planet

Workshop

LL1 PI and Blockchain for optimized door-to-door Asia-Europe corridors: Mediterranean Corridor

27 April 2023

COSCO SHIPPING Lines (Spain) S.A

DHL Spain

ITAINNOVA, NGS, FVP, KNT, VLTN

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Agenda

BUSINESS CASE

- Living Lab Scope and objectives
- UC1 COSCO / UC2 DHL & Citylogin
  - Scenario description
  - Applied solutions mapped with Business Objectives

TECHNICAL SOLUTIONS & Business Value

- PI Concept & PI Network Model including digital clone
- IoT Architecture
- Blockchain platforms
- Intelligent PI Nodes and PI Network LL1 services

IMPACT ASSESSMENT & CONCLUSIONS

- Impact assessment
  - KPIs baseline, target and actual values
  - Business impacts/value for COSCO and DHL & Cityloging
- Conclusions
- Q&A - discussion

Living Lab 1 Scope

PI and Blockchain for optimised door-to-door Asia-EU corridors Mediterranean Corridor

High level objectives / Biz challenges

Examine role of new technologies on EU's strategic transport:

- **BC** for **paperless** and real-time **secure data sharing**
- **AI** for better **forecast** and **intelligent decision** at logistics nodes
- **IoT** for **real-time** logistics assets
- **Digital Clones** for design-planning, operation and optimization of logistics infrastructure in warehouses

Concepts & Technologies

Test new Concepts (PI) & technologies (IoT, AI, BC)

Scope

Improve processes, operations and efficiency of D2D linking **Maritime Silk Road** and **EU corridors**

UC1

Warehouse operations optimization & **last mile** efficiency and sustainability

UC2

On **containerized cargo optimization** between China and Spanish hinterland (Valencia, Barcelona, Algeciras ports)

Tasks and deliverables

1. AS-IS analysis for LL specifications and innovation implementation & assessment — D3.1
2. Install and technically validate the Cloud Open EGTN Infrastructure in the LLs and monitor its performance — D3.2
3. Develop required functionalities for each LL EGTN Solution and obtain measurements of KPIs — D3.10
4. Operate the LL, collect measurements, assess impacts and provide feedback for refinements

UC1 Business story & objectives

High level objectives / Biz challenges

Improve processes, operations and efficiency of door to door services linking **Maritime Silk Road** and **EU corridors.**

Based on **containerized cargo optimization** between China and the Spanish hinterland

Testing new Concepts (PI) and examining role of new technologies on EU's strategic transport:

PI — Physical Internet

Create a PI Network framework incl. ports, city hubs & warehouses

AI — Artificial Intelligence:

For better forecast and intelligent decision at logistics nodes, saving time, economical and environmental costs

BC — Blockchain:

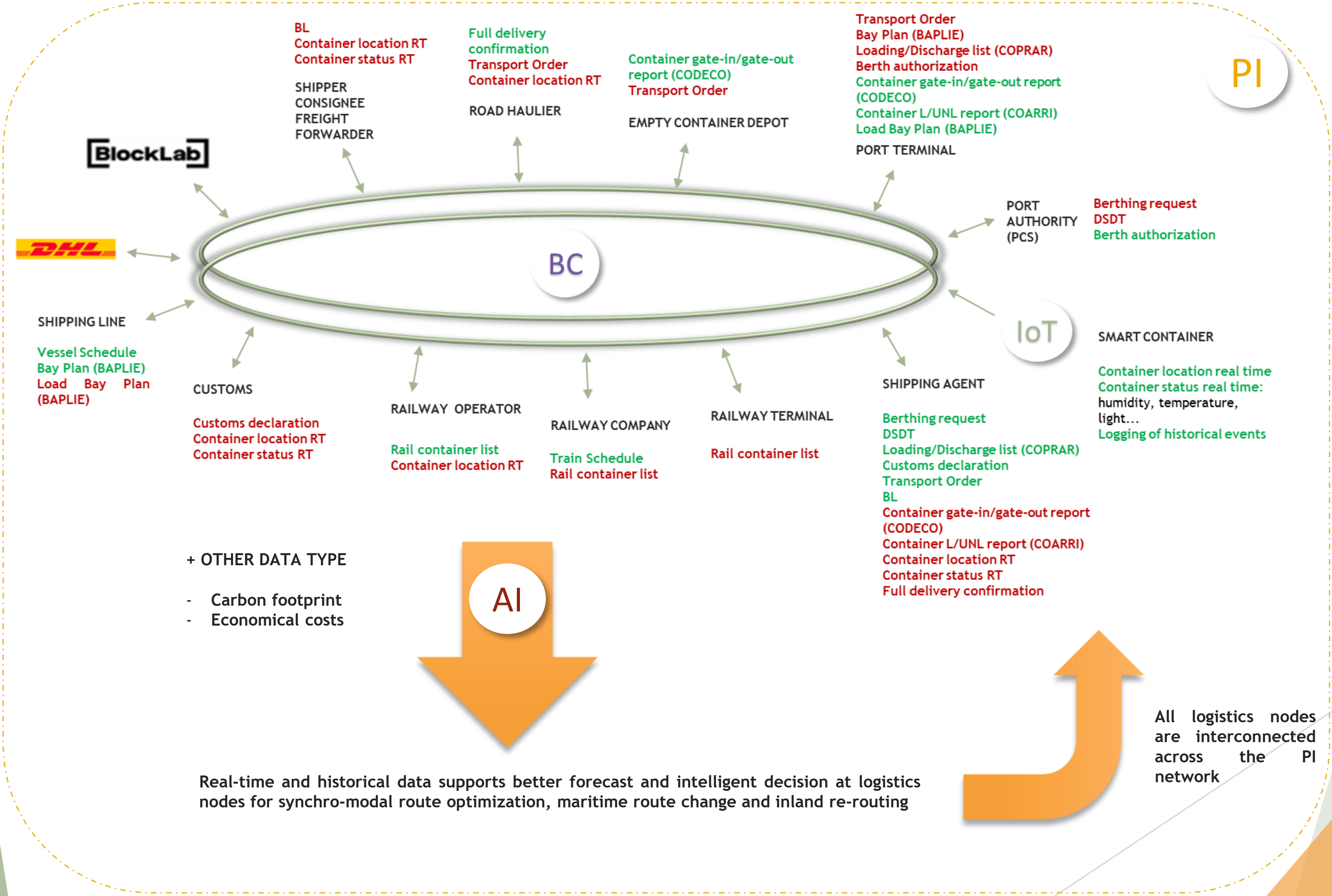
Exchange of real-time and secure data
Reduction of paper-based processes
Customer experience improvement

IoT — IoT devices:

For **real-time** logistics assets:

Know container location & cargo status in real time, by exchanging information to all actors interested and keeping events registered

Applied solutions mapped with Business Objectives



UC2 Business story & objectives

High level objectives / Biz challenges

Improve processes, operations and efficiency of door to door services linking **Maritime Silk Road** and **EU corridors**

Based on **warehouse operations optimization** & **last mile** efficiency and sustainability

Testing new Concepts (PI) and examining role of new technologies on EU's strategic transport:

PI – Physical Internet

Create a PI Network framework incl. ports, city hubs & warehouses

ML – ML & Data Analytics

For better demand forecast and last mile collaboration, reducing transport/operational/environmental costs and increasing collaboration speed and improve delivery times

BC – Blockchain & AI:

Exchange of real-time and secure data for smart contracts to decrease disruptions of the supply chain and decrease urban uncertainty in last mile deliveries

DC – Digital Clones:

Simulation of the warehouse layout to calculate the spare capacity and stock level to increase operational speed

IOT – IoT devices:

For **real-time** logistics assets:

Know container location & cargo status in real time, by exchanging information to all actors interested and keeping events registered

Applied solutions mapped with Business Objectives

DEMAND FORECAST:
- Volumes forecasted
- Plan resources in advance (transport & HR)

DHL WAREHOUSE

WAREHOUSE SIMULATION:
- Optimization of resources
- Scenario simulation
- Improve layout warehouse
- Visibility to spare capacity

DC

AI

ALGORITHM LM COLLABORATION:
- Reduce uncertainty
- Reduce delivery time
- Reduce km/cost/CO2

B2C CHANNEL

Green vehicles fleet to execute the LMD

MADRID CITY

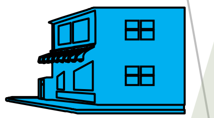
ML DA

COSCO SHIPPING

PORT

B2B CHANNEL

PET SHOP



URGENT TRANSPORTS

SMART CONTRACTS DSS:
- Reduce management time
- Increase automation in operational decisions
- Reduce transport cost
- Reduce delivery time

BC

IoT

SMART CONTAINER:
- Container location real-time
- Container location real-time: humidity, temperature, etc.
- Logging historical events

All logistics nodes are interconnected across the PI network

Real-time and historical data supports better forecast and intelligent decision at logistics nodes for synchro-modal route optimization, maritime route change and inland re-routing

PI

UC2 Citylogin

Activity 1
PI Applies to Last Mile

- Optimizer/Planification: Development of a tool than can manage the amount of deliveries planned in Urban area planning, based on the available vehicles and their capacities, the optimal delivery routes.
- Multicriteria capacity of selection: Less Cost, Less Emissions, Less Time, Less Kms.

Activity 2
IoT deployment for delivery tracking

- Install sensors in deliveries to monitor freight on urban area.
- Monitoring of the development of the delivery operation vs previously planned/optimized.

Activity 3
AI Management Decision Assistance: Rerouting

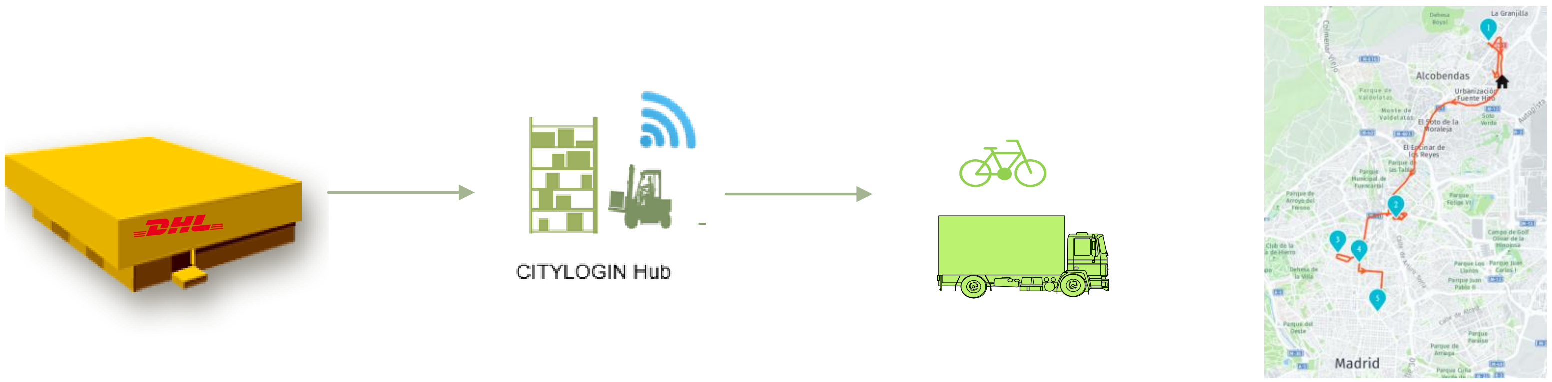
- Once activity 1 is developed and activity 2 is underway, the variations on the planned vs executed are observed.
- Support for the decision to help about a vehicle that goes below what was planned. Select the moment (Time) the place, which deliveries the assistant must pick up and in what order they must be delivered. All of this while adhering to the planned limits of capacity and asset distribution time.

Activity 1 PI Applies to Last Mile

- IBM: Apply ML & Analytics to enhance predictive logistics operations planning

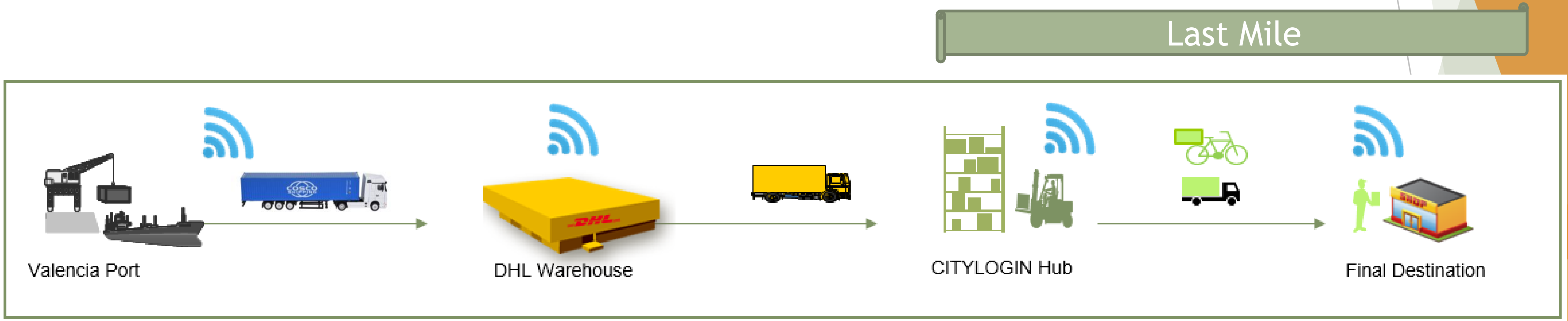
Objective: Planing the task forecast based on the means available for delivery.

METHODOLOGY	Apply ML & Analytics to logistics for volume forecast
1. Delivery Task forecast	Volume forecast based on advanced predictive analytics.
2. Available Fleet asignation	Availability of vehicles and characteristics.
3. Route planning and optimization	Scenario execution selecting optimization preferences. Less cost, less emissions, less time, less kms.



Activity 2 IoT deployment for delivery tracking

OBJECTIVE: Improve Track and trace for warehouse and transportation planning	
METHODOLOGY	Install IoT sensors on containers to monitor freight on inland transport and warehouse
1. Real-time monitoring	Parcel monitored along the complete trade lane
2. Data collection	Position, temperature, humidity, distance travelled, stop, motion and speed

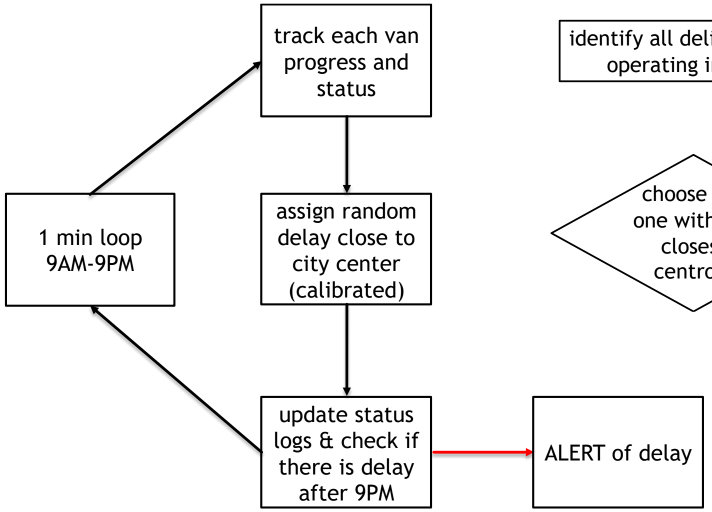


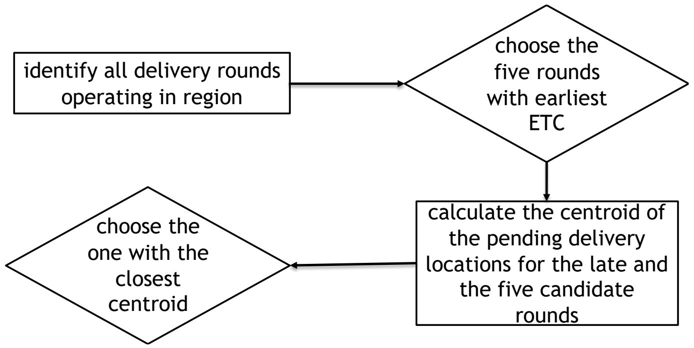
Activity 3 AI Management Decision Assistance: Rerouting

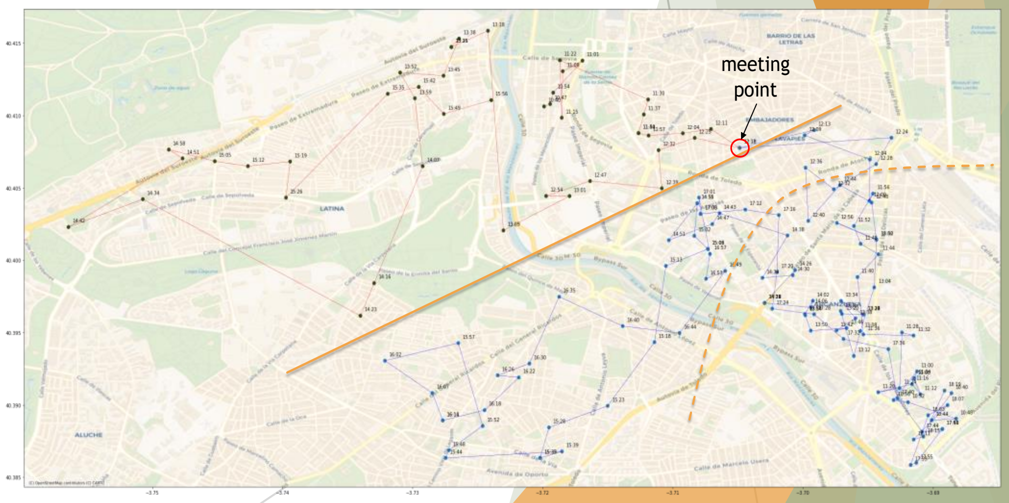
- **VLTN: Apply Ai, ML & Analytics to enhance predictive solutions to avoid deviations real vs planned**

Objective: Planing the task forecast based on the means available for delivery.

METHODOLOGY	**Apply Ai to deliveries for executed vs planned**
1. Check planned vs real executed	Evaluate the differences between planned and executed.
2. Alert of a deviation that prevents 100% execution.	Communicates risk of deviation as planned.
3. Execute a solution to the deviation.	Calculate the diversion range and select the best available vehicle to help, where and at what time they should meet, how many shipments should be transferred, and their delivery order.







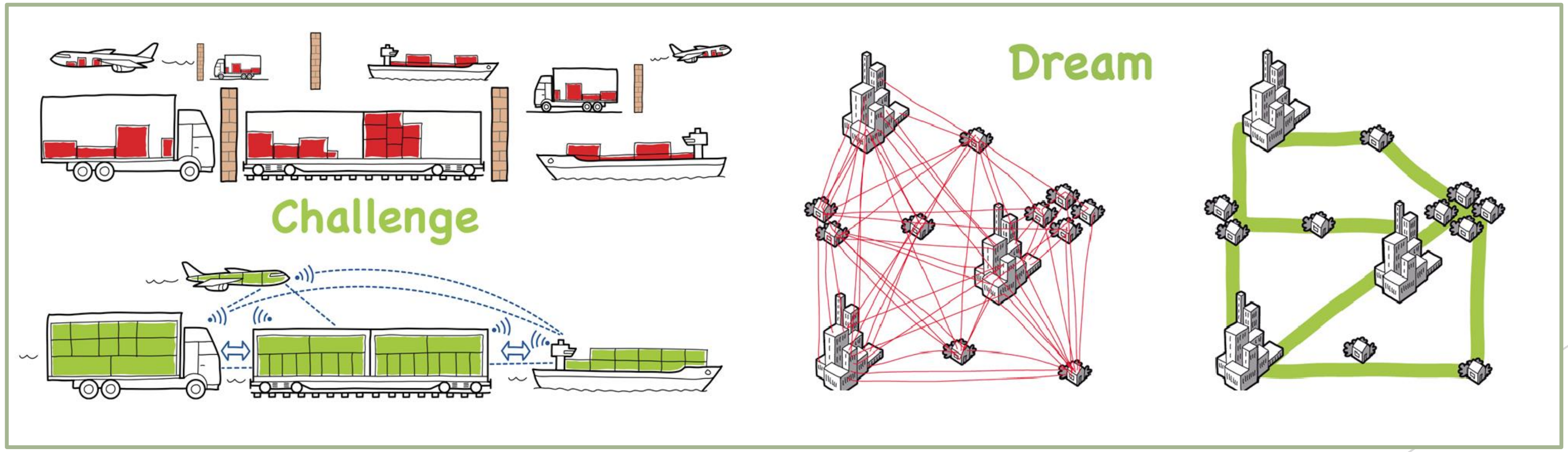
PI concept
PI Network Model including digital clone

ITAINNOVA

David Ciprés
José Luis López Ramón

The Physical Internet Concept

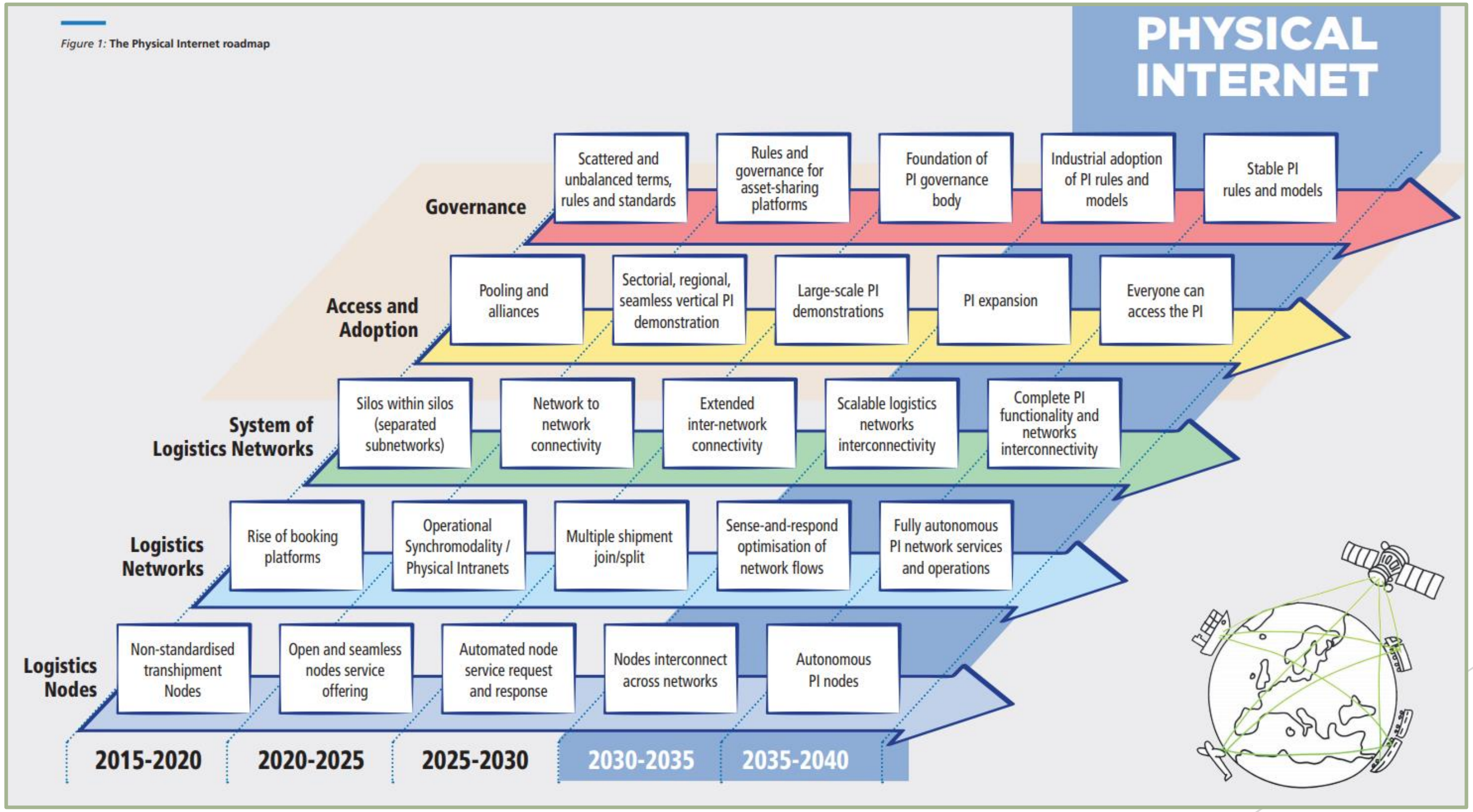
- Current Challenges:
  - As outlined in the European Green Deal, the European Union aims to become the world's first climate-neutral continent by 2050, with the goal of decreasing CO2 emissions by 50%-55% by the year 2030.
  - The existing idle capacity of assets in all modes of transport and storage could be better utilized, and flows could be managed in a more consolidated way using and combining transport modes and other logistics assets smartly (ALICE-ETP, 2020. Roadmap to the Physical Internet.).



Progress of SENSE project on developing Physical Internet (PI). ALICE-ETP, 2018.

The Physical Internet Concept

- The Physical Internet (PI) aims to integrate logistics networks into an open and interconnected global system through standard containers and routing protocols.



The Physical Internet roadmap. ALICE-ETP, 2020. Roadmap to the Physical Internet.

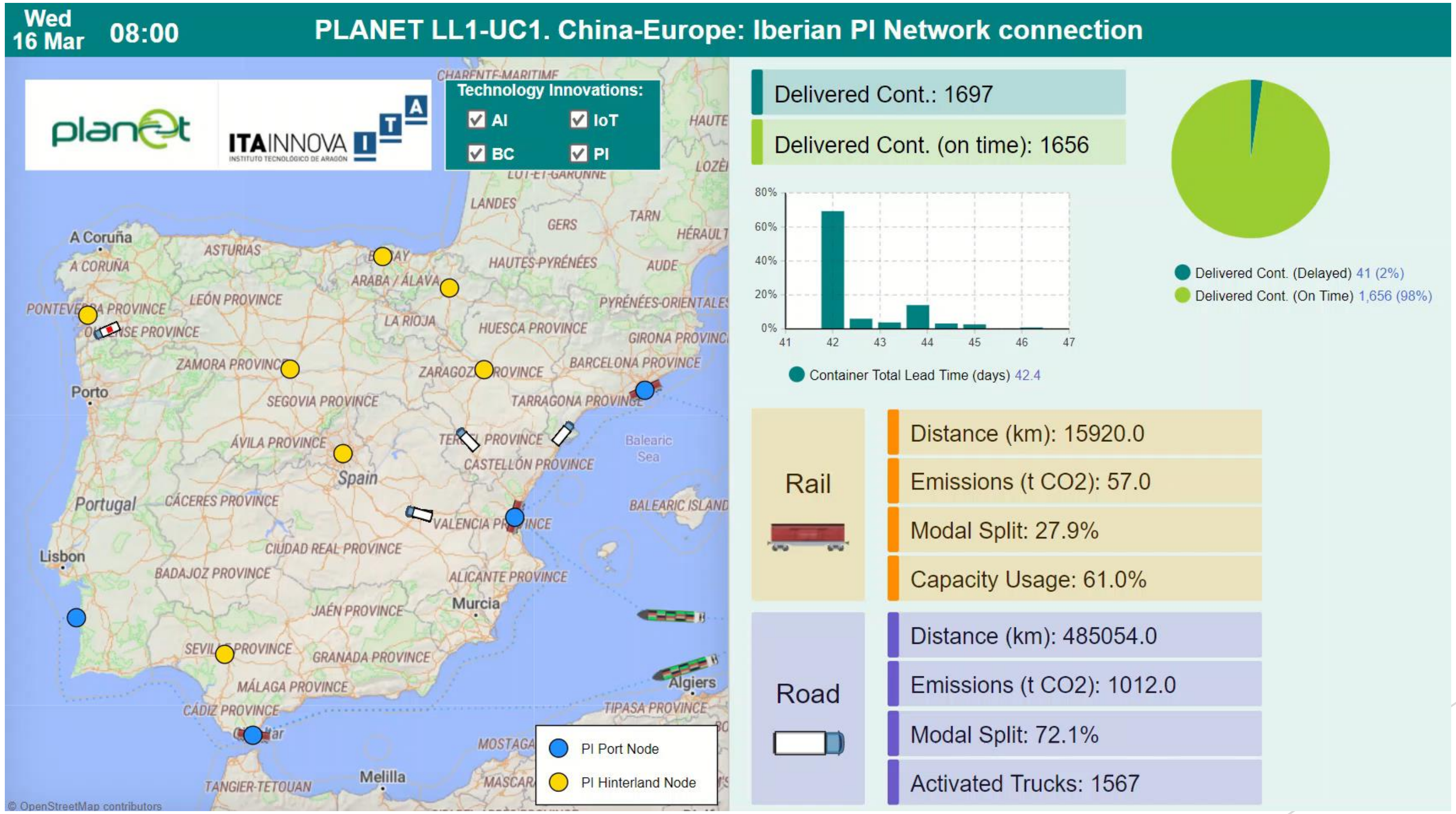
PI Network Models & Digital Clones

- Technical solution: several dynamic **simulation models / digital twins** have been developed, providing the PLANET project the ability to explore the effect of **Physical Internet and innovative technologies** at different points in the supply chain: **intercontinental freight transportation**, **urban distribution** and **warehouse operations**.

- Business value:
  - Simulation provides a virtual model that reproduces real-life situations, allowing for analysis in a controlled environment. Then, testing of different scenarios and strategies can be done safely, quickly, and at a much lower cost than in real life.
  - By simulating and analyzing logistics operations, digital twins can identify opportunities for reducing energy consumption and emissions. This can help logistics companies meet sustainability goals and reduce their environmental impact.
  - Digital twins can be used to optimize logistics operations, such as inventory management, route planning, and warehouse layout. This can lead to reduced costs, improved delivery times, and increased customer satisfaction.

PI Network Simulator

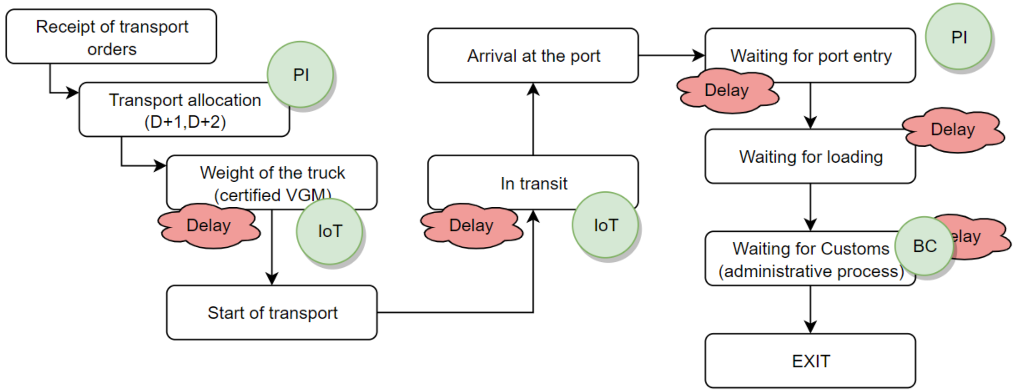
- In **UC1**, the **PI Network Simulator** was used to assess how the impact of Physical Internet concepts in combination with new technologies (IoT, AI, BC) can improve processes, operations, and efficiency of transport chains between China and the EU.



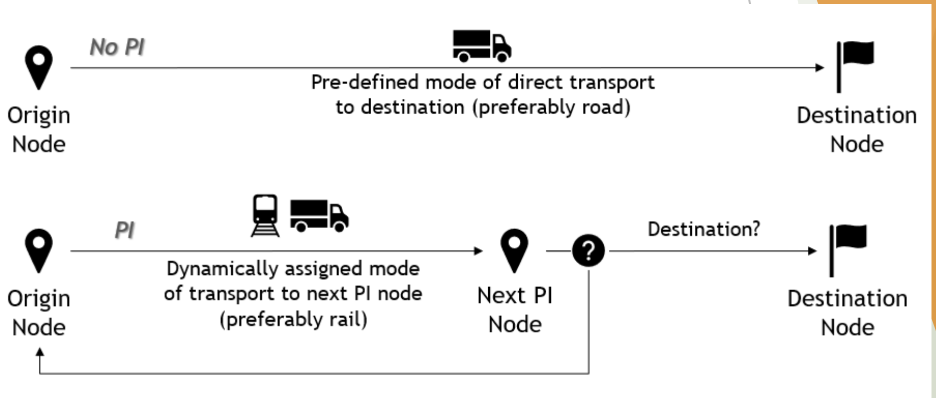
PI Network Simulator

- Test Case: **COSSP** intercontinental freight transportation

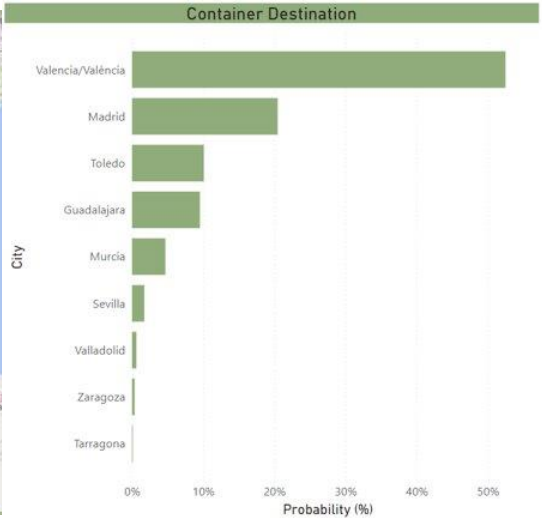
1) Technology impact identification (PI, IoT, AI, BC)



2) Technology impact modelling



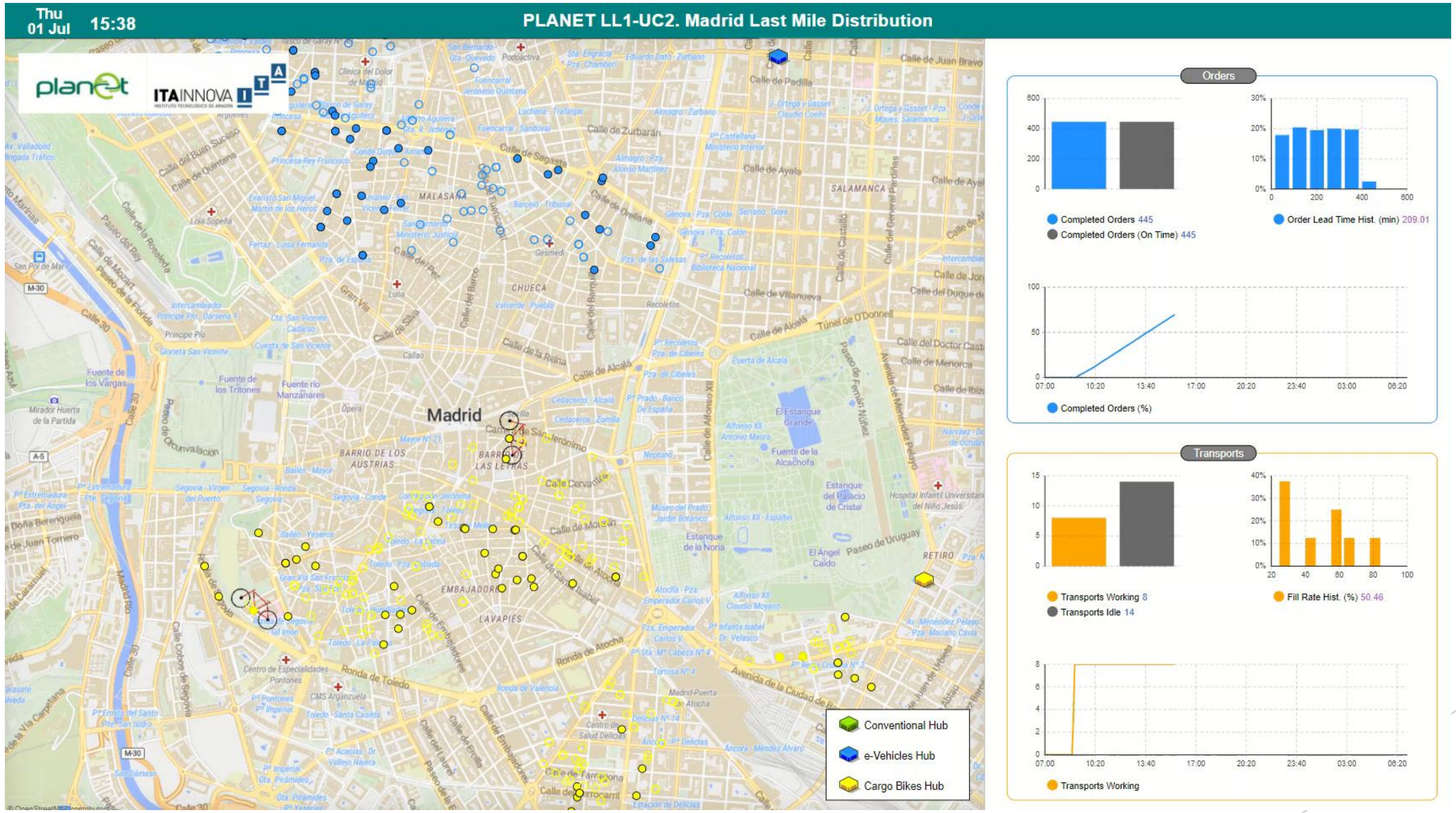
3) COSSP Data Analysis



4) Simulation results

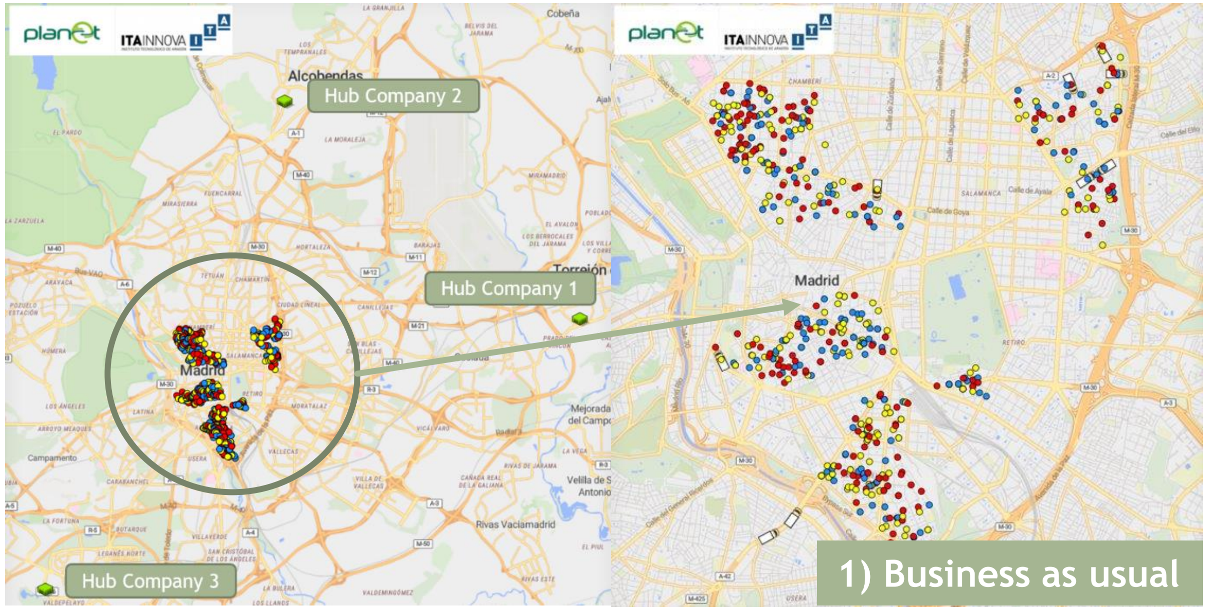
Last Mile Delivery Model

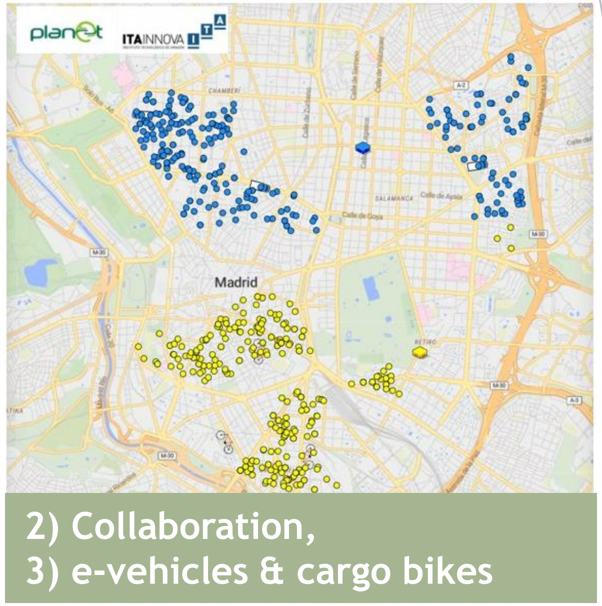
- In **UC2**, the **Last Mile Delivery Model** was used to assess how the impact of Physical Internet concepts in combination with algorithms for last mile collaboration and the utilization of green vehicles can improve processes, operations, and efficiency of urban logistics.



Last Mile Delivery Model

- Test Case: **CityLogin** last mile distribution in Madrid

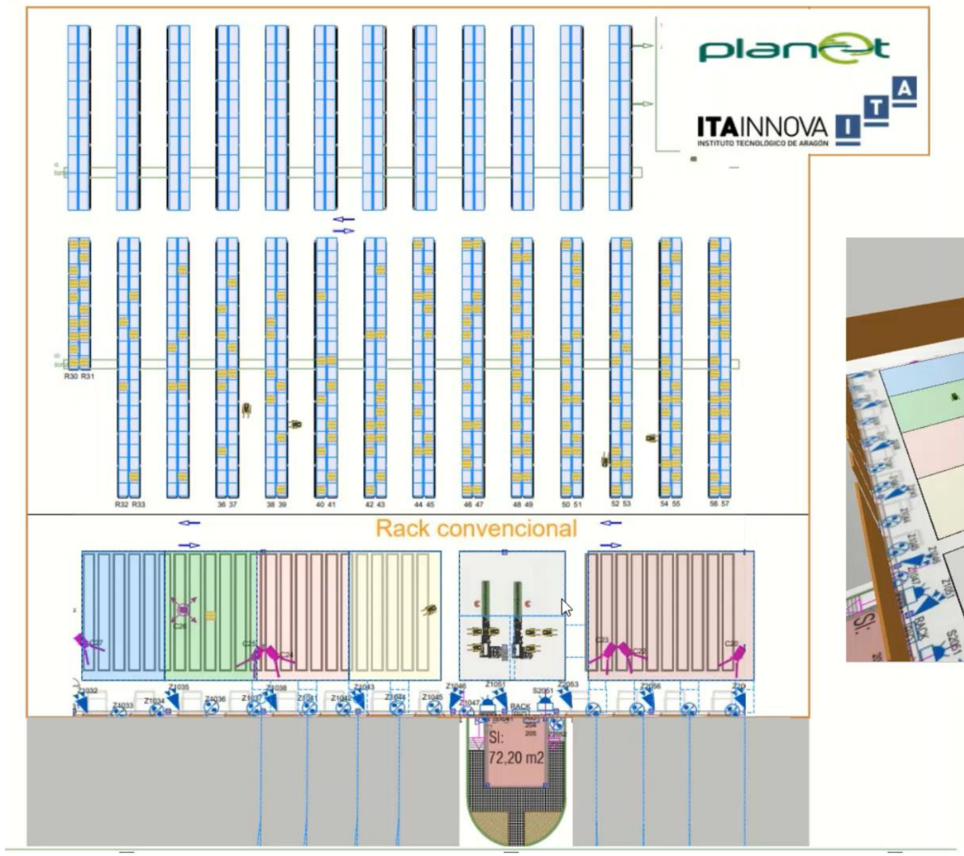


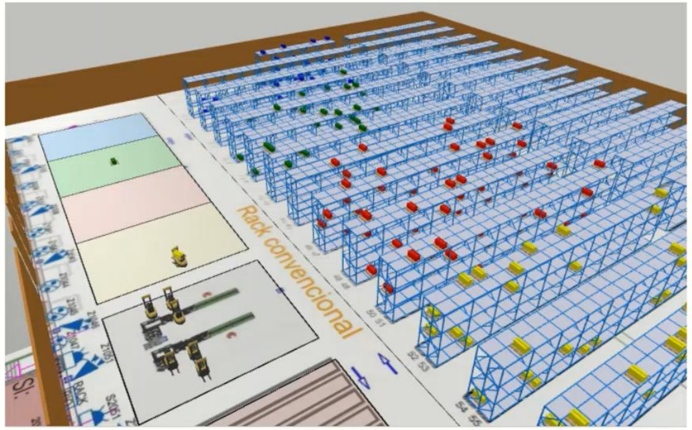


- S1) Business as usual. Several companies operating in city center in the traditional, non-collaborative manner.
- S2) **Collaborative urban consolidation PI hubs** are implemented to facilitate collaborative cargo distribution using the Physical Internet approach, resulting in **lower operational and transportation costs**, as well as **improved order lead times**.
- S3) Traditional delivery vehicles are replaced **with electric vehicles (EVs) and cargo bikes**, resulting in a **reduction of CO2 emissions**.

PI Warehouse Digital Clone

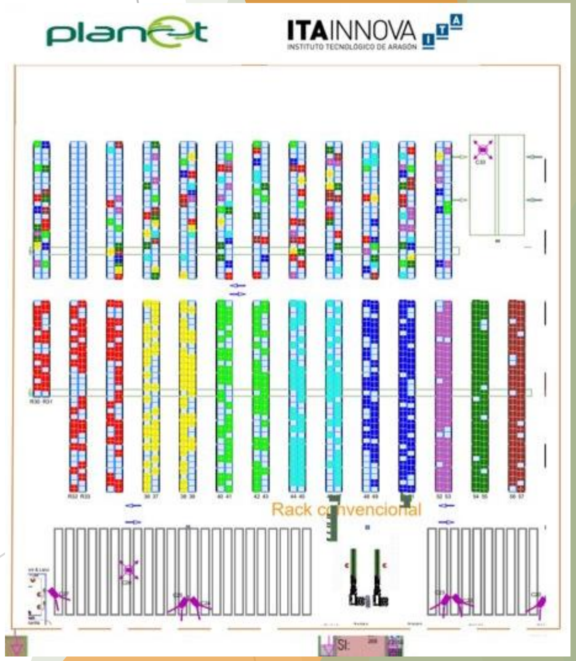
- In **UC2**, the **PI Warehouse Digital Clone** was used to assess how operations and processes within a warehouse are affected when PI concepts in combination with new technologies such as AI are applied.





PI Warehouse Digital Clone

- Test Case: **DHL** Warehouse Digital Clone
  - A DHL warehouse was analysed to identify the operations and processes that occur within a conventional warehouse and used as the basis for the construction of the digital clone.
  - The digital clone allows users to explore the results under different configurations or scenarios:
    - S1) Baseline. Conventional picking process.
    - S2) **Collaborative Physical Internet**. Deployment of order synchronization in a collaborative warehouse which is functioning under the Physical Internet concept so the number of **orders can be reduced** and **picking routes can be optimized**.
    - S3) **Artificial Intelligence**. Use of demand forecasting models to **adequate the pickers to the daily workload** giving a more accurate number of employees required to effectively complete the picking process.
    - S4) **Physical Internet & Artificial Intelligence**. Use of demand forecasting methods to **optimize the number of resources while considering the warehouse as a PI Node**.



Conclusions & Lessons Learned

- The Physical Internet is considered to be the visionary paradigm supplying an integrated approach to address logistics integration and collaboration issues and to pave the road forward to deploying efficient supply chains.

- The PLANET project aims to evaluate methods for speeding up the adoption of the PI paradigm. This is accomplished by simulating PI hubs and corridors, and showcasing and evaluating technologies that promote PI in the Living Labs.

- Simulation models can be easily utilized by stakeholders through user-friendly interfaces that allow them to provide data, simulate scenarios, and analyze results. This leads to enhanced decision-making, resulting in higher operational efficiency, competitiveness, and recognition of the advantages associated with a transition towards PI.

IoT Architecture

NGS

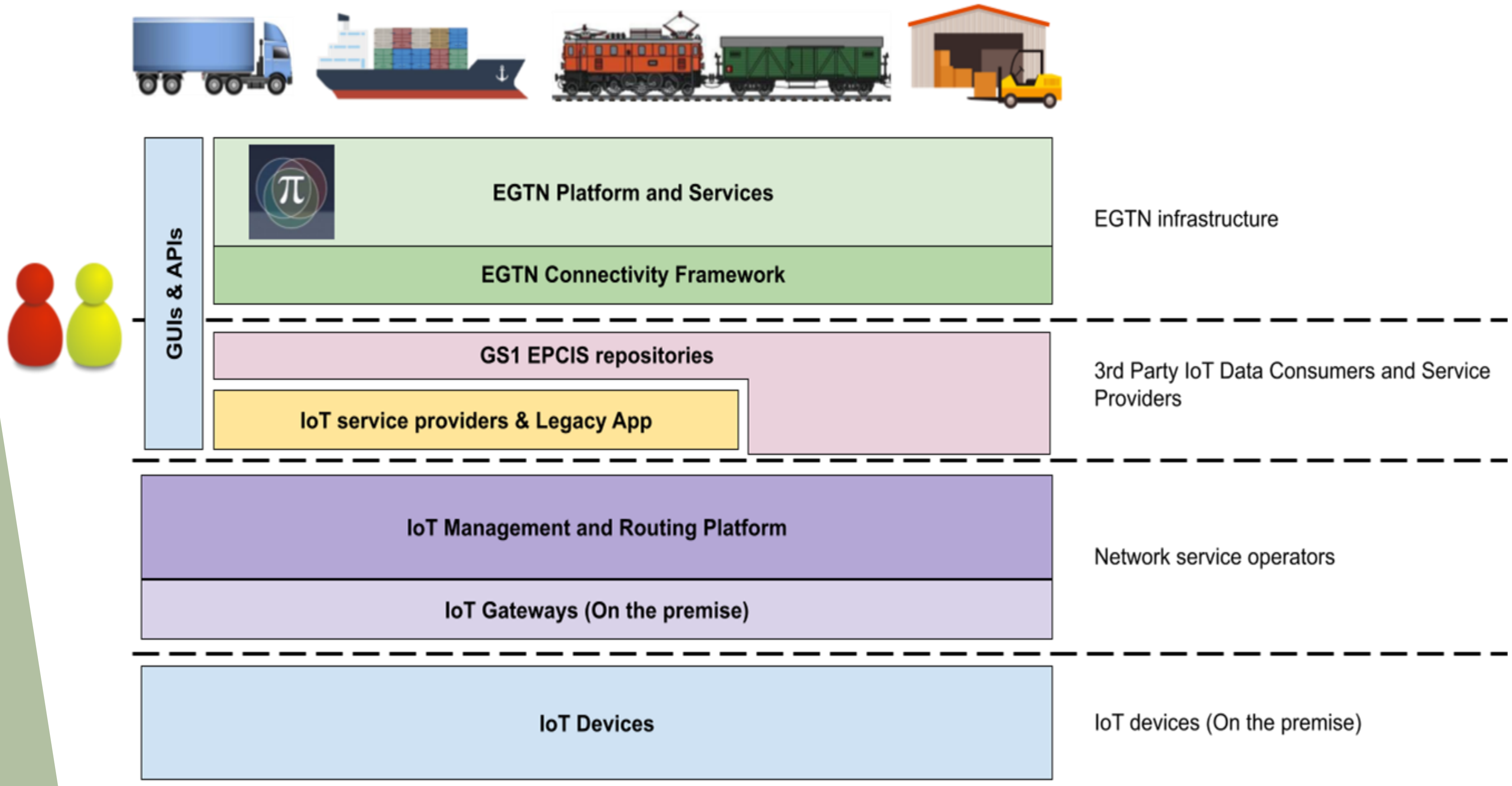
Claudio Salvadori

IoT layer toward the complete visibility of the SC

Key drivers

- **Complete visibility of the supply chain (both last-mile and cargo)**
  - T&T
  - Monitoring (specialised for the goods)
- **Interoperable, competitive & cooperative, horizontal and "as a service" environment in the premises**
  - **Coexistence of different IoT Service providers** (different business models)
  - **Organisational interoperability** (GS1 EPCIS)
- **Improved interoperability in data sharing (up to organisational – EPCIS 2.0)**
  - Secure and ad-hoc access
  - Seamless integration with EGTN

Generalised as a service architecture for EGTN IoT Infrastructure



Innovative architecture for:

Enabling mode-agnostic, open, horizontal IoT environment

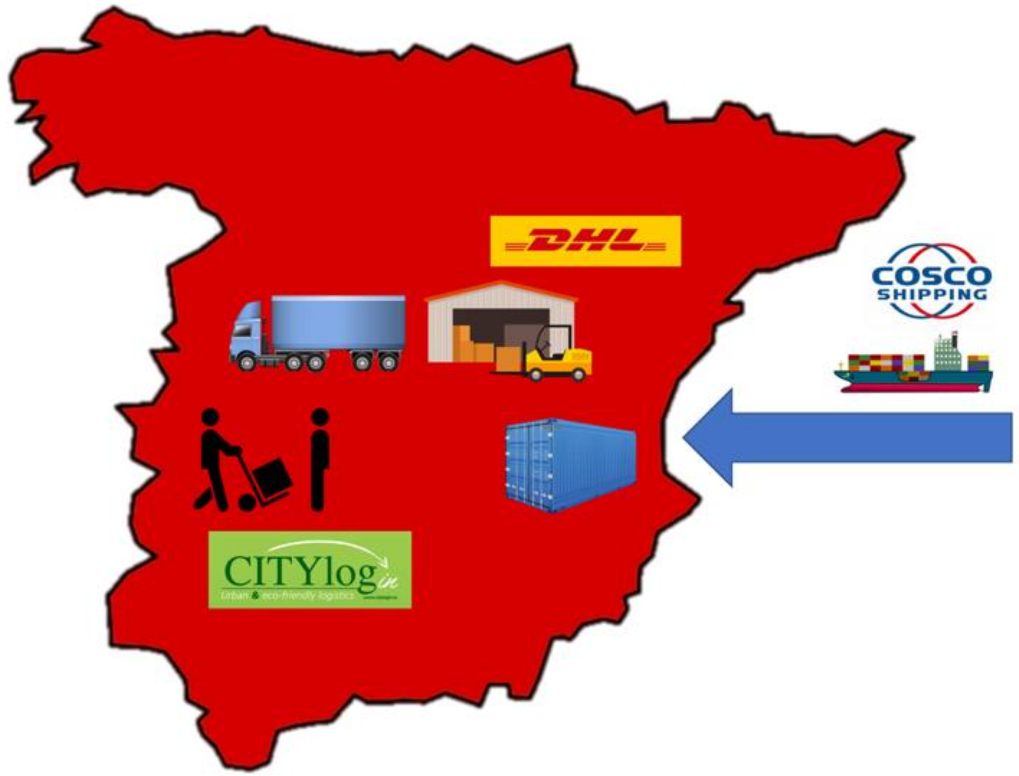
Accommodating different and competitive service providers and business models

Seamless integration & organisational interoperability, service provider independent

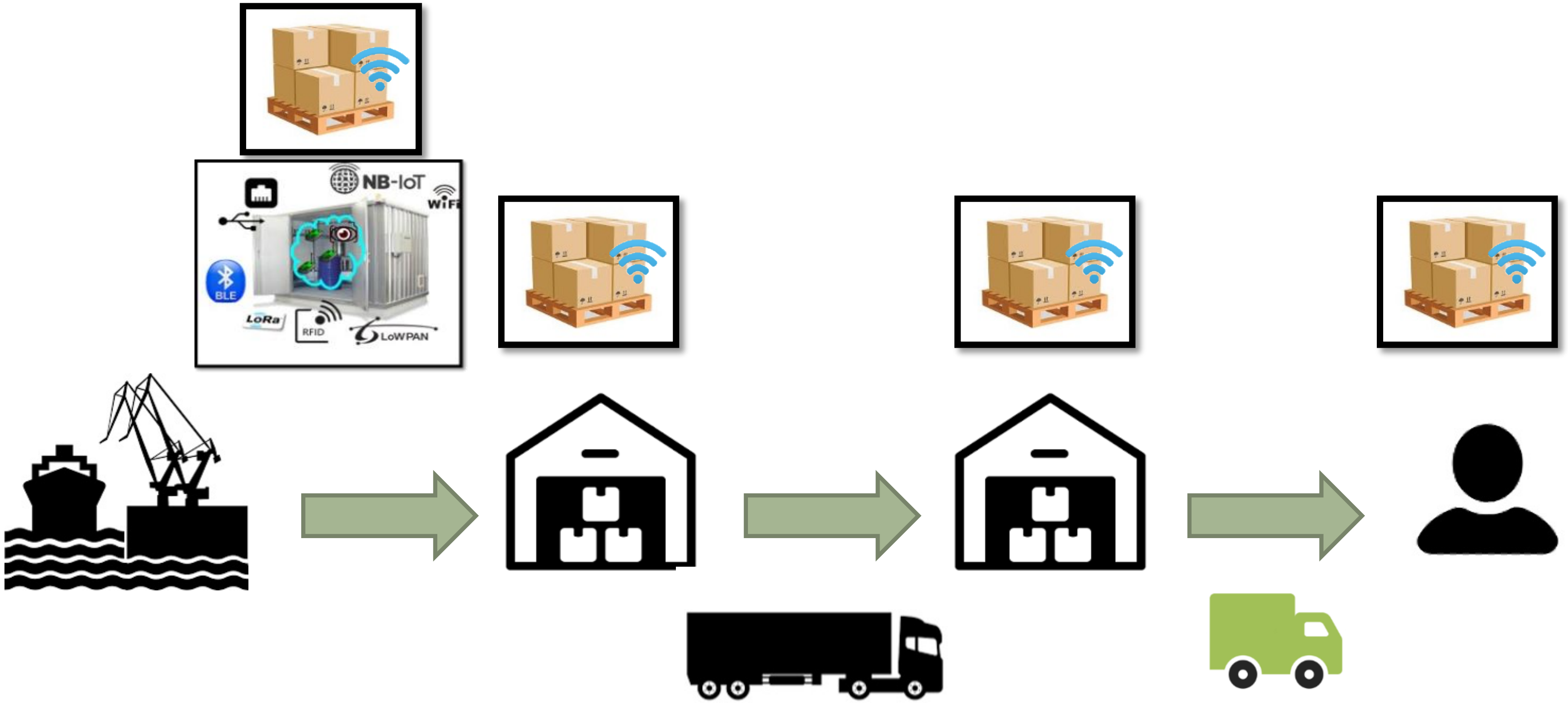
LL1 IoT environment objectives

Enabling the complete visibility of the SC

- Covering the whole China to Spain supply chain
- From cargo logistics toward delivery
- Tracking, tracing and (dedicated) monitoring LUs in a mode agnostic manner
- Involvement of different logistics operators
  - COSCO → cargo logistics
  - DHL → warehousing and last mile logistics
  - Citylogin → warehousing and delivery



LL1 scenario



Valencia

Madrid

LL1 features

- T&T&M container/truck
- T&T&M LUs
- T&T Assets
- Secure ad hoc access
- Interoperation with higher EGTN levels using GS1 EPCIS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    "cbv": "https://ns.gs1.org/cbv/"
  }, {
    "ngs": "https://ngs-sensors.it/"
  }],
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  "creationDate": "2022-09-21T11:08:55.418519",
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    "eventList": [{
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      }],
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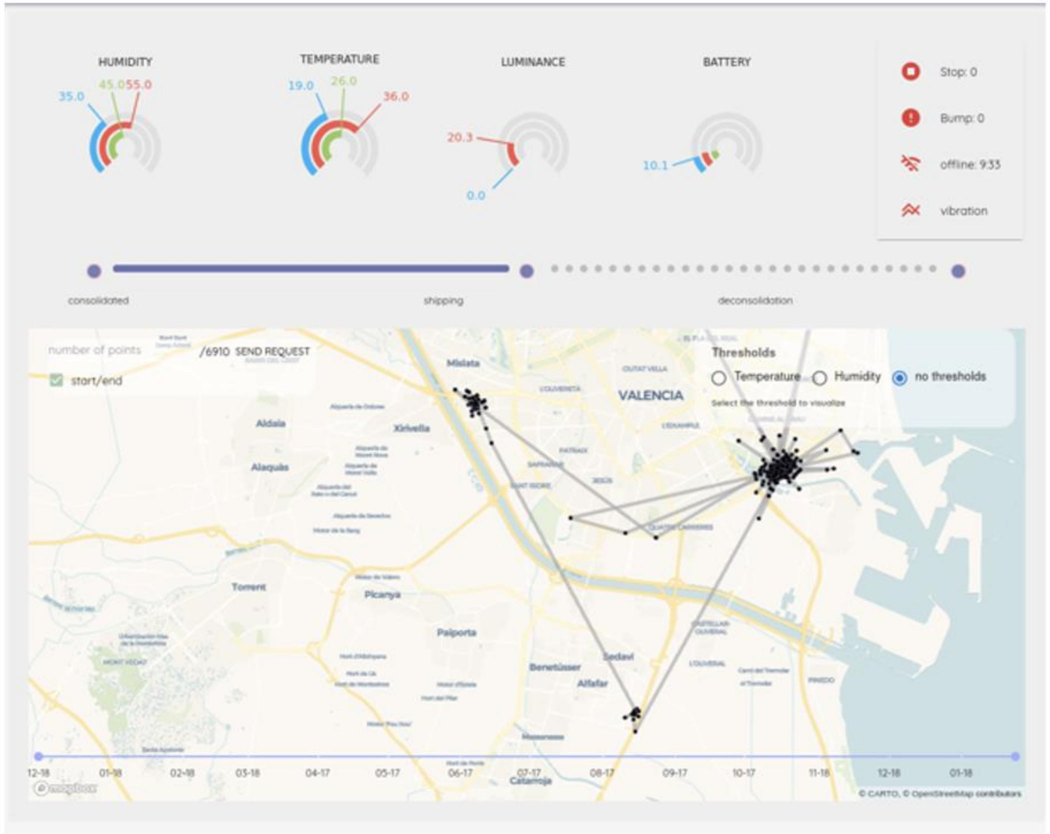
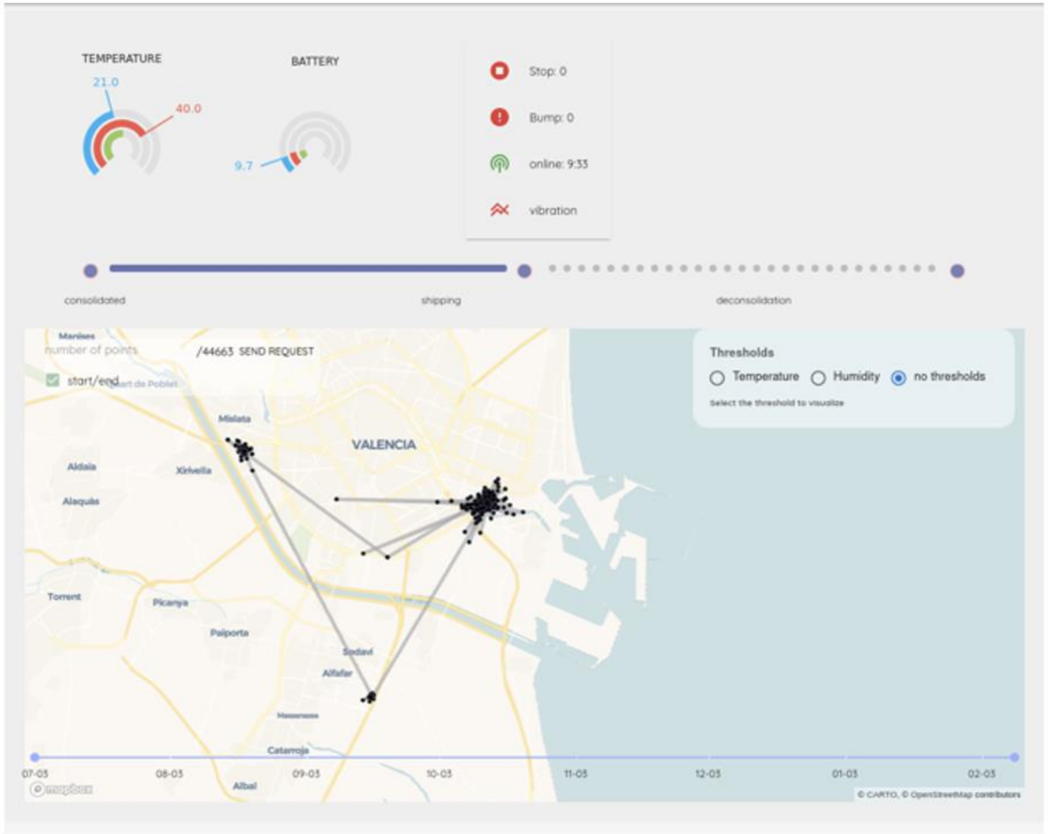
Results: ad-hoc visibility

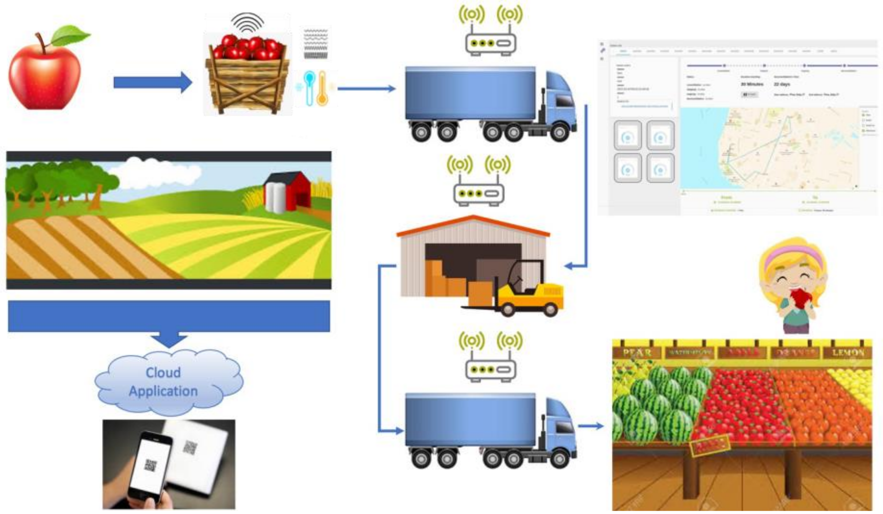


Container View



LU View

Results: dedicated monitoring



Solution Functionalities

- Goods and logistics units identification
  - Using GS1 coding
- Consolidation support
  - Which items are inside the Logistic Units?
- Logistics unit characterisation
  - Automatic weight and size measurements
- Dedicated tracking, tracing, and monitoring
  - Each logistics unit is tracked and traced
  - Each logistics units has a specialised monitoring functionalities
- GUI and interoperable API
  - GS1 EPCIS 2.0

Blockchain Platforms

Fundación Valenciaport

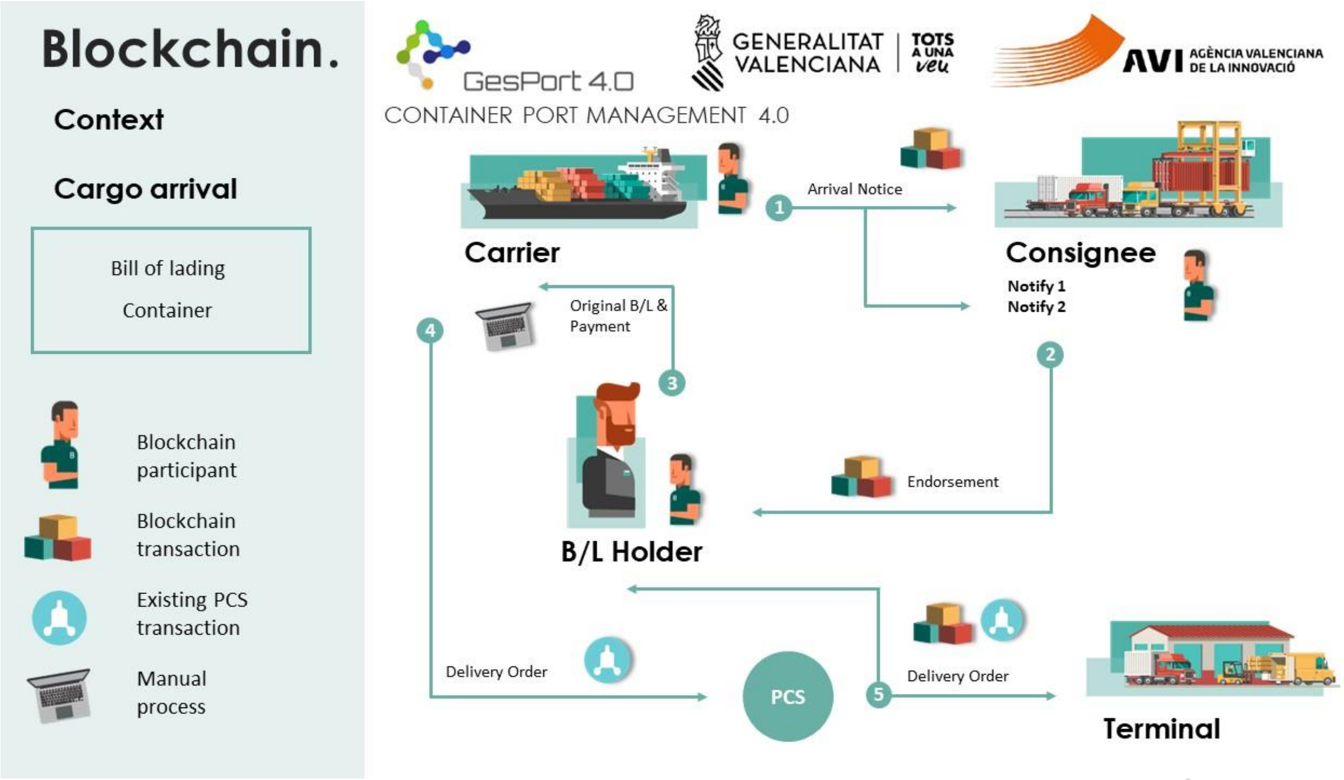
Borja Sanz

Konecta/Inlecom

Harris Niavis

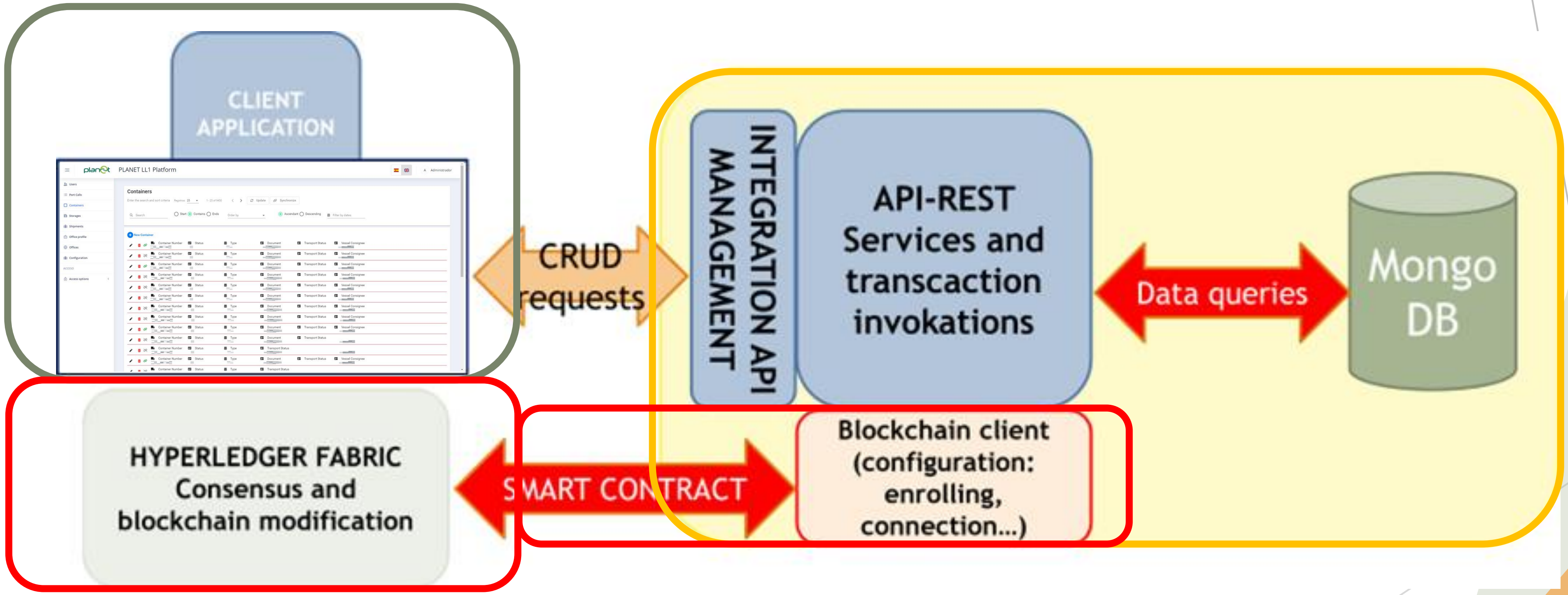
Port of Valencia Blockchain

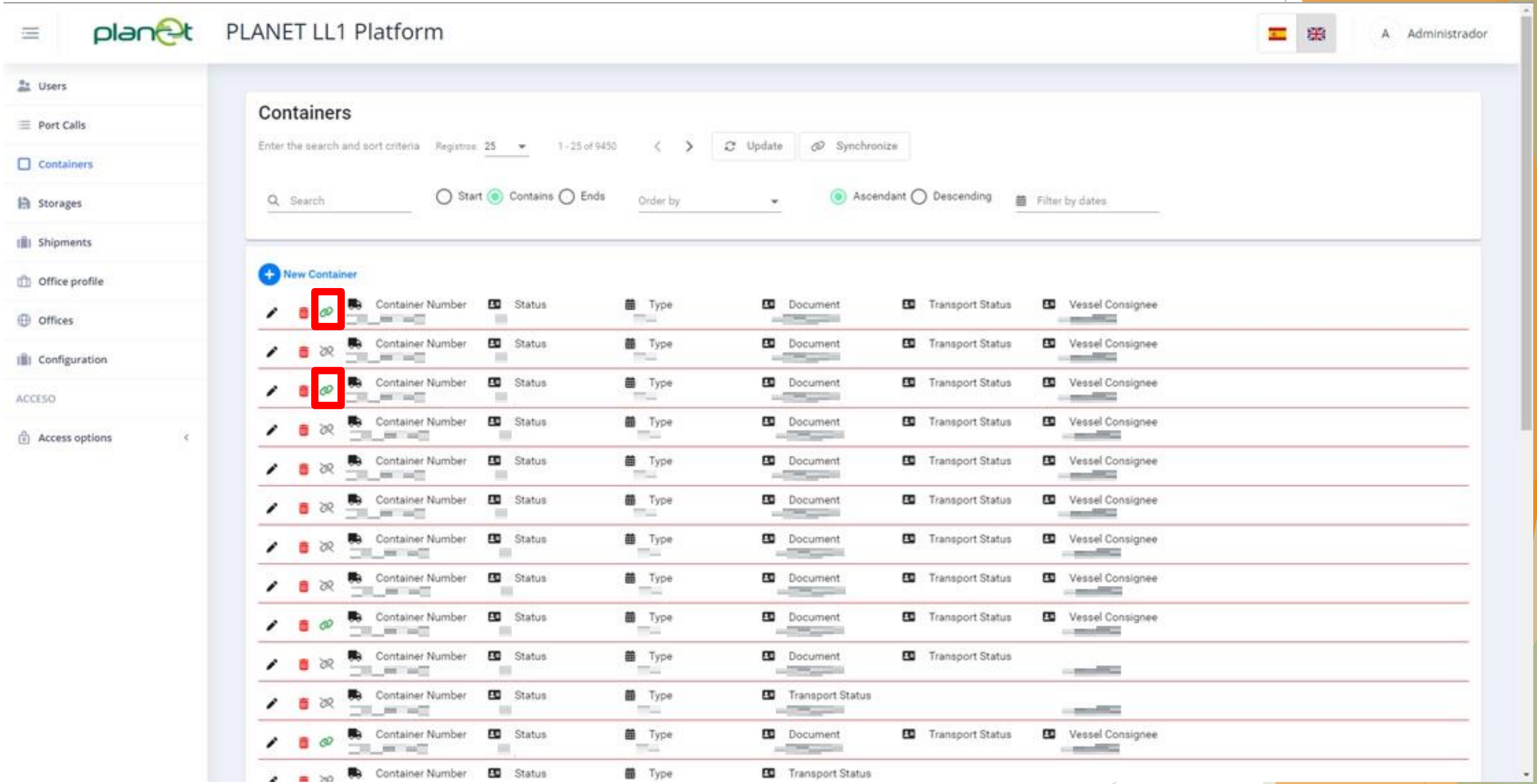
- Blockchain technology in the port sector
  - Key features: **transparency, immutability and security**
  - Wider **traceability** of the supply chain, improved security and **trust** and, **simplified** documentation and transactions



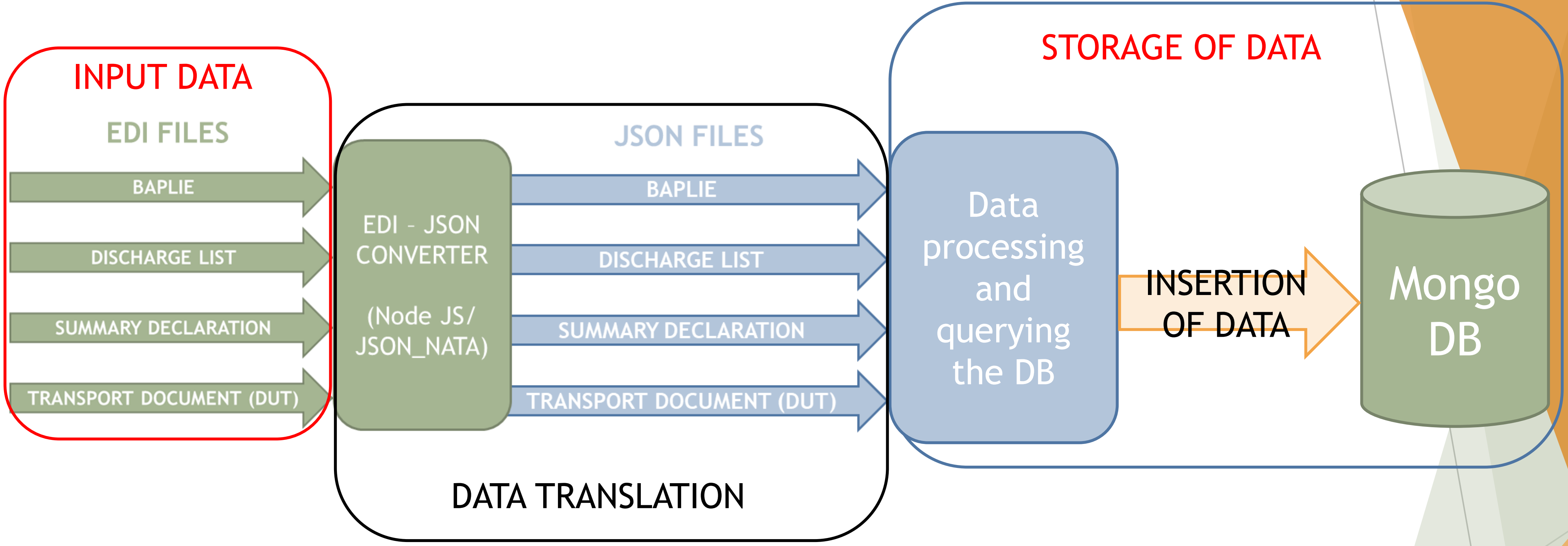
Web-based application and blockchain component integration

- Semantic model




planet
PLANET LL1 Platform
Administrador
Users
Port Calls
Containers
Storages
Shipments
Office profile
Offices
Configuration
ACCESO
Access options
Containers
Enter the search and sort criteria
Registros: 25
1 - 25 of 9450
Update
Synchronize
Search
Start
Contains
Ends
Order by
Ascendant
Descending
Filter by dates
New Container
Container Number
Status
Type
Document
Transport Status
Vessel Consignee

Data ingestion



- Data extraction and transformation is performed
- Insertion of data in order to create assets: conveyor (ship calls), transport unit (containers), stock item (storages in depot/terminal) and shipment models

Blockchain technology validation

Customer satisfaction

- Enabling the integration of the web-based application and the blockchain component contributes to increase customer satisfaction qualitatively

Legit data history

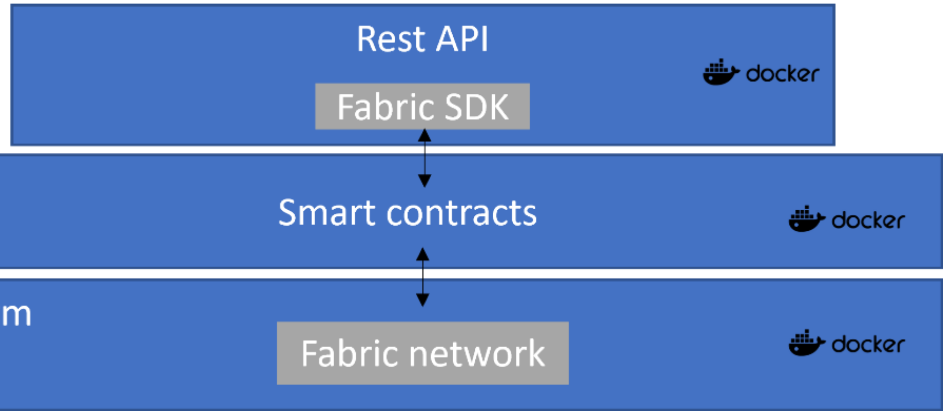
- Tracking of data modifications (history) allows to reduce paper-based procedures by a 30%

Reduction of disputes

- Blockchain technology allows to reduce the number of disputes by a 10%, according to the qualitative assessment done

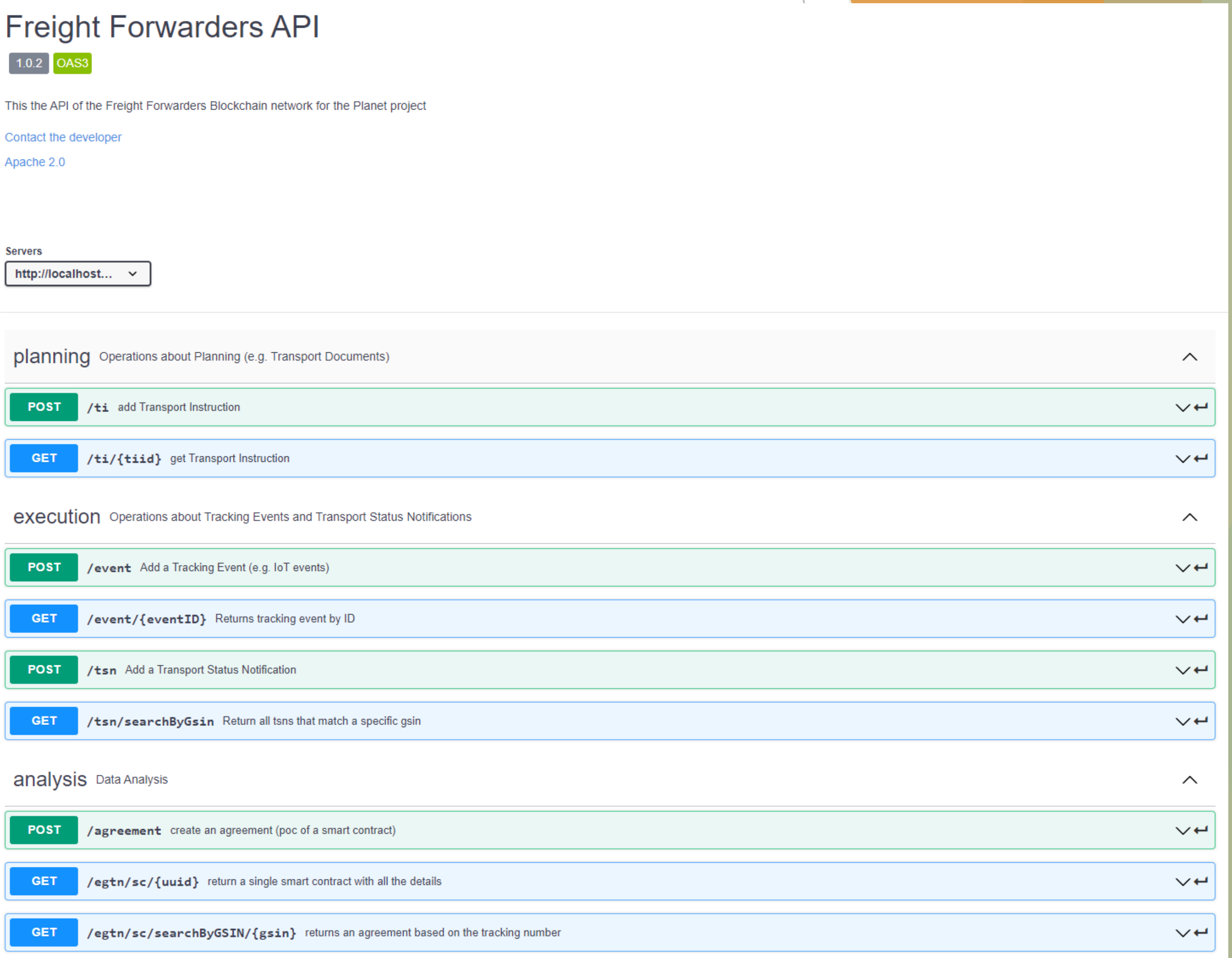
Freight Forwarders (DHL) Blockchain

- Blockchain infrastructure for the Freight Forwarders community of LL1
- All inbound and outbound communication to the FF blockchain happens through a REST API for storing/retrieving transactions
- The REST Server enables the interaction with the underlying smart contracts and the blockchain network
- The blockchain network is based on Hyperledger Fabric



Freight Forwarders (DHL) Blockchain

- The REST API follows the OpenAPI specification and provides a Swagger UI
  - Description of the endpoints
  - Expected responses
  - Request examples
  - Documentation
- Smart contracts in Go for ensuring the integrity of the data entering the ledger and for automating processes in the logistics chain

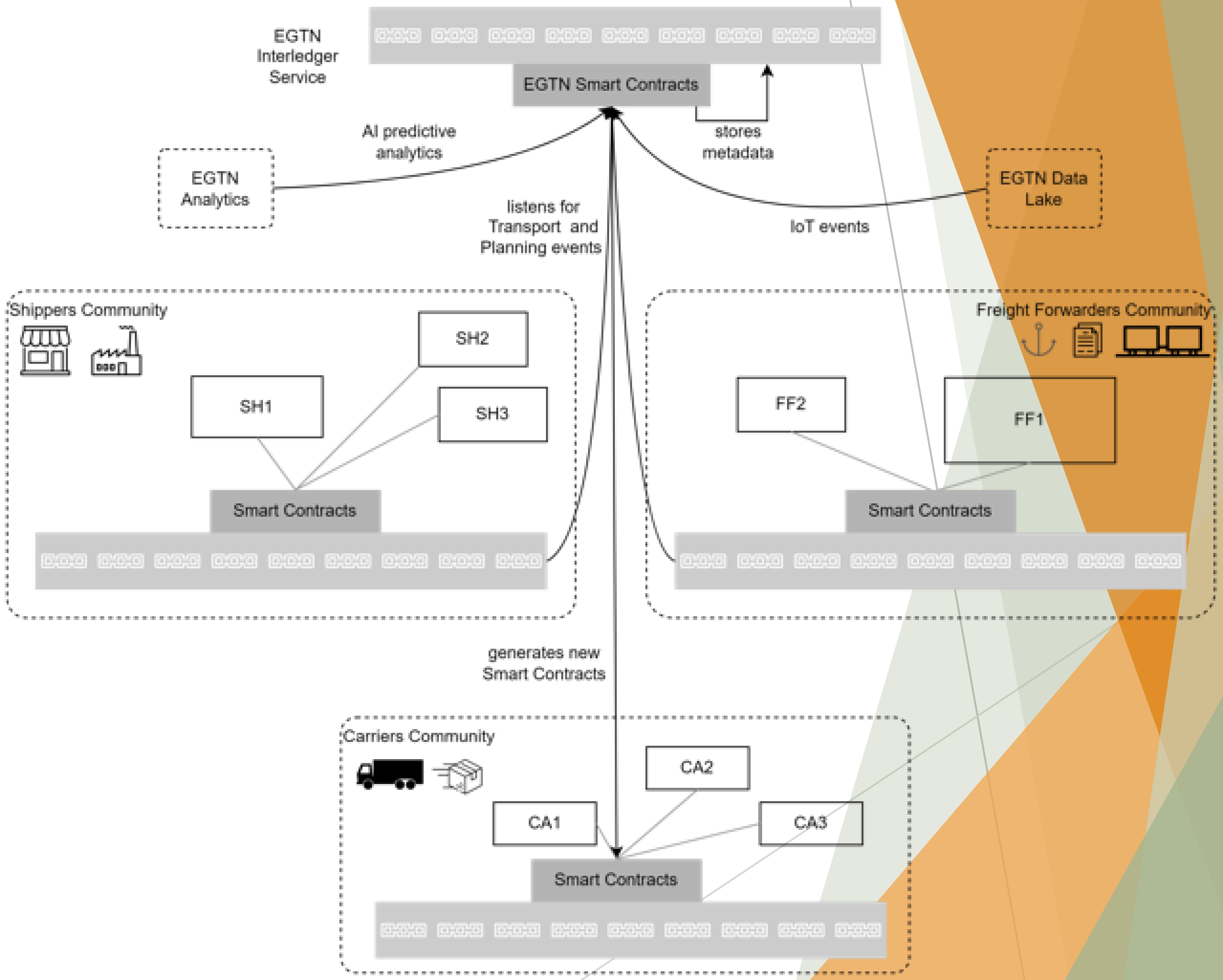


Freight Forwarders (DHL) Blockchain

- Data on chain (following the GS1 standard):
  - **Planning data:** mostly static data to be used as a reference during the execution and analysis, involving:
    - Transport Instructions (TIs)
    - The hash of transport documents
  - **Execution data:** monitoring data during the transportation of goods. IoT sensors are feeding the platform with IoT data:
    - Transport Status Notifications (TSNs) e.g. TSN:71b ready for transport, TSN:24 departure
    - IoT events e.g. hashed list of temperature measurements
  - **Analysis data:** analysis is happening upon the arrival of the goods at the destination and during the transport
    - Smart contracts check the SLA Agreements based on the planning and the execution data

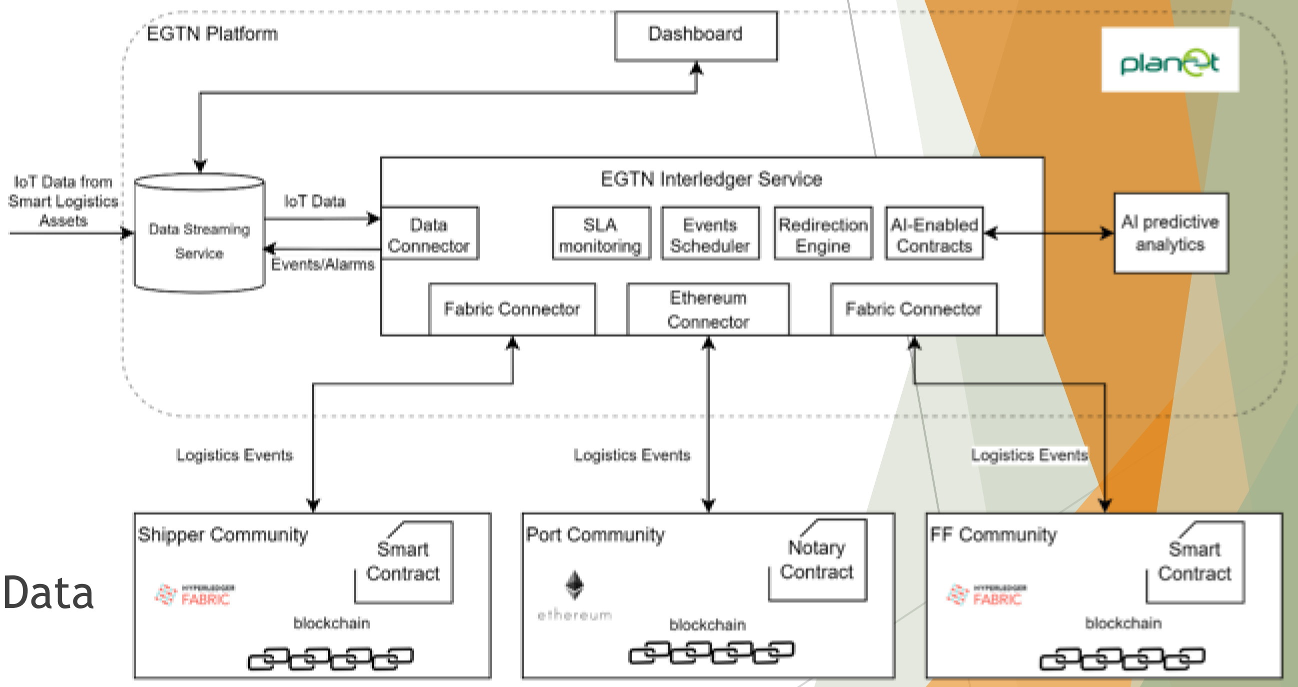
Blockchain Interoperability in LL1

- PoV and DHL blockchains are connected through the EGTN Interledger Service, which enables trusted exchange of data between different blockchain communities
- Events are redirected from PoV to DHL and vice-versa
- The service employs IoT events from the EGTN Platform to cross-validate logistics events
- It also employs predictive analytics services to provide AI-enabled smart contracts



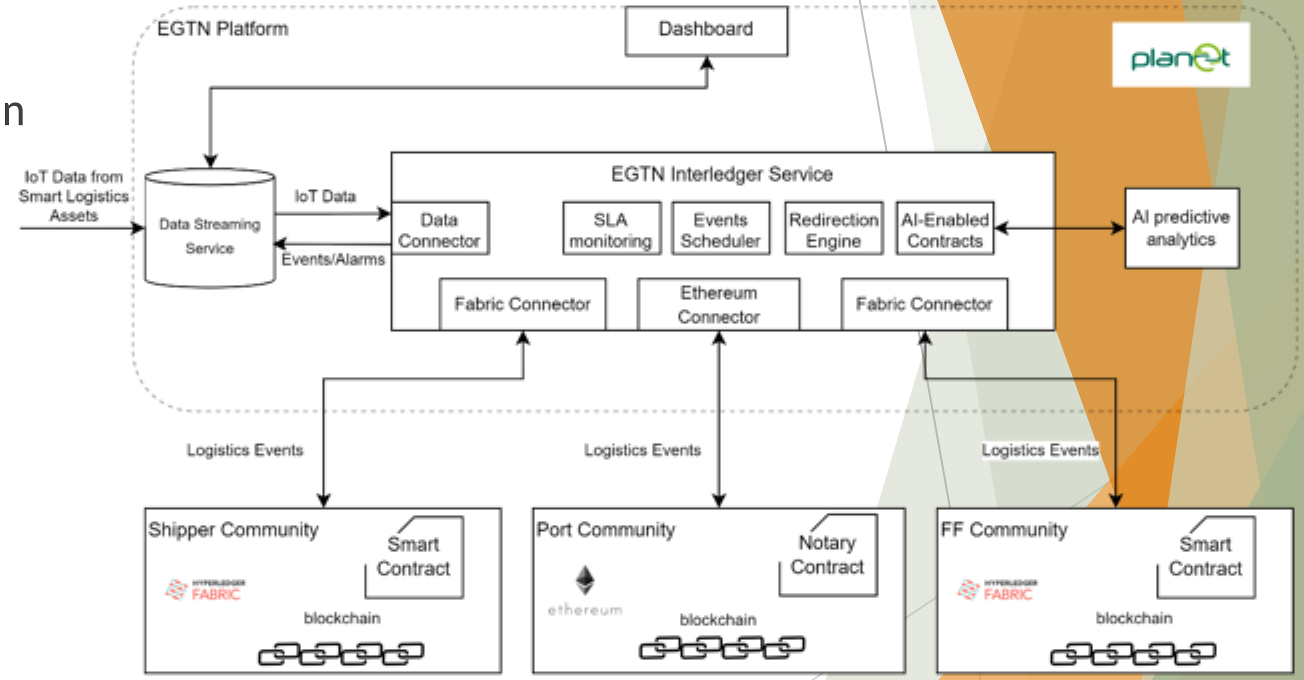
EGTN Interledger Service

- Connected Blockchains
  - Shippers community
    - Port of Valencia (FV)
    - COSCO SHIPPING LINES SPAIN (COSCO)
  - Freight Forwarders community
    - DHL EXEL SUPPLY CHAIN SPAIN (DHL)
    - CityLogin
  - Port community
    - Port of Rotterdam (PoR)
- Communicates with the Dashboard through the Data Streaming Service (Kafka)
- A single data model for the events, commonly agreed with the communities



EGTN Interledger Service

- Internal modules:
  - Connectors with the heterogeneous blockchain systems
  - Data connector with the Data Streaming Service (Kafka)
  - Events scheduler
  - Redirection Engine
  - AI-enabled smart contracts
  - SLA monitoring



EGTN Interledger Service

Increased Efficiency and Transparency

- Seamless information exchange between communities (shipping lines, ports, warehouses, last mile)

Digitisation & Automation of processes

- Smart contracts eliminate paper-based processes, optimising costs & time (e.g. AI-enabled smart contracts)

Limited ratio of disputes in SLAs

- Blockchain brings immutability of transactions and non-repudiation, which enables instant dispute resolution in agreements

A step towards the PI

- Interconnectivity between systems of different T&L actors, breaking data and system silos

Intelligent PI Nodes and PI Network LL1 services

Fundación Valenciaport

Jorge Feliu

VLTN

Kostas Zavitsas

Artificial Intelligence algorithms for Planning and reschedule of maritime routes and inland transport of shipments

Integration of AI technology and transition from manual processes towards the technologisation of the T&L sector.

Adoption of AI models and algorithms.

Key concepts

- Artificial Intelligence
- Maritime routes
- Hinterland transports – Trucks & Trains
- Optimisation

Artificial Intelligence algorithms for Planning and reschedule of maritime routes and inland transport of shipments

Benefits of the use of AI in maritime route planning and port hinterland

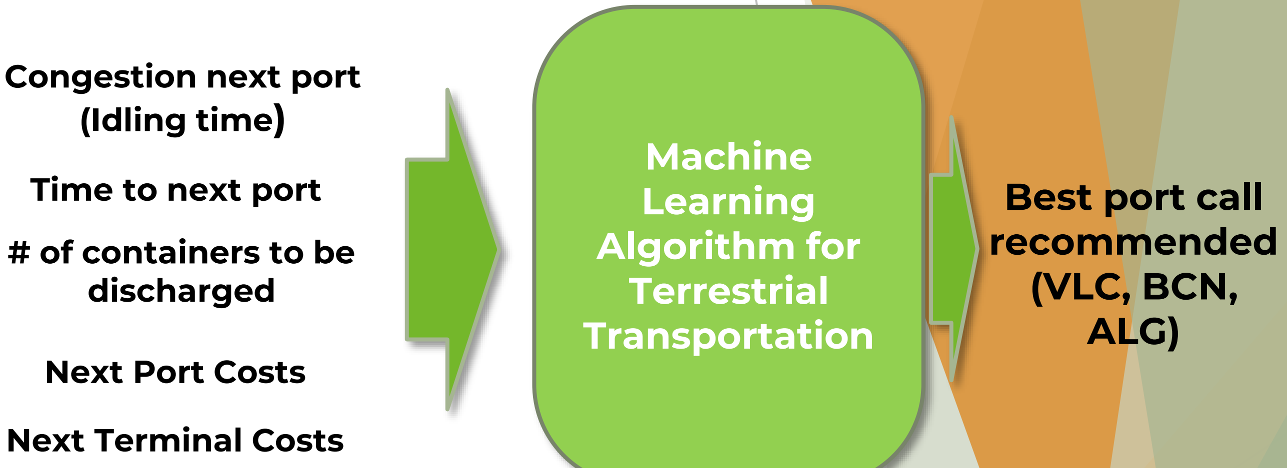
- Use **real-time data** to identify **optimal maritime routes**
- Identify the optimal mode of transport: truck or rail
- Optimise the use of infrastructure and **resources in the port facilities**
- Consider the **environmental impact** of shifting from sea to land
- Predict and mitigate supply chain disruptions and risks
- Reduce human error and improve process accuracy
- Increase supply chain **visibility and transparency**

Artificial Intelligence algorithms for Planning and reschedule of maritime routes and inland transport of shipments

Maritime Transportation

Decision Support Algorithm: time and cost impact of changes in routing of ships from China, considering the ports of Valencia, Barcelona and Algeciras.

Aim: Service that jointly return all parameters that could influence the decision-making process.



- **Inputs:**

Vessel Schedules, Inbound Cargo Lists, Port Call and terminal Costs, Maritime trip durations, idling times, vessel info

- **Outputs:**

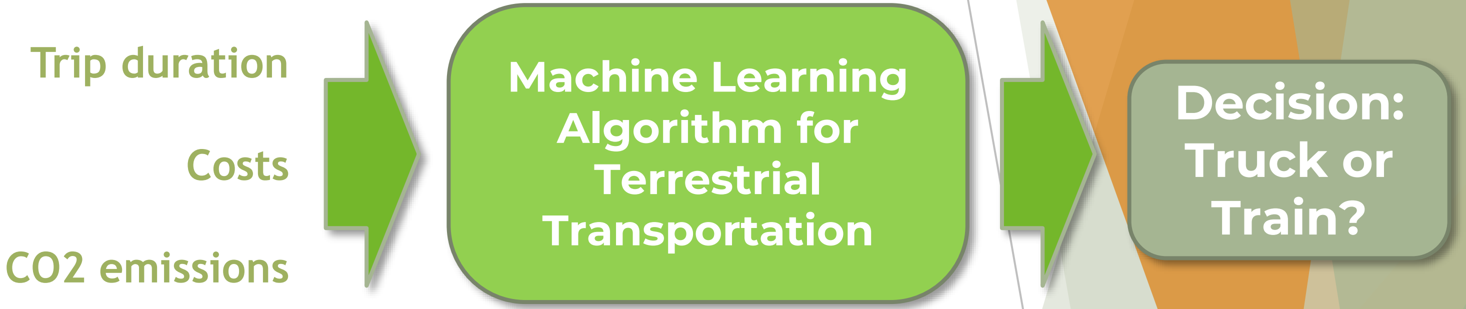
VesselName	Date	Current_Port	Potential_Next_Port	Time_to_Next_Port	Num_Containers	Costs_Port	Costs_Terminal	Idle_Time
CMA CGM HOPE	11/10/2022	BCN	ALG	39	0	25009,20004	0	28,6
CMA CGM HOPE	11/10/2022	BCN	VLC	12	185	25694,7463	11470	24
CMA CGM KIMBERLEY	17/05/2022	FOS	VLC	26	280	25829,78807	17360	24
CMA CGM KIMBERLEY	17/05/2022	FOS	BCN	13	329	15507,09984	29281	29,6
CMA CGM KIMBERLEY	17/05/2022	FOS	ALG	52	0	25009,20004	0	28,6
CMA CGM KIMBERLEY	20/05/2022	BCN	VLC	12	280	25829,78807	17360	24
CMA CGM KIMBERLEY	20/05/2022	BCN	ALG	39	0	25009,20004	0	28,6
CMA CGM SCANDOLA	10/07/2022	FOS	VLC	26	160	25697,38316	9920	24
CMA CGM SCANDOLA	10/07/2022	FOS	BCN	13	534	15396,7081	47526	29,6
CMA CGM SCANDOLA	10/07/2022	FOS	ALG	52	0	24566,51537	0	28,6

Artificial Intelligence algorithms for Planning and reschedule of maritime routes and inland transport of shipments

Terrestrial Transportation

ML-based algorithm: Recommendation for the best transportation option based on past transportation events.

Truck or **Train** considered as possible transportation means.



Coordinates Destination	ProposedDate	Distance Truck	Distance Madrid-Lo	Duration Truck	Duration Port-Train Madrid-Lo	isRail	Cost by Truck (€)	Cost using Train (€)	Greenhouse Emissions Truck (Tonn	Greenhouse Emissions DryPort+FinalDest (Tonnes CO2)	Best Route
38.055,-1.07647	2021-07-13T06:00:(	219,31	398,898	2:33:17	12:24:18	false	260,98 €	670,69 €	0,143716	0,315003	['Truck']
39.96229,-0.25935	2021-07-13T06:00:(	73,022	418,168	1:01:56	12:40:40	false	86,90 €	693,62 €	0,047852	0,327630	['Truck']
40.47973,-3.5989	2021-07-15T00:00:(	370,495	13,712	4:08:43	8:18:03	true	440,89 €	212,32 €	0,242790	0,062586	['Truck']
40.47973,-3.5989	2021-07-15T00:00:(	370,495	13,712	4:08:43	8:18:03	true	440,89 €	212,32 €	0,242790	0,062586	['Truck']
38.26518,-0.69891	2021-07-13T00:09:(	176,145	415,989	2:05:02	12:33:44	false	209,61 €	691,03 €	0,115430	0,326202	['Truck']
39.29224,-0.4139	2021-07-13T15:00:(	25,83	364,638	0:27:11	12:02:22	false	30,74 €	629,92 €	0,016927	0,292552	['Truck']
39.29224,-0.4139	2021-07-20T07:00:(	25,83	364,638	0:27:11	12:02:22	false	30,74 €	629,92 €	0,016927	0,292552	['Truck']
38.10984,-0.79192	2021-08-03T08:00:(	199,617	439,461	2:19:44	12:48:26	false	237,54 €	718,96 €	0,130811	0,341584	['Truck']

Artificial Intelligence algorithms for Planning and reschedule of maritime routes and inland transport of shipments

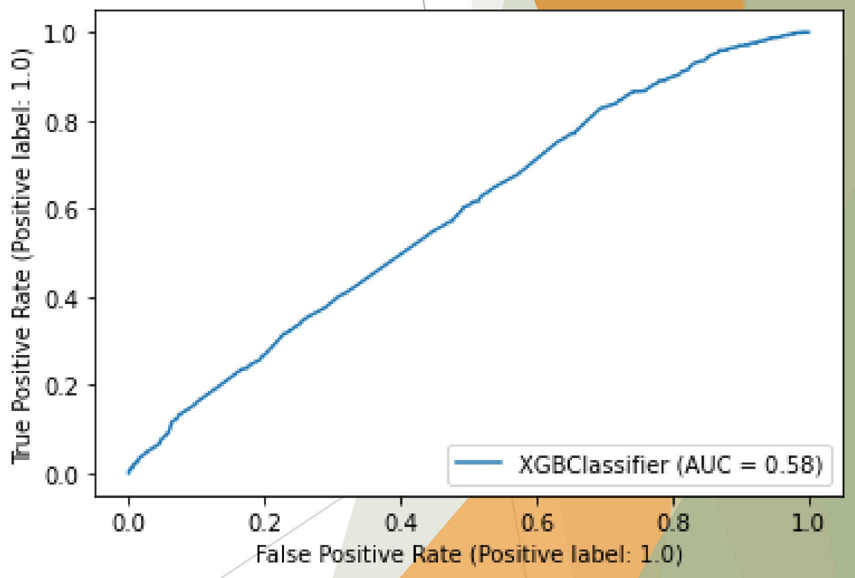
Terrestrial Transportation

Evaluated different ML Classification Algorithms under the same data and conditions.

Main evaluated ML Classification Algorithms:

- Naive Bayes Classifier → 51% Success
- Random Forest → 56% Success
- K-Nearest Neighbour (KNN) → 57% Success
- **XGBoost → 58% Success**

Best ML Classification algorithm

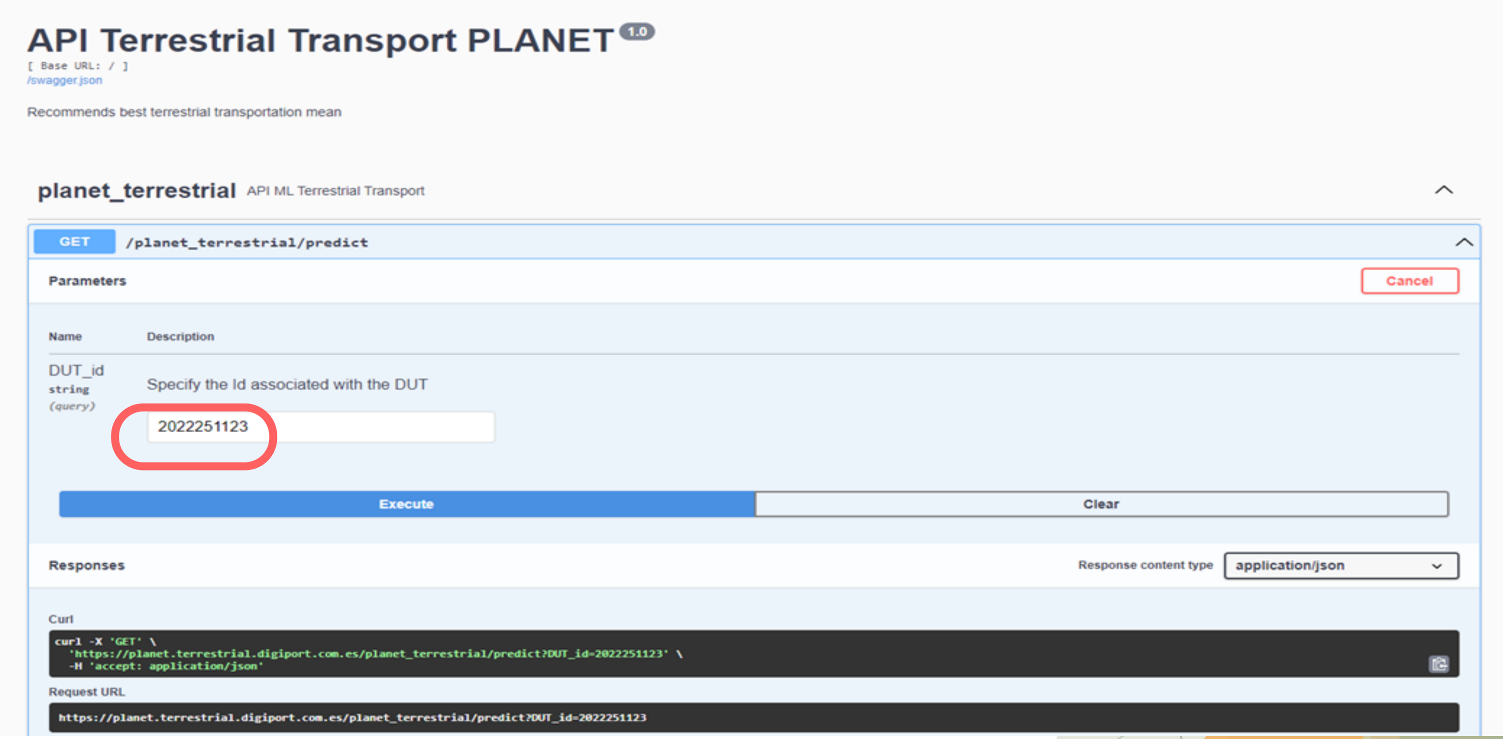


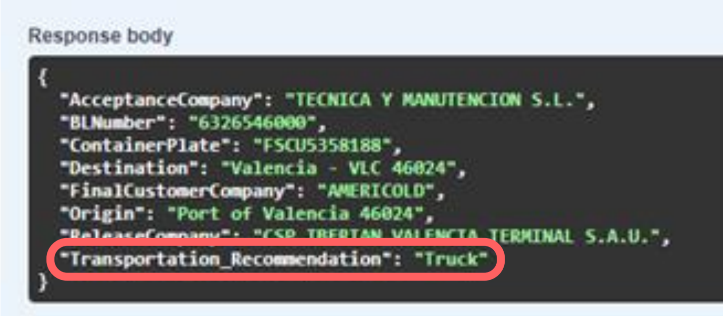
Artificial Intelligence algorithms for Planning and reschedule of maritime routes and inland transport of shipments

Terrestrial Transportation

API for predicting and estimating best terrestrial transport alternative based on XGBoost Classifier algorithm.

- **Input:** DUT
- **Output:** Train or Truck Recommendation





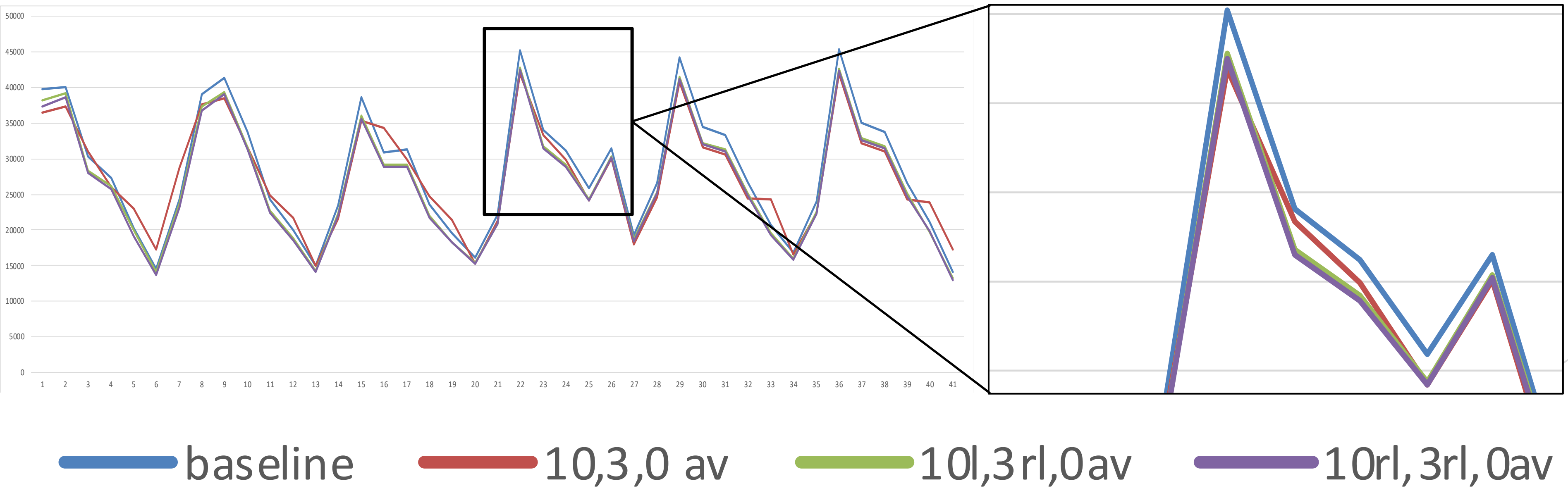
Transportation Recommendation: **Truck**

Artificial Intelligence algorithms for Planning and reschedule of maritime routes and inland transport of shipments

- The use of the AI, through the optimization of synchro-modal routes and maritime route change and inland re-routing allows all the logistic actors to **save time and both economical and environmental costs**.
- Decision support algorithm can lead to reducing CO2 emissions more than a 30%
- Impact on the reschedule of transport orders to rail transportation in more than 15% of the orders
- Asses operational time associated to transportation by truck and train considering schedules/final destinations

Capacity Booking for Smart Contracts service

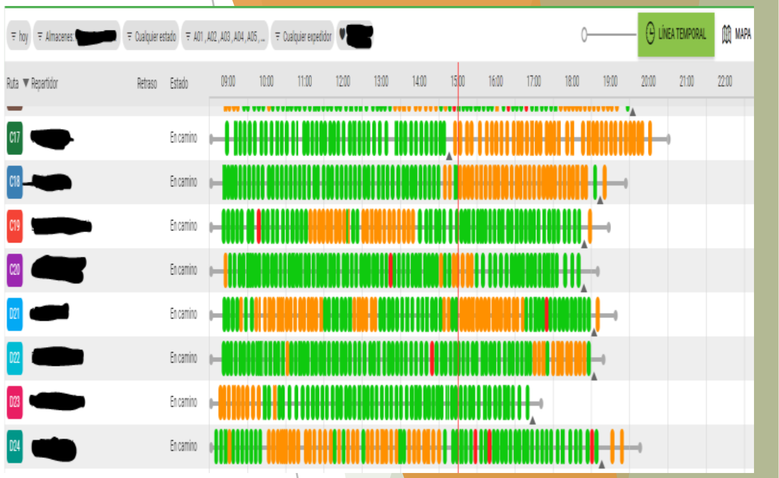
- Serviced determines optimal capacity to book automatically through a smart contract
- Interoperability with the prediction service and the Smart Contracts service
- Utilizes confidence intervals from predictive model, a route specific cost structure and replenishment theory
- Applies stochastic analysis through Monte Carlo simulation for a 10-day planning horizon

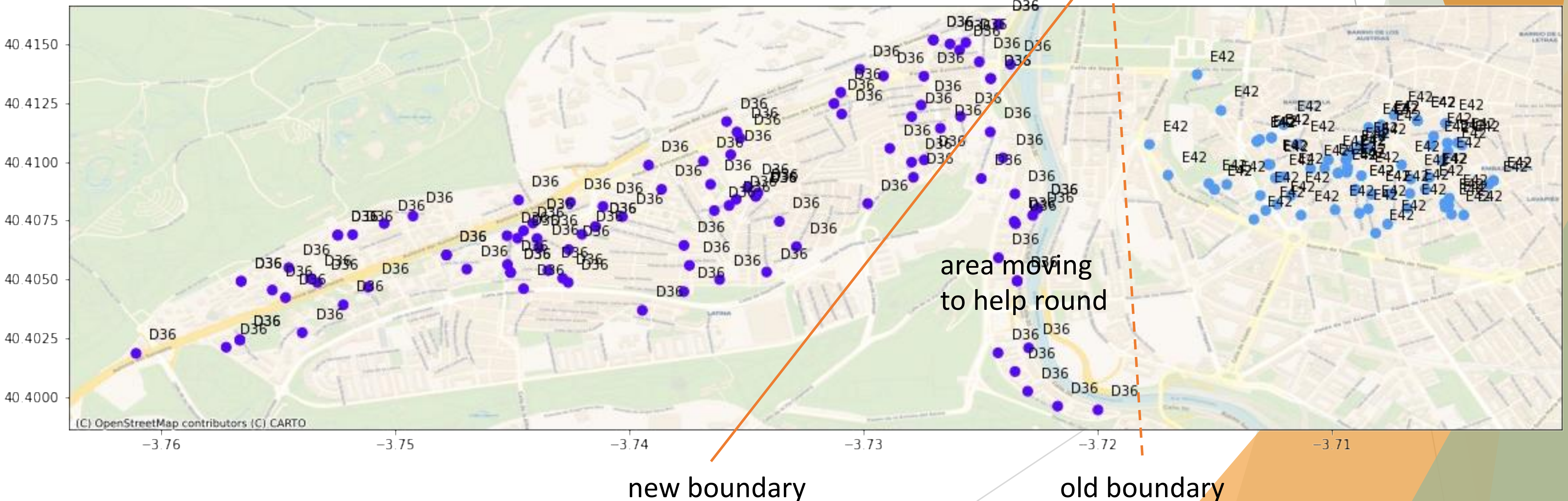


	$ savings (%)
Baseline	0
average	2.54
start_low	5.35
start_EOQ	6.39
absolute	8.63

Parcel Reshuffling service

- Last mile collaboration for dynamically addressing delays
- Automates and optimizes reshuffling process that is currently undertaken manually aiming to make it more efficient
- Interoperates with last mile routing service and HM interface





Impact assessment – UC1

KPI ID	KPI	Baseline Measurement	Target	How to be measured	Actual Values	Business impact
KPI 1	Delivery lead time in inland transport	4 days	10% Reduction	Measuring time of inland transport	12% Reduction (PI+AI+BC+IoT)	Improve forecasting, planning and rerouting maritime/inland transport decisions Increase visibility along the whole supply chain by having access to real time data Increase sustainability of supply chain Reduce redundant data transactions Reduce cost of paper-based processes Reduce logistics costs Optimize end-to-end transport service improving transport service levels Improve customer experiences by bringing trust, transparency and collaboration Increase revenues
KPI 2	Time of interactions between supply chain stakeholders	2 days	20% Reduction	Measuring time of interactions	20-50% depending on the process (BC)	
KPI 3	Access to temperature, humidity, bump, gate opening and tracking in shipping containers and pallets	N.A.	Real-time access thanks to IoT tracking devices	Smart container with sensors as GPS, humidity, temperature,light, accelerometer…	Traceability of location and status of container data (IoT)	
KPI 4	Operating costs in transport and logistics	800 €	7% Reduction	Cost Calculation	592 € [-26%] (PI+AI+BC+IoT)	
KPI 5	CO2 emissions related to transport and logistics operations(TTW & WTW)	0,45 t/CO_2eq	15% Reduction	Estimation of new CO_2 emissions	0,315 t/CO_2eq [-30%]	
KPI 6	Number of transport orders shifted to rail	0	15%	Inspection of new number orders	15,63% (AI)	
KPI 7	Number of transport orders fulfilled through Blockchain	0	5% of use of BC platforms	Counting the number of transport orders fulfilled through Blockchain	Not achieved	
KPI 8	Customer satisfaction	N.A.	Qualitative increase	Survey of satisfaction	62%	
KPI 9	Cost of paper-based processes	150 €	15% Reduction	Cost Calculation	105 € [-30%] (BC)	
KPI 10	Ratio of disputes	18%	10% Reduction	Survey of satisfaction	9% [-50%]	

Impact assessment – UC2

KPI ID	KPI	Baseline Measurement	Target	How to be measured	Actual Values	Business impact
KPI 1	Transport cost reduction	600 €	10% reduction	Cost Calculation (Demand Forecast + DSS)	28% reduction	Reduce transport/operational costs Improve forecasting, planning and rerouting inland/LMD transport decisions Increase visibility along the whole supply chain by having access to real time data Increase visibility of the spare capacity Increase operational efficiency (time) Increase collaboration with other companies Reduce CO2 emissions Optimize end-to-end transport service improving transport service levels Decrease disruption of the Supply Chain process Increase revenues
KPI 2	Operational cost reduction	70 workers	3% reduction	AS-IS vs TO-BE (Simulator)	17% reduction (PI+AI)	
KPI 3	Operational efficiency (delivery time reduction)	90 minutes	7% reduction	AS-IS vs TO-BE (LMD collaboration algorithm)	>10% reduction on delivery time	
KPI 4	Increase speed of collaboration decisions -automation in routing decisions	30 minutes	20% increase	AS-IS vs TO-BE (LMD collaboration algorithm + smart contracts)	>20% increase achieved	
KPI 5	CO2 emissions related to transport and logistics operations.	CO2 7.06 kg	15% reduction	AS-IS vs TO-BE (using CityLogin green vehicles)	57% average reduction considering all scenarios simulated	
KPI 6	Decrease disruptions of the Supply Chain (in the hiring process in the spot market for specific vehicle)	30 minutes	7% reduction	AS-IS vs TO-BE (smart contracts)	10% reduction	
KPI 7	Increase speed of inventories	N.A	Visibility to the spare capacity	Digital Clones and simulations to calculate the spare capacity	Achieved through Digital Clones	
KPI8	Access to temperature, humidity, bump, gate opening and tracking in shipping containers and pallets.	N.A.	Real-time access thanks to IoT tracking devices	Smart container with sensors as GPS, humidity, temperature, light, accelerometer…	Traceability of location and status of container data	

Conclusions - Benefits UC1 & UC2

- The use of the AI, through the optimization of synchro-modal routes and maritime route change and inland re-routing, will allow Cosco and all the logistic actors, to **save time and both economical and environmental costs**.

- The use of Blockchain solution will allow the **reduction of paper-based processes**, **exchange of real-time and secure data** and **customer experience improvement**. This blockchain will ensure that every stakeholder has access only to the information that he needs. We will explore also the Blockchain interoperability, that will allow the exchange of information in between totally independent Blockchains.

- The IoT devices will allow to **know container location and cargo status in real time**, by exchanging information to all actors interested and **keeping events registered**.

- Data Analysis combined with Machine Learning will provide demand forecast to hire Transport and Human resources in advance for a **better logistics planning**.

- Digital Clones & Simulations will **improve the warehouse management** and model potential logistics scenarios to face unforeseen Supply Chain disruptions.

Discussion

- Do you think that the solutions developed by PLANET would bring some addedd value to your business?

- Is there any interesting aspect that you find missing and you think that it will be interesting to develop in future projects?

Thank you!