Impact of Blockchain Technology in Automotive

F. Falcini (Independent Consultant – ISTI/CNR)

G. Lami (ISTI – CNR)

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Purpose

- To identify a few realistic automotive scenarios in which BC-based architectures may play an important role

- To trigger a debate in the Automotive SPIN Italia community in order to start building awareness on the role BC technology may play in the next future

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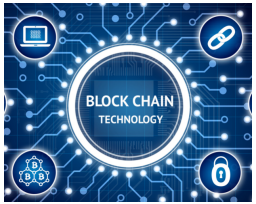
Blockchain

- La blockchain è una tecnologia che permette la creazione e gestione di un grande database distribuito per la gestione di transazioni condivisibili tra più nodi di una rete.
- Si tratta di un database strutturato in Blocchi (contenenti più transazioni) che sono tra loro collegati in rete in modo che ogni transazione avviata sulla rete debba essere validata dalla rete stessa nell'"analisi" di ciascun singolo blocco.
- La blockchain risulta così costituita da una catena di blocchi che contengono più transazioni ciascuno.



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Blockchain

➢La blockchain e’ un Registro pubblico per la gestione di dati correlati alle transazioni presenti nei blocchi e gestite tramite crittografia dai partecipanti alla rete che verificano, approvano e successivamente registrano tutti i blocchi con tutti i dati di ciascuna transazione su tutti i nodi.

➢La stessa “informazione” è dunque presente su tutti i nodi e pertanto diventa immodificabile se non attraverso una operazione che richiede l’approvazione della maggioranza dei nodi della rete e che in ogni caso non modificherà lo storia di quella stessa informazione.

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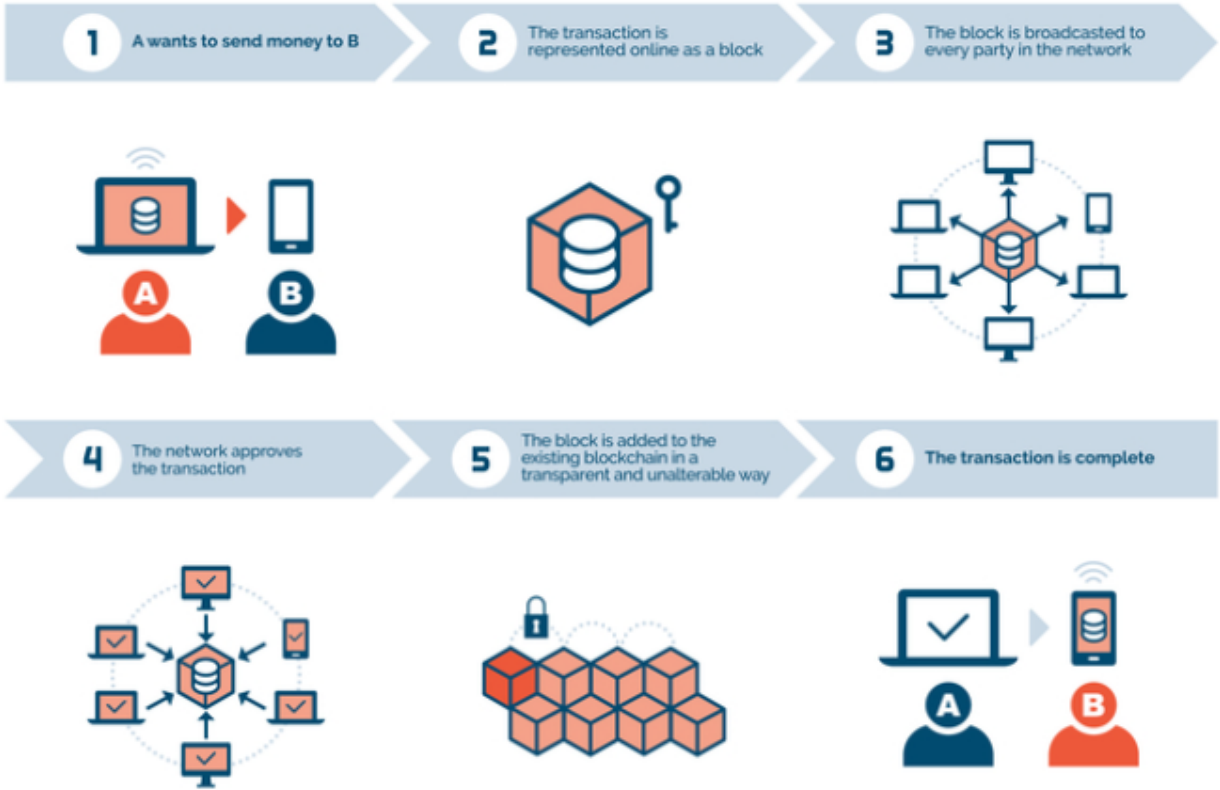
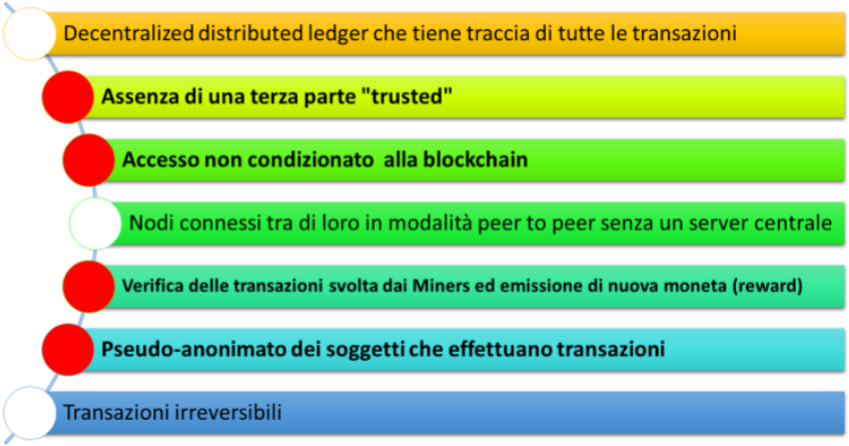
Blockchain Key Components

- **Nodi**: sono i partecipanti alla blockchain e sono costituiti fisicamente dai server di ciascun partecipante.
- **Transazione**: è costituita dai dati che rappresentano i valori oggetto di “scambio” e che necessitano di essere verificati, approvati e poi archiviati.
- **Blocco**: è rappresentato dal raggruppamento di un insieme di transazioni che sono unite per essere verificate, approvate e poi archiviate dai partecipanti alla blockchain.
- **Ledger**: è il registro pubblico nel quale vengono “annotate” con la massima trasparenza e in modo immutabile tutte le transazioni effettuate in modo ordinato e sequenziale. Il Ledger è costituito dall’insieme dei blocchi che sono tra loro incatenati tramite una funzione di crittografia e grazie all’uso di hash.
- **Hash**: è una operazione (Non Invertibile) che permette di mappare una stringa di testo e/o numerica di lunghezza variabile in una stringa unica ed univoca di lunghezza determinata. L’Hash identifica in modo univoco e sicuro ciascun blocco. Un hash non deve permettere di risalire al testo che lo ha generato.

Simplified Blockchain workflow



Blockchain Permissionless vs. Permissioned



BC permissionless

Figura 2: Principali caratteristiche delle Blockchain permissionless

BC permissioned

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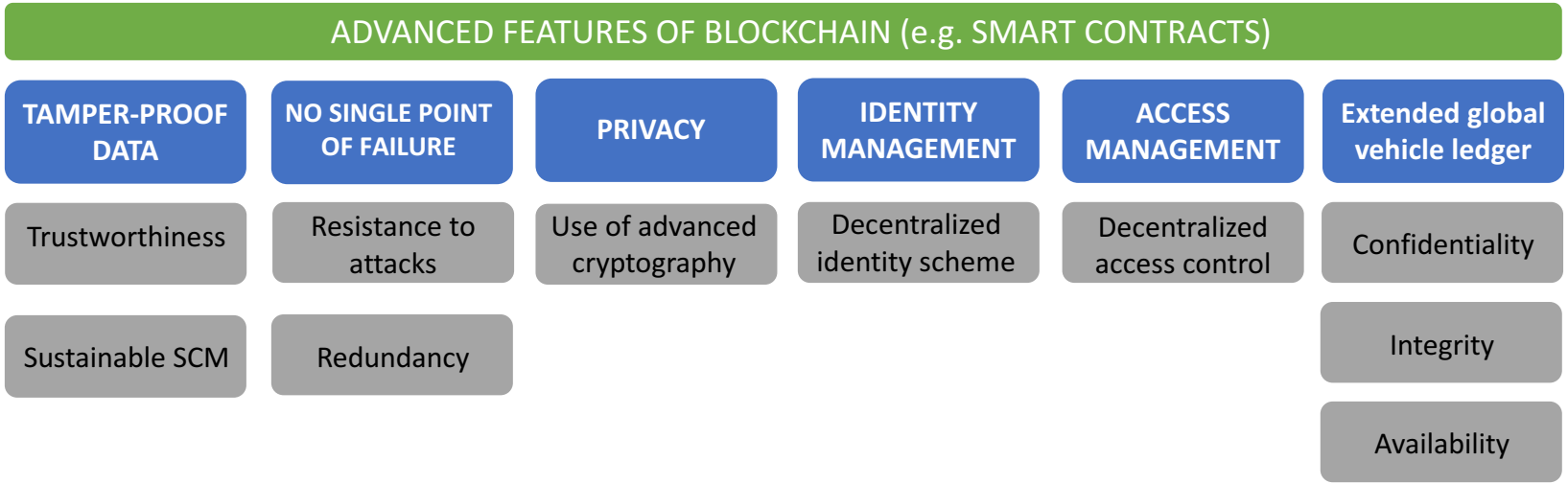
Blockchain Capabilities



Fraga-Lamas, Paula & Fernández-Caramés, Tiago. (2019). A Review on Blockchain Technologies for an Advanced and Cyber-Resilient Automotive Industry. IEEE Access. 7. 17578-17598

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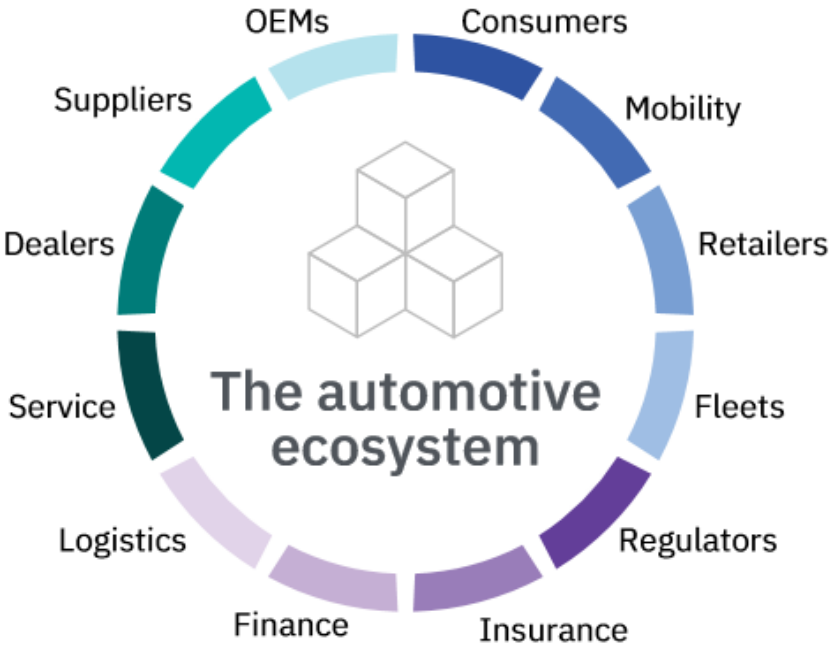
Automotive Arena



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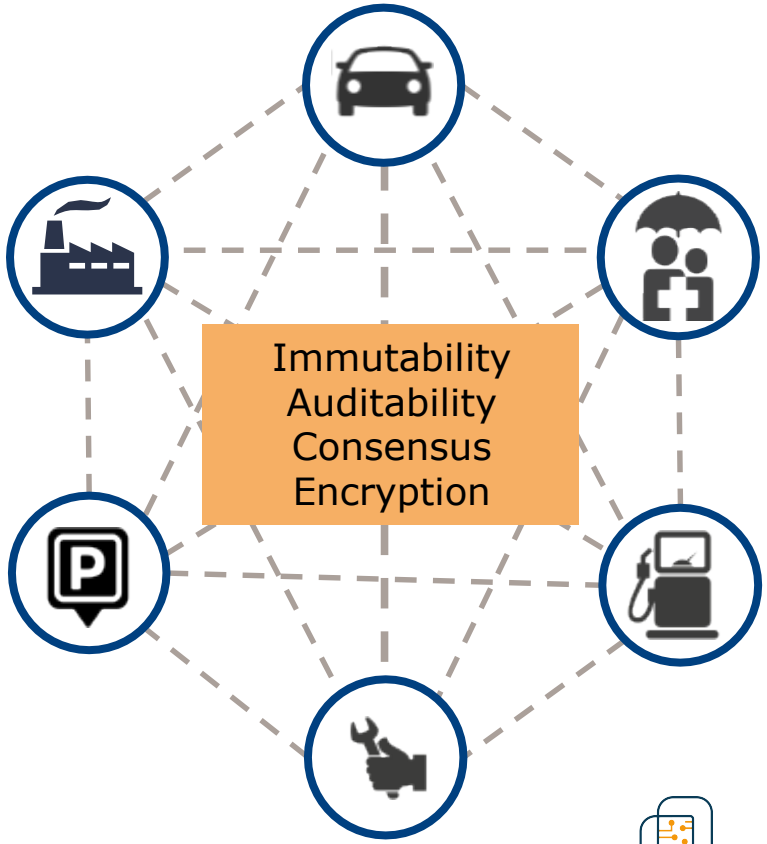
Blockchain for Automotive

Promising Use-Cases

- Payments
- Identity
- Supply Chain & Manufacturing
- Extended Services
- V2X

Connecting multiple players and processes to improve:

- Connected Car Ecosystem – How Data & Apps are used
- Mobility Services – How cars are shared
- Security & Safety – Addressing hacking and privacy concerns
- Ownership - How cars are owned



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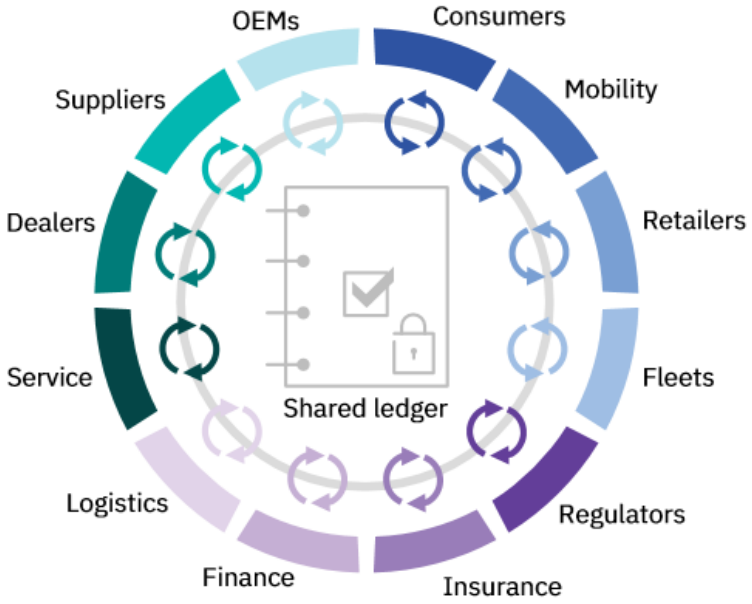
Blockchain in Automotive

Blockchain offers a single source of information that is transparent to all participants



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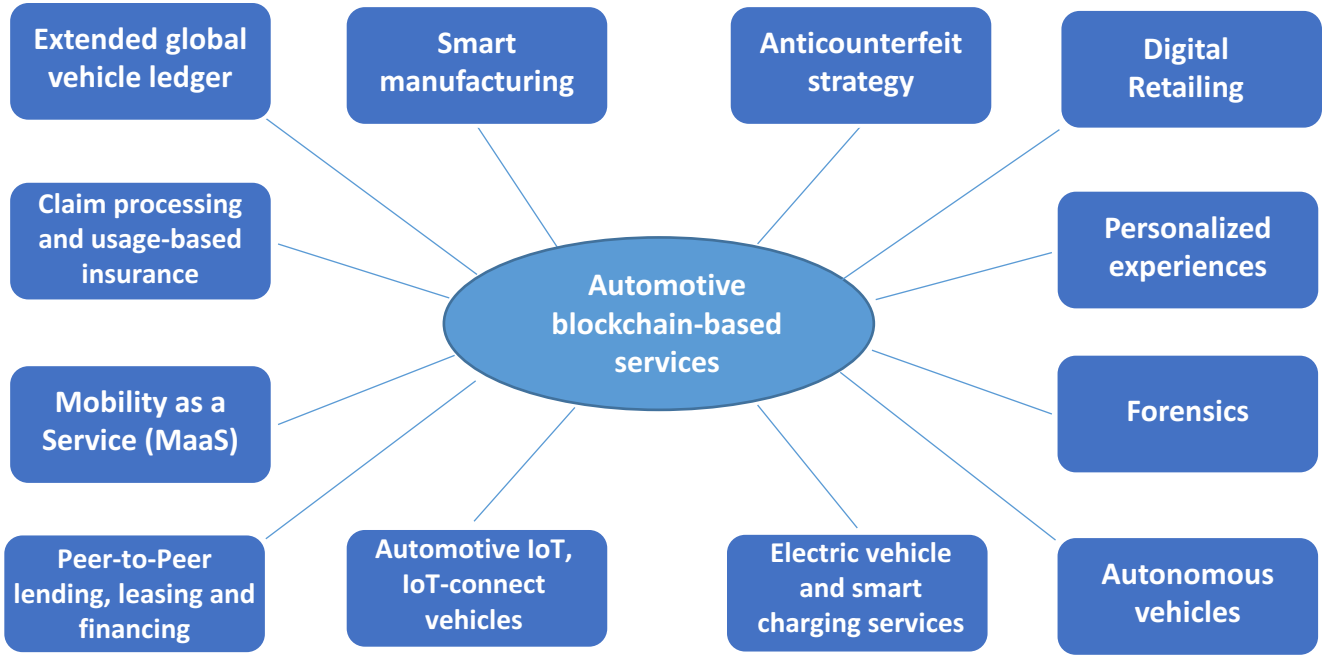
Automotive Blockchain-based Services



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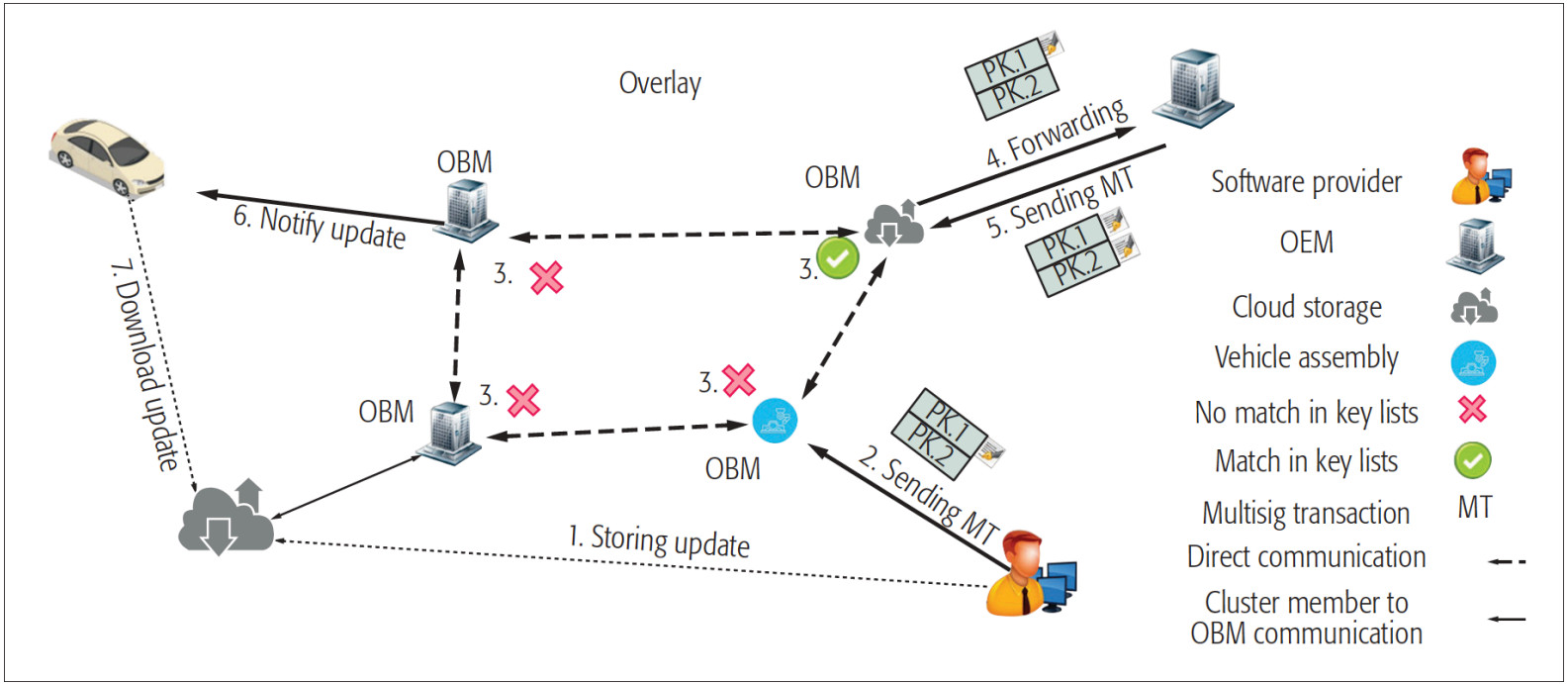
Blockchain-based vs. Conventional Methods

Application	Conventional methods	Advantages introduced by BC
WRSU	• Centralized – not scalable • Partial participation: not addressing the full chain starting from a SP all the way to a service center • Lack of privacy: a direct link between the vehicle and OEM can compromise the driver's privacy (e.g., driver behavior or location) • Only an OEM can verify communications or history of update downloads.	• Distributed data exchange and security provides scalability • End-to-end: involving SP, OEMs, vehicles, service centers, assembly lines, and so on • Ensure privacy of the user (also for diagnostics) • Update history as well as authenticity of the software can be publicly verified
Insurance	• Current systems are often insecure, which endangers the vehicle's integrity [10] • Users lack control over the exchanged data • Privacy-sensitive data must be continuously sent to the insurance company for receiving services	• Secure, distributed, and privacy-preserving data exchange • Users control the exchanged data • Privacy-sensitive data is shared on demand (e.g., accident happened) instead of a continuous data exchange. Authenticity of data stored in the vehicle can be publicly confirmed
Electric vehicles	• Central payment and accounting • The location and behavior (e.g., using a specific charger on a specific day) of the user can be tracked.	• Private and distributed security, payments, and accounting • User data such as location information remain private
Car-sharing services	• Central payment and accounting • Users can be tracked by their identity • Central authorization	• Private and distributed security, payments, and accounting • Users use changeable identities • Distributed authorization

A. Dorri, M. Steger, S. S. Kanhere and R. Jurdak, "BlockChain: A Distributed Solution to Automotive Security and Privacy," in *IEEE Communications Magazine*, vol. 55, no. 12, pp. 119-125, Dec. 2017.

Application of Blockchain in Automotive: Wireless Remote SW Update use case



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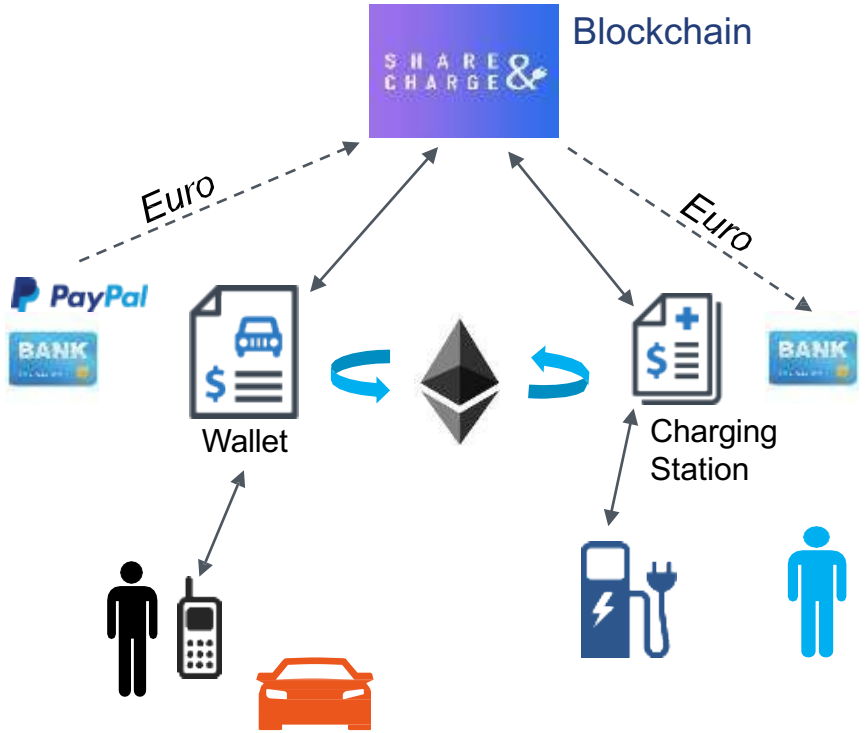
P2P Charging for Electric Cars

SHARE & CHARGE



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An initiative

Mobility Open Blockchain Initiative[4]

IBM is collaborating with BMW, Bosch, Ford, General Motors, Groupe Renault and a number of other companies on a new transport organization called the Mobility Open Blockchain Initiative (MOBI). The group will explore the use of blockchain to help make mobility safer, more affordable and more widely accessible. MOBI will explore how blockchain can be used in the new digital mobility ecosystem to meet customer demands. Some of MOBI's initial projects will focus on secure mobility commerce; usage-based mobility pricing and payments; and vehicle identity, history and usage.

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Summary

- Blockchain is rapidly developing beyond Financial Services
- Automotive industry is facing fundamental transformation and blockchain is a natural fit
- Autonomous cars will require decentralized ecosystem
- Standards and co-operation is required to make real progress

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Conclusions and Starting Points

- Connected vehicles and autonomous driving introduce new security, privacy and reliability issues in automotive. Blockchain technology may represent a relevant technology to support those issues.
- Is the Italian automotive community aware enough of the challenges due to upcoming blockchain technologies?
- What are the Italian automotive community needs in terms of resources and skills?
- Does Automotive SPIN Italia may contribute in supporting Italian automotive community?

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