Blockchain-Based Systems Engineering

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Blockchain-based Systems Engineering

Entwicklungsprojekte

- Landesnotarkammer Bayern: Digitaler Nachlass
- IHK München: Digitale Zeugnisse
- Chip Card Solutions, DRK: Absicherung von Blutkonserven mit RFID und Blockchain-Technologie
- Noumena Digital AG: Language Engineering for Smart Contracts
- Tr8cy: Peer2Peer Trade Financing Platform

Ausbildung und Beratung

- Vorlesung Blockchain-based Systems Engineering (2V + 2Ü)
- GS1 Köln: Blockchain Governance (Tauschplattform für Paletten)
- Blockchain Hackathons (IBM, TU München, Ethereum, …)
- Bayerische Ministerien (Justiz, Finanzen, Soziales)
- IHK, Münchner Kreis
- Unternehmen (Siemens, Münchner Rückversicherung, goetzpartners, …)
- Öffentlichkeit (Konferenzen, Workshops, Deutsches Museum, …)
- VC Investoren
- Juristen

The interdisciplinary blockchain research cluster at TU Munich

blockchain.tum.de

Blockchain technology is …

...the new Internet and the foundation for a new economy.

It enables **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

Decentralized Autonomous Organizations (DAOs)

Idea

- Create a fully digital (virtual) organization.
- The organization exclusively uses Smart Contracts to interact with its shareholders, employees, customers, suppliers, partners and public authorities.
- These stakeholders can be humans or organizations in the "real world" or other DAOs.

IOTA and the Tangle
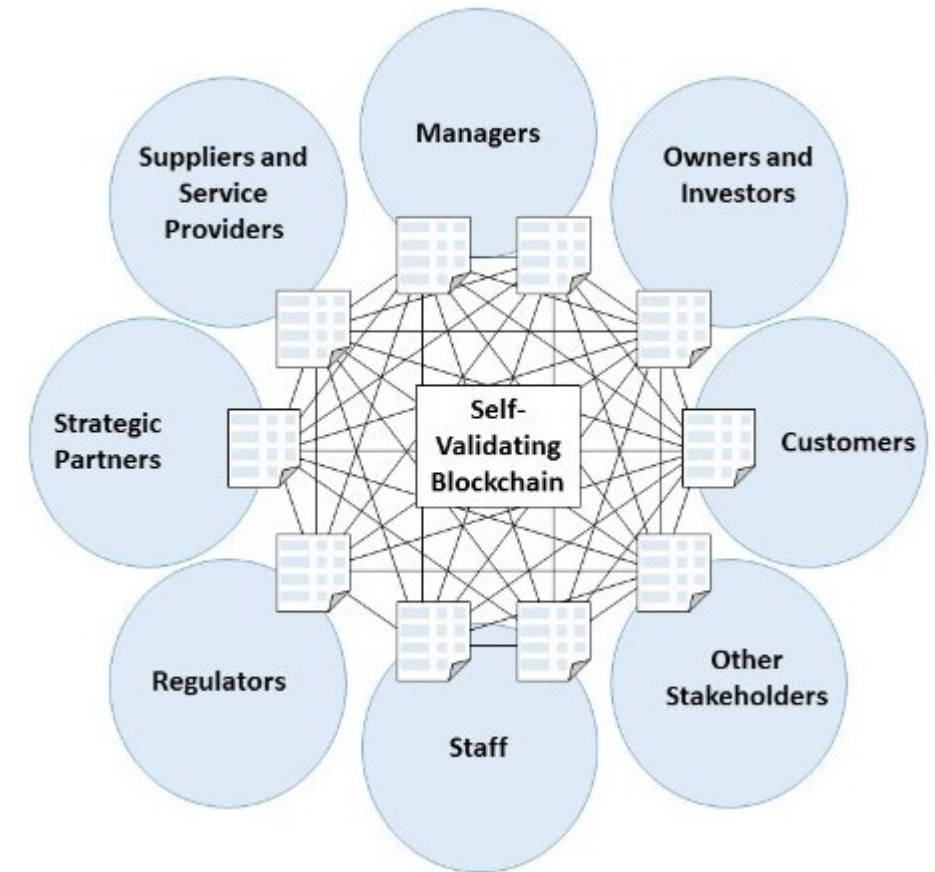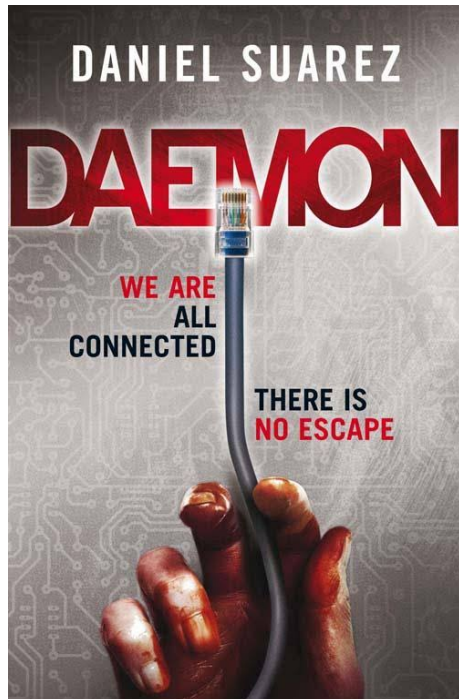
Idea

- Focus on cross-enterprise Internet of Things use cases that do not require strict transactional semantics.

Example: Inductive charging of e-car

- 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
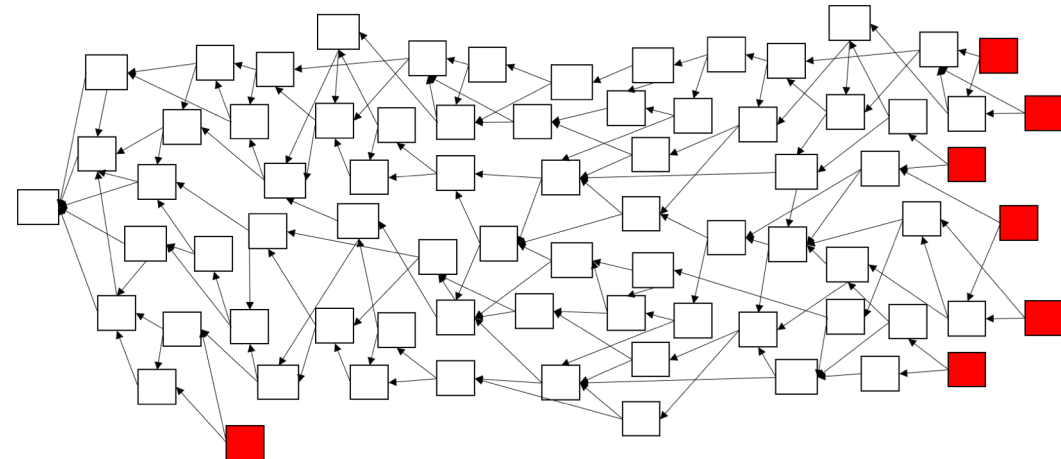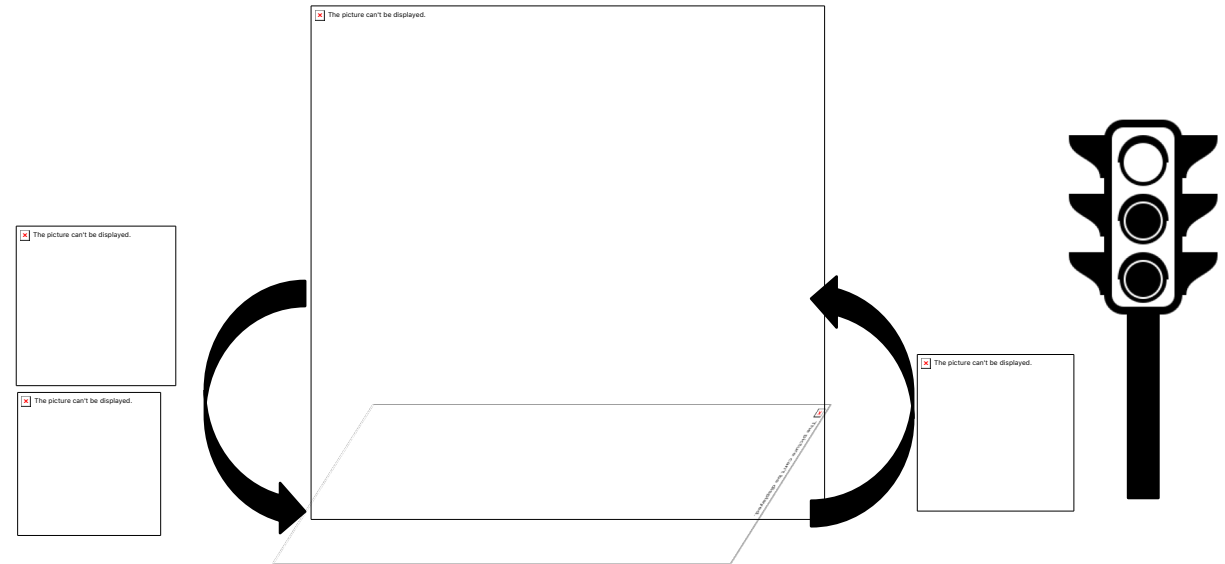
Self-owning technical systems

Mechanic   —pays—   Car   —owes—   Industry

Investor —invests—   User —uses—   User —uses—   → Car

Blockchains and Bitcoin have a reputation problem

- Incredible waste of energy and resources

- Use for shady business models
  - Speculative trading
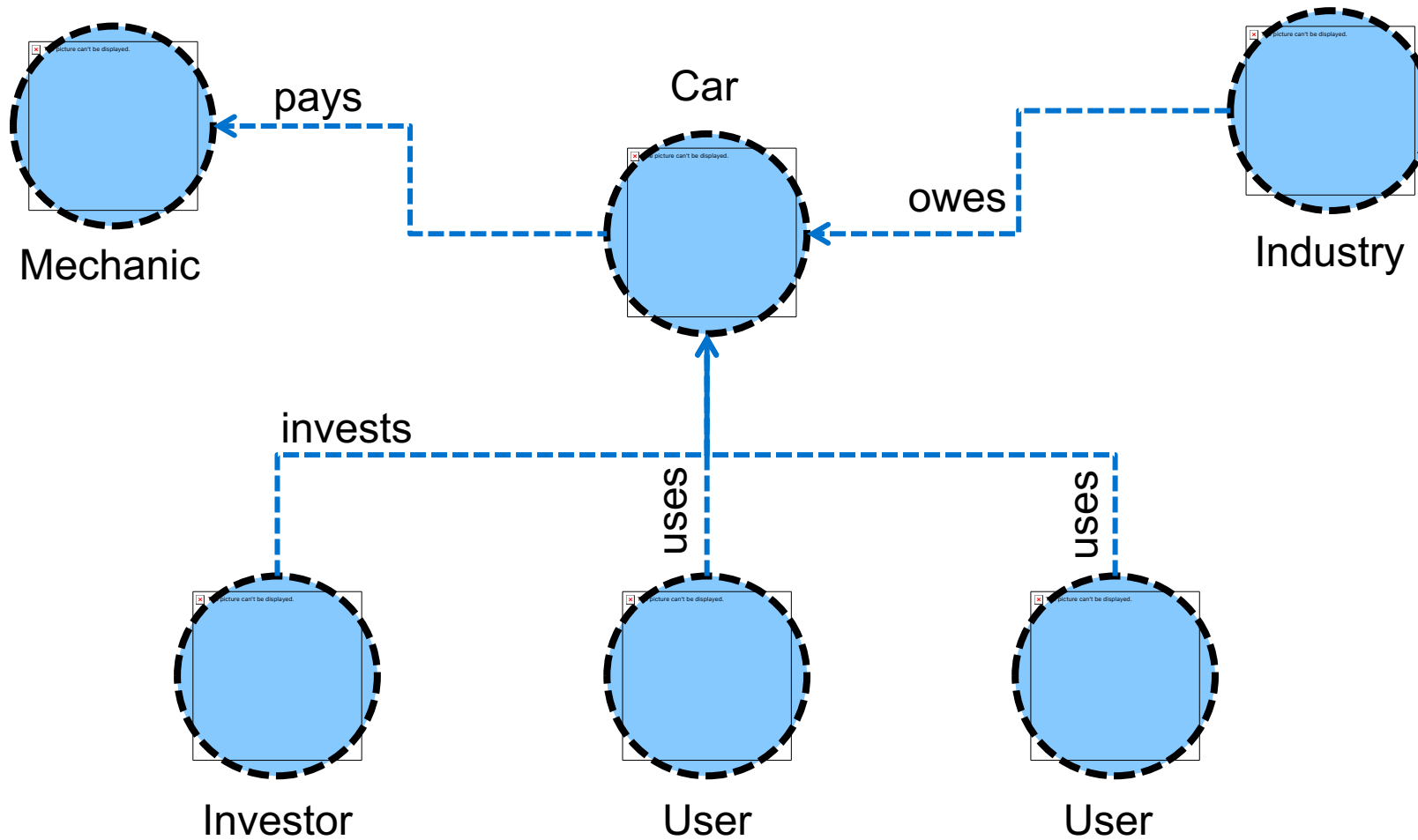 - Gambling
  - Trafficking (humans, drugs, …)
  - Cyber crime
  - Ransomware attacks
  - …

- Casino economy
  - ICO scams
  - Exchange frauds
  - "Lost" or "locked" crypto money
  - …

- Huge gap between expectations and maturity of the technology

Comparison of <u>current</u> Blockchain-based technologies with established centralized solutions

Advantages
- Decentralized management (trust in one party ➜ trust in a system of multiple parties)
- Transparency of all transactions
- Traceability of the complete transaction history
- Pseudonymity of the wallet owners
- *Built-in* financial incentives for early adopters and network growth (➜ business model)

Opportunities
- Innovation thrust for IT solutions in the global markets (finance, energy, mobility, heath-care, trade, …)
- Lowered entry barriers for IT-savvy players with limited financial resources
- Impetus to re-evaluate established business models and economic mechanisms (e.g. platform economy)

Disadvantages
- Technical complexity
- Efficiency & scalability (energy, space, time)
- Semantic complexity (game theory, probabilistic reasoning, concurrency, …)
- Difficult to understand and use (by end-users, developers)
- Challenging security requirements (public, transparent, high-stake, …)

Risks
- Regulatory (ethical, legal) risks
- Over-promising, inflated expectations