

Blockchain in Urban Mobility

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Smart Mobility Data

- Enabled via Information and Communication Technology (ICT)
- Ubiquitous, longitudinal, and high spatio-temporal resolution

Smart Mobility Data

Focus on collection with minimal input from data generator
Centralized management and control

Smart Mobility Data Considerations

What `can' vs `is to' be done with the data?

What is the shelf life of the data ?

Privacy and cybersecurity by design

Is the existing data model right for smart cities / smart mobility?

Future proofing the data chain

Data: Information efficiency, energy use, environmental impact

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Data Management for Smart Mobility

Blockchain for Smart Mobility Data-market (BSMD) ([Lopez & Farooq, 2020](#))

Core concept: Data as a tradable commodity

Generator of data owns their data, manage who can use/share, make value, and control their own privacy

Privacy and Cybersecurity

General framework of a public closed Blockchain for Smart Mobility Data-market (BSMD).

Layers

Figure: Blockchain network and data collectors

Identification Layer

Nodes are in control of their data

Privacy Layer

The BSMD protect users from external agents, but the LBSs know the location

Geomasking where the real locations displaced in a doughnut

Geo-indistinguishability (GeoInd)

Quantum-resistant algorithms

Contract Layer

Composed of Smart Contracts and data Brokers

A Smart Contract defines the set of assets available to transfer and the type of transactions

Smart Contracts
Brokers are nodes in the network that arrange transactions

Communication Layer

Nodes communicate using Decentralized Identifiers (DID)

DIDs are URLs that any node can create

A single node will have multiple DIDs

Each connection with other nodes use a unique DID

Consensus

For the BSMD a Byzantine variant may be adequate

PoW and PoS consumes too much resources

PoW 25% CPU power, PoS 51% of the stakes, pBFT and Tendermint 33.3% \voting" power

PoW and PoS for open networks, pBFT and Tendermint closed network.

Incentives

Is a way to motivate the participants to stay and maintain the network

Active nodes for participating in the consensus mechanisms and write blocks in the ledger.

All nodes for Sharing (selling) information or providing services

Transaction

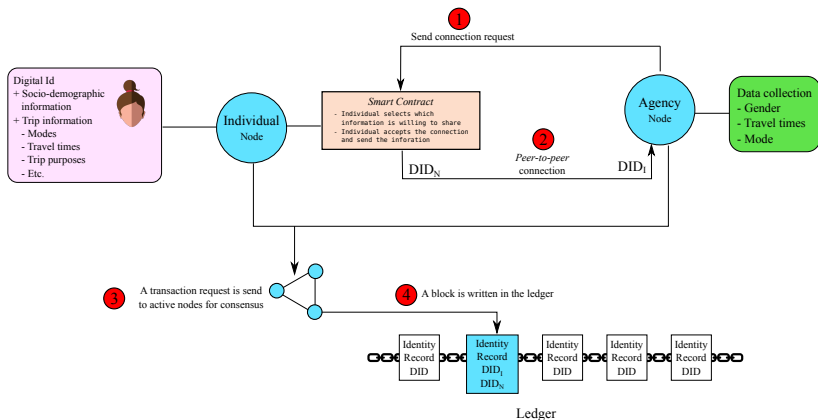


Figure: Blockchain network and data collectors

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Use cases

- Travel demand modelling
 - ▶ Discrete choice modelling
 - ▶ Machine learning
- Mobility carbon-credit market
- GPS trajectory based real-time mobility services
- Cybersecurity and privacy risk assessment
- ...

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Conclusions

BSMD is designed to solve the privacy, security and management issues related to the sharing large-scale data

Data ownership In BSMD all information is stored at user devices and they explicitly select with whom they want to share the information

Fine-grained access control Smart contract allows individuals which information they want to share

Data transparency and auditability BSMD is public and distributed so every one can track all transactions and no one is in control of the ledger

Conclusions

Possible future applications :

- Smart card and travel survey data management and analytics
 - Easy access and usage control

- Framework for Mobility as a Service

 - Fixed as well as price-formation markets

- Communication and data transfer of connected and autonomous vehicles

 - Low-latency not currently possible

References

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Thanks very much for your attention!

Check the implementation at: <https://github.com/LiTrans/BSMD>