UITP ADVANCING PUBLIC TRANSPORT

IP4MaaS

PROJECT BRIEF

TESTING MAAS TECHNOLOGIES TO ADVANCE SEAMLESS MULTIMODAL MOBILITY IN EUROPE

JULY | 2023

INTRODUCTION

In order to maintain its role as the backbone of the transport system and to remain a more-attractive mobility option, rail needs to respond better to customer needs and support an 'anytime, anywhere' door-to-door mobility, fully integrated with other transport modes. To do so, rail needs to take advantage of advances in areas such as cloud computing, big data and open data, as well as the proliferation of the internet and social media, recognising the impact of the increasing connectivity of people and objects.

The Shift2Rail (now Europe's Rail[1]) Innovation Programme 4 (IP4), a framework addressing and designing IT solutions for attractive railway services, has the ambition to achieve this, making rail the true backbone of the (multimodal) transport system. Within IP4, the IP4MaaS research project has sought to advance 'Mobility as a Service' (MaaS) in Europe by testing available IP4 MaaS technologies in six demonstration sites in Europe. Their main aim was to create and test a better multimodal travel system making everyday trips more sustainable, flexible and efficient for passengers. This Project Brief presents the key results from IP4MaaS.

CHALLENGES

The aim of the project was to act as a bridge between the needs and requirements of Transport Services Providers (TSPs) and travellers with the technologies developed within Europe's Rail to expand the functions of the IP4 digital ecosystem and in particular of the Travel Companion (the travel application developed within Shift2Rail allowing users to plan, book and execute their multimodal trips). The challenge was to provide the individual IT solutions developed in Shift2Rail/Europe's Rail projects and to combine them into solutions suitable for specific demonstration scenarios in Europe.

By testing IP4 solutions in real environments, IP4MaaS could provide evidence-based assessments of IP4 from a range of perspectives, including: (i) the effectiveness of the deployment of these solutions; (ii) their capacity to meet the diverse requirements of customers (travellers) and transport operators; (iii) the equity of their deployment in society; and (iv) their potential for acceptance by the mobility market.

1 https://rail-research.europa.eu/

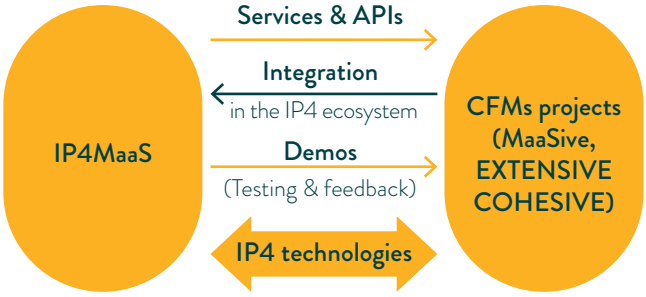


Figure 1: IP4MaaS interaction with CFM projects/IP4 ecosystem

Objectives

The main objective of IP4MaaS was to:

Design, execute, monitor and assess the Shift2Rail IP4 demonstrations by liaising between CFMs[2], TSPs and users. Undertake co-creation activities with all partners in IP4MaaS and beyond. Coordinate and assess the activities, with the goal of delivering successful demonstrations and a solid demonstration execution scheme that can be deployed by other projects.

In the following sections, we will further elaborate on the IP4MaaS objectives.

OBJECTIVES 1 & 2: DESIGNING AND DEVELOPING DEMONSTRATIONS

MAPPING OF THE AVAILABLE TECHNOLOGIES AND ANALYSIS OF THE STATE-OF-THE-ART

In its role as the bridge between European TSPs and CFM technology providers, IP4MaaS had a key responsibility in making the connection seamless. The project therefore started with an analysis of the landscape from the travellers' perspective, via a survey and a social media mining experiment. The first result provided a clear picture of the needs, expectations and preferences for mobility services and how technology could assist passengers on their journeys.

Subsequently, co-creation workshops were held with TSPs from the demonstration sites to evaluate both the current status of their systems and services along with the evolution foreseen to help match customers' expectations. The results allowed the project team to identify the mobility pain points in each area and how the IP4 solution could address them, thereby linking the travellers' needs and expectations with the technologies being tested.

The main outputs of the IP4MaaS analysis, based on the co-creation methodology, were the following definitions:

- **User Journeys,** which identified different types of itineraries.
- **Current User Journey Maps,** which expanded on user journeys describing the current travel experience, focusing on existing problems and areas of potential improvement.
- **Future User Journey Maps,** which revised the current user journey maps, including those new travel experiences enabled by IP4 solutions.
- **Demonstration Scenarios,** for the TSPs to test the functionalities provided by the IP4M ecosystem.

PLANNING OF DEMONSTRATIONS

After mapping of the available technologies and services, along with user preferences and needs, participants were then selected according to different sociodemographic profiles (age, gender, income) and included persons with reduced mobility (PRM). The technologies available in the IP4 ecosystem were matched with the services offered, while also taking into account the context of each site.

OBJECTIVE 3: EXECUTION AND MONITORING OF THE DEMOS

HIGHLIGHTS OF IP4MAAS DEMOS

To demonstrate the added value of the IP4 solutions, six demonstrations were organised during spring 2023 (with the exception of the Athens demo phase 1, which was held in summer 2022). Each lasted for approximately one week. In addition to bus and long-distance/suburban/urban rail operators, representatives from shared and private travel modes took part in the demonstration activities. They were

2 Call for Members – Partners from Projects, created following a call for members amongst members of Shift2Rail Joint Undertaking.

joined by transport authorities and ancillary services providers, and supported by universities and research centres.

For demonstration purposes, the local operators and travel service providers:

- Provided real data in an operational environment.
- Provided a realistic and adequate environment in which to integrate and run the demonstration.
- Defined a clear interface to access their web services, and provided real data to allow integration and demonstration of the IP4 functionalities.
- Provided access to their facilities and amenities and supported activities for implementing and testing of IP4 Technology demonstrators.
- Accompanied, and took part in, project activities supporting user engagement and dissemination of the demonstrations, attracting people and enhancing the project visibility.

The demonstration sites tested the following IP4 functionalities:

	FUNCTIONALITY	DESCRIPTION	ATHENS	PADUA	LIBEREC	WARSAW	LIBEREC-WARSAW LONG DISTANCE	OSIJEK	BARCELONA
Traveller	Journey Planner/Offer Builder	Calculates multimodal routes from origin to destination; these routes can include offer prices.	●	●	●	●	●	●	●
	Booking	Permits booking of all online parts of an offer that require payment.	●	●	●		●		●
	Issuing	Issues entitlements to travel (such as tickets).	●	●	●		●		●
	Mobility Packages	Creates packages of trips with better offers than the same trips bought separately.	●						
	Validation and Inspection	Provides the ability to validate and/or inspect traveller's tickets.			●		●		
	Trip Tracking	Provides Real Time (RT) information from the selected trips to the user by combining data from different TSPs.			●				
	Alternatives Calculation	Provides alternative trips in the event of a trip disruption.			●				
	Location Based Experience	Offers entertainment services based on the location of the user (such as quizzes or commercial offers).	●						
	Travel Companion web-portal	Allows the traveller to use journey planning, booking and issuing functionalities online.			●				
	Navigation	Provides detailed directions on the traveller's journey.	●	●	●	●	●	●	
	Traveller's feedback	Allows the traveller to report situations around them.	●	●	●	●			
	Trip Sharing	Allows the traveller to share a trip with another user.	●	●	●	●	●	●	
	Travel Arrangement	Allows a travel arranger to prepare trips for other users.			●	●	●	●	
	Guest User	Allows a TC user to use limited functionalities of the application without logging in.	●	●	●	●		●	
	Preferences and Profiles	Provides the users with different travel preferences with the ability to set different preferences for each profile.	●	●				●	
	Trip Planning Hierarchy	Sorts results in an order that reflects the user's preferences/profile, such as by transport mode or TSP.						●	
	Dynamic Display of Map Content	Manages the balance between information requirements of the transport provider on the map and end user experience with content displayed according to user-selected zoom-level and content filter.	●						
	Smart Locations	Enables trip planning to take account of the user's travel preferences for most-frequented locations.	●		●		●		
	Improved Intermodal Travel	Improves intermodal travel solutions that can also include private travel as main part of the solution.			●			●	
	Improved Travel Shopping	Finds trips and offers according to multiple criteria via Journey Planning.						●	
	Individual Last Mile	Improves trips by including individual transport (walking, cycling, driving) as options for the first and last mile of the existing route for an end-to-end travel experience.			●			●	
	Digital Onboarding	Allows registration using biometrics.				●			
	Collaborative Space	Allows the traveller to see reports that have been made by other traveller or TSPs around them. They will be able to comment, validate/reject or add media to the reports.		●		●			●

	FUNCTIONALITY	DESCRIPTION	ATHENS	PADUA	LIBEREC	WARSAW	LIBEREC-WARSAW LONG DISTANCE	OSIJEK	BARCELONA
Traveller	Group Travelling/Group Creation	Enables a user to create a group by inviting other users. The group admin can book a trip for the whole group and pay for a group ticket that all members can access via the TC. Group members receive push notifications of invitations, bookings and issued tickets.						●	
	Trip Price overview	Allows each user of the TC to see the prices for all offers associated with the itinerary in the booking view.						●	
TSP	Asset Manager	Allows the TSP to insert and describe their web services.	●	●		●			
	Contractual Management Marketplace	Allows the TSP to describe products that can be added to mobility packages, and to propose new mobility packages to other stakeholders.	●						
	Location Based Experience Editor	Allows the creation and editing of location-based experiences.	●						
	Specific Messages	Allows the TSP to send messages to one or more travellers (for example, if they are in a specific zone).	●	●					
	Traveller Orchestration & Supervision	Allows the TSP to add or update points of interest or location based experience positions on the map interface. It also allows TSPs to see the traveller's location in the tool interface.	●						
	Collaborative Space Portal	Allows the TSPs to manage the reports created by traveller as well as create their own, via a web portal.		●					

The IP4MaaS demonstrations are set out in the sections below, including their main outcomes.

ATHENS DEMO

The Athens demonstration was conducted in two phases. During the first phase (July 2022), preliminary results were collected to advance the tool for phase 2 (March 2023). In phase 2, a broader range of functionalities was tested.

PHASE 1

Modes involved: metros, buses, taxis, bikes and walking
Number of participants[3]: 23

PHASE 2

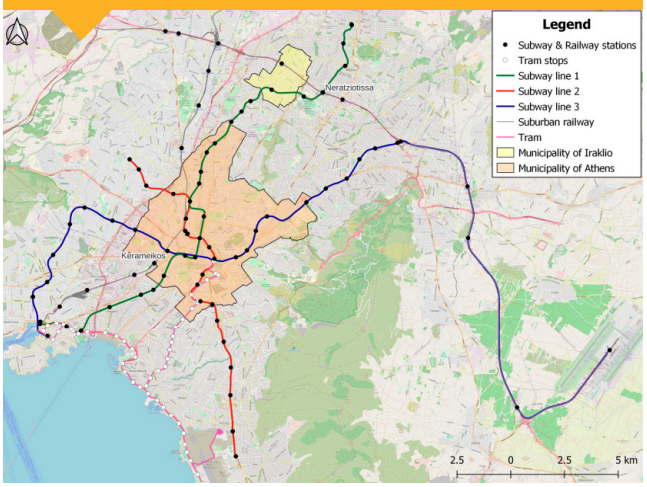
Modes involved: metros, buses, taxis, bikes and walking
Number of participants: 36

DESCRIPTION

The demonstration focused on enhancing multimodality by providing journey planning and integrated ticketing via a single app covering a range of transport modes (metros, buses, taxis, bikes and walking). The demonstration site was located within the urban area of Athens, also including a small PTO — the Municipality of Iraklio — located 8.5 km from central Athens and directly providing public transport services in its territory.

Figure 2: Dissemination of the demonstration — Omonoia Station in Athens

Figure 3: The Athens demonstration area (Phases 1 and 2)



3 Number of participants refer to the testers involved in the demo, who filled out the survey at the end of their experience.

RESULTS AND FEEDBACK

The overall results of the demonstration were positive, as users were enthusiastic about the attempts to develop a step towards MaaS in Athens. In spite of this strong interest among users in a tool simplifying multimodal trips in the city and surroundings, the demonstration assessment also highlighted significant challenges. These were related to technological and legal issues. Although solutions were found that worked in the context of the demonstration, these drew attention to the need to address MaaS challenges for building a competing mobility service that is reliable, satisfies user needs and improves accessibility for all.

PADUA DEMO

Modes involved: train, buses
Number of participants: 13

DESCRIPTION

The demonstration took place within a 40-km radius around the urban centre of Padua (Veneto Region, Italy) and involved urban and regional mobility service (rail, bus) providers. The main objectives of the demonstration were to:

- Improve urban-surrounding connections
- Improve the efficiency of public transport services (although most areas with transport infrastructures are well equipped, they sometimes lack integration between different modes of transport)
- Reduce GHG emissions and traffic/parking congestion
- Reduce bad travel habits, such as preferring cars to public transport

RESULTS AND FEEDBACK

Users genuinely appreciated the application, as it improved the urban-rural connections and helped reduce emissions. The 'travellers' feedback' function was particularly appreciated, as it allowed users to inform other travellers about the status of the trip, enhancing the user experience. The functionalities tested worked adequately, with no bugs. However, training on how to use the app, to be carried out before the demonstration, was considered important for properly realising its potential. Adequate communication and the selection of a targeted user group (university students) was also seen as important. Users would appreciate being able to find the app on widely-used app download platforms.

LIBEREC DEMO

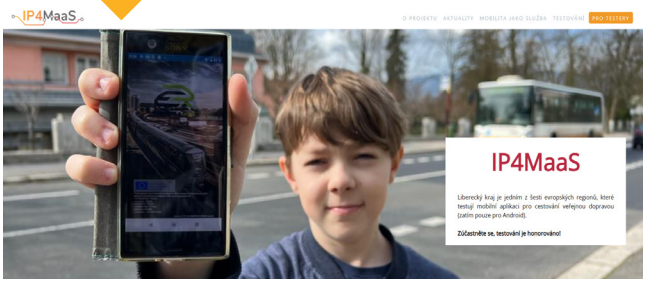
Modes involved: trams, buses, trains
Number of participants: 124

DESCRIPTION

The Liberec region (Czech Republic) is a mountainous area with scattered rural settlements and with industrial centres focused on the automotive sector. Public transport is fully integrated and managed by KORID, and involves a total of 19 operators with one integrated ticket. The main objectives of Liberec demo were to:

- Achieve better and smoother travelling within Liberec region
- Improve the integration of all available public transport mode
- Enhance the quality, availability and comfort of public transport services
- Understand passenger needs and preferences

Figure 5: Liberec Demonstration website



RESULTS AND FEEDBACK

The demonstration involved 124 testers totalling 2,036 journeys. It proved highly successful, and met the expectations of all involved partners, mainly thanks to the close cooperation between all actors involved. The main results that the testers emphasised were that the apps are user-friendly and easy to use, as they integrate all transport modes into a single travel solution and also support eco-friendly transport solutions. At the same time, the testers suggested a number of possible improvements to the app in order to further increase its user-friendliness and efficiency.

WARSAW DEMO

Modes involved: metro, trams, buses
Number of participants: 211

DESCRIPTION

The main objectives of the Warsaw demo were to enhance the knowledge and practice of user profiling, to support the development of the tools created and implemented by the city of Warsaw (ZTM). It also sought to support Warsaw's MaaS readiness by extending the understanding of creating and managing MaaS schemes and of different functionalities integration. The demonstration covered the whole Warsaw public transport area of operation (Warsaw and 34 communes; 2,693,426 people, 2,751 km).

RESULTS AND FEEDBACK

The general goal of the demo within the scope of the IP4MaaS project (to test the usefulness of the tools and understand the engagement of people), as well as the local goal of the City of Warsaw as the IP4MaaS consortium partner (to get experienced with MaaS tools) were accomplished. The feedback received via surveys was strongly positive. The feedback indicated that the TC application has a considerable potential, but will require improvement and refinement if it is to be used on a large scale commercial basis. The feedback from the Warsaw testers has seen refinements to newer versions of the TC.

Figure 6: Screenshot showing information displayed on MZA web kiosk

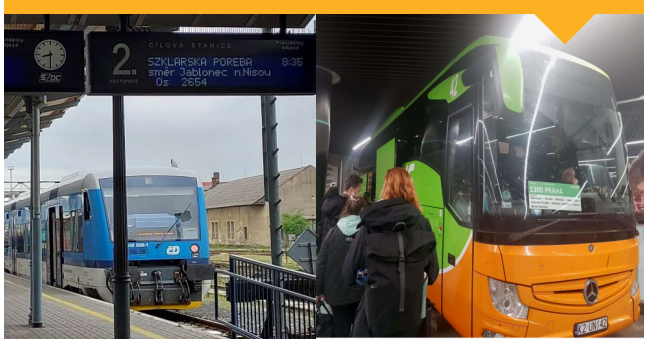
LIBEREC-WARSAW LONG-DISTANCE DEMO

Modes involved: buses, trains
Number of participants: 10

DESCRIPTION

The purpose was to test the multimodal cross-border connections between Liberec and Warsaw. For the purposes of this demonstration, services that had been integrated within Liberec and Warsaw demonstrations were used together with AMS (long-distance buses) services.

Figure 7: Long-distance demonstration



RESULTS AND FEEDBACK

The services had 10 testers, travelling from Liberec to Warsaw by train and from Warsaw to Liberec by various combinations of transport modes — primarily by bus. The testers were recruited internally, and were strongly satisfied with the IP4 idea itself. In particular, they liked the aggregation of a large number of services within a single application and thus the possibility of using a single app for travelling in Liberec, Warsaw and cross-border.

OSIJEK DEMO

Modes involved: trams, buses, shared bikes
Number of participants: 41

DESCRIPTION

The Osijek demo area was defined by the administrative borders of the urban agglomeration of Osijek (Croatia), which consists of the City of Osijek and 18 neighbouring municipalities. The demonstration focused on the areas where the public transport service/network is available. The objectives of the demo were to:

- Explore the potential of creating a MaaS ecosystem in the Osijek area, gaining knowledge and experience and accelerating the future uptake of IP4 technologies.
- Test and demonstrate the integration of traditional modes of public transport with innovative new services.

RESULTS AND FEEDBACK

In Osijek, the testing helped integrate traditional modes of public transport, namely GPP's trams and buses with innovative e-bike and bike-sharing services. The Journey Planner was found to be the best solution, demonstrating the advantages of the synergies between bike sharing and public transport to users. Users could report issues that contributed to improving the ecosystem via the demonstration experience. Users recognised and appreciated the potential of the tools, despite the fact that the technological solutions would need further development and improvement to be able to meet the growing demands for multimodal mobility.

BARCELONA DEMO

Modes involved: metro, trams, buses, shared/on-demand buses
Number of participants: 31

DESCRIPTION

The Barcelona demo focused on commuters and students, and set out to test the integration of transport-on-demand and public transport services. In particular, tests were focused on the urban-rural connections from the city centre to the outskirts and vice versa, despite the overall demo area being the whole city of Barcelona and its surroundings.

RESULTS AND FEEDBACK

The overall feedback was highly positive, particularly the responses from the focus group, whose objective was to explain the functionalities to be used in the demonstration and then to test them in a real-world environment. The focus group was successful, as the users understood the complexity of the system and the technical partners gained a better understanding of the users' needs. It allowed the testers to openly express their opinion, promptly solve possible misunderstanding, and complete all testing phases in depth.

OBJECTIVE 4: ASSESSMENT AND EVALUATION OF THE DEMONSTRATIONS

IMPACT AND CONCLUSIONS

The results provided data that allowed project partners to evaluate the demonstration activities, assessing the performances and impacts generated. These actions used a methodology that resulted in:

- Defining common metrics for assessing and benchmarking environmental, transport and socioeconomic performances and considering their combined effects
- Measuring KPI values before and after the demonstrations
- Understanding the implications of MaaS for local mobility models.

A set of indicators were derived from both the ecosystem itself (operational KPIs) and from the user satisfaction surveys collected from travellers and TSPs. A combined overview of impact assessment indicators, grouped in four classes, is reported in the table below, showing positive results (on a scale of 1 to 5) for all project demonstration sites:

	USER ACCEPTANCE	STAKEHOLDER ACCEPTANCE	QUALITY OF SERVICE	MULTIMODALITY
Athens	3.7	3.5	4.1	3.7
Barcelona	2.5	2.0	3.3	3.6
Liberec	3.9	5.0	4.3	3.2
Osijek	3.8	3.0	3.4	3.8
Padua	3.8	3.5	3.9	3.1
Warsaw	3.5	3.3	3.4	3.7

The final evaluation demonstrated the viability of the IP4MaaS solution. Overall, the feedback from users and TSPs was positive, and provided significant inputs for improvement and enhancements to the proposed services.

CONCLUSION

The feedback from the IP4MaaS evaluation, gathered from all actors involved, led to the overall recommendation that the users' mobility experience is closely linked to the availability of effective digital applications. However, to encourage consumers to change their habits and leave their comfort zone, defining a level of convenience for the change is needed. IP4MaaS proved that the idea of integrating TSPs within a large and EU-wide network such as the IP4 could create the ideal conditions to promote this behavioural change and overcome some of the current barriers for a large-scale MaaS adoption. The evaluation methodology designed and applied in the project may act as a reference for future assessments when implementing complex mobility scenarios within EU cities.

The IP4MaaS project helped connect TSPs, travellers and their needs to the technologies developed within Shift2Rail. The project successfully organised demonstration activities in six European locations, involving both more-traditional and innovative transport modes. It also tested the IT solutions developed within Shift2Rail with hundreds of users in different contexts, allowing the project to test the technology and collect direct feedback from real travellers and TSPs. This in turn allowed CFMs to improve the ecosystem and make an additional step towards achieving the Shift2Rail (now Europe's Rail) ambition of affirming rail as the backbone of the (multimodal) transport system in Europe.

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