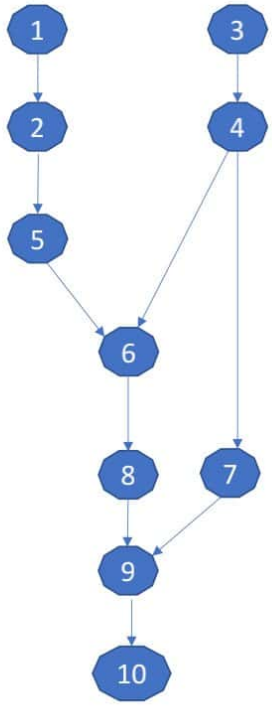

COMPLETE
NOTES ON
BLOCKCHAIN

Different tools provide different functionality

	Activities \ Tools	Remix	Ganache	MyEtherWallet	Geth
1	Configure the Blockchain	-	-	-	+
2	Deploy the Blockchain	Not Persistent	+	-	+
3	Develop the contract	+	-	-	+
4	Compile the contract	+	-	-	+
5	Create user account	+	+	+	+
6	Deploy the contract	+	-	+	+
7	Create the UI for interacting	+	-	+	+
8	Run the client	+	-	+	+
9	Interact with the contract & have fun	+	-	+	+
10	Monitor the execution	-	+	-	+

https://remix.ethereum.org/
http://truffleframework.com/ganache/
https://github.com/kvhnuke/etherwallet/releases/tag/v3.21.06



Use which tool for what purpose? (1/2)

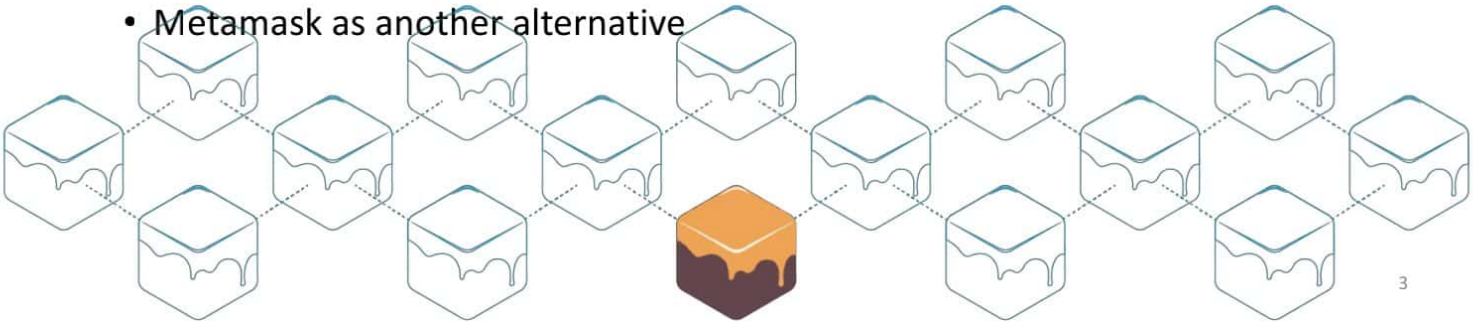
- Use Geth for everything?
  - Powerful but command-line only

- What should I use?
  - As a starting point for developing contracts – mostly Remix
- What cannot Remix do?
  - Configure the blockchain
  - Create real (non-test) user accounts and transfer funds between user accounts
  - Monitor the execution
  - Other advanced operations

Use which tool for what purpose? (2/2)

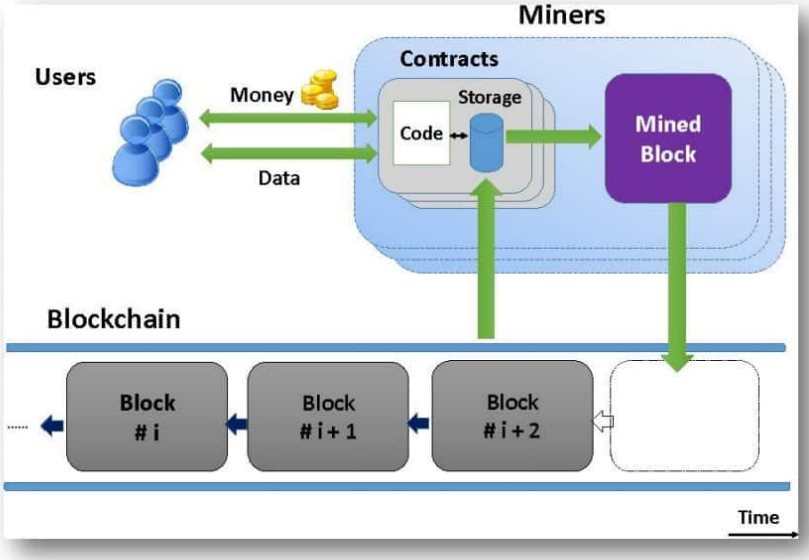
- Why use Ganache?
  - To inspect and monitor the execution
  - To visualize certain elements in a better way

- Why use MyEtherWallet?
  - To create a personal wallet (real user account), transfer funds between user accounts, and interact with contracts
  - Metamask as another alternative



Smart Contracts

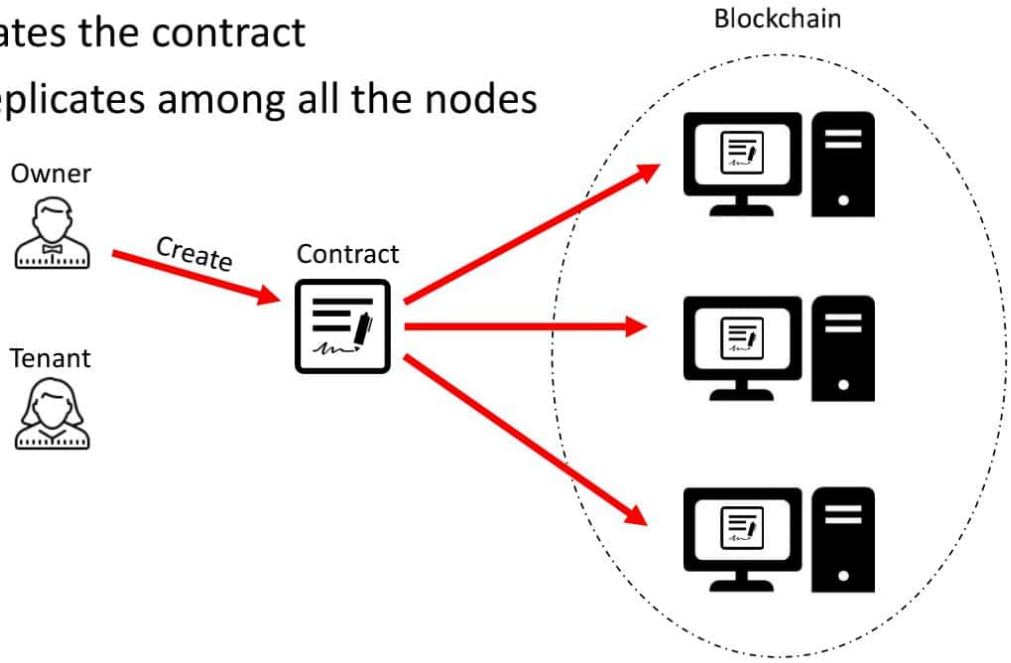
- In the form of code
- Stored on a blockchain
- Executes under given conditions



- K. Delmolino, M. Arnett, A. E. Kosba, A. Miller, and E. Shi, "Step by Step Towards Creating a Safe Smart Contract: Lessons and Insights from a Cryptocurrency Lab," *IACR Cryptology ePrint Archive*, vol. 2015, p. 460, 2015.

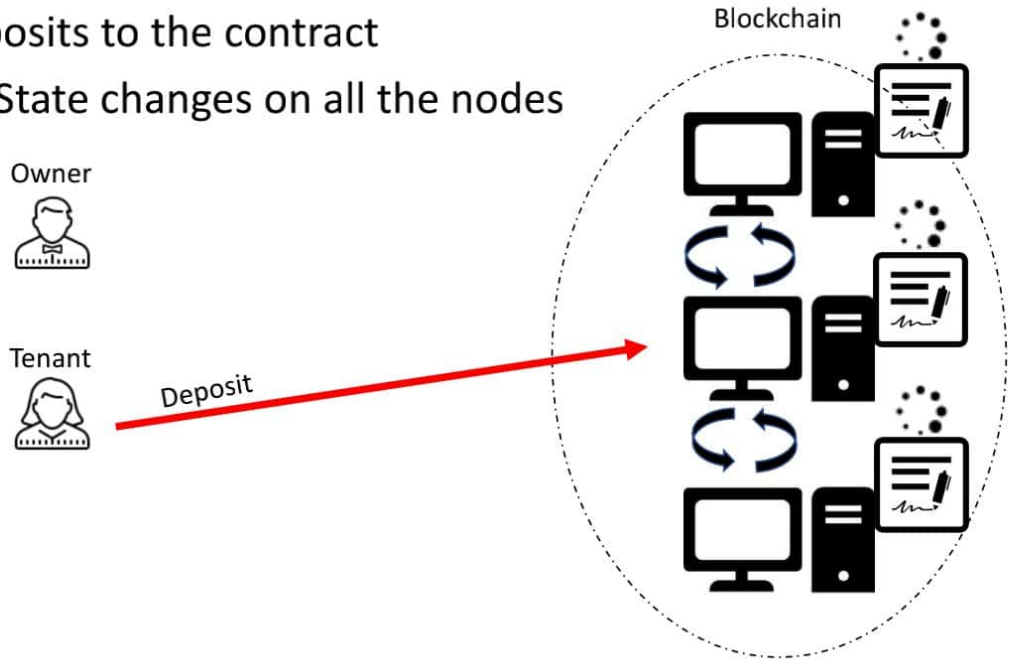
Smart Contracts Example (1/3)

- Owner creates the contract
- Contract replicates among all the nodes



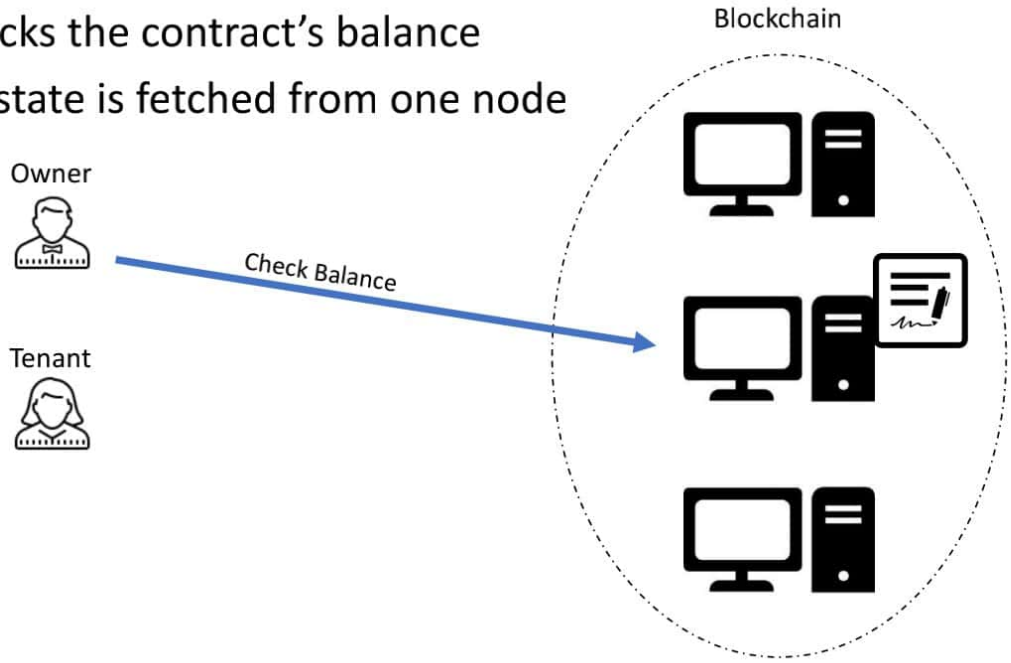
Smart Contracts Example (2/3)

- Tenant deposits to the contract
- Contract's State changes on all the nodes



Smart Contracts Example (3/3)

- Owner checks the contract's balance
- Contract's state is fetched from one node

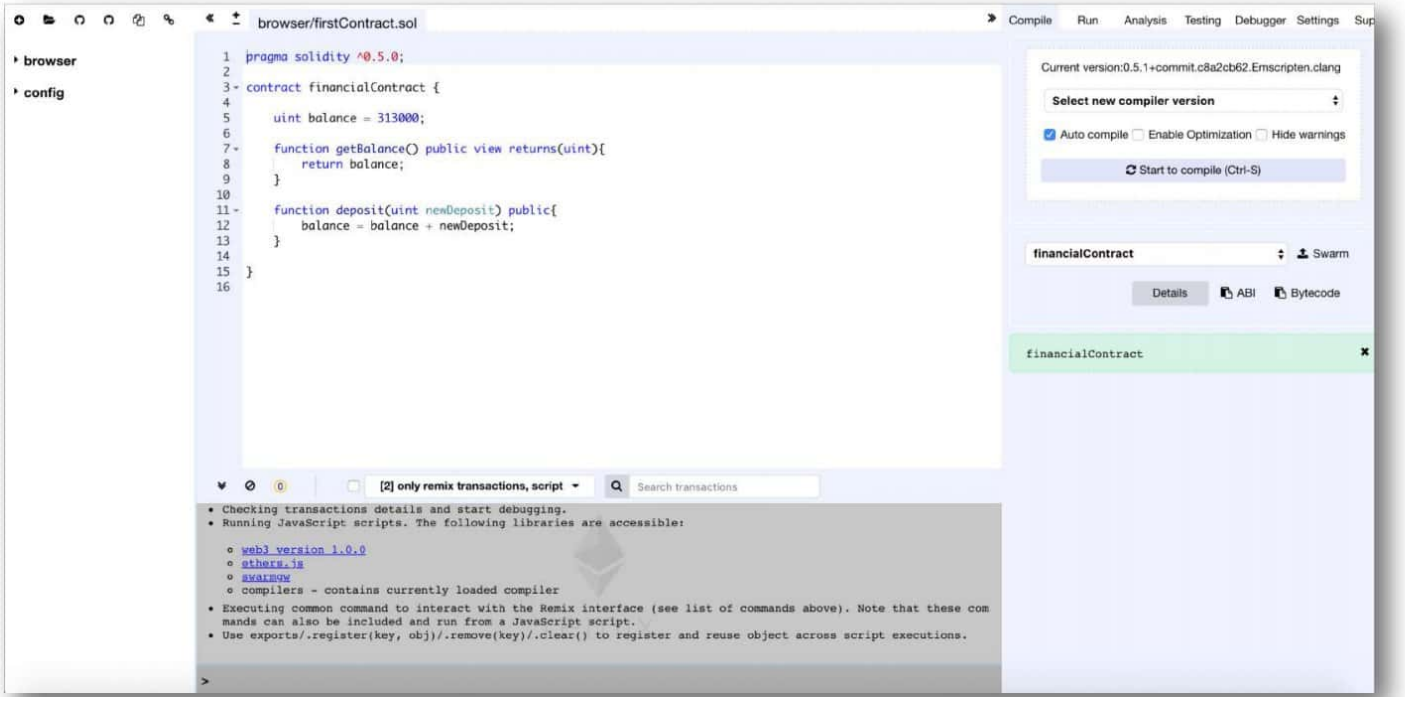


Smart Contracts

1. Developing a simple contract
2. Compiling the contract
3. Deploying the contract
4. Interacting with the contract
5. Adding more functions to our code to make it more practical

Open Remix : remix.ethereum.org

- An open source tool for writing, compiling and testing Solidity contracts



Solidity

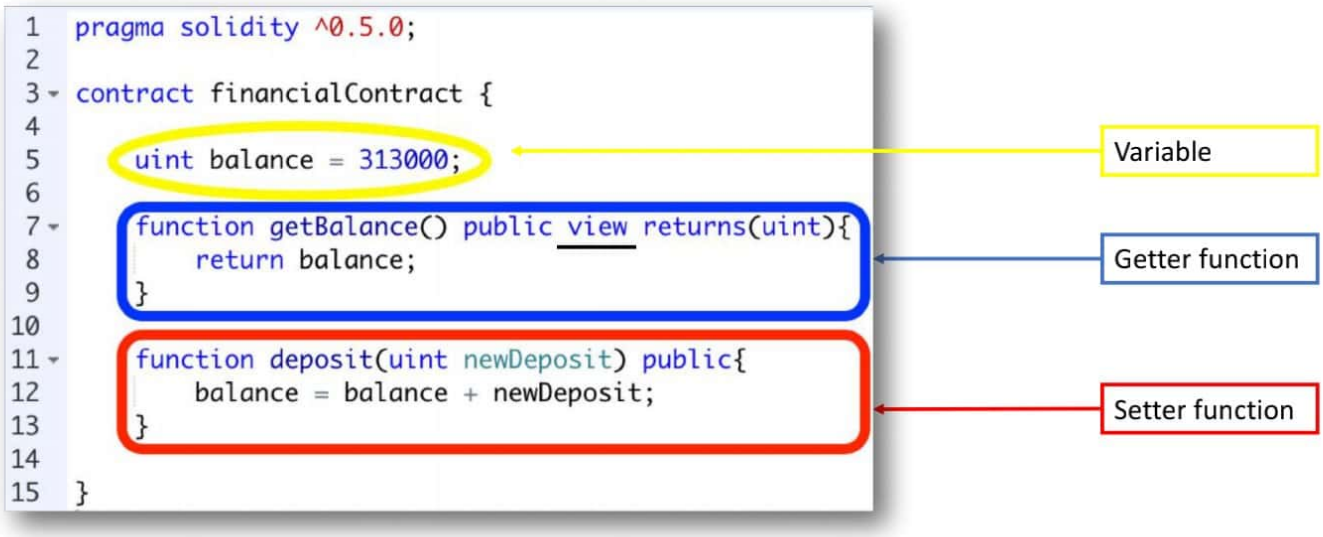
- Object-oriented
- Contract-oriented
- High-level language
- Influenced by C++, Python, and JavaScript
- Target Ethereum Virtual Machine (EVM)

Serpent as an Alternative?

- Low-level language
- Complex compiler

Start Coding

- Setter and Getter: Set and get the information.

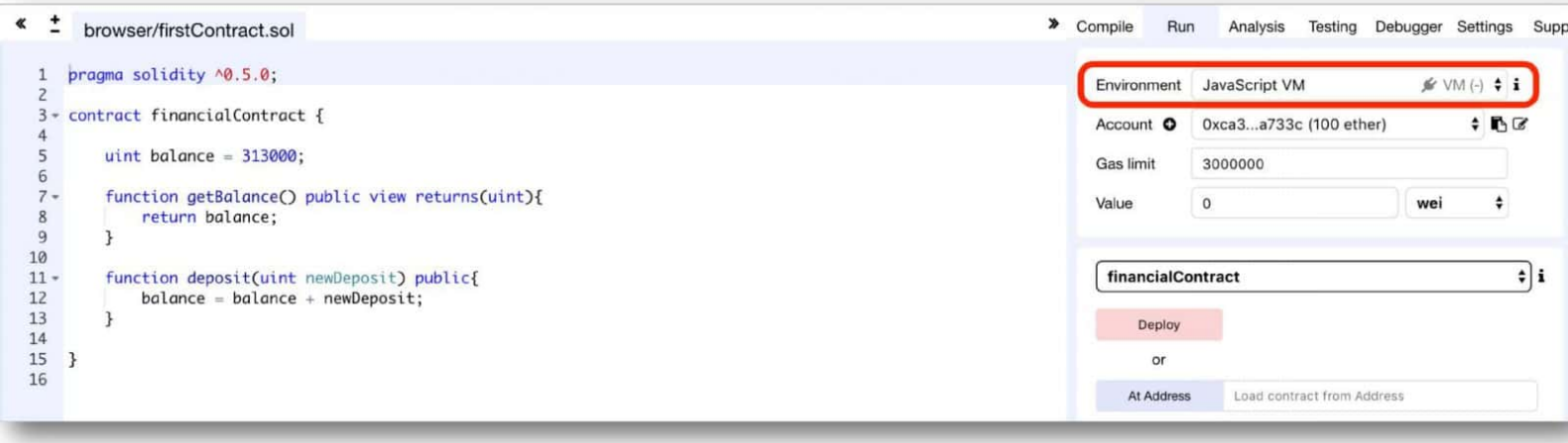


Compile the Contract

- Compile tab: Start to compile button

Set Deployment Parameters (1/2)

- Run tab: Environment = JavaScript VM



Set Deployment Parameters (2/2)

- JavaScript VM: All the transactions will be executed in a sandbox blockchain in the browser. Nothing will be persisted and a page reload will restart a new blockchain from scratch, the old one will not be saved.
- Injected Provider: Remix will connect to an injected web3 provider. Mist and Metamask are example of providers that inject web3, thus they can be used with this option.
- Web3 Provider: Remix will connect to a remote node. You will need to provide the URL address to the selected provider: geth, parity or any Ethereum client.

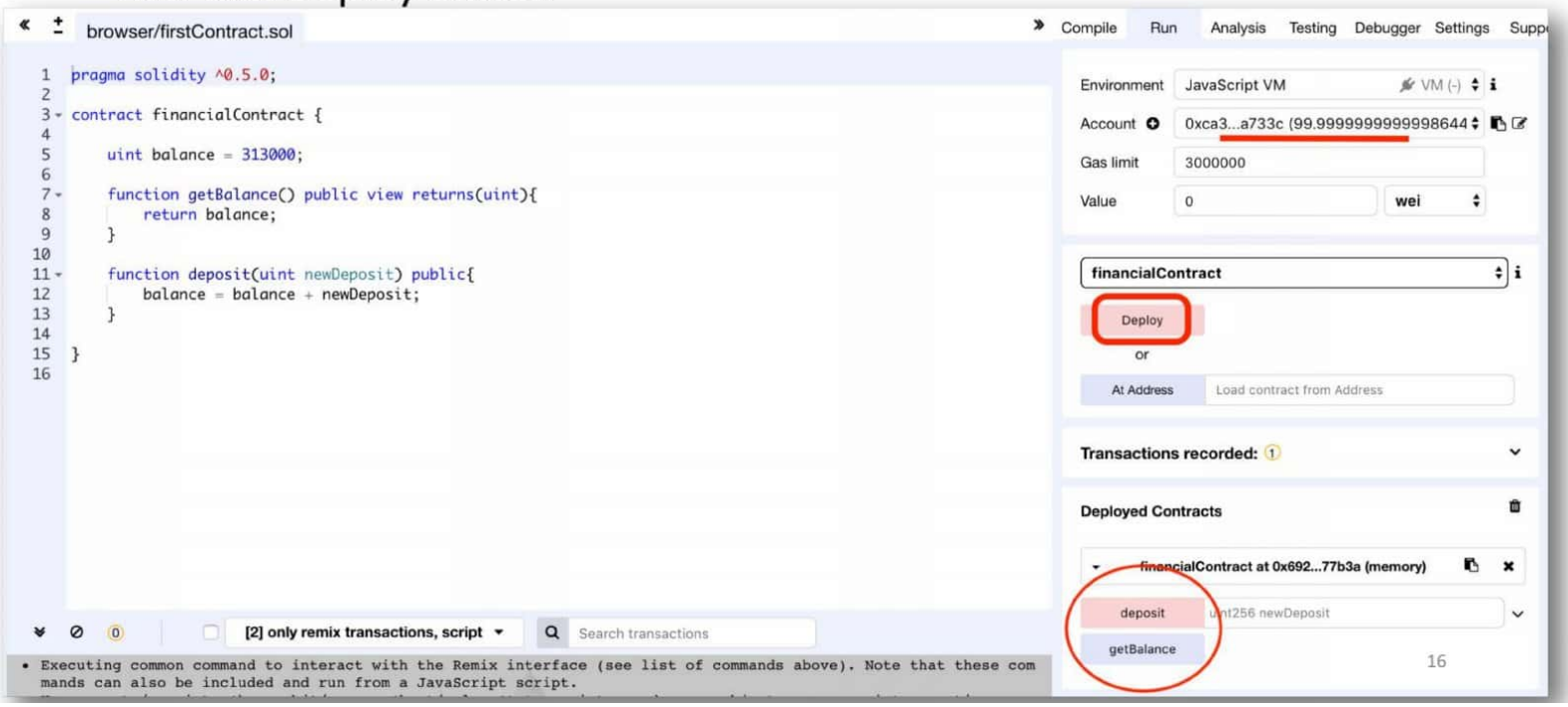
- Gas Limit: The maximum amount of gas that can be set for all the instructions of a contract.
- Value: Input some ether with the next created transaction (wei = 10^{-18} of ether).

Types of Blockchain Deployment

- Private: e.g., Ganache sets a personal Ethereum blockchain for running tests, executing commands, and inspecting the state while controlling how the chain operates.
- Public Test (Testnet): Like Ropsten, Kovan and Rinkeby which are existing public blockchains used for testing and which do not use real funds. Use faucet for receiving initial virtual funds.
- Public Real (Mainnet): Like Bitcoin and Ethereum which are used for real and which available for everybody to join.

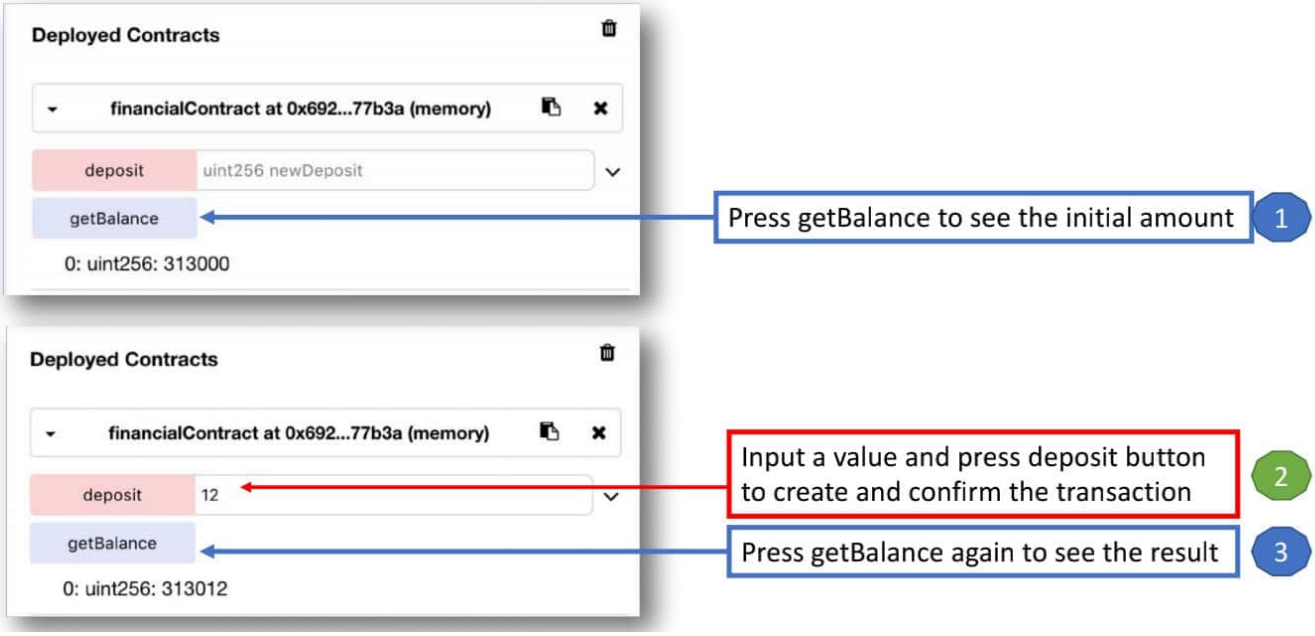
Deploy the Contract on the Private Blockchain of Remix

- Run tab: Deploy button



Interact with the Contract

- Setter = Red Button: Creates transaction
- Getter= Blue Button: Just gives information

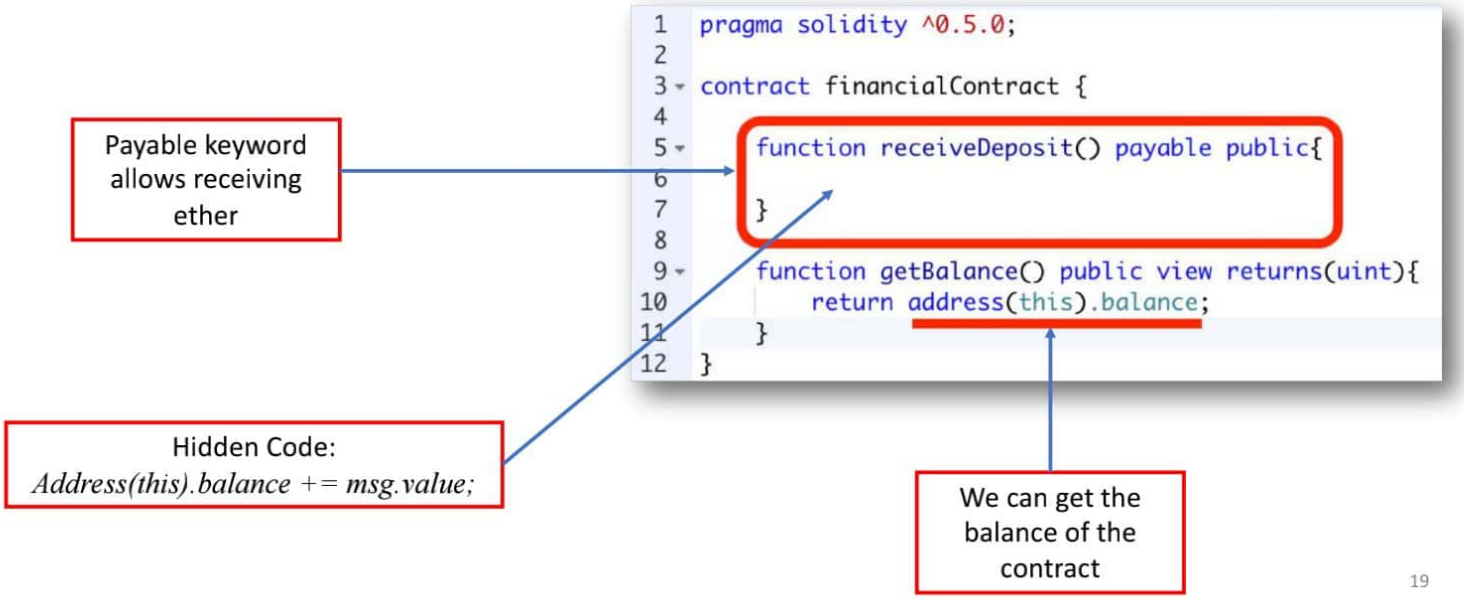


Additional features

- Transferring funds from an account to the contract
- Saving the address of the contract creator
- Limiting the users' access to functions
- Withdrawing funds from the contract to an account

Receive ether (1/2)

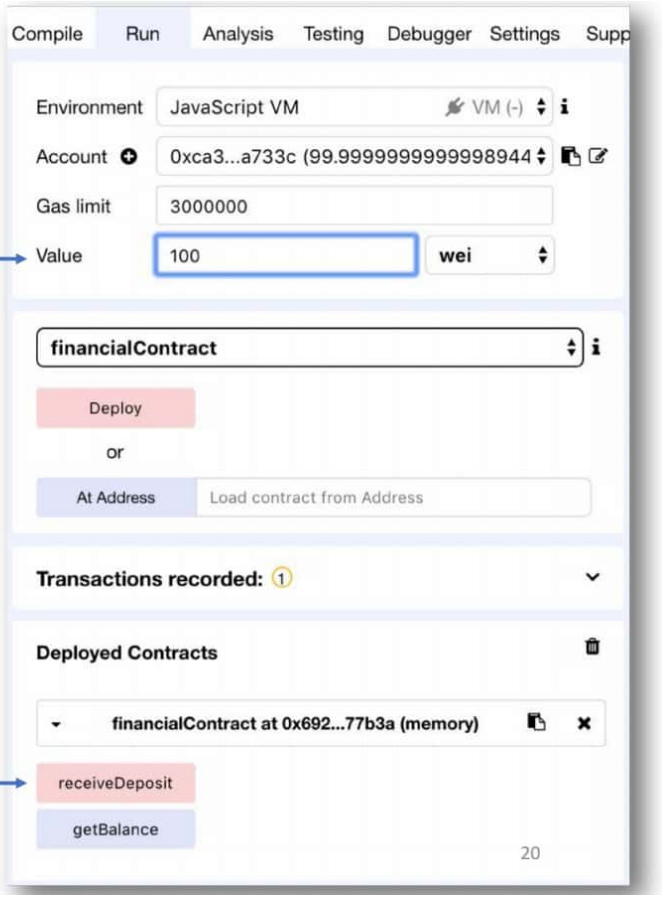
- Transfer money to the contract



Receive ether (2/2)

1. Input the value as wei (10^{-18} of ether)

2. Click the receiveDeposit button to transfer the money to the contract



Constructor

- Will be called at the creation of the instance of the contract

```
1  pragma solidity ^0.5.0;
2
3  contract financialContract {
4
5      address owner;
6
7      constructor() public{
8          owner = msg.sender;
9      }
10
11     function receiveDeposit() payable public{
12
13     }
14
15     function getBalance() public view returns(uint){
16         return address(this).balance;
17     }
18 }
```

We want to save the address of the contract creator

Withdraw funds

- Modifier: Conditions you want to test in other functions
- First the modifier will execute, then the invoked function

```
1  pragma solidity ^0.5.0;
2
3  contract financialContract {
4
5      address owner;
6
7      constructor() public{
8          owner = msg.sender;
9      }
10
11     modifier ifOwner(){
12         if(owner != msg.sender){
13             revert();
14         }else{
15             _;
16         }
17     }
18
19
20     function receiveDeposit() payable public{
21
22     }
23
24     function getBalance() public view returns(uint){
25         return address(this).balance;
26     }
27
28     function withdraw(uint funds) public ifOwner{
29         msg.sender.transfer(funds);
30     }
31 }
```

Only the contract's creator is permitted to withdraw

Transfer some money from the contract's balance to the owner

Now deploying a smart contract on an external blockchain

	Tools / Activities	Remix	Ganache	MyEtherWallet	Geth
1	Configuring the Blockchain	-	-	-	+
2	Deploying the Blockchain	Not Persistent	+	-	+
3	Developing the contract	+	-	-	+
4	Compiling the contract	+	-	-	+
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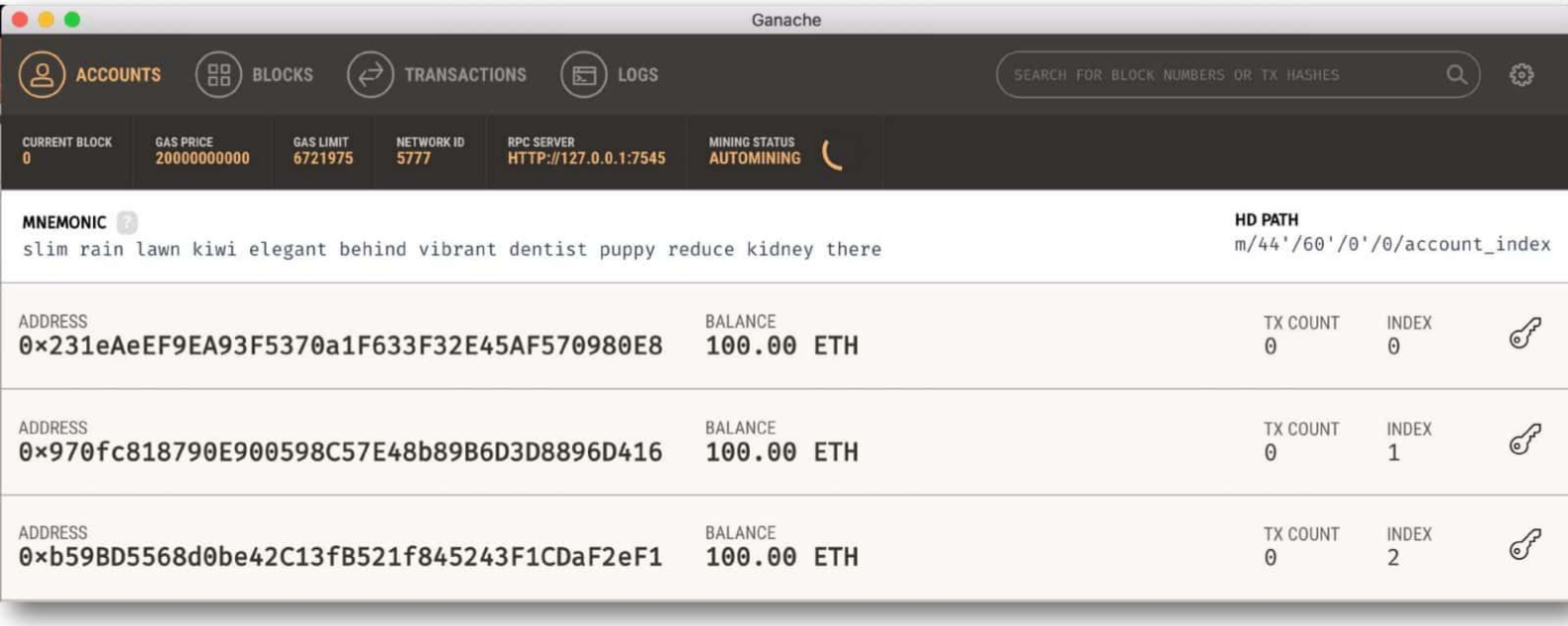
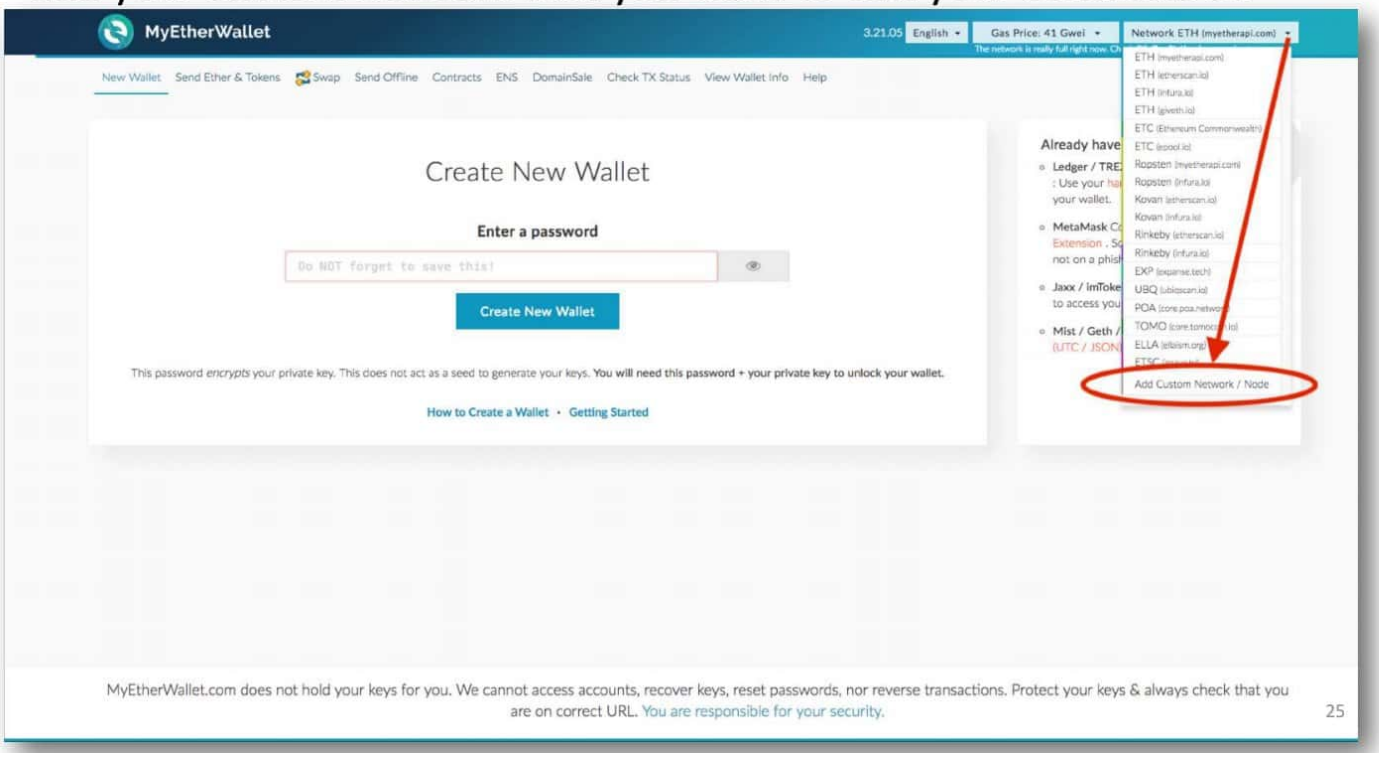
9	Interact with the contract & have fun	+	-	+	+
10	Monitoring the execution	-	+	-	+

Run Ganache

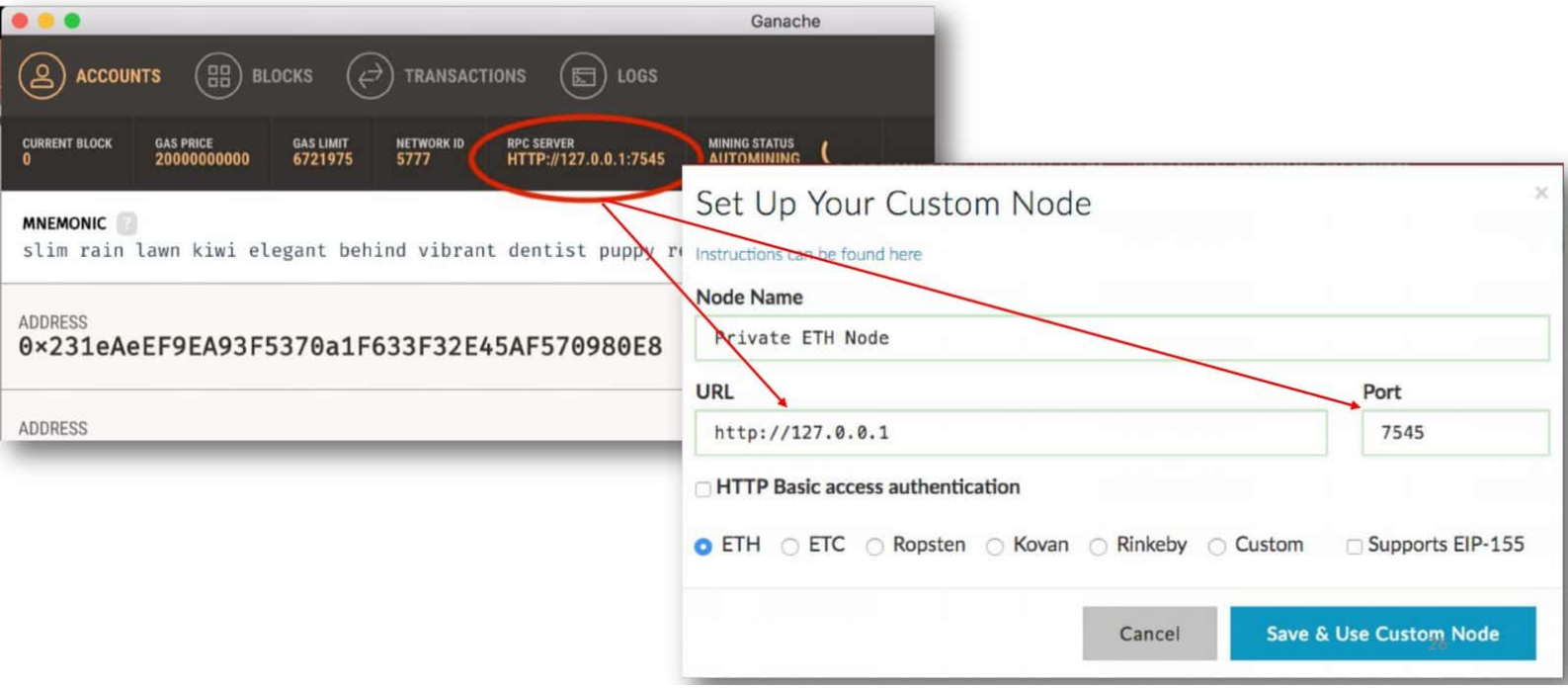


MyEtherWallet

- add your custom network that you want to test your contracts on

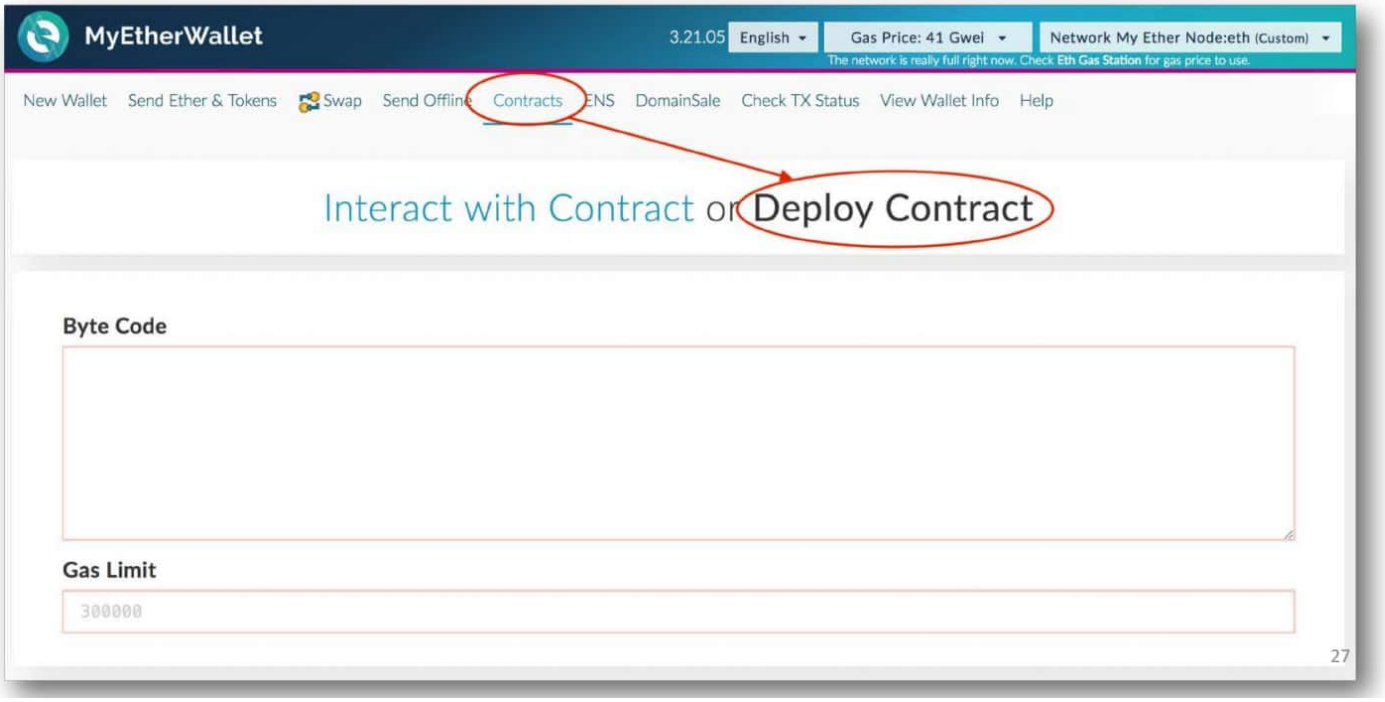


Import your RPC server address and the port number from Ganache to MyEtherWallet



MyEtherWallet

- Contracts tab: Deploy Contract



Remix

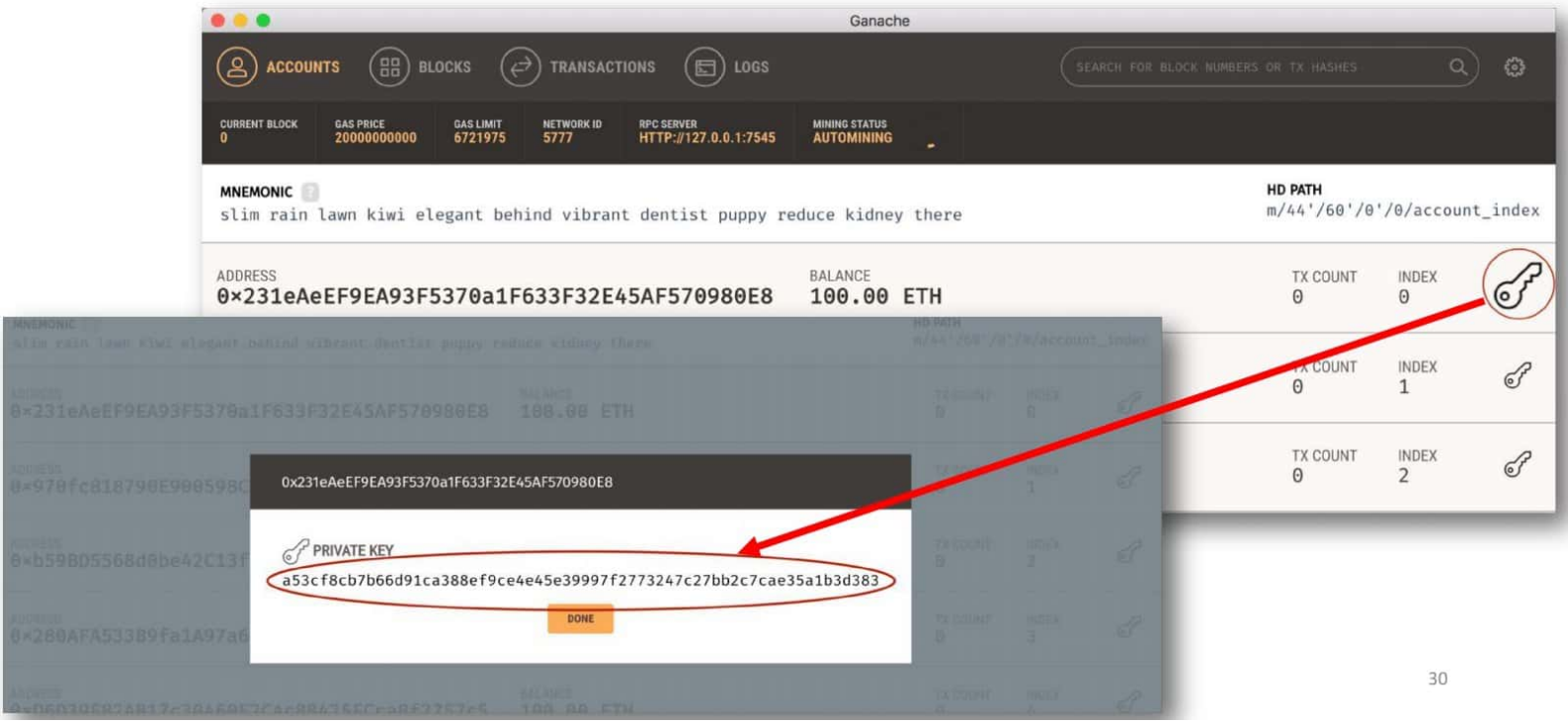
- Type your contract and compile it

Remix

Click on Details Button: access ByteCode to import it to MyEtherWallet

Ganache

Access your private key for signing your contract in MyEtherWallet.



MyEtherWallet

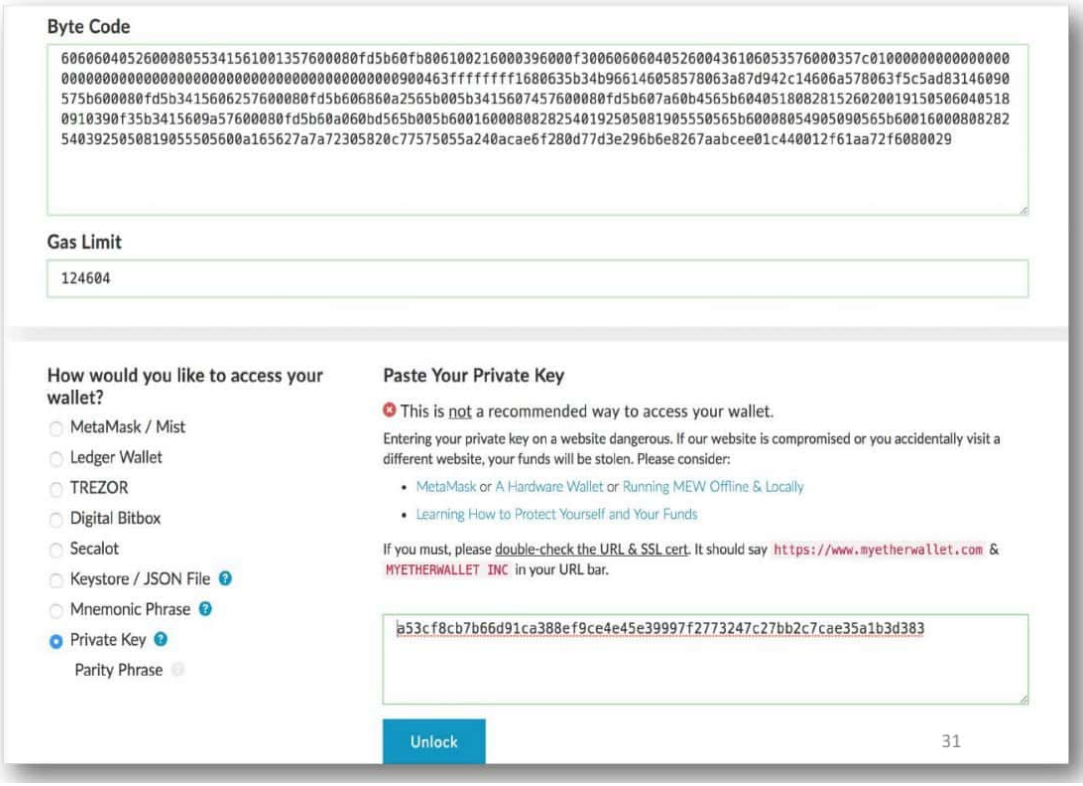
1. Paste the contract's ByteCode from Remix

2. Gas Limit will automatically be calculated

3. Paste your private key from Ganache

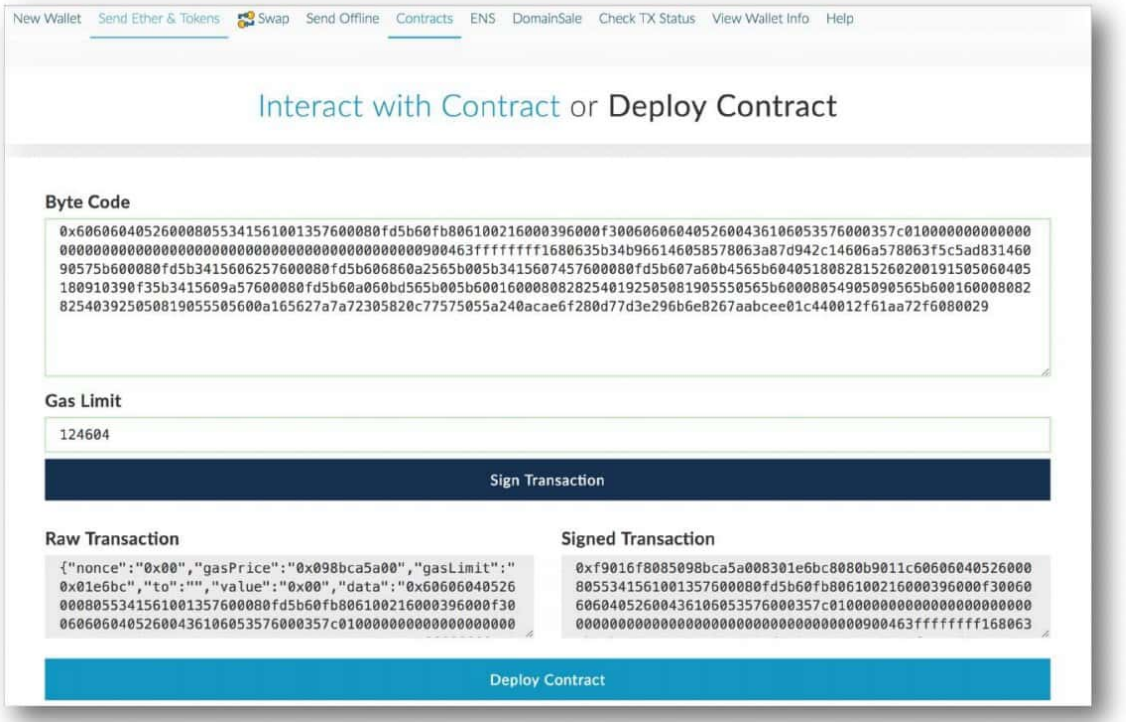
4. Click Unlock

5. Now you have access to your wallet



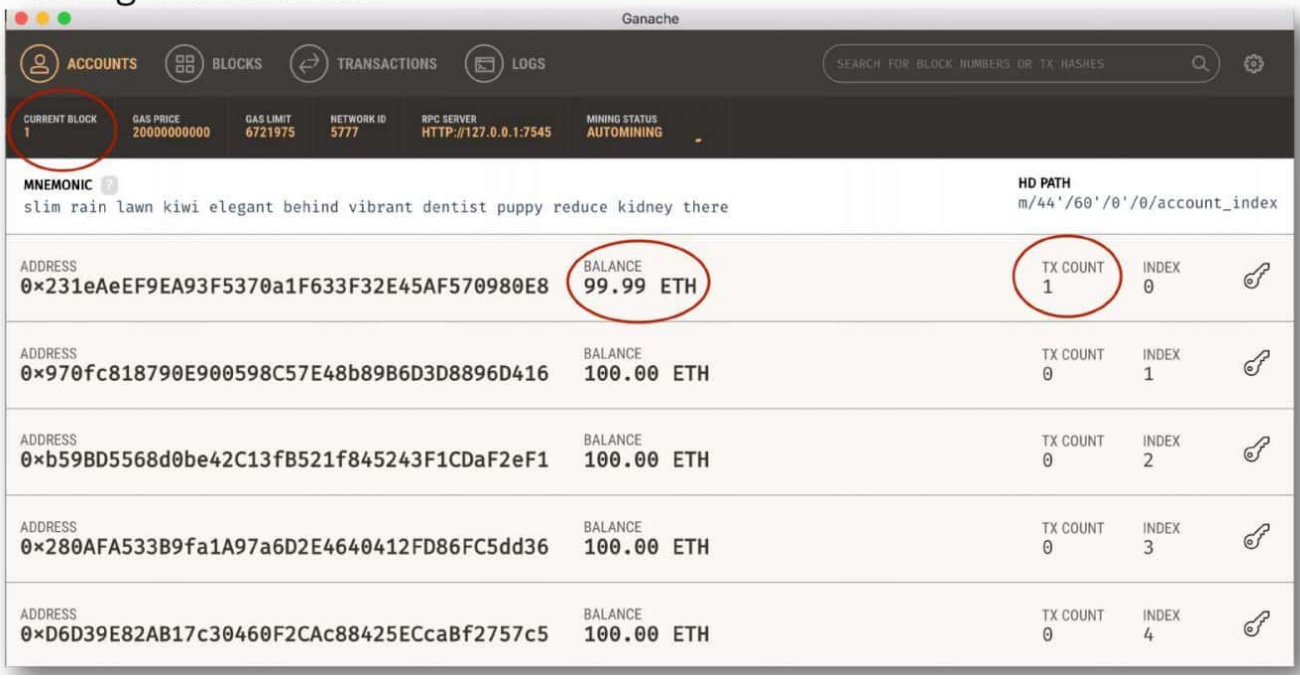
MyEtherWallet

Click on *Sign Transaction* button to deploy your contract

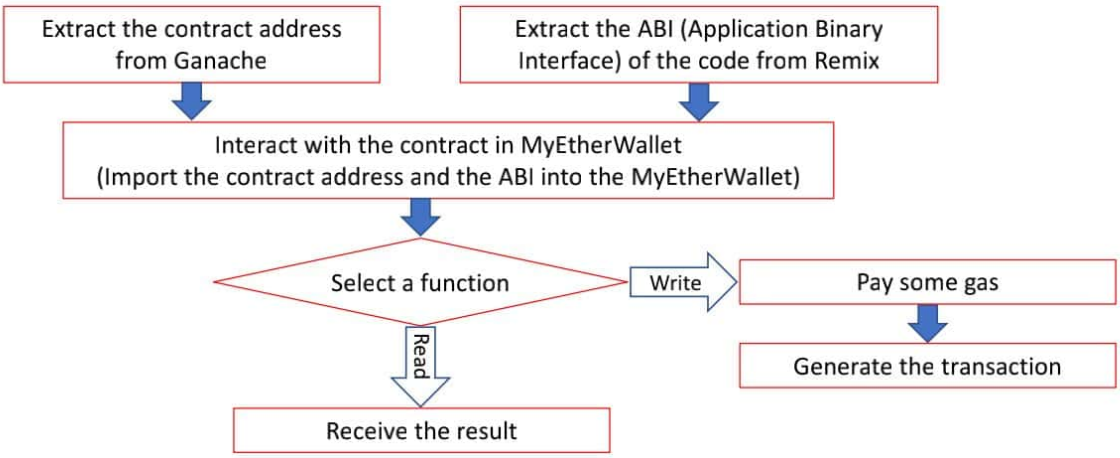


Ganache

You can see now you have one transaction for your address and your balance has been changed because of the amount of gas you paid for creating the contract.

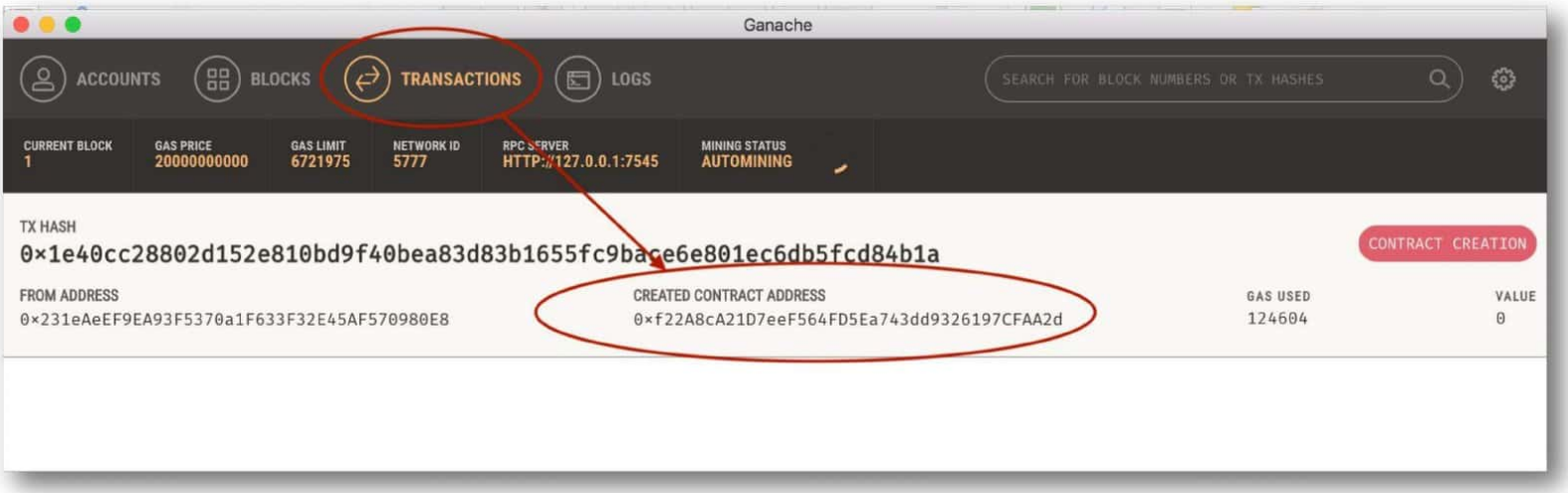


Interacting with the smart contract



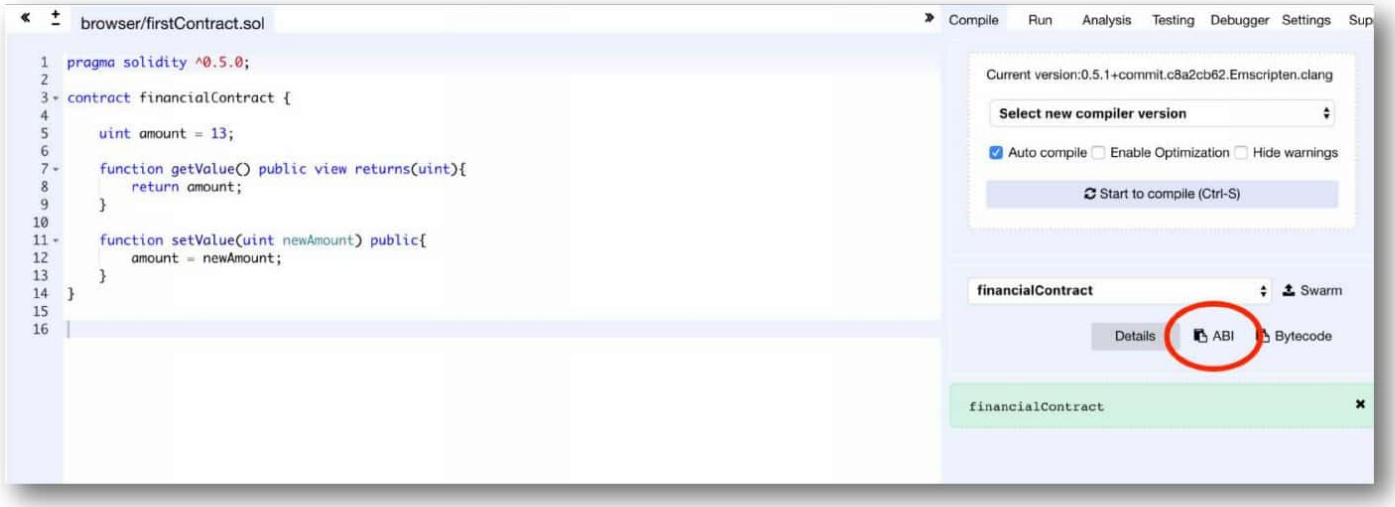
Ganache

Transactions tab: Copy the created contract address



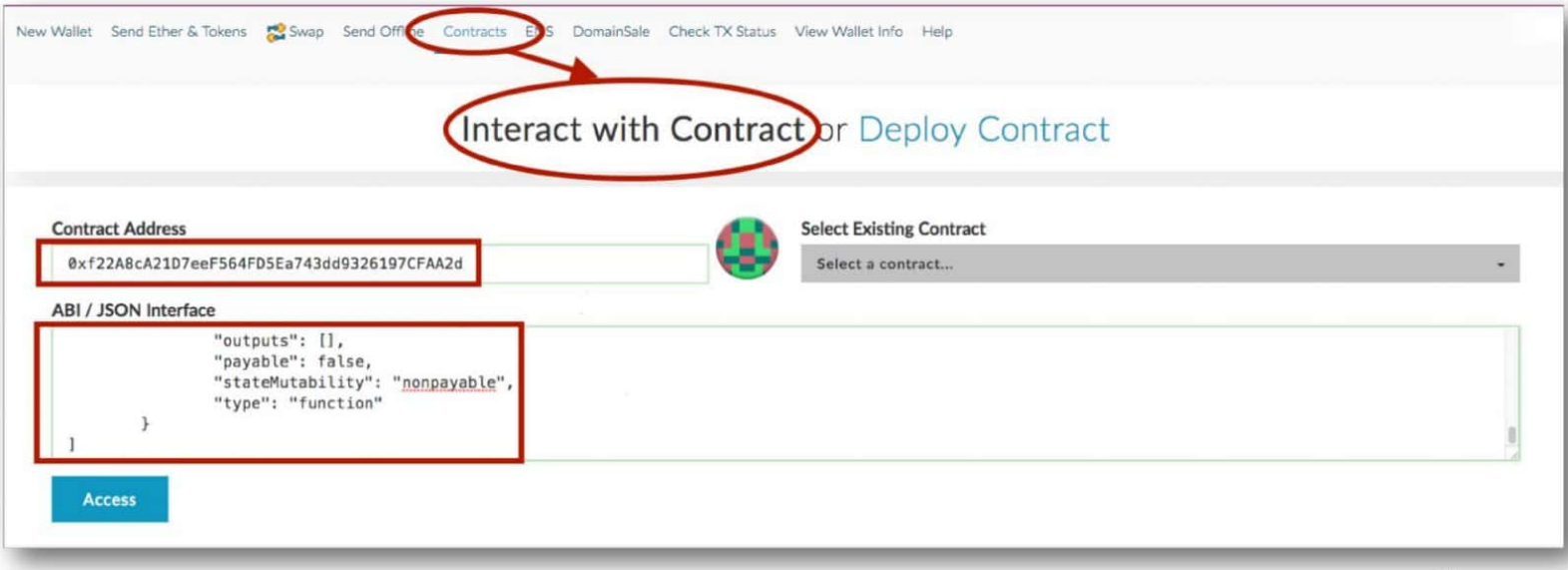
Remix

Copy the ABI
(ABI is the interface that tells MyEtherWallet how to interact with the contract)



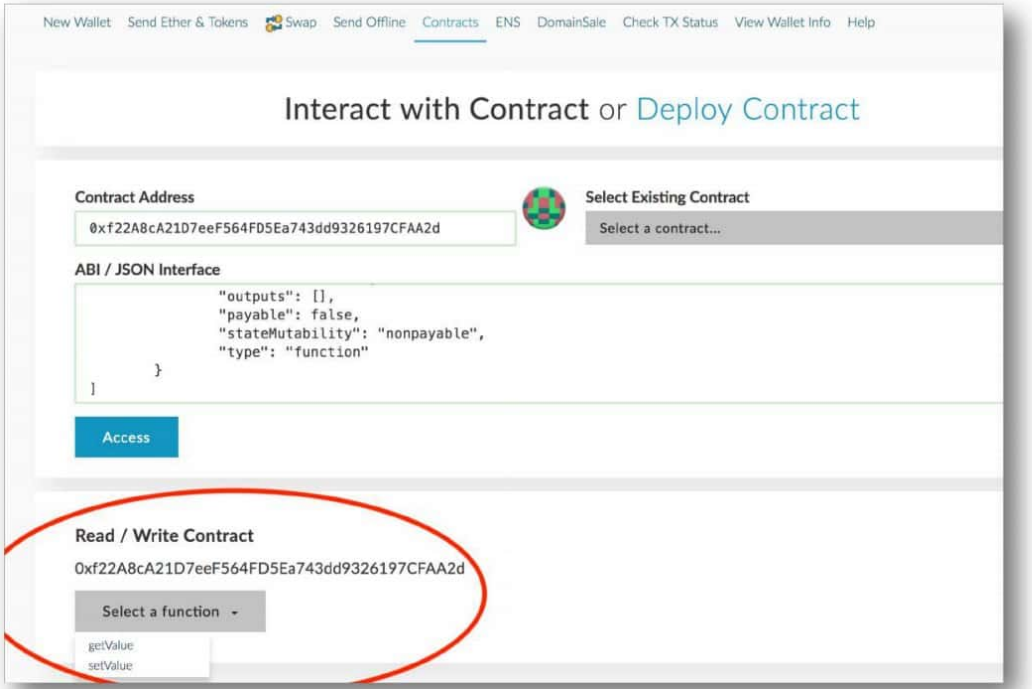
MyEtherWallet

Contracts tab:
Interact with Contract = Paste the contract address from Ganache and the ABI from Remix



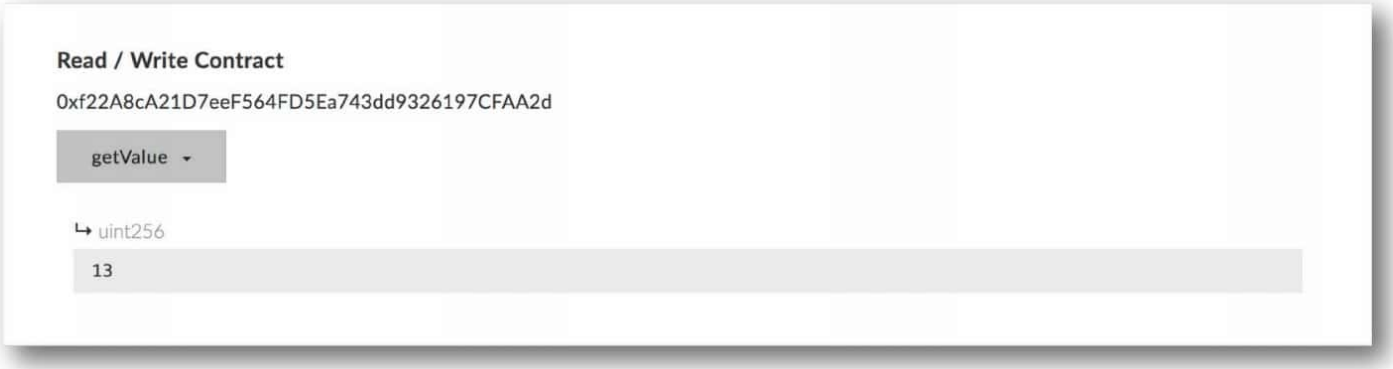
MyEtherWallet

You now can interact with the contract by selecting a function and invoking it



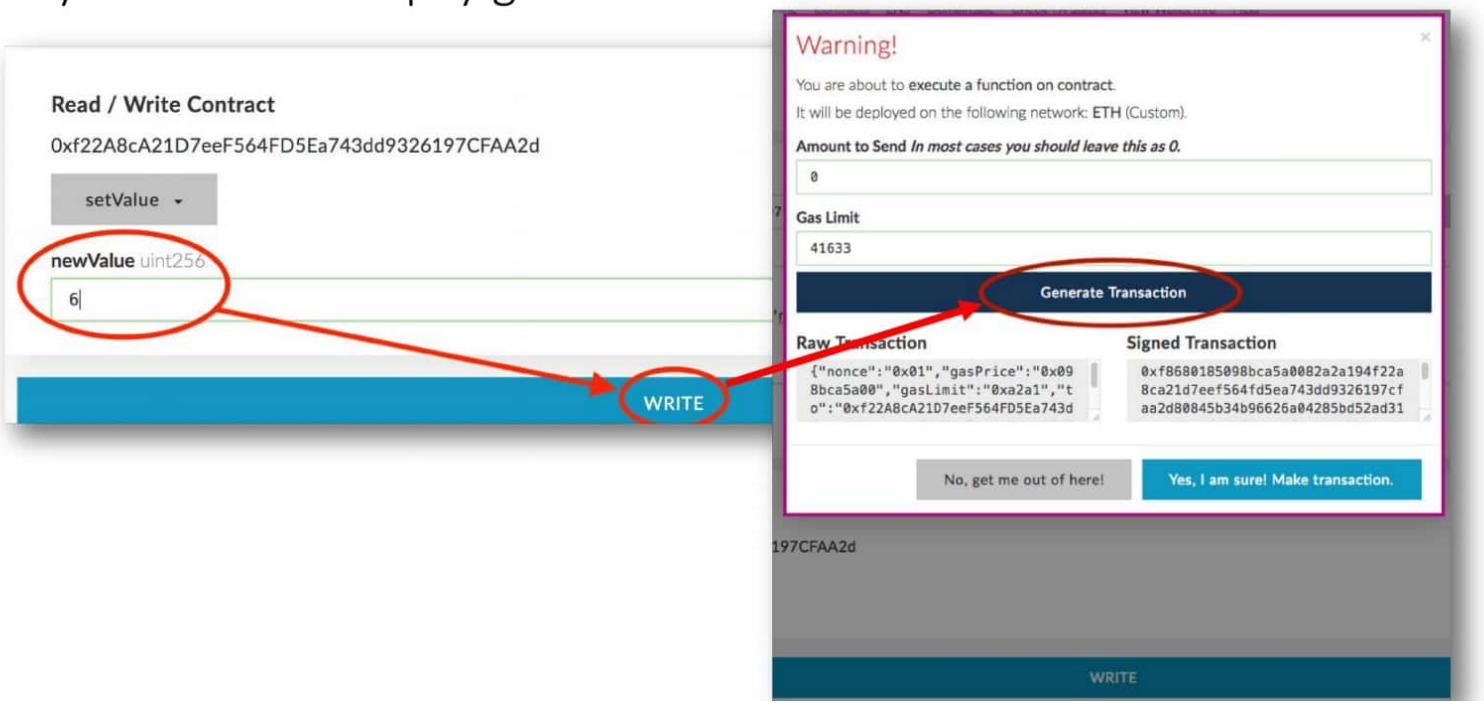
MyEtherWallet

If you select the getValue function you will receive the value without paying any gas
(There is no operation cost for getting information)



MyEtherWallet

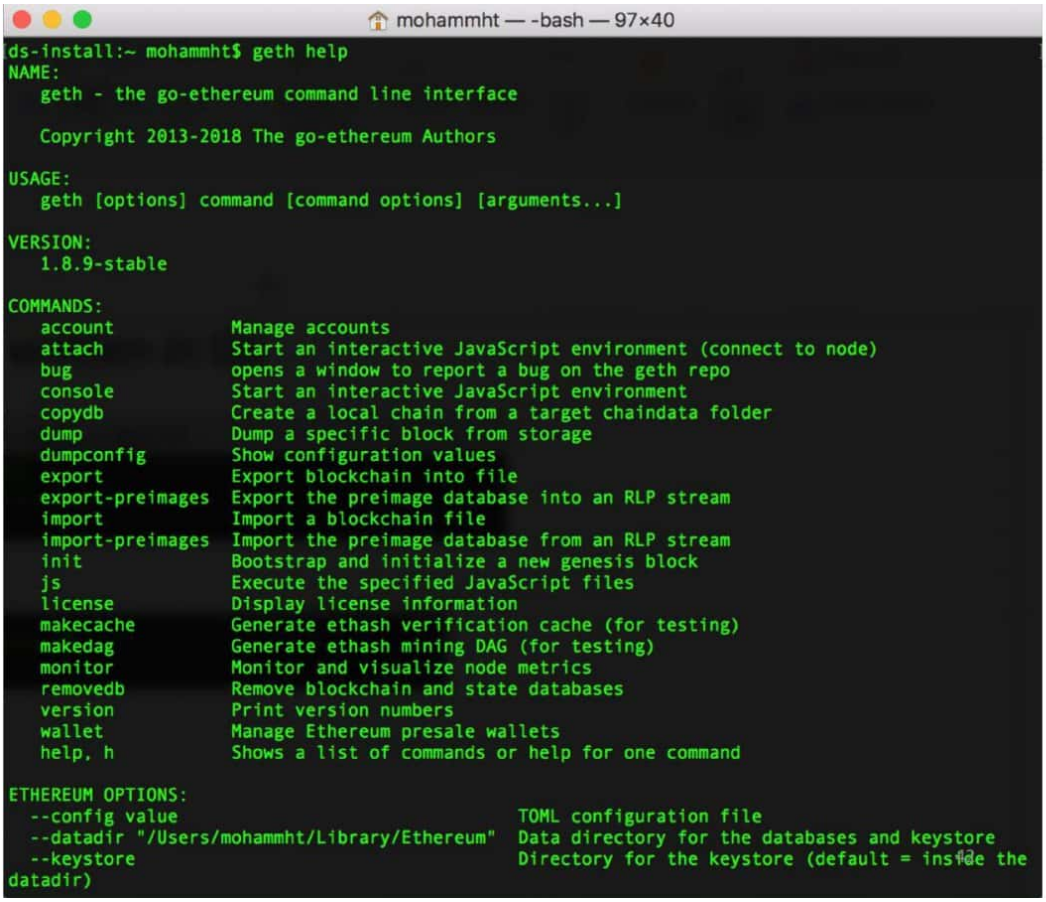
If you choose a function that updates the state of the contract, you will need to pay gas for it in a transaction.



Create Custom Ethereum Blockchain

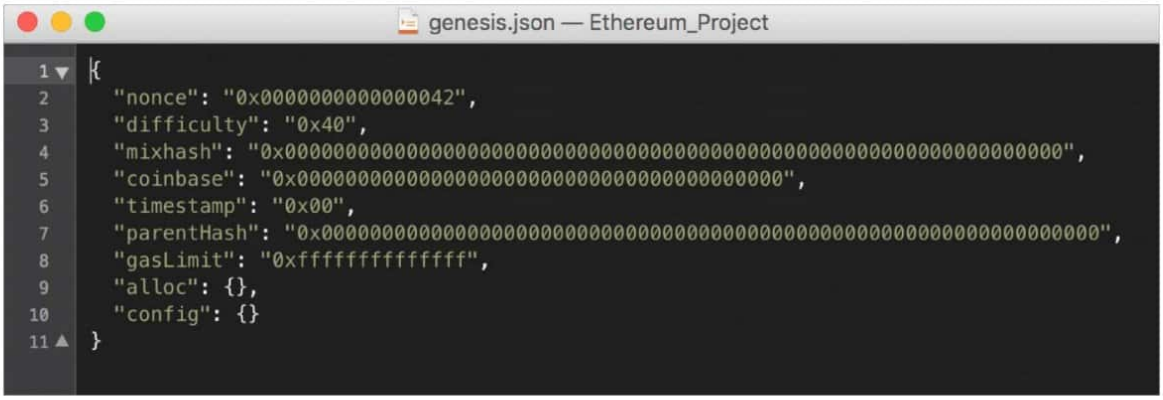
- Instead of using Ganache with its default properties for private blockchain you can run your own blockchain
- Install Geth: One of the implementations of Ethereum written in Go
- Create the genesis block
- Create storage of the blockchain
- Deploy blockchain nodes
- Connect MyEtherWallet to your blockchain to interact with it

Geth help



Genesis block

- The first block in the chain and a json file that stores the configuration of the chain

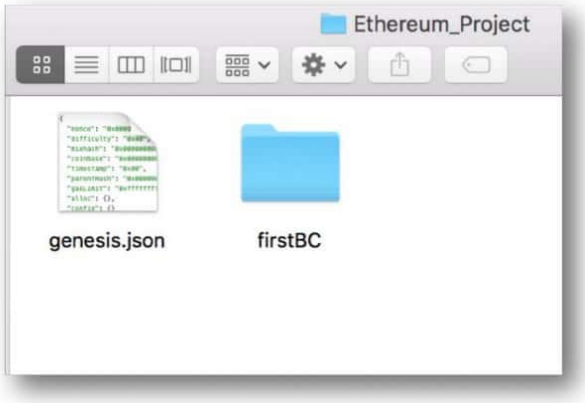


- Create and store the file as genesis.json

Create the storage of the blockchain

- Go to the directory of the genesis.json file
- Specify directory of your blockchain
- Create the storage from the genesis block

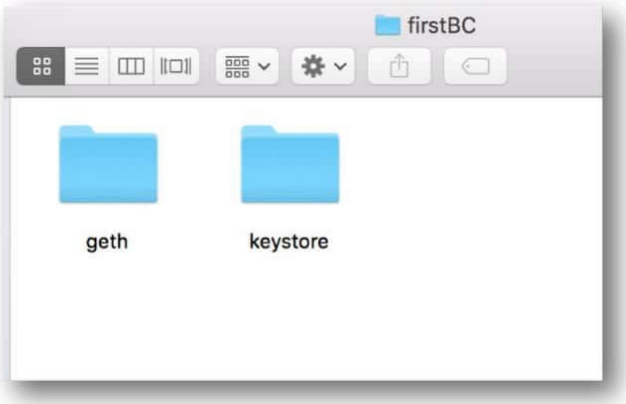
```
ds-install:Documents mohammht$ cd Ethereum_Project/
ds-install:Ethereum_Project mohammht$ geth --datadir firstBC init genesis.json
```



Folder name of your blockchain

Inside the Blockchain Folder

- geth folder: Store your database
- keystore: Store your Ethereum accounts



Start the Ethereum peer node

- Start the blockchain

```
geth --datadir fistBC --networkid 100 console
```

- Networkid provides privacy for your network.
- Other peers joining your network must use the same networkid.

Blockchain started

- Type *admin.nodeInfo* to get the information about your current node

Create an account

- Type *personal.newAccount* to create as many accounts as you need

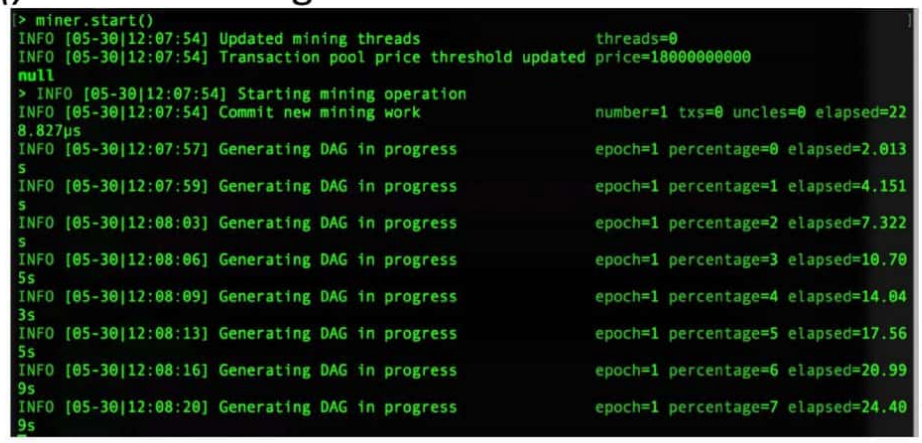
```
> personal.newAccount('Type your password here')
"0xa78eb41a10f096d4d8c4c9ca5196427aaa3fdb33"
>
```

- See the created account(s)

```
> eth.accounts
["0xa78eb41a10f096d4d8c4c9ca5196427aaa3fdb33", "0x354d952e40fc35a47562d479c86e41f6623e5f8c"]
>
```

Mining

- Type *miner.start()* to start mining



- Type *miner.stop()* to stop mining

Thank you

ADARSH CHETAN