

Hardcore Bank

Implementing Time Deposits with Smart Contracts to Achieve Goals by Conditioning with Negative Reinforcers

January 20, 2022 kumo+bcali WIP

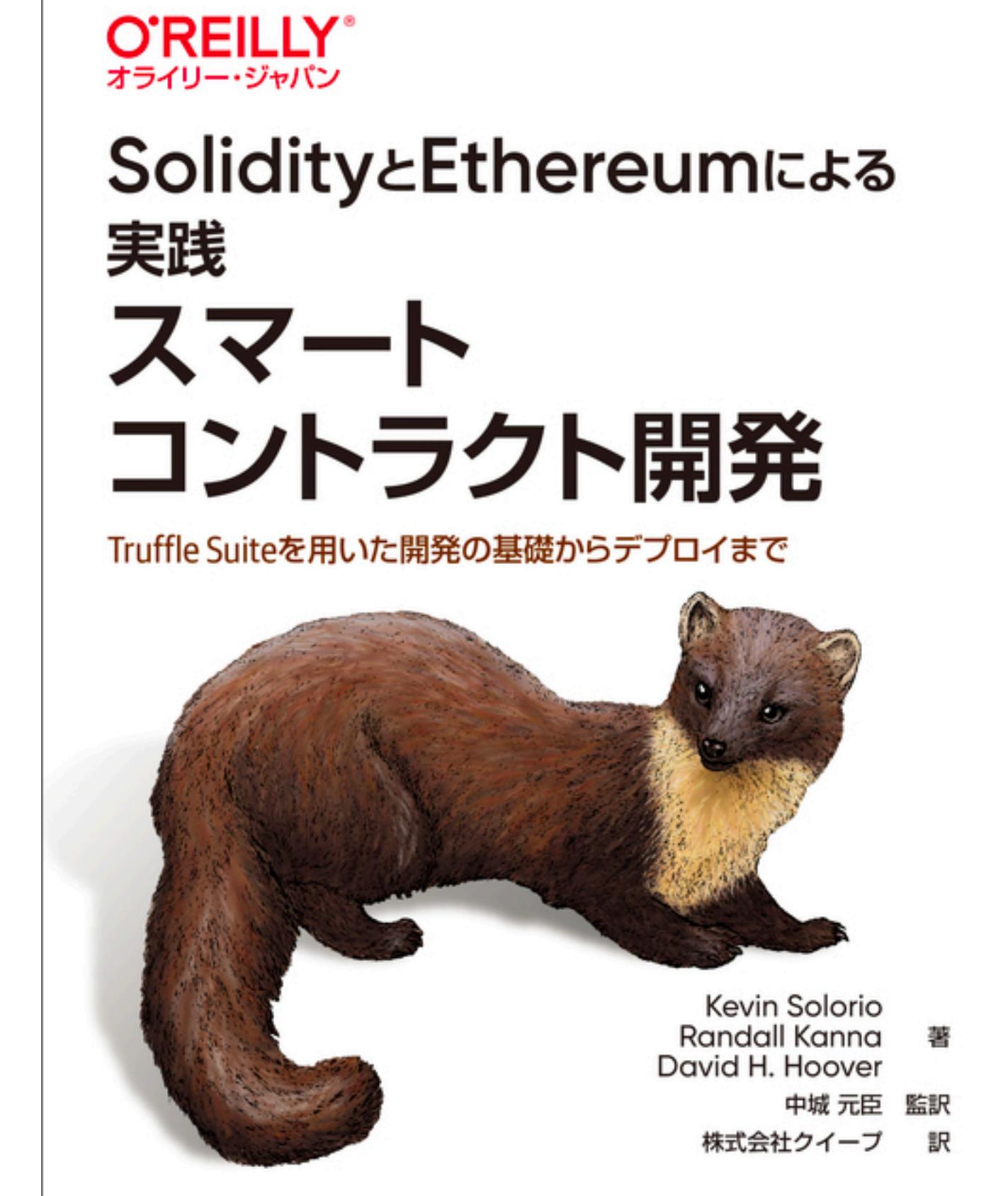
B1 kekeho

0. What I studied in 2021.

Learned Solidity

- I learned Solidity from books.
- As a deliverable, I developed a smart contract from scratch by myself.
- Personally, I've been wanting to implement an extrinsically motivated time deposit.

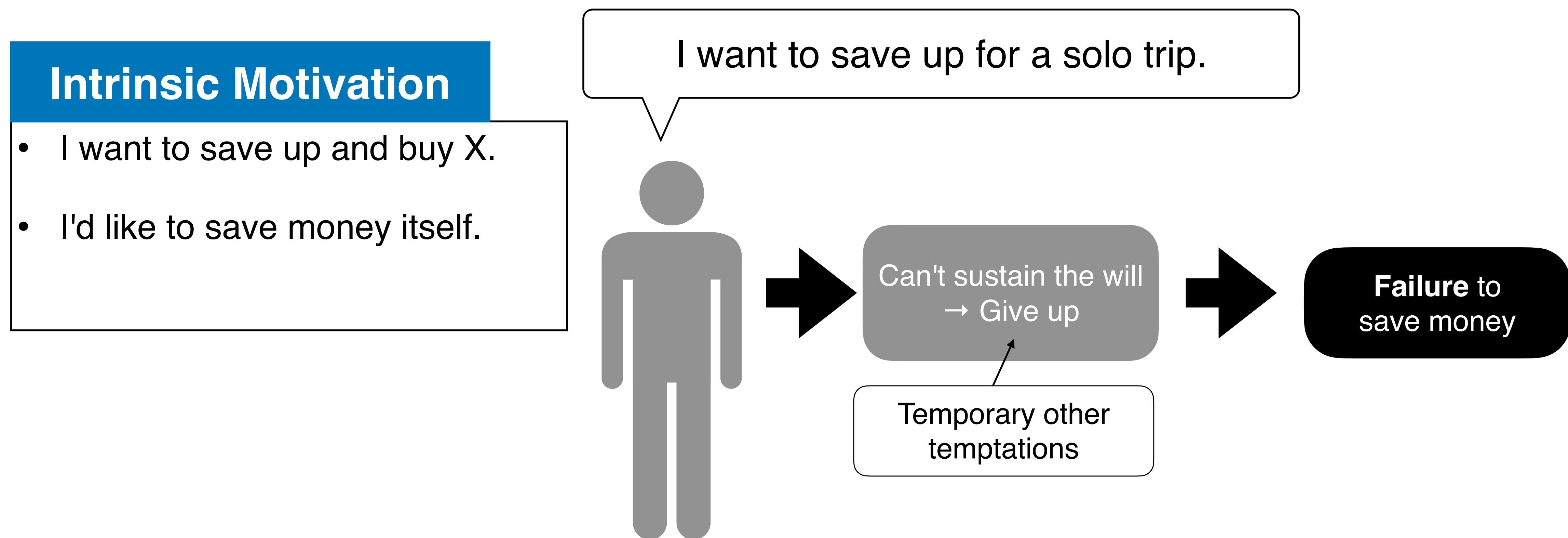
Book I've read



<https://www.oreilly.co.jp/books/9784873119342/>

1. Background

It is difficult for people with **weak willpower** (kekeho) to continue saving only with **intrinsic motivation**.



1. Background

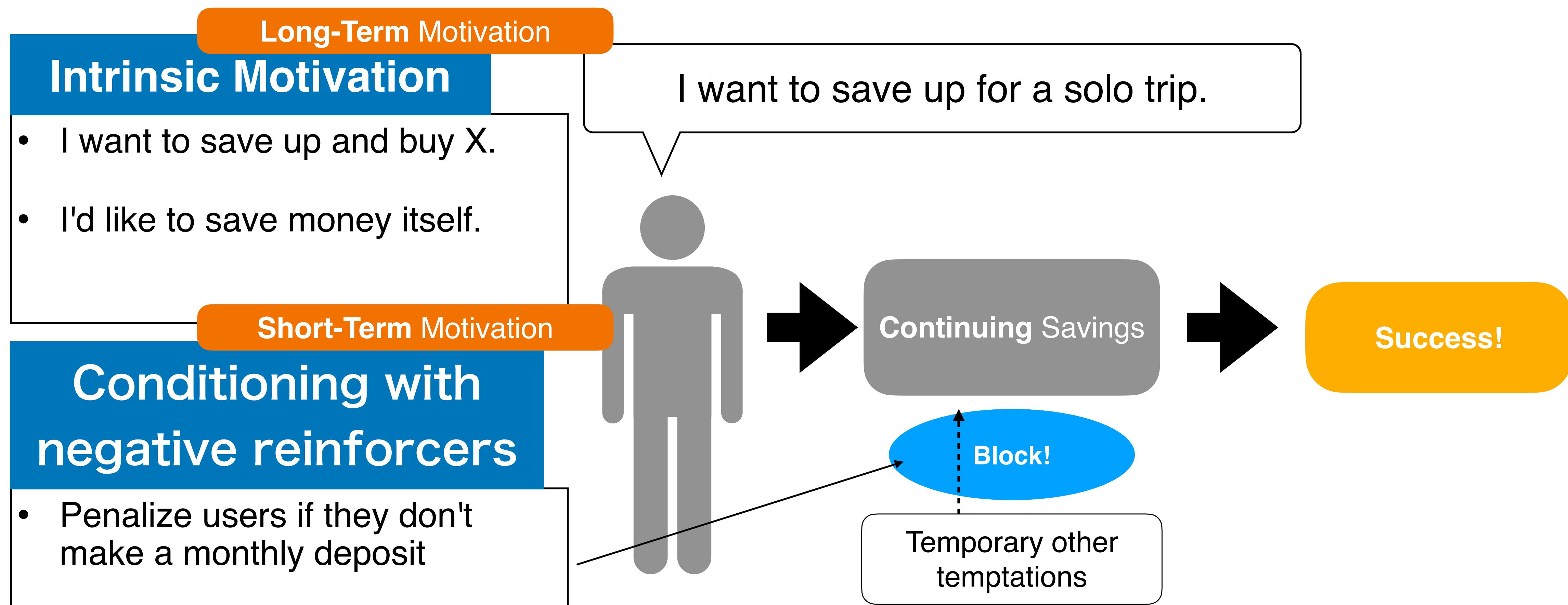
Hypothesis: Conditioning with negative reinforcers may make it easier to save money.

- Instrumental Conditioning
 - The probability of occurrence of the behavior increases or decreases depending on the environmental phenomenon that follows the behavior.
 - **Reinforcement:** A process by which the probability of a behavior occurring increases with the accompanying stimulus.

	Definition	Example
Positive Reinforcement	Behavioral responses are followed by the supply of pleasant or desirable stimuli.	If you study hard and perform well in exams, you will study harder.
Negative Reinforcement	After the behavioral response, the aversive stimulus is removed.	If you can find peace by leaving a noisy place, you will not visit it again.

1. Background

Hypothesis: Conditioning with negative reinforcers may make it easier to save money.

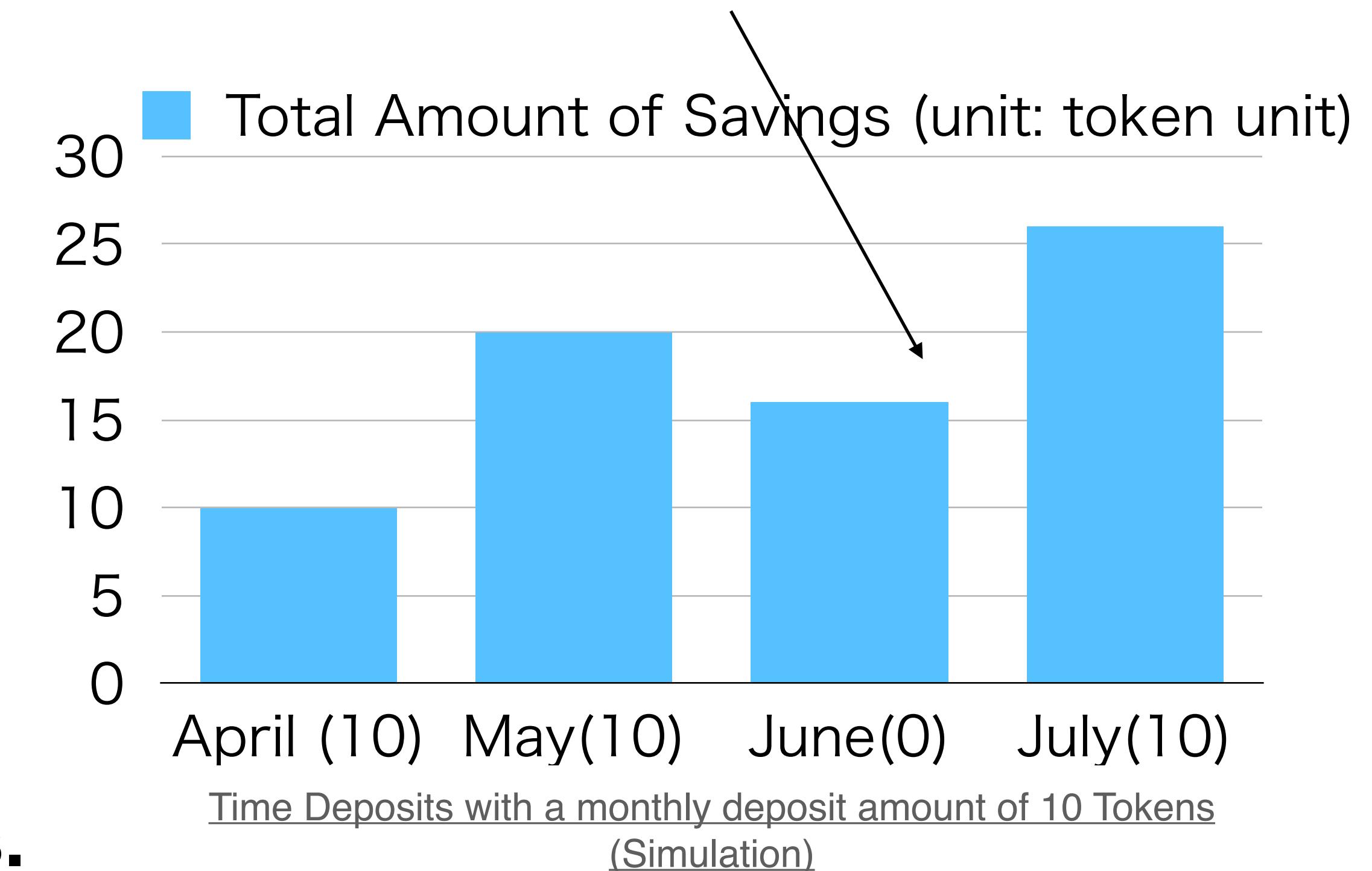


2. Applying Negative Reinforcement

Set up a time deposit account where 20% of your savings will be lost if you fail to meet your monthly target.

- Create a time deposit account with a target amount and a set monthly deposit amount.
 - No withdrawals are allowed until the savings amount exceeds the target amount.
- Negative Reinforcer**
- **If you fail to deposit more than the target amount in each month, you will lose 20% of your accumulated savings.**

No transfer, balance down 20%. Everybody doesn't want this to happen!



2. Applying Negative Reinforcement

Set up a time deposit account where 20% of your savings will be lost if you fail to meet your monthly target.

- **If you fail to deposit more than the target amount in each month, you will lose 20% of your accumulated savings.**
 - The bank owner withdraws the lost money and spends it as he pleases. ← Everybody doesn't want this.
 - We will help users achieve their goals by providing short-term negative reinforcement, such as "*I don't want to lose the assets I have accumulated so far, so I will make another deposit this month.*"

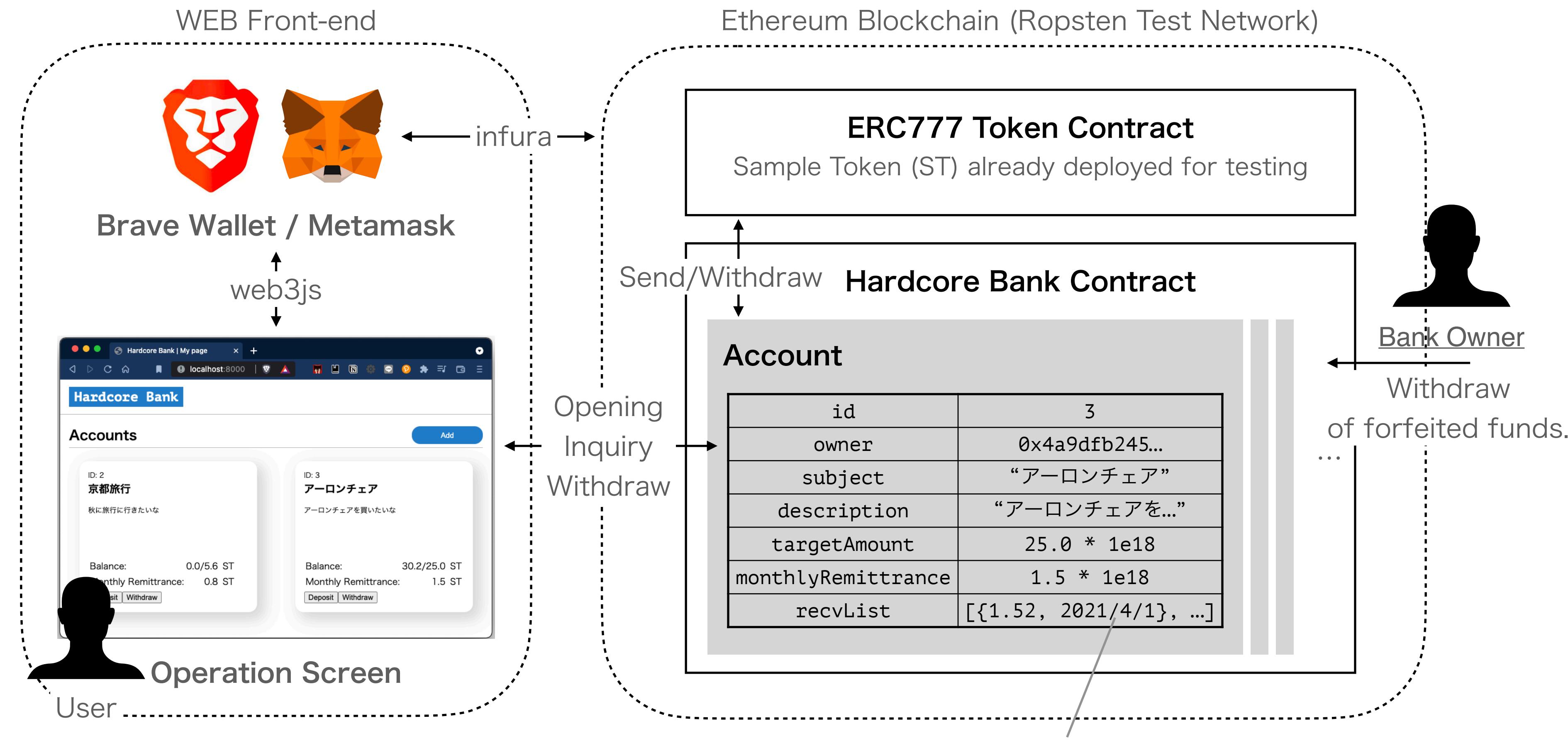
3. Implementation

Implementing Ethereum Smart Contracts

- Implement the aforementioned time deposit account with a smart contract.
- Deposited currency: **ERC777 token**
- Deploy to Ropsten test network

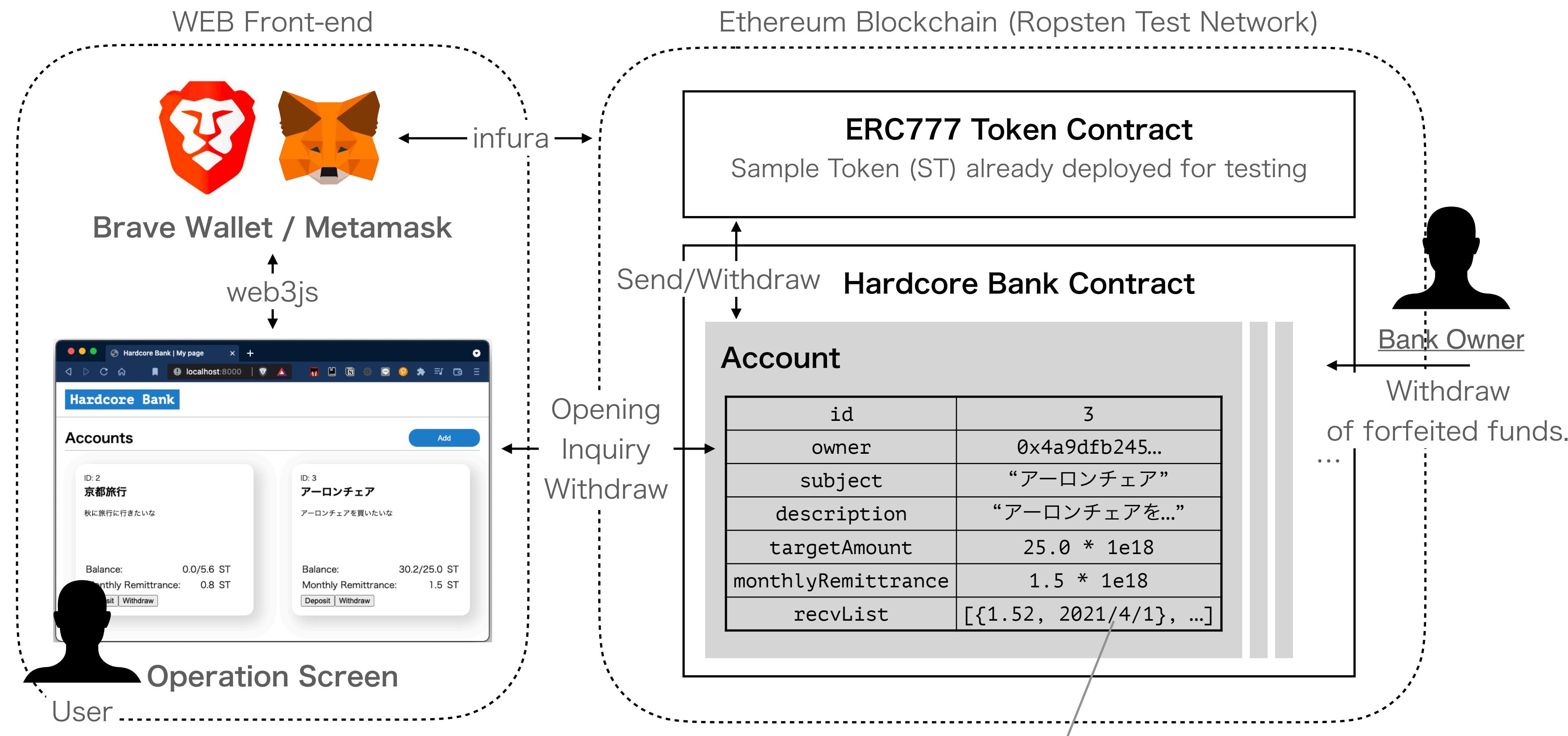
3. Implementation System

- Operation Screen
 - Elm, Javascript (web3js)
- Hardcore Bank Contract
 - Solidity with Brownie



3. Implementation System

- Sample Token Contract
 - For testing
 - Using the OpenZeppelin implementation

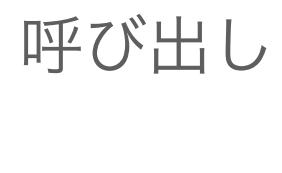


3. Implementation System

- Deploy only one Hardcore Bank contract and it have multiple Accounts as data
 - Users can deploy a contract for each account, but user has to pay 0.08 ETH to register as "ERC777TokensRecipient" in ERC1820 Registry every time...
 - When sending token, specify the account id in the data argument of the send method to send money to a specific account.

```
function send(address to, uint256 amount, bytes calldata data) external;
```

ERC777Token's send method



```
interface ERC777TokensRecipient {  
    function tokensReceived(  
        address operator,  
        address from,  
        address to,  
        uint256 amount,  
        bytes calldata data,  
        bytes calldata operatorData  
    ) external;  
}
```

Hardcore Bank contract's tokensReceived method

3. Implementation

Operation Screen

Opening Account

Hardcore Bank

Create Account

Subject
京都旅行

Description
秋に旅行に行きたいな

Token Contract Address
0x6C5C631707c55c1771D76C27A3890BAf7cf621

Target Amount
5.6

Monthly Remittance
0.8

Create

List of Accounts

Hardcore Bank

Accounts

Add

ID	Name	Balance	Monthly Remittance
2	京都旅行	0.0/5.6 ST	0.8 ST
3	アーロンチェア	30.2/25.0 ST	1.5 ST

Deposit Withdraw

Withdraw

Hardcore Bank

Deposit #3

アーロンチェア

アーロンチェアを買いたいな

Balance: 30.2/25.0 ST

Monthly Remittance: 1.5 ST

Withdraw

4. Discussion

Current Issues: Soaring Fees, The Need for a Demonstration Experiment

- The cost of gas is too high, and it costs a lot of money to open an account and transfer ERC777 tokens.
- Psychological effects need to be verified through empirical experiments.
 - Is a 20% reduction rate appropriate? It is necessary to find the appropriate rate of decrease.

5. Future Plans

What I want to do during spring break and next year

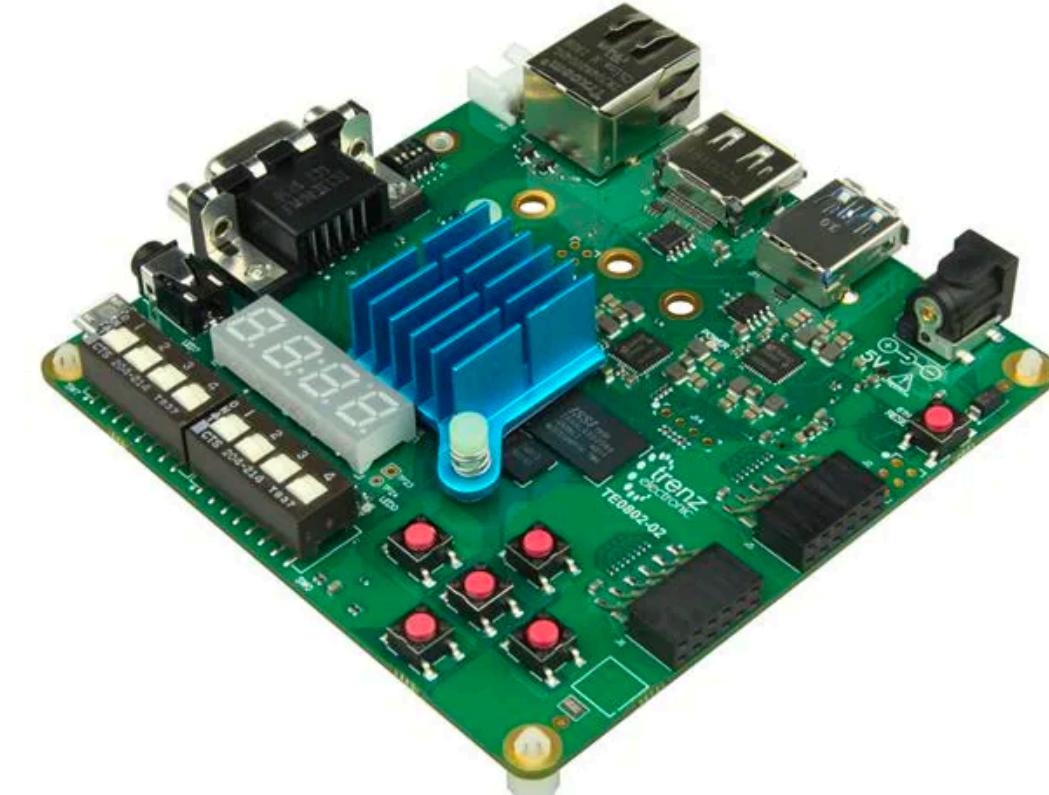
- Make an ERC777 compliant stabling token (unsecured type)
- I'd like to study some lower layers and do some research-like work.
 - Low layer of Blockchain
 - FPGA
 - I'd like to build a very fast HTTP server and host my blog on it.
 - I've been playing with FPGAs for a few days now. I'd like to try it for a year or two.



VerilogでLEDを光らせて遊んだ



読了(実機で遊んだ)



5. Future Plans

What I want to do during spring break and next year

- I want to digest my stack of books.



And more...

References

1. S. Nolen-Hoeksema, B. L. Fredrickson, G. R. Loftus, and C. Lutz, Atkinson & Hilgard's Introduction to Psychology (Japanese Edition), 16th ed. Kongo shuppan, 2015, isbn: 9784772414388.
2. J. Dafflon, J. Baylina, and T. Shababi, Eip-777: Token standard, <https://eips.ethereum.org/EIPS/eip-777>, (Accessed on 01/20/2022).
3. F. Vogelsteller and V. Buterin, Eip-20: Token standard, <https://eips.ethereum.org/EIPS/eip-20>, (Accessed on 01/20/2022).