Data Platform for the Connection of Cognitive Ports

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Responsible:	Organisation:	Contributing WP:
Héctor Iturria	PRO	WP5

Authors (organisation):	
Héctor Iturria (PRO)	Grigorios Dimitriadis (THPA)
Enrique Ivancos (PRO)	Eirini Tserga (THPA)
Sofia Terzi (CERTH)	Christos Gizelis (OTE)
Konstantinos Votis (CERTH)	Pablo Giménez (VPF)
Vasilis Siopidis (CERTH)	Hanane BECHA (TRX)
Alexandros Zerzelidis (CERTH)	Paolo Calciati (ITI)
Konstantinos Glykos (CERTH)	Francisco Valverde (ITI)

Abstract:

This deliverable will document the plan of activities and milestones for integration, quality assurance and testing activities regarding the industrial pilots. It will include technical, operational and organizational aspects.

Keywords:

Integration, quality assurance, deployment, testing, pilot, demonstration, use cases

Revision History

Revision	Date	Description	Author (Organisation)
V0.1	14.10.2020	First version of the document.	Héctor Iturria (PRO)
V0.2	01.02.2021	New template and content.	Héctor Iturria (PRO)
V0.3	22.02.2021	Version for the plenary	Héctor Iturria (PRO)
V0.4	25.02.2021	Port Management Integration use cases	Héctor Iturria (PRO)
V0.6	22.03.2021	Corrections and use case additions	Héctor Iturria (PRO)
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V0.11	23.04.2021	Use case descriptions updates	Héctor Iturria (PRO)
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More information available at https://DataPorts-project.eu

Copyright Statement

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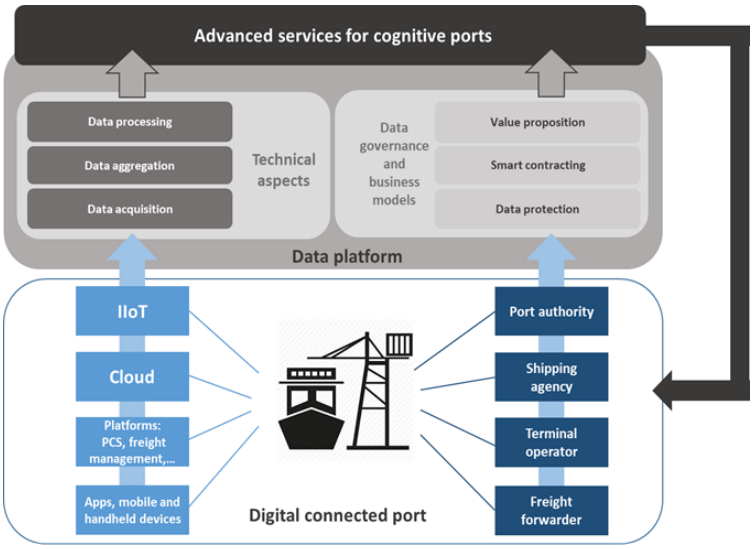
1 INTRODUCTION

1.1 DATAPORTS PROJECT OVERVIEW

DataPorts is a project funded by the European Commission as part of the H2020 Big Data Value PPP programme, and coordinated by the ITI - Technological Institute of Informatics. DataPorts rely on the participation of 13 partners from five different nationalities. The project involves the design and implementation of a data platform, its deployment in two relevant European seaports connecting to their existing digital infrastructures and addressing specific local constraints. Furthermore, a global use case involving these two ports and other actors and targeting inter-port objectives, and all the actions to foster the adoption of the platform at European level.

Hundreds of different European seaports collaborate with each other, exchanging different digital data from several data sources. However, to achieve efficient collaboration and benefit from AI-based technology, a new integrating environment is needed. To this end, DataPorts project is designing and implementing an Industrial Data Platform.



The DataPorts Platform aim is to connect to the different digital infrastructures currently existing in digital seaports, enabling the interconnection of a wide variety of systems into a tightly integrated ecosystem. In addition, to set the policies for a trusted and reliable data sharing and trading based on data owners' rules and offering a clear value proposition. Finally, to leverage on the data collected to provide advanced Data Analytic services based on which the different actors in the port value chain could develop novel AI and cognitive applications.

DataPorts will allow establish a future Data Space unique for all maritime ports of Europe and contribute to the EC global objective of creating a Common European Data Space.

1.2 DELIVERABLE PURPOSE AND SCOPE

Specifically, the Description of Action (DoA) states the following regarding this Deliverable:

This deliverable will document the plan of activities and milestones for integration, quality assurance and testing activities regarding the industrial pilots. It will include technical, operational and organizational aspects.

WP5 is composed of a series of tasks whose main purpose is to integrate the DataPorts platform in real port environments and to demonstrate the benefits resulting from such integration. To this end, a series of use cases and scenarios must be defined, executed, and evaluated in which the new platform developed in this project will be used to securely share and make use of data between different stakeholders according to the specified objectives.

This document describes the steps, information and processes required for the correct execution of the tasks that make up this work package. As part of these actions, it includes the specifications of the different use cases and scenarios that are part of the pilots to be evaluated, described in detail, as well as all the activities necessary for their realisation and validation.

The content of the document can be divided into two categories. Part of the information included is the current description of what the pilots are intended to achieve, and related information already available.

On the other hand, the document contains plans, activities, and milestones for the development of the points mentioned above. These points will guide the development, implementation, integration, and evaluation of the pilots throughout the period established for this purpose. These activities include different aspects such as identifying stakeholders and participants, both as part of the consortium developing the project and as end users, specifying and securing the necessary infrastructures for the final integration or even the development or modification of the current technologies present in the pilot environments according to the established objective.

1.3 DELIVERABLE CONTEXT

Its relationship to other documents is as follows:

Primary Preceding documents:

- Description of Action (DoA): Provide the foundation for the actual research and technological content of DataPorts. Importantly, the Description of Action includes a description of the overall project work plan.
- D2.1 - Industrial Data Platforms and seaport community requirements and challenges: the content of the analysis of current infrastructures is the basis for the use case definitions.

Primary Dependant documents:

- D4.3 - Secure environment for data sharing and trading: The code review will require information about the applications and interactions involved in the pilots.
- D5.3 - Use case oriented pilots initial version: The activities performed from M15 to M24, whose descriptions should be included in the deliverable, will be guided by this document.
- D5.4 - Use case oriented pilots final version: The activities performed from M24 to M36, whose descriptions should be included in the deliverable, will be guided by this document.
- D5.5 - Use cases and applications evaluation report: Contains the results of the DataPorts requirements and use cases evaluation.

1.4 DOCUMENT STRUCTURE

This deliverable is broken down in the following sections:

- **Section 1 Intro:** It includes an introduction to the project, a short description of the purpose and scope of this document and the dependencies with other deliverables.
- **Section 2 Plan of activities:** It contains the activities, milestones and tasks that need to be performed from the start of the pilots to the end of the project to be able to validate the DataPorts platform functionalities.
- **Section 3 Common vocabulary:** It defines general terms and means, gathering concepts and descriptions that are part of the use cases, so any involved party is able to understand their scope.
- **Section 4 Pilots and use cases:** It describes the use cases and scenarios where the DataPorts platform is going to be integrated and evaluated.

Annexes:

- **Annex A**: Data Access Questionnaire
- **Annex B**: Data sources

2 PLAN OF ACTIVITIES

This section identifies and describes the main tasks and activities needed to integrate the platform in the ports ecosystems, build and configure the DataPorts components and develop all the elements needed to succeed in the evaluation of the final environment and pilots demonstrations. That means having DataPorts, and thus its components, deployed and functional in each of the ports.

The pilots are expected to run from M25 to M36. So, most of the platform components should have a first version ready before the start of that interval. During the last year of the project components will be improved depending on the pilot's integration with the platform.

The proposed timeline and milestones are depicted in the Figure 1 – Task Roadmap:

	Year 2										Year 3											
	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Use cases specifications																						
Common vocabulary																						
Description of scenarios																						
Functionalities demonstration matrix																						
Roles																						
Data access																						
Data models																						
Required infrastructure																						
Implementation																						
Platform components																						
Current applications																						
New applications																						
Integration																						
Platform components																						
Current applications																						
New applications																						
Security and quality assurance																						
Testing and evaluation																						
Deliverables	D5.1									D5.3												D5.4
	D5.2																					D5.5

Figure 1 – Task Roadmap

The previous picture shows the proposed calendar for the execution of the activities required for the evaluation of the pilots through the implementation and demonstration of the use cases described in Section 4.

Although some tasks may last to the end of the project, it should be highlighted that the main effort in development and configuration should be performed util M31, leaving the last months of the project for evaluation and fixes.

Also, each of the scenarios should confirm the availability for those dates or, in case they have different milestones, include it in the deliverables D5.3 Use case oriented pilots initial version (M24) and D5.4 Use case oriented pilots final version (M36).

2.1 USE CASES SPECIFICATIONS

Duration: M10-M22

This task contains all the definitions and description required to understand what is going to be demonstrated through the execution and evaluation of the pilots of the project.

2.1.1 Common vocabulary

Duration: M15-M22

A glossary with the descriptions of the terms, concepts and means that appear on the use case scenarios definitions will be created so the involved parties and other interested organizations are able to understand their objectives.

A first version of the vocabulary is included in Section 3 of this document and will be updated in the deliverables D5.3 Use case oriented pilots initial version (M24) and D5.4 Use case oriented pilots final version (M36).

2.1.2 Description of scenarios

Duration: M10-M22

From the beginning of the project some scenarios have been proposed for the evaluation of the platform. These scenarios are still being defined and extended in order not only to support all the functionalities expected from DataPorts, but also for improving the processes managed currently by the ports.

The definition of the use cases contains the actors involved, the role that they play in them, the description of the port processes and how DataPorts will improve them. Also, the starting conditions and the expected results must be clear.

The current version of the scenarios is described in the Section 4 of this document and will be updated in the deliverables D5.3 Use case oriented pilots initial version (M24) and D5.4 Use case oriented pilots final version (M36).

2.1.3 Functionalities demonstration matrix

Duration: M15-M22

The main objective of the pilot's implementation and evaluation is to demonstrate that the DataPorts platform has implemented the functionalities previously defined through real examples of usage.

For that reason, a table that matches the scenarios with the functionalities of the platform will be built. This matrix will be updated in the deliverables D5.3 Use case oriented pilots initial version (M24) and D5.4 Use case oriented pilots final version (M36), showing in the last one the final relationships between them.

The table will have the scenarios in one axis and the functionalities in the other axis. Table 1 – Functionalities Matrix shows an example of how the table will be built.

FUNCTIONALITY		MANAGEMENT SYSTEM INTEGRATION	
ID	**DESCRIPTION**	**POSIDONIA VESSEL EVENTS**	**POSIDONIA NOTIFICATIONS**
F-2.1	The DataPorts platform provides various platform governance capabilities and interoperability among different platforms	X	X
F-2.2	The DataPorts platform sets a data driven ecosystem ready for a comprehensive exploitation of data, and virtual data repositories		
F-2.3	The DataPorts platform introduces a novel, decentralized architecture, data and events can be recorded on a blockchain for transparency and credibility	X	X

FUNCTIONALITY		MANAGEMENT SYSTEM INTEGRATION	
ID	**DESCRIPTION**	**POSIDONIA VESSEL EVENTS**	**POSIDONIA NOTIFICATIONS**
F-2.4	The DataPorts platform (through blockchain technology) implements all the authentication and authorization mechanisms to allow data sharing and trading in a secure and reliable way	X	X
F-2.5	The DataPorts platform will be aligned with IDS reference model, offering data owners the option to describe connectors where type and conditions of data will be clearly stated and offered to data consumers	X	X
F-2.6	The DataPorts platform provides Orion Context Broker and Blockchain component, registering the description of the data	X	X
F-2.7	The DataPorts platform enables the data owners to exchange data	X	X
F-2.8	The DataPorts platform enables data sovereignty	X	X
F-3.1	The DataPorts platform enables connections with external sources of data supported by data agents manager		
F-3.2	The platform will enable a real connection among ports, allowing them to share data and knowledge		
F-3.3	The DataPorts platform provides data sanitization algorithm to guarantee data quality integrity		
F-3.4	The DataPorts platform establishes machine learning models		
F-3.5	The DataPorts platform enables the federation of data varying in syntax and semantics	X	X
F-3.6	The DataPorts platform provides efficient and effective techniques for data wrapping to represent the underlying mechanism to support a selective, release, storage, and analytics on data		

FUNCTIONALITY		MANAGEMENT SYSTEM INTEGRATION	
ID	**DESCRIPTION**	**POSIDONIA VESSEL EVENTS**	**POSIDONIA NOTIFICATIONS**
F-3.7	The DataPorts platform enables efficient processing over protected data while preventing (or limiting) access to actual data content by other parties		
F-3.8	The DataPorts platform provides semantic stream processing	X	X
F-3.9	The DataPorts platform provides semantic data compression	X	X
F-3.10	The DataPorts platform provides declarative, distributed data aggregation		
F-3.11	DataPorts platform provides an innovative user interface to guide the user in specifying privacy and data access policies	X	X
F-3.12	The DataPorts platform provides the data owners data driven analytic services		
F-3.13	The DataPorts platform provides the consumers and end users new AI and cognitive applications		
F-3.14	The DataPorts platform provides tools to help decision processes	X	X
F-3.15	The DataPorts platform provides smart API for cognitive services		
F-3.16	The DataPorts platform processes streams of records and publish and subscribe to streams of data	X	X
F-3.17	The DataPorts Platform provides a framework for semantic interoperability from several sources.	X	X
F-3.18	The DataPorts Platforms offers an ontology to guarantee semantic interoperability.	X	X
F-3.19	The DataPorts Platform provides REST-style interaction with Linked Data.	X	X
F-3.20	The DataPorts Platform provides a data source metadata registry	X	X

FUNCTIONALITY		MANAGEMENT SYSTEM INTEGRATION	
ID	**DESCRIPTION**	**POSIDONIA VESSEL EVENTS**	**POSIDONIA NOTIFICATIONS**
F-3.21	The DataPorts Platform provides data from a federated database on demand		
F-3.22	The DataPorts Platform provides data from a federated database through publish and subscribe model	X	X
F-4.1	Provide a platform to ensure data sharing among the actors operating in diverse supply chains per the defined data governance rules that respect the competitive advantage of all (who access what).	X	X
F-4.2	The DataPorts platform provides services to ensure security and protection of shared data	X	X
F-4.3	The DataPorts platform ensures the needed anonymization or de-identification mechanisms while preserving the individual features required for effective big data analytics		
F-4.4	The DataPorts platform provides clear rules on how data will be accessed	X	X
F-4.5	The DataPorts platform provides a flexibility of policies on data distribution	X	X
F-4.6	The DataPorts platform provides end to end secure environment	X	X
F-4.7	The DataPorts platform ensures fully compliance with GDPR		

Table 1 – Functionalities Matrix

2.2 ROLES

Duration: M15-M24

The demonstration of each of the use cases may involve many different organisations or individuals. Those involved may be related not only to different tasks, but also at different levels and with different roles.

One of the main activities is to identify those involved in each use case and scenario, whatever the relationship they have or will have in the final assessment.

This section identifies and describes the different roles to consider for the development and evaluations of the project's pilots. The role assignation to the platform users and other involved organizations should be described for each use case definition in Section 4.

Future deliverables D5.3 Use case oriented pilots initial version (M24) and D5.4 Use case oriented pilots final version (M36) will review this section until the final list is available.

Among the roles to be identified, the following should be considered:

- Use case leader / manager: defines the use case and oversees the tasks to be performed in general.
- Data owner: owns the data that is part of one or more use cases. It is possible to be both a data owner and a data provider.
- Data provider: makes the data accessible, responsible for its control and dissemination. A data provider may also be a data owner.
- Data consumer: uses data provided by other persons or systems.
- Developer: developer of the different parts needed, be they platform components, such as agents, algorithms, APIs, etc... or the creation and/or modification of applications or connectors.
- Integrator: in charge of making it all work. Knows the requirements of the use cases and the different parts of the platform that make up the solution. Specifies what is needed, how each of the developed parts will be put together, as well as their functionality. It will also help with the deployment of the applications and tools.
- Tester: responsible for testing the components. It is common for the role of tester to be assumed by the developer himself.
- Reviewer: validate that the use case meets the expected requirements.

These roles consider not only the actors that are involved in the evaluation of the pilots, also all the organizations that will take part in the development and integration of the platform components.

2.3 DATA ACCESS

Duration: M15-M32

Throughout the first months of the project, information has been collected on the data to be shared with the platform in the development and evaluation of the pilots, identifying the owners of the data, as well as the permissions and restrictions on them. In addition, the technical details of the databases or systems that produce them have been specified, so that at this point the way for accessing them is already known.

One of the main features of DataPorts is that it is a platform for sharing data, so a very important part of it are the mechanisms it provides for acquiring, transforming, and storing or transmitting information. To this end, a layer has been implemented that manages the integration of the platform with the different data sources that currently contain the information.

Each of the data sources will require one or more specific components in charge of transferring the information between systems. They are the so-called agents, and for their development it will be necessary to know, for each one, the conditions and forms of access to the systems where the digitised information is currently located.

Port environments, like other digitised environments, are constantly evolving, so they may change during the implementation of the project, either at a technological level or simply a change in the information being shared. For this reason, two strategies will be followed:

- Data source access information for each use case scenario shall always be kept up to date, from the methods of accessing the information to the structure of the data.
- Whenever possible, version control shall be maintained between the access APIs and the agents that make use of them. If this is not possible, agents shall be upgraded to the new conditions if they are not compatible with them.

The following steps should be taken to provide the necessary information for each scenario:

1. Identify data sources

2. Calculate the number of agents required according to the information to be retrieved.
3. For each agent, complete the questionnaire in Annex A.
    a. In case of changes, update the content.
    b. If it is possible to have different versions of the agent, maintain separate questionnaires as well.

2.4 DATA MODELS

Duration: M15-M36

The information managed by the DataPorts platform is transformed and stored according to a series of semantic data models. This means that the data acquired by the platform undergoes a transformation process from raw information, with the original format and structure, to an object with semantic information according to the data model to which it corresponds.

Data models will be defined because of the architecture design and included in the deliverable D2.2 Scalability, Interoperability and Definition Standards (M24), and should be extended, if necessary, to support all the information that is sent from the different sources or services. So, the final set of models is expected by the end of the deliverable deadline and the required extensions should be identified and added before.

For each of the data sources involved in each of the scenarios, the first step is to identify into which data model the information is to be transformed. For this purpose, the DataPorts platform must have a list of models defined and available, together with a description of their content. It is supposed that all data sources have been previously described and so there will be a data model already identified for each of them.

Once the semantic data model has been selected, the next step involves establishing the correspondence between the data coming into the platform and the fields in which it will store this information. In case there is information that does not have a direct match, the extension of the model will be considered to add the necessary fields.

Finally, a matrix of models and scenarios will be built, unequivocally identifying the use of each one of them. In this way, if a model needs to be updated or undergoes any change, those responsible for the use cases that make use of it must be notified. An example of a model matrix can be seen in the following Table 2 - Data Models Matrix:

	PORT MODEL	TRUCK MODEL	CONTAINER MODEL
Tracking of Transport Operations			X
Sharing Verified Gross Mass		X	
Digital Consignment Note		X	
Data driven application for strategic and real time decisions	X	X	X
Facilitation of passengers, professionals, and visitors of the port	X		

Table 2 - Data Models Matrix

This data model matrix table will be reviewed and updated in the deliverables D5.3 Use case oriented pilots initial version (M24) and D5.4 Use case oriented pilots final version (M36).

2.5 REQUIRED INFRASTRUCTURE

Duration: M16-M36

The pilots and use cases will be executed and evaluated in three different port environments: Valencia, Thessaloniki, and another European port to be determined. Each of these locations has a unique ecosystem of technologies, applications, and conditions, communicated to a greater or lesser extent, that enable the management of the daily operations carried out in the port.

The current port infrastructure and software requirements are described in the deliverable of the WP2: D2.1 Industrial Data Platforms and seaport community requirements and challenges. This document should be the starting point for understanding the port environments and processes that will be around DataPorts.

The integration of DataPorts into each of these ecosystems will therefore require not only the intrinsic conditions of the platform but also the environment of which it must be part. To ensure that the requirements for the deployment and integration of the platform are met, the following aspects must be considered:

- Identify the components that are going to be integrated in the use case scenarios. The DataPorts platform is built from different modules or components that communicate with each other, each with a specific functionality. In the same way that they have their own tasks, the needs for their deployment and implementation are specific and independent. This means that to specify the infrastructure requirements necessary for the deployment of DataPorts, this action is essential to be able to extract from this information the final list of features to be satisfied.
- Identify and establish communication with the responsible persons or administrators in each port environment for the physical systems. The systems department of each port must be able to:
  - Provide the necessary equipment or servers to deploy the DataPorts platform components.
  - Ensure internal access to data from different sources. DataPorts must be able to access the data or the interfaces that provide them, and for this purpose we will need internal users and permissions, and be included in the same network if necessary.
  - Define the different working environments. They are not mandatory, but if required, specify the environments for development, integration, testing / pre-production, and production.
- Identify actions that require physical components that are not currently available in the ports. For example, the sensors to be fitted to containers for the container tracking use case. For each of them it is very important to specify:
  - Which component is needed?
  - Who is responsible for providing it?
  - When could it be provided?
  - Where is it going to be deployed?
  - Who is the responsible of the installation?
  - Is it required the integration with other systems? If yes, who is going to do it?
  - Is it needed an additional validation after the integration? If yes, who oversees it?
- Identify actions that require software components that are not currently available in the ports. For example, the blockchain infrastructure. For each of them it is very important to specify:
  - Which component is needed?
  - Who is responsible for providing it?
  - When could it be provided?
  - Where is it going to be deployed?
  - Who is the responsible of the installation?
  - Is it required the integration with other systems? If yes, who is going to do it?
  - Is it needed an additional validation after the integration? If yes, who oversees it?
- If the use cases have described the development of new applications as part of the work to be done, these solutions must be compatible with the environment where they will be integrated.

- All the activities should be logged in order to be included in the deliverables D5.3 Use case oriented pilots initial version (M24) and D5.4 Use case oriented pilots final version (M36).

2.6 IMPLEMENTATION

Duration: M16-M36

The implementation of the scenarios implies the realisation of all the necessary developments for the integration of the platform in the different pilots and the evaluation of the use cases. In other words, given the descriptions contained in point 2 of this document, the elements to be built or modified in both the DataPorts platform and the current port environments will be identified.

For the communication between the development teams and the other members of the consortium, the next communication channels are defined:

- Email: there are distribution lists for each of the work packages and a contact list with the directions of the partners that are part of the project.
- Slack[1]: There is a slack group available for every member of the project.
- Microsoft Teams[2]: meetings will be scheduled for the overview of the progress and small groups for discussing small topics.

The code and other resources will be shared using the provided infrastructures:

- Nextcloud[3]: for user manuals, documents, guides and references.
- Git[4] repository: for sharing, backup and version control of the code.

2.6.1 Platform components

Duration: M16-M30

All the platform components have not only to be identified, but also to be configured or even developed. Table 3 – Agents, Smart Contracts and IA Services Implementation shows how should be implemented these components.

Agents
For each scenario and each data source, the agents to be developed will be analysed to share the corresponding information with the platform, under the corresponding conditions. The development of the agents is linked to the specifications of the data sources and related activities previously mentioned in point 3.2 of this document. The functionality, the behaviour, and therefore the implementation, depends on the inputs provided in the questionnaire mentioned in that point and shown in Annex A. The above information, together with the tools provided by the platform, more specifically by the data access component (DAC), will be used to create the agent templates and the customization of the input fields mapping. The DAC will provide an interface for the agent development, where users will be able to set their desired features, choosing between the available options, to obtain the file to start from and that should be completed. For this step, the implementation requires knowledge of the corresponding semantic

[1] https://slack.com/intl/es-es/

[2] https://www.microsoft.com/es-es/microsoft-teams/group-chat-software

[3] https://nextcloud.com/

[4] https://git-scm.com/

data model, as well as the mapping of the fields to the final structure, and so depends on the tasks mentioned in Section 3.4 of this document.
Smart Contracts
The blockchain smart contracts will be used for data sharing, data trading and data governance management. Each time a dataset is uploaded, a smart contract will be utilized to add the metadata related to it and make it searchable throughout the DATAPORTS platform. Furthermore, data governance rules along with blockchain permissions will secure the access to these datasets and handle rights regarding them. Three blockchain networks, one for data shared at the platform level and two for the local use cases, have been deployed for this reason. Every participant of the global network will use a front-end solution that integrates a blockchain client to interact with the smart contracts and perform operations on the ledger. No special deployment of a software agent is needed, as the abovementioned services for the datasets will be served as online services (Blockchain as a Service). DataPorts will include various the smart contracts and all the required actions will be described in the deliverable D5.3 Use case oriented pilots initial version (M24).
AI and Machine Learning services
The DataPorts platform provides two main components to be configured to provide AI and ML Services: The Automatic Model Training Engine and the Process-Based Analytics. Regarding the Automatic Model Training engine, its deployment requires a distributed infrastructure of at least four computing nodes with 8GB of RAM and 4 VCPUs, ideally connected in the same network. One node will act as a master node, hosting the dashboard and the engine, whereas the rest of the nodes will act as workers for increasing the training performance. Specific configuration details, for instance the nodes' IP, their role, etc., will be manually defined using specific configuration files as it is possible to define different node topologies. This infrastructure should be based on a Linux system but both a local or/and a cloud infrastructure could be used. The specific functional components, namely the dashboard and the ML training engine, will be provided as Docker containers. Therefore, Docker and Docker-compose must be previously installed on the computing nodes. The component also requires a Hadoop HDFS filesystem to store temporally the Parquet files required for training. This filesystem must be configured following the general guidelines and installation procedures described in the HDFS documentation. The volume size of the filesystem depends on the expected size of the datasets to be used. Finally, trained models will be accessed using a REST API, so it is recommended to expose a public port (80 or equivalent) for a accessing the API. We expect additional configurations to connect with the rest of the platform components, mainly the Data Governance Smart Contracts, the IDS Broker and the IDS connector, when needed. Regarding the Process-Based Analytics component, no specific compute requirements exist at the time of reporting. Current implementations run on regular compute infrastructure (such as standard PCs), but could be sped up using dedicated hardware, such as GPUs and TPUs, to speed up training of the prediction models. The specific functional components, namely the five process-based analytics components (process monitoring cockpit, prescriptive process monitoring, explainable predictive process monitoring, and ensemble predictive process monitoring), will be provided as Docker containers. Therefore, Docker and Docker-compose must be previously installed on the computing nodes. DataPorts will provide the tools to create machine learning services and all the required actions will be described in the deliverable D5.3 Use case oriented pilots initial version (M24).

Table 3 – Agents, Smart Contracts and IA Services Implementation

2.6.2 Current applications

Duration: M19-M36

DataPorts, as a sharing data platform, will need interactions from data providers and data consumers, so the information flows in and out of the platform with different targets. In order to be able to process it and succeed in the pilots' evaluations, it is possible that already existing applications need to be modified or updated adding the expected functionality.

All the tasks and activities performed under this scope will be included in the deliverables D5.3 Use case oriented pilots initial version (M24) and D5.4 Use case oriented pilots final version (M36).

2.6.3 New applications

Duration: M19-M36

It is possible that new applications or interfaces must be created to achieve the use cases results. These applications will not be part of the DataPorts platform but part of the port ecosystem.

All the tasks and activities performed under this scope will be included in the deliverables D5.3 Use case oriented pilots initial version (M24) and D5.4 Use case oriented pilots final version (M36).

2.7 INTEGRATION

Duration: M23-M36

2.7.1 Platform components

Duration: M23-M34

Platform components will be integrated and deployed in each pilot ecosystem by the organization in charge of them with the help of the IT department of the ports, or the current organization that plays this role. The partner responsible of the security of the platform will also help in this task.

Once the platform is available, users and access privileges will be configured for the port organizations that interact with DataPorts in any of the pilots.

DataPorts provides several User Interfaces (UI) for the configuration of its components so when available, the use case integrators and the components responsible will setup these elements. Table 4 – Data Sources, Agents, Smart Contracts and AI integration shows the integration plan for each of the components.

Data Sources
Data sources will be registered using the platform configuration interface.
Agents
Agents will be managed through the Data Access Manager interface. Once the agents are built, this DataPorts platform component will allow users to upload the files and create docker images from them. Once the container images are created the instances of the agents can be run or stopped using the web interface of the component. This integration requires that the agents have access to the expected data sources and other resources.
Smart Contracts
Smart contracts will be defined using the platform configuration interface.
AI and Machine Learning Services
Each component to support the AI and Machine Learning Services has its own integration mechanism with

the rest of the DataPorts platform. The Automatic Model Training Engine provides two main integration mechanisms. First, the dashboard acts as main interaction mechanism with the stakeholders. This dashboard could be use for training, deploying, and monitoring the trained models. Secondly, the component provides and API to programmatically access to the model's predictions and enable the development of additional services on top of such models. In terms of authentication mechanism this component uses the approach defined in the data governance component. It is also expected to expose the models APIs using an IDS connector to ensure a trustful sharing of the generated data.

Table 4 – Data Sources, Agents, Smart Contracts and AI integration

2.7.2 Current applications

Duration: M23-M36

Modified versions of the applications will be deployed and integrated with DataPorts.

All the tasks and activities performed under this scope will be included in the deliverables D5.3 Use case oriented pilots initial version (M24) and D5.4 Use case oriented pilots final version (M36).

2.7.3 New applications

Duration: M24-M36

The new applications developed for the pilot evaluation will be deployed and integrated with DataPorts.

All the tasks and activities performed under this scope will be included in the deliverables D5.3 Use case oriented pilots initial version (M24) and D5.4 Use case oriented pilots final version (M36).

2.8 SECURITY AND QUALITY ASSURANCE

Duration: M23-M36

The code quality assurance plan will be part of the deliverable D4.3 - Secure environment for data sharing and trading (M20, M30). In this document there will be a topic for the Security code review that will need the owners of the applications and components of the platform involved in the pilots to provide some information to determine the testing scenario for the code audit, to estimate the scope of testing, as well as to plan the tests agreed.

The requested information will cover the following aspects:

- Information system architecture: the main languages and frameworks involved, entry points.
- Scope of testing: number of files, lines, and modules involved, nature of testing to be carried out and main business security issues.

The domains that will be requested are:

- General information: information to determine the scope of the audit.
- Specific information: information about the type of audit to be carried out.
- Previous audits: information about previous audits.
- Software entry points: information about the application entry points (interaction with third-party systems)
- Other queries: information about some tests and considerations to be taken into account by the auditor regarding current legislation and regulations.
- Requirements: additional information required.

There are different kind of analysis to consider for the quality assurance:

- Surface analysis: Analysis where code security tools are used for a manual review of the Critical and High severity risk results.
- Standard analysis: Analysis where code security tools are used to perform a manual review of the results, also checking third-party dependencies (and/or libraries) that make up part of the software.
- In-depth analysis: Standard analysis comprising a manual audit of part of the software.
- Holistic analysis: In-depth analysis of code along with a dynamic audit of software during runtime.

2.9 TESTING AND EVALUATION

Duration: M25-M36

All the testing, validation, evaluations and pilot results plan are described in the deliverable D5.2 Evaluation plan (M15).

3 COMMON VOCABULARY

In this section can be found the definitions of the terms, concepts, and means that appear in the use case descriptions of Section 4, and the introduction to actors and systems involved.

3.1 GLOSSARY

The Table 5 - Glossary describes the terms that are used in the use case descriptions in Section 4.

Term	Description
AIS	The automatic identification system (AIS) is an automatic tracking system that uses transceivers on ships and is used by vessel traffic services (VTS). [1]
Bunkering	The provision of solid, liquid, or gaseous fuel or of any other energy source used for the propulsion of the waterborne vessel as well as for general and specific energy provision on board of the waterborne vessel whilst at berth. [2]
Cargo	Items that are placed on the ship to be transported to another port, such as boxes, pallets, cargo transport units, and bulk liquid and non-liquid matter. [3]
Carrier	Freight transporting company. [4]
Container Terminal	Designated for the handling, storage, and possibly loading or unloading of cargo into or out of containers, and where containers can be picked up, dropped off, maintained, stored, or loaded or unloaded from one mode of transport to another (that is, vessel, truck, barge, or rail).
Customs (Authority/Agency/Office)	The customs authorities are responsible of the administration and the application of national and international customs law through the collection of duties and taxes, for importation, exportation, movement or storage of goods in ports. [5]
Customs Agent/Officer	A law enforcement agent who enforces customs laws, on behalf of a government. [4]
Customs Trade	Trade data summary provided by customs. The data includes information of the type of transaction, type of goods, origin destination country, weight, transport mode, delivery conditions, etc.
Data Provider	An organization which produces data or metadata.
Data Consumer	An organization using data as input for further processing.
Data Prosumer	An organization that produces and uses data or services.

Term	Description
Forwarder (Freight Forwarder / Forwarding Agent / Local Agent / NVOCC: Non-Vessel Operating Common Carrier)	A person or company that organizes shipments for individuals or corporations to get goods from the manufacturer or producer to a market, customer, or final point of distribution [4].
Freight consignee	The consignee is the receiver of this good, also a person, a company, or an organisation. [5]
Freight sender	The sender is the person, company, or organisation, at the origin of the forwarding of a good or other item which can be sent by sea. [5]
Harbour	Area of water providing shelter for ships, used to build ports. [4]
Hinterland connectivity	The port, as an interface between the sea and the hinterland transport systems, has hinterland connectivity assets such as railway stations and rolling stock loading and dispatch systems, road infrastructure, intermodal stations, canals, and port infrastructures connecting with inland waterways. [4]
Maritime stakeholder	A policy actor and/or an organisation/entity/person involved in the shaping of maritime policies and directives. [4]
Maritime Transport	An Inland, sea and coastal passenger and freight water transport companies (as defined for maritime transport in Annex I to Regulation (EC) No 725/2004 of the European Parliament and of the Council) not including the individual vessels operated by those companies. [6]
OCR	Optical Character Recognition, a technology for automated identification and tracking.
Operator	Represented in the transport chain as forwarder, intermodal operator, agent, or terminal operator having each of their function either to plan and/or to control each transport stage and/or load unit handling in the terminals. [4]
Pilotage	Guidance service of a waterborne vessel by a pilot or a pilotage station to allow for safe entry or exit of the waterborne vessel in the waterway access to the port or safe navigation within the port. [2]
Port	(1) A specified area of land and water, with boundaries defined by the Member State in which the port is situated, containing works and equipment designed to facilitate commercial maritime transport operations. [7] (2) Location on a coast or shore containing one or more port facilities where ships can berth and transfer people or cargo to or from land. [8]

Term	Description
Port Authority	A governmental or almost governmental public authority, sitting at the heart of the interactions between all stakeholders, in collaboration with other local and national authorities, is responsible of maintaining and developing the port infrastructure and the transport infrastructure, ensuring the global safety and security of port and ship operations through the harbour master. Moreover, the Port Authority oversees some controls and inspections in respect with national, European, and international legislations. [5]
Port Community System	It is usually owned and managed by the Port Authority or port stakeholders, increasingly organised, as a single window system to share information on port operations related to the vessels between all the port stakeholders (date of arrival or departure of the ship given by the shipping companies, mandatory declarations such as crew list, dangerous goods declarations, bookings of vessel services, etc.). [5]
Port service ships	The port has dedicated service ships at disposal to deliver specific services on water to the vessels: pilot boats, tugboats, boatage and mooring assistance, supply vessels, safety vessels, inspection, and security vessels. [5]
Road Haulier	A company operating and /or owning trucks and carrying out road transport functions concentrating on the physical movements of goods. [4]
Scale Operator	Provides the weight data from each container after it is measured.
Ship	Ship itself, an agent in the port of call, the owner or management company, or any other entity that can legally represent the ship in the transaction. [8]
Shipping and maritime freight companies	These private companies oversee transferring and forwarding freight from a place to another, by bookings services for all kind of transport (maritime transport, railways, etc.). [5]
Shipping line / coastal / oversea shipping line	A company operating and /or owning vessels for sea transport. [4]
Smart Container	A “Smart Container” is a marine shipping container, which is fitted with an installed smart monitoring device. A “smart device” (aka IoT device) is an electronic device embedded with a set of sensors enabling it to measure real-time information such as identifying location, door opening and closing, vibrations, temperature, and humidity.
Smart Port	An automated port that uses nascent technologies such as big data, Internet of Things (IoT), blockchain solutions and other smart technology-based methods to improve performance and economic competitiveness. With these technologies, smart ports can also improve environmental sustainability. [9]
Terminal	A terminal is a facility where cargo is trans-shipped between different transport modes, for onward transportation. [4]

Term	Description
TEU	Twenty Foot Equivalent Unit. The two most common international standardised container types are twenty and forty foot. A twenty-foot unit measures about 6 meters, a forty foot about 12 meters (external dimensions). Depending on whether the ship loads twenty- or forty-foot containers (or a combination of the two), the number of containers held on board the ship will differ. As to express the capacity of a container ship in a uniform manner, the number of containers that the ship can load is converted into several containers of the smallest size, i.e., those that are twenty feet in length. [10]
Towage	The assistance given to a waterborne vessel by means of a tug in order to allow for a safe entry or exit of the port or safe navigation within the port by providing assistance to the manoeuvring of the waterborne vessel. [2]
Vessel	Ship.
Vessel Traffic Service	A marine traffic monitoring system. [5]

Table 5 - Glossary

3.2 ORGANIZATIONS

Table 6 - Organizations describes the organizations involved in the pilots.

Name	Description
Valencia Port Authority	The operator of the port of Valencia.
Thessaloniki Port Authority / THPA	The operator of the port of Thessaloniki.
Traxens	IoT Service providing insight about the physical trip execution, the container movements, and the conditions under which the goods got transported.
Prodevelop	Enterprise and developers of the Posidonia Port Solution, that includes Posidonia Management and Posidonia Operations.
CERTH	Research Institution which provides analytical services to the port of Thessaloniki.
ITI	Research Institution which provides analytical services to the port of Valencia.
OTE	Large company which acts as Data Provider in the port of Thessaloniki.

Table 6 - Organizations

3.3 PLATFORMS

Table 7 - Platforms describes the platforms that participate in the use cases defined in Section 4.

Name	Description
Traxens Platform	A platform collecting Smart Container data from TRAXENS IoT devices installed on the Dry containers, then cleaning, processing, and displaying that enriched data the parties who are entitled to access to it.
Tradelens	Open and neutral supply chain platform underpinned by Blockchain technology. It allows true information sharing and collaboration across supply chains. The data includes information from the shipping lines, ports and other actors about the transport events.
Posidonia Operations	A solution for the centralized management of vessel operations. Posidonia Operations is a comprehensive Port Operations Management System that allows a port to optimize the maritime activities related to the flow of vessels within the port's service area; the integration of all stakeholders and all relevant information systems. Developed by Prodevelop SL, it is part of Posidonia Port Solution.
Posidonia Management	Software conceived and designed to fulfil the management need of the different Port Authorities. Developed by Prodevelop SL, it is part of Posidonia Port Solution.
Valenciaport PCS	The Port Community System of Valenciaport is a system where companies are exchanging transactions to organize the container freight transport.
vForwarding	Software used by Freight Forwarder's companies, connecting their offices and operating in the air, road and sea freight transport. The data includes information of the transport such as type, origin port, destination port, or payment, and detail of the cargo such as weight, value, quantity, etc.
Valencia Port Platform	The industrial IoT platform in the port of Valencia managing several data sources coming from sensors, meters, and other industrial systems. The data includes information of the port gate accesses.
Valencia Port Management System	The management system used by the Port Authority of Valencia managing several data sources coming from port operations.

Table 7 - Platforms

4 PILOTS AND USE CASES

The DataPorts project will be evaluated through the execution of two pilots in the ports of Valencia and Thessaloniki, and two global use cases that will have as main end users both Port Authorities.

These pilots are split into different use cases where the necessary activities will be carried out to achieve specific objectives. Each of the ports defines its own scenarios, so the tasks to be performed in each of the pilots do not necessarily have to be the same, but will depend on the objective, the stakeholders, and the related processes. These activities must consist of at least one process or task that involves the use of the DataPorts platform, either as a means of obtaining and sharing data, processing data, providing a service, or consuming data. The two global use cases define their own defined scenarios, which will be adapted, integrated, and evaluated in each of the ports.

The objective of these use cases is to demonstrate an improvement of the processes that are currently performed at the ports, or even the development of new processes that will be possible thanks to the integration of DataPorts in the port's ecosystem. Also, these scenarios will validate the DataPorts functionalities that are expected from the platform.

This section describes in detail the use cases that will be implemented in each of the pilots.

4.1 VALENCIA PORT

The Valencia pilot defines four different scenarios that can be deployed during the pilot execution phase to demonstrate how DataPorts could be used by several port organizations. The first scenario focus on monitoring and tracking (container and goods tracking and transport operations) in order to increase the knowledge about a transport operation. The second scenario uses data aggregation and advanced analytics (port authority data sharing) for providing cognitive services, i.e., predictive services for a specific KPI for port stakeholders. And finally, this pilot develops two scenarios to create a trusted environment for sharing port documentation and weight verification.

4.1.1 Tracking of Transport Operations

Shipping lines are the owners of hundreds of thousands of containers spread around the world that are handled by container terminals and road haulier companies and used by their clients to load and discharge goods. Specifically in the case of Valencia Port, this translates to yearly more than 5 million of TEUs managed by the different organizations. Because of several entities being involved in the transport operations with different IT systems, it is difficult to know the status and real-time location of containers.

Different stakeholders, for instance an importer/exporter organization, are usually interested in knowing the location of their goods in real-time, so that they can manage transportation properly. With such information they could take appropriate actions in case of delays and receive a better service from transport and logistic providers. In some cases, it is not enough with the information about the tracked container to know the status of the goods. So, the container tracking data must be enriched by additional heterogeneous and decentralized IT systems.

With DataPorts, every port organization gathering data involved in transport operations with containers and goods becomes a potential data provider. The overall idea is that DataPorts will provide a secure, immediate, and reliable access to data distributed among a wide set of systems, also complying with all confidentiality and data protection requirements. Next, we highlight some examples of data providers:

- The access to the port or the container terminals is managed by several automatic gate systems. These systems register automatically using OCR mechanisms the access of a container when arrives or departs using a truck, therefore they provide a trustful timestamp and location.

- Container tracking devices, such as the Traxens smart container device, provide a stream of events related with container position and potential hazardous events to the goods (container door opened).
- Container weight systems could also act as a timestamp of the container or goods arrival to a specific weight point.
- ValenciaPort Community System provides information regarding departure and arrival of the vessels in which the goods or the containers are transported.
- Posidonia solution, which could be deployed in different port premises, generates events related with the vessels approaching the port using an AIS system.

This scenario defines DataPorts as a hub for tracking events in the context of ValenciaPort to which port stakeholders could subscribe to. The data providers will publish relevant information related to a unique identifier relevant in a maritime logistic chain: a container identification number, a ship identifier, or a goods identifier. Regarding the latter identifier, we will follow the recommendations provided by the Plug Play functionalities for the Federated Network of Platforms of the DTLF's Subgroup II5. Such published events will be available to data consumers using the DataPorts data governance framework. For instance, a freight forwarder using DataPorts subscribes to every event related to a container identification number and/or the vessel transporting such container. If access is granted by the owners of the data, this freight forwarder will receive in near real-time such events, which can then be used to improve its transport operations. The freight forwarder could, for example, be notified when the vessel with the container has arrived at the port, or when the container has left the port premises by truck, etc.

DataPorts will provide a single access point for all the relevant events without the need of implementing specific integration or authentication mechanisms for each data provider. As every event data/message follows the data model already defined by DataPorts, also the process of understanding the received data is simplified: there is no need of understanding the underlying information system of the data provider.

Additionally, is quite common for port stakeholders to be using a transport operations application to manage their current business processes. Such applications can be improved using the DataPorts services and enabling the use of the third-parties' data transparently. For such applications, DataPorts can provide access to data coming from several companies involved in transport, like the ones previously mentioned, which will become data providers or data sources for the transport operations application. Then, the data consumers are the current applications which need to be customized to exploit the data coming from DataPorts.

Actors	Roles
Freight forwarder	Needs to know the specific location of the containers they are managing for different customers. They will use DataPorts for getting container data from any data provider. A common service is providing access to cargo tracking data to their customers. For that, they need to use DataPorts to provide an identification for the cargo and the related tracking data.
Importer/exporter	Provides access to cargo tracking data to their customers. For that, they need to use DataPorts to provide an identification for the cargo and the related tracking data

[5] https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupMeetingDoc&docid=35431

Actors	Roles
Shipping lines	Are owners of the containers and are interested in the location of their own containers. They will use DataPorts for getting container location from any data provider.
Valencia Port Authority	Will publish container locations using the DataPorts platform. These locations are gathered from the automatic gate system and the Port Community System.
Digital platforms	Traxens, Tradelens and Posidonia will integrate their current digital platforms with DataPorts. These platforms can provide the location in real time, directly from the device or when arriving to some specific locations.

Table 8 – Tracking of Transport Operations Actors

Preconditions
The different actors involved in the transport operations as data provider or consumer (freight forwarder, the importer/exporter organization, Port Authority, Digital Platforms etc.) must be already enrolled and providing at least a data service of the DataPorts platform.

Triggers
Any actor involved in the transport operations is publishing some relevant event related to a container, goods or vessel.

The main flow of this scenario is:

- An actor involved in a logistic operation, such as a freight forwarder, which is already enrolled in the Dataports platform, requests access to the events for a container identification number.
- Data providers grant access to their specific events if there are not publicly available to the rest of the partners.
- The freight forwarder subscribes to the different events. New events will be received as they are generated by the data provider.
- The freight forwarder could use the received information to be integrated into a specific application and provide services to its customers.

Instead of using a single id in the first of the flow, some relevant options are:

- An actor, such a shipping line, can subscribe to a set of container identification numbers. For instance, every container transported in a vessel.
- Instead of tracking a container, an actor could be interested to know where their goods are.
- The subscription could use one or several ids, not only container numbers, such as a truck plate, a vessel name, vessel IMO, DUA number, etc. Every event from such ids will be received by the actor.

Postconditions
The freight forwarder involved in the transport operation receives all the requested events until the subscription is closed or the permission are revoked by the data provider.

4.1.2 Port Authority Data Sharing and Analytics Services

In Valencia Port, different systems and channels are used to gather historical data from the companies in the port environment. The Valencia Port authority needs to receive and aggregate such data to provide services to other companies operating in the port, such as haulier companies, customs, and other organizations. Some of this data is received through the ValenciaPort PCS, but this system is only focused on transport transactions. At this moment, there is no standard way to share data with the Valencia Port Authority: this data is sent by different communication channels and using several data formats. Therefore, a specific process for each data source is required, and it is not straightforward to build such services.

The DataPorts platform will improve the current data sharing approach. Using DataPorts historical data will be processed and transformed into a common data format. Next the relevant metadata of a data source will be published in the platform for simplifying the discovery process. This metadata will be shared internally with the different departments in the port authority, or externally with interested and authorized stakeholders, using the data governance framework provided by DataPorts. Thanks to this data aggregation, it also is feasible to provide analytical services in top of such data to help the port stakeholders. The overall idea is to enable the creation of analytical services for a specific business KPI that evolves over time.

As an example, for this scenario, we will gather data related with the customs import/export statistics and vessel calls. Using such data, is feasible to forecast the tons expected to be imported/exported in the following weeks or a prediction of the estimated time of arrival for a vessel. We also foresee the use of data from the road transport operations recorded in the ValenciaPort PCS. The resulting analytical service will be made available to rest of the port stakeholders using the DataPorts platform's interoperability and governance mechanisms. Additionally, the resulting service could be included inside an already working application.

Actors	Roles
Valencia Port authority	As port manager, the port authority is receiving data from several entities in the port and transport domain. It needs a platform to collect all the data, process it, and finally provide specific analytical services to different stakeholders.
AEAT Customs	Spanish Customs provides aggregated data about the tax procedures that import/export companies do when they transport goods.
ValenciaPort PCS	Terminals, road hauliers, freight forwarders, and other companies involved in the transport operation send information to the port authority though the PCS.

Table 9 - Port Authority Data Sharing and Analytics Services Actors

Precondition
Valencia port authority and the interested data providers deploy an instance of the DataPorts platform at their premises.

Trigger
Any of the companies participating in transport operations send data to the platform.

The main flow for the port authority data sharing scenario is:

- The port authority has a DataPorts instance which is receiving data from the already deployed agents in real time or periodically.
- Data is shared to the interested stakeholders using the data governance framework and the platform interoperability mechanisms.
- Using the available data, the end-user could configure the building of a cognitive service for forecasting or predicting a KPI the DataPorts analytical components. This service focus on a specific target variable, already included in the shared data, such as the amount of received goods, number of containers delivered to a specific Spanish region, import/export figures and so on.
- The resulting service is accessible to the granted end-users to get predictions and forecasts about the expected target for the KPI.

Postcondition
All the stakeholders have access to the data provided by the analytical services built using DataPorts.

4.1.3 Sharing Verified Gross Mass

In 2014, the International Maritime Organization (IMO) amended (MSC.1Circ.1475) the Convention on the Safety of Life at Sea (SOLAS) to require, as a condition of loading a full container on a ship for export, that the container must have a verified gross weight. The shipper became the responsible for obtaining the Verified Gross Mass (VGM) of a full container and communicating it to the shipping company, with a VGM certificate.

The regulation prescribes two methods by which the loader can obtain the verified gross weight of a full container:

- Method 1: once the packaging and sealing of a container has been completed, the loader can weigh, or arrange for a third party to weigh the full container.
- Method 2: the shipper or, by shipper's order, a third party may weigh all packages and cargo items, including the weight of pallets, stowage wood and other packaging and fastening materials packed in the container, and add the tare weight of the container that appears on the door of the container to the sum of the individual weights of the contents of the container. (subject to national regulation, currently in draft)

DataPorts platform provides more added value than existing solutions by having a verifiable and immutable information on shared data through the entire chain to all concerned business participants serving as a source of truth and providing transparency and non-repudiation process.

Actors	Roles
Road hauliers	Wants to use the DataPorts platform to register the certified gross mass of its trucks and semi-trailers required for the calculation of the VGM (mainly equipment gross weight and plate identifiers) and to get notified when I have to go to weigh a container.
VGM requestor (freight forwarder or shipper)	Wants to use the DataPorts platform for submitting the container weight request, ensure the payment of the services, obtaining the VGM certificate and making it available to interested parties.

Actors	Roles
Scale operator	Interested in offering their services through the business network using DataPorts Blockchain solution and managing the payment of this digital service directly from the platform.

Table 10 - Sharing Verified Gross Mass actors

Precondition
All the actors involved in the weight operation are registered on the platform.

Trigger
New VGM request is registered.

The main flow for the VGM scenario is:

- The shipper or the freight forwarder creates a weight request with all the required information.
- The scale operator introduces the weight result updating the weight request.
- The shipper and the freight forwarded are notified on the VGM certificate.
- The scale operator registers an invoice, and the payment is performed through the platform.
- The VGM certificate is automatically generated and sent to the Port Community System (PCS), the platform used in the port of Valencia for sharing document among the involved stakeholders.

The weight request can be created by the scale operator if does not exist.

Postcondition
The VGM certificate is available to the involved stakeholders through DataPorts and PCS.

4.1.4 Digital Consignment Note

Nowadays the difficulties in using electronic transport documents are a subject of concern by the European Commission[6]. To tackle these difficulties, the EC is proposing a regulation on electronic Freight Transport Information (eFTI) that establishes the full obligation for Member State authorities to accept regulatory cargo transport information or documentation, with partially harmonised implementation. DataPorts capabilities should be able to tackle with the European Interoperability Framework[7] and the functional requirements for eFTI platforms service providers.

The requirements for regulatory information made available electronically for the economic operators concerned is that the data shall be processed in a certified eFTI platform and, if applicable, by a certified eFTI service provider. The regulatory information shall be made available in machine-readable format and, at the request by the competent authority, in human-readable format.

[6] Proposal for a regulation of the European Parliament and of the Council on electronic freight transport information. COM (2018) 279 final.

[7] European Interoperability Framework – Implementation Strategy, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (COM(2017) 134).

Information in machine-readable format shall be made available via an authenticated and secure connection to the data source of an eFTI platform. Economic operators concerned shall communicate the Internet address via which the information can be accessed, together with any other elements that are necessary to allow the competent authority to uniquely identify the regulatory information.

Information in human-readable format shall be made available on the spot, on the screen of electronic devices owned by the economic operator concerned or by the competent authorities.

The competent authorities, eFTI services providers and economic operators concerned shall take measures to ensure confidentiality of commercial information processed and exchanged (Article 6).

Actors	Roles
Freight forwarder	Wants that electronic transport documents are produced from the data it is already available, shared to all the involved organizations and recognized by authorities complying with the future eFTI regulation. DataPorts blockchain infrastructure for off-chain data sharing will take care of the requirements established for eFTI platforms using digital hashes, identities, timestamps and smart contracts to ensure the consensus, origin, immutability and finality of these legal documents and data, acting as a digital notary of these documentation.
Road Haulier	Will use the consignment note during the transport if it is required by the authorities (e.g., police)

Table 11 - Digital Consignment Note Actors

Precondition
The information regarding the consignment note is registered in the Valenciaport PCS platform.

Trigger
Road haulier confirms the validity of the data for the consignment note.

The main flow for the VGM scenario is:

- Freight forwarder and road haulier need the last version consignment note for their operations.
- Consignment note data is received from ValenciaportPCS to DataPorts platform.
- Consignment note is registered as PDF/A document in a document database and the operation registered in Blockchain off-chain. A proof of registration is annotated in blockchain.
- Stakeholders related to consignment note data (shipper, consignee, road haulier, container owner, empty container depot/terminal and authorities) can download the consignment note PDF/A document and check the integrity and traceability through the DataPorts platform.

As an alternative flow:

- Consignment note data is modified or completed once it is registered in DataPorts by the stakeholders that participate in the transport operation (shipper, consignee, road haulier, container owner and empty container depot/terminal).
- New consignment note data is received from ValenciaportPCS to DataPorts platform.
- Amended consignment note is registered as PDF/A document in a document database and the

operation registered in DataPorts.

- Stakeholders related to consignment note data can download the new consignment note PDF/A document and check the integrity and traceability through the DataPorts platform.

Postconditions
The consignment note data is available to stakeholders involved through DataPorts. When the transport concludes consignment note will not be able to be modified.

4.2 THESSALONIKI PORT

The Port of Thessaloniki is going to make use of the Blockchain feature of the DataPorts platform, to implement two use cases that showcase secure information sharing between the Port and related parties (shipping agents and trucking companies), involving the business cycle of the electronic request to pick-up a container.

DataPorts' features of big data analytics are going to be utilised in use cases involving a) the production of statistics and queues predictions based on operational data and b) the merging of data coming from multiple sources including open (public) data and mobility data, to produce analytics and predictions related to activity in the port area.

Finally, the implementation of the two global use cases will showcase the integration of the Posidonia Operations Management System and Traxens' Smart Container to provide better operational insight to the Port and related stakeholders.

4.2.1 Data-Driven Application for Strategic and Real-Time Decisions

Container loading or discharge is a core port activity for the port of Thessaloniki. The following description refers to the case of a container discharge from the port premises. The procedures involve a Shipping Agent, as the beneficial cargo owner at the time, who wishes to pick-up a container from the yard and a Trucking company, which picks-up the container, on his behalf.

Today, for ThPA to release a container from its premises, all relevant paperwork must be in place (customs clearance, invoicing, etc); however, it requires sometimes the physical presence of the respective shipping agent in ThPA premises for the issuing or filling in of relevant documentation. After evaluation, ThPA then notifies only the related shipping agent, and he in turn contacts the trucking company to pick it up, without further THPA involvement.

Through the DataPorts solution, a new environment is set up, where all the life cycle of the container release/pick-up can be followed by all three involved parties. The Shipping Agent sends a COREOR request XML message to ThPA's TOS (Terminal Operating System), specifying the Trucking Company to pick-up the container. The responsible Department of ThPA checks the applications in TOS and relevant processes (invoicing, customs clearance); if everything is in order then issues a Permit ID for that COREOR, to be returned to the Shipping Agent and the Trucking Company. Using this Permit ID, the Trucking Company can proceed to pick-up the container.

Actors	Roles
THPA Terminal Operator	Staff that processes the requests (verifying XML message, related paperwork)
Shipping Agent	Company that sends the COREOR request and receives the COREOR validation and Permit ID.

Actors	Roles
Trucking company	The company specified by the Shipping Agent as eligible to pick-up the container. Receives notification / Permit ID.

Table 12 - Data driven application for strategic and real time decisions actors

Preconditions
The container is unloaded from ship, is in the container yard.
Shipping Agent has subscribed to THPA's system and has an account that enables them to send the XML request.
Trucking Company has registered to THPA's system and has an account that enables them to receive the relevant confirmation and Permit ID.

Triggers
The scenario starts when Shipping Agent sends the COREOR XML message.

The main flow of this scenario is:

- Shipping agent logs into THPA and DataPorts platform
- Platform presents COREOR form
- Shipping agent fills COREOR webform. Among other details (related voyage, container id, etc), the Trucking Company eligible for the pick-up of the container is defined.
- THPA/DataPorts builds the COREOR XML from the form, and sends it to a THPA endpoint
- THPA endpoint accepts the request, stores it to the local (TOS) database,
- Verification of successful insertion of COREOR back to DataPorts
- DataPorts informs Shipping Agent of success
- Following a series of operational procedures (invoicing, customs clearance, etc), THPA issues a Permit ID for the pick-up of the container
- THPA stores the Permit ID locally and sends initial COREOR Message code& generated Permit ID to DataPorts
- DataPorts forwards Permit ID to Shipping Agent
- DataPorts forwards Permit ID to Trucking Company

If the COREOR XML message is not accepted (due to errors, such as that the container specified does not belong to the Shipping Agent) it is required a request to resend.

If the container is blocked for inspection by Authorities (e.g., Customs), then it cannot be picked up.

Postcondition
A COREOR Permit ID has been issued to both the Shipping Agent and Trucking Company, Trucking Company can now proceed with booking a slot and pick-up the container.

4.2.2 Permit ID for Container Pick-up

Following the above description of a container pic-up, the next step through the DataPorts solution is that the registered Trucking Company, after having received the Permit ID related to the Shipping agent's COREOR request, can proceed to the booking of an available time-slot to pick-up or deliver a container.

Now, this is done in two steps:

- Trucking Company logs in to THPA's Truck Appointment System, to book a time slot. User is presented with a web form, where they enter their preferred timeslot to drop-off or pick-up, and the container ID. A booking ID is generated, stored locally, and sent via email to the Trucking Company.
- The above step is necessary to secure entrance to THPA premises, but it is neither 'binding' about the exact container being declared for pick-up, nor is there a check that the declared container is indeed eligible for pick-up. Slots can be booked days in advance (as placeholders) when the actual trucker (employee if the company) is not yet known. On the day of the pick-up, the trucker logs in to THPA's Freezone web site, where they enter the Permit ID and their details. On successful submission, the system generates a Ticket ID, and an email with all the details is sent to the trucker. This email has an attachment with a QR code, containing all the details, and the QR is used when the truck arrives at THPA's gates.

Actors	Roles
THPA Truck Appointment system	Web application for time-slot booking.
THPA Freezone system	Application for generating Ticket (preannouncement).
Trucking company	The company specified by the Shipping Agent as eligible to pick-up the container.
Truck driver	The one who receives the QR code, for picking up the container.

Table 13 - Permit ID for container pick-up actors

Preconditions
Shipping agent has sent the COREOR request, both Shipping Agent and Trucking company have received the Permit ID issued by THPA.
Truck company has registered to Truck Appointment and Freezone systems to book the slot.

Table 14 - Permit ID for container pick-up preconditions

Triggers
Trucking company accesses booking system.

The main flow of this scenario is:

- User (Trucking company employee) visits TAS webpage.
- After successful authorization, user is presented with options to book slot or change an existing one.
- User fills form, specifying containers to be picked up, and time slot.
- Data is sent via POST, a booking ID is generated and stored locally.
- User receives confirmation via email, containing the booking ID and the booking details in an attached PDF.
- Before visiting the Port, the user (Trucking company employee) visits Freezone app webpage.

- After successful authorization, user is presented with options to issue a new Ticket.
- User fills form, giving the Permit ID and details (truck plates).
- Data is sent via POST, a Ticket ID / QR code is generated by the application and stored locally.
- Ticket is forwarded to DataPorts.
- Also, an email confirmation is sent to the trucker, with an attachment having a QR code that contains all the relevant information. Additionally, if the truck driver consents, they can get the QR code on their mobile phone. This happened through a mobile application that will be developed for that reason.
- Truck approaches ThPA Gate, where the QR code is scanned. If the driver has agreed to receive the QR code on his/her mobile, no paper hard copies are needed.
- After cross-check of the information of the QR code by Gate personnel, truck is allowed in the Container Terminal yard and receives the container.

If the Truck company cancels the time slot the flow is interrupted.

Postconditions
Trucker prints the PDF attached in the confirmation email, to have the QR ready for scanning.

4.2.3 Statistics for THPA Prediction

ThPA collects operational data from several internal applications; in this case the Terminal Operating System (TOS), the Truck Appointment System (TAS), and the Gate Access System. What is presently missing, is a 'fusion' of all this data, to get more meaningful information. Through DataPorts solution, these data can be combined to produce statistics while metrics and KPIs, calculated via the DataPorts Platform can provide valuable insight of operations performance to the Terminal Operator. The Terminal Operator can then decide on any corrective measures, if necessary (i.e., if the discharge of the vessel is taking more than expected, he can allocate another Ship-to-Shore (STS) crane, to countermeasure the delay). Operational data coming from the TOS (Terminal Operating System) includes information about a ship call – time the vessel arrived at / left the dock, compared to scheduled time declared (by shipping agent). The ‘scheduled’ times are sent to THPA (and stored to the TOS database) with a CALINF XML message, through THPA’s e-Document submission system. Additionally, the ‘scheduled’ time of arrival can be checked against the date/time the shipping agent also declared separately by the agent (in a separate web form), that is also published at THPA’s website. The latter information is often more up to date, as shipping agents usually first fill the form and send the CALINF days later.

Moreover, data on flow of trucks can be added – for this, the Truck Appointment System (TAS) and the Gate Access System will provide information, on trucks bookings (to pick-up or drop-off containers) and ‘actual’ passes from the Gates, respectively.

Actors	Roles
THPA Terminal Operator	Accessing produced statistics through the platform
TOS	THPA’s Terminal Operating System. The application that keeps operational data such as vessel arrival, containers unloaded/loaded, etc
TAS	THPA’s Truck Appointment System. The application that is used for trucks booking slots to deliver or pick up containers
Gate	THPA’s Gate application, recording passes of vehicles in real time.

Table 15 - Statistics for THPA Prediction Actors

Precondition
Input: time of berth, total time of operations, resources required (machinery/staff/energy), no of drawbacks (machinery failure, mis-position of container).

Trigger
Terminal Operator accessing DataPorts platform.

The main flow of this scenario is:

- TOS sends data on vessels (embarkation, disembarkation) to DataPorts
- TAS sends data on bookings to DataPorts
- Gate System sends data on (vehicles) passes from Gates to DataPorts
- THPA Operator requests statistics
- DataPorts calculates statistics
- THPA Operator views statistics
- THPA Operator evaluates info

If the data set for metric required by the Operator is not available, then the workflow is interrupted.

Postcondition
Productivity of berth and patterns definition. Operational insight to provide the basis for decisions of Strategic interest, such as future investment/procurement of funds.

4.2.4 Queues Predictions

Data that is stored in the port, from various sources and types, can be combined to estimate traffic in and around the port premises, in relation to its operations. Through the Dataports solution, the Terminal Operator can get queues predictions. As all movement to/from the Port is directly related to its activities, operational data will be used, more specifically:

Data coming from the TOS (Terminal Operating System) includes information about a ship call – time the vessel arrived at / left the dock, compared to scheduled time declared (by shipping agent). The 'scheduled' times are sent to THPA (and stored to the TOS database) with a CALINF XML message, through THPA's e-Document submission system. Additionally, the 'scheduled' time of arrival can be checked against the date/time the shipping agent also declared separately by the agent (in a separate web form), that is also published at THPA's website. The latter information is often more up to date, as shipping agents usually first fill the form and send the CALINF days later.

Also, vessel calls for the Conventional Cargo are a factor (since loading/unloading bulk cargo also involves trucks entering/exiting the port), so data from the Statistics application will be used.

Moreover, data on flow of trucks can be added – for this, the Truck Appointment System (TAS) and the Gate Access System will provide information, on trucks bookings (to pick-up or drop-off containers) and 'actual' passes from the Gates respectively.

Data related to trucks movement will come from two sources, the Truck Appointment System (TAS) and the Gate Access System. TAS provides the number and distribution of bookings through the day, and thus gives

a picture of what is expected in the near future, and GAS has the 'real' info, vehicles actually crossing the Gates.

The idea is that, when fed with all this operational data, for a period, DataPorts will recognize patterns that will help make predictions. An example would be, when vessel X (traditionally involving many moves loading/unloading) calls, historically queues peak Y hours later, as trucks book/arrive to pick-up containers (or bulk cargo).

Actors	Roles
THPA Terminal Operator	Accessing produced analytics & predictions through the platform
TOS	THPA's Terminal Operating System. The application that keeps operational data such as vessel arrival, containers unloaded/loaded, etc
TAS	THPA's Truck Appointment System. The application that is used for trucks booking slots to deliver or pick up containers
Gate	THPA's Gate application, recording passes of vehicles in real time.

Table 16 - Queues predictions actors

Precondition
DataPorts platform is 'fed' with enough historical data, to be able to recognize patterns and thus predict queues.

Trigger
Terminal Operator accessing DataPorts platform.

The main flow of this scenario is:

- TOS sends data on vessels (embarkation, disembarkation) to DataPorts
- TAS sends data on bookings to DataPorts
- Gate System sends data on (vehicles) passes from Gates to DataPorts
- THPA Operator requests statistics
- DataPorts calculates predictions of queues
- THPA Operator views queues predictions

If the data set for metric required by the Operator is not available, the workflow is interrupted.

Postcondition
Terminal Operator is aware of the movement of vehicles in and around port premises

4.2.5 Facilitation of Passengers, Professionals, and Visitors of the Port

Through the DataPorts solution, when visitors or professionals visit the port, they may enter the DataPorts platform to evaluate the surrounding traffic in the port premises. Different users, with diverse needs, result in different time intervals or comfort conditions. A professional with an arranged appointment in or around

the port (where a great number of offices and businesses are) will want to assess the traffic conditions and parking spots in the area, to avoid coinciding with passengers or trucks disembarking. On the other hand, a professional that wants to set an outdoor exhibition to promote his products/services, will want to "exploit" the disembarking of people in the port premises, while avoiding days of trucks discharging in the area. The platform "returns" information such as traffic and time required to reach the port premises. If the visitor is to reach the port premises for travel, suggestions of itinerary, parking spots, points of interest and choices of means, can be returned.

Actors	Roles
THPA	Providing mobility analytics through its web informative system
Visitors and professionals	Accessing the web informative system
CERTH	Service provider. Runs algorithms on mobility information
OTE	Mobility data provider. Sends the mobility data

Table 17 - Facilitation of passengers, professionals and visitors of the port actors

Preconditions
Mobility data (OTE) is available, data analysis, uploaded to THPA web page.
Queues predictions (see section 4.2.4 use case "Queues predictions") are available
THPA parking space statistics, for availability of parking slots inside the port premises

Triggers
Professional/visitor accesses the web page.

The main flow of this scenario is:

- OTE sends mobility data to CERTH
- OTE adds mobility metadata to DataPorts
- THPA sends parking availability data to CERTH
- THPA adds parking availability metadata to DataPorts
- CERTH runs algorithms to calculate mobility info and predictions
- CERTH adds mobility info metadata to DataPorts
- THPA gets notification from DataPorts for available mobility info, publishes on webpage
- Professional accesses produced mobility predictions through webpage
- Professional decides on actions on specific dates

Postconditions
Prediction – analysis of THPA visitors per day/time/month, available through web page and alternatively through a mobile app that will be developed for that purpose.
Combined statistics from multiple sources

4.2.6 Statistics for Passengers/Visitors - Covid-19

Due to the unforeseen impacts of Covid-19, ThPA as part of its CSR (Corporate Social Responsibility), wants to provide data on mobility to serve as indicators for social distancing. Through the DataPorts solution, this can be accomplished, using mobility data provided by OTE.

Actors	Roles
THPA	Providing mobility analytics through its web informative system
Passengers, Visitors and professionals	Accessing the web informative system
CERTH	Service provider. Runs algorithms on mobility information
OTE	Mobility data provider. Sends the mobility data

Table 18 - Statistics for Passengers/Visitors - Covid-19 actors

Preconditions
Mobility data (OTE) is available, data analysis, uploaded to THPA web page.

Triggers
User accesses the web page, chooses area of interest.

The main flow of this scenario is:

- OTE sends mobility data to CERTH
- OTE adds mobility metadata to DataPorts
- THPA sends parking availability data to CERTH
- THPA adds parking availability metadata to DataPorts
- CERTH runs algorithms to calculate mobility info and predictions
- CERTH adds mobility info metadata to DataPorts
- THPA gets notification from DataPorts for available mobility info, publishes on webpage
- Passenger accesses produced mobility predictions through webpage. Alternatively, they can download a mobile application if they want to access this information directly and get personalized information and notifications. A mobile app will be developed for that purpose
- Passenger decides whether to visit the Port premises or not

Postcondition
Prediction – analysis of THPA visitors per day/time/month, available through web page and alternatively through a mobile app that will be developed for that purpose.

4.3 GLOBAL USE CASES: SMART CONTAINERS

During any given container trip, many transport operators are involved, and no single one has total door-to-door visibility. Hence, as a common asset, a container—once equipped with smart technologies—will enable stakeholders to have better visibility based on additional reliable physical data generated by IoT devices.

Visibility enables actors to enhance their processes, resulting in the reduction of transport lead time and costs.

A “Smart Container” is a marine shipping container, which is fitted with an installed smart monitoring device. A “Smart Device” (aka, IoT device) is an electronic device embedded with a set of sensors, enabling it to measure real-time information such as identifying location, door opening and closing, vibrations, temperature, humidity, and any measured physical parameters of the surrounding environment of the container. The smart device has a communication capability, which enables it to send out the measured data to a collection centre. Using the Smart Container data, new services could be generated: an example is the ETA of the container, which can be compiled based on the current position of the container and the time estimated to get to the next place (e.g., zone of interest).

The use of Smart Containers within the supply chain provides benefits in many ways to the various transport chain stakeholders. The Smart Container provides a complementary source of information for traffic management and traffic management information provides for a better understanding of what movements and operations have occurred linked to the containers. This means that additional awareness of which containers are on the move, their status, as well as opportunities to detect forgotten or delayed ones, can be derived. Smart Container data enables the supply chain stakeholders to understand, predict, anticipate, and take corrective actions to adjust their plans based on well-informed decisions.

In this Section, we explore how different port stakeholders can benefit from the integration of Smart Containers data in the DataPorts platform.

4.3.1 Global Use Case – Tracking containers using IoT devices

In this use case, regular containers will be fitted by IoT devices provided by Traxens. These IoT devices will periodically generate and communicate GPS position, informing about the position of the container at a given time.

A container trip plan is an end-to-end routing from first pick-up to last drop-off of the Smart Container. A Trip (voyage, journey) may consist of multiple Segments (a.k.a. legs) or may only be a single Segment. The endpoints of the segments are geographical areas which are a predefined Zones of Interest (ZOI) relevant for tracking a container or other transport equipment/means, along the supply chain.

The geofencing capability is the crossing in/out of a predefined, geofenced Zone of Interest.

By making use of the GPS positions transmitted by the Smart Container and having geofenced key ZOI, it is possible to receive notifications when the position of the subject Smart Container intersects with the geofenced area.

In addition, knowing the next ZOI, it is possible to calculate an estimation of the Estimated Time of Arrival (ETA) based on the distance between the current position of the container and the target area (the next ZOI).

The Smart Container services can be used globally by any stakeholder participating in port operations involving containers. As an example, they are considered in detail in the Use Case description in Sections 4.1.1 and 4.1.2. Those scenarios use data coming from various systems, including the Smart Containers services described in this Section. Moreover, a sample scenario is presented in Section 4.3.2.

In this global use case, Smart Container solutions provide three types of services to the supply chain stakeholder who will be empowered to react proactively and plan container operations or cargo logistics accordingly.

Service 1: The Gate In/Gate Out to a well-defined geographical zone

A message with the Gate In/Gate Out of the container from a given position can be sent out to the identified actors. When an empty Smart Container enters/departs the premises of a depot, this event can be reported to the container operator and all interested parties. This event reported by the Smart Container might be

duplicate to the event that the depot operator should send out, typically by EDI message CODECO, for the same container. Making use of the GPS positions of the Smart Container and geofenced Zone Of Interest (ZOI) identified as a particular depot, the tracking solution will detect entering/departing this given ZOI and generate the Empty gate-in/gate-out at Depot event. As an example, the container operator will be able to check whether the container is back to the depot or has left the depot and at what time without having to go check the container physically.

Service	Zone of Interest Get In/Get out
Data Transmitted	Container ID, timestamp, GPS, ZOI ID: The place of the event per the UN/LOCODE (if any such Terminal code, Depot code, GS1 Global Location Number (GLN), etc.), Boolean (IN/OUT)

Table 19 – Zone of Interest Get In/Out service

Service 2: The ETA at the next zone of interest

A message with new Estimated Time of Arrival (ETA) at the next planned point or approaching final destination can be transmitted periodically or upon request. ETA is an estimation of arrival time based on actual time and distance to the next planned point. Being informed and situationally aware is essential to effectively plan operations. The utilization of Smart Container tracking solutions provides stakeholders at key delivery points with meaningful data and updates regarding the ETA of the container. The message receiver can the react proactively and plan container operations or cargo logistics accordingly.

Service	ETA at the Next Zone of Interest (ZOI)
Data Transmitted	Asset ID, Polygon: a set of GPS positions (latitude and longitude) representing the next Zone of Interest (ZOI) as defined in the trip plan by the consignee: it could be the transhipment point or the final place of delivery), Calculated ETA of the next ZOI The place of the event per the UN/LOCODE (if any such Terminal code, Depot code, GS1 Global Location Number (GLN), etc.), GPS position, Timestamp of the trigger event,

Table 20 – ETA at the Next Zone of Interest service

Service 3: Container Status Message

The Smart Container data might be communicated to the cross-border agencies to enable them to include physical data in their risk assessment even before arrival. The individual authorities define which data they require for their risk assessment. Cross-border agency Speed up operational clearance, reduce unexpected delays, improve data quality/visibility, and increase reliability of time schedule. Benefit also for the cross-border agencies to have more efficient operations.

Before a container arrives at a border, the transport organizer or the shipper declares to customs the intended routing of the container from the place of stuffing (origin) to the place of stripping (final destination)

along with the appropriate transport references (such as the bill of lading, the air waybill, the CMR, the booking ID, …), the operator code and the container number for identification. When the Smart Container passes through a ZOI (before the ZOI at the border), this information goes to the cross-border customs to start the risk analysis. The arrival of a Smart Container at the border will trigger sharing with the agency the required digital documents and send various Smart Container information such as all known geofences that it has been through since the point of origin (where it has been) and possibly the GPS positions of the unexpected door opening detections during the whole trip. As a result, the Smart Container may already be cleared when it arrives at the border.

The following table summarises the data that will be provided by the Smart Container solution along with other data sources as part of the container status message.

Service	Container Status Message
Data Transmitted	Container ID, History of container usage, Door opening detection Alerts, Long last stops, ETA, Actual Executed Transit Time, Alerts

Table 21 – Container status service

4.3.2 Using Smart Container data in the Port of Thessaloniki

Containers are intermodal (e.g., the door-to-door trip relies on several different modes of transportation: ocean freight, air freight, rail, trucking) by definition, and the terminals are the place where they change transportation modes. Hence, having access to reliable physical data on the trip execution using the Smart Container technologies can help improve the door-to-door trip and the scheduling of port operations

For example, thanks to the Smart Container solutions, Shipping Agent can gain valuable knowledge on the exact whereabouts and status of their container, enabling them to improve their logistics. By receiving a notification that the container has been unloaded from the ship, the Agent is enabled to proceed to dispatch a truck to pick it up at the optimal time. On the other hand, container terminals play an instrumental role in the movement of containerized cargo from consignor to consignee. Smart Container solutions will enable terminal operators to verify the exact location of each container in their yard efficiently, and in real time.

The ship agent is responsible for handling shipments and cargo and act on behalf of their customers: the Beneficial Cargo Owners. Hence, the ship agent needs to have the most complete and timely information about the consignment to take the right decision in a timely manner and perform their work in the mist efficient way. Today, the ship agent has very limited information about the consignment during the door-to-door transportation process resulting in limited actions in case of occurrence of any incident negatively impacting the consignment. The availability of Smart Container information in the Dataports platform will empower the ship agent to take an active role in mitigating negative circumstances in a timely manner based on factual physical data. In general, even when no negative incident occurs, having Smart Container data will allow the ship agent to make decisions to optimize the handling of the shipment which may result in reduction of lead time, including in the customs clearance process. Having Smart Container data may also decrease cargo loss, legal costs, insurance fees and investigation processes and damage to goods. At the same time, door-to-door visibility may result in increased cargo security; better service level, on-time deliveries since the processes flow better.

DataPorts will be able to provide Smart Container data to the shipping agents. The agent can have access to the data related to their containers and act if needed (i.e., container misplaced, door opening detection outside of depots, etc.). In addition, a message with the Gate In/Gate Out of the container from the port premises, can be sent out to the identified ship agents. This will be computed based on cartography data, the GPS positions of the Smart Container and geofenced Zone of Interest –ZOI, (i.e., port premises) Port, the tracking solution will detect entering/departing and generate the Empty gate-in/gate-out message.

The status of the container (i.e., door opening) is a functionality of DataPorts can be useful for THPA in potential disputes. Since the Smart Container detects any unexpected door opening during the whole trip, in an event of such an unauthorized opening, data from THPA's TOS (regarding the container's stay in the yard), can be cross-checked with the data sent by the IoT device, to verify exact time and location of the event, thus settling THPA's responsibility or not.

In this use case, both the Shipping Agent and the Port Authority benefit from the use of Smart Containers.

Actors	Roles
THPA	The container enters its premises, so it is responsible for its handling. THPA will be able to see all Smart Container presents in their defined geographical area (Zone of Interest delimiting the port and /or a given terminal)
The Shipping Agent	The ship agent is responsible for handling shipments and cargo and act on behalf of their customers. The Shipping Agent will be able to get information only on containers that belong to them.
TRAXENS	IoT Service providing allowing the supply chain stakeholders to gain insight about the physical trip execution, the container movements, and the conditions under which the goods got transported.

Table 22 - Using Smart Container data in the Port of Thessaloniki actors

Preconditions
The container is equipped with an IoT device. The device is working properly which means, it has enough energy an access to communication services. In addition, sensors are not faulty and have not been tampered with
The IoT device can communicate.
The IoT device is within the defined geographical zone of interest.
Shipping agent has registered to DataPorts platform to access the information.

Triggers
For the Getting In/Getting Out service/ the definition of the geographical zone.
THPA and Shipping agent will have a similar view, so this scenario is triggered when either THPA or Agent logs in to DataPorts platform.

The main flow of the use case is:

- From TRX end, the IoT device installed on the container will generate tracking and monitoring data related to the execution of the physical trip which will be then transmitted to the TRAXENS platform in near real time for further analysis, alerts, or general reporting. This data will be available in the DataPorts platform as three different services: a timestamped Gate in/Gate out of a given container, the ETA of a given container and its status message.
- The authorised shipping agents can get access to the ETA of their containers via the DataPorts platform. Indeed, they are interested in knowing the ETA of the container to organize the pickup at the destination port and to schedule any needed handling operations such loading /unloading the container and having the depots ready if it is needed.
- The authorised shipping agents can get access to the Gate in/get out messages of their containers via the DataPorts platform. Indeed, they are interested in getting the timestamped message of the Gate in/get out of the container, so they have evidence on the arrival of their container at a given geographical zone.
- The authorised shipping agents can have access to the status messages of their containers via the DataPorts platform. Indeed, they are interested in having access to the container status message to be able to delineate the responsibilities of the different players involved in the multimodal trip and act accordingly.
- The ThPA can have access to the ETA of a given container. Indeed, ThPA are interested in knowing the ETA of the containers to better plan their operations including scheduling container loading/unloading from and to the ships.
- The ThPA are interested in knowing the get in/get out message to be able to have a precise view of the container that are still on their premises and under their responsibilities.

Postcondition
The Smart Container stakeholders have access to regular events and alerts generated by the container including timestamped GPS position, and timestamped door opening detections.

4.4 GLOBAL USE CASES: PORT MANAGEMENT SYSTEM INTEGRATION

This use case is focused on the integration of a Port Management System with the DataPorts platform. The chosen one is the Posidonia Port Solutions software, owned by Prodevelop, that is a suite whose modules can be deployed separately or together and cover the vast majority of a Port Authority's management processes.

Due to the condition of a modular suite of different applications, there are many data sources providing data for various kinds of processes, and although there are some existing mechanisms to share and sync information between them, this information is not always available and even less often for external stakeholders.

DataPorts is a data platform that can solve this problem providing the components to make it possible and easier the sharing, also the trading, of the data processed by the Posidonia Port Solutions suite with other stakeholders.

The task where the objective of this use case is described says:

*This task involves two global use cases that **will showcase the potential of the integration of DataPorts with existing IT solutions** (containers tracking devices and **port management system**) to provide end-to-end and inter-ports data driven connectivity. [..] **Initially**, the task will focus on a first integration of DataPorts platform with TRX and PRO solutions at port level, **involving Valencia and Thessaloniki ports**. **In a second stage**, the scope will be enlarged to **include** all **ports where those solutions are present**.*

So, this use case will have two stages:

1. Integration of the management system in the ports of Valencia and Thessaloniki.
2. Integration of the management system in other Port Authority where they are already using the Posidonia Port Solution suite.

Below are described the two parts.

4.4.1 Vessel events notifications

This scenario involves the ports of Valencia and Thessaloniki, where the port management system will be integrated with the DataPorts platform.

Since there is not a Posidonia module already working in these ports, this case requires the deployment of Posidonia Operations, a comprehensive Port Operations Management System that allows a port to optimize the maritime activities related to the flow of vessels within the port's service area, it both ports and the subsequent integration of the data processed by the application in the ports' ecosystem.

Every day at the ports, when a vessel enters the port services area, many activities related to its flow and port operations take place. Posidonia Operations is a solution that processes and centralises all this information by detecting events corresponding to the life cycle of a vessel in port. Once Posidonia Operations is deployed and configured in a port, these actions and service events will be captured by the application, that will process the information from different sources like the AIS radar of the ports and the ports' cartography. The output of this task is the source data for the Posidonia Operations solution, whose user interface helps the operations department of the port to monitor and manage these events.

With the integration of the application in DataPorts, this information will be published into the platform becoming an available data source included in the platform's catalogue. For that reason, the input data will be translated to the semantic ontology through the transformation of the events with the Posidonia data structure into the expected data models. This will ensure that other services already prepared to work with the same ontology, provided by the platform itself or by other organizations, can use this data as it is stored or published.

Once this information is available, it will be accessible under the governance rules and security environment provided by DataPorts. At this point, the organizations that are interested in this data will have the opportunity to negotiate the access to this service. In this case, under the project scope, the ports of Valencia and Thessaloniki will subscribe to this information for free to integrate some of the events in their own scenarios.

The events that are included in the subscriptions to the data source through the DataPorts sharing features are depicted in the following tables (Table 23 – Vessel events notifications AIS status signals, Table 24 - Vessel events notifications Vessel actions, Table 25 - Vessel events notifications Services). More details can be found in the Annexes:

AIS signals	Descriptions
AIS_IN / AIS_OUT	Vessel detection within / out of range of the AIS station
AIS_SWITCHED_ON / AIS_SWITCHED_OFF	The AIS signal is enabled (it was OFF) / disabled (it was ON)
AIS_FREQUENCY_TOO_LOW	Too much time between AIS messages

Table 23 – Vessel events notifications AIS status signals

Vessel actions and positions	Descriptions
WAYPOINT	Vessel crossing a detection point, line or zone
STOP_OVER_IN / STOP_OVER_OUT	Entering / leaving port or pilotage server zone
ANCHOR_IN / ANCHOR_OUT	Anchoring start / end
ANCHOR_IN_START	Anchored vessel begins to move without leaving the anchor area yet
ANCHOR_REIN	Vessel detection in anchoring area where previously anchored but never left
ANCHOR_OUT_ASSUMED	Assumed anchorage end
DOCK_STOP / DOCK_START_OUT	Berthing start / end
DOCK_STOP_START	Docker vessel begins to move without leaving the dock yet
DOCK_APPROACH	Vessel near a dock
DOCK_RESTOP	Change of dock
FORBIDDEN_ANCHOR_IN	Start anchoring in forbidden area
CONTROL_ZONE_IN / CONTROL_ZONE_OUT	Control area entry / exit
SPEED_LIMIT_EXCEEDED	Max speed exceeded

Table 24 - Vessel events notifications Vessel actions

Services	Descriptions
PILOT_START / PILOT_AWAY	Pilotage start / end
TUG_START / TUG_AWAY	Towing start / end
OIL_START / OIL_STOP	Bunkering start / end

Table 25 - Vessel events notifications Services

At this point there will be at least two different stakeholders, one from each of the ports. The usage of the data is described separately for them as they manage different objectives.

4.4.1.1 Using vessel events data at the Port of Valencia

In the Valencia Port Authority, VPF is leading the scenario Tracking of Transport Operations (4.1.1) that uses data coming from various systems and used as described in its own section. One of the sources to which the users of the scenario are subscribed is Posidonia Operations. In the Table 26 - Using vessel events data at the Port of Valencia actors there are included some of the stakeholders that may use the data provided by the application:

Actors	Roles
Posidonia Operations	System that is going to be integrated with DataPorts. Processes and provides the data from the vessels to the platform
Posidonia Administrator	Responsible of setting the access rights of the data and the conditions of its availability.
Freight forwarder	Interested in the arrival to the port or destination berth. Port areas can be defined in order to trigger these events.
Importer/exporter	Interested in the arrival to the port or destination berth. Port areas can be defined to trigger these events.
Port Authority and services enterprises	Some of the services are managed by specialized companies and DataPorts is the perfect platform to share service events with all of them. For example, the pilotage start and end of service, and the same for the towage and the bunkering.

Table 26 - Using vessel events data at the Port of Valencia actors

Preconditions
The AIS radar is working and available for Posidonia Operations.
Posidonia Operations is active and working as expected.
The DataPorts platform components are deployed, and the platform is active.
The required DataPorts components are created or prepared. The data source has been registered in the platform and its privileges and access rules have been configured.

Triggers
This scenario starts when a message coming from the AIS radar is processed by Posidonia Operations.

The main flow of this scenario is the following. When an AIS message is processed by Posidonia Operations, the solution will translate and enrich the information included. The application will send this data to the DataPorts platform.

DataPorts must be able to receive messages from Posidonia Operations and share them with the stakeholders that are subscribed to this kind of topics.

So, the steps of the scenario are:

- The Posidonia Administrator registers the Posidonia Operations data source in DataPorts so it is included in the platform's data catalogue and available for subscriptions.
- Stakeholders in the Port of Valencia subscribe for the Posidonia Operations events: Freight forwarder, importer/exporter and the Port Authority.
- DataPorts validates that the subscription is valid depending on the access rights that have been previously set up.

- Posidonia Operations receives an event from the AIS radar, translates and processes it building the final message with enriched content.
- Posidonia Operations publishes, using the mechanisms provided by DataPorts, the message to the platform.
- DataPorts uses its semantic interoperability tools to transform and homogenize the message content.
- The platform searches for the subscribers that have valid access rights and provides them with the data.
- Data is sent to the found subscribers under the specified conditions.
- The usage of the data is described in the Valencia Port's scenarios Container and Goods Tracking (4.1.1) and Transport Operations (4.1.2).

Postconditions
As part of other scenarios, the result here is that the stakeholder receives the data of the event from DataPorts.
More results are defined in the Valencia use cases Container and Goods Tracking (4.1.1) and Transport Operations (4.1.2)

4.4.1.2 Using vessel events data at the Port of Thessaloniki

In the Port of Thessaloniki, data from the Posidonia Operations data source will be combined with the results of the Statistics for THPA predictions (Section 4.2.3) scenario for the improvement of the port's operations.

The Terminal Operator will have the ability to know in real-time the exact time a vessel berthed / sailed, and can draw conclusions on operational aspects, such as efficiency of operations, observe patterns (i.e., a vessel of certain size, that docks on a certain Pier, carrying a certain cargo, spends X time at berth, takes X amount of time and X resources to be loaded/unloaded) and take corrective measures if needed (i.e., allocate additional equipment to speed up operations). This will be achieved by combining the vessel events from the platform, with THPA Operational data from THPA's "Statistics" application. Also, by combining data from these two sources, the Terminal Operator may be able to spot the existence (and extent) of potential inconsistencies between berth / operations time from the events processed by Posidonia Operations and retrieved from the DataPorts platform vs the "Statistics" application, which is data filled at a later stage by tallymen.

Actors	Roles
Posidonia Operations	System that is going to be integrated with DataPorts. Processes and provides the data from the vessels to the platform
Posidonia Administrator	Responsible of setting the access rights of the data and the conditions of its availability.
THPA Terminal Operator	Getting the events from the platform

Table 27 - Using vessel events data at the Port of Thessaloniki actors

Preconditions
The AIS radar is working and available for Posidonia Operations.

Posidonia Operations is active and working as expected.
The DataPorts platform components are deployed, and the platform is active.
The required DataPorts components are created or prepared. The data source has been registered in the platform and its privileges and access rules have been configured.
THPA operational data from Statistics application are available.

Triggers
A message coming from the AIS radar is processed by Posidonia Operations.
Terminal operator logs into the statistics application, requests for data.

The main flow is very similar to the flow already described for the Port of Valencia. Data will be processed and published in DataPorts the same way, but witch different stakeholders and goals.

So, the steps of the scenario are:

- The Posidonia Administrator registers the Posidonia Operations data source in DataPorts so it is included in the platform's data catalogue and available for subscriptions.
- Stakeholders in the Port of Thessaloniki subscribe for the Posidonia Operations events: terminal operator and the Port Authority.
- DataPorts validates that the subscription is valid depending on the access rights that have been previously set up.
- Posidonia Operations receives an event from the AIS radar, translates and processes it building the final message with enriched content.
- Posidonia Operations publishes, using the mechanisms provided by DataPorts, the message to the platform.
- DataPorts uses its semantic interoperability tools to transform and homogenize the message content.
- The platform searches for the subscribers that have valid access rights and provides them with the data.
- Data is sent to the found subscribers under the specified conditions.
- THPA Terminal Operator logs into the system looking for statistics.
- THPA Terminal Operator may filter to see info / events of one or more vessels / docks, etc.

If for any reason Posidonia is not able to process data and share it with the platform, then the logs of the applications and the platform will be reviewed, but there is not a concrete list of actions or work flow defined when something goes wrong.

Postconditions
Data of Posidonia Notifications of the Port of Thessaloniki is available in the DataPorts platform for subscribing.
Data of the vessel events is available in the THPA Statistics Application.

4.4.2 Posidonia Notifications

In this other scenario the second stage is evaluated. So, the integration with the platform is repeated in another port where modules of Posidonia Port Solution are already part of the port's ecosystem, and where the required DataPorts platform components will be integrated.

This scenario has many similarities with the previous one described in the point 4.4.1. Posidonia Operations will be registered in DataPorts as a data source but also another solution of the Posidonia suite will be included: Posidonia Management, a software conceived and designed to fulfil the management need of the different Port Authorities improving their efficiency, productivity, and competitiveness.

In the same way as in the main pilot ports, data will be published from these solutions to DataPorts, that will process and add the information as an available data for access under the platform established rules and security measures.

In addition to the events described in the previous scenario, the events that are included in the subscriptions to the data source through the DataPorts sharing features coming from Posidonia Management are included in the Table 28 – Posidonia Management events. More details can be found on the data sources section.

Events	Descriptions
Stopover Authorization	When a visit is authorized by the Port Authority
Stopover Start	When the visit starts
Stopover End	When the visit ends
ETA Update/change	ETA has changed
ETD Update/change	ETD has changed
Manifest Activation	Cargo manifest has been activated

Table 28 – Posidonia Management events

In this case, there is another Posidonia application that will subscribe for these events through the sharing mechanisms of DataPorts: Posidonia Notifications, a software to be developed for the management of alerts and communications for all kind of users, from Posidonia Port Solutions clients to external stakeholders without the required resources for the platform integration.

Under the project demonstration, the publication of the events and the access to them in this second stage scenario will be free of charge.

For this purpose, a user of Posidonia Notifications will subscribe the application topics, that are directly related with the events available in the DataPorts platform, and so alerts will be created and listed in the application while forwarded to the user's email.

Actors	Roles
Posidonia Operations	System that is going to be integrated with DataPorts. Processes and provides the data from the vessels to the platform
Posidonia Management	System that is going to be integrated with DataPorts. Processes and provides the data from vessel stopover

Actors	Roles
Posidonia Administrator	Responsible of setting the access rights of the data and the conditions of its availability.
Posidonia Notifications	System that will subscribe for previous mentioned data sources updates and create the alerts for the application users
Port Authority	Will receive notifications about the services start and end.
Terminal Operator	Will get information about changes in the ETA of the vessels.

Table 29 – Posidonia Notifications actors

Figure 2 – Posidonia Notifications scenario illustrates the components involved in the use case:

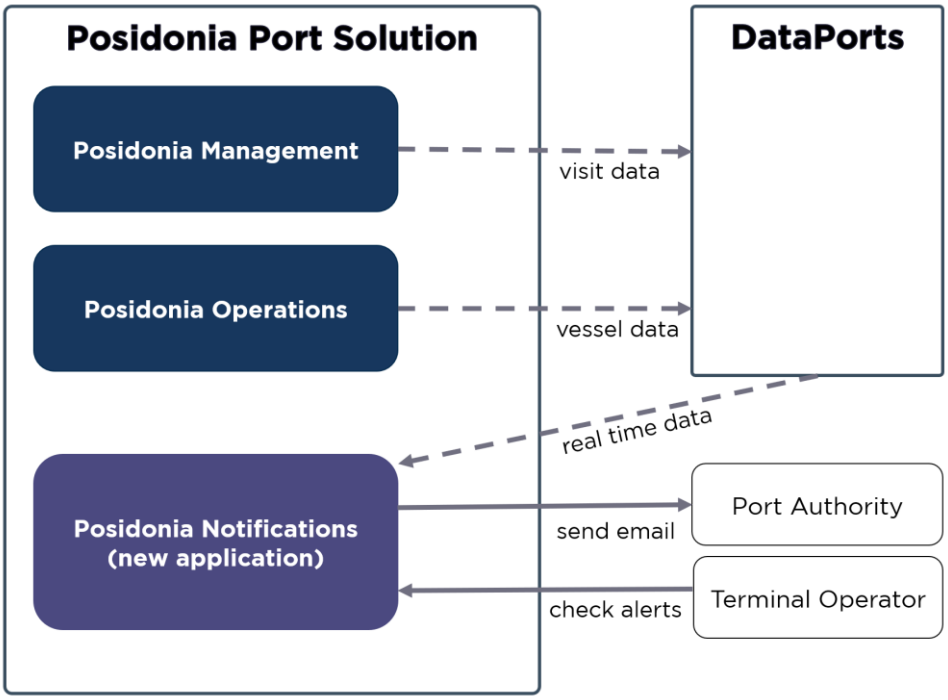


Figure 2 – Posidonia Notifications scenario

Preconditions
The AIS radar is working and available for Posidonia Operations.
Posidonia Operations is deployed and running.
Posidonia Management is deployed and running.
Posidonia Notifications is deployed and running.
The required DataPorts platform components are deployed and running.
All systems are integrated and can be connected to the other systems of the platform.

Triggers
Posidonia Operations processes a vessel event.
Posidonia Management processes a vessel stopover event.

For the main flow we will start assuming that Posidonia Operations and Posidonia Management are two modules of the Posidonia Port Solution so they are two different data sources or event publishers of the same system, although they can be deployed independently and work standalone.

When an AIS message is processed by Posidonia Operations, the solution will translate and enrich the information included. The application will send this data to the DataPorts platform. The same for the events created from Posidonia Management.

DataPorts must be able to receive messages from both systems and share them with Posidonia Notifications, that would act as a data consumer.

So, the steps of the scenario are:

- The Posidonia Administrator registers the Posidonia Operations and Posidonia Management data sources in DataPorts, so they are included in the platform's data catalogue and available for subscriptions.
- Posidonia Notifications subscribes for both data sources using the DataPorts interfaces and services.
- DataPorts validates that the subscription is valid depending on the access rights that have been previously set up.
- One of the conditions that starts the process is triggered: an AIS message, an ETA that changes, a Cargo Manifest is activated.
- Posidonia Operations or Management publishes, using the mechanisms provided by DataPorts, the message to the platform.
- DataPorts uses its semantic interoperability tools to transform and homogenize the message content.
- The platform searches for the subscribers that have valid access rights and provides them with the data.
- The Posidonia Notifications subscription is found, and data is sent to the system.
- Posidonia Notifications receives notifications from DataPorts. These notifications are processed to notify the interested parties. Port Authority and terminal operators will use the application for alerts on ETA changes or vessel mooring events. For this to happen, previously, in Posidonia Notifications the interested parties register in the system and subscribe to topics[8] corresponding to events defined in the system and specify the channels through which they wish to receive the notifications. If they have not specified a channel, the system will assign a default channel. Also, the notifications or alerts will be available from the application's interface for the corresponding users.

When an exception occurs in the sending or receiving of an event message from Posidonia Operations or Posidonia Management, the latter are not notified of it.

If the exception occurs during the processing of a message coming from DataPorts in Posidonia Notifications, the exception is logged in the system.

[8] The topics correspond to events included in the notifications received.

Postconditions
Vessel event data detected and processed by Posidonia Operations and events corresponding to vessel stopovers processed by Posidonia Management are shared by DataPorts in near real time with stakeholders using common communication channels through Posidonia Notifications.
This means that an alert appears in the notifications list of the stakeholder and, in case email is selected as the desired communication channel, a message is sent to him.

5 CONCLUSIONS

The DataPorts platform is going to be integrated in the ports of Valencia and Thessaloniki, use cases and scenarios to demonstrate the platform's functionalities have been defined.

The main goal of this deliverable is to identify all the activities and steps that must be considered to achieve the expected integration. A complete list of tasks has been described along with the estimated time intervals where they should be performed.

The plan contains the following activities:

- Use case specification.
- Role definitions and assignment.
- Data access requirements.
- Data models definitions.
- Specification of required infrastructure.
- Implementation of the components, modifications, and new developments.
- Integration of the platform in the ports with all the other systems, applications, and data sources.
- And finally, security and quality assurance, and testing and evaluation (which are included in the roadmap but defined in other reports).

This plan of activities will be followed by all the project involved organizations, that will use the described tools to communicate with others and synchronize the progress of the tasks and their results.

The descriptions of the use cases that are going to be developed show the current processes where the platform is going to be integrated, including the organizations and stakeholders' descriptions, the interactions between them and other port systems. There are four use cases in the Port of Valencia and six in the Port of Thessaloniki, and two global use cases that will be implemented in both ports, providing information about Smart Containers and vessel events through the integration of a Smart Container platform and a port management system with DataPorts.

Next deliverable *D5.3 Use case oriented pilots initial version (M24)* will report activities carried out and status of the different developments of the pilots until M24.

6 REFERENCES AND ACRONYMS

6.1 REFERENCES

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6.2 ACRONYMS

Acronym List	
AIS	Automatic Identification System
CSR	Corporate Social Responsibility
DoA	Description of Action
eFTI	electronic Freight Transport Information
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure

Acronym List	
GPS	Global Positioning System
IT	Information Technology
OCR	Optical Character Recognition
QR	Quick Response Code
STS	Ship-to-Shore
TAS	Truck Appointment System
TEU	Twenty Foot Equivalent Unit
TOS	Terminal Operating System
UI	User Interface
ZOI	Zone Of Interest

Table 30 – Acronyms

7 ANNEX A: DATA ACCESS QUESTIONNAIRE

Pilot name
Use case name
Data source
Data source version
Data description
Data format
Data provider
VPN (Y/N)
Access control (Y/N)
Data Source Type
Data Access Type
Connection Type (as server / as client)
Sync frequency (real time / scheduled / on demand)
URL (API / SOAP / FILE PATH)
URL Description (Swagger / WSDL / Document)

8 ANNEX B: DATA SOURCES

8.1 PORT OF VALENCIA

This section contains the information about the data sources involved in the pilot. It will be updated in next deliverables *D5.3 Use case oriented pilots initial version (M24)* and *D5.4 Use case oriented pilots final version (M36)* with the inputs of the data sources questionaries.

8.1.1 Valenciaport PCS

The Port Community System of Valenciaport, is a system where companies are exchanging transactions to organize the container freight transport. Some of the data includes that is going to be used is:

- Information of the container trade.

GENERAL FEATURES	
Id	vlc_1_pcs_trade
Name	valenciaportPCS Trade
Description	An open and neutral electronic platform allows a safe and smart information exchange between public and private agents in order to improve our competitive position as a Port Community
Owner	Valencia Port authority
Classification	Commercially available
Type of data source	File system

DATA ACCESS	
Description	Direct Access
Authentication	No
User Access Controls	No
Periodicity	Annually
Connection type	-
Data format	DDBB File

DATA		
Field	Type	Description
Container	string	Container number
PortCallReference	string	PCS portcall code
ContainerOperationType	string	Load/Discharge?
ContainerType	string	ISO 6346
Full_Empty	string	Full/Empty
EquipmentStatus	string	Export/Import
ContainerGrossWeight	int	Weight
IsVGM	bool	True/False
CustomsDocument	string	Customs document
CustomsDocumentType	string	Type of document: DUA/DUE/DVD/ATA/JEC
CustomsStatus	string	Dispatched/Non Dispatched
ContainerDeliveryPlaceCode	string	International Port Code
ContainerNextPrevLoadDischargePortCode	string	International Port Code
ContainerDischargePortCode	string	International Port Code
TARIC	int	Goods type
CustomDocumentGrossWeight	Int	Weight (g)
Units	int	Number of units inside the container
CustomDocumentDestinationCountry	string	ISO code
CustomDocumentDestinationProvince	int	Postal code
CustomDocumentOriginCountry	string	ISO code
CustomDocumentOriginProvince	int	Postal code
PackageType	string	ICS Package code

PackageQuantity	int	Number of packages per container
PortIndex	int	Valencia (1), Sagunto (3), Gandia (2)
TARIC_N4	int	Goods category

- Information of the road transport operations. The data is anonymized.

GENERAL FEATURES	
Id	vlc_4_pcs_road
Name	valenciaportPCS Road
Description	An open and neutral electronic platform allows a safe and smart information exchange between public and private agents in order to improve our competitive position as a Port Community
Owner	Container transport companies
Classification	Commercially available
Type of data source	File system

DATA ACCESS	
Description	Direct Access
Authentication	No
User Access Controls	No
Periodicity	Annually
Connection type	-
Data format	DDBB File

DATA		
Field	**Type**	**Description**
CreationDate	datetime	Registry creation

ContainerNumber	string	Container number
ReleaseTruckPlate	string	Delivery truck plate
AcceptanceTruckPlate	string	Admision truck plate
Operation	string	Operation
ReleaseClosingTime	datetime	Delivery closing time date
ReleaseExpirationDate	datetime	Delivery expiration date
AcceptanceClosingTime	datetime	Admission closing time date
AcceptanceExpirationDate	datetime	Admission expiration date
ISOType	string	Container ISO code
ReleaseState	string	Edelivery status
AcceptanceState	string	Admission status
ReleaseCompanyName	string	Delivery company
AcceptanceCompanyName	string	Admission company
UnloadingBerthRequestNumber	string	Dischargue vessel portcall
LoadingBerthRequestNumber	string	Load vessel portcall
UnloadingVesselName	string	Dischargue vessel
LoadingVesselName	string	Vessel
EarliestLoadingUnloadingCity	string	Load/dischargue city
EarliestLoadingUnloadingPostalCode	int	Load/dischargue postal code
LoadDate	datetime	Load date
DischargeDate	datetime	Dischargue date
ReleaseDateEstimated	datetime	Delivery request date
ReleaseDateProposed	datetime	Delivery estimated date
ReleaseDateReal	datetime	Delivery real date

AcceptanceDateEstimated	datetime	Admission request date
AcceptanceDateProposed	datetime	Admission sestimated date
AcceptanceDateReal	datetime	Admission real date
Exit date	datetime	Truck exit date
Operation date	datetime	Truck operation date

- The consignment note data as it is being updated by relevant stakeholders (shipper, consignee, road haulier, container owner and empty container depot/terminal).

8.1.2 vForwarding

Software used by Freight Forwarder's companies, connecting their offices and operating in the air, road and sea freight transport. The data includes information of the transport such as type, origin port, destination port, or payment, and detail of the cargo such as weight, value, quantity, etc.

GENERAL FEATURES	
Id	vlc_3_vforwarding
Name	vforwarding
Description	Platform used by Freight Forwarder's companies, connecting their offices and operating in the air, road and sea freight transport
Owner	Container transport companies
Classification	Commercially available
Type of data source	Server system

DATA ACCESS	
Description	Direct Access
Authentication	User/Password
User Access Controls	Yes
Periodicity	Nearly real-time data

Connection type	Agent as server
Data format	JSON

DATA		
Field	**Type**	**Description**
Transport_Type	string	Type of transport
Registration	string	Container number
Ctn_typ	string	ISO 6346
Reefer	string	Reffer
Seal	string	Seal
pack_typ	string	ICS Package code
sum_quantity	int	Quantity
sum_gross_weight	int	Gross Weight
ud_weight	string	unit of measurement
sum_value_goods	int	Value of goods
currency_val	string	Currency value of goods
Descriptions_of_goods	string	Description of goods
Loading_port	string	Port of loading
Discharge_port	string	Port of discharge
Origin_airport	string	Airport From ISO
Destination_airport	string	Airport To ISO
Origin_Country	string	Origin Country ISO
Destination_Country	string	Destination Country ISO
Ship_comp	string	Shipping company ISO

Airline.iso	string	Airline ISO
Incoterm	string	Incoterm
Code	string	Vessel
Fligh_Number	string	Fligh number
Num_awb	string	AWB Number
Terms_of_payment	string	Terms of payment

8.1.3 TradeLens

Open and neutral supply chain platform underpinned by Blockchain technology. It allows true information sharing and collaboration across supply chains. The data includes information from the shipping lines, ports and other actors about the transport events.

GENERAL FEATURES	
Id	vlc_6_tradeLens
Name	TradeLens
Description	TradeLens is a Blockchain based platform used by all the stakeholders involved in the container transport to share reliable information about estimated and actual milestones for the shipments
Owner	Valencia Port Authority
Classification	Private
Type of data source	Server system

DATA ACCESS	
Description	Direct Access
Authentication	User/Password
User Access Controls	Yes
Periodicity	Nearly real-time data

Connection type	Agent as server
Data format	JSON

8.1.4 Port Platform

The industrial IoT platform in the port of Valencia managing several data sources coming from sensors, meters, and other industrial systems. The data includes information of the port gate accesses.

GENERAL FEATURES	
Id	vlc_2_portPlatform
Name	Port 4.0 platform
Description	Industrial platform that ports use managing several data sources coming from sensors and other industrial systems
Owner	Valencia Port Authority
Classification	Private
Type of data source	Server system

DATA ACCESS	
Description	Direct Access
Authentication	User/Password
User Access Controls	Yes
Periodicity	Nearly real-time data
Connection type	Agent as server
Data format	JSON

8.1.5 Port Management System

The management system used by the Port Authority of Valencia managing several data sources coming from port operations.

8.1.6 Customs Trade

Trade data summary provided by customs with some anonymization of sensitive data. The data includes information of the type of transaction, type of goods, origin destination country, weight, transport mode, delivery conditions, etc.

GENERAL FEATURES	
Id	vlc_5_customs
Name	Customs Trade
Description	Public trade data from Spanish customs
Owner	Customs
Classification	Public
Type of data source	File system

DATA ACCESS	
Description	Direct Access
Authentication	No
User Access Controls	No
Periodicity	Monthly
Connection type	-
Data format	Text File

DATA		
Field	**Type**	**Description**
Flow	string	Export/Import
Year	int	Year
Month	int	Month
Customs province	int	Postal code

Document admission date	int	AA/MM/DD
Statistics position	int	TARIC
I/D Declaration type	string	I=INTRASTAT D=DUAS
Additional codes	string	Additional codes
Origin / destination country	string	ISO code
Origin/Expedition country	string	ISO code
Origin / destination province	int	Postal code
Customs regime requested	int	Regime requested
Preceding regime requested	int	Preceding regime
Weight	int	Weight (g)
Unit number	int	Package quantity
Statistical value	int	Value (cents)
Invoice value	int	Value (cents)
Country currency	string	ISO 4217
Container	bool	Yes (1)/No (0)
Transport regime	string	Transport regime
Transport mode on borders	int	UNECE code
Country transport mode	int	UNECE code
Transport nationality	string	ISO code
Exchange zone (UE or third countries)	string	C = European Union T = Third countries
Transaction nature	int	Customs Transaction Nature Codes
Delivery conditions	string	Incoterms 2020
Contingent	int	Contingent Id within the Communitary

		Regulation (Not mandatory)
Tariff preference	int	Duty Regime
Vessel freight	int	Vessel freight
Fiscal address province	int	Postal code

8.1.7 Scale Operator

Provides the weight data from each container after it is measured.

8.2 PORT OF THESSALONIKI

This section contains the information about the data sources involved in the pilot. It will be updated in next deliverables *D5.3 Use case oriented pilots initial version (M24)* and *D5.4 Use case oriented pilots final version (M36)* with the inputs of the data sources questionaries.

8.2.1 Data from TOS

In THPA's Terminal Operating System, various operational data is kept, including vessels arrivals, loading/unloading times, containers loaded/unloaded, etc.

GENERAL FEATURES	
Id	THPA_1_CTMIS
Name	Terminal Operating system
Description	Data from Terminal Operating system
Owner	THPA
Classification	Restricted
Type of data source	Server-based

DATA ACCESS	
Description	Direct Access
Authentication	App user list (user/pass)
User Access Controls	Yes
Periodicity	Batch
Connection type	JSON text

Data format	DB data -> text

Data of containers

DATA	REQUESTED CONTAINER	
Field	Type	Description
ARRIVAL_DATETIME	Datetime	Date/Time the container entered the Container Terminal yard (unloaded from ship).
CONTAINER_ID	String	Unique ID of container
CTYPE_CODE	String	Type of container (Dry, Reefer, etc)
CSIZE_CODE	String	Size of container (20”, 40”)
LOADED	Bit	Whether container is laden with goods, or empty
VO_CODE_IMP	String	Voyage code
VESSEL_NAME_IMP	String	Vessel name
COMPANY_ID	String	Company – Shipping Line
COM_COMPANY_ID	String	Company – Shipping Agent

EXAMPLE	REQUESTED CONTAINER

	{
	"ARRIVAL_DATETIME":"2021-02-01 08:18:56.673",
	"CONTAINER_ID":"APZU3630825",
	"CTYPE_CODE":"PC",
	"CSIZE_CODE":"20",
	"LOADED":"1",
	"VO_CODE_IMP":"0TFAVS1MA",
	"VESSEL_NAME_IMP":"LANGENESS",
	"COMPANY_ID":"CMA",
	"COM_COMPANY_ID":"CMA",
	}

Data of vessels

DATA	VESSEL TIMES	
Field	**Type**	**Description**
vo_code	string	Unique ID assigned to a ‘voyage’
vessel_name	string	Name of vessel

arrival_date	Datetime	Actual date/time of berthing
departure_date	Datetime	Actual date/time of un-berthing
arrival_date_sched	Datetime	Scheduled date/time of arrival (ETA) (as declared by shipping agent)
departure_date_sched	Datetime	Scheduled date/time of departure (ETD) (as declared by shipping agent)

EXAMPLE	VESSEL TIMES

	{
	"vo_code":"ABX052S20",
	"vessel_name":"ROZA A",
	"arrival_date":"2021-01-12 10:26:13.050",
	"departure_date":"2021-01-14 19:23:15.773",
	"arrival_date_sched":"2021-01-04 08:00:00.000",
	"departure_date_sched":"2021-01-05 10:00:00.000",
	}

8.2.2 COREOR

GENERAL FEATURES	
Id	THPA_2_COREOR
Name	COREOR XML Message
Description	XML for Container Request Qrder
Owner	THPA
Classification	Restricted
Type of data source	Web

DATA ACCESS	
Description	Direct Access
Authentication	App user list (user/pass)
User Access Controls	Yes
Periodicity	N/A (when agents sends request)
Connection type	Web call

Data format	XML

DATA	COREOR XML MESSAGE	
Field	**Type**	**Description**
COREOR	String	[Not data, XML element tag]
Recipients_List	String	[Not data, XML element tag]
Port	String	Port receiving request (always ‘GRSKG’)
Company	String	Port Company receiving request (always ‘THPA’)
Header	String	[Not data, XML element tag]
Sender	String	ID of XML message sender (shipping agent)
EDI_Recipient_ID	String	[Not used]
Message_Code	String	Unique id of request
Message_Date	Date	Date message sent
Captain_Name	String	Captain (of vessel) name
Passengers_No	Int	Number of passengers
VO_Code	String	Unique ID of (vessel’s) voyage code
Ship_Name	String	Name of vessel
Ship_Arrival_Date	Date	Ship arrival date
Port_Origin	String	Port where container was loaded
Port_Destination	String	Destination Port
Message_Type	String	[Internal to THPA TOS]
Detail	String	[Not data, XML element tag]
Container	String	[Not data, XML element tag]
Primary_Agent	String	ID of shipping line / agent
Trucking_Company	String	ID of trucking company
SEQ_ID	Int	Detail sequence
Container_ID	String	Unique ID of container

Container_Type	String	Type of container
Container_Size	String	Size of container
IMO_Class	String	Type of (dangerous) cargo (zero if not)
Seal_No	String	Seal Number (by Customs)
Cargo_Type	String	Cargo type (description of goods)
Cargo_Weight	Int	Cargo weight
Handling_Date_Schedule	Date	Handling date schedule
Delivery_Date_Schedule	Date	Delivery date schedule
Origin_Code	Int	[Internal to TOS]

EXAMPLE	COREOR XML MESSAGE

```
<?xml version="1.0" encoding="ISO-8859-7"?>
<!DOCTYPE COREOR SYSTEM "http://fnet.thpa.gr/www/COREOR.dtd">

<COREOR>
      <Recipients_List>
            <Port>GRSKG</Port>
            <Company>THPA</Company>
      </Recipients_List>
      <HEADER Sender="997642" EDI_Recipient_ID=""
Message_Code="1201999297870"
            Message_Date="25/01/2021 09:19:37" Captain_Name="MAERSK"
            Passengers_No="4"
            VO_Code="XX" Ship_Name="XX"
            Ship_Arrival_Date="25/01/2021 08:30:00"
            Port_Origin="GRSKG"
            Port_Destination="GRSKG"
            Message_Type="1"
      />
      <DETAIL>
            <Container Primary_Agent="SATHREE"
            Trucking_Company="12345"
                  SEQ_ID="0" Container_ID="ABCU0000999"
                  Container_Type="PC"    Container_Size="40"
IMO_Class="0"
                  Seal_No="NONE" Cargo_Type="KENO"
Cargo_Weight="4000"
                  Handling_Date_Schedule="25/01/2021 08:30:00"
                  Delivery_Date_Schedule="25/01/2021 08:30:00"
                  Origin_Code="4"
            />
      </DETAIL>
</COREOR>
```

8.2.3 Truck Appointment System (TAS)

Data comes from the applications database.

GENERAL FEATURES	
Id	THPA_3_TAS
Name	Truck Appointment System
Description	Details of truck bookings
Owner	THPA
Classification	Restricted
Type of data source	Server-based

DATA ACCESS	
Description	Direct access
Authentication	App user list (user/pass)
User Access Controls	yes
Periodicity	Batch
Connection type	JSON text
Data format	DB data -> text

DATA	TAS	
Field	**Type**	**Description**
bookingNumber	integer	Unique ID of the booking
timeWindowID	integer	Refers to a system-specified time window (lookup)
bookDate	integer (to be interpreted as date/time)	Booking date
userID	integer	User
companyID	integer	Company

containersNumberExport	integer	Number of containers to drop-off to the CT yard (1 or 2)
containersNumberImport	integer	Number of containers to pick-up from the CT yard (1 or 2)
exportContainer1	string	Unique container ID
exportContainer2	string	Unique container ID
importContainer1	string	Unique container ID
importContainer2	string	Unique container ID
status	integer	Booking status (lookup)
changedBy	integer	User that changed (edited) the booking
changedDateTime	integer (to be interpreted as date/time)	Time of change
enterDateTime	integer (to be interpreted as date/time)	Actual time of entering
origTimeWindowFrom	integer	Originally booked time window to enter
timeWindowFrom	integer	Time window actually used, if arrival was 15' earlier
origTimeWindowTo	integer	Originally estimated time window to leave
timeWindowTo	integer	Time window actually used
timeWindowDate	integer (to be interpreted as date)	Date of the time window

EXAMPLE	TAS
	{ "ID":"92071", "timeWindowID":"2871", "bookDate":"20200918210941", "userID":"4", "companyID":"4", "bookingNumber":"940920712", "containersNumberExport":"1", "containersNumberImport":"0", "exportContainer1":"TCLU7408306",

```
        "exportContainer2":"NULL",
        "importContainer1":"NULL",
        "importContainer2":"NULL",
        "status":"1",
        "changedBy":"NULL",
        "changedDateTime":"NULL",
        "enterDateTime":"NULL",
        "origTimeWindowFrom":"480",
        "timeWindowFrom":"465",
        "origTimeWindowTo":"540",
        "timeWindowTo":"555",
        "timeWindowDate":"20200919",
        "isTransit":"0"
}
```


8.2.4 Freezone Application

Containing the ticket details (QR code).

GENERAL FEATURES	
Id	THPA_4_FZ
Name	Freezone booking
Description	Freezone booking details for container pick-up
Owner	THPA
Classification	Private
Type of data source	Server-based

DATA ACCESS	
Description	Direct access
Authentication	App user list (user/pass)
User Access Controls	yes
Periodicity	Batch
Connection type	JSON text
Data format	DB data -> text

DATA	QR Code	

Field	Type	Description
permit_id	integer	Permit ID issued by THPA for the COREOR request
message_ticket_id	integer	Id of the ticket
qrcode	String	QR code
barcode	String	Barcode
message_ticket_created_at	Datetime	Date/Time ticket was created
truck_plate_no	String	Truck registration plates
sender	integer	Account ID of trucker
container_number	String	Unique ID of container

EXAMPLE	QR Code

```
{
      "permit_id":"4128656",
      "message_ticket_id":"3213",
      "qrcode":"@210221NZZ72129",
      "barcode":"210221NZZ72129",
      "message_ticket_created_at":"2021-02-21 21:29:01.940",
      "truck_plate_no":"TEST1234",
      "sender":"3",
      "container_number":"MSKU7386246"
}
```

8.2.5 Expected container vessel calls

Information is sent from Shipping Agents to THPA, stored in a THPA database, and publicized to THPA's webpage. Will also be available through a web call.

GENERAL FEATURES	
Id	THPA_06_EXPECTED
Name	Expected container vessel calls
Description	List of container ships to call THPA in the near future
Owner	Shipping Agents (notify THPA)
Classification	Public

Type of data source	Server-based

DATA ACCESS	
Description	Direct access
Authentication	no
User Access Controls	no
Periodicity	batch
Connection type	JSON text
Data format	DB data -> text

DATA	Vessel data	
Field	**Type**	**Description**
vo_code	string	Unique ID assigned to a 'voyage'
vname	string	Name of vessel
edate	Datetime	Scheduled date/time of arrival (ETA)
sl	string	Shipping line
moves	Int	Estimated moves to be performed – number of containers unloaded and loaded

EXAMPLE	Vessel data

	{
	"vo_code":"TROUPER 2107",
	"vname":"TROUPER",
	"edate":"2021-01-18 16:00:00.000",
	"sl":"SBS",
	"moves":"600",
	}

8.2.6 Gate Access System (GAS)

Data from the application.

GENERAL FEATURES	

Id	THPA_6_GAS
Name	Gate Access System
Description	Information of vehicles passing through THPA Gates
Owner	THPA
Classification	Private
Type of data source	Server-based

DATA ACCESS	
Description	Direct Access
Authentication	App user list (user/pass)
User Access Controls	yes
Periodicity	Batch
Connection type	JSON text
Data format	DB data -> text

DATA	QR Code	
Field	**Type**	**Description**
vRegNo	string	License plate (will be anonymized)
vMaker	string	Vehicle maker
vModel	string	Vehicle model
vColour	string	Vehicle colour
vCompany	string	Company the vehicle belongs to
inACU	int	Entry Gate sensor ID
inTime	bigint (UNIX timestamp)	Date/time of entrance
outACU	int	Exit Gate sensor ID
outTime	bigint (UNIX timestamp)	Date/time of exit

RFID	string	Vehicle unique RFID tag (will be anonymized)
vehicleType	int	Type of vehicle (lookup)

EXAMPLE	QR Code

	{
	"vRegNo","XXXXXXXXX",
	"vMaker","FORD",
	"vModel","FOCUS",
	"vColour","ΜΠΛΕ",
	"vCompany","Β ΤΕΛΩΝΕΙΟ ΘΕΣ/ΝΙΚΗΣ",
	"inACU","1",
	"inTime","1600410861",
	"outACU","0",
	"outTime","0",
	"RFID","XXXXXXXXX",
	"vehicleType","1"
	}

8.2.7 THPA's Statistics Application

Data from the application.

GENERAL FEATURES	
Id	THPA_7_VESSEL_CALLS
Name	Vessel calls
Description	Details of vessel calls from Statistics application
Owner	THPA
Classification	Restricted
Type of data source	Server-based

DATA ACCESS	
Description	Direct access
Authentication	App user list (user/pass)
User Access Controls	Yes
Periodicity	Batch

Connection type	JSON text
Data format	DB data -> text

DATA	VESSEL CALL	
Field	**Type**	**Description**
ship_descr	String	Name of vessel
ship_type_category	String	Vessel category
Ship_type_class	String	Vessel classification
imo_code	Int	Vessel IMO code
date_katapl	Datetime	Arrival date/time
time_prosdesi	Datetime	Berthing date/time
time_apodesi	Datetime	Un-berthing date/time
start_work	Datetime	Start of works (loading/unloading)
end_work	Datetime	End of works (loading/unloading)
departure_date	Datetime	Departure date/time
work_latin_descr	String	Description of work performed
empor_latin_descr	String	Cargo description
cf_empty	Int	No of empty containers (if container ship)
cf_emforta	Int	No of loaded containers (if container ship)
cf_tonnage	Int	Quantity in tons (if bulk)

EXAMPLE	VESSEL CALL
	{ "imo_code":"9344356", "ship_type_category":"LIQUID BULK", "ship_type_class":"OIL TANKER", "ship_descr":"EVIA PETROL II ", "date_katapl":"Jan 12 2021 02:16:00:000AM", "date_apopl":null, "time_prosdesi":"Jan 13 2021 01:12:00:000PM", "start_work":"Jan 13 2021 02:00:00:000PM", "end_work":"Jan 14 2021 07:30:00:000AM", "time_apodesi":"Jan 14 2021 07:30:00:000AM", "departure_date":"Jan 14 2021 07:50:00:000AM",

```
        "work_latin_descr":"DEMBARKATION-UNLOADING",
        "empor_latin_descr":"PETROLEUM (NON-CUTTING)",
        "cf_empty":"0",
        "cf_emforta":"0",
        "cf_value":2447,
        "cf_tonnage":2447
}
```


8.2.8 Cruise Ships Calls

Details about cruise ships calling the Port. This is not read from an application, can be a list-file updated manually by THPA and shared to the DataPorts platform.

GENERAL FEATURES	
Id	THPA_9_CRUISE
Name	Cruise ship calls
Description	Details of cruise ship calls
Owner	Cruise operators (THPA just receives plan)
Classification	Public
Type of data source	Static file

DATA ACCESS	
Description	Direct access
Authentication	No
User Access Controls	No
Periodicity	Batch
Connection type	JSON text
Data format	text

DATA	CRUISE CALL	
Field	**Type**	**Description**
ETA_date	Date	Estimated time of arrival - date
ETA_time	Time	Estimated time of arrival - time

ETD_date	Date	Estimated time of departure - date
ETD_time	Time	Estimated time of departure - time
vessel_name	String	Vessel name
passengers	Int	Number of passengers
prev_port	String	Name of previous city/port
next_port	String	Name of next city/port

EXAMPLE	CRUISE CALL

	{
	"ETA_date":"17/5/2020",
	"ETA_time":"08:00",
	"ETD_date":"17/5/2020",
	"ETD_time":"18:00",
	"vessel_name":"RIVIERA",
	"prev_port":"Κων/πολη",
	"next_port":"Βόλος",
	"passengers":"550"
	}

8.2.9 Mobility data

Data provided by the OTE.

GENERAL FEATURES	
Id	OTE_mobility_data_Premium
Name	OTE_mobility_data_Premium
Description	Customer Mobility Data - Services obtained by OTE customers in Thessaloniki area and their mobility. (1 hour aggregation level)
Owner	OTE
Classification	DataPorts Internal use only
Type of data source	Network Traffic Data coming from OTE subscribers

DATA ACCESS	
Description	Permission Control Mechanism

Authentication	HL Fabric Blockchain Based IDM
User Access Controls	Read / Write / Share
Periodicity	Quarterly
Connection type	HTTPS - POST
Data format	.csv files

DATA	MOBILITY DATA	
Field	**Type**	**Description**
distinct_users	bigint	Number of distinct users
voice_in	bigint	Number of incoming voice calls
voice_out	bigint	Number of outgoing voice calls
sms_in	bigint	Number of incoming sms
sms_out	bigint	Number of outgoing sms
bytes_up	bigint	Total bytes uploaded
bytes_down	bigint	Total bytes downloaded
cell_municipality	string	Municipality which group of cells, that users for this time period used, are located
cell_lat	string	Latitude which group of cells, that users for this time period used, are located
cell_lon	string	Longtitude which group of cells, that users for this time period used, are located
prev_cell_municipality	string	Municipality which group of cells, that users used for the previous time period, are located
prev_cell_lat	string	Latitude which group of cells, that users used for the previous time period, are located
prev_cell_lon	string	Longtitude which group of cells, that users used for the previous time period, are located
time_period	int	Time period in Hours (eg 0, 1,..,23)
event_date	string	Date of events
week_day	string	Day of the week

is_weekend	string	Flag if this date is weekend day
is_bank_holiday	string	Flag if this date is a bank holiday

EXAMPLE	MOBILITY DATA
Sample Raw	179,THESSALONIKIS,40.60205894,22.963992,8,PULAIAS HORTIATI,40.60708333,22.98416666,21,20200202,1,1,0 –

GENERAL FEATURES	
Id	OTE_mobility_data_Premium
Name	OTE_mobility_data_Simplified
Description	Customer Mobility Data - Mobility info of OTE customers in Thessaloniki area and their mobility. (1 hour aggregation level)
Owner	OTE
Classification	DataPorts-related contacts use
Type of data source	Network Traffic Data coming from OTE subscribers

DATA ACCESS	
Description	Permission Control Mechanism
Authentication	HL Fabric Blockchain Based IDM
User Access Controls	Read
Periodicity	Quarterly
Connection type	HTTPS - POST
Data format	.csv files

DATA	MOBILITY DATA	
Field	**Type**	**Description**
distinct_users	bigint	Number of distinct users
cell_municipality	string	Municipality which group of cells, that users for this time period used, are located

cell_lat	string	Latitude which group of cells, that users for this time period used, are located
cell_lon	string	Longtitude which group of cells, that users for this time period used, are located
prev_cell_municipality	string	Municipality which group of cells, that users used for the previous time period, are located
prev_cell_lat	string	Latitude which group of cells, that users used for the previous time period, are located
prev_cell_lon	string	Longtitude which group of cells, that users used for the previous time period, are located
time_period	int	Time period in Hours (eg 0, 1,..,23)
event_date	string	Date of events
week_day	string	Day of the week
is_weekend	string	Flag if this date is weekend day
is_bank_holiday	string	Flag if this date is a bank holiday

EXAMPLE	MOBILITY DATA
Sample Raw	179,2,2,0,0,22243828,91812516,THESSALONIKIS,40.60205894,22.963992,8,PULAIAS – HORTIATI,40.60708333,22.98416666,21,20200202,1,1,0

8.2.10 Local ships

Schedule of local ships to nearby destinations inside the Thessaloniki Gulf.

This is normally published on a dedicated website, but also announced to THPA, so THPA will set up a static list-file to share to the platform.

8.2.11 Municipality of Thessaloniki

Open data from the Municipality of Thessaloniki, on controlled and open parking areas:

https://opendata.thessaloniki.gr/el/search/field_topic/%CE%91%CF%83%CF%84%CE%B9%CE%BA%CF%8C%CF%82-%CE%A3%CF%87%CE%B5%CE%B4%CE%B9%CE%B1%CF%83%CE%BC%CF%8C%CF%82-6?query=parking&sort_by=changed&sort_order=DESC

NOTE: This is a **potential** dataset, it is external and currently there are no guarantees if it will be provided. It has turned out that it is not regularly updated. Under review, will be revised in a future version. If it turns out not to be of any value, will be omitted.

8.2.12 THPA's Parking Areas

NOTE: This is a **potential** dataset, it is external (even though the parking is inside THPA premises, the system is external) and currently there is no final agreement on how exactly it will be provided. Under review, will be revised in a future version.

8.2.13 IMET

Open traffic data: http://opendata.imet.gr/dataset?tags=Thessaloniki

NOTE: This is a **potential** dataset, it is external and currently there are no guarantees if it will be provided. It has turned out that it is not regularly updated. Under review, will be revised in a future version. If it turns out not to be of any value, will be omitted.

8.2.14 TRAFFICTHESS

Open traffic data: https://www.trafficthess.imet.gr/

NOTE: This is a **potential** dataset, it is external and currently there are no guarantees if it will be provided. It has turned out that it is not regularly updated. Under review, will be revised in a future version. If it turns out not to be of any value, will be omitted.

8.3 POSIDONIA PORT SOLUTIONS

This section contains the information about the data sources involved in the pilot. It will be updated in next deliverables *D5.3 Use case oriented pilots initial version (M24)* and *D5.4 Use case oriented pilots final version (M36)* with the inputs of the data sources questionaries.

In these scenarios data is published and integrated in DataPorts by Posidonia Operations and Posidonia Management. These data sources stream the events processed, but there is not a data base to query or get results on demand.

All the processed available events are shared with the platform so in this case all the structure of the messages and all kind of them are involved. Information is sent in nearly real time through JSON messages.

8.3.1 Posidonia Operations

The Posidonia Operations data source is explained below in the next tables:

GENERAL FEATURES	
Id	pos_ope
Name	Posidonia Operations
Description	Vessel events will be sent to the DataPorts platform in JSON

	format.
Owner	Port Authority
Classification	Restricted
Type of data source	Real-time messages through HTTP request

DATA ACCESS	
Description	The agent will be listening for incoming messages
Authentication	N/A
User Access Controls	N/A
Periodicity	Nearly real-time data
Connection type	Agent as server
Data format	JSON

DATA	AISEVENT	
Field	**Type**	**Description**
update	Long	Update timestamp in miliseconds
autPor	Long	Port Authority code where the event happens. Depends on the Port Authority
codPor	String	Port code. Depends on the Port Authority
aisSentence	Object	See AISSENTENCE description
aisSentenceAux	Object	Second aisSentence event needed when AIS events involve two vessels. See AISSENTENCE description
event_type	Long	Event code
geomId	String	Geometry (zone) Id. Depends on port cartography
geomDesc	String	Description of the geometry (zone): dock name, terminal name... Depends on port cartography
updateAsDate	String	Update date as a date string
updateAsDateWs	String	Update date using an internal format used to integrate Operations with Management

DATA	AISSENTENCE		
Field	**Message**	**Type**	**Description**
update		Long	Update date timestamp in miliseconds
updateAsDate		String	Update date as a date string
updateAsDateWs		String	Internal format used to integrate Operations with Management
ais_name		String	Name of the AIS server or antena
dte		Boolean	Data Terminal Equipment (available/not available)
dirty_123		Boolean	Whether aisSentence contains info of message type 123
dirty_5		Boolean	Whether aisSentence contains info of message type 5
type	Type 123 and 5	Long	AIS message type
repeat	Type 123 and 5	Long	AIS internal parameter
mmsi	Type 123 and 5	Long	Maritime Mobile Service Identity of the vessel (9 digits)
status	Type 123	Enum	Status of the vessel. See values below
turn	Type 123	Float	Rate of Turn (ROT)
speed	Type 123	Float	Speed over the ground (knots)
accuracy	Type 123	Boolean	Position accuracy
lon	Type 123	Float	Longitude
lat	Type 123	Float	Latitude
course	Type 123	Float	Course over the ground (COG)
heading	Type 123	Long	True heading (HDG)
second	Type 123	Long	Timestamp
maneuver	Type 123	Enum	Maneuver indicator. See values below

raim	Type 123	Boolean	RAIM flag
radio	Type 123	Long	Radio status
ais_version	Type 5	Long	AIS version
imo	Type 5	Long	IMO ship ID number
callsign	Type 5	String	Call sign
shipname	Type 5	String	Vessel name
shiptype	Type 5	Enum	Ship type. See values below
to_bow	Type 5	Long	Dimension to bow
to_stern	Type 5	Long	Dimension to stern
to_port	Type 5	Long	Dimension to port
to_starboard	Type 5	Long	Dimension to starboard
epfd	Type 5	Enum	Position fix type. See values below
month	Type 5	Long	ETA month
day	Type 5	Long	ETA day
hour	Type 5	Long	ETA hour
minute	Type 5	Long	ETA minute
draught	Type 5	Float	Ship draught
destination	Type 5	String	Ship destination

VALUES	AISEVENT.TYPE_EVENT
Field	**Description**

1	ais_in, vessel detection within range of the AIS station
2	waypoint, vessel crossing detection in a point, line or zone
3	stop_over_in, entering the pilotage service zone. Entering port
4	anchor_in, anchoring start
5	anchor_out, anchoring end
6	pilot_start, pilotage start
7	tug_start, towing start
8	dock_stop, berthing start
9	dock_stop_start, docked vessel beging to move without leaving the dock yet
10	dock_start-out, end of docking
11	pilot_away, pilotage end
12	tug_away, towing end
13	stop_over_out, exiting the pilotage service zone. Exiting port
14	ais_out, vessel out of AIS range
15	oil_start, bunkering service start
16	oil_stop, bunkering service stop
17	anchor_in_start, anchored vessel begins to move without leaving the anchor area yet
18	forbidden_anchor_in, start anchoring in forbidden area
19	dock_restop, amended vessel berth (movement threshold lower than the length)
20	ais_switched_off, detection off (previously on)
21	asi_switched_on, detection on (previously off)
22	ais_frequency_too_low, AIS message frecuency too low

23	anchor_rein, vessel detection in anchoring area where previously anchored but never left it.
24	dock_approach, vessel approach to dock (may berth in it or may pass by)
25	control_zone_in, entry in control area
26	control_zone_out, exit from control area
27	speed_limit_exceeded, max speed exceeded
28	anchor_out_assumed, assumed anchorage end

VALUES	AISSENTENCE.STATUS
Field	**Description**
0	under_way_using_engine
1	at_anchor
2	not_under_command
3	restricted_manoeuverability
4	constrained_by_draught
5	moored
6	aground
7	engaged_in_fishing
8	under_way_sailing
9	reserved_for_future_amendment_for_hcs
10	reserved_for_future_amendment_for_wig
11	reserved_for_future_use_1
12	reserved_for_future_use_2
13	reserved_for_future_use_3
14	ais_start_active

15	not_defined

VALUES	AISSENTENCE.MANEUVER
Field	**Description**
0	not_available_maneuver
1	no_special_maneuver
2	special_maneuver
3	exception_maneuver

VALUES	AISSENTENCE.SHIPTYPE
Field	**Description**
0 to 9	not_available
10	reserved_for_future_use,all_ships_of_this_type
11	reserved_for_future_use,_Hazardous_category_A
12	reserved_for_future_use, _Hazardous_category_B
13	reserved_for_future_use, _Hazardous_category_C
14	reserved_for_future_use, _Hazardous_category_D
15	reserved_for_future_use,_Not_under_command
16	reserved_for_future_use,_Restristed_by_her_ability_to_maneuver
17	reserved_for_future_use,_Constrained_by_her_draught
18	reserved_for_future_use,_Spare
19	reserved_for_future_use,_No_aditional_information
20	wing_in_ground_(WIG),_all_ships_of_this_type
21	wing_in_ground_(WIG),_Hazardous_category_A
22	wing_in_ground_(WIG),_ Hazardous_category_B
23	wing_in_ground_(WIG),_ Hazardous_category_C
24	wing_in_ground_(WIG),_ Hazardous_category_D

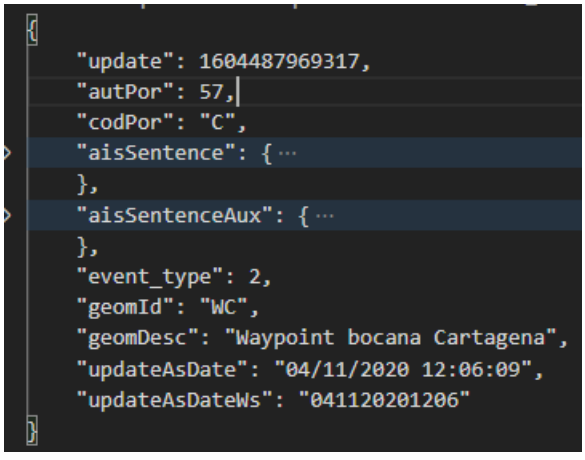
25	wing_in_ground_(WIG),_Reserved_for_future_use
26	wing_in_ground_(WIG),_ Reserved_for_future_use
27	wing_in_ground_(WIG),_ Reserved_for_future_use
28	wing_in_ground_(WIG),_ Reserved_for_future_use
29	wing_in_ground_(WIG),_ Reserved_for_future_use
30	fishing
31	towing
32	towing_length_exceeds_200m_or_breadth_exceeds_25m
33	dredging_or_underwater_ops
34	diving_ops
35	military_ops
36	sailing
37	pleasure_craft
38	reserved
39	reserved
40	high_speed_craft_(HSC),_all_ships_of_this_type
41	high_speed_craft_(HSC),_Hazardous_category_A
42	high_speed_craft_(HSC),_ Hazardous_category_B
43	high_speed_craft_(HSC),_ Hazardous_category_C
44	high_speed_craft_(HSC),_ Hazardous_category_D
45	high_speed_craft_(HSC),_Reserved_for_future_use
46	high_speed_craft_(HSC),_ Reserved_for_future_use
47	high_speed_craft_(HSC),_ Reserved_for_future_use
48	high_speed_craft_(HSC),_ Reserved_for_future_use
49	high_speed_craft_(HSC),_No_additional_information
50	pilot_vessel
51	search_and_rescue_vessel

52	tug
53	port_tender
54	vessel_with_anti_pollution_equipment
55	law_enforcement_vessel
56	spare_-_for_assignments_to_local_vessels
57	spare_-_for_assignments_to_local_vessels
58	medical_transport
59	ship_according_to_RR_resolution_No._18
60	passenger,_all_ships_of_this_type
61	passenger,_Hazardous_category_A
62	passenger,_Hazardous_category_B
63	passenger,_Hazardous_category_C
64	passenger,_Hazardous_category_D
65	passenger,_not_under_command
66	passenger,_Restricted_by_her_ability_to_maneuver
67	passenger,_Constrained_by_her_draught
68	passenger,_Spare
69	passenger,_no_additional_information
70	cargo,_all_ships_of_this_type
71	cargo,_Hazardous_category_A
72	cargo,_Hazardous_category_B
73	cargo,_Hazardous_category_C
74	cargo,_Hazardous_category_D
75	cargo,_not_under_command
76	cargo,_Restricted_by_her_ability_to_maneuver
77	cargo,_Constrained_by_her_draught
78	cargo,_Spare

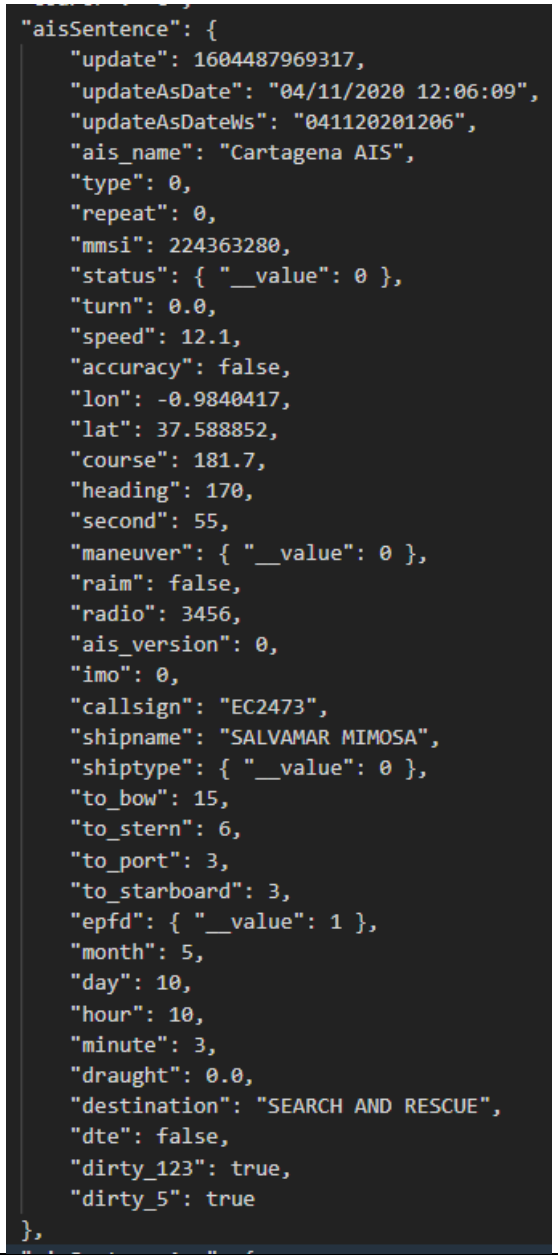
79	cargo,_No_additional_information
80	tanker,_all_ships_of_this_type
81	tanker,_Hazardous_category_A
82	tanker,_Hazardous_category_B
83	tanker,_Hazardous_category_C
84	tanker,_Hazardous_category_D
85	tanker,_not_under_command
86	tanker,_Restricted_by_her_ability_to_maneuver
87	tanker,_Constrained_by_her_draught
88	tanker,_Spare
89	tanker,_No_additional_information
90	other_type,_all_ships_of_this_type
91	other_type,_Hazardous_category_A
92	other_type,_ Hazardous_category_B
93	other_type,_ Hazardous_category_C
94	other_type,_ Hazardous_category_D
95	other_type,_not_under_command
96	other_type,_Restricted_by_her_ability_to_maneuver
97	other_type,_Constrained_by_her_draught
98	other_type,_Spare
99	other_type,_No_addtional_information

VALUES	AISSENTENCE.EPFD
Field	**Description**
0	undefined
1	gps
2	glonass

3	combined_gps_glonass
4	loran_c
5	chayka
6	int_nav_system
7	surveyed
8	galileo
9	nodata
10	nodata
11	nodata
12	nodata
13	nodata
14	nodata
15	nodata

EXAMPLE	AISEVENT
	

EXAMPLE	AISSENTENCE



8.3.2 Posidonia Management

The Posidonia Operations data source is explained below in the next tables:

GENERAL FEATURES	
Id	pos_mng
Name	Posidonia Management
Description	Port Authority's management messages will be sent to the

	DataPorts platform in JSON format.
Owner	Port Authority
Classification	Restricted
Type of data source	Messages through HTTP request

DATA ACCESS	
Description	The agent will be listening for incoming messages
Authentication	N/A
User Access Controls	N/A
Periodicity	To be configured by each Port Authority
Connection type	Agent as server
Data format	JSON

DATA	MANEVENT	
Field	**Type**	**Description**
date	Long	Date timestamp in miliseconds
vessel	Object	Basic vessel information
stopover	Object	Basic stopover information
event_type	Long	Event code
event_info	Object	Information of the event (depends on event-type)

DATA	MANEVENT.VESSEL	
Field	**Type**	**Description**
imo	String	IMO code
vessel_code	Long	Vessel code
vessel_name	String	Vessel name

DATA	MANEVENT.STOPOVER	

Field	Type	Description
port_code	String	Port code
year	Long	Stopover year
stopover_code	Long	Stopover code
eta	Long	Timestamp in miliseconds
etd	Long	Timestamp in miliseconds
stopover_num	String	Stopover Number
state_code	String	State code

DATA		MANEVENT.EVENT_INFO	
Field	**Type**	**event_type**	**Description**
state_code	String	1, 2 or 3	State code
new_date	Long	4 or 5	New timestamp (ms)
old_date	Long	4 or 5	Old timestamp (ms)
port_code	String	6	Stopover Number
year	Long	6	Manifest year
manif_code	Long	6	Manifest code
dec_num	String	6	Declaration number
dec_type	String	6	Declaration type (D, C or T)
consignee_id	Long	6	Consignee ID
dec_date	Long	6	Declaration timestamp (ms)

VALUES	MANEVENT.STOPOVER.STATE_CODE
Value	**Description**
LD	Payable
RE	Rejected
AC	Requested

AU	Authorized
DE	Denied
AN	Cancelled
IN	Initiated
FI	Finalized

VALUES	MANEVENT.EVENT_TYPE
Value	**Description**
1	Stopover Authorization
2	Stopover Start
3	Stopover End
4	ETA Update/change
5	ETD Update/change
6	Manifest Activation

VALUES	MANEVENT.EVENT_INFO.DEC_TYPE
Value	**Description**
D	Summary unloading Declaration
C	Load manifest
T	Land transit