# THE STARK TRUTH ABOUT DEXes

Eli Ben-Sasson, Chief Scientist (East) | February 2019

STARKWARE

# StarkWare

$40M

Funding
(equity + EF grant)

20

Team
members

Alpha

DEX scalability
engine

**We're hiring!** **Jobs@starkware.co**

**Learn more!** **workshop@starkware.co**

# OUTLINE

1. STARKs as a Scalability Solution
2. DEXes
3. StarkDEX

# STARKs and Scalability

# DELEGATED ACCOUNTABILITY

| | OLD WORLD<br>(banks, pension funds...) |
|---|---|
| TRUST | assumption |
| VERIFY | delegated to auditors, accountants, regulators |

## DELEGATED ACCOUNTABILITY

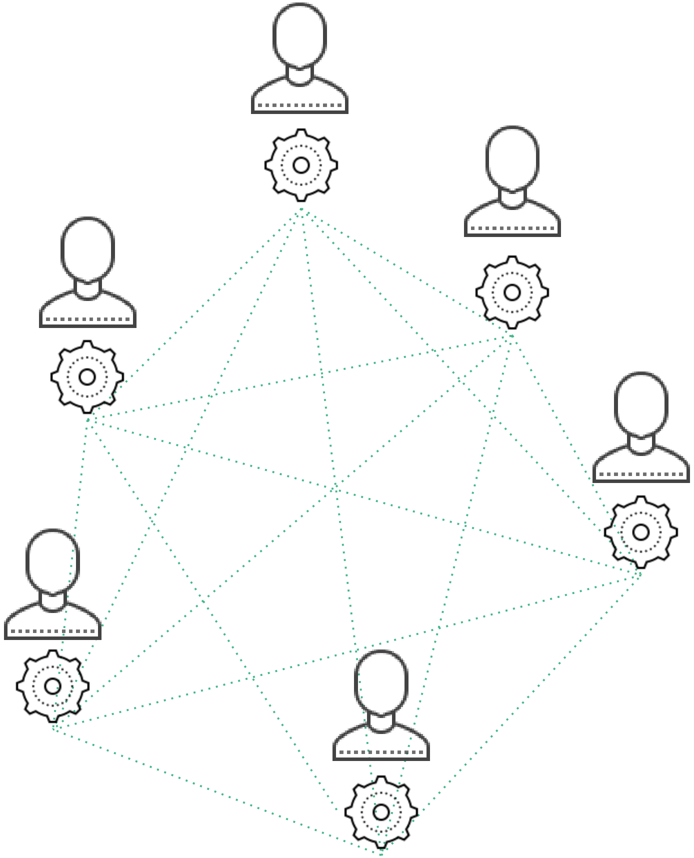
### OLD WORLD

(banks, pension funds...)

## INCLUSIVE ACCOUNTABILITY

### NEW WORLD

| | DELEGATED ACCOUNTABILITY | INCLUSIVE ACCOUNTABILITY | |
|---|---|---|---|
| TRUST | assumption | don’t trust, verify | TRUST |
| VERIFY | delegated to auditors, accountants, regulators | | |



# INCLUSIVE ACCOUNTABILITY

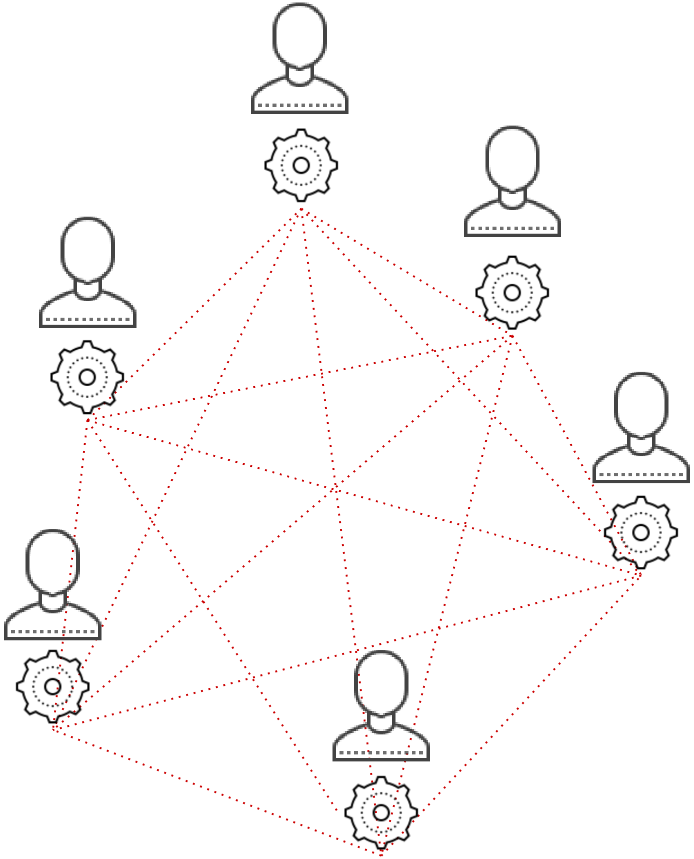
## NEW WORLD

don't trust, verify

TRUST

everyone should be able to verify integrity of the system, using a laptop

VERIFY

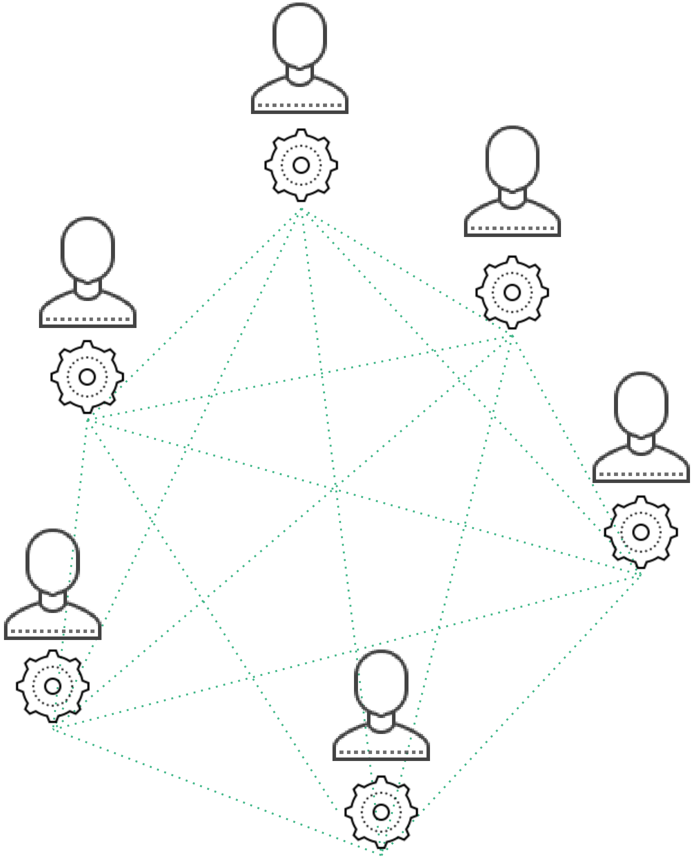


# INCLUSIVE ACCOUNTABILITY

## 2 PROBLEMS

everyone sees every Tx — PRIVACY

require small throughput to allow accountability even on weaker devices (i.e: laptop) — SCALABILITY



# INCLUSIVE ACCOUNTABILITY

STARK SOLVES BOTH

everyone sees every Tx

PRIVACY

shield transactions
(like ZK-SNARKs do for Zcash)

ZK-STARKs

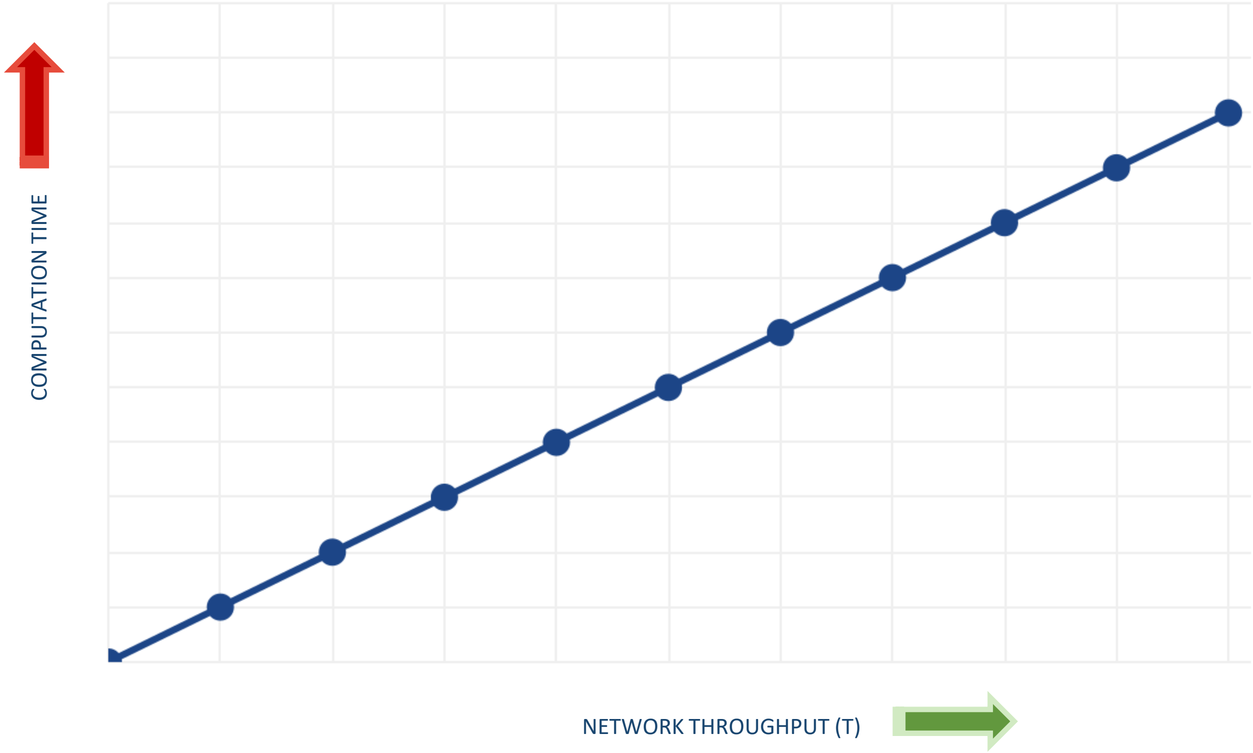
require small throughput to
include accountability on
weaker devices (i.e: laptop)

SCALABILITY

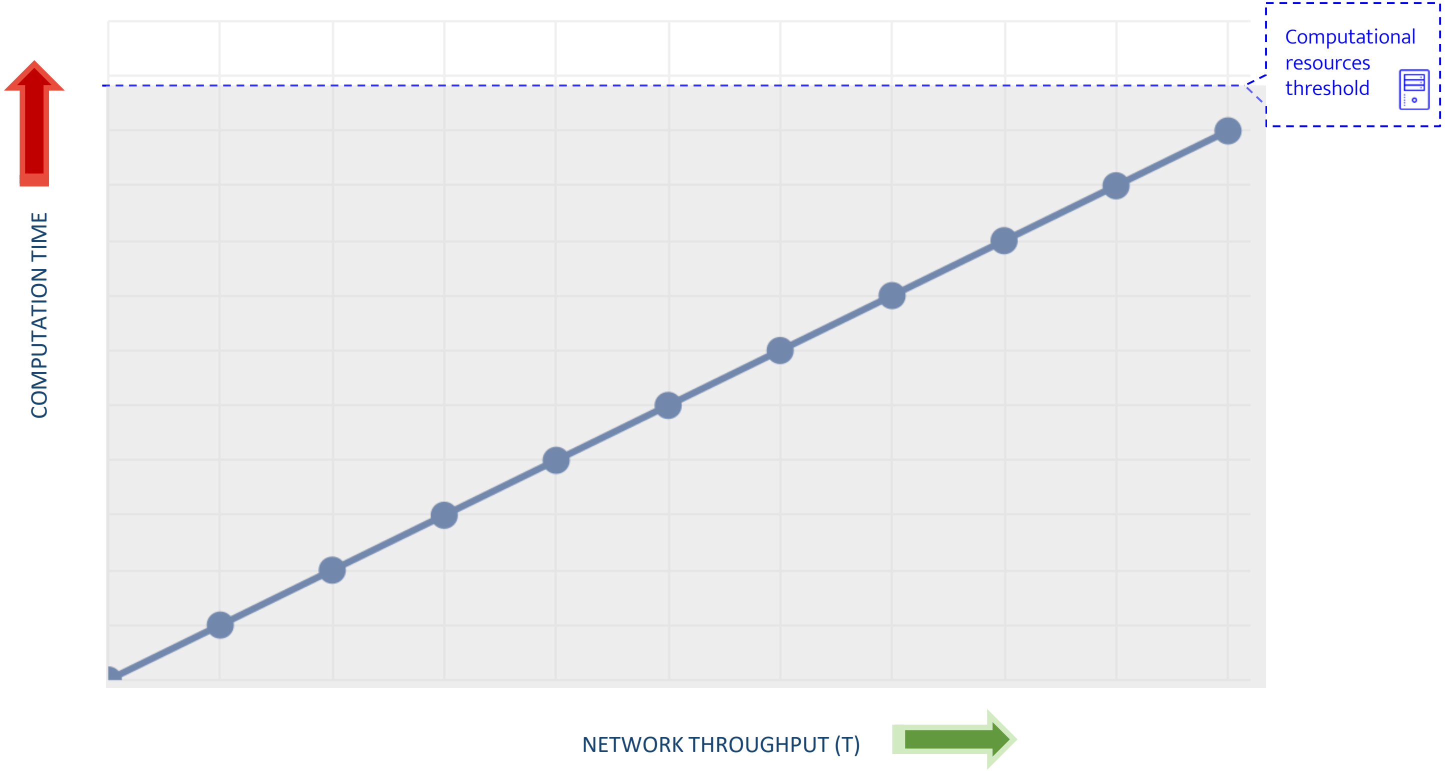
S == scalability

ZK-STARKs

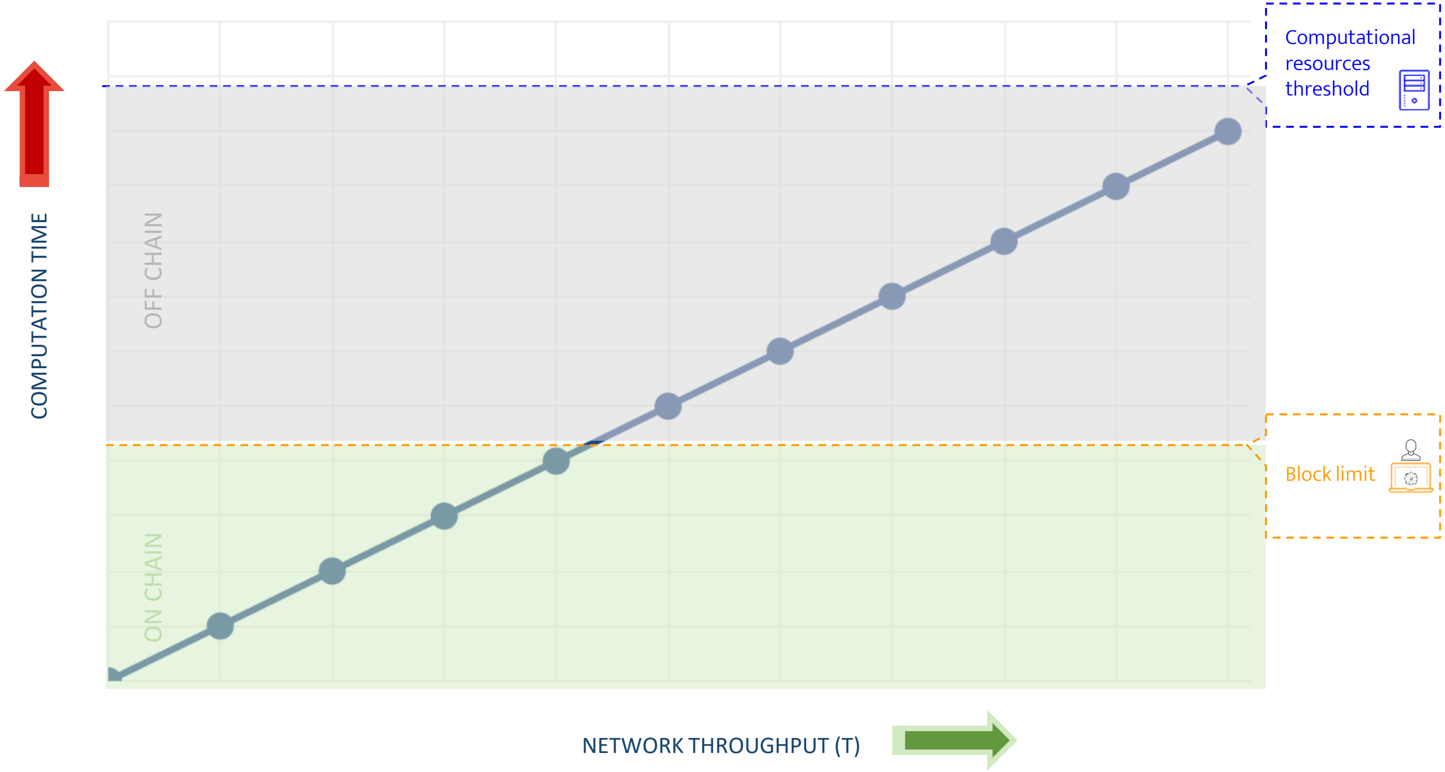
# Inclusive Accountability - Scalability Problem



# Inclusive Accountability - Scalability Problem



# Inclusive Accountability - Scalability Problem

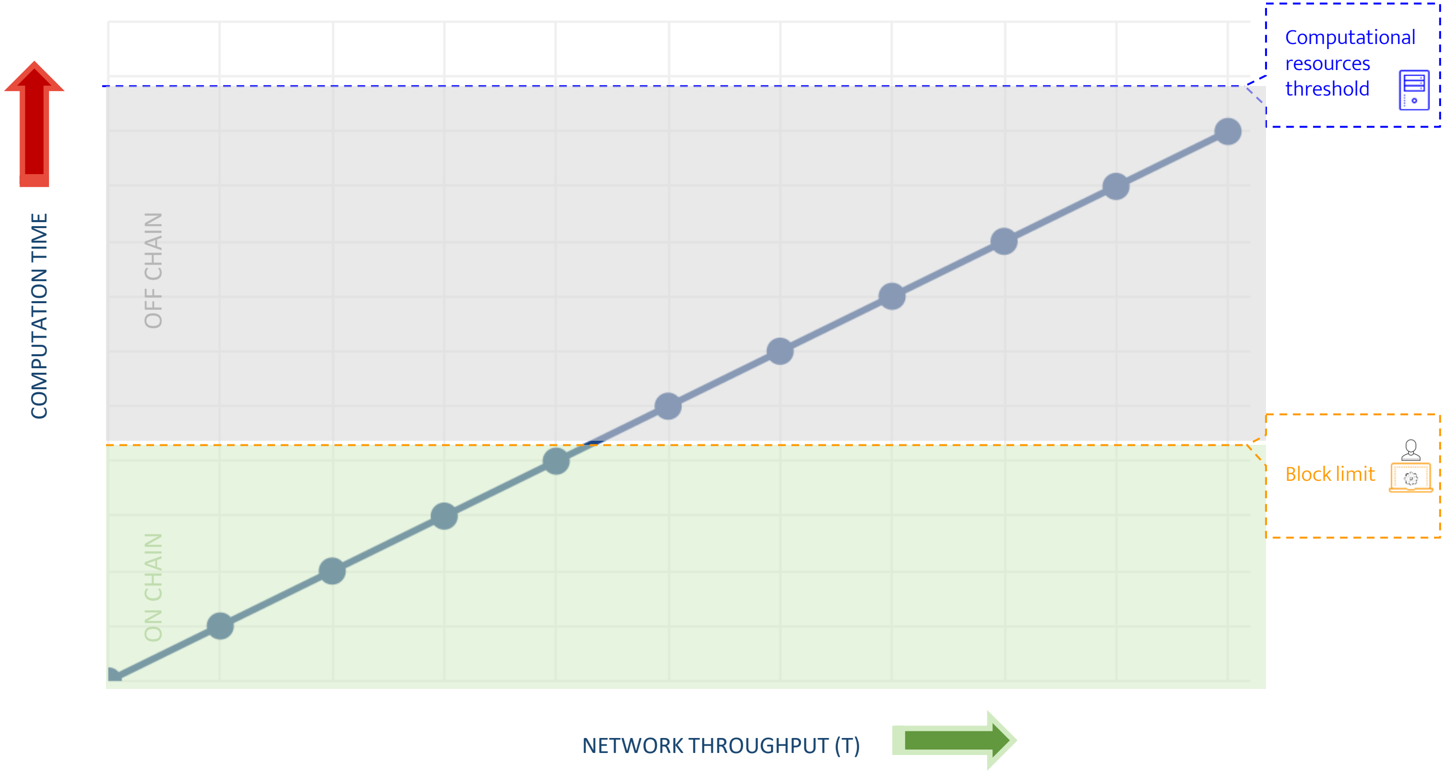


# STARK Scalability

Prover time is nearly linear in T

&

Verifier time exponentially smaller than T



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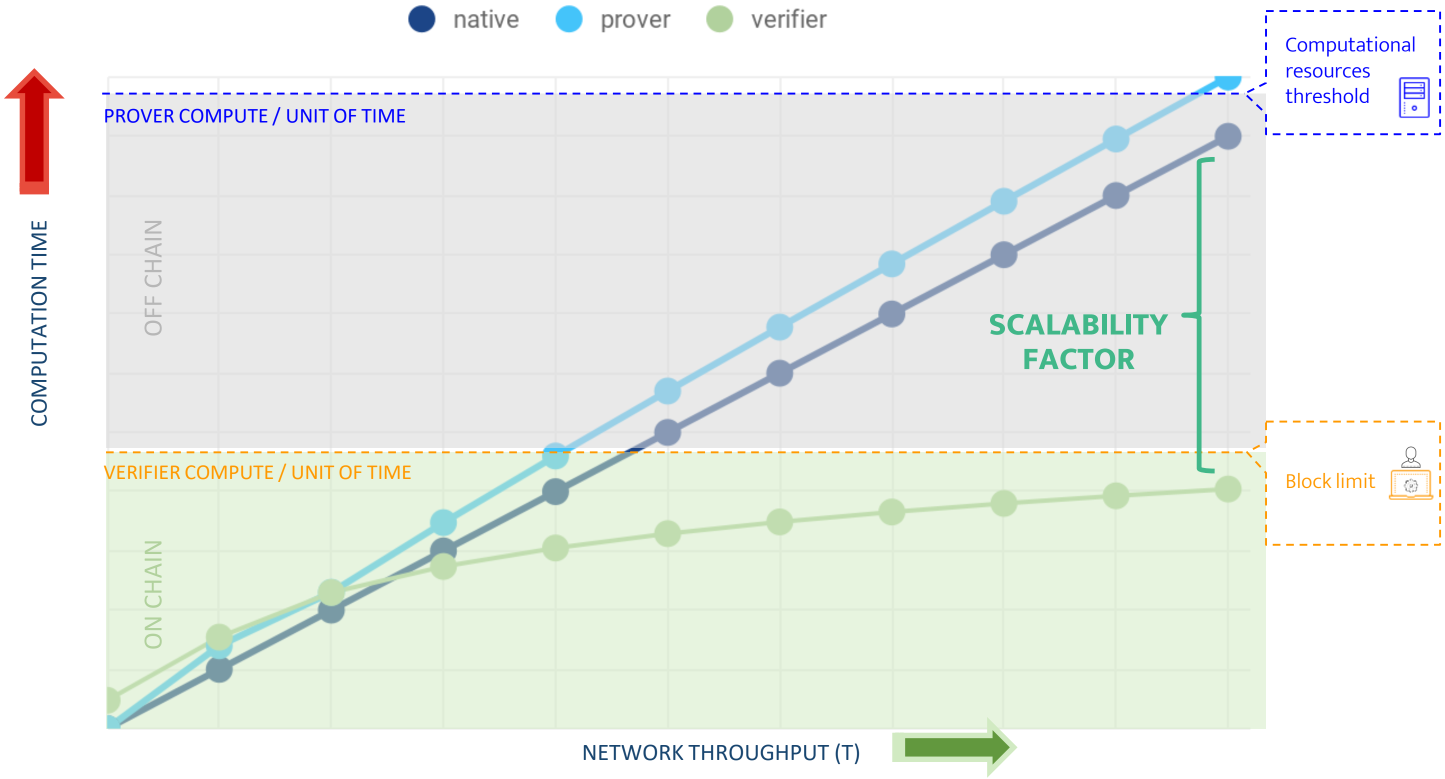

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# STARK & Other ZKP Systems

BulletProof

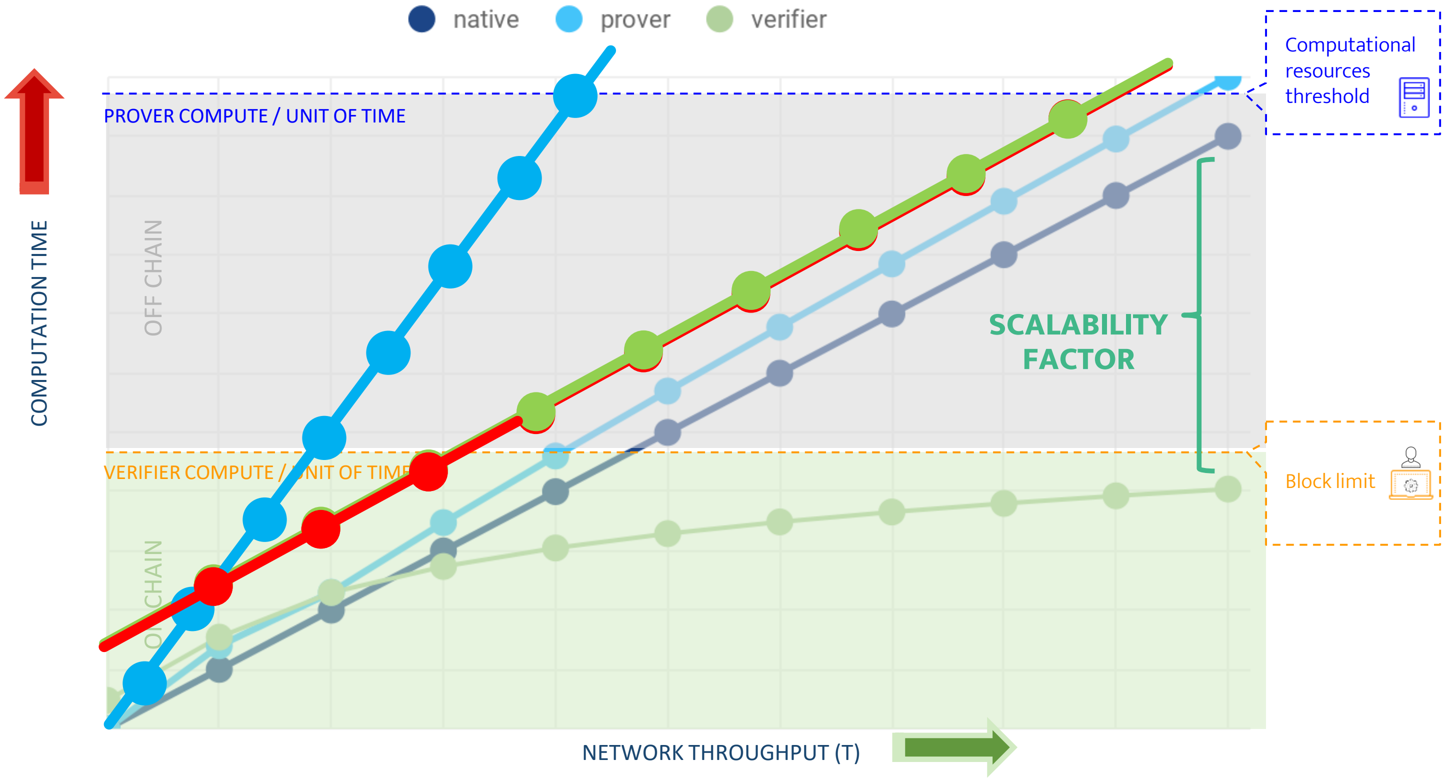
Verifier time scales linearly

SNARK

Trusted setup scales linearly

Recursive SNARK

Trusted setup, inefficient prover



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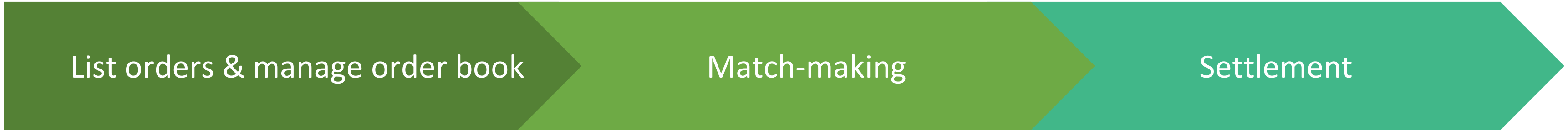
# DEXes and Scalability

# Exchange:  the 3-Act Play



List orders & manage order book

Match-making

Settlement

# Exchange:  the 3-Act Play

List orders & manage order book

Match-making

Settlement

|  | Centralized Exchange<br>(CEX) | Decentralized Exchange<br>(DEX) |  |
|---|---|---|---|
| CUSTODY | exchange holds all assets | stays with traders | CUSTODY |
| SETTLEMENT | off-chain | on-chain | SETTLEMENT |
| Tx / TRADES | #On-chain tx’s << #trades | #On-chain tx’s == #trades | Tx / TRADES |

# DEXes

## ADVANTAGES

No central honeypot luring thieves & embezzlers

DEX does not assume counterparty risk:

- No exposure to 51% attack
- Faster/cheaper listing of crypto pairs

## DISADVANTAGES

Total dex volume ~ 1% of total CEX volume

Transaction (settlement) cost: ~200K gas, implies upper bound of 3 tx/sec in Ethereum

low tx volume means poor liquidity

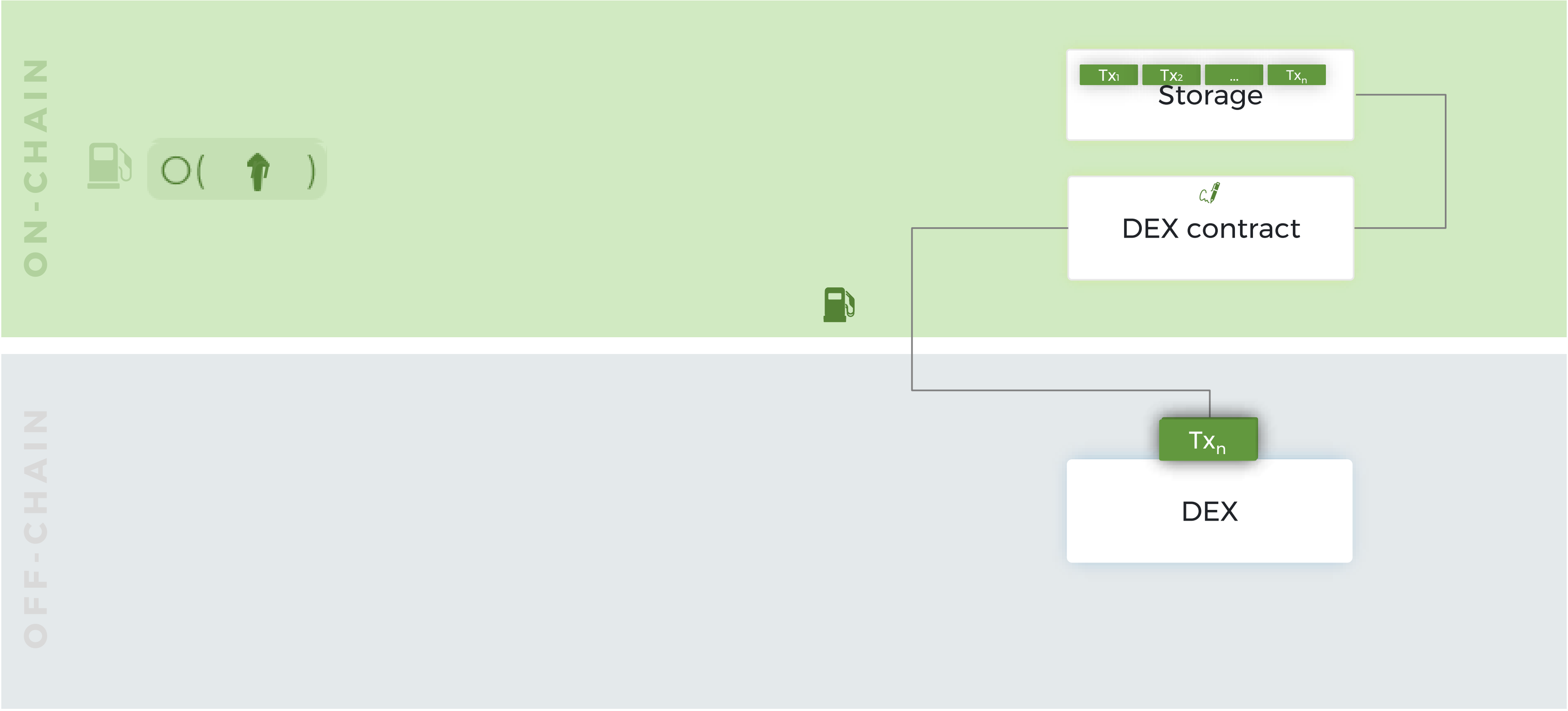
# StarkDEX

# StarkDEX Overview

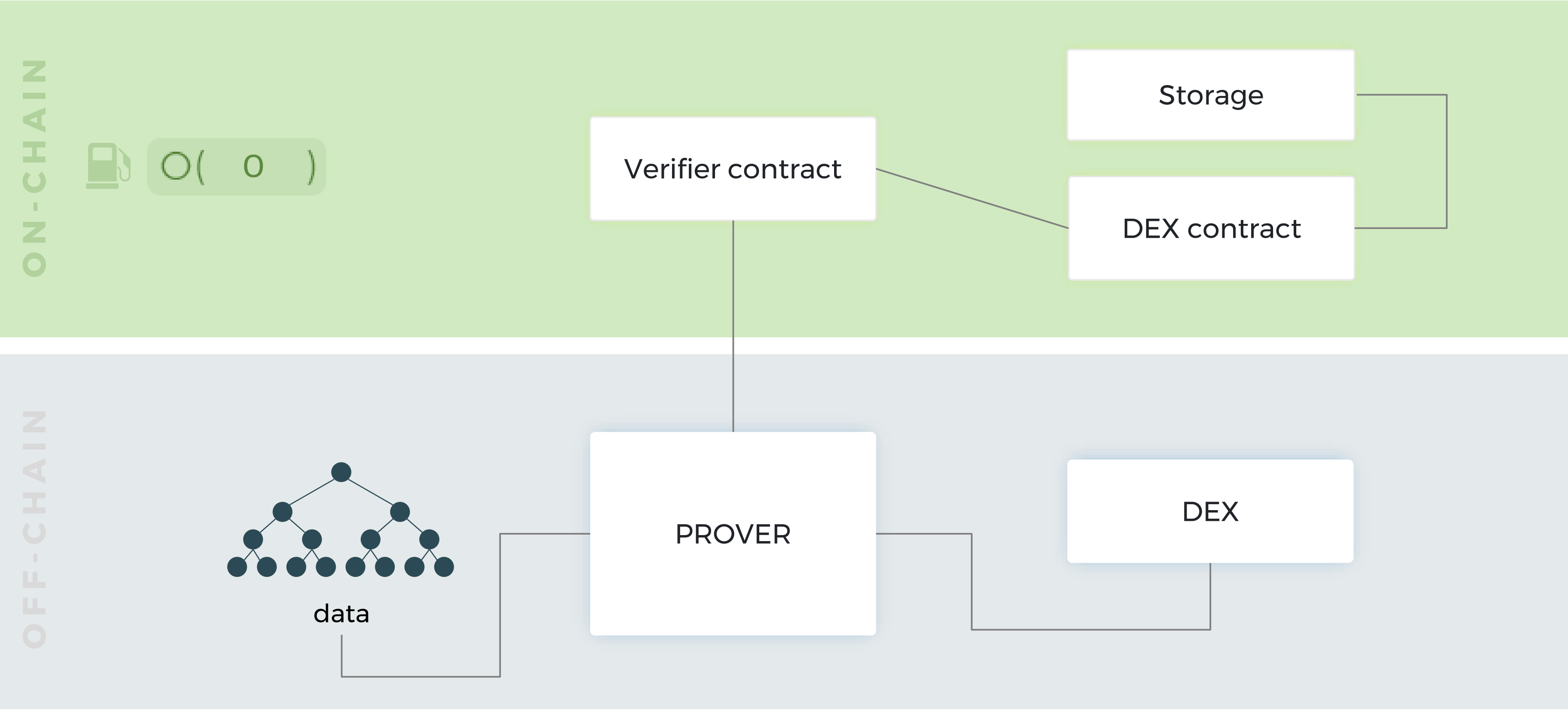
ON-CHAIN

OFF-CHAIN

# Current DEXes



# StarkDEX – High Level



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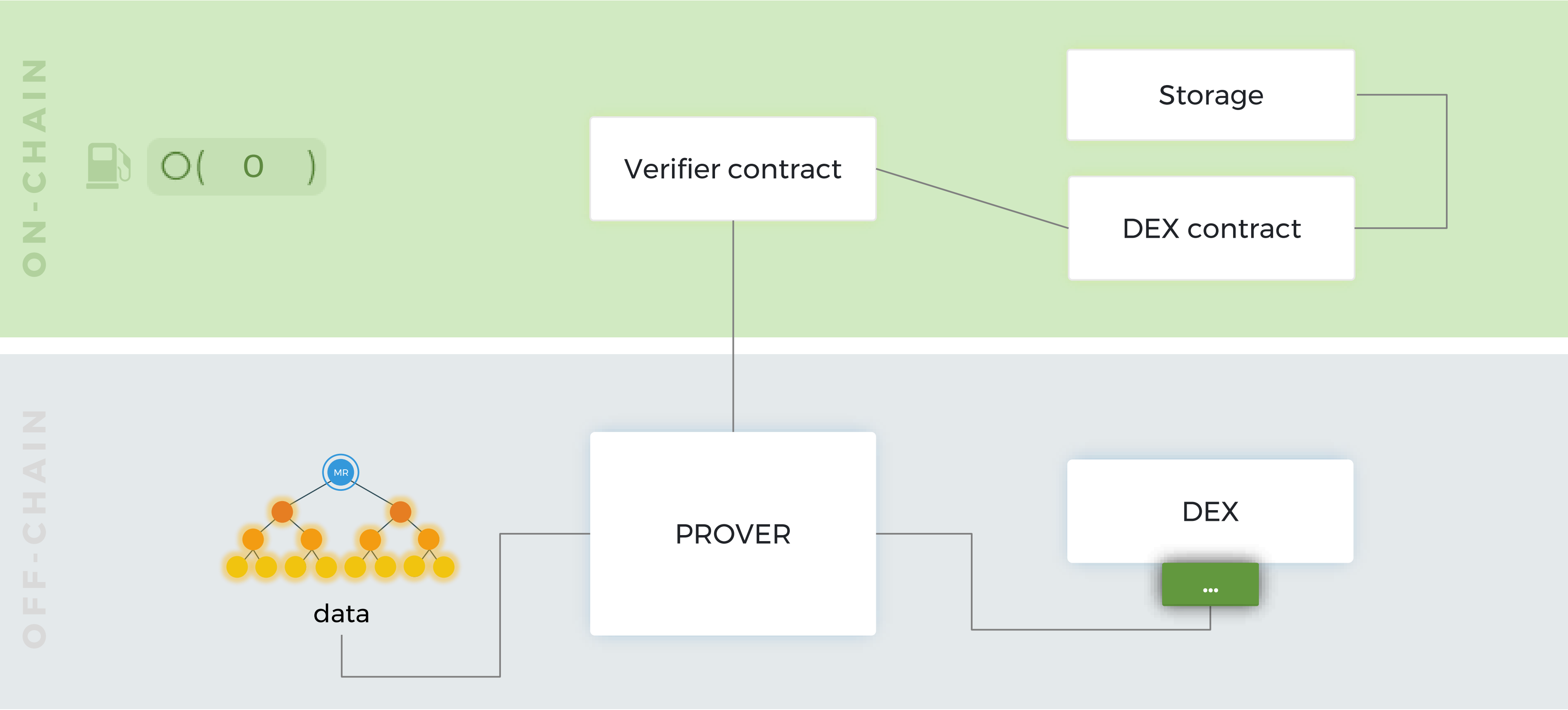


ON-CHAIN

O( 0 )

Verifier contract

Storage

DEX contract

OFF-CHAIN

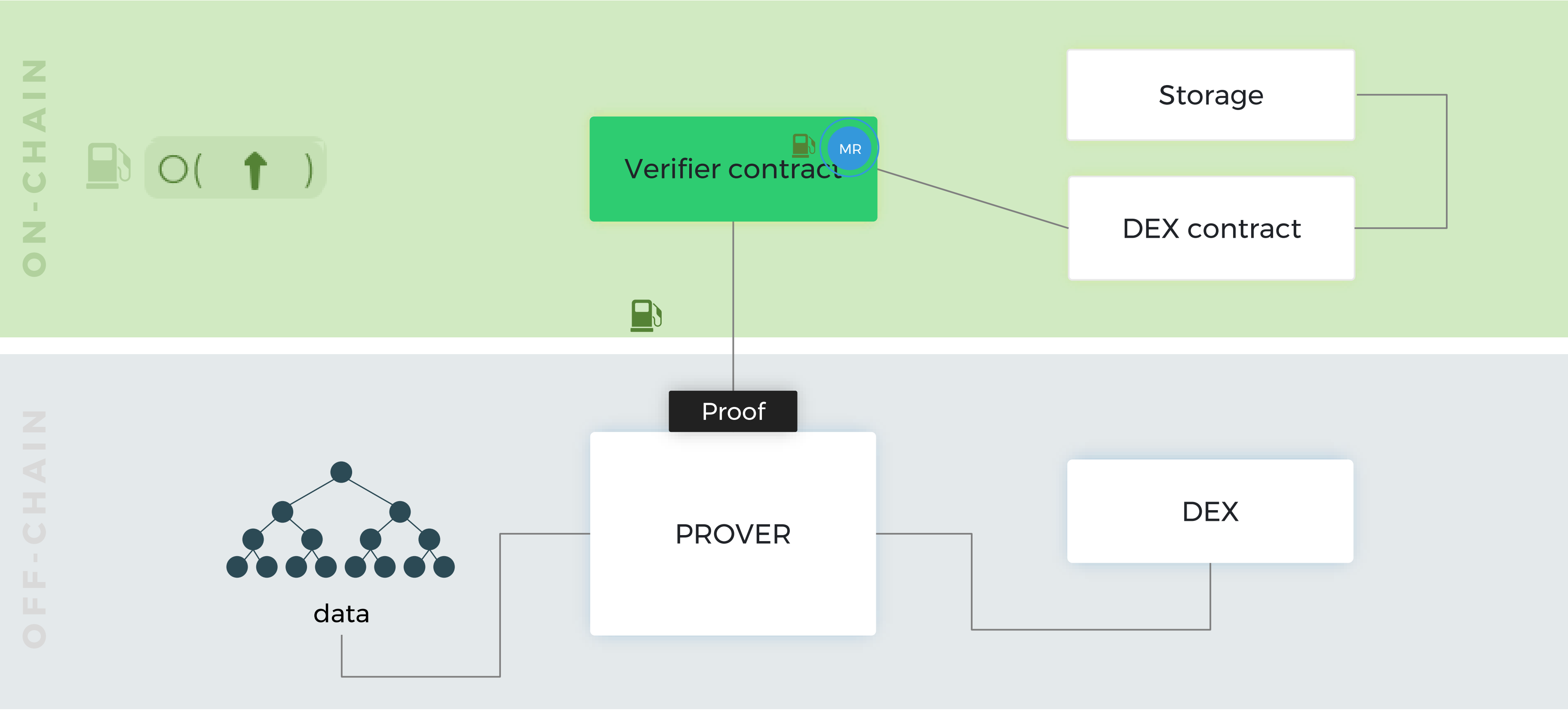
data

PROVER

DEX

...

# StarkDEX – High Level



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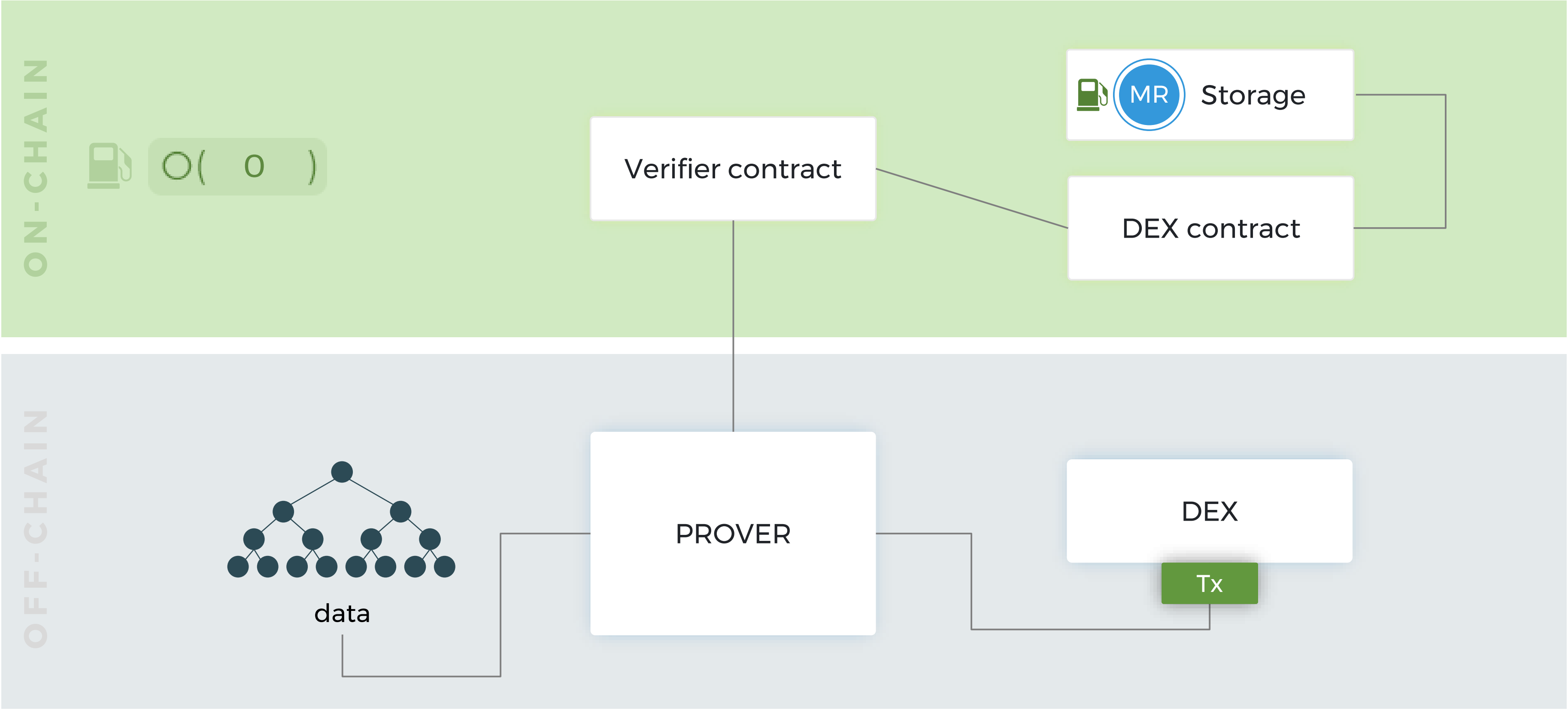

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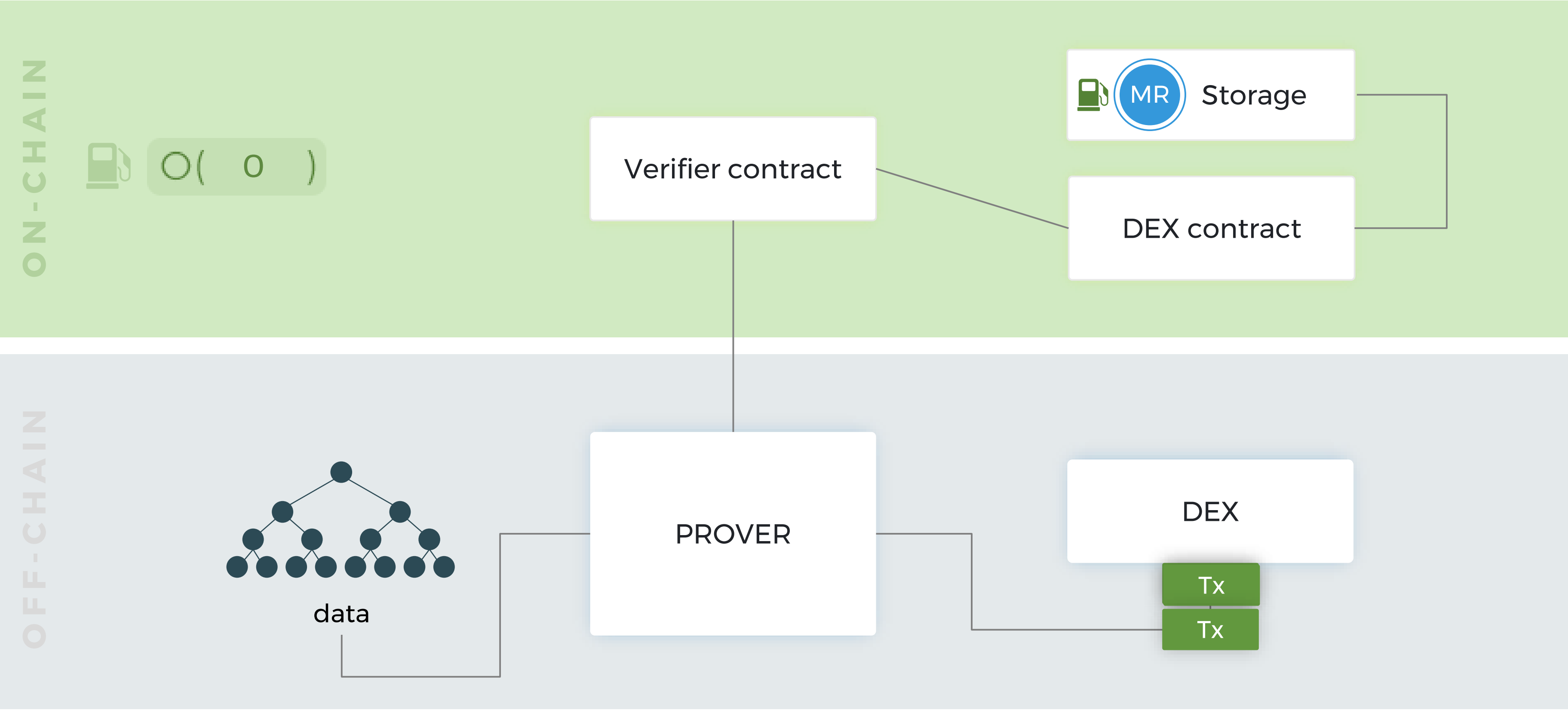

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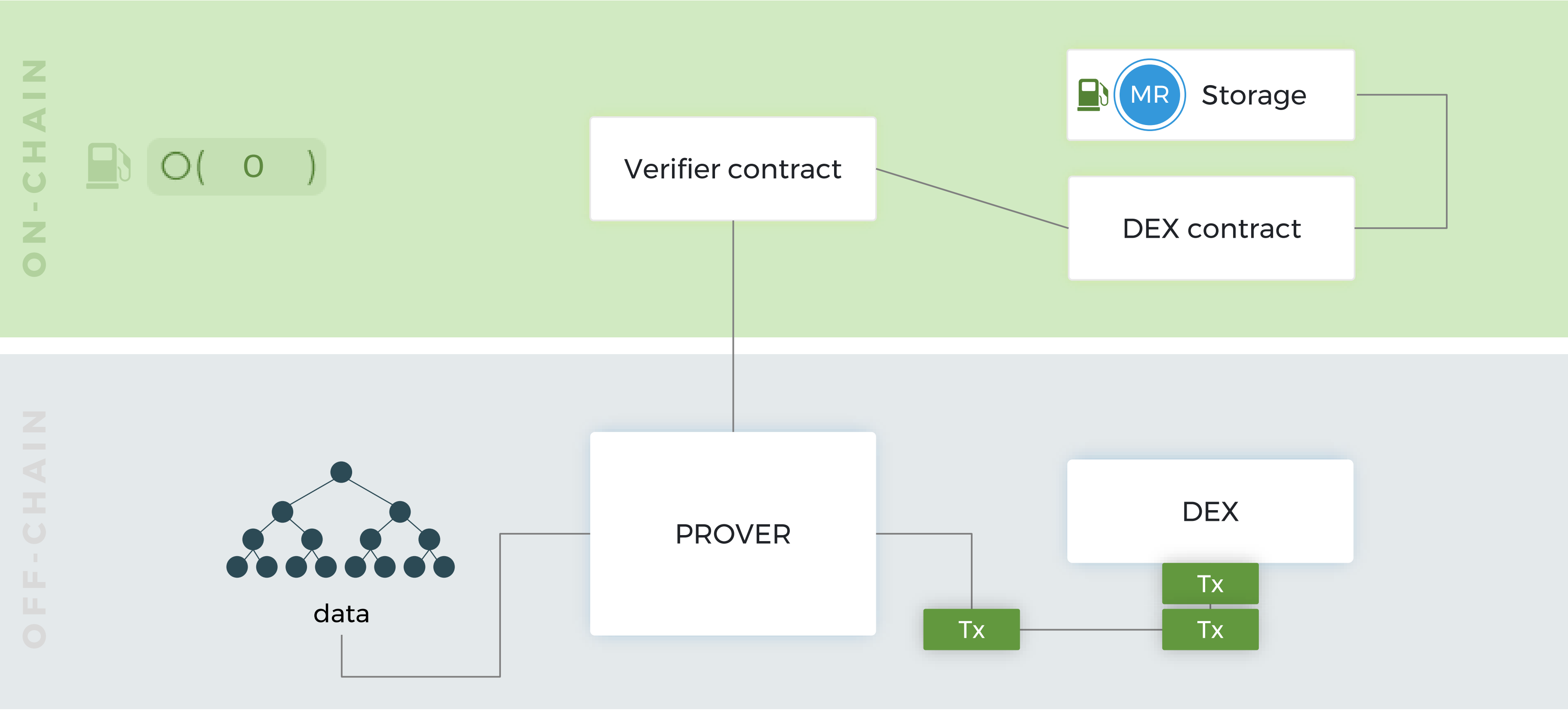

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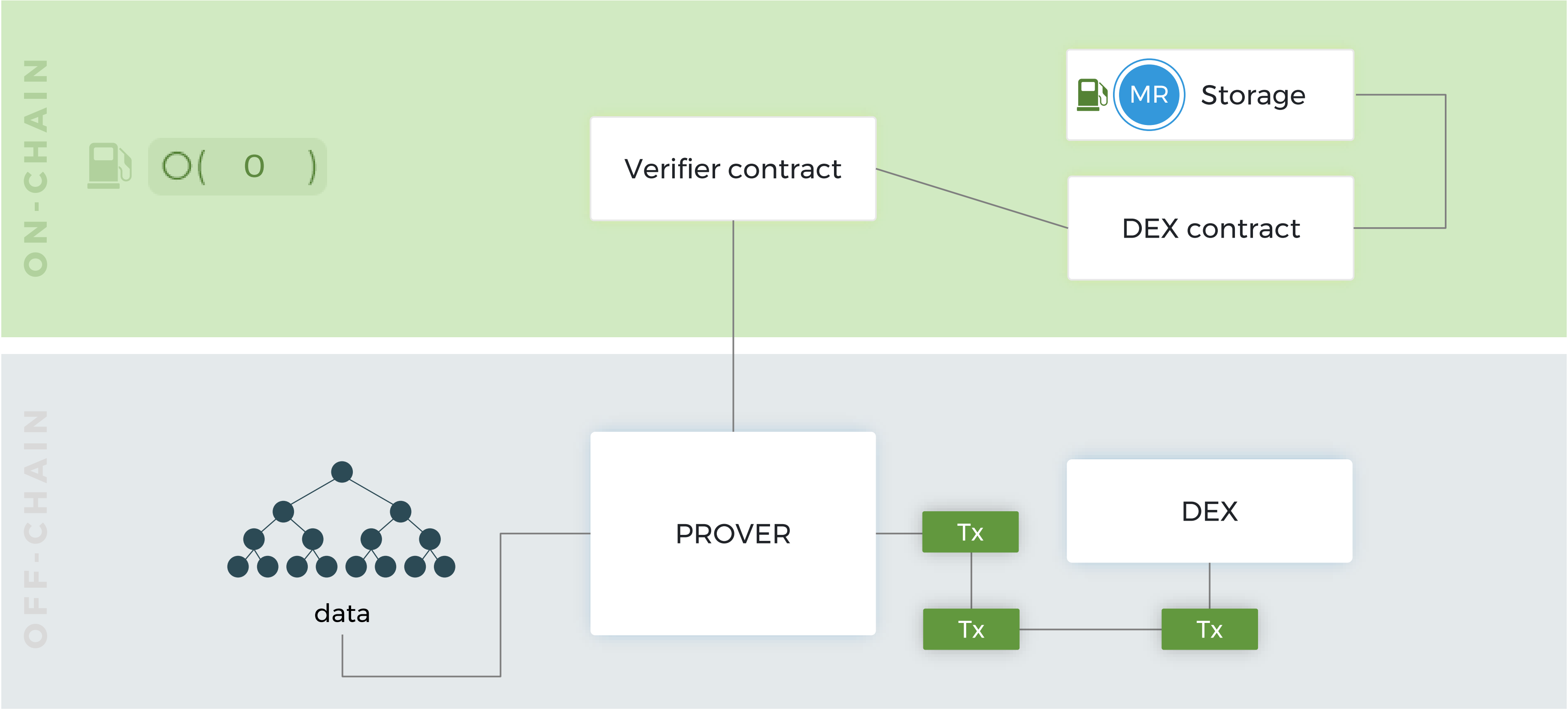
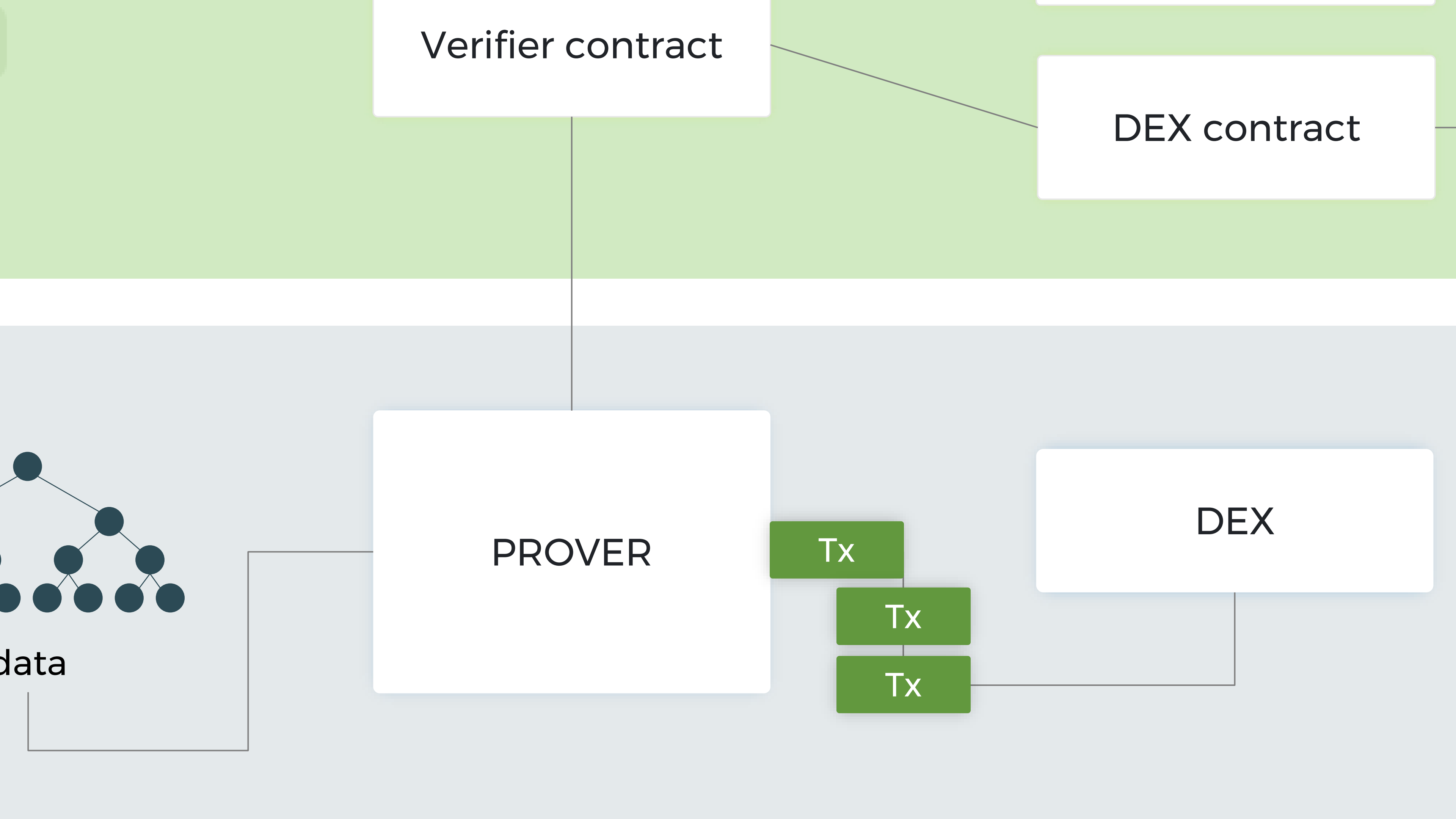




Verifier contract

DEX contract

PROVER

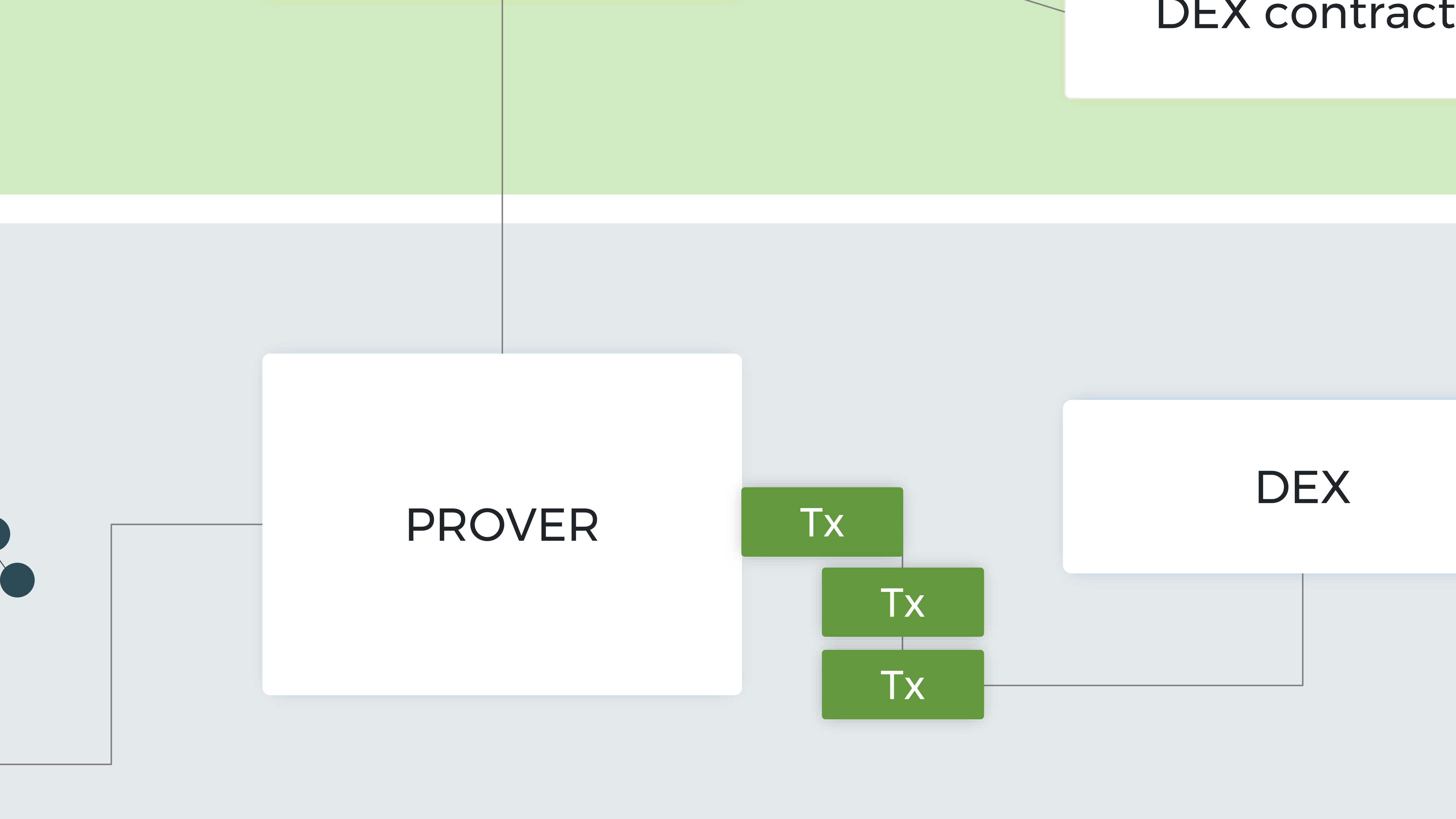
Tx

Tx

Tx

DEX

data



DEX contract

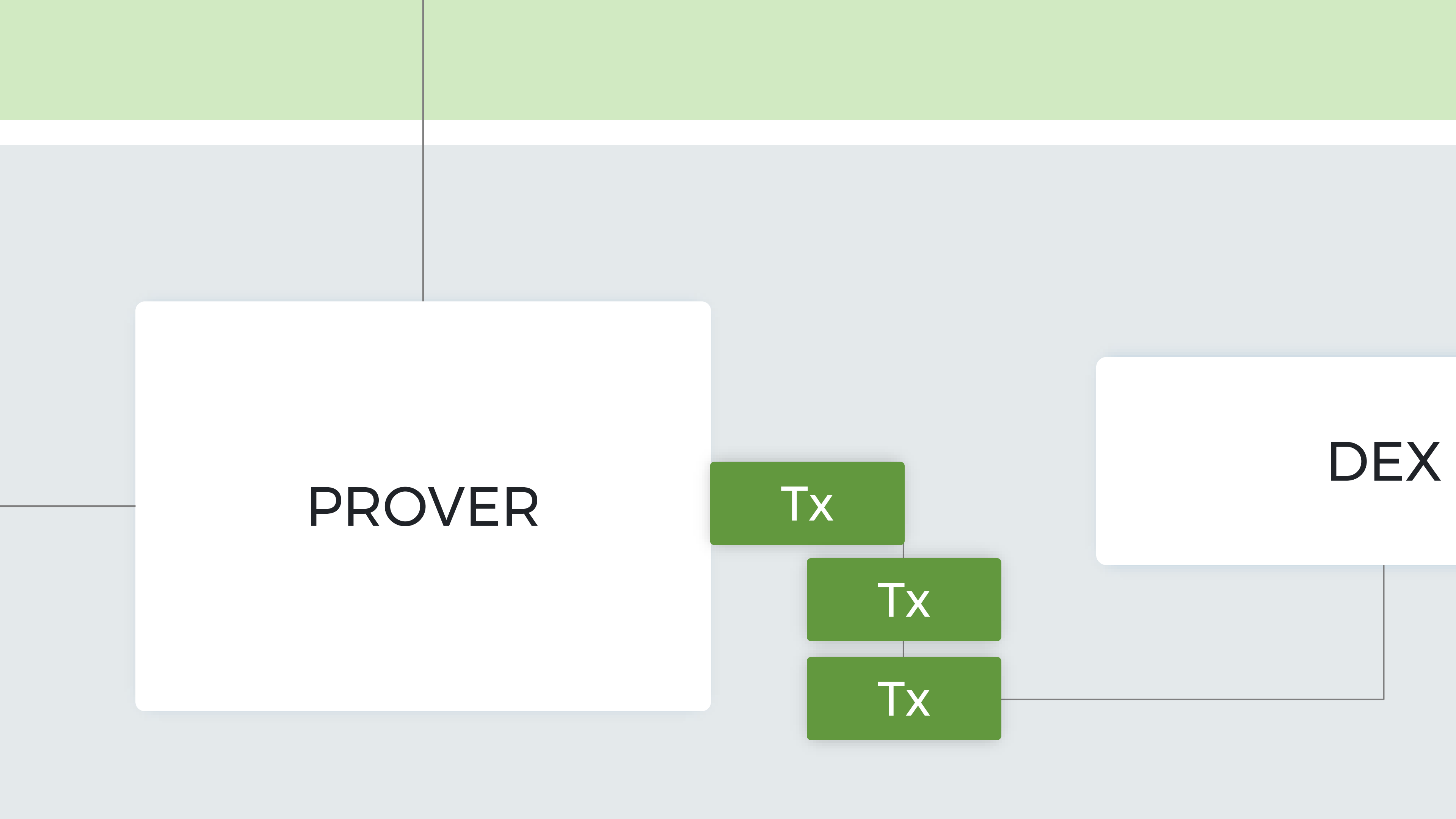
PROVER

Tx

Tx

Tx

DEX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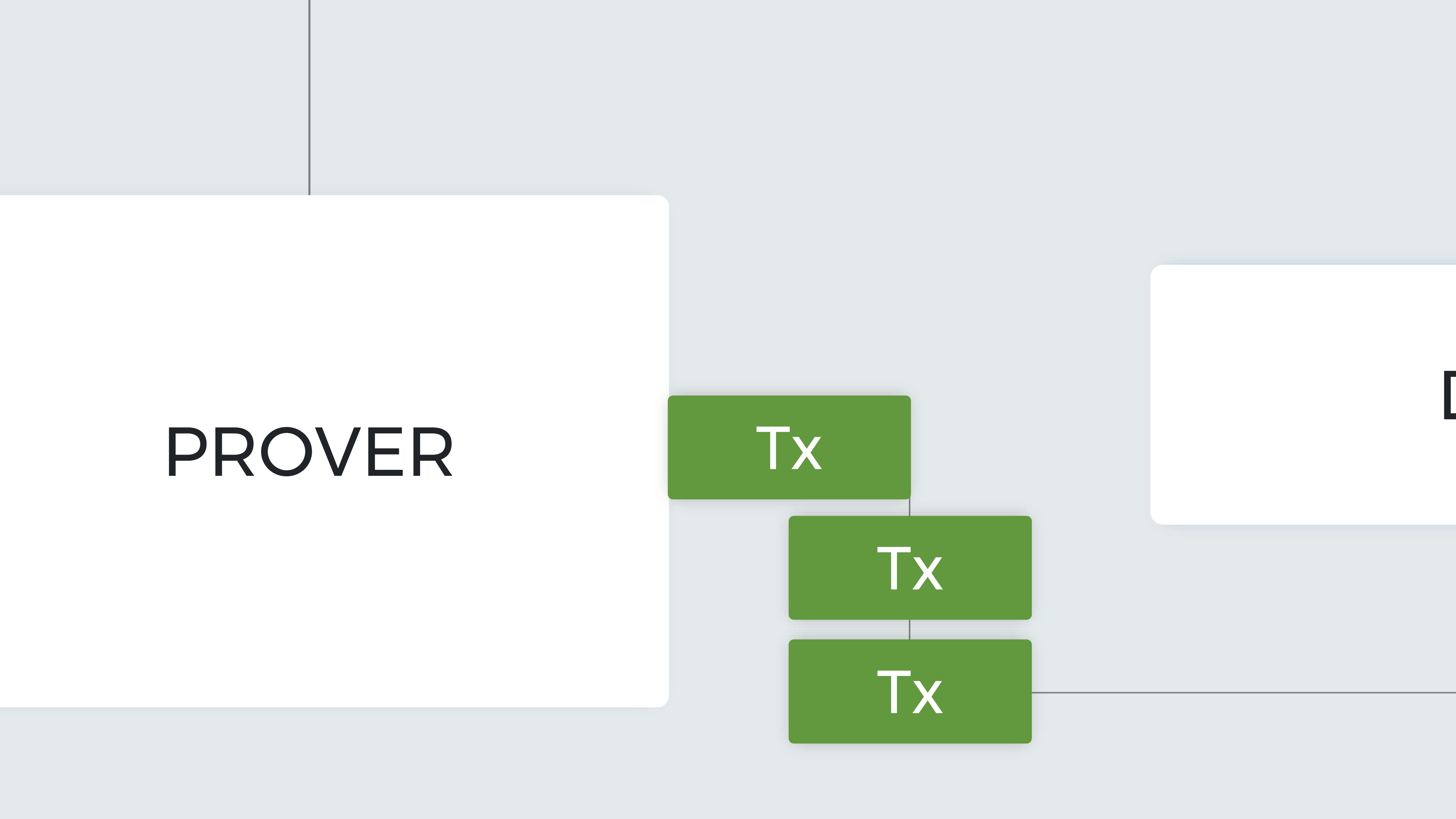

PROVER

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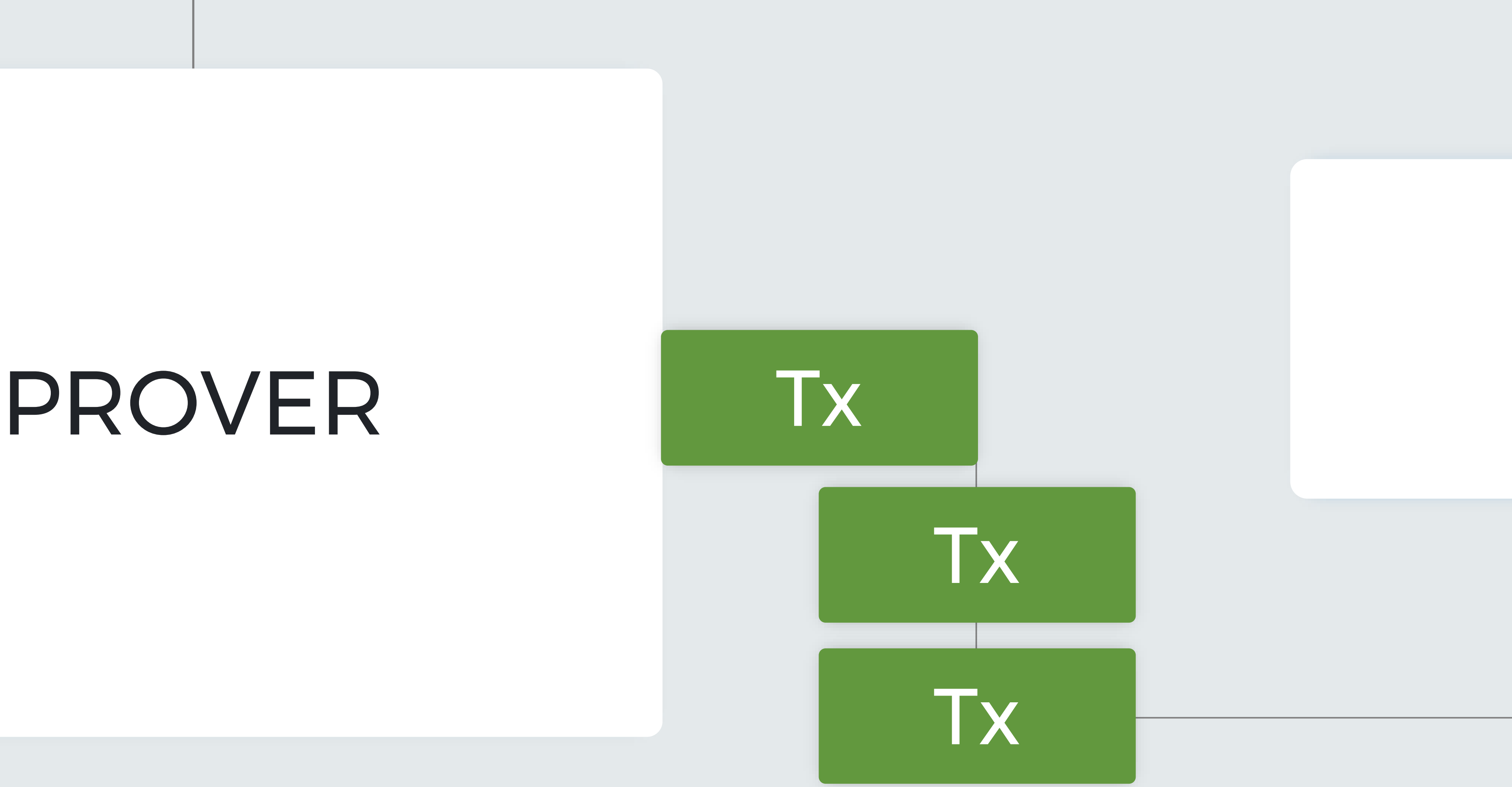

PROVER

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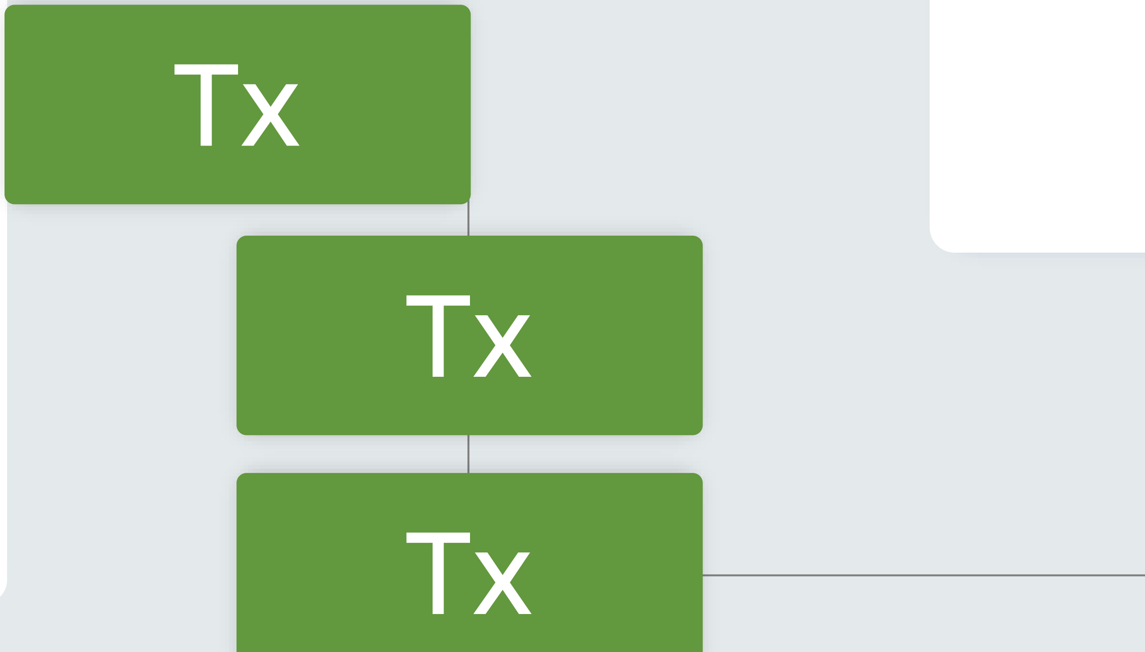

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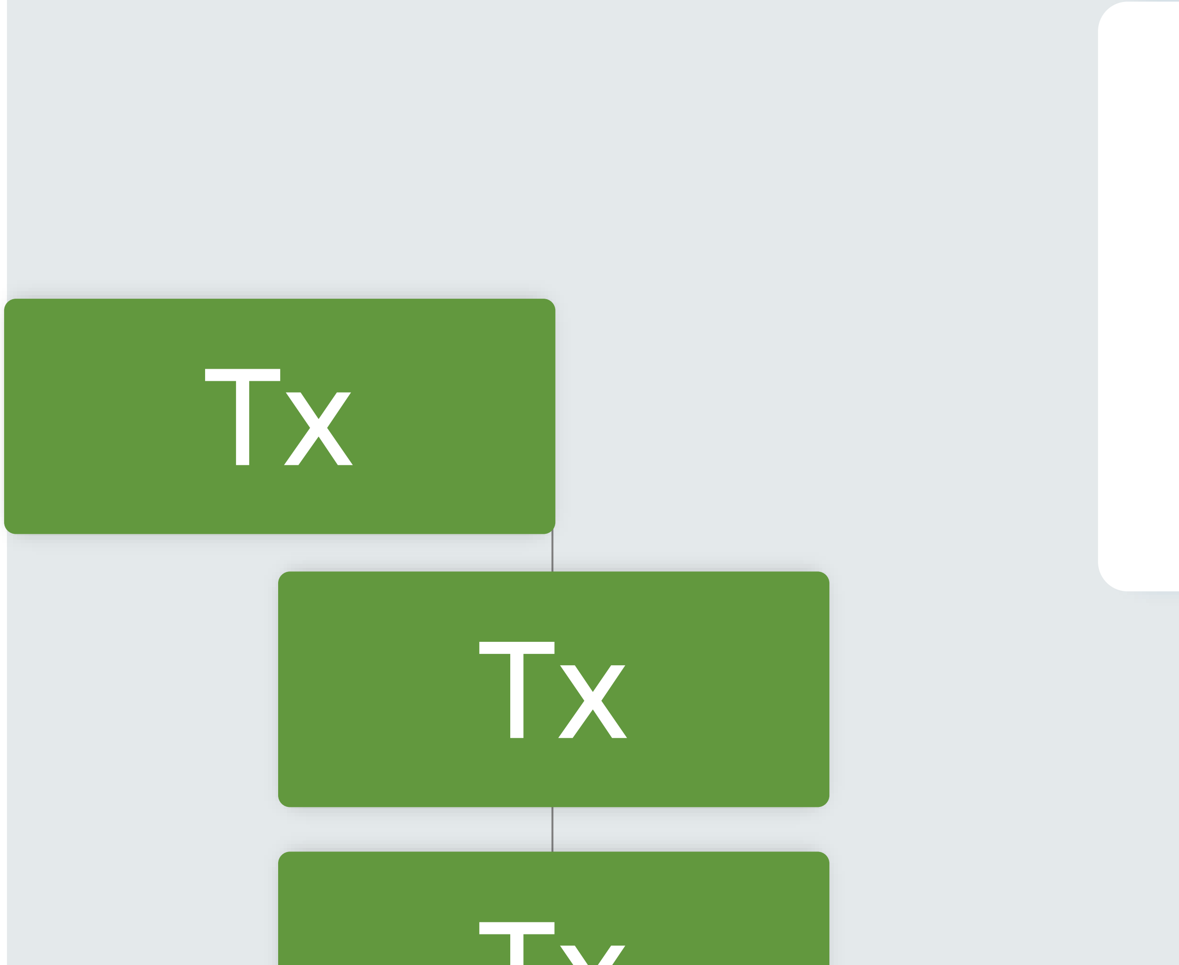
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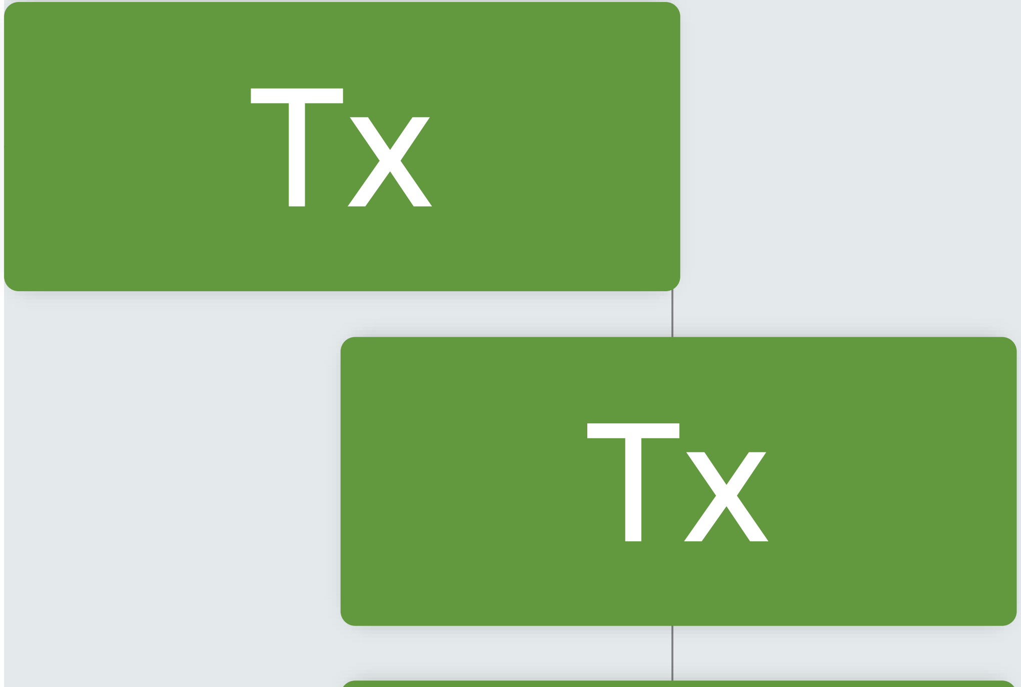

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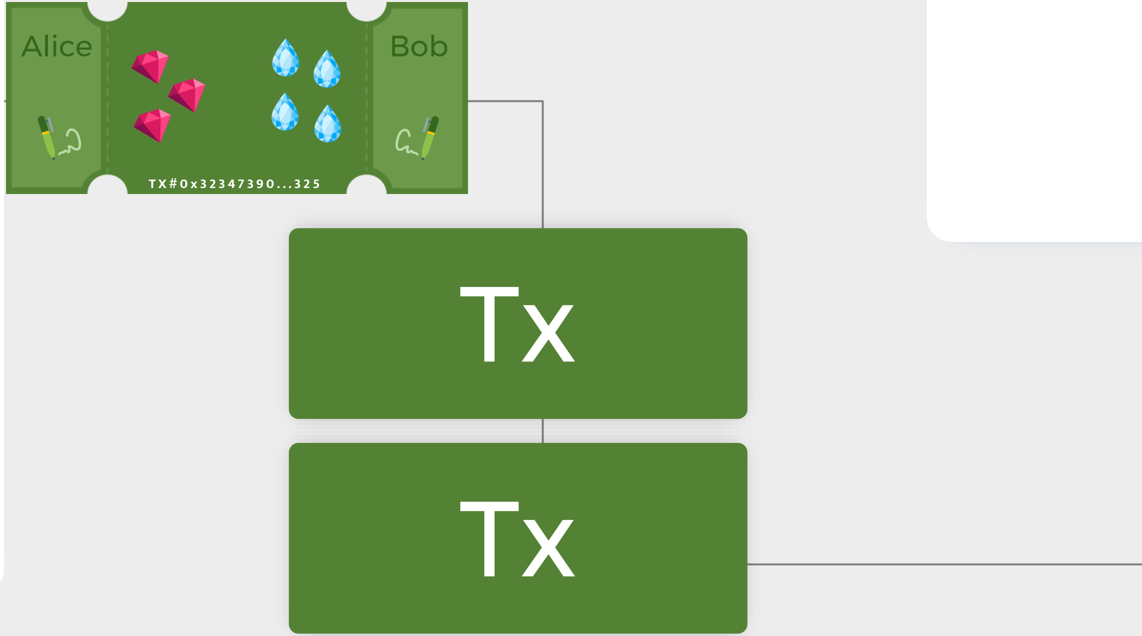
Alice
Bob
TX#0x32347390...325

Tx

OVER



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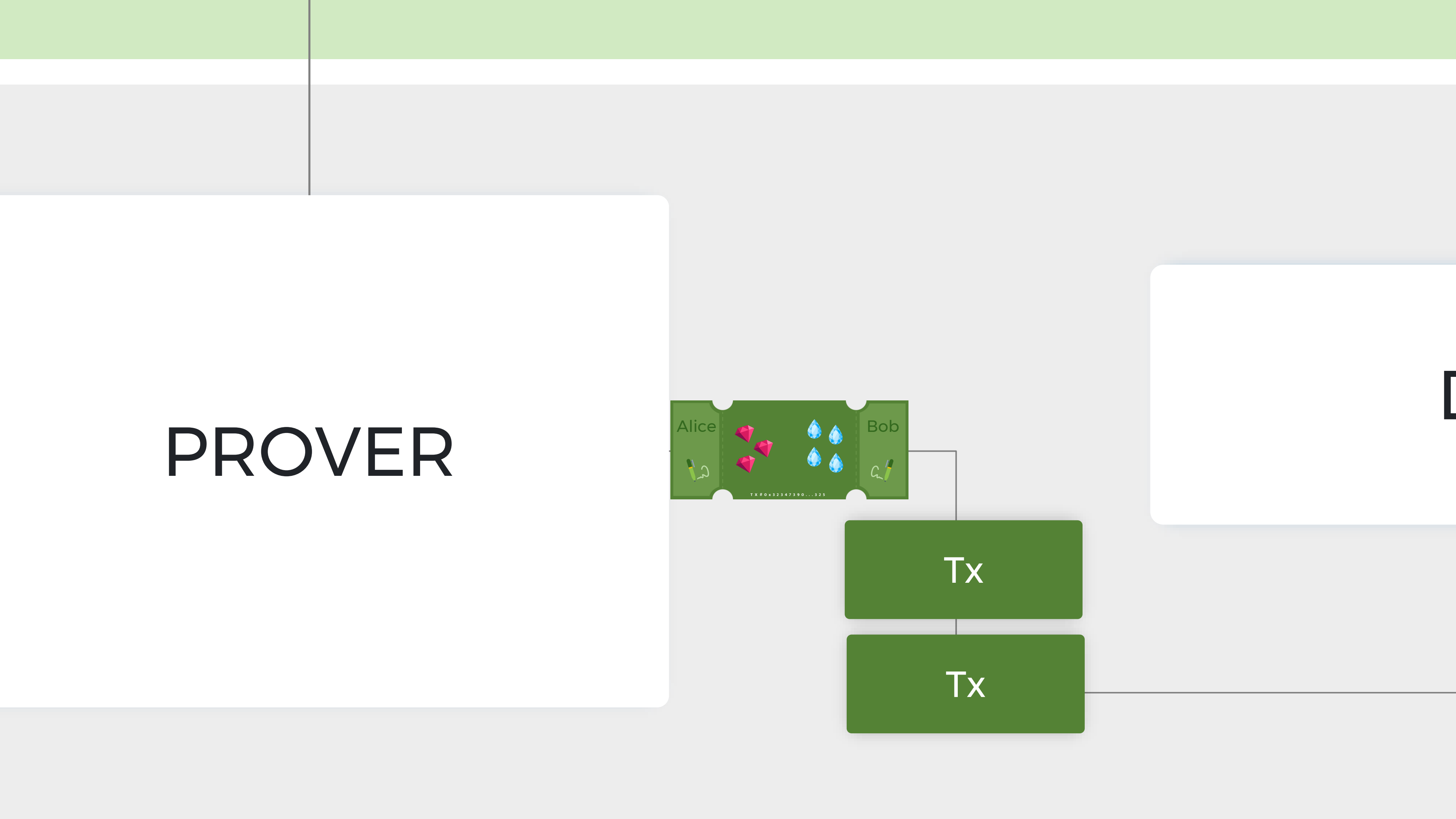

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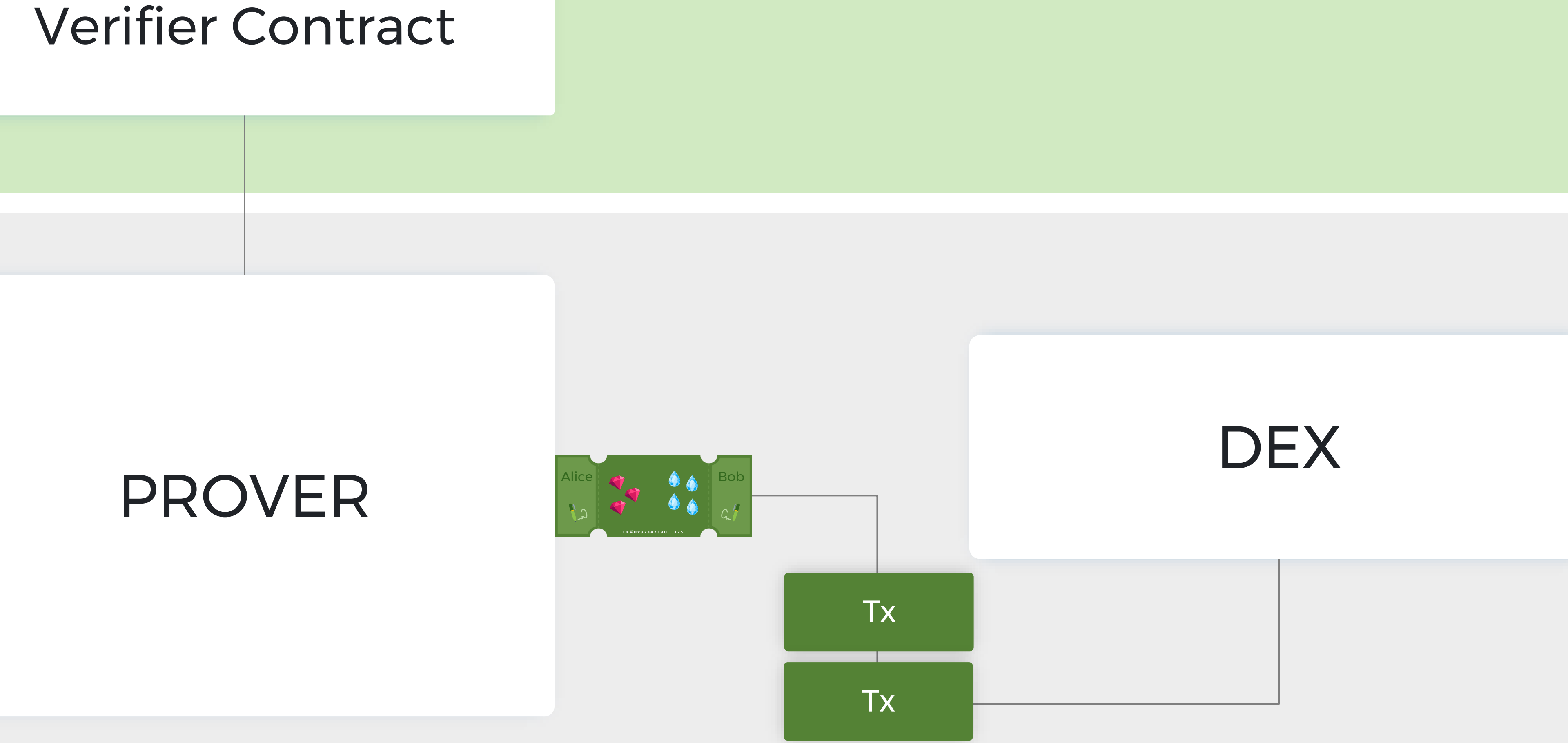
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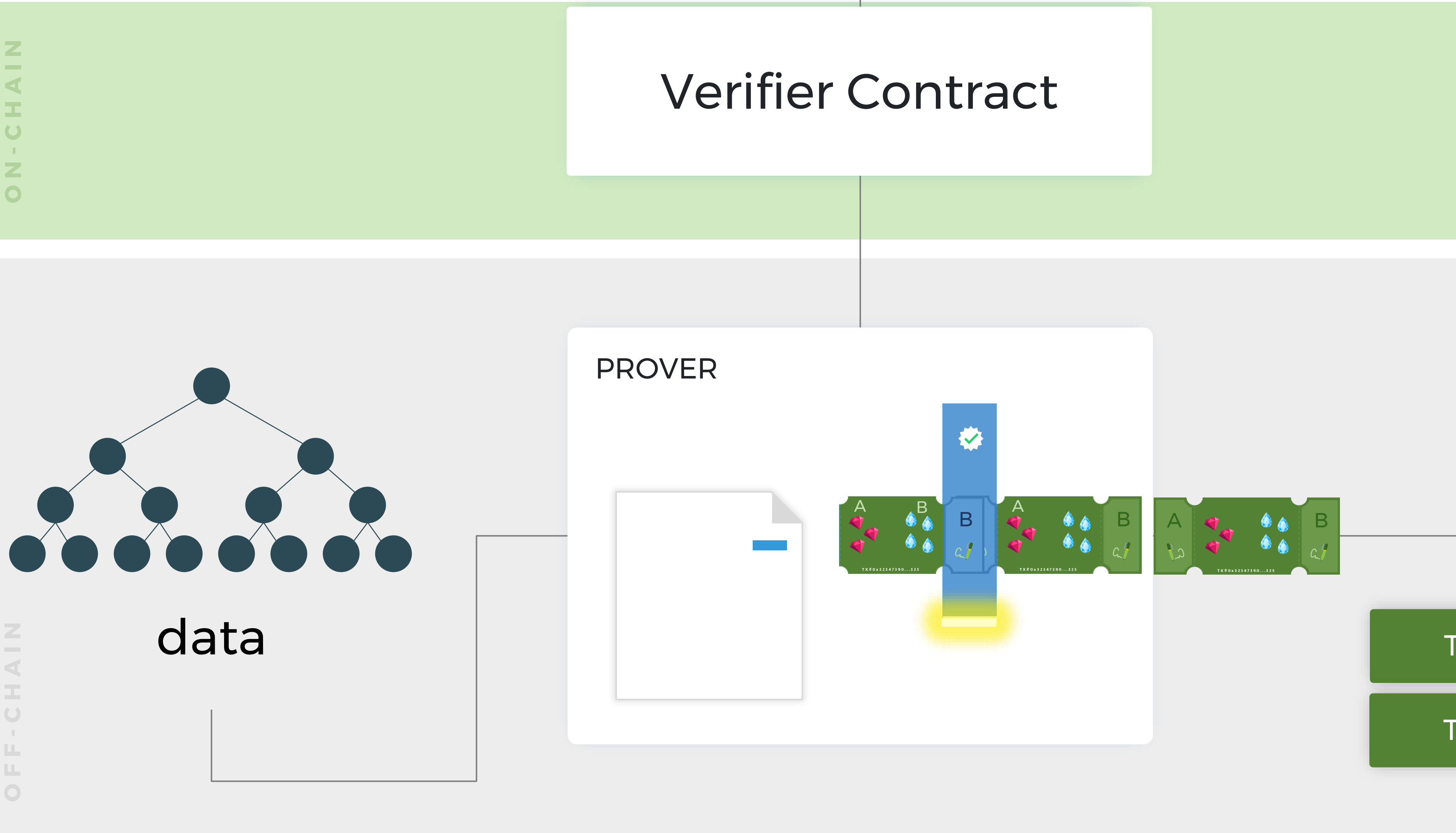


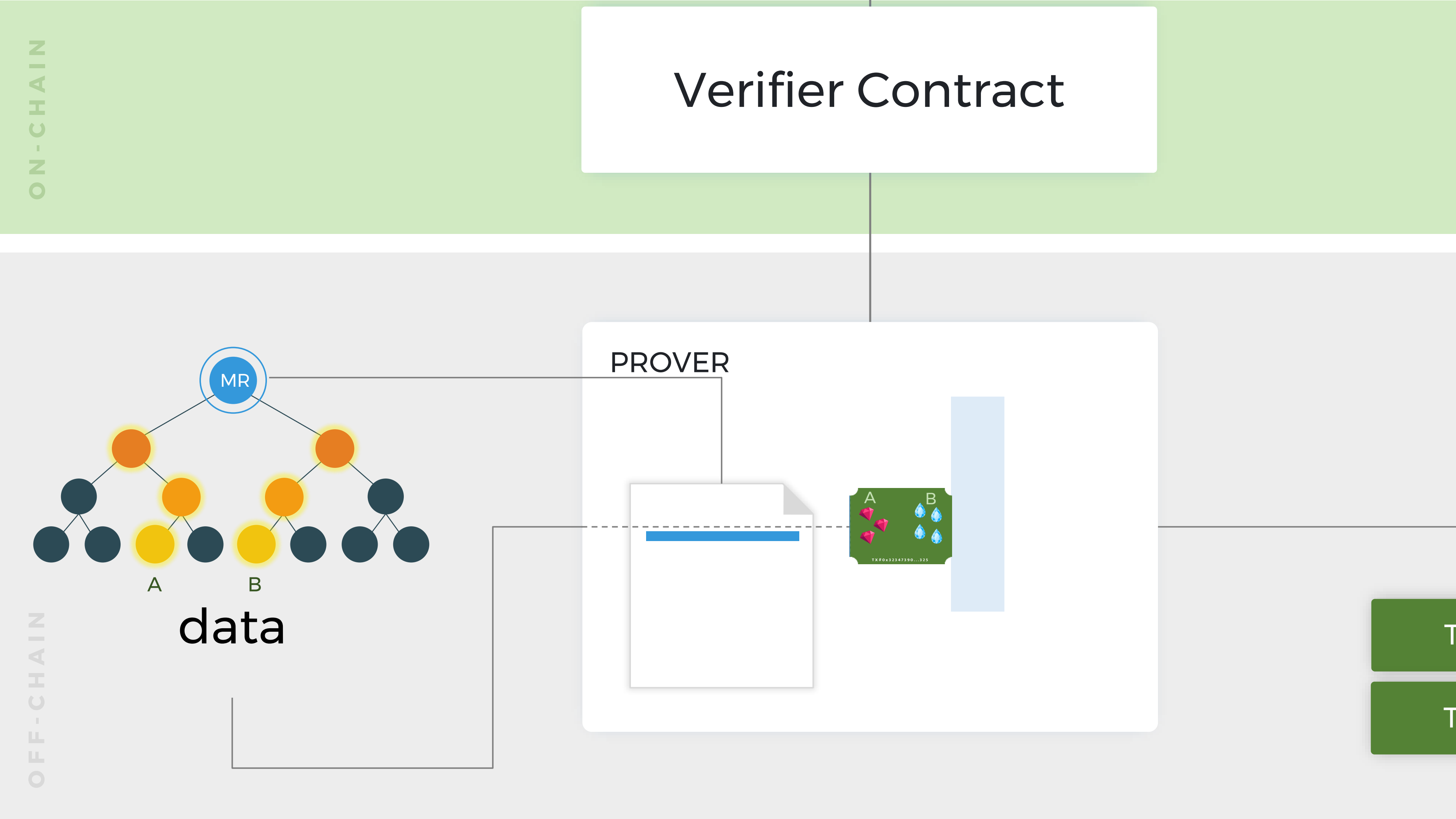
ON-CHAIN

Verifier Contract

OFF-CHAIN

data

PROVER



ON-CHAIN

Verifier Contract

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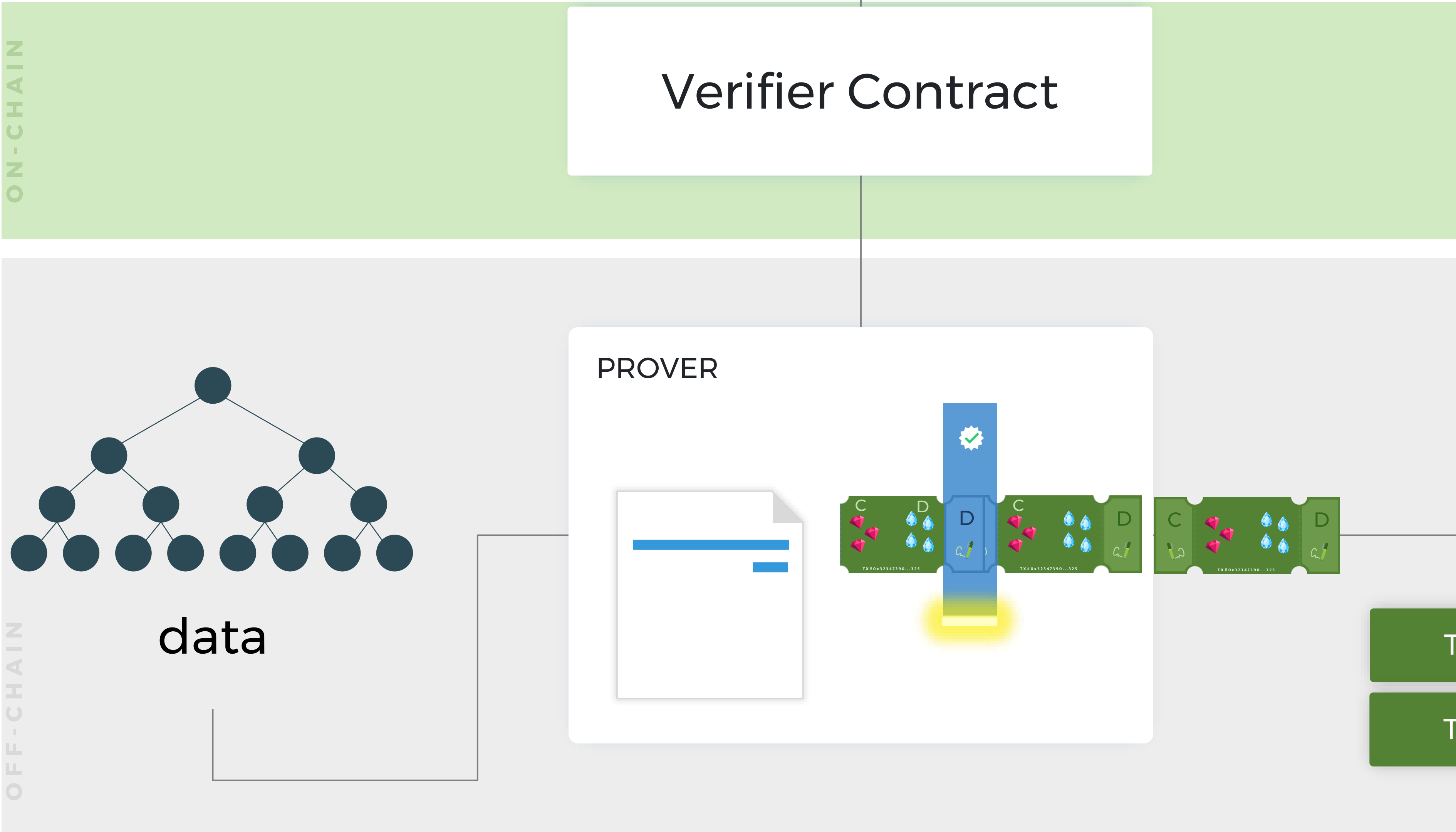
OFF-CHAIN



ON-CHAIN

Verifier Contract

PROVER

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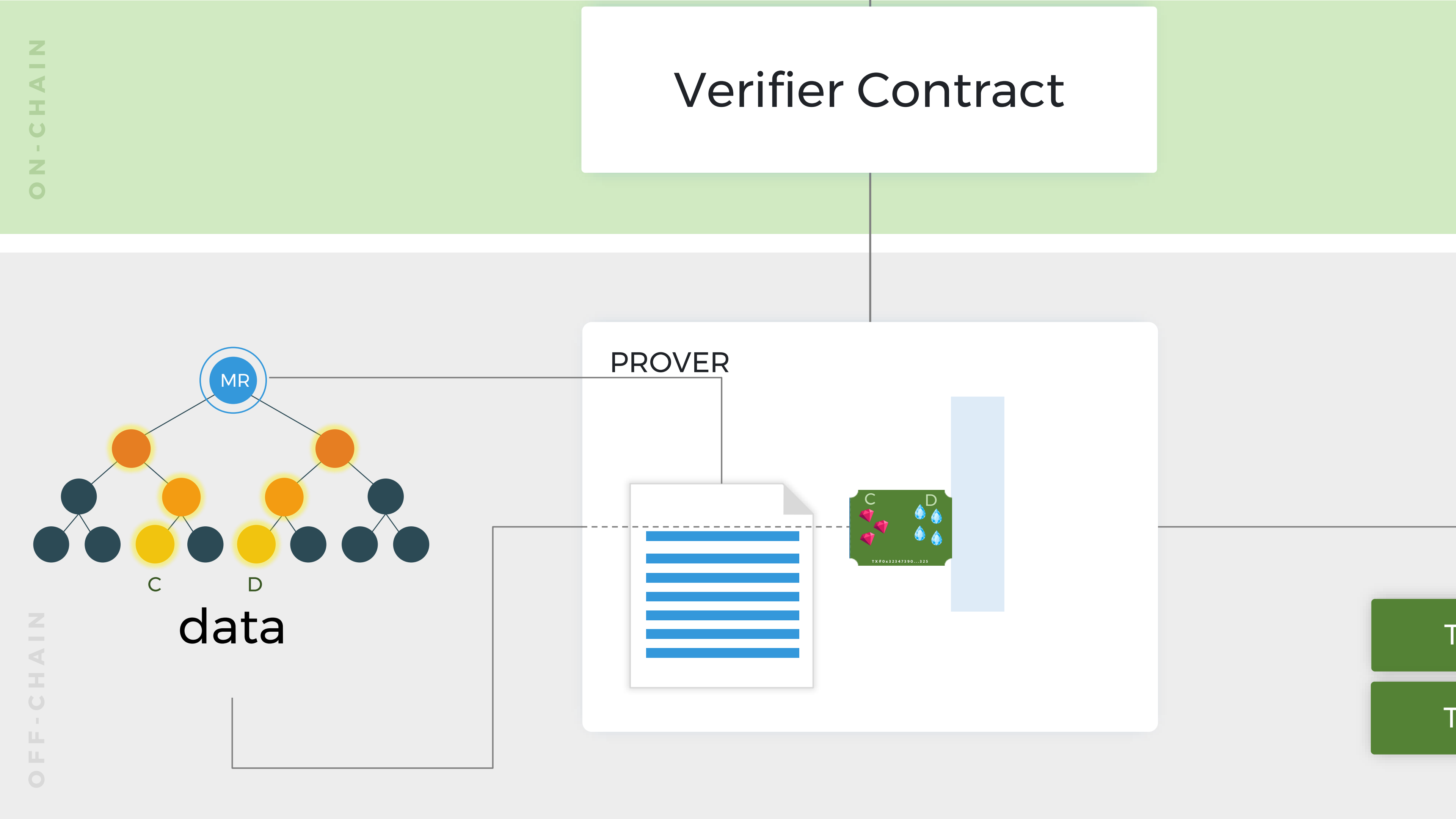
OFF-CHAIN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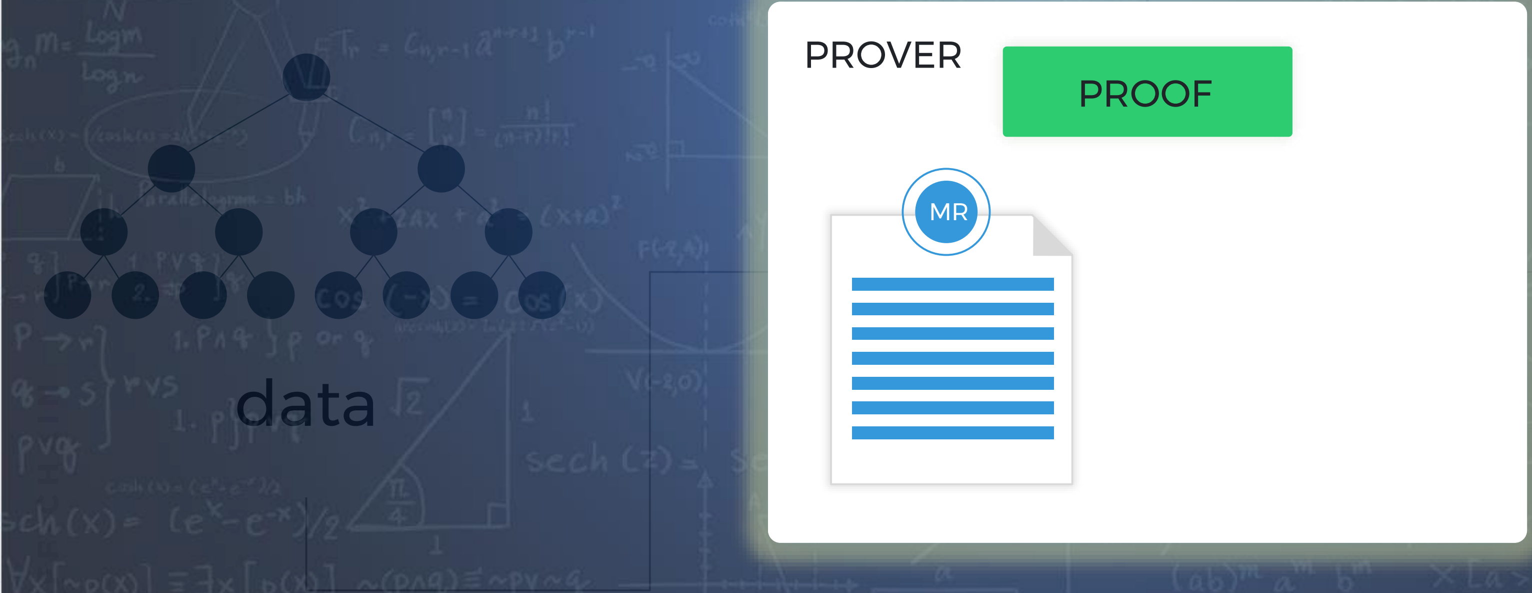
# Verifier Contract



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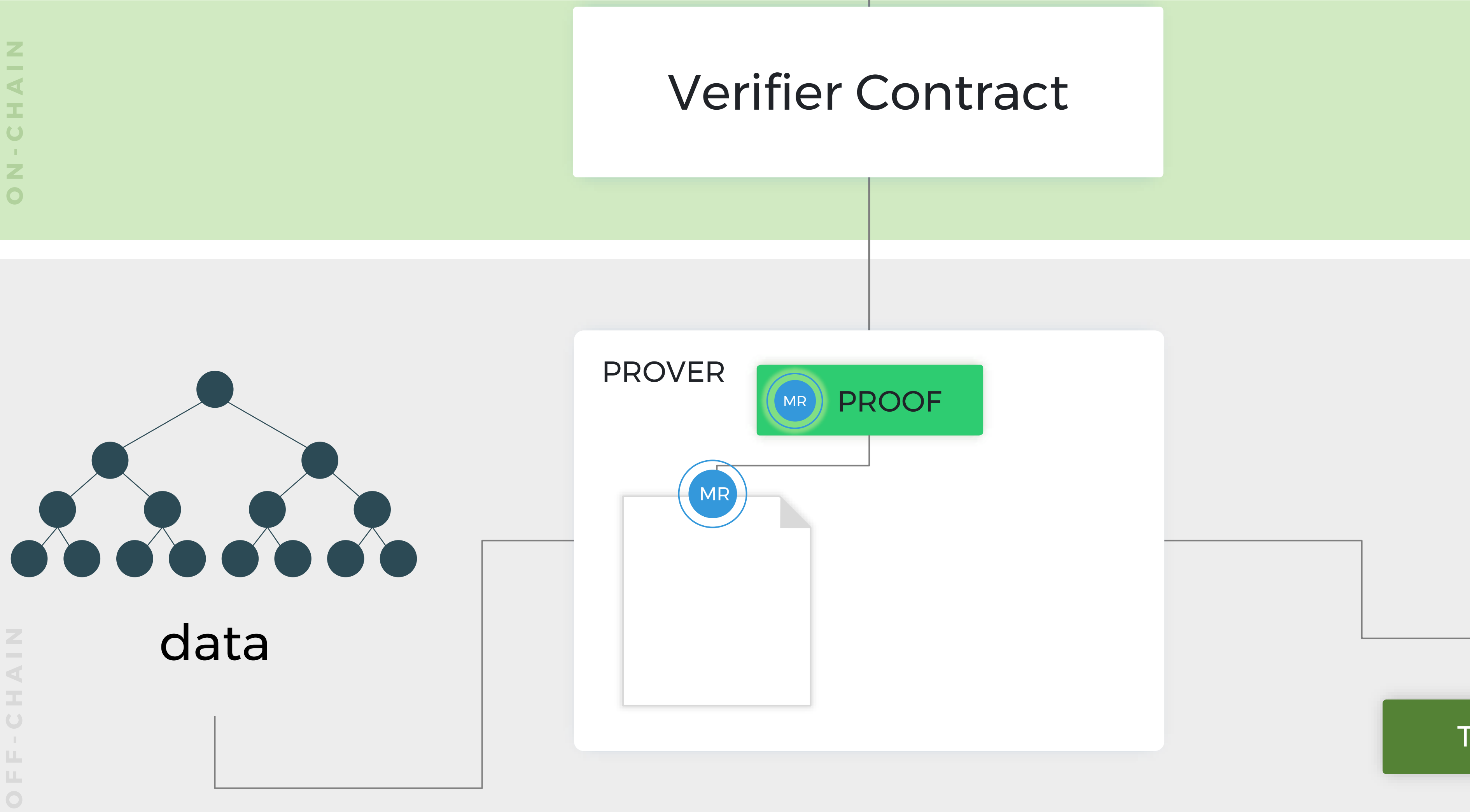

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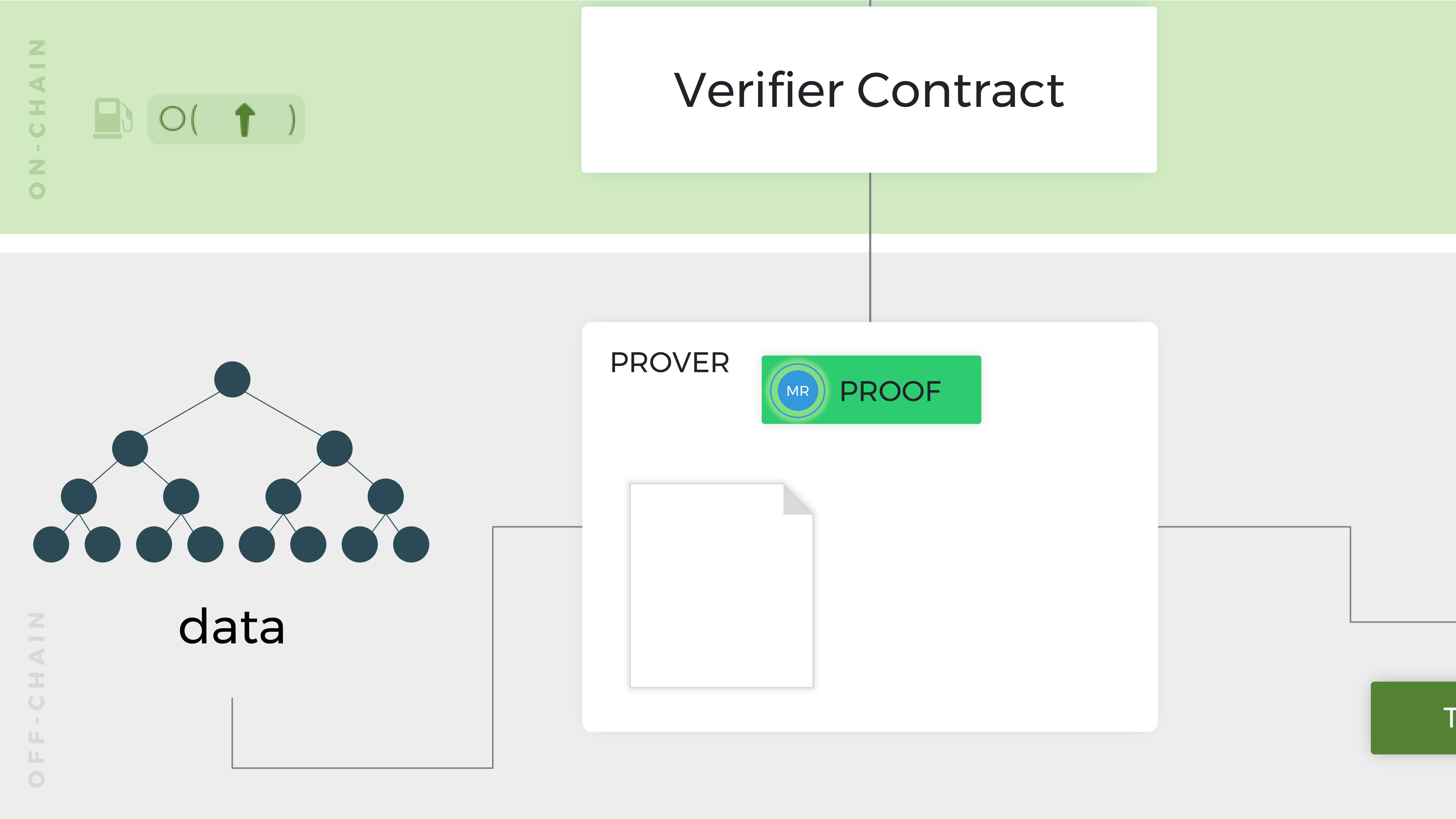

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# Verifier Contract

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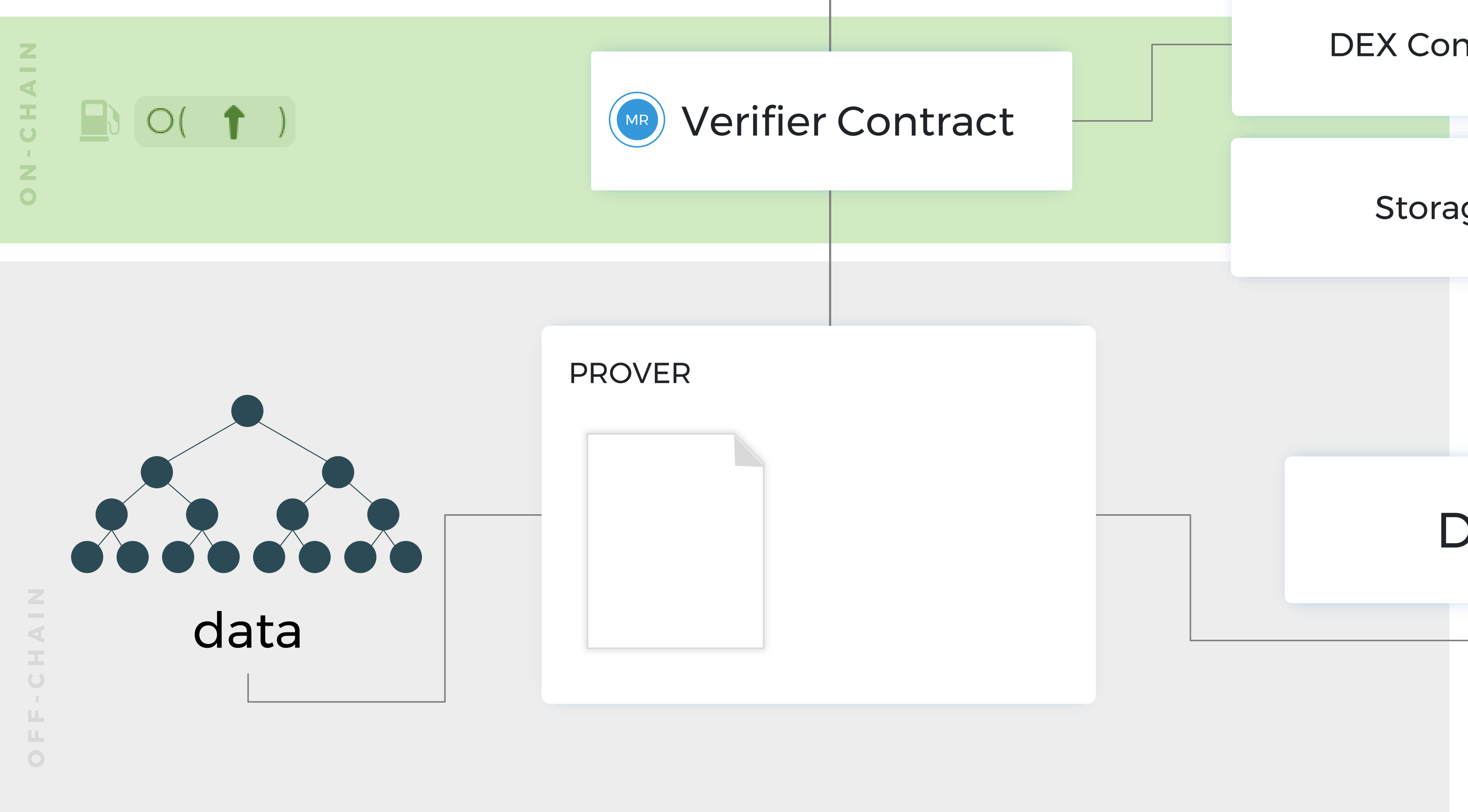

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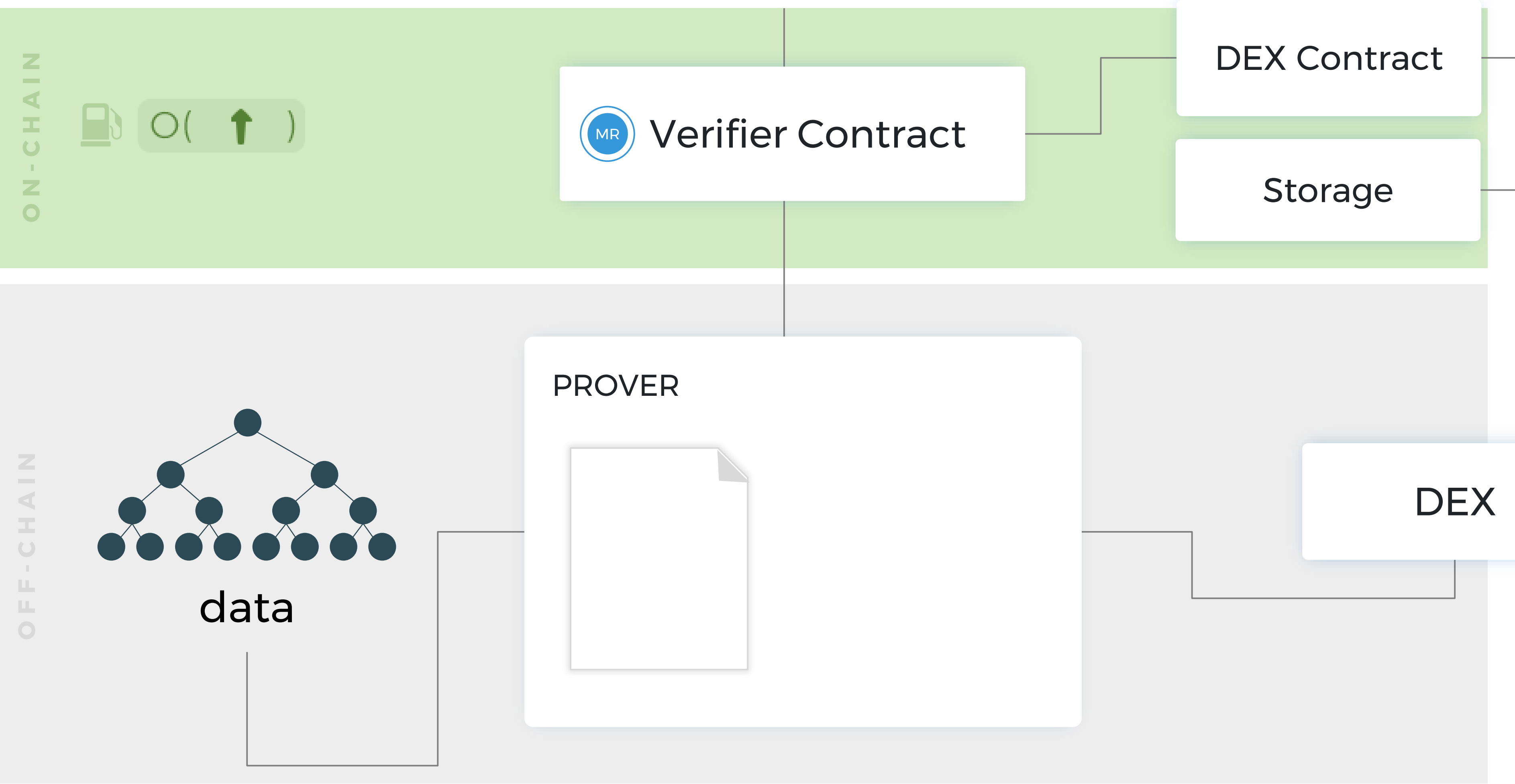
# Starked Dex – Tx Anatomy



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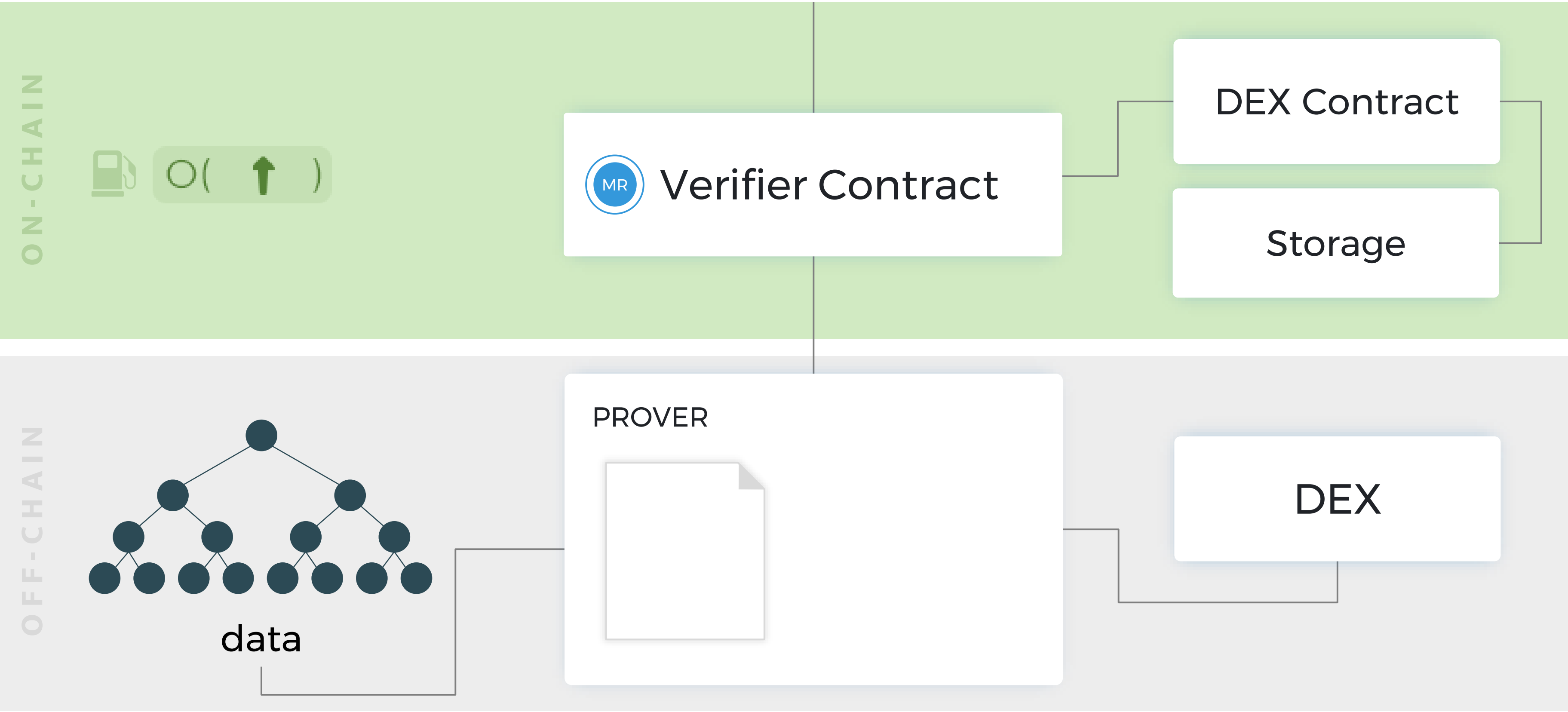

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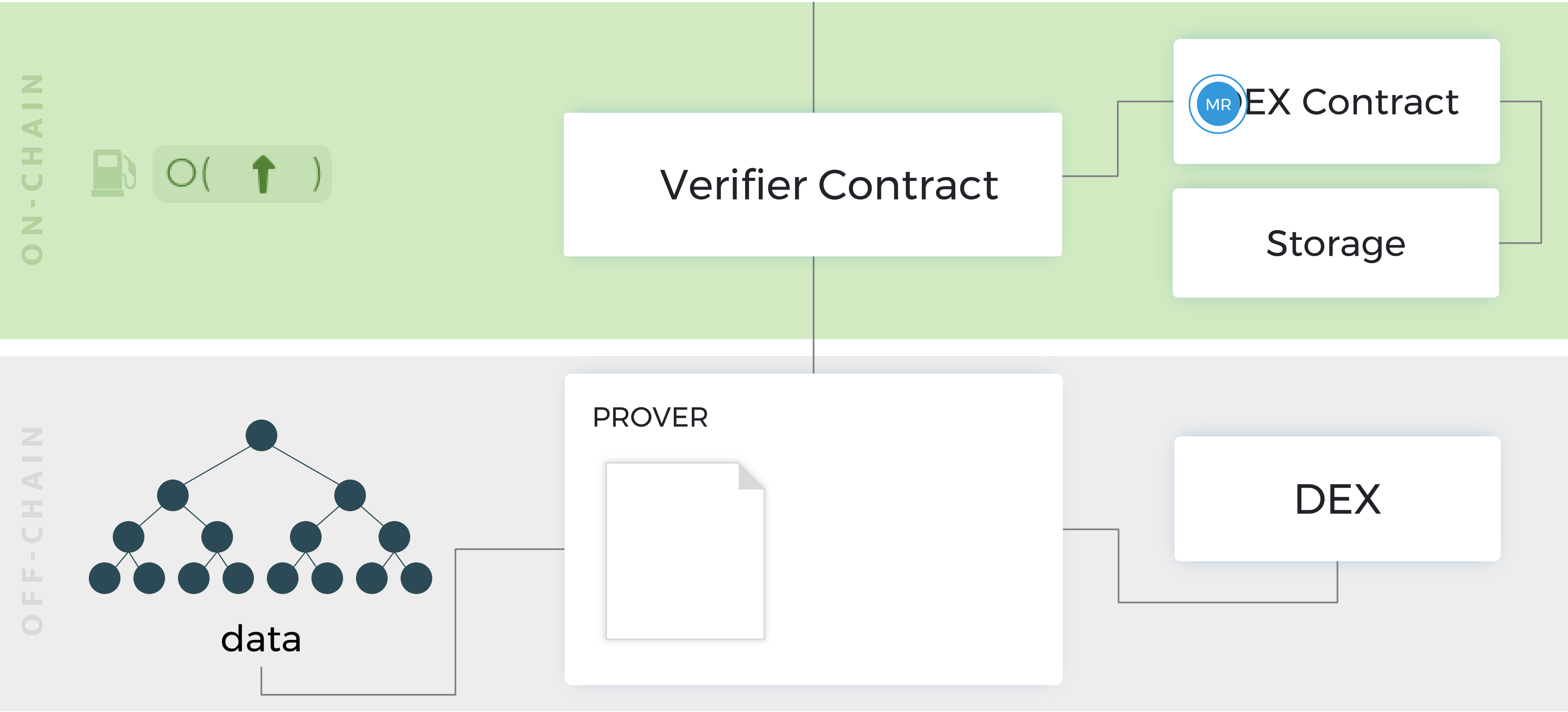

ON-CHAIN

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Storage

OFF-CHAIN

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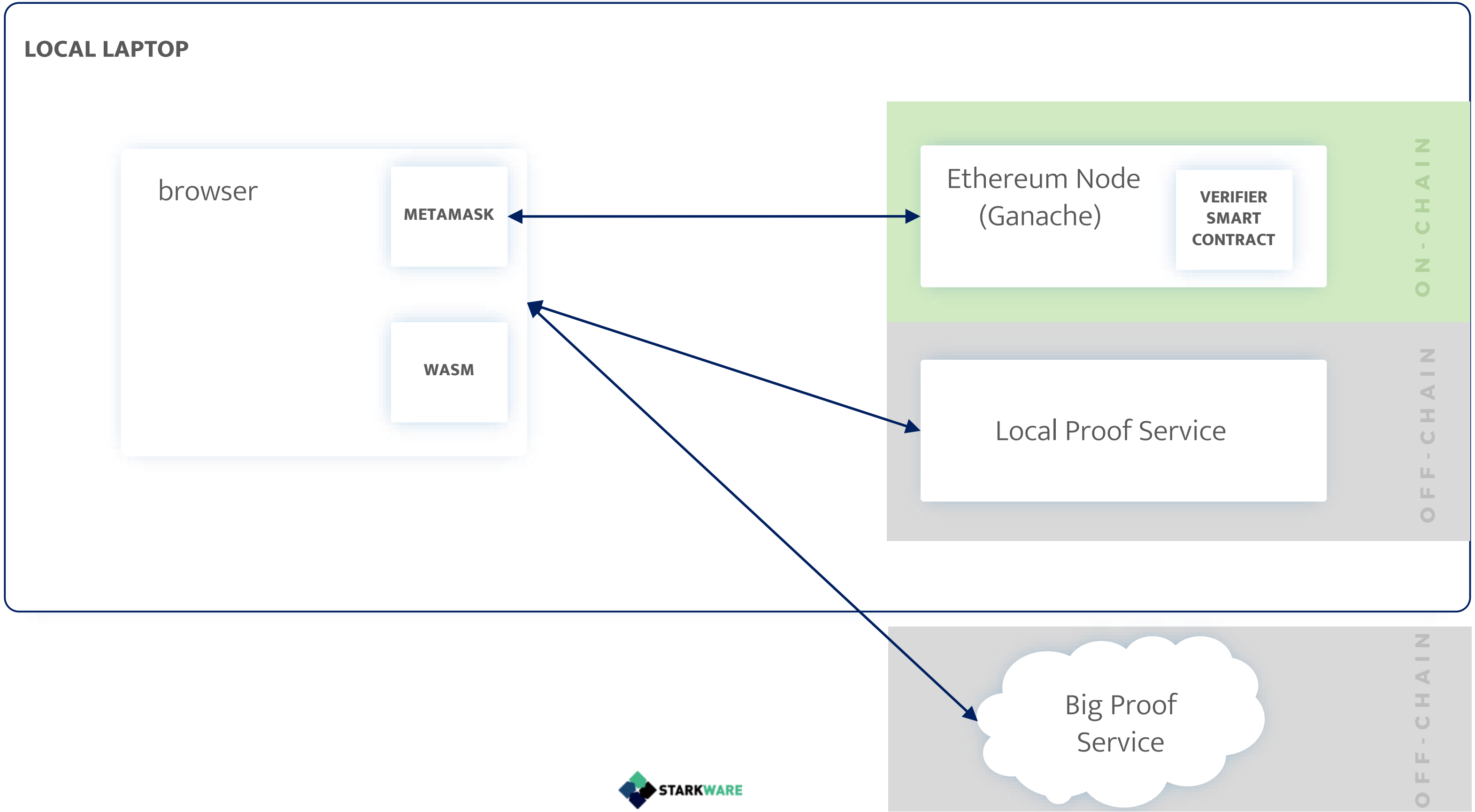
PROVER

DEX

# ONE MORE THING...

# DEMO



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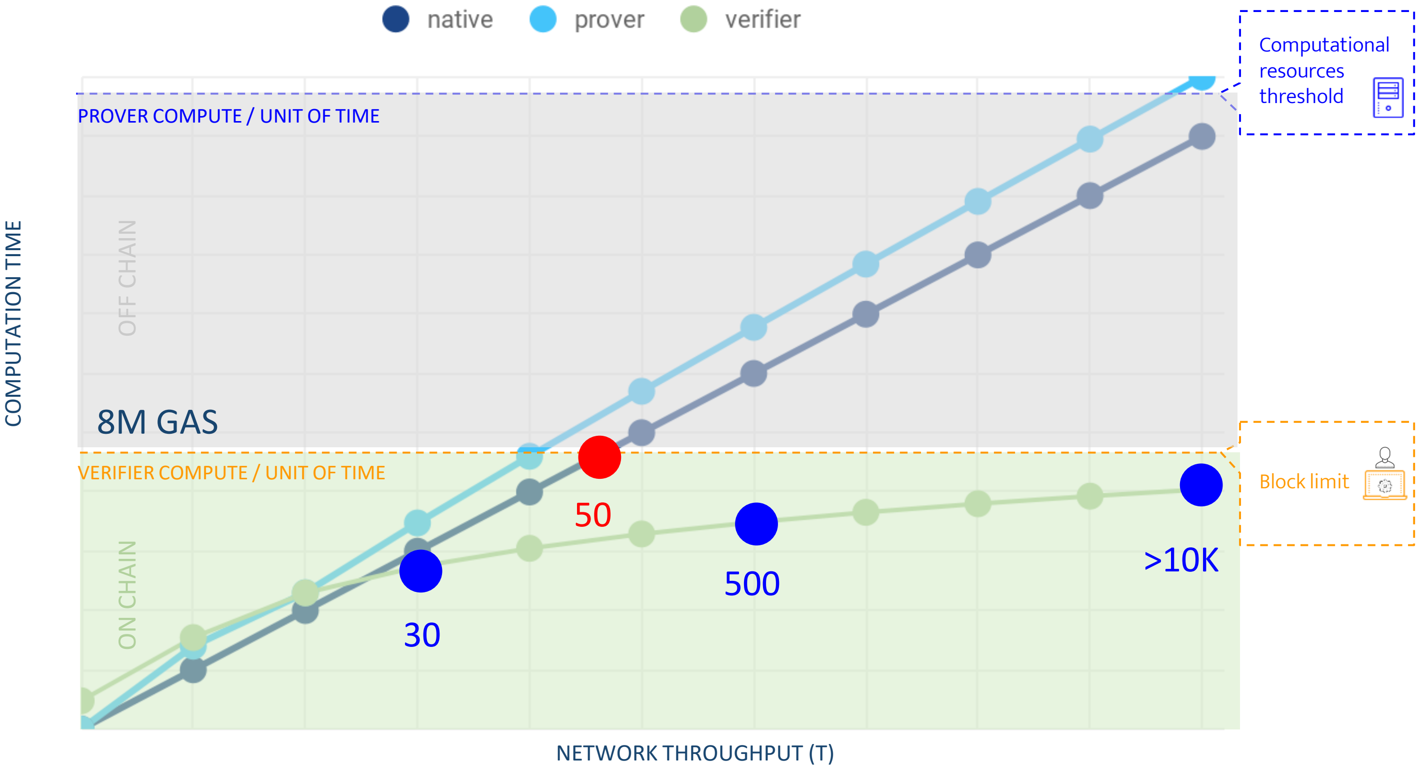
# STARK Scalability



WORK IN PROGRESS

## Current DEX

max out @ **50 DEX Txs / Block**
(100K-200K gas / DEX tx)

## StarkDEX

**30** DEX Txs @ **5.5M** gas
(180K gas / StarkDEX tx)

**500** DEX Txs @ **6.7M** gas
(13.5K gas / StarkDEX tx)

verification **on-chain** can be done for **over 10K txs/block** (800 gas / StarkDEX tx)

**Blockchain-Bound** → **AWS-Bound**

# THANK YOU