



搭建以太坊私链

下载

1. 下载 geth 项目

```
| git clone https://github.com/ethereum/go-ethereum.git
```

2. 编译 geth cli 可执行文件（位于 build/bin 目录下）

```
| make geth
```

3. 将可执行文件添加到环境变量中

```
| cp /build/bin/geth /usr/local/bin
```

4. 测试

```
| geth --help
```

搭建私有链

1. 配置初始状态

要运行以太坊私有链，需要定义自己的创世区块，创世区块信息写在一个 JSON 格式的配置文件中。首先将下面的内容保存到一个 JSON 文件中，例如 `genesis.json`



```
mkdir workspace/privatechain
```

```
cd privatechain
```

```
mkdir data0
```

```
vi genesis.json
```

```

"config": {
  "chainId": 10,
  "homesteadBlock": 0,
  "eip150Block": 0,
  "eip155Block": 0
},
"alloc" : {},
"coinbase" : "0x000000000000000000000000000000000000000000000000",
"difficulty" : "0x20000",
"extraData" : "",
"gasLimit" : "0x2fefd8",
"nonce" : "0x0000000000000042",
"mixhash" : "0x0000000000000000000000000000000000000000000000000000000000000000",
"parentHash" : "0x0000000000000000000000000000000000000000000000000000000000000000",
"timestamp" : "0x00"
}

```

其中，**chainID** 指定了独立的区块链网络 ID。网络 ID 在连接到其他节点的时候会用到，以太坊公网的网络 ID 是 1，为了不与公有链网络冲突，运行私有链节点的时候要指定自己的网络 ID。不同 ID 网络的节点无法相互连接。配置文件还对当前挖矿难度 difficulty、区块 Gas 消耗限制 gasLimit 等参数进行了设置。

2. 初始化：写入创世区块

准备好创世区块配置文件后，需要 **初始化区块链**，将上面的创世区块信息写入到区块链中。首先要新建一个目录用来存放区块链数据，假设新建的数据目录为 `~/privatechain/data0`，`genesis.json` 保存在 `~/privatechain` 中，此时目录结构应该是这样的：

```

privatechain
├── data0
└── genesis.json

```

执行初始化命令

```
geth init --datadir data0 genesis.json
```

上面的命令的主体是 `geth init`，表示初始化区块链，命令可以带有选项和参数，其中 `--datadir` 选项后面跟一个目录名，这里为 `data0`，表示指定数据存放目录为 `data0`，`genesis.json` 是 `init` 命令的参数。

运行上面的命令，会读取 `genesis.json` 文件，根据其中的内容，将创世区块写入到区块链中。如果看到以下的输出内容，说明初始化成功了。

```

# apple @ appledeMacBook-Air1 in ~/Public/区块链相关/ETH/privatechain [5:56:53]
$ geth --datadir data0 init genesis.json
INFO [03-19|05:56:54.842] Maximum peer count                ETH=50 LES=0 total=50
INFO [03-19|05:56:54.846] Set global gas cap                cap=50,000,000
INFO [03-19|05:56:54.846] Allocated cache and file handles  database="/Users/apple/Public/区块链相关/ETH/privatechain/data0/
geth/chaindata" cache=16.00MiB handles=16
INFO [03-19|05:56:54.869] Opened ancient database           database="/Users/apple/Public/区块链相关/ETH/privatechain/data0/
geth/chaindata/ancient/chain" readonly=false
INFO [03-19|05:56:54.869] Writing custom genesis block
INFO [03-19|05:56:54.870] Successfully wrote genesis state   database=chaindata hash=5e1fc7..d790e0
INFO [03-19|05:56:54.870] Allocated cache and file handles  database="/Users/apple/Public/区块链相关/ETH/privatechain/data0/
geth/lightchaindata" cache=16.00MiB handles=16
INFO [03-19|05:56:54.933] Opened ancient database           database="/Users/apple/Public/区块链相关/ETH/privatechain/data0/
geth/lightchaindata/ancient/chain" readonly=false
INFO [03-19|05:56:54.934] Writing custom genesis block
INFO [03-19|05:56:54.934] Successfully wrote genesis state   database=lightchaindata hash=5e1fc7..d790e0

```

初始化成功后，会在数据目录 data0 中生成 `geth` 和 `keystore` 两个文件夹，此时目录结构如下：

```
$ tree -L 4
.
├── data0
│   ├── geth
│   │   ├── LOCK
│   │   ├── chaindata
│   │   │   ├── 000006.log
│   │   │   ├── CURRENT
│   │   │   ├── CURRENT.bak
│   │   │   ├── LOCK
│   │   │   ├── LOG
│   │   │   ├── MANIFEST-000007
│   │   │   └── ancient
│   │   ├── lightchaindata
│   │   │   ├── 000001.log
│   │   │   ├── CURRENT
│   │   │   ├── LOCK
│   │   │   ├── LOG
│   │   │   ├── MANIFEST-000000
│   │   │   └── ancient
│   │   └── nodekey
│   └── keystore
└── genesis.json

7 directories, 14 files
```

其中 `geth/chaindata` 中存放的是区块数据，`keystore` 中存放的是账户数据。

3. 启动私有链节点

```
geth console --networkid 110 --datadir data0
```

上面命令的主体是 `geth console`，表示启动节点并进入交互式控制台，`--datadir`选项指定使用`data0`作为数据目录，`--networkid`选项后面跟一个数字，这里是 `110`，表示指定这个私有链的网络id为110。

网络id在连接到其他节点的时候会用到，以太坊公网的网络id是1，为了不与公有链网络冲突，运行私有链节点的时候要指定自己的网络id。

运行上面的命令后，就启动了区块链节点并进入了该节点的控制台：

```
INFO [03-19|06:16:07.195]
INFO [03-19|06:16:07.195] Loaded most recent local header
INFO [03-19|06:16:07.195] Loaded most recent local full block
INFO [03-19|06:16:07.195] Loaded most recent local fast block
WARN [03-19|06:16:07.195] Failed to load snapshot
INFO [03-19|06:16:07.196] Rebuilding state snapshot
INFO [03-19|06:16:07.196] Resuming state snapshot generation
INFO [03-19|06:16:07.196] Generated state snapshot
INFO [03-19|06:16:07.197] Regenerated local transaction journal
INFO [03-19|06:16:07.198] Gasprice oracle is ignoring threshold set threshold=2
WARN [03-19|06:16:07.199] Error reading unclean shutdown markers
WARN [03-19|06:16:07.199] Engine API enabled
WARN [03-19|06:16:07.200] Engine API started but chain not configured for merge yet
INFO [03-19|06:16:07.200] Starting peer-to-peer node
INFO [03-19|06:16:07.222] New local node record
INFO [03-19|06:16:07.223] Started P2P networking
20daf32ca4b7e0f4b562f8a880c2ba6a91f5d3d5c8b747@127.0.0.1:30303
INFO [03-19|06:16:07.224] IPC endpoint opened
INFO [03-19|06:16:07.224] Generated JWT secret
INFO [03-19|06:16:07.243] WebSocket enabled
INFO [03-19|06:16:07.243] HTTP server started
WARN [03-19|06:16:07.270] Served eth_coinbase
Welcome to the Geth JavaScript console!

number=0 hash=5e1fc7...d790e0 td=131,072 age=53y11mo3w
number=0 hash=5e1fc7...d790e0 td=131,072 age=53y11mo3w
number=0 hash=5e1fc7...d790e0 td=131,072 age=53y11mo3w
err="missing or corrupted snapshot"

root=56e81f...63b421 accounts=0 slots=0 storage=0.00B dangling=0 elapsed="126.291µs"
accounts=0 slots=0 storage=0.00B dangling=0 elapsed="377.25µs"
transactions=0 accounts=0
threshold=2
error="leveldb: not found"
protocol=eth

instance=Geth/v1.11.0-unstable-db82ea2e-20221229/darwin-arm64/go1.19
seq=1,679,177,767,221 id=b08d2088767a1512 ip=127.0.0.1 udp=30303 tcp=30303
self=enode://19fd63b85f27f60051d81e41089905146db5b41ef641fb1538b237f175d369062bd7002c845b8172a2

url="/Users/apple/Public/区块链相关/ETH/privatechain/data0/eth.ipc"
path="/Users/apple/Public/区块链相关/ETH/privatechain/data0/eth/jwtsecret"
url=ws://127.0.0.1:8551
endpoint=127.0.0.1:8551 auth=true prefix= cors=localhost vhosts=localhost
reqid=3 duration="11.417µs" err="etherbase must be explicitly specified"
```

```
Welcome to the Geth JavaScript console!

instance: Geth/v1.11.0-unstable-db82ea2e-20221229/darwin-arm64/go1.19
at block: 0 (Thu Jan 01 1970 08:00:00 GMT+0800 (CST))
datadir: /Users/apple/Public/区块链相关/ETH/privatechain/data0
modules: admin:1.0 debug:1.0 engine:1.0 eth:1.0 ethash:1.0 miner:1.0 net:1.0 personal:1.0 rpc:1.0 txpool:1.0 web3:1.0
```

这是一个交互式的 JavaScript 执行环境，在这里面可以执行 JavaScript 代码，其中 > 是命令提示符。在这个环境里也内置了一些用来操作以太坊的 JavaScript 对象，可以直接使用这些对象。这些对象主要包括：

- eth：包含一些跟操作区块链相关的方法；
- net：包含一些查看 p2p网络状态的方法；
- admin：包含一些与管理节点相关的方法；
- miner：包含启动&停止挖矿的一些方法；
- personal：主要包含一些管理账户的方法；
- txpool：包含一些查看交易内存池的方法；
- web3：包含了以上对象，还包含一些单位换算的方法。

控制台操作

进入以太坊 Javascript Console 后，就可以使用里面的内置对象做一些操作，这些内置对象提供的功能很丰富，比如查看区块和交易、创建账户、挖矿、发送交易、部署智能合约等。

常用命令有：

- personal.newAccount()：创建账户；
- personal.unlockAccount()：解锁账户；
- eth.accounts：枚举系统中的账户；
- eth.getBalance()：查看账户余额，返回值的单位是 Wei（Wei 是以太坊中最小货币面额单位，类似比特币中的聪，1 ether = 10¹⁸ Wei）；
- eth.blockNumber：列出区块总数；
- eth.getTransaction()：获取交易；
- eth.getBlock()：获取区块；

- miner.start() : 开始挖矿 ;
- miner.stop() : 停止挖矿 ;
- eth.coinbase : 挖矿奖励的账户
- web3.fromWei() : Wei 换算成以太币 ;
- web3.toWei() : 以太币换算成 Wei ;
- txpool.status : 交易池中的状态 ;
- admin.addPeer() : 连接到其他节点 ;

1. 创建账户

输入 `eth.accounts` 查询系统中的账户 :

```
eth.accounts
```

显示为 `[]`, 表示没有账户, 接下来使用 `personal.newAccount()` 来创建一个账户 :

```
personal.newAccount()
```

输入两次密码, 得到 `0x593abc88dfd6c6078f3739e7d6a3420d5b3609dd`

再次创建一个账户

```
0xfe1aba3e41de132145767943f4e046d004b4a12e
```

账户默认会保存在数据目录的 `data0/keystore` 文件夹中。可以查看其中的文件



```
# apple @ appledeMacBook-Air1 in ~/Public/区块链相关/ETH/privatechain/data0 [6:31:00]
$ cd keystore

# apple @ appledeMacBook-Air1 in ~/Public/区块链相关/ETH/privatechain/data0/keystore [6:31:02]
$ ls
UTC--2023-03-18T22-29-24.284020000Z--593abc88dfd6c6078f3739e7d6a3420d5b3609dd
UTC--2023-03-18T22-30-17.799964000Z--fe1aba3e41de132145767943f4e046d004b4a12e
```

```
"address": "593abc88dfd6c6078f3739e7d6a3420d5b3609dd", "crypto": {"cipher": "aes-128-ctr", "ciphertext": "118eb16afb095035cb5bee89f390447ec7355c15f10d4609716f0a5d2c24603a", "cipherparams": {"iv": "0ec67ac1a10b342da6c2579f803289e2"}, "kdf": "scrypt", "kdfparams": {"dklen": 32, "n": 262144, "p": 1, "r": 8, "salt": "9e821fd2728376f9198f1a893cd166e4a9cb24e7ef9c3aa2cf31a36fb9fc75e1"}, "mac": "2cff2c270ec3a3accdfbef6b7caf54f66839cbfb17038196da45a4e50a3fb40b"}, "id": "144977a0-7d5c-4d2a-b88e-8dde0980e04d", "version": 3
```

2. 查看账户余额

```
eth.getBalance("address")
```

```

> eth.getBalance("INFO [03-19|06:33:24.178] Looking for peers
> eth.getBalance("0xfe1aba3e41de132145767943f4e046d004b4a12e")
0
> eth.getBalance(0xfe1aba3e41de132145767943f4e046d004b4a12e)INFO [03-19|0
> eth.getBalance("0x593abc88dfd6c6078f3739e7d6a3420d5b3609dd")
0
> _

```

目前两个账户的以太币余额都是0，要使账户有余额，可以从其他账户转账过来，或者通过挖矿来获得以太币奖励。

3. 启动&停止挖矿

通过 `miner.start()` 启动挖矿

miner.start()

其中 `start` 的参数表示挖矿使用的 `线程数`。第一次启动挖矿会先生成挖矿所需的 `DAG` 文件，这个过程有点慢，等进度达到 100% 后，就会开始挖矿，此时屏幕会被挖矿信息刷屏。

```

> miner.start()
INFO [03-19|06:34:58.230] Updated mining threads          threads=8
INFO [03-19|06:34:58.231] Transaction pool price threshold updated price=1,000,000,000
INFO [03-19|06:34:58.232] Etherbase automatically configured address=0x593Abc88dfd6c6078f3739E7D6A3420d5B3609DD
null
> INFO [03-19|06:34:58.236] Commit new sealing work      number=1 sealhash=74b164..038eeb uncles=0 txs=0 gas=0 fees=0 elapsed=3.678ms
INFO [03-19|06:34:58.237] Commit new sealing work      number=1 sealhash=74b164..038eeb uncles=0 txs=0 gas=0 fees=0 elapsed=4.893ms
INFO [03-19|06:34:59.032] Generating DAG in progress   epoch=0 percentage=0 elapsed=325.862ms
INFO [03-19|06:34:59.369] Generating DAG in progress   epoch=0 percentage=1 elapsed=663.442ms
INFO [03-19|06:34:59.694] Generating DAG in progress   epoch=0 percentage=2 elapsed=987.768ms
INFO [03-19|06:35:00.021] Generating DAG in progress   epoch=0 percentage=3 elapsed=1.315s
INFO [03-19|06:35:00.362] Generating DAG in progress   epoch=0 percentage=4 elapsed=1.656s
INFO [03-19|06:35:00.684] Generating DAG in progress   epoch=0 percentage=5 elapsed=1.977s
INFO [03-19|06:35:01.044] Generating DAG in progress   epoch=0 percentage=6 elapsed=2.338s
INFO [03-19|06:35:01.396] Generating DAG in progress   epoch=0 percentage=7 elapsed=2.690s
INFO [03-19|06:35:01.739] Generating DAG in progress   epoch=0 percentage=8 elapsed=3.033s
INFO [03-19|06:35:02.073] Generating DAG in progress   epoch=0 percentage=9 elapsed=3.366s
INFO [03-19|06:35:02.394] Generating DAG in progress   epoch=0 percentage=10 elapsed=3.688s
INFO [03-19|06:35:02.726] Generating DAG in progress   epoch=0 percentage=11 elapsed=4.020s
INFO [03-19|06:35:03.100] Generating DAG in progress   epoch=0 percentage=12 elapsed=4.394s
INFO [03-19|06:35:03.548] Generating DAG in progress   epoch=0 percentage=13 elapsed=4.842s

```

```
geth console --networkid 110 --datadir data0
INFO [03-19|06:35:42.538] Commit new sealing work
INFO [03-19|06:35:42.541] Commit new sealing work
INFO [03-19|06:35:42.990] Generating DAG in progress
INFO [03-19|06:35:43.401] Successfully sealed new block
INFO [03-19|06:35:43.401] ^ mined potential block
INFO [03-19|06:35:43.401] Commit new sealing work
INFO [03-19|06:35:43.401] Commit new sealing work
INFO [03-19|06:35:43.536] Successfully sealed new block
INFO [03-19|06:35:43.536] ^ mined potential block
INFO [03-19|06:35:43.536] Commit new sealing work
INFO [03-19|06:35:43.537] Commit new sealing work
INFO [03-19|06:35:43.882] Successfully sealed new block
INFO [03-19|06:35:43.882] ^ mined potential block
INFO [03-19|06:35:43.882] Commit new sealing work
INFO [03-19|06:35:43.882] Commit new sealing work
INFO [03-19|06:35:43.961] Successfully sealed new block
INFO [03-19|06:35:43.961] ^ mined potential block
INFO [03-19|06:35:43.961] Commit new sealing work
INFO [03-19|06:35:43.961] Commit new sealing work
INFO [03-19|06:35:44.055] Generating DAG in progress
INFO [03-19|06:35:45.398] Looking for peers
INFO [03-19|06:35:45.655] Generating DAG in progress
INFO [03-19|06:35:46.676] Successfully sealed new block
INFO [03-19|06:35:46.677] ^ mined potential block
INFO [03-19|06:35:46.677] Commit new sealing work
INFO [03-19|06:35:46.678] Commit new sealing work
INFO [03-19|06:35:46.916] Generating DAG in progress
INFO [03-19|06:35:47.589] Successfully sealed new block
INFO [03-19|06:35:47.589] ^ mined potential block
INFO [03-19|06:35:47.589] Commit new sealing work
INFO [03-19|06:35:47.589] Commit new sealing work
INFO [03-19|06:35:48.075] Generating DAG in progress
INFO [03-19|06:35:48.224] Successfully sealed new block
INFO [03-19|06:35:48.224] ^ block reached canonical chain
INFO [03-19|06:35:48.225] ^ mined potential block
INFO [03-19|06:35:48.252] Commit new sealing work
INFO [03-19|06:35:48.280] Commit new sealing work
INFO [03-19|06:35:49.145] Generating DAG in progress
number=2 sealhash=4c530a..b39834 uncles=0 txs=0 gas=0 fees=0 elapsed=2.081ms
number=2 sealhash=4c530a..b39834 uncles=0 txs=0 gas=0 fees=0 elapsed=4.930ms
epoch=1 percentage=1 elapsed=1.959s
number=2 sealhash=4c530a..b39834 hash=fe8b13..53a082 elapsed=863.115ms
number=2 hash=fe8b13..53a082
number=3 sealhash=451705..78d73b uncles=0 txs=0 gas=0 fees=0 elapsed="129.583µs"
number=3 sealhash=451705..78d73b uncles=0 txs=0 gas=0 fees=0 elapsed="294µs"
number=3 sealhash=451705..78d73b hash=e247dc..eebe23 elapsed=134.685ms
number=3 hash=e247dc..eebe23
number=4 sealhash=b53c75..2fc8b2 uncles=0 txs=0 gas=0 fees=0 elapsed="214.834µs"
number=4 sealhash=b53c75..2fc8b2 uncles=0 txs=0 gas=0 fees=0 elapsed="454.292µs"
number=4 sealhash=b53c75..2fc8b2 hash=8839d9..ccdadf elapsed=345.472ms
number=4 hash=8839d9..ccdadf
number=5 sealhash=ccf827..5e67db uncles=0 txs=0 gas=0 fees=0 elapsed="179.334µs"
number=5 sealhash=ccf827..5e67db uncles=0 txs=0 gas=0 fees=0 elapsed="310.084µs"
number=5 sealhash=ccf827..5e67db hash=dfa754..fd5021 elapsed=78.747ms
number=5 hash=dfa754..fd5021
number=6 sealhash=f2c9a5..587f31 uncles=0 txs=0 gas=0 fees=0 elapsed="58.917µs"
number=6 sealhash=f2c9a5..587f31 uncles=0 txs=0 gas=0 fees=0 elapsed="138.375µs"
epoch=1 percentage=2 elapsed=3.024s
peercount=2 tried=86 static=0
epoch=1 percentage=3 elapsed=4.624s
number=6 sealhash=f2c9a5..587f31 hash=a9d2c6..fbb0ca elapsed=2.714s
number=6 hash=a9d2c6..fbb0ca
number=7 sealhash=f27ed6..eaf6bb uncles=0 txs=0 gas=0 fees=0 elapsed="176.709µs"
number=7 sealhash=f27ed6..eaf6bb uncles=0 txs=0 gas=0 fees=0 elapsed="539.25µs"
epoch=1 percentage=4 elapsed=5.886s
number=7 sealhash=f27ed6..eaf6bb hash=472244..18fc4c elapsed=911.554ms
number=7 hash=472244..18fc4c
number=8 sealhash=17fid9..706bd6 uncles=0 txs=0 gas=0 fees=0 elapsed="58.417µs"
number=8 sealhash=17fid9..706bd6 uncles=0 txs=0 gas=0 fees=0 elapsed="130.875µs"
epoch=1 percentage=5 elapsed=7.045s
number=8 sealhash=17fid9..706bd6 hash=2c400f..aff99b elapsed=635.482ms
number=8 hash=6a27a3..c0fe98
number=8 hash=2c400f..aff99b
number=9 sealhash=f0f046..5720c8 uncles=0 txs=0 gas=0 fees=0 elapsed="102.417µs"
number=9 sealhash=f0f046..5720c8 uncles=0 txs=0 gas=0 fees=0 elapsed=28.392ms
epoch=1 percentage=6 elapsed=8.115s
```

停止挖矿，在 console 中输入：

`miner.stop()`

```
INFO [03-19|06:36:30.057] Generating DAG in progress
INFO [03-19|06:36:30.442] Generating DAG in progress
INFO [03-19|06:36:31.095] Generating DAG in progress
INFO [03-19|06:36:31.491] Generating DAG in progress
INFO [03-19|06:36:31.901] Generating DAG in progress
INFO [03-19|06:36:32.302] Generating DAG in progress
INFO [03-19|06:36:32.725] Generating DAG in progress
INFO [03-19|06:36:33.614] Generating DAG in progress
INFO [03-19|06:36:33.616] Generated ethash verification cache
INFO [03-19|06:36:35.485] Looking for peers
epoch=1 percentage=32 elapsed=49.007s
epoch=1 percentage=93 elapsed=49.412s
epoch=1 percentage=94 elapsed=50.065s
epoch=1 percentage=95 elapsed=50.460s
epoch=1 percentage=96 elapsed=50.871s
epoch=1 percentage=97 elapsed=51.272s
epoch=1 percentage=98 elapsed=51.695s
epoch=1 percentage=99 elapsed=52.584s
epoch=1 elapsed=52.586s
peercount=0 tried=94 static=0
```

挖到一个区块会奖励5个以太币，挖矿所得的奖励会进入矿工的账户，这个账户叫做coinbase，默认情况下coinbase是本地账户中的第一个账户：

`eth.coinbase`

```
> eth.coinbase
"0x593abc88dfd6c6078f3739e7d6a3420d5b3609dd"
>
```



```
> eth.getBalance("0x593abc88dfd6c6078f3739e7d6a3420d5b3609dd")
1050000000000000000000
> _
```

可以通过 `miner.setEtherbase()` 将其他账户设置成 `coinbase` 即可

```
miner.setEtherbase("0xfe1aba3e41de132145767943f4e046d004b4a12e")
```

```
> miner.setEtherbase("0xfe1aba3e41de132145767943f4e046d004b4a12e")
true
> eth.coinbase
"0xfe1aba3e41de132145767943f4e046d004b4a12e"
> _
```

重新启动挖矿，查看 `eth.accounts[1]` 是否可以获得以太币

```
> eth.accounts[1]
"0xfe1aba3e41de132145767943f4e046d004b4a12e"
> INFO [03-19|06:38:56.393] Looking for peers peercount=0 tried=62 static=0
> eth.accounts
["0x593abc88dfd6c6078f3739e7d6a3420d5b3609dd", "0xfe1aba3e41de132145767943f4e046d004b4a12e"]
> _
```

查询账户余额：

```
eth.getBalance(eth.accounts[0])
eth.getBalance(eth.accounts[1])
```

```
> eth.getBalance(eth.accounts[0])
1050000000000000000000
> INFO [03-19|06:40:26.710] Looking for peers
> eth.getBalance(eth.accounts[1])
1450000000000000000000
> _
```

`getBalance()` 返回值的单位是wei，wei是以太币的最小单位，1个以太币=10的18次方个wei。要查看有多少个以太币，可以用 `web3.fromWei()` 将返回值换算成以太币：

```
web3.fromWei(eth.getBalance(eth.accounts[0]))
web3.fromWei(eth.getBalance(eth.accounts[1]))
```

```
> web3.fromWei(eth.getBalance(eth.accounts[0]))
105
> web3.fromWei(eth.getBalance(eth.accounts[0])) INFO [03-19|06:41:47.605] Looking for peers
> web3.fromWei(eth.getBalance(eth.accounts[1]))
145
>
```

4 发送交易

从账户0转移10个以太币到账户1,首先要解锁账户0,才能发起交易:

```
personal.unlockAccount(eth.accounts[0])
```

输入密码解锁账户

```
> personal.unlockAccount(eth.accounts[0])
Unlock account 0x593abc88dfd6c6078f3739e7d6a3420d5b3609dd
Passphrase:
true
>
```

先将 10 ETH 转换为 wei 单位 并赋给变量 amount

```
amount = web3.toWei(10, 'ether')
eth.sendTransaction({from:eth.accounts[0],to:eth.accounts[1],value:amount})
```

```
> eth.sendTransaction({from:eth.accounts[0],to:eth.accounts[1],value:amount})INFO [03-19]06:47:09.872] Looking for peers peercount=0 tried=8
8 static=0

INFO [03-19]06:47:10.311] Setting new local account address=0x593Abc88df6c6078f3739E7D6A3420d5B3609DD
INFO [03-19]06:47:10.312] Submitted transaction hash=0x5e2f33b639920de139d01f8facc2fb13d34bfc9cda6c560b21abbfe5219845ed from=0x593Abc88df6c6078f3739E7D6A3420d5B3609DD nonce=0 recipient=0xFE1ABA3E41DE132145767943F4e046D00454a12E value=10,000,000,000,000,000,000
"0x5e2f33b639920de139d01f8facc2fb13d34bfc9cda6c560b21abbfe5219845ed"
>
```

查询 账户1 的余额：

```
INFO [03-19|06:47:50.226] Looking for peers                peercount=0 tried=92 static=0
> eth.getBalance(eth.accounts[1])
14500000000000000000000000
> INFO [03-19|06:48:20.319] Looking for peers                peercount=1 tried=46 static=0
> eth.getBalance(eth.accounts[0])
10500000000000000000000000
```

发现账户余额没有发生改变，此时交易已经提交到区块链，但还未被处理，这可以通过用 `txpool.status` 命令可以看到本地交易池中有一个待确认的交易：

```

> txpool.status
{
  pending: 1,
  queued: 0
}
>

```

其中有一条pending的交易，pending表示已提交但还未被处理的交易。

要使交易被处理，必须要挖矿。这里我们启动挖矿，然后等待挖到一个区块之后就停止挖矿：

```
miner.start(1);admin.sleepBlocks(1);miner.stop()
```

```

> miner.start(1);admin.sleepBlocks(1);miner.stop()
INFO [03-19|06:49:40.432] Updated mining threads      threads=1
INFO [03-19|06:49:40.433] Transaction pool price threshold updated price=1,000,000,000
INFO [03-19|06:49:40.435] Commit new sealing work      number=51 sealhash=e25fb9..c7d0fa uncles=0 txs=0 gas=0 fees=0 elapsed=1.015ms
INFO [03-19|06:49:40.436] Commit new sealing work      number=51 sealhash=41ea3d..4136c1 uncles=0 txs=1 gas=21000 fees=2.1e-05 elapsed=2.733ms
INFO [03-19|06:49:40.780] Looking for peers            peercount=1 tried=72 static=0
INFO [03-19|06:49:46.383] Successfully sealed new block number=51 sealhash=41ea3d..4136c1 hash=f27728..c853ce elapsed=5.947s
INFO [03-19|06:49:46.384] block reached canonical chain number=44 hash=a43d5b..a07f9f
INFO [03-19|06:49:46.384] ^ mined potential block      number=51 hash=f27728..c853ce
INFO [03-19|06:49:46.384] Commit new sealing work      number=52 sealhash=3f6185..b3bbd6 uncles=0 txs=0 gas=0 fees=0 elapsed="378.917µs"
INFO [03-19|06:49:46.384] Commit new sealing work      number=52 sealhash=3f6185..b3bbd6 uncles=0 txs=0 gas=0 fees=0 elapsed="456.209µs"
null
> INFO [03-19|06:49:50.782] Looking for peers            peercount=2 tried=89 static=0

```

```
web3.fromWei(eth.getBalance(eth.accounts[0]))
```

```
web3.fromWei(eth.getBalance(eth.accounts[1]))
```

```

> web3.fromWei(eth.getBalance(eth.accounts[0]))
94.999979
> WARN [03-19|06:51:09.462] Snapshot extension registration failed peer=16be5500
> web3.fromWei(eth.getBalance(eth.accounts[1]))
160.000021

```

发现账户收到了账户的钱，还多了5个以太币。其实多出的5个以太币是挖矿奖励。

5 查看交易和区块

查看当前区块总数：

```
eth.blockNumber
```

```

INFO [03-19|06:52:15.505] Looking for peers
> eth.blockNumber
51
>

```

通过区块号查看区块：

