SmartPort: Application for displaying large amounts of data (Big Data) from sensors connected to the Internet (IoT).

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***Abstract*—Incoming technologies assist the capture and analysis of data for all kind of organizations. A good example of this trend is the ports that generate data regarding sensors connected to Internet or Internet f Things (IoT). However, among time, this sensors generates an enormous amount of data, also known as Big Data which must be managed with a proper architecture. In the line of the management systems based on GIS, we have developed the SmartPort application. SmartPort offers a rich-internet application that allows the user to visualize and manage the different sources of information of a port environment. The backend management is based on the FIWARE tools and architecture. At the same time, the Glob3 Mobile SDK for the development of map apps will support the 3D visualization of the port's scenery and its data sources.**

Keywords: GIS, Big Data, Port, SmartPort, FIWARE, Glob3 Mobile, 3D Visualization, Internet of Things

I. INTRODUCTION

A port is an environment that combines natural and anthropic elements, that is extremely complex and dynamic and of great economical and social importance for coastal areas. Numerous activities of diverse nature take place in it, such as goods and travellers transportation or fishing as well as maintenance operations, rescue and protection of the natural surroundings.

The port authority is the body entrusted with the decision-making within the boundaries of the port, regarding all its activities and available resources. Therefore, it is of vital importance for this organization to have a system that allows the management, visualization and analysis of the elements present at the port just like all the natural ambient factors. Other examples of this kind of visualization platforms can be found, for instance, in other papers (Georgas et al, 2009), regarding the data analysis of New York's Harbor.

In a general way, there are many sources of available data within a port area. They can be subdivided into the following groups, depending on their nature.

Human made resources and port activities. This group includes all the human elements within the port. These elements are important for the port authority that has to manage them and for the users of the port that could make use of them.

- Port infrastructure.
- Terrestrial and marine sensors.
- Vessel's activities and positions. Routes and schedules.
- Available piers.
- Transported goods and passengers.

II. MANAGING RECENT AND HISTORICAL DATA

A. Recent data

Several sensors are available at the Port of las Palmas, such as metrological and boys which needs fast queries to get and show the recent values very fast.

Once we get the latest values read by the sensors, we proceed to send them to Orion. The Orion Context Broker is an implementation of the Publish/Subscribe Context Broker in FIWARE, providing the NGSI9 and NGSI10 interfaces. Using those interfaces, clients can do several operations:

- Register context producer applications.
- Update context information.
- Being notified when changes on context information take place or with a given.
- Query context information

Scripts written in Python language, making use of the Request library, that simplifies the HTTP transactions, perform this step. Thanks to this utility we are able to get a real time visualization of the ports situation.

Reached the moment to make use of the available data, we decided to develop a web application which shows the geo-referenced sensors in a three dimensional map.

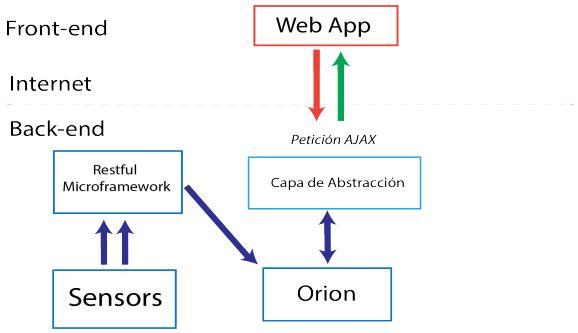

Figure 1. General architecture for recent data

B. *Historical data*

The next request functionality that we undertook was the possible the possibility to display the time evolution of the sensors data and even make an analysis on a given dataset.

For this purpose, we decided to make use of the Big Data Analysis Cosmos; an implementation of the Big Data enabler, allowing the deployment of private computing clusters based on Hadoop ecosystem. Cosmos allows users to:

- I/O operations regarding Infinity, a persistent storage cluster based on Hadoop Distributed File System (HDFS).
- Creation, usage and deletion of private computing clusters based on MapReduce and SQL-like querying systems such as Hive or Pig.
- Manage the platform, in many aspects such as services, users, clusters, etc, from the Cosmos API or the Cosmos CLI. There is also a component called Cygnus in charge of receiving context data from Orion (Context Broker GE implementation) and storing it in a HDFS. In first instance, Orion need to be connected with Cosmos by Cygnus, that creates the connection with Cosmos and manages the data queue to be stored.

Using all that we retrieve data in the frontend.

III. VISUALIZATION

Since the SmartPort Project was defined it was clear that the front-end of the application needs a viewer for the available georeferenced data. In a resource management system like SmartPort, it is important for the final user to spatially locate the available items and data sources.

We have chosen the Glob3 Mobile (G3m) framework to develop our virtual globe viewer, as it provides all the features that the SmartPort's front- end demands.

This allows us to visualize all data processed at the back end, for instance, last information retrieved from the sensor.

Figure 2. Recent data of a meteorogical sensor

Figure 3.

IV. CONCLUSIONS AND FUTURE WORK

The enormous amount of data generated by a regular seaport infrastructure is generally poorly used and often displayed through many channels. Due to this situation, most port authorities obtain a lesser benefit from their quite complex and expansive sensors networks. However, for the first time, it is now possible to process, store and show these Big Data environments so they can offer a truly added value.

Next work in SmartPort will be focused to find new data and develop versions compatible with mobile devices and tablets.

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