



# Designing a Dynamic Platform for the Next Generation of Multi-Modal Logistics

**2024 EuCNC & 6G Summit, 05 June 2024**

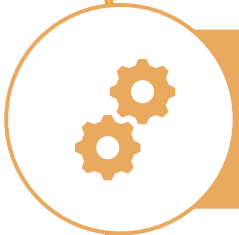
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Funded by the European Union under Grant Agreement no. 101069731. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency. Neither the European Union or the granting authority can be held responsible for them.



FOR-FREIGHT Architecture and Specifications



Development Status of the Central Platform



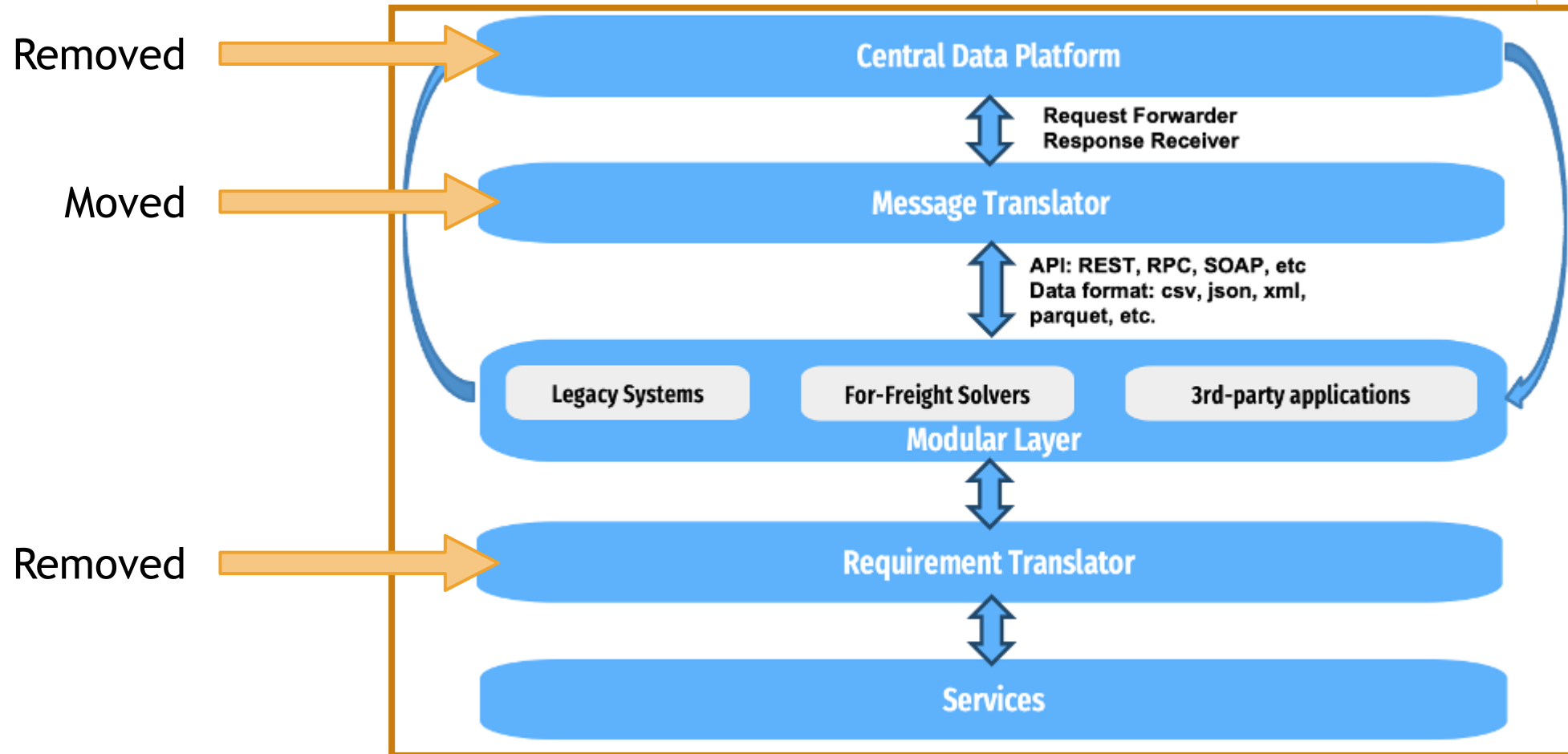
Further Discussion

# Agenda

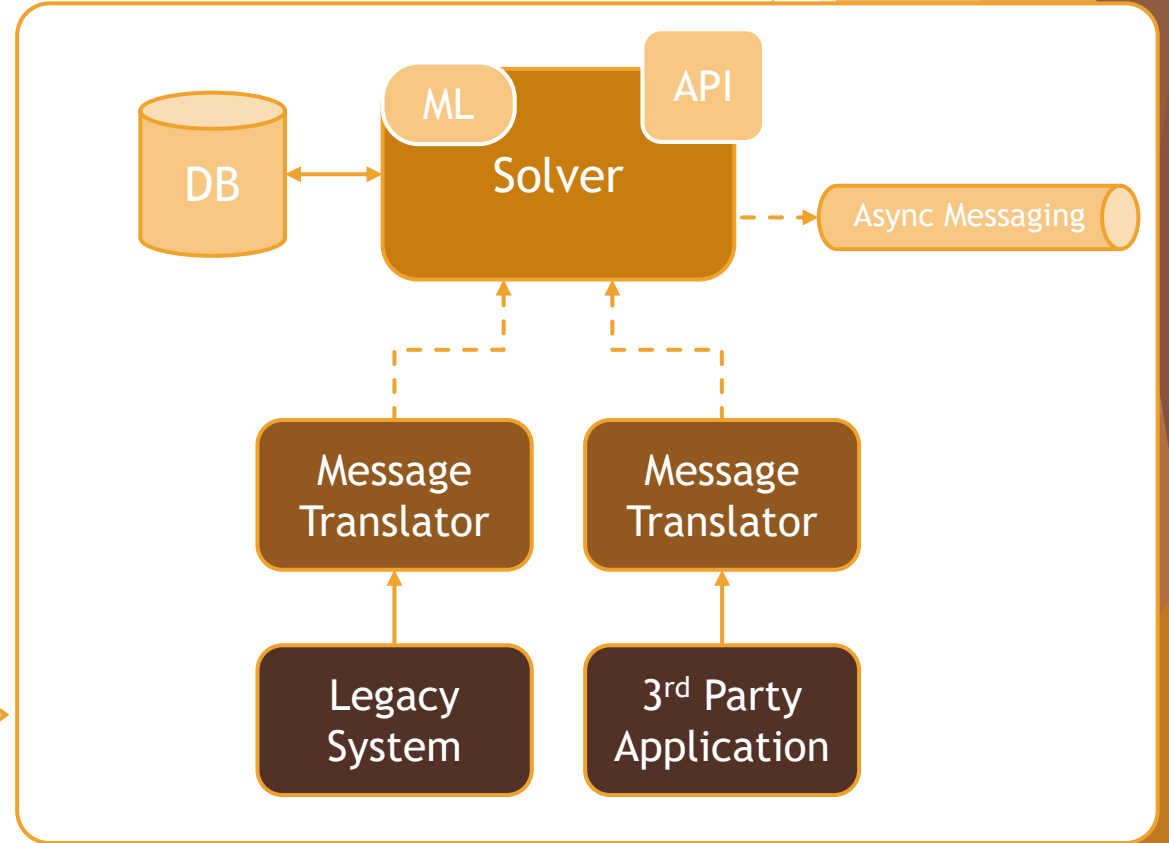
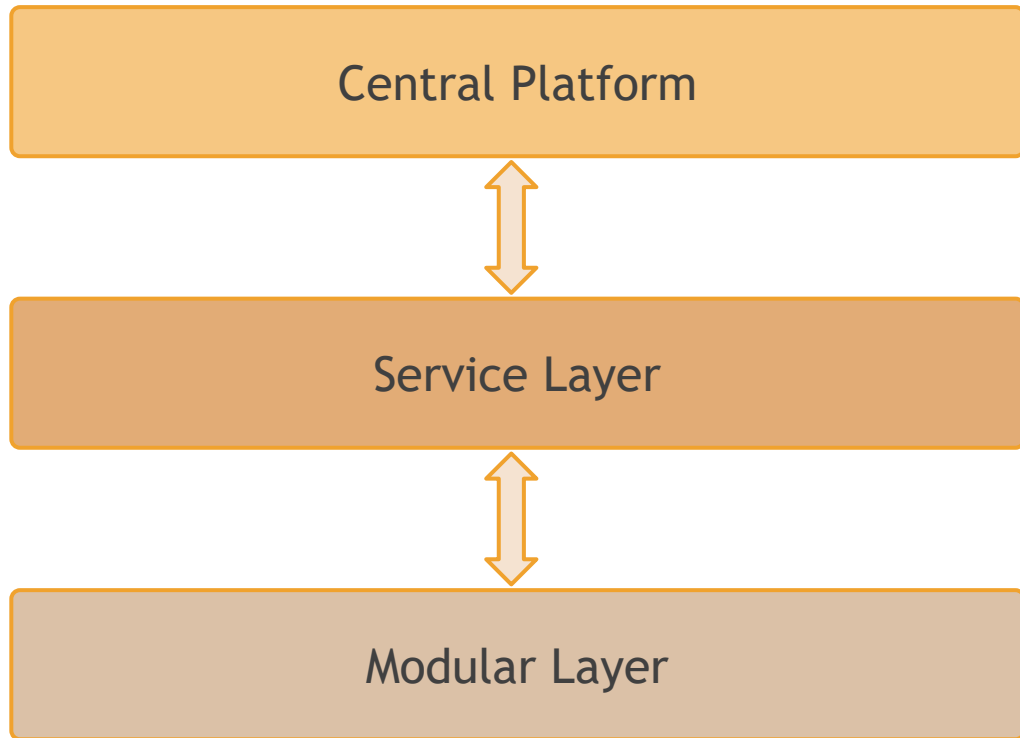
# FOR-FREIGHT Architecture



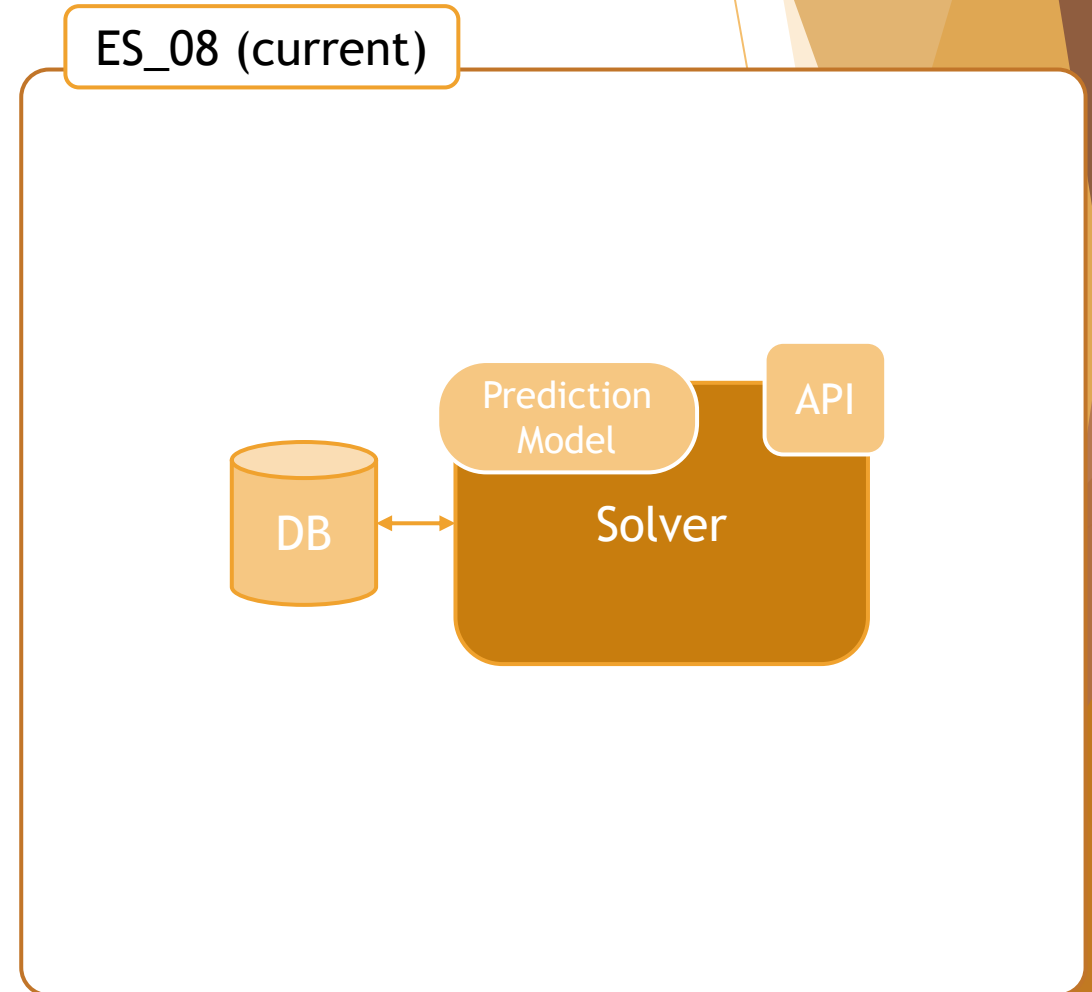
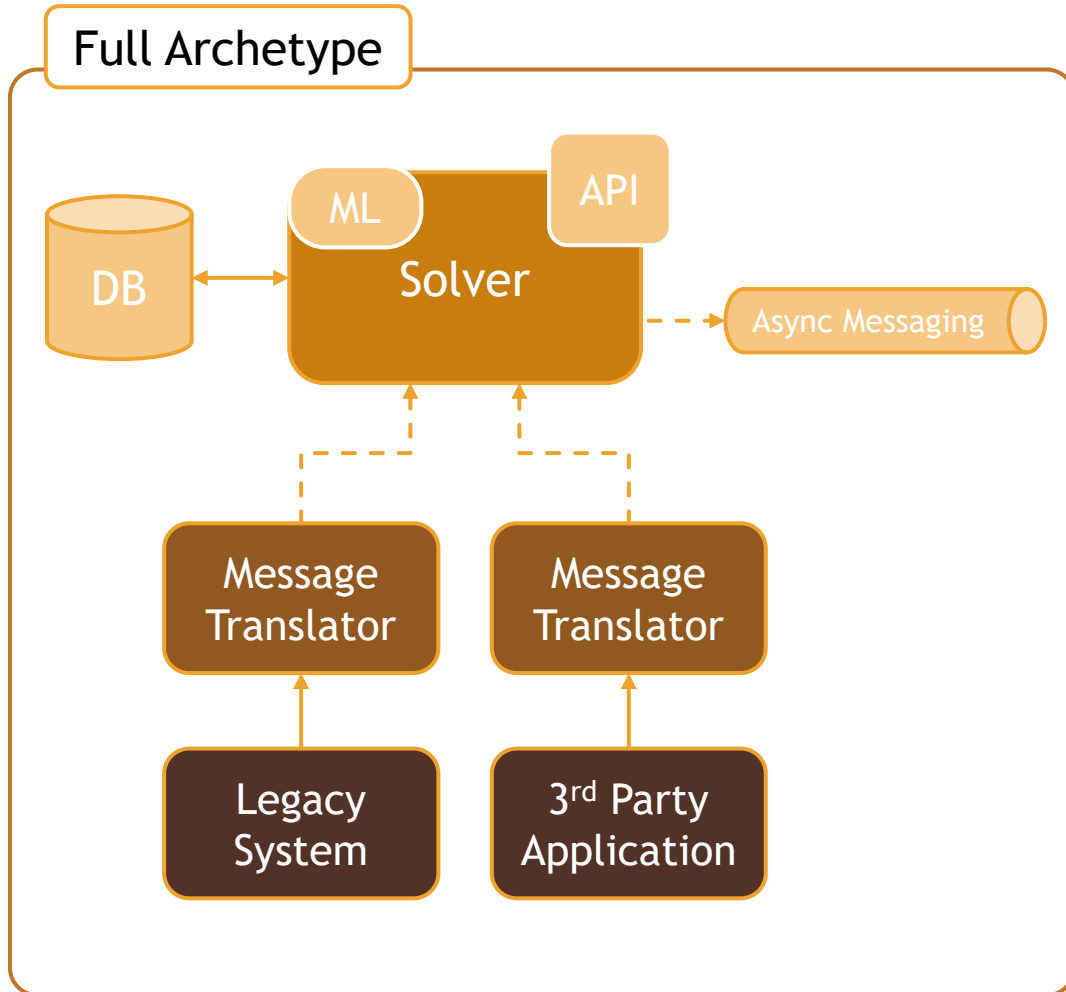
# Previous Architecture Overview



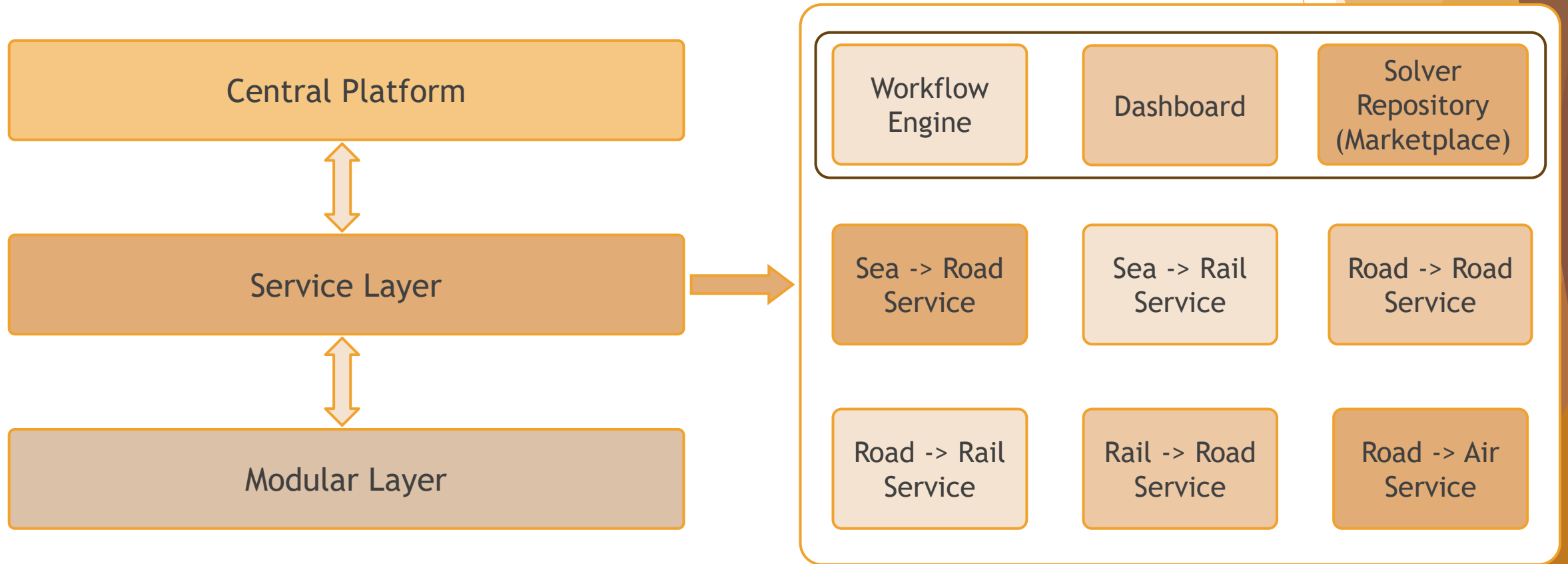
# Modular Layer



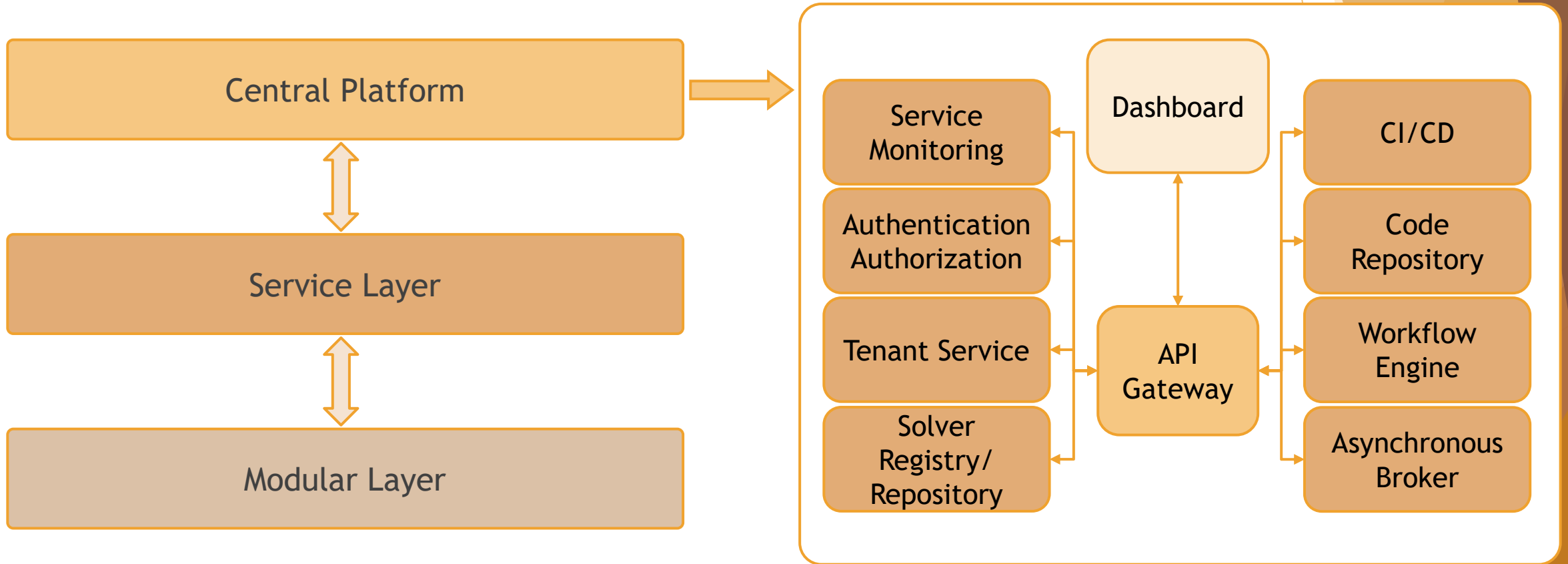
# Different Solvers = Different Utilizations



# Service Layer

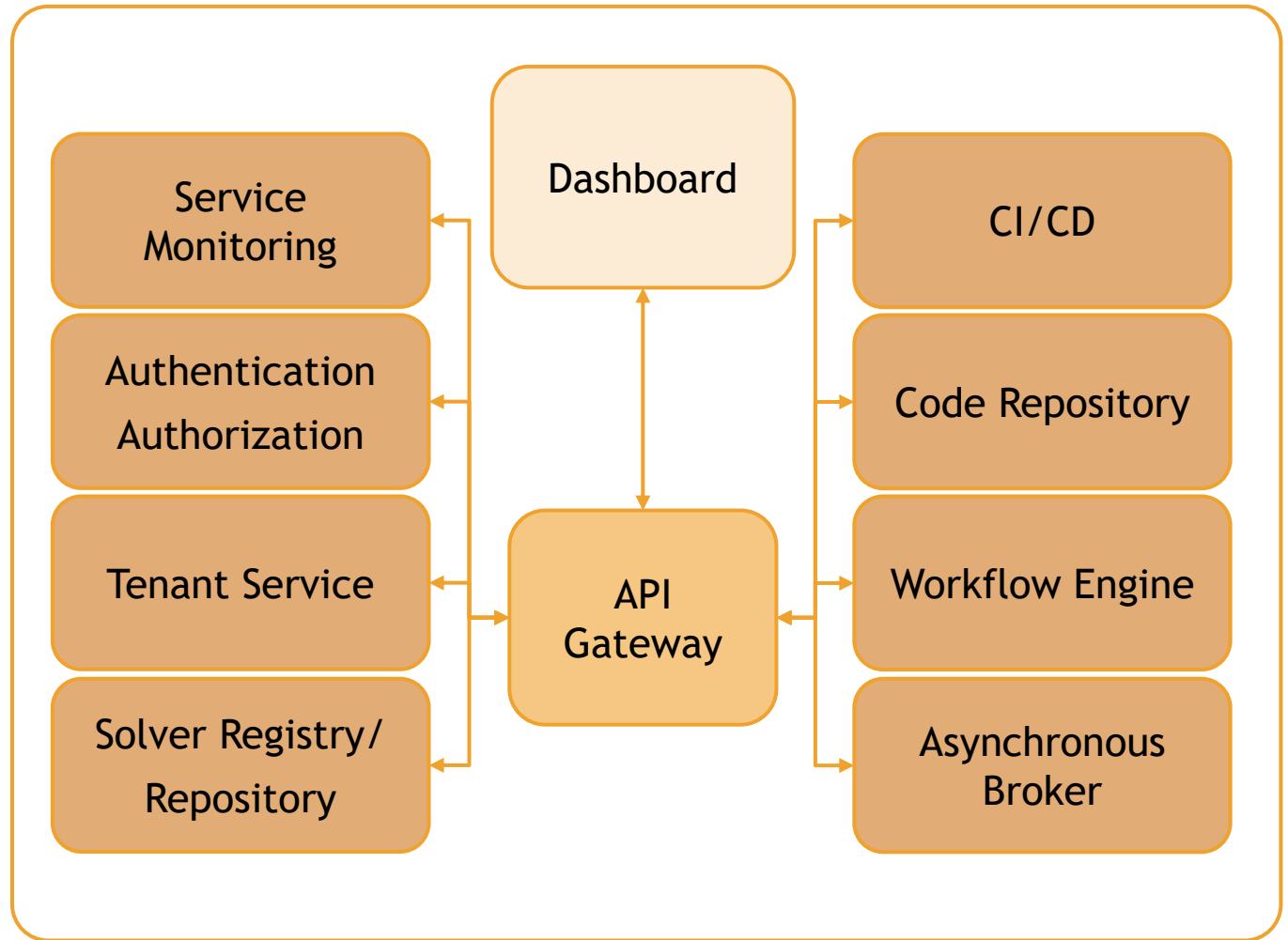


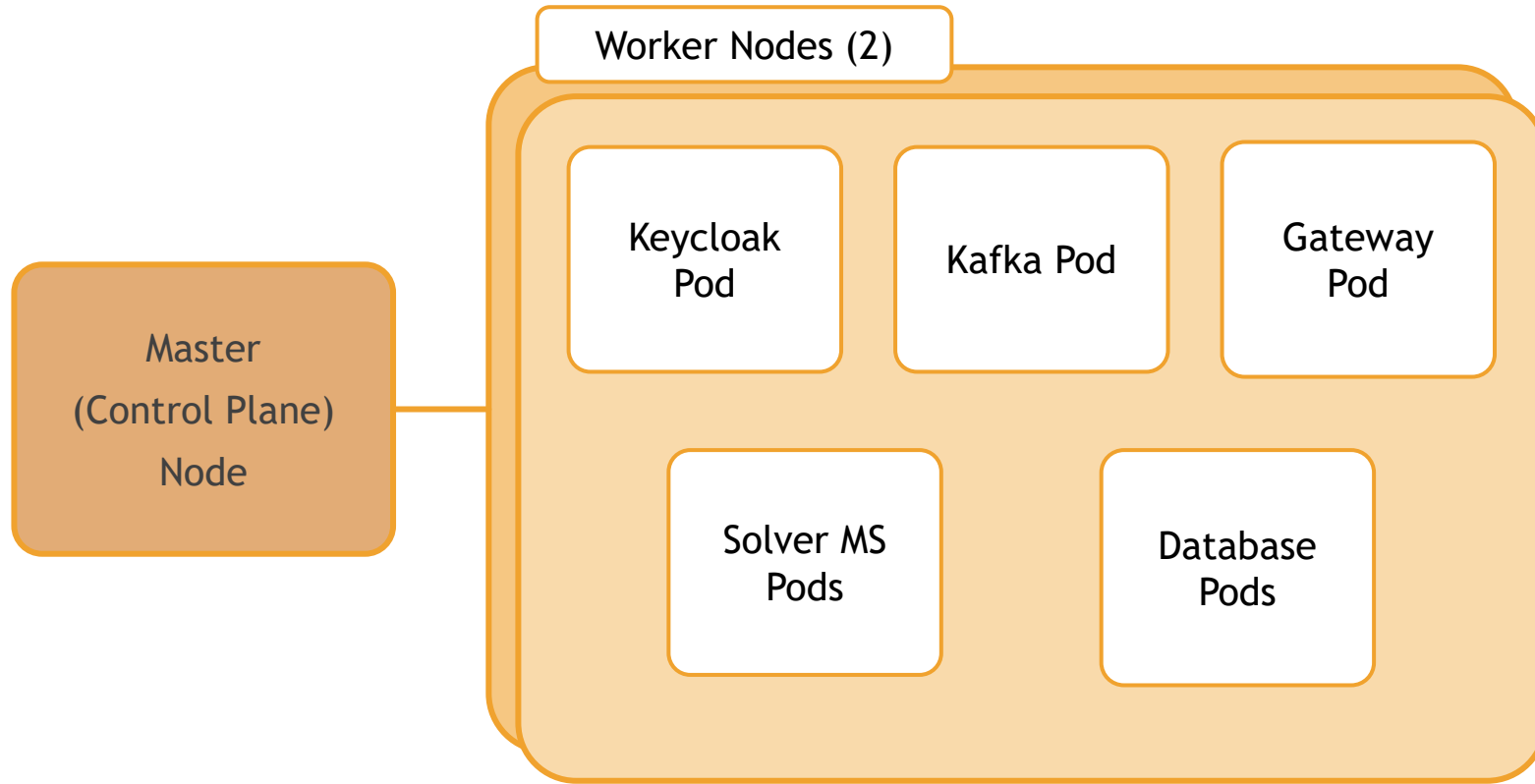
# Central Platform



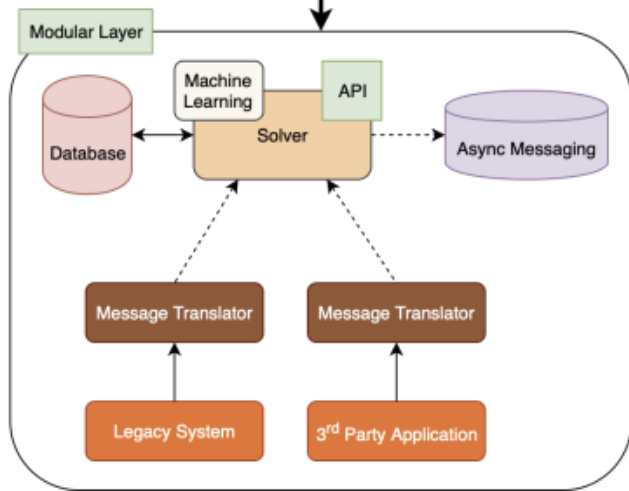
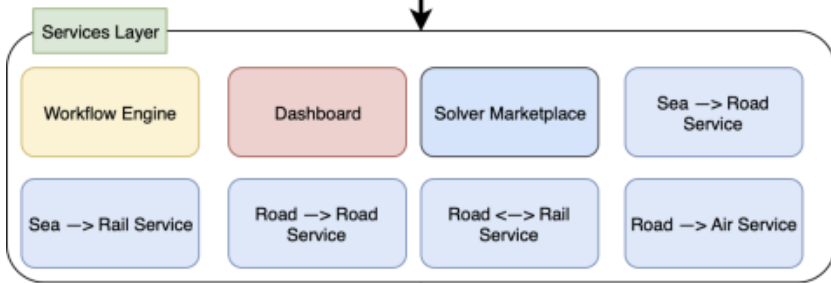
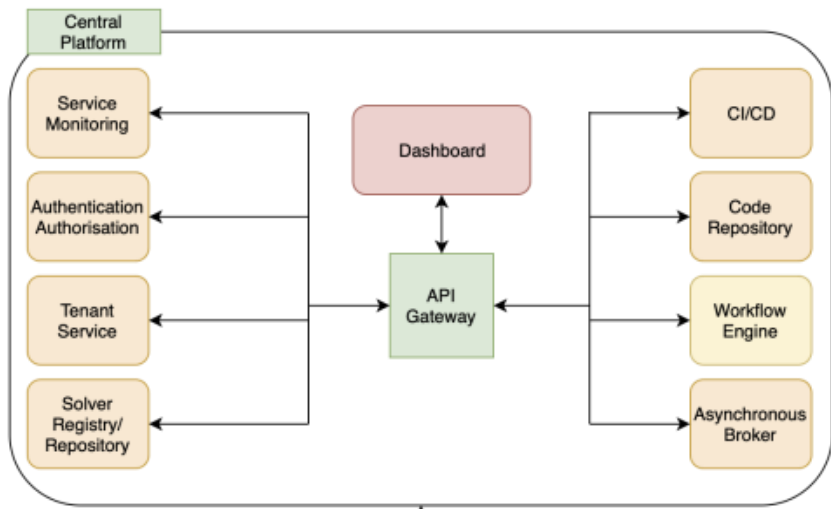


# Central Platform Development





# Kubernetes Cluster



# FOR-FREIGHT Platform High-Level Architecture

# Kubernetes Cluster

- ▶ Status: Deployed on-premises (ABS).
- ▶ Achievements:
  - ▶ Successfully deployed different nodes to the cluster;
  - ▶ Successfully deployed keycloak, kafka, nginx controller and additional microservice pods;
- ▶ Deviations:
  - ▶ On-premise bare metal configurations requires additional setup (e.g.: Load balancer, Storage provisioner,...)
- ▶ Timeline:
  - ▶ ???: Deploy cluster on CERTH premises.

# Service Monitoring



- ▶ For adequate monitoring over the various services deployed in the cluster, the thought of solution is to use Prometheus;
- ▶ This tool allows for:
  - ▶ Kubernetes cluster status monitoring;
  - ▶ Microservice status monitoring;
  - ▶ Alert generation and management;

Should any other monitoring needs arise, Prometheus allows for custom metrics management and monitoring.

# Authentication/ Authorization



- ▶ Keycloak has been setup to authenticate every request made to the accessible microservices in the cluster;
- ▶ The developed solvers won't need any additional setup as the incoming requests will be redirected via proxy;

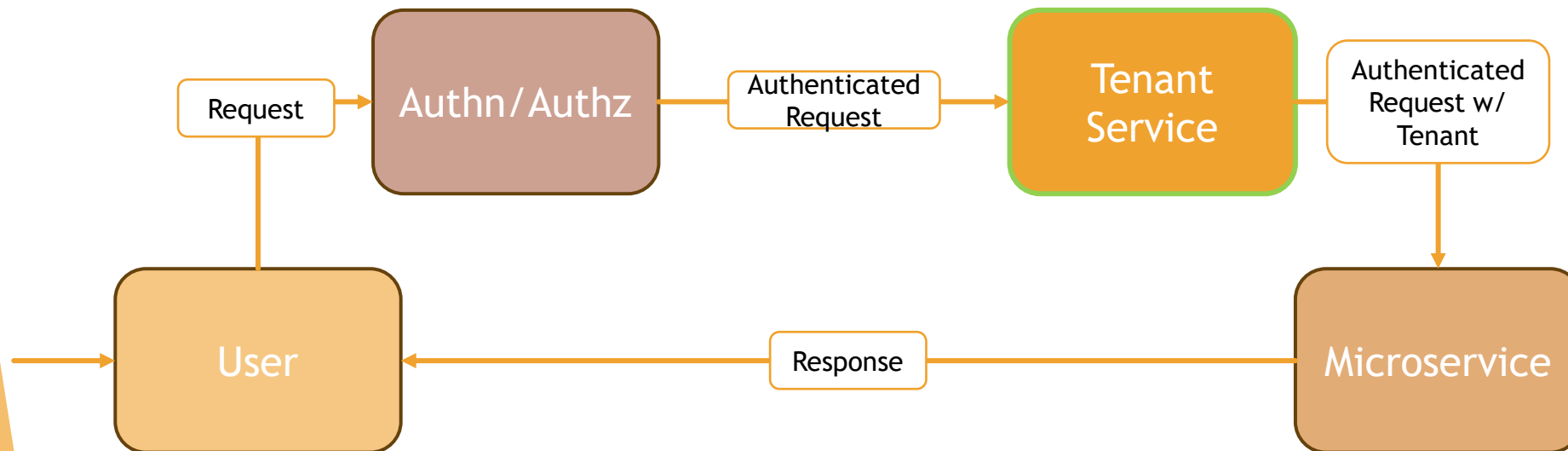
## Sign In

 Remember me

New user? [Sign Up](#)  
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# Tenant Service

- ▶ The purpose of the Tenant service is to act as an additional layer between the authorization and the different services that will be included in the platform;
- ▶ This ensures that users will only access information they are supposed to.

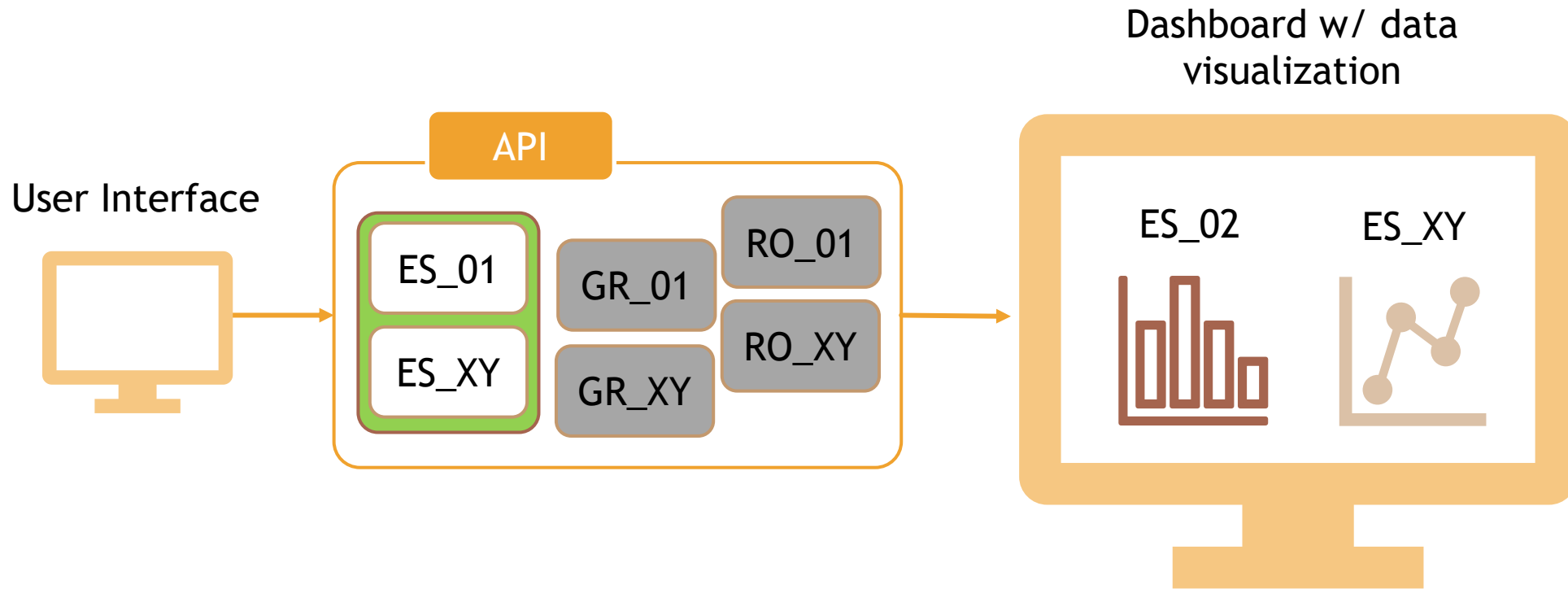


# Solver Registry/Repository

- ▶ This component will allow users to select different solvers according to their use case;
- ▶ Once selected, they will be available for data visualization or chaining with other solvers if needed;
- ▶ This behavior can be achieved through an API with appropriate data storage.



# Solver Registry/Repository (example)



# Solver Archetype(s)

- ▶ There are two different archetypes available for partners responsible for solver development;
  - ▶ Java (Springboot);
  - ▶ Python (FastAPI);
- ▶ These archetypes include an OpenAPI compliant microservice with MongoDB and Kafka integrations;
- ▶ Furthermore, the archetype also includes a Helm chart, which allows for easier deployments;

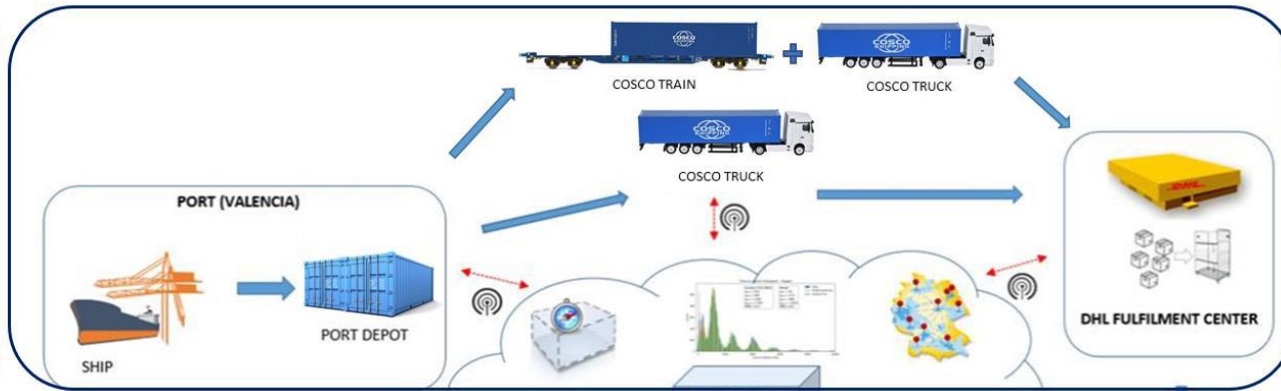
# Validating the platform through FOR-FREIGHT's Use Cases

## ► The Spanish Use Case

- **Valencia Port:** activities where containers will be unloaded from the vessel and loaded either on a truck or on train plus truck for DHL's warehouse destination in Madrid.
- **Madrid:** activities carried out from DHL warehouse to final customer (last-mile distribution) through Metro de Madrid network.

### Scenario 1

Activities carried out at Valencia Port with the connection to the warehouse

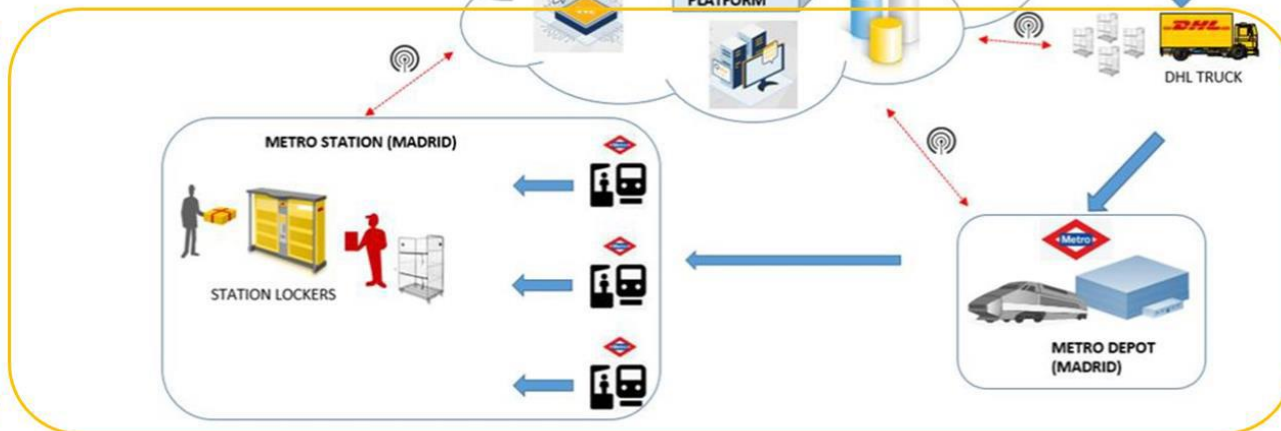


### Main goals

To optimize connection vessel – truck/train of containerized import traffics managed by CSLS by improving port operations and transport to DHL facilities.

### Scenario 2

Activities carried out from the warehouse to final customer (last mile distribution)



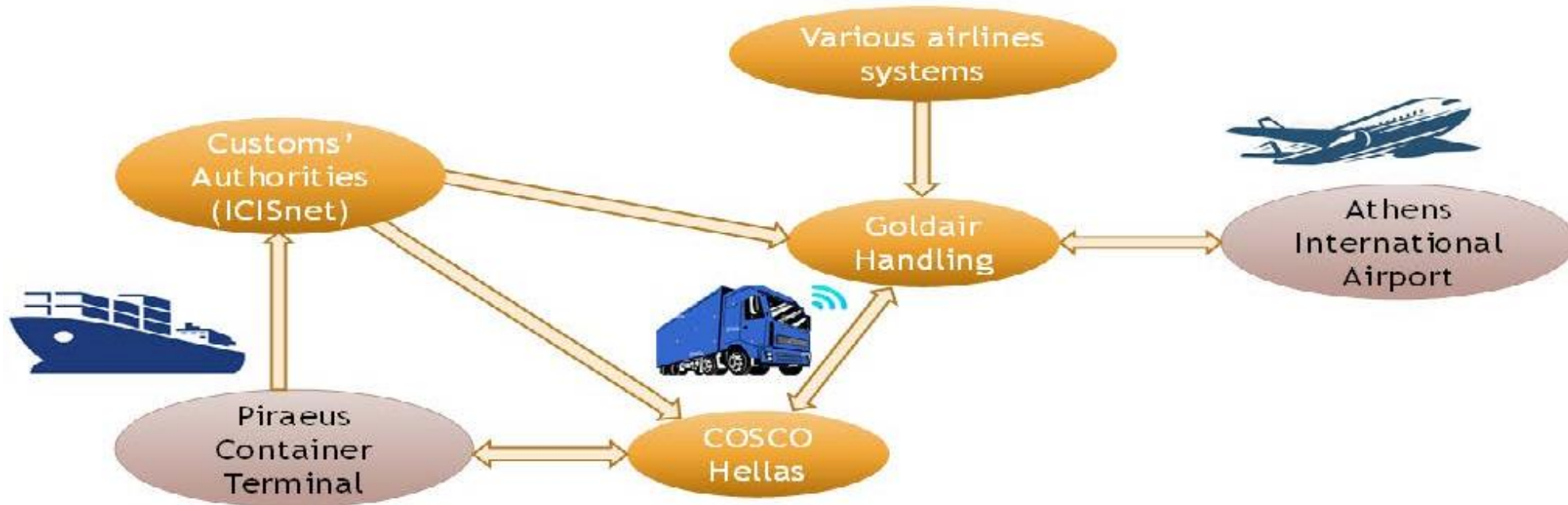
### Main goals

To use the most efficient, sustainable, fastest and safest transport mode in the last mile distribution focus on the existing Metro network.

# Validating the platform through FOR-FREIGHT's Use Cases

## ► The Greek Use Case

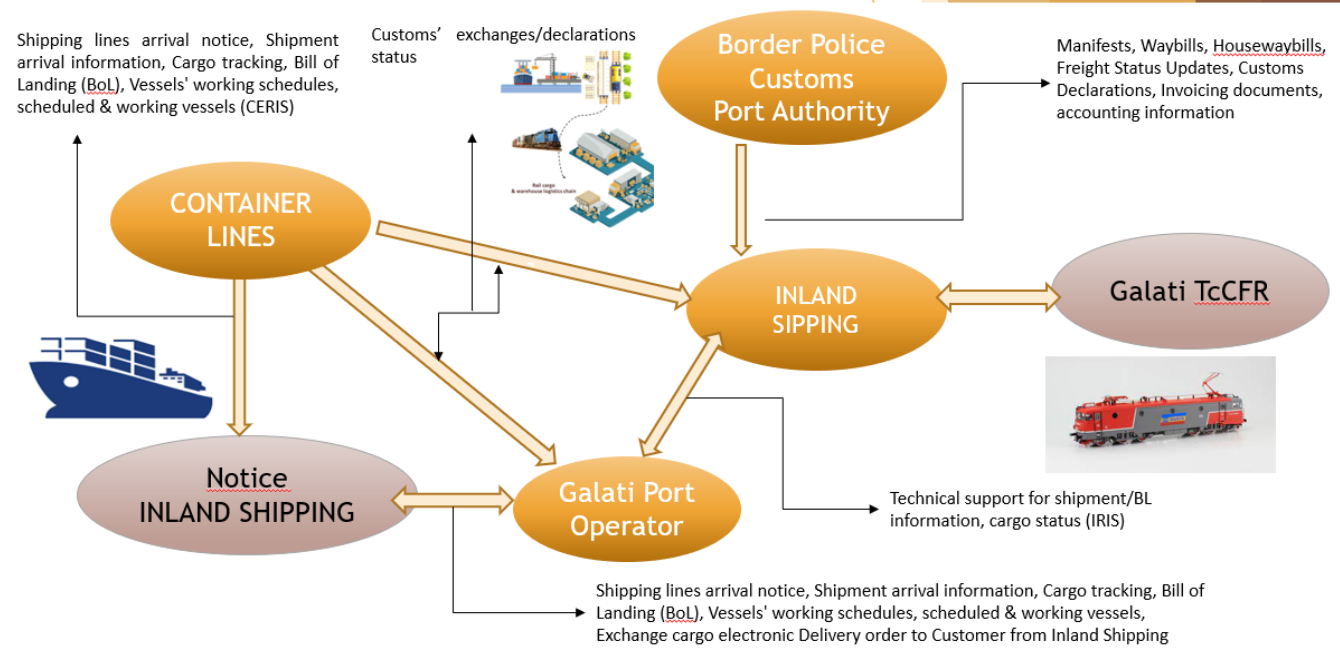
The Greek UC combines Sea Port, Airport (air-freight) and road transport (truck) for an end-to-end optimization with DSS and real-time monitoring and control capabilities.



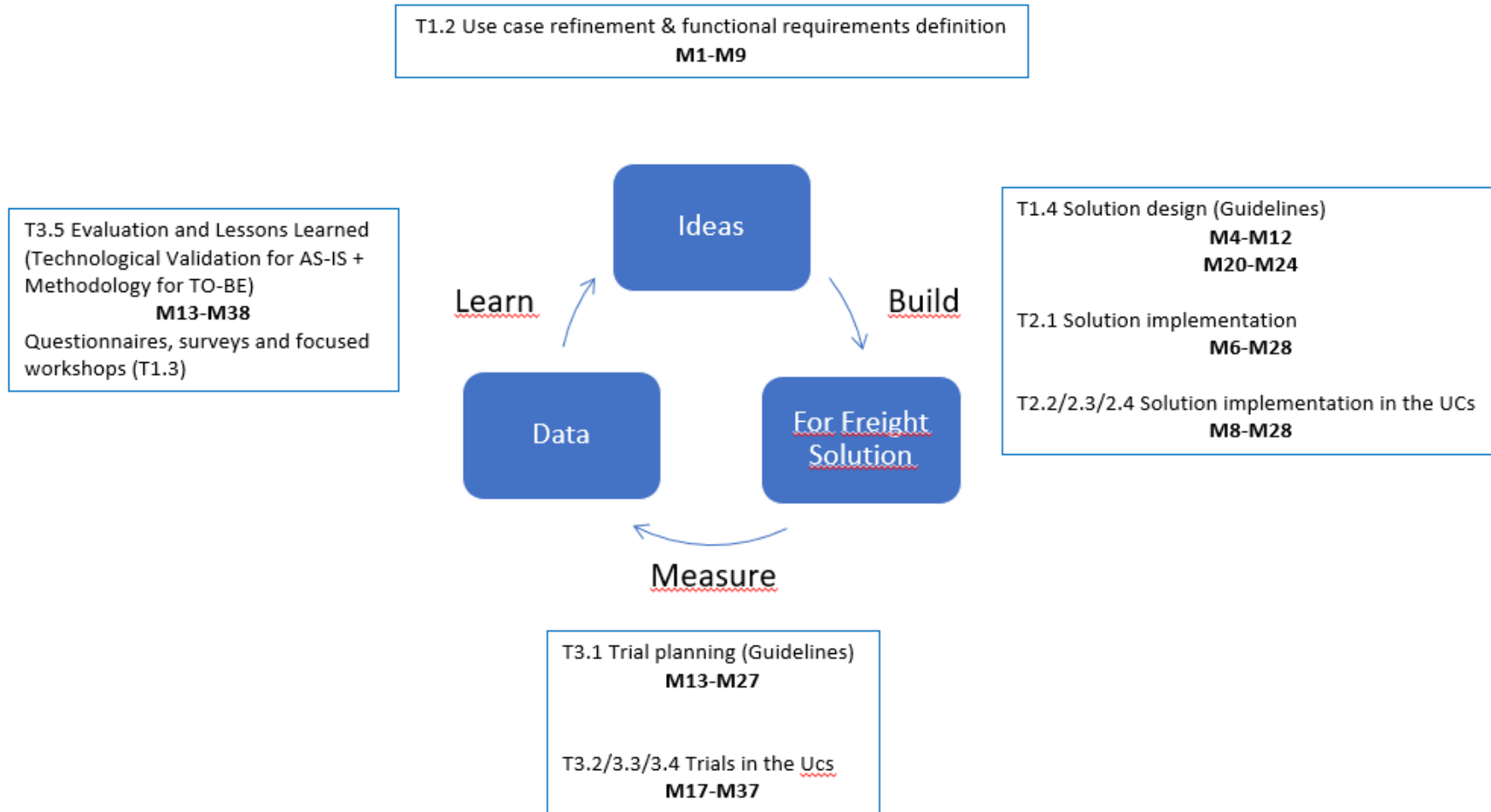
# Validating the platform through FOR-FREIGHT's Use Cases

## ► The Romanian Use Case

- **Transport Sequence:** Involves the transportation of a container via Inland Shipping to Galati port
- **Rail Cargo Transition:** Container is unloaded at Galati port and loaded as rail cargo
- **Unique Identification:** Utilizes a unique identification code for tracking
- **Tracking Data:** Historical and real-time tracking data are employed
- **ETA Updates:** Automatic updates of Estimated Time of Arrival (ETA) for end-to-end process tracking
- **User Accessibility:** Allows authorized users to access a comprehensive view of the entire process with tracking capabilities
- **Decision Support System (DSS):** Provides advisory services to port authorities, logistics operators, and customs agencies regarding resource requirements
- **Rail Freight Operator Support:** DSS advises rail freight operators on storage space and resource needs based on updated ETA
- **Railway Reservation Automation:** Enables automatic reservation capabilities for railway companies to optimize operations.



# Business Validation Methodology





# Questions & Discussion

