Blockchains in 12 Easy Steps

and Observations to Ponder…

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ICANN60
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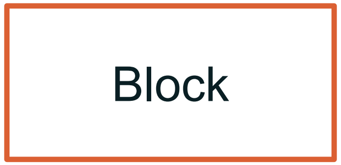
Blockchains at ICANN:

- Namecoin was presented at ICANN58 in the “Emerging identifier session”.
- The community requested ICANN/Office of the CTO to make a broader study of blockchains.
  - Focus is on understanding the technology and performing a risk analysis.
  - Main issue in mind: scalability
- Blockchain panel at ICANN60 at “Emerging identifier session”

Caveats:

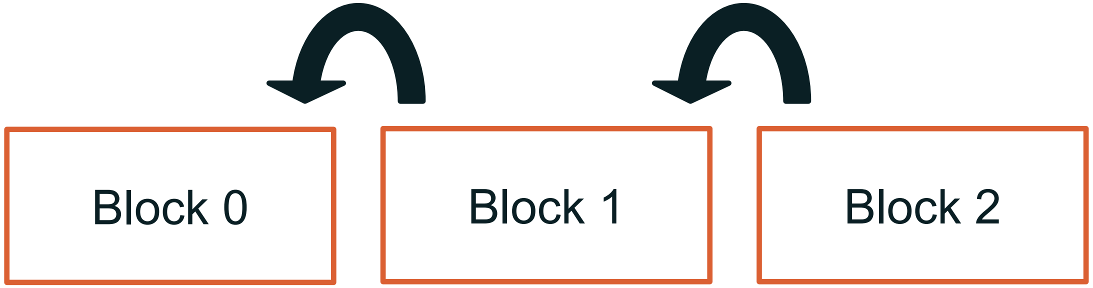
- The steps described in the presentation are generic and not descriptive of any specific blockchain implementation.
- Thus, the list of those steps is neither fully accurate nor fully complete.
- Some steps reflect the Bitcoin model, some don’t.

Step 1: A Block



Blocks can contain arbitrary information. Each block is cryptographically signed.

Step 2: A Blockchain



Block 0

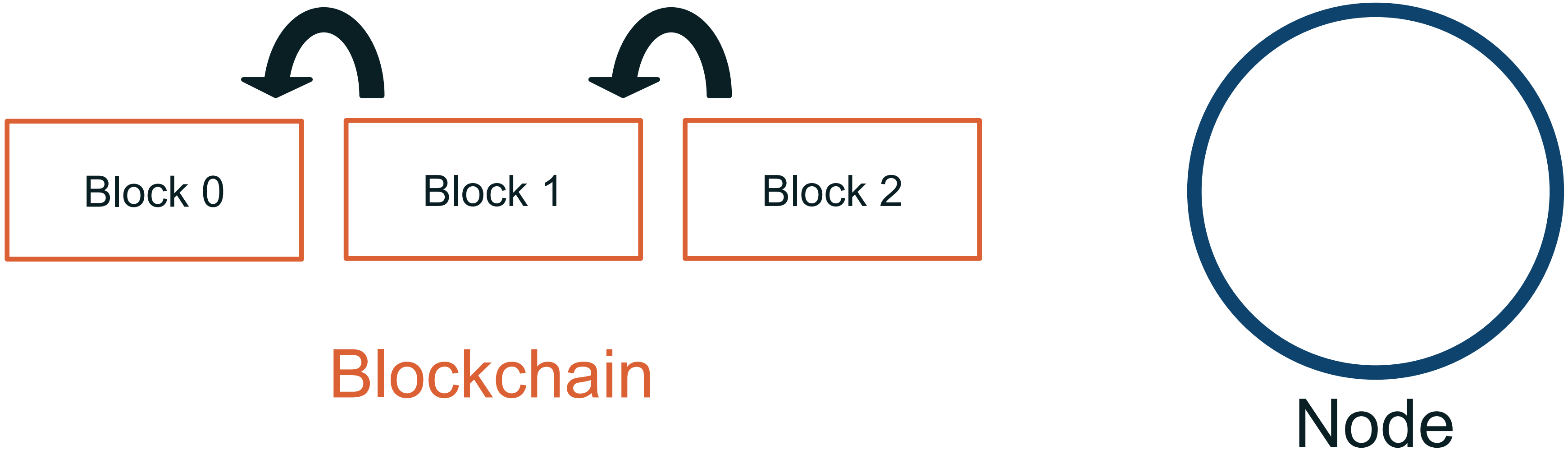
Block 1

Block 2

Blockchain

A Blockchain is a list of blocks that are chained back to each other. In other words, each block in the chain has a pointer to the block immediately before.

Step 3: Nodes



Block 0

Block 1

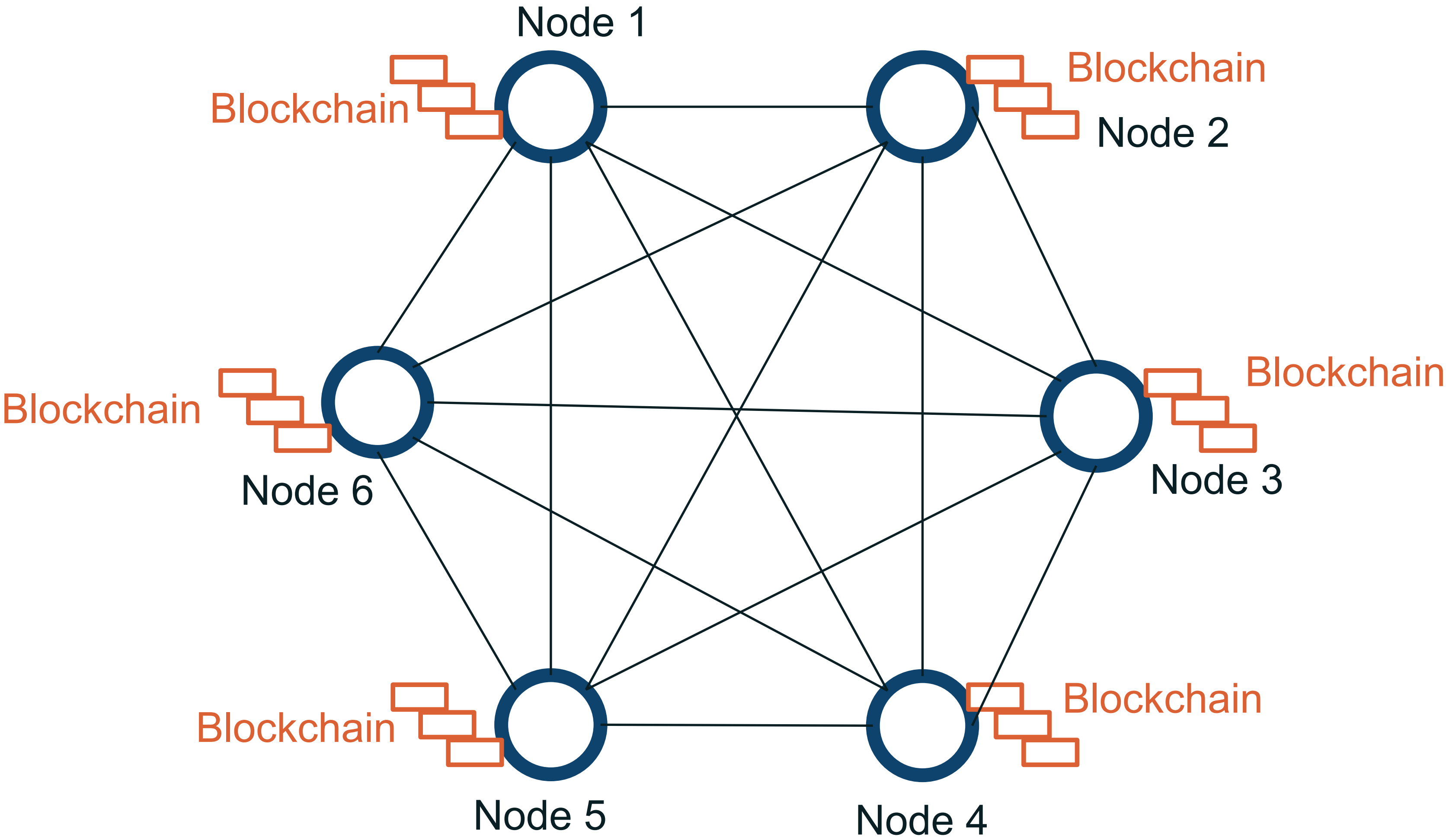
Block 2

Blockchain

Node

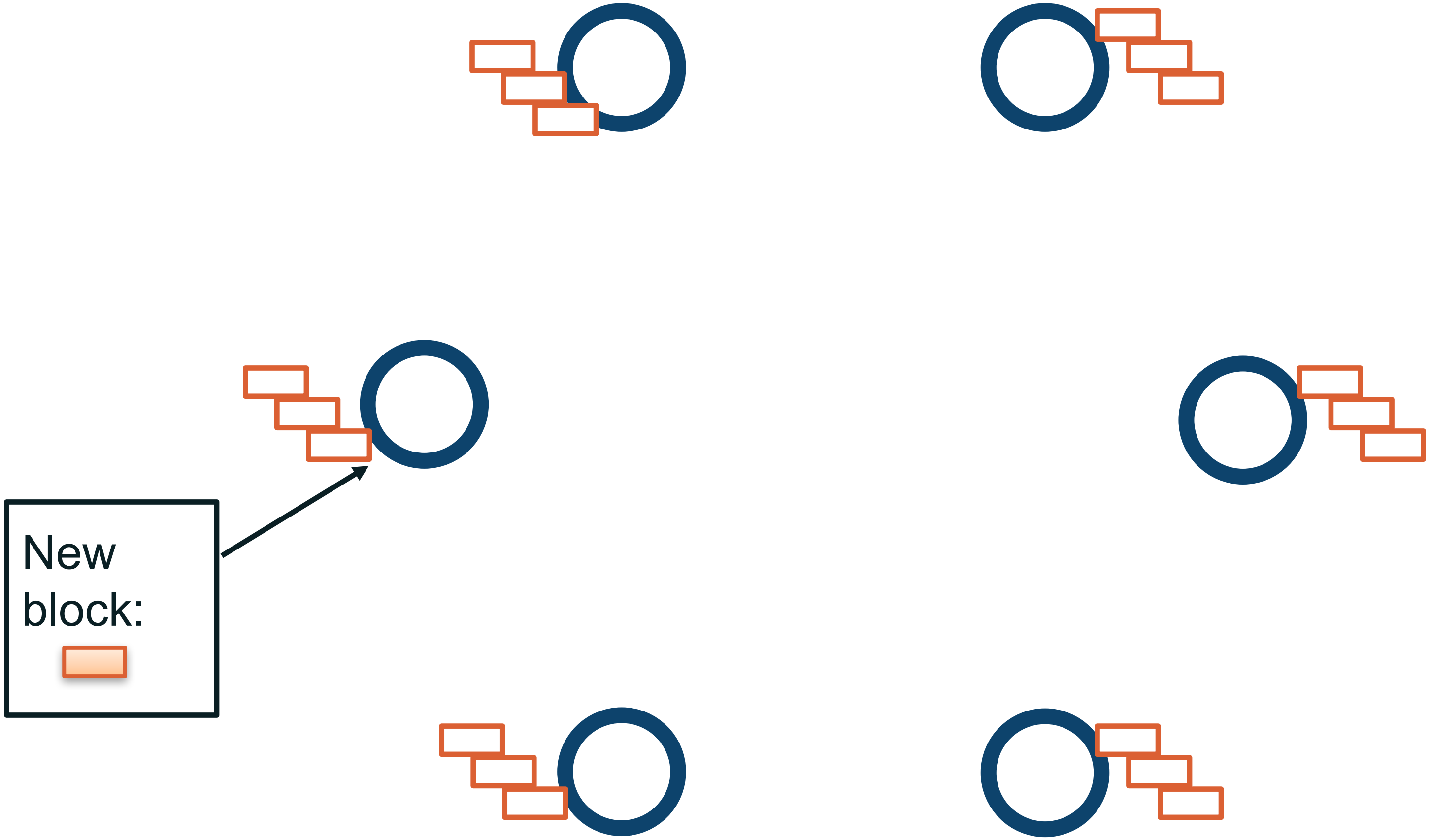
Any node can maintain a local copy of the blockchain.

Step 4: The Nodes Form a Peer-to-Peer Network



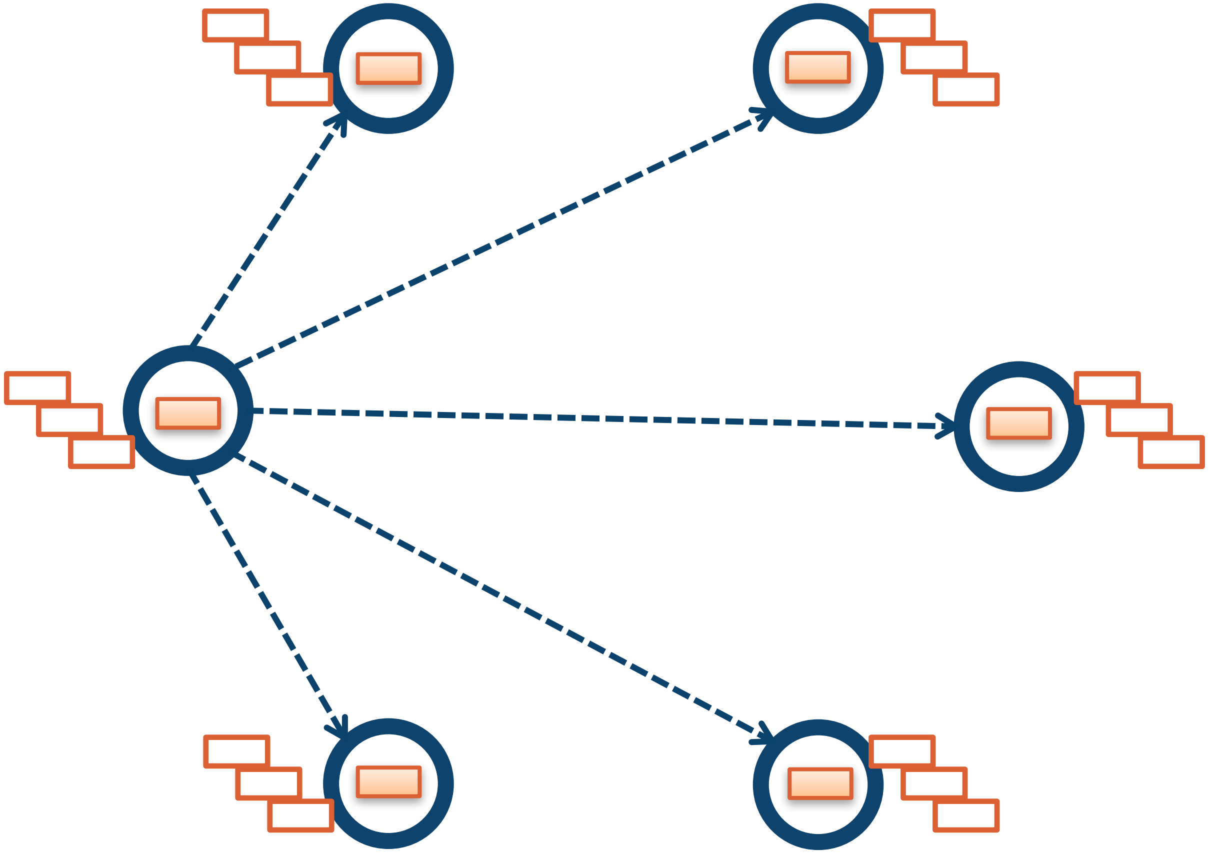
Nodes have identical copies of the blockchain.

Step 5: A Node Wants to Add a New Block



New block will be added at the end of the blockchain.

Step 6: Distributing Candidate Block to All Nodes



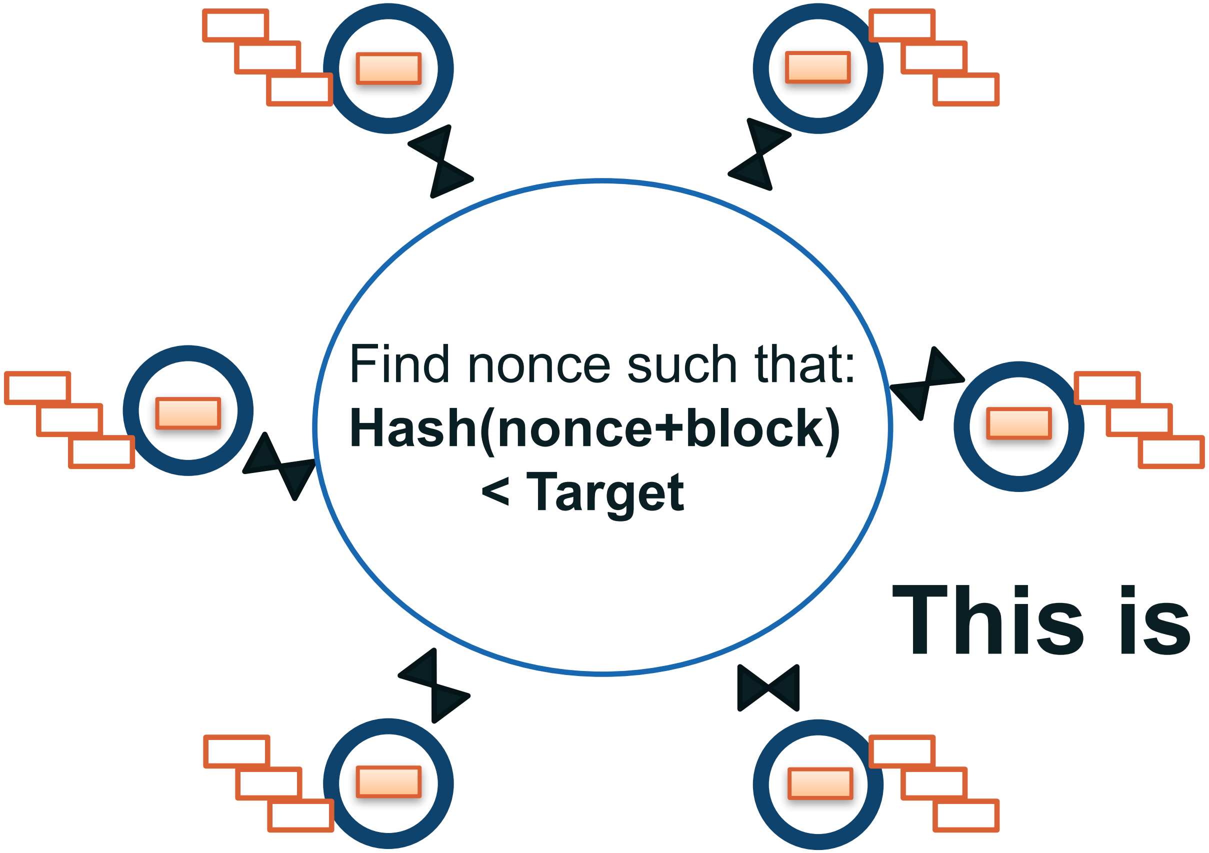
The requesting node send the new block to all participating nodes.

Step 7: All Nodes Try to Solve a Complex Puzzle

This phase has to be completed within a specific time frame.
Over time, the difficulty of the task will increase (the target value will decrease).

Proof of Work

There is an alterative approach: **Proof of Stake**

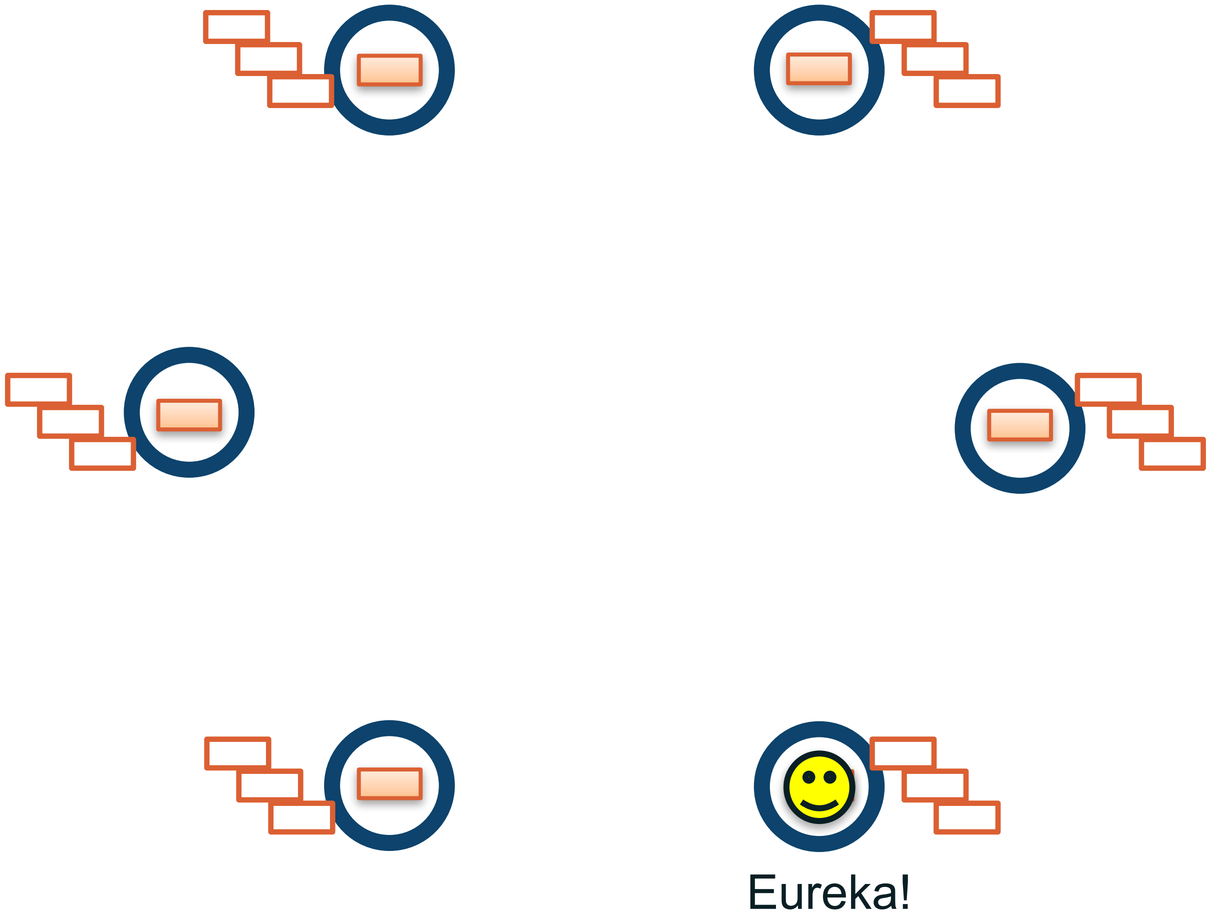


Find nonce such that:
Hash(nonce+block) < Target

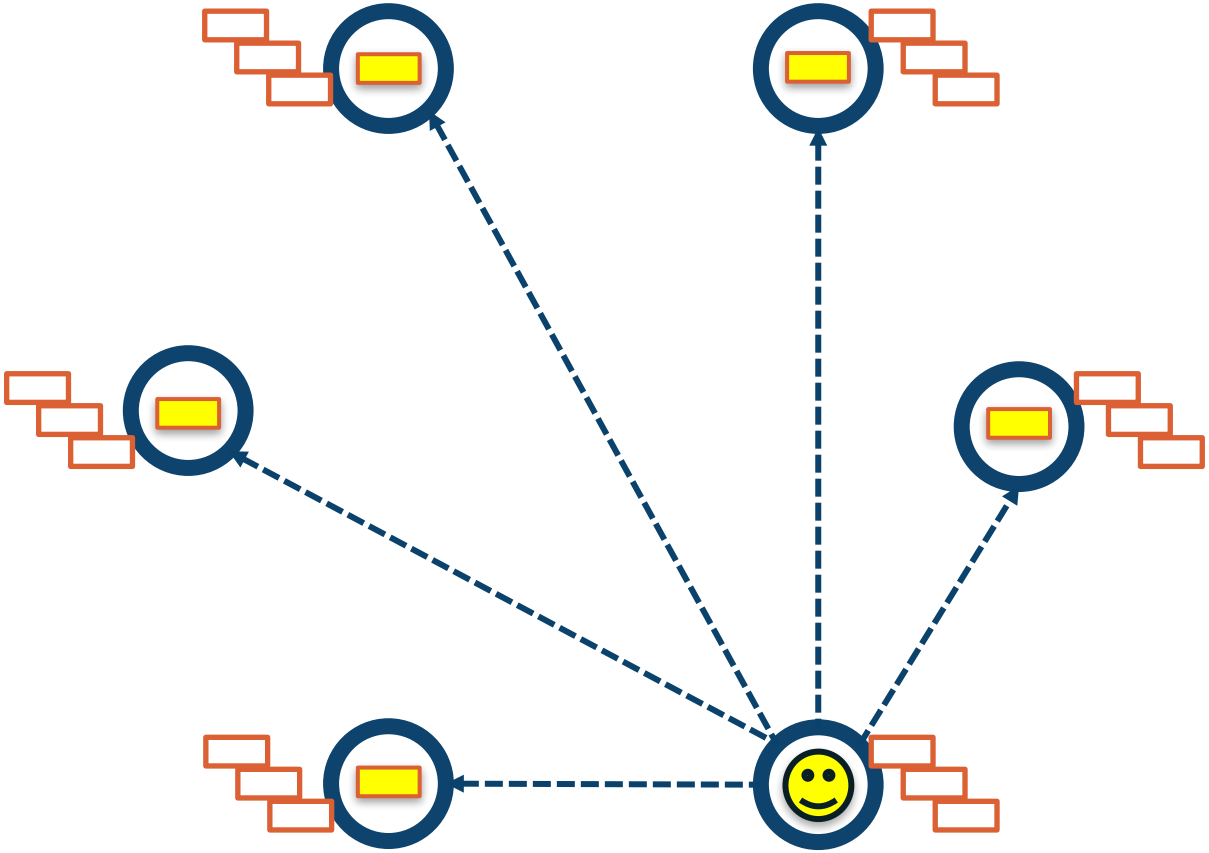
This is a race!

The proof of work is solely to build a “voting poll tax” into the system.
Only nodes willing to offer significant compute power can participate.
It protects against rogue node joining the network to perform the 51% vote attack.

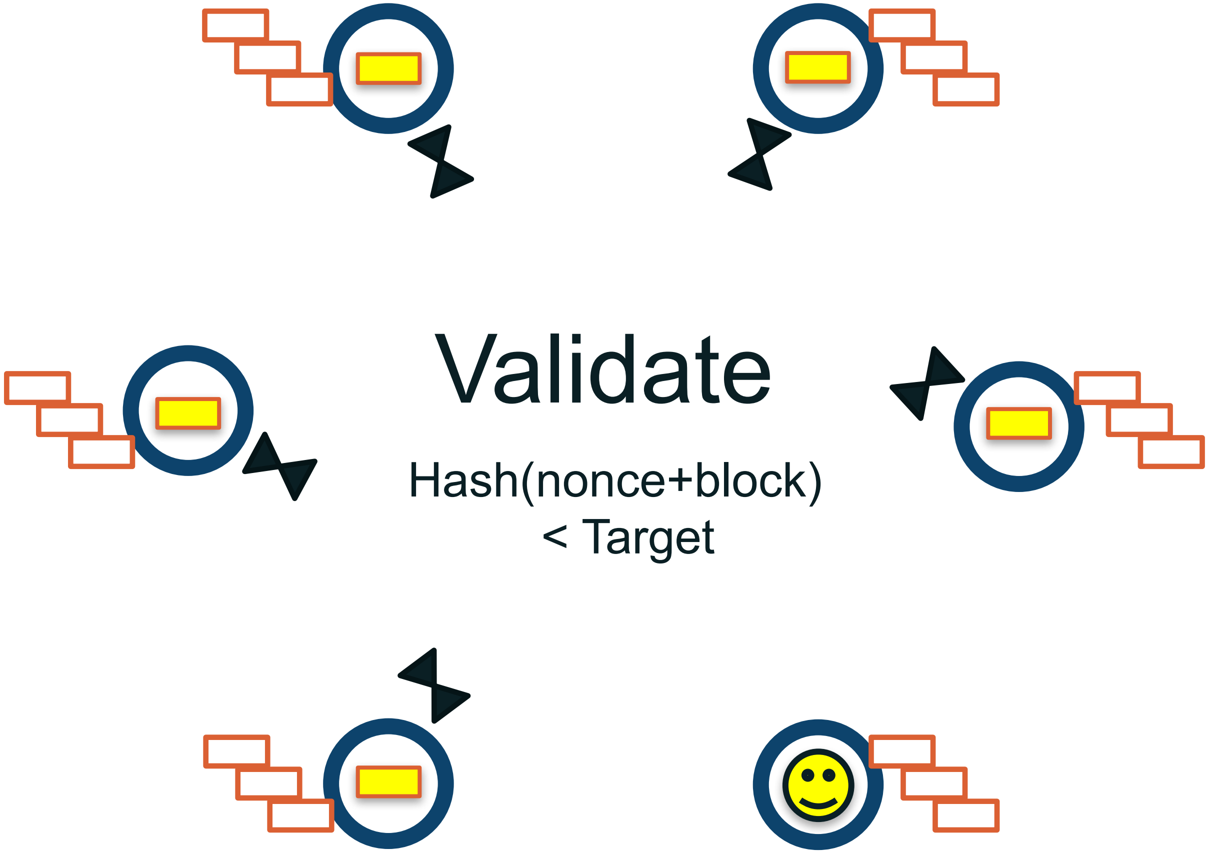
Step 8: A Node Finds the Answer First



Step 9: Winner Propagates Solution to All Nodes



Step 10: All Nodes Validate the Proposed Solution

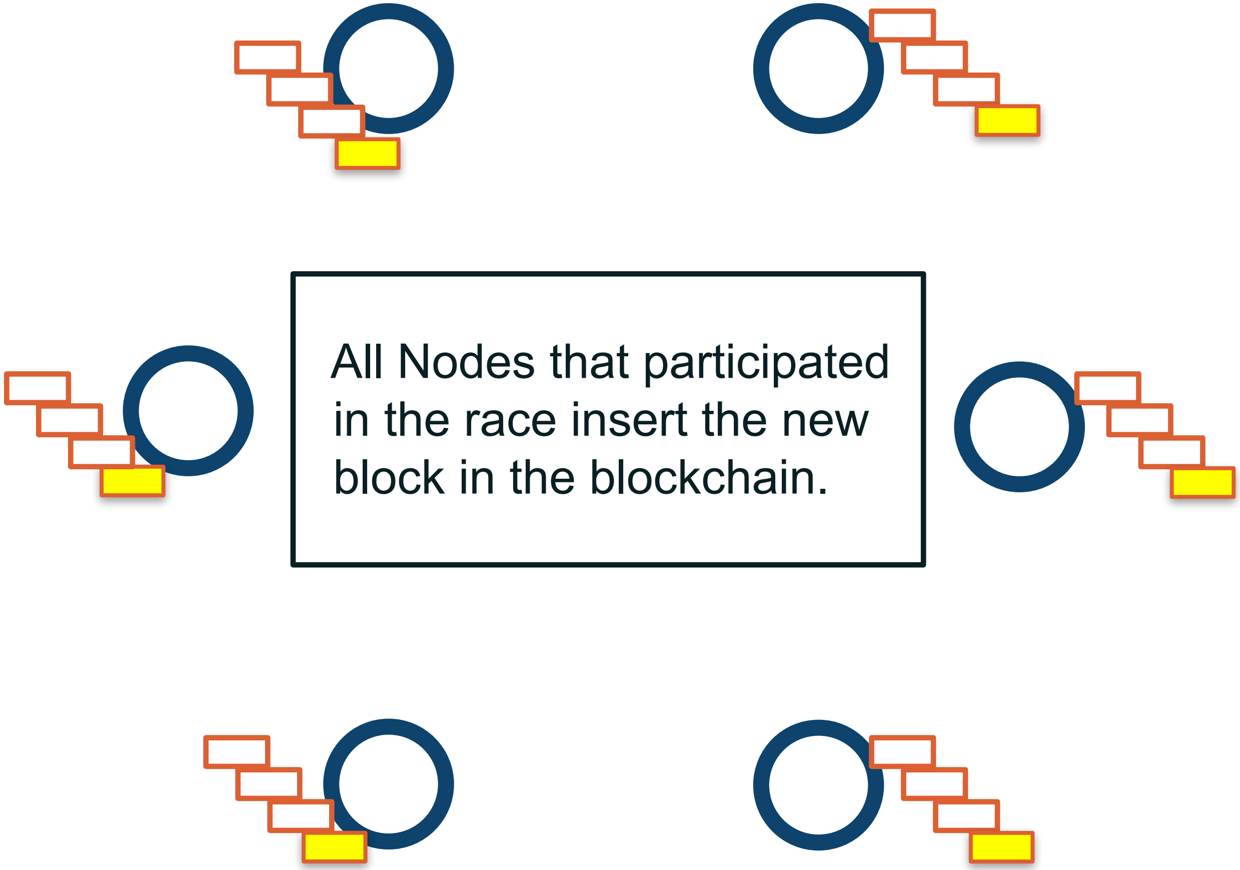


Validate

Hash(nonce+block)
< Target

Note: The validation phase is very fast (a single hash calculation).

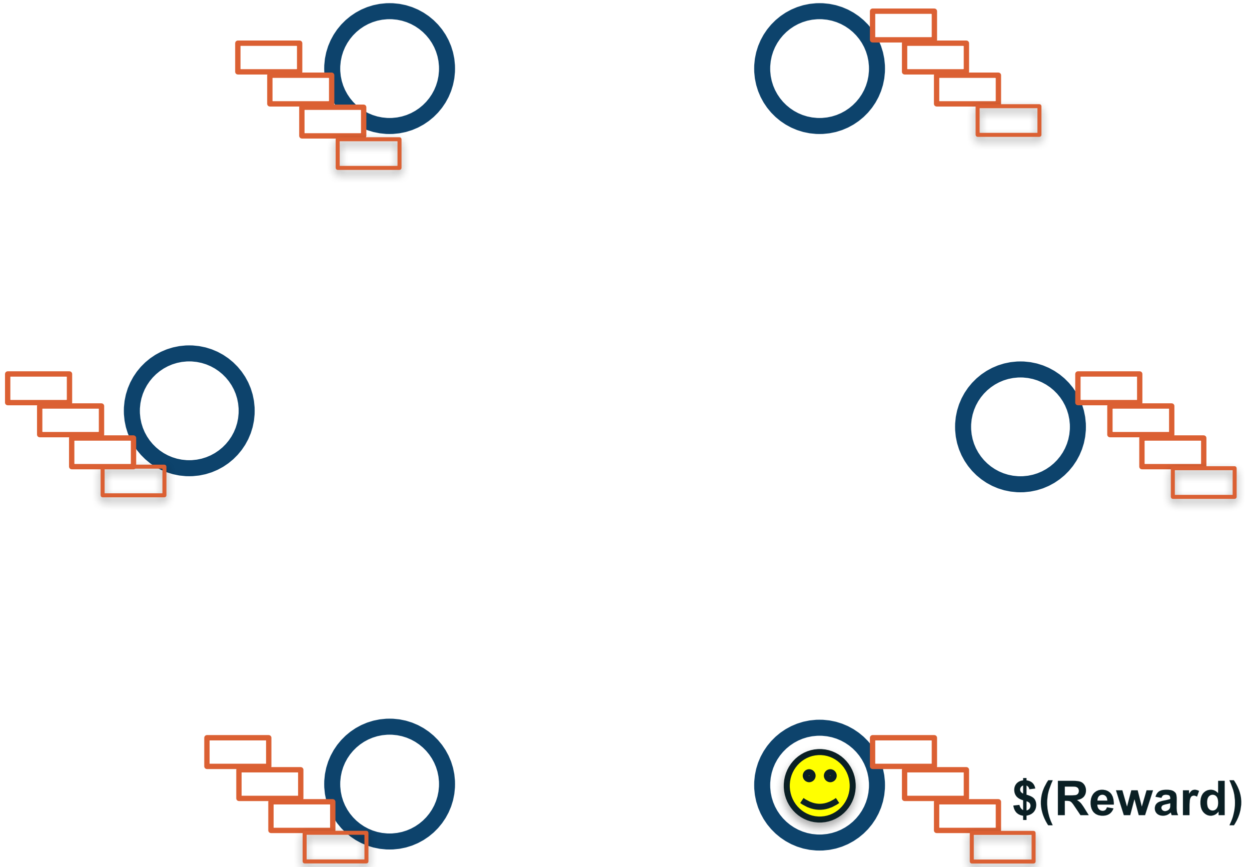
Step 11: New Block is Inserted in the Blockchain



All Nodes that participated in the race insert the new block in the blockchain.

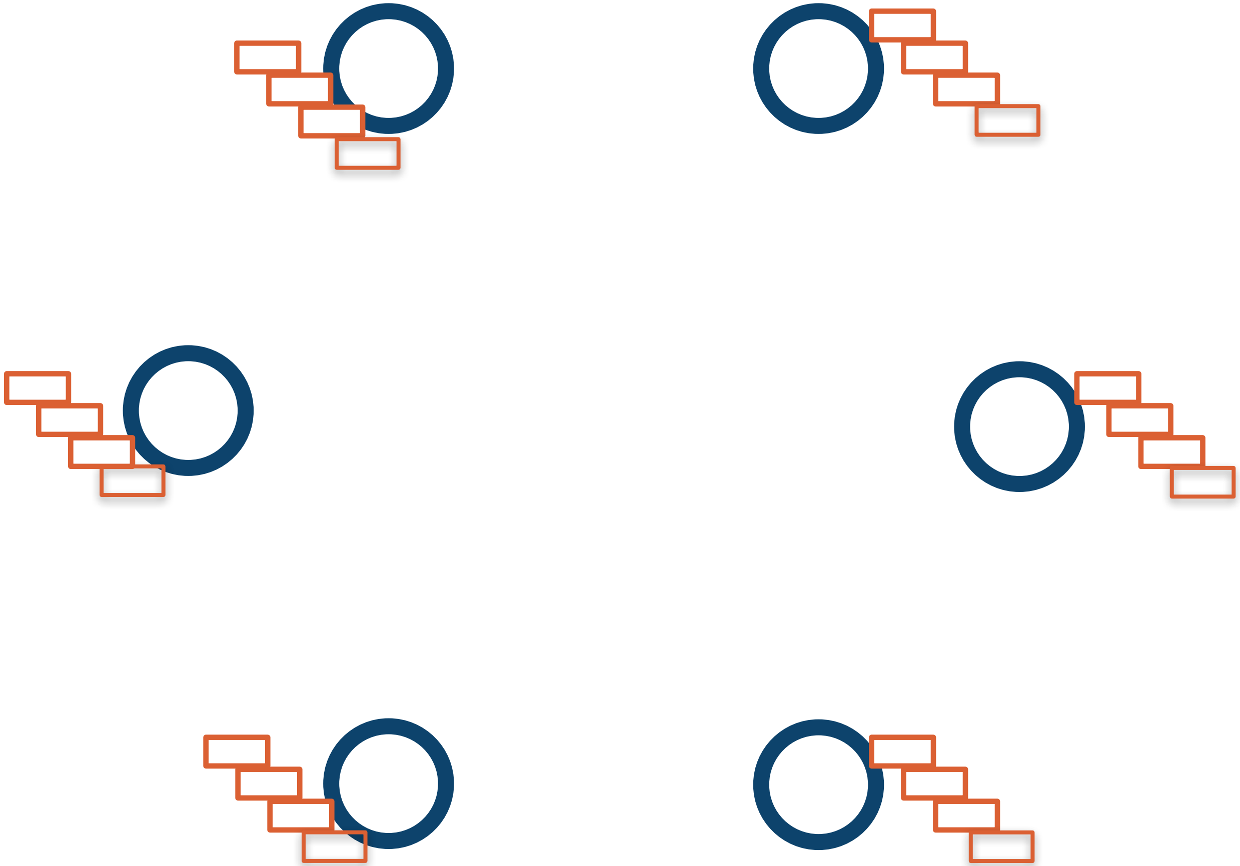
This phase is happening at a predefined clock time.

Step 12: Winner Gets a Reward



The “reward” is here to incentivize nodes to participate to the system and provide compute resources for proof-of-work.

Repeat: The New Block is Ready to Be Used



Repeat…!

Evolution: From Proof-of-Work to Proof-of-Stake

- Replace seemingly mindless random number generation by “Proof-of-Stake”
  - Token to update chain given (randomly or round-robin) to a party with stake
- Acceleration of the cycle
  - From 1 transaction per 10 seconds to 10 transaction per second: conflicts can happen often
  - This forces each node to decide which way to go in case of possible fork
- Strong incentive ($$$) to remain in the majority
  - Each node “guess” where the community is going
  - Whoever control the resources effectively controls the blockchain.

Observations: 1/2

- Every node keep a complete copy of the entire blockchain.
  - Blockchain size always increases… to infinity!
  - Scaling issue: Maximum size of the blockchain
    → May limit participation to few very large nodes.
- The complexity of the ”Proof-of-Work” always increases to protect against the 51% vote attack.
  - Access to low cost electric power becomes a selection factor that may create a bias in the system.
  - Proof-of-stake and smart contracts are proposed as a replacement of Proof-of-Work in newer blockchains.
- The rate of adding blocks to the chain is fixed.
  - Scaling issue: update rate is fixed
    → Not all transaction will be recorded immediately.

Observations: 2/2

- Transactions can’t be deleted
  - No way to correct a mistake
- All blocks are visible
  - No privacy, no “right to forget”.
- Control to a node is via public key/private key
  - No way to recover lost passwords
- What can blockchains be used for?
  - Just about anyplace where a community-managed open ledger is desirable…
    …as long as one is not concerned about the above considerations.
  - Today: mostly used by the financial sector, not just Bitcoin.

Examples of Application to Identifiers

Preliminary research…

Example 1:

BLOCKCHAIN FOR NAME MANAGEMENT

Namecoin
https://www.namecoin.org

See presentation from Jeremy Rand
at the Emerging Identifier Session, ICANN58

Namecoin

- Fork of Bitcoin
- Names are registered on a first-come, first-serve basis.
- They are stored in the transaction blockchain database.
- Code is synced with Bitcoin, uses Proof-of-Work.

Examples of Application to Identifiers

Example 2:

BLOCKCHAIN FOR IP ADDRESS MANAGEMENT

Preliminary research…

draft-paillisse-sidrops-blockchain-00

See presentation from Jordi Paillissé
at the Emerging Identifier Session, ICANN60

Blockchain for IP addresses

- IP addresses as coin: unique, divisible, transferable
- Starts from delegation of IANA to RIRs
- Proof-of-Stake: Party with more IP address controls the blockchain