User-Centered Digital Mobility Services
Lessons learned, open challenges and new opportunities

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www.tum-llcm.de
Cars are becoming a victim of their own success

Mittlerer Ring, München, Germany

Source: http://www.sueddeutsche.de/muenchen/citymaut-debatte-in-muenchen-freie-fahrt-gegen-bezahlung-1.1487380
Rail infrastructures suffer from limited adaptability

Munich subway station

https://www.abendzeitung-muenchen.de/943bf8e-c82c-4483-abc1-ac43718893c4.html
Rail infrastructures suffer from limited adaptability

Munich Olympic village of 1972 as of today
Connected and clean mobility options keep growing

**Mobility services and car sharing**
- From ownership to access

**Convenient and clean mobility**
- E-bike, E-scooter, E-Car, Segway

**Increasing automation**
- Drivers become passengers
- Sharing will be the new normal
Company-centered business models are challenged
Grow my fleet, my customer base, my apps, my data

Examples in Munich: DriveNow, Car2Go, Obeo, ...
User-centered and networked business models will win
Your journey, your options, your preferences, your data

Apple Platform
- Apple Maps
- Apple Siri
- Apple Passbook
- Apple Wallet
- Apple Watch

Google Platform
- Google Maps
- Google Android
- Google Analytics
- Google Now

Everything, immediately, for the lowest price
Digital mobility solutions have to be adapted to a very specific context

**Existing infrastructures**: Urban vs. rural areas

**Culture & Governance**: Munich vs. Hamburg vs. Copenhagen vs. Singapore vs. Mexico City

**Legislations**: EU, US, China, …
- Privacy, liability, protected businesses, role of the state, …

**Mobility demands of a specific target groups**
- School kids, students
- Families
- Tourists
- Business travelers
- Elderly people
- Handicapped people
- Enterprises
- Cities & public services (police, fire brigade, medical doctors, …)
Alternative 1: Build your own platform through acquisitions and partnerships
Alternative 2: Create an open digital marketplace for mobility services
The Connected Mobility Lab of BMW GROUP, SIEMENS, (HERE)
The TUM Living Lab Connected Mobility
Achievements in research, development and technology transfer

Modular & personalized mobility services
Reusable technology building blocks
Empirical studies and design patterns

Results available at www.tum-llcm.de
Example of a TUMLLCM startup

RideBee - Carpooling for companies

2-3 more to come (V2X, Indoor Navigation, Personalized Travel Recommendations)
Networking and community building is essential
Workshops, demonstrations, events & hackathons

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A highly dynamic and cross-sectoral ecosystem
Lessons learned the hard way

Severe cultural clashes
- Startups, incumbents
- Industry, academia
- Good guys, bad guys (public transport, car manufacturers)
- Us, them (BMW employee selling train tickets?)

Everybody calls for a change
- But not everybody wants to change

Lack of mobility data for research and innovation
- Legal constraints (data is the new oil asbestos)
- Lack of trust
- Lack of business models

Clarify your mission and target audience
Political pressure and Regulations
Data Cooperatives? Blockchains & Smart Contracts?
Data cooperatives are a novel approach to personal data management

**Shared Data and Services**

- **Provider-centered**
  - Mobility Platform
  - Web Site
  - Social Media
  - Intranet
  - CRM
  - ERP

- **Customer centered**
  - Our Data Cooperative
  - Education
  - Energy
  - Health
  - Mobility

**Data Silos**

- **Mobility Provider**
  - Web Site
  - Social Media
  - Intranet
  - CRM
  - ERP

- **My Personal Data**
  - Education
  - Energy
  - Health
  - Mobility
  - Insurance
The potential of blockchain technologies

They enable **intermediary-free** transactions of **digital, non-copyable goods** without the need to trust the other party.

Digital identities of people or **machines** can enter into secure transactions and all transaction details are stored **immutable** and **decentralized**.

**Automated, programmable contracts** can ensure contract compliance.

"We believe that the Blockchain will have the greatest influence on contracts, logistics and supply chain, healthcare, public administration, asset clearing, property and transactions."

- Greg LaBlanc
What is a “Blockchain“?

Technical definition

“A blockchain […] is a distributed database that maintains a continuously-growing list of ordered records called blocks. Each block contains a timestamp and a link to a previous block. By design blockchains are inherently resistant to modification of the data: once recorded, the data in a block cannot be altered retroactively.”

https://en.wikipedia.org/wiki/Blockchain_(database)

Functional description

[…] are systems that enable parties who don’t fully trust each other to form and maintain consensus about the existence, status and evolution of a set of shared facts.

Richard Brown, R3 CTO
Example: Hyperledger - blockchain technologies for business

Hyperledger is an **open source** collaborative effort created to advance cross-industry blockchain technologies. It is a global collaboration, hosted by The Linux Foundation, including leaders in finance, banking, IoT, supply chain, manufacturing and technology.

- **Hyperledger Fabric**: A (federated, permissioned, private) blockchain based on a peer-to-peer network executing and validating chaincode.
- **Hyperledger Composer**: Development environment for smart contracts contributed by IBM.
- Several other (competing) projects

- Focus on business and cross-enterprise use cases
- Broad industry support
- Currently used mostly for education and internal proof-of-concept solutions
Idea
- Focus on cross-enterprise Internet of Things use cases that do not require strict transactional semantics.

Example: Inductive charging:
- Instant authentication
- Trustless micro-payments
- Fast
- Scalable
- Immutable

Core Concepts
- Replace the linear chain by a directed acyclic graph. Do not use blocks, but transactions only.
- Atomic exchange of information and payments
- Each transaction has to validate two other transactions.

Not yet ready for production
Blockchains are a team sport

The parties in the ecosystem interact via shared executable contracts on shared blockchains.

**Banking**: R3 Consortium (2014)
- 200 members

**Energy**: Energy Web Foundation (1/2018)

**Insurance**: B3i Consortium (3/2018)
- Achmea, Aegon, Ageas, Allianz, Generali, Hanover Re, Liberty Mutual, Munich Re, SCOR, Swiss Re, Tokio Marine, XL Catlin, Zurich Insurance Group

**Mobility**: Mobi Open Blockchain Initiative (5/2018)
- BMW, General Motors, Renault, Ford, Bosch, ZF, …

Visit [blockchain.tum.de](http://blockchain.tum.de) to learn more
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