

BLOCKCHAIN: AN INNOVATION TO EMPOWER ALL

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Introducing myself..

Ph.D. in Computer Engineering: Fault tolerance in distributed systems
Faculty at CSE and University at Buffalo (UB) for the past 3 decades



Launched a 4-courses [certification on blockchain on Coursera MOOC](#)



--More than 200,000 learners and 500,000 visitors from all over the world



supported Data-intensive computing since 2009 and recently in blockchain

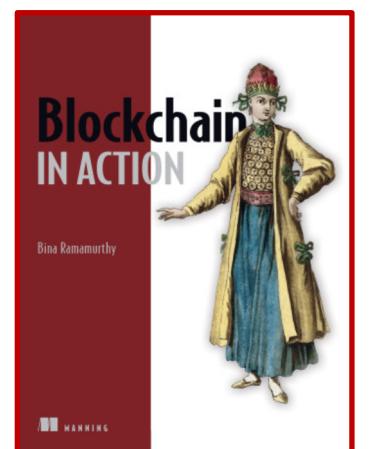


SUNY chancellor's award for excellence in teaching



My latest:

Author of a technical book: [Blockchain in Action](#) (Manning.com)



Goals for this presentation

Part I: What is blockchain? The innovation

Part II: Decentralized Application ~~development environment and~~ exploration.

Hands-on activity: experience a decentralized application.

Explore real transaction for information and intelligence

PART I : WHAT IS BLOCKCHAIN?

The innovation and the basic concepts

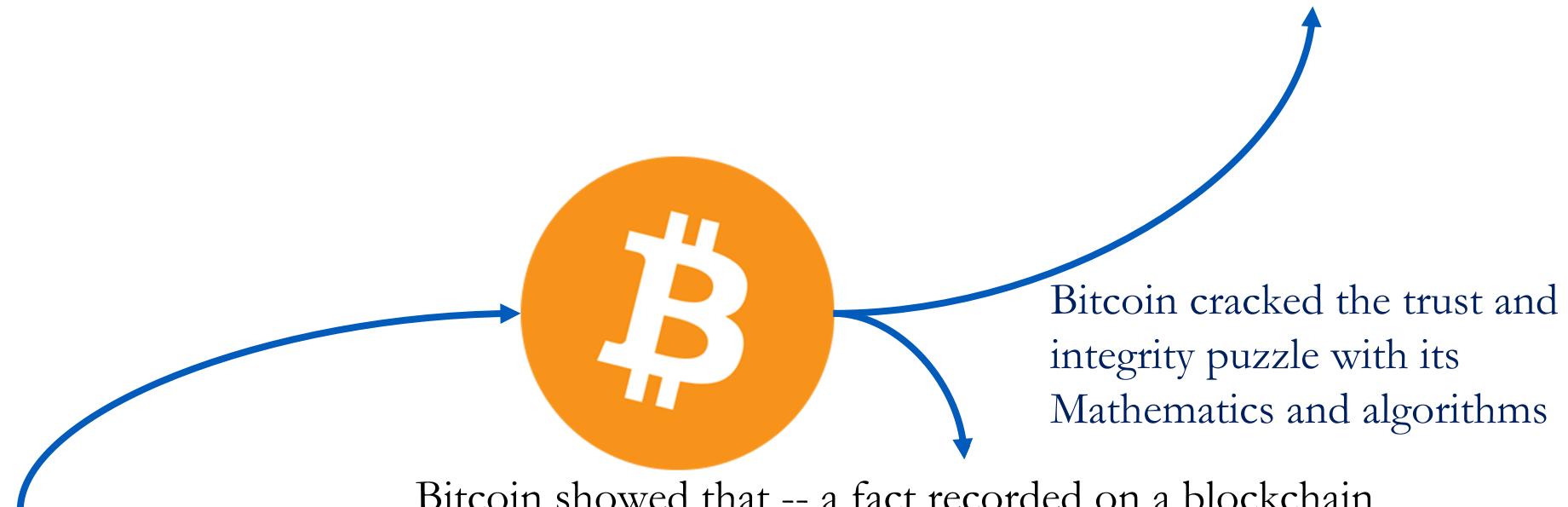


Bitcoin & Blockchain



2007-2008 financial meltdown

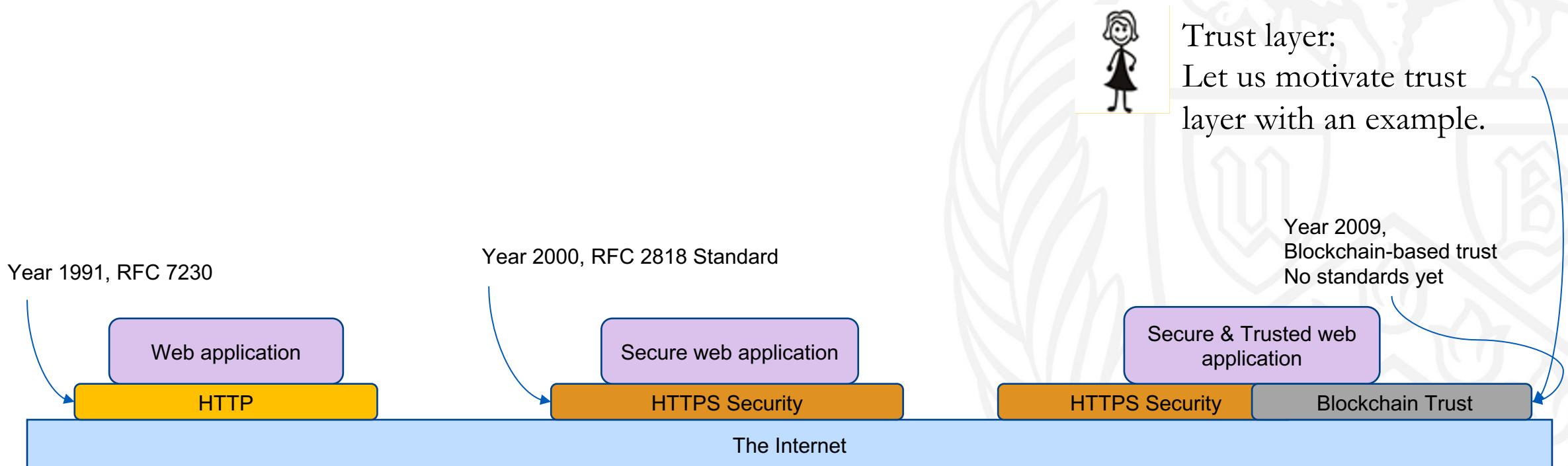
- Bitcoin 0.1.0 was released on 9 January 2009



Innovation: blockchain technology

Idea: What worked for cryptocurrency should work for other business transactions

- Trust is a critical component for trade and any type of business transaction.
- Take a look at the evolution of our Internet as shown here.



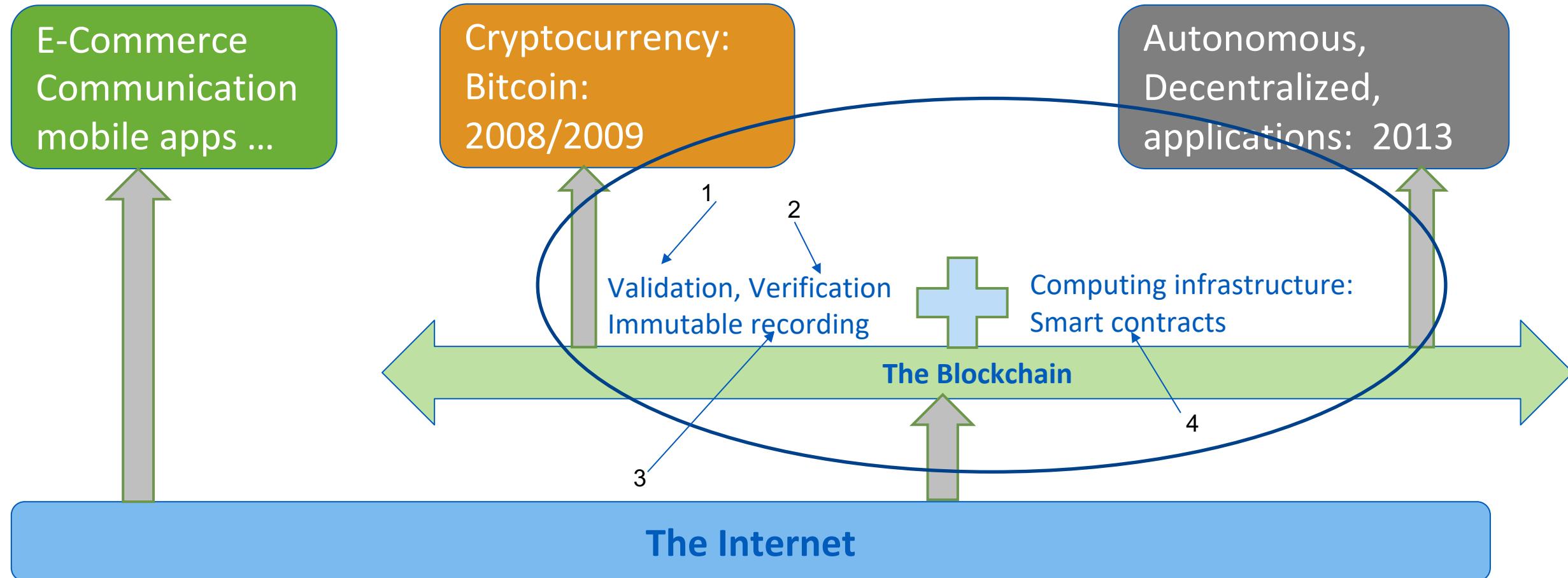
Blockchain is a... trust layer.

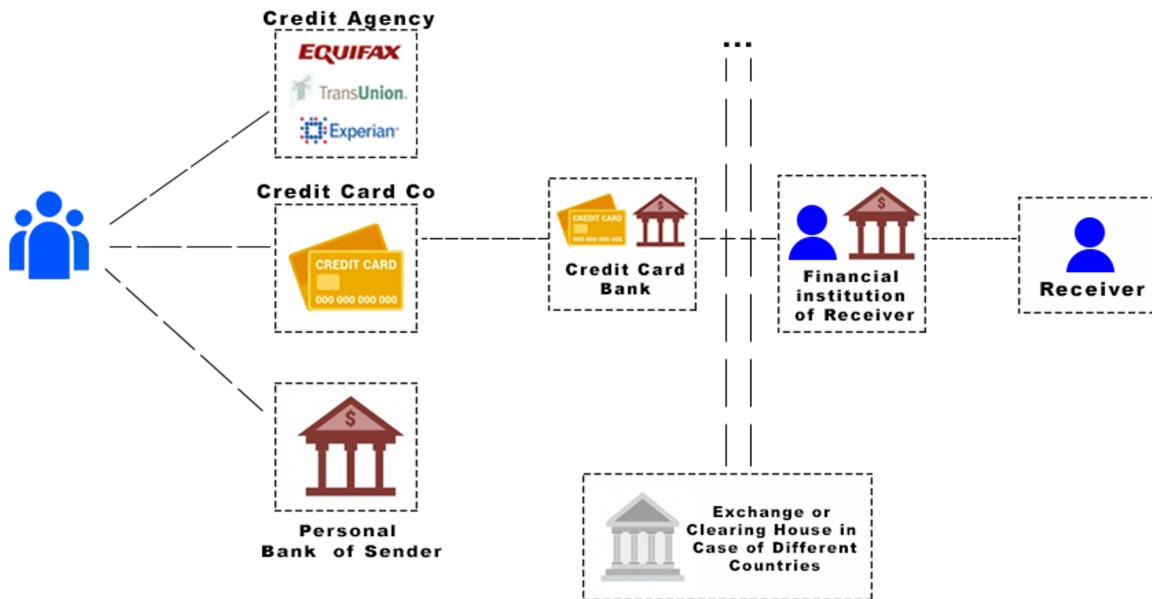
It is trust layer over the internet!

It enables peer-peer transactions without an intermediary or custodian like a bank.

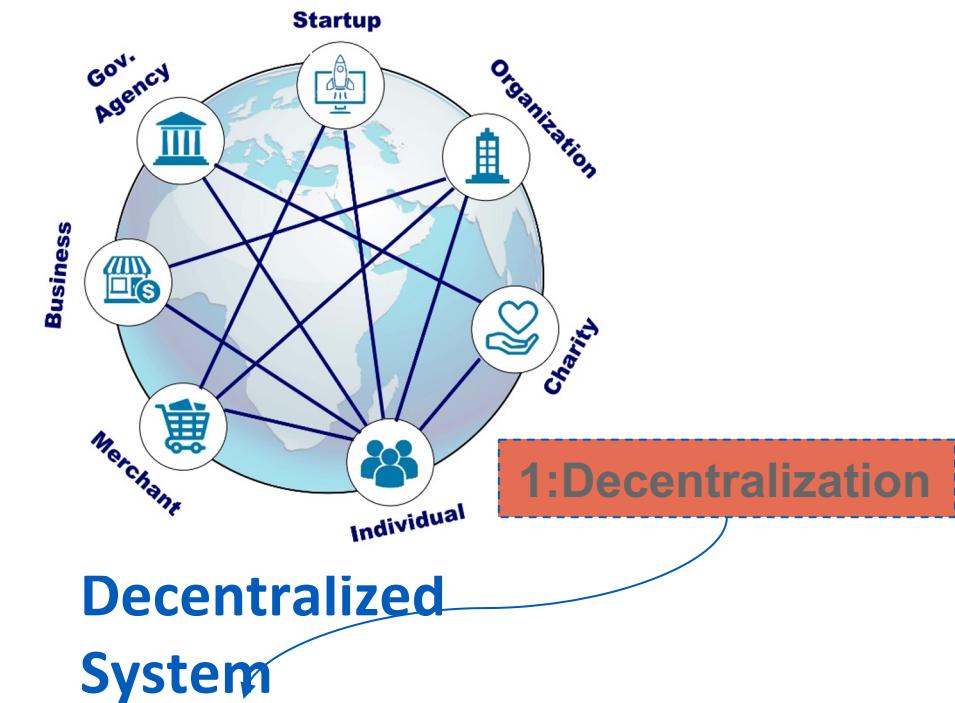
How does it do it?

How DO YOU do it? How do you establish trust about somebody... at the airport, at a **hotel check-in**, at a super market?



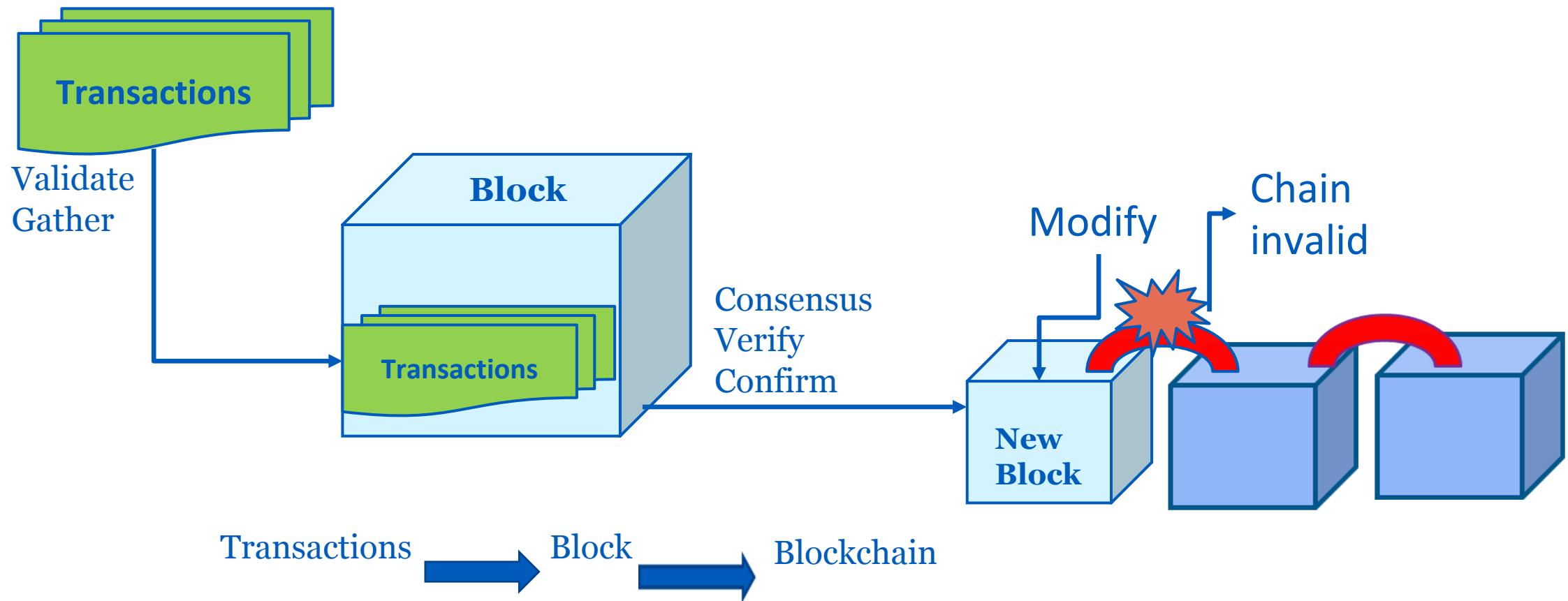


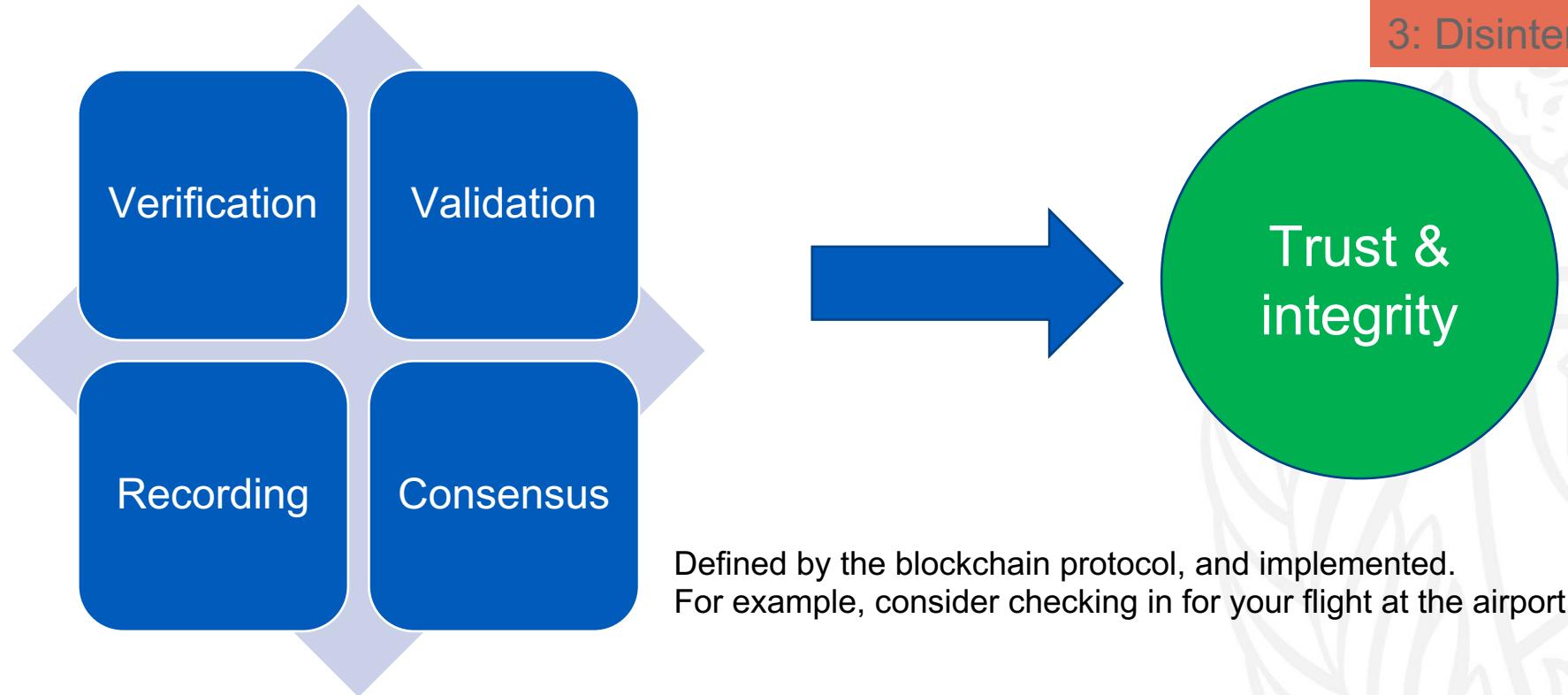
Traditional Centralized System



Functions of the intermediaries are shifted to the peer participants and the blockchain nodes:
 Disintermediation: validation, recording, verification using blockchain software

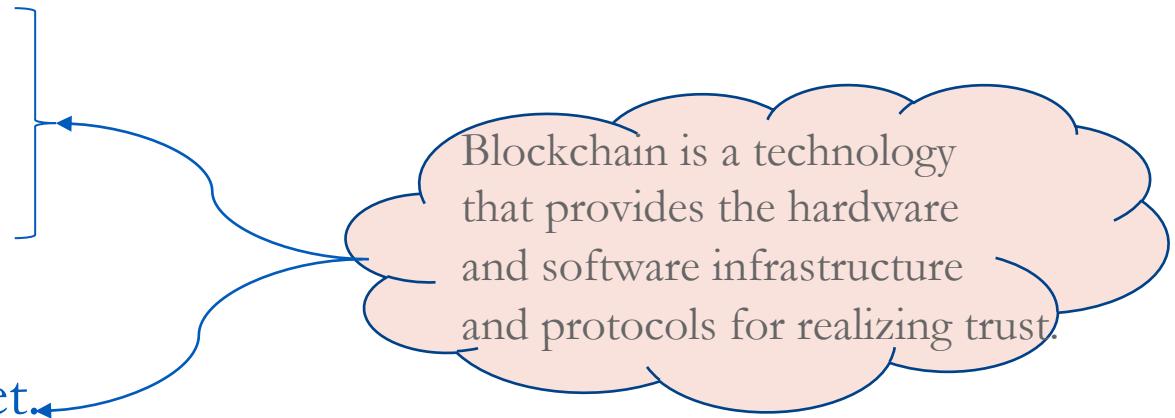
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- Decentralization
- Disintermediation
- Distributed Immutable Ledger

Blockchain is a trust layer on the internet.



On a strong foundation of more than 40 years of scientific research (cryptography, hashing, p2p, consensus protocols)

Enabling automation, accountability, auditability, efficiency, accuracy, fidelity, fairness, and inclusiveness.

PART II : ALL ABOARD THE BLOCKCHAIN TRAIN

Hands-on activities



Blockchain is people centered

- A major difference is that blockchain is meant for “trusted” peer-peer transactions.
- It is people/participant centered.
- It is not all about programming and application development.
- There is a role for every one of us to play.
- The decentralized applications are for planetary level participants.
- The technology encompasses all business domains not just FinTech and DeFi!
- It is like the Internet, but with a trust layer.
- It will allow enterprise and people to **transact** across the geographical borders.



Many blockchain platforms exists: we'll work with Ethereum.

Things you need to get on a blockchain

1. **Decentralized identity** : self-generated, self-managed. Cryptographically generated!
2. Hmm.. You need a **wallet and some accounts** connected to your identity!
3. You need some **balance (crypto) in your accounts!!**
4. **Spend** the crypto by sending to others and by transacting and interacting with applications!!!!

WHAT applications? Global cleanup, emergency services, food programs!



1. Let's generate by ourselves a decentralized identity! Yes, you can do it, without any central authorities.
 - ② Keep the seed phrase (mnemonic) representing your identity safe and secure. Do not share it with anybody.
2. Set up a digital wallet – add a plugin for your crypto wallet – MetaMask
 - ② Using the mnemonic in step 1, you can generate a deterministic set of account addresses for your wallet
 - ② The first account is the coinbase account. (This term is not about the coinbase exchange: In fact coinbase company name is derived from this terminology)
3. Let's collect some ethers for your wallet
 - ② Link to ether faucets for collecting some test ethers:
<https://faucet.dimensions.network/> or <https://faucet.ropsten.be/>
 - ② BTW, we are going to be on Ropsten **testnet**, a fork of mainnet Ethereum
4. Let's deploy the UI and interact with a Dapp. In this case, a simple decentralized counter.

Refer to the handouts here: <https://drive.google.com/drive/folders/16nfgN-Qg6Lhcg8o-4LZGG-RPReLH2gon?usp=sharing>

- Hope you are all prepared with the document I sent earlier. If you are not please install the software I requested you to install NOW. Otherwise, you'll have to do the hands-on activity yourself.
- We'll use a web tool : Ian Coleman's BIP39 web tool.
- Follow along the handout provided.
- One of my identity: 0xF6117c946a33Cc0A105Ac131fDED8f17fbD9F4e6
- You can reveal your identity to the world but not the mnemonic or key phrase

- Here are some ways you identify yourself to the business system you are in : Driver's license, social security number, person number in an education institution, employee number.
- Think about these, these are all your affiliations to a centralized institutions.
- In a decentralized system, where participants are unknown, and can join and leave as they wish, how can we identify them?
- We need a self-generated secure identity for you. Let's do that.
 - Derived from a private-public key pair of 256 bits each, your identity is derived from this pair, 160 bits account number on Ethereum "blockchains".

- Do you have Chrome browser installed?
 - Make sure you've added MetaMask plugin to your Chrome browser.
 - MetaMask will serve as your account manager and a wallet.
 - Create one or more accounts.
-
- Next step is to get some Ethers to your wallet. Follow along in the handout.

Get some test ethers

- There are faucets that provide limited number of test ethers per account.
- Sometimes the limits are per day: 1 Ether per day in Ropsten faucet
- <https://faucet.dimensions.network/> or <https://faucet.ropsten.be/>

- We are using Ropsten test network.
- Prerequisite is that you have a github account.
- From your chrome browser, link to faucet.kovan.network
- Copy and paste your address.
- Get 1 ether transferred to your account. You can get 1 Ether (test ether) every 24 hours.
- Now you're ready to run a decentralized app (Dapp) I have deployed.

- Download the decentralized app from google drive:
<https://drive.google.com/drive/folders/16nfgN-Qg6Lhcg8o-4LZGG-RPReLH2gon?usp=sharing>
- Hope you had already installed node.js
- If you have not, it is time to do that now.
- Unzip the counter.zip, navigate to the folder:

```
npm install
```

```
npm start
```

- Prerequisite: All the software I has provided in the handout should have been installed.
- Unzip the code counter-app.zip
- Open a terminal window by typing cmd on Windows, opening a terminal on Mac.
- Navigate to the directory /folder where you unzipped the counter-app
- Issue the command

npm install

npm start

- You should see several information lines followed by this message:

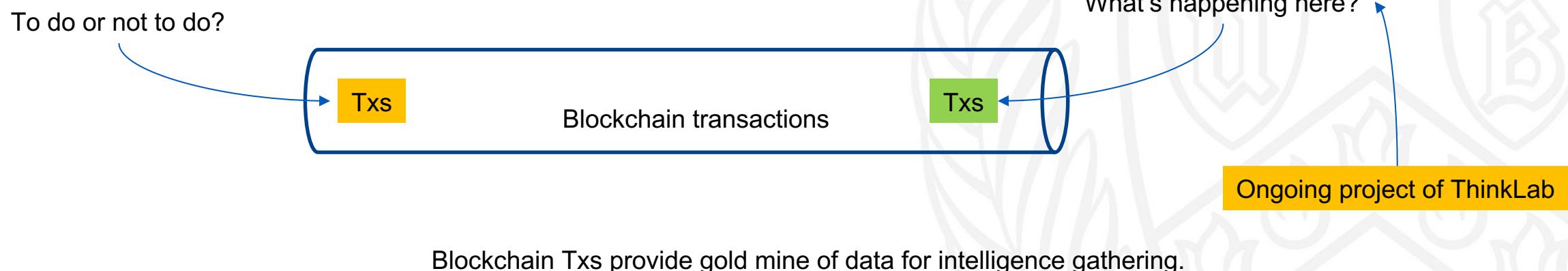
Counter Dapp listening on port 3010!

- Now open the chrome bowser, and link to localhost:3010
- You should see an interface to interact. Wait for my instructions at this time before you interact.

- Link to localhost:3010
- Enable your accounts on the wallet using the mnemonic phrase.
- You'll have to connect to the web interface of the Dapp from MetaMask wallet.
- Why the wallet? Every interaction with the Dapp costs Txn fees and you'll have to sign/confirm the Txn.
- What do you do after you connect?
- Let's interact. Make sure your values for incrementing and decrementing are within 1-100.

Relating blockchain to intelligence (AI)

- Upstream AI processes can inform what Txns can you initiate.
- Blockchain Txns.
- Downstream analysis on the blockchain Txns to gather intelligence.



A peek into blockchain Txns.

We can also break down the parameters of the Txns.

Txn Hash	Method ⓘ	Block	Age	From ⚠	To ⚠	Value	Txn Fee
0xf9853740fe747135182...	0x59664f34	10202261	18 mins ago	0xf6117c946a33cc0a105...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.000028606
0x1d6bd9a49108efdd52...	0xc03c3003	10202243	24 mins ago	0xf6117c946a33cc0a105...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.000043574
0x194392543a1b691cad...	0xc03c3003	10177594	3 days 23 hrs ago	0x5e0a075f0000000000000000...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.000013423
0x2db705fd0ea9d59fe4f...	0xdb7dd6b5	10177576	3 days 23 hrs ago	0x5e0a075f0000000000000000...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.000026688
0x7c8bc4fb3f1b9d74812...	0xdb7dd6b5	10177563	3 days 23 hrs ago	0x5e0a075f0000000000000000...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.000026688
0xbadb889efa53c1b113...	0xdb7dd6b5	10096428	15 days 14 hrs ago	0xc49c2f70465d5104adc...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.000026736
0x8780056aa434a5b032...	0xdb7dd6b5	10096414	15 days 14 hrs ago	0x40e5f653ae504afcee3...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.000026832
0x974ea1850ce866d0b6...	0xdb7dd6b5	10096413	15 days 14 hrs ago	0x40e5f653ae504afcee3...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.000026832
0x0c2e8d8e2d1d9434fe...	0xdb7dd6b5	10096411	15 days 14 hrs ago	0x40e5f653ae504afcee3...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.000026832
0x68aefeb7b810edf43fc...	0xdb7dd6b5	10096404	15 days 14 hrs ago	0x40e5f653ae504afcee3...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.00002682
0xd3e3804a6af0562634...	0xdb7dd6b5	10096402	15 days 14 hrs ago	0x40e5f653ae504afcee3...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.000026712
0x2efdc03752b9b44fb10...	0xdb7dd6b5	10096390	15 days 14 hrs ago	0xc49c2f70465d5104adc...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.00013368
0x8c5fbcd27ef86815367...	0xdb7dd6b5	10096376	15 days 14 hrs ago	0xc49c2f70465d5104adc...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.000026736
0x4f9b94a89110729b86...	0xdb7dd6b5	10096376	15 days 14 hrs ago	0xc49c2f70465d5104adc...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.000026544
0x3e8b3eca1eb75ef0ec...	0xdb7dd6b5	10096360	15 days 14 hrs ago	0x3f9a6916e18e8a665...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.00002652
0xb016c352b0c357c0bc...	0xdb7dd6b5	10096357	15 days 14 hrs ago	0x40e5f653ae504afcee3...	IN 0xbeaf8319e8bd47fa82c...	0 Ether	0.000026532

What next?

- Counter-app is just one small example!
- What you've experienced is tiny tip of the iceberg. Find more details in my book Blockchain in Action.
- I chose to use the Ethereum blockchain platform because its code is open source.
- Solidity language, Remix and Truffle IDEs, test chains Ganache and Ropsten, MetaMask browser-plugin wallet.
- Six end-to-end Dapps: Not only for developers but also for other thinkers:
 1. Digital democracy
 2. Blind auction (decentralized auction platform)
 3. Airline consortium (Marketplace for seats)
 4. Micropayment channel (for planetary level operations)
 5. Tokenization of assets (for global trade)
 6. Educational credentialing (counting education from various sources)
- More 150 figures explaining the various concepts

Summary

- Blockchain technology is not about cryptocurrency anymore.
 - It is used for broad range of applications across many industries: finance, healthcare, government, manufacturing, and distribution.
- Blockchain can enable an inclusive economy.
- Blockchain has created exciting new opportunities and innovative application models:
 - Global collaboration systems, self-governing systems, open government.
 - Private, public and permissioned models to meet diverse business needs.
 - It is here to stay, in one form or another.

Sinical view

To make a railroad round the world available to all mankind ...-- Henry David Thoreau

In his famous book *Walden*

Blockchain can be that railroad that Thoreau never got to see.