M2M Billing for Electric Autonomous Vehicles

Manuel Mazzara, 5.12.2018

Our team

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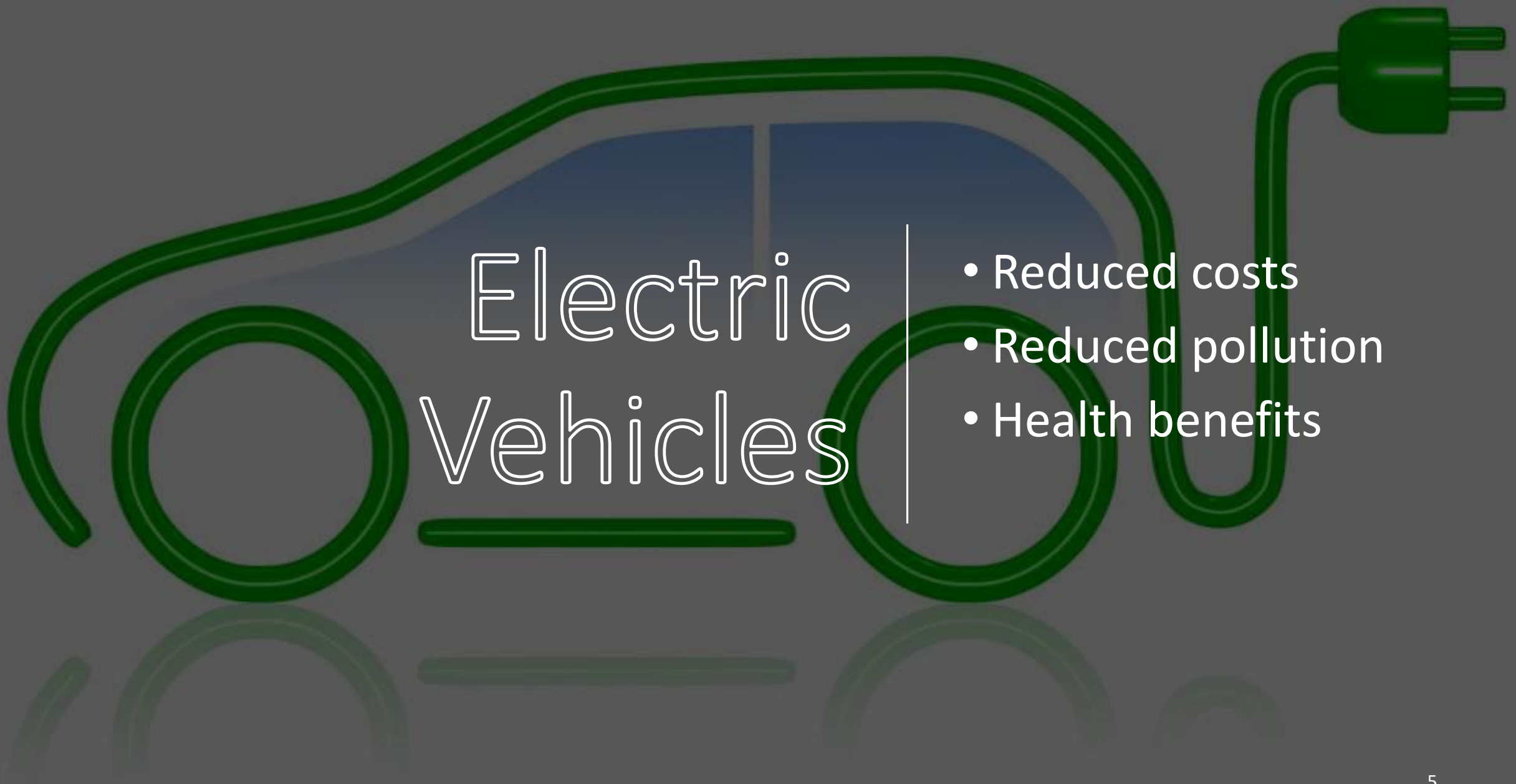
Our expertise

- Internet of Things
- Service Engineering
- Security
- Vehicular Ad-Hoc Networks
- Autonomous systems
- Sensor integration

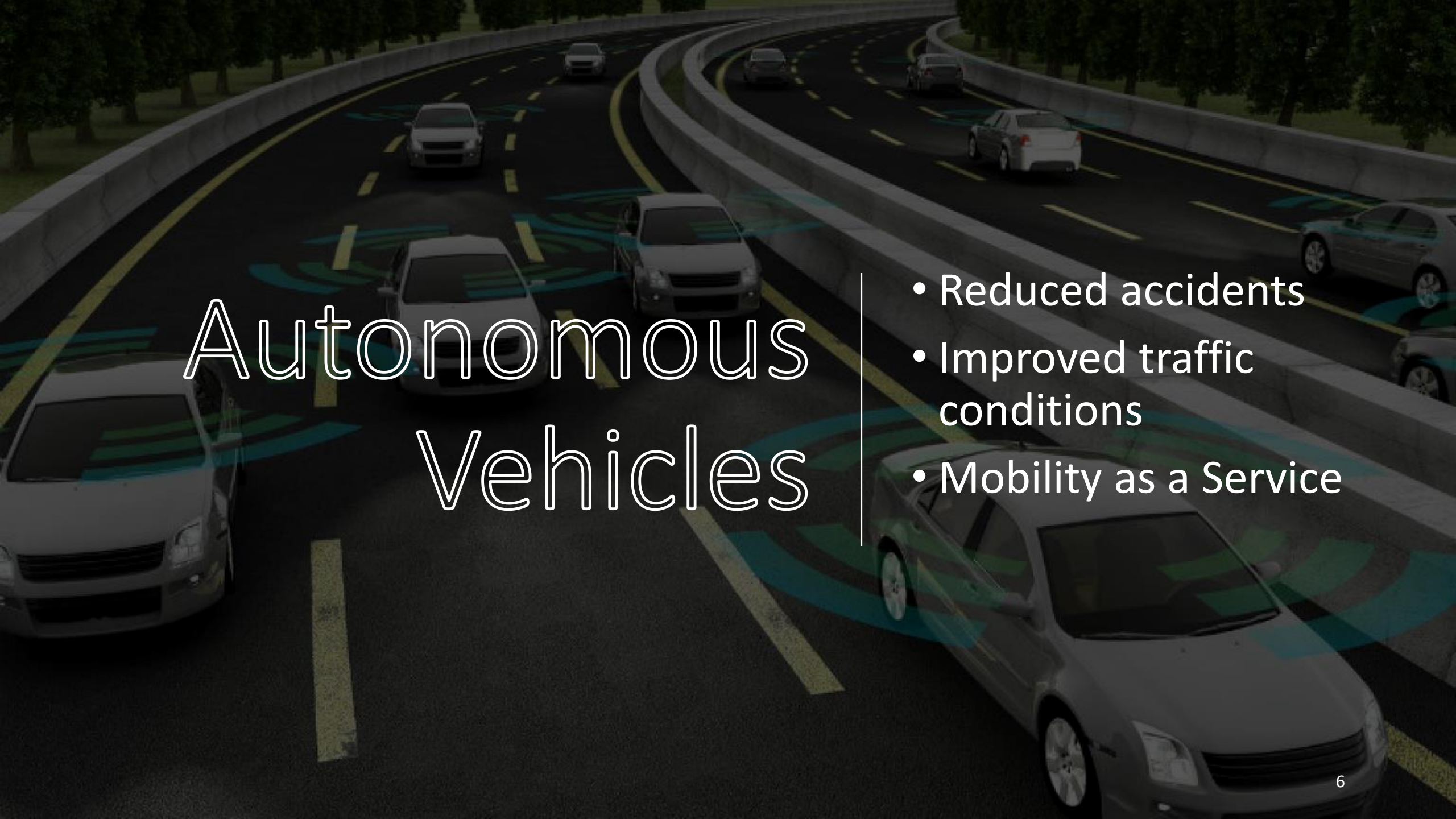
Focus

- Electric Vehicles (EV)
- Autonomous Vehicles (AV)
- Distributed Ledger Technology (DLT)
- M2M



Electric Vehicles

- Reduced costs
- Reduced pollution
- Health benefits



Autonomous Vehicles

- Reduced accidents
- Improved traffic conditions
- Mobility as a Service

Distributed Ledger Technologies

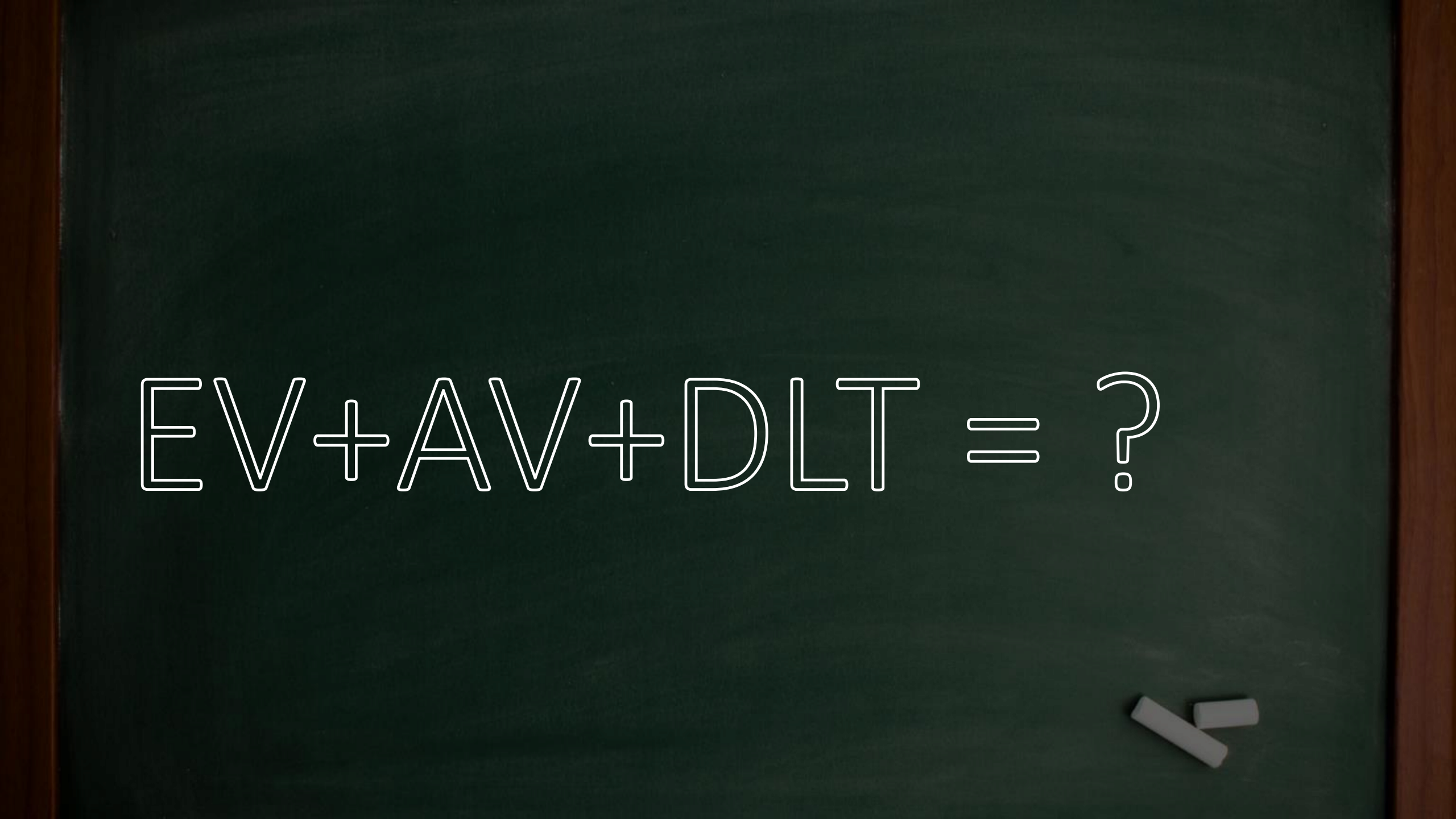
- No central administrator or centralized data storage
  - Peer-to-peer network
  - Consensus algorithms
- Lack of central authority
- Distributed ledgers for payments

IOTA

- Data exchange between sensor-equipped machines populating the Internet of Things
- No traditional blockchain
  - Tangle: Directed Acyclic Graphs (DAG)

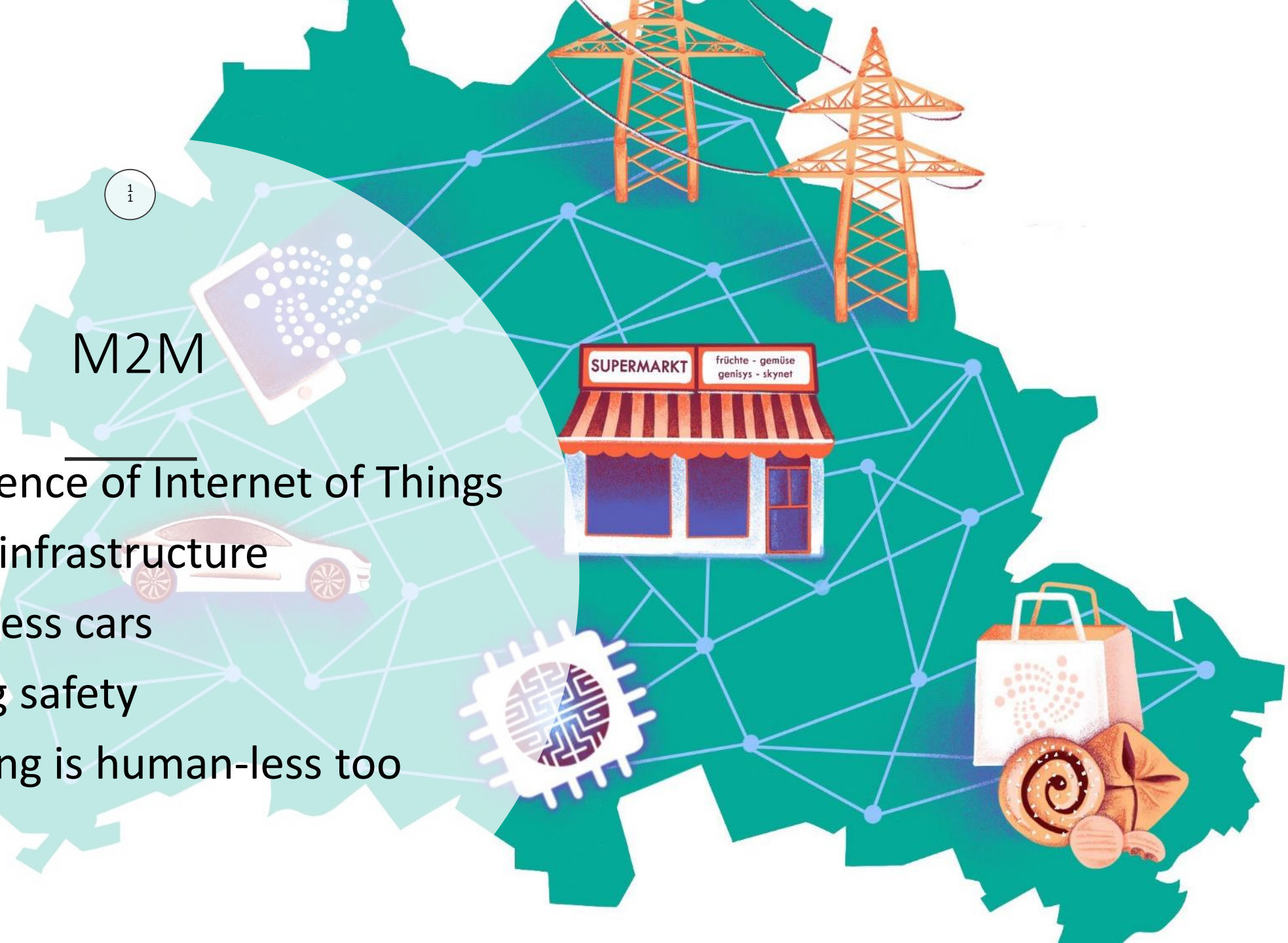
Advantages

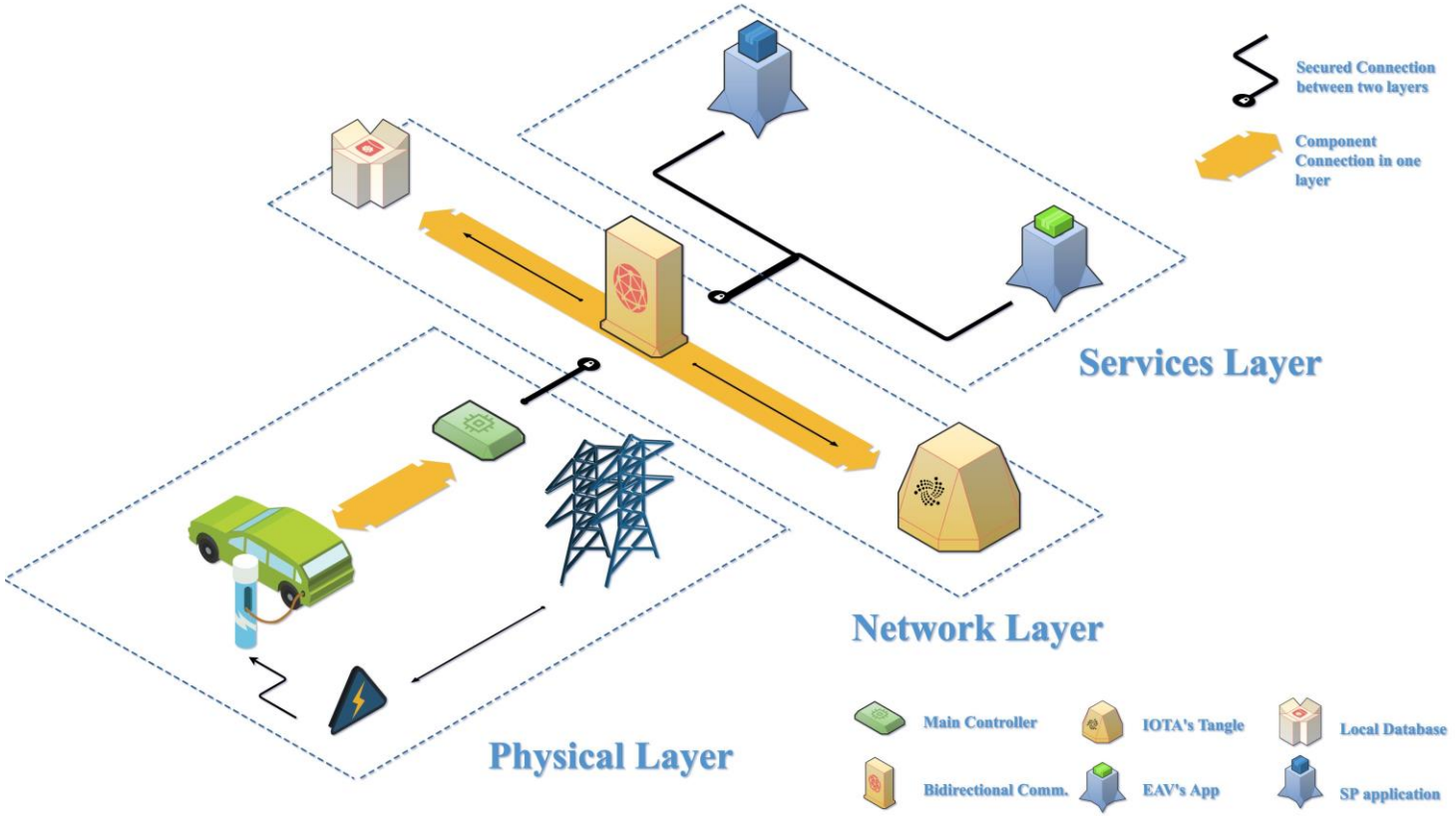
- For its own transaction to be valid, each node in a DAG Tangle must approve two previous transactions at other node
  - No miners
  - Removes possible bottlenecks


EV+AV+DLT = ?

M2M

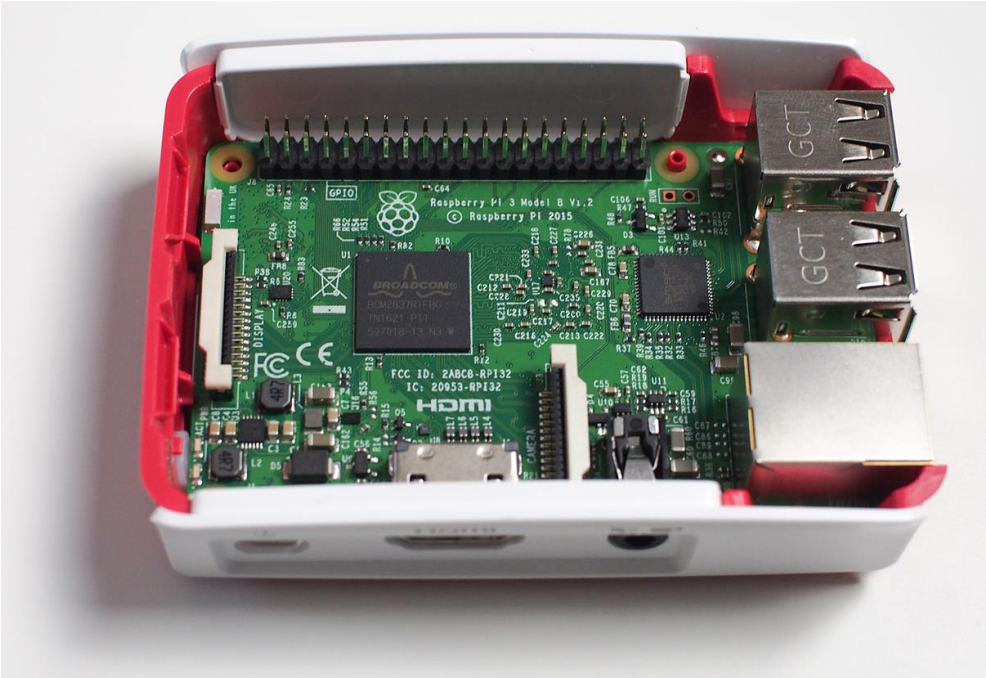
- Emergence of Internet of Things
- Smart infrastructure
- Driverless cars
- Driving safety
- Charging is human-less too



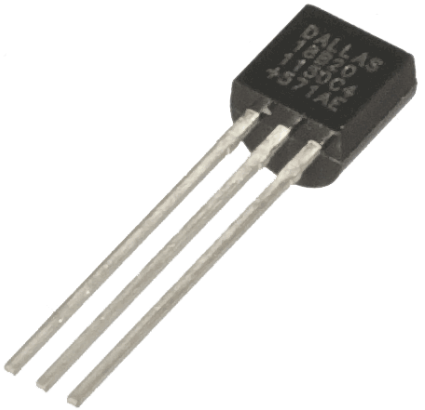


EAV Charging & Billing Architecture

Proof-of-Concept



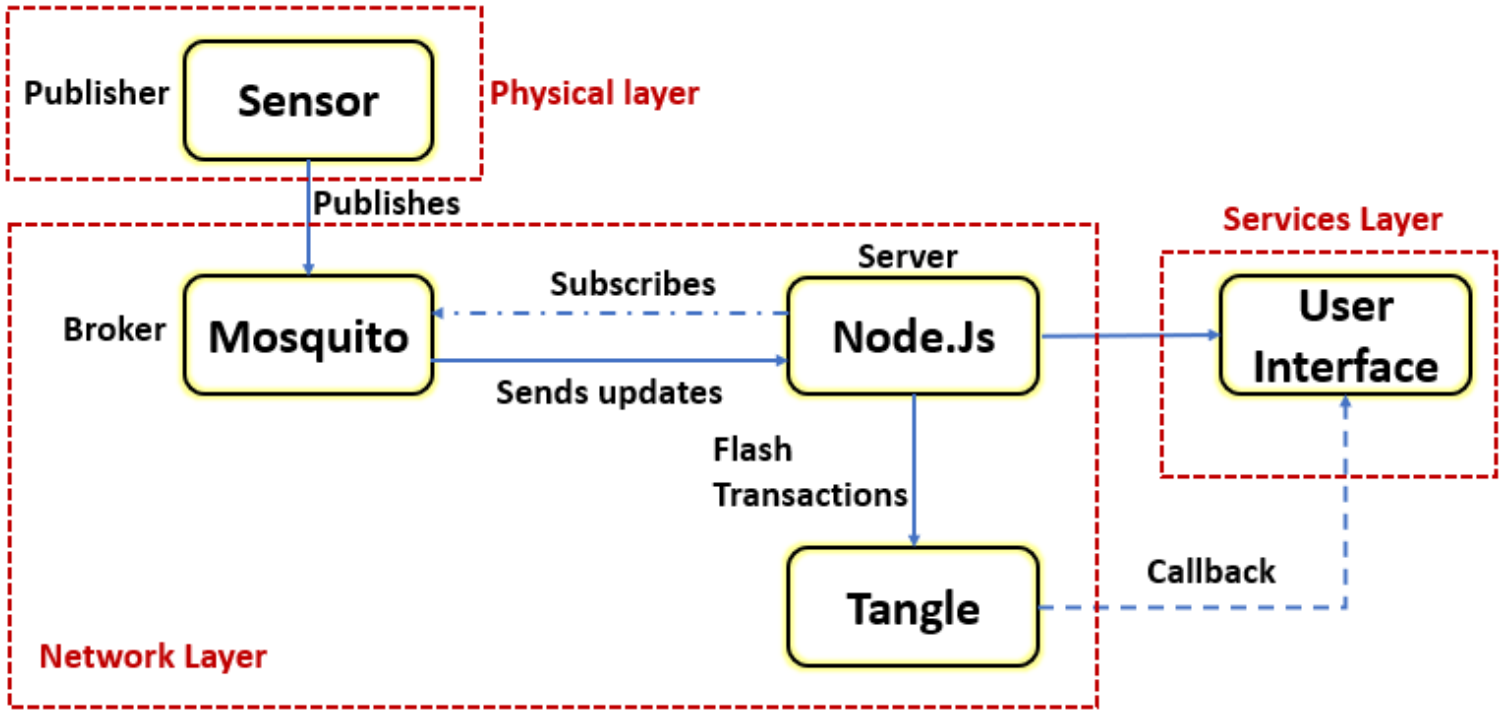
Raspeberry Pi 3



Dallas Semiconductor DS18B2

Temperature sensor

Setup


Publisher
Sensor
Physical layer
Publishes
Services Layer
Server
Subscribes
Broker
Mosquito
Node.Js
User Interface
Sends updates
Flash Transactions
Callback
Tangle
Network Layer

Results


INNOIOTA
Analytics
Payments
Temperature Recordings Chart
Temperature
Temperature in Celsius
30.0
29.5
29.0
28.5
28.0
27.5
27.0
26.5
26.0
25.5
25.0
16 hr: 15 min: 3 sec
16 hr: 15 min: 9 sec
16 hr: 15 min: 14 sec
16 hr: 15 min: 20 sec
16 hr: 15 min: 26 sec
16 hr: 15 min: 31 sec
16 hr: 15 min: 37 sec
16 hr: 15 min: 42 sec
16 hr: 15 min: 48 sec
16 hr: 15 min: 54 sec
16 hr: 15 min: 59 sec
16 hr: 16 min: 5 sec
16 hr: 16 min: 10 sec
16 hr: 16 min: 16 sec
16 hr: 16 min: 22 sec
16 hr: 16 min: 27 sec
16 hr: 16 min: 33 sec
16 hr: 16 min: 39 sec
16 hr: 16 min: 44 sec
16 hr: 16 min: 52 sec
End Transactions
Balance of PI (IOTA)
1003
Transactable IOTA left
1994
Balance of User (IOTA)
997

Summary

- Autonomous and (Electric) Cars
- Distributed Ledger Technology (DLT)
- M2M Economy
- IOTA-based billing framework for autonomous electric cars
- Proof-of-concept