

# Decentralized Shared Mobility – Bringing Peer-to-Peer Carsharing to Rural Areas

## Potentials of Blockchain Technology for Peer-to-Peer Carsharing

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**Abstract**—Carsharing is a type of shared mobility service that has grown in popularity in recent years. Although it is considered an environmental-friendly alternative to individual transport, and ascribed the power to reshape the mobility sector, it is only little prevalent in rural areas. Since the underlying reasons are mostly related to the technical infrastructure, we propose an open, blockchain-based platform that enables peers to share cars in rural areas.

**Index Terms**—Blockchain, P2P Carsharing, Sustainable Mobility, Rural Areas.

### I. PROBLEM DEFINITION

Motorized individual transport is still the most frequently chosen means of transport in many countries. At the same time, private vehicles stay unused in public spaces for an average of 23 hours a day. Especially in rural areas, people are dependent on private cars because they lack mobility alternatives such as public transport or sharing services. The scarcity of mobility options is often due to the absence of economic benefits for mobility providers. In our research, we are investigating how blockchain technology can be usefully applied to facilitate a sustainable mobility offering in rural areas and to promote the sharing of cars by individuals, companies, municipalities, organizations and other peers.

Peer-to-Peer (P2P) Sharing Economy, the origin of shared mobility services, describes an “economic model enabled by modern information and communication technology (ICT), based on the sharing of digital content, physical goods, or the participation in commercial, cultural or social projects to access underutilized assets for monetary or non-monetary benefits” [7]. The basic idea is a joint consumption following the principle ‘sharing rather than owning’. Products are not owned by the consumer, instead these only get a temporary right to use a service or a good – usually for a certain fee [1]. Shared mobility services are also a large and currently growing market in the Sharing Economy [5] that includes suppliers who rent vehicles like bicycles (e.g. Nextbike), cars (e.g. ShareNow), and more recently kick scooters (e.g. Tier), as well as seats in vehicles (e.g. Uber).

While shared mobility services are growing extensively in urban areas around the world, comparable offerings in

rural areas are rare today. In addition, the corresponding challenges for shared mobility services to contribute to a successful mobility transformation are different. Rural areas are mostly dominated by private transport and a private car is usually unavoidable. In most places, public transport in rural areas is usually less well developed and often even further reduced for cost reasons. Here, shared mobility services could increase the mobility of people, but currently are rare and, if existent, isolated from one and another. One of the main reasons is that shared mobility providers, for economic reasons, follow a top-down approach where they reduce their offerings with decreasing population density. At the same time installation hurdles for non-profit-seeking providers are large, especially regarding the technical infrastructure required to operate such a service. A decentralized and open platform for shared mobility services could enable a bottom-up growth but is not yet existent.

### II. TECHNICAL DEPLOYMENT

To address the before-mentioned challenges of carsharing in rural areas, as well as to facilitate and support the adoption and provision of more services, we propose an open mobility architecture which is shown in the following figure.

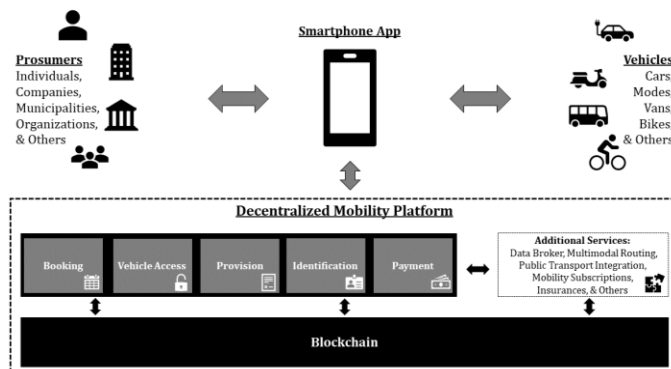


Fig. 1. Open Mobility Architecture

The core component of the overall architecture presented in figure 1 is the decentralized mobility platform. The platform

can be described as an open, blockchain-based system that enables peers to share vehicles. Peers could be individuals, companies, municipalities, organizations and others that need on-demand access to vehicles (consumers), want to provide their vehicles to others (providers) or take over both roles (prosumers). Vehicles could be cars but also scooters, mopeds, bikes, or others. Inside the platform, several services run in the form of smart contracts on top of a distributed computing platform, i.e. a blockchain. Main services are, for example, the booking and vehicle access contracts to rent and access vehicles from peers, the provision contract to allow peers to rent own vehicles, as well as contracts that handle driver identification and payment transactions. Additional functionally could be provided by external services, e.g., data brokers, multimodal routing, public transport integration, mobility subscriptions, or insurances. The depicted smartphone app is an example of a software application that connects to the platform and provides a user interface to book and provide vehicles while also acting as a digital key. However, additional applications that connect to the platform could be built and also existing applications could (partially) integrate the platform.

### III. REASONABLENESS IN USING A BLOCKCHAIN

The implementation of a blockchain-based sharing platform is not necessarily more complex than the development of a platform with a central database. Peck (2017), Wüst and Gervais (2018), among others, discussed the framework conditions for the use of a blockchain [6, 9]. However, there are also cases where there is no incentive for a trustworthy third-party platform provider to operate a sharing platform. Despite the possibility of outsourcing the operation of the platform to a trustworthy third-party, there are several reasons against it. Mostly, the reasonableness and necessity of a blockchain are based on technology-driven arguments such as scalability, security, storage capacity or openness of the code.

In the P2P-Sharing Economy, sustainability is often stated as a motivator and driver [4, 8]. It becomes apparent that economic sustainability is often a knockout criterion for the operation of a sharing platform, whereas the ecological and social aspects represent a bonus, but not a necessity, for the third-party operator [3]. Many P2P platforms have not yet reached their economic viability and to generate sufficient revenue to be profitable in the market. Companies are mainly financed by investors, as the start-up phase of platforms requires a lot of financial resources, to reach a critical mass. The future development and spread of P2P sharing concepts depend crucially on whether the sharing companies succeed in financing themselves. Some P2P sharing concepts, such as P2P carsharing, require a high supply and demand density in order to be economically viable. Due to lack of economic efficiency, this may result in sharing services not being offered despite existing demand. This scenario can be compared with the theory of public goods from the national economy: although public goods offer a benefit in principle, potential users are not willing to pay for them because they cannot exclude other participants [2, 10]. A blockchain-based approach could remedy this, since

it is not based on economic interests and can be operated either completely open and decentral or by public institutions.

### IV. POSTER & PROTOTYPE PRESENTATION

We would like to present our work at the ICT4S conference to show how an open mobility architecture could address mobility demands in rural areas. To foster discussions, we would demonstrate a blockchain-based prototype that includes a smartphone app for carsharing and discuss its potentials for rural areas. We also would give insights into the technology stack we plan to employ. In particular, the *evan.network*, which is a fork of the Ethereum blockchain. Here we would discuss advantages and disadvantages compared to traditional centralized platform infrastructures, as well as differences to other blockchain technologies.

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