Patterns:

- Repository of sample code

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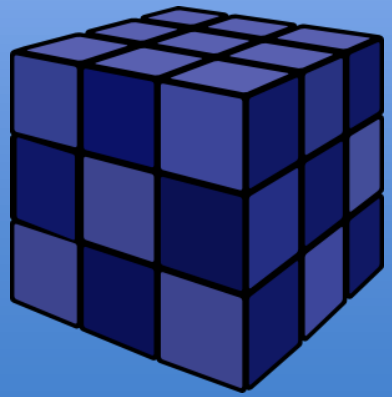

https://github.com/acloudfan/Blockchain-Course-Patterns

Patterns:

- Self Destruction

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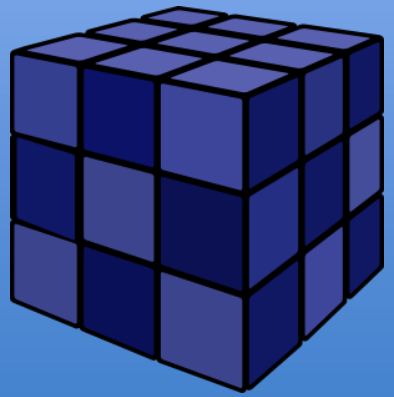
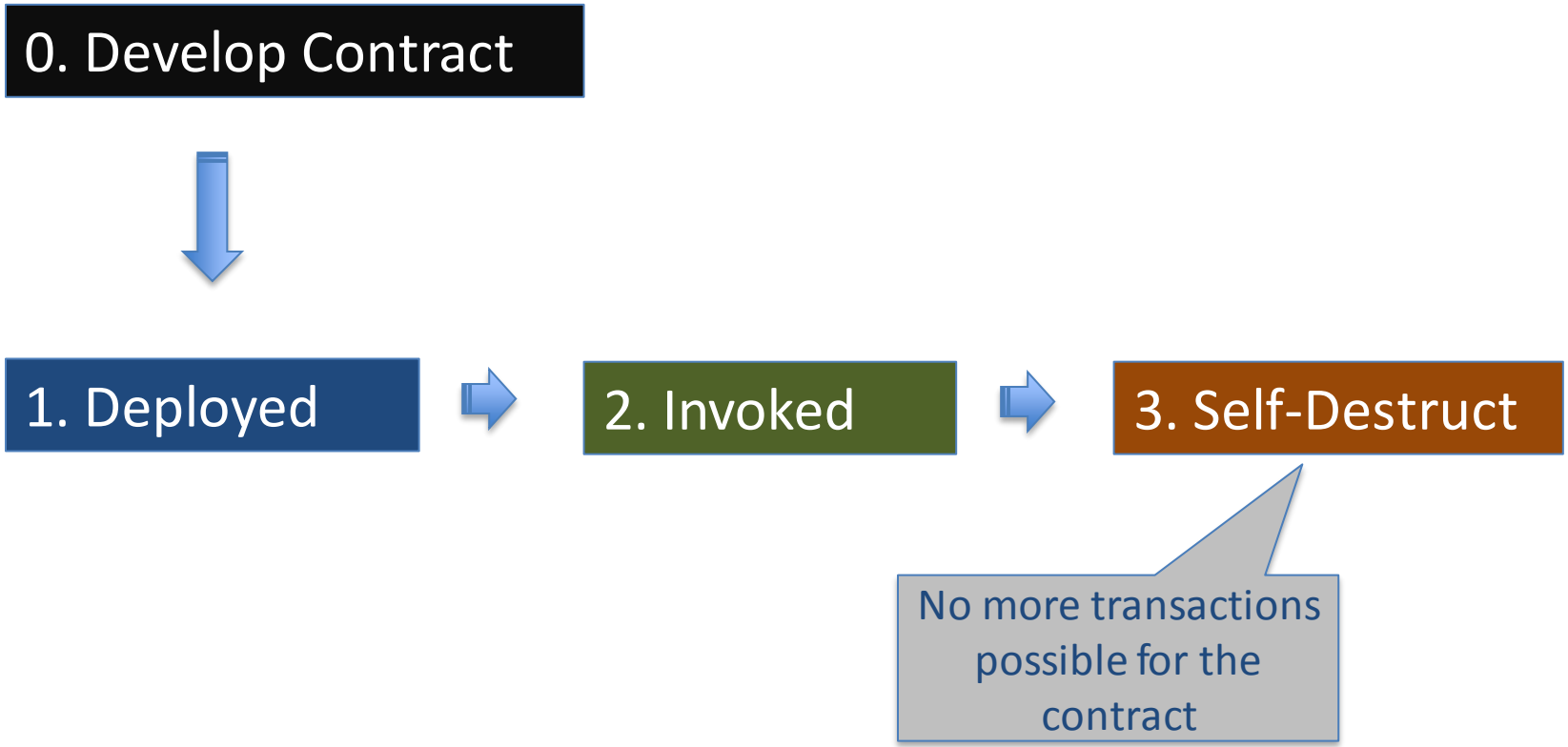


Contract Lifecycle



Why self destruct?

- Needs driven by business

Example: Timed contracts

E.g., Bidding, after the win no more bids allowed

Example: Nature of business

E.g., Loan contract destroyed after the loan is paid off

3. Self-Destruct

- The contract becomes unavailable after it self-destruct's

Existing transactions on contract stay forever but no new transaction

```
// This is where the contract is destroyed
function  killContract()  OwnerOnly {
  suicide(owner);
}
```

Restrict who can cause self destruction

All funds held in the contract sent to this address

Dead Contract Transactions

- Transactions will fail
- Fund's sent to a self destructed contract will be LOST

To prevent fund loss:

1. Remove all references to dead contracts
2. *OR* Call get before send to ensure that contract is NOT dead

Patterns:

- Contract Factory

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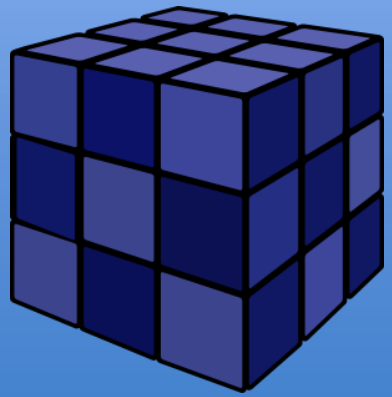
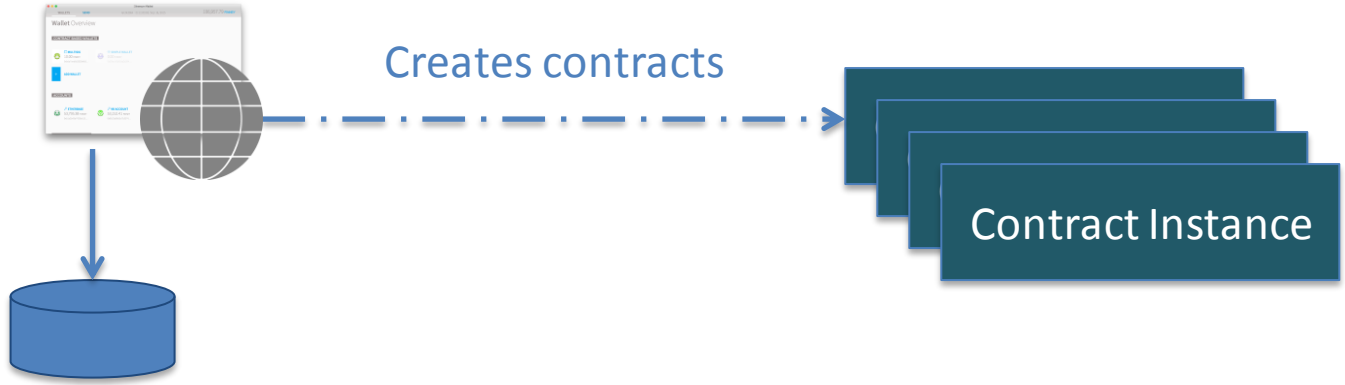
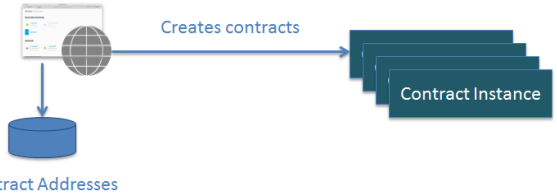
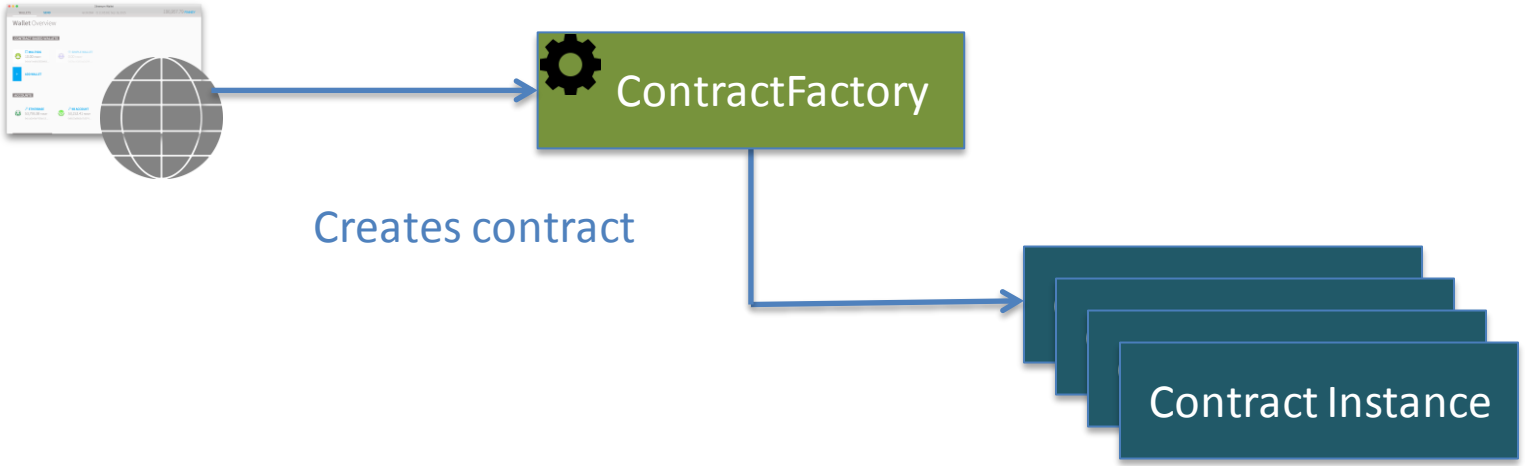


Contract Creation



Factory Pattern





- External persistent storage not needed
- Storage on EVM will cost gas

Benefits

- Hides the complexity & encapsulates business rules
- May manage the contracts in a collection
- Insulates the Dapp from contract changes & additions

Common Scenarios

- Digital tokens or assets
- Multi-contract management
- Rules for contract creation

Example

AccountFactory

SavingAccount

SilverAccount

GoldAccount

PlatinumAccount

Avg Balance >= $1000

Interest Rate= 1%

Transaction/month = 5

Avg Balance >= $10,000

Interest Rate= 3%

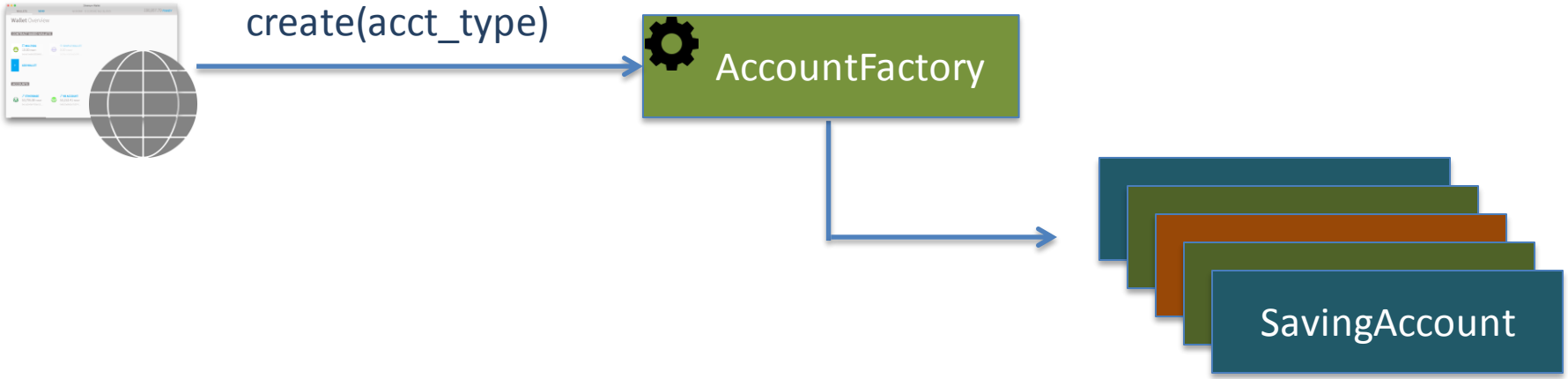
Transaction/month = 15

Avg Balance >= $100,000

Interest Rate= 6%

Transaction/month = 100

Factory Pattern



- Based on type a new contract is created
- New account types may be added without needing change in Dapp
- Factory contract instance may manage contracts in a collection

Patterns:

- Registry Pattern

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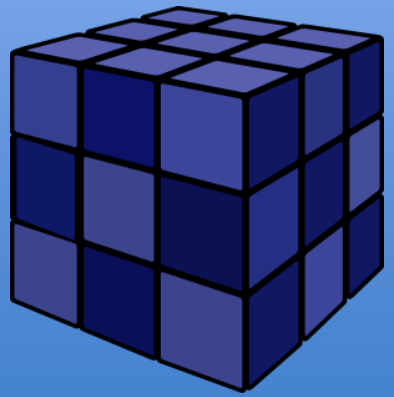
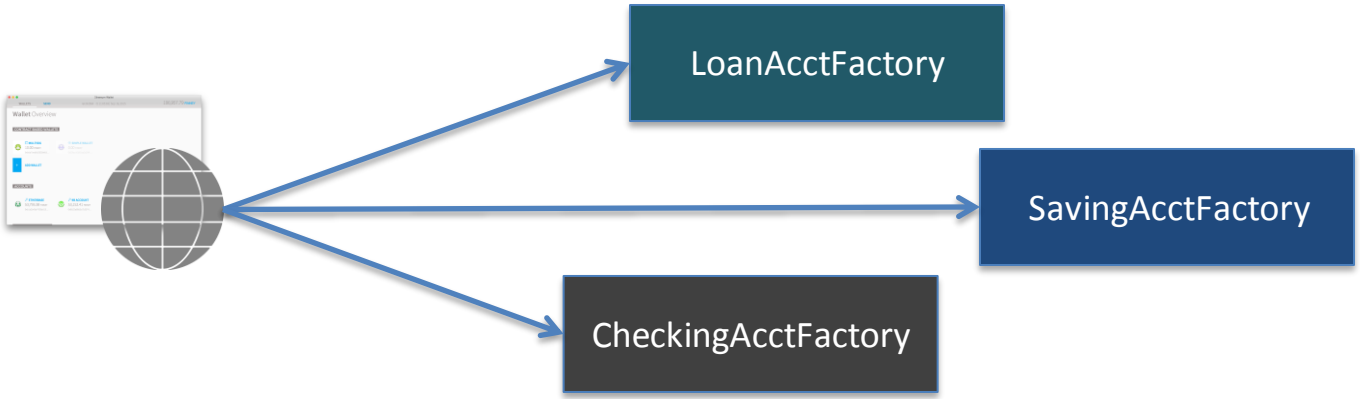


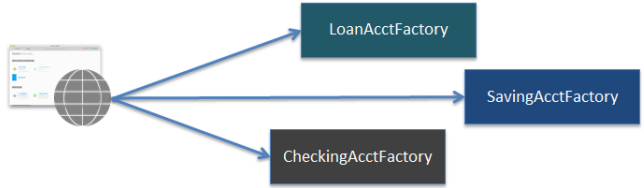
Contract References

- Complex apps may have dependency on multiple contracts



- App needs to maintain addresses for these contracts
- The contracts may need to be change/switched over time

Name Registry



Invoke Contract

getAddress('LoanFactory');

Registry

LoanAcctFactory

SavingAcctFactory

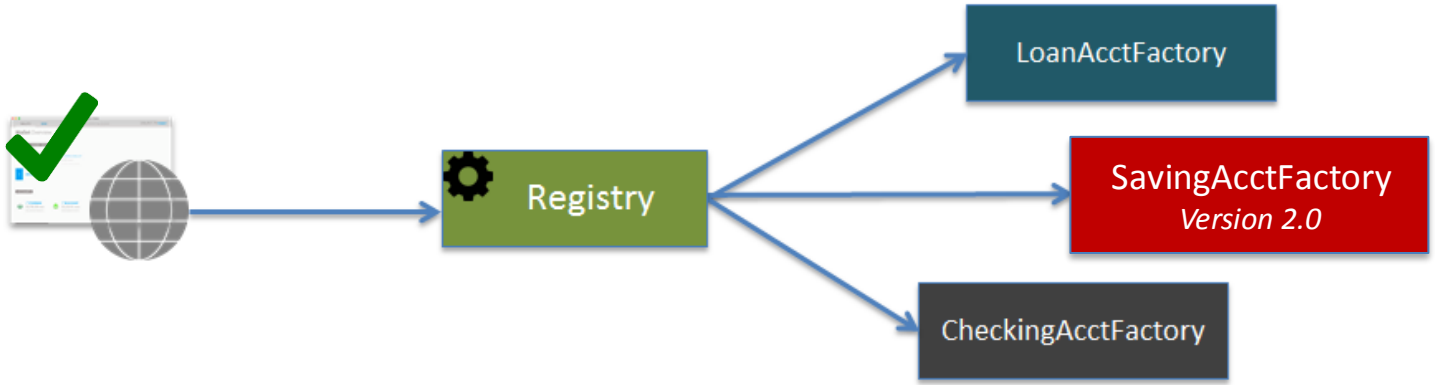
CheckingAcctFactory

Manages mapping

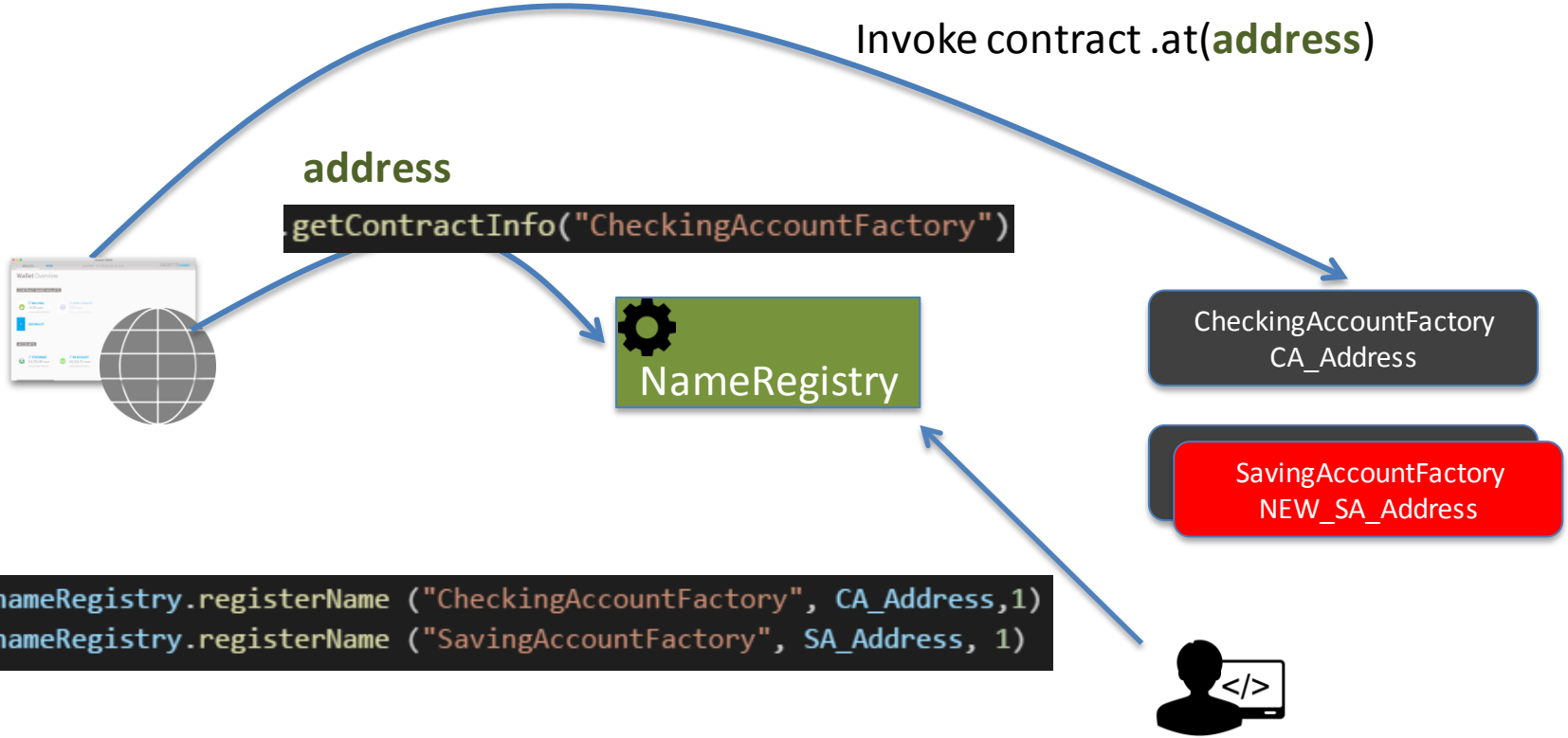
LoanFactory=0x....
SavingFactory=0x...
CheckingFactory=0x...

Benefits

- Simpler dependency management
  - Application uses names instead of addresses
  - Newer versions of dependency will not impact the Dapp



Sample


Invoke contract .at(address)
address
getContractInfo("CheckingAccountFactory")
NameRegistry
CheckingAccountFactory
CA_Address
SavingAccountFactory
NEW_SA_Address
nameRegistry.registerName ("CheckingAccountFactory", CA_Address,1)
nameRegistry.registerName ("SavingAccountFactory", SA_Address, 1)
nameRegistry.registerName("CheckingAccountFactory", NEW_SA_Address,2)

Patterns:

- Mapping Iterator

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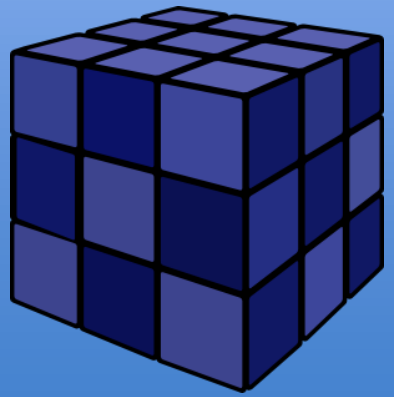

Mapping Iterator

- No out of the box feature available

```
mapping(address => bytes32)  addressMap;
```

```
address[] keys = addressMap.keys()
```

// Not possible

Iteration Pattern

- Use a separate array for maintaining the keys

```
mapping(address => bytes32)  addressMap;

address[]   addresses;
```

- All operations carried out on both the mapping & the array

Implementation

Insert
Address = Name

Function
addKeyValue(...)

```
mapping(address => bytes32)  addressMap;

address[]   addresses;
```

Iterator

Get Key
count

Function
getKeyCount()

```
return addresses.length;
```

Loop
(0..count-1)

Function
getValueAtIndex()

```
return addressMap(addresses[index]);
```

Iterator Caveat

- As the number of keys will grow the cost of iteration will go up
  - Storage costs will go up
  - Optimization possible – avoid iteration
- Iteration in a constant function is OK

https://github.com/acloudfan/Blockchain-Course-Patterns

```
contract UserAddressRegistry
```

Patterns:

- Private Network Setup

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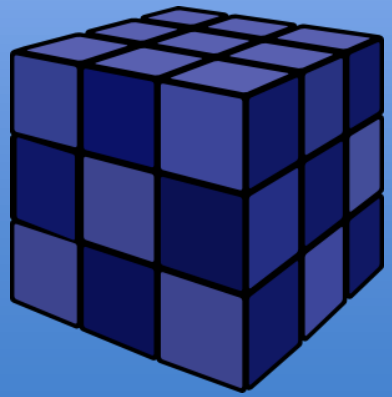


Motivation

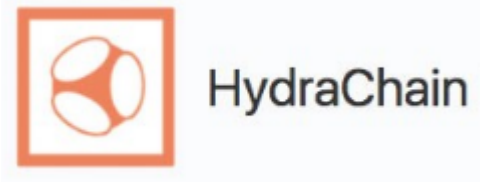
- Business Use Case
- Development of contracts (DevOps)
- Consortium
- Experimentation

Considerations

- No public access to the chain
- Peers are restricted to known entities (nodes)
- Chain need to be Permissioned
- Proof of Work is NOT the preferred consensus model
- Transaction Speed & Fees

Examples

MONAX



Creating a Private Network

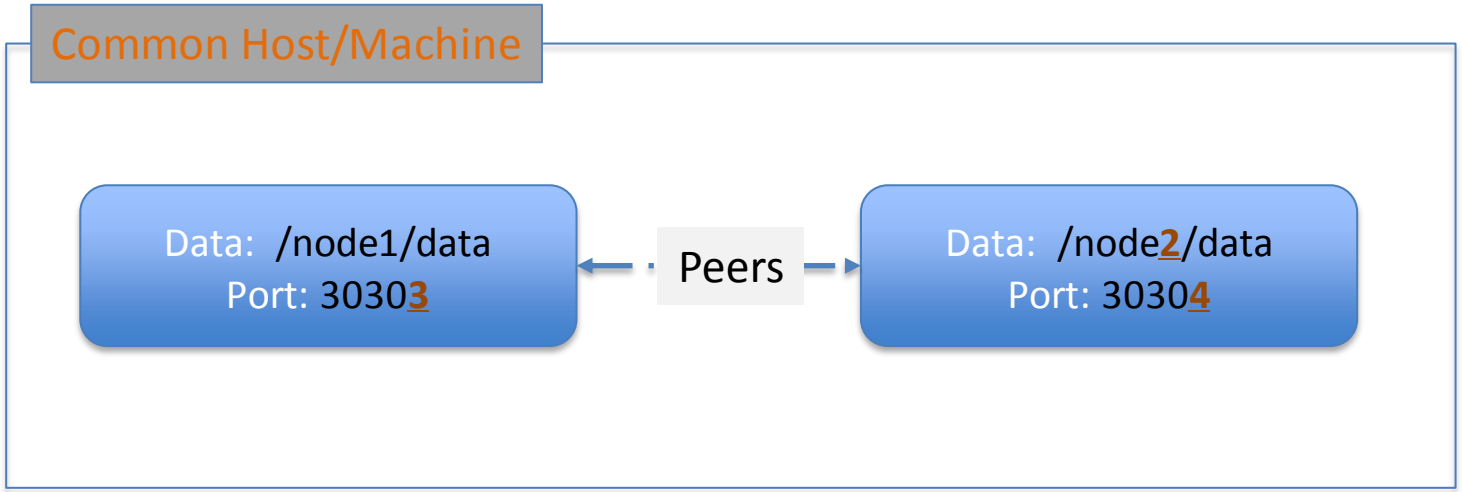
1. Single Node for experimentation 

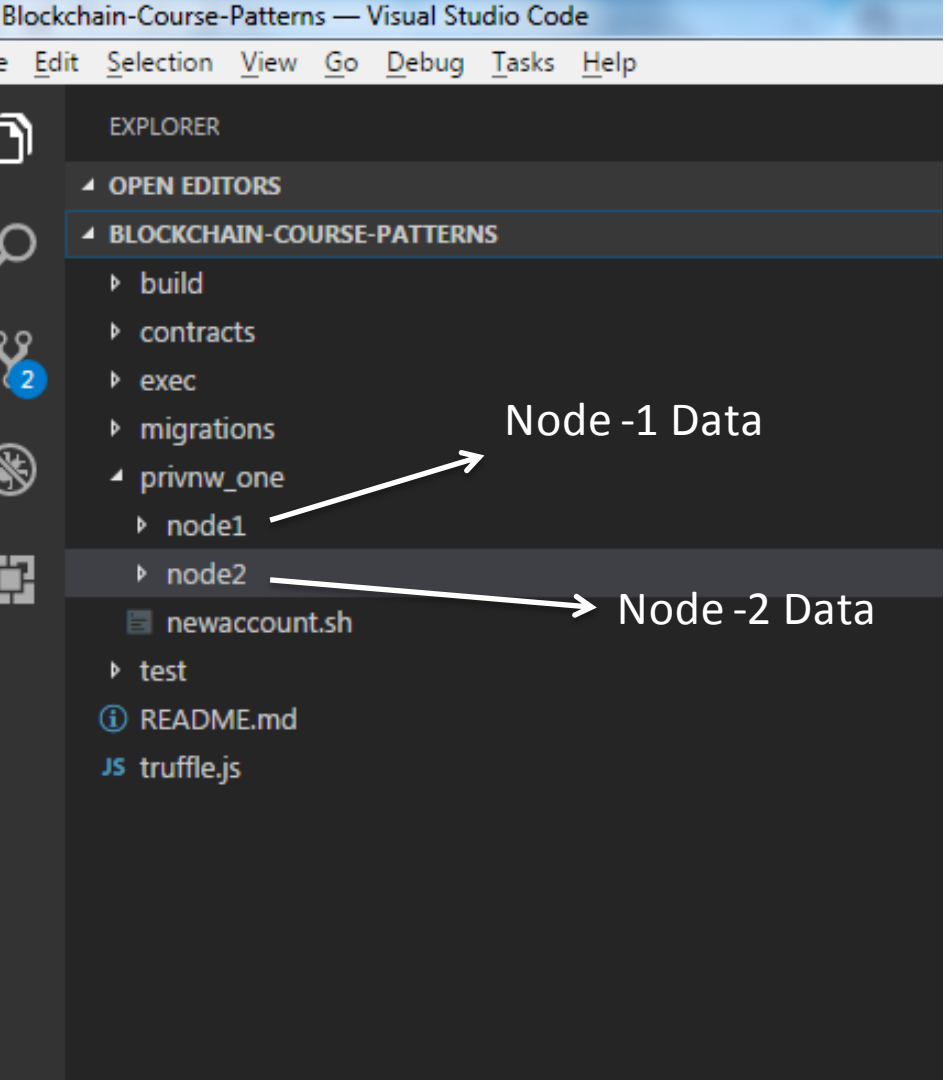
   > geth --dev

2. Multi Node on single Host (machine/server)

3. Multi Node on multiple hosts (Amazon EC2)

Demo Setup


Common Host/Machine
Data: /node1/data
Port: 30303
Peers
Data: /node2/data
Port: 30304



/acloudfan/Blockchain-Course-Patterns

Private Chain

1. Create an account : node1

2. Setup *genesis.json*

3. Initialize the chain on 2 nodes

4. Add as peer

Private Network

- Setting up a private node is a 4 step process

1. Create an account : node1

> geth --datadir ".." account new

2. Setup *genesis.json*

- Set chain ID
- Allocate to account

3. Initialize the chain on 2 nodes

> geth --datadir ".." init *genesis.json*

4. Add as peer

> admin.nodeInfo.enode

> admin.addPeer(...enode url....)

- Setup <datadir>/static-nodes.json

Patterns:

- Withdrawal Pattern

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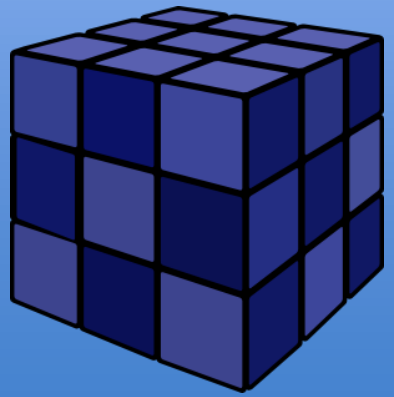
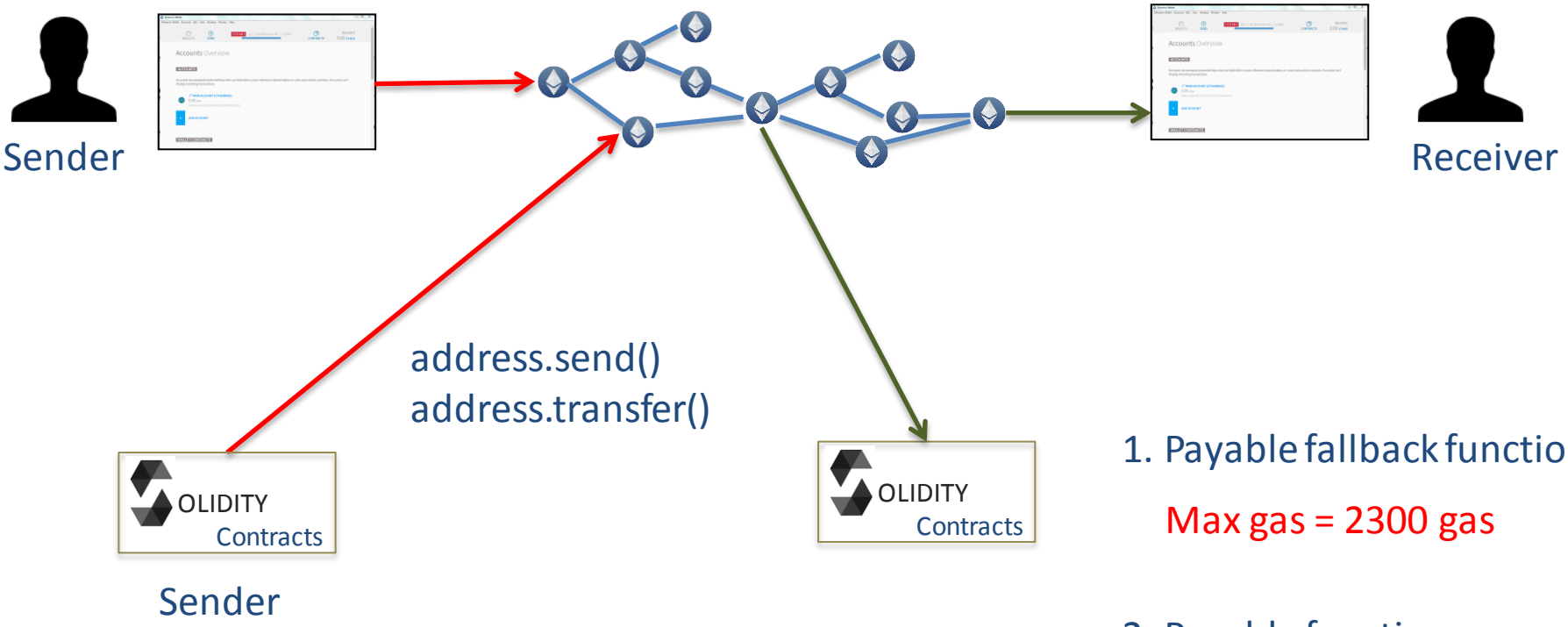


Send Pattern

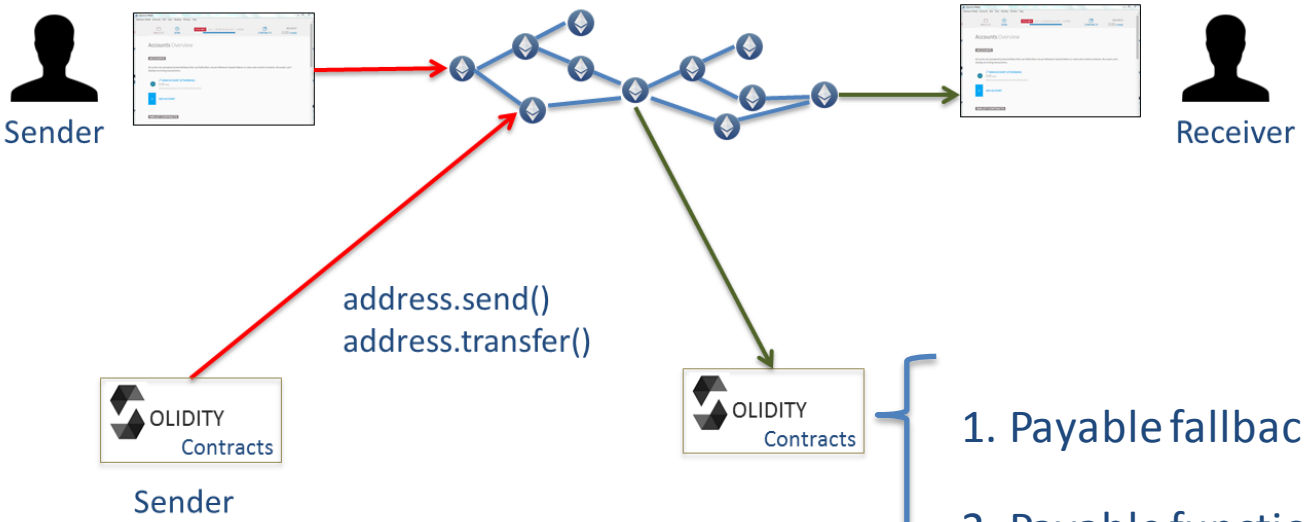


1. Payable fallback function

   Max gas = 2300 gas

2. Payable function

Send/Transfer can Fail



1. Payable fallback function runs out of gas
2. Payable function runs out of gas
3. Payable function throws exception

send() Vs. transfer()

address.send()

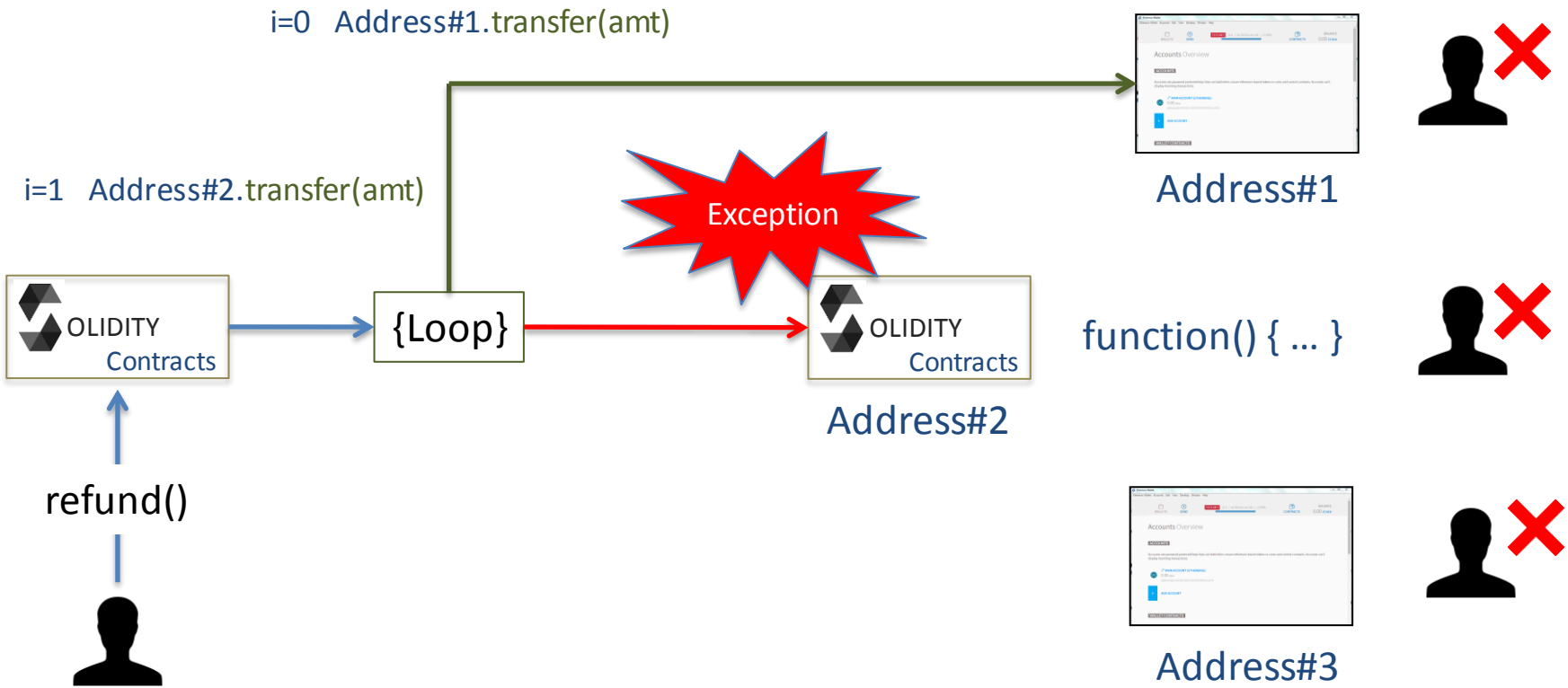
- Returns false on failure *BUT* it does not HALT contract execution

address.transfer()

- Throws exception on failure; HALTs the execution

Best Practice: Check return from send() Better to use transfer()

Challenge

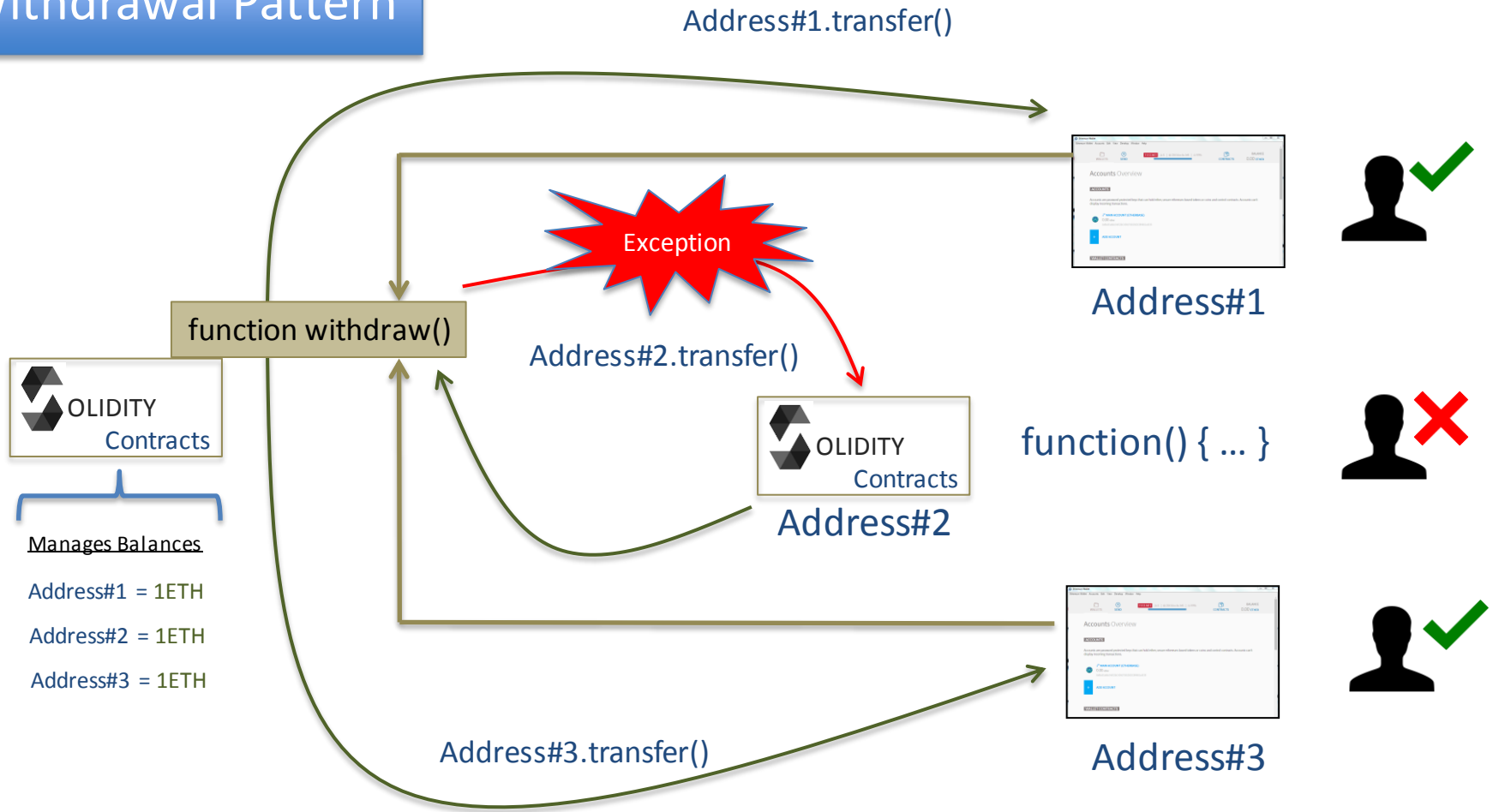


Funds stuck in the contract as exception will cause all state changes to Roll back

Withdrawal Pattern

- Sender contract exposes a withdraw function
  - The receivers invoke the withdrawal function for getting ethers

Withdrawal Pattern



Sender Versus Withdrawal Pattern

- Sender pattern
  - Sending contracts uses send() or transfer()
  - Send() returns false on failure ; transfer() throws an exception
  - Misbehaving code in fallback or payable function can cause issues
- Withdrawal pattern
  - Receiver calls the withdraw() function to initiate send/transfer