

# An introduction to Bitcoin

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(*Bitcoin and Decentralized Trust Protocols*, Newsletter of the European Math. Soc., 100, June 2016. ArXiv 1601.05254)

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- 1 Electronic gold
- 2 The blockchain
- 3 The Bitcoin Network
- 4 The Byzantine Generals Problem
- 5 Bitcoin addresses
- 6 Monetary Theory
- 7 Why bitcoin is money?

# Bitcoin paper

S. Nakamoto, November 1st 2008,

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

## Bitcoin: A Peer-to-Peer Electronic Cash System

Satoshi Nakamoto  
satoshi@bitcointalk.org  
www.bitcoin.org

**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 still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the largest pool of CPU power. As long as a majority of CPU power is controlled by nodes that are not cooperating to attack the network, they'll generate the longest chain and outpace attackers. The network itself requires minimal structure. 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, bounding them for extra information that 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 an 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 willing parties to transact directly with each other without the need for a trusted third party. Transactions that are computationally infeasible to reverse would protect sellers

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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.*

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

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





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## **The Byzantine Generals Problem.**

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- The miner that solves it receives an award in newly created bitcoins.



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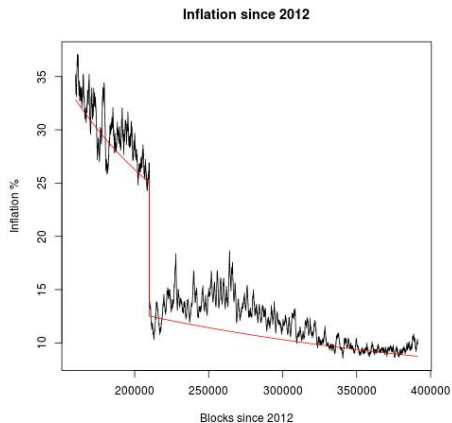
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- Bitcoin is a deflationnary currency.
- Each bitcoin is composed by 100 million satoshis (basic unit).

# Monetary inflation

## Bitcoin monetary inflation tends to 0



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  - 3 Bitcoin is backed by mathematics and the computation power of the network.

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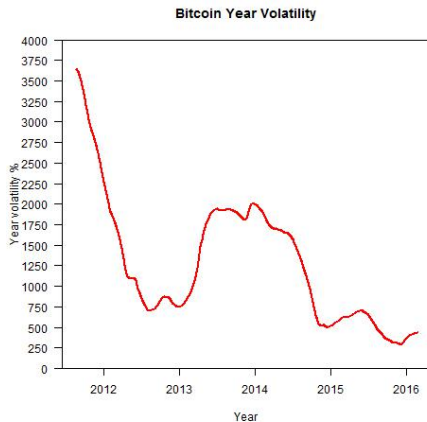
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- Good money is not volatile.

# Bitcoin volatility

Bitcoin exchange rate volatility is high but decreases over time



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