An Analysis of Atomic Swaps on and between Ethereum Blockchains

Research Project I

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Centralized cryptocurrency exchanges

- Transactions via the exchange
- Exchanges hold funds
- SPOF (wallet database)
- Hacks and disappearances
- Untrustworthy trusted third party

Atomic swaps

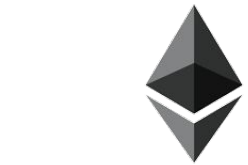
- More decentralized process
- Less dependence on (centralized) third parties
- Less chance of loss of funds

“A transaction between two parties that does not depend on a third party, for instance a centralized exchange, and either happens in full, or not at all.”

Are there reliable methods for making atomic swaps on and between blockchains?

Ethereum

- TNO Techruption blockchain
- Ethereum Classic (ETC) & Quorum
- Mining process similar to Bitcoin (PoW)
- Smart contracts



ethereum

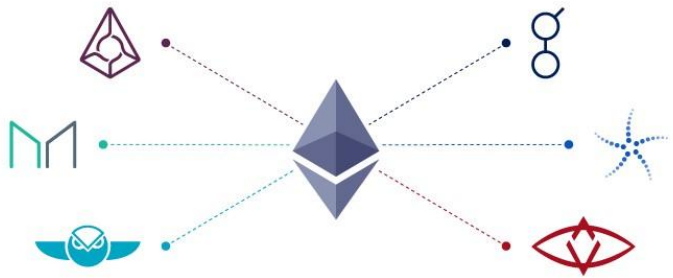
Smart contracts

- Programs stored on the blockchain
- Solidity
- Static and open-source code
- Gas costs
- Executed by miners to verify
- Tokens are implemented using smart contracts

ERC-20 Token Standard

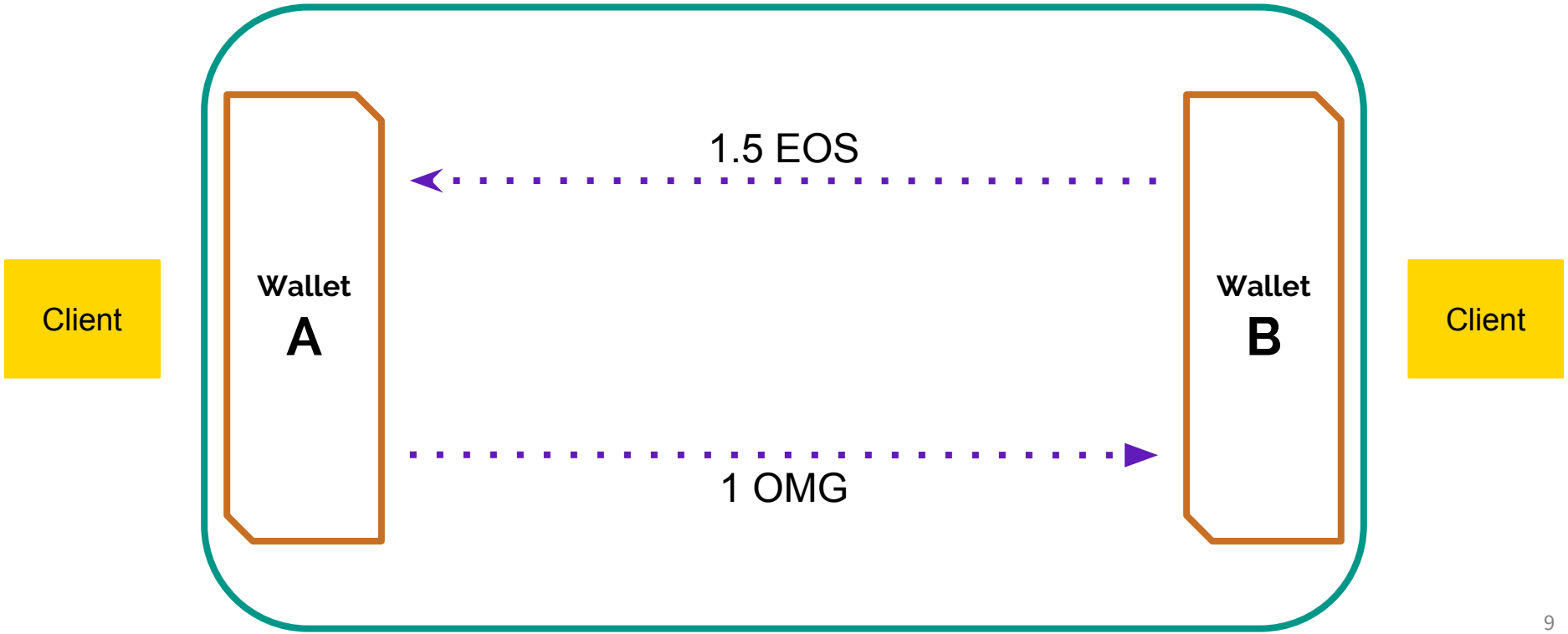
- Homogeneity
- Smoother integration with crypto software.
- Requires the implementation of the ERC-20 interface
    - Return total supply
    - Keep track of wallet balances
    - Transfer tokens
    - Allowances

Types of atomic swaps

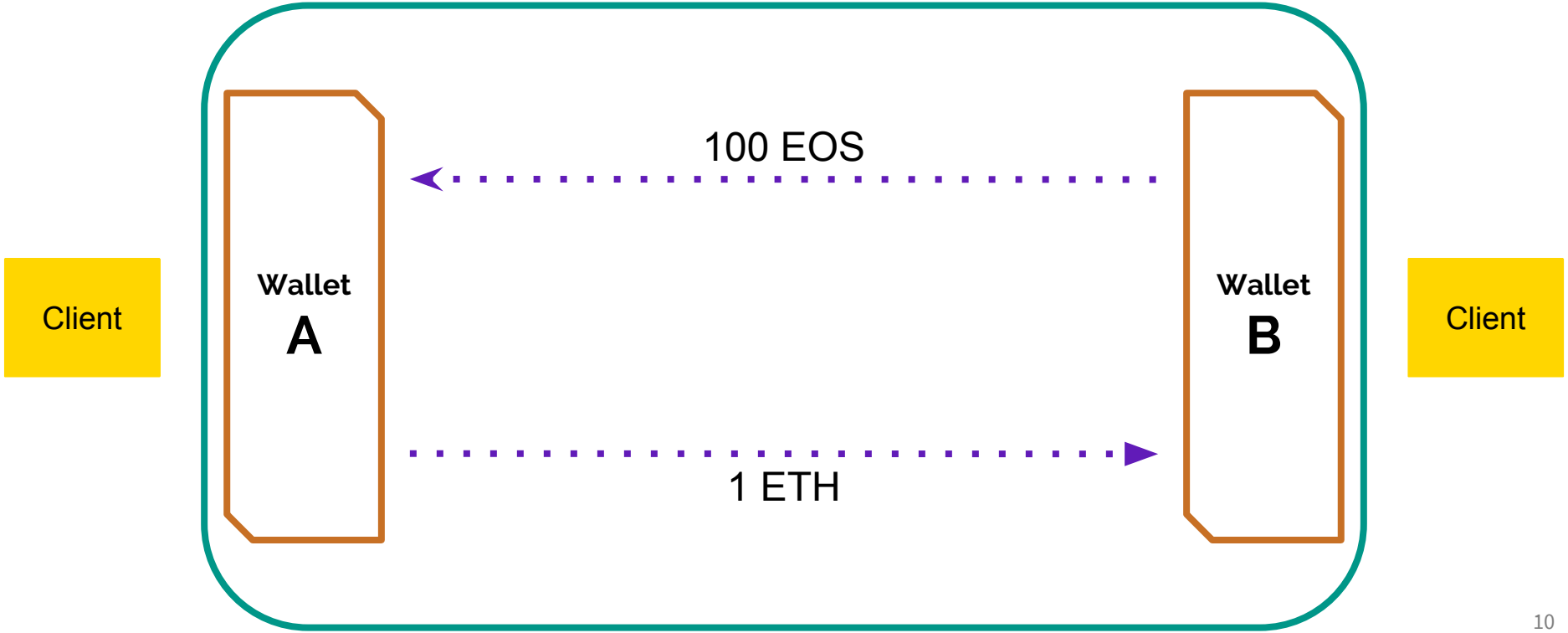


1. Single-chain token swaps
2. Single-chain coin/token swaps
3. Cross-chain coin swaps
4. Cross-chain token swaps
5. Cross-chain coin/token swaps

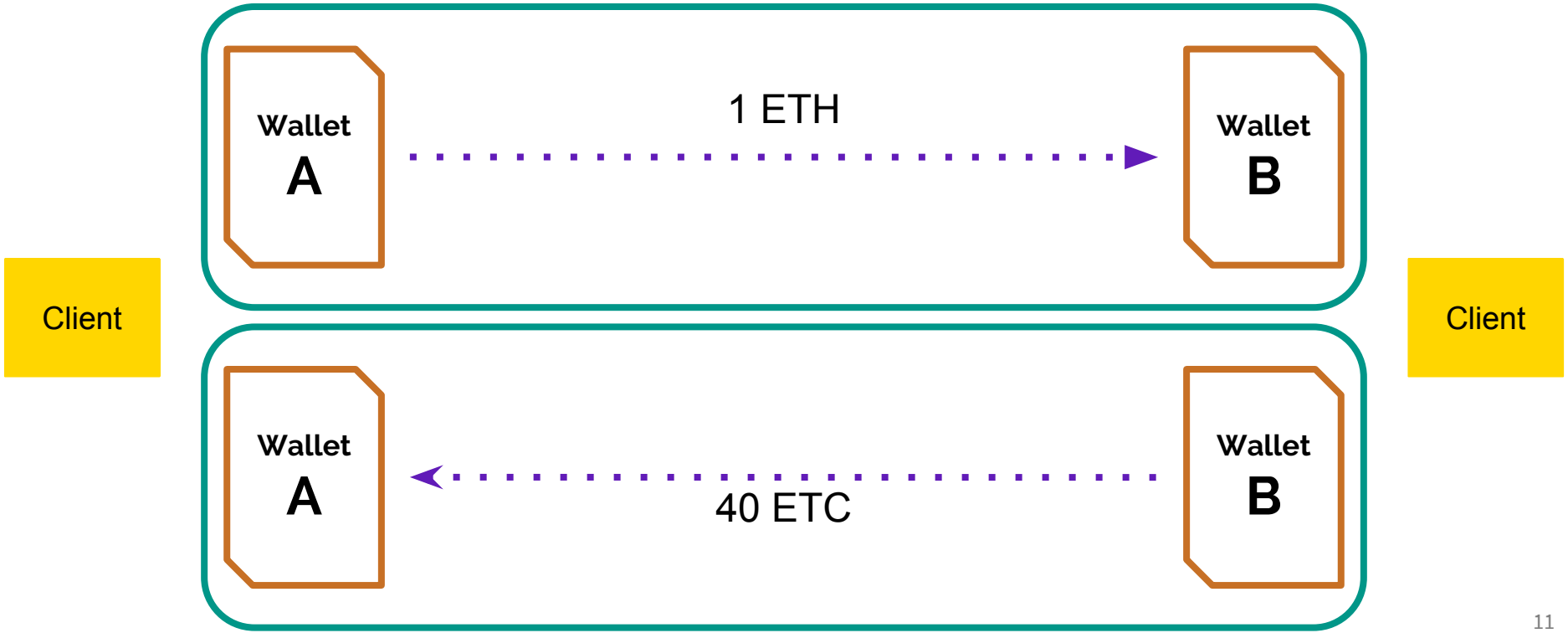
1. Single-chain token swap



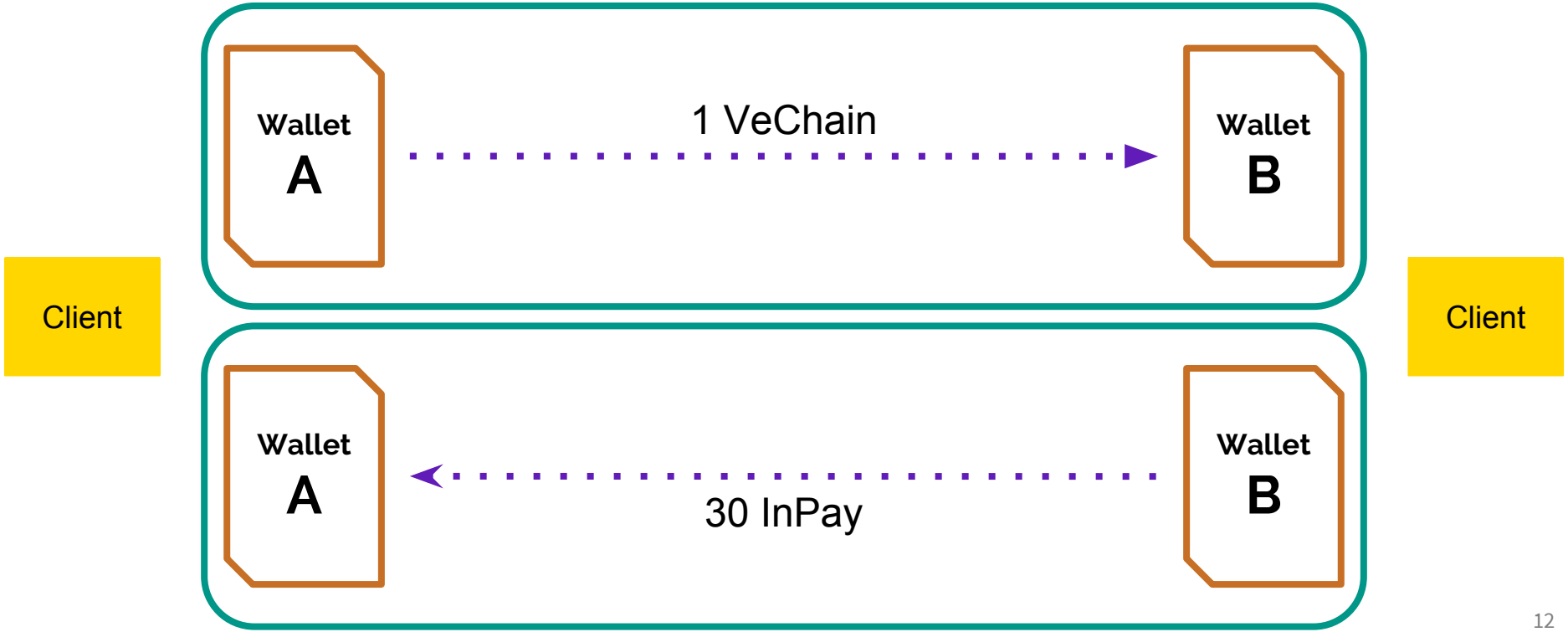
2. Single-chain token/coin swap



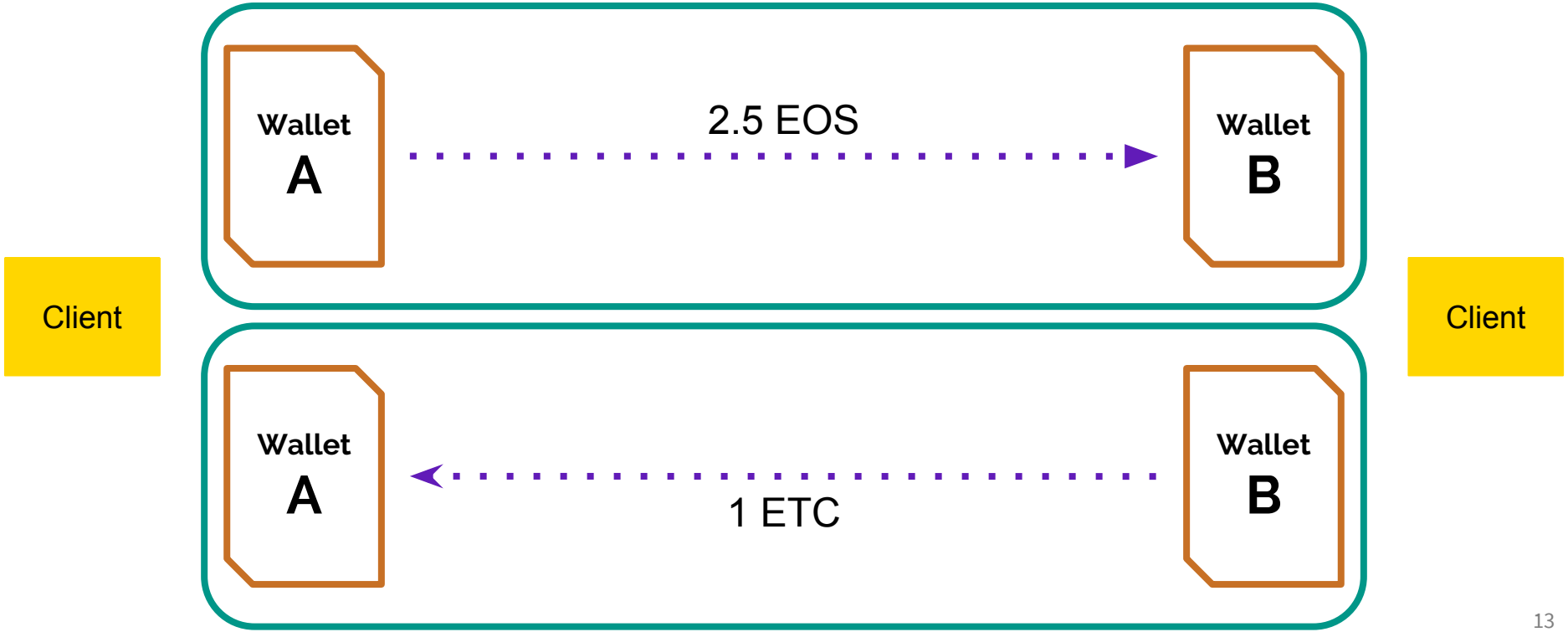
3. Cross-chain coin swap



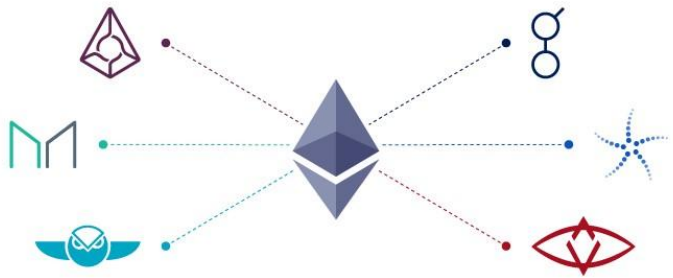
4. Cross-chain token swap



5. Cross-chain token/coin swap



Types of atomic swaps

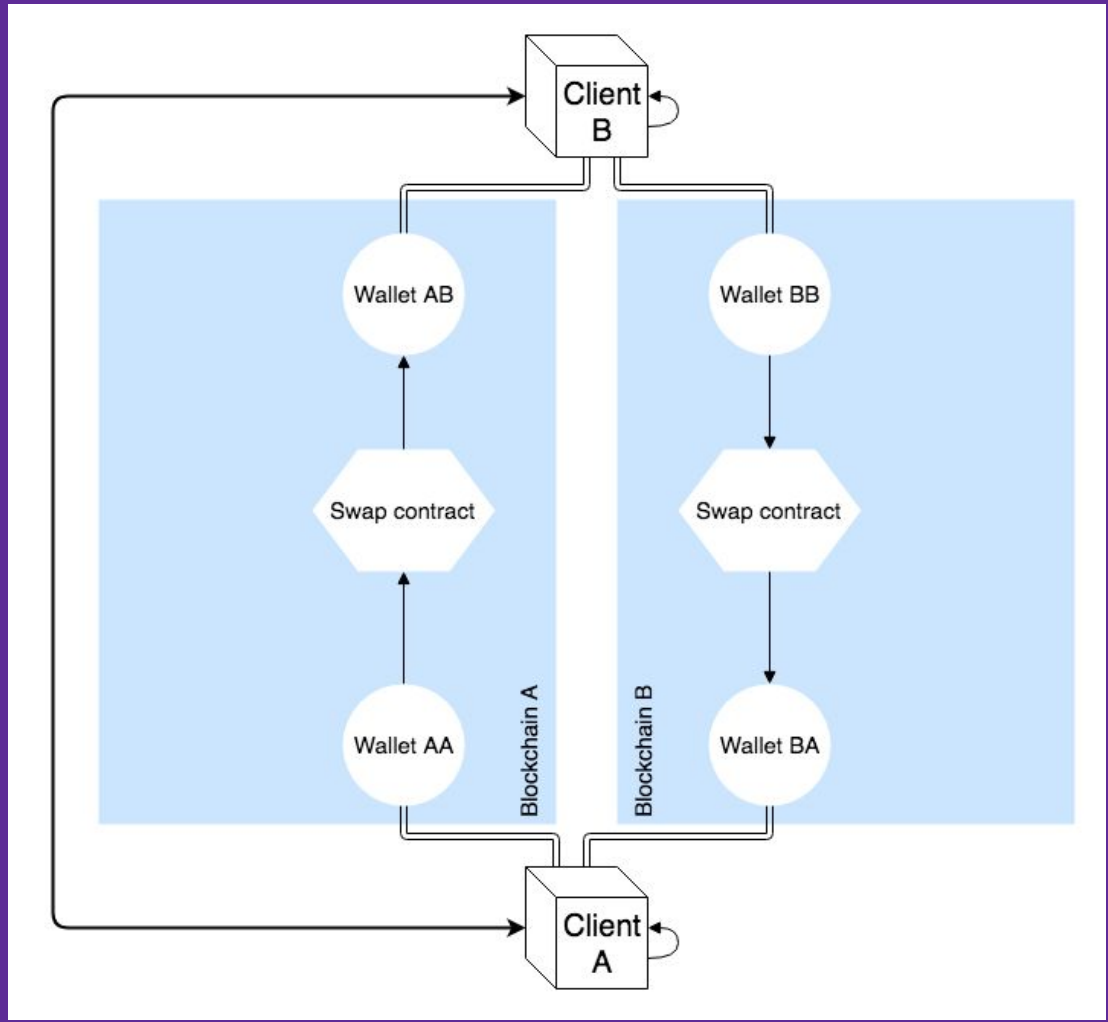


1. Single-chain token swaps
2. Single-chain coin/token swaps
3. Cross-chain coin swaps
4. Cross-chain token swaps
5. Cross-chain coin/token swaps
6. *Single-chain coin swaps*

Design & implementation

- Single usage swap contracts
- Transaction via the contract
- Rinkeby & Ropsten test networks
- Hashed TimeLocked Contract (HTLC)
- Compatible with all ERC-20 tokens

Cross-chain coin swap

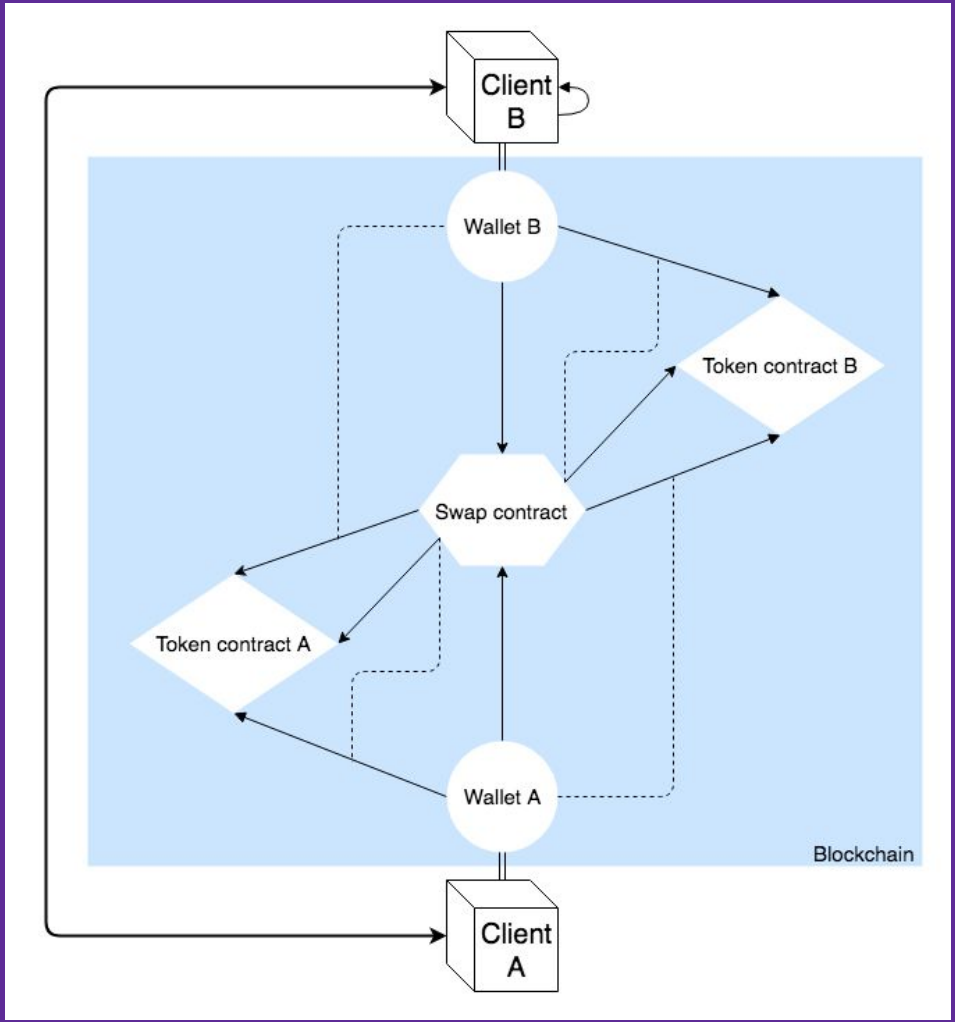


Why is this atomic?

- If client A does not claim their funds, client B cannot either
- If client A claims, they reveal the secret to client B, who can then can also claim their funds

```
function claim(string _secret) public returns (bool) {
    if (hashed_secret == sha256(_secret) &&
      now < timeOut){
         selfdestruct(clientB);
    } else {
         return false;
    }
}
```

Single-chain token swap



Why is this atomic?

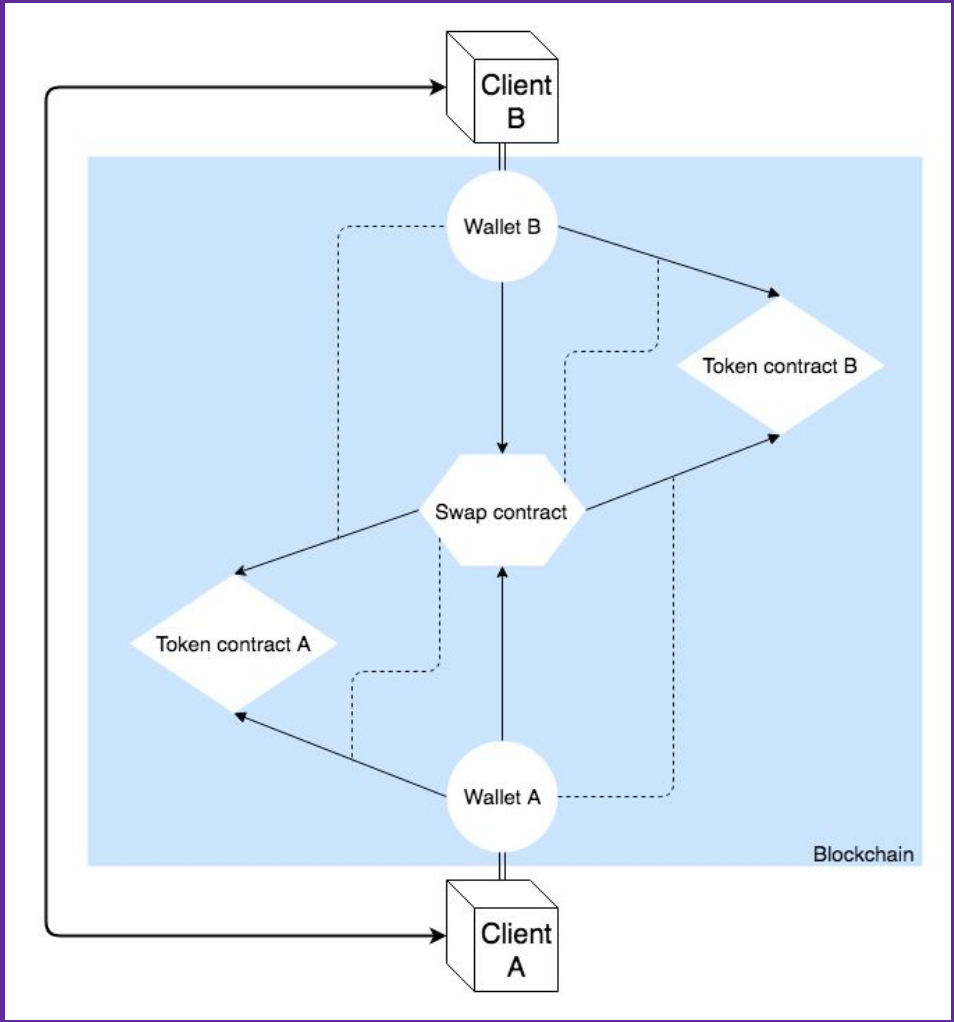
- When claim() is called the contract is in full control of the funds

```
function claim() onlyParticipant public returns (bool) {
    uint token1_balance = token1_instance.balanceOf(this);
    uint token2_balance = token2_instance.balanceOf(this);
    if (token2_balance >= amountOf_token2 &&
      token1_balance >= amountOf_token1 && now < timeOut) {
        token1_instance.transfer(clientB, token1_balance);
        token2_instance.transfer(clientA, token2_balance);
        selfdestruct(clientA);
    } else {
        return false;
    }
}
```

Reusable contracts

- Indefinitely and concurrently
- Scales better
- No deployment costs

Reusable single-chain token swap



Conclusion

- Reliable swaps are possible

Project git repository:
`github.com/clvang000/SNE_TNO_RP1`

Future research

- Reusability
- Other blockchains
- Off-chain
- Decentralized exchanges (use cases)
- Investigate attack vectors

Questions . . .

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