SNAP4CITY

www.snap4city.org
www.snap4solutions.org

KM4CITY

www.km4city.org

# Overview: IoT App. / Proc.Logic, Ingestion and Interoperability

February 2025, Course, day 2 TOURISMO

https://www.snap4city.org/944

https://www.snap4city.org/577

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

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

# https://www.snap4city.org/944

***On Line Training Material (free of charge)***

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

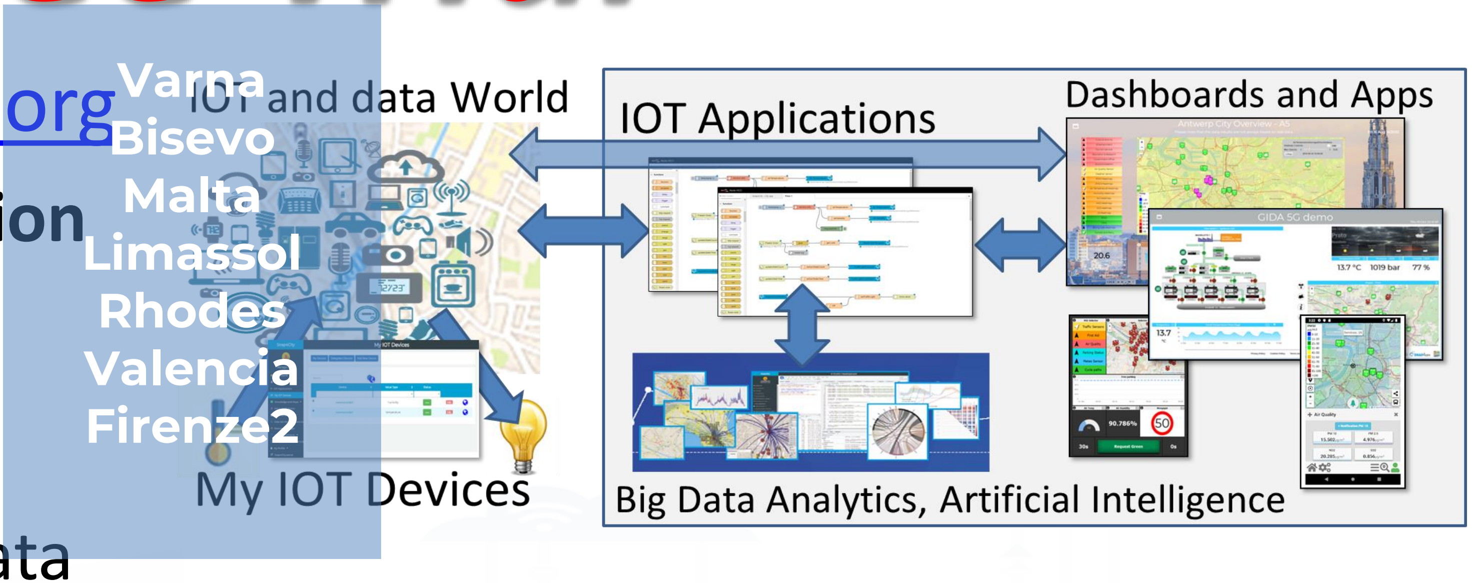
|  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|
| ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube |
| ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube |
| ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube | ▶ You Tube |

# Note on Training Material

- **Snap4City for Dummies** https://www.snap4city.org/1046
- **Course**: https://www.snap4city.org/944
  - Introductionary course to Snap4City technology
- **Older version Course** https://www.snap4city.org/577
  - Full training course with much more details on mechanisms and a wider set of cases/solutions of the Snap4City Technology
- **Documentation** includes a deeper round of details
  - Snap4City Platform Overview:
    - https://www.snap4city.org/drupal/sites/default/files/files/Snap4City-PlatformOverview.pdf
  - Development Life Cycle:
    - https://www.snap4city.org/download/video/Snap4Tech-Development-Life-Cycle.pdf
  - Client Side Business Logic:
    - https://www.snap4city.org/download/video/ClientSideBusinessLogic-WidgetManual.pdf
- **On line cases and documentation**:
  - https://www.snap4city.org/108
  - https://www.snap4city.org/78
  - https://www.snap4city.org/426

# Free Trial

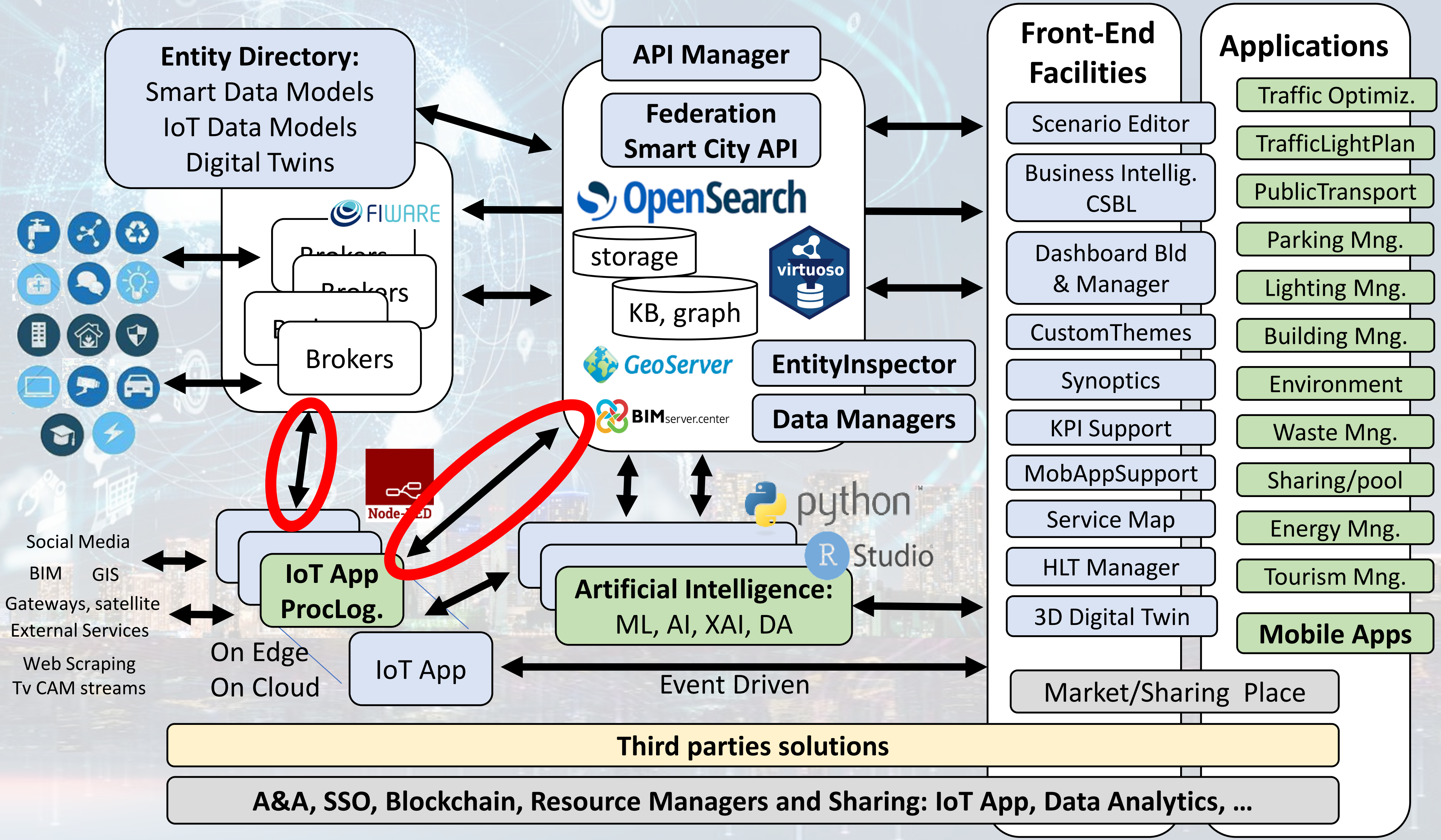
- Register on [WWW.snap4city.org](WWW.snap4city.org)
  - Subscribe on **YOUR Organization**
- **You can:**
  - Access on basic Tools
  - Access to a large volume of Data
  - Create Dashboards
  - Create IOT Applications
  - Connect your IOT Devices
  - Exploit Tutorials and Demonstrations



Varna
Bisevo
Malta
Limassol
Rhodes
Valencia
Firenze2

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

# Technical Architecture



**Entity Directory:**
Smart Data Models
IoT Data Models
Digital Twins

FIWARE

Brokers

**API Manager**

**Federation**
**Smart City API**

OpenSearch

storage

KB, graph

virtuoso

GeoServer

BIMserver.center

**EntityInspector**

**Data Managers**

**Front-End Facilities**

- Scenario Editor
- Business Intellig. CSBL
- Dashboard Bld & Manager
- CustomThemes
- Synoptics
- KPI Support
- MobAppSupport
- Service Map
- HLT Manager
- 3D Digital Twin

**Applications**

- Traffic Optimiz.
- TrafficLightPlan
- PublicTransport
- Parking Mng.
- Lighting Mng.
- Building Mng.
- Environment
- Waste Mng.
- Sharing/pool
- Energy Mng.
- Tourism Mng.
- **Mobile Apps**

Market/Sharing Place

Social Media
BIM GIS
Gateways, satellite
External Services
Web Scraping
Tv CAM streams

Node-RED

**IoT App**
**ProcLog.**

On Edge
On Cloud

IoT App

python

R Studio

**Artificial Intelligence:**
ML, AI, XAI, DA

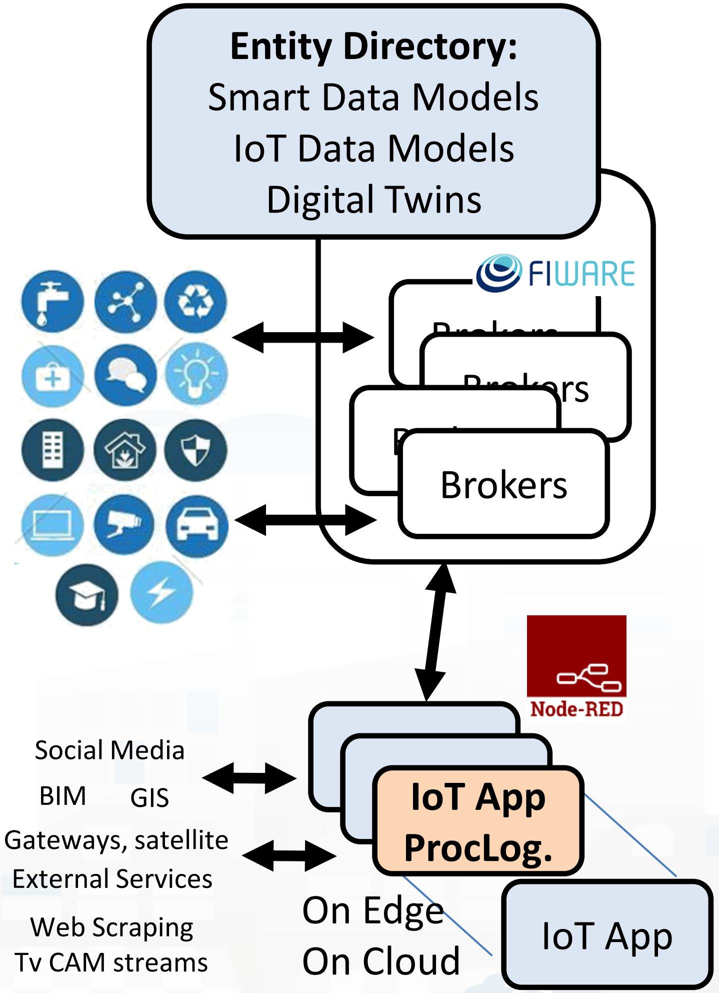
Event Driven

**Third parties solutions**

**A&A, SSO, Blockchain, Resource Managers and Sharing: IoT App, Data Analytics, …**

2025/8

# Data Ingestions Strategy



Entity Directory:
Smart Data Models
IoT Data Models
Digital Twins

FIWARE

Brokers

Node-RED

IoT App
ProcLog.

IoT App

On Edge
On Cloud

Social Media
BIM GIS
Gateways, satellite
External Services
Web Scraping
Tv CAM streams

1 1) Via ***internal Brokers***: NGSI V1/V2, MQTT (beta), JSON

- the data messages arriving in **PUSH** on the platform,
  - if compliant to a known Model **and** referring to a known Device/Entity
  - They are AUTOMATICALLY: *stored, indexed,* and ready to be used by Wizard, Dashboards, Views and Applications

- 2) Via ***external Brokers***: NGSI V2, NGSI LD (beta), JSON
  - the data messages arriving in **PUSH** on the external broker,
    - Have to be **mapped** to a known Model **and** referring to a known Device/Entity
    - To be AUTOMATICALLY: *stored, indexed,* and ready to be used by Wizard, Dashboards, Views and Applications

3 3) Via **any other broker, GateWay, API, server, WebService, database, protocol and/or format of the many available on Snap4City, in PUSH/PULL have to be**

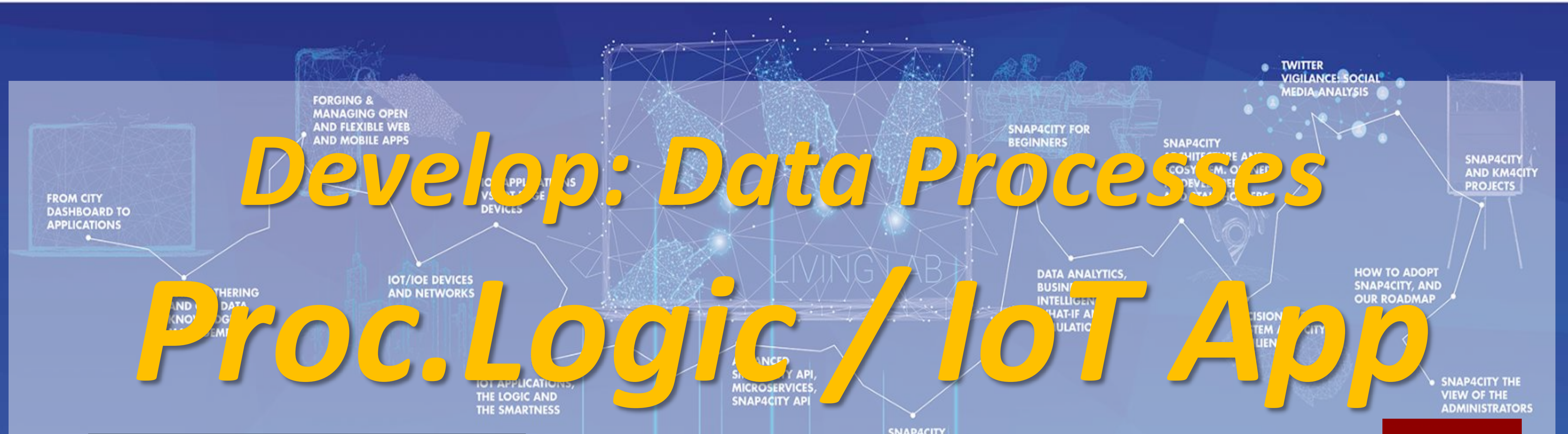
- **mapped** on an Snap4City IoT/Entity Model and Entity/Device Instance
- **ingested in real time or batch**, by a process implemented as
  - an **IoT App/Proc.Logic, on container, on cloud or Edge**
  - a **Python or other language, on container, on cloud or Edge**

# Basic Concepts of Data Ingestion for 1 3

- **Basic entity elements**
  - – Static and Real-Time / Time Series
  - – Classification of Entities
  - – References among Entities
- **Knowledge Base: Modelling and ServiceURI as Entity Identifier**
  - – Entity Indexing and Unified Identifications
- **Models vs Devices/Entities and Registration**
  - – Entity Models / IoT Device Models
  - – Entity Instanced / IoT Device Instances
  - – Messages over time/version
  - – Variable as Attributes

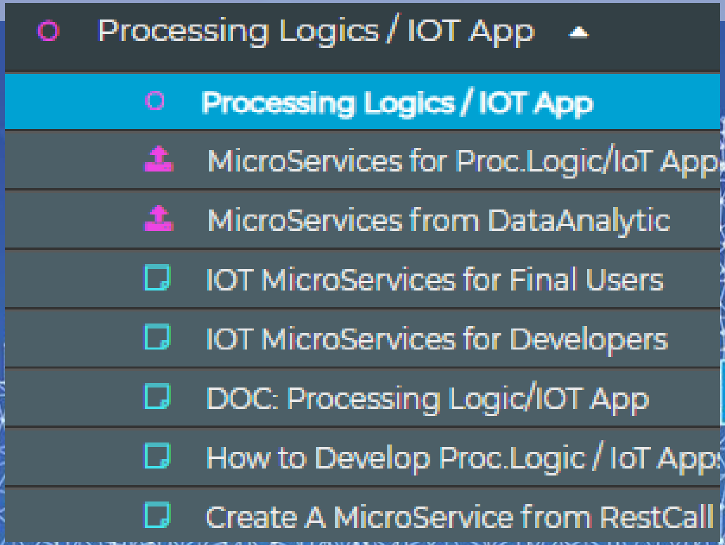
# Terminology

| Former name | new name, from 2023 | What |
|---|---|---|
| **IoT Device Model** | Entity Model | A data model |
| **IoT Device** | Entity Instance | A data instance ready to get message for time series |
| **IoT Device Variable, metric** | Entity Variable | A variable of an Entity Instance or of an Entity Model |
| **IoT Device Message, device message** | Entity Message | A data message |
| **IoT Directory** | Entity Directory | The tool for managing models, entities, data models, etc. |
| **IoT Applications,**<br>**IoT App** | Processing Logic | = Node-RED + Snap4City Libraries<br>The tool for visual programming, node-red JavaScript, data flow, ingestion logic, data transformation, data loading, interoperability, business logic. |
| **Dashboards** | Views and Dashboards | The Snap4City Dashboards are effectively Views of some Web Application, with all the interaction and connection the developer would create among them. |


FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS
FROM CITY DASHBOARD TO APPLICATIONS
IOT/IOE DEVICES AND NETWORKS
IOT APPLICATIONS, THE LOGIC AND THE SMARTNESS
MICROSERVICES, SNAP4CITY API
LIVING LAB
SNAP4CITY FOR BEGINNERS
TWITTER VIGILANCE: SOCIAL MEDIA ANALYSIS
SNAP4CITY AND KM4CITY PROJECTS
DATA ANALYTICS, BUSINESS INTELLIGENCE
HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP
SNAP4CITY THE VIEW OF THE ADMINISTRATORS
SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK

# Develop: Data Processes

# Proc.Logic / IoT App



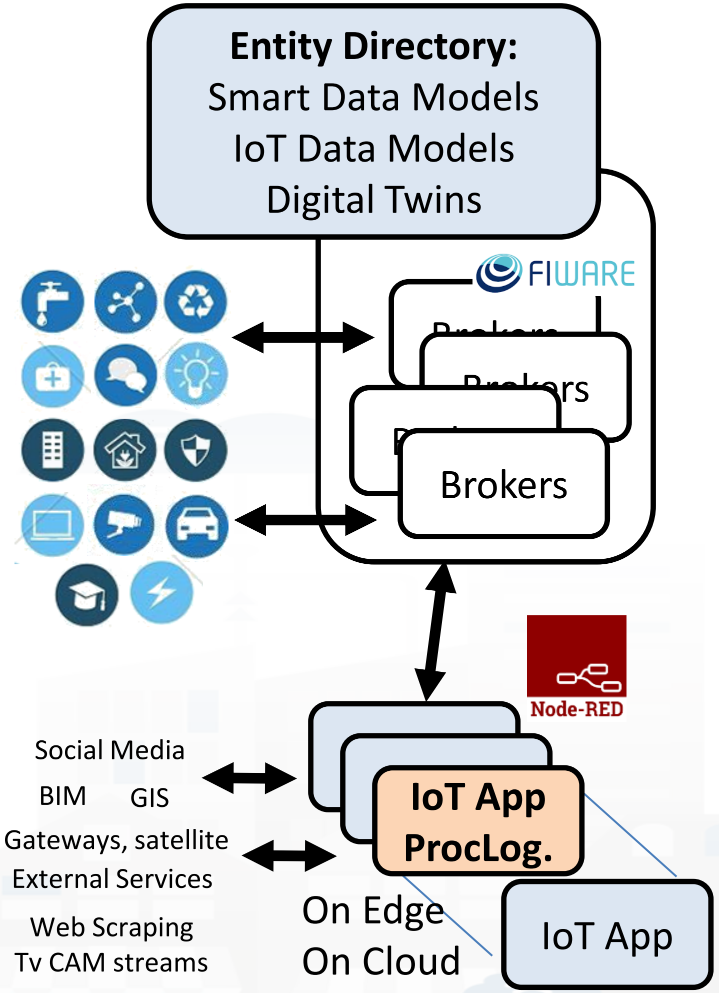
○ Processing Logics / IOT App ▲

○ Processing Logics / IOT App

- MicroServices for Proc.Logic/IoT App
- MicroServices from DataAnalytic
- IOT MicroServices for Final Users
- IOT MicroServices for Developers
- DOC: Processing Logic/IOT App
- How to Develop Proc.Logic / IoT Apps
- Create A MicroService from RestCall

Node-RED

# Data Ingestions Strategy



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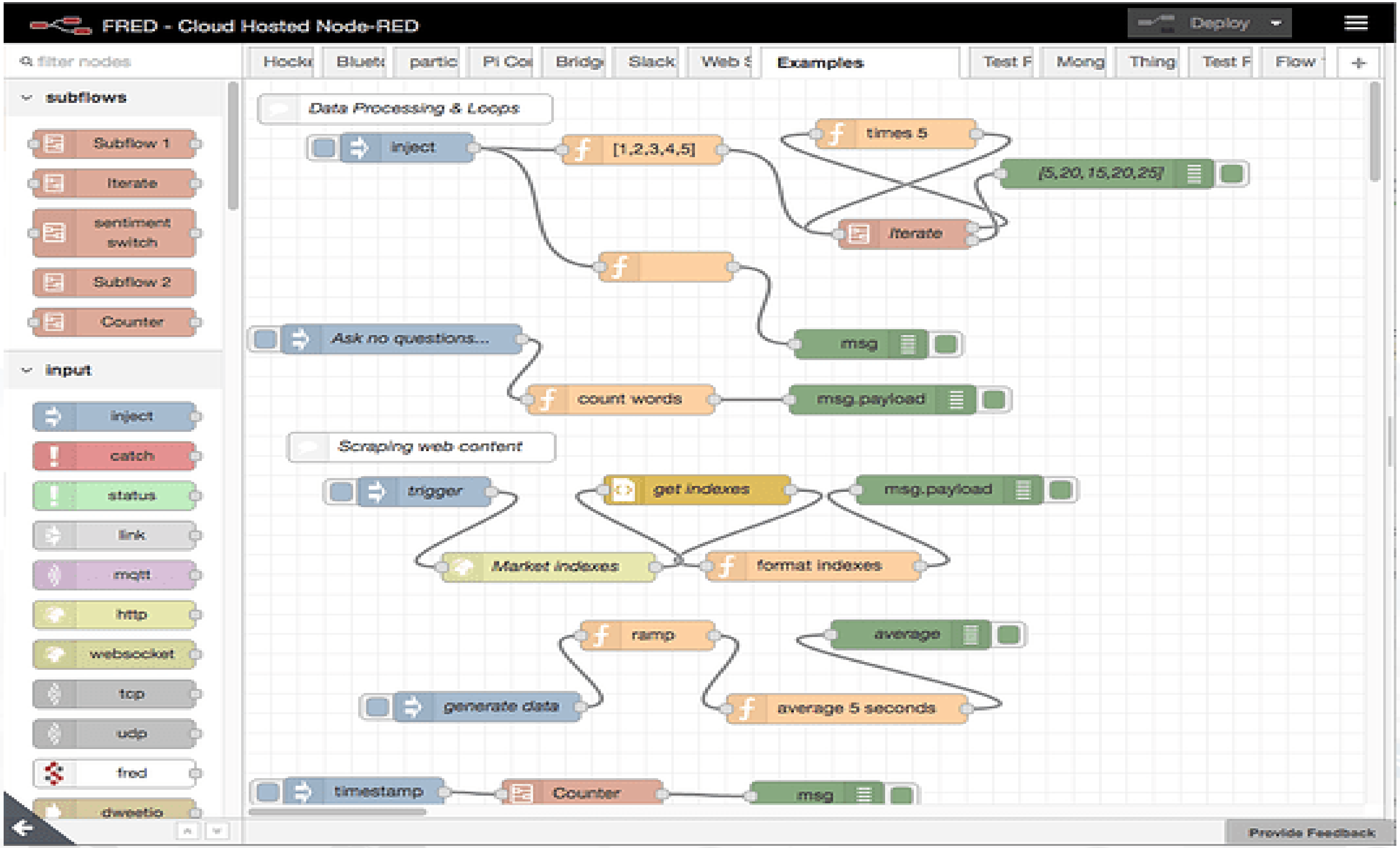
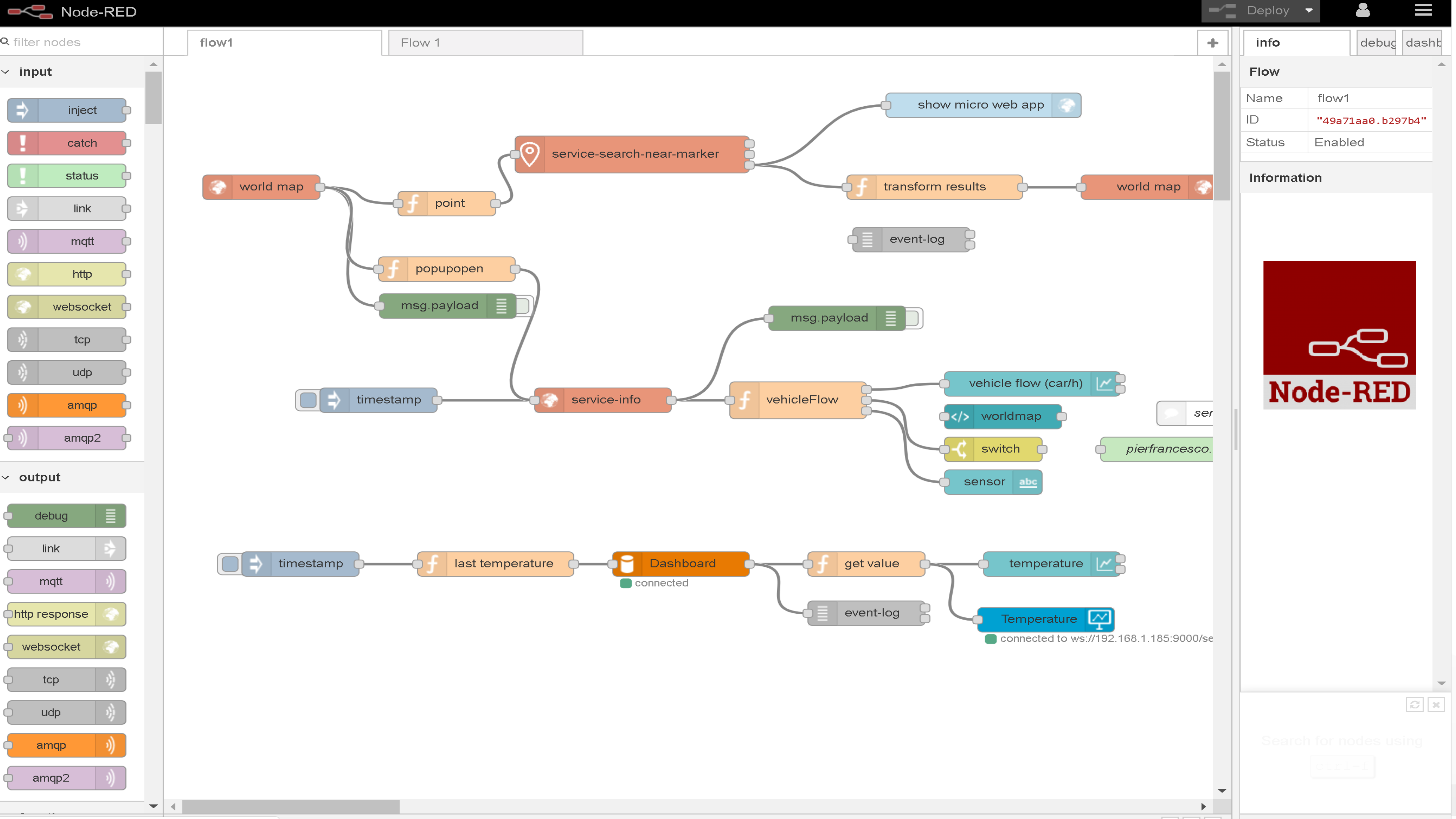

FRED - Cloud Hosted Node-RED
Deploy
filter nodes
Hock
Bluet
partic
Pi Co
Bridg
Slack
Web S
Examples
Test F
Mong
Thing
Test F
Flow
subflows
Subflow 1
Iterate
sentiment switch
Subflow 2
Counter
input
inject
catch
status
link
mqtt
http
websocket
tcp
udp
fred
dweetio
Data Processing & Loops
inject
[1,2,3,4,5]
times 5
[5,20,15,20,25]
Iterate
msg
Ask no questions...
count words
msg.payload
Scraping web content
trigger
get indexes
msg.payload
Market indexes
format indexes
ramp
average
generate data
average 5 seconds
timestamp
Counter
msg
Provide Feedback

# Node-RED

Node-RED

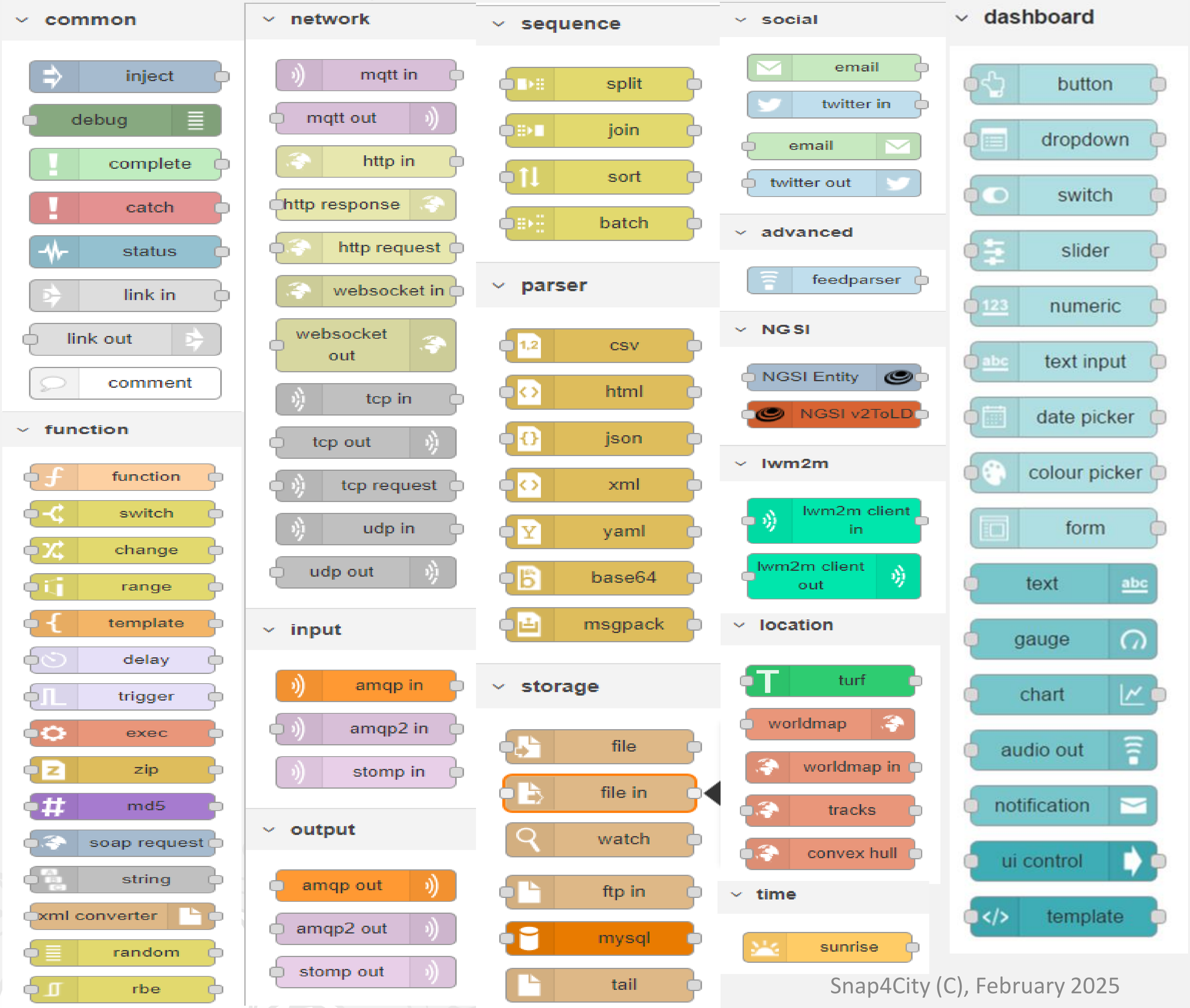


Flow

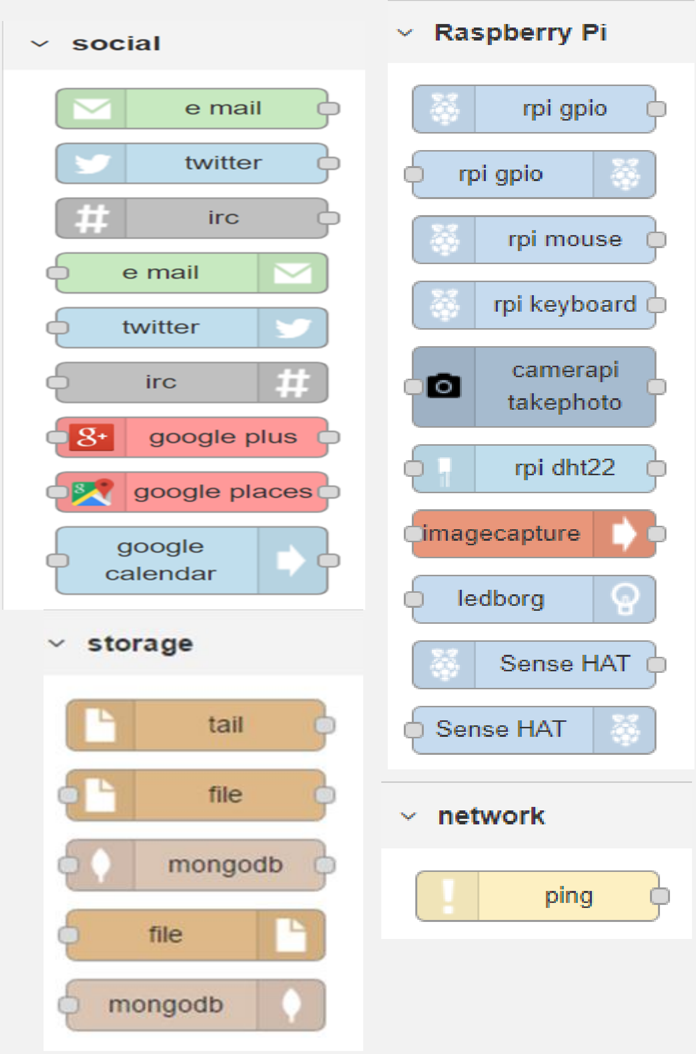
| | |
|---|---|
| Name | flow1 |
| ID | "49a71aa0.b297b4" |
| Status | Enabled |

Information

# Basic Node.js Blocks on NodeRed on our Advanced IOT Apps



## + on IOT Edge Raspberry

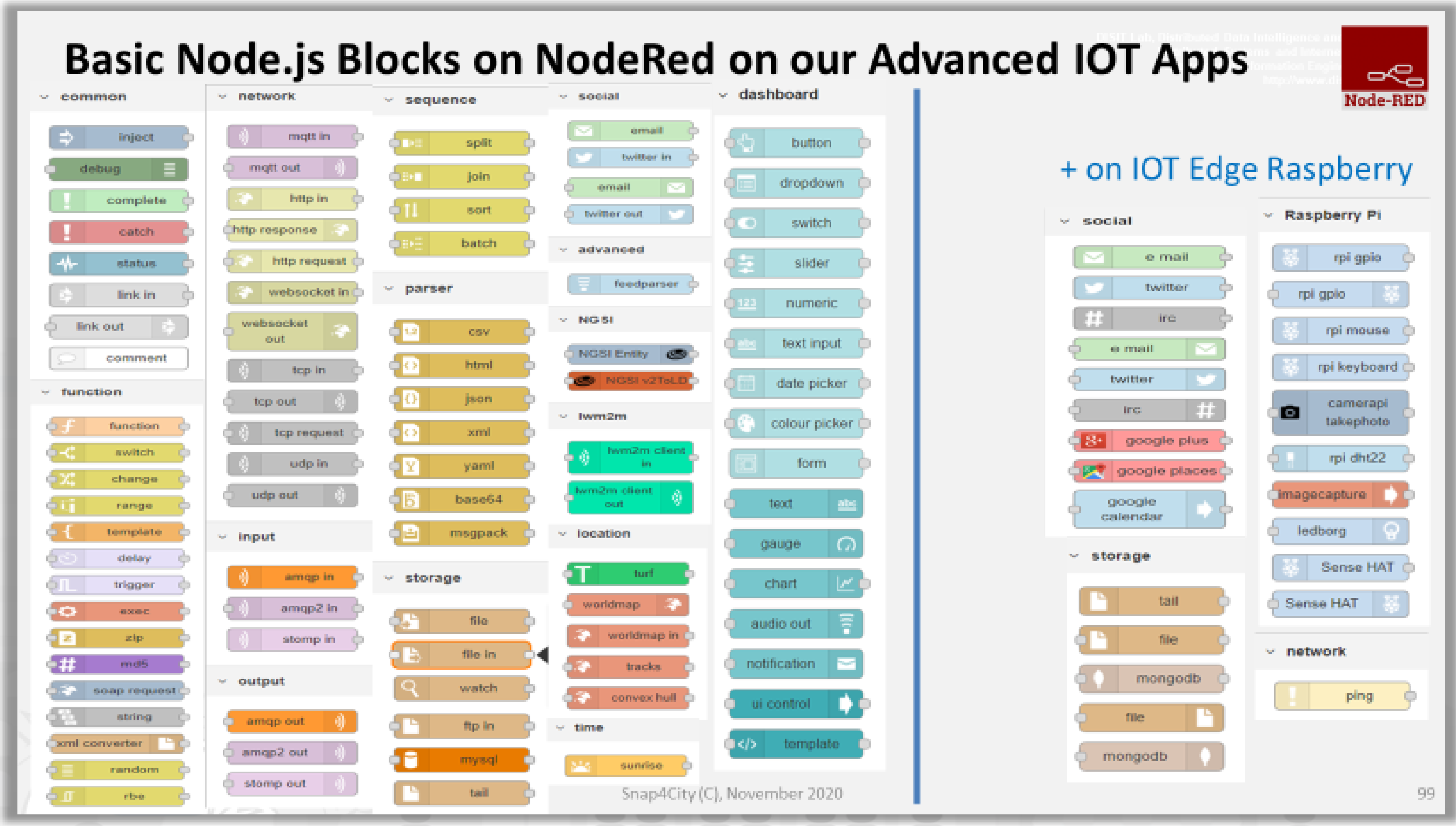


# Node-RED Basic Blocks

It is provided with **a minimum set** of functionalities (the building blocks/nodes) while other blocks can be easily added loading them from a **large library** made available by the **JS Foundation**.

Despite to its diffusion, for the usage in the context of Smart City it was **not powerful** to cope with the **basic requirements** of the domain.

The classical nodes provided in the standard version can be classified as: input, output, function, social, storage, analysis, advanced, and dashboard.



## Basic Node.js Blocks on NodeRed on our Advanced IOT Apps

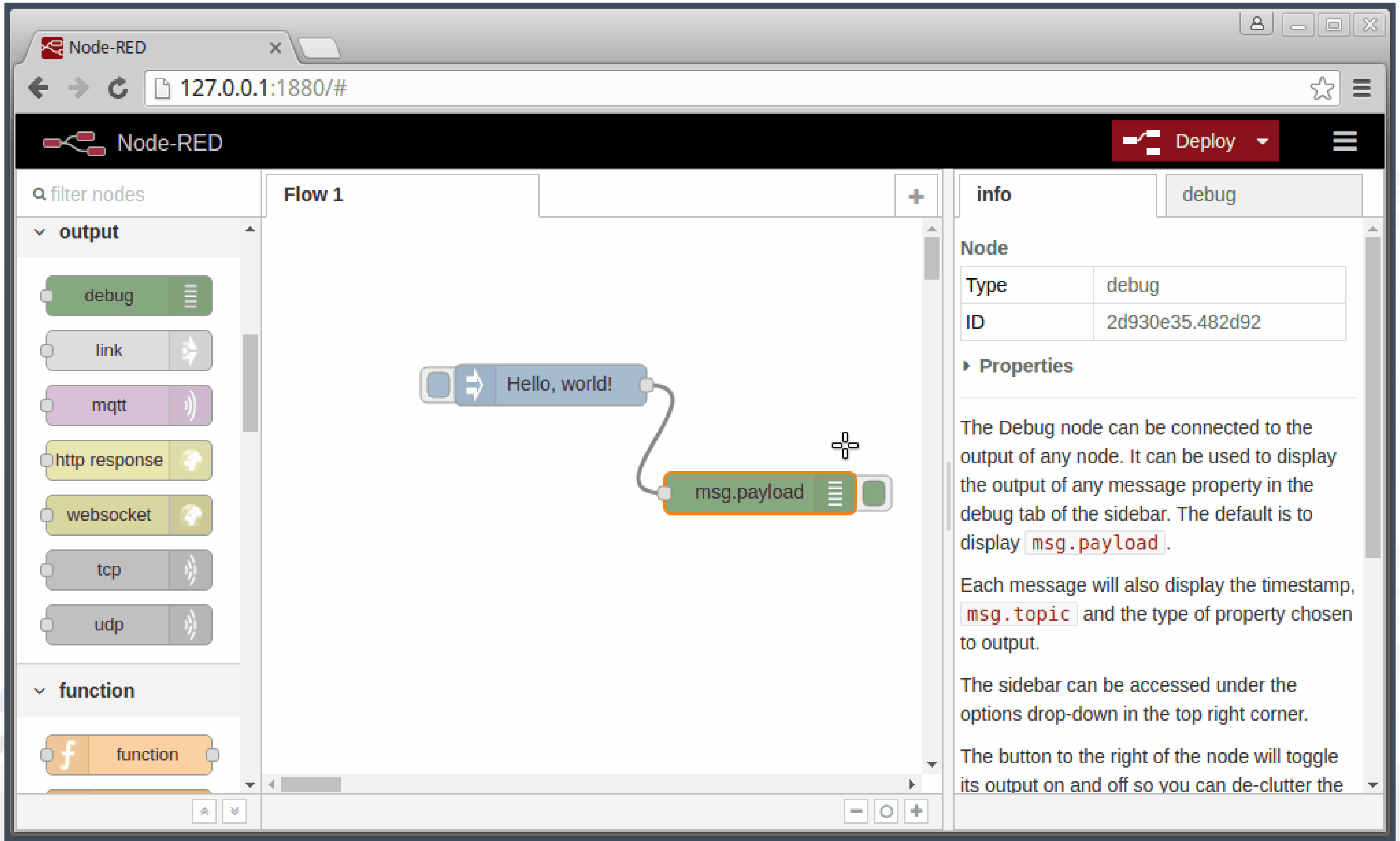
+ on IOT Edge Raspberry

Snap4City (C), November 2020

99

# Hello World of Node-RED

- http://developer.opto22.com/nodered/general/getting-started/node-red-hello-world/



Node

| Type | debug |
|---|---|
| ID | 2d930e35.482d92 |

Properties

The Debug node can be connected to the output of any node. It can be used to display the output of any message property in the debug tab of the sidebar. The default is to display `msg.payload`.

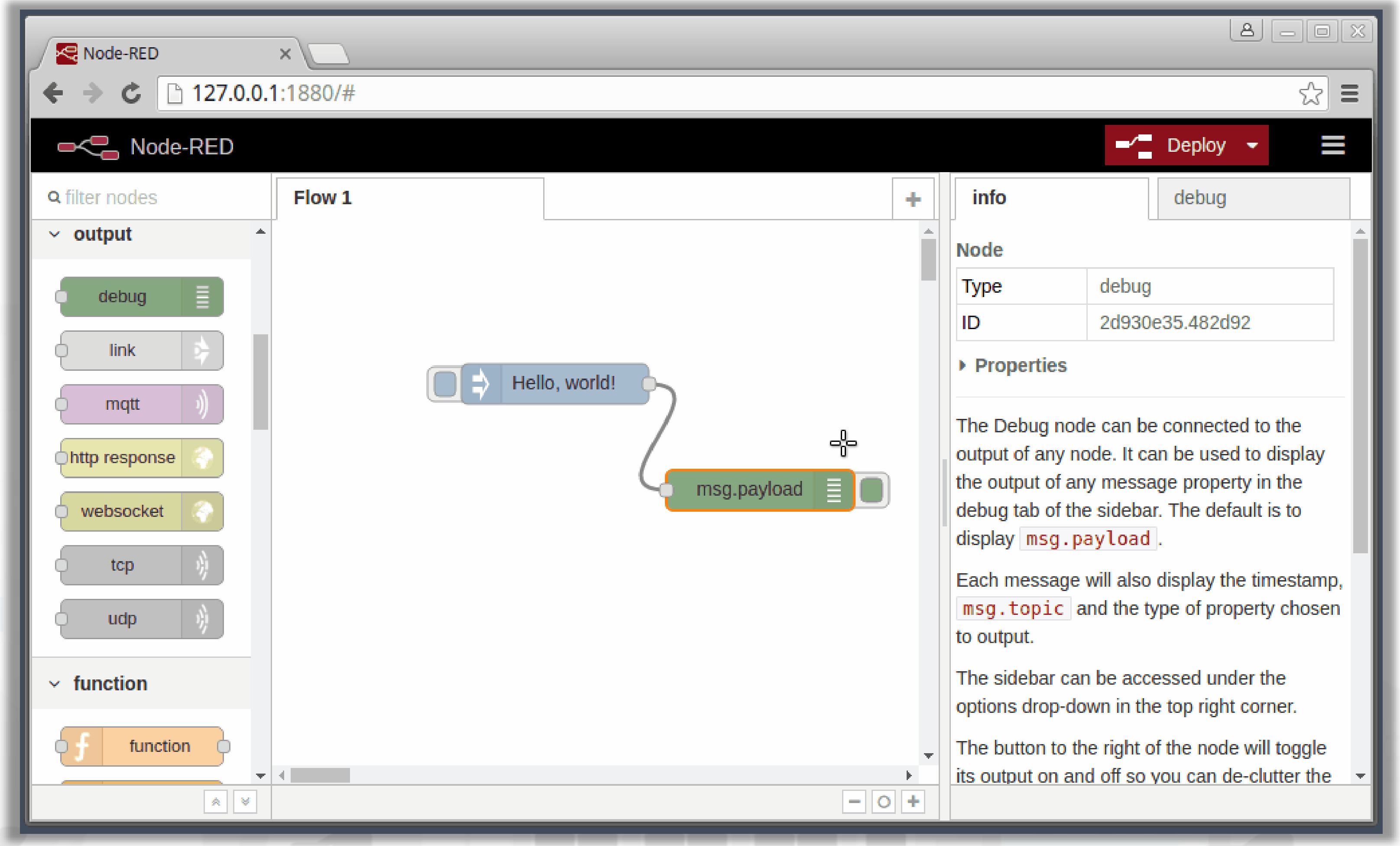
Each message will also display the timestamp, `msg.topic` and the type of property chosen to output.

The sidebar can be accessed under the options drop-down in the top right corner.

The button to the right of the node will toggle its output on and off so you can de-clutter the

# Node-RED

- Node-RED is a **flow-based** development tool for visual programming proposed by **JS Foundation**
- The Node-RED approach is a mix of **visual composition** of **nodes/blocks** to compose the so-called **flows** that are concurrently executed by an engine **Node.js**.
- It is quite diffuse being also directly provided into **official releases** of IOT devices as **Raspberry Pi** family
- Based on **Node.js**
- 100% **open source**



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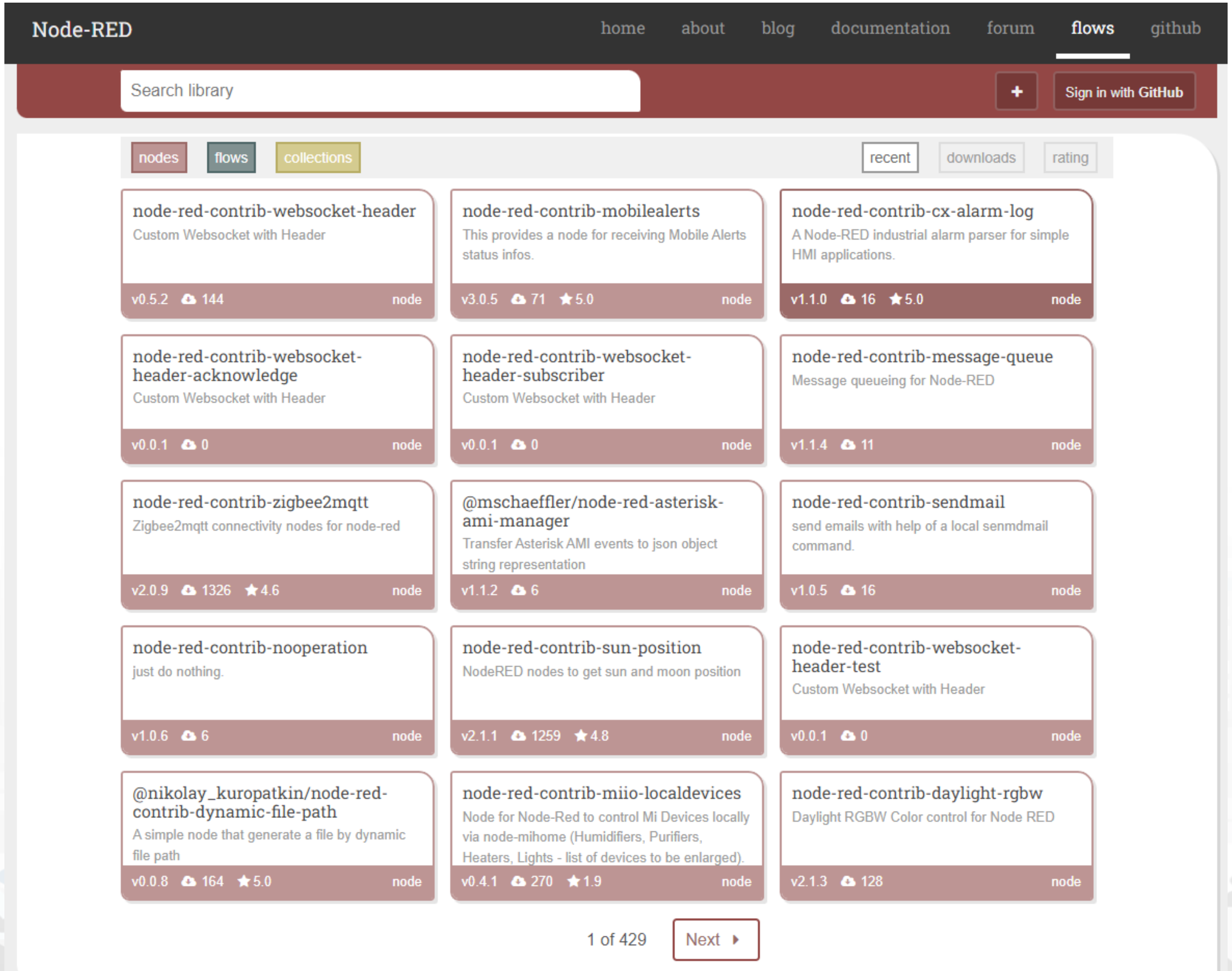
# Node-RED Libraries

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



Node-RED | home | about | blog | documentation | forum | flows | github

Search library | + | Sign in with GitHub

nodes | flows | collections | recent | downloads | rating

node-red-contrib-websocket-header
Custom Websocket with Header
v0.5.2 ☁ 144 node

node-red-contrib-mobilealerts
This provides a node for receiving Mobile Alerts status infos.
v3.0.5 ☁ 71 ★ 5.0 node

node-red-contrib-cx-alarm-log
A Node-RED industrial alarm parser for simple HMI applications.
v1.1.0 ☁ 16 ★ 5.0 node

node-red-contrib-websocket-header-acknowledge
Custom Websocket with Header
v0.0.1 ☁ 0 node

node-red-contrib-websocket-header-subscriber
Custom Websocket with Header
v0.0.1 ☁ 0 node

node-red-contrib-message-queue
Message queueing for Node-RED
v1.1.4 ☁ 11 node

node-red-contrib-zigbee2mqtt
Zigbee2mqtt connectivity nodes for node-red
v2.0.9 ☁ 1326 ★ 4.6 node

@mschaeffler/node-red-asterisk-ami-manager
Transfer Asterisk AMI events to json object string representation
v1.1.2 ☁ 6 node

node-red-contrib-sendmail
send emails with help of a local senmdmail command.
v1.0.5 ☁ 16 node

node-red-contrib-nooperation
just do nothing.
v1.0.6 ☁ 6 node

node-red-contrib-sun-position
NodeRED nodes to get sun and moon position
v2.1.1 ☁ 1259 ★ 4.8 node

node-red-contrib-websocket-header-test
Custom Websocket with Header
v0.0.1 ☁ 0 node

@nikolay_kuropatkin/node-red-contrib-dynamic-file-path
A simple node that generate a file by dynamic file path
v0.0.8 ☁ 164 ★ 5.0 node

node-red-contrib-miio-localdevices
Node for Node-Red to control Mi Devices locally via node-mihome (Humidifiers, Purifiers, Heaters, Lights - list of devices to be enlarged).
v0.4.1 ☁ 270 ★ 1.9 node

node-red-contrib-daylight-rgbw
Daylight RGBW Color control for Node RED
v2.1.3 ☁ 128 node

1 of 429 Next ▸

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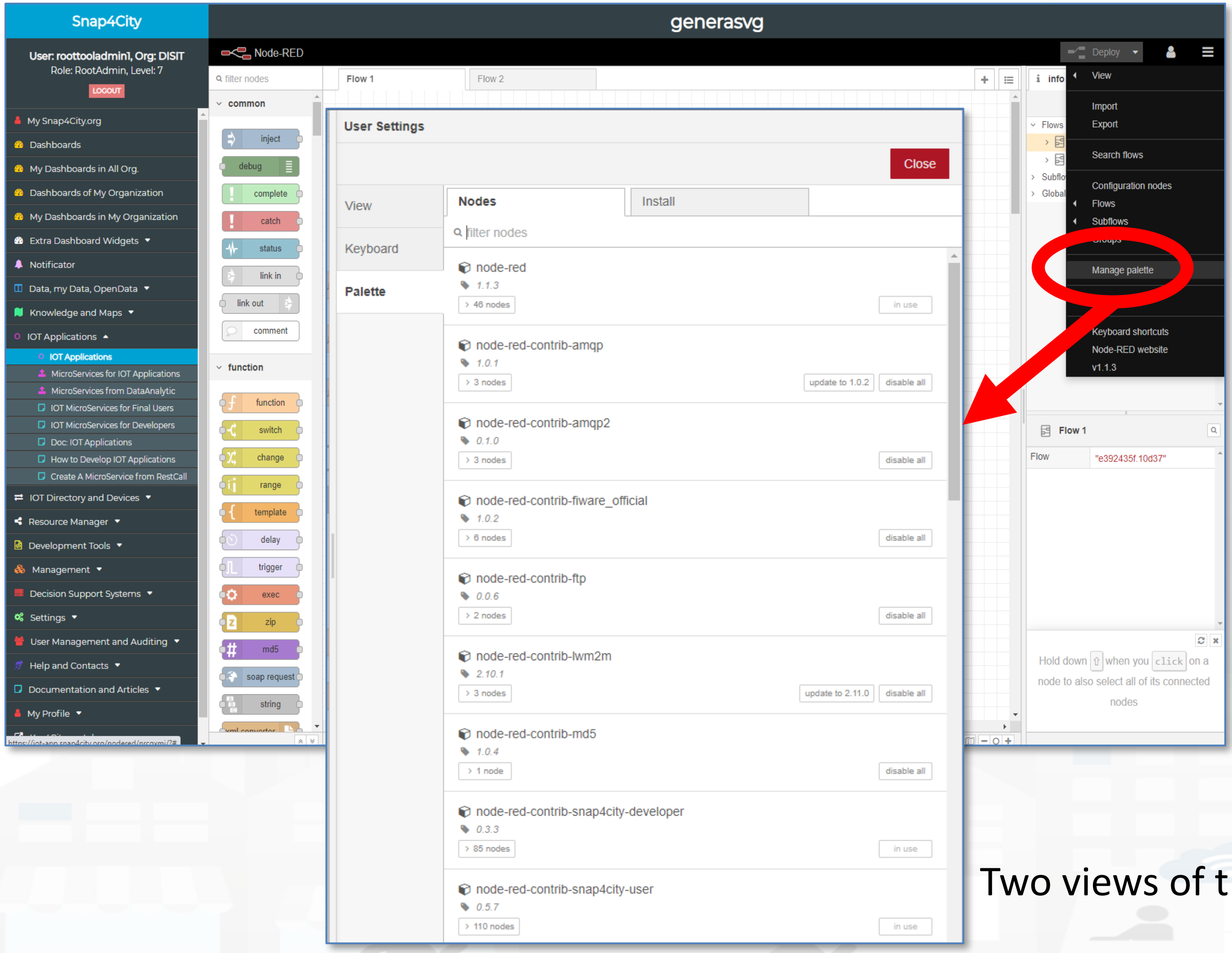
# Load Library from Palette


Snap4City

generasvg

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
- Extra Dashboard Widgets
- Notificator
- Data, my Data, OpenData
- Knowledge and Maps
- IOT Applications
  - IOT Applications
  - MicroServices for IOT Applications
  - MicroServices from DataAnalytic
  - IOT MicroServices for Final Users
  - IOT MicroServices for Developers
  - Doc: IOT Applications
  - How to Develop IOT Applications
  - Create A MicroService from RestCall
- IOT Directory and Devices
- Resource Manager
- Development Tools
- Management
- Decision Support Systems
- Settings
- User Management and Auditing
- Help and Contacts
- Documentation and Articles
- My Profile

Hold down ⇧ when you click on a node to also select all of its connected nodes

User Settings

Close

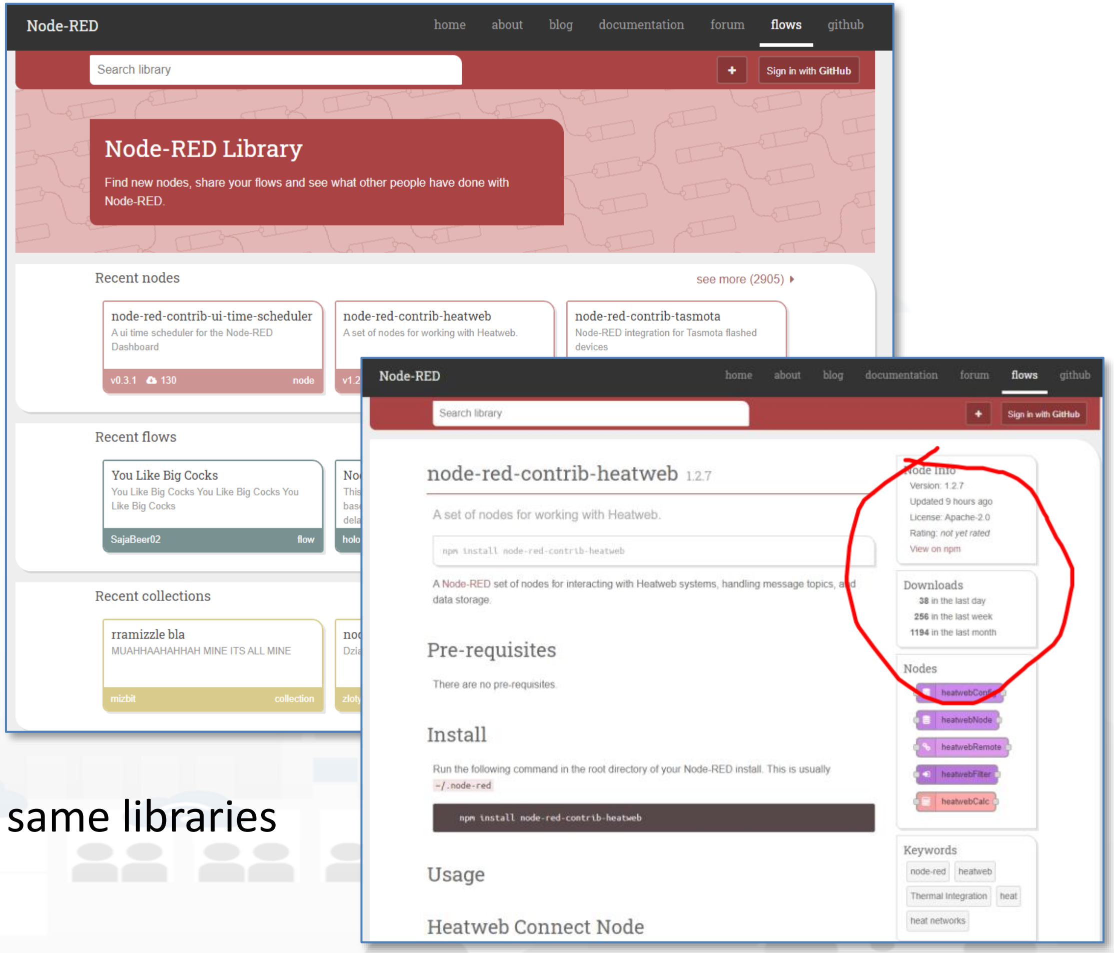
View | Keyboard | Palette

Nodes | Install

filter nodes

| Node | Version | Nodes | Action |
|---|---|---|---|
| node-red | 1.1.3 | 46 nodes | in use |
| node-red-contrib-amqp | 1.0.1 | 3 nodes | update to 1.0.2 · disable all |
| node-red-contrib-amqp2 | 0.1.0 | 3 nodes | disable all |
| node-red-contrib-fiware_official | 1.0.2 | 6 nodes | disable all |
| node-red-contrib-ftp | 0.0.6 | 2 nodes | disable all |
| node-red-contrib-lwm2m | 2.10.1 | 3 nodes | update to 2.11.0 · disable all |
| node-red-contrib-md5 | 1.0.4 | 1 node | disable all |
| node-red-contrib-snap4city-developer | 0.3.3 | 85 nodes | in use |
| node-red-contrib-snap4city-user | 0.5.7 | 110 nodes | in use |

https://flows.nodered.org/



Node-RED Library

Find new nodes, share your flows and see what other people have done with Node-RED.

Recent nodes — see more (2905)

- node-red-contrib-ui-time-scheduler — A ui time scheduler for the Node-RED Dashboard — v0.3.1 · 130 · node
- node-red-contrib-heatweb — A set of nodes for working with Heatweb.
- node-red-contrib-tasmota — Node-RED integration for Tasmota flashed devices

Recent flows

- You Like Big Cocks — You Like Big Cocks You Like Big Cocks You Like Big Cocks — SajaBeer02 · flow

Recent collections

- rramizzle bla — MUAHHAAHAHHAH MINE ITS ALL MINE — mizbit · collection

node-red-contrib-heatweb 1.2.7

A set of nodes for working with Heatweb.

```
npm install node-red-contrib-heatweb
```

A Node-RED set of nodes for interacting with Heatweb systems, handling message topics, and data storage.

Pre-requisites

There are no pre-requisites.

Install

Run the following command in the root directory of your Node-RED install. This is usually ~/.node-red

```
npm install node-red-contrib-heatweb
```

Usage

Heatweb Connect Node

Node Info
Version: 1.2.7
Updated 9 hours ago
License: Apache-2.0
Rating: not yet rated
View on npm

Downloads
38 in the last day
256 in the last week
1194 in the last month

Two views of the same libraries

# Node-RED
# Snap4City Libraries

Node-RED

# Proc.Logic / IoT App Editor: NODE-RED

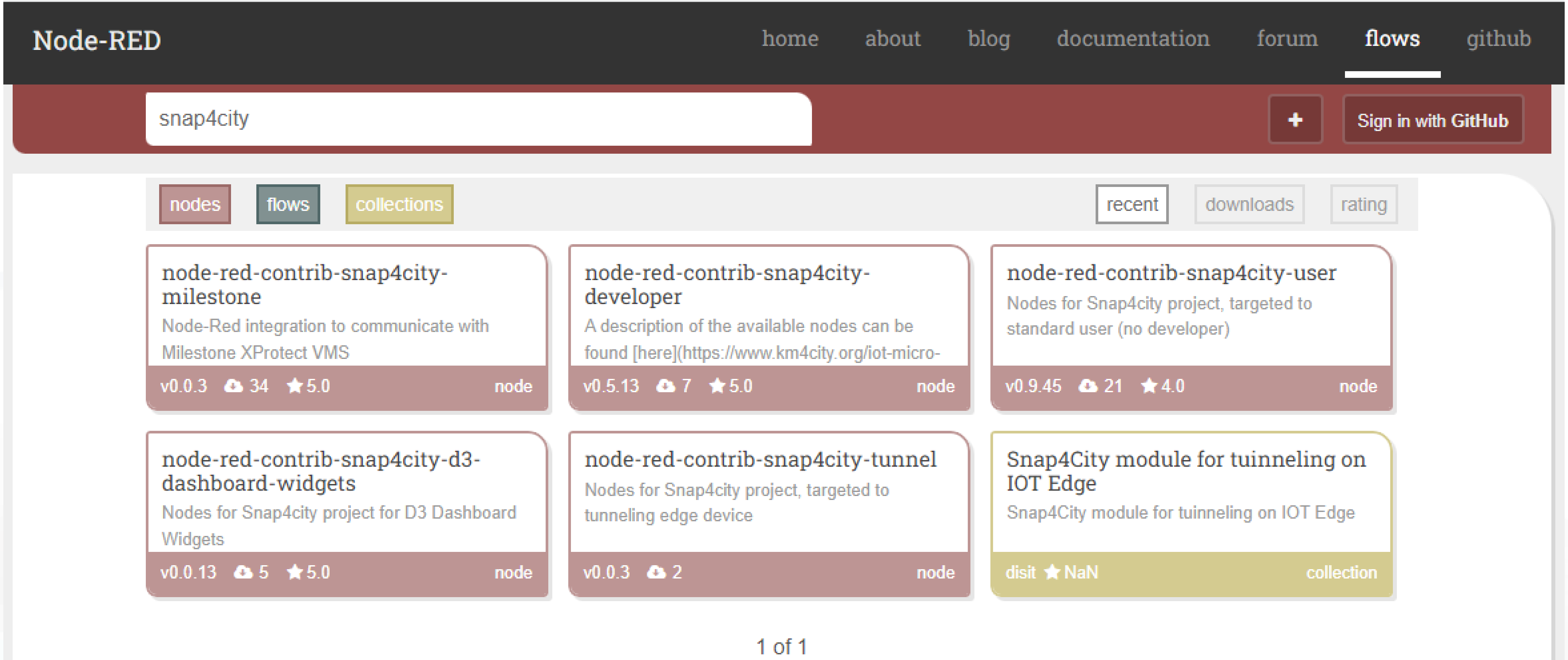
Node-RED

- In the Proc.Logic / **IoT App of Snap4City**, it is possible to:
  - Execute flows that process data as: Event Driven, Batch (periodic or not)
  - Create multiple concurrent Flows for each IoT App / Proc. Logic
  - Create subflows as macros to be reused
  - Create Groups of nodes as macro
  - **Save/load**, **share**, of nodes, flows and applications with other users via
    - the Snap4City Resource Manager or
    - with JS Foundation or
    - via email, skype, file sharing in general
  - ..

# IoT App / Proc.Logic Editor: NODE-RED

- In the **IoT Apps / Proc.Logic of Snap4City**, it is possible to Extend the Capabilities:
  - Load other Nodes, segments of flow and entire flows from several sources: email, libraries, S4C repository, etc.
  - Load other libraries of MicroServices/Nodes/Blocks from **Manage Palette**
    - A large set of Libraries of Node is available.
    - The loading may have some limitations for security reasons
  - **Get more IOT App / Proc.Logic** above the Limit that may depend on the organization and/or on personal authorizations, ask to Admin
  - ..

# Snap4City Libraries on Node-RED



**node-red-contrib-snap4city-milestone**
Node-Red integration to communicate with Milestone XProtect VMS
v0.0.3 ☁ 34 ★ 5.0 node

**node-red-contrib-snap4city-developer**
A description of the available nodes can be found [here](https://www.km4city.org/iot-micro-
v0.5.13 ☁ 7 ★ 5.0 node

**node-red-contrib-snap4city-user**
Nodes for Snap4city project, targeted to standard user (no developer)
v0.9.45 ☁ 21 ★ 4.0 node

**node-red-contrib-snap4city-d3-dashboard-widgets**
Nodes for Snap4city project for D3 Dashboard Widgets
v0.0.13 ☁ 5 ★ 5.0 node

**node-red-contrib-snap4city-tunnel**
Nodes for Snap4city project, targeted to tunneling edge device
v0.0.3 ☁ 2 node

**Snap4City module for tuinneling on IOT Edge**
Snap4City module for tuinneling on IOT Edge
disit ★ NaN collection

1 of 1

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

# Snap4City Libraries on Node-RED

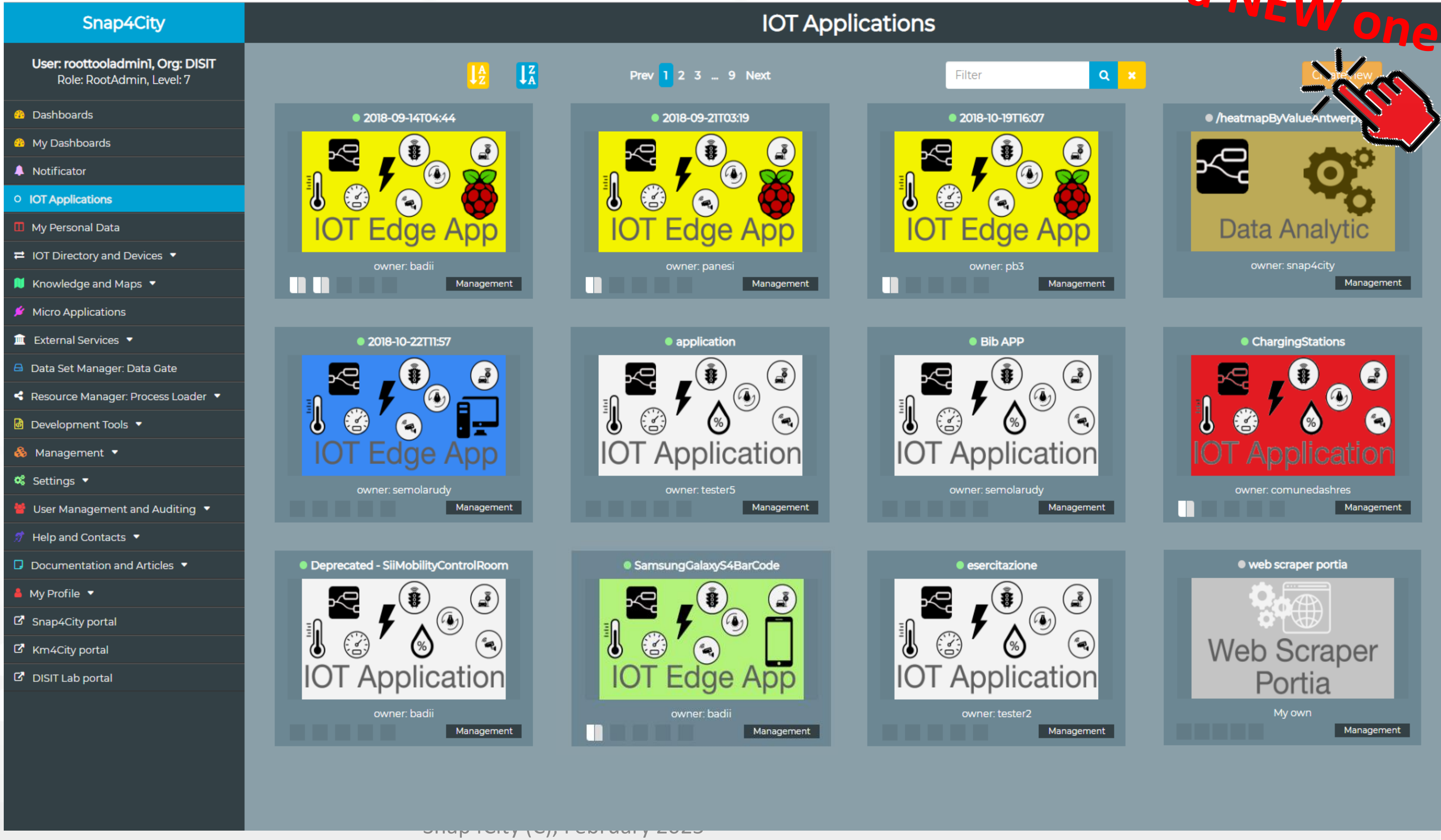
- https://flows.nodered.org/search?term=snap4city
  - ○ https://flows.nodered.org/node/node-red-contrib-snap4city-user
  - ○ https://flows.nodered.org/node/node-red-contrib-snap4city-developer
  - ○ https://flows.nodered.org/node/node-red-contrib-snap4city-d3-dashboard-widgets
  - ○ https://flows.nodered.org/node/node-red-contrib-snap4city-tunnel
  - ○ https://flows.nodered.org/node/node-red-contrib-snap4city-milestone
  - ○ https://flows.nodered.org/node/node-red-contrib-snap4city-clearml

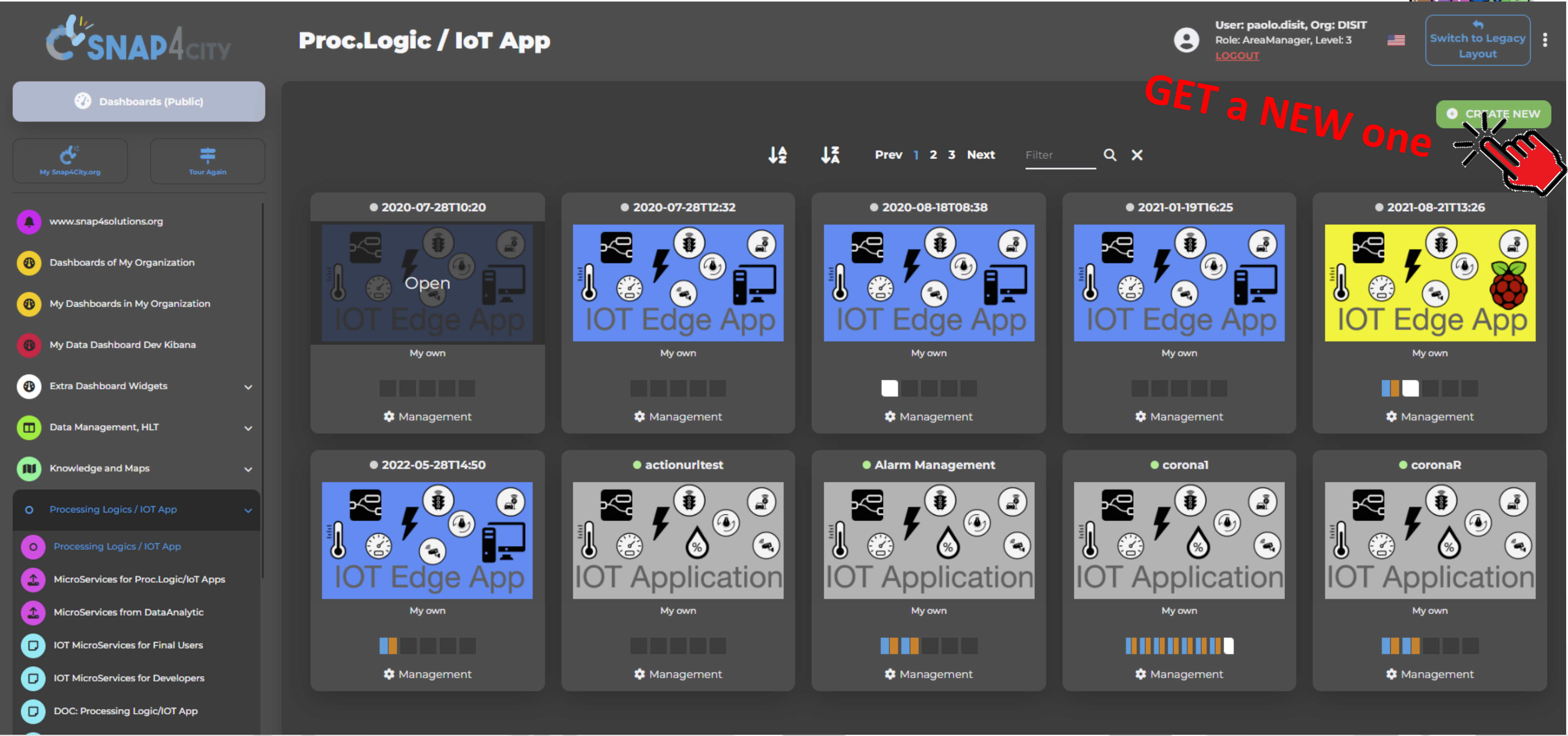
# Node-RED in SnaP4City

# IOT Application/Proc.Logic Listing

GET a NEW one

- Basic (white)
- Advanced (red)
- IoT Edge
  - Raspberry Pi
  - Android
  - Win/Linux
- Data Analytic (Plumber)
- Web Scraper (Portia)




SNAP4CITY
Proc.Logic / IoT App
User: paolo.disit, Org: DISIT
Role: AreaManager, Level: 3
LOGOUT
Switch to Legacy Layout
Dashboards (Public)
My Snap4City.org
Tour Again
www.snap4solutions.org
Dashboards of My Organization
My Dashboards in My Organization
My Data Dashboard Dev Kibana
Extra Dashboard Widgets
Data Management, HLT
Knowledge and Maps
Processing Logics / IOT App
Processing Logics / IOT App
MicroServices for Proc.Logic/IoT Apps
MicroServices from DataAnalytic
IOT MicroServices for Final Users
IOT MicroServices for Developers
DOC: Processing Logic/IOT App
CREATE NEW
Prev 1 2 3 Next
Filter
2020-07-28T10:20
Open
IOT Edge App
My own
Management
2020-07-28T12:32
IOT Edge App
My own
Management
2020-08-18T08:38
IOT Edge App
My own
Management
2021-01-19T16:25
IOT Edge App
My own
Management
2021-08-21T13:26
IOT Edge App
My own
Management
2022-05-28T14:50
IOT Edge App
My own
Management
actionurltest
IOT Application
My own
Management
Alarm Management
IOT Application
My own
Management
corona1
IOT Application
My own
Management
coronaR
IOT Application
My own
Management

GET a NEW one

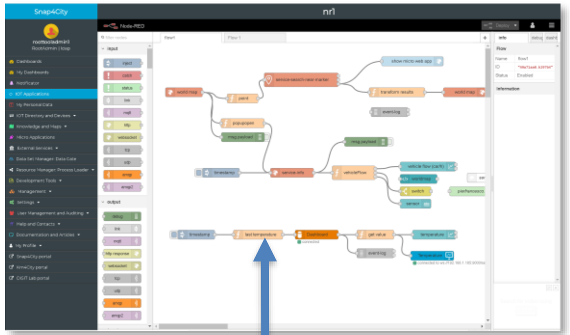
# IOT Applications Listing

– Basic / Advanced

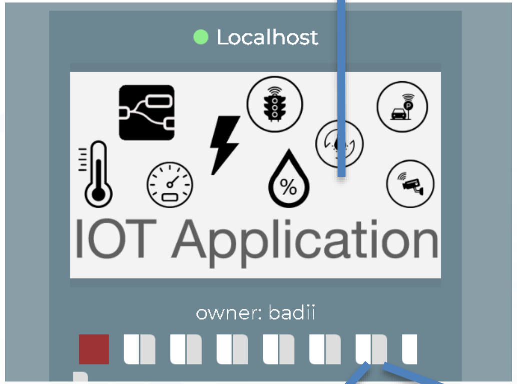
– On IOT Edge Raspberry Pi

– On IOT Edge Android

– On IOT Edge Win/Linux

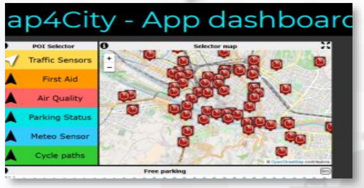


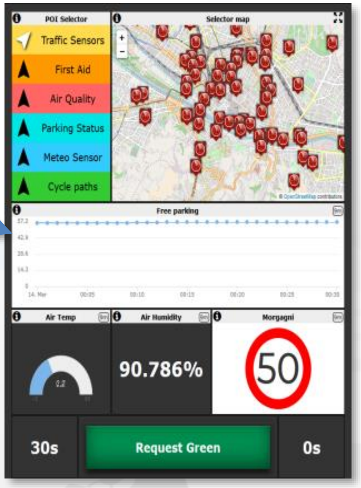
EDIT IOT APP

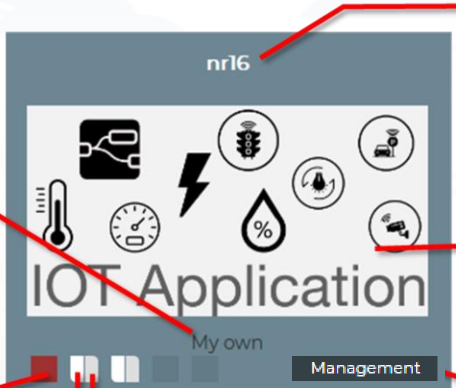


VIEW

EDIT







IOT App title

Ownership of the IOT App

Click the icon to edit the IOT App

Click to open the Node-RED IOT App dashboard

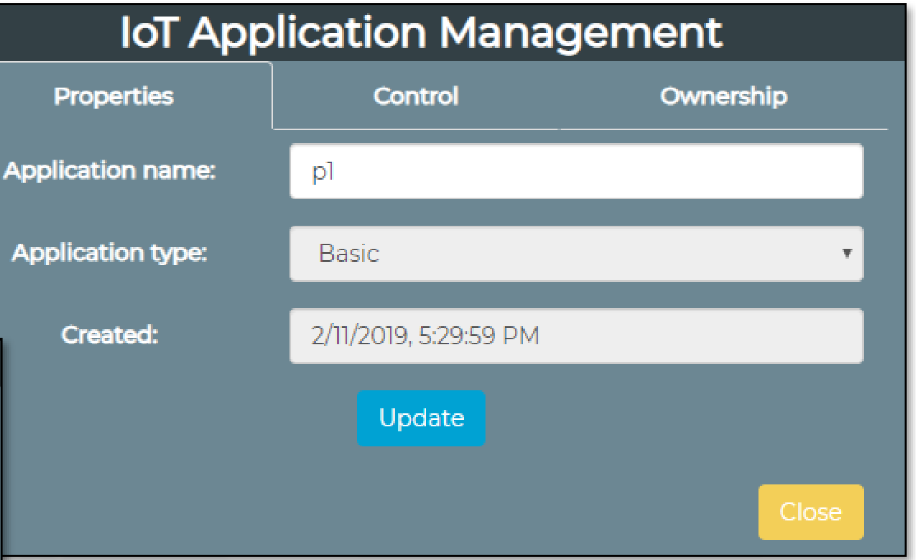
Click to edit IOT App properties

Click to view the Snap4City Dashboard

Click to edit the Snap4City Dashboard

# IOT Application Self Control

- **Properties**
  - Name, Type, Creation date
- **Control**
  - Restart Container
  - Delete IOT App
- **Change of ownership**
  - Pass to another Snap4City User
- **From inside the IOT App**
  - Restart
  - Update Snap4City Library



IoT Application Management

Properties | Control | Ownership

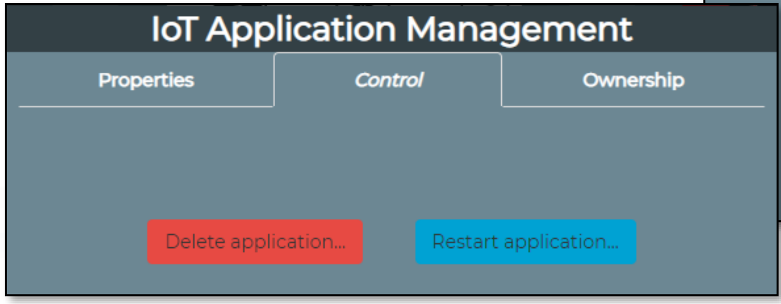
Application name: p1

Application type: Basic

Created: 2/11/2019, 5:29:59 PM

Update

Close

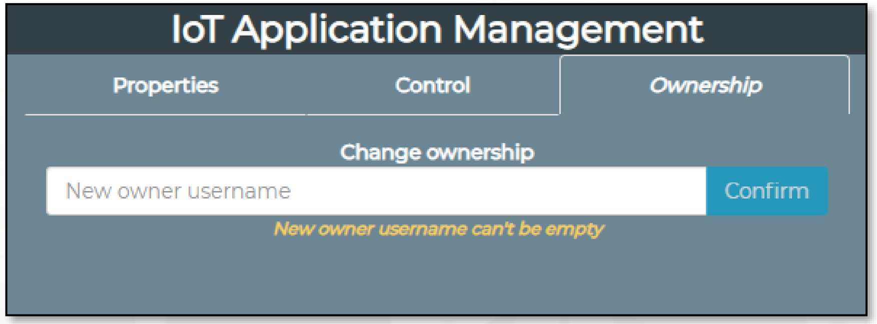


IoT Application Management

Properties | *Control* | Ownership

Delete application...

Restart application...



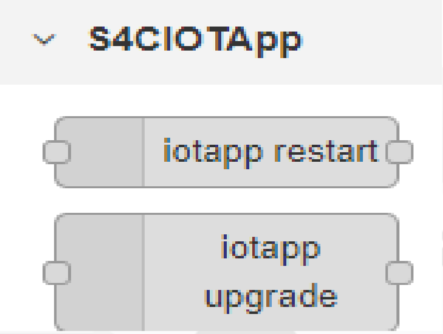
IoT Application Management

Properties | Control | *Ownership*

Change ownership

New owner username | Confirm

*New owner username can't be empty*



S4CIOTApp

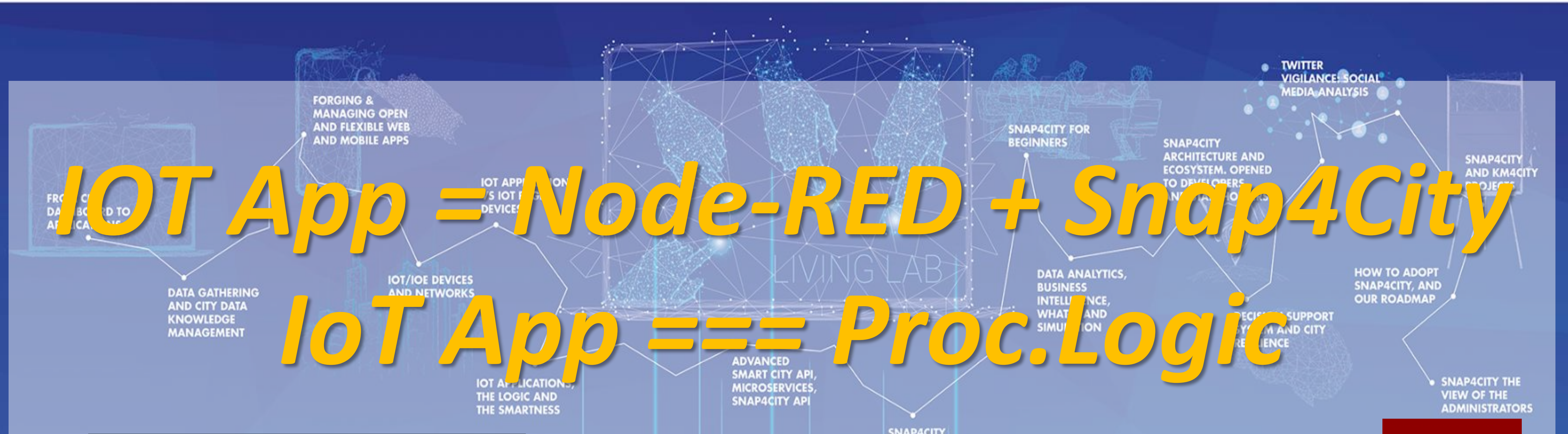
iotapp restart

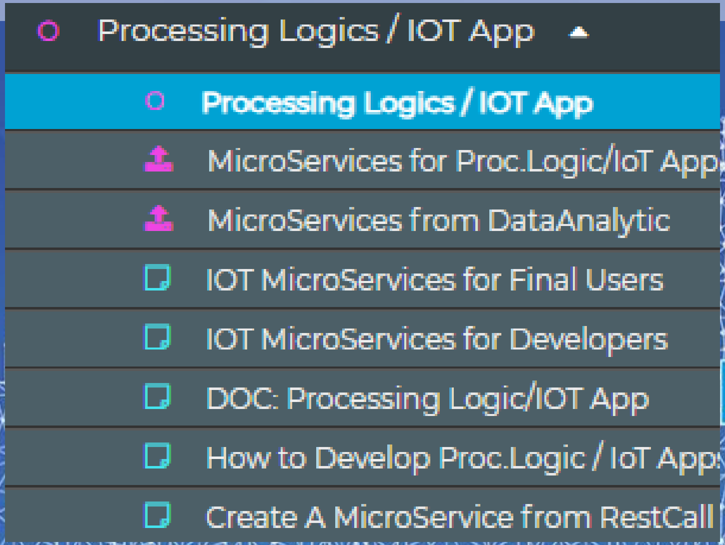
iotapp upgrade

Automating restart and update

# IOT App = Node-RED + Snap4City

# IoT App === Proc.Logic


FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS
TWITTER VIGILANCE: SOCIAL MEDIA ANALYSIS
SNAP4CITY FOR BEGINNERS
SNAP4CITY ARCHITECTURE AND ECOSYSTEM. OPENED TO DEVELOPERS
SNAP4CITY AND KM4CITY PROJECTS
IOT/IOE DEVICES AND NETWORKS
DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT
LIVING LAB
DATA ANALYTICS, BUSINESS INTELLIGENCE, WHAT IF AND SIMULATION
HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP
DECISION SUPPORT SYSTEM AND CITY RESILIENCE
ADVANCED SMART CITY API, MICROSERVICES, SNAP4CITY API
IOT APPLICATIONS, THE LOGIC AND THE SMARTNESS
SNAP4CITY THE VIEW OF THE ADMINISTRATORS
SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK


○ Processing Logics / IOT App ▲

○ Processing Logics / IOT App

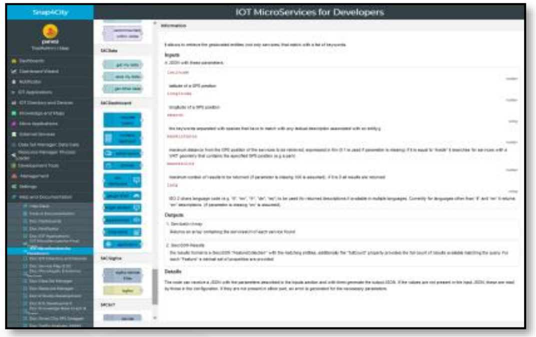
- MicroServices for Proc.Logic/IoT App
- MicroServices from DataAnalytic
- IOT MicroServices for Final Users
- IOT MicroServices for Developers
- DOC: Processing Logic/IOT App
- How to Develop Proc.Logic / IoT Apps
- Create A MicroService from RestCall

Node-RED

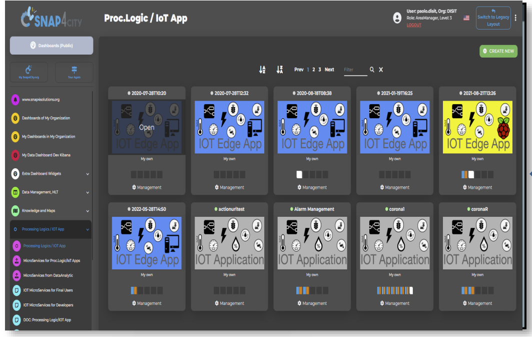
# IOT Applications Development

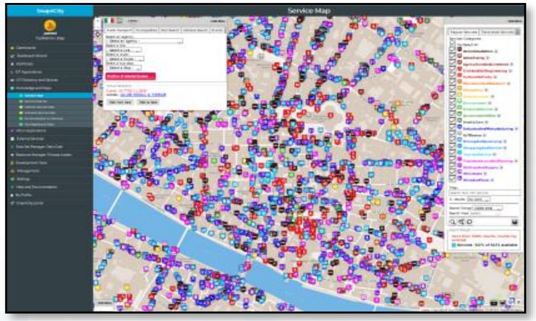
IOT Discovering

MicroServices collections

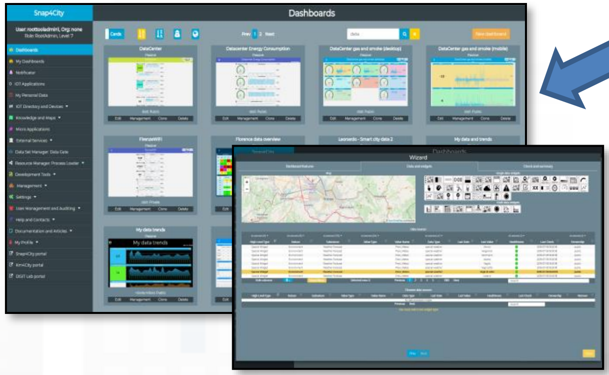


My IOT Applications



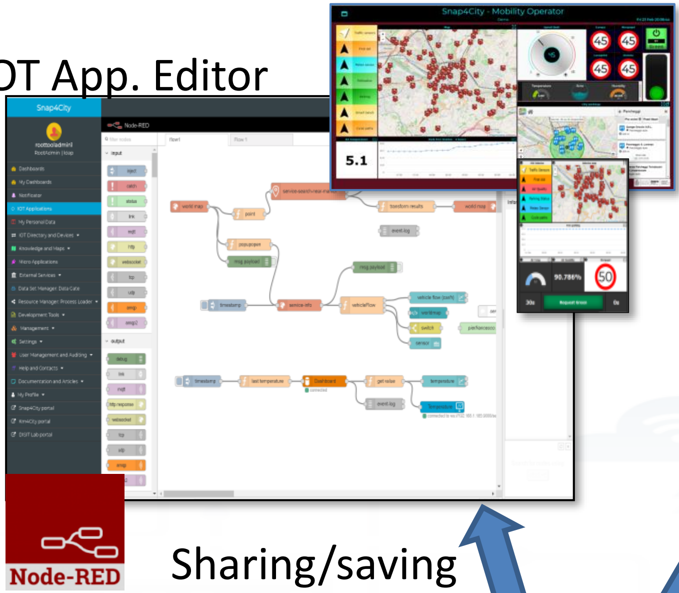


ServiceMap Discovery



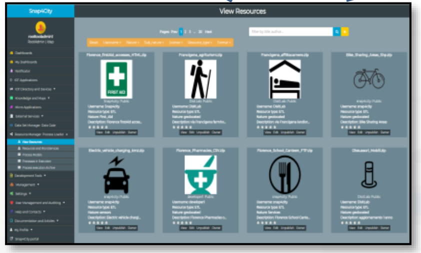
Dashboard Collection, Editor and Wizard

IOT App. Editor



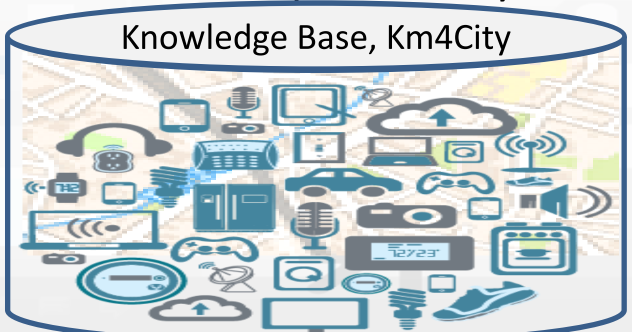
Generating IOT App With Dashboard

Sharing/saving reusing IOT App



Resource Manager

Knowledge Base, Km4City



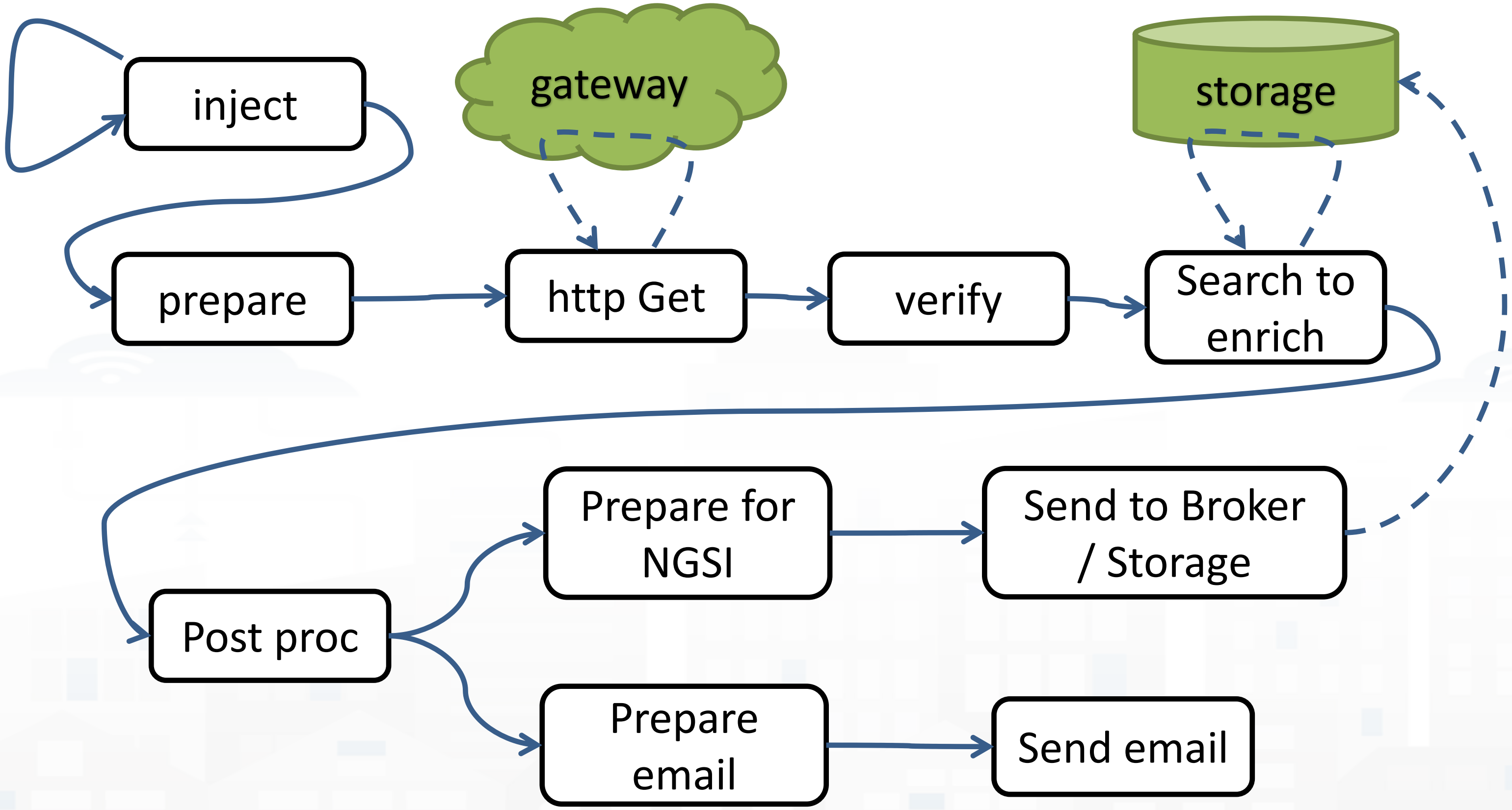
# Develop Snap4City IoTApp Processing Logic

Node-RED

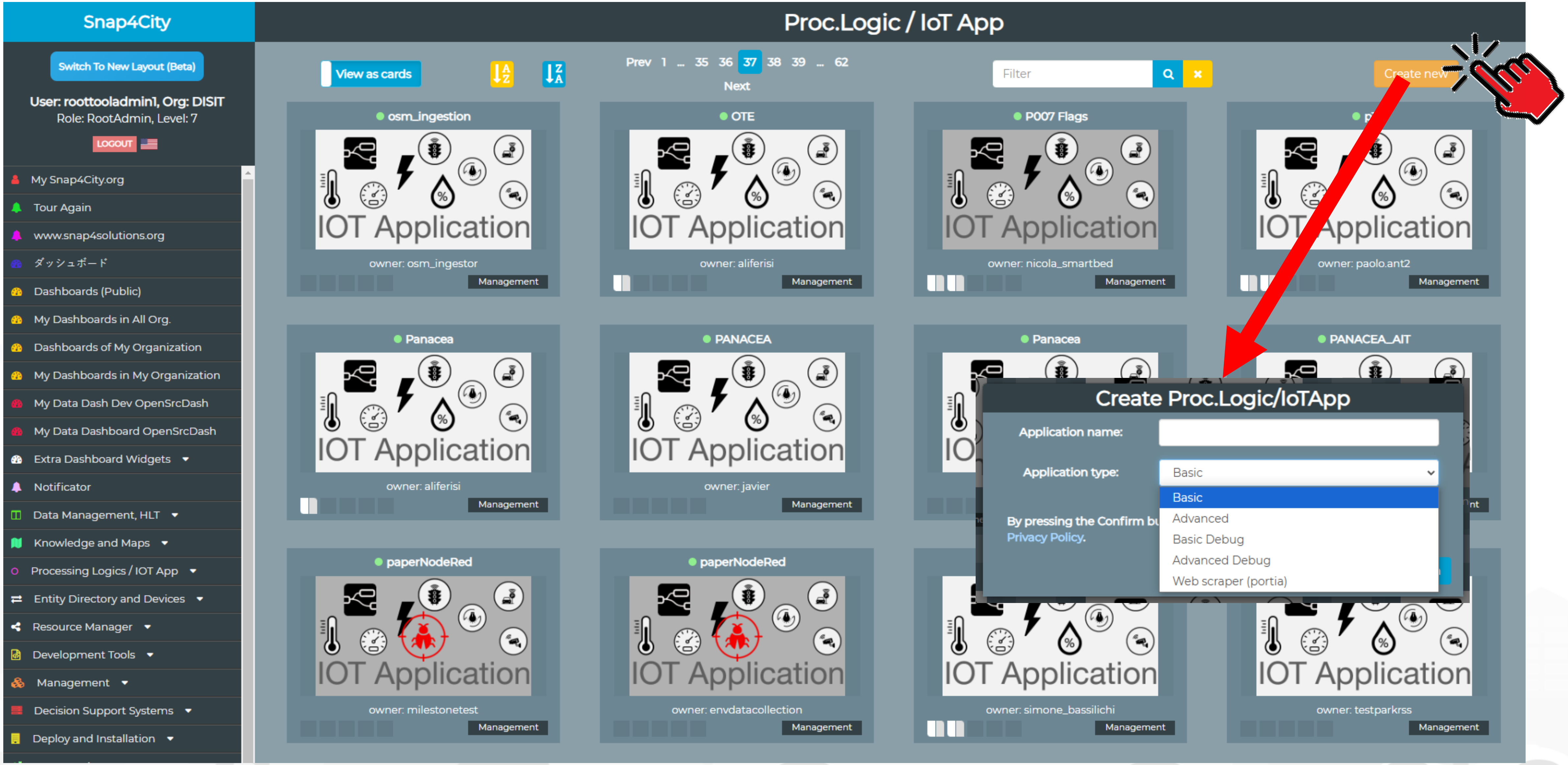
# How to Design

1. **Business Logic** is going to be implemented in Proc.Logic (IoT App), with a set of flows.
2. **Decompose your problem** and sequence diagram in single Data/event Flows, from client side and server side.
3. **Identify the single Data/Event Flow**, as those that start from a certain event (periodic or provoked from other messages), and that finish with: sending of data in the storage, change status, send an event, provide a message into a dashboard, send an email, etc.
4. **Design the single Data/Event Flows** with a mixt of possible **activities**.
   1. The design can be performed using data flow diagrams.
   2. It can have sequences, switch, serialization, packing, joining, distribution, communication, transformation, search, etc.
5. When  the design of Data/Event Flow mechanism is clear the designers can pass to directly sketch the flow in Node-RED which is a visual programming.
6. **Incrementally improve the Proc.Logic** (IoT App) Node-RED flows by adding nodes needed
7. **Once obtained the Proc.Logic** (IoT App) Node-RED flows in the correct data model you can send data to the ingestion broker, but also perform many other actions on several services.

# IoT App / Proc.Logic Design, for each Data/Event Flow



a. Periodically activate the flow
b. Call a gateway to get data
c. Verify the correctness of data
d. Enrich the data with other information coming from Cloud data into the storage
e. Transform the data in the correct forma
f. Send the data into the IoT Broker, and thus send the data in the storage on a specific IoT Device
g. Send also a notification via email

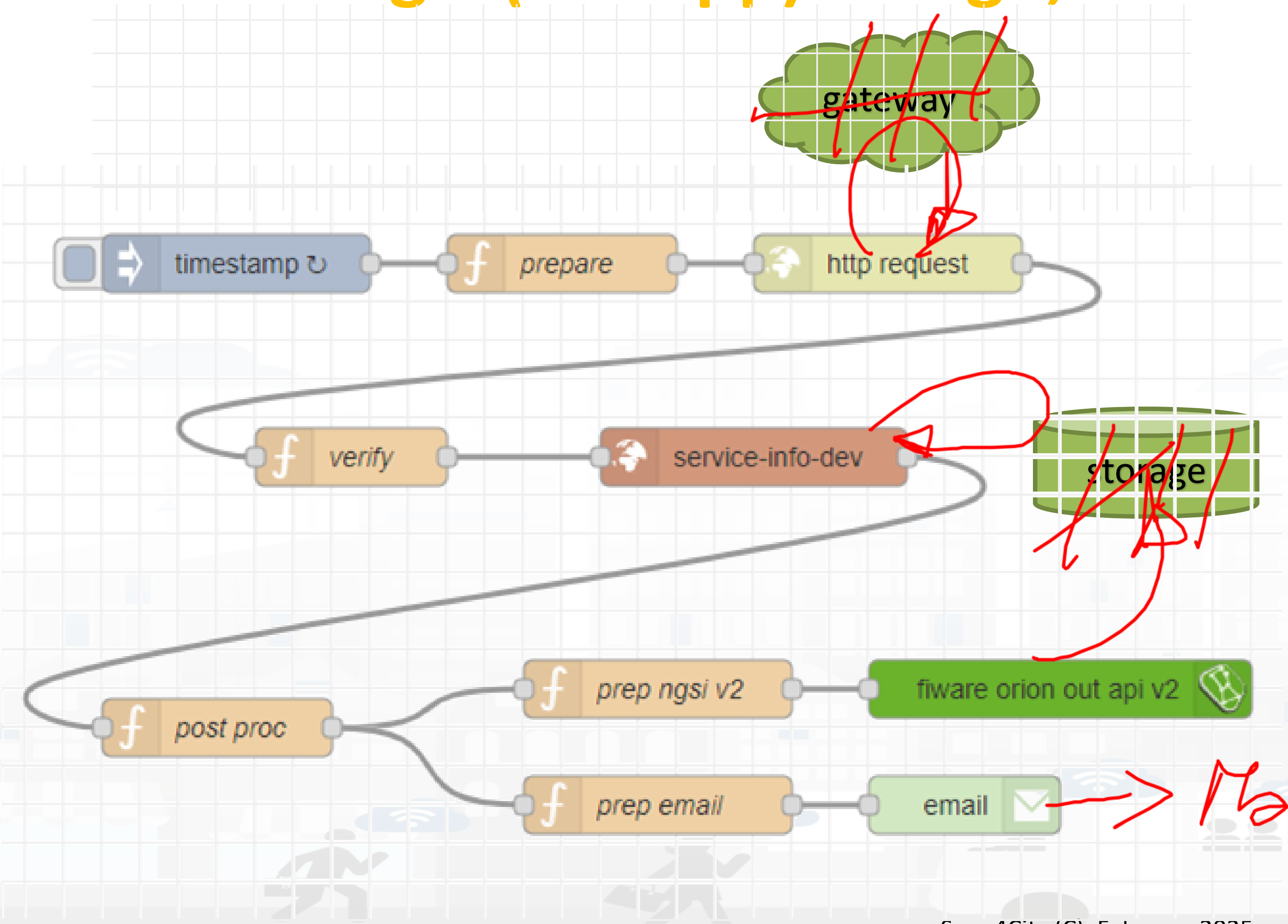


Create Proc.Logic/IoTApp

Application name:

Application type: Basic

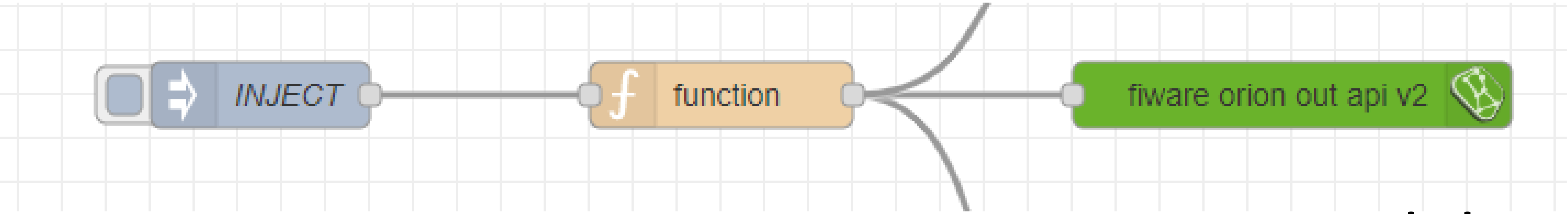
# Proc.Logic (IoT App) Design, for each Data/Event Flow



a. Periodically activate the flow
b. Call a gateway to get data
c. Verify the correctness of data
d. Enrich the data with other information coming from Cloud data into the storage
e. Transform the data in the correct forma
f. Send the data into the Broker, and thus send the data in the storage on a specific Entity Instance
g. Send also a notification via email

***Implicit services are not drawn***

# A sample of Data Ingestion

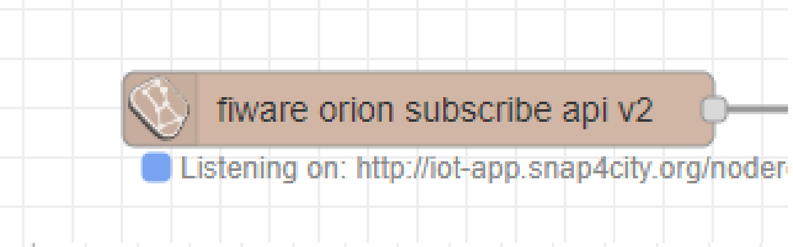


Function, example of NGSI V2 payload:

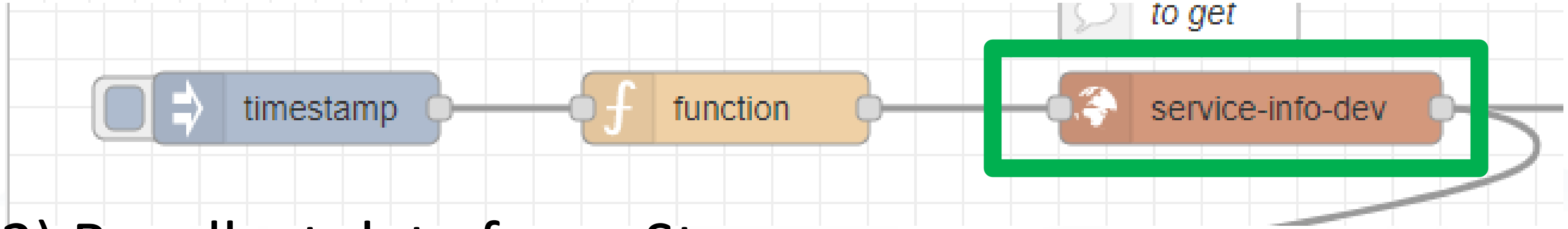
```
var time_now = new Date().toISOString();
var arandvalue = Math.random()
msg.payload =
        {"id":"mydev",
        "type":"mydevSensor",
        "anID":{"type": "integer", "value": "http://www.disit.org/km4city/resource/iot/............./anuser"},
        "VDDValue":{"type":"float","value":arandvalue},
        "dateObserved":{"type":"string","value":time_now},   // it is a time serie
        "latitude":{"type":"float","value":"28.61810"},         // it may move over time
        "longitude":{"type":"float","value":"11.34300"},        // it may move over time
        "status":{"type":"integer","value":34}
        }
return msg;
```

Posted data on IoT Brokers green nodes are automatically saved into the data Storage

# Read and share Data and Context Data


fiware orion subscribe api v2
Listening on: http://iot-app.snap4city.org/noder

1) Event driven from Broker, read last context data. It is not sure that this  change is on Storage



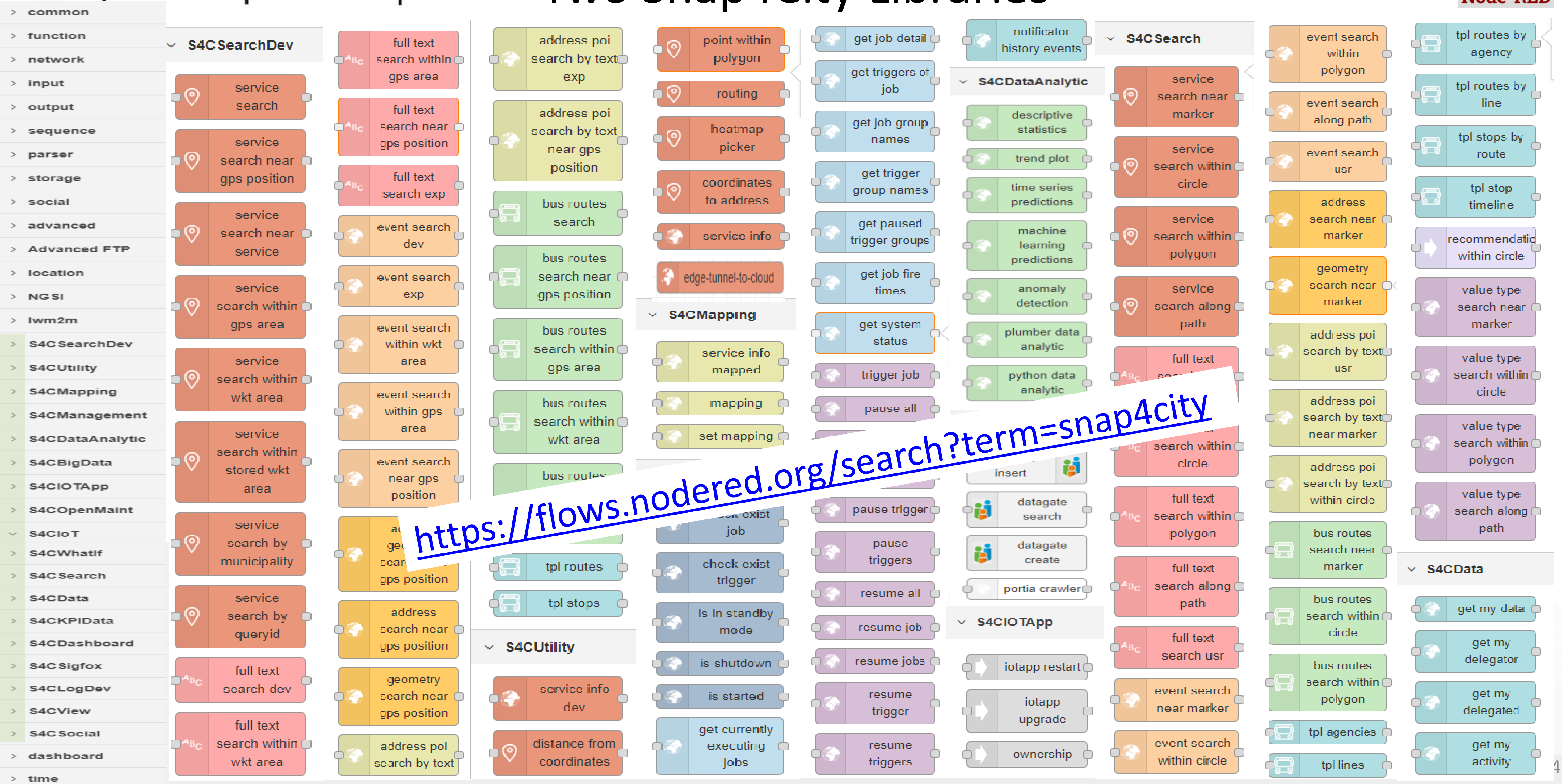
2) Recollect data from  Storage

- This node uses the Smart City API

- Any External Application can get the same data in authenticated authorized manner via Smart City API
- Smart City API is a better approach instead of producing a file outside or providing data via some local API service created from IoT Application (feasible but not protected)

# Snap4City MicroServices and programming Patterns

# Sept 2024 collection
# Two Snap4City Libraries


common
function
network
input
output
sequence
parser
storage
social
advanced
Advanced FTP
location
NGSI
lwm2m
S4CSearchDev
S4CUtility
S4CMapping
S4CManagement
S4CDataAnalytic
S4CBigData
S4CIOTApp
S4COpenMaint
S4CIoT
S4CWhatif
S4CSearch
S4CData
S4CKPIData
S4CDashboard
S4CSigfox
S4CLogDev
S4CView
S4CSocial
dashboard
time
S4CSearchDev
service search
service search near gps position
service search near service
service search within gps area
service search within wkt area
service search within stored wkt area
service search by municipality
service search by queryid
full text search dev
full text search within wkt area
full text search within gps area
full text search near gps position
full text search exp
event search dev
event search exp
event search within wkt area
event search within gps area
event search near gps position
address search near gps position
geometry search near gps position
address poi search by text
address poi search by text exp
address poi search by text near gps position
bus routes search
bus routes search near gps position
bus routes search within gps area
bus routes search within wkt area
bus routes
tpl routes
tpl stops
S4CUtility
service info dev
distance from coordinates
point within polygon
routing
heatmap picker
coordinates to address
service info
edge-tunnel-to-cloud
S4CMapping
service info mapped
mapping
set mapping
check exist job
check exist trigger
is in standby mode
is shutdown
is started
get currently executing jobs
get job detail
get triggers of job
get job group names
get trigger group names
get paused trigger groups
get job fire times
get system status
trigger job
pause all
pause trigger
pause triggers
resume all
resume job
resume jobs
resume trigger
resume triggers
notificator history events
S4CDataAnalytic
descriptive statistics
trend plot
time series predictions
machine learning predictions
anomaly detection
plumber data analytic
python data analytic
insert
datagate search
datagate create
portia crawler
S4CIOTApp
iotapp restart
iotapp upgrade
ownership
S4CSearch
service search near marker
service search within circle
service search within polygon
service search along path
full text search within circle
full text search within polygon
full text search along path
full text search usr
event search near marker
event search within circle
event search within polygon
event search along path
event search usr
address search near marker
geometry search near marker
address poi search by text usr
address poi search by text near marker
address poi search by text within circle
bus routes search near marker
bus routes search within circle
bus routes search within polygon
tpl agencies
tpl lines
tpl routes by agency
tpl routes by line
tpl stops by route
tpl stop timeline
recommendation within circle
value type search near marker
value type search within circle
value type search within polygon
value type search along path
S4CData
get my data
get my delegator
get my delegated
get my activity

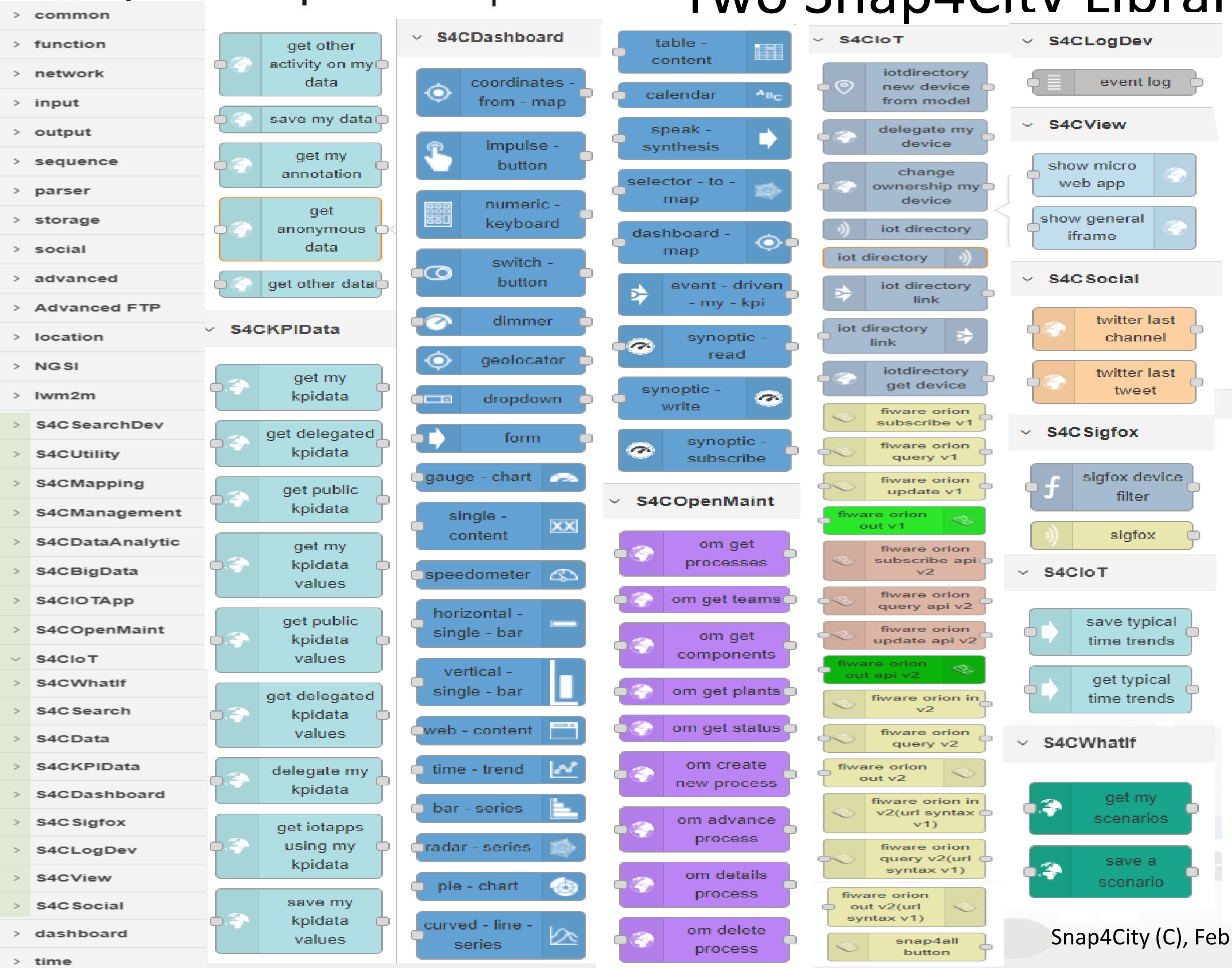
https://flows.nodered.org/search?term=snap4city

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

# Sept 2024 collection

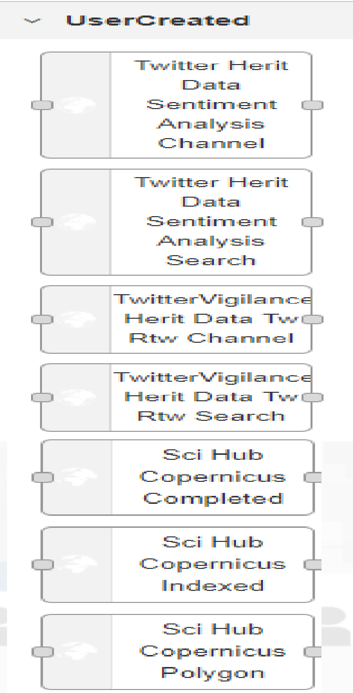
## Two Snap4Citv Libraries

SNAP4CITY | Node-RED



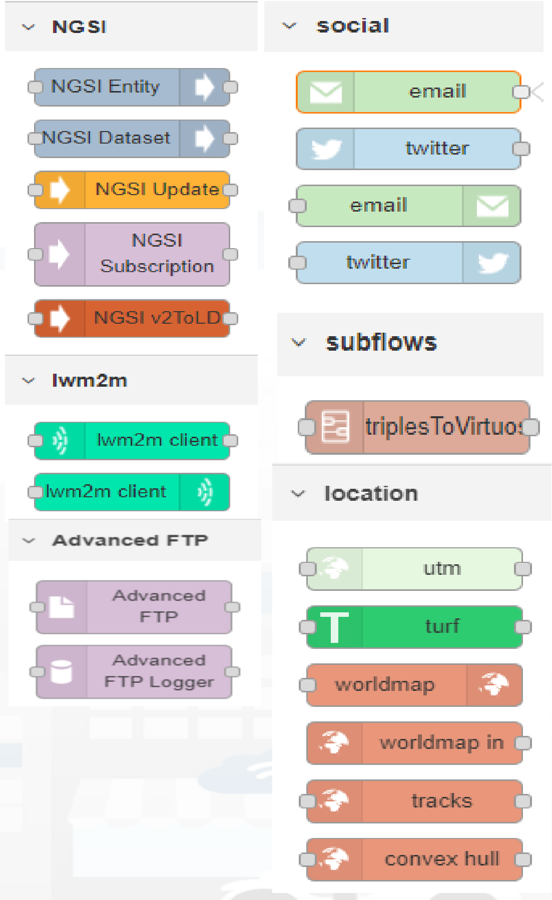
https://flows.nodered.org/search?term=snap4city

AND: From Resource Manager



UserCreated
Twitter Herit Data Sentiment Analysis Channel
Twitter Herit Data Sentiment Analysis Search
TwitterVigilance Herit Data Tw Rtw Channel
TwitterVigilance Herit Data Tw Rtw Search
Sci Hub Copernicus Completed
Sci Hub Copernicus Indexed
Sci Hub Copernicus Polygon

We suggest also to install:



# The Processing Logic (IoT App) microservices

Actually, there are more than 180 nodes/blocks in the Snap4City libraries on Processing Logic (IoT App) which can really facilitate your life and save you time in producing Smart Applications for composition of the following microservices and using those that you can install from internet, thousands of functionalities:

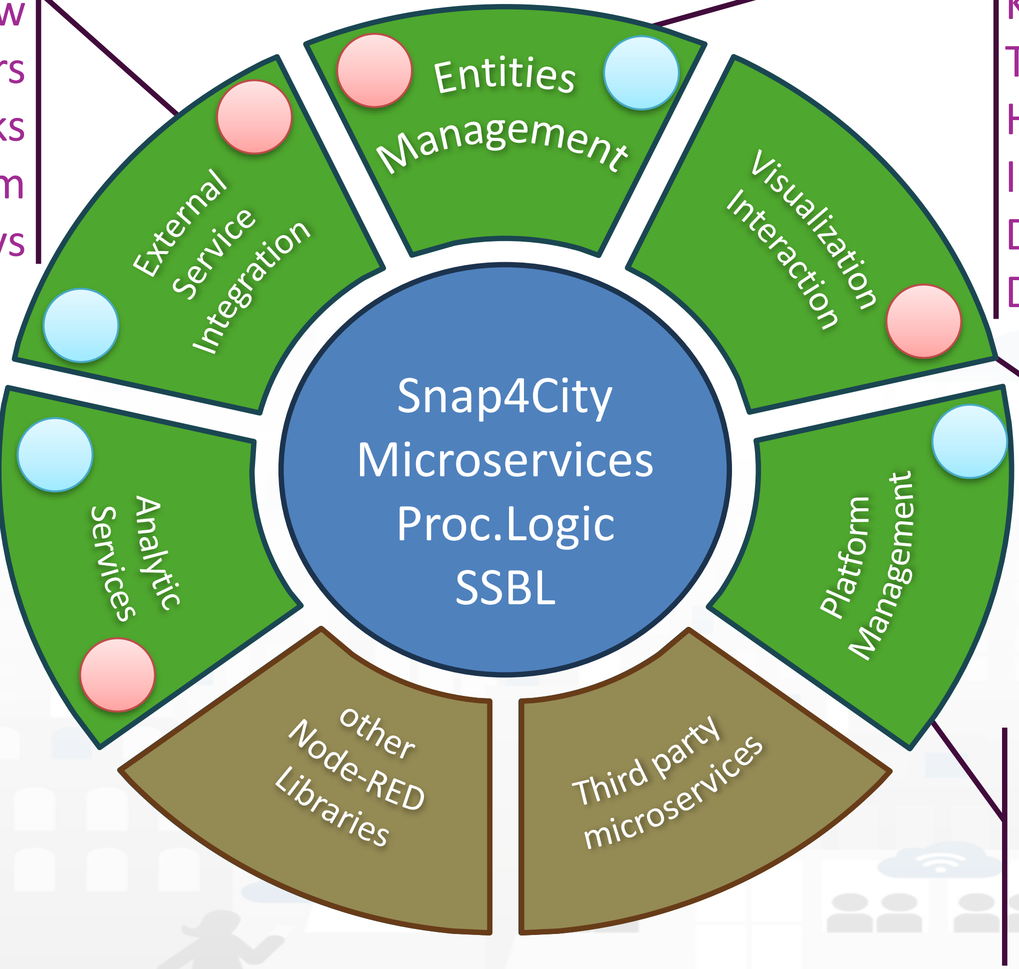
- **Data ingestion**: more than 100 protocols IOT and Industry 4.0, web Scraping, external services, any protocol database, etc.
- **Data access**: save/retrieve data, query search on expert system, georeverse solution, search on expert system Km4City ontology, call to Smart City API, etc.
- **Data Transformation/transcoding:** binary, hexadecimal, XML, JSON, String, any format
- **Integration**: CKAN, Web Scraping, FTP, Copernicus satellite, Twitter Vigilance, Workflow OpenMaint, Digital Twin BIM Server, any external service REST Call, etc.
- **Manipulation of complex data**: heatmaps, scenarios, typical time trend, multi series, calendar, maps, etc.
- **Access to Smart City Entities and exploitation of Smart City Services**: transport, parking, POI, KPI, personal data, scenarios, etc.
- **Data Analytic**: managing Python native, calling and scheduling Python/Rstudio containers as snap4city microservices (predictions, anomaly detection, statistics, etc.)
- **User interaction on Dashboard**: get data and message from the user interface, providing messages to the user (form, buttons, switches, animations, selector, maps, etc. ), send data to special graphical widgets: D3, Highcharts, etc.
- **Custom Widgets**: SVG, synoptics, animations, dynamic pins on maps, etc
- **Event management**: Telegram, Twitter, Facebook, SMS, WhatsApp, CAP, etc.
- **Special tools as**: routing, georeverse, Twitter Vigilance and sentiment analysis, etc.
- **Hardware Specific Devices**: Raspberry Pi, Android, Philips, video wall management, etc.
- **Etc**. etc.

# MicroServices Areas

> 60.000 downloads

Open Data CKAN
Ticket Management, workflow
BIM Servers
Social Networks
Video Management system
Gateways

Data Load / Search / Retrieval
KPI, POI, GIS Data, Scenarios
Time Series, Public transport
High Level Types: heatmaps, ODM,…
IoT / Entity Discovery
Delegation Management
Data Mapping


Entities Management
Visualization Interaction
Platform Management
Third party microservices
other Node-RED Libraries
Analytic Services
External Service Integration
Snap4City Microservices Proc.Logic SSBL

Data Analytics
Statistic, Optimization
Simulation
Artificial Intelligence
What-if Analysis Support
Geo Utilities Support
Routing & Traffic Flow
MLOps support
Python support
R Studio Support

Dashboards
Widgets: Graphic Libraries
Interactive Widgets
Maps, 3D representations
Synoptics, External Content
Micro Web App

IoTApp Management
Data Logs, A&A, Security
Ownership Management
VPN remote access

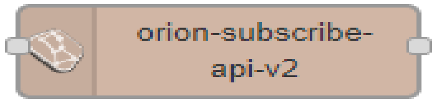
Node-RED

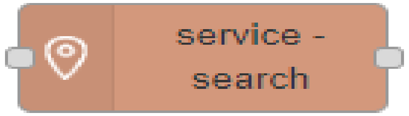
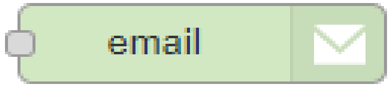
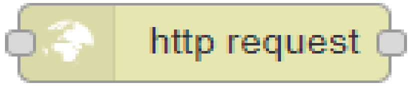
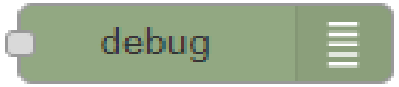
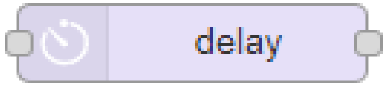
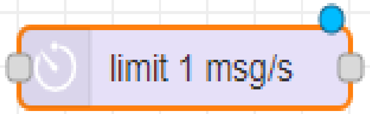
# examples

Saving Data on Storage

Even Driven

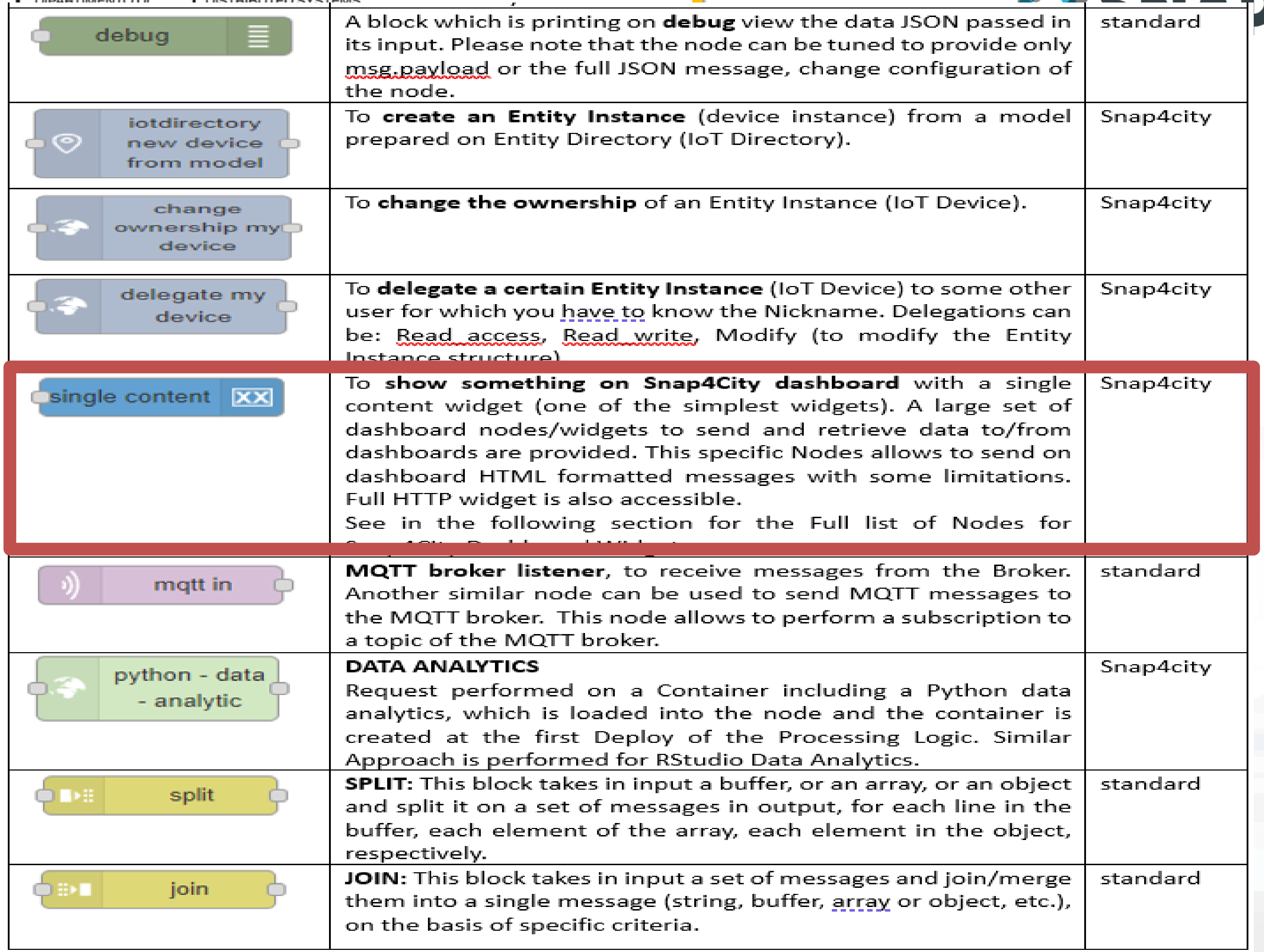
Get Data from Storage

| Node shape | Description | Snap4City or standard |
|---|---|---|
| inject | To **generate injection messages** into a flow, scheduled/periodic or on manual demand by click it on left. | standard |
| function | **DATA TRANSFORM**<br>A **JavaScript function**, from a JSON input to one or more JSON outputs, which can be produced by setting it. | standard |
| fiware orion out api v2 | **SAVE to STORAGE via internal BROKER**<br>To send an Entity Message of an Entity Instance into the storage. The Entity Instance has to be registered on Entity Directory (IoT Directory) and you have to be the owner or to be delegated in READ-WRITE to send messages to it. The node represents the broker, so that the same node can be used to send any Entity Message you need. Please manage the error in output. | Snap4city |
|  orion-subscribe-api-v2 | **SUBSCRIBE** to an Entity change on BROKER<br>To subscribe the Processing Logic (IoT App) to receive event-driven notifications related to Entity Instances changes. The node is substantially a listener connected to an Orion Broker. You can subscribe to many Entities and then to get all of them from the output of the listener. The new version will go to provide an input port to send at this listener multiple subscriptions.<br>**PLEASE NOTE THAT ALL THAT YOU CAN DO IN MQTT CAN BE DONE IN ORION BROKER NGSI. Moreover, Orion broker is authenticated, in SSO, provides JSON, etc. This node-red block allows you to subscribe to a topic / device and get event driven actions on IoT App directly.** Please manage the error in output. | Snap4city |
| service info dev | **READ from STORAGE**<br>Query call to Smart City API to get any information about a SURI, ServiceURI. There are many other Nodes which can be used to pose Smart City API queries in very simple manner and recover vectors of ServiceURIs. Please manage the error in output. | Snap4city |

| | | | |
|---|---|---|---|
| **Get Data from Storage** | <br> | **SEARCH on STORAGE**<br>To perform queries on the storage to obtain a list of ServiceURI. The nodes of this family can allow you to perform searching queries by filtering for distance, area, subnature/category, values of attributes, time period, etc. Please manage the error in output. | Snap4city |
| **Send email** | <br> | Send email. With other nodes you can send Telegram, SMS, etc. | standard |
| **Gen/access to HTTP, HTML pages** | <br> | To send a **REST CALL** (get, post, etc.). Please USE THIS NODE ONLY for the access at external API and not to access at the Snap4City API for which a lot of MicroServices are accessible as NODEs/Blocks in the Processing Logic and they are simpler to be used and ready to use. Please manage the error in output. | standard |
| **Monitor messages** | <br> | A block which is printing on **debug** view the data JSON passed in its input. Please note that the node can be tuned to provide only msg.payload or the full JSON message, change configuration of the node. | standard |
| **Stream Delay, limiting rate** | <br> <br><br> | A node to insert a delay to each message arriving, or to limit the rate of messages in output. In some cases, the node creates a buffer of messages regularizing the rate in output if the rate in input is greater in some moments. | standard |

# examples

USage To be trained

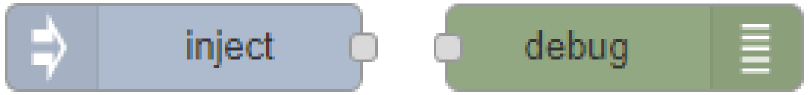


| | | |
|---|---|---|
| debug | A block which is printing on **debug** view the data JSON passed in its input. Please note that the node can be tuned to provide only msg.payload or the full JSON message, change configuration of the node. | standard |
| iotdirectory new device from model | To **create an Entity Instance** (device instance) from a model prepared on Entity Directory (IoT Directory). | Snap4city |
| change ownership my device | To **change the ownership** of an Entity Instance (IoT Device). | Snap4city |
| delegate my device | To **delegate a certain Entity Instance** (IoT Device) to some other user for which you have to know the Nickname. Delegations can be: Read access, Read write, Modify (to modify the Entity Instance structure). | Snap4city |
| single content | To **show something on Snap4City dashboard** with a single content widget (one of the simplest widgets). A large set of dashboard nodes/widgets to send and retrieve data to/from dashboards are provided. This specific Nodes allows to send on dashboard HTML formatted messages with some limitations. Full HTTP widget is also accessible.<br>See in the following section for the Full list of Nodes for Snap4City Dashboard Widgets. | Snap4city |
| mqtt in | **MQTT broker listener**, to receive messages from the Broker. Another similar node can be used to send MQTT messages to the MQTT broker. This node allows to perform a subscription to a topic of the MQTT broker. | standard |
| python - data - analytic | **DATA ANALYTICS**<br>Request performed on a Container including a Python data analytics, which is loaded into the node and the container is created at the first Deploy of the Processing Logic. Similar Approach is performed for RStudio Data Analytics. | Snap4city |
| split | **SPLIT:** This block takes in input a buffer, or an array, or an object and split it on a set of messages in output, for each line in the buffer, each element of the array, each element in the object, respectively. | standard |
| join | **JOIN:** This block takes in input a set of messages and join/merge them into a single message (string, buffer, array or object, etc.), on the basis of specific criteria. | standard |

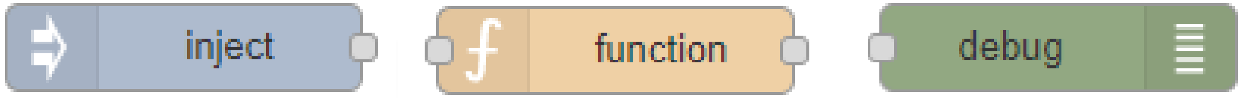
# Some patterns

**Periodic or Sporadic events to data collection, processing**

1) Hello world of node-red, the inject may provide a string to the debug.

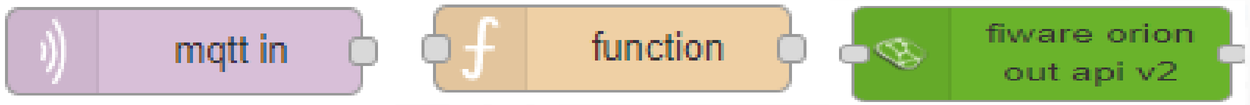


2) Hello world of node-red at two steps, the inject provides a push while a JSON is created into the function as *msg.payload = {…………}* and sent/shown to/by the debug.

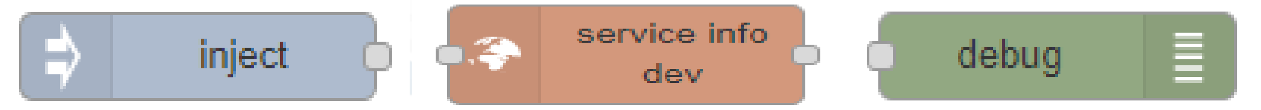


**Even Driven**

3) Event data reception from an MQTT broker, transformation and send it to the storage pushing data into the Orion Broker V2.

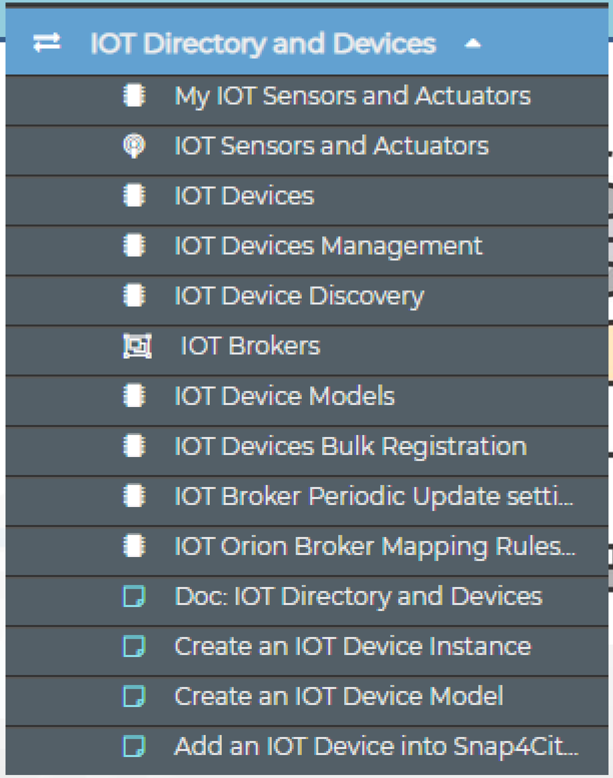


4) request on inject of a SURI to the storage to see data on debug.



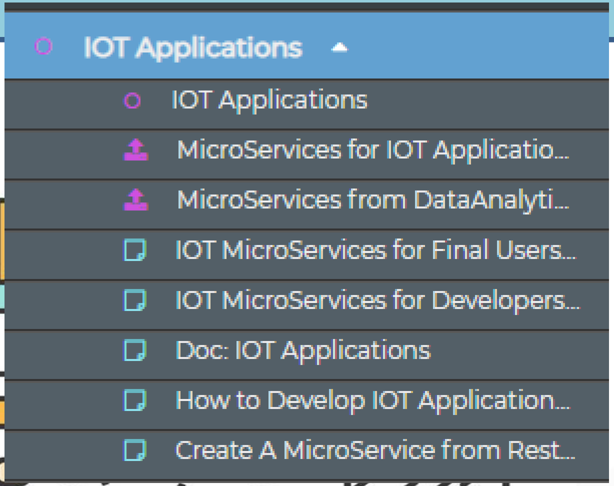
- **Please note that**
  - the most important blocks nodes to interact with the platforms are reported in these tables to familiarize with the main concepts. ***They are actually families of blocks/nodes*** since many others are present that allow you to perform a very large number of other features.
  - You do not need to take care of Authentication and Authorization, all is performed via SSO, Access Tokens.
  - YOU DO NOT HAVE TO ACCESS AT THE API all is provided in terms of NODEs/BLOCKS into IoT APP. Everything can be parametrized via JSON passed in input to the nodes.
  - nodes input as JSON is primary mode for setting parameters
    - While they can be also configured from their user settings via user interface

# Entity / Device Registration from IOT App/Proc.Logic (automation)



IOT Directory and Devices

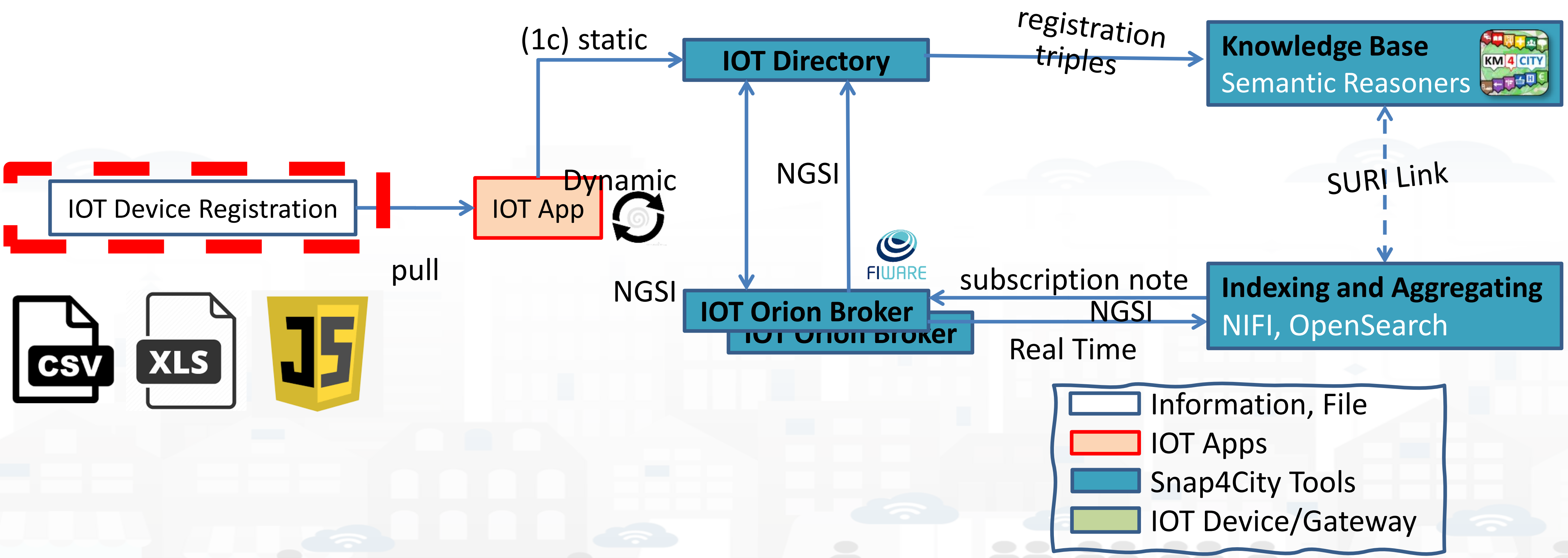
- My IOT Sensors and Actuators
- IOT Sensors and Actuators
- IOT Devices
- IOT Devices Management
- IOT Device Discovery
- IOT Brokers
- IOT Device Models
- IOT Devices Bulk Registration
- IOT Broker Periodic Update setti...
- IOT Orion Broker Mapping Rules...
- Doc: IOT Directory and Devices
- Create an IOT Device Instance
- Create an IOT Device Model
- Add an IOT Device into Snap4Cit...



IOT Applications

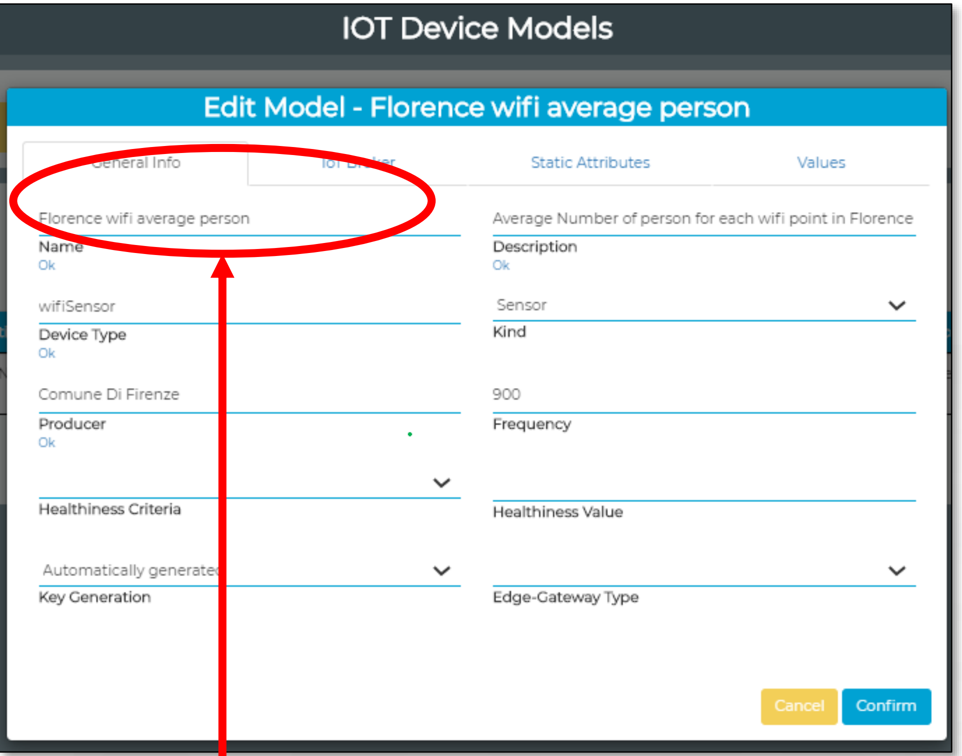
- IOT Applications
- MicroServices for IOT Applicatio...
- MicroServices from DataAnalyti...
- IOT MicroServices for Final Users...
- IOT MicroServices for Developers...
- Doc: IOT Applications
- How to Develop IOT Application...
- Create A MicroService from Rest...

# Snap4city Data Ingestion Flow Diagram



# Dataset Creation

## 1) Model creation



IOT Device Models

Edit Model - Florence wifi average person

General Info | IoT Broker | Static Attributes | Values

Name: Florence wifi average person (Ok)

Description: Average Number of person for each wifi point in Florence (Ok)

Device Type: wifiSensor (Ok)

Kind: Sensor

Producer: Comune Di Firenze (Ok)

Frequency: 900

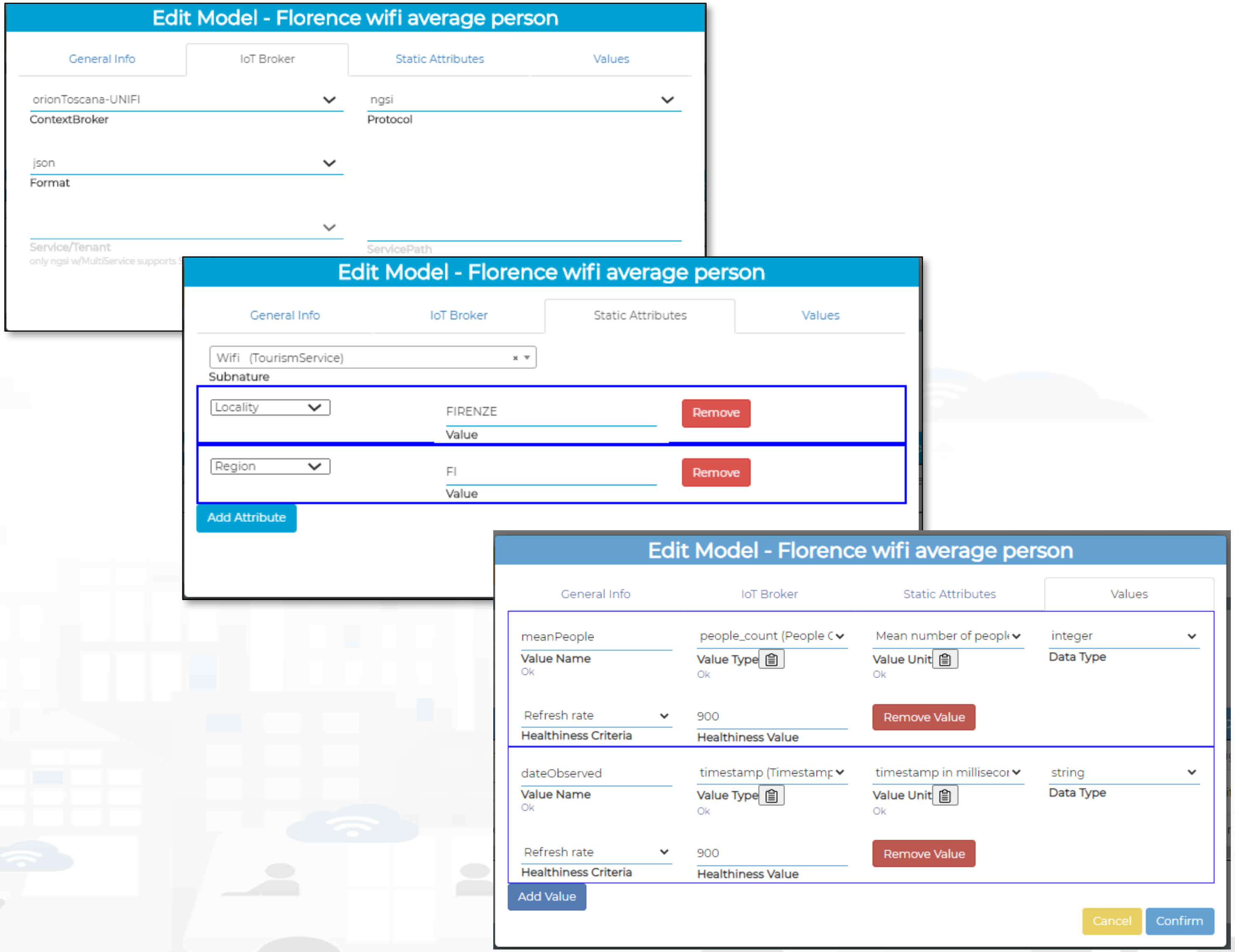
Healthiness Criteria:

Healthiness Value:

Key Generation: Automatically generated

Edge-Gateway Type:

Model name: Florence wifi average person



Edit Model - Florence wifi average person

General Info | IoT Broker | Static Attributes | Values

ContextBroker: orionToscana-UNIFI

Protocol: ngsi

Format: json

Service/Tenant: (only ngsi w/MultiService supports)

ServicePath:

Edit Model - Florence wifi average person

General Info | IoT Broker | Static Attributes | Values

Subnature: Wifi (TourismService)

Locality — Value: FIRENZE — Remove

Region — Value: FI — Remove

Edit Model - Florence wifi average person

General Info | IoT Broker | Static Attributes | Values

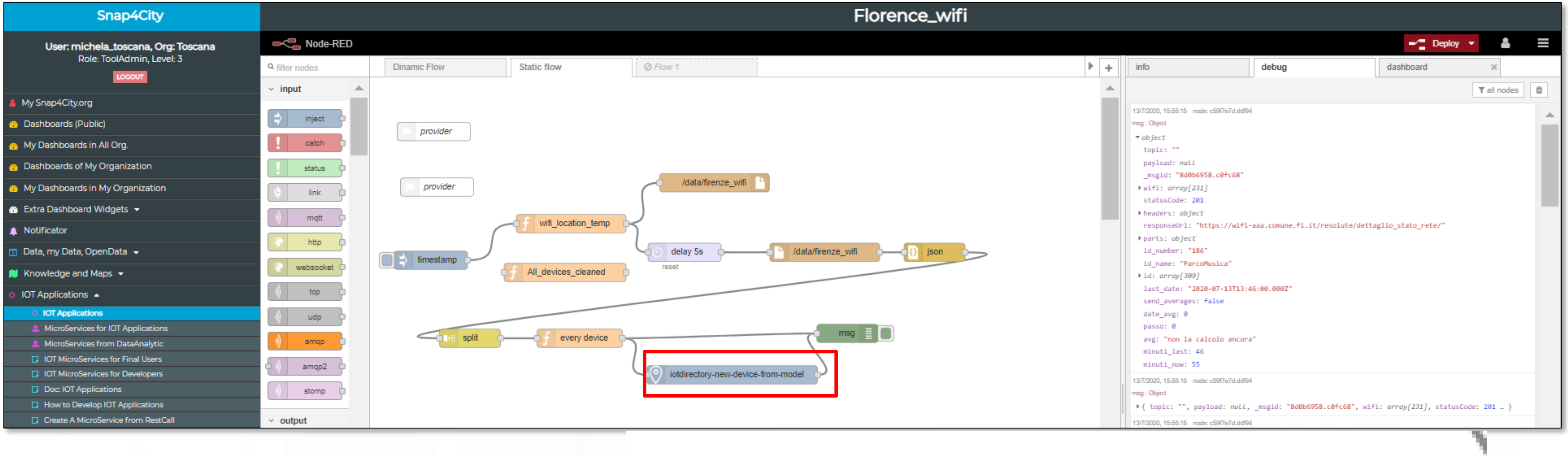
Value Name: meanPeople (Ok) — Value Type: people_count (People C (Ok) — Value Unit: Mean number of peopl (Ok) — Data Type: integer

Healthiness Criteria: Refresh rate — Healthiness Value: 900 — Remove Value

Value Name: dateObserved (Ok) — Value Type: timestamp (Timestamp (Ok) — Value Unit: timestamp in milliseco (Ok) — Data Type: string

Healthiness Criteria: Refresh rate — Healthiness Value: 900 — Remove Value

# IoTApp static flow

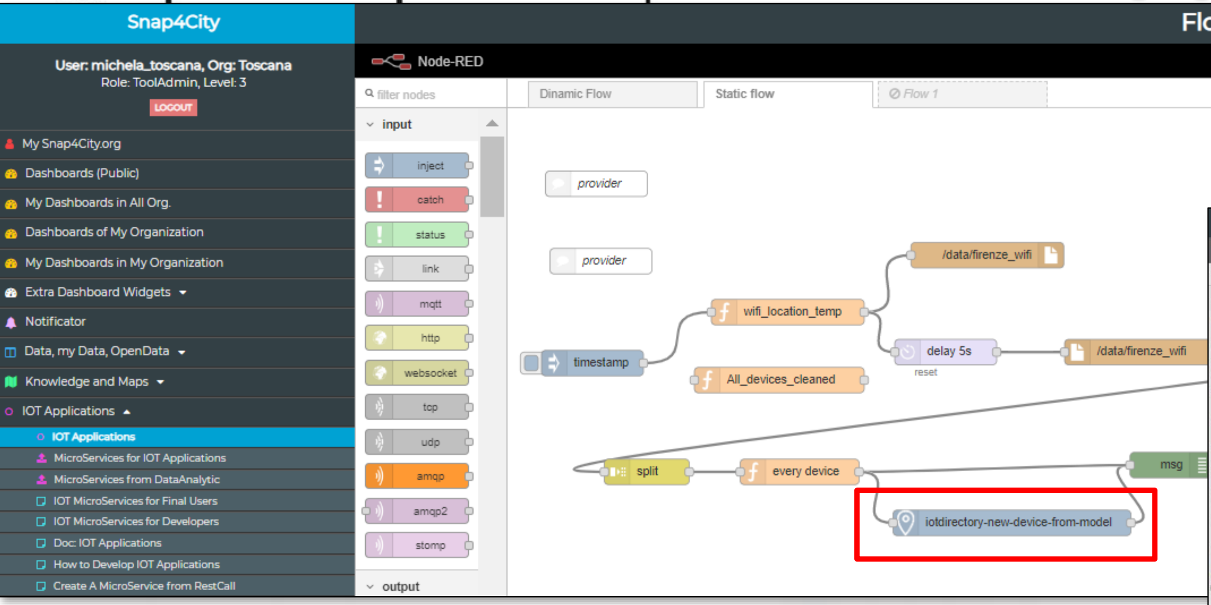


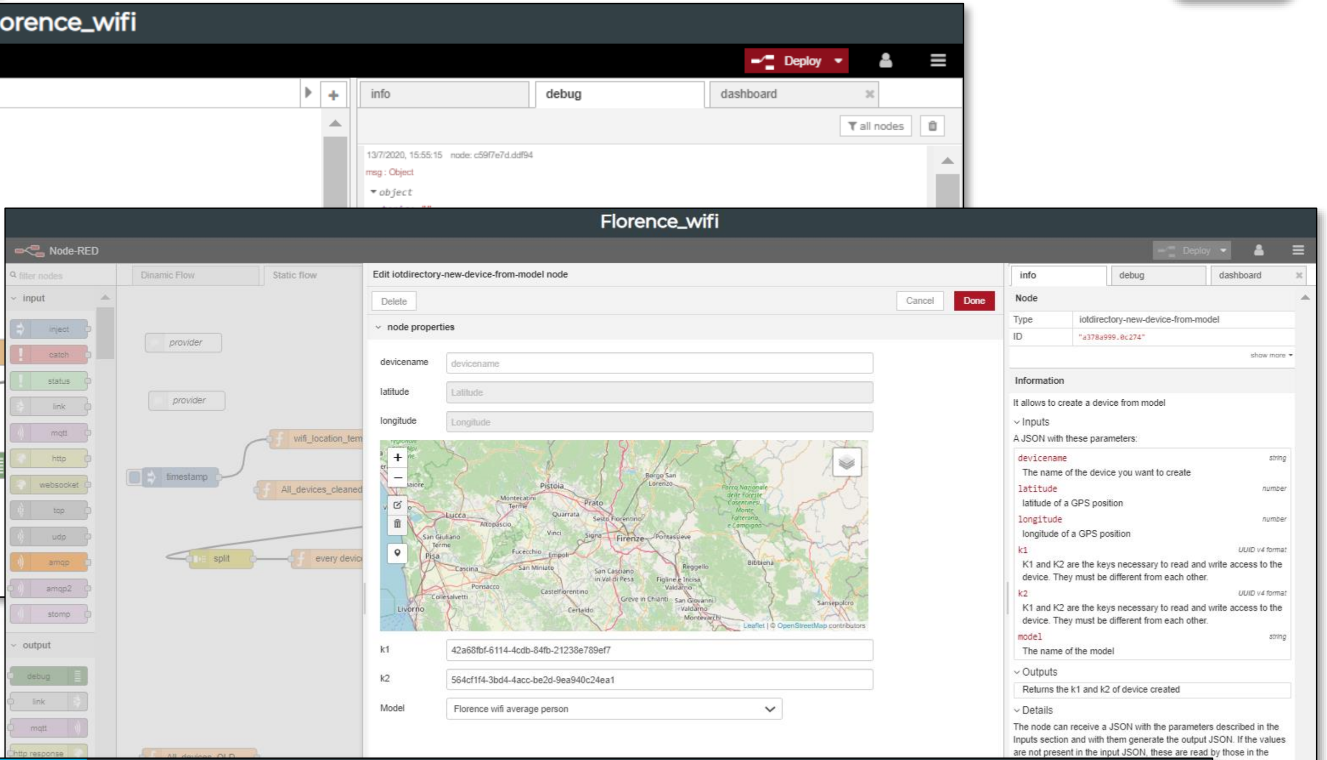
```
13/7/2020, 15:55:15   node: c59f7e7d.ddf94
msg : Object
▾object
  topic: ""
  payload: null
  _msgid: "8d0b6958.c0fc68"
 ▸wifi: array[231]
  statusCode: 201
 ▸headers: object
  responseUrl: "https://wifi-aaa.comune.fi.it/resolute/dettaglio_stato_rete/"
 ▸parts: object
  id_number: "186"
  id_name: "ParcoMusica"
 ▸id: array[309]
  last_date: "2020-07-13T13:46:00.000Z"
  send_averages: false
  date_avg: 0
  passo: 0
  avg: "non la calcolo ancora"
  minuti_last: 46
  minuti_now: 55
13/7/2020, 15:55:15   node: c59f7e7d.ddf94
msg : Object
▸{ topic: "", payload: null, _msgid: "8d0b6958.c0fc68", wifi: array[231], statusCode: 201 … }
13/7/2020, 15:55:15   node: c59f7e7d.ddf94
```

## 2) IoT Devices Creation from IOT APP

BLOCK: ‘IoTDirectory-new-device-from-model’
Model name: Florence wifi average person

# IoTApp static flow





Edit iotdirectory-new-device-from-model node

node properties

devicename: devicename

latitude: Latitude

longitude: Longitude

k1: 42a68fbf-6114-4cdb-84fb-21238e789ef7

k2: 564cf1f4-3bd4-4acc-be2d-9ea940c24ea1

Model: Florence wifi average person

Node

Type: iotdirectory-new-device-from-model

ID: "a378a999.0c274"

Information

It allows to create a device from model

Inputs

A JSON with these parameters:

devicename — string — The name of the device you want to create

latitude — number — latitude of a GPS position

longitude — number — longitude of a GPS position

k1 — UUID v4 format — K1 and K2 are the keys necessary to read and write access to the device. They must be different from each other.

k2 — UUID v4 format — K1 and K2 are the keys necessary to read and write access to the device. They must be different from each other.

model — string — The name of the model

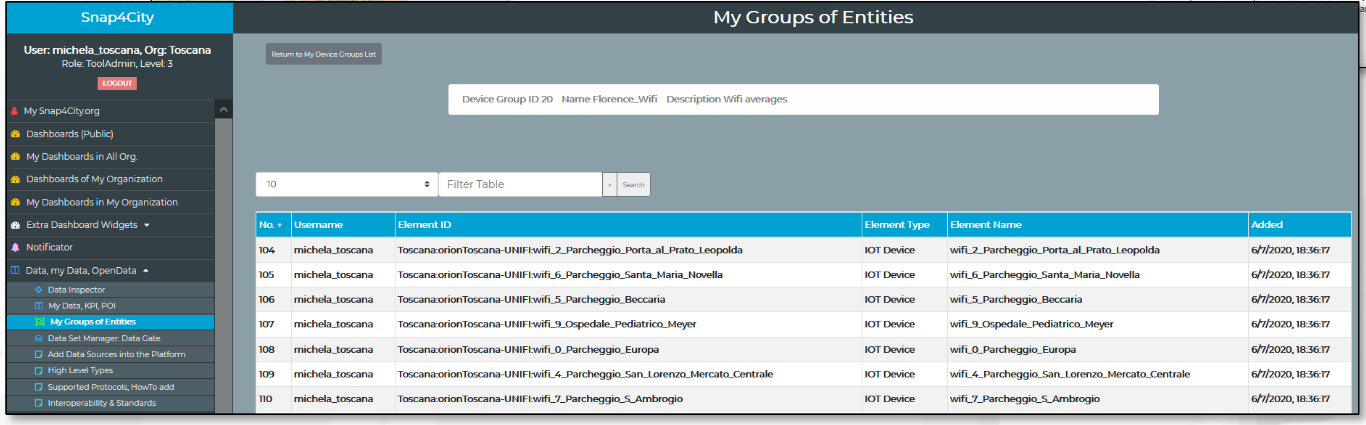
Outputs

Returns the k1 and k2 of device created

Details

The node can receive a JSON with the parameters described in the Inputs section and with them generate the output JSON. If the values are not present in the input JSON, these are read by those in the ... an error is

3) Group Creation (more than 200 devices) -> put all the devices in the group and put them as 'public' (or they remain private)


Snap4City
User: michela_toscana, Org: Toscana
Role: ToolAdmin, Level: 3
LOGOUT
My Snap4City.org
Dashboards (Public)
My Dashboards in All Org.
Dashboards of My Organization
My Dashboards in My Organization
Extra Dashboard Widgets
Notificator
Data, my Data, OpenData
Data Inspector
My Data, KPI, POI
My Groups of Entities
Data Set Manager: Data Gate
Add Data Sources into the Platform
High Level Types
Supported Protocols, HowTo add
Interoperability & Standards
Return to My Device Groups List
10
Filter Table
Search

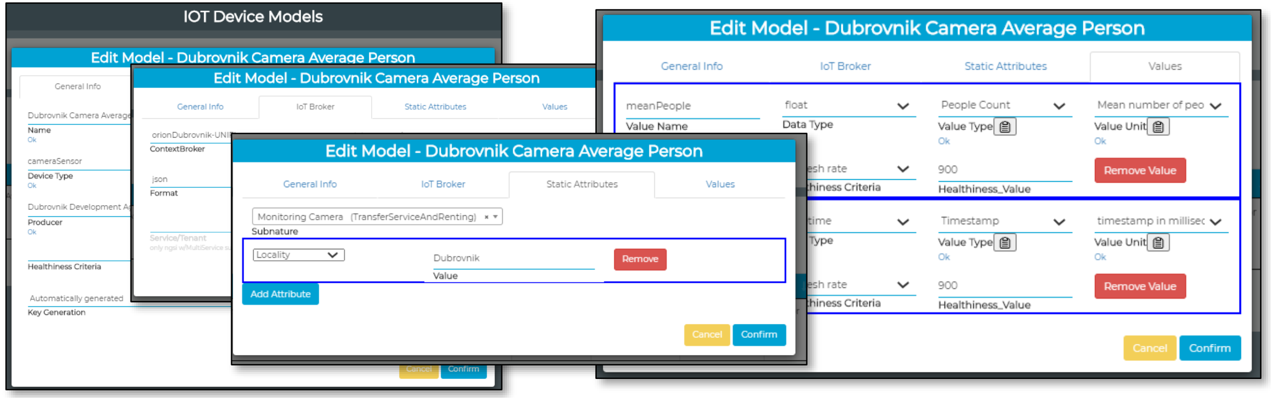
My Groups of Entities

Device Group ID 20 Name Florence_Wifi Description Wifi averages

| No. | Username | Element ID | Element Type | Element Name | Added |
|---|---|---|---|---|---|
| 104 | michela_toscana | Toscana:orionToscana-UNIFI:wifi_2_Parcheggio_Porta_al_Prato_Leopolda | IOT Device | wifi_2_Parcheggio_Porta_al_Prato_Leopolda | 6/7/2020, 18:36:17 |
| 105 | michela_toscana | Toscana:orionToscana-UNIFI:wifi_6_Parcheggio_Santa_Maria_Novella | IOT Device | wifi_6_Parcheggio_Santa_Maria_Novella | 6/7/2020, 18:36:17 |
| 106 | michela_toscana | Toscana:orionToscana-UNIFI:wifi_5_Parcheggio_Beccaria | IOT Device | wifi_5_Parcheggio_Beccaria | 6/7/2020, 18:36:17 |
| 107 | michela_toscana | Toscana:orionToscana-UNIFI:wifi_9_Ospedale_Pediatrico_Meyer | IOT Device | wifi_9_Ospedale_Pediatrico_Meyer | 6/7/2020, 18:36:17 |
| 108 | michela_toscana | Toscana:orionToscana-UNIFI:wifi_0_Parcheggio_Europa | IOT Device | wifi_0_Parcheggio_Europa | 6/7/2020, 18:36:17 |
| 109 | michela_toscana | Toscana:orionToscana-UNIFI:wifi_4_Parcheggio_San_Lorenzo_Mercato_Centrale | IOT Device | wifi_4_Parcheggio_San_Lorenzo_Mercato_Centrale | 6/7/2020, 18:36:17 |
| 110 | michela_toscana | Toscana:orionToscana-UNIFI:wifi_7_Parcheggio_S_Ambrogio | IOT Device | wifi_7_Parcheggio_S_Ambrogio | 6/7/2020, 18:36:17 |

# How to....

## 1) IoTModel



IOT Device Models

Edit Model - Dubrovnik Camera Average Person

General Info | IoT Broker | Static Attributes | Values

Monitoring Camera (TransferServiceAndRenting)
Subnature

Locality | Dubrovnik Value | Remove

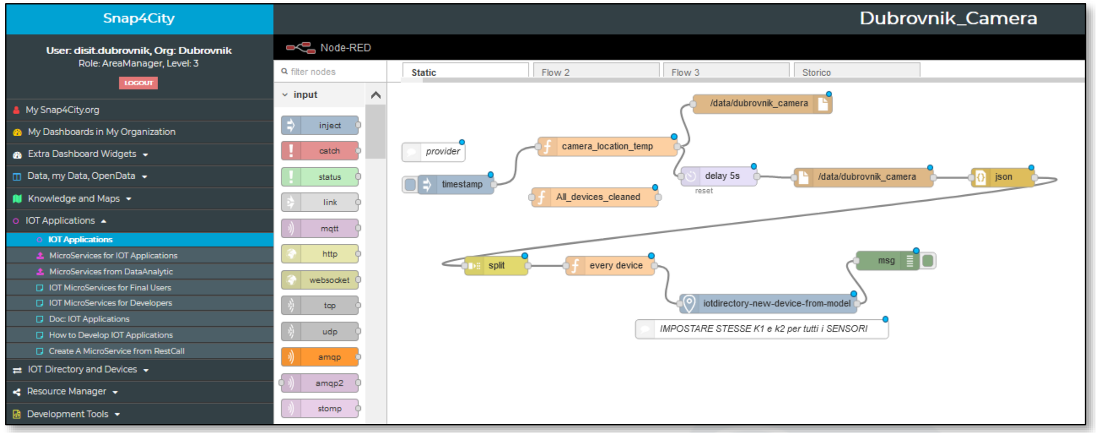
Add Attribute

Cancel | Confirm

| | | | |
|---|---|---|---|
| meanPeople<br>Value Name | float<br>Data Type | People Count<br>Value Type<br>Ok | Mean number of peo<br>Value Unit<br>Ok |
| | refresh rate<br>Healthiness Criteria | 900<br>Healthiness_Value | Remove Value |
| | time<br>Data Type | Timestamp<br>Value Type<br>Ok | timestamp in millisec<br>Value Unit<br>Ok |
| | refresh rate<br>Healthiness Criteria | 900<br>Healthiness_Value | Remove Value |

Cancel | Confirm

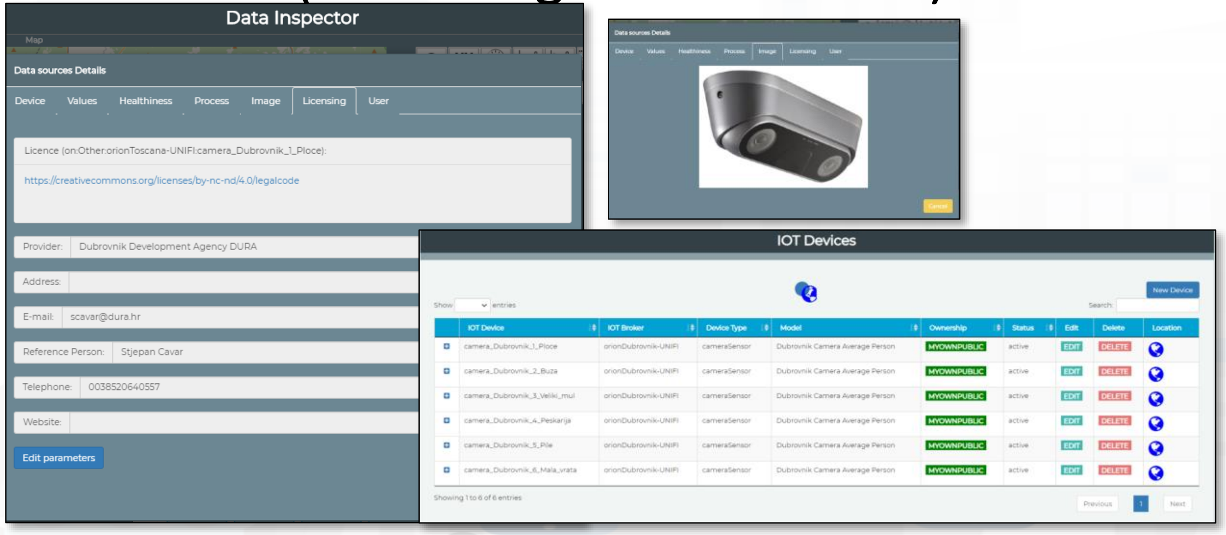
## 2) Static Flow to create IoTDevices



Snap4City | Dubrovnik_Camera

User: disit.dubrovnik, Org: Dubrovnik
Role: AreaManager, Level: 3

## 3) Add the license and Make Public the IoTDevices (according to the license)



Data Inspector

Data sources Details

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

Licence (on:Other:orionToscana-UNIFI:camera_Dubrovnik_1_Ploce):

https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode

Provider: Dubrovnik Development Agency DURA

Address:

E-mail: scavar@dura.hr

Reference Person: Stjepan Cavar

Telephone: 0038520640557

Website:

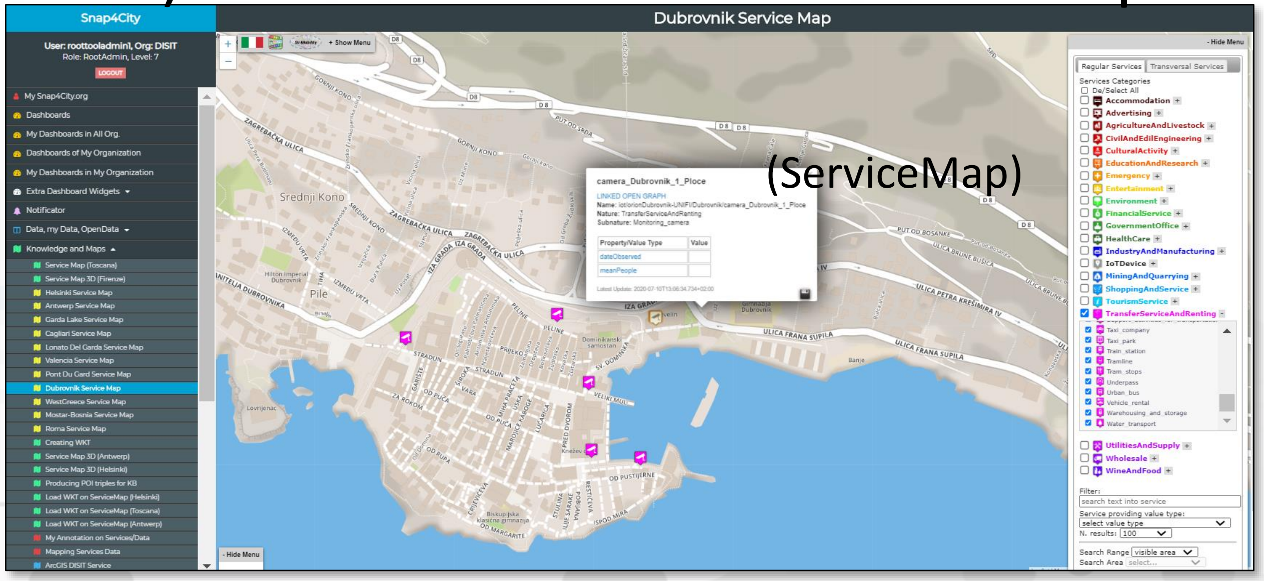
Edit parameters

IOT Devices

| | IOT Device | IOT Broker | Device Type | Model | Ownership | Status | Edit | Delete | Location |
|---|---|---|---|---|---|---|---|---|---|
| ⊞ | camera_Dubrovnik_1_Ploce | orionDubrovnik-UNIFI | cameraSensor | Dubrovnik Camera Average Person | MYOWNPUBLIC | active | EDIT | DELETE | ● |
| ⊞ | camera_Dubrovnik_2_Buza | orionDubrovnik-UNIFI | cameraSensor | Dubrovnik Camera Average Person | MYOWNPUBLIC | active | EDIT | DELETE | ● |
| ⊞ | camera_Dubrovnik_3_Veliki_mul | orionDubrovnik-UNIFI | cameraSensor | Dubrovnik Camera Average Person | MYOWNPUBLIC | active | EDIT | DELETE | ● |
| ⊞ | camera_Dubrovnik_4_Peskarija | orionDubrovnik-UNIFI | cameraSensor | Dubrovnik Camera Average Person | MYOWNPUBLIC | active | EDIT | DELETE | ● |
| ⊞ | camera_Dubrovnik_5_Pile | orionDubrovnik-UNIFI | cameraSensor | Dubrovnik Camera Average Person | MYOWNPUBLIC | active | EDIT | DELETE | ● |
| ⊞ | camera_Dubrovnik_6_Mala_vrata | orionDubrovnik-UNIFI | cameraSensor | Dubrovnik Camera Average Person | MYOWNPUBLIC | active | EDIT | DELETE | ● |

Showing 1 to 6 of 6 entries

## 4) Search for the Cameras on Map



Snap4City | Dubrovnik Service Map

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

(ServiceMap)

camera_Dubrovnik_1_Ploce

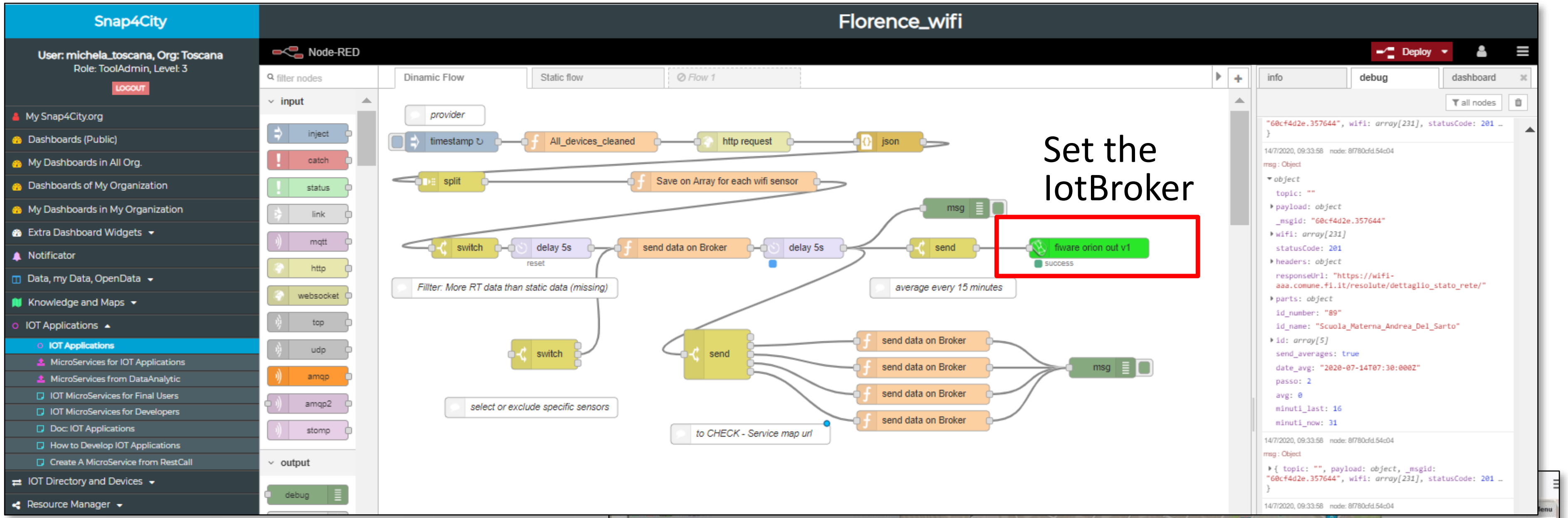
LINKED OPEN GRAPH
Name: iot/orionDubrovnik-UNIFI/Dubrovnik/camera_Dubrovnik_1_Ploce
Nature: TransferServiceAndRenting
Subnature: Monitoring_camera

| Property/Value Type | Value |
|---|---|
| dateObserved | |
| meanPeople | |

Latest Update: 2020-07-10T13:06:34.734+02:00

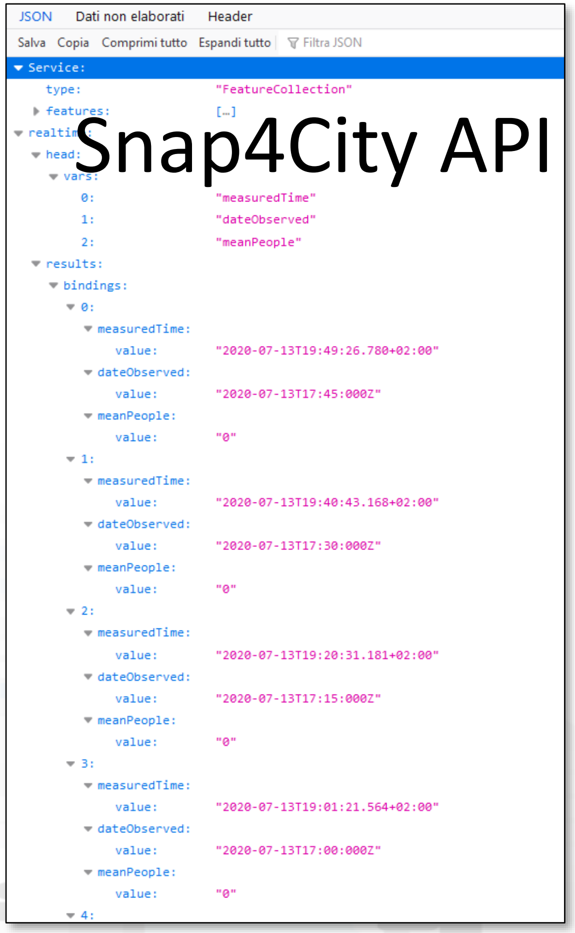
5) **Working on** Dynamic Flow to save Average #people every 15 minutes for each IoTDevice

# IoTApp Dynamic Flow



```
"60cf4d2e.357644", wifi: array[231], statusCode: 201 …
}
14/7/2020, 09:33:58   node: 8f780cfd.54c04
msg : Object
▾object
  topic: ""
 ▸payload: object
  _msgid: "60cf4d2e.357644"
 ▸wifi: array[231]
  statusCode: 201
 ▸headers: object
  responseUrl: "https://wifi-
  aaa.comune.fi.it/resolute/dettaglio_stato_rete/"
 ▸parts: object
  id_number: "89"
  id_name: "Scuola_Materna_Andrea_Del_Sarto"
 ▸id: array[5]
  send_averages: true
  date_avg: "2020-07-14T07:30:000Z"
  passo: 2
  avg: 0
  minuti_last: 16
  minuti_now: 31
14/7/2020, 09:33:58   node: 8f780cfd.54c04
msg : Object
▸{ topic: "", payload: object, _msgid:
"60cf4d2e.357644", wifi: array[231], statusCode: 201 …
}
14/7/2020, 09:33:58   node: 8f780cfd.54c04
```

Set the IotBroker

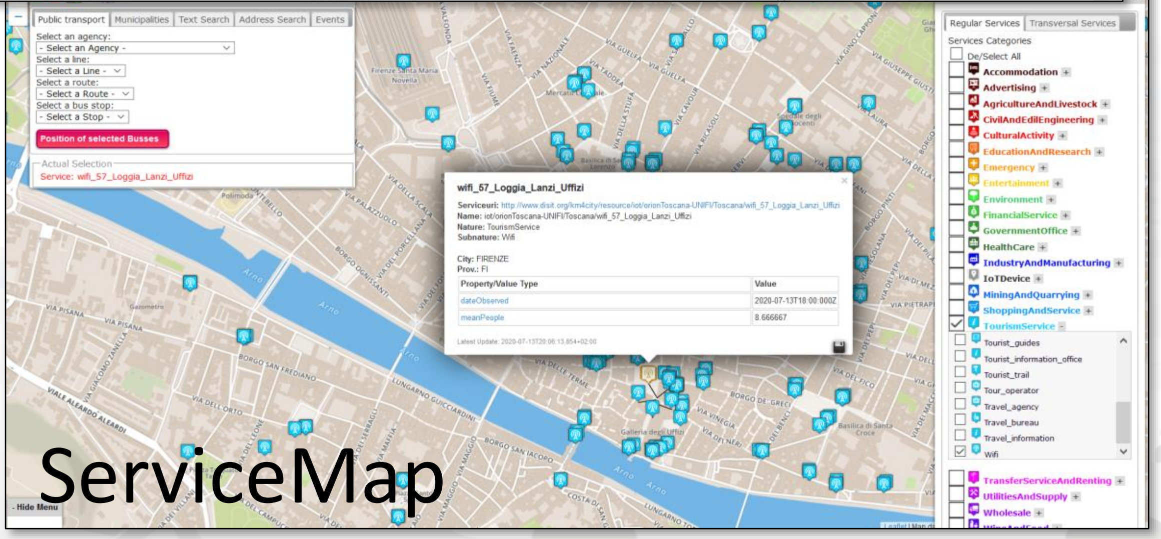


```
▾ Service:
    type:                     "FeatureCollection"
  ▸ features:                 […]
▾ realtime:
  ▾ head:
    ▾ vars:
        0:                    "measuredTime"
        1:                    "dateObserved"
        2:                    "meanPeople"
  ▾ results:
    ▾ bindings:
      ▾ 0:
        ▾ measuredTime:
            value:            "2020-07-13T19:49:26.780+02:00"
        ▾ dateObserved:
            value:            "2020-07-13T17:45:000Z"
        ▾ meanPeople:
            value:            "0"
      ▾ 1:
        ▾ measuredTime:
            value:            "2020-07-13T19:40:43.168+02:00"
        ▾ dateObserved:
            value:            "2020-07-13T17:30:000Z"
        ▾ meanPeople:
            value:            "0"
      ▾ 2:
        ▾ measuredTime:
            value:            "2020-07-13T19:20:31.181+02:00"
        ▾ dateObserved:
            value:            "2020-07-13T17:15:000Z"
        ▾ meanPeople:
            value:            "0"
      ▾ 3:
        ▾ measuredTime:
            value:            "2020-07-13T19:01:21.564+02:00"
        ▾ dateObserved:
            value:            "2020-07-13T17:00:000Z"
        ▾ meanPeople:
            value:            "0"
      ▾ 4:
```

Snap4City API

5) Send RT data to the IoTDevices

6) Verify RT Data via Snap4City API or via ServiceMap



**wifi_57_Loggia_Lanzi_Uffizi**

Serviceuri: http://www.disit.org/km4city/resource/iot/orionToscana-UNIFI/Toscana/wifi_57_Loggia_Lanzi_Uffizi
Name: iot/orionToscana-UNIFI/Toscana/wifi_57_Loggia_Lanzi_Uffizi
Nature: TourismService
Subnature: Wifi

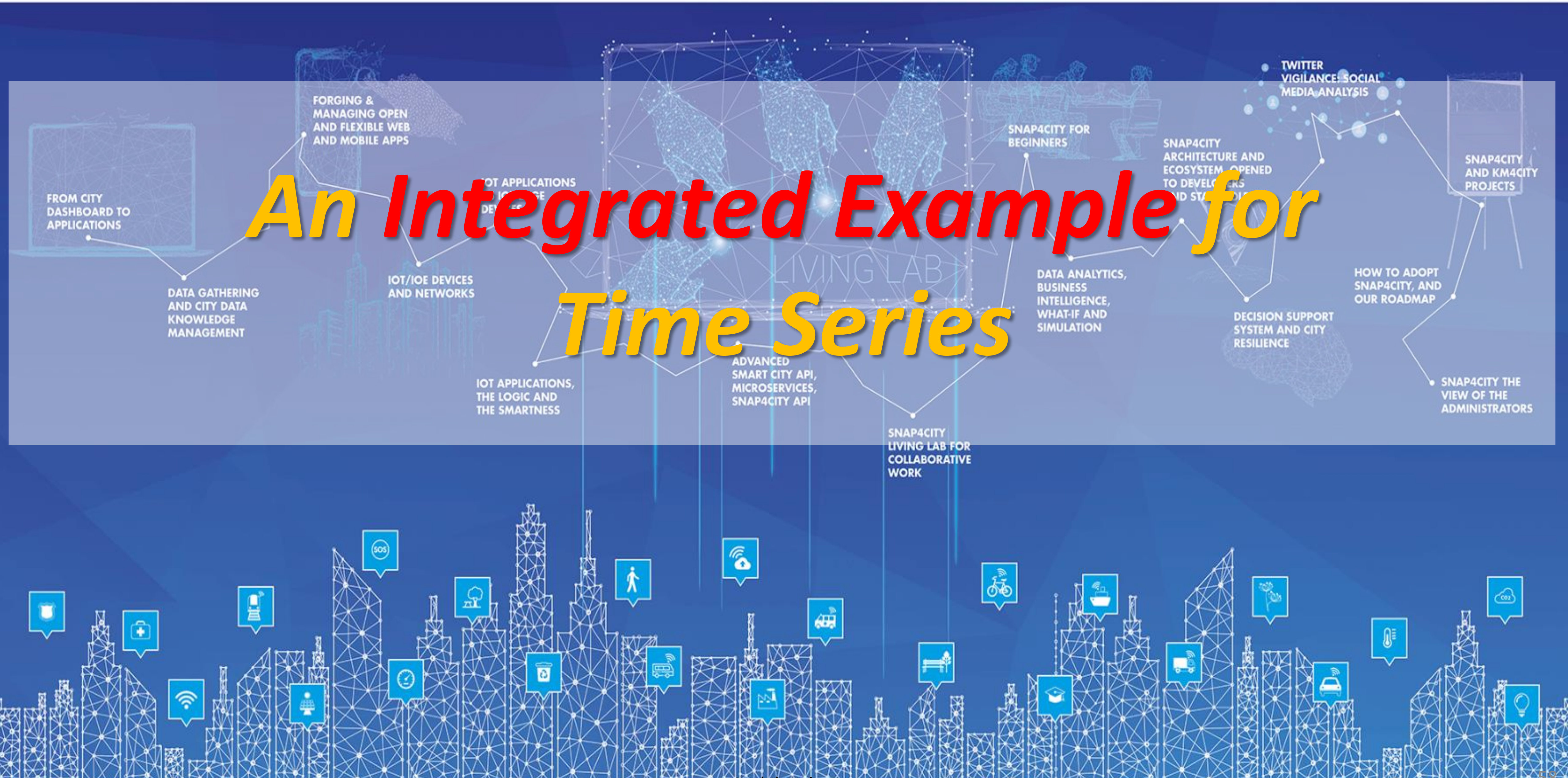
City: FIRENZE
Prov.: FI

| Property/Value Type | Value |
|---|---|
| dateObserved | 2020-07-13T18:00:000Z |
| meanPeople | 8.666667 |

Latest Update: 2020-07-13T20:06:13.854+02:00

ServiceMap

# An Integrated Example for Time Series


FROM CITY DASHBOARD TO APPLICATIONS
DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT
FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS
IOT/IOE DEVICES AND NETWORKS
IOT APPLICATIONS
IOT APPLICATIONS, THE LOGIC AND THE SMARTNESS
LIVING LAB
ADVANCED SMART CITY API, MICROSERVICES, SNAP4CITY API
SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK
SNAP4CITY FOR BEGINNERS
DATA ANALYTICS, BUSINESS INTELLIGENCE, WHAT-IF AND SIMULATION
SNAP4CITY ARCHITECTURE AND ECOSYSTEM OPENED TO DEVEL RS
TWITTER VIGILANCE: SOCIAL MEDIA ANALYSIS
DECISION SUPPORT SYSTEM AND CITY RESILIENCE
SNAP4CITY AND KM4CITY PROJECTS
HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP
SNAP4CITY THE VIEW OF THE ADMINISTRATORS

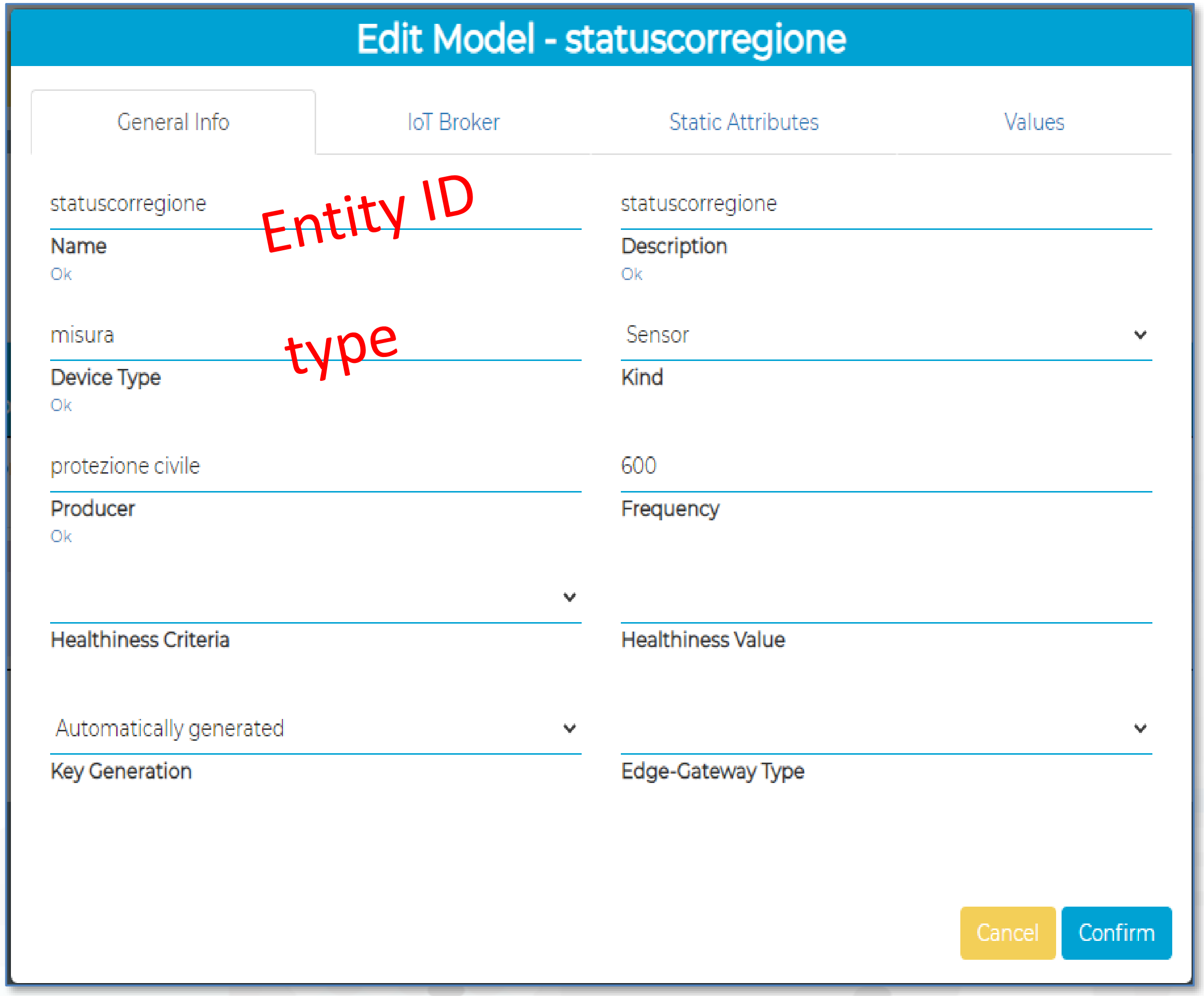
# Activities for Registration on Directory

- **Manual Registration**
  - From scratch Single Device / Entity Registration → **Entity Directory / IoT Directory**
  - From a template (the templates are called Models)
- **Automated Registration for bulk/massive registration: N** Entities / Devices
  - From IoT App on the basis of some **Models** from IoT App
  - From IoT App **loading a CSV** (with or without a reference IOT Model)
  - Programming  from scratch or from a **Model**
  - On the basis of some EXCEL file with data by using the **Data Table Loader, which create model, devices and data**
  - Etc.

1 **Entity/IoT Directory**

Manual or automated
Registration
of Entities/Devices

# created a Model as:



## Edit Model - statuscorregione

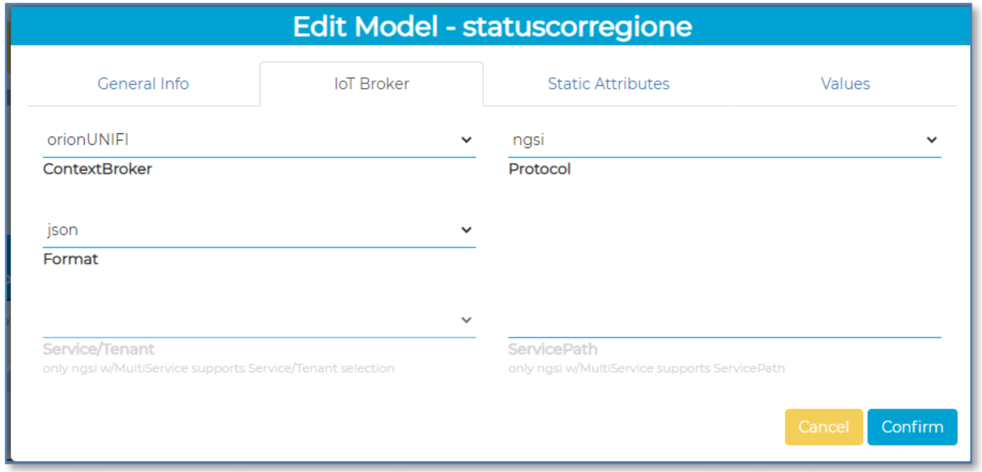
General Info | IoT Broker | Static Attributes | Values

| | |
|---|---|
| Name: statuscorregione (Ok) | Description: statuscorregione (Ok) |
| Device Type: misura (Ok) | Kind: Sensor |
| Producer: protezione civile (Ok) | Frequency: 600 |
| Healthiness Criteria: | Healthiness Value: |
| Key Generation: Automatically generated | Edge-Gateway Type: |

Cancel | Confirm

Entity ID

type

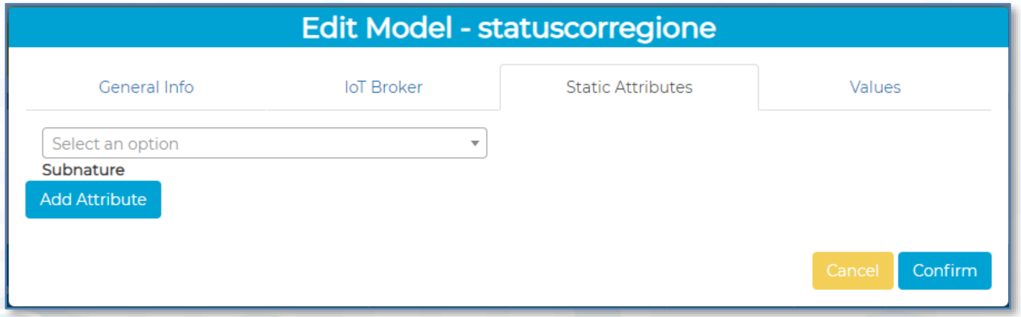


## Edit Model - statuscorregione

General Info | IoT Broker | Static Attributes | Values

| | |
|---|---|
| ContextBroker: orionUNIFI | Protocol: ngsi |
| Format: json | |
| Service/Tenant: | ServicePath: |
| only ngsi w/MultiService supports Service/Tenant selection | only ngsi w/MultiService supports ServicePath |

Cancel | Confirm



## Edit Model - statuscorregione

General Info | IoT Broker | Static Attributes | Values

Subnature: Select an option

Add Attribute

Cancel | Confirm

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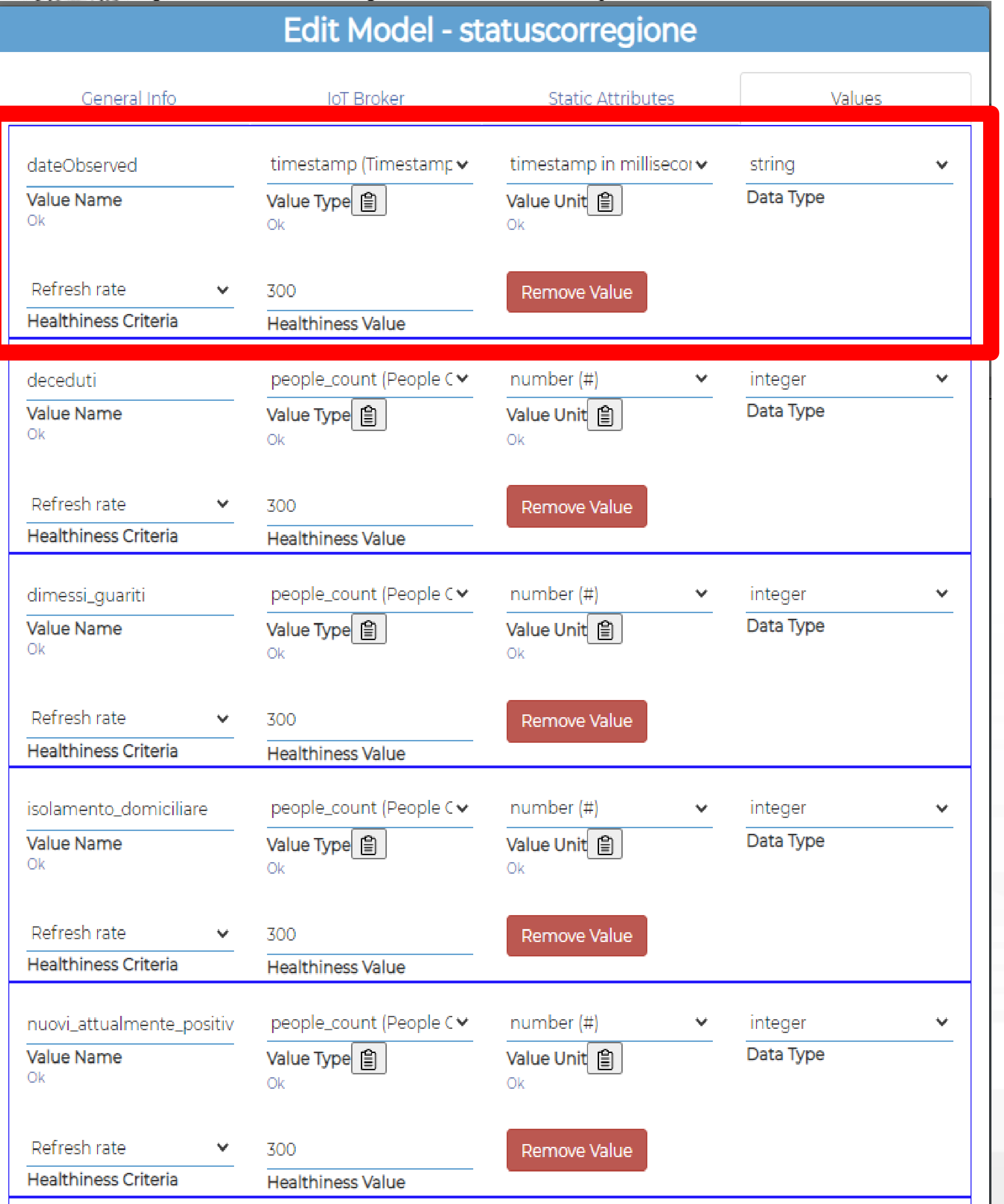


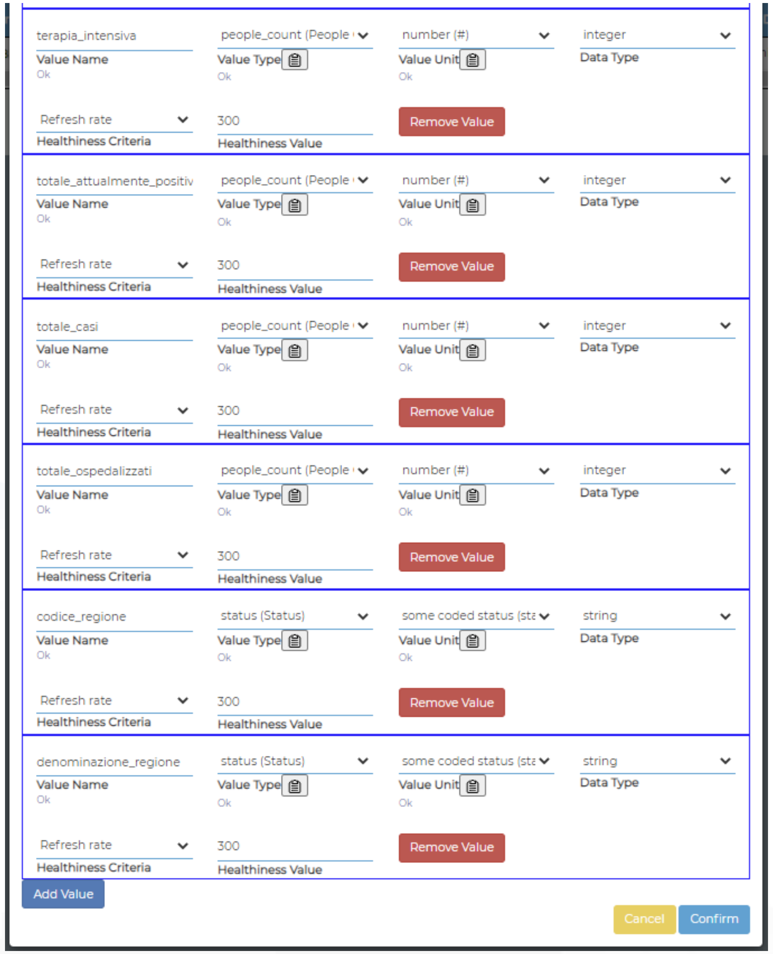
## Edit Model - statuscorregione

General Info | IoT Broker | Static Attributes | Values

| Value Name | Value Type | Value Unit | Data Type | Healthiness Criteria | Healthiness Value |
|---|---|---|---|---|---|
| dateObserved | timestamp (Timestamp | timestamp in millisecoı | string | Refresh rate | 300 |
| deceduti | people_count (People C | number (#) | integer | Refresh rate | 300 |
| dimessi_guariti | people_count (People C | number (#) | integer | Refresh rate | 300 |
| isolamento_domiciliare | people_count (People C | number (#) | integer | Refresh rate | 300 |
| nuovi_attualmente_positiv | people_count (People C | number (#) | integer | Refresh rate | 300 |

# For Time Series

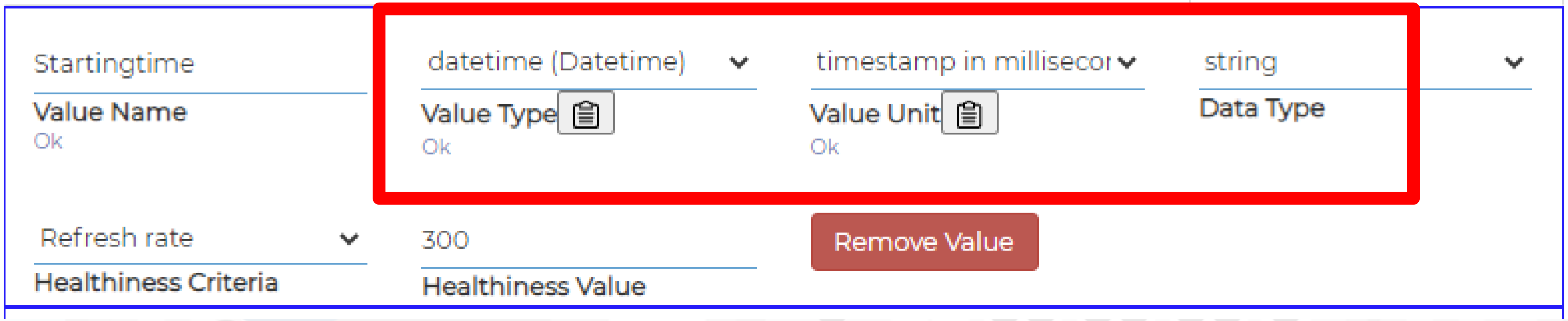
- **ValueName: dateObserved**
- **ValueType: timestamp**
- **ValueUnit: timestamp in millisecond**
- **DataType: string**
- **E.g.: ISO string of the date-time**



| Value Name | Value Type | Value Unit | Data Type | Healthiness Criteria | Healthiness Value |
|---|---|---|---|---|---|
| terapia_intensiva | people_count (People ( | number (#) | integer | Refresh rate | 300 |
| totale_attualmente_positiv | people_count (People ( | number (#) | integer | Refresh rate | 300 |
| totale_casi | people_count (People ( | number (#) | integer | Refresh rate | 300 |
| totale_ospedalizzati | people_count (People ( | number (#) | integer | Refresh rate | 300 |
| codice_regione | status (Status) | some coded status (sta | string | Refresh rate | 300 |
| denominazione_regione | status (Status) | some coded status (sta | string | Refresh rate | 300 |

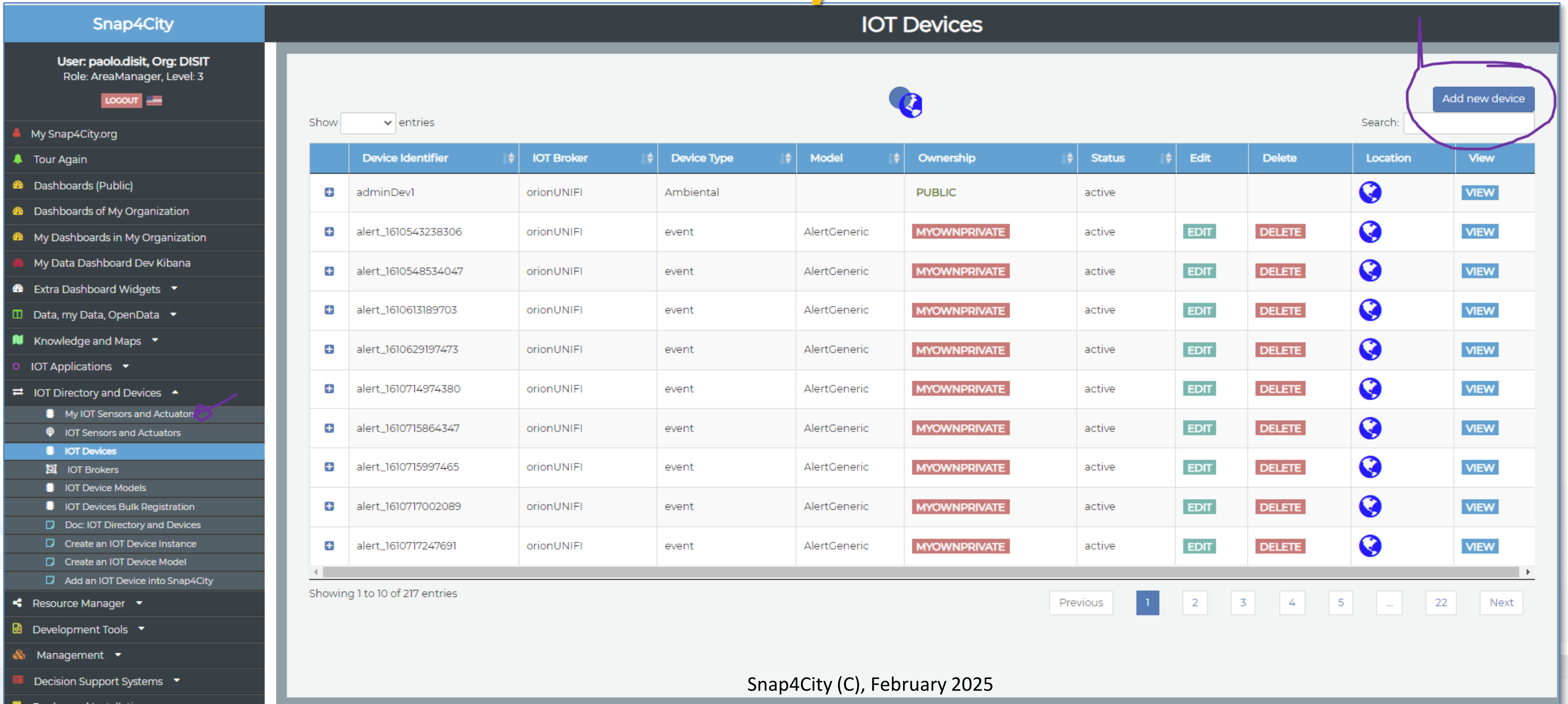
# Please note for Time Series of IoT Devices

- Snap4City engine recognizes as time basis for the TimeSerie only 1 Varible with
  - ValueType as TimeStamp (in milliseconds)
- **If you need more than one variable as timestamp** in milliseconds use:
  - ValueType = ***Datetime*** (in milliseconds)



| | | | |
|---|---|---|---|
| Value Name: Startingtime<br>Ok | Value Type: datetime (Datetime)<br>Ok | Value Unit: timestamp in millisecor<br>Ok | Data Type: string |
| Healthiness Criteria: Refresh rate | Healthiness Value: 300 | Remove Value | |

# From Model, you can create instances of Entities / Devices



Snap4City

User: paolo.disit, Org: DISIT
Role: AreaManager, Level: 3

LOGOUT

- My Snap4City.org
- Tour Again
- Dashboards (Public)
- Dashboards of My Organization
- My Dashboards in My Organization
- My Data Dashboard Dev Kibana
- Extra Dashboard Widgets
- Data, my Data, OpenData
- Knowledge and Maps
- IOT Applications
- IOT Directory and Devices
  - My IOT Sensors and Actuators
  - IOT Sensors and Actuators
  - IOT Devices
  - IOT Brokers
  - IOT Device Models
  - IOT Devices Bulk Registration
  - Doc: IOT Directory and Devices
  - Create an IOT Device Instance
  - Create an IOT Device Model
  - Add an IOT Device into Snap4City
- Resource Manager
- Development Tools
- Management
- Decision Support Systems

## IOT Devices

Add new device

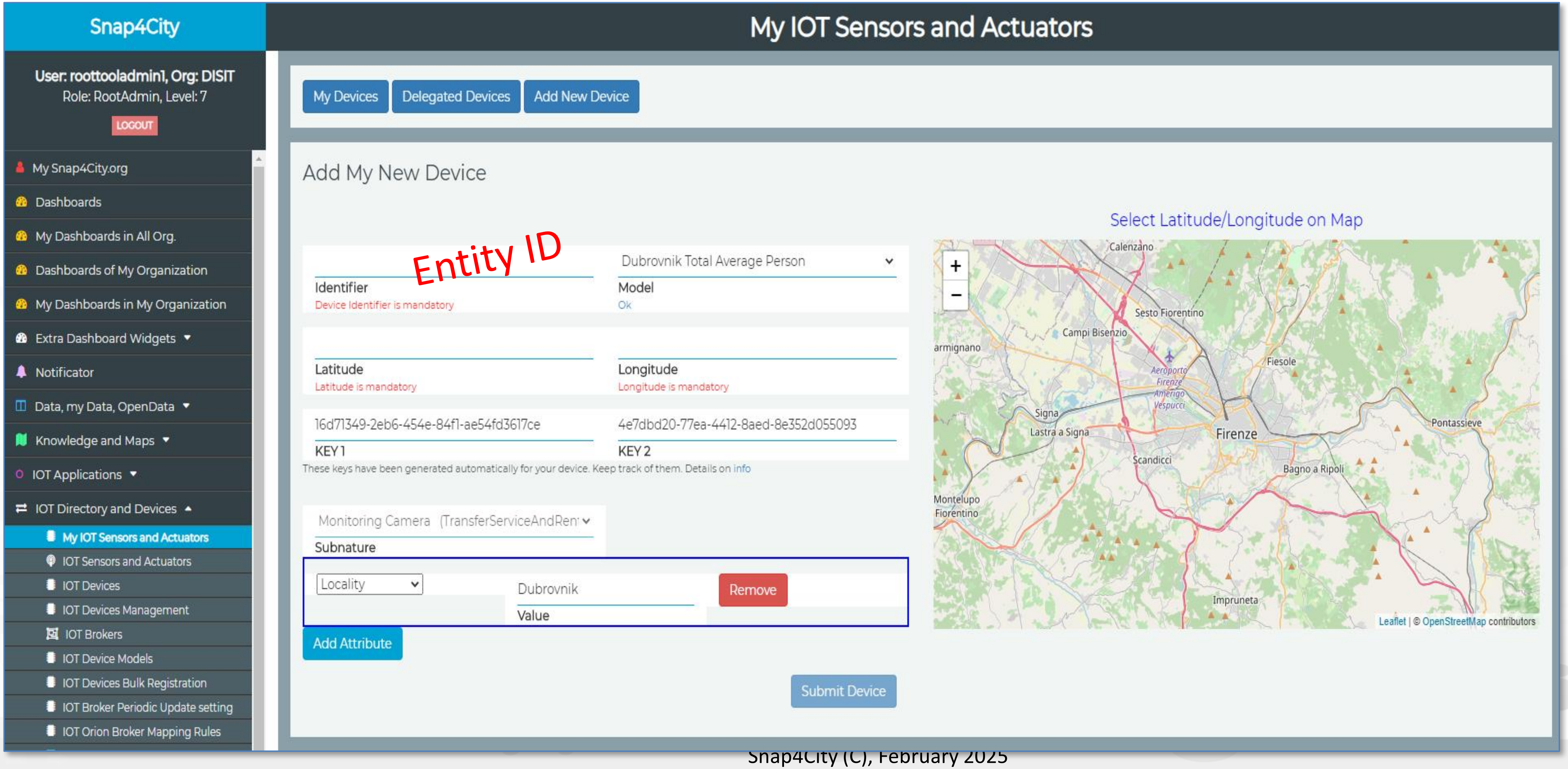
Show entries　　　　Search:

| | Device Identifier | IOT Broker | Device Type | Model | Ownership | Status | Edit | Delete | Location | View |
|---|---|---|---|---|---|---|---|---|---|---|
| ⊞ | adminDev1 | orionUNIFI | Ambiental | | PUBLIC | active | | | | VIEW |
| ⊞ | alert_1610543238306 | orionUNIFI | event | AlertGeneric | MYOWNPRIVATE | active | EDIT | DELETE | | VIEW |
| ⊞ | alert_1610548534047 | orionUNIFI | event | AlertGeneric | MYOWNPRIVATE | active | EDIT | DELETE | | VIEW |
| ⊞ | alert_1610613189703 | orionUNIFI | event | AlertGeneric | MYOWNPRIVATE | active | EDIT | DELETE | | VIEW |
| ⊞ | alert_1610629197473 | orionUNIFI | event | AlertGeneric | MYOWNPRIVATE | active | EDIT | DELETE | | VIEW |
| ⊞ | alert_1610714974380 | orionUNIFI | event | AlertGeneric | MYOWNPRIVATE | active | EDIT | DELETE | | VIEW |
| ⊞ | alert_1610715864347 | orionUNIFI | event | AlertGeneric | MYOWNPRIVATE | active | EDIT | DELETE | | VIEW |
| ⊞ | alert_1610715997465 | orionUNIFI | event | AlertGeneric | MYOWNPRIVATE | active | EDIT | DELETE | | VIEW |
| ⊞ | alert_1610717002089 | orionUNIFI | event | AlertGeneric | MYOWNPRIVATE | active | EDIT | DELETE | | VIEW |
| ⊞ | alert_1610717247691 | orionUNIFI | event | AlertGeneric | MYOWNPRIVATE | active | EDIT | DELETE | | VIEW |

Showing 1 to 10 of 217 entries

Previous 1 2 3 4 5 … 22 Next

# They have been created by «Add new Device»


Snap4City
My IOT Sensors and Actuators
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
Extra Dashboard Widgets
Notificator
Data, my Data, OpenData
Knowledge and Maps
IOT Applications
IOT Directory and Devices
My IOT Sensors and Actuators
IOT Sensors and Actuators
IOT Devices
IOT Devices Management
IOT Brokers
IOT Device Models
IOT Devices Bulk Registration
IOT Broker Periodic Update setting
IOT Orion Broker Mapping Rules
My Devices
Delegated Devices
Add New Device
Entity ID
Remove
Add Attribute
Submit Device
Select Latitude/Longitude on Map
+
−
Calenzano
Sesto Fiorentino
Campi Bisenzio
armignano
Aeroporto Firenze Amerigo Vespucci
Fiesole
Signa
Lastra a Signa
Firenze
Pontassieve
Scandicci
Bagno a Ripoli
Montelupo Fiorentino
Impruneta
Leaflet | © OpenStreetMap contributors

## Add My New Device

Identifier
Device Identifier is mandatory

Model: Dubrovnik Total Average Person
Ok

Latitude
Latitude is mandatory

Longitude
Longitude is mandatory

KEY 1: 16d71349-2eb6-454e-84f1-ae54fd3617ce

KEY 2: 4e7dbd20-77ea-4412-8aed-8e352d055093

These keys have been generated automatically for your device. Keep track of them. Details on info

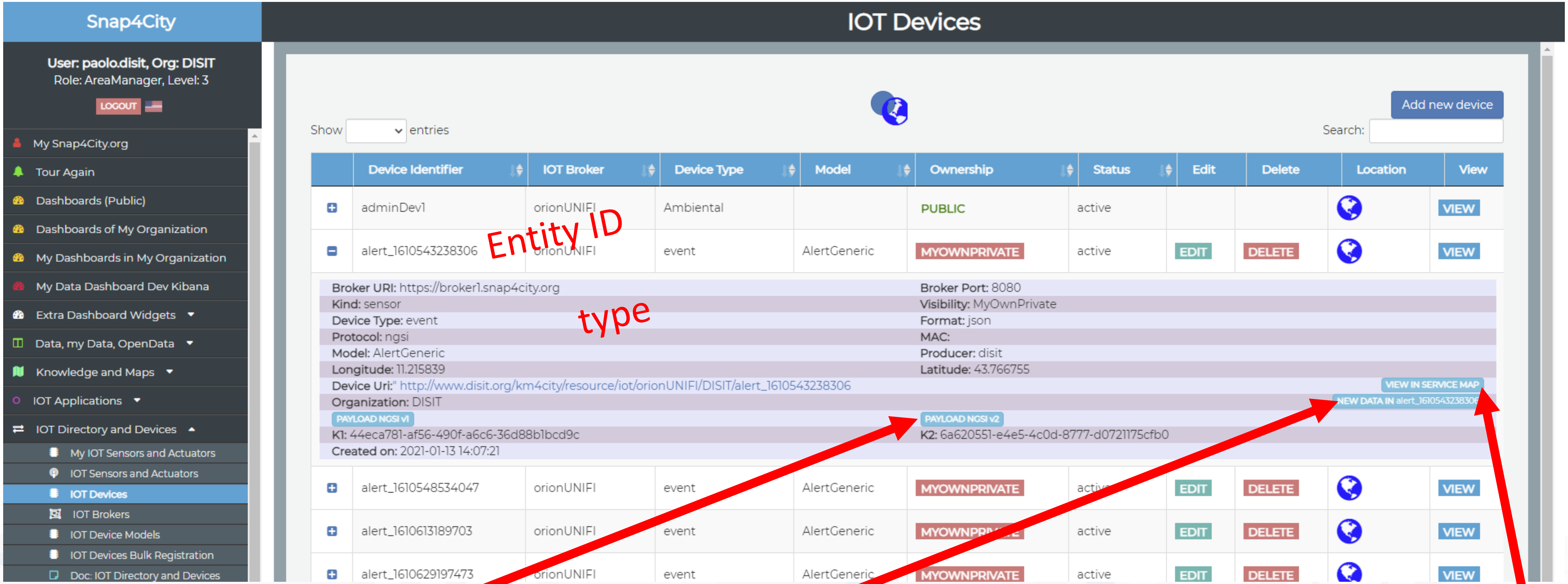
Subnature: Monitoring Camera (TransferServiceAndRen

Locality | Value: Dubrovnik

# Device from Model by Providing:

- **NAME (it has to be unique)**
- Select the IoT/Entity Model: «**statuscorregione**»
  - Thus the K1, K2 appears since the model is associated with an Orion Broker that needs to have them, the Snap4City tools generate them for you, while you can impose if you like
    - Another usage can be from an external device on field, or from an application not in SSO with Snap4City, etc.
    - They are usually different for different users and delegations
  - See in previous slide the ID name of the IOT Broker used
- **Lat** and **Lon**, GPS coordinates you can:
  - pick on the map
  - Write the coordinates manually and see the pin on map

# Once Created, I may send a new data to it


Snap4City
IOT Devices
User: paolo.disit, Org: DISIT
Role: AreaManager, Level: 3
LOGOUT
My Snap4City.org
Tour Again
Dashboards (Public)
Dashboards of My Organization
My Dashboards in My Organization
My Data Dashboard Dev Kibana
Extra Dashboard Widgets
Data, my Data, OpenData
Knowledge and Maps
IOT Applications
IOT Directory and Devices
My IOT Sensors and Actuators
IOT Sensors and Actuators
IOT Devices
IOT Brokers
IOT Device Models
IOT Devices Bulk Registration
Doc: IOT Directory and Devices
Add new device
Show entries
Search:
Entity ID
type
VIEW IN SERVICE MAP
NEW DATA IN alert_1610543238306
PAYLOAD NGSI V1
PAYLOAD NGSI V2

| | Device Identifier | IOT Broker | Device Type | Model | Ownership | Status | Edit | Delete | Location | View |
|---|---|---|---|---|---|---|---|---|---|---|
| ⊞ | adminDev1 | orionUNIFI | Ambiental | | PUBLIC | active | | | 🌐 | VIEW |
| ⊟ | alert_1610543238306 | orionUNIFI | event | AlertGeneric | MYOWNPRIVATE | active | EDIT | DELETE | 🌐 | VIEW |
| ⊞ | alert_1610548534047 | orionUNIFI | event | AlertGeneric | MYOWNPRIVATE | active | EDIT | DELETE | 🌐 | VIEW |
| ⊞ | alert_1610613189703 | orionUNIFI | event | AlertGeneric | MYOWNPRIVATE | active | EDIT | DELETE | 🌐 | VIEW |
| ⊞ | alert_1610629197473 | orionUNIFI | event | AlertGeneric | MYOWNPRIVATE | active | EDIT | DELETE | 🌐 | VIEW |

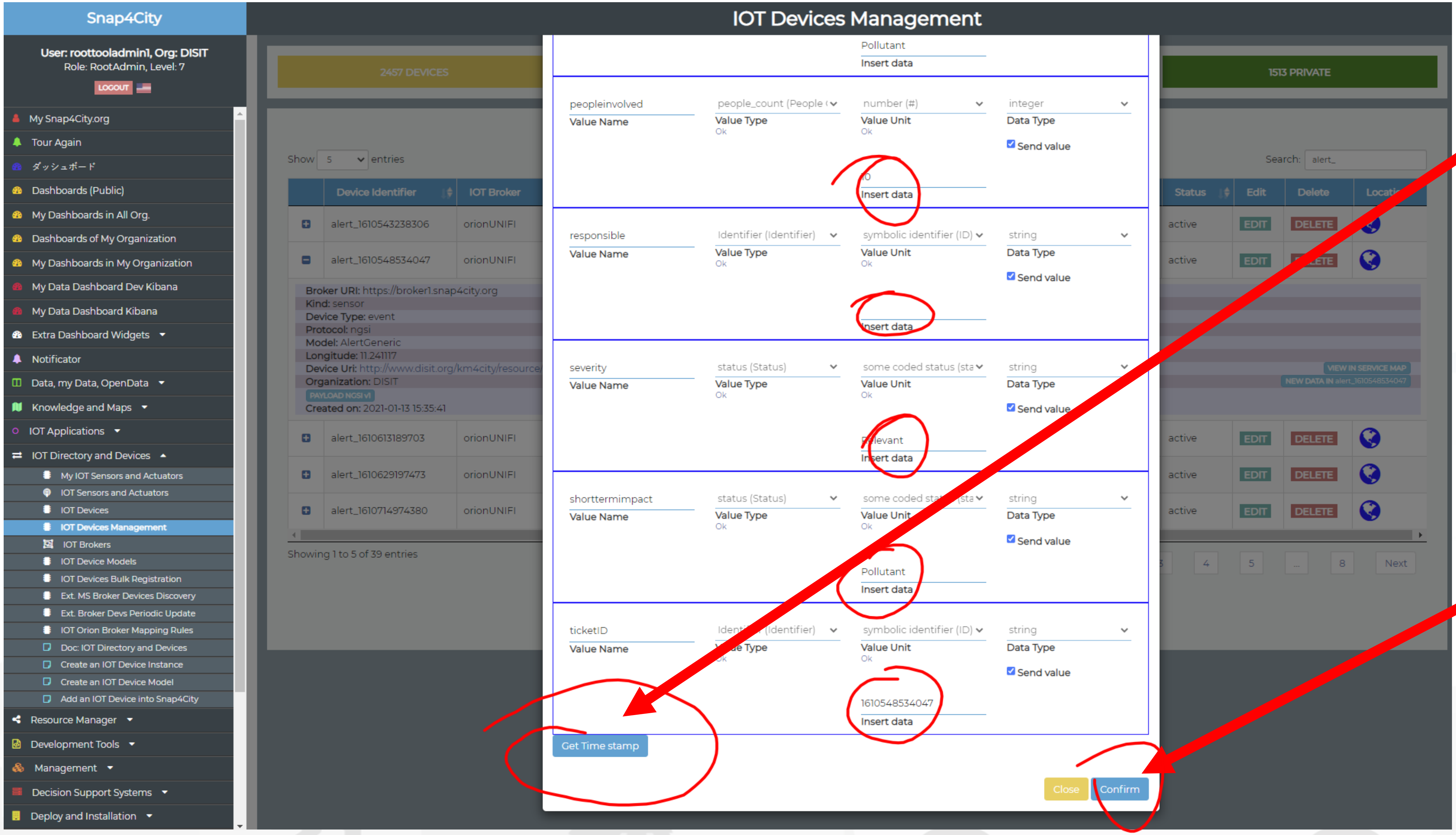
**Broker URI:** https://broker1.snap4city.org
**Broker Port:** 8080
**Kind:** sensor
**Visibility:** MyOwnPrivate
**Device Type:** event
**Format:** json
**Protocol:** ngsi
**MAC:**
**Model:** AlertGeneric
**Producer:** disit
**Longitude:** 11.215839
**Latitude:** 43.766755
**Device Uri:**" http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT/alert_1610543238306
**Organization:** DISIT
**K1:** 44eca781-af56-490f-a6c6-36d88b1bcd9c
**K2:** 6a620551-e4e5-4c0d-8777-d0721175cfb0
**Created on:** 2021-01-13 14:07:21

Get/See last message from Broker

Generate a New Message towards the Device, Storage

View IoT Device on map and its last value

# Edit Message



Snap4City
User: roottooladmin1, Org: DISIT
Role: RootAdmin, Level: 7
LOGOUT
My Snap4City.org
Tour Again
ダッシュボード
Dashboards (Public)
My Dashboards in All Org.
Dashboards of My Organization
My Dashboards in My Organization
My Data Dashboard Dev Kibana
My Data Dashboard Kibana
Extra Dashboard Widgets
Notificator
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My IOT Sensors and Actuators
IOT Sensors and Actuators
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IOT Devices Management
IOT Brokers
IOT Device Models
IOT Devices Bulk Registration
Ext. MS Broker Devices Discovery
Ext. Broker Devs Periodic Update
IOT Orion Broker Mapping Rules
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Create an IOT Device Model
Add an IOT Device into Snap4City
Resource Manager
Development Tools
Management
Decision Support Systems
Deploy and Installation
IOT Devices Management
2457 DEVICES
1513 PRIVATE
Show 5 entries
Search: alert_
Device Identifier
IOT Broker
Status
Edit
Delete
Location
VIEW IN SERVICE MAP
NEW DATA IN alert_1610548534047
PAYLOAD NGSI v1
Showing 1 to 5 of 39 entries
4
5
...
8
Next

| Device Identifier | IOT Broker | Status | Edit | Delete |
|---|---|---|---|---|
| alert_1610543238306 | orionUNIFI | active | EDIT | DELETE |
| alert_1610548534047 | orionUNIFI | active | EDIT | DELETE |
| alert_1610613189703 | orionUNIFI | active | EDIT | DELETE |
| alert_1610629197473 | orionUNIFI | active | EDIT | DELETE |
| alert_1610714974380 | orionUNIFI | active | EDIT | DELETE |

Broker URI: https://broker1.snap4city.org
Kind: sensor
Device Type: event
Protocol: ngsi
Model: AlertGeneric
Longitude: 11.241117
Device Uri: http://www.disit.org/km4city/resource/
Organization: DISIT
Created on: 2021-01-13 15:35:41

Pollutant
Insert data

| Value Name | Value Type | Value Unit | Data Type | Send value | Insert data |
|---|---|---|---|---|---|
| peopleinvolved | people_count (People ( | number (#) | integer | ☑ | 10 |
| responsible | Identifier (Identifier) | symbolic identifier (ID) | string | ☑ | |
| severity | status (Status) | some coded status (sta | string | ☑ | Relevant |
| shorttermimpact | status (Status) | some coded status (sta | string | ☑ | Pollutant |
| ticketID | Identifier (Identifier) | symbolic identifier (ID) | string | ☑ | 1610548534047 |

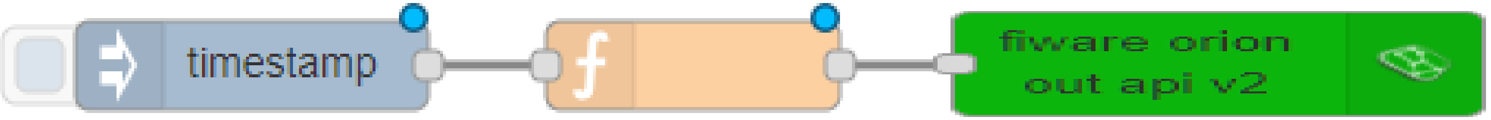
Get Time stamp

Close Confirm

Impose current date time on dateObserved

Send the Message to the Device, Storage

# Once created the Device you may send data on it



- You may create a Proc.Logic / IOT App, where:
  - Function: is preparing the JSON package
  - Block «FIWARE Orion OUT V2» is sending the data to the Orion Broker. Namely: «OrionUNIFI», and from that on Snap4City Storage Automatically
  - Please note that several version of ORION Brokers and protocols exists:
    - So that you have to know which protocols you need to use for your broker

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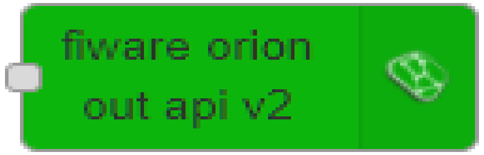
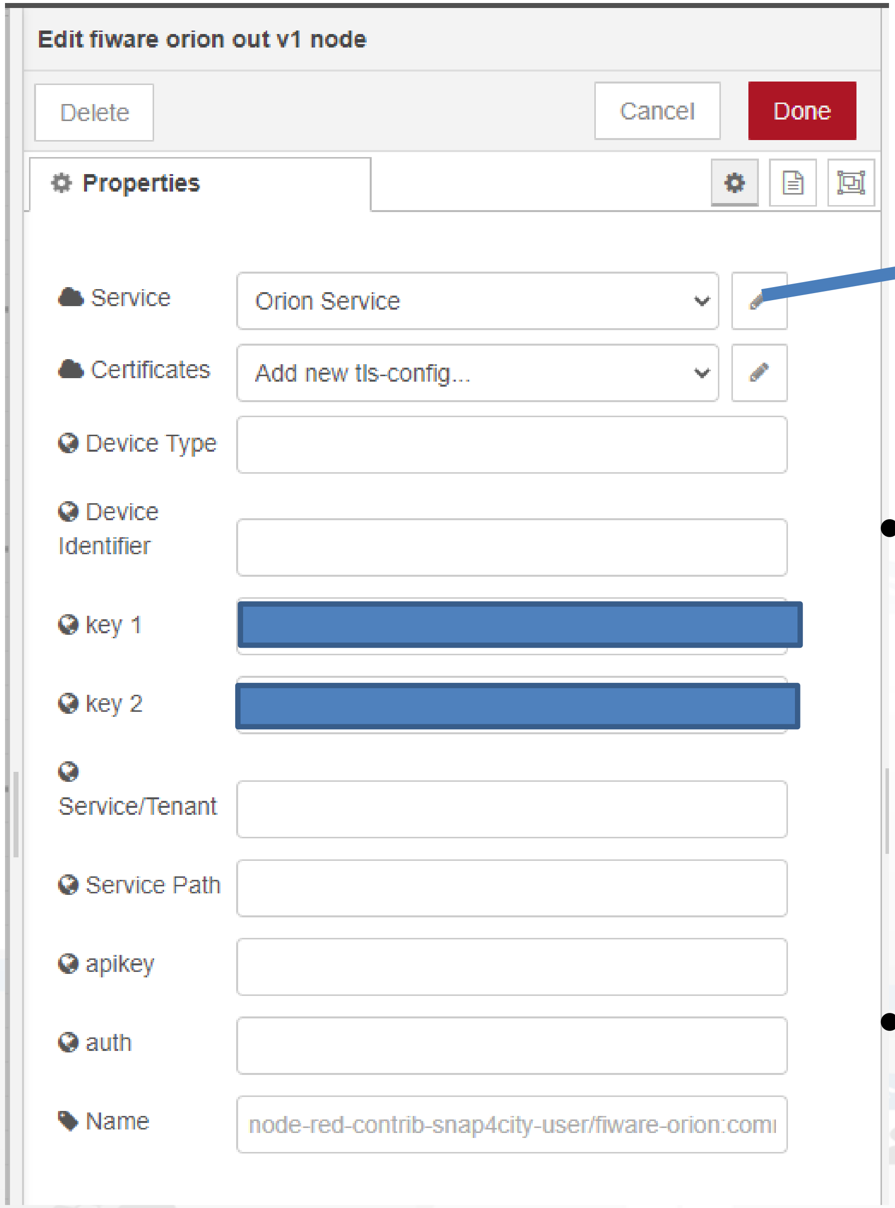
# Settings ?



- Certificates are automatically loaded at the first authentication
- Done!!


Edit fiware orion out v1 node

Service: Orion Service

Certificates: Add new tls-config...

Device Type:

Device Identifier:

key 1: [redacted]

key 2: [redacted]

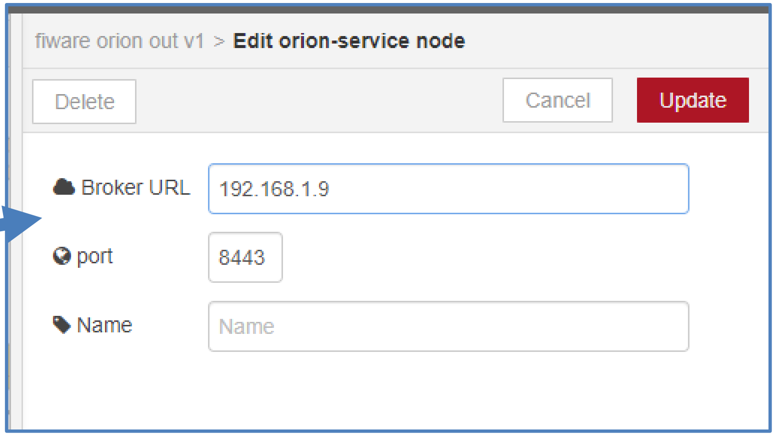
Service/Tenant:

Service Path:

apikey:

auth:

Name: node-red-contrib-snap4city-user/fiware-orion:comı


fiware orion out v1 > Edit orion-service node

Broker URL: 192.168.1.9

port: 8443

Name: Name

- IP if the Broker is in cloud (internal)
  - List of brokers is automatically provides
  - The K1, K2 is automatically provided if you are authenticated
- Symbolic address of Broker can be taken from Directory

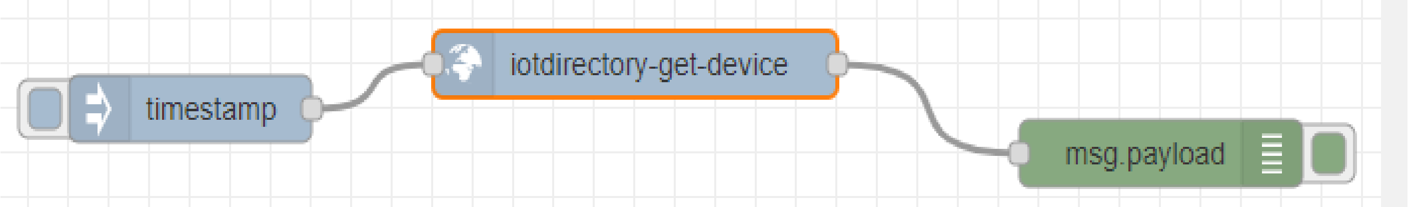
- A Json from the IOT App
  - NGSI V1
- **ID**: The Name of the IOT Device: «corveneto»
- **Type** as that defince in the IOT Device when you created
- The **Time stamp**: “dateObserved” to have a time series data
  - “str” is a string with the date and time in standard ISO, such as ,
  - “2020-08-04T04:00:00+02:00”,
  - “2020-08-03T00:00:00.000Z”
- And the **vector** of **“attributes”**

```
msg = { payload : {
   "id": "corveneto",
   "type": "misura",
   "attributes":[
 {  "name": "dateObserved", "value": str, "type": "timestamp"  },
 {  "name": "stato",   "value": “active”,   "type": "string"  },
 {  "name": "ricoverati_con_sintomi",   "value": 12,   "type": "integer"  },
 {  "name": "terapia_intensiva",   "value": 34,   "type": "integer"  },
 {  "name": "totale_ospedalizzati", "value": 34,  "type": "integer"  },
 {  "name": "isolamento_domiciliare",  "value": 334,  "type": "integer"  },
 {  "name": "totale_attualmente_positivi",   "value": 12,   "type": "integer"  },
 {  "name": "nuovi_attualmente_positivi", "value": 33,   "type": "integer"  },
 {  "name": "dimessi_guariti",   "value": 22222,   "type": "integer"  },
 {  "name": "deceduti",    "value": 2,  "type": "integer"   },
 {  "name": "totale_casi",    "value": 2222,    "type": "integer"   },
 {  "name": "tamponi",    "value": 222222344,    "type": "integer"   }
 ]
}
}
return msg;
```

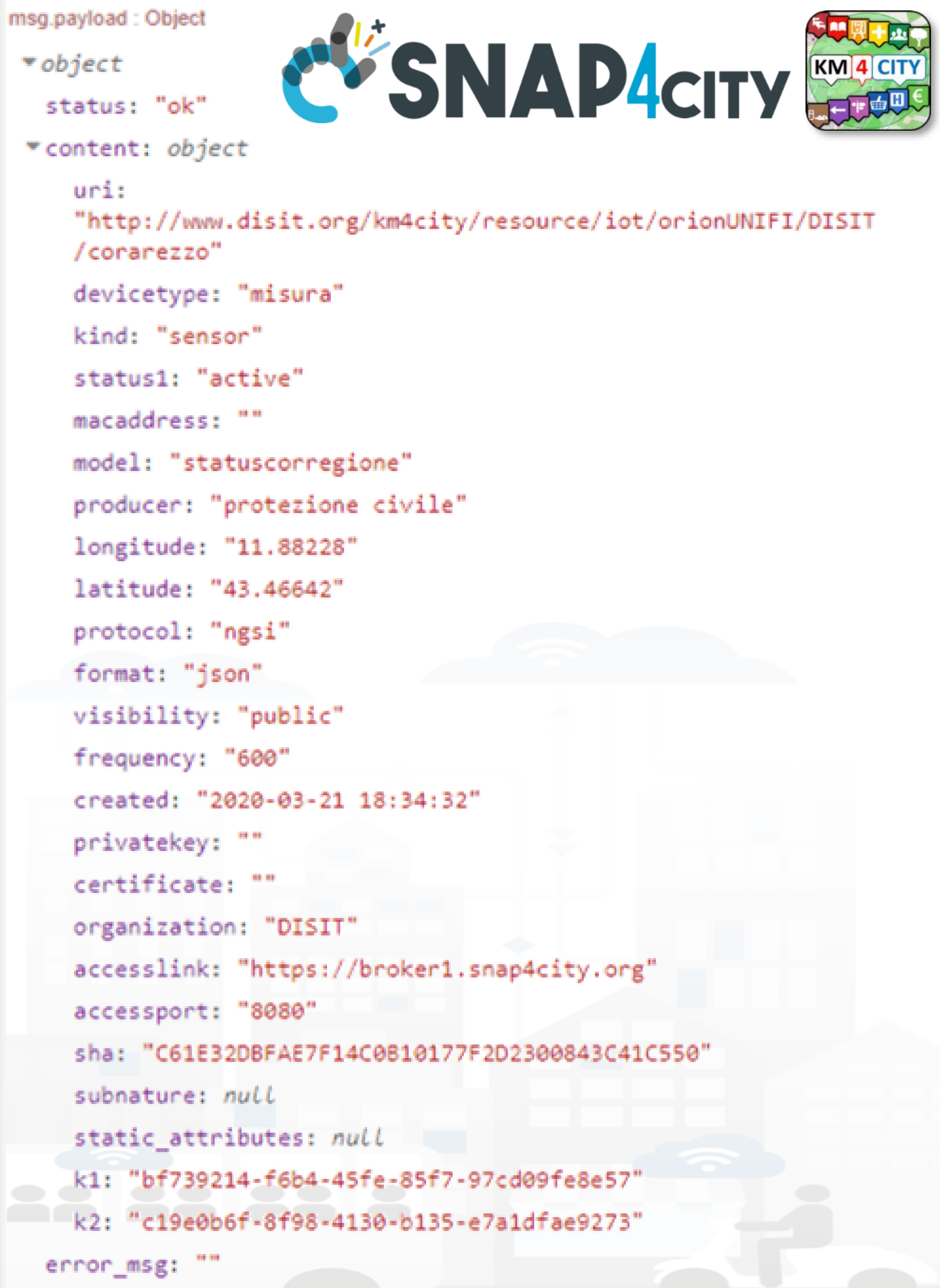
# DateObserved

- The **Timestamp**: “dateObserved” to have  a time series data
  - “str” is a string with the  date and time in standard ISO, such as ,
  - “2020-08-04T04:00:00+02:00”,
  - “2020-08-03T00:00:00.000Z”
- In JavaScript you can obtain by using:
  - Var str = new Date().toISOString();
  - **Str** has to be the ISO date string of today-now (at the current time).

# Get IOT Device Info

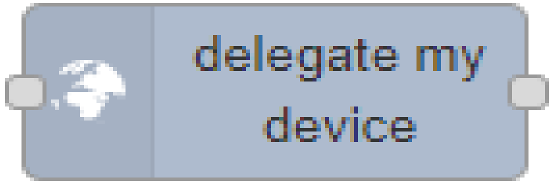


- You can create smart Proc.Logic / IoT App that on the basis of the list of Devices would request all what you need to load data into **YOUR OWN** Devices including:
  - **Service URI**
  - **K1, K2**
  - Authentication

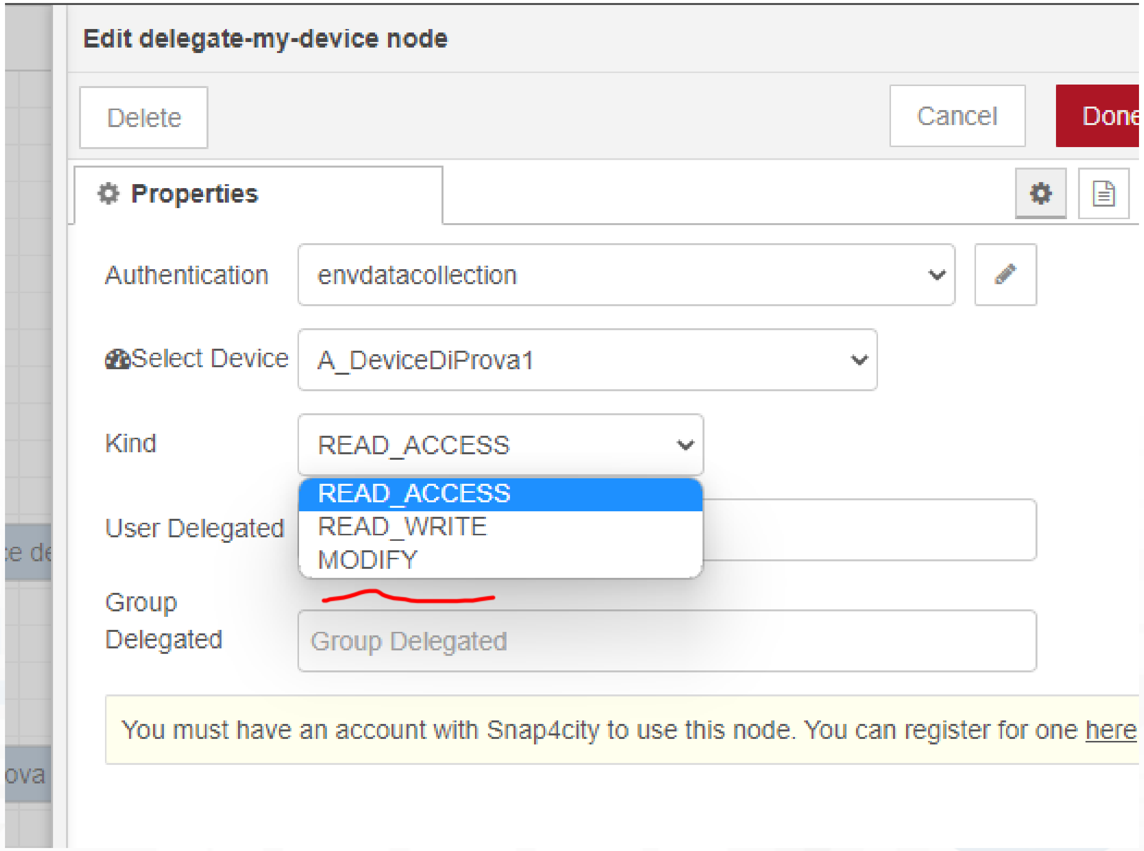


```
msg.payload : Object
▾object
  status: "ok"
 ▾content: object
    uri:
    "http://www.disit.org/km4city/resource/iot/orionUNIFI/DISIT
    /corarezzo"
    devicetype: "misura"
    kind: "sensor"
    status1: "active"
    macaddress: ""
    model: "statuscorregione"
    producer: "protezione civile"
    longitude: "11.88228"
    latitude: "43.46642"
    protocol: "ngsi"
    format: "json"
    visibility: "public"
    frequency: "600"
    created: "2020-03-21 18:34:32"
    privatekey: ""
    certificate: ""
    organization: "DISIT"
    accesslink: "https://broker1.snap4city.org"
    accessport: "8080"
    sha: "C61E32DBFAE7F14C0B10177F2D2300843C41C550"
    subnature: null
    static_attributes: null
    k1: "bf739214-f6b4-45fe-85f7-97cd09fe8e57"
    k2: "c19e0b6f-8f98-4130-b135-e7a1dfae9273"
  error_msg: ""
```

# Delegate Management from IoT App



To delegate a certain device to some other user/group of users



Edit delegate-my-device node

Authentication: envdatacollection

Select Device: A_DeviceDiProva1

Kind: READ_ACCESS

- READ_ACCESS
- READ_WRITE
- MODIFY

User Delegated

Group Delegated: Group Delegated

You must have an account with Snap4city to use this node. You can register for one here

# Exploiting Storage data by using: IoT App / Proc. Logic

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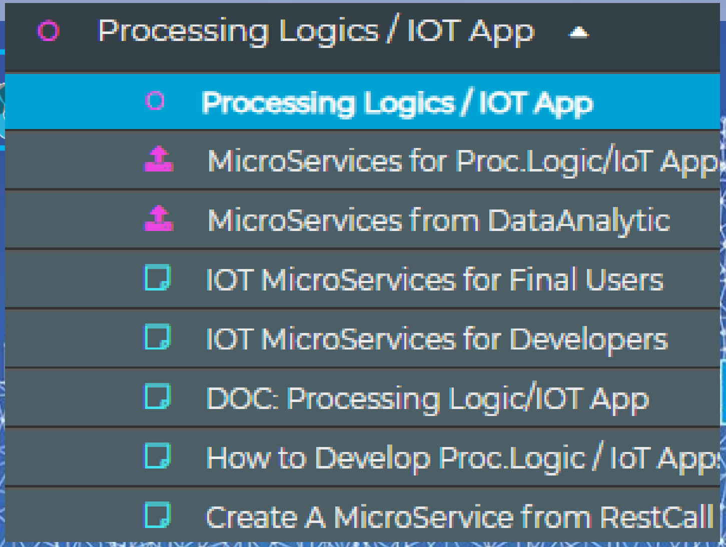
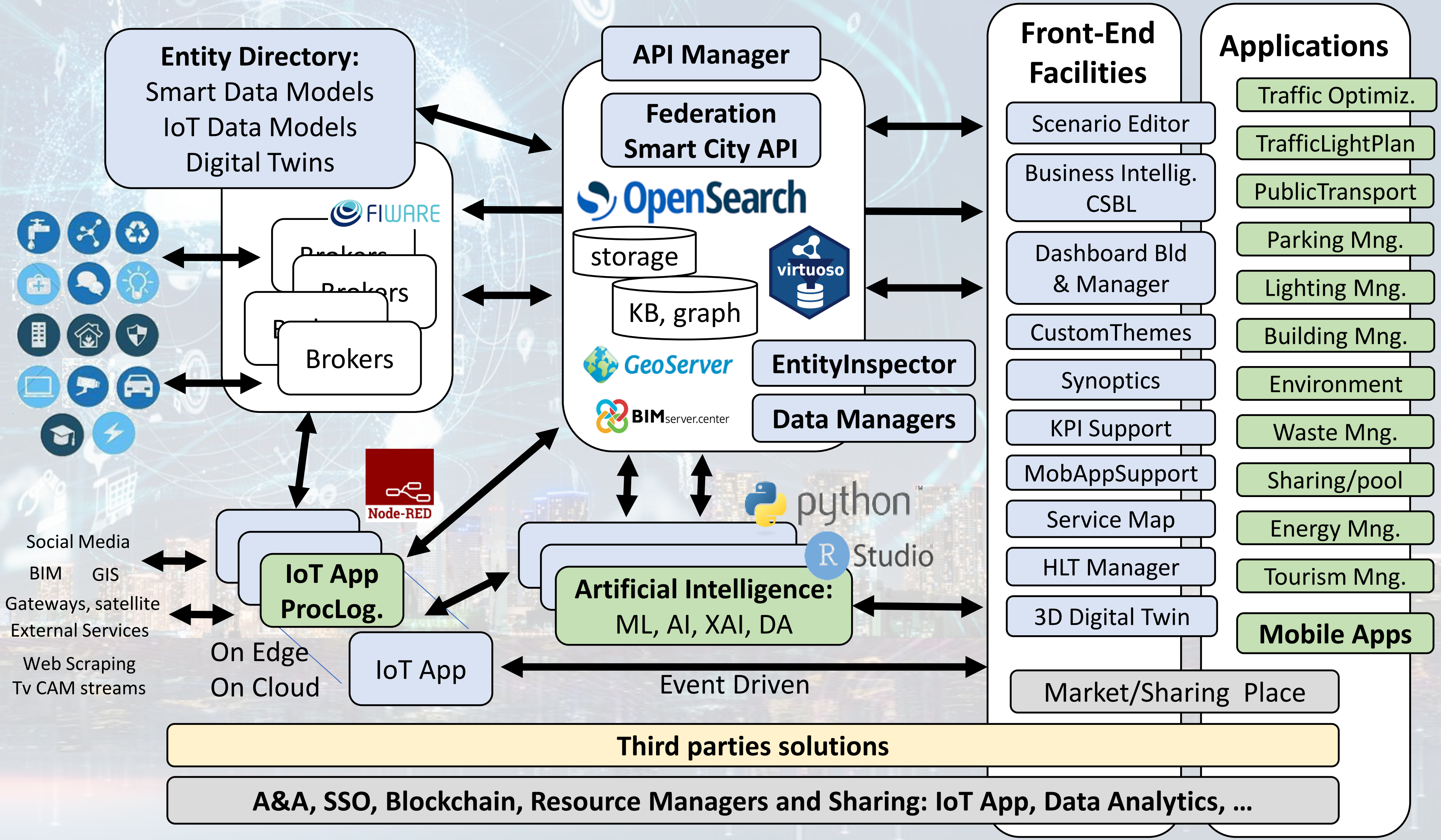
SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK


Processing Logics / IOT App
Processing Logics / IOT App
MicroServices for Proc.Logic/IoT Apps
MicroServices from DataAnalytic
IOT MicroServices for Final Users
IOT MicroServices for Developers
DOC: Processing Logic/IOT App
How to Develop Proc.Logic / IoT Apps
Create A MicroService from RestCall

Node-RED

# Technical Architecture



Entity Directory:
Smart Data Models
IoT Data Models
Digital Twins

FIWARE

Brokers

API Manager

Federation
Smart City API

OpenSearch

storage

KB, graph

virtuoso

GeoServer

EntityInspector

BIMserver.center

Data Managers

Front-End Facilities

- Scenario Editor
- Business Intellig. CSBL
- Dashboard Bld & Manager
- CustomThemes
- Synoptics
- KPI Support
- MobAppSupport
- Service Map
- HLT Manager
- 3D Digital Twin

Applications

- Traffic Optimiz.
- TrafficLightPlan
- PublicTransport
- Parking Mng.
- Lighting Mng.
- Building Mng.
- Environment
- Waste Mng.
- Sharing/pool
- Energy Mng.
- Tourism Mng.
- **Mobile Apps**

Market/Sharing Place

Node-RED

Social Media
BIM GIS
Gateways, satellite
External Services
Web Scraping
Tv CAM streams

IoT App
ProcLog.

On Edge
On Cloud

IoT App

python

R Studio

Artificial Intelligence:
ML, AI, XAI, DA

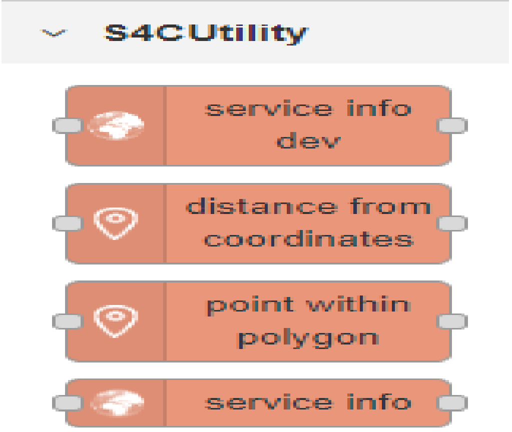
Event Driven

**Third parties solutions**

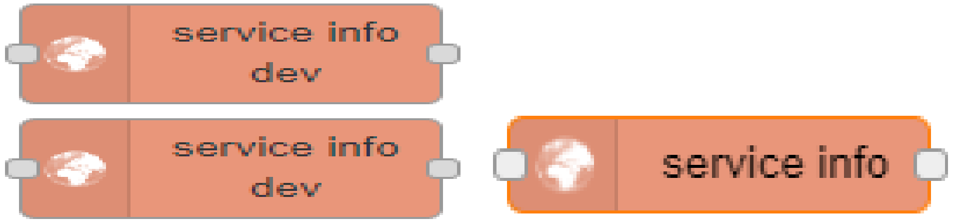
**A&A, SSO, Blockchain, Resource Managers and Sharing: IoT App, Data Analytics, …**

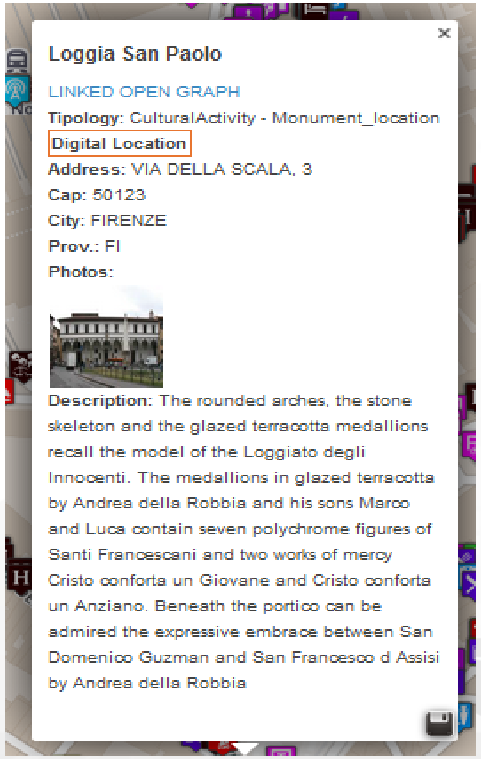
2024/8

# S4CSearch


S4CUtility

- ANY kind of sensors
- **To Get DATA of a Service / POI /sensor**
  - Historical and real time
  - Real Time




Loggia San Paolo

LINKED OPEN GRAPH

Tipology: CulturalActivity - Monument_location

Digital Location

Address: VIA DELLA SCALA, 3

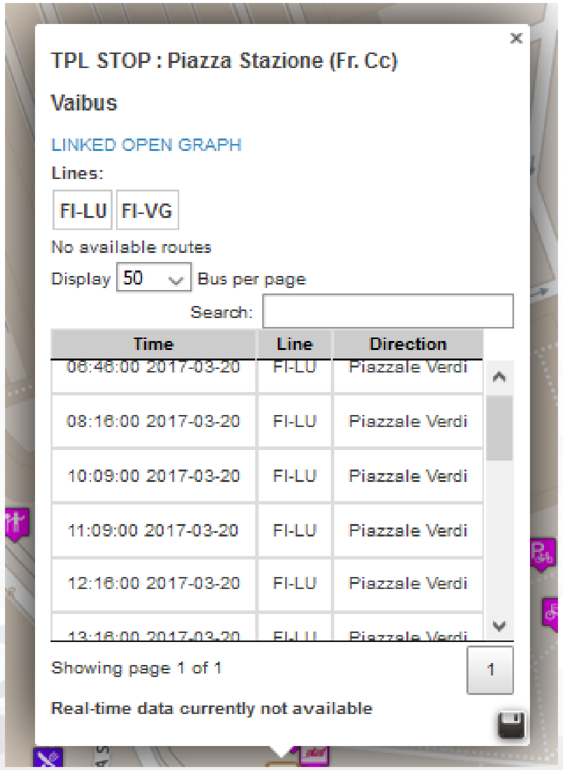
Cap: 50123

City: FIRENZE

Prov.: FI

Photos:

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


TPL STOP : Piazza Stazione (Fr. Cc)

Vaibus

LINKED OPEN GRAPH

Lines:

FI-LU FI-VG

No available routes

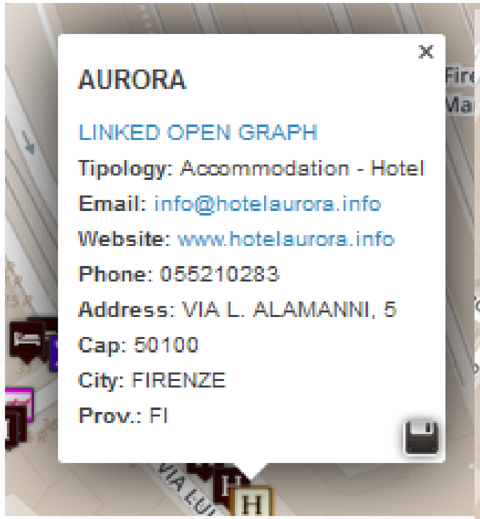
Display 50 Bus per page

Search:

| Time | Line | Direction |
|---|---|---|
| 06:46:00 2017-03-20 | FI-LU | Piazzale Verdi |
| 08:16:00 2017-03-20 | FI-LU | Piazzale Verdi |
| 10:09:00 2017-03-20 | FI-LU | Piazzale Verdi |
| 11:09:00 2017-03-20 | FI-LU | Piazzale Verdi |
| 12:16:00 2017-03-20 | FI-LU | Piazzale Verdi |
| 13:16:00 2017-03-20 | FI-LU | Piazzale Verdi |

Showing page 1 of 1

Real-time data currently not available


AURORA

LINKED OPEN GRAPH

Tipology: Accommodation - Hotel

Email: info@hotelaurora.info

Website: www.hotelaurora.info

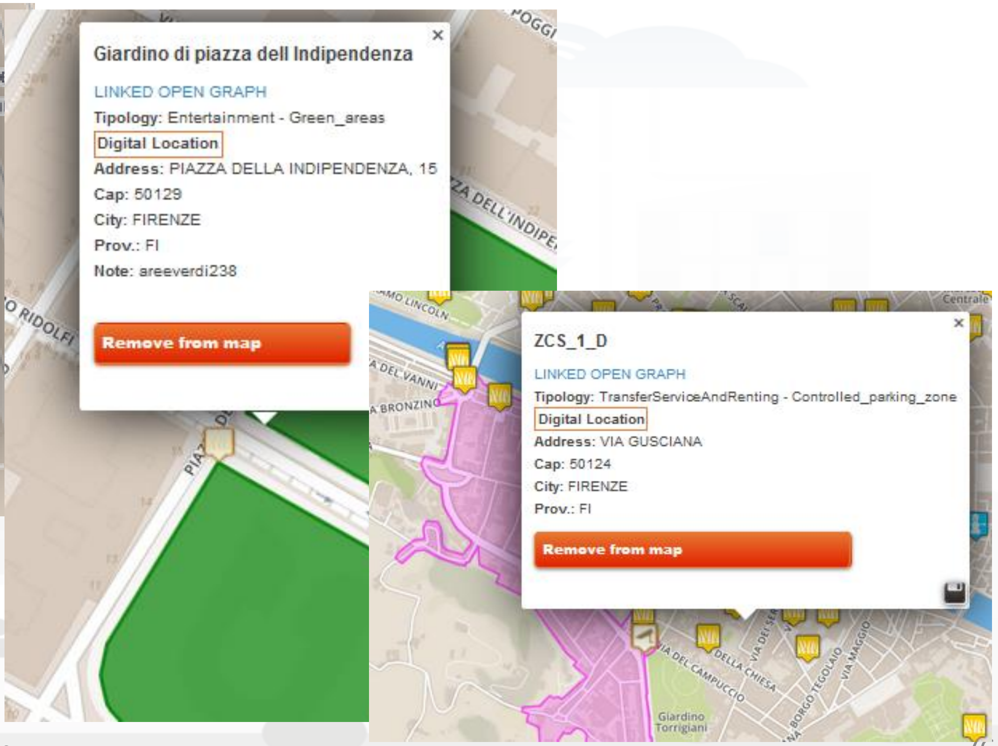
Phone: 055210283

Address: VIA L. ALAMANNI, 5

Cap: 50100

City: FIRENZE

Prov.: FI


Giardino di piazza dell Indipendenza

LINKED OPEN GRAPH

Tipology: Entertainment - Green_areas

Digital Location

Address: PIAZZA DELLA INDIPENDENZA, 15

Cap: 50129

City: FIRENZE

Prov.: FI

Note: areeverdi238

Remove from map

ZCS_1_D

LINKED OPEN GRAPH

Tipology: TransferServiceAndRenting - Controlled_parking_zone

Digital Location

Address: VIA GUSCIANA

Cap: 50124

City: FIRENZE

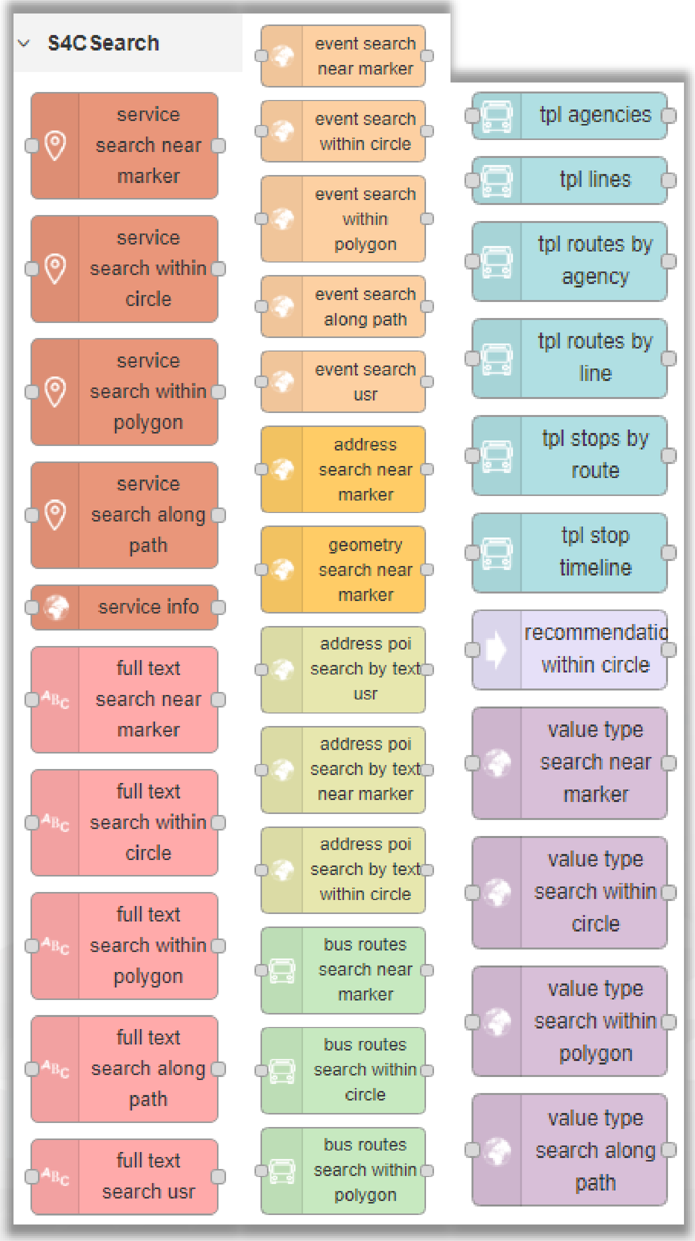
Prov.: FI

Remove from map

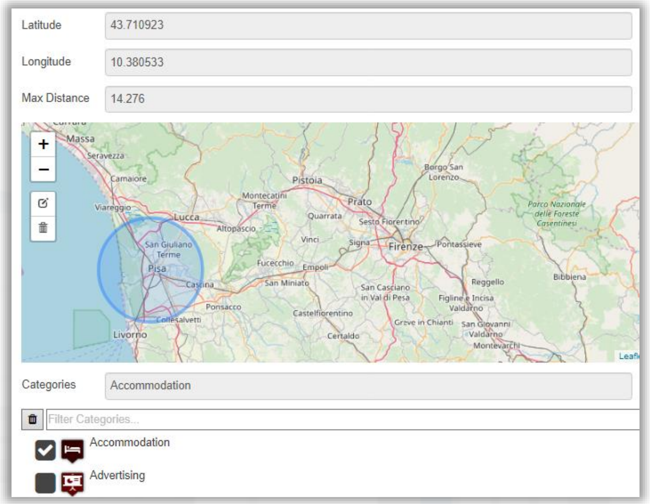
# S4CSearch

## Smart City Entities Search

Simple and Fast


S4C Search
service search near marker
service search within circle
service search within polygon
service search along path
service info
full text search near marker
full text search within circle
full text search within polygon
full text search along path
full text search usr
event search near marker
event search within circle
event search within polygon
event search along path
event search usr
address search near marker
geometry search near marker
address poi search by text usr
address poi search by text near marker
address poi search by text within circle
bus routes search near marker
bus routes search within circle
bus routes search within polygon
tpl agencies
tpl lines
tpl routes by agency
tpl routes by line
tpl stops by route
tpl stop timeline
recommendation within circle
value type search near marker
value type search within circle
value type search within polygon
value type search along path

- **For example to search for:**
  - POIs:
    - near a GPS position, from text, along a path, in an area, etc..
  - Public Transport information / data
  - Suggestions
  - Public Transport Means Routes/Paths
  - Events in the area
  - Value Type (kind of data)
  - Etc.



Latitude 43.710923

Longitude 10.380533

Max Distance 14.276

Categories Accommodation

Filter Categories...

☑ Accommodation

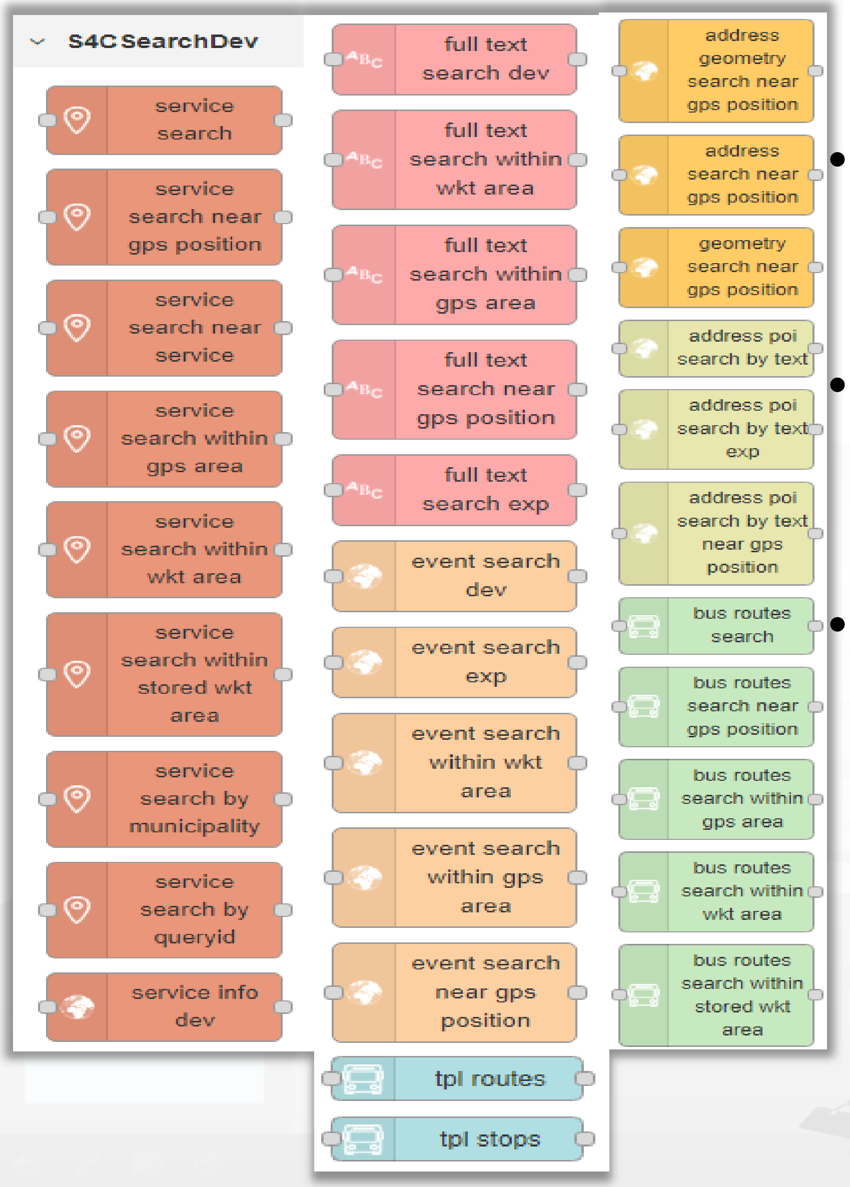
□ Advertising

- **To Get DATA of a Service / POI /sensor**
  - Real Time
  - ANY kind of sensors

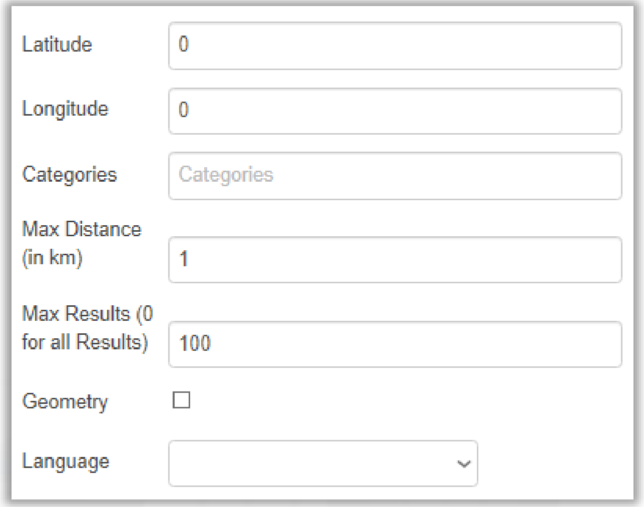
# S4CSearch Adv

# Smart City Entities Advanced Search

Flexiblity


S4CSearchDev
service search
service search near gps position
service search near service
service search within gps area
service search within wkt area
service search within stored wkt area
service search by municipality
service search by queryid
service info dev
full text search dev
full text search within wkt area
full text search within gps area
full text search near gps position
full text search exp
event search dev
event search exp
event search within wkt area
event search within gps area
event search near gps position
tpl routes
tpl stops
address geometry search near gps position
address search near gps position
geometry search near gps position
address poi search by text
address poi search by text exp
address poi search by text near gps position
bus routes search
bus routes search near gps position
bus routes search within gps area
bus routes search within wkt area
bus routes search within stored wkt area

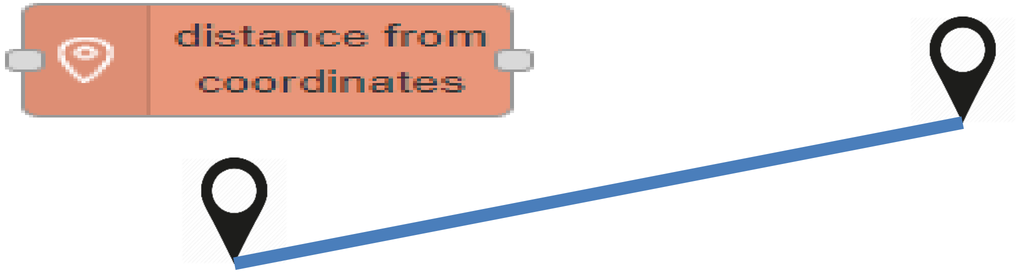
- Similar to basic Search functions but with more flexibility of the function for programming the search
- Adding Dynamic behavior:
  - Getting in input JSON with parameters
- **To Get DATA of a Service / POI /sensor**
  - Historical and real time
  - ANY kind of sensors



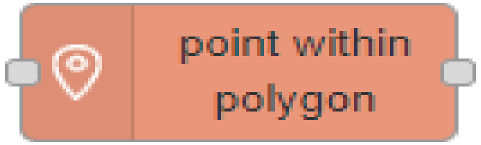
| | |
|---|---|
| Latitude | 0 |
| Longitude | 0 |
| Categories | Categories |
| Max Distance (in km) | 1 |
| Max Results (0 for all Results) | 100 |
| Geometry | □ |
| Language | |

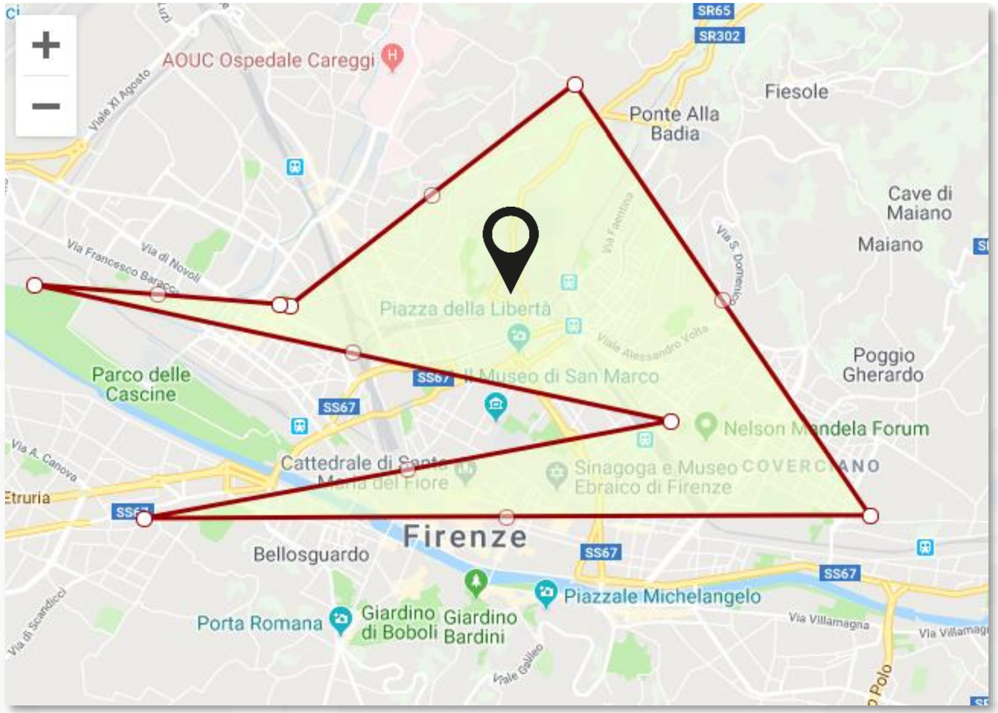
# S4CSearch

- **Distance from GPS point**

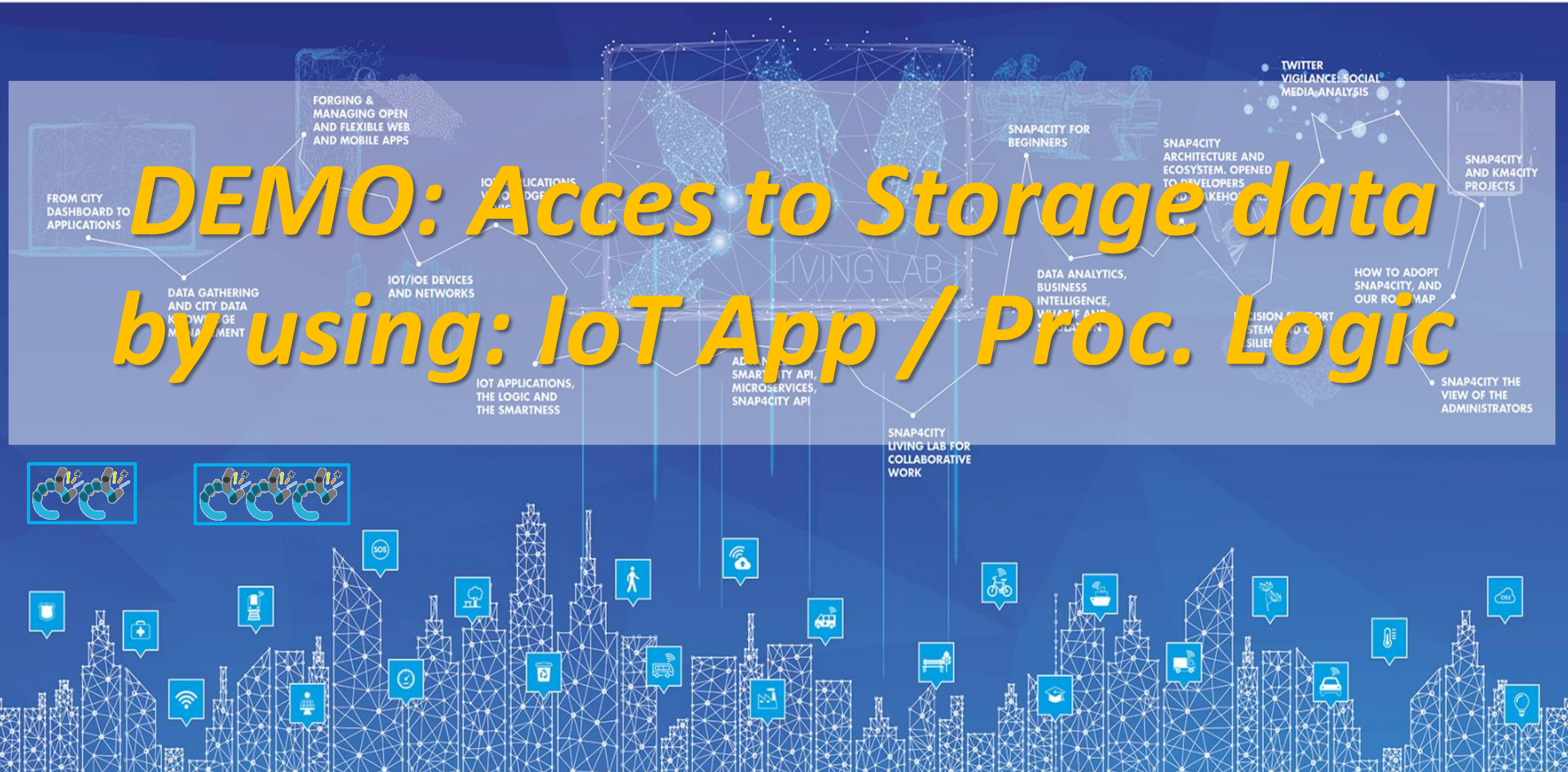


- **Point 📍 is in Polygon ?**
  - **Polyline as WKT**
  - **Polyline as GeoJSON**





# DEMO: Acces to Storage data by using: IoT App / Proc. Logic


FORGING & MANAGING OPEN AND FLEXIBLE WEB AND MOBILE APPS
FROM CITY DASHBOARD TO APPLICATIONS
DATA GATHERING AND CITY DATA KNOWLEDGE MANAGEMENT
IOT/IOE DEVICES AND NETWORKS
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SMART CITY API, MICROSERVICES, SNAP4CITY API
LIVING LAB
SNAP4CITY LIVING LAB FOR COLLABORATIVE WORK
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TWITTER VIGILANCE: SOCIAL MEDIA ANALYSIS
SNAP4CITY AND KM4CITY PROJECTS
HOW TO ADOPT SNAP4CITY, AND OUR ROADMAP
SNAP4CITY THE VIEW OF THE ADMINISTRATORS
SOS

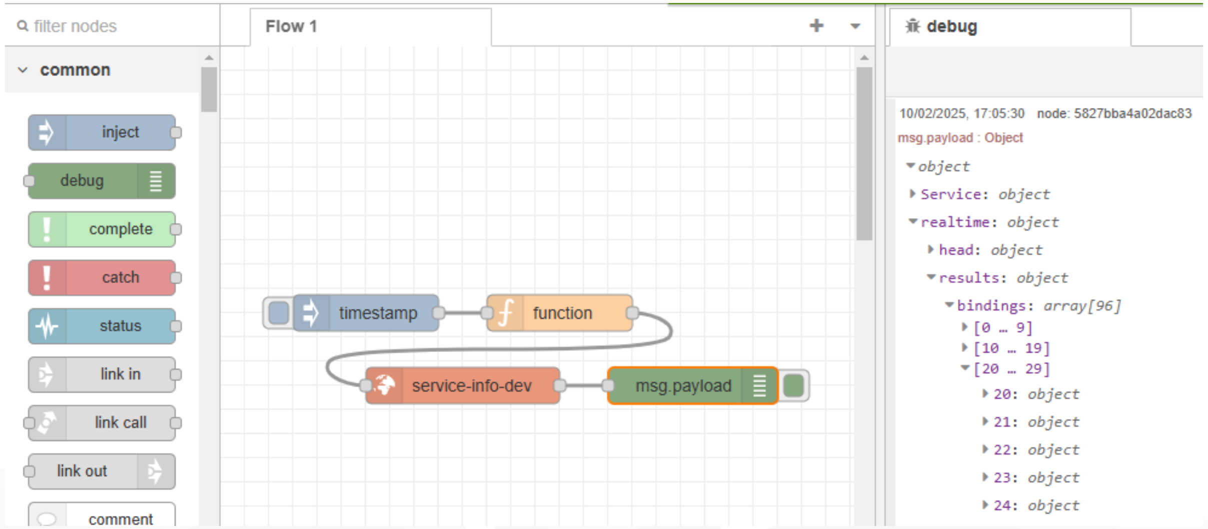
# the exercise

- On IoT device/Entity on Service map… e.g., OpenWeather….
  - – Identification of the service URI, SURI
  - – Go on Service Map, multi Org, or Super
  - – Alternatively: get SURI from the Entity Directory
- Create an example
  - – Inject SURI on Service Info Dev, see the data, and time series
    - if you are an Area Manager
  - – Use pattern: Inject → function → service info dev → debug
  - – Retrieve a data, retrieve a set of data in the last 24/48 hours, 2 days

# the exercise

- SERVICE URI: [http://www.disit.org/km4city/resource/iot/orionFirenze2-UNIFI/Firenze2/ow_air_pollution_fir1](http://www.disit.org/km4city/resource/iot/orionFirenze2-UNIFI/Firenze2/ow_air_pollution_fir1)
- Create Advanced IOTAPP

```
msg.payload={
"serviceuri":"http://www.disit.org/km4city/resou
rce/iot/orionFirenze2-
UNIFI/Firenze2/ow_air_pollution_fir1",
"fromtime":"48-hour"}
return msg;
```



```
10/02/2025, 17:05:30   node: 5827bba4a02dac83
msg.payload : Object
▾object
 ▸Service: object
 ▾realtime: object
   ▸head: object
   ▾results: object
     ▾bindings: array[96]
       ▸[0 … 9]
       ▸[10 … 19]
       ▾[20 … 29]
         ▸20: object
         ▸21: object
         ▸22: object
         ▸23: object
         ▸24: object
```

- Set of data in the last 24/48 hours, 2 days

SNAP4CITY

KM4CITY

100% OPEN SOURCE

*Be smart in a SNAP!*

SMARTCITY
EXPO WORLD CONGRESS

SNAP4
Appliances and Dockers
**Installations**

**CONTACT**

DISIT Lab, DINFO: Department of Information Engineering
Università degli Studi di Firenze - School of Engineering

Via S. Marta, 3 - 50139 Firenze, ITALY
https://www.disit.org

www.snap4city.org

Email: snap4city@disit.org

Office: +39-055-2758-515 / 517
Cell: +39-335-566-86-74
Fax.: +39-055-2758570

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