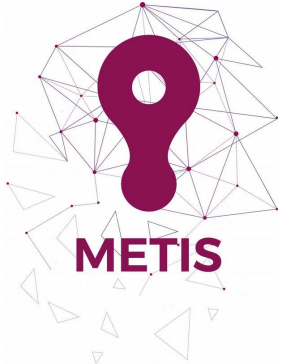
New challenges, Smart solutions.

Context

Flow **monitoring** and **positioning** make for a powerful tool in both urban and industrial environments. Knowing how people and vehicles move within a certain location constitutes useful information to make **mobility policies** and **decisions** based on reliable data.

In the last years, recent technologies have motivated the arisal of efficient, reliable and secure tools that, applied with technical expertise, make for great IoT solutions such as **METIS**.

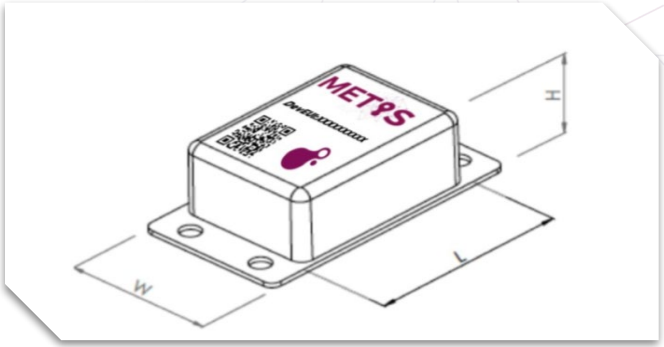
METIS generates and sends reports containing unique identifiers of close mobile entities. By analyzing this data, it's possible to extract information about **occupancy**, **flow patterns**, **time/occupancy matrixes**, **predictions** and many other useful tools that can greatly improve mobility.



METIS system: **Device characteristics**

METIS is based on an IoT **end-device** that monitors mobile entities via radiofrequence analysis.

The device consists on a **multiple connectivity** board that can operate with WiFi, Bluetooth and LoRaWAN protocols, which resides inside an **enclosure** of the size shown below. To operate, it only needs a 220 V outlet connection (power plug included) on a location with **LoRaWAN** coverage. The device comes preconfigured, so as soon as it is plugged in it joins the LoRaWAN network, starts the monitoring process and sends the collected data regularly.



Approximated measurements:

82 mm(L) x 57 mm (W)x 33 mm (H)

The device can be installed horizontally or in a wall.

METIS system: **Device operation**

Once the METIS device joins the LoRaWAN network, it starts its radiofrequence monitoring process, which achieves the following benefits:

- **Non intrusive** 

It detects mobile entities monitoring radio packets **passively**.

- **Completely anonymous** 

The collected information is anonymized applying irreversible cryptographic algorithms, keeping **privacy** at all times.

- **Unique identifiers** 

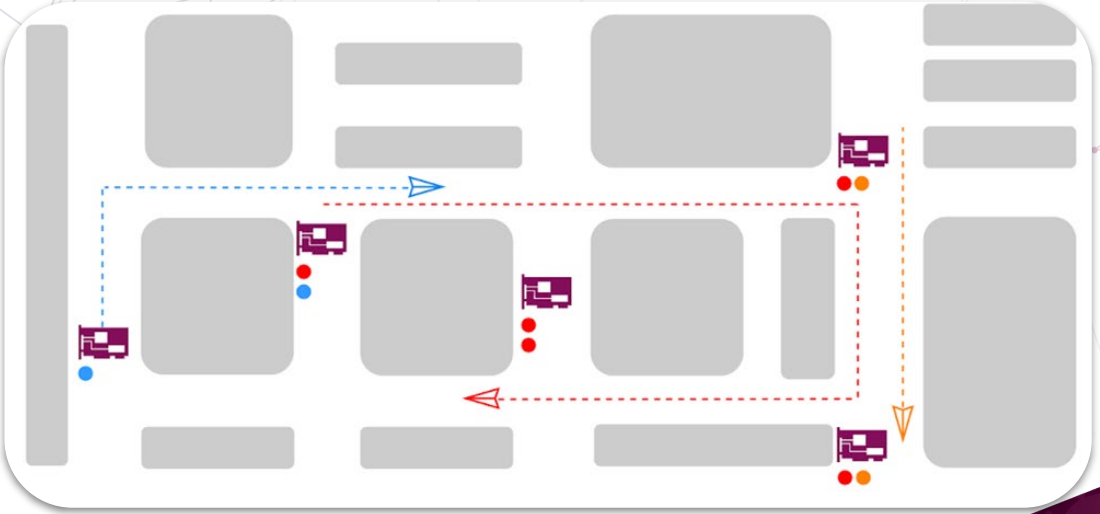
The cryptographic algorithm generates unique identifiers, and different devices will always generate the **same identifier** with the same input data, while remaining anonymous.

- **Long Range** 

Thanks to the use of **LoRaWAN** technology, the device can transmit data within a long range even in harsh environments, reducing network related costs while increasing device location possibilities.

METIS system: **Multiple devices**

A single METIS is a powerful device that can measure occupancy and some data analytics like occupancy/time matrixes or patterns in a location by itself. However, the system's value increases exponentially when deploying **several devices** in the same application. Since each end device generates the same identifiers, the system can track passersby and vehicle **flows between different locations**, allowing valuable information like **relations** between zones, maximum and minimum occupancy of the different locations, time comparisons, and so on.



METIS system: **Complete vertical**

Metis is designed as a **modular** solution, enabling a complete **integration** with different networks and systems. Generally, we can divide the solution in three different blocks:

- **End-devices**, all of them centralized in one network.

- LoRaWAN **network**, enabling data transmission and collection via internet.

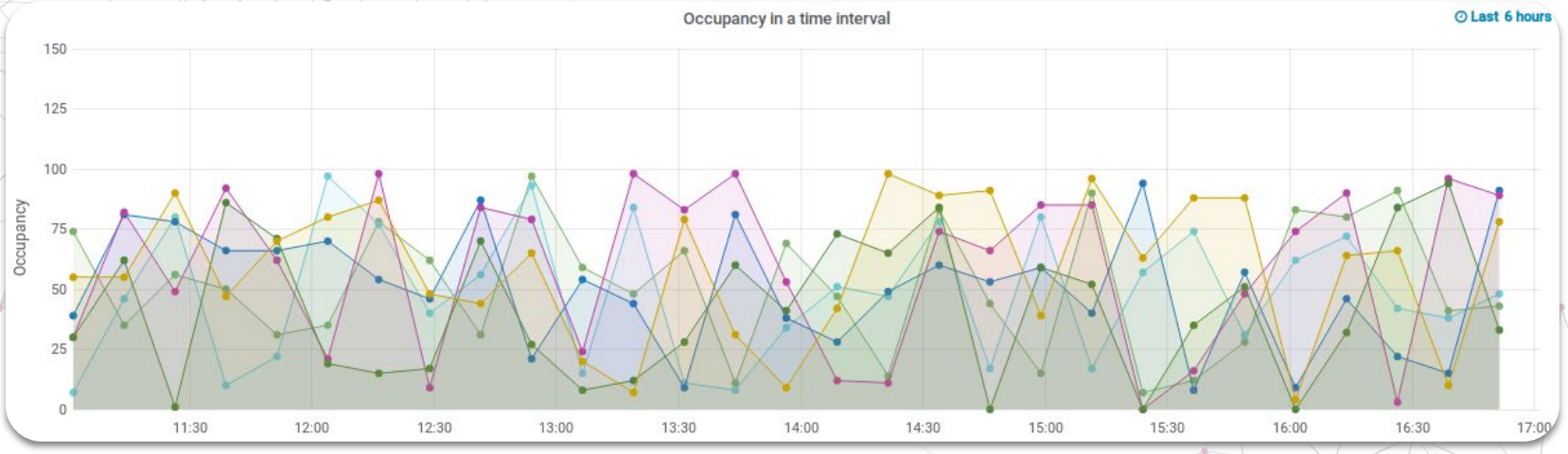
- The IT **systems**, usually formed by databases and data analytic tools.

METIS system: **Data analytics**

Each Metis device reports frames containing every unique identifier seen since the last report, so any given data analytics solution can process them, providing a true **technological independency**, however, in **Purple Blob** we have already developed analytic tools that make the most of the solution.

METIS system: **Data analytics**

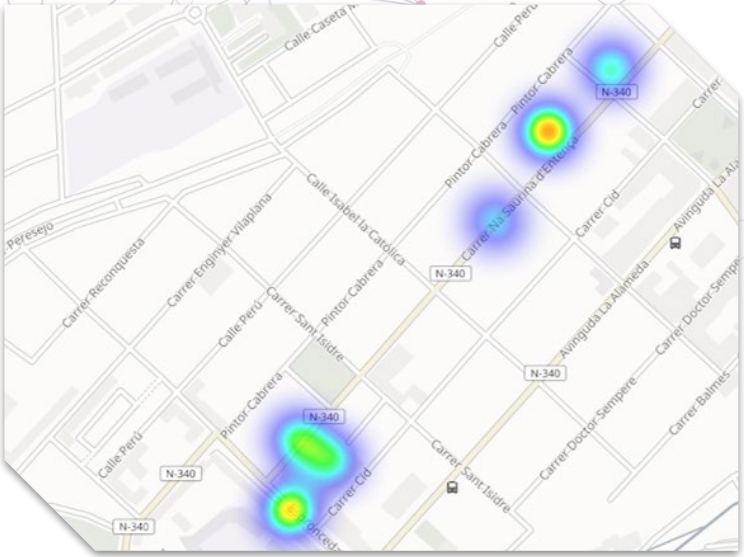
- **Occupancy in a time interval** (how many entities are detected in each zone during a certain time interval?)

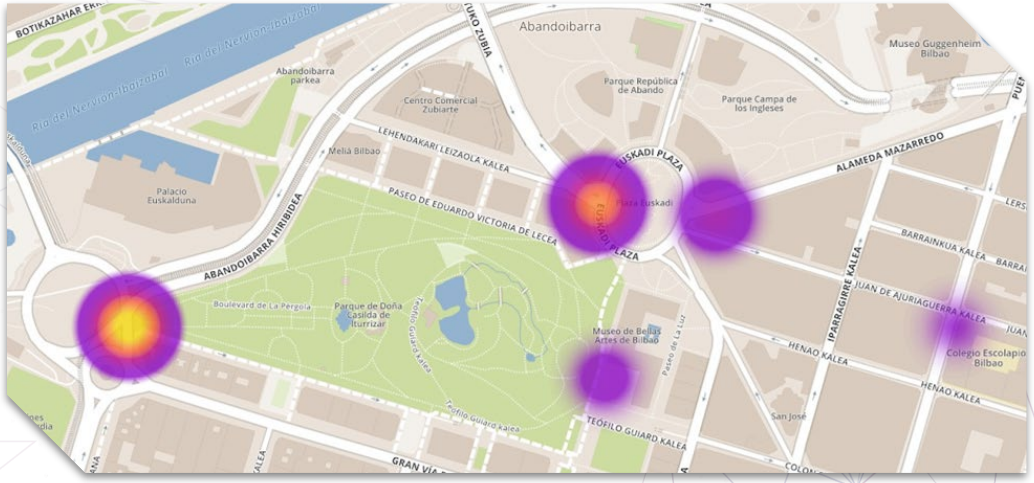


- Are there any places that are **full** at certain times of the day?
- Are there any **businesses** that are less visited at some time of the day? What is the reason behind it?
- Can we accomplish and measure any given action to **improve** the affluence of people?

METIS system: **Data analytics**

- **Location heatmaps** (which zones have more transit)

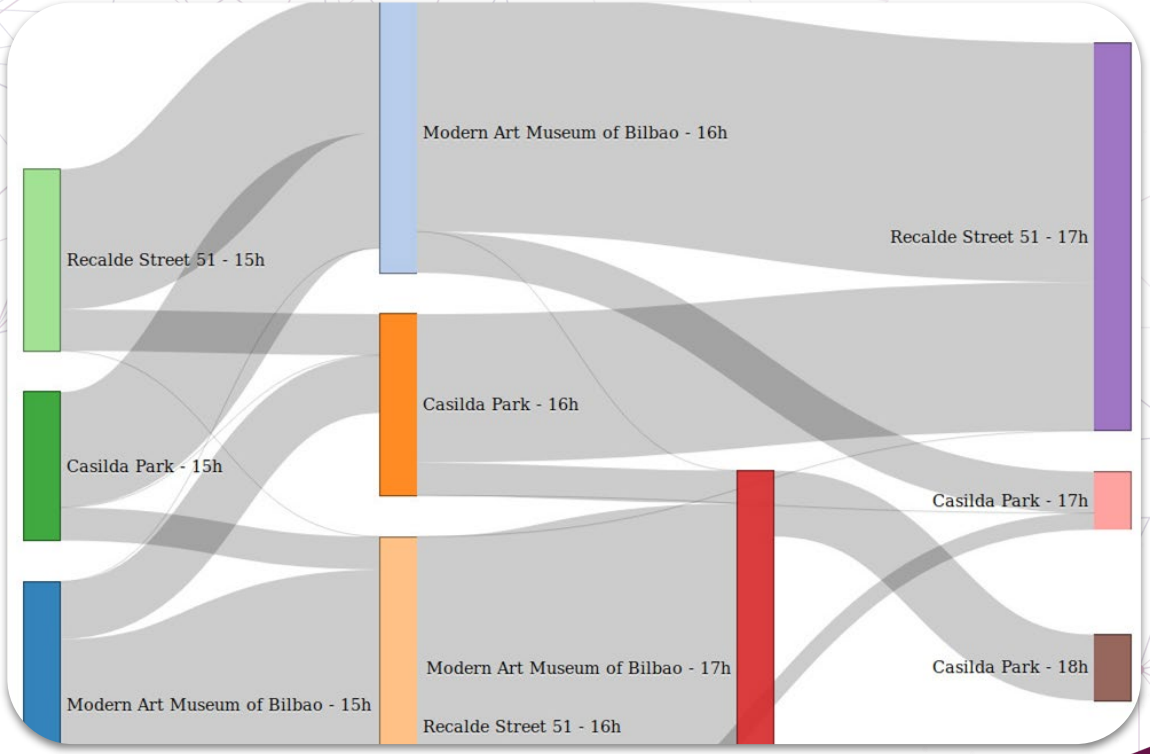




- What are the most **attractive** places and times for the local businesses?
- What are the causes for a place to be more attractive? Are there any events or other **factors** that could have caused that?

METIS system: **Data analytics**

- **Relational** (Is there a pattern in the data? How much people from a certain location appears in another one on a given time range?)



- Are there **groups** of people that usually meet in the **same place** and **time** range?
- **Where** and **when** do they meet?

METIS system: **Data analytics**

Thanks to our knowledge in the data analytics field, we can extend, adapt, and create totally new **analytics** and **real time** dashboards that satisfy each and every information need.

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