https://goo.gl/CzXpph

Ethereum / Solidity Workshop

2017/02/17

Outline

- 加入以太坊 : Ethereum 環境建置
- 使用電子錢包 : Ethereum-Wallet
- 智能合約範例
- Solodity　程式架構/練習

加入以太坊 : Ethereum 環境建置

- Geth
  - Ethereum node
  - 使用Go語言實作Ethereum協議的程式
- 創世塊 (Genesis Block)
- 建立帳戶
- 建立私有鏈
- 進行挖礦
- 使用電子錢包
- 進行交易
- 部屬合約

創世塊 Genesis Block

genesis-block.json(點我下載)

```
{
  "nonce": "0x0000abcdef",
  "difficulty": "0x0",
  "mixhash": "0x0000000000000000000000000000000000000000ffffffffffffffffffffffff",
  "coinbase": "0x0000000000000000000000000000000000000000",
  "timestamp": "0x00",
  "parentHash":
"0x0000000000000000000000000000000000000000000000000000000000000000",
  "extraData": "0xffffff",
  "gasLimit": "0xfffffff"
}
```

加入私有鏈

static-nodes.js(點我下載)

```
admin.addPeer("enode://b9f46f29aa21c43e2b74ff81c7cd44f567ca08e74bfef78c2015919df161d961b53d388d79e02544e7cb4afbe8934c6686b99ed64ade9da9ca79207d3898ebb2@140.119.164.155:50505")
```

Geth環境建置---[Mac](Installing with Homebrew)

- Step 0.0 —安裝Homebrew
  - https://brew.sh/index_zh-tw.html
- Step 0.1 —清空原有帳號資料(若曾經安裝過)
  - rm -r ~/Library/Ethereum
  - rm -r ~/.ethash
- Step 1 —安裝Geth
  - brew tap ethereum/ethereum
  - brew install ethereum
- Step 2 —取得 private chain 連線資訊
  - 將genesis.json ,static-node.js與geth擺至同目錄下 -- 預設路徑為/usr/local/Cellar/ethereum/1.5.9/bin
  - mv ~/Downloads/genesis-block.json /usr/local/Cellar/ethereum/1.5.9/bin
  - mv ~/Downloads/static-nodes.js /usr/local/Cellar/ethereum/1.5.9/bin
- Step3 —初始化
  - cd /usr/local/Cellar/ethereum/1.5.9/bin
  - geth init genesis-block.json
- Step 4—新增帳號
  - geth account new
- Step 5 — 啟動
  - geth --networkid 16888 --port 30303 --nodiscover --maxpeers 25 --nat "any" --rpc --rpccorsdomain "*" --rpcapi "eth,net,web3,debug" --targetgaslimit 8888888888 --preload static-nodes.js console
  - 註 : --preload fileName.js表示 先執行該script後再啟動Geth

Geth環境建置---[Windows]

- Step 0.1 —清空原有帳號資料(若曾經安裝過)
  - 刪除 C:\Users\使用者\AppData\Roaming\Ethereum
  - 刪除 C:\Users\使用者\AppData\Ethash

- Step 1 —安裝Geth
  - 點我下載 備份連結64bit 備份連結32bit
- Step 2 —取得 private chain 連線資訊
  - 將genesis-block.json ,static-node.js與geth擺至同目錄下 (C:\Program Files\Geth)

- Step3 —初始化
  - cd C:\Program Files\Geth
  - geth init genesis-block.json

- Step4—新增帳號
  - geth account new
  -
- Step5 — 啟動
  - geth --networkid 16888 --port 30303 --nodiscover --maxpeers 25 --nat "any" --rpc --rpccorsdomain "*" --rpcapi "eth,net,web3,debug" --targetgaslimit 8888888888 --preload static-nodes.js console
  - 註 : --preload fileName.js表示 先執行該script後再啟動Geth
  -

Geth---常用指令 [查詢,設定連線資訊]

- **進入本地端 JavaScript Console**
  - geth attach (connect to node) / geth console
- **加入 peer (於JavaScript Console)**
  - 法一 (於JavaScript Console) :
    - admin.addPeer("邀請者之Enode資訊") example
  - 法二 :
    - 加入js檔於geth目錄資料夾
    - 啟動Geth時指令加入 --preload static-nodes.js console (表示先執行該js檔再啟動Enode)
-

```
>admin.addPeer("enode://b9f46f29aa21c43e2b74ff81c7cd44f567ca08e74bfef78c2015919df
161d961b53d388d79e02544e7cb4afbe8934c6686b99ed64ade9da9ca79207d3898ebb2@14
0.119.164.155:50505"")
>true
```

Geth---常用指令 [查詢,設定連線資訊]

- 查詢本機Enode資訊

```
> admin.nodeInfo
{
  enode:
"enode://9a4ba9d5ff67f221f89a6bb93a5be9c59ce8d7efef8a309d6253ca2298d0f8827d405ffa5d8203dc7312d02dcc0c9953022d83650e4bca680
c6b40c161707576@[::]:30303?discport=0",
  id:
"9a4ba9d5ff67f221f89a6bb93a5be9c59ce8d7efef8a309d6253ca2298d0f8827d405ffa5d8203dc7312d02dcc0c9953022d83650e4bca680c6b40c1
61707576",
  ip: "::",
  listenAddr: "[::]:30303",
  name: "Geth/v1.5.9-stable/windows/go1.7.4",
  ports: {
            discovery: 0,
            listener: 30303
  },
  protocols: {
            eth: {
            difficulty: 43004232,
            genesis: "0xaff2017dd15f884cdf9f3cd5cf97eeda83ff0bdf4d349fe224f1d7a20f98ef02",
            head: "0x707bac8a5833f04b67e547d39afc6432a0516a90c9dc7e9e90d077796150b5ea",
            network: 16888
            }
  }
}
```

Geth---常用指令 [查詢,設定連線資訊]

- 查詢目前peer對象

```
> admin.peers
[{
        caps: ["eth/62", "eth/63"],
        id:
        "b9f46f29aa21c43e2b74ff81c7cd44f567ca08e74bfef78c2015919df161d961b53d388d79e02544e7cb4afbe8934c6
686b99ed64ade9da9ca79207d3898ebb2",
        name: "Geth/v1.5.9-stable-a07539fb/linux/go1.7.3",
        network: {
        localAddress: "140.119.163.194:63971",
        remoteAddress: "140.119.164.155:50505"
        },
        protocols: {
        eth: {
        difficulty: 43004232,
        head: "0x707bac8a5833f04b67e547d39afc6432a0516a90c9dc7e9e90d077796150b5ea",
        version: 63
        }
        }
}]
```

Geth---常用指令 [查詢,設定連線資訊]

- 查詢目前node中的accounts
  - >eth.accounts
- 新增帳號
  - >personal.newAccount("密碼")
- 挖礦
  - >miner.start(2)
    - 表示使用 2個thread mining
  - >miner.stop()

Geth---常用指令 (Web3.ja Javascript API)

- 查詢帳號餘額
  - >eth.getBalance(YOUR_ACCOUNT_ADDRESS) [此時單位是 wei]
  - >web3.fromWei(eth.getBalance(YOUR_ACCOUNT_ADDRESS), "ether")
- 查詢當前挖礦預設帳號(coinbase)
  - >eth.coinbase
- 切換coinbase為第1個帳戶(預設為第0個)
  - >eth.coinbase = eth.accounts[1]

    改成miner.setEtherbase(eth.accounts[1])

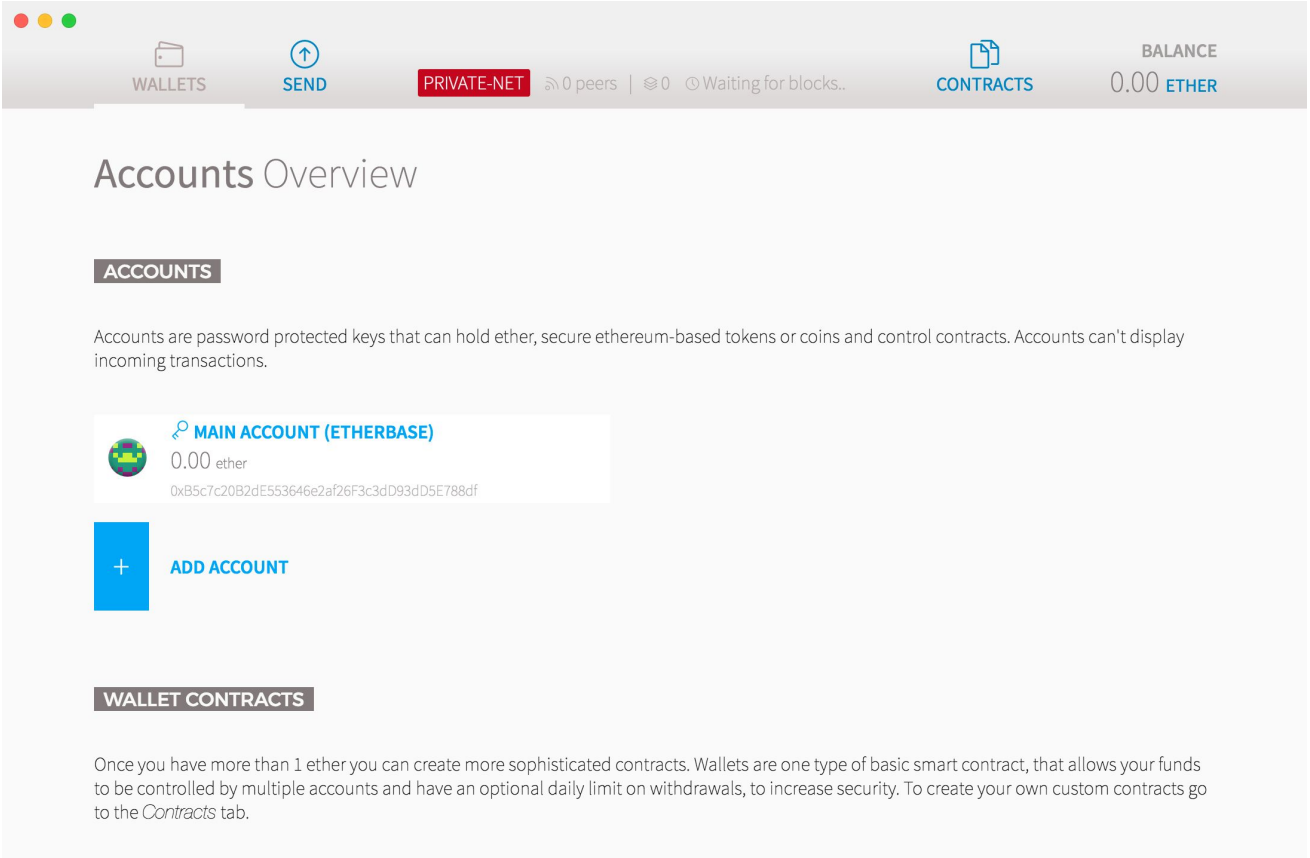
Geth---第一個 Transaction

- UnlockAccount
  - 指令
    - geth --unlock <YOUR_ACCOUNT_ADDRESS> --password <YOUR_PASSWORD>
  - JavaScript Console (API)
    - >personal.unlockAccount("address", "password")

- Send Transaction(需要先UnlockAccount)
  - Send ethCoin
    - 格式
      - >eth.sendTransaction({from:senderAddr, to:receiverAddr, value: amount})
    - 範例
      - >eth.sendTransaction({from:eth.coinbase, to:eth.accounts[1], value: web3.toWei(0.05, "ether")})

使用電子錢包：Ethereum Wallet

最新版本



Solidity 基本介紹

- 乙太坊智能合約語言
- 風格類似JavaScript
- 強型別

Solidity 開發環境

- 線上IDE(推薦)

建議
https://chriseth.github.io/browser-solidity/#version=soljson-latest.js

  - Browser-Solidity (via http, not https, for local enode connection)
- Solc編譯器
  - `npm install solc -g`
  - `solcjs --help`
  - `solcjs contract.sol`
- 文字編輯器套件
  - Atom : linter-solidity
  - Vim : vim-solidity
  - Code : vscode-solidity

First Contract

```
pragma solidity ^0.4.8;

contract myFirstContract {
  /* define variable */
  int myNumber;
  string myName;

  /* this runs when the contract is executed */
  function myFirstContract(string name) public {
    myName = name;
  }

  /*  function */
  function setNumber(int newNumber)  returns (bool) {
    myNumber=newNumber;
    return true;
  }

  function getMyName() constant returns (string) {
    return myName;
  }

  function getNumber() constant returns (int) {
    return myNumber;
  }
}
```

Solidity Layout

- Version Pragma
  - `pragma solidity ^0.4.10;`
- Comments
  - `// This is a single-line comment.`

```
/*
This is a
multi-line comment.
*/
```

Solidity 基本架構(1/4)

- State Variables(狀態變數)
  - 儲存狀態
    -

```
pragma solidity ^0.4.0;


contract SimpleStorage {
    uint storedData; // State variable
    // ...
}
```

Solidity 基本架構(2/4)

- Functions(函式)
  - 改變狀態、與其他合約互動、建構子
    - pragma solidity ^0.4.0;

```
contract SimpleAuction {
    function bid() payable { // Function
        // ...
    }
}
```

Solidity 基本架構(3/4)

- Function Modifiers(函式描述子)
  - 前置條件(前提)

```
pragma solidity ^0.4.0;
contract modifierSample {
    address public Owner;
    modifier onlyOwner() {  // Modifier
        if (msg.sender != Owner) throw;
        _;
    }
    function modifierSample(){Owner=msg.sender;}
    function close() onlyOwner {  // Modifier usage
        selfdestruct(Owner); // ...
    }
}
```

Solidity 基本架構(4/4)

- Events(事件)
  - 與鏈外事件互動
    -
```
pragma solidity ^0.4.0;

contract eventSample {
    event payEvent(address from,address to,uint amount); // Event

    function payOthers(address targetAddr,uint amount)  payable {
    targetAddr.send(this.balance);
    payEvent(this, targetAddr,this.balance);  // Triggering event
        }
    }
```

Solidity 實值型別(1/2)

- Booleans
  - `true` and `false`
  - Operators
    - `!` logical negation
    - `&&` logical conjunction, “and”
    - `||` logical disjunction, “or”
    - `==` equality
    - `!=` inequality
- Integers
  - `int`
  - `uint (unsigned integer)`
- address
  - 20 byte value (size of an Ethereum address).
- *`string`*
  - *Dynamically-sized UTF-8-encoded string.*
- 常數修飾詞
  - `constant`

Solidity 實值型別(2/2)

- `uint x;`
- `int constant a = 8;`
  - *`int256 contant a = 8;` // 與上行效果一樣*
- `bool b = true;`
  - *`var b = true;` // 與上行效果一樣*
  - *`var` 可用於型別推論*
- `address public owner;`
  - *帳戶有兩種*
    - *合約帳戶(Contract Account)*
    - *外部帳戶(External Account)*
  - *合約帳戶指合約，外部帳戶指外部個體帳戶*
- `owner.balance;`
  - *得到 `owner` 的帳簿餘額(無論此為合約帳戶或外部帳戶)*

練習(請使用First Contract)

- 練習1.
  - 請加入myOwner變數以及修改FirstContract建構子,
  - 當合約部署時將部署者之名稱記錄至 myName及Address記錄至myOwner
    - function Name:FirstContract(string name,_____ Owner)
    - parameters: name,Owner
- 練習2.
  - 回傳Owner之address，並判斷是否可加入 ”constant“,若否則不用加入。
    - function Name: getOwner()
    - parameters: none
    - return s: address 。
- 練習3.
  - 請加入event ,並使用wallet觀察contract所發出event
  - 當setNumber被呼叫時則發出 event告知外部(1)myNumber(2)newNumber(2)由呼叫此function
    - event name: numberChangeEvent
    - parameter: oldNumber,newNumber,from

Solidity 参考型別(1/2)

- Arrays
  - `T[]  t;` // an array of dynamic size
  - `T[N]  t;` // N-length array
  - `T[N][M]  t;` // M*N array

Solidity 参考型別(2/2)

- Structs
  - ```
    pragma solidity ^0.4.0;
    contract Test {
        struct Student { // Struct
            uint id;
            string name;
        }

        Student A = Student({
            id = 1234,
            name = ”John”;
        });
        //or
        Student B = Student(1234, ”John”);
    }
    ```
    ```

Solidity 其他型別

- 型別轉換
  - 隱含轉換
    - uint8 -> uint16 (O)
    - int8 -> int16 (O)
    - int8 -> uint8 (X)
  - 明確轉換
    - `int8 y = -3; uint x = uint(y);  // x is now 0xfffff..fd`
    - `uint32 a = 0x12345678; uint16 b = uint16(a);  // b is now 0x5678`

Mappings

- `mapping(_KeyType => _ValueType)`
  - `_KeyType` can be almost any type except for a mapping
  - `_ValueType` can actually be any type, including mappings
  - ```
    mapping (string => uint) public balances;
    balances["John"] = 10 ether;
    ```
    ```

Solidity 全域變數

- block
  - `block.blockhash(uint blockNumber) returns (bytes32)`
  - `block.coinbase  // miner's address`
  - `block.gaslimit  // current block gaslimit`
  - `block.number    // current block number`
  - `block.timestamp // current block time (before commit)`
- msg
  - `msg.sender   //sender of the message (current call)`
  - `msg.value    //number of wei sent with the message`
- now
  - alias for `block.timestamp`
- tx
  - `tx.origin    //sender of the transaction (full call chain)`

Solidity 流程控制(1/2)

- Control Structure
  - 邏輯
    - `if`
    - `else`
    - `?:`
  - 迴圈
    - `while`
    - `do`
    - `for`
    - `break`
    - `continue`
  - 函式
    - `return`
    - `return` *`VALUE,..;`*
    - `function` *`NAME(ARG,..)`* *`VISIBILITY`* `returns (`*`TYPE,...`*`) {}`

Solidity 流程控制(2/2)

- Assignment
  - ```
    function f() returns (uint, bool, uint) {
            return (7, true, 2);
    }
    function g() {
        var (x, b, y) = f(); // x = 7, b = true, y = 2
        (x, y) = (2, 7); // x = 2, y = 7
        (x, y) = (y, x); // x = 7, y = 2
    }
    ```
- Exception
  - `throw`
  - 目前 solidity 暫時無法處理例外
    ```

Solidity 單位

- Ether Units
  - `1 = 1 wei`
  - `1 ether = 1000 finny`
  - `1 ether = 1000000000000000000 wei = 10^18 wei`
- Time Units
  - `1 == 1 seconds`
  - `1 minutes == 60 seconds`
  - `1 hours == 60 minutes`
  - `1 days == 24 hours`
  - `1 weeks = 7 days`
  - `1 years = 365 days`

Example 1

```
pragma solidity ^0.4.8
contract ReferenceTypeTest {
        struct Student {
                uint id;
                string name;
                uint age;
        }

        mapping (uint => Student) students;

        function putStudent(uint _id, string _name, uint _age) {
                students[_id] = Student({
                        id: _id,
                        name: _name,
                        age: _age
                });
        }
        function getStudent(uint _id) returns (uint id, string name, uint age) {
                var student = students[_id];
                id = student.id;
                name = student.name;
                age = student.age;
        }
}
```

Example 2

```
pragma solidity ^0.4.8
contract Test{
        struct coinWallet {
                uint redCoin;
                uint greenCoin;
                string userName;
        }
        coinWallet public myWallet;
        mapping (address => coinWallet) public allWallets;

        function Test(){
                myWallet.redCoin = 500;
                myWallet.greenCoin = 250;
                myWallet.userName = "me";

                allWallets[tx.origin] = myWallet;
        }
        function GetRed() returns (uint redAmount){
                return myWallet.redCoin;
        }
        function GetTotal() returns (uint totalAmount){
                return myWallet.redCoin + myWallet.greenCoin;
        }
}
```

練習

- 請在右邊程式碼加入 function
- newUser()
  - 新增使用者
- getUserInformation()
  - 查詢使用者資訊

```
pragma solidity ^0.4.5;

contract phoneSample{
struct user{
   string userName;
   bool oftenToUse;
   uint monthlyFees;
}

mapping (address => user)  users;

function phoneSample(string myName,bool isOftenToUse,uint myMonthlyFees){
   users[msg.sender].userName = myName;
   users[msg.sender].oftenToUse = isOftenToUse;
   users[msg.sender].monthlyFees = myMonthlyFees;

}


function getMyUserInformation() constant returns (string myName,bool
isOftenToUse,uint myMonthlyFees){
   myName = users[msg.sender].userName;
   isOftenToUse = users[msg.sender].oftenToUse;
   myMonthlyFees = users[msg.sender].monthlyFees;
}


}
```