DA51 Lab Session 2: The Geth client

Description:

This session teaches us how to set up a private Ethereum network with Geth, focusing on the Clique Proof of Authority (PoA) consensus algorithm. It covers creating accounts, a genesis block, and signer account keys for the network. The session also explains the structure of the extradata field in the genesis block for Clique Proof of Authority.

A private Ethereum blockchain is created, initialized, and two nodes are established. A bootnode is configured to facilitate peer-to-peer connections, and the nodes are launched with unique IDs and ports. Ether is transferred between accounts on the nodes, demonstrating transaction functionality.

Transfer ether between addresses using Wei units.

Question 5:

```
PS C:\dev\lab-session-2> geth --datadir node1 account new
INFO [09-18|14:07:15.461] Maximum peer count                       ETH=50 total=50
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:   0x547a58C011f6121F913C378F7338B95A43526353
Path of the secret key file: node1\keystore\UTC--2024-09-18T12-07-19.616153200Z--547a58c011f6121f913c378f7338b95a4352635
3

- 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!
```

The command creates a keyfile that is stored in the keystore path

Question 10:

The command initializes the database. To connect the two nodes later, this initialization must be done in both directories.

```
PS C:\dev\lab-session-2> geth init --datadir node1 genesis.json
INFO [09-18|16:15:57.383] Maximum peer count                       ETH=50 total=50
WARN [09-18|16:15:57.391] Lowering memory allowance on 32bit arch  available=8026 addressable=2048
WARN [09-18|16:15:57.391] Sanitizing cache to Go's GC limits       provided=1024 updated=682
INFO [09-18|16:15:57.393] Set global gas cap                       cap=50,000,000
INFO [09-18|16:15:57.393] Initializing the KZG library             backend=gokzg
INFO [09-18|16:15:57.750] Defaulting to pebble as the backing database
INFO [09-18|16:15:57.750] Allocated cache and file handles         database=C:\dev\lab-session-2\node1\geth\chaindata cache=16.00MiB handles=16
INFO [09-18|16:15:57.800] Opened ancient database                  database=C:\dev\lab-session-2\node1\geth\chaindata\ancient/chain readonly=false
INFO [09-18|16:15:57.801] State schema set to default              scheme=hash
INFO [09-18|16:15:57.802] Writing custom genesis block
INFO [09-18|16:15:57.806] Persisted trie from memory database      nodes=3 size=405.00B time=2.1806ms gcnodes=0 gcsize=0.00B gctime=0s livenodes=0 livesize=0.00B
INFO [09-18|16:15:57.826] Successfully wrote genesis state         database=chaindata hash=166a0e..3ccd7f
INFO [09-18|16:15:57.826] Defaulting to pebble as the backing database
INFO [09-18|16:15:57.826] Allocated cache and file handles         database=C:\dev\lab-session-2\node1\geth\lightchaindata cache=16.00MiB handles=16
INFO [09-18|16:15:57.889] Opened ancient database                  database=C:\dev\lab-session-2\node1\geth\lightchaindata\ancient/chain readonly=false
INFO [09-18|16:15:57.890] State schema set to default              scheme=hash
INFO [09-18|16:15:57.890] Writing custom genesis block
INFO [09-18|16:15:57.893] Persisted trie from memory database      nodes=3 size=405.00B time=2.6261ms gcnodes=0 gcsize=0.00B gctime=0s livenodes=0 livesize=0.00B
INFO [09-18|16:15:57.909] Successfully wrote genesis state         database=lightchaindata hash=166a0e..3ccd7f
```

Question 12:

```
PS C:\dev\lab-session-2> bootnode -nodekey boot.key -addr :30305
enode://ec572066a2059f2f330b7f2a9bc53e3cdc7b12614c90fd94c155103be7a2
da15247f96f62b42bae60029b862dd3c1c35159d878134d433b73b1483ede2b904c5
@127.0.0.1:0?discport=30305
Note: you're using cmd/bootnode, a developer tool.
We recommend using a regular node as bootstrap node for production d
eployments.
INFO [09-18|14:21:26.532] New local node record                    s
eq=1,726,662,086,529 id=10c5af03f5e031bf ip=<nil> udp=0 tcp=0
```

Question 13:

First command: geth --datadir node1 --port 30307 --bootnodes enode://7f851530fc477c9f183d02719e4066e4252b6bd2572d29d4f3d57e785701b6a19a87c12c499327d5cbcd5dac5afbd437ab57cc69c02c5619f65f327d9da40580@127.0.0.1:0?discport=30305 --networkid 1234567890 --unlock B6E9D58c3A76f9E5640e6920cA03dF9d30FcD331 --password node1/password.txt --authrpc.port 8551 --ipcpath node1 --miner.etherbase 0xB6E9D58c3A76f9E5640e6920cA03dF9d30FcD331

Second command: geth --datadir node2 --port 30308 --bootnodes enode://7f851530fc477c9f183d02719e4066e4252b6bd2572d29d4f3d57e785701b6a19a87c12c499327d5cbcd5dac5afbd437ab57cc69c02c5619f65f327d9da40580@127.0.0.1:0?discport=30305 --networkid 1234567890 --unlock c2024d10C9F18176A0Eb290F9e35DAd6F10BeeF4 --password node2/password.txt --authrpc.port 8552 --ipcpath node2

I needed to add –ipcpath because of a forbidden access of the start of the two commands at the same time. In the same way, I needed to add –miner.etherbase to sepecify the etherbase in order to mine, requirement for something later in the TP.

Question 15:

As I specified in the previous question the -ipcpath the command look like : geth attach \\.\pipe\node1 for the node 1 and geth attach \\.\pipe\node2 for the node 2.

```
PS C:\dev\lab-session-2> geth attach \\.\pipe\node1
Welcome to the Geth JavaScript console!

instance: Geth/v1.13.15-stable-c5ba367e/windows-386/go1.21.6
coinbase: 0xb6e9d58c3a76f9e5640e6920ca03df9d30fcd331
at block: 2 (Wed Sep 18 2024 16:26:05 GMT+0200 (CEST))
 datadir: C:\dev\lab-session-2\node1
 modules: admin:1.0 clique:1.0 debug:1.0 engine:1.0 eth:1.0 miner:1.0 net:1.0 rpc:1.0 txpool:1.0 web3:1.0

To exit, press ctrl-d or type exit
```

```
PS C:\Users\jules> geth attach \\.\pipe\node2
Welcome to the Geth JavaScript console!

instance: Geth/v1.13.15-stable-c5ba367e/windows-386/go1.21.6
at block: 0 (Thu Jan 01 1970 01:00:00 GMT+0100 (CET))
 datadir: C:\dev\lab-session-2\node2
 modules: admin:1.0 clique:1.0 debug:1.0 engine:1.0 eth:1.0 miner:1.0 net:1.0 rpc:1.0 txpool:1.0 web3:1.0

To exit, press ctrl-d or type exit
```

Question 16:

```
> net.peerCount
1
```

Question 17:

```
> admin.peers
[{
    caps: ["eth/68", "snap/1"],
    enode: "enode://baea567b4a411d5052fa5b83de8bc0ef1ba0020a4670bb0c21f884feab7b2449a3bb460ef552146f52d9dbdbf1b2b982b2dfa68a6655c4b31ff8c5c9bcb6b982@127.0.0.1:58004",
    id: "4b566c159451beea618364c4f8e7ac3d1408d4c505529101d7241f82ea69173f",
    name: "Geth/v1.13.15-stable-c5ba367e/windows-386/go1.21.6",
    network: {
      inbound: true,
      localAddress: "127.0.0.1:30307",
      remoteAddress: "127.0.0.1:58004",
      static: false,
      trusted: false
    },
    protocols: {
      eth: {
        version: 68
      },
      snap: {
        version: 1
      }
    }
}]
```

Question 18:

```
> eth.getBalance(eth.accounts[0])
9.999999934101971356999e+22
```

Question 19:

eth.sendTransaction({to: 'c2024d10C9F18176A0Eb290F9e35DAd6F10BeeF4', from: eth.accounts[0], value: 25000});

```
> eth.sendTransaction({to: 'c2024d10C9F18176A0Eb290F9e35DAd6F10BeeF4', from: eth.accounts[0], value: 25000});
"0x7f459fe9b10a7ebb012be79e2b629bbdb964f550d81aaac81207780817d8f524"
```

Question 20:

In order to get the value, we need to start the miner by miner.start()

```
> miner.start()
null
```

```
> eth.getBalance('c2024d10C9F18176A0Eb290F9e35DAd6F10BeeF4');
125000
```

Question 21:

```
PS C:\Users\jules> geth attach \\.\pipe\node2
Welcome to the Geth JavaScript console!

instance: Geth/v1.13.15-stable-c5ba367e/windows-386/go1.21.6
at block: 0 (Thu Jan 01 1970 01:00:00 GMT+0100 (CET))
 datadir: C:\dev\lab-session-2\node2
 modules: admin:1.0 clique:1.0 debug:1.0 engine:1.0 eth:1.0 miner:1.0 net:1.0 rpc:1.0 txpool:1.0 web3:1.0

To exit, press ctrl-d or type exit
```

Question 22:

```
> eth.getBalance(eth.accounts[0])
125000
```

Question 23:

Yes, it matches

Question 24:

Balance in Ethereum is represented in Wei by default.

Question 25:

1 ether is equal to 10^{18} Wei

Question 26:

List of command in this order:

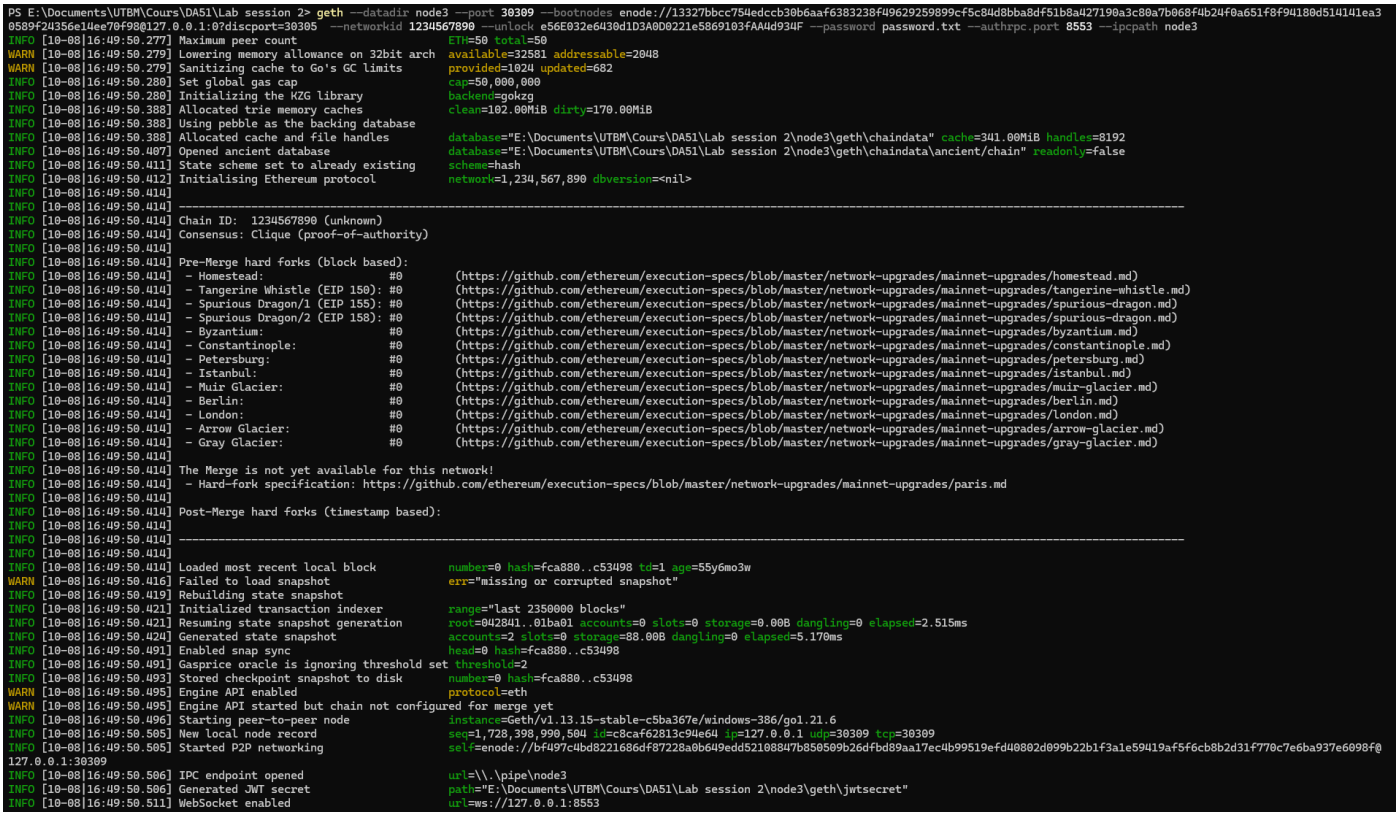
- mkdir node3
- geth –datadir node3 account new

```
PS E:\Documents\UTBM\Cours\DA51\Lab session 2> geth --datadir node3 account new
INFO [10-08|16:48:08.822] Maximum peer count                       ETH=50 total=50
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:   0xe56E032e6430d1D3A0D0221e5869103fAA4d934F
Path of the secret key file: node3\keystore\UTC--2024-10-08T14-48-12.925717600Z--e56e032e6430d1d3a0d0221e5869103faa4d934f

- 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!
```

- geth init --datadir node3 genesis.json

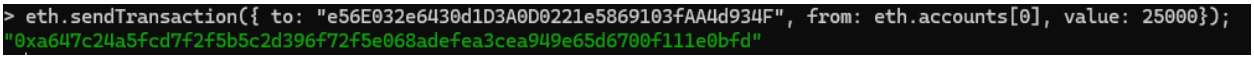
```
PS E:\Documents\UTBM\Cours\DA51\Lab session 2> geth init --datadir node3 genesis.json
INFO [10-08|16:45:15.327] Maximum peer count                       ETH=50 total=50
WARN [10-08|16:45:15.331] Lowering memory allowance on 32bit arch  available=32581 addressable=2048
WARN [10-08|16:45:15.331] Sanitizing cache to Go's GC limits       provided=1024 updated=682
INFO [10-08|16:45:15.331] Set global gas cap                       cap=50,000,000
INFO [10-08|16:45:15.331] Initializing the KZG library             backend=gokzg
INFO [10-08|16:45:15.432] Defaulting to pebble as the backing database
INFO [10-08|16:45:15.432] Allocated cache and file handles         database="E:\Documents\UTBM\Cours\DA51\Lab session 2\node3\geth\chaindata" cache=16.00MiB handles=16
INFO [10-08|16:45:15.457] Opened ancient database                  database="E:\Documents\UTBM\Cours\DA51\Lab session 2\node3\geth\chaindata\ancient/chain" readonly=false
INFO [10-08|16:45:15.457] State schema set to default              scheme=hash
INFO [10-08|16:45:15.457] Writing custom genesis block
INFO [10-08|16:45:15.459] Persisted trie from memory database      nodes=3 size=405.00B time=1.5574ms gcnodes=0 gcsize=0.00B gctime=0s livenodes=0 livesize=0.00B
INFO [10-08|16:45:15.470] Successfully wrote genesis state         database=chaindata hash=fca880..c53498
INFO [10-08|16:45:15.470] Defaulting to pebble as the backing database
INFO [10-08|16:45:15.470] Allocated cache and file handles         database="E:\Documents\UTBM\Cours\DA51\Lab session 2\node3\geth\lightchaindata" cache=16.00MiB handles=16
INFO [10-08|16:45:15.498] Opened ancient database                  database="E:\Documents\UTBM\Cours\DA51\Lab session 2\node3\geth\lightchaindata\ancient/chain" readonly=false
INFO [10-08|16:45:15.498] State schema set to default              scheme=hash
INFO [10-08|16:45:15.498] Writing custom genesis block
INFO [10-08|16:45:15.500] Persisted trie from memory database      nodes=3 size=405.00B time=1.5357ms gcnodes=0 gcsize=0.00B gctime=0s livenodes=0 livesize=0.00B
INFO [10-08|16:45:15.511] Successfully wrote genesis state         database=lightchaindata hash=fca880..c53498
```

- geth --datadir node3 --port 30309 --bootnodes enode://13327bbcc754edccb30b6aaf6383238f49629259899cf5c84d8bba8df51b8a427190a3c80a7b068f4b24f0a651f8f94180d514141ea30589f24356e14ee70f98@127.0.0.1:0?discport=30305 --networkid 1234567890 --unlock e56E032e6430d1D3A0D0221e5869103fAA4d934F --password password.txt --authrpc.port 8553 --ipcpath node3



To send money to node3 from node1:

eth.sendTransaction({ to: "e56E032e6430d1D3A0D0221e5869103fAA4d934F", from: eth.accounts[0], value: 25000});



Conclusion:

Geth commands are used to initialize Ethereum nodes, specifying datadir, port, bootnodes, networkid, unlock accounts, and other parameters. Transactions are sent between nodes using eth.sendTransaction, and miners are started with miner.start(). Balance is displayed in Wei, with 1 ether equal to 10^18 Wei.