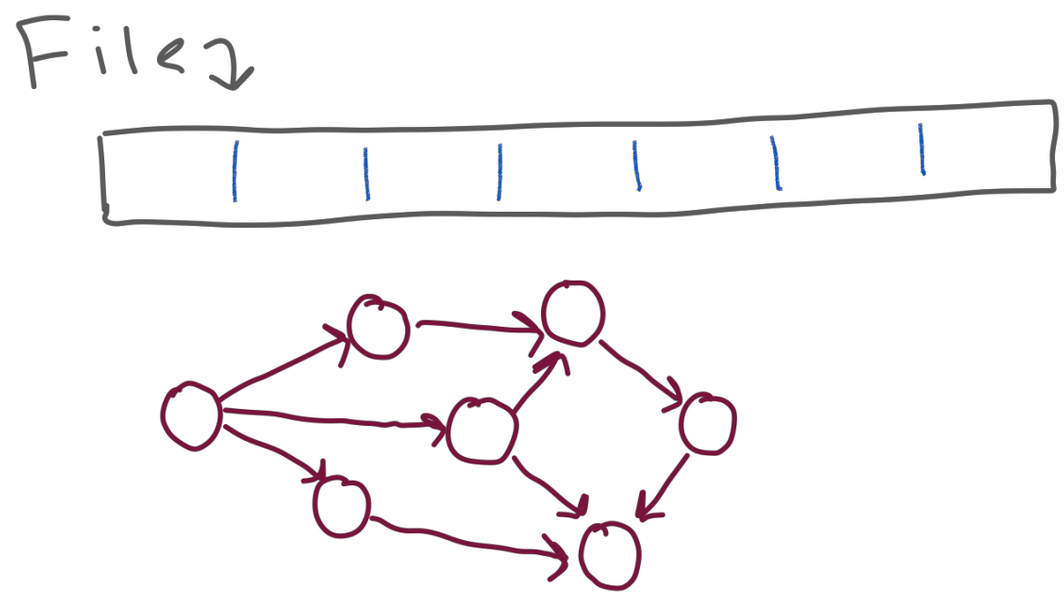
VDFs and Filecoin

Exploring how Filecoin might use Verifiable Delay Functions

Areas of Exploration

- Proof of Replication
- Proof of Space Time
- Expected Consensus

Proof of Replication



- A slow, unique encoding of some input data (any data!)
- Protects against deduplication ‘attacks’
- In context of PoSt, protects against generation attacks

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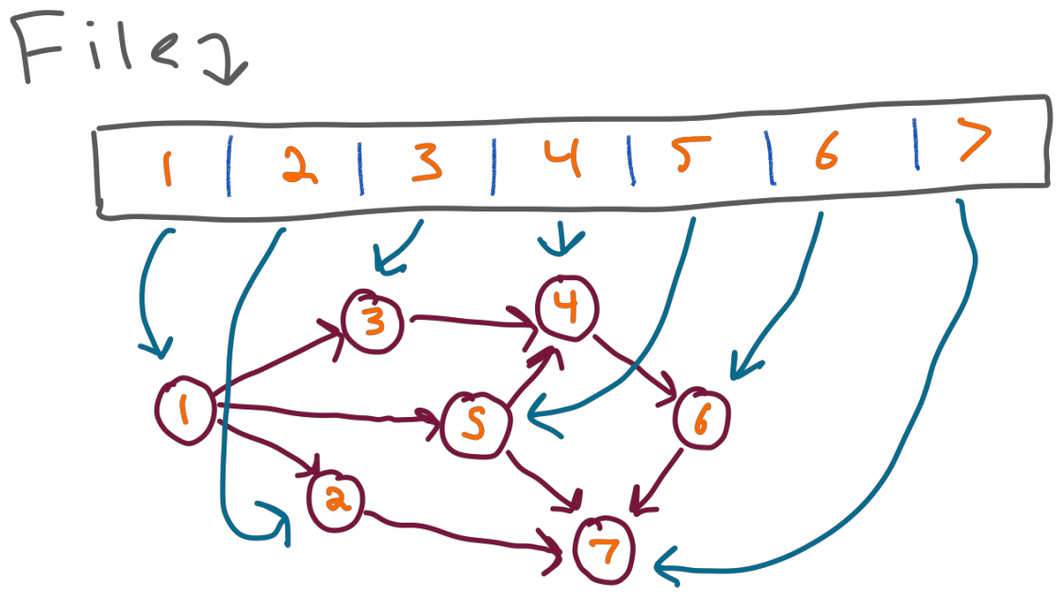

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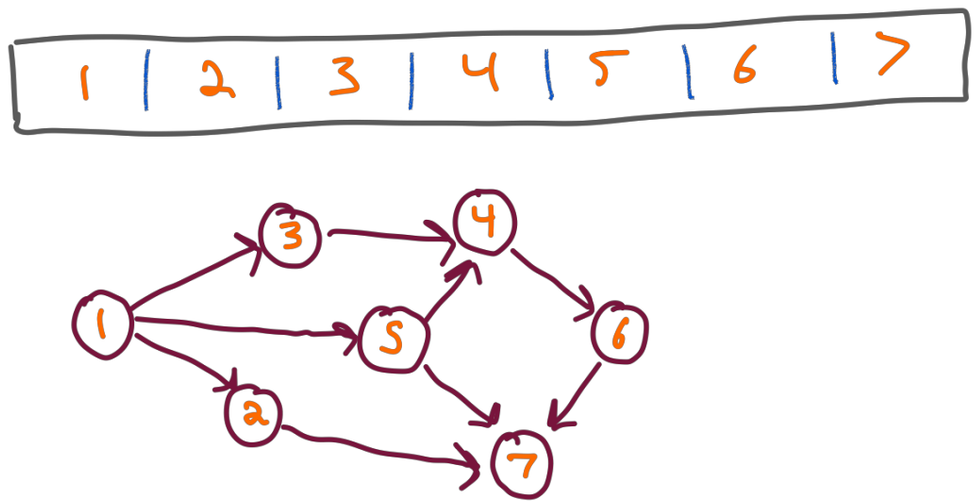

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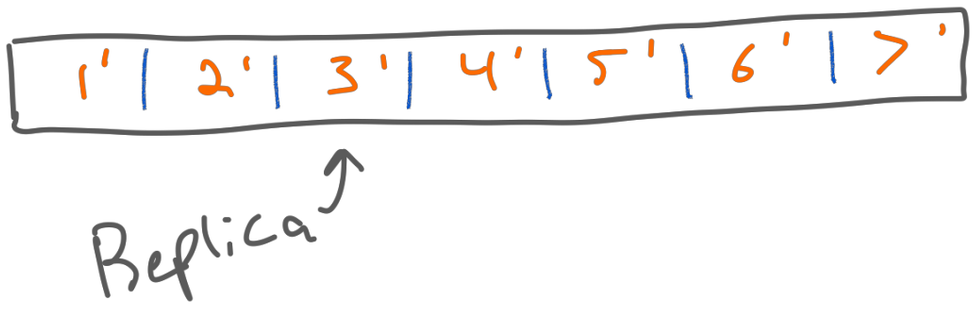
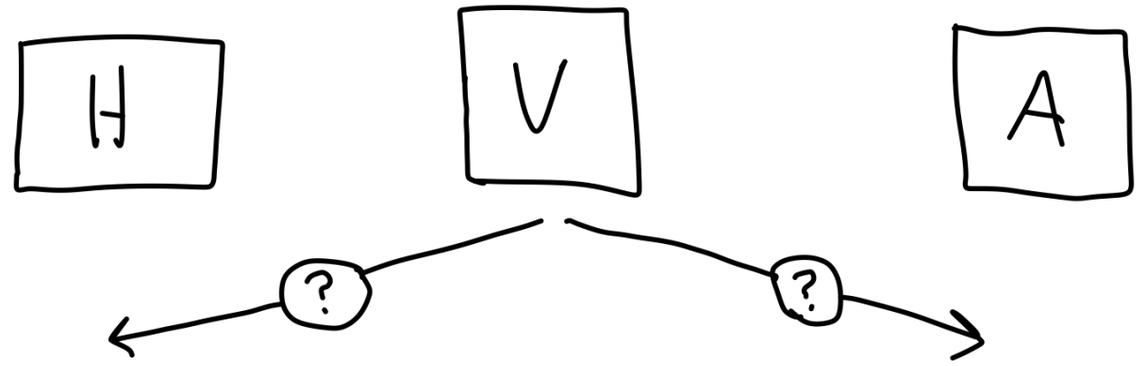


Proof of Replication

- VDFs in PoRep help protect against ‘generation attacks’ in PoSt



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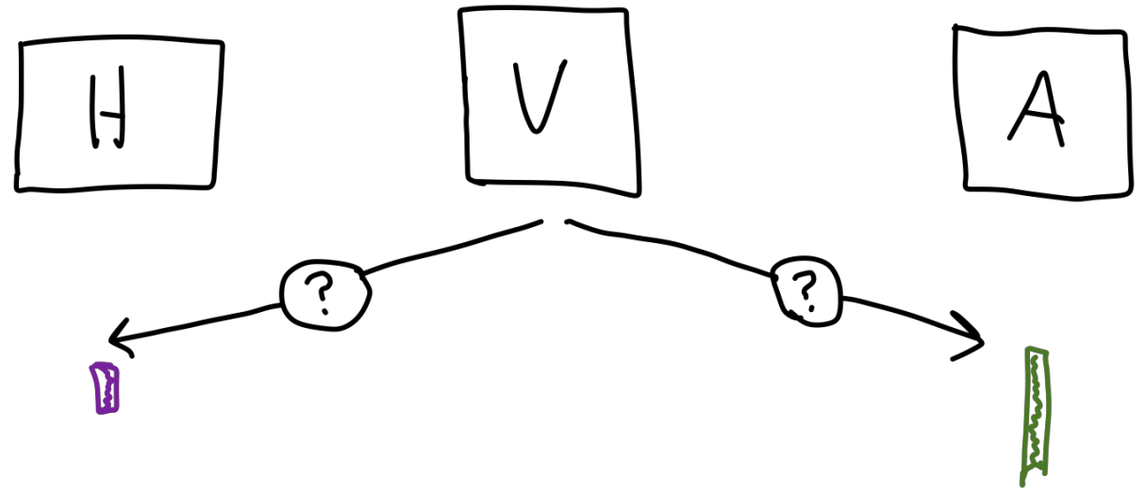

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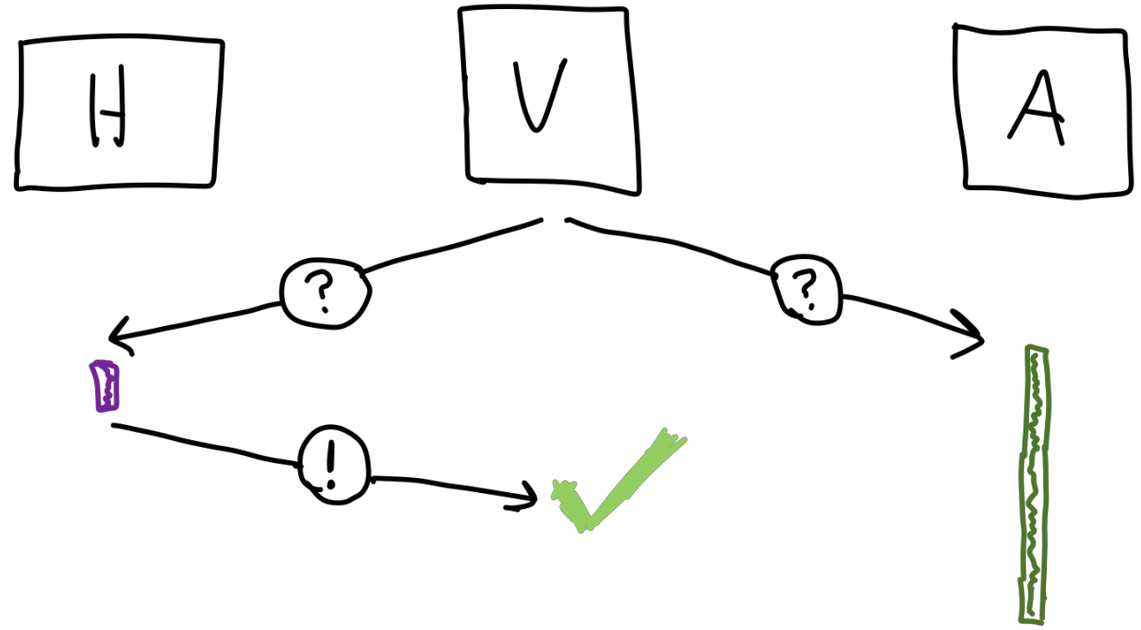

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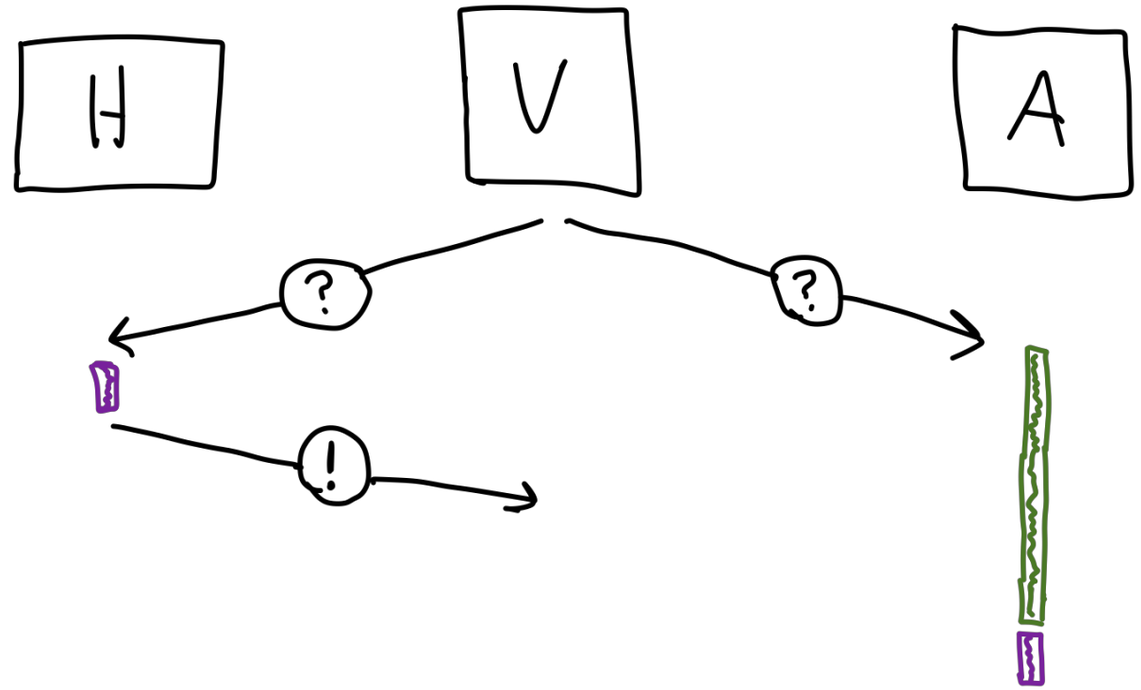

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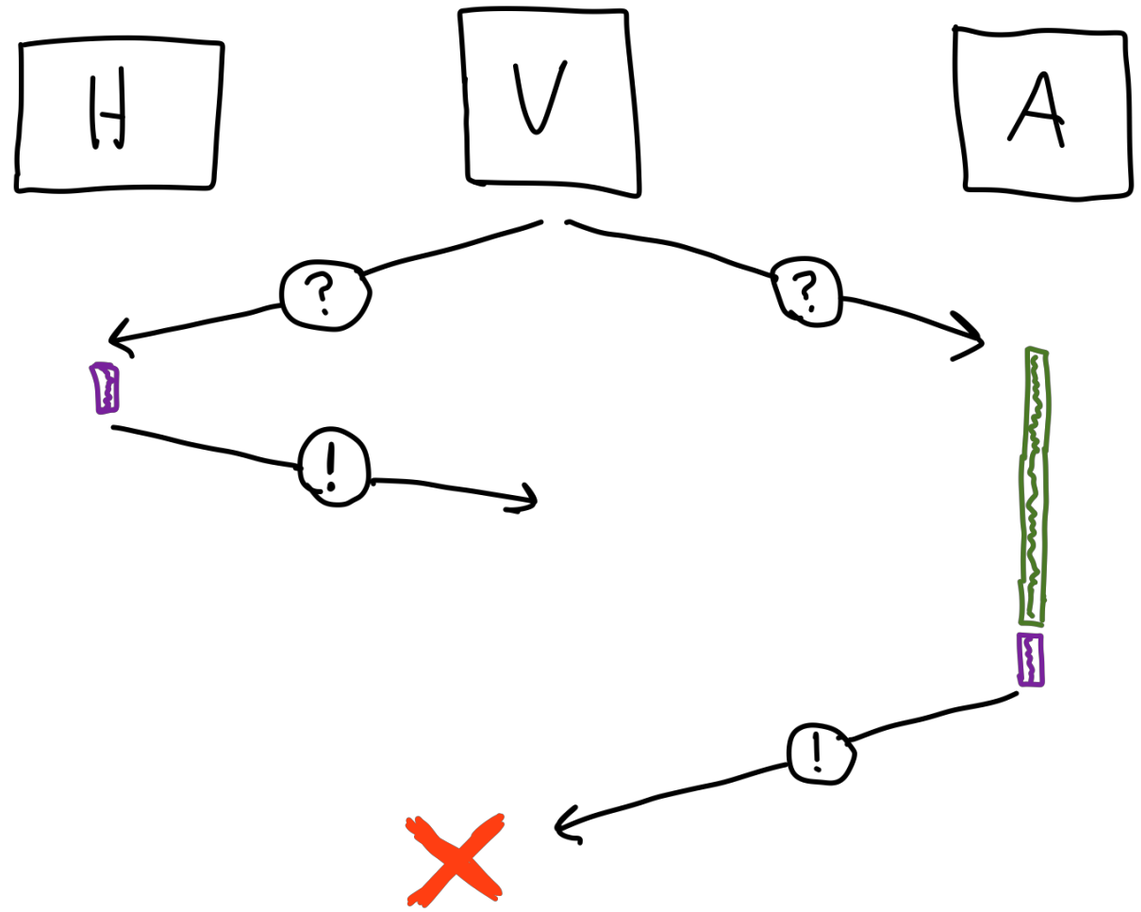

PoRep is a VDF

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How?

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- Takes some inputs, produces an output after a prescribed time
- The same inputs should always produce the same output
- A verifier can efficiently check that the process was done correctly

Proof of SpaceTime

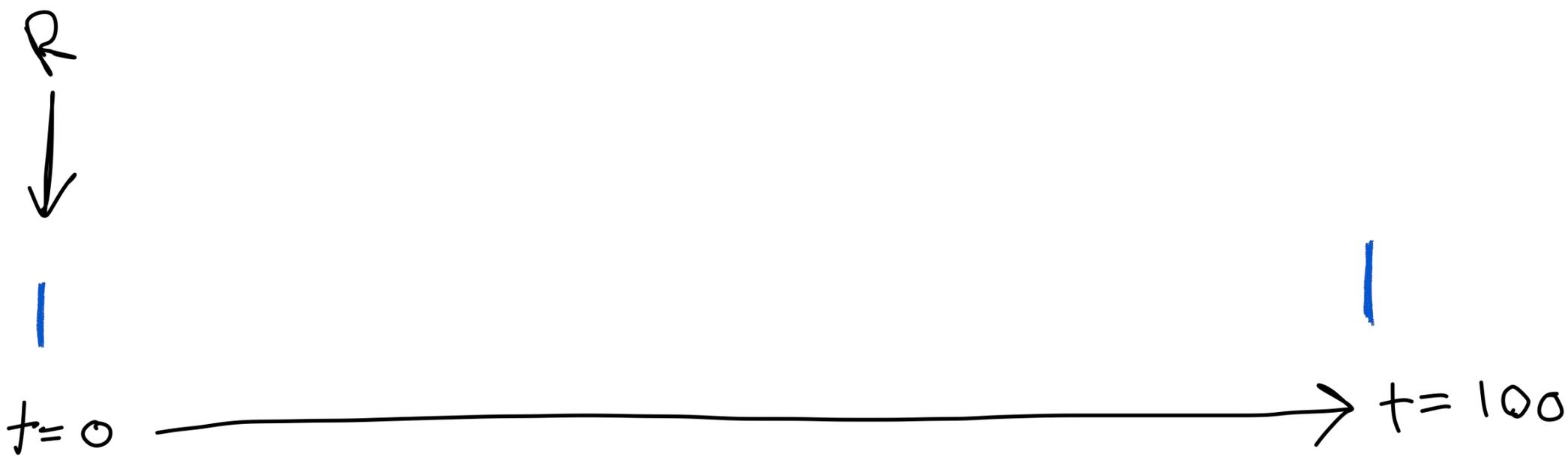
- Proves to the verifier that some known data was correctly stored over a given period of time.

- Ensures the space wasn’t used for storing anything else during the proof.

Proof of SpaceTime

- non-interactive, succinct output
- must not be computable too much faster than the expected duration

Proof of SpaceTime



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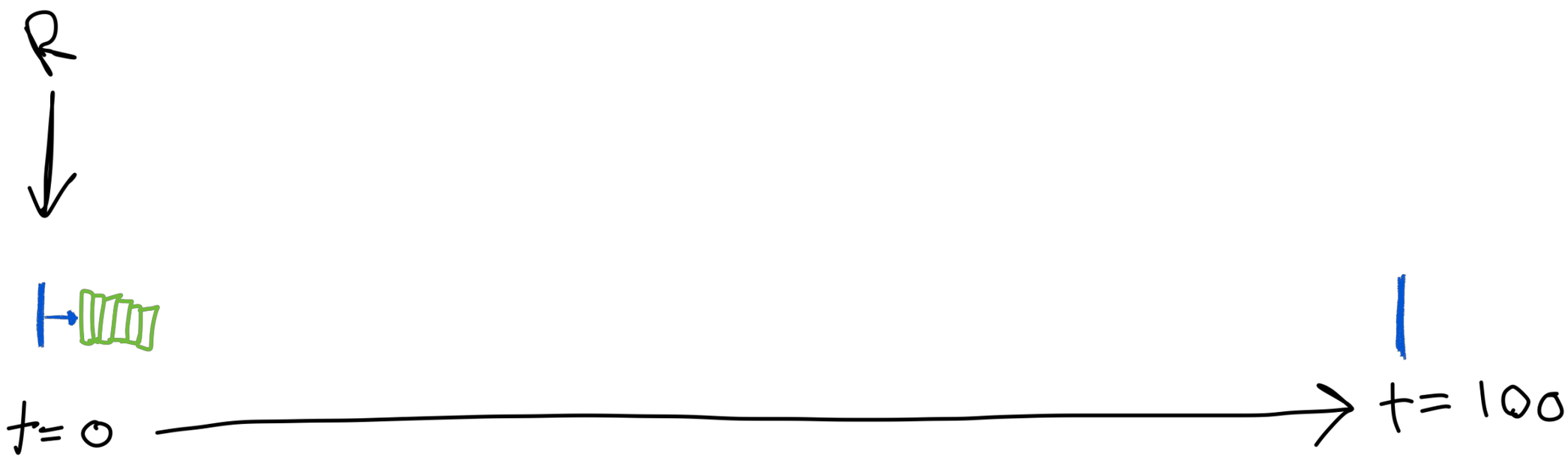

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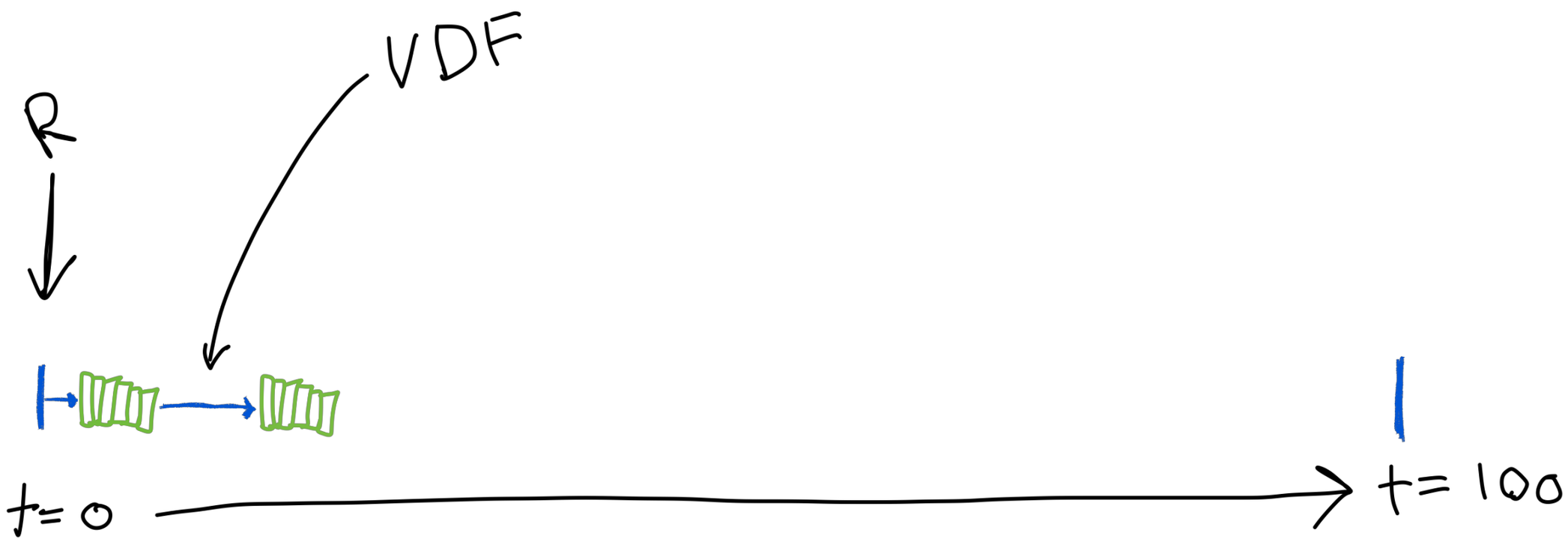

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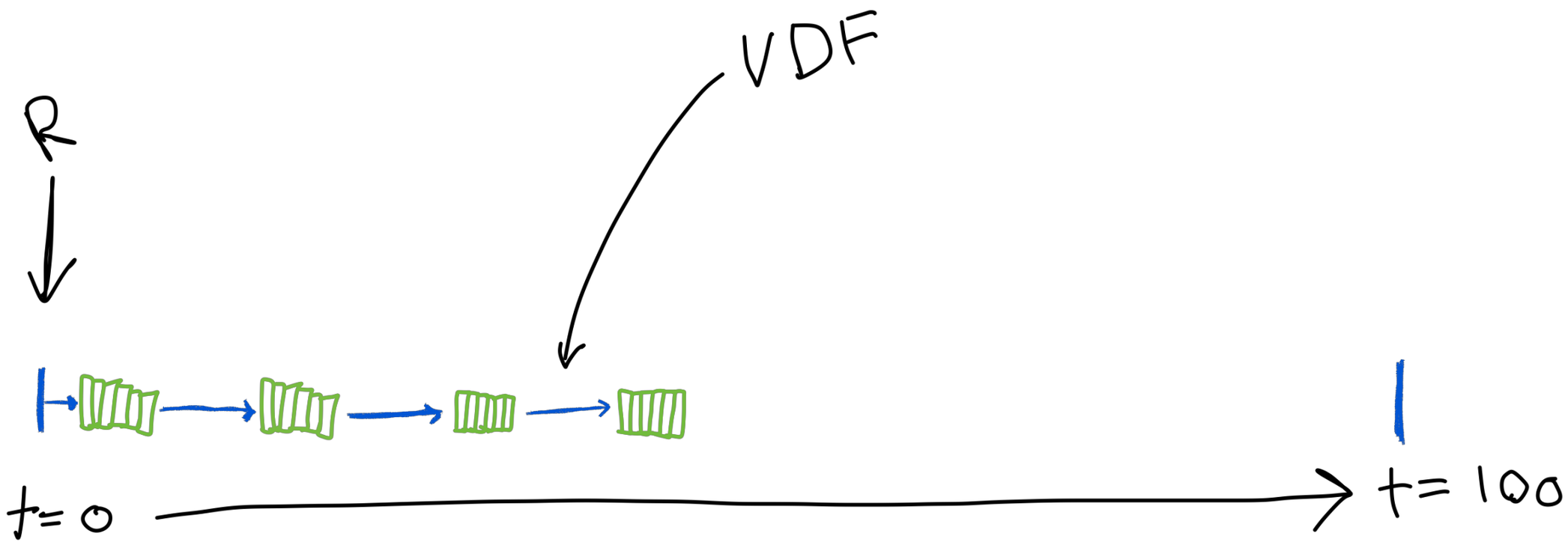

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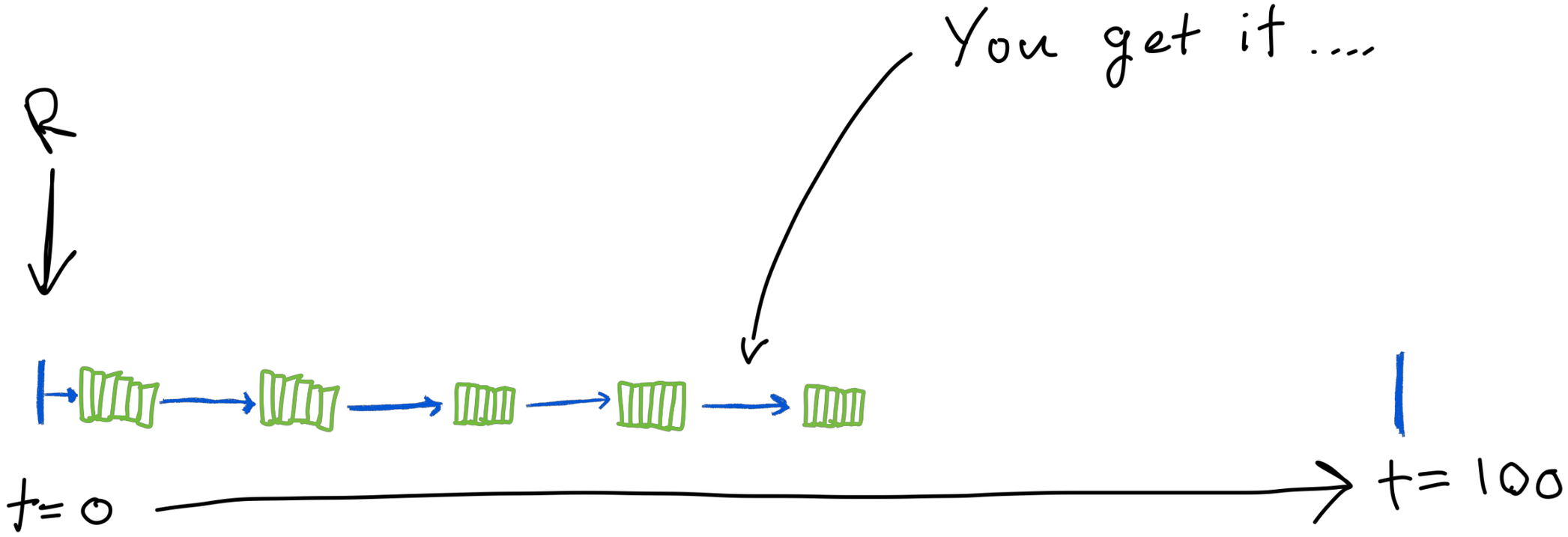

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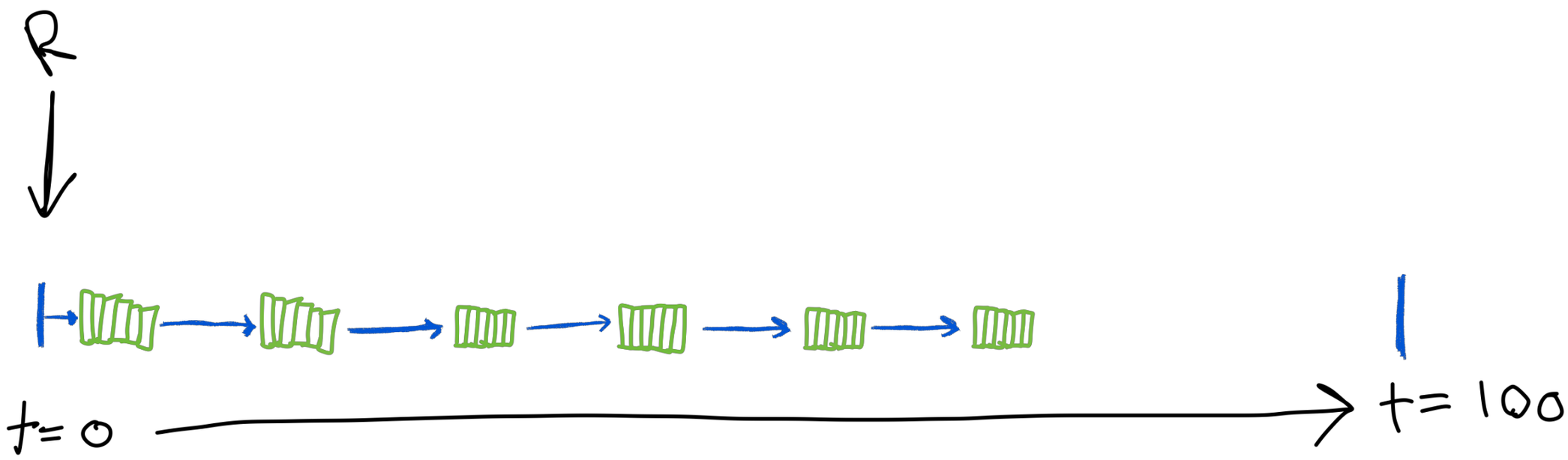

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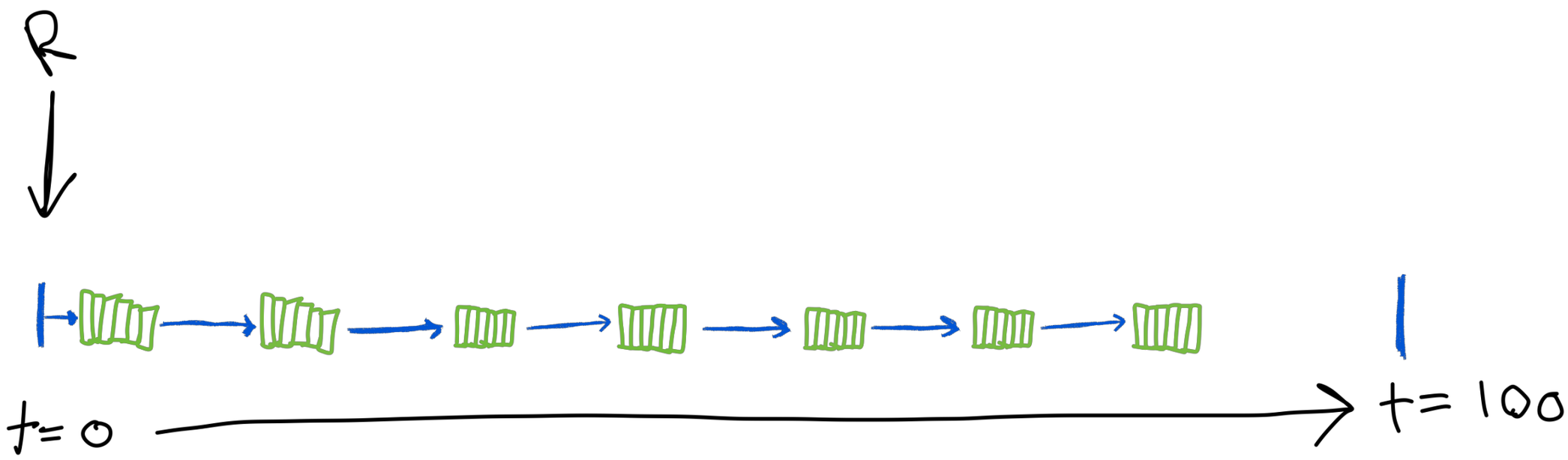

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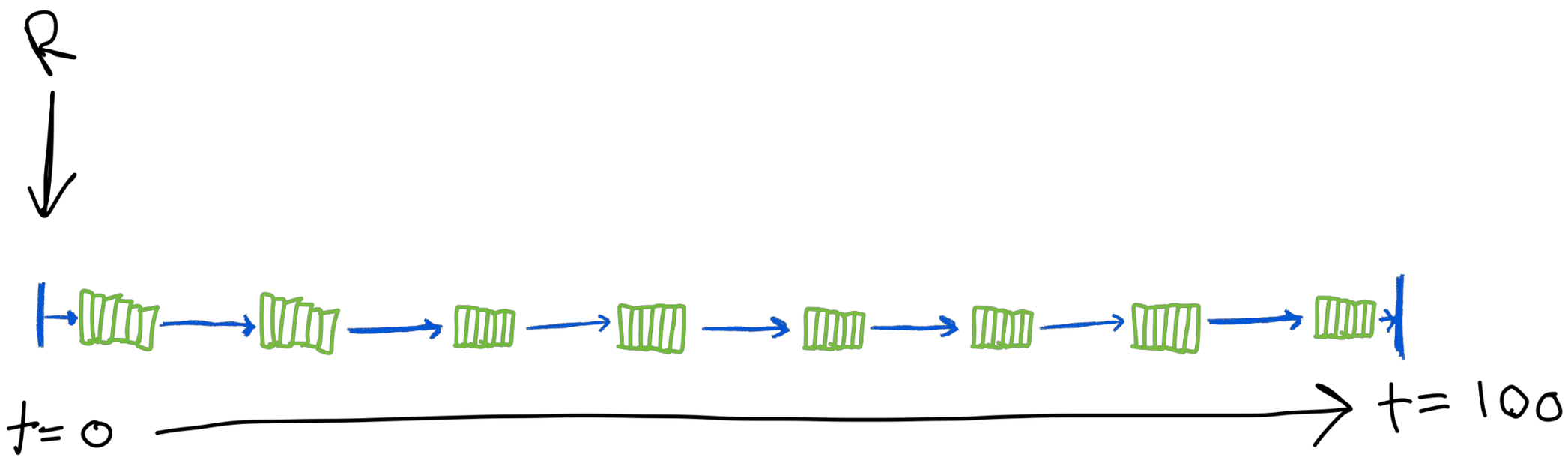

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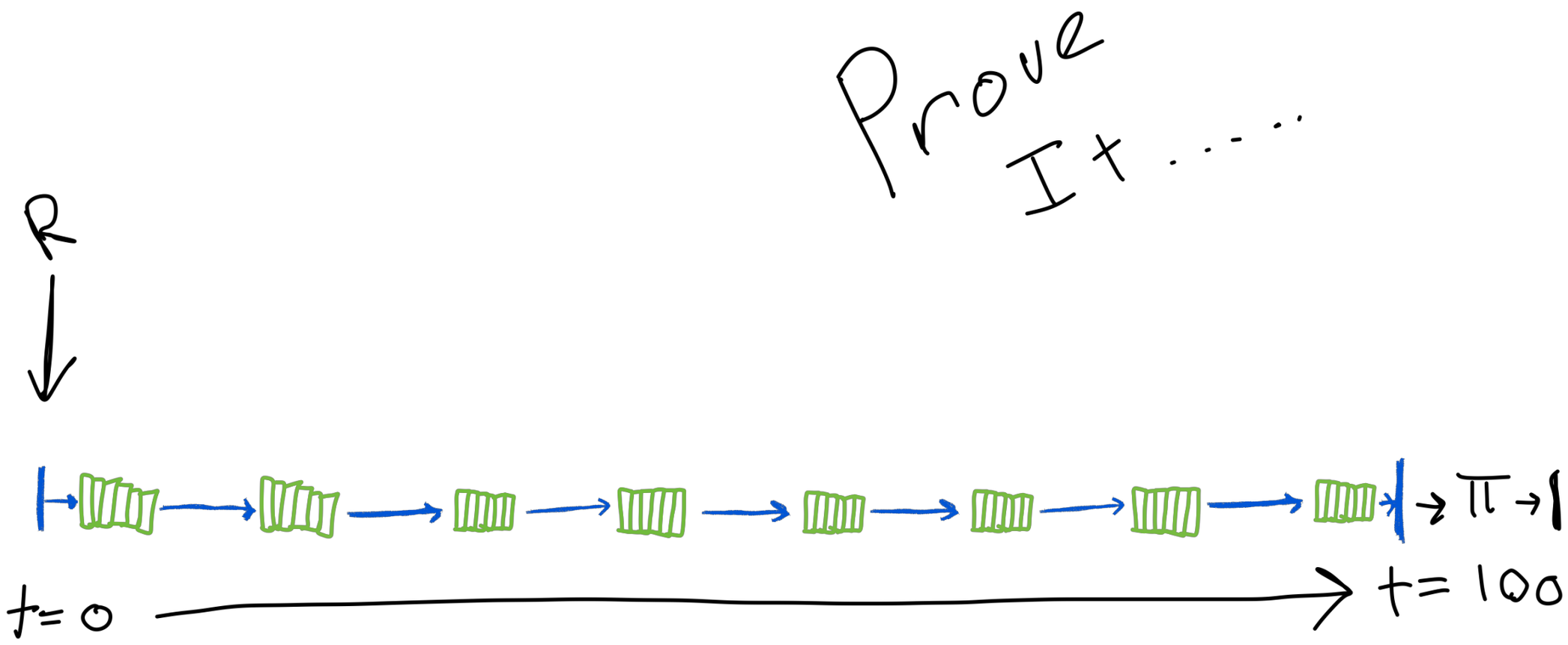

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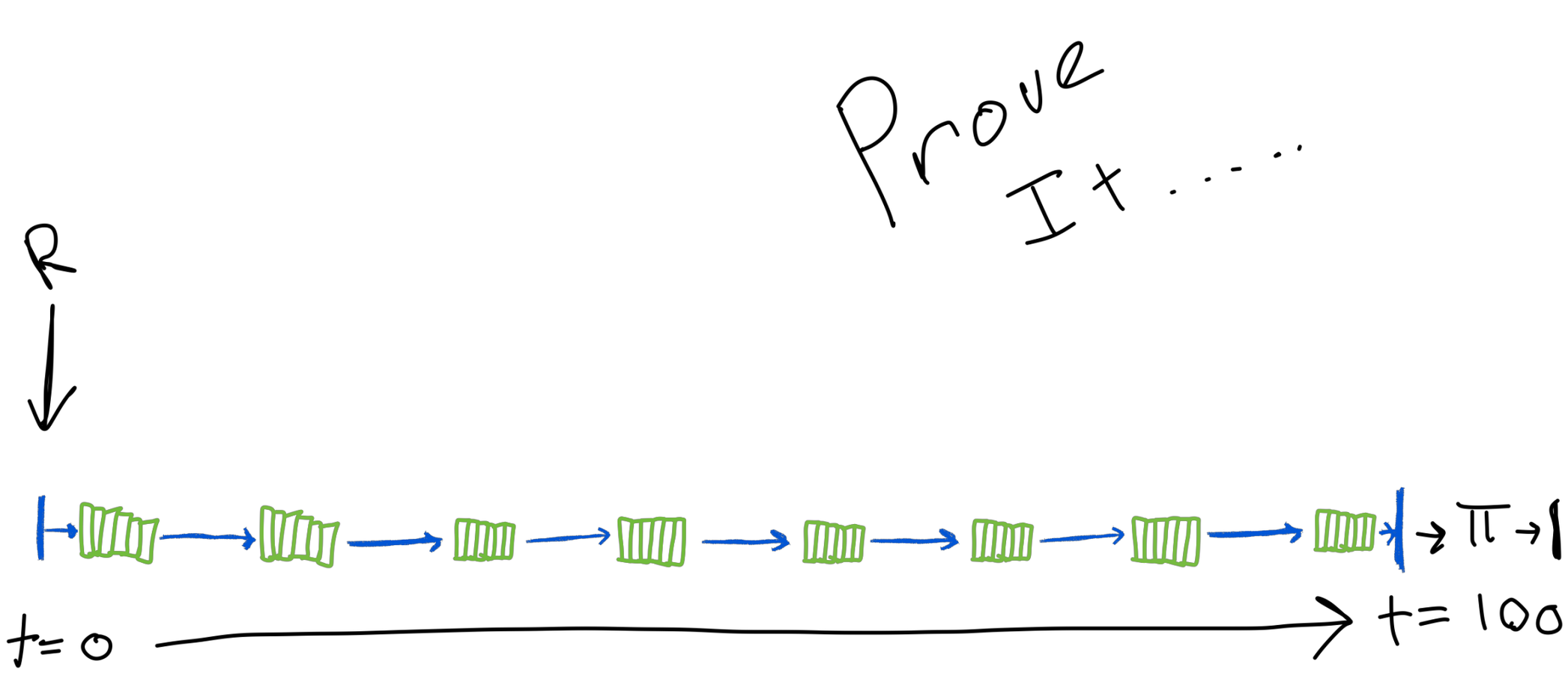

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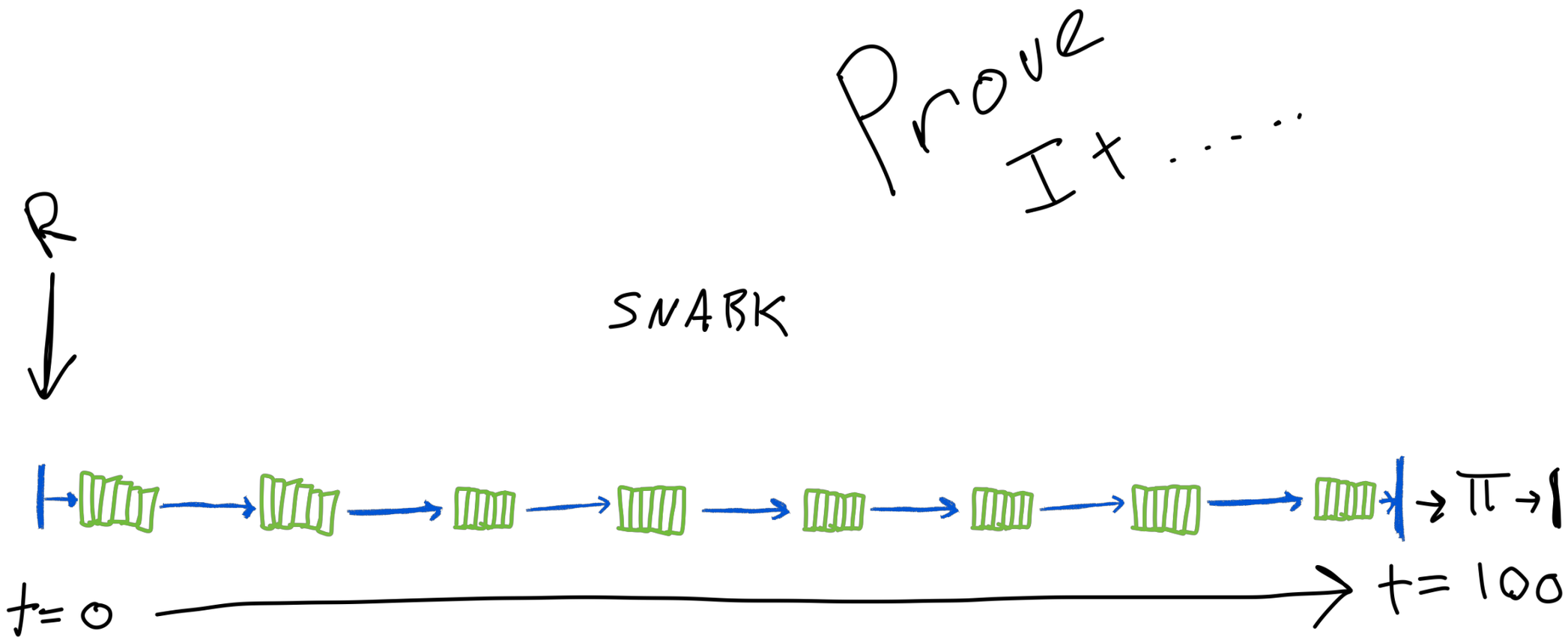

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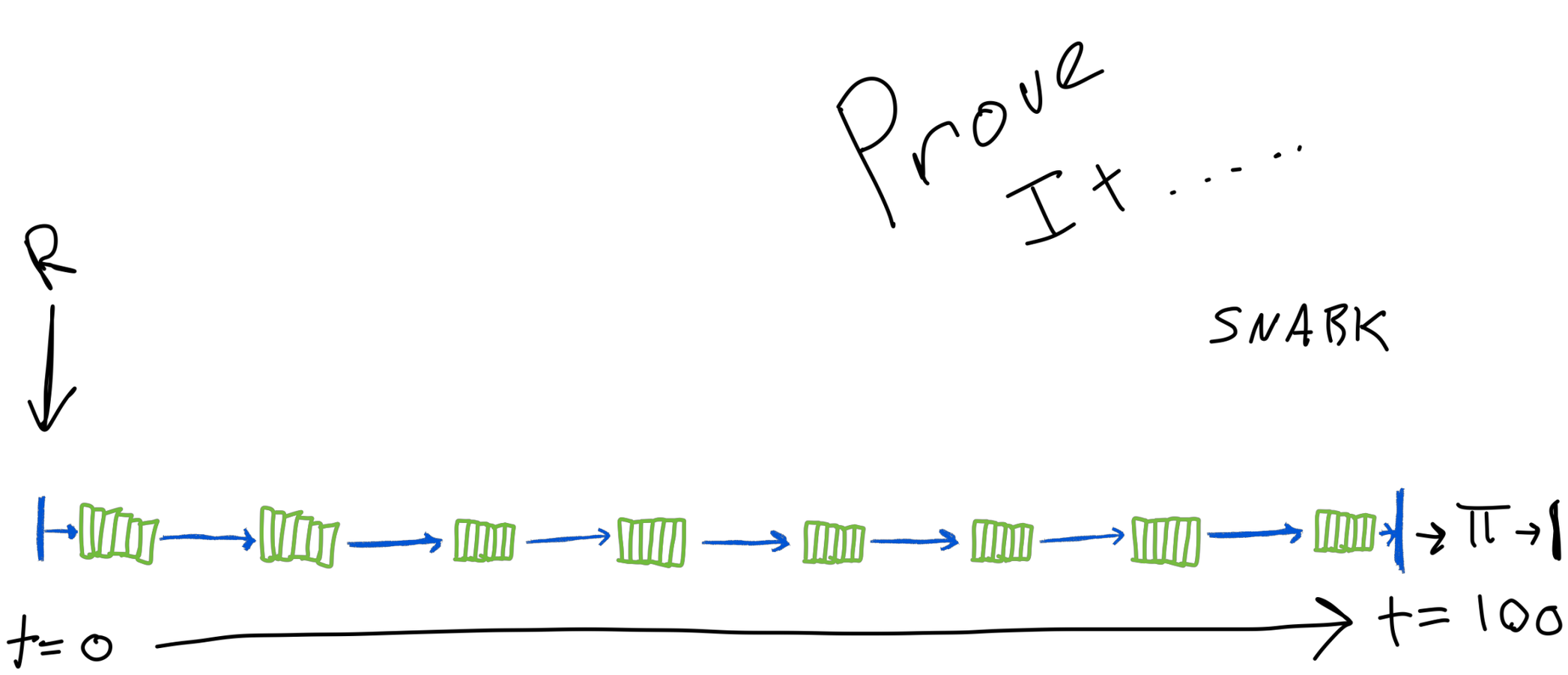

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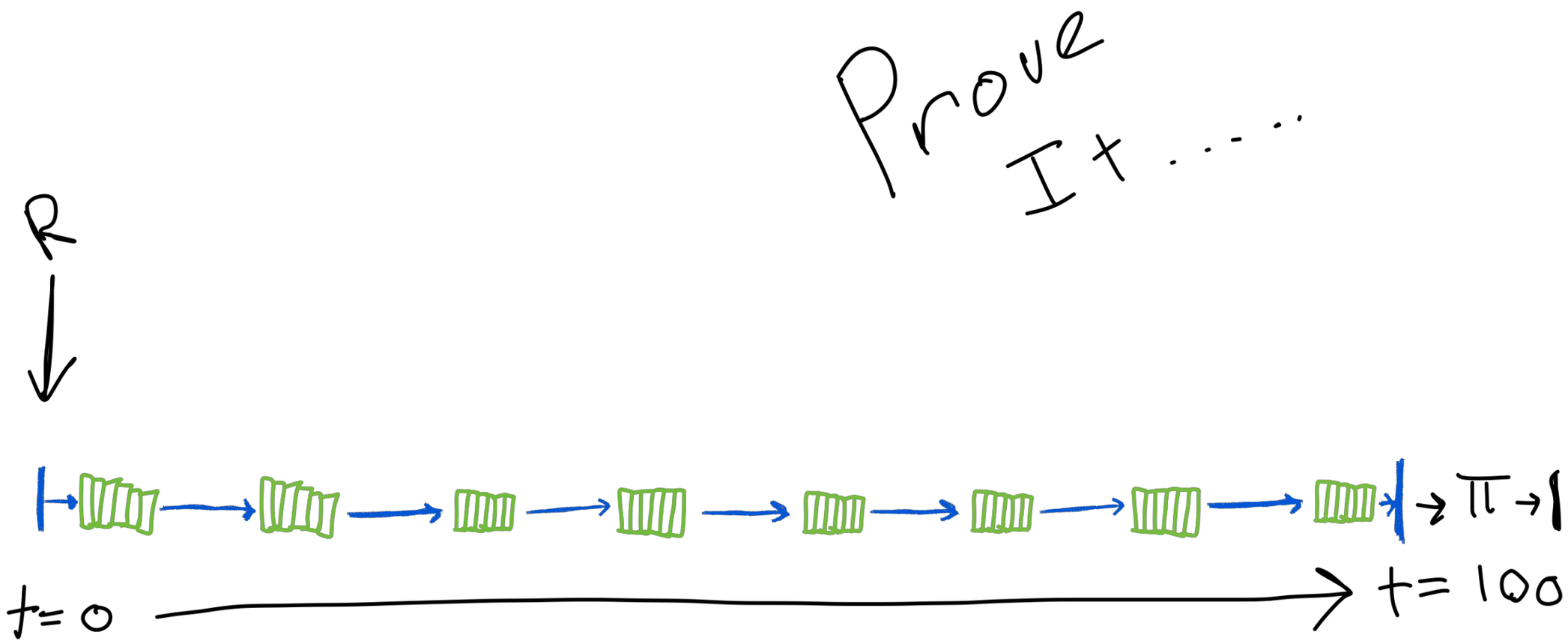

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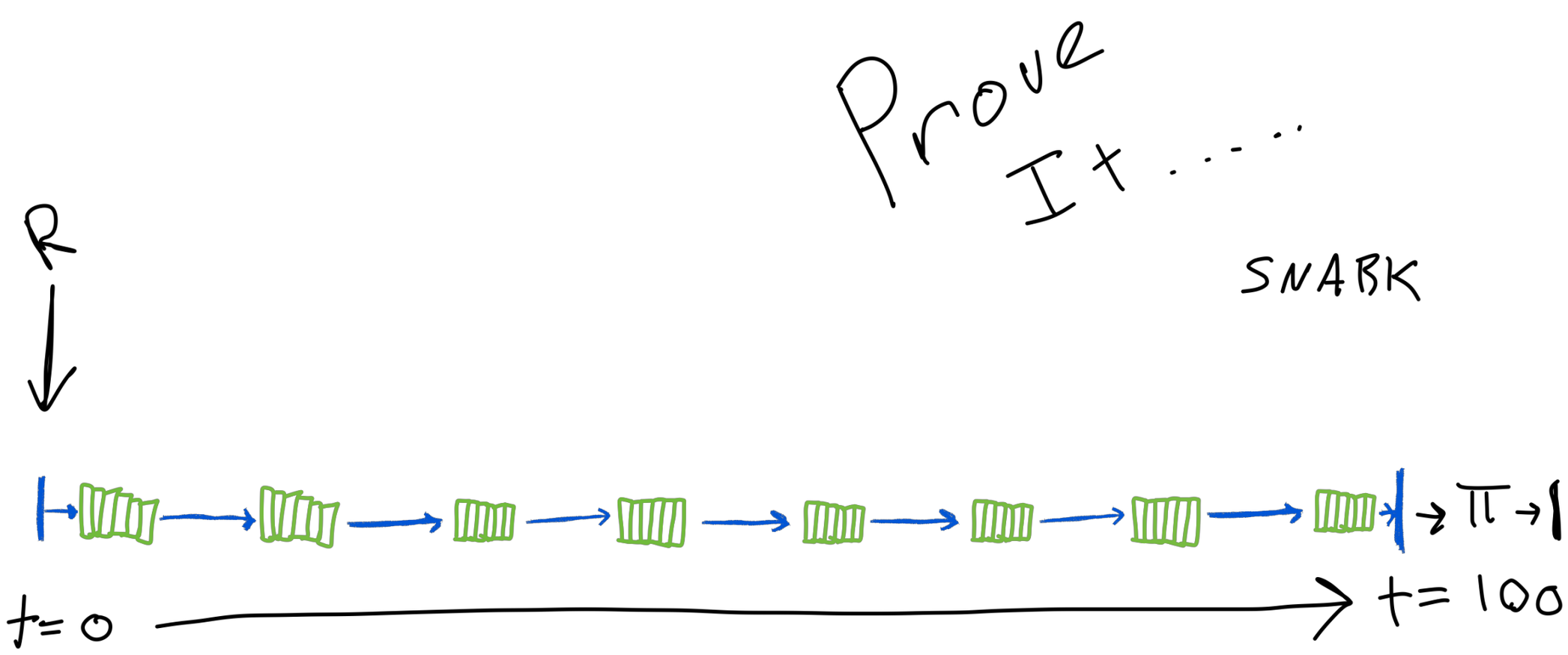

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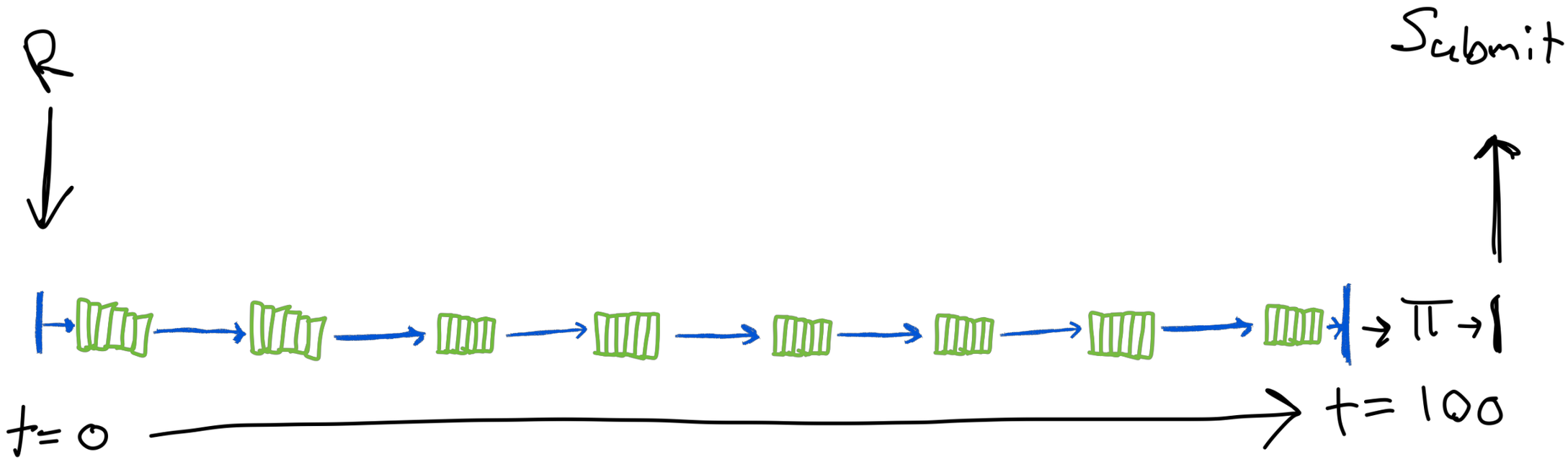
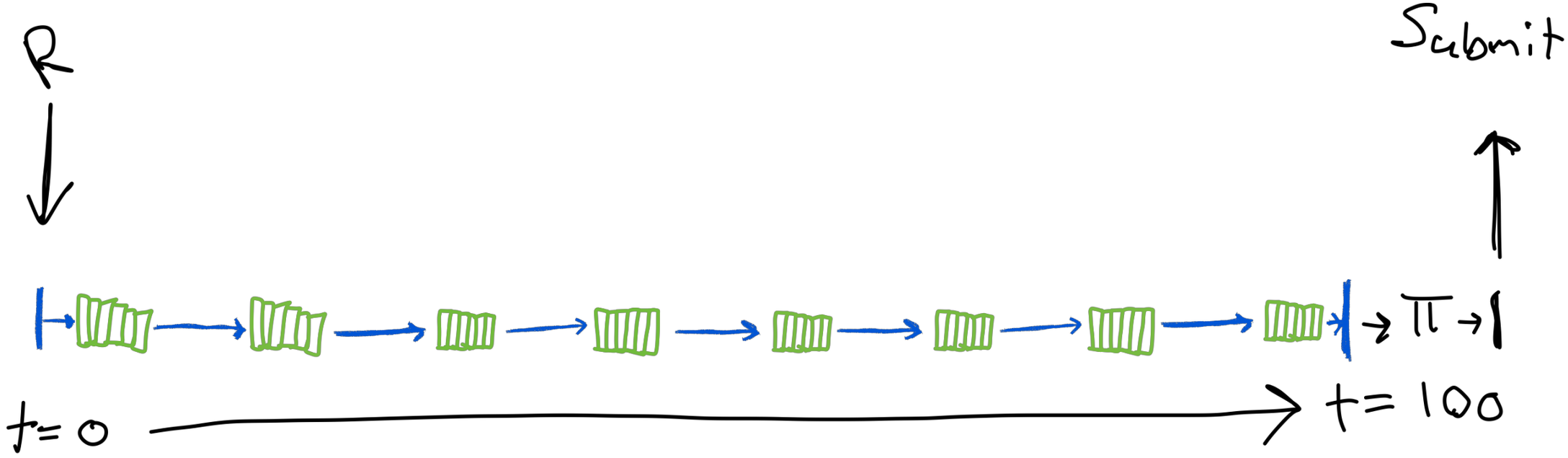


Proof of SpaceTime

What Else?



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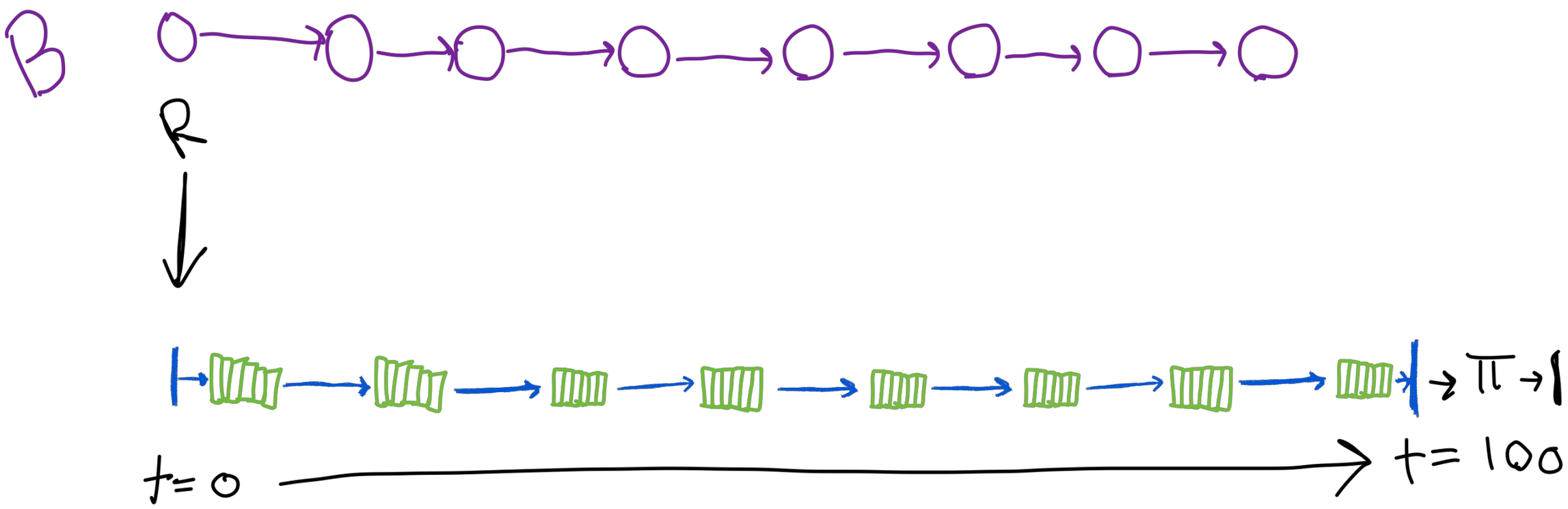

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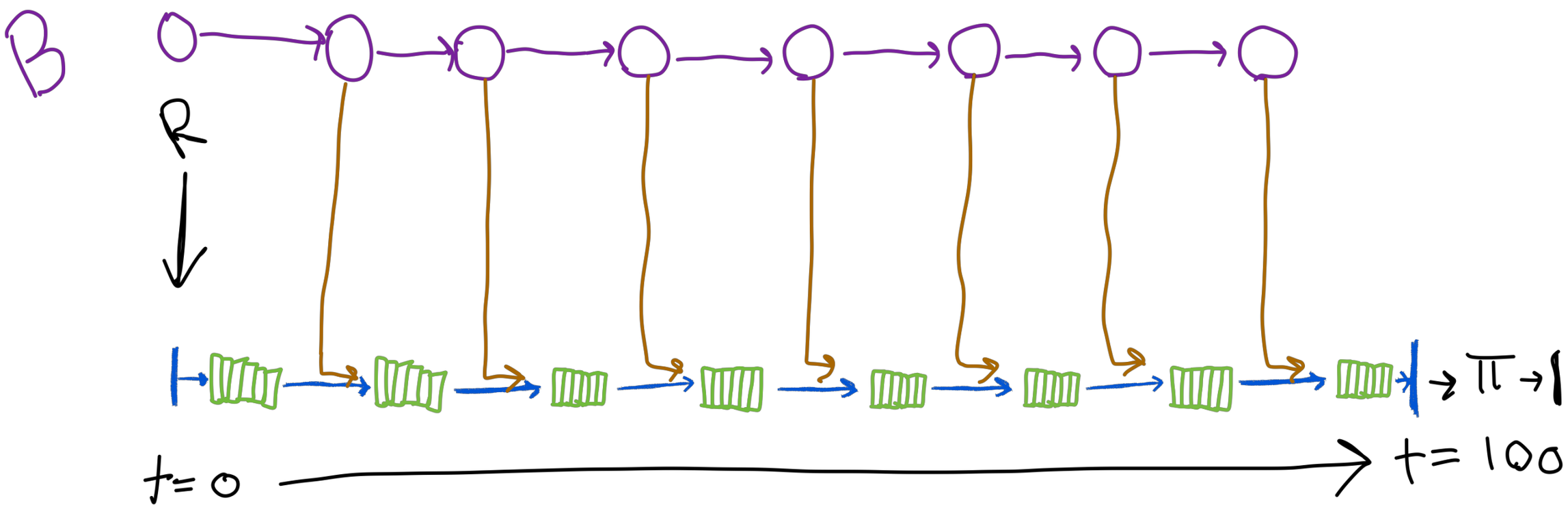


Expected Consensus

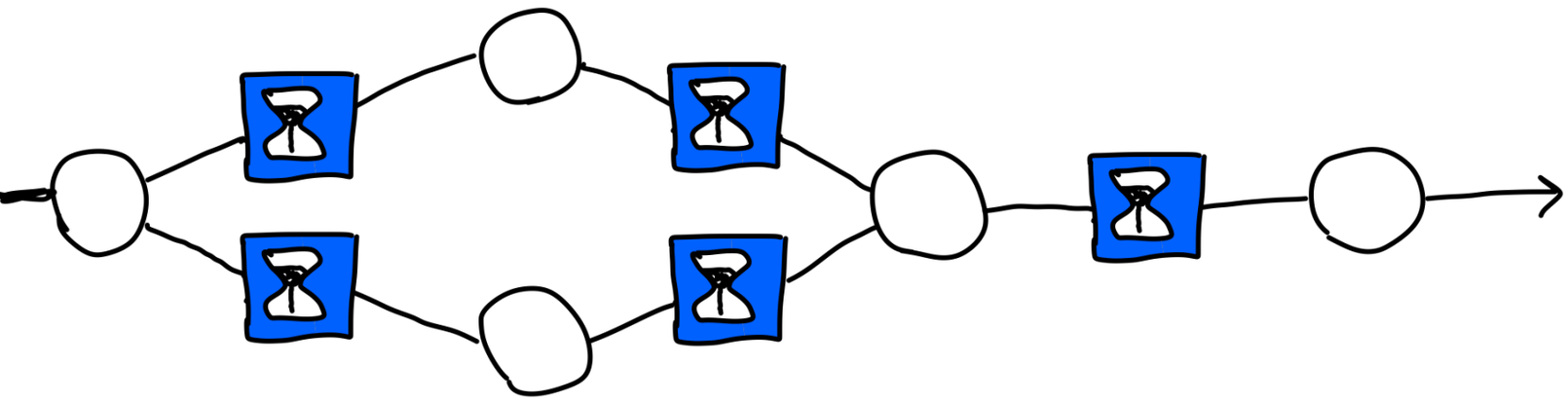
- Filecoin Consensus Mechanism

- Elects on ***expectation*** one leader per round

- Include all blocks from previous round as parents

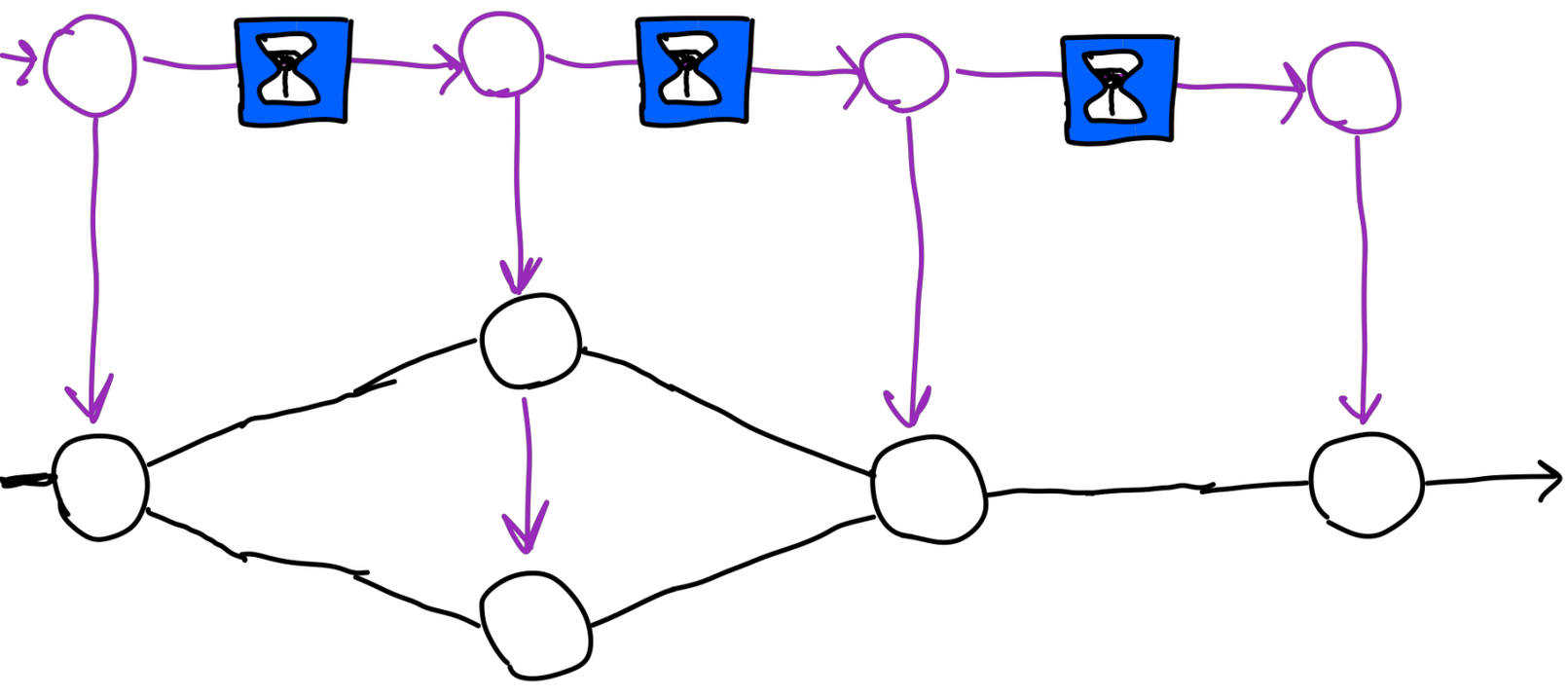
Expected Consensus

- Maybe use VDF for enforcing block delays



Expected Consensus

- Alternatively... Use a random beacon for enforcing delay



Thank You!

@whyrusleeping