



**PROJECT DELIVERABLE REPORT**



**Greening the economy in line with  
the sustainable development goals**

**D7.4 NAIADES Architecture of the NAIADES Marketplace**

A holistic water ecosystem for digitisation of urban water sector

SC5-11-2018

Digital solutions for water: linking the physical and digital world for water solutions

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**Abbreviations**

API	Application Programming Interface
CDM	Context Data Management
CPU	Central Processing Unit
DCA	Data Collection Aggregation
GUI	Graphical User Interface
HMI	Human Machine Interface
HTTP	Hypertext Transfer Protocol
IAM	Identity and Access Management
IoT	Internet of Things
IP	Internet Protocol
KSI	Keyless Signatures Infrastructure
NGSI	Next Generation Safeguards Initiative
REST	Representational State Transfer
SDK	Software Development Kit
SSD	Solid-State Drive
SSH	Secure Shell network
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UI	User Interface
URL	Uniform Resource Locator
WMS	Water Monitoring System
WP	Work Package

## 1 Summary

This report describes the NAIADES Marketplace and it reveals the main aspects regarding its role in the ability of allowing other applications to integrate with certain NAIADES services, which perform monitoring, analysis and reporting of the measured, calculated and simulated parameters for water consumption.

The document provides an overview of the communication between the NAIADES Marketplace public microservices and NAIADES private microservices.

The deliverable also outlines all the significant information about the infrastructure in which NAIADES Marketplace will run, including the hardware specifications and microservices architecture structure.

Other relevant aspects of the deliverable include the provision of details on the installation of the Marketplace, as well as the security mechanisms employed.

## 2 Introduction

The idea of an online marketplace for NAIADES project represents a suitable and beneficial option for online world users that are interested in water consumption and water quality management solutions. External users can benefit from services already optimized and tested by the developers of the NAIADES application, services that greatly facilitate the processes of water consumption and water quality management, through the NAIADES Marketplace. These services offer a complete machine learning mechanism on the basis of which predictions or warnings can be accurately established for an increased or too low water consumption, or for the tendency to deviate from the nominal water quality. The NAIADES Marketplace application also offers weather prediction services based on a weather history based on which weather forecasts can be generated. NAIADES Marketplace has a friendly user interface in which all public users over the internet can see the list of NAIADES services and the description of them. In addition, the Marketplace offers technical support for integration of the external applications with NAIADES public services, support consisting of a text description as well as a documentation of the exposed API as REST services of HTTP protocols.

To attract new potential users (service or data consumers, end-users or new services providers) by presenting all the services and the available data in a structured and accessible way, to allow them to test if NAIADES platform is what they need by having access to examples of the API functionalities depending of their interest zone. It will have information about the requirements to join the platform (communication platform, data models, authentication and authorization, predictive models and data storage. It is FIWARE compliant so FIWARE applications could be easily integrated). In addition, external users can test the documented API in the interface in order to facilitate the integration of an external application with the NAIADES application.

Also D7.4 Architecture of the NAIADES Marketplace - Midterm represents a detailed description of the Marketplace architecture and the communication with the Identity Management and Data Management microservices.

The scope of the deliverable is to get an overview of Marketplace contents and to reveal how internal NAIADES services could be consumed by external users. This report also aims to show the way the external users communicate with the cloud platform.

The general aspects of the Marketplace can be found in section 3 - Marketplace. Here it is described the main flow of the Marketplace, the communication of the Marketplace components and also the communication between Marketplace and internal NAIADES layers. Moreover, information regarding integration of external applications is described, also, the UI structure and content and the technical

requirement information. Aspects regarding Marketplace components structure, deployment and starting up the application are described in section 4 - Marketplace Deployment and set up. The current progress and next implementation steps are described in section 5 - Conclusions and Future work

## 3 Marketplace

### 3.1 Introduction

NAIADES Marketplace is a web-based application, intended for external users on the Internet. External users can access Marketplace application, as “public users” or as “authenticated users”. The public NAIADES services are shown in a public page that does not require authentication. In that way, all external users can see the NAIADES services exposed, in the default Marketplace page, with a minimum of effort and in the easiest way possible just accessing the Marketplace main page <https://naiadesproject.eu/marketplace>.

NAIADES Marketplace offers a description of NAIADES water processing, analysis and monitoring services as well as water consumption, and the possibility of integration of the external application with these NAIADES services. The final objective being the integration of other external applications with the internal NAIADES services through the Marketplace application.

The benefits of showing all NAIADES services descriptions, in a public way, is that external users can see what NAIADES application exposes, with a minimum effort, without authentication, to arouse users interest (and to facilitate users finding what they need).

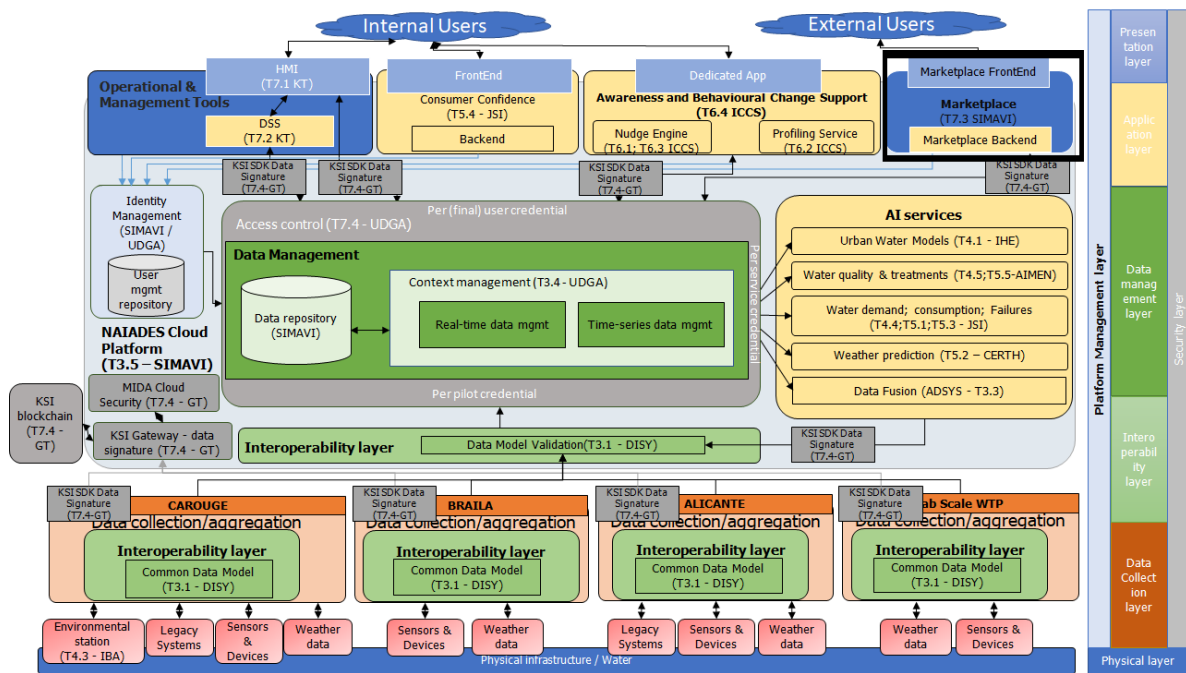
Once a public user has seen the description of a service in a public way, and is interested in it, the user can log into the platform to see the technical details of the API of this service, through which an external application can be integrated with the service described. Furthermore, in the Marketplace technical service description, the user has the opportunity to test the service API directly in a dedicated page, in order to see how the communication request/response looks like. After external users test the API, the user can easily integrate the API in his external application.

In this 3.2 section, aspects about the main flow of the NAIADES Marketplace are presented; like general aspects, internationalization and communication of the Marketplace components. The subsection 3.2.3 describes public and private UI contents, near subsection 3.2.4 where detailed backend content is presented. The authentication mechanism is presented in subsection 3.2.5.

In section 3.3, page structure and content are presented, beside the authentication and register functionalities. The communications between Marketplace components and between Marketplace and internal NAIADES services are described in section 3.4. Information regarding Marketplace requirements and installation process can be found in subsections 3.4.3 and 3.5.1. Information regarding security mechanism can be found in section 3.6. Finally, in section 3.7, ports that Marketplace use internally inside the cloud are presented.

### 3.2 Main Flow

For a better understanding of the NAIADES Marketplace, this chapter is dedicated to the general aspects and to the specific aspects regarding public services exposed, authentication and consuming and testing some dedicated APIs. In Figure 1 *NAIADES Architecture*, the layers of NAIADES in which Marketplace exists, are presented.



**Figure 1 NAIADES Architecture. In black, Marketplace location.**

### 3.2.1 General

Marketplace is a web-based application dedicated to desktop computers. The external users have the possibility to see the public services that NAIADES exposes, without needing to have a previously created account. They can visualize a preview of the services on display and a brief description of them. In order to view the details and the detailed description of the API as well as the possibility to test these APIs, the authentication is necessary. They have a dedicated window to sign up for creating the account.

### 3.2.2 Marketplace internationalization

Marketplace have six languages in which all content can be displayed, English, Spanish, Italian, Romanian, Greek and French. Default, Marketplace is displayed in English language. The language can be changed by selecting the desired language from the language selector at the top right of the page header.

### 3.2.3 Marketplace UI content

Marketplace web page content is divided in two based on access rights.

#### Marketplace public content

This is the public content that does not require authentication and it allows users to see NAIADES Marketplace public services in a structured way. These services can be accessed to retrieve a brief description.

In this stage of the project, the services that Marketplace displays are:

- Urban water models
- Water quality
- Water demand and consumption and failure



- Consumer confidence
- Weather prediction
- Awareness and behavioral

These services are shown for development process, but in the next stage of the project, it will be decided exactly what services should be exposed and described as Marketplace services.

#### Marketplace private content

This is the private content that requires authentication. The authentication procedure is required in order to allow user access to the selected service's API documentation and to test this API directly in the interface. Based on that information, any external user can create/prepare external applications so they can be integrated with NAIADES services via Marketplace.

#### 3.2.4 Marketplace backend content

NAIADES Marketplace has its own backend in order to block requests from external users or external applications to call directly the private internal NAIADES services of IoT platform. Also, the backend stores, in configuration, files the API description of the public services presented in UI; in that way the API content is loaded from backend through an HTTP request from UI only if the user has already been authenticated. Marketplace backend also intermediates the communication with Identity management.

#### 3.2.5 Authentication

To establish the communication between Marketplace and IoT Data Management, the cloud platform will offer a dedicated microservice for authentication provided by cloud Access Control layer (see D3.9 NAIADES IoT Platform: midterm).

Furthermore, KSI is for data signature, to guarantee data integrity, this is, to monitor that data sent by the Marketplace it not being manipulated at any point.

The modules for authentication and access control are FIWARE Wilma and Keyrock. The authorization at the cloud platform level will be done through Identity Management using access control layer that will validate external users' requests received from the Marketplace UI and from external applications via Marketplace backend API. KSI can sign and verify the integrity of the requests data.

#### 3.2.6 Obtaining services processed data

NAIADES Marketplace will expose needed dedicated APIs as REST HTTP request with different signature to the public users, totally different from the NAIADES private APIs. Not all internal services will be exposed to the external users through Marketplace.

### 3.3 Marketplace UI windows

The NAIADES Marketplace UI is the frontend part of the Marketplace microservice. Marketplace is an independent application of Marketplace backend. It runs on different port internally.

### 3.3.1 Marketplace URL

NAIADES Marketplace can be accessed at URL: <https://naiadesproject.eu/marketplace>.

The URL displays the default Marketplace that shows NAIADES public services in a structural way. The page does not require authentication. This is the HOME page of the frontend. See **Figure 2**.

### 3.3.2 Marketplace UI pages structure

General content

a) **Header**

The Header component is a fixed component that contains the next items:

- NAIADES logo
- Menu bar which contains the next menu entries:
  - Home
  - Contact
  - About
- Internationalization dropdown selector
- User logged in name
- LOG IN / LOG OUT button

b) **Main content**

The Main content is a dynamic component in which all services are displayed and documented .and it contains:

- Services preview body
- Service description body
- Contact body
- About body

c) **Footer**

The Footer component is a fixed component that contains the next items:

- EU logo
- Grand agreement No.

User Authentication and Register

**Authentication**

- User login

**Register**

- User register

### 3.3.3 Marketplace UI pages descriptions

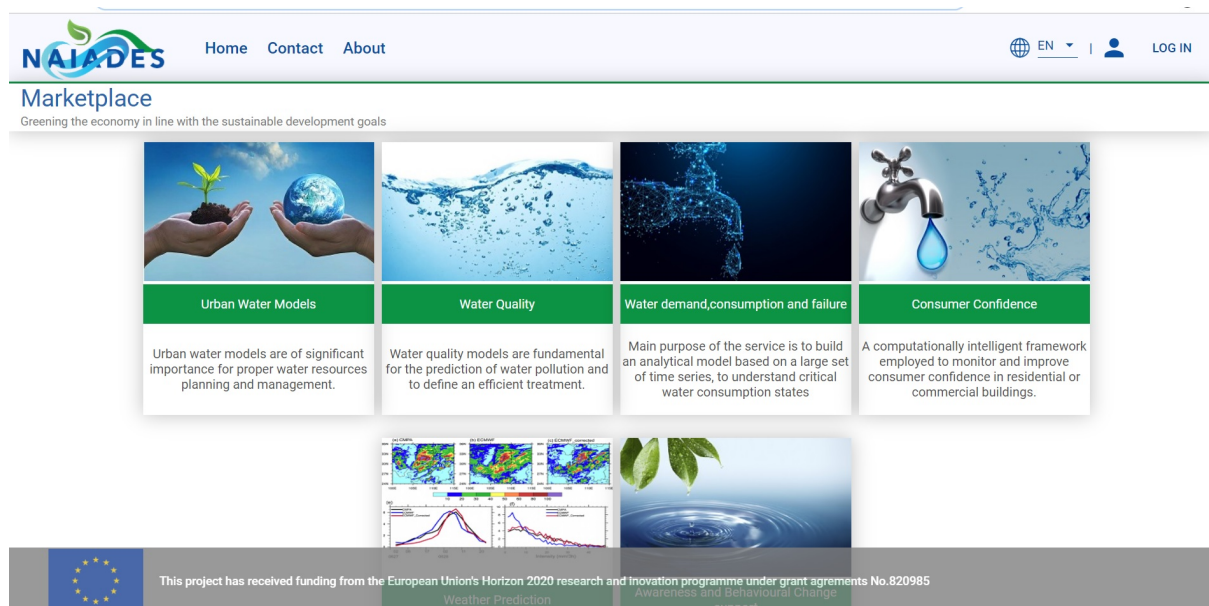
In the following paragraphs, the functionalities of the Marketplace are presented.

#### Home

The “Home button” redirects to default page that is loaded when user access the Marketplace URL

<https://naiadesproject.eu/marketplace>.

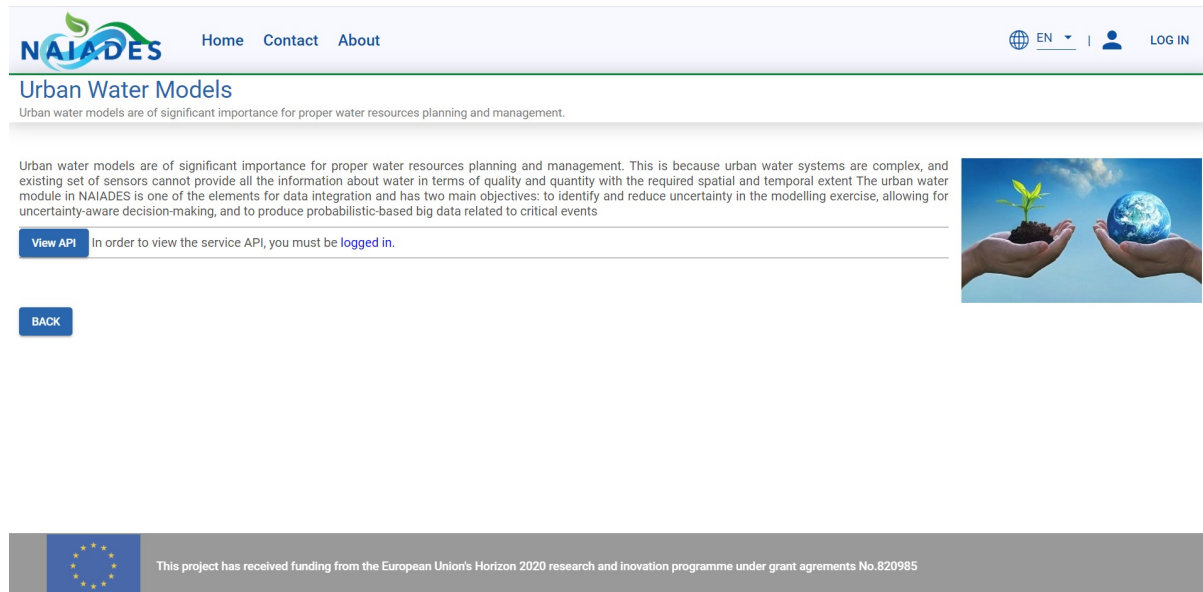
It contains public services that NAIADES exposes to external users. It can be accessed without authentication. The public NAIADES Marketplace service list can be seen in **Figure 2** Marketplace home.



*Figure 2 Marketplace home*

All services presented here could be selected in order to view its description. When user selects a service, will be redirected to that service URL as <https://naiadesproject.eu/marketplace/urbanWaterModel>. The URL will open service public content with a text description of the selected service. This content could be seen without authentication.

To see its API endpoint description and to be able to test the API in the interface, an authentication is required, the UI informs about that and offers a shortcut link to access the authentication page. The endpoint API description is stored in Marketplace backend in order to be loaded just by the authenticated users. In addition, the user can be redirected back to the “Home page” by pressing the “Home Button”, or by pressing the “Back button”. The view API only permits the authenticated users to see the API REST documentation. The public content of a selected service can be shown in **Figure 3** Marketplace public service description.



NAIADES Home Contact About

EN | LOG IN

## Urban Water Models

Urban water models are of significant importance for proper water resources planning and management.

Urban water models are of significant importance for proper water resources planning and management. This is because urban water systems are complex, and existing set of sensors cannot provide all the information about water in terms of quality and quantity with the required spatial and temporal extent. The urban water module in NAIADES is one of the elements for data integration and has two main objectives: to identify and reduce uncertainty in the modelling exercise, allowing for uncertainty-aware decision-making, and to produce probabilistic-based big data related to critical events.

[View API](#) In order to view the service API, you must be [logged in](#).

[BACK](#)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements No.820985

*Figure 3. Marketplace public service description*

### 3.3.3.1 Contact

The “Contact button” redirects to “Contact page”, which contains a list of persons in charge for NAIADES public services. The “Contact page” is loaded when user access the Marketplace URL: <https://naiadesproject.eu/marketplace/contact>. The “Contact content” will be established in the next stage of the project.

### 3.3.3.2 About

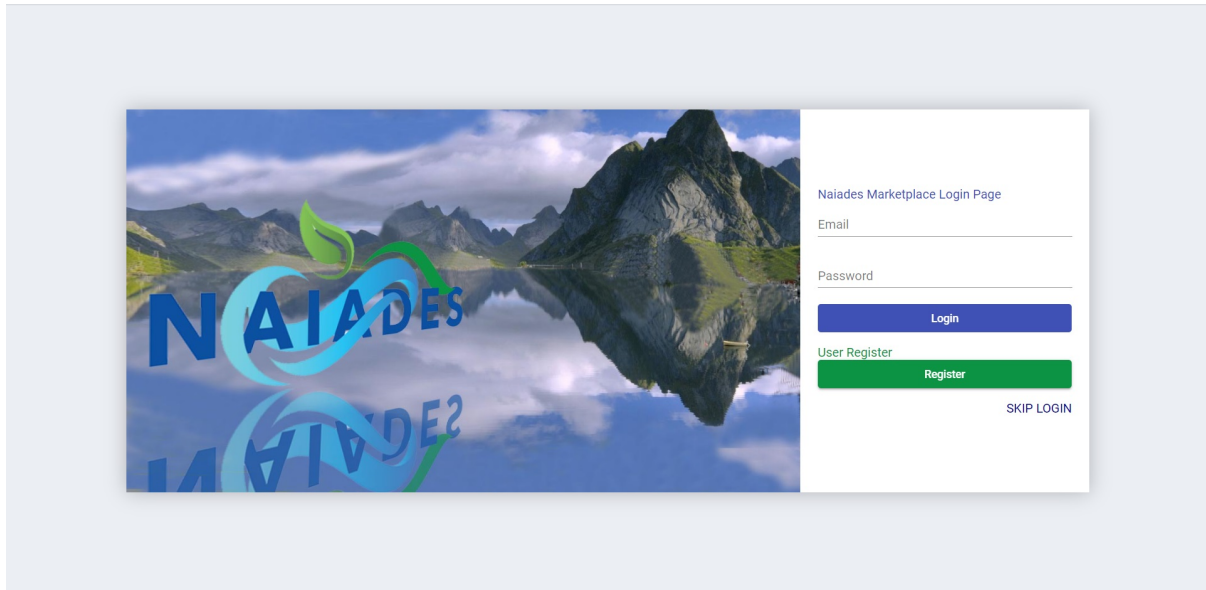
The “About button” redirects to “About page” which will contain a brief description of how NAIADES Marketplace can integrate other applications and its benefits. The “About page” is loaded when the user accesses the Marketplace URL: <https://naiadesproject.eu/marketplace/about>. The “About content” will be established in the next stage of the project.

### 3.3.3.3 Authentication

The authentication functionality has role to authenticate users in order to test the services APIs directly in Marketplace frontend and see APIs documentation for external applications integration. The authentication process will be handled by NAIADES Identity Management. The user must provide the username (email address format) and the password. A real time email validation will prompt out if email format is not valid.

#### **Authentication general**

The authentication page can be accessed by LOG IN button, it redirects to the authentication URL <https://naiadesproject.eu/marketplace/login> like in *Figure 4* Marketplace login.



*Figure 4 Marketplace login*

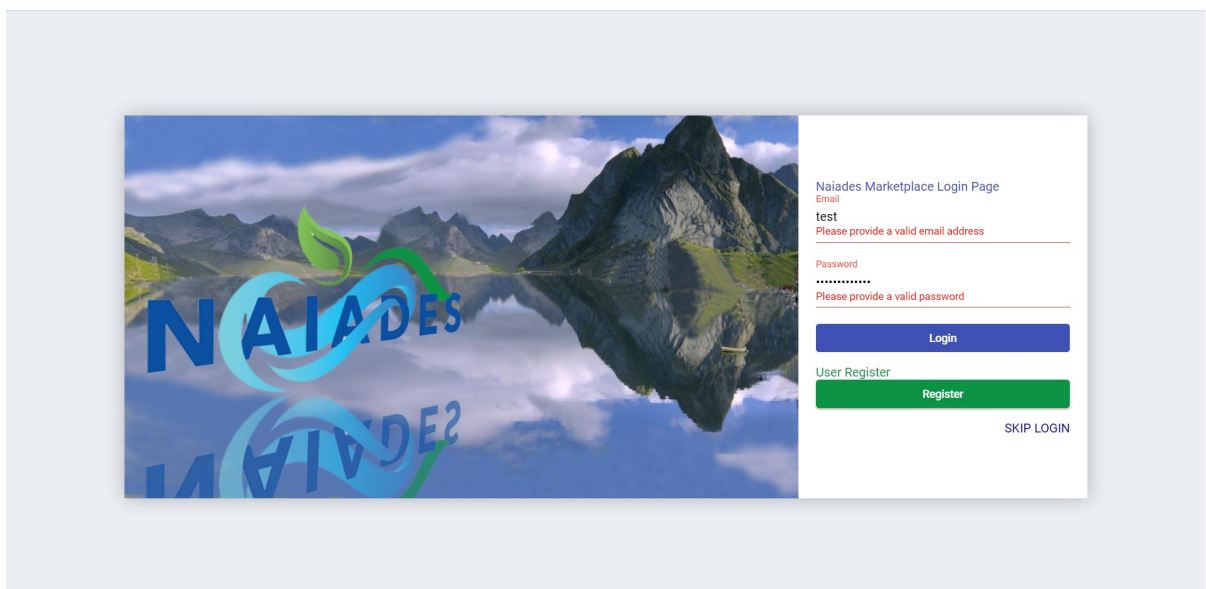
User has the possibility to skip the login and go to the public information like Home page by pressing the “SKIP LOGIN” button. In addition, if the user does not have an account it can press “Register” button.

#### **Authentication invalid fields**

Some of the fields of the registration form (email address and password) are validated by format checking. This functionality ensures the consistency of the inserted data, without having to reach the backend to be validated. If the user does not complete the email field with a valid email format, the application informs about it with a red error message and “Login” button is disabled.

Also, if the password does not meet a minimum complexity pattern the application informs about that and the “Login button” is not functional.

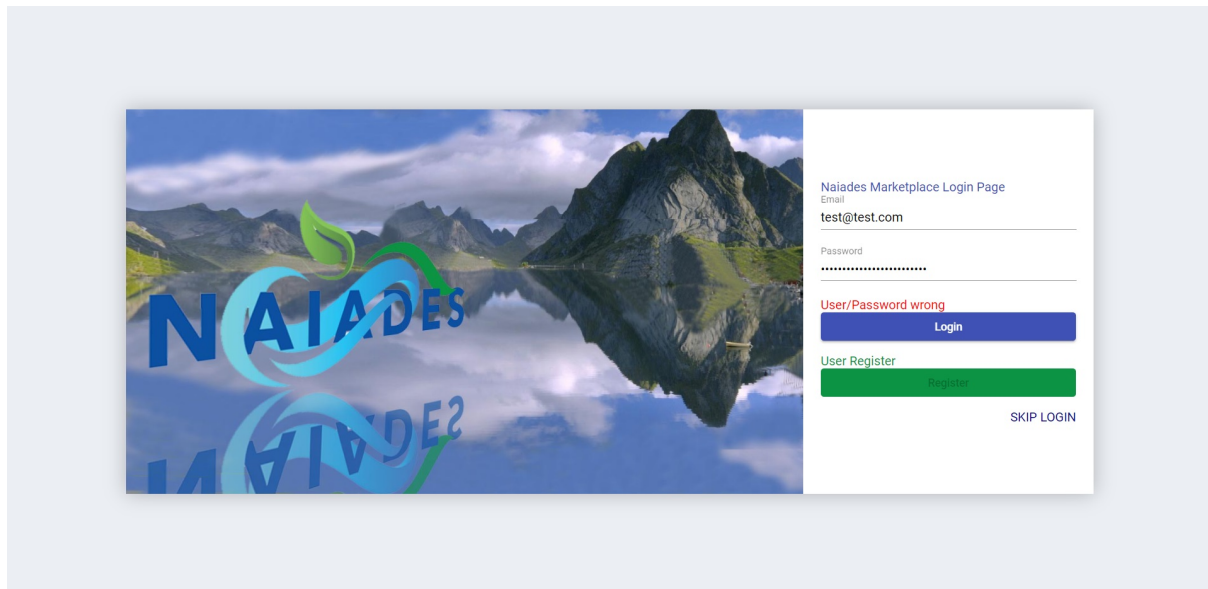
The field validation can be seen in *Figure 5* Marketplace invalid fields.



*Figure 5 Marketplace invalid fields*

### Authentication invalid credentials

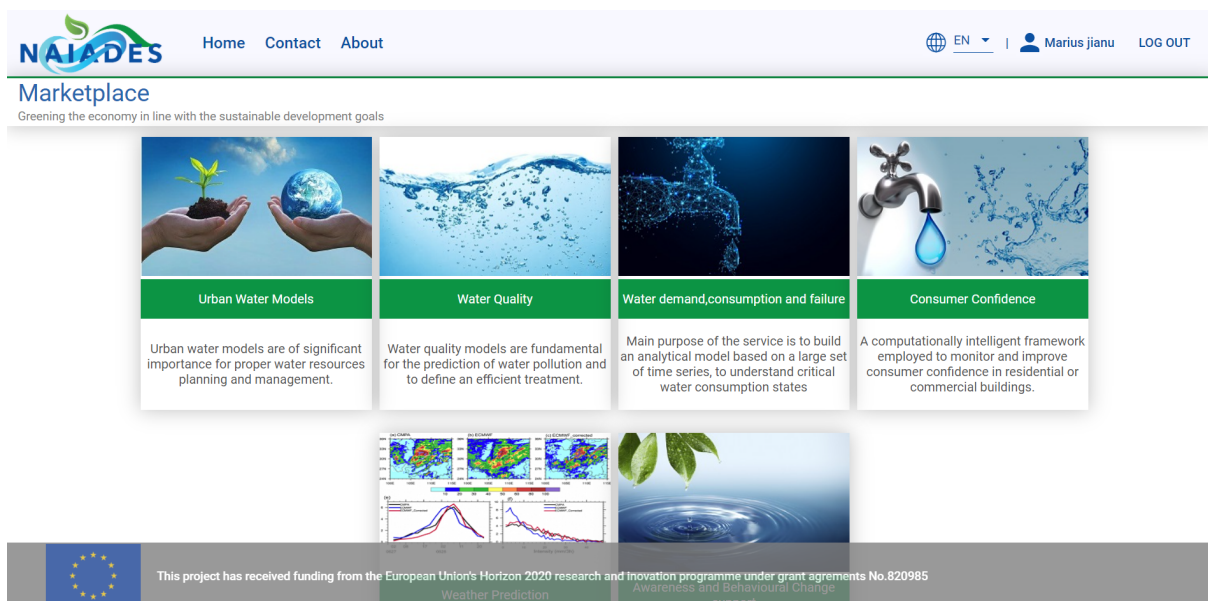
If user's email or password does not exist in the Identity Management, the application will display an error message that informs about that, like in **Figure 6** Marketplace invalid credentials.



*Figure 6 Marketplace invalid credentials.*

### Authentication success

If user credentials exist in Identity Management, then user is redirected to Marketplace Home page, and username appears in the right side of the header, and near it will exist just a button for "LOG OUT", like in **Figure 7** Marketplace success login.



*Figure 7 Marketplace success login.*

### 3.3.3.4 Register

Marketplace is an application dedicated to external users; the register functionality is required when accessing the API content.

Marketplace has a register page in which an external user can create an account in order to consume NAIADES public services.

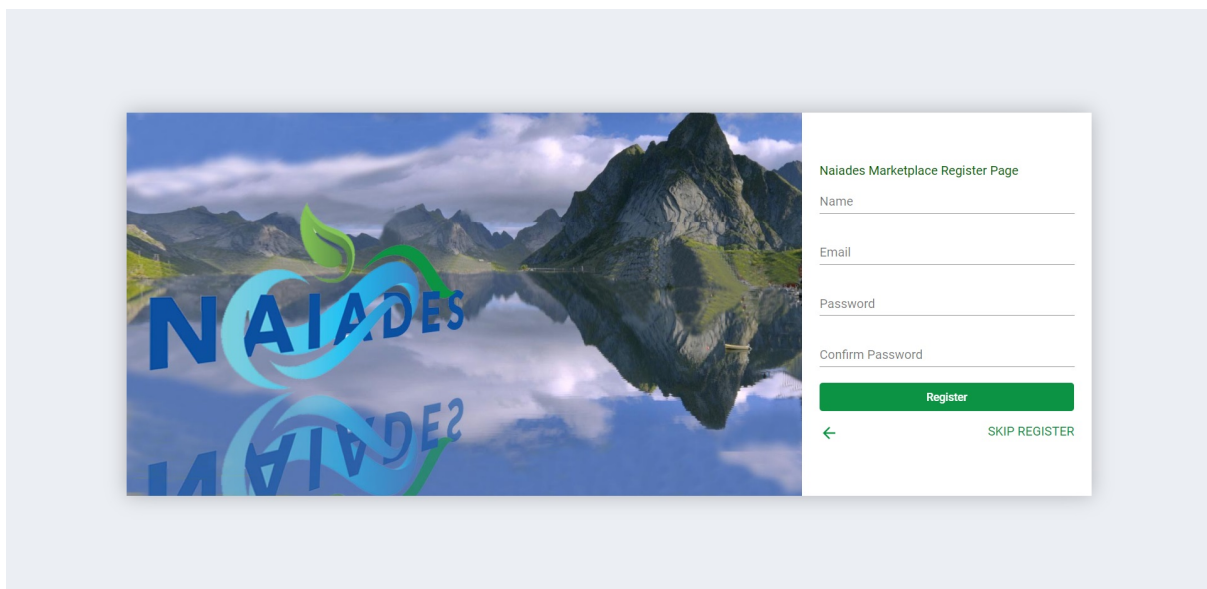
User must press “Register button” from “Login form” and the user will be redirected to register page with URL.

<https://naiadesproject.eu/marketplace/register>

Register page requires the next parameters:

- Name.
- Email.
- Password.

Password field requires a password confirmation. The register form is in **Figure 8** Marketplace register.



*Figure 8 Marketplace register*

A matching password mechanism will check if the confirmed password is the same as original one in real time, and the same email validator as in login form is applied. In case of format errors, an error message will be displayed.

### 3.3.3.5 Service API documentation

Once the external user is authenticated, the user can see the service API documentation in order to consume the request, by testing it in the interface or calling it from external application.

After selecting a service, the user will be redirected to the service API documentation page, in which he can find all information about the REST HTTP request signature, payload, headers and response.

The redirected URL will be, in case of selecting Urban Water model, the next one <https://naiadesproject.eu/marketplace/urbanWaterModel>

In **Figure 9** Marketplace API docs is presented how API documentation looks like.

module in NAIADES is one of the elements for data integration and has two main objectives: to identify and reduce uncertainty in the modelling exercise, allowing for uncertainty-aware decision-making, and to produce probabilistic-based big data related to critical events

[View API](#) In order to view the service API, you must be [logged in](#).



#### Service API

This section describes the Urban Water Models public web service and how it can be call

##### General

Request URL: `http://localhost:8080/marketplaceBackendPublic/testUrbanWater`  
 Request Method: `POST`  
 Method name: `testUrbanWater`  
 Accept: `application/json, text/plain, */*`

##### Payload data parameters

```
{
  "testParam1": "testParam1Val1111",
  "testParam2": "testParam2Val2222"
}
```

##### Headers

"Authorization": "Bearer marius.jianu@siveco.ro|qwe123l#@#0.0287533627300903260.37361612717147885"

#### Test request

This section serve for testing the request

##### Headers

"Authorization": "Bearer marius.jianu@siveco.ro|qwe123l#@#0.0287533627300903260.37361612717147885"

##### General

Request URL:



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*Figure 9 Marketplace API docs*

### 3.3.3.6 Service API testing

Once external users have access to the service API documentation, Marketplace frontend has the possibility to test directly in the interface the documented API.

After completing the form based on API documentation, the user must press the “Send Request” button. Frontend gets the real response with proper HTML status code in the same interface. For example, if user wants to test the service for Urban Water model, the redirected URL will be, the next one: <https://naiadesproject.eu/marketplace/urbanWaterModel>

The test result could be seen in **Figure 10** Marketplace API test.

#### Test request

This section serve for testing the request

##### Headers

"Authorization": "Bearer marius.jianu@siveco.ro|qwe123l#@#0.0287533627300903260.37361612717147885"

##### General

Request URL:  
`http://localhost:8080/marketplaceBackendPublic/testUrbanWater`

##### Request Method

`POST`

Accept type - possible values: `application/json, text/plain, */*`  
`*/*`

##### Payload data parameters

```
{
  "testParam1": "testParam1Val1111",
  "testParam2": "testParam2Val2222"
}
```

#### Send request

##### Response

Response status  
`200 OK: true`

##### Response data

`{ "responseOne": "processed 1 is testParam1Val1111"; "responseTwo": "processed 2 is testParam2Val2222"; "responseThree": "processed testParam1 + testParam2 is testParam1Val1111 testParam2Val2222" }`



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements No.820985

*Figure 10 Marketplace API test*



### 3.4 Marketplace Technical information

The Marketplace Communication sub-item presents information related to the business aspects of the marketplace, about the technical performances as well as about the structure of its microservices.

NAIADES Marketplace is a microservice composed by two parts:

- Frontend
- Backend

NAIADES Marketplace microservice will be deployed and run inside NAIADES cloud platform, in the same environment where the IoT applications are deployed.

#### 3.4.1 Frontend

Marketplace frontend is an independent application that runs in the same environment as Marketplace backend. Frontend is a Type Script application developed in Angular 8 built with NodeJS, minimum version 11, preferred version 13. Angular is an open source and currently maintained framework. Marketplace frontend uses Material Design for defining all the icons from pages in different colors and dimensions. All icons are saved locally as SVG in project resource. For a very good styling of the elements and for the use of dynamics elements, Marketplace Frontend uses Angular Materials, and it covers all the needs of a dynamic interface and user feedback.

To establish the communication with Marketplace backend, the frontend uses HTTP Client object that handles the HTTP REST request.

#### 3.4.2 Backend

Marketplace backend is an independent application that run in the same environment as Marketplace frontend. Backend is a java application with Spring boot 2 built with Apache Maven 3.6. and dedicated Maven libraries for accomplish the project goals.

Marketplace backend expose APIs as REST HTTP web services, both for frontend communication but also fir external applications integration. Moreover, Marketplace backend communicate with Identity Management in order to authenticate the user and with Data Management to access private NAIADES services.

#### 3.4.3 Marketplace requirements

NAIADES Marketplace application has no concurrence access. In the first stage of the project, the number of the users will be very low; no concurrency access can harm the system. The concurrence access will be increased by the access of the Marketplace by external users and external applications, but this will happen in the next steps, and is not part of the pilot's test cases in this midterm report.

Marketplace application does not need performing environment to run, the optimal resources system to run is the following one:

- CPU: Medium performance (eg. i5 or i7)
- GPU: No need
- RAM: Medium performance (eg. 8gb-16gb)
- HDD: HDD or SSD (the applications takes around 150 MB )
- Browsers compatibility: Mozilla Firefox, Google Chrome, MS Edge

Marketplace does not contain any Data Base, it uses Identity Management Data Base.

### 3.4.4 Cloud microservices structure

The SDKs of the Marketplace microservice can be deployed in the cloud platform as docker and docker-compose configuration. In that way, the microservice could be analyzed, tracked and administered separately/independently. In addition, Frontend can be run in the same server as backend runs, or in a separate server. Frontend application can be run in Node js server or in any Java-based server like Apache Tomcat 8+.

The NAIADES Marketplace application will be installed as docker images and the communication between the dockers will be done using the configuration within docker-compose files based on image names, inside the cloud.

The NAIADES cloud platform has domain name “naiadesproject.eu”. The Marketplace frontend application will be accessible from the outside through one port only (see *Table 1*).

Environment	Host	Opened ports	Services running
PRODUCTION	naiadesproject-eu/marketplace	80/tcp 443/tcp	Not public

*Table 1 Cloud public ports*

#### IoT Platform services:

The Marketplace internal services can be found in the *Table 2* Marketplace internal services:

Service	Purpose	open API (REST)
fiware-keyrock	manages identities and roles	e.g NAIADES-application-eu/identity-api
fiware-orion	context manager, API server for all entities	e.g. NAIADES-application-eu/context-api

*Table 2 Cloud internal services*

#### Marketplace needed services

In *Table 3* Cloud needed services for Marketplace, are presented services with which Marketplace will communicate inside the cloud.

Service	Purpose	open API (REST)
Marketplace-HMI	NAIADES Marketplace Human Interface dedicated to external users/applications	e.g NAIADES-application-eu/marketplace
Marketplace-backend	NAIADES Marketplace backend dedicated to external users/applications	e.g NAIADES-application-eu/marketplace-api

*Table 3 Cloud needed services for Marketplace*

### KSI service

In **Table 4** Cloud KSI service is presented KSI service that will run in the cloud.

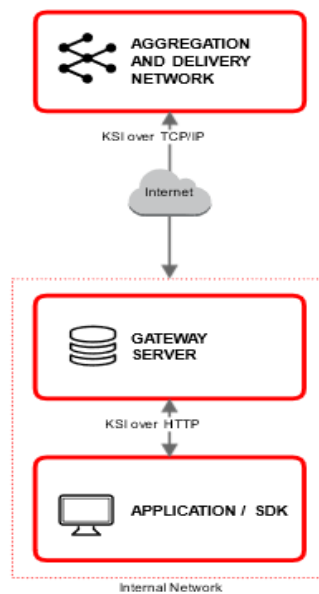
Service	Purpose	Open API (REST)
KSI - Gateway	KSI gateway tool for establish communication with KSI blockchain	e.g NAIADES-application-eu/authorization-api

*Table 4 Cloud KSI service*

The cloud platform internal API will be accessed using an NGINX reverse proxy tools described in section 3.6

#### 3.4.4.1 Communication between KSI Blockchain and KSI SDKs in NAIADES cloud platform

The communication between Guardtime's KSI Blockchain and KSI Gateway will be done over the TCP and UDP protocol. Communication between KSI Gateway and KSI SDKs will be done over HTTP(S) (which is RESTful) and if needed the TCP can be used instead. The request from outside the platform will be handled by NGINX reverse proxy and redirect internally.



*Figure 11 Cloud KSI Communication*

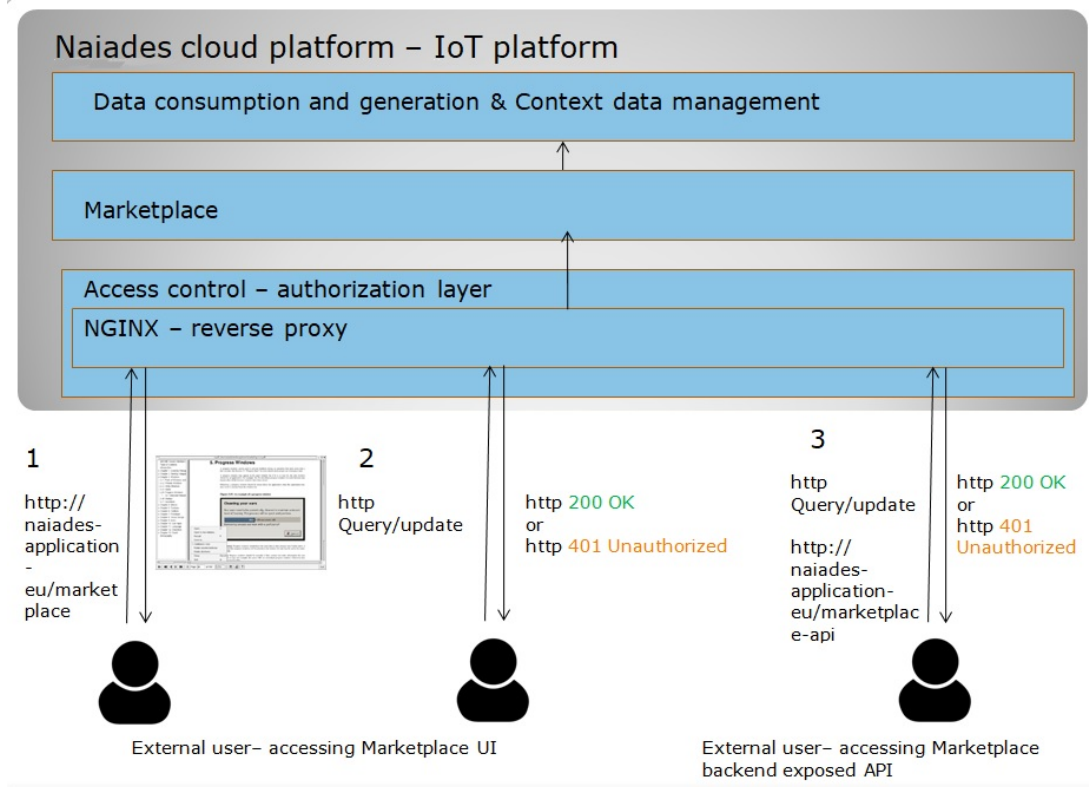
#### 3.4.4.2 Communication between external users and cloud platform - Marketplace

The Marketplace frontend and backend microservices will be hosted inside the cloud platform. NGINX proxy will be configured to expose outside the platform HMI based on the URL. If the user types the main URL of the platform e.g. “naiadesapplication.eu/marketplace”, NGINX will redirect the request inside to the internal application that loads the Marketplace UI.

The requests from frontend Marketplace UI to Marketplace backend inside platform will be authorized by Access Control authorization layer. The request from the external users or external applications that wants to integrate NAIADES application, based on marketplace API described in the interface, will be

done using a communication between external-users/applications – marketplace backend using HTTP REST web service protocol. All requests will be authorized by Access Control authorization layer and will be handled using the NGINX proxy. All requests from Marketplace backend to IoT platform process layer will be done internal and they are also authorized.

External users can access dedicated NAIADES services via Marketplace backend, they do not have direct access to the main processing services, even if the user is authorized. Custom web services will be exposed to the Marketplace API in order to let other external applications use it.

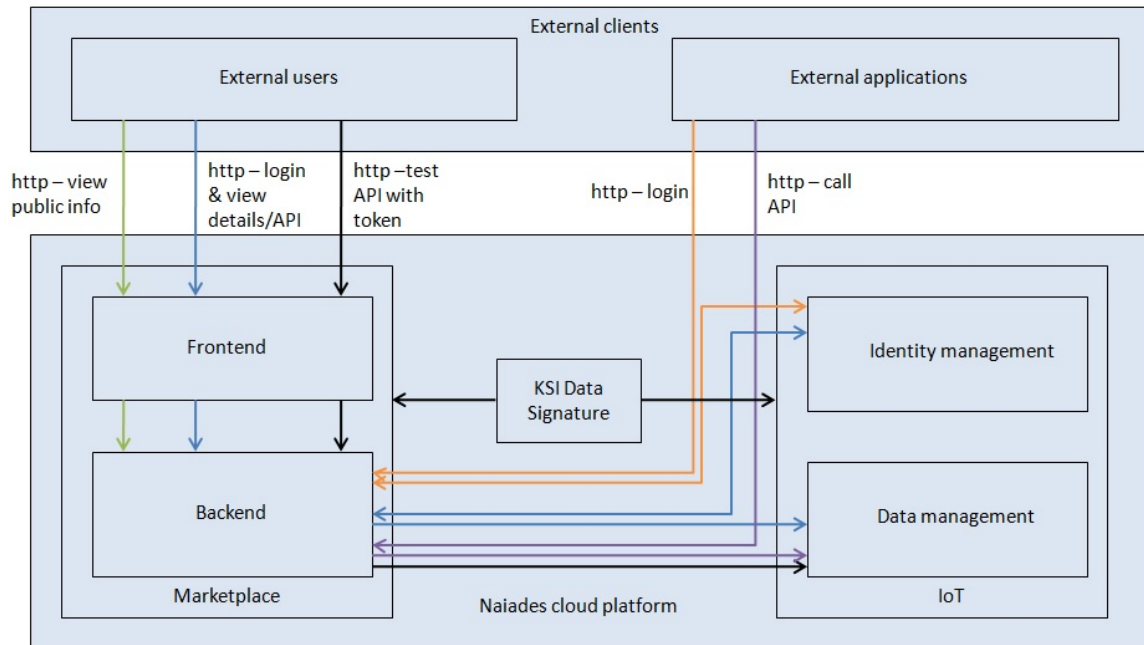


*Figure 12 Cloud External users Communication*

### 3.4.4.3 Communication inside the cloud platform – Marketplace

Inside the cloud, the Marketplace application communicates with Identity Management to authenticate the external users. After external users are authenticated, the Marketplace backend can consume NAIADES private services from Data Management. The requests are secured by KSI Data signature procedure. The request regarding creating user and login comes from Marketplace frontend and it will be forwarded by backend to the Identity Management microservice. The requests regarding business process will be forward to the Data Management microservice. All internal requests will be done through HTTP REST requests in a synchronic way.

Assuming the external user is already logged in, in case the user wants to see just a service API description, the communication will be done just between Marketplace frontend and Marketplace backend. If the user wants to test the API, even from frontend or external application, the communication will be done between Marketplace frontend, Marketplace backend and Data Model.



*Figure 13 Cloud internal Marketplace Communication*

### 3.5 Installation details

The installation of the new Marketplace SDKs (frontend and backend) on the cloud platform will be done using the admin account for Amazon platform with root permission on the EC2 Amazon instance.

The installation of the new release SDK will require to stop the microservice docker, and redeploy the Marketplace SDK docker just for the needed microservice. Not all Marketplace services need to be stopped.

All NAIADES Cloud SDKs are containerized with Docker container, but in the situation where it is needed to install or configure some tool that is not containerized, Ubuntu command line scripts will be used.

#### 3.5.1 Marketplace installation

In first version of the NAIADES Cloud Platform SDK's Marketplace will not be available.

Marketplace will be added in the next development stage as a module, containing:

- Marketplace UI
- Marketplace backend

##### 3.5.1.1. Marketplace Frontend UI

Marketplace UI will be a separated application service that will communicate with Marketplace backend service.

From the parent folder of the Marketplace SDK folder /marketplace/UI must be run the docker compose command to build and start the application:

```
docker-compose up -build
```

### 3.5.2.2. Marketplace backend

From the parent folder of the Marketplace SDK folder /marketplace/backend must be run the docker compose command to build and start the application

**docker-compose up –build**

## 3.6 Security mechanism

NAIADES application will be deployed in cloud platform. The Marketplace frontend application will be secured by security certificates of the cloud platform; it will be accessed using HTTPS protocol. The user access will be restricted by authentication and authorization mechanism of Identity Management microservice. The communication with Identity Management will be made through Marketplace backend, inside the platform using KSI signature. Also, the communication between Marketplace backend and Data Management will be done through Access Management. The KSI signature mechanism is detailed in D3.12.

## 3.7 NAIADES Marketplace internal ports

The cloud platform will run each microservice on the same host but with different ports, in order to ensure an internal and private communication between the microservices. The internal microservices ports used cannot be accessed outside the platform. Example ports are presented in Figure 14 Marketplace internal and private ports.

MARKETPLACE_UI	4200 – internal use
MARKETPLACE_BACKEND	8083 – internal use

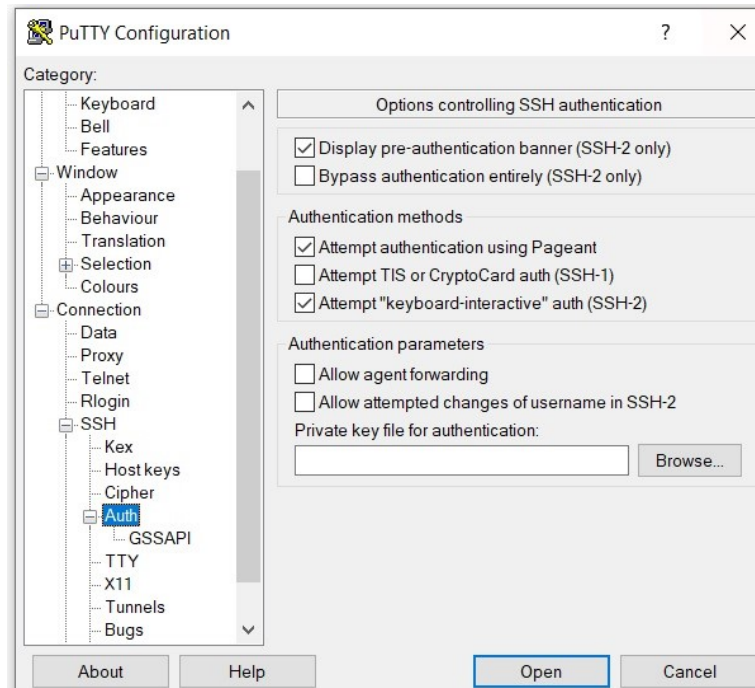
*Figure 14 Cloud Marketplace internal and private ports*

All the ports will be private. The NGINX proxy mechanism will be configured and will use just two ports: 80/tcp and 443/tcp. The two ports will be public and accessible from Marketplace. All requests that come from Marketplace will access the NAIADES cloud platform just using port 80. Based on the URL text, inside the cloud platform, the NGINX proxy will redirect the request internally to the services that run using internal ports. For a secure protocol https, it will be necessary to add security certificates.

## 4 Marketplace Deployment and set up

The connection to the cloud platform will be made through a Secure Shell network (SSH) protocol using Amazon Web Service (AWS) credentials. To establish the connection, Admin user must use a SSH client together with a command line interface like PuTTY, using both public and private key.

An example of SSH client is presented in Figure 15 PuTTY, using SSH connection with authorization PuTTY private key.



*Figure 15 Putty SSH Client*

New SDK binaries and needed resources can be uploaded in the platform using SSH protocol.

Microservices are managed by commands typical for Ubuntu operating system together with the commands necessary for the docker and docker compose containerization tool. An installation manual with details about connection and deploy in the cloud platform for all microservices will be available.

## 5 Conclusions and Future work

This report includes the most relevant aspects about the Marketplace microservice and the installation instructions.

For the first version of NAIADES Marketplace some mockup services are described by Marketplace frontend and exposed by Marketplace backend. The current version of Marketplace contains the communication between Marketplace frontend and Marketplace backend.

Moreover, the current frontend version presents Urban Water Models, Water Quality, Water Demand and Consumption, Consumer Confidence, Weather Prediction, Awareness and Behavioral Change Support services, without a login requirement. Also, an API description and test functionality exist for Urban Waters Model service.

For simulating the real authentication between Marketplace frontend and Marketplace backend, a temporary user managements mechanism is stored in the Marketplace backend for the moment, that generate an fake access token, for the frontend, composed from some random characters. It will be integrated with NAIADES Identity Management for getting the real access token. The mechanism of authentication is done, by obtaining the access token at login, and store it in the browser, because later it is attached to the header of each requests, but the token generated by backend is a mockup one now, the real one will be obtained after integration with Identity Management.

Furthermore, the API technical description are stored in backend and received in frontend depending on the user authentication status (if is logged in or not). The protocol for testing the API and display the success or error message in the frontend is done with a mockup test REST web service for Urban Waters Model service. This mockup service provides some locale process; it will be integrated with Data Management in next versions to provide real data.

In the second version of NAIADES Marketplace it will be established exactly what will be the services that NAIADES will describe for public users. In addition, in next stage of the project it will be described which are the services for which the API will be exposed and described, and will require authentication for viewing these APIs. The internal NAIADES services endpoints that will be consumed by NAIADES Marketplace backend will be decided.