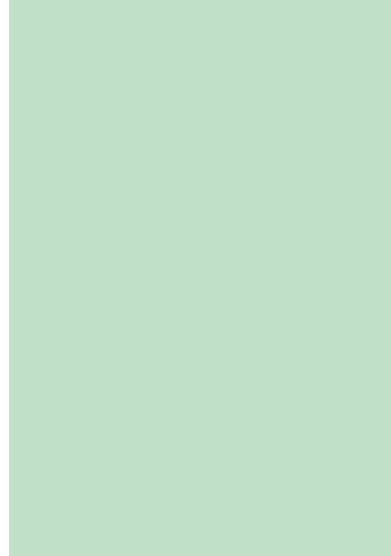


# Delivering Multimodal Door-to-Door Travel Services





# 1. Multimodal D2D mobility

The travel ecosystem has historically focused on optimizing the travellers' experience of a single transport provider or – thanks to standardization and cooperation efforts – of a specific mode of transportation across different providers. However, **travellers need door-to-door journeys that often encompass different modes of transport.**

Several cities and regions have implemented integrated ticketing schemes involving rail companies and local transportation providers. However, these **integrated ticketing schemes are limited in scope and cannot be easily scaled.** Market fragmentation, coexistence of different proprietary standards and rigid partnership schemes, typically requiring that all parties share the same ticketing and validation infrastructure, make it difficult to integrate new partners and transport modes and to provide intuitive and engaging door-to-door travel experiences to customers.

**Integration between rail and other surface transportation services**, such as local public transportation, buses, car parking, car/bike sharing, **can provide benefits to all parties.** For rail companies, the main benefits include improved customer service, additional passenger volumes, enablement of modal shift, new ancillary revenue sources and the opportunity to evolve from a pure transport provider to a mobility service player. Other surface transportation companies could access new markets and sales channels, leverage new efficient revenue collection and drive additional passenger volumes. Also, local authorities could benefit from enhanced cooperation between transport operators. Indeed, they could provide benefits to citizens, attract leisure and business travel, improve planning and implementation of mobility policies driving modal shift and reduce congestion.

Furthermore, technology is transforming consumer behaviours, travel experiences and the travel ecosystem. **Customers increasingly expect seamless multi-channel and multi-device experiences**, as those enabled by integrated solutions. The future of D2D is therefore closely tied to the transport providers' capacity to provide better answers to the actual customer's needs: cost-effective mobility, trustworthy and easy-to-take journeys, as enabled by integrated door-to-door solutions. Technology is a main enabler of this vision. New mobility models, such as integrated ticketing and MaaS, have been developed also thanks to the possibility of representing the **same entitlement with different forms of tokens**, depending on the needs of the infrastructure, and thanks to the rise of **account-based dematerialisation**, that enables travellers' to experience ticketless journeys.

Finally, demand for environmentally friendly mobility opportunities are coming from a growing audience of users, and this is reflected in international actions. Integrated multimodal travel is tightly linked to the **EU's commitment towards the promotion of sustainable passenger mobility** across Europe. It has been considered a matter of priority and has evolved into the core principle that has inspired policy and regulatory work carried out by the EU.

The D2D Project, sponsored by UIC Passenger Service Group, aims at **facilitating the development of intermodality between rail and other surface transport** providers by removing technical obstacles and providing accelerators for developing integrated offerings. The objective is helping the enhancement of digital integrated mobility solutions by member rail companies as well as the growth of an ecosystem and marketplace of digital integrated mobility services involving 3rd parties.



## 2. Why digital changes everything

The objective of providing integrated multimodal door-to-door services has been pursued through several initiatives over the years. The geographical scope has been urban, regional, national and even international. For example, the EU has been funding research and development aimed at enabling pan-European multi-modal seamless mobility.

The digital era we are living in opens a world of **new opportunities**. These include:



Provide seamless **customer experience**



Break silos among **mobility modes** and **providers**



Facilitate **integration** and **interoperability**



Simplify **payments**



Facilitate **revenue apportionment** and **settlement** among parties



Support **policies** that incent more **sustainable** and health conscious choices



Make easier the establishment of **multi-lateral agreements**



Develop innovative **business models**

Moreover, few events had such a huge impact on recent history as the **Covid-19 pandemic**, which has accelerated digitalization and has affected habits of common people related to day-by-day mobility.

As for any other disruptive wave, the digitalization of multi-modal mobility brings with it a set of opportunities, but also **obstacles to be overcome**. Some of them are related to **ticketing** payment, issuing and control. The most recent solutions such as Pay-as-you-go or Account-based-ticketing enable smooth and convenient passenger experiences. However, new challenges need to be faced. The first is a need for **standards to guarantee interoperability** when multiple issuers and actors are involved. The second point concerns the fact that all these new solutions are largely dependent on the **collection, storage, retrieval and accessibility of data**.





### 3. Mobility-as-a-Service

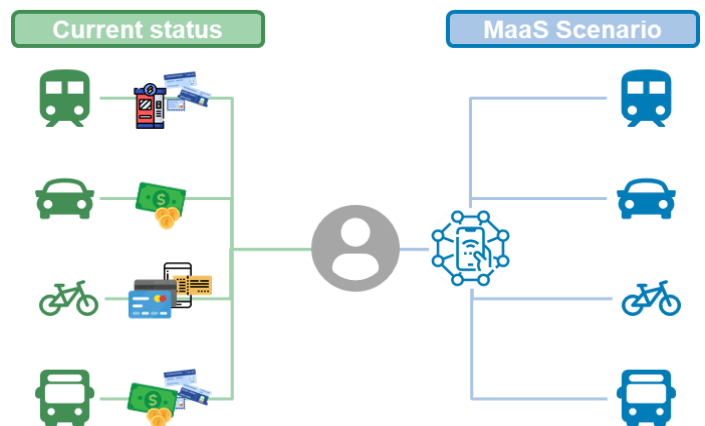
The concept of **Mobility-as-a-Service (or MaaS)** can be described, to borrow the definition provided by the MaaS Alliance, as “the integration of various forms of transport services into a single mobility service accessible on demand”. This definition allows to identify **three main features of MaaS**:

- The presence of **different means of transport**. It indicates the ability of MaaS to combine multimodal mobility services.
- The integration in a **seamless and consistent single service**. This process implies different layers of coordination and efforts among the parties, including: the capability (and willingness) to align own services standards to those of the other providers; the availability to sustain the necessary investments in order to develop the digital requirements for intercommunicating; and the necessary agreements on revenue apportionment and allocation of responsibilities among the parties. For rail operators, it may imply a review of the pre-purchased ticket model in favour of account-based ticketing.
- The availability of a **user-centered and on-demand** digital point of access to mobility services, through an app or a web browser. This typically requires the ability to interface and exchange data with digital services of all the involved parties through specific APIs.

Establishing business models that are viable for all the parties involved is essential for the success of MaaS. Both private-led and publicly-led business models are possible.

MaaS requires the solution of technical and operational issues, such as systems interoperability through common standards and APIs, appropriate use of data, enabling a seamless customer experience, delivering customer care, agreement on roles and responsibilities.

It is necessary that an open and inclusive ecosystem, including data exchanges among stakeholders, is fostered (and regulated) properly by policymakers, and made financially and economically sustainable.



### Digital music consumption

The world of music consumption has seen a huge transformation in the last years. Physical media, such as vinyl records, cassette tapes and CDs, have been for decades the primary way to listen to music. Digital has completely transformed the industry and streaming has become the preferred channel for music distribution. More recently, the subscription model to audio streaming has become dominant, as shown by the global success of Spotify, that provides access to a wide catalog of music from different labels through a single customer interface.

A similar evolution can be imagined in the distribution of mobility services, from physical tickets, to digital rights to MaaS, which corresponds in some sense to the Spotify subscription model.

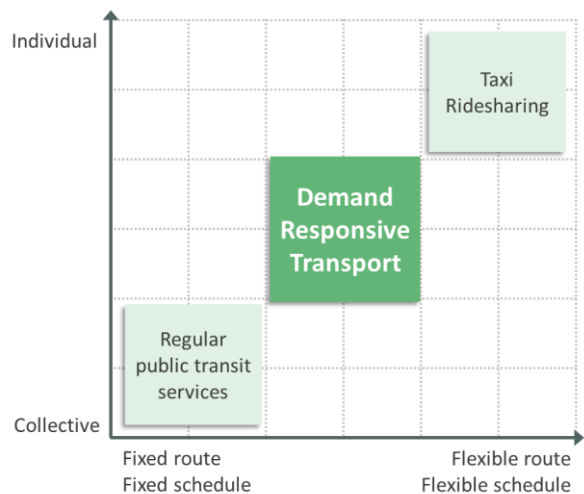
# 4. Demand Responsive Transport (DRT)

Demand-responsive transport (DRT) is a flexible mode of transportation that adapts to the demands of its user groups. It is a form of **shared mobility** whereby the **vehicles alter their itineraries** each journey **based on individual transport demand**.

DRT services are usually carried out through public or private fleet of vans or shuttles especially designed for ridesharing, centrally coordinated and operating in or between specifically assigned areas, often embedded in the public transport network. The service enables passengers to book their journey at a convenient time during normal operating hours. Passengers can **book trips with a central dispatcher**, typically through a smartphone App, and can designate the pick-up and drop-off location. **The DRT system plans the route of each vehicle used according to the requests received.**

Journeys may be completely free form, or accommodated onto skeleton routes and schedules, varied as required. A DRT system works by **aggregating passenger demand into clusters** then dispatching vehicles to those locations. From there, once the system has allocated vehicles, complex routing and scheduling occurs and pick up and drop off times are calculated.

The most important element of a DRT system is the **routing and matching engine**, which consists of a series of algorithms that calculate a route from the location of a vehicle, the time and the origin & destination of the passenger. The service works seamlessly taking multiple incoming requests, matching them to a vehicle then providing navigation support for the drivers to deliver passengers at their destination on time.



## Benefits

Cost-efficient connectivity in unserved and rural areas	High cost of service
Peak feeder function	Managing the level of flexibility
Supporting citizens with limited mobility	Need for strong public-private challenges
Reducing CO2 emissions and improving transport flows	Interaction with the existing public transport system
Visibility to onboard capacity & better fleet data	Impact on general traffic

## Challenges





# 5. The current context

An **unprecedented transformation is taking place in mobility**, powered by digital technologies. **Key drivers** include:

- **New mobility services**, such as ride-sharing and vehicle-sharing
- The push towards **sustainable and inclusive mobility**
- **Innovative paradigms**, like Mobility-as-a-Service and Demand Responsive Transport
- Users' raised expectations of more **user-centric and seamless services**
- The evolution (or, in some cases, disruption) of traditional **approaches to ticketing**

As far as ticketing is concerned, a **key trend is the dematerialisation of the transport rights**. The proof of entitlement to travel and any records of travel are held in a central system and not on physical media held by the passenger, such as a paper ticket or a smart card. To prove their entitlement to travel, passengers need a unique identifier linked to their e-ticket or account. This can be a cEMV payment card, an id communicated by their smartphone (via display, NFC or Bluetooth), a home-printed barcode.

**Dematerialisation regards all mobility modes**. The airline sector has abandoned paper tickets since 2008. Increasingly, rail passengers are traveling with e-tickets

Account-based ticketing is being adopted by a growing number of public transport organisations and by public transport authorities for integrated multimodal schemes. **Mobility services like ride-sharing and vehicle-sharing are natively digital and account-based**.

Traditional integrated multimodal offerings are usually limited to a region (or country) and managed by a single Transport Authority. **Dematerialisation reduces the dependencies from legacy equipment, offers more flexibility and opens new opportunities**. Rail operators and other transport service providers that operate across regions and borders can create more flexible partnerships and offerings to customers.

**Public authorities**, at European, national or regional level, **are developing frameworks of rules and standards** for the digital integration of different types of mobility services.

## Roaming

Roaming is a **common concept in mobile communications**. Mobile users, when traveling, can easily access services by different Telco providers. They do not need a different contract or SIM for every country they visit. Standardisation and interoperability enable Telco providers to establish flexible partnerships and to provide an integrated, seamless experience to customers.

Interoperability in travel and mobility services is definitely more complex, as multiple modes and many more providers are involved. However, **creating seamless “roaming” experiences for travelers across regions and borders is an objective that can be achieved** or at least approached by leveraging available technologies and technical specifications.

## Technical Specifications



## 6. Opportunities for Rail Operators

Rail operators can play a **key role** in making **door-to-door travel services a reality**:

- Rail and public transport are the backbone of integrated mobility systems
- Rail is recognized as the most sustainable mode of transportation, for both urban and non-urban travel
- Rail operators have a long experience in cooperating and interoperating with local mobility providers
- Technology expertise on interconnected and integrated mobility is common in the rail industry
- The rail industry has established international standards and cooperation to facilitate cross-border travel.

Door-to-door solutions are also an opportunity to make **rail transport more attractive**, facilitating access to other means of transport to achieve the first and last mile of a train journey.

To transform door-to-door travel, a collaborative approach and a climate of mutual **trust among different providers and public authorities** is key. Rail operators can collaborate on the same level with other mobility providers, to create joint offerings that improve the overall passenger experience. Also, rail operators can collaborate with public authorities to help implementing policies aimed at more convenient, inclusive and sustainable mobility for citizens.



## 7. Challenges for delivering door-to-door services

As discussed above, digital technologies change everything. Digital may enable transport service providers to design and implement new door-to-door services and can make new mobility paradigms, such as MaaS and DRT, possible. However, a number of challenges need to be faced.

**How to establish cooperation with partners?** Several examples of **multi-lateral partnerships** for providing integrated transportation services, typically regulated and promoted by Public Transport Authorities or by governments, are available. Digital technologies are changing the ecosystem. New types of partnerships can be established and new business models emerge. “Roaming” bilateral agreements are a possibility. The business, technology and regulatory frameworks are dynamic and need agility and adaptation.

**How to facilitate interoperability?** Fragmentation is a major obstacle. It involves business and data models, processes, tariffs, system, standards. Wide variations exist among different modes, providers and regions / countries. As efforts are ongoing to increase the adoption of common standards, it is helpful to simplify as much as possible integration among partners. Also, it must be recognised that players in the mobility ecosystem have different digital maturity levels and different capability to invest in technology. A one-model-fits-all approach is not recommended. Rail operators should cooperate with digitally advanced partners by interfacing systems, leveraging APIs and platforms, but also be able to offer to less advanced potential partners simple, out-of-the-box solutions requiring minimal investments.

**How to integrate multiple modes and providers in constructing and distributing mobility offerings?** In door-to-door services, customer centricity is key. The end-to-end customer experience should guide service design. This encompasses all steps: journey planning and shopping, ticketing (to be intended in a wide sense, as it may consist in the enrollment in a MaaS program), fulfilling the travel right, validation and inspection, after-sales services, management of delays and disruptions, claims and refunds.

**How to provide passengers with a single media carrying multiple travel rights?** Passengers will increasingly expect to travel with something that they already carry in their pockets, such as a smartphone or a credit card, or perhaps to demonstrate their travel rights through biometric recognition. The need to collect and hold multiple proprietary media is an obstacle.

# 8. How UIC can help

**D2D** is an ongoing project by UIC Passenger Services Group. It aims at providing resources to Rail Operators and other mobility ecosystem players to facilitate the creation and delivery of door-to-door services. Such resources include **guides** that can help understanding relevant market and technology trends, available standards and specifications, challenges and opportunities, use cases and customer journey, implementation guidelines. Domains covered by the guides include: schedules and journey planning, fares, availability and reservation, ticketing, validation and inspection, customer care, revenue sharing, responsibilities. The D2D project is **staffed by an experienced team** of UIC and railway experts and industry consultants that is available to support the launch of efforts by rail operators and their partners to develop door-to-door services and implement MaaS.

The D2D team includes experts that are also leading the design of **UIC services and specifications** that aim at transforming the passenger experience. This includes facilitating the integration of multiple modes with rail services. A quick overview follows.



The **MERITS data service** now provides up-to-date **rail timetables in GTFS format**, very commonly used to exchange public transport schedules.



**eTCD** is a platform and digital service allowing carriers to validate and inspect electronic entitlements issued by other carriers. Passengers just need to show a digital token on their smartphone to be recognised. Ticket information is shared almost in real time. Ticket issuers receive up to date information on ticket control and usage. It greatly simplifies interoperability among carriers (and, potentially, other mobility ecosystem players) as it does not require an integration of ticketing or booking systems.



**Flexible Coded Barcode** is a UIC specification that allows to represent digital travel rights with a 2D-barcode in a secure and seamless way. It supports multiple use cases, including offline and online control, opening of station gates, refunds and after sales processes, annotations. Besides rail products, it is suitable for local transport, intercity bus, ferries, shared vehicles, on demand transport.



**OSDM** (Open Sales and Distribution model) includes specifications for the offline exchange of fares as well for online API interfaces supporting distribution of transport products. OSDM already supports a wide range of fares, providing high flexibility for example in defining zones and conditions of regional validity. The online APIs are suitable to manage different types of mobility services. OSDM is evolving and over time will include additional features, extending its applicability to different use cases.

The combination of the above resources can be a **game-changer for Rail Operators** interested in providing door-to-door services. Benefits include simpler interoperability with partner mobility service providers, interlining with partner rail operators (so enabling roaming services across borders), reduced investments and increased reuse across multiple ecosystems.



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