MOBILITY MARKETPLACES AND MAAS

BUILDING A COMMON, CONNECTED, AND INTEROPERABLE GROUND FOR THE FUTURE OF MOBILITY

EXECUTIVE SUMMARY

Mobility as a Service (MaaS) is the integration of various forms of mobility into a single multi-modal mobility service. Its success relies on access to data produced and shared by mobility stakeholders. Mobility marketplaces provide access to this data. They are platforms where data providers and data consumers trade, **exchange**, or monetize **data assets**. These are datasets, data services, and Application Programming Interfaces (APIs).

Mobility marketplaces provide **a setting where**:

- **Data providers can promote their assets** and share, license or sell these assets,
- **Data consumers can discover**, access, **and use these assets** to address their specific needs.

Both data providers and data consumers build **interactions within marketplaces**. Such interactions **depend on the governance and operations setting of marketplaces**.

Marketplaces have **three core building blocks**:

- a **catalogue** of assets,
- a **user authentication** system,
- a **framework for value exchange**.

They can also rely on option features such as payment integration or tools built for data assets.

It is important that **mobility marketplaces are interoperable** within the MaaS ecosystem. Interoperability can be **between data assets, marketplaces, or both** based on local regulations.

There are **three main business models** for marketplaces: **non-commercial, commercial, and hybrid**. It is the **biggest differentiation factor** between mobility marketplaces.

On the relationship between mobility marketplaces, data spaces and National Access Points:

- **Mobility marketplaces are a building block of data spaces** as they offer two of the main features of data spaces,

- **National Access Points** (NAPs) **are mobility marketplaces** characterized by their national coverage and non-commercial business model.

Marketplaces are essential for MaaS, but **their success will depend on**:

- Their **interaction with NAPs** and how they define their differences in added services,
- Their **capacity to refine and clarify their business models**, governance, and operations,
- The **interoperability** of their chosen technology, standards, and interfaces.

The **MaaS Alliance recommends that public and private organizations align their perspectives on**:

- **data assets sharing**,
- the definition of **quality** for data assets, its qualification, and its funding,
- the **control** of data assets

We could very well **envision a world where**:

- **NAPs are public-owned mobility marketplaces** for data assets that are not sensitive and shared under open data licenses,
- **Private mobility marketplaces offer dedicated data assets and services** to stakeholders in the MaaS ecosystem.

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INTRODUCTION

Mobility as a Service (MaaS), as defined by the MaaS Alliance[1], integrates various forms and modes of mobility and their related services into **a single, comprehensive, on-demand multimodal mobility service**. MaaS offers end users the opportunity to access a wide range of mobility services using a single application and a single payment channel.

The **operator of a MaaS platform must** cater for a wide range of traveler's requests, so MaaS operators **host a diverse menu of transport options**. That includes, but is not limited to, public transport including trains and buses, active modes such as walking and cycling, and all rental and assets sharing schemes such as car and bike sharing, taxis, as well as car rental.

Any individual journey may contain a mix of these travel modes: walking, a train, and a taxi for example. **MaaS aims to recommend and facilitate a journey that offers the best value proposition for travelers** (or users). When it works well, MaaS **also becomes the best value proposition for societies and for the environment**. Then, we expect that any climate change related policies (e.g., Green Deal in the European Union) and decisions made at all relevant political levels will support further the deployment of MaaS along with what is needed for it to succeed.

For MaaS to succeed, sharing data and data services is crucial: a variety of organizations require access to the data produced by mobility stakeholders. **One way to facilitate access to data is through** data marketplaces dedicated to mobility. These marketplaces are called **mobility marketplaces**. They can have different definitions and there are different views on their implementation and business models.

That is why the MaaS Alliance Working Group on Technology and Standards is taking the opportunity to study mobility marketplaces via this white paper. We aim to:

- **Define** mobility marketplaces in the context of an open MaaS ecosystem,
- **Identify the building blocks** of mobility marketplaces, including what marketplaces should offer for MaaS stakeholders (who may be deciding whether to participate in them),
- **Build the ground for interoperability** between mobility marketplaces,
- **Explore the relationship between** mobility data marketplaces, mobility **data spaces and National Access Points** (NAPs).

[1] MaaS Alliance website: https://maas-alliance.eu/homepage/what-is-maas/

LEGAL NOTE

The authors of the position paper chose not to discuss the legal framework of mobility marketplaces. Legal frameworks vary significantly from one region to the other, comprehensively discussing legal aspects would divert readers' attention from the technology aspect of marketplaces.

It is nonetheless key to note that the data exchanged using mobility marketplaces may be subject to regulation, especially when the data relates to personal or commercial data (e.g., the Data Governance Act[2] in the European Union).

A mobility marketplace, therefore, needs to explicitly refer to, and comply with, the legal frameworks of the region in which it operates (e.g., the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport[3] in the European Union).

[2] European legal act: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R0868

[3] European legal act: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02010L0040-20180109

AUDIENCE & SCOPE

AUDIENCE

The MaaS Alliance is a public-private partnership dedicated to creating and advancing the foundations for a common approach to MaaS. For that reason, this position paper was designed with **two main types of readers** in mind.

First, we aim this position paper at **all private MaaS stakeholders** that are currently questioning whether they should enter mobility marketplaces or not. This paper intends to provide them with a technical overview of mobility marketplaces, including benefits and evaluation criteria that can help guide decisions on their future course of action.

We also aim to inform **public authorities and non-profit MaaS stakeholders** that are questioning the relationships between existing public data catalogues and mobility marketplaces. This position paper intends to provide this group with an overview of mobility marketplaces and their relationships within the MaaS ecosystem. It is designed to help them explore the best way forward.

The information contained in this paper is also relevant any other stakeholder in the MaaS ecosystem such as mobility operators, policymakers, NAPs, etc.

SCOPE

In this paper we will focus on the technological aspects of mobility marketplaces, but also as it pertains to business stakeholders. We will also look at how mobility marketplaces relate to other technology solutions that exist in the MaaS ecosystem, especially Mobility Data Spaces and National Access Points (NAPs). We aim to answer these questions:

- **What** are mobility marketplaces and who are they beneficial to (e.g., organizations producing mobility data, organizations consuming mobility data, travelers),
- The **features** and **common architecture** found in mobility marketplaces,
- The **relative positions** of mobility marketplaces within the MaaS ecosystem.

MOBILITY MARKETPLACES: DEFINITION AND FEATURES

DEFINITION

Mobility marketplaces are **platforms or environments where data providers and data consumers** come together to trade, **exchange**, or monetize **data assets**. These are datasets, data services, and Application Programming Interfaces (APIs). Mobility marketplaces provide a setting where:

- **Data providers can promote their assets** and share, license or sell these assets,
- **Data consumers can discover, access, and utilize these assets** to address their specific needs.

Thanks to mobility marketplaces data providers can offer data consumers the ability **to build interactions** based on their individual needs or requirements. The interactions are regulated, regulations are determined by the marketplace setting and the stakeholders involved.

OBJECTIVES

Mobility marketplaces **support the establishment of an open MaaS ecosystem based on four main pillars**.

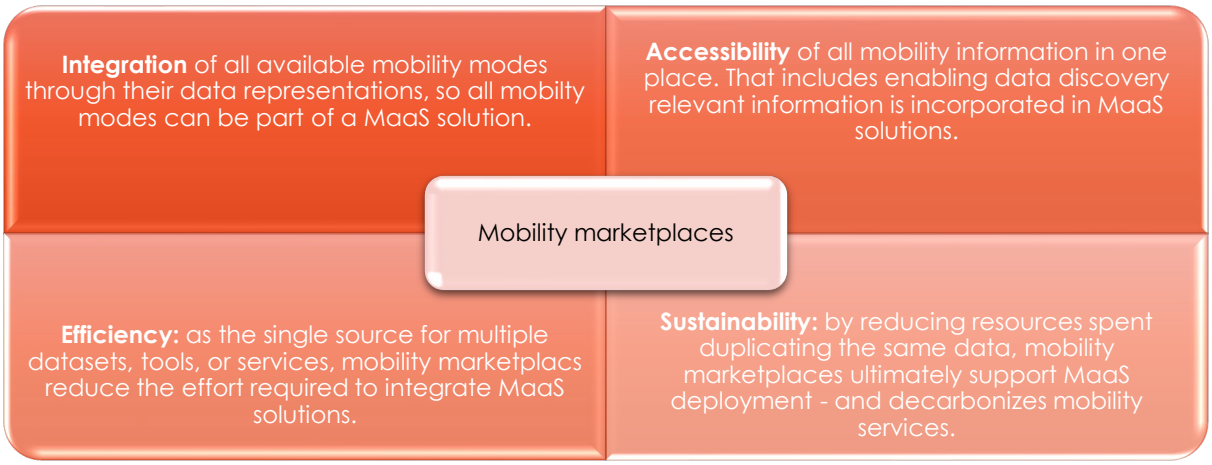

FIGURE 1: MOBILITY MARKETPLACES PILLARS

FEATURES

The **features of mobility marketplaces are also their building blocks**. They define a marketplace scope (e.g., regional floating car data only) and its operating scheme (e.g., flat fees for each exchange). They serve as the **criteria to classify marketplaces** and **to decide whether to join a marketplace**.

The authors of this report classify the building blocks (features) of mobility marketplaces into **two categories**, based on their level of importance:

- **Mandatory** features are the **minimum features required** for the functioning of a mobility marketplace,
- **Optional** features are "nice to have", but which also act as the **differentiation factors** between marketplaces.

The features represented[4] and described below are the result of the research done by the authors. The list of optional features is not exhaustive as features will depending on the target audience, geographical context, and the scope of services provided by the marketplaces.

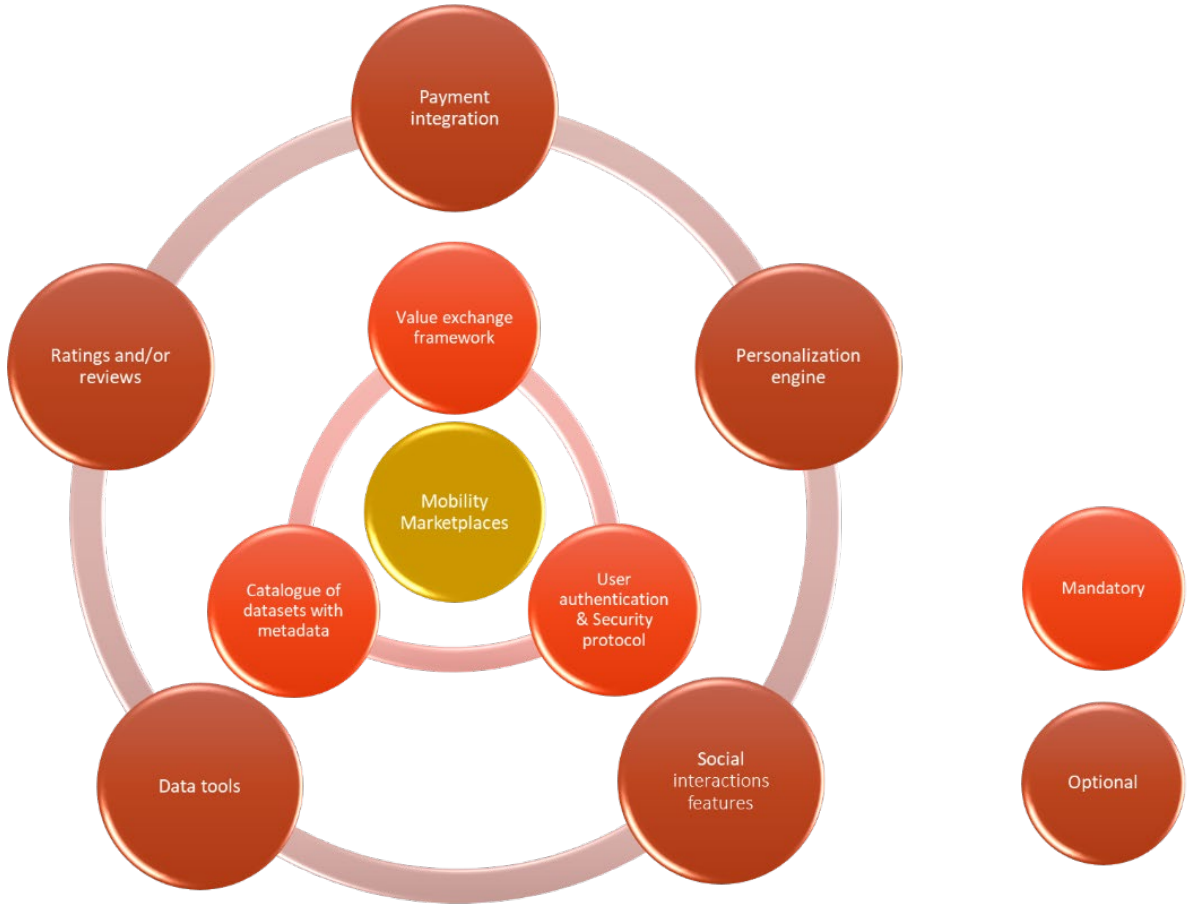

FIGURE 2: MOBILITY MARKETPLACES FEATURES

CORE BUILDING BLOCKS

To define a marketplace, there are **three mandatory building blocks**:

- **A catalogue of data assets with metadata.** This is the very core of a mobility marketplace because it lists all available assets for exchange. In the

[4] The representation in the diagram does not imply any order of importance to build marketplaces. Instead, we intend to show that optional features can be added or removed from the architecture of a mobility marketplace without changing its balance or completeness as a product.

catalogue, data assets are identified and categorized by their metadata. At a minimum they should include:

- Name of the data asset,
- Name of the data producer,
- Contact point for the data producer (direct link, email, user profile on the marketplace, etc.),
- Type of the data asset (type of data, data format, covered mobility services, etc.),
- Date of upload,
- Frequency of update or date of last update.

The more metadata is made available, the easier it is to navigate the catalogue of data assets available. Extensive metadata also supports the assessment of data quality and its relevance for data consumers.

- **A user authentication system and security protocols**. Authentication allows data providers and data consumers to connect to the mobility marketplace and securely enter into an exchange agreement. It ensures that parties are confident that their transaction is secured and confidential. At minimum, security protocols must ensure that personal data privacy is protected in accordance with local regulations (e.g., GDPR[5] in Europe) and their data is safely stored.
  We note that **browsing the catalogue of data assets does not necessarily require for the users to be authenticated**. It **allows the data consumers to evaluate their interest in** creating an account and **entering the marketplace**.

- A **value exchange framework**. The value exchange framework defines the business model of the marketplace. It is a framework that specifies the guidelines for data providers and data consumers, and the terms under which they proceed with the exchange of data assets. Characteristics of a framework could include:
  - Free exchange under certain conditions, governed by the license under which the data is publicized and used (e.g., Open Data Portals),
  - Flexible fees per data asset, or flat fees per transaction,
  - Holding auctions for each data asset,
  - "Exchange of services" which are regulated via an agreement between the provider and the consumer.

  The value exchange framework could also be a mix of several options listed above.

[5] General Data Protection Regulation - https://gdpr.eu/

OPTIONAL BUILDING BLOCKS

For mobility marketplaces, optional building blocks can be seen as "*nice-to-have*" but these optional building blocks also enable differentiation between mobility marketplaces. Optional building blocks include, but are not limited to:

- **Payment integration:** Facilitating payments allows parties to directly execute a commercial. It can be as simple as integrating a common online payment solution, like those found on online shopping websites.
- **Data tools:** Enable the ability to produce, edit, qualify, or share data assets. Highly recommended tools include canonical validators, that are provided by most entities who are maintaining data standards and specifications (e.g., DATA4PT canonical validator for NeTEx[6]). It ensures a quality check is run on data assets before they are made available.
- **Ratings and reviews**: Rate or review the data assets, data providers, or data consumers. These can be leveraged as either a quality assessment of assets or a trust-building mechanism between data providers and data consumers.
- **Personalization engine**: An engine that provides personalized recommendations based on the user's transactions history or line of work. It conceivably also recommends to data providers the need to add a new data asset which is in high demand but is not yet included in the catalogue.
- **Social interaction features**: where data consumers and data providers can discuss or comment on data assets before proceeding with an exchange of their contact details. These features can be feedback forms, Q&A, online help, or chat support functions, etc.

Other optional features can be built by marketplaces owners based on their audience, their coverage, or the mobility modes they cover. Such optional features are also strongly dependent on the local regulation frameworks applicable to data assets exchange (e.g., Data Act in the European Union[7]).

[6] The Canonical NeTEx Validator by DATA4PT: https://greenlight.itxpt.eu/

[7] European policies related to data: https://digital-strategy.ec.europa.eu/en/policies/data-act

REFERENCE ARCHITECTURE

These features are enabled by a reference architecture that is represented in the diagram below. In this diagram, only core and mandatory features mentioned above are included.

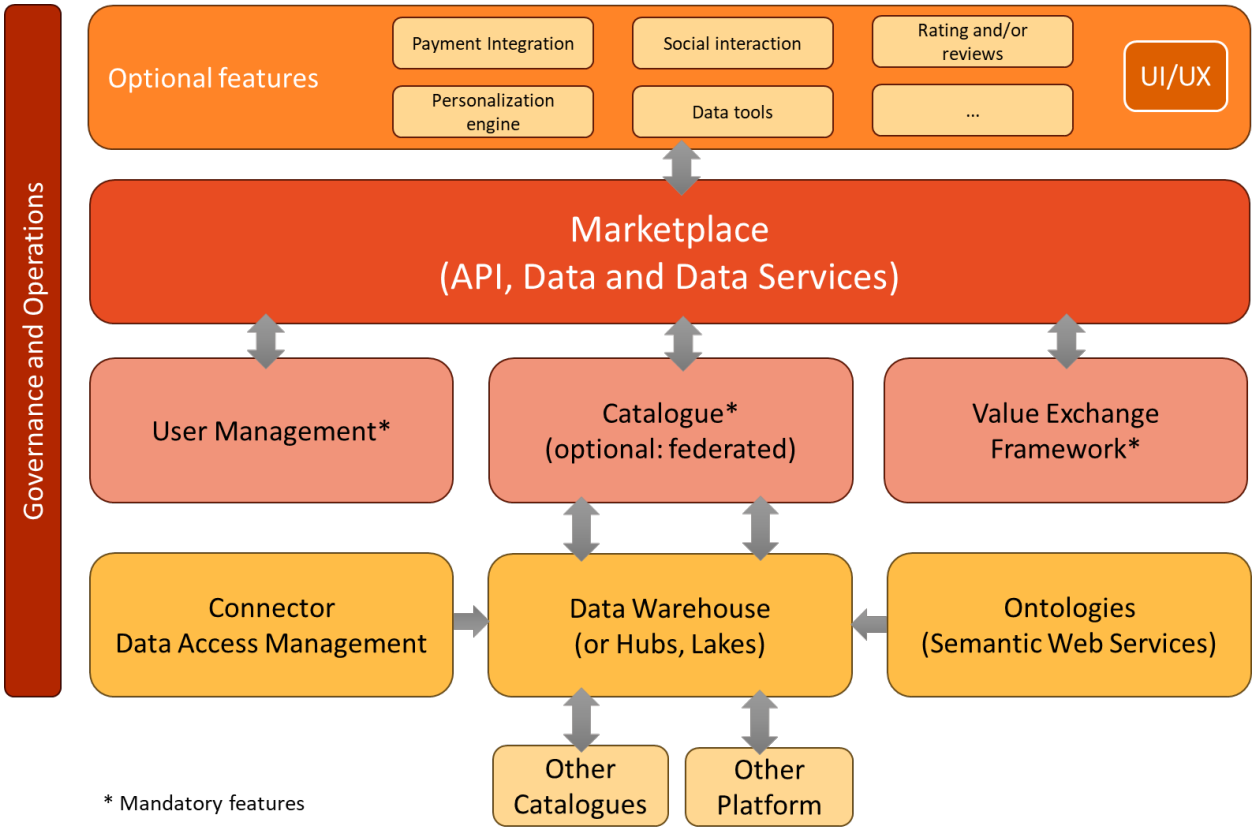

FIGURE 3: REFERENCE ARCHITECTURE FOR MOBILITY MARKETPLACES

In the diagram above, UI is for User Interface and UX is for User Experience. They represent the visible part of mobility marketplaces for stakeholders using them.

We decided not to discuss the Governance of mobility marketplaces as they vary based on the local application regulations. In the European Union, for example, the Data Governance Act[8] creates mandate for data intermediaries[9] to comply with specific rules and declarations.

[8] Impact of the EU Data Governance Act explained: https://digital-strategy.ec.europa.eu/en/policies/data-governance-act-explained#ecl-inpage-l4ihlqt9

[9] Common logos for trusted data intermediaries in the EU: https://digital-strategy.ec.europa.eu/en/news/data-governance-act-common-logos-easily-identify-trusted-eu-data-intermediaries-and-data-altruism

MARKETPLACES: DATA ASSETS AND VALUE EXCHANGE

DATA ASSETS AND RELATED SERVICES

As we have discussed, mobility marketplaces are designed for **data assets** to be exchanged. For that reason, **they can be considered as both the primary input and the primary output** of marketplaces.

Data assets can also **be complemented by other products or services**. Below we list the most common inputs and outputs we have seen when exploring different types of mobility marketplaces.

First, data can be categorized in two parts:

- **Static (or scheduled) data**, which is data that relates to different transport modes or aspects of mobility that do not often change, or covering planned changes[10] (e.g., schedule at a bus stop, bike sharing network data, etc.),
- **Dynamic (or real-time) data,** which is data that relates to different transport modes or aspects of mobility that changes often or on a regular basis[11] (e.g., location of a vehicle on a network, scooters available for rent at a given time, etc.).

Then, we can also distinguish:

- **Raw data**: Data that has not been processed in any way, for example data coming directly from sensors, vehicles' equipment, or any other data source,
- **Formatted data:** A collection of raw data that has been put into a specific format to form a single data asset, ready to be exchanged,
- **Aggregated data**: Data assets that combine several elements of formatted data. It includes, but is not limited to travel patterns, trip durations, mode of transportation, traffic volumes, and other relevant mobility metrics. The data may also be the results of an anonymization process to protect the privacy of travelers or a preliminary analysis with the correction of systemic errors.

In addition to data assets, participants of marketplaces can also exchange:

- **Application Programming Interfaces (APIs)**: To provide direct access to data feeds or their related services, which allows data consumers to access and integrate mobility data directly into their own systems or applications. API integration allows for faster data updates and more robust end services with a reliable data source. For the data providers, it can also allow a better overview of how their data is integrated in other mobility services or platforms.

[10] Based on the definition of static data found in the Commission Delegated Regulation (EU) 2017/1926 of 31 May 2017 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide multimodal travel information services

[11] Same as for static data

- **Data visualization services:** Dashboards, combining several data assets, that support the production of insights. For data consumers, it can help make the data assets easier to understand during data-driven decision making. For data providers, it provides perspectives on how their data is used by others and can support an increase of data quality as a tool to identify gaps or inaccuracies in the data.
- **Data analysis tools or services:** Leverage the available data assets to help further qualification or consumption of the data, but also enables access to insights without having to manually process the assets. This can also involve pieces of software used to test and/or work on the data assets.
- **Targeted data subscriptions:** Subscriptions can provide regular updates or access to specific types of mobility data that cater to the needs of the data consumer. These subscriptions could be used to reduce the research effort for new data assets by the data consumers. They can be offered by either the marketplaces or third parties using data assets from one or several marketplaces.

VALUE EXCHANGE

Value exchange is probably, as of today, the biggest differentiation factor between mobility marketplaces. It relates to the **business model** of the mobility marketplace and indeed the monetization of data assets. We see three main categories:

- **Non-commercial**: The exchange of data assets is free of charge for both parties. Most often, these mobility marketplaces are led by public entities or non-profit organizations.
- **Commercial**: Exchange is valued on (or priced at) certain rules that can be found in the marketplace's value exchange framework. The framework can include several value grids based on what is exchanged (data assets, tools, services, or others). Most often, these marketplaces are led by organizations from the private sector.
- **Hybrid**: where the exchange is compensated either on monetary basis or in-kind with another data asset or access to the solution/analysis built with the original data asset.

The **value of a data asset itself is hard to define**. It is usually a **combination of**:

- The **perceived value** of the data asset (e.g., how hard it is to find it),
- The **quality** and the amount of effort required to consume it,
- I**mpact** for the final MaaS solution/analysis/product,
- Any other factors related to the data asset or its related services and tools.

INTEROPERABILITY BETWEEN MARKETPLACES

Considering that marketplaces are different in scope and operations, it is important for both data providers and data consumers that mobility marketplaces are **interoperable to a certain extent**[12]. It avoids having to invest further resources to enter every marketplace and it reduces their complexity.

INTEROPERABILITY FOR DATA ASSETS

The **first layer** of interoperability resides in **the data assets themselves leveraging standardized data formats, APIs, and protocols**[13]. By agreeing upon common API specifications, data formats, and communication protocols, marketplaces allow **seamless integration** and interoperability between their platforms. This also reinforces **data interoperability** within the mobility industry, and they **lower the costs** of producing and consuming data assets.

If marketplaces do not use the same standardized data formats, APIs, and protocols, they can provide **data formats mapping and other routes to harmonization**. Mappings, as long and complex as they can be, support interoperability between formats by aligning data structures and definitions. Data mappings **foster the creation of conversion tools that can lead to harmonization** between formats. They are recommended when data assets come from different sectors or perspectives.

A step further to data formats mapping is **the harmonization and standardization of metadata and taxonomies**. Both are being used to identify and classify data assets within a marketplace. Standardization simplifies the upload, classification, research, and consumption of data assets. Not only does it ease data discovery and exchange, but it also allows a better comparison of available resources between marketplaces.

INTEROPERABILITY FOR MARKETPLACES

The **second layer** of interoperability resides **in the marketplaces themselves**. They can come together **to form an association or federation** that would allow the use of a **federated identity and a single access management system**. It would allow users to access multiple marketplaces using a single set of credentials. This simplifies user authentication and authorization processes, reducing the need for separate accounts and credentials for each marketplace.

Within the same federation or not, marketplaces can also contract **cross-platform data exchange agreements**. They allow marketplaces to discuss agreements or

[12] DSSC Insight Series | Interoperability – crucial for success in data spaces: https://dssc.eu/space/Events/blog/57606317/DSSC+Insight+Series+%7C+Interoperability+%E2%80%93+crucial+for+success+in+data+spaces

[13] MaaS Alliance – Working Group Technology & Standards – Position paper published in 2021 - https://maas-alliance.eu/wp-content/uploads/2021/11/20211120-Def-Version-Interoperaability-for-Mobility.-Data-Models-and-API-_-FINAL.pdf

protocols for data sharing and exchange on a 1:1 basis. This can involve defining data usage rights, access controls, licensing frameworks, and data privacy considerations. Such agreements facilitate secure and controlled data sharing between participating marketplaces.

Within the same line of idea, marketplaces can establish **cooperation agreements and partnerships**. This can involve sharing technical expertise, jointly developing standards, or participating in joint initiatives to enable seamless data exchange and integration between platforms.

This interoperability ties into the European Union (EU) Interoperability Act[14]which is set to rely on improved cooperation between the administrations in EU Member States – with better data sharing contributing to more efficient public services.

GLOBAL INTEROPERABILITY

The **third layer** of interoperability resides in the **regulatory frameworks** that support the establishment of a level-playing field. Policymakers establish guidelines, regulations, or frameworks that encourage marketplaces to adopt interoperable standards and technical specifications, share data, or collaborate in a federated manner.

If no direct interoperability can be built between two marketplaces, platforms can still rely on **intermediary platforms or brokers for exchange**. The latter will act as intermediaries between marketplaces, facilitating data exchange, translation, and mediation. These platforms provide a central hub where data assets from multiple marketplaces can be aggregated, transformed, and made available to other marketplaces or data consumers.

[14] EU Interoperability Act: https://ec.europa.eu/commission/presscorner/detail/%20en/ip_22_6907

MARKETPLACES, DATA SPACES, AND NATIONAL ACCESS POINTS (NAPS)

MARKETPLACES AND DATA SPACES

Mobility marketplaces and data spaces are often linked for a good reason: we could see **marketplaces as a building block of data spaces**. Mobility marketplaces offer two of the main features of data spaces (access to the data and means of sharing data between two parties)[15].

However, **data spaces serve a different purpose** as they aim to set up a **collaborative environment and governance framework for data sharing**, while marketplaces primarily focus on the enabling of data exchange. In addition, data spaces will have a further interest in data semantics and interoperability[16] as they aim to have a 1:n relationship for each data asset.

NATIONAL ACCESS POINTS AS MARKETPLACES

Each European Member State must establish a National Access Point (NAP) for mobility data, mandated by the ITS Directive 2010/40/EU10 and its Delegated Regulations[17]. By now, there are more than 30 operational National Access Points, where mobility related data is published and made available for use[18].

Since the core objective of **a NAP** is to make available mobility data for all at a national level, it **can be considered as a** type of **mobility marketplaces** characterized by:

The geographic coverage of their data assets which is primarily national, except for mobility services that are cross-border,

The value exchange framework, which is usually based on non-commercial agreements since the data assets are publicly available.

The **main characteristic** of the NAPs as marketplaces lies in their definition. As they **focus on data assets that are made publicly available**, there is no enlisting of commercially sensitive data assets, thus the business model is quite trivial: the data assets are open and free.

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[15] MaaS Alliance – Working Group Technology & Standards – White paper published in 2022 - https://maas-alliance.eu/wp-content/uploads/2022/10/MaaS-Alliance-Whitepaper-on-Mobility-Data-Spaces-1.pdf

[16] Same as above.

[17] Link to the European mandate: https://transport.ec.europa.eu/transport-themes/intelligent-transport-systems/road/action-plan-and-directive/national-access-points_en

[18] Link to the European funded project to facilitate the harmonization of NAPs https://napcore.eu/

The data formats are limited to the ones that are detailed under the EU Delegated regulations or fully compatible to the explicitly mentioned ones. This contributes to the interoperability of data. For the time being, the implementation status of the NAPs (data types provided) varies considerably from country to country. Some NAPs solely provide a data catalogue without user authentication.

MARKETPLACES TODAY

The below table enlists some of the mobility marketplaces that the authors have looked at to draft this position paper. It does not mean to be an exhaustive list of available marketplaces. It does not presume either of their response to the goals pursued by MaaS stakeholders.

Name	Description	Ownership	Related links
HERE Mobility Marketplace	HERE Mobility Marketplace is a global platform that connects mobility services, including ride-hailing, taxi, and car rental companies, with various transportation providers. It offers a marketplace where mobility service providers can access a wide range of transportation options to expand their offerings and improve service coverage.	Private	Global website Marketplace
National Access Points (NAPs)	The ITS Directive 2010/40/EU and its Delegated Regulations require that each European Member State must establish a National Access Point (NAP) for mobility data.	Public	List of existing NAPs in Europe NAPCORE project
ODPT	Public Transportation Open Data Center provides the data from the public transportation operators participating in Association for Open Data of Public Transportation as a one-stop service to general developers, ICT vendors, etc. - The Center supports data including real-time data from railway, bus and airline operators. - Cleansed data in common JSON format is provided via REST API. - Data in GTFS format, mainly bus service is provided.	Non-profit	Global website Marketplace

	The Center has been operated since 2019 to contribute to smooth public transportation during 2020 Tokyo Olympic and Paralympic Games. Starting with data related to railway and bus provided by Bureau of Transportation, Tokyo Metropolitan Government, the Center intends to offer more data in the future.		
The Mobility Database	Led by the non-profit organization MobilityData is an open data initiative that acts as a global repository for transit agencies and developers to access and add any transit data expressed in GTFS Schedule and GTFS Realtime	Non-profit	Global website Marketplace (via a GitHub repository)

EXAMPLES OF MOBILITY MARKETPLACES

Based on the list above, the below is the detailed presentation of a public mobility marketplace (the Finish National Access Point) and of a private one (managed by HERE Technologies).

FINAP – The Finnish National Access Point

The Finnish NAP acts as an open public access point where transport providers must submit key details on their services through digital interfaces. The NAP service forms part of a larger initiative that seeks to develop novel, combined, and user-friendly mobility and data services.

FINAP does not target end users or passengers, but instead caters to transport service providers and developers.

For FINAP, transport services span passenger transport services (by road, sea, and air); stations, ports and terminals; vehicle-hire services and commercial shared mobility services; general commercial parking services and brokerage services. As of August 2023, its catalogue includes over 3,400 services which involve over 5,700 companies or organizations.

Key details contain data points such as operating areas, routes, timetables, prices, service times and accessibility data, including ticket, booking and sales channel details and accepted payment methods.

The NAP service catalogue targets service developers, where developers can find transport service data and interfaces. Registration is not needed to use NAP information. For direct access to the service catalogue an API is available on GitHub[19].

FINAP facilitates the development of more comprehensive journey planners and new transport services.

FINAP is being put into use is to enable competitive and scalable traffic and mobility services for both Finnish and international markets, and cost-efficient and scalable platforms and solutions that will facilitate safe, low-emission and user-oriented travel and transport chains combining different modes of transport.

The Finnish Transport and Communications Agency operates the FINAP service through the Traffic Management Company Fintraffic Ltd. Traficom monitors the transmission of data and the data content of the interfaces published in FINAP.

Mobility marketplace by HERE Technologies

HERE Technologies operates a commercial mobility marketplace that enables customers to access, manage, and monetize location data.

As a provider of mapping and location services, HERE offers an open platform that brings together data producers and data consumers to foster innovation in the mobility sector. Some key offerings from HERE's mobility marketplace include:

- HERE Workspace: A platform for collaborating on the development, deployment, and scaling of location-based products and services. It provides tools for data analytics, visualization, and more.
- HERE Marketplace: A platform for buying and selling data. Producers can monetize their data while data consumers can access datasets to build new services.
- HERE Data: Map and location content that can be used to enrich existing datasets. Includes dynamic data on traffic, weather, and other real-time information.
- HERE Studio: A location data management portal with capabilities for visualizing, editing, and managing geospatial data. Allows users to gain insights from location data.
- HERE Connected Services: A portfolio of services delivering real-time information on things like parking, electric vehicle charging, traffic, and road hazards. These data points are valuable for enhancing mobility experiences.

[19] Link to FINPA API: https://github.com/tmfg/mmtis-national-access-point/blob/master/docs/api/README.md

Key benefits of HERE's marketplace include frictionless data sharing, monetization opportunities, tools to manage and analyze data, global scale and coverage, and the ability to customize solutions.

By bringing together diverse data assets on an open platform, HERE enables innovation in mobility services, autonomous driving, smart city planning, and more. The company claims that its neutrality and focus on privacy help build trust and participation.

CONCLUSION

Since the success of Mobility-as-a-Service strongly relates to numerous parties agreeing to constantly exchange data assets, there is a need for mobility marketplaces to exist. However, their success will depend on:

- Their interaction with NAPs and how they define their differences in added services,
- Their capacity to refine and clarify their business models, governance, and operations,
- The interoperability of their chosen technology, standards, and interfaces.

Moving forward, the MaaS Alliance recommends that public and private organizations align their perspective on data assets sharing, its quality assessment, and the control over such data assets. We could very well envision a world where:

- NAPs are public-owned mobility marketplaces for data assets that not sensitive and can be shared under open data licenses,
- Private mobility marketplaces offer dedicated services to stakeholders in the MaaS ecosystem.

Also, all organizations should also better align on their definition of data quality and how to fund its improvement globally. It would support the global deployment of effective MaaS solutions for the travelers and to support actions taken to limit the weight of transportation in climate change.

REFERENCES & AUTHORS

REFERENCES

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Authors sincerely thank Stephan Venter for his copywriting talent and supporting the final review of this present paper.

SUPPORTING ORGANIZATIONS AND PROJECTS

The organizations listed below appear in alphabetical order.

DATA4PT

The DATA4PT project aims to advance data-sharing practices in the public transport sector by supporting the development of data exchange standards and models in order to fulfil the needs of multimodal travel information service providers: "By supporting EU Member States in deploying a set of harmonized European public data standards (Transmodel, NeTEx and SIRI), DATA4PT wants to enable union-wide multimodal travel information services and contribute to a seamless door-to-door travel ecosystem across Europe that covers all mobility services.

The main objectives of DATA4PT consist of technical and organizational activities to facilitate the development and deployment of the European public transport data standards Transmodel, NeTEx and SIRI.

All these actions aim to enable the interoperable exchange of travel and traffic data and enhance partnerships amongst public authorities and travel information service providers.

ITxPT

ITxPT is the non-profit association that enables an open architecture, data accessibility and interoperability between IT systems. The members of ITxPT develop the IT architecture for public transport and other mobility services together, based on standards and best practices.

Through its EU-funded projects DATA4PT and NAPCORE, ITxPT supports the European Union Member States and all relevant stakeholders (data providers, data consumers, PTAs, PTOs, Transport Associations, IT suppliers etc.) in the development and implementation of European CEN public transport data standards.

The ITxPT governance is fairly shared between decision makers (public transport authorities and operators) and industry (vehicle manufacturers and IT suppliers).

MaaS Alliance

The MaaS Alliance (Alliance) is a public-private partnership working to establish the foundations for building a common approach to MaaS and unlocking the economies of scale needed to support the successful implementation and uptake of MaaS

globally. The MaaS Alliance's vision is to facilitate an open MaaS ecosystem that benefits users, societies, and the environment. To reach this goal, the Alliance brings together stakeholders from all sectors to enable the successful deployment of MaaS around the world.

The MaaS Alliance is governed by a Board of Directors and driven forward by its Members and Partners.

NAPCORE

To work on a better alignment the National Access Point Coordination Organization for Europe (NAPCORE) project was started.

NAPCORE is co-financed by a Programme Support Action under the European Commission's Connecting Europe Facility. NAPCORE has been launched as a coordination mechanism to improve interoperability of the National Access Points as backbone of European mobility data exchange. NAPCORE improves the interoperability of mobility data in Europe with mobility data standard harmonization and alignment. Also, NAPCORE increases access and expands availability to mobility related data by coordinated data access and better harmonization of the European NAPs. Furthermore, NAPCORE empowers National Access Points and National Bodies by defining and implementing common procedures and strategy, strengthening the position and the role of NAPs, supporting steps towards the creation of European-wide solutions to better facilitate the use of EU-wide data.

NAPCORE has been created in the spirit of consultation and cooperation. It includes 36 participants: 33 Beneficiaries covering 26 EU Member States and 3 associated partners. In addition, there are 37 Implementing Bodies. The initial runtime of the Programme Support Action is until the end of 2024, but the goal is to establish a long-lasting and future-oriented platform organization.

TOMP-API Working Group (TOMP-WG)

The TOMP-WG (Transport Operator, MaaS Provider – Working Group) is a collaborative initiative to create a standardized language for the technical communication between Transport Operators and MaaS Providers within the MaaS ecosystem by means of an API (Applicable Programming Interface). The standard language describes how the different stakeholders should communicate with each other.

The TOMP-API is being developed by an open source working group with public and private stakeholders, aimed at facilitating the implementation of MaaS and the corresponding exchange of data. TOMP-API describes a full MaaS journey, including operator information, planning, booking, support, payments, and trip execution.

GLOSSARY

The glossary below defines most of the technical wording used in this white paper in the context of mobility marketplaces. Some of the wording use can be very general and have other definitions in other contexts.

Term	Definition
API	*Abbreviation of "Application Programming Interfaces"* A specific set of messages to invoke functionality on another system, including the exchange of data. APIs enable systems to invoke programs and access information remotely. In our context, an API is a running, implemented instance of a proprietary or standard API specification.
API Specification	A specification that defines interactions between multiple software applications or mixed hardware-software intermediaries. APIs are often described using the OpenAPI specification. An API specification doesn't just describe the data format (like the exchange format), but also specifies actions to fetch and/or modify the data.
App *(or mobile app)*	*Abbreviation of "Application"* A software that is developed specifically for a use on a small and wireless computing device (e.g., smartphone, tablet). Mobile apps are designed to run on specific mobile operating systems. When an app is downloaded and installed on a device, it is stored in the device's memory and is launched using the device's operating system.
Catalog *(Or catalogue)*	A list of available data assets with a link to access them. The assets are sorted by, at least, on metadata such as the name of the data provider.
Data *(Or information)*	Any sequence of one or more symbols. In the mobility industry, it is often considered as the information used to describe an offer and its characteristics.
Data assets	Relates to datasets, data services, and APIs
Data exchange format	A clearly specified format to encode data for exchange.
Data Space	a decentralized infrastructure for trustworthy data sharing and exchange in data ecosystem based on commonly agreed principles.
Dataset *(Or data set)*	A collection or a group of data that is organized in a certain structure, based on a technical specification or

	standard. It can be accessed individually or in combination with other datasets.
Ecosystem	It designates all stakeholders, public and private, involved in the mobility industry. They produce, consume, or regulate data. End-users (i.e., travelers) are not included in this at the exception of cases dealing with personal information.
Interoperability	An alignment of data semantics sufficient to enable the remote exchange of products and services and which, given the number of stakeholders and complexity of the industry, typically requires robust open standards and rules of engagement to be established
Marketplace	Platforms or environments where data providers and data consumers come together to trade, exchange, or monetize data assets.
Metadata	Often referred to as data that describes other data, metadata is structured reference data that helps to sort and identify attributes of the information it describes.
Protocol	Communication procedure used to exchange data between two systems.
Service	Any additional tertiary product that can be offered by a mobility marketplace. It can range from the evaluation of a data asset to consultancy for API integration.
Tool	Any piece of software that can be used to produce, edit, qualify, or share data asset. They can be embedded or not within the mobility marketplace. They are not necessarily free to use.