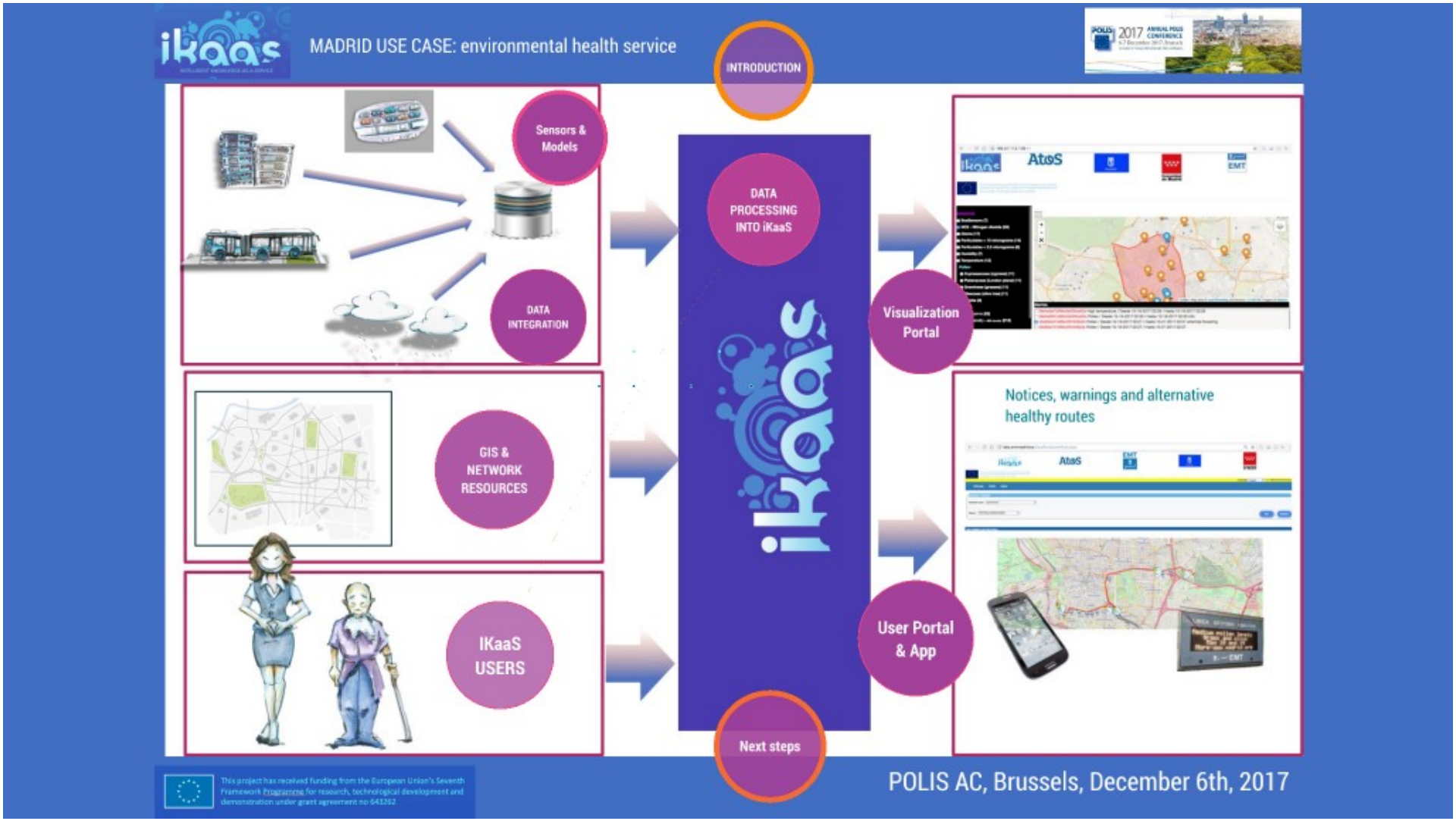
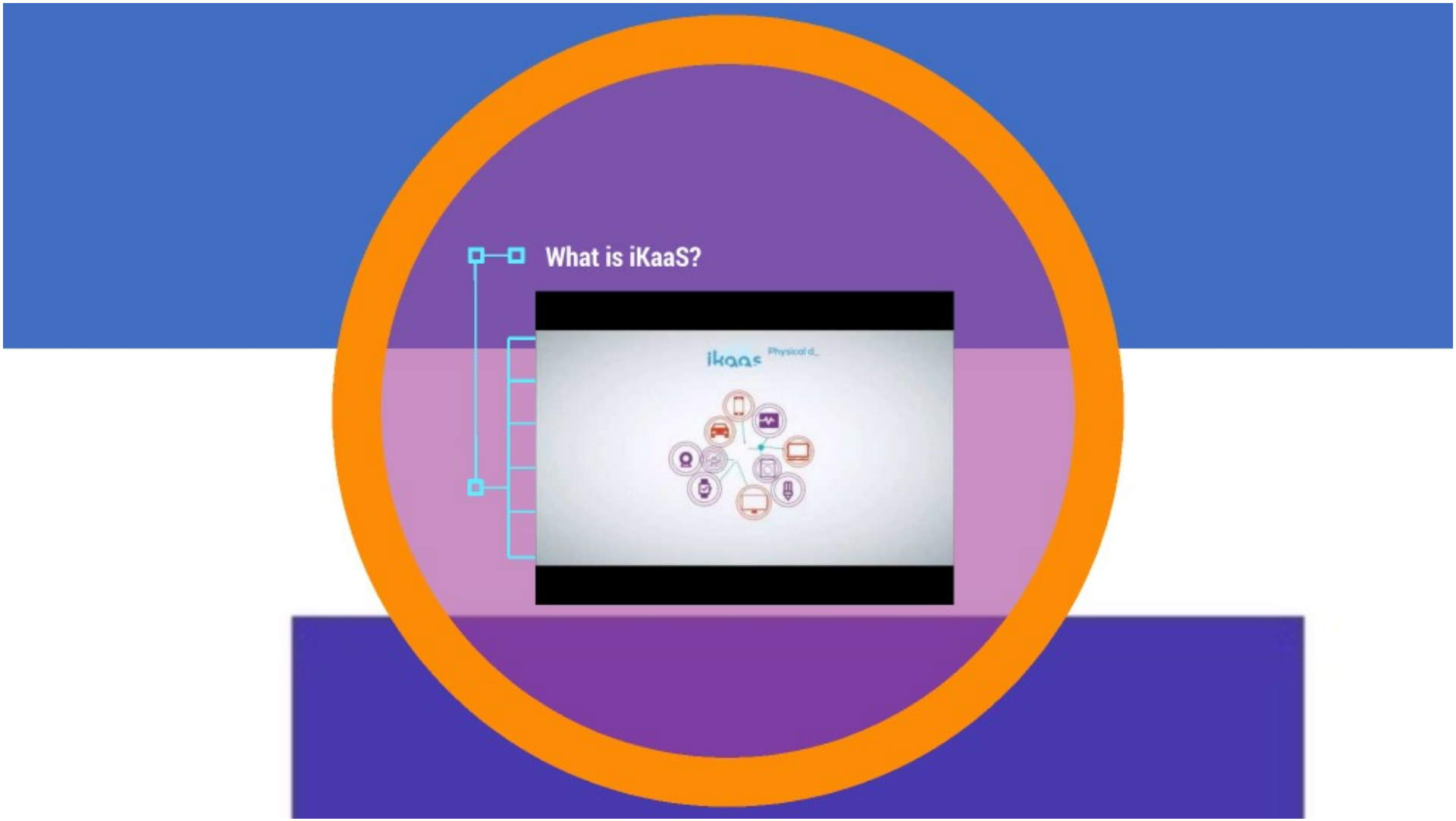
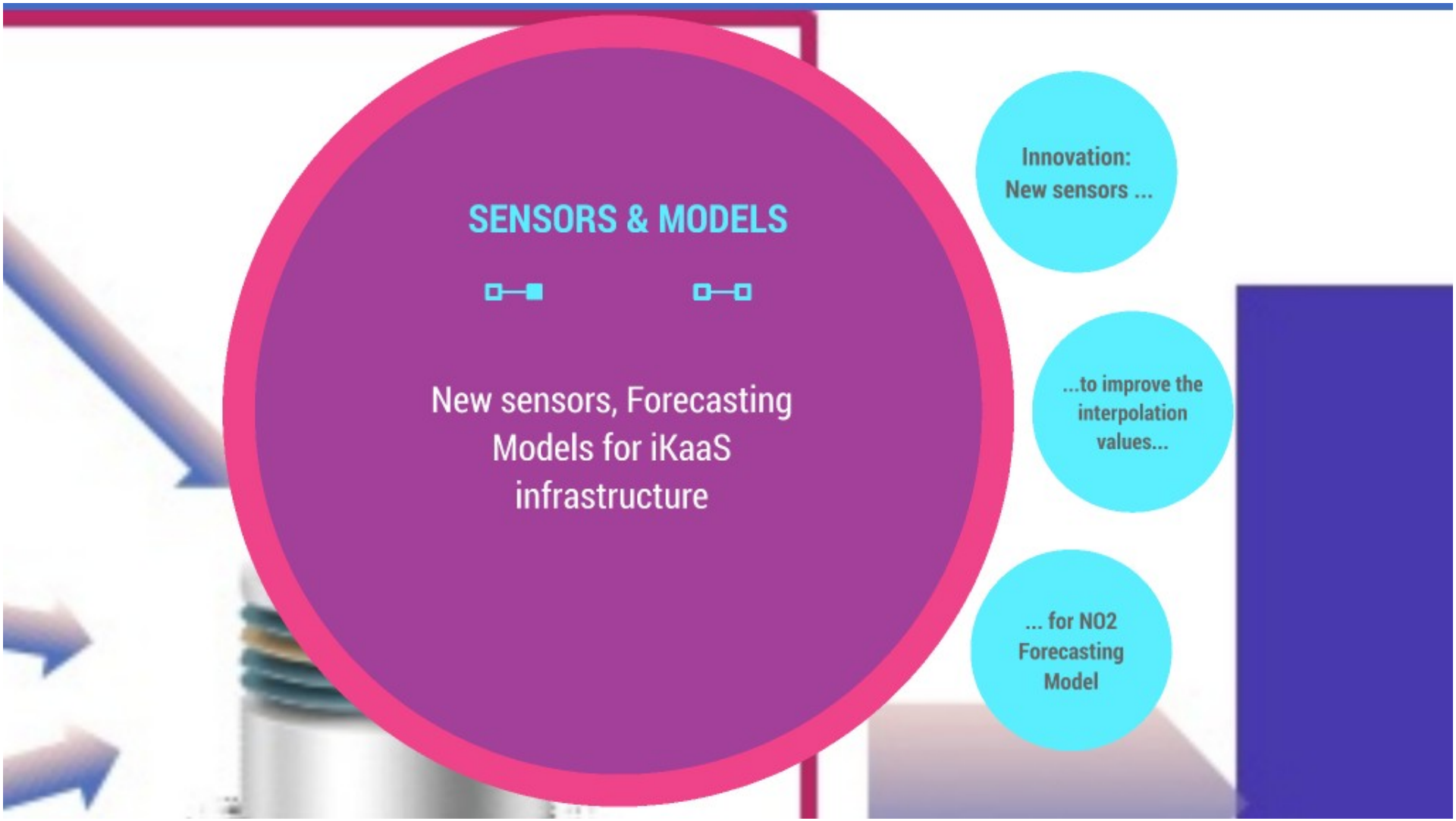

MADRID USE CASE: environmental health service
INTRODUCTION
Sensors & Models
DATA INTEGRATION
GIS & NETWORK RESOURCES
IKaaS USERS
DATA PROCESSING INTO iKaaS
Visualization Portal
User Portal & App
Next steps
Notices, warnings and alternative healthy routes
This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 643262
POLIS AC, Brussels, December 6th, 2017


What is iKaaS?
ikaas


SENSORS & MODELS
New sensors, Forecasting Models for iKaaS infrastructure
Innovation: New sensors ...
...to improve the interpolation values...
... for NO2 Forecasting Model

Innovation: New sensors ...

Sensors: statics vs mobile

AIRBORNE POLLEN SENSORS

- Integration volumetric spore trap
- Web services implementation
- On-line daily airborne pollen information

NEW methodology

Scattering method

New sensors on bus

Minute, hourly, daily data

AIR QUALITY SENSORS

- Integration different static sensors
- Pollutants network
- On- line pollutants

NEW methodology

Micro-sensors **on bus**

Minute, hourly, daily data

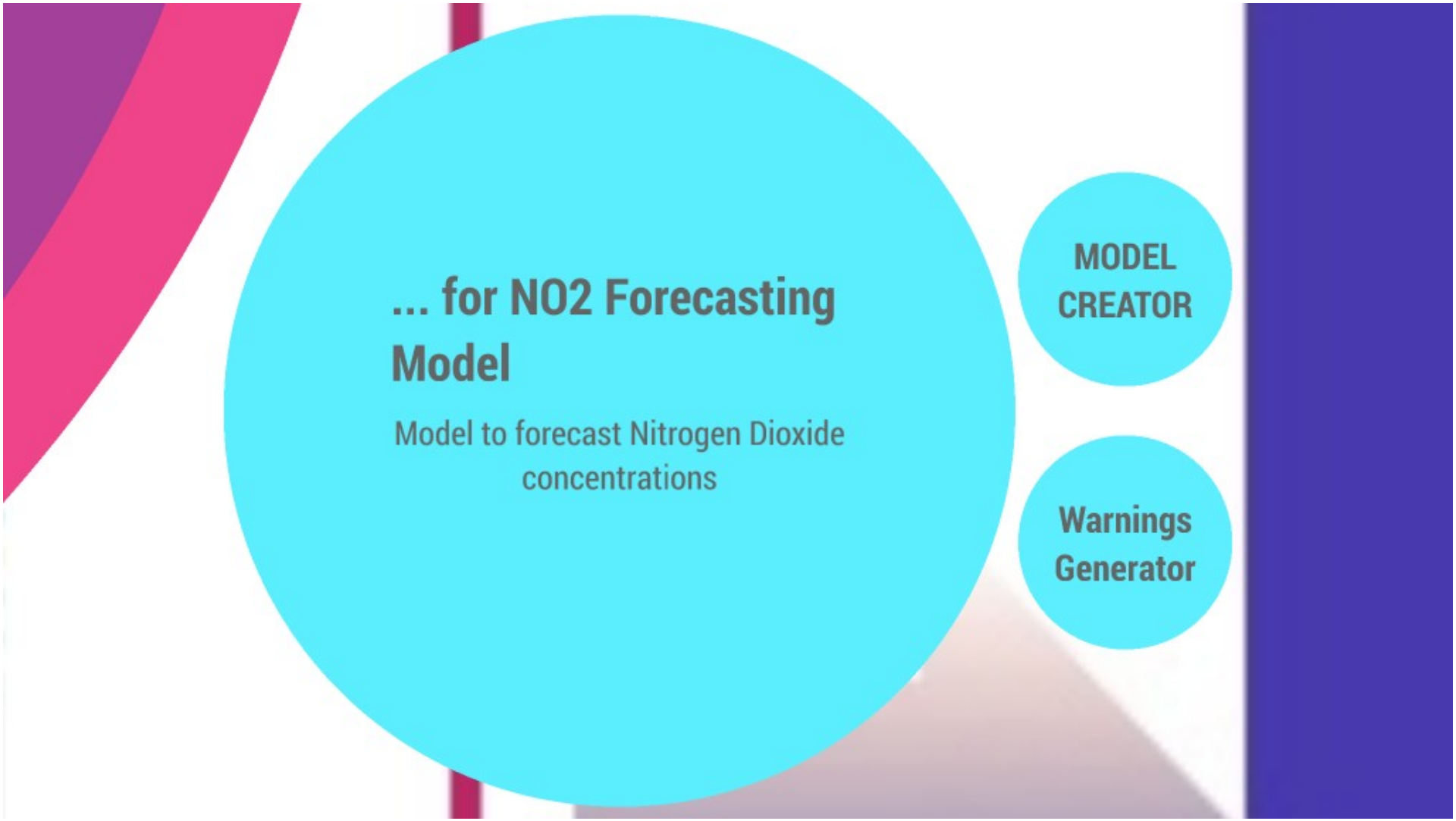
...to improve the interpolation values...

HAVE BEEN ADQUIRED DEVICES FOR iKaaS infrastructure:

3 KUNAK: GASES (NO2, CO2, O3, PM2.5 PM10)
5 SHINYEI: POLLEN
5 LIBELIUM: GASES (NO2, CO2, O3)

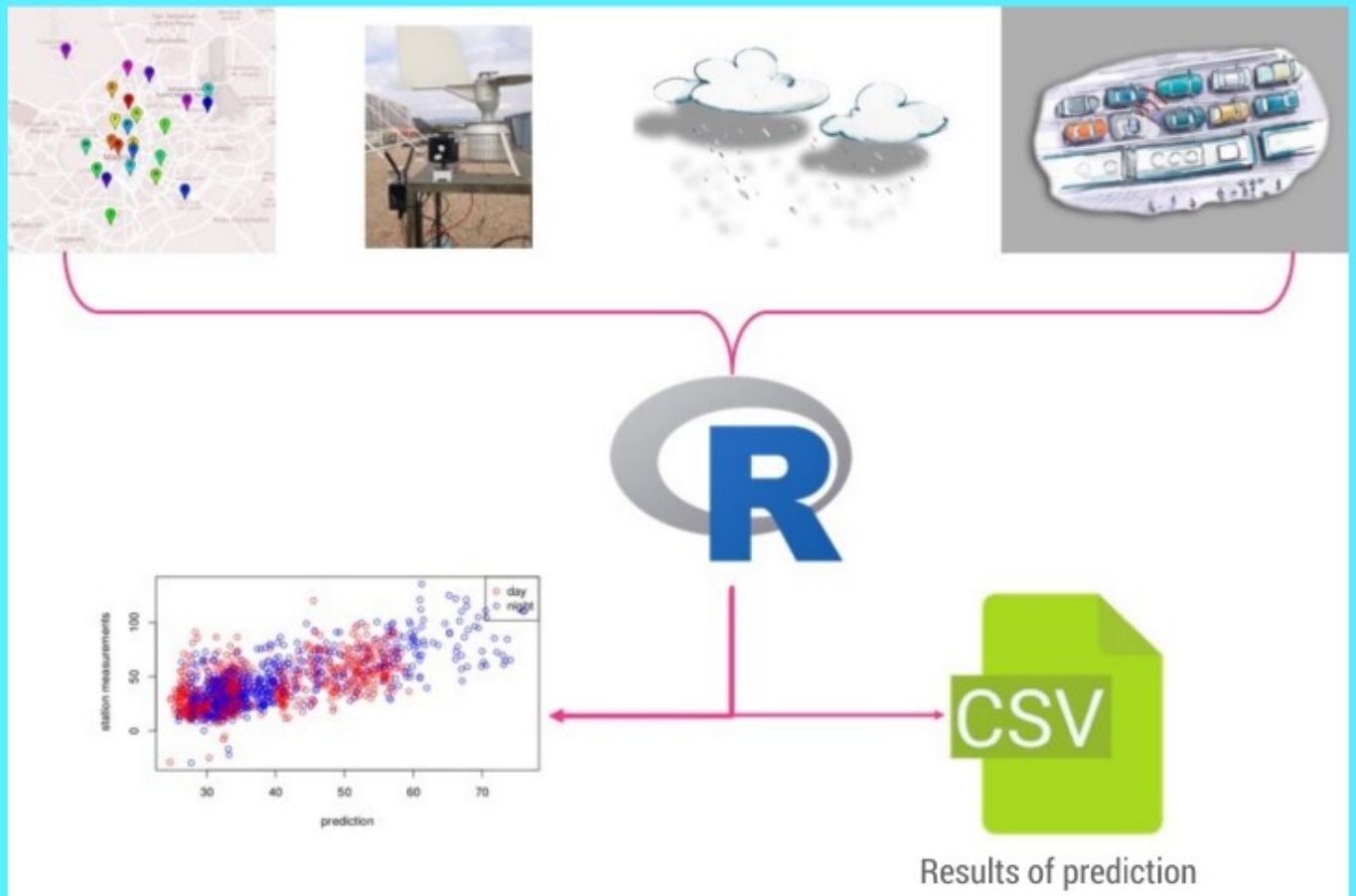
LOCATION	Type of sensor	Brand	Number of devices
Bus (providing Service in bus line number 44)	Gases (pollutants)	Libelium	1
	Gases (pollutants)	Kunak	1
Bus (providing Service in bus line number 27)	Gases (pollutants)	Libelium	1
	Pollen	Shinyei	1
Madrid City Council	Pollen	Shinyei	1
Farmacy faculty	Pollen	Shinyei	1
Las Rozas	Pollen	Shinyei	1
EMT central office (C/Cerro de la Plata 4)	Pollen	Shinyei	1
EMT central office laboratory (C/Cerro de la Plata 4)	Location	Libelium	1
Arganzuela district hall	Gases (pollutants)	Libelium	1
Escuelas Aguirre	Gases (pollutants)	Kunak	1
	Gases (pollutants)	Libelium	1
Atos building	Gases (pollutants)	Kunak	1


kunak


... for NO2 Forecasting Model
Model to forecast Nitrogen Dioxide concentrations
MODEL CREATOR
Warnings Generator

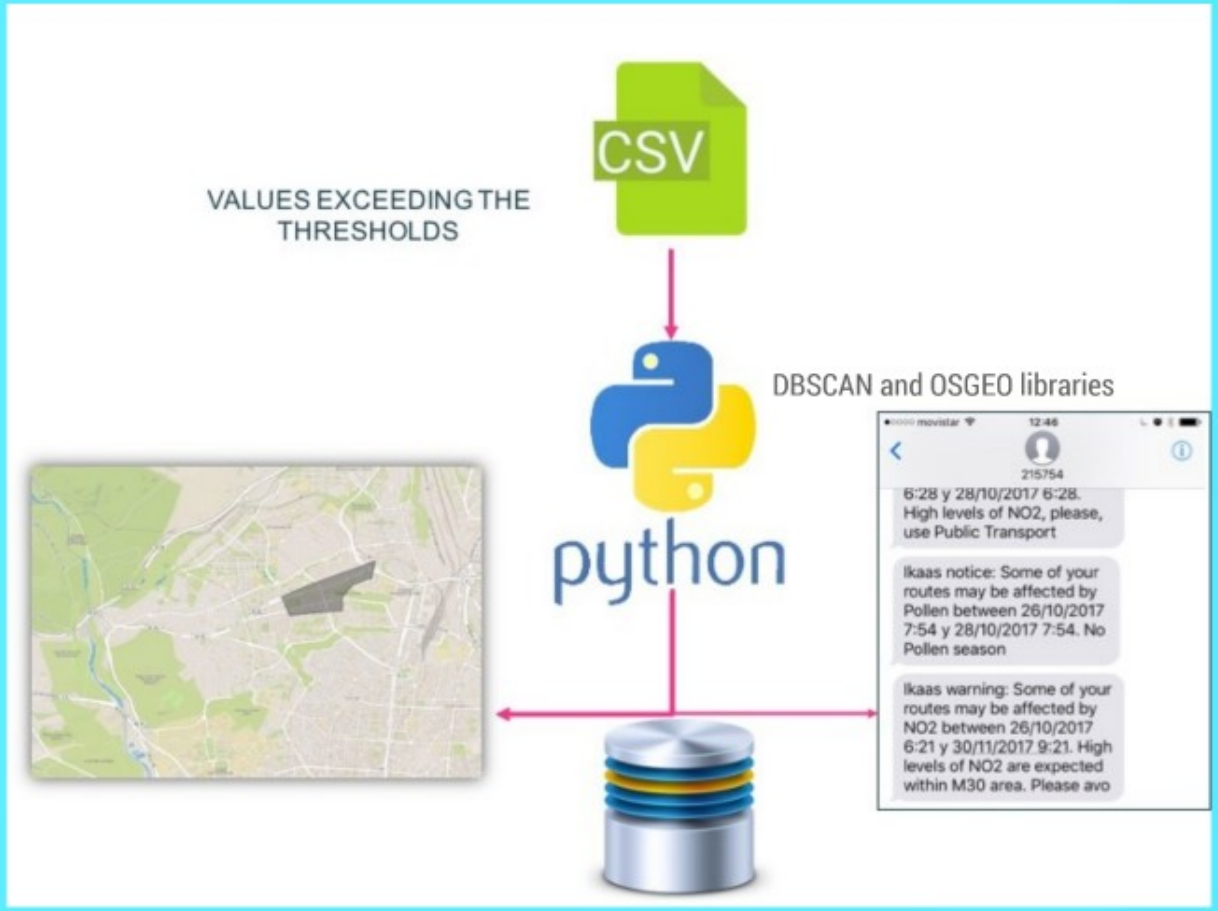
MODEL CREATOR

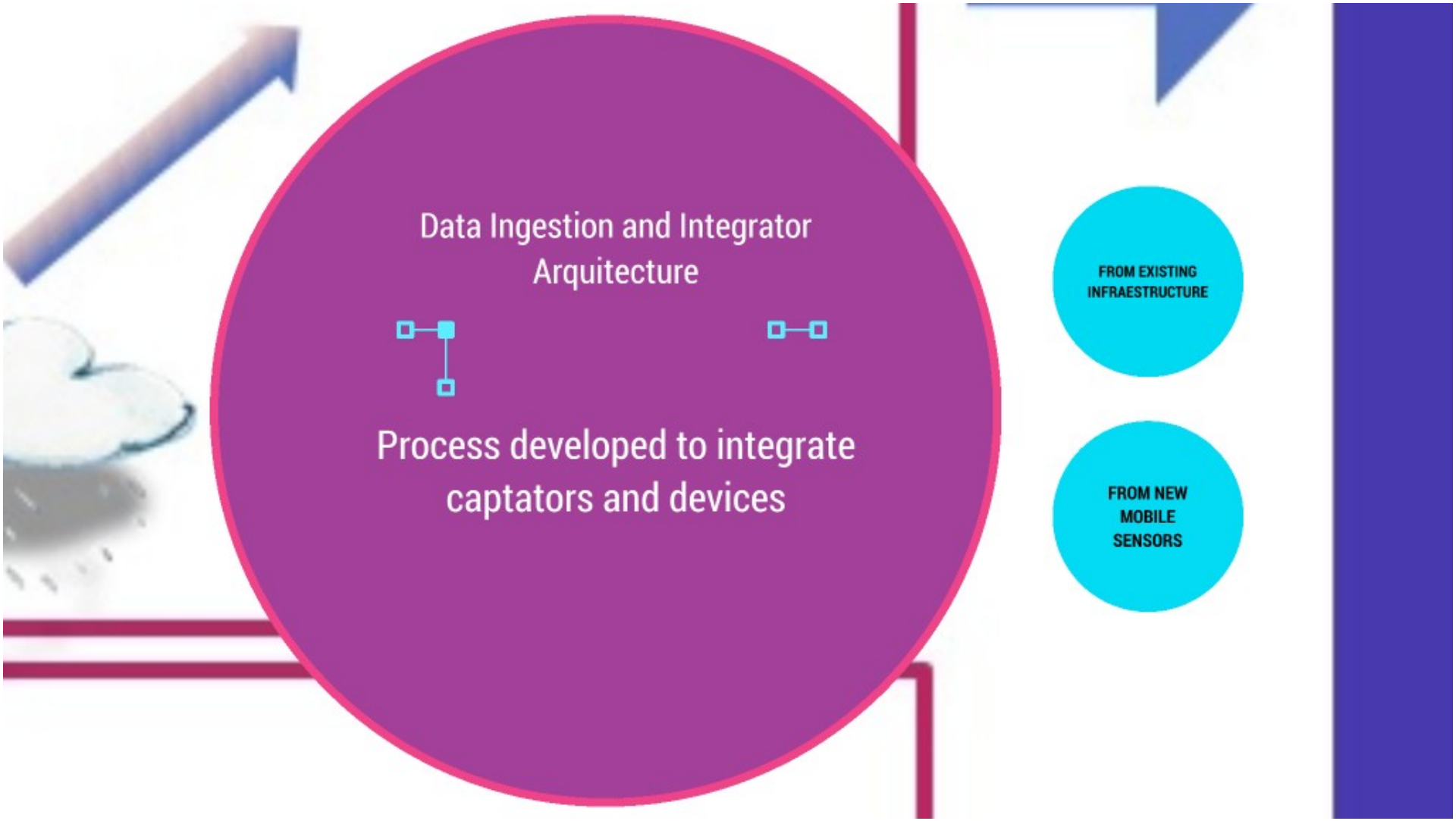
- Spatio-temporal modelling: 24 fixed monitoring stations, hourly data, from 2001 to present.
- Model: numerical pollution predictions based on regression-kriging.
- Exploit spatio-temporal characteristics of the data: forecasts in time and space (future concentrations in arbitrary locations-grid).

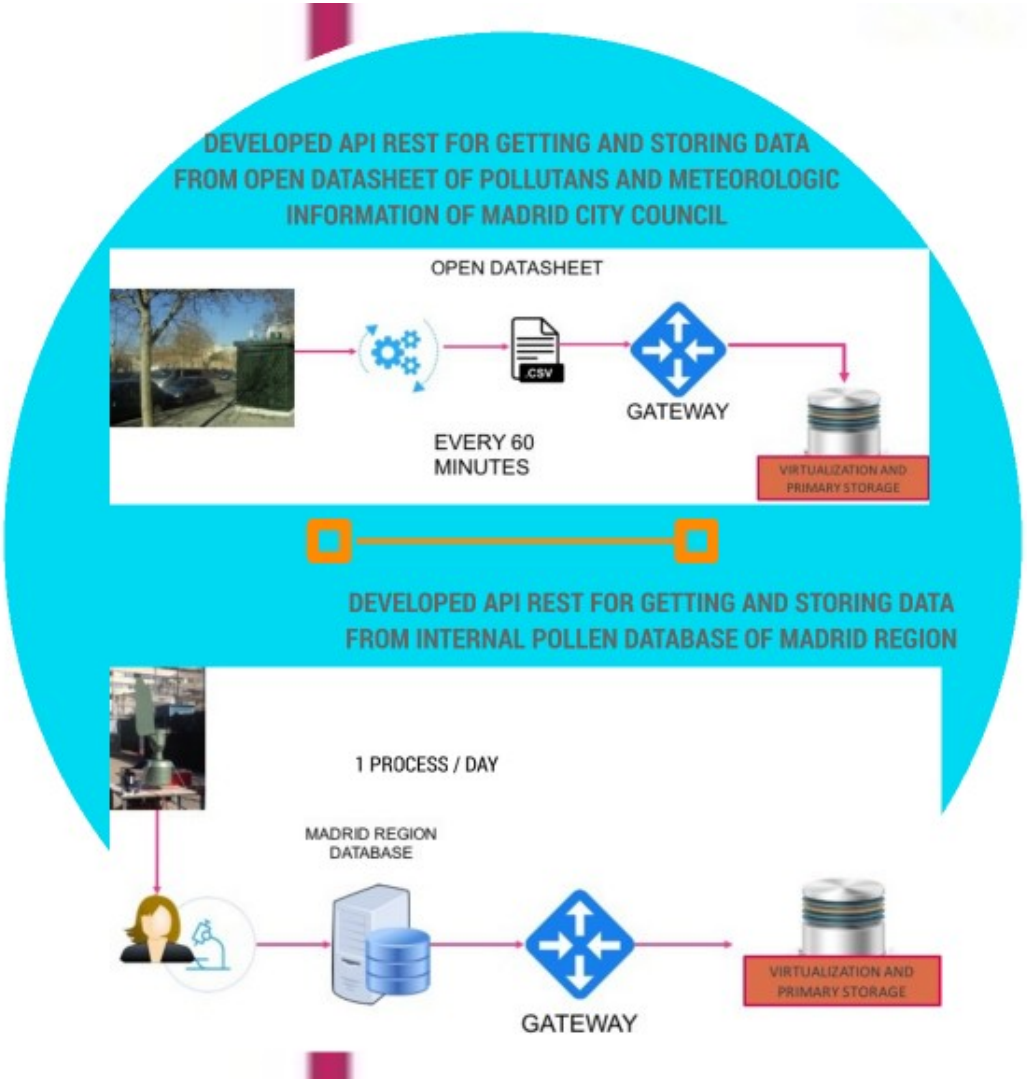


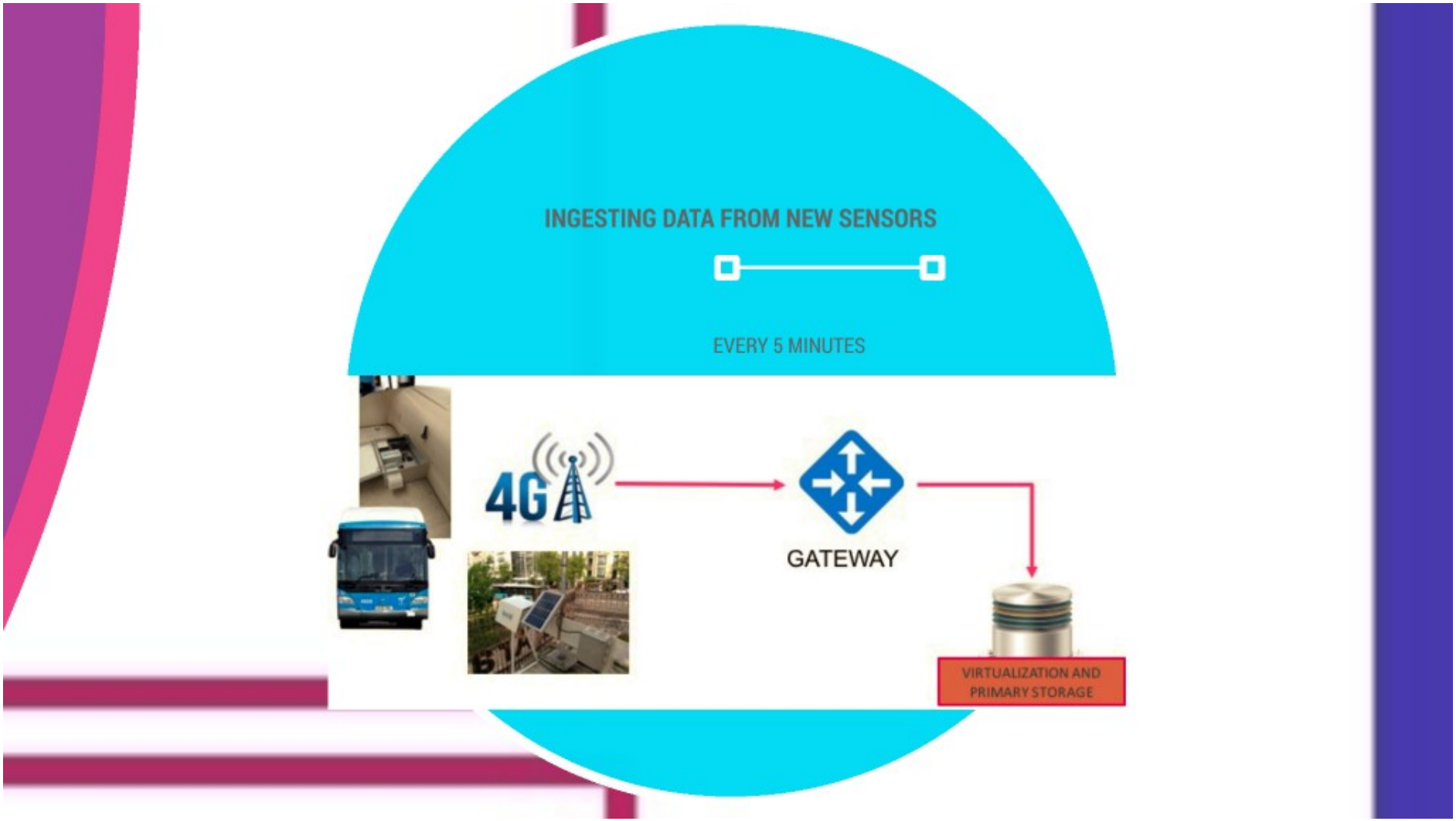
Warnings Generator

- For each of the groups (cluster) obtained, a list of points (longitude, latitude) is created with the smallest convex polygon .
- These polygons are converted on Warnings in the database
- This allows to launch messages related to favorite routes and routes on demand.



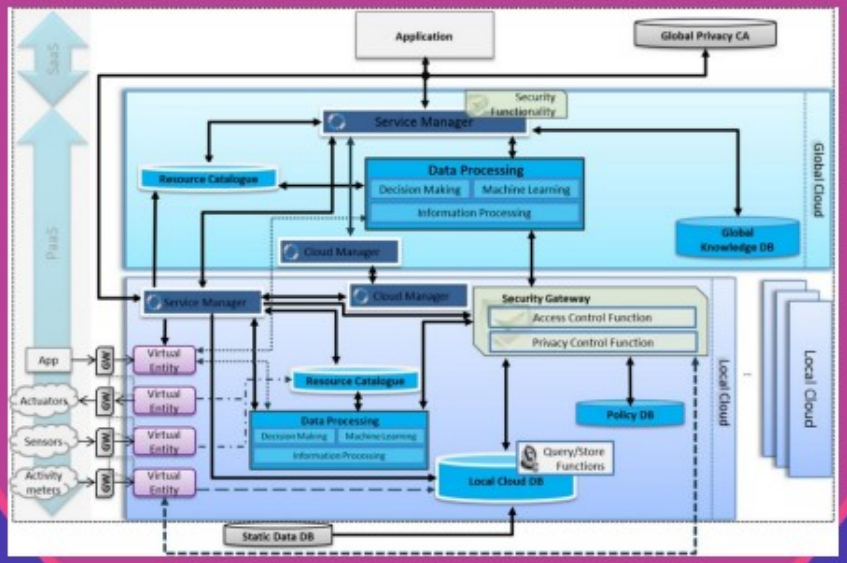

Data Ingestion and Integrator Arquitecture
Process developed to integrate captators and devices
FROM EXISTING INFRAESTRUCTURE
FROM NEW MOBILE SENSORS


DEVELOPED API REST FOR GETTING AND STORING DATA
FROM OPEN DATASHEET OF POLLUTANS AND METEOROLOGIC
INFORMATION OF MADRID CITY COUNCIL
OPEN DATASHEET
.CSV
GATEWAY
EVERY 60
MINUTES
VIRTUALIZATION AND
PRIMARY STORAGE
DEVELOPED API REST FOR GETTING AND STORING DATA
FROM INTERNAL POLLEN DATABASE OF MADRID REGION
1 PROCESS / DAY
MADRID REGION
DATABASE
GATEWAY
VIRTUALIZATION AND
PRIMARY STORAGE


INGESTING DATA FROM NEW SENSORS
EVERY 5 MINUTES
4G
GATEWAY
VIRTUALIZATION AND
PRIMARY STORAGE

DATA PROCESSING INTO iKaaS

Assuring stability of data



Data integration
Data processing
Learning function

GIS & NETWORK RESOURCES

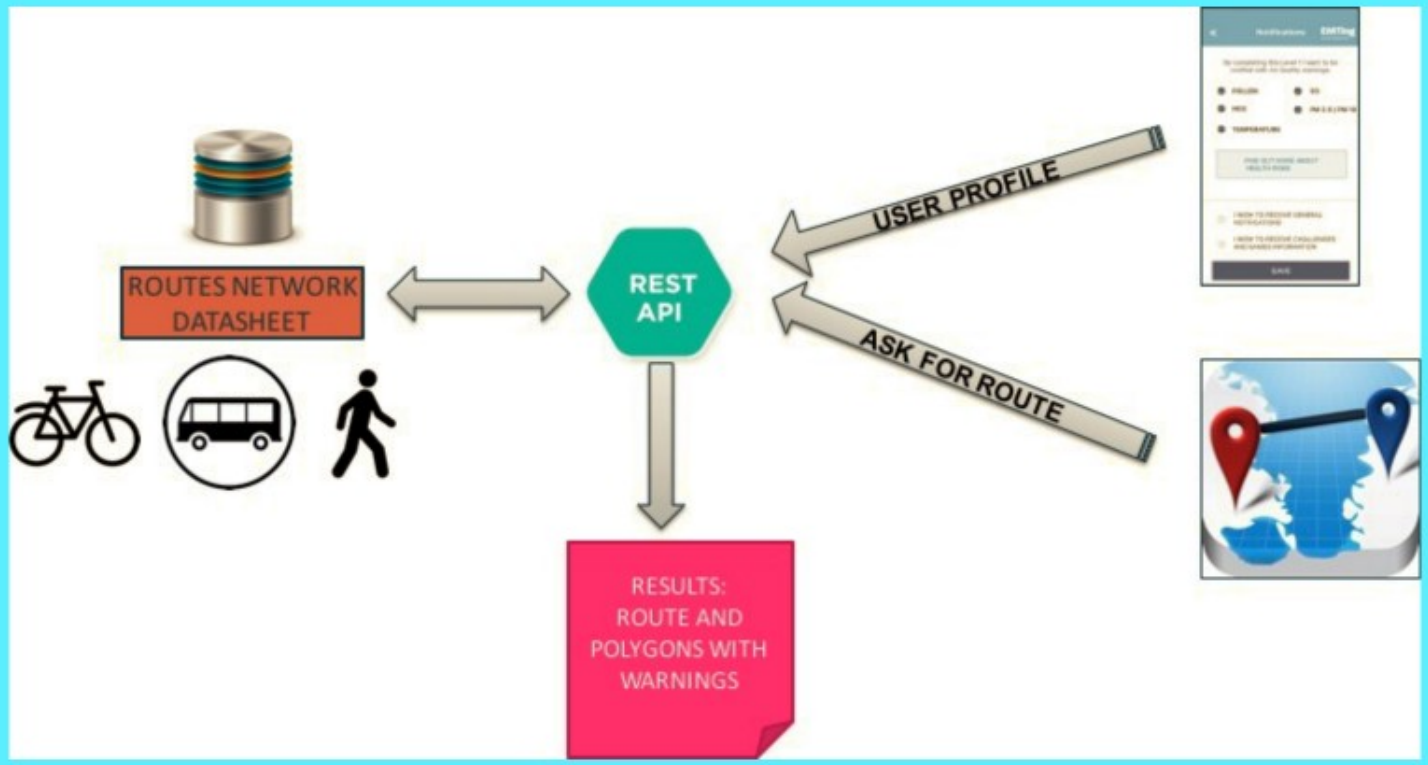
New routes engine for public transport (Bike sharing, Urban Bus) and Walking

Opendata API REST for Routes (Part I)

Opendata API REST. Alternative Routes (Part II)

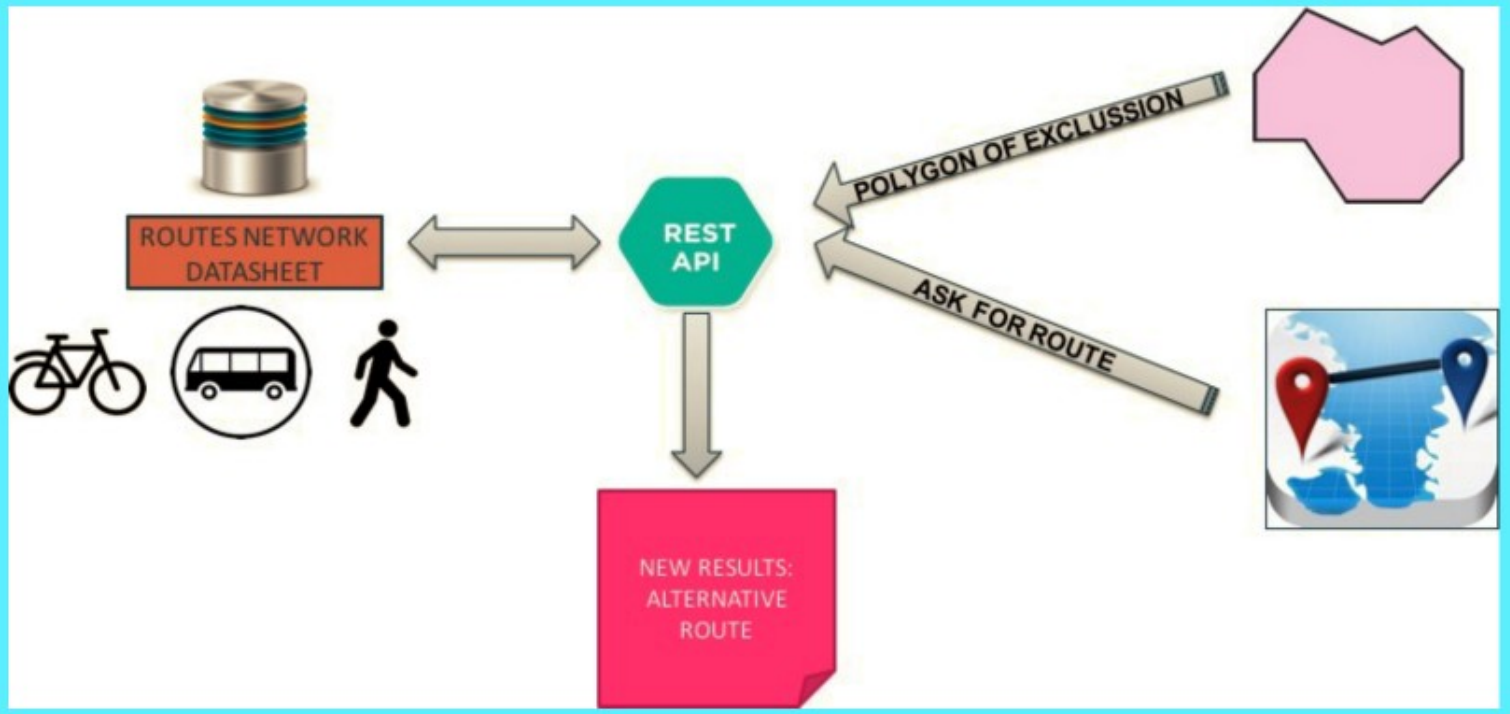
Opendata API REST for Routes (Part I)

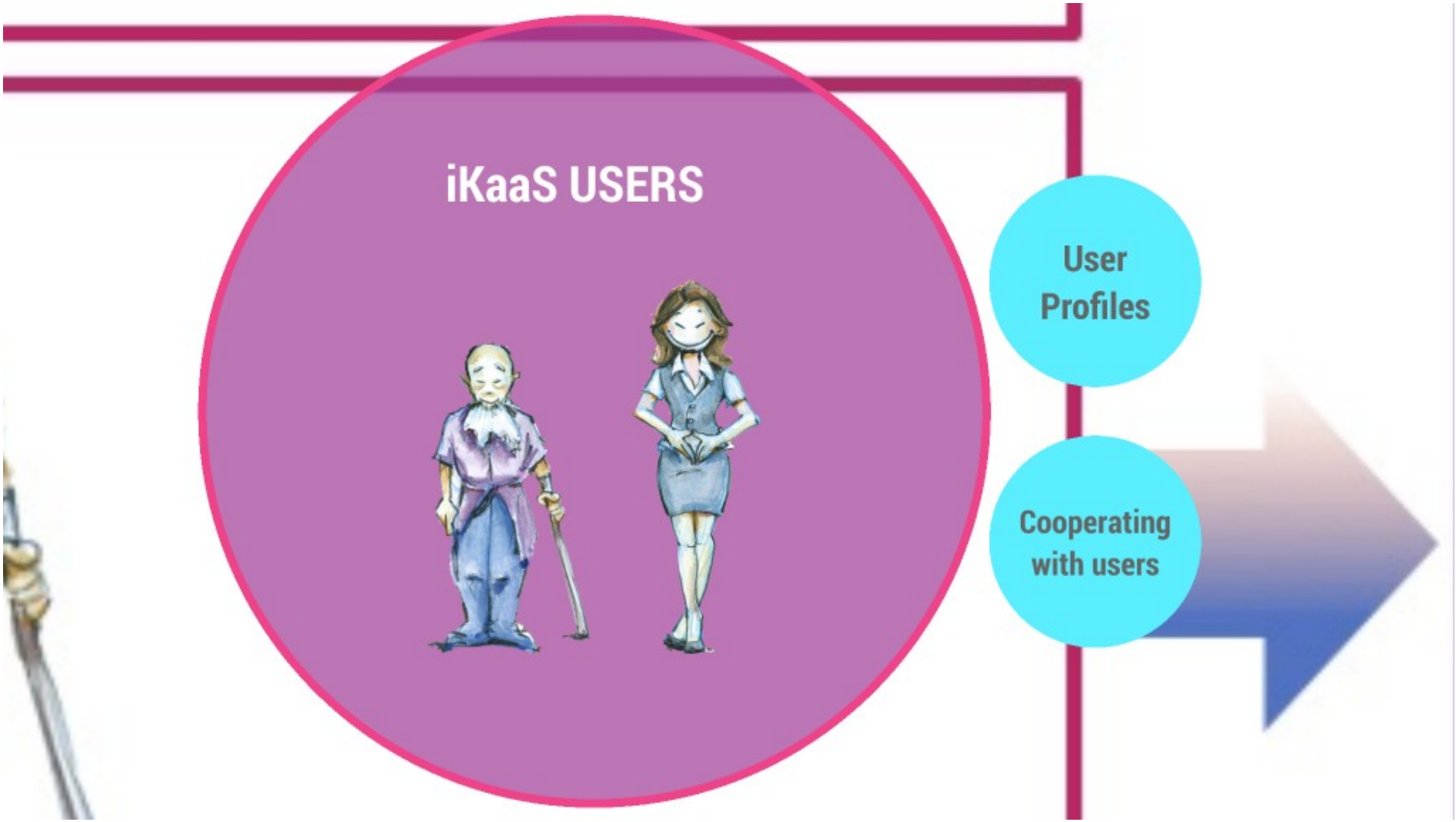
Opendata API (WebService) has been developed to provide personalized Warnings related to the user profile and to cross check routes affected by environmental risk areas (polygons)



Opendata API REST. Alternative Routes (Part II)

Opendata API (WebService) has been developed to ask for alternative routes when existing any Polygon with some warning related to health preferences.




iKaaS USERS
User Profiles
Cooperating with users

User Profiles

TYPES OF POLLUTANTS
Pollen
Ozone
Nitrogen dioxide
Particles
High Temperatures

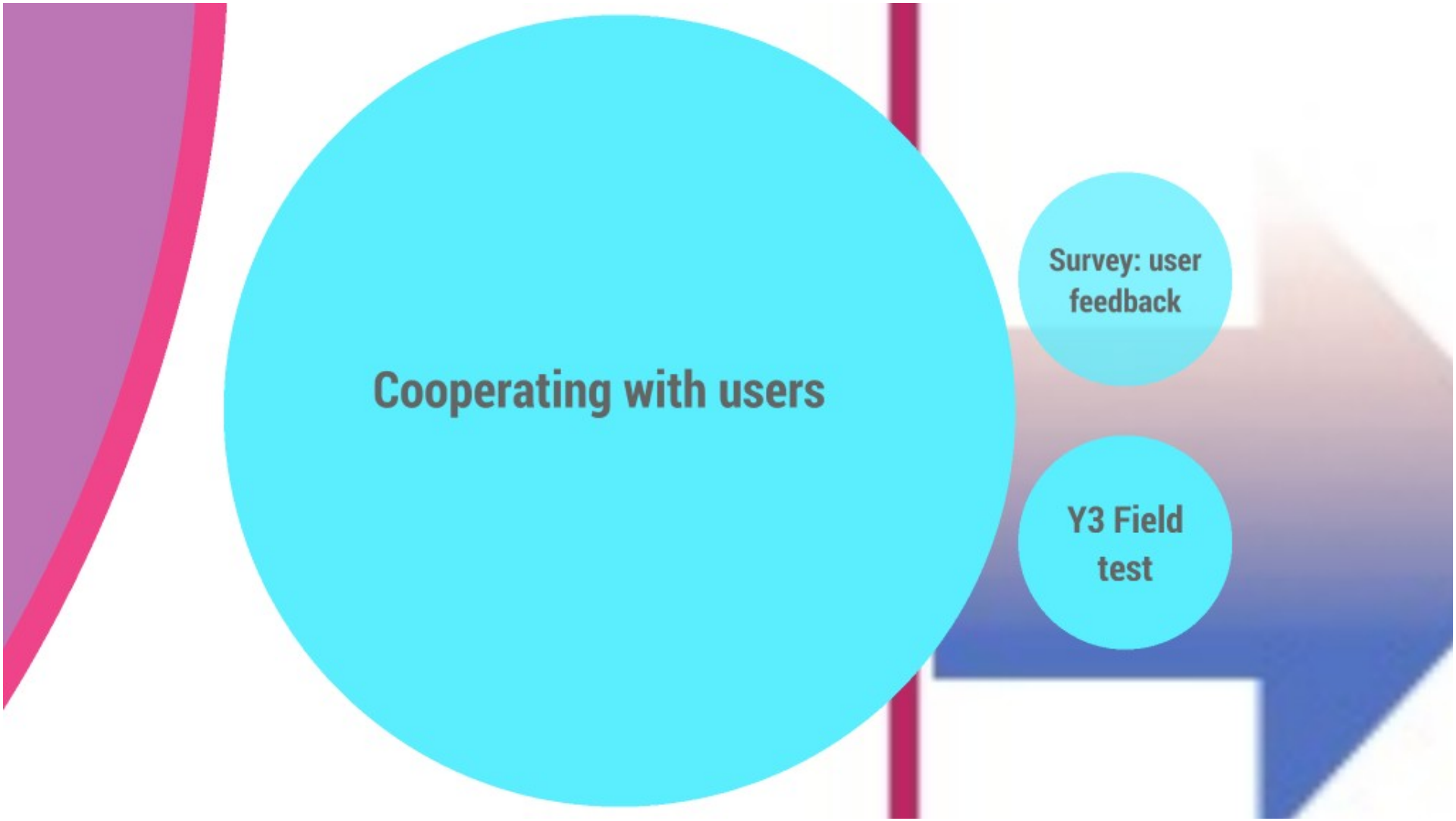
ADMINISTRATION

ZONES
1 (Inside M30)
2 SE
3 NE
4 NW
5 SW
ON DEMAND

Madrid Environmental Health service

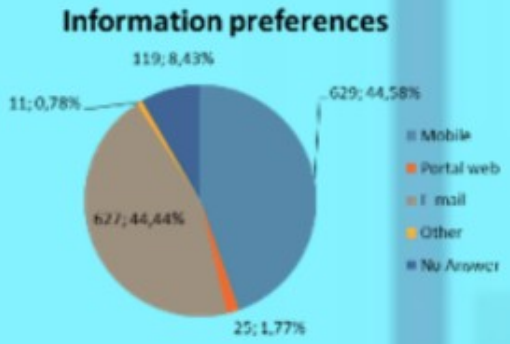
NOTICE SERVICE (Informative)
Pollen and pollution values

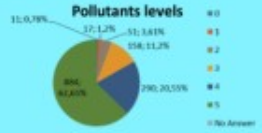
WARNING SERVICE
High level of Pollen and Pollutants
Health routes
Health recommendations

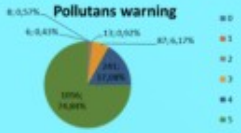

Cooperating with users
Survey: user feedback
Y3 Field test

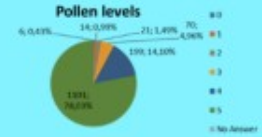
Survey: user feedback

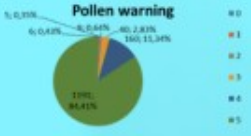
1411 participants / 99% wants to get this kind of information

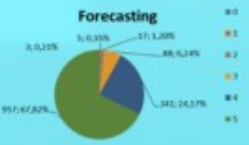


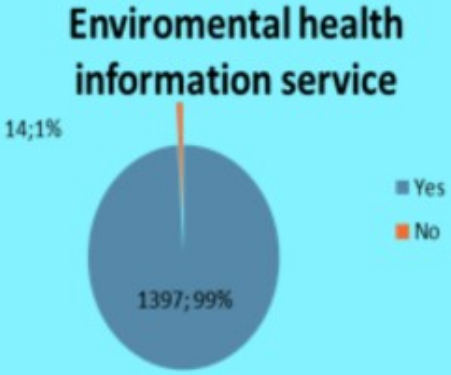


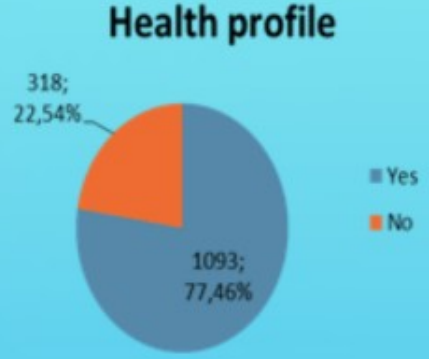












Y3 Field test

- Field testing with selected population
- Start: September 9th / End: November 7th
- Results:
  - Number of users: 44
  - Number of routes: 77
  - Messages sent:
    - By sms: 389
    - By email: 250
  - Notices: 592
    - Pollen: 212
    - NO2: 190
    - PM: 56
    - O3: 102
    - Temperature: 32
  - Warnings: 47
    - Pollen: 19
    - NO2: 9
    - PM: 5
    - O3: 6
    - Temperature: 8

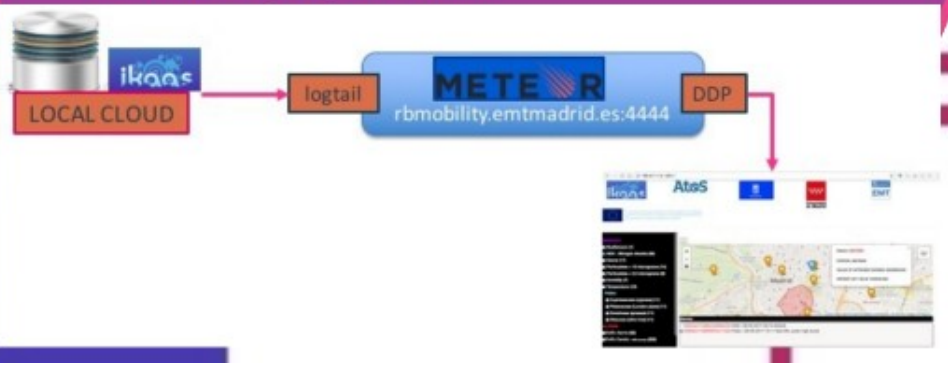
Visualization Portal

To visualize in Real Time all the integrated environmental (Pollutants, Meteorology, Airborne Pollen) and traffic information.

http://195.57.112.129:81

How does it works?

- Data are observed from Madrid Local Cloud using DDP Protocol (Reactive Server).
- Panels selector allows to check what kind of pollutans does user wants to view.
- Different active warnings are showed in the bottom area.
- Data is offering in Opendata mode.



User Portal & App

http://labs.emtmadrid.es/CareRoutes/

Managing Warnings, Routes and Subscriptions

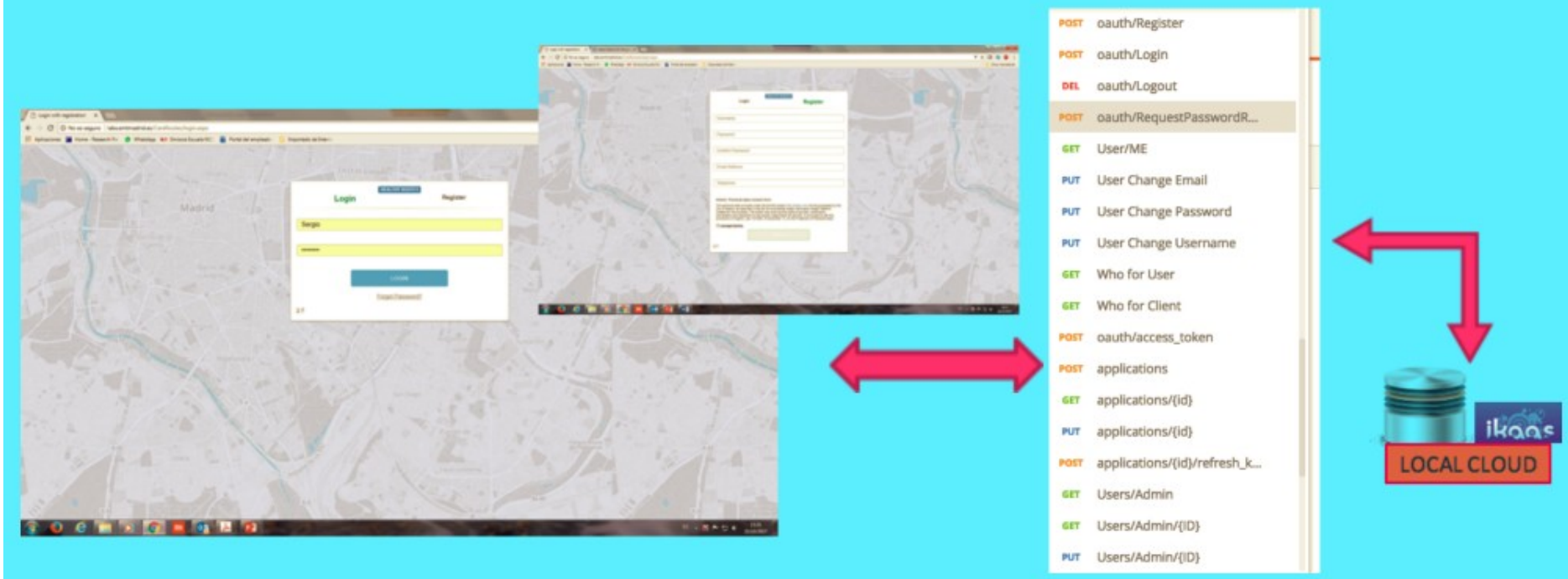
The Madrid iKaaS Use Case Storyline

Ms Akiko arrives in Madrid for a meeting

Ms Akiko, aged 33, is a Japanese worker, that is now in Madrid for business, she has to stay in the city for several days. She is going to stay in a hotel in the centre of the city and one of her hobbies is to practice running at least half an hour every day, and she´s planning to go to Retiro´s park for practicing it. Ms Akiko suffers pollinosis and asthma, so she is very interested in air quality in each city when she has to travel.

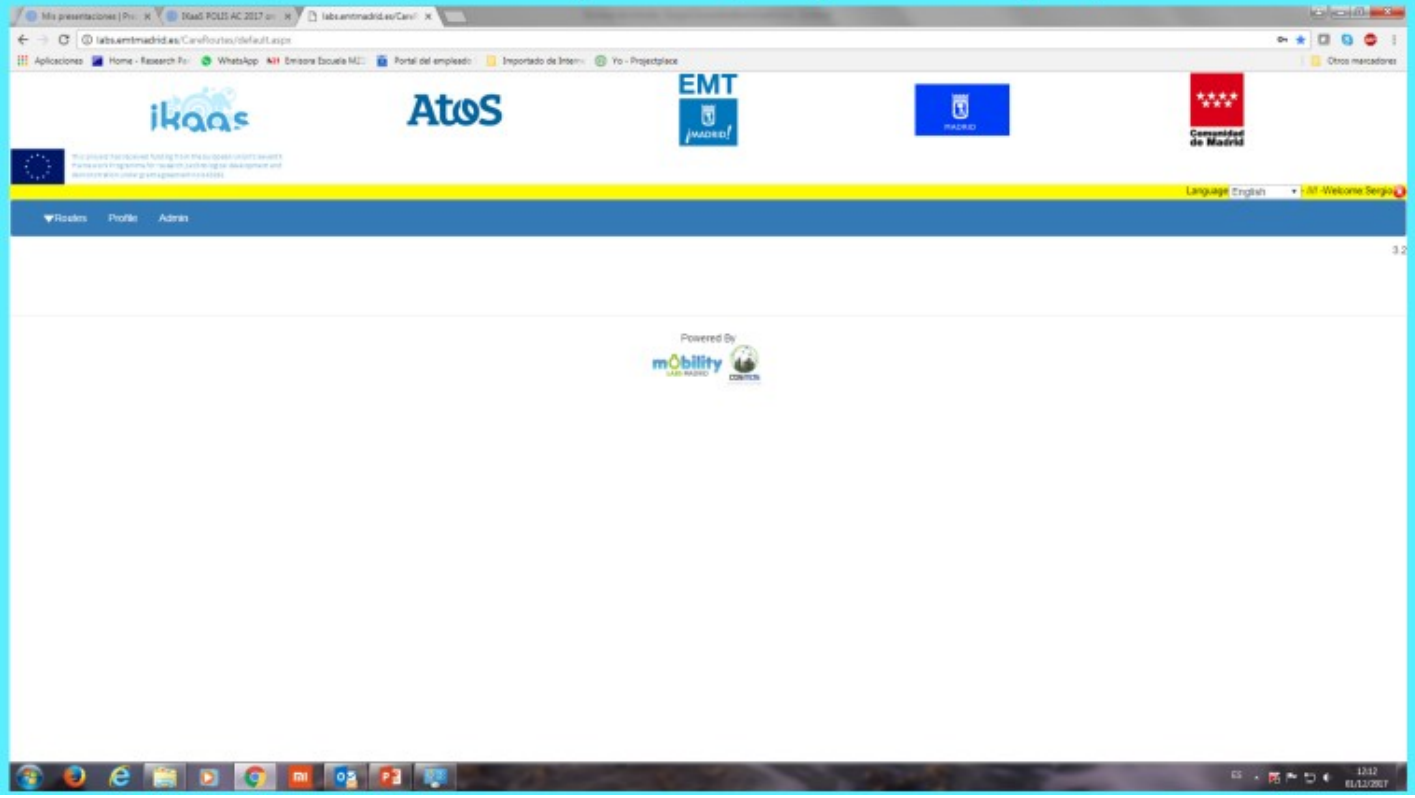
Registry process

System allows a Local Registry using oAuth. The repository of APIs contains methods for interchange of profiles between with Global Cloud Security Datamodel and Madrid Local Cloud



The environment

Three tabs: Routes / Profile/ Admin (this one, only for managers)

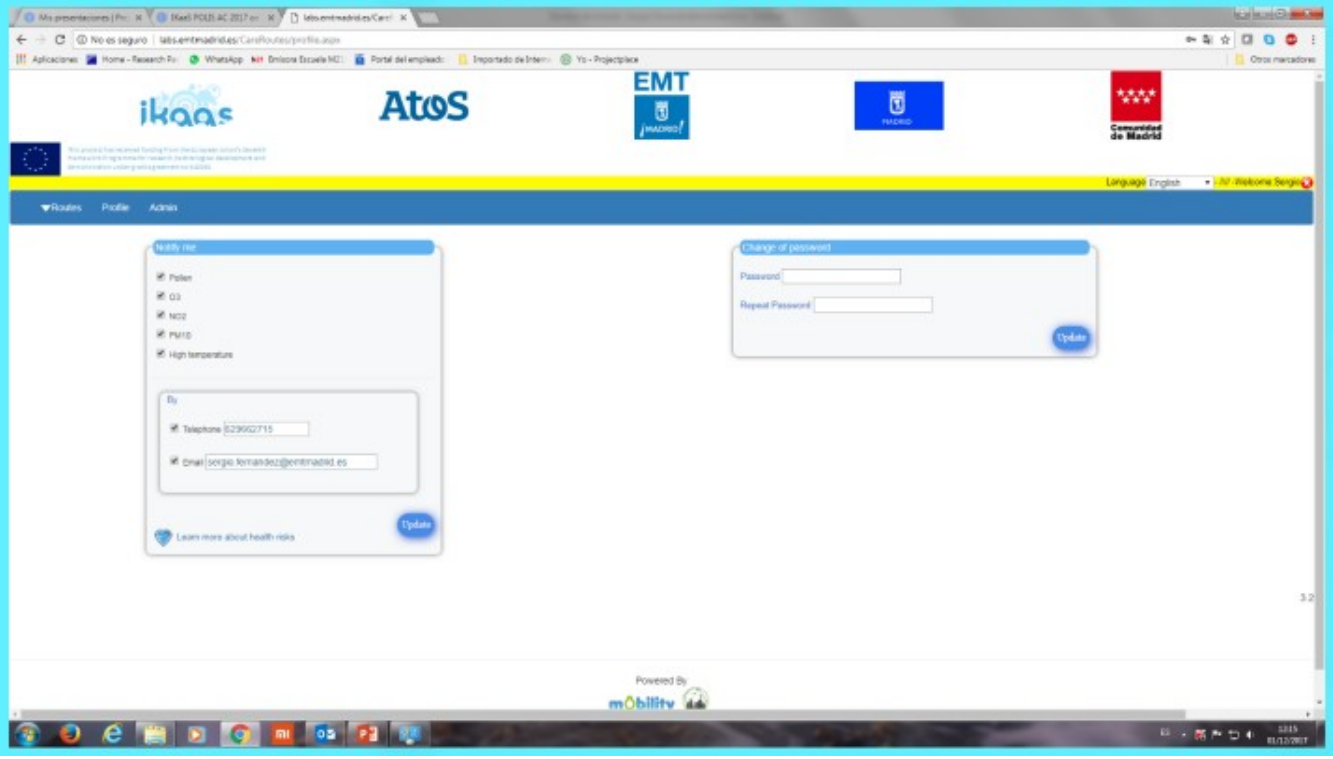


Setting preferences

Choose pollutans / pollen information to receive

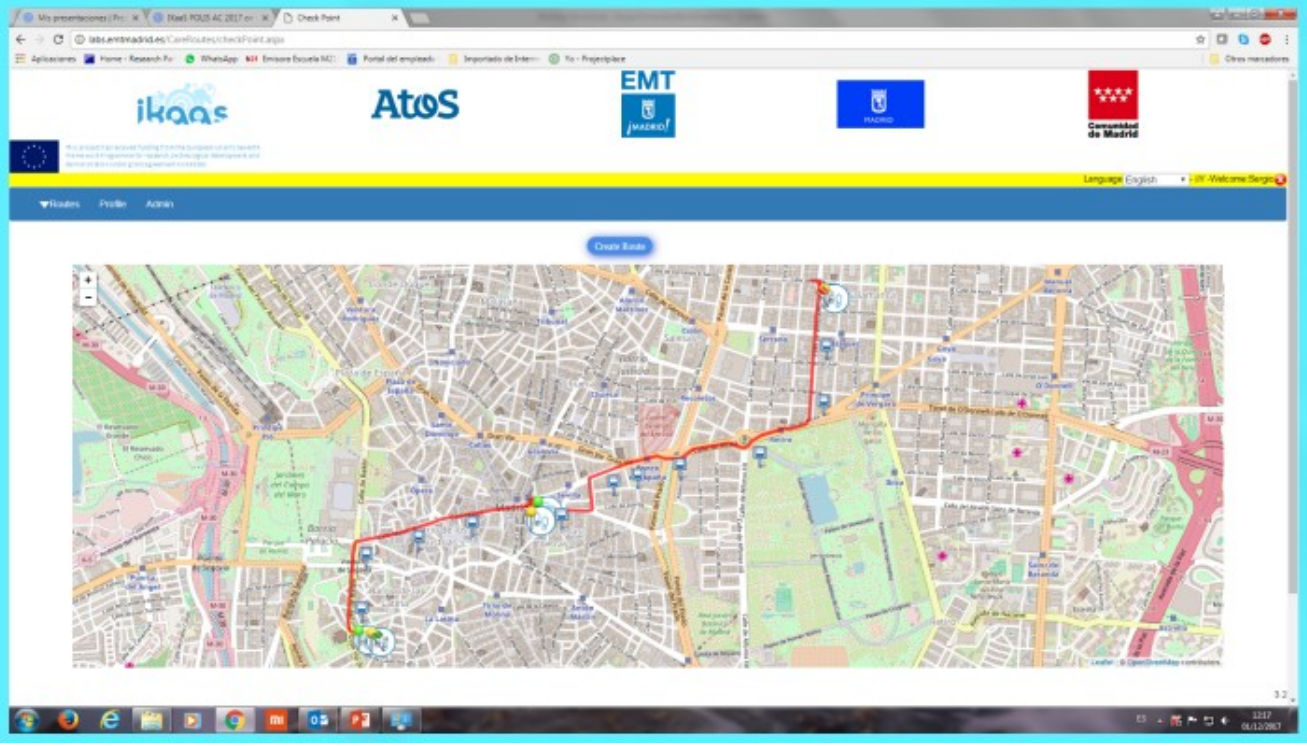
Fill with your phone number / email

Lear more about health risks http://labs.emtmadrid.es/CareRoutes/aboutHealthRisks.html



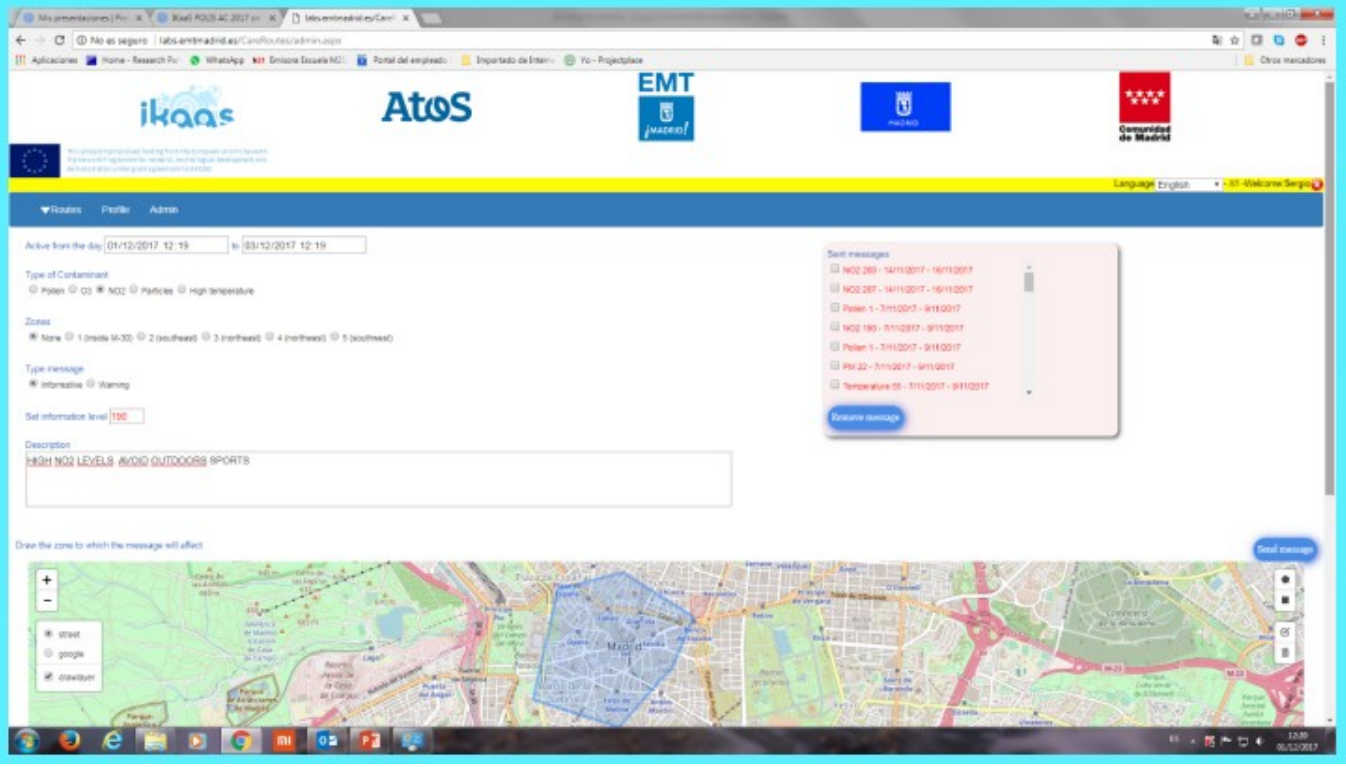
Creating "my Favourites routes"

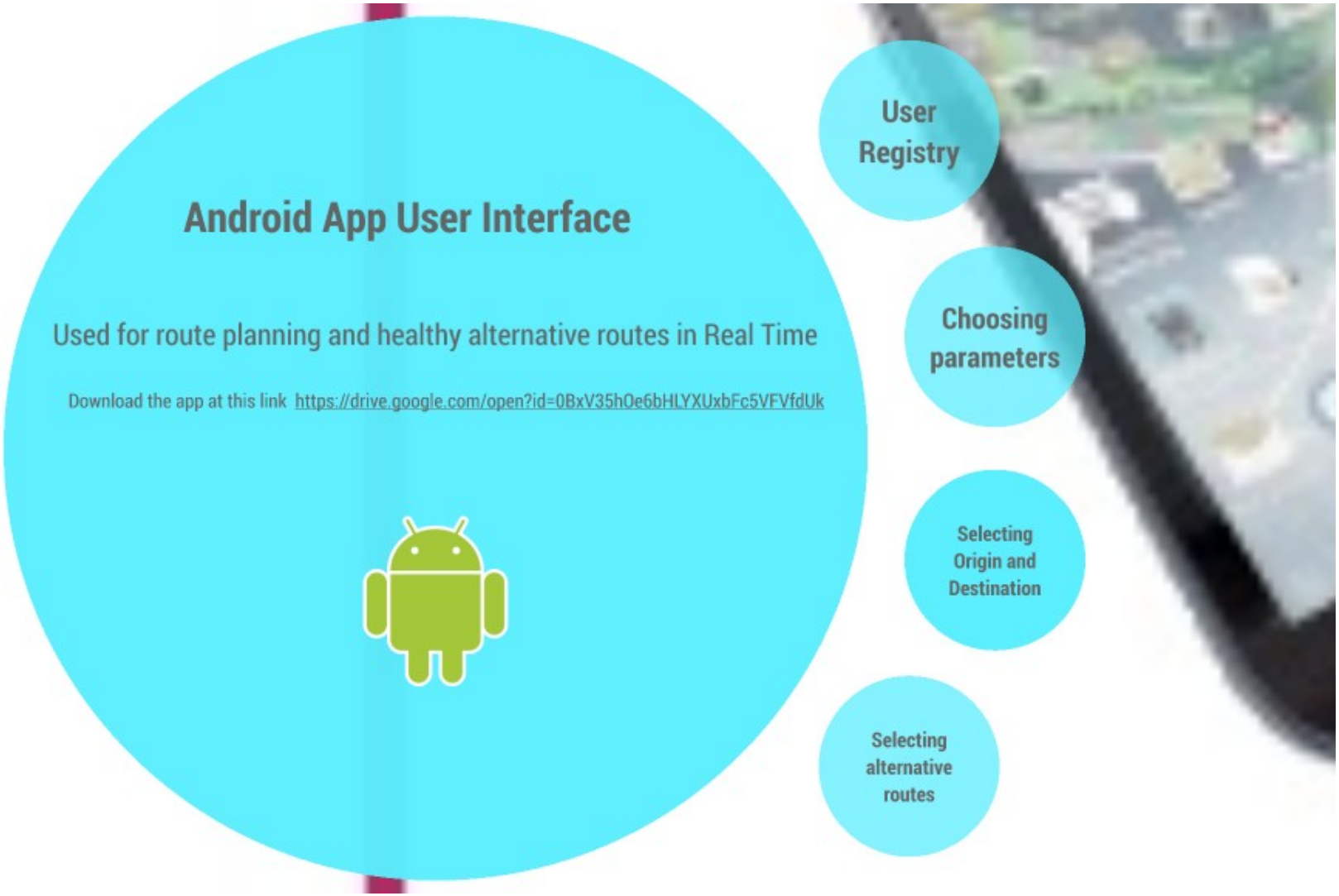
Option used for define "usual" routes. Allows to system to anticipate messages (warnings) before the user is "on route".



Admin UI - Launch notices and warnings

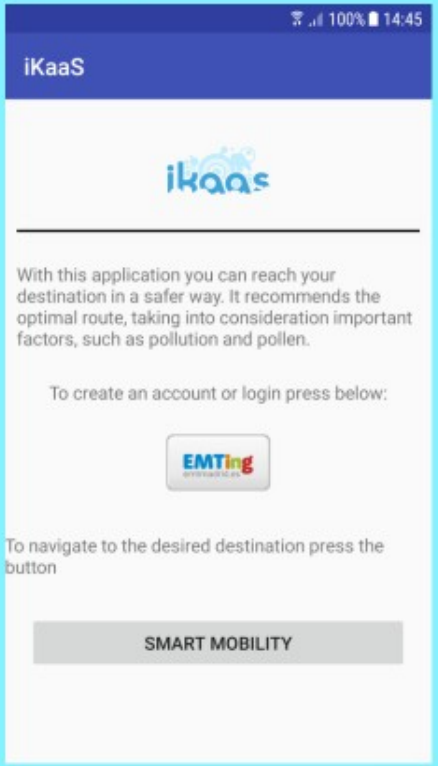
Support definitions of polygons of pollutans, categorization, managing and launching warnings.
Contains engine for sending eMails, SMS and Telegram bots.

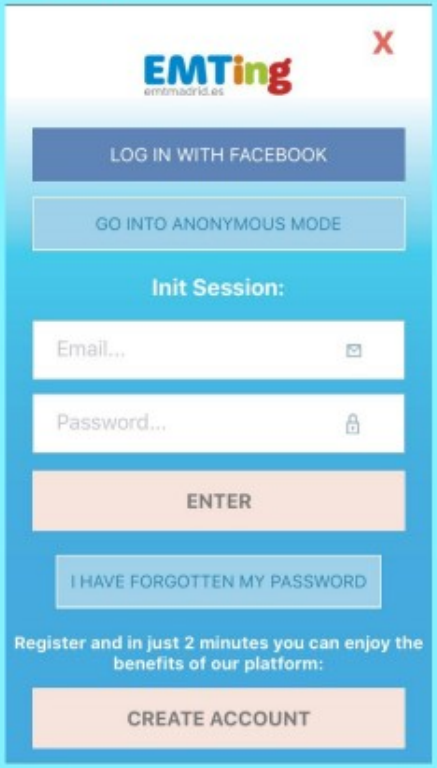


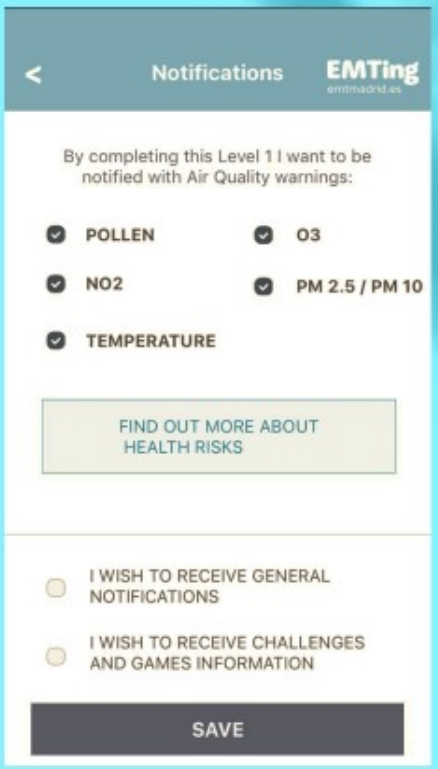

Android App User Interface
Used for route planning and healthy alternative routes in Real Time
Download the app at this link https://drive.google.com/open?id=0BxV35hOe6bHLYXUxbFc5VFVfdUk
User Registry
Choosing parameters
Selecting Origin and Destination
Selecting alternative routes

User Registry

Implementation of iKaaS User preferences has been integrate into a special SDK for transport named EMTING. Achivement: Healthy user preferences and warnings now belongs as part of estable Madrid Transport Infraestructure

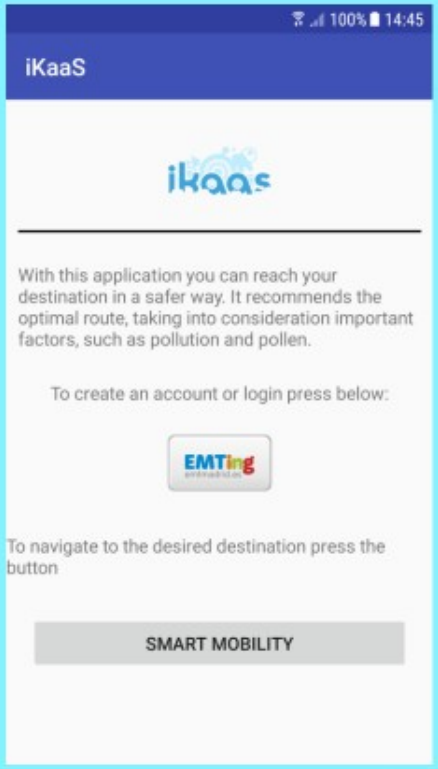


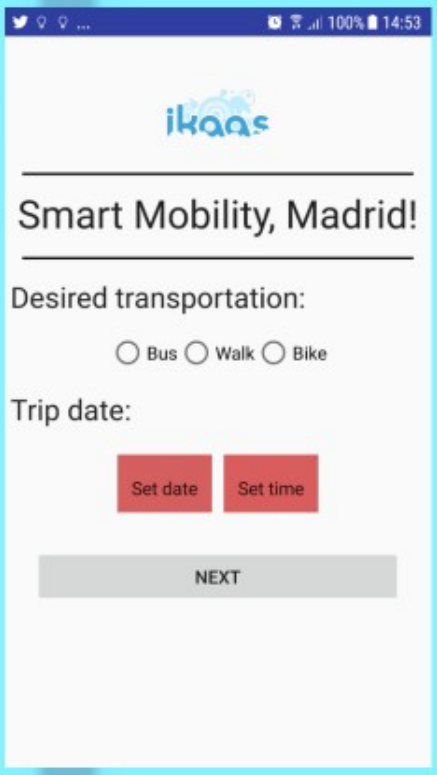


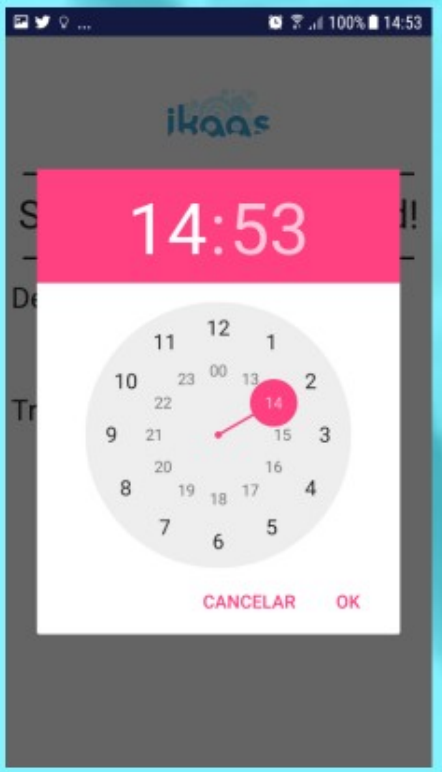


Choosing parameters

Mode of transport, then date and time

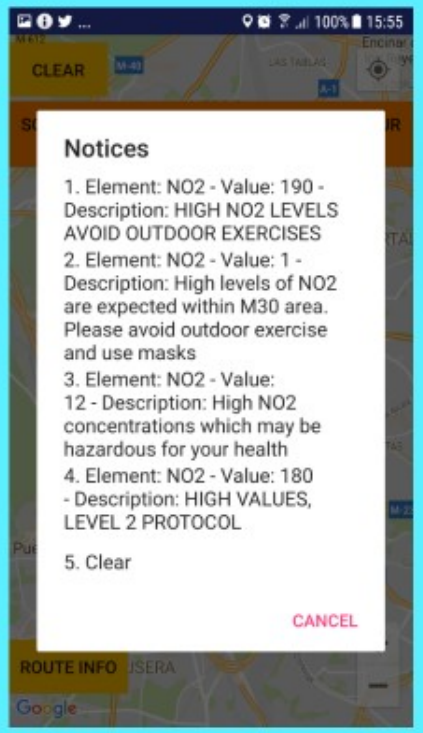






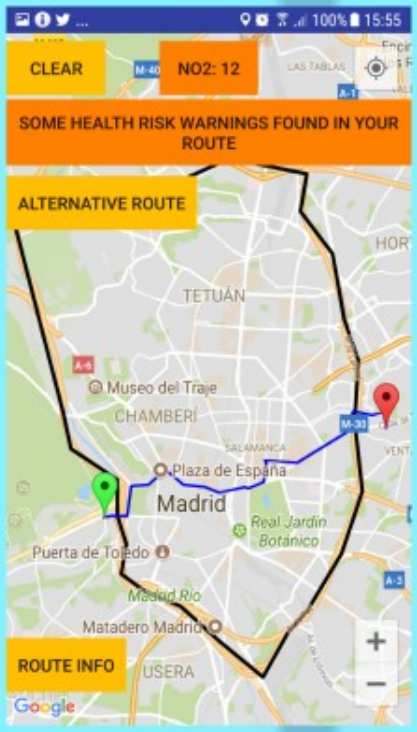
Selecting Origin and Destination

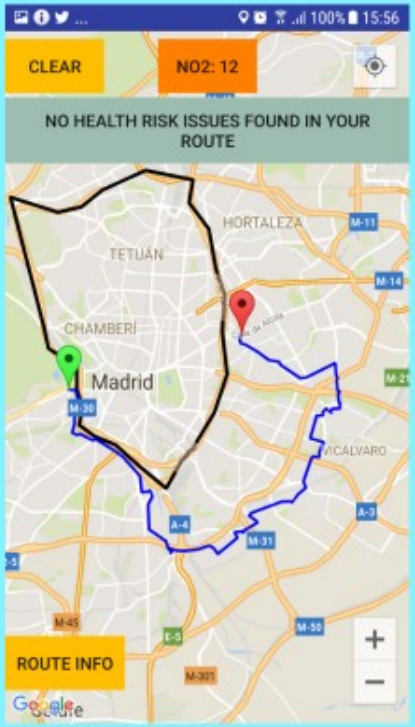
By clicking on the screen, set origin and destination. If the route is affected by any environmental parameter, the "choose risk warning" option will activate, and by clicking on it we can see the active notices and choose anyone



Selecting alternative routes

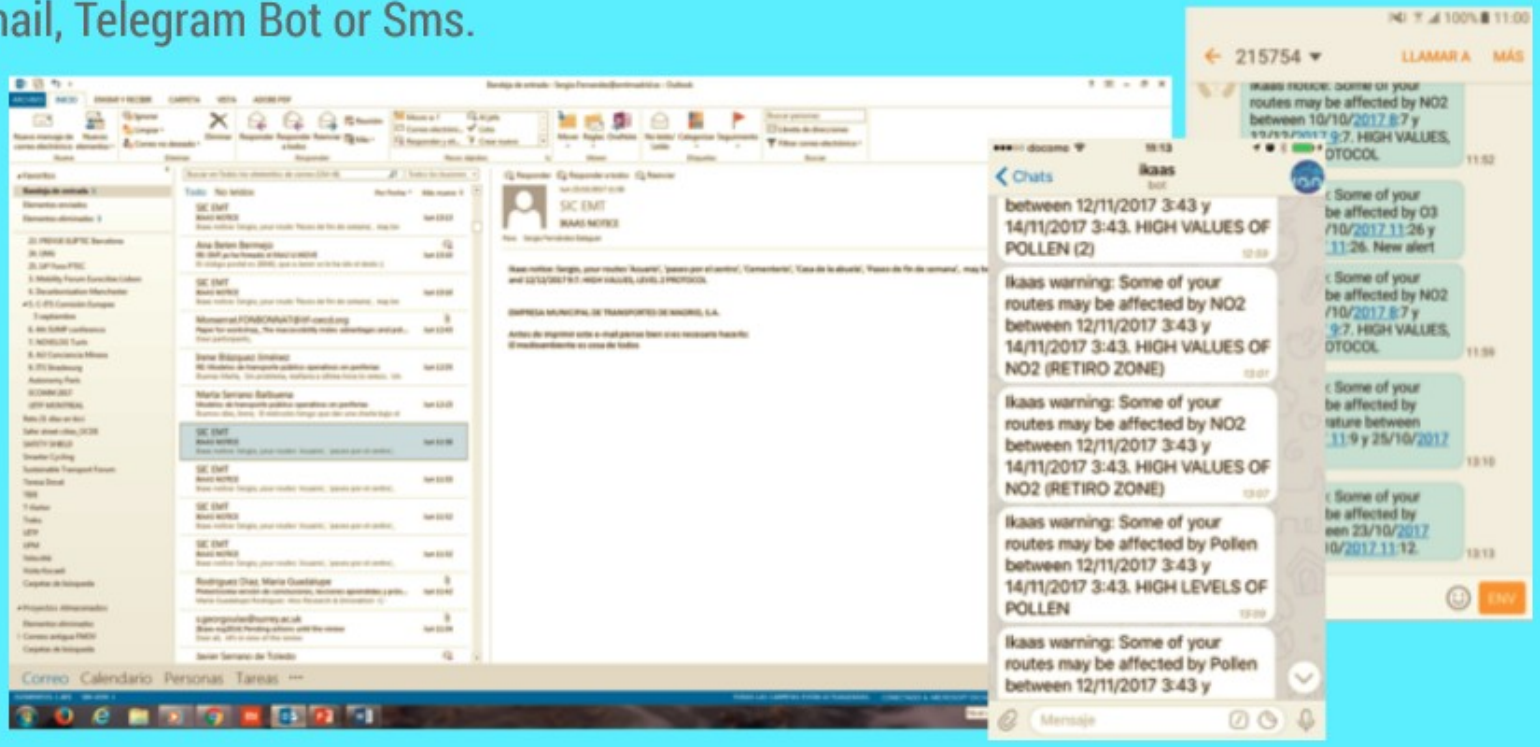
Once we have chosen the notice, we can visualize that our route crosses the polygon in which the notice is active. By clicking on "alternative route" the app will show us the alternative healthy route





Service Warnings

Whenever any of your routes is affected by any notice or warning, you may get the info via email, Telegram Bot or Sms.




WHAT'S NEXT
New sensors
Inclusion more pollutants
Graphic interface M.L.
Information provided by citizens
Prediction & Forecasting models
New channel notifications
Launch service to citizens
Enlarge to Madrid Region