

THE ROLE OF SMART CONTRACTS IN SMART PRODUCTION

U.S.-German Standards Panel

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SMART PRODUCTION, BLOCKCHAINS AND SMART CONTRACTS

DEFINITIONS (1/2)

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**
- **asynchronicity**

SMART PRODUCTION, BLOCKCHAINS AND SMART CONTRACTS

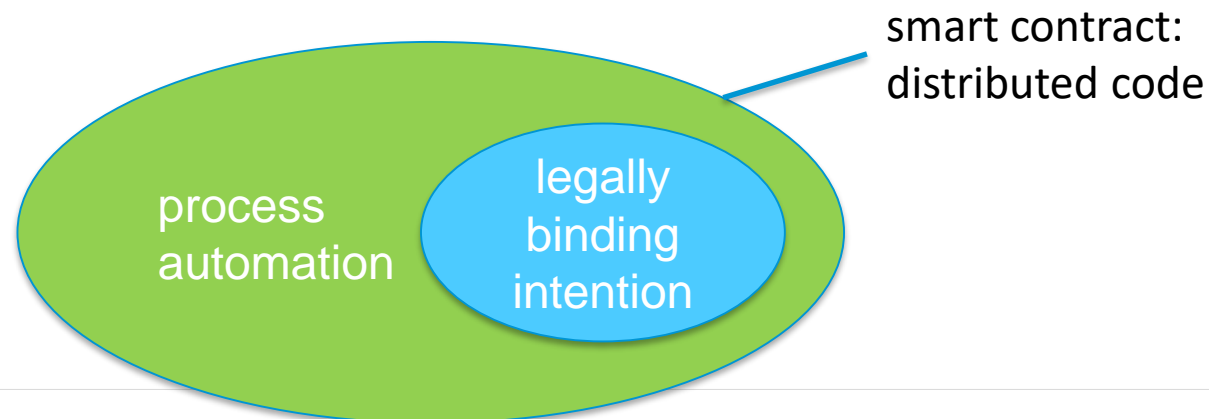
DEFINITIONS (2/2)

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 primarily intended to be legally binding.**

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



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 they 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

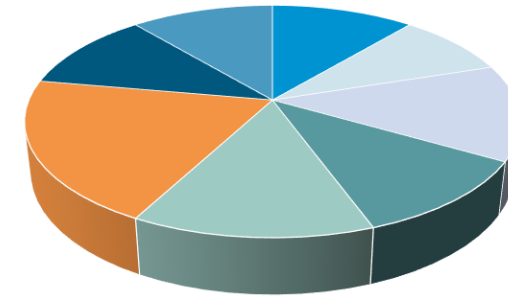
➔ It's crucial for the success and acceptance of BC/DLT to find a good use case

WHAT MAKES A USE CASE A GOOD USE CASE?

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

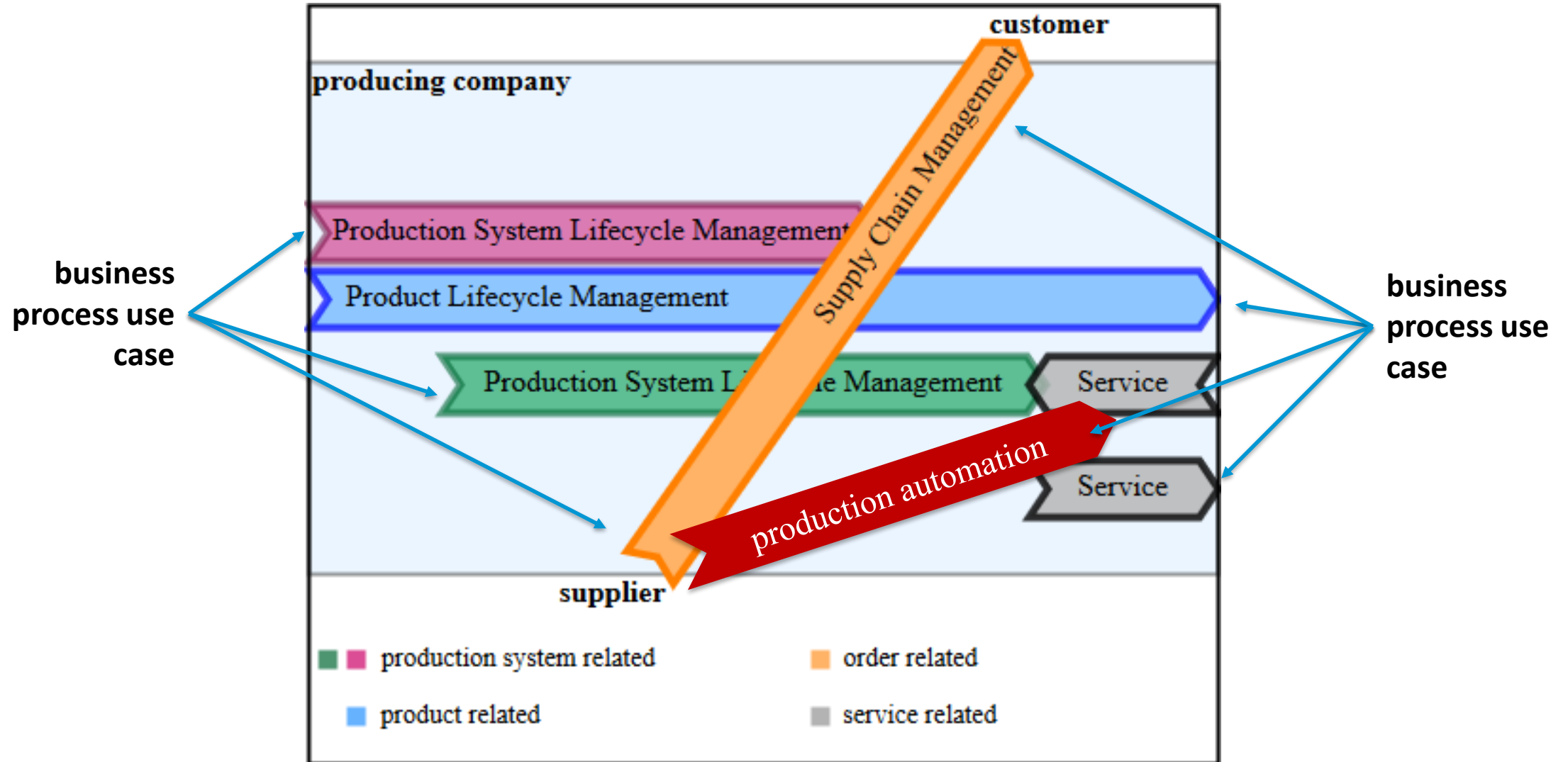
- trust
- distribution – temporally or spatially
- communication
- (reduction of) interfaces
- asynchronicity

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

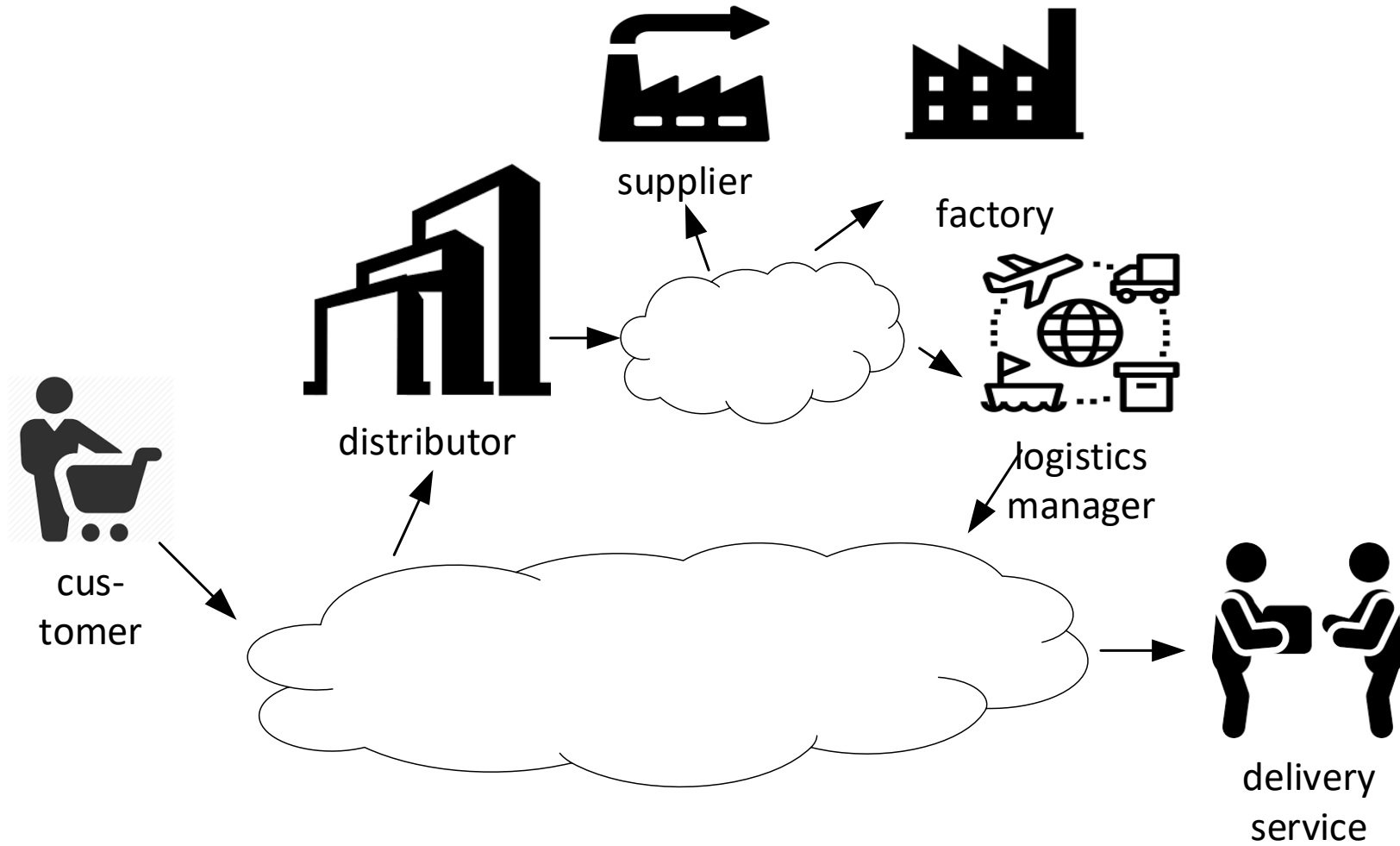
POTENTIAL USE CASES FOR INDUSTRIE 4.0



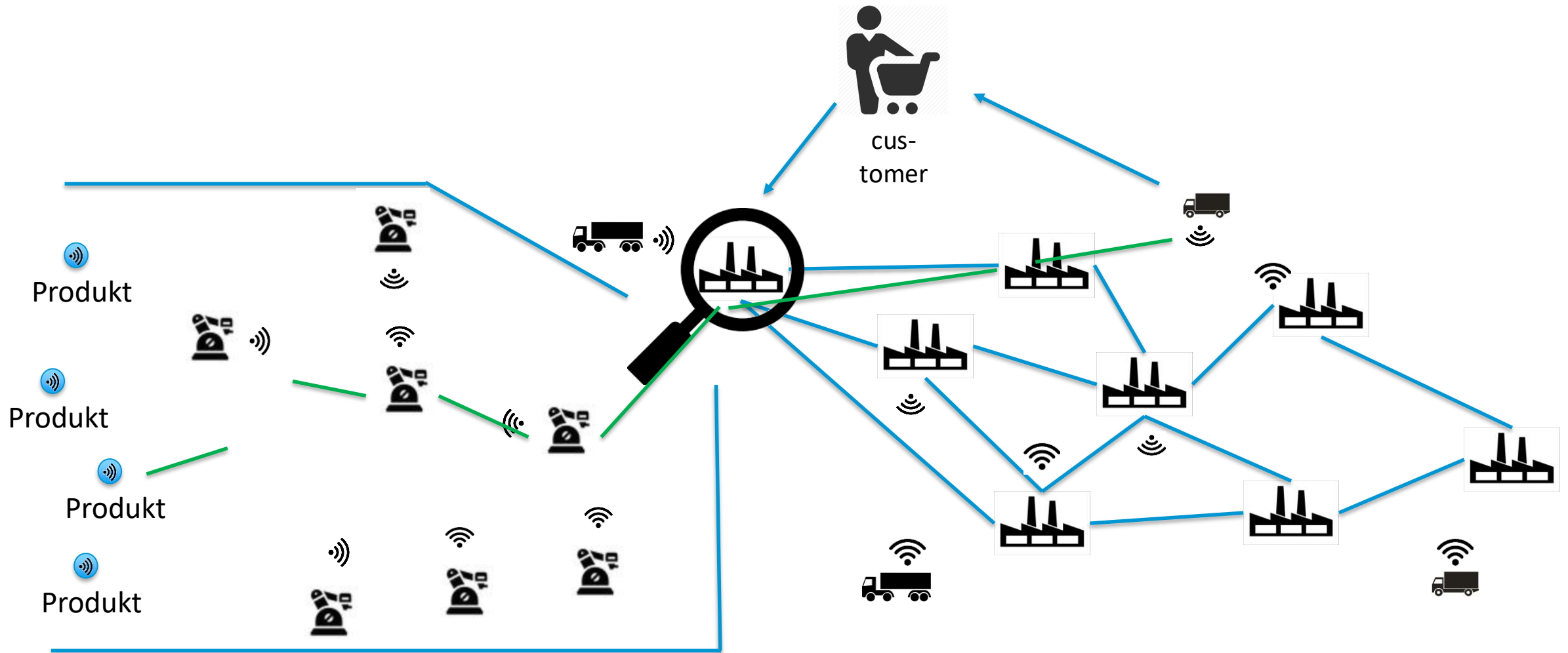
KNOWN ONGOING PROJECTS FOR I4.0 APPLICATIONS ON BLOCKCHAINS

- **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

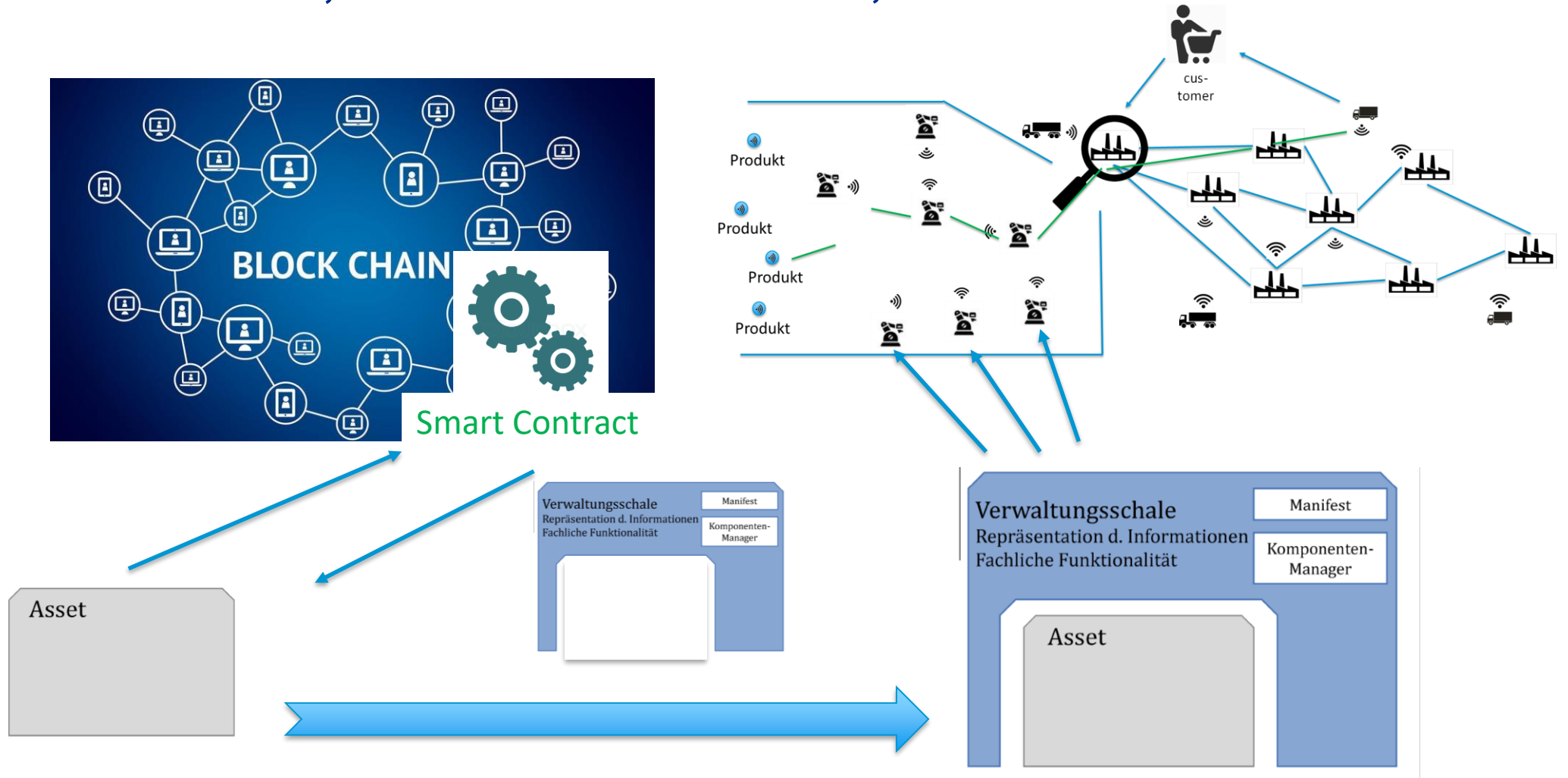
USE CASE 1: SELF-ORGANIZED ADAPTIVE LOGISTICS



USE CASE 2: ORDER-ENTRY-MANAGED PRODUCTION



USE-CASE 3: INTEGRATION OF NODE DATA INTO THE BLOCKCHAIN ADMISSION PROCEDURE, LICENSE MANAGEMENT, ...



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
 - ...

... 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**

THANK YOU FOR YOUR ATTENTION.

QUESTIONS???

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