



Demand-Responsive  
Transport to ensure  
accessibility, availability  
and reliability of rural  
public transport

## INTEGRATED TICKETING AND DRT

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## List of abbreviations

API - Application Programming Interface  
DRT - Demand responsive transport  
GDPR - General Data Protection Regulation  
ICT - Information and Communications Technology  
IT - Information Technology  
MaaS – Mobility as a service  
PT - Public Transport  
PTA - Public Transport Authority

# 1. RPT – Regular Public Transport DRT business model

Very often demand responsive transport (DRT) services are completely separated from the regular public transport (RPT) in terms of routing, booking, ticketing and payment, which leads to excessive administration and lack of coordination of schedules and booking for passengers and providers. This leads to significant obstacles for the users of public transport (PT) affecting the satisfaction levels in user experiences and readiness to use different PT services. The introduction of more automatized systems that coordinate multiple transport services, including RPT and DRT has the potential to significantly improve the cost-effectiveness of the authorities.

Based on the analysis, that identifies the existing barriers to data flow both from the legal as well as technological point of view and business analysis, this report proposes a concept of the ICT solution for integrated in routing, booking, ticketing and payment planning. The concept takes into account partner regions' key challenges in this issue and finds potential solutions to these.

## 2. The need for integrated public transport and ticketing

Promoting sustainable transport opportunities like PT, being it RPT or any form of DRT is very much dependant on the level of convenience for the users, but also for the planners and providers. With the rise in the different types of public transport services, advancements in the level of digitalisation and different systems used for planning and ticketing (different transport modes are shown on figure 1) it has become more and more important to provide one easy to use integrated system for different end-users. Many solutions are also described in a recent UITP report<sup>1</sup>.

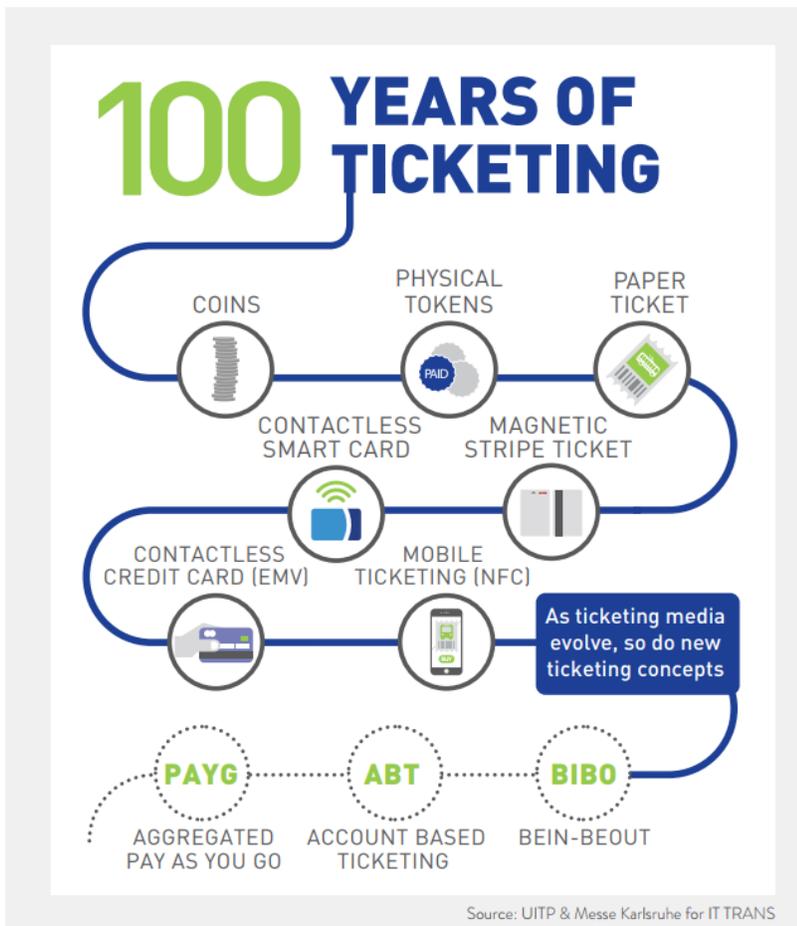


Figure 1. History of ticketing (UITP)

This is very much in line with the Mobility as a Service concept gaining momentum in transport planning. Mobility as a Service (MaaS) is the integration of various forms of transport services into a single mobility service accessible on-demand, that can offer added value for the user by using a single application to provide access to mobility with a single payment channel instead of multiple ticketing and payment operations.<sup>2</sup> Integrated public transport planning, ticketing and fair tariffs can help to overcome the perceived and objective barriers for users and increase the attractiveness of public transport.

<sup>1</sup> [UITP. Demystifying ticketing and payment in public transport](#)

<sup>2</sup> [MaaS Alliance](#)

The absence of an integrated public transport system tends to neglect the needs of customers and can cause problems and inconveniences for all users, such as lack of comfort and information, bringing along increased travel time and costs, ultimately resulting in decreasing ridership. Combining and integrating different systems, using both physical and ICT solutions, gives the opportunity to use the entire public transport system across a local or regional area independently of transport modes, tariffs, fares, schedules, or ticket systems.<sup>3</sup>

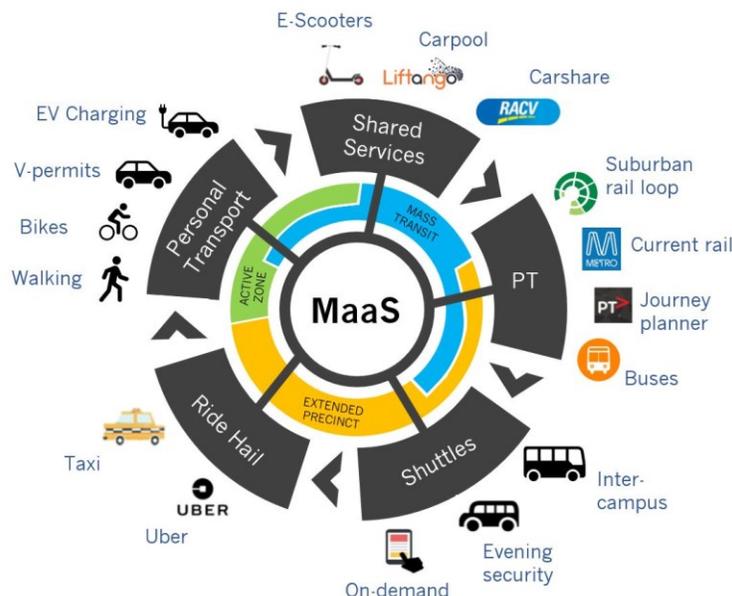


Figure 2 Example of various mobility services that may be available in a MaaS system<sup>4</sup>

Currently, where multimodal transportation does exist, it often requires riders to book and pay separately for each leg of the journey, making the systems troublesome and frustrating to use. Both, integrated ticketing and MaaS solutions imply the close integration of pre-trip and on-trip information, timetables, pricing schemes, regulatory and organisational frameworks, and booking and payment systems. This will also help with getting a better insight on peoples travel habits and utilizing the enormous amounts of travel data that is being generated daily. This information can then be used to provide personalized travel information, dynamic pricing based on supply and demand and improve the whole transport network. Integrating all transport services into a single platform would help transport service providers address the issues of overcrowding and congestion, optimise capacity for all transport modes and help to solve the first/last mile problem.<sup>5</sup>

## 2.1. Integrated ticketing and DRT services

In recent years the market for providing platforms and apps connected to mobility services, PT, DRT services, including planning, booking and ticketing, has risen rapidly. There are many international players who cooperate with public authorities and private companies all over the world (Table 1). Also local development and usage of digital systems have developed rapidly, i.e. in Denmark and Norway, where different DRT solutions have been in use for a longer time.

<sup>3</sup> [CIVITAS INSIGHT. Integrated ticketing and fare policy for public transport.](#)

<sup>4</sup> [Mobility as a service](#)

<sup>5</sup> [Mobility-as-a-Service and overcoming the issues to get Critical MaaS](#)

Table 1 Examples of international providers for DRT ICT support and/or integrated ticketing

Platform provider	Main functionalities
<b>Liftango</b> <sup>6</sup>	Public transport utilisation, live vehicle tracking, data driven service design, DRT scheduling and routing
<b>Siemens</b> <sup>7</sup> <b>XiXo.easy</b> <b>Bytemark</b> <b>Bridge</b>	Plan, Book & Pay platform. Ticketing, DRT management
<b>Padam</b> <b>Mobility</b> <sup>8</sup>	Mobile apps, simulation and management interfaces are tailored to the needs of our customers: Transit Operators, Transport and Local authorities, private companies, in the interest of users and territories
<b>SpareLabs</b> <sup>9</sup>	Operating platform that allows you to easily launch and manage your microtransit, paratransit and ridehailing services.
<b>ViaVan</b> <sup>10</sup>	Via platform is flexible enough to seamlessly integrate with public transport. All solutions from planning, routing, payment
<b>Mobileo</b> <sup>11</sup>	Multi-modal journey planning engine, integrated ticketing and payment for different modes, data gathering and analytics

Next to digital systems, integrated planning, booking, and ticketing opportunities have increased for the customer side too through websites and apps combining all available services in the area as part of MaaS approach. In some cases, this also includes integrated ticketing for different PT modes, in others it is just to help the planning of journeys.

Table 2 Examples of national/regional travel planning and integrated ticketing approaches

Travel planner, country	Included in the travel planner	DRT services inclusion
Transport for Greater Manchester <sup>12</sup> , UK	All available RPT modes in same journey planner with ticketing	DRT service can be accessed through the same website, booking and tickets separate
Entur <sup>13</sup> , Norway	Countrywide travel planner with ticketing on some routes	Does not specify if DRT services are also included
Ruter <sup>14</sup> , Norway /	All available RPT modes in same journey planner. Tickets available through App	DRT service can be accessed through the same website, booking and tickets available through a separate App
Wiener Linien <sup>15</sup> , Austria	All available RPT modes in same journey planner. Tickets available through App	

<sup>6</sup> <https://www.liftango.com/>

<sup>7</sup> <https://www.mobility.siemens.com/global/en/portfolio/intermodal/ticketing.html>

<sup>8</sup> <https://padam-mobility.com/en/>

<sup>9</sup> <https://sparelabs.com/en/>

<sup>10</sup> <https://www.viavan.com/>

<sup>11</sup> <https://www.mobilleo.com/>

<sup>12</sup> <https://tfgm.com/>

<sup>13</sup> <https://entur.no/>

<sup>14</sup> <https://ruter.no>

<sup>15</sup> <https://www.wienerlinien.at/web/wl-en>

Resjeplanen <sup>16</sup> , Denmark	Countrywide travel planner with ticketing on some routes	Does not specify if DRT services are also included, but includes companies that provide DRT services
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## 2.2. Barriers and enablers

There can be many issues and barriers related to implementing ICT for public transport provision, especially in regards to integrated ticketing. Privacy and data protection are most often talked about as providing an efficient transport service requires tracking vehicle movements and accessing some sensitive personal data, like financial or medical information. But there may be several other barriers like access to data and cooperation between stakeholders that need to be overcome to provide better IT support for DRT and integrated ticketing. A general overview of these is described in Table 3 and discussed further below.

Table 3 Overview of main barriers regarding integrated ticketing

BARRIER	EXAMPLES
<b>LEGAL</b>	Liability Intellectual property Privacy Data protection
<b>FINANCIAL</b>	Revenue sharing Costs for acquiring Costs of maintenance
<b>DATA</b>	Adequacy of data Access to existing data Different data formats
<b>TECHNOLOGICAL</b>	Durability of the system Interaction with existing infrastructure Usability of existing standards

This is by no means a comprehensive list of all barriers and relevant enablers and only depicts one possible view. For example, according to World Road Association,<sup>17</sup> the primary enablers of integrated, multi-modal ticketing schemes are:

- common minimum standards for the method of payment and their readers (where smart cards or proximity cards are used)
- performance requirements
- contractual relationships between service providers
- ensuring wide availability of methods of payment
- common branding, marketing & public communications

<sup>16</sup> <https://www.rejseplanen.dk/>

<sup>17</sup> [Multi-use-and intermodal ticketing](#)

## Access to data

According to the European Commission's study<sup>18</sup> one of the main challenges for integrated ticketing is ensuring fair and equal access to multimodal travel data, which may include timetables, stops, fare information, accessibility information and other dynamic data like vehicle location, traffic flow, disruptions etc. The access to relevant data has to be in digital, machine-readable and non-proprietary format. Ticketing and reservation systems are also of utmost importance.<sup>19</sup>

Both, transportation users and planners need access to freely shared, up-to-the-minute information to make the best decisions for travel. Transportation data needs to be provided in an open format, up-to-the-minute, and readily accessible to anyone who needs it.

Even though there is a growing trend of public transport authorities opening up static and limited dynamic data APIs to developers a challenge remains, the willingness of transportation service providers to make this information available to third parties, either private or public, most often due to commercial interests. This has been also stressed in a joint opinion on EU-wide integrated ticketing<sup>20</sup>, that data (captured through ticket sales, location data, etc) should flow automatically as opposed to upon request. Data asymmetry (data-poor transport operators and authorities and data-rich platforms), which could lead to a situation where local travel demand data are held by large tech companies outside of Europe, must be avoided. This also applies to information on user preferences, that often is not available for use on another service provider's platform and must be re-entered more than once by the end-user.

Poor quality and incompleteness of data in many instances are also hindering optimization of transport services. Data of services might be inaccurate, outdated, not in digital format, or even missing certain components.

Another problem that may arise is, that data is collected and made available in different formats due to lack of common rules and standards leading to every public or private transport operator having its own data format. Non-existent standards and non-standardised data sets, plus lack of consensus on data formats are very much hindering efforts for the integration of transport services into a single platform.

## Legal

Integration of transport modes has been supported also on the EU level since the 2001 White Paper on transport policy was published, therefore several legislative initiatives have been undertaken to formulate relevant legal framework for integrated ticketing and payment services. More details can be found in the EU study<sup>18</sup>. The study shows that most European countries do not have specific legislation in place mandating or enabling access to fare data and integrated ticketing schemes, and that currently applicable legislation is mainly designed for conventional transport systems. Where transport integration exists, it mainly involves public transport operators, or it is mostly achieved by means of private agreement between transport operators.

The GDPR compliance and privacy rules may also increase the level of complexity as extensive personal information is needed in order to issue tickets and proceed to the payment.

In future terms demand-responsive services and last-mile services must be included in the same legal framework to be able to provide a seamless door-to-door service, including integrated ticketing. This will also help to avoid the necessity to comply with too many different legal requirements that increases both the complexity and costs.

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<sup>18</sup> [Frazzani, S., Taranic, I., Jensen, M., Zamboni, A., Noti, K., Piantoni, M., European Commission., ... Wavestone. \(2019\). Remaining challenges for EU-wide integrated ticketing and payment systems: Executive summary.](#)

<sup>19</sup> [No data no MaaS](#)

<sup>20</sup> [Joint opinion on EU-wide integrated ticketing](#)

All relevant legal obligations related to travel information and ticketing should apply to all types of vendors, including digital platforms. In addition, same constraints (i.e. the pricing decided by PTAs or transport service providers) must be respected. The same rules and regulations, i.e. related to passenger rights or accessibility information must be applicable to all types of mobility operators.<sup>20</sup> In terms of rights and responsibilities, the platforms must be obliged to offer all relevant available services, not only the services with the highest revenue potential. Exclusivity between transport service providers and vendors, that may lead to parallelly operating, walled-garden ecosystems must be prevented to ensure best possible access to transport services for all and the most effective and sustainable use of public space and infrastructure over time.

## **Integration of networks and tariffs**

Ideally, when implementing an integrated public transport system, tariff and fare integration should be implemented in parallel with the network and timetable integration<sup>21</sup>. Using one ticket with an easily understandable and transparent fare system raises the level of convenience for users significantly. Integration can cover long-term tickets like seasonal passes or include all ticket types including single and multiple trip tickets.

The easier solution would be the mutual acceptance of tickets on the same route, independent of the service provider that according to Civitas<sup>22</sup> can often be done even without complex revenue allocation. Compensation payment will be needed if one operator sells many more tickets than the other or provides far more services than the other on a common route.

For mutual acceptance of tickets within the same network with two or more service providers, adequate revenue allocation may be required, and network and timetable integration become more relevant.

The third possibility to provide a single ticket for the user is tariff unions, where all operators in a specific network aim to integrate several tariffs to create a transparent tariff and fare system. Revenue distribution is undoubtedly necessary within a tariff union.

## **Revenue sharing**

According to the EU study, one possible major barrier for applying integrated ticketing relates to the subsidization of tickets for public transport, especially the revenue sharing among public transport providers and commercial operators. The level of public subsidies, the range of subsidized services and specific rules regarding subsidized operations vary in different countries, but difficulty to distribute revenue across the value chain while also considering compensation for the part of the journey provided by the public transport operator may arise in all of them.

## **Interoperability**

Certain technological and design barriers may also obstruct a complete integration of transport services into a single platform. Even though ticketing and payment processing is not a new technological advancement per se, it is still not accessible to all. Not all platforms can be expanded easily to support multi validation technologies or different revenue-sharing rules that would satisfy the needs of different transport providers. To provide interoperability between legacy systems more flexible approaches are needed.

Upgrading the existing infrastructure to support the provision of quality data or integration with other systems and platforms requires also financial resources, that are not always there. Especially as there is rarely a straightforward financial benefit to integrated services and ticketing and financial return can be rather measured through enhancing the usability and increasing ridership.

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<sup>21</sup> CIVITAS INSIGHT. [Integrated ticketing and fare policy for public transport.](#)

<sup>22</sup> CIVITAS INSIGHT. [Integrated ticketing and fare policy for public transport.](#)

## 3. Overview of public transport planning and ticketing in different RESPONSE project countries

### 3.1. Regular public transport

In order to get an overview of how RPT is currently planned in the partnering countries of the project, a survey was conducted amongst authorities' who are responsible for some parts of the PT planning in the associated countries (Table 4).

When looking at the country level, the variety of public transport services provided in all countries is high, ranging from metro to ferry services. Also, the planning system is with a top-down approach, where general decisions, strategic goals and financing is mostly decided on national level, whereas the actual planning and provision of services is the task of either regional or local governments or in some countries specific regionwide Public Transport Agencies have been formulated. This means in turn, that each region or municipality is responsible for detailed planning (including financial matters) of the services within their borders often even competing with commercial services. As this process is happening in somewhat isolated units, information systems used for planning and management of public transportation also vary with public transport agencies and service providers. In most cases there are no unified countrywide systems in use for local PT, but there are some examples of a unified platform for regional and intercity PT network management<sup>23</sup>.

The actual transport service providers are often tendered from private companies and are not always provided by the same company within one region for different transport modes. This means, that in one city or region there may be 4-5 different transport operators active at the same time, both public and private, managing under different contractual and financial conditions. The ticket types (paper, electronic/mobile, pre-paid/smart) and the ways tickets can be purchased (from the driver, retailers, ticket machines, web page, apps) also vary depending on the specific region. But the trend is certainly towards a multitude of options and moving away from selling paper tickets on board of vehicles or by retailers and towards different digital solutions. Integrated ticketing on the other hand is not so easily available, especially in smaller regions or where several operators are at play. The approaches are different with either having the same ticket within the same region or for all services from the same operator, in some cases nationwide smart cards can be used on some transport modes.

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<sup>23</sup> I.E. Managing the nationwide and regionaal network is done by using plavorm provided by Estonian road adnistratation. <https://www.mnt.ee/et/uhistransport/uhistranspordi-infosusteem>

Table 4 Overview of public transport systems in Response partner countries

Country	Estonia	Denmark	Latvia	Norway	Sweden
<b>What types of public transportation (PT) are available?</b>	Bus/trolleybus, Tram/light rail/Urban rail service, Intercity bus service, Intercity/regional rail service, Ferry	Bus/trolleybus, Intercity bus service, Intercity/regional rail service, Ferry	Bus/trolleybus, Tram/light rail/Urban rail service, Intercity bus service, Intercity/regional rail service	Bus/trolleybus, Tram/light rail/Urban rail service, Metro, Intercity bus service, Intercity/regional rail service, Ferry	Bus/trolleybus, Tram/light rail/Urban rail service, Metro, Intercity bus service, Intercity/regional rail service, Ferry
<b>On what level is PT planning done?</b>	Municipality/local government, Local/regional transport centres, National government	Municipality/local government, County/regional government, PTA	Municipality/local government, County/regional government	County/regional government, National government	County/regional government, National government
<b>Are PT services provided by public or private companies?</b>	Public and private companies, mostly dependent on service type.	Bus services by private companies (tendering) and rail services by public company	Mostly private companies, with some public companies in some national level cities	All public transport is tendered to private operators.	Mostly private companies, with some public companies in some national level cities
<b>Is PT provided by the same company?</b>	Some are same, some different, mostly depending on the region and services	All different providers	Some are same, some different, mostly depending on the region and services	Mostly the same provider within each region.	Some are same, some different, mostly depending on the region and services
<b>What types of tickets are available?</b>	Paper, Electronic/mobile, pre-paid/smart cards	Paper, Electronic/mobile, pre-paid/smart cards	Electronic/mobile, pre-paid/smart cards	Paper, Electronic/mobile, pre-paid/smart cards	Paper, Electronic/mobile, pre-paid/smart cards
<b>How can tickets be bought?</b>	From the driver, Ticket machines, Web page, Retailers	From the driver, Ticket machines, Web page, Apps	From the driver, Ticket machines, Apps, Retailers	From the driver, Ticket machines, Retailers, Apps	Ticket machines, Web page, Apps
<b>Is integrated ticketing available for some/all modes?</b>	Available for some modes. Nationwide smartcard system available	Bus (all modes) and rail (all modes incl. light and metro). Nationwide smartcard system available	Integrated ticketing available where same PT operators and on some routes.	Integrated ticketing available where same PT operators	Integrated ticketing available in some regions

## 3.2. Pilots

Within the Response project, several pilots were also launched to provide demand-responsive services either to a specific group or all people in a region<sup>24</sup>.

The level of digital support in planning and booking the piloting DRT solutions has been at different levels in the test sites. This is both due to the level of fragmentation in transport planning in the country and division of responsibilities but also depending on the already available ICT systems either by the PTA or service provider.

In some pilot cases specific booking sites have been developed by the service provider, not all services have an app in use for the end-users, as the main target group prefers in-person contact via phone.

Table 5 Overview of pilots and ticketing systems from Response partner countries

Service, country	IT systems in use for planning, routing	IT systems in use for booking	Tickets
<b>Nes, Norway</b>	Used available digital plan system to create routes based on customer's demand	Mobile RuterBillett app for booking	Same tickets (cash, travelcard and app) as used on RPT
<b>Sauda, Norway</b>	Developed Digital plan system for planning and routing	Online booking site, launching mobile app	Same tickets (cash, travelcard and app) as used on RPT
<b>Gjøvik, Norway</b>	In house" planning tool for scheduling, exported to the national travel planner "EnTur".	Online booking site	Same tickets (cards and apps) as used on RPT
<b>Värmland, Sweden</b>	Existing planning systems for RPT used	Specially developed digital booking platform	Same as regular RPT
<b>Saaremaa, Estonia</b>	Existing software VEDAS for planning and routing	Mobile app being launched soon	Free

In the pilot cases the tickets used have been the same as the ones that were already being used in the RPT, meaning that integration of the ticketing side has already taken place to some extent. What would need more integration and cooperation is the planning and booking of the services and having the information about the pilot services easily available also on general web pages and apps providing information on public transport.

There are different reasons why integrateion and unified planning and booking pages have not been used in many pilot cases so far, some of these may also be related to the pilots often being part of different EU funded projects. Also the fact, that DRT providers are often deparate from PT providers and may have already their own systems in use before starting the pilots.

During the implementation of pilot projects (including some prior to/outside of Response project) several barriers related to data flows and software solutions have been identified that are described in Table 6. The identified barriers clearly overlap with the ones already identified in international literature. These barriers are equally important in all countries, with minor deviations on the effect and root causeses being in relation to the length of experiences in planning and using DRT services.

<sup>24</sup> You can find more information on pilots on the project website <http://response-project.eu/pilots>

Table 6 Barriers identified in Reponse partner countries for DRT services ICT systems support

Name of the barrier	Sweden	Denmark	Norway	Estonia	Lithuania
<b>Access to data platform is expensive</b>		A data platform is part of the FlexTrafik (DRT) planning system. However, data are used broader for statistics and analysis. So the barrier is the data platforms lack of certain features - not access to data	We use the same data platform on more services than DRT, which makes it cheaper.	Important problem	
<b>Availability/Quality of the data for regular analysis</b>	Data availability is okay, but the problem is the quality and how to uphold it especially in flows where the main input will be manual and not sensory/automatic. Maps or GIS data in general can be used in open-source-way (OpenStreetMap for instance) but more qualified services can be bought once-off or per-period through the Swedish Lantmäteriet or by 3rd party providers such as ESRI, HERE, Google or others.	Good data sources are available and is open for use. Movia complies with GDPR-regulation and is monitored externally. Movia monitor FlexDanmark (our provider of the planning system) on their compliance with GDPR		Accuracy of data in sparsely populated areas is low	There is no clear data available. We have lack of information about real-time flows, and it could be indicated as main issue.
<b>It is costly to be the software maintainer for the DRT service provider</b>	Costly to be the maintainer of the software solution	Cost is shared between the five regional PTA's in Denmark	We do not act as a software maintainer for the DRT service provider	DRT software not maintained by the PTA-s in the pilot regions	We are not using any kind of software for DRT so it supposed to be extra costs for us.

Name of the barrier	Sweden	Denmark	Norway	Estonia	Lithuania
<b>Limitations of proposed software package (booking options via different means (app, webpage, phone etc) depending on the user group in one software/platform)</b>		Our IT-platform is difficult and rather old, new services are difficult and costly to develop. A new planning IT-system in planning		There are many software package options in the world, but very good ones are very expensive and the ones that are not so expensive are not so user friendly.	N/A
<b>General Data Protection regulation restricts the usage of data</b>		Not a restriction to the value of data, but takes resources to rinse out social security numbers, names, addresses etc.	The legal barriers limit how the data can be stored and used	GDPR regulation hinders innovative approach to data usage.	
<b>Lack of existing DRT Data specification standards and API-s to fall back on</b>	Harder to make structured integrations - costly				

## 4. Concept for integrated ticketing

Implementation of integrated ticketing, planning, and booking gives users access to convenient transport options, enables to shape transport services through adapting to actual needs and through this support intermodal travel. This means that all the important functions of information, booking, payment, usage, and billing are supported equally. As most PTAs and PT providers already have some ICT solutions in use, it is more the question of how to ensure interoperability between different systems than building new platforms.

The key is providing the entire travel chain from door-to-door in a single web page or application with a single payment, not depending on the transport mode or the provider, considering the user preferences. Meaning that the IT solution plans the journeys and manages the full trip with different smart card and billing systems cooperating with each other. The system also is responsible for trips and revenues being distributed amongst transport providers.

There is no one solution fits all approach for integrated ticketing, especially with the rapidly developing market in digital public transport services and especially MaaS platforms. When developing new public transport services, including DRT services, it is important to put the end-user needs first and look for ways to simplify the process for the customer. This can be best achieved through API based integration of different system components or modular solutions to support the necessary level of flexibility.

The system components that are most important for the end-user are described on Figure 3. They all reflect the need for personalized information and services that is based on their preferences. This highlights the significance of user profile management, where accessibility preferences, cost preferences, preferred transport modes and payment methods can be specified.

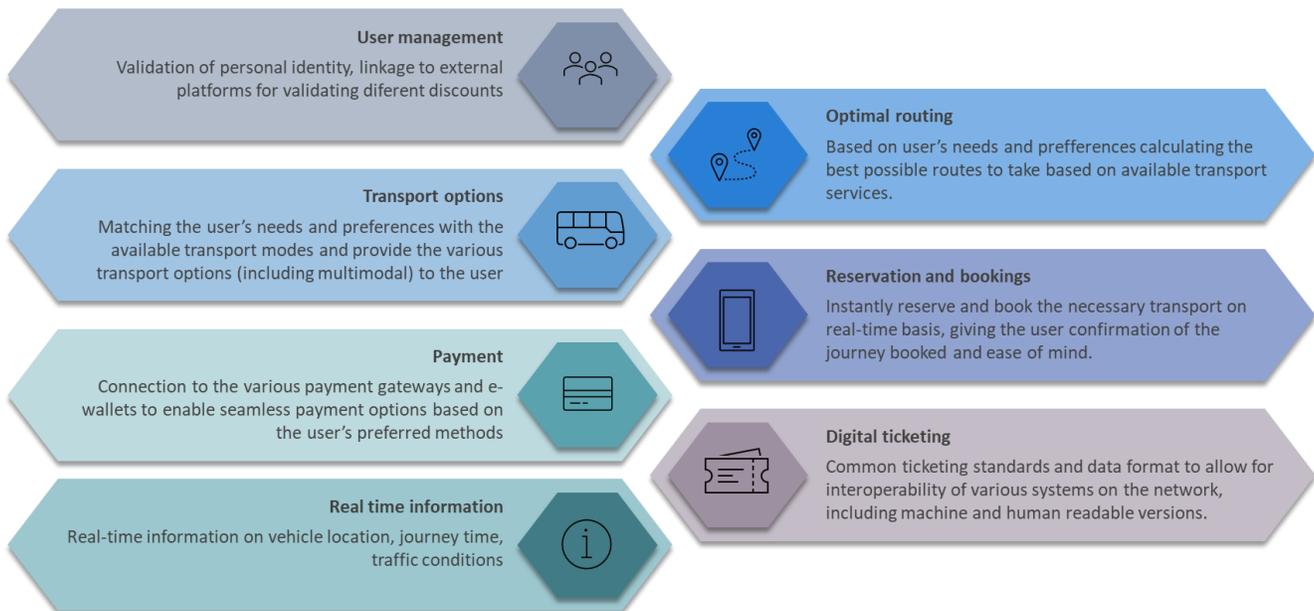


Figure 3. Most important components in the system for the end-user

Considerations to keep in mind when providing planning and booking options for the users:

- Simplified ticket purchasing, ID-/account based ticketing systems
- Offering best-price fare calculations
- Intermodal payment structures
- Implementation of Open Payments (EMV)

- The use of Apple Pay, Google Pay, Samsung Pay etc should be facilitated
- Integrated virtual smart cards in mobile wallets
- Multiple sales channels should be available

To create a complete digital ticketing system and respond to the user needs PTAs should use a platform to interconnect several parties' services. An example of a typical set-up is given in Figure 4. This may either be developed by the PTA or use a readymade solution by an application provider. Figure 5 describes the possible components for integrated ticketing between different services.

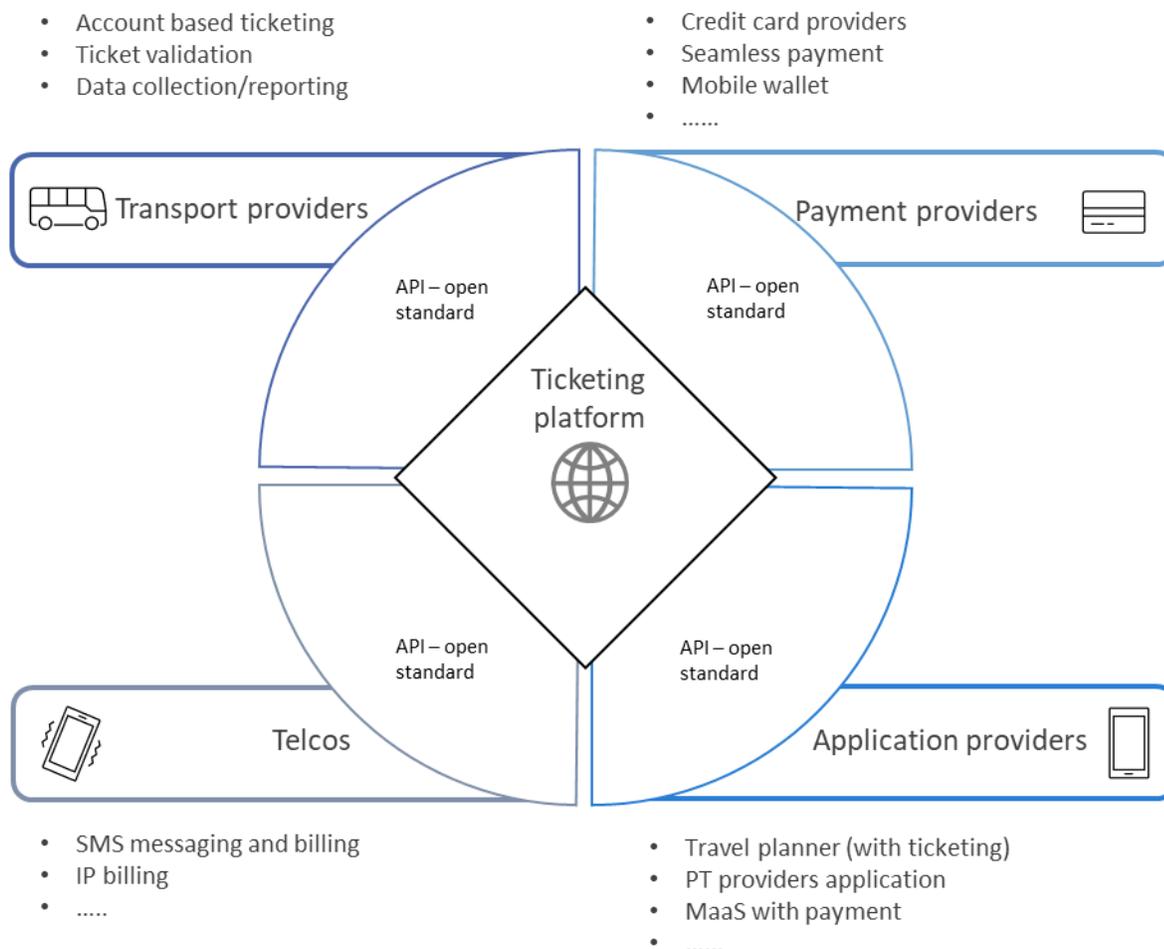


Figure 4. Typical set-up of a digital ticketing system.

Considerations for integrated platforms:

- This platform must provide payment options for ticket purchasing, transmit required data to back-office systems (i.e. for account based ticketing, reporting), enable the management of these transactions via user interfaces.
- There also needs to be a connection to PTA back-office systems or other relevant registries in case of account-based ticketing to gather user information, determine ticket properties like personal discounts and insert ticket purchase data.
- Automated clearing house function for correct distribution of revenues.
- Seamless integration with operations control & real-time passenger information.
- Compliance with international standards such as VDV-KA, ITSO and EMV even within one integrated system.
- Business rules editing for PT providers in order to offer the best personalized options for the traveller.

- A data management and analytics module needs to support anonymised user data collection including travel patterns, mobility mix, user behaviours etc.

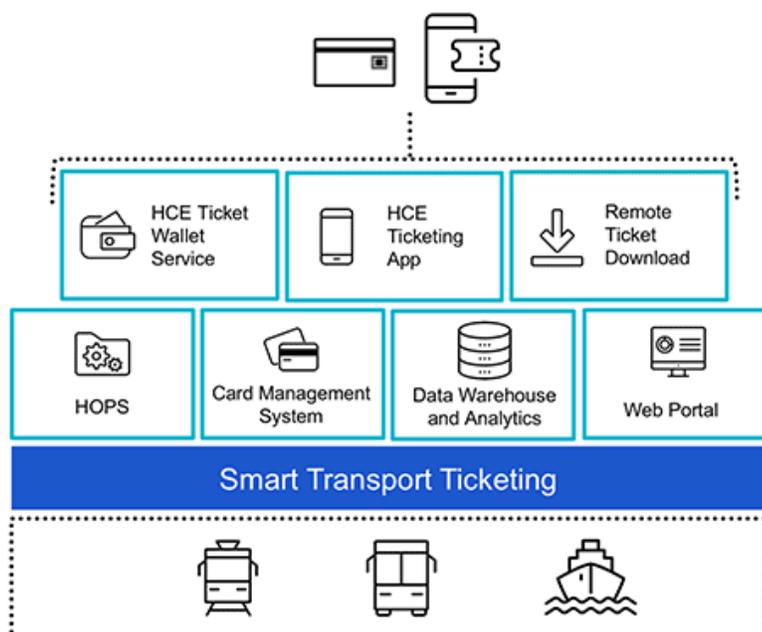


Figure 5 Components for smart ticketing<sup>25</sup>

The following International (ISO) and European (CEN) Standards apply currently to Smart Ticketing that should be taken into consideration:

- Media: ISO 14443
- CEN/TS 16794 Edition 2
- File Structure: ISO / IEC 7816-4
- Secure Element Security: ISO 15408 (Common Criteria)
- Roles and Use Cases: ISO 24014 Part 1
- Part 3 (IFM) / STA use case document
- Transport Applications: EN 15320 (IOPTA)
- Transport Data Elements: EN 1545
- STA Reference documents

<sup>25</sup> [IoT Innovator](#)

## 5. Conclusion

Ticketing and payment systems are key elements for providing a convenient and easy to use public transport system for the user. With the rising demands for improved customer experience that is connected to a multimodal integrated transport system with a simple ticketing system regardless of the used transport service, the need for a future-proof solution is apparent.

For overcoming the different data related, legal and financial barriers related to integrated ticketing and PT service provision, it is of utmost importance, that public and private sector players start cooperating more. As many topics are relevant on the whole EU level, also the solutions, mostly legal, will hopefully be tackled on a EU wide level. If not, they need to be addressed on the local level, with keeping in mind the interests of the end-users and equal obligations to all the participants.

When PT services are launched and new ICT systems are developed, it is important to provide only one unified platform for the end-user. This means that all ICT solutions in use for planning, managing, ticketing different PT services, these systems must be flexible, with open interfaces and open access to API's, expandable and economical. It is also advisable to focus on integrating all activities related to using different mobility services in one app or web page and not only to focus on ticketing.

## 6. Project partners

