# THE ROLE OF SMART CONTRACTS IN SMART PRODUCTION

## U.S.-German Standards Panel

Volker Skwarek

Hamburg University of Applied Sciences

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**Industrie 4.0:** „[…] for **an equal cooperation** between I4.0 components with an **open arbitration**, a **protocol oriented interaction** is required […]
protocol oriented means: abstraction of the functionality by an automaton  […]:
- **asynchronous**
- **horizontal**
- **peer-to-peer**
- **loosely coupled**"

source: Bundesministerium für Wirtschaft und Energie ed: Weiterentwicklung des Interaktionsmodells für Industrie 4.0-Komponenten,

**blockchains and distributed ledger systems** represent a **protocol** leveraging the following **properties:**
- **trust**
- **distribution – temporally or spatially**
- **communication**
- **(need for reduction of) interfaces**
- **asynchrony**

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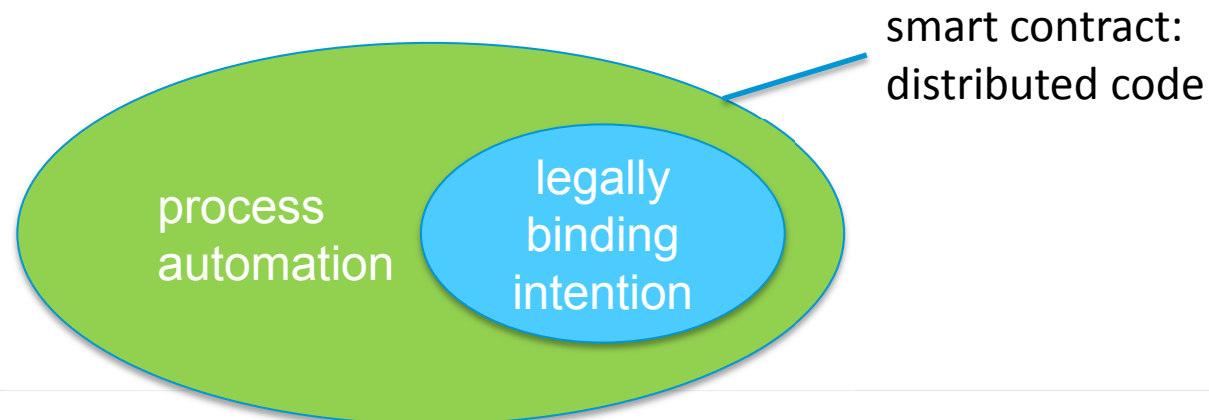**smart contract**:

- **distributed code**
- representing a **process automation**
- executed on a blockchain or distributed ledger which,
- once validated and confirmed, **results in an outcome**
- **that is agreed upon by participants in a transaction**.

Note 1 to entry: The outcome of a smart **contract may or may not primariliy intended to be legally binding**.

source: working draft definition from TC 307 „Blockchain and Distributed Ledger Systems" WG1 - Terminology



smart contract:
distributed code

process automation

legally binding intention

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# BC/DLT AS A GENERAL SOLUTION?

- ☑ BC/DLT are able to secure transactions without a trusted central instance
- ☒ BC/DLT require a lot of memory capacity as the do not forget (in their pure sense)
- ☒ BC/DLT consume a lot of bandwidth for communication
- ☒ BC/DLT (may) consume a lot of energy depending on their mining and consensus process

**Let's use BC/DLT – applications where we don't have better solutions without them**

➔ It's crucial for the success and acceptance of BC/DLT to find a good use case

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# WHAT MAKES A USE CASE A GOOD USE CASE?

Use Cases should leverage at least one or more of the basic propertiers of BC/DLT

- trust
- distribution – temporally or spatially
- communication
- (reduction of) interfaces
- asynchronity

classification of use cases for smart contracts (45 evaluated)
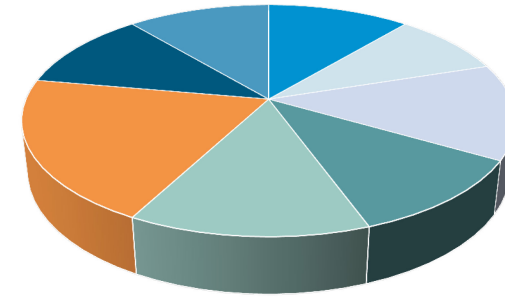


- ■ supply chain management
- ■ license management
- ■ machine-machine-automation
- ■ energy trading/management
- ■ automated regular contractual transactions
- ■ registry services
- ■ tracking and quality control

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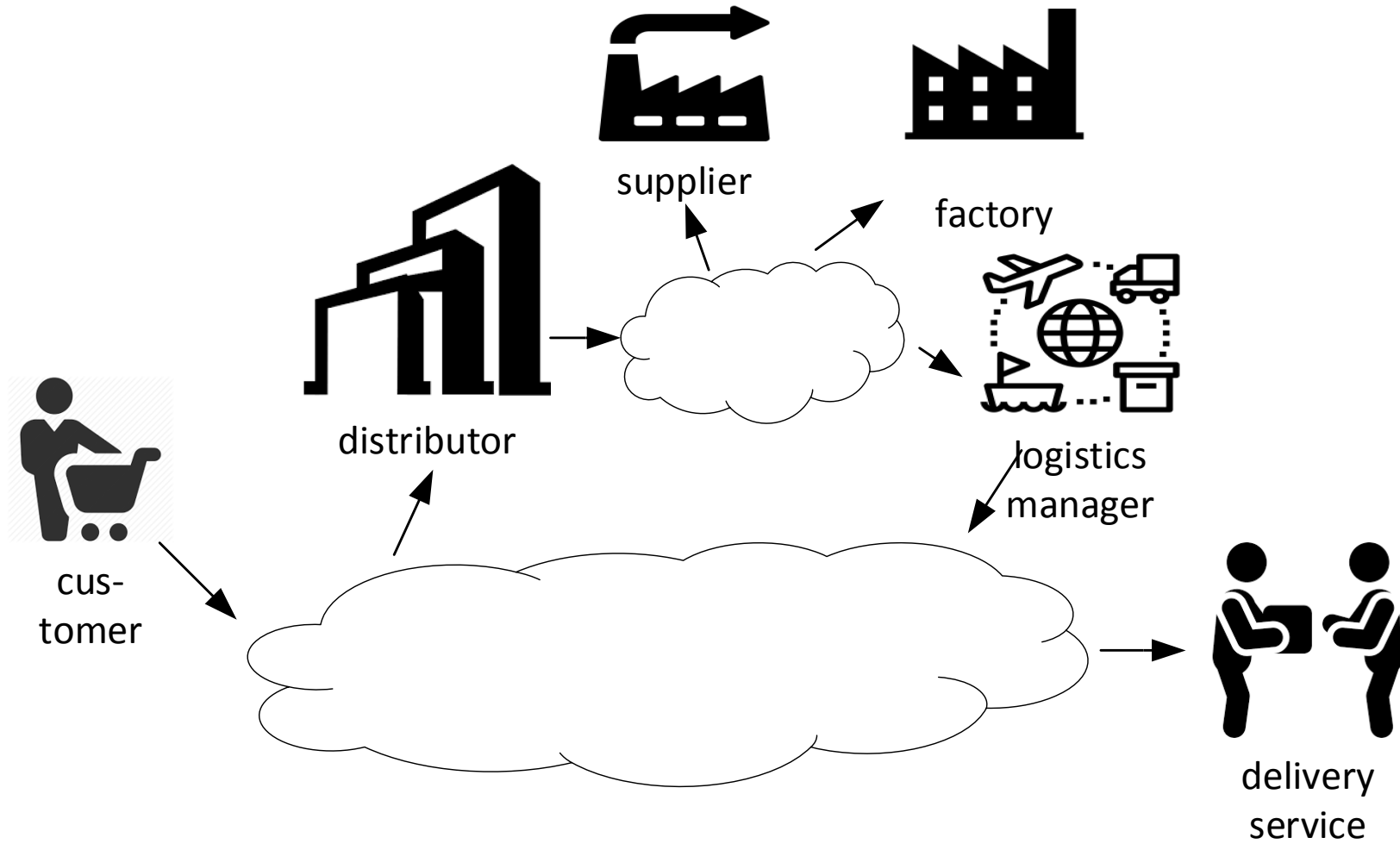The Role of Smart Contracts in Smart Production

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# POTENTIAL USE CASES FOR INDUSTRIE 4.0
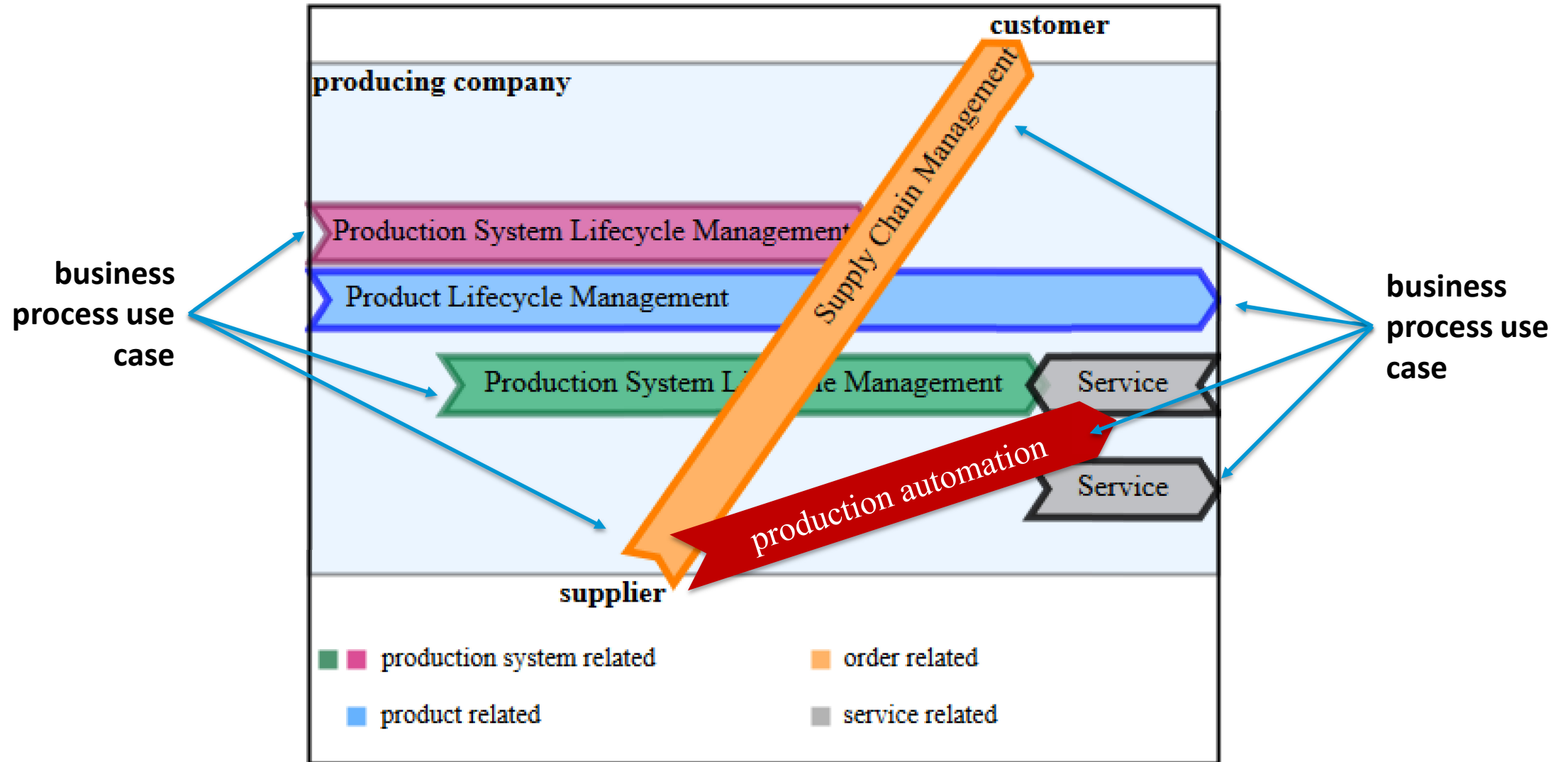
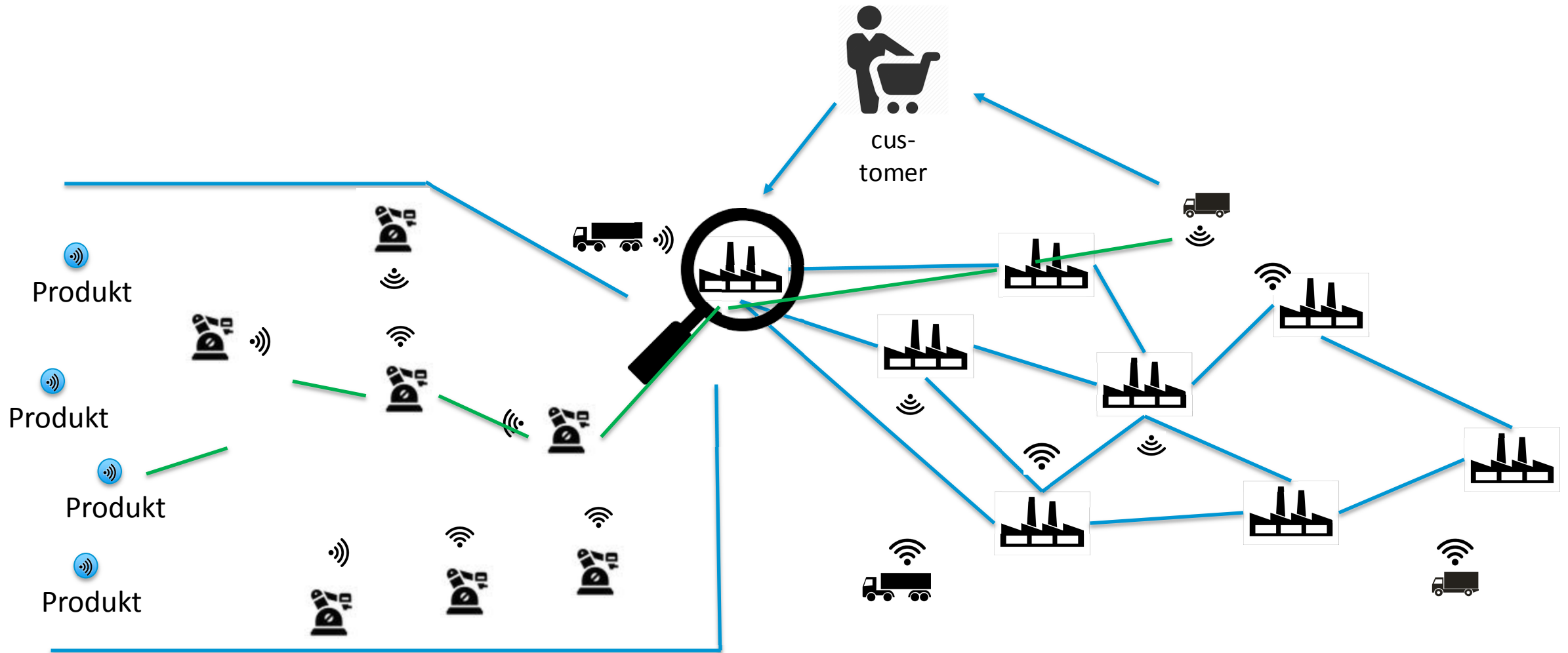# KNOWN ONGOING PROJECTS FOR I4.0 APPLICATIONS ON BLOCKCHAINS

- **license management**
    - authorization to produce goods
    - identity transfer between spare parts
- **supply chain management**
    - product security
    - product delivery and storage
    - extralogistics
        - product tracking
        - counterfeit protection
- **life-cycle-management**
    - production
    - operation

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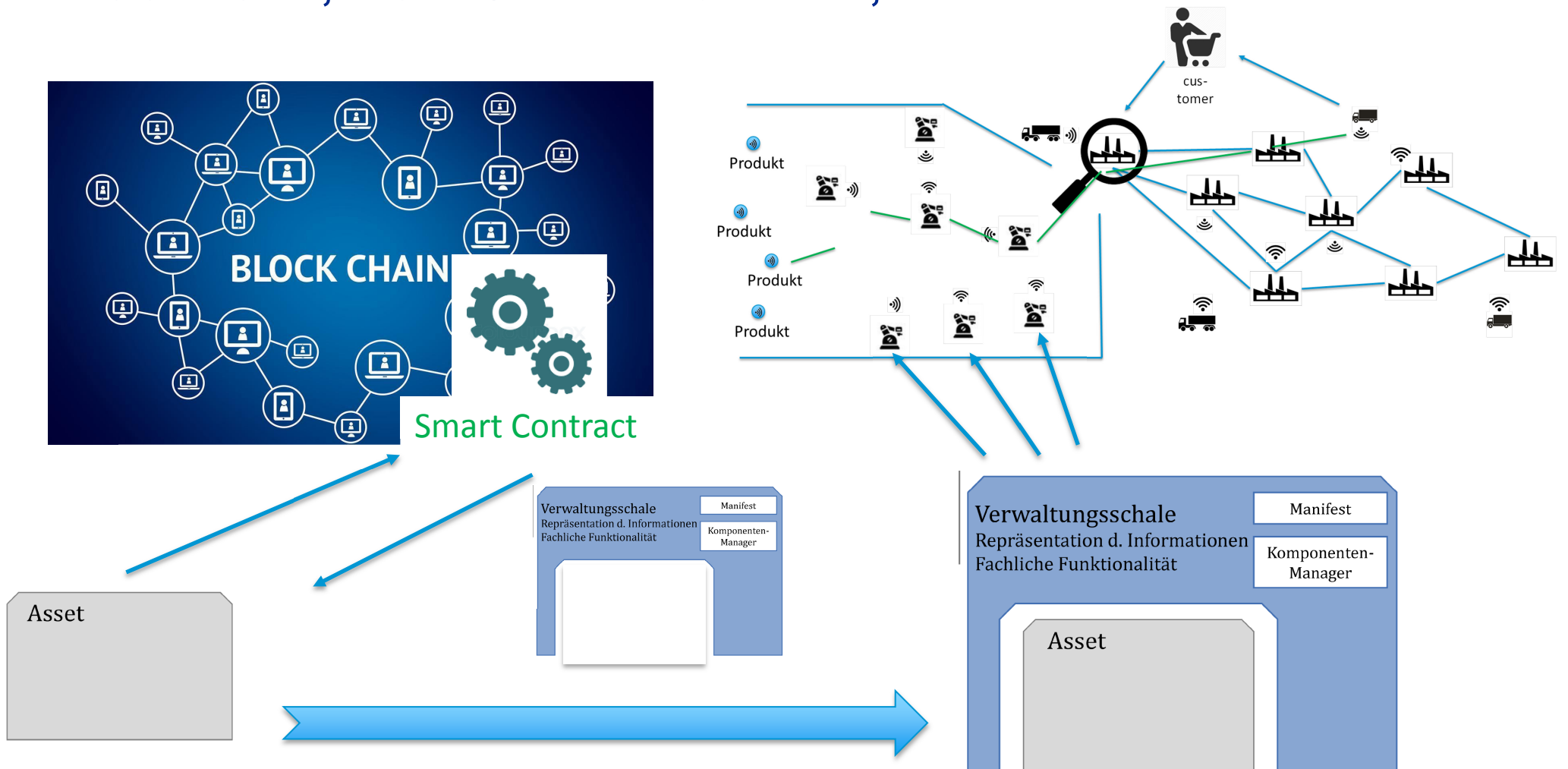
# USE CASE 1: SELF-ORGANIZED ADAPTIVE LOGISTICS

# USE CASE 2: ORDER-ENTRY-MANAGED PRODUCTION

customer

Produkt

Produkt

Produkt

Produkt

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# CURRENT ACTIVITIES IN STANDARDIZATION …

- **ISO TC 307 „Blockchain and distributed ledger systems" – WG 3 „Smart contracts"**
- **ITU-T – FG Distributed Ledger Technologies**
- **Platform Industrie 4.0 – Reference Architecture Model Industrie 4.0 (RAMI)**
- **OPC-UA – Industrie 4.0 Interface Architecture**
- **JTC 1/SC 41 – AHG 11 „Industrial Internet of Things"**

- **not yet consistently covered**
  - smart contracts for process automation at all – DIN Spec project only
  - overarching identity mechanisms for distributed identities as required in distributed processes
  - data protection, hiding- and roll-back mechanisms
  - …

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# … AND THE LITTLE BIT MORE

- **if BC/DLT are a communication protocol –
  why not designing them as an „Internet of the future", a**
  - optional,
  - configurable protocol stack
  - on top of TCP/IP
  - such as SMTP or HTTPS
  - for securing distributed peer-to-peer communication
- **smart contracts can be handled such as an application layer on top of it**
- **„legal smart contracts" may be a standardized sub-layer to implement a „legal constitution" with mandatory legal aspects to be fulfilled to be compliant with law**

- **but this requires a lot of standardization – similar to TCP/IP**

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# THANK YOU FOR YOUR ATTENTION.

## QUESTIONS???

Contact:

Prof. Dr.-Ing. Volker Skwarek

volker.skwarek@haw-hamburg.de

http://www.ls.haw-hamburg.de/~blockchain/



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