How Blockchain* May Disrupt the Automotive Industry – An Insider’s View

• Data usage
• Market mechanics
• Cooperation models

Peter Busch
Product Owner DLT Mobility

*Rather „Distributed Ledger Technology“ (DLT)
The Bosch Group – Four Business Sectors

Key figures 2018

<table>
<thead>
<tr>
<th>Sector</th>
<th>Key Figures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bosch Group</strong></td>
<td>▶ 78 billion EUR in sales* ^</td>
</tr>
<tr>
<td></td>
<td>▶ 409.881 associates* ^</td>
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<tr>
<td></td>
<td>▶ 280 plants in 60 countries</td>
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<tr>
<td><strong>Mobility Solutions</strong></td>
<td>▶ One of the world's largest suppliers of mobility solutions</td>
</tr>
<tr>
<td></td>
<td>▶ 60% share of sales</td>
</tr>
<tr>
<td><strong>Industrial Technology</strong></td>
<td>▶ Leading in drive and control technology, packaging, and process technology</td>
</tr>
<tr>
<td><strong>Energy and Building Technology</strong></td>
<td>▶ One of the leading manufacturers of energy-efficient heating products and hot-water solutions and leading in security and communication technology</td>
</tr>
<tr>
<td><strong>Consumer Goods</strong></td>
<td>▶ Leading supplier of power tools and accessories</td>
</tr>
<tr>
<td></td>
<td>▶ Leading supplier of household appliances</td>
</tr>
<tr>
<td></td>
<td>▶ 40% share of sales</td>
</tr>
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</table>

^ as of 12.18
BOSCH: SUSTAINABLE MOBILITY

costs  hybrid  electrified  automated  connected
roaming  power electronics  range  emergency braking assistant  augmented reality
hybrid  electric motor  power electronics  legislation  electronic horizon  internet of things
electrified  plug-in  charging infrastructure  emergency braking assistant  smartphone integration
market ramp-up  battery  redundancy  auto pilot  vehicle to vehicle
ramp-up  smart charging  electric steering  highway pilot  vehicle to infrastructure
sensors  digital environment  valet parking  eCall
connected

eCall  cloud  vehicle to infrastructure  services  fleet management

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Introduction

Enabling technologies for the Economy of Things

Taking the IoT to the next level
Emerging technologies enable new use cases

Services + Software + Sensors

Artificial Intelligence
Cloud & Fog Computing
Blockchain
IoT Networks

*Rather „Mutual Distributed Ledgers“ (MDL) or „Distributed Ledger Technology“ (DLT)
OMNIPRESENT – THE INTERNET OF THINGS

CONNECTED PRODUCTS

~50%

All electronic Bosch-product categories are IP-enabled

MARKET PRESENCE

38m

IoT-Products

Sold by Bosch in 2017

INNOVATIVE PLATFORM

170

Bosch-Projects

Currently realized on Bosch-IoT-Cloud
DLT* enable the Next Generation of the IoT

IOT: CONNECTED DEVICES

> Internet of Things generates DATA
> DATA enables new products

ECONOMY OF THINGS

> CONNECTED devices become ECONOMIC devices
> Devices do seamless Business
> Towards AUTONOMOUS, LEGAL entities

DLT AND SMART CONTRACTS

> Foundation of crypto-currencies
> Decentralization and Trust
> Machine2Machine Value Exchange

**DLT-based business backbone as alternative to proprietary platforms**
Bosch Corp. DLT-Project “Economy of Things”
An Alternative Approach to GAFA* Platform Monopolies

Decentralization
Organizational and technical

Immutability
Tamper proof recording of events and their evidence

Trustless exchange
Fair market place without platform monopolies

5-Steps Strategy of the Bosch DLT-Project

1. Digital Currency
   - Car eWallet

2. Digital Notary
   - Track & Trace

3. Digital Identity
   - Seamless Sign-on

4. Smart Contracts
   - Brokerage

5. Economic Device
   - Energy Trading

DLT enables decentralized algorithmic Consensus suited for the ECONOMY OF THINGS

Automotive Technology | Economy of Things - Peter Busch | Nov 2019

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*) GAFA: GoogleAmazonFacebookApple
DISRUPTION I:
DATA USAGE
IoT Building Block XDK and Eclipse MITA
Make Machine2Machine Economy REAL

Bosch XDK
Cross Development Kit

Eclipse Mita
A complete example to build a shock detector connected using MQTT over WLAN
Easy programming of IoT devices
Transpiles to C
Declarative setup of sensors
Declarative setup of connectivity
Direct access to sensor readings

/* Mita has packages which are the main unit of isolation package main; */
// Every Mita program must import a platform, here we use the XDK
import platform.xdk;
// System resources are configured using the setup keyword,
// Here, we configure the WLAN connectivity of the XDK.
setup device: WLAN {
    ssid = "[networkssid]";
    psk = "[supersecretkey]";
}
// Software resources are resources nonetheless and thus are set up
// using the setup keyword. Notice how we refer to the device WLAN setup
// as means of transport, and instantiate a signal to the /events topic.
setup backend: MQTT {
    transport: device;
    url = "mqtt://iot.eclipse.org:1883";
    clientId = "shockdetector1";
    var events = topic("name","events");
}
// Functions use the fn or function keyword. If the return type was omitted
// the mita compiler would infer it automatically. Also, notice the type
// parameter of the array.
fn max(x: array:uint32): uint32 {
    ...
}
// Variables can be immutable (let) or mutable (var).
// for arrayPosition we do not have to explicitly give a type as our
// type inference infers it from the initialization.
let acceleration = new array<uint32>(size=10);
var arrayPosition = 0;
// The every keyword handles events. Here we use time as an event source and
// run at a regular interval.
every 10 milliseconds {
    // Sensor data (and other modalities) are available due to the platform import above
    // One can use some resources even if they were not configured beforehand.
    acceleration[arrayPosition] = accelerometer.magnitude(read());
    arrayPosition = arrayPosition + 1 % acceleration.length();
    // The means() function can be called using the familiar OO-style notation.
    // The expression on the left side of the dot becomes the first argument
    // of the function call.
    // [acceleration.map(x => x + 100)].
    // Writing to the signal instance we’ve created in the signal block
    // above sends out the MQTT message (backend is an MQTT resource
    // after all). Using beciktos we can use string interpolation.
    // Here we construct a 250M string inline to the function call.
    backend.events.write({ "type": "shock", "msg": $([acceleration.map(x => x + 100)].join()); });
}
// Events are described and offered by the platform.
// This exposed event exists because the XDK platform imported
// above declares it.
every button_was_pressed {
    for(var i = 0; i < acceleration.length(); i++) {
        acceleration[i] = 0;
    }
    arrayPosition = 0;
}
DISRUPTION II:
MARKET MECHANICS
## Disrupting Market Mechanisms

**Example: Smart Cities / EV Charging**

<table>
<thead>
<tr>
<th>Market Mechanics</th>
<th>Characteristics</th>
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<tbody>
<tr>
<td><strong>Bundling</strong></td>
<td>• Platform Business entity as the “monarch”&lt;br&gt;• Danger of Market-Stall: Fierce fights of incumbents over platform dominance&lt;br&gt;• Very difficult to establish, but Winner-takes-it-all</td>
</tr>
<tr>
<td><strong>Discovery</strong></td>
<td>• Division of power into at least three parties: Discovery, Contract, Execution</td>
</tr>
<tr>
<td><strong>Contracting</strong></td>
<td>• Potentially easy to establish&lt;br&gt;• More price signals&lt;br&gt;• Federated market structure&lt;br&gt;• Enabled by Smart Contracts&lt;br&gt;• Secured by Blockchain</td>
</tr>
<tr>
<td><strong>Execution</strong></td>
<td></td>
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</tbody>
</table>
Example: Hazard Spot Warning

Afraid of unforeseeable black-ice or upcoming hydroplaning (or any other valuable data)?

Let all drivers collect data and let all the others know!

What difference does DLT bring propose?

Incentive for cars to collect valuable info to sell the data to the cloud (to buy other services)!

Depending on the value of the data, the market prices would be brokered by Smart Contracts.
Example: Firmware-Over-The-Air (FOTA)

Warranty claims significantly reduce the profit margin.

BOSCH FOTA allows for a remote update of the vehicle’s Soft- and Firmware

FOTA saves approx. 50 Euros per vehicle compared to a field action.

What difference does DLT bring propose?

Tamper-proof documentation of the vehicles components and software in distributed Ledgers

Additional features and services bought from the market place via Smart Contracts
DISRUPTION III:

COOPERATION MODELS
What’s next: From an Automotive to an IoT Ecosystem
The give-and-take in an Ecosystem

- Partners
  - Customer
  - Solutions / Components
  - Market potential

- Market potential
- Customers
- Revenue

- Customers
  - Service / Products
  - Need satisfaction
  - Experience

- External Developers
  - Know How
  - Exchange
  - Service Portfolio
  - Extension

- Services
- Revenue
- Exchange

- Bosch
  - Revenue
  - New Markets
  - New Customers

- New business models
  - Mobility Services
  - Energy Services
  - Smart home Services
  - IoT Services
  - Enterprise Integration
  - Infra-structure
  - Big Data
  - Market Place
  - ...
Consortial Collaboration: Trusted IoT Alliance
Founders Meeting – May 18th 2017 @ CISCO in Santa Clara

Open Source Software Foundations to support the creation of a SECURE, SCALABLE, interoperable, and TRUSTED IoT and Blockchain Ecosystem
Consortial Collaboration: **Trusted IoT Alliance**

Open Source Foundation with Focus on IoT

**Enterprise Companies**

- Bosch
- Cisco
- Gemalto
- HCL
- BNY Mellon
- Swiss Re
- US Bank
- UBS
- EDF
- Deutsche Telekom
- Siemens

**Blockchain Technology Companies**

- XAIN
- Bitse
- Chronicled
- Deem
- Aero Group
- Modum
- Ledger
- Skuchain
- Bigchain
- NEM
- Foam
- Global Blockchain
- Streamr
- IOTA
- Riddle & Code
- Clause
- Vechain

**IoT Technology Companies**

- Augmate
- Paradox Engineering
- Homeboy
- Ubirch

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MOBI: Mobility Open Blockchain Initiative
Blockchain Consortium dedicated to Automotive

Use Cases
- Digital History: Tracking Vehicle Data
- Auto Component Supply Chain Tracking
- Autonomous Machine Payments
- Mobility Commerce Platform
- Data Markets for AV Driving Data & Research
- Car & Ride Sharing
- Usage-based Insurance
“Everybody wants to own the platform plus Nobody wants to be locked in on other platforms results in Small platforms without benefits of scaling networks

A new concept to break this deadlock is The Economy of Things”
Conclusion from an Automotive Insider
Blockchain Will Disrupt the Automotive Industry!

• Data usage

• Market mechanics

• Cooperation models
Thank YOU!

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