Guest Lecture: An Introduction to bitcoin

Murch

2015-06-02

Introduction

What is Money?

What is Bitcoin?

History of Bitcoin

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History of Bitcoin

Who am I?

Name: Murch

Job: my job

Why here? Because I can’t stop talking and thinking about Bitcoin

Qualification: Spent lots of time reading and writing about Bitcoin

Introduction

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History of Bitcoin

What is money?

Examples for Money?

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Examples for Money?

Properties of Money?

Definition of Money

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Definition [en.wikipedia.org/wiki/Money]

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Money is a technology that facilitates trade.

Two Categories of Money

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Definition

Commodity Money is based on the inherent value of the exchange medium.

Examples:

Two Categories of Money

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Examples: US Dollar $, Euro €, Bank statement

What shortfalls does Money have?

So, Money is pretty useful, but...

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So, Money is pretty useful, but...

What problems can you think of?

Currency is inefficient and slow

- Wire transfers take 2+ days
- Intercontinental wire transfers 7+ days
- Handling cash is inconvenient

Currency is expensive to maintain

- Cash has to be counted and transported
- Bills have to be replaced every 2-5 years
- After time coins’ value lower than production cost

Digital currency lacks privacy

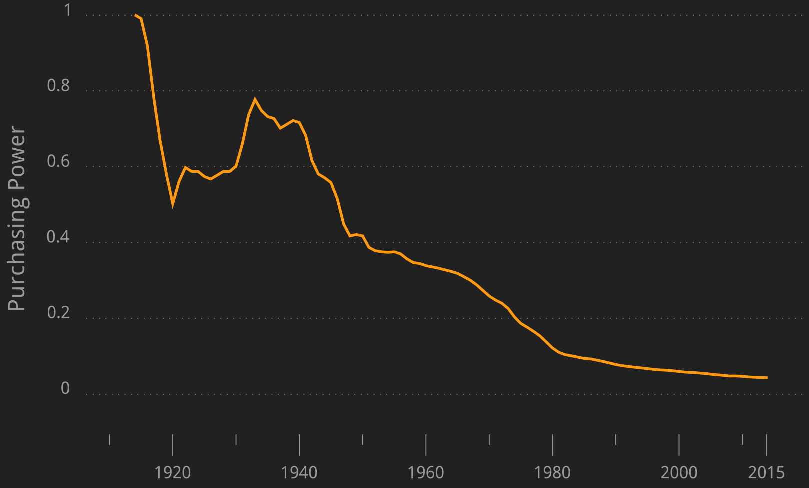
- Bank tracks your payments
- Credit Card Companies track your payments
- Government tracks your payments

Only cash is private.

Inflation

- Goverments set money policy
- Banks create additional money

Loss of Purchasing Power



Data: U.S. Bureau of Labor Statistics, Detailed CPI report 2015-04

Lack of Control

- Transfer and Storage controlled by third parties
- Limited Freedom to choose recipients
- Counter-party risk

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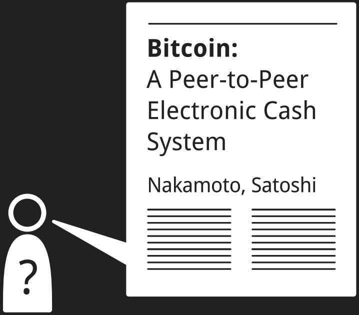
What is the connection to Bitcoin?

Bitcoin is a new payment system designed to address these problems.

Enter Satoshi Nakamoto



Bitcoin:
A Peer-to-Peer Electronic Cash System

Nakamoto, Satoshi

Bitcoin in a nutshell

- New way to send payments via internet

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- Agreement to treat digital tokens named bitcoins as money

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- Users remain private

Privacy in Bitcoin

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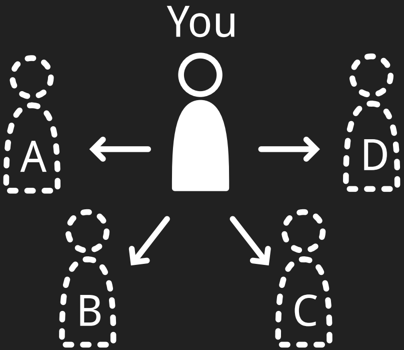
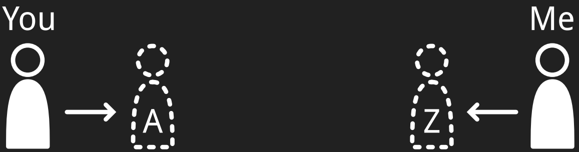


Spending bitcoins

You

Me

Spending bitcoins



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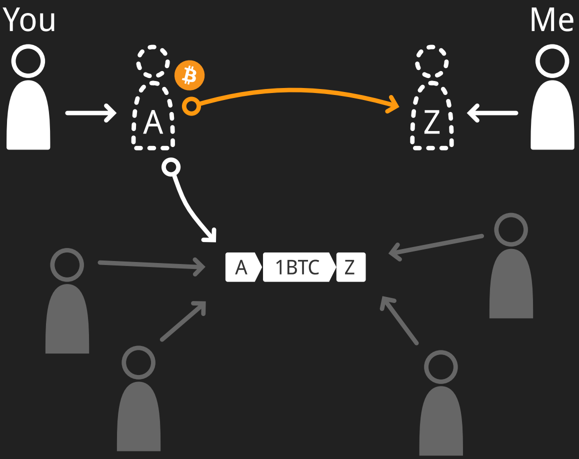

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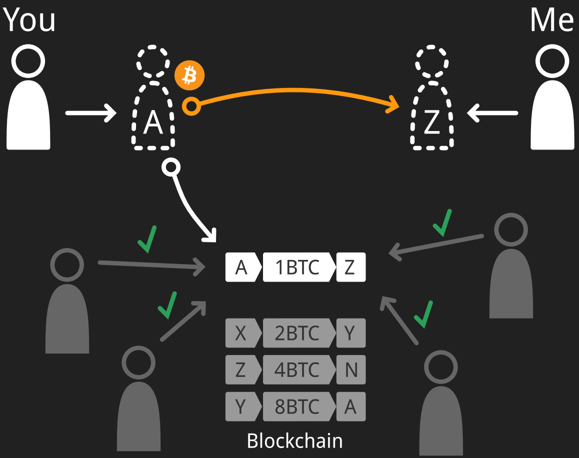

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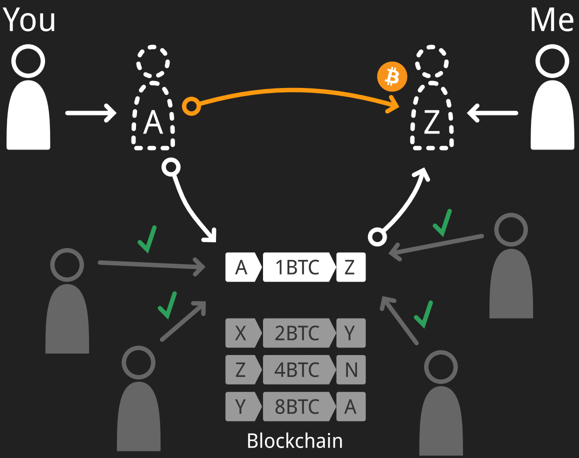
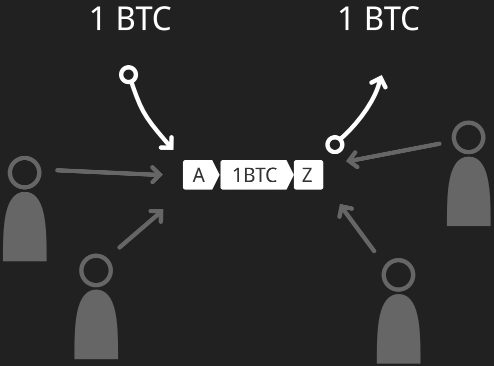


Let’s see this live

Address: 1LNHme4E5mrhUk4tbLpb75Q5aq81F8Mb95

Who pays for Bitcoin?



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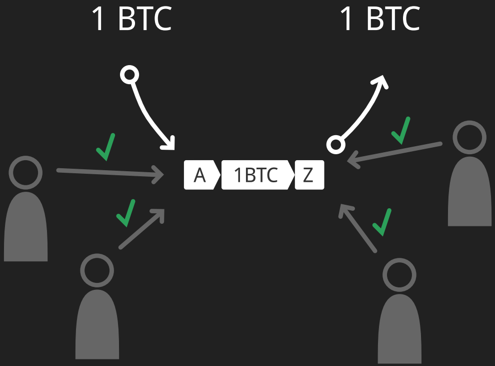

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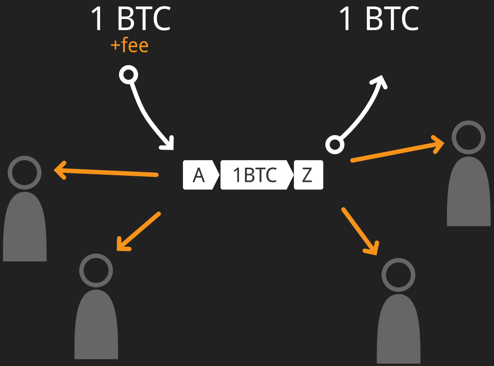

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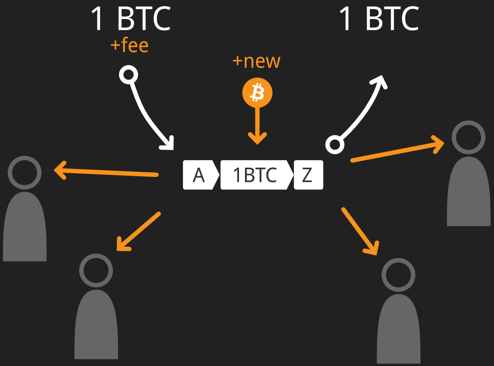

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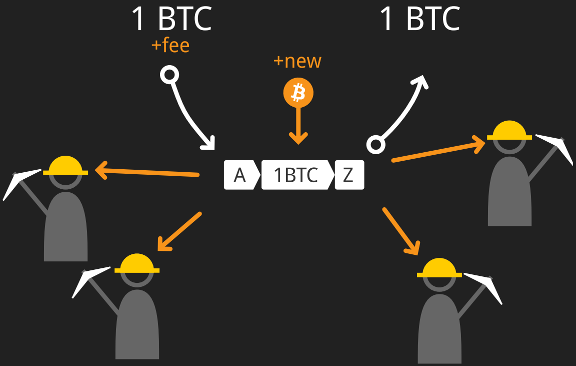
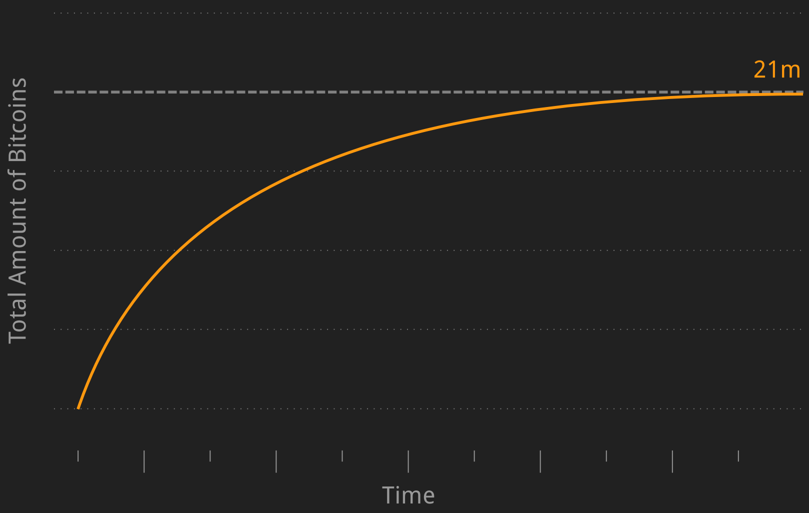


Bitcoin is a Limited Resource



Getting started with Bitcoin

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2. Get a wallet

Desktop	MultiBit
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3. Get bitcoins
4. Spend bitcoins

That’s how Bitcoin works

Any questions so far?

Review: Definition of Money

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Does Bitcoin solve other Moneys’ shortfalls?

Issue	Bitcoin
Slow	Fast
Expensive to maintain	Network pays for itself
Lack of Privacy	Private/Pseudonymous
Inflated	Limited Supply
Lack of Control	Puts user in control

What makes bitcoins valuable?

Bitcoin is a limited resource and useful/convenient.

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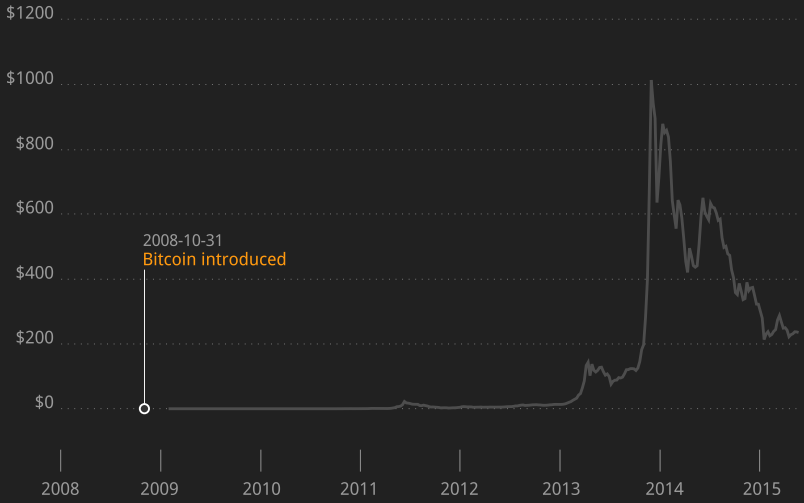
- Reputation

A Brief History of Bitcoin



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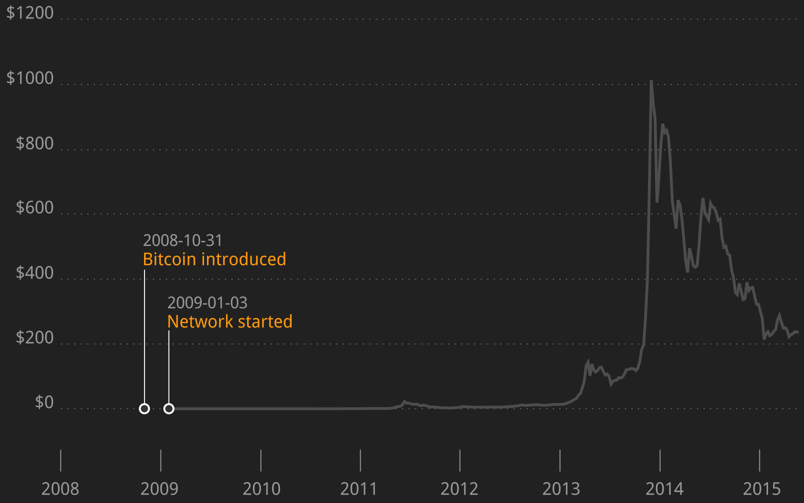

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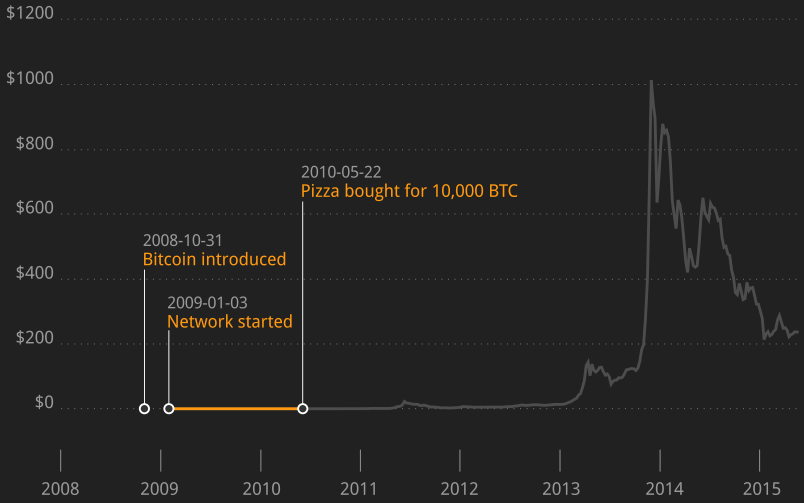

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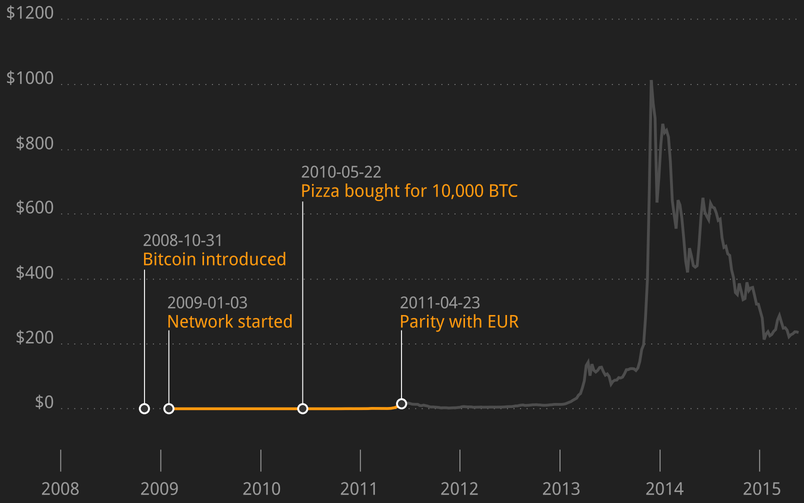

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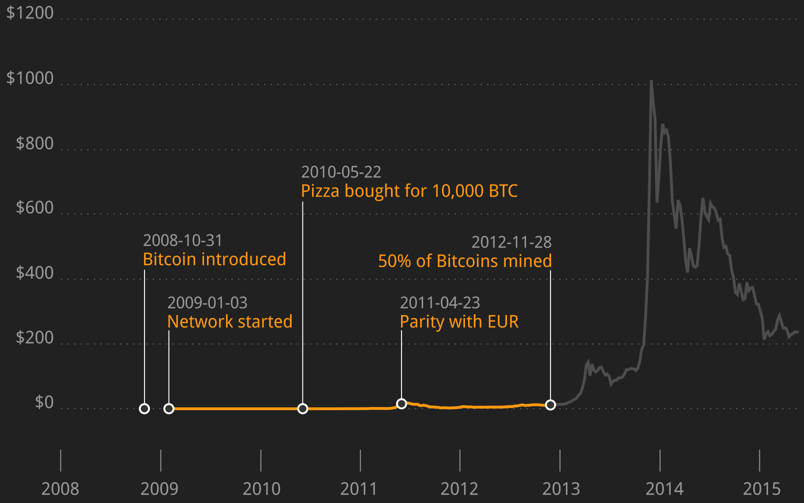

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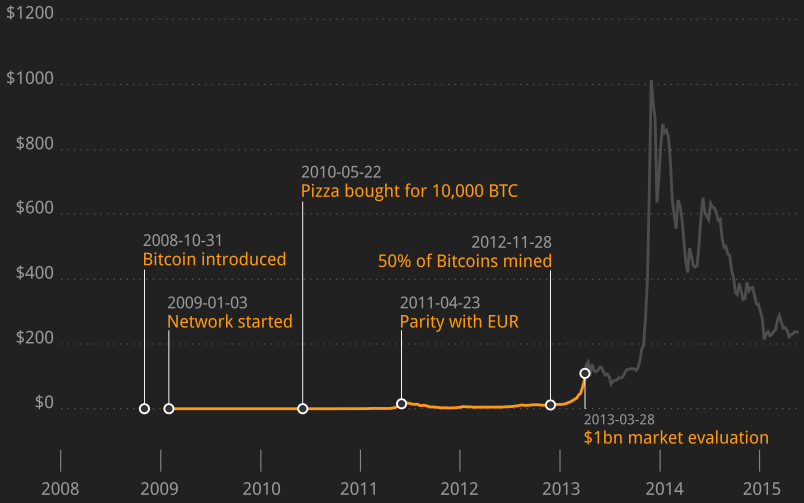

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$1bn market evaluation

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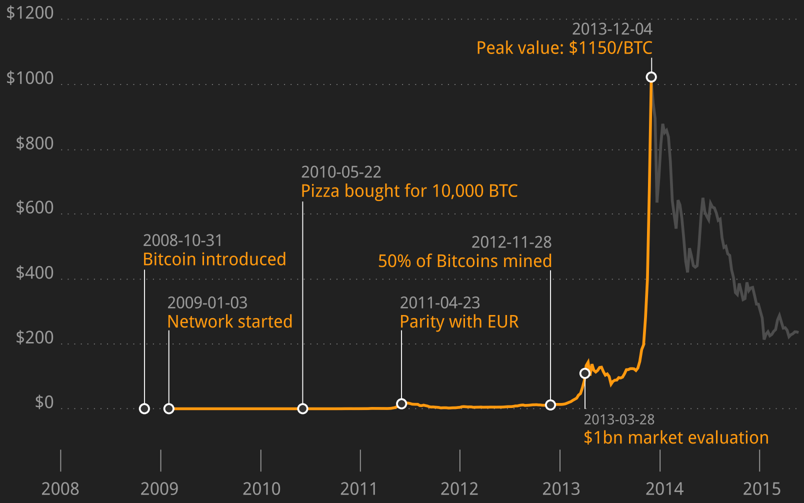

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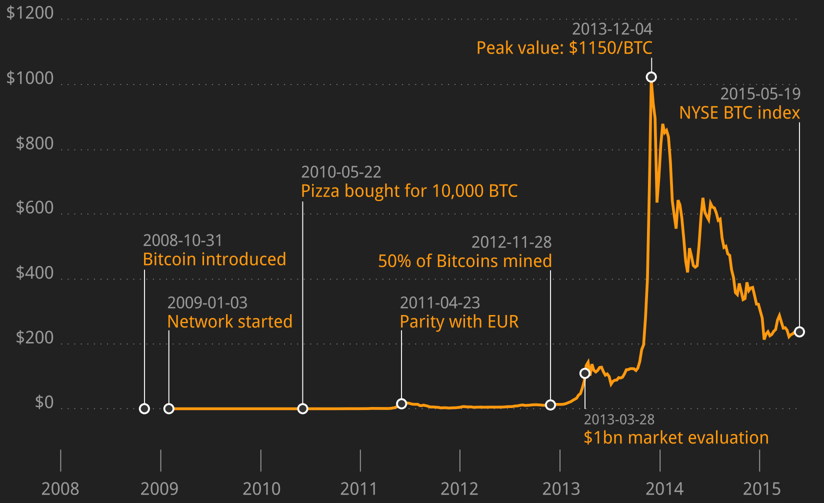

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- Altcoins: $\sim$725, e.g. , , , ,

Thank you for your attention

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Any more questions?

Byzantine Generals’ Problem

Bitcoin solves the *Byzantine Generals’ Problem*: How to achieve consensus in a distributed network with potential adversaries.

Alternative Bitcoin Definition

Definition

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... quite a mouthful, huh?

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- Solves the double-spend problem, and counterfeiting.

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Conclusion

As the Bitcoin network is useful, but not owned by any

Detailed Comparison to other forms of Money

Transaction Cost	Precious Metals	Fiat Currencies	Bitcoin
Storage	0.15% to 1% p.a.	Subsidized by FRB	Free
Transportation	Expensive	Inconvenient	Easy & Free
Fiduciary Media	Inevitable	Inherent	Impossible
Recordkeeping	Manual	Mostly manual	Automatic
Issuance	Mining	Politics	Algorithm
Payment Clearing	Expensive	Centralized	Cheap & Distributed
Scarcity	High	Arbitrary	Fixed - 21 million
Authentication	Expensive Assay	Trust counterparty	Built-in
Security	Physical	Institutional	Cryptographic

Addresses in Detail

Transactions in Detail

Blocks in Detail

Private Keys in Detail

Transactions in Detail

Blockchain in Detail

Who controls Bitcoin?

Is Bitcoin a Pyramid Scheme?

How is Scarcity Implemented?

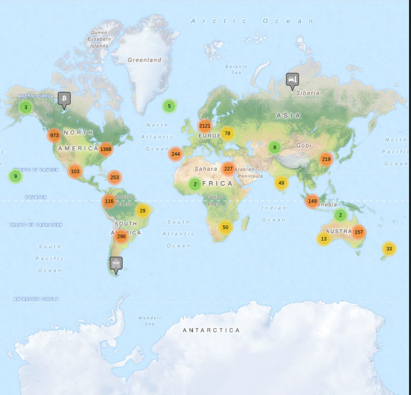
Why can't bitcoins be counterfeited?

Who is *Satoshi Nakamoto*?

Hardly any personal information available.
Commits during US east coast working times
used British and American spelling at times
Probably not a cryptographer by trade -> source
Combination of Economics, Computer Science,
Programming, Ideology

Where can one spend Bitcoin?

A range of internet merchants already accepts Bitcoin such as: Microsoft, Dell, Overstock,...
Brick-and-mortar store adoption is coming more slowly:



How does one obtain Bitcoin?

- Buy them on Exchanges, such as Bitstamp.com
- Offer goods or services for Bitcoin
- Mining (only on industrial scale today)

Is Bitcoin anonymous?

No. Bitcoin is private, but completely transparent. Therefore, it is not anonymous per se, but rather pseudonymous.

Strategies to maintain privacy in the network:

- Use every address only once, i.e. especially don't get your salary always paid to the same address.
- Don't spend transaction outputs together from accounts that should not be linked.

Nodes don't have identities. Addresses can be changed frequently, mining is performed almost independently of either of those.

Identity in the Bitcoin Network

- Addresses stand in as *Identities* in the Bitcoin network.
- Only the owner can speak for the identity as only the owner of the secret key can validly sign messages

Why is it easy to verify blocks, but hard to find them?

- To find a block one has to find a combination of the block content and a random value which maps to a subset of the possible hashoutputs

Double-Spending

Double-Spending: How do you know that you are the sole owner of a digital good? I.e. images are easy to copy and distribute. The problem is to create a distributed consensus.

Bitcoin solves the Double-Spending problem. This happens by publishing updates to the balances in the network through a blockchain. The blockchain is immutable, because it is secured by Proof of Work.

What is a Cryptographic Hashfunction?

How does Bitcoin achieve decentralization?

Who maintains the ledger? Who has authority over transaction validity? Who creates new bitcoins? Who determines changes in the rules of the Bitcoin systems? Why are Bitcoins valuable?

Distributed Consensus

Goal

When the protocol terminates, all correct nodes decide on the same value.

Challenges

- Malicious Nodes
- Latency and no "global time"
- Byzantine generals problem
- not all nodes interconnected / online at all times

Solution

Embraces randomness
Incentivizes good behavior