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Integrated passenger and freight transport: seamless door-to-door mobility and optimal use of resources

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Introduction - Challenge

- Transportation is a cornerstone of global economy and vital for free movement of people, services and goods – More than 9% of EU gross value added and 10 million employees at EU level [1].
- Increased interest in transport optimization through sustainable and reliable models (increased mobility, lower cost, reduced environmental footprint).
- Growing transport challenges related to urbanization trends, increasing complexity of stakeholder scene, e-commerce, rising fragmentation of freight transport [2].
- Inadequate governance and regulatory systems, leading to independent and disconnected sectors, and debate on passenger and freight transport integration, especially after Covid-19 crisis [3].
- Common goal for both transport systems– movement from origin to destination in a quick, easy, safe and reliable way, with the lowest possible cost and environmental footprint.
- Implementation of integrated model in aviation and rail transportation (infrastructure use for simultaneous movement of people and goods) [4].
- Distinct and independent mobility types in road transportation, with different modes of operation, separate infrastructures and isolated solutions not considering possible interactions and potential opportunities for synergy.
- Need for common framework enabling the integration of passenger and freight transport systems, through the implementation of integrated models satisfying both needs and requirements.

Integrated passenger and freight transport

Integrated transport model concept: "people and goods using common infrastructure, means of transport and services for simultaneous or parallel movement, without one system hindering the other".

Goal: increased efficiency and reliability based on mixed traffic model, leading to more sustainable operations than the existing model

Functional differences:

Passenger transportation

- People acting as independent decision-making units and selecting transport mode based on subjective criteria
- Loose, irregular and fluctuating transport pattern (dynamic change of flows even for commuters, leading to modelling complexity).

Freight transportation

- Goods managed throughout their transport, from origin to destination, based on specific criteria of cost and efficiency
- Consideration of additional processes (e.g. (un)loading, management, storage and distribution infrastructure) and associated human resources
- Predefined transport pattern (known routes leading to easier network management and optimized traffic flows).

Limitations:

- Independent systems at operational, institutional and legal level
- Different governing authorities and mechanisms per system
- Need for compliance with different rules and guidelines
- Implementation of different contractual and employment structures
- Lack of alignment on regulatory aspects, as well as consistent policies and coherent planning [5].

Vision:

- Simultaneous sharing of resources, increasing model sustainability and reducing service time and energy waste.
- Utilization of excess capacity of passenger transport means for freight (simultaneously with passengers or during inactivity periods)

Benefits:

- Reduction of required routes to meet transport needs
- Optimization of traffic load and flows and avoiding traffic congestion
- Minimization of congestion and reduction of accidents/emissions
- Lower direct and generated costs for all parties involved
- Improvement of environmental impact and higher social value

Opportunities:

- Combination with ITS – optimization of provided services and efficiency increase
- Urban logistics: major contribution to first/last mile management and delivery [6]
- Exploitation of passenger transport hubs for management and distribution of freight loads
- Improvement of distribution process and better use of urban space – transport impact mitigation and social acceptance increase

DELPHI concept

DELPHI focuses on the strategic dimension of integrating passenger and freight transport in a single system, working towards integrating sectors, harmonizing data, and leveraging advanced methodologies, to transform transportation systems, for a sustainable future.

- Delivery of technical and governance/regulatory enablers
- Federated network of platforms for multi-modal passenger and freight transport
- Seamless and secure data sharing among cross-sectoral, multi-modal transport data sources and traffic management systems

Objectives

Towards the overall project's concept and mission, the following five interdisciplinary implementation objectives have been defined:

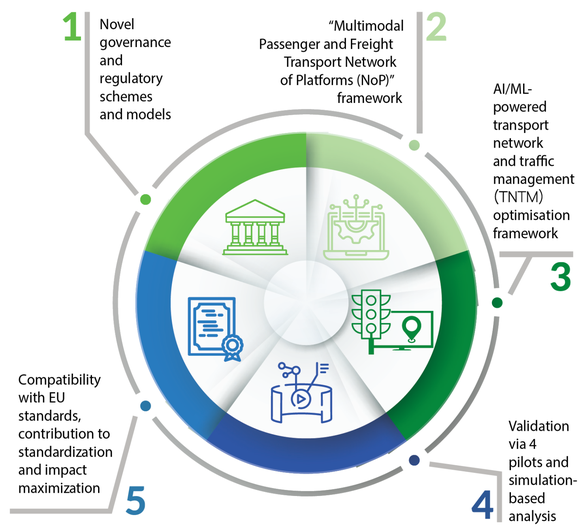


Figure 1. DELPHI's project objectives

To achieve these objectives, DELPHI will deliver an overall architectural design that will enable a secure data federation in a Data Spaces-driven approach, novel governance and regulatory schemes and novel and ultra-efficient methodologies for traffic monitoring, such as Unmanned Aerial System-powered monitoring. Furthermore, it will provide multi-/inter-modal optimization, Artificial Intelligence (AI) /Machine Learning (ML)-powered optimizations and frameworks and will exploit diverse modes for hybrid passenger and freight transport in different ecosystem types.

Use cases

The validation and evaluation of DELPHI's federated ecosystem will be performed in real-life settings through four complementary use cases and associated pilot demonstrations across different transport networks and environments. DELPHI's demos aim to facilitate the effective preparation and seamless integration of systems, involving continuous monitoring of progress, to ensure smooth functioning and improved interconnectivity.

USE CASE #1
Multimodal transport for a Sustainable LMD supported by blockchain for sharing economy in the e-commerce Channel in Madrid (Spain)

USE CASE #2
Integrated freight and passengers' models and data sharing framework in urban environment in the Attica region (Greece)

USE CASE #3
Integrated freight and passengers' models and data sharing framework in suburban/rural environment in the island of Mykonos (Greece)

USE CASE #4
Integrated passengers' models and data sharing governance framework in the Cluj-Napoca Metropolitan Area (Romania)

Outcomes – Impact

Improved multimodal network and traffic management

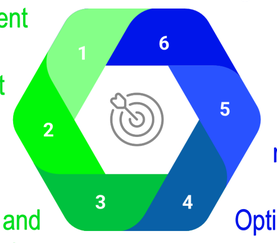
Effective and resilient network-wide data exchange

Enhanced prediction and resolution of bottlenecks

High market adoption and transferability

New governance arrangements for multimodal transport

Optimized mobility flows and reduced emissions



Conclusion – Summary

The adoption of a model for combined movement of people and goods can significantly mitigate traffic congestion, environmental burden, limited use of existing infrastructure, extensive spatial coverage etc.

The identification of interactions and revision of transport approach is crucial for addressing the ever-increasing transport needs and associated traffic problems. Towards addressing existing challenges, novel solutions' must be introduced, such as:

- Novel governance and regulatory systems
- Advanced technical and functional specifications towards interoperability and federation of existing/novel platforms, harmonized data specification and reference information models
- Common approaches and methodologies towards an integrated approach for passenger and freight transport.

DELPHI project will enable the creation of a federated ecosystem and architecture for seamless interaction of diverse freight/passenger transport and traffic management, as well as monitoring platforms, supporting beyond state-of-the-art multimodal transport optimization models and methods, towards reduced cost, delivery time and emissions.

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Project facts

DELPHI

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Consortium

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