



## Deliverable D5.2

### Final report on Barcelona demonstration execution

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## 1. Executive Summary

The aim of the Deliverable 5.2 “Final report on Barcelona Demonstration execution” is to present the preparation and execution activities of Barcelona Demonstration site taking place as a part of the IP4MaaS project within the framework of the Shift2Rail Joint Undertaking (now Europe Rail). The demonstrated technologies were selected functionalities of the Travel Companion application.

The demonstration consisted in integration of the services of certain Transport Service Providers (TSPs) of Barcelona Metropolitan Area considering technical, legal, and business aspects and then recruiting testers/volunteers to test and provide feedback on the Travel Companion application. The testers had to download the application and use it while travelling by means of Public Transport (i.e., buses, metro) and combined itineraries with private transport on demand services (test multimodality) and to provide us feedback regarding the selected functionalities with the use of the online User Satisfaction Index questionnaire form. The USI questionnaire was developed as part of the WP3, task T3.2 “User satisfaction with IP4 solutions”.

To this end, the Deliverable 5.2 outlines the various activities that took place as part of coordination and fostering of the Barcelona Demo preparation and execution, reports the contribution of the Barcelona demonstration team to technological integration. Finally, this deliverable reports the internal testing results of the integrated technologies and the outcomes and findings of the Barcelona demonstration activities.

## 2. Abbreviations and acronyms

<b>Abbreviation / Acronym</b>	<b>Description</b>
CFM	Calls for Members
DL	Dissemination and exploitation leader
DoA	Description of the Action
EL	Ethical leader
EU	European Union
FS	Financial Statement
GA	Grant Agreement
H2020	Horizon 2020
IP4	Innovation Programme 4
OC	Open Call
PC	Project coordinator
PM	Project manager
PMO	Project Management Office
PMT	Project Management Team
PO	Project Officer
QAC	Quality Assurance Committee
S2R JU	Shift2Rail Joint Undertaking
TC	Travel Companion
TL	Technical leader
TSPs	Transport Service Providers
WP	Work Package
WPL	Work package leader

### 3. Background

The present document constitutes the Deliverable D5.2 “Final report on Barcelona demonstration execution” of the T5.2 “Barcelona demonstration” (WD) of the WP5 in the framework of the IP4MaaS project (GA 101015492, S2R-OC-IP4-01-2020) under the Innovation Programme 4 (IP4) of the Shift2Rail Joint Undertaking, executed in cooperation with Call for Members Consortia COHESIVE (GA 777599, S2R-CFM-IP4-02-2017), CONNECTIVE (GA 777522, S2R-CFM-IP4-01-2017) and ExtenSive (GA 101015462, S2R-CFM-IP4-01-2020) also being a part of the Shift2Rail Joint Undertaking and connected with the IP4MaaS Consortium by means of the Collaboration Agreement.

Additionally, it needs to be mentioned that Barcelona demonstration was one of the six demo sites of the IP4MaaS, thus its results and conclusions contribute to Task 5.1 of the IP4MaaS project – “Coordination of the demonstrations executions” and the corresponding Deliverable D5.1 “Results of the demonstrations”. Finally, they contribute as well to WP6 and the respective deliverable D6.2 “Performance assessment”.

## 4. Objective/Aim

This document aims to detail the activities (i.e., preparation and execution) conducted for T5.2 “Barcelona Demonstration” as well as the results of these activities and recommendation to improve the testing processes.

The IP4MaaS project aim is to promote the adoption of Mobility as a Service (MaaS) schemes by testing the technologies developed within the IP4 Shift2Rail through six demonstrations conducted in Europe: Athens, **Barcelona**, Liberec, Osijek, Padua, and Warsaw. The aim of the document is to:

- provide general information on the Barcelona demonstration site and the overall goal of this demonstration.
- detail the selected functionalities for testing, mentioning the obstacles encountered and aspects that limited the selection process.
- outline of the User Engagement Strategy designed and implemented by Barcelona’s team and in coordination with the other demo sites (Barcelona was the last demo hence the lessons learnt from other demo sites were taken into consideration)
- present the division of tasks among the Barcelona team members.
- show the activities and feedback of the internal testing.
- conclude with the demo execution planned activities and their results focusing on the Travel Companion (TC).



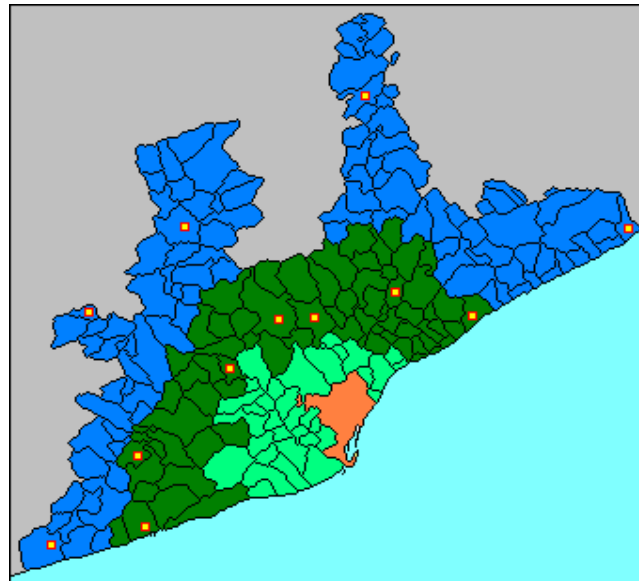
## 5. General information about demonstration site

It is a common secret that Barcelona is one of the most popular cities on the world concerning its urban planning (i.e., superblocks). Furthermore, intends to analyse its transformation from a traditional agglomeration to a twenty-first century metropolis. So, the case of Barcelona is of special interest, to be considered as a leading metropolis in Europe due to its apparent desire, reflected by its current policies regarding urban planning and sustainable mobility. Barcelona's mobility model is based on the four following strategic pillars: safe, active, fair, and efficient. Moreover, the mobility habits in Barcelona as everywhere in the world have developed over the last 50 years are evolving into new ways of getting around, especially in the post COVID era.

For this reason, Barcelona is continuously:

- i) adapting is urban space to guarantee a more equitable distribution of space for the various modes of transport, by opening cycling spaces for bicycles,
- ii) improving the bus network,
- iii) giving priority to people travelling on foot and soft modes (such as bikes and electric bikes)
- iv) promoting traditional and innovative on-demand transport services, improving the flexibility of its infrastructures and services and provide alternatives to commuters to and from sub urban areas.

Considering the aforementioned aspects of the metropolitan area of Barcelona (Figure 1) and the fact that Barcelona Metropolitan area can be characterized as a polynuclear urban region (PUR). Thirty-six municipalities compose Barcelona Metropolitan Area (AMB), where in 2020 a population of 3,339,279 inhabitants resided, in such a way that it concentrated in a territory of 636 km<sup>2</sup> (barely 2% of the surface of Catalonia) 42% of its population. The AMB can be divided in 3 zones; each zone contains several Municipalities. The main characteristics of these zones are: i) Proximity, ii) Increasing regional integration, iii) Economic dependencies, iv) Growing cross boundary issues and v) More efficient labour and housing market interaction.



**Figure 1: Barcelona metropolitan area**

Hence, for the Barcelona demonstration it was decided to focus on **commuters and students** who live in the second or third zone of the Metropolitan area and work at the first zone (and more specifically to Barcelona) or vice versa: live in the first zone and work at the second or third zone. Hence, they have to commute each day and cross different zones.

The **fundamental goal** of the demonstration is to incentivize multimodal travel and shared modes of transport, targeting:

- i) users traveling from the same starting point to different destinations in Barcelona and
- ii) users traveling from different starting points to the same destination in the suburban/rural area of Barcelona.

The primary anticipated innovation is the orchestration of individual mobility offers and services in one seamless journey, including urban and peripheral areas.

For this demonstration **4 different Transport Service Providers (TSPs)** collaborated/participated:

1. [Transports Metropolitans de Barcelona \(TMB\)](#) is the main public transit operator in Barcelona. It covers the entire Metropolitan area of Barcelona and consists of a comprehensive network of multiple PT means: Bus and Metro. Additionally, it handles the cable car of Barcelona and the tourist red buses. The Barcelona Metro network serves 125,4km with 183 trains and 165 stations to cover a demand of 278,24 million journeys. On the other hand, TMB's fleet of 1.135 buses serves a network of 839,21 km with its 106 lines and 2.653 stops, covering a demand 147,27 million journeys (based on the official

statistics published at TMB's landing page). (Additional information and a visualization of the public transport system is provided in section 10 Appendices).

2. [BUSUP](#) is a private transport on demand bus provider. More specifically, BUSUP is a mobility service provider that thanks to its technology and innovative business model offers efficient and flexible corporate commuting services. BUSUP operates fixed route shuttle networks that are often co-founded and shared by multiple organizations and populations of riders. Our operator agnostic approach gives shuttle clients the price transparency and service reliability they deserve. Being the #1 company in the EU and Latin America (Latam) and first company in the world to offer shared corporate shuttle services, BUSUP has disrupted a very traditional and low digitized sector, bringing efficiency and convenience to all its stakeholders: Passengers, Clients, Operators and Public Administration. Today BusUp attends more than 40.000 daily commuters and has more than 100 clients worldwide. Specifically in the Barcelona metropolitan area BUSUP has 5 different clients including Hospitals, Business parks and Factories offering them more than 900 services per month in 56 active routes.
  
3. [Flexitransport Catalunya](#) is a mobility solution created by the AMTU (Association of Municipalities for Mobility and Urban Transport), which adapts to your needs and facilitates your daily travel. Its flexible and adaptive system allows you to book your trip, indicating the origin and destination, but without depending on a fixed schedule and route, both in real time and with prior reservation. Currently, it is operating in specific areas of the second zone (e.g., Alella, Terrassa) either with taxis or shuttle buses and aims to expand to more municipalities in the following years.
  
4. [SocialCar](#) provides car hiring and car sharing services.

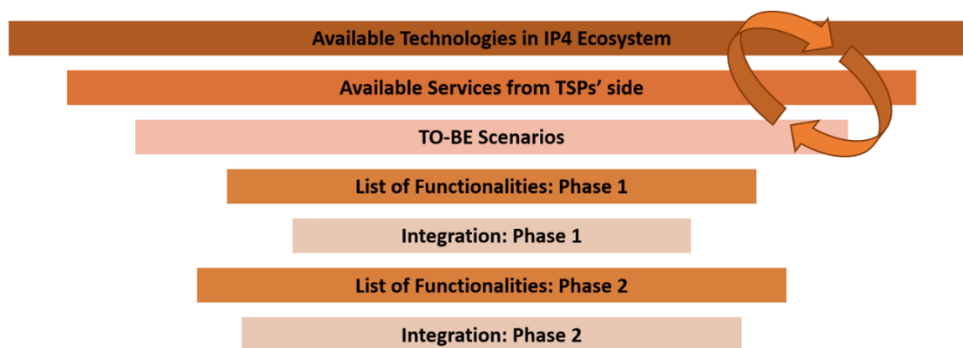
Additionally, this demo is supported by two technical partners [Sparsity Technologies](#) and [Mosaic Factor](#).

Currently, the PTA (Public Transport Authority) of Barcelona Metropolitan area (ATM) provides a reloadable card (i.e., T-mobilitat card), which may be topped up with multiple fare products depending on trip needs and affordability. Nevertheless, the users can still use the products/tickets of T-casual, T-mensual, etc. Furthermore, several Travel Companion applications are present in Barcelona Metropolitan area such as SMOU, TMB app, FlexiTransport app, Trànsit, MyTaxi, FREE NOW, etc. These apps have similarities and differences with the Travel Companion (TC) created by the Shift2Rail CFMs projects as mentioned above in section 3 and IP4MaaS project was devoted to the demonstration of the IP4 technologies and not to the differentiation of this

app with other existing apps. Nevertheless, the demonstration aimed to enhance the TCs ecosystem with a new proposal combining transport on demand and public transport to connect the city centre of Barcelona (zone 1) with the peripheral areas of zone 2. The demonstration runs the proposed developments in real areas that has the potential to prepare the MaaS eco-system deployment and market uptake. The rationale for the selection lies in the existence of multimodal transport for people on a daily basis and the lack of an optimal scheme of connections between them to improve the overall performance of the transportation system.

## 6. Phases

Barcelona’s demo, as mentioned in D4.1, followed the filtering methodology like all the demo sites of the project with the slight difference of an iteration to align the activities with the addition of a new TSP (FlexiTransport) later on during the project (i.e., not planned from the beginning) as shown in Figure 2. Social Car due to internal issues (i.e., lack of resources, business policy) could not provide available services to the CFMs to be integrated in the IP4 ecosystem and was involved in the demo not as a TSP to be integrated but rather as a supporting partner for the demo leader.



**Figure 2: Filtering methodology for Barcelona demo site**

The activities of Barcelona demo site were planned for the 2<sup>nd</sup> phase of the demos and more specifically from **5/6/2023-12/6/2023**. Being Barcelona the last planned demo in IP4MaaS project, it had certain advantages and disadvantages. The main advantage was that it was possible to use the lessons learnt from the other IP4MaaS demos and that the Travel Companion features were already tested more times internally. The main disadvantage was that delays in integration of TSPs services or due to other reasons could put at risk the demo execution.

The stakeholders’ (TSPs) tasks were to provide the necessary documentation and facilitate the integration of their services to the IP4 ecosystem. This process required various iterations and a continuous communication and testing between the TSPs technical team, IP4MaaS integration team and the CFMs.

Like all demos of IP4, Barcelona's demo activities were split in the following way:

## 1. Preparation phase

*Scope:* This phase aimed to enable the dialogue between the stakeholders (CFMs and TSPs), involve the Committees (i.e., integration, data and management) and the demo leaders, examine the tasks in detail, identify risks and prepare the technology integration process. At this stage the Committees (Integration, Data and Management) have the duty to facilitate the exchanges of information, ensure everyone is up to date, all exchanges are clear and conducted in a timely manner among all partners and CFMs involved.

More specifically, below the list of the activities that were part of the Barcelona preparation phase can be found. The most significant ones i.e., User Engagement Strategy, selection of Travel Companion Functionalities for the Barcelona demo, as well as internal testing and trainings and focus groups are described in more detail in the following sections.

The Barcelona's demo preparation phase consisted of the following activities:

- Regular coordination calls/meetings between the demo participants
- Task division between demo leader and TSPs
- Creation of User Engagement Strategy and modification of the User Engagement Strategy to align it with the finding of the other demos and the technical developments.

*What went well?* The Committees helped the demo leaders to understand the requirements of integration and data and facilitate the communication with the CFMs.

*What can be improved?* Identification of common requirements per type of TSP and definition of the obstacles based on different categories such as technical, regulatory, business logics, etc. to assist the faster and more efficient integration of new TSPs of different countries.

## 2. In-house development & Administrative tasks:

*Scope:* This phase is more technical and includes some preparatory development activities from both CFMs and TSPs to facilitate the technology integration. Administrative tasks that need to be done simultaneously are also included in this phase. The Asset Manager is to be kept up-to-date and all technical requirements of each component to be assessed and fulfilled for these components to be integrated later and, in the end, demonstrated in the respective demo sites. More specifically, in Barcelona this was particularly true as FlexiTransport was included in the demo and Social Car role was revised after the official amendment n.1 of the project. Furthermore, updates and follow ups occurred in order to

keep all material delivered to CFMs up to date to prepare and run the demo (some of the files had an expiration date).

*What went well?* Asset Manager worked as a files' repository.

*What can be improved?* The access to the Asset manager should be granted to the TSPs to manage the updates of their own files.

### 3. Integration & Administrative tasks:

*Scope:* This phase aims to monitor the progress of the technology integration plan, facilitate the communication, data exchange, and coordination between CFMs, demo leaders, and TSPs, maintain and update a technical activities' backlog and resolve any integration problem that may arise.

*What went well?* Most of the initial functionalities planned to be tested were integrated.

*What can be improved?* CFMs should give more time to integration. The time planned for integration ended being quite short, so it is recommended to extend it in the future to have a reasonable integration window that can allow the mitigation of the effects of potential delays.

### 4. Testing:

*Scope:* This phase aims to test the usability of the technologies that have been integrated, identify potential issues, and resolve them at an early stage, ensuring the smooth execution of the demonstrations. At first, the CFMs will conduct tests by using the test cases the demo sites have provided and resolve issues that may arise. Then the first .apk of the Travel Companion will be provided for the demo leaders and TSPs to test, provide feedback, and report bugs via a platform the CFMs will provide to assess and resolve. Then the final .apk of the app will be provided for the demo site partners to conduct tests and ensure that this final version is functioning correctly prior to distributing it to the public to use during the demonstration.

*What went well?* The MANTIS platform (it is a platform to monitor software development and report issues which promotes collaboration within different technical teams) is a useful tool to report bugs and enhance collaboration between the TSPs of IP4MaaS and the CFMs.

*What can be improved?* More time and effort should be dedicated to the bug-fixing during the internal tests.

## 5. Demo preparation:

*Scope:* This phase includes all the activities required before the demo execution: the user engagement, the delivery of the application to be used (.apk), along with User Guide and Terms & Conditions documents, the exact planning and timeline of the activities, and the preparation of the questionnaire for the participants, end users and TSPs alike. During this phase, a checklist is being compiled and checked regularly within meetings with WP4 and WP5 Leaders, the respective demo leader, and TSPs for each demo site.

*What went well?* The experience and lessons learned were valuable to set up the demo of Barcelona. The checklist used in each demo preparation phase assisted to track and order the activities performed (please also refer at section 6.3). Additionally, cooperation with AITEC in preparing and translating the USI questionnaire for Barcelona worked well.  
*What can be improved?* TSPs could be more active in preparation activities.

## 6. Demo execution:

*Scope:* This phase includes the demo execution activities and the data collection that will be used in WP6 for the assessment of the demonstrations. The Travellers and TSPs USIs are to be filled in and collected, the data to be stored during the demos in the CFMs' repositories; at the end of the demonstrations, the incentives are to be provided to all engaged end users that participated and provided their feedback via the USI questionnaires.

*What went well?* The coordination between different WPs of IP4MaaS during the demo execution.  
*What can be improved?* More time is needed for the demo execution, as one week does not allow volunteers to highly interact with the app.

## 6.1 Demonstrated functionalities

During the demonstration of Barcelona, the version 156-demo was tested and Table 1 shows the functionalities per TSP<sup>1</sup> that were demonstrated.

**Table 1: Functionalities planned and demonstrated in Barcelona’s demo site**

ID	IP4 Technologies	TMB	BusUp	AMTU (FlexiTransport)
1	Journey Planner/ Offer Builder	√	√	√ <sup>2</sup>
2	Booking	×	√	×
6	Validation and Inspection	×	√	×
10	Navigation	√	√	×
11	Travelers’ feedback	√	√	√
12	Trip sharing	√	√	√
15	Travel companion Web-Portal	×	√	×
16	Guest user	√	√	√
17	Preferences and Profiles	√	√	√
20	Travel Companion for Kids	×	√	×
21	Asset manager*	√	√	√
P1	Digital Onboarding	√	√	√
P5	New functionalities Web Portal (Payment, Registration with Gmail, and Purchase Mobility Packages)	×	√	×
P6	New functionalities CMMP (Manual inclusion of Products and new registration process)	√	√	√
P8	Collaborative Space (Traveler)	√	√	√
A1	Trip Planning Hierarchy	√	√	√
A5	Improved Intermodal Travel	×	×	√
A6	Improved Travel Shopping	√	√	√
A7	Individual Last Mile	×	√	√

The following paragraphs present in more detail the functionalities of the Travel Companion accompanied with some screen shoot to provide a visualization of the demo app.

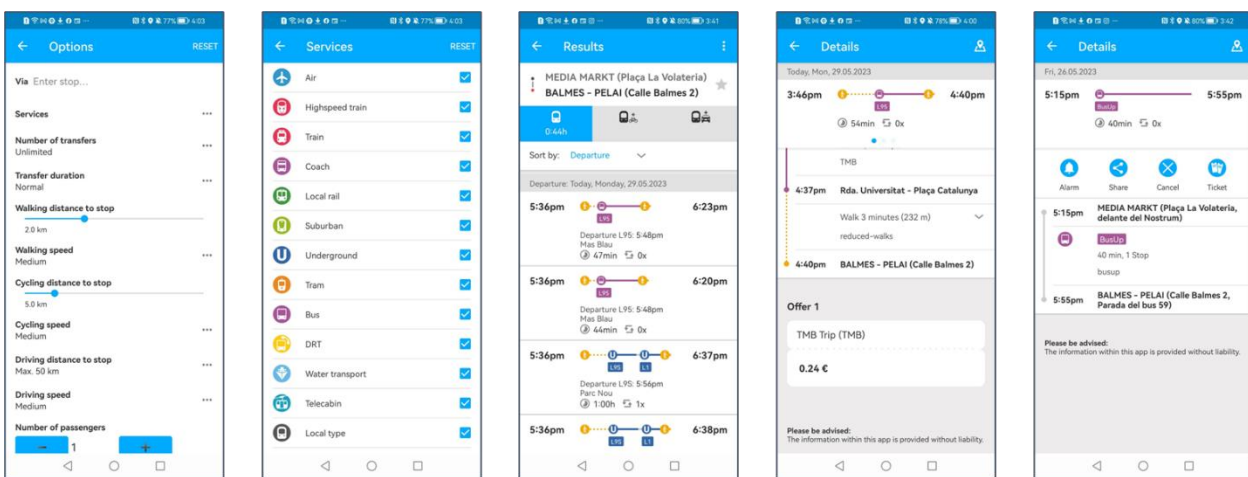
[1] **Journey planner / Offer Builder:** Calculates multimodal routes from origin to destination, these

<sup>1</sup> Social Car did not provide adequate information to allow its services to be integrated in the IP4 ecosystem.

<sup>2</sup> Although all the necessary documentation was provided for the integration of this FlexiTransport services due to lack of time and resources this functionality was not demonstrated for FlexiTransport.



routes can include offers price calculation. This functionality is one of the most crucial functionalities of the Travel Companion as it provides the basis for all the other functionalities. For the integration of the TSPs different documentation was required; for public transport (i.e., TMB) GTFS and for the shared mobility TSPs (i.e., BusUP, Social Car and FlexiTransport) the following 3 documents and connection of services i) Service Areas (multi-polygon GeoJSON) ii) Journey planner web-service (API), iii) Web-service providing fares (API). For the offer builder the pricing of the TSPs services was necessary. The screenshots in Figure 3 present the different options provided to the traveller to identify the best transport mode combination and therefore itinerary based on his/her preferences.



**Figure 3: Journey planner / Offer Builder screens**

[2] **Booking:** Booking of all online payable parts of an offer. Nevertheless, not all TSP/products requires a booking, for example urban offers do not require a seat reservation such as the services of TMB. However, BusUP has a booking service in order to make sure that the employees of BusUP clients (companies that require transfers of their employees) are the ones boarding the BusUP vehicles. For this functionality a Web service allowing booking had to be provided by the TSP. More specifically, BusUP offers its service, and it confirms the booking with the creation of a QR code (Figure 4) with should be presented at the validation process.



**Figure 4: Screenshot of the QR code created after the booking of BusUP**

[6] **Validation and Inspection:** Ability to validate and/or inspect travellers' tickets. BusUP tests allowed the validation and inspection with the validation app of the respective buses.

[10] **Navigation:** Provides guidance on the traveller's trip. The app shows the position where the traveller should be according to trip schedule Information provided for example Stops/Time till arrival, arrival, next departure time, ..."

[11] **Travelers' feedback:** It allows the traveller to report situations around him. These situations can be delays, a crowded station, broken equipment, etc. as shown in Figure 5.

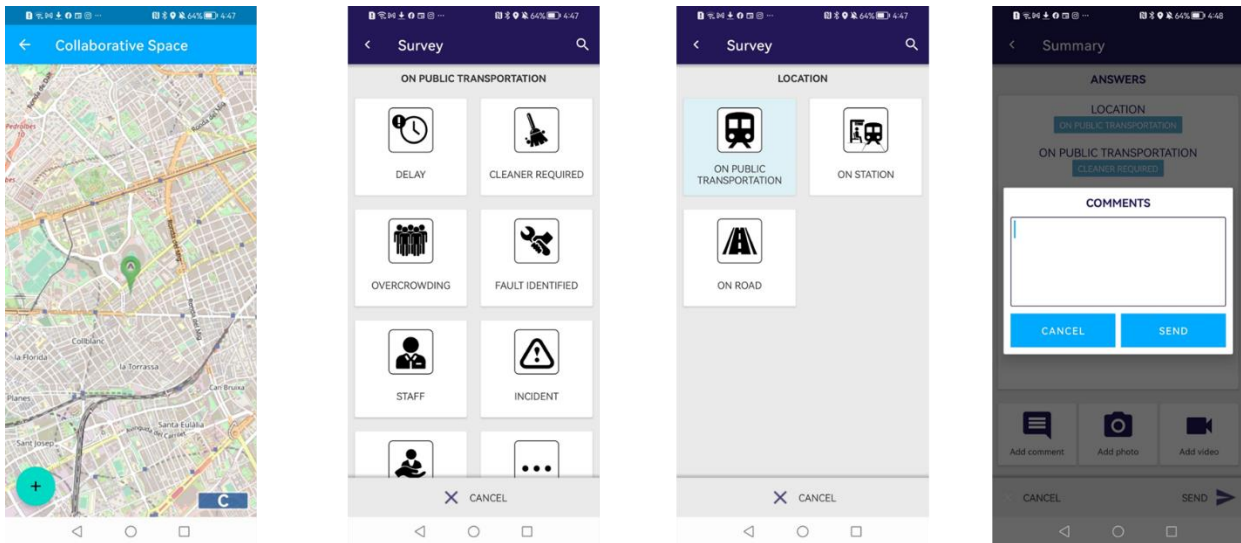


Figure 5: Screens of travellers' feedback

[12] **Trip sharing:** It allows the traveller to share a trip with another user. One prerequisite of this functionality is that both users are registered.

[15] **Travel companion Web-Portal:** Allows the traveller to use Journey planning, booking and issuing functionalities on web-portal (<https://public-client.shift2railcloud.com/>). In other words, it is the web version of the Travel Companion application (Figure 6).

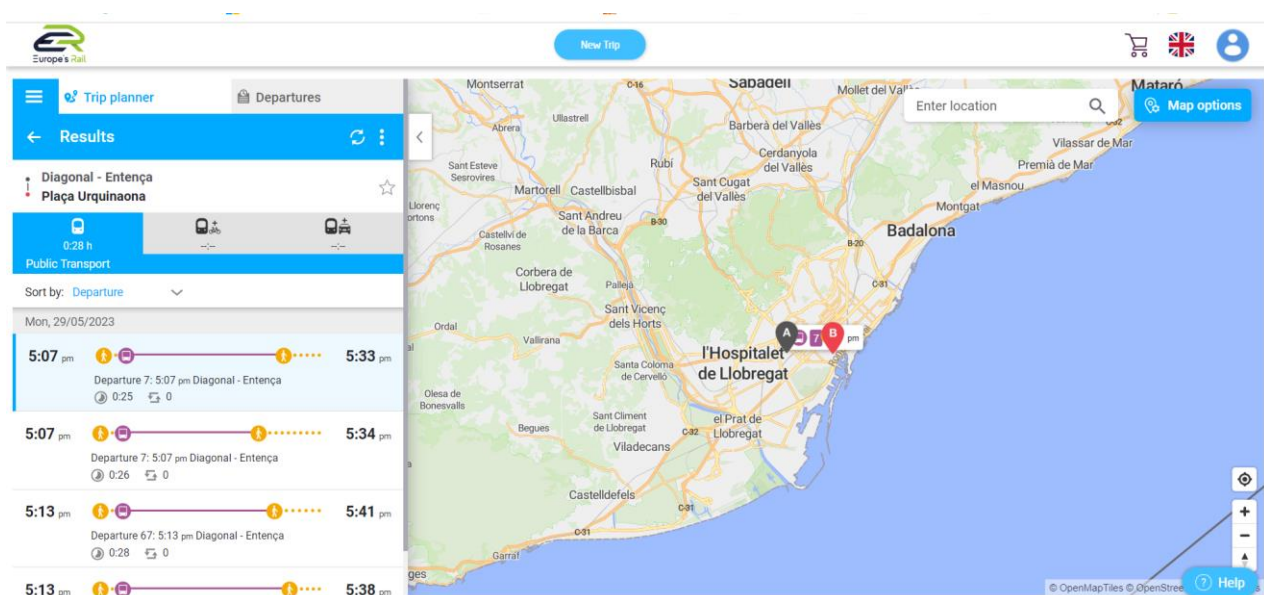
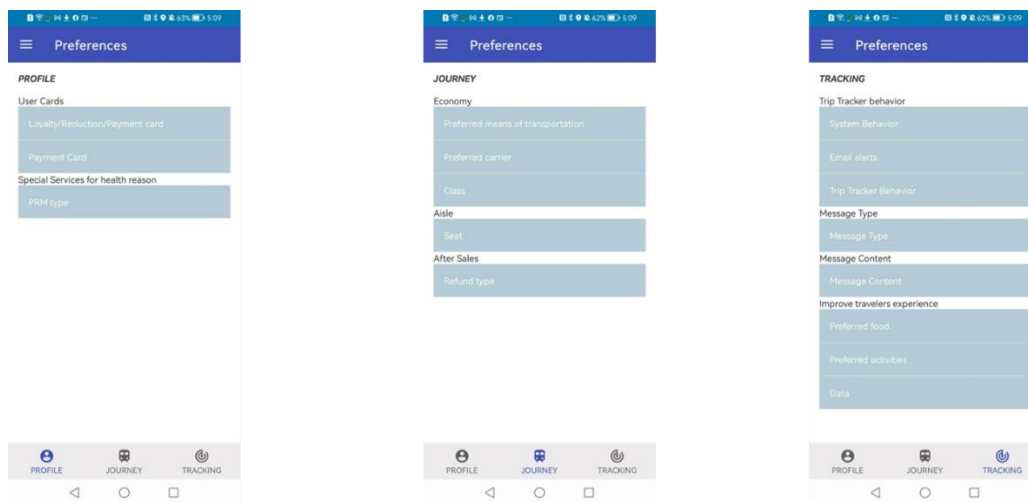


Figure 6: Screen of Travel Companion Web -Portal

[16] **Guest user:** It allows a TC user to use limited functionalities of the personal application without the need for registration.

[17] **Preferences and Profiles:** It provides different travel preferences to the users, having the chance to have different set of preferences for each profile (Figure 7).

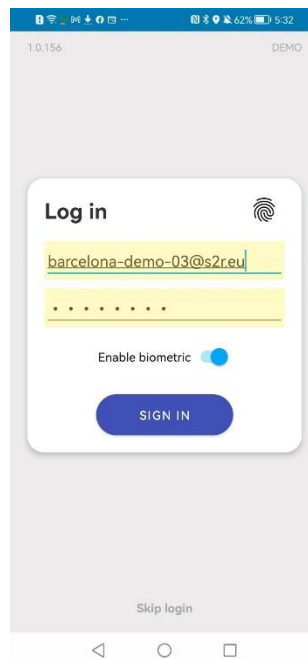


**Figure 7: Screens of preferences and profiles**

[20] **Travel Companion for Kids:** It has a child-oriented User Interface- UI, reduced functionality, account free usage, only Shopping; no Booking/Issuing functionality is included, easy Shopping feature (e.g., predefined destinations), navigation without map and most importantly a “get help” function.

[21] **Asset manager:** It allows the TSP to insert and describe their web-services. It is a platform to provide and describe the services and facilities in the IP4 platform and identify the integration of these services in the IP4 ecosystem.

[P1] **Digital Onboarding:** A functionality allowing the user to register by using biometrics such as fingerprint (Figure 8).



**Figure 8: Screen of Digital Onboarding:**

[P5] **New functionalities Web Portal** (Payment, Registration with Gmail, and Purchase Mobility Packages)

[P6] **New functionalities CMMP** (Manual inclusion of Products and new registration process. CMMP allows the TSP to describe product that can be added to mobility packages. Also, it allows the TSP to propose new mobility package to other stakeholders.

[P8] **Collaborative Space** (Traveller): Travel companion app component that allow the traveller to see reports that have been done by another traveller or TSPs around him. He/she will be able to comment, validate/reject or add media to the reports (see Figure 5)

[A1] **Trip Planning Hierarchy** - Adding a hierarchy for the presentation of the increasing variety of results in intermodal trip planning (e.g., by transport mode or TSP)

[A5] **Improved Intermodal Travel:** To improve intermodal travel solutions calculated by the Travel Shopping, it will enable private transport to be the main part (in the middle of) the travel solution.

[A6] **Improved Travel Shopping:** It will find trips and offers according to multiple criteria Pareto-optimization.

[A7] **Individual Last Mile:** Individual trips of user will be enriched by the existing router for individual transport (walk, bike, car) to serve the first and last mile for an end-to-end travel experience. Improved Travel shopping

## 6.2 User engagement strategy

The User Engagement Strategy for Barcelona demo was mainly focused on the selection of the target groups of testers, defining communication channels and recruitment process as well as selecting proper incentives that would encourage active participation and delivering the filled in USI questionnaires.

Barcelona's engagement strategy has threefold.

- i) Volunteers attracted by the social media announcements.
- ii) Volunteers visiting UITP summit and final event of IP4MaaS
- iii) Focus group of Barcelona demo

To attract expert users/travellers, the demo team took advantage of the UITP Global Public Transport Summit, the biggest worldwide event dedicated to public transport. Finally, to have more detailed feedback a focus group was organized for testing the application with a restricted and more focused group of users.

The first and second group of volunteers was provided with an incentive of a T-casual ticket that includes 10 trips for the Barcelona area (zone 1) excluding the airport. The participants to the focus group were given a T-casual and additionally a 2-person entrance for the Telefèric (cable car) of Barcelona (Figure 9).

In all cases, volunteers have been provided with concrete guidelines i) to download the application and ii) to test it and iii) know their incentive procedure for participating in Barcelona's demo. These guidelines are presented in Figure 10, based on the lessons learnt by the other demos the volunteers want to:

- 1) Be able to download the app without having to open many different files.
- 2) Have simple instructions on how to open an .apk file.
- 3) Have in front of them their credentials and do not have to open an email as having two screens on the same it is not preferred.
- 4) Have an easy access to the questionnaire and answer it as soon as they finalized the testing of the app (at least to complete one itinerary).

These guidelines were distributed in different ways to the volunteers, and they were translated in Spanish and Catalan to attract more volunteers. All volunteers had access to the TC manual, however as most of the volunteers of the second and third category followed the IP4MaaS-Extensive-CONNECTIVE (Final Event) projects' presentation, they had sufficient information concerning the functionalities of the app.



**Figure 9: Focus group compensation material**



## Barcelona Demo Guidelines


**How to install the app?**

- Open APK files

Opening an Android app on your Android device just requires that you download it like you would any file, and then open it when asked. However, APK files installed outside the Google Play Store might not install right away because of a security block put into place. To bypass this download restriction and install APK files from unknown sources, navigate to one of these menus depending on your Android version:

*Settings > Apps > Special app access > Install unknown apps*  
*Settings > Apps & notifications > Advanced > Special app access > Install unknown apps*  
*Settings > Apps and notifications*  
*Settings > Security*

- Scan this QR code:




**How to participate at the demo of Barcelona?**

- Register by using the following credentials and enjoy your journeys!

<b>Username:</b> barcelona-31@ip4maas.eu	<b>Password:</b> BCNip4maas31
--	-------------------------------

- After conducting one or more itineraries answer the IP4MaaS USI questionnaire



IP4MaaS – GA 101015492

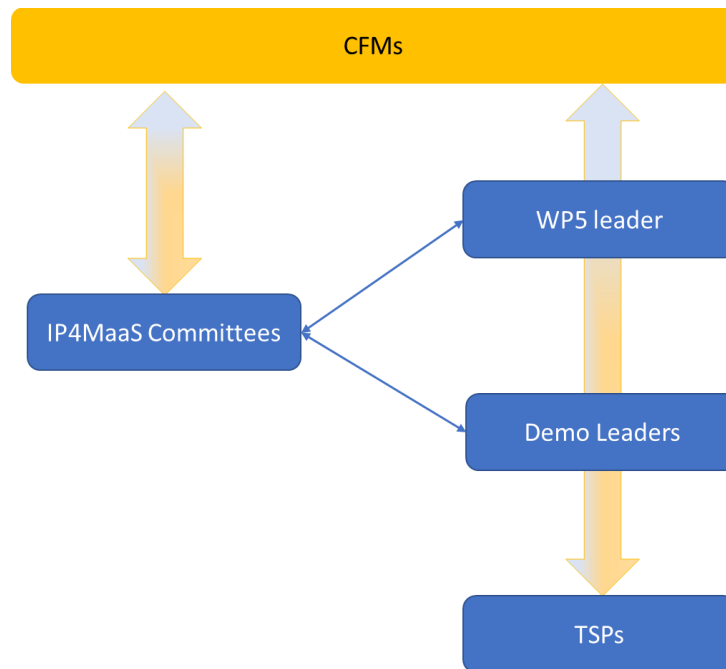
**Figure 10: Guidelines for downloading and testing the app**

### 6.3 Internal coordination

As mentioned in section 5, Barcelona demo was composed by four TSPs supported by two technical partners. Additionally, it was necessary to coordinate the internal activities of the demo preparation with the activities of the project and the activities of the other demos for two reasons: i) to optimize resources and ii) to allow the smooth integration of technologies into the IP4 ecosystem. For this reason, the coordination followed the scheme shown in Figure 11. **Both IP4MaaS committees and the coordination performed by the WP5 leader were crucial for the success of the demos.** The WP5 leader organized a monthly meeting with all demo leaders to discuss and align the demos activities. Additionally, three months before the execution of the demo a weekly meeting was organized between WP5 leader and the demo leader (i.e., Sparsity).



Furthermore, the demo leader organized six meetings with all the TSPs of Barcelona and several ad hoc meetings to tackle specific issues on the integration or for the organization of the focus group, etc. Finally, several meetings were organized with specific TSPs and the CFMs for providing clarifications for the integration of the TSPs and the technologies provided by the IP4 ecosystem.



**Figure 11: Internal coordination scheme for Barcelona demo**

Apart from the calls and the emails exchanged between the actors presented in the previous figure, a checklist assisted the internal coordination. This checklist was updated with high frequency (almost daily) by the demo leader. It contained activities from all the phases presented in section 6. The final checklist of Barcelona’s demo contained more than 60 lines/activities detailing the priority, the responsibility (partners involved), and the status of each one, that have to be performed to finalize this demo. The following figure (Figure 12) presents an example of Barcelona’s check list to show the detailed follow up of the demo’s activities.

Check-list - Barcelona demo site 05.06.-16.06.2023						
Task	Priority	Deadline	Status	Responsible partner	Comment	
1 BusUp integration (Shopping)	High	19/5/2023	Completed	INDRA	New GTFS sent on 10/3 by BusUP, mail under title of IP4MaaS_feedback on the app from BCN partners, GTFS data set causing errors	
2 Issue with the API	High	4/5/2023	Completed	INDRA-BusUp	Issue reported by INDRA 27/4. BusUP answered 27/4 that they will look at it 27/4. Kind reminder of BusUp on 3/5.	
2.1 new issue with API of Busup	High	12/5/2023	Completed	INDRA-BusUp	Meeting on the 9.05	
2.2 check if the QR code for BusUP works	High	30/5/2023	Completed	INDA-BusUP	Tested and worked	
3 Update GTFS or TMB	High	5/5/2023	Completed	HACON	Reminder to send the link to update the GTFS date by HACON on 24/4/2023, action was taken by TMB 26/4/2023. GTFS of TMB are regularly updated at the portal that is publicly available <a 2"="" href="https://developer.tmb.cat/data?_gl=1*txiq9*_ga*MTY1Mzk0ODMxNj4xNjc0NTY5Njcw*_ga_V8YKKTJ445*MTY4MzAyNTQ2MC4xNj4xLjE2ODMwMjU0NzAuM C4wLjA. Matthias confirmed (2/5) that they are ok.&lt;/a&gt;&lt;/td&gt; &lt;/tr&gt; &lt;tr&gt; &lt;td&gt;4 FlexiTransport integration&lt;/td&gt; &lt;td&gt;High&lt;/td&gt; &lt;td&gt;19/5/2023&lt;/td&gt; &lt;td&gt;Completed&lt;/td&gt; &lt;td&gt;INDRA&lt;/td&gt; &lt;td colspan=">analyzed</a>	
4.1 FlexiTransport issue in integration	High	30/5/2023	Ongoing	INDRA	Reported by INDRA on 26/5	
5 To prepare test cases for CFMs	High	28/4/2023	Completed	SPA	Use cases were sent to CFMs and were updated also.	
6 To confirm the final list of functionalities to be demonstrated	High		Completed	SPA		
7 TC translation and multilanguage (Spanish and Catalan)	High		Ongoing	SPA		
8 To determine the final version of user engagement strategy	High	5/5/2023	Ongoing	SPA	Write it down in deliverable	

**Figure 12: Example of Barcelona’s demo checklist**

Responsibilities of demo partners:

- **Sparsity Technologies**– Barcelona demo leader – coordination of all demo’s preparatory activities, supervision over preparation, preparation of all relevant project documents, necessary translations, publishing information about Barcelona demo, purchase of incentives, internal testing, cooperation with CFMs, distribution of incentives
- **Transport Service Providers (TSPs)**– support, feedback and active participation in Barcelona demo preparatory activities, revision of prepared documents, publishing information about Barcelona, purchase of incentives, internal testing and providing feedback about the Travel Companion application to the demo leader. More specifically, TSPs had to check if the integration of their services was correct and provide relevant feedback and also conduct bilateral technical meetings with the CFMs to reassure the smooth integration of their services.

## 6.4 Internal testing

The internal testing for the Barcelona Demo took place between 29-05-2023 and 2-06-2023. Nevertheless, after the communication and agreement with the CFMs, Barcelona’s partners tested also earlier version before the aforementioned dates. At least 2 persons from each team member downloaded and test the application with special focus on the functionalities selected for Barcelona demo. The provided feedback including description of the issues, screenshots, and screen recordings to the demo leader, who was responsible for reporting all issues through the Mantis bug reporting tool and for communication with the respective CFM representatives.

The reporting of the issues was kept open during the demo execution as well as right after the demonstration, when final feedback was provided to the CFMs due to the fact that some of the testers provided additional feedback after the demonstration.

The internal testing phase reporting comprised several issues, the most significant are listed in the

table below (Table 2). It is important to mention that most of the issues identified has been closed either as solved or closed as suspended to be solved at the following versions of the application.

**Table 2: Travel Companion’s issues identified during internal testing.**

WD internal testing TC app issues reported				
No.	Issue	Description	Significance	Issue status
1	<b>General TC app issue</b>	The TC app doesn’t open or respond after an itinerary creation	critical	Occurred multiple, closed as solved
2	<b>Logout issue</b>	Sometimes, it is impossible to log out from the TC app	high	Closed as suspended – to be improved
3	<b>Journey Planner issue</b>	Certain itineraries appeared as unknow lines	critical	Close as solved, parts of the data bases were deactivated as another demo of IP4MaaS was running in parallel to have a more stable environment
4	<b>Journey Planner issue</b>	The alarm for planned journey doesn’t send push notifications	low	Closed – the reason for the issue is that the notification are related to disruptions
5	<b>Journey Planner issue</b>	Recommendation for taking a bike was not rational	low	Closed as not needing attendance – the TC app prioritises bike with a certain algorithm.
6	<b>Journey Planner issue</b>	Long connection search time	high	Closed as improved
7	<b>Saved/Shared Trips issue</b>	Saved or shared trips can’t be cancelled – the full history is displayed	low	Closed as not going to be solved
8	<b>Digital onboarding issue</b>	The title of BusUp was the same displayed for all passengers	high	Closed as solved
9	<b>Traveller’s Feedback issue and collaborative space</b>	The difference between these two tabs is not obvious	low	closed as suspended – to be improved in the next TC versions
10	<b>Navigation issue</b>	Navigation is not taking into account the position changing of the traveller	high	closed as suspended
11	<b>Interface issue</b>	Mix of languages in different tabs	low	closed as suspended – to be improved in the next TC versions

## 6.5 Training session(s)

Tester training activities for Barcelona's demo site were the following divided in TSP oriented (section 6.5.1) and travelers-oriented trainings (sections 6.5.2 and 6.5.3).

### 6.5.1 Contractual Management Market Place (CMMP) online training

CMMP is a system that provides the travel service provider with an intuitive tool through which they can communicate with other suppliers to provide common agreements and common package offers composed of products from one or more suppliers.

The web application is aimed at Travel Service Providers, distributors or a user who performs both functions. The distinction so far is that the distributor is not required to have its own products to make a package offer involving other suppliers. The process to use the application is easy. First, you must register in the system, once registered you can choose between agreements, packages and products.

Barcelona's TSPs were interested in testing the CMMP, hence the corresponding partner from the CFMs provided access and material (a video and a user manual). The TSPs made several trials but although the material was complete and the steps quite clear, they encountered significant difficulties. Therefore a 2h online training session was organized on Tuesday 16th of May. This session allowed the TSPs to see the functionalities of the CMMP and also to identify the gaps in order to be able to create the mobility packages. On the other hand, the TSPs provided feedback at the representatives of CFMs (i.e., INDRA) to improve the tool. The results of this training are presented in the following section Evaluation phase and results.

### 6.5.2 UITP summit presentation

Taking advantage of the conduction of UITP summit in Barcelona, a presentation of IP4MaaS Barcelona's demo was performed during the "Innovation in the Spotlight" session on June 5<sup>th</sup>, to launch the activities of this demo. A short training session followed as after the presentation the demo leader allowed the audience to download the app and interact with it, due to the latter could be considered as a mini training. The demo was also presented during the project final event in Barcelona on June 6<sup>th</sup>.

### 6.5.3 Barcelona Focus Group

Considering the lessons learned from the previous IP4MaaS demo. the Barcelona demo group decided to emphasize the organization and execution of a focus group of travelers to get detailed and more direct feedback. Most of the demos had feedback from the USI which gives a good indication of the various issues affecting the TC, however it does not allow the end users to provide suggestions, to elaborate on the issues encountered in a direct way to the development team. Furthermore, the focus group organization used the ADDIE (Analysis, Design, Development, Implementation and Evaluation) model which is the classic 5 step model of instructional design. This approach is used to build effective learning solutions and it is often "borrowed" to workshop and focus groups designing. Hence, this approach was adjusted to the needs and the means of IP4MaaS, but all the steps presented in Figure 13 were considered.

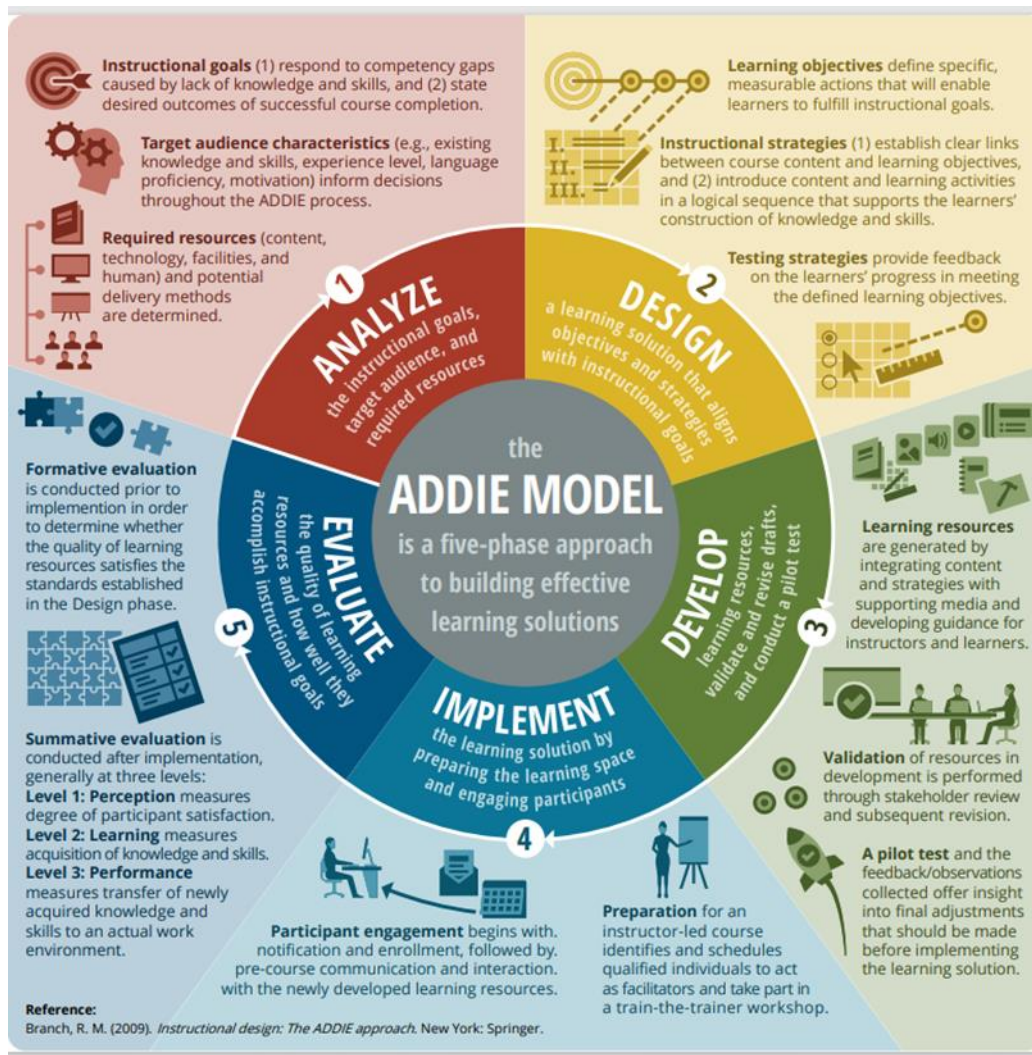


Figure 13: ADDIE model (Branch, 2009)

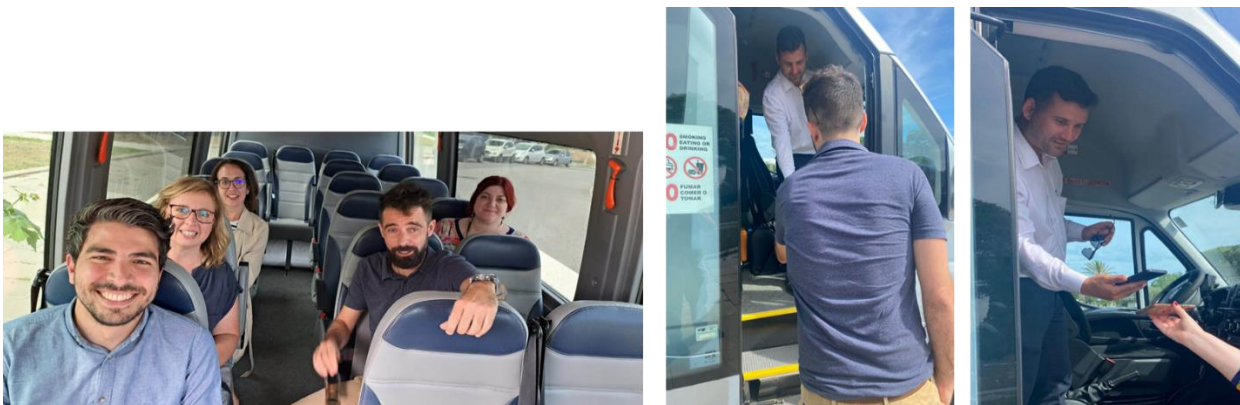
The selection of the focus group participants followed some criteria to fulfill the following aspects: gender equality, age diversity and familiarity with application and technical background. The CFMs have prepared a presentation on the functionalities that were presented for testing in Barcelona demo site (see also section Demonstrated functionalities). The representative of the CFMs presented one functionality and then allowed the 13 participants to test it, assist them if it was necessary and note down issues and suggestions of the participants. The focus groups feedback is described in section Evaluation phase and results.





**Figure 14: Screenshots of Barcelona’s focus group**

After these 3h intensive hours of training the participants were given a T-casual to use the public transport and provide their feedback at the USI questionnaire. Additionally, a smaller number of people tested in the same afternoon BusUP integration. This special test was organized as BUSUP is a private TSP and its routes are not open to the general public and due to legal issues, a contract with another company that uses the services of BUSUP was complicated to alter.



**Figure 15: Screenshots of Barcelona’s focus group for BUSUP**

## 7. Pilot execution

### Dates of the Barcelona demo:

The Barcelona demo took place between 5<sup>th</sup> and 9<sup>th</sup> June 2023.

### Functionalities tested:

The functionalities tested are displayed in the table in the section 6.1 “Demonstrated functionalities”.

### The area coverage:

The demonstration covered the whole area of operation of the first zones and many of the second

zones due the services of BUSUP and FlexiTransport.

**Testers:**

A small number of testers (31) was achieved in Barcelona for volunteering due to the specification of downloading the application. Therefore, Barcelona team aimed to have more detailed feedback from the focus group testers.

**Communication:**

The communication between the testers and the volunteers was done directly to the CFM representative during the focus group and the other testers were able to send their feedback to Barcelona's demo leader.

## 8. Evaluation phase and results

The Barcelona Demo site has proven a source of valuable insights and feedback not only to the IP4MaaS project consortium but also to the Travel Companion application developers (i.e., CFMs). The design and execution of the Barcelona activities and, most importantly, the feedback received from the testers of the focus group, have brought results that can be considered important lessons learned and a set of guidelines in future activities and further developments for the IP4 technologies. The following paragraphs cluster the lessons learnt based on the different steps executed to fulfil the activities of T5.2.

**Lessons Learned regarding the design of the demonstration:**

- Design of procedures to use the mobility services; due to the enriched Travel Companion functionalities, new procedures may be required. The new procedures should be well discussed with TSPs and their key personnel. The requirements of integration should be clear from the beginning not only from a technical perspective but also from a business and legal perspective.
- The registration procedure and feedback needs to be re-designed to get more insights from the testers.
- The actual costs of the mobility services during the demonstrations should be thoroughly explained and clarified to the engaged users, to ensure their participation and avoid misunderstandings that could prevent them from using the application. (This was one of the issues that we faced with BUSUP and FlexiTransport services usage in the demo. As the payment method was not clear we couldn't engage many users.)
- Clear and encouraging incentives also are a key in engaging users.
- The testing of private TSPs services needs to be aligned with the business perspective and legal aspects which pose hard requirements. For example, the BUSUP lines serve specific lines and BUSUP has specific contracts with private companies, modifying these contracts in order to perform testing is was impossible although BUSUP tried it from the very

beginning of the project. BUSUP contacted at least 10 private companies to check with them if the demo could be facilitated by them, but none provided a positive answer although the modification of the day-to-day commuting was slightly altered (i.e., to download the app of the CFMs).

- Onsite trainings and workshops are more effective than online dissemination and engagement of users.
- Users that have experience in the transport network are preferred for such demonstrations.

#### **Lessons Learned regarding the preparation of the demonstrations:**

- The technical environment is essential to be stable, regarding APIs, GTFS/NetEX data, etc.
- Exhaustive testing of the app before distributing it to the testers is a key factor of success.
- Integration of technologies should be tackled weeks before the demo launch to avoid last minute issues and the smooth execution of demos.

#### **Lessons Learned regarding user management:**

- Users need less steps to download and use the app in an easy way.
- Terms and Conditions should appear at the registration and the user should had the right to accept or deny. So, Terms and Conditions can be made more visible in the app.
- Continuous technical support to the TSPs and the traveller during the demonstration is of essence.

#### **Lessons Learned regarding the questionnaires:**

- Future surveys should be possibly even more customized for each demo site, and shorter.
- The questionnaire should be possibly integrated into the app so the traveller could answer it on the spot.

#### **Lessons Learned regarding the focus group.**

##### ***General***

- Downloading the application with an apk was an issue even for the group that had assistance. It is recommended to simplify the download procedure.
- Using a pre-defined set of credentials (shared with users before the demo, to comply with GDPR and do not input any personal data in the ecosystem) risked confusing the testers.
- The app has a lot of features but the fact that they are not all developed gives a bad impression to the testers.
- The app many times has a slow response to propose itineraries.

##### ***Per functionality presented and tested***

- Identification: it is not nice to show "null" in fields (  Figure 16)





**Figure 16: Identification**

- **Preferences:** It is nice that the user has many options to choose. In the section journey→ preferred carrier BUSUP is not appearing although its services were integrated.
- **Trip planner:** many issues have been identified. The most important ones are the following:
  - The search engine offers many options, and some do not correspond to the geographical area of the user which is confusing to the user (e.g., “plaza real Barcelona” see Figure 17).
  - There was one trip with identical legs but different walks for the first mile, one of them was very long and weird ( Figure 18).
  - Walking instructions were not clear, the app prioritizes longer walking because the departure time is earlier which seems not logical.



Figure 17: Search engine

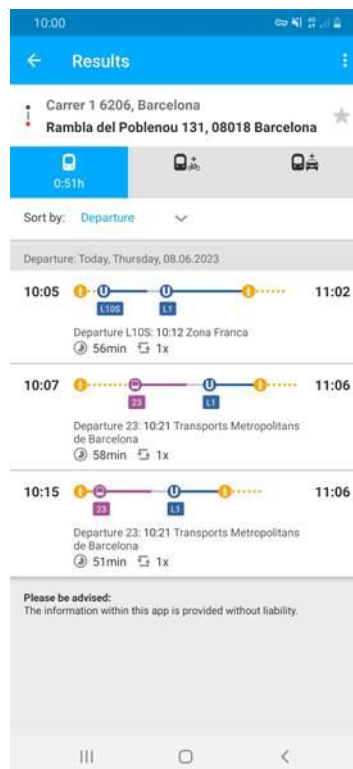


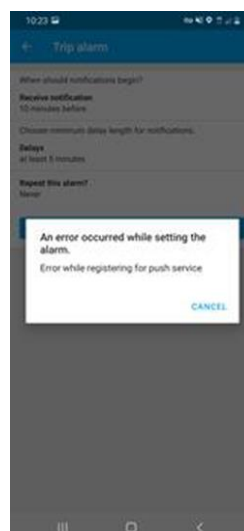
Figure 18: Similar options



**Figure 19: Walking integration issue**

- **Alarms**

- All the testers perceived the alarms as a notification/reminder to start the trip not as designed alerts to notify the traveler if a disruption occurs and with a certain frequency. Wording is misleading (rather understood as a reminder functionality)
- An error occurred trying to save the alarm.



**Figure 20: Error of alarm saving**

- **Report and Collaborative space**

- They are not intuitive.
- It is a nice idea but with difficult implementation from the point of view of the TSPs, who has the responsibility to correct the issues reported. How the issues are communicated to the TSPs and how it is communicated to the user that it is fixed.
- Open a window for “trolls”.
- It should be somehow supervised as people can write or upload any kind of photo.
- A proposal is that the system could have a “rating” of post trip.
- It is well designed in terms of interface.
- It could be used to value and perform analytics in different itineraries.

- **Map:**

- It does not present the names of lines of Bus and Metro (Figure 21).
- 



**Figure 21: Line names**

- **Navigation**

- The most mentioned issue during the focus group. Navigation should follow the location of the user and not the clock. The app is named “Travel **companion**”, so it should accompany the user during his/her trip “. Navigation should be based on actual position, not just on time.

## General

- Logout did not work.
- Locations close by should be put first (e.g., if location with same name exists in different cities)
- When user A shared a trip for which he has bought a ticket with user B, user B could also access the QR code/ticket.
- When returning from the trip planner via the Android back button, it was not possible to re-enter the trip planner without going to another menu entry and then again to the trip planner.
- Login: No option to make password visible to check if it is written correctly.

All the previous points/issues were reported to CFMs and elaborated by the testers accompanied with screenshots and brief descriptions. As Barcelona was the last demo site the CFMs did not have the time to resolve these issues but the provided input will be used in future projects for improving the IP4MaaS technologies. Hence, it is important to note that the testers did not only report issues, but also provided recommendations which can be a great added value as they reflect the needs and novel requirements for the TC. In other words, testers provided constructive feedback despite the complexity, or the imperfections of the TC and they were inspired during the focus group.

Finally, the thorough assessment performed allowed us to generate conclusions for both the integration of technologies, the collaboration with the CFMs and for IP4MaaS Barcelona demo site presented at the following section.

## 9. Conclusions

The goal of the Barcelona as part of the IP4MaaS project was to obtain and deliver feedback on the functioning and usefulness of selected functionalities of the TC application from its users, as well as to provide lessons learnt for MaaS future applications and the IP4 technologies created in the CFMs and the integration of TSPs into the ecosystem.

This report details the activities and the results of the integration of TMB, BUSUP, FlexiTransport and Social Car services into the IP4 ecosystem by the CFMs. During the integration process limitations concerning the business aspects (e.g., Social Car integration), legal aspects and provision of data (e.g., TMB and provision of booking and ticketing services, these services do not belong to TMB but to ATM), technical and time restrictions have been encountered. The latter was the most common issue and in future projects the CFMs need to consider that proper integration needs more time despite the on-time provision of information from the part of the TSPs. Furthermore, testing time was short and did not allow the technical teams to respond in a timely manner and consequently the same issues were encountered in different versions and demos of IP4MaaS.

Additionally, this report presents the design of the user engagement and the demo preparation activities. Users (especially commuters/workers, which was the target group of Barcelona demo) are not keen to use an application that is not mature even if they have incentives. The creation of pre-defined credentials to ensure GDPR along with the difficulty of downloading the application in an .apk form and the lessons learnt by the other demos, imposed requirements on the designing of Barcelona's demo. To overcome these challenges, a set of supportive tools and methods were used, such as QR codes, re-direction to other apps by providing a link, and support by the demo partners. Although these solutions worked in the context of the demo, they also prove the need of addressing MaaS challenges for building a competing mobility service that is reliable, satisfies user needs and improves accessibility for all users.

Furthermore, the Barcelona team decided to have a targeted focus group to get qualitative feedback for the TC.

Feedback from users showed that overall impressions of the demo were quite positive and that users understood the potential of the tool, but also critical, as quoted by one of them:

*"This MaaS application is a good idea, but it lacks maturity, and the user experience needs to be more elaborated as the competition with other apps is big".*

Barcelona's demo faced some challenges, but the lessons learnt were valuable towards the orchestration of individual mobility offers and services in one seamless journey, including urban and peripheral areas. Finally, Barcelona Metropolitan area wants to foster the integration of traditional and innovative on-demand transport services, that can provide the level of flexibility to the public transport needed to provide both a better service while reducing the exploitation costs and IP4MaaS was a window of opportunity to implement and test such integration. The TC has a room for exploitation after duly analysed its functionalities and the complex ecosystem of IP4.

## 10. References

1. Branch, R, M. (2009), Instructional design: The ADDIE approach. New York: Springer
2. IP4MaaS project, “Deliverable D 3.1 List of operational KPIs, analysis of the users’ satisfaction and methodology as a whole, C-REL,” 2021.  
<https://doi.org/10.5281/zenodo.6685640>
3. IP4MaaS project, “Deliverable D 3.2 List of operational KPIs, analysis of the users’ satisfaction and methodology as a whole, F-REL,” 2022.  
<https://doi.org/10.5281/zenodo.7566160>
4. IP4MaaS project, “Deliverable D 6.2 TOOL FOR PERFORMANCE ASSESSMENT,” 2022.  
<https://www.ip4maas.eu/>.

## 11. Appendices

### 11.1 Barcelona Rail Maps

The letters in front of the number of lines mean:

- L for local, or metro-like, lines;
- S for suburban lines
- R for regional lines
- T for tram

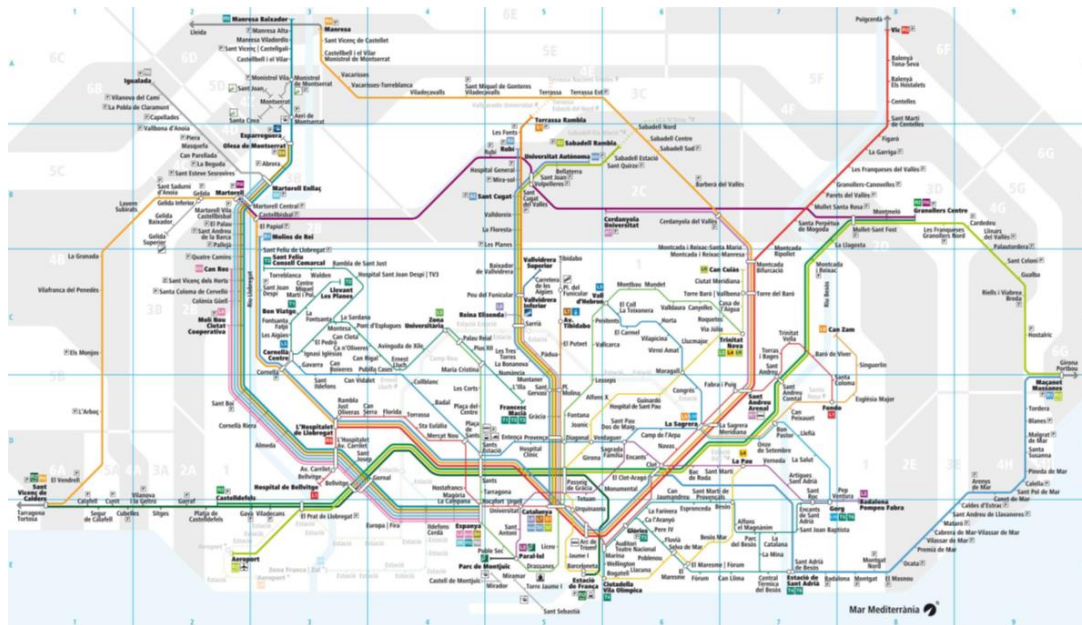


Figure 22: Rail map of Barcelona





Figure 23: Metro map of Barcelona

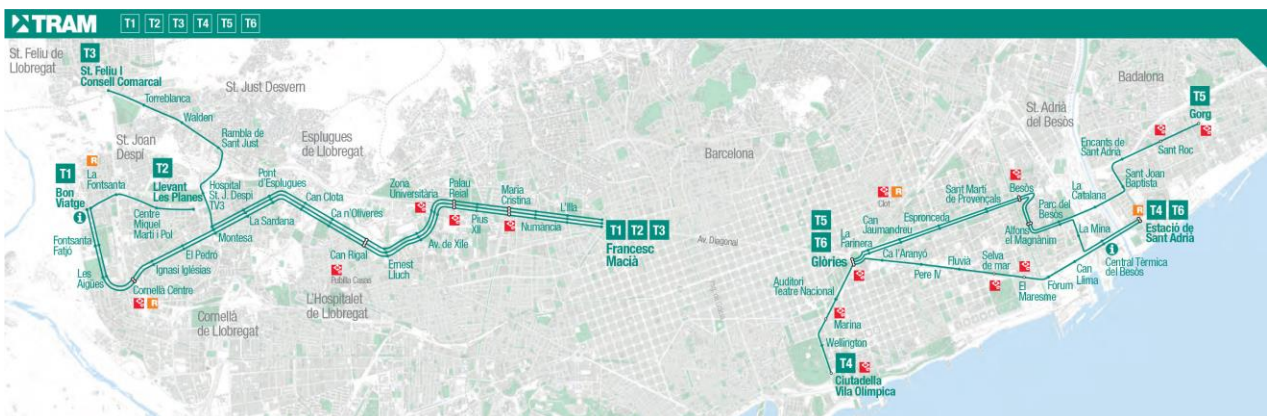


Figure 24: Tram map of Barcelona



## 11.2 Barcelona Bus Maps

The letters in front of the bus lines mean:

- H for horizontal routes
- V for vertical routes
- D for diagonal routes
- N for night buses (running usually from 1am until 6am.)

Numbered for routes that do not fall under the abovementioned categories.



Figure 25: Bus lines of Barcelona



Figure 26: Touristic bus lines of Barcelona