Using a Verifiable and Decentralized Ledger as a Basis for Trusting Hospital Endpoints

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January 2020

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The whitebox infrastructure

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- GP's own a whitebox which controls data access

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- GP's own a whitebox which controls data access
- Patient transfers code to establish trust

Research Question

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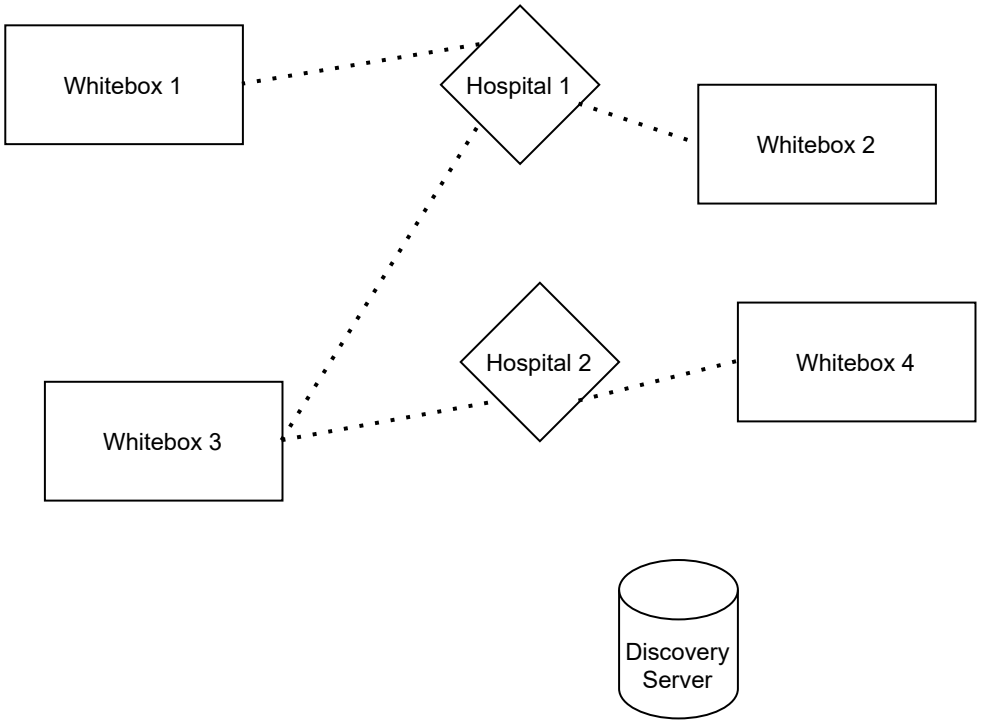
- Can we record trust by whiteboxes in a verifiable way?
- How can we use this record to identify hospital endpoints?
- How do we account for loss of trust?
- Does the proposed system scale efficiently enough?

A Design Overview



- Record established trust in a decentralized ledger

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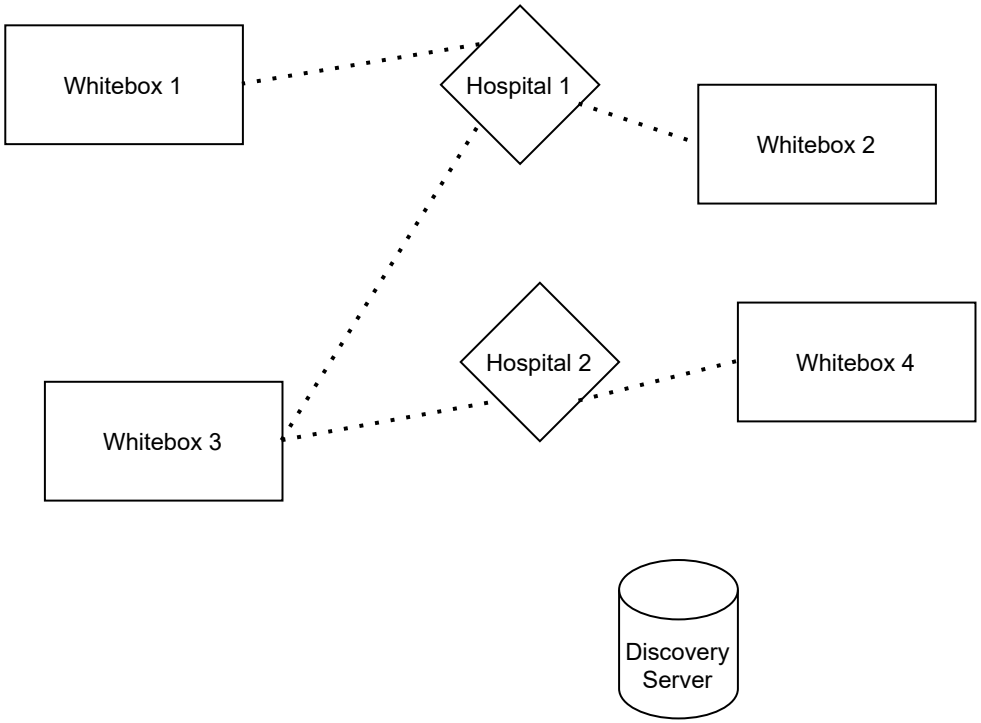

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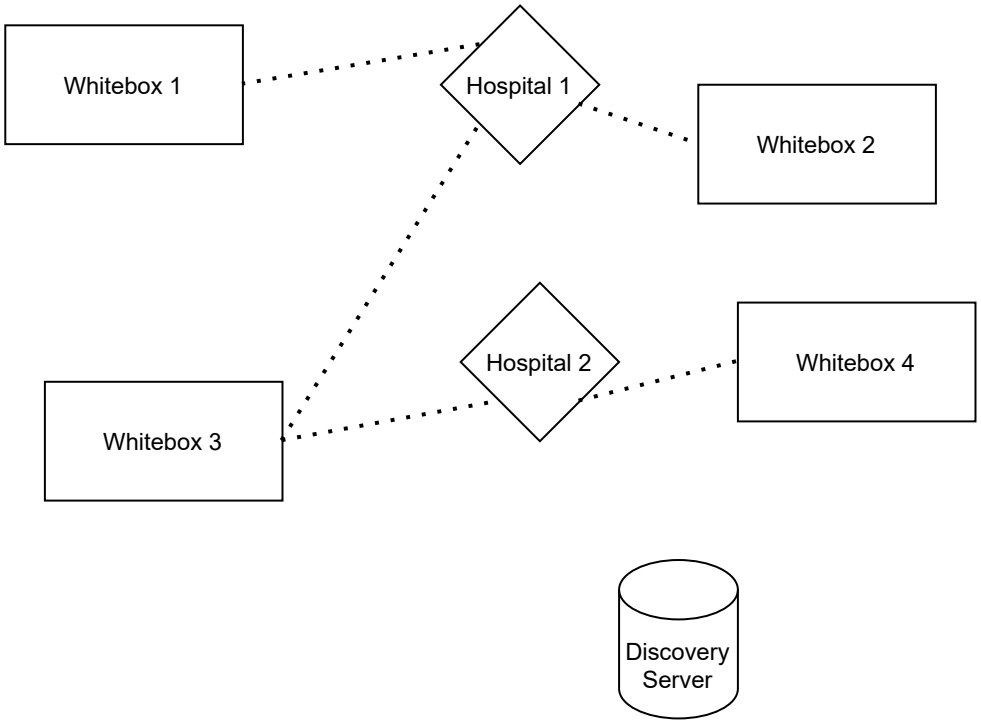

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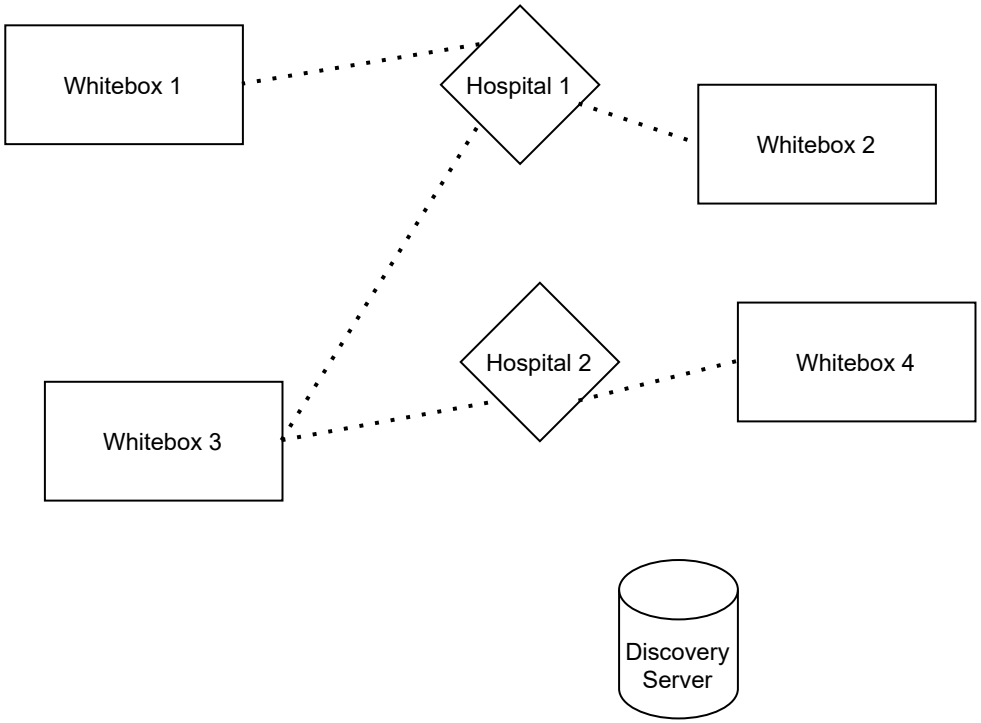

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- Record addition and removal operations to allow for revocation
- Allow for negative trust-links
- Use proof of authority as consensus algorithm

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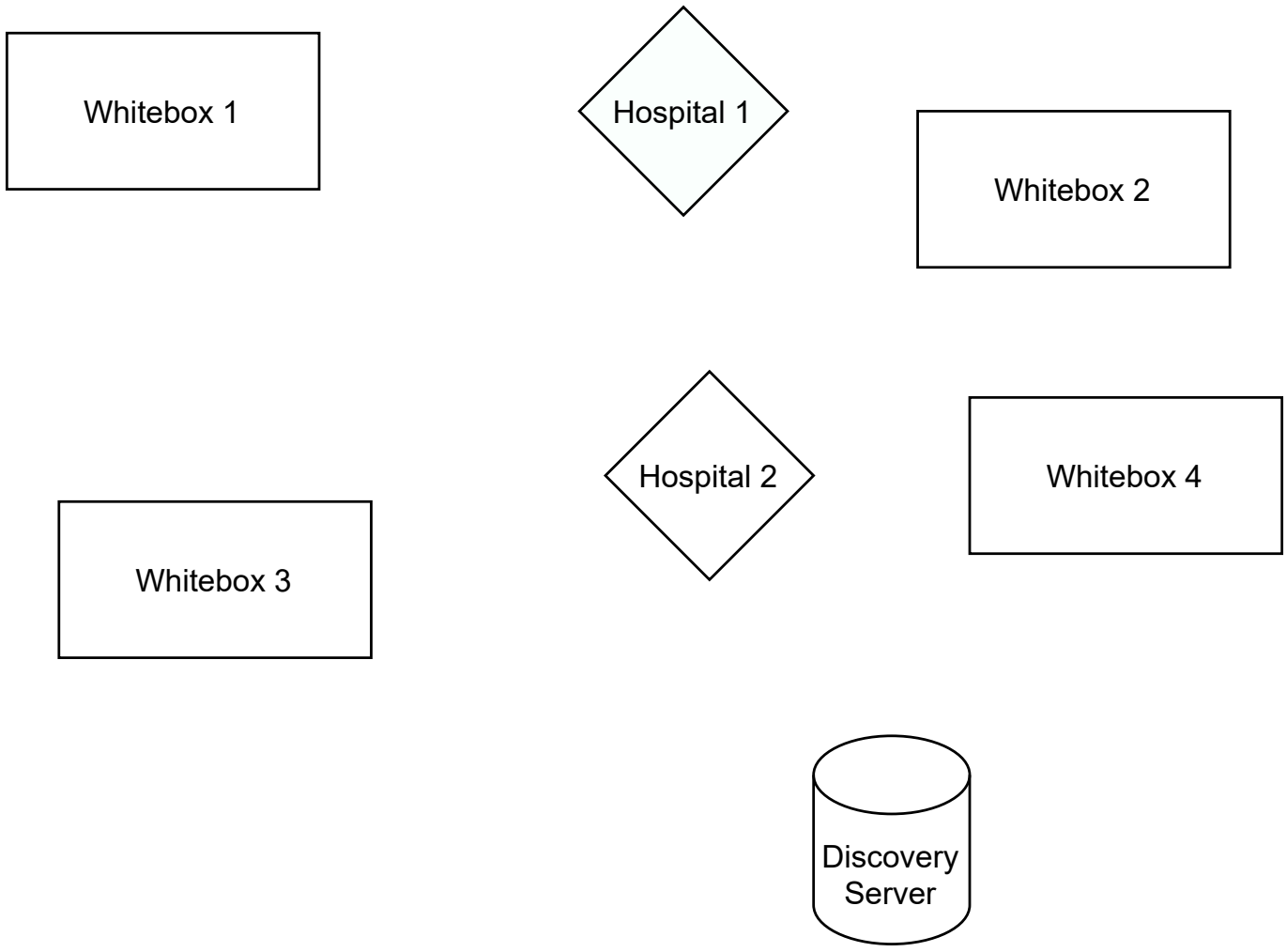
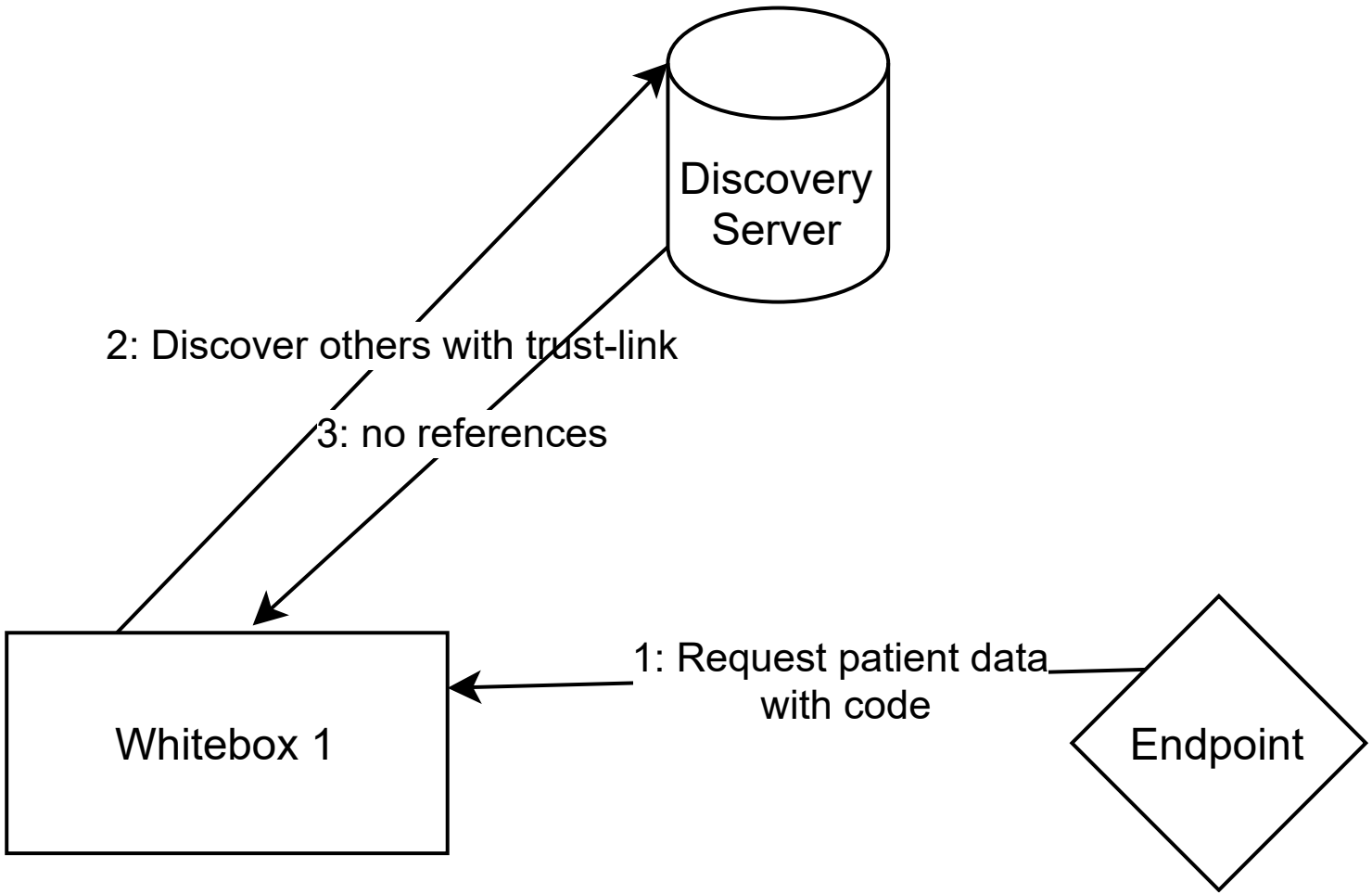
- Timestamp used to determine order

Scenario 1: No trust-links



Establishing first trust-link



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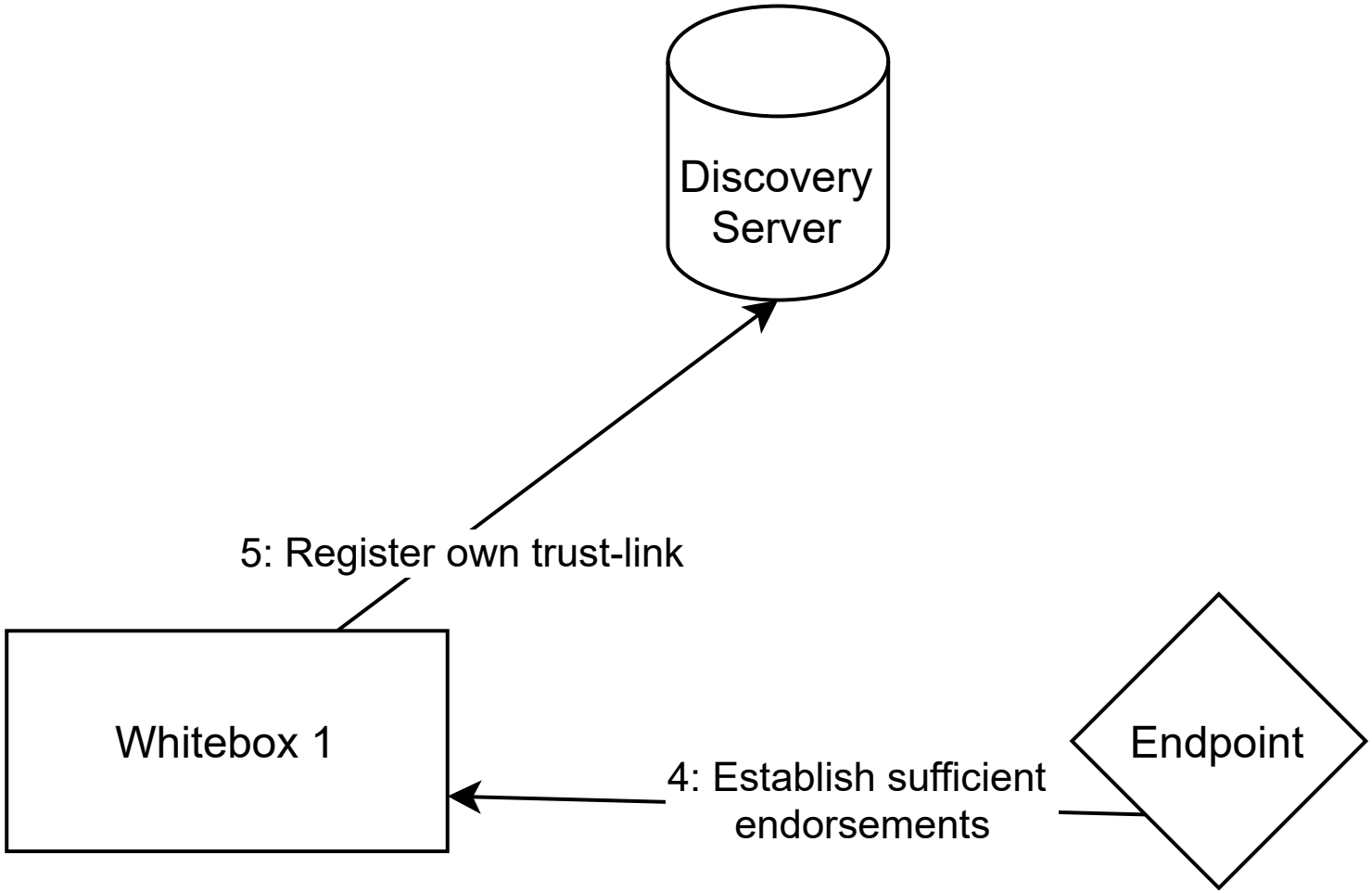
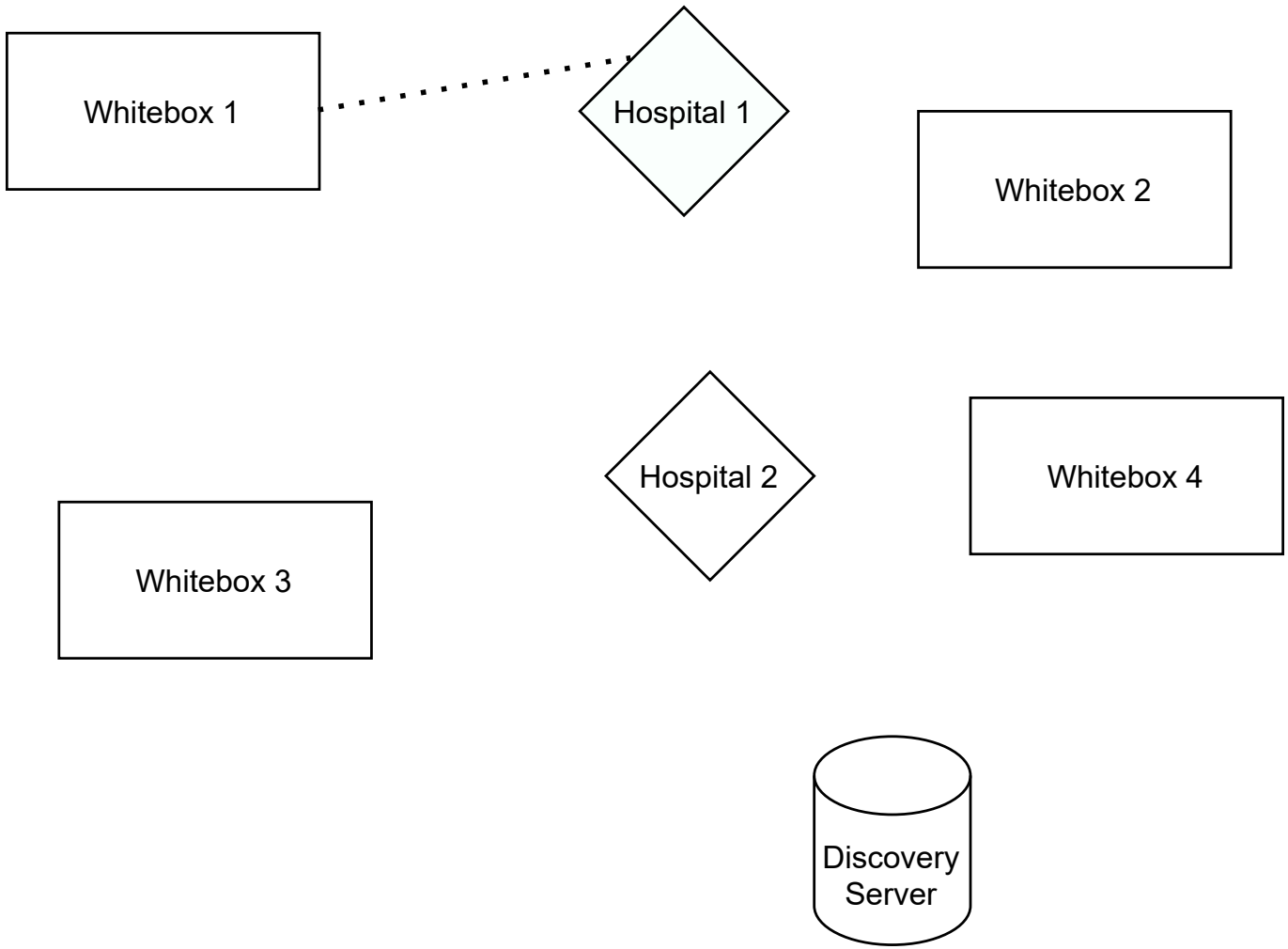
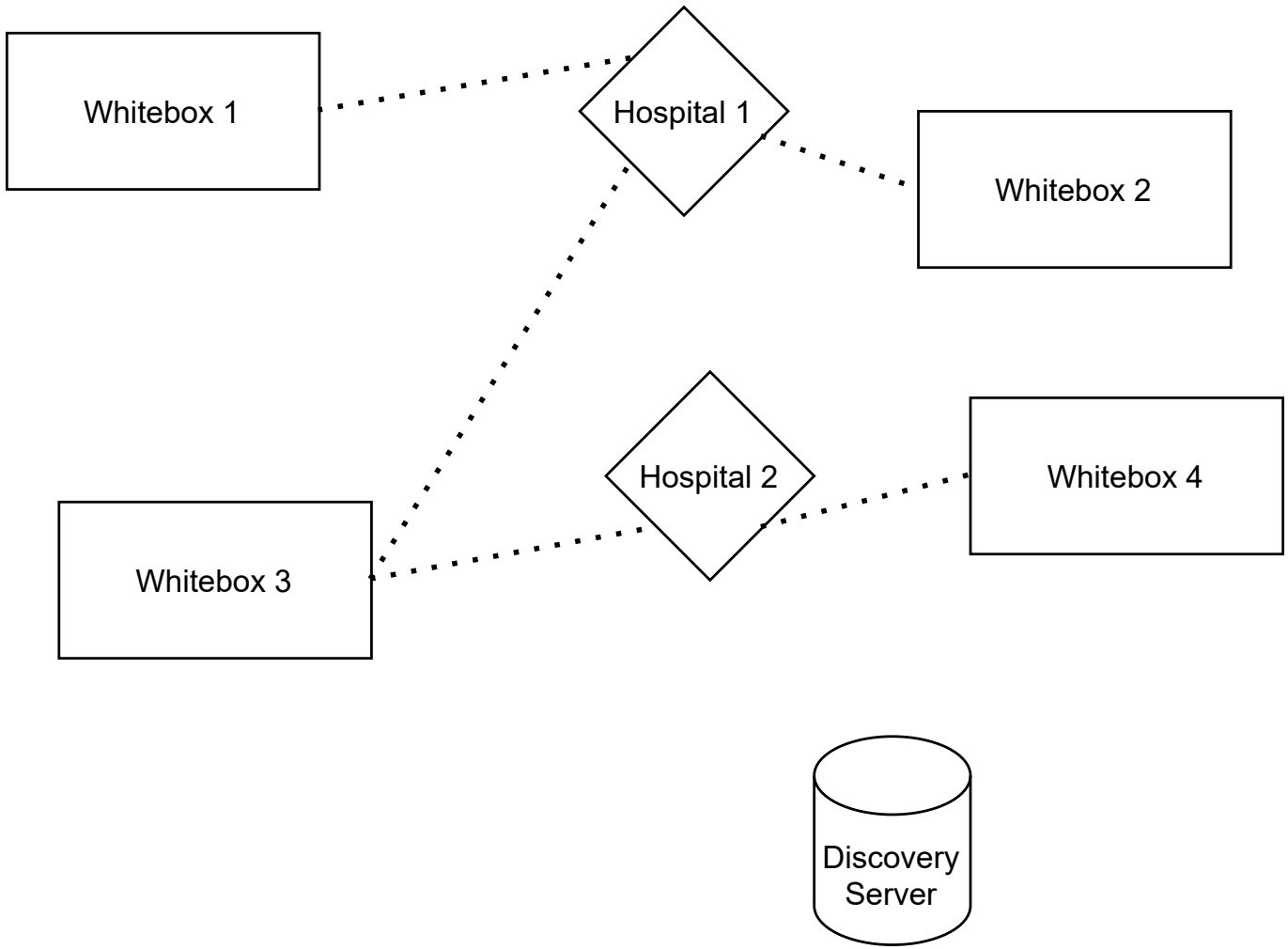


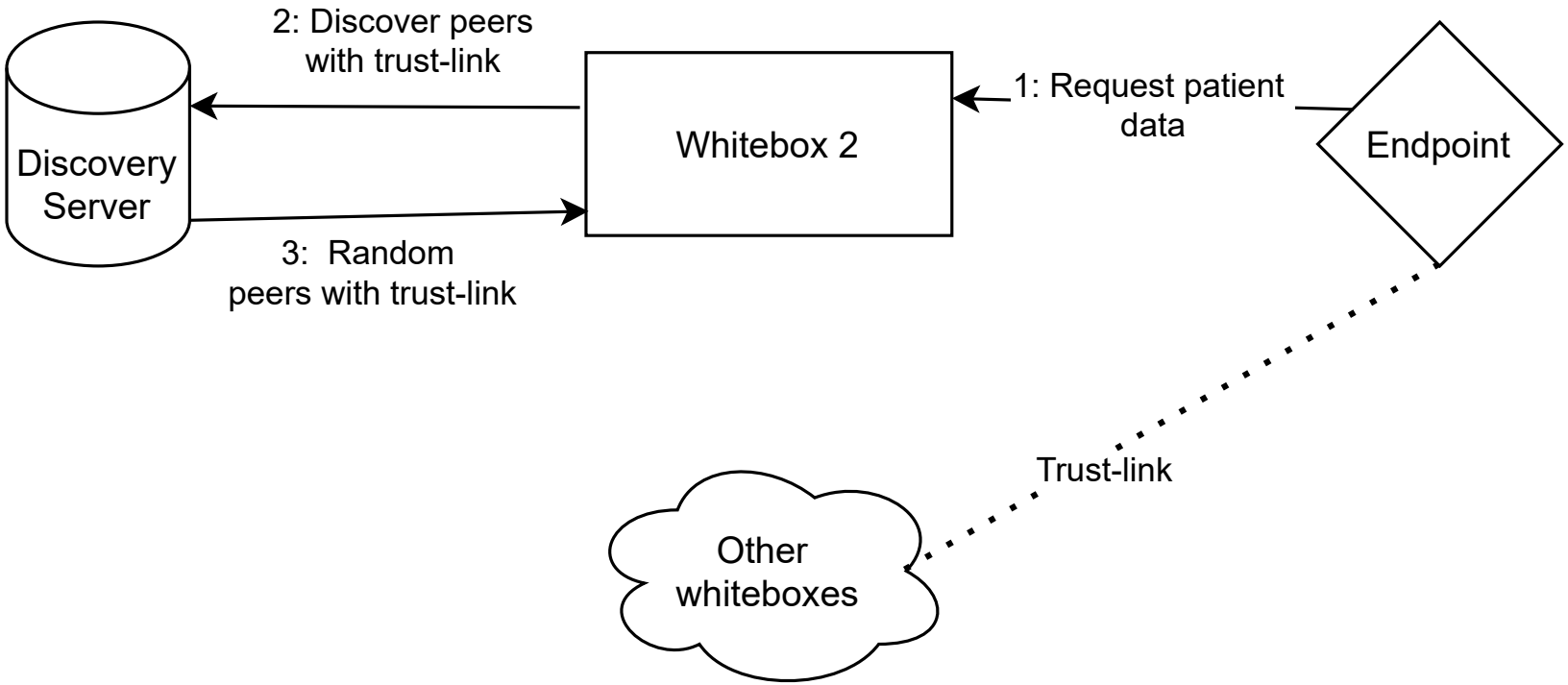
Scenario


Whitebox 1
Hospital 1
Whitebox 2
Hospital 2
Whitebox 4
Whitebox 3
Discovery Server

Scenario 2: Trust exists



Checking Trust



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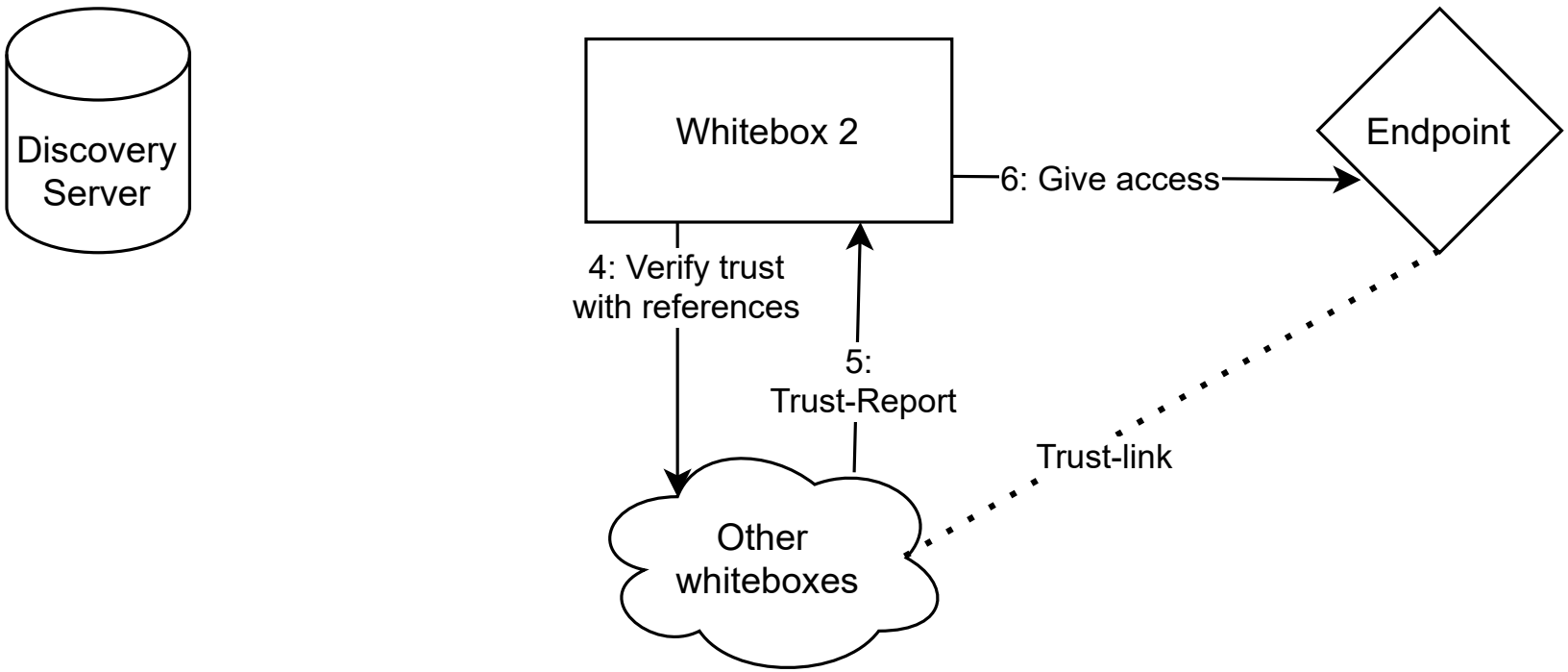
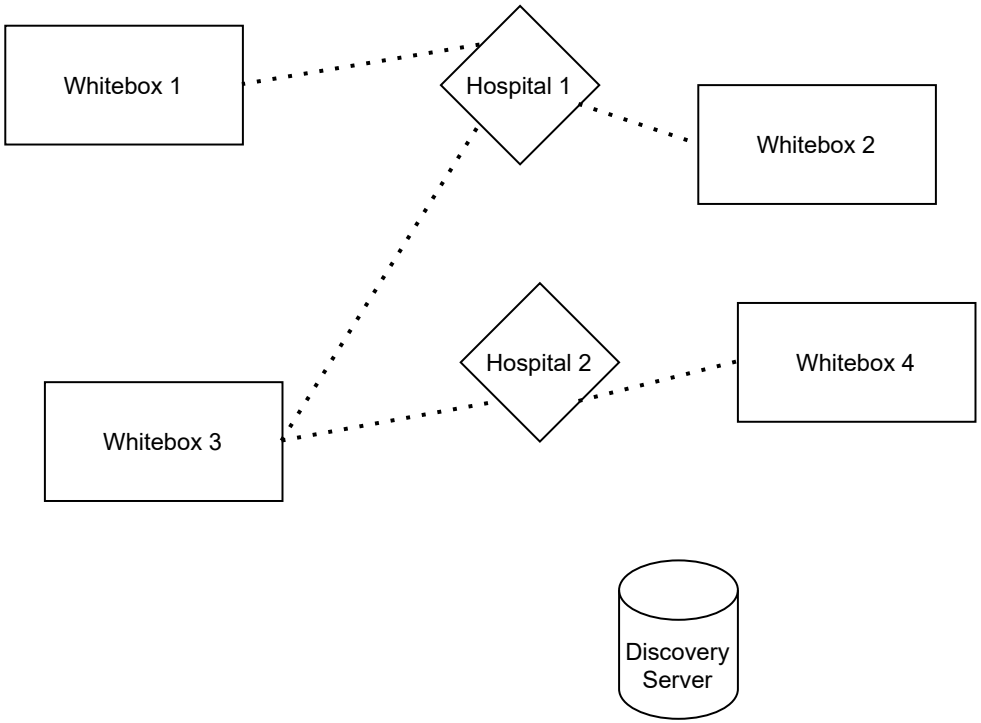


Security Parameter



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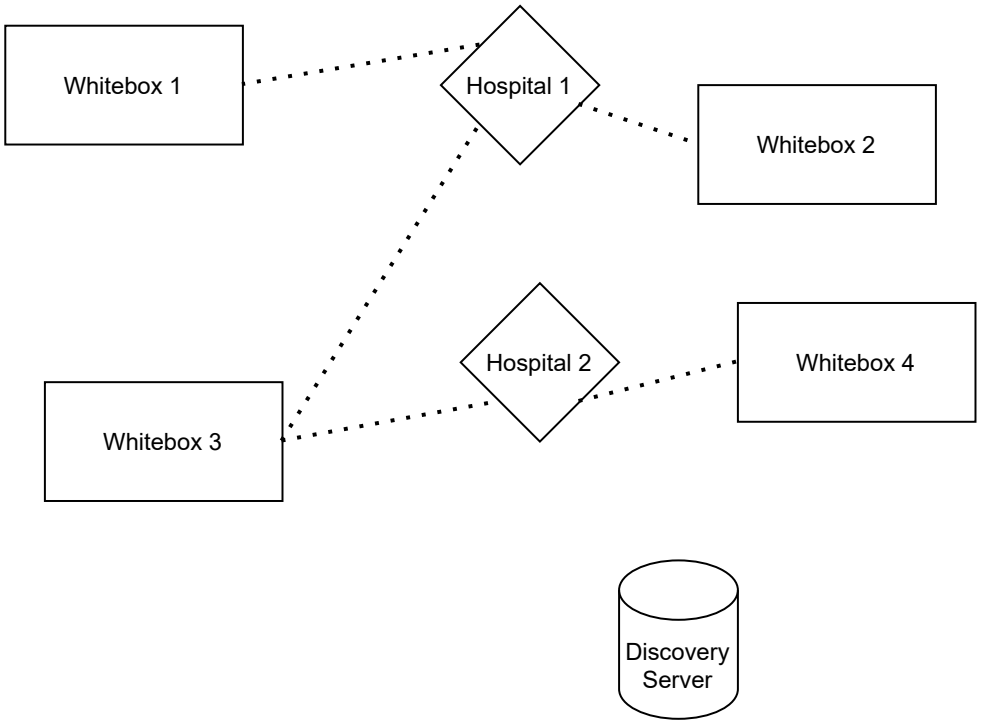

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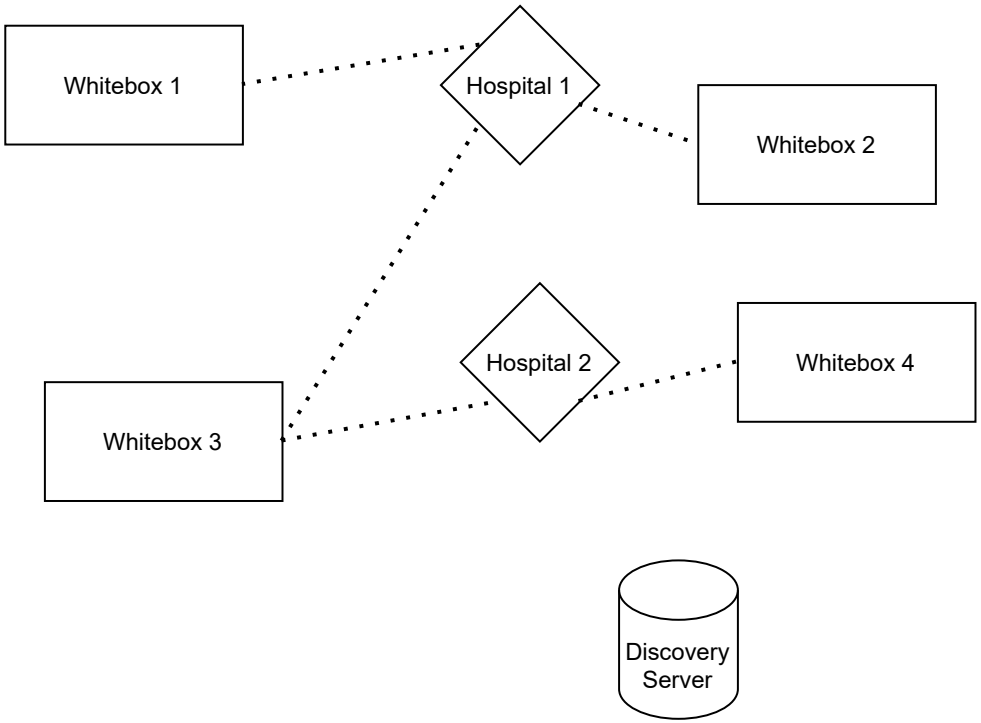

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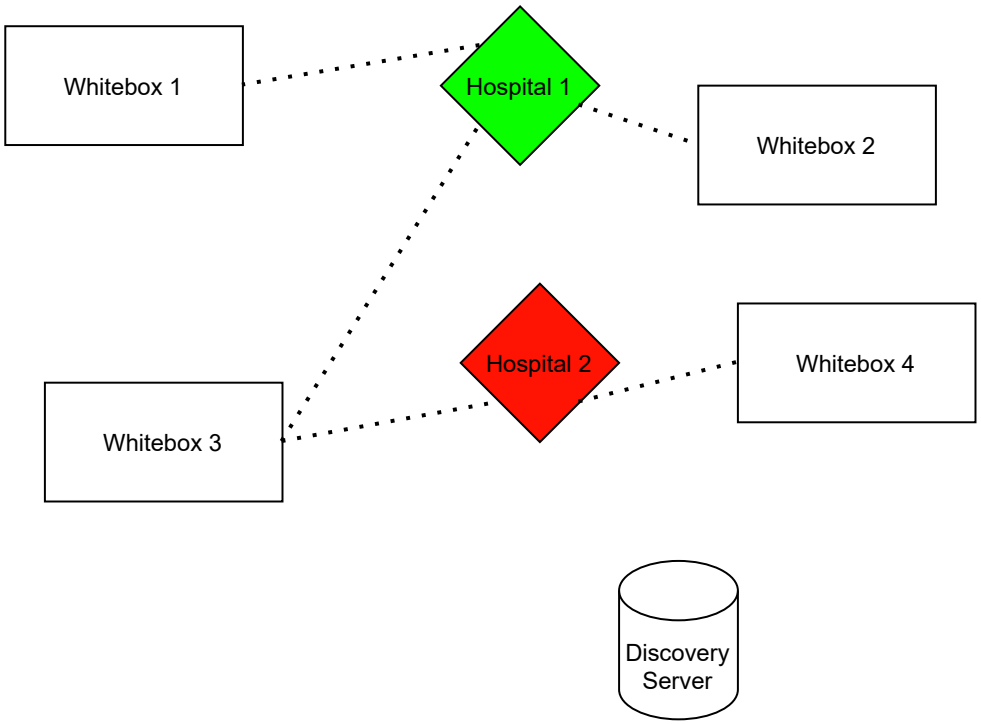

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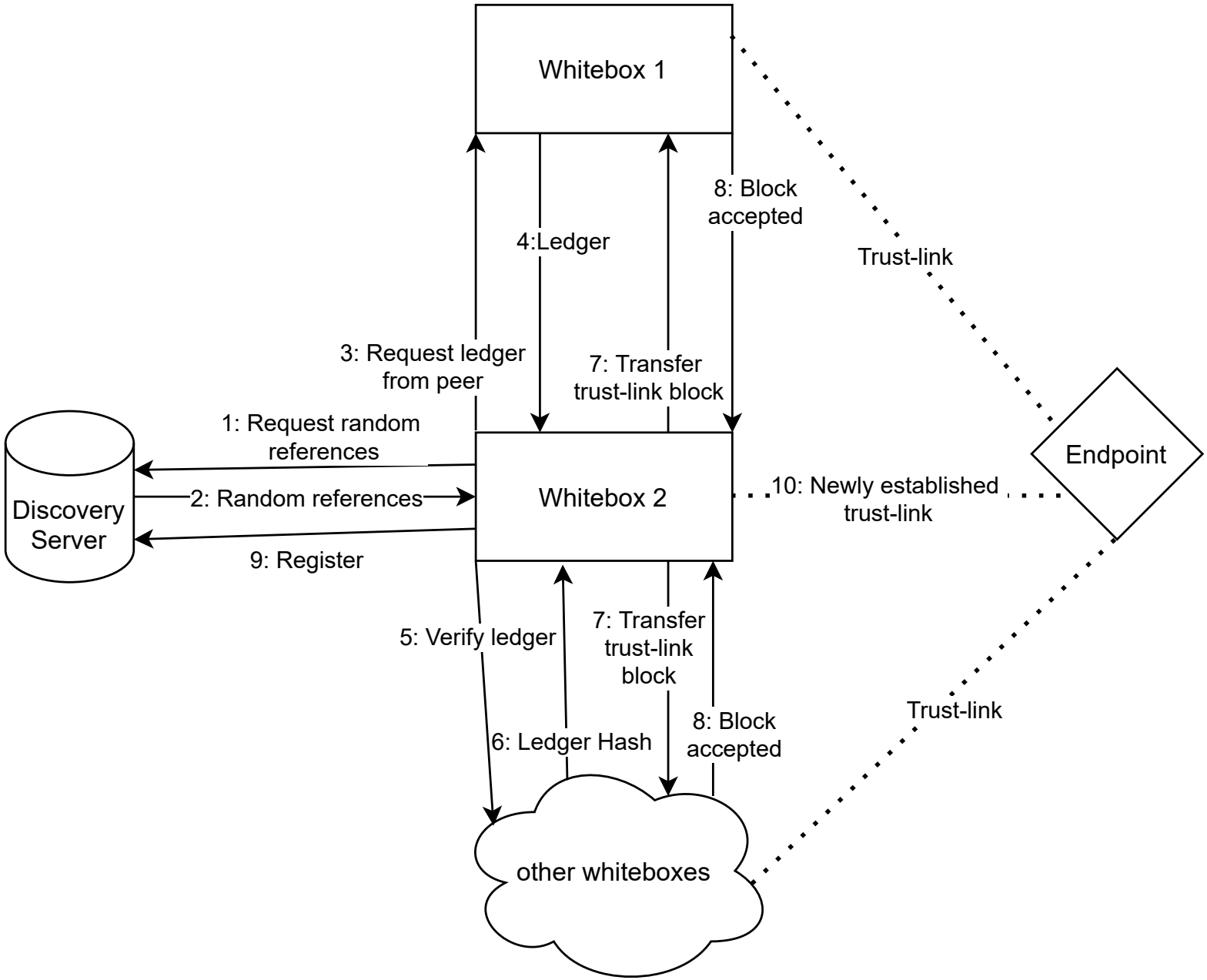
- Example: S=3

Establishing Trust(2)



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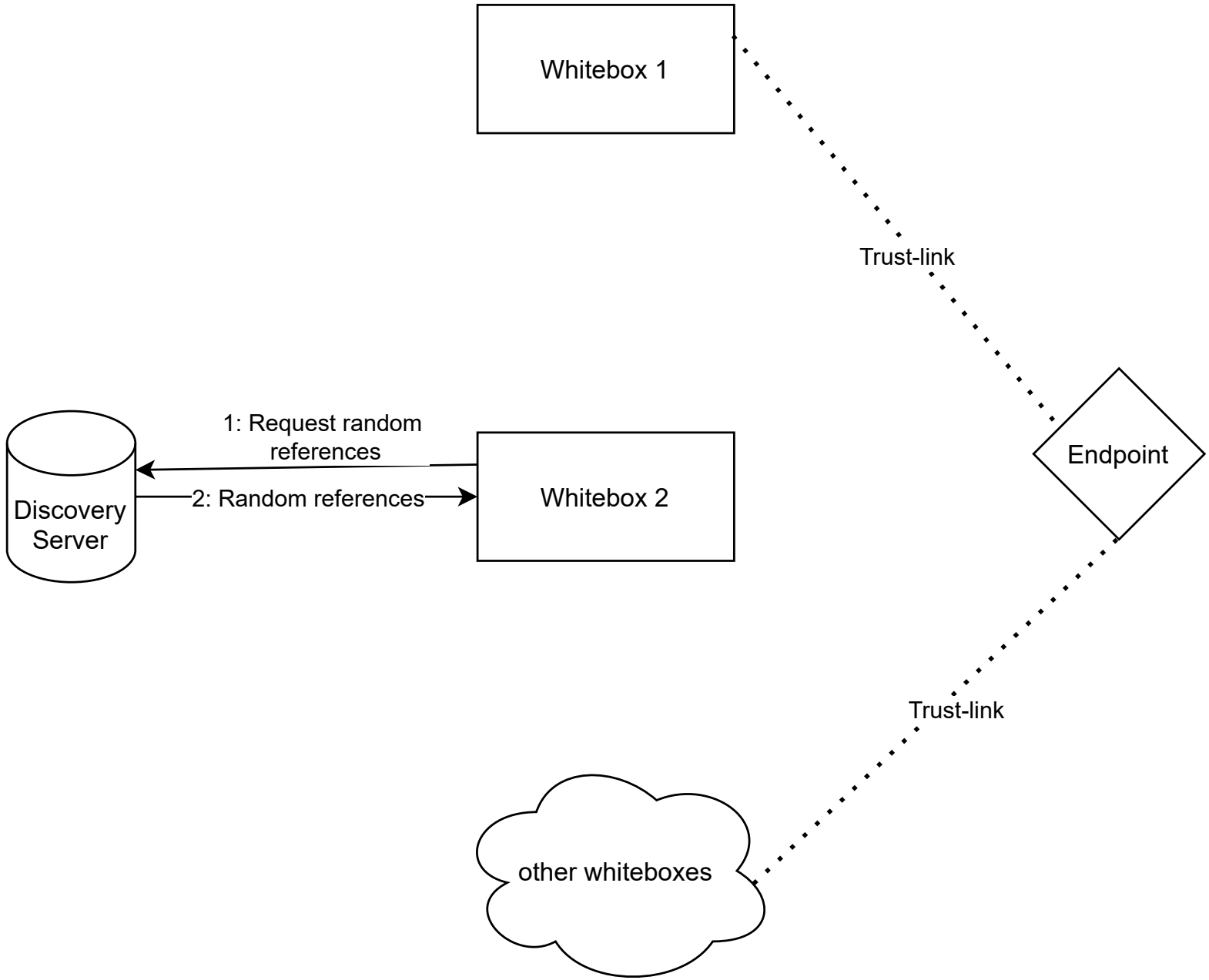

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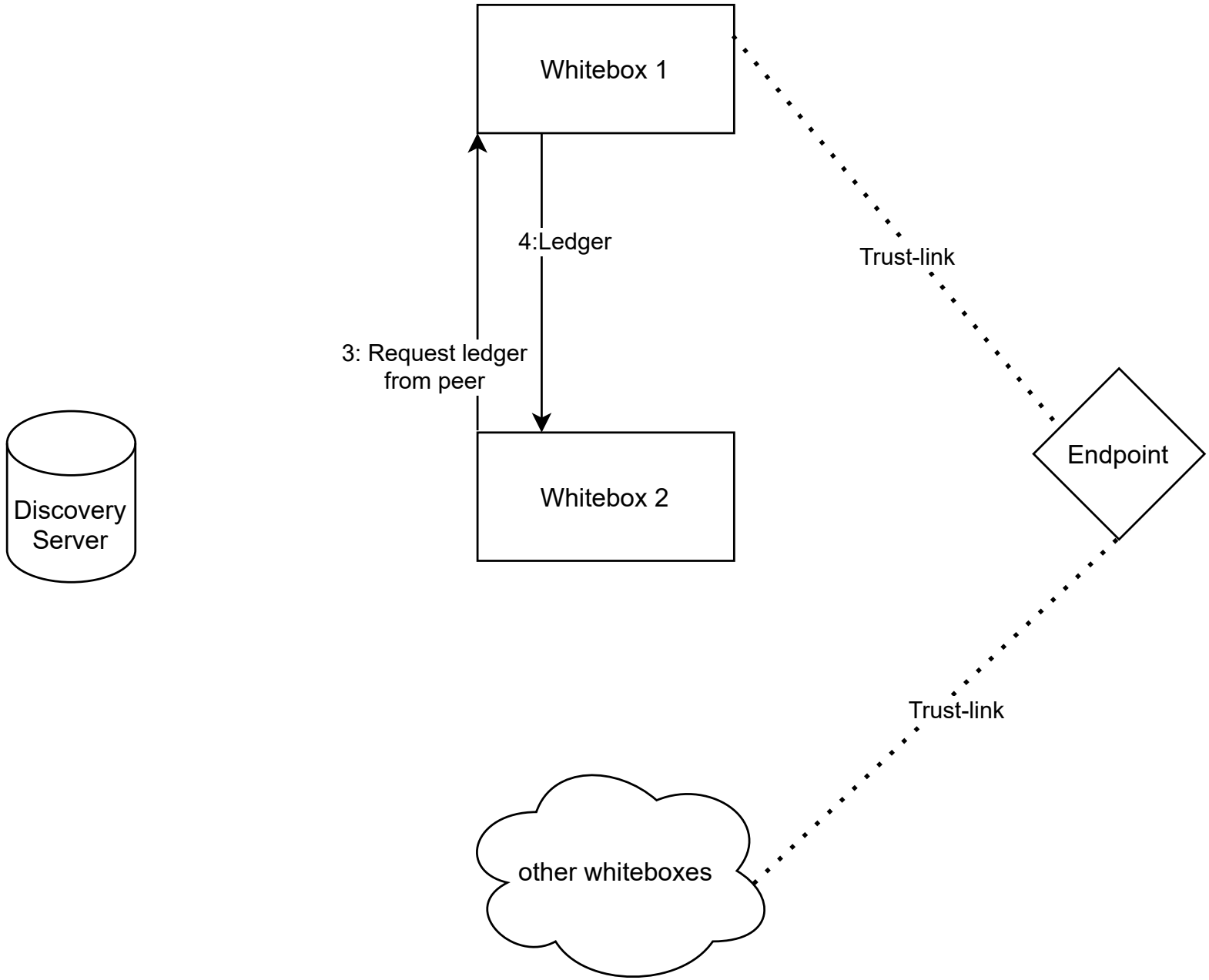

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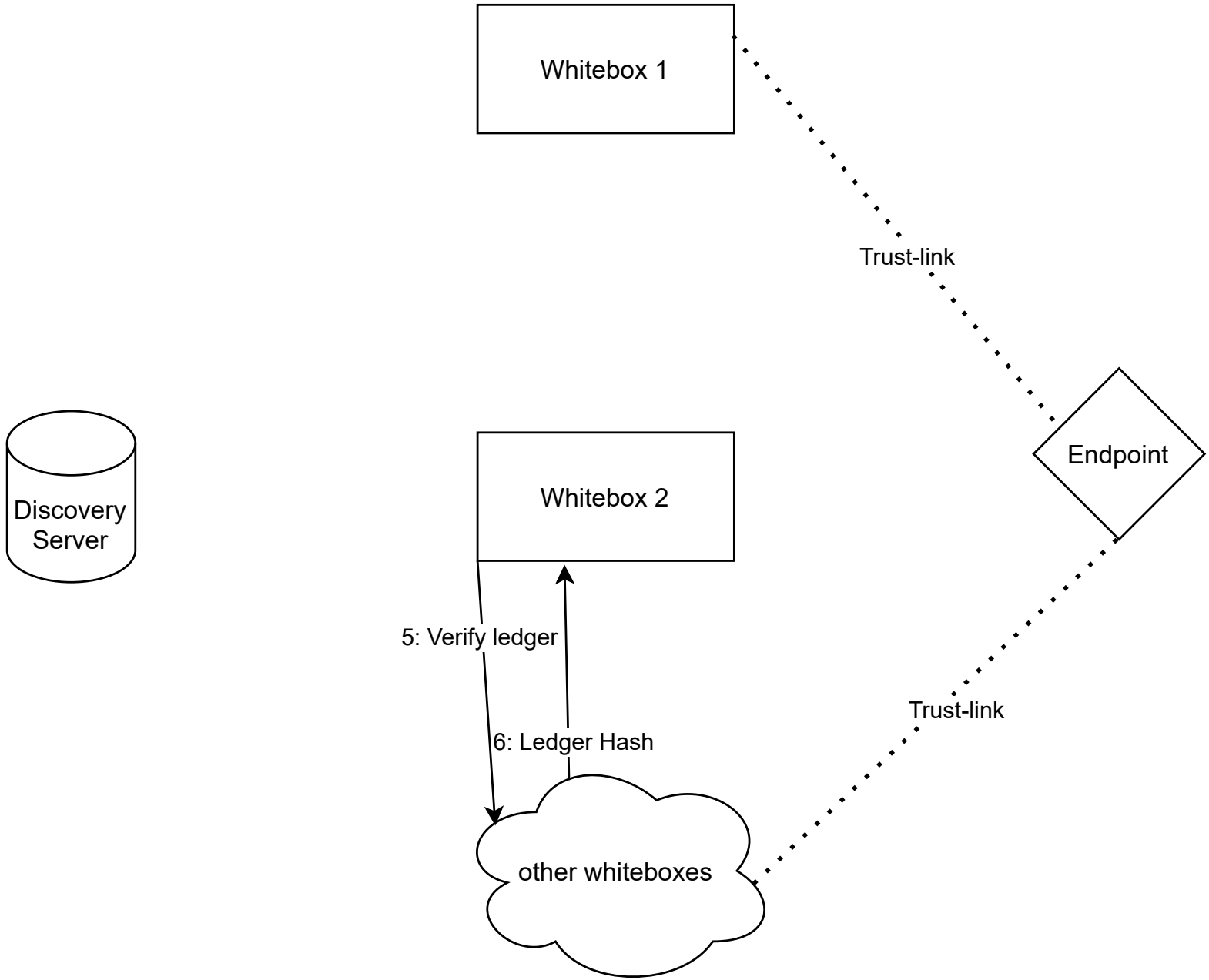

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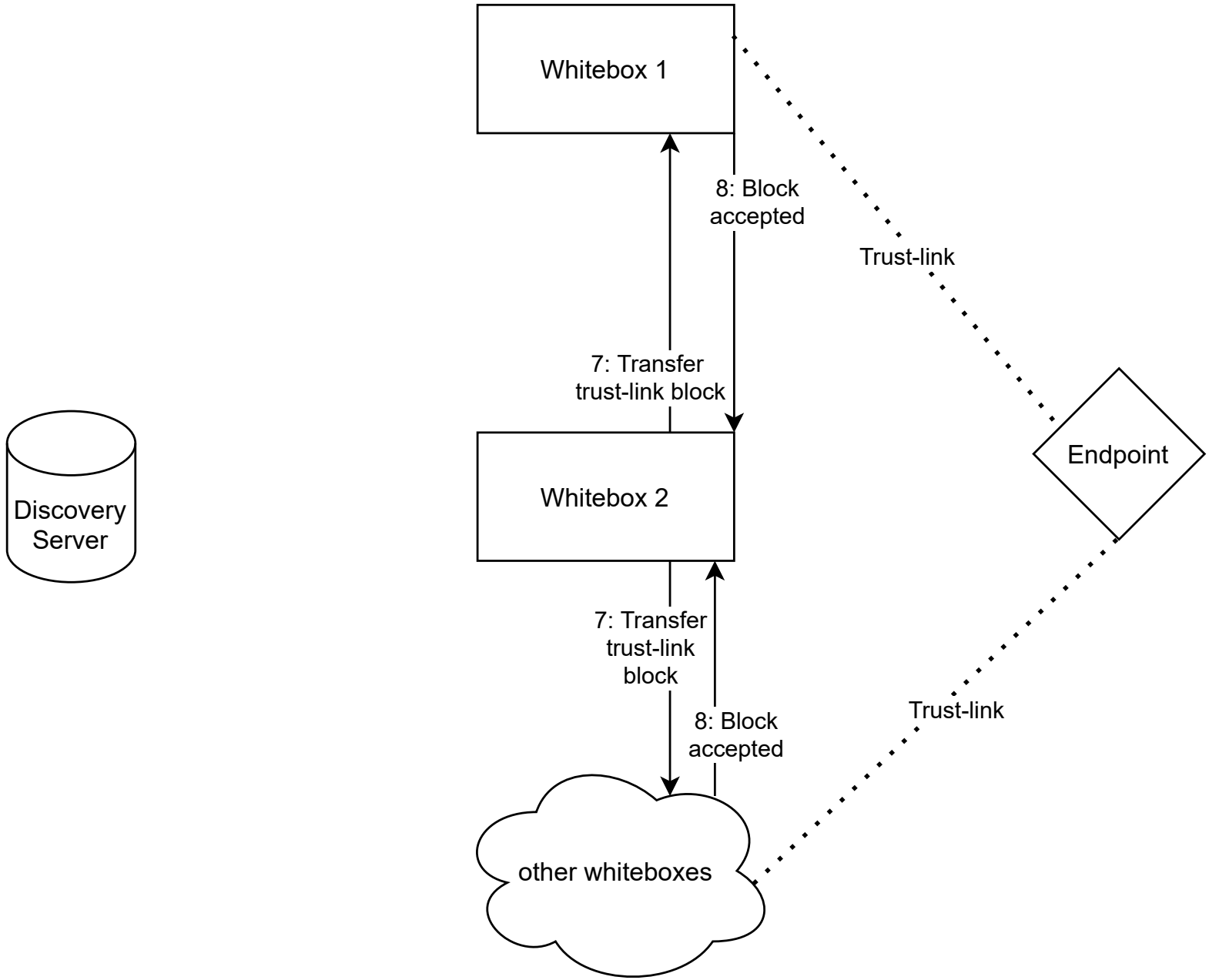

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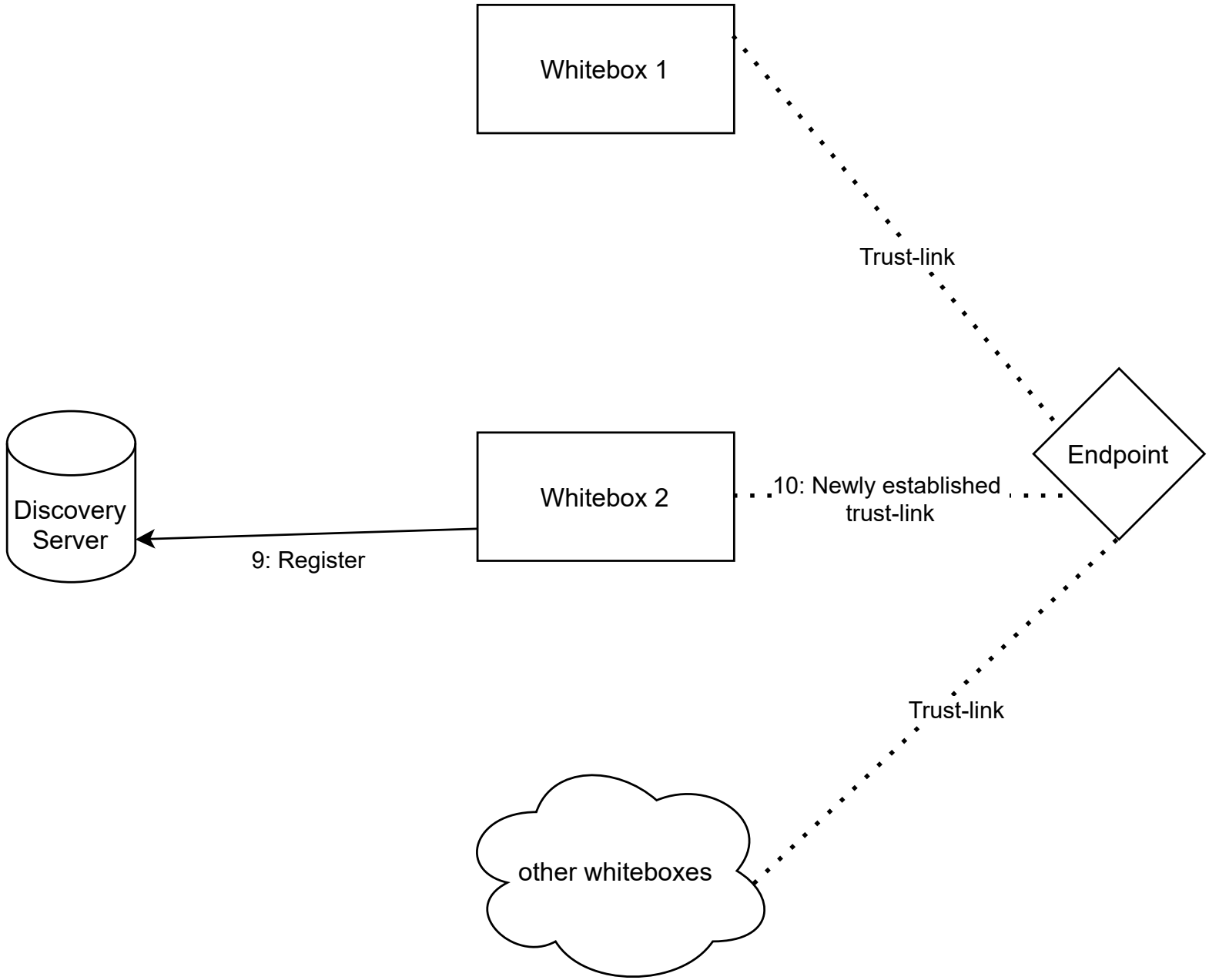

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- Discovers and resolves conflicts during publishing
- Blocks older than one hour become immutable
- Unless majority disagrees

Threat Models

- Malicious whiteboxes establish an endpoint

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- Denial of service attack on the discovery server
- Inference attack

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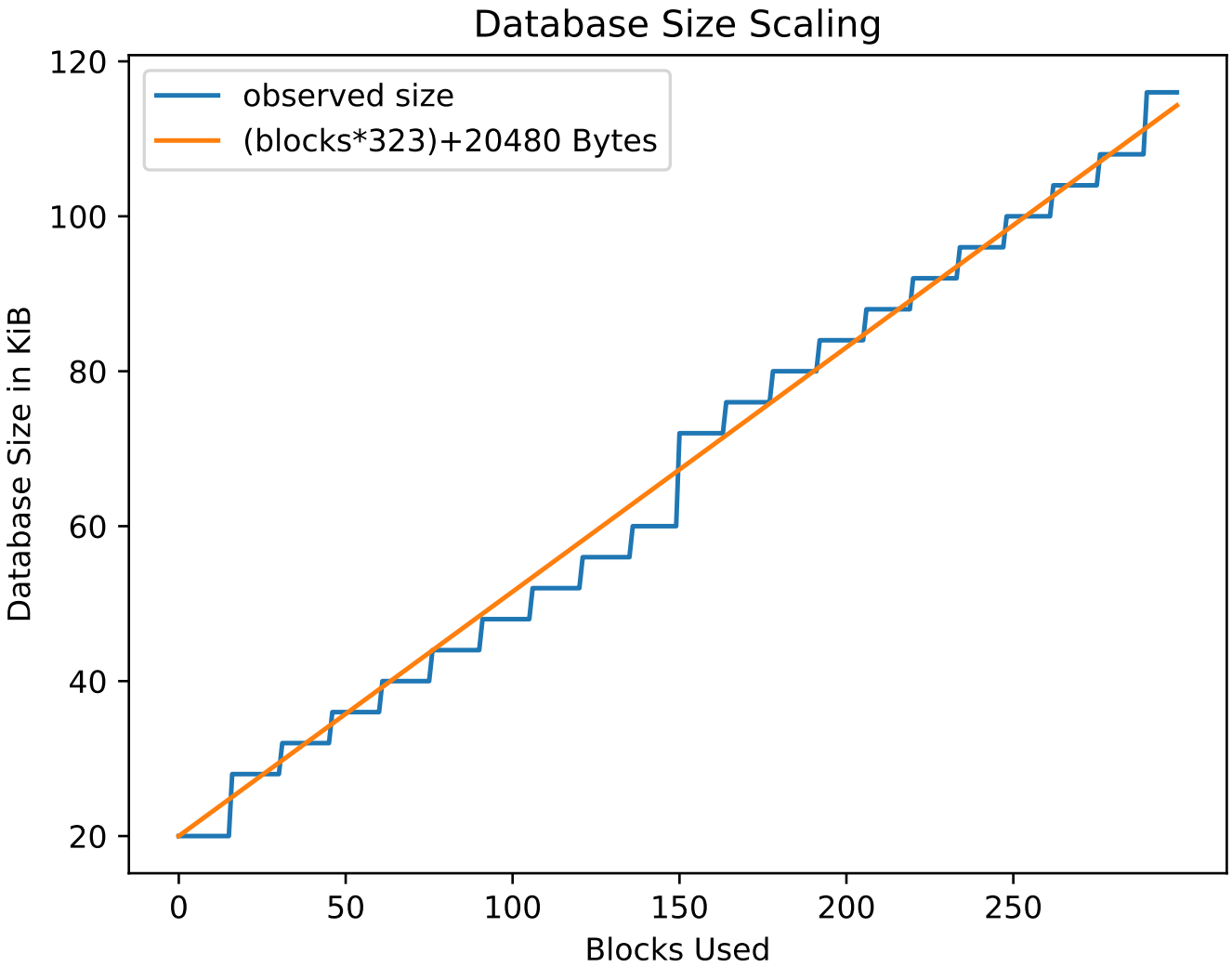
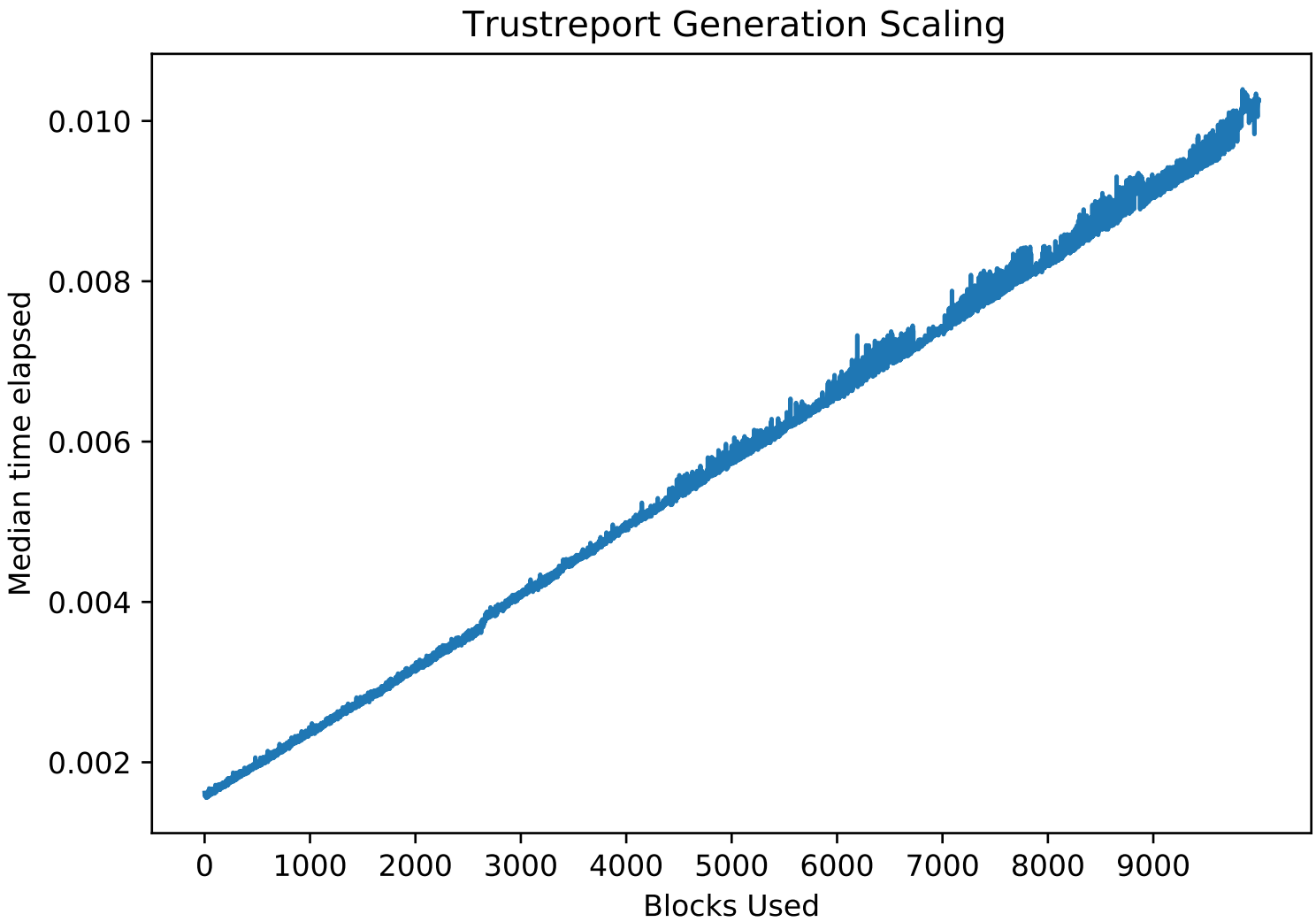
- Storage used should be reasonable
- +-5000 whiteboxes, each with 150 or so ledgers

Scaling(2)


Database Size Scaling
observed size
(blocks*323)+20480 Bytes
Database Size in KiB
120
100
80
60
40
20
0
50
100
150
200
250
Blocks Used

Scaling(3)


Trustreport Generation Scaling
Median time elapsed
0.010
0.008
0.006
0.004
0.002
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
Blocks Used

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- Discovery server is central point of failure
- Whitebox Systems is source of trust for whitebox identification

Future Work

- Implement and improve consensus algorithm

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- Replace discovery method
- Decentralize trust in whiteboxes