

# Concept Design for an Open Mobility Service Platform: UMOs

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# Concept Design for an Open Mobility Service Platform: UMOS

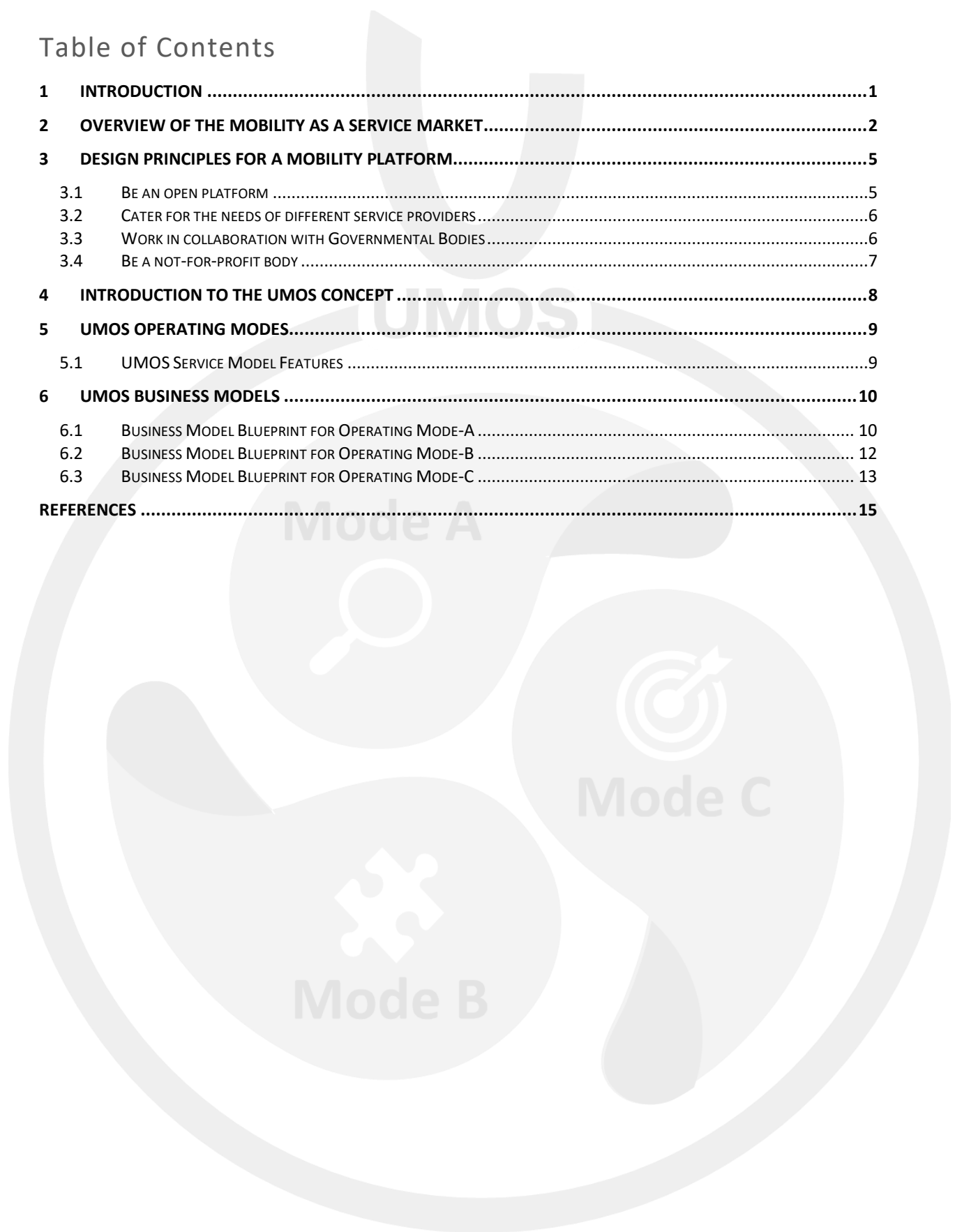
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# 1 Introduction

Today, players in mobility form scattered modes while the mobility domain is getting more fragmented. Each provider or ecosystem fulfills core mobility and its complementary services for customers in a silo. For each ecosystem and solution, a user needs a different application and user account. The objective of the UMOS project is to build a pan-European open mobility service platform to offer a one-stop shop for optimized and customized travel experience.

This document aims to introduce the UMOS concept design. In section 2, we summarize the result of the market analysis in the mobility domain, focusing on the existing Mobility as a Service (MaaS) initiatives. In section 3, we focus our attention on the UMOS concept design. We provide a brief description of the envisioned operating modes (service model) and corresponding business models of the UMOS platform. Next, we present an overview of the Operating modes, followed by the business model blueprints and corresponding stakeholder interactions.

## 2 Overview of the Mobility as a Service Market

Building a case for the UMOS platform and defining the design criteria for the UMOS concept require a careful analysis of the existing MaaS initiatives, particularly those in Europe. We have performed a review of the MaaS market to get an overall picture of the mobility in Europe, and settings that would enable a successful MaaS for European Mobility Service Providers (MSPs). In this section, we provide a brief overview of the findings.

Fueled by the rapid technological developments, the extent and number of mobility services are also increasing. For a successful MaaS, different actors need to work together in a connected mobility ecosystem. With MaaS, all actors in the ecosystem face different and more complex challenges. For instance, in the traditional scenario the traveler insures his/her private car. With MaaS, a traveler needs to insure his/her journey regardless of the means used for the travel. Figure 1 presents the key parties in the MaaS in the layered ecosystem.

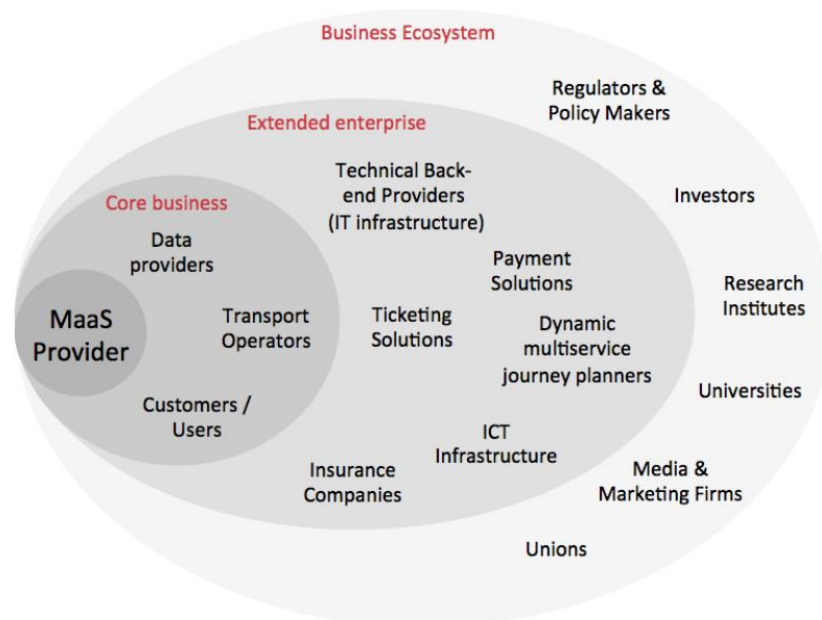
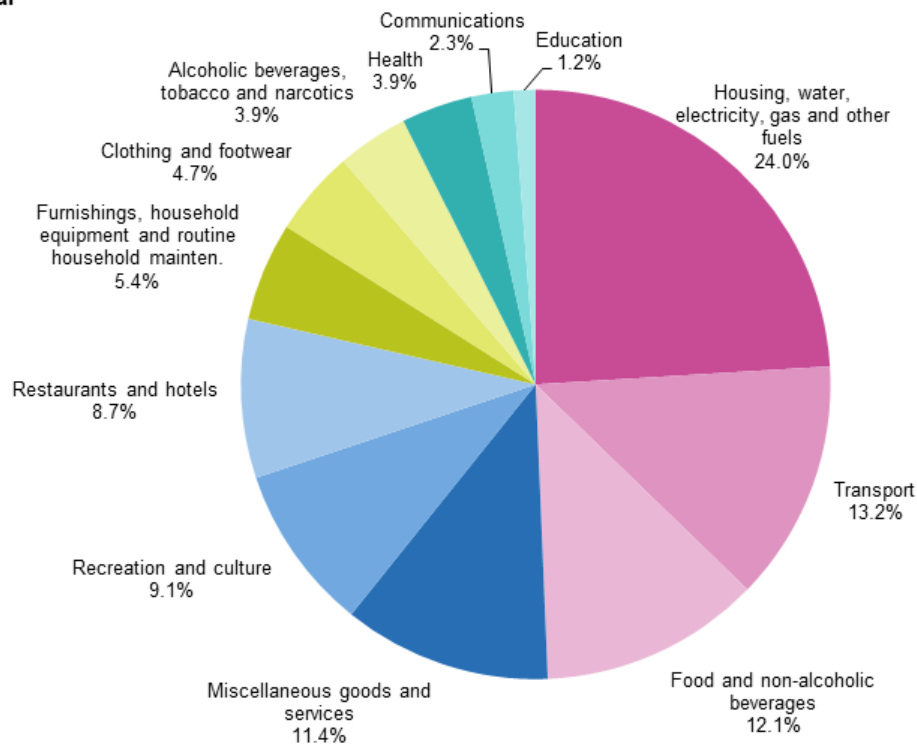


Figure 1. The Business Ecosystem of Mobility as a Service [1]

The belief that MaaS is the future of mobility drives an increasing number of existing organizations as well as start-ups to enter the MaaS field with a wide array of service offerings. The mobility market is one of the biggest markets. On average the mobility spending is one of the top spending in a household. In Europe, the household spending on mobility is on average 13.2% (Figure 2). With the ongoing shift to MaaS, everyone wants their piece of the cake.

### Household expenditure by consumption purpose - COICOP, EU-28, 2018, share of total



Source: Eurostat (online data code: nama\_10\_co3\_p3)

eurostat 

Figure 2. Household expenditure by consumption purpose <sup>1</sup>

Many companies are entering the MaaS domain because of its growth potential:

- The mobility as a service market is projected to grow at a CAGR of 31.7% from 2020 to 2030, and the market size is expected to grow from USD 6.8 billion in 2020 to USD 106.8 billion by 2030.
- According to the market research report published by P&S Intelligence, the global mobility as a service market <sup>2</sup> was valued at \$171.5 billion in 2018, and is projected to reach \$347.6 billion in 2024. The market is predicted to grow with a CAGR of 11.9% during the forecast period (2019–2024).
- A new report from Tractica forecasts<sup>3</sup> that the global market for MaaS to grow at a compound annual growth rate (CAGR) of 24.0% to become a \$563.3 billion market by 2025, largely driven by ride-hailing applications.
- Joint research by the Transport Systems Catapult and Deloitte has found that by 2030 the global Intelligent Mobility Industry could be worth around 1.4 trillion pounds<sup>4</sup>.

<sup>1</sup> <https://ec.europa.eu/>

<sup>2</sup> <https://www.psmarketresearch.com/market-analysis/maas-market>

<sup>3</sup> <https://tractica.omdia.com/research/mobility-as-a-service/>

<sup>4</sup> <https://ts.catapult.org.uk/news-events-gallery/news/change-now-to-capture-1-4billion-opportunity/>

MaaS offers efficient solutions to move traffic in more convenient, faster, and less expensive manner. In addition, the rapid growth of the telecom sector, widespread penetration of smartphones on 3G, 4G, and 5G networks, and high connectivity levels will facilitate the growth of this market<sup>6</sup>.



*Figure 3. MaaS Market Prospect<sup>6</sup>*

As can be seen in Figure 3, the MaaS market is expected to make a substantial growth to about 107 Billion USD in 2030. The ride-hailing segment is expected to witness highest growth owing to its global acceptance at all levels—from personal to enterprises need. The ease of booking and passenger comfort offered by ride hailing are the major reasons for its popularity. It can also be easily integrated with the public transportation, as it is an on-demand transportation service. It has a dominant share in the ride sharing market because of these factors and subsequently will have dominant share in the market as well<sup>5</sup>.

MaaS has an immense potential disrupts the current mobility ecosystem. Despite several MaaS platforms and initiatives, MaaS has (in the writing of this report) not taken off yet as a significant model. Not because the underlying technology is not present, but mainly because a successful mobility ecosystem relies much more than the technology that builds upon. Business, network, and end-user/human aspects should also be carefully considered. A diverse set of stakeholders from different domains have to work closely together to make MaaS work effectively.

One of the current challenges is that most organizations focus only on their own business model, and have a scattered approach over several initiatives. A Pan-European initiative should focus on value co-creation and collaboration to better fulfill the needs of the traveler and public bodies. Collaboration between mobility service providers, governmental bodies and traffic authorities is of utmost importance to make MaaS a success.

Europe hosts are several MaaS initiatives – including those funded by the European Union and European countries, to make Europe MaaS-ready. Big overseas players are waiting for the right level of maturity to capitalize the European market. Hence, there is an urgent need for a European open

<sup>5</sup> <https://www.marketsandmarkets.com/Market-Reports/mobility-on-demand-market-198699113.html>

mobility platform in the form of an extended MaaS, that is ambitious, caters for the needs of all stakeholders – starting with the European citizens/travelers, governmental bodies, and mobility and related service providers, and acts in accordance with laws and regulations.

A Pan-European mobility platform should also communicate relevant data back to the service providers to improve their services. They can give feedback about the future travel needs and criteria based on collected data, while protecting the privacy of the traveler according to European regulations. Hence, service providers will be able to accurately focus their services based on the needs of the traveler. To truly fulfill the needs of the traveler, service providers have to work together, because in general the traveler needs more than one travel option to complete their journey. This will foster collaboration amongst service providers to create a seamless travel experience for the traveler.

### 3 Design Principles for a Mobility Platform

Based on the analysis of the mobility domain and market conditions, we can derive a set of design principles that a pan-European mobility platform should address. Hence, a Pan-European mobility platform should ...

- be an open platform,
- cater for the needs of different service providers,
- work in collaboration with governmental bodies
- be a not-for-profit body

#### 3.1 Be an open platform

To enable travelers to use a single application for their entire journey, the MSP's need to work together. In order to create the best experience for the traveler, MaaS needs a variety of MSP's to fulfill various needs of the traveler. Nevertheless, the mobility market is still fragmented. Especially in Europe, which results in a fragmented mobility infrastructure. Therefore, a MaaS platform should be open to any mobility service provider and the focus should be on interoperability.

As MaaS is relatively new and not yet established; external parties might be hesitant to join in fear of the unknown. This can hinder the success of the platform. This reticence can be amplified if the affiliated parties get the feeling that they lose or won't have control over their services. However, by being transparent, an organization can gain trust from its stakeholders<sup>6</sup>. Hence, openness should lie at the core of a pan-European mobility solution and should be expressed in three different domains: transparency, participation, and control.

**Transparency:** To gain trust from all the stakeholders, the solution should be transparent about its mechanisms, operations and the way it handles data. One way of giving external parties insight in how a MaaS solution handles data, is to make the source code open to everyone. By publishing the source code, people will be able to see how data is handled exactly, without disclosing any data. It should also be open about the way it makes its revenue and how it invests.

**Participation:** Any service provider should be able to enter into the MaaS ecosystem. The more services are available (in numbers and in diversity), the better experience the platform would offer the traveler. To create a fair playground, the ecosystem should treat all parties equally. There should be no entry barriers for large or small parties and without preferred suppliers off any sort.

**Control:** To control a MaaS solution, the right governance mechanisms need to be in place. It should define to what extent the affiliated parties can exert control on the governance and resources of the

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<sup>6</sup> <https://prjournal.instituteforpr.org/wp-content/uploads/Measuring-the-relationship.pdf>



MaaS solution. There should be a right level of co-ownership of the platform, without endangering the core values of the solution and its business model.

### 3.2 Cater for the needs of different service providers

Today, MSPs need to support their core business with a mobile/web application. With an application, MSPs are able to communicate service information with their customers (e.g., to facilitate the planning, payment and ticketing). Although the true value of their service lies in the actual provisioning of mobility services, some still value their own application.

Depending on their customer base and the availability of their own application, MSPs have different needs concerning the platform. Those that are established would be hesitant in leaving their applications and switching to a new mobility platform.

Therefore, a mobility platform should aim to address the needs of both large and established service providers and those that are small or medium. This can be achieved by offering multiple operating modes. The mobility solution platform should help large providers in increasing their reach and enhancing their services by allowing them to connect to the service platform and gather services of other providers to complement and enhance their own. On the other side, it should lower the level of investments required from small/medium size service providers by allowing them to use the platform as their single and only platform. In this mode of operation, the mobility solution platform should provide its own mobile/web application to the end-users and should act as the customer-facing party. This operating mode would also thrive innovation, as it makes it easier for new players to enter into the market without the need to develop their own application (touchpoint). The only thing the service provide would need to do is to upload their travel scheme to the mobility solution platform and run their service. This would also allow such new entrants to benefit from the immediate access to the customer base of the existing platform.

One concern to take into account is that service providers do not want to lose their touchpoint, while at the same time having touchpoints for every mobility service provider is the problem that needs to be tackled. View it from the service providers that have built a platform for their users to use their service. They have put significant investment on developing and maintaining their own application platform to communicate with their customer base. We see a similar case also in the area of hospitality. Being part of a site like theFork (part of TripAdvisor) in the beginning has been beneficial for restaurants. It has the potential to increase traffic to the restaurant but lately the power of the platform and the fees that need to be paid to theFork has triggered Koninklijke Horeca Nederland (association representing hospitality businesses in the Netherlands) to build their own platform for reservations. Some restaurants are on both platforms, others have their own site / use other platforms.

### 3.3 Work in collaboration with Governmental Bodies

Today, governmental bodies are struggling with controlling new mobility service providers. Take Uber for example. The government has to react to the actions of Uber, because their focus on aggressive growth and intense competition and the failure to prioritize compliance caused a lot of trouble. However, the new modality is not fully aligned with the traditional taxi services, and there was a lack of policy in place yet for the governmental bodies to cope with the raising issues. Such entrants aim to grow as fast as possible without considering the consequences for the cities, their mobility strategies and vision, and relevant policies.

An effective Pan-European mobility platform should collaborate closely with governmental bodies to consider their services in perspective with the strategies set forth for specific regions, cities, and districts by governmental bodies. Here, governmental bodies can also take on a pro-active approach,

(instead of the current reactive approach) and take immediate actions to develop relevant policies and strategies (also to minimize issues, such as those with Uber, Bird, etc). Take e-scooters as an example. Suddenly e-scooters were popping up and cities had to react as it was causing significant challenges and nuisance in urban areas. However, it was difficult to cope with these challenges because of the lack of necessary regulations and policies in place, and direct cooperation of service providers and governmental organizations.

Not only can governmental bodies limit new mobility services, but they are also in a unique position to incentivize mobility services. For instance, governmental bodies can offer free public parking for electric vehicles. A Pan-European mobility platform should enable governmental bodies to implement such policies that serve the city to become less congested or open up livable spaces. The data produced by the platform can help cities to improve their services in many ways, such as the city infrastructure, planning, traffic, pollution, etc.

However, there is a catch. Innovation and regulation do not always fuse well. That is why political interventionism needs to be delimited in order for MaaS to spread in cities to its full potential, as innovation is often mainly driven by private enterprises. However, a fluid cooperation with public authorities is essential, as public transportation, no doubt, must be a central piece of a mobility scheme. By working closely with cities, certain transportation modes can be incentivized through legislation. Hereby the MaaS solution can offer an exceptional user experience that others cannot, while protecting the interest of the cities.

### 3.4 Be a not-for-profit body

Trust among all stakeholders is immensely important for a successful mobility ecosystem. In this current market conditions, it is difficult to establish trust among travelers, governmental bodies and service providers particularly when the platform owner is a profit-seeking company that can potentially pursue interests justified through only financial concerns but are not shared by other stakeholders. Hence, the body that will govern the mobility platform should be a not-for-profit organization that can ensure longer term commitments on platform sustainability. Its services should, therefore, also be following EU laws and regulations. This is a pre-requisite to emerge as a trusted body for EU citizens and for all service providers in the ecosystem.

## 4 Introduction to the UMOS Concept

UMOS is envisioned as a universal open service platform for optimized, customized and seamless mobility for the traveller. For this travel experience, it integrates various mobility and related services as a one-stop platform. The integrated mobility services are multi-modal and wide in range (including car- and bike-rental and sharing, and taxi, as well as different forms of public transportation).

However, UMOS is not only a Mobility as a Service (MaaS) solution; it is beyond MaaS. It envisions an ultimate experience for the traveller, hence, incorporates also services, such as parking and insurance, which complement and enhance this experience.

The vision of optimized, customized and seamless travel experience is enabled with the open platform that hosts a wide-range of services, which facilitate the generation of end-to-end travel options taking into consideration the real-time traffic conditions, as well as the specific needs and preferences of the traveller. It learns from past travels of its users, their preferences, and end-user reviews of services, and continuously improves its recommendations. With the support of policy makers, it contributes to the increased liveability of cities by offering more sustainable alternatives to private cars.

Mobility solutions inherently require multiple stakeholders to collaborate tightly, and this is of paramount importance also for UMOS. UMOS' vision can be recognised only with a strong cooperation of a large number of stakeholders that include not only private businesses but also public bodies. Figure 4 presents the conceptual framework projected for UMOS.

Mobility service providers (MSP) (including also the MaaS providers) and other relevant parties, such as the parking and insurance service providers, which enrich the mobility experience, are core parties of UMOS. However, UMOS requires also the traffic authorities and governmental bodies as essential stakeholders. Traffic authorities generate and share real-time traffic information to provide critical input for UMOS to offer effective travel options, while governmental bodies issue relevant policies, endorse and enforce them to regulate the mobility domain for more liveable cities for citizens. This support can also be in the form of facilitating UMOS service providers in market entrance and visibility.



Figure 4. UMOS Conceptual Framework

## 5 UAMOS Operating Modes

UMOS aims to achieve its vision of optimized, customized and seamless mobility experience through a service *platform* accessible to end-users via a *software application* (mobile & web) and to other systems through APIs (application program interfaces) that use standardized data exchange mechanisms. The UAMOS *service platform* is the critical backbone of the UAMOS architecture, where real-time service data (mobility and other services, and traffic) is published by providers and kept up-to-date through APIs.

To achieve its vision, UAMOS will operate in 3 concurrent *operating modes (service model)*, as depicted in Figure 4, to cater for the needs and conditions of the mobility market.

In *Mode-A*, UAMOS acts as an open service platform that mobility and other service providers connect -through APIs- to access the services of other providers and to integrate them into their offerings to enhance their value propositions to their customers. In this mode, UAMOS is an invisible layer to the traveller but help lifting the barriers between service providers.

In *Mode-B*, the traveller can access UAMOS's planner, which is in the form of a mobile/web application to plan his/her travel end-to-end. Enabled by the platform operating in Mode-A, the UAMOS offers optimized and customized mobility for the traveller as its value proposition in Mode-B. The traveller planner application provides alternative travel options and once the selection is made, it directs the traveller to the selected service providers' applications (touchpoints) to complete with the ticketing.

*Mode-C* takes a step further than Mode-B and takes over the ticketing functionality to become the one-stop shop for the travel experience to offer seamless mobility. In this mode, UAMOS also allows service providers to use the platform as their single point of contact/reach to their customers. This is particularly important to lower the entry barriers for the new service providers in the domain, as it lowers the investment and (potentially) operational cost of the technology infrastructure.

In offering three operating modes, UAMOS aims to balance the needs and expectations of end-users and the concerns of service providers. Considering the diverse characteristics and strategic concerns of the mobility service providers, UAMOS aims to offer different value propositions with respect to the level of visibility that a service provider would like to keep for its customers. While large and established providers may opt for Mode-A or Mode-B and benefits from providing enhanced mobility services to its customers, Mode-C would be attractive for small and medium size service providers, which would prefer to focus on their core capabilities (of offering their mobility and relevant services) and rely on continuously maintained GDPR compliant UAMOS platform to act as their interface to all European travellers, thereby increasing their reach.

### 5.1 UAMOS Service Model Features

In Section 3, we list the design criteria for a Pan-European mobility platform. Below, we present important characteristics of the UAMOS service model that address these criteria and help UAMOS to differentiate itself from the increasing number of MaaS and alike initiatives in Europe and beyond.

- 1- *UMOS is not-for-profit*. Parallel to the case for the mobility service providers, MaaS providers are scattered, often aiming to address the needs of local or regional travellers, leading to a more fragmented ecosystem. This makes the mobility arena more vulnerable to profit-seeking big players that potentially pursue non-ideal interests. UAMOS is a *not-for-profit organization* and a Pan-European solution. It acts in accordance with EU laws and regulations, and as such, aims to be the *trusted body* for EU citizens and for all service providers in the ecosystem. It aims to contribute to the standardisation efforts for secure and GDPR compliant service data exchange.
- 2- *UMOS operates in multi-mode*. UAMOS offers different operating modes to address distinct concerns of service providers. It takes into consideration the varying challenges of large and established service providers by helping them to increase their reach with enhanced service

offerings, while lowers the entrance barriers for small and medium size service providers by decreasing the resources requirements for their operations.

- 3- *UMOS cooperates with Governmental Bodies.* UMOS collaborates strongly with governmental bodies to help them implement certain mobility policies in their area of control. While generating travel options to users, it also takes into account the policies (that can also be dynamically changing based on, (e.g., traffic conditions) that are effective on certain regions or districts. For instance, it promotes or imposes only certain modalities for UMOS end-users in specific regions to help support such policies.
- 4- *UMOS is beyond MaaS.* It incorporates not only mobility services, but also those that are enhancing, such as parking, insurance, and even accommodation and entertainment. Hence, it aims to be a one-step open platform for end-to-end travel experience.
- 5- *UMOS is an open platform.* It is open at two levels of governance. First, it places minimal barriers for any service provider to offer its services in the UMOS platform. Second, UMOS aims for an inclusive governance structure and aims to incorporate other interested bodies, which are interested in UMOS's strategic decision-making process.

## 6 UMOS Business Models

Aligned with each operating mode, we have developed a business model (BM) blueprint using the SDBM/R (Service-Dominant Business Model Radar) method [2]–[4]. An SDBM/R depicts how a network of organizations aims to co-create value for and with the customer. Mobility domain is suitable to use this representation, as service solutions in this domain inherently require close collaboration of multiple stakeholders each with specific expectations regarding the costs and benefits, and individual value propositions [5], [6]. SDBM/R provides a simple yet effective way to represent such collaborations in the form of business model blueprints [7]–[9].

We have conducted several workshops with the participation of stakeholders in the mobility domain – particularly those in the UMOS consortium, to design and synthesise business model blueprints for each UMOS operating modes.

### 6.1 Business Model Blueprint for Operating Mode-A

As described in Section 5, in Mode-A, UMOS's core architectural element is the service platform, which allows mobility and other service providers to connect through APIs to access the services of other providers and to integrate them into their offerings. Figure 5 depicts the business model blueprint for UMOS Mode-A. The value proposition of UMOS in this mode is the *enhanced service provisioning for service providers*. Accordingly, the main *customer* of UMOS in this mode are the *mobility service providers*. UMOS operates in the background and allows them to connect to the platform to publish their services and integrates services of other providers into their offering to enhance the value of the mobility services they offer to their customers.

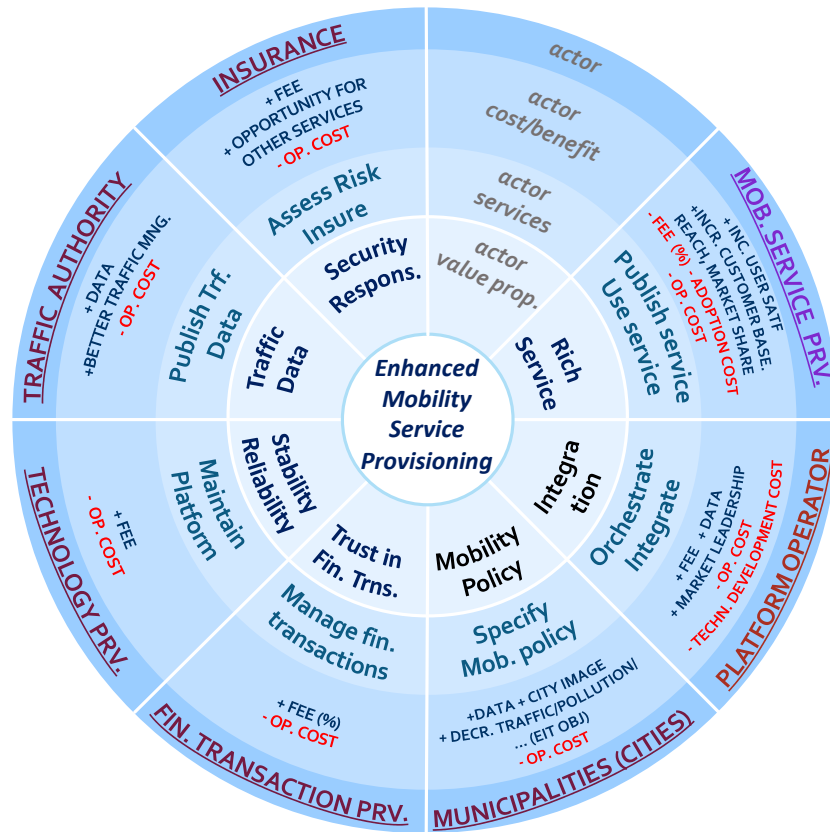


Figure 5. UMOS BM Blueprint for Operating Mode-A

As the *platform operator*, UMOS is the focal organization that offers the APIs for the platform to allow for the publishing of services offered by the providers and for keeping them up-to-date.

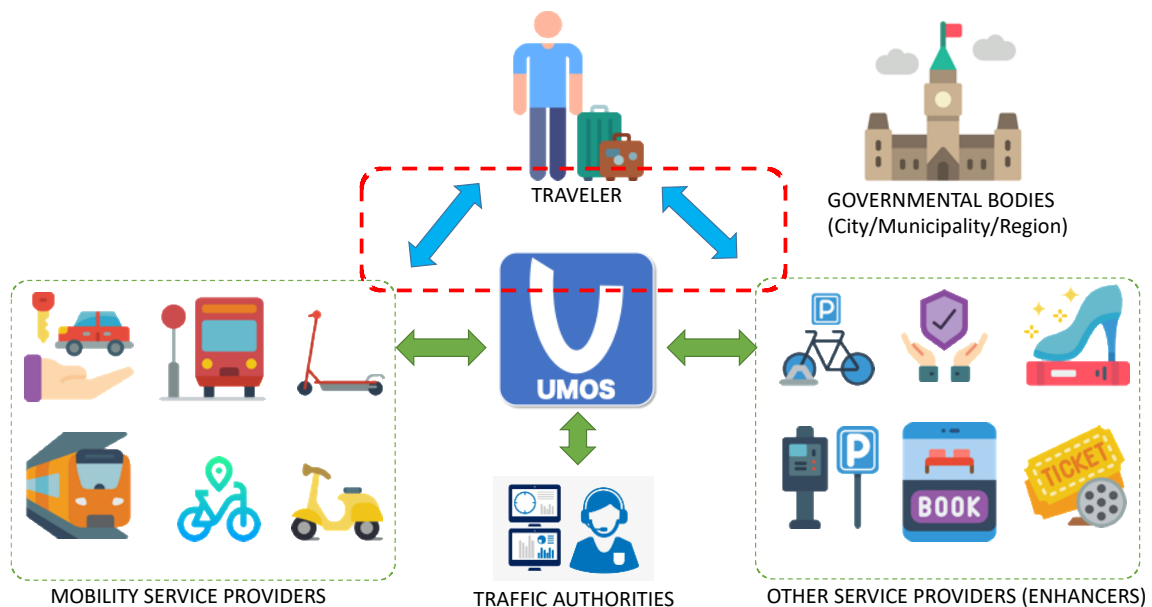


Figure 6. Stakeholder Interactions in Mode-A

## 6.2 Business Model Blueprint for Operating Mode-B

In Mode-B, UMOS is accessible to the end-user through a *mobile/web application* and offers *optimized and customized mobility for the traveller* as its value proposition. In this mode, the travel is UMOS's end-user and therefore, its direct customer. Figure 7 depicts the business model radar for Mode-B.

Mode-B requires the platform that is running already in Mode-A. That is, the mobility and other service providers are expected to offer their services through the platform and to update these services such that real-time or up-to-date information can be displayed to the traveler. As depicted in the blueprint, service providers (including – for instance, insurance providers) are asked to pay a fee for their presence on the platform, balanced by the benefit of a potential increased customer base (and as such, increased revenue). This fee can be per transaction, per time or per number of customers, dependent on the revenue model.

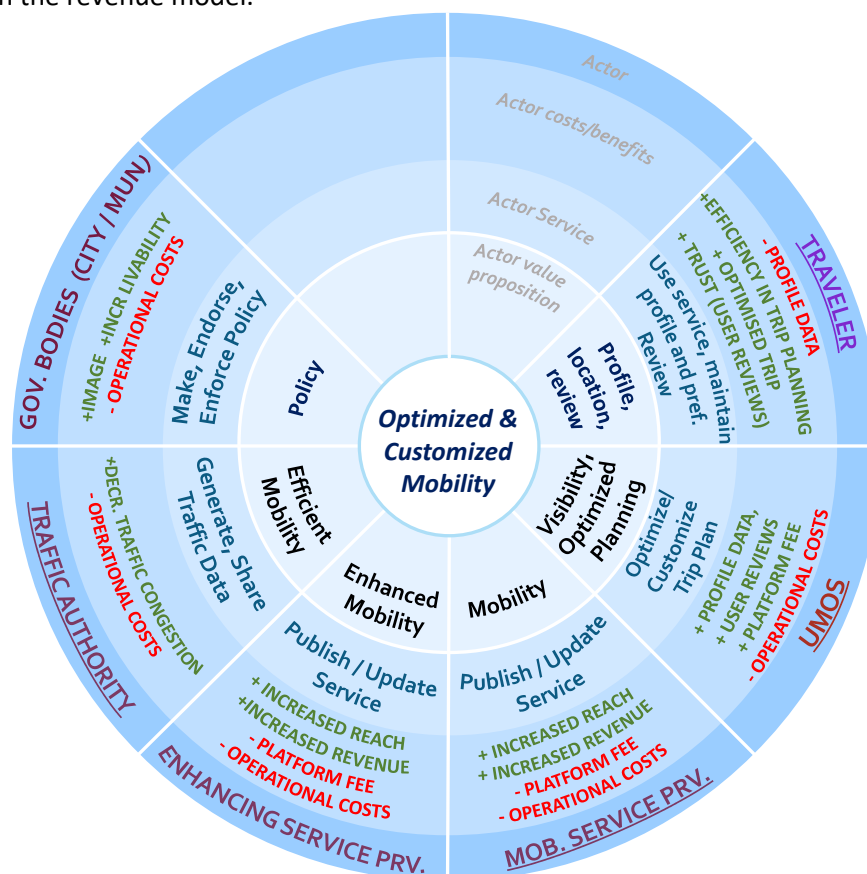


Figure 7. UMOS BM Blueprint for Operating Mode-B

The mobile/web application acts a traveller planner which connects to the service platform, retrieves suitable services and offers alternative travel options as a response to user's trip specifications. These options are optimized based on the real-time traffic information, and customized based on traveller's past trips, profile data and other preferences. (These may include –for instance- priorities on the dimensions of trip time, cost, comfort, or CO2 emission, or preferences regarding modalities, or user satisfaction scores of service providers.) Where applicable, the options are complemented by enhancing services. In case multiple alternatives are available, the traveler has the option to select the service provider that he/she prefers (also based on existing user ratings). The trip can moreover be insured if needed through the set of insurance providers that participate in UMOS.

Once the traveller makes the selection, s/he is facilitated to complete the transactions (ticketing, etc.) through the service providers that are involved in the selected option. This enables service providers to keep their customer touchpoints, while enjoying the increased visibility and reach through the platform, thereby increasing their revenue.

The governmental institution (cities, municipalities, etc.) is present in the model to ensure that traffic and mobility policies are enforced or stimulated. This may vary from managing the set of mobility service providers that can act in UMOS in a certain city or to stimulate mobility service providers that adhere to rules and regulations through UMOS.

Figure 8 presents the stakeholders involved in this scenario and their interaction with the traveller. In this scenario, the traveller benefits from increased efficiency in trip planning. Acting as the starting point for the traveller, UMOS learns from past travels and user preferences and reviews, and continuously improves its recommendations.

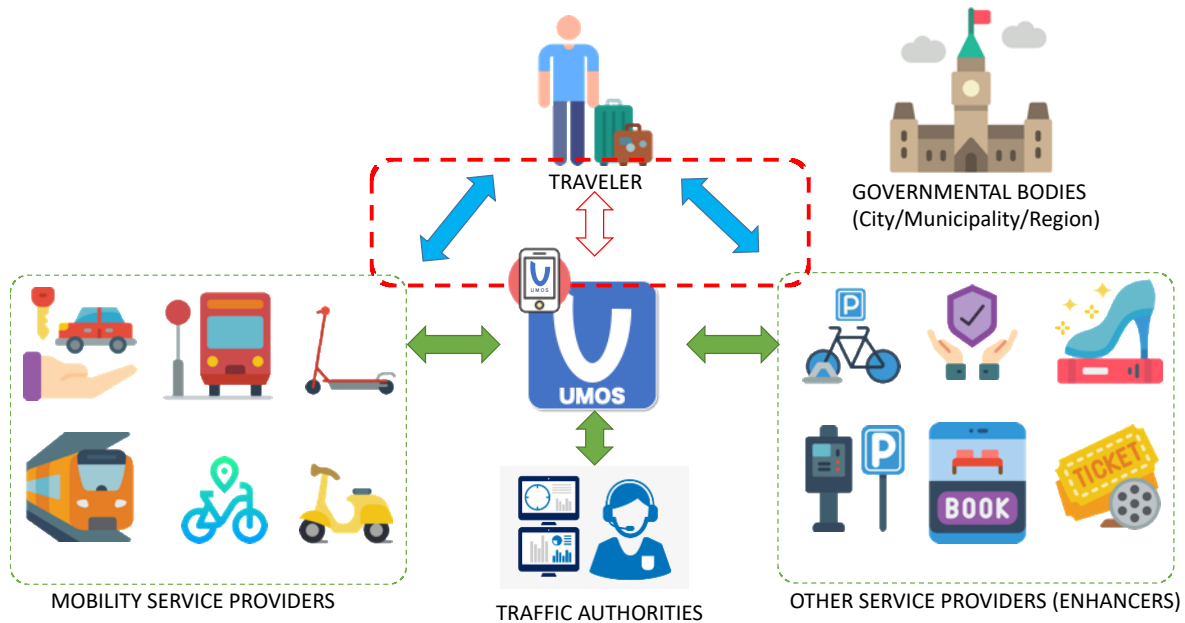


Figure 8. Stakeholder Interactions in Mode-B

### 6.3 Business Model Blueprint for Operating Mode-C

Mode-C builds upon Mode-B and realizes the ultimate UMOS vision of becoming the one-stop shop for the travel experience, offering not only *optimized and customized*, but also *seamless* mobility. In this mode, UMOS enables also the *ticketing and related transactions* to be performed directly through its offerings, orchestrating the data exchange between service providers for the end-to-end travel. The blueprint and the stakeholders are presented in Figure 9 presents the business model blueprint for Mode-C. As can be seen, the blueprint is very similar in terms of the structure and stakeholders, while the cost-benefit structure and the underlying scenario differs significantly.

In this blueprint and unlike the scenario in Mode-B, in this mode the traveller pays once for a single ticket for all services involved. The financial transactions taking place in the background between UMOS and service providers are secured by the financial transaction provider, and potentially insured by the insurance provider.



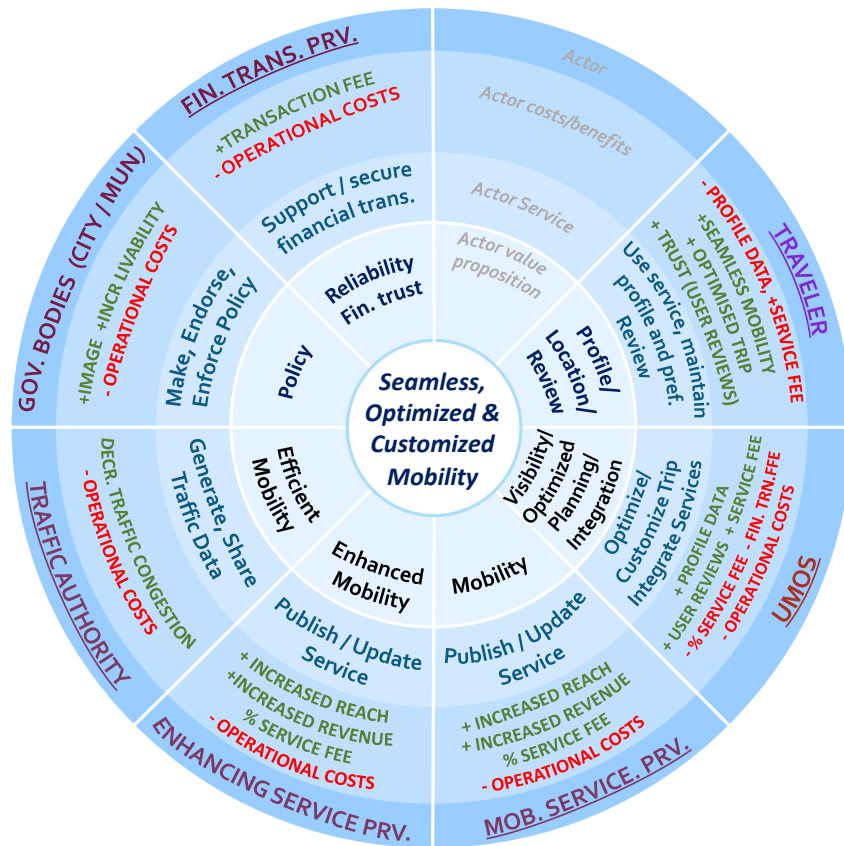


Figure 9. UMOS BM Blueprint for Operating Mode-C

The stakeholders are presented in Figure 10. As can be seen, in this mode, UMOS is the only traveller-facing party during the travel planning stage. (Service providers will be facing the traveller during operation/service provisioning stage; however, the traveller does not necessarily be informed about the exact service provider and may contact the provider only through UMOS.)

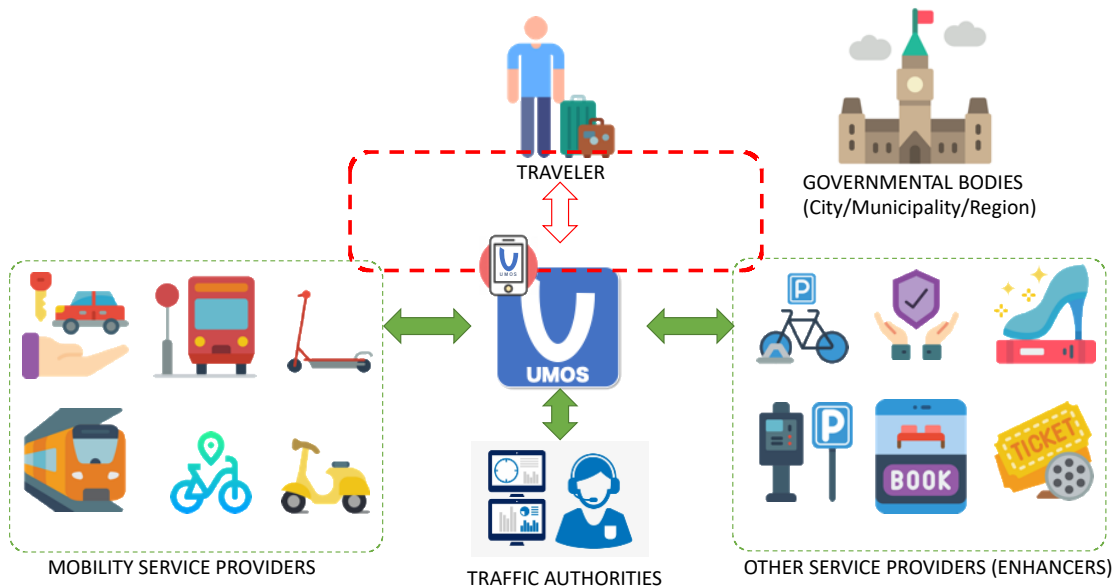


Figure 10. Stakeholder Interactions in Mode-C

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