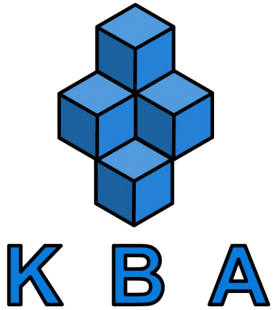
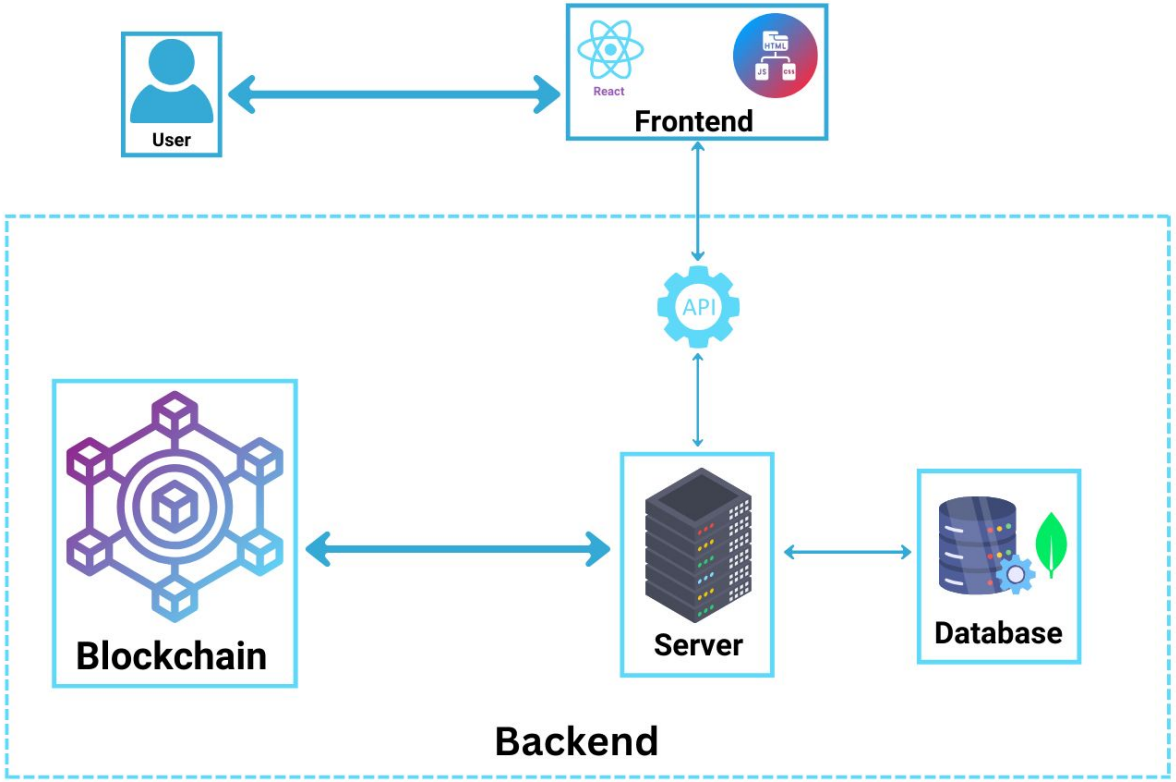


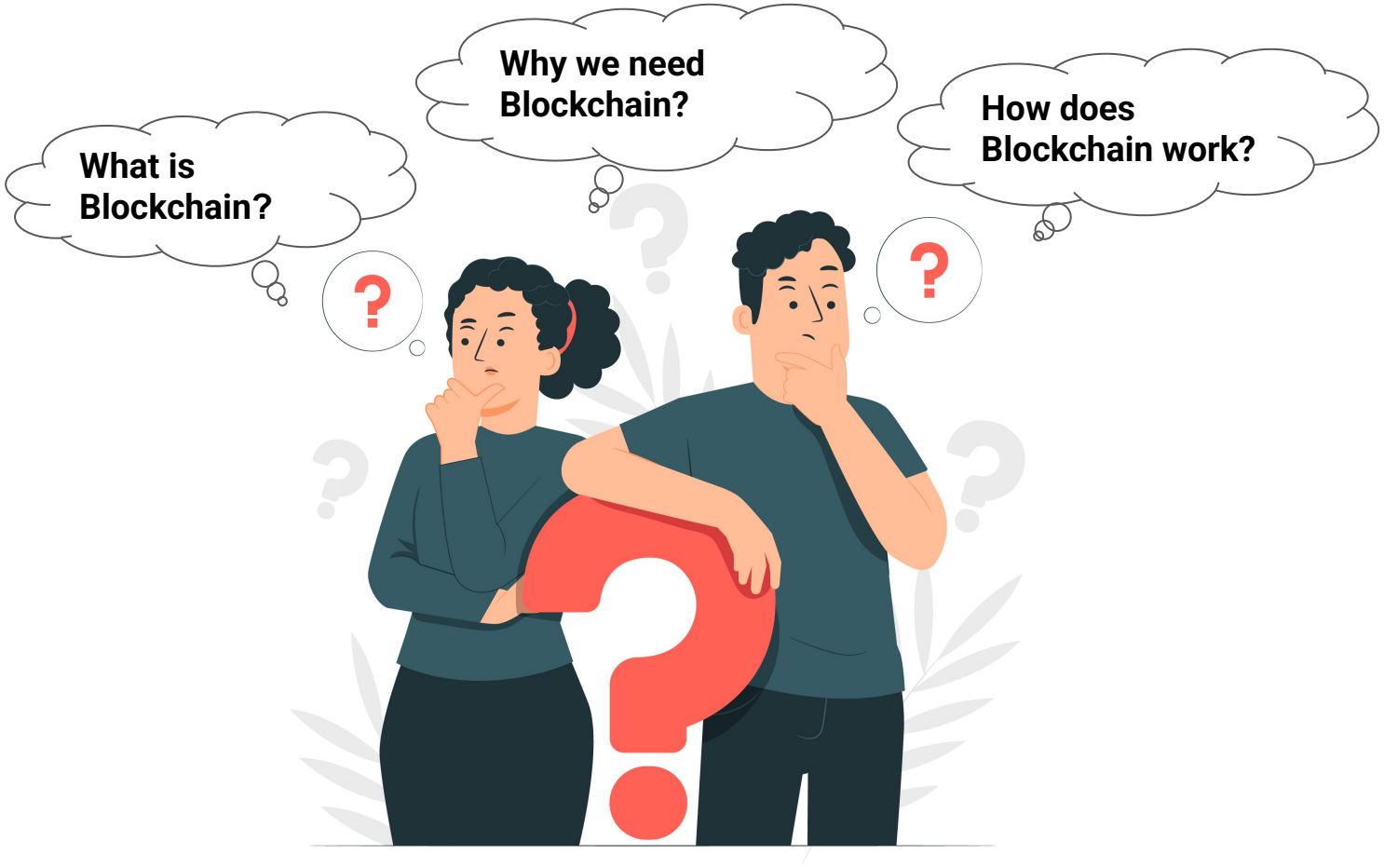
Introduction to Blockchain

Development Architecture

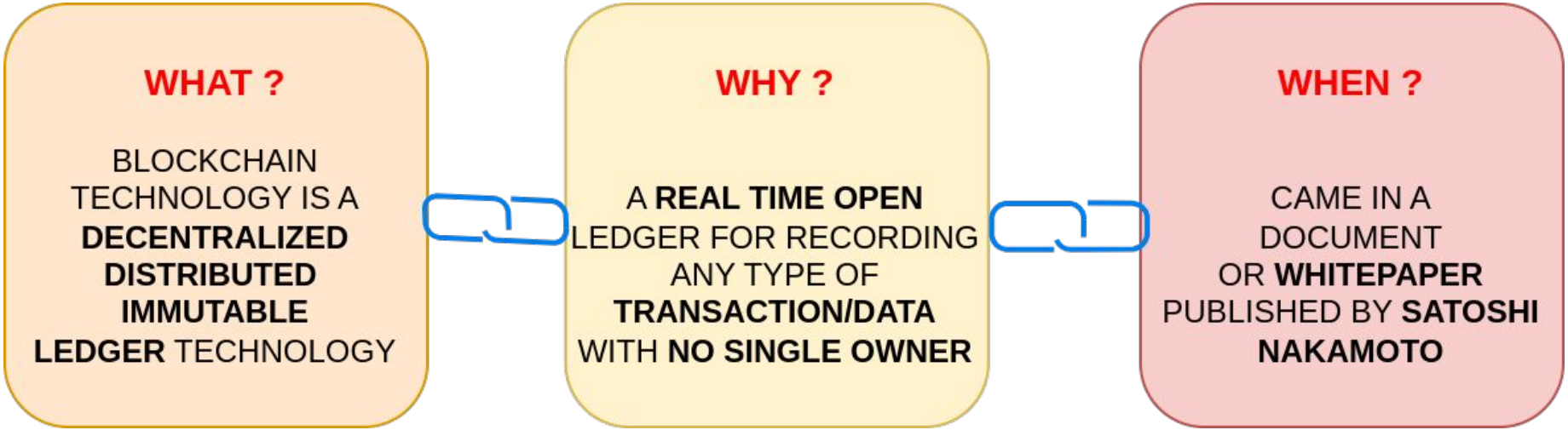


Agenda

- Blockchain Introduction
- Consensus algorithms
- Types of Blockchains
- Application areas


What is Blockchain?
Why we need Blockchain?
How does Blockchain work?

DEFINING A CHAIN



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CENTRALIZED

DECENTRALIZED

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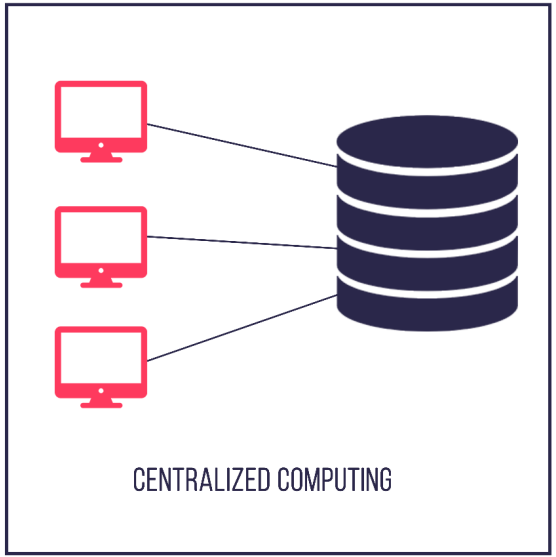
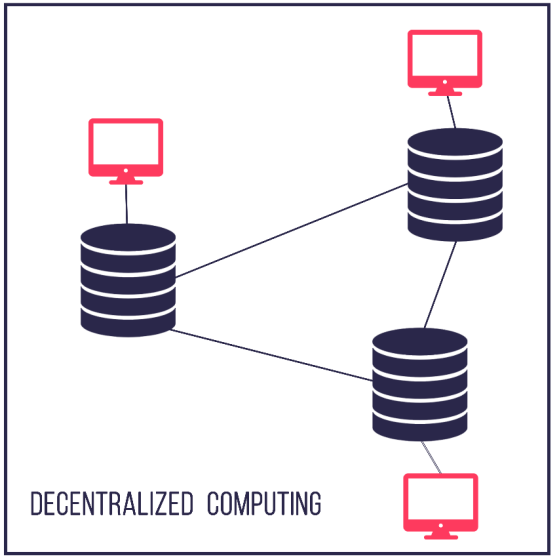
Decentralized Computing





KBA

2008

"Bitcoin: A peer to peer electronic cash system" by an anonymous entity called Satoshi Nakamoto

2009

Satoshi launches Bitcoin as an alternative to current financial system

2010

Laszlo Hanyecz bought 2 pizzas for 10,000 bitcoins (BTC). As per current price, it amounts to 29366956230 INR (Nov, 2023)

2023

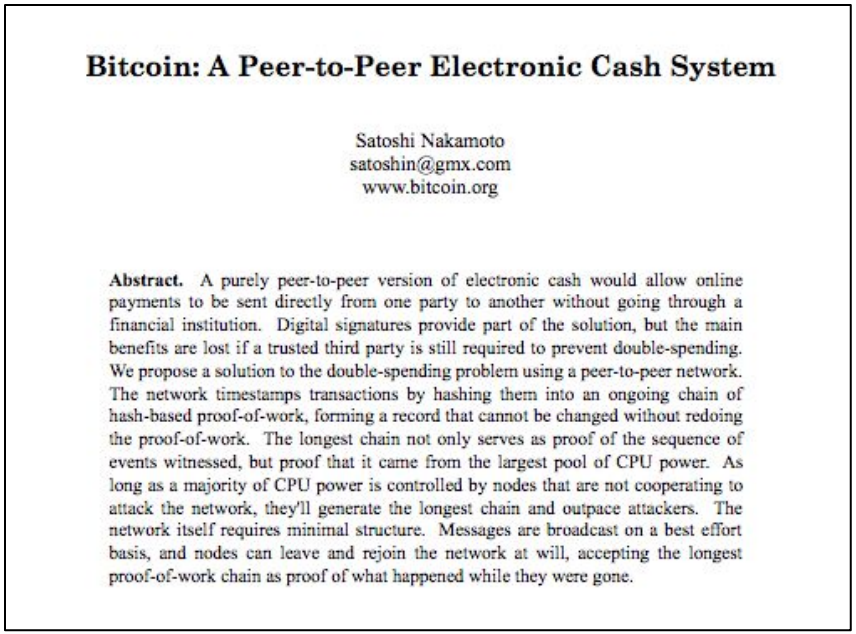
Bitcoin consumes an estimated 150 terra watt- hours of electricity annually, more than the annual consumption of Netherlands

The Bitcoin Whitepaper

- The idea was published in 2009 by an pseudonymous person/group of people, named **Satoshi Nakamoto.**

  Goal with Bitcoin was:

  - To create a **trustless** system, using cryptography
  - Solve double-spending problem of previous digital currencies
  - Create digital assets that can be owned, with proof of ownership



Bitcoin: A Peer-to-Peer Electronic Cash System

Satoshi Nakamoto
satoshin@gmx.com
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.

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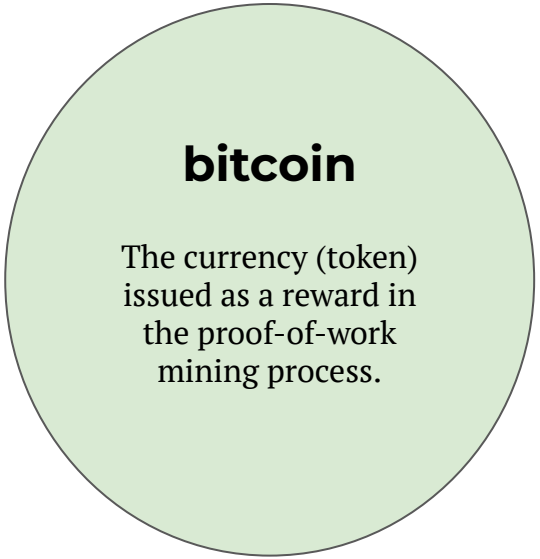
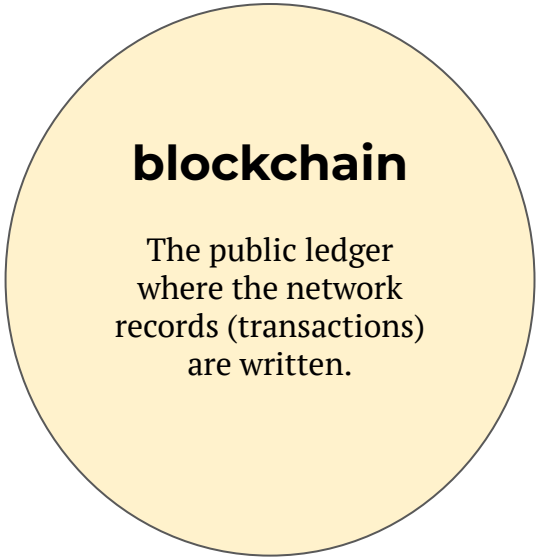
WHAT LIES UNDER THE HOOD ?

Bitcoin / bitcoin / blockchain





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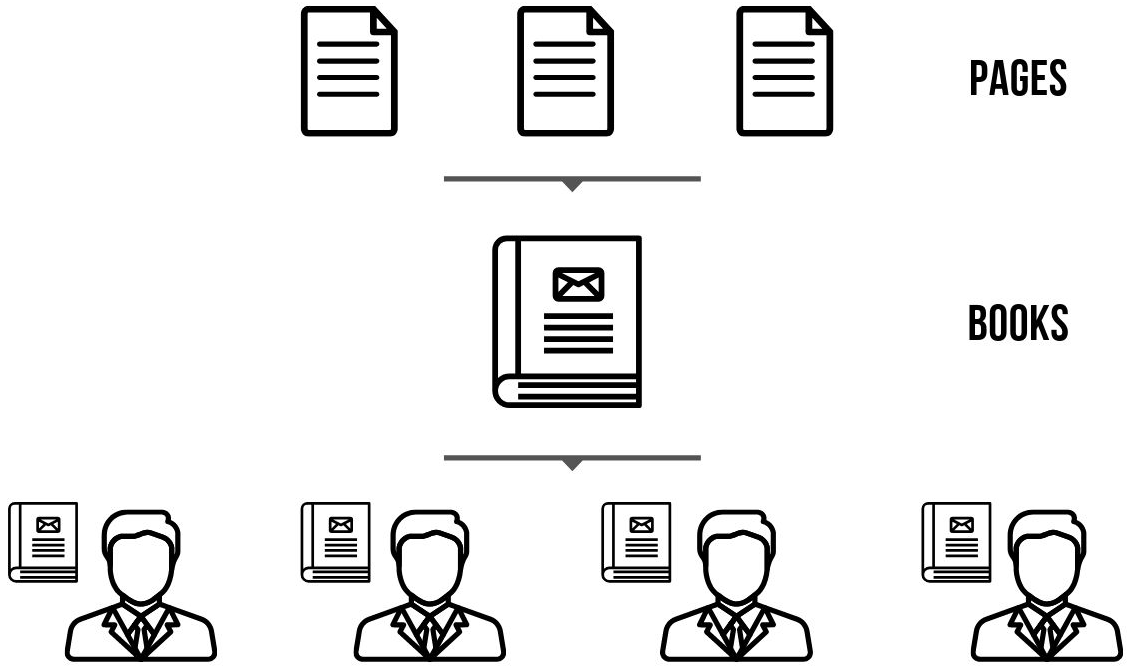
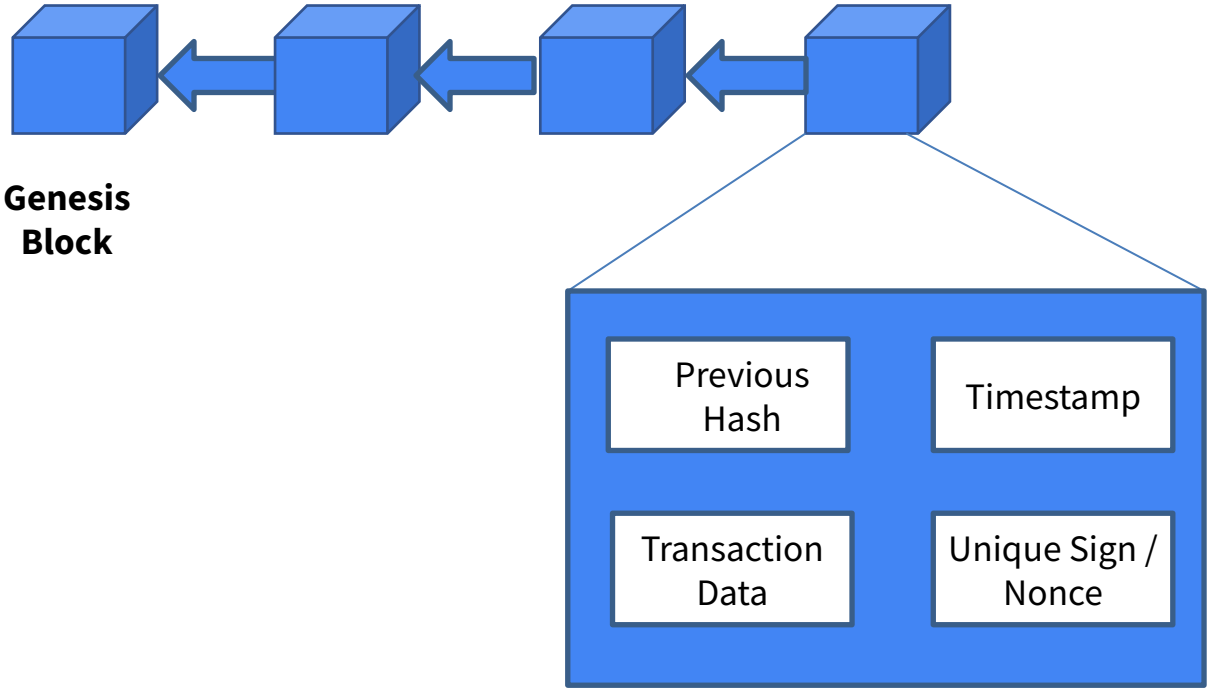
BREAKING IT DOWN...



Blockchain



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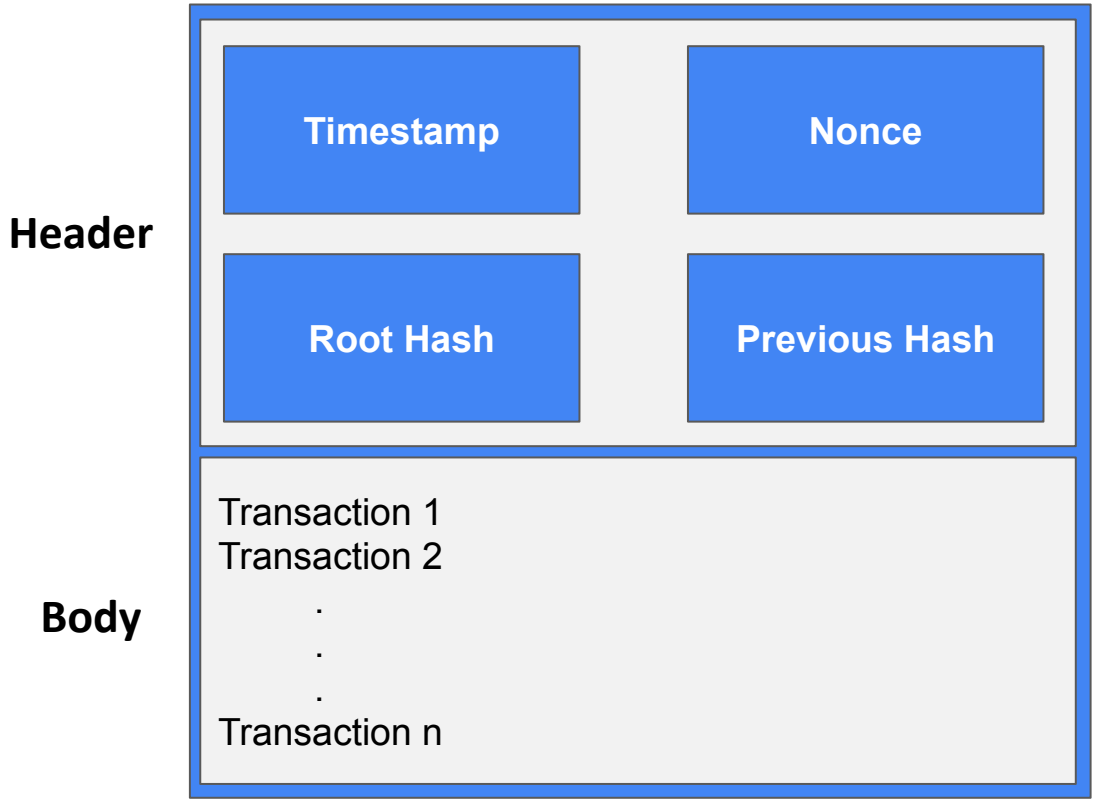
Block


Header
Timestamp
Nonce
Root Hash
Previous Hash
Body
Transaction 1
Transaction 2
.
.
.
Transaction n

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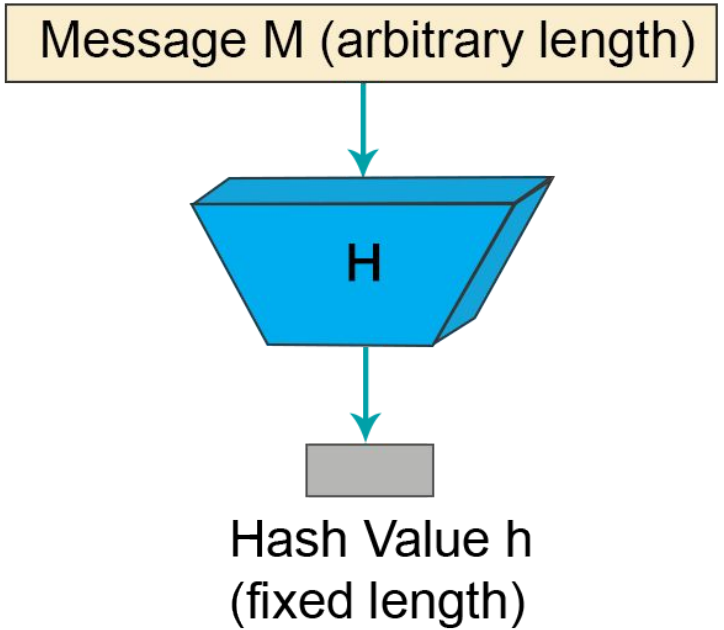
Hash

- A mathematical function - turns data into a hash
- Takes the input data and turns it into an output of a fixed length
- Same hash for same input
- If even one character in the input text or data is changed, the output hash will change
- One-way function
- Eg:- SHA256.



Hash demo - https://andersbrownworth.com/blockchain/hash

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Hash Example

SHA 256

Input

from: person1

to: person2

amount: **5000**

Hash

A1BA93299F5836B8A58543CAD52B8818F0C95F12991635609B0F7CAAF6388A58

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Hash Example

SHA 256

Input

from: person1

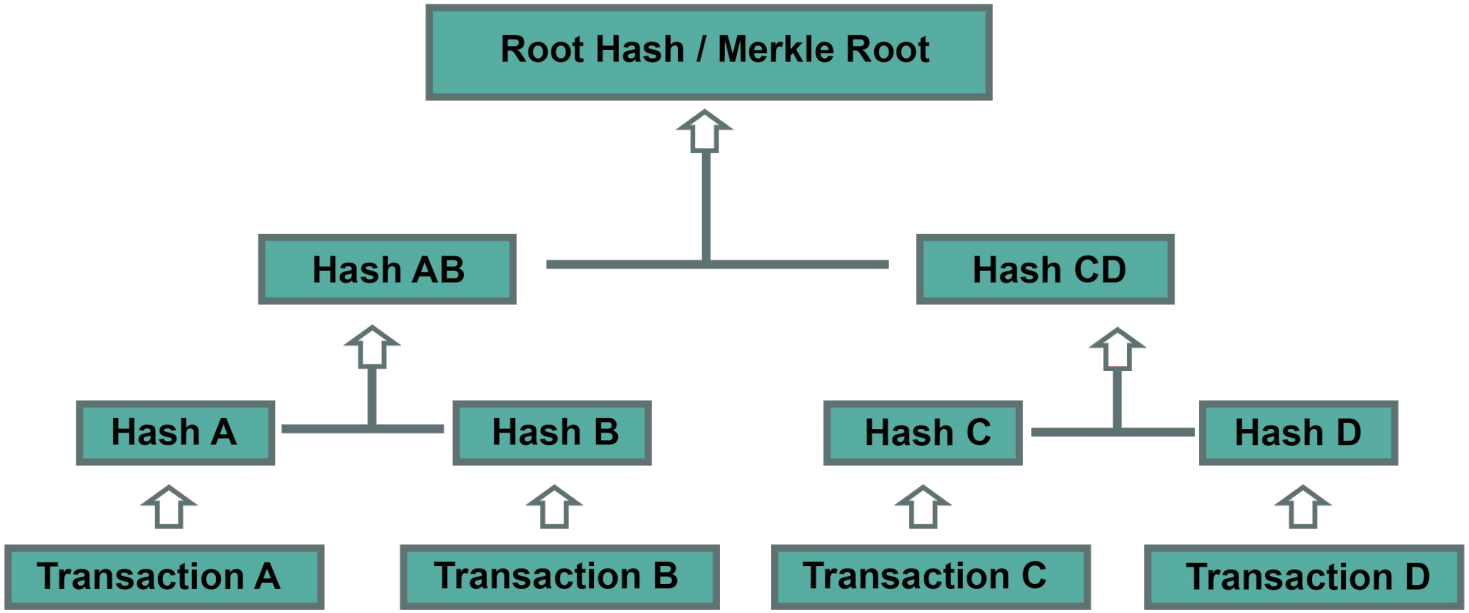
to: person2

amount: **5001**

Hash

C677256A3CD1F73CD4476204BCA19050E0A11AB11FAEBF14CD7B37FB696F73C5

Merkle Trees



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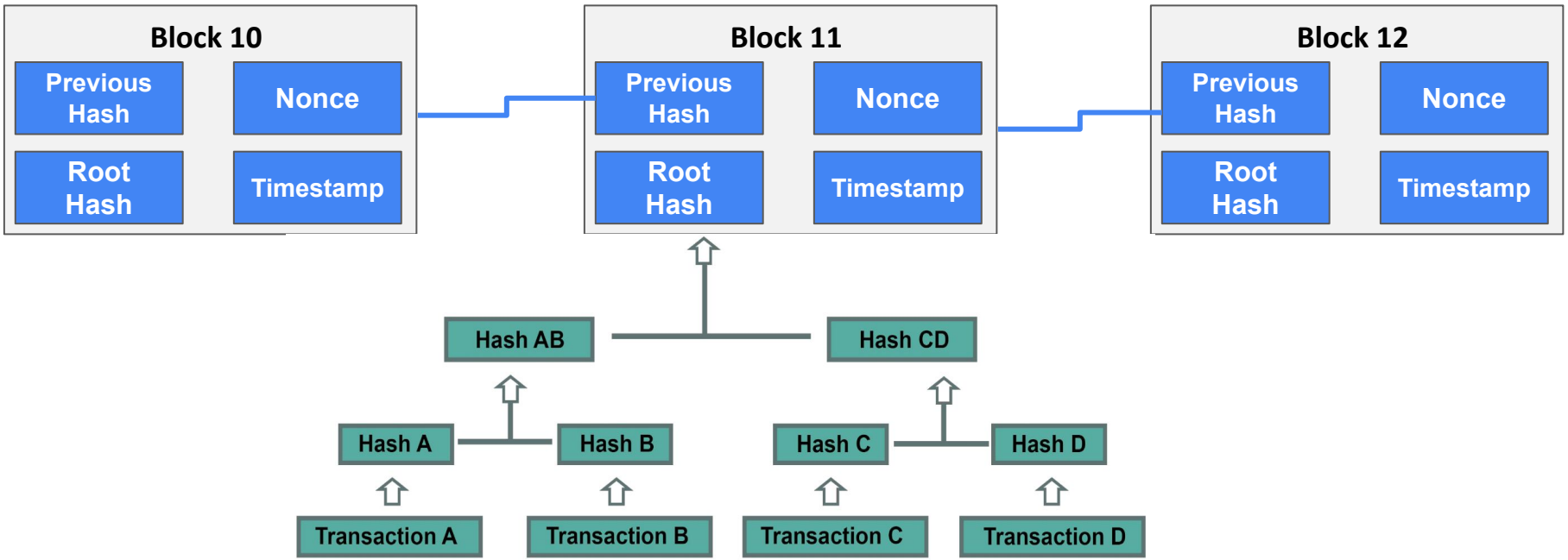
Hash Chain



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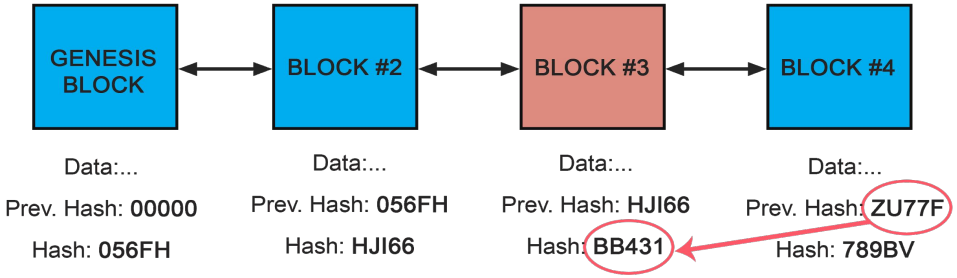
Tamper Proof

- Each block in the chain contains transaction data.
- Is cryptographically hashed.
- The blocks of hashed data draw upon the previous-block in the chain
- This ensures all data in the overall "blockchain" has not been tampered with and remains unchanged.
- Hacker would need to change the block containing that record as well as those linked to it to avoid detection.



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Entering the Blockchain Network

KBA

Bitcoin
A public deposit box

Anyone can deposit

Private Key

Like a very long PIN,
only the owner can unlock

A Bitcoin Address

Used to identify where
to deposit the payment

Bitcoin Address

37LRvHjJdhdEergQEJEduREAtuRBF8dLL7

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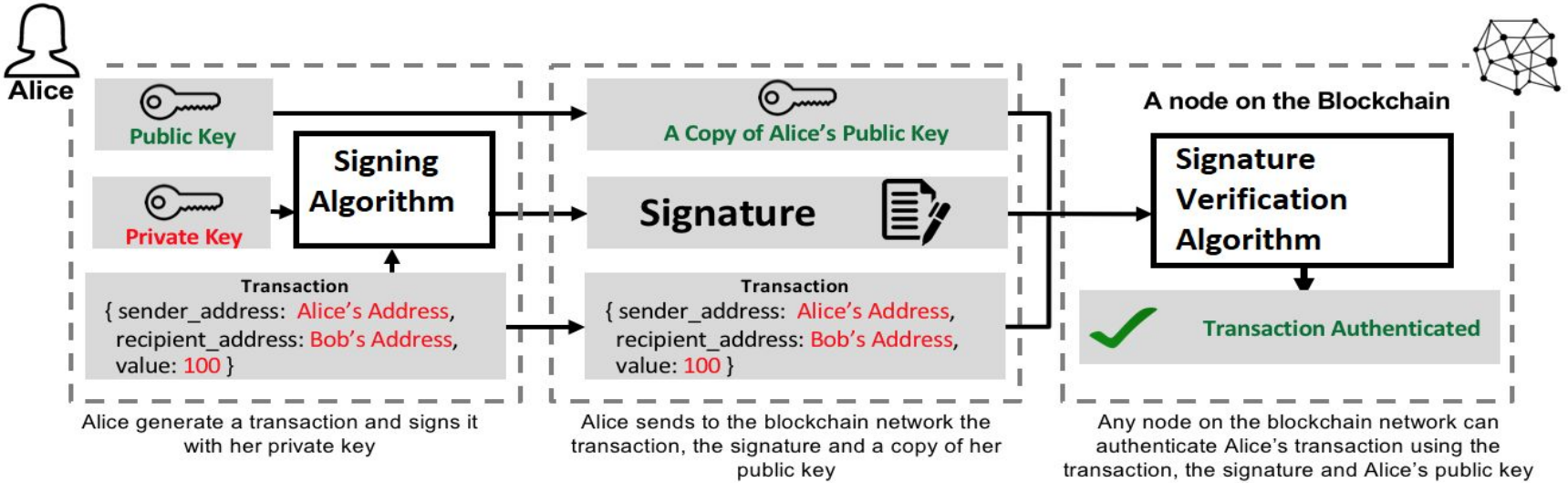
Authentication of Transaction



Authentication Process for Transactions on the Blockchain

source:http://adilmoujahid.com/posts/2018/03/intro-blockchain-bitcoin-python/

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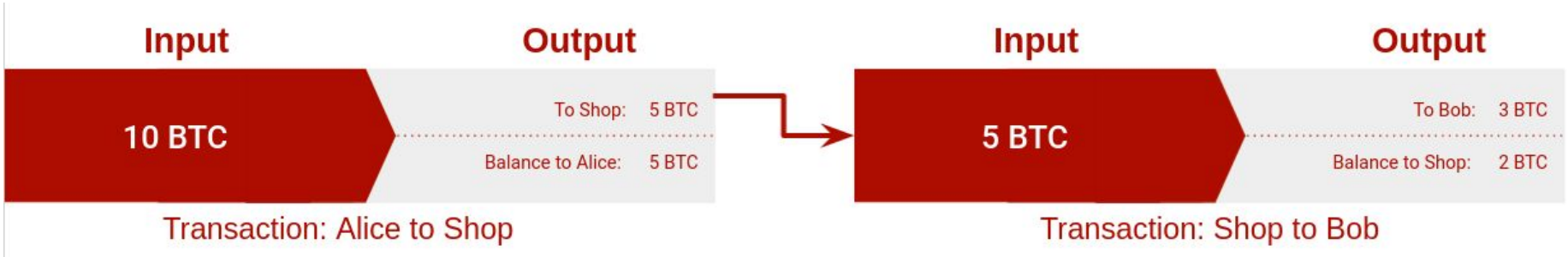
Transaction - UTXO



Consensus

Dictionary

Search for a word

consensus

/kənˈsɛnsəs/

noun

a general agreement.
"there is a growing consensus that the current regime has failed"

Similar: agreement | harmony | concord | like-mindedness | concurrence

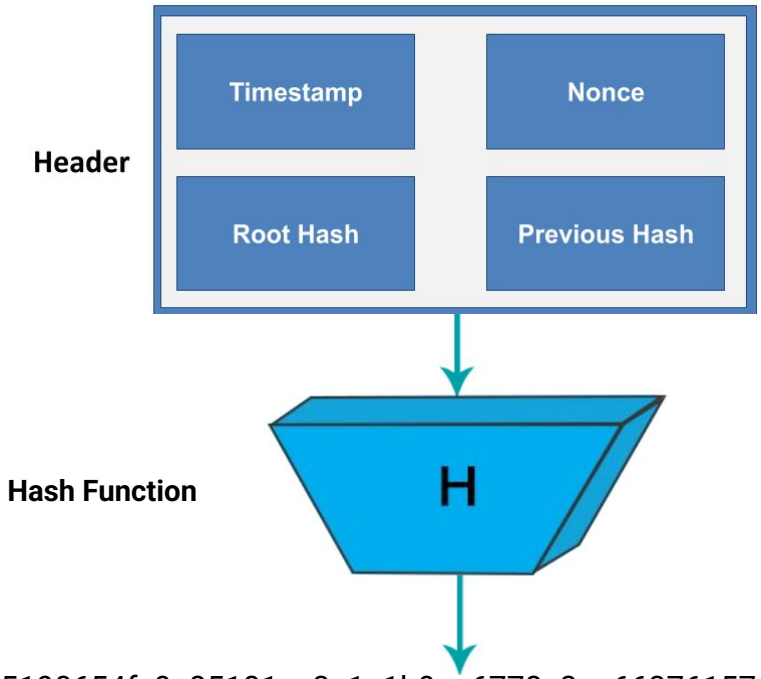
Translations, word origin and more definitions

Definitions from Oxford Languages *Feedback*

Proof of Work

- Transactions are bundled together into a block
- Miners verify that transactions within each block are legitimate
- To do so, miners should solve a mathematical puzzle known as proof-of-work problem
- A reward is given to the first miner who solves each blocks problem
- Verified transactions are stored in the public blockchain

The Puzzle



Nonce = 0

Solution

Block Hash*

9740a25190654fc9e85181ec3e1c1b9aa6778e3aa66376157ebccce0869e6e62

compared to

Threshold value*

0000000000000000011011900000000000000000000000000000000000000

IF Block Hash > Threshold
Increment Nonce value &
Repeat hashing

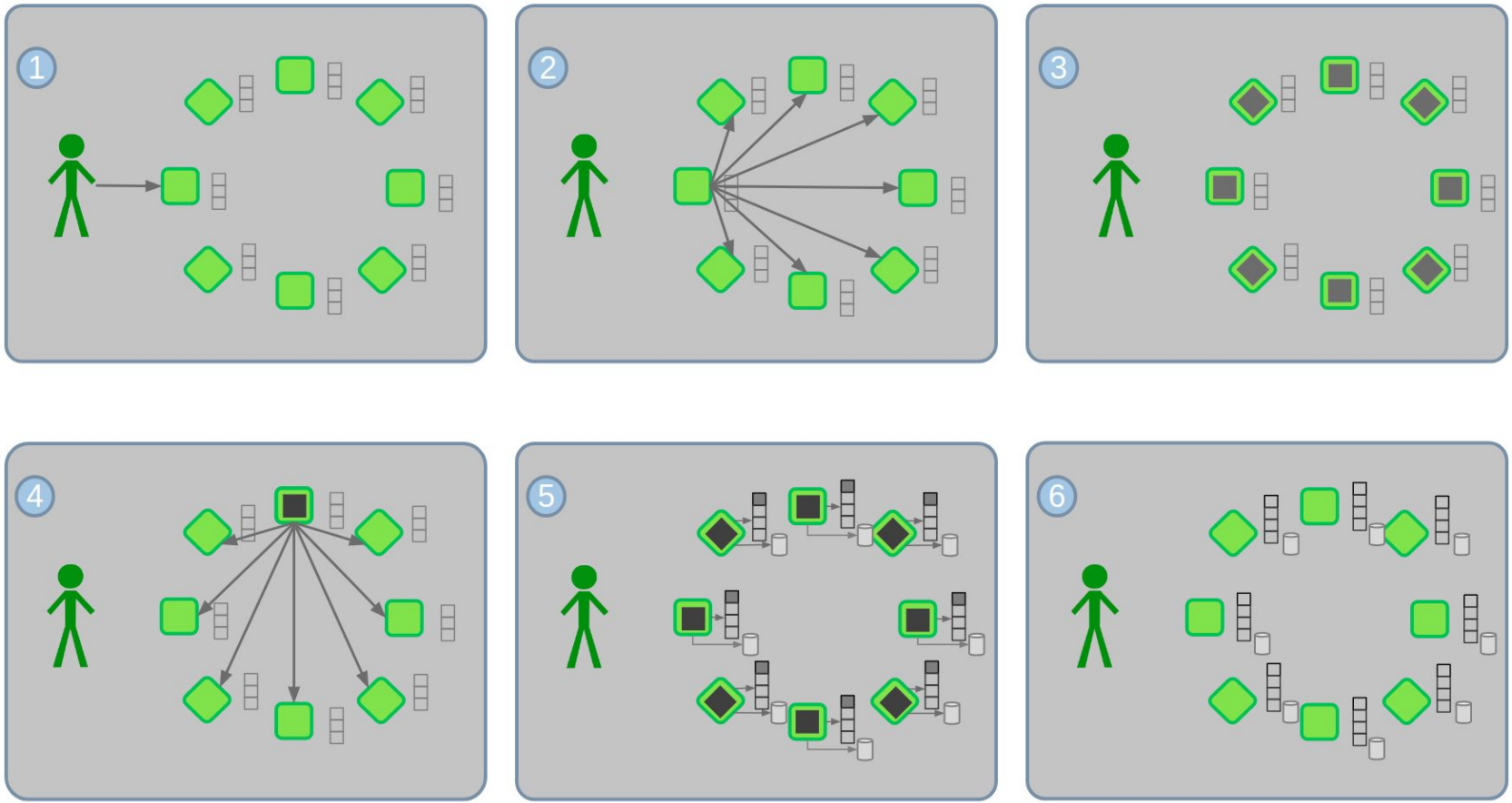
IF Block Hash < Threshold
Result Found

Sample result*

00000000000000000000000000012ae6d18c21690f7fa8faa8a8ce91c78312b6

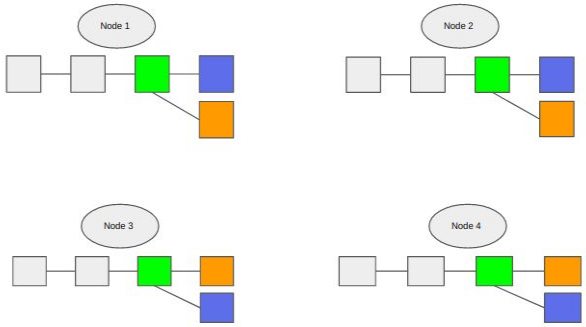
*All values are for demonstration purpose only

Transaction Flow - Blockchain Network

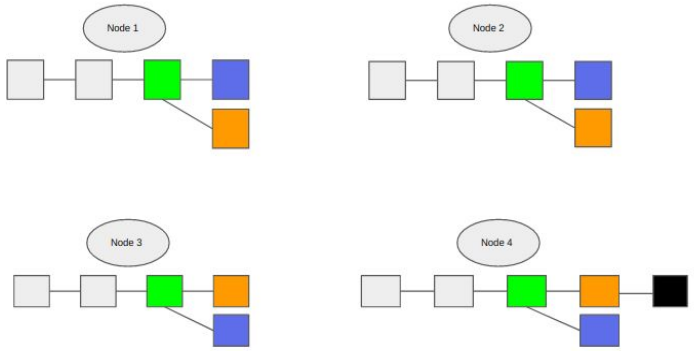


Fork Resolution

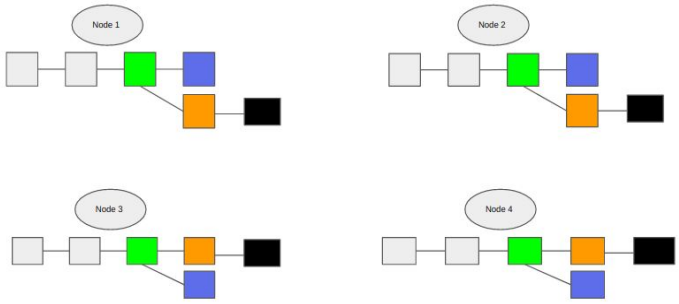
1



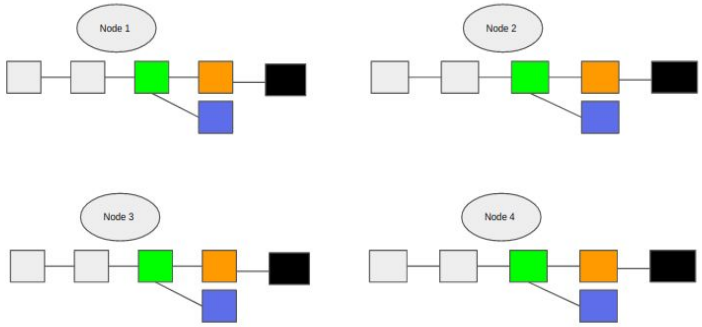
2



3

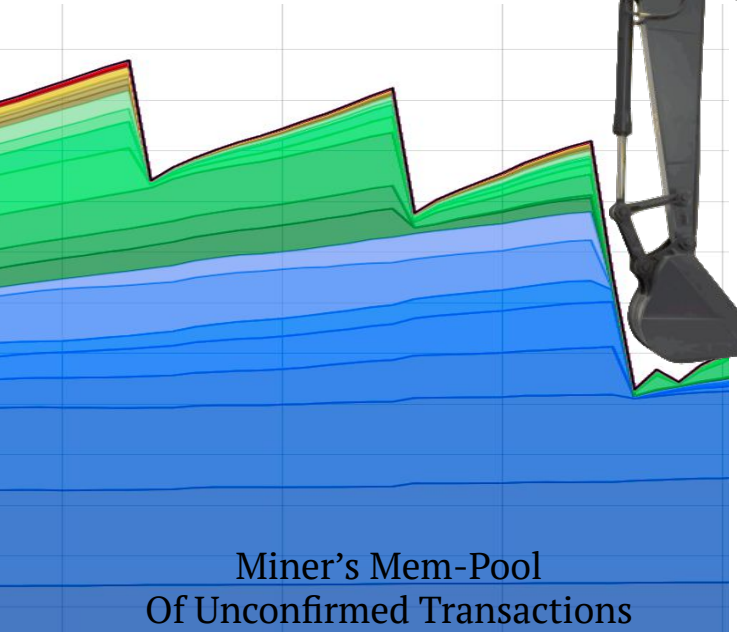


4



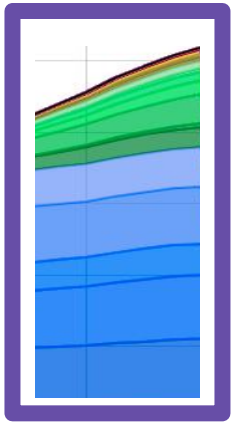

Erste Hilfe

Miners Add Transactions to Blocks



Miner’s Mem-Pool
Of Unconfirmed Transactions

Miner



Miner’s
Candidate Block

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Mining Incentives

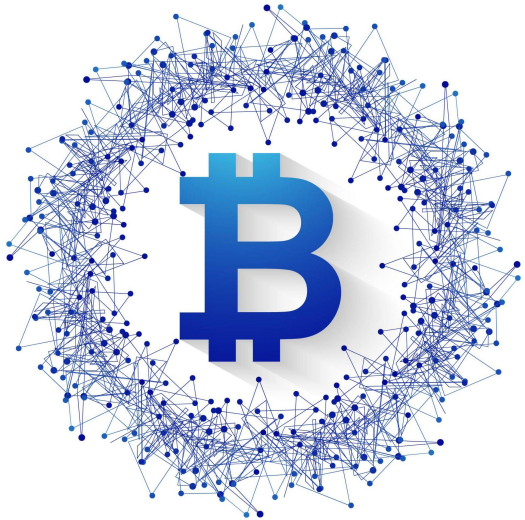
Miners currently receive two types of rewards in return for the security provided by mining:

(1) new coins created with each new block, and

(2) transaction fees from all the transactions included in the block.

Bitcoin Halving: Regulating the supply to deal with inflation

Where Bitcoin Network fell Short ?



Was meant only for bitcoin

Cannot perform complex computation

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The Smart Contract

- A smart contract is a computer protocol intended to digitally facilitate, verify, or enforce the negotiation or performance of a contract.
- Smart contracts allow the performance of credible transactions without third parties.
- These transactions are trackable and irreversible.

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Programmable Blockchain

Vitalik Buterin (OP)
Sr. Member

Activity: 330
Merit: 394

[ANN] Ethereum: Welcome to the Beginning
January 23, 2014, 11:33:17 AM #1

Merited by BayAreaCoins (10), tk808 (10), notbatman (8), suchmoon (7), IncludeBeer (7), Kda2018 (7), Abiky (5), nutildah (5), alani123 (5), redsn0w (5), klintay (5), dragonvslinux (5), zork (5), somacoin (5), vapourminer (4), Mrpumperitis (3), goldcoinminer (3), Cloudpost (3), Northa (3), OmegaStarScream (2), pangu (2), julerz12 (2), PuertoLibre (2), bitcampaign (2), V1saya (2), Eddyc (2), batang_bitcoin (1), Jcga (1), Husna QA (1), wmaurik (1), Raja_MBZ (1), mandor (1), Easteregg69 (1), bubbalex (1), kopisusu (1), HBKMusiK (1), FreedomCoin (1), Financisto (1), Tyr808 (1), iwantmyhomepaidwithbtc2 (1), CrowdFunder (1), tammuz (1), safexscam (1), NeStore (1), gabbello (1), heyspongebob (1), Neo Baudrillard (1)

Welcome to the New Beginning

When the grand experiment that is bitcoin began, the anonymous wizard desired to test two parameters- a trustless, decentralized database enjoying security enforced by the austere relentlessness of cryptography and a robust transaction system capable of sending value across the world without intermediaries. Yet the past five years years have painfully demonstrated a third missing feature: a sufficiently powerful Turing-complete scripting language. Up until this point, most innovation in advanced applications such as domain and identity registration, user-issued currencies, smart property, smart contracts, and decentralized exchange has been highly fragmented, and implementing any of these technologies has required creating an entire meta-protocol layer or even a specialized blockchain. Theoretically, however, each and every one of these innovations and more can potentially be made hundreds of times easier to implement, and easier to scale, if only there was a stronger foundational layer with a powerful scripting language for all of these protocols to build upon. And this need is what we seek to satisfy.

Ethereum is a modular, stateful, Turing-complete contract scripting system married to a blockchain and developed with a philosophy of simplicity, universal accessibility and generalization. Our goal is to provide a platform for decentralized applications - an android of the cryptocurrency world, where all efforts can share a common set of APIs, trustless interactions and no compromises. We ask for the community to join us as volunteers, developers, investors and evangelists seeking to enable a fundamentally different paradigm for the internet and the relationships it provides.

Who is Behind Ethereum?

Our primary core devs are:

- Vitalik Buterin → Inventor of Ethereum, protocol developer and researcher
- Gavin Wood →Lead C++ developer
- Jeffrey Wilcke → Lead Go developer

Evolution of Chain

The Currency

The implementation of distributed ledger technology led to its first and obvious application: **Cryptocurrencies**

Smart Contracts

An extension of blockchain into privacy, smart contracts and the emergence of non-native asset blockchain tokens and capabilities

Decentralized Applications

Adoption to mainscale applications, blockchain scaling. Improves speed without sacrificing security

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Blockchain Variants

Permission-less

- Anyone can join the network and participate in consensus
- No need to prove identity.
- Proof of Work and Proof of Stake are some of the consensus used.
- Eg: Bitcoin and Ethereum

Permissioned

- Only a restricted set of users have the rights to validate the block transactions
- Paxos, Raft, PBFT consensus : Only approved actors participate in consensus
- Eg: Hyperledger Fabric, Corda

HYPERLEDGER
FABRIC

c·rda

KBA

Blockchain Vs Database

Feature	Blockchain 	Database
Data Integrity	Immutable – once data is added, altering it is very difficult.	Mutable – data can be updated or deleted.
Control	Decentralized; no single entity has control.	Centralized; administered by database admins.
Trust Mechanism	Consensus algorithms and cryptographic proofs.	Access control and trust in the database system.
Redundancy	Data stored across multiple nodes; high redundancy.	Often single points, but can be backed up/cloned.
Security Model	Trustless – doesn't rely on a central authority.	Trust-based – relies on security protocols & admins.
Use Cases	Cryptocurrencies, transparent ledgers, smart contracts.	General data storage, CRUD operations, reporting.

K B A

Why Industry loves Blockchain ?

Traceability

Enhanced Security & Availability

Auditability

Universal record

Third party elimination

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Where does the chain fit ?

DIGITAL IDENTITY

A SELF SOVEREIGN ID CAN BE USED TO VERIFY IDENTITY WITHOUT NEEDING AN INDIVIDUAL TO PRODUCE NUMEROUS DOCUMENTS

SUPPLY CHAIN MANAGEMENT

BLOCKCHAINS ALLOW MULTIPLE PARTIES TO ACCESS A DATABASE TO ACT AS THE SINGLE SOURCE OF TRUTH. RECORDED TRANSACTIONS ARE IMMUTABLE, ARE APPEND ONLY AND PROVIDE A TIME STAMPED AUDIT TRAIL .

HEALTHCARE

USING BLOCKCHAIN TECHNOLOGY TO RECORD PATIENT INFORMATION ON A DISTRIBUTED LEDGER CAN ALLOW DIFFERENT STAKEHOLDERS CONDITIONAL ACCESS TO A SINGLE SOURCE OF TRUTH

REAL ESTATE

BLOCKCHAIN ALLOWS PEOPLE TO TRANSFER FUNDS, PROPERTY TITLES AND DATA IN A MORE PEER-TO-PEER MANNER THAT IS DIGITAL AND OPEN SOURCE

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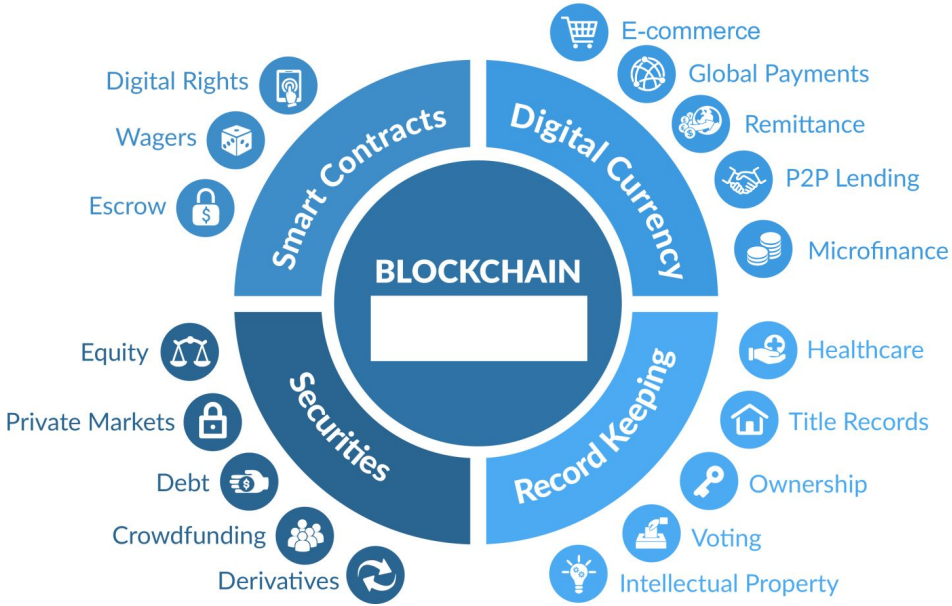
Value of Blockchain

- Distributed environment.
- Trust-free consensus based transactions.
- Auditable public ledger system.
- Resilient systems.
- Reduction in cost and complexity.
- Trace intruders and attackers.



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Queries?