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EVM TIME CAPSULE

NOVEL ENCRYPTION PROTOCOL VIA VERIFIABLE DELAY FUNCTION (VDF)

ETHGlobal 2023 Hackathon
Istanbul, Turkey

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Memento is a dapp for storing private notes and media on a public blockchain to be unlocked in the future.

Powered by a novel EVM time-locking privacy protocol, built from scratch and inspired by Proof-of-Time consensus algorithm.

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Potential Use Cases of Time Capsule Encryption - 1

- **Digital Time Capsules**
  Users can create digital time capsules, storing personal memories or significant historical events, to be revealed at a future date.

- **Wills and Inheritance**
  Individuals can use Memento to store their wills or details of inheritance, which can be time-locked to be revealed or accessed only after their passing, ensuring privacy and reducing the risk of premature disclosure or tampering.

- **Future Predictions and Time Capsules**
  Users or groups could store predictions about the future or messages to their future selves, to be unlocked years later to see if they came true.

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Potential Use Cases of Time Capsule Encryption - 2

- **Educational Uses**
  Teachers can store educational content, revealing it to students at a predetermined time to align with their curriculum.

- **Confidential Business Agreements**
  Businesses can time-lock sensitive agreements, contracts, or strategic plans, ensuring they remain confidential until a specified future date.

- **Personal Goal Setting**
  Individuals can set goals and lock away messages of encouragement or reminders, which will be revealed at future checkpoints.

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Potential Use Cases of Time Capsule Encryption - 3

- **Event Planning and Announcements**
  Event organizers can create buzz by time-locking important announcements or details about upcoming events, creating a sense of mystery and excitement.

- **Artistic Projects**
  Artists and writers can use Memento to release their works publicly at a future date, adding an element of surprise and anticipation to their art.

- **Historical Record Keeping**
  Governments or organizations can store important historical documents to be unlocked at significant future anniversaries or milestones.
- **Research Data Release**
  Scientists can time-lock their research data or findings to be released in the future, allowing for timed disclosure of sensitive or impactful information.

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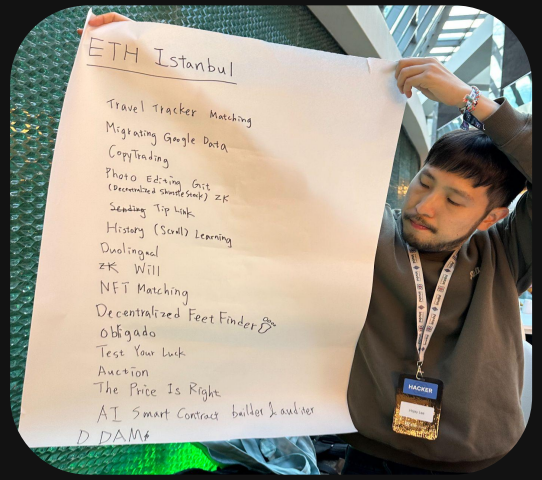
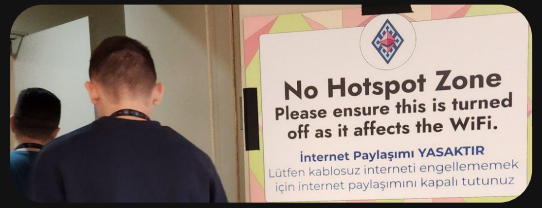
As most hackers, we just wanted to build some privacy dApps on EVM...





...but, surprisingly there was no tech to time-lock a content fully on chain in Ethereum ecosystem yet.

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"The best way to predict the f u t u r e is to invent it."

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The Giant Pivot: Let's propose an EIP!

ethereum / EIPs

Code | Issues 10 | Pull requests 77

Edit | Code | Jump to bottom

EIP for Time Capsule Encryption via Verifiable Delay Functions (VDFs) #7971

Open

hojayxyz wants to merge 1 commit into `ethereum:master` from `hojayxyz:patch-2`

Conversation 2 | Commits 1 | Checks 15 | Files changed

hojayxyz commented 53 minutes ago • edited

Add EIP Draft: Time Capsule Encryption via VDFs

ethereum-magicians.org/t/eip-for-time-capsule-encryption-via-verifiable-delay-functions-vdfs/16

✨ Fellowship of Ethereum Magicians ✨

EIP for Time Capsule Encryption via Verifiable Delay Functions (VDFs)

EIPs erc, evm

hojayxyz 1h

EIP for Time Capsule Encryption via VDFs - Seeking Community Feedback

I am excited to share with the community a draft of an Ethereum Improvement Proposal (EIP) that I've been working on, titled "Time Capsule Encryption via Verifiable Delay Functions (VDFs)." This proposal introduces a mechanism to securely encrypt content on the Ethereum blockchain with a time-delayed decryption feature.

Overview of the EIP

The primary goal of this EIP is to enhance the Ethereum ecosystem by enabling secure, time-locked encryption of data. This would be particularly useful for applications requiring time-bound confidentiality, such as sealed bidding, timed message releases, or digital inheritance.

Key features of the proposal include:

- **Secure On-chain Encryption:** Users can encrypt content (text or files) and upload it to the blockchain.
- **Time-Delayed Decryption:** Decryption is only possible after a pre-defined period, using Verifiable Delay Functions (VDFs).
- **Integrity and Authenticity:** Ensures that the content remains secure and unaltered until the specified unlock time.

Nov 18

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Nov 18

1h ago

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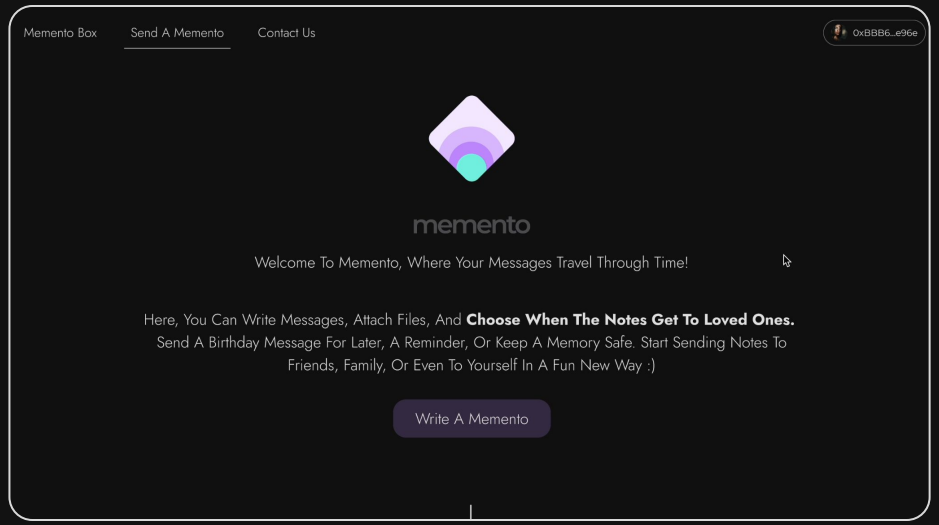
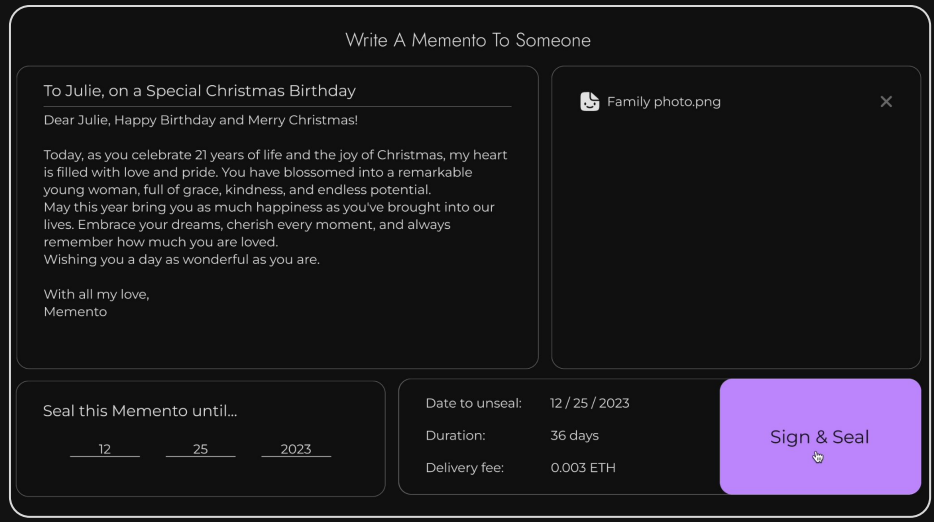
Memento in Action (sending)





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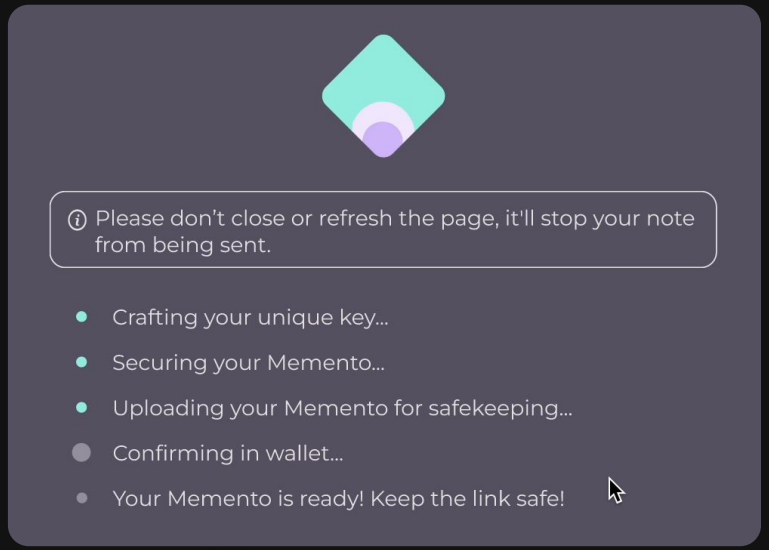
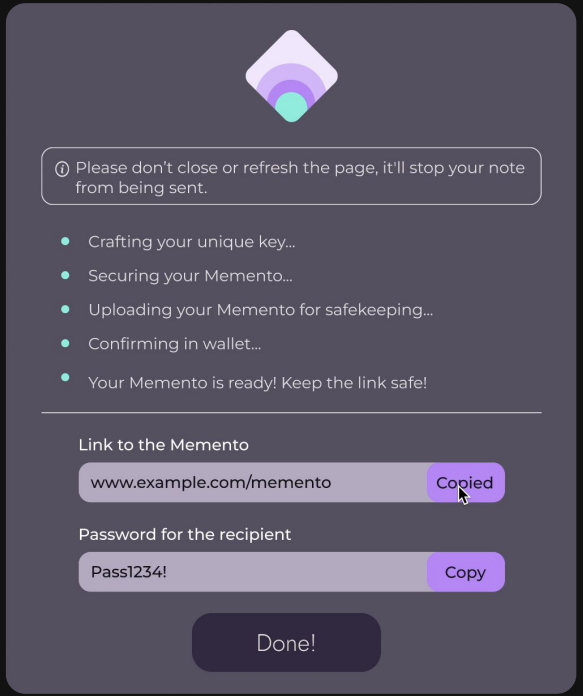
Memento in Action (sending)





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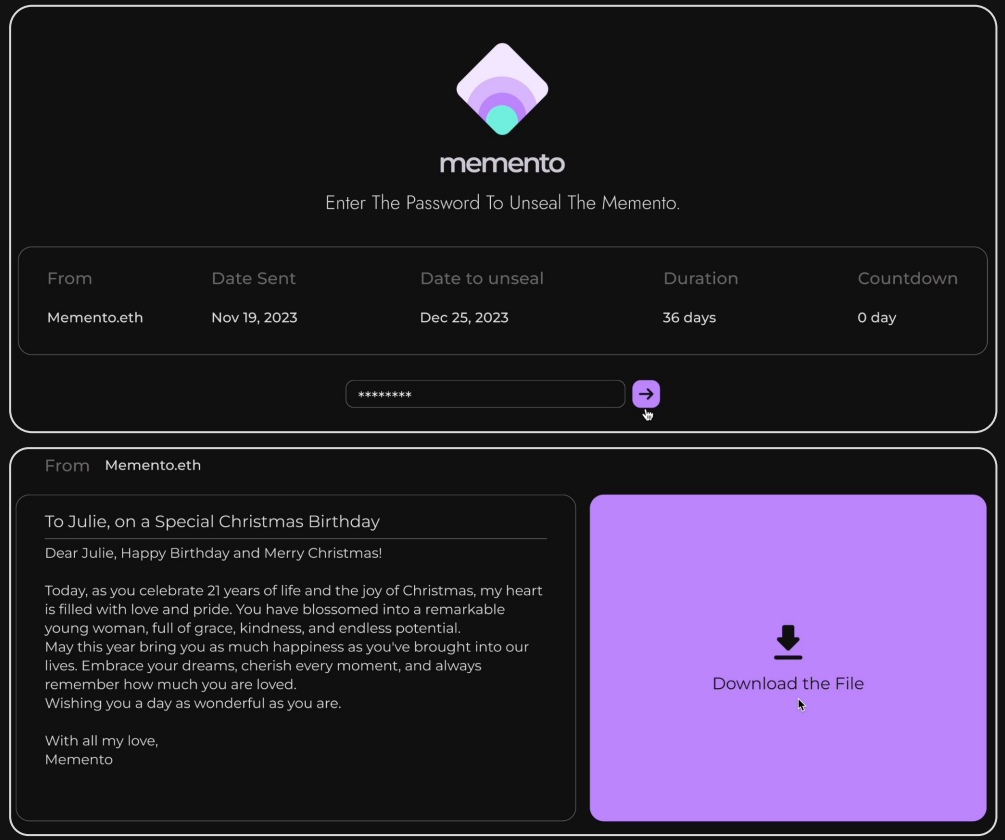
Memento in Action (receiving)



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The tech under the hood

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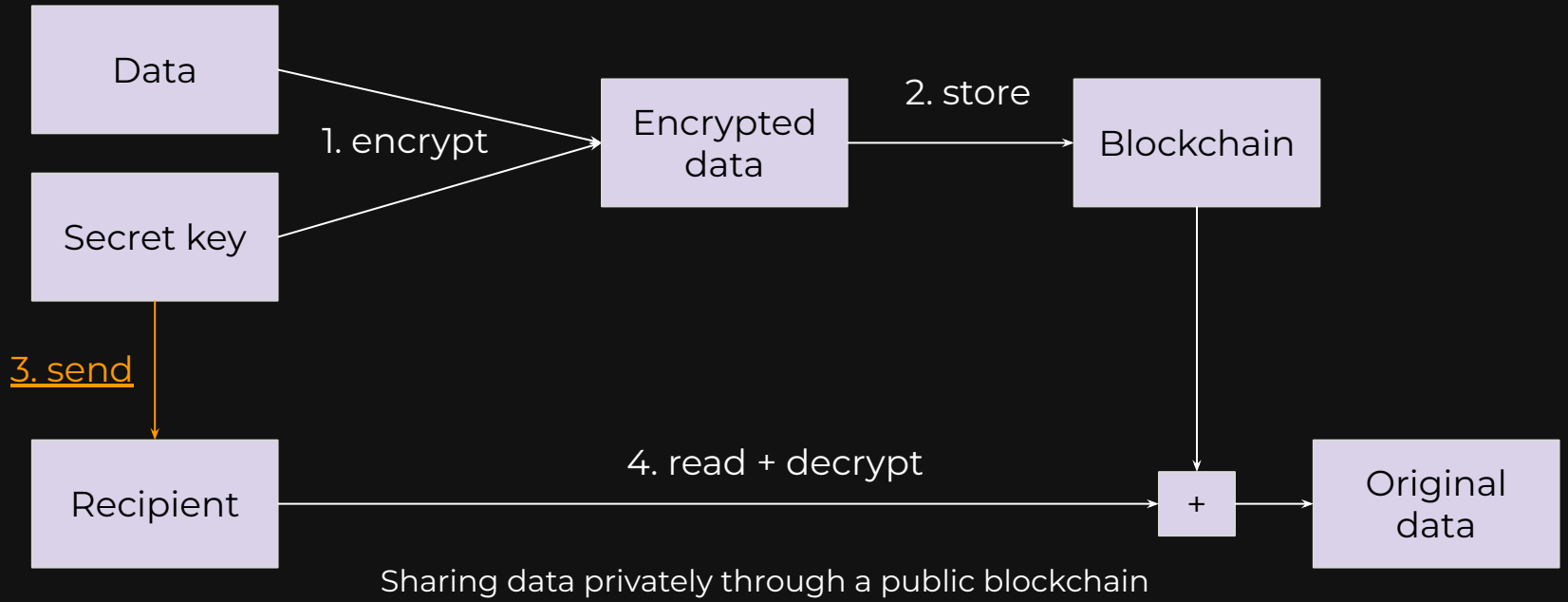
The concept of time-locking puzzles - 1



Sharing data privately through a public blockchain

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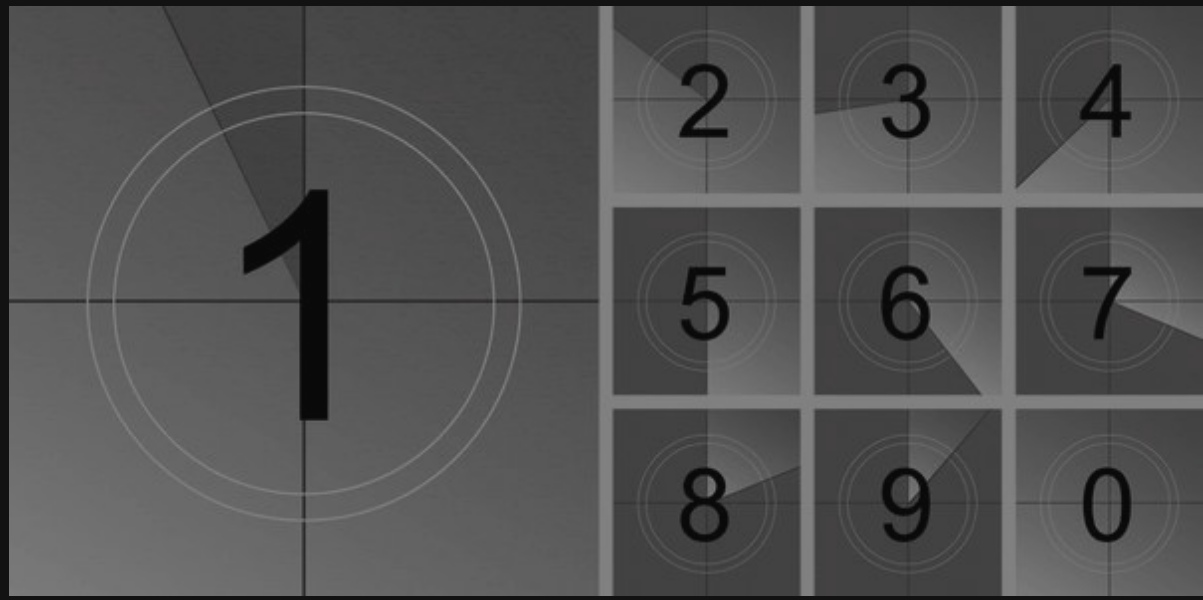
How can we prevent the recipient from reading the message **until a certain moment in the future?**



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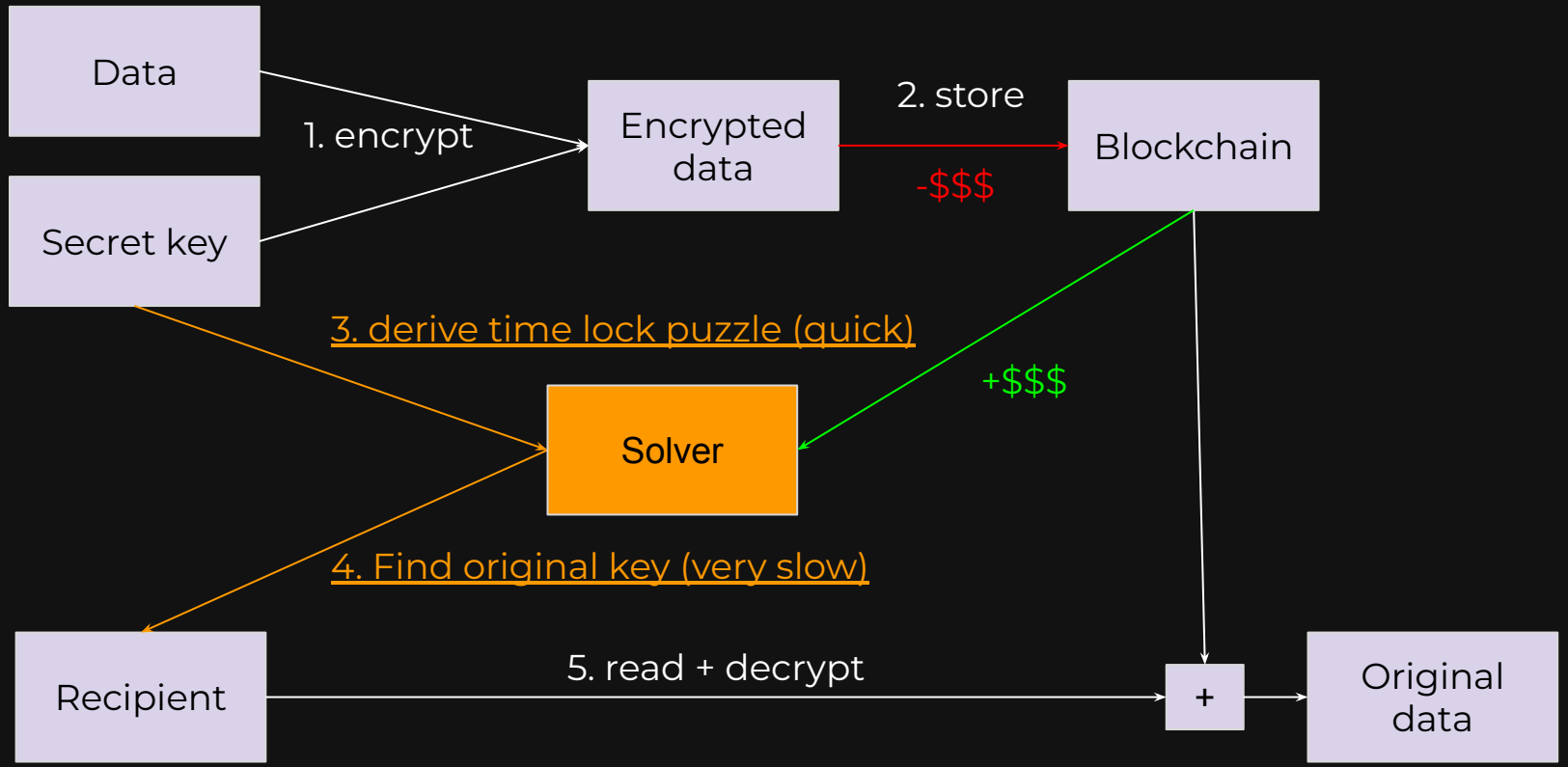
The concept of time-locking puzzles - 2



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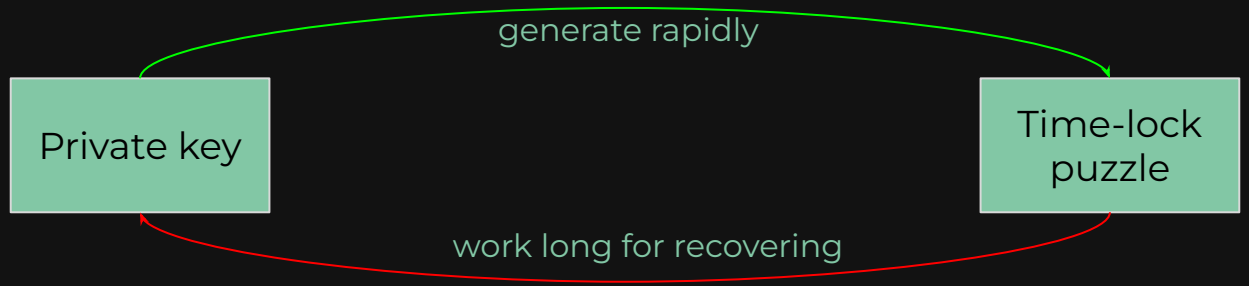
Verifiable Delay Function (VDF)

- Used in Proof-of-time consensus mechanism.
- Can be used for delaying the key delivery
  - Sender generates an encryption secret Y, very rapidly derives X from it and broadcasts it
  - Recipient recovers Y very slowly by recursively running N steps of VDF(X(t)) = VDF(X(t-1)) for the starting value VDF(0) = X



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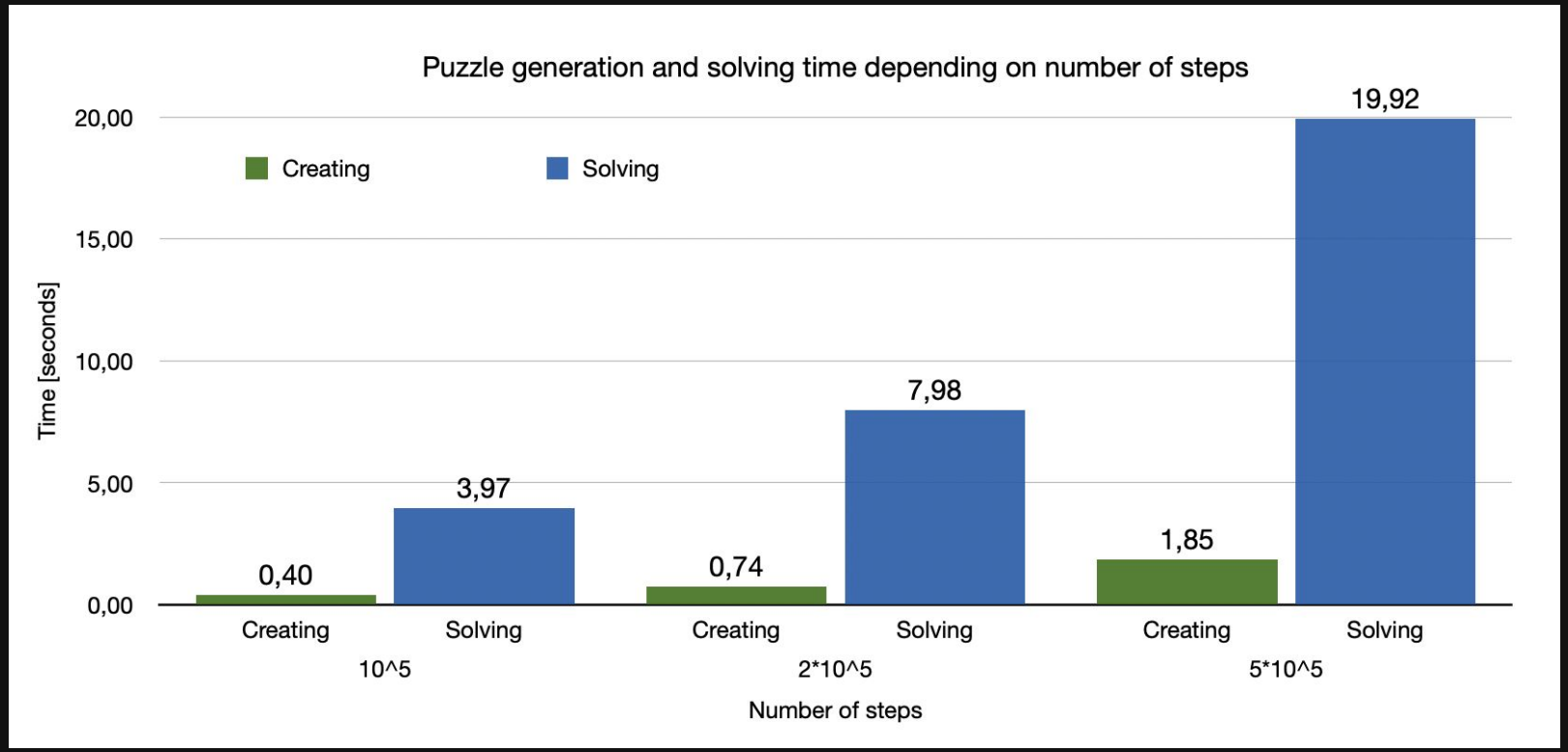
Our Verifiable Delay Function



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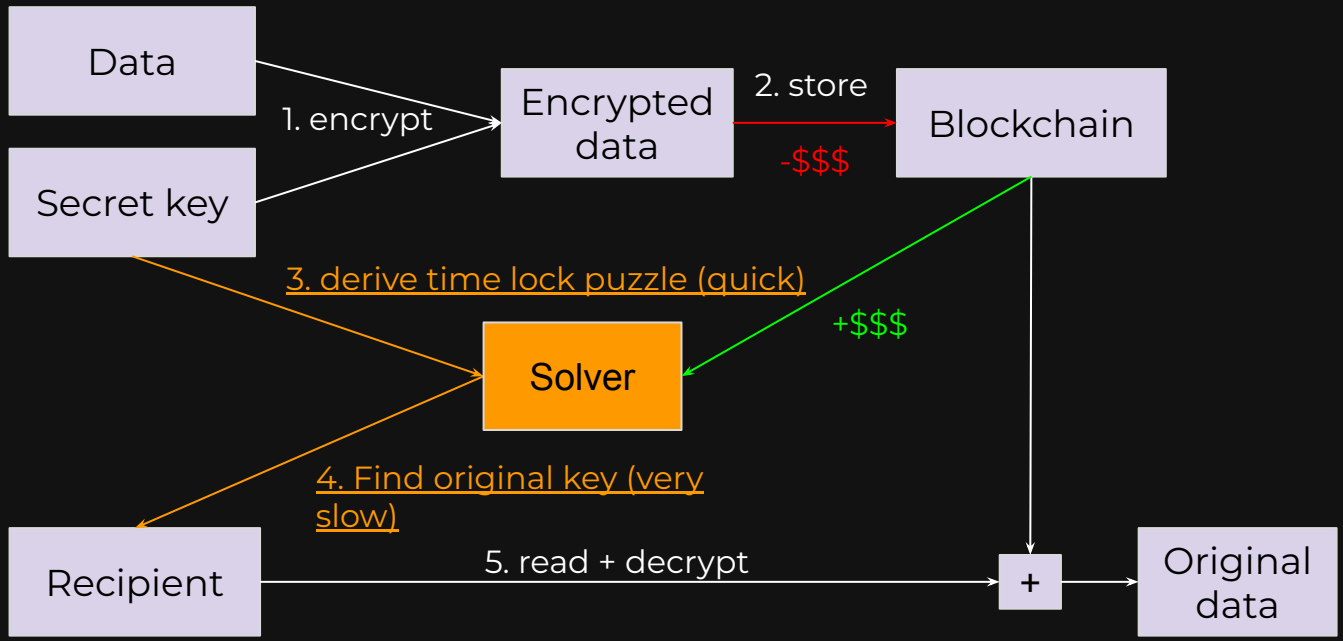
Memento Solver's bounties

- Solvers will be paid to compute small increments of M steps, where M is much smaller than N
- After each small computation the **checkpoint** is made so any other solver can take the computation from there
  - This is the moment the Solver gets a small part of the bounty



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Roadmap

Functionality Implemented In This Hackathon

- Built fully functional Next.js frontend
- Hosted on NEAR x BOS distributed frontend
- Encrypted note and media upload to IPFS fully working
- Rust time-lock puzzle solver implemented in Rust
- Designed a robust protocol with economic incentive for solving time-lock puzzles
- Submitted EIP for it

Future Plans

- Multiple recipients
- Other triggers (proof of life, oracle-driven triggers and others)
- Mobile friendly version
- Implementation of reward distributions to puzzle solvers

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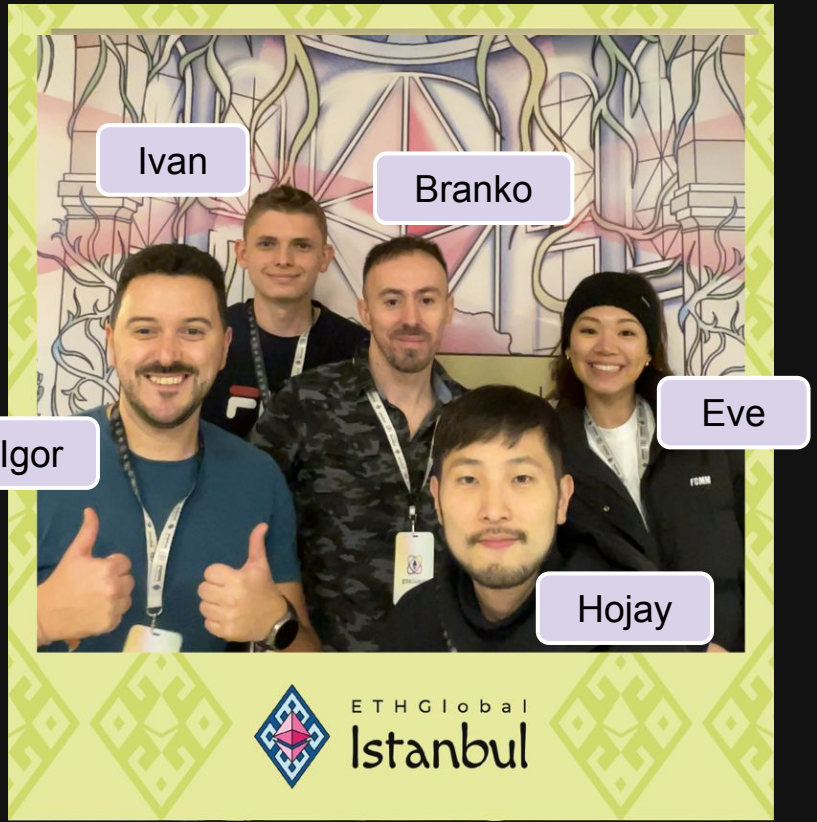
Meet Our Team



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Thank you!