Blockchain, Ethereum and Business Applications

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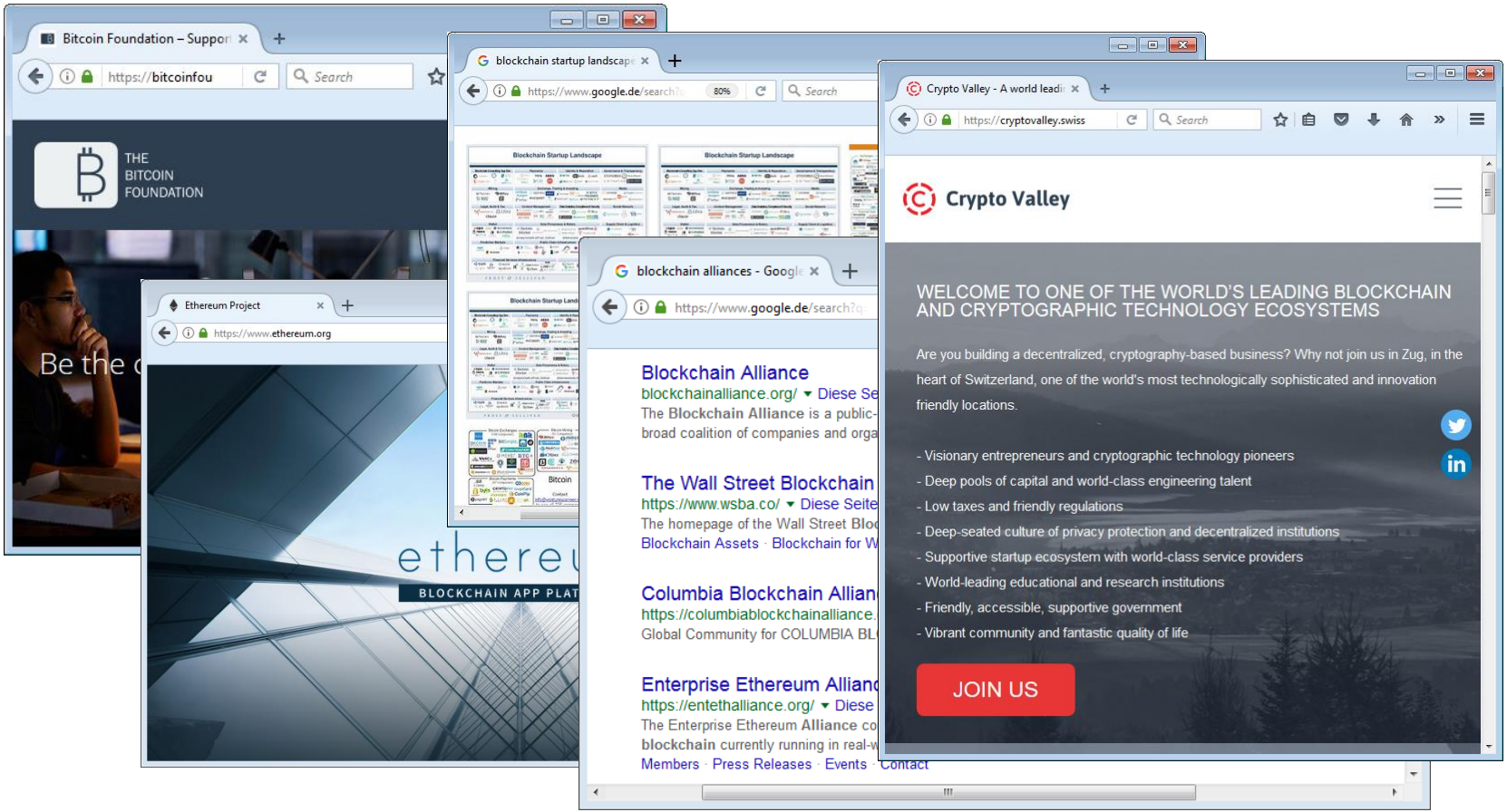
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Are you building a decentralized, cryptography-based business? Why not join us in Zug, in the heart of Switzerland, one of the world's most technologically sophisticated and innovation friendly locations.
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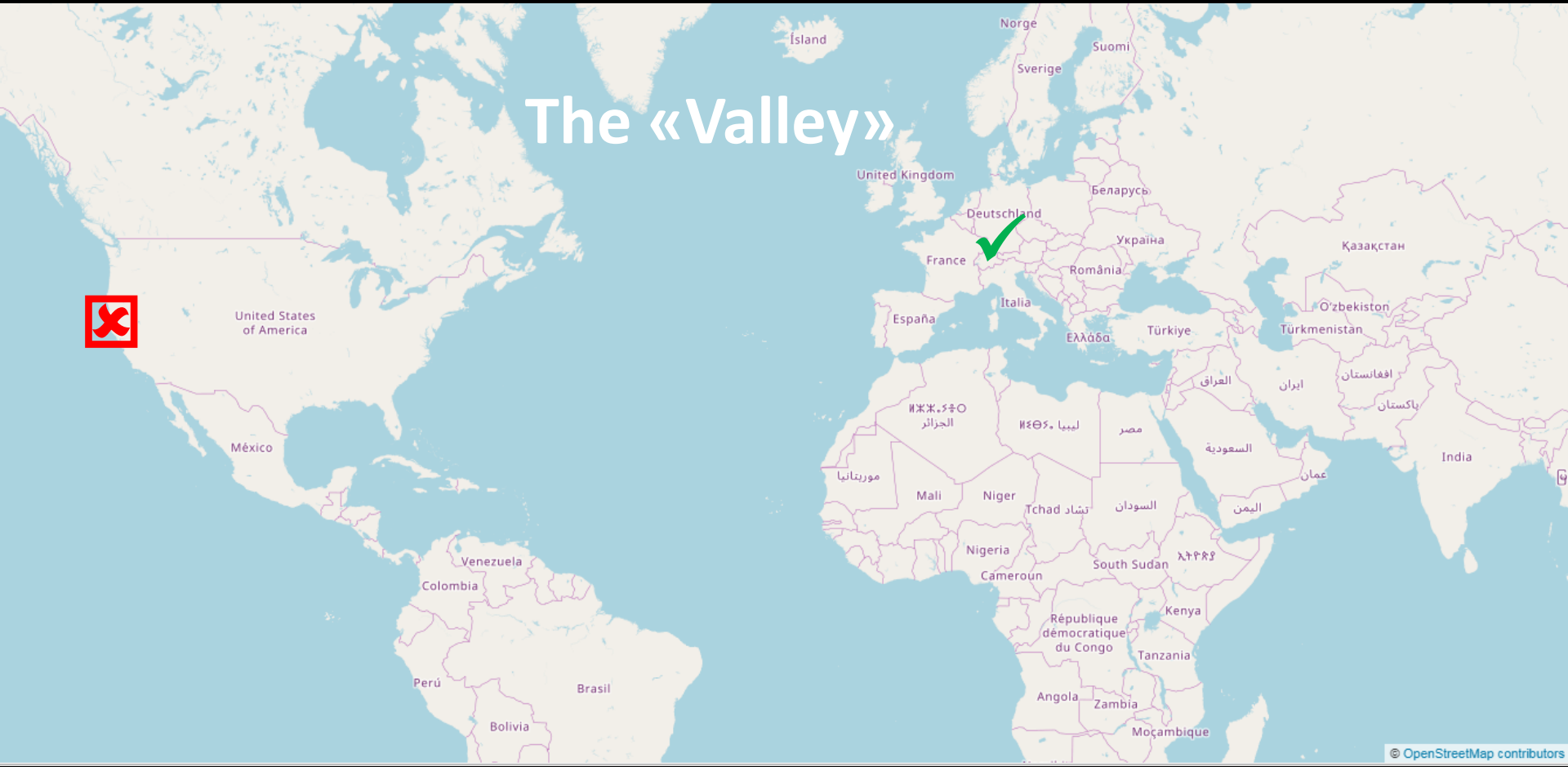
- World-leading educational and research institutions
- Friendly, accessible, supportive government
- Vibrant community and fantastic quality of life
JOIN US

The «Valley»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السودان
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México
Nigeria
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Colombia
Kenya
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Blockchain Market

#	Name	Market Cap	Price	Volume (24h)	Circulating Supply
1	Bitcoin	$96,108,095,812	$5779.73	$1,929,760,000	16,628,475 BTC
2	Ethereum	$31,326,302,991	$329.24	$482,471,000	95,147,607 ETH
3	Ripple	$9,936,089,410	$0.257869	$866,836,000	38,531,538,922 XRP *
4	Bitcoin Cash	$5,864,609,962	$351.12	$346,000,000	16,702,438 BCH
5	Litecoin	$3,358,412,564	$62.88	$188,348,000	53,412,332 LTC
6	Dash	$2,307,274,645	$302.54	$38,470,400	7,626,321 DASH
7	NEM	$2,025,387,000	$0.225043	$8,065,810	8,999,999,999 XEM *
8	Monero	$1,451,708,799	$95.32	$31,838,500	15,229,142 XMR

List by the International Monetary Fund (Partial forecasted estimates for 2017)[5]

Rank	Country	GDP (millions of Int$)
	World	**126,687,917**
1	China[n 1]	23,194,411
—	*European Union*[n 2]	20,852,702
2	United States	19,417,144
84	Croatia	100,006
85	Côte d'Ivoire	95,887
125	Macedonia	31,924
126	Cyprus	31,093

elizabeth stark gefällt das

Neil Woodfine 聂尔 @nwoodfine · 9 Std.

Understanding bitcoin VS. when to buy and when to sell

Original (Englisch) übersetzen

23 357 818

Towards understanding Bitcoin …

«history's first» Blockchain

- Satoshi Nakamoto (?)
- White Paper 2008
- Open Source Software 2009

Coffee at Bob‘s

Source: «Mastering Bitcoin», *Andreas M. Antonopoulos*

What is a Bitcoin Address?

Addresses == **«Accounts»**

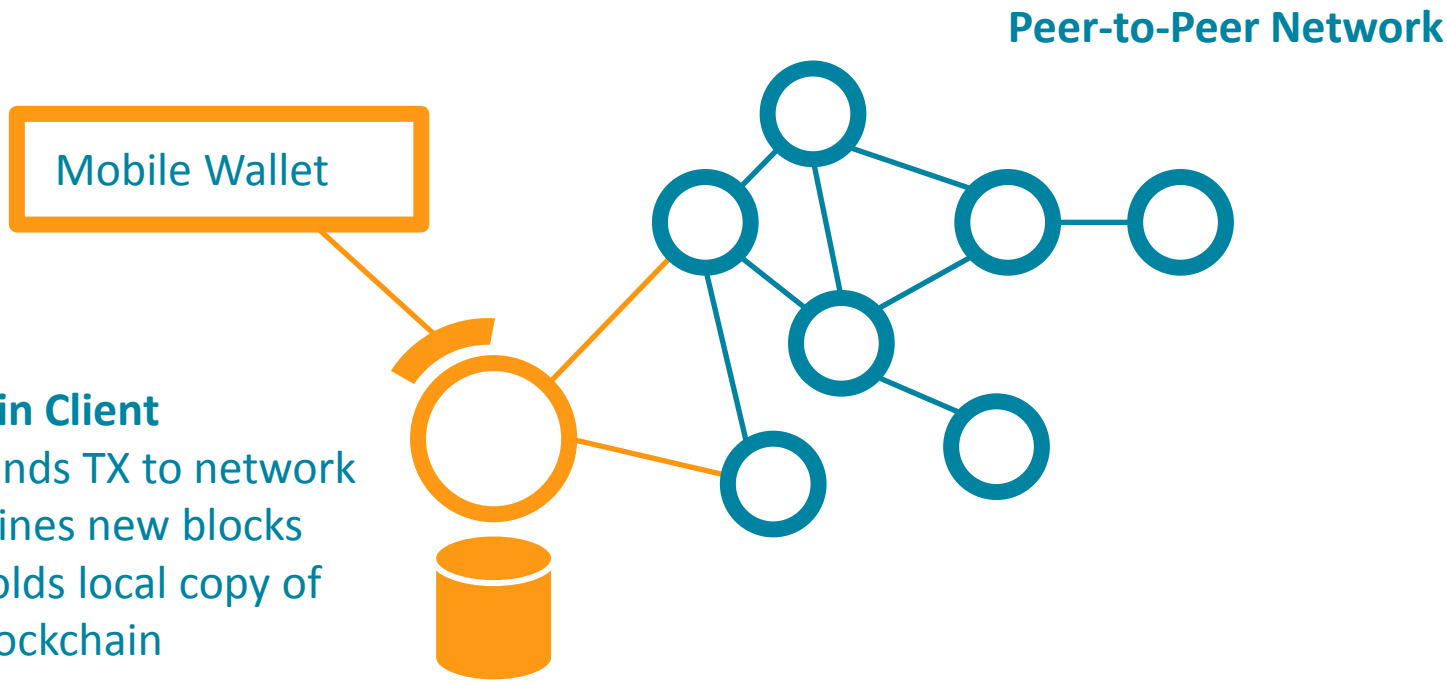
Encoded Numbers

- ➔ Example: `1GdK9UzpHBzqzX2A9JFP3Di4weBwqgmoQA`
- ➔ Derived from a **public/private key pair**

Getting, using and loosing it

- ➔ Create your own addresses, no need to ask anyone
- ➔ No ID required, no showing up at local branch, …
- ➔ To send Bitcoins you need your private Key
- ➔ **You loose your private key → you loose your money**

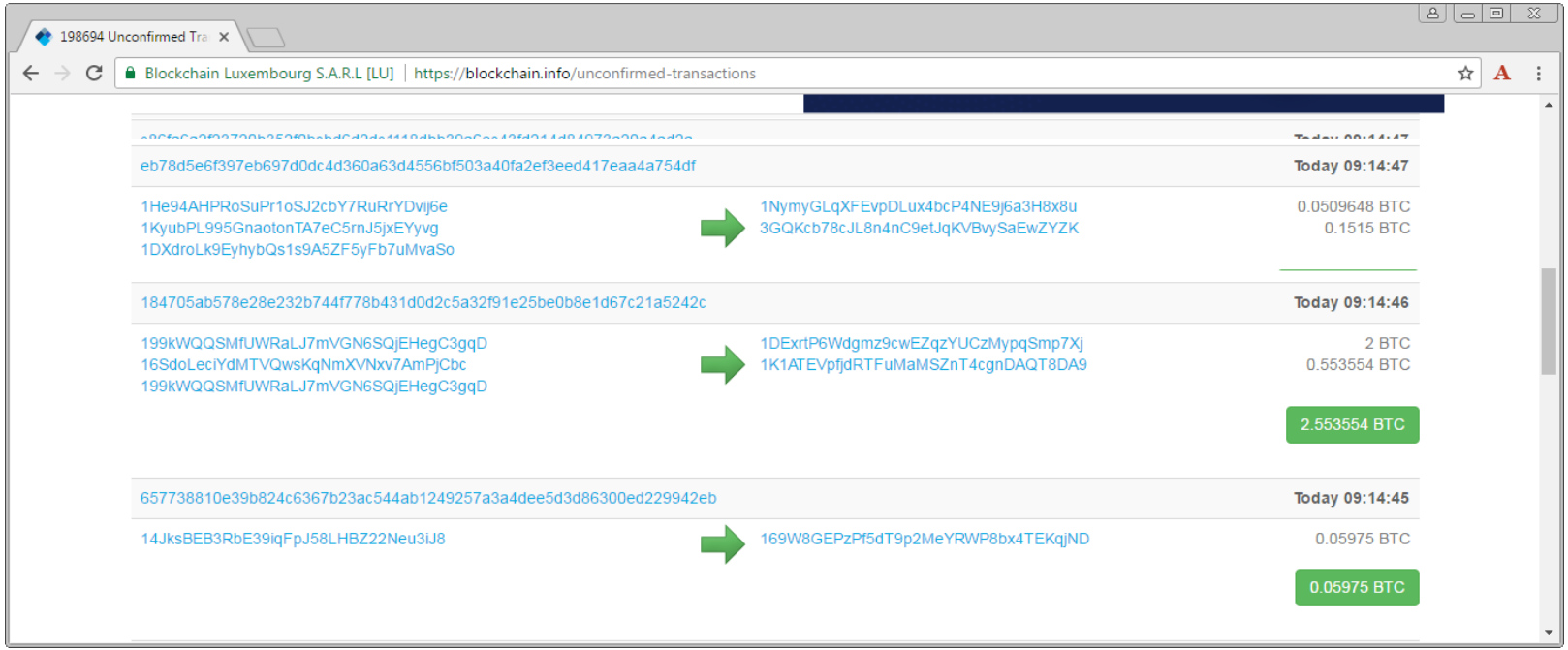
Bitcoin Network



Bitcoin Client

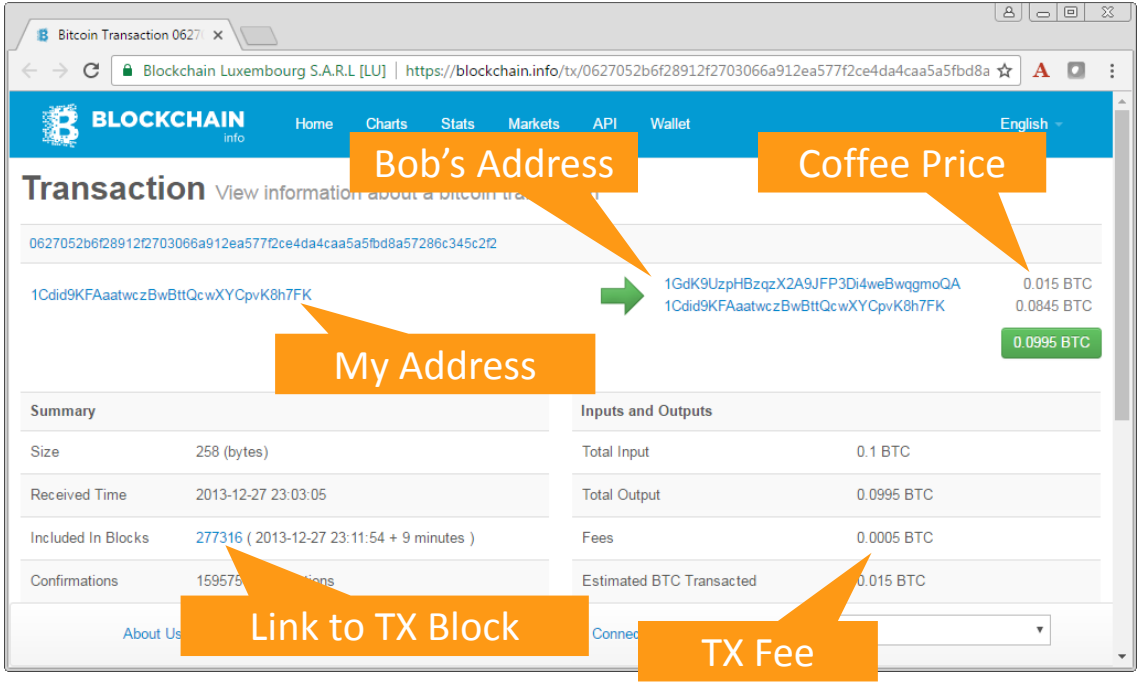
- Sends TX to network
- Mines new blocks
- Holds local copy of blockchain

Distribution of unconfirmed TX



The Coffee Transaction

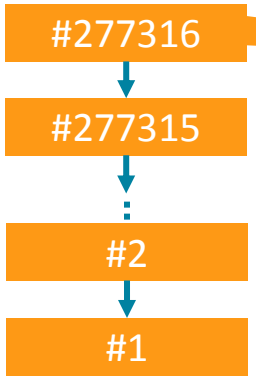
- To confirm TX:
  - TX mined into block
  - 5 new blocks on top
- Network mines TX in ~ 10 min.
- Sometimes this takes hours …

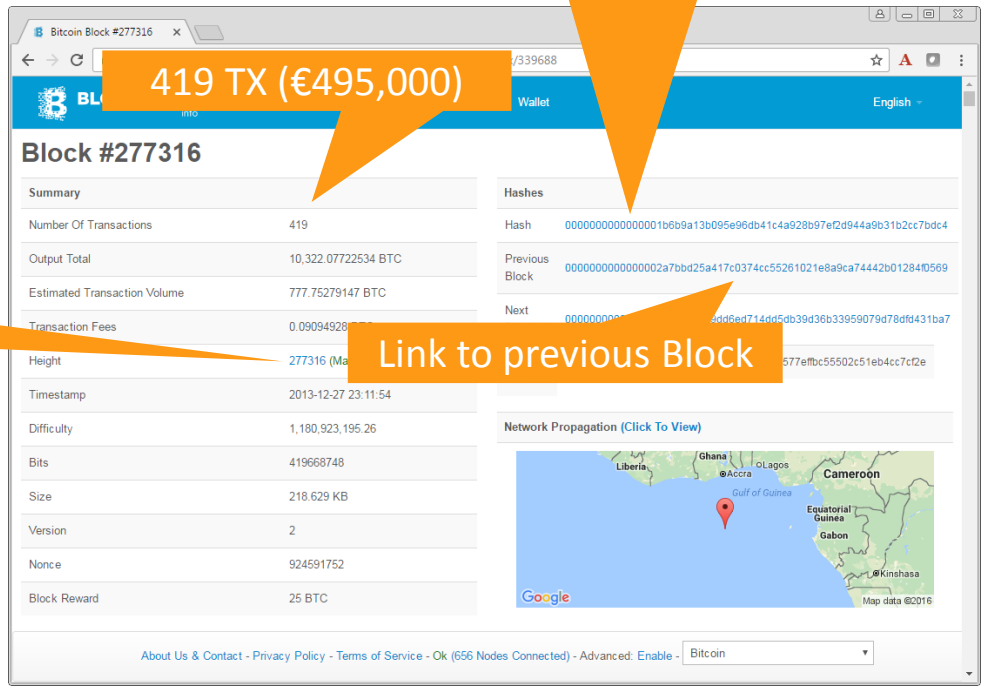


Screenshot: blockchain.info

TX Blocks and the Blockchain

- **Block** #277316
  includes coffee TX





Screenshot: blockchain.info

From Transactions to Blocks (Mining)

1. New TX are propagated through Bitcoin **peer-to-peer network**
2. Bitcoin client receive new TX and add it to local **«mempool»**
3. Client starts to **«mine»** transactions:
   - Assemble TX from mempool to **block candidate**
   - Starts to solve the block candidate's **crypto challenge**
   - Client solving the challenge first, gets **block reward** and all **TX fees**
3. Winning client sends the new block to its peers
4. Arrival of new block triggers the next challenge

Block Hashes and Crypto Challenge

```
mzi@BSI ~/Desktop/oss/events/2017/jug_blockchain_2017

$ java DummyBitcoinMiner 1
…
B37060F28617A5DFA3DB9A3D547663B3:I am Satoshi Nakamoto:lubf -> CF6BB3C636DF380E357E28271D948BBC
B37060F28617A5DFA3DB9A3D547663B3:I am Satoshi Nakamoto:jauj -> E6F1EB09AEF0BF331261B64E1C798EAB
B37060F28617A5DFA3DB9A3D547663B3:I am Satoshi Nakamoto:dwpt -> 0CEE0B104F133062073BDD810D3DB6CF
Success with nonce 'dwpt' for difficulty '0'. Hashes calculated: 29

$ java DummyBitcoinMiner 4
…
B37060F28617A5DFA3DB9A3D547663B3:I am Satoshi Nakamoto:quyc -> 89BD526A2DF7EBF41ACD227BFC6B78FE
B37060F28617A5DFA3DB9A3D547663B3:I am Satoshi Nakamoto:ceaw -> 0000AD30B2DDD8A773B8E5AABB5282AD
Success with nonce 'ceaw' for difficulty '0000'. Hashes calculated: 11584
```

Difficulty Oct’ 17: 18 leading zeros

Bitcoin Recap

Bitcoin Success

- ➔ Completely decentral currency (no need for banks)
- ➔ Open Source (GitHub) and Open Data (complete TX history)
- ➔ First successful implementation of any crypto currency
- ➔ «Gold Standard» since 2009
- ➔ Record price levels in 2017

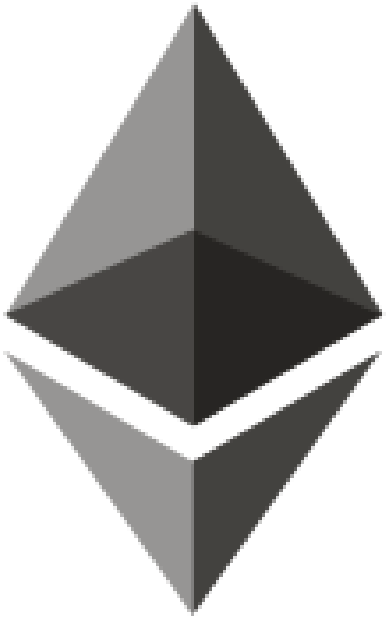
Bitcoin Challenges

- ➔ Scaling debate/war
- ➔ Declining market share (Ethereum, …)

Bitcoin Resources

https://github.com/bitcoin/bitcoin https://github.com/bitcoinbook/bitcoinbook

Ethereum



Currency and Smart Contracts

- 2014 by Vitalik Buterin
- Distributed VM (Turing complete)
- Open source software

Ethereum vs Bitcoin

Common Traits

- ➔ Virtual currency
- ➔ Peer-to-peer network/nodes with local blockchain
- ➔ Concepts of addresses, transactions, mining

Main Differences

- ➔ **Specification** with different implementations (Bitcoin reference client)
- ➔ **Smart contracts** and Ethereum virtual machine
- ➔ **Gas** to execute smart contracts and TX

Gas

What is gas?

- ➔ Unit to pay mining nodes
- ➔ Unit of gas has price in Ethers

What can we buy with gas?

- ➔ Pay TX fees
- ➔ Execute smart contracts
- ➔ Computations performed by clients: **Ethereum Virtual Machine** (EVM)
- ➔ EVM is working as long as there is gas
- ➔ **Example 1**: **SHA3** computation costs 30 gas
- ➔ **Example 2**: EVM always terminates (stays in **infinite loop** until gas runs out)

Ethereum Smart Contracts

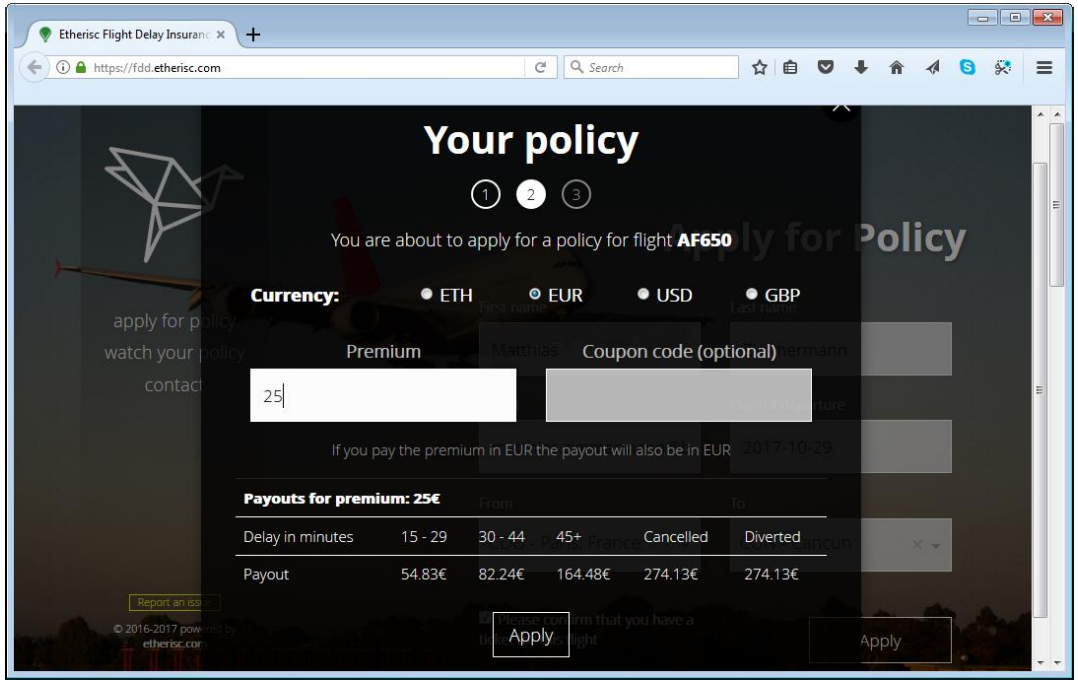
What is a Smart Contract?

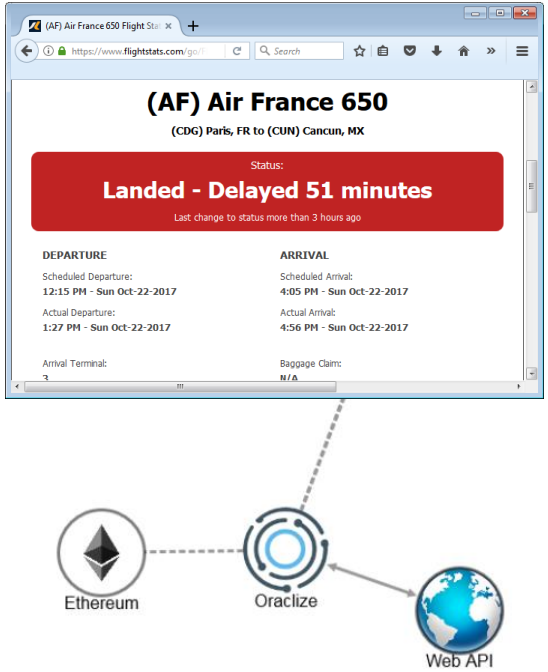
- ➔ Code written in high level language «Solidity»
- ➔ Code is compiled into byte code
- ➔ Byte code executed on client by EVM
- ➔ Has owner
- ➔ Has address
- ➔ Can hold currency

Examples

1. Flight delay insurance
2. «Truly» autonomous cars

Flight Delay App





https://fdd.etherisc.com http://oraclize.it http://www.flightstats.com

«Truly» Autonomous Cars

Uber's self-driving cars are now picking up passengers in Arizona

Tempe or bust

by Andrew J. Hawkins | @andyjayhawk | Feb 21, 2017, 1:55pm EST

SHARE TWEET LINKEDIN

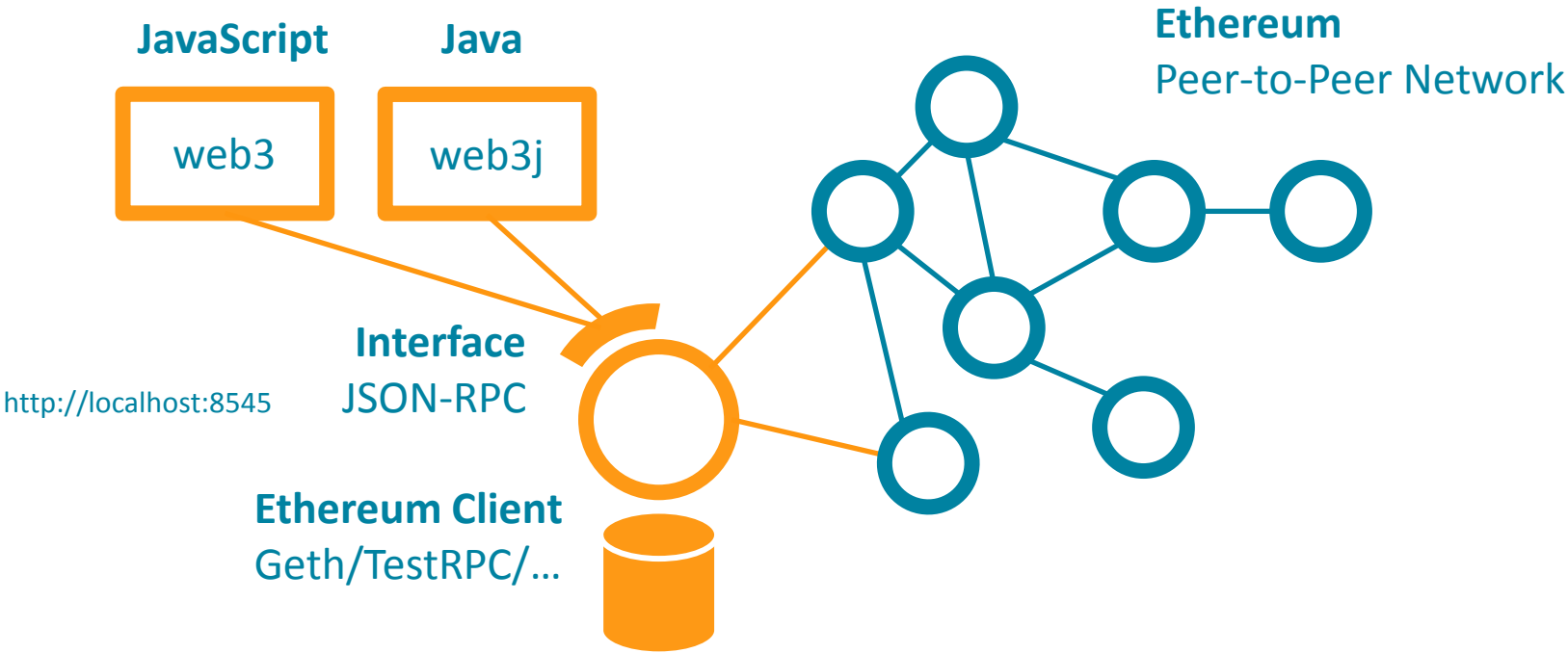
In 2017 RWE introduces charging stations connected to Ethereum blockchain

- ➔ **Smart contract**: Order car to transport people (fees go to car contract)
- ➔ **Smart contract**: Car pays for energy/services (car pays with it's own funds)

http://www.trustnodes.com/2017/04/29/germanys-energy-giant-launches-100s-ethereum-based-electric-cars-charging-stations
https://www.theverge.com/2017/2/21/14687346/uber-self-driving-car-arizona-pilot-ducey-california

«Greeter» with web3
Smart Contract Hello World

Ethereum and Applications



«Hello World» (greeter.sol)

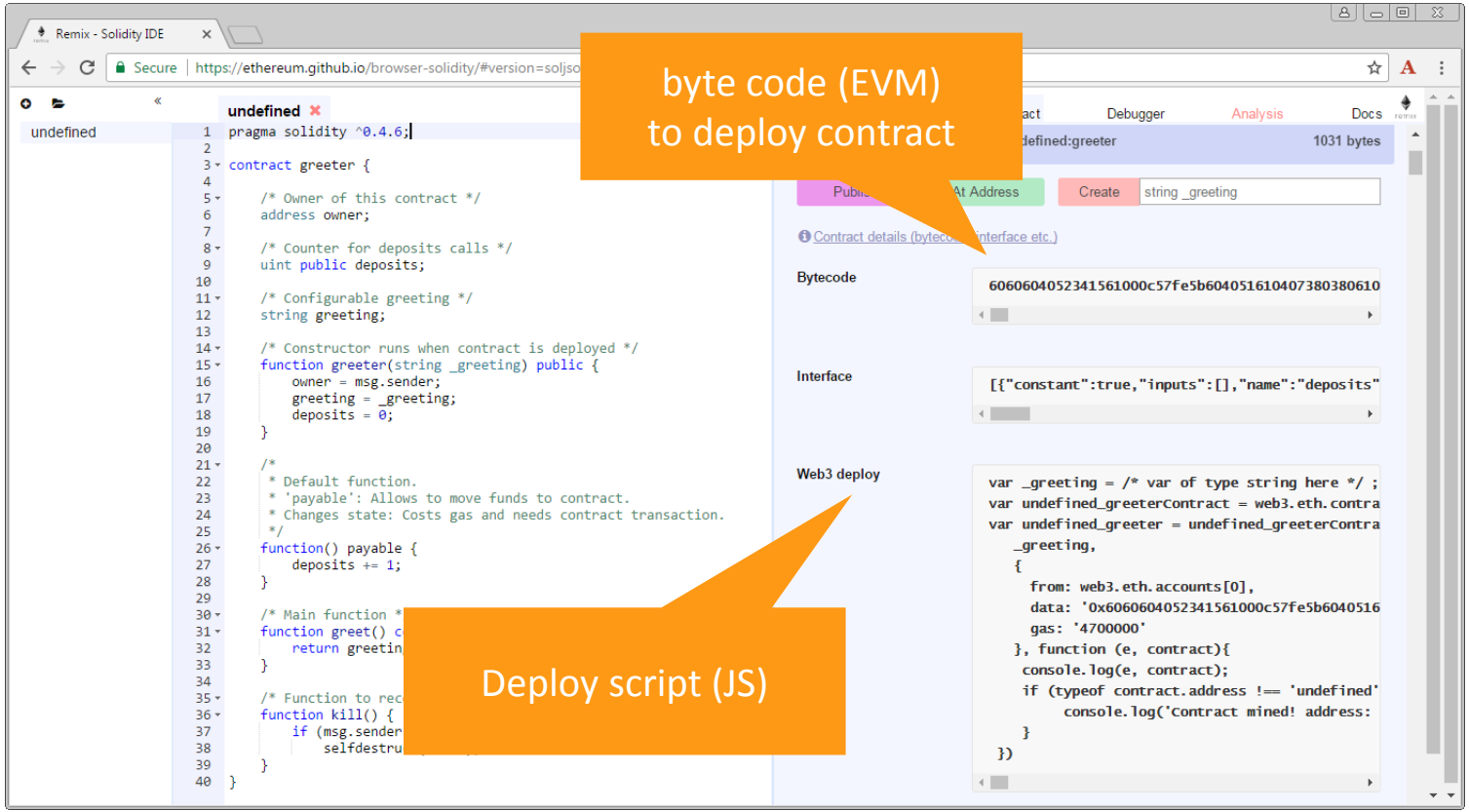
```
contract greeter {

    /* Owner of this contract */
    address owner;

    /* Configurable greeting */
    string greeting;

    /* Constructor runs when contract is deployed */
    function greeter(string _greeting) public {
        owner = msg.sender;
        greeting = _greeting;
    }

    /* Main function */
    function greet() constant returns (string) {
        return greeting;
    }

    /* Function to recover the funds on the contract */
    function kill() {
        if (msg.sender == owner)
            selfdestruct(owner);
    }
}
```

```
contract greeter {

    /* Counter for deposits calls */
    uint public deposits;

    /*
     * Default function.
     * 'payable': Allows to move funds to contract.
     * Changes state: Costs gas and needs contract transaction.
     */
    function() payable {
        deposits += 1;
    }

    /*
     * Returns number of deposits.
     * 'const': This function does not change contract state.
     * Does not change state and does not cost gas/fees.
     * No contract transaction needed.
     */
    function deposits() constant returns (uint) {
        return deposits
    }

    address owner;
    string greeting;

    function greeter(string _greeting) public { deposits = 0; ... }
    function greet() constant returns (string) { ... }
    function kill() { ... }
}
```

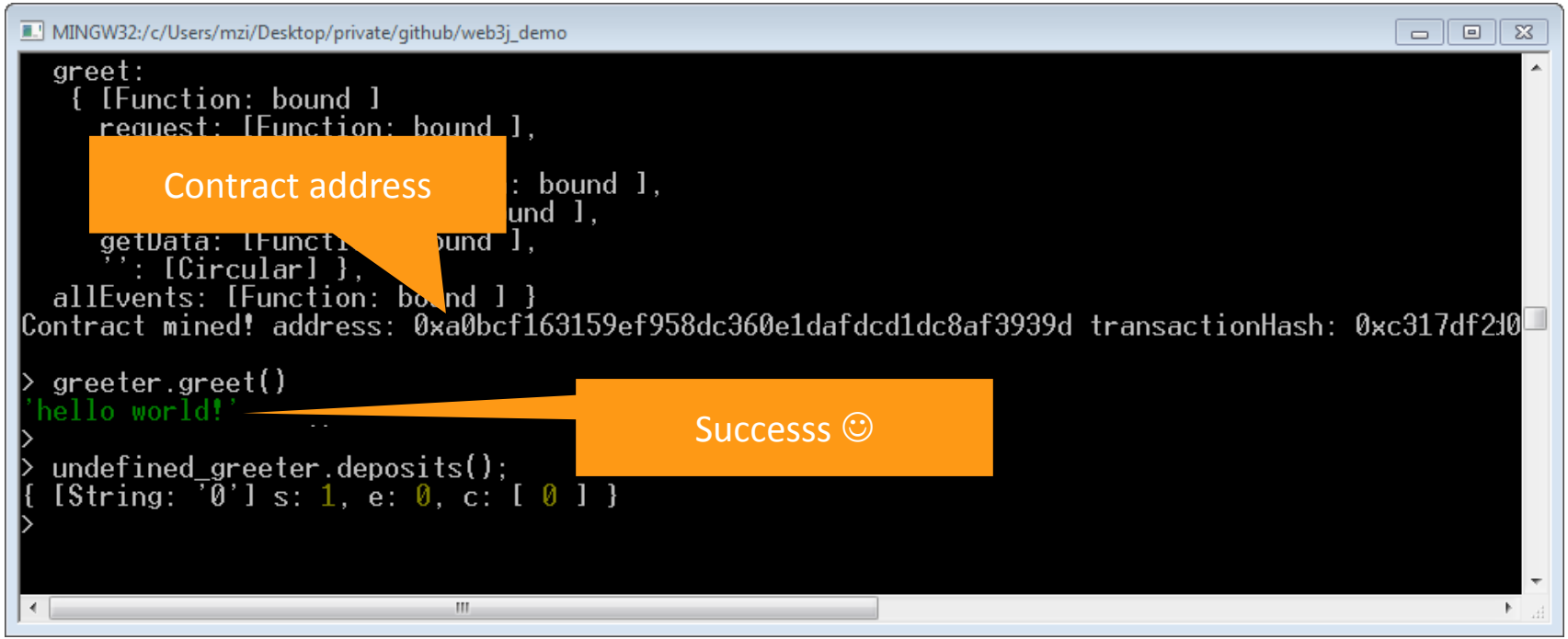
greeter.sol

+ additional state
+ ‘payable’

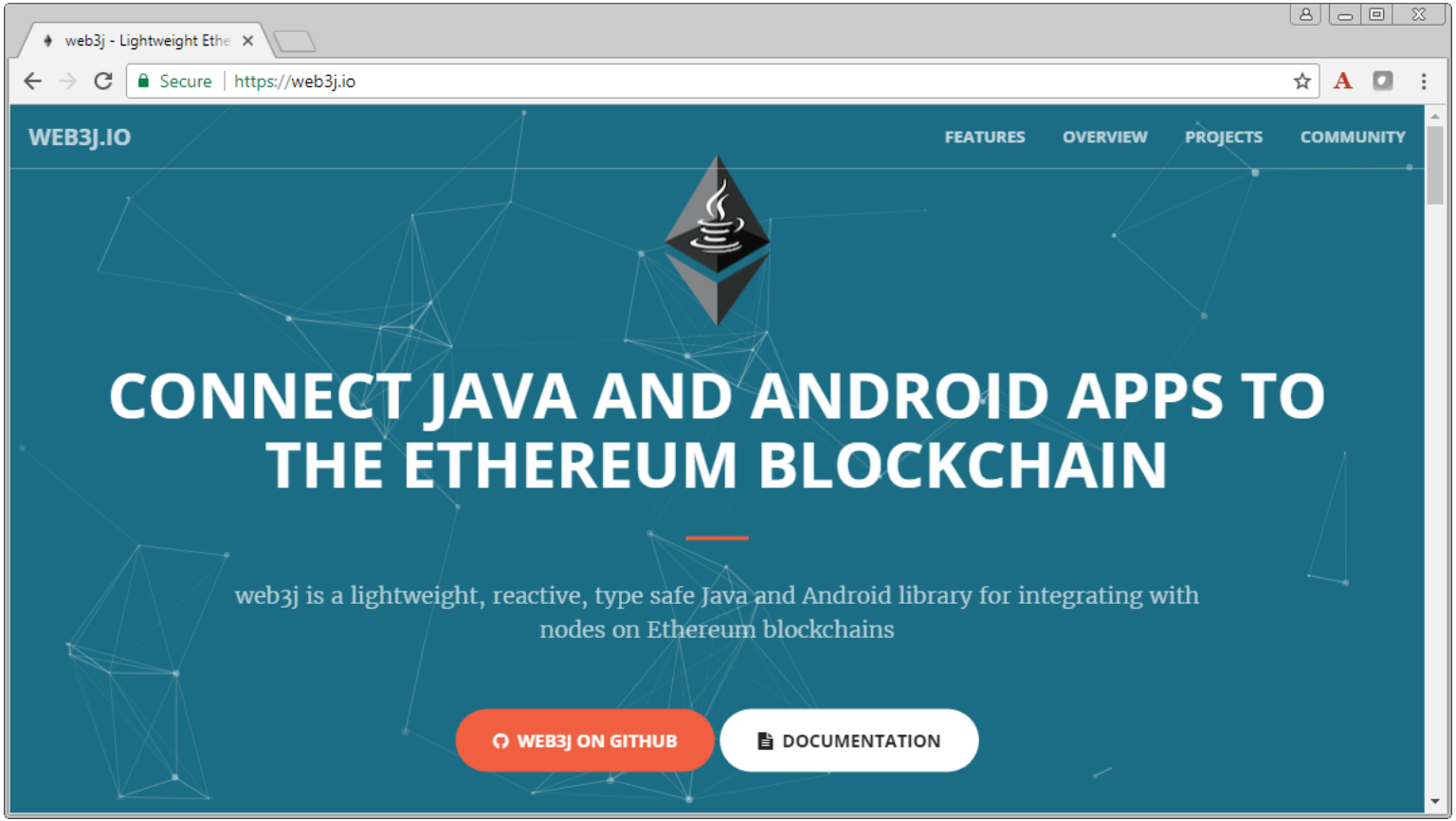
Solidity Compiler (online)



Deploy (Console)

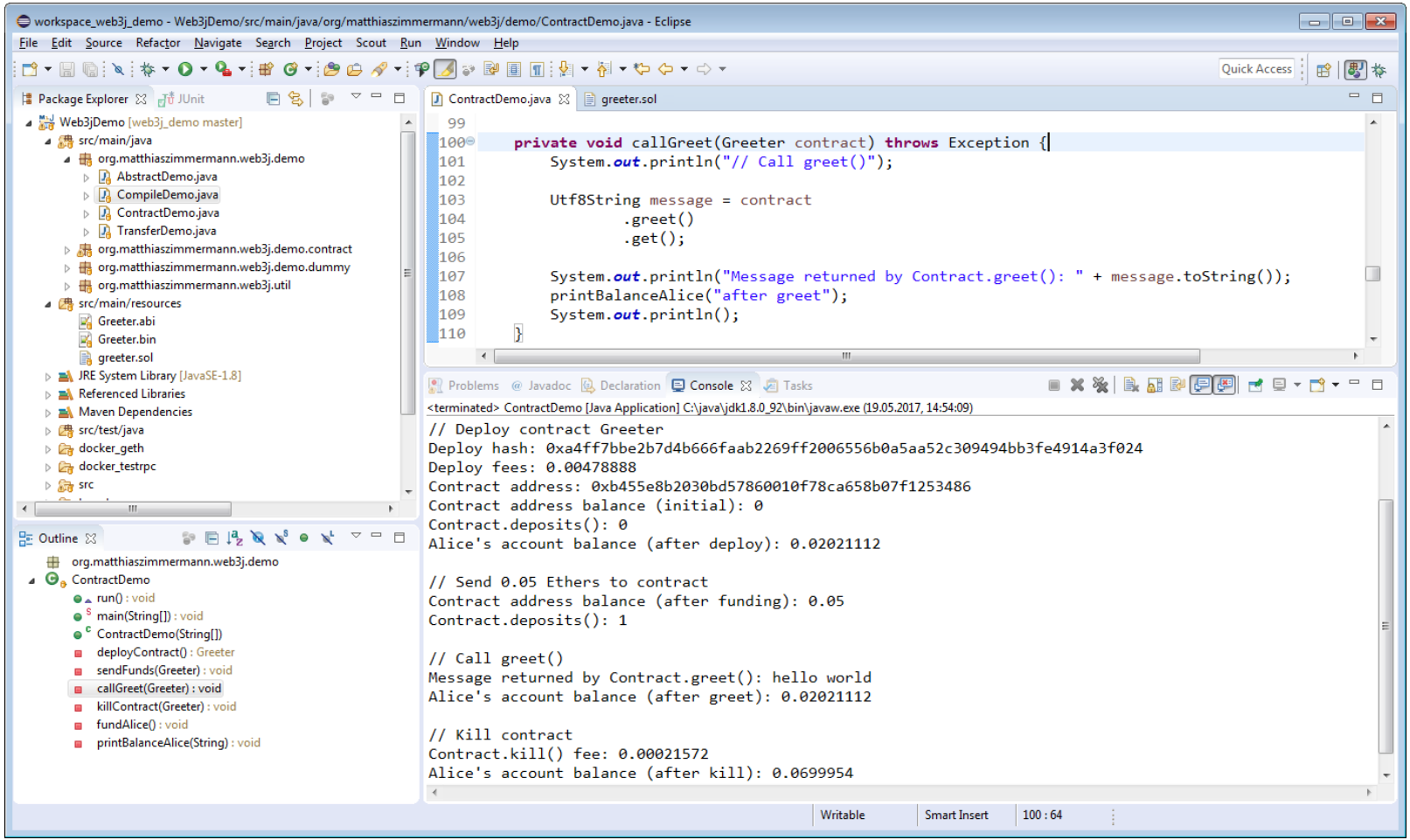


«Greeter» with web3j


web3j - Lightweight Ethe
Secure
https://web3j.io
WEB3J.IO
FEATURES
OVERVIEW
PROJECTS
COMMUNITY
CONNECT JAVA AND ANDROID APPS TO THE ETHEREUM BLOCKCHAIN
web3j is a lightweight, reactive, type safe Java and Android library for integrating with nodes on Ethereum blockchains
WEB3J ON GITHUB
DOCUMENTATION

greeter.sol → Greeter.java

1. Compile `greeter.sol`
   - → `greeter.bin`
   - → `greeter.abi`
2. Create wrapper class (use Web3j command line tool)
   - → `Greeter.java`



https://github.com/matthiaszimmermann/web3j_demo

Trading-Network Demo

Ethereum, web3j, Eclipse Scout

Trading Network Demo

Use Case

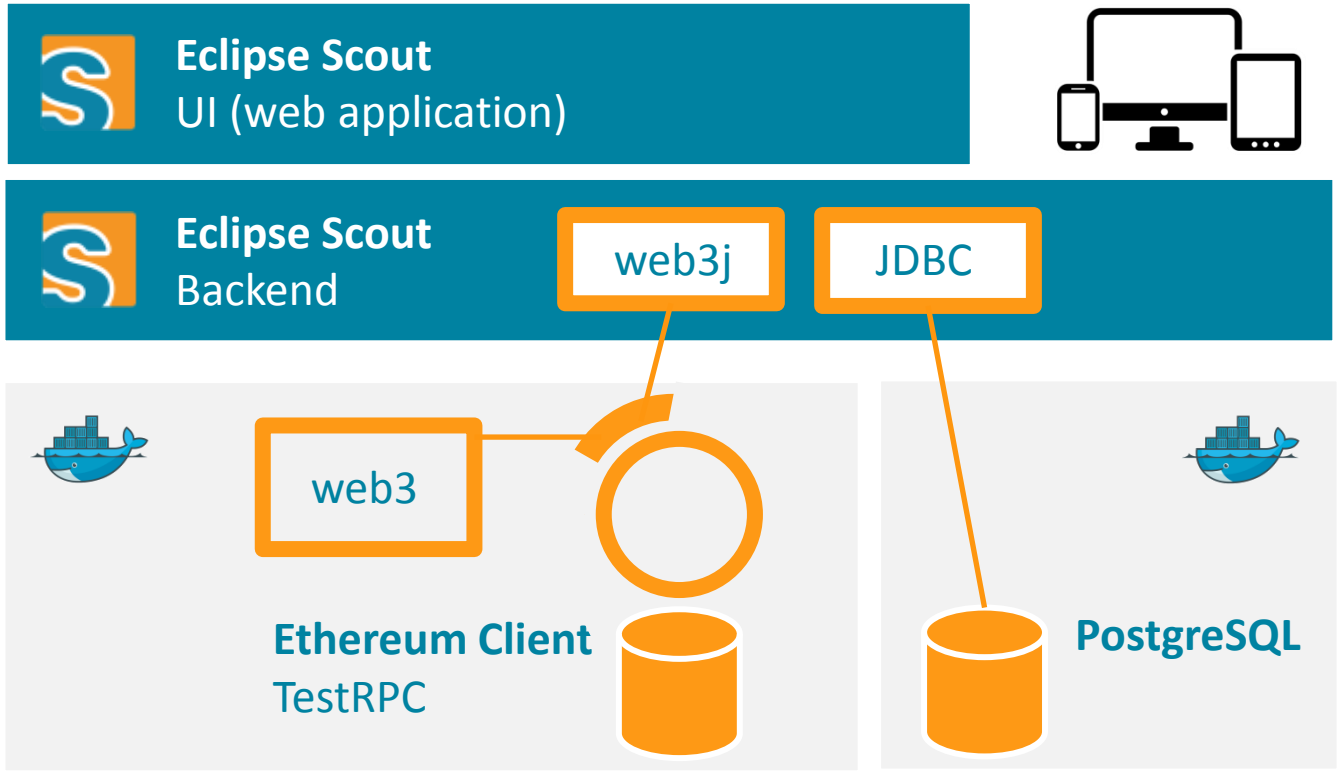
➔ **Currency Hedging**: Manage buy and sell orders for € / US$

➔ **Classical Business App**

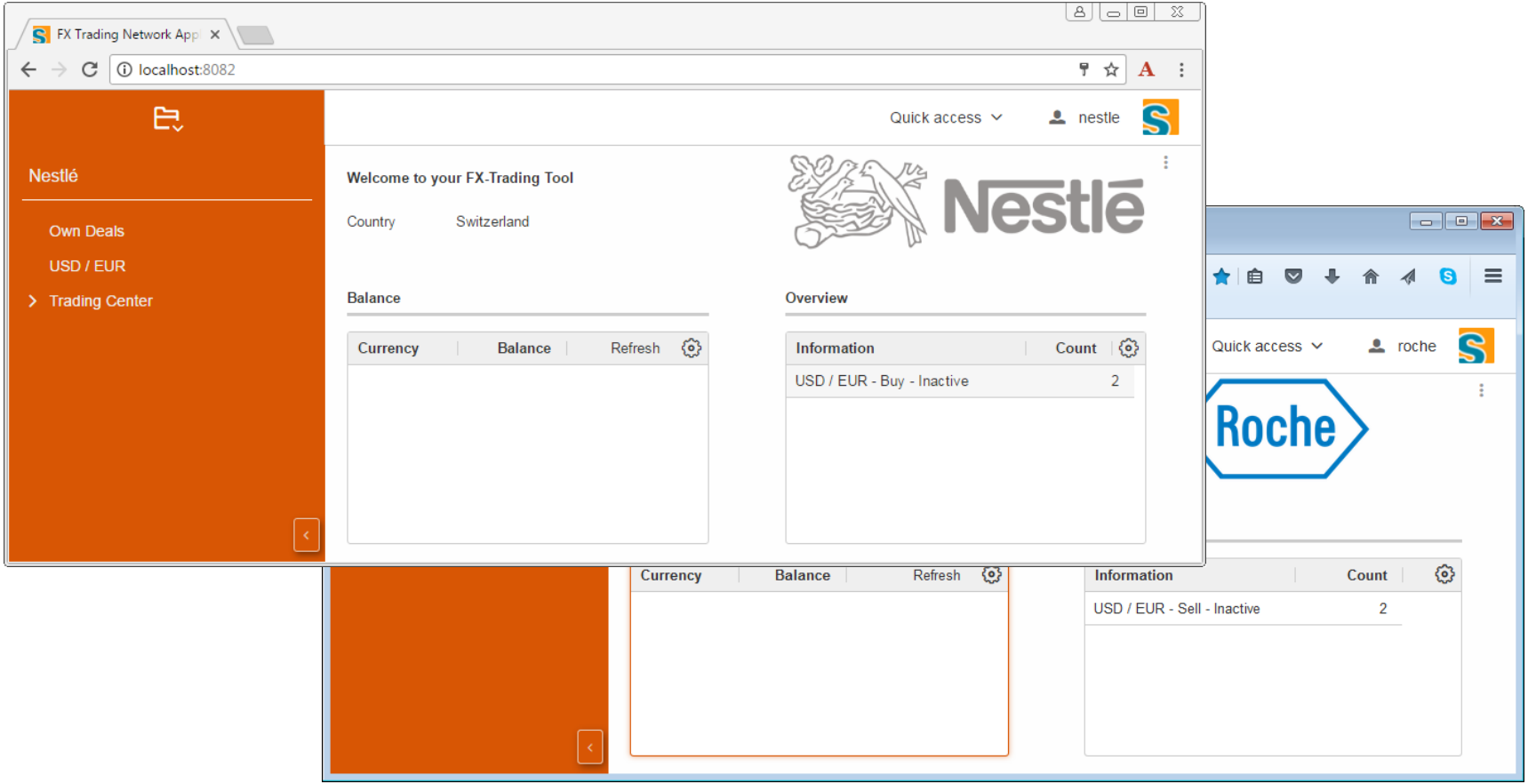
- **Idendity management:** Map users with Ethereum addresses
- **web3j** library to access Ethereum client
- **Eclipse Scout** to build application

➔ **Blockchain Benefits**

- **Efficiency**: No central organization/infrastructure
- **Trust**: Tampering-proof ledger, trust by blockchain



https://github.com/BSI-Business-Systems-Integration-AG/trading-network/tree/features/matthiaszimmermann/jugch_talk_2017


FX Trading Network App
localhost:8082
Quick access
nestle
Nestlé
Own Deals
USD / EUR
Trading Center
Welcome to your FX-Trading Tool
Country
Switzerland
Nestlé
Balance
Currency
Balance
Refresh
Overview
Information
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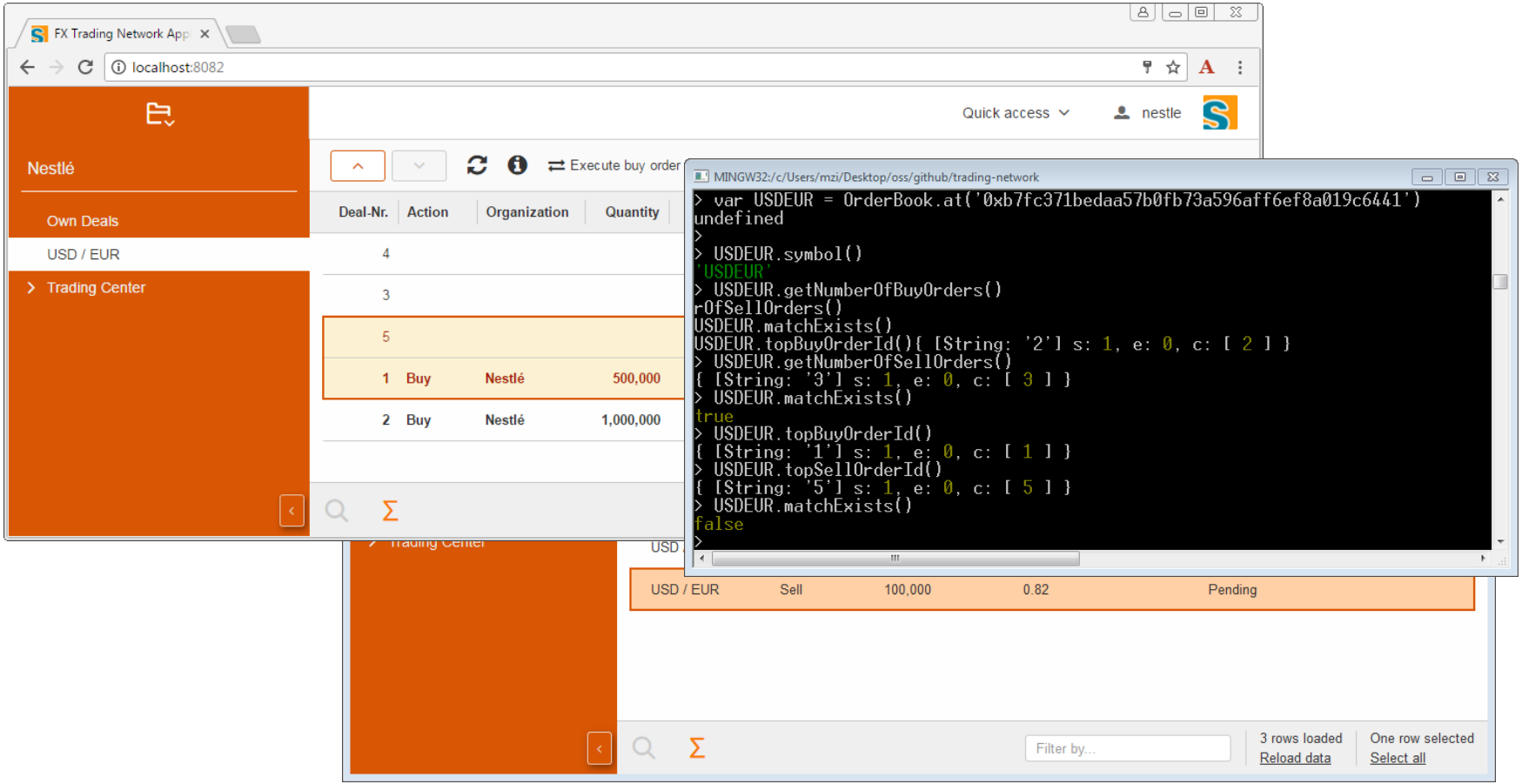
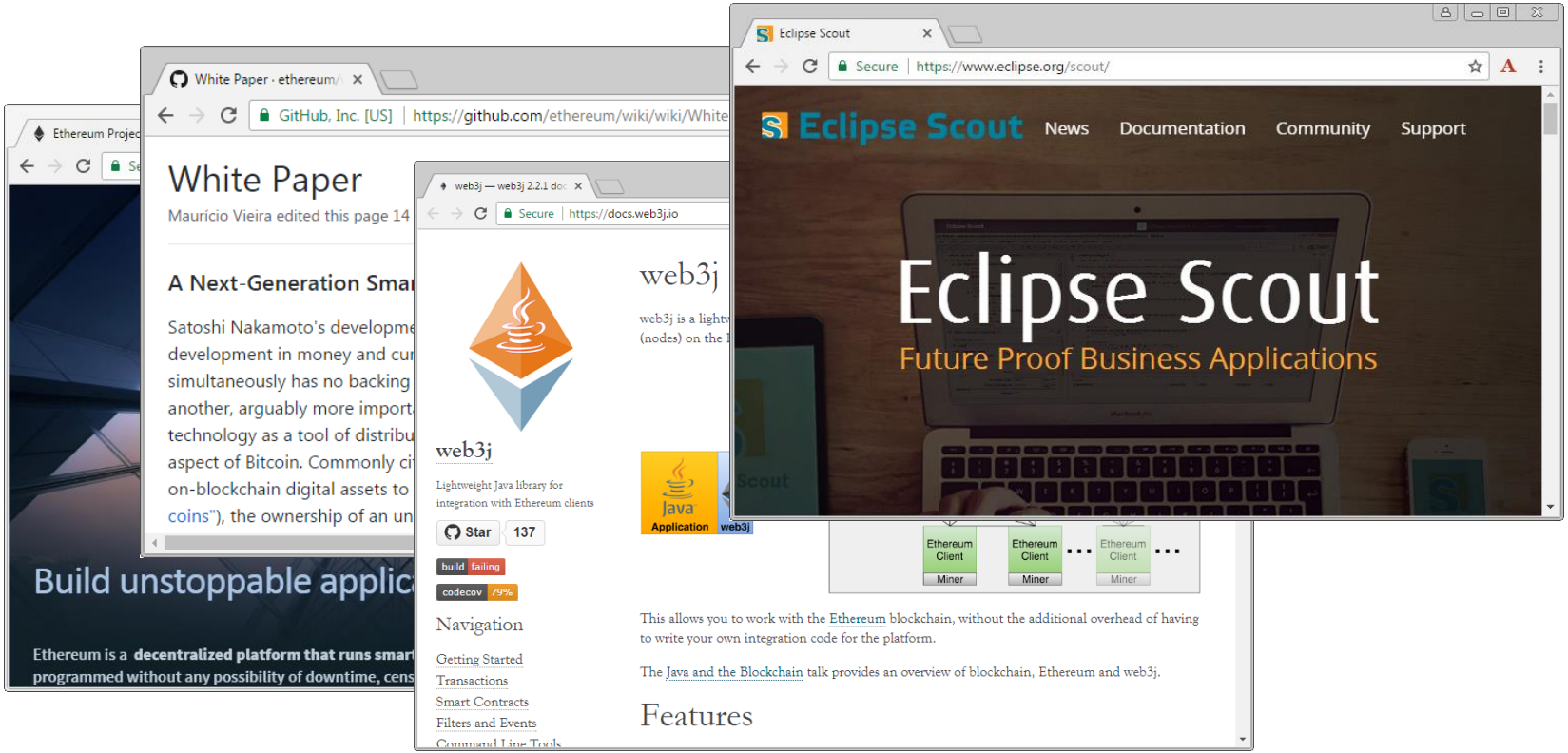

FX Trading Network App
localhost:8082
Quick access
nestle
Nestlé
Own Deals
USD / EUR
Trading Center
Execute buy order
Deal-Nr.
Action
Organization
Quantity
4
3
5
1 Buy Nestlé 500,000
2 Buy Nestlé 1,000,000
MINGW32:/c/Users/mzi/Desktop/oss/github/trading-network
> var USDEUR = OrderBook.at('0xb7fc371bedaa57b0fb73a596aff6ef8a019c6441')
undefined
> USDEUR.symbol()
'USDEUR'
> USDEUR.getNumberOfBuyOrders()
rOfSellOrders()
USDEUR.matchExists()
USDEUR.topBuyOrderId(){ [String: '2'] s: 1, e: 0, c: [2] }
> USDEUR.getNumberOfSellOrders()
{ [String: '3'] s: 1, e: 0, c: [3] }
> USDEUR.matchExists()
true
> USDEUR.topBuyOrderId()
{ [String: '1'] s: 1, e: 0, c: [1] }
> USDEUR.topSellOrderId()
{ [String: '5'] s: 1, e: 0, c: [5] }
> USDEUR.matchExists()
false
>
USD / EUR Sell 100,000 0.82 Pending
Filter by...
3 rows loaded
Reload data
One row selected
Select all

Resources



https://www.ethereum.org/ https://github.com/ethereum/ https://docs.web3j.io/ https://www.eclipse.org/scout/

Summary

Wrap-up

Blockchain

- Internet of decentralized trust
- Cool new technology

Technology is great for

- «unbanked»: Machines AND people
- Efficient trustless global exchange for values (and information)
- Distributed business models

Challenges

- Privacy
- Scalability (Bitcoin can do 7 tx/s)
- Energy consuption (Bitcoin power consumption ~ Ecuador)
- Maturity (blockchain still in it's infancy)
- Regulatory (it's a mess …)

Thanks!

«Blockchain, Ethereum and Business Applications»

Additional Material

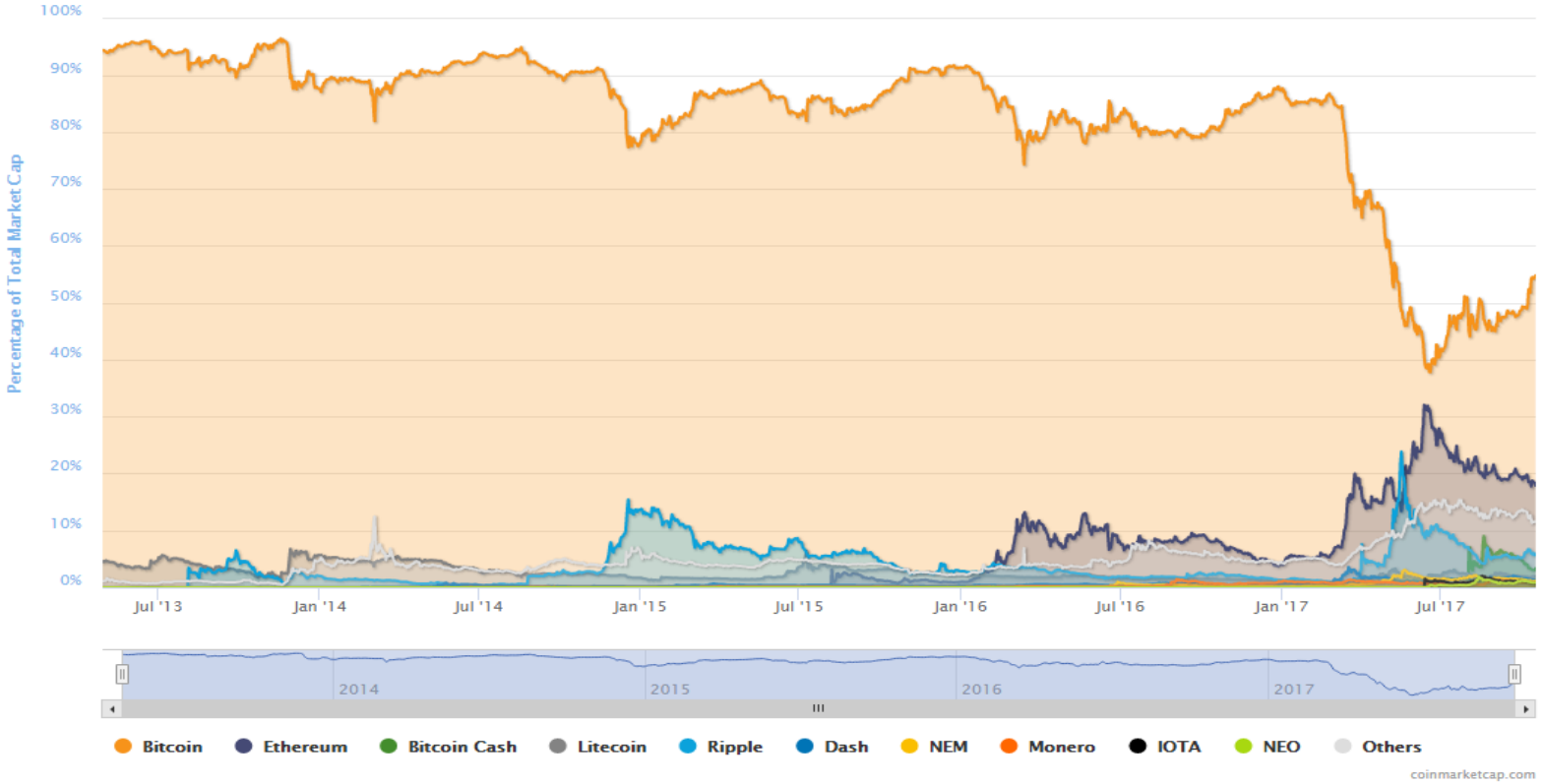
Bitcoin · $5,554.90 Ethereum · $298.16 Litecoin · $55.19

1H 1D 1W 1M 1Y ALL

$5,554.90

BITCOIN PRICE

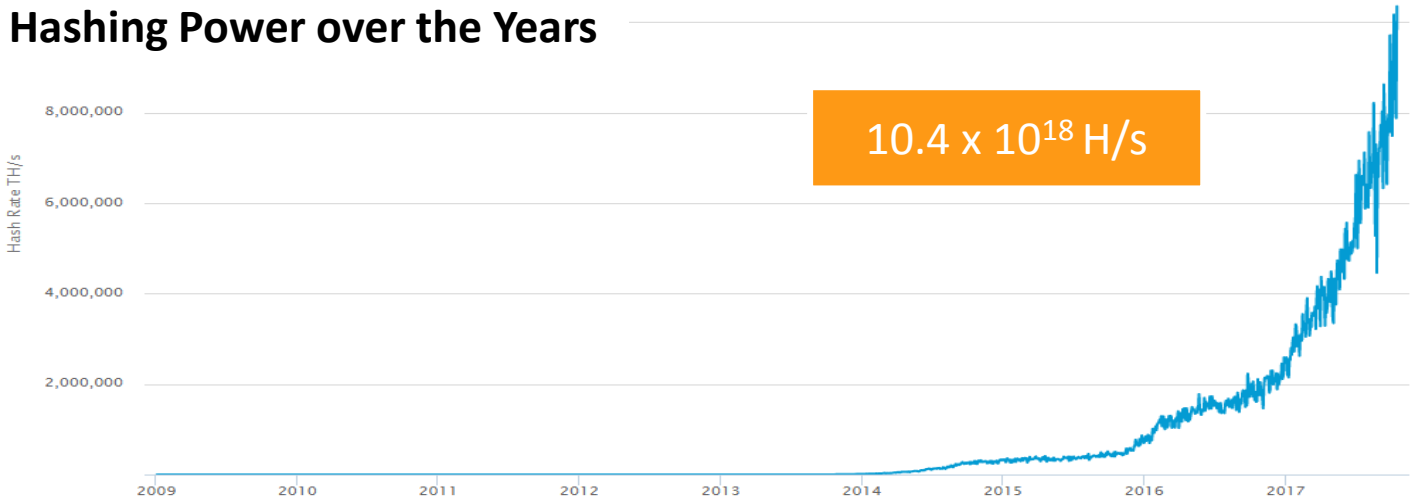
Bitcoin Market Share



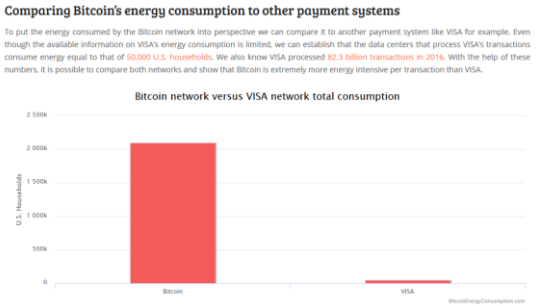
Bitcoin Mining Today

- **Mining-pools**: Include many ASIC computers (PC way too slow)
- **AntMiner**: 10,000x faster than PC, burns 10x more electricity
- **Energy Costs**: # of hashes per KWh is central criteria + cooling(!)

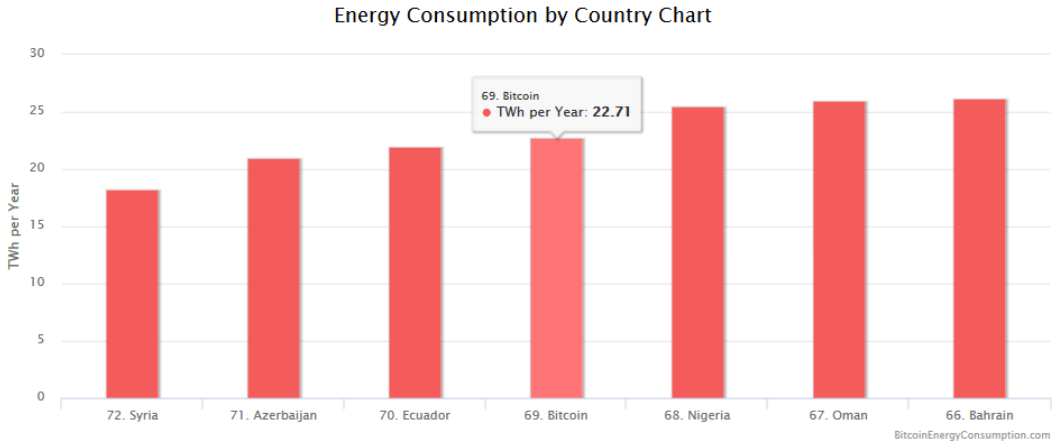
Hashing Power over the Years



Bitcoin Energy Consumption Index

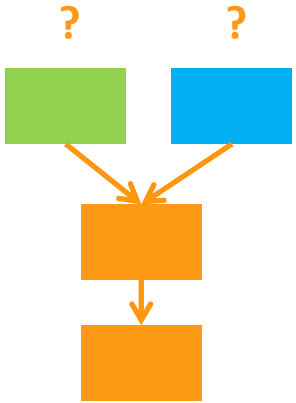


Bitcoin vs VISA



Bitcoin compared to countries

Consensus Mechanism
«Preventing Forks»



The Challenge

- ➔ Mining clients build block candidates independently
- ➔ **Several new blocks** might be found **at the «same» time**
- ➔ Clients may receive new blocks that are inconsistent
- ➔ The local copy of the blockchain may have forks

The Solution

- ➔ The «true» blockchain is defined by the **highest cumulative PoW** (difficulty)
- ➔ By selecting the greatest-difficulty chain, **eventual consensus** is achieved
- ➔ Miner **majority vote** defines the true chain
- ➔ Miners «vote» for the true chain by deciding which block/fork to extend

Financial Industry getting ne