universität innsbruck

Tracking Payment Flows in Ethereum

Michael Fröwis

Overview

Content:
This talk explains the differences of money-flow tracking between Bitcoin and Ethereum.

We outline challenges for forensic investigations in Ethereum.

What is Ethereum ?

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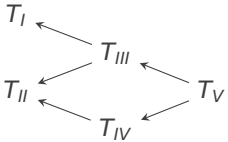
- $\approx$ 14 second block time

Tracking Payment Flows: From Bitcoin to Ethereum

Transaction graph



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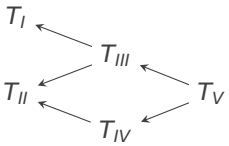

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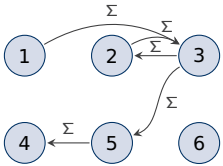

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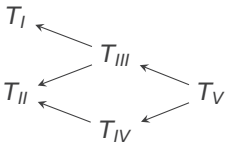

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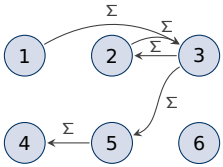

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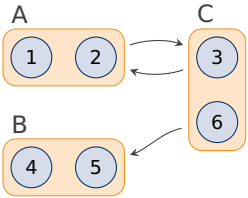

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usefulness

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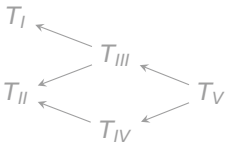

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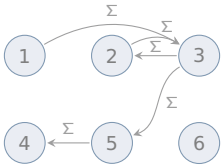

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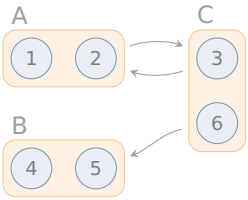

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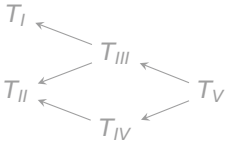

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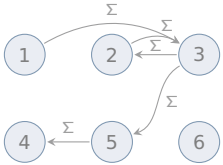

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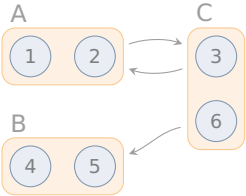

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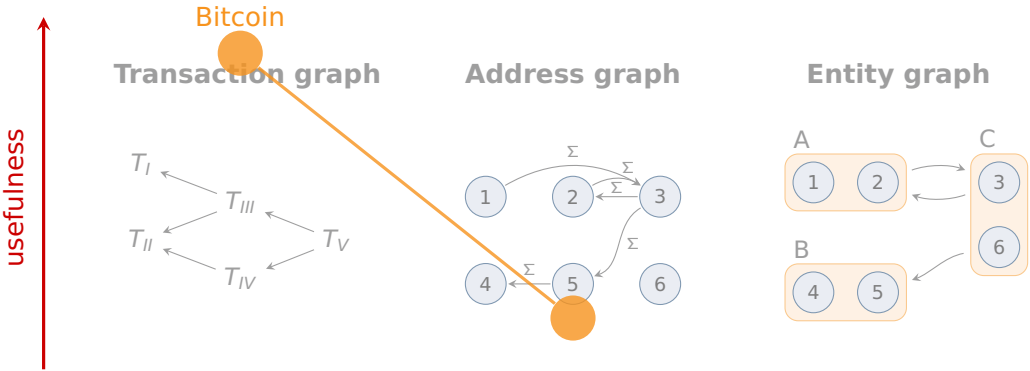

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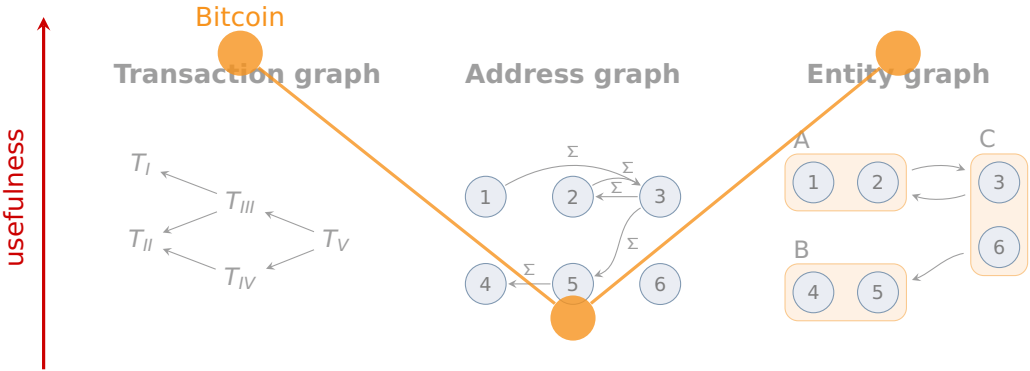

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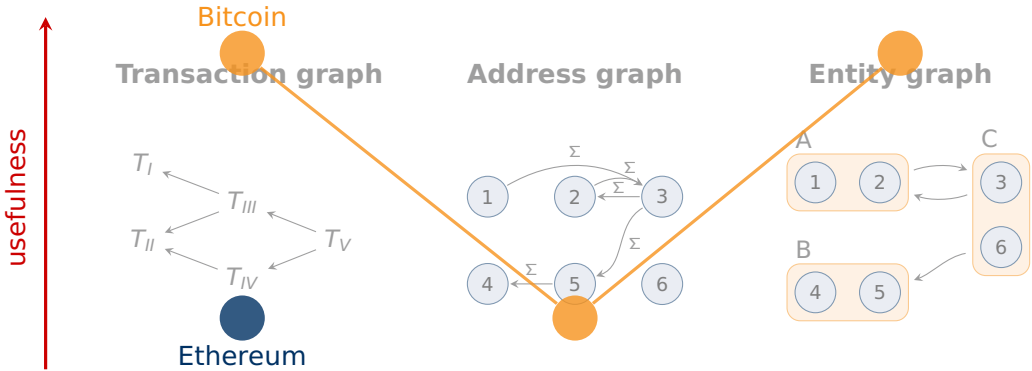

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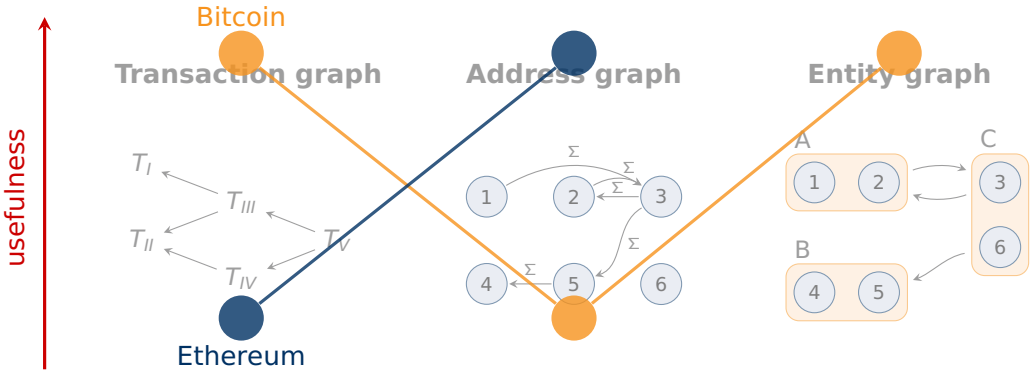

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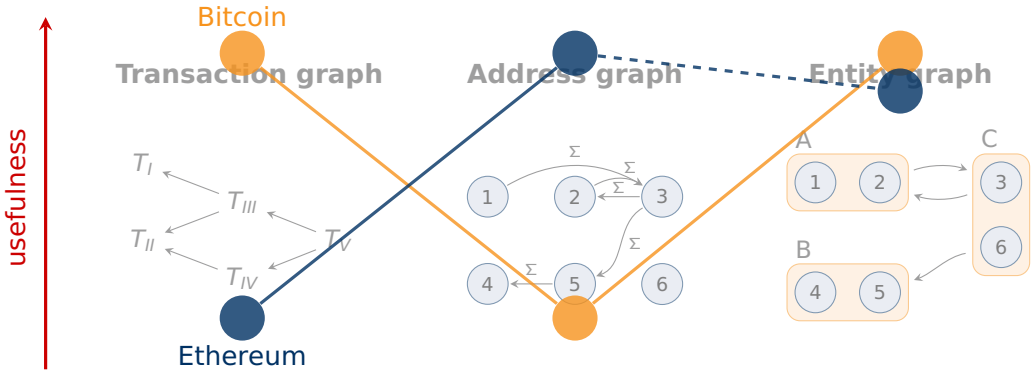

Ethereum

Account model: Analogy std. bank transfer, accounts have balances

Externally Owned Account (EOA):

Alice (EOA)
Balance: 3 ETH

Bob (EOA)
Balance: 6 ETH

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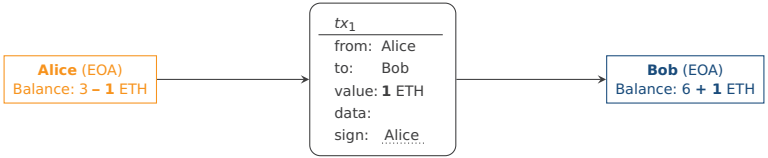

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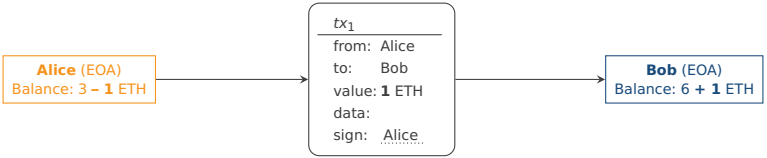

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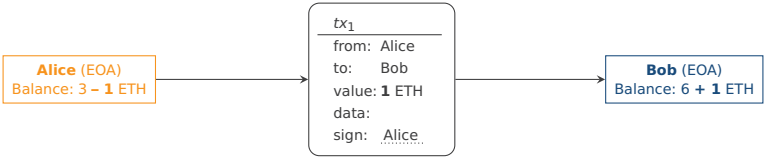

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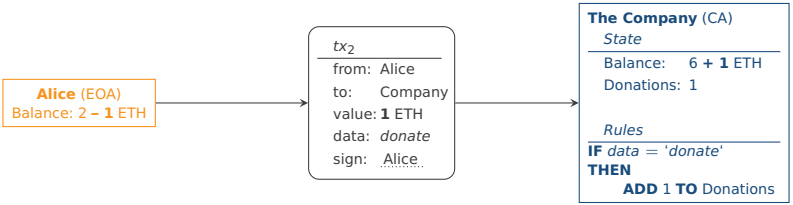

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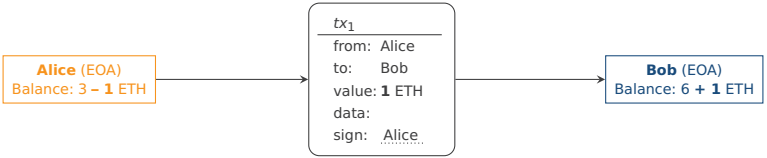

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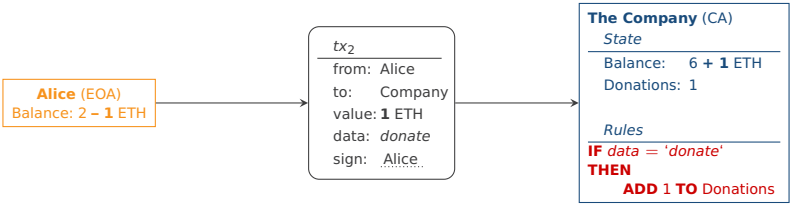

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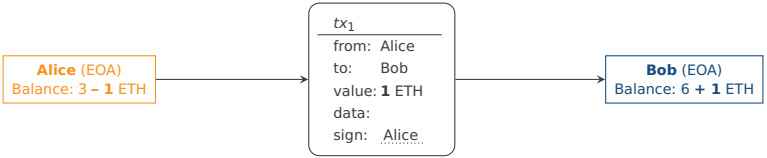

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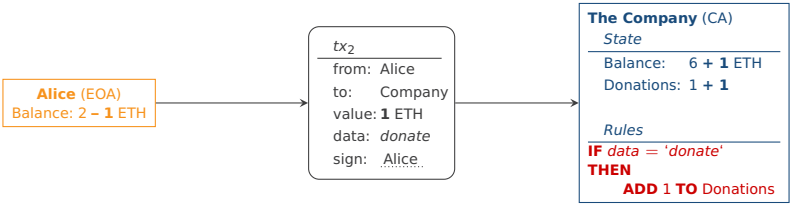

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Why is this useful ?

Gambling services, decentralized exchanges, prediction markets, wallets, state channels and payment channels, . . .

But most prominently token systems.

What Is a Token System?

Token: Jargon for exchangeable virtual asset, fungible or non-fungible.

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Use-cases: Sub-VCs, crowdfunding, shares, votes, reward systems, . . .

How Does a Token System Work ?

Alice (EOA)
Balance: 3 ETH

My Token (CA)

State

Balance:	0 ETH
Alice:	2
Bob:	0

Rules

IF *data* = '*send*';*to*;*val*
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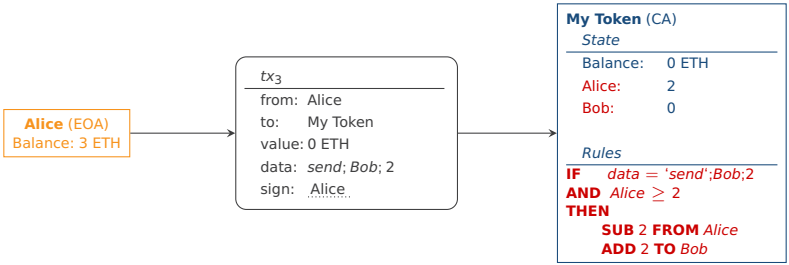

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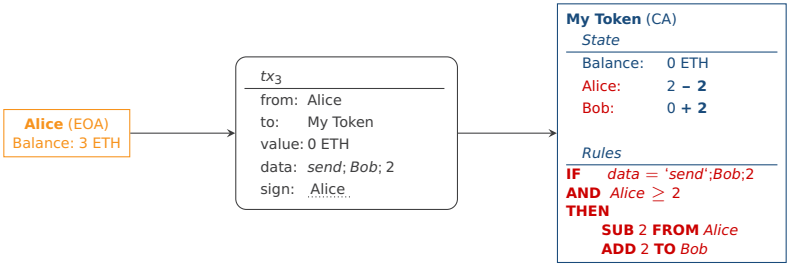

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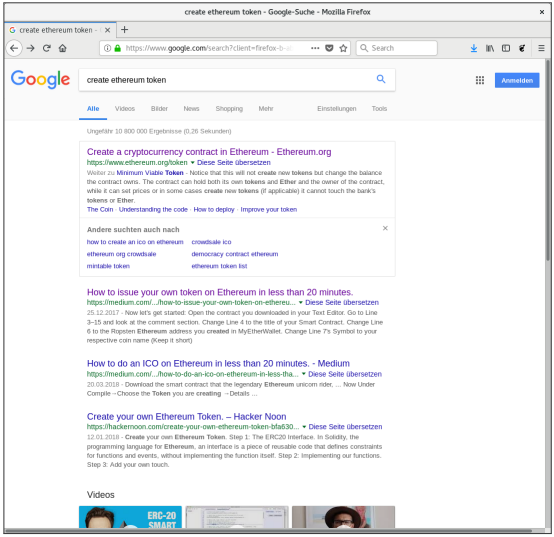

What Does It Take to Create a Token System ?

Create a cryptocurrency contract in Ethereum - Mozilla Firefox

Create a cryptocurrency

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ETHEREUM » Create your own crypto-currency

NEXT

The Coin

We are going to create a digital token. Tokens in the Ethereum ecosystem can represent any fungible tradable good: coins, loyalty points, gold certificates, IOUs, in-game items, etc. Since all tokens implement some basic features in a standard way, this also means that your token will be instantly compatible with the Ethereum wallet and any other client or contract that uses the same standards.

MINIMUM VIABLE TOKEN

The standard token contract can be quite complex. But in essence a very basic token boils down to this:

```
pragma solidity ^0.4.20;

contract MyToken {
    /* This creates an array with all balances */
    mapping (address => uint256) public balanceOf;

    /* Initializes contract with initial supply tokens to the creator of the contract */
    function MyToken(
        uint256 initialSupply
        ) public {
        balanceOf[msg.sender] = initialSupply;              // Give the creator all initial tokens
    }

    /* Send coins */
    function transfer(address _to, uint256 _value) public returns (bool success) {
        require(balanceOf[msg.sender] >= _value);           // Check if the sender has enough
        require(balanceOf[_to] + _value >= balanceOf[_to]); // Check for overflows
        balanceOf[msg.sender] -= _value;                    // Subtract from the sender
        balanceOf[_to] += _value;                           // Add the same to the recipient
        return true;
    }
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THE CODE

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OPEN CHAT

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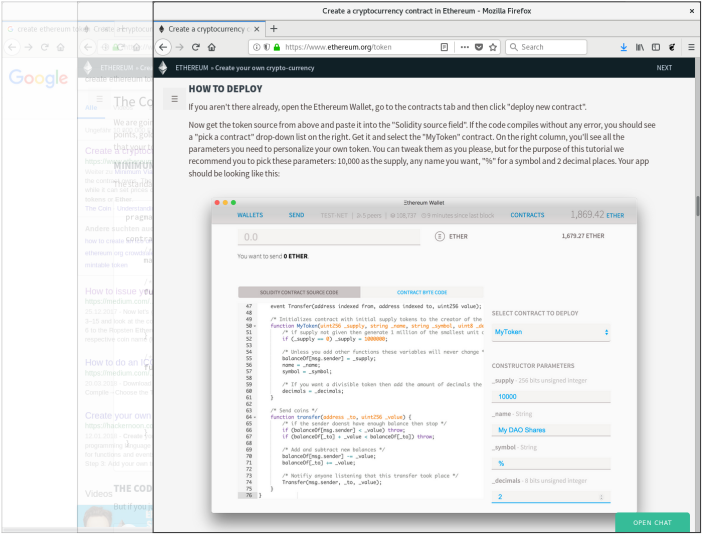

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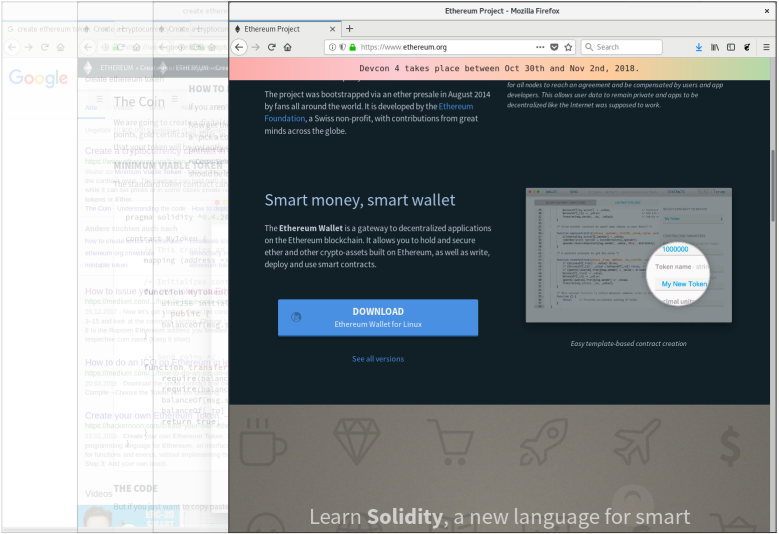

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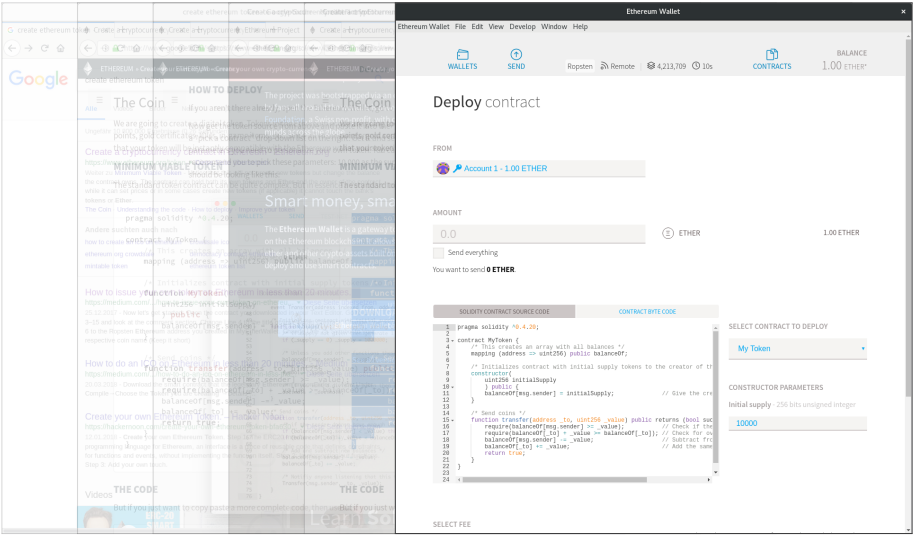

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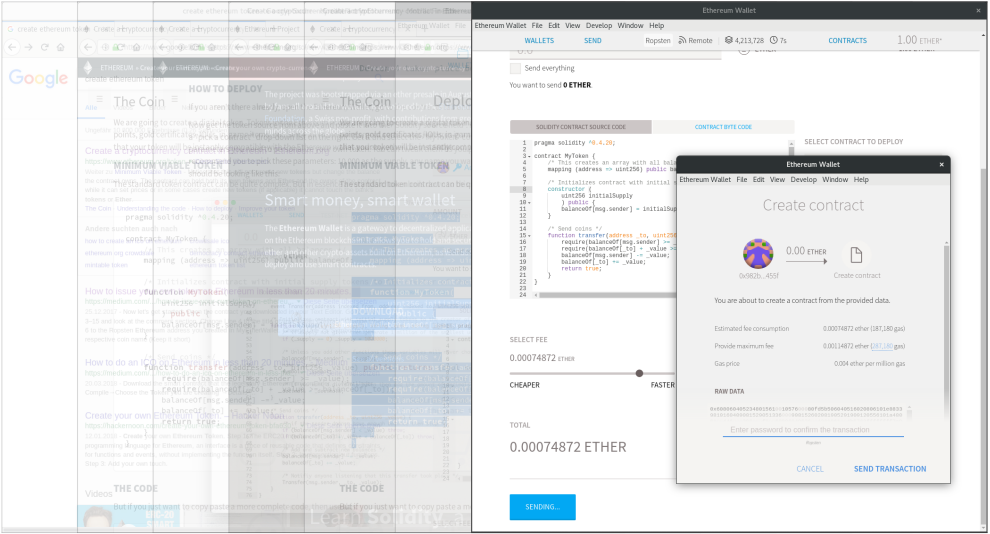

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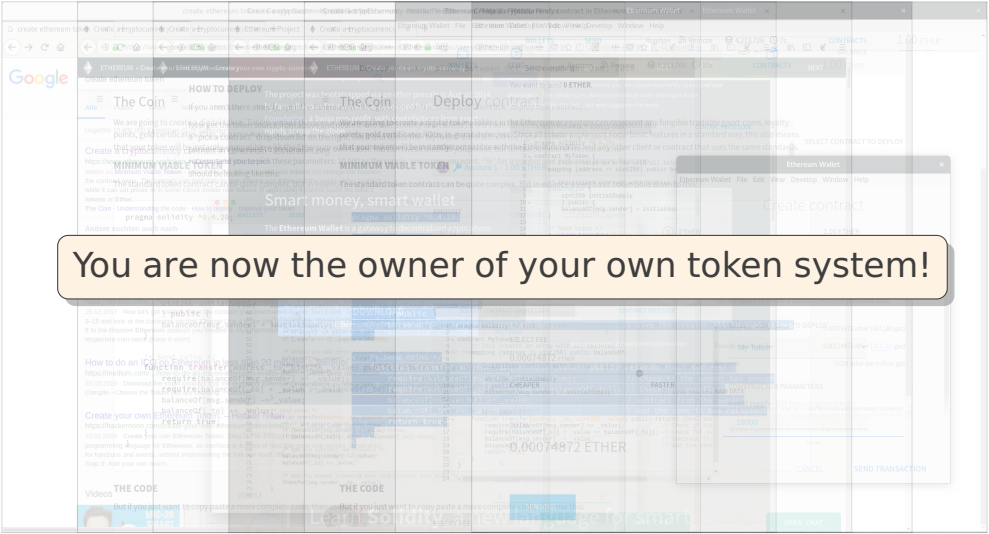
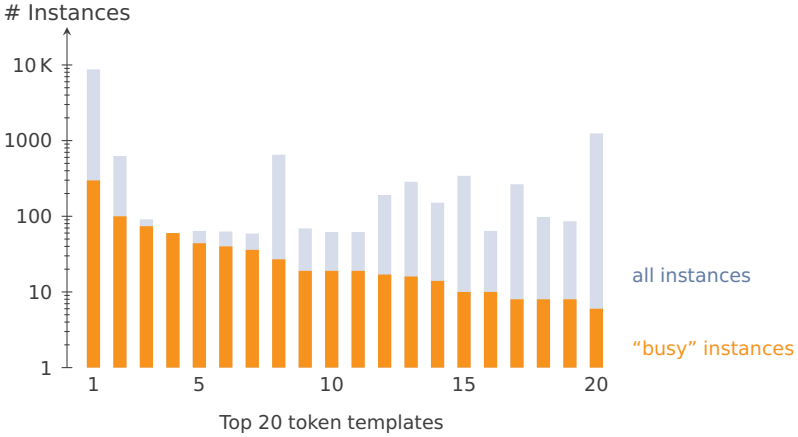


You are now the owner of your own token system!

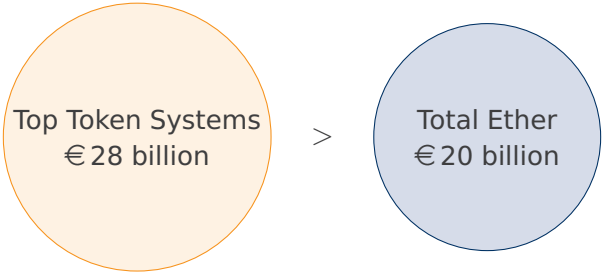
Code Reuse in Ethereum



Source: own research, data until May 30th, 2018

Why Are Token Systems Interesting ?

Market valuation:



Sources: Etherscan, coinmarketcap.com, October 9th, 2018

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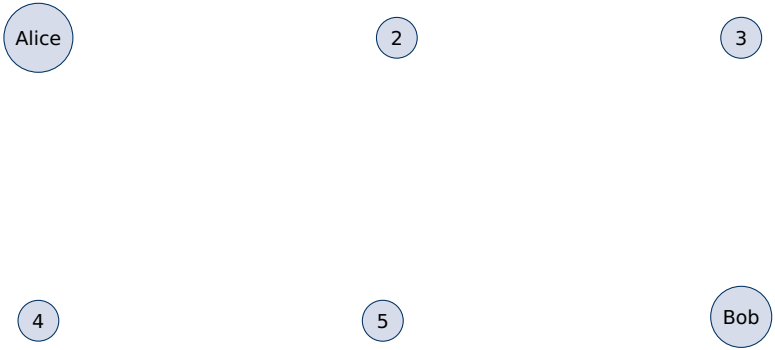

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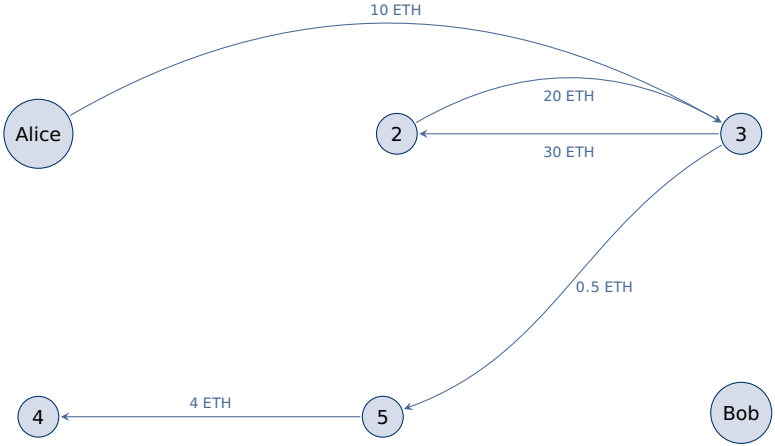

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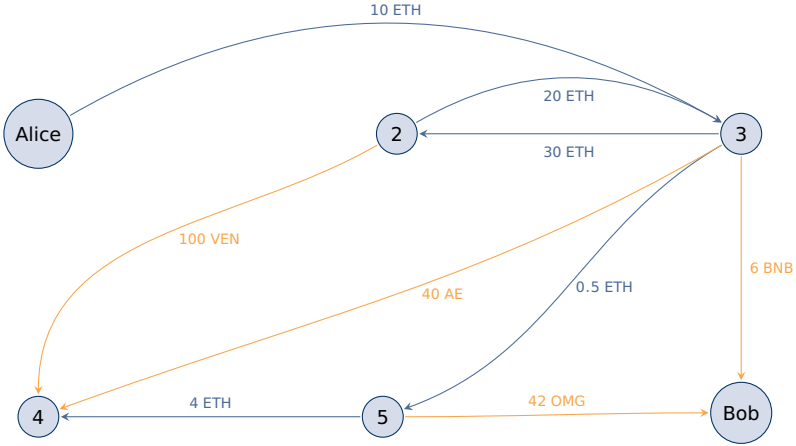

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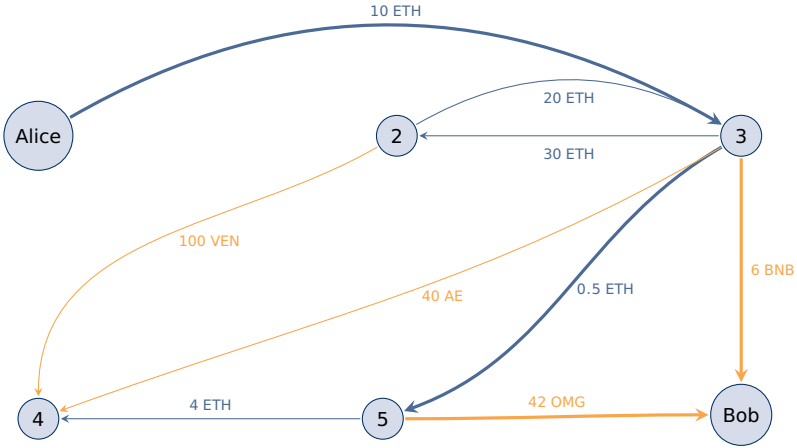

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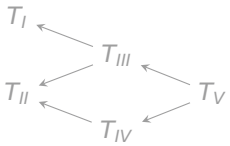

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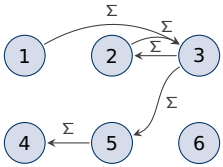

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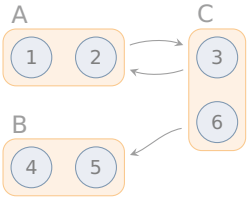

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Upside:

- Many *CAs* follow standards to make them more observable.

Challenges:

- But there is no obligation for *CAs* to be transparent.
- Automatic identification of the purpose of a system is a research topic.

Take Home Messages

Privacy was not a design goal of Ethereum

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- Ethereum wallets are built for one identifier per person.

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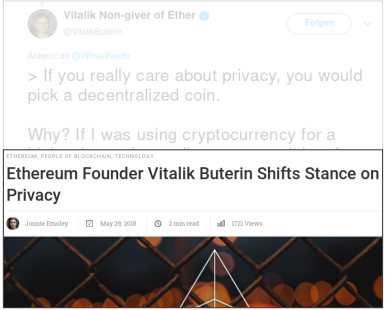

Privacy was not a design goal of Ethereum

- Identifiers are more sticky than in Bitcoin.
- Ethereum wallets are built for one identifier per person.
- But there are efforts to improve privacy.

Take Home Messages (cont'd)

Tracking Ether is easy, but . . .

Take Home Messages (cont'd)

Tracking Ether is easy, but . . .

- incomplete.

Take Home Messages (cont'd)

Tracking Ether is easy, but . . .

- incomplete.
- tokens and other services must be considered.

Take Home Messages (cont'd)

Tracking Ether is easy, but . . .

- incomplete.
- tokens and other services must be considered.
- programmers of *CAs* decide what is easily observable.

Take Home Messages (cont'd)

Tracking Ether is easy, but . . .

- incomplete.
- tokens and other services must be considered.
- programmers of *CAs* decide what is easily observable.
- we lack adequate tools for investigations and monitoring.

Take Home Messages (cont'd)

Why should regulators care?

Ethereums is not criminals' first choice. But ...

Take Home Messages (cont'd)

Why should regulators care?

Ethereums is not criminals' first choice. But ...

- everyone can issue their own financial products. $\rightarrow$ Security regulation

Take Home Messages (cont'd)

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Ethereums is not criminals' first choice. But ...

- everyone can issue their own financial products. → Security regulation
- there are shady services and business practices. → Consumer protection

Take Home Messages (cont'd)

Why should regulators care?

Ethereums is not criminals' first choice. But ...

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Ethereum is relevant and different.

Regulators who take Bitcoin as a model may **miss** important aspects.

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Tracking Payment Flows in Ethereum

Thank you for your attention

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Fungible vs. Non-fungible

Asset

Fungible

Non-fungible