Security Without a Node

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Free State Blockchain Digital Assets Conference

Hash Function

What is a hash function?

- A function that takes any digital information and outputs a large number.
- It's *very* difficult to predict the output from the input.
- Given the output, it's hard to determine the input.
- Can be easy to compute or hard to compute.
- Used in cryptography and Bitcoin security.

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Satoshi

Citation

Security without having a full node goes back to the original paper from Satoshi.

Notice the following screen shot from Satoshi's paper.

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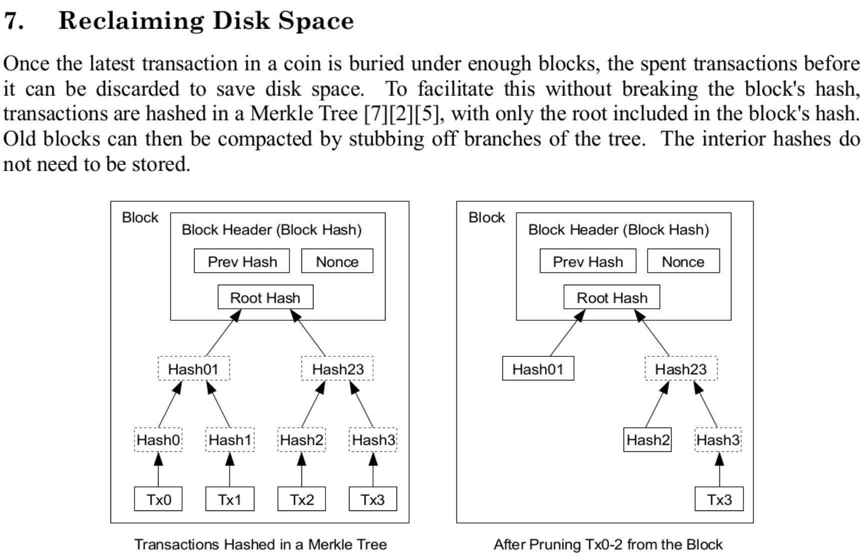
Merkle Trees



7. Reclaiming Disk Space

Once the latest transaction in a coin is buried under enough blocks, the spent transactions before it can be discarded to save disk space. To facilitate this without breaking the block's hash, transactions are hashed in a Merkle Tree [7][2][5], with only the root included in the block's hash. Old blocks can then be compacted by stubbing off branches of the tree. The interior hashes do not need to be stored.

Transactions Hashed in a Merkle Tree

After Pruning Tx0-2 from the Block

Bitcoin Blocks

Bitcoin blocks have:

- A block header
- List of transactions

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Block Headers

Block headers include:

- Version
- Hash of previous block header
- Merkle root for transactions in the block
- Time
- Difficulty
- Nonce

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Proof of Work

Six valid proof of work blocks require about the energy in 4,000 gallons of gasoline.

The Bitcoin (SegWit) network requires this amount of energy every hour.

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Simplified Payment Verification

Simplified Payment Verification works by:

- Checking with several nodes for the longest proof of work chain of block headers.
- Asking for transactions and merkle *proofs* associated with addresses.
- This is hard to spoof.
- Vulnerability of lying by omission addressed by querying several nodes.

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Satoshi Revisited

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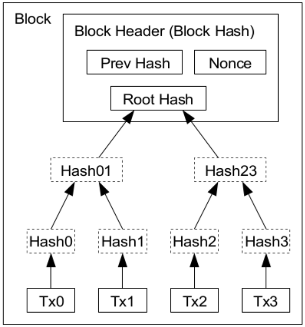

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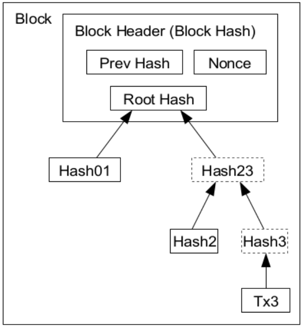

After Pruning Tx0-2 from the Block

Thank You

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Any Questions?