CERIAS

The Center for Education and Research in Information Assurance and Security

DUST-BT: Preventing Supply Chain Tampering using Blockchain Technology

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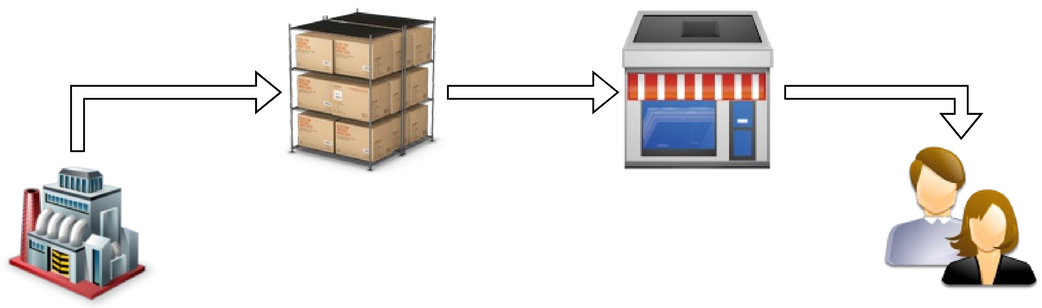
(1) Supply Chain

Purpose: Supervised transfer of products from suppliers to consumers

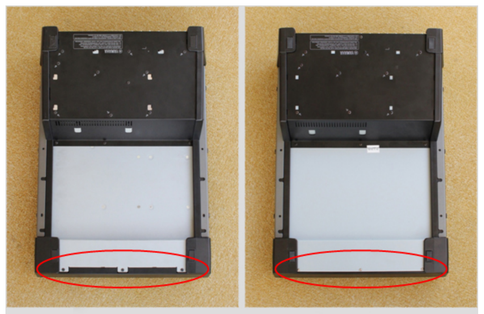


Traditional Supply Chains:

- Track product components using RFID
- Local logs maintained at each supplier

(2) What is the Problem?

Counterfeiting. How to distinguish between products with genuine components and counterfeit ones?



Global trade in fake goods worth nearly half a trillion dollars a year!

(3) Building Block: Blokchain

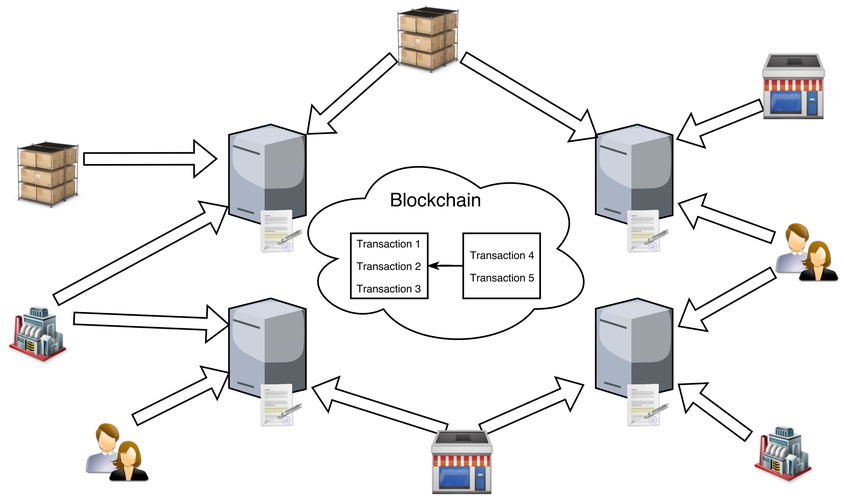
- Interesting **properties**:
  - → Conflicting transactions can be easily detectable checking the blockchain
  - → Transactions added to the blockchain cannot be removed
- **Successfully deployed** in several applications today:
  - → Cryptocurrencies (Bitcoin, Ethereum)
  - → Credit networks (Ripple, Stellar)

Question: Can we leverage blockchain to avoid counterfeit in supply chain?
Challenges:

1. Blockchain must maintain transactions tailored to supply chain
2. Complex logic for product management

(4) Our Solution: DUST-BT

1. **Create smart contract:** All supply chain participants agree on a set of rules and logic
2. **Deploy smart contract:** Rules and logic are installed in a set of validators. Validators initialize the blockchain
3. **Append transactions to blockchain:** Transactions (e.g., create or transfer product) are added to the blockchain according to the smart contract



(5) DUST-BT: Smart Contracts

Main ideas:

- Convert agreed logic and rules into functions
- Automatic verification of supply chain correctness

NewProduct(Product p)

if $p \notin blockchain$ then
  $blockchain.insert(p)$
  return OK
else
  return $ERROR$

TransferProduct(Product p, CurrentEntity ce, NewEntity ne)

if $p \in blockchain$ then
  if $p.currentEntity = ce$ then
    $p.currentEntity = ne$
    $blockchain.update(p)$
    return OK
return $ERROR$

TransferProductSignal(Product p, CurrentEntity ce, NewEntity ne)

if $p \in blockchain$ then
  if $p.currentEntity = ce \wedge externalSignal() = True$ then
    $p.currentEntity = ne$
    $blockchain.update(p)$
    return OK
return $ERROR$

(6) DUST-BT: Implementation

Our implementation is composed of:

- **Hyperledger architecture:** Hyperledger software
- **Smart Contracts:** Our own implementation in Golang
- **Graphical Interface:** Our own implementation in Flask and Javascript

(7) Conclusions

- Counterfeiting can be prevented leveraging blockchain technology
- DUST-BT offers a flexible yet effective supply chain management

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