An introduction to Bitcoin

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1. Electronic gold
2. The blockchain
3. The Bitcoin Network
4. The Byzantine Generals Problem
5. Bitcoin addresses
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7. Why bitcoin is money?
S. Nakamoto, November 1st 2008,

“Bitcoin: A peer-to-peer electronic cash system”

Abstract. A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timelocks transactions by linking them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be altered without making the proof-of-work invalid. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the longest pool of CPU power. As long as a majority of CPU power is controlled by nodes that are not conspiring to attack the network, they’ll generate the longest chain and outpace attackers. The network itself requires minimal resources. Messages are broadcast on a best-effort basis, and nodes can leave and rejoin the network at will, accepting the longest proof-of-work chain as proof of what happened while they were gone.

1. Introduction

Commerce on the Internet has come to rely almost exclusively on financial institutions serving as trusted third parties to process electronic payments. While the system works well enough for most transactions, it still suffers from the inherent weaknesses of the trust-based model. Completely non-reversible transactions are not really possible, since financial institutions cannot avoid mediating disputes. The cost of mediation increases transaction costs, limiting the minimum practical transaction size and cutting off the possibility for small casual transactions, and there is a broader cost in the loss of ability to make non-reversible payments for non-reversible services. With the possibility of reversal, the need for trust spreads. Merchants must be wary of their customers, handling them as much information as they would otherwise need. A certain percentage of fraud is accepted as unavoidable. These costs and payment uncertainties can be avoided in person by using physical currency, but no mechanism exists to make payments over a communications channel without a trusted party.

What is needed is an electronic payment system based on cryptographic proof instead of trust, allowing any two parties to transact directly with each other without the need for a trusted third party. Transactions that are computationally impractical to reverse would protect sellers from being defrauded by the goods being returned and then the proceeds being stolen. The network serves to verify transactions between parties and to prevent double-spending. We refer to this network as the Bitcoin Network.
Transparency Theorem

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- Bitcoin protocol runs on open software.
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To avoid the “**double spend problem**” Bitcoin relies on a public ledger. This is general and necessary:

**Theorem**

*Transparency Theorem*: An *electronic decentralized currency must rely on a public ledger.*
The blockchain

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- The blocks are generated by “miners” that validate current transactions.
The Trust Machine

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- The mechanism of consensus: “The trust machine”.

The Economist

How the technology behind bitcoin could change the world
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Reaching consensus

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**The Byzantine Generals Problem.**

*The situation can be described as the siege of a city by a group of generals of the Byzantine army. Communicating only by messenger, the generals must agree upon a common battle plan. However, one or more of them may be traitors who will try to confuse the others. The problem is to find an algorithm to ensure that the loyal generals will reach an agreement.*
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- The miner that solves it receives an award in newly created bitcoins.
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- Public address: 14xuSZXtfGw5XqfYxEjp4crwYGYQDWmZ12
Monetary mass

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- The next halving in production of bitcoins will be next July 2016. Then 12.5 will be created with each new block.
- Bitcoin is a deflationnary currency.
- Each bitcoin is composed by 100 million satoshis (basic unit).
Monetary inflation

Bitcoin monetary inflation tends to 0

Inflation since 2012

Blocks since 2012

Inflation %

200000 250000 300000 350000 400000
What is money?

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The distinction between good and bad money is CONFIDENCE

- Confidence to be able to spend it in the future keeping its value.
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  2. Gold is backed by its physical properties.
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  2. Gold is backed by its physical properties.
  3. Bitcoin is backed by mathematics and the computation power of the network.
Properties of good money

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- Good money preserves or increases its value over time.
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- Good money is not volatile.
Bitcoin volatility

Bitcoin exchange rate volatility is high but decreases over time
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