4.3.1. LOCAL IT SYSTEMS INTEGRATED WITH ICT SMART CITY PLATFORM CONCEPT

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement Nº 691735

FIRENZE CITTÀ FARO

Smart City Control Room Architecture

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

Sentient Smart City

Dashboards and IOT Intelligence

Paolo Nesi

Paolo.nesi@unifi.it , Https://www.disit.org

Https://www.snap4city.org https://www.km4city.org

Sentient Smart City
Dashboards and IOT Intelligence

REPLICATE
This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement Nº 691735

FIRENZE CITTÀ FARO

Dashboards with data driven IOT Applications enforcing intelligence

City Data & IOT

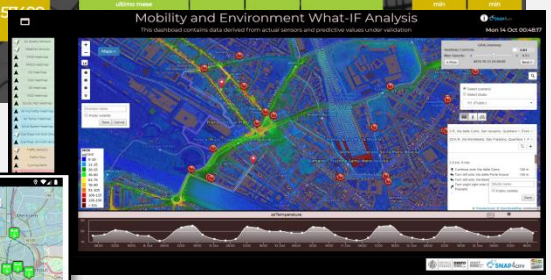
IOT Devices

IOT Applications

Big Data Analytics, Artificial Intelligence

SNAP4CITY KM4CITY

Dashboards and Apps



Smart City Control Room (architecture)

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Transport systems
Mobility, parking

Public Services,
Govern, events, …

Sensors, IOT Cameras,
Wi-Fi

Environment, Water,
energy

Shops, services,
operators

Social Media

Social Media Crawler and Manager

Data Sources PULL Data

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

Data Ingestion, aggregation, regularization, reconcile ETL, NIFI, DISCES

Big Data Cluster HDFS, Hbase, Phoenix

Knowledge base Semantic reasoners

Indexing and aggregating Elastic search

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

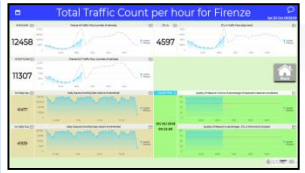
IOT Applications Node-RED + Snap4City MicroSrvs

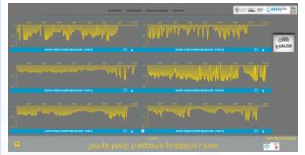
Search and Query, Smart City API Facet, semantic search

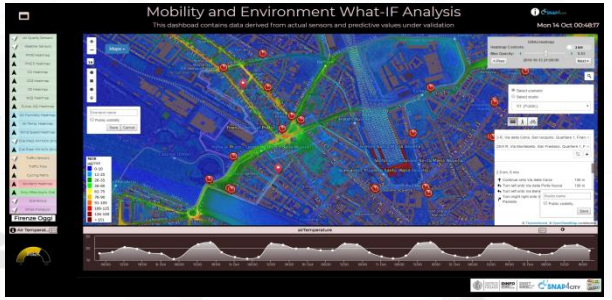
Visual Analytics Special dash/ tools

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

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







Snap4City/Km4City Platform

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement Nº 691735

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

100% OPEN SOURCE

APPLIANCES CONTAINERS

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

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

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

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

EU GDPR COMPLIANT

PEN Test Passed

IOT APPLICATIONS - INSTANT APPS

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

DASHBOARDS & APPLICATIONS

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

MOBILE & WEB APPLICATIONS

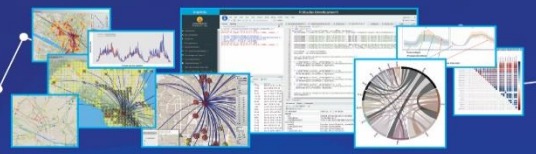
DEVELOPMENT KIT • SUGGESTIONS • MOBILE APPS • MONITORING PANELS • PLATFORM UTILITIES • READY TO USE SMART APPLICATIONS

MICROSERVICES & ADVANCED SMART CITY API

LIVING LAB - DEV TOOLS - COWORKING

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

BIG DATA - DATA ANALYTICS



DATA ANALYTICS TOOLS - MICRO-APPLICATIONS

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

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

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

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

Any kind of data/formts and streams

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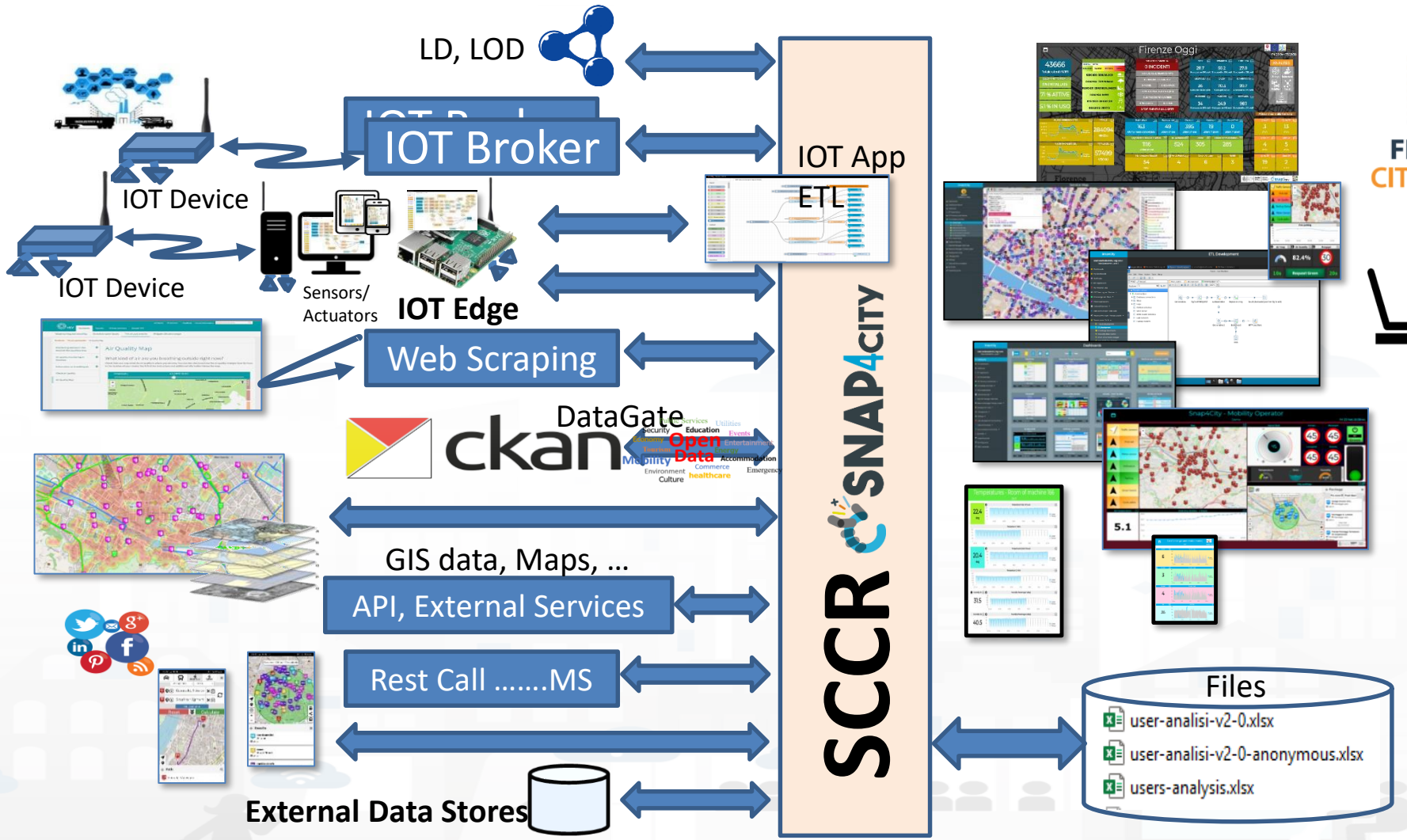
- **Open Data:**
  - Data gate, federation of Open Data Portals
  - ETL processes (PULL)
  - IOT Application processes
- **IOT Networks:**
  - IOT Application processes, data driven or PULL
  - IOT Brokers (Push) → IOT Shadow
- **Web Pages:**
  - Web scraping, crawling processes
- **Social media: Twitter,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



Standards and Interoperability

REPLICATE
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FIRENZE CITTÀ FARO

Compliant with: AMQP, COAP, MQTT, OneM2M, HTTP, HTTPS, TLS, Rest Call, SMTP, TCP, UDP, NGSI, LoraWan, TheThingsNetwork, SigFOX, DATEX II, SOAP, WSDL, Twitter, FaceBook, Telegram, SMS, OLAP, MySQL, Mongo, HBASE, SOLR, SPARQL, EMAIL, FTP, FTPS, WebSocket, WebSocket Secure, ModBUS, OPC, GML, RS485, WFS, WMS, ODBC, JDBC, Elastic Search, Phoenix, XML, JSON, CSV, db, GeoJSON, Enfuser FMI, Android, Raspberry Pi, Local File System, ESP32, Libelium, IBIMET, OBD2, SVG, XLS, XLSX, TXT, HTML, CSS, etc.

Node-RED
JS Foundation
FI-WARE
E015 digital ecosystem
bee smart city
sigfox partner network
ckan
GJL
LABGEO
esri Italia
EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB
SNAP4CITY
KM4CITY

Firenze

43.7693, 11.2560

Wed 9 Nov @ 23:36:04

REPLICATE

2017

Wifi operativi (9 min)

100% 0%

SmartDS: via Santa Marta 3 (9 min)

36.0% 30.9% 33.2%

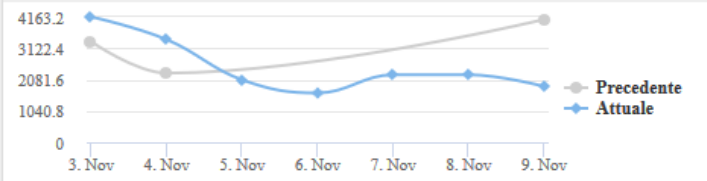
Informazioni disponibili (9 min)

Servizi attivi su Firenze	23452
Eventi del giorno a Firenze	2173
Open Data disponibili	138

Servizi du... (9 min)

42.4%

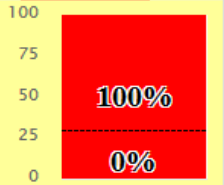
Accessi ai servizi singoli (web e mobile) (31 sec)



Bus Attivi (29 sec)

24

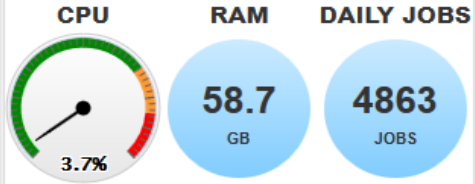
Ataf RT (30 sec)



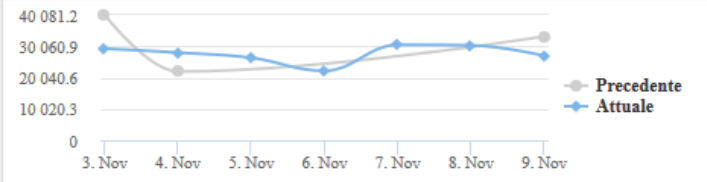
Parcheggi... (29 sec)

55.4%

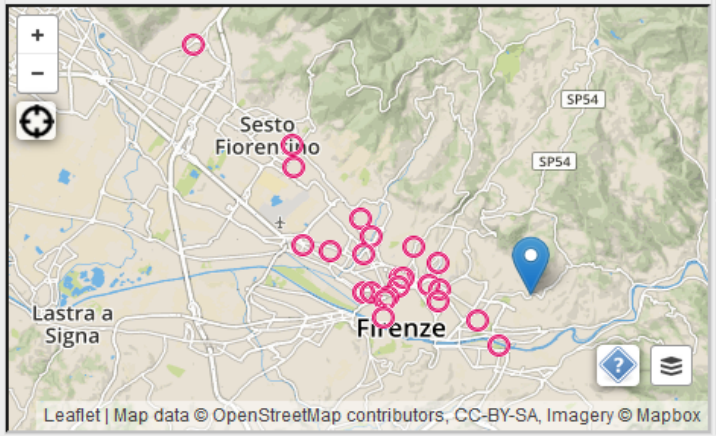
Smart City Engine (30 sec)



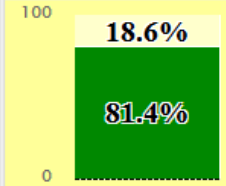
Rilievi wifi (9 min)



Real time position ATAF bus



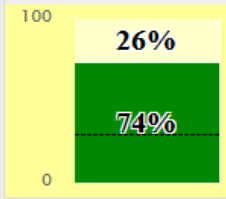
Sensori RT (29 sec)



Previsioni meteo: FIRENZE (359 min)

Wednesday	Thursday	Friday	Saturday	Sunday
light rain	cloudy	moderate rain	cloudless	cloudy
7°C / 13°C	6°C / 16°C	7°C / 16°C	/	/

Parcheggi... (30 sec)



Twitter Trends/citazioni (30 sec)

PRINCIPALI TREND TWITTER:

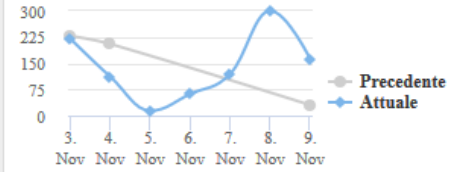
#FIRENZE

#FIORENTINA

#UFFIZI

CITAZIONI:

Query Servicemap (31 sec)

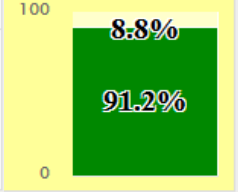


Stato linee ATAF (29 sec)

STATO | LINEE MONITORATE | DATI

46%	5%	49%
IN ORARIO	IN ANTICIPO	IN RITARDO

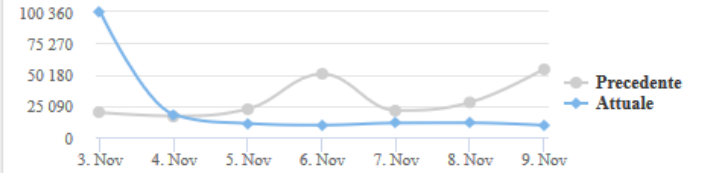
Previsioni... (30 sec)



Elenco eventi del giorno (30 sec)

- Il restauro delle "Storie della Genesi" di Paolo Uccello
- Il restauro delle "Storie della Genesi" di Paolo Uccello
- Tra arte e moda
- Tra arte e moda (2)
- Winkelmann. Firenze e gli Etruschi - Il padre

Query Km4city API (31 sec)



http://www.darionardella.it/il-sindaco-dario-nardella-in-missione-a-madrid-e-barcellona/

Firenze Oggi 2019

Fri 25 Oct 23:29:38

43666
Totale utenti WIFI

COLONNINE RICARICA
176 INSTALLATE
71 % ATTIVE
5.1 % IN USO

GENERAL | METEO

MINIMO	BASSO	MEDIO	ALTO

RISCHIO IDRAULICO
RISCHIO TEMPORALI
RISCHIO IDROGEOLOGICO
RISCHIO NEVE
RISCHIO GHIACCIO
RISCHIO VENTO

SITUAZIONE VIABILITA
0 INCIDENTI
0 CHIUSURE AL TRAFFICO (TOT)
0 CHIUSURE PER CANTIERI
0 PROGR. | 0 NON PROG.
0 LIMITAZIONI AL TRAFFICO (TOT)
0 LIMITAZIONI PER CANTIERI
0 NON PROG. | 0 PROGR.
0 TOT. EVENTI SULLA RETE

SMN	BINARIO16	FORTEZZA
28.7 % occupati su 607 posti	55.2 % occupati su 165 posti	27.8 % occupati su 521 posti
LEOPOLDA	**CALZA**	**S.AMBROGIO**
36 % occupati su 300 posti	70.3 % occupati su 148	99.7 % occupati su 379 posti
PARTERRE	**CAREGGI**	**BECCARIA**
34 % occupati su 656 posti	24.9 % occupati su 406 posti	98.1 % occupati su 210 posti

ANALYSIS
Energy | Environment | Mobility | Social | Resilience

FLUSSI INGRESSO CITTA
26 393.2 / 19 794.9 / 13 196.6 / 6598.3 / 0 — 12:00 — Current / Previous

TOTALE
284094
VEICOLI

FLUSSI INGRESSO ZTL
5522 / 4141.5 / 2761 / 1380.5 / 0 — 12:00 — Current / Previous

TOTALE ZTL
57499
VEICOLI

Nati Italiani	Nati stranieri	Deceduti	Matrimoni	Unioni Civili
163 ultimo mese consolidato	49 ultimo mese	395 ultimo mese	19 ultimi 7 giorni	0 ultimi 7 giorni

Segnalazioni ricevute in attesa	In Lavorazione	Risolte	Chiuse senza risoluzion...
1116 ultimo mese	524	305	285

Manutenzioni Stradali	Verde Pubbli...	Decoro Urbano	Relitti
54 oggi	4	6	3

Attesa media alla fermata

Linea 6	Linea 13
3 min	13 min
Linea 17	**Linea 23**
4 min	5 min
Linea 31	**Linea 36**
19 min	2 min

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

Smart City Control Room
a set of dashboards and tools

REPLICATE
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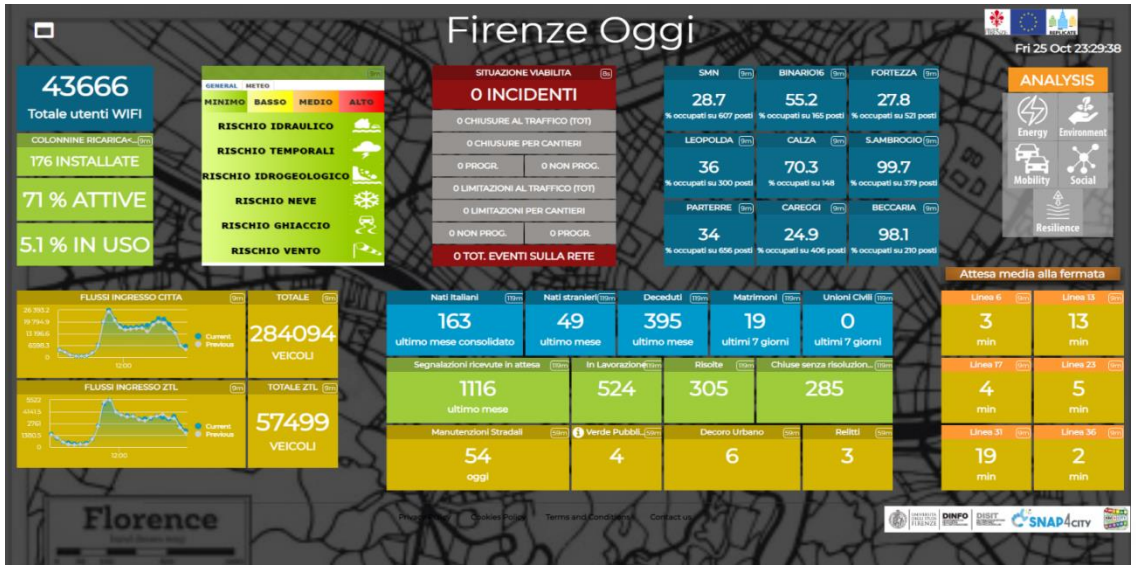
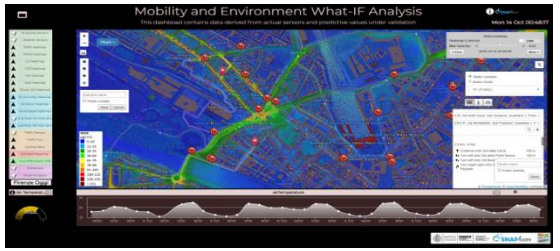
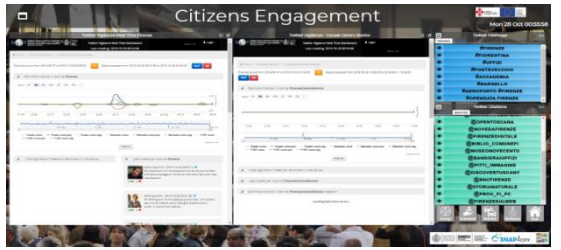
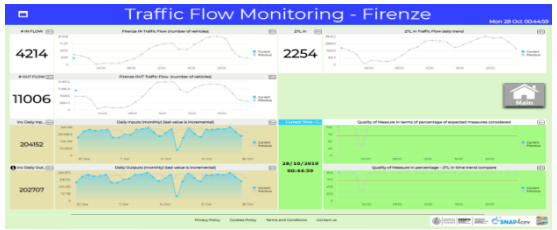
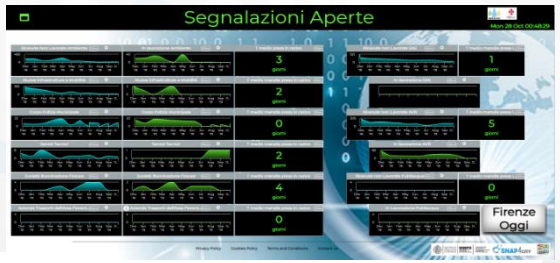
FIRENZE CITTÀ FARO

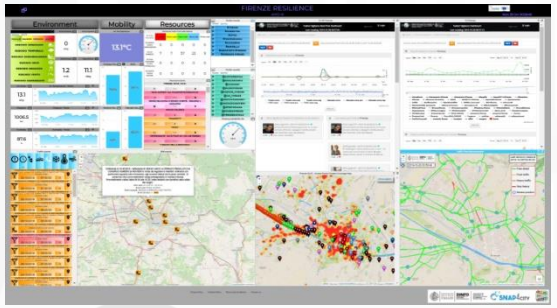


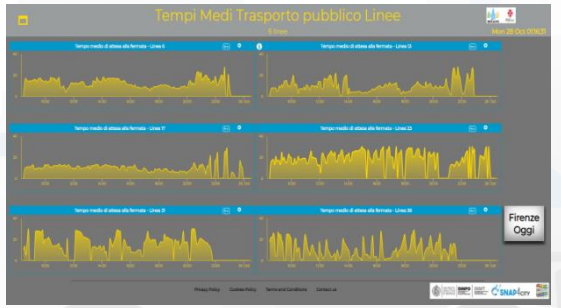












Smart City Control Room

a set of dashboards and tools

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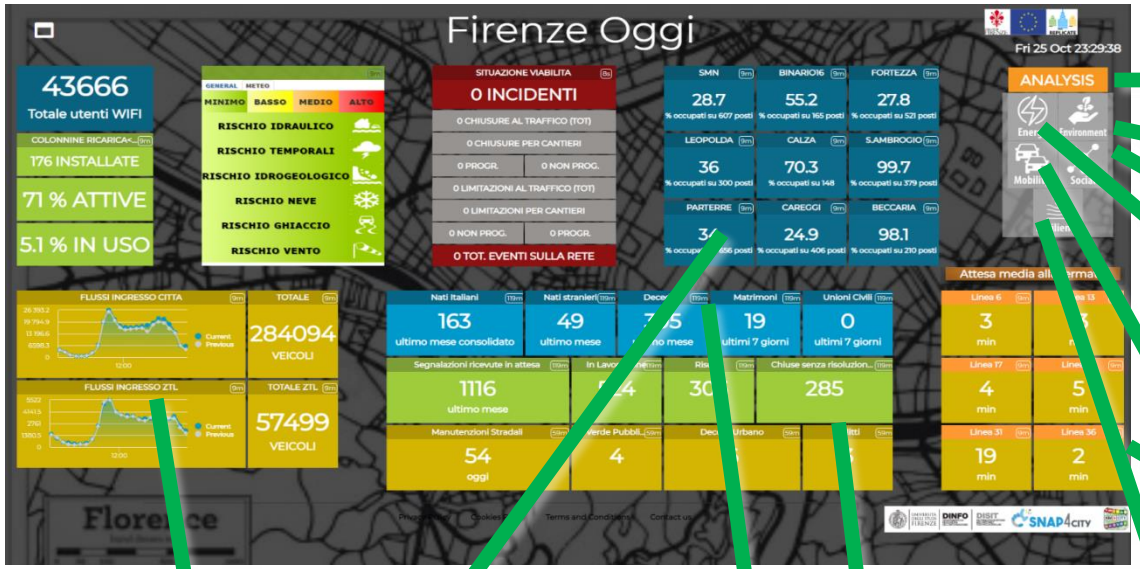
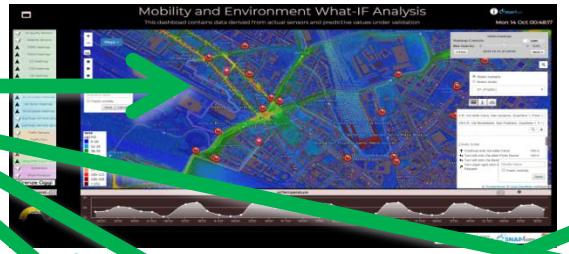
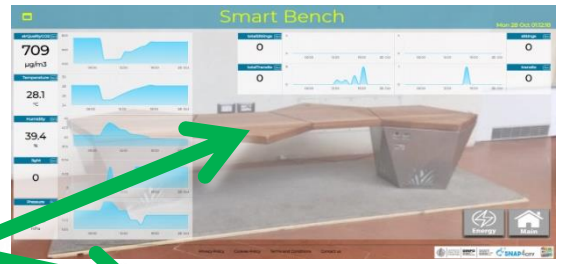
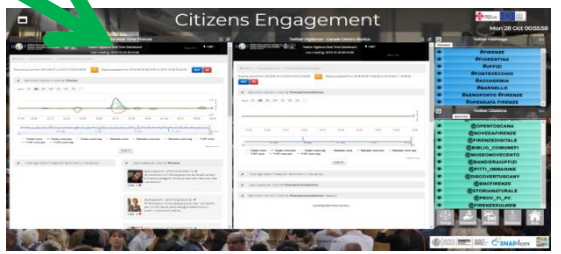
REPLICATE

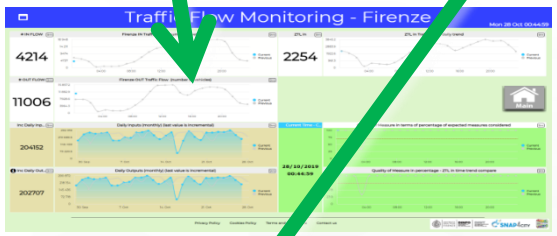
FIRENZE CITTÀ FARO

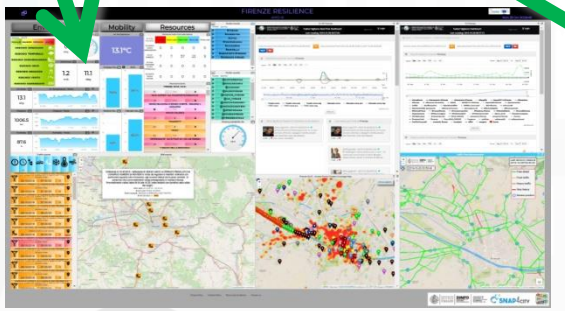


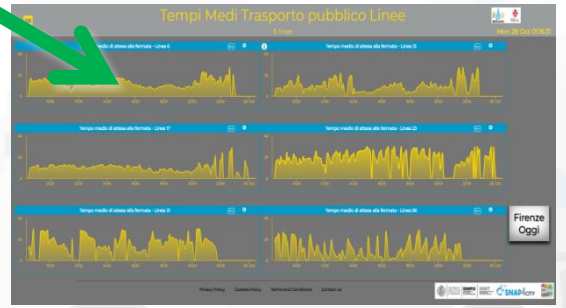












UNIVERSITÀ DEGLI STUDI FIRENZE | DINFO DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE | DISIT DISTRIBUTED SYSTEMS AND INTERNET TECHNOLOGIES LAB

SNAP4CITY

KM4CITY

REPLICATE
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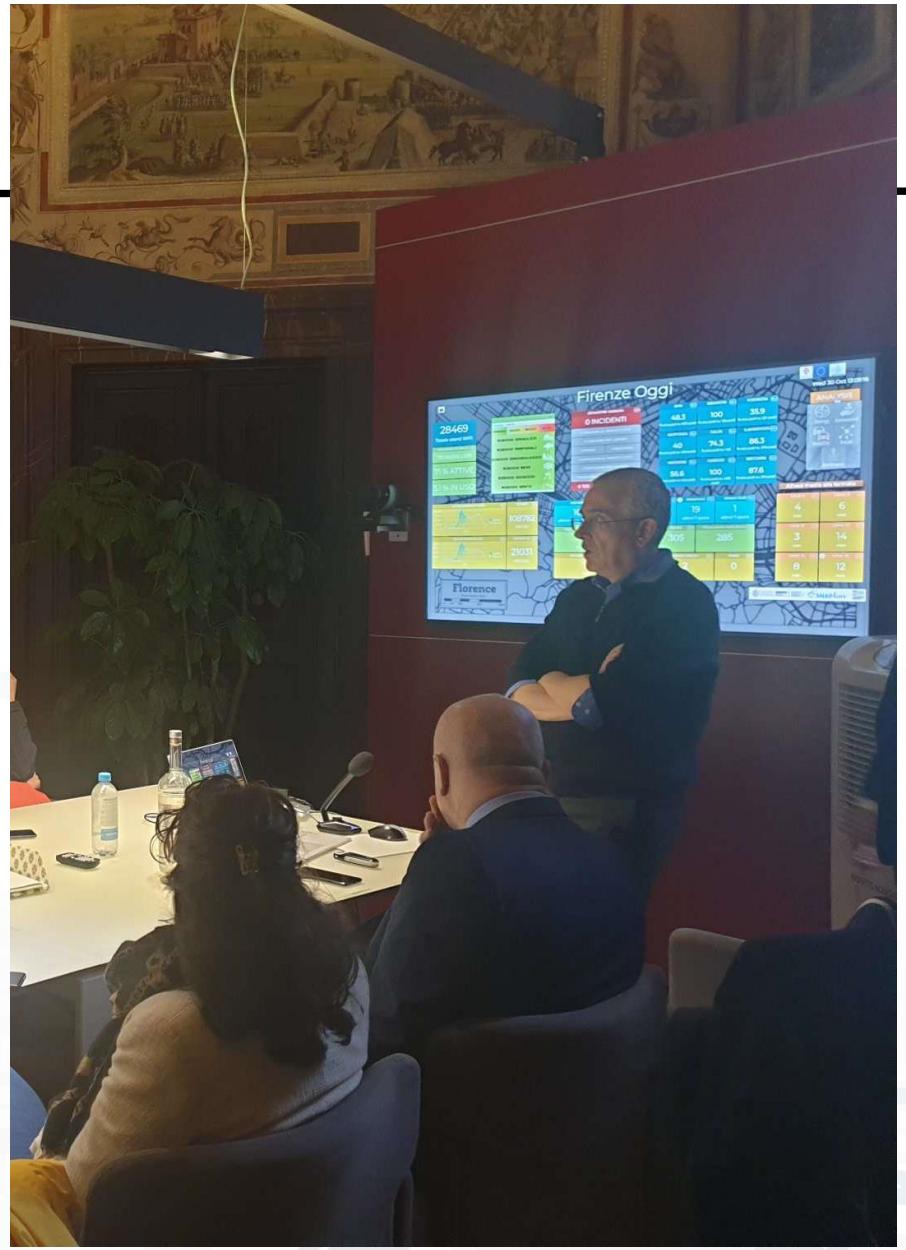
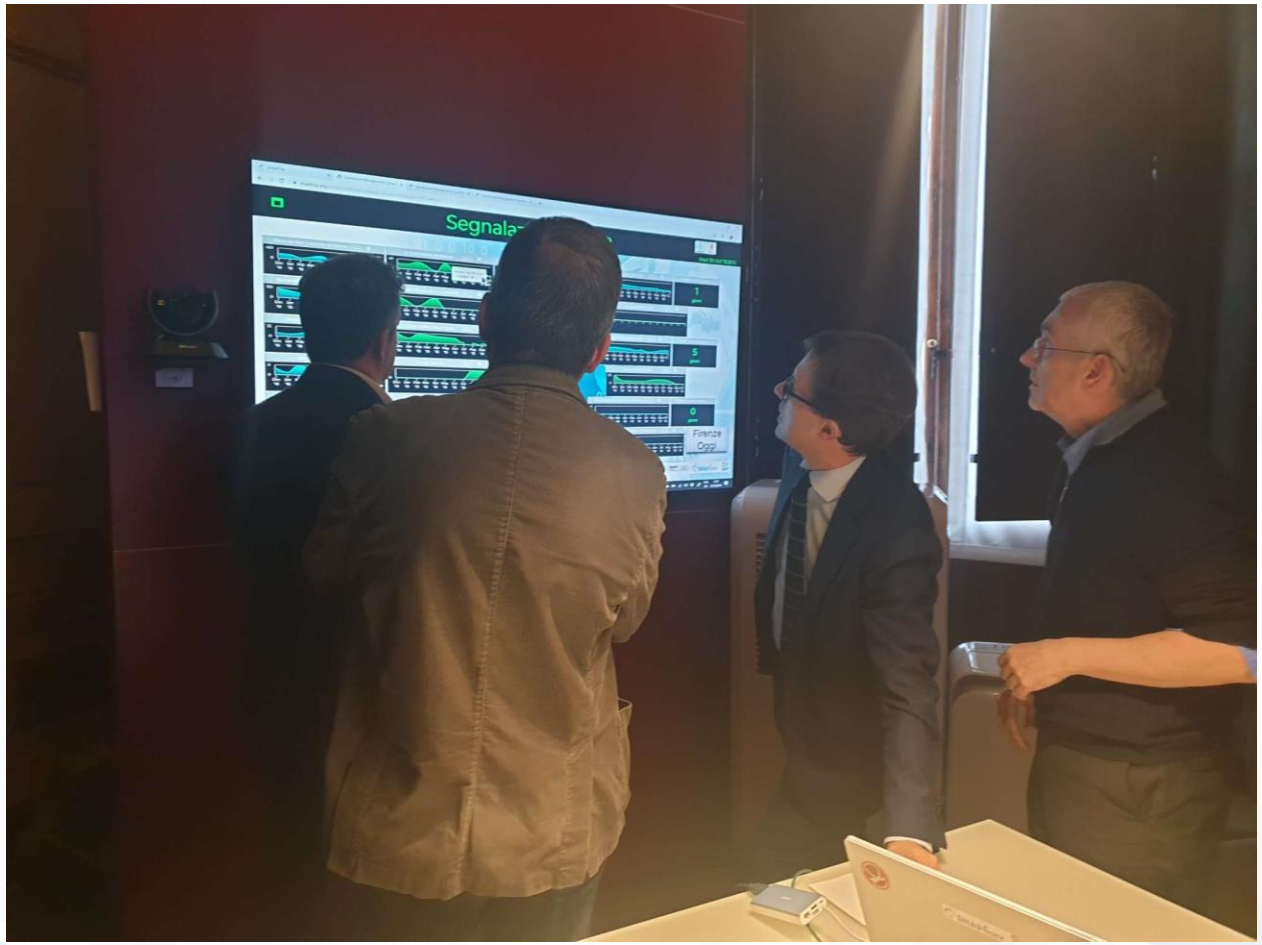
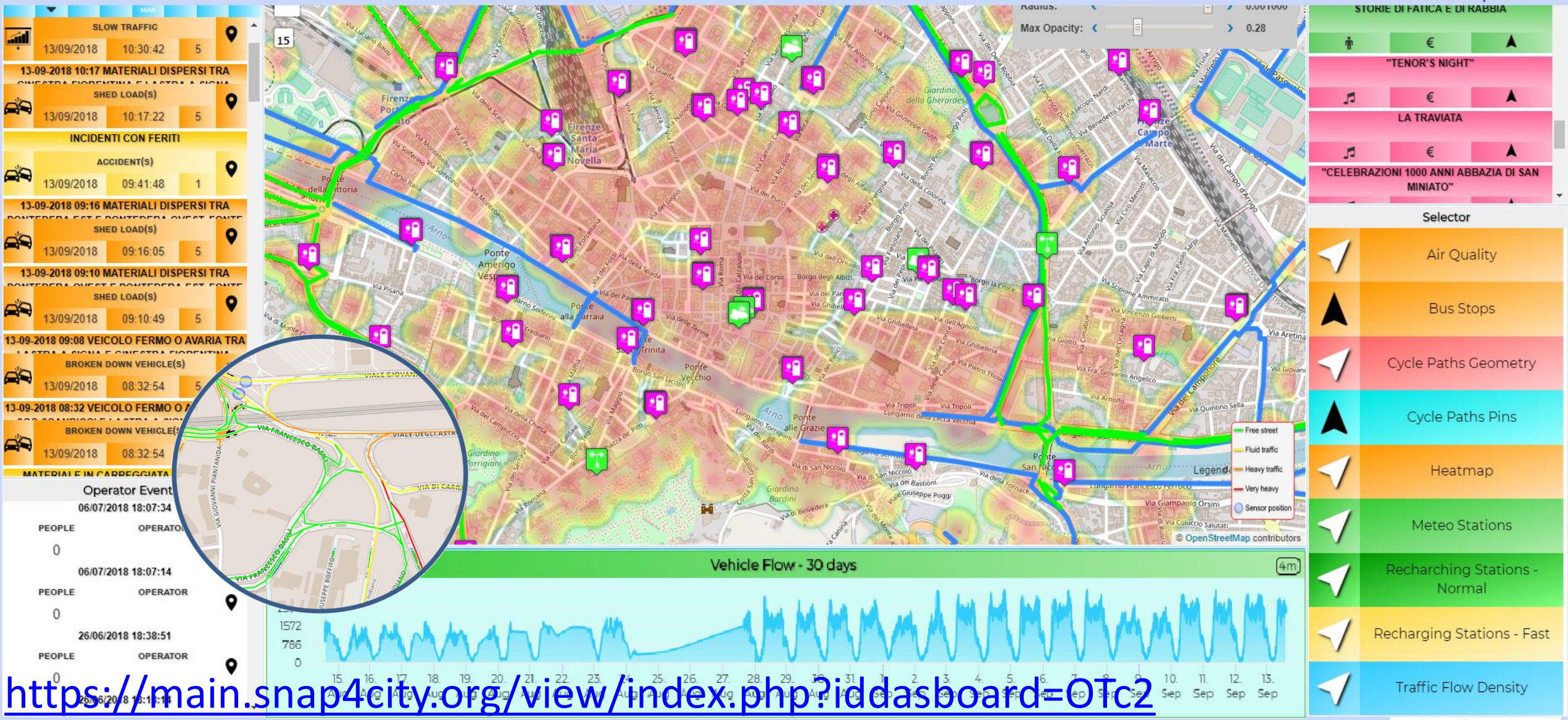




FIRENZE CITTÀ FARO

Multi-Widget Map



https://main.snap4city.org/view/index.php?iddasboard=OTc2

Mobility and Environment What-IF Analysis

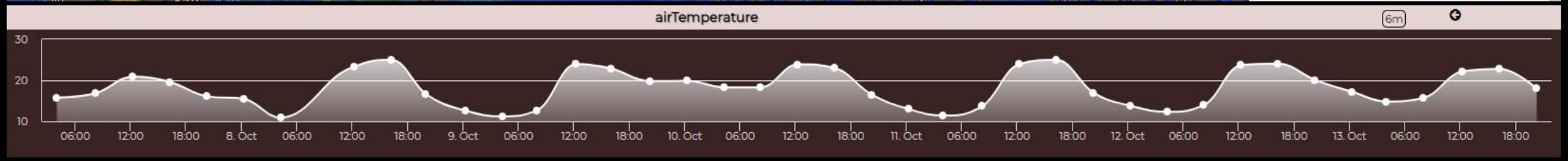
This dashboad contains data derived from actual sensors and predictive values under validation

Mon 14 Oct 00:48:17

- Air Quality Sensors
- Weather Sensors
- PM10 Heatmap
- PM2.5 Heatmap
- CO Heatmap
- CO2 Heatmap
- O3 Heatmap
- NO2 Heatmap
- Europ. AQI Heatmap
- Air Humidity Heatmap
- Air Temp. Heatmap
- Wind Speed Heatmap
- Gral Pred. HM NOX (3m)
- Gral Pred. HM NOX (6m)
- Traffic Sensors
- Traffic Flow
- Cycling Paths
- Accident Heatmap
- Only HRes Anym. Gral
- Scenarious
- What-if analysis

Firenze Oggi

Air Temperat... 6m



https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MjE5MA==

Smart City Control Room (Data View)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement Nº 691735

- **Mobility**:
  - quality of public transportation service (mean delay on bus-stops)
  - public transport operators schedule and paths, routing, multimodal routing
  - traffic flow reconstruction (Sii-Mobility)
  - Smart parking: predictions
  - Accidents and events, Log, heatmaps
- **Environment**:
  - irrigators
  - smart waste (are coming)
  - Sensors: PM10. PM2.5,…..
  - Pollination
  - Heatmaps: PM10, PM2.5, ….
  - NOX predictions (TRAFAIR CEF)
- **Energy**:
  - recharging stations (fast and reg.)
  - consumption meters (smart info)
  - smart light, street lights
- **Weather**
  - Forecast and actual
- **Social**:
  - smart benches
  - Entertainment events
  - Twitter monitoring, Sentiment analysis, NLP text
  - TV camera streams
  - Triage status of some Hospital
- **People Flows**:
  - Wi-Fi status
  - Origin destination matrices, people flow (RESOLUTE)
- **Governmental and Communications**:
  - KPI of the City
  - Digital Signage
  - Civil protection, Resilience (Resolute)
- **Tourism and Culture:**
  - POI, etc.

Analysis:

- what-if routing, scenarios,
- traffic flow, environmental predictions

FIRENZE CITTÀ FARO

MORE data in other locations that we manage

REPLICATE
This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement Nº 691735

- **Mobility**:
  - RT Underpasses
  - RT Ferry and railways
  - RT tracking of busses
  - RT ODB2 monitoring vehicles data and trajectories
  - RT Mobile trajectories
  - Bike sharing
  - Connected Driving
  - Fuel station prices
- **Environment**:
  - Sensors: Noise, …
  - Heatmaps: Noise, ….
  - Mobile sensors
  - FMI predictions
- **Energy**:
  - **…..**

- **Weather**
  - Forecast and actual, several sources
- **Social**:
  - PAX Counters
  - Mobile PAX Counters
  - Engagement data collected
  - Clicks on Mobile Applications
  - Ranking, comments and images
  - Entertainment event different kinds
- **People and People Flows**:
  - Mobile Applications
  - Origin destination matrices, people flow
- **Governmental and Communications**:
  - Notification of events
- **Tourism and Culture:**
  - POI, many many kinds

Analysis:
- what-if routing, scenarios,
- traffic flow, environmental predictions

FIRENZE CITTÀ FARO


- Nascondi Menu
Fermate Firenze
Comuni in Toscana
Ricerca Testuale
Seleziona una provincia:
FIRENZE
Seleziona un comune:
FIRENZE
Actual Selection
COMUNE di FIRENZE
- Nascondi Menu
Servizi Regolari
Servizi Trasversali
search text into service
Categorie Servizi
De/Select All
Accommodation
Advertising
AgricultureAndLivestock
CivilAndEdilEngineering
CulturalActivity
EducationAndResearch
Emergency
Entertainment
Environment
FinancialService
GovernmentOffice
HealthCare
IndustryAndManufacturing
Linked Open Graph
SiiMobility (by DISIT)
Your data
Type of relations
Status
Linked Open Graph
museo ferragamo
- Nascondi Menu
Previsioni Meteo per il comune di FIRENZE:
Martedi
Mercoledi
Giovedi
Venerdi
Sabato
poco nuvoloso
23°C / 27°C
pioggia debole e schiarite
20°C / 30°C
poco nuvoloso
20°C / 33°C
poco nuvoloso
/
velato
/
Ultimo Aggiornamento: 2015-09-15T09:07:00+02:00
LINKED OPEN GRAPH
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

REPLICATE
This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement Nº 691735

TOP

Data Ingestion, back office

Sentient Smart City
Dashboards and IOT Intelligence

REPLICATE
This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement Nº 691735

FIRENZE CITTÀ FARO

Dashboards with data driven IOT Applications enforcing intelligence

City Data & IOT

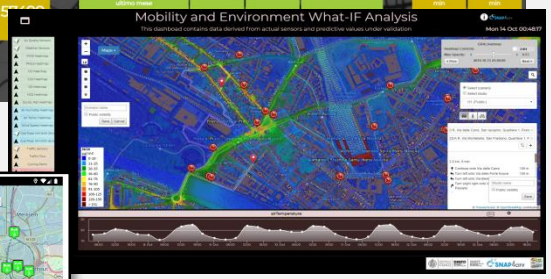
IOT Devices

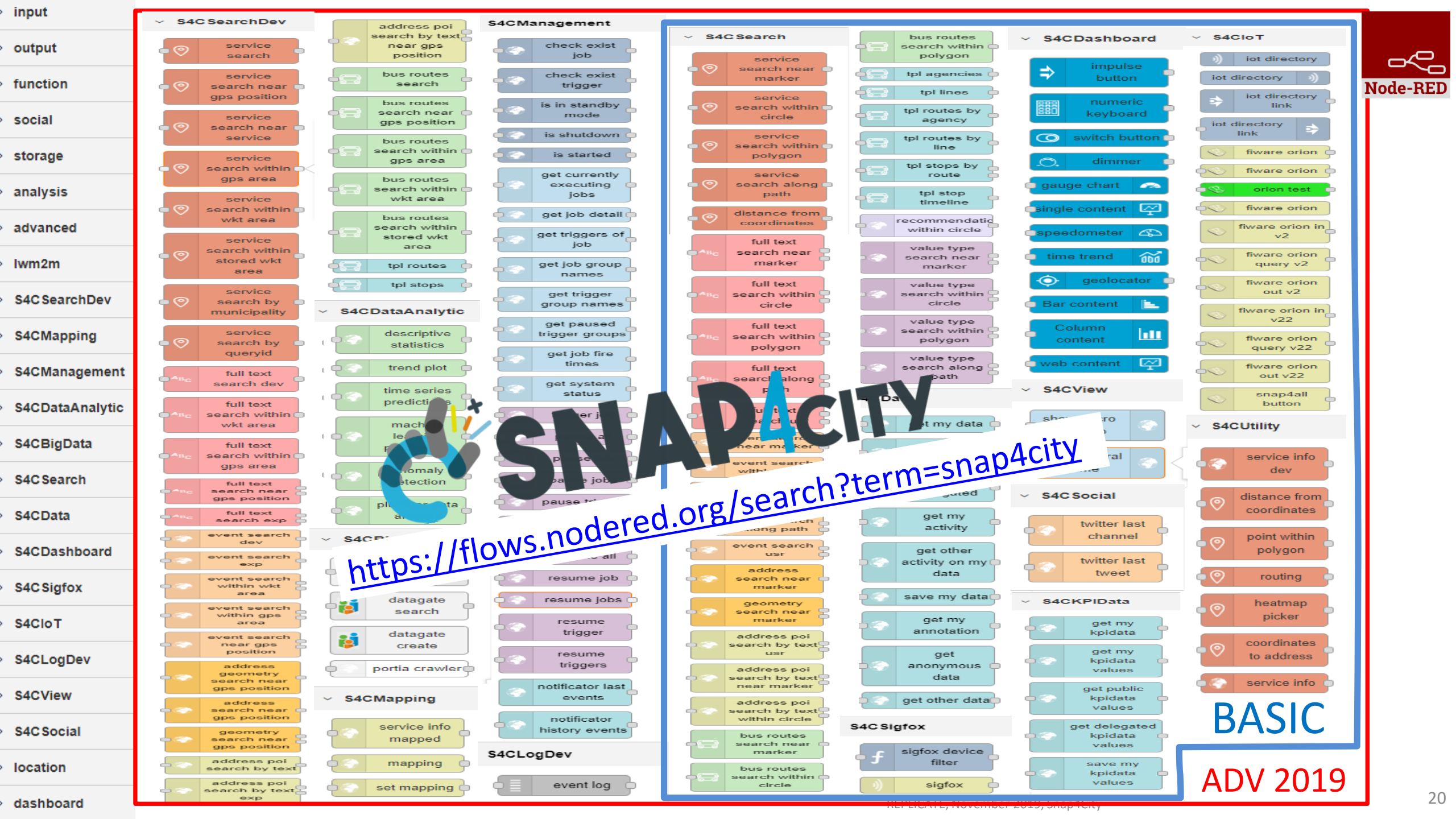
IOT Applications

Big Data Analytics, Artificial Intelligence

SNAP4CITY KM4CITY

Dashboards and Apps

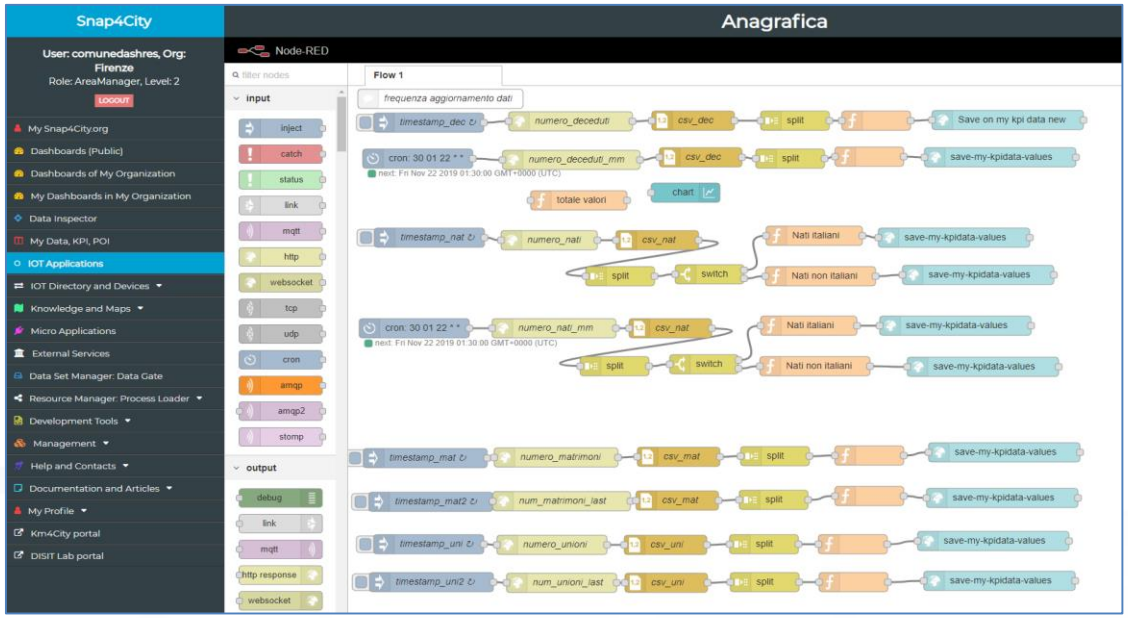


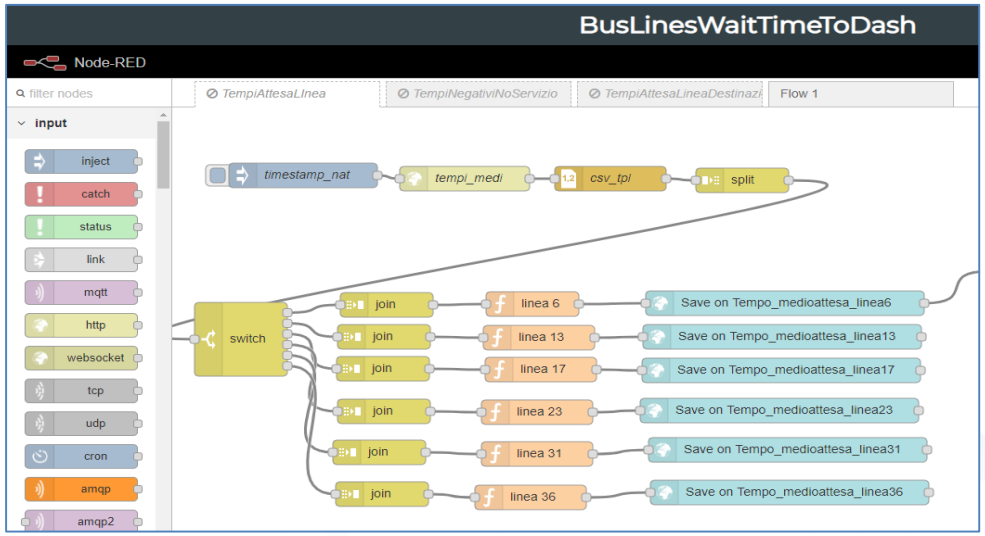

input
output
function
social
storage
analysis
advanced
lwm2m
S4CSearchDev
S4CMapping
S4CManagement
S4CDataAnalytic
S4CBigData
S4CSearch
S4CData
S4CDashboard
S4CSigfox
S4CIoT
S4CLogDev
S4CView
S4CSocial
location
dashboard
Node-RED
SNAP4CITY
https://flows.nodered.org/search?term=snap4city
BASIC
ADV 2019

The Back-Office Data Flows (selection) Exploiting *the Snap4City Node-RED MicroServices*

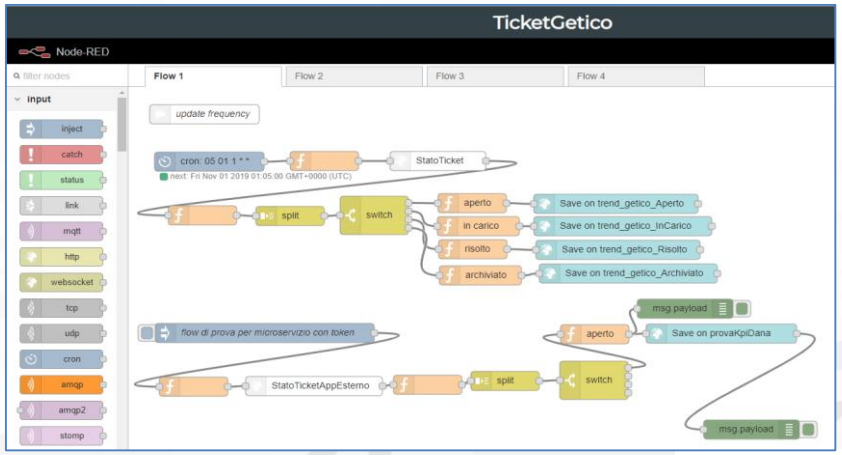
REPLICATE

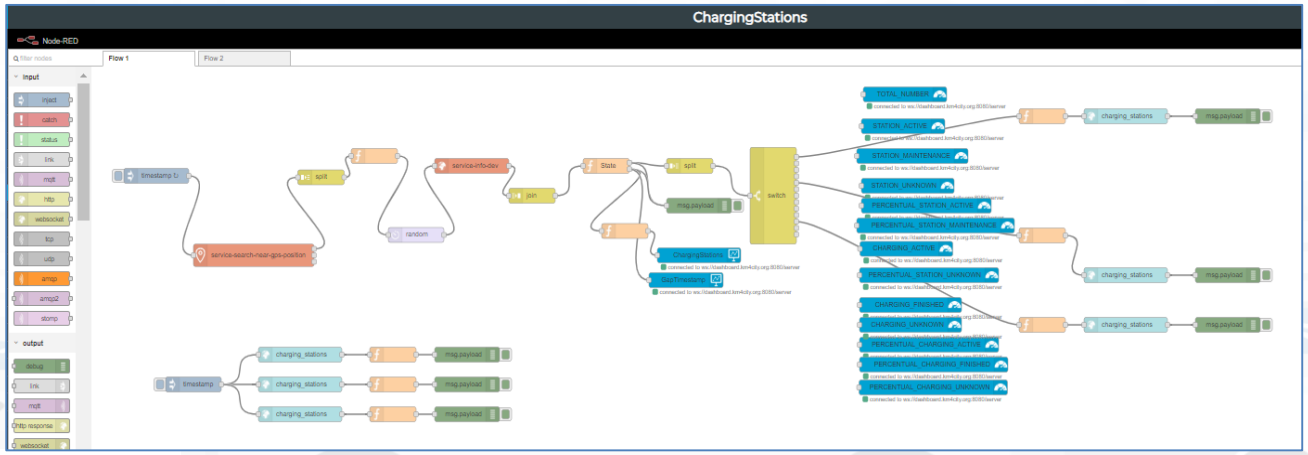
This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement Nº 691735



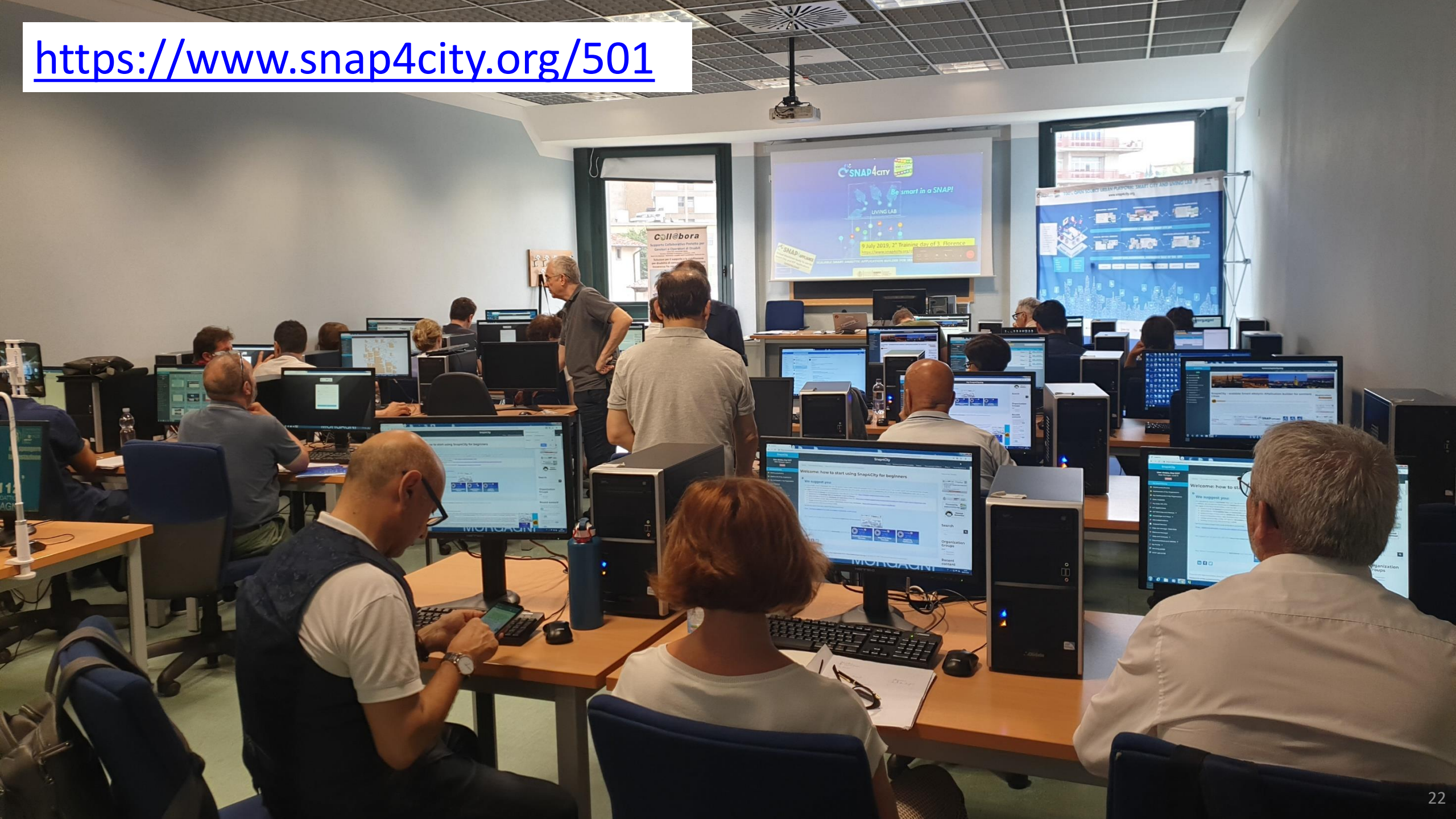


FIRENZE CITTÀ FARO



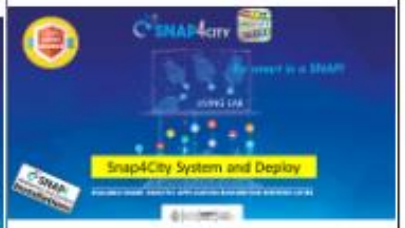


https://www.snap4city.org/501



https://www.snap4city.org/501

November 2019 Training for Barcelona Smart City World Expo Congress

	1st day	2nd day	3rd day	4th day	5th day	6th day
what	General	Dashboards	IOT App, App, Network	Data Analytics	DataWareHouse Data Ingestion	System and Installation
PDF						 Installations
Inter active						

The updated Snap4City mobile development App Kit as open source for developing mobile and web App using Cordoba Apache is accessible on GitHUB from:

https://github.com/disit/snap4cityAppKit

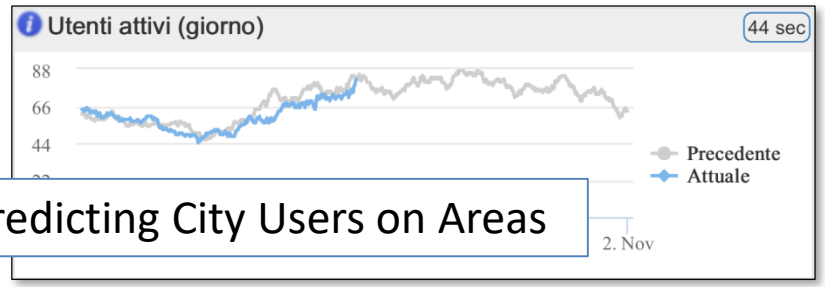
Swagger documentation of Smart City API is on: https://www.km4city.org/swagger/external/index.html

7th day, the Mobile App Development exploiting the Smart city API					
Slides ENG in PDF about the structure of the kit and main tools		interactive SLIDES ENG about the structure of the kit and main tools		video ENG on HOW to use the Dev Kit from zero	

Some Data Analytics

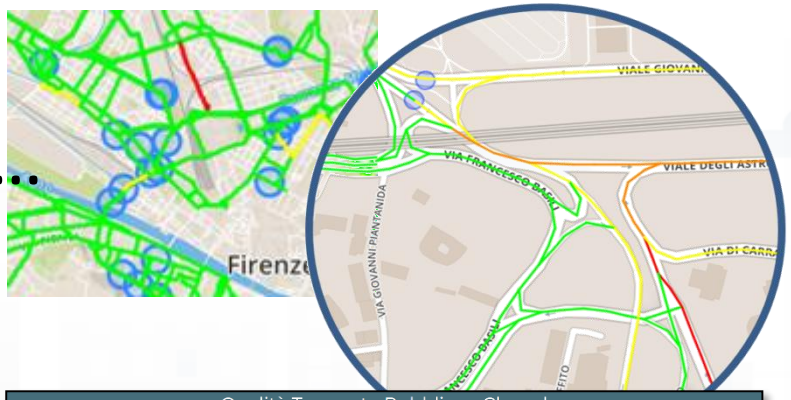
REPLICATE
This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement Nº 691735

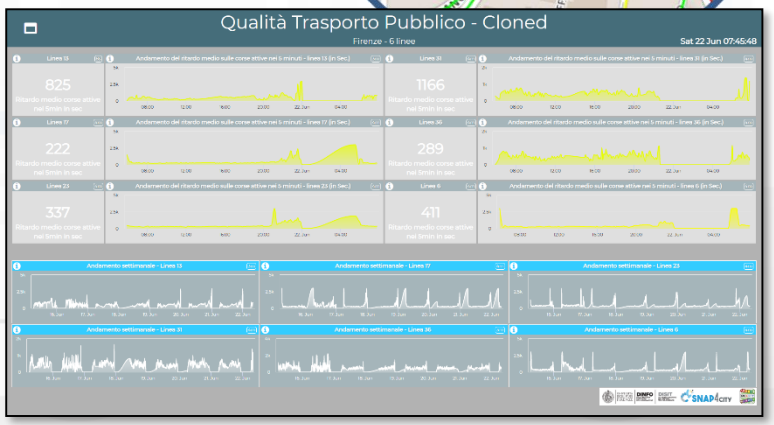
- **Aiming at improving**
  - quality of service, distributing workload
  - early warning
- **Predictions**: **Short** (15 min, 30 Min) and mid Term (1 week)
- **Data Analytics**: ML, NLP/SA, Clust., …
  - Traffic Flows → multi-flow reconstruction
  - Parking Status → free slots
  - Environmental Alarms
  - Air Quality parameters and indexes
  - People Flows (Wi-Fi, Twitter) → crowd , #number of people



Predicting City Users on Areas

FIRENZE CITTÀ FARO





DATA ANALYTICS

- Traffic flow reconstruction from sensors and other sources: parking predictions: wi-fi people flow prediction and reconstruction
- What-if analysis, dynamic routing, origin destination matrices production from a large range of sources
- Analysis of the demand vs offer of mobility according to public transportation and multiple data sources
- Resilience and risk analysis
- Early warning computation
- Accidents heatmaps
- Traffic flow predictions
- NOX pollution prediction on the basis of traffic flow, 48 hours see
- Pollution prediction at 48 hours, every hour
- User engagement for sustainable mobility
- User's behaviour analysis, data reconstruction and calibration
- Tracking fleets, people, devicesOBD2 support
- People flow analysis from PAX Counters
- Social media analysis on specific channel, specific keywords: see Twitter Vigilance, for NLP and Sentiment Analysis, SA
- Data quality assessment, prediction, anomaly detection
- Maintenance prediction and costs predictions
- ReTweet proneness, retweet-ability of tweets
- Audience prediction to TV channels and physical events

Other Cases

Helsinki

Helsinki Case

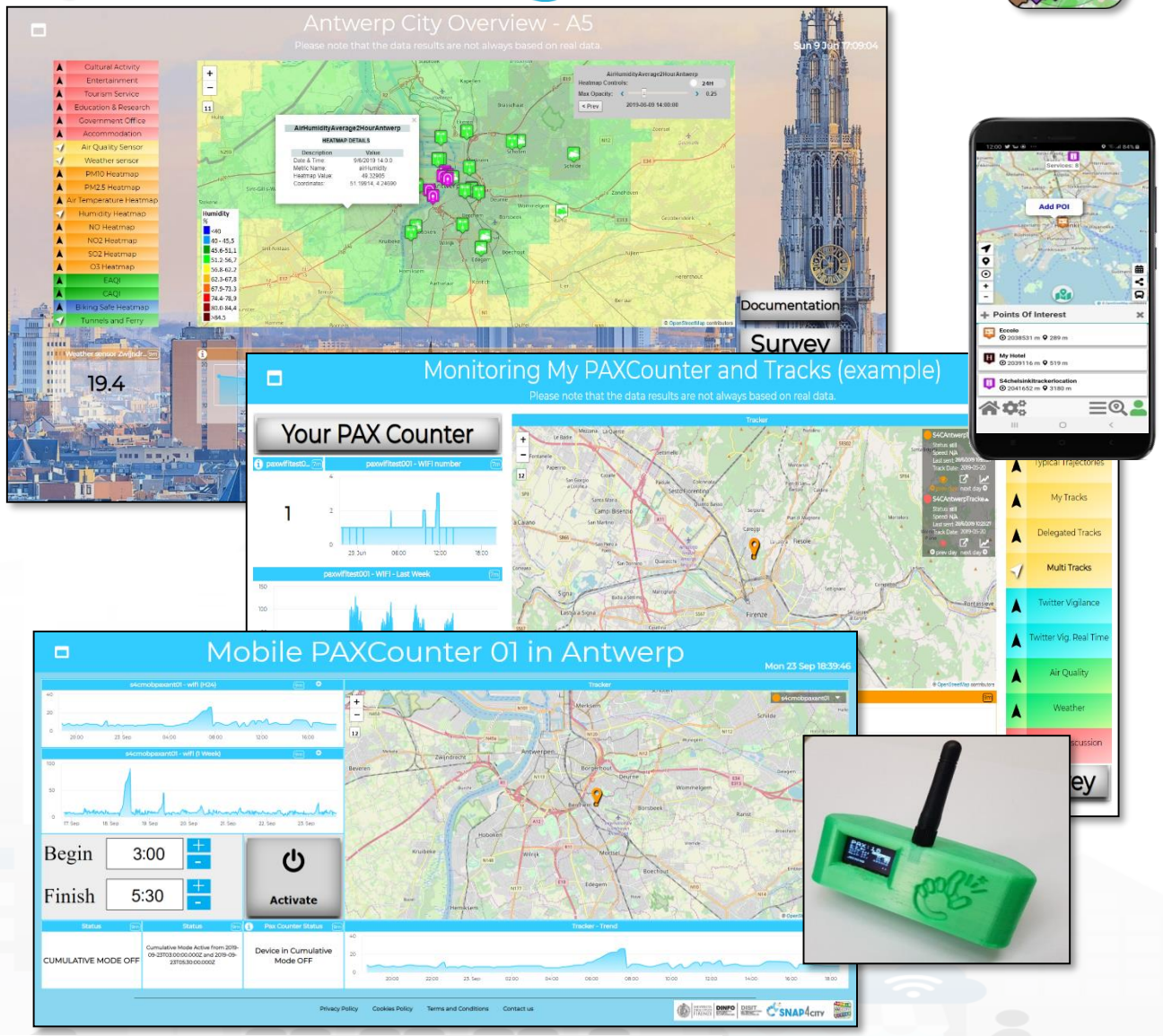
- **Dashboards & Services**:
  - **Environment** & **Weather**, PM10, PM2.5,NO, SO2, CO, noise, etc.
    - Sensors values, Heatmap & **Alerts** on critical
    - FMI Enfuser prediction: PM10, PM2.5, ..
    - GRAL predictions PM10, validations
    - Private sensors in Jätkäsaari area (personal dashboards)
  - **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==

Antwerp

Antwerp Case

- **Dashboards & Services**:
  - **Environment** & **Weather**: PM10, PM2.5,NO, SO2, CO, etc.
    - Heatmap & **Alerts** on critical
  - **Mobility**: public transport Operators schedule and path, monitoring of river crossing, routing, what-if
  - **PAX Counters:** museum and public services, mobile PAX Counter for events
  - **Social**: Twitter Vigilance, early warning
  - **Life in Antwerp**: OD matrix people flow, Twitter Vigilance SA, hot places, ...
  - **Tourism and Culture**
- **Mobile App and MicroApplications:**
  - Antwerp in a Snap (all stores)

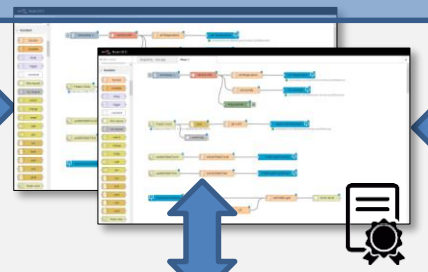


https://www.snap4city.org/dashboardSmartCity/view/index.php?iddasboard=MTQwNw==

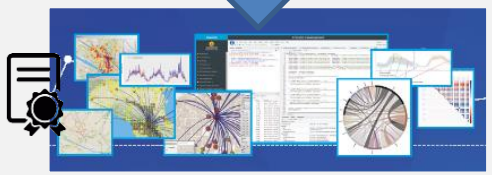
GIDA set up

Smart City data from many sources

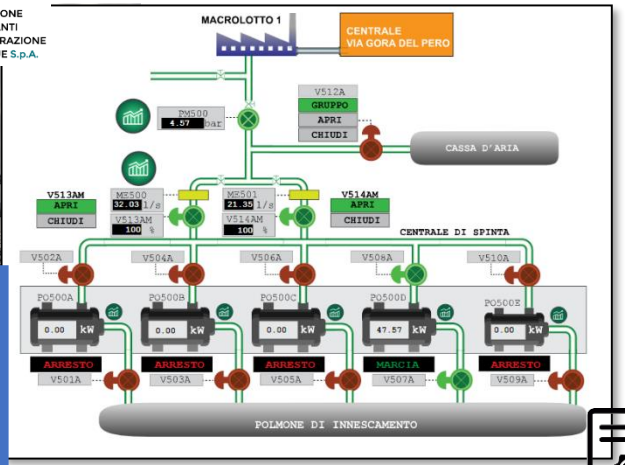
IOT Applications



Dashboards and Apps



Big Data Analytics, Artificial Intelligence



IOT Data Shadow Snap4City

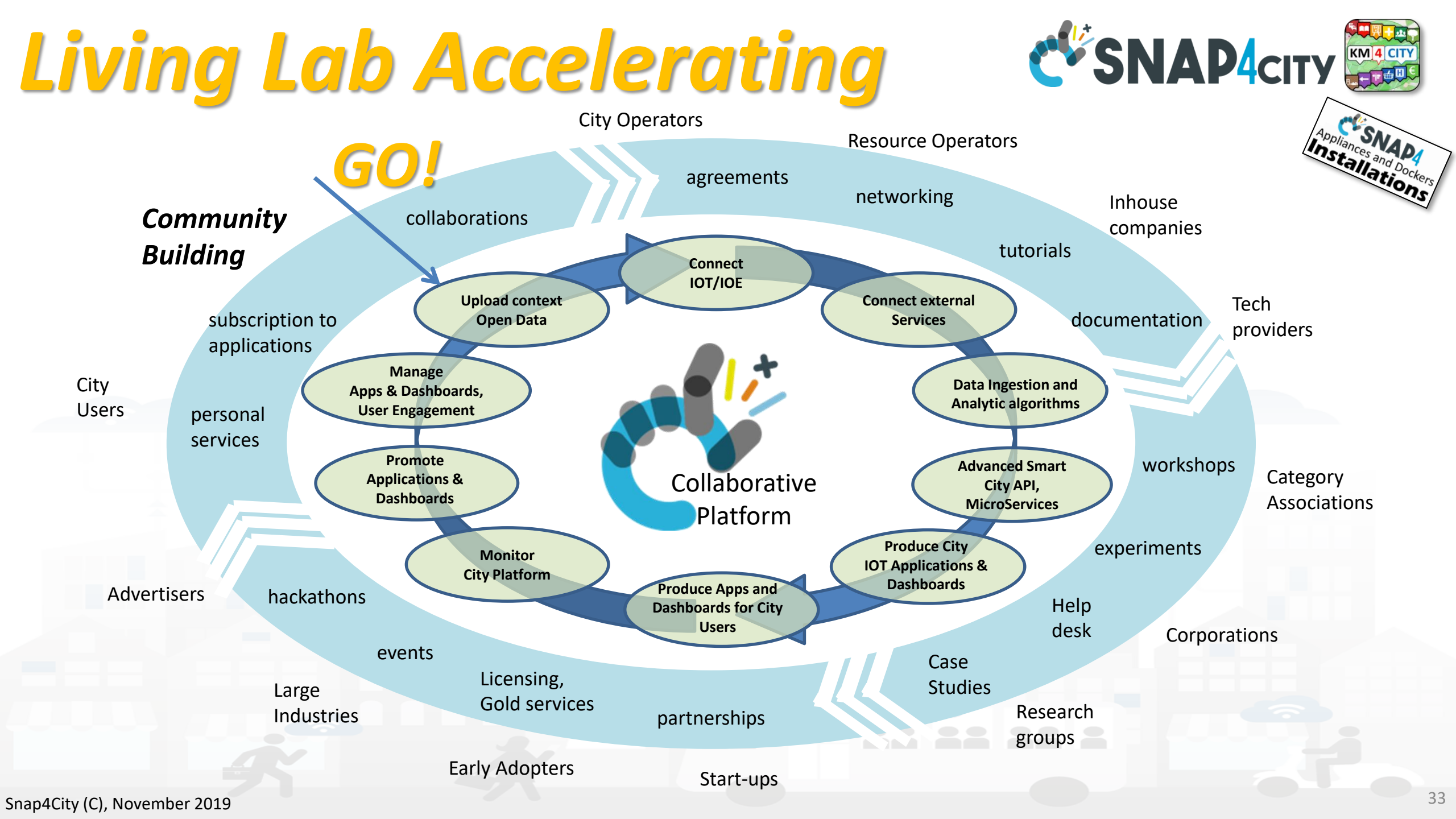
ModBus to Snap4City Gateway Edge

5G network devices

Telemonitoring
Telecontrol

Life Cycle

Living Lab Accelerating



Snap4City

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

Your Level

- Dashboards (Public)
- Dashboards of My Organization
- My Dashboards in My Organization
- IOT Applications
- My IOT Devices
- Knowledge and Maps
- Micro Applications
- External Services
- Data Set Manager: Data Gate
- Resource Manager
- Help and Contacts
- Documentation and Articles
- My Profile
- Snap4City portal
- Km4City portal
- DISIT Lab portal

All Tools

Snap4City

Home | Partners and Interoperability | Tools | Tutorials and Videos | Blog | Contributions

Home / Tutorials and Videos / Welcome: how to start using Snap4City for beginners

Welcome: how to start using Snap4City for beginners

Personalized Suggestions

Snap4City developers suggest you reading:

You have already created a **Dashboard**. Now, you may decide to make it public (visible and accessible) to all on WEB, or to provide access in view to other specific users that you know by nickname.
In addition, you can pass the Ownership of a **Dashboard** to some other user of the system, and you can clone the **Dashboard** as well. So that you can create **Dashboard** for other users as well.
We sugget to test these functionaltiies since you can:

- access to Data Set **Manager** to upload/download, share data sets as files in CSV: https://datagate.snap4city.org/ssologin_handler
- upload data for the **knowledge base** and **dashboards** via Data Set **Manager**,
- access and share of resources as: **dashboards**, **IOT Applications**, blocks, etc.; https://processloader.snap4city.org/.../ssoLogin.php?redirect=page.php%3FshowFrame=false
- access to help and contacts, FAQ, documentation and articles
- manage personal data: profile, IOT Sensors, **Annotations**, Personal Data, **Dashboards**..; https://www.snap4city.org/drupal/myprofiledata
- Auditing Access to My Data according to **GDPR**.

See this ... ca... ... ... above possibilities:

TC1.10. Dashboard delegation to access and passage of ownership, and/or cloning

Exercises

If you are not registred please apply for a **free registration from https://www.snap4city.org** and then pass to ACCESS AT THE TOOLS and full Snap4City environment

Snap4City puts in the hands of City Users a flexible environment to quickly create a large range of smart city applications/views exploiting heterogeneous data and services of stakeholders by IOT/IOE and big data technologies. For Snap4City, City Users can be citizens, students, operators, researchers, decision makers, developers, etc. see Users' Roles on Snap4City.

- **Manager:** is a **final user**, has the capability of: accessing and creating Dashboards with a large set of data (high level types as: POI, sensors, KPI, micro applications, external services, etc.), attaching alerts and notifications; registering IOT Devices; creating IOT Applications exploiting MicroServices; loading and sharing data sets; managing personal data and annotations; full access to documentation, help desk, FAQ, coworking; managing personal profile and data according to GDPR; **NOTE:** accessible features are mainly visual and simple to understand and to use, and provide a limited number of parameters on each dialog and for each action. Default values of created elements can be changed editing elements.
- **AreaManager:** is a **Developer/researcher, students, city operator**, with additional capabilities with respect to the Manager to: register IOT Brokers; creating advanced IOT applications; create massive data transformation processes; create data analytics in multiple languages, testing and load them, create microservices; adding external services; sharing results, loading shapes; analyzing performance of the back office; **NOTE:** technical views and details are fully accessible

SLIDES

Flyer

News

VIDEOS

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

This page would guide you along few steps to ... how the solution allows you to incrementally pass from **Level 0 to 5, from a Manager to an Area Manager:**

- Level 0 user: access at data/services views of the city by using public Dashboards; (Public User) **(overview on dashboards)**
- Level 1 user: create personal/professional views/dashboards on data; (Manager) **(how Dashboards can be created)**

Full Search

Search

Search

Your Org

Organization Groups

DISIT
- Operativo

Recent comments

- 1 month 6 days ago

Last Art.

Recent content

Ti Suggeriamo come realizzare la tua prima Dashboard (Step 1) new
roottooladmin1

Benvenuto al nostro Sindaco ed al suo Team
new
roottooladmin1

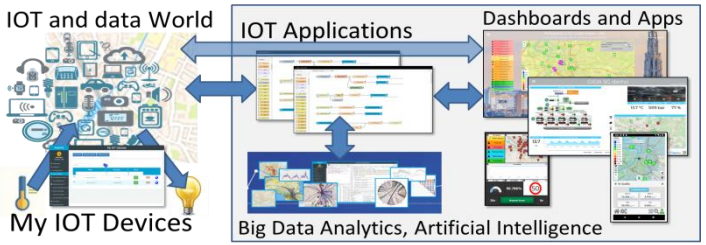
We sugges to Antwerp Developers: How to manange my Dashboards

Username: adifino

Powered by www.km4city.org

How to adopt Snap4City

On your premise



Installation on your premise

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

Mixed solutions! For example:

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

Download and deploy

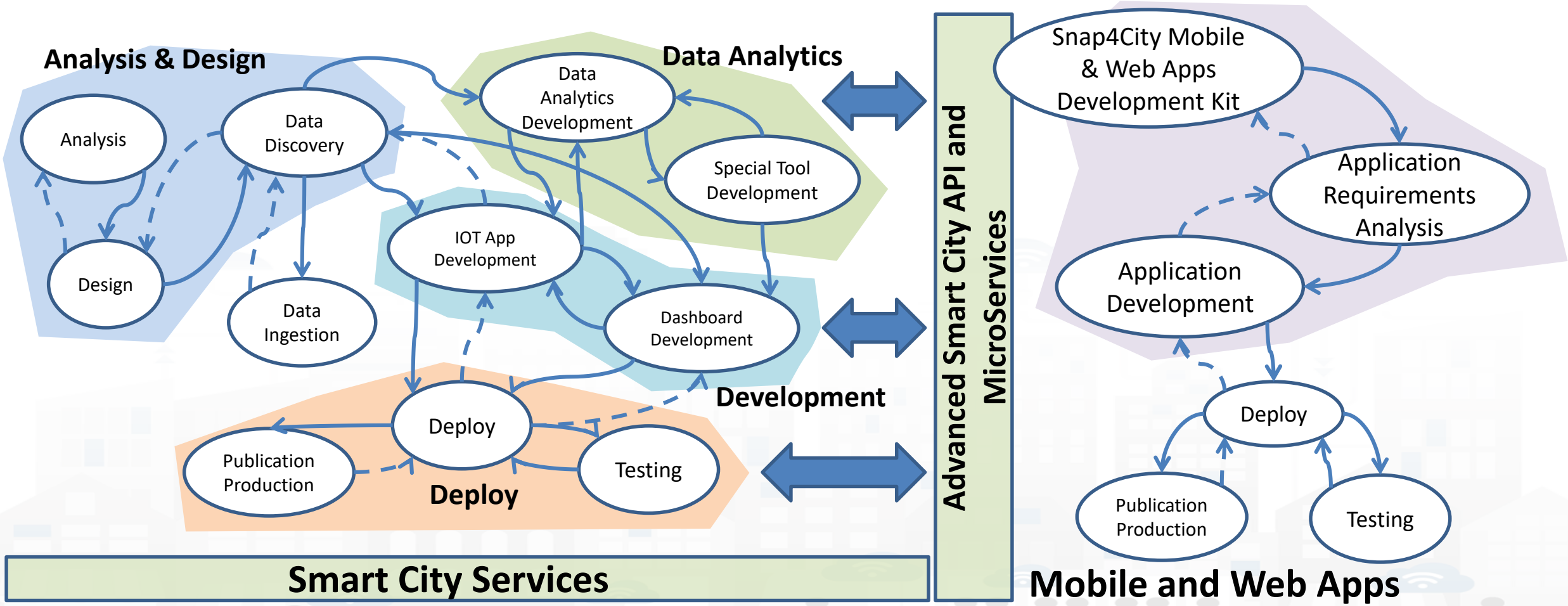
Https://www.snap4city.org

Smart City as a Service

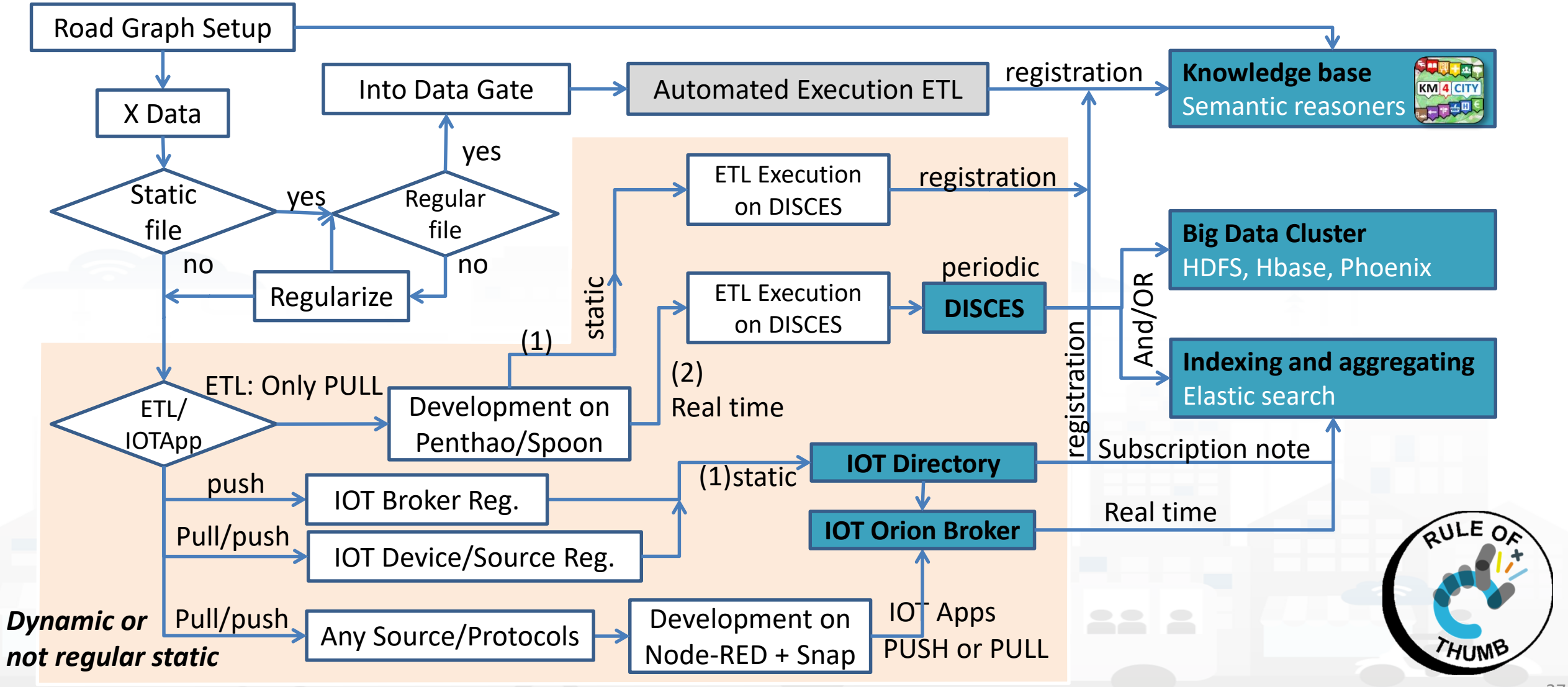
- Supporting Org
- 100% Open Source Platform: Github
- Further developments
- Publishing Appliances and Dockers
- Training courses, docs
- Consulting
- Forums
- Etc.

SNAP4CITY on EUROPEAN OPEN SCIENCE CLOUD MARKETPLACE

Develop Mobile & Web Applications Exploiting Snap4City Smart City Services



Data Ingestion Flow Guideline, thumb rules



DISIT lab roadmap vs model and tools' usage

2013 Km4City Ontology 1.1

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

2014

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

ckan

- Twitter Vigilance
- Social Media Analytics, Sentiment Analysis

Km4City 1.4

2015

- Sardinia Region Smart City Strategies and plan

FIWARE

SII-MOBILITY SCN (2016-19)

Km4City 1.5 (2016-21) H2020

resolute (2015-18) H2020

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

E015 digital ecosystem

2016

Km4City 1.6.2

- Infomobility
- Mobile App
- Routing
- Multimodality

- Smart Energy
- Sustainable Mobility
- Control Room Dashboard

REPLICATE

Km4City 1.6.4

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

GHOST SIR (2016-19)

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

Km4City 1.6.6 IOT/IOE

Node-RED

SNAP4CITY

SELECT for Cities H2020 (2017-19)

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

life weee (2017-20)

- Smart Waste

2017

TRAFAIR CEF (2018-21)

GREEN IMPACT
POR FESR 2014-2020

- Industry 4.0
- Critical Plant
- Monitoring

2018

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

MOSAiC (2018-20)

- Mobility Demand / Offer Analytics and Strategy

(2018-21) 5G tech
Energy
Industry 4.0
Synoptics

- Traffic and Mobility Impact on Pollution
- NOX predictions

2019

EUROPEAN OPEN SCIENCE CLOUD

2020

…2022

Reverberi Enetec
Gruppo MPES

bee smart city

GREEN FIELD PEAS
Soda4.0

SIRIUS

LAID Smart Bed

Comparison

State of the Art Solutions vs Snap4City

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

FI-WARE

SMART CITIES REFERENCE ARCHITECTURE

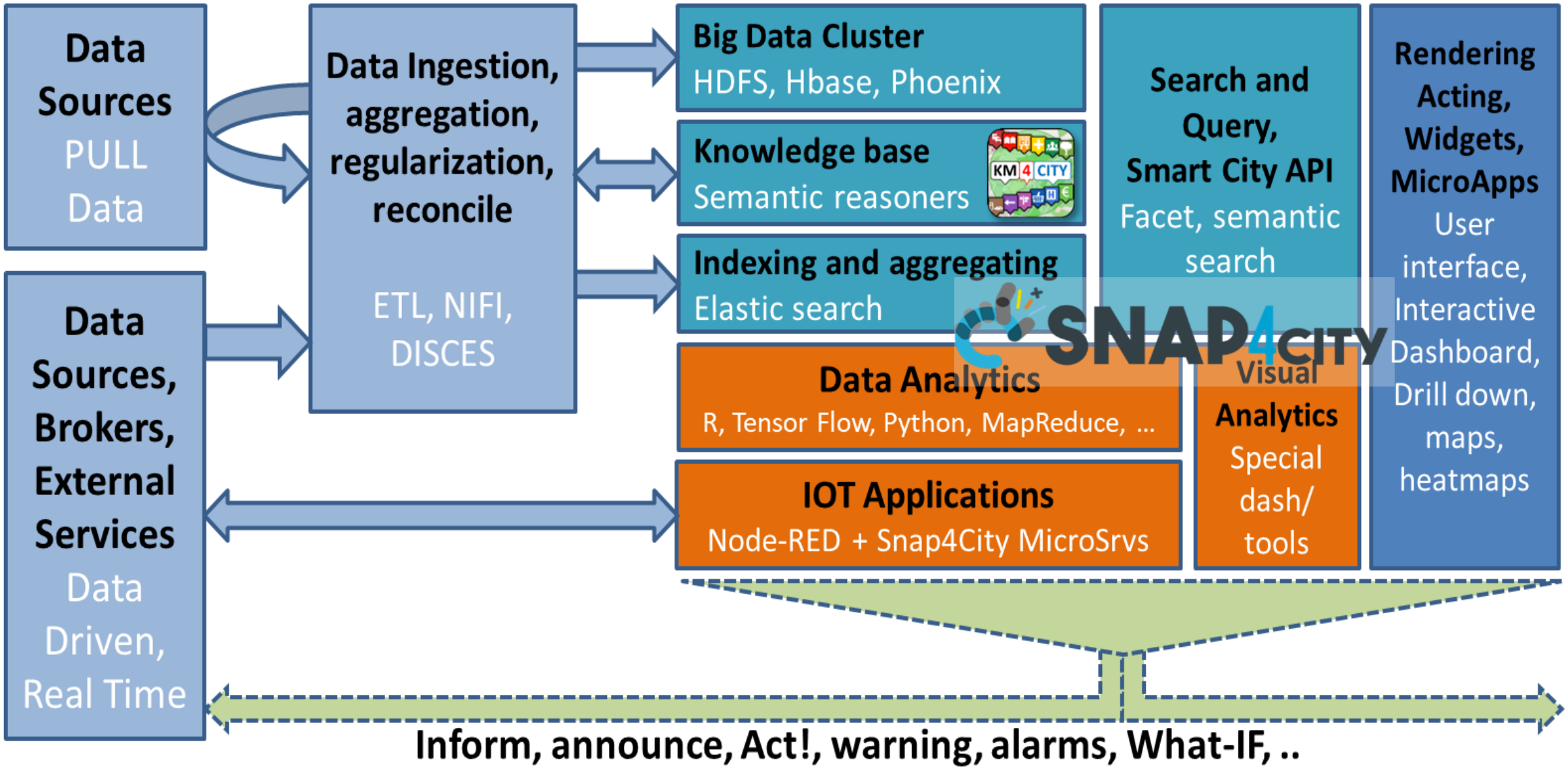
VS

SNAP4CITY

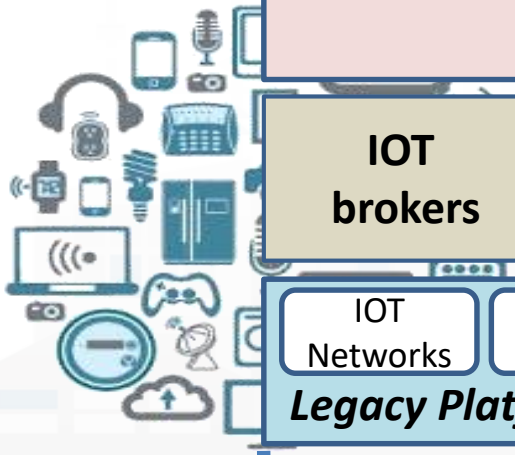
- Is open to the Development of Applications leaving large space to developers
- Is cantered on the Orion Broker that result central in the architecture: any Broker or data source is sending data to Orion
- Security level is not clear, partially demanded to developers
- Visual Flexible IOT processing is not clearly provided
- **Limited API** for IOT data access
- **Knowage BI** presents several limitations in showing Smart City Data
- Market place on Open Data
- Support of Developers via Fi-Ware
- Deployed as VM and Dockers
- open source, not the application parts

- Is open to the Development of Applications leaving large space and providing a **large set of ready to use applicative tools** and solutions to build their solutions on top or aside.
- Is fully distributed, **any kind of data source** can be ingested, automatically.
- **Orion Broker is only one of the Brokers** that can be used. It can be also protected by Snap4City tech, with Mutual Authentication
- **Visual Flexible IOT processing is provided** as Node-RED and Snap4City MicroServices suites
- **Advanced Smart City API** are provided on top of Knowledge Base
- **Dashboard Builder** has been designed for Smart City Data and automated dashboards' production
- **Market Place** on Open Data, tools, processes, experiences
- Full Support for Living Lab of the city, coworking, tutorials
- Deployed as VM and Dockers
- 100% open Source

Deploy


Data Sources
PULL Data
Data Sources, Brokers, External Services
Data Driven, Real Time
Data Ingestion, aggregation, regularization, reconcile
ETL, NIFI, DISCES
Big Data Cluster
HDFS, Hbase, Phoenix
Knowledge base
Semantic reasoners
KM4CITY
Indexing and aggregating
Elastic search
Data Analytics
R, Tensor Flow, Python, MapReduce, …
IOT Applications
Node-RED + Snap4City MicroSrvs
Search and Query, Smart City API
Facet, semantic search
Visual Analytics
Special dash/ tools
Rendering Acting, Widgets, MicroApps
User interface, Interactive Dashboard, Drill down, maps, heatmaps
SNAP4CITY
Inform, announce, Act!, warning, alarms, What-IF, ..

Overview of Snap4City platform, for Buyers, for all



Other Services And Servers

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

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

IOT brokers

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

Legacy Platform

Back End

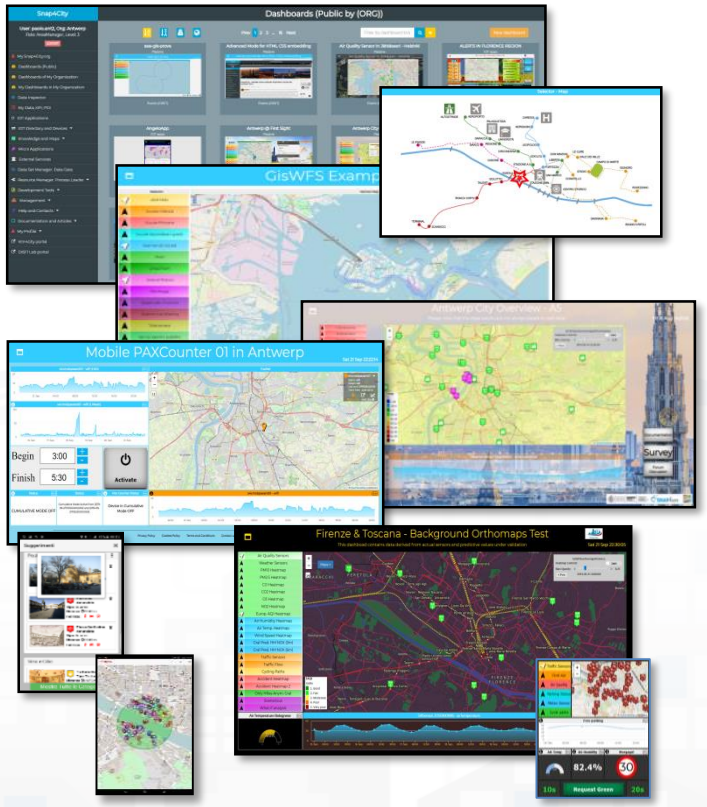
Snap4City MAIN
Dashboard, User Management, etc.

Knowledge base, semantic Store

HeatMaps and Maps

Living Lab Portal

Front End



Mobile Apps, Dashboards

Overview of Snap4City platform, for Buyers, for all

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

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

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

IOTOBSFs
- IOTBrokers, secure

Data Shadow Cluster
IOTDSES
NIFI, Elastic Search, DevDash, Amma

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

Legacy Platform

Back End

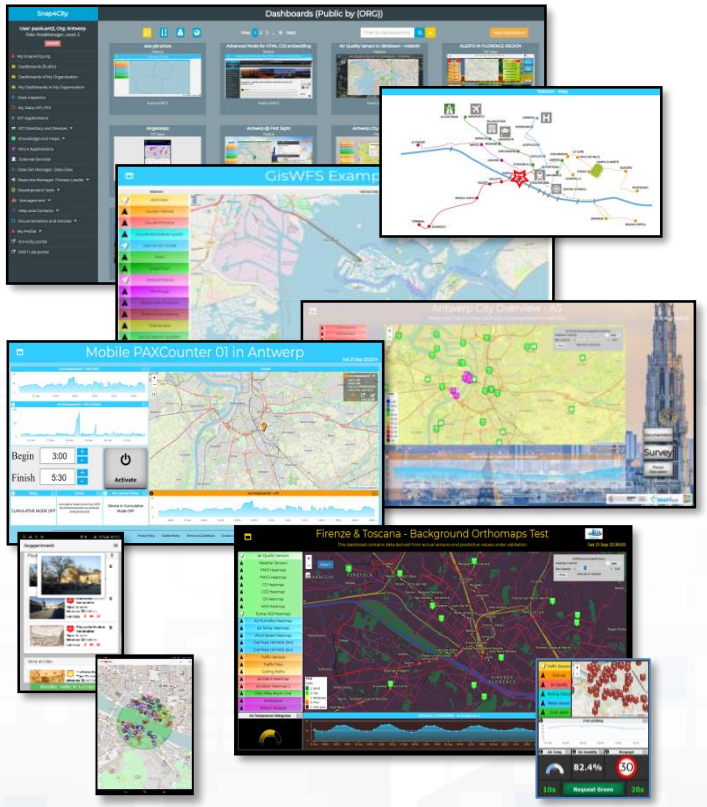
Snap4City MAIN
Dashboard Builder, Data Inspector, User Stats, ExternalSrv, Res Manager, MyKPI, MyPOI, Synoptic, IOT Device Manager, Micro Applications, Authorization/ Authentication, Roles, …

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

GISGeoServer
Heatmap Manager, WFS, WMS

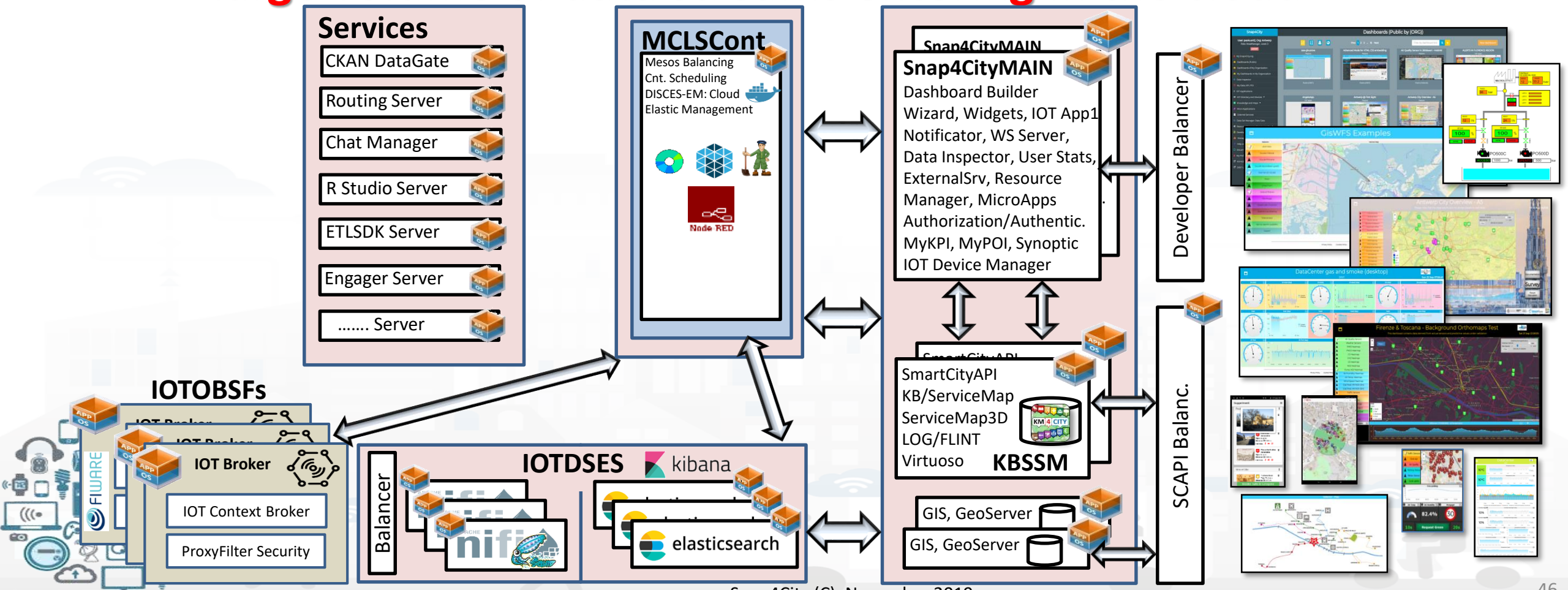
Living Lab Portal
Drupal support CRM, ..

Front End

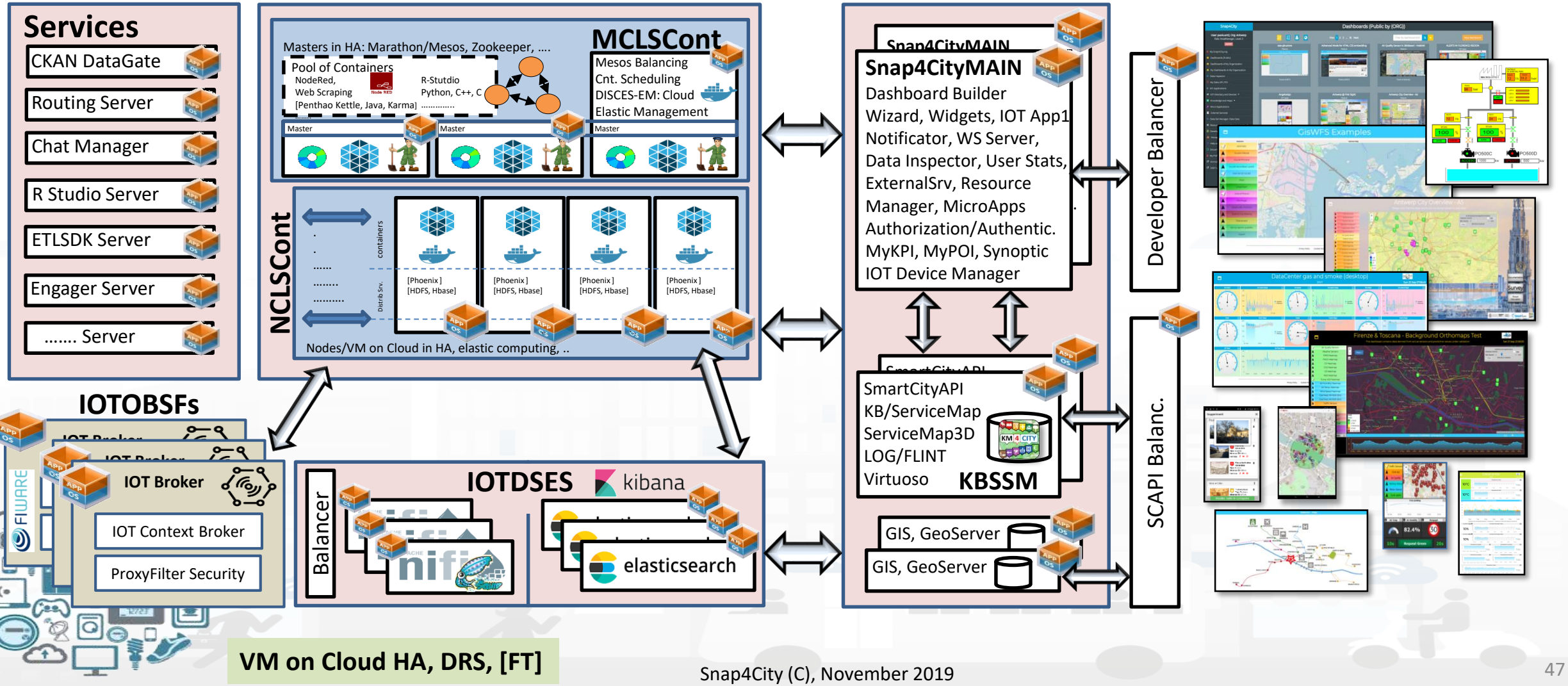


Mobile Apps, Dashboards

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



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



Monitoring Resource Consumption and Traffic

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

LOGOUT

MSG COUNT BY MOTIVATION

DB_Storage ASCAPI Dashboard FileSystem_Storage MyData
PlumberDataAnalytic MicroserviceUserCreated

% MSG COUNT BY AGENT

ETL Node-Red

MSG COUNT BY COMMUNICATION TYPE

TX RX

HITS

1,922,214
TOTAL HITS

PAYLOAD TRAFFIC (KB) BY MOTIVATION

ASCAPI FileSystem_Storage Dashboard DB_Storage MyData

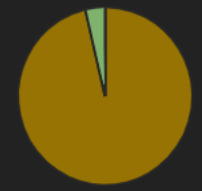
PAYLOAD TRAFFIC (KB) BY AGENT

Node-Red ETL

PAYLOAD TRAFFIC (KB) BY COMMUNICATION TYPE

RX TX

SERVICE SCOPE (INT/EXT)



INTERNAL EXTERNAL

FACET FIELDS

motivation
Select...

agent
Select...

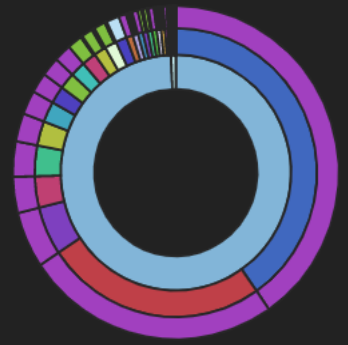
service_scope
Select...

ip_ext
Select...

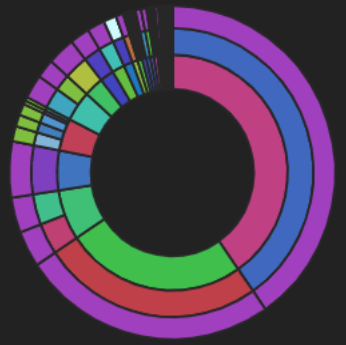
lang

ip_local
Select...

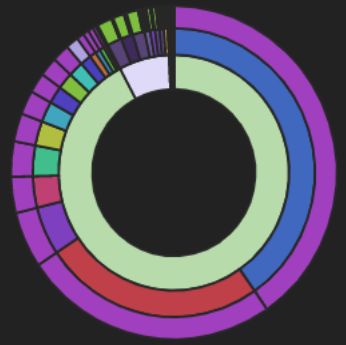
IP TRAFFIC (KB) BY COMMUNICATION MODE



IP TRAFFIC (KB) BY PID_LOCAL



IP TRAFFIC (KB) BY MOTIVATION



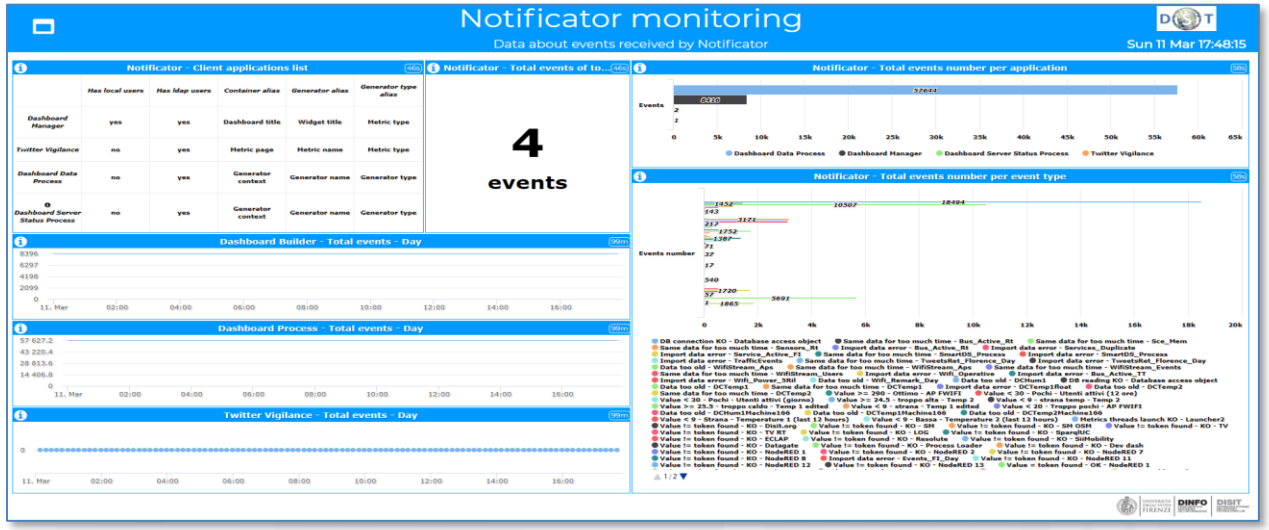
IP TRAFFIC (COUNTS) BY COMMUNICATION MODE

IP TRAFFIC (COUNTS) BY PID_LOCAL

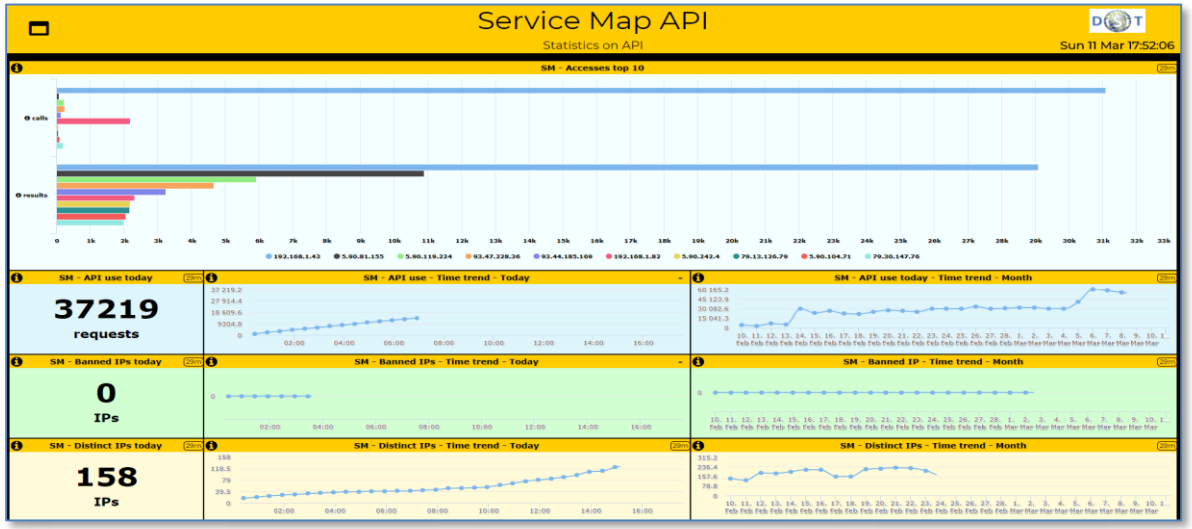
IP TRAFFIC (COUNTS) BY MOTIVATION

Monitoring Infrastructure Status

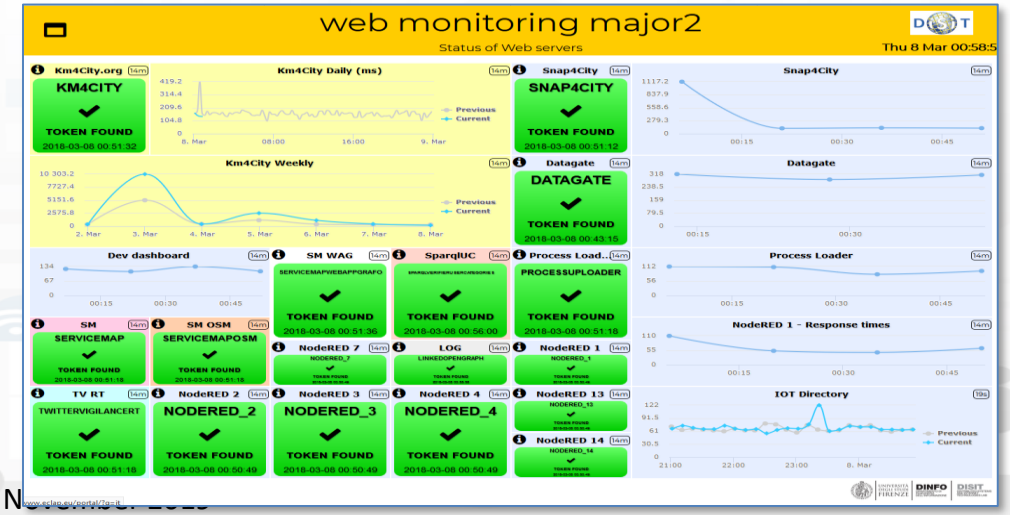
http://www.disit.org/dashboardSmartCity/view/index.php?iddasboard=MTQ4

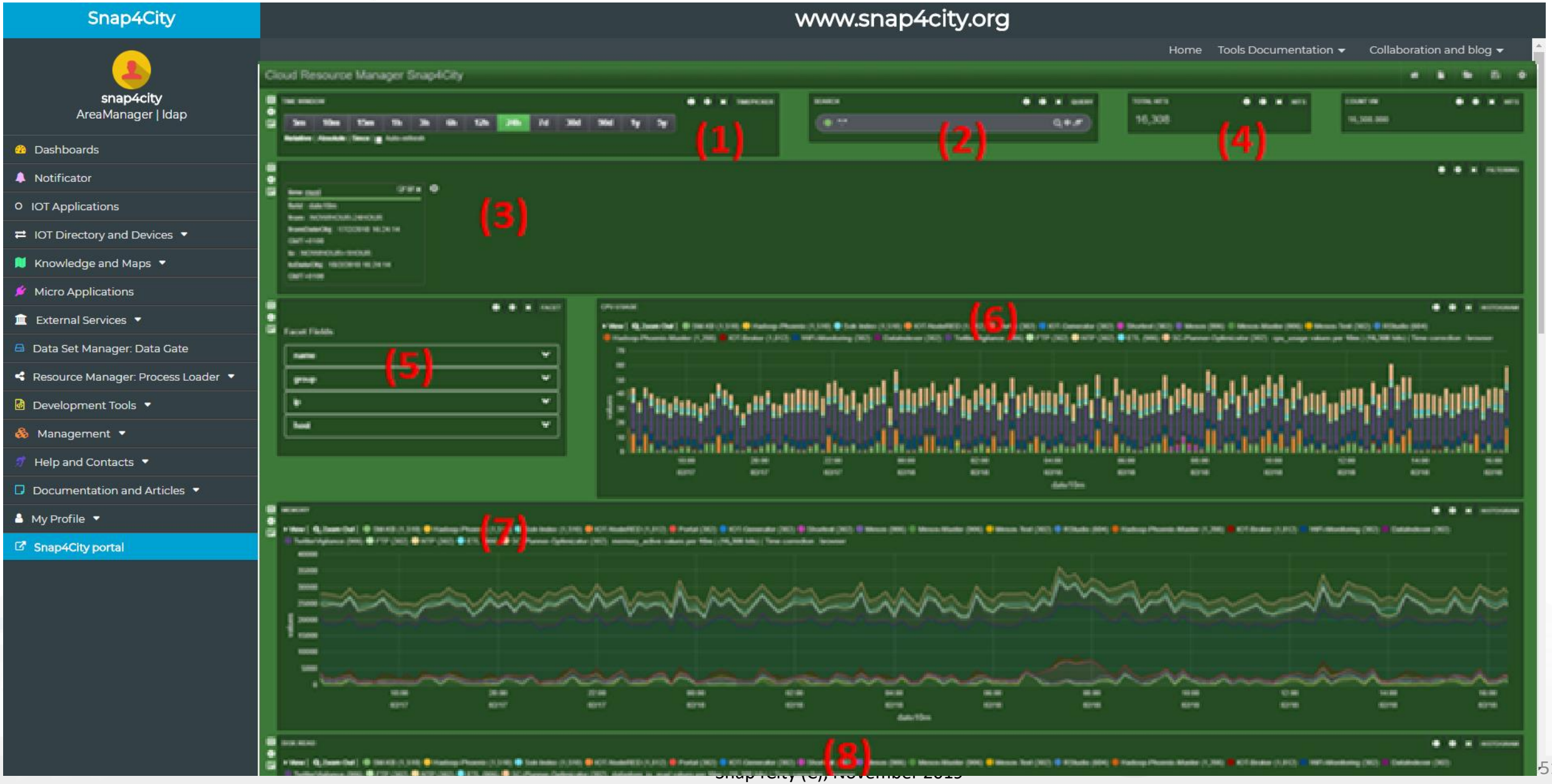


http://www.disit.org/dashboardSmartCity/view/index.php?iddasboard=MTkw



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




Snap4City
www.snap4city.org
Home
Tools Documentation
Collaboration and blog
Cloud Resource Manager Snap4City
snap4city
AreaManager | ldap
Dashboards
Notificator
IOT Applications
IOT Directory and Devices
Knowledge and Maps
Micro Applications
External Services
Data Set Manager: Data Gate
Resource Manager: Process Loader
Development Tools
Management
Help and Contacts
Documentation and Articles
My Profile
Snap4City portal
(1)
(2)
(3)
(4)
(5)
(6)
(7)
(8)

Auditing Activities

Auditing Data Access Try-out

Snap4City

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

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

Reset Filters

15

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

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

Auditing Personal Data

Reset Filters

15

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