E-Mobility, Blockchain & The Grid

Alain Brenzikofer REM Forum 24.5.2019

Vision meets reality.

Supercomputing Systems AG Technopark 1 CH-8005 Zürich Phone +41 43 456 16 00 Fax +41 43 456 16 10 www.scs.ch



BOURNS_CAY16-44+

BOURNS_CAY16-J4

BOURNS_CAY16-J4

CA

BOURNS_CAY16

R24'

Zürich 21.06.2019 © by Supercomputing Systems AG

Electromobility Tomorrow

EV drivers like minimal interaction with the charging process:

- No searching for charging stations
- No logins, no mobile apps, no passwords
- Payment happens without drawing a card

But a driver also wouldn't like his movements to be tracked by a roaming service or a payment system provider

Grid Operators shouldn't put more copper into the ground just to mitigate congestion if it can be avoided

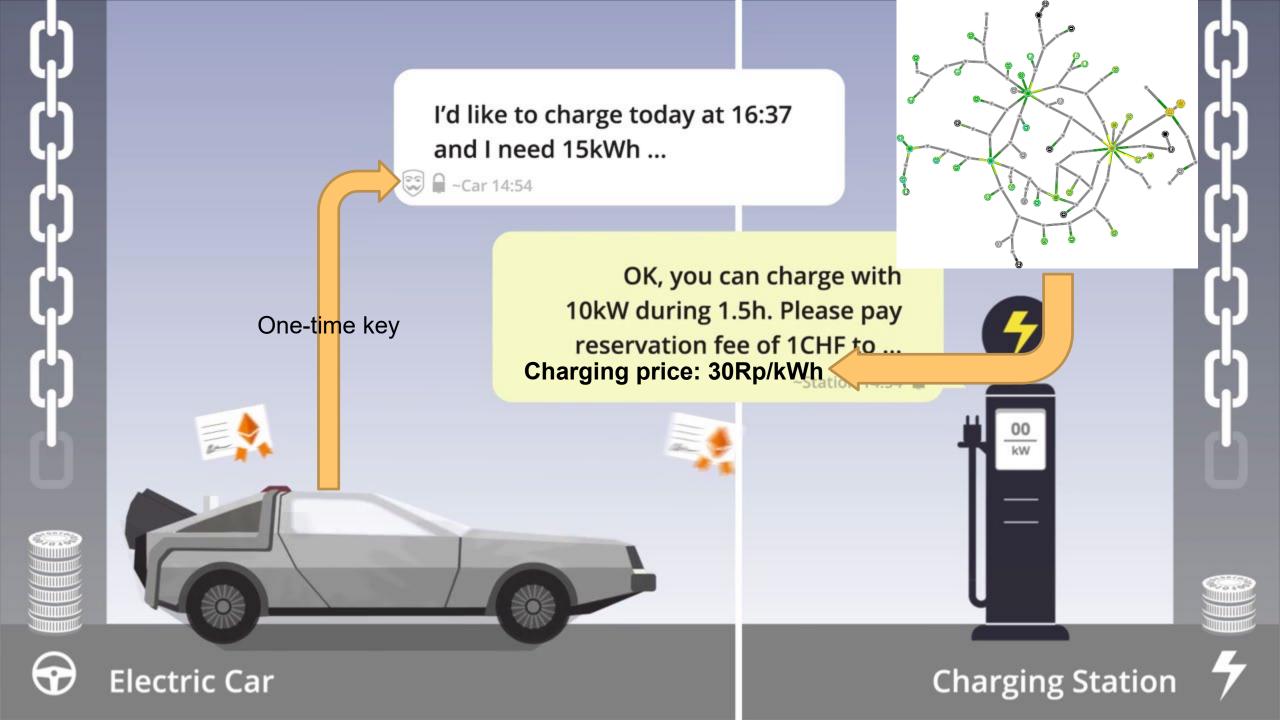
The following proposal has been developed as a proof-of-concept at SCS



eCharge an innovative reservation and payment process

> 00 kW

by **SCS**





OK, you can charge with 10kW during 1.5h. Please pay reservation fee of 1CHF to ...

~Station 14:54

Confirming reservation from 16:37 to 18:07 with 10kW

~Station 14:55

00 kW

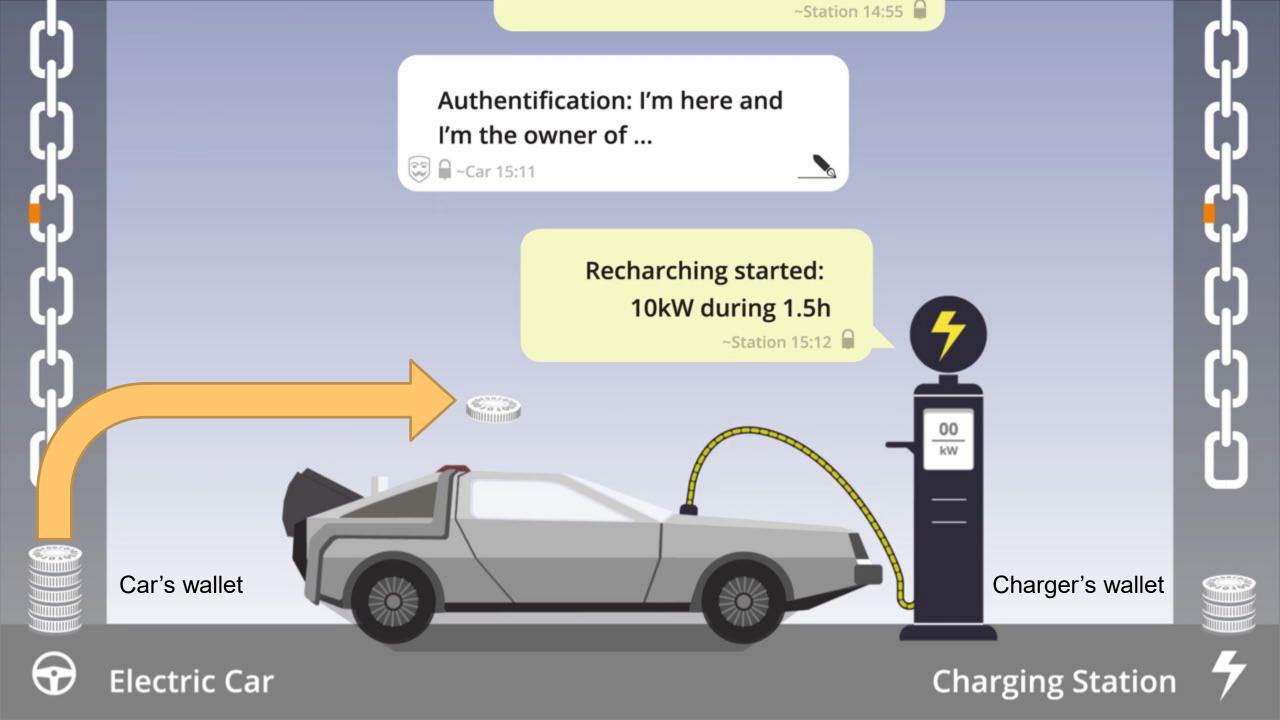
Electric Car

 \mathbf{T}





Charging Station '



Reservation Successful

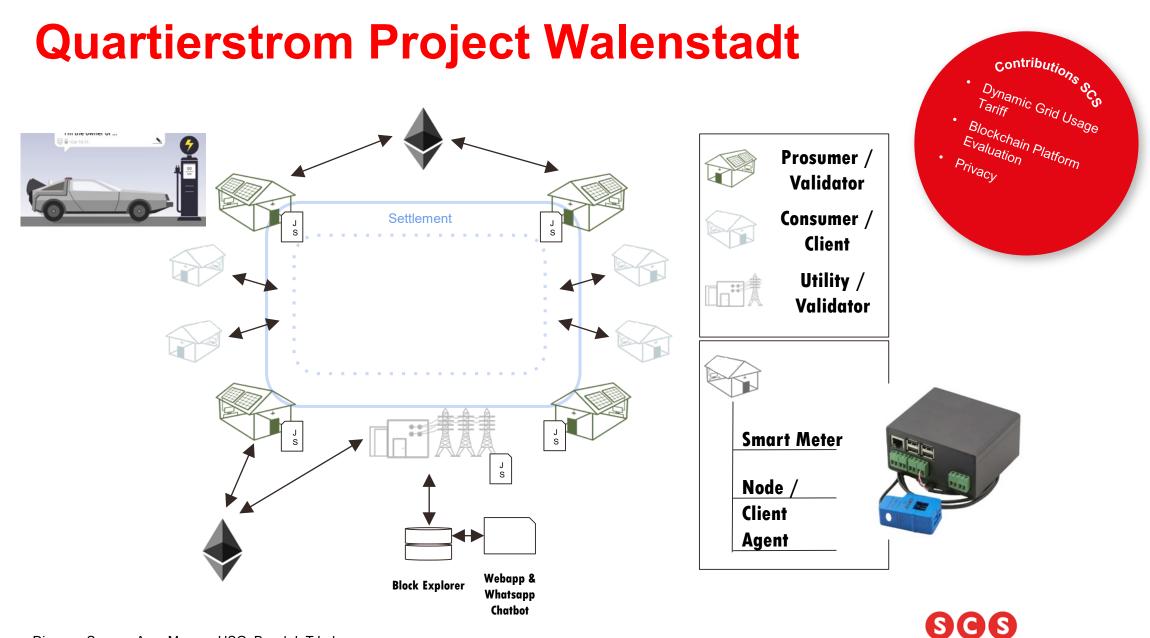
8

0 0

wits/v1.8.2 beta-156

https://youtu.be/xJUKNIV79pg

A NOV + +	∫ ∧ huty = +
🔲 👗 🏓 🔆 🗇 192.MA.1.391.0100/systems — C 🖨 G 🥥 🗏	■ ▲ ● ← (C 192.168.1.202 /11) win 192.168.1.200 #160 win 192.168.1.200 #160
NODE LOGS	NODE LOGS
· "S≡	· "5=
Imported #9 7064_eddb (1 1xs, 0.02 Mgas, 3.10	10.01.001, 11.11.00 Imported #9 7864.eddb (1 tax, 0.02 Hqss, 9.39
1/25 peers 15 Kin chain 18 Kin db 0 bytes googe 9 Kin sync SPC: 2 cons, 2 reg/s, 185 pe	Transaction mined (hash 19bdf7od0od71e4586409od57esb57e5d71t985ac5f54648d34570b7
1/25 peers 15 KiB chain 18 KiB db 0 bytee guesse 9 KiB syng RPC: 2 cone, 2 reg/s, 189 ps	1/25 peeze 20 KiB chain 17 KiB db 0 bytes guess 9 KiB sync KPC: 2 conn, 3 reg/s, 255 ps
1/25 peers 15 KiB chain 18 KiB db 0 bytes geaus 9 KiB sync RFC: 1 conn, 2 reg/s, 355 us	1/25 poers 20 KiB ohain 17 KiB db 0 bytes guess 9 KiB sync RPC1 2 conn, 1 reg/s, 184 pe
provident, storage, may 0.67 King 1164.0637 (1 txe, 0.02 Mpss, 3.23	1/25 peers 20 KiB chain 17 KiB db 0 bytes graces 9 KiB sync MXC: 2 conn, 1 reg/s, 177 pe
1/25 peers 14 KiB chain 17 KiB db 0 bytes genes 9 KiD sync MDC: 2 conn, 22 reg/s, 1480 ps	1/25 peers 20 Kill chain 17 Kill db 0 bytes (11.11.111), 11.111 db 1 gurue 5 Kih symo NPC: 2 comm, 118 ren/s, 2500
Interior, Longing Imported #7 9601_ebec [1 txs, 0.02 Myns, 3.20 mm, 0.67 KiB)	iiii
Emported #4 abea.5f75 [1 taxa, 0.02 Mgam, 3.87 mm, 0.67 KiB)	Transaction mined (bash 20173e127746ddaa763d35332acbcc3Wcd22730df22543e3af7ecb7
1/25 peers 13 KiB chain 10 KiB db 0 bytes goese 9 KiB sync RPC: 2 cone, 23 reg/s, 2649	Ilitiation income Imported #7 9601.ebec (1 tax, 0.02 Mgas, 7.13 ma, 0.67 KiB)
pe Imported #5 4f2a.baf9 (1 txe, 0.02 Mpas, 3.24	Chainer CabdideBcCCcde77elalbes59b66649546d67786a5527e0eBaa301
ma, 0.67 KID) Taported #4 6982.4566 (1 tam, 0.02 Mynes, 4.4) en, 0.67 KID)	1/25 peers 17 Kib chain 16 KiB db 0 bytes poultant, introd, ganue 9 KiB sync NPC: 2 cosn, 116 req/s, 5156
1/25 pers 11 KiB chain 9 KiD db 0 bytes queue 9 KiB syno 80C: 2 conn, 22 reg/s, 1089 µm	Internet 100 m Imported #6 elem_5f75 (1 tas, 0.02 Mgas, 7.10
Incommutation, Emported #3 \$15%_f%b% (1 tan, 0.02 Mgns, 3.7%	Transotion mined (hash bd4b435aletaaa7e592d14cal4e820ae7b8cdadc0208d767e3331a5
1/25 peers 10 KiB chain 8 KiB db 0 bytes queue 9 KiB syng EPC: 2 conn. 2 reg/s. 533 up	Inported #5 4f2m.haf9 (1 tan, 0.02 Mgas, 8.15 ms, 0.47 KiB)
1/25 peers 10 KiB chain 8 KiB db 0 bytes queue 9 KiB sync 27C: 2 conn, 31 reg/s, 174 pe	Transaction mined (hash 377dc785dfcd7cc5d5dfa97d2e11a9687ca7513f7e483976cb18155
And a second	An other states of the second



super computing systems

Diagram Source: Arne Meeuw, HSG, Bosch IoT Lab

Why Blockchain: Trust

- **Integrity**: The counterparty plays fair.
- **Competence**: Ability to protect information
- **Confidentiality**: The counterparty isn't curious and doesn't use my data for non-declared purposes

Utility companies and car industry enjoy their customers' trust

Regarding their integrity.

Not so much regarding their competence or curiosity





• **Decentralization doesn't come for free** (and hasn't really been achieved so far)

PoW Mining for Bitcoin consumes the equivalent of Switzerland in electrical energy There are «green» alternatives, but they don't come for free neither

Scalability is limited

Public Blockchains can only process few tx/s

Solutions:

do as much as possible «off-chain»

2nd layer protocols (Lightning), side-chains (Cosmos, Polkadot) and others.

• **Confidentiality** (GDPR: Right for deletion, protection of personal data)

Cryptography: Zero-Knowledge-Proofs, Ring Signatures, Homomorphic Commitments Trusted Execution Environments (TEE) (Intel SGX, ARM TrustZone, Keystone *(announced)*)

super computing systems

Conclusion

- Applying Blockchain can make sense IF it's a matter of **trust and commitment**.
- Confidentiality is no natural feature of blockchain. Quite to the contrary.
- Decentralization has limits.
- Still: Scalable, ecological and confidential solutions are possible on a blockchain.
 SCS is working on it: substraTEE: <u>https://github.com/scs/substraTEE</u>





Vielen Dank für Ihre Aufmerksamkeit

alain.brenzikofer@scs.ch

Vision meets reality.

Supercomputing Systems AG Technopark 1 CH-8005 Zürich Phone +41 43 456 16 00 Fax +41 43 456 16 10 www.scs.ch



BOURNS_CAY16-44+

R23 BOURNS_CAY16-J4

R24* BOURNS_CAY16-J4

BOURNS_CAY16 TC/2

0

TT.