     |        |                     |       |
|---------------------|--------|---------------------|-------|
| PM10                | 25.722 | PM10                | 7.065 |
| NO2                 | 27.644 | NO2                 | 1.921 |
| CO                  | 36.672 | Benzeno (µg)        | 1.878 |
| PM10 (Station) (µg) | 5.8    | PM10 (Station) (µg) | 4.825 |
| PM10 (Station) (µg) | 5.8    | PM10 (Station) (µg) | 1.825 |

Air Quality - Toscana in a Snap

|      |        |              |        |
|------|--------|--------------|--------|
| PM10 | 63.02  | PM10         | 56.665 |
| NO2  | 33.585 | NO2          | 1.863  |
| CO   | 36.672 | Benzeno (µg) | 4.948  |

Air Quality Jatkasaari - Helsinki in a Snap

|                     |        |                     |       |
|---------------------|--------|---------------------|-------|
| PM10                | 25.722 | PM10                | 7.065 |
| NO2                 | 27.644 | NO2                 | 1.921 |
| CO                  | 36.672 | Benzeno (µg)        | 1.878 |
| PM10 (Station) (µg) | 5.8    | PM10 (Station) (µg) | 4.825 |
| PM10 (Station) (µg) | 5.8    | PM10 (Station) (µg) | 1.825 |

Air Quality Sensors - Antwerp in a Snap

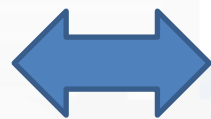
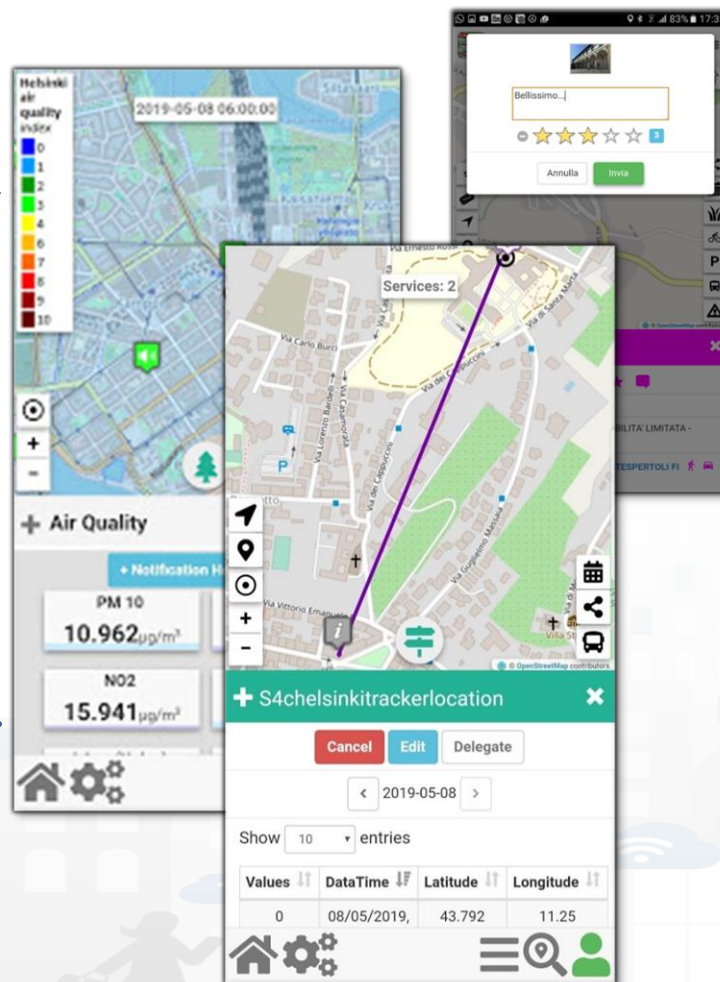
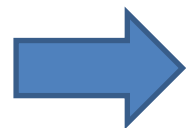
Air Quality Sensors - Helsinki in a Snap





# The App is a Bidirectional Device

- GPS Positions
- Selections on menus
- Views of POI
- Access to Dashboards
- searched information
- Routing
- Ranks, votes
- Comments
- Images
- Subscriptions to notifications
- ....



## Produced information

- Accepted ?
- Performed ?
- ...

## Derived information

- Trajectories
- Hot Places by click and by move
- Origin destination matrices
- Most interested topics
- Most interested POI
- Delegation and relationships
- Accesses to Dashboards
- **Cumulated Scores from Actions**
- Requested information
- Routing performed
- .....

## Produced information

- Suggestions
- Engagements
- Notifications
- ...

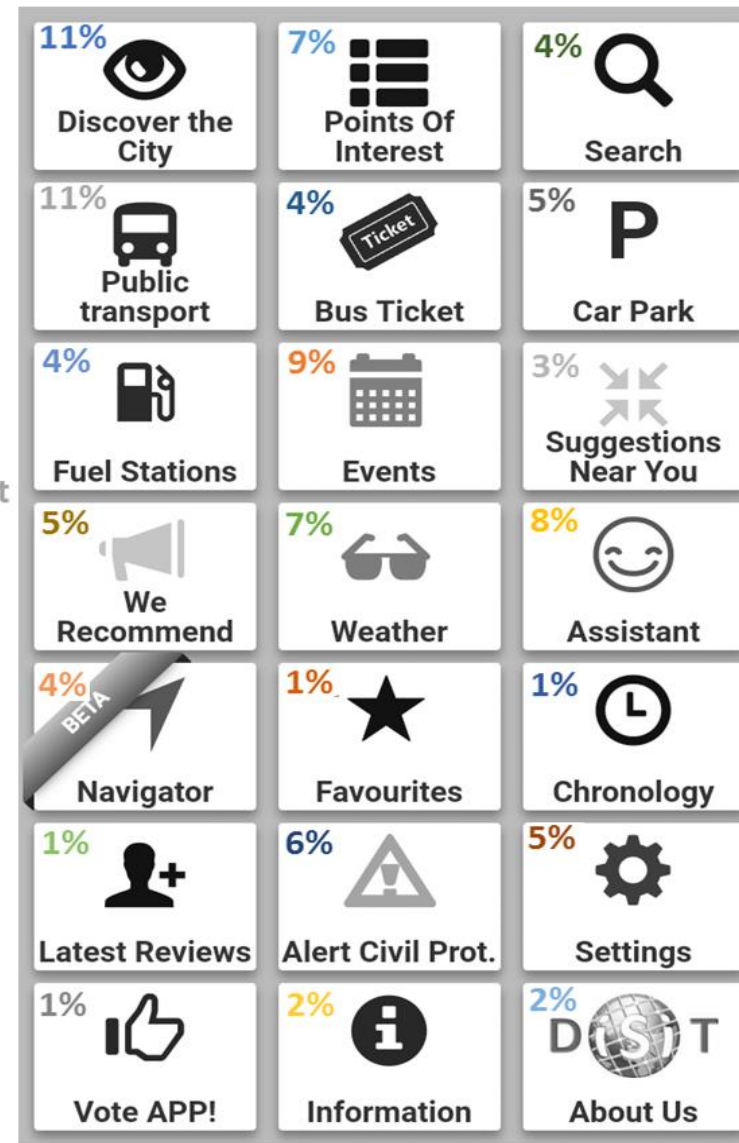
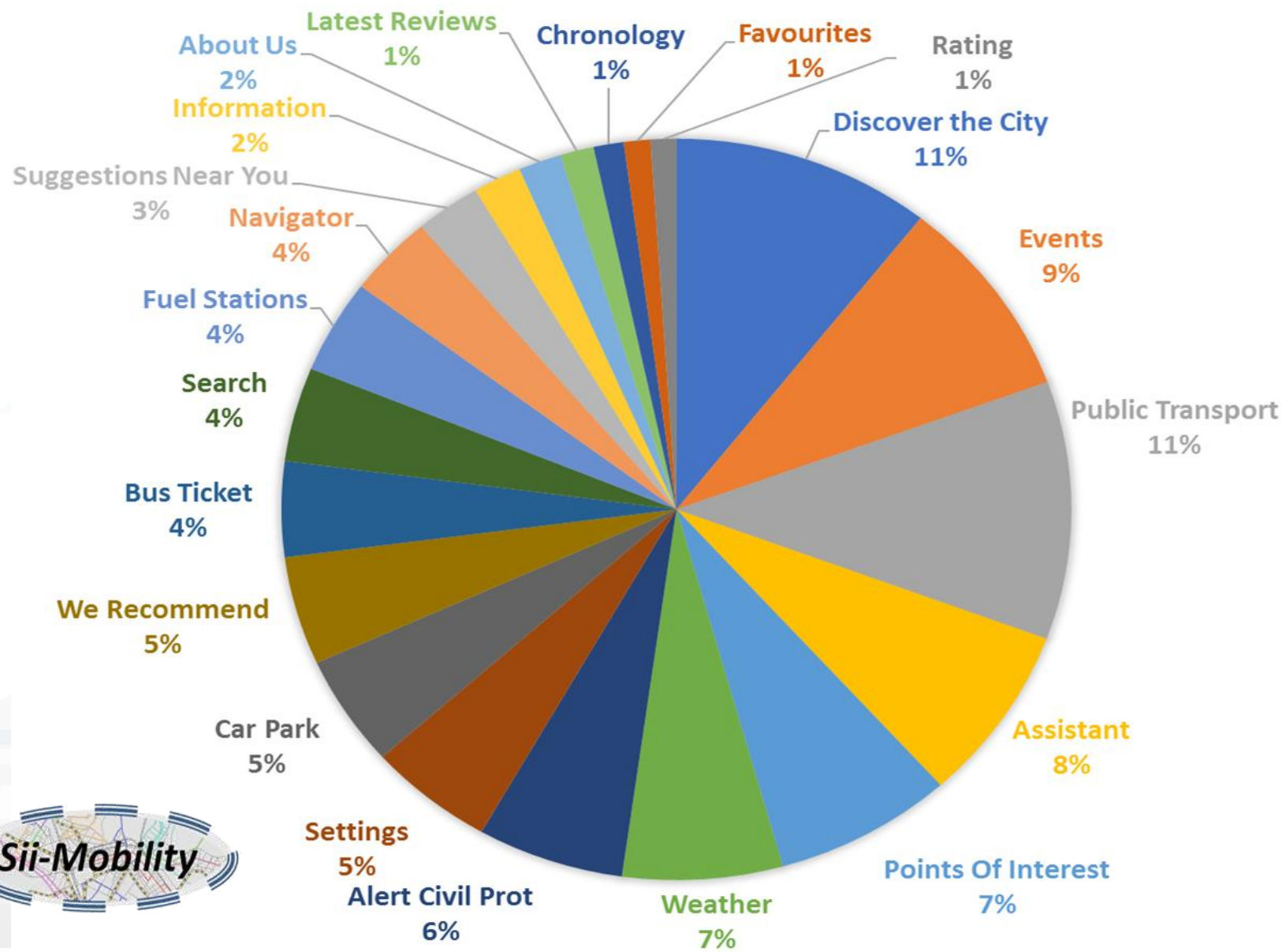


Users

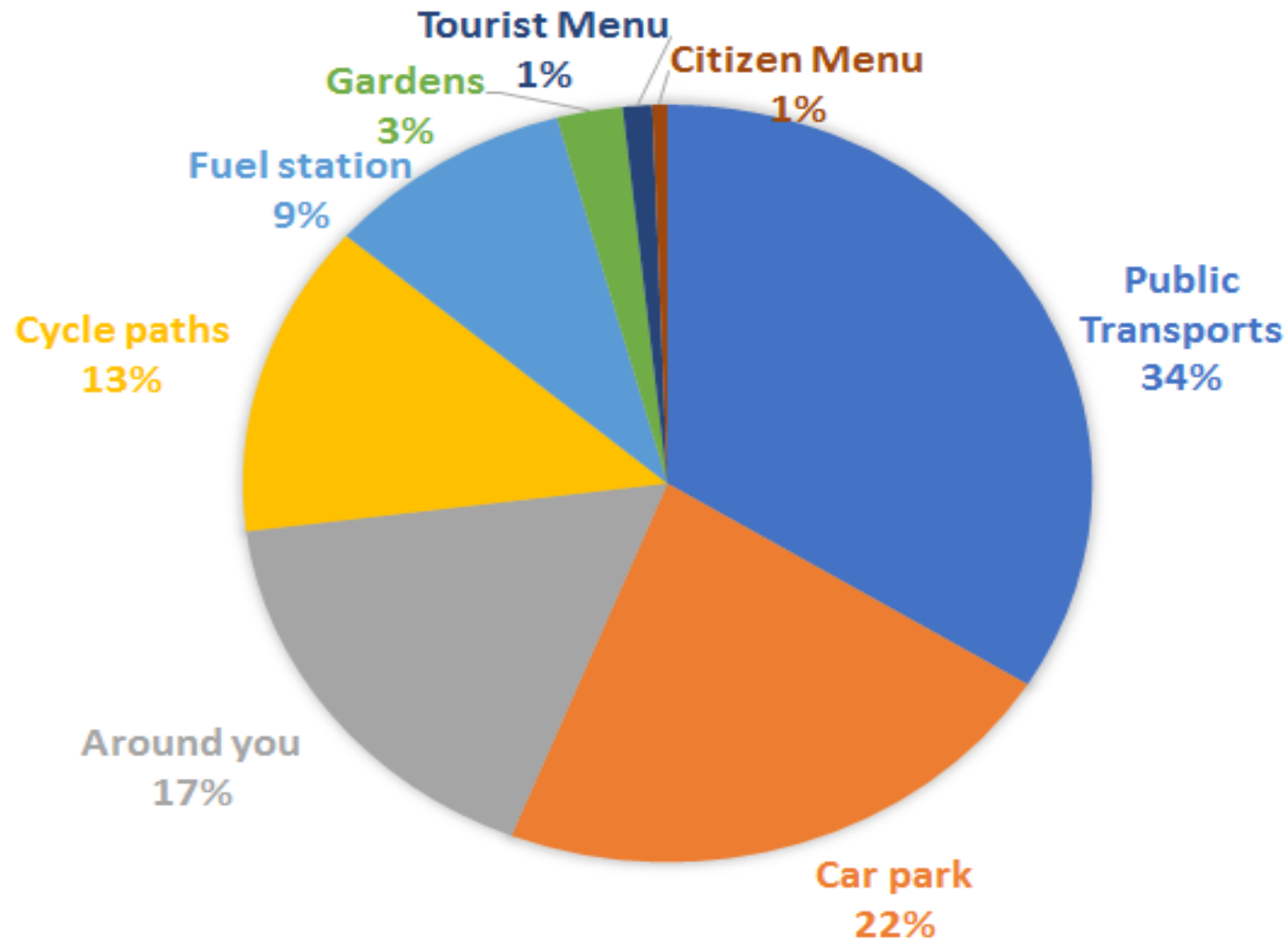
System



# Users' preferences

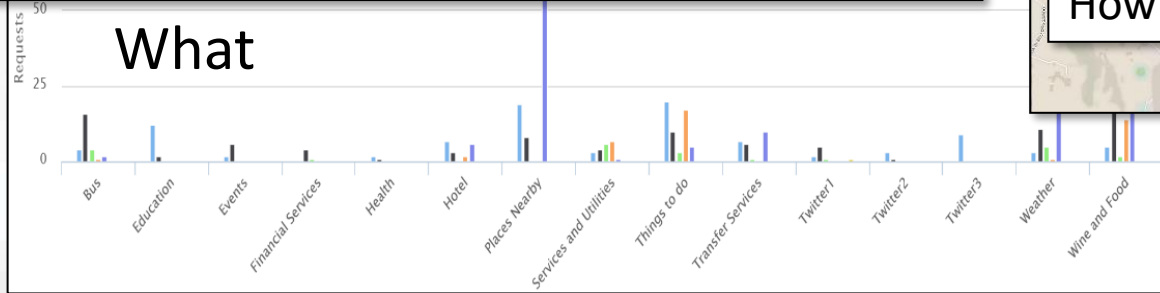
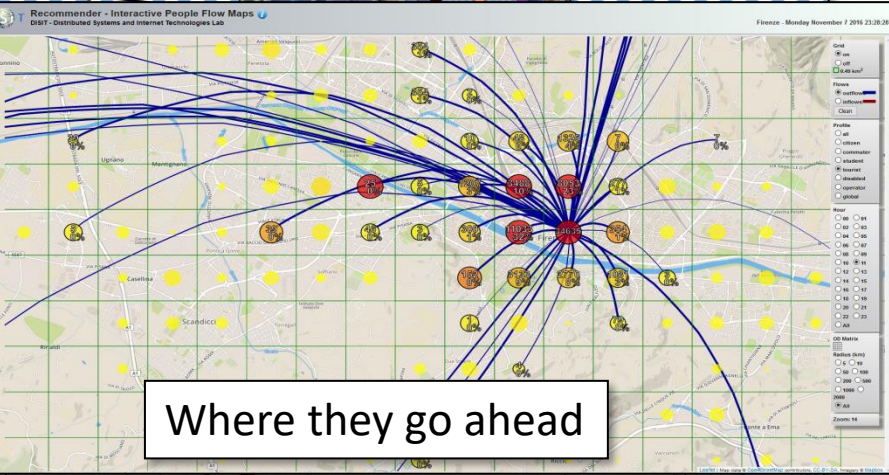
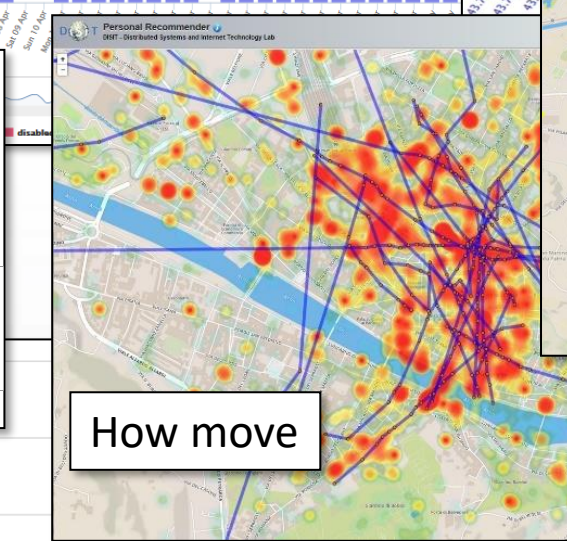
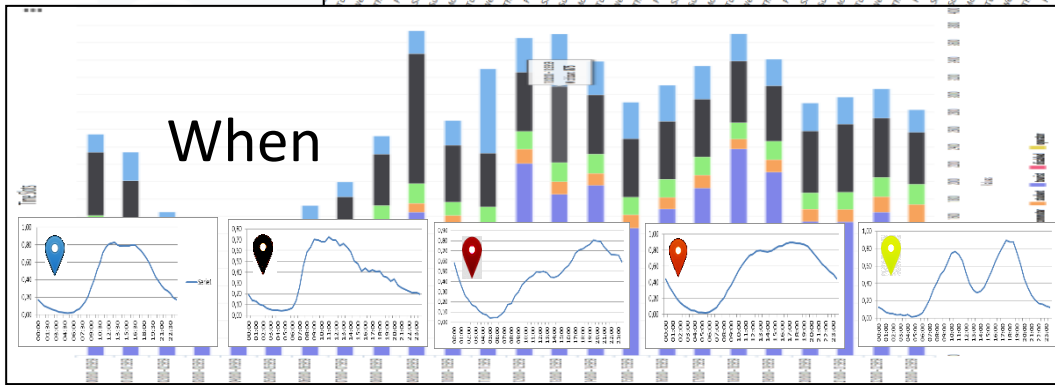
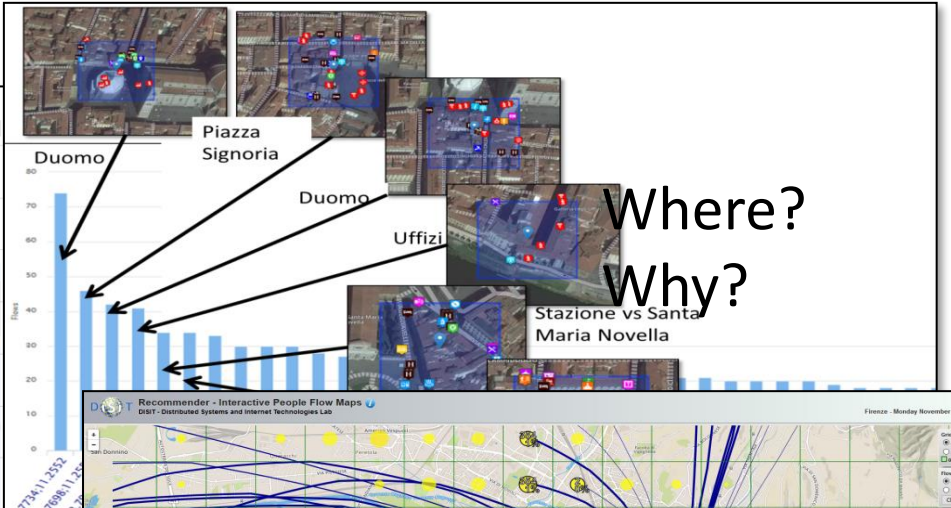
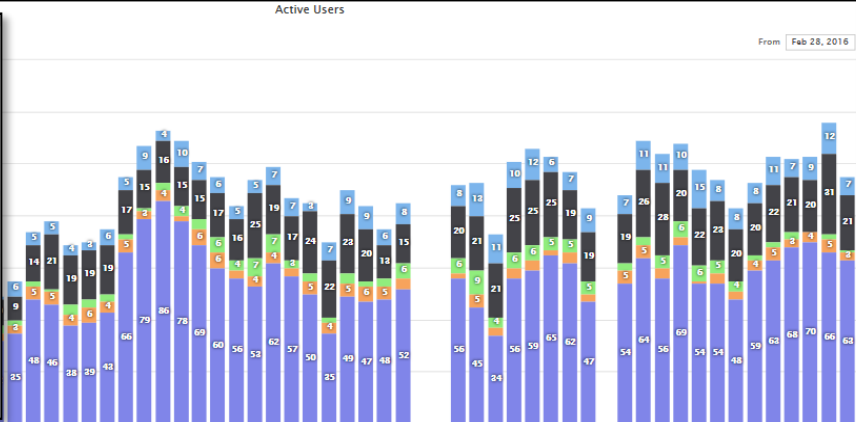
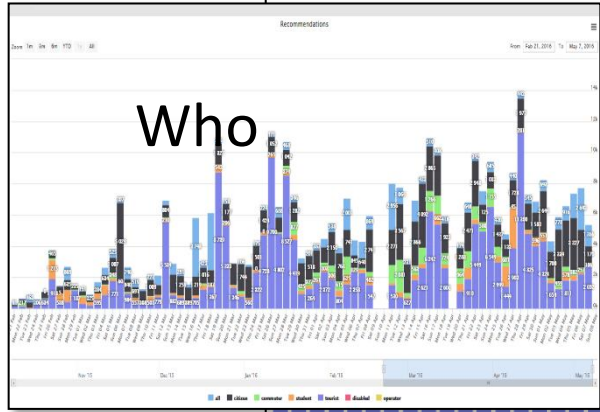


# Preferred Users' Categories



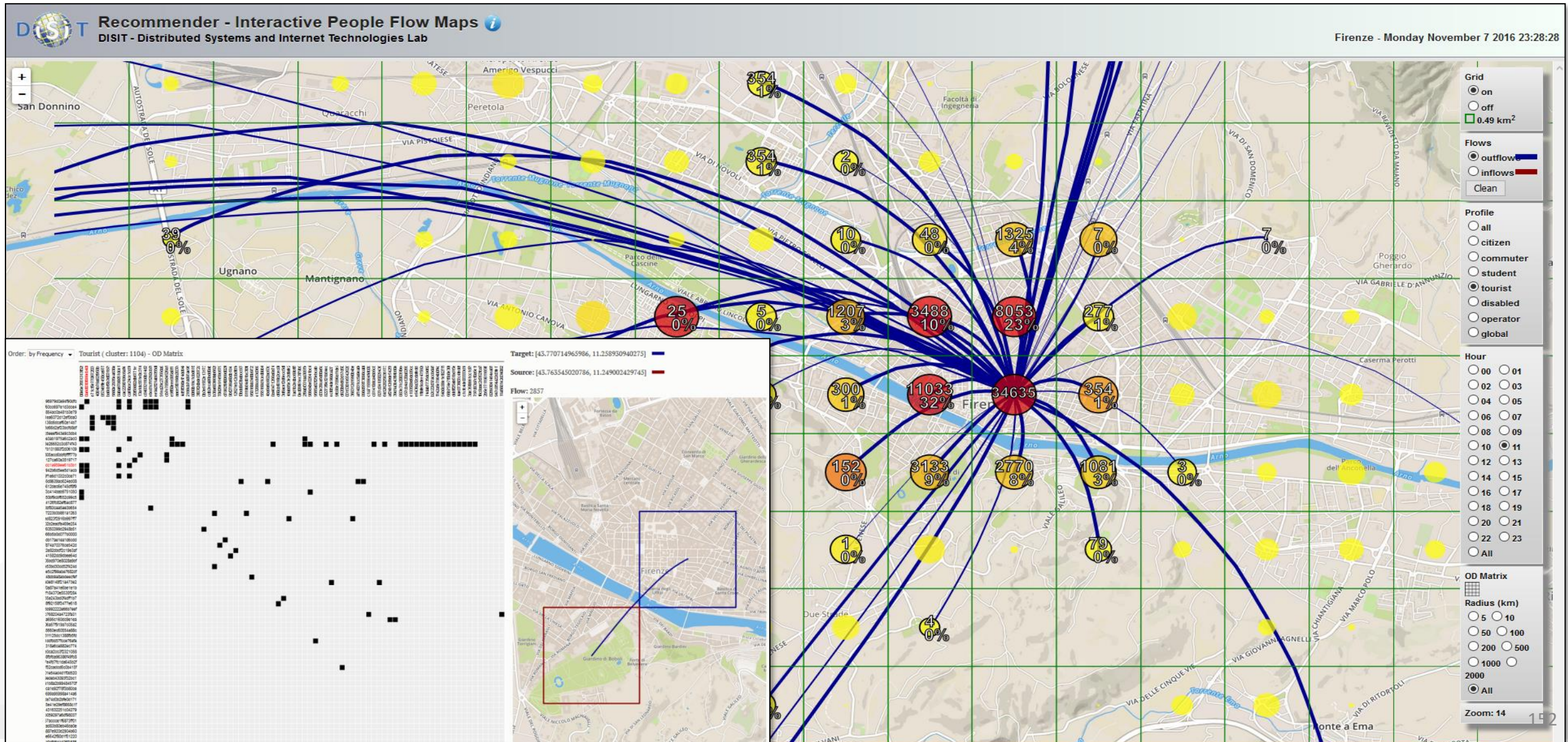


# User Behavior Analyser for Collective Profiling





# Scalable OD Matrix



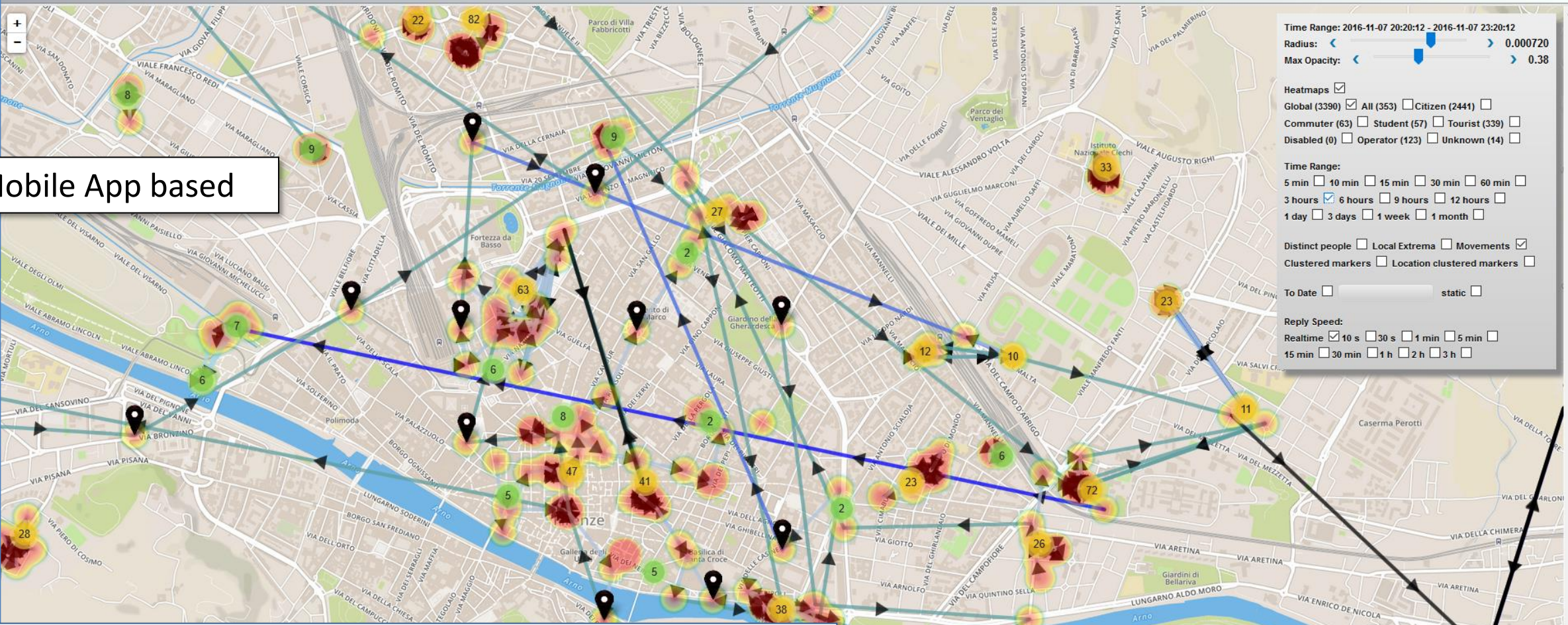


# Real Time Tracking: User Behaviour Analysis



DISIT Recommender  
DISIT - Distributed Systems and Internet Technologies Lab

Firenze - Monday November 7 2016 23:20:15



Mobile App based

How city users are moving ! REAL TIME TRACKING







# Understanding City User Behaviour

- **Mobile Applications** can send data via Advanced Smart City API to collect data about the city usage by the city users via a signed consent
  - See Mobile and Web App: Toscana in a Snap, Helsinki in a Snap, Antwerp in a Snap.
- **City User behavior analysis** includes production of:
  - suggestions, trajectories, hot places/heatmaps, etc.
  - origin destination matrices
  - data for the city user engagement
  - Etc.



<https://www.snap4city.org/drupal/node/489>

TOP

# *Engaging City Users Towards Virtuous Participated Attitude*





# Engaging via Mobile Apps

FROM CITY  
DASHBOARD TO  
APPLICATIONS

DATA  
AND  
KNOW  
MAN



SNAP4CITY  
AND KM4CITY  
PROJECTS

TO ADOPT  
4CITY, AND  
ROADMAP

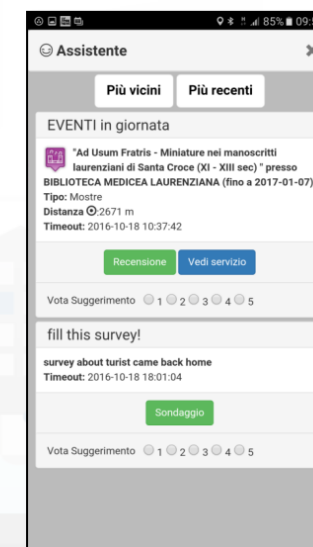
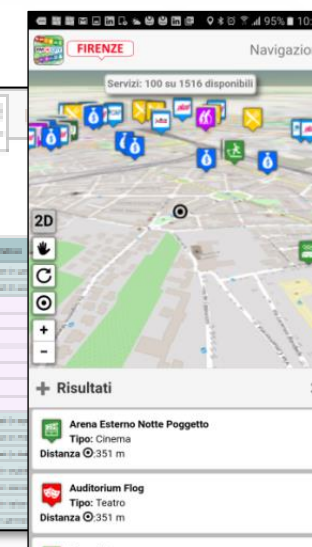
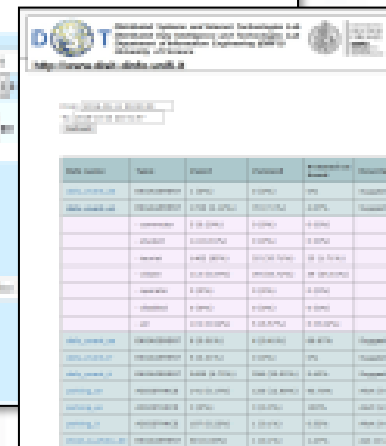
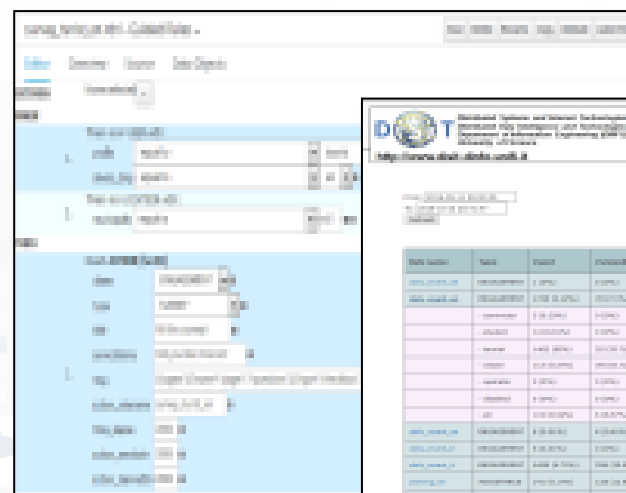
SNAP4CITY THE  
VIEW OF THE  
ADMINISTRATORS





# Profiled Engagements to City Users

- The users are profiled to learn habits:
  - Personal POI, paths, Mobility habits
- Information and engagements sent to the users are programmed according to the context and user behavior to:
  - Stimulate virtuous habits
  - More sustainable habits
  - More healthy habits, etc.
  - Get feedbacks
  - Provide bonus and prices, .....
  - Send alerts, ....







# Citizen Engagement via Mobile Apps

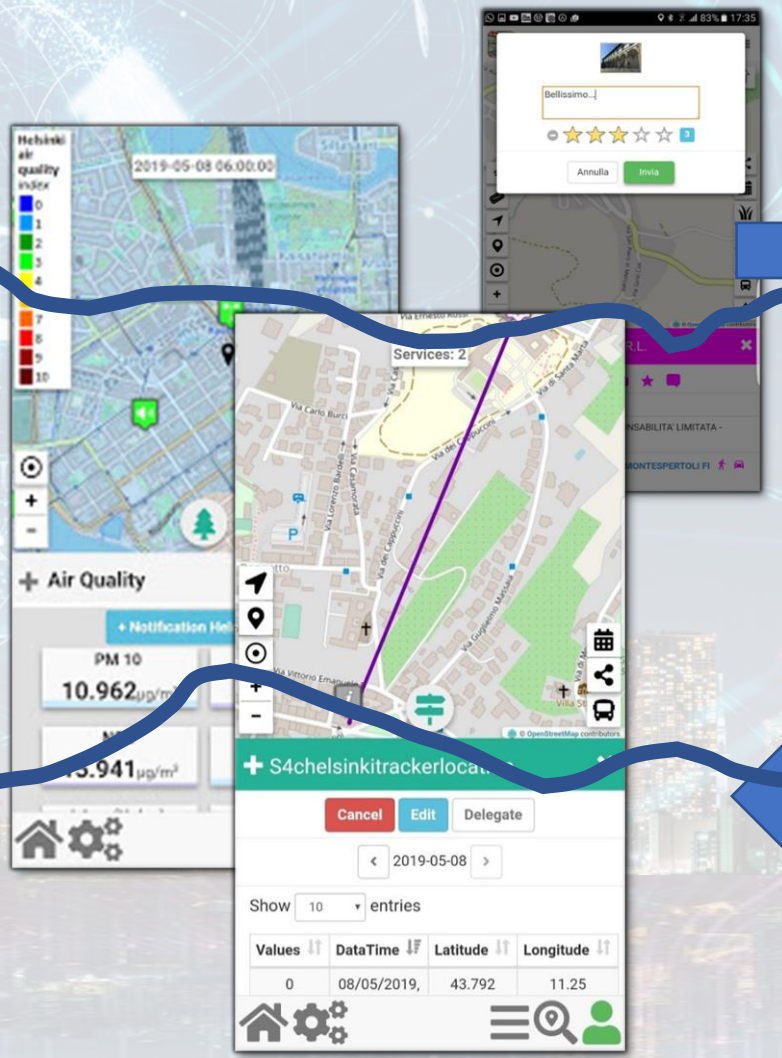
- GPS Positions
- Selections on menus
- Views of POI
- Access to Dashboards
- searched information
- Routing
- Ranks, votes
- Comments
- Images
- Subscriptions to notifications
- ....

## Produced information

- Viewed ?
- Accepted ?
- Performed ?
- ...

Users

Snap4City (C), Sept. 2024



## Derived information

- Trajectories
- Hot Places by click and by move
- Origin destination matrices
- Most interested topics
- Most interested POI
- Delegation and relationships
- Accesses to Dashboards
- **Cumulated Scores from Actions**
- Requested information
- Routing performed
- .....

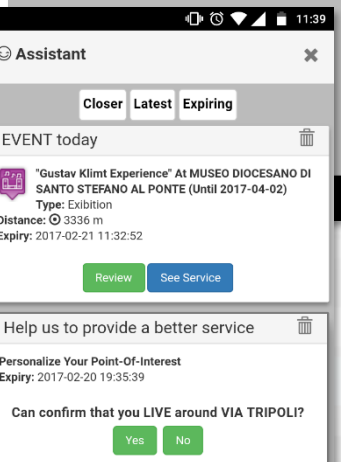
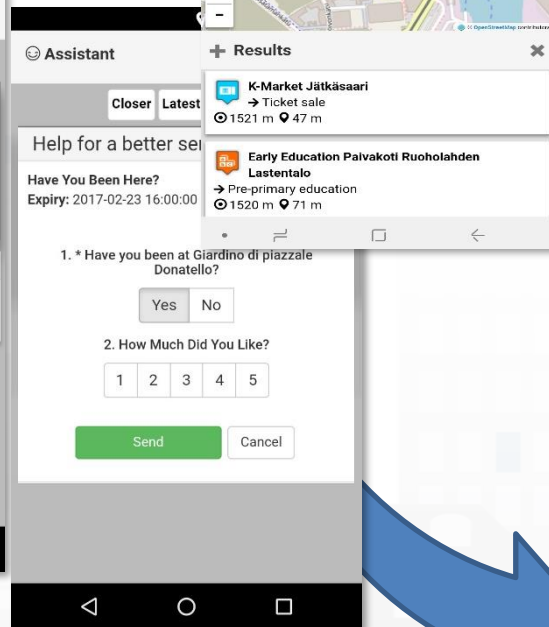
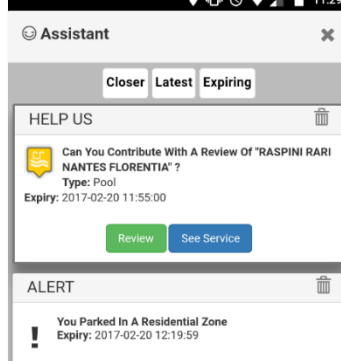
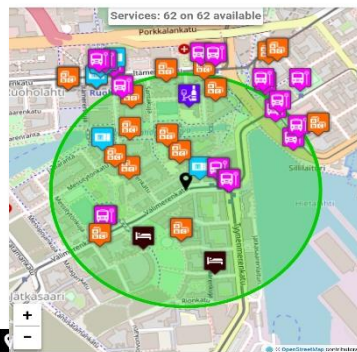
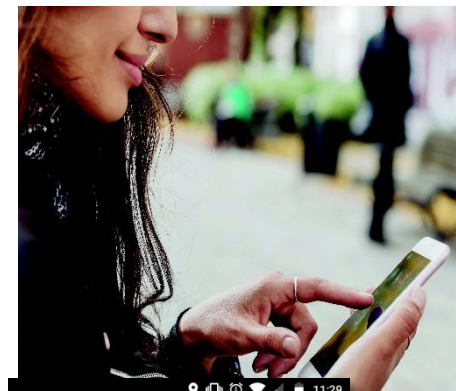


## Produced information

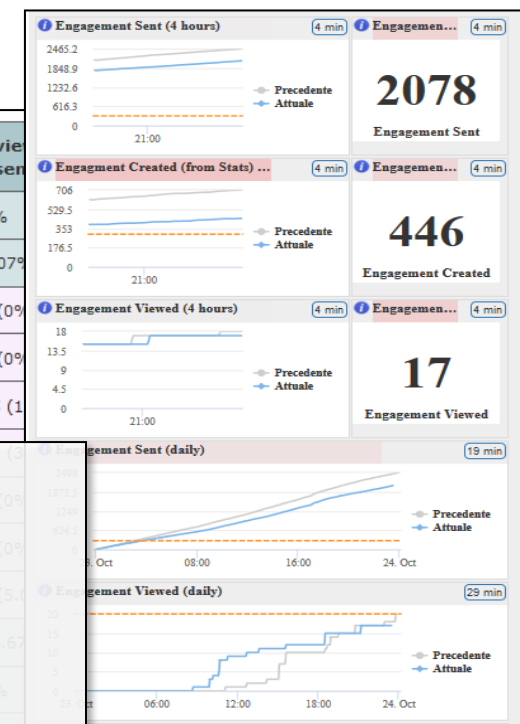
- Suggestions
- Engagements
- Notifications
- ...

System

# Users' Engagement



| Rule name      | Type       | #sent        | #viewed     | #viewed / #sent |
|----------------|------------|--------------|-------------|-----------------|
| daily_event_de | ENGAGEMENT | 1 (0%)       | 0 (0%)      | 0%              |
| daily_event_en | ENGAGEMENT | 1720 (2.12%) | 70 (7.1%)   | 4.07%           |
| - commuter     |            | 5 (0.29%)    | 0 (0%)      | 0 (0%)          |
| - student      |            | 14 (0.81%)   | 0 (0%)      | 0 (0%)          |
| - tourist      |            | 1462 (85%)   | 25 (35.71%) | 25 (17.1%)      |



**Inform**  
Air Quality forecast is not very nice  
You have parked out of your residential parking zone  
The Road cleaning is this night  
The waste in S.Andreas Road is full

**Engage**  
Provide a comment, a score, etc.

**Stimulate / recommend**  
Events in the city, services you may be interested, etc..

**Provide Bonus, rewards if needed**  
you get a bonus since you parked here  
We suggest: leave the car out of the city, this bonus can be used to by a bus ticket

User context

City context

Rules

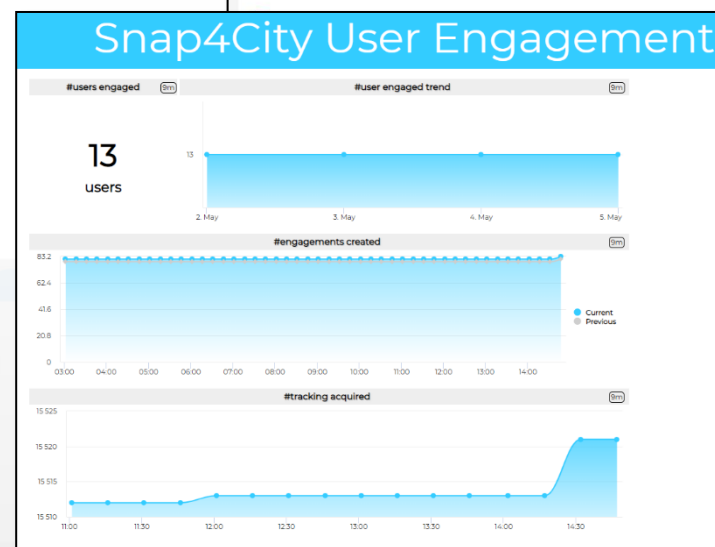
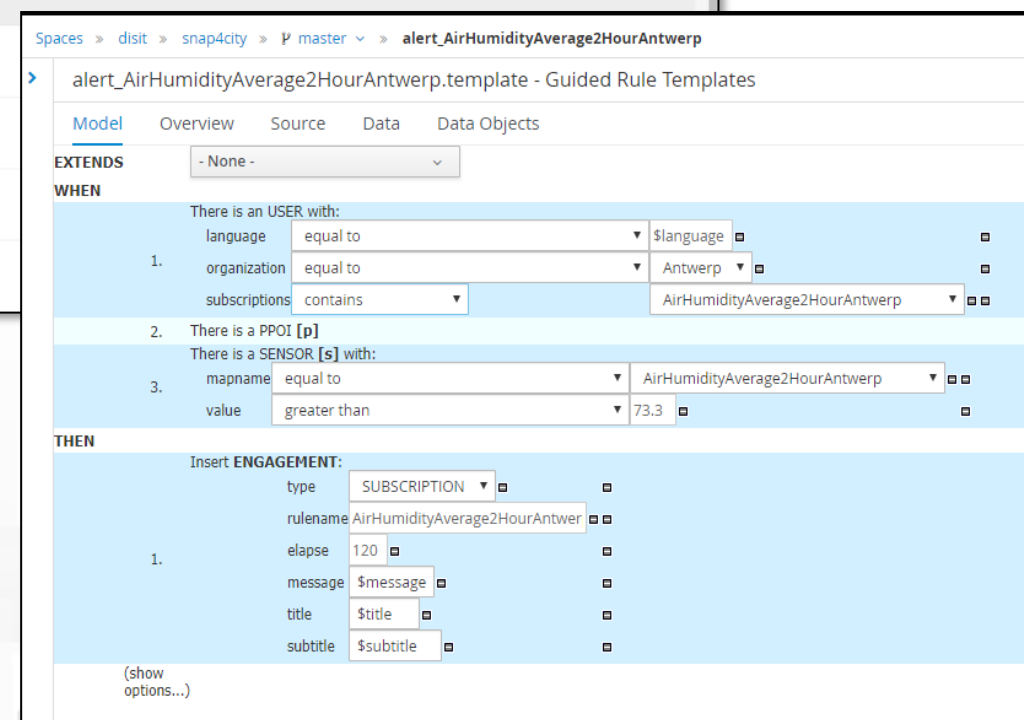
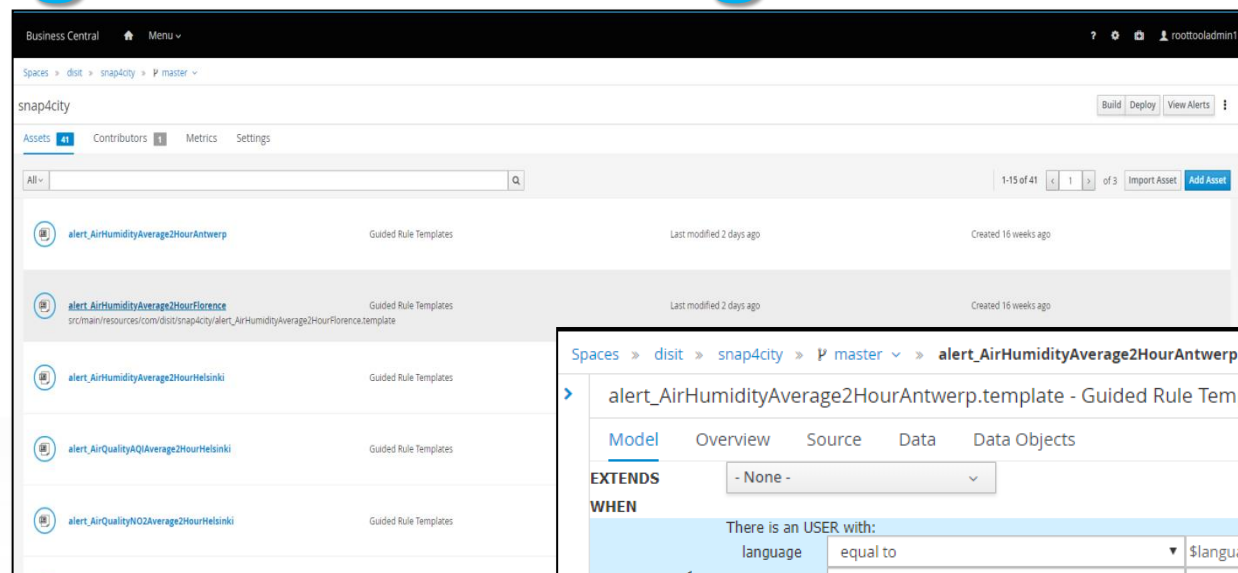


# Engaging City Users

- **Mobile Applications** can use Advanced Smart City API to collect data about the city usage by the city users via a signed consent
- It can be used for sending engagements to them such as to:
  - **Inform**
    - You have parked out of your residential parking zone
    - The Road cleaning is this night
    - The waste in S.Andreas Road is full
  - **Engage**
    - Please Provide a comment, a score, etc.
  - **Stimulate / recommend**
    - Events in the city, services you may be interested, etc..
  - **Provide Bonus**
    - Since you have parked here you can get 1 Bonus
    - We suggest you to leave the car out of the city, this bonus can be used to buy a bus ticket

# Engagement Manager

- Definition of Rules for campaigns
- Monitoring and follow-up for each City
- Segmented for user kind and interest





# Sii smart. Sii-Mobility!

Scarica

Dal 15 aprile al 15 luglio scegliere il trasporto pubblico ti premia! Scarica l'app "Toscana dove, cosa" e guadagna punti viaggiando in autobus e vinci tanti fantastici premi! Per maggiori informazioni visita il sito [info.sii-mobility.org](http://info.sii-mobility.org)

In palio per te  
Carnet multicorsa Cap e  
voucher per:

# Sii smart. Sii-Mobility!

Scarica, viaggia, vinci!

Dal 15 aprile al 15 luglio scegliere il trasporto pubblico ti premia! Scarica l'app "Toscana dove, cosa", guadagna punti viaggiando in autobus e vinci tanti fantastici premi! Per maggiori informazioni visita il sito [info.sii-mobility.org](http://info.sii-mobility.org)



In palio per te  
Carnet multicorsa Cpt e  
voucher per:



Ci Prendiamo cura del tuo benessere



# Sii smart. Sii-Mobility!

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# Campaing on Sustainable Mobility

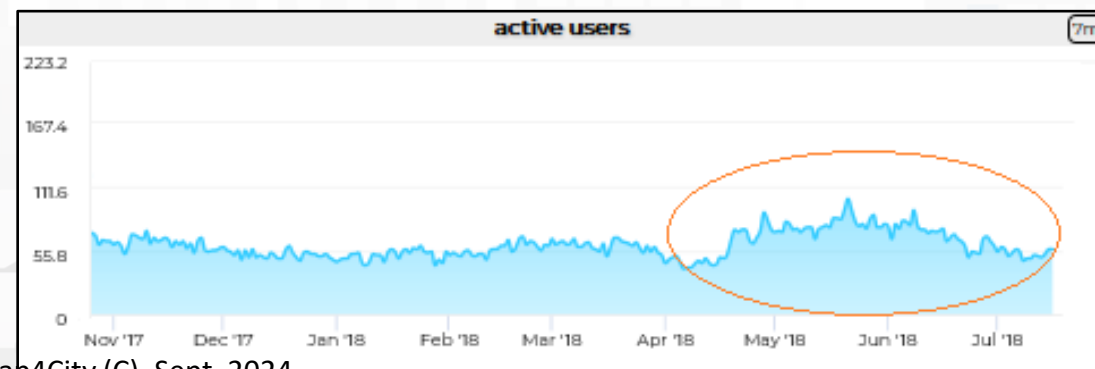
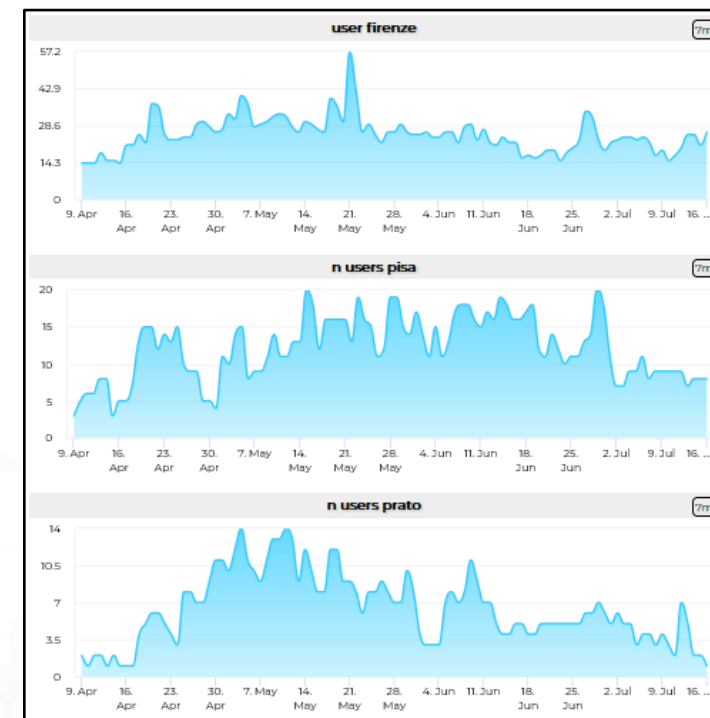
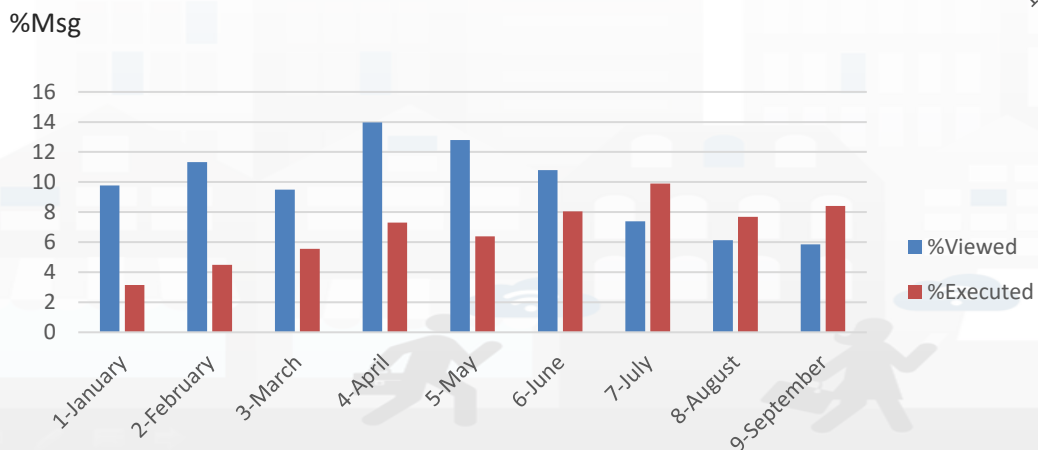
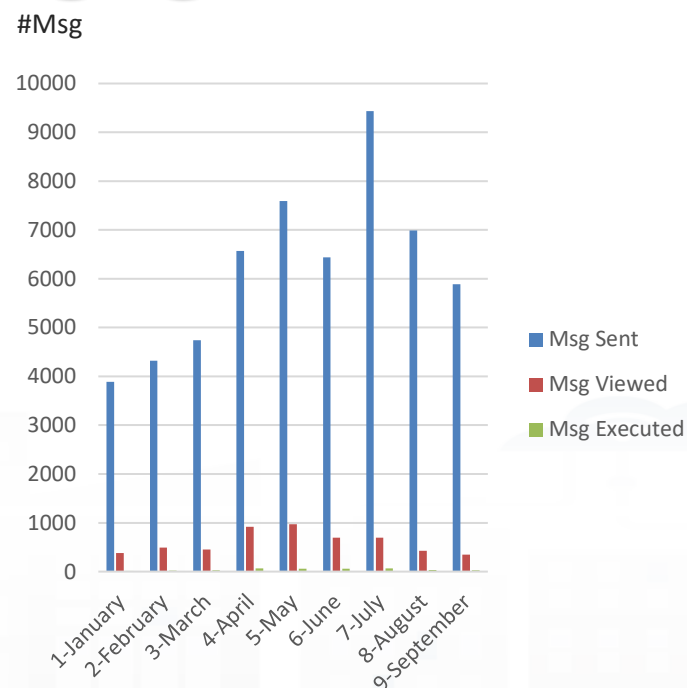
# Rules for Rewards

- **ASSISTANCE**
- If public transport is detected after bus line suggestion on trajectory usually made on private transport → **10points**
  - Why don't you take the bus line 4 in Piazza Marconi to reach your workplace? You save money, you respect the environment and you will be stress free for not worry about parking!
- Once a day, if public transport is detected after suggestion on an alternative bus line availability → **3points**
  - Why don't you take the bus line 4 that stop just 50 meters far from you? You save money, you respect the environment and you will be stress free for the traffic jam!
- If public transport is detected for at least **30(?)** minutes a day → **1point**
- **ENGAGEMENT**
- Survey on commuter and their preferred way of mobility → **1point**
  - How many minutes you usually commute to go to work?  
How do you rate the service?
- Feedback on public transport → **1point**
  - Which current public transport are you using? Are the service in line with your expectation?
- **Comments/Photo/Rate or survey on POI (public transport) → 1point**
- Survey on use of the App after N days or for tourist coming home → **1point**
- Feedback on PPOI or mobility → **1point**



# Validation of user Engagement

| Months      | Msg Sent | Msg Viewed | Msg Executed |
|-------------|----------|------------|--------------|
| 1-January   | 3888     | 380        | 12           |
| 2-February  | 4319     | 489        | 22           |
| 3-March     | 4739     | 450        | 25           |
| 4-April     | 6567     | 918        | 67           |
| 5-May       | 7594     | 972        | 61           |
| 6-June      | 6437     | 695        | 55           |
| 7-July      | 9432     | 697        | 69           |
| 8-August    | 6988     | 429        | 73           |
| 9-September | 5885     | 345        | 49           |
| Total       | 55849    | 5375       | 433          |



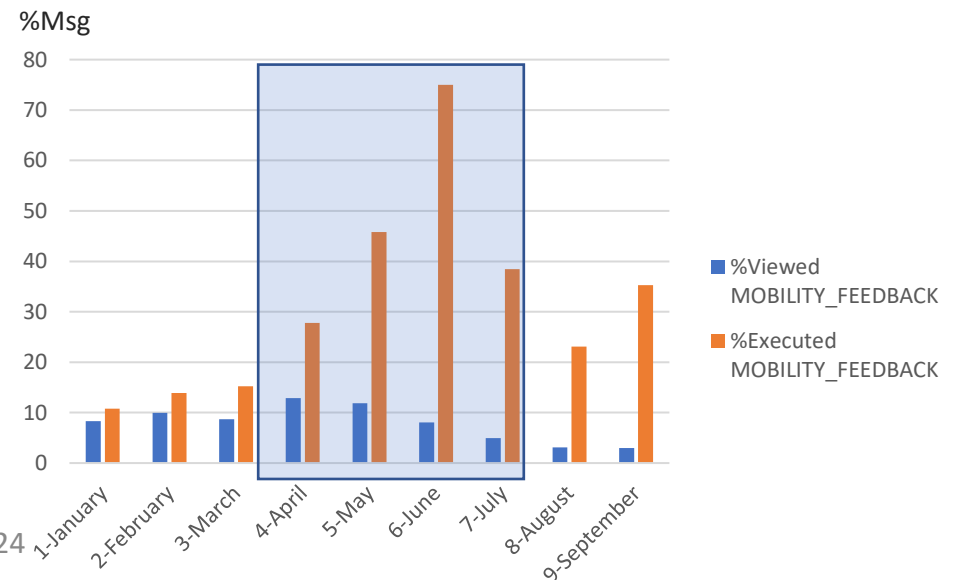
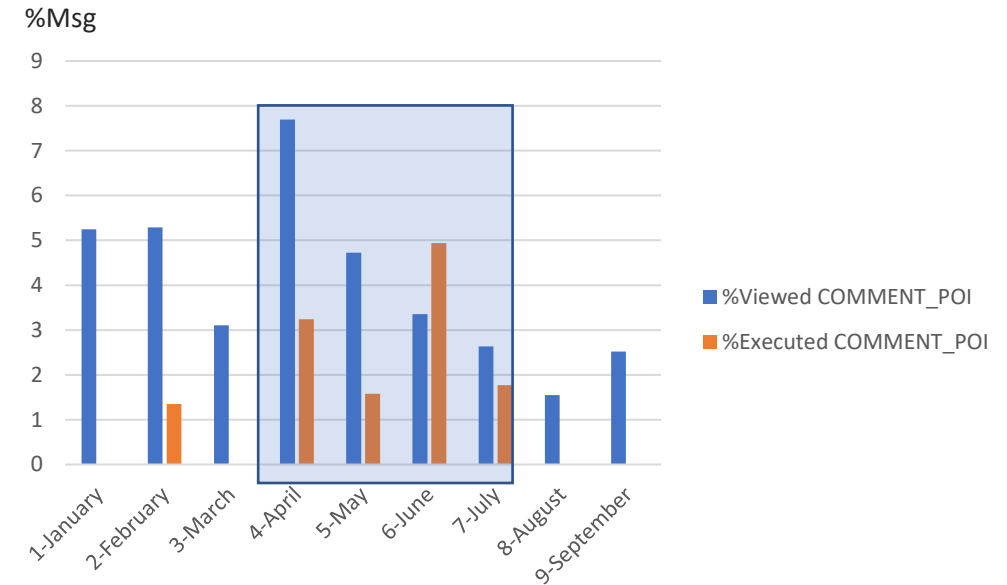
# User Behaviour Analysis



## VALIDATION

- During the PILOT new rules has been added (30 on a total of 80) and mostly all of them are still online
- COMMENT\_POI: requires more user interaction and not very contextualized (POI proximity) → higher rate of sent, lower rate on execution
- MOBILITY\_FEEDBACK: requires less user iteration and very contextualized (user in MOBILITY) → normal rate of sent, high rate on execution

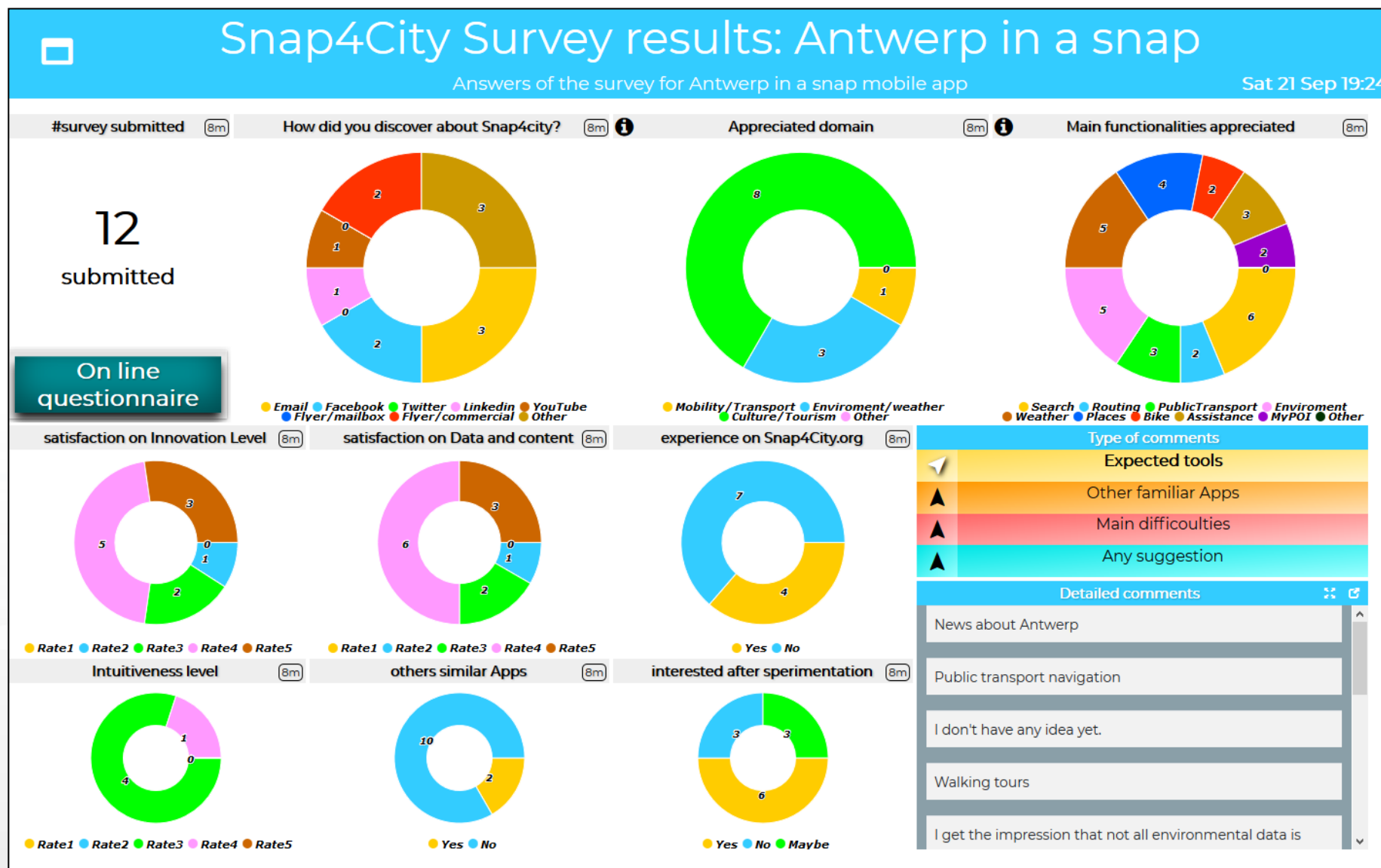
|                   | Msg Sent | Msg Viewed | Msg Executed |
|-------------------|----------|------------|--------------|
| COMMENT_POI       | 21632    | 804        | 15           |
| MOBILITY_FEEDBACK | 5378     | 371        | 94           |





<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc2OQ==>

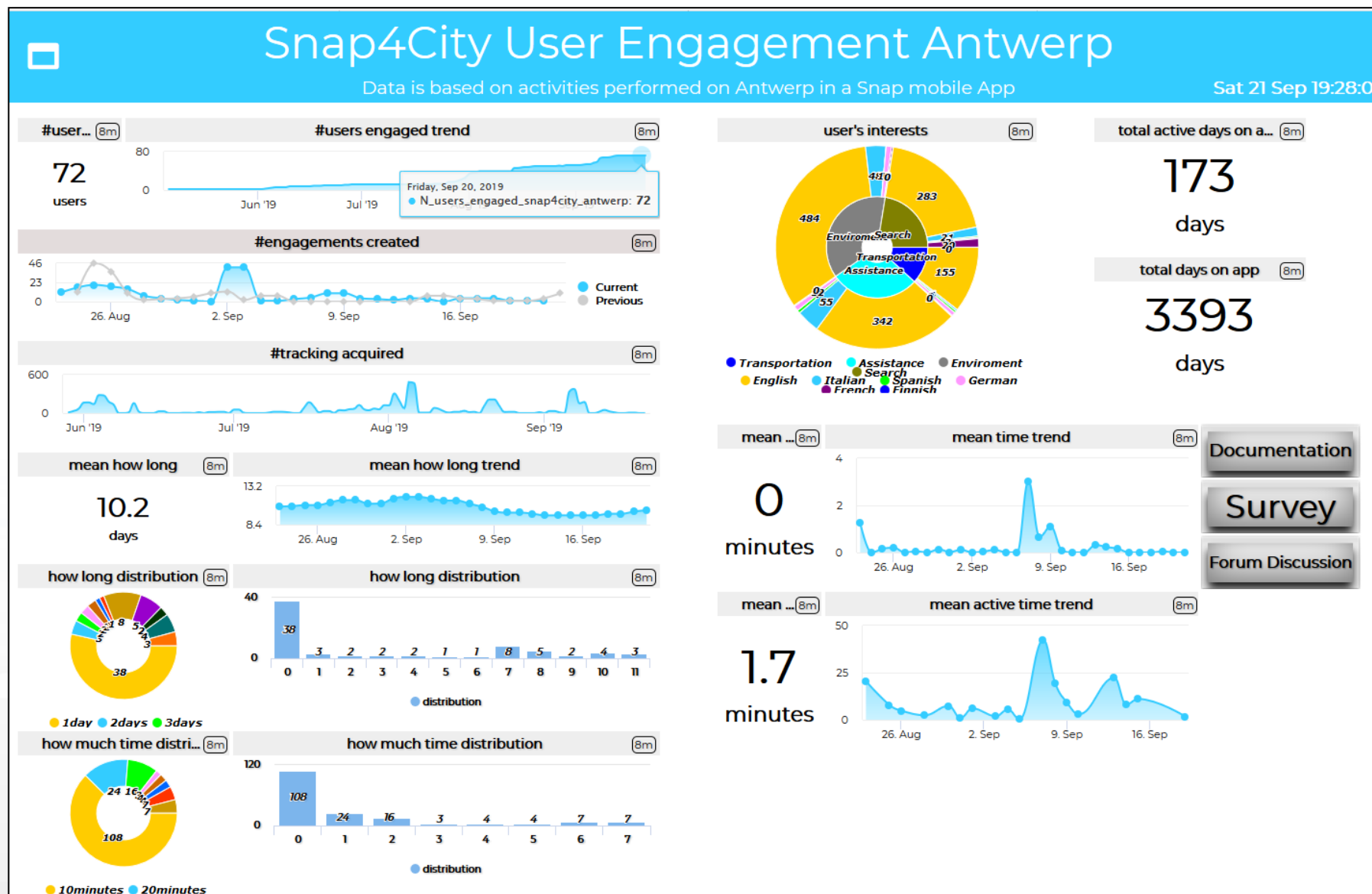
Dashboard  
created to monitor  
in real time the  
answers to the  
survey provided  
on the Mobile  
App directly by the  
Engagement tool



<https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc1OQ==>

## Dashboard monitoring the Mobile App:

- Collecting the clicks
- Describing the community of users in terms of the profile aspects
- Measuring the time spend, and topics of interest of the users, etc.





TOP

# Connected Drive

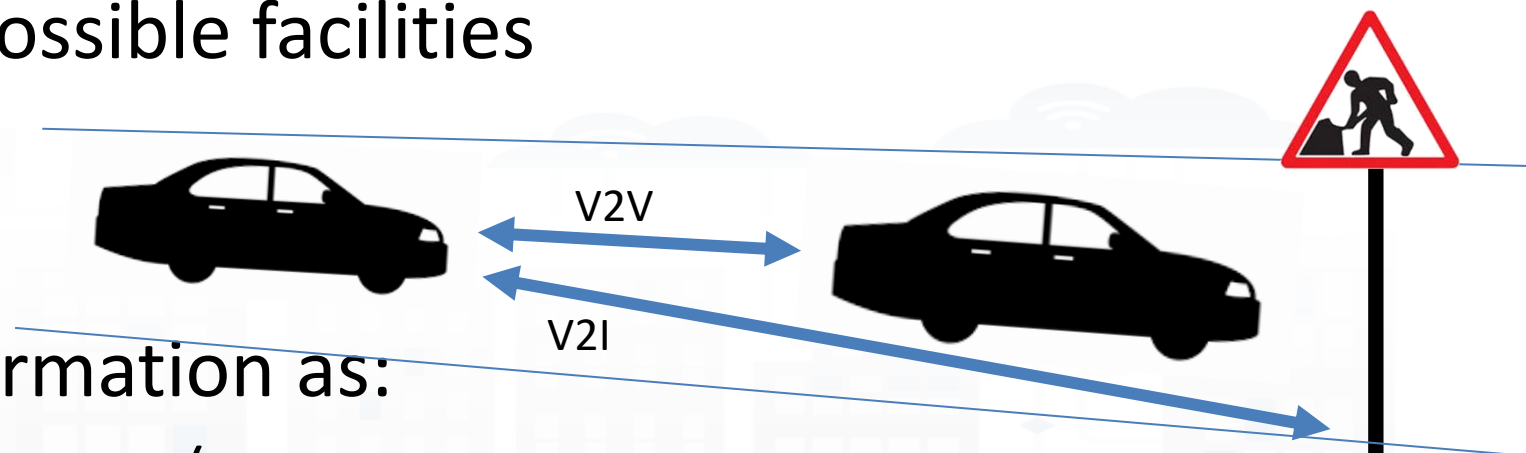


# Main Concept of Connected Drive

- Different kinds of communications may arrive on the vehicles on board devices
- Mobile Phones can be a possible facilities



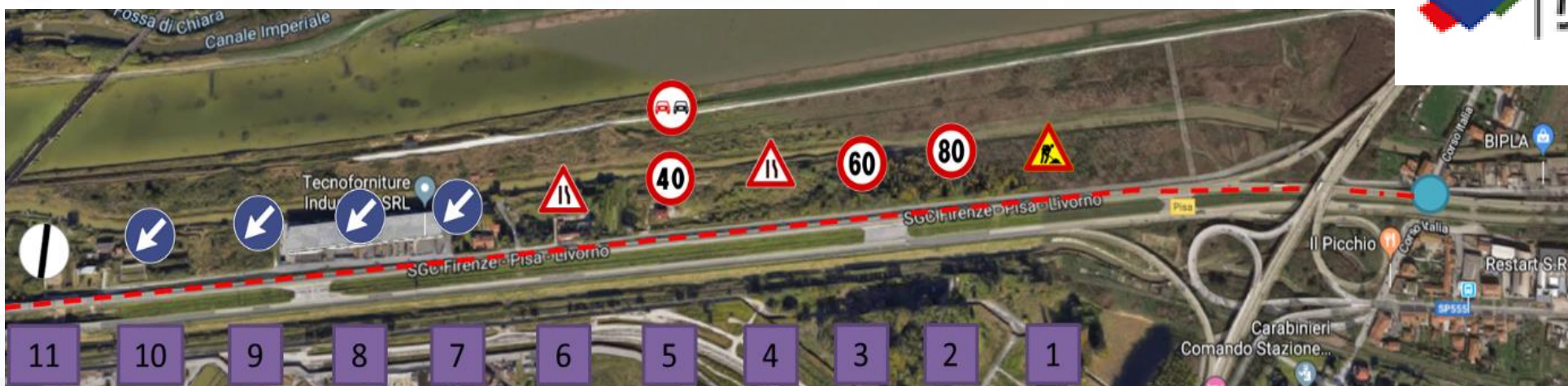
- Geolocated Real time Information as:
  - Alerting, dynamic digital signage (may not present physically on the road)
  - Supporting autonomous driving vehicles





# Experimentation on «Toscana Dove Cosa»

- Mobile App supporting connected Drive V2I connections:
  - <https://play.google.com/store/apps/details?id=org.disit.toscana&hl=it>
  - <https://apps.apple.com/it/app/toscana-where-what-km4city/id1064554200>
  - For the MOSAIC project and pilot in Tuscany
- The mobile App has a Navigator which includes now the acquisition of connected drive messages

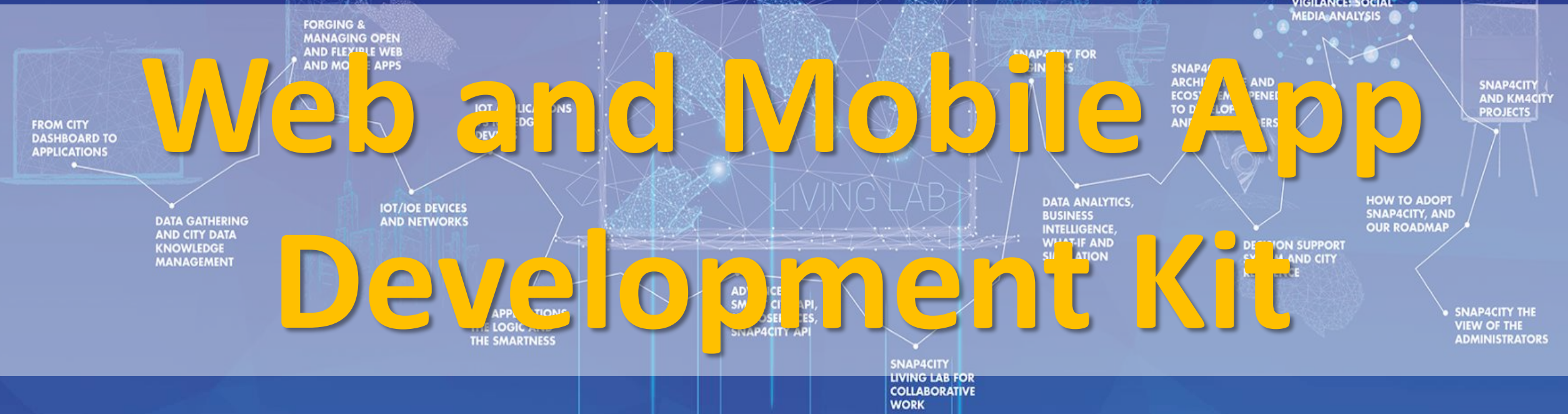






TOP

# Web and Mobile App Development Kit



# VIDEO



TOP

# Web and Mobile App Development Kit

FROM CITY DASHBOARD TO APPLICATIONS

DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT

IOT/IOE DEVICES AND NETWORKS

APPLICATIONS LOGIC THE SMARTNESS

ADVANCED API, SERVICES, SNAP4CITY API

SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK

DATA ANALYTICS, BUSINESS INTELLIGENCE, WHAT-IF AND SIMULATION

DECISION SUPPORT FOR CITIES AND CITY PLANNERS

HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP

SNAP4CITY THE VIEW OF THE ADMINISTRATORS

FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS

IOT/IOE DEVICES AND NETWORKS

SNAP4CITY FOR BUSINESS

SNAP4CITY ARCHITECTURE AND OPEN API TO DEVELOPERS

TWITTER VIGILANCE SOCIAL MEDIA ANALYSIS

SNAP4CITY AND KM4CITY PROJECTS





APACHE  
**CORDOVA**™

- **Apache Cordova** is a set of **JavaScript APIs** that enable the devices to the application developer to access native features of the device such as the camera or accelerometer, storage, network, gps ....
- Combined with a user **interface framework** such as Dojo Mobile or jQuery Mobile or Sencha Touch, allows the development of smartphone applications using only **HTML, CSS and JavaScript**.
- When using the Cordova API, an application can be built without any native code (Java, Objective-C, C# etc.). The **web technologies** used are **hosted in the same application** at the local level (usually not on a remote http server).
- These **JavaScript API** are **consistent** and **valid** for the **different platforms** of mobile devices, in this way the application built on the Web standard, should be **portable** with a **minimum of changes**.



# Mustache JS

- The library is **independent** from specific framework but there are plugins for the integration with jQuery, Dojo, and YUI.
- Possibility to work with **javascript objects** and then exploit the communication of **data** in **JSON format** from a **REST** call via AJAX.
- The **templates** for Mustache may be assigned or loaded as a string to a variable and the placeholder are identified by two braces, for example: `{{miopplaceholder}}`.
- One of the most interesting of the library feature is support in **enumerable values**
- Documentation and downloads are available on the official website:  
<http://mustache.github.io>

# Mustache JS

Template



```
<h1>{{titolo}}</h1>
<p>{{descrizione}}</p>
{{#risultato}} //solo se risultato è true
 {{#citta}}
 {{nome}} ({{sigla}})

{{/risultato}}
{{^risultato}} //altrimenti...
 <p>Nessuna città trovata!</p>
{{/risultato}}
```

JSON



```
var data = {
 risultato: true,
 titolo: Città italiane,
 descrizione: Lista delle città italiane,
 citta: [
 {nome: Milano, sigla: MI},
 {nome: Roma, sigla: RM}
]
};
```

# Mustache JS

Template



```
<h1>{{titolo}}</h1>
<p>{{descrizione}}</p>
{{#risultato}} //solo se risultato è true
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```

JSON



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var data = {
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 {nome: Milano, sigla: MI},
 {nome: Roma, sigla: RM}
]
};
```

Template + JSON + Mustache

## Città italiane

Lista delle città italiane

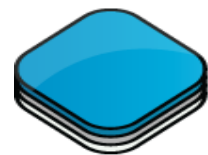
- Milano (MI)
- Roma (RM)



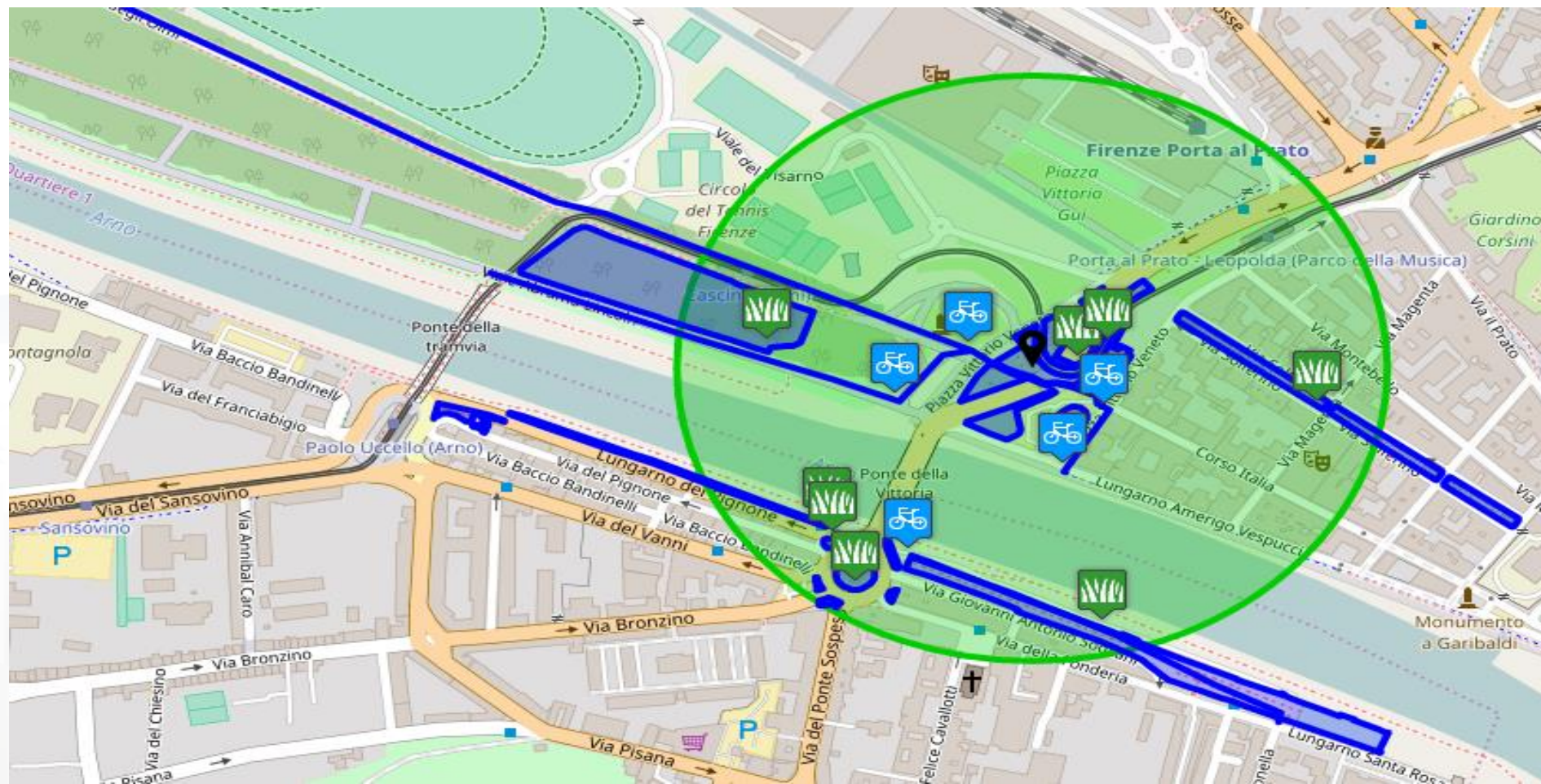


# OpenLayers 3.0

- **OpenLayers** is an open source **JavaScript library** for **displaying map data** in web browsers and can be used with a hybrid application developed with Cordova
- In the **early versions** of the app, the map was managed by **Leaflet.js** library. This was replaced because it didn't support the rotation, which is required to insert navigation functions within the app
- In addition, OpenLayers 3.0 builds the map and objects added to it with a **canvas** renderer, which is **very efficient** when objects are **numerous and small** as the markers displayed for each search done with the app
- Documentation and downloads are available on the official website: **<http://openlayers.org>**

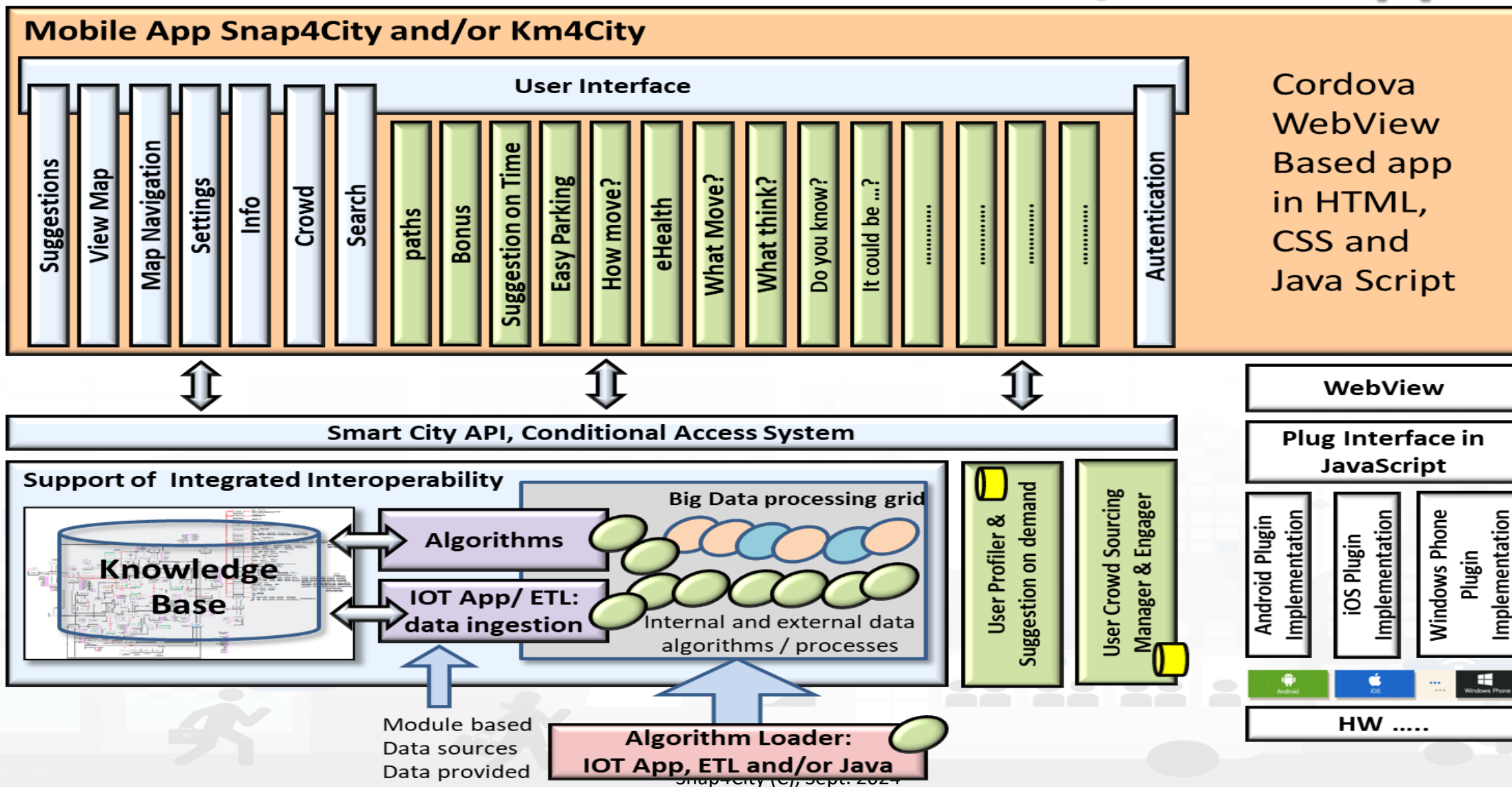


# OpenLayers 3.0





# General architecture of Mobile / Web App








# Create ParkingSearcher Module

In the slides following there is an **example** of how to add a **module** to the app.

The goal of this example is to create a **new module** that in addition to viewing the list of car parks as is already the case for the button named "Parking" will **show directly** the **number of free parking lots** for each car park found

# Create ParkingSearcher Module

- Files required for creating a new module are as follows

	ExampleModule.js Tipo: File JavaScript
	exampleModule.labels. * .json Tipo: JSON File
	exampleModule.principalMenu.json Tipo: JSON File

A **Javascript** file containing the **logic**








5 JSON files (**ita, eng, esp, deu, fra**) containing **labels** to be included in the new interface

A JSON file that contains one or more **buttons** to be added to **principal menu** to allow the user to interact with the newly created module

# Create ParkingSearcher Module

- Copy these files to a **new folder** that will have the **name of the new module** (i.e., **ParkingSearcher**): the **names of the files** copied have to be changed to get the **module name as a prefix**

oro > workspace > siiMobilityAppKit > www > js > modules > parkingSearcher

	ParkingSearcher.js Tipo: File JavaScript
	parkingSearcher.labels.deu.json Tipo: JSON File
	parkingSearcher.labels.eng.json Tipo: JSON File
	parkingSearcher.labels.fra.json Tipo: JSON File
	parkingSearcher.labels.ita.json Tipo: JSON File
	parkingSearcher.labels.spa.json Tipo: JSON File
	parkingSearcher.principalMenu.json Tipo: JSON File



# ParkingSearcher in main menu

- **Field descriptions for creating buttons in the main menu**

```
{
 "callback": "PrincipalMenu.hide(): MapManager.centerMapOnGps():",
 "iconId": "",
 "iconClass": "icon ion-android-bus",
 "iconFontSize": "41px",
 "iconColor": "#CC0000",
 "imgSrc": "img/ticketmenu.png",
 "imgHeight": "37px",
 "text": "P",
 "textFontSize": "38px",
 "textColor": "#CC0000",
 "captionId": "principalMenuParkingSearcher",
 "captionTextId": "moduleParkingSearcher",
 "step": true,
 "stepId": "eventsBadge",
 "ribbon": true,
 "ribbonId": "",
 "ribbonStyle": "background: #336633;background: linear-gradient(#33FF33 0%, #336633 100%);",
 "ribbonText": "Beta",
 "removed": false,
 "index": 0
}
```

parkingSearcher.principalMenu.json

This field contains the **callback** for the new module.

The present callbacks should be left, because they serves to **close the main menu** and to **center the map on the GPS**

# ParkingSearcher in main menu

- **Field descriptions** for creating buttons in the **main menu**

```
[
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 "removed": false,
 "index": 0
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```

parkingSearcher.principalMenu.json

These blocks of fields are **mutually exclusive**. Allow you to choose the icon that will identify the button that you are creating. This icon can be chosen as an **image**, a **text**, a **glyphicon** (Bootstrap) or **ionicons** (ionicons.com).

N.B. Field **iconId** can be useful if you plan to edit the selected icon **dynamically**

# ParkingSearcher in main menu

- Field descriptions for creating buttons in the main menu

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 "ribbon": true,
 "ribbonId": "",
 "ribbonStyle": "background: #336633;background: linear-gradient(#33FF33 0%, #36633 100%);",
 "ribbonText": "Beta",
 "removed": false,
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 "removed": false,
 "index": 0
}
]
```

parkingSearcher.principalMenu.json

**captionId** serves to indicate the **container tag** of the text that is located at the bottom of each button.

**captionTextId** indicates the name of the field in labels.\*.json whose value is the text to be inserted in the previous container.

# ParkingSearcher in main menu

- **Field descriptions** for creating buttons in the **main menu**

```
[
{
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 "iconId": "",
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 "imgHeight": "37px",
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 "textFontSize": "38px",
 "textColor": "#CC0000",
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 "ribbonId": "",
 "ribbonStyle": "background: #336633;background: linear-gradient(#33FF33 0%, #336633 100%);",
 "ribbonText": "Beta",
 "removed": false,
 "index": 0
}
]
```

parkingSearcher.principalMenu.json

These blocks of fields are used to show the user **badges containing information** related to the button on which are located

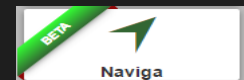
# ParkingSearcher in main menu

- **Field descriptions** for creating buttons in the **main menu**

```

{
 "callback": "PrincipalMenu.hide(); MapManager.centerMapOnGps();",
 "iconId": "",
 "iconClass": "icon ion-android-bus",
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 "iconColor": "#CC0000",
 "imgSrc": "img/ticketmenu.png",
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 "text": "P",
 "textFontSize": "38px",
 "textColor": "#CC0000",
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 "step": true,
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 "index": 0
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```



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parkingSearcher.principalMenu.json



# ParkingSearcher in main menu

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 "textColor": "#CC0000",
 "captionId": "principalMenuParkingSearcher",
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 "stepId": "eventsBadge",
 "ribbon": true,
 "ribbonId": "",
 "ribbonStyle": "background: #336633;background: linear-gradient(#33FF33 0%, #336633 100%);",
 "ribbonText": "Beta",
 "removed": false,
 "index": 0
}
]
```

parkingSearcher.principalMenu.json

**removed** field is useful to allow the removal and the insertion of the buttons in the main menu by the user.

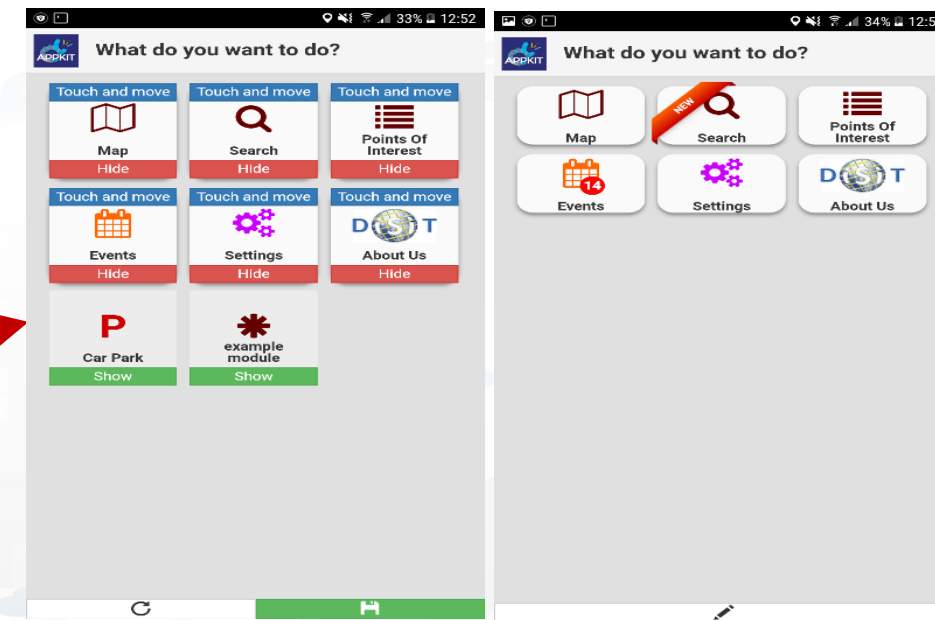
**index** field is useful for rendering the buttons in the order chosen by the user.

# ParkingSearcher in main menu

- Field descriptions for creating buttons in the main menu

```
{
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 "iconId": "",
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 "iconFontSize": "41px",
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 "ribbonStyle": "background: #336633; background: linear-gradient(#33FF33 0%, #336633 100%);",
 "ribbonText": "Beta",
 "removed": false,
 "index": 0
}
```

parkingSearcher.principalMenu.json



## ParkingSearcher in main menu

- Loading **new buttons modules** within the main menu, takes place by **comparing the captionId** field.
- If the menu already has a button with the **same captionId**, the first is **replaced** with the **new one**.
- To **remove** a button from the main menu (field **removed** hides it) add a **delete** field with value equal to **true**.



# ParkingSearcher in main menu

- First version of the button

```
[
{
 "callback": "PrincipalMenu.hide(); MapManager.centerMapOnGps();",
 "iconId": "",
 "iconClass": "",
 "iconFontSize": "",
 "iconColor": "",
 "imgSrc": "",
 "imgHeight": "",
 "text": "LP",
 "textFontSize": "38px",
 "textColor": "#CC0000",
 "captionId": "principalMenuParkingSearcher",
 "captionTextId": "moduleParkingSearcher",
 "step": "",
 "stepId": "",
 "ribbon": true,
 "ribbonId": "",
 "ribbonStyle": "background: #CC0000;background: linear-gradient(#FF6600 0%, #CC0000 100%);",
 "ribbonText": "NEW",
 "removed": false,
 "index": 0
}
]
```

parkingSearcher.principalMenu.json



Label missing

# Labels of ParkingSearcher

- Description of **label.\*.json** files

label.ita.json

```
{
 "principalMenu": {
 "moduleParkingSearcher": "Lista Parcheggi"
 }
}
```

label.eng.json

```
{
 "principalMenu": {
 "moduleParkingSearcher": "Car Park List"
 }
}
```

label.deu.json

```
{
 "principalMenu": {
 "moduleParkingSearcher": "Parkplatz Liste"
 }
}
```

label.fra.json

```
{
 "principalMenu": {
 "moduleParkingSearcher": "Liste parkings"
 }
}
```

label.esp.json

```
{
 "principalMenu": {
 "moduleParkingSearcher": "Lista de Aparcamiento"
 }
}
```

## Three important things to check:

- Languages shall be indicated by 3 characters: **ita**, **deu**, **esp**, **fra**, **eng**
- The label for the button must be contained within the object "**principalMenu**"
- The name of the field inside "principalMenu" must be the same of "**captionTextId**" seen before

# Labels of ParkingSearcher

- Description of **label.\*.json** files

```
[
 {
 "callback": "PrincipalMenu.hide(); MapManager.centerMapOnGps();",
 "iconId": "",
 "iconClass": "",
 "iconFontSize": "",
 "iconColor": "",
 "imgSrc": "",
 "imgHeight": "",
 "text": "LP",
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 "stepId": "",
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 "ribbonId": "",
 "ribbonStyle": "background: #CC0000;background: linear-gradient(#",
 "ribbonText": "NEW",
 "removed": false,
 "index": 0
 }
]
```

parkingSearcher.principalMenu.json

label.ita.json

```
{
 "principalMenu": {
 "moduleParkingSearcher": "Lista Parcheggi"
 }
}
```

label.eng.json

```
{
 "principalMenu": {
 "moduleParkingSearcher": "Car Park List"
 }
}
```

label.deu.json

```
{
 "principalMenu": {
 "moduleParkingSearcher": "Parkplatz Liste"
 }
}
```

label.fra.json

```
{
 "principalMenu": {
 "moduleParkingSearcher": "Liste parkings"
 }
}
```

label.esp.json

```
{
 "principalMenu": {
 "moduleParkingSearcher": "Lista de Aparcamiento"
 }
}
```

```
$(captionId).html(
 labels.principalMenu[
 captionTextId]);
```



# Labels of ParkingSearcher

- Description of `label.*.json` files

```
[
 {
 "callback": "PrincipalMenu.hide(); MapManager.centerMapOnGps();",
 "iconId": "",
 "iconClass": "",
 "iconFontSize": "",
 "iconColor": "",
 "imgSrc": "",
 "imgHeight": "",
 "text": "LP",
 "textFontSize": "38px",
 "textColor": "#CC0000",
 "captionId": "principalMenuParkingSearcher",
 "captionTextId": "moduleParkingSearcher",
 "step": "",
 "stepId": "",
 "ribbon": true,
 "ribbonId": "",
 "ribbonStyle": "background: #CC0000;background: linear-gradient(#CC0000 49%, #CC0000 49%, #CC0000 51%, #CC0000 51%);",
 "ribbonText": "NEW",
 "removed": false,
 "index": 0
 }
]
```








parkingSearcher.principalMenu.json



# Create ParkingSearcher Module

- It is seen as fill most of the files in the folder of new module ParkingSearcher that is developed in this presentation

oro > workspace > siiMobilityAppKit > www > js > modules > parkingSearcher

 ParkingSearcher.js	TODO
 parkingSearcher.labels.deu.json	✓
 parkingSearcher.labels.eng.json	✓
 parkingSearcher.labels.fra.json	✓
 parkingSearcher.labels.ita.json	✓
 parkingSearcher.labels.spa.json	✓
 parkingSearcher.principalMenu.json	✓

# ParkingSearcher Module Functions

- Functions contained in **ParkingSearcher.js**

```
show: function () {
 application.resetInterface();
 MapManager.showMenuReduceMap("#" + ParkingSearcher.idMenu);
 $("#" + ParkingSearcher.idMenu + "Collapse").hide();
 ParkingSearcher.open = true;
 InfoManager.addingMenuToManage(ParkingSearcher.varName);
 application.addingMenuToCheck(ParkingSearcher.varName);
 application.setBackButtonListener();
},
```

```
hide: function () {
 $("#" + ParkingSearcher.idMenu).css({ 'z-index': '1001' });
 MapManager.reduceMenuShowMap("#" + ParkingSearcher.idMenu);
 InfoManager.removingMenuToManage(ParkingSearcher.varName);
 application.removingMenuToCheck(ParkingSearcher.varName);
 ParkingSearcher.open = false;
},
```

**Closes** any previously **opened menu**, **shrinks the map** to display the menu, **hides the button** to reduce the menu, since it will open already reduced.

Recording to other variables to get notifications when:

- users press the **back button**
- users change the **device orientation**
- must be **closed the menu** opened by this module



# ParkingSearcher Module Functions

- **Functions contained in ParkingSearcher.js**

```
show: function () {
 application.resetInterface();
 MapManager.showMenuReduceMap("#" + ParkingSearcher.idMenu);
 $("#" + ParkingSearcher.idMenu + "Collapse").hide();
 ParkingSearcher.open = true;
 InfoManager.addingMenuToManage(ParkingSearcher.varName);
 application.addingMenuToCheck(ParkingSearcher.varName);
 application.setBackButtonListener();
},
```

```
hide: function () {
 $("#" + ParkingSearcher.idMenu).css({ 'z-index': '1001' });
 MapManager.reduceMenuShowMap("#" + ParkingSearcher.idMenu);
 InfoManager.removingMenuToManage(ParkingSearcher.varName);
 application.removingMenuToCheck(ParkingSearcher.varName);
 ParkingSearcher.open = false;
},
```

Does the **opposite functions** to those performed by the **function show**, also reset the z-index of the menu

# ParkingSearcher Module Functions

- **Functions contained in ParkingSearcher.js**

```
checkForBackButton: function () {
 if (ParkingSearcher.open) {
 ParkingSearcher.hide();
 }
},

refreshMenuPosition: function () {
 if (ParkingSearcher.open) {
 MapManager.showMenuReduceMap("#" + ParkingSearcher.idMenu);
 Utility.checkAxisToDrag("#" + ParkingSearcher.idMenu);
 if (ParkingSearcher.expanded) {
 ParkingSearcher.expandBusRoutesMenu();
 }
 }
},

closeAll: function () {
 if (ParkingSearcher.open) {
 ParkingSearcher.hide();
 }
},
```

These are the **callbacks** called to **notify** the occurrence of an event among those described previously (see show function) and for which we recorded the module

- users press the **back button**
- users change the **device orientation**
- must be **closed the menu** opened by this module

# ParkingSearcher Module Functions

- Functions contained in **ParkingSearcher.js**

```
refreshMenu: function () {
 if ($("#" + ParkingSearcher.idMenu).length == 0) {
 $("#indexPage").
 append("<div id=\"" + ParkingSearcher.idMenu + "\" class=\"commonHalfMenu\"></div>")
 }
 ViewManager.render(ParkingSearcher.results, "#" + ParkingSearcher.idMenu, "ParkingMenu");
 Utility.movingPanelWithTouch("#" + ParkingSearcher.idMenu + "ExpandHandler",
 "#" + ParkingSearcher.idMenu);
},
```

- Checks if there is the **element** that will **contain the html code** created through the use of **Mustache** library.
- It is generated the html code with **template ParkingMenu.mst.html** and **JSON ParkingSearcher.results** and added to the element container.
- Finally, the **feature** that allows the users **to widen the menu by dragging** the handler is added to it



# ParkingSearcher Module Functions

- Functions contained in **ParkingSearcher.js**

```
refreshMenu: function () {
 if ($("#" + ParkingSearcher.idMenu).length == 0) {
 $("#indexPage").
 append("<div id=\"" + ParkingSearcher.idMenu + "\"" class=\"commonHalfMenu\"></div>")
 }
 ViewManager.render(ParkingSearcher.results, "#" + ParkingSearcher.idMenu, "ParkingMenu");
 Utility.movingPanelWithTouch("#" + ParkingSearcher.idMenu + "ExpandHandler",
 "#" + ParkingSearcher.idMenu);
},
```

- Checks if there is the **element** that will contain the **html code** created through the use of **Mustache** library.
- It is generated the html code with **template ParkingMenu.mst.html** and **JSON ParkingSearcher.results** and added to the element container.
- Finally, the **feature** that allows the users to **widen the menu by dragging** the handler is added to it

# ParkingSearcher Module Functions

- **Functions contained in ParkingSearcher.js**

```
successQuery: function (response) {
 ParkingSearcher.results = responseObject["Results"];
 ParkingSearcher.refreshMenu();
 ParkingSearcher.show();
 MapManager.addGeoJSONLayer(responseObject);
 ParkingSearcher.resetSearch();
},

errorQuery: function(error) {
 navigator.notification.alert(
 Globalization.alerts.servicesServerError.message,
 function () { },
 Globalization.alerts.servicesServerError.title);
},
```

These are the callbacks that should be called once the **JSON**, containing the **data to be displayed** to the user, is created. The **success callback**:

- will locally save the response
- will create the menu
- will show it.

If the menu will contain **elements** that it is possible to **show on the map** they will be added to the map by last function

# ParkingSearcher Module Template

- Before adding the logic of the new module, we create the template to be filled with the correct JSON.

```
<div id="parkingMenuHeader" class="panel panel-default" style="position: absolute;right: 0px;left: 0px;border-radius: 0px;">
 <div id="parkingMenuExpandHandler" class="grippyContainer grippyContainer-horizontal" style="text-align: center;">
 <div class="grippy grippy-horizontal"></div>
 </div>
 <div class="panel-heading" style="padding: 0px 10px;height: 52px; border: none;">

 <i class="glyphicon glyphicon-remove"
 style="float: right; padding-left: 8px; color: #777; line-height: 52px;"></i>

 <i class="glyphicon glyphicon-plus" style="padding-right: 8px; color: #777; line-height: 52px;"></i>

 <i class="glyphicon glyphicon-minus" style="padding-right: 8px; color: #777; line-height: 52px;"></i>

 <b id="parkingMenuHeaderTitle" style="line-height: 52px;color: #333;">
 <script>
 $("#parkingMenuHeaderTitle").html(
 Globalization.labels.parkingMenu.title)
 </script>

 </div>
</div>
<div id="parkingMenuInner" class="commonHalfMenuInner">
</div>
```

**ParkingMenu.mst.html**

This default template will **simply show a menu with a header and body empty. Must have the same name as the string entered as the third parameter in the call**

```
ViewManager.render (
 ParkingSearcher.results,
 "#" + ParkingSearcher.idMenu,
 "ParkingMenu");
```



# ParkingSearcher Module Template

- Before adding the logic of the new module, we create the template to be filled with the correct JSON.

```
<div id="parkingMenuHeader" class="panel panel-default" style="position: absolute;right: 0px;left: 0px;border-radius: 0px;">
<div id="parkingMenuExpandHandler" class="grippyContainer grippyContainer-horizontal" style="text-align: center;">
<div class="grippy grippy-horizontal"></div>
</div>
<div class="panel-heading" style="padding: 0px 10px;height: 52px; border: none;">

<i class="glyphicon glyphicon-remove"
 style="float: right; padding-left: 8px; color: #777; line-height: 52px;"></i>

<i class="glyphicon glyphicon-plus" style="padding-right: 8px; color: #777; line-height: 52px;"></i>

<i class="glyphicon glyphicon-minus" style="padding-right: 8px; color: #777; line-height: 52px;"></i>

<b id="parkingMenuHeaderTitle" style="line-height: 52px;color: #333;">
<script>
 $("#parkingMenuHeaderTitle").html(
 Globalization.label: parkingMenu.title)
</script>

</div>
</div>
<div id="parkingMenuInner" class="commonHalfMenuInner">
</div>
```

This template will be saved in the folder called «**templates**».  
To add a title to the header we should add this item to all files labels.\*. Json

```
{
 "principalMenu": {
 "moduleParkingSearcher": "Lista Parcheggi"
 },
 "parkingMenu": {
 "title": "Parcheggi"
 }
}
```

**templates/ParkingMenu.mst.html**

# ParkingSearcher Module Template

- Before adding the logic of the new module, we create the template to be filled with the correct JSON.

```

<div id="parkingMenuHeader" class="panel panel-default" style="position: absolute;right: 0px;left: 0px;border-radius: 0px;">
 <div id="parkingMenuExpandHandler" class="grippyContainer grippyContainer-horizontal" style="text-align: center;">
 <div class="grippy grippy-horizontal"></div>
 </div>
 <div class="panel-heading" style="padding: 0px 10px;height: 52px; border: none;">

 <i class="glyphicon glyphicon-remove"
 style="float: right; padding-left: 8px; color: #777; line-height: 52px;"></i>

 <i class="glyphicon glyphicon-plus" style="padding-right: 8px; color: #777; line-height: 52px;"></i>

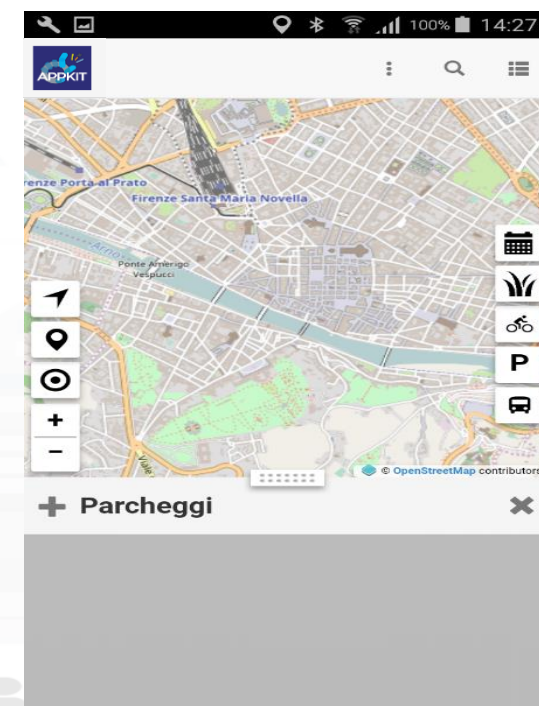
 <i class="glyphicon glyphicon-minus" style="padding-right: 8px; color: #777; line-height: 52px;"></i>

 <b id="parkingMenuHeaderTitle" style="line-height: 52px;color: #333;">
 <script>
 $("#parkingMenuHeaderTitle").html(
 Globalization.labels.parkingMenu.title)
 </script>

 </div>
</div>
<div id="parkingMenuInner" class="commonHalfMenuInner">
</div>

```

**templates/ParkingMenu.mst.html**



# Create ParkingSearcher Module

The goal of this example is to create a **new module** that in addition to viewing the list of car parks as is already the case for the button named "Car Park" will **show directly** the **number of free parking lots** for each car park found

In ParkingSearcher.js must be made the logic that **retrieves data** from API describer in previous presentations and creates the **JSON** to fill the **template** and generate the new menu



# ParkingSearcher Called API

- The following API returns **the list of parking** that are located at a maximum distance of 300 meters from the location sent. The list is limited to 100 items.

<http://www.disit.org/ServiceMap/api/v1/?>

selection=**43.7778;11.2481**&

categories=**Car\_park**&

maxResults=100&

maxDists=0.3&

format=json&

lang=it&

geometry=true

# ParkingSearcher Called API

- The returned data are not sufficient to create the final JSON, because these **data are lacking** on the realtime information

```
▼ object {1}
 ▼ Services {3}
 fullCount : 5
 type : FeatureCollection
 ▼ features [5]
 ▼ 0 {4}
 ▼ geometry {2}
 type : Point
 ► coordinates [2]
 type : Feature
 ▼ properties {7}
 name : Garage La Stazione Spa
 tipo : Parcheggio_auto
 typeLabel : Parcheggio auto
 serviceType : TransferServiceAndRenting_Car_park
 hasGeometry : false
 serviceUri : http://www.disit.org/km4city/resource/RT04801702315PO
 multimedia : {value}
 id : 1
 ► 1 {4}
```

There are data from **all car parks nearby**, but there are **few properties** that are received

# ParkingSearcher Called API

- The following API which returns all information relating to a single service

[http://www.disit.org/ServiceMap/api/v1/?](http://www.disit.org/ServiceMap/api/v1/?serviceUri=http://www.disit.org/km4city/resource/RT04801702315PO&format=json&lang=it)

[serviceUri=http://www.disit.org/km4city/resource/RT04801702315PO&  
format=json&  
lang=it](http://www.disit.org/km4city/resource/RT04801702315PO&format=json&lang=it)



# ParkingSearcher Called API

- The returned data are not sufficient to create the final JSON, because these data are **relative to only one car park**

```
▼ object {2}
 ▼ Service {2}
 type : FeatureCollection
 ▼ features [1]
 ▼ 0 {4}
 ► geometry {2}
 type : Feature
 ► properties {26}
 id : 1
 ► realtime {2}
 ► head {2}
 ▼ results {1}
 ▼ bindings [1]
 ▼ 0 {6}
 ► capacity {1}
 ▼ freeParkingLots {1}
 value : 282
 ► occupiedParkingLots {1}
 ► occupancy {1}
 ► status {1}
 ► updating {1}
```

There are data from **one car parks nearby**, but there are **many properties** that are received

# ParkingSearcher Module Logic

- The idea is to **call the first API that returns the complete list** of nearby car park, and for each car park in the list **call the second API that returns detailed information with the number of free parking lots**

# ParkingSearcher Module Logic

- The first API can be call in the app with the following functions

```
search: function(){
 var parkingQuery = QueryManager.createCategoriesQuery(['Car_park'], SearchManager.searchCenter, "user");
 APIClient.executeQuery(parkingQuery, ParkingSearcher.searchInformationForEachFeature, ParkingSearcher.errorQuery);
},
```

<http://www.disit.org/ServiceMap/api/v1/?>

selection=43.7778;11.2481&

categories=Car\_park&

maxResults=100&

maxDists=0.3&

format=json&

lang=it&

geometry=true

The **first function** creates the string that contains the **parameters** from “?” to the end.

The **second function** adds the URL of the API and makes the call. When the data has been received calls the error or success callback.



# ParkingSearcher Module Logic

- The second API can be call in the app with the following functions

```
searchInformationForEachFeature(response) {
 for (var category in response) {
 if (response[category].features.length != 0) {
 ParkingSearcher.responseLength = response[category].features.length;
 ParkingSearcher.temporaryResponse = {
 "Results": {
 "features": [],
 "fullCount": ParkingSearcher.responseLength,
 "type": "FeatureCollection",
 }
 };
 Loading.showAutoSearchLoading();
 for (var i = 0; i < response[category].features.length; i++) {
 var serviceQuery = QueryManager.createServiceQuery(response[category].features[i].properties.serviceUri, "app");
 APIClient.executeQueryWithoutAlert(serviceQuery,
 ParkingSearcher.mergeResults,
 ParkingSearcher.decrementAndCheckRetrieved);
 }
 SearchManager.startAutoSearch(ParkingSearcher.varName);
 }
 }
}
```

For each car park listed is called the **API that returns details.**

If there is **no car park** in the list is called a function which **doubles the radius** of the search area **until at least one car park is in the list** or the radius is greater than 200 km

# ParkingSearcher Module Logic

- The number of free parking lots is copied **from realtime object in the properties** to make writing the template easier. Is also added as a property a string that identifies the **text color** based on the number of free parking lots

```
mergeResults: function (response) {
 for (var category in response) {
 if (response[category].features != null) {
 if (response[category].features.length != 0) {
 if (response.realtime != null) {
 if (response.realtime.results != null) {
 if (response.realtime.results.bindings[0] != null) {
 if (response.realtime.results.bindings[0].freeParkingLots != null) {
 response[category].features[0].properties.freeParkingLots = response.realtime.results.bindings[0].freeParkingLots.value;
 if (response[category].features[0].properties.freeParkingLots > 20) {
 response[category].features[0].properties.freeParkingLotsColor = "green";
 } else if (response[category].features[0].properties.freeParkingLots > 0) {
 response[category].features[0].properties.freeParkingLotsColor = "orange";
 } else {
 response[category].features[0].properties.freeParkingLotsColor = "red";
 }
 }
 }
 }
 }
 }
 ParkingSearcher.temporaryResponse["Results"].features.push(response[category].features[0]);
 }
 }
 ParkingSearcher.decrementAndCheckRetrieved();
},

decrementAndCheckRetrieved: function(){
 ParkingSearcher.responseLength--;

 if (ParkingSearcher.responseLength == 0) {
 ParkingSearcher.successQuery(ParkingSearcher.temporaryResponse);
 Loading.hideAutoSearchLoading();
 }
},
```

This function controls how many calls have already returned the details or returned error.

# ParkingSearcher Module Logic

```
successQuery: function (response) {
 var responseObject = response;

 if (SearchManager.typeOfSearchCenter == "selectedServiceMarker") {
 MapManager.searchOnSelectedServiceMarker = true;
 }
 for (var i = 0; i < responseObject["Results"].features.length; i++) {
 responseObject["Results"].features[i].id = i;
 Utility.enrichService(responseObject["Results"].features[i], i);
 }
 if (responseObject["Results"].features[0].properties.distanceFromSearchCenter != null) {
 responseObject["Results"].features.sort(function (a, b) {
 return a.properties.distanceFromSearchCenter - b.properties.distanceFromSearchCenter
 });
 } else {
 responseObject["Results"].features.sort(function (a, b) {
 return a.properties.distanceFromGPS - b.properties.distanceFromGPS
 });
 }

 ParkingSearcher.results = responseObject["Results"];
 ParkingSearcher.refreshMenu();
 ParkingSearcher.show();
 MapManager.addGeoJSONLayer(responseObject);
 ParkingSearcher.resetSearch();
},
```

This is the **function** that receives the **end JSON** and shows it to the user, by creating the marker on the map and **populating** the list through the **template**.

The **JSON** is **enriched** with additional information such as **distance from GPS** or from a manual search and **list is sorted** according to these values.

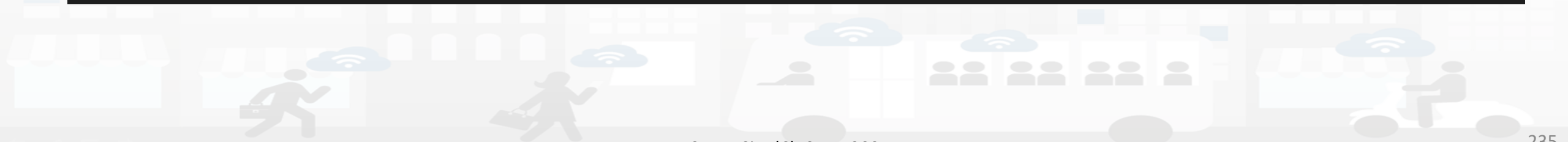


# ParkingSearcher Module Template

- This is the **final template** that allows you to show the user a list of car parks in its vicinity with an **indication of the number of free parking lots**

```
<!-- {{#features}} {{#properties}} -->
<div class="panel panel-default" style="margin: 0px 5px 10px 5px; color: #000; text-decoration: none;" onclick="InfoManager.showInfoAboutOneMarker('{{#properties}}
<div class="panel-body card-2" style="position: relative">
 {{#commentLine}}
 {{#freeParkingLots}}<b style="position: absolute; bottom: 0px; right: 10px; font-size: 24px; color: {{#freeParkingLotsColor}}">
 {{#freeParkingLots}}{{/#freeParkingLots}}
 {{#imageThumb}}{{/#imageThumb}}

 <b style="text-align: center;">{{#unescapeHtml}}<#name>{{/#unescapeHtml}}
 {{#typeLabel}}
<b id="parkingMenuTypeLabel{{#identifier}}">
 <script>$("#parkingMenuTypeLabel{{#identifier}}").html(Globalization.labels.infoMenu.type)</script>
 {{#typeLabel}}
 {{#distanceFromSearchCenter}}
<b id="parkingMenuTextSearchDistanceFromSearchCenter{{#identifier}}">
 <script>$("#parkingMenuTextSearchDistanceFromSearchCenter{{#identifier}}").html(Globalization.labels.textSearchMenu.distanceFromSearchCenter)</script>
 {{#distanceFromSearchCenter}} m{{/#distanceFromSearchCenter}}
 {{#distanceFromGPS}}
<b id="parkingMenuTextSearchDistanceFromGPS{{#identifier}}">
 <script>$("#parkingMenuTextSearchDistanceFromGPS{{#identifier}}").html(Globalization.labels.textSearchMenu.distanceFromGPS)</script>
 {{#distanceFromGPS}} m{{/#distanceFromGPS}}{{#properties}}
</div>
</div>
<!-- {{/features}} -->
```



# ParkingSearcher in main menu

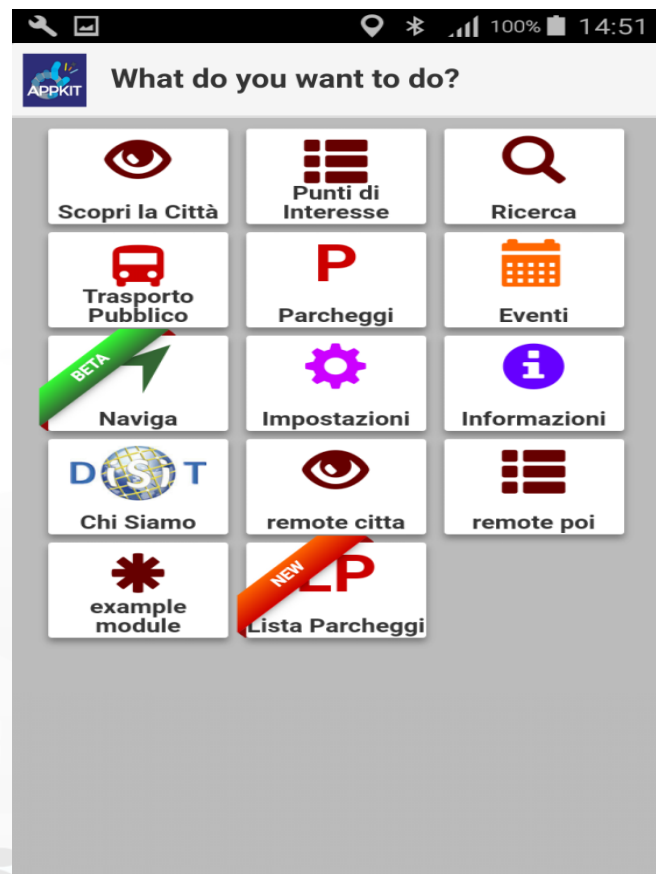
- Final version of the button with call to module logic

```
{
 "callback": "PrincipalMenu.hide(); MapManager.centerMapOnGps(SearchManager.search('ParkingSearcher'))";
 "iconId": "",
 "iconClass": "",
 "iconFontSize": "",
 "iconColor": "",
 "imgSrc": "",
 "imgHeight": "",
 "text": "LP",
 "textFontSize": "38px",
 "textColor": "#CC0000",
 "captionId": "principalMenuParkingSearcher",
 "captionTextId": "moduleParkingSearcher",
 "step": "",
 "stepId": "",
 "ribbon": true,
 "ribbonId": "",
 "ribbonStyle": "background: #CC0000;background: linear-gradient(#FF6600 0%, #CC0000 100%);",
 "ribbonText": "NEW",
 "removed": false,
 "index": 0
}
```

parkingSearcher.principalMenu.json

The search function of the variable SearchManager asks the user where want search (GPS, Manual or Last Service) and then call the **search function** of the variable which is passed as string

# ParkingSearcher Module Finished





For the creation of the app through the modules it is necessary to compile it with grunt before doing it with Cordova



→ Getting Started   ⚙️ Configuring Tasks   📁 Plugins   📖 Documentation

# GRUNT

## The JavaScript Task Runner

<https://gruntjs.com>



# Gruntfile

Inside the root folder of the Sii Mobility App Kit there is a gruntfile.js which will merge the js and json files as described inside it. Inside the root there is also a node\_modules directory within which there must necessarily be these folders containing the plugins useful for merging files.

- disit-json-merger
- es6-promise-plugin
- grunt
- grunt-contrib-clean
- grunt-contrib-concat
- grunt-contrib-uglify
- grunt-json-merger

# Gruntfile

To compile the files, the grunt command must be launched on the open terminal in the project root  
If everything works properly the screen that should appear is as follows. If some package is missing it can be installed with the `npm i packagename` command. If `disit-json-merger` is missing download it from [https://github.com/disit/siiMobilityAppKit/tree/master/node\\_modules/disit-json-merger](https://github.com/disit/siiMobilityAppKit/tree/master/node_modules/disit-json-merger)

```
Running "concat:dist" (concat) task
Running "concat:allTogether" (concat) task
Running "clean:0" (clean) task
>> 1 path cleaned.
Running "disit-json-merger:singleTemplate" (disit-json-merger) task
File "www/js/build/singleTemplate.json" created.
Running "json-merger:ita" (json-merger) task
File "www/js/build/labels.ita.json" created.
Running "json-merger:eng" (json-merger) task
File "www/js/build/labels.eng.json" created.
Running "json-merger:deu" (json-merger) task
File "www/js/build/labels.deu.json" created.
Running "json-merger:esp" (json-merger) task
File "www/js/build/labels.esp.json" created.
Running "json-merger:fra" (json-merger) task
File "www/js/build/labels.fra.json" created.
Done.
```



# Gruntfile

If the grunt command was successful as in the image of the previous slide then the command Cordova build android can be launched and if all goes well you will have a screen like the following one

```
: compileDebugSources
: transformClassesWithDexBuilderForDebug
: transformDexArchiveWithExternalLibsDexMergerForDebug
: transformDexArchiveWithDexMergerForDebug
: transformNativeLibsWithMergeJniLibsForDebug
: transformResourcesWithMergeJavaResForDebug
: packageDebug
: assembleDebug
: cdvBuildDebug

BUILD SUCCESSFUL in 1m 54s
44 actionable tasks: 44 executed
Built the following apk(s):
 C:/Users/badii.DISIT/Lavoro/workspace/siiMobilityAppKit/
apk
```

## Further readings

- [TC5.16. Exploiting Smart City API for developing Mobile and Web Apps](#)
- [TC5.15. Snap4City Smart City API Collection and overview, real time](#)
- [TC5.17. Search on Services via Smart City API: MicroApplication, Exploiting Micro Applications in HTML5 based on Advanced Smart City API](#)
- [TC5.18. Snap4City API are documented in Swagger, and tested in Postman](#)
- [TC5.19. Using ServiceMap as a Tools for Developing web and mobile apps and micro applications](#)



# 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

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

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

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

*On Line Training Material (free of charge)*



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






# Training Material




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





# Note on Training Material

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

[Switch To New Layout \(Beta\)](#)User: paolo.disit, Org: DISIT  
Role: AreaManager, Level: 3[LOGOUT](#) [Home](#) / [Tutorials and Videos](#) / Welcome: how to start using Snap4City for beginners

## 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](mailto: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](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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## Search

**Training on Tools and Platform**Powered by [www.km4city.org](http://www.km4city.org)  

## Organization Groups

DISIT

- Developer
- Operativo

## Updates on Tools

Training Course Snap4City - 2023 Edition [new](#)  
drupaladminSnap4City Newsletter of April 2023 [new](#)  
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

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

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## Search

Search    
-Any-

**WHAT IS Snap4City**

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

**Articles**

**LATEST NEWS**

**SELECT for CISEN**  
1<sup>o</sup> Place award to **SNAP4CITY**

**Snap4City Training on Tools and Platform**

**Flyer**

**SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE**

**SNAP4CITY HACKATHON**  
BUILD YOUR APP FOR A CONNECTED CITY

**INDUSTRY 4.0**  
Snap4Industry

**SMART**  
Snap4Home

**Organizations**

**Tutorials**

**Scenarios**

**Innovations**

**Interoperability**

**Installations**

**API**  
Smart City API

**Ontology**  
Smart City Ontology

**Work with Us**

**Powered by**  
[www.km4city.org](#)

**FIWARE**

**Node-RED**

**Sii-Mobility**

- 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/DBL\\_SNAP4SOLL.pdf](https://www.snap4city.org/download/video/DBL_SNAP4SOLL.pdf)

## Organization Groups

- DISIT
- Developer
  - Operativo

## Updates on





# 2023 booklets

- Smart City



[https://www.snap4city.org/download/video/DPL\\_SNAP4CITY.pdf](https://www.snap4city.org/download/video/DPL_SNAP4CITY.pdf)

- Industry



[https://www.snap4city.org/download/video/DPL\\_SNAP4INDUSTRY.pdf](https://www.snap4city.org/download/video/DPL_SNAP4INDUSTRY.pdf)

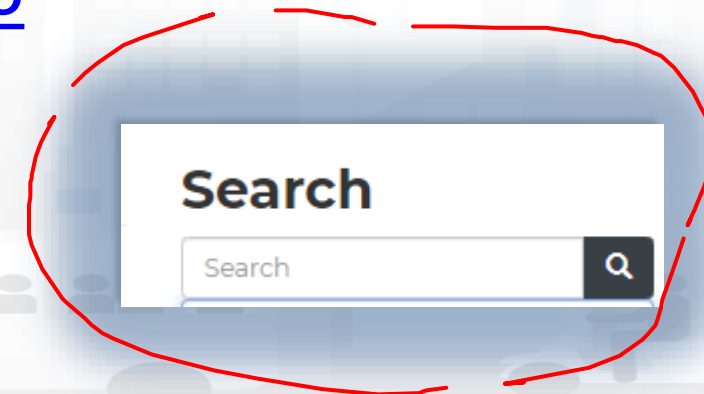
- Artificial Intelligence



[https://www.snap4city.org/download/video/DPL\\_SNAP4SOLU.pdf](https://www.snap4city.org/download/video/DPL_SNAP4SOLU.pdf)

# The Platform

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



### 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](mailto: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](mailto: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

# Client Side Business Logic

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



## Client-Side Business Logic Widget Manual

### From Snap4City:

- We suggest you read <https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf>
- We suggest you read the TECHNICAL OVERVIEW:
  - <https://www.snap4city.org/download/video/Snap4City-PlatformOverview.pdf>
- slides go to <https://www.snap4city.org/577>
- <https://www.snap4city.org>
- <https://www.snap4solutions.org>
- <https://www.snap4industry.org>
- <https://twitter.com/snap4city>
- <https://www.facebook.com/snap4city>
- <https://www.youtube.com/channel/UC3tAQ09EbNba8f2-u4vandu>

Coordinator: Paolo Nesi, [Paolo.nesi@unifi.it](mailto: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](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**

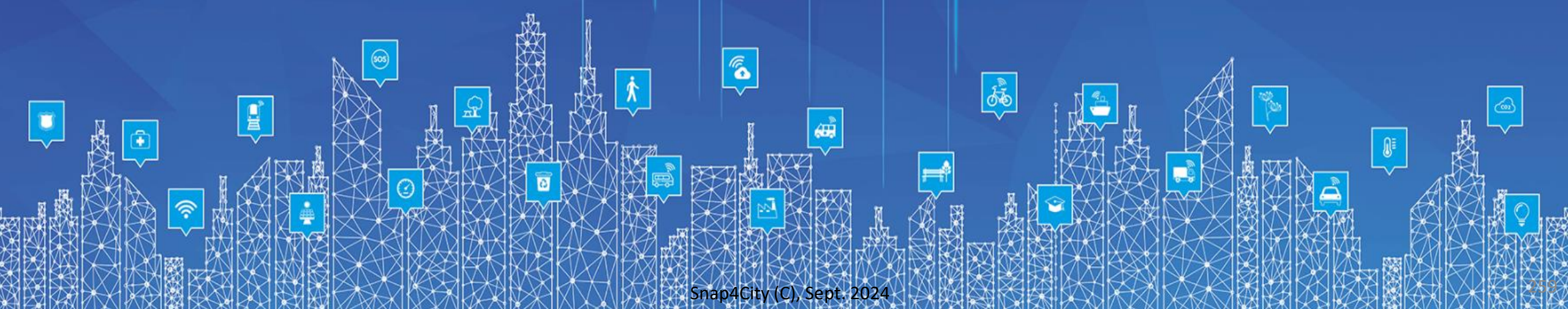
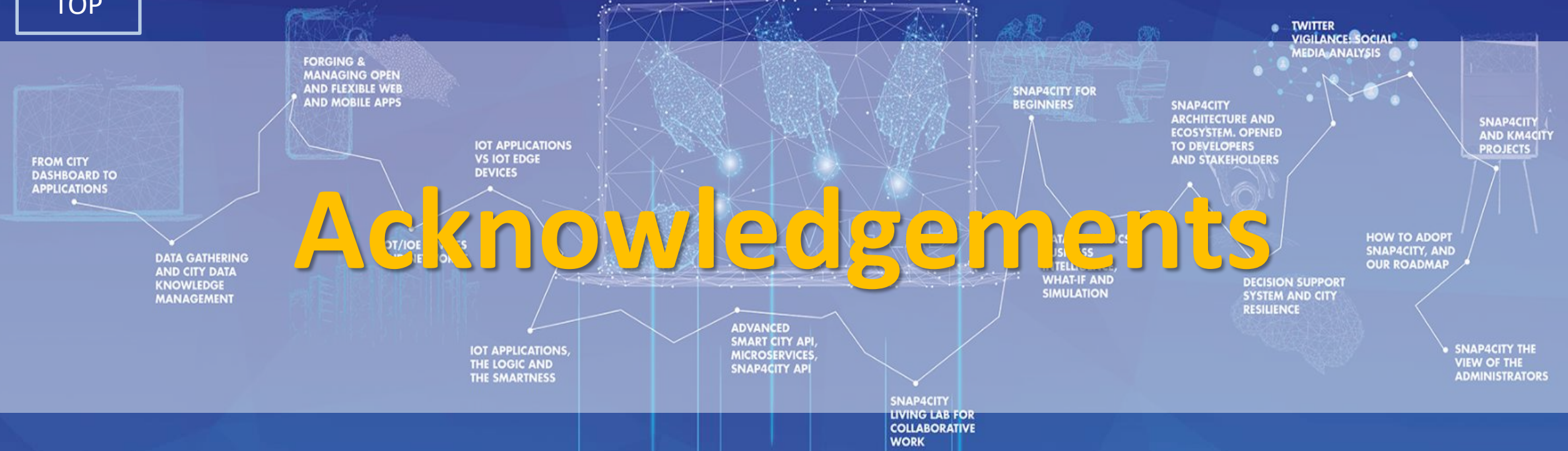
With the contribution of





TOP

# Acknowledgements





(2016-21)



**Km4City 1.6.4**



(2018-20)

- Mobility Demand / Offer Analytics and Strategy



(2018-21)

5G tech  
Energy  
Industry 4.0  
Synoptics



# 2013 Km4City Ontology 1.1

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



H2020

**REPLICATE**

- Smart Energy
- Sustainable Mobility
- Control Room
- Dashboard



# 2018



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



TRAFAIR

- Traffic and Mobility Impact on Pollution
- NOX predictions

# 2019



EUROPEAN OPEN SCIENCE CLOUD



SODA

Winner of Select4Cities PCP

# 2014

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



(2016-21)

**SII-MOBILITY SCN**

- Infomobility
- Mobile App
- Routing
- Multimodality



GHOST SIR

- Sardinia Region Smart City Strategies and plan



Node-RED

IOT/IOE

**Km4City 1.6.6**



**SELECT for Cities**

(2017-19)

- Twitter Vigilance
- Social Media Analytics, Sentiment Analysis

# 2016



**GREEN IMPACT**

- POR FESR 2014-2020
- Industry 4.0
- Critical Plant
- Monitoring

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



LAID Smart Bed



GREEN FIELD PEAS Soda4.0

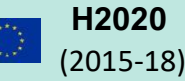
- Industry 4.0



- Smart Lonato

# Km4City 1.4

# 2015



H2020

(2015-18)

**resolute**

**ckan**

**life weee**

# 2017



(2017-20)

- Smart Waste



# DISIT lab roadmap vs model and tools' usage





**2020**



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



- Smart Mobility
- PISA, PUMS
- Living lab



**Km4City 1.6.7**

Smart Ambulance (2021-22)

Enterprise (2021-22)  
Industry 4.0



**2021**

PC4City (2020-21)  
Monitoring Terrain

Winner of Open Data Challenge of  
**enel x**

**CAPĒLON**

- Smart Light
- Sweden

Almafluida Industry 4.0 (2021-22)

AMPERE (2021-22)  
Industry 4.0

SYN-RG-AI  
SmartCity



**uni.systems**  
SmartCity, 2021-23



AXIS collab  
SmartCity

**2022**



Asymmetrica Smart City, 2022-23



Contract, 2022-23

**2023**



Contract, 2022-23



**enel x**  
Contract, 15min



**Smartea**



Italferr, Smart City



CN MOST, 2022-26



EI THE, 2022-26



G. Agile, 2021-23



2023-26



Merano, smart light

OceanRace, Genova, AWS

Cuneo, smart city

**2024**

TOURISMO



Co-funded by the European Union



AMMIRARE

ELLIE IA 2025-2027



Contract, 2024-25

CAI4DSA



OPTIFaaS  
**MOST**



SASUAM  
**MOST**



Rhodes, smart city

eShare  
UNIFI TUSS

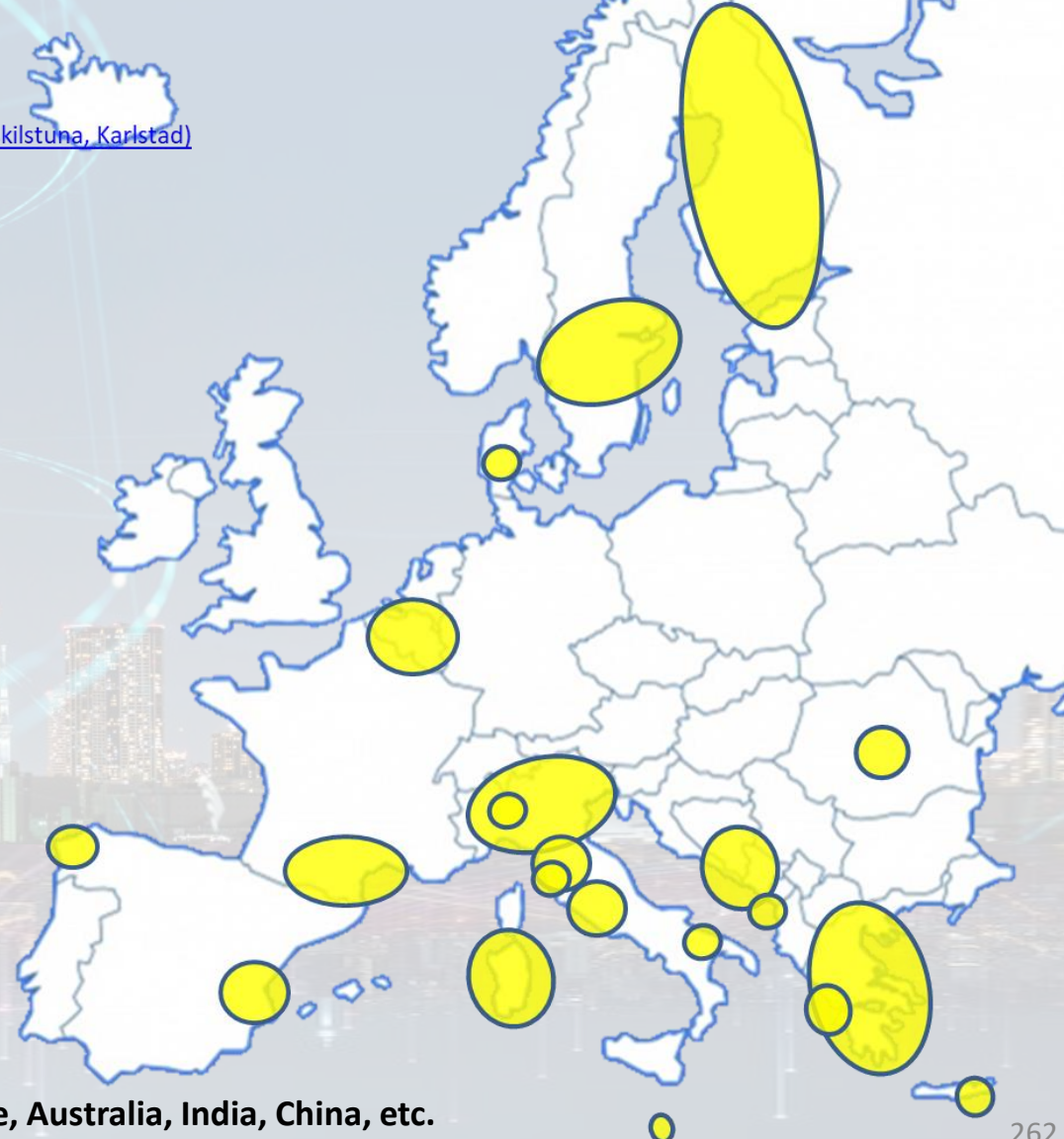




PEN Test  
Passed



EU GDPR  
COMPLIANT



## Main Organizations/areas

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

- 11 running installations in Europe
  - Snap4.city.org, Greece, Merano, Cuneo, ...
  - Toscana, Pisa, Sweden, ISPRA, Snap4.eu,
  - Altair, Italmatic, Romania, ....
- 16 projects, 12 pilots on 10 Countries
  - >40 cities/area
- **Widest MULTI-tenant deploy has**
  - 24 Organizations / tenant
  - > 8850 users on
  - > 1800 Dashboards
  - > 17 mobile Apps
  - > **2.2 Million of structured data per day**
  - > 580 IoT Applications/node-RED
  - > 750 web pages with training
  - > 75 videos, training videos

• + Israel, Colombia, Brasile, Australia, India, China, etc.



TOP



*Be smart in a SNAP!*



**SMARTCITY**  
EXPO WORLD CONGRESS

## CONTACT

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Università degli Studi di Firenze - School of Engineering

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[www.snap4city.org](http://www.snap4city.org)

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Appliances and Dockers  
**Installations**

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DIPARTIMENTO DI  
INGEGNERIA  
DELL'INFORMAZIONE

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AND NETWORK  
TECHNOLOGIES LAB