Chapter 5 - Solidity 101

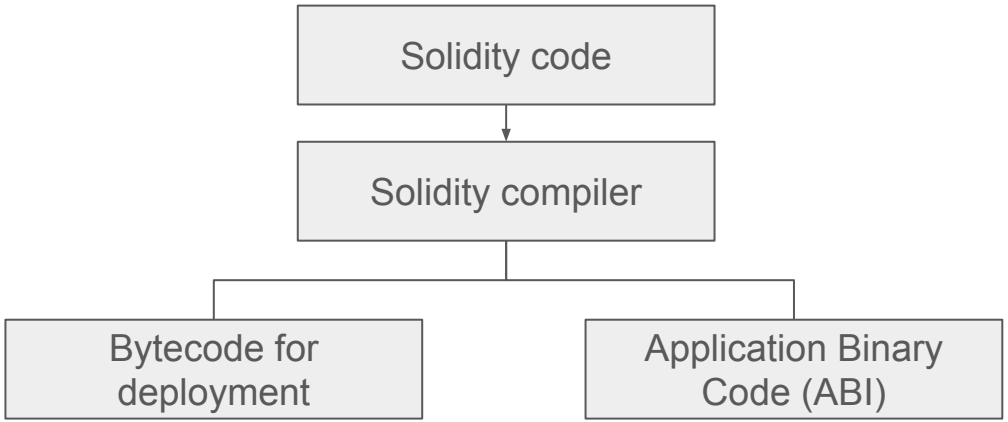
Learn Blockchain Technologies and be ready for the future.

What is the smart contract?

- An instruction is written in code which gets executed when under certain condition
- There are two types of accounts in Ethereum
  - Externally Owned Accounts (EOA) which is controlled by public-private keys
    - EOA is independent of any network
  - Contract Accounts or Smart Contract, controlled by code
    - Smart Contract is only accessible from specific network where it's deployed
- Properties inside Smart Contract transaction
  - Additional properties in smart contract transaction
    - Balance
      - Amount of ether this contract owns
    - Storage
      - Data store in this contract
    - Code
      - Machine level code for this contract

Solidity Programming Language

- The primary code is written in Ethereum smart contract
    - High-level language, influenced by C++, Python and JavaScript. Extension .sol
- Strongly typed language
    - Need to define the type for each variable
- If you know ECMAScript syntax, that would make you learn solidity faster



Solidity Compiler

- Remix (browser-based IDE with integrated compiler)
  - Recommend for quickly learn Solidity
  - https://remix.ethereum.org/
- Node.js
  - Using solcjs, a Solidity compiler
- Truffle framework
  - You can compile, deploy or test with Truffle suite

Solidity code example

Please note this contract is only for learning purpose, it doesn't fully implemented all security practices

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```
pragma solidity ^0.4.17;


contract Coin {
 // Visibility of the variable
 address public minter;
 // Mapping
 mapping (address => uint) public balances;

 // Events allow client to be notified if this event emitted
 event Sent(address from, address to, uint amount);

 // The constructor code will execute when this contract is deployed.
 constructor() public {
    minter = msg.sender;
 }

 function mint(address receiver, uint amount) public {
    require(msg.sender == minter);
    balances[receiver] += amount;
 }

 function send(address receiver, uint amount) public{
    require(balances[msg.sender] >= amount);
    balances[msg.sender] -= amount;
    balances[receiver] += amount;
    emit Sent(msg.sender, receiver, amount);
 }
}
```

Solidity code structure


```
pragma solidity ^0.4.17;
```

The version of the solidity code is written

```
contract Coin {
```

Declare a new contract name

```
address public minter;
// Mapping
mapping (address => uint) public balances;
```

Declare state permanent variables and its type

```
function mint(address receiver, uint amount) public {
    require(msg.sender == minter);
    balances[receiver] += amount;
}

function send(address receiver, uint amount) public{
    require(balances[msg.sender] >= amount);
    balances[msg.sender] -= amount;
    balances[receiver] += amount;
    emit Sent(msg.sender, receiver, amount);
}
```

Define all functions of this contract

```
// Events allow client to be notified if this event emitted
event Sent(address from, address to, uint amount);
```

Declare the event where client can be notified if this event emit

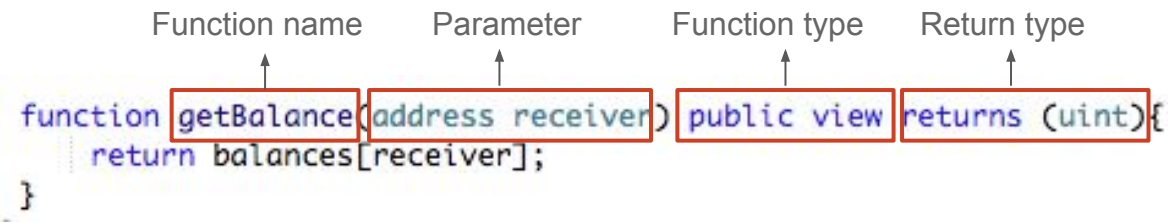
```
// The constructor code will execute when this contract is deployed.
constructor() public {
    minter = msg.sender;
}
```

The logic will be called when new contract is deployed

Solidity type

- **string**
  - Sequence of character
- **bool**
  - True or false value
- **int**
  - Integer, either positive or negative and no decimal
- **uint**
  - Unsigned integer, positive number only and no decimal
- **fixed/unfixed**
  - Fixed point number, number with a decimal after it
- **address**
  - For wallet address and has functions for checking balance or sending money

Function Declaration



- Public : anyone can access
- Private: only this contract can access
- View: this function returns data and doesn't modify data
- Pure: this function will not modify or read data
- Payable: Need to send ether to execute method

Gas and Transaction

- Ethereum use Proof of Work as consensus algorithm
  - Computation power is not free, user of blockchain have to pay for that computation
  - The payment is calculated in **Gas** and Gas is paid in **Ether**
- Gas computation
  - All transaction has a base gas cost 21,000.
  - It takes 21,000 gas if you only transferring ether and not making any state changes to the blockchain
  - If you make state changes to the blockchain, transaction takes 21,000 gas plus the addition gas associated with the change

Transaction cost = Gas usage (21,000) * Gas Price (in Wei)

That’s all the basics of Solidity

By far you can call yourself a crypto girl or boy!

Cheers.

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