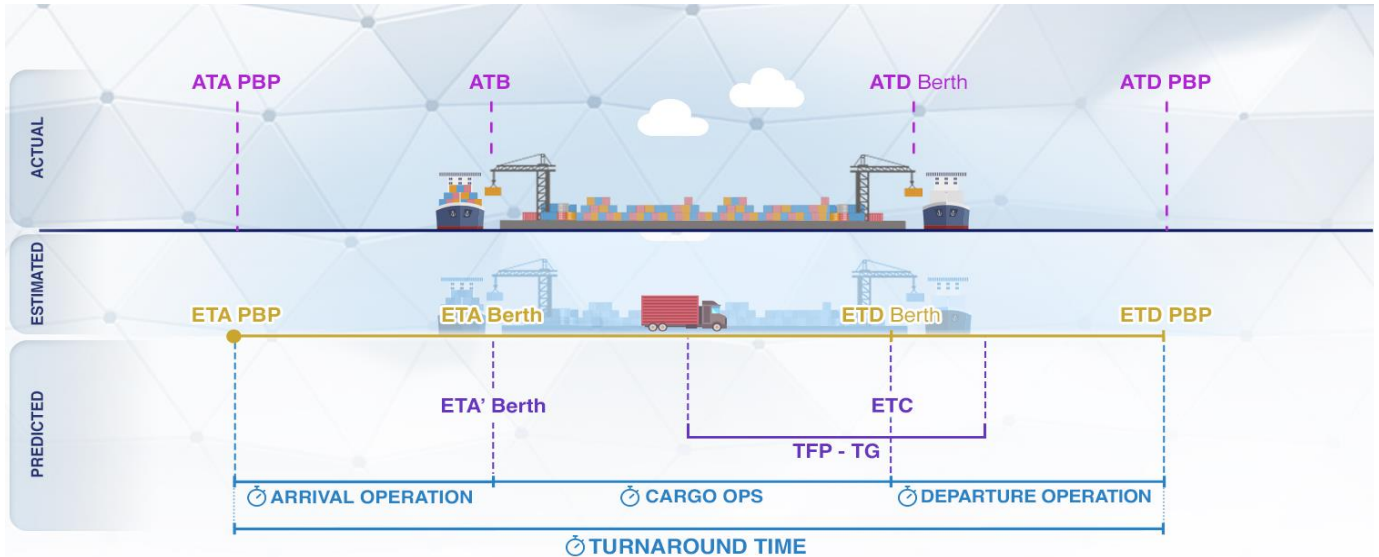


# SmartEDIPort

Dataspace for the optimization  
of the maritime-port logistics chain in Smartports,  
based on EDI data sharing



SmartPorts

Dataspace for the optimization of the maritime-port logistics chain in Smartports, based on EDI data sharing

With the contribution of:



HIADES Business Patterns SL

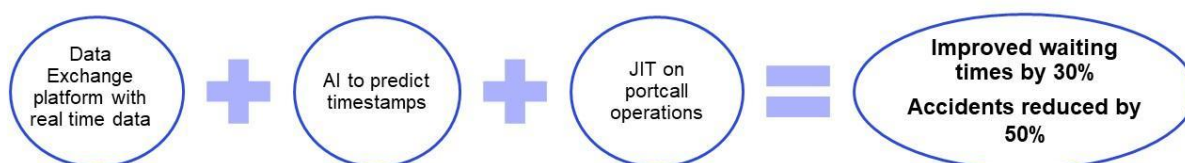
# Challenge & Context

The SmartEDIPort project consists of the creation of a dataspace for the optimization of the maritime-port logistics chain in Smartports, based on EDI data sharing.

Currently, the different actors involved in the maritime-port logistics chain often share data one by one, with no real-time information, duplicate information, lots of radio or e-mail communications and a paper-intensive administrative process.

In this context, one of the most important challenges in the port sector is to change the current situation of the traditional model (represented on the left side below) to an optimized situation (on the right side, based on the PortCDM -a Collaborative Decision Making- model) as the new concept of SmartPorts, where sharing data platforms are more and more necessary.

## Challenge and why trusted data sharing is needed



*Source: European project 'STM Validation'*

### Objective:

**Creation of a Dataspace oriented to the ingestion, sharing and exploitation of data related to the maritime-port logistics chain through Just In Time. We will optimize the forecast of ship berthing times and the completion of loading and unloading operations, as well as predicting the traffic flow at the gate of a Container Terminal before and after the arrival of the vessels.**

### Datasets:

1. Portcalls data.
2. Raw EDI data that complies with the UN/EDIFACT messaging standard.
3. AIS data with static and dynamic characteristics of the vessels.

3

 i4Trust

*Figure 1. Challenge SmartEDIPorts*

According to the European Project STM Validation, the impact of a platform based on shared data that ensure Just in Time in portcall operations, supported by Artificial Intelligence applied to estimated timestamps, and real-time data from port agents, will improve waiting times by 30%, and it will reduce accidents by 50%. Our empirical experience also confirms that it reduces the use of radio calls by 80%.

The SmartEDIPort experiment arises from the real need of the Port of Huelva to optimize the maritime-port logistics chain, through JIT methods to improve the efficiency, safety and coordination of port operations, positively impacting the coordination and efficiency also of its stakeholders. Port of Huelva, it is among the five ports with the highest volume of port traffic in Spain, ranking twenty fifth in traffic in Europe out of a total of one thousand and two hundred commercial ports. It is also the second fastest growing port in Europe in the last decade. The main mission of its strategic plan is the provision of intermodality services to transport logistics chains, promoting the Multimodal Platform located in the South Dock of the Port with direct connection to the maritime container terminal, as well as the Logistics Activity Zone, where different companies provide value-added services to the logistic chains in the port area.

We will solve the following challenge. This image illustrates a ship arriving at the port and starting its cargo unloading service managed by the terminal.

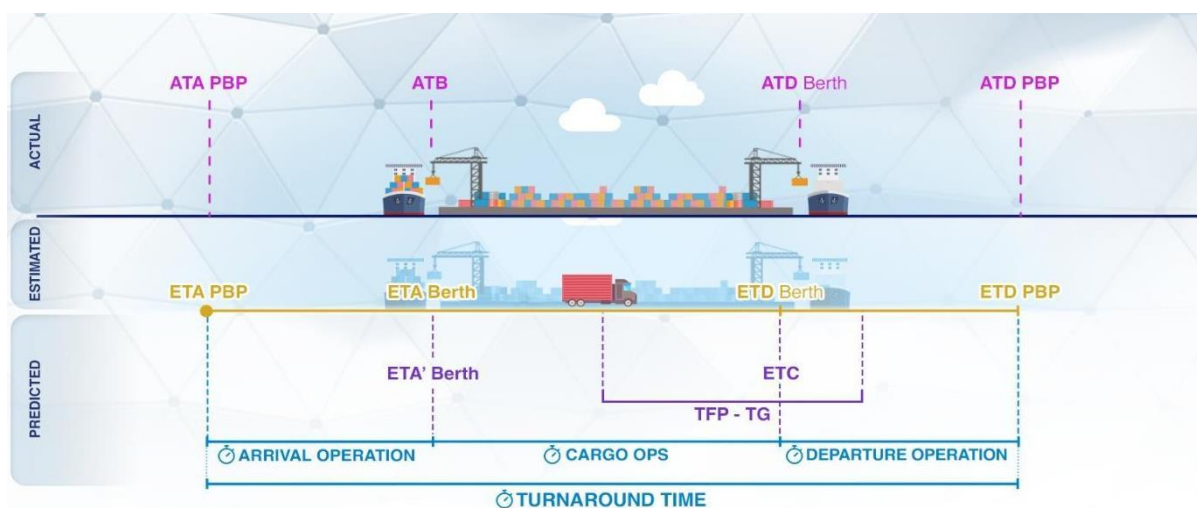


Figure 2. Challenge

Firstly, there is an official Estimated Time of Arrival (the ETA PBP and the ETA Berth), known by all the agents usually since one week before the arrival. The problem there is that this estimation is generally not accurate, and may have a deviation of hours from the actual time of arrival (ATA). Having a better estimate of the ETA is critical, not only for the terminal, but also for all the agents involved in the arrival, such as pilots, tugboats, moorers and, of course, port control, the control tower where all arrivals and departures are managed.

On the other hand, there is usually no accurate estimate of how long loading and unloading operations will take, and therefore of the Estimated Time of

Completion (ETC). This again is critical for an optimal management of the services at berth, and also for whole traffic of the port.

Also, the Terminal has to manage the truck services in the Gate Terminal to transport the cargo, both to bring to the terminal the cargo that will be loaded, and to take off the containers that will be unloaded from the ship.

So, SmartEDIPort solves these problems. Some companies of the consortium enrich the shared data by adding the following 3 data, which are obtained by applying ML methods:

- ETA Berth' (Improved ETA at Berth): that is, a better prediction of the arrival time of ships
- ETC (Estimated Time of Completion): the date and time when cargo - loading and unloading- operations are finished
- TFP-TG: an estimation of the numbers of trucks that are needed at the gate of a Container Terminal before and after the arrival of the vessels.

## Solution

The objective of the SmartEDIPort Experiment is the creation of a Dataspace oriented to the ingestion, sharing and exploitation of data related to the maritime-port logistics chain through Just in Time.

The first challenge we solve is to optimize the forecast of ship berthing times and the completion of loading and unloading operations, as well as predicting the traffic flow at the gate of a Container Terminal before and after the arrival of the vessels. This will improve the efficiency, safety, and coordination of the maritime and land operations, and of all the agents involved in them.

And how do we collect the data?

The Dataspace will receive 3 types of datasets:

- Portcalls information (from APH), with data related to the ship's stay in the port, for example an initial estimate of arrival/ departure of the vessel at/ from the port.
- EDI CODECO messages (from APH, shared by Terminals), with information related to the cargo transported by the ship, for example, the date and time of entry and exit of containers through the Gate Terminal.

- AIS data (from HIADES), with unique identification, position, course, and speed of all the ships operating at the port, received in real time every 3-6 seconds.

Being more precise, Figure 2 illustrates a ship arriving at the port and starting its cargo unloading service managed by the terminal. Also, the Terminal has to manage the truck services in the Gate Terminal to transport the cargo. In this context we have here 3 scenarios of data, depicted on the left side of the image:

- The Estimated Scenario: It contains the estimated data officially used by the origin and destination ports, and Terminals and Shipping companies, normally one week before the travel. The data we will use from this scenario are:
  - Portcalls Data, whose time estimations usually have a high margin of error:
  - ETA PBP (Estimated Time of Arrival at the Pilot Boarding Point),
  - ETA Berth (Estimated Time of Arrival at Berth),
  - ETD Berth (Estimated Time of Departure from Berth),
  - ETD PBP (Estimated Time of Departure from Pilot Boarding Point),
  - 'EDI Codeco' Data, which gives us the Date and Time of entry and exit of containers through the Terminal Gate.
- The Actual Scenario: once the ship arrives at the port, we have the actual dates and times of the previous events, given by the AIS data.
- A Predictive Scenario: is the one in which the SmartEDIPort consortium will apply advanced analytics, mainly based on Machine Learning, to give a more optimized time estimation or to infer useful information for the maritime-port logistics chain. More specifically, in this Predictive Scenario, because of the SmartEDIPort experiment we will have:
  1. ETA Berth', which is a better prediction of the ETA Berth,
  2. ETC (Estimated Time of Completion), a prediction of the date/time of completion of the container unloading operations,
  3. TFP-TG, a forecast of truck traffic flows at the terminal gate around vessel arrivals,
  4. Dashboards: Business Intelligence applied to obtain dashboard data services, with a comparative analysis of estimated/predicted vs. actual times, e.g. ETA Berth' vs. ATA, ETC vs. ATC, etc.

The final product of SmartEDIPort is the data space or marketplace for port authorities, with other by-products for their stakeholders: sale of data packages (containing the data of the 3 use cases above) and services such as on-demand dashboards and reports.

The new data packages or data-based services will be consumed through a marketplace by the Port Authority of Huelva and by its stakeholders – all the agents involved in the maritime-port logistics chain, mainly: Terminals, Ship Agencies and Nautical Services (maritime pilots, moorers, tugs), as well as agents interested in this field (R&D groups, etc).

But especially, for Terminals and Shipping Agencies it will mean a significant cost reduction since a 30-minute error costs four-thousand euros (€4.000).

The SmartEDIPort consortium is led by HIADES company. All the companies of the consortium are established in the Canary Islands, except “La Lonja de la Innovación”, of Huelva:

- HIADES Business Patterns SL is the leader of the project. We are a software provider specialized in Digital Twins in port areas, with products in more than 20 international ports. HIADES has business specialists, analyst programmers and system integrator experts specialized in the Port sector, and it is highly positioned in the Port sector.  
<https://hiades.es/>
- PLEYONE Management Capital SL is a software provider of advanced IT solutions with a highly innovative component, focused on the port and maritime sector. PLEYONE has experts in IT, IoT and GIS systems.  
<https://pleyone.es/>
- 2312 CONSULTORES is a company specialized in Business Intelligence and advanced analysis, as well as consulting in Digital Transformation, with the application of agile methodologies, Design Thinking, Lean Startup and Business Strategy with various approaches to disruptive innovation.  
<https://2312consultores.com/>
- La Lonja de la Innovación, the Fiware iHub of the Port Authority of Huelva, as the DIH, which will act as facilitator, giving the support to the coordination and dissemination.  
<https://lalonja.tech/>
- STARTAPP 2030, S.L. is a technological Solutions company specializing in network installation and support.



# How it works

The operation of SmartEDIPort is represented by the SmartEDIPort data value chain (Figure 3), in which data transfer is represented by the flow of arrows, mainly from upstream (service providers) to downstream (service consumers).

The arrows also indicate which data packages to be published in the i4Trust Marketplace and shared among SmartEDIPort partners, with the color of each arrow being the color representing the partner that owns the data. Note that, in addition to participating SMEs, external users (port stakeholders) can be consumers of data through the APH.

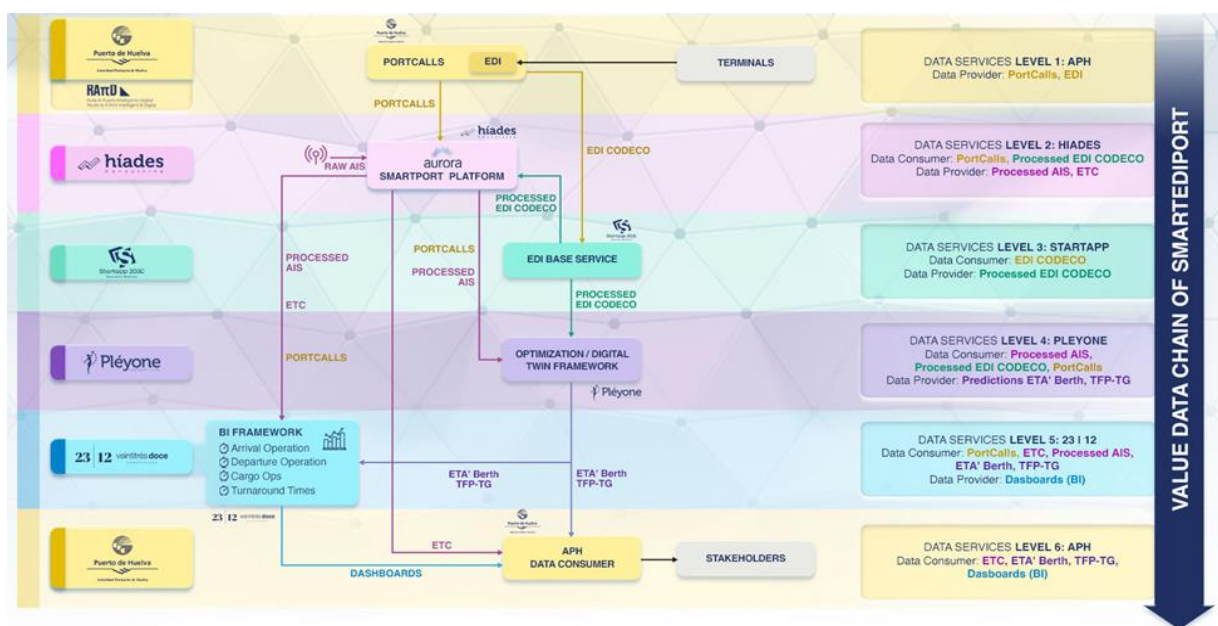


Figure 3. SmartEDIPort's Data Value Chain. Source: HIADES

As we can see in Figure 3:

- The Port Authority will provide EDI raw data and Portcalls data.
- HIADES will provide processed AIS data.
- STARTAPP 2030 will provide the EDI processed data.
- PLEYONE will infer the ETA PBP and the TFP-TG, that is, traffic flow at the gate of a Container Terminal before and after the arrival of the vessels.
- 2312 CONSULTORES will apply Business Intelligence to do a comparative analysis of Estimated/Predicted versus the Actual times.

Finally, these new data packages services will be consumed by the Port Authority of Huelva and through a marketplace by its stakeholders as Terminals,



Shipping Agencies, as well as the nautical technical services (pilots, tugs and moorers).

SmartEDIPort Experiment facilitates data exchange through a FIWARE-powered platform with an i4Trust Marketplace. The iSHARE specifications related to access protection and access tracking are met by implementation of a IdM that will act as an Authorization Registry together with PDP (Policy Decision Point) and PEP (Policy Enforcement Point) in order to provide security and usage analysis. For data interoperability and information exchange between the parties, FIWARE Context Broker building block will be used through the standard API NGSI-LD.

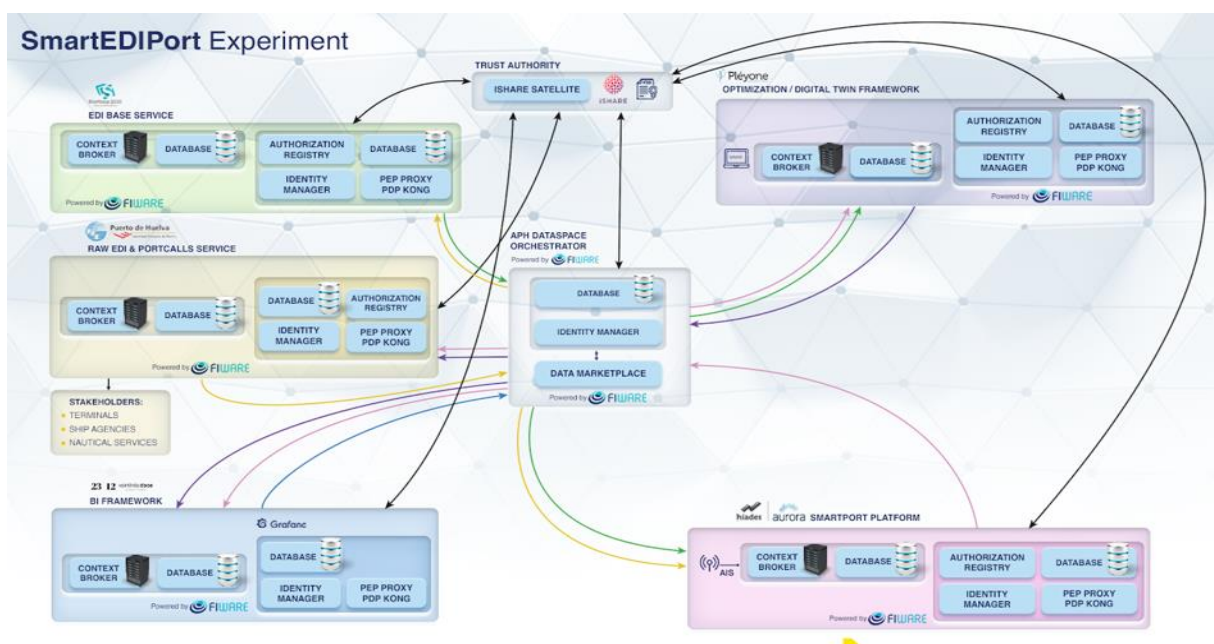


Figure 4. Architecture of SmartEDIPort. Source: HIADES

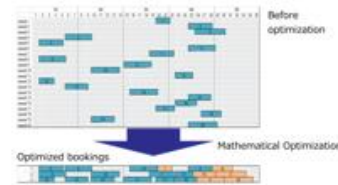
In this Experiment, the data processing, analysis and visualization tasks are mainly concentrated in the companies of the consortium that consume data from SmartEDIPort. Different innovative services are derived depending on the time scale selected for data processing, which is near real time or historical.

iShare Satellite will enable, in coordination with the Identity Provider and Authorization Registry, to validate whether participants sharing data in the SmartEDIPort dataspace are trusted organizations.

# Benefits & Impact

## Marketplace for:

- **Data package services.**
- **Dashboards with information of high value to port agents** (average duration of stay of ships in the port, of operations in the terminal, of departure operations, etc.).



*Figure 5. Marketplace. Source: HIADES*

Several end-users have been identified:

- Port Authorities (Port of Huelva)
- Terminals
- Shipping agencies
- Nautical services operators: Maritime pilots, Tugs, Moorers
- Other agents: R&D groups

Some plans for the future are, in the first place, commercial actions to the ports. We prioritize here the markets of Spain and South and Central America, since HIADES already has a solid commercial network, and also the USA, since HIADES is currently opening this market with an international partner. We have a total TAM (Total Addressable Market) of more than a thousand ports.

In addition, we plan to improve the accuracy of the inferred ETA Berth', ETC and introduce new datasets to infer other timestamps involved in the maritime-ports logistics chain.

The results are oriented, as end-users, to Port Authorities, or by delegation, PortControl, terminals, shipping agencies and other port agents.

Under a conservative assumption to reach 59 ports in 5 years, that is, a SOM of 5,1% of TAM, being TAM=1.164 ports from Spain and South/Central America

(where HIADES already has commercial networks) and USA (market that is currently opening HIADES), with the following sales forecast:

SmartEDIPort Dataspace	2024	2025	2026	2027	2028	TOTAL
iGreenPort Dataspace (new implementation)	2	6	10	15	26	59

SmartEDIPort Services	2024	2025	2026	2027	2028
Data packages (punctual sales)	160	640	1440	2640	4720
Reports (1-year subscription)	6	24	54	99	177
Dashboards (1-year subscription)	12	48	108	198	354
Predictive models (1-year subscription)	10	40	90	165	295

SmartEDIPort will have more than 6M€ in the fifth year and an interannual increase of profit during the following 5 years, above 30%.

## Added value through i4Trust

The application of Smart Cities platforms to Smart Ports is one of the most important trends for the next few years in the port sector. i4Trust is a suitable technology for big data exchange projects (mainly collected from IoT) in the port sector, as well as more and more demand.

The i4Trust program has provided us with:

- Training and knowledge of a new architecture to develop in the company a promising line of business such as the sale of data packages.
- New tools to explore and analyse data-driven business models.
- The expansion of our network of partners, with mentors, our consortiums, etc.

The main value-added created in SmartEDIPort has been the development of a new architecture, based on the i4Trust standards, with which for the first time many companies can optimize the maritime-port logistics chain by applying Just in Time methods. Likewise, it is of high value to amplify the reach and accessibility of this data to a large number of end users.

Besides, two advantages that I would highlight of using Fiware and i4Trust components:

- The ability to ingest data in real time.
- The possibility to comply with global communication standards ports, for example, the IALA S-200 family or the DCSA events standard.

## Next steps

The next steps to be taken are to carry out two more proofs of concept and, from this point onwards, we would consider it a consolidated product and begin commercial actions.

## Authors & Contributors

- HIADES Business Patterns SL, [www.hiades.es](http://www.hiades.es)  
Coqui García Román, Director of the R+D+i Departament, [cgarcia@hiades.es](mailto:cgarcia@hiades.es)  
Julia Ramos González, Tender and Quality Manager, [jramos@hiades.es](mailto:jramos@hiades.es)
- Pleyone Management Capital SL, [www.pleyone.es](http://www.pleyone.es)  
Eva Arteaga Acosta, Innovation Technician of the R+D+i Departament, [earteaga@pleyone.es](mailto:earteaga@pleyone.es)

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