

DSMPM

(DATA SPACE for MULTIMODAL PASSENGER MOBILITY)

Deploying multimodal passenger mobility
in a trusted, federated and interoperable way



Smart Mobility

DSMPM: introducing the 'transaction broker'
Decentralising the alignment of data exchange
between multiple agents

With the contribution of:



FRCB Consultancy B.V.,



Cap5 B.V.,



RWTH Aachen (DIH),



FairsFair B.V.,



ID Tree B.V.

and FAIR register B.V.

Challenge & Context

Confronted with the fragmentation in the mobility industry including the ticketing side of things as the outcome of recent research programmes in the Benelux region, finding a way in which agents in different parts of the industry could collaborate in a many-to-many fashion was the objective. In order to support a seamless, multimodal even cross-border experience, a platform transcending way of collaboration sought after.

To collaborate one needs to identify each other and understand how they will contribute, whether this is in facilitating payments, digital services like multimodal planning or wayfinding, booking and even the physical access to the different mobility services offered by a multitude of operators.

The technological boundaries consisting of regional bounds of the solution purchasers, the boundaries of different legal systems, even the constitutional boundaries of local, regional and national authorities and operators all had a negative influence on the goal. A goal that in itself has the opportunity to change individual, organizational and even societal behaviour in offering a collective alternative to the private car.

In addition, in other domains like healthcare, skills (work), leisure etc. platforms are not compatible on a semantical or even technical level. This makes the DSMPM challenge one that is relevant for all those, seeing that digital services and physical ones that should be complementing each other are fragmenting the ease of use of the citizen.

Finally, an additional challenge is posed by the requirement of compliance with GDPR. As long as a platform is a closed environment, mitigating measures can

take place managing the risk of privacy liabilities. The pseudonymisation over a longer period of time, whilst relating personal and privacy sensitive transactional data opens the possibilities of re-identification when data was to become public or simply when the systems are hacked.

How to establish a way in which the citizen is the linking pin over all domains, thus connecting the different data spaces as the main marketplace: the consumer centric one?

Solution

A process is defined by a sequence of activities

Often we look at the whole puzzle, instead of the pieces. Putting together IKEA furniture or a LEGO feature is a step-by-step process. A sequence of construction activities in which assembly takes place. After verifying upon each step that the elements have been included as instructed, to move on to the next. If you come back to the project, to witness that someone else has picked up where you left off, you know that in following the same procedure the outcome will be the same. Concluding that everyone with the right skills can contribute to each activity of the process, if properly informed of the state of play and the desired outcome.

To find what binds us

Although the hourly rate may differ between similar jobs from one company to another, even services are completely different in the health and mobility industry. They all have the same concept at their core: the process of value exchange - services versus compensation - based on a mutual agreement.

With the digital gateway becoming ever more present. Most offerings are a combination of digital and physical activities. In order to align them, a digital representation of those services is required. The mutual agreement describing services for a compensation between parties during a specific period of time under general or specific terms and conditions organises these elements harmoniously.

Organisation of resources

With the digitization of money, banks organise our financial resources. The

transfer of funds between parties is orchestrated between the 'acquiring' bank, receiving the funds on behalf of the supplier of the services or products and the 'issuing' bank, authorising the payment on behalf of the consumer. A similar exchange over multiple parties is enabled by using identifying mechanisms, like the account id and payment id.

In parallel with this exchange, we can easily imagine that the same can apply to the exchange of personal data attributes, from personal data to account and related media (tokens). Moreover, the exchange of the right to consume the service: the entitlement. Note that there is a difference between exchanges between legal entities and those, which face natural persons, bringing General Data Protection Regulation in play.

Initiate and communicate

In the international rules for banking there is a role called the 'payment initiation service provider'. Basically, an intermediary role that can access and present financial information and even move money from the customer's bank account. In order to do so it needs the customer's account details and its approval. This entails that the customer has expressed its volition, allowing such actions to be undertaken. This 'will' is communicated, triggering the activities of the authorisation and execution of payment.

Seeing that a mutual agreement is similarly subject to the expression of 'will'. It would not only initiate the payment, when communicated, but also initiate and communicate the desire to allow designated parties to authorise access to personal data and/or media, and vice versa to transfer the rights to consume the service or product ownership.

Transaction Broker

In the data spaces architecture, intermediary roles are those that facilitate activities that used to be part of the platform design. For instance, the identification of consumers and suppliers; providing the vocabulary stipulating where to find or how to name data; the clearing of data, enabling the designated organisation to receive the proper data sets.

In light of the above, several functionalities could be combined that help parties in the process of exchanging funds, data and entitlements. An independent mechanism validating the transaction, organising the sequence of activities and communicating the state of play of a specific process to the designated stakeholders is what we refer to as a 'transaction broker'.

How it works

Instead of perceiving the platform as the central component, like we have seen in web 2.0. We see its digitisation as a part of digitalisation, where data insights are not merely proprietary to the platform, but all stakeholders are in the position to reuse the digital trace to help them in their cause. Ranging from improving operations, to orchestrating mobility over all modes or simply changing personal behaviour to match one's financial means, or other grounds.

The main change is not to look at the relationship between the supplier, the platform, and the consumer, but how each of them contributes to the delivery of the product both the digital and the physical elements. The transaction broker is mainly focussed on the value exchange and how to get there. That means that a value exchange is part of the format of a mutual agreement, parties exchanging service for compensation (money). This transaction needs to be identifiable (*transaction-id) for all stakeholders take need to be involved, and in case of authorities informed (*list of stakeholders). For each transaction, the transaction broker issues a unique identifier. Allowing them to, in the role of transaction intermediary, attribute all the different aspects of the transaction, the service description of the price, which data attributes need to be provided for authorising and executing payment as to authorising and executing the service. In case, and in preparation of the eIDAS, DGA and Personal Data Intermediary role, or simply instructing a trusted data holder (which can be the platform, MVP), such a list of pre-authorized data and media can be selected by the citizen (*pre-authorization of stakeholder x activity x credential/media) under that transaction-id. Finally, the consumer selects the way in which it wants to pay, whether this is done in advance, afterwards or with a deposit or guarantee up front (*entitlement).

Once all the preparations are in place the citizen accepting the terms and conditions expresses its 'will' to enter into that mutual agreement. By returning the transaction, the transaction-id (*) that was issued to the transaction intermediary is validated and communicated to the list of stakeholders (*). The sequence of activities of the entitlement (*) is organised using smart contracts, specifically designed for pre or post payment. Each activity that has been completed by one of the stakeholders, like payment authorisation, payment execution, service authorisation and service execution is validated and communicated to those stakeholders that need to be involved or informed.

By leading the validation and communication over a decentralised independent

third party the transaction process becomes the binding factor not the relations amongst the stakeholders, placing the citizen (pre)authorising the presentation of data in full control and allowing them to reuse all their personal data, account/media credentials in a controlled fashion. Secondly, by looking merely at the state of the activity, detailed semantics or technical interoperability do not stand in the way of collaboration.

For the identification, even the authorisation of the stakeholders in their roles in the exchange with the transaction broker, the iSHARE trust framework was a logical addition. Although the 'naked version' was also equipped with oAuth2, now the same identities can be reused for legal entities. This 'cleans up' any doubling or separate id's or registrations.

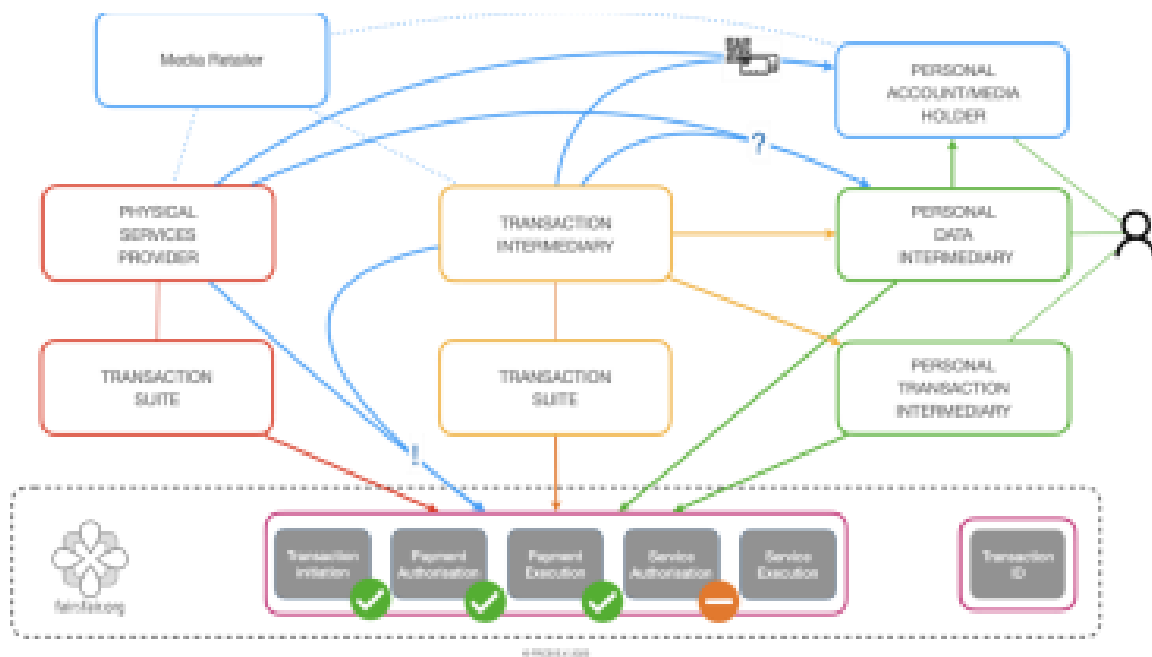
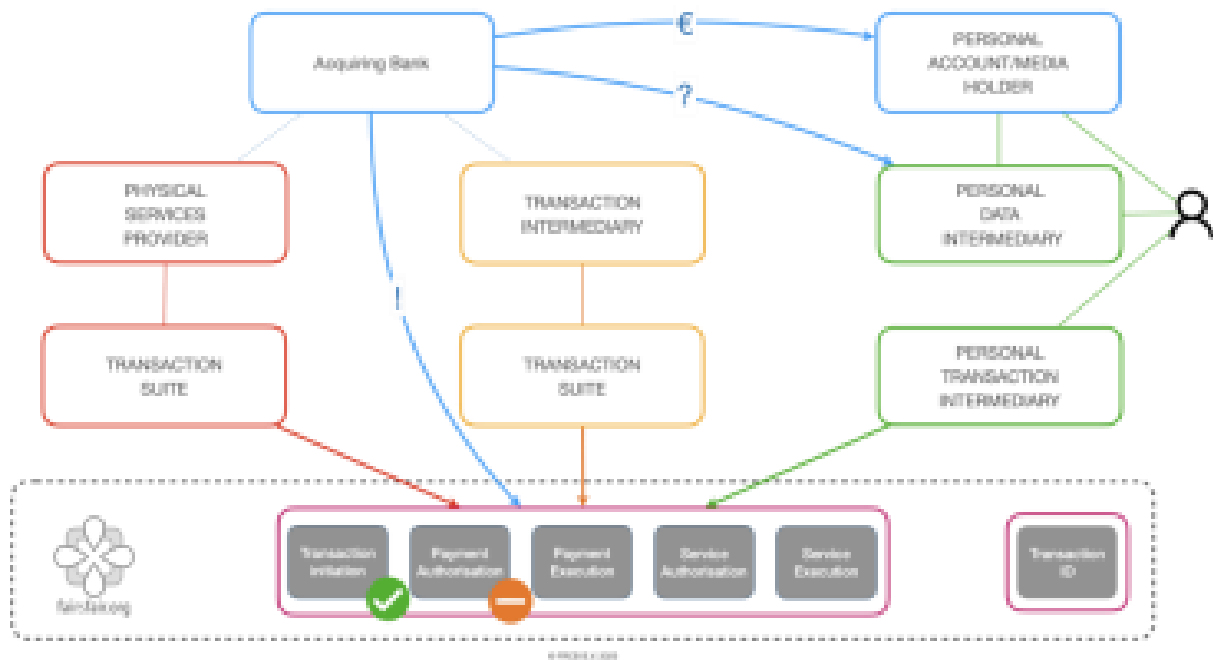
Leaving the data at the source or federated concept sits well with concepts of data ownership and GDPR. In its intermediary role, bringing the physical, payment and digital services together the 'platform' combines all the transaction or contract details. From there, upon reception of the transaction-id, representing the initiation of a transaction relevant to the stakeholder, the latter can retrieve the details from the transaction initiating platform, again leaving the data at the source as much as possible. On the other hand, the data clearing aspect, which was infused in the initial designs is taken out, making the transaction broker less vulnerable (privacy sensitive data) and even more lightweight.

The FIWARE Context Brokers allow stakeholders to subscribe to the state of play of the activities that follow the transaction initiation, thus being aligned to the whole process. Between those that are involved allow access to those data sets that they require to fulfil their tasks. Essentially this allows an acquiring bank to contact the PDI, or personal data holder to be presented the preauthorised selected data of the issuing bank selected by the citizen for this transaction and after authorising payment inform the others via the transaction broker, or the completed state, either to execute the payment in pre-paid or to start the authorisation activity to access the service (or take ownership of the product).

Besides the information being shared, the context brokers can also translate specific semantic languages into others, creating understanding on either. Finally, components were used to support the authorisation process of the iSHARE oAuth2.

With the ultimate aim to bring the decentralised 'transaction broker' into several data spaces, leaving data at the source to be cleared by the context brokers and

reusing the iSHARE Identity and Authorisation register, will help substantially to contribute to the European values, strategy and the compliance to GDPR, placing the citizen in the centre and levelling out the playing field.



Benefits & Impact

Although our project is more relevant on the level of research and development than the creation of a marketplace, the result will help any marketplace regarding trust, interoperability and with that scalability and compliance with GDPR. Where the initial data spaces are very much business and government oriented, the transaction broker opens the doors to citizens as consumers, fully. Including the developments on 'how to' regarding personal data management in data spaces (IDSA WG), MiM4 (OASC WG) and the role and interaction with data intermediaries (MyData Global), the decentralised transaction broker under the label 'fairsfair' looks to lead the way.

No users to date, merely enthusiasts. And that enthusiasm growing under the Data Space Support Centre consortium members and being part of the consortium for the deployment of the European Mobility Data Space (on data governance) we hope to service each citizen in Europe and beyond, that is allowed to take control over its personal data and credentials.

Having consulted many Ministries in the Benelux and beyond, Regional Transport Authorities and operators and part of a large network regarding ticketing (or payment) in the industry, the outcome of our project being a demo of the MVP proving that we can travel seamlessly, using any mode of transport anywhere, whilst catering to GDPR compliance and democratising data will tick a lot of boxes.

We hope to become part of the DSSC data spaces architecture to be developed further by Simple. The investments over the past years have been substantial, and next investments need to come from the actual authorities, ticketing platforms and operators, or from any other domain that is looking for scale and improving the efficiency of resources in their domain. We therefore expect that growth can be exponential. With the technology stack we embraced such growth is possible, seeing that it can be offered as a service by a multitude of organisations.

Assisting the citizen in bringing them back in control over their data, but also in touch with all their transactions in any domain, will help them to calibrate their position in the market after years of being subject to platform interests and marketing. Invigorating.

For as we started with a main idea that now has grown into a butterfly, we

imagine a growth percentage that is through the roof. Although we will combine the efforts of some, the ease of use for the transport operators and MaaS/ticketing platforms we started this development and even the access to information for authorities, operators and individuals will help to create efficiency in the domain and a seriously attractive alternative for the private car.

Added value through i4Trust

Let's start by stressing that it was not a walk in the park. Neither for the iSHARE and FIWARE mentors, nor for us. Although we started out with the concept of facilitating a marketplace, the initial consortium partners stepped back due to lack of development resources and the fact that they wanted to see 'it' before entering it wholeheartedly.

During the nine months we learned more of the technical ins and outs and of the possibilities that both FIWARE and iSHARE components offer. Although we are not as happy with some of the obligations of reusing components that are not generally in use, thus making us partly a reseller for others, creating additional sales thresholds for introducing the concept of the transaction broker is already hard enough.

By deepening out the niche, releasing roles, like identification, data clearing, data translations etc. We did reinvent the idea that 'fairsfair' represented and made it even stronger. Seeing the opportunities of subscriptions, introducing iSHARE in the world of personal data sharing and embracing linked data, it was a fantastic journey.

By proving the implementation of iSHARE and of FIWARE components, we stress the interconnectivity, and the uniqueness of the 'transaction broker' proposition. It will also work with similar components by other, still standing out for its own qualities. We have also outgrown our skepticism and although there is still work to be done, we are confident in a future together.

Next steps (if applicable)

Having stipulated that the DSMPM project did not lead to a marketplace as such, it brought a concept to the next level. We can safely say, it introduced the 'transaction broker'. Armed with a clickable prototype, an MVP demo set-up, tested smart contracts which are EVM-compatible and the requirements for a naked version, and one with i4trust components, we will reach out into our network for piloting possibilities. We already know that the Benelux cross border project is opening up such possibilities and the French are working on a nationwide project where this fits right in.

As mentioned, the other destination is DSSC's data space architecture. Seeing the value for citizens throughout all the data spaces, the 'transaction broker' will take a prominent place allowing for scale and collaboration throughout. Allowing organisations to reduce the cost of ownership of those administrations they can combine or leave in the hands of specialised stakeholders.

The 'fairsfair' label will use all the tools to work the market and with the initial testers improve on the initial designs (change management), test other connectivity and activity, certify production environments and evangelise the decentralised transaction broker over a multitude of domains, to authorities, physical and digital service providers.

References

During the past months, this use of the transaction broker and its effect on personal data ownership and collaboration have been actively involved in working groups within the mobility domain: Smart Ticketing Alliance, OASC MIMs 4 and the IDSA working group on personal data.

Authors & Contributors

We want to thank all the organisations we referred to above and others that have supported our efforts over the last three years and the last (nine) months in particular. We want to thank IBM Consultancy for their help in coming to a very sweet solution. We want to thank i4trust and the Selection Committee having gone through numerous changes to cope with personal and organisational unforeseeable situations, and Emil and Jason for their mentorship.

For future reference, please contact:

Ferdinand Burgersdijk MBA

CEO a.i.

ferdinand@fairsfair.org

+31634023175

Categories

Domain(s): Mobility, HealthCare, Leisure, Tourism, Skills/Work,

Key words: Collaboration, GDPR-compliance, Level Playing Field, Citizen Centric, Intermediary, Blockchain Technology, Transaction Broker, FAIR data principles, DGA: data custodian

Disclaimer: In accordance with our Guidelines concerning the use of endorsements and Impact Stories in advertising, please be aware of the following: Impact Stories appearing on the i4Trust site and partner's site or in other digital or printed materials. It is possible to hand in text, audio or video submissions. They are individual experiences, reflecting real life experiences of those who have used our technology and/or services in some way or another. We do not claim that they are typical results that customers will generally achieve. I4Trust partner's reserves the right to revise the contents, make them shorter and adapt them as required.

DSMPM

(DATA SPACE for MULTIMODAL PASSENGER MOBILITY)

Deploying multimodal passenger mobility
in a trusted, federated and interoperable way

Do you have questions or want to know more?

[CONTACT US](#)

Founding Partners



iSHARE



i4Trust has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement no 951975.

