The Problem that the Blockchain Solves

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Bitcoin

What is Bitcoin?

- An open-source software
- A peer-to-peer network
- A payment network
- A currency

Bitcoin

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- An open-source software
- A peer-to-peer network
- A *decentralized* payment network
  Like cash, unlike Paypal
- A *decentralized* currency
  Like gold, unlike the US Dollar

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  Like cash, unlike Paypal
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BankCoin

Alice

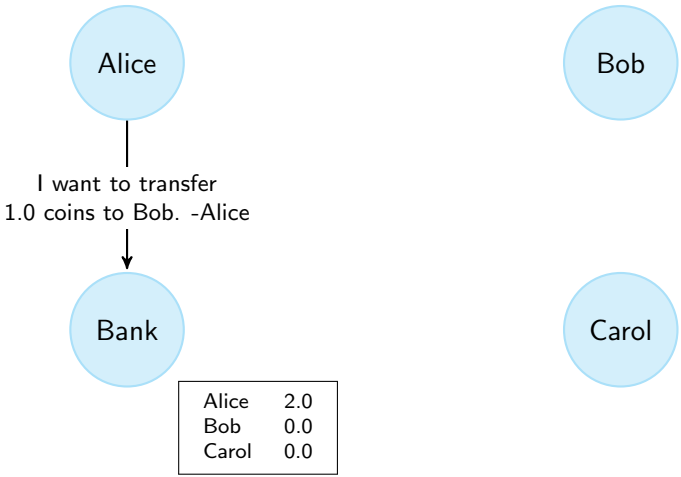
Bob

Bank

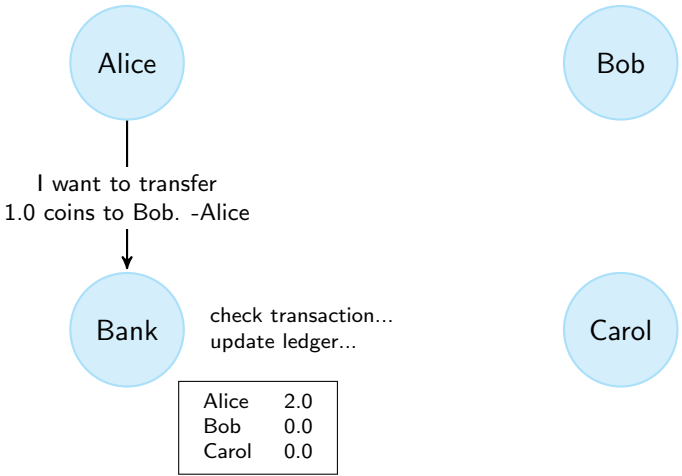
Carol

Alice	2.0
Bob	0.0
Carol	0.0

BankCoin


Alice
Bob
I want to transfer
1.0 coins to Bob. -Alice
Bank
Carol
Alice 2.0
Bob 0.0
Carol 0.0

BankCoin


Alice
Bob
I want to transfer
1.0 coins to Bob. -Alice
Bank
check transaction...
update ledger...
Carol
Alice 2.0
Bob 0.0
Carol 0.0

BankCoin

Alice

Bob

Bank

Carol

Alice	1.0
Bob	1.0
Carol	0.0

BankCoin

BankCoin Rules

- The bank has the ledger
- The bank accepts all valid transactions it receives and updates its ledger
- Everybody sends transactions to the bank

Problem

- The bank can censor transactions, create money, etc.
- Can we design a protocol without a central intermediary?
- In such a protocol, who would maintain the ledger?

NaiveCoin

Alice

Alice	2.0
Bob	0.0
Carol	0.0

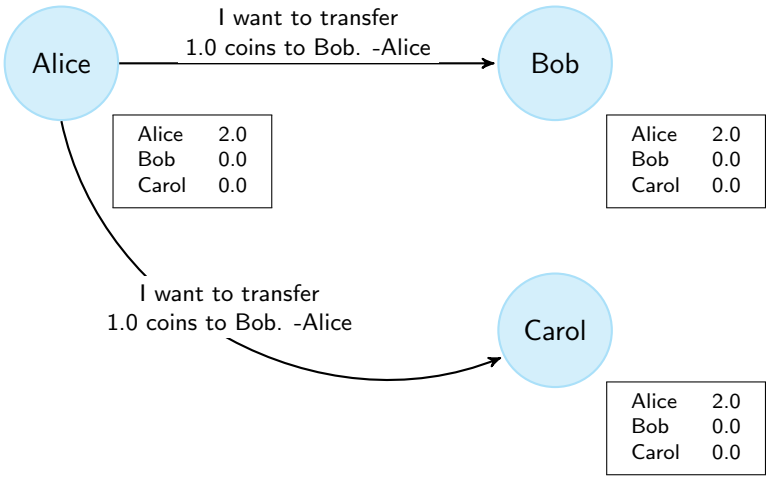
Bob

Alice	2.0
Bob	0.0
Carol	0.0

Carol

Alice	2.0
Bob	0.0
Carol	0.0

NaiveCoin


Alice
I want to transfer
1.0 coins to Bob. -Alice
Bob
Alice 2.0
Bob 0.0
Carol 0.0
Alice 2.0
Bob 0.0
Carol 0.0
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Alice 2.0
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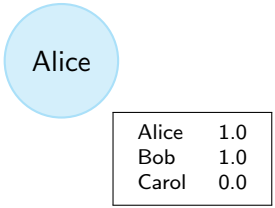
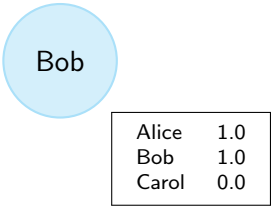
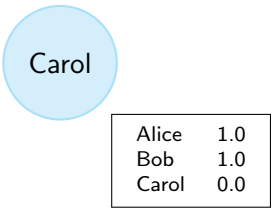
NaiveCoin


Alice
Alice 1.0
Bob 1.0
Carol 0.0


Bob
Alice 1.0
Bob 1.0
Carol 0.0


Carol
Alice 1.0
Bob 1.0
Carol 0.0

NaiveCoin

NaiveCoin Rules

- Each node has a copy of the ledger
- Each node accepts all valid transactions it receives and updates its ledger
- Each node broadcasts its transactions to all nodes

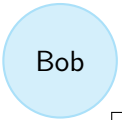
Problem solved

- No more bank!

New Problem

- The Double Spending Problem

The Double Spending Attack



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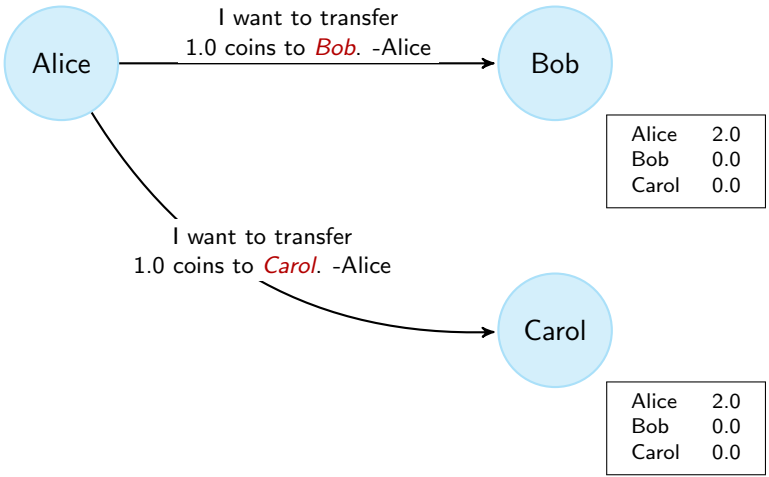
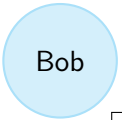
The Double Spending Attack



The Double Spending Attack



Alice	1.0
Bob	1.0
Carol	0.0

Alice	1.0
Bob	0.0
Carol	1.0

The Double Spending Attack

- Both Bob and Carol think they have been payed
- Bob will have trouble when he later tries to pay Carol
- The network is not in *consensus* anymore

- The problem of how to avoid this attack is the famous *double spending problem*
- This problem has only recently been solved by Satoshi Nakamoto in the Bitcoin whitepaper

Book

Kai Brünnler. Blockchain kurz & gut.
O'Reilly, 2018.

You can download a draft here.