Open APIs for Open Minds

NGSI: geoqueries and Carto integration

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Geospatial features

- Orion Context Broker geospatial features
  - Entities may have a **location**
  - Queries/subscriptions may use the location as search criteria

- Historical context persistence geospatial features
  - Entities location is progressed to geo-enabled persistence backends through **Cygnus** tool
  - **Carto** is the main persistence backend used by Cygnus when dealing with geo-located entities
    - **Cloud-based** service
    - **Visualizations**, **analysis** and **widgets** can be added to maps

Geo-locating an entity

```
POST /v2/entities
{
  "id": "E",
  "type": "T",
  "location": {
    "type": "geo:point",
    "value": "40.41,-3.69"
  }
}
```

Point location

```
POST /v2/entities
{
  "id": "E",
  "type": "T",
  "location": {
    "type": "geo:line",
    "value": [ "2, 2", "8, 7" ]
  }
}
```

Line location (e.g. a street)

```
POST /v2/entities
{
  "id": "E",
  "type": "T",
  "location": {
    "type": "geo:box",
    "value": [ "2, 2", "8, 7" ]
  }
}
```

Box location (e.g. a squared building)

```
POST /v2/entities
{
  "id": "E",
  "type": "T",
  "location": {
    "type": "geo:polygon",
    "value": [ "2, 2", "8, 7", "-1, 4", "2, 2"]
  }
}
```

Polygon location (e.g. a city district)

```
POST /v2/entities
{
  "id": "E",
  "type": "T",
  "location": {
    "type": "geo:json",
    "value": {
      "type": "Polygon",
      "coordinates": [ [ [2, 1], [4, 3], [5, -1], [2, 1] ] ]
    } } }
```

GeoJSON geometry (full flexibility)

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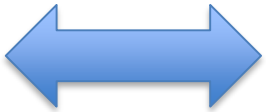
Important remark regarding coords order

```
POST /v2/entities
{
   "id": "E",
   "type": "T",
   "location":  {
      "type": "geo:point",
      "value": "40.41,-3.69"
   }
}
```



same location

```
POST /v2/entities
{
   "id": "E",
   "type": "T",
   "location":  {
      "type": "geo:json",
      "value":  {
        "type": "Point“,
        "value": "-3.69, 40.41"
   }
}
```

geo:json uses **long-lat**, while other formas use **lat-long**
Cygnus is able to **swap** coordinates when persisting data!

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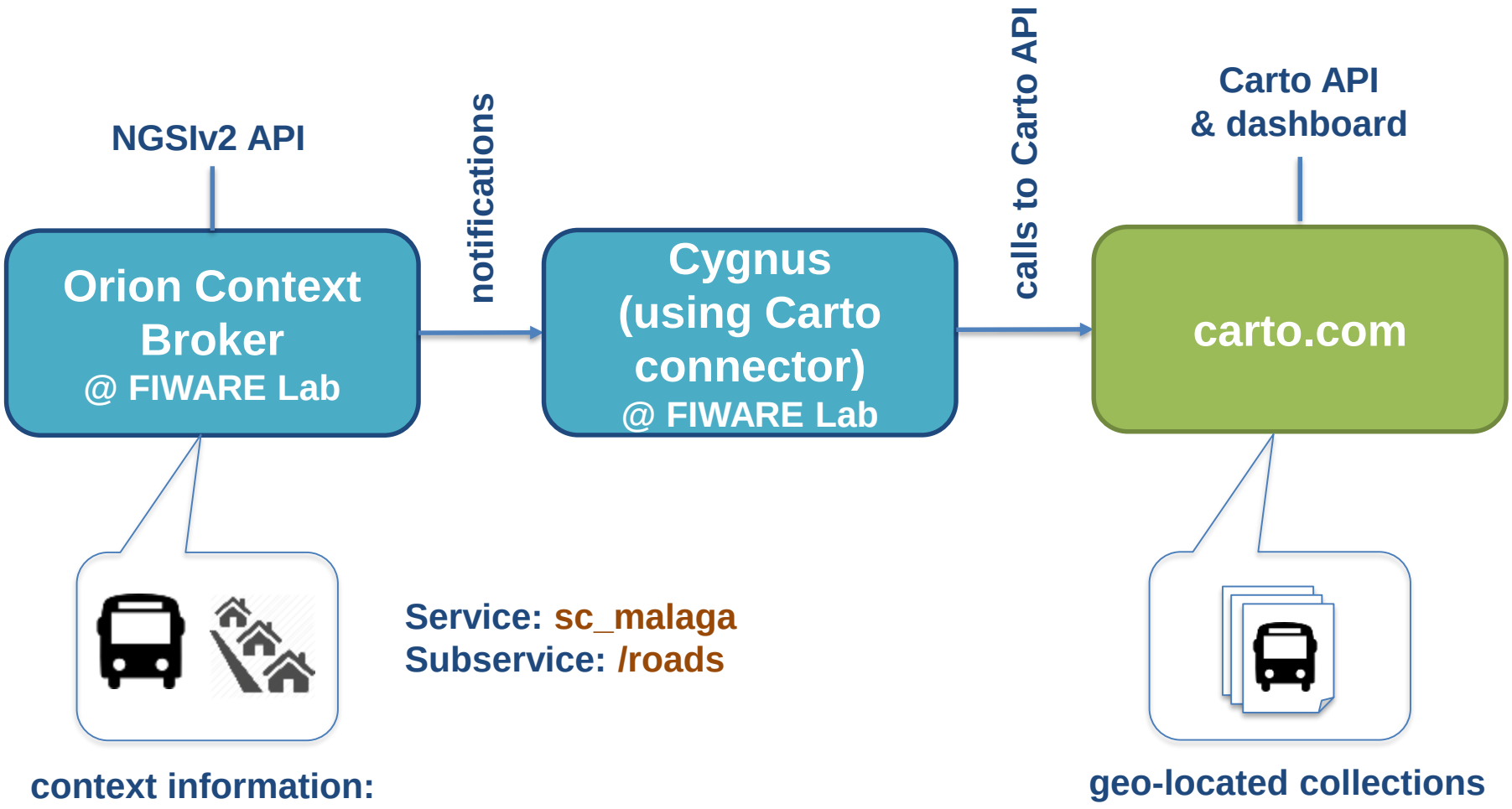
Geospatial queries at Context Broker

- They can be used both in synchronous (GET /v2/entities) and asynchronous (subscriptions) queries
- Queries are based on a **spatial relationship** and a **geometry**
- Spatial relationships:
  - near (max and min distance)
  - coveredBy
  - intersects
  - equal
  - disjoint
- Geometries
  - point
  - line
  - box
  - polygon

Persistence of geo-locates entities in Carto through Cygnus

- Cygnus is able to create 3 (4) kind of persistence:
  - **Raw historic**
    - A table is created for each entity. It contains the history regarding the position (and any other attribute) of the entity
  - **Raw snapshot**
    - A single table handles the last position (ant the last value of any other attribute) of the entity
  - **Distance historic**
    - A table is created for each entity. It contains already processed distance-based analytics
      - Total distance and time
      - Last stage distance, time and speed
      - Maximum and minimum distance, time and speed
      - Average distance, time and speed, and variance
  - (**Distance snapshot** - roadmap)

Demo setup


NGSIv2 API
notifications
calls to Carto API
Carto API
& dashboard
Orion Context Broker
@ FIWARE Lab
Cygnus (using Carto connector)
@ FIWARE Lab
carto.com
Service: sc_malaga
Subservice: /roads
context information:
Malaga buses & streets
geo-located collections


Demo time!

Thank you!

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Demo 1 (basic queries) script

- Prep:
  - Run the script to update bus lines each 5s
- Steps
  - Show Malaga maps with the bus moving around the city
  - Do a ?type=bus query, then pick an specific bus and do several queries to see how location is shown and how it changes from time to time
  - Stop the script in a moment in which some buses are inside and some outside the center district. Now the buses got halted on the web page
  - Pick a point and do near-to queries in progressive distance, to see how more buses get grabbed
  - Do a polygon query for center district

Demo 2 (advanced queries) script

- Pre
  - Use https://drive.google.com/open?id=1jr5qnBQVTfXnD2EBG__XR2Vk-dc&usp=sharing
- Scripts:
  - https://gist.github.com/fgalan/2143bff997ed039555ae8d0eafaa6b5f
- Steps
  - Do a ?type=street query and show how location is modeled in some of them
  - Query 1: streets close to a given point (e.g. bus stop), 10 meters to 150 m
  - Query 2: streets that cross a given street
  - Query 3: streets that don't cross a given street
  - Query 4: streets fully inside Malaga center district
  - Query 5: streets partially inside Malaga center district
  - Query 5: streets outside Malaga center district

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