



Deliverable D 4.5

Report on the actions of the Integration, Data, and Management Committees

WP4 - Demonstration Execution Planning and Monitoring

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1. Executive Summary

This document constitutes deliverable D4.5 “Report on the actions of the Integration, Data and Management Committees” of the IP4MaaS project. The main goal of the document is to describe the activities carried out during the project by the three committees in charge of following the demonstrations: the Integration Committee, the Data Committee, and the Management Committee.

The deliverable provides a summary of:

- the software services that have been integrated with the Shift2Rail Innovation Program 4 (IP4) ecosystem for each demonstration;
- the data and the information that was exchanged between the IP4MaaS project partners (and in particular the Transport Service Providers) and the partners of the Call For Member projects before, during, and after the demonstrations (for example, to compute Key Performance Indicators after the demonstrations have been carried out);
- the activities carried out to organize and manage the demonstrations.

The contents of this deliverable will be the basis for possible dissemination activities to be carried out after the end of the project.

2. Abbreviations and acronyms

Abbreviation / Acronym	Description
AM	Asset Manager
API	Application Programming Interface
CFM	Calls for Members
COLA	Collaboration Agreement
C-REL	Core Release
FAQ	Frequently Asked Questions
GA	Grant Agreement
GTFS	General Transit Feed Specification
IP4	Innovation Programme 4
JP	Journey Planner
JU	Joint Undertaking
KPI	Key Performance Indicator
LBE	Location-Based Experience
OC	Open Call
OSM	Open Street Map
OTP	Open Trip Planner
PO	Project Officer
POI	Point of Interest
pTT	partial Trip Tracker
RP	Reporting Period
S2R JU	Shift2Rail Joint Undertaking
TC	Travel Companion
TMT	Technical Management Team
TRIAS	Travellers Realtime Information and Advisory Standard
TSP	Travel service provider
TTO	Trip Tracking Orchestrator
URL	Uniform Resource Locator
USI	User Satisfaction Index
VDV	Verband Deutscher Verkehrsunternehmen
WP	Work Package
WSDL	Web Services Description Language

3. Background

This deliverable is strictly linked to the demonstration activities carried out in the IP4MaaS project in Work Package 5 (WP5). As such, it is closely related to the WP5 deliverables that describe the activities and the outcomes of the six demonstrations:

- “D5.2 - Final report on Barcelona demonstration execution” [1]
- “D5.3 - Final report on Padua demonstration execution” [2]
- “D5.4 - Final report on Athens demonstration execution” [3]
- “D5.5 - Final report on Osijek demonstration execution” [4]
- “D5.6 - Final report on Liberec demonstration execution” [5]
- “D5.7 - Final report on Warsaw demonstration execution” [6]

The demonstrations carried out in the IP4MaaS project concern technologies developed in Call Form Member (CFM) Shift2Rail (S2R) projects, such as the Travel Companion (TC) app. Hence, whereas the actual demonstrations have been executed in the context of IP4MaaS, no technical activity was carried out in the project. IP4MaaS, instead, supported the technical activities of the CFM projects by providing the information that was necessary to integrate the software services of the IP4MaaS Travel Service Provides (TSP) into the S2R ecosystem.

4. Objective/Aim

The goal of this deliverable is to summarize the activities carried out by the three committees established in WP4 to support the execution of the demonstrations of the IP4MaaS project: the Integration Committee, the Data Committee, and the Management Committee.

Each committee is described separately. More precisely, Chapter 5 concerns the Integration Committee, Chapter 6 the Data Committee, and Chapter 7 the Management Committee.

5. Integration Committee

The goal of the Integration Committee is to provide CFM project members with the necessary support and information to integrate the services provided by IP4MaaS TSPs with the S2R IP4 ecosystem. Its activities have been defined in Deliverable D4.3 [7] and are reported in Table 1. The list of services to be integrated and demonstrated in the various demo sites has been identified in Deliverable D4.3 [7]. It has been revised during the integration phase, after the delivery of Deliverable D4.3, and the final version is presented in Annex I.

Not all functions demonstrated in the various demo sites required actual integration of software services in the S2R ecosystem (that is, interactions between components of the S2R ecosystem and software services provided by IP4MaaS TSPs). This section focuses especially on the activities regarding the integration of software services, though it will occasionally mention also functions that only required the exchange of information with CFM project partners, but not software integration.

The rest of this section (i) provides an overview of the kinds of software services that have been integrated and of the general activities carried out to this end then, (ii) it describes some integration issues and activities related to each demonstration site.

Phases	Preparation phase	In-house development & Administrative tasks	Integration & Administrative tasks	Testing	Demo preparation	Demo execution
Integration Committee	<ul style="list-style-type: none"> • Monitor the activities of Integration Preparation • Keep the Technology Integration Plan up to date (requirements, specific tasks, risks) • Facilitate communication and coordination between CFMs and demo partners • Organise periodic meetings with demo partners • Organise workshops between CFMs and TSPs • Present the Technology Integration Plan to CFMs and demo partners and inform them in detail about the next steps • Report to Management Committee 	<ul style="list-style-type: none"> • Monitor the preparatory development activities • Ensure the implementation of the necessary tasks • Facilitate communication and coordination between CFMs and demo partners • Execute periodic meetings with demo partners • Execute workshops between CFMs and TSPs • Identify problems and track issues both from the CFMs' side and demo partners' side • Transfer knowledge across demo sites • Maintain shared documentation for integration activities • Report to Management Committee 	<ul style="list-style-type: none"> • Monitor the progress of the Technology Integration • Facilitate communication and coordination between CFMs and demo partners regarding integration tasks • Execute periodic meetings with demo partners • Execute workshops between CFMs and TSPs • Identify problems and track issues both from the CFMs' side and demo partners' side • Transfer knowledge across demo sites • Maintain a backlog of integration activities for all demo partners • Collect information regarding obstacles determined for integrating technologies and provide it to T4.1 to update the Technology Integration Plan and WP2 to update requirements and scenarios. • Report to Management Committee 	<ul style="list-style-type: none"> • Resolve integration issues that may arise • Report to Management Committee 	<ul style="list-style-type: none"> • Resolve integration issues that may arise • Report to Management Committee 	<ul style="list-style-type: none"> • Resolve integration issues that may arise • Report to Management Committee

Table 1 - Integration Committee Role and Responsibilities (from [7])

5.1. Activities

The software services integrated with the demonstration sites are the following:

- Journey Planner
- Booking service
- Issuing service
- Trip Tracking service

The technical requirements to carry out the integration were identified in Deliverable D4.1 [8]. Not all services are available in all demonstration sites. The next sections provide details about the services that have been integrated with each demonstration site.

Mainly, the activities carried out to facilitate the integration include:

- The provision of documentation regarding the software services to be integrated and of related clarifications, if necessary.
- The provision of access to the endpoints, including the necessary credentials, which in some cases have required the striking of specific agreements (e.g., non-disclosure agreements) between parties.
- The provision of data that was necessary to set up the components on the S2R side; this includes GTFS data for timetable-based services, information regarding the area served by floating services (e.g., bike sharing services) in GeoJSON format, but also information needed to set up Location-Based Experiences (LBE).
- After the integration was carried out and the Travel Companion application was delivered to each demonstration site, internal tests were carried out in each demonstration site and feedback concerning integration issues was provided to CFM project partners through a Mantis bug-tracking tool provided by the latter.

The next sections provide some further information regarding the integration activities carried out in each demonstration site.

Athens

Four TSPs were involved in the Athens demonstration site: OASA, MIRAKLIO, Brainbox, and Taxiway.

Data and Software Services Provided

The software services integrated for each TSP are the following:

- OASA: Journey Planner, Issuing service.
- Miraklio: Journey Planner.

- Brainbox; Journey Planner, Issuing service.
- Taxiway: Journey Planner, Booking service, Issuing service.

The deployment of the Travel Companion (TC) app for the Athens pilot requires information from local TSPs' systems for the modes involved, such as public transport, bike sharing, and taxis. The following information has been provided.

For all modes:

- Their service area, as a polygon, in GeoJSON format.
- Multimodal routing output.

For Public Transport (OASA and MIRAKLIO TSPs)

- GTFS data.
- Ticket product types and costs.
- Points of Interest (POIs) as an input to the Location Based Experience S2R function.
- For taxis, the taxi company's reservation system was integrated. Moreover, a cost calculator was set up by the demo site, which was estimating the approximate taxi ride cost based on time and distance information.
- For bike sharing, the Brainbox issuing server was integrated.

Integration Issues

The integration was completed smoothly following a series of iterative discussions between the CFMs and local pilot site partners. There have been a few issues, some of which were technical but in essence were minor, easily managed, and normal for the integration process; there were also a few more significant issues regarding mostly the harmonization of operations between the TC app and the existing local systems. All issues were ultimately successfully tackled.

In total, the integration had to do with the following:

- Multimodal routing integration (including cost calculation) with TC shopping function.
- Brainbox (bike sharing) issuing server integration with issuing function.
- Taxi reservation integration with booking/issuing function.

The most important issues encountered during the integration process are briefly described below.

Regarding taxis, the actual, existing reservation process requires a manual procedure; the user has many options, including a mobile app, to book a taxi; however, eventually, the taxi reservation centre must call the user to confirm the booking. In order to comply with GDPR, the TC app/IP4 ecosystem does not collect personal details such as email addresses and/or telephone numbers; as a result, the confirmation in the "traditional" way used by Taxiway cannot be completed. This issue has been bypassed by issuing a specific booking identification code when the booking is performed; the user had to call the taxi's reservation centre and provide the booking ID to the operator to guarantee the reservation.

For what concerns bike sharing, a major problem was that the Open Trip Planner (OTP) server does not return bike solutions if the path is considered not safe for bike use. As a result, the route is divided between bike and pedestrian trip legs, and the actual route is not clear to the end user. One possible solution is that the routing system hides the pedestrian trip legs (i.e., replaces them with bike trip legs).

A problem related to cost calculation was that the multimodal routing delivered to the TC multiple travel legs; the TC assumed separate tickets for each leg, while multiple public transport legs required one, single ticket. This was solved at the multimodal routing system part.

Lessons Learned

The lessons learned in the framework of the two phases of the Athens demo have been thoroughly described in the corresponding reports, namely deliverables D5.1 [9] and D5.4 [3]. The main lessons learned regarding integration, however, can be summarized as follows:

- One week of internal testing poses the risk of being inadequate to test all features and solutions extensively, while at the same time becoming more and more familiar with the application and its features. Even if, in IP4MaaS, the tight integration calendar, and in particular the high number of integrations to be performed and their complexity, in a way imposed a short testing period, it is suggested to try to extend this internal testing period as much as possible.
- All material to be distributed to people involved in the demos should be included in one single download, via one single link.
- All apps should be incorporated into one application. For example, in Athens, LBE and TC were downloaded separately in Phase 1, and the LBE was then opened via the TC once downloaded; this process was found by testers to be complex and not user-friendly.
- The fact that each user had to replicate the bike selection through both the TC app and the custom Brainbox application was a challenge. A suggestion for future TC versions is to allow it to integrate external apps (such as the one custom-developed by Brainbox), to achieve seamless usage and transactions and to avoid the need for duplicating actions.
- Local names such as POIs, names of stations, etc. should be in the native language of the demo site, in order to allow the locals to use the application more comfortably.

Barcelona

Four TSPs were planned to be integrated for Barcelona's demo. Nevertheless, only the three TSPs were able to provide relevant information and access to their services to be integrated, namely TMB, BusUp and AMTU (provided by FlexiTransport). In particular, the services that were planned to be integrated are the following:

- TMB: Journey Planner

- BusUp: Journey Planner, Booking service, Issuing service.
- FlexiTransport: Journey Planner, Booking service.

Due to the integration issues that are detailed in the following paragraphs, the software services that were integrated and demonstrated are the following:

- TMB: Journey Planner.
- BusUp: Journey Planner, Booking service, Issuing service.

Data and Software Services Provided

The deployment of the TC app for the Barcelona demonstration required information from local TSP systems for the modes involved, such as public transport (i.e., metro and bus), BusUp buses and FlexiTransport services. More precisely, the following information has been provided:

For BusUp:

- GTFS data.
- API to access booking and issuing services.
- Their service area, as a polygon, in GeoJSON format.
- Multimodal routing output.

For Public Transport (TMB)

- GTFS data.
- Tariff data scheme.

For FlexiTransport:

- Their service area, as a polygon, in GeoJSON format.
- Multimodal routing output and API.

Integration Issues

The integration was completed following a series of iterative discussions between the CFM project partners and local demo site partners. Barcelona's TSPs integration, on the one hand, suffered from the lack of time as it was the last demo; on the other hand, the experience obtained from other TSPs was useful for a quicker integration of Barcelona's TSPs. Most of the encountered issues were minor and often occurred in integration processes; however, there were a few more significant ones, mostly regarding the harmonization of operations between the TC app and the existing local systems. All issues were ultimately successfully tackled.

In total, the integration had to deal with the following:

- Multimodal routing integration (including cost calculation) with the TC shopping function.
- BusUp issuing server integration with issuing function.

- Integration of FlexiTransport services was ultimately not possible due to lack of time as the integration started one week before the demo and a critical bug was encountered. Both technical teams tried to solve it, but as it required a lot of resources and there was not enough time for testing the integration, it was mutually decided not to proceed with the integration.

The most important issues encountered during the integration process were the following.

BusUp had to newly create GTFS files and an API accessible to third parties, which was not available at the beginning of the project, but it was needed to provide access to CFM project partners. Also, some booking and validation issues were encountered during internal testing; in particular, the same QR code was generated for all passengers using the S2R TC, so this had to be changed and tested during the demo.

Concerning the integration of TMB's services, an issue occurred in the calculation of single ticketing costs; indeed, the app was dividing a monthly ticket, so it was showing a lower cost than normal, but this was noticed during internal testing and was fixed before the demonstration.

Lessons Learned

The lessons learned extracted from Barcelona's demo have been thoroughly described in the corresponding reports, namely deliverables D5.1 [9] and D5.2 [1]. However, the main lessons regarding integration can be summarized as follows and they are similar to the lessons learned from other demos:

- One week of internal testing poses the risk of being inadequate to test all features and solutions extensively, while at the same time becoming more and more familiar with the application and its features. Even if, in IP4MaaS, the tight integration calendar, and in particular the high number of integrations to be performed and their complexity, in a way imposed a short testing period, it is suggested to try to extend this internal testing period as much as possible.
- Integration processes should not start one week before the demonstration as technical issues on integration might occur and, as mentioned above, internal testing is important.
- The app should be more mature before being distributed to the testers.

Liberec

The Liberec demonstration site included two TSPs: KORID and AMS. The latter is also related to the Warsaw demonstration site, as it provides bus routes between the two cities, and it has been integrated due to the long-distance pilot between Liberec and Warsaw demos.

Data and Software Services Provided

The software services integrated are the following:

- KORID: Journey Planner, Issuing service, Trip Tracking service.
- AMS: Journey Planner, Booking service, Issuing service.

The deployment of the TC app for the Liberec demonstration required information from KORID as the local public transport authority in the whole area. Thanks to the integration of KORID services (mentioned above), it was possible to integrate with the IP4 ecosystem all available transport modes of all carriers in the Liberec region. The following information was provided:

- Service area, as a polygon, in GeoJSON format.
- Journey Planner: API documentation, endpoint, GTFS data.
- Issuing service: API documentation, endpoint.
- Trip Tracking service: API documentation, endpoint.

When it comes to AMS services, the following information was provided:

- Journey Planner: API documentation, endpoint, GTFS data.
- Booking service: API documentation, endpoint.
- Issuing service: API documentation, endpoint.

Integration Issues

The integration was completed smoothly following a series of iterative discussions between the CFMs and demo partners. The main reason why the integration went smoothly was that most of the services were already integrated in previous S2R IP4 projects. However, there were a few minor issues; for example, it has been necessary to update GTFS data according to the requirements from the CFM side, i.e., missing coordinates for several stops, inconsistencies in stop names, etc.

Lessons Learned

The lessons learned in the framework of the Liberec demo are described in the corresponding reports, namely deliverables D5.1 [9] and D5.6 [5]. The main lessons learned can be summarized (for what concerns the integration issues) as follows:

Preparation and planning

- A precise integration plan should be created, given the large number of TSPs to be integrated and the tight demonstrations' timeline, in order to have enough time for integration and also possible tailoring of the TSPs' services to the IP4 ecosystem. For this reason, regular and smooth communication among all involved partners is paramount.

Internal testing

- As mentioned in the Athens section, one week of internal testing poses the risk of being inadequate to test all IP4 functionalities and familiarize with the TC app and its features. Eliminating the identified potential technical issues can be time-consuming and requires a lot of interaction with the technical partners of CFM projects, particularly for non-experienced demo actors who are unfamiliar with IP4 tools. Therefore, the internal testing has to be more intensive, should last for (possibly) more than a week, and should involve several people on the demonstration site-side, in order to allow them to become familiar with the tools that are to be shared with the users.

Osijek

GPP and Nextbike are the TSPs available for the Osijek demonstration site. A Journey Planner covering both of them was available for integration, but there are no other services suitable to be integrated with the S2R ecosystem.

Data and Software Services Provided

There is only one software service that has been integrated for the Osijek demo, the OpenTripPlanner¹ (OTP) Journey Planner.

The following information was provided to CFM partners to facilitate the integration of the services:

- GTFS file, API documentation, data about tariffs/prices (provided by GPP Osijek),
- bike sharing API (provided by Nextbike), and
- service area, as a polygon, in GeoJSON format (provided by Dyvolve).

Integration Issues

Since TSP GPP Osijek does not have its own Journey Planner (JP), the Osijek demo team proposed a new JP solution for testing in the Osijek demo site. Initially, the demo team and WP5 leader OLTIS agreed to use the CRWS JP (described in Deliverable D2.1 [10]) provided by OLTIS in the Osijek demo supported by available GPP Osijek and Nextbike data. The first issue was that the data from GPP Osijek was outdated and not completely integrable with CRWS (e.g., missing, or wrong coordinates for several stops). The second issue was that tariffs/prices and shared mobility data were not initially available in the existing GTFS file.

Despite all the necessary preparations and technical prerequisites that Nextbike and GPP Osijek fulfilled, new challenges with Nextbike integration emerged on OLTIS/HaCon's side. Based on the proposition from OLTIS, the demo team agreed on using the open-source JP tool called OpenTripPlanner (OTP), an alternative to CRWS. OLTIS had to take some time to learn more about OTP JP and decided that it could be used as an integration tool in Osijek. However, during the

¹ www.opentripplanner.org

internal testing, the demo team and CFM found out that the updated GTFS had discrepancies in data that caused some functionalities to work inaccurately.

Technical prerequisites that the demo partners needed to be fulfilled:

- GPP Osijek updated the GTFS file and API, which OLTIS tested.
- GPP Osijek integrated tariffs/prices data into the updated GTFS file/API.
- Nextbike had to provide a separate API to integrate bike-sharing data. GPP Osijek and Nextbike established cooperation; Nextbike's API and related documentation was sent to OLTIS for reviewing.
- TSPs provided access to data sources through APIs.
- OLTIS prepared the OTP JP for integration into the TC.

The most common issues during internal testing were long loading times, not accurately drawn routes on the map, and unknown and inaccurate public transport lines. Some of the inconsistent and non-logical routes in OTP appeared because of the problem in Open Street Map (OSM) data which the demo team used as one of the data sources. Instances in which a wrong tram or bus line number appeared in the app were mostly related to inconsistent data in the used GTFS file (e.g., inconsistencies in line names/codes).

Lessons learned

The TC application functionalities highly depend on the quality of data TSPs provide and the data integration process. During internal testing, some of the main issues were related to data integration problems (mostly with GTFS files), demanding a lot of time and communication between partners to resolve issues, causing a risk to the project time plan. Therefore, more time and effort should be put into the project's data check and data integration phase where testing is also needed.

Many of the reported bugs and shortcomings were common within all demo sites. Therefore, the reported issues need to be refined and constantly upgraded in the following versions of the TC.

Padua

In the Padua demonstration site, there are two TSPs available: Trenitalia and Busitalia.

Data and Software Services Provided

The software services integrated with the Padua demo site are the following:

- Trenitalia: Journey Planner, Booking service, Issuing service.
- Busitalia: Journey Planner (created through a mechanism provided by CFM project partners).

In addition, the following information was provided to CFM partners, to facilitate the integration of the services:

- Trenitalia: GTFS files, API documentation, Fares.

- Busitalia: GTFS files.

Integration Issues

The main integration issues faced, related to the Trenitalia services, can be separated into two groups: those encountered during the set-up phase, and those related to the development step.

Set-up stage issues

In the initial set-up phase, there was dense communication with the technical CFM partners whose objective was to identify the values to be entered in the parameters of the operations to retrieve the different calls (i.e., to invoke the Trenitalia API). A “call” corresponds to the operation whereby the user, from the application, executes commands, such as selecting the day and time of a particular trip, and the system returns a series of options based on the selected trip choices (other examples of calls are basic search, retrieving the map for selecting the seat, booking the travel option, selecting a particular train, finalizing the purchase, etc.). In the initial stages, the main difficulty that was encountered was the configuration of the initial parameters for the dialogue of the API layer of Trenitalia in terms of either networking and/or software components.

The first discussions with CFM partners, therefore, focused on instructing and explaining to the technical partners how to create configurations in order to be able to interact with Trenitalia's system. Trenitalia has different types of parameters, each of which requires a different type of approach in order to be implemented: static parameters were provided by email, in addition to instructions on how to set each parameter; other types of parameters, on the other hand, were the result of responses to previous calls that had to be traced back to subsequent calls. For instance, the transition ID is generated each time a search is made. The user who, via the application, selects a travel option results in a series of alternatives. The user can select an option and from time to time enrich the chosen travel option with further details that will lead to the finalization of the trip and the final purchase.

Development stage issues

After the set-up phase, the next step was to explain to the technical CFM partners the flow and how to develop the Journey Planner, Booking service, and Issuing service. Firstly, support was provided by making available the necessary documentation that outlined the steps to be taken to set up the integration. This was not sufficient, hence conference calls involving technical staff have been organised to show and discuss practical examples. The main difficulties were in developing the correct orchestration flow (choreography) of the requests necessary to be able to search and visualize a solution contained in the walk-through guide. In summary, the major complications were due to the complexity of the API system and the related integration issues, and to the necessity to extensively explain to CFMs all the system specificities.

Lessons Learned

For optimal finalization of integration operations, it would be preferable to put more effort into the initial stages and specifically organize ad hoc calls for initial training activities in which the concepts behind the integration are explained, outlining how to proceed when reading the

documentation and how to refer to it. Support calls should be made constantly and frequently focusing mainly on the set-up phase in order to establish the foundations of the system to be integrated and to monitor the development of the application and promptly intervene, if necessary.

Warsaw

In Warsaw, 3 local partners cooperated to execute the IP4 demonstration activities: 2 TSPs (MZA, the municipal bus operator, and TW, the municipal tram operator) and ZTM, Warsaw Public Transport Authority, representing the City of Warsaw.

Data and Software Services Provided

The available software service was the Journey Planner (a private-owned Jakdojade application and web service with possible access to the Jakdojade API, which has been provided by ZTM for the Warsaw demonstration activities).

In order to enable the demonstration of the selected IP4 functionalities, ZTM provided access to the Jakdojade journey planner API, as well as to the open-source GFTS data from mkuran.pl/gtfs.

Integration Issues

The integration of the Jakdojade API with the IP4 ecosystem was timely and effective, although several issues appeared on the way:

- API access problem (January 2023): The issue was passed to the Jakdojade specialists and a solution was offered that closed the issue.
- An issue regarding the shopping area (February 2023). It was solved between CFMs and Jakdojade specialists.

The confirmation of full integration of Jakdojade API with the IP4 technology to be demonstrated has been sent to the Warsaw demonstration team by the CFMs on 6th February 2023.

Lessons Learned

In the case of the Warsaw demonstration, where access to the journey planning API was provided by a third party representing the private sector and therefore had to be contracted, the main lesson is that the start of the preparation of the agreement between a city stakeholder taking part in the project and a private sector stakeholder who is delivering a solution should begin very early in the demo activities preparation phase, as it may turn out extremely time-consuming.

If the API belongs to a third party, it is also recommended to have consultation meetings between the API owner's specialists and the integrators of the technology to be demonstrated.

Good coordination of issue reporting during the integration phase is crucial and a demonstration team representative should facilitate and supervise the communication between the integrators

and API owner's specialists to ensure an effective issue solution and proper contract execution.

5.2. Conclusions and recommendations for future projects

This section briefly summarizes the most important lessons learned from the integration of the services provided by IP4MaaS TSPs in the S2R IP4 ecosystem.

A common – unsurprising – remark that emerged from the demonstrations is that, in the preparation and integration phase, suitable (ample) time should be allocated to the testing, especially by TSP personnel, of the integration of the services provided by the TSPs with the S2R IP4 ecosystem. This would help test a wider range of scenarios and increase the number of cases covered. Unfortunately, especially due to the number of services to be integrated and the time required for the integration as communicated by CFM project partners, the integration timeline in the IP4MaaS project was very tight, and this left only a few weeks for each demonstration to carry out proper testing. This was critical, especially for the early demonstrations. Later demonstrations were able to benefit from the knowledge acquired during the earlier ones, which meant that the compressed timeline was less problematic.

In addition, for demonstrations that are geographically distributed not only on a wide territory, but also across different countries (which typically have different rules and constraints), cultures, and languages, the ecosystem should be flexible enough to accommodate this heterogeneity; in addition, the planning of the demonstrations, and in particular their timeline, should also take into account the specificities of each country involved in the demonstrations (e.g., vacation periods). Somewhat related to this, the demonstrations highlighted the importance of relying on data of good quality (e.g., correct, harmonised GTFS files) when integrating the services.

The demonstrations also showed (and confirmed) that integrating all functions in a single app, instead of using several, dedicated apps, is highly appreciated by users. Hence, it is worth spending efforts to make apps extensible and foresee from the very beginning the possibility to add functions to them, as new TSPs are integrated into the ecosystem.

6. Data Committee

The Data Committee had a twofold goal: to facilitate the data exchanges between the TSPs and the CFMs' technology providers, in the scope of integration and demo activities, as well as to organise and collect data during the demonstrations, for assessment purposes in the context of WP6 (Performance and impact assessment).

In particular, the Data Committee during all phases of the demonstrations' preparations (prior to the demonstrations, during the demonstrations execution, and post-execution), as described also in Deliverable the D4.3 [7] and as listed in Table 2, had the crucial role of conducting the following activities:

- Facilitate data exchange between TSPs and CFMs' technology providers.
- Create shared documentation (e.g., using SVN, Cooperation Tool, or SharePoint), allowing demo partners and CFMs to log information.
- Monitor data requirements and availability from CFMs and TSPs.
- Monitor exchanges between CFMs and TSPs and disseminate the knowledge to other demo locations.
- Update the backlog with the progress of data exchanges.
- Update and fine-tune the Key Performance Indicators (KPIs) of TSPs and travellers, in close collaboration with WP3 and the CFMs' technology providers:
 - Retrieve data sources for updating KPIs.
 - Fine-tune performance KPIs.
 - Determine the final list of KPIs and impact indicators for each demo site.
 - Align the KPIs across all demo sites.
 - Assess the feasibility of measurement and success-showing potential.
- Co-create and participate in user engagement workshops to facilitate data exchange.
- Report to Management Committee.

Phases	Preparation phase	In-house development & Administrative tasks	Integration & Administrative tasks	Testing	Demo preparation	Demo execution
Data Committee	<ul style="list-style-type: none"> Facilitate data exchange between TSPs and CFMs' technology providers Create shared documentation (e.g., using SVN or SharePoint), allowing demo partners and CFMs to log information Monitor data requirements and availability from CFMs and TSPs Monitor exchanges between CFMs and TSPs and disseminate the knowledge to other demo locations Update the backlog with the progress of data exchanges Update and fine-tune the KPIs of TSPs and travellers: <ul style="list-style-type: none"> Retrieve data sources for updating KPIs Fine-tune performance KPIs Determine the final list of KPIs and impact indicators for each demo site Align the KPIs across all demo sites Assess the feasibility of measurement and success-showing potential Co-create and participate in user engagement workshops to facilitate data exchange Report to Management Committee 	<ul style="list-style-type: none"> Facilitate data exchange between TSPs and CFMs' technology providers Maintain shared documentation Monitor data requirements and availability from CFMs and TSPs Monitor exchanges between CFMs and TSPs and disseminate the knowledge to other demo locations Update the backlog with the progress of data exchanges Align IP4 data requirements with TSP data availability Participate in user engagement workshops to facilitate data exchange Report to Management Committee 	<ul style="list-style-type: none"> Facilitate data exchange between TSPs and CFMs' technology providers Maintain shared documentation Monitor data requirements and availability from CFMs and TSPs Monitor exchanges between CFMs and TSPs and disseminate the knowledge to other demo locations Update the backlog with the progress of data exchanges Align IP4 data requirements with TSP data availability Participate in user engagement workshops to facilitate data exchange Report to Management Committee 	<ul style="list-style-type: none"> Facilitate data exchange between TSPs and CFMs' technology providers Maintain shared documentation Monitor data requirements and availability from CFMs and TSPs Monitor exchanges between CFMs and TSPs and disseminate the knowledge to other demo locations Update the backlog with the progress of data exchanges Report to Management Committee 	<ul style="list-style-type: none"> Validate the User Satisfaction Index survey Validate the final list of KPIs to be monitored and the subject of performance assessment in WP6 across all pilot sites Validate user engagement plan/strategies (provided by WP4) Organise data collection activities during demonstrations Maintain shared documentation Monitor exchanges between CFMs and TSPs and disseminate the knowledge to other demo locations Update the backlog with the progress of data exchanges Report to Management Committee 	<ul style="list-style-type: none"> Conduct the User Satisfaction Index survey Collect data during demonstrations Provide data collected to be used by WP6 Provide the data exchanges backlog to WP4 for reporting Report to Management Committee

Table 2 - Data Committee Role and Responsibilities (from [7]).

During the *preparation phase*, as well as the *in-house development and integration phases*, the Data Committee created shared documentation, allowing demo partners and CFMs to log information. Data requirements, availability and exchanges from CFMs and TSPs were monitored, and this knowledge was shared with demonstration actors.

Two classes of data were addressed by the work of the Data Committee:

- **Transport data**, mutually exchanged among CFMs and TSPs, to enable technology integration and IP4MaaS experimentations. While for some IP4 functionalities, classified as *Passive*, there was no technical action required from the IP4MaaS TSPs (e.g., Navigation or Traveller feedback, deployed throughout the TC), other functionalities, classified as *Active*, required data exchange between CFMs' technology providers and IP4MaaS TSPs. This data exchange (which was achieved in part through the Asset Manager) was the crucial asset to integrate technologies and enable demo activities. This data is site-dependent and may be classified as follows:
 - Per user (traveller/TSP).
 - Per IP4Technology (Journey planner, Booking, Issuing, Trip tracking).
 - Per data exchange method (API, direct input).

Data types reflected standard formats when possible (e.g., GTFS) as well as ad hoc layouts and were identified through a technology survey and agreed upon among parties during the demo preparation phase. Details are reported in Deliverable D4.3 [7].

- **Evaluation data**, retrieved by the demo sites to enable impact and process assessment. Concerning the IP4MaaS impact and project assessment activities, carried out in WP6, two streams of data were initially defined in Deliverable D3.2 [11] and then elaborated during subsequent demo activities up to the final evaluation phases:
 - Objective data: these are the operational KPIs gathered by IP4 Technologies (Journey planner, offer builder, Trip tracking, etc). These KPIs were validated by CFMs and their attributes (availability, significance, non-redundancy, accuracy) were assessed by the Data Committee that ensured their provision for project evaluation purposes.
 - Subjective data: consisting of the User Satisfaction Index (USI) surveys [11] prepared and administered to travellers and TSPs, to evaluate their satisfaction level with IP4 functionalities tested in the project.

In the preparation phase, the Data Committee also supported the accurate definition of data structures and assessed data sources in order to assist WP3 activities to set the methodological framework of IP4 demonstrations, and WP6 to fine-tune operational KPIs and to validate USI surveys.

During the *In-house development & Administrative tasks*, the Data Committee has contributed to the writing of the TC Terms & Conditions that have been distributed to demo leaders before the F-REL demonstrations (and included by CFM project partners in the TC app after validation).

In the same phase, together with WP3, the Data Committee has also contributed to establishing a

User Engagement Strategy [12] mainly based on dissemination activities, online meetings/training sessions and incentives; it also helped define the processes and the methodology to distribute the USI surveys among demo leaders and the distribution of the project incentives to users after demo executions, in full compliance with GDPR, data, and privacy protection. In this regard an ethics application form for the USI was prepared, including data collection campaign details, a description of the research involving human participants, data protection, copyright, and related considerations, and the USI questionnaire to be administered to TSPs and travellers.

Concerning the *Integration & Administrative tasks*, the Data committee supported the preparation of the Collaboration Agreement between the CFM Consortia COHESIVE, CONNECTIVE, ExtenSive and the Open Call Consortium IP4MaaS by contributing to defining specific provisions related to data access and management. The Collaboration Agreement was finalized in early 2023 and signed in June 2023.

During the *test, validation, and execution phases*, the Data Committee supervised data collection and validation, monitoring the exchanges between the CFMs and TSPs and ensuring to feed WP6 activities for project evaluation.

7. Management Committee

The Management Committee is responsible for monitoring the execution of the demonstration execution plan (monitoring timeline, executing risk management), coordinating between WP4 and WP5 and resolving communication or other managerial issues during and before demonstrations, coordinating between WP4, WP5 and WP7 for the execution of co-creation and workshop activities. It provides input for the different iterations of the demonstration execution plan (D4.3, D4.4). Thus, its purpose is to ensure that demonstrations, as far as IP4MaaS is concerned, are executed smoothly.

More simply, the Management Committee is responsible for the management and coordination actions of the demos acting on behalf of the project board for low-level decision actions (time-sensitive decision-making). It executes the following actions:

- monitor the demo execution timeline;
- monitor the risk management plan regarding demos' execution, implementation of mitigation actions and activation of contingency plans;
- monitor the implementation of use cases developed during the planning pillar;
- collaboration and co-planning of activities with the outreach pillar;
- execution of coordination actions between the different stakeholders of the demos.

The Management Committee acts as the managerial link between the IP4MaaS board, CFM projects, and IP4MaaS TSPs and it takes executive actions based on the Demonstration Execution Plan, to move the demonstrations forward when problems arise. The Management Committee is the low-level planning link between all parts of IP4MaaS and maintains the in-project responsibility that all committees execute the envisioned actions.

The Management Committee acted during the project at multiple levels as required by the different stages of project development, as represented in Table 3, which recaps Management Committee's role and responsibilities. All the above-mentioned tasks have been carried out by UITP in strict cooperation with all the Task partners.

The committee activities followed the project phases, and also the repartition in the two Reporting Periods (RPs).

Phases	Preparation phase	In-house development & Administrative tasks	Integration & Administrative tasks	Testing	Demo preparation	Demo execution
Management Committee	<ul style="list-style-type: none"> • Monitor the execution of the activities planned • Timeline supervision • Monitor the risk management plan regarding demos' execution, implementation of mitigation actions, and activation of contingency plans • 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 plans • Intervene to resolve barriers that might emerge • Coordinate the execution of workshops • Coordinate actions between the different stakeholders of the demos (Committees, Demo Leaders, CFMs, TSPs) • Collaborate and co-plan activities with the outreach pillar • Collaborate with other projects (e.g., CFMs, Ride2Rail) • Monitor Integration and Data Committees' activities 	<ul style="list-style-type: none"> • Monitor the execution of the activities planned • Timeline supervision • Manage risks, implement mitigation actions, and activate contingency plans (if needed) • 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 plans • Intervene to resolve barriers that might emerge • Coordinate the execution of workshops • Coordinate actions between the different stakeholders of the demos (Committees, Demo Leaders, CFMs, TSPs) • Collaborate and co-plan activities with the outreach pillar • Collaborate with other 	<ul style="list-style-type: none"> • Monitor the execution of the activities planned • Timeline supervision • Manage risks, implement mitigation actions, and activate contingency plans (if needed) • 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 plans • Intervene to resolve barriers that might emerge • Coordinate the execution of workshops • Coordinate actions between the different stakeholders of the demos (Committees, Demo Leaders, CFMs, TSPs) • Collaborate and co-plan activities with the outreach pillar • Collaborate with other 	<ul style="list-style-type: none"> • Monitor the execution of the activities planned • Timeline supervision • Manage risks, implement mitigation actions, and activate contingency plans (if needed) • 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 plans • Intervene to resolve barriers that might emerge • Coordinate actions between the different stakeholders of the demos (Committees, Demo Leaders, CFMs, TSPs) 	<ul style="list-style-type: none"> • Monitor the execution of the activities planned • Timeline supervision • Manage risks, implement mitigation actions, and activate contingency plans (if needed) • 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 plans • Intervene to resolve barriers that might emerge • Coordinate actions between the different stakeholders of the demos (Committees, Demo Leaders, CFMs, TSPs) 	<ul style="list-style-type: none"> • Monitor the execution of the activities planned • Timeline supervision • Manage risks, implement mitigation actions, and activate contingency plans (if needed) • 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 plans • Intervene to resolve barriers that might emerge • Coordinate actions between the different stakeholders of the demos (Committees, Demo Leaders, CFMs, TSPs) • Collaborate and co-plan activities with the outreach pillar

		<p>projects (e.g., CFMs, Ride2Rail)</p> <ul style="list-style-type: none"> • Monitor Integration and Data Committees' activities 	<p>projects (e.g., CFMs, Ride2Rail)</p> <ul style="list-style-type: none"> • Monitor Integration and Data Committees' activities 	<ul style="list-style-type: none"> • Monitor Integration and Data Committees' activities 	<ul style="list-style-type: none"> • Collaborate with other projects (e.g., CFMs, Ride2Rail) • Monitor Integration and Data Committees' activities 	<ul style="list-style-type: none"> • Collaborate with other projects (e.g., CFMs, Ride2Rail) • Monitor Integration and Data Committees' activities
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Table 3 - Management Committee Role and Responsibilities (from [7]).

In RP1 (M1-18) the committee focused on the kick-off and planning of its activities, with specific regards to “setting the scene” for the demos’ Phase 1 and supporting the preparation of the drafts of the Integration Plan and planning of the demos’ documentation.

Starting at M13, the committee activities have been set up by the task leader in cooperation with the task partners. In particular, there has been strong coordination with the Integration and Data Committees about the collection of information and access to TSPs services to be integrated for the demos, with particular regard for the Athens demonstration’s Phase 1. An intense exchange of updates/information took place between UITP, CFM partners, and the Project Officer (PO) for monitoring the update of the information/accesses given to CFM project partners for Phases 1 and 2. Intense work took place for monitoring the update of the Asset Manager (AM), with specific meetings organized with CFMs, POLIMI, and CEFRIEL. Meetings have been also organized with CFMs on the timeline of the demos, in which all partners involved in the committee participated. Regular monitoring of the demo execution planning and demo timeline was held in strong coordination with other WP4 actors and WP Leader AETHON. Management Committee Leader and partners participated in the regular WP5 calls, organized monthly to monitor the progress at the demo level. The Management Committee responded to questions and supported the preparation of the demos, in particular for what concerns the Athens demo preparation (Phase 1). Multiple aspects have been taken into consideration: GDPR/Confidentiality, technical support, risk assessment, Terms and Conditions, demo test cases, users’ engagement/incentives, USI surveys, and translation of material for dissemination and user engagement purposes. The committee acted at all levels, internally in the project (with WP2-3-5-7 in particular) and externally with CFMs and the JU, for ensuring the smooth execution of all activities planned in preparation for the demos. During regular (monthly) calls with WP leaders, to which UITP invited also relevant technical partners, further coordination of the committee activities took place.

Partners of T4.4 have been also involved in the production and review of D4.2/D4.4 prepared within WP4. UITP was also in touch with the PO and the WP Leader for addressing the comments received in the D4.2 review.

Communication with CFMs has been regular, in particular on GDPR issues/Terms and Conditions, involvement of users, integration of services in the IP4 ecosystem, testing/bug fixing, and translation of the TC app.

The project was presented twice at the ExtenSive project TMT Meeting. It was an occasion to update CFM project partners about the IP4MaaS progress, in particular for what concerns the demo preparation and more specifically on the technical requirements that TSPs/mobility services providers need to fulfil in order to be duly integrated with the IP4 ecosystem. Intense exchange, in this sense, took place with CFM project partners in order to coordinate the collection of material necessary for integrating the TSPs in the Athens demo site. This happened in strict cooperation with CFM partners HaCon, Thales and Indra in particular (with CS Group particularly involved on all subjects concerning the LBE/LBE editor). UITP coordinated these exchanges in strict

cooperation with WP5 leader OLTIS, Integration Committee leader POLIMI (also responsible for the AM update), and WP4 leader AETHON.

Three official collaboration meetings have been organized by UITP, in strict compliance with Task 1.5 requirements and schedule. On top of these, multiple additional meetings have been organized on several topics:

- demo timeline and schedule for TSPs integrations
- overview on ExtenSive functionalities
- AM presentation and functioning
- CFM COHESIVE functionalities
- status of TSPs services
- LBE
- GDPR and confidentiality issues (with particular regards to the Terms and Conditions, drafted by IP4MaaS and RIDE2RAIL partners, and validated by CFM project partners)
- TRIAS
- Trip Tracking functionality
- Taxiway booking process
- LBE
- test case production

Additional so-called “informal collaboration meetings” have been organized by UITP with CFM project partners and IP4MaaS technical partners to recap the work produced and the pending issues towards the completion of scheduled tasks, and for clarifying any kind of doubts that emerged on technical issues.

Finally, WP4 was presented in a dedicated session at the UITP stand at IT-TRANS Karlsruhe, on 12 May 2022, in a presentation jointly developed with WP5. The presentation, held at the UITP stand in front of potentially interested stakeholders from the digitalization in the transport sector, was focused on the demo activities in preparation for the Athens demo Phase 1 and, about Phase 2, for all other demo sites. It was performed by OLTIS but prepared in conjunction with AETHON/WP4.

In RP2 (M19-31), the committee activities have been carried out by the task leader in cooperation with the task partners, following the evolution of the preparation phase for the 1st Phase demonstration in Athens, and the planning of the 2nd Phase in all other demo sites. As done in the previous period, there has been strong coordination with the Integration and Data Committees about the collection of information and access to TSP services to be integrated for the demonstrations, with particular regard for the Athens demonstration of the 1st Phase (July 2022). TSPs to be integrated with the ecosystem in some cases provided additional material or updated versions of the previously shared one. This material was regularly and timely updated on the AM by POLIMI. Regular exchange between UITP and the CFM partners took place, for following the

preparation phase for the Athens demonstration, the planning of Phase 2, and for monitoring the update of the information/accesses given to CFM project partners for the 1st and 2nd Phase. Meetings and interactions have been also organized with CFM project partners on the subject of the demonstration timeline, the status of the integrations, and the testing of the functionalities (and TC app), to which partners involved in the committee participated.

UITP as project coordinator but also as leader of the Management Committee participated in the regular WP5 calls, answering questions and getting insights on the demonstration preparation. The regular monthly call with WP Leaders and technical partners kept being an additional moment of sharing and mutual updating about the activities. The committee was also the “bridge” between demo actors and CFM project partners. Regular monitoring of the demonstration execution planning and timeline was held in strong coordination with other WP4 actors and WP Leader AETHON. The Management Committee supported the preparation of the Athens demonstration in July 2022 and the 2nd Phase (Spring 2023) and supported the organization of a meeting with CFM project partners and all demo actors for discussing the lessons learnt from Athens, after the execution of the Athens demonstration. This has been an important occasion for sharing lessons and finding strategies to avoid mistakes and improve the efficiency of the organization. This meeting was organized in strict connection with WP5. UITP was also regularly informed about the status of the demonstrations’ progress, from the IP4MaaS side and CFM side. Communication with CFM project partners was regular. In particular, 1 Official Collaboration meeting has been organized by UITP, in strict compliance with Task 1.5 requirements and schedule. On top of this, multiple additional meetings have been organized on several topics: LBE, Orchestration & Supervision Tool, Mobility Packages, CMMP, Distributed Ledger, Best Price functionalities, demo preparation/demo progress, TC presentation and training, integration status, alignment with CFM projects and PO on integrations, lessons learnt from demos.

In addition, the execution of operational KPIs for the Athens demonstration site 1st Phase has been monitored and evaluated. This task has been done to validate whether the inputs worked well for the next iterations and demonstration sites. This was held in cooperation with WP6 partners.

The committee also supported the preparation, drafting, signature and distribution of a NDA needed for providing Trenitalia/Busitalia information to CFMs (necessary to perform the Padua demo). A similar activity was managed with regard to Nextbike in Osijek. Meetings have been organized with Trenitalia, FSTECH, Dyvolve and GPP, Indra and Thales to discuss the integration of Padua/Osijek TSPs and to give CFM project partners all the necessary information for performing this task. The correct performance of the integrations has been monitored by the Committee, in cooperation with the Integration and Data Committees.

Particularly relevant have been the efforts carried out to refine and finalize the calendar of integrations/calendar of demonstrations about Phase 2. In particular, it needs to be noted that this calendar, initially agreed upon in RP1, had to be slightly modified according to the inputs

received and given by CFM project partners about the difficulties in the integrations and the timely provision of the material for performing the integrations (accesses, GTFS files, coordinates, timetables, etc). In some cases, demos for which material was already provided and for which integrations were easier were performed before, adjusting the calendar based on the complexity of the integration process. This process was constantly revised with the support of the inputs provided by Indra, HaCon and Thales in particular.

About the connections with WP7, it is important to mention that WP4 was presented in a dedicated session at the UITP stand at TRA2022 Lisbon, on 16 November 2022 (the session was organized to present IP4 solutions and discuss with some IP4MaaS and RIDE2RAIL demo leaders how these have been used at demo level).

Finally, the IP4MaaS Final Event was organized jointly with two S2R/ER complementary projects, ExtenSive and Connective. This was done on purpose to better highlight the importance of the collaboration that took place during all the projects' lifetime among these projects, sealed formally by the signature, in 2023, of a Collaboration Agreement (COLA). The Final Event was held in Barcelona on 6 June 2023 and was organized as a side event of the UITP Global Public Transport Summit, the biggest and most important worldwide event dedicated to Public Transport. The fact that the event was organized during the Summit and in the same area helped the partners of all these projects to gather the attention of interested stakeholders, expanding their audiences and allowing an increased number of people to benefit from the research carried out. The final event was preceded by a 30-minute session, held on the 5th of June in the Summit's exhibition area, dedicated to the kick-off of the Barcelona demo. UITP coordinated all these activities (about the Final Event, together with Network Rail).

The Management Committee kept acting in the whole RP2 as the managerial link between the IP4MaaS board, CFM projects, and IP4MaaS TSPs and it took executive actions based on the Demonstration Execution Plan that moved the demonstrations forward when problems arose.

The risk registry was constantly monitored with the support of Task 1.2 and 1.3 partners (and in particular task leaders). This was kept available by all project partners as it was updated on the Cooperation Tool. Particular attention was dedicated to "unforeseen risks" and relative mitigation actions.

8. Conclusions

The present deliverable described the activities of the three committees – Integration Committee, Data Committee and Management Committee – in support of the demonstrations carried out in the IP4MaaS project.

As the deliverable comes at the end of the project, its contributions are twofold. On the one hand, it documents the actions taken within IP4MaaS to help prepare and run the demonstrations, and the issues that were faced. On the other hand, it can serve as a vade mecum that can help future projects that need to carry out demonstrations that have similar characteristics as those of IP4MaaS (user engagement, wide range of technologies to be demonstrated, different demonstration sites, spread across different countries) better prepare for the demonstrations and avoid some of the issues that arose during IP4MaaS.

9. References

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10. Annexes

Annex I

Final list of functionalities selected for each demonstration site.