

使用Geth佈建Ethereum Private Chain與挖礦

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台灣陽光雲有限公司 本公司其他工作

■ 工作內容

【工作內容】

負責以太坊區塊鏈架構與智能合約撰寫

【技術需求】

對比特幣/ 數位貨幣/區塊鏈行業有一定瞭解

研究區塊鏈的運行機制和底層實現

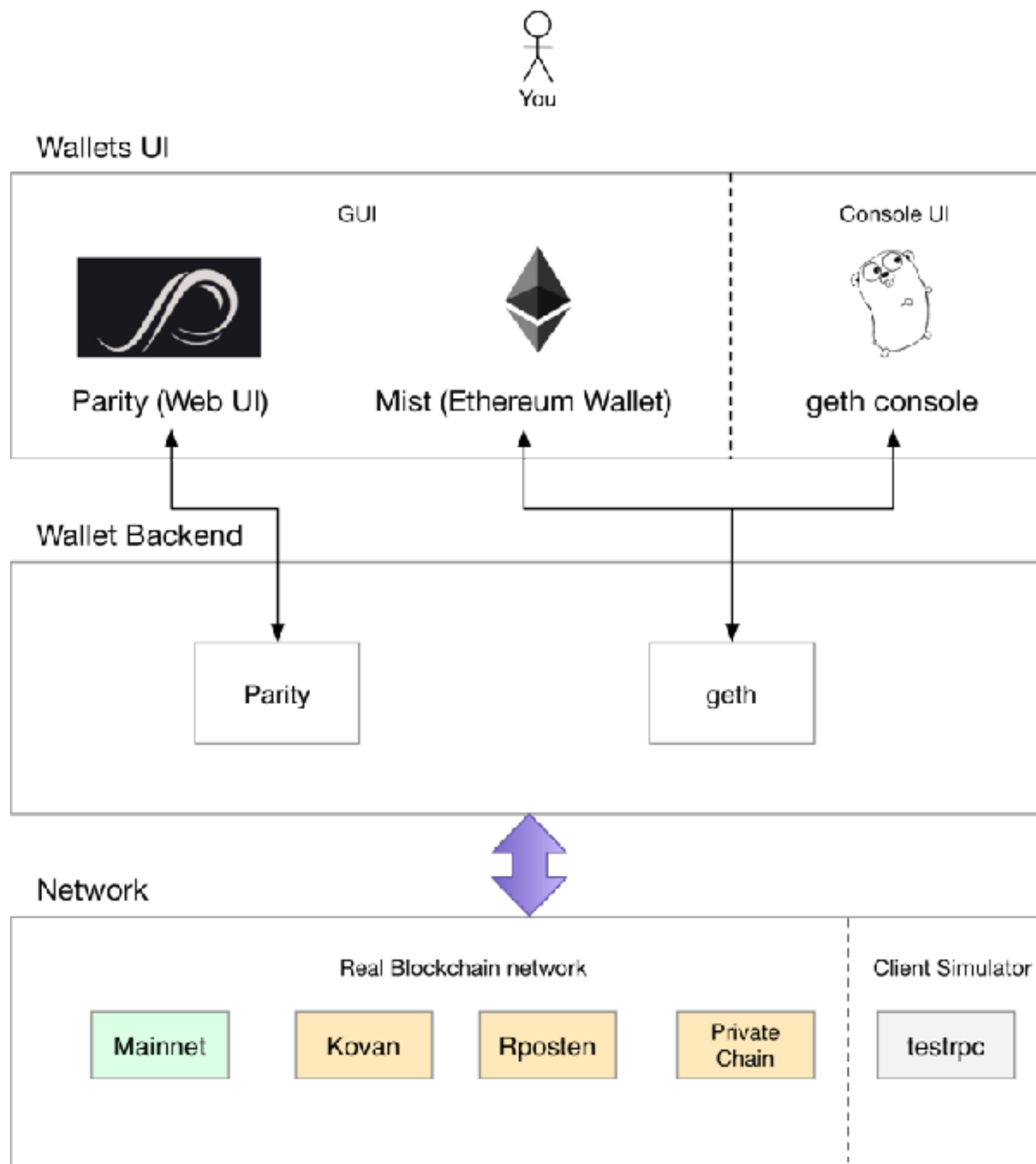
熟悉資訊安全協定和架構

具備加密演算法經驗尤佳

熟悉node.js 或 Python

【程式語言需求】

nodejs or Python 2 年以上經驗



可以用 parity 作為 backend 搭配 Mist 的介面了

學習重點

- 觀察 以太坊 單一節點的區塊鏈其運作情形
- 觀察以太坊 錢包Mist的介面與操作流程
- 實操以太坊錢包Mist的建立新的錢包地址
- 實操以太坊錢包Mist的轉帳流程 並觀察如何寫入帳本？
- 實操聯名帳戶在以太坊實踐的過程
- 實操以太坊發出交易之後，註記一些重要信息置入區塊鏈上

實作步驟：

- 在GCP上安裝好desktop版本的Ubuntu
- 下載 `geth_v1.6.7_install.sh`的腳本檔
- 複製`geth_v1.6.7_install.sh`到家目錄
- 接著啟動Mist 錢包，在視窗裡面設立一個主帳號地址
- 用另一個終端機 下指令：`geth attach`
- `>miner.start()`
- `>miner.stop()`

Geth + Mist

tar -xvf

下載好geth之後，

cp ./geth /usr/local/bin/

On Linux(Ubuntu)

```
geth --dev --ipcpath=~/.ethereum/geth.ipc
```

```
ta02@vnc:~$ geth --dev --ipcpath=~/.ethereum/geth.ipc
WARN [10-19|22:07:21] No etherbase set and no accounts found as default
INFO [10-19|22:07:21] Starting peer-to-peer node               instance=Geth/v1.7.2-stable-1db4ecdc/linux-amd64/go1.9
INFO [10-19|22:07:21] Allocated cache and file handles         database=/tmp/ethereum_dev_mode/geth/chaindata
cache=128 handles=1024
INFO [10-19|22:07:21] Writing custom genesis block
INFO [10-19|22:07:21] Initialised chain configuration          config="{ChainID: 1337 Homestead: 0 DAO: <nil>
DAOSupport: false EIP150: 0 EIP155: 0 EIP158: 0 Byzantium: 0 Engine: ethash}"
WARN [10-19|22:07:21] Ethash used in test mode
INFO [10-19|22:07:21] Initialising Ethereum protocol          versions="[63 62]" network=1
INFO [10-19|22:07:21] Loaded most recent local header         number=0 hash=e5be92...38f3bc td=131072
INFO [10-19|22:07:21] Loaded most recent local full block     number=0 hash=e5be92...38f3bc td=131072
INFO [10-19|22:07:21] Loaded most recent local fast block     number=0 hash=e5be92...38f3bc td=131072
INFO [10-19|22:07:21] Regenerated local transaction journal    transactions=0 accounts=0
INFO [10-19|22:07:21] Starting P2P networking
INFO [10-19|22:07:21] RLPx listener up                       self="enode://d35bbddc0d22f9a2d434286d541d3bc7
c38d2ea003e59dc6af9b14d72ca72a45db114c2c518ee289616329560c153c27f220ab1fede017d7b4cfd12b7ac3312d@[::]:32871?discport=0"
INFO [10-19|22:07:21] started whisper v.5.0
INFO [10-19|22:07:21] IPC endpoint opened: /home/ta02/.ethereum/geth.ipc
```

Geth — dev — ipcpath

```
luruishande-MacBook-Pro:geth admin$ geth --dev --ipcpath=~/.ethereum/geth.ipc
WARN [10-19|22:04:22] No etherbase set and no accounts found as default
INFO [10-19|22:04:22] Starting peer-to-peer node instance=Geth/v1.6.5-stable-
cf87713d/darwin-amd64/go1.8.3
INFO [10-19|22:04:22] Allocated cache and file handles database=/var/folders/hl/
lzt3qrj55vvgkx6gmtY20lz00000gn/T/ethereum_dev_mode/geth/chaindata cache=128 handles=1024
INFO [10-19|22:04:22] Writing custom genesis block
INFO [10-19|22:04:22] Initialised chain configuration config="{ChainID: 1337
Homestead: 0 DAO: <nil> DAOSupport: false EIP150: 0 EIP155: 0 EIP158: 0 Metropolis: 0 Engine:
ethash}"
WARN [10-19|22:04:22] Ethash used in test mode
WARN [10-19|22:04:22] Upgrading db log bloom bins
INFO [10-19|22:04:22] Bloom-bin upgrade completed elapsed=42.168µs
INFO [10-19|22:04:22] Initialising Ethereum protocol versions="[63 62]" network=1
INFO [10-19|22:04:22] Loaded most recent local header number=0 hash=e5be92...38f3bc
td=131072
INFO [10-19|22:04:22] Loaded most recent local full block number=0 hash=e5be92...38f3bc
td=131072
INFO [10-19|22:04:22] Loaded most recent local fast block number=0 hash=e5be92...38f3bc
td=131072
INFO [10-19|22:04:22] Starting P2P networking
INFO [10-19|22:04:22] started whisper v.5.0
INFO [10-19|22:04:22] RLPx listener up self="enode://
a86da18324c646c396210087119cca5f3af74eccb0e2509e161670bb48a2cad00c43dc06bfd5d926f4c2200f321a8
e56115687f36beb538ed60a572213ca1697@[::]:59504?discport=0"
INFO [10-19|22:04:22] IPC endpoint opened: /Users/admin/Library/Ethereum/geth.ipc
```

whisper is a communication protocol for DApps to communicate with each other.

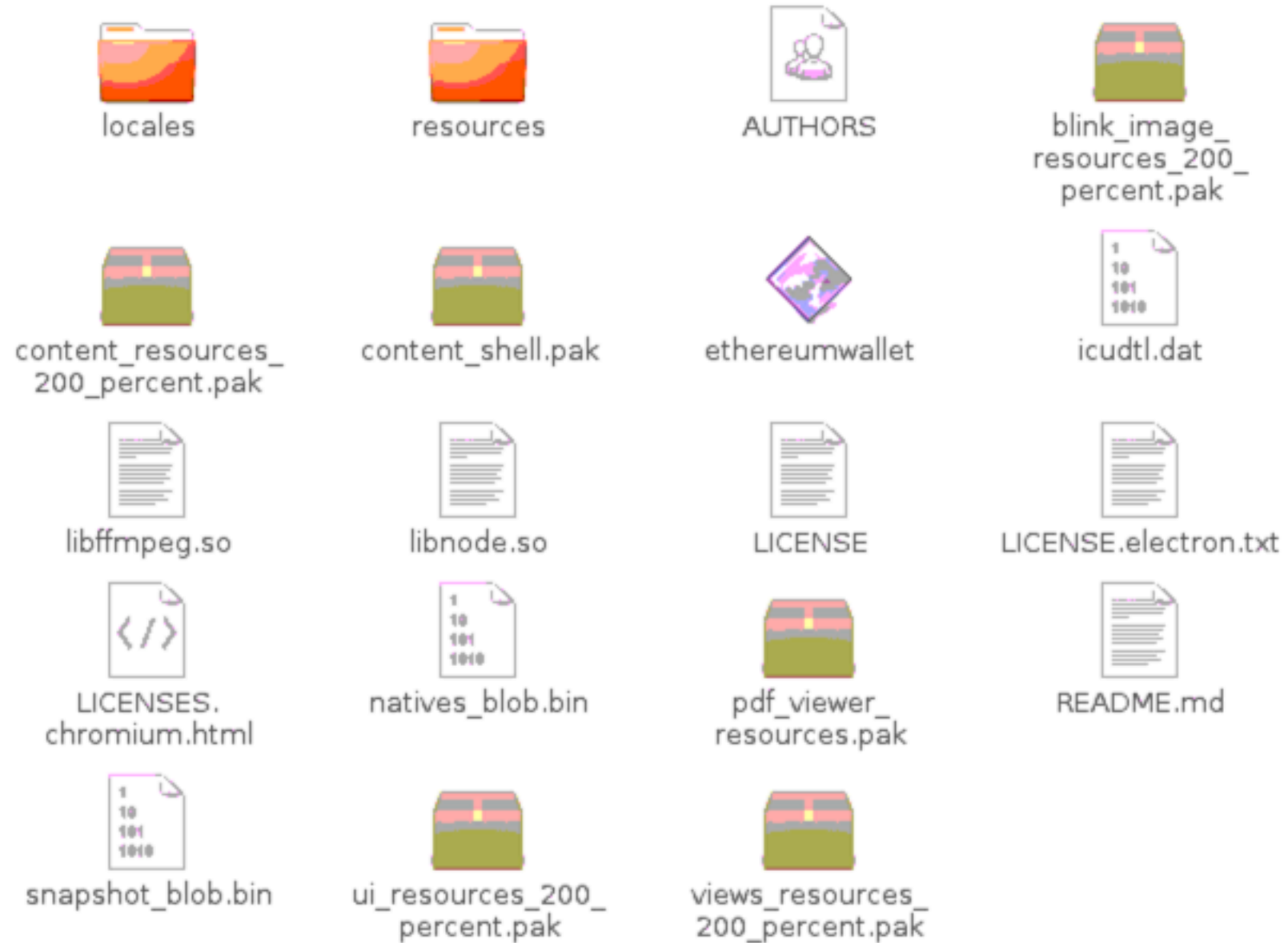


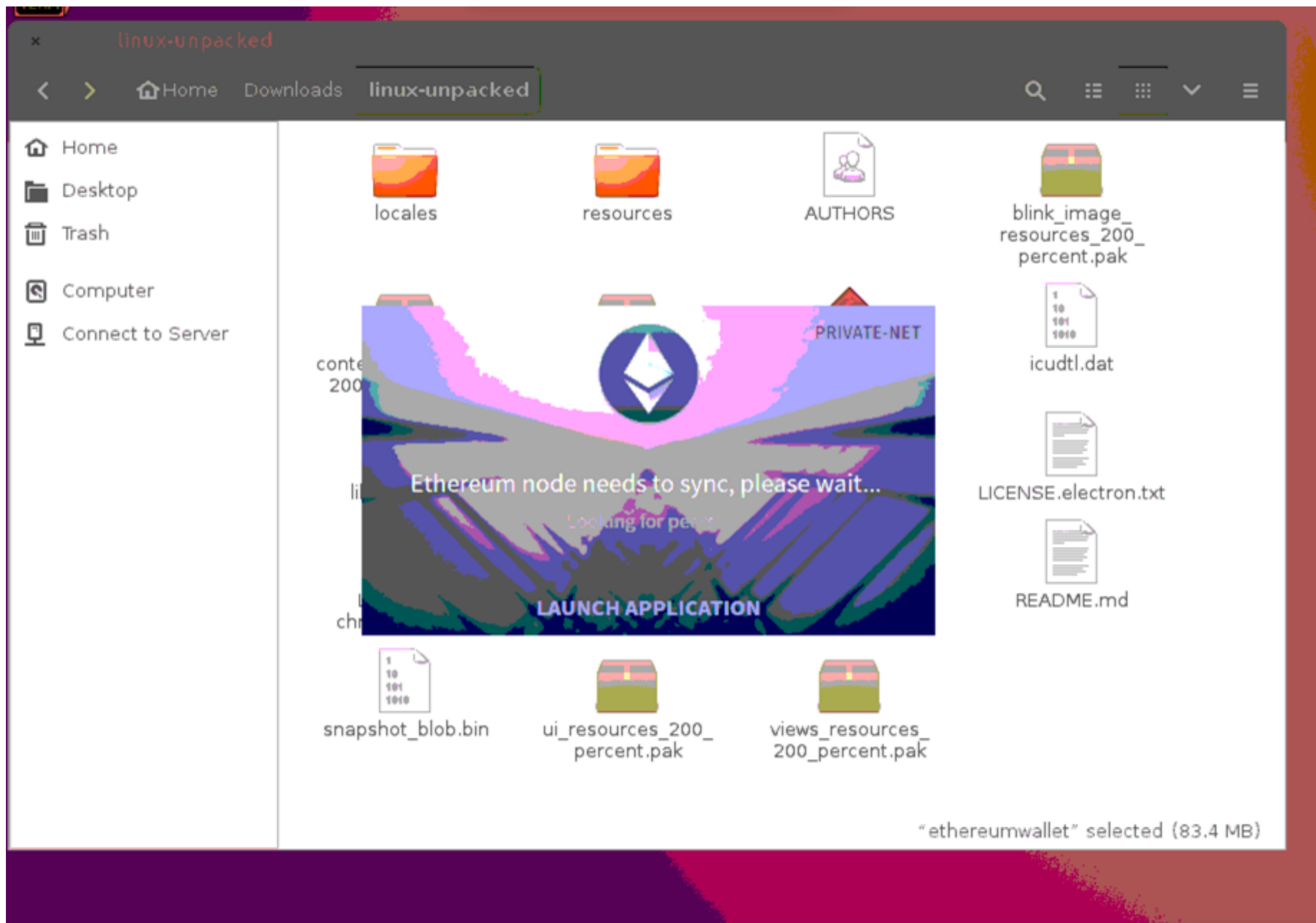
linux-unpacked

< > Home Downloads linux-unpacked



- Home
- Desktop
- Trash
- Computer
- Connect to Server






WALLETS


SEND


PRIVATE-NET

 0 |  0 


CONTRACTS

BALANCE
0.00 ETHER*

Accounts Overview



ADD ACCOUNT

YOU HAVE NO ACCOUNTS YET

You need to create at least one account with a strong password.

NO TRANSACTIONS YET

Mac OS上的啟動指令

Geth — dev — ipcpath

```
luruishande-MacBook-Pro:geth admin$ geth --dev --ipcpath=~/.Library/Ethereum/geth.ipc
WARN [10-19|22:04:22] No etherbase set and no accounts found as default
INFO [10-19|22:04:22] Starting peer-to-peer node                               instance=Geth/v1.6.5-stable-cf87713d/darwin-amd64/go1.8.3
INFO [10-19|22:04:22] Allocated cache and file handles                       database=/var/folders/hl/lzt3qrj55vvgkx6gmt20lz00000gn/T/ethereum_dev_mode/geth/chaindata cache=128 handles=1024
INFO [10-19|22:04:22] Writing custom genesis block
INFO [10-19|22:04:22] Initialised chain configuration                        config="{ChainID: 1337 Homestead: 0 DAO: <nil> DAOSupport: false EIP150: 0 EIP155: 0 EIP158: 0 Metropolis: 0 Engine: ethash}"
WARN [10-19|22:04:22] Ethash used in test mode
WARN [10-19|22:04:22] Upgrading db log bloom bins
INFO [10-19|22:04:22] Bloom-bin upgrade completed                           elapsed=42.168µs
INFO [10-19|22:04:22] Initialising Ethereum protocol                       versions="[63 62]" network=1
INFO [10-19|22:04:22] Loaded most recent local header                       number=0 hash=e5be92...38f3bc td=131072
INFO [10-19|22:04:22] Loaded most recent local full block                   number=0 hash=e5be92...38f3bc td=131072
INFO [10-19|22:04:22] Loaded most recent local fast block                   number=0 hash=e5be92...38f3bc td=131072
INFO [10-19|22:04:22] Starting P2P networking
INFO [10-19|22:04:22] started whisper v.5.0
INFO [10-19|22:04:22] RLPx listener up                                     self="enode://a86da18324c646c396210087119cca5f3af74eccb0e2509e161670bb48a2cad00c43dc06bfd5d926f4c2200f321a8e56115687f36beb538ed60a572213ca1697@[::]:59504?discport=0"
INFO [10-19|22:04:22] IPC endpoint opened: /Users/admin/Library/Ethereum/geth.ipc
```

whisper is a communication protocol for DApps to communicate with each other.

帳本 : database=/var/folders/hl/lzt3qrj55vvgkx6gmt20lz00000gn/T/ethereum_dev_mode/geth/chaindata

Ethereum的 Single node mining

實作步驟：

- `$geth --dev --ipcpath=~/.Library/Ethereum/geth.ipc`
- 接著啟動Mist或是Ethereum Wallet
- `$geth attach`
- `>miner.start()`
- `>miner.stop()`

**停止挖礦，然後試著發送一筆
交易，然後重啟挖礦，該筆交
易就會被打包**

發出轉帳交易

Ethereum Wallet

帳號 編輯 檢視 開發 視窗 幫助

47%

週四 下午11:48

WALLETS

SEND


PRIVATE-NET 0 peers | 70 an hour since last block

CONTRACTS


BALANCE
350.00 ETHER*

Send funds

FROM

 Main account (Etherebase) - 115.00 ETHER

TO

 0x68B26Dbe93C30E70ccB6b300bae7408ec7d6Eb12

AMOUNT

115

☒ Send everything

You want to send **115 ETHER**.

SHOW FEWER OPTIONS

DATA

0xe5beb7e6988ee8b2a1e7b693e7a791e68a80e5a4a7e5acb8e79ba7e7919ee5b1b1e69599e68e88e698afe58fb0e781a3e58d80e5a18ae98f88e68a80e8a193e5b088e5aeb6

You can add extra data to send along with your transaction. If you don't know what this is then **don't**

Unicode converter

**[https://www.branah.com/
unicode-converter](https://www.branah.com/unicode-converter)**

Unicode Converter - Decimal, text, URL, and unicode converter

Convert

Unicode text (Example: a 中 Я)

Add spaces

Remove spaces

☐ Convert whitespace characters

☐ Little Endian

Convert

UTF-16 (Example: \u0061 \u4e2d \u042f) ☐ Remove \u

Convert

UTF-32 (Example: 00000061 00004e2d 0000042f) ☒ Remove u+

Convert

UTF-8 text (Example: a ä, Ð)

Convert

UTF-8 (Example: \x61 \xe4\xb8\xad \xd0\xaf) ☒ Remove \x






Convert

Percent Encoding (Example: a%20%e4%b8%ad%20%d0%af)

Convert

Decimal (Example: 97 20013 1071)

觀察第47,48,49塊的出塊log紀錄

```
INFO [10-19|22:13:28] Commit new mining work number=47 txs=0 uncles=0
elapsed=2.000s
INFO [10-19|22:13:29] Successfully sealed new block number=47 hash=bb84a4...86a617
INFO [10-19|22:13:29]  block reached canonical chain number=42 hash=7b3de5...ae636a
INFO [10-19|22:13:29]  mined potential block number=47 hash=bb84a4...86a617
INFO [10-19|22:13:29] Commit new mining work number=48 txs=0 uncles=0
elapsed=160.822µs
INFO [10-19|22:26:46] New wallet appeared url=keystore:///var/folders/
hl/lzt3... status=Locked
INFO [10-19|22:37:03] Submitted transaction
fullhash=0x798500c79158a1d1bd1a31df096b3d0bca5c6842fd2ab82ded098a1059513e52
recipient=0x68b26dbe93c30e70ccb6b300bae7408ec7d6eb12
INFO [10-19|22:55:00] Updated mining threads threads=0
INFO [10-19|22:55:00] Transaction pool price threshold updated price=0
INFO [10-19|22:55:00] Starting mining operation
INFO [10-19|22:55:00] Commit new mining work number=48 txs=1 uncles=0
elapsed=588.094µs
INFO [10-19|22:55:00] Successfully sealed new block number=48 hash=58d705...0ee098
INFO [10-19|22:55:00]  block reached canonical chain number=43 hash=a5769d...180907
INFO [10-19|22:55:00]  mined potential block number=48 hash=58d705...0ee098
INFO [10-19|22:55:00] Commit new mining work number=49 txs=0 uncles=0
elapsed=203.103µs
INFO [10-19|22:55:00] Successfully sealed new block number=49 hash=6dd4a1...015d71
INFO [10-19|22:55:00]  block reached canonical chain number=44 hash=4f3fd5...6c64b5
INFO [10-19|22:55:00]  mined potential block number=49 hash=6dd4a1...015d71
INFO [10-19|22:55:00] Mining too far in the future wait=2s
```

查看區塊47

[illegible]

查看區塊48

[illegible]

eth.getTransactionFromBlock(48)

```
> eth.getTransactionFromBlock(48)
{
  blockHash: "0x58d7050b9d9c96e34d6a33d4bfe88b3e9a9a5bacc985afcd1cfef4107d0ee098",
  blockNumber: 48,
  from: "0xa5a423ef40af37f237d4a8e13e240d4e36b95293",
  gas: 25693,
  gasPrice: 0,
  hash: "0x798500c79158a1d1bd1a31df096b3d0bca5c6842fd2ab82ded098a1059513e52",
  input: "0xe5beb7e6988ee8b2a1e7b693e7a791e68a80e5a4a7e5adb8e79ba7e7919ee5b1b1e69599e68e88e698afe58fb0e781a3e58d80e5a18ae98f88e68a80e8a193e5b088e5aeb6",
  nonce: 0,
  r: "0xc1fb062e5dc3550d2f324b0ee2955df03b58088434cd78bfcccc42b2ea7b42db",
  s: "0x590eeff6366f523cd4ab986ed3bb783d60b9b231515b6dd43f117121614e9126",
  to: "0x68b26dbe93c30e70ccb6b300bae7408ec7d6eb12",
  transactionIndex: 0,
  v: "0xa96",
  value: 2350000000000000000000
}
```

```
> eth.getTransactionFromBlock(48)
{
  blockHash: "0x58d7050b9d9c96e34d6a33d4bfe88b3e9a9a5bacc985afcd1cfef4107d0ee098",
  blockNumber: 48,
  from: "0xa5a423ef40af37f237d4a8e13e240d4e36b95293",
  gas: 25693,
  gasPrice: 0,
  hash: "0x798500c79158a1d1bd1a31df096b3d0bca5c6842fd2ab82ded098a1059513e52",
  input:
"0xe5beb7e6988ee8b2a1e7b693e7a791e68a80e5a4a7e5adb8e79ba7e7919ee5b1b1e69599e68e88e698afe58fb0
e781a3e58d80e5a18ae98f88e68a80e8a193e5b088e5aeb6",
  nonce: 0,
  r: "0xc1fb062e5dc3550d2f324b0ee2955df03b58088434cd78bfccccc42b2ea7b42db",
  s: "0x590eeff6366f523cd4ab986ed3bb783d60b9b231515b6dd43f117121614e9126",
  to: "0x68b26dbe93c30e70ccb6b300bae7408ec7d6eb12",
  transactionIndex: 0,
  v: "0xa96",
  value: 23500000000000000000000000
}
>
```


Unicode Converter - Decimal, text, URL, and unicode converter

Convert

Unicode text (Example: a 中 Я)

德明財經科技大學盧瑞山教授是台灣區塊鏈技術專家

Add spaces

Remove spaces

☐ Convert whitespace characters

☐ Little Endian

Convert

UTF-16 (Example: \u0061 \u4e2d \u042f) ☐ Remove \u

\u5fb7\u660e\u8ca1\u7d93\u79d1\u6280\u5927\u5b78\u76e7\u745e\u5c71\u6559\u6388\u662f\u53f0\u7063\u5340\u584a\u93c8\u6280\u8853\u5c08\u5bb6

Convert

UTF-32 (Example: 00000061 00004e2d 0000042f) ☒ Remove u+

00005fb70000660e00008ca100007d93000079d1000062800000592700005b78000076e70000745e00005c7100006559000063880000662f000053f000007063000053400000584a000093c80000628000008

Convert

UTF-8 text (Example: a ä , ð)

å¾æ è²ç¶ ç§ æ å±§å,ç §ç å±±æ æ æ ¯å °ç £å å¡ é æ è¡ å° å¶¶

Convert

UTF-8 (Example: \x61 \xe4\xb8\xad \xd0\xaf) ☒ Remove \x

e5beb7e6988ee8b2a1e7b693e7a791e68a80e5a4a7e5adb8e79ba7e7919ee5b1b1e69599e68e88e698afe58fb0e781a3e58d80e5a18ae98f88e68a80e8a193e5b088e5aeb6

Convert

Percent Encoding (Example: a%20%e4%b8%ad%20%d0%af)

%e5%be%b7%e6%98%8e%e8%b2%a1%e7%b6%93%e7%a7%91%e6%8a%80%e5%a4%a7%e5%ad%b8%e7%9b%a7%e7%91%9e%e5%b1%b1%e6%95%99%e6%8e%88%e6%98%af%e5%8f%b0%e7%81%a3%e5%8d%80%

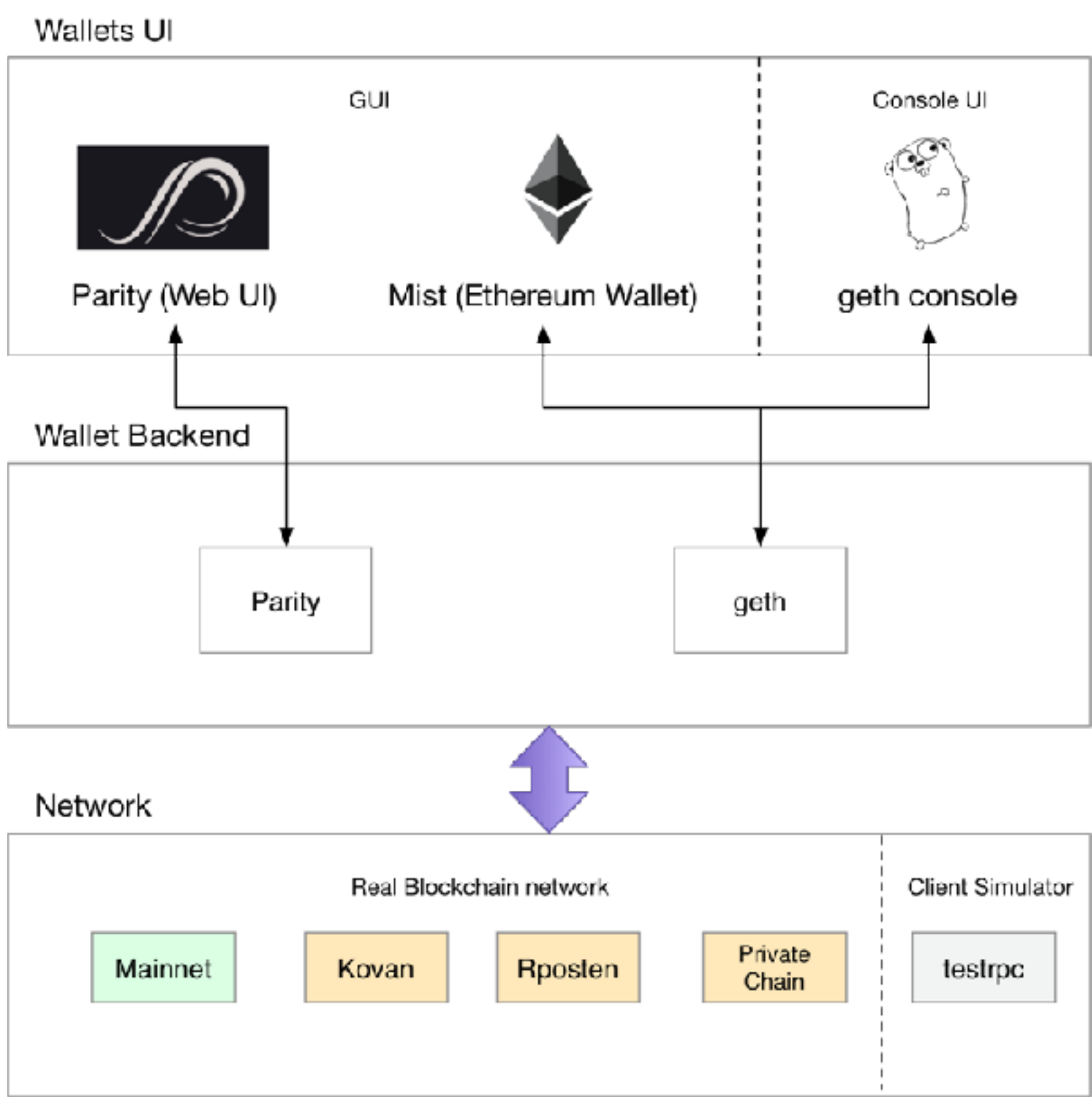
Convert

Decimal (Example: 97 20013 1071)

2450326126360013214731185252162282323416304392979023665259452548026159214882877121312226023783225216348992356023478

使用Geth佈建Ethereum Private Chain與挖礦

盧瑞山 教授、唐林誼



準備工具geth

- 可以在這下載到geth,亦可自行編譯,本範例使用 1.6.6
<https://ethereum.github.io/go-ethereum/downloads/>
- Mac OS 安裝ethereum
brew tap ethereum/ethereum
brew install ethereum
- 移除ethereum 指令： brew uninstall ethereum

建立區塊鏈目錄

- 先建立好區塊鏈目錄 `mkdir node1 node2 signer1 signer2`

```
Lin-Yide-MacBook-Pro:ethtest lursun$ mkdir node1 node2 signer1 signer2
Lin-Yide-MacBook-Pro:ethtest lursun$ ls
total 0
drwxr-xr-x  2 lursun  staff  68  7 16 09:02 node1
drwxr-xr-x  2 lursun  staff  68  7 16 09:02 node2
drwxr-xr-x  2 lursun  staff  68  7 16 09:02 signer1
drwxr-xr-x  2 lursun  staff  68  7 16 09:02 signer2
```

建立Ethereum帳號

- `cd node1 ;geth --datadir ./data account new`
設定密碼即會產生一組帳號，帳號密碼記住之後用到

- 如法炮製

```
cd ../node2 ;geth --datadir ./data account new
cd ../signer1 ;geth --datadir ./data account new
cd ../signer2 ;geth --datadir ./data account new
```

- 範例四組帳號（隨機）

```
ae77263cb7e9f09f0d2dd296fca36d6c82dce23a
311b96ecfcfb9dda3b8da45144391550c2a1e96
02176d46a71ffab971c35dbfea551d56d61c2666
4ac7b40218f57b82386c0ee45f70c4180310d229
```

```
Lin-Yide-MacBook-Pro:ethtest lursun$ cd node1 ;geth --datadir ./data account new
WARN [07-16|09:03:32] No etherbase set and no accounts found as default
Your new account is locked with a password. Please give a password. Do not forge
t this password.
Passphrase:
Repeat passphrase:
Address: {ae77263cb7e9f09f0d2dd296fca36d6c82dce23a}
```

建立創世區塊

- 使用 puppeth 這互動式工具

- # puppeth

- 輸入網路名稱
>poa_for_fun

- 選擇 設定創世區塊
>2

- 選擇 Clique PoA共識
>2

- 設定出塊時間(秒)
>10

```
Please specify a network name to administer (no spaces, please)
> poa_for_fun
Sweet, you can set this via --network=poa_for_fun next time!
```

```
INFO [07-16|09:12:47] Administering Ethereum network
WARN [07-16|09:12:47] No previous configurations found
n/.puppeth/poa_for_fun
```

```
name=poa_for_fun
path=/Users/lursu
```

```
What would you like to do? (default = stats)
1. Show network stats
2. Configure new genesis
3. Track new remote server
4. Deploy network components
> 2
```

```
Which consensus engine to use? (default = clique)
1. Ethash - proof-of-work
2. Clique - proof-of-authority
> 2
```

```
How many seconds should blocks take? (default = 15)
> 10
```


- 指定打包角色
>前一頁 某個 Signer 帳號
- 指定幾個帳號一點ether(以太幣)
>前一頁 某個 Signer 帳號 和 Node帳號
- 設定網路ID
>直接Enter 用隨機
- 寫一些資訊到創世塊
>皆可
- 選擇存擋
>2
- 檔名
>直接Enter 預設
- Ctrl + c 跳離
- ls
node1 node2 signer1 signer2 xxxxxxxx.json

```
Which accounts are allowed to seal? (mandatory at least one)
> 0x02176d46a71ffab971c35dbfea551d56d61c2666
> 0x
```

```
Which accounts should be pre-funded? (advisable at least one)
> 0xae77263cb7e9f09f0d2dd296fca36d6c82dce23a
> 0x02176d46a71ffab971c35dbfea551d56d61c2666
> 0x
```

```
Specify your chain/network ID if you want an explicit one (default = random)
>
```

```
Anything fun to embed into the genesis block? (max 32 bytes)
> hello world
```

```
What would you like to do? (default = stats)
1. Show network stats
2. Save existing genesis
3. Track new remote server
4. Deploy network components
> 2
```

```
Which file to save the genesis into? (default = poa_for_fun.json)
>
INFO [07-16|09:17:32] Exported existing genesis block
```

```
Lin-Yide-MacBook-Pro:ethtest lursun$ ls
total 48
drwxr-xr-x  3 lursun  staff   102  7 16 09:03 node1
drwxr-xr-x  3 lursun  staff   102  7 16 09:03 node2
-rw-r--r--  1 lursun  staff 21646  7 16 09:17 poa_for_fun.json
drwxr-xr-x  3 lursun  staff   102  7 16 09:04 signer1
drwxr-xr-x  3 lursun  staff   102  7 16 09:20 signer2
```


初始化各目錄

- `geth --datadir node1/data init xxxxxxxx.json`
- `geth --datadir node2/data init xxxxxxxx.json`
- `geth --datadir signer1/data init xxxxxxxx.json`
- `geth --datadir signer2/data init xxxxxxxx.json`

```
Lin-Yide-MacBook-Pro:ethtest lursun$ geth --datadir node1/data init poa_for_fun.json
INFO [07-16|09:20:59] Allocated cache and file handles      database=/Users/lursun/ethtest/node1
/data/geth/chaindata cache=16 handles=16
INFO [07-16|09:20:59] Writing custom genesis block
INFO [07-16|09:20:59] Successfully wrote genesis state      database=chaindata
                                hash=bdf5a7...21d294
INFO [07-16|09:20:59] Allocated cache and file handles      database=/Users/lursun/ethtest/node1
/data/geth/lightchaindata cache=16 handles=16
INFO [07-16|09:20:59] Writing custom genesis block
INFO [07-16|09:20:59] Successfully wrote genesis state      database=lightchaindata
                                hash=bdf5a7...21d294
```

啟動節點

- 移動到各節點目錄

```
geth --datadir ./data --networkid 55688 --port 2000 console
```

```
geth --datadir ./data --networkid 55688 --port 2001 console
```

```
geth --datadir ./data --networkid 55688 --port 2002 console
```

```
geth --datadir ./data --networkid 55688 --port 2003 console
```

- 注意 要打包的 要改成

```
geth --datadir ./data --networkid 55688 --port 200x --
```

```
unlock 帳號 console
```

然後要輸入密碼

```
Lin-Yide-MacBook-Pro:node1 lursun$ geth --datadir ./data --networkid 55688 --port 2000 console
INFO [07-16|09:22:44] Starting peer-to-peer node               instance=Geth/v1.6.6-stable-10a45cb5/darwin-amd64/go1.8.3
INFO [07-16|09:22:44] Allocated cache and file handles         database=/Users/lursun/ethtest/node1/data/geth/chaindata cache=128 handles=1024
WARN [07-16|09:22:44] Upgrading chain database to use sequential keys
INFO [07-16|09:22:44] Initialised chain configuration          config="{ChainID: 16713 Homestead: 1 DAO: <nil> DAOSupport: false EIP150: 2 EIP155: 3 EIP158: 3 Metropolis: <nil> Engine: clique}"
INFO [07-16|09:22:44] Database conversion successful
WARN [07-16|09:22:44] Upgrading db log bloom bins
INFO [07-16|09:22:44] Bloom-bin upgrade completed             elapsed=580.502µs
INFO [07-16|09:22:44] Initialising Ethereum protocol          versions="[63 62]" network=55688
INFO [07-16|09:22:44] Loaded most recent local header         number=0 hash=bdf5a7...21d294 td=1
INFO [07-16|09:22:44] Loaded most recent local full block     number=0 hash=bdf5a7...21d294 td=1
INFO [07-16|09:22:44] Loaded most recent local fast block     number=0 hash=bdf5a7...21d294 td=1
INFO [07-16|09:22:44] Starting P2P networking
INFO [07-16|09:22:46] UDP listener up                         self=enode://89d13308671670a1c2023f30e45c6bae2902ffb11b6e9aac9bf0fef70c6690353c55c1d1e156b140070ae2f9e356dfe45b187b138719d7ec14f2b6c99f0271d70[::]:2000
INFO [07-16|09:22:46] RLPx listener up                       self=enode://89d13308671670a1c2023f30e45c6bae2902ffb11b6e9aac9bf0fef70c6690353c55c1d1e156b140070ae2f9e356dfe45b187b138719d7ec14f2b6c99f0271d70[::]:2000
INFO [07-16|09:22:46] IPC endpoint opened: /Users/lursun/ethtest/node1/data/geth.ipc
Welcome to the Geth JavaScript console!

instance: Geth/v1.6.6-stable-10a45cb5/darwin-amd64/go1.8.3
coinbase: 0xae77263cb7e9f09f0d2dd296fca36d6c82dce23a
at block: 0 (Sun, 16 Jul 2017 09:12:48 CST)
  datadir: /Users/lursun/ethtest/node1/data
modules: admin:1.0 clique:1.0 debug:1.0 eth:1.0 miner:1.0 net:1.0 personal:1.0 rpc:1.0 txpool:1.0 web3:1.0

> █
```



```
Lin-Yide-MacBook-Pro:signer1 lursun$ geth --datadir ./data --networkid 55688 --port 2002 --unlock 02176d46a71ffab971c35dbfea551d56d61c2666 console
INFO [07-16|09:26:08] Starting peer-to-peer node           instance=Geth/v1.6.6-stable-10a45cb5/darwin-amd64/go1.8.3
INFO [07-16|09:26:08] Allocated cache and file handles     database=/Users/lursun/ethtest/signer1/data/geth/chaindata cache=128 handles=1024
WARN [07-16|09:26:08] Upgrading chain database to use sequential keys
INFO [07-16|09:26:08] Database conversion successful
INFO [07-16|09:26:08] Initialised chain configuration      config="{ChainID: 16713 Homestead: 1 DAO: <nil> DAOSupport: false EIP150: 2 EIP155: 3 EIP158: 3 Metropolis: <nil> Engine: clique}"
WARN [07-16|09:26:08] Upgrading db log bloom bins
INFO [07-16|09:26:08] Bloom-bin upgrade completed         elapsed=77.546µs
INFO [07-16|09:26:08] Initialising Ethereum protocol      versions="[63 62]" network=55688
INFO [07-16|09:26:08] Loaded most recent local header      number=0 hash=bdf5a7...21d294 td=1
INFO [07-16|09:26:08] Loaded most recent local full block  number=0 hash=bdf5a7...21d294 td=1
INFO [07-16|09:26:08] Loaded most recent local fast block  number=0 hash=bdf5a7...21d294 td=1
INFO [07-16|09:26:08] Starting P2P networking
INFO [07-16|09:26:10] UDP listener up                     self=enode://d33cfaf4f34bcf9824b33df2262d5623a920a125bda07a329e9272e246f08dcfbff9fbaf4508cd40aa79c0eb138c038d2af07487a83a7fb9d56e8ed502604790@[::]:2002
INFO [07-16|09:26:10] RLPx listener up                   self=enode://d33cfaf4f34bcf9824b33df2262d5623a920a125bda07a329e9272e246f08dcfbff9fbaf4508cd40aa79c0eb138c038d2af07487a83a7fb9d56e8ed502604790@[::]:2002
Unlocking account 02176d46a71ffab971c35dbfea551d56d61c2666 | Attempt 1/3
INFO [07-16|09:26:10] IPC endpoint opened: /Users/lursun/ethtest/signer1/data/geth.ipc
Passphrase:
INFO [07-16|09:26:20] Unlocked account                   address=0x02176d46a71ffab971c35dbfea551d56d61c2666
Welcome to the Geth JavaScript console!

instance: Geth/v1.6.6-stable-10a45cb5/darwin-amd64/go1.8.3
coinbase: 0x02176d46a71ffab971c35dbfea551d56d61c2666
at block: 0 (Sun, 16 Jul 2017 09:12:48 CST)
```

連線各節點

- 其中一個找到 RLPx listener up 這行 複製
enode://* * * * * @[:]:200x
- 改成 enode://* * * * * @127.0.0.1:200x
- 可以用 admin.peers 查看節點變化(不含自己)
- 在其他各節點console 下指令

```
admin.addPeer("enode://* * * * * @127.0.0.1:200x")
```

```
> admin.peers
[]
> admin.addPeer("enode://89d13308671670a1c2023f30e45c6bae2902fffb11b6e9aac9bf0fef70c6690353c55c1d1e156b140070ae2f9e356dfe45b187b138719d7ec14f2b6c99f0271d7@127.0.0.1:2000")
true
> admin.peers

[{"
  caps: ["eth/63"],
  id: "89d13308671670a1c2023f30e45c6bae2902fffb11b6e9aac9bf0fef70c6690353c55c1d1e156b140070ae2f9e356dfe45b187b138719d7ec14f2b6c99f0271d7",
  name: "Geth/v1.6.6-stable-10a45cb5/darwin-amd64/go1.8.3",
  network: {
    localAddress: "127.0.0.1:62001",
    remoteAddress: "127.0.0.1:2000"
  },
  protocols: {
    eth: {
      difficulty: 1,
      head: "0xbdf5a70cfabedb3aa111d4c5e57204f54c0597447b1dc29c41d2775a4721d294",
      version: 63
    }
  }
}]
_
```

- 最後被連線的 admin.peers 有三個節點
- 而主動連線的 admin.peers 只有一個節點

挖礦

- 在有 --unlock 的console 就是某個可打包Signer的 console
- miner.start() 開始挖礦

```
> miner.start()  
INFO [07-16|09:37:54] Transaction pool price threshold updated price=18000000000  
INFO [07-16|09:37:54] Starting mining operation  
null  
> INFO [07-16|09:37:54] Commit new mining work number=1 txs=0 uncles=0 elapsed=4  
16.214µs  
INFO [07-16|09:37:54] Successfully sealed new block number=1 hash=d755d7...c304ff  
INFO [07-16|09:37:54] ⚡mined potential block number=1 hash=d755d7...c304ff  
INFO [07-16|09:37:54] Commit new mining work number=2 txs=0 uncles=0 elapsed=997  
.552µs  
INFO [07-16|09:38:04] Successfully sealed new block number=2 hash=13fb05...b6a514  
INFO [07-16|09:38:04] ⚡mined potential block number=2 hash=13fb05...b6a514  
INFO [07-16|09:38:04] Commit new mining work number=3 txs=0 uncles=0 elapsed=854  
.753µs
```


查看區塊

[illegible]

查看餘額

- 可用 `eth.getBalance("帳號")` 查看
- 前面在設定創世塊時，可以發現所指定的帳號餘額不為0

```
> eth.getBalance("ae77263cb7e9f09f0d2dd296fca36d6c82dce23a")
9.04625697166532776746648320380374280103671755200316906558262375061821325312e+74
> eth.getBalance("311b96ecfcfb9dda3b8da45144391550c2a1e96")
0
> eth.getBalance("02176d46a71ffab971c35dbfea551d56d61c2666")
9.04625697166532776746648320380374280103671755200316906558262375061821325312e+74
> eth.getBalance("4ac7b40218f57b82386c0ee45f70c4180310d229")
0
_
```


交易

- `personal.unlockAccount("當前node console 帳號")` 要輸入密碼

```
> personal.unlockAccount("ae77263cb7e9f09f0d2dd296fca36d6c82dce23a")
Unlock account ae77263cb7e9f09f0d2dd296fca36d6c82dce23a
Passphrase:
true
```

- `eth.sendTransaction({ from:"當前console帳號",to:"收款帳號",value:web3.toWei(0.05,"ether")})`

- 經過打包後,可用 `eth.getBalance("帳號")` 查看餘額變化

```
> eth.sendTransaction({from:"ae77263cb7e9f09f0d2dd296fca36d6c82dce23a",to:"311b96ecfcfb9dda3b8da45144391550c2a1e96",value:web3.toWei(0.05,"ether")} )
INFO [07-16|09:45:17] Submitted transaction                      fullhash=0x0a968ee885781ec5ee1890bf54bfd44abd0c583826e5b2bf0fe66a9ce00db7ed recipient=0x311b96ecfcfb9dda3b8da45144391550c2a1e96
"0x0a968ee885781ec5ee1890bf54bfd44abd0c583826e5b2bf0fe66a9ce00db7ed"
> INFO [07-16|09:45:26] Imported new chain segment                  blocks=1 txs=0 mgas=0.000 elapsed=440.936µs mgasps=0.000 number=36 hash=8d26f6...62f84e
INFO [07-16|09:45:36] Imported new chain segment                  blocks=1 txs=1 mgas=0.021 elapsed=.639ms mgasps=7.955 number=37 hash=f1c620...ca8507
INFO [07-16|09:45:46] Imported new chain segment                  blocks=1 txs=0 mgas=0.000 elapsed=46.382µs mgasps=0.000 number=38 hash=b8f96a...5d2ed5
> eth.getBalance("311b96ecfcfb9dda3b8da45144391550c2a1e96")
5000000000000000000
```

增加信任打包者

- 在沒有授權的 signer miner.start() 會失敗

```
> miner.start()  
INFO [07-16|09:49:13] Transaction pool price threshold updated price=18000000000  
INFO [07-16|09:49:13] Starting mining operation  
null  
> INFO [07-16|09:49:13] Commit new mining work number=59 txs=0 uncles=0 elapsed=  
151.177µs  
WARN [07-16|09:49:13] Block sealing failed err=unauthorized
```

- 在以被授權帳號console 下指令 授權
clique.propose("0x需被授權打包帳號")
- 回到原本沒有授權的 signer miner.start() 及開始挖礦
- PS:挖礦也需要事先解鎖
personal.unlockAccount("當前signer console 帳號")