A Framework for rapid implementation of
- Sustainable Smart Solutions
- Decision Support Systems
as a no-coding, low-coding

Training for Pont Du Gard
13-12-2021

SCALABLE SMART ANALYTIC APPLICATION BUILDER FOR SENTIENT CITIES
Agenda

• Process Overview
• Some Examples
• Aims of Solutions Development
• Your questions?
• Overview on Dashboard Production
• Dashboards by Selecting Data vs Widgets
• Dashboards with Business Logic/Intelligence
• Overview of Data Ingestion
• Just to start! - See many other features

Snap4City (C), December 2021
From Strategies to (re-)Actions

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

Governance: goals, directives, high level decisions, plans
Other Stakeholders

Operators

Smart City Engine

Data: Public and Private, Static and Real Time

Snap4City (C), December 2021
Data Driven Decision Support

- Decision Support system
- Assessment / Strategies
- Data Rendering, visual analytics
- Data Processing
- Data aggregation, Storage, indexing
- Data Ingestion
Requirements and Objectives

- Serve as a **City Dashboard, App User Interface**, etc.
  - Real time and historical data, any device, sensors and actuators
  - Sensors, KPI, maps, data trends, real time data, charts, etc.
  - Multi domain, smart city + industry 4.0 scenarious

- **Data Analytics**: Machine Learning, statistics, reasoning, optimization, ...

- **Data Driven Real Time communication & processing**:
  - IOT Applications, IOT edge, multiple operating systems, embedded systems, **MicroServices**
  - In/out data driven from/to the field into: applications, notifications, etc.

- Referral / **historical data, Open/private Data**:
  - Shadow, access (API, storage, any protocol), production of OD, export

- **Serve as Living Lab**: open innovation, co-working; collaborative work; sharing: data, processes, dashboard, experiences, solutions, ....

- From **small to large scale cases**
Non functional requirements

• **Open**
  – any **Standard, fully modular and interoperable**
  – **Open Source** based 100%
  – **Heterogeneous**: any device, any format, private and public, custom and..

• **Multi tenant**:
  – to cope with multiple organization with a single installation

• **Scalable, Robust, Distributed** and Decoupled, modular, Service Oriented, open to external services and data sets, big data

• **Security** by Design: PENTest, HTTPS, TLS, ... compliant with EC

• **User Centric** Design: respect privacy by Design (and **GDPR**), personalized, personal data management, ...
Avoiding to have a collection of verticals

Simplifying the development and integration of verticals
Integrated Platform

- Smart City API for exploitation
  - AI, Data Analytics and processing for smart applications
  - Data Aggregation and Semantic model
  - Smart City API for ingestion and actions

- Flexible Data interface
- Any data format and channel
- Third party gateways

- Dashboard control
- Third party Applications
- Visual Analytics
- Decision Sup. Syst.
- Smart City API federation
- Authenticat. Authoriz.
- Accounting and Billing

Snap4City (C), December 2021
Concept

Dashboards and Apps

IOT Apps

IOT Brokers

API, External Services

Web Scraping

KPI, POI, MyKPI, …

WorkFlow

Data Analytics, Artificial Intelligence

Big Data

KB

LD, LOD

GIS

Node-RED

IOT Brokers

IOT Broker

IOT Broker

IOT Broker

FIWARE

ckan

FI-WARE

Node-RED

Web Scraping

API, External Services

KPI, POI, MyKPI, …
Ingestion, aggregation ➔ exploitation

• **Snap4City** efficient tools for
  - Bidirectional data channels
  - Any format, any channel, any data, any broker, any protocol, ...

• **Km4City** Knowledge base Ontology reasoning on geo, space, time, relationships
**Data Type Coverage**

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

Snap4City (C), December 2021
Standards and Interoperability (2021)


https://www.snap4city.org/65
Expert System semantic queries

• via:
  • Smart City API for Apps and third party
  • MicroServices data driven develop via visual language Node-RED

https://www.snap4city.org/19

License Free 1.6.7
Ingestion, aggreg. → exploitation

• IoT App Visual Programming, no coding
  • Data transformation
  • Integration
  • Scripting Data Analytics
  • Data ingestion
  • Business logic

• MicroServices data driven develop via visual language Node-RED
Data Adaptation, Transformation, Conversion, Integration

Business Logic vs Dashboards

Data Analytics control

Everywhere: Cloud, on IoT Edge Devices
Snap4City Libraries of MicroServices on Node-RED
Sentient and active processes

- Big Data Analytics
- Semantic Computing
- Machine Learning
- Explainable Artificial Intelligence
- Deep Learning
- Geo Spatial Reasoning
- Text Analysis, Sentiment Analysis
- What If Analysis
- Simulations
- Visual Analytics
- Engagement Analysis
- ....
Big Data Analytics + Artificial Intelligence

• Decision support
  • Early warning, City Indexes, etc.
  • What-IF analysis (simulation + AI + data)

• Predictions
  • Short and Long terms predictive models on:
    • traffic, parking, people flow, maintenance, land sliding, NO2
  • 3D Flow prediction: Pollutant (NOX, NO2, ...)

• Suggestions and recommendations

• Modeling, simulation, routing
  • Traffic Flow reconstruction
  • Constrained Routing

AI & XAI:
  • RF, XGBoost, BRNN, RNN, SVR, DNN, LSTM, CNN-LSTM, Autoencoders, ...
  • Clustering: K-means, K-Medoid, ...
  • XAI: Shap, variations,

Computational processes:
  • Heatmaps, ..
  • trajectories,
  • OD matrices,
  • Typical Time Trends, etc.

Data Analytics on Snap4City platform

Swagger

Ontology Schema

LOG.disit.org

Knowledge Base, Km4City

Big Data Store Facility

Smart City API from Knowledge Base and other tools

Creating MicroServices

Saving / Sharing reusing

Using them into IOT Applications

Node-RED

Resource Manager

TensorFlow

R Studio

Smart City API from Knowledge Base and other tools
Solutions: reliable, secure and fast to realize

• Via Snap4City tools
  • Dashboard Wizard
  • Dashboard Builder
  • Data/Visual Analytic

• Smart Solutions results to be
  • Real time data drive
  • Secure end-to-end
  • GDPR compliant
  • Reliable, interoperable
  • Auditable, marketable
2021/10: Snap4City Numbers

• > 120 Protocols
• Mobility, energy, people flow, environment, Industry 4.0, tracking, smartbed, smart ambulance, Tourism, smart light, culture, etc...
  • 6 running installations
  • 13 projects, 12 pilots on 9 Countries

• On the largest deploy
  • 17 Organizations / tenant
  • > 4800 users on https://www.Snap4City.org
  • > 1300 Dashboards
  • > 15 mobile Apps
  • > 2 Million of structured data per day
  • > 550 IoT Applications/node-RED /Docker
  • > 680 web pages with training
  • > 140 videos, training videos

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

Last minute:
- Installation in Israel
- Coverage of all Greece is coming
One Snap4City Platform may serve Multiple Cities

Snap4City (C), December 2021
Some examples
Smart City Control Room
Florence Metropolitan City

- **Multiple Domain Data**
  - Thousands of Open/Private data, POI, IOT, etc.
  - *mobility and transport*: accidents, public transport, parking, traffic flow, Traffic Reconstruction, KPI, ...
  - **AND**: environment, civil protection, gov KPI, covid-19, social & social media, people flow, tourism, energy, culture, ...

- **Multiple dash/tool Levels & Decision Makers**
  - Real Time monitoring, Alerting, quality assess.
  - Predictions, KPI, DSS, what-if analysis

- **Historical and Real Time data**
  - Billions of Data

- **Services Exploited on:**
  - Multiple Levels, Mobile Apps, API

- **Since 2017**

https://www.snap4city.org/747
Estimation of the mean waiting time at bus stops
3D views

3D Multi Data Map - Digital Twin Global - Firenze

demonstrator

Wed 3 Nov 19:05:27

Snap4City (C), December 2021

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjUxMA==
3D Multi Data Map - Digital Twin Global - Firenze

demonstrator

Thu 16 Sep 17:56:49
**Twitter Vigilance**

**Early Warning**

**Predictive models**

**Hot flows**

Attendance at long lasting events: EXPO2015

Attendance at recurrent events: TV, football

Snap4City (C), December 2021
Tuscany Region
Firenze, Pisa, Livorno, Prato, etc.

https://www.snap4city.org/760
**Tuscany Region**

- **Dashboards & Services:**
  - **Mobility**: public transport operators schedule and paths, traffic Fi-Pi-Li main road, parking status and predictions, traffic sensors, Origin Destination matrix, routing, multimodal routing, etc.
  - **Social**: Hospitals and triage, etc.
  - **Environment**: sensors, heatmaps, alerting,
  - **Pollution Forecast**: NOX, NO2
  - **Weather Forecast**, etc.
  - **Culture and Tourisms**
  - Etc.

- **Mobile App and MicroApplications:**
  - Tuscany in a Snap (all stores)
  - Tuscany where what... km4city (all stores)

- **Numbers**: 1.5 M complex events per day
Environment and Quality of Life

Air Quality Predictions

- Multiple Domain Data
  - Traffic Flow data, Pollutant: NOX, CO2, PM10, PM2.5, O3, ...
  - 3D City structure, weather, ...

- Multiple Decision Makers
  - Pollutant Predictions: NOX, NO2, ...
  - City officers, energy industries
  - Dashboards, What-IF analysis
  - Traffic Flow Reconstruction

- Historical and Real Time data
  - Billions of Data

- Services Exploited on:
  - Dashboards, Mobile App

- Since 2020
Mobility and Transport
Traffic Flow Analysis

- Multiple Domain Data
  - Traffic Flow sensors, city structure, weather
- Decision Makers Multiple Locations
  - Real time Monitoring, predictions
  - Traffic Flow Predictions,
  - Traffic Reconstructions, routing
  - Dashboards, What-IF analysis
  - Mobile App, people flows
- Historical and Real Time data
- Services Exploited on:
  - Dashboards, Mobile App
- Since 2017, 2019

Cities: Firenze, Pisa, Livorno, Modena, Santiago di Compostela

Snap4City (C), December 2021
Traffic Flow Reconstruction for the cities

Last sensors measure 2019-10-14 00:25:14

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc5NQ==
COVID-19
1st phase
Accidents and elements blocking Points and Shapes taken into account for:

– Routing
– Traffic Flow reconstruction
– Evacuation paths
– Rescue team paths

Assessment on the basis of changes:

– Mobility demand assessment
– Mobility Offer assessment

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**
- **Viewed ?**
- **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**
- ...

Snap4City (C), December 2021
User Behavior Analyser for Collective Profiling

Who

When

What

Where?

Why?

Where they go ahead

How move
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 buy a bus ticket
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

Campaing on Sustainable Mobility

Snap4City (C), December 2021
Antwerp, Belgium
https://www.snap4city.org/526
People Monitoring on Pub Services

DIGIPOLIS Antwerp

• Multiple Domain Data
  • PAX Counters: museum, pub services, COVID-19

• Multiple Levels & Decision Makers
  • Business Intelligence Dashboards
  • People flow, OD flows
  • Detection of critical conditions

• Historical and Real Time data
  • 20 fixed PaxCounters
  • 2 Mobile PaxCounters

• Services Exploited on:
  • Dashboards, Mobile Apps, API/data
  • Fully Controlled Devices by Digipolis

• Since 2019
Antwerp

Unique Dashboard builder Multiple Styles


Snap4City (C), December 2021
Programmable PAX counting

Antwerp

Snap4City (C), December 2021
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.
Pont du Gard, France

https://www.snap4city.org/740
**Pont du Gard**

- **Tourism Domain**
  - KPIs
  - Social Media
  - People Flows
  - Bike Flows

- **Dashboards**
  - Monitoring KPI
  - People and bikes flows
  - Twitter Vigilance

- **Historical and updated data**

- **Services Exploited on:**
  - Dashboard

- **Since 2020**
Dubrovnik, Croatia

https://www.snap4city.org/741
Dubrovnik

- Tourism Domain
  - Counting People
  - TV Cameras and WiFi
  - Social Media
- Dashboards
  - Monitoring and real-time control
  - People flow
  - Twitter Vigilance
- Historical and Real Time data
- Services Exploited on:
  - Dashboard
- Since 2020
Valencia, Spain

https://www.snap4city.org/742
Valencia, FSMLR

- Tourism Domain
  - Counting People
  - Environmental data
  - Social Media

- Dashboards
  - Monitoring and real-time control
  - People flow
  - Twitter Vigilance

- Historical and Real Time data

- Services Exploited on:
  - Dashboard

- Since 2020
Mostar, Bosnia-Herzegovina

https://www.snap4city.org/744
Mostar, Bosnia Herzegovina

- Tourism Domain
  - KPIs
  - People flows
  - POI

- Dashboards
  - Monitoring KPI
  - POI, flows

- Historical and updated data

- Services Exploited on:
  - Dashboard

- Since 2020

Snap4City (C), December 2021
West Greece (Patra)

https://www.snap4city.org/743
West Greece

- Tourism Domain
  - KPIs: ODM, Flows, ...
  - Social Media
  - People Flows
- Dashboards
  - Monitoring KPI
  - People flows
  - Twitter Vigilance
- Historical and updated data
- Services Exploited on:
  - Dashboard
- Since 2020
Traffic Flow Reconstruction for the cities

Santiago di Compostela

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTc5NQ==
Helsinki, Finland

• Dashboards & Services:
  • Environment & Weather, PM10, PM2.5, NO, SO2, CO, noise, etc.
    • Sensors values, Heatmap & Alerts on critical
    • FMI Enfuser prediction: PM10, PM2.5, ..
    • GRAL predictions PM10, validations
    • Private sensors in Jätkäsaari area (personal dashboards)
  • Mobility: Traffic Sensors, Operators, routing, multimodal routing, whatif
  • Social: Twitter Vigilance, early warning
  • Life in Helsinki: OD matrix people flow, Twitter Vigilance SA, hot places, etc.
  • Tourism and Culture

• Mobile App and MicroApplications:
  • Helsinki in a Snap (all stores)

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

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddashboard=MTc1Mg==
**Smart City / Smart Parking + Environment**

**Reverberi, Lonato del Garda**

- **Multiple Domain Data**
  - Smart Parking, Environment, Wi-Fi

- **Multiple Decision Makers**
  - City Officer, operators
  - Data monitoring, alerting
  - analytics

- **Historical and Real Time data**
  - Dashboards

- **Services Exploited on:**
  - Dashboards, API

- **Since 2019**
Smart Light Control of CAPELON

- **Energy Domain**
  - Smart Light, MQTT, ....
  - IoT Orion Broker FIWARE

- **Dashboards**
  - Map coverage on Sweden
  - Monitoring and real time control
  - Energy control, analytics
  - Direct control

- **Historical and Real Time data**

- **Services Exploited on:**
  - Multiple Levels, API
  - Dashboards

- **Since 2020**
Roma Demo3 (Qualità dell'Aria)

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjcyNg==
Monitoring Cross Road Venaria - (AXIS Camera)

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

1) Smart Ambulance: Collecting and managing local data from tools and sensors inside the ambulance, IoT Devices, Tablets, Drones etc.

2) Personal Health devices: e.g.: glucometers, etc.

3) Smart Bed: Collecting and managing data from smart bed sensors, monitoring parameters in real-time
What would support my neighborhood to become a 15-Minute City?

Using the Open Data:
We developed a data analytic tool based on municipal and national open data to assess services adequacy for people living in each 15 minutes areas of the city.

Good public transport services: bus, new tram line, train stations, cycle paths.

Careggi/Rifredi is a relevant district in Florence because of hosting the main Florence/Tuscany hospitals Careggi and Meyer, but also university headquarters and many other workplaces.

The tool supports the becoming of a 15-Minute city evaluating the service level in various domains.

15MinCityIndex Dashboard

This Dashboard contains data estimated by the Snap4City 15Min index on the basis of Open Data accessible at https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjkzOA==

Sn4City (C), December 2021
15 Min City Index on Bologna

15 minuti index – Bologna Città Metropolitana (beta)

Smart Building

DIDA data 2

Santa Verdiana - DIDA, poid: 720897

Project tree:
- Santa Verdiana - ...

Last Value

Time Trend Chart: DIDA - 7 days

19.90 °C
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 at the same time you are interested in helping others in conquering higher levels on the city smartness ranking, and provisioning of smart services to all city users!

So that we could be interested in engaging and elevating your role in the Snap4City community as the coordinator of thematic groups, for example on Mobile APP development.

Dashboard on Mobility, IOT Application Development, etc., according to your preferences.

Please contact paolo.disit@gmail.com!
Develop Mobile & Web Applications
Exploiting Snap4City Smart City Services

Analysis & Design
- Analysis
- Design
- Data Discovery
- Data Ingestion

Data Analytics
- Data Analytics Development
- Special Tool Development
- Dashboard Development

IOT App Development

Advanced Smart City API and MicroServices
- Snap4City Mobile & Web Apps Development Kit
- Application Requirements Analysis
- Application Development

Deployment & Testing
- Deployment
- Publication Production
- Testing

Smart City Services

Mobile and Web Apps
- Snap4City Mobile & Web Apps Development Kit
- Application Requirements Analysis
- Application Development

Deploy
- Deployment
- Publication Production
- Testing
## On Line Training Material (free of charge)

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<td>3:41</td>
<td>2:00</td>
<td>2:48</td>
<td>2:35</td>
<td>1:47</td>
</tr>
</tbody>
</table>
SNAP4CITY
EXPO WORLD CONGRESS
19-21 November 2019 - Barcelona
See you at Snap4City Stand A118
Overview

- 2021
- [https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf](https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf)

Snap4City Platform

Technical Overview

From: DISIT Lab of University of Florence, with its DISIT Lab, [https://www.disit.org](https://www.disit.org) and its Snap4City solution

Snap4City:
- Web page: [https://www.snap4city.org](https://www.snap4city.org)
- Twitter: [https://twitter.com/snap4city](https://twitter.com/snap4city)
- Facebook: [https://www.facebook.com/snap4city](https://www.facebook.com/snap4city)

Contact Person: Paolo Nevi, Paolo.nevi@unifi.it
- Phone: +39-335-5668674
- LinkedIn: [https://www.linkedin.com/in/paolo-nevi-84499a51/](https://www.linkedin.com/in/paolo-nevi-84499a51/)
- Twitter: [https://twitter.com/paolonevi](https://twitter.com/paolonevi)
- Facebook: [https://www.facebook.com/paolo.nevi2](https://www.facebook.com/paolo.nevi2)

Access Level: Public.
Date: 05-04-2021
Version: 5.3
Overview


Snap4City (C), December 2021
Overview on Dashboard Production
Control Room

https://www.snap4city.org/621
From Data to Visualization
TYPES OF DATA VISUALIZATION CHARTS

1. **Line Chart**
   - Display trends over time

2. **Area Chart**
   - A line chart with areas below the lines filled with colors

3. **Bar Chart**
   - Display trends with multiple variables

4. **Histogram**
   - Display the shape and spread of continuous dataset samples

5. **Scatter Plot**
   - Show correlation in a dataset

6. **Bubble Chart**
   - Show and compare the relationship between the labeled circles

7. **Pie Chart**
   - Show the contribution of data point inside a whole dataset

8. **Gauge**
   - Visualize the distance between intervals

9. **Map**
   - Show data with location as a variable

10. **Heat Map**
    - Show magnitude of a phenomenon
Two Main Lines for Dashboarding

- Kibana (DevDash, My Dashboard (Dev) Kibana)

Ready to use
You can customize
Limited details

- Dashboard Builder of Snap4City

You need to create / customize
Full Control
Professional details
<table>
<thead>
<tr>
<th>Features</th>
<th>Snap4City Dashboard Builder</th>
<th>Kibana, Grafana</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Collection of Widgets</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Custom Widgets SVG of any kind, full defined process for customization</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Real time event driven widgets and data</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Business Logic for data transformation with visual programming: Node-RED</td>
<td>YES: visual/coding</td>
<td>coding</td>
</tr>
<tr>
<td>Maps with custom PIN, bubbles, animated and moving, etc.</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Maps with paths, shapes, traffic flow, scenarios, routing, heatmaps, what-if, ...</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Maps with Orthomaps from WFS, WMS, GIS connection, etc.</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>TV camera event integration and selection</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Widgets for business logic integration on real time: buttons, selector, switch, etc.</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Kiviat, Spider net, Calendar</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Typical Time Trends: day hours, month week, month days, .....</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Time Trend Compare: day, eek, month, year</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Selectors/Menus: text, icons, etc., also in connection with IOT APP, Node-RED</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Full control of graphic layout, font, colours, refresh per widget, etc.</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Iframe integration of third party widgets and web pages, nesting dashboards, embedding Kibana</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Connection among multiple Dashboards and Widgets</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Synchronization with Video Wall, and Operators Views</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Multiseries, bar lines, charts, pie, donut, simple selectors, trends, etc., also from business logic</td>
<td>YES</td>
<td>Limited</td>
</tr>
<tr>
<td>Single content, string, html, any data, etc.</td>
<td>YES</td>
<td>Limited</td>
</tr>
<tr>
<td>Special widgets: Weather forecast, civil protection, road plates, Twitter, etc...</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Digital Twin Local and Global</td>
<td>YES</td>
<td>Nothing</td>
</tr>
<tr>
<td>Faceted search</td>
<td>YES: selectors, forms, buttons</td>
<td>YES</td>
</tr>
</tbody>
</table>
Data Type Coverage

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

Snap4City (C), December 2021
Dashboards by Selecting data vs Widgets
Simple Dashboards

Data and relationships

Data gather, production

Big Data Analytics, Artificial Intelligence

Storage

Dashboards and Apps

Snap4City (C), December 2021
Dashboard Builder: Development

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

Dashboard Wizard

IOT Applications

Knowledge Base, Km4City

Data Transformation Business Logic

Knowledge and Storage

Data from the Field and City + MyKPI ++

Widget Collection

Dashboard Editor

External Services

Custom Widgets/Synoptics

Micro Applications

Public Dashboard Collection

My Own Dash/App

Data Transformation Business Logic

IOT Applications

Knowledge Base, Km4City

Data from the Field and City + MyKPI ++

Dashboard Wizard

Dashboard Editor

External Services

Custom Widgets/Synoptics

Micro Applications

Public Dashboard Collection

My Own Dash/App
Dashboard List and Editor

Snap4City (C), December 2021
From Templates to Wizard and Dashboards

- to create a new Dashboard
- to add widgets and/or groups of them on any Dashboard
Select the area of your interest: panning and zooming

Select the

- graphic aspect of your interest, or
- High Level Type of your interest, or
- Make a search if you a have a precise idea or
- Act on filters: nature, subnature, type, name, value, date, health, owner, …
- Combine them as you like

- Select the lines of your interest
- Then click on Next and get the Dashboard by wizard
ICONS of Widgets

Single data

Multi data

Map Controls

Snap4City (C), December 2021
The Wizard helps you in selecting only possible combinations of data and graphic representations.
Wizard

Dashboard - tester14

Use Wizard to add more widgets

CONTEXTUAL MENU to edit features
Manual Addition of Widgets

Dashboard - tester14

Add new widget to dashboard

Metric and widget choice

Generic widget properties

Specific widget properties

Metric and widget choice

Widget category

Actuator

Data viewer

Generic widget properties

Title

Background color

Content font size

Content font color

Header color

Header text color

Specific widget properties

Widget type

widget GaugeChart

Widget link

widget GaugeChart

widget IntervalCompare

widget Intensity

widget Speedometer

widget Time

widget CarrierPosition

SNAP4City (C), December 2021
### HLT: Unified Classification for Data and Services

#### Snap4City (C), December 2021

<table>
<thead>
<tr>
<th>High-Level Type</th>
<th>Nature</th>
<th>SubNature</th>
<th>Dev/Model name</th>
<th>Broker name</th>
<th>Value Name</th>
<th>Value Type</th>
<th>Data Type</th>
<th>Value Unit</th>
<th>Last Date/Time</th>
<th>Last Value</th>
<th>Healthiness</th>
<th>Last Check</th>
<th>Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>IoT Device Variable</td>
<td>IoT Device</td>
<td>IoT Sensor</td>
<td>dev0r0at10t</td>
<td>oronUNIFI</td>
<td>temperature</td>
<td>temperature</td>
<td>float</td>
<td>°C</td>
<td>2019-05-31 18:16:03</td>
<td>2019-05-31 18:16:03</td>
<td>healthy</td>
<td>private (my Own)</td>
<td></td>
</tr>
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<td>oronUNIFI</td>
<td>humidity</td>
<td>humidity</td>
<td>float</td>
<td>%</td>
<td>2019-05-31 18:16:03</td>
<td>2019-05-31 18:16:03</td>
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<td>temperature</td>
<td>string</td>
<td>%</td>
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<td>%</td>
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<td>2019-05-31 18:16:03</td>
<td>healthy</td>
<td>private (my Own)</td>
<td></td>
</tr>
</tbody>
</table>
• Click with the mouse on it

HLT: Sensor

Knowledge Base view

Snap4City (C), December 2021
Advanced Features of the Data Inspector

• Some features accessible only for the Owner and *Admin, such as:
  – Specific information on the basis of the High Level Type
  – Values connected to the data (structure of the single data)
  – Details regarding the ingestion process
  – Eventual image representing the City Entity, for example the sensor
  – Ownership (licensing) details regarding the data owner

• So that you can access on all of them in the Snap4City version if you install on premise.

• A part of these features can be activated for the Organization Managers, namely: «ToolAdmin» roles.
Helsinki City Overview (H5a)

Please note that the data results are not always based on real data.

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

Snap4City (C), December 2021
Unique Dashboard builder Multiple Styles

Widget Multi Data Map

Single values

- Single Content
- Speedometer
- Gauge
- Single Bar

Most of the multi xxxx widgets can show also single values
• Time Trend

• Time Trend Compare
  – Comparing trends of the same time series

• Multi Series
  – Showing multiple trends of multiple time series with same unit

• Typical Time Trend
  – Showing the typical trend of a time serie: multiple modalities

https://www.snap4city.org/710

https://www.snap4city.org/705
• Staked, shaded or regular,
• Grouped by Value_unit, **linear** or **Logarithmic**
• From historical data and/or **dynamic** data from IOT Applications

Ordered Data Series

• A series or multiple series which are ordered by a number:
  – E.g., 1,2,3,4,5,......N

• For each number (position over X axis, a value on Y axis is provided)

• It is provided from the multiseries widget with setting parameters from MoreOptions

• Series can be also provided from IOT Apps

Snap4City (C), December 2021
A tool for visual Analytics, Comparing

- **4 hours** wrt those before, or same hours of previous day
- **12 hours** wrt those before, or same hours of previous day
- **Day** wrt day before, or same day of previous week or month
- **Week** wrt to previous week, or
  - week starting on Monday
- **Month** wrt to previous month, or
  - previous month starting 1\(^{st}\) day, or
  - same month of the previous year
- **6 Months** wrt to previous 6 months, or
  - Aligned day 1 or same 6 months previous year day 1 or
  - 6 months previous year day 1 aligned 1\(^{st}\) or 2\(^{nd}\) semester
- **Year** wrt to previous year, or
  - previous year starting 1\(^{st}\) day, or
  - previous year starting same month
Showing: **Sum, Average or Median** value of a variable as a colored calendar:

- **Year**
  - 1 Year, 12 months, by weeks, per days
  - Time Range: 1D, 7D, 1M, 6M, 1Y
- **Month**
  - 30 days, 24 hours
  - Time Range: 1D, 7D, 1M, 6M, 1Y
- **You can scroll in history**
- **They manage HLT: Sensor, MyKPI and work receiving Dynamic data from IOT App**

https://www.snap4city.org/706


Snap4City (C), December 2021
Typical Time Trends

Typical Time Trend Example

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzA5MQ==

Snap4City (C), December 2021
Barseries

- Stacked and grouped by Value_Name / Value_Type
- Oriented: Vertical and Horizontal
- ordered by value: crescent, descendent
- From historical data and/or dynamic data from IOT Applications

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

Snap4City (C), December 2021
Pie & Donut

- Single level Pie and two levels as Donut
- Grouped ValueType, ValueUnit

Tables

<table>
<thead>
<tr>
<th>value type</th>
<th>value name</th>
<th>airHumidity</th>
<th>airTemperature</th>
<th>PM2.5</th>
<th>PM10</th>
<th>O3</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBIMET_SMART_01</td>
<td>38.9</td>
<td>19</td>
<td>235.38</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBIMET_SMART_03</td>
<td>48</td>
<td>13.3</td>
<td>97.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBIMET_SMART_04</td>
<td>50.6</td>
<td>13.4</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBIMET_SMART_06</td>
<td>51.4</td>
<td>10.9</td>
<td>14.47</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBIMET_SMART_07</td>
<td>84</td>
<td>10.6</td>
<td>13.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBIMET_SMART_08</td>
<td>80</td>
<td>21.9</td>
<td>2.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBIMET_SMART_09</td>
<td>32.3</td>
<td>9.5</td>
<td>12.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Neutral or Colormapped, the same of heatmaps
- Number/text

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

Snap4City (C), December 2021
Normalized, multiple value units

Hystorical, KPI and Dynamic from IOT App

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjUwNQ==
OLAP Data Cubes
Multi Data Map Widget

- The most powerful Data Map rendering tool, it supports:
  - **KB Sensor data**: POI, sensors, actuators, etc. (see in the following), moving devices
  - **WFS data** (see in the following)
  - **WMS background maps**
    - Ask to a RootAdmin for activating this feature on your MultiDataMap widgets once created the dashboard
    - Maps can come from GIS servers, and WMS
  - **WMS Heatmaps GeoTIFF**
  - **WMS Traffic Flow GeoTIFF**
  - **GTFS data from Public Transport**
  - **Special tools**
    - Scenario (see in the following)
    - What-IF (see in the following)

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjE5MA==#
Orthomaps
Menu Icon and PINs as Icons


Snap4City (C), December 2021
Technical Selector: TECH MultiDataMap

Antwerp Selector Tech

https://www.snap4city.org/dashboardSmartCity/view/index.php?id=dashboard=MjMxOA==
Unique Dashboard builder Multiple Styles

3D views

3D Multi Data Map - Digital Twin Global - Firenze

demonstrator

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

Snap4City (C), December 2021
3D Multi Data Map - Digital Twin Global - Firenze

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

Snap4City (C), December 2021
Weighted Bubbles

Roma Demo1 (mappe e dati real time)

https://www.snap4city.org/dashboardSmartCity/view/index.php?id=dashboard=MjcyNQ==
Custom Dynamic Pins

Custom Pins on Map - test GP

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjk5MA==
Dashboards with Business Logic/Intelligence
Business Logic/Visual Analytics

1. increasing cognitive resources, using a visual resource to expand human working memory,
2. reducing search, representing a large amount of data in a small space,
3. enhancing the recognition of patterns, organize in space and time by relationships,
4. make easy perceptual inference of relationships that are otherwise more difficult to induce,
5. perceptual monitoring large number of potential events, and
6. Way to real time manipulation to explore data space in time and relationships.
Visual Analytics: Business Logic/intelligence

Data and relationships

Storage

Business LOGIC

Data gather,production

Big Data Analytics, Artificial Intelligence

Dashboards and Apps
15MinCityIndex Firenze

15MinCityIndex Dashboard
This Dashboard contains data estimated by the Snap4City 15Min index on the basis of Open Data accessible


Snap4City (C), December 2021
Alert Registration

Alerting Generation

This dashboard contains data derived from actual sensors and predictive values under validation.

Kind: River Flooding
Severity: Relevant
People Involved: 10
Impact 1: People Disease
Impact 2: Pollutant
GPS: 43.77614;11.210861
City: FIRENZE
Addr: VIA ADRIANO CECONI N. undefined
Registered: Green:610755283309

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MzA0OQ==
IOT App with Dynamic Web Pages

- HTML pages can
  - be dynamically generated from the IOT App
  - provide forms to produce data to the IOT App, also including interactive elements
  - collect file from users, and produce files to web and to the system
  - have CSS and AJAX controls
SVG Custom Widgets Examples 2

https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=Mjk4Ng==
Advanced IOT Applications

- Synoptics can ......
  - do all 😊
- Widgets can
  - send/receive dynamic data,
  - change data sources, etc.
  - Provide interactive maps
- HTML pages can
  - be dynamically generated
  - provide forms to produce data for IOT Applications
  - Collect files on web and system
  - produce files on web ad system
  - have CSS and AJAX control

Snap4City (C), December 2021
Data Adapation
Transformation, Conversion
Integration
Business Logic vs Dashboards
Data Analytics control
Everywhere: Cloud, on IoT Edge Devices
April 2021 collection
Two Snap4City Libraries

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

We suggest also to install:

AND: From Resource Manager
Two Snap4City Libraries

- Search and management of Services, POI, Parking, Public Transport, etc.
- Event management, ticket management
- Routing, Data Analytic, Open Data processing
- IoT device registration, Virtual Devices full control
- IOT adaptation, network management
- Dashboard management
- Personal data management, KPI, etc.

...
Widgets Interacting with IOT Apps
virtual Sensors and Actuators
From Dashboard to IOT Devices/App

• **Widgets:**
  – Impulse Button
  – Button
  – Switch
  – Dimer/Knowb
  – KeyPad
  – Geolocator
  – Selection/Dropdown
  – Form
  – Map Picking

• **Registered** on some IOT brokers with NGSI mutual authentication

Acting on your systems
From Dashboard to IOT App

Dashboard - IOT App

MyKPI variable onchange
Synoptics
MapClick

IOT Application

impulse button
numeric keyboard
switch button
dimmer
geolocator
dropdown
form
coordinates from map
event driven my kpi
synoptic read
synoptic subscribe

Snap4City (C), December 2021
Geolocation of Mobile Device

- Complete message
  - Returns a JSON containing all information about geolocation
- Latitude
  - Returns the latitude
- Longitude
  - Returns the longitude
- Accuracy
  - Returns the accuracy of latitude and longitude
- Altitude
  - Returns the altitude
- Altitude Accuracy
  - Returns the altitude accuracy
- Heading
  - Returns the heading
- Speed
  - Returns the speed

Web Browser GPS data rendering the Snap4City Dashboard can be passed to IOT Applications and saved 😊
Multi Data Map ServiceURI selection vs IOT App

1) Click on PIN
2) GET event with:
   - Lat,Long
   - ServiceURI

• 3) The click on the map passes GPS coordinates into IOT App and the ServiceURI. Thus you can use them to:
   – search for location
   – picking the value of one or more heatmaps
   – dynamically change data on widgets and dashboards
   – Get all the ServiceURI information and exploit them on Business Logic
   – Etc.
DropDown Selector

- Selecting MSG to be sent on the Business Logic IOT Application

```javascript
msg.payload = {value:JSON.parse(msg.payload).selected};
return msg;
```
Dashboard - IOT App

From IOT App to Dashboard

Nature

IOT Application

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

20.3°C
Single Content Widget (flexibility)

From Dashboard Editor and IOT Applications, accepts in input:

- Numbers
- String
- HTML code

https://www.snap4city.org/578
Controlling Maps from IOT Apps

- Show points on maps
- Get Points
- Tracks
- See examples on:
  - https://iot-app.snap4city.org/nodered/nrve0e3/ui/#1/0
  - https://www.snap4city.org/409
  - https://www.snap4city.org/417

Snap4City (C), December 2021
Synoptic, Custom Widgets and PINS Creation
Special Custom Widgets

- Smart parking
- Smart Energy
- Smart Light
- Smart ....
- Energy View
- Custom Controls
Custom Widget / Synoptic / PIN Development

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

Inkscape editor on your computer

Create, save a Custom Widget in SVG

Create, save, load, delegate, grant access

SVG Symbols Collection

Dashboard Editor

Knowledge Base, Km4City

Knowledge and Storage

Data from the Field and City

IOT Applications

Public Dashboard Collection

My Own Dash/App

SVG

SVG

SVG

SVG
How to create a custom Widget

• User manual on: https://www.snap4city.org/595
Create, save a Custom Widget in SVG

Upload as Custom Widget Template

List of Custom Widgets / Synoptics

Dashboard Editing/wizard

Select MyKPI and Sensor Data for Synoptics cases

From any open library

SVG Symbols Collection

CW with a single READ Variable are automatically usable as PINS

Select

Instantiate as Custom Widgets / Synoptics
Connect with WebSockets

Final Dashboard

Snap4City (C), December 2021
Overview of Data Ingestion
Short cut Data Ingestion from Excel file

Snap4City Architecture

- Data Loader
  - Data Table Loader
    - Data Table
  - IOT App for Data Table Loader
- IOT App for POI Loader
- IOT Orion Broker
  - IOT Device Registration
  - IOT Device Time Series
  - NGSI
- IOT Directory
- Dictionary
- Knowledge Base
  - Semantic Reasoners
  - Indexing and Aggregating
    - NIFI, OpenDistro per ElasticSearch
- Dashboard Builder
  - Real Time data
  - SURI Link
  - Real Time data
### Uploaded Files (18)

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<th>File Name</th>
<th>Status</th>
<th>Upload Date &amp; Time</th>
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<td>KOK2021_J87019342_SAMPLE demo.xlsx</td>
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<td>Tue, 8 Jun 2021 08:41:41 GMT</td>
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<td></td>
<td>Instance(s): Not Created</td>
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<td>Instance(s): Created</td>
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</table>

(use Excel button to upload file)

General guidelines:
- Use "Previous" and "Next/Save" (not browser navigation) buttons to move to previous and next pages.
- In multi-sheet files, column headers in all sheets must be the same. If they are different and describe a different kind of data, the file can be split into more than one.
- In multi-sheet files, the number of columns in all sheets must be the same.
- Avoid using special characters in file name (e.g., @, %, \) and non-UTF-8 (e.g., non-English) letters in the file name and column headers (e.g., tZ,x).
Data from INSETE
Basic Sizes of Incoming Tourism

### Basic Sizes of Incoming Tourism of the Region of Western Greece 2019

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<td>1.9%</td>
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</table>

Source: BoG Border Research, INSETE Intelligence Editing

### Basic Sizes of Incoming Tourism of the Region of Western Greece 2018

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<td>3.4%</td>
<td>1.4%</td>
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## Resulted Data Table Loaded by Row Model

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<th>Region</th>
<th>Visits_in_Thousands</th>
<th>Receipts_in_Millions_Euro</th>
<th>Nights_in_Thousands</th>
<th>Expenditure_per_Vist_Euro</th>
<th>Cost_per_Night_Euro</th>
<th>Average Length of Stay</th>
<th>dataObserved</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Nature</th>
<th>Sub-Nature</th>
<th>Context Broker</th>
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<td>Tourism</td>
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<td>Europe</td>
</tr>
</tbody>
</table>
Checking data ingestion results

- Data Inspector
- ServiceMap, SCAPI
  - LOG / LOD viewer
  - Super Service Map
- IOT Directory
- SCAPI: Swagger
- IOT Broker
- Data Inspector
- ServiceMap, SCAPI
- My Data Dashboard (Kibana), DevDash
- Open Distro (ElasticSearch)

Some functionalities are limited to certain roles

Snap4City (C), December 2021
Snap4city Data Ingestion Flow Diagram

Static Models

- Static or quasi Static Data: POI, etc.
- IOT Broker Registration
- IOT Device Model Reg.
- IOT Device Registration

Dynamic Models

- Real Time data in Pull
  - Any gateway, server
  - IOT Device/Gateway

Time Series

- IOT Orion Broker
- IOT App
- IOT Device
- IOT Brokers

Knowledge Base

- Semantic Reasoners

Indexing and Aggregating

- NIFI, OpenDistro (ES+Kibana)

Snap4City Tools

- Information, File
- IOT Apps
- Snap4City Tools
- IOT Device/Gateways
Just to start!
See many other features
### On Line Training Material (free of charge)

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<th>2nd part (*)</th>
<th>3rd part (*)</th>
<th>4th part (*)</th>
<th>5th part (*)</th>
<th>6th part (*)</th>
<th>7th part (*)</th>
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<td>Dashboards</td>
<td>IOT App, IOT Network</td>
<td>Data Analytics</td>
<td>Data Ingestion processes</td>
<td>System and Deploy Install</td>
<td>Smart City API: Web &amp; Mob. App</td>
</tr>
<tr>
<td>Inter active</td>
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Not addressed today but accessible on training

- Dashboard features:
  - GDPR ad ownership management, delegation
  - Dashboard cloning and management, monitoring dashboard usage
  - From dashboard to IoT App and viceversa
  - Chat per dashboard
  - Structure of the Applications, and data relationships
  - Exporting Dashboards into Third Party Web Pages
  - Dashboards for mobile devices

- Data / services
  - What if Analysis, Tools ready to use
  - Advanced Data Types: trajectories, traffic flow, heatmaps, ..
  - GIS integration, getting GIS data and producing GIS data
  - Exploiting external services into dashboards
  - Exploiting MicroApplications
  - Deep going into Data Inspector
  - Event management: email, telegram, SMS, etc..
  - BIM Integration and exploitation, local digital twin
  - 3D modelling exploitation, global digital twin

- Kibana Dashboards
- Routing, multimodal routing, dynamic routing, ready to use
- Decision support systems: System Thinking, FRAM for resilience, etc.
- Integration with ticketing management
Data Type Coverage

- POI, IOT, shapes,..
- KPI, personal KPI,..
- Dynamic icons/pins,..
- Synoptics, animations,..
- Social media, Twitter
- Maps, orthomaps, GTFS, GIS WFS/WMS, GeoTiff,..
- Calibrated heatmaps,..
- Traffic flow, typical trends,..
- Trajectories, events,..
- 3D, BIM, Workflow,..
- OD Matrices, scenarios,..
- Prediction models,..
- Decision support,..
- Routing,..
- Linked Data,..
- Satellite data,..
- Etc.
Acknowledgements
Overview

- 2021
- [https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf](https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf)
Main running instances (11/21)

- Sii-Mobility → mobility and transport, sustainability
- REPLICATE → ICT, smart City Control room, Energy, IOT
- RESOLUTE → Resilience, ICT, Big Data
- GHOST → Strategies, smart city
- TRAFAIR → Environment & transport
- MOSAIC → mobility and transport
- WEEE Life → Smart waste, environment
- Smart Garda Lake → Castelnuovo del Garda, SMARTEA
- 5G → Industry 4.0 vs SmartCity
- Green Impact → Industry 4.0, Chemical Plant, control and plan
- SmartBed (Laid) → smart health
- Green Field Peas (Soda) → Industry 4.0, Chemical plant
- MobiMart and PISA Agreement → data aggregation, mobility and transport, Living Lab
- Lonato del Garda → smart parking, environment
- Herit Data → tourism, culture and management
- ISPRA JRC → site management and services
- Capelon (Sweden) → smart light solutions
- PC4City → land slide monitoring and predictions
- Italmatic → industry 4.0 production control
Acknowledgements

- Thanks to the European Commission for founding. All slides reporting logo of Snap4City [https://www.snap4city.org] of Select4Cities H2020 are representing tools and research founded by European Commission for the Select4Cities project. Select4Cities has received funding from the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation Programme (grant agreement n° 688196).

- TRAFAIR is a CEF project. All slides reporting logo of TRAFAIR project are representing tools and research founded by the EC on CEF programme [http://trafair.eu/]

- Thanks to the European Commission for founding. All slides reporting logo of REPLICATE H2020 are representing tools and research founded by European Commission for the REPLICATE project. REPLICATE has received funding from the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation Programme (grant agreement n° 691735).

- Thanks to the European Commission for founding. All slides reporting logo of RESOLUTE H2020 are representing tools and research founded by European Commission for the RESOLUTE project. RESOLUTE has received funding from the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation Programme (grant agreement n° 653460).

- Thanks to the MIUR for co-founding and to the University of Florence and companies involved. All slides reporting logo of Sii-Mobility are representing tools and research founded by MIUR for the Sii-Mobility SCN MIUR project.

- Km4City is an open technology and research line of DISIT Lab exploited by a number of projects. Some of the innovative solutions and research issues developed into projects are also compliant and contributing to the Km4City approach and thus are released as open sources and are interoperable, scalable, modular, standard compliant, etc.

193 Snap4City (C), December 2021
Be smart in a SNAP!

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