

## **Project Report**

### **D5.1.1 Digital Urban Platform – Evolution 1.0**

#### **Work Package 5 Aveiro is Open (AiO)**

##### **Activity 5.1 AiO Urban Platform**

<b>Deliver Partner:</b>	<b>Deliverable Number:</b>	<b>Title:</b>	<b>Delivery date:</b>
Altice Labs	D5.1.1	Digital Urban Platform – Evolution 1.0	31/05/2019

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Report date: 30/06/2019

Delivery date: 31/05/2019

Approval Date: 17/07/2019

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## 1. Introduction

Aveiro STEAM City Digital Urban Platform (DUP) is intended to collect, process and share data and information from multiple sources (e.g. machines/sensors or databases) enabling value creation for the City through advanced analytic and predictive services to be deployed in the project. The platform will handle data from IoT devices, managed sensor systems and information repositories (e.g. city's databases) from project's partners and other stakeholders, providing advanced data analytic services supported in the city data lake via specific APIs.

Besides acting as the city services' enabler for R&D projects and digital industries, it will allow city operations optimization via information enrichment and unified transversal access. A powerful City Dashboard application – the City Governance Centre Portal – will facilitate the understanding of the aggregated information, to assist decision making.

## 2. Objectives

This report describes the main functionalities and procedures necessary for the installation and connection setup of the first version (Evolution 1.0) of the Digital Urban Platform (DUP).

This first delivery focuses on the installation of the DUP core that will integrate (ingest) the first data sets identified and offer the possibility to connect a set of actuators/sensors and smart systems, already available in the AiO ecosystem. Evolution 1.0 technical user interface gives the platform manager the means to manage platform's relevant entities and setup the basic analytical capabilities that will allow manipulating and visualizing the data collected/ingested. A first set of services (functions) will be created and made available for access via dedicated APIs.

At this stage (Evolution 1.0) it will be possible to automatically import data from external sources (i.e. content subscription) in batch mode, store them and make them available for use (i.e. client applications), so it can be analyzed on the fly or later on. Within the scope of WP4 – Aveiro Labour Market Observatory, this functionalities will be used to connect the multiple data sources from the relevant data domain and resources, linked with competencies and job requirements, practices and behaviours (A4.1) such as <https://www.ine.pt/> [Portuguese Statistics] or <https://www.pordata.pt/> [PORDATA], among many others.

The enrolment process that will allow to a DUP client – i.e. partner/ enterprise/ RD&I organization – to get access to the data and digital assets in the context of Digital Urban Platform will be also ready to be tested.

Complementarily, the necessary mechanisms for the visualization of the first set of KPIs calculated will be made available for visualization in the city dashboard – the City Governance Portal.

### 3. DUP Evolution 1.0 – Functional Architecture

The architecture adopted in this implementation is represented in Figure 1. Detailed information about DUP Evolution 1.0 components, including technical quick guides, can be found in the product web site (<https://iot.alticelabs.com/>).

DUP functional architecture encompasses three main layers in order to allow heterogeneous data ingestion, data analysis and data sharing using open REST-based API: the Data Source layer, the Middleware layer and the Data Sharing Layer.

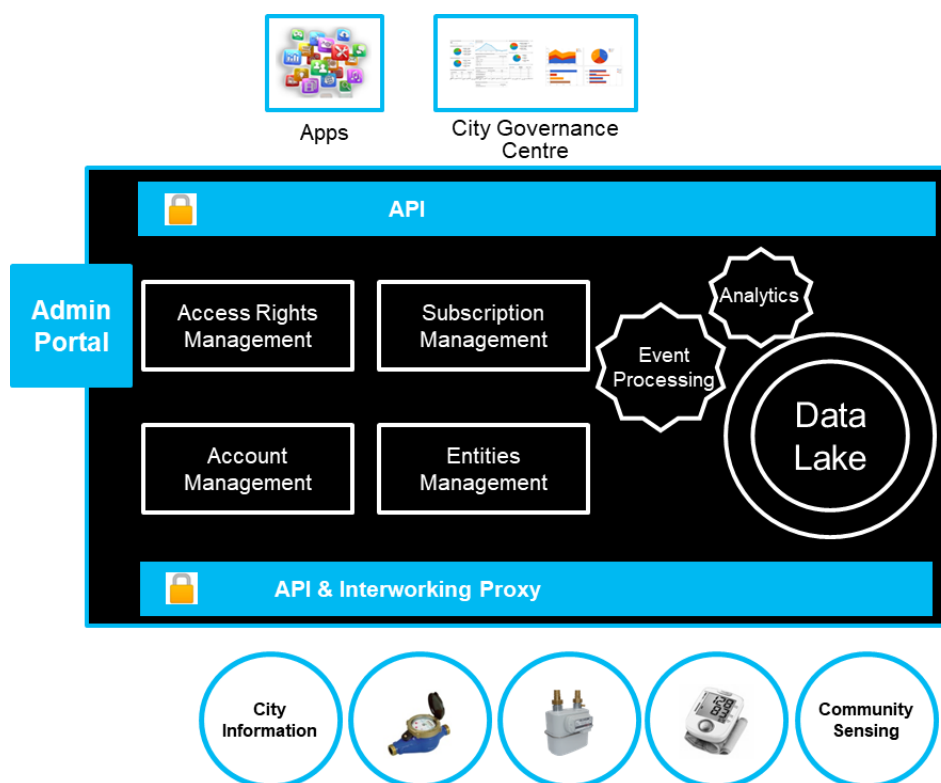


Figure 1 - DUP Evolution 1.0 – Functional Architecture

#### Data Source Layer

This layer provides the functionalities required for the ingestion of data from a wide range of differentiated sources, including IoT devices, web-based applications or file sharing systems. The collected data is first adapted, based on the existing data information model of the platform, through interworking proxies. It is possible to collect data in batch mode, through file ingestion, or in streaming mode, using available REST API. The information collected is then stored in the Digital Urban Platform database and available to be processed and/or shared with pre-authorized entities.

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## Digital Urban Platform middleware

DUP middleware layer allows to gather, analyze, enrich and share the collected data with the different client applications willing to consume it. Its main features include:

- Account Management – The platform usage requires the creation of an account. For this, the user will have to make a request and only after validation he will be given access to the platform's services.
- Access Right Management – The platform has a very fine control of access rights. Only users with a valid account can access the information. In addition, each information source, associated to an account, must use a set of credentials that control its access to the database. Moreover, within a specific account the exchange of information between distinct entities presupposes the use of access tokens. Finally, each account manages their own data and can share it with external entities from different accounts through access tokens.
- Data brokerage – Applications and devices can access data using open APIs. The Digital Urban Platform allows synchronous and asynchronous communication modes. Entities requiring access must have an account and valid credentials to collect the information.
- Entities Management – An entity represents any system capable of producing or consuming information. Devices such as sensors or actuators, web applications or other components and systems capable of exchanging information with the platform. For that they need to be associated with an account and be able to communicate using entities' credentials.
- Subscription Management – This functionality allows for the subscription of specific events. Entities can subscribe for any data or for data under specific conditions. Subscriptions are only allowed if subscribers have access rights over the data.
- Storage & Data access – Data is stored in a cloud-based database being ensured persistency and historic access. Moreover, real time data can be accessed using open API made available by the platform.
- Event Processing and Analytics – The Digital Urban Platform provides access to a set of mathematical functions for data processing. These tools are particularly useful for extracting information in streaming mode.

## Data Sharing

This layer enables the sharing of data and information between DUP users/entities. Both raw data and processed data can be accessed, according to the specific access rights granted. Applications, such as the City Governance Centre or mobile apps, can consume this information but they can also provide new insights to the Digital Urban Platform, enriching the available data.

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## 4. Digital Urban Platform deployment

Deployment of Evolution 1.0 of the Digital Urban Platform was done using an initial set of data relative to residential electrical power consumption. Since, at this point in time, it is not still possible to get the real information from Aveiro inhabitants, similar data from a specific Lisbon area was used for testing purposes.

### Data ingestion and storage

Data ingestion is mainly done using REST API. Applications or devices intending to ingest data resort to open API to publish the required information. Publishing entities must be associated to an account and need to be registered in the platform. Moreover, it is possible to upload files using the platform's functionalities. The information is stored and persisted in the Digital Urban Platform and becomes available for authorized entities. Additional information on the ingestion process can be found in the [platform public site](#).

### Data processing /analytics

DPU enables real time data analysis over sequence values. It brings the concept of alerting rules, allowing to define alert conditions based on Prometheus expression language. To create alerting rules PromQL language is used. Figure 2 below presents an example for the creation of an alert to check if the average temperature in the last 30 minutes is above the value 35.

Further information on data processing and analytics is available in the [platform public site](#).

```
{
  "name": "Temperature is high",
  "description": "Monitor room temperature",
  "expr": "avg_over_time(temperature[30m]) > 35"
}
```

Figure 2 – Alert creation example

### Data consumption / visualization

Authorized entities can consume DUP data over open APIs. There are two distinct way to access data. The first one uses publish & notification mechanisms – whenever a new data event reaches the platform, DPU sends a notification to the subscriber entities. In the second mechanism the entities interested periodically pool the platform in order to get the relevant data.

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For the setup of the first version of the Digital Urban Platform (Evolution 1.0) sharing of raw and enriched data between the platform and external entities was demonstrated using an initial prototype of the city governance portal, to test the data consumption mechanisms available in the DUP. Figure 3 presents a screenshot of data visualization mechanisms presented in the city control centre.

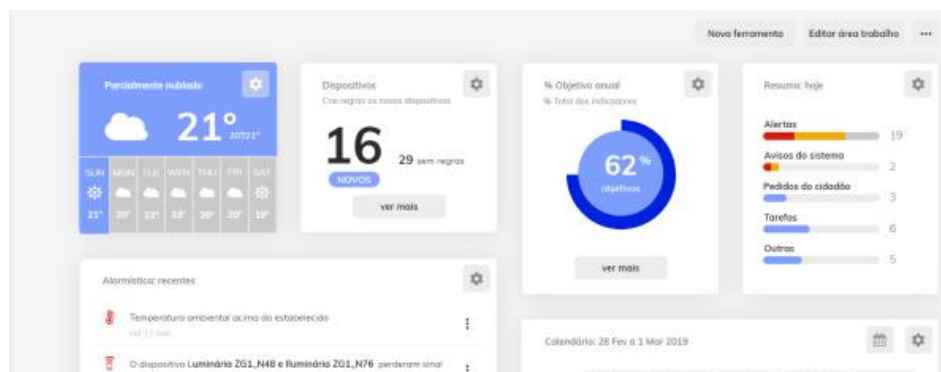


Figure 3 - Screenshot of the city governance portal

## Platform Management and Data Management

The management of the platform is supported by a REST API interface. Authorized users can resort to CRUD operations in order to create, retrieve, update or delete platform resources. The admin can CRUD new account, devices, applications, subscription, among others enabling the full control of the platform.

## 5. Conclusions

By deploying Evolution 1.0 of the Digital Urban Platform it was possible to evaluate main difficulties that can be expected when deploying the future evolved version of the platform.

At this stage a single (real) data source has been used to test the data ingestion and data sharing capabilities of the integrated layered solution – data ingestion, middleware layer and data visualization layer – since there was not local information available from project's stakeholder, relative to mobility, environment or energy consumption. To overcome that drawback it was used residential electrical power consumption data from a specific Lisbon area, totally similar to the kind of that that is expected to be available in Aveiro STEAM City project.

Despite the limited number of data feeds used, the lessons learned from the integration process allow the developing team to anticipate the solution of a relatively large number of issues that may occur when scaling the platform to the next developing stages.

Interoperation with external data sources and data consuming entities will demand a huge amount of technical development and team coordination work that should now start to be planned right away. This must include not only the elaboration of a DUP usage procedures' manual, but also a detailed regulatory document describing the rights and obligations of both platform owners and users.

The evolved version (2.0) of the Digital Urban Platform and of the platform Management Portal, planned to the end of the third quarter of 2019, will provide enhanced services to customer applications, necessary to support project's planned Urban Challenges and use cases – Environment, Energy and Mobility – as well as the R&D projects willing to use the platform and explore its capabilities.

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