Blockchain and Cryptocurrency

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What is a Blockchain?

- Comparison with traditional Database
- Why we need new technology?
- Definition:

❑Distributed/Decentralized Ledger Technology

A blockchain is a continuously growing list of records, called blocks, which are linked and secured using cryptography

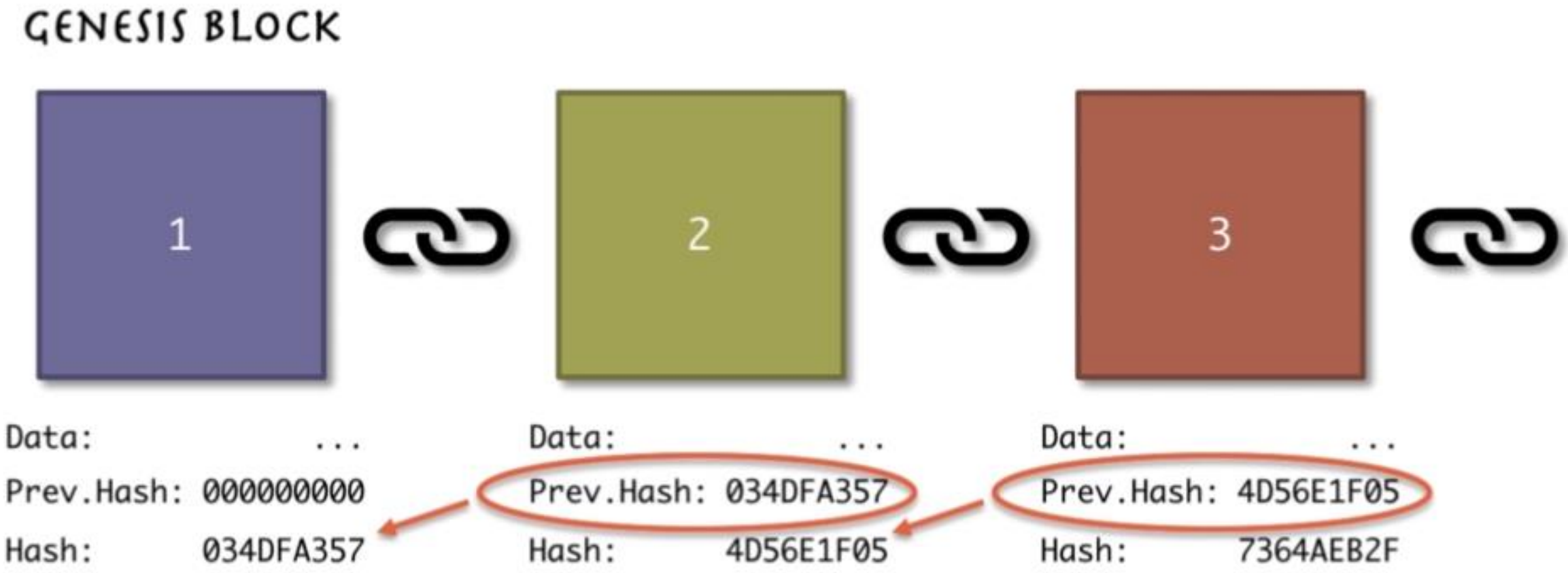
Block in Blockchain

Information that a single block contains:

- Data e.g "Hello World"
- Previous Hash
- Hash - fingerprint of the block

First block is called Genesis Block

- Doesn't have a Previous hash


GENESIS BLOCK
1
2
3
Data: ...
Prev.Hash: 000000000
Hash: 034DFA357
Data: ...
Prev.Hash: 034DFA357
Hash: 4D56E1F05
Data: ...
Prev.Hash: 4D56E1F05
Hash: 7364AEB2F

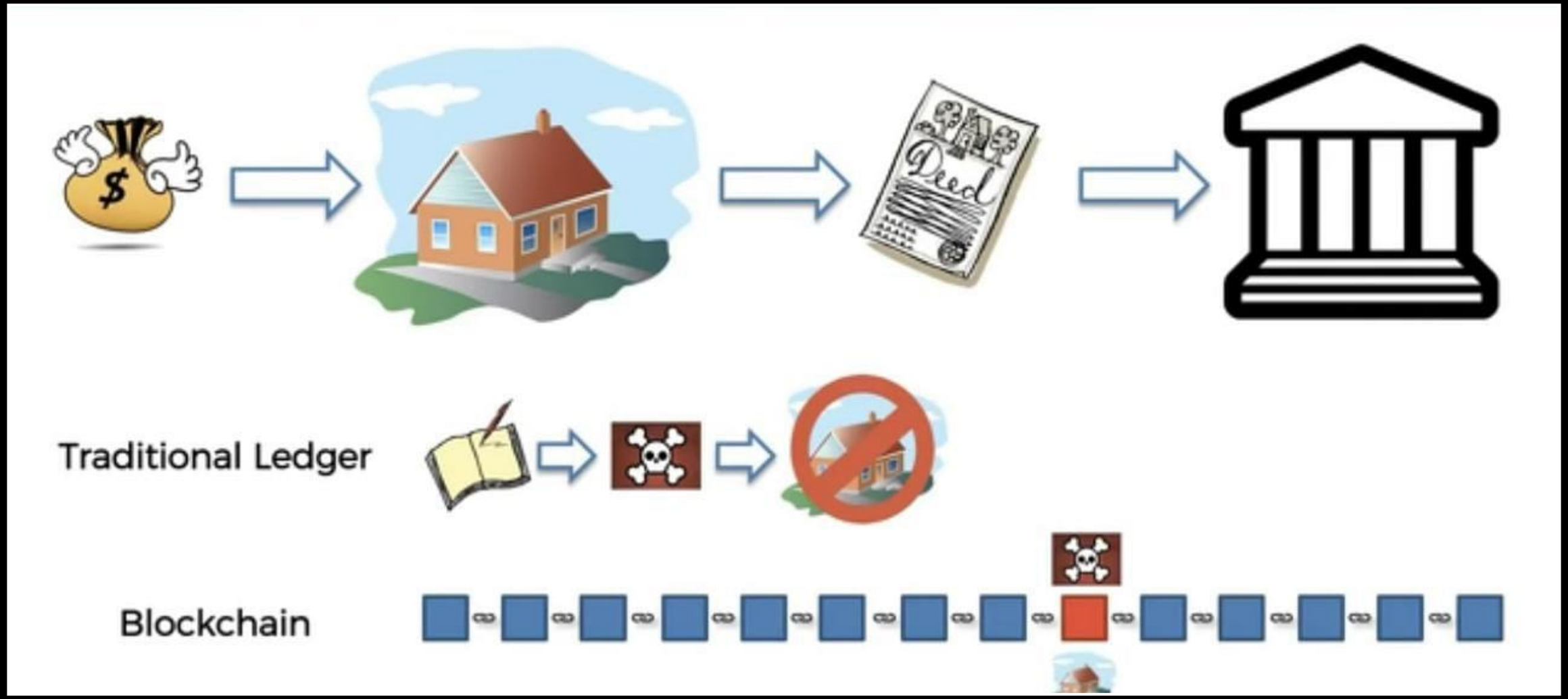
Blockchain

Understanding SHA256 Hash:

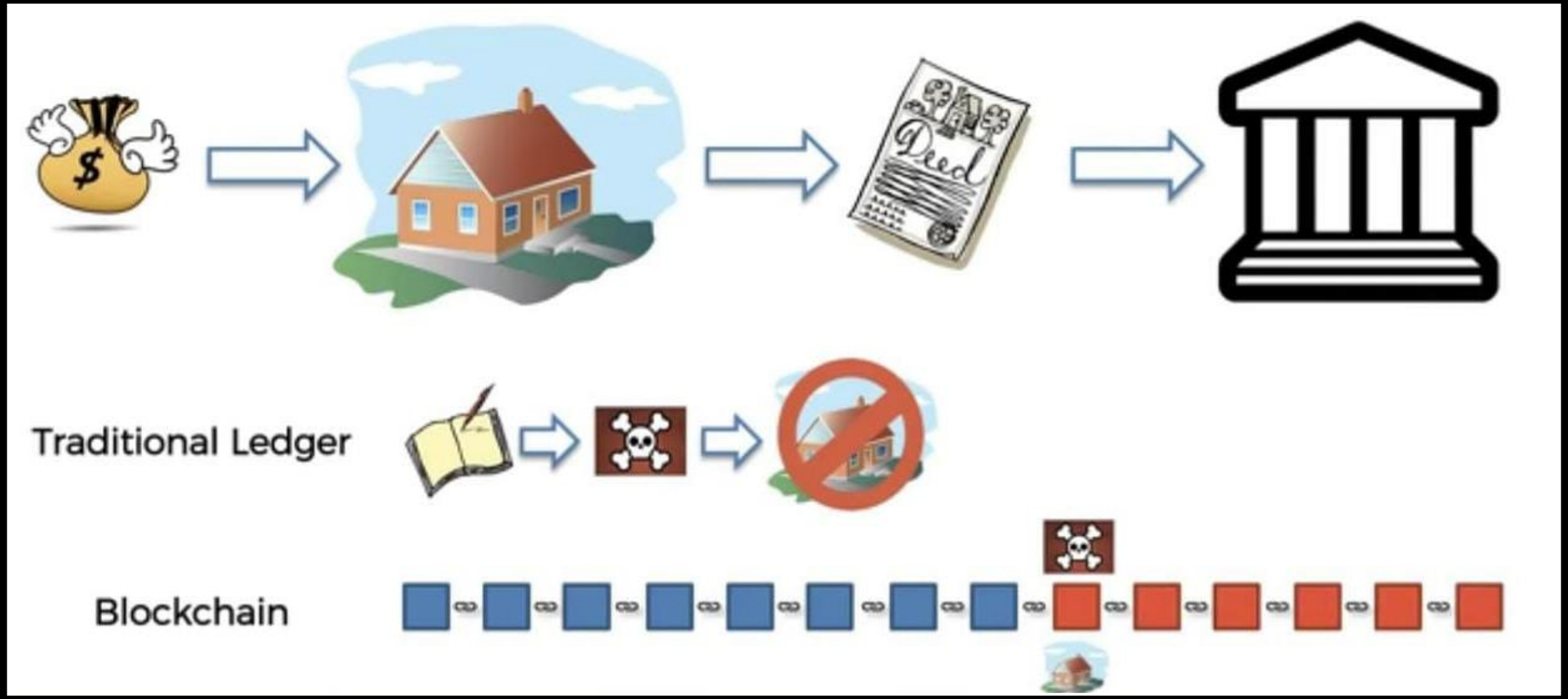
- Different people have different fingerprints
- Fingerprint of a file is called a SHA256 Hash
- Developed by the NSA
- SHA - Secure Hash Algorithm
- 256 - number of bits it takes in memory - 64 characters long
- A file will always have the same hash
- If we change even one character, the whole hash will change
- **Requirements of a successful Hash algorithm**
  - One-way - you cannot restore or reverse engineer the document
  - Deterministic - get the same result everytime
  - Fast computation -
  - Avalanche effect - Even a single bit of data would result in an absolutely different hash
  - Must withstand collisions - Creating/altering documents to have the same Hash should not be possible

Immutable Ledger - 1

- Traditionally, you get a deed for every transaction (purchase of house)
  - Use of books, where records are kept
  - Can be altered or destroyed
- Blockchain prevents alteration of data
- Traditional ledgers are unreliable
- World Bank estimates that 70% of the population does not have entitlement to their properties.



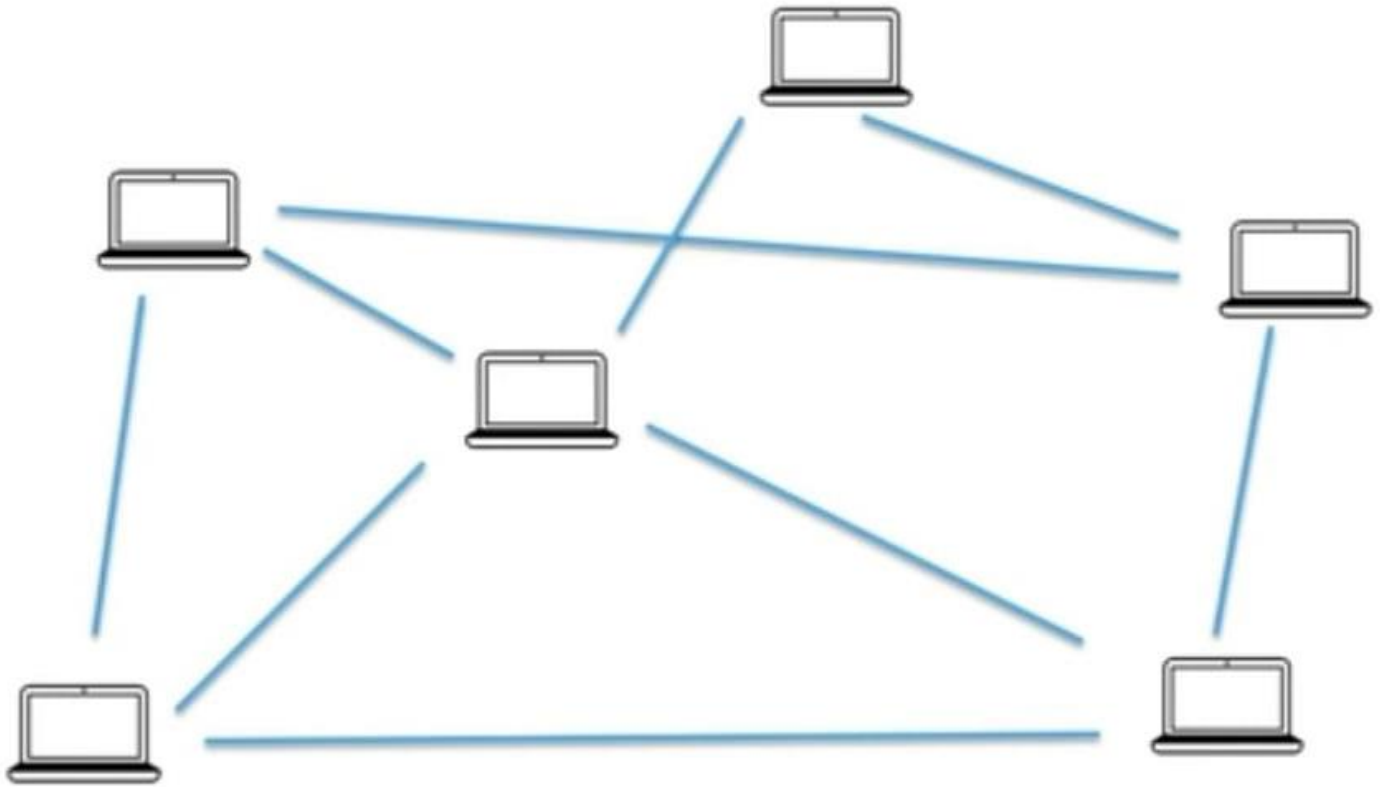
Immutable Ledger - 2



Immutable Ledger – Forge the Blockchain

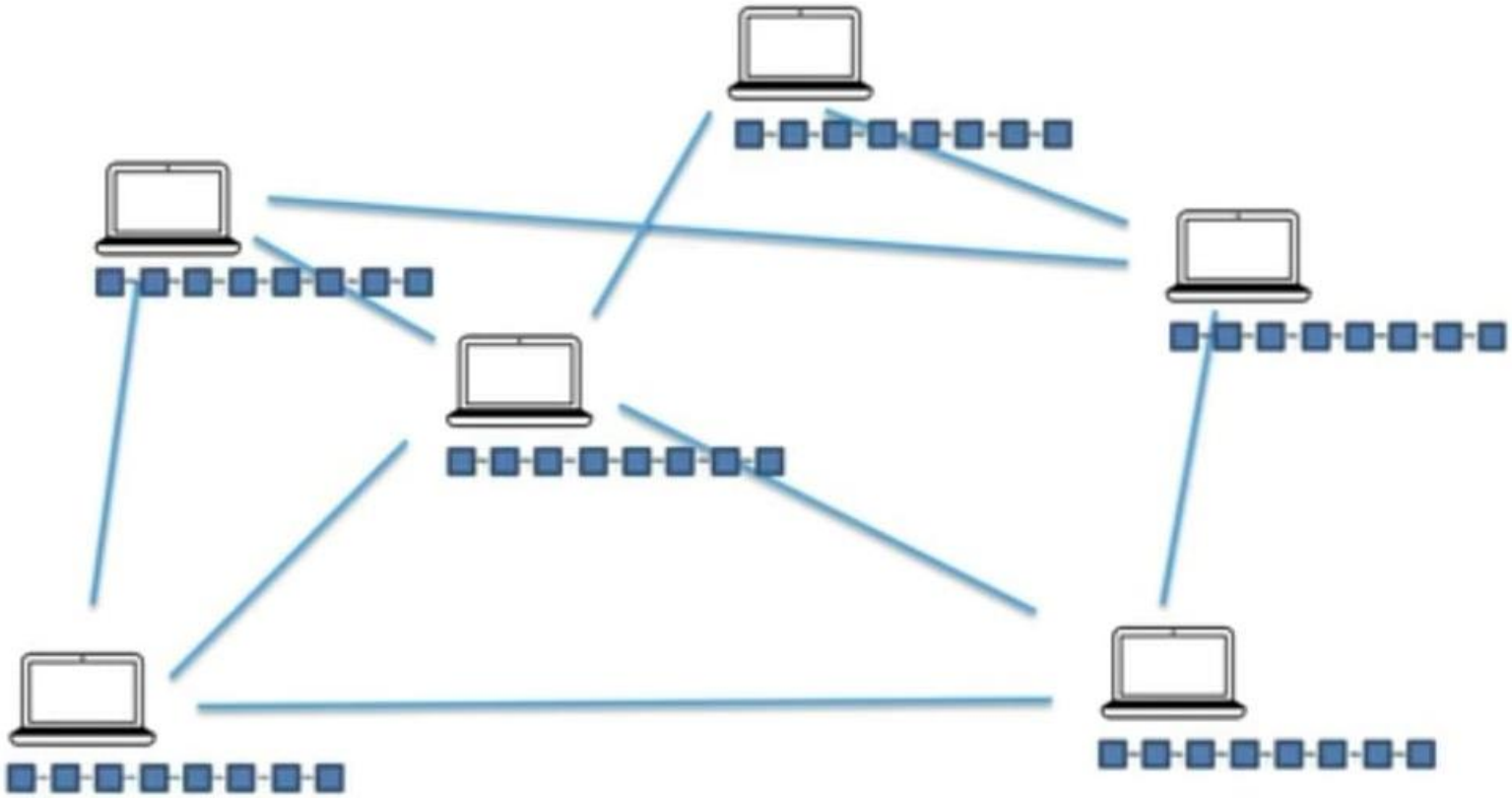
Distributed P2P Network

Peer-to-Peer Network

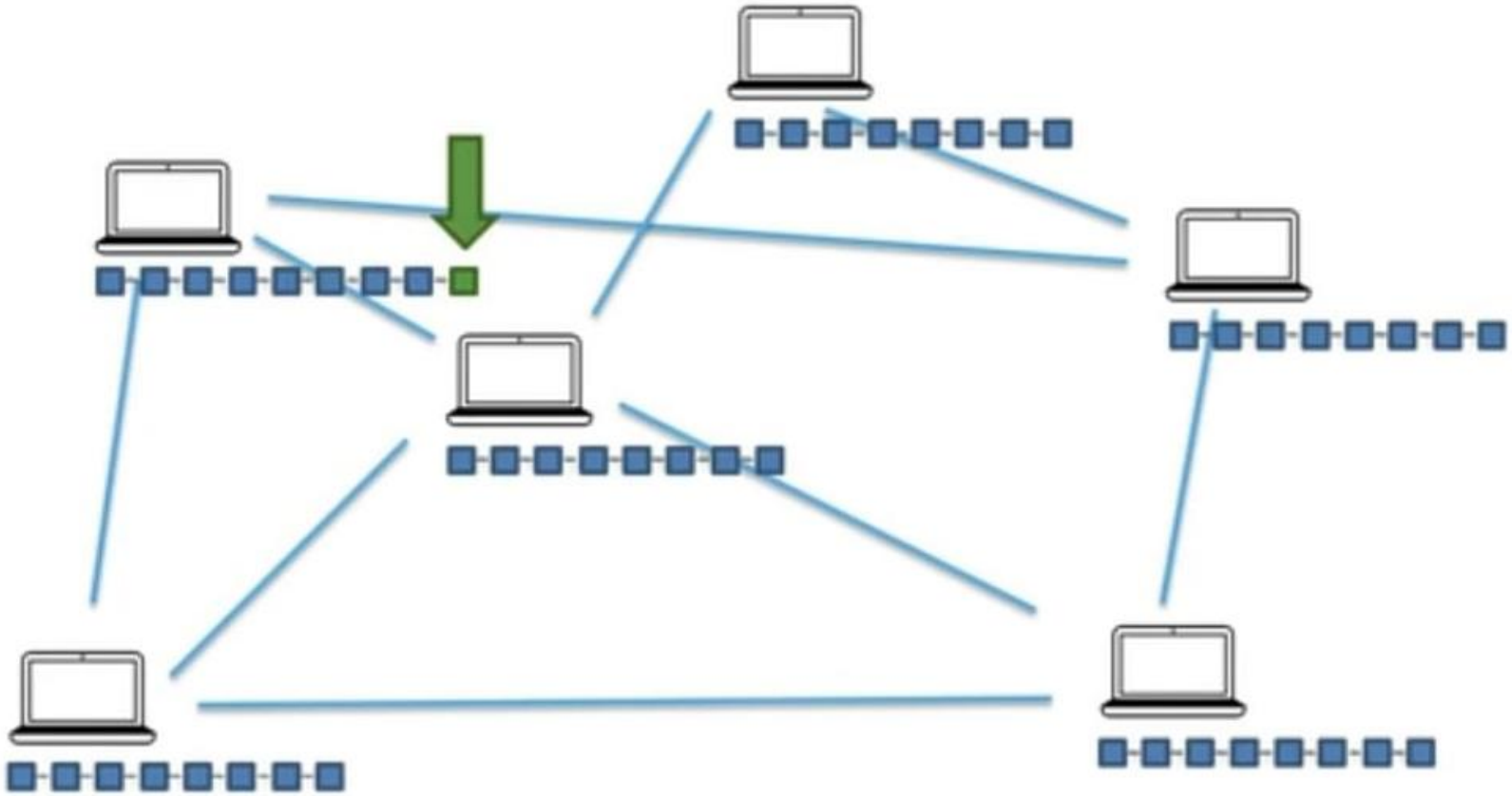


Anonymity: No real identity

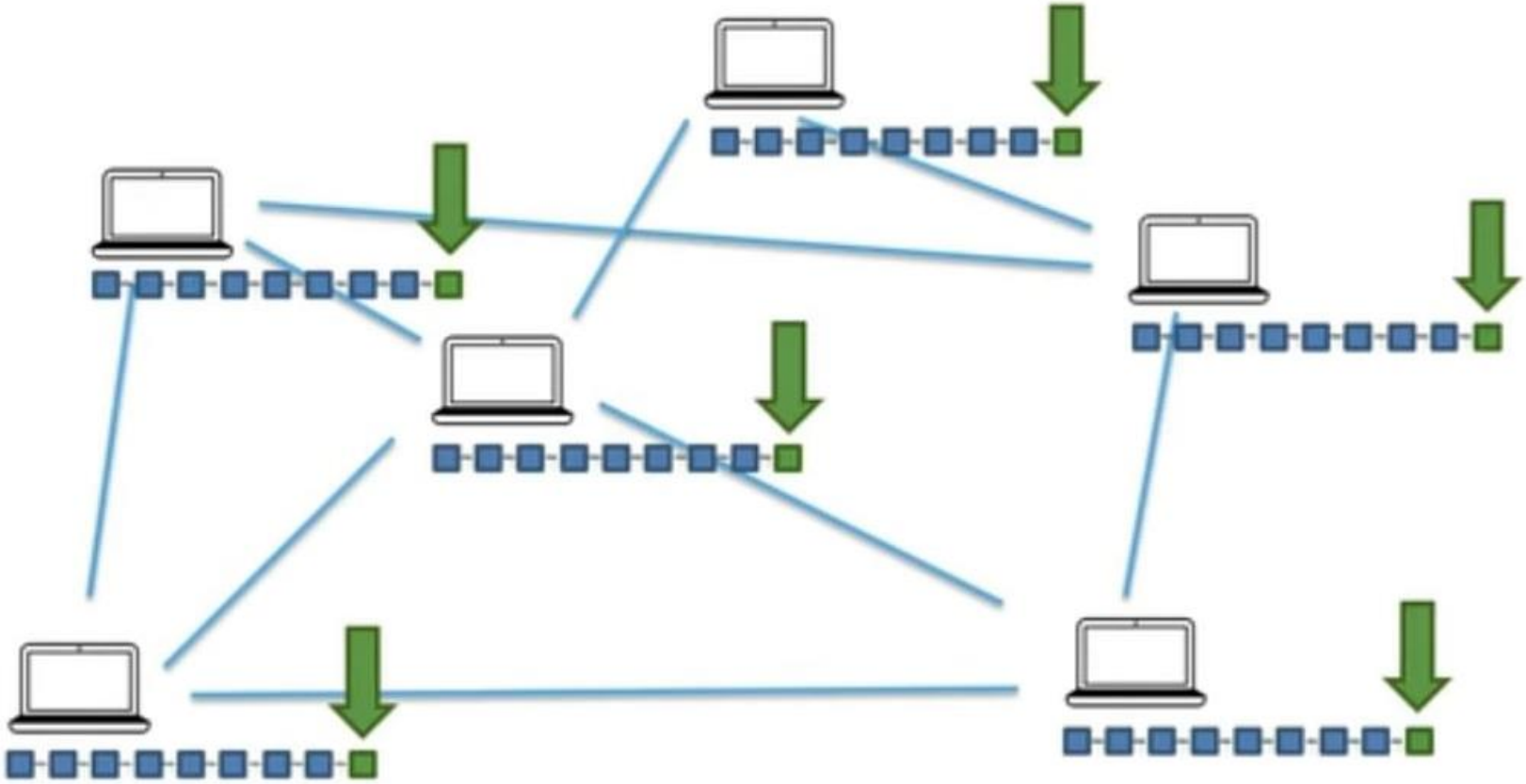
Each Node has a copy of Blockchain



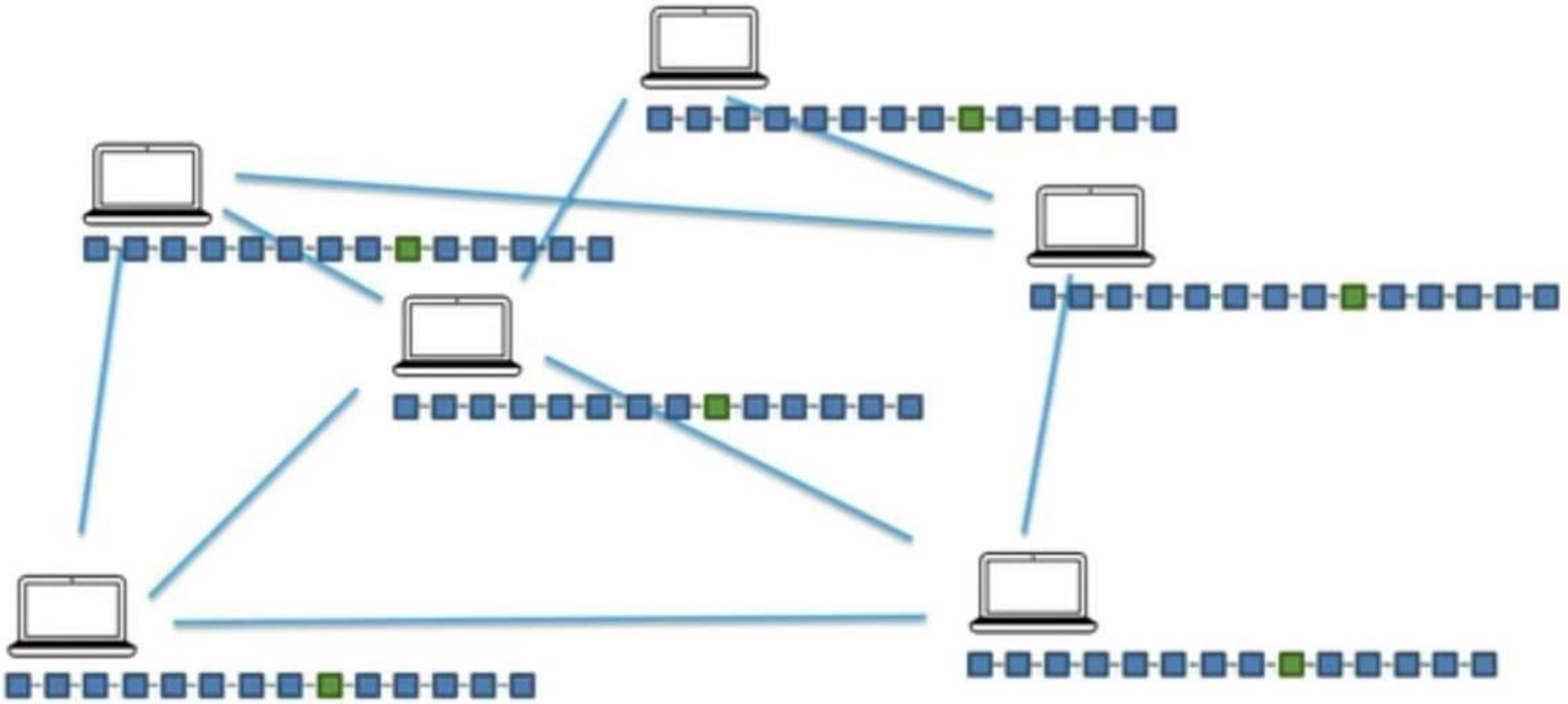
If a block is added to a Blockchain



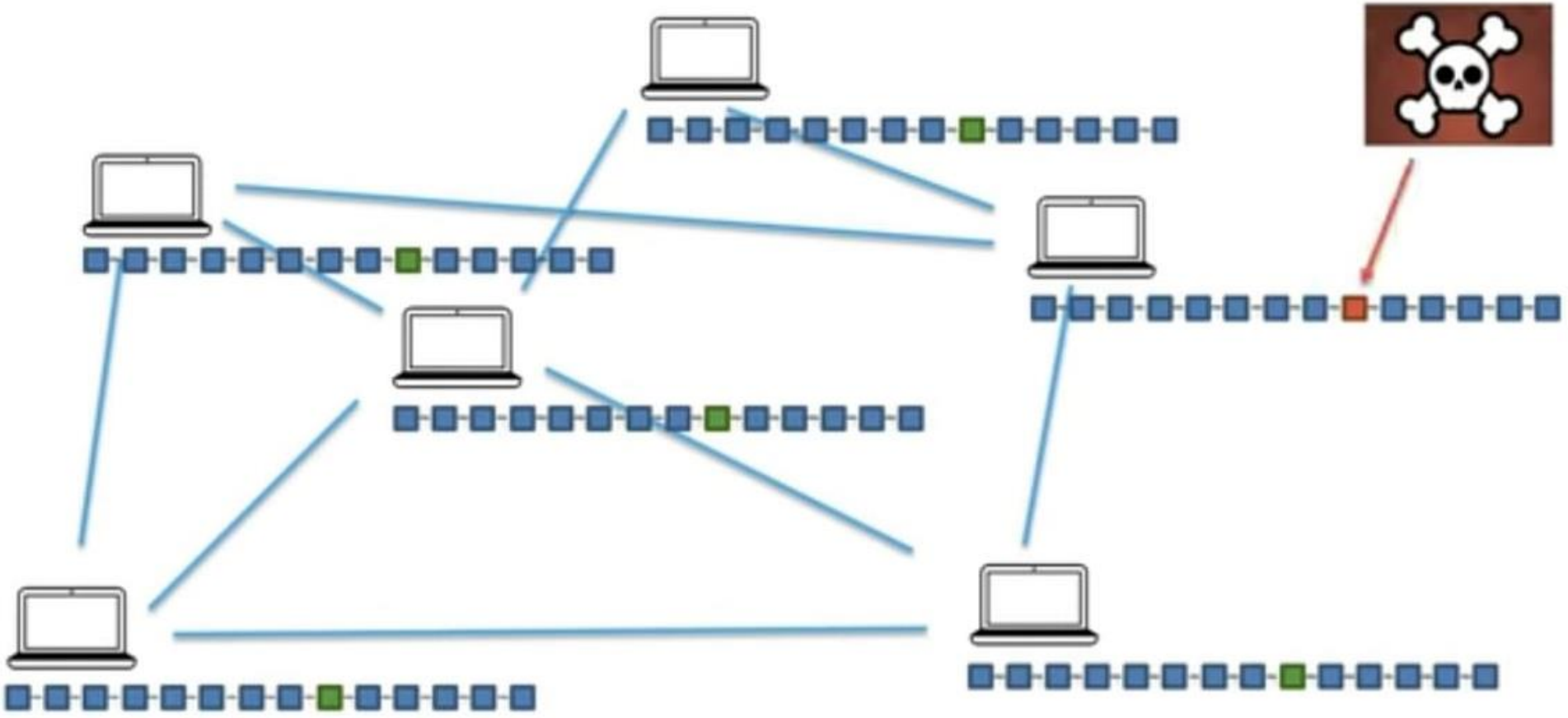
Whole network must update it’s copy



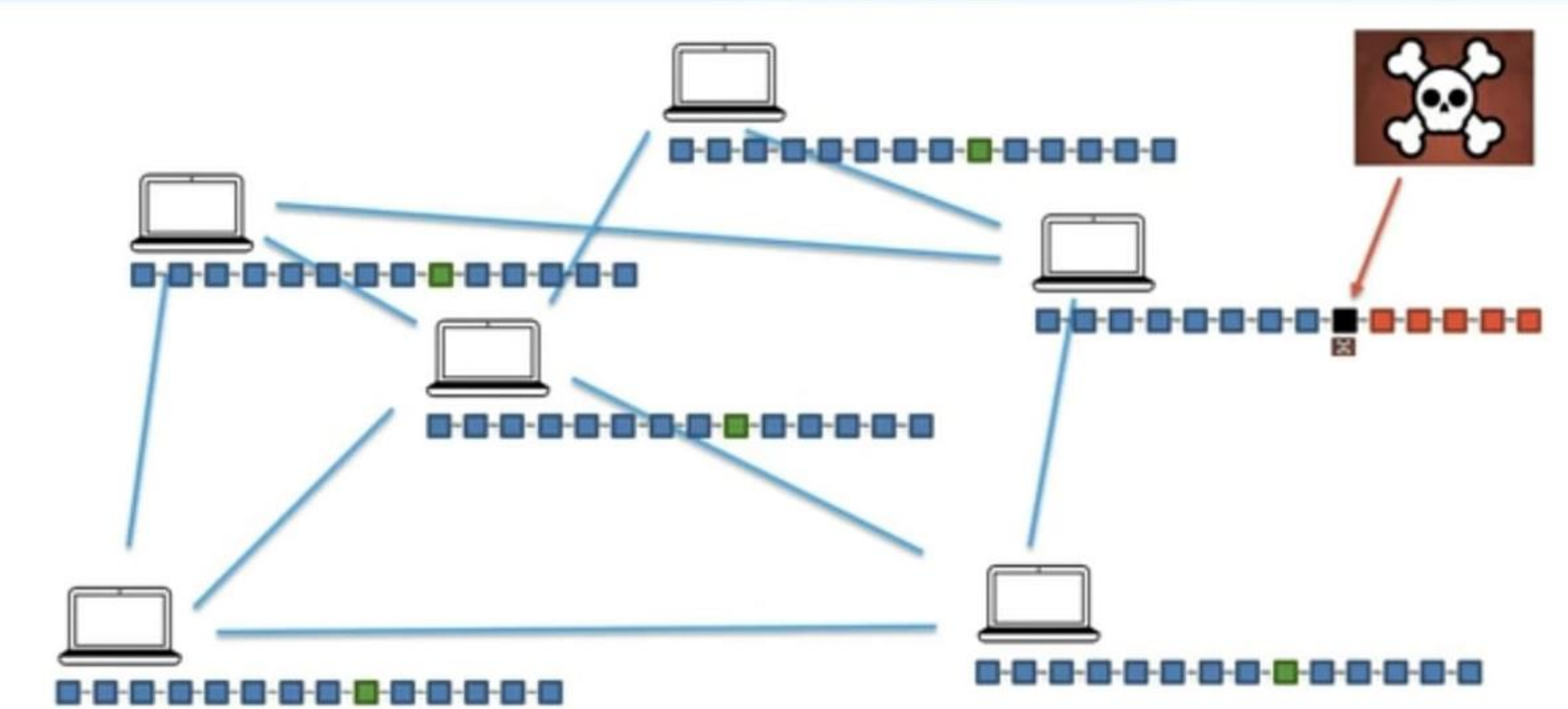
With the passage of time, more and more blocks are being added



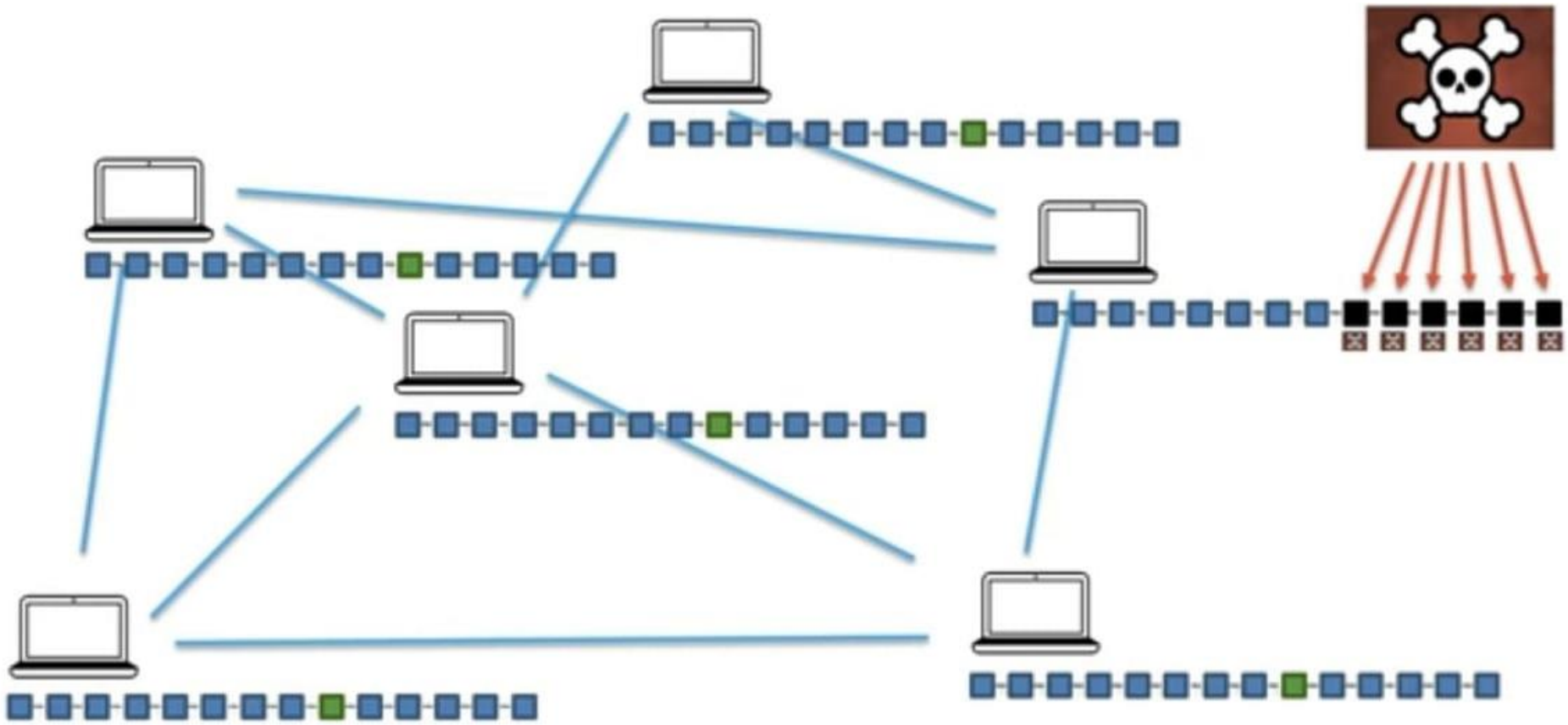
Someone attacking on blockchain through the network node



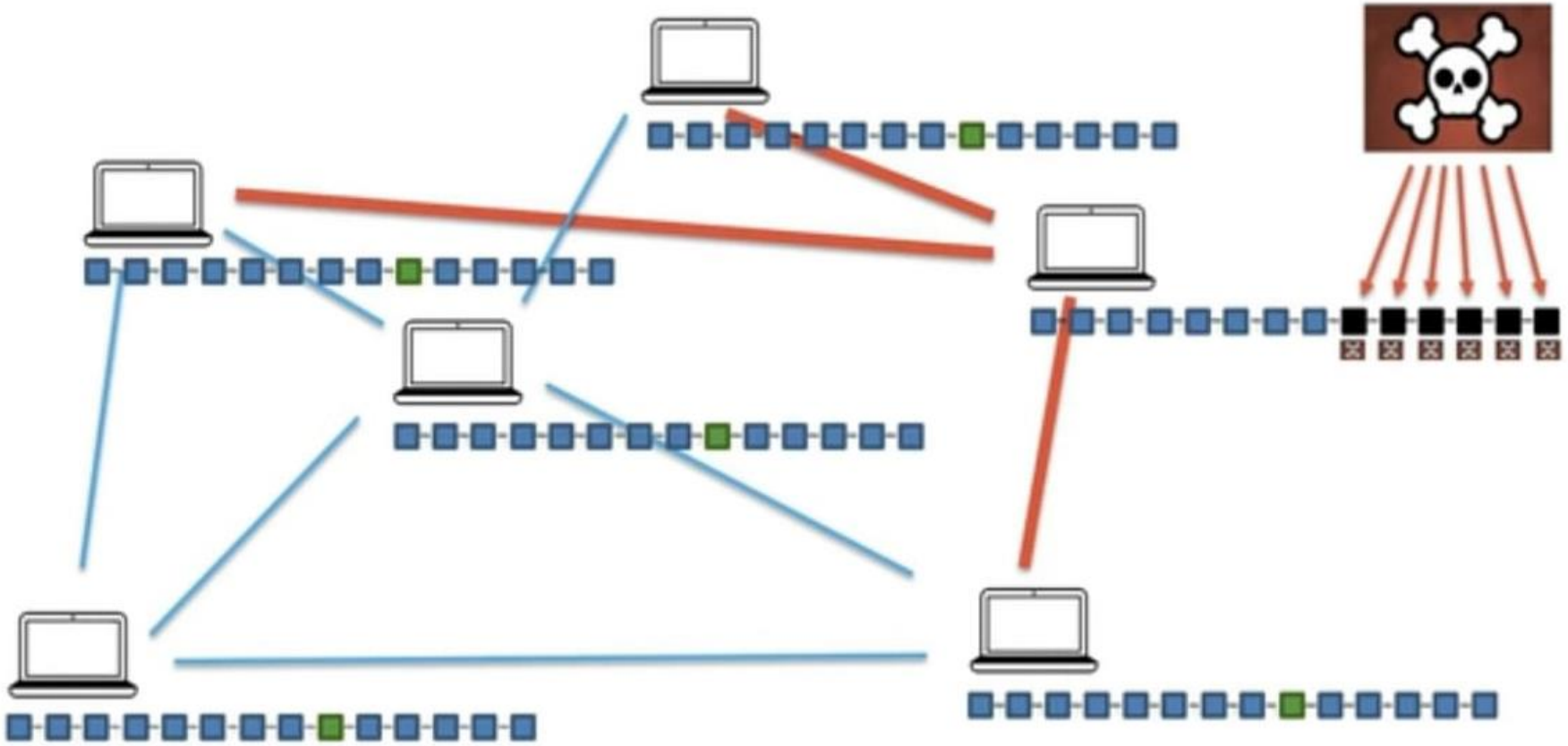
Hacker has to forge the blockchain



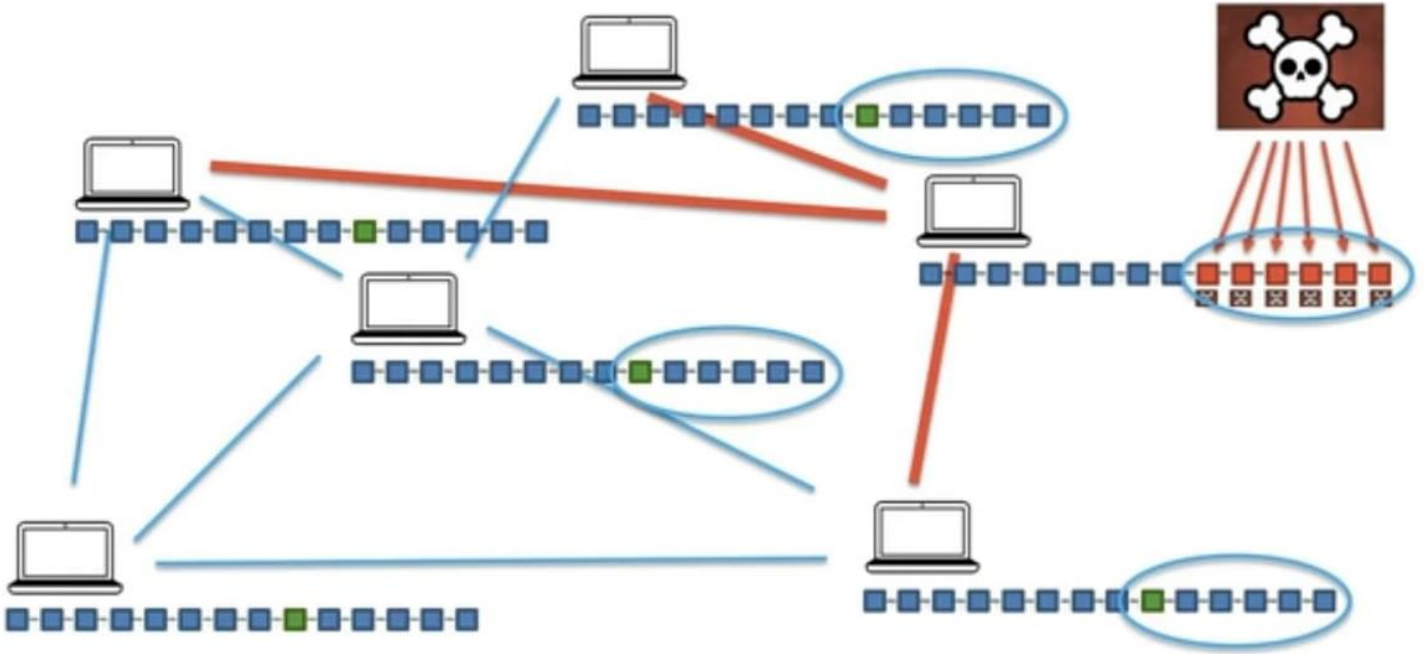
Hacker successfully forged the blockchain



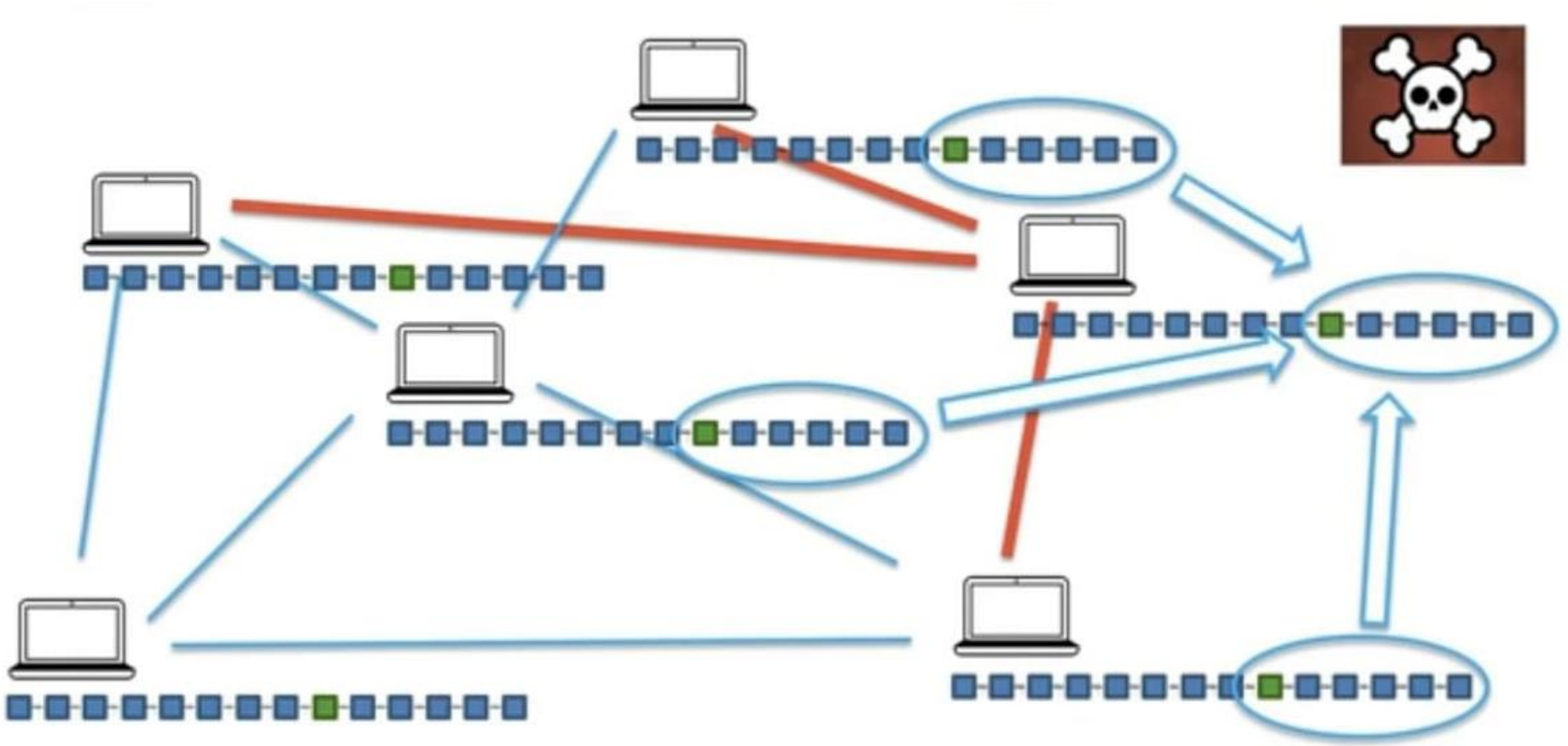
Network is constantly looking at peers to have the same copy of Blockchain



Copy of attacked node is not consistent with the majority



Correct copy is Restored

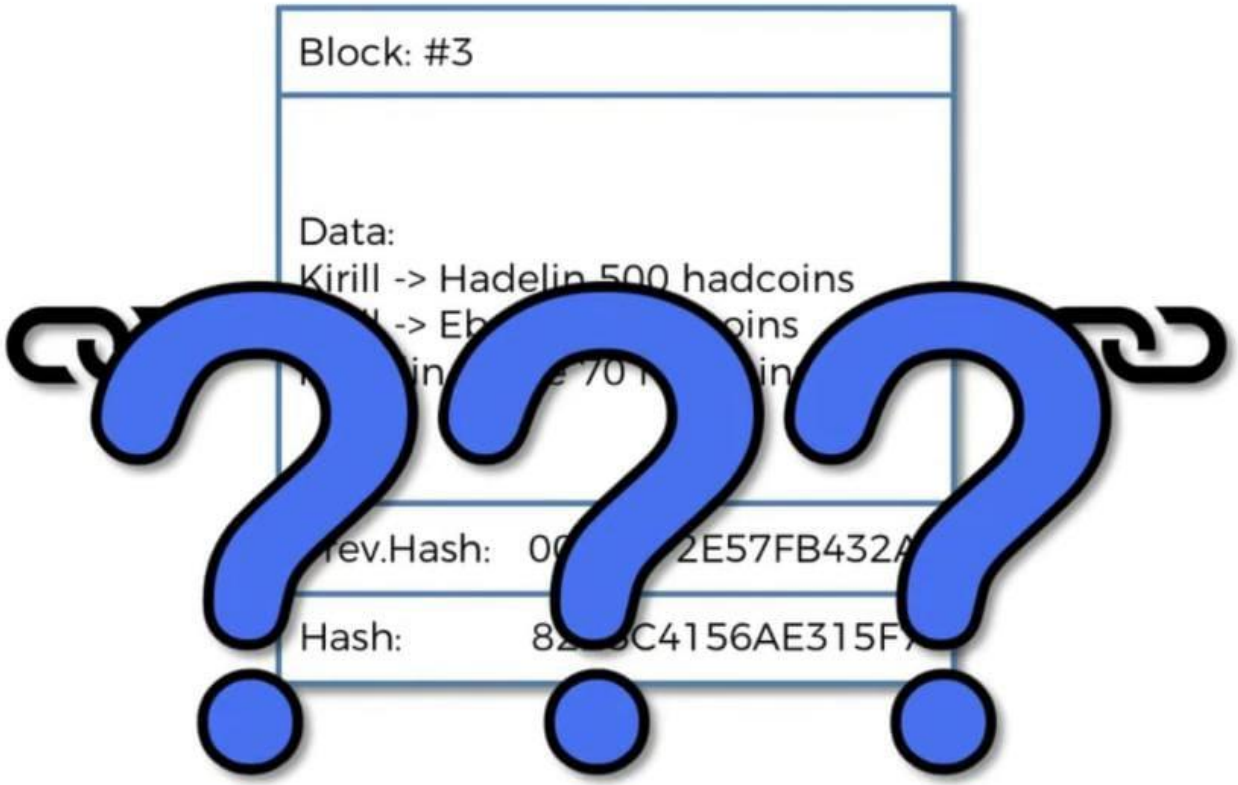


How mining works?
(The Nonce)

Information that a Block has:

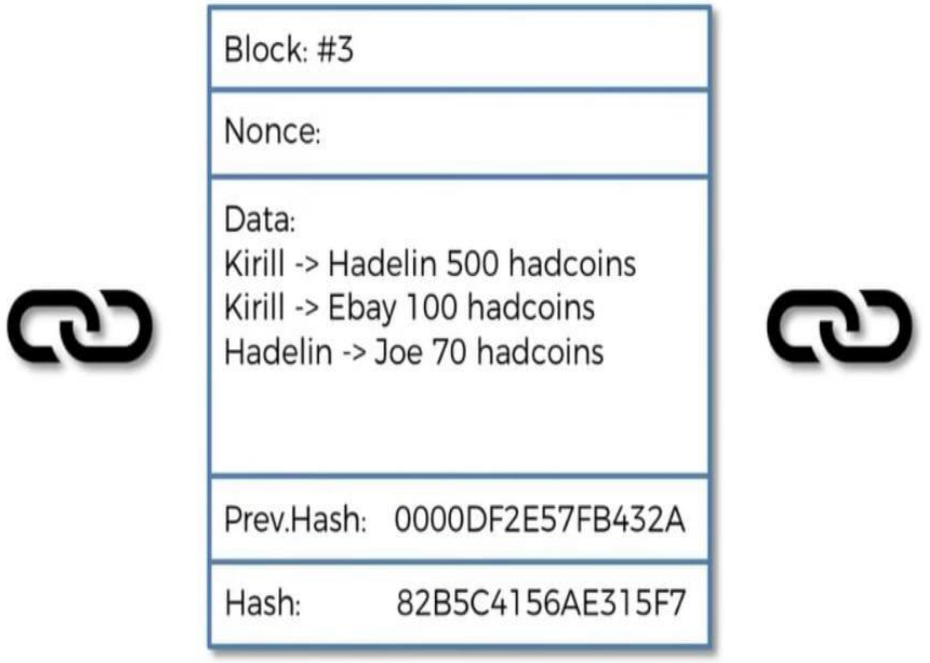
Computing Hash of a Block

If a generation of hash is this much simple, then for what the miners are in race ?



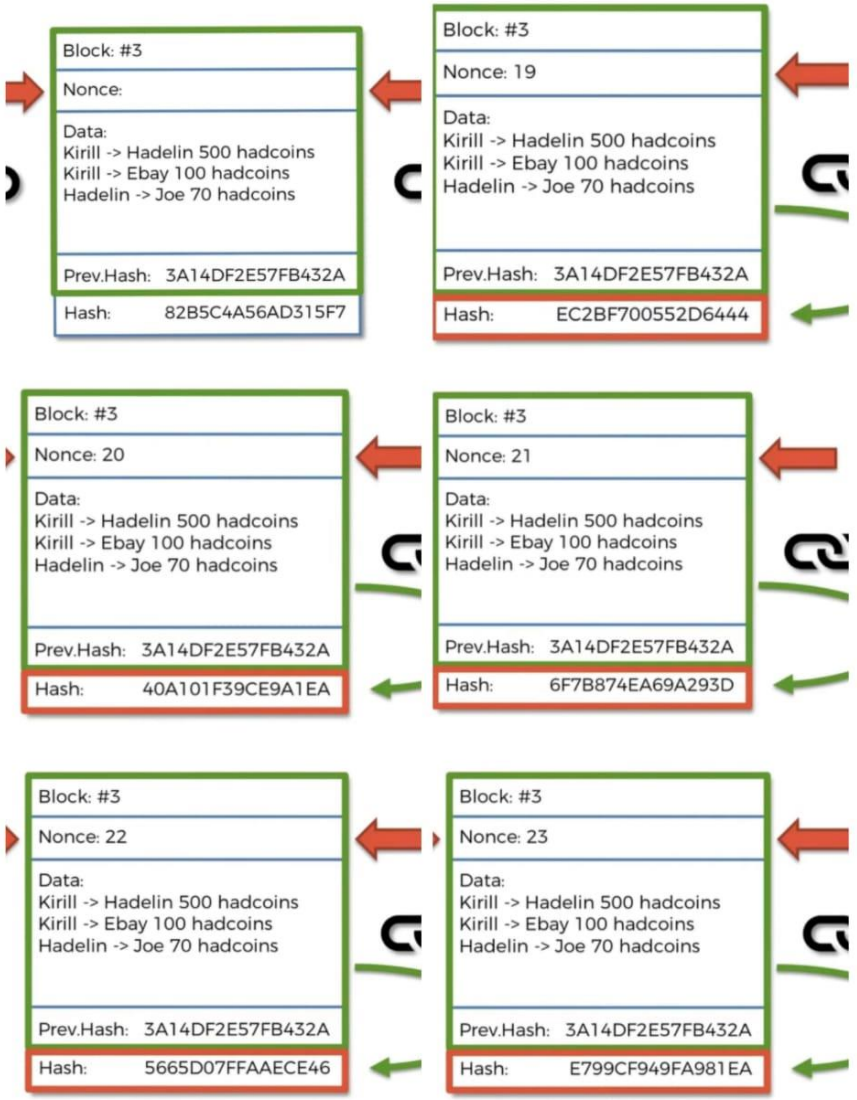
The Nonce

- Nonce: Number only used once
- Nonce is also included in computing the Hash along with Block Number, Data and Previous Hash
- The nonce keeps on changing which results in the changing of the Hash.

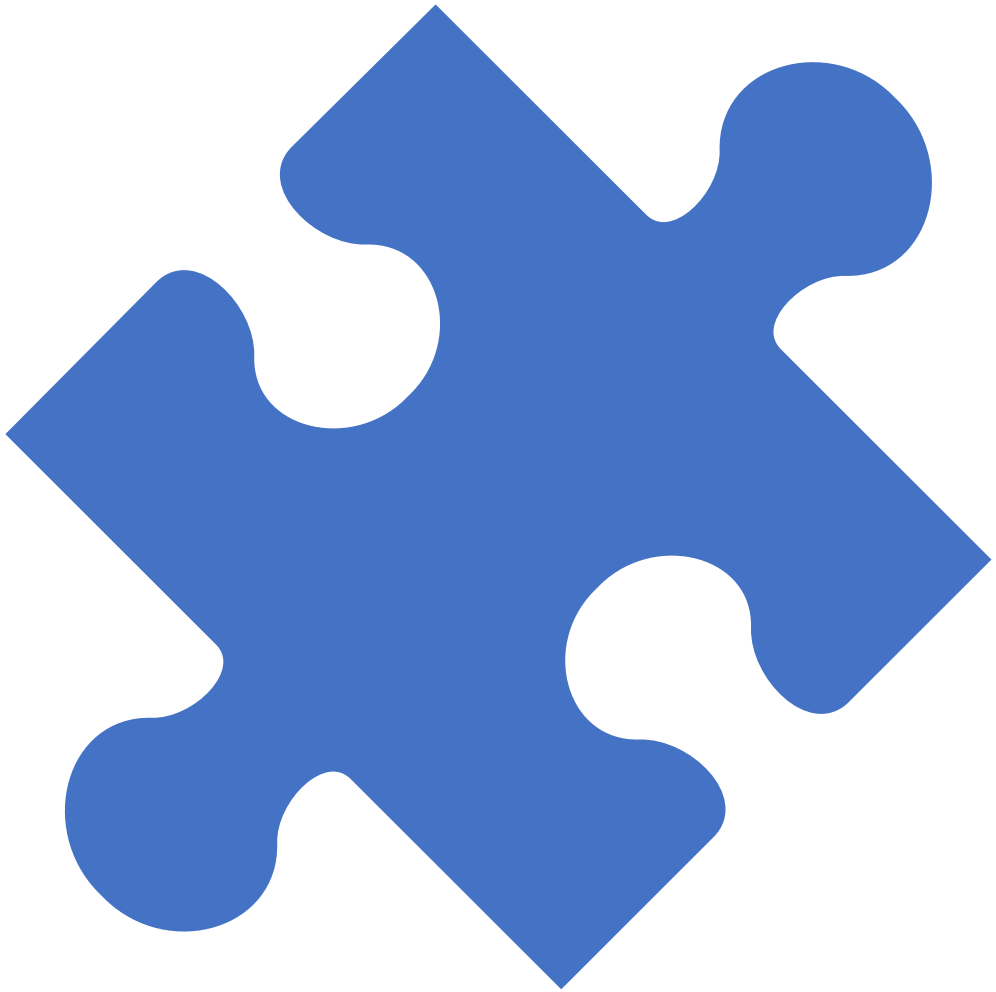


Nonce added extra power and flexibity to the security of the network


Block: #3
Nonce:
Data:
Kirill -> Hadelin 500 hadcoins
Kirill -> Ebay 100 hadcoins
Hadelin -> Joe 70 hadcoins
Prev.Hash: 3A14DF2E57FB432A
Hash: 82B5C4A56AD315F7


Block: #3
Nonce:
Data:
Kirill -> Hadelin 500 hadcoins
Kirill -> Ebay 100 hadcoins
Hadelin -> Joe 70 hadcoins
Prev.Hash: 3A14DF2E57FB432A
Hash: 82B5C4A56AD315F7
Block: #3
Nonce: 19
Data:
Kirill -> Hadelin 500 hadcoins
Kirill -> Ebay 100 hadcoins
Hadelin -> Joe 70 hadcoins
Prev.Hash: 3A14DF2E57FB432A
Hash: EC2BF700552D6444
Block: #3
Nonce: 20
Data:
Kirill -> Hadelin 500 hadcoins
Kirill -> Ebay 100 hadcoins
Hadelin -> Joe 70 hadcoins
Prev.Hash: 3A14DF2E57FB432A
Hash: 40A101F39CE9A1EA
Block: #3
Nonce: 21
Data:
Kirill -> Hadelin 500 hadcoins
Kirill -> Ebay 100 hadcoins
Hadelin -> Joe 70 hadcoins
Prev.Hash: 3A14DF2E57FB432A
Hash: 6F7B874EA69A293D
Block: #3
Nonce: 22
Data:
Kirill -> Hadelin 500 hadcoins
Kirill -> Ebay 100 hadcoins
Hadelin -> Joe 70 hadcoins
Prev.Hash: 3A14DF2E57FB432A
Hash: 5665D07FFAAECE46
Block: #3
Nonce: 23
Data:
Kirill -> Hadelin 500 hadcoins
Kirill -> Ebay 100 hadcoins
Hadelin -> Joe 70 hadcoins
Prev.Hash: 3A14DF2E57FB432A
Hash: E799CF949FA981EA

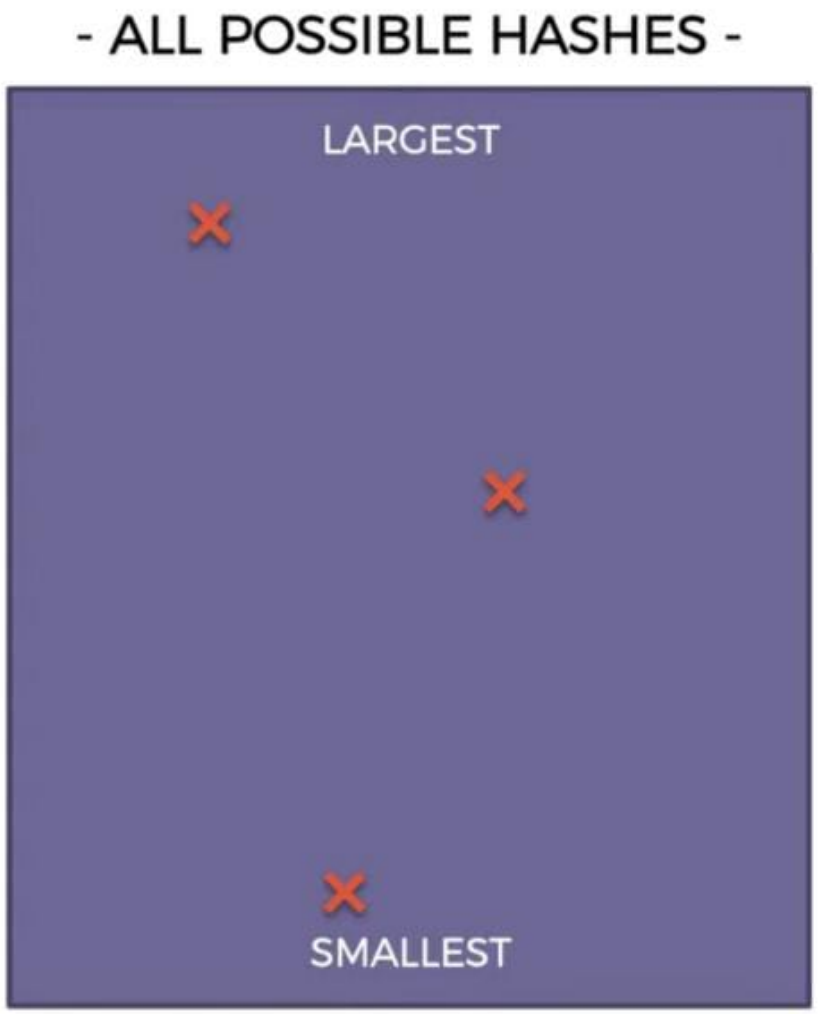
How mining works? (The cryptographic puzzle)



18D5A1AEDCBF543BC630130BEF99CFAD55D1B7413EF05B9AF927432FDE808C68

00000000000087EC6D4886046788DCB49E9897F03C0A063F1F0CB57EEE7F0923

0000000000000000000000000000000000000159CAA4B1EDA0FED66CB5E915C8F

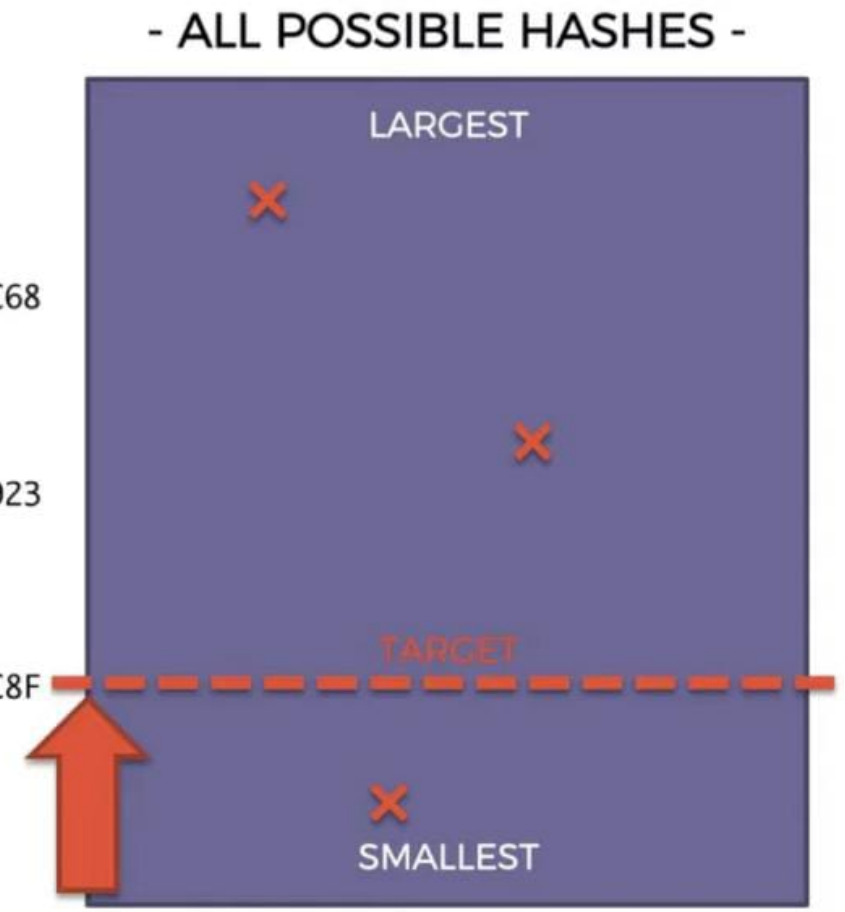


Network arbitrary selects the target for the miners

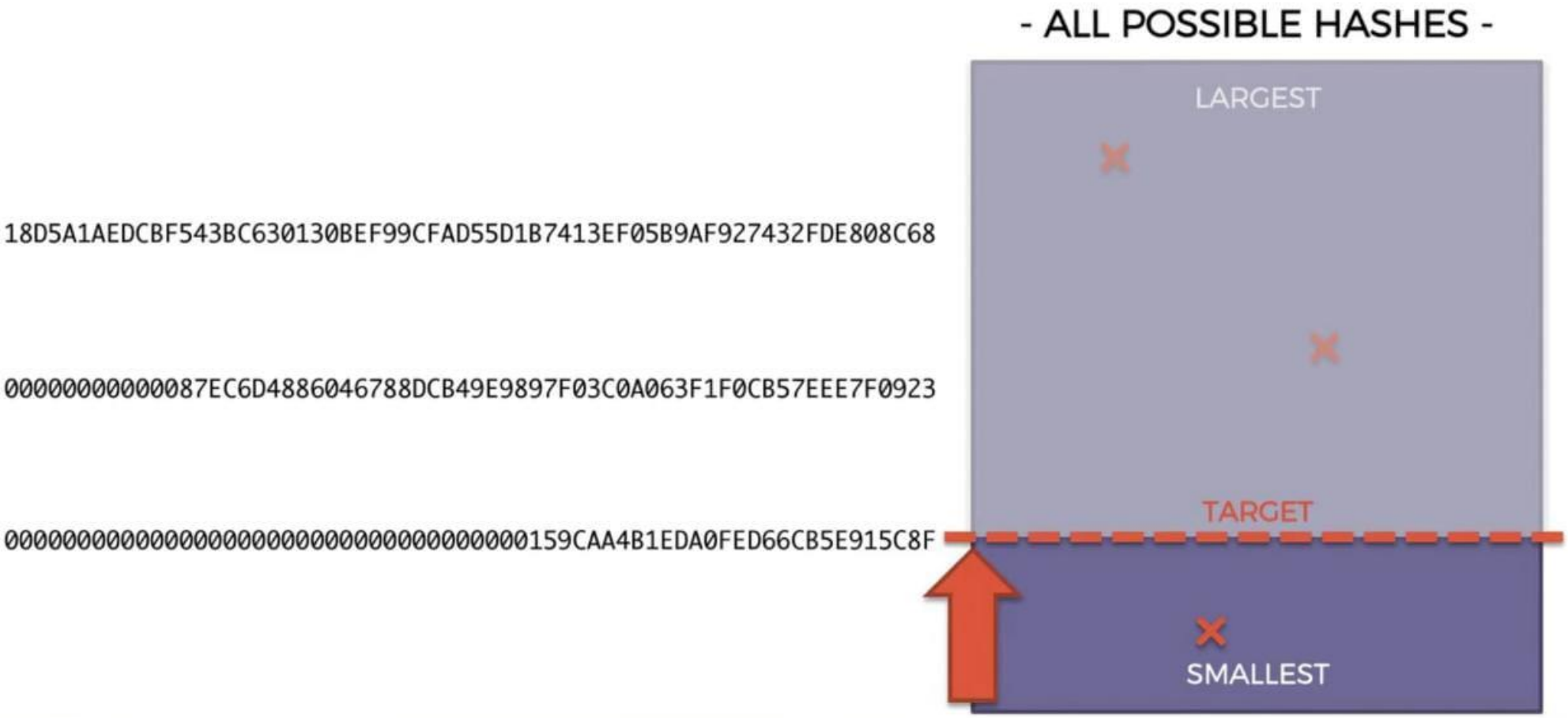
18D5A1AEDCBF543BC630130BEF99CFAD55D1B7413EF05B9AF927432FDE808C68

00000000000087EC6D4886046788DCB49E9897F03C0A063F1F0CB57EEE7F0923

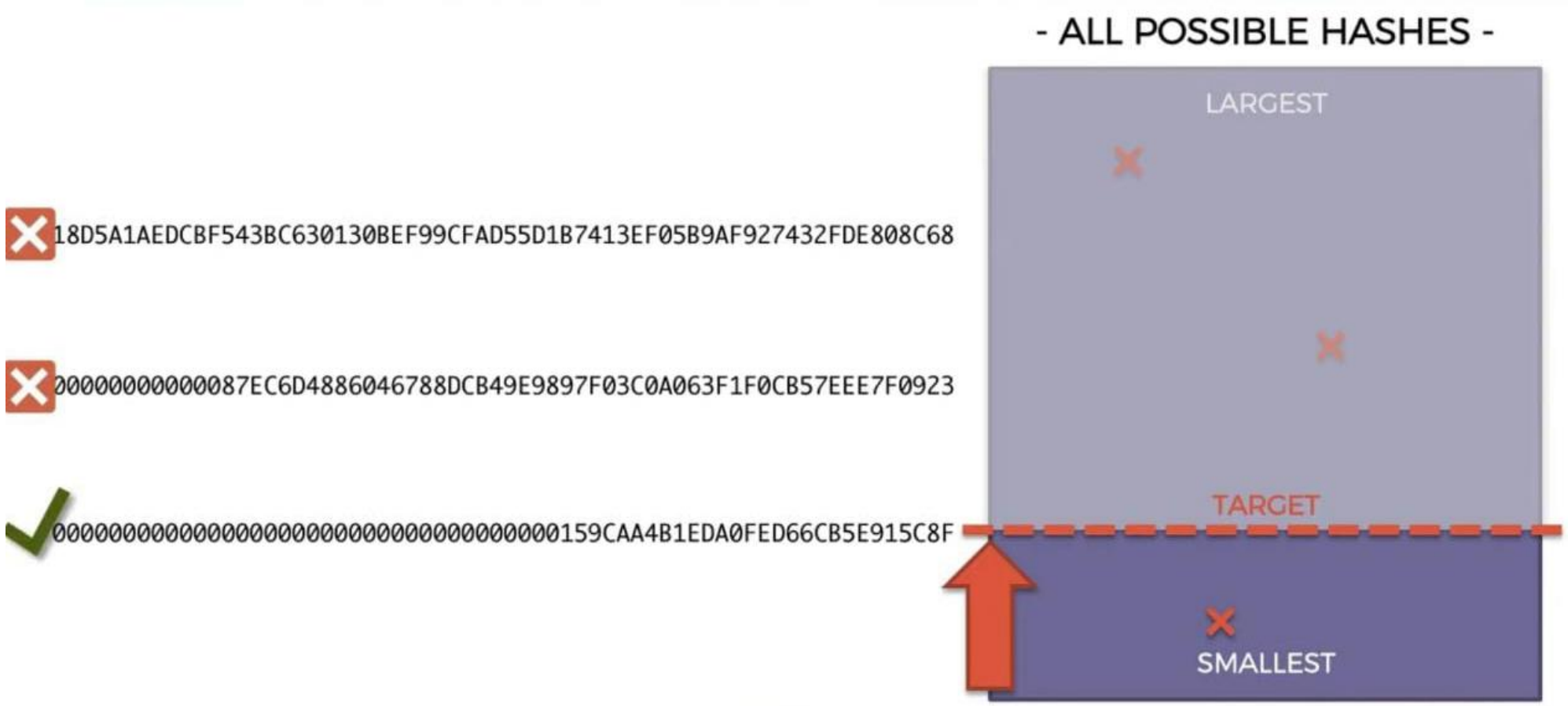
0000000000000000000000000000000000000159CAA4B1EDA0FED66CB5E915C8F

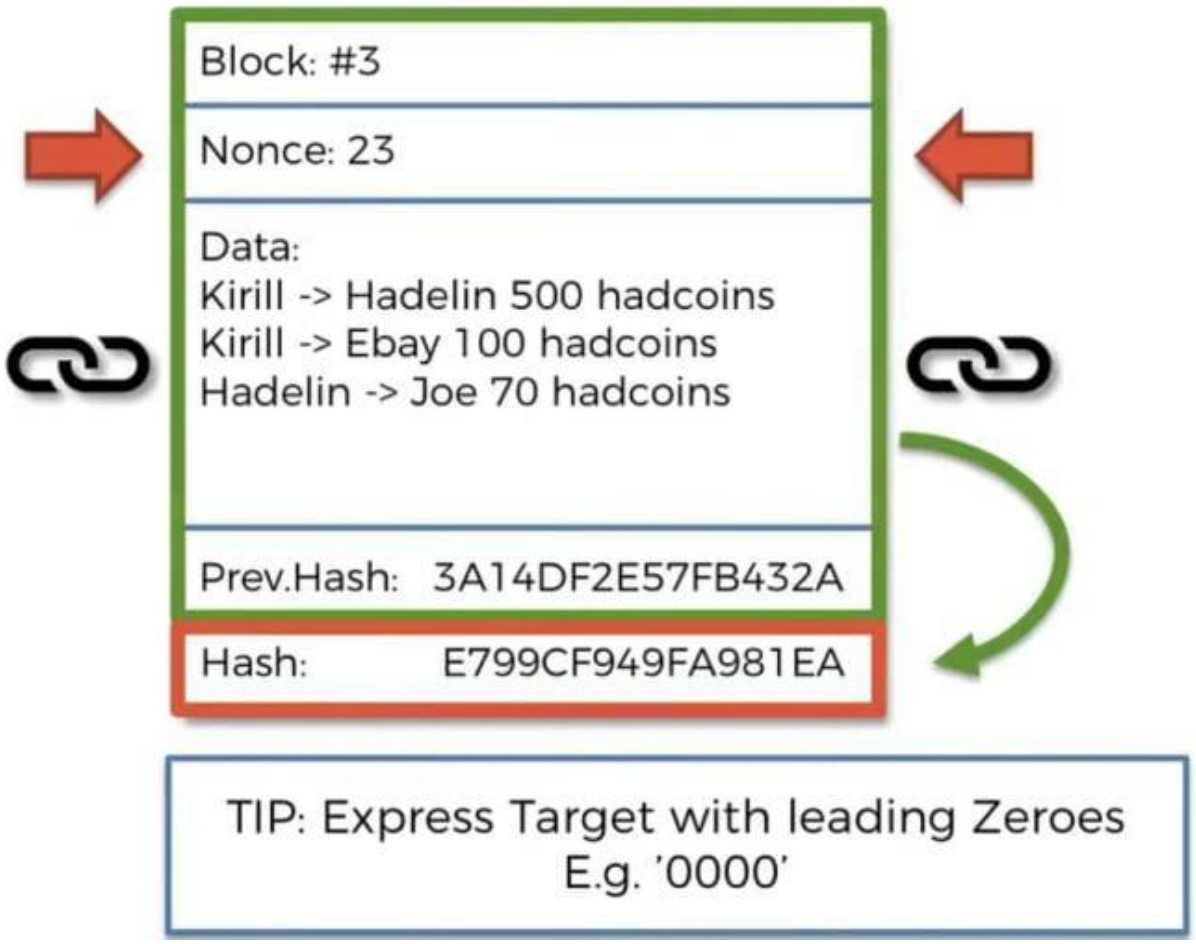


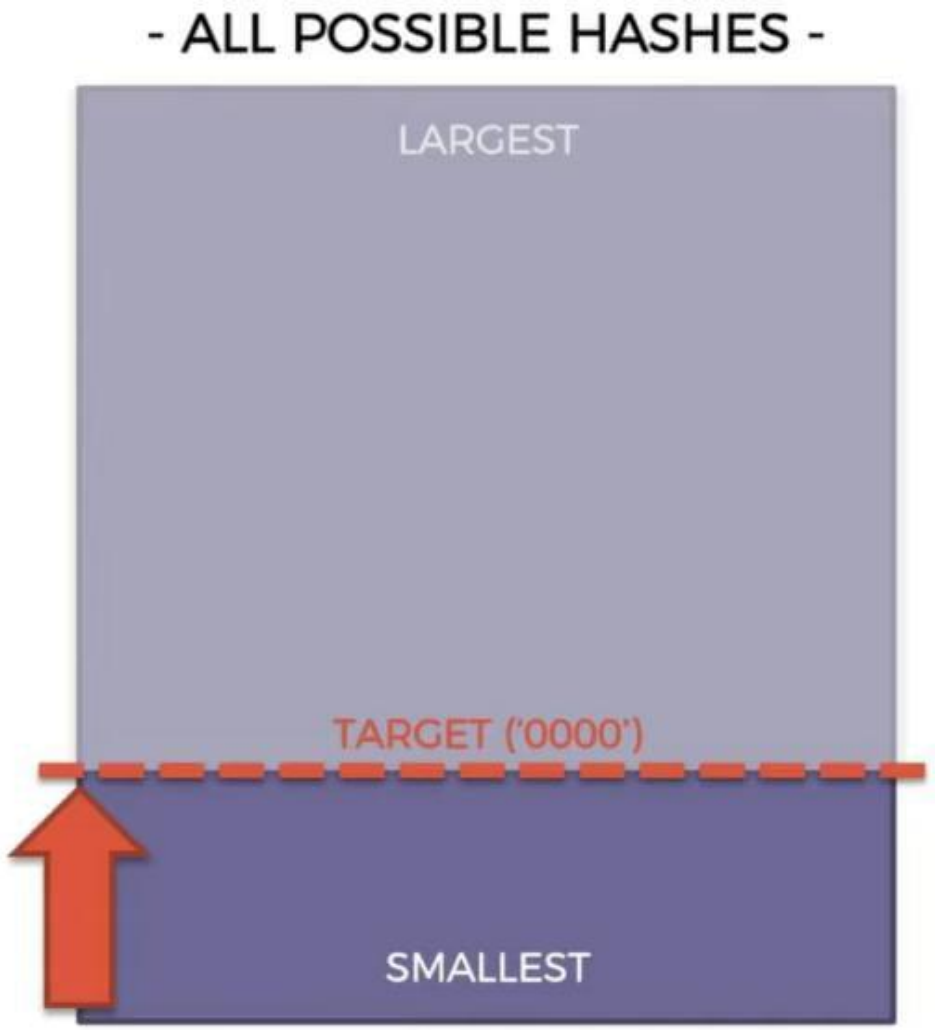
Any hash above the target doesn't count



The only reason for it is to create a hurdle for the miners

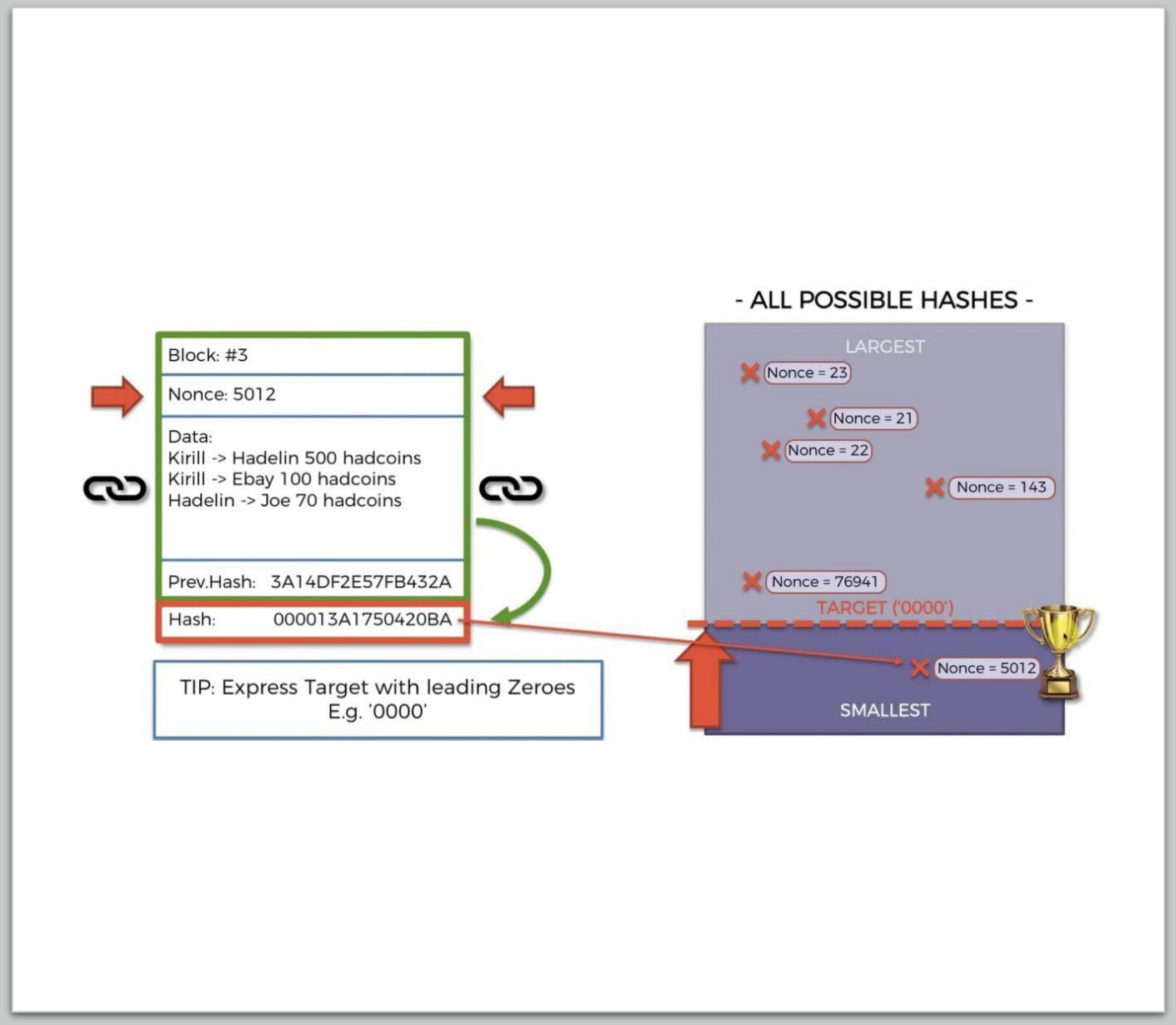


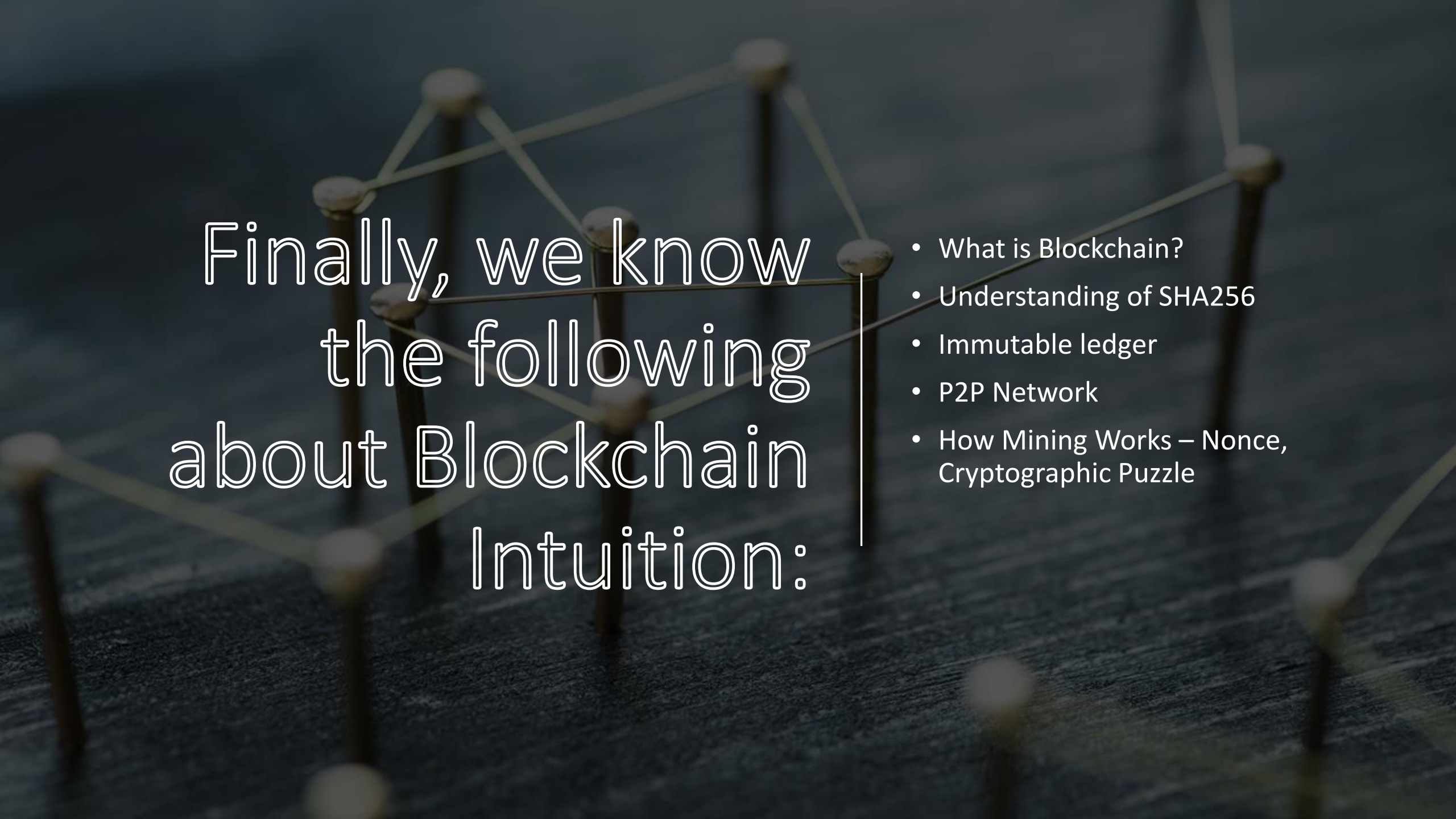

Block: #3
Nonce: 23
Data:
Kirill -> Hadelin 500 hadcoins
Kirill -> Ebay 100 hadcoins
Hadelin -> Joe 70 hadcoins
Prev.Hash: 3A14DF2E57FB432A
Hash: E799CF949FA981EA
TIP: Express Target with leading Zeroes
E.g. '0000'


- ALL POSSIBLE HASHES -
LARGEST
TARGET ('0000')
SMALLEST

Found Golden Nonce:

- If you find a hash below the target, you will be allowed to create a block
- Miners just guess the nonce to generate a hash which is below the target
- Nonce = 5012 (Golden Nonce) was able to generate a hash that is below the target and hence gets to create a block in the blockchain





Finally, we know the following about Blockchain Intuition:

- What is Blockchain?
- Understanding of SHA256
- Immutable ledger
- P2P Network
- How Mining Works – Nonce, Cryptographic Puzzle

Acknowledgement and Source:

- https://www.udemy.com/course/build-your-blockchain-az/