Fast and Furious Withdrawals from Optimistic Rollups

Mahsa Moosavi

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WHOAMI

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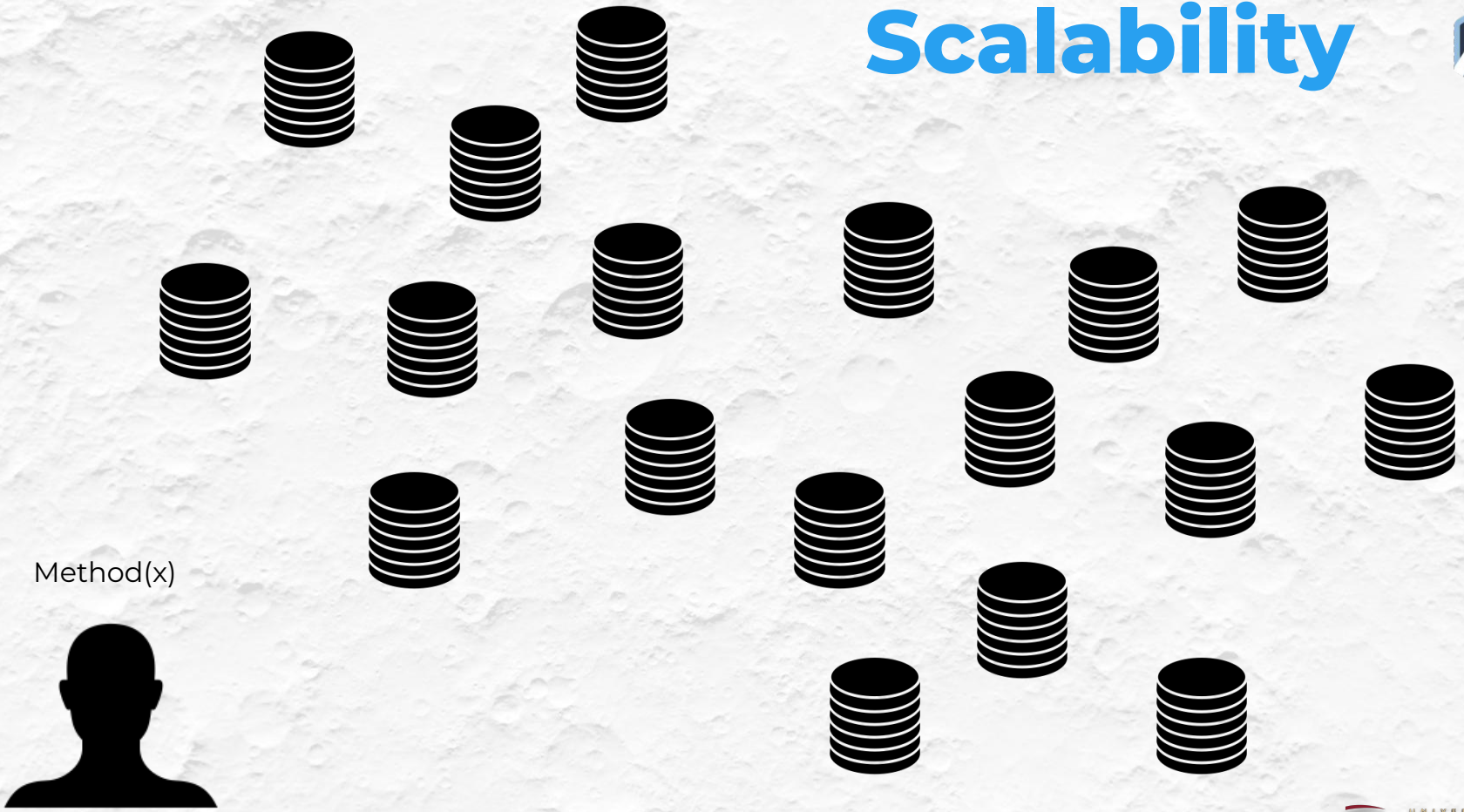
- Integration Engineer @OffchainLabs

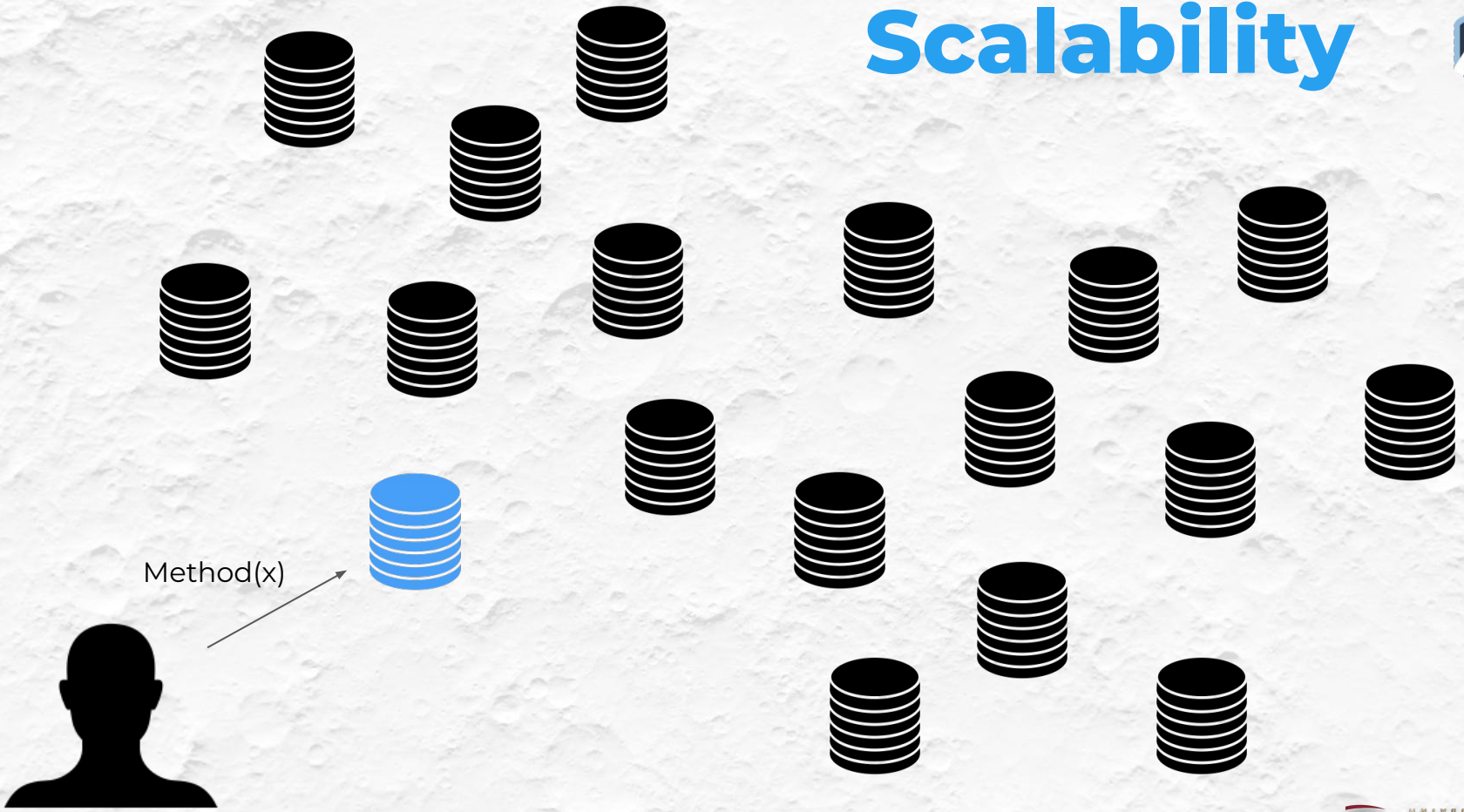
mahsamoosavi.com

Why is Ethereum slow and expensive?

Scalability



Scalability



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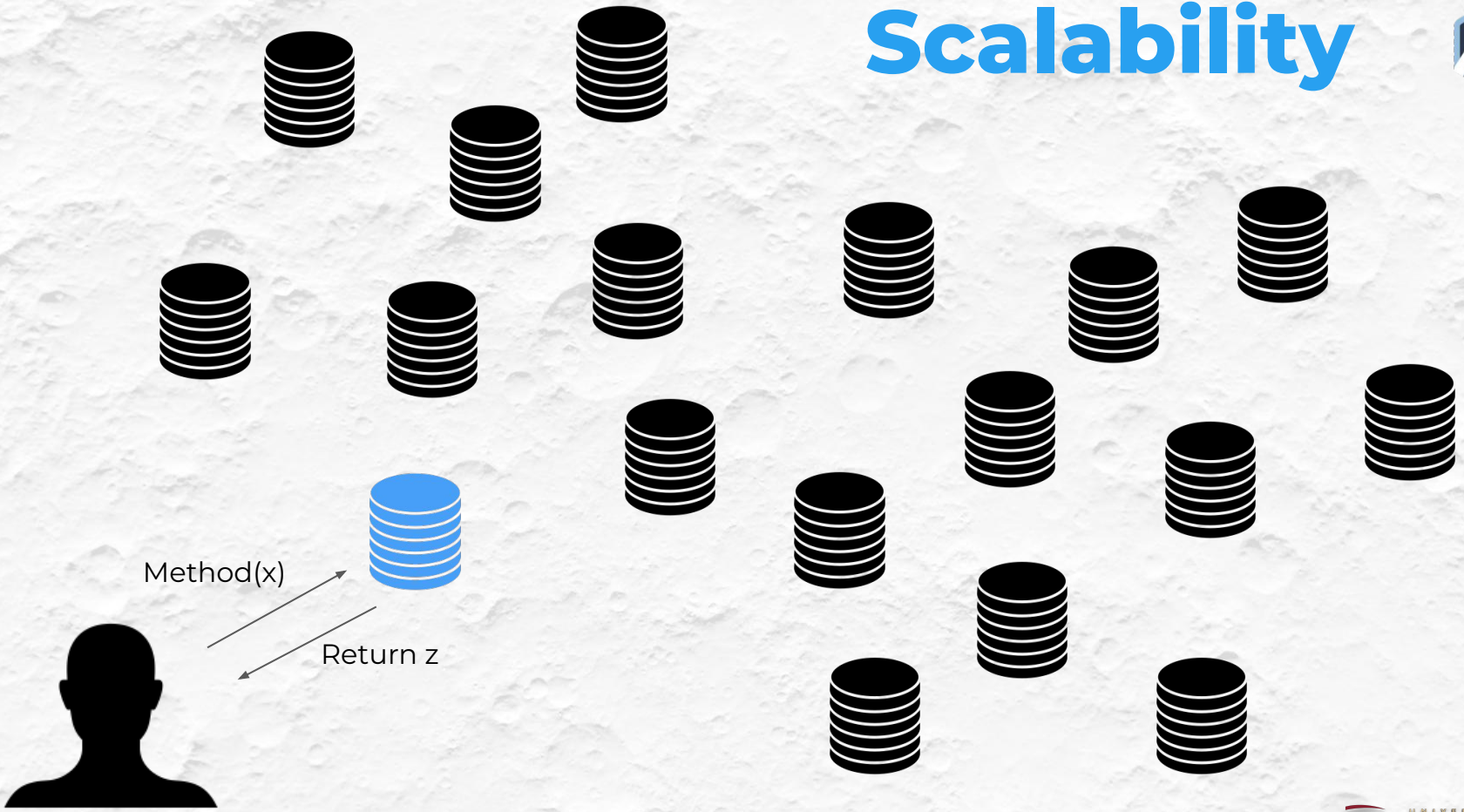

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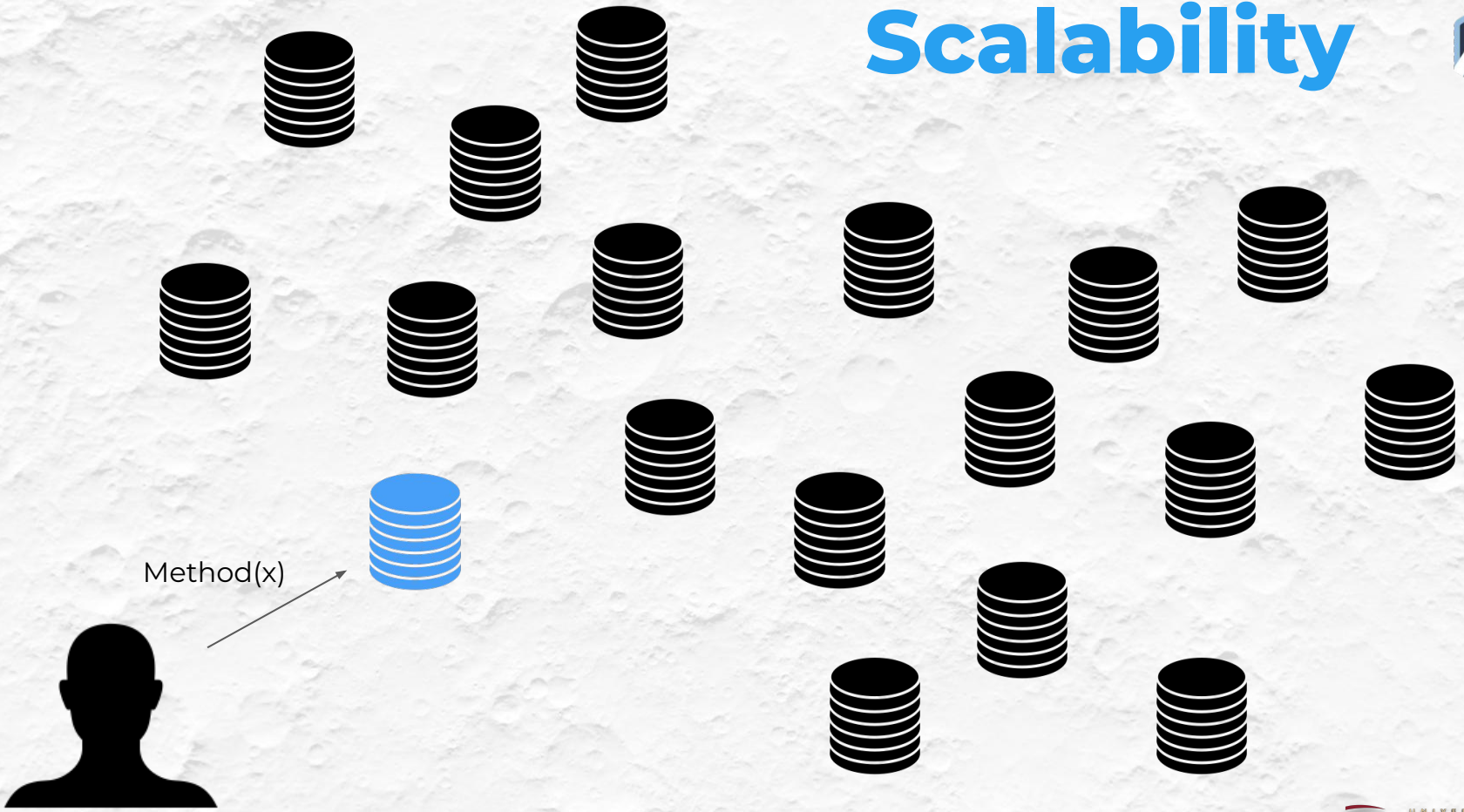

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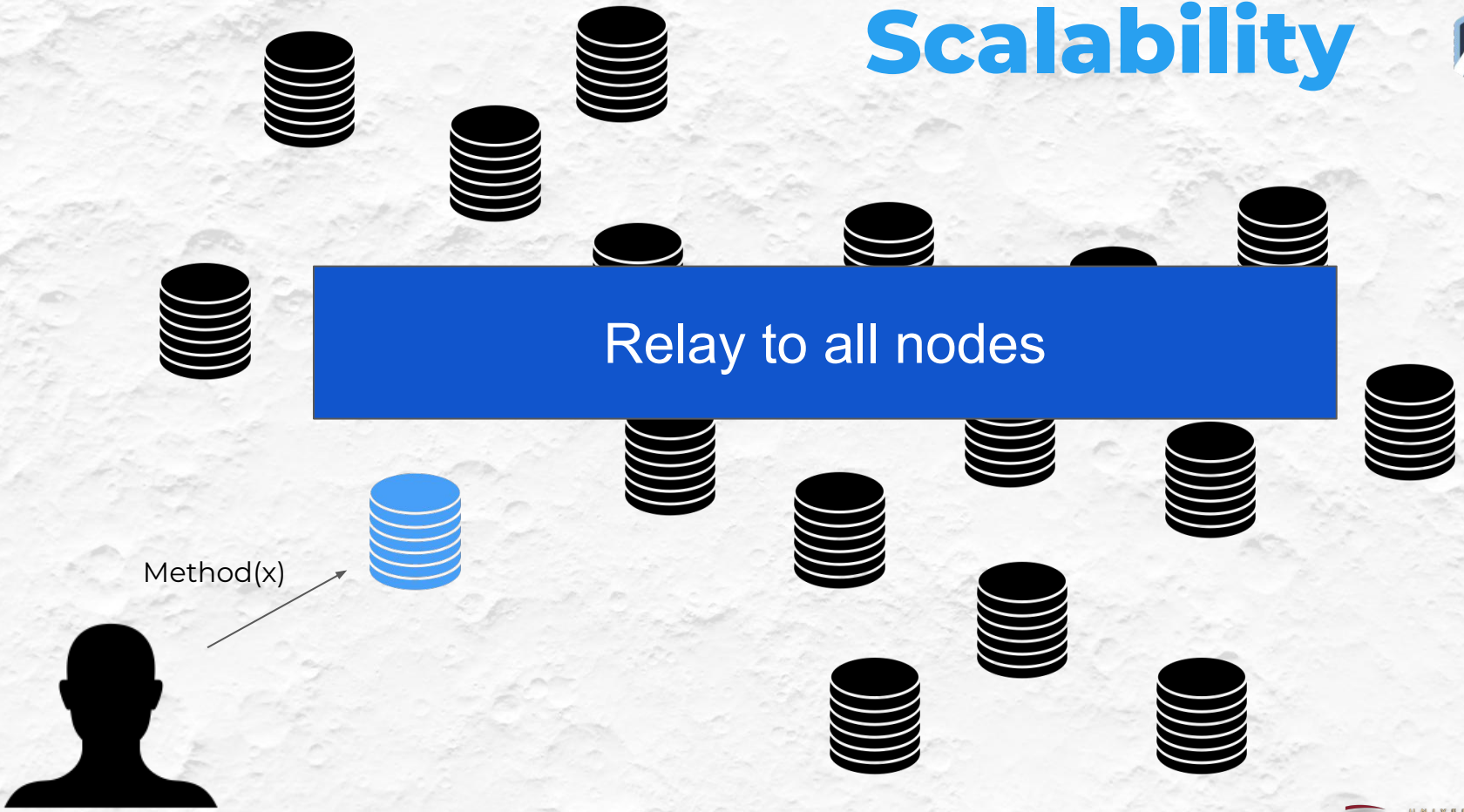

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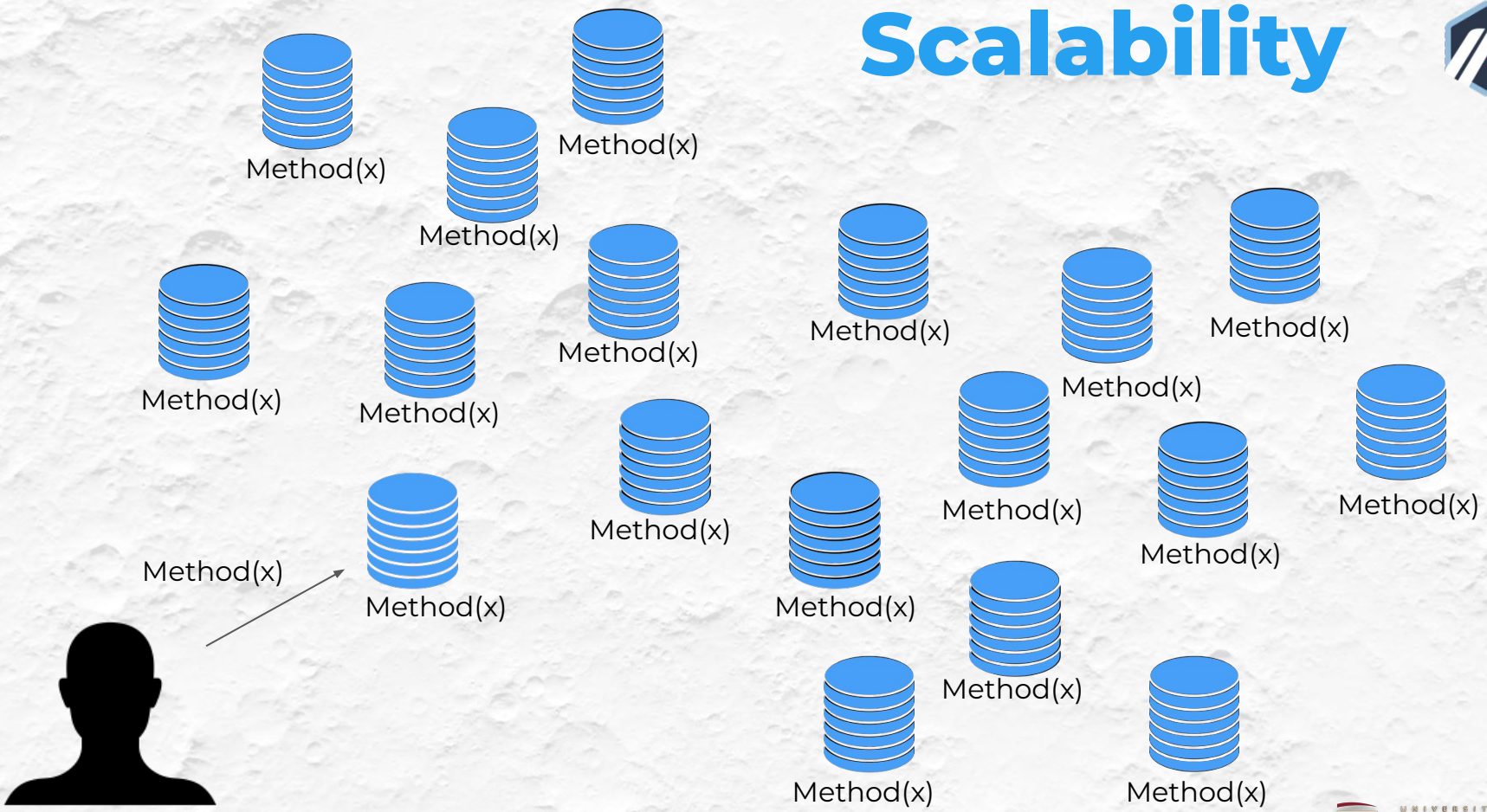

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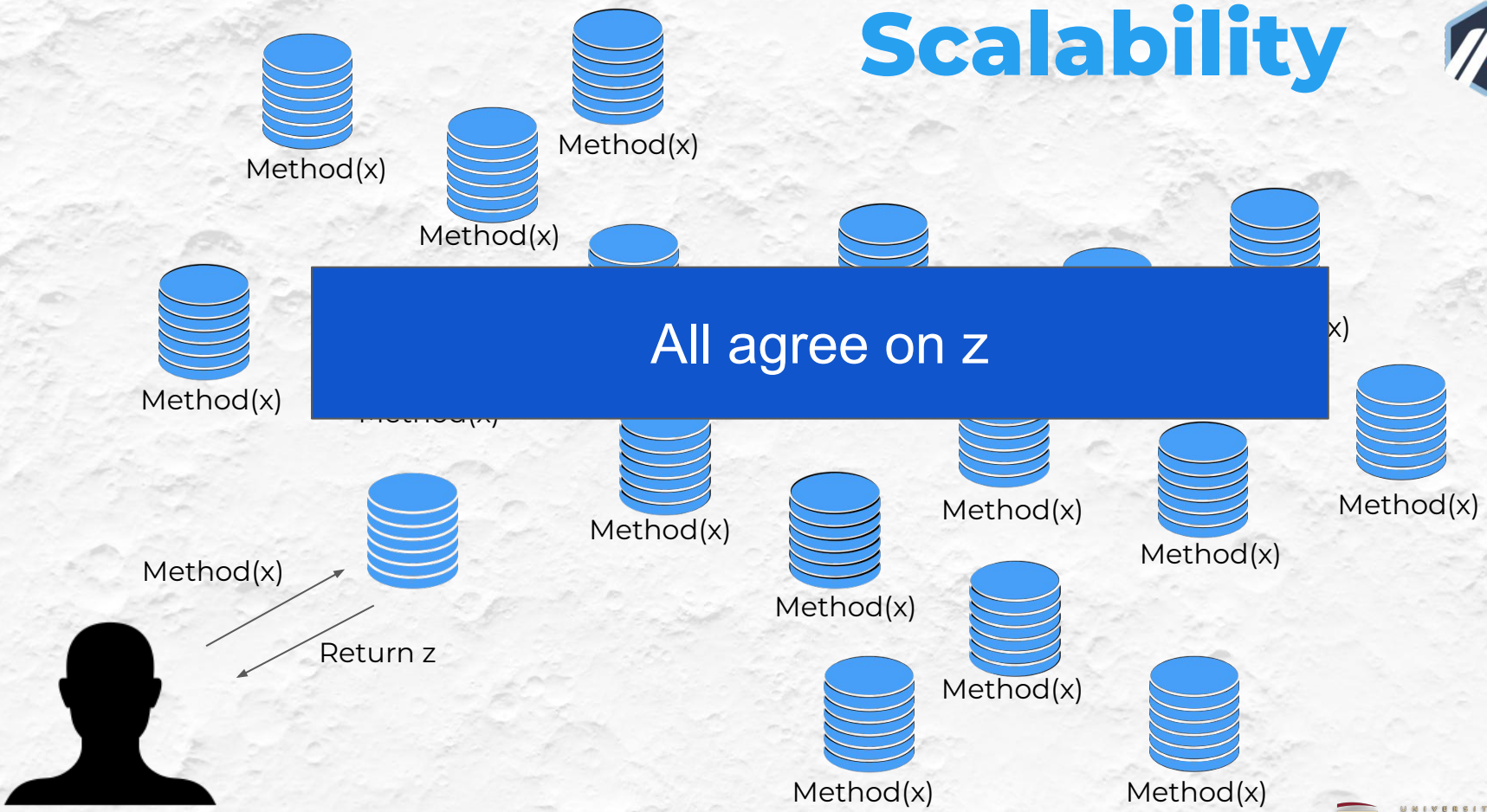


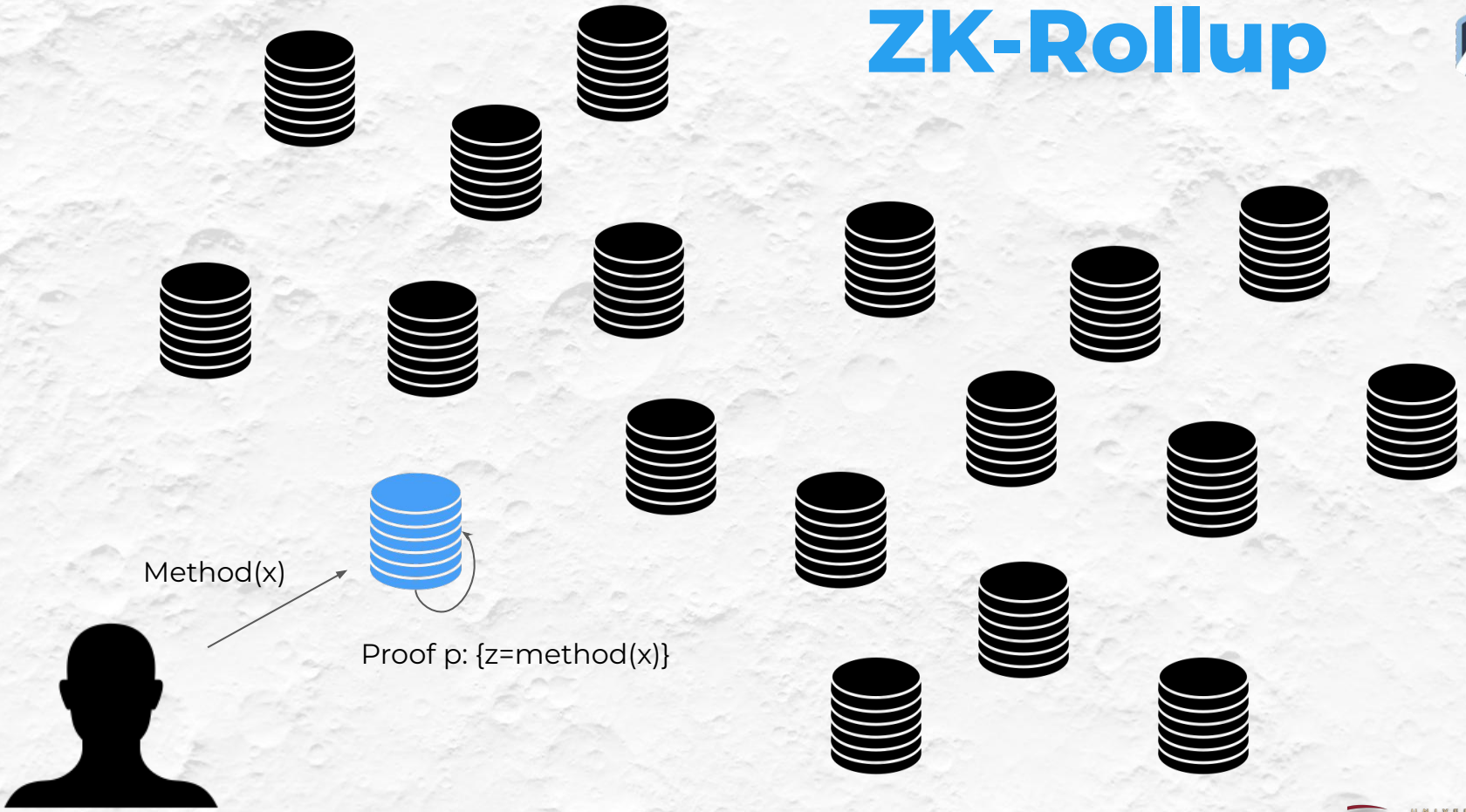
Why does every node compute?

- Consensus on the ***correct*** output
- Computing it for yourself is the most straightforward way to know it is ***correct***
- But can you be convinced something is correct without computing it?

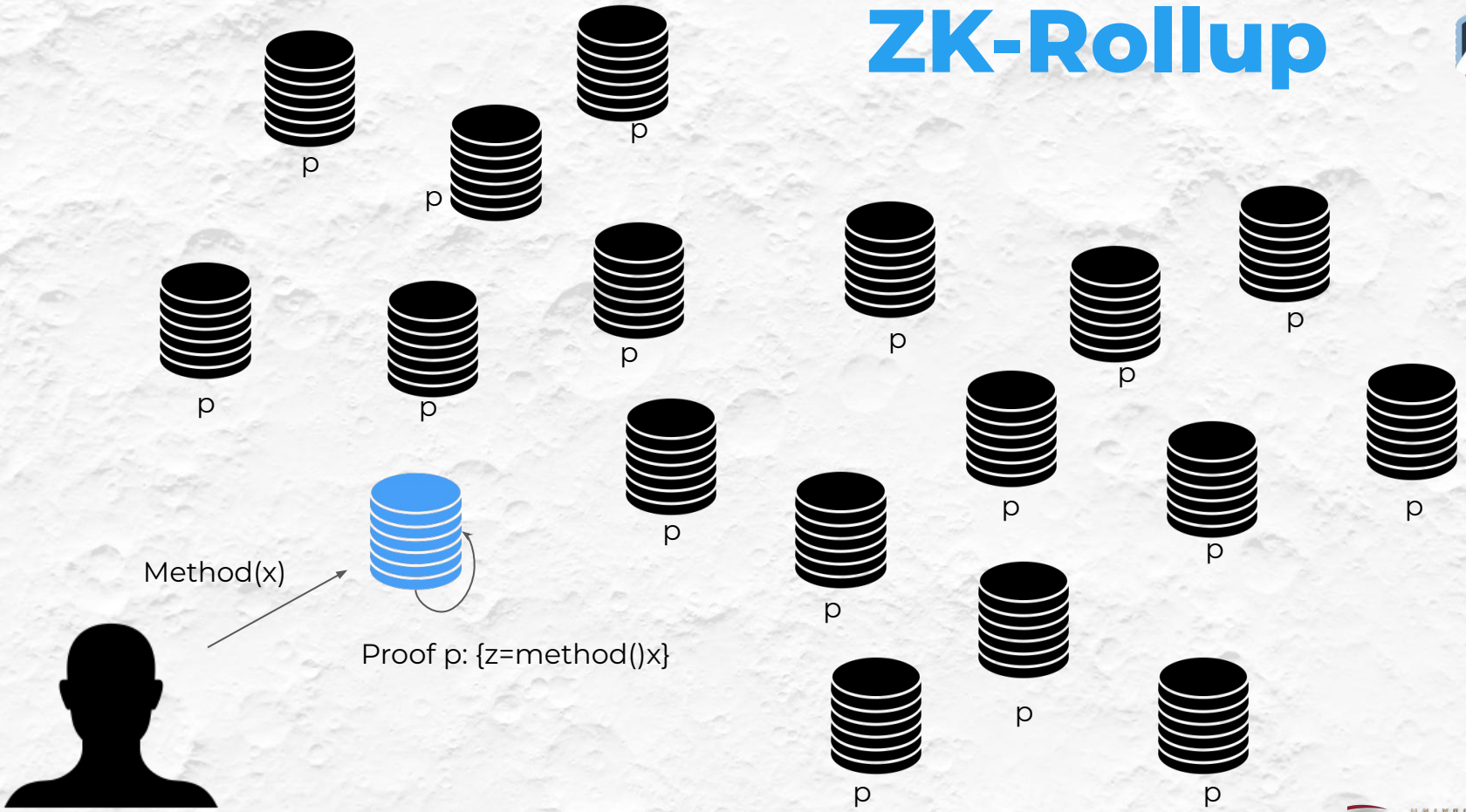
Why does every node compute?

- **You could be given a mathematical proof it is correct**
  - Checking a proof of an output needs to be less work than computing the output
  - ZK-Rollups

ZK-Rollup



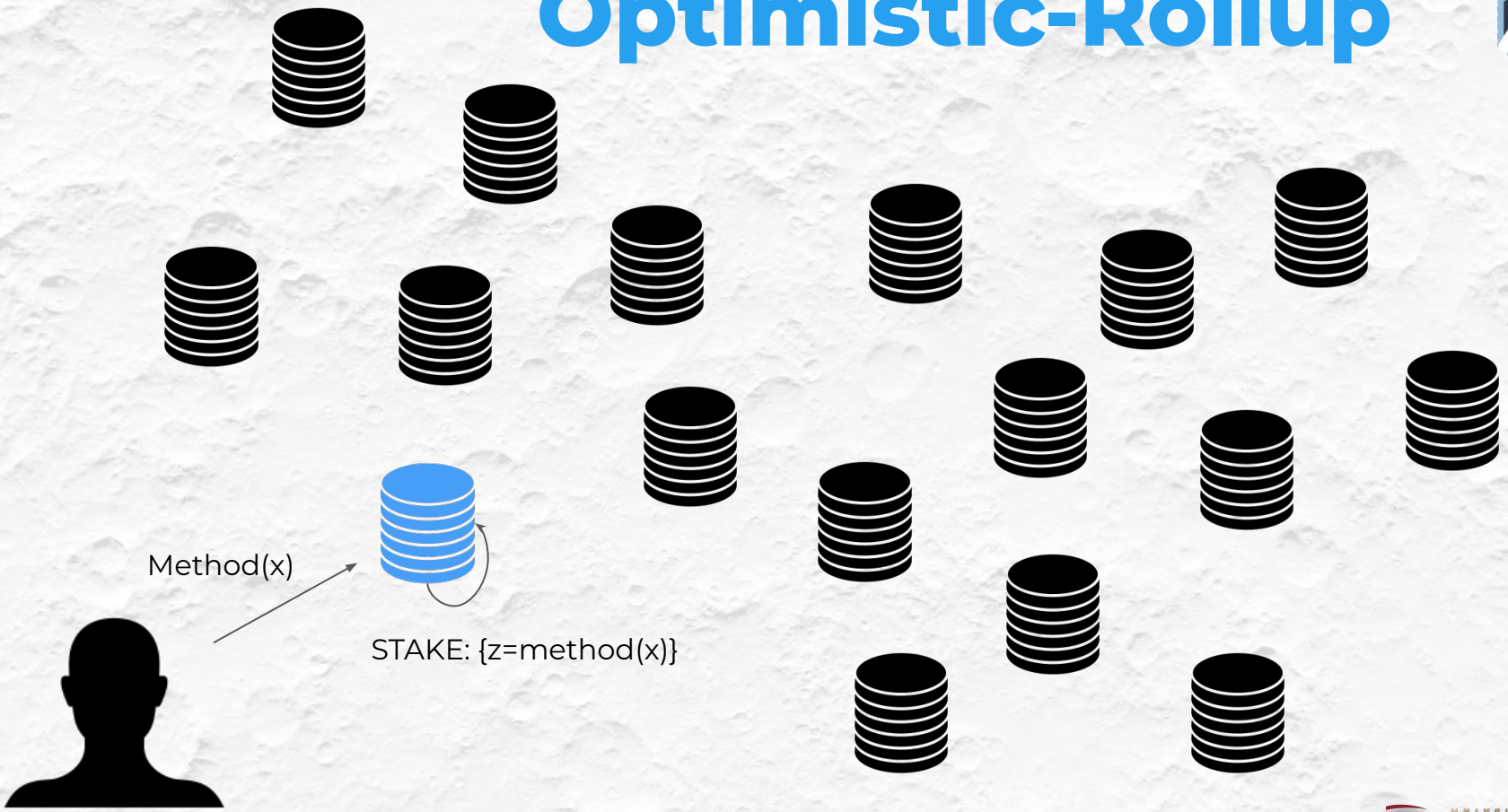
ZK-Rollup

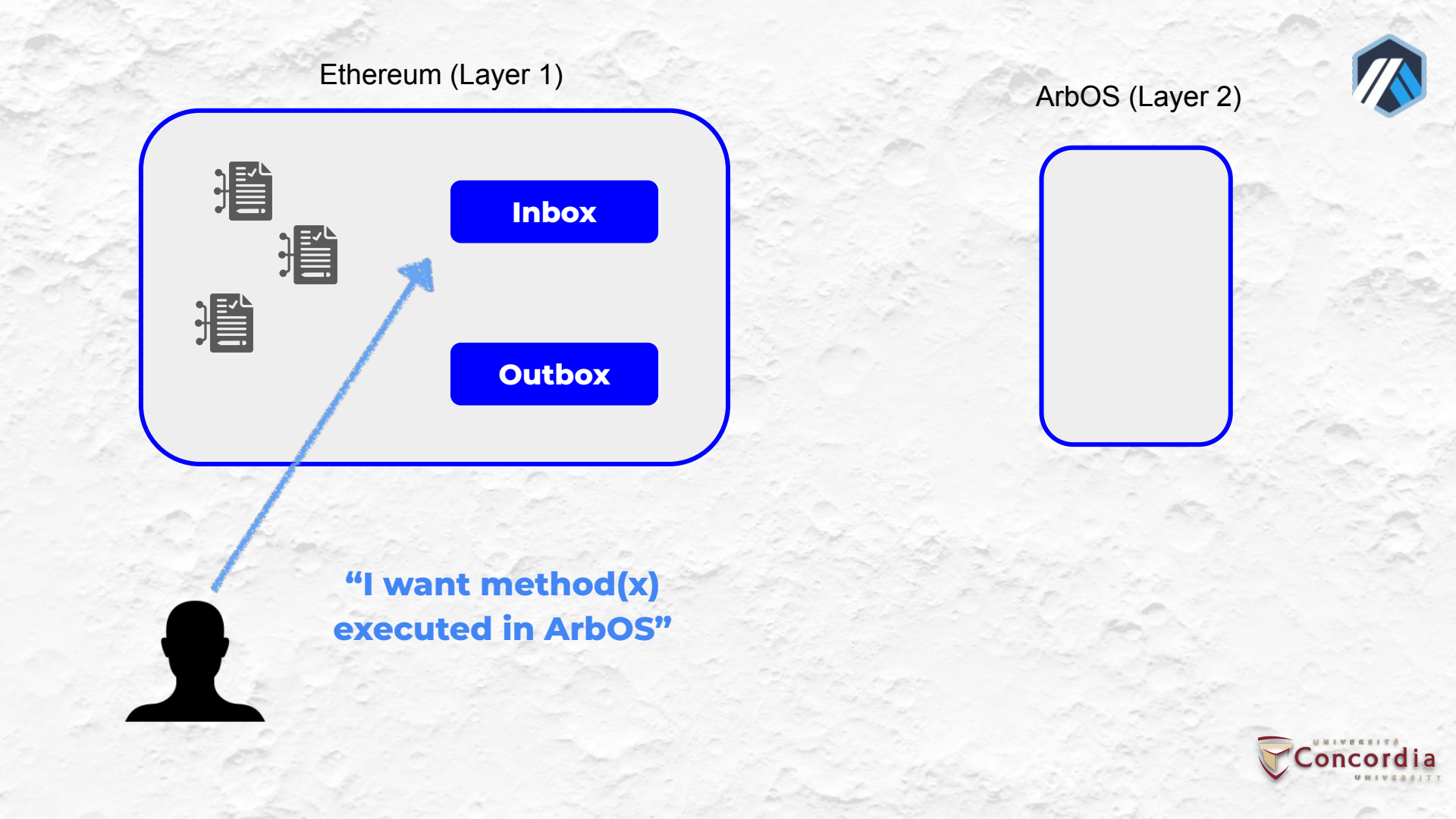


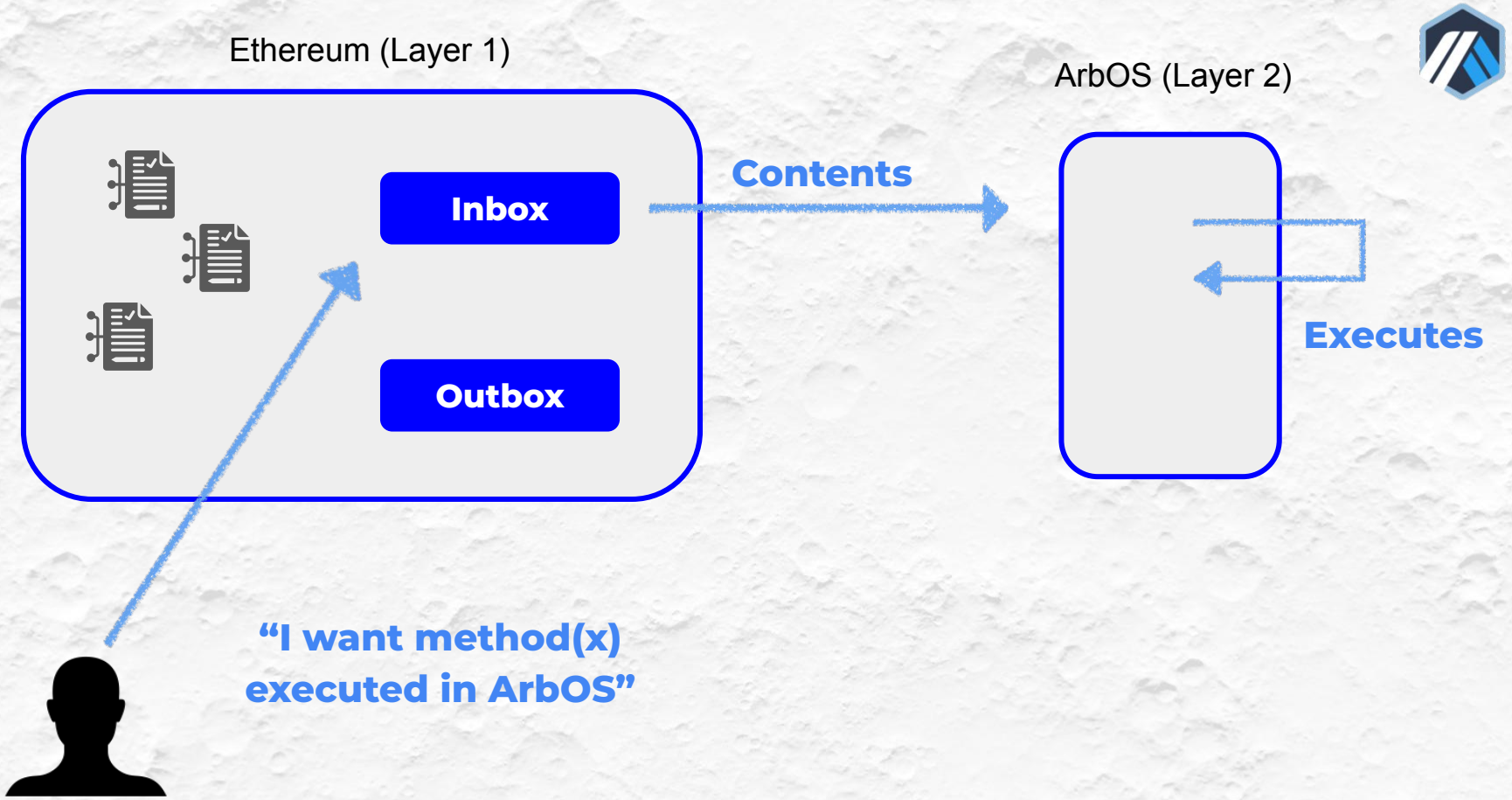
Why does every node compute?

- **You could be given a mathematical proof it is correct**
  - Checking a proof of an output needs to be less work than computing the output
  - ZK-Rollups
- **Someone can assert an output and stake a large amount of money**
  - Anyone can dispute but also needs to stake
  - If no disputes after a week, it is considered **correct**
  - If disputes; parties pinpoint the disagreement, ask all nodes to compute it
  - Optimistic-Rollups

Optimistic-Rollup




Ethereum (Layer 1)
Inbox
Outbox
ArbOS (Layer 2)
“I want method(x) executed in ArbOS”


Ethereum (Layer 1)
Inbox
Outbox
Contents
ArbOS (Layer 2)
Executes
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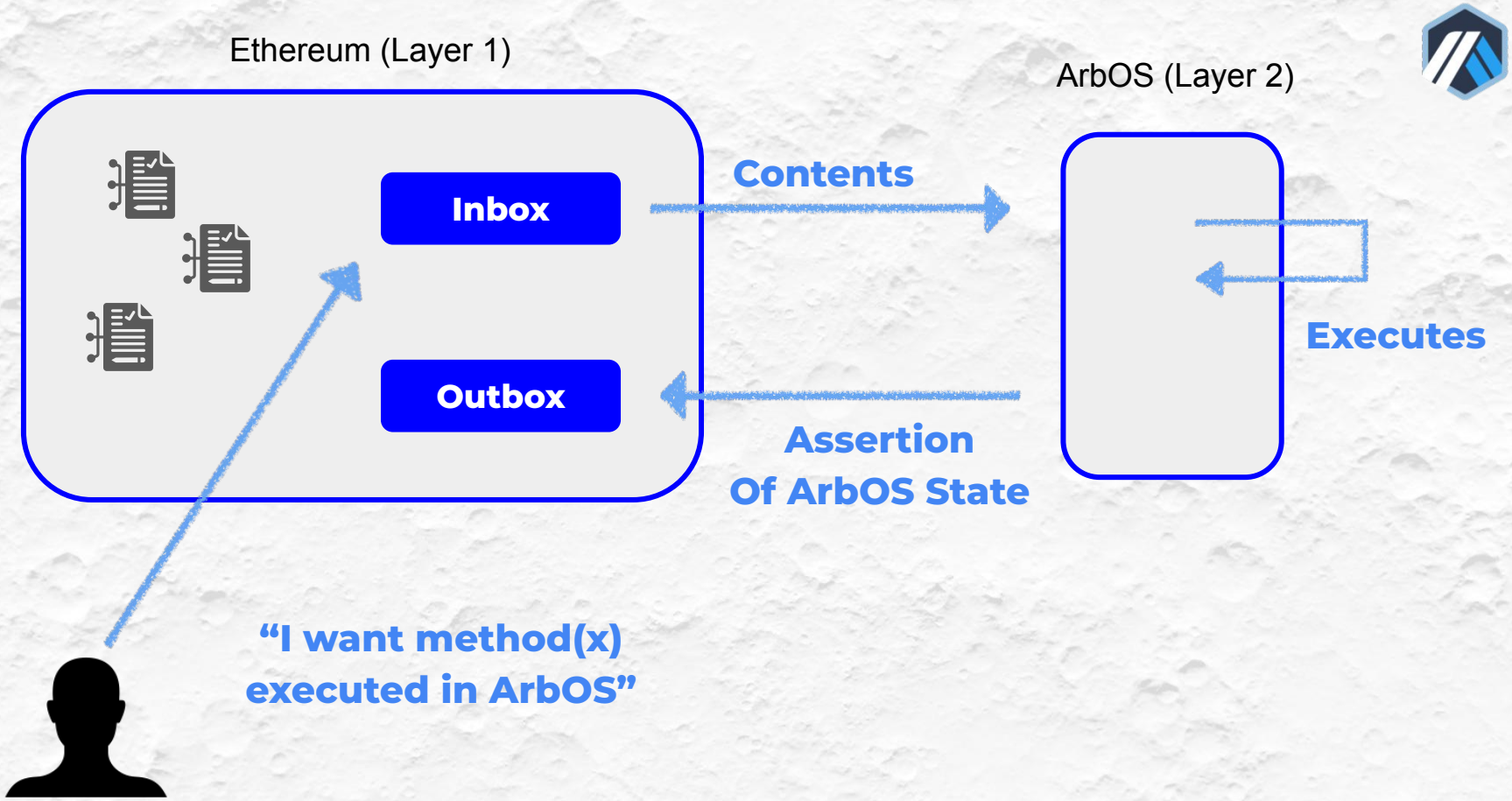
Ethereum (Layer 1)
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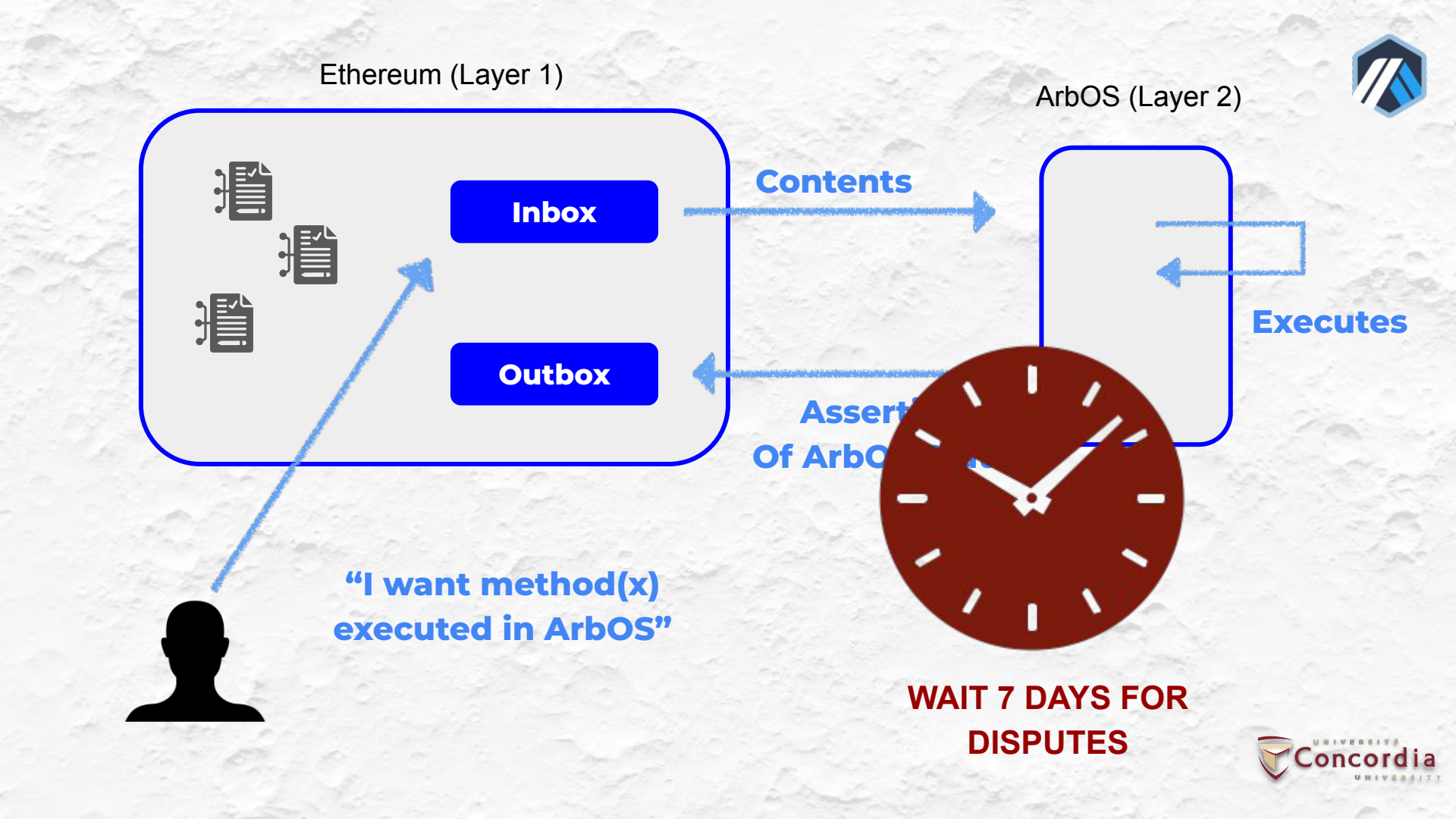
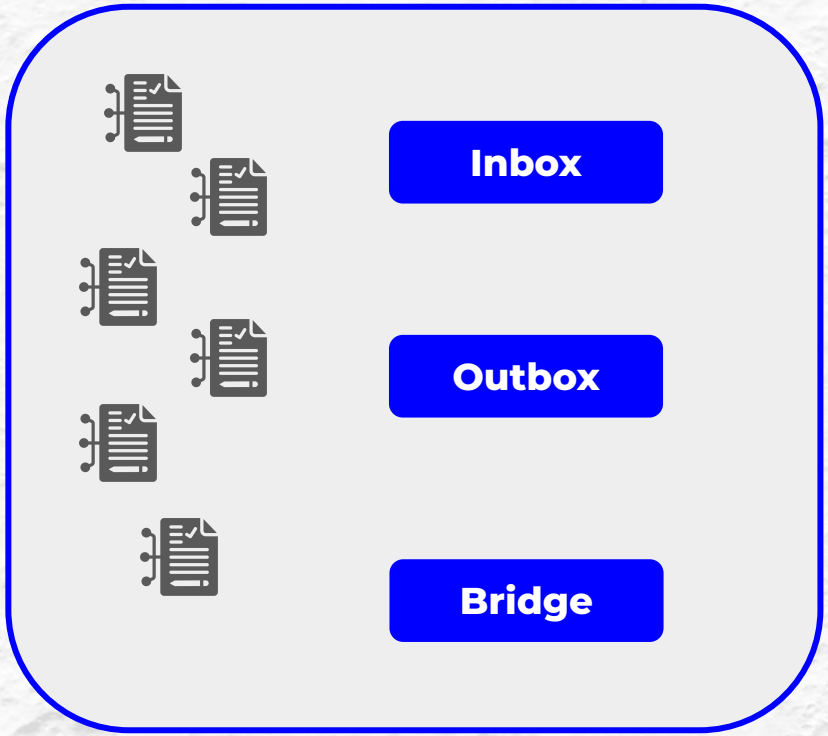
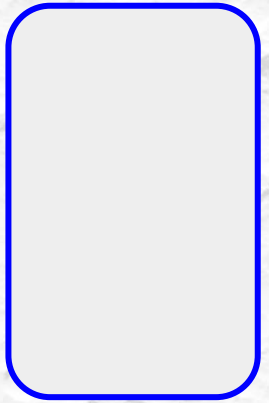
Inbox
Outbox
Contents
Executes
Assertion
Of ArbOS State
“I want method(x)
executed in ArbOS”


Ethereum (Layer 1)
ArbOS (Layer 2)
Inbox
Outbox
Contents
Executes
Assert
Of ArbO
"I want method(x) executed in ArbOS"
WAIT 7 DAYS FOR DISPUTES

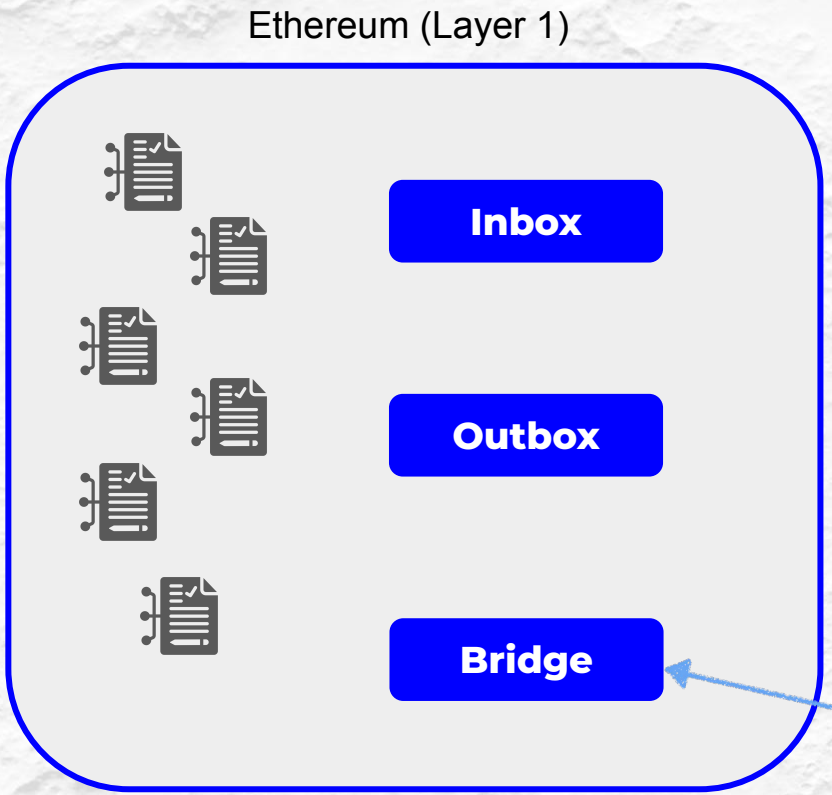
Ethereum (Layer 1)



ArbOS (Layer 2)



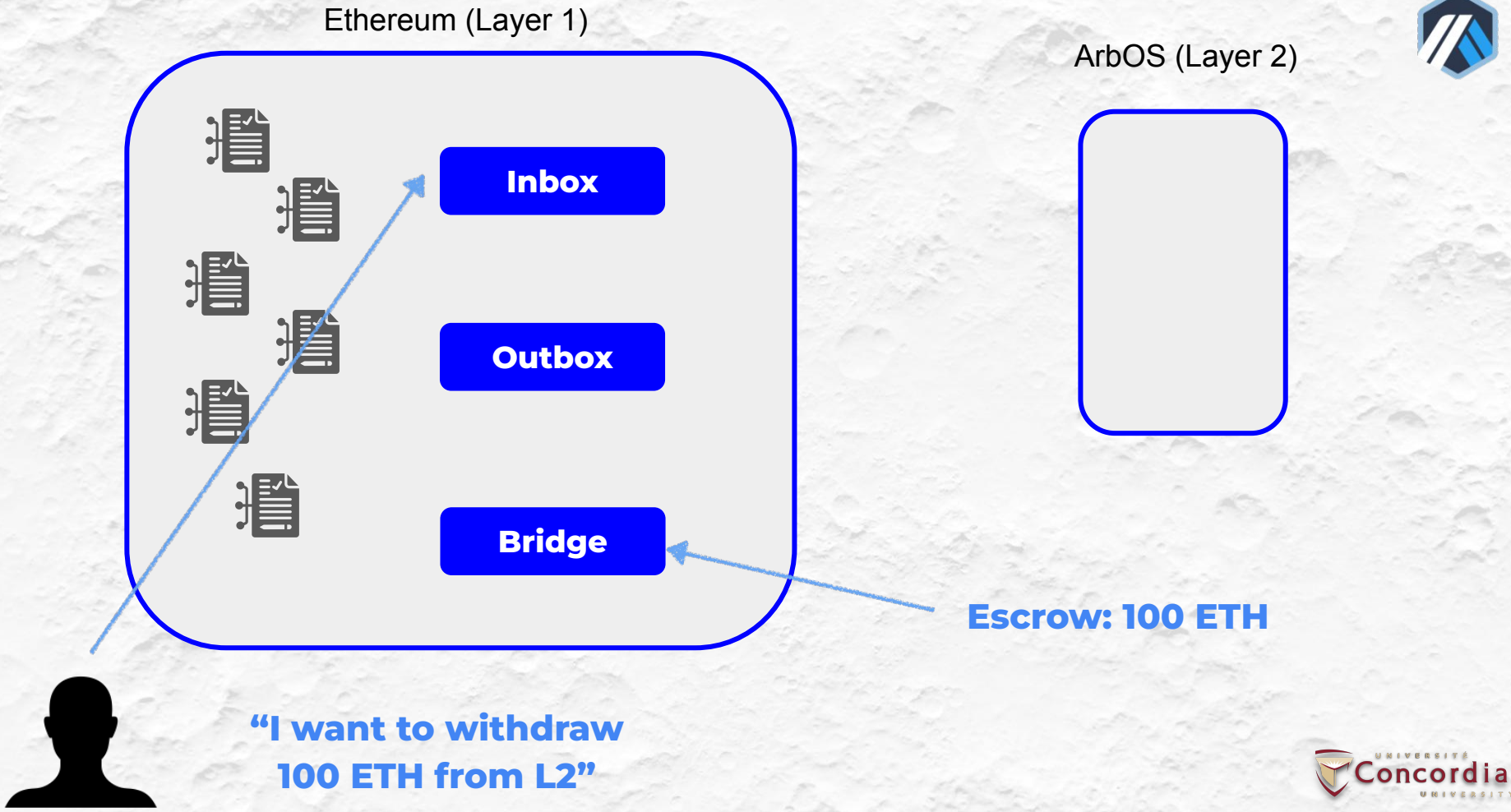
“I want to withdraw 100 ETH from L2”



ArbOS (Layer 2)

Escrow: 100 ETH

"I want to withdraw 100 ETH from L2"


Ethereum (Layer 1)
ArbOS (Layer 2)
Inbox
Outbox
Bridge
Escrow: 100 ETH
“I want to withdraw
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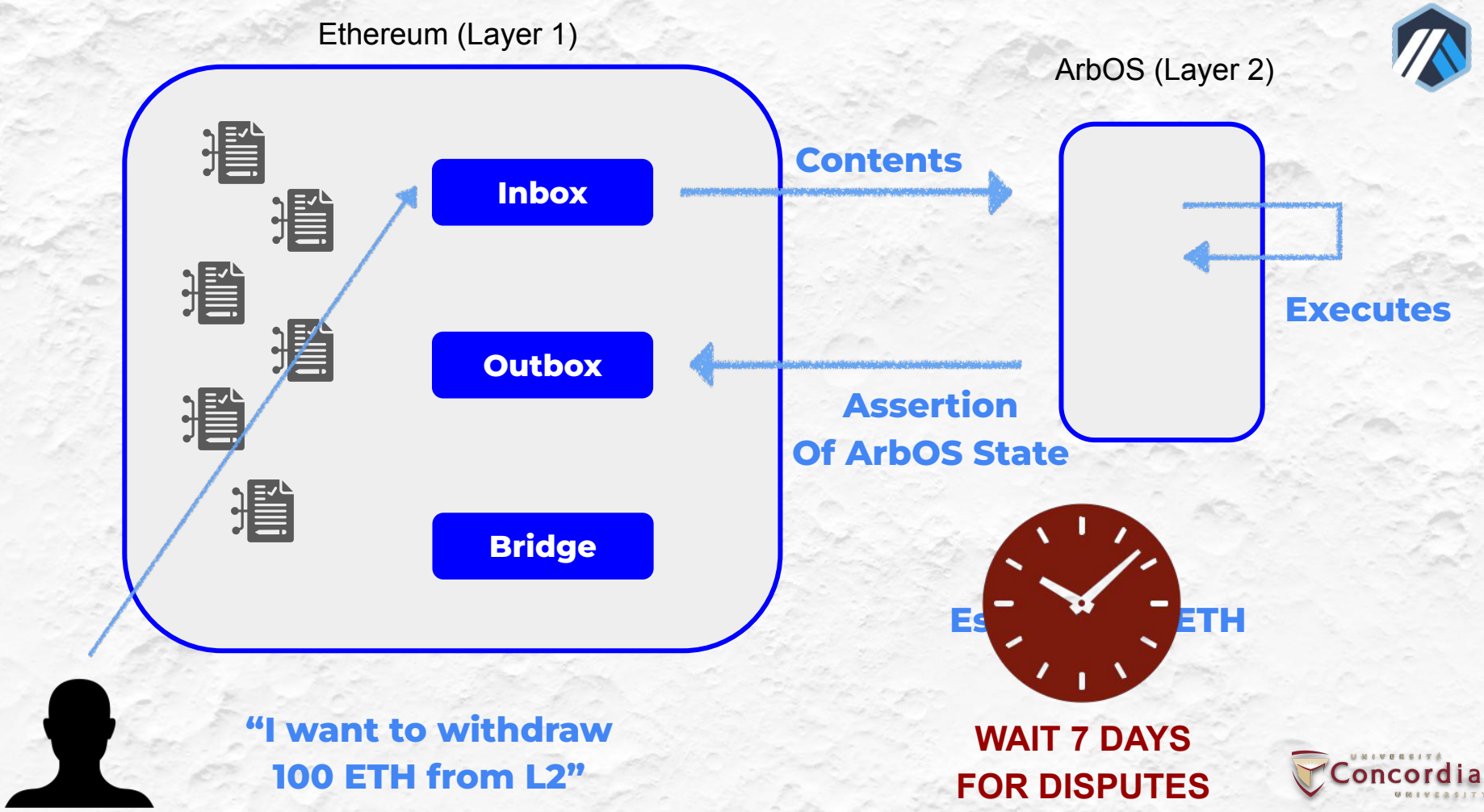
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WAIT 7 DAYS
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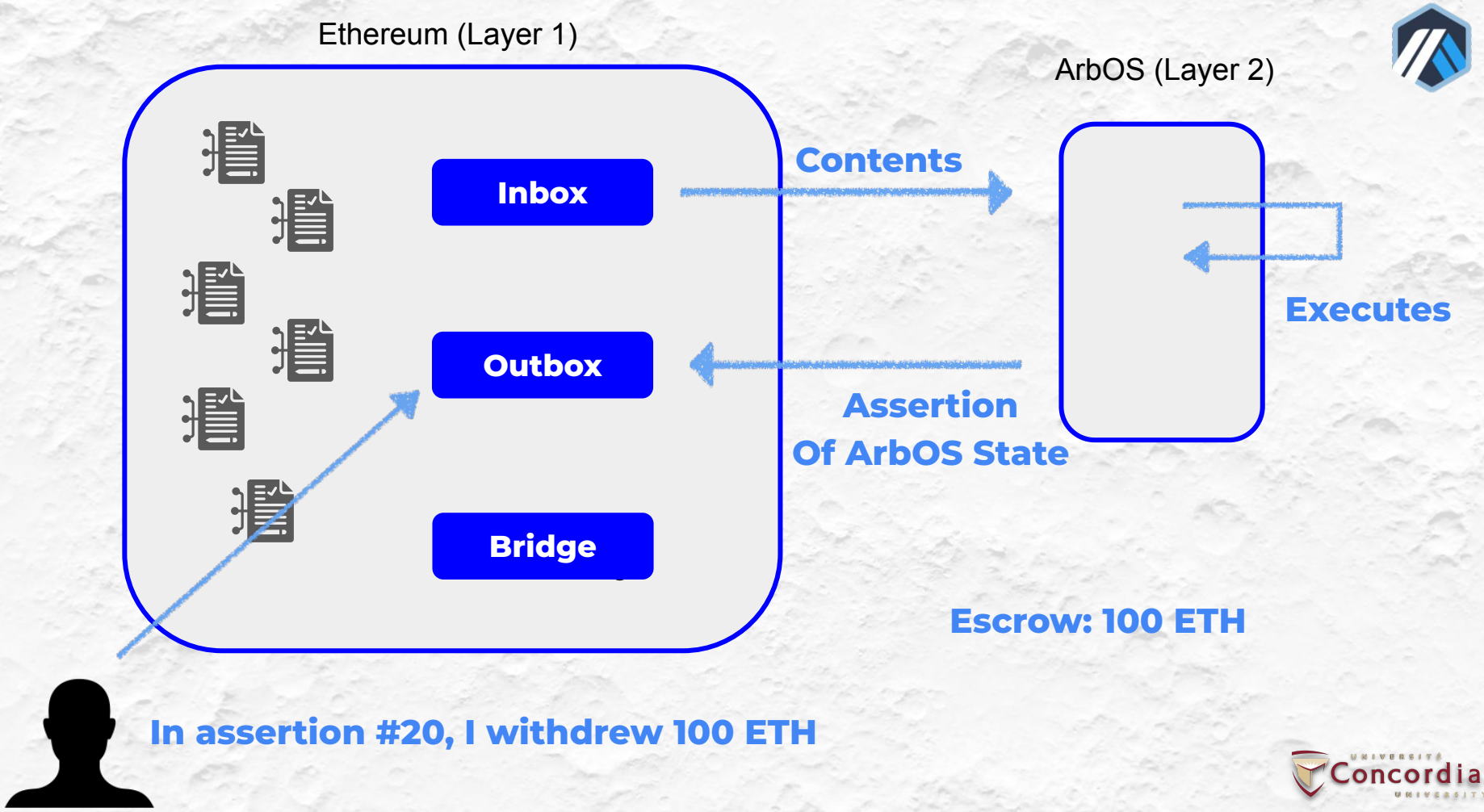
Ethereum (Layer 1)
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Inbox
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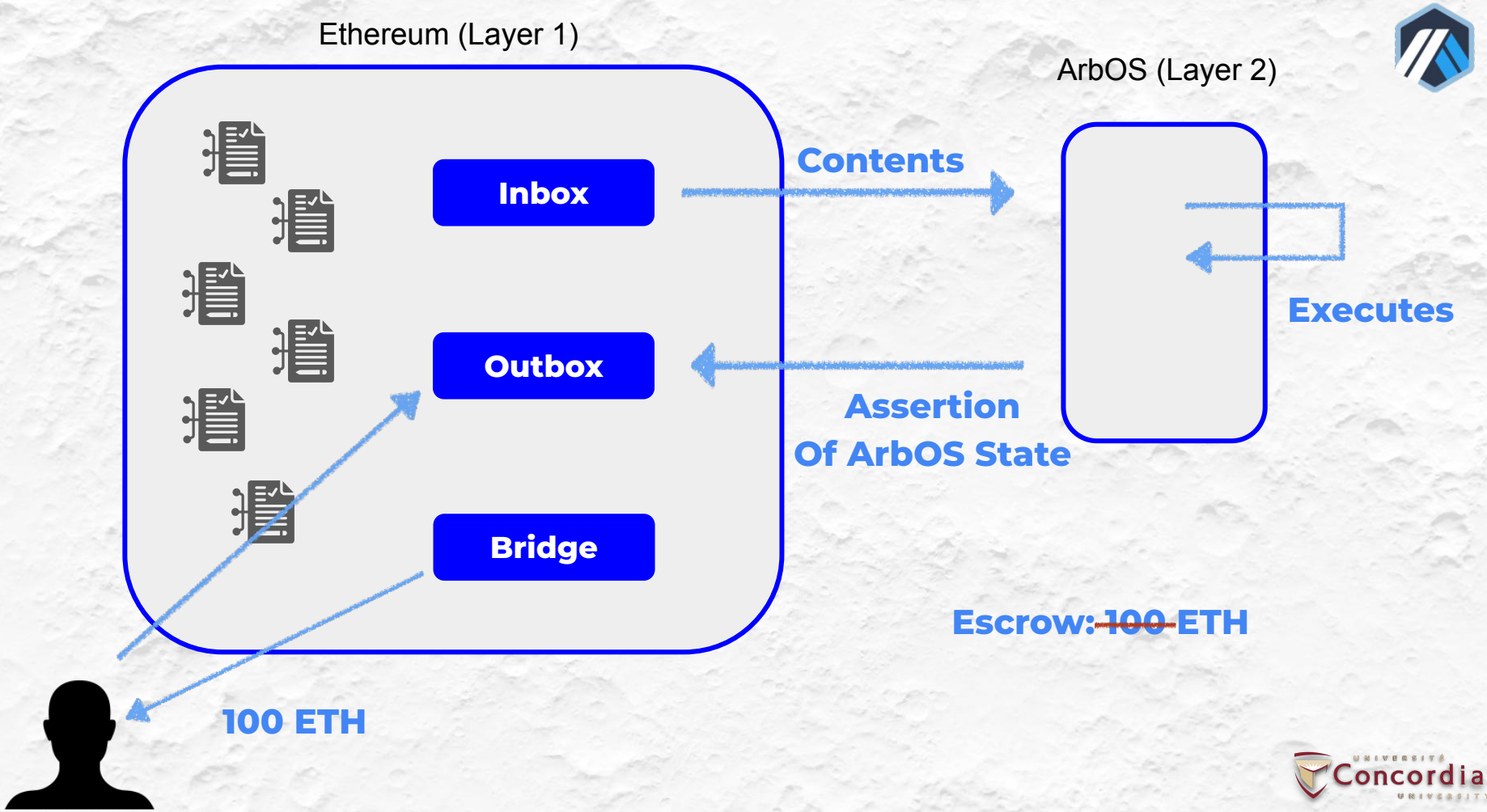
Bridge
Contents
Executes
Assertion
Of ArbOS State
Escrow: 100 ETH
In assertion #20, I withdrew 100 ETH


Ethereum (Layer 1)
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Bridge
Contents
Executes
Assertion
Of ArbOS State
Escrow: 100 ETH
100 ETH

Withdrawal Speed

- Withdrawals have to wait 7 days for finality
- Could be longer: disputes extend the window

  ! Note: There have been no dispute ever, but they are not impossible

- 7 days is arbitrary but there needs to be some time window

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Interesting

Anyone running a validator (checking the inbox transactions do result in the assertion) is 100% sure the ETH will be available

Can Alice withdraw 100 $ETH_{(L2)}$ from Arbitrum in less than 7 days?

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Solution #1

- ✓ Alice goes to a centralized exchange and trades 100 $ETH_{(L2)}$ for 100 ETH
- ✗ It's centralized

Can Alice withdraw 100 $ETH_{(L2)}$ from Arbitrum in less than 7 days?

Solution #2

✅ Alice has 100 $ETH_{(L2)}$ - Bob has 100 ETH ➡️
Atomic Swap

❌ It does not finalize

Can Alice withdraw 100 $ETH_{(L2)}$ from Arbitrum in less than 7 days?

Solution #3

- ✓ Alice does the withdrawal and while it is pending, the outbox gives her a “ticket” for the withdrawal on L1
- ✓ Bob validates Arbitrum assertion, knows ticket is valid, and buys it from Alice for 99 ETH
- ✓ Bob has a dual role: has liquidity (has 100 ETH on L1) and is a validator
- ✗ Bob is scarce

Can Alice withdraw 100 $ETH_{(L2)}$ from Arbitrum in less than 7 days?

Solution #4

- A **prediction market** is setup for the **"the 10th assertion will become finalized"** on L1
- For 1 ETH, you can buy a share for "YES" and a share for "NO" and resell them
- If it becomes valid, a "YES" share can be redeemed for 1 ETH and a "NO" share is worth nothing
- If it does not become valid, a "YES" share is worth nothing and a "NO" share is worth 1 ETH

Can Alice withdraw 100 $ETH_{(L2)}$ from Arbitrum in less than 7 days?

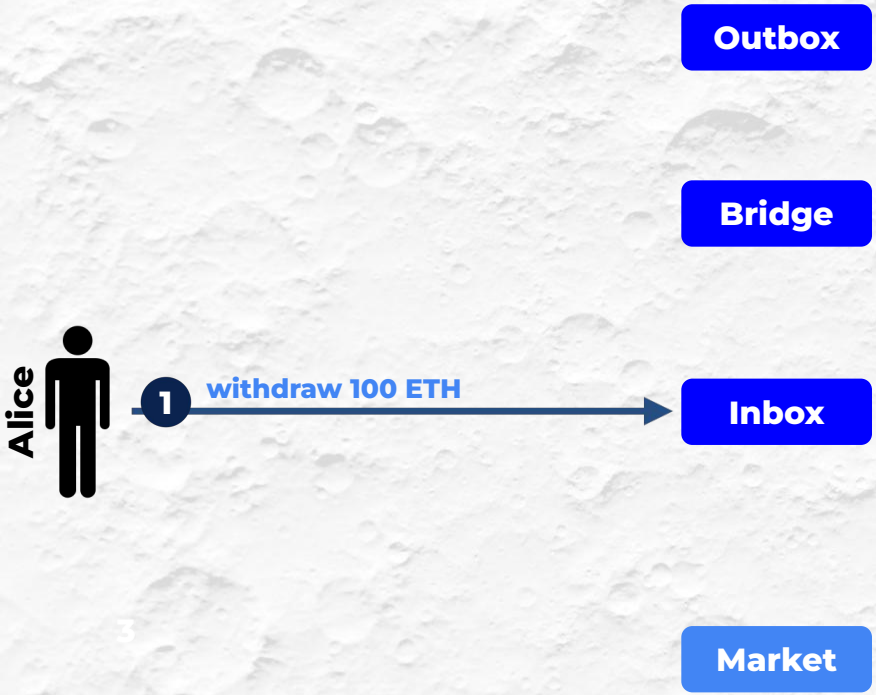
Solution #4

- Alice deposits 100 ETH for 100 “YES” and 100 “NO” shares
- Alice sells to David (who runs a validator): 100 “YES” shares for 0.99 ETH each
- Alice sells to Carol (who has liquidity): 1 ticket for 100 ETH & 100 “NO” shares
- If assertion is valid: 100 ETH can be withdrawn and “NO” shares are worth nothing
- If assertion is invalid: ETH cannot be withdrawn but “NO” shares are worth 100 ETH

Implementation

- Modified Arbitrum Nitro to support solutions and provide measurements
  - Solution #3:
    - Implemented an L1 market
    - Modified the Outbox
  - Solution #4:
    - Modified the Rollup and Outbox contracts

Implementation



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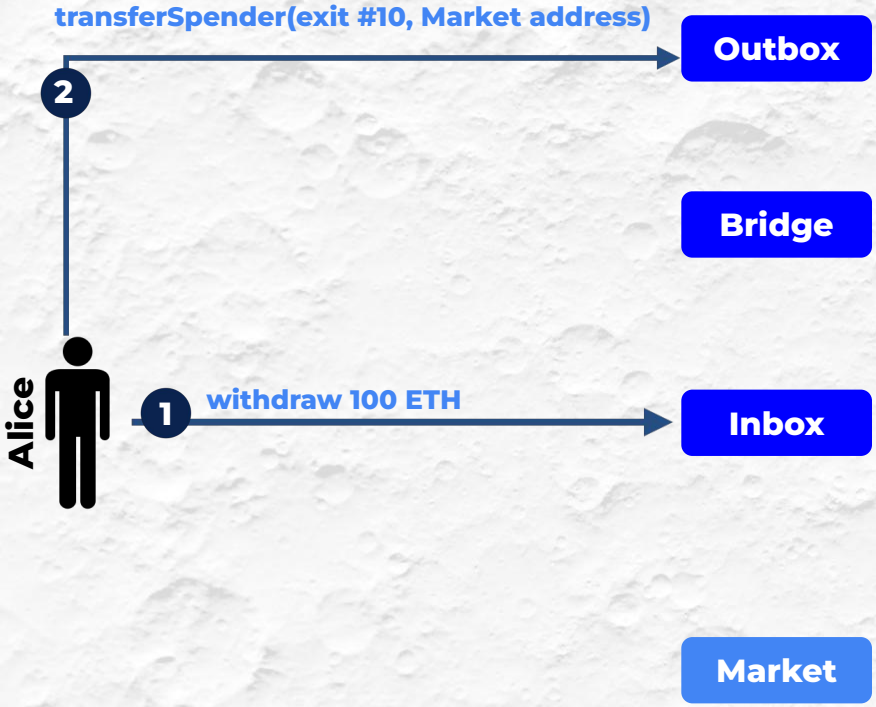

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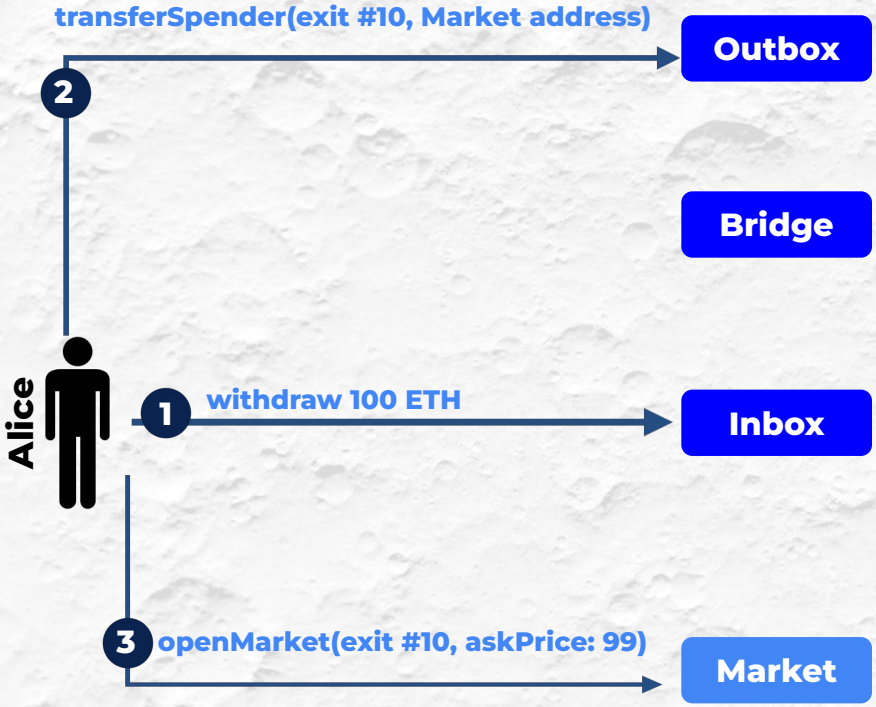

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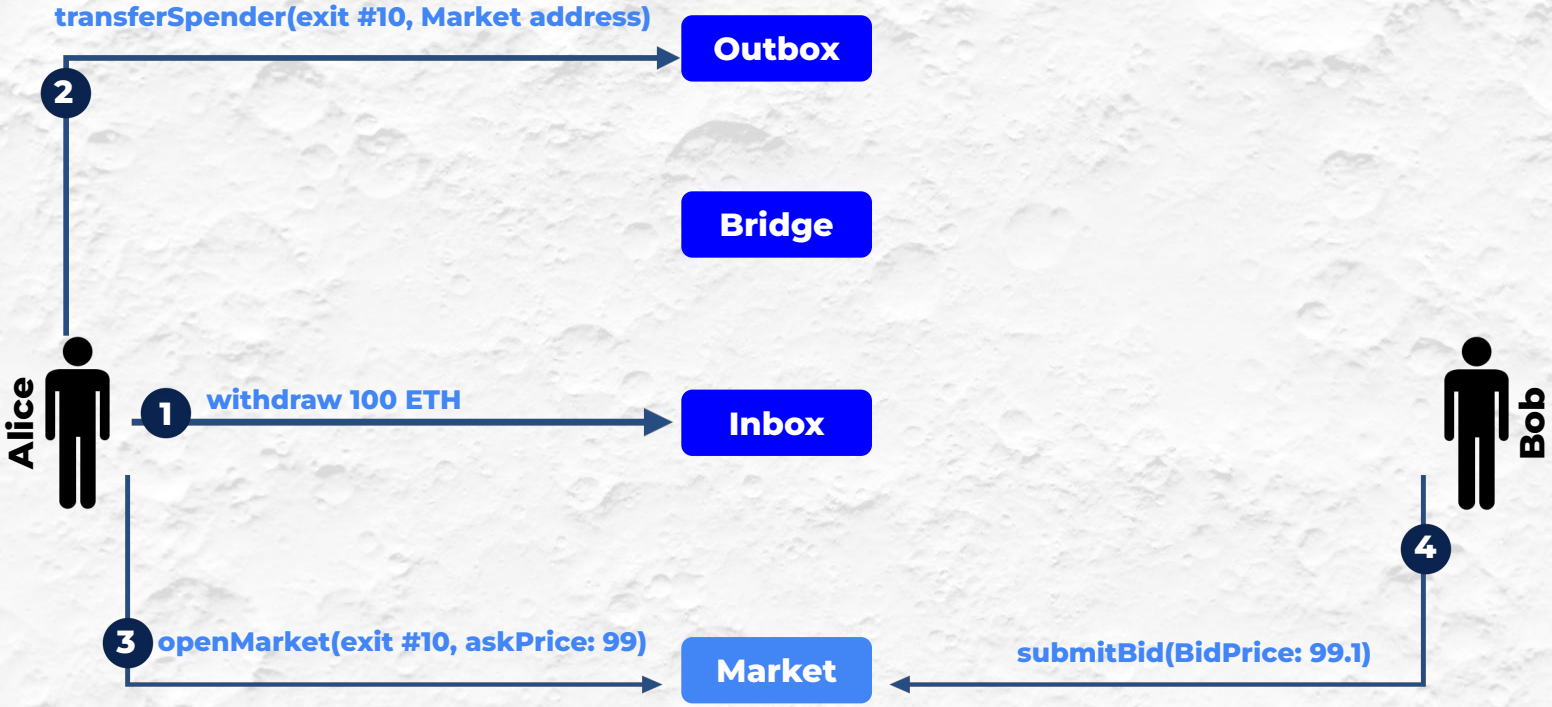

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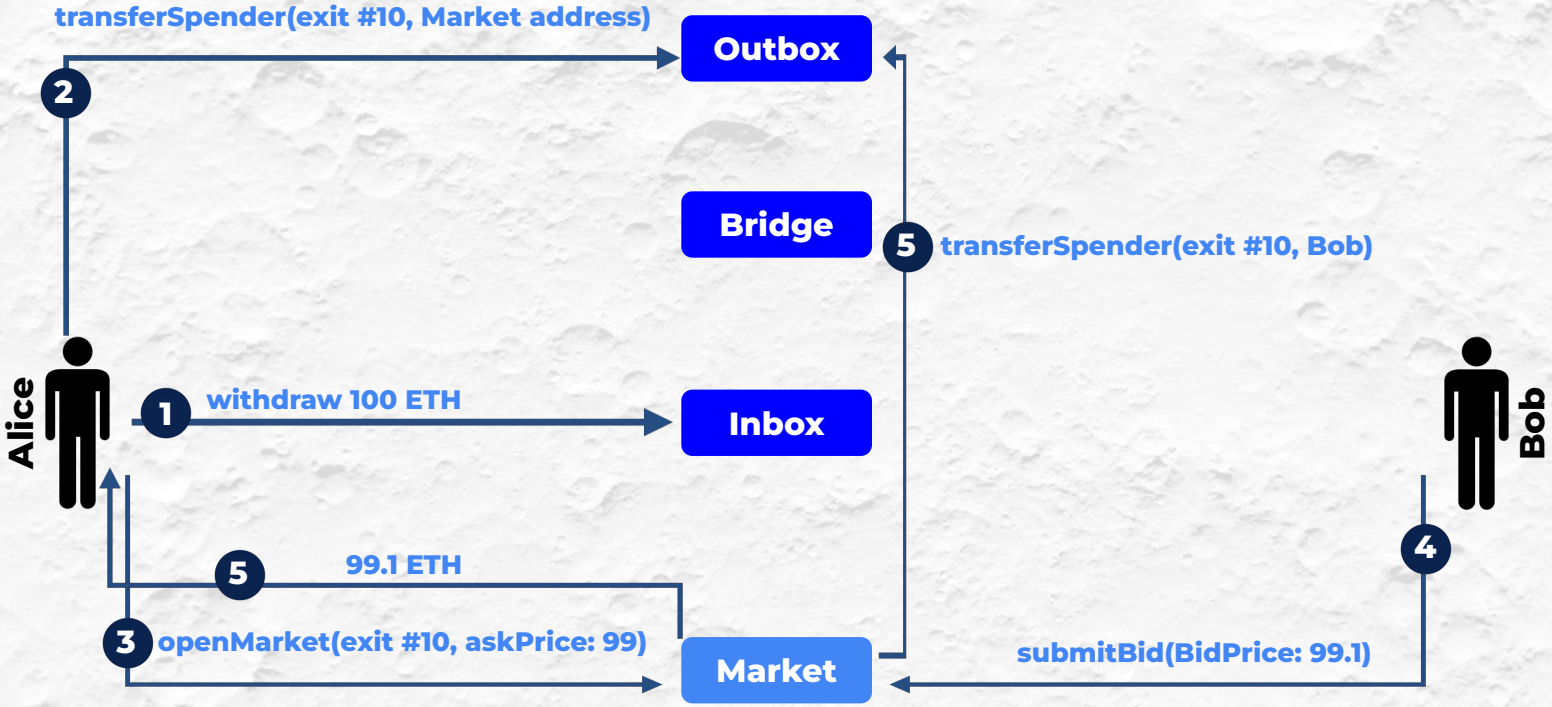

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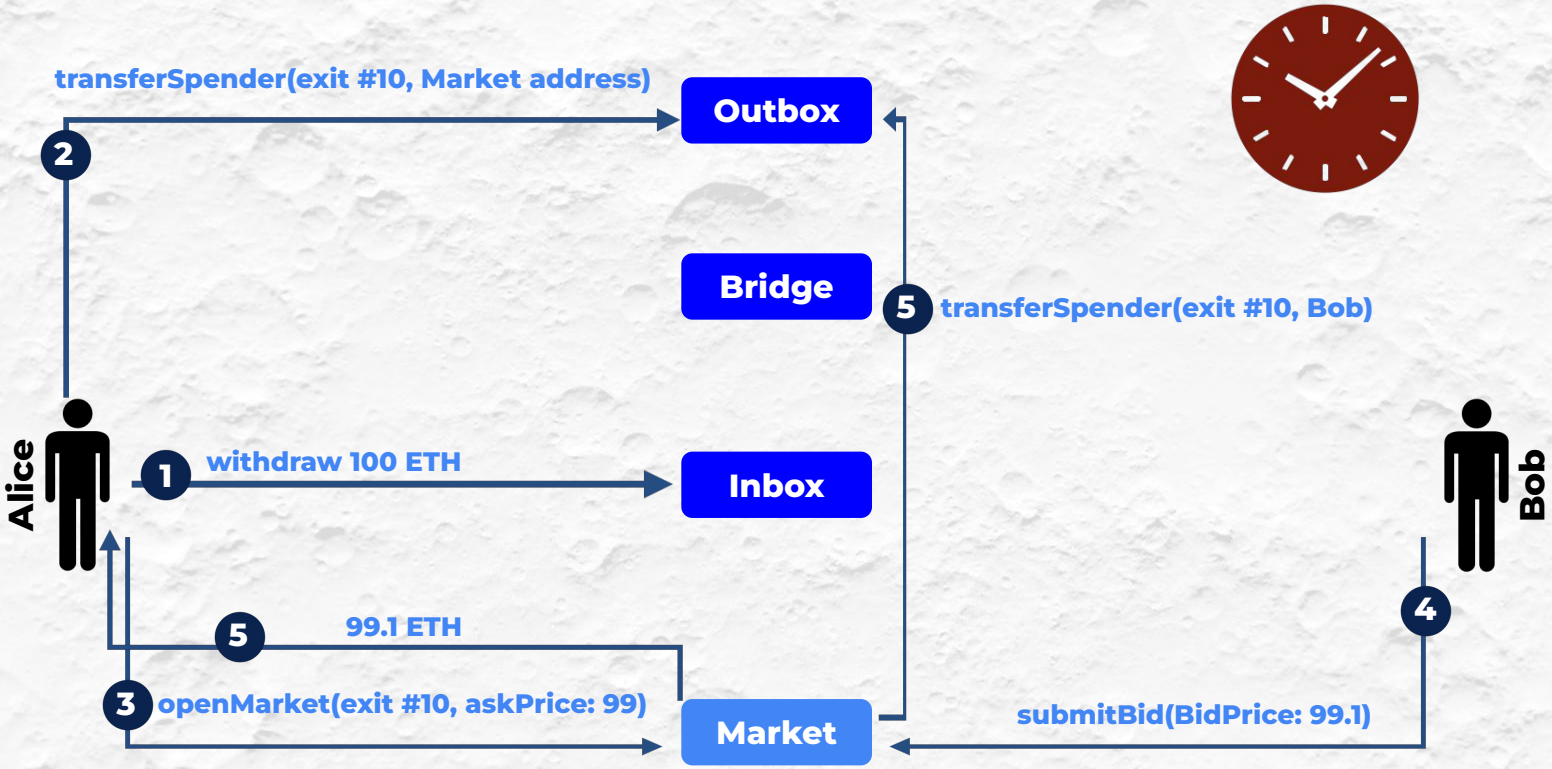

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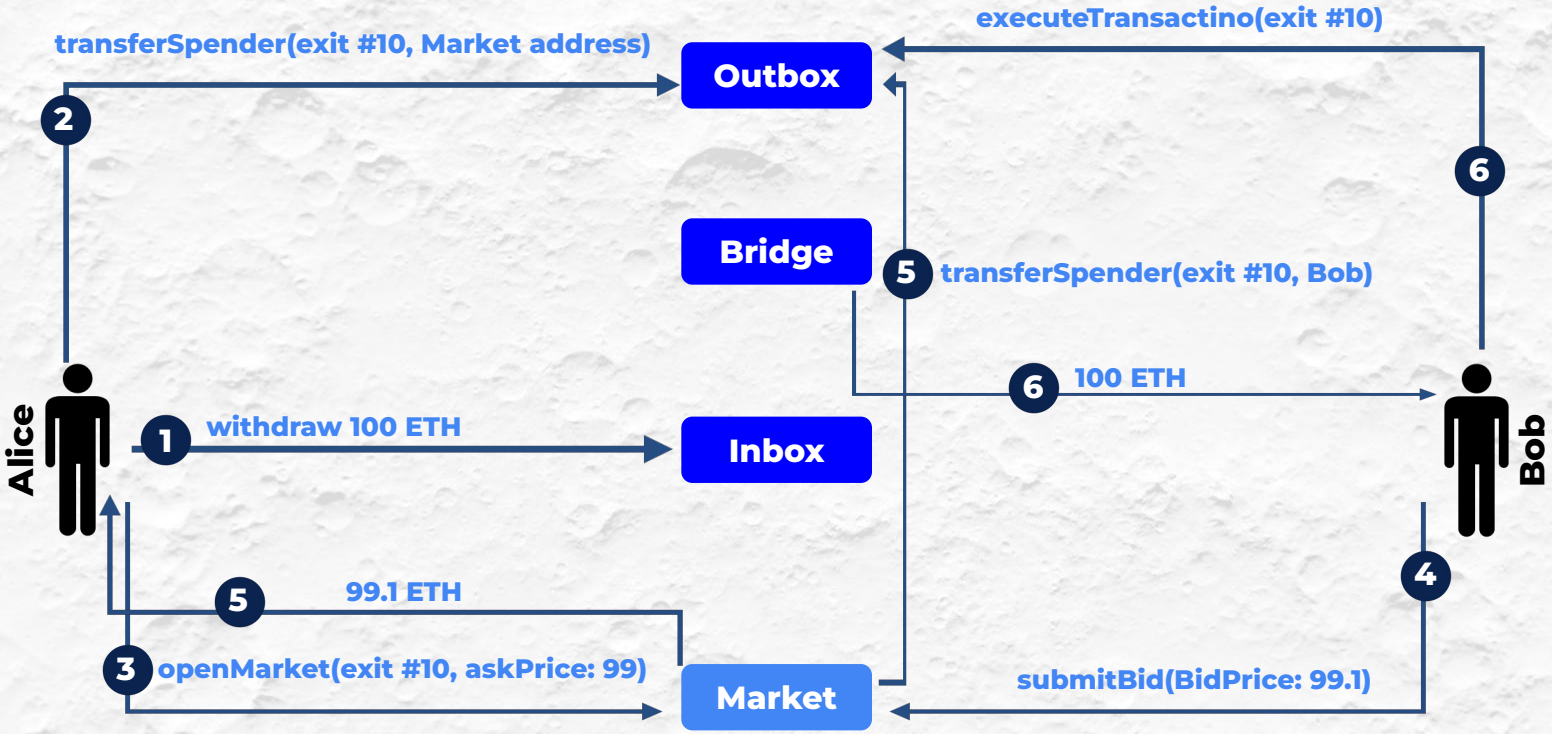
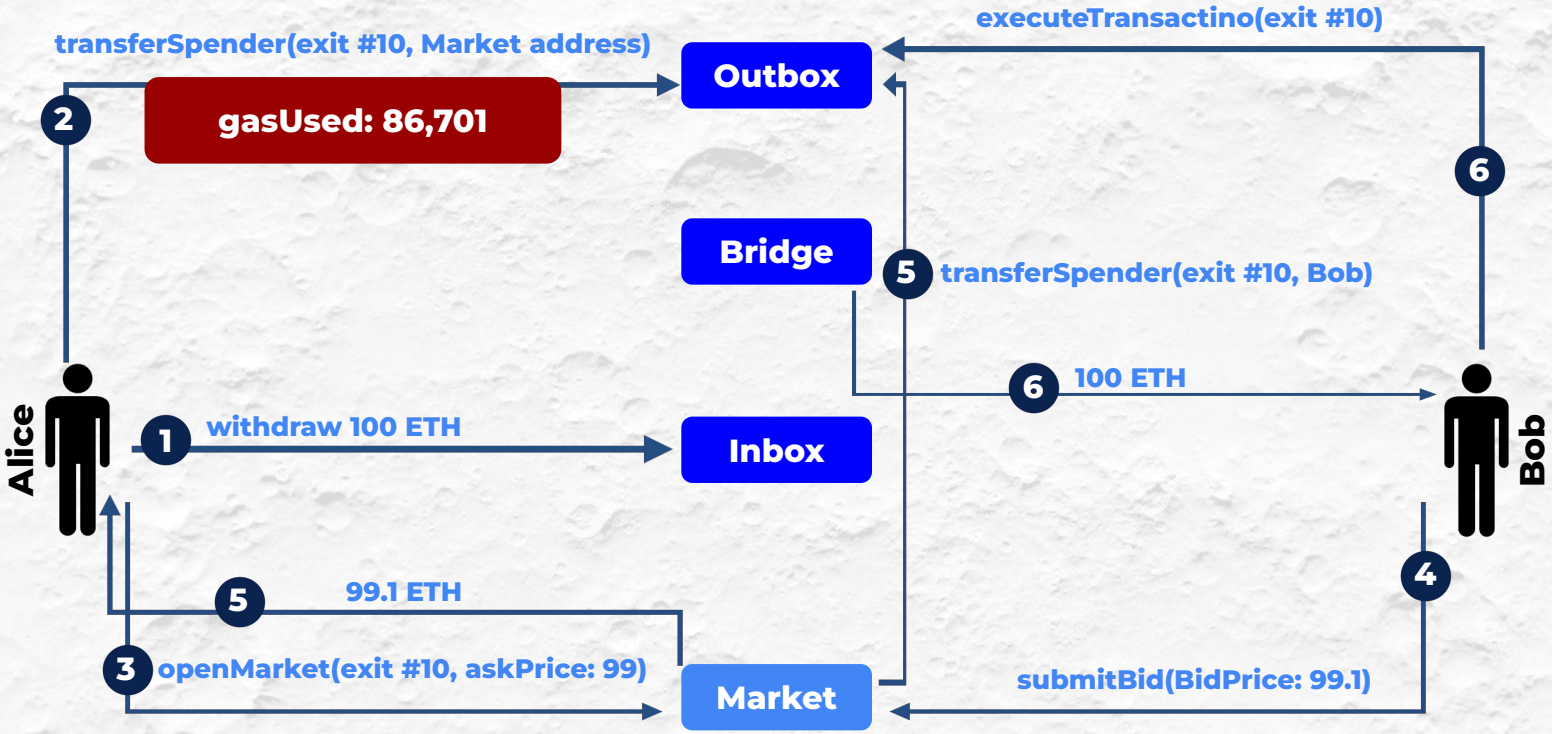


Measurements



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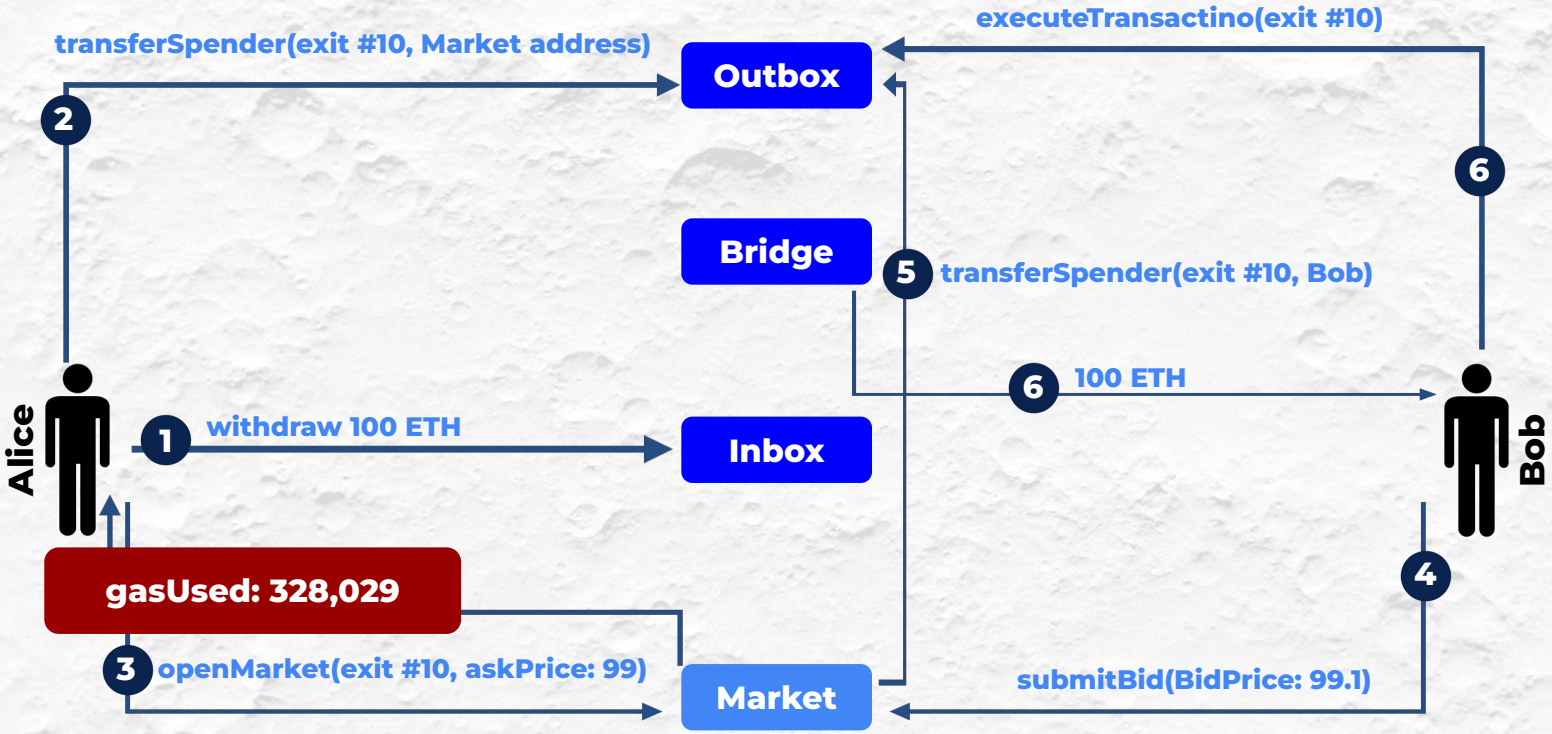

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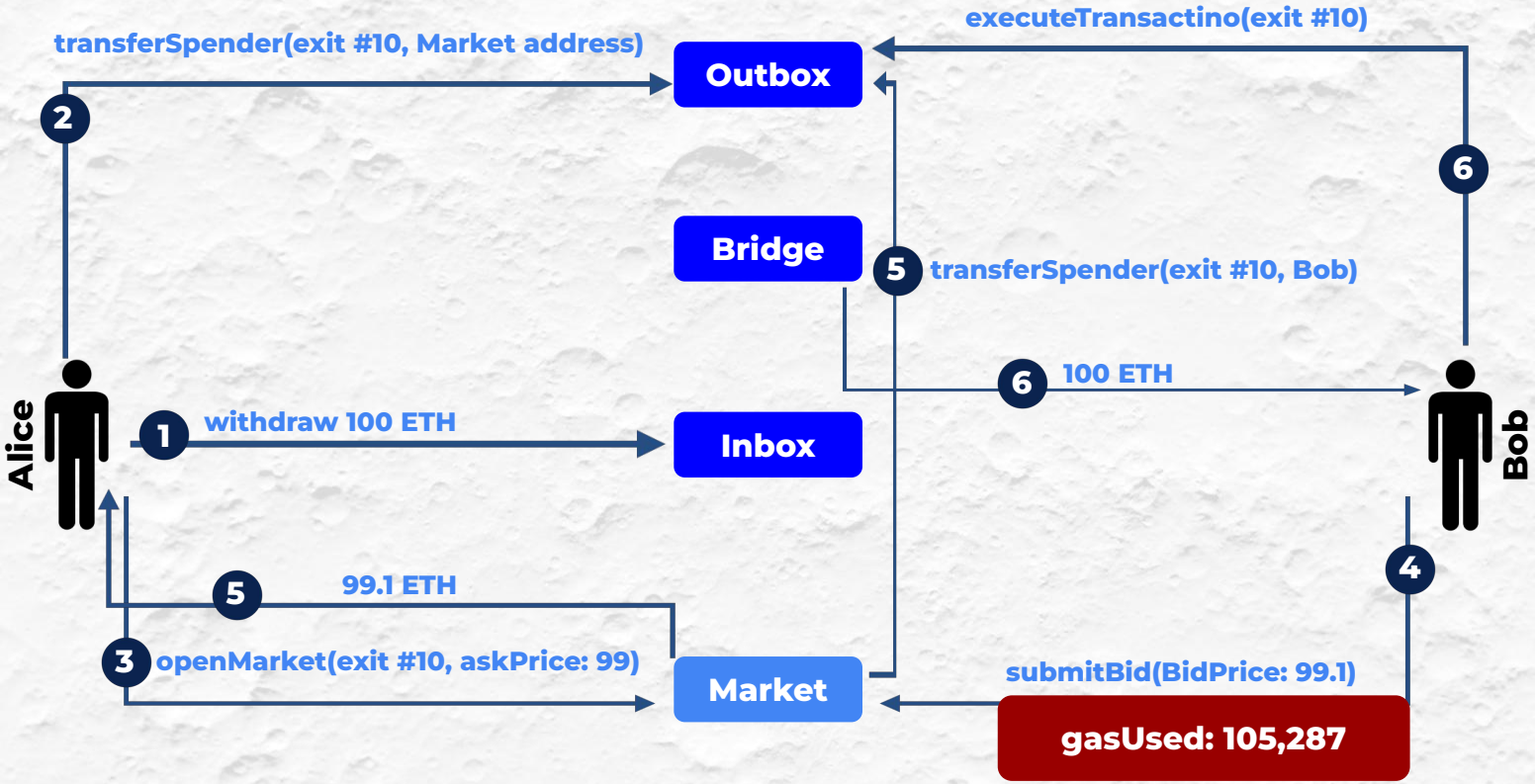

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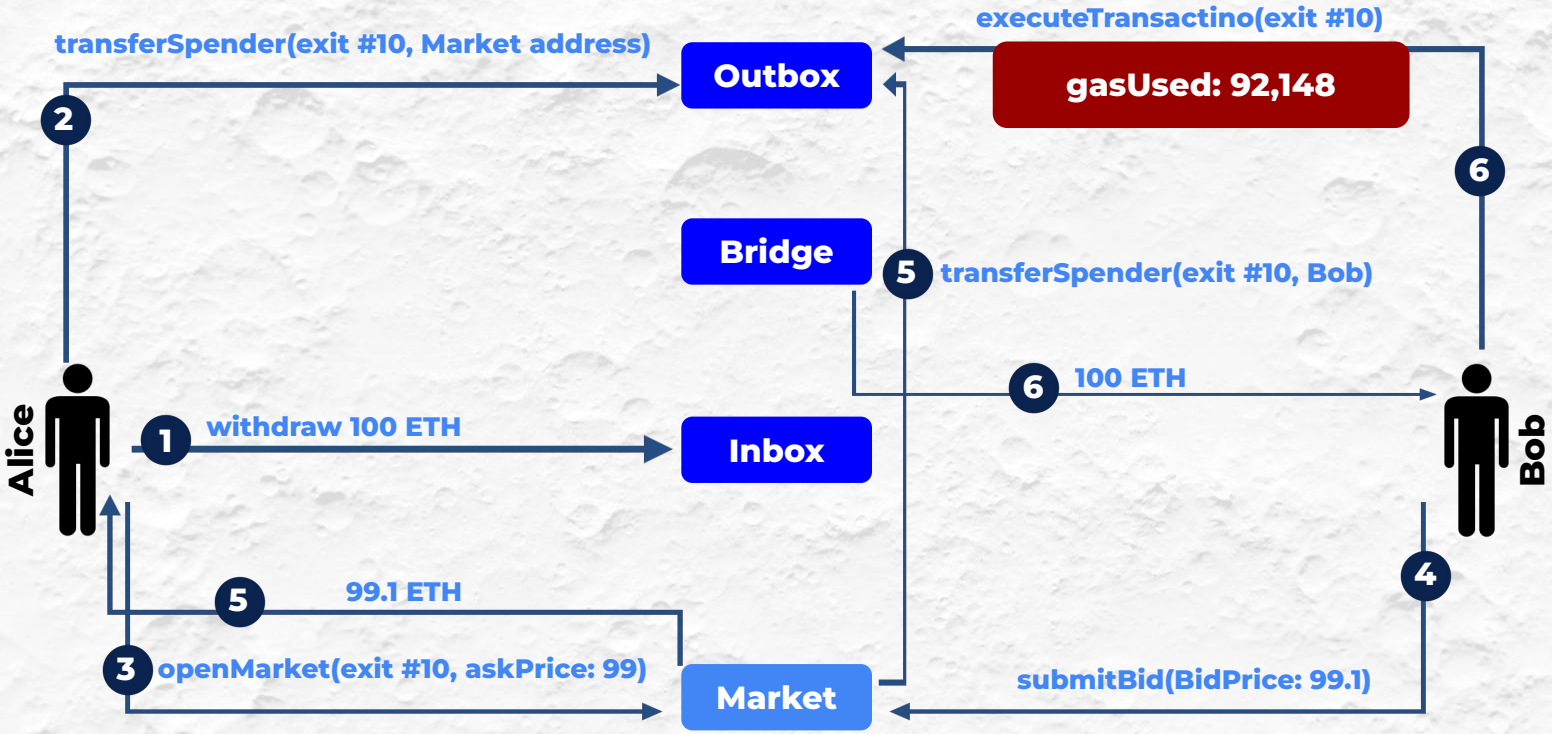

Thank you!

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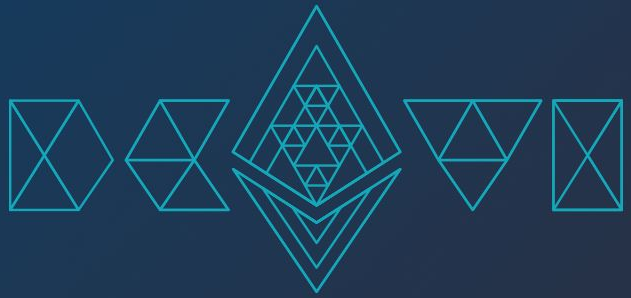

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Section 1

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Section 2 details with a main point. Enter title here.

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Here’s the timeline.

Event 1

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Event 2

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Event 3

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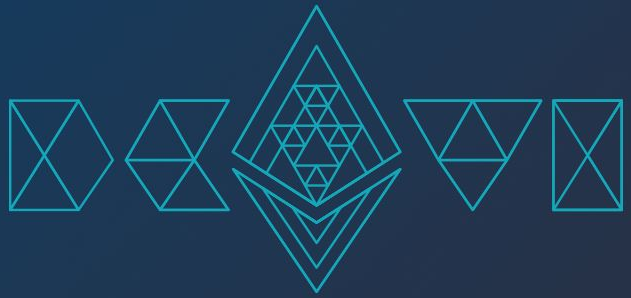

Thank you!

Your Name

Your title, your organization

email@emailaddress.com

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