# NEWSLETTER #6

June 2022

PROGRESS TOWARDS FEDERATED LOGISTICS THROUGH THE INTEGRATION OF TEN-T INTO A GLOBAL TRADE NETWORK

COORDINATION

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FUNDACIÓN VALENCIAPORT

## Contents




This project is funded from the European Union´s Horizon 2020 research and innovation programme under grant agreement No 860274

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# Living Lab 1: major breakthroughs

## Living lab 1 at a glance

### Physical Internet and Blockchain for optimised door-to-door Asia-Europe corridors – Mediterranean Corridor

PLANET LL1 is evaluating how novel technologies and concepts such as **Blockchain** (BC), **Artificial Intelligence** (AI), **Internet of Things** (IoT), **Machine Learning** (ML) or **Physical Internet** (PI) can enhance the efficiency of the processes and operations performed along the door-to-door (D2D) transport and logistics in the link between the Maritime Silk Road and EU internal corridors.

## Use Cases

### **UC 1** on improving container cargo operations between China and Spanish hinterland

Use Case 1 focuses on import / export D2D transport chain of containerized cargo between China and Spain and is evaluating how the combination of IoT (for real-time monitoring of logistics assets), AI (for better forecasts and intelligent decisions based on machine learning algorithms) and Blockchain (for paperless transactions and the register of transport events), can contribute to a better management of the transport chain.

| | |
|---|---|
| **Activity 1** INTELLIGENT DECISIONS AT LOGISTIC HUBS | Enhance transport planning by applying AI and ML |
| **Activity 2** PI NETWORKS IN SPAIN | Extend Activity #1 simulation to the last mile delivery to build flexible and resilient D2D service |
| **Activity 3** BLOCKCHAIN & INTEROPERABILITY | Interoperable business network for integrated data sharing from seaport to hinterland |
| **Activity 4** IoT FOR CONTAINER TRACKING | Get tracking data remotely in real-time of the containers to improve operations and monitoring of container and cargo |

### **UC 2** on optimizing warehouse operations and automation and last mile deliver efficiency and sustainability

Use Case 2 focuses on warehouse operations and is exploring how new IoT, AI, AR (Augmented Reality) and automation technologies can contribute to the development of intelligent automated logistics nodes of the Integrated Green EU-Global T&L Network (EGTN) PI network.

This use case will complement Use Case 1, particularly on how to integrate smart Warehouse Nodes for EGTN routing decisions, ultimately creating PI Warehousing Nodes.

| | |
|---|---|
| **Activity 1** INTELLIGENT DECISIONS AT LOGISTIC HUBS | Enhance transport planning by applying AI and ML |
| **Activity 2** PI NETWORKS IN SPAIN | Simulate optimal routes to deliver goods coming from ports to warehouses and city-hubs |
| **Activity 4** IoT FOR CONTAINER TRACKING | Get tracking data remotely in real-time of the containers to improve operations and monitoring of container and cargo |



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## Physical Internet Network

In the last few weeks, the virtual simulation model for the Living Lab 1 (LL1) application has been presented. This model can be used to evaluate the Physical Internet (PI) behaviour in different multimodal transport networks. In this case, it will be applied to the evaluation of the PI network, including entry nodes such as ports and warehouses in the Spanish transport network (see Figure 1).

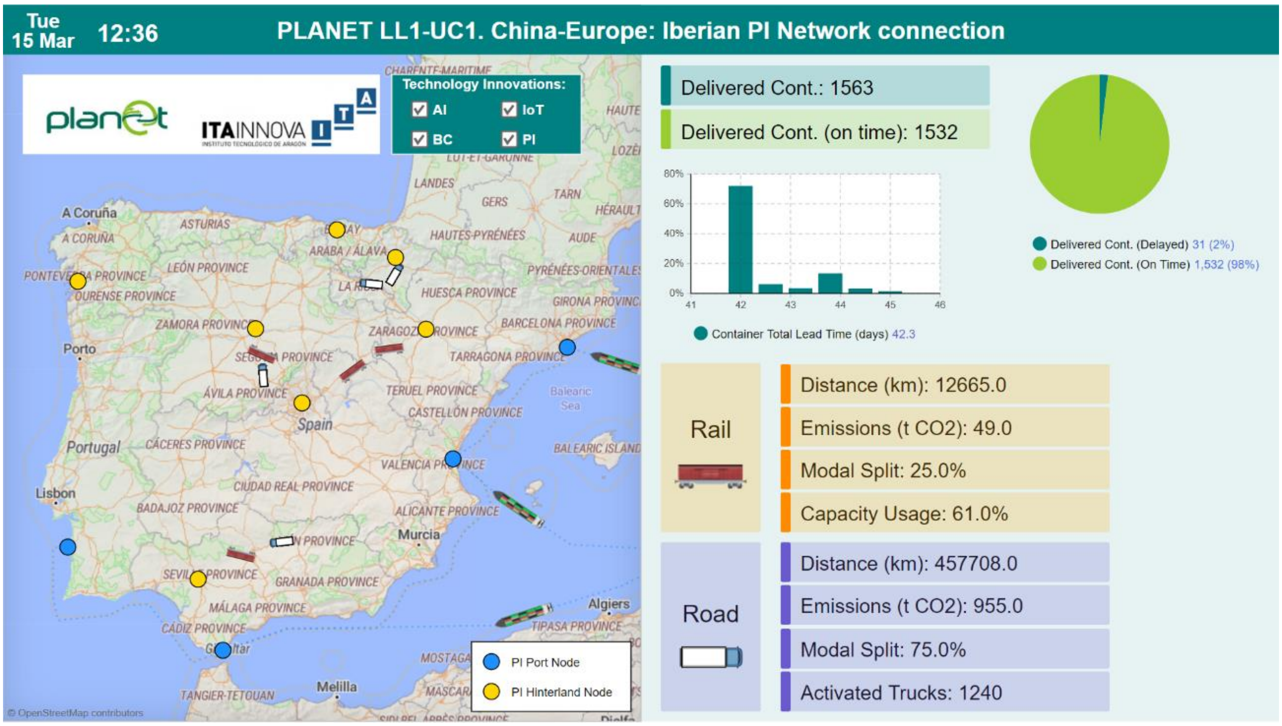


*Figure 1. Main view of the PI Network Simulator.*

This model will support the evaluation of the impact of PI concepts in combination with new technologies (IoT, AI, BC) can improve the processes, operations, and efficiency of transport chains between China and the EU. In particular, the objective is to simulate and evaluate the impact that different combinations of these technologies and concepts have on containerized cargo flows between China and Spain.

## Artificial Intelligence

In activities #1 and #2, LL1 is exploiting the use of AI to assess the optimization of maritime and terrestrial logistics flows from the port of origin in China until the last-mile delivery in the Spanish hinterland.

IBM is currently using machine learning based AI models for the development of intelligent algorithms to optimise these freight flows within the transportation networks considered in LL1.

On the one hand, the intelligent algorithms are currently under development for applications such as predictive transport models. The predictive modes are to help quantifying future changes in volume of the transported cargo across both maritime and inland shipment routes within the Iberian Peninsula. The AI based algorithms consider corridor-node transferability variables such as time and cost to determine how the improvement in transporting cargo faster and cheaper, might correlate to future increased volumes of


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transported freight across corridors. Having such predictions on the likelihood of future changes in transported volumes, given the reduction of transportation cost and time, might support potential investments in current or additional nodes in different areas of the current TEN-T and perhaps other freight networks.

Other intelligent algorithms under development are considered for application of routing optimisation within the last-mile delivery, and for planning and replanning set schedules for transportation across maritime or inland corridor routes. The AI based intelligent algorithms are to enable a more robust optimisation or route (re-) planning tool. The tool makes use of machine learning as a predictive node-spatial interaction model, to be able to output future values of time, cost and CO2 emissions to determine future optimal routes for transportation. Also, in this way the ML based predictive model could be used with other available variables that might affect constantly the usability of routes or sequence of routes, and from which updated information might not be available constantly as required. In this way the machine learning based AI routing tool would enable continuous, and potentially more-in-advance information updates regarding relevant spatial interaction variables to be used jointly for a more robust criterion in defining, optimising and planning delivery-transportation routes.

Finally, PLANET's LL1 also applies intelligent algorithms for supplier collaboration and warehouse analytics. The intelligent algorithm makes use of machine learning based AI predictive models to forecast the inflow of pallets and containers to warehouses. The forecasted changes in the inflow of pallets and containers are to be used to optimise cost, using tools such as the smart contracts, for the allocation of warehouse resources. Also used as predictive tools to plan more robust warehouse operations that handle sudden changes in the inflow of cargo.

As a result, **AI algorithms are being developed at UC1** to assess the impact that changes out of planned schedules in maritime routes may have on inland transport of shipments. Additionally, algorithms also cover inland transport planning in order to decide the way of transportation (i.e., either train or truck) for goods arriving to Spanish ports (see Figure 2).

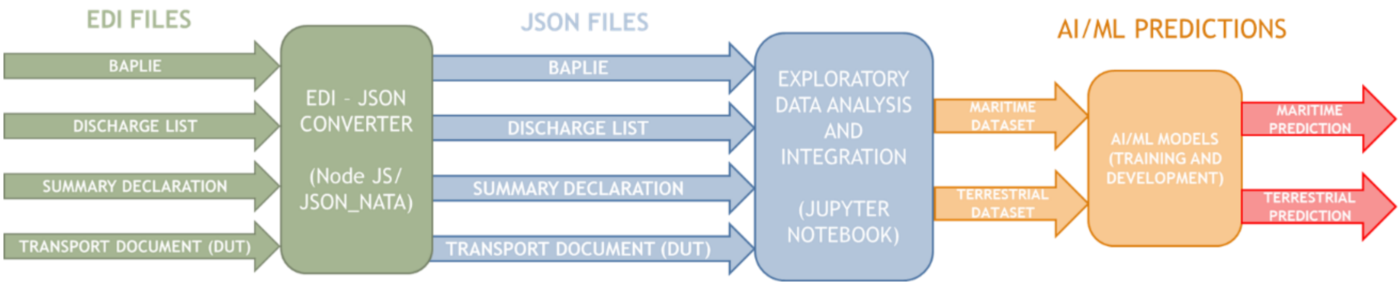


*Figure 2. Information Flows for AI/ML Predictions*

Regarding the maritime segment (see Figure 3), the intelligent algorithm is evaluating the time and cost impact of changes in the maritime routing of ships departing from China and considering Valencia, Barcelona and Algeciras as potential destinations (see Figure 3). In general, vessels departing from China select Valencia as initial destination and during the trip will assess the viability of keeping or changing the port of destination depending on time and cost factors that could be affected by the predicted ETA (Estimated Time of Arrival), the availability of equipment and services at the terminal, the congestion and the number of vessels attending at the port and the terminal, the distance to the port of destination, the size of the vessel, the destination of cargo aboard the vessel, etc.

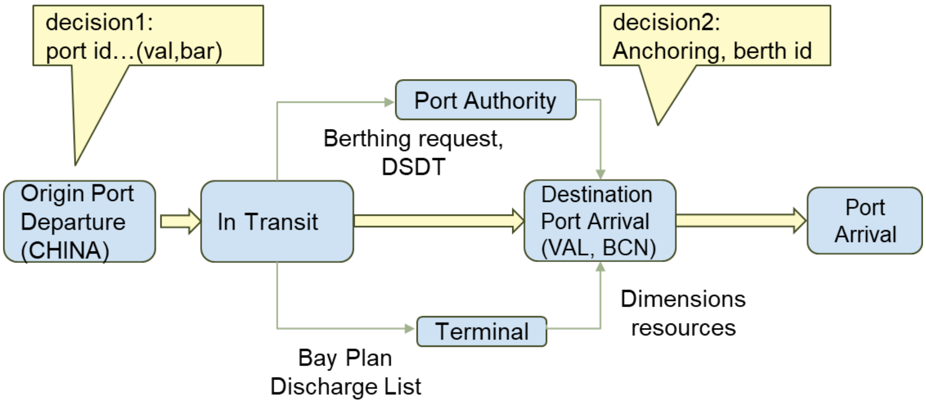


*Figure 3. Maritime Operational Processes*

All these data inputs have been provided by COSCO Shipping Lines in the shape of different documents such as Bay Plans (BAPLIES), discharge lists, summary declarations and transport order documents (DUT). After converting these files from EDI to JSON format, Fundación Valenciaport and VLTN are currently exploring the different data variables in order to model the best approach to make the decision.

On the other hand, the intelligent algorithm is also evaluating the time impact of deciding which is the best way for transporting containers from the Port of Valencia to DHL warehouses in Madrid and Zaragoza, covering the inland transport planning (see Figure 4). For this casuistic, both truck and train options are being considered. In this sense, Fundación Valenciaport and VLTN have started modelling the use case by calculating the distance and trip duration from the Port of Valencia, Barcelona and Algeciras to the different destinations provided in the transport order documents. This calculation has been performed by considering post codes as the way of calculating the coordinates of the points of interest. The calculation of distances and trip durations has been performed by leveraging Nominatim OpenStreetMap API and OSRM API.

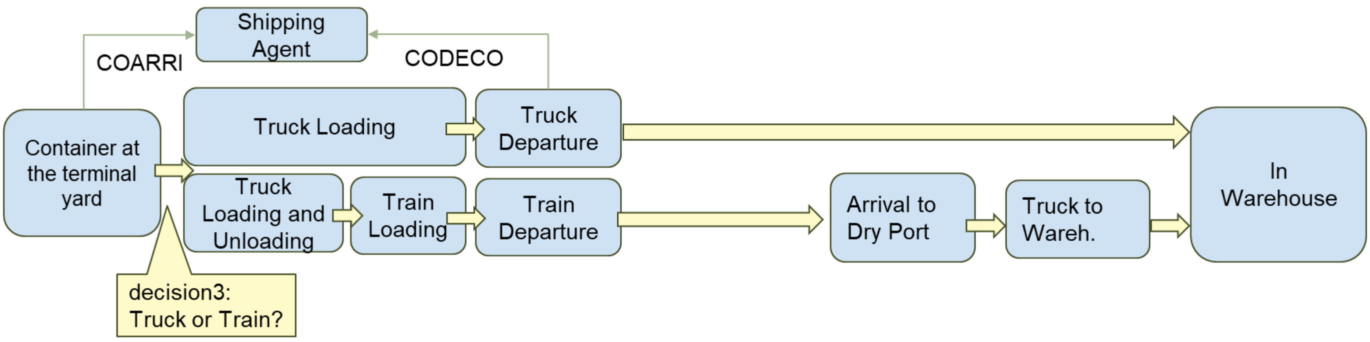


*Figure 4. Inland Operational Processes*

In UC2, AI-based prediction models have been developed to optimize the operative in warehouses together with the flow of packages and pallets towards last mile destinations.

Regarding warehouse scenarios, the prediction models aim at improving supply chain efficiency by anticipating an estimation of the volume flow into the warehouse for the next days. In transportation towards the warehouse, the outcomes of the models are expected to help: to improve the hiring of transport resources in peak seasons, to plan the transport routes according to the volumes forecasted, to optimize truck loads and, to enhance transport service levels. Complementing this, warehouse operative is also expected to be enhanced by planning and adjusting human resources according to forecasted volumes, improving operational efficiency and increasing asset utilization.

For this purpose, the intelligent decision-making algorithm utilizes static information such as the warehouse layout, inflow and outflow processes, the mechanical and human resources available and their productivity rates, as well as dynamic information such as the predictions of the inflow and outflow quantities based on historical inflow/ outflow data. For each available resource, the decision-making tool identifies an optimal plan of detailed actions/ jobs to undertake.

With respect to last mile deliveries, the intelligent decision-making algorithm is being built on predictive traffic modelling tools to: identify suitable help candidates from the vans operating nearby, reshuffling parcel for assisting late running vans, identify meeting points for exchanging parcels, and rerouting bans through the meeting point and all delivery locations. In this case, the algorithm is applied in a case study based in central Madrid (Spain), where a static vehicle routing plan dataset has been provided by CityLogin.

The identification of vans available to help is based on the Expected Time of Completion (ETC) prediction, as well as by measuring the proximity of the centroids of all delivery locations for each van. This enables the creation of a shortlist of candidate vehicles, that are then analysed to identify the optimal help round in terms of proximity. For the reshuffling of the packages, a machine Learning K-means clustering algorithm has been used to assign pending deliveries to both vehicles based on the expected delay. Finally, to reroute vehicles after the parcel reshuffling, the algorithm identifies a meeting point and then produces the new routes solving a Travelling Salesman Problem with time windows for both vehicles (see Figure 5).

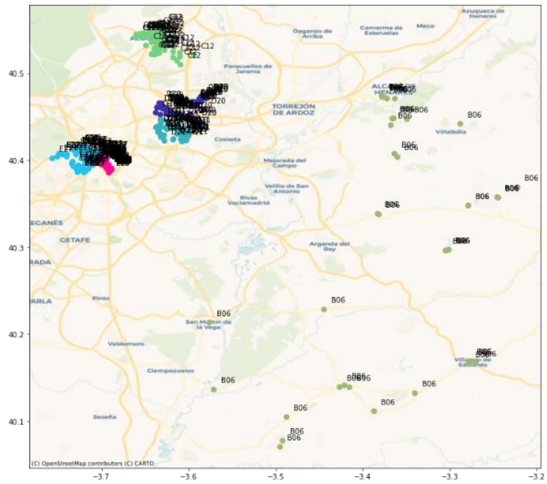

*Figure 5. Pending delivery locations for the later rounds and the five-candidate help rounds*

## Blockchain

The **PLANET Blockchain solution** focuses on the seamless interaction and information exchange between different Blockchain systems belonging to different transport and logistic (T&L) actors. To that end, two Blockchain solutions have been developed by Fundación Valenciaport, Konnecta Systems, and Inlecom. These register transactions and transport events between the port of Valencia (COSCO Shipping Lines) and freight forwarder's community (DHL) in Spain. Both solutions aim at enabling paperless exchanges of transport and

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container documents between the different stakeholders along the supply chain, which in turn foster digital integration and secure monitoring of transactions among actors through a win-win strategy.

As indicated above, the Port of Valencia Blockchain has integrated port container management information through the ingestion of data from different documents such as Bay Plans (BAPLIES), Lists of Discharge, Summary Declarations and Transport Order Documents (DUT). The information, which was received in EDI file format, was first converted to JSON format and then integrated into a back-end and front-end application, where it is stored and visualized. The Blockchain network – developed in Hyperledger Fabric 1.4 - is able to register data available in the application and show the history of events related to vessel calls, discharge and storage of containers, and shipments, thanks to the creation of different smart contracts. In the coming months, the integration and generation of transport document information will be addressed.

A second Blockchain network was developed, namely the Freight Forwarder's Blockchain, that enables the exchange of information related to terrestrial transportation between warehouse providers, freight forwarders, and last-mile delivery companies. This second Blockchain is also based on Hyperledger Fabric and brings together different partners, namely DHL and CityLogin, in a private, permissioned Blockchain network.

The PLANET Blockchain solution fosters collaboration and coordination between T&L actors by enabling Blockchain Interoperability. The solution uses and extends the SOFIE Interledger component, which is an outcome of the H2020 SOFIE project.

A third Blockchain network representing a Port Community - developed by BlockLab - using the public Ethereum Blockchain will also be integrated in the coming months. Finally, the interoperability between all the different Blockchain networks (see Figure 6) will be further demonstrated.

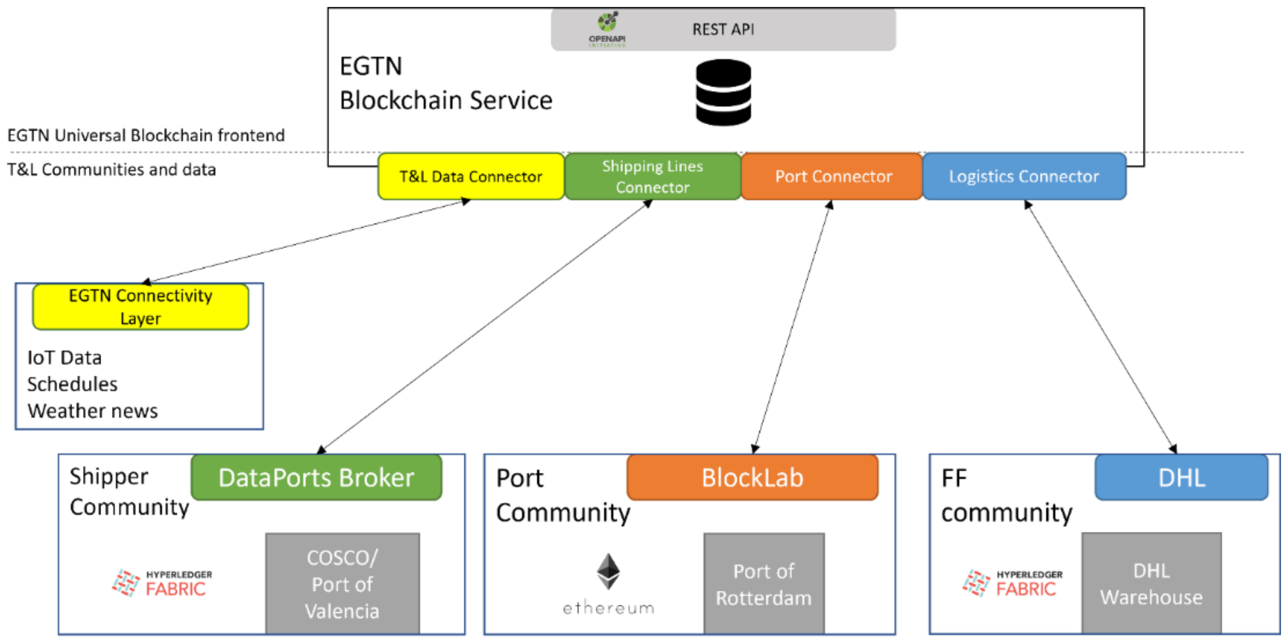


*Figure 6. LL1 Blockchain Interoperability Framework.*



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## Internet of Things for Track&Trace&Monitor

The **IoT services for Track&Trace&Monitor** (T&T&M) aim at enabling the end-to-end (E2E) complete visibility of the supply chain, as depicted in Figure 7. This goal is enabled by an improved granularity approach, where logistics units will be equipped by configurable, secure and active IoT devices, capable to identify it and to implement a dedicated monitoring for it.

*Figure 7. E2E supply chain complete visibility.*

In such a scenario, the logistics units can enable the following services:

1. Goods consolidation, enabling a strict link between these and the logistics unit considered. In this manner, documents (e.g., transport document) can be dematerialised, reducing the paper consumption and supporting their storage in trusted ledgers.
2. Supporting circular economy, transforming logistics assets (e.g., pallet, boxes, …) in reusable smart objects.
3. Logistics units' characterisation, automatically measuring weight and size of the goods (exploiting third parties' devices). In such a scenario, the container/truck/wagon can be efficiently consolidated.
4. Tracking, tracing and monitoring service for each logistics unit.

All the data gathered are collected through scalable and secure Cloud components, based on NGS based proprietary technology, and made available ad-hoc to all the users involved in the logistics transactions, through GUI and standardised APIs (based on GS1 EPCIS 2.0).

The big picture of the T&T&M services deployed in the PLANET LL1 is shown in Figure 8 below.

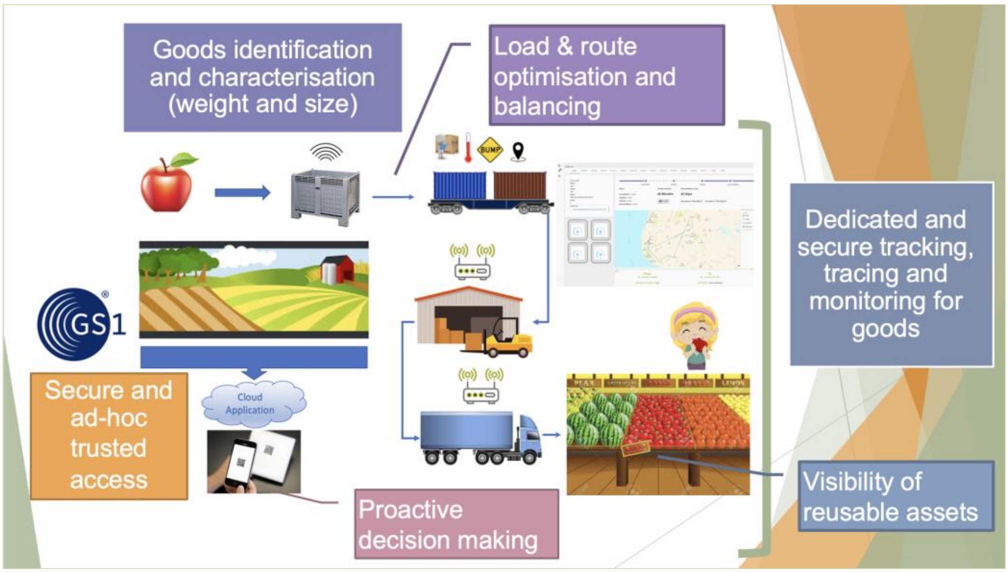


*Figure 8. LL1 T&T&M solution big picture*


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# Attended events


## MARCH 29, 2022 – DAY 1 H2020RTR21, ICT infrastructure for road transport Session

PLANET was presented by the Senior Researcher Kostas Zavitsas (VLTN) and the Project Coordinator Makis Kouloumbis (INLECOM) at the 5th edition of the H2020RTR (2021).

If you missed out, you can find the full recording of PLANET's 15-minute and the presentation here!

## JUNE 1, 2022 – DAY 2 ITS EUROPEAN CONGRESS, TECH. PROGRAMME 24 – INNOVATIVE LOGISTICS


The ITS Congresses represent the ultimate showcase of mobility services deployment and are the means for the ITS Community to keep pace with the incredible evolution of the industry.

PLANET took part at the *Technical Programme 24 – Innovative Logistics* on 1st June 2022, addressing the fifth ITS Congress topic. During this technical programme, Mr. Camill Harter (RSM, Erasmus University) focused on introducing the concept of Integrated Green EU-Global T&L Network (EGTN) as proposed by PLANET and illustrating how T&L innovations at the micro level impact network performance at the macro level.

You can find more information here!


## JUNE 20, 2022 – DAY 1 ACCELERATION EVENT: BLOCKCHAIN MADE EASY FOR SMEs AND EUROPEAN VALUE CHAINS

This event was conceived as 'acceleration event' to understand the BlockChain technology and its potential application.

PLANET was presented at the session entitled *Blockchain-enabled Ports: The Experience of the PLANET H2020 project and Blockchain interoperability*, as part of the Focus Part 1 (Day 1 – 20 June, 2020) The blockchain technology in railways and multimodal logistics: uses cases and challenges. During this presentation, Mr. Harris Niavis (Inlecom) and Mr. Claudio Salvadori (NGS) addressed the NGS solution developed in PLANET, as well as the EGTN results, with special focus on the blockchain interoperability.

You can find more information and the presentation here!



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# News: PLANET's 3rd General Assembly, liaison actions and more

## MAY 17-18, 2022 – PLANET 3rd GENERAL ASSEMBLY MEETING

PLANET 3rd General Assembly followed a hybrid format, making possible the first face-to-face meeting of the project. This meeting shared and advanced the technical developments that the project is implementing, resulting in an interactive meeting with representation from all project partners.

You can find more information here!

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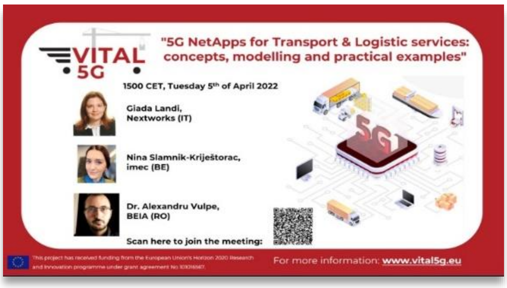
## PLANET ATTENDED THE 5G NETAPPS FOR TRANSPORT & LOGISTIC: SERVICES, CONCEPTS AND PRACTICAL EXAMPLES WEBINAR: APRIL 5, 2022

Dr. Kostas Zavitsas (VLTN) attended the webinar in an effort to incorporate possible findings in PLANET Project, specially with the 5G technologies promising to transform network connectivity, streamline operations with higher capacities and ultimately upgraded mobile network offering revolutionary potential capable to transform network and data interconnection.

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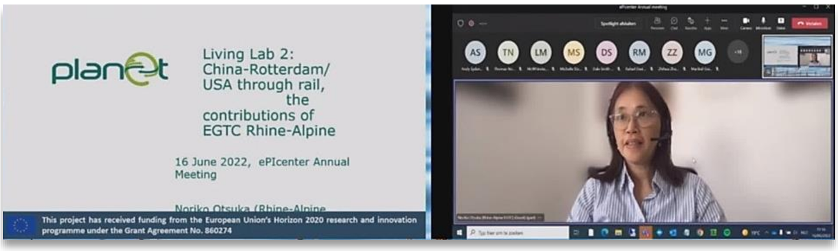
## PLANET AT THE 3rd ANNUAL EPICENTER CONFERECEN: JUNE 16, 2022

Dr. Noriko Otsuka (EGTC) introduced PLANET's vision, the EGTN (EU-Global Trade & Logistics Networks) concept and the Living Labs (LLs). During her intervention on the session *Smart ports innovations & related EU projects*




PLANET was presented as a project that aims to improve efficiency along the door-to-door transport chains and coordinate complex supply by researching and testing innovative solutions, concepts and technologies.

You can find more information and the presentation here!

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## PLANET'S FEEDBACK TO THE EU GUIDELINES FOR THE DEVELOPMENT OF THE TEN-T

PLANET contributed to the public consultation process of the revision of Regulation (EU) 1315/2013 - Union guidelines for the development of the trans-European transport network (TEN-T) -, providing specific comments on the proposed legislative text. Soon available on PLANET's website!


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## COORDINATOR OF THE PLANET PROJECT

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CITYlogin — Urban & eco-friendly logistics

CPSI — Comunidade Portuária de Sines — Ao serviço do Porto, da Logística e da Indústria

DHL

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