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

SNAP4CITY

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Data Ingestion and Inspection for Smart City Applications

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https://www.disit.org, Https://www.snap4city.org

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http://www.smart-comp.info/

100% OPEN SOURCE

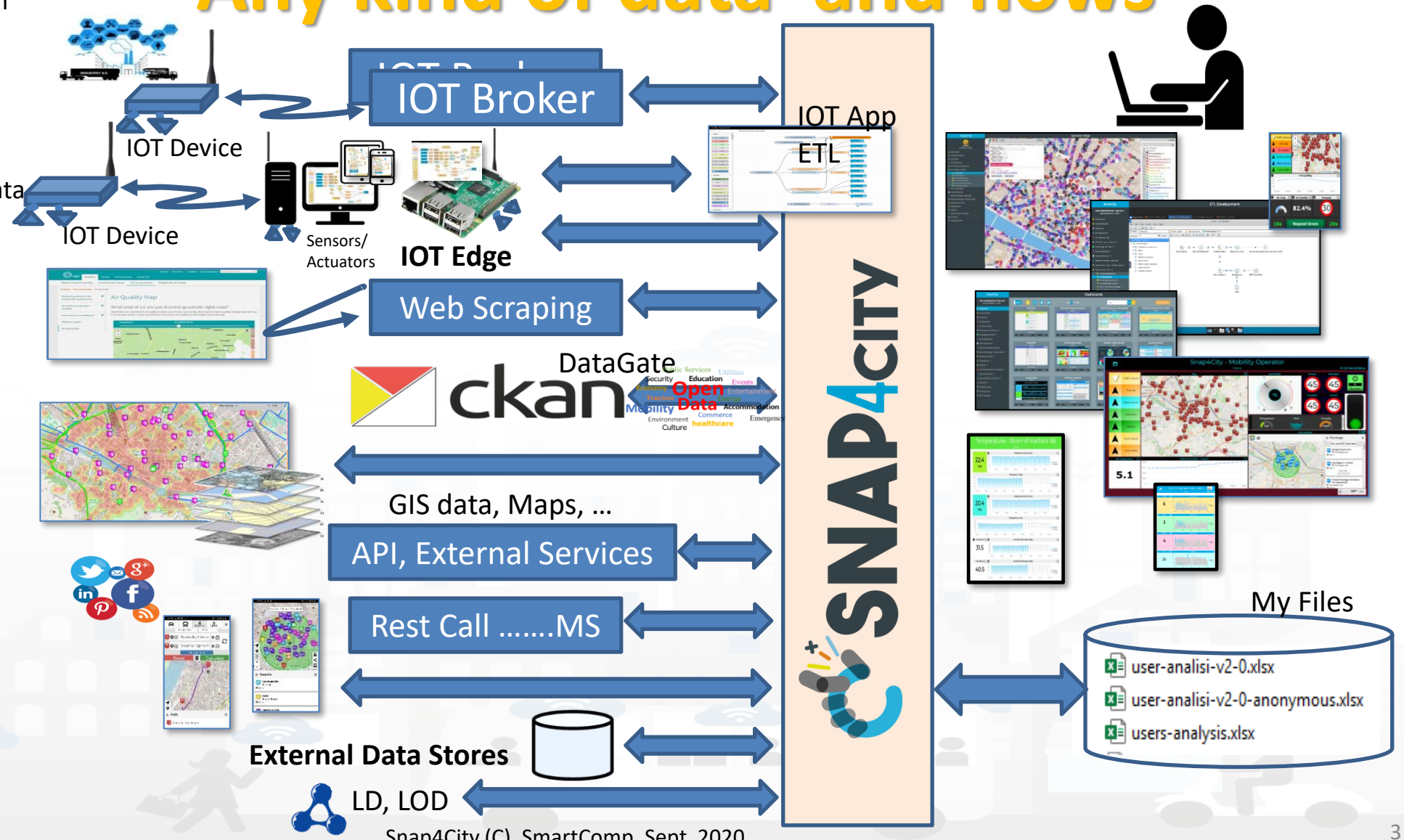
Context and Problems

- Smart city context includes solutions that presents
  - **Data**: Heterogeneous, large volume, several protocols, legacy systems, semantics, real time, multiple domains
  - **Processes**: several of different kinds, aperiodic, periodic, event driven,.
  - **Relationships**: among data and processes and mixt
  - **Non Func. Req**: security, GDPR, reliability, quality, scalability, etc.
    - Interoperability: legacy, protocols, modularity,

- **Data Ingestion**: the models and mechanism for data gathering
- **Data Inspection**: the model and solution to identify problems, and understand solution

Any kind of data and flows

- **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, LD, LOD, etc.**
  - IOT Applications, ETL
- **Data base accesses**
  - GIS: WFS, WMS
  - ETL, IOT Application



SNAP4CITY

KM4CITY

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

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

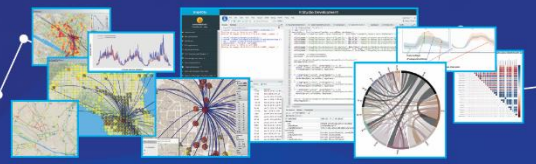
DEVELOPMENT KIT • SUGGESTIONS • MOBILE APPS • MONITORING PANELS • PLATFORM UTILITIES • READY TO USE SMART APPLICATIONS

MICROSERVICES & ADVANCED SMART CITY API

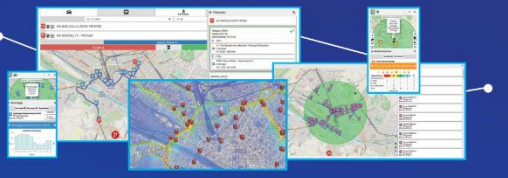
LIVING LAB - DEV TOOLS - COWORKING

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

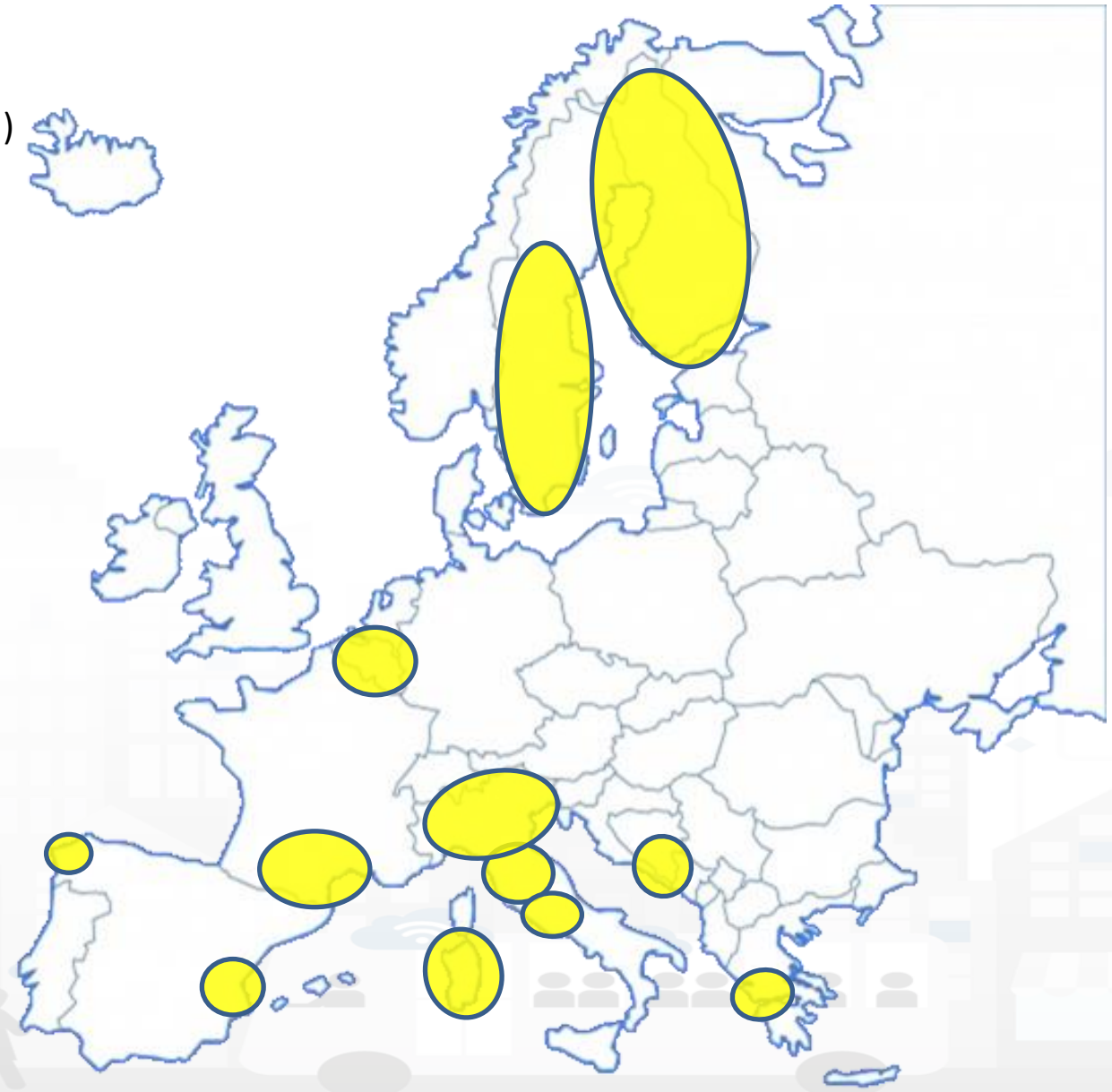
IOT MNG - DATA MNG - DATA INSPECTOR – PROCESS MNG – USER ENGAGEMENT – GDPR MNG ...

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

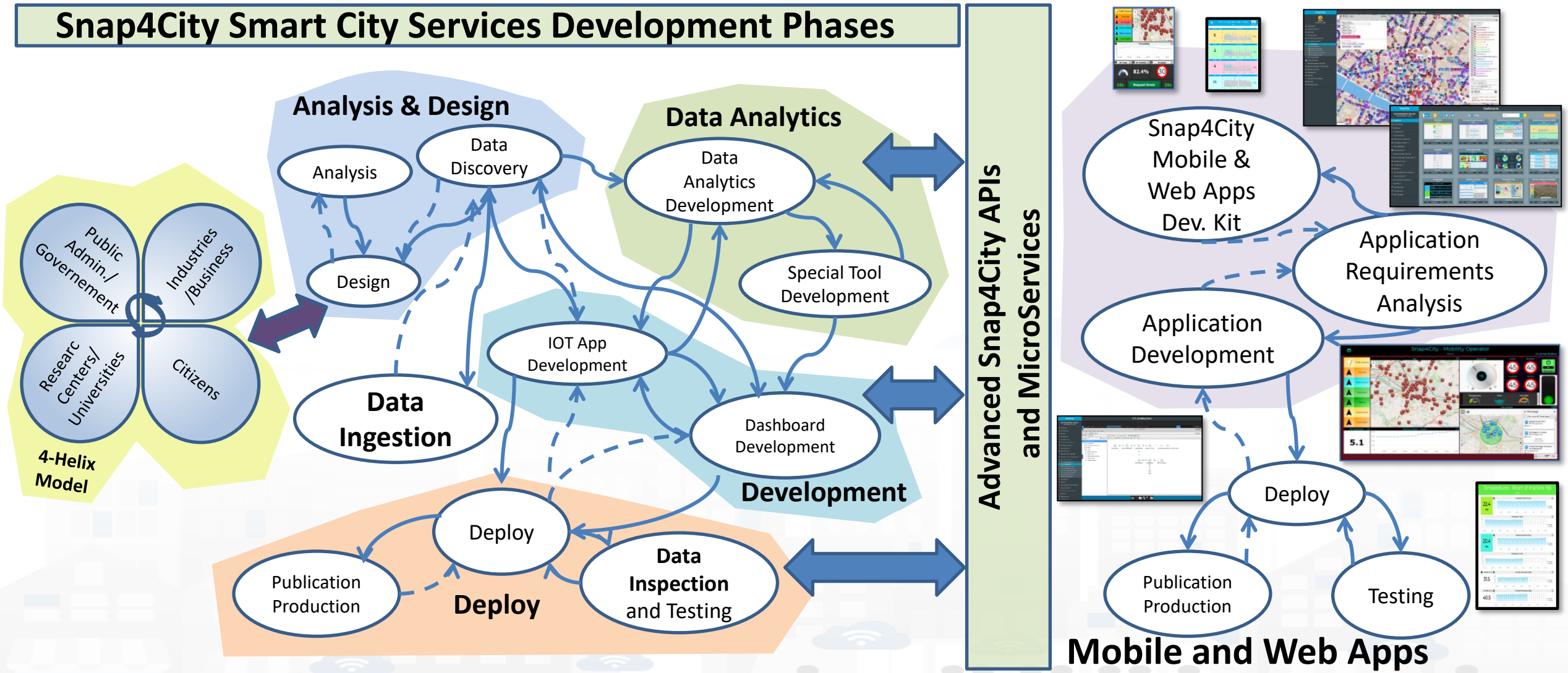
Coverage 2020

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)



Snap4City Smart City Services Development Phases



Smart City Functional Architecture

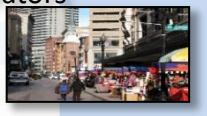
Transport systems
Mobility, parking

Public Services,
Govern, events, …

Sensors, IOT Cameras,
Wi-Fi

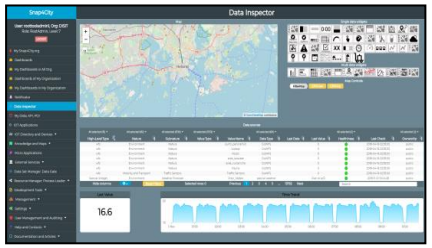
Environment, Water,
energy

Shops, services,
operators



Social Media

Social Media Crawler and Manager



Back-End ⟵ ⟶ Front-End

Data Sources, External Services *PULL Data*

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

Data Ingestion, aggregation, regularization, reconcile:
NIFI, IOT App

Knowledge base
Semantic reasoners

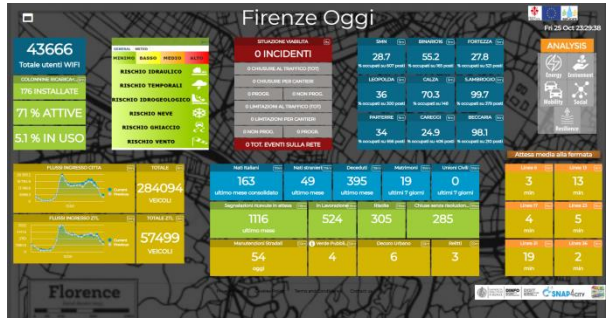
Indexing and aggregating
Elastic search

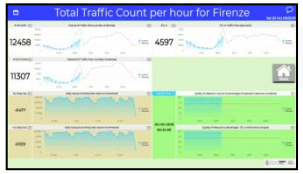
Search and Query, Smart City API
Facet, semantic search

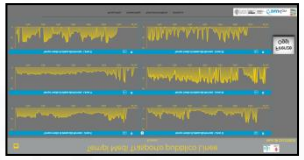
Data Analytics, Simulations
R, Tensor Flow, Python, ….

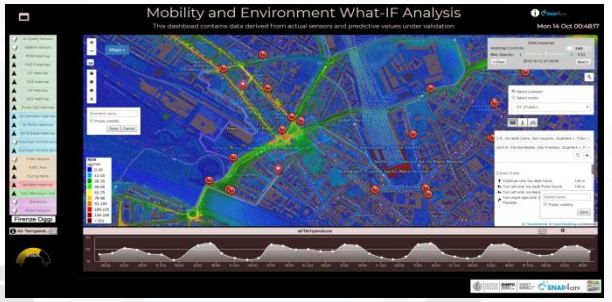
IOT Applications, Business Logic
Node-RED + Snap4City MicroServices

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









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

Data are **not** so Simple as one can imagine

- Data to be managed into the Smart City IOT are not so simple as one may imagine, and not limited to take into account only IOT Devices.
- THUS, a large number of data TYPES and sources have also to be addressed:
  - E.g.: external services, heatmaps, trajectories, maps, OD matrices, actuators, personal data, KPI, API descriptors, special widgets, events, predictions, Tweets, posts, GIS, mobile devices, etc.
  - With their complexity of managing data, licensing, etc…
- THEY are called **High Level Types: how and which tool / process can cope with them into the Smart City Platform?... See next!**
  - **Thus a unified model is needed.**
- **In 2nd part we have shown how to show specific types of data**

Unified Data and Services Model/Classification

MyKPI	All selected (8)	All selected (15)	All selected (30)		All selected (3)	6 selected			true		All selected (2)	
High-Level Type	Nature	Subnature	Value Type	Value Name	Data Type	Value Unit	Last Date	Last Value	Healthiness	Last Check	Ownership	Organizations
MyKPI	Environment	Weather_sensor	Gradi Centigradi	BatteryTemperatureGalaxyTabS4	float-mykpi	°C	2019-11-21 15:51:25	28		2020-04-03 10:23:02	private	Firenze,dc=ldap,dc=disit,dc=org,
MyKPI	Environment	Weather_sensor	Gradi Centigradi	BatteryTemperatureS6Edge	float-mykpi	°C	2020-01-23 12:37:34.25.299999237060547			2020-04-03 10:23:02	private	DISIT
MyKPI	Environment	Weather_sensor	Gradi Centigradi	BatteryTemperatureSamsungS9	float-mykpi	°C	2019-04-23 05:54:21.24.399999618530273			2020-04-03 10:23:02	private	Firenze,dc=ldap,dc=disit,dc=org,
MyKPI	Environment	Smart_waste_container	Level_percentage	Bin_001	percentage-mykpi	%	1970-01-01 01:00:00			2020-04-03 10:23:02	private	DISIT,dc=ldap,dc=disit,dc=org,
MyKPI	Environment	People_counter	Battery Percentage	borrowed_tbeam_pax_green BATTERY	percentage-mykpi	%	2019-03-13 20:24:52	4.202		2020-04-03 10:23:02	private	Firenze,dc=ldap,dc=disit,dc=org,
MyKPI	Environment	People_counter	Battery percentage	borrowed_ttgov21new_pax_black BATTERY	percentage-mykpi	%	2019-05-06 10:03:55	4.132		2020-04-03 10:23:02	private	Firenze,dc=ldap,dc=disit,dc=org,
MyKPI	Environment	People_counter	Battery Percentage	borrowed_ttgov21new_pax_green BATTERY	percentage-mykpi	%	2019-11-19 08:56:56	4.072		2020-04-03 10:23:02	private	Firenze,dc=ldap,dc=disit,dc=org,
MyKPI	HealthCare	Health_district	tassodicrescita	corkpimemilia	float-mykpi	%	1970-01-01 01:00:00			2020-03-24 13:13:24	private	DISIT

Hide columns | Reset filters | Selected rows: 0 | Previous 1 2 3 4 5 ... 35 Next | Search

High Level Types

Nature

SubNature

Value Type

Value Name

Data Type

Value Unit

Last Date/Time

Last Value

Healthiness

Last Check

Ownership

Organization

Semantic

Technical meaning

RealTime Status

For Admin

How to Ingest

All of them can be shown on Dashboards, what about manipulate them!!!!

HLT, High Level Types++	GPS	Static	Dynamic	Single	Time Series	Trajectory	HTTP	How to ingest/change/manage/see
POI (Point of Interest)	Yes	Yes		Yes				DataGate, ETL, IOT App, API
MyPOI data	Yes	Yes		Yes				Dashboard, IOT App, UserInterface, API
KPI (metrics) data		Yes	Yes	Yes	Yes			Dashboard, IOT App, API, SQL calls x Metrics
Dashboard-IOT App (msg)		Yes	Yes	Yes	Yes			Dashboard, IOT App, API
Dashboard-IOT App real time			Yes	Yes	WS			Dashboard, IOT App, API WS
My Personal Data		Yes	Yes	Yes	Yes			Dashboard, IOT App, UserInterface, API
MyKPI data	Yes	Yes	Yes	Yes	Yes	Yes		Dashboard, IOT App, UserInterface, API
Sensor data	Yes	Yes	Yes	Yes	Yes			Dashboard, IOT Directory, IOT App, UserInterface, API
Sensor Actuator data	Yes	Yes	Yes	Yes	Yes			Dashboard, IOT App, UserInterface, API
Synoptics data			Yes	Yes	Yes			Dashboard, IOT App, UserInterface
Special Widget (complex)		Yes	Yes	Yes	Yes		Yes	Dashboard, ETL, special, IOT App, API
Complex Event (msg)	Yes	Yes	Yes	Yes	Yes			Dashboard, ETL, special, IOT App, API
WFS/WMS (GIS data)	Yes	[yes]	[yes]				Yes	Dashboard, GIS tools, or GeoServer, IOT App
GTFS	Yes	Yes	Yes	Yes	Yes			ETL, special [IOT App], MicroApplications
OD Matrices	Yes	Yes	Yes	Yes	Yes			Special tools, MicroApplications

How to Ingest

All of them can be shown on Dashboards, what about manipulate them!!!!

HLT, High Level Types++	GPS	Static	Dynamic	Single	Time Series	Trajectory	HTTP	How to ingest/change/manage
API (Ext. Srv., any prot.)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	ETL, Special, IOT App, …
External Service (web pag)		Yes	--				Yes	ETL, Special, IOT App, Web Scraper, …
MicroApplication (webapp)		Yes	--				Yes	Dashboard, IOT App, API, FTP, …
Heatmap matrix	Yes	Yes	Yes	Yes	Yes			Maps, IOT App, MicroService, UserInterface, API
Synoptics (group)		Yes	(Yes)	(Yes)	(Yes)		Yes	Dashboard, Special Tools, IOT App, API, …
Special Tools (functional)	(Yes)		(Yes)	(Yes)		(Yes)	Yes	As MyPersonalData, …
Typical Trends (not yet)	(yes)	Yes	(Yes)		Yes		Yes	MicroApp, Special tools, (API) , …

Non HLT

Traffic Flows (are coming)	(yes)	Yes	Yes		Yes	Yes	Yes	Maps, Special tools, API, …
Color Maps		Yes		Yes				Maps, Tables, Special tool, User Interface, API
GTFS (see Sensors, POI)	Yes	Yes	Yes		Yes	Yes		Maps, Special tools, API, …
Typical Trajectory (MyKPI)	Yes	Yes	Yes		Yes	Yes		Maps, Special tools, API, …

- Now, it is more clear about what we intend as:
  - ***High Level Types***

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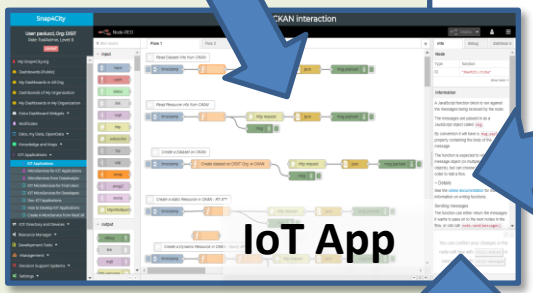
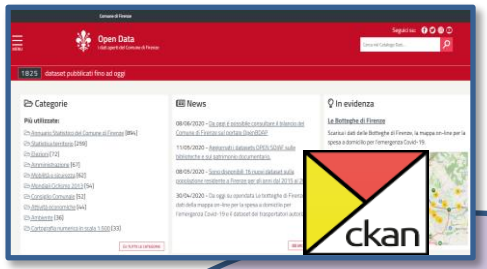
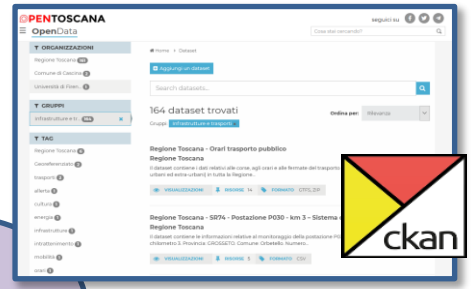
Snap4City Portal and Integrated tools

IoT App – Automatize:

- Import data from CKAN to Snap4City
- Upload Public Data from Snap4City to CKAN
- Data Harvesting
- Dashboards and Mobile/Web Apps creation





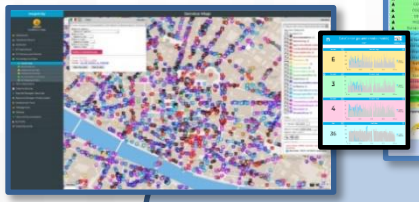


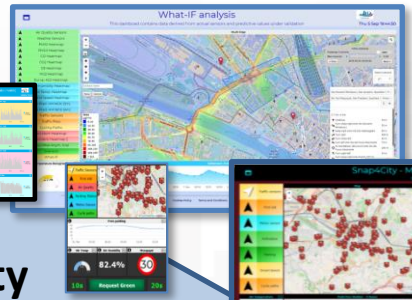
Open or Private External CKAN Data Portals

Advanced Snap4City APIs and MicroServices

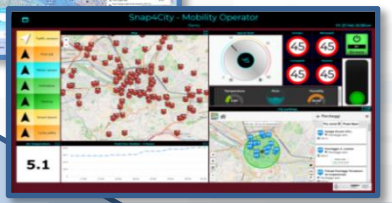
Knowledge and Storage Data from the Field and City

Real Time Data





Heatmaps
What-IF Analysis



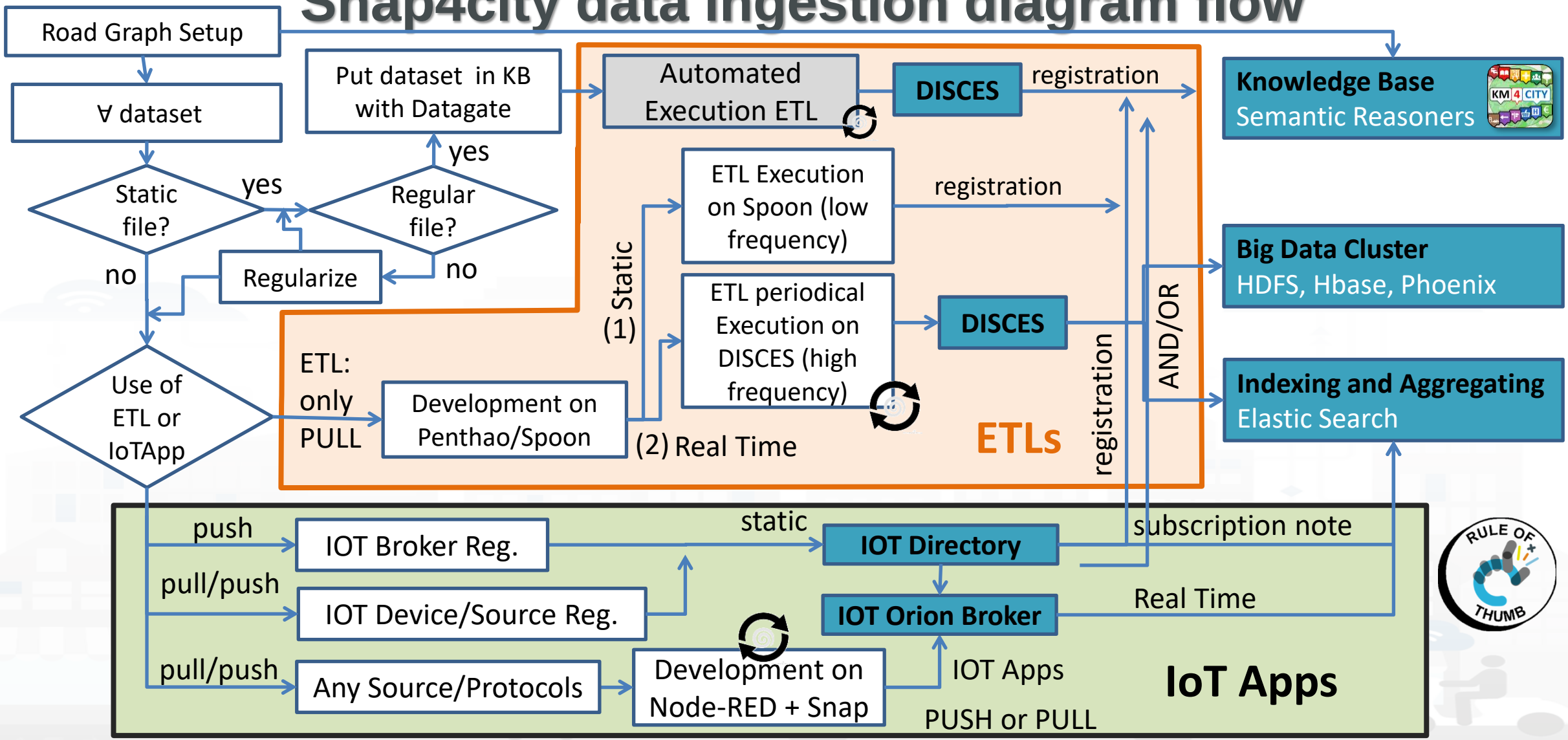
Remote Control

Snap4City Dashboards Mob & Web Apps

Historical Data

Snap4City Comp, S

Snap4city data ingestion diagram flow



IOT App vs ETL

IOT Applications

- Created on browser
- A huge number of Protocols https://www.snap4city.org/65
- Scheduled internally and managed as Container
- Largely diffused approach as Node-RED
- Large number of Snap4City MicroServices, well documented
- PUSH and PULL models
- Simple mechanism to add new Features
- Very diffused in IOT
- Static and Dynamic data models depending on IOT Broker capabilities
- Scalable on Cloud
- Also present in IOT Edge devices

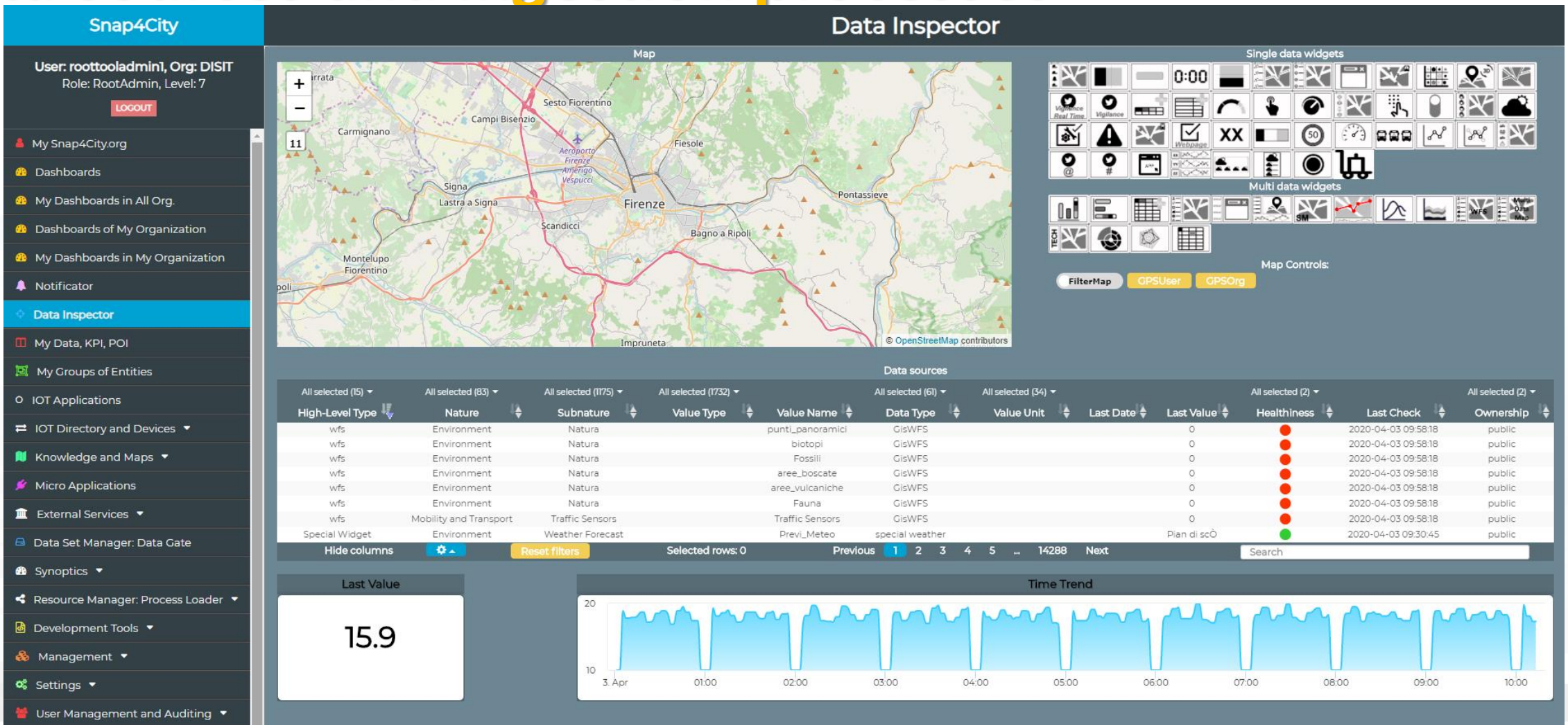
ETL processes

- Created with Spoon editor on VM (on premise or via remote access to VM)
- A Large number of protocols https://www.snap4city.org/65
- Scheduled by DISCES in the back office
- Well known data warehouse model
- Well documented for the process
- Only PUSH models
- Complex mechanism to add a new functionality
- Very diffused in Data transformation
- Static and Dynamic data models well linked ..

Data Inspector (Digital Twin info) Major Submodels

- **Digital Twin**
  - Device and sensors data
  - Values
  - Healthiness criteria and values
    - Machine learning tools
  - Images and phyiscal world
  - Licensing
  - Users
- **Process Views**
  - Device Management tool
  - Data ingestion processes
    - ETL, IOT Apps
  - Data storage access views
    - Index views
    - Relatioships view
  - Data Analytics and Trasformation
    - IOT App, R Studio, Python
  - Data Rendering Dashboards
  - Processes' Developers

Data Inspector: all you need to know about data, data sources and ingestion processes



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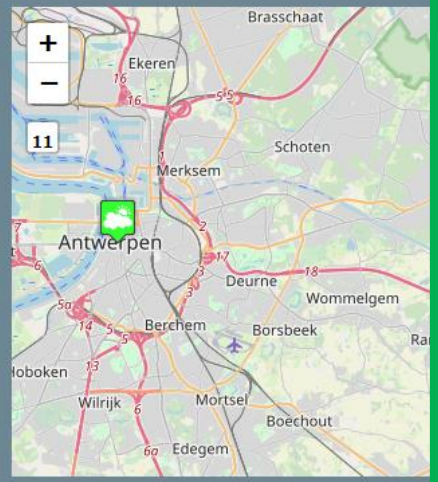
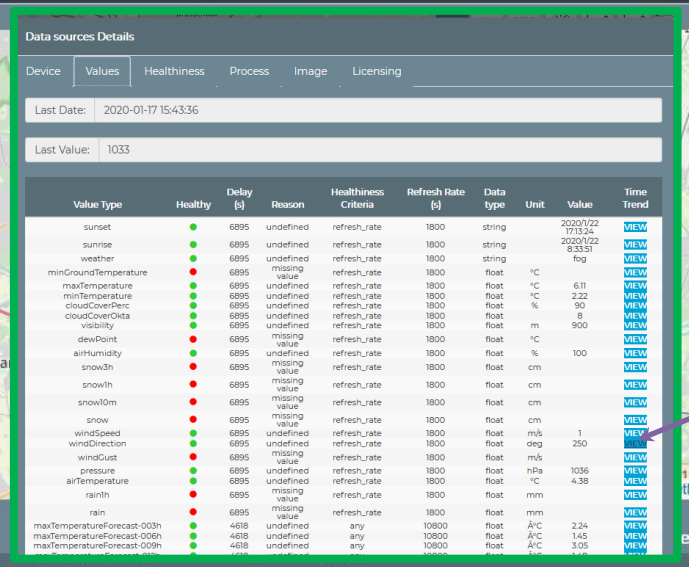
Data Inspector

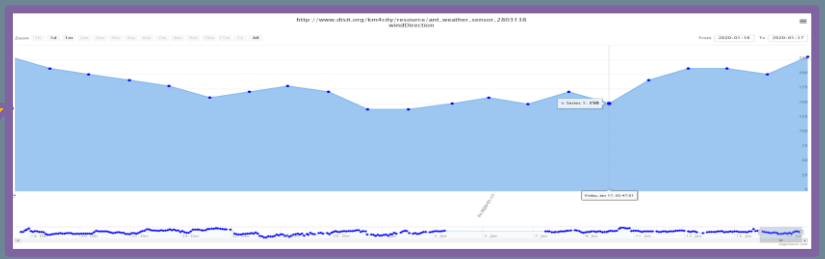
Snap4City

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

- My Snap4City.org
- Dashboards
- My Dashboards in All Org.
- Dashboards of My Organization
- My Dashboards in My Organization
- Notificator
- Data Inspector
- My Data, KPI, POI
- My Groups of Entities
- IOT Applications
- IOT Directory and Devices
- Knowledge and Maps
- Micro Applications
- External Services
- Data Set Manager: Data Gate
- Resource Manager: Process Loader
- Development Tools
- Management
- Settings
- User Management and Auditing







All selected (15) | All selected (83) | All selected (1142) | All selected (1623) | All selected (61) | All selected (3) | All selected (2)

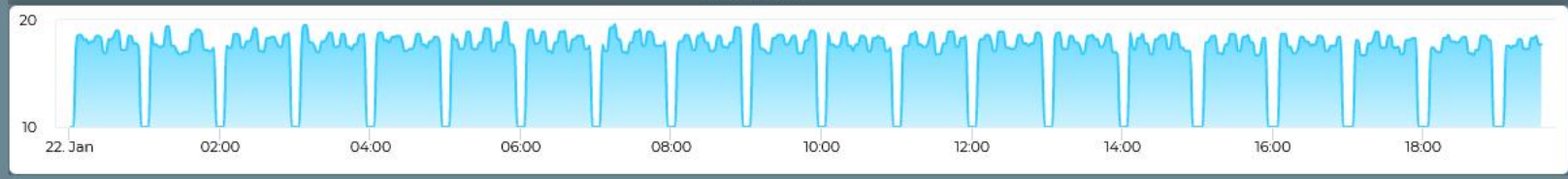
High-Level Type	Nature	Subnature	Value Type	Value Name	Data Type	Last Data	Last Value	Healthiness	Last Check	Ownership
Sensor	Environment	Weather_sensor	seaLevelPressureForecast-048h	Weather sensor Antwerpen	float	2020-01-17 15:43:36	1040		2020-01-17 16:17:25	public
Sensor	Environment	Weather_sensor	seaLevelPressureForecast-045h	Weather sensor Antwerpen	float	2020-01-17 15:43:36	1038		2020-01-17 16:17:25	public
Sensor	Environment	Weather_sensor	seaLevelPressureForecast-042h	Weather sensor Antwerpen	float	2020-01-17 15:43:36	1035		2020-01-17 16:17:25	public
Sensor	Environment	Weather_sensor	seaLevelPressureForecast-039h	Weather sensor Antwerpen	float	2020-01-17 15:43:36	1033		2020-01-17 16:17:25	public
Sensor	**Environment**	**Weather_sensor**	**seaLevelPressureForecast-036h**	**Weather sensor Antwerpen**	**float**	**2020-01-17 15:43:36**	**1033**		**2020-01-17 16:17:25**	**public**
Sensor	Environment	Weather_sensor	seaLevelPressureForecast-033h	Weather sensor Antwerpen	float	2020-01-17 15:43:36	1031		2020-01-17 16:17:25	public
Sensor	Environment	Weather_sensor	seaLevelPressureForecast-030h	Weather sensor Antwerpen	float	2020-01-17 15:43:36	1030		2020-01-17 16:17:24	public
Sensor	Environment	Weather_sensor	seaLevelPressureForecast-027h	Weather sensor Antwerpen	float	2020-01-17 15:43:36	1027		2020-01-17 16:17:24	public

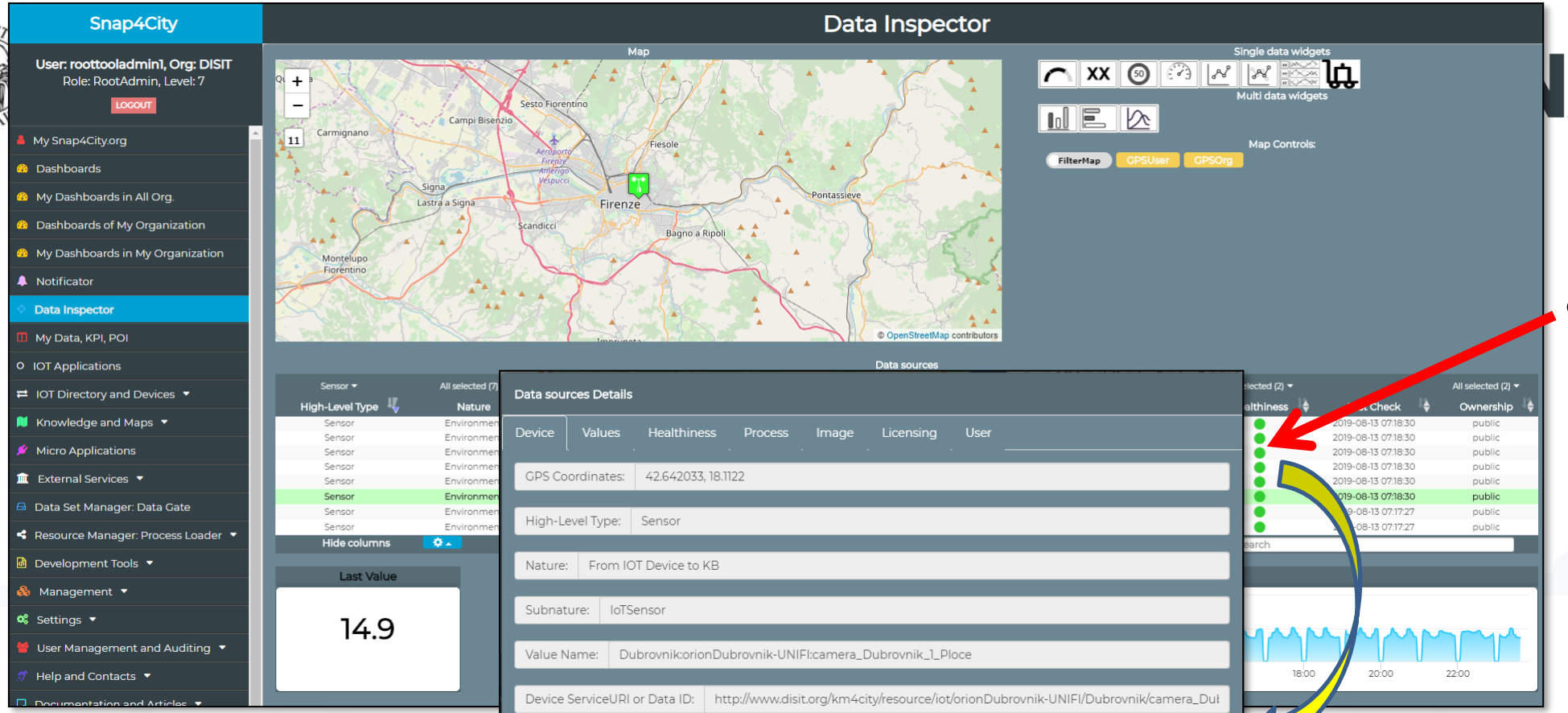
Hide columns | Reset filters | Selected rows: 1 | Previous 1 2 3 4 5 ... 860 Next | seaLevel

Last Value

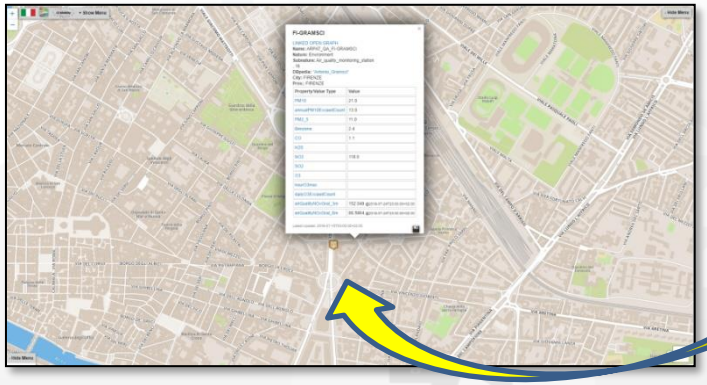
15.9

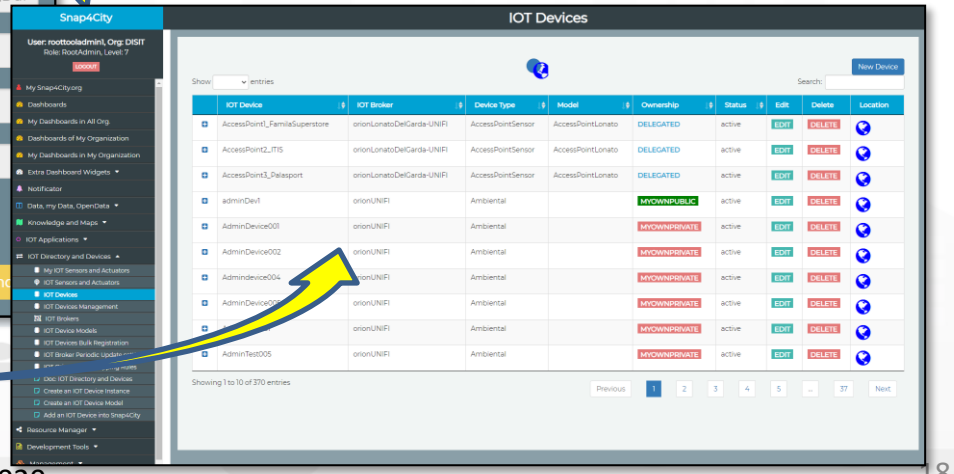
Time Trend





Knowledge Base view





- Click with the mouse on it

HLT: Sensor

Some functionalities are limited to certain roles

HLT: Sensor

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

Data sources Details

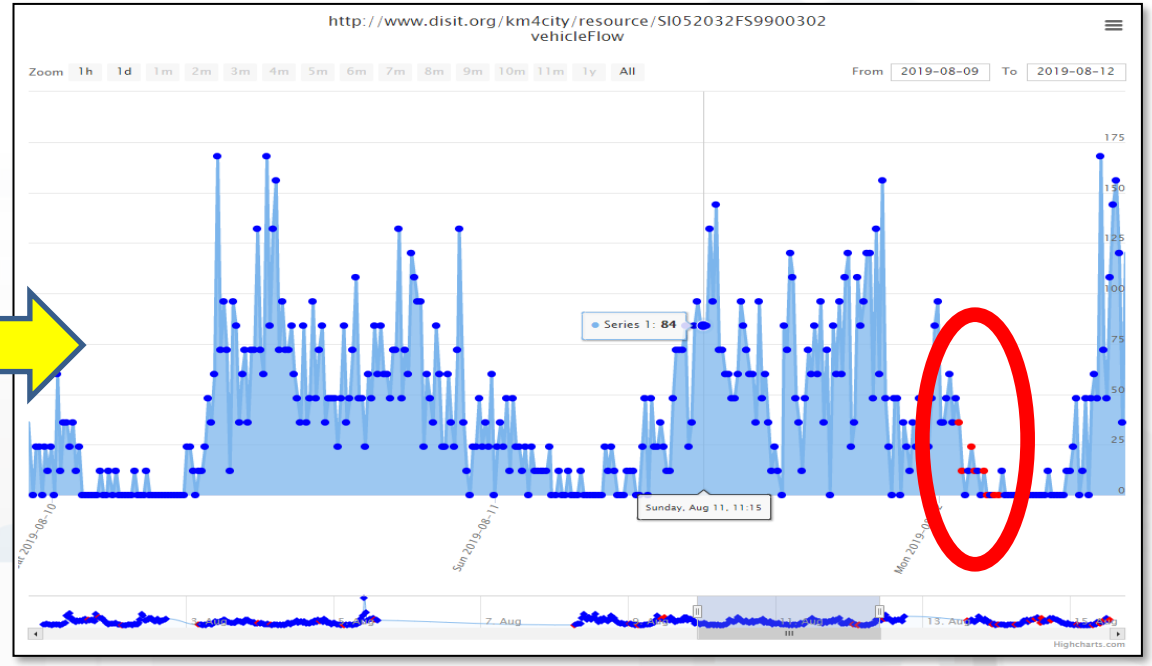
Device | Values | Healthiness | Process | Image | Licensing | User

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

Last Value:

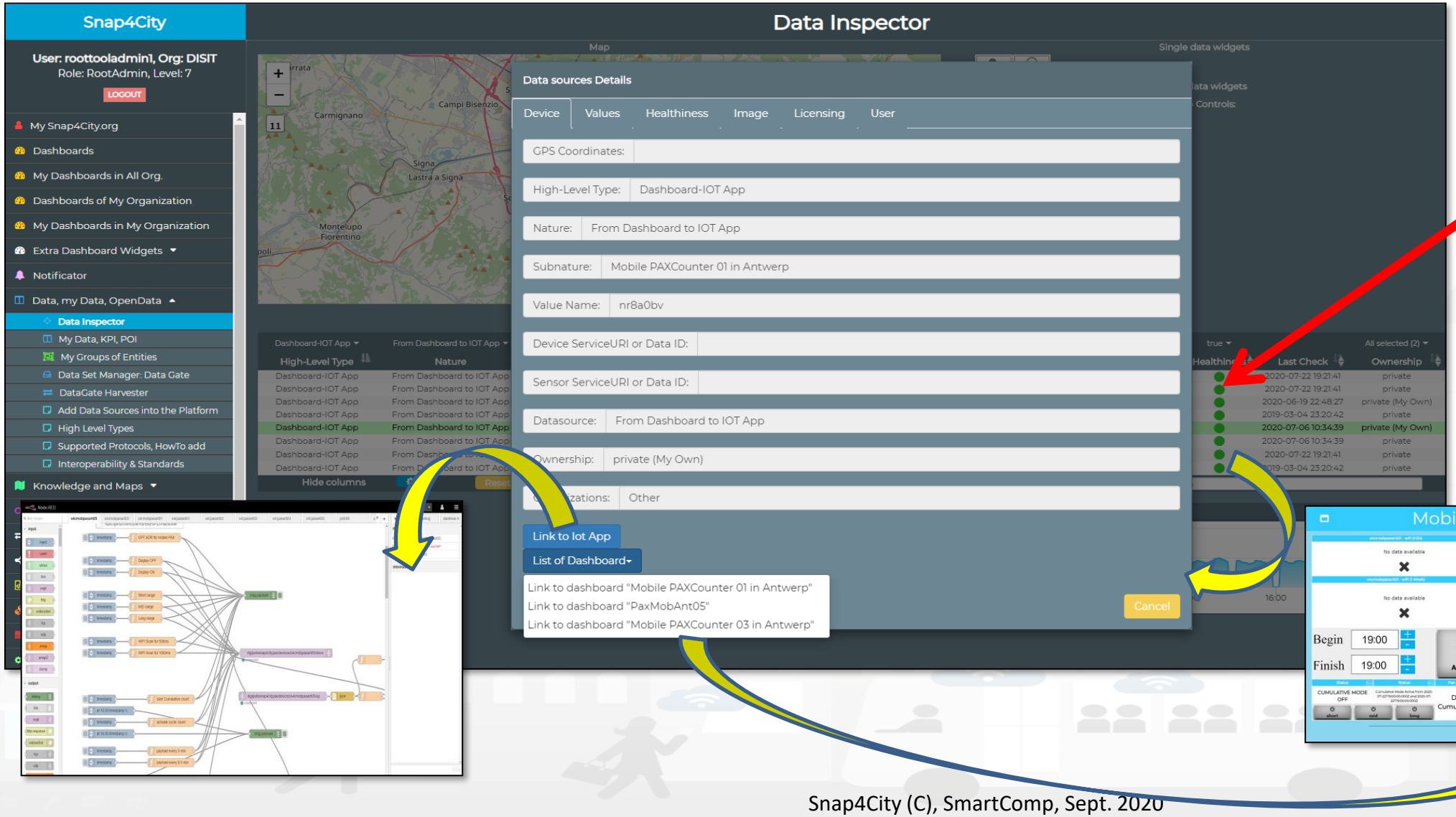
Value Type	Healthy	Delay (s)	Reason	Healthiness Criteria	Refresh Rate (s)	Data type	Unit	Value	Time Trend
dateObserved	●	61890	undefined	undefined	300	time	timestamp	2020-07-21T17:00:00.000Z	VIEW
deceduti	●	61890	undefined	undefined	300	integer	#	16797	VIEW
dimessi_guariti	●	61890	undefined	undefined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

Cancel



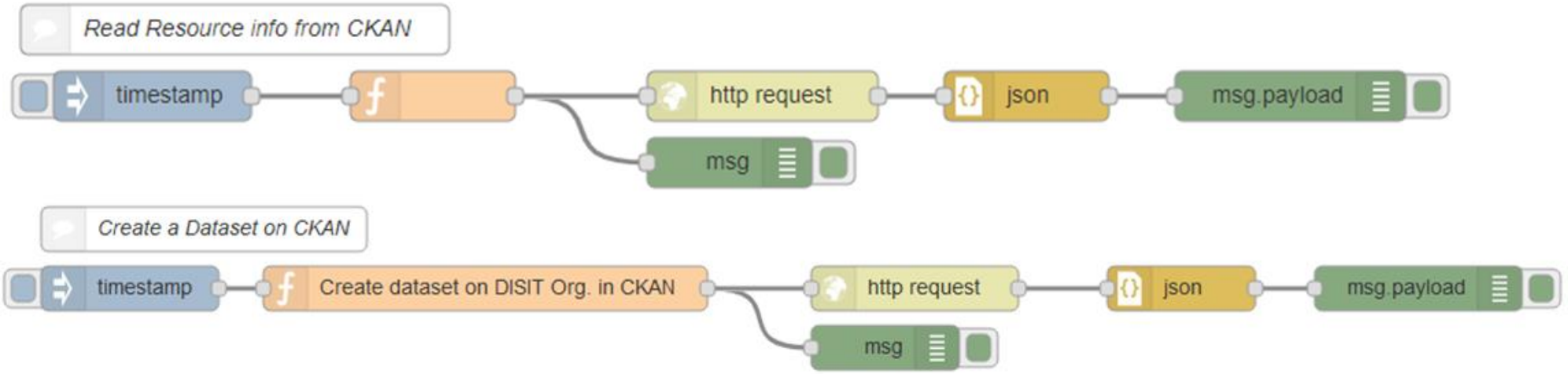
Some functionalities are limited to certain roles

HLT: From Dashboard to IOT APP

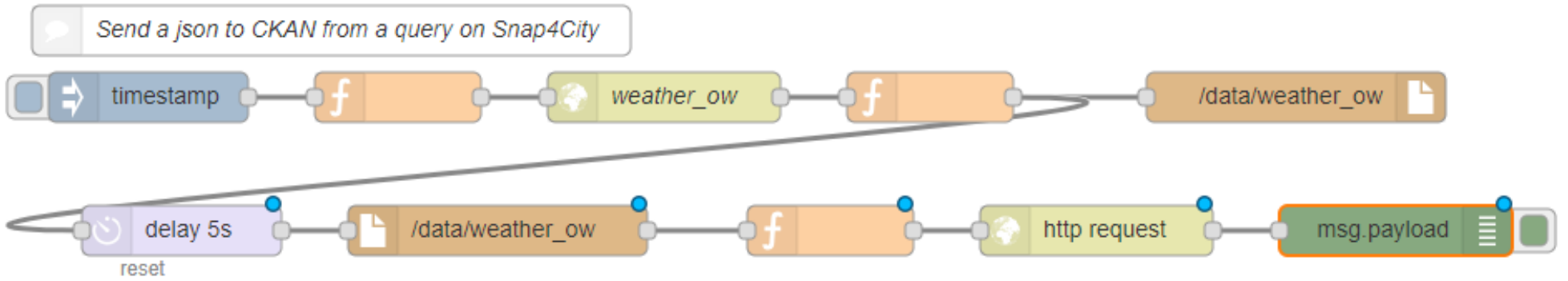


- Click with the mouse on it

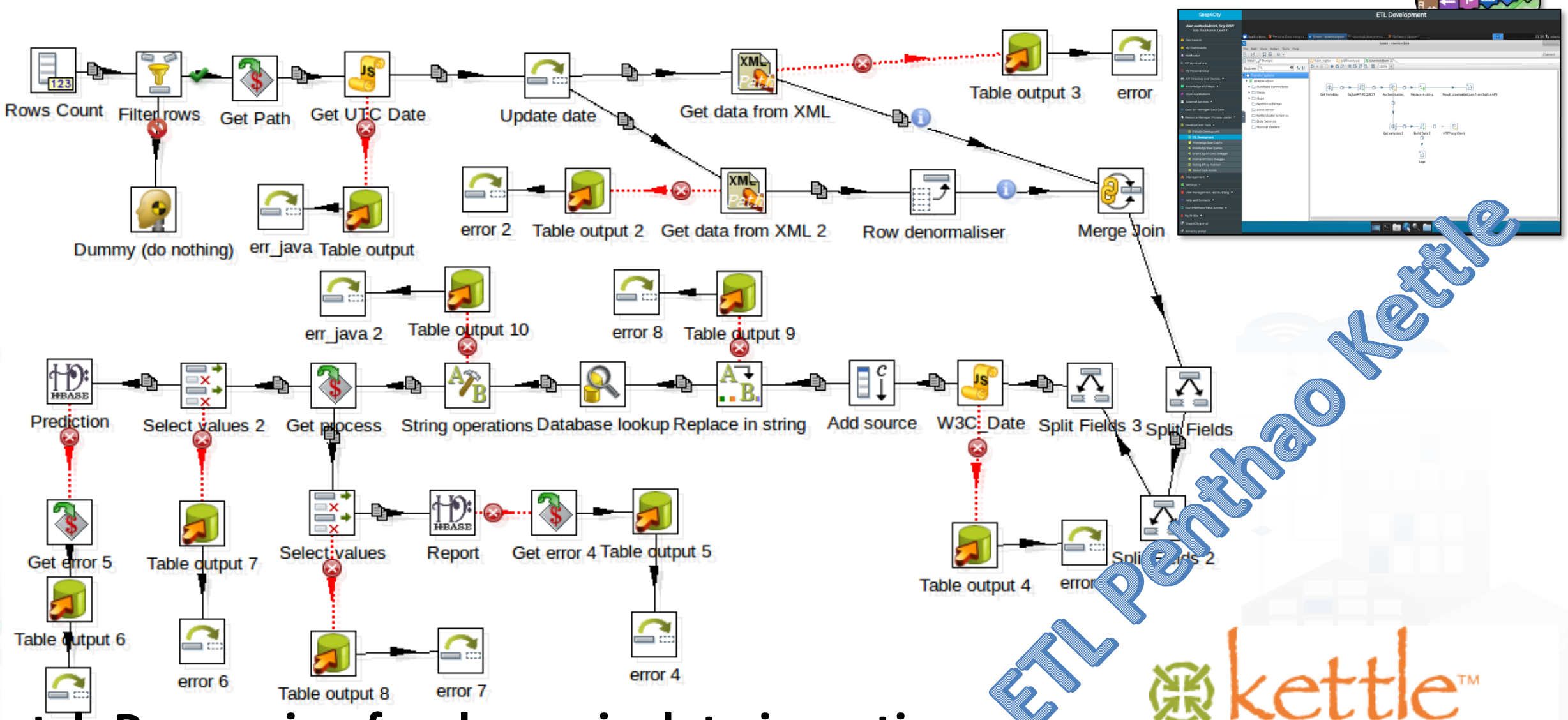
Some IOT App segements



Almost all the calls to CKAN are quite similar



Integrated ETL development



ETL Penthao Kettle

Batch Processing for dynamic data ingestion

Data Ingestion Methods Comparison

	Datagate	ETL	IoTApp
types of data managed	S	S, P	S, P, RT
Data protocol types managed	PULL	PULL	PULL and PUSH
Scheduling	external	external	internal
Flows to manage N instances of the same dataset	N	N	1
Users' technical level	without	medium/high	low
Development time	1,2 hours	1, 2 weeks	3, 4 days
Semantic (KM4City)	standard template	ad hoc (manual)	ad hoc (semi-automatic)
Developed number	1334 datasets	162	76
Mean number of blocks	0	120.333	27,67
Mean number of lines of code	0	275	229

Conclusions

- **Problems**
  - Complex data models, multiple processes, multiple tenancy/organizations, etc.
- **Integrated approach from ingestion and inspection**
  - Formal methodology support:
    - data discovery, development, living lab
  - Unified data model, avoiding pillars since the data model
  - Formal Model support:
    - data vs processes vs developers/owners
  - Powerful Tool as Data Inspector exploiting knowledge base as expert systems: data, processes, relationships, events, etc.

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TOP

Be smart in a SNAP!

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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
- LOD

- Twitter Vigilance
- Social Media Analytics, Sentiment Analysis

Km4City 1.4

2015
Km4City 1.5

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

ckan, resolute

H2020 (2015-18)

2016
(2016-21) H2020 REPLICATE

- Smart Energy
- Sustainable Mobility
- Control Room
- Dashboard

Km4City 1.6.2

Sii-Mobility (2016-21) MIUR

SII-MOBILITY SCN

- Infomobility
- Mobile App
- Routing
- Multimodality

FIWARE

2017
Km4City 1.6.4

Sii-Mobility

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

E0l5 digital ecosystem (Powered by EXPO MILANO 2015)

(2016-19) MIUR

GHOST SIR

- Sardinia Region Smart City Strategies and plan

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

GREEN IMPACT
POR FESR 2014-2020

- Industry 4.0
- Critical Plant
- Monitoring

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

life weee (2017-20)

- Smart Waste

2018
MOSAiC MObility 4.0 for SmArt (i) City (2018-20)

- Mobility Demand / Offer Analytics and Strategy

Sii-Mobility

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

IOT/IOE

Km4City 1.6.6

Node-RED

SNAP4CITY

SELECT for Cities H2020 (2017-19)

2019
5G (2018-21)

- 5G tech
- Energy
- Industry 4.0
- Synoptics

TRAFAIR

CEF (2018-21)

- Traffic and Mobility Impact on Pollution
- NOX predictions

EUROPEAN OPEN SCIENCE CLOUD

SIRIUS

LAID Smart Bed

- Smart Health

GREEN FIELD PEAS Soda4.0 (NaOH) Optimization and Automated Decision System 4.0

- Industry 4.0

bee smart city

- Smart Lonato

Reverberi Enetec Gruppo MPES

- PCP Award

2020
…2022

2021
- CAPELON
- Sweden

smartGARDAlake

Interreg MARITTIMO-IT FR-MARITIME MOBI MART

- Smart Mobility
- PISA, PUMS
- Living lab

Interreg Mediterranean HERIT-DATA

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