



## Deliverable D1.7

# Report on collaboration activities and guidelines for TSPs joining the IP4 ecosystem

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## 1. Executive Summary

Since the main aim of the IP4MaaS project (S2R-OC-IP4-01-2020, GA 101015492) is to design, execute, monitor, and assess the Shift2Rail IP4 demonstrations by liaising between CFMs, TSPs, and users, it is necessary to understand how the project positions itself in the context of S2R IP4 projects, and which are the recommendations for operators and actors in the mobility sector (Europe-wide and beyond) to join the ecosystem.

D1.7 presents an overview of S2R ecosystem, with a specific focus on Innovation Pillar 4: its main features, its challenges, its technical demonstrators, the research and innovation activities performed and the main objectives and outcomes. A calendar of IP4MaaS and CFM (Call For Members) meetings and interactions was presented, in order to showcase all the different occasions in which, formally and informally, the projects had the opportunity to exchange. Official Collaboration meetings have been organized regularly in order to coordinate the collaboration between consortia. Additional meetings have been organized around a specific topic every time it was needed. The interaction facilitated the exchange of material (in particular accesses, documentation, GTFS files, APIs, credentials) needed for the integration of TSPs in the S2R ecosystem, it allowed the preparation and execution of demos. In some case, it helped the project actors to get familiar with the IP4 ecosystem. To facilitate this, as a joint exercise carried out by IP4MaaS and RIDE2RAIL projects with the support of CFMs partners, an “IP4 Terminology and Glossary” Excel file was kept constantly updated by OC partners (in particular UITP, CEFRIEL, AITEC, POLIMI). The aim of the glossary is to help OC and CFM projects to use in their activities the same glossary, harmonizing as much as possible the terminology used not only in the official documents but also in the day-to-day project activities.

A comprehensive list of functionalities utilized and tested within IP4MaaS is presented in this document, highlighting its main features and nature (passive/active according to CFMs nomenclature).

An overview of all the requirements to integrate each of the functionalities selected by each demo team is also provided. This facilitates each potential TSP willing to be integrated in the ecosystem to understand the requirements (APIs, web services, GTFS, GeoJson coordinates, among the most relevant) needed for the integration. To facilitate the understanding of the process to be followed for being integrated, the description of the integration process per each TSP in each demo site is presented, with the support of public deliverables issued by CFMs projects and the support of demo actors involved in IP4MaaS.

Finally, recommendations for a smooth integration of TSPs and involvement of users are provided, with some lessons learnt coming from the demo preparation and execution process.

As supporting tools, the overall IP4 glossary, developed jointly by Open Calls (RIDE2RAIL-IP4MAAS) and CFMs project partners and kept updated throughout the project by all these partners coordinated by UITP, is provided as Annex.

The list of technical requirements for each of the IP4 functionalities has been provided as Annex II. This would help the reader to understand the requirements that each TSP/mobility service provider should provide for being part of the IP4 ecosystem.

## 2. Abbreviations and acronyms

<b>Abbreviation / Acronym</b>	<b>Description</b>
AM	Asset Manager
CFM	Calls for Members
EU	European Union
ER JU	Europe's Rail Joint Undertaking
GA	Grant Agreement
IP4	Innovation Programme 4
IT	Information Technology
JP	Journey Planner
KPI	Key Performance Indicator
LBE	Location Based Experiences
MAAP	Multi-Annual Action Plan
MaaS	Mobility as a Service
OC	Open Calls
S2R JU	Shift2Rail Joint Undertaking
TC	Travel Companion
TSP	Transport Service Providers
USI	User Satisfaction Index
WP	Work Package
WPL	Work package Leader



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## 5. Background

IP4MaaS<sup>1</sup> project aim was to design, execute, monitor, and assess demonstrations to test technologies developed under the Innovation Programme 4 (IP4)<sup>2</sup> of the Shift2Rail<sup>3</sup> Joint Undertaking and advance the uptake of Mobility as a Service (MaaS) schemes.

It aims to provide complementary and continuous solutions already started within previous Shift2Rail CFMs projects (MaaSive<sup>4</sup>, ATTRACTIVE<sup>5</sup>, CO-ACTIVE<sup>6</sup>) to enhancing traveller experience and improve travel services in travel shopping, trip tracking, booking, and ticketing.

IP4MaaS project acts as an intermediary between the CFM projects on one side and TSPs/travellers on the other and used input from COHESIVE<sup>7</sup>, CONNECTIVE<sup>8</sup>, ExtenSive<sup>9</sup>, and other CFM projects.

Thus, the IP4 functionalities IP4MaaS utilized and tested in both C-REL and F-REL (intermediate and final releases) are outcomes of the above mentioned CFMs projects, and IP4MaaS outcomes can be useful for other projects to improve IP4 functionalities even further and overcome identified limitations.

The present document constitutes the Deliverable D1.7 “Report on collaboration activities and guidelines for TSPs joining the IP4 ecosystem” in the framework of the WP1, Task 1.5, of the IP4MaaS project (S2R-OC-IP4-01-2020, GA 101015492). The D1.7 is linked to WP4, Task 4.4 “Operation of the Management Committee” and WP7, Task 7.3 “Transferability and Recommendations for Market Uptake”.

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<sup>1</sup> [https://projects.shift2rail.org/s2r\\_ip4\\_n.aspx?p=S2R\\_IP4MaaS](https://projects.shift2rail.org/s2r_ip4_n.aspx?p=S2R_IP4MaaS)

<sup>2</sup> <https://shift2rail.org/research-development/ip4/>

<sup>3</sup> <https://shift2rail.org/about-shift2rail/>

<sup>4</sup> [https://projects.shift2rail.org/s2r\\_ip4\\_n.aspx?p=MaaSive](https://projects.shift2rail.org/s2r_ip4_n.aspx?p=MaaSive)

<sup>5</sup> [https://projects.shift2rail.org/s2r\\_ip4\\_n.aspx?p=ATTRACTIVE](https://projects.shift2rail.org/s2r_ip4_n.aspx?p=ATTRACTIVE)

<sup>6</sup> [https://projects.shift2rail.org/s2r\\_ip4\\_n.aspx?p=CO-ACTIVE](https://projects.shift2rail.org/s2r_ip4_n.aspx?p=CO-ACTIVE)

<sup>7</sup> [https://projects.shift2rail.org/s2r\\_ip4\\_n.aspx?p=COHESIVE](https://projects.shift2rail.org/s2r_ip4_n.aspx?p=COHESIVE)

<sup>8</sup> [https://projects.shift2rail.org/s2r\\_ip4\\_n.aspx?p=CONNECTIVE](https://projects.shift2rail.org/s2r_ip4_n.aspx?p=CONNECTIVE)

<sup>9</sup> [https://projects.shift2rail.org/s2r\\_ip4\\_n.aspx?p=EXTENSIVE](https://projects.shift2rail.org/s2r_ip4_n.aspx?p=EXTENSIVE)



## 6. Objective/Aim

This document has the following objectives:

- Providing an overview of the IP4 ecosystem.
- Providing an overview of the collaboration activities performed between IP4MaaS project partners and CFMs project partners.
- Providing an overview of the functionalities used in IP4MaaS demos and the requirements for their integration.
- Providing an overview of the integration process performed by CFM project partners with the support of the material provided by IP4MaaS partners.
- Providing recommendations for TSPs willing to be integrated in the ecosystem and, as annexes, the IP4 terminology and glossary developed within CFMs-OC projects and the technical requirements for IP4 functionalities.

## 7. The S2R Ecosystem

The Shift2Rail Joint Undertaking (S2R JU, from 2022 Europe’s Rail JU) is a public-private joint undertaking in the rail sector, established under Horizon 2020 programme, aimed to provide a platform for coordinating research and innovation activities in the rail sector. It was established on 7 July 2014, following the entry into force of Council Regulation (EU) No 642/2014 of 16 June 2014 establishing the Shift2Rail Joint Undertaking<sup>10</sup>.

The activities of the S2R JU are defined in a strategic Master Plan and represented by five Innovation Programmes: IP1 ‘Cost-efficient and reliable trains, including high-capacity and high-speed trains’, IP2 ‘Advanced traffic management & control systems’, IP3 ‘Cost-efficient and reliable high-capacity infrastructure’, IP4 ‘IT Solutions for attractive railway services’, IP4 ‘Technologies for sustainable & attractive European freight’.

Europe’s Rail Joint Undertaking (EU-Rail)<sup>11</sup> is established by Council Regulation (EU) 2021/2085 of 19 November 2021. It is the new European partnership on rail research and innovation established under the Horizon Europe programme (2020-2027) and the successor of the Shift2Rail Joint Undertaking.

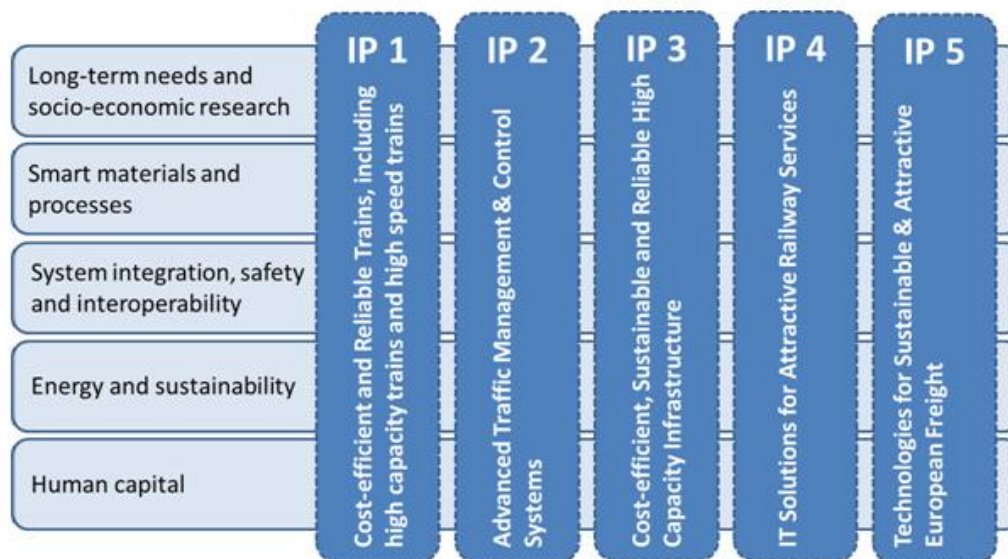


Figure 1: Shift2Rail Innovation programmes and cross-cutting activities (Reference: Shift2Rail website)

<sup>10</sup> [https://ec.europa.eu/transport/modes/rail/shift2rail\\_en](https://ec.europa.eu/transport/modes/rail/shift2rail_en)

<sup>11</sup> <https://rail-research.europa.eu/>

Shift2Rail created a ‘Travel Companion’ application for the European market. This personal application has the ambition to connect rail with other transport modes providing multimodal travel offer connecting the first and the last mile of long-distance journeys Europe-wide. The main objective is to put the traveller at the centre of solutions’ design, ease access to rail services, increasing its attractiveness, and give one-stop-shop access to all multimodal travel services. To achieve this, IP4 developed an Interoperability Framework including tools and technologies that allow data exchange between different actors of the transport ecosystem, enabling interoperability between new and existing systems.

## 7.1. Innovation Programme 4<sup>12</sup>

### 7.1.1 Challenges

To become a more attractive option, rail must respond to customer needs to support anytime, anywhere, door-to-door, intermodal journeys encompassing distinct modes of transportation. Rail must achieve interoperability with other transport modes and mobility services, with regions, cities and people engaged in social and economic activities, and with the key elements of the supply chains which can make rail products and services available to those people. In order to achieve this, rail needs to take due advantage of the increasing connectivity of people and objects, the availability of European Global Navigation Satellite Systems (GNSS)-based locations, the advances in cloud computing, big, linked and open data and the widespread diffusion of internet. The step towards sharing data needs to be considered and progressively developed, in order to enable service developers to provide connected travellers with the services they need and expect. Customers are nowadays increasingly technology-savvy, and expect to have relevant information at their fingertips in a few clicks, through a wide variety of data channels offering real-time and personalised information. To achieve a full seamless multimodal travel experience, customers must be able to easily plan and purchase door-to-door journeys. Ticketless or multi-application solutions that guarantee interconnectivity no matter where the traveller roams should become the norm.

Improved information technology, management and exploitation, and cross-industry collaboration must help to provide passengers with smart and personalised services for journey information and ticket purchase, together with entertainment and communication services. The development of multimodal infrastructures, providing for simple and seamless interchanges, including across different transport modes (i.e. urban and regional rail, air transport, road transport, cycling and walking) should make transfers easy, comfortable and reliable. For this reason, timetables should be increasingly integrated across transport modes to allow better modal integration and minimise travellers’ inconvenience. Station and staff information systems and personalised messaging help passengers throughout their journey, including the offer of alternative arrangements in case of disruption.

In this respect, it is essential to ensure that sufficient data are made available from all relevant

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<sup>12</sup> <https://rail-research.europa.eu/research-development/ip4/>

actors in the railway sector, so as to properly reap the benefits of these innovative IT services, which are key to the establishment of a fully functioning Single European Railway Area (SERA) and Single European Transport System.

### 7.1.2 IP4 Research and Innovation activities

Work in IP4 is organised so as to achieve the objectives of the three R&I areas listed in the Shift2Rail Master Plan: Technical framework, Customer experience applications and Multimodal travel services.

IP4 is organised around six Technology Demonstrators (TDs). All of these TDs focus on one element of providing a travel application for seamless passenger experience.

**TD 4.1 - Interoperability Framework**

**TD 4.2 - Travel Shopping**

**TD 4.3 - Booking & Ticketing**

**TD 4.4 - Trip Tracker**

**TD 4.5 - Travel Companion**

**TD 4.6 - Business Analytics Platform**

**TD 4.7 - Overall IP4 Coordination and Demonstrations**

Figure 2: Technological Demonstrators of S2R IP4<sup>13</sup>.

Besides it, there is a specific additional IP4-integrated Technical Demonstrator (iT4.7), to integrate all developments from other TDs and acts as an orchestrator of all technologies developed within the Programme.

The aim of the '*Interoperability Framework*' (TD4.1) is to facilitate multimodal travel in a highly diverse environment and with many transport modes. The world of transportation service providers needs to be open-ended; it evolves at its own pace, and uses multiple data formats and interfaces. Interoperability at the semantic level defines formal and explicit models of the transportation domain in an open, standard, machine-readable language that is exchanged automatically by computers.

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<sup>13</sup> [https://projects.shift2rail.org/s2r\\_ip\\_TD.aspx?ip=4](https://projects.shift2rail.org/s2r_ip_TD.aspx?ip=4)

The *'Travel Shopping'* (TD4.2) aims to provide a comprehensive shopping application enabler which combines all modes of transport, all operators, and provides a list of customer-relevant trip offers which are guaranteed available for booking, purchase and ticketing. The IP4 approach promotes the integration of distributed travel operators' data and the orchestration of services such as expert journey planning. It is facilitated by the Interoperability Framework by enabling applications based upon different standards or coding lists, to communicate meaningfully but without costly application adaptations.

The *'Booking & Ticketing'* (TD4.3) orchestrates multiple parallel interactions with several booking, payment and ticketing engines, including the all-important roll-back activities, should any single transaction fail, in order to eliminate risk. Thanks to the concept of a unique traveller identifier and wallet, the traveller has easy access to the complete and integral components of his/her journey, including easy production of the entitlement tokens required for all ticket validation controls encountered en route. This tool simplifies the traveller's life, by abolishing uncertainties associated with 'behind-the-scenes' multiple booking, payment and ticket processes.

The *'Trip-tracker'* (TD4.4) gives travellers in-trip assistance when navigating transport nodes, while also providing personalised information (related to predefined preferences) and up-to-date status reports on subsequent legs of the journey; it supports them in case of disruption, by proposing updated booking possibilities together with updated rights to travel.

The traveller needs to have full control of the journey, thanks to their own personal and secured *'Travel Companion'* (TD4.5), which stores and shares their personal preferences in a wallet. It gives access to all travel services needed for the journey, shopping and booking, and allows storage of the rights to travel. At the same time, retailers and operators are able to identify and authorise the Travel Companion to access their own systems and networks.

All the services related to individual travels and to additional sensors generate a great deal of data which have great value for both operators and end users. It is the role of the *'Business Analytics'* (TD4.6) to manage those data. Novel 'big data' technologies such as 'intentional' semantic information (denoting objects by properties rather than by values) improve the capabilities to analyse distributed and heterogeneous linked data, creating numerous possibilities to generate unprecedented insights for all the actors of the ecosystem, and new intelligence for the benefit of operators and travellers.

Although IP4 is organised around six Technology Demonstrators (TDs) with clear and non-overlapping objectives, all input contribute to a specific IP4-integrated Technical Demonstrator (iT4.7), which act as the orchestrator of other TDs' developments, and which ensure the systems approach to integrate the different TDs' results. More info on IP4 can be found on the Europe's Rail website <https://rail-research.europa.eu/>, where a section dedicated to S2R can be explored.

## 8. Collaboration with CFMs complementary projects

IP4 is a long-term programme comprised of different linked projects, each with its own specific goal. The IP4 projects' pool includes projects led by Call-for-Members (CFM) projects consisted of members of S2R JU and so-called open-call (OC) projects consisted of other "non S2R members" from rail and public transport sectors. The whole set of technologies used in IP4MaaS have been developed by CFMs partners within multiple projects (the already mentioned COHESIVE, CONNECTIVE, MaaSive, Attractive, Co-Active, ExtenSive).

CFMs project partners and IP4MaaS partners constantly collaborated since the very beginning of the project lifetime, in order to facilitate the integration of TSPs in the IP4 ecosystem, the exchange of technical documentation supporting the understanding of the ecosystem itself and the demo performance and execution. Multiple interactions have been activated in several ways:

- Exchange of material and information via email;
- Formal and informal Collaboration Meetings;
- Invitation to attend and to speak at relevant IP4MaaS meetings, events and workshops;
- Bi-lateral calls with targeted partners, to discuss technical and operational aspects of the project;
- Participation to WP calls for demo preparation;
- Support for credentials creation;
- Support for TC Terms of Reference;
- Support for KPI investigation;
- Signature of a COLA-Collaboration Agreement.

### 8.1. Calendar of Interactions with CFM complementary projects

As previously mentioned, CFMs project partners and IP4MaaS partners constantly collaborated since the very beginning of the project lifetime, in order to facilitate the integration of TSPs in the IP4 ecosystem, the exchange of technical documentation supporting the understanding of the ecosystem itself and the demo performance and execution. Official and informal exchanges took place over the 31 months of the project lifetime.

A comprehensive list of meetings is provided in this paragraph, to facilitate the reader in understanding the multiple occasion in which the IP4MaaS consortium interacted at different levels with CFM partners. Official Collaboration meetings have been organized regularly in order to coordinate the collaboration between consortia. Additional meetings have been organized around a specific topic every time it was needed. The interaction facilitated the exchange of material (in particular accesses, documentation, GTFS files, APIs, credentials) needed for the integration of TSPs in the S2R ecosystem, it allowed the preparation and execution of demos. In some case, it helped the project actors to get familiar with the IP4 ecosystem. To facilitate this, as a joint exercise carried out by IP4MaaS and RIDE2RAIL projects with the support of CFMs partners, an "IP4 Terminology and Glossary" Excel file was kept constantly updated by OC partners (in

particular UITP, CEFRIEL, AITEC, POLIMI). The aim of the glossary is to help OC and CFM projects to use in their activities the same glossary, harmonizing as much as possible the terminology used not only in the official documents but also in the day-to-day project activities. This document, based on the MaaSive project glossary, is included as annex to this Deliverable.

The full calendar of meetings with CFMs is included in this document as Annex III.

## Integration coordination and pilots

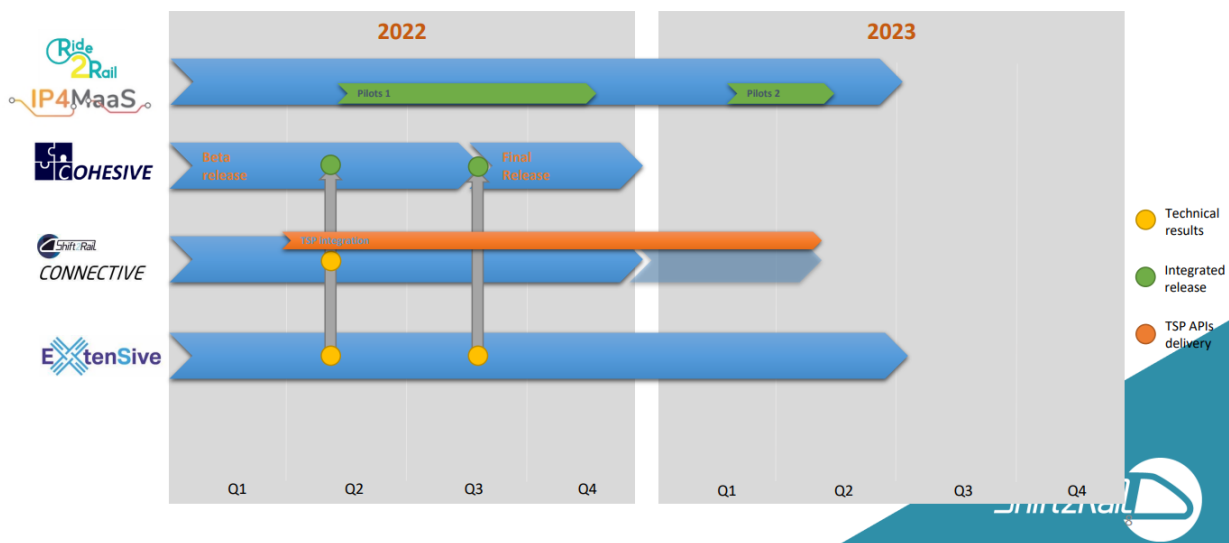


Figure 3: Timeline of demonstrations and interaction with CFMs complementary projects. Courtesy of COHESIVE project<sup>14</sup>

On top of the above-listed meetings, IP4MaaS organized WP specific calls (in particular for everything concerning WP4 and WP5) involving from time-to-time CFMs project partners. The main objectives of the above were to support the organization of the demo activities on the technical point of view, providing additional information about specific functionalities to be used in specific demo sites.

UITP, as coordinator of IP4MaaS, collaborated with CFM complementary projects also on dissemination activities. UITP was invited to several TMT Meetings organized by ExtenSive project, and, as a speaker, to: S2R Innovation Days 2021 and 2022, COHESIVE Final Event January 2023. IP4MaaS was also presented at ExtenSive mid term event November 2022. CFM partners have been invited as speakers to: IP4MaaS Stakeholders' Workshop May 2022, UITP Stand presentation at TRA November 2022. A joint IP4MaaS-ExtenSive-CONNECTIVE Final Event has also been

<sup>14</sup> Source: IP4 Advisory Board Meeting (Online), 3 May 2023.

organized in Barcelona, in June 2023, boosting once again the collaboration among project partners for improving the synergies between OC and CFMs. Among OC, it is also worth mentioning RIDE2RAIL project, coordinated by UITP and whose consortium is also joined by several IP4MaaS partners. The two mentioned OC project and CFMs projects, facilitated by the UITP’s role of coordinator, intensely collaborated, facilitating the exchanges and the synergies. This has been particularly relevant with regards to the collection of material from TSPs to be integrated (some demos have been organized in parallel in RIDE2RAIL and IP4MaaS) and for the organization/definition of the calendar of the different demos (Phases 1 and 2).

UITP, as leader of the IP4MaaS Management Committee (WP4), played a role of facilitator in the interaction between CFMs and IP4MaaS partners (involving RIDE2RAIL partners in some of the exchanges, due to the links between the projects and the synergies potentially coming from the mutual participation of several partners in both OC projects, in particular for what concerns the demos organized in Czech Republic, Greece, Italy, and some technical partners participating in both projects).

The roles and responsibilities of the Management Committee are presented in the Table below.

Phases	Preparation phase	In-house development & Administrative tasks	Integration & Administrative tasks	Testing	Demo preparation	Demo execution
<b>Management Committee</b>	<ul style="list-style-type: none"> <li>• Monitor the execution of the activities planned</li> <li>• Timeline supervision</li> <li>• Monitor the risk management plan regarding demos' execution, implementation of mitigation actions, and activation of contingency plans</li> <li>• Monitor the risk of identifying issues (lack of data/documentation etc.) at a later stage for the</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor the execution of the activities planned</li> <li>• Timeline supervision</li> <li>• Manage risks, implement mitigation actions, and activate contingency plans (if needed)</li> <li>• Monitor the risk of identifying issues (lack of data/documentation etc.) at a later stage for the demo sites in F-REL, put in place relevant mitigation</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor the execution of the activities planned</li> <li>• Timeline supervision</li> <li>• Manage risks, implement mitigation actions, and activate contingency plans (if needed)</li> <li>• Monitor the risk of identifying issues (lack of data/documentation etc.) at a later stage for the demo sites in F-REL, put in place relevant mitigation</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor the execution of the activities planned</li> <li>• Timeline supervision</li> <li>• Manage risks, implement mitigation actions, and activate contingency plans (if needed)</li> <li>• Monitor the risk of identifying issues (lack of data/documentation etc.) at a later stage for the demo sites in F-REL, put in place relevant mitigation</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor the execution of the activities planned</li> <li>• Timeline supervision</li> <li>• Manage risks, implement mitigation actions, and activate contingency plans (if needed)</li> <li>• Monitor the risk of identifying issues (lack of data/documentation etc.) at a later stage for the demo sites in F-REL, put in place relevant mitigation</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor the execution of the activities planned</li> <li>• Timeline supervision</li> <li>• Manage risks, implement mitigation actions, and activate contingency plans (if needed)</li> <li>• Monitor the risk of identifying issues (lack of data/documentation etc.) at a later stage for the demo sites in F-REL, put in place relevant mitigation</li> </ul>



<p>demo sites in F-REL, put in place relevant mitigation plans</p> <ul style="list-style-type: none"> <li>• Intervene to resolve barriers that might emerge</li> <li>• Coordinate the execution of workshops</li> <li>• Coordinate actions between the different stakeholders of the demos (Committees, Demo Leaders, CFMs, TSPs)</li> <li>• Collaborate and co-plan activities with the outreach pillar</li> <li>• Collaborate with other projects (e.g., CFMs, Ride2Rail)</li> <li>• Monitor Integration and Data Committees' activities</li> </ul>	<p>plans</p> <ul style="list-style-type: none"> <li>• Intervene to resolve barriers that might emerge</li> <li>• Coordinate the execution of workshops</li> <li>• Coordinate actions between the different stakeholders of the demos (Committees, Demo Leaders, CFMs, TSPs)</li> <li>• Collaborate and co-plan activities with the outreach pillar</li> <li>• Collaborate with other projects (e.g., CFMs, Ride2Rail)</li> <li>• Monitor Integration and Data Committees' activities</li> </ul>	<p>plans</p> <ul style="list-style-type: none"> <li>• Intervene to resolve barriers that might emerge</li> <li>• Coordinate the execution of workshops</li> <li>• Coordinate actions between the different stakeholders of the demos (Committees, Demo Leaders, CFMs, TSPs)</li> <li>• Collaborate and co-plan activities with the outreach pillar</li> <li>• Collaborate with other projects (e.g., CFMs, Ride2Rail)</li> <li>• Monitor Integration and Data Committees' activities</li> </ul>	<p>plans</p> <ul style="list-style-type: none"> <li>• Intervene to resolve barriers that might emerge</li> <li>• Coordinate actions between the different stakeholders of the demos (Committees, Demo Leaders, CFMs, TSPs)</li> <li>• Monitor Integration and Data Committees' activities</li> </ul>	<p>plans</p> <ul style="list-style-type: none"> <li>• Intervene to resolve barriers that might emerge</li> <li>• Coordinate actions between the different stakeholders of the demos (Committees, Demo Leaders, CFMs, TSPs)</li> <li>• Collaborate with other projects (e.g., CFMs, Ride2Rail)</li> <li>• Monitor Integration and Data Committees' activities</li> </ul>	<p>plans</p> <ul style="list-style-type: none"> <li>• Intervene to resolve barriers that might emerge</li> <li>• Coordinate actions between the different stakeholders of the demos (Committees, Demo Leaders, CFMs, TSPs)</li> <li>• Collaborate and co-plan activities with the outreach pillar</li> <li>• Collaborate with other projects (e.g., CFMs, Ride2Rail)</li> <li>• Monitor Integration and Data Committees' activities</li> </ul>
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Figure 4: Management Committee Role and Responsibilities.

More information on the work of the Management Committee can be found in the Deliverable D4.5 “Report on the actions of the Integration, Data and Management Committees” available on the IP4MaaS Zenodo community <https://zenodo.org/communities/ip4maas/> and on the IP4MaaS website <https://www.ip4maas.eu/>.

## 9. Integration of IP4MaaS TSPs in IP4 Ecosystem

### 9.1 Demo sites and operators

The Demonstrations of IP4MaaS cover six different countries (**Spain, Italy, Greece, Croatia,**

**Czech Republic, and Poland).** The project has tested a large pool of mobility solutions, both in urban and rural areas since it aimed at enhancing the connectivity of rural, urban, and peri-urban areas through different modes of transport.

The Operators that participated in the IP4MaaS Demonstrations represented several means of transport:

- **One Railway Undertaking (RU)**, Trenitalia SpA, involved through FSTechnology, fully owned by the FSI Group, a company in charge of the entire range of ICT services that enables transport mobility operations for Trenitalia and Busitalia.
- **Six Public Transport Operators**, involving bus, tram, trolley, and metro: TMB, MZA, TRAM Warsaw, OASA, MIRAKLIO, GPP.
- **Two Transport Authorities**, acting as coordinators of public transport services in cities and regions involved in the demonstrations: KORID, MIASTO Warsaw.
- **Three ridesharing, taxi, and MaaS operators**: Taxiway, BrainBox, and Social Car<sup>15</sup>.
- **Two demand responsive transport operators**: BusUp and AMTU-Flexittransport (involved in the project as subcontractor of Sparsity).

The IP4MaaS project followed an iterative approach that consisted of 2 demonstration phases. The iterations are named C-REL (core release) and F-REL (final release). The 1<sup>st</sup> Demo Phase was executed only in Athens in 2022, while the 2<sup>nd</sup> Phase involved all six demo sites (Padua, Athens, Barcelona, Liberec, Warsaw, Osijek) in 2023. For additional information on the C-REL demonstration execution plan, please refer to document D4.2 and D4.3, available on the project website.

The timeline of all demonstration sites for both the IP4MaaS (and the RIDE2RAIL project too, whose demonstration activities were partially carried out in parallel with IP4MaaS ones), as well as the complementary project ExtenSive, along with the overview of the components that have been demonstrated, is depicted in the following figure as provided from the CFMs.

Figure 6 provides the legend for Figure 5. Both figures refer to the functionalities that need effort from the side of the CFMs, to analyze, integrate and test, not the passive functionalities or any other that do not require action from CFMs' and OCs' side.

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<sup>15</sup> Social Car was not integrated in the ecosystem and participated to the Barcelona demo activities as a supporting partner for the Demo Leader, as stated in the IP4MaaS Amendment n.1.

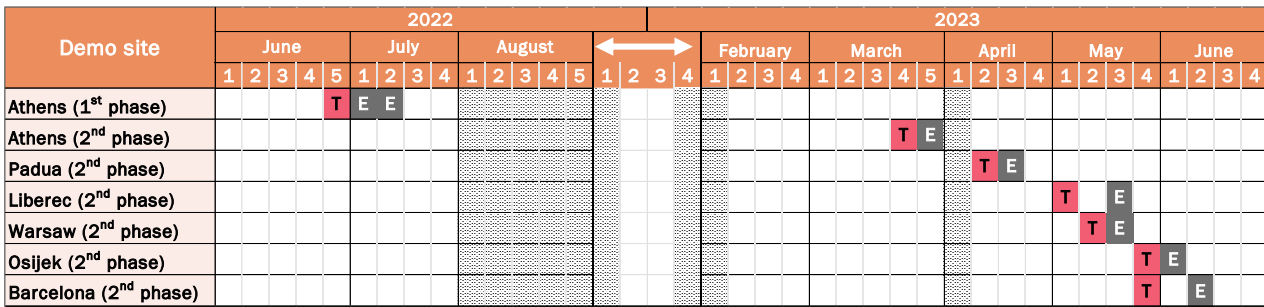


Figure 5: Integration, testing, and demonstrations roadmap (R2R & IP4MaaS, plus Extensive F-REL)

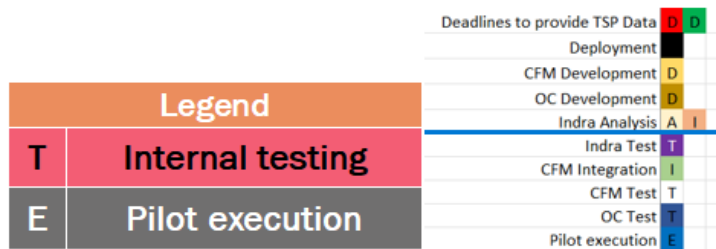


Figure 6: Figure 5 Legend

## 9.2 Functionalities to be demonstrated and requirements for each IP4MaaS TSP

A comprehensive description of the available IP4 functionalities and how they are used in IP4MaaS is included in D4.3 and D4.5, available on the IP4MaaS website.

The first step for defining the elements demonstrated in IP4MaaS demo sites was the mapping of the technologies available in the S2R IP4 Ecosystem and their level of Technological Readiness Level (TRL). This mapping was possible thanks to a deep analysis of the documentation provided by CFMs in 2 Collaboration Meetings and exchanged via IP4MaaS WP2-3-4 partners via email. CFMs divide the IP4 functionalities in 2 categories: passive and active.

**Table 1:** Overview of all IP4 Functionalities and their corresponding TRL level. The list also indicates for each functionality the respective target end user (traveler or the TSP) and the status of each functionality (ready or still under development). TRL 5 technologies are validated in a relevant environment. TRL 6 technologies are demonstrated in a suitable environment. The goal of the IP4MaaS Project is to establish systems prototypes in an operational environment, i.e., TRL 6.

Some functionalities have been excluded from this list since they have been deemed not testable in the context of IP4MaaS, while others (those planned to be demonstrated in F-REL, from ID P1 all the way to ID S7) have yet to be released. For additional information, please see the notes underneath the list. Therefore, some technical requirements are not yet known. All known

technical requirements for all functionalities are included in the Annex at the end of this document.

Table 1: Overview of all IP4 Functionalities

ID	IP4 Technologies	TRL	User	Availability	P/A
1	Journey Planner / Offer Builder	6	Traveler	Ready	Active
2	Booking	6	Traveler	Ready	Active
3	Issuing	6	Traveler	Ready	Active
4	Ancillary service	6	Traveler	Ready	Active
5	Mobility packages	5	Traveler	Depends on TSPs	Active
6	Validation and Inspection	N/A	Traveler	N/A	Active
7	Trip tracking	6	Traveler	Ready	Active
8	Alternatives' calculation	6	Traveler	Ready	Active
9	Location based experiences (LBE)	6	Traveler	Ready	Active
10	Navigation	6	Traveler	Ready	Passive
11	Traveler's feedback	5	Traveler	Ready	Passive
12	Trip sharing	6	Traveler	Ready	Passive
13	Group travelling	6	Traveler	Ready	Active
14	Travel Arrangement	6	Traveler	Ready	Passive
15	Travel companion Web-Portal	5	Traveler	Ready	Active
16	Guest user	5	Traveler	Ready	Passive
17	Preferences and Profiles	5	Traveler	Ready	Passive
18	Best price optimization	5	Traveler	Ready	Active
20	Travel Companion for Kids	5	Traveler	Ready	Active
21	Asset manager	5	TSP	Ready	Active
22a	Contractual Management Market Place (CMMP)	5	TSP	Ready	Active
22b	Business analytics	5	TSP	Ready	Active
24	LBE editor	6	TSP	Ready	Passive
25	Inspection with Fraud Control	6	TSP	Ready	Active
P1*	Digital Onboarding	7	Traveler	Availability: 31 January 2023	Passive
P5	Web Portal (Payment, Registration with Gmail, and Purchase Mobility Packages)	7	Traveler	Availability: 31 January 2023	Passive
P6	CMMP (Manual Inclusion of Products and new Registration Process)	7	TSP	Availability: 31 July 2022	Passive

<b>P7</b>	CRM Portal	7	TSP	Availability: 31 January 2023	Passive
<b>P8</b>	Collaborative Space (Traveler)	7	Traveler	Availability: 31 July 2022	Passive
<b>P9</b>	Collaborative Space Portal (TSP)	7	TSP	Availability: 31 July 2022	Passive
<b>A1**</b>	Trip Planning Hierarchy	7	Traveler	Availability: 31 January 2023	Active
<b>A2</b>	Dynamic Display of Map Content	7	Traveler	Availability: 31 July 2022	Active
<b>A3</b>	Smart Locations	7	Traveler	Availability: 31 January 2023	Active
<b>A5</b>	Improved Intermodal Travel	7	Traveler	Availability: 31 January 2023	Active
<b>A6</b>	Improved Travel Shopping	7	Traveler	Availability: 31 January 2023	Active
<b>A7</b>	Individual Last Mile	7	Traveler	Availability: 31 July 2022	Active
<b>A8</b>	LBE Score Sharing	7	Traveler	Availability: 31 July 2022	Active
<b>A9</b>	Meeting Point	7	Traveler	Availability: 31 January 2023	Active
<b>A10</b>	Specific Messages	7	Traveler	Availability: 31 July 2022	Active
<b>A11</b>	Travelers Orchestration and Supervision	7	Traveler	Availability: 31 July 2022	Active
<b>A12</b>	Siri SX based pTT	7	Traveler	Availability: 31 July 2022	Active
<b>A13</b>	pTT CEP Rule Editor	7	TSP	Availability: 31 July 2022	Active
<b>A14</b>	SaaS Siri SX based pTT	7	PST	Availability: 31 January 2023	Active
<b>A15</b>	Distributed Ledger – Transaction Anchoring	7	TSP	Availability: 31 January 2023	Active
<b>S1***</b>	Enrolment Token Generator System	7	TSP	Availability: 31 July 2022	Only selected TSP
<b>S2</b>	Event Detection	7	TSP	Availability: 31 July 2022	Only selected TSP
<b>S3</b>	Plan Data Provisioning for TSPs	7	TSP	Setup of TSP: 31 July 2022 Update plan data: 31 January 2023	Only selected TSP
<b>S4</b>	Incident Messages	7	Traveler	Availability: 31 January 2023	Only selected TSP
<b>S5</b>	Adding Travel Shopping Service to TSP	7	TSP	Availability: 31 January 2023	Only selected TSP

<b>S6</b>	Distributed Ledger – TSP Inclusion	7	TSP	Availability: 31 January 2023	Only selected TSP
<b>S7</b>	Intermodal Fare Optimization	7	Traveler	Availability: 31 January 2023	Only selected TSP

\*P in the ID stands for Passive Functionality

\*\* A in the ID stands for Active Functionality

\*\*\* S in the ID stands for Only Selected TSP Functionality, meaning that those S functionalities are special, require significant effort to be integrated, and can be selected by only 1 TSP to be demonstrated.

The Integration requirements of the Functionalities to be tested in the various IP4MaaS demo sites are presented in the Tables below. For an extensive overview on this topic, please refer to D4.3 of IP4MaaS project, available on IP4MaaS website. In the tables below, whenever a TSP matched the criteria for integrating a function (that has fulfilled the respective technical requirements and all data has been provided to the CFMs), a “v” symbol appears. This symbol also indicates that either the analysis and integration are complete or that the analysis has been concluded and the functionalities’ integration is feasible, and the respective functionality can be demonstrated. It also applies to passive functionalities; no requirements are needed to be fulfilled, and the respective TSP agrees to demonstrate it since it complies with its goal and the demo site’s objectives. Those functionalities that are not applicable for a TSP or, due to technical gaps, the integration was not feasible, are indicated with an “x” symbol. The functionalities that could be neither developed nor integrated for none of all the TSPs have been removed from the list.

Also, it has to be noted that the technologies in green have been identified in WP2 as the IP4 solutions to the areas of potential improvement for each demo site. For additional details on those solutions, please consult D2.2 and D2.3 (available on IP4MaaS website), which provide an updated picture of the software services available in each demonstration site for integration into the Shift2Rail digital ecosystem.

## ATHENS

Table 2: IP4 Technologies of OASA, BrainBox, Taxiway, MIRAKLIO - Athens

ID	IP4 Technologies	Requirements	OASA	Brain box	Taxi way	MIR AKLIO
1	Journey Planner/ Offer Builder	<ul style="list-style-type: none"> <li>GTFS files/Service Areas (multi polygon GeoJSON) and basic mode of transport</li> <li>Journey planner web-service (API)</li> <li>Web-service providing fares (API)</li> </ul>	v	v	v	v
2	Booking	Web-service allowing booking (API)	x	x	v	x
3	Issuing	Web-service allowing to issue tickets (API) – [The web service will allow to	v	v	v	x

		issue vouchers; the end users will use vouchers to get tickets]				
5	Mobility packages	Mobility packages defined through the CMMP	✓	x	✓	x
6	Validation and Inspection	Means to validate/inspect tickets (i.e., hardware validators or validation apps) to be provided by the TSP	x	x	x	x
9	Location-based experiences	Location-based experience using LBE editor (24)	✓	x	x	✓
10	Navigation	Integration of IP4 Journey Planner solution (Passive)	✓	x	x	✓
11	Travelers' feedback	N/A (Passive)	✓	x	x	✓
12	Trip sharing	Integration of IP4 Journey Planner solution (Passive)	✓	✓	✓	✓
15	Travel companion Web-Portal	<ul style="list-style-type: none"> <li>• Shopping services</li> <li>• Booking services</li> <li>• Issuing services</li> </ul>	✓	✓	✓	x
16	Guest user	N/A (Passive)	✓	✓	✓	✓
17	Preferences and Profiles	N/A (Passive)	✓	✓	✓	✓
21	Asset manager*	Data or web-services to be integrated	✓	✓	✓	✓
22a	Contractual Management Market Place (CMMP)	Description of products (e.g., daily/monthly subscriptions) in NeTEx format.	✓	x	✓	x
24	LBE editor	N/A (Passive)	✓	x	x	✓
P5	New functionalities Web Portal (Payment, Registration with Gmail, and Purchase Mobility Packages)	N/A (Passive)	✓	✓	✓	✓
P6	New functionalities CMMP (Manual inclusion of Products and new registration process)	N/A (Passive)	✓	✓	✓	x
A1	Trip Planning Hierarchy	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓	✓	✓	✓

A2	Map Content	POIs (CSV, ESRI-Shape, GeoJson, XML)	✓	✓	✓	✓
A3	Smart Locations	<ul style="list-style-type: none"> <li>Stations (GTFS format)</li> <li>Optional: Addresses, POI</li> </ul>	✓	✓	✓	✓
A5	Improved Intermodal Travel	<ul style="list-style-type: none"> <li>GTFS data</li> <li>Journey Planning API</li> </ul>	✓	✓	✓	✓
A6	Improved Travel Shopping	<ul style="list-style-type: none"> <li>GTFS data</li> <li>Journey Planning API</li> </ul>	✓	✓	✓	✓
A7	Individual Last Mile	<ul style="list-style-type: none"> <li>GTFS data</li> <li>Journey Planning API</li> </ul>	✓	✓	✓	✓
A8	LBE SCORE sharing	LBE game developed using the LBE editor (assets and scenario)	✓	✗	✓	✓
A10	Specific messages	Use Orchestration and supervision tool	✗	✗	✓	✗
A11	Travelers Orchestration and supervision	Use Orchestration and supervision tool	x✓	✓	✗	✓
A15	Distributed Ledger –Transaction Anchoring	Registration in CMMP	✗	✗	✗	✗
S6	Distributed Ledger – TSP Inclusion	Deployment of Distributed Ledger node	✗	✗	✗	✗
S7	Intermodal Fare Optimization	Best Price Service (to be defined further)	✗	✗	✗	✗

*\*POLIMI, which is a member of the Integration Committee, makes use of this tool, and all necessary information from TSPs are provided via that tool. The Asset Manager facilitates the exchange of information for F-REL between TSPs and CFMs. The TSPs have a chance to use it if they express such a wish, during the 2nd demo phase, to provide feedback later on via the TSPs surveys. This applies to all TSPs of all the demo sites in F-REL. More info on the Asset Manager can be found in D2.3, “Demonstration requirements and scenarios F-REL.” This note applies to all the following tables of the IP4 solutions for all demo sites.*

## INTEGRATION DESCRIPTION IN ATHENS<sup>16</sup>

To support the identified functionalities on the IP4 ecosystem, the below integrations have been performed.

### **CERTH/HIT**

<sup>16</sup> The sections dedicated to integrations descriptions has been drafted with the support of COHESIVE project Deliverable D5.3 Definition of the demonstration for Final release v2.



- Integration of custom journey planning and offer build service in the Interoperability Framework (containing also Attiko, BrainBox and Taxyway offers)
- Integration of custom booking service for taxiway in the Interoperability Framework
- Integration of custom issuing service for taxiway and OASA in the Interoperability Framework

#### OASA:

- Integration of GTFS data on IP4 meta-network (containing also Attiko Metro network)
- Integration of service area on IP4 meta-network

#### BrainBox:

- Integration of service area on IP4 meta-network
- Integration of custom issuing service in the Interoperability Framework

#### TaxyWay:

- Integration of service area on IP4 meta-network
- Integration of existing reservation system with custom booking system with CERTH

## PADUA

Table 3: IP4 Technologies of Busitalia & Trenitalia - Padua

ID	IP4 Technologies	Requirements	Busitalia	Trenitalia
1	Journey Planner/ Offer Builder	<ul style="list-style-type: none"> <li>• GTFS files/Service Areas (multi polygon GeoJSON) and basic mode of transport</li> <li>• Journey planner web-service (API)</li> <li>• Web-service providing fares (API)</li> </ul>	✓	✓
2	Booking	Web-service allowing booking (API)	x	✓
3	Issuing	Web-service allowing to issue tickets (API) – [The web service will allow to issue vouchers; the end users will use vouchers to get tickets]	x	✓
10	Navigation	Integration of IP4 Journey Planner solution (Passive)	✓	✓
11	Travelers' feedback	N/A (Passive)	✓	✓
12	Trip sharing	Integration of IP4 Journey Planner solution (Passive)	✓	✓
16	Guest user	N/A (Passive)	✓	✓

17	Preferences and Profiles	N/A (Passive)	✓	✓
21	Asset manager*	Data or web-services to be integrated	✓	✓
P8	Collaborative space (traveler)	N/A (Passive)	✓	✓
P9	Collaborative space portal (TSP)	N/A (Passive)	✓	✓
A1	Trip Planning Hierarchy	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	x	✓
A6	Improved Travel Shopping	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	x	x
A10	Specific messages	Use Orchestration and supervision tool	✓	✓
A11	Travelers Orchestration and supervision	Use Orchestration and supervision tool	✓	✓
S3	Adding Travel Shopping Service to TSP	TBD	✓	x
S5	Adding Travel Shopping Service to TSP	TBD	✓	x

### INTEGRATION DESCRIPTION IN PADUA

#### **Trenitalia:**

- Integration of GTFS data on IP4 meta-network.
- Integration of custom journey planning and offer build service in the Interoperability Framework.
- Integration of custom booking service in the Interoperability Framework.
- Integration of custom issuing service in the Interoperability Framework.

#### **Busitalia:**

- Integration of GTFS data on IP4 meta-network.
- Adding Travel Shopping Service to TSP (SaaS).

For facilitating the exchange of information regarding Trenitalia and Busitalia, a NDA has been prepared and signed in 2022, between Trenitalia, CFMs, FSTech and UITP.

### **BARCELONA**

Table 4: IP4 Technologies of TMB, BusUp, AMTU - Barcelona

ID	IP4 Technologies	Requirements	TMB	BusUp	AMTU
1	Journey Planner/ Offer Builder	<ul style="list-style-type: none"> <li>• GTFS files/Service Areas (multi polygon GeoJSON) and basic mode of transport</li> <li>• Journey planner web-service (API)</li> <li>• Web-service providing fares (API)</li> </ul>	✓	✓	✓
2	Booking	Web-service allowing booking (API)	✗	✓	✗
5	Mobility packages	Mobility packages defined through the CMMP	✗	✗	✗
6	Validation and Inspection	Means to validate/inspect tickets (i.e., hardware validators or validation apps) to be provided by the TSP	✗	✓	✓
10	Navigation	Integration of IP4 Journey Planner solution (Passive)	✓	✓	✗
11	Travelers' feedback	N/A (Passive)	✓	✓	✓
12	Trip sharing	Integration of IP4 Journey Planner solution (Passive)	✓	✓	✓
15	Travel companion Web-Portal	<ul style="list-style-type: none"> <li>• Shopping services</li> <li>• Booking services</li> <li>• Issuing services</li> </ul>	✗	✓	✗
16	Guest user	N/A (Passive)	✓	✓	✓
17	Preferences and Profiles	N/A (Passive)	✓	✓	✓
20	Travel Companion for Kids	N/A (Passive)	✗	✓	✗
21	Asset manager*	Data or web-services to be integrated	✓	✓	✓
22a	Contractual Management Market Place (CMMP)	Description of products (e.g., daily/monthly subscriptions) in NeTEx format.	✗	✗	✗
P1	Digital Onboarding	N/A (Passive)	✓	✓	✓
P5	New functionalities Web Portal (Payment, Registration with Gmail, and Purchase Mobility Packages)	N/A (Passive)	✗	✓	✗

P6	New functionalities CMMP (Manual inclusion of Products and new registration process)	N/A (Passive)	✓	✓	✓
P8	Collaborative Space (Traveler)	N/A (Passive)	✓	✓	✓
A1	Trip Planning Hierarchy	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓	✓	✓
A5	Improved Intermodal Travel	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	×	×	✓
A6	Improved Travel Shopping	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓	✓	✓
A7	Individual Last Mile	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	×	×	✓

*Note on CMMP in Barcelona: a section on the CMMP has been drafted on IP4M D5.1, providing Barcelona TSPs/Demo actors opinion based on the training session that held in May 2023 with INDRA.*

### INTEGRATION DESCRIPTION IN BARCELONA

#### **TMB:**

- Integration of GTFS data on IP4 meta-network
- Integration of custom journey planning and offer build service in the Interoperability Framework

#### **BusUp:**

- Integration of GTFS data on IP4 meta-network
- Integration of custom journey planning and offer build service in the Interoperability Framework
- Integration of custom booking service in the Interoperability Framework

#### **FlexiBus (AMTU):**

- Integration of GTFS data or service area on IP4 meta-network
- Integration of custom journey planning and offer build service in the Interoperability Framework

### **LIBEREC**

Table 5: IP4 Technologies of KORID, Liberec

ID	IP4 Technologies	Requirements	KORID
1	Journey Planner/ Offer Builder	<ul style="list-style-type: none"> <li>• GTFS files/Service Areas (multi polygon GeoJSON) and basic mode of transport</li> <li>• Journey planner web-service (API)</li> <li>• Web-service providing fares (API)</li> </ul>	✓
2	Booking	Web-service allowing booking (API)	✓
3	Issuing	Web-service allowing to issue tickets (API) – [The web service will allow to issue vouchers; the end users will use vouchers to get tickets]	✓
6	Validation and Inspection	Means to validate/inspect tickets (i.e., hardware validators or validation apps) to be provided by the TSP	✓
7	Trip Tracking	Web-service (API) providing Real Time information is the format: TRIAS, GTFS-RT, Siri-SX	✓
8	Alternatives Calculation	Journey planning and Trip tracking service integrated	✓
10	Navigation	Integration of IP4 Journey Planner solution (Passive)	✓
11	Travelers' feedback	N/A (Passive)	✓
12	Trip sharing	Integration of IP4 Journey Planner solution (Passive)	✓
14	Travel Arrangement	N/A (Passive)	✓
15	Travel companion Web-Portal	<ul style="list-style-type: none"> <li>• Shopping services</li> <li>• Booking services</li> <li>• Issuing services</li> </ul>	✓
16	Guest user	N/A (Passive)	✓
21	Asset manager*	Data or web-services to be integrated	✓
P5	New functionalities Web Portal (Payment, Registration with Gmail, and Purchase Mobility Packages)	N/A (Passive)	✓
A1	Trip Planning Hierarchy	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓
A3	Smart Locations	<ul style="list-style-type: none"> <li>• Stations (GTFS format)</li> <li>• Optional: Addresses, POI</li> </ul>	✓
A5	Improved Intermodal Travel	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓

A6	Improved Travel Shopping	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓
A7	Individual Last Mile	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓

### INTEGRATION DESCRIPTION IN LIBEREC

#### **KORID:**

- Integration of GTFS data on IP4 meta-network
- Integration of custom journey planning and offer build service in the Interoperability Framework
- Integration of custom booking service in the Interoperability Framework
- Integration of custom issuing service in the Interoperability Framework
- Integration of a TRIAS Trip Tracking service in the Interoperability Framework

#### **LONG DISTANCE CONNECTION LIBEREC-WARSAW:**

- Integration of GTFS data on IP4 meta-network
- Integration of custom journey planning and offer build service in the Interoperability Framework
- Integration of custom booking service in the Interoperability Framework
- Integration of custom issuing service in the Interoperability Framework

### **WARSAW**

Table 6: IP4 Technologies of ZTM, MZA & TW - Warsaw

ID	IP4 Technologies	Requirements	ZTM	MZA	TW
1	Journey Planner/ Offer Builder	<ul style="list-style-type: none"> <li>• GTFS files/Service Areas (multi polygon GeoJSON) and basic mode of transport</li> <li>• Journey planner web-service (API)</li> <li>• Web-service providing fares (API)</li> </ul>	✓	✓	✓
10	Navigation	Integration of IP4 Journey Planner solution (Passive)	✓	✓	✓
11	Travelers' feedback	N/A (Passive)	✓	✓	✓
12	Trip sharing	Integration of IP4 Journey Planner solution (Passive)	✓	✓	✓
14	Travel Arrangement	N/A (Passive)	✓	✓	✓

16	Guest user	N/A (Passive)	✓	✓	✓
21	Asset manager*	Data or web-services to be integrated	✓	✓	✓
P1	Digital Onboarding	N/A (Passive)	✓	✓	✓
P8	Collaborative Space (Traveler)	N/A (Passive)	✓	✓	✓
A1	Trip Planning Hierarchy	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓	✓	✓
A5	Improved Intermodal Travel	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓	✓	✓
A6	Improved Travel Shopping	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓	✓	✓
A7	Individual Last Mile	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓	✓	✓

## INTEGRATION DESCRIPTION IN WARSAW

### Jakdojade<sup>17</sup>:

- Integration of GTFS data on IP4 meta-network
- Integration of custom journey planning and offer build service in the Interoperability Framework

## OSIJEK

Table 7: IP4 Technologies of GPP - Osijek

ID	IP4 Technologies	Requirements	GPP PT	GPP SM
1	Journey Planner/ Offer Builder	<ul style="list-style-type: none"> <li>• GTFS files/Service Areas (multi polygon GeoJSON) and basic mode of transport</li> <li>• Journey planner web-service (API)</li> <li>• Web-service providing fares (API)</li> </ul>	✓	×
10	Navigation	Integration of IP4 Journey Planner solution (Passive)	✓	✓
P7	CRM Portal	N/A (Passive)	✓	✓
A1	Trip Planning Hierarchy	<ul style="list-style-type: none"> <li>• GTFS data</li> </ul>	✓	×

<sup>17</sup> The GTFS data have been taken from an external open source: <https://mkuran.pl/gtfs/>

		<ul style="list-style-type: none"> <li>• Journey Planning API</li> </ul>		
A5	Improved Intermodal Travel	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓	×
A6	Improved Travel Shopping	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓	×
A7	Individual Last Mile	<ul style="list-style-type: none"> <li>• GTFS data</li> <li>• Journey Planning API</li> </ul>	✓	×

### INTEGRATION DESCRIPTION IN OSIJEK

#### **GPP PT:**

- Integration of GTFS data on IP4 meta-network
- Integration of custom journey planning and offer build service in the Interoperability Framework

#### **GPP sharing mobility:**

- Integration of GTFS data or service area on IP4 meta-network
- Integration of custom journey planning and offer build service in the Interoperability Framework
- Integration of custom booking service in the Interoperability Framework

For facilitating the exchange of information regarding Nextbike, a NDA has been prepared and signed in 2023, between Indra and Nextbike, with the Demo leader DYVOLVE coordinating the whole task/exchange.

## 10. Recommendations for TSPs joining the IP4 ecosystem

Since IP4 goal is to use an ontology-based translation<sup>18</sup>, there were not strict integration requirements for the TSPs joining the ecosystem, compared to other system that need to follow standards. The provided services just needed to be compatible with the ontology domain and then an adapter needed to be developed providing a mapping of the service terms to the ontology model. The above process was performed, during IP4MaaS project execution, on CFMs' side.

As previously mentioned, the main services integrated in the ecosystem (and the basic requirements needed) were:

<sup>18</sup> As stated in COHESIVE Project D2.1.



- **Travel Shopping** – Allowing to get itineraries, fares, GTFS and GeoJSON files from the TSPs
  - To be integrated, the TSP just needs to provide an itinerary based on a request from the point A to B at a defined time
  - Optionally the itineraries provided should include the fare to realize this trip
  
- **Booking** – Allowing to block a service provided by the TSP
  - To integrate a booking service, the TSP only needs to have a service allowing to block the inventory of a service, being this service a seat on a train, or a taxi vehicle to pick the traveller
  - Usually, this service is provided before during the Travel Shopping flow
  - The booking flow is not mandatory to provide a trip to a traveller, TSPs providing public transportation on urban regions normally do not have booking processes
  
- **Issuing** – Allowing to issue tickets for a service provided by the TSP
  - The TSP needs to have some service able to issue a digital ticket that can be used as an entitlement to travel, this can be a token, a QR code or a PDF file
  - Usually, this service is provided before during the Travel Shopping flow
  
- **Trip tracking** – Allowing to provide real time events with impact on the services provided by the TSP
  - The TSP needs to provide a feed of events with impact on their services, those will be integrated as event sources on the system
  - The system is ready to produce TRIAS messages, to process events in GTFS-RT or SIRI-SX format, other type of event would require the development of new complex event processing rules, to enable the calculation on impacts on user trips.

The whole set of available functionalities and the list of requirements for their integration in the ecosystem have been provided by CFM partners in 2 meetings organized in 2021 and in a set of slides shared with IP4MaaS demo actors after the above-mentioned meetings.

During the IP4 program the TSP integrations on the ecosystem were coordinated by the IP4 projects COHESIVE and CONNECTIVE. The IP4MaaS coordinator (also leader of the Management Committee), supported by technical partners, facilitated the exchange of material between TSPs/Demo Actors and COHESIVE/CONNECTIVE partners (particularly Thales Portugal, Indra, CS Group and HaCon). On CFMs side, COHESIVE had the role of coordinator of the interactions with the different stakeholders involved and collected the necessary data and services. On the other hand CONNECTIVE was the responsible to perform the technical work necessary for those integrations. The integration process (performed by CFMs) followed the steps below:

1. Discussion with demo leaders regarding the scope of the demo in a specific site and the TSPs that could be involved

2. The IP4 members (CFMs) shared with the demo leaders and TSPs the IP4 functionalities available for the demo and the corresponding requirements
3. The demo leaders and the involved TSPs defined the final scope of the demo and shared the TSP data/services to be integrated
4. CONNECTIVE analysed the provided services, to understand if the service respected the system processes and could be integrated with the defined ontology
5. If no problems were found, CONNECTIVE developed the necessary mapping to the IP4 ontology
6. The service was integrated and tested (first within CFMs project, then internally among IP4MaaS partners) using the IP4 Travel Companion tool and the other tools developed by CFMs. To integrate more TSPs on such ecosystem without the support of the IP4 projects, the TSP would need to get knowledge of the ecosystem itself (and its needs/requirements) and how to perform the terms mapping from their interface. Issues and problems have been constantly reported via Mantis, a tool used by CFMs for this specific purpose, to which Hacon granted access to all involved parties.

During all the integration activities it emerged that the transportation sector has not been always committed to follow standard interfaces when providing services through digital channels. In some cases, the TSPs identified had different interfaces using different data models. This constituted an obstacle/barrier to the integration of these services, but in other hand it shows the importance of having an Interoperability framework based on ontologies. In IP4MaaS, technical meetings have been organized between CFMs and demo partners, supported by the Management Committee, to try to solve potential problems and to find solutions to any integration-related issue.

In the short sections below, some advantages and disadvantages of using ontologies are listed, together with some lessons learnt. These sections are based on the COHESIVE D2.1 and are helpful for further considerations coming from the exchanges happened in IP4MaaS on integration issues and more in general on demo preparation and execution.

#### Advantages of using Ontologies

- Re-use of IT2Rail project components (more infos available on <http://www.it2rail.eu/>)
- Ontologies represent the complexity of the structure of the system. Receiving ontologies for each of the services to be integrated could facilitate its integration.
- Ontologies facilitate interoperability based on the transfer of knowledge

#### Disadvantages of using Ontologies

- Ontologies are not a mature technology for data transformation.
- Ontologies and SPARQL knowledge are not well extended among developers, this is an issue for a massive integration of services as it happened for IP4MaaS
- Lack of knowledge and its tough learning curve due to the complexity of SPARQL complicates integration and its debugging processes
- Performance of SPARQL is not valid for operational environments and it is difficult to optimise it.

#### Lessons learnt

Ontologies is an interesting technology that has a lot of potential. However, the lack of technical

knowledge among developers and the lack of tools that facilitates the usage of ontologies has the consequence that ontologies are not the best option for a real deployment of a MaaS platform. There are other technologies that are easier to use, well spread and performant enough that speed up the integration of services.

#### Lessons learnt from IP4MaaS experience

Among the lessons learnt coming from the demo preparation and execution process, it is important to mention that the knowledge of the ecosystem facilitates a lot the provision of material and the proper integration of each TSP. That is why it is very important for each actor willing to be integrated in the ecosystem (being TSP/Transport Operator or other provider of mobility services), to get properly instructed about the ecosystem itself, its features, its requirements, the available functionalities and the steps needed for the integration. A recommendation for IP4 would be to organize training sessions and workshops presenting the ecosystem and its features to all TSPs and actors willing to be integrated, with a deep overview of the functionalities and the requirements for the integration, together with a live demo of the Travel Companion and all tools for users and operators. In this way, the demo team (or whoever actor willing to replicate the IP4MaaS experience) can more easily choose what they want to integrate, according to their wishes and expectations, but also according to what their system allows them (in some cases, functionalities could not be integrated because of TSPs working with data in a non-compatible/different format, or with standards not suitable for meeting the integration requirements of the ecosystem). On this point, it is important to mention that the IP4 ecosystem itself appeared to be in some cases rigid in terms of requirements needed for a TSP/mobility service provider to be integrated in a smooth and easy way. Case-by-case solutions have been studied and applied, when and if possible, with the CFMs. A more flexible ecosystem would allow more TSPs (in particular shared modes, especially with free-floating fleets) to be integrated and more functions to be tested.

Once functionalities are selected by the demo teams (or whoever actor willing to replicate the IP4MaaS experience), the TSPs involved are asked to provide all necessary documentation and accesses to the service being integrated in the format required by CFMs and in the time frame envisaged. This would facilitate the integration process. However, this was not always possible in IP4MaaS, due to internal processes and confidentiality issues on TSPs side. During the project lifetime, 2 NDAs have been signed in order to allow CFMs to receive all the documentation and the accesses to services from 3 TSPs/service providers (Trenitalia, Busitalia, Nextbike). Every document was made available, for Phase 2, on the Asset Manager (AM), a tool developed by IP4MaaS partner CEFRIEL<sup>19</sup>, used to collect information and give access to it to CFMs. The Asset Manager was used as a “TSP document/accesses repository”. This process of Asset Manager update was performed by the IP4MaaS partner POLIMI, in collaboration with CEFRIEL. A training session on the tool was organized. All new/updated versions of some material needed for the integrations (APIs, GTFS files, stations’ geographic coordinates) had to be provided by the demo teams to CFMs in due time and needed to be in place/up and running before the demo testing phase (i.e., at least two weeks before the demo official start date). All information about update

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<sup>19</sup> <https://www.cefriel.com/?lang=en>

of services or modifications in the system had to be communicated to CFMs in due time. This is important to be kept in mind for any other TSP/actor willing to replicate a similar experience.

In IP4MaaS, several interaction moments have been organized, from plenary calls to bi-lateral calls specifically targeted to discuss a specific demo or a specific functionality. A proper communication and the utilization of a common and harmonized glossary/terminology are considered vital to avoid misunderstandings, and need to be taken into account for replicating the experience. A training/live demo of the available tools was also paramount for the TSP least experienced with the ecosystem, to get acquainted with it, boosting the positive aspects of having a common, Europe-wide system allowing users to organize their movements in a seamless way. This is particularly true as the IP4 ecosystem is constantly in evolution, with new and updated functionalities that are not always customer/user friendly and require to be properly described both in terms of requirements for the TSP/service to be integrated, and for the functionality to be understood by the demo team willing to test them in real conditions in the demos. On the other side, demo teams had to be properly instructed about what is required from their side for performing the integration process smoothly. A proper training of the demo teams, as already remarked, is paramount for any replication attempt.

Being the IP4 tools developed within research projects, TSPs and users in general needed to be duly informed about the potential limitations of the ecosystem, in order to avoid misunderstandings in terms of what is asked to the final user in the execution of the demonstration activity. A way of familiarising people with the tools used during the demos was to organize focus groups and sessions, in the local language, held by the demo leaders (the basic users' counterpart in the whole demo). This was an occasion to properly instruct the users, making them become familiar with the ecosystem, and presenting not only the tools to be used, but also the whole demo process, the functionalities chosen for the demo. These were also important moments for solving potential problems, reply to technical questions and inform users about which are the steps to be followed. This specific strategy was used in IP4MaaS and proved to be particularly successful. Therefore, as a recommendation for replicability, it is important that occasion of users-training are created.

Another very important element was to ensure a proper communication with the people involved in the demo (not only the demo team and the CFMs partners, but also with the end users). In IP4MaaS this was performed by demo leaders, the real contact points between the testers and the tool(s). In the preparation and execution phases, the demo team was in constant contact with CFMs partners, to solve technical issues and provide immediate feedback to all potential problems. The already mentioned Mantis<sup>20</sup> has been chosen as tool used for reporting issues during the testing phase. Once again, it is paramount to establish proper communication between the technical partners on the CFM side and the counterpart involved at demo/local level (TSPs and users).

It was reported as “very important” that the demo leader receives the final version of the tools to

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<sup>20</sup> <https://www.mantisbt.org/>

be used well before the demo start (i.e. with all the integrations finalized and the bugs fixed by CFMs). In this way, the demo leader is capable to provide to the users (but also to the TSPs involved) all the answers to possible questions and have the sufficient time to check the tools, familiarize with them, test them and solve additional potential bugs/issues. In IP4MaaS, due to the tight calendar of demos, this was not always possible, resulting in high pressure on the demo team due to the limited time to understand the ecosystem, getting familiar with it, and in the meantime keep working in engaging with users, attracting them to the demo, providing them support in case this was needed and coordinating the efforts with the TSPs involved. To plan more time for understanding all the functionalities and their features is considered very important for potential replication of IP4MaaS experience. During the project, this problem was partially solved through a constant communication with CFMs (in particular HaCon, Thales and Indra) and with the organization of a training session on the IP4 tools, organized by UITP with HaCon before Phase 2. Demo leaders not only understood better the ecosystem, but also asked questions about integration and requirements for users and TSPs and could also receive a first non-final version of the Travel Companion useful for starting the internal testing. A user guide was produced by CFMs and readapted/rephrased by IP4MaaS demo partners, but this was believed too technical for being completely understood by someone not expert/familiar with IP4. It is recommended to improve the user manuals for further replication. Another potential complication came from the fact that the app was not “customized” per each demo site, and demo leaders had to understand and instruct the users about the functionalities integrated in each demo site. In some cases, demo leaders/demo teams in IP4MaaS, on a voluntary basis have been contributing to the translation of the used tools, and this resulted in something positively evaluated by users, who could use the application in their own local languages.

Due to GDPR reasons, users could not log in the ecosystem with their real email addresses and had to be duly informed by the demo teams about the privacy policy of the partners collecting their information (even if anonymized/aggregated). In IP4MaaS, it was agreed to provide the users with a pre-defined set of credentials, to be used to log in the application. A needed “next step” for spread replication of the IP4MaaS experience on a wider scale is to adjust the ecosystem in order to allow users to log in using their real email addresses and information, in a secure and GDPR compliant way.

Finally, on a more “market uptake” side, it is important to mention that although the technology is already proven and it has been tested multiple times in multiple contexts (IP4MaaS is just the last of the several projects in which demonstration activities for IP4 solutions were tested), there are still some barriers to overcome:

- Lack of digitalization of Travel Services in some regions;
- Lack of legislation to open transport ecosystems;
- Business cases adaptations to ensure commercial sustainability and to enable the interoperability at a large scale;
- Adequate assessment of the efforts needed from CFMs side for the integration efforts;
- Clear information about ecosystem and infrastructure governance, in order to allow easy identification of the responsible partners, in particular for the integration process.

## 11. Conclusions

As leader of the IP4MaaS Management Committee within WP4, UITP, supported by Task 4.4 partners, had the role of facilitators for the exchange of information among relevant partners, for supporting demo leaders and technical partners to find solutions to their questions, for making sure that the collaboration activities were executed in a timely way, minimizing risks and solving potential disruptions. This has been particularly relevant with regards to the organization of the demos, from the planning phase to the calendar definition, to the preparation, execution and evaluation/follow up. The Management Committee acted as a bridge with the other OC project, RIDE2RAIL<sup>21</sup>, a UITP-coordinated project with many partners from CFMs and OC side in common with IP4MaaS.

A comprehensive list of functionalities utilized and tested within IP4MaaS is presented in this document, highlighting its main features and nature (passive/active according to CFMs nomenclature).

An overview of all the requirements to integrate each of the functionalities selected by each demo team is also provided. This facilitates each potential TSP willing to be integrated in the ecosystem to understand the requirements (APIs, web services, GTFS, GeoJson coordinates, among the most relevant) needed for the integration. To facilitate the understanding of the process to be followed for being integrated, the description of the integration process per each TSP in each demo site is presented, with the support of public deliverables issued by CFMs projects and the support of demo actors involved in IP4MaaS.

Finally, recommendations are provided in the final part of the document, in particular for TSPs/mobility services providers to join the IP4 ecosystem, with some lessons learnt coming from the demo preparation and execution process, useful for replicating the IP4MaaS experience in the future. It is important to mention that the knowledge of the ecosystem facilitates a lot the provision of material and the proper integration of each TSP. That is why it is very important for each actor willing to be integrated in the ecosystem, to get properly updated about the ecosystem itself, its features, its requirements, the available functionalities and the steps needed for the integration. A proper communication and the utilization of a common and harmonized glossary/terminology are vital to avoid misunderstandings. A training/live demo of the available tools is also paramount for the TSP least experienced with the ecosystem, to get acquainted with it, boosting the positive aspects of having a common, Europe-wide system for allowing users to organize their movements in a seamless way. It is important, in this sense, that the training is performed with the most updated version of the tools, ready to be first internally tested and then shared with users. Being a research project, TSPs and users in general need to be duly informed about the potential limitations/rigidity of the ecosystem. A proper communication also on this aspect is important, and in IP4MaaS it was performed by demo leaders, the real contact points between the testers and the tool(s). Due to GDPR reasons, users could not log in the ecosystem with the real email addresses and had to be duly informed about the privacy policy of the partners collecting their information (even if anonymized and aggregated every time it was possible).

On a more “market uptake” side, it is important to mention that although the technology is already proven and it has been tested multiple times in multiple contexts, there are still some barriers to

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<sup>21</sup> <https://ride2rail.eu/>

overcome, such as the lack of digitalization among some TSPs (key aspect if the ambition is to achieve a well working seamless Europe-wide system), legislative framework that in some Countries can prevent a smooth provision of data for the integration (openness of the system and similar privacy/confidentiality issues), viability of the business case adaptation to ensure commercial stability once and if the tools are further exploited and made ready for the market. Confidentiality and GDPR issues are also paramount and must be kept very well into consideration if further exploitation on a non-demo/research project context is foreseen.

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## 13. Annexes

### 14.1 Annex I: IP4 Terminology and Glossary



Terminology\_IP4\_RID  
E2RAIL\_IP4MaaS\_MAS

The full list of IP4 Terminology and Glossary is available upon request to the project coordinator, and has been made available for all project partners on the Cooperation Tool

**<https://www.cooperationtool.eu/projects/goto.aspx?p=IP4MAAS&doc=ebef3137-4b3b-45c3-817e-ddf708d5ce3b>**

### 14.2 Annex II: Technical Requirements for IP4 Functionalities

ID	IP4 Functionalities/Technologies	Technical Requirements
1	Journey Planner / Offer Builder	Public Transport (GTFS) Shared Mobility (Service Areas: multi-polygon GeoJSON) Basic mode of transport (car, bike) Journey Planner web-service (API) Web-service providing fares (API)
2	Booking	Web-service allowing booking (API)
3	Issuing	Web-service allowing to issue tickets (API) (QR Code, images, PDF, URL link)
4	Ancillary service	Web-service (API) allows listing available services, book said services (optional) & issue available services
5	Mobility packages	Usage of Shift2Rail operator's portal to configure products in NeTeX format
6	Validation and Inspection	Means to validate/inspect issued tickets (Hardware Validators, validation apps)
7	Trip tracking	Web-service (API) providing Real-Time information in the format: TRIAS, GTFS-RT, Siri-SX
8	Alternatives' calculation	Journey Planning and Trip Tracking service integrated
9	Location-based experiences (LBE)	Usage of LBE Editor to build experiences. Information needed: stops names, coordinates, text of quiz/information, photos, 3D models, videos, and others.
10	Navigation	N/A
11	Traveler's feedback	N/A
12	Trip sharing	N/A



<b>13</b>	Group travelling	N/A
<b>14</b>	Travel Arrangement	N/A
<b>15</b>	Travel companion Web-Portal	Shopping, Booking, Issuing services integrated
<b>16</b>	Guest user	N/A
<b>17</b>	Preferences and Profiles	N/A
<b>18</b>	Best price optimization	Best price service
<b>20</b>	Travel Companion for Kids	Journey Planning integrated
<b>21</b>	Asset manager	Data or web-services to be integrated
<b>22a</b>	Contractual Management Market Place (CMMP)	Products to be integrated (NeTEx format)
<b>22b</b>	Business analytics	Provision of transport data to be analysed
<b>23</b>	Trip Tracking CEP configuration	Trip tracking integration with real-time data in Siri-SX
<b>24</b>	LBE editor	It will be provided from CFMs to the TSPs that wish to try it.
<b>25</b>	Inspection with Fraud Control	Issuing service integrated QR Code (UIC or VDV) ATTENTION: License fee (to be validated)
<b>P1</b>	Digital Onboarding	N/A
<b>P5</b>	Web Portal (Payment, Registration with Gmail, and Purchase Mobility Packages)	N/A
<b>P6</b>	CMMP (Manual Inclusion of Products and new Registration Process)	N/A
<b>P7</b>	CRM Portal	N/A
<b>P8</b>	Collaborative Space (Traveler)	N/A
<b>P9</b>	Collaborative Space Portal (TSP)	N/A
<b>A1</b>	Trip Planning Hierarchy	GTFS Data Journey Planning API
<b>A2</b>	Dynamic Display of Map Content	POIs (CSV, ESRI-Shape, GeoJSON, XML)
<b>A3</b>	Smart Locations	Stations (GTFS format) Optional: Addresses, POIs
<b>A5</b>	Improved Intermodal Travel	GTFS Data Journey Planning API
<b>A6</b>	Improved Travel Shopping	GTFS Data Journey Planning API
<b>A7</b>	Individual Last Mile	GTFS Data Journey Planning API
<b>A8</b>	LBE Score Sharing	LBE game developed using the LBE Editor (assets and scenario)

<b>A9</b>	Meeting Point	Use TSP Orchestration and Supervision Tool 3D plan of the station 2D plan of the station List of the station's POIs or meeting POIs
<b>A10</b>	Specific Messages	Use Orchestration and Supervision Tool
<b>A11</b>	Travelers Orchestration and Supervision	Use Orchestration and Supervision Tool
<b>A12</b>	Siri SX based pTT	TSP integrated to TD 4.2 and 4.3 demonstrators Siri-SX event source, notifying network perturbations (Siri 2.0 Siri-SX compliant, using only mandatory fields) Transport network description (GTFS) TSP has defined its impact generation process based on its provided Siri-SX events
<b>A13</b>	pTT CEP Rule Editor	Siri-SX based pTT running (fulfills requirements of A12)
<b>A14</b>	SaaS Siri SX based pTT	Siri-SX based pTT running (fulfills requirements of A12)
<b>A15</b>	Distributed Ledger – Transaction Anchoring	Registration in CMMP
<b>S1</b>	Enrolment Token Generator System	API for issuing products, Metadata structure (optional), Embodiment configuration information
<b>S2</b>	Event Detection	Real Time Events (format TBD*)
<b>S3</b>	Plan Data Provisioning for TSPs	TBD*
<b>S4</b>	Incident Messages	GTFS Data Journey Planning API RT Information
<b>S5</b>	Adding Travel Shopping Service to TSP	TBD*
<b>S6</b>	Distributed Ledger – TSP Inclusion	Deployment of Distributed Ledger Note (TSP shall volunteer to instantiate a GL node)
<b>S7</b>	Intermodal Fare Optimization	Best price service (TBD*)

\*TBD = to be defined

### 14.3 Annex III: List of meetings with CFMs

EVENT	DATE	PLACE	TOPIC	DETAILS ABOUT IP4MAAS PARTICIPATION
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<b>Kick off Meeting</b>	10/12/2020	Online	Kick Off + Consortium Meeting.	Presentation of Project structure, objectives, WPs, activities to partners, S2R and complementary projects.
<b>1st Informal Collaboration Meeting IP4MaaS-Projects</b>	22/02/2021	Online	Timeline of IP4MaaS activities	Alignment of activities, discussion on common research/technologies. Pilot Ph. 1 discussion.
<b>1st Collaboration Meeting IP4MaaS-Projects</b>	14/05/2021	Online	Terminology/glossary, alignment of activities.	Alignment of activities, discussion on project progresses and alignment of terminology.
<b>Meeting with CFMs on Demo Timeline and TSP integration</b>	23/06/2021	Online	Demo timeline and TSP integration.	Alignment of demo timeline to the suggestion given by CFM partners. Phase 1 and 2 organization.
<b>Meeting on Demo Timeline and TSP integration</b>	02/07/2021	Online	Demo timeline and TSP integration.	Alignment of demo timeline to the suggestion given by CFM partners. Phase 1 and 2 organization. Details on TSPs to be integrated.
<b>Meeting with CFMs on Demo Timeline and TSP integration</b>	12/07/2021	Online	Demo timeline and TSP integration.	Alignment of demo timeline to the suggestion given by CFM partners. Phase 1 and 2 organization. Details on TSPs to be integrated.
<b>Meeting with CFMs and JU on Demo Timeline and TSP integration</b>	15/07/2021	Online	Demo timeline and TSP integration.	Alignment of demo timeline to the suggestion given by CFM partners. Phase 1 and 2 organization. Details on TSPs to be integrated. Risks and concerns evaluated with

				the JU.
<b>Meeting with CFMs on Extensive functionalities</b>	21/09/2021	Online	Extensive functionalities.	Alignment of Extensive functionalities for IP4MaaS demo phase 2.
<b>2nd Meeting with CFMs on Demo Timeline and TSP integration</b>	06/10/2021	Online	Demo timeline and TSP integration.	Alignment of demo timeline to the suggestion given by CFM partners. Details on TSPs to be integrated. Adaptation issues. Functionalities' matrix.
<b>3rd Meeting with CFMs on Demo Timeline and TSP integration</b>	13/10/2021	Online	Demo timeline and TSP integration.	Alignment of demo timeline to the suggestion given by CFM partners. Details on TSPs to be integrated. Adaptation issues. Functionalities' matrix.
<b>2nd Collaboration Meeting IP4MaaS-CFM Projects</b>	19/11/2021	Online	Discussion on demo+technical issues. Terminology. Alignment of activities.	Alignment of activities, discussion on project progresses and alignment of terminology. Planning of demos.
<b>Meeting with CFMs on Asset Manager</b>	23/11/2021	Online	Discussion on Asset Manager utilization for Phases 1 and 2	Discussion on Asset Manager utilization for Phases 1 and 2
<b>Meeting with CFMs and PO on status of TSP services</b>	14/12/2021	Online	Discussion on TSP services to be integrated.	Presentation of the current status of the TSP information and services with timeline for delivery of access and barriers to overcome/challenges.

<b>Meeting with CFMs on BusUp functionalities</b>	22/12/2021	Online	Functionalities' matrix for BusUp Phase 1	Discussion on the functionalities matrix for BusUp (Phase 1), in particular on Journey Planning web services.
<b>2nd Meeting with CFMs and PO on status of TSP services</b>	14/01/2022	Online	Discussion on TSP services to be integrated.	Update on current status of the TSP information and services with timeline for delivery of access and barriers to overcome/challenges.
<b>3rd Meeting with CFMs and PO on status of TSP services</b>	21/01/2022	Online	Discussion on TSP services to be integrated.	Update on current status of the TSP information and services with timeline for delivery of access and barriers to overcome/challenges.
<b>4th Meeting with CFMs and PO on status of TSP services</b>	28/01/2022	Online	Discussion on TSP services to be integrated.	Update on current status of the TSP information and services with timeline for delivery of access and barriers to overcome/challenges.
<b>Meeting with CFMs on LBE in Athens (WP4)</b>	31/01/2022	Online	Discussion/clarifications on LBE.	Discussion on LBE for the Athens Demonstration Site, for both demo phases (defining/clarifying the LBE and their nature, how exactly will they be build, what exactly is required from the TSPs, any other specific technical issues/inquiries regarding LBE).
<b>RIDE2RAILIP4 MaaS joint informal Collaboration Meeting with</b>	10/2/2022	Online	Discussion on demo preparation/integration TSPs	Discussion about demo preparation, timeline, risks&mitigation, engagement of users, integration of TSPs and

<b>CFMs</b>				functionalities.
<b>RIDE2RAIL IP4MaaS joint meeting on demo timeline</b>	16/2/2022	Online	Discussion on new demo timeline	Open discussion on the new demo timeline presented by CFMs and potential alternative solutions/impacts on the projects.
<b>Meeting on Chimera workshops and Asset Manager with CFM</b>	23/02/2022	Online	Discussion on Chimera workshop/Asset Manager	Open discussion on Chimera workshop organization and Asset Manager issues
<b>RIDE2RAIL IP4MaaS meeting with CFMs on GDPR and confidentiality issues</b>	03/03/2022	Online	Discussion on GDPR and confidentiality issues	Discussion on IP4 report on GDPR. Discussion on how to deal with confidentiality and GDPR issues affecting the R2R components integrated in the TC. Discussion on confidentiality issues in users engagement strategy for both projects.
<b>2nd Meeting on Chimera workshops and Asset Manager with CFM</b>	03/03/2022	Online	Discussion on Chimera workshop/Asset Manager	Open discussion on Chimera workshop organization and Asset Manager issues
<b>RIDE2RAIL IP4MaaS joint informal Collaboration Meeting with CFMs on demo timeline</b>	11/03/2022	Online	Discussion on demo timeline	Open discussion on timeline of demos and next steps in demo activities

<b>Meeting with CFMs on Athens LBE functionalities</b>	24/03/2022	Online	Discussion on LBE in Athens	Open discussion on LBE functionalities to be integrated for Athens demo.
<b>2nd RIDE2RAIL IP4MaaS meeting with CFMs on GDPR and confidentiality issues</b>	08/04/2022	Online	Discussion on GDPR and confidentiality issues	Discussion on how to handle agreement between data controller(s) and processor(s) in the projects and if/how to involve CFMs.
<b>3rd Collaboration Meeting IP4MaaS-CFM Projects</b>	05/05/2022	Online	Discussion on demo+technical issues (AM, phase 2 matrix). Alignment of activities/integration TSPs.	Alignment of activities, discussion on project progresses. Planning of demos. Overview on Asset Manager material, Matrix Phase 2 and Demo preparation.
<b>Meeting with CFMs on TRIAS and Trip Tracking</b>	13/05/2022	Online	Discussion on TRIAS and TT.	Discussion on TRIAS format and Trip Tracking functionalities. Additional discussion on demo preparation.
<b>Alignment call with CFMs and PO</b>	16/06/2022	Online	Discussion on GDPR affecting the transfer of data.	Alignment on GDPR issues (data transfer from S2R ecosystem to R2R components and vice versa).
<b>Meeting with CFMs on Taxiway booking process</b>	25/05/2022	Online	Discussion of Taxiway booking Athens.	Discussion of Athens booking process for taxi in phase 1 and 2. Solution of potential GDPR issue.
<b>Meeting with CFMs on Athens LBE functionalities</b>	09/06/2022	Online	Discussion on LBE in Athens	Open discussion on LBE functionalities to be integrated for Athens demo.
<b>RIDE2RAIL-IP4MaaS Demo Progress Meeting with</b>	22/06/2022	Online	Discussion on demo preparation and status	Discussion on progresses for Athens demo (checklist, missing inputs, to do list, first outcomes, risks,

<b>CFMs</b>				potential new timeline, terms and conditions, engagement of users, technical issues).
<b>IP4MaaS RIDE2RAIL Meeting with CFMs on lessons learnt from Athens demo</b>	29/07/2022	Online	Discussion on Athens demo outcomes	Investigation of lessons learnt and barriers from Athens demo and how to improve processes in the future
<b>4th IP4MaaS-CFMs Collaboration Meeting</b>	16/12/2022	Online	Collaboration Meeting on status/timeline integrations.	Presentation of calendar for integrations. Debate on integration status and next steps for Phase 2.
<b>Meeting with CFMs on LBE+Orchestration and Supervision tool Athens</b>	24/01/2023	Online	Exchange of technical information on LBE, quiz function, Orchestration and Supervision tool + requirements and next steps.	Exchange of technical information on LBE, quiz function, Orchestration and Supervision tool + requirements and next steps.
<b>Meeting with CFMs on Orchestration and Supervision tool Padua/Warsaw</b>	24/01/2023	Online	Exchange of technical information on Orchestration and Supervision tool + requirements and next steps.	Exchange of technical information on Orchestration and Supervision tool + requirements and next steps.
<b>Meeting with CFMs Best price functionality and/or Mobility Packages Athens</b>	27/01/2023	Online	Exchange of technical information on Best price functionality and/or Mobility Packages.	Exchange of technical information/requirements on Best price functionality and/or Mobility Packages. Decision if to use these in the demo.
<b>Follow up meeting with CFMs on LBE Athens</b>	03/02/2023	Online	Exchange of technical information on LBE, quiz function, Orchestration and Supervision tool + requirements and next	Exchange of technical information on LBE, quiz function, Orchestration and Supervision tool + requirements and next



			steps.	steps.
<b>2nd Meeting with CFMs on LBE+Orchestration and Supervision tool Athens</b>	07/02/2023	Online	Exchange of technical information on Orchestration and Supervision tool + requirements and next steps. Decision taken.	Exchange of technical information on Orchestration and Supervision tool + requirements and next steps. Decision taken.
<b>RIDE2RAIL IP4MaaS Meeting with CFMs about TC presentation and training</b>	08/02/2023	Online	Training/testing of TC	Training/testing of TC. Calendar of integrations/demos. Questions to CFMs.
<b>Meeting with CFMs on Orchestration &amp; Supervision Tool training Athens</b>	22/03/2023	Online	Training of LBE+Orchestration/Supervision tool.	Training of LBE+Orchestration/Supervision tool with Athens demo partners in order to help them instructing the users about these functionalities (how to download and use them, particular features, etc).
<b>Coordination call with CFMs on integration status</b>	22/03/2023	Online	Discussion on integration status with "core group".	Update with "core group" on integrations status and pending points. Discussion on missing information and how to address issues.
<b>RIDE2RAIL IP4MAAS Meeting with CFMs on update on integration process</b>	28/03/2023	Online	Update on integrations and pending issues. Q&A.	CFMs update on TSPs integration status and pending issues/next steps. Project partners to discuss questions on technical and operational side, getting immediate support and feedback.

<b>WP5 Meeting + Focus on lessons learnt from Padua demo</b>	12/05/2023	Online	Discussion on Padua demo outcomes	Recap of WP5 status with demo leaders. Investigation of lessons learnt and barriers from Padua demo and how to improve processes in the future.
<b>Training session on CMMP and Distributed Ledger functionalities</b>	16/05/2023	Online	Training on CMMP/DL.	Training on CMMP and Distributed Ledger functionalities, held by CFM partners to facilitate Barcelona demo leader/actors in understanding how to use these functionalities. Testing of the functionalities. Q&A.