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MaaS in Europe: Lessons from the Helsinki, Vienna and Hanover experiments

Full Study Report - December 2019

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MaaS in Europe: lessons from the Helsinki, Vienna and Hanover experiments

Often presented as a tool to revolutionise the use of mobility services, Mobility as a Service (MaaS) refers to a digital service that allows travellers to access a wide range of collective, shared or private transport services, in a given area. Many MaaS systems are developing in large urban areas. Based on a smartphone application, they provide travellers with more personalized and easily accessible mobility services. However, the concept of MaaS reflects very different realities from one urban area to another. This paper offers insights into the design, implementation and effects of MaaS services based on the experiences of three pioneering cities in Europe: Helsinki (Whim), Vienna (WienMobil) and Hanover (Mobilitätsshop).

Location of MaaS examples analysed (Cerema map)

MaaS: what are we talking about?

Variable levels of integration behind the MaaS concept

The principle of MaaS is to integrate different transport services into the same mobility offer. However, the concept is still a recent one, and there is no unanimous definition. As most commonly understood, it is considered to be an integrated system providing information, reservation, purchase and validation of tickets for the widest possible range of mobility services. This is done through a single account where passengers define their profile and preferences and manage their purchases and payments for all means of transport.

From the standpoint of the user, the level of integration of different mobility services varies from one MaaS to another. A typology of MaaS services (Sochor et al, 2018[1]) distinguishes 4 levels, depending on the degree of integration:

- The minimum level (level 1) concerns the integration of information: the system is in this case a multimodal route planner providing fare information.
- The intermediate levels also allow passengers to purchase and validate their tickets, either individually (level 2), by subscription or in the form of packages giving rights to access different mobility services (level 3). The three MaaS systems in Vienna, Hanover and Helsinki are at these intermediate levels.
- Finally, in the most integrated systems (level 4), MaaS takes into account societal objectives, such as encouraging the use of the most virtuous means of transport.

Level of integration from the passenger's point of view		Examples of MaaS
4	Taking societal objectives into account (by public policies, incentives, etc.)	whim WienMobil Mobilitätsshop
3	Integration of information, booking and payment (subscriptions, packages, etc.)	
2	Integration of information, booking and payment (single trips)	
1	Integration of information only (multi-modal planner)	

Typology of MaaS service and positioning of services that have been benchmarked (after Sochor et al, 2018)

Tramway in Helsinki (photo: Cerema)

Towards rural MaaS? MaaS services generally cover large urban areas. But in Finland, several pilot projects are aiming to develop MaaS services in rural areas. Unlike urban MaaS systems, these projects include one or more actions directly related to the mobility offer, ranging from optimising or decompartmentalising existing mobility offers to creating new mobility services, generally in the form of demand-responsive transport or shared taxis. Other projects aim to create MaaS services on a regional or even international scale.

Numerous expected benefits for a targeted clientele

There are many benefits that a MaaS system could provide for the mobility system.

- For **local authorities**, MaaS is a tool that facilitates information and access to the various mobility services. By providing a door-to-door mobility offer, MaaS can encourage a modal shift from solo car use to other modes and have positive effects in terms of social inclusion or limiting pollution emissions. MaaS can also be an opportunity to collect more accurate data on mobility practices, which can contribute to better planning and adaptation to the needs of transport supply.
- For **transport operators**, MaaS offers new sales and information channels, as well as new fare products that not only build loyalty among their regular users, but also reach out to new customers. By facilitating intermodality, MaaS also makes it possible to boast a door-to-door mobility offer. This helps to increase the use of the collective or shared mobility services, and thus to improve their economic efficiency.
- For **passengers**, MaaS offers easy access to a wide range of mobility services, giving them more choice and more comfort in use: unified information about all mobility services to make travel easier and help them to make informed choices of means of transport, making it easier to purchase tickets, etc.

[1] Sochor J., Arby H., Karlsson M., Sarasini S. (2018), A topological approach to Mobility as a Service: A proposed tool for understanding requirements and effects, and for aiding the integration of societal goals, *Research in Transportation Business & Management*, vol. 27, pp 3-14.

What is the target clientele for MaaS? The MaaS services observed as part of this benchmark operation mainly target three main categories of passengers:

- **Private car users.** The purpose of MaaS is to encourage a modal shift by providing comprehensive information on alternatives to the car and making them easier to use.
- **Multimodal passengers** who use public transport and other shared mobility services on a more or less regular basis. The purpose of MaaS is to build loyalty among these passengers by providing them with greater ease and comfort of use for these various services, and to restrict the use of private cars.
- **Tourists**. MaaS can be an opportunity to provide an integrated and easily accessible mobility offer for visitors discovering the town, thereby offering them a better tourist experience. This requires a specific communication strategy.

A recurring difficulty for MaaS operators is to identify the needs of users in order to offer products that bring real added value to their customers. In Helsinki, MaaS Global successively launched several packages, to assess the demand for certain types of products.

MaaS in practice: analysis of offers in Helsinki, Vienna and Hanover

Analysis of the MaaS services set up in Helsinki, Vienna and Hanover shows very contrasting approaches. A first difference is the diversity of the mobility services included in these services:

- In **Helsinki**, the Whim application is the most integrated example, both in terms of features and range of accessible mobility services. In addition to public transport, Whim offers direct access to bike sharing, taxis, car-sharing and conventional rental cars. These services are booked and paid for directly via the application.
- In **Vienna** and **Hanover**, the WienMobil and Mobilitätsshop applications have lower levels of integration. They provide direct access to public transport and allow people to pay for the corresponding ticket. Only the route planner is integrated for other modes of travel. In Hanover, users therefore have to call the taxi company to book a journey, and to set up an account on the car-sharing service application in order to access the service. Payment is made directly to the service operator, not via the Mobilitätsshop application. In Vienna[2], the WienMobil application similarly links to the car-sharing and bike-sharing service applications for booking and payment, and offers to call to the taxi company.

In all cases, the integration of the different mobility services is never total: some mobility services are not accessible via the MaaS application. This is due to service operators not wanting to integrate MaaS, technical difficulties in integrating these services within MaaS, or the MaaS operator wanting to limit the diversity of accessible services or not to include competing services within the same offer.

[2] In Vienna, the operator MaaS Global introduced a new MaaS offer in October 2019, called Whim, as in Helsinki, and in all urban areas where MaaS Global has rolled out its services. As Whim was launched commercially in Vienna only after our visit, this service is not analysed in detail here.

Public transport, however, is an essential component of any MaaS offer. In Helsinki, as in Vienna and Hanover, all local and regional public transport (buses, trams, metros, regional trains, ferries, etc.) are systematically accessible via the MaaS application. This is partly explained by the fact that, in these three urban areas, all of these modes have historically been integrated within the same transport network, both in terms of information, ticketing and fare system. In any case, it does not seem conceivable to propose a MaaS offer that does not include all public transport.

Vienna Underground (photo CC-BY-SA 2.0 Nick Savchenko via Wikimedia Commons)

	whim Helsinki	WienMobil Vienna	Mobilitätsshop Hanover
Main line trains	✕	✕	✕
Regional trains	■	■	■
Underground, Tram, Bus	■	■	■
Bike sharing	■	■	✕
E-scooter sharing	✕	■	✕
Moped sharing	✕	■	✕
Car-sharing*	■	■	■
Taxis*	■	■	■
Car service with driver	✕	✕	✕
Personal bike	■	■	■
Personal car	✕	■	✕
Rental car	■	✕	✕
Car park*	✕	■	✕

Range of mobility services accessible via the MaaS application

■ Route calculation, booking, ticket purchase and validation

■ Route calculation only ✕ Non-integrated service * Some operators only

A second difference is the type of access options to mobility services offered by the MaaS application. Several models coexist, ranging from the non-subscription option “Pay-as-you-go” to packages including unlimited access to a range of services.

- In **Helsinki**, the innovative character of the Whim system lies in the multimodal packages on offer. These packages range from less than €60 per month for the use of public transport, bike sharing and taxis (with a maximum charge of €10 for journeys of less than 5 km) to €499 per month for unlimited use of public transport, bike sharing, car-sharing (up to 2 hours of use per day), conventional hire cars and taxis (for journeys of less than 5 km). In addition, a non-subscription formula makes it possible to pay only per use, without any additional charge compared to purchasing directly from the various operators.
- In **Vienna** and **Hanover** no similar package is offered. In Hanover a single public transport ticket can be purchased via the Mobilitätsshop application. In Vienna, the WienMobil application allows users to buy a more diverse range of public transport tickets and subscriptions, but not the annual subscription.

	Helsinki	Vienna	Hanover
Pay-as-you-go	▬	▬	▬
Public transport subscription	▬	▬	×
Package of mobility services	▬	×	×

Formulas available via the MaaS application

▬ Option available × Option unavailable

Setting up a MaaS: what lessons have been learned?

Contrasting governance principles

The examples of Helsinki, Vienna and Hanover show contrasting governance principles. UITP[3] identifies three main organizational and governance methods in the MaaS approach, in which the authorities are involved to varying degrees.

- In the **commercial integrator** model, the MaaS operator signs bilateral agreements with the various transport operators. The MaaS is set up in an open competitive framework, with minimal investment by the authorities. This corresponds to the example of Whim in Helsinki, which was developed and is financially supported by the private company MaaS Global, without support from the local authorities.
- In the **open back-end platform** model, the local authority sets up a platform into which data from the various mobility services (timetables, route calculation, booking, ticketing, pricing, etc.) are integrated. MaaS operators then use this platform to build their MaaS solution, allowing competition between different MaaS services. This corresponds to the example of Vienna, where the open public platform was developed by a subsidiary company of two public entities. The MaaS WienMobil service, led by the public transport operator Wiener Linien, is built using this platform, as is the Whim service developed more recently by MaaS Global.
- Finally, in the **transport as the integrator** model, it is the urban transport network operator that develops the service and seeks to attract other mobility service operators to its MaaS solution. This corresponds to the example of Hanover, where Mobilitätsshop is led by the main urban transport operator Üstra and the transport authority. This model also corresponds in part to the example of Vienna, since the MaaS WienMobil offer is operated by Wiener Linien.
- A fourth model may be considered, in which the authority awards a contract to select a MaaS integrator, which may be the transport operator or another company.

[3] UITP (2019), Mobility as a service, report.

Model	Commercial integrator	Open back-end platform	Transport as the integrator
Example	whim **Helsinki**	WienMobil **Vienna**	Mobilitätsshop **Hanover**
Investment by the authorities	Low	Average	High
Ability to innovate and provide customer-oriented offers	Assumed to be high by private MaaS operators	Left to the initiative of MaaS operators	Assumed to be more limited by the transport operator
Ability to integrate different mobility services	Assumed to be high		Risk of focusing on the transport operator's historical partners
Presentation of mobility offers	Risk of favouring the commercial interests of the MaaS operator	Possibility of imposing fair and non-discriminatory rules	Possibility of imposing fair and non-discriminatory rules
Contribution to public policy	Risk of favouring the commercial interests of the MaaS operator		Alignment with public policies
Customer relationship	Risk of losing the customer relationship by the local authority		Control of customer relations by the local authority
Control of data	Risk of losing control of data for the local authority	Control of supply data, risk of losing control of usage data	Control of data by the local authority
Competition between MaaS operators	Possible competition between several MaaS operators	Competition facilitated, as part of the investment is paid for by the public authorities.	Monopoly of the authority (except in the case of an offer created by a commercial integrator)

Analysis of the strengths and weaknesses of the different MaaS governance models
Strength Opportunity Threat Weakness

Each of the governance models has its strengths and weaknesses. The commercial integrator model is perceived as the one that allows the most innovation and a better consideration of customers' needs (private operators would be better able to set up mobility packages and develop efficient communication), at the risk of a discrepancy between the objectives pursued by the MaaS operator and public policies. Conversely, the transport as the integrator model will directly contribute to public policy objectives for mobility, but is often perceived as less innovative and less customer-oriented. The intermediate open platform model allows the local authority to guide the actions of MaaS operators, while leaving them the freedom to offer innovative services. While it facilitates the development of MaaS offers led by private operators, this open platform model allows public transport operators to develop their MaaS offer, as is the case in Vienna.

The question of competition or complementarity of the MaaS application with other applications developed by transport operators arises differently depending on the governance model chosen. In Helsinki, Whim and the HSL transport network application offer similar features (route calculation, purchase and validation of single tickets and subscriptions), although only Whim offers packages combining different mobility services such as taxis or car-sharing. In Vienna, the WienMobil MaaS application has replaced the public transport network application and will integrate the few functions whose absence still justified the existence of another application, called Qando.

Advertisements for HSL and Whim applications in Helsinki (photos: Cerema)

The technical facilitators of a MaaS initiative. There are many obstacles to the development of a MaaS, particularly in terms of governance and financing. Beyond the regulatory framework that can create a favourable environment for MaaS, some technical factors may make the development of such services easier:

- A **diversified and efficient mobility system**. This requirement particularly concerns the public transport network, which forms the backbone of the mobility offer accessible via the MaaS application. The existence of integrated fare prices, common ticketing systems and unified information upstream of the MaaS project are all facilitators.
- **Open data and data exchange infrastructure.** The existence of programming interfaces (APIs) for route calculation, booking, ticketing and fare system for the various mobility services, and in particular for public transport, is a prerequisite for the development of MaaS services. The regulatory framework or national or local initiatives that encourage the opening up of transport data may create a favourable context.
- **Open ticketing systems.** Not requiring validation of a ticketing medium to access the public transport network facilitates the development of MaaS services. In Helsinki, Vienna and Hanover, the transport networks are open and ticket inspection is performed only afterwards, by visual inspection or QR-code scanning.
- **Good coverage by the mobile phone network or WiFi.** MaaS services are based on applications that require real-time data transfers between the different entities involved. Reliable mobile internet access is therefore indispensable, and the level of smartphone ownership must be high.
- **Facilitated physical intermodality.** In order to support the digital intermodality provided by the MaaS, physical connections between the different mobility services must be facilitated. This involves the development of interchange hubs and signage.

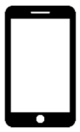
A difficult economic balance to achieve

The question of the economic model is a sensitive issue for the MaaS approach. The response is highly dependent on the governance model chosen.

For **local authorities** (or their transport operators), the implementation of a MaaS service provided by a private operator requires at least opening up the supply data and making them available to the MaaS operator via APIs, which may represent an investment cost and operating expenses. Developing the API for selling tickets, for example, represented an investment of several hundred thousand euros for HSL, the Helsinki transport authority.

Depending on the governance model, the financial contribution of local authorities may be higher if they choose to develop (or have their transport operators develop) an open public platform, or even a MaaS application. However, this public contribution can be justified by the contribution that the MaaS makes to public mobility policies.

For **mobility service operators**, MaaS represents an opportunity to reach new customers and increase the activity of their services. They can also outsource certain charges to the MaaS operator (customer relations, transaction and billing fees, etc.) for services purchased via the MaaS application. In return, the operator can sell its services to the MaaS operator at a reduced rate. This reduction can be passed on to the price paid by the customer via the MaaS application. This is the model chosen for mobility services such as taxis or car rental, in Hanover (where mobility service operators are obliged to offer benefits to customers accessing their services via the Mobilitätsshop application) and in Helsinki.



For the **MaaS operator**, several business models can be considered. In addition to the costs related to the provision and maintenance of its service, the MaaS operator incurs costs related to communication, customer relationship management, transaction fees, etc. To make profits, the MaaS operator can combine several strategies:

- Charge a commission on the sale of services offered by operators;
- Benefit from discounts linked to the volume of mobility services purchased;
- Resell service packages at a higher rate than the cost price.

However, in the absence of public subsidy (the commercial integrator model or, to a lesser extent, the open platform model) economic equilibrium is difficult to achieve. In Helsinki, for example, the transport authority HSL sells tickets for its network to MaaS operators at the same price as the general public rate. As MaaS Global does not wish to resell them at a higher rate, it does not make any margin on the sale of public transport tickets, which nevertheless represent the vast majority of tickets sold via the Whim application. MaaS Global's strategy is to convince its customers to buy mobility service packages, hoping that their actual consumption (paid to transport operators) is lower than the volume purchased (collected by the MaaS operator). MaaS Global also makes profits on the sales of other mobility services.

Case-by-case integration of mobility services

The processes for choosing and integrating new mobility services into MaaS offers vary greatly from one system to another.

- In **Helsinki**, the MaaS Global operator decides whether or not to include a mobility service in its Whim offers, according to its own criteria. MaaS Global takes into account the technical conditions of integration into MaaS (existence of quality open data, openness of the ticketing system, etc.), the relevance of the mobility packages offered, the possibility of entering into an agreement with the operator concerned, etc. Concerning the public transport and bike sharing services set up by local authorities, MaaS Global has simply signed the standardised conditions of use of the APIs proposed by the transport authority HSL. For other mobility services such as taxis or car rentals, MaaS Global signs agreements on a case-by-case basis that define the conditions of access to the service, fare system, etc.
- In **Vienna**, the offers included in the WienMobil package are the result of a historic partnership between the transport network operator Wiener Linien and various partner service operators. However, the range of accessible offers has been reduced due to the withdrawal of a car-sharing operator who wishes to develop its own application. In its future contracts with bike sharing and car-sharing operators, the City of Vienna (which Wiener Linien is answerable to) will require that their services be integrated into the open platform, which will mean that they can be included in the WienMobil offer.
- In **Hanover**, new services are integrated into the Mobilitätsshop offer after discussions between the transport authority GVH and the various transport operators involved in the MaaS offer, who may oppose the arrival of a new operator. For example, the Mobilitätsshop's partner taxi company opposes the integration of car service with driver companies, which it regards as competitors.

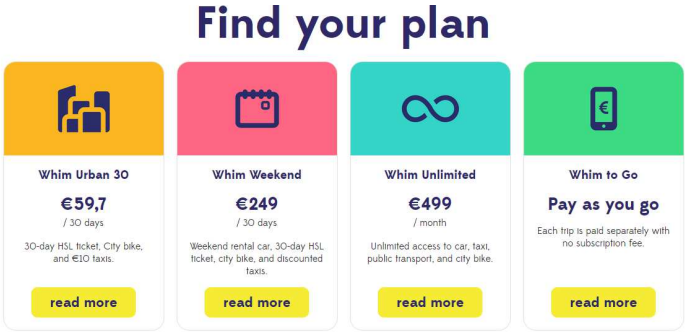
Bus in front of Hanover railway station (photo: Cerema)

Current MaaS services: niche markets

The MaaS offers available in Helsinki, Vienna and Hanover target only a part of the population: mainly working people who are used to using several modes of transport. In Helsinki, the mobility packages offered by Whim, and particularly the Whim Unlimited offer, which starts at €499 per month, are aimed at a minority section of the population. Over year after launching the service, approximately 70,000 people, or 6% of the population of the Helsinki region in which Whim offers are available, had an active Whim account. In Hanover, the Mobilitätsshop application, which only allows users to buy public transport tickets individually, has only a few thousand users.

The MaaS penetration rate is therefore limited for the time being. Several avenues are being considered to democratize the use of MaaS:

- **Make the MaaS application the reference application** for the widest possible range of customers and usages. This is the strategy in **Vienna**, where the WienMobil application is gradually integrating the functions of the other applications for the urban transport network, which it is gradually replacing[4]. The number of WienMobil users is expected to increase, even if most of them will, at least initially, use only some of its features (information, route planner, etc.).
- **Increase the number of offers and service packages**, in order to respond to the largest number of users. This is the strategy of Whim, which already has four different offers in **Helsinki**. However, the multiplication of offers, potentially put in place by different operators, is likely to make the system difficult for passengers to understand.



Various Whim offers in Helsinki (source: Whimapp)

Communication: a key factor. Communication with the general public is of paramount importance at the launch of the MaaS offer, but also in the long term. The concept of MaaS is complex to grasp and may lead to some reluctance on the part of passengers. It is essential to work on the legibility of the offers, detail the content of the packages, and explain how they work step by step in order to get passengers to subscribe to them. This requires suitable communication. The low number of users for some MaaS offers, such as in Hanover, is partly explained by the low level of communication on the subject.

Results to be consolidated in terms of changing mobility practices

Assessments of the effects of MaaS on mobility are few, partly because MaaS systems are still recent and partly because they concern a limited number of passengers. While some initial evidence shows positive effects, it is not possible to say at this time whether the MaaS is able to break travel routines. Further surveys of MaaS service users will be necessary to better understand their mobility practices and to assess a possible modal shift to alternative modes to solo car use. Of the few results of studies on the impact of MaaS systems:

- In Vienna, the assessment of the Smile project[5], which foreshadowed the WienMobil application, showed a change in mobility practices among users of the Smile application: a reduction in car use for 21% of those surveyed, an increase in the use of urban transport for 26%, train use for 22%, bike sharing for 10%, car-sharing for 4%, an increase in intermodal journeys, etc.
- In Helsinki, assessment of the Whim service[6] for the year 2018 shows that Whim users make more frequent use of public transport and taxis than the average population, but does not allow conclusions to be drawn regarding possible changes in practices related to subscribing to a Whim offer.

[4] The recent development of the Whim application in Vienna, however, risks fragmenting the market.
[5] Smile mobility project (2015), Results of the Smile pilot.
[6] Ramboll (2019), Whimpact: insights from the world's first Mobility-as-a-Service (MaaS) system.

Conclusion and outlook

These examples from Helsinki, Vienna and Hanover show that the MaaS concept covers a variety of achievements, in terms of portage, accessible mobility services or level of integration for the user. Moreover, these experiments are too recent to really evaluate their effects and to confirm their economic models.

WienMobil Station in Vienna (photo: Cerema)

These approaches are largely shaped by local contexts. MaaS applications are primarily deployed in towns where the offer of alternative services to private cars is robust and attractive. The level of integration of pre-existing offers in the area is a determining factor in what is offered via the MaaS. The local context plays on the role of the authorities in the MaaS project: while they are necessarily stakeholders, some of them position themselves directly as MaaS operators, in Vienna and Hanover.

The scalability of MaaS applications is also a recurring point, whether they are initiated through research projects, deployed from pilot versions or developed from previous ticketing and multimodal information systems. In the future, other features might appear: incentive schemes to encourage the use of certain modes of transport, travel guaranteed in the event of unavailability of the proposed mobility offer, interoperable MaaS services from one urban area to another, new packages integrating new services outside the field of mobility, etc.

While the promise of an alternative mobility to the simplified and easily “consumable” private car is attractive, the MaaS has yet to mature and prove itself. One of the main challenges is that these offers contribute to the development of sustainable mobility for all and in all types of area. They effectively support or amplify policies encouraging a modal shift towards alternative modes to solo car use. In France, it is with this objective in mind that the State is seeking to encourage the development of MaaS offers via the provisions of the framework law on mobility on the opening of data and online sales services in particular.

WeChat x MyHelsinki: towards "Life as a Service"? The *MyHelsinki* mini-programme for the WeChat smartphone application is a first move towards integrating urban and mobility services within the same device. This mini-programme was developed in collaboration between the City of Helsinki, MaaS Global and the Chinese company Tencent. It has been available since the summer of 2019, and allows Chinese tourists to access tourist and transport-related information, and to pay for all services (transport, tourist sites, restaurants, etc.).

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Appendices

Helsinki and Turku (Finland)

MaaS in Finland: a favourable context

The first reflections on MaaS in Finland, with the definition and further development of the concept, were launched in the early 2010's on the initiative of the Ministry of Transport and Telecommunications and the association ITS Finland. Soon, private companies and research centres began to grow the movement.

Highly motivational legislation

Finnish public policies have historically been favourable to the development of digital innovation in transport. This trend has been confirmed by the Finnish Transport Services Act, the majority of its provisions coming into force in July 2018. The purpose of this law is to facilitate the provision of user-oriented mobility services, including MaaS services. It has substantially amended Finnish legislation in the areas of competition between operators of mobility services and data openness:

- The law requires all mobility operators, whatever the mode (public transport, taxis, public parking, etc.), to make essential data on their services freely accessible from an API in a standard format. This essential data should include at least information on routes, stops, timetables, prices, availability and accessibility. By the end of 2019, the Finnish Ministry of Transport estimates that about 80% of mobility operators have opened their data.
- The law also requires all mobility operators to make their ticket sales and reservation interfaces accessible from an API. The obligation covers at least the possibility of booking a journey and purchasing a single ticket.

Public support facilitating the development of MaaS operators

In 2015, the Finnish government launched a programme, managed by the Ministry of Transport and Tekes, the public innovation funding agency, to support the creation of MaaS operators. This programme has promoted the development of several MaaS companies in Finland. Of these, two world-leading companies are based in Helsinki:

- MaaS Global, founded in 2016, which positions itself as an exclusively MaaS operator. MaaS Globlal mainly targets large urban areas in all regions of the world. Its Whim application is aimed directly at the general public.
- Kyyti, also founded in 2016, is developing a MaaS application and several other services, including a shared taxi system and a transport analysis and optimization service. Kyyti is interested in all types of areas, and is aimed both at companies (setting up services for their employees), transport operators (analysis and optimisation of the offer), local authorities (setting up and optimising mobility services, developing MaaS services in partnership with local authorities) and the general public.

In addition to the existence of these MaaS operators, the excellent coverage of the entire Finnish territory by the 4G network and the very high number of households equipped with smartphones are other assets for the development of MaaS services in Finland.

Several visions for MaaS in Finland

Today, there are several visions for MaaS in Finland:

- MaaS in urban areas, where the multimodal mobility offer is large and diversified, and where the main challenge is the modal shift from private cars to other mobility services. MaaS offers single portal for access to various mobility offers. The services at a fairly targeted category of the population: multimodal passengers. These systems are developed and supported by private companies, in a competitive framework, without any intervention from local authorities. This is the case of the Whim system developed by MaaS Global in Helsinki.
- MaaS in rural areas, where the mobility offer is more restricted, usually limited to bus services. Social issues related to accessibility, education, employment and health are predominant. Several pilot projects for the development of MaaS services have been launched in rural Finland with public funding. In these cases, MaaS has been considered in a broader framework: in addition to unified access to mobility offers, the MaaS approach also seeks to optimise and decompartmentalise the various existing transport services (public transport, schools, health services, etc.), or even to develop new services. Rural MaaS targets a much more diverse population.

Helsinki: a global showcase for MaaS

Helsinki, the capital of Finland, is located on the shores of the Baltic Sea. The city centre developed on a peninsula, surrounded by an archipelago of more than 350 islands. The urban area is experiencing marked population growth, which is putting increasing pressure on transport networks.

The municipality of Helsinki has about 650,000 inhabitants. With a density of about 3,000 inhabitants per square kilometre, Helsinki is a relatively sparsely populated capital city.

The Greater Helsinki metropolitan area consists of 14 municipalities and has a population of approximately 1.5 million people, with a density of 400 inhabitants per square kilometre. It is by far the most densely populated urban area in Finland and its main economic centre.

View of Helsinki city centre (photo: Cerema)

Public transport: an essential component of the urban mobility offer in Helsinki

Since January 2010, public transport in the Helsinki region has been organised by HSL (Helsingin seudun liikenne - Helsinki Region Transport), an inter-municipal association founded in 2009. HSL comprises 9 of the 14 municipalities in Greater Helsinki, with a total population of approximately 1.1 million.

HSL is responsible for the organisation of suburban train, metro, tram, bus and ferry services in its 9 municipalities. HSL does not provide any transport services of its own, but contracts them out to different operators. HSL is also responsible for:

- long-term public transport planning for the Greater Helsinki area,
- the validation of public transport fares,
- the sale and control of tickets,
- passenger information for the public transport network.

The HSL network

The main metro and tram network mainly serves the municipality of Helsinki. Suburban train and bus lines complete the network, including in outlying communes. Overall, the network is judged to be reliable and efficient. It comprises:

- 14 suburban train lines,
- 2 metro lines, serving the municipalities of Helsinki and Espoo,
- 11 tram lines, serving the municipality of Helsinki,
- 290 bus lines, which account for almost half of the trips made on the network,
- 2 ferry lines, which serve an island in the Helsinki archipelago.

Helsinki tramway (photo: Cerema)

Service		Network	Operators	2017 user numbers
	Suburban train	14 lines	VR	65 million trips
	Metro	2 lines	HKL	68 million trips
	Tramway	11 lines	HKL	60 million trips
	Bus	290 lines	Helsingin Bussiliikenne Oy, Nobina Finland Oy, and 15 other operators	180 million trips
	Ferry	2 lines	Suomenlinnan Liikenne Oy	2 million trips

Characteristics of the different urban transport services (source: HSL)

The public transport network provides about 375 million trips per year, which is 25% of the modal shares of the inhabitants of Greater Helsinki.

HSL has introduced fare integration for all public transport in the Helsinki region. The region is divided into four fare zones: A, B, C and D. Zone A corresponds to the centre of the municipality of Helsinki, zones B and C to the outlying areas of Helsinki and the municipalities of Espoo, Vantaa and Kauniainen, and zone D to the most remote and least densely populated municipalities.

Tickets can be bought for 2, 3 or 4 zones, depending on the route taken (there is no ticket valid for a single zone, except for zone D).

Map of tariff zones (source: HSL)

There are different ranges of tickets:

- Single tickets: these are valid for 80 to 110 minutes depending on the tariff zones chosen. Connections are allowed.
- Day tickets: these are valid for 1 to 7 periods of 24 hours from the first validation or purchase, depending on the chosen medium.
- Subscriptions: these are variable for a customizable period of time, from 14 days to one year. Discounts apply for children, students, pensioners, people over 70 and people with reduced mobility. Subscribers can purchase “extensions” on a per-unit basis, allowing them to travel occasionally in tariff zones where their subscription is not active.

Tickets are available in several formats:

- **On paper, for single and day tickets.** These can be obtained from vending machines, kiosks, or directly from bus drivers. No validation is required before using public transport, except on board buses where paper tickets must be shown to the driver.
- **As electronic ticketing with the HSL card, for all available tickets.** The HSL card is subject to a fee (5 €) and can be personal or anonymous. Discounts are only available for personal cards. The card must be validated when boarding a vehicle or at the entrance to a train or metro station. It can also be used as a “wallet”: after loading an amount onto the card, it can be debited each time it is used by selecting the desired tariff zones on the validator.
- On the HSL application, for single tickets, daily tickets and most subscriptions (some discounted subscriptions are available only on the HSL card). The ticket takes the form of an animation on the screen. No validation is required before using public transport, except on board buses where the application must be presented to the driver.

Zones		Single ticket	Day tickets		Subscriptions	
			1 day	7 day	30 day	1 year
A B		€ 2.80	€ 8.00	€ 32.00	€ 59.70	€ 636.00
A B C		€ 4.60	€ 12.00	€ 48.00	€ 107.50	€ 1140.00
A B C D		€ 6.40	€ 17.00	€ 68.00	€ 156.40	€ 1668.00
B C		€ 2.80	€ 8.00	€ 32.00	€ 59.70	€ 636.00
B C D		€ 5.40	€ 14.00	€ 56.00	€ 115.80	€ 1236.00
C D		€ 4.20	€ 11.00	€ 44.00	€ 98.00	€ 1044.00
D		€ 2.80	€ 8.00	€ 32.00	€ 59.70	€ 636.00
Medium	HSL application	•	•		•	
	HSL card	•	•		•	
	Paper ticket	•	•			

Main tariffs 2019 (source: HSL)

Other urban mobility services, provided by both private and public entities

Other mobility services are on offer in the Helsinki urban area, including:

- Car-sharing services, including CityCarClub (car-sharing in a loop with stations, about 100 stations) and ALD (car-sharing in a loop with one station)
- A bike sharing service with City Bike stations (1500 bicycles for 150 stations), jointly set up by the municipalities of Helsinki and Espoo, HSL being responsible for communication and marketing. The service operates only from April to October, and is deactivated during the winter period.
- Several free-floating electric scooter services, set up by private operators (Lime, Tier, Voi and Hoop, available in the centre of Helsinki), unrelated to local authorities.
- A scooter sharing service with stations, set up as part of a partnership between HSL and the operator Samocat (300 scooters including 150 electric scooters and 150 kick scooters for 28 stations, located in the Vusuoari district, at the terminus of a metro line).

Whim, the MaaS system in Helsinki

Whim is a MaaS application in the Helsinki region. It was developed and is operated by the company MaaS Global. Whim was tested from October 2016 in a version not available to the general public, then commercially launched in November 2017.

By July 2018, one million trips had been made with Whim in the Helsinki region. The 2 million trip milestone was passed in October 2018.

Advertisement for Whim in Helsinki station (photo: Cerema)

MaaS Global: a quick look at the history

In late 2015, an initial €0.7 million round of financing was raised from private entities (including the French transport operator Transdev, the Turkish car manufacturer Karsan, the Finnish national rail operator VR, the car service with driver platform Uber and several other companies) in order to make the MaaS concept a reality. This led to the creation of MaaS Finland in January 2016, renamed MaaS Global in June 2016.

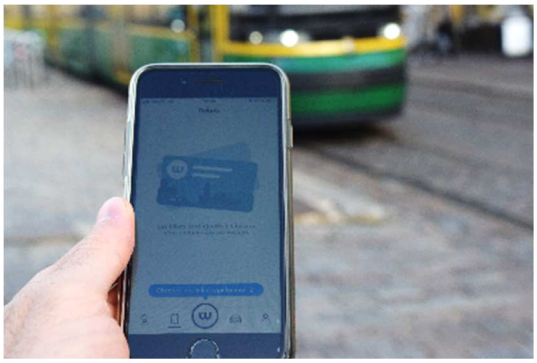
The pilot version of the Whim application was developed in the summer of 2016, and the first commercial trip using the application was made to Helsinki in October 2016.

In August 2017, a new round of fundraising enabled brought in €14.5 million for MaaS Global. New investors entered MaaS Global's capital, including Japanese car manufacturers Toyota and Mitsubishi, and Japanese real estate developer Mitsui Fudosan. The commercial version of the Whim application was launched in Helsinki in November 2017.

In parallel with its activities in the Helsinki region, MaaS Global has expanded outside Finland. MaaS Global deployed the Whim system in Birmingham in December 2016, Antwerp in September 2017 and Vienna in November 2019, based on models similar to the Helsinki model.

Whim: a unique application with complementary offers

Whim is a smartphone application that allows users, with a single account, to calculate a route, access mobility services and pay for their use, combining all the public transport organised by HSL, the *City Bikewhi* bike sharing service, taxis, car rental and car-sharing. Whim is available throughout the Helsinki region.



Whim application (photo: Cerema)

By late 2019, Whim was offering 4 different packages. Three of these are based on a monthly subscription principle, with a tariff which depends on the available tariff zones of the public transport network. The last one, without subscription, allows users to pay according to the use of the different services actually used.

- **Whim Urban 30** is a subscription option that includes unlimited access to the public transport network and bike sharing schemes. In addition, Whim Urban 30 holders can use taxis with a capped fare for journeys of less than 5 km, and benefit from reduced rates for car rental. The fare is the same as the monthly public transport network subscription, i.e. €59.70 for zones AB.
- **Whim weekend** is another subscription that includes urban transport and bike sharing under the same conditions as Whim Urban 30, as well as the rental of an economy car during the weekend.
- **Whim Unlimited** includes urban transport, bike sharing, car rental, access to car-sharing service and taxi fares for journeys of less than 5 km. The basic rate is €499 per month for zones AB.
- **Whim To Go** is a non-subscription "Pay-as-you-go" option, which allows payment for mobility services (public transport, taxi and car rental) at standard rates, depending on usage.

Option	Whim Urban 30	Whim Weekend	Whim Unlimited	Whim To Go

Monthly rate	From €59.70 (zones AB) to €156.40 (zones ABCD)	From € 249 (zones AB) to € 345.70 (zones ABCD)	From € 499 (zones AB) to € 596 (zones ABCD)	€ 0
Urban transport	**30-day subscription included**	**30-day subscription included**	**Unlimited number of single tickets**	**Available with an extra charge** Standard single rate
Bike sharing	**Included** **Unlimited travel** 30 minutes free per rental, then €1 per 30 minutes	**Included** **Unlimited travel** 30 minutes free per rental, then €1 per 30 minutes		**Not available**
Taxi	**Available with an extra charge** Journeys of less than 5 km: price capped at €10. Journeys of over 5 km: standard rate	**Available with an extra charge** 15% discount on the standard rate	**Included with conditions** Journeys of less than 5 km: free of charge **Available with an extra charge** Journeys of over 5 km: standard rate	**Available with an extra charge** Standard rate
Car-sharing	**Not available**	**Not available**	**Included with conditions** 2 hours free per day, then €5 per 30 minutes	**Not available**
Car rental	**Available with an extra charge** Economy car: €49 per day Other categories of cars: standard rate	**Included with conditions** Economy car, the weekend from Friday at 3:00 pm to the following Monday at 2:00 pm **Available with an extra charge** Economy car from Monday at 2:00 pm to Friday at 3:00 pm: €49 per day Other categories of cars: supplement from €9.90 to €49 per day	**Included with conditions** Economy car **Available with an extra charge** Other categories of cars: supplement from €9.90 to €49 per day of hire	**Available with an extra charge** Standard rate

Characteristics of the different Whim offers in late 2019 (source: Whim)

The customer pathway

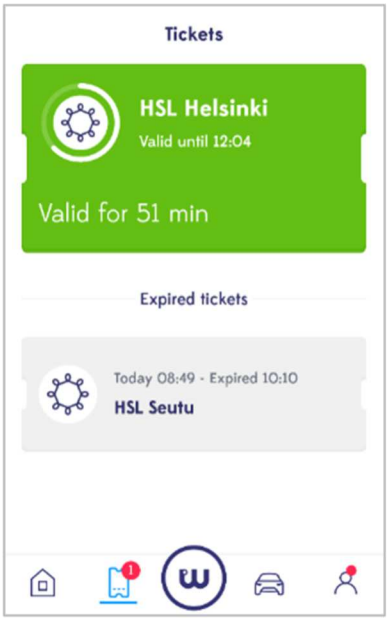
Users wanting to access the Whim service must download the application and set up a customer account. To use the full features of Whim, they must also provide a credit card number.

Using public transport with Whim

Whim Unlimited and Whim To Go users must activate their ticket via the Whim application before using public transport. Whim To Go users select the ticket they want (either directly or after a route search) and pay for it via the application.

Whim Urban 30 and Whim Weekend users automatically have a ticket valid for 30 days, which does not need to be activated (except in special cases, if they wish to purchase a zone extension, for example).

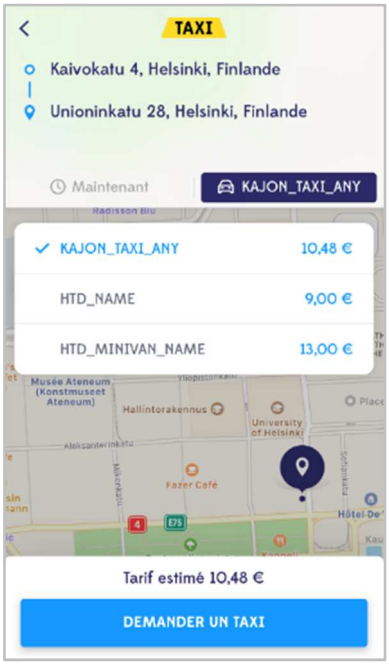
The valid ticket appears in the ticket section of the application. It takes the form of an on-screen animation. No validation is required to access trains, metros and trams. Users only need to show the active application to the bus driver or ticket inspectors if they request it. The phone battery must always be charged to allow the ticket to be checked. Otherwise, the user is liable to a fine.



How a ticket appears on the Whim application (source: Whim)

Use of taxis

The Whim application can be used to book a taxi from a simple route search. The route planner estimates the fares of different taxi companies. Users select their company and pay for the trip if it is not included in their Whim offer. The booking is then sent to the company. The booking can be cancelled (the amount paid is then credited to the user's account), but not modified. When the taxi arrives, the driver just needs to be shown the booking displayed in the application.



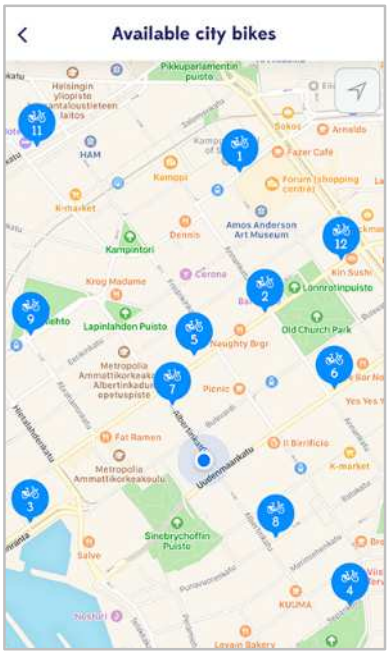
Screen for booking a taxi from a route search on the Whim application (source: Whim)

Use of bike sharing

Self-service bicycles can be unlocked using a personal ID (7-digit code) and a PIN code (4-digit code), which can be entered on a keypad located on the handlebars of each bicycle.

To use the bike sharing service, Whim users must first select the starting station in the application (the application shows the number of bikes and spaces available at each station) and request to take out a bike. The application then generates an ID and a PIN code (the ID remains valid as long as the user has subscribed to a Whim offer with subscription, but the PIN code changes with each booking). The user enters his user ID and PIN code on the bike keypad, which unlocks the bike. To return the bike, the user simply engages it into an available terminal. A message on the bike's screen and a notification in the Whim application indicate that the rental has ended.

Each time a PIN code is generated, a fee of €1 is pre-authorized on the user's bank card. This amount is returned if the bike is returned within 30 minutes of unlocking it, or if the PIN code is not used.

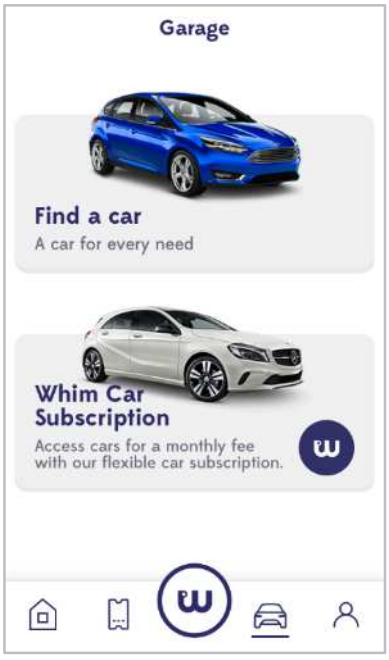


Self-service bicycles available shown on the Whim application (source: Whim)

Use of rental cars or car-sharing

The Whim application can be used to book and pay for the car rental, if it is not included in the user's Whim offer. Vehicles are rented in an agency with conventional rental companies such as Hertz or Sixt, following their own procedures.

The use of ALD car-sharing vehicles is in the experimental phase. It is currently only possible for users subscribing to the Whim Unlimited offer. Only 5 vehicles are available. Users must first send a photo of their driver's license via the Whim Application help centre. Once the driver's license is validated, the application allows users to make the booking, lock and unlock the vehicle doors, and end the rental.



Rental car booking screen on the Whim application (source: Whim)

An offer defined and supported by MaaS Global

The Whim offer has been set up and is managed by MaaS Global, without any direct intervention from the authorities (the cities of Helsinki, Greater Helsinki, HSL, etc.) or their operators (HKL, etc.).

Defining the content of Whim offers

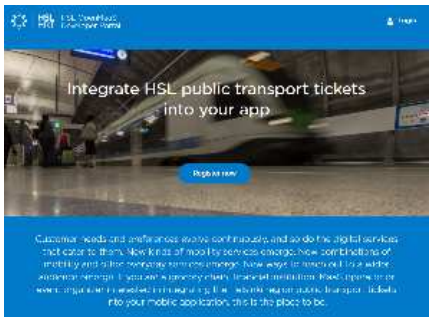
The types of services available and the prices of the different Whim offers have been defined by MaaS Global, based on criteria that are specific to the company. Integrating public transport into Whim offers was a matter of course. Concerning the other mobility services, the technical conditions for integrating the service into the Whim offer (availability of open data, access to the ticketing system, availability of APIs with sufficient features) are a determining factor in this choice.

MaaS Global wants to continue to develop its offers, and does not rule out integrating new mobility services if the conditions are met. The Whim Weekend offer, for example, was recently created to provide an intermediate offer between Whim Urban 30 (the basic offer) and Whim Unlimited (a very comprehensive but expensive offer).

Relations with other public and private mobility providers

The role of the authorities, and in particular the transport authority HSL, is limited to opening up its data and ticketing system and providing APIs to allow third parties to access it.

HSL opened up its static and real-time data more than a decade ago. Before Finnish law required the opening of the ticketing systems, MaaS Global and HSL had entered into an agreement allowing MaaS Global to market certain HSL tickets. Since then, HSL has opened its ticketing system and set up an API to access it. The development of this API represented a significant investment on the part of HSL, estimated at around €1 million, excluding personnel and maintenance costs. HSL is gradually expanding the range of transport tickets accessible via this API, in particular by including a 30-day subscription.



Screenshot of the API giving access to HSL tickets (source: HSL)

Today, there is no longer any special agreement between MaaS Global and the authorities or their operators. MaaS Global has only signed the terms of use of the APIs that allow access to timetables and ticketing for public transport and self-service bicycles. MaaS Global therefore accesses data and ticketing under the same conditions, including for tariffs, as any other provider. However, MaaS Global is the only provider to use HSL's ticketing API on a permanent basis. Occasionally, event organisers use it to offer tickets that combine access to the event with a public transport ticket.

Concerning private operators, such as taxi companies or car rental companies, MaaS Global draws up specific agreements with each operator. This agreement defines the tariff conditions, the terms and conditions for transferring MaaS Global's revenues to the operator, etc.

A difficult economic balance

MaaS Global does not receive any government funding for setting up or operating the Whim Offer. Its only sources of revenue are fundraising from private stakeholders, and the sale of Whim offers.

HSL has decided not to grant any reduction to those who sell on tickets, irrespective of their status or the volume of sales made, in order to put all retailers on an equal footing. This concerns MaaS operators, other operators offering combined tickets (tourism + transport or event + transport, for example), and kiosks. Retailers, on the other hand, are allowed sell on HSL tickets at a higher rate if they so wish.

In this way, MaaS Global buys HSL tickets at the same price that a user would pay if he bought the ticket in an HSL distributor, for example. However, if the user buys his ticket from a distributor, all costs (transaction fees, customer support, etc.) are borne by HSL. If the user buys it via a Whim offer, MaaS Global bears these costs. From a strictly economic point of view, it is therefore more advantageous for HSL for users to buy their titles via a Whim offer, as the revenue is the same but the costs incurred are lower.

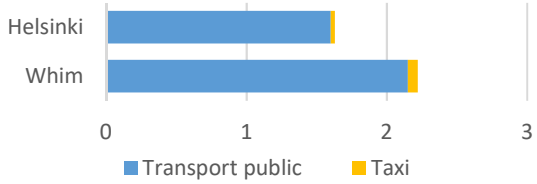
MaaS Global has chosen to match the price of its Whim Urban 30 offers to the prices of the corresponding HSL tickets. This choice is advantageous for Whim users, who benefit from additional services at no extra cost (access to the bike sharing service, capped prices for taxi fares, reduced rates for rental cars). On the other hand, it is very unfavourable for MaaS Global, which loses money on every Whim Urban 30 title sold. The same applies to the Whim To Go offer, for which MaaS Global does not take any commission (the prices paid by the user correspond to the rates charged by the various operators) but bears the transaction and customer support costs. For the time being, this strategy is justified by MaaS Global's aim of recruiting a larger number of customers. The shortfall is currently compensated by MaaS Global's equity capital. However, this strategy is not economically viable in the long term.

MaaS Global's business model consists of gradually switching its customers to more expensive offers, Whim Weekend and Whim Unlimited, on the assumption that customers will not systematically use all the services included in these offers. In other words, MaaS Global hopes that its customers will buy a right to access services that they will not fully use, thus allowing it to make a profit.

Effects on mobility practices

The *Whimpact* study carried out by Ramboll[7] provides information on the profile of Whim users and their mobility practices. This study compiles data from the year 2018, which is the first year of "commercial" service for Whim. Among the main results of this study:

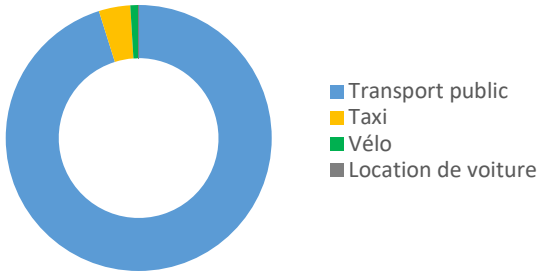
- The number of users is still limited: about 70,000 users have an active Whim account, which is about 6% of the population of the Helsinki region where the service is available. However, the number of users has been steadily increasing since the service was launched.
- The 18-40 age group is over-represented among Whim users, and people over 50 are under-represented.
- The mobility of Whim users is comparable to the average mobility in the Helsinki region: 3.4 trips per day and per person, compared to 3.3.
- Whim use is higher in areas with a high density of public transport.
- Whim users make more frequent use of public transport and taxis than the rest of the population. Whim users make three times as many taxi trips as the average, and these trips are more often in connection with the HSL network.



Number of trips per day per person

(source: Ramboll, Whimpact)

- Whim is used almost exclusively for public transport: 95% of the trips made with Whim are made on the HSL network. This confirms that public transport is the essential component of MaaS services. Taxis account for about 4% of trips, bicycles 1%, rental cars less than 0.1%.



Modal shares of Whim trips

(source: Ramboll, Whimpact)

- Whim users respect the limitations of Whim offers: 97% of bike journeys last less than 30 minutes (maximum free rental time), 87% of taxi journeys are less than 5 km long (the maximum distance to benefit from the €10 fare cap)

[7] Ramboll (2019), Whimpact: insights from the world's first Mobility-as-a-Service (MaaS) system.

Outlook

Upcoming developments for Whim offers

MaaS Global regularly changes its offers, according to the use that is made of them and opportunities. The recent creation of the Whim Weekend offer is an example of this. The inclusion of new mobility services (other car-sharing solutions, shared electric scooters, etc.) into existing Whim offers may also be considered.

The development of new offers integrating services in areas other than mobility is one of the improvements envisaged by MaaS Global.

- The *MyHelsinki* mini-programme for the WeChat smartphone application is one such development in this field. Developed through a collaboration between the city of Helsinki, MaaS Global and Tencent (a Chinese company specialising in internet services), it enables Chinese tourists to access tourist and transport-related information, and to pay for all services (transport, tourist sites, restaurants, etc.). This application targets a niche market but is growing, as Chinese tourists travel individually. It has been active since July 2019.
- MaaS Global also wants to work on the reasons for travel, especially trips to and from home. MaaS Global is therefore considering forging partnerships with people working in housing, for example to include a Whim offer in the price of rents.

Screenshots of the WeChat MyHelsinki application (source: City of Helsinki / MyHelsinki)

On an international scale, MaaS Global is working on “roaming” between the different regions covered by the Whim application. This would allow a user with a Whim account in Helsinki to use the application in other cities where it is available, such as Vienna or Antwerp, without having to re-register.

A desire for competition between MaaS operators

During the initial reflections on MaaS in Helsinki, several private stakeholders made ready to develop such a service. Only MaaS Global has managed to market an offer, and is therefore in a de facto monopoly situation.

However, both the authorities and MaaS operators are in favour of competition between MaaS operators in the same region. As in the case of mobile telephony, they consider it preferable for several operators to share the market in order to offer a diversified range of products and services to a larger number of potential customers. Competition is seen not only as a way to stimulate innovation, but also to expand the MaaS market.

However, the arrival of different MaaS operators in a medium-sized city such as Helsinki, where the customer potential for MaaS services is still small, does not appear to be economically viable.

In addition, the transport authority HSL provides advanced features, such as ticket purchasing, directly via its application. HSL does not consider its application to be a MaaS application, as it concerns only public transport. However, this application meets the same needs as the Whim application, for passengers who use only public transport services.

Advertising for the HSL application (photo: Cerema)

Turku: a pioneering urban area for MaaS

Turku (Abö in Swedish) is the sixth largest city in Finland and has a population of almost 190,000. The Turku region, which comprises 11 municipalities, is the third most populated region in Finland with 317,000 inhabitants. Turku was the capital of Finland until 1812, when the capital was moved to Helsinki by the Russians, considering Turku geographically too close to Sweden.

Mobility services in the Turku region

Since 2014, public transport in Turku and its region has been organised by Föli (Turun seudun joukkoliikenne - Turku Region Public Transport), an inter-municipal organization that includes 6 municipalities and approximately 240,000 inhabitants.

Föli has set up an integrated transport system, also known as Föli, which includes 41 urban bus lines and 35 regional bus lines, demand-responsive transport services, a funicular railway, a ferry and a bike sharing service. Föli delegates the operation of these services to different operators (there are 8 bus operators). The network provided 27 million trips in 2017, representing approximately 10% of modal share.

The Turku region is also served by 3 railway stations. Several electric scooter operators are also present.

Föli network bus (photo: Cerema)

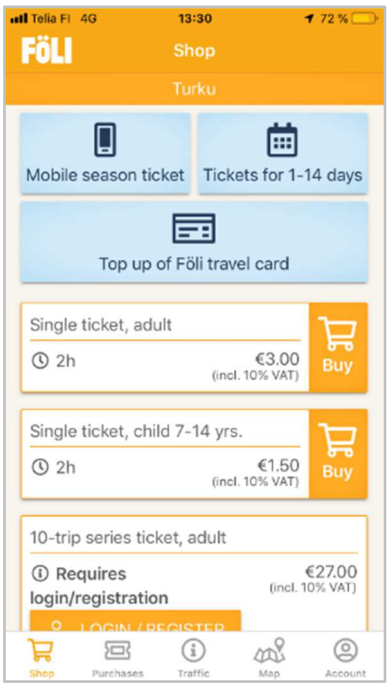
Föli self-service bikes (photo: Cerema)

The fare system is integrated on the Föli network, based on flat pricing throughout the entire network. There are single tickets, day tickets (for 1 to 14 days), or subscriptions valid for 30, 90 or 180 days. An exception is the bike sharing system, which has its own fare system (but Föli subscription holders can access it at no extra cost).

As early as 2014, Turku was the first transport network in Finland (and one of the first in the world) to change its ticketing architecture from a card-based system (where the ticketing card stores information) to an ID-based ticketing system (where the card serves only to identify the passenger, with all passenger data and rights stored on a remote server). This change proved to be less expensive than making over the ticketing system as it was, and much more scalable. This has made it possible, as of 2014, to sell dematerialised tickets via the application, and allows third parties to sell tickets in the form of QR-codes. This change nevertheless required all ticketing equipment and Föli cards to be renewed.

There are three types of media for tickets:

- Paper (for single or day tickets). The ticket must be shown to the bus driver.
- An electronic ticketing card called Föli (for all tickets). The card can also be used as a "wallet": to do this, a sum of money must be loaded onto the card; this amount is then debited each time it is used (at a lower rate than the single ticket). The Föli card must be validated each time the user boards a bus.
- The Föli smartphone application. The application can be used with or without a customer account (if there is no account, the price of the tickets is reflected on the telephone operator's bill). All tickets are available via the application, which also allows the Föli card to be reloaded. The application generates tickets in the form of QR-codes, which must be validated each time the user boards.



Screenshot of the Föli application allowing tickets to be purchased

Tuup: a short-lived MaaS system in Turku

In 2014, Föli was also one of the first public transport networks to open up its data and ticketing to third parties, thus enabling the creation of MaaS services. Today, Föli makes all its transport data available in real time via an online API. The use of this API is free and open to all, without prior registration. Föli also offers an API for the sale of Föli tickets. This API is open to all organizations wishing to sell Föli tickets, which must first sign an agreement with Föli. The prices of the tickets purchased via the API are identical to those for the general public: Föli does not grant discounts to operators who wish to retail their tickets.

In April 2016, the start-up Tuup (which has since joined Kyyti) was the first to use the APIs offered by Föli and to include the sale of Föli tickets in its MaaS application, also known as Tuup.

The Tuup application provided access to all transport options via a mobile application offering a route planner that allowed users to plan trips and compare routes on foot, by bike, by public transport, by car or by taxi, information on real-time public transport departures and the possibility to purchase corresponding tickets (on a pay-per-use basis). The application was set up on an experimental basis by the Tuup company, with no direct link to Föli (apart from the signing of the agreement for the retail of tickets). Tuup ended the experiment in 2018, probably due to the very low number of tickets sold through the application.

Screenshots of the Tuup application (source: Kyyti)

The Finnish railway operator VR is to date the only one to use the API for the sale of Föli tickets on a permanent basis. VR gives its customers travelling by train from or to one of the stations in the Turku region the option of buying a combined Föli train and bus ticket for an additional €3, which corresponds to the price of a single Föli ticket.

In general, Föli is in favour of the development of MaaS services and even of competition between different MaaS operators. As a transport authority, Föli sees in the development of MaaS offers opportunities to strengthen the use of its network: new information vectors on its network, sales channels for additional tickets, the possibility of creating more personalised combined mobility offers, making it possible to meet the expectations of a larger population. However, Föli recognises that in a medium-sized urban area like Turku, the MaaS market is small. In addition, Föli has developed its own application which already offers advanced features (real-time information, purchase and validation of public transport tickets, etc.). However, Föli sees its application as a simple payment option, and considers that it does not compete with a possible MaaS service that might offer added value, such as the "mobility packages" offered by Whim in Helsinki.

Lessons learned

These case studies of MaaS initiatives in the Helsinki and Turku urban areas highlight the following lessons:

- The observation that **MaaS cannot be possible without a certain number of prerequisites**:
  - Mobility infrastructure and services (MaaS is only relevant when the public transport network is efficient and competitive compared to private cars).
  - Communications infrastructures (MaaS services are based on smartphone applications, which require permanent access to the 4G network).
  - Intelligent transport systems adapted to MaaS services (need for real-time multimodal information, opening up ticketing systems allowing access to the public transport network with a smartphone application, etc.).
  - Data exchange infrastructures (opening up offer data, ticketing systems, etc. to enable MaaS operators to develop their services).
- **The Finnish context is very favourable to the implementation of MaaS,** both from a legislative point of view (Finnish law imposes the opening of data and ticketing for all mobility service providers, public and private, individual, shared and collective), industrial (a tradition of innovation, several Finnish companies at the forefront on the issue of MaaS), technological (excellent coverage of the mobile phone network throughout the area), social (very high number of people equipped with smartphones) etc.
- The differentiation between **two main categories of MaaS services:**
  - Urban MaaS, in sectors where the multimodal offer is diversified, with modal shift issues: MaaS offers a new way of accessing mobility services, and can be envisaged in a competitive framework, without direct intervention by local authorities.
  - Rural MaaS, where the mobility offer is limited, where social and accessibility issues are paramount: MaaS is part of a broader approach to optimising and decompartmentalising the various existing transport services, and requires public funding.

- **A consensus as to the point of having the MaaS initiative led by a private stakeholder,** independent of the organising authorities and transport operators. According to everyone we met, this is the best way to stimulate innovation and the implementation of diversified mobility “packages” adapted to the needs of customers.
- **A need for action on the part of local authorities,** not to set up and propose MaaS offers, but to make it possible for such offers to emerge. This mainly concerns the opening up of data, ticketing systems, provision of suitable APIs, etc.
- **The finding that MaaS offers respond to a niche market,** and that it is therefore necessary to multiply the offers in order to reach a larger population and expand the market.
- **A shared desire for competition between different MaaS service providers** in the same geographical area, despite the small size of the market. Competition is seen as a way to stimulate innovation and adapting MaaS offers to users' needs. Each provider can propose different offers and different mobility packages, potentially integrating other non-mobility services in order to reach a diversified customer base.
- A question about the business model(s) of the MaaS service providers. This model is highly dependent on the tariff of public transport tickets paid by MaaS operators, as public transport is the service most used via MaaS applications.

List of people met

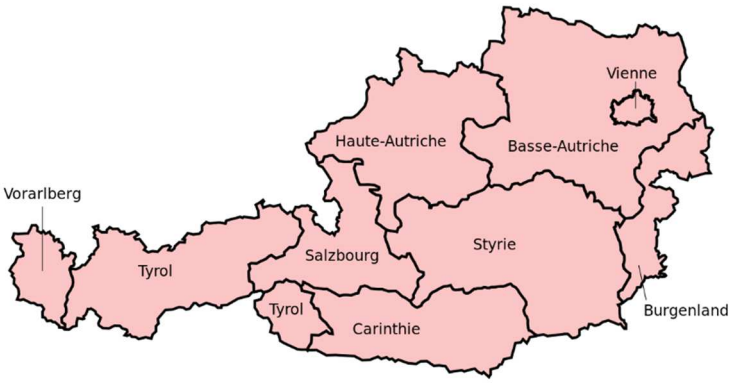
- Jenni Eckhard (VTT)
- Laura Eiro (ITS Finland)
- Noora Haavisto (Kyyti)
- Heidi Heinonen (Forum Virium)
- Krista Huhtala-Jenks (MaaS Global)
- Juho Kostiainen (City of Helsinki)
- Michel A. Mont Rabet (Kyyti)
- Pekka Niskanen (Kyyti)
- Topias Pihlava (City of Turku)
- Saara Reinimaki (LVM)
- Sami Sahala (Forum Virium)
- Jemina Uusitalo (HSL)

Vienna (Austria)

Mobility in Vienna

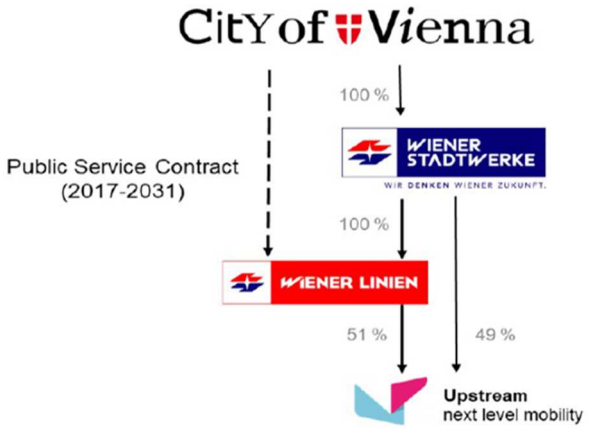
The city of Vienna is the capital of Austria, and is one of the 9 Austrian Länder (federal states), each with its own government and administration.

The city of Vienna has 1.8 million inhabitants in an area of 415km² while the urban area of Vienna has 2.6 million inhabitants.



Map of the Austrian Länder
(source: CC-BY-SA 3.0 Poux via Wikimedia commons)

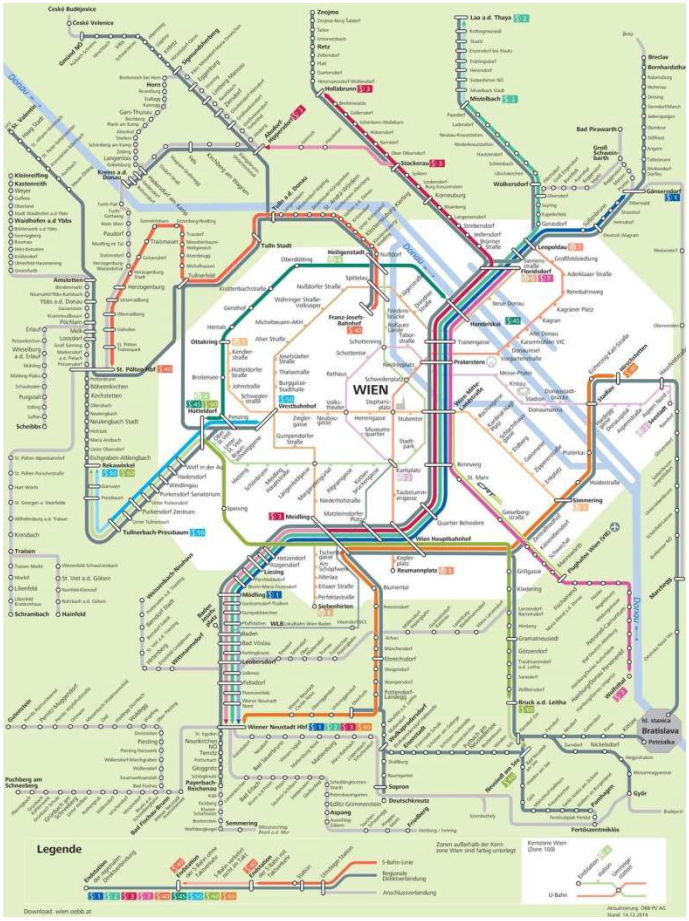
In terms of public transport, a public service contract binds the city of Vienna with the public operator Wiener Linien for the period 2017-2031. Wiener Linien is wholly owned by a public structure called Wiener Stadtwerke. It operates various public services for Vienna (public transport, funeral services, energy, etc.).



Links between the city of Vienna and its various operators
(source: Upstream Mobility)

The public transport offer consists of the following services:

- 5 metro lines forming a network of 83 km;
- 129 regular bus lines including 21 night buses;
- 28 tramway lines over 220 km;
- 9 S-Bahn (regional express network) lines which also serve the interior of the city of Vienna.



Map of the public transport network in Vienna (source: ÖBB)

In addition, there are, as of June 2019:

- electric scooters: There are 8 operators in Vienna.
- Free-floating car-sharing vehicles with a total of 1,600 cars (the two historical operators Car2Go and DriveNow have now merged to become ReachNow) as well as a station-based car-sharing operator (Stadtauto which operates 16 shared cars and has 700 users). In addition, the city of Vienna is planning to launch a consultation to further develop car-sharing, the objective being the deployment of 900 electric cars and 1,500 shared cars with a station.
- A bike sharing scheme (City Bike) operated by JC Decaux under contract with the City of Vienna over 120 stations. As far as free-floating bicycles are concerned, following a new regulation on 1 August 2018, providing for a €500 fine for any “inopportune” bicycle (one vandalised or badly parked in public spaces) or even seizure of the bicycle, 780 bicycles (i.e. almost all the fleet still remaining in Vienna in the summer of 2018) were seized and the last remaining operator in the Austrian capital withdrew.

In terms of usage, with a 39% modal share, public transport is the main means of transport in Vienna. If we add a 7% modal share for cycling and a 27% share for walking, there is only 27% modal share left for private cars[8]. The change in modal shares between 1993 and 2016 has been largely to the detriment of private cars, since the modal share of the car fell from 40% in 1993 to 27%, while that of public transport rose from 29% to 39%.

In public transport, there were about 900 million passengers in 2013 and the target is to exceed 1 billion passengers in 2020.

The fares proposed are shown opposite.

In 2012, the annual subscription fell from €449 to €365 (with the "spend €1 a day for your mobility" marketing operation), leading to an increase of more than 37% in the number of subscriptions sold, which rose from 372 to 512 million between 2011 and 2012.

Single ticket	€2.40 (all users) €1.20 (children)
24-hour flat rate	€ 8.00
48-hour flat rate	€ 14.10
Weekly pass (valid only from Monday to Monday 9:00 am)	€ 17.10
Annual pass	€ 365.00

Main fares offered on the urban transport network (source: Wiener Linien)

Tickets are valid until the user arrives at his/her destination, including changes. Children up to 6 years of age travel free of charge, and children under 15 years of age travel free of charge on Sundays and public holidays as well as during school holidays in Vienna. Tickets are sold:

- in automatic multilingual ticket machines (in metro stations);
- in all sales outlets and in Wiener Linien's online store;
- in most tobacconists;
- with ticket by mobile phone.

It should be noted that these services are developed as part of a strategic STEP 2025 approach, which is applied to urban planning and mobility.

STEP 2025 strategic approach (source: City of Vienna)

[8] Source: Wiener Linien, 2016 data.

The developing the WienMobil system

The Smile project: the beginnings of MaaS in Vienna

Screenshot of the Smile application (source: Wiener Linien)

In 2010-2011, the Numo project laid the foundations for a multimodal service with information and payment. In 2012, the Smile project started for 3 years, as part of a European call for projects. The Vienna transport operator (Wiener Linien) and the national railway operator (ÖBB) were the main entities involved in the project.

The goal was to develop an innovative integrated mobility service, but as the project leaders themselves admitted, this seemed utopian. Nevertheless, the project was a resounding success, in terms of technology, governance and usage (1,000 people were selected as testers). The first mobility operators were difficult to convince, but then the following ones easily joined the initiative.

The service offered the highest level of integration with a single account for all means of transport, access to multimodal information, and the ability to book, pay and use the various mobility offers with one's smartphone. However, the user had separate contracts with each operator, and separate tickets for each modal journey, all of which were integrated into the application. A summary of usage was provided to the user, but this was not a real bill.

At the end of the Smile project, the success was so great that each of the two protagonists wanted to develop a MaaS system on their own, with a radically different approach. The ÖBBs sought a private investor and had the WegFinder application developed. For their part, Wiener Linien chose to internalise the skills (its costs in the framework of the Smile project were €500,000 per year, financed by this European project; but the continuation of the project gave rise to additional funding allocated by the City of Vienna). Wiener Linien bought the technology from Fluidtime (which was part of the Smile project and already had a multimodal application called Qando as early as 2009) and first developed the BeamBeta application. Then the principle of a single global invoice was stopped, as it was too risky on a large scale and not popular (unlike the single account), and the application was renamed WienMobilLab.

Wiener Linien then set up a subsidiary dedicated to MaaS, convinced that the authorities themselves should take responsibility for their own developments so as not to be dependent on the commercial logic of private entities. Upstream Mobility was thus created in 2016, with 5 people. They are now 60, and probably soon 100. As foreseen at its inception, it needed subsidies from the City of Vienna only for the first 2 years. It then reached a balance thanks to its economic model and its support offer for towns wishing to develop a MaaS service (consulting, IT development and supply of the digital platform that integrates all the data and manages all the interfaces with mobility operators, the MaaS operator, and even the user).

The current WienMobil application

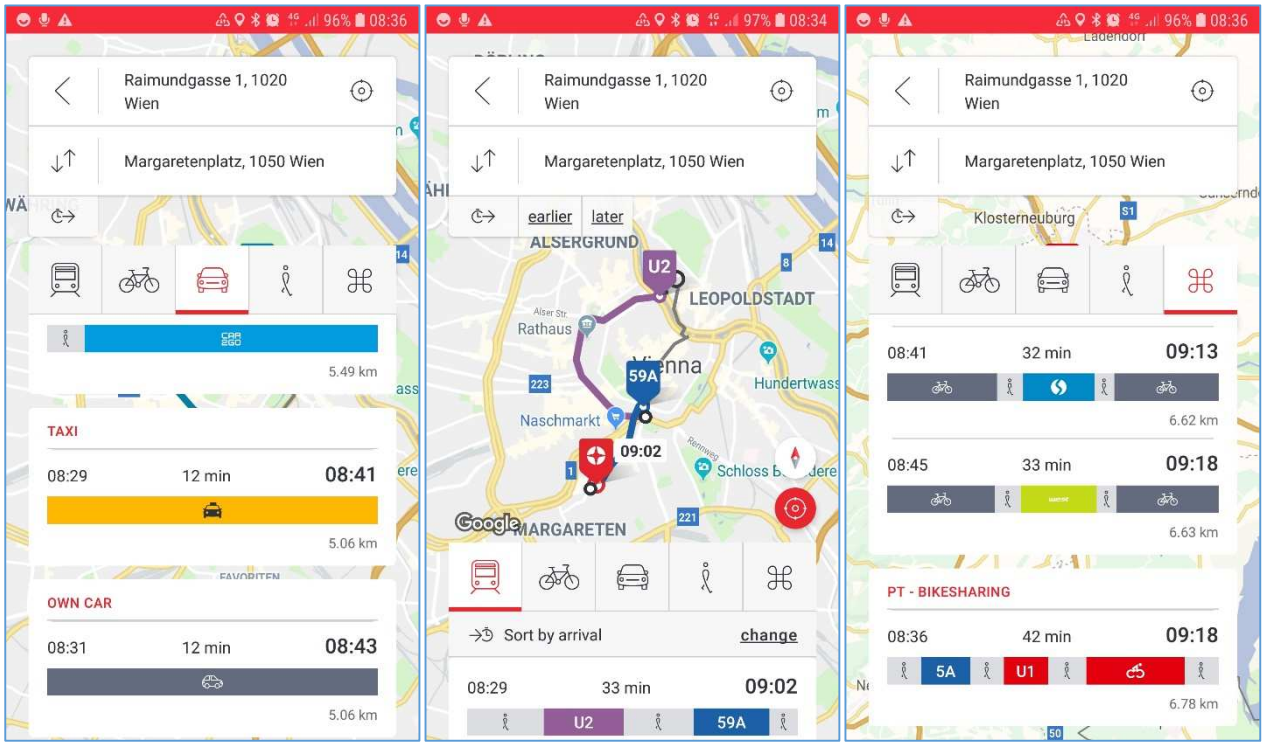
The WienMobil application is operated by Wiener Linien, the public transport operator of the city of Vienna. It was developed by the company Upstream Mobility, owned by the public entity Wiener Stadtwerke and its subsidiary Wiener Linien on behalf of the latter.

Features

The WienMobil application now offers **information on all means of transport in Vienna** (including, recently, electric scooters and mopeds) and **a route search** for public transport, bicycles, bike-sharing, car-sharing, private cars and taxis. It also offers multimodal trips. The parameters used for route calculation can be changed and the user can authorize the use of the phone's GPS data collected via the application and made anonymous (50% of people give this authorization).

For each proposed route, the application offers the possibility to purchase public transport tickets online. For other services, information is given at route level on the availability of services (number of bikes shared in the station, type of vehicle for car-sharing, etc.) and links to partner applications for registration/booking or offers to manage the phone call for taxis.

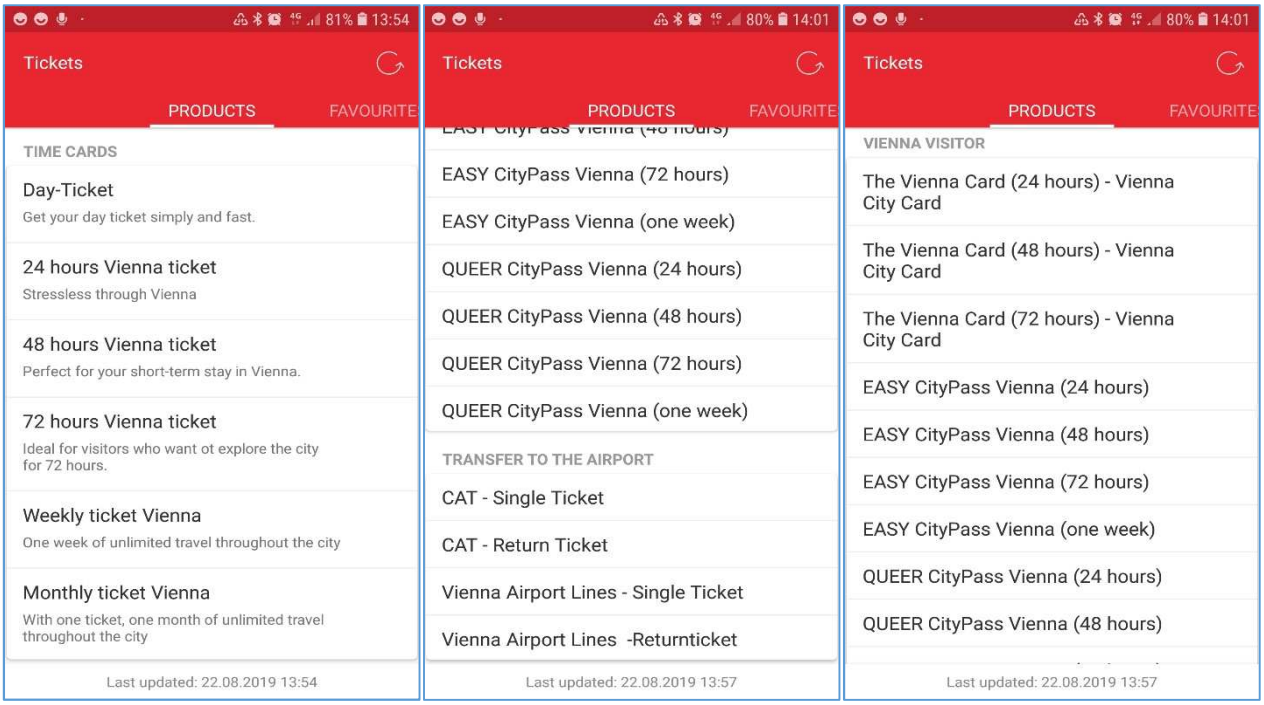
For a while, it proposed direct booking for car-sharing with DriveNow. This feature is no longer available since the Car2go and DriveNow services merged to become ReachNow: the new strategy of the operators, Daimler and BMW, is currently to develop an application dedicated to ReachNow, rather than integrating the service into the WienMobil application.



Screenshots of the WienMobil application (source: Wiener Linien)

The application thus allows numerous public transport tickets to be purchased and the ticket is integrated into the application (no validation is required to enter the network and the dematerialized ticket is presented in the event of inspection).

All public transport tickets are in fact available via the multimodal platform (used by WienMobil but also accessible to other MaaS operators), with the exception of the annual subscription, which Wiener Linien wants to be the only one to sell in order to maintain this advantageous customer knowledge link.



Screenshots of the WienMobil application (source: Wiener Linien)

Other features are proposed by the application:

- It can be used **to locate the various mobility services close to the user**, and see availability (including the number of parking spaces).
- It can also link to partner applications for the registration or booking of services, or the management of phone calls to reach taxis.
- It broadcasts real-time information on disruptions.
- A tutorial is proposed when opening the application to learn how to use it.

This application is already in wide use, as one third of the inhabitants of Vienna are already users.

Economic aspects

Few economic data have been provided about the Wien Mobil service. In general, to develop a MaaS application, a local authority will commit to:

- IT costs that can range from several hundred thousand euros to a million euros. These costs cover:
  - adapting products developed by companies such as Fluidtime or Upstream Mobility to local specificities;
  - deployment and installation of these products locally;
  - the development of new features according to the desired level of integration (information, routes, booking, ticket, payment) and the number of operators involved.
- Legal costs for support from lawyers on the agreements to be signed between the various entities involved (mobility service providers, MaaS application providers, etc.).

In the case of WienMobil, the development of the application did not lead to specific payment between the City of Vienna and Wiener Linien. Most of the costs were covered by the Smile project, and the subsequent adaptation costs are part of Wiener Linien's Research and Development budget, which includes it in its contractual assignments. Depending on future developments, additional funding requests may be made to the local authority.

In Austria, there is also financial cooperation between the various urban transport authorities, which enables them to purchase services jointly and share the costs according to the size of the area. This is how it was done for the WienMobil application, whose initial investment was borne by Wiener Linien but which was then extended to other Austrian cities (Graz, Salzburg and Linz) at a lower cost.

In principle, for each mobility service operator, a double contract must be envisaged: between Upstream Mobility and the mobility operator (for technical integration subjects) and between Wiener Linien (as a MaaS operator) and the mobility operator.

Outlook

MaaS implementation in Vienna was a long-term project, with the authorities at the centre of the initiative, and relying almost exclusively on smartphones.

In 2015, Wiener Linien launched the WienMobil Card, a multimodal access card that allows users to store their annual public transport subscription, validate access to car-sharing vehicles and bicycles, car parks and electric charging stations, and to pay for their taxis. Nevertheless, this card was abandoned, as only 5000 people had applied for it.

Multimodal map launched in 2015 (source: Wiener Linien)

WienMobil's roadmap for 2019 includes the further integration of self-service bicycles and cars.

- The City of Vienna wants to wait for the further roll-out of bike sharing before integrating these services into the platform and the WienMobil application. The bike sharing contract with JCDecaux is coming to an end soon and a new contract will cover the supply of self-service bicycles in larger quantities, fully integrated with the WienMobil application.
- Discussions have been ongoing since May 2019 with ReachNow (resulting from the merger of Car2Go and DriveNow) to enable booking via the application. However, ReachNow is not looking for complete integration, wanting keep the link with its customers, or even to become a multimodal platform.
- Free-floating operators should also be quickly included in the application with functions initially restricted to information in. Nevertheless, as this market is very volatile, the city of Vienna and Wiener Linien prefer to wait and see who will stay to avoid unnecessary development work.

In addition, Wiener Linien's roadmap for the further development of the application over the next few months makes provision for:

- Changes to the “ticket” part of the application, which will make it possible to permanently close an old Wiener Linien application; as well as integrating all available information on the Qando application.
- Consideration is also being given to the introduction of multimodal packages, with, for example, 10 hours of car-sharing included in a monthly subscription (without any increase in fare compared to the current public transport subscription).

This is in a local context where a competing MaaS application was released in September 2019. After entering into discussions with Upstream Mobility, MaaS Global settled in Vienna, using Upstream Mobility's open platform to develop its Whim service.

The MaaS platform is central to the Viennese system

An open multimodal platform

At the request of Wiener Linien, Upstream Mobility has developed an open digital multimodal platform, able to handle millions of requests and covering the entire territory of the Eastern Austrian region (which was not the case with the prototype developed in the Smile project), and above all capable of interfacing with different MaaS operators who can freely connect to this platform. This modularity was also not allowed by the Smile project architecture.

Architecture of the platform developed by Upstream Mobillity (source: Upstream Mobility)

The MaaS features have initially been significantly reduced compared to the Smile project, but with greater robustness, and also taking account of blind or visually impaired users. The modes and features are implemented as development proceeds, but the architecture and platform are already there, ready to manage route calculation, booking, payment, account management, etc.

All public transport tickets are available via the platform, except for the annual public transport subscription, which Wiener Linien wants to be the only one to sell.

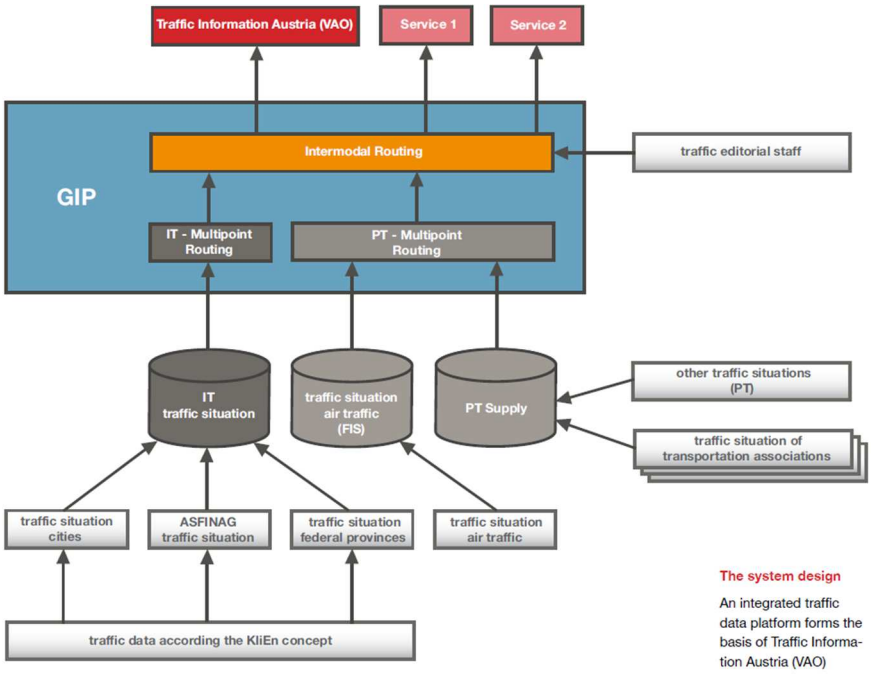
The other modes (taxis, bicycles, car-sharing, etc.) have not yet been integrated. However, towns are increasingly putting pressure on free-floating operators to join the platform in return for authorisations or discounts for the use of public space. These mobility operators have every advantage in appearing on such platforms when they are not very visible, but when they become more important some of them want to become MaaS platforms themselves and are therefore more reluctant (this is the case of ReachNow or Uber-Jump). For the next few months the roadmap plans the integration of station-based bike-sharing and probably partial integration of ReachNow car-sharing.

MaaS Global also started discussions with Upstream Mobility in early 2019 to implement its MaaS Whim service in Vienna using Upstream Mobility's open platform. Wiener Linien sees it as a competitor to WienMobil, even though Wiener Linien owns 51% of Upstream Mobility. The Whim service was launched in Vienna in September 2019. The coming months will tell us whether this will pull WienMobil upwards or whether it will slow down its development.

A platform that uses shared services

The platform uses the fare system APIs (remotely searchable services) set up at regional level and the route calculation APIs developed at national level.

GIP [9] is the reference multimodal transport graph for the whole of Austria. It contains all roads with profile information and very quick updates, public transport timetables, cycling infrastructure, bike-sharing and car-sharing stations. Each federal state (or ITS Vienna region, for the Länder of Vienna, Lower Austria and Burgenland) populates the GIP in its territory.



Architecture of the GIP graph (Source: VAO)

Each official decision (road closure, changes to the cross-section, modification of the speed, etc.) is put into a standard form, which allows automatic integration in the form of a geographic information system in GIP. There are 100 people working on this GIP.

Every Austrian town centralizes housing permits, and therefore has the information from the list of inhabited addresses. Each town is asked to connect each of these addresses to the nearest road, cycle and pedestrian network in the GIP's geographic information system, and then ITS Vienna Region does the work of quality enhancement and harmonisation. This system also allows ambulances and police to arrive quickly and more safely at the scene.

The EVIS project[10], currently under way, aims to integrate real-time traffic data.

VAO provides multimodal and intermodal routes throughout Austria. This is one of the main applications that uses GIP. This calculator is used by all Austrian regions and towns, ensuring consistent information between all sources.

[9] See the detailed presentation of the GIP graph.
[10] See the presentation of the EVIS project on the project website.

A platform used far beyond Vienna

Upstream Mobility has been able to build the platforms of several Austrian towns and the city of Hamburg, as well as the associated application (GrazMobil...) along the same lines. New features paid for by one customer can then benefit others at a lower cost.

Its business model is based on its main products:

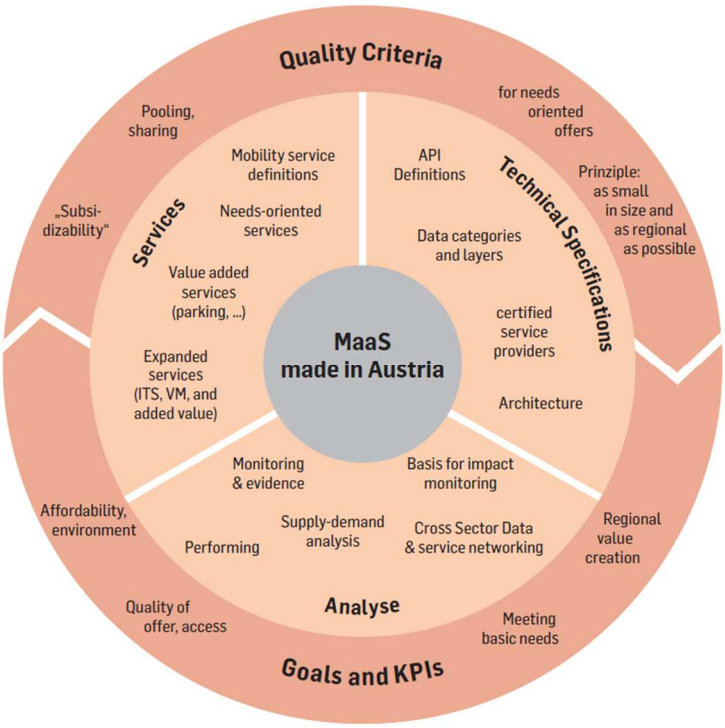
- Development of a multimodal platform that can manage the interfaces with each mobility operator on the one hand, and each MaaS operator on the other.
- Development of complete applications.
- Analysis of the data resulting from the use of the application. This applies only to GPS tracking data that has been made anonymous, where 30% to 50% of users give their consent to use their personal data for these purposes. The open metro network and the principle of subscriptions without validation do not allow mode usage data to be obtained from the application. The clients of these analyses tend to be public people, from the tourism sector for example.

A major national ecosystem supporting ambitious MaaS development

Austria's national framework for MaaS is based on two key players:

- VAO and the practical tools it offers (GIP graph and multimodal route calculation API).
- AustriaTech, which is a centre of expertise on ITS, 60 % financed by the Ministry of Transport and 40 % self-financed (mainly European projects). Its primary objective is to push research work towards industry and deployment in different areas.

AustriaTech is one of the major players in the "MaaS made in Austria" initiative, which aims to define the national strategy for the development of MaaS. Working groups of 20 to 30 people meet regularly and the process led to an initial first publication[11] in October 2019, providing the framework. The main idea is to prevent the emergence of global players, such as Booking in the hotel sector. It is then planned to set up a skills centre to provide support for towns and regions in their MaaS projects. One of the points examined is guaranteed travel (by taxi or a car service with driver if there is no alternative, for example).



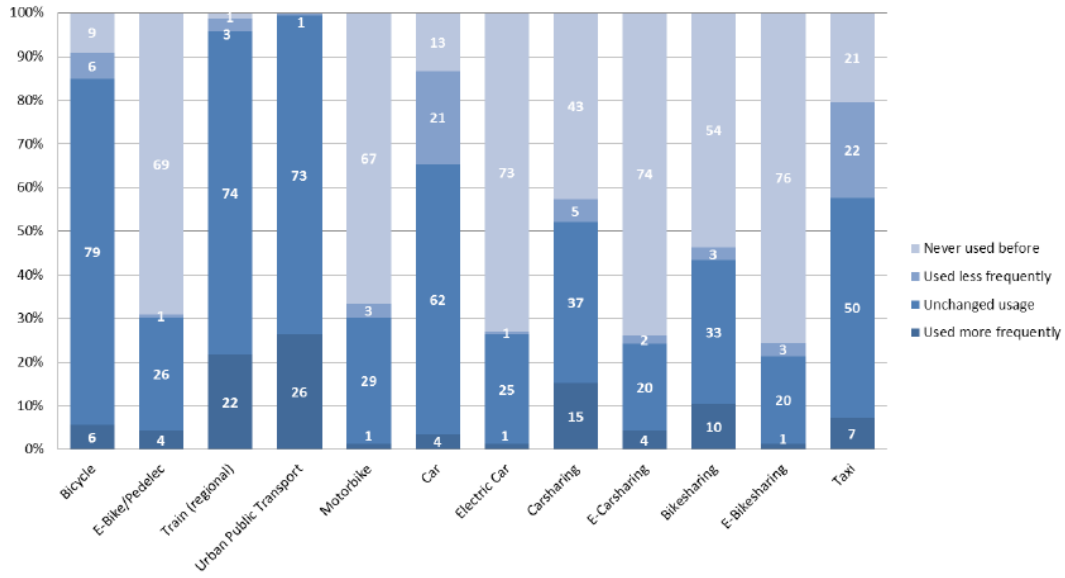
"MaaS made in Austria" initiative (source: AustriaTech)

[11] ITS Austria – Austriatech (2019), MaaS made in Austria, National framework conditions for the realisation of Mobility as a Service in Austria.

A limited assessment, but one that shows more virtuous practices

The assessment carried out as part of the Smile project[12] brought in 188 questionnaires, representing a sample of mainly men between 20 and 60 years old, living in urban areas, and with a high level of education. This sample uses bicycles and public transport more than the average of the inhabitants of the Vienna urban area. The results indicate that 26% make more intermodal trips using car and public transport in succession than before, and 20% make more trips combining cycling and public transport. This increase in intermodal trips is due to the realization that some intermodal trips may be faster than trips made entirely by car.

In addition, 48% have changed their mobility practices, 55% make more intermodal trips, 60% have discovered new routes for their leisure trips, and 69% indicate that the application offers them better routes than those they used before.



Changing use of different means of transport with the Smile application (source: Smile project)

Finally, the application has led to changes in mode: 26% use urban transport more than before, with a modal shift of 22% for trains, 10% for bike sharing, 4% for car-sharing and 4% for electric bicycles. 21% have reduced their use of private care (but 4%, in contrast, use their private car more).

The most popular options are the route planner, maps and the “explore nearby” function.

[12] Smile mobility project (2015), Results of the Smile pilot.

Lessons learned

This study of the situation in Vienna highlights the following lessons:

- **The certainty, shared by everyone involved, that the future of daily mobility will require the development of digital tools for people** to facilitate the use of alternatives to the car. This was one of the reasons for the development of internal skills within the transport operator company through the creation of Upstream Mobility, with the aim of developing the Wien Mobil application.
- **One thing is obvious: a MaaS service can exist only if there is a consistent mobility service offer in the area,** built around a robust public transport offer.
- **A local and national context fostering the emergence of MaaS solutions.** The Vienna MaaS strategy is part of a favourable national framework, with an AustriaTech agency and open tools existing at national level (national public route calculation) and regional level (distribution of public transport tickets for all networks) on which the Vienna MaaS platform is based.
- **The implementation of a MaaS led by the public transport operator has advantages and disadvantages**. As the public transport offer is the real backbone of the MaaS offer, the transport operator has the recognition and the "dominant" position to also operate the MaaS service. However, as a MaaS operator, it may tend to consolidate the features that attract a larger customer base and seek to build customer loyalty, without necessarily seeking to maximise the integration of all existing mobility services.
- **A MaaS deployment model**, shared by all those involved locally, **based on a multimodal platform managed by public stakeholders**, which connects MaaS operators and mobility operators. In this scheme, all mobility service operators must open up their APIs according to the platform's standards. This schema goes hand in hand with the idea that there can be several MaaS applications (each aimed at a specific target audience) coexisting in the same area. In the same way, the authorities must regulate this platform and keep control of supply and usage data to guide the development of offers in line with the needs and public mobility policies of the area. All the more so as they are perceived as the only ones seeking to develop sustainable mobility, unlike private stakeholders who have other objectives.
- **Gradual implementation of MaaS.** In Vienna, it all started with a research project (the Smile project) that laid the foundation for the application that is now being built. However, in the summer of 2019, the WienMobil application was offering a still very partial integration of services. The focus for the moment has been on technological choices that can support high demand and that respect accessibility standards. The next steps will be to integrate the functions available today in separate applications, along with the route planner and ticket sales functions available more comprehensively online today. Complementary modes of transport will be integrated gradually, with the future markets which will be set up soon. This step-by-step approach is pragmatic and proactive.
- **The risk of losing customer relationships,** which every mobility service provider wishes to retain, is a barrier to the integration of different mobility operators into MaaS applications. Wiener Linien, for instance, allows MaaS operators to retail public transport tickets but not the annual subscription.
- **Initial evidence from the assessment is fairly promising** in terms of the impacts of MaaS services on modal practices. The assessment of the 1000 people who tested the application tends to show a positive impact on travel practices (26% of users reported using public transport more than before and 21% using private cars less).
- **The digital intermodality offered by the MaaS must be accompanied by physical intermodality.** This involves the development of physical hubs that combine services for cars (recharging stations and shared cars) and for bicycles (inflaters, parking stalls, shared bicycle stations), as well as a multimodal information terminal.
- An economic model based on openness, replicability and analysis of usage data. **Upstream Mobility analyses GPS data from users** who have given their consent for anonymous use of their data, but the system does not track validation data. This is because it is customary for public transport subscribers not to validate when boarding the vehicle (the metro is also open), but simply to provide justification in the event of a check, which does not allow the system to have validation data.

List of people met

- Klaus Bamberger (Wiener Linien)
- Reinhard Birke (Upstream Mobility)
- Martin Boehm (AustriaTech)
- Fabien Dorner (Vienna University of Technology – TU Wien)
- Hans Fiby (ITS Vienna Region)
- Klaus Heimbuchner (ITS Vienna Region)
- Michael Kieslinger (Fluidtime)
- Christoph Kirchberger (Vienna University of Technology – TU Wien)
- Michael Lichtenegger (Upstream Mobility)
- Vlad Marica (Fluidtime)
- Martin Russ (AustriaTech)
- Gregor Stratil-Sauer (City of Vienna)
- Thomas Vith (City of Vienna)

Hanover (Germany)

Mobility in Hanover

The city of Hanover (Hannover in German), located in northern Germany, is the capital of the state of Lower Saxony. It is the state's largest city and the third largest city in Northern Germany after Hamburg and Bremen.

Hanover is the seat of Region Hannover (Hanover Region), a grouping of 21 municipalities. The Hanover region is a subdivision (Landkreis in German) of the Land of Lower Saxony.

The Hanover region (Source: CC0 Hagar66 via Wikimedia Commons)

	City of Hanover	Region Hannover
Inhabitants	540,700 (2016)	1,144,481 (2015)
Jobs	308,272 (2015)	480,814 (2016)
Surface area	204 km² (2016)	2,291 km² (2016)
Urbanised area	65 km² (31.7 %) (2016)	510 km² (22.3 %) (2016)

Socio-demographic characteristics

of the city and the Hanover region

(source: Landesamt für Statistik Niedersachsen)

The transport authority GVH, the main operator Üstra, and associated partners

The transport authority is called GVH (Großraum-Verkehr Hannover GmbH - Greater Hanover Transport Association). GVH's main shareholder is the Region of Hanover. It is responsible for the organisation and financing of the public transport network for road and rail services.

Public transport offer in the Hanover region (Source: GVH)

The other GVH shareholders are:

- **Üstra**: municipal transport company managing buses and trams. Üstra's buses and trams run in the city of Hanover and some neighbouring towns. The company employs 1900 people and manages around 160 million trips per year.
- **Deutsche Bahn AG (DB)**: manages the 9 suburban railway lines and two local public transport lines. Through its subsidiary DB Regio, Deutsche Bahn's network is integrated into GVH with nine suburban railway lines and two local transport lines. It provides fast connections in the region with its network of regional and commuter trains.
- **Metronom Eisenbahngesellschaft mbH**: metro operator. As the largest private rail operator in Germany, Metronom is also part of GVH. Their trains run on the Uelzen-Hanover-Göttingen line as well as on the Hanover-Lehrte-Gifhorn-Wolfsburg line.
- **Erixx GmbH**: With 25 trains, Erixx operates the "Heidekreuz" lines from Bremen to Uelzen and from Hanover to Buchholz. Since December 2014, Erixx Gmbh has been covering the Hanover to Bad Harzburg, Bad Harzburg to Braunschweig, Braunschweig to Uelzen and Lüneburg to Dannenberg routes with 28 trains.
- **Regiobus Hannover GmbH**: public transport company (buses and coaches) in the Hanover region. It employs over 700 people and mainly connects the various municipalities in the suburbs. Some lines also run in the city centre of Hanover.
- **Westfalen Bahn GmbH**: operates three regional express lines in Lower Saxony and North Rhine-Westphalia. This company, based in the Hanover region, operates on the line from Minden to Braunschweig via Hanover (www.westfalenbahn.de).

Tramway operated by Üstra in Hanover (photo: Cerema)

Pedestrian-priority zone, Hanover railway station (photo: Cerema)

Regiobus Hannover bus (photo: Cerema)

There is no specific tax to fund public transport (such as the French transport tax paid by companies with more than 10 people). It is the local government that sets the level of funding allocated to public transport.

GVH's partnership organisation (source: GVH)

The transport offer in the Hanover region

Local public transport in the Hanover region is part of a strong network: 150 bus lines, 12 tram lines, 9 regional train lines and 10 suburban train lines (Hannover S-Bahn). Over 200 million trips are recorded each year on this network.

GVH offers all public transport users a passenger guarantee allowing them the use of a taxi should a public transport service not be provided (delayed by more than 20 minutes).

Forecourt of Hanover Central Station (photo: Cerema)

In addition, there are many other mobility service operators in the Hanover region:

- Stadtmobil: free-floating car-sharing service;
- Hallo Taxi 3811: Hanover taxi company;
- NextBike: free-floating bicycle service;
- Mobike: free-floating bicycle service;
- Lime: free-floating electric scooter service;
- Tier: free-floating electric scooter service;
- MOIA: ride-sharing service operated by Volkswagen.

Bicycle and electric scooter parking near the central station (photos: Cerema)

Network service level

The offers of all transport companies are coordinated in order to give priority to connections, whatever the network. Where buses and trams do not cover the area, minibuses or taxis are available for passengers.

The range of tickets is diverse: round-trip tickets (KurzstreckenTickets), day tickets for groups of up to 5 people (TagesGruppenTickets), cards for passengers over 60, and company subscriptions .

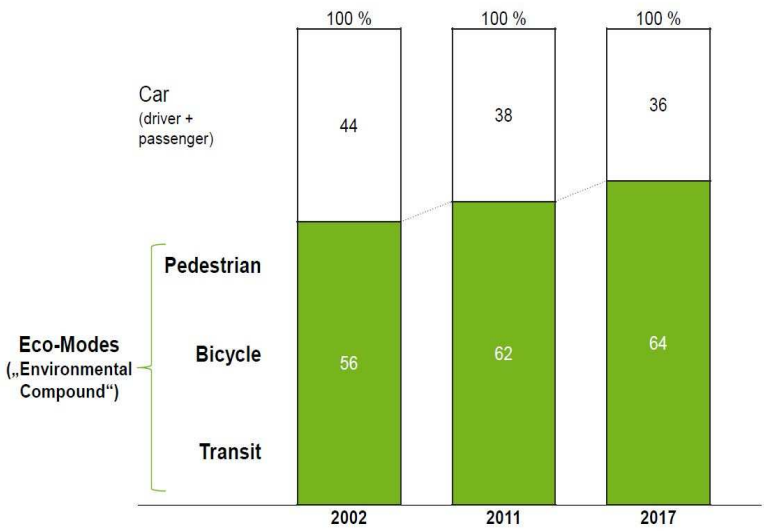
A standard fare is applied in all the transport companies' buses and trams. The GVH transport ticket makes for interoperability over the entire network.

Almost all tram stops and all bus fleets provide access for people with reduced mobility.

Modal shares

The mobility survey carried out in 2017 for the city of Hanover showed the modal shares given opposite.

The modal shares of public transport are above 20%, as are the modal shares of cycling and walking.



City of Hanover mobility survey 2017

(source: MiD Landeshauptstadt Hannover - Üstra)

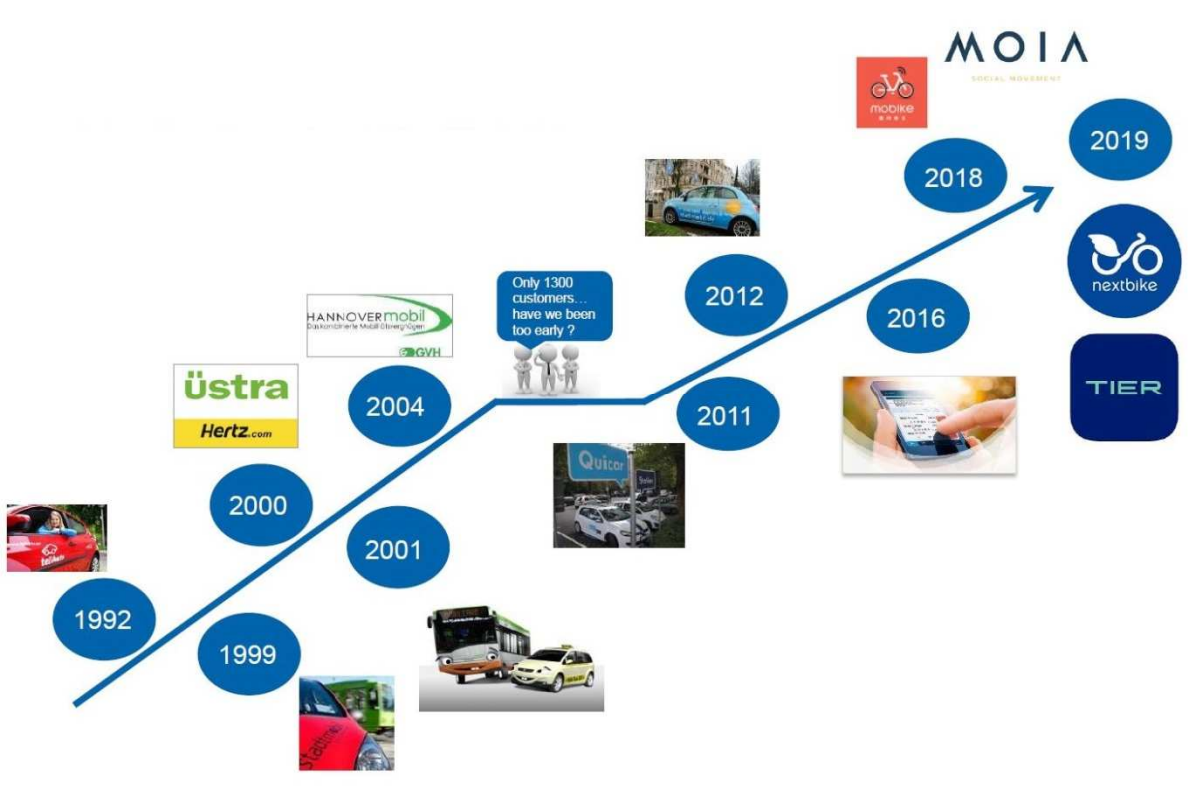
The Hanover MaaS and its platform, Mobilitätsshop

The MaaS project is led by the transport authority GVH and the main public transport operator Üstra. GVH's Mobilitäts-Plattform (mobility platform) department is the project leader of the MaaS project.

The objective stated from the outset on the platform was to contribute to measures to reduce the modal share of cars and household car ownership.

Genesis of the MaaS project in Hanover

- 1992: creation of the first car-sharing company, TeilAuto
- 1999: first cooperation between Üstra and TeilAuto
- 2000: cooperation with Hertz
- 2001: creation of Taxibus (a joint venture between Üstra and Hallo Taxi 3811)
- 2004: Üstra launched HannoverMobil, the first platform to integrate various mobility services (public transport, taxis, bicycles and car-sharing). This platform was a failure, with only 1300 users in 2004. Its use was penalized by the low level of smartphone ownership, which restricted the number of passengers taking it up.
- 2011: Launch of Quicar by Volkswagen (station-based car-sharing)
- 2012: Launch of Stadtmobil (free-floating car-sharing)
- 2016: Launch of Mobilitätsshop by GVH, twelve years after the first HannoverMobil experiment. Despite the experiment, GVH encountered difficulties in implementing its project: the need to convince operators when creating the Mobilitätsshop platform and then to convince users to use it.



Genesis of the MaaS project in Hanover (source: Üstra)

The Mobilitätsshop platform

The gateway to the MaaS service in Hanover is the Mobilitätsshop platform. Mobilitätsshop is accessible on the internet (via the websites of GVH and Üstra, which host the platform) or via the GVH and Üstra mobile applications.

Mobilitätsshop on the GVH website

Mobilitätsshop on the Üstra site

The application allows the management of a single customer account, defined with his/her contact details and preferences. The reference database is that of GVH. The data management provided by the platform does not allow real-time "tracking" of customers, even for public transport.

The choice was made to develop a neutral intermodal calculator, with no predefined choice for the user: the customer has a choice and this choice must be respected in order to gain his confidence.

Integrated transportation services

The service offers all the public transport services organised by GVH and alternative forms of mobility to public transport: car-sharing, taxis and bicycles. Partners from outside the GVH consortium have been involved in the Mobilitätsshop project: Stadtmobil for car-sharing and the Hanover taxi company Hallo Taxi 3811.

Public transport

For public transport, when selecting their ticket, users can purchase their ticket online from their computer or smartphone, and print it or receive it as a QR-code on their mobile phone. The interoperability of this digital ticket is ensured throughout the entire public transport network managed by GVH.

However, MaaS is not offered to public transport subscribers. The service is therefore intended more for a population of occasional users.

Car-sharing with Stadtmobil

For the free-floating car-sharing service, users are sent by Mobilitätsshop to the Stadtmobil website, where they can open a Stadtmobil customer account free of charge, with no admission fee and no monthly basic fee for the basic offer (the "mikro" rate: this offer has slightly higher travel costs than the "standard" and "plus" rates).

The other two offers from Stadtmobil require a monthly subscription:

- "Standard" rate: €5 per month with a deposit of €500, or €10 per month without deposit
- "Plus" rate: €11 per month with deposit of €500, or €16 per month without deposit

The difficulty in including the car-sharing offer in the intermodal journey planner arises from the fact that data about station location and vehicle availability are considered as commercial data, as they reflect the attractiveness of sites and services. They are therefore considered as trade secrets.

Taxi with Hallo Taxi 3811

Mobilitätsshop users are offered the alternative of travelling by taxi. Hallo Taxi 3811, operating in Hanover, offers a 10% discount for each trip through the platform.

Other mobility services

The application offers a bicycle route planner, accompanied by a dynamic map display of the route. GVH have chosen not to include bike sharing. The companies offering a free-floating bicycle service (Nextbike and Mobike) in the Hanover urban area are currently not included in the Mobilitätsshop offer.

Associating the DeutschBahn (DB) was complex and a failure. It had been planned for the DB card to be filled in on the customer account and taken into account in billing. But in the end this project could not be completed.

Procedure for integrating a new service into the MaaS platform

In order to be associated with the platform, GVH and interested operators open negotiations. As there are no financial exchanges, it is agreed that integrated operators offer an advantage to customers going via the platform to encourage them to use it. In return, depending on their level of association, operators have a greater or lesser access to the database. A “Premium Partner” can in this way have commercial use of the customer base. The others have only limited access and use.

The integration of multiple operators by GVH should enable public transport to gain customers, even those who initially come to look for another means of transport.

The integration of a new operator requires the agreement of the other operators already associated. For example, Moia offers a ride-sharing service in the Hanover area (a single driver can make a trip with several independent passengers). Taxis perceive this service as competitive and refuse to have it integrated into the platform for the time being.

Business model

The Mobilitätsshop platform redistributes ticket revenues directly to the individual operators.

This choice is justified by the fact that each operator is responsible for its offer and the quality of service provided. GVH is also entirely responsible for financing the application and the entire IT system (software, hardware and databases). The initial investment cost was low - a few tens of thousands of euros - because the development was based on an existing platform.

MaaS penetration level

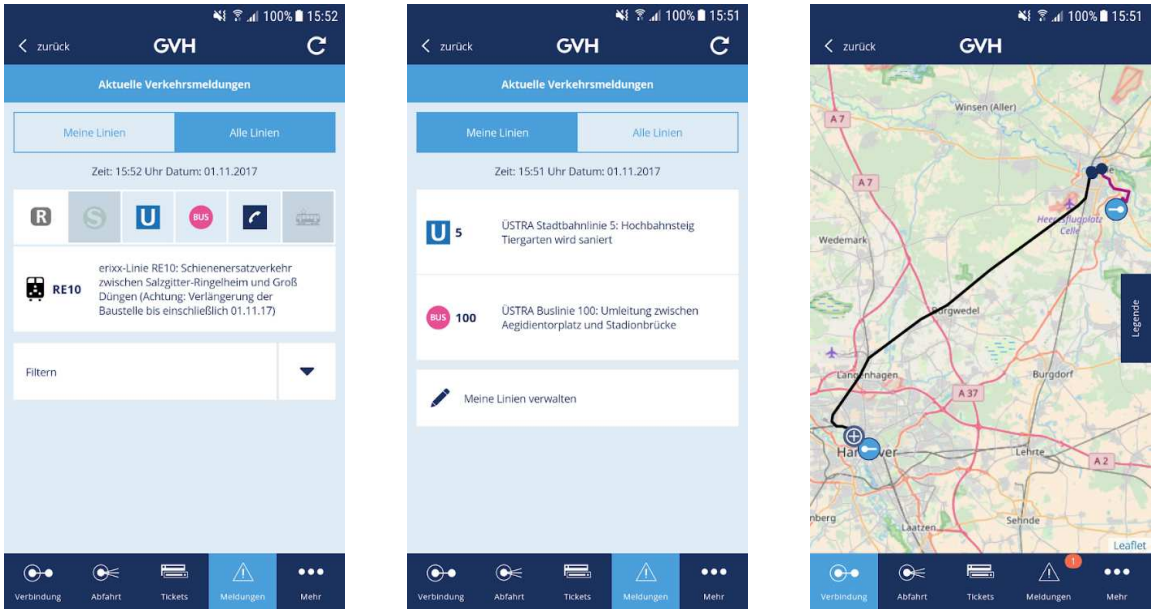
The multimodal service is currently used by approximately 2,000 users. This low rate of use of the platform can be explained by the fact that the technology has not yet been perfected, intermodality is still complex for the user, and governance is still closed to developments of the tool and services. It should be noted that the first people who signed up did so primarily for environmental reasons. The low rate of use is also explained by the low level of communication that the platform has received so far.

The features of the GVH App and Üstra App applications

The two applications from GVH and Üstra propose Mobilitätsshop and are compatible with all types of smartphones. The application most commonly used is the GVH application. Both offer the following features:

- Real-time display of GVH bus and tram timetables;
- Display of all departures from the selected origin, or display of the planned route (departure - arrival), in addition to the travel planner for Lower Saxony and the city of Bremen;
- Multimodal calculator integrating public transport (buses, coaches, U-Bahn and S-Bahn), bikes, car-sharing and taxis;
- Price overview: the fares for the trips are displayed directly;
- Purchase and digital display of public transport tickets;
- Geolocation and display of the route on dynamic maps;
- News: display and description of timetable changes, special transport or detours;
- Customization: users can save stations, addresses, locations or connections as favourites for faster information ;
- Planning: recording trip schedules in the diary;
- Reservation of taxi services via the application ;
- Link to the Stadtmobil car-sharing application.

GVH App and Üstra App applications (source: GVH, Üstra)



Overview of the user interface of the GVH application (source: GVH)

Outlook:

- Offer in Mobilitätsshop accessible routes for people with reduced mobility and family packs.
- Integrate the free-floating bicycle offer (Nextbike and Mobike), the free-floating electric scooter offer (Lime and Tier) and Volkswagen's ride-sharing service offer (MOIA), particularly for the last few kilometres outside the public transport area.

Lessons learned

To enable the implementation of a MaaS project:

- Clear needs and objectives must be defined.
- It is essential to have a motivated project manager who is able to bring together the people involved and convince them.
- The issue of data ownership needs to be addressed quickly and a clear consensus reached.

For large-scale diffusion of MaaS:

- Strong and sustained political support is essential.
- Significant communication must be provided when launching the MaaS offer, but also on a regular basis to maintain momentum and encourage new customers to join.
- The integration of mobility services within the MaaS offer must be anticipated and meet with a consensus.

List of people met

- Claudia Kempka (Cantamen)
- Patricia Actun (Cantamen)
- Martin Röhrleef (Üstra)
- Dirk Esters (Hacon)

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