Block Chain Implementation Using Ethereum

We are going to implement this using command line interface. For making it more user friendly we could have created an HTML page that runs on a local host.

TLDR:

We will create a private blockchain network of two accounts and carry out mining and do some transactions between them for ethers.

Steps to check transation:

0. Change directory to FirstEthereum and follow the procedure.
1. Launch a geth console.

```
ashutosh@ashu-pc:~/FirstEthereum$ geth --datadir node1 --networkid 98765 console
INFO [02-15|12:17:30.456] Maximum peer count                       ETH=50 LES=0 total=50
INFO [02-15|12:17:30.457] Smartcard socket not found, disabling    err="stat /run/pcscd/pcscd.comm: no such file or directory"
INFO [02-15|12:17:30.458] Set global gas cap                       cap=25000000
INFO [02-15|12:17:30.458] Allocated trie memory caches             clean=256.00MiB dirty=256.00MiB
INFO [02-15|12:17:30.458] Allocated cache and file handles         database=/home/ashutosh/FirstEthereum/node1/geth/chaindata cache=5
INFO [02-15|12:17:30.772] Opened ancient database                  database=/home/ashutosh/FirstEthereum/node1/geth/chaindata/ancient
INFO [02-15|12:17:30.773] Initialised chain configuration          config="{ChainID: 1907 Homestead: 0 DAO: <nil> DAOSupport: false E
: <nil> Istanbul: <nil>, Muir Glacier: <nil>, YOLO v2: <nil>, Engine: unknown}"
INFO [02-15|12:17:30.773] Disk storage enabled for ethash caches   dir=/home/ashutosh/FirstEthereum/node1/geth/ethash count=3
INFO [02-15|12:17:30.774] Disk storage enabled for ethash DAGs     dir=/home/ashutosh/.ethash count=2
INFO [02-15|12:17:30.774] Initialising Ethereum protocol           versions="[65 64 63]" network=98765 dbversion=<nil>
WARN [02-15|12:17:30.774] Upgrade blockchain database version      from=<nil> to=8
INFO [02-15|12:17:30.775] Loaded most recent local header          number=0 hash="357b5e…1b20b9" td=10 age=51y10mo1w
INFO [02-15|12:17:30.776] Loaded most recent local full block      number=0 hash="357b5e…1b20b9" td=10 age=51y10mo1w
INFO [02-15|12:17:30.776] Loaded most recent local fast block      number=0 hash="357b5e…1b20b9" td=10 age=51y10mo1w
INFO [02-15|12:17:30.776] Regenerated local transaction journal    transactions=0 accounts=0
INFO [02-15|12:17:30.785] Allocated fast sync bloom                size=512.00MiB
INFO [02-15|12:17:30.786] Initialized fast sync bloom              items=0 errorrate=0.000 elapsed="44.208µs"
INFO [02-15|12:17:30.786] Starting peer-to-peer node               instance=Geth/v1.9.25-stable-e7872729/linux-amd64/go1.15.6
INFO [02-15|12:17:30.886] New local node record                    seq=1 id=6672585db95f4b3c ip=127.0.0.1 udp=30303 tcp=30303
INFO [02-15|12:17:30.887] Started P2P networking                   self=enode://5a98152210a602acb42e4029ba4dbffe445ff374d72c9d06fb18b
7.0.0.1:30303
INFO [02-15|12:17:30.891] IPC endpoint opened                      url=/home/ashutosh/FirstEthereum/node1/geth.ipc
INFO [02-15|12:17:30.954] Etherbase automatically configured       address=0xf8bF842ed3851dfc2BDB9f7733249eAA6814DD4A
Welcome to the Geth JavaScript console!

instance: Geth/v1.9.25-stable-e7872729/linux-amd64/go1.15.6
coinbase: 0xf8bf842ed3851dfc2bdb9f7733249eaa6814dd4a
at block: 0 (Thu Jan 01 1970 05:30:00 GMT+0530 (IST))
 datadir: /home/ashutosh/FirstEthereum/node1
 modules: admin:1.0 debug: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

To exit, press ctrl-d
> INFO [02-15|12:17:32.156] New local node record                    seq=2 id=6672585db95f4b3c ip=103.69.22.151 udp=30303 tcp=30303
```

2. To check balance.

```
> eth.getBalance(eth.coinbase)
17000000000000000000
```

3. Now we've got some ether in the first account, let's send it to the 2nd account we created. The source account has to be unlocked before it can send a transaction.
Password for both account: *node1*

```
> personal.unlockAccount(eth.accounts[0])
Unlock account 0xf8bf842ed3851dfc2bdb9f7733249eaa6814dd4a
Passphrase:
true
```

4. Now transferring some ethers to account 2.

```
> eth.sendTransaction({from: eth.accounts[0], to: eth.accounts[1], value: web3.toWei(3,"ether")})INFO

INFO [02-15|12:34:20.522] Setting new local account                address=0xf8bF842ed3851dfc2BDB9f773
INFO [02-15|12:34:20.523] Submitted transaction                    fullhash=0xec4801afb5d3feac9ef72448
"0xec4801afb5d3feac9ef72448dabd289aab3b083be27f81ba69d0f80f8e13fa01"
```

5. The ethers wont be sent until a miners validates the transaction. Since there are no other nodes on the network so we need to mine for it.

```
> miner.start(1)
INFO [02-15|12:34:32.932] Updated mining threads                   threads=1
INFO [02-15|12:34:32.933] Transaction pool price threshold updated price=1000000000
null
```

6. Finally Stop the mining and check balance of account 2.

```
> miner.stoINFO [02-15|12:34:54.274] Looking for peers                          peercount=0 tried=46  static
> miner.stop()INFO [02-15|12:34:55.591] Successfully sealed new block             number=47 sealhash="939f48
INFO [02-15|12:34:55.591] 🔗 block reached canonical chain          number=40 hash="5852c6…ea1980"
INFO [02-15|12:34:55.591] 🔨 mined potential block                  number=47 hash="785a04…904827"
INFO [02-15|12:34:55.592] Commit new mining work                   number=48 sealhash="86a962…d316fb" uncle

null
> eth.getBalance(eth.accounts[1])
3000000000000000000
```

Pre Requisite:

1. c compiler
2. Install Go Ethereum (geth)

```
sudo apt-get install software-properties-common
sudo add-apt-repository -y ppa:ethereum/ethereum
sudo apt-get update
sudo apt-get install ethereum
```

Full Steps:

1. Create a directory for Ethereum Implementation

```
mkdir FirstEthereum
```

2. Create a genesis.json file and place it in the directory.

Content -

```
{
    "config": {
      "chainId": 1907,
```

```
    "homesteadBlock": 0,
    "eip155Block": 0,
    "eip158Block": 0
  },
  "difficulty": "10",
  "gasLimit": "2100000",
  "alloc": {}
}
```

If there is an error for not enabled eip block, add it to the genesis.json file.

Ex: *Failed to write genesis block: unsupported fork ordering: eip150Block not enabled, but eip155Block enabled at 0.*

Sol:

```
"eip150Block": 0,
```

3. Create an account in node1.
   Execute the same command again to create another account in node1.

```
ashutosh@ashu-pc:~/FirstEthereum$ mkdir node1
ashutosh@ashu-pc:~/FirstEthereum$ geth --datadir node1 account new
INFO [02-15|12:10:31.798] Maximum peer count                       ETH=50 LES=0 total=50
INFO [02-15|12:10:31.798] Smartcard socket not found, disabling    err="stat /run/pcscd/pcscd.comm: no such file or directory"
Your new account is locked with a password. Please give a password. Do not forget this password.
Password:
Repeat password:

Your new key was generated

Public address of the key:   0xf8bF842ed3851dfc2BDB9f7733249eAA6814DD4A
Path of the secret key file: node1/keystore/UTC--2021-02-15T06-40-42.444018040Z--f8bf842ed3851dfc2bdb9f7733249eaa6814dd4a

- You can share your public address with anyone. Others need it to interact with you.
- You must NEVER share the secret key with anyone! The key controls access to your funds!
- You must BACKUP your key file! Without the key, it's impossible to access account funds!
- You must REMEMBER your password! Without the password, it's impossible to decrypt the key!
```

4. Choose a network id of your private network and initialize the first node.

```
ashutosh@ashu-pc:~/FirstEthereum$ geth --datadir node1 init genesis.json
INFO [02-15|12:16:55.393] Maximum peer count                       ETH=50 LES=0 total=50
INFO [02-15|12:16:55.393] Smartcard socket not found, disabling    err="stat /run/pcscd/pcscd.comm: no such file or directory"
INFO [02-15|12:16:55.395] Set global gas cap                       cap=25000000
INFO [02-15|12:16:55.395] Allocated cache and file handles         database=/home/ashutosh/FirstEthereum/node1/geth/chaindata cach
INFO [02-15|12:16:55.497] Writing custom genesis block
INFO [02-15|12:16:55.498] Persisted trie from memory database      nodes=0 size=0.00B time="12.166µs" gcnodes=0 gcsize=0.00B gctim
INFO [02-15|12:16:55.500] Successfully wrote genesis state         database=chaindata hash="357b5e…1b20b9"
INFO [02-15|12:16:55.500] Allocated cache and file handles         database=/home/ashutosh/FirstEthereum/node1/geth/lightchaindata
INFO [02-15|12:16:55.597] Writing custom genesis block
INFO [02-15|12:16:55.598] Persisted trie from memory database      nodes=0 size=0.00B time="8.701µs"  gcnodes=0 gcsize=0.00B gctim
INFO [02-15|12:16:55.599] Successfully wrote genesis state         database=lightchaindata hash="357b5e…1b20b9"
```

5. Now launching a geth console

```
ashutosh@ashu-pc:~/FirstEthereum$ geth --datadir node1 --networkid 98765 console
INFO [02-15|12:17:30.456] Maximum peer count                       ETH=50 LES=0 total=50
INFO [02-15|12:17:30.457] Smartcard socket not found, disabling    err="stat /run/pcscd/pcscd.comm: no such file or directory"
INFO [02-15|12:17:30.458] Set global gas cap                       cap=25000000
INFO [02-15|12:17:30.458] Allocated trie memory caches             clean=256.00MiB dirty=256.00MiB
INFO [02-15|12:17:30.458] Allocated cache and file handles         database=/home/ashutosh/FirstEthereum/node1/geth/chaindata cache=5
INFO [02-15|12:17:30.772] Opened ancient database                  database=/home/ashutosh/FirstEthereum/node1/geth/chaindata/ancient
INFO [02-15|12:17:30.773] Initialised chain configuration          config="{ChainID: 1907 Homestead: 0 DAO: <nil> DAOSupport: false E
: <nil> Istanbul: <nil>, Muir Glacier: <nil>, YOLO v2: <nil>, Engine: unknown}"
INFO [02-15|12:17:30.773] Disk storage enabled for ethash caches   dir=/home/ashutosh/FirstEthereum/node1/geth/ethash count=3
INFO [02-15|12:17:30.774] Disk storage enabled for ethash DAGs     dir=/home/ashutosh/.ethash count=2
INFO [02-15|12:17:30.774] Initialising Ethereum protocol           versions="[65 64 63]" network=98765 dbversion=<nil>
WARN [02-15|12:17:30.774] Upgrade blockchain database version      from=<nil> to=8
INFO [02-15|12:17:30.775] Loaded most recent local header          number=0 hash="357b5e…1b20b9" td=10 age=51y10mo1w
INFO [02-15|12:17:30.776] Loaded most recent local full block      number=0 hash="357b5e…1b20b9" td=10 age=51y10mo1w
INFO [02-15|12:17:30.776] Loaded most recent local fast block      number=0 hash="357b5e…1b20b9" td=10 age=51y10mo1w
INFO [02-15|12:17:30.776] Regenerated local transaction journal    transactions=0 accounts=0
INFO [02-15|12:17:30.785] Allocated fast sync bloom                size=512.00MiB
INFO [02-15|12:17:30.786] Initialized fast sync bloom              items=0 errorrate=0.000 elapsed="44.208µs"
INFO [02-15|12:17:30.786] Starting peer-to-peer node               instance=Geth/v1.9.25-stable-e7872729/linux-amd64/go1.15.6
INFO [02-15|12:17:30.886] New local node record                    seq=1 id=6672585db95f4b3c ip=127.0.0.1 udp=30303 tcp=30303
INFO [02-15|12:17:30.887] Started P2P networking                   self=enode://5a98152210a602acb42e4029ba4dbffe445ff374d72c9d06fb18b
7.0.0.1:30303
INFO [02-15|12:17:30.891] IPC endpoint opened                      url=/home/ashutosh/FirstEthereum/node1/geth.ipc
INFO [02-15|12:17:30.954] Etherbase automatically configured       address=0xf8bF842ed3851dfc2BDB9f7733249eAA6814DD4A
Welcome to the Geth JavaScript console!

instance: Geth/v1.9.25-stable-e7872729/linux-amd64/go1.15.6
coinbase: 0xf8bf842ed3851dfc2bdb9f7733249eaa6814dd4a
at block: 0 (Thu Jan 01 1970 05:30:00 GMT+0530 (IST))
 datadir: /home/ashutosh/FirstEthereum/node1
 modules: admin:1.0 debug: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

To exit, press ctrl-d
> INFO [02-15|12:17:32.156] New local node record                  seq=2 id=6672585db95f4b3c ip=103.69.22.151 udp=30303 tcp=30303
```

6. The first account you created is set as *eth.coinbase* or *eth.accounts[0]* and second account is *eth.accounts[1]*. This will earn ether through mining. It does not have any ether yet, so we need to mine some blocks.

```
> miner.start(1)
INFO [02-15|12:18:39.262] Updated mining threads                   threads=1
INFO [02-15|12:18:39.262] Transaction pool price threshold updated price=1000000000
null
> INFO [02-15|12:18:39.263] Commit new mining work                   number=1 sealhash="4375f8…490e36" uncle
INFO [02-15|12:18:39.751] Looking for peers                        peercount=0 tried=69  static=0
INFO [02-15|12:18:40.601] Generating DAG in progress               epoch=0 percentage=0 elapsed=726.553ms
INFO [02-15|12:18:41.337] Generating DAG in progress               epoch=0 percentage=1 elapsed=1.462s
```

First time you run this it will create the DAG. This will take some time. Once the DAG is completed, leave the miner running for a while until it mines a few blocks. When you are ready to stop it, stop it with `miner.stop()`

```
INFO [02-15|12:21:56.670] Commit new mining work                   number=34 sealhash="921f97…ab087b" uncle
> miner.INFO [02-15|12:22:00.906] Successfully sealed new block           number=34 sealhash="921f97…ab087
INFO [02-15|12:22:00.906] 🔗 block reached canonical chain          number=27 hash="0f3bde…34e364"
INFO [02-15|12:22:00.906] 🔨 mined potential block                  number=34 hash="59ac0a…a0b388"
INFO [02-15|12:22:00.906] Commit new mining work                   number=35 sealhash="22afe8…cd3e30" uncle
> miner.sINFO [02-15|12:22:01.766] Looking for peers                      peercount=0 tried=58  static=0
> miner.stop()
null
```

7. To check balance.

```
> eth.getBalance(eth.coinbase)
17000000000000000000
```

8. Now we've got some ether in the first account, let's send it to the 2nd account we created. The source account has to be unlocked before it can send a transaction.

```
> personal.unlockAccount(eth.accounts[0])
Unlock account 0xf8bf842ed3851dfc2bdb9f7733249eaa6814dd4a
Passphrase:
true
```

9. Now transferring some ethers to account 2.

```
> eth.sendTransaction({from: eth.accounts[0], to: eth.accounts[1], value: web3.toWei(3,"ether")})INFO

INFO [02-15|12:34:20.522] Setting new local account                address=0xf8bF842ed3851dfc2BDB9f773
INFO [02-15|12:34:20.523] Submitted transaction                    fullhash=0xec4801afb5d3feac9ef72448
"0xec4801afb5d3feac9ef72448dabd289aab3b083be27f81ba69d0f80f8e13fa01"
```

10. The ethers wont be sent until a miners validates the transaction. Since there are no other nodes on the network so we need to mine for it.

```
> miner.start(1)
INFO [02-15|12:34:32.932] Updated mining threads                   threads=1
INFO [02-15|12:34:32.933] Transaction pool price threshold updated price=1000000000
null
```

11. Finally Stop the mining and check balance of account 2.

```
> miner.stoINFO [02-15|12:34:54.274] Looking for peers                        peercount=0 tried=46  static
> miner.stop()INFO [02-15|12:34:55.591] Successfully sealed new block           number=47 sealhash="939f48
INFO [02-15|12:34:55.591] 🔗 block reached canonical chain          number=40 hash="5852c6…ea1980"
INFO [02-15|12:34:55.591] 🔨 mined potential block                  number=47 hash="785a04…904827"
INFO [02-15|12:34:55.592] Commit new mining work                   number=48 sealhash="86a962…d316fb" uncle

null
> eth.getBalance(eth.accounts[1])
3000000000000000000
```

Hence we were able to create a private block chain and go through some transactions and mining.