Rapport Blockchain

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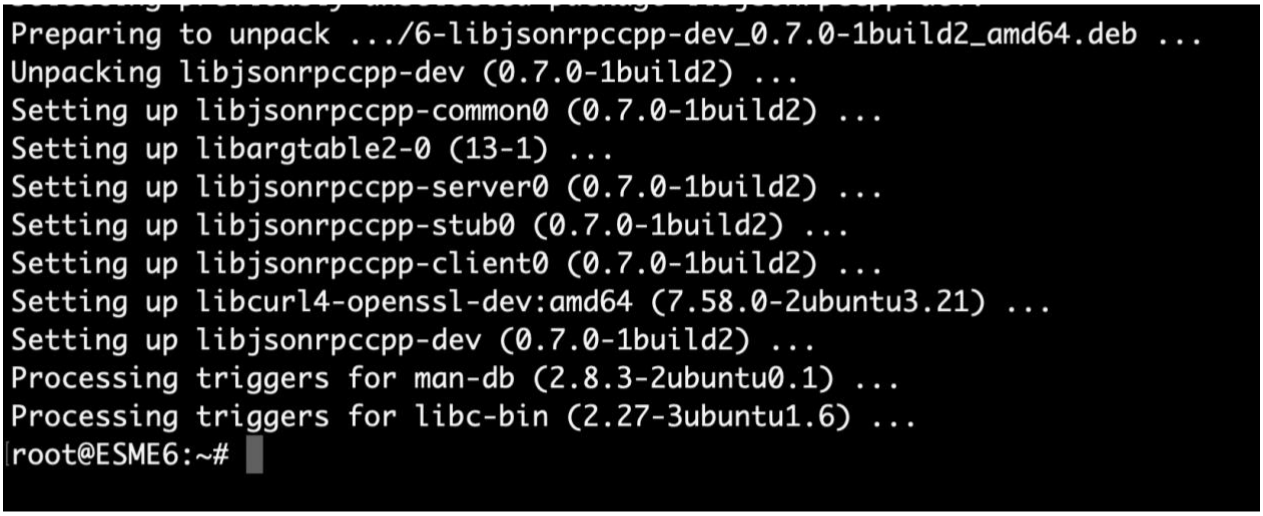
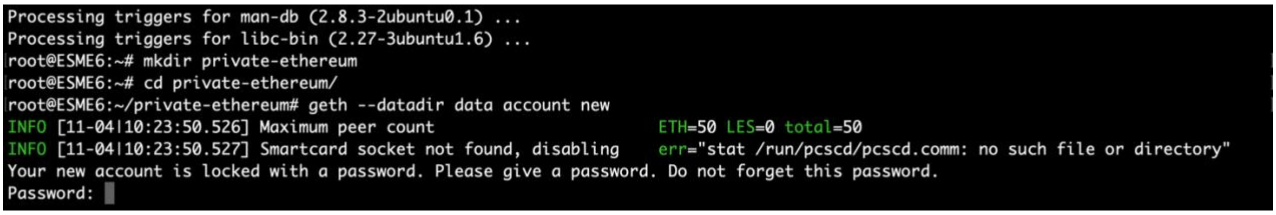
I. Installation d'Ethereum sur Ubuntu (Linux recommandé)



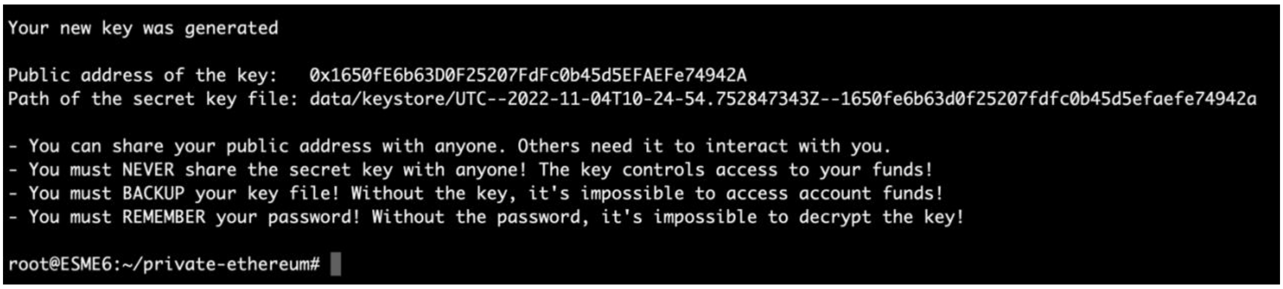
```
Preparing to unpack .../6-libjsonrpccpp-dev_0.7.0-1build2_amd64.deb ...
Unpacking libjsonrpccpp-dev (0.7.0-1build2) ...
Setting up libjsonrpccpp-common0 (0.7.0-1build2) ...
Setting up libargtable2-0 (13-1) ...
Setting up libjsonrpccpp-server0 (0.7.0-1build2) ...
Setting up libjsonrpccpp-stub0 (0.7.0-1build2) ...
Setting up libjsonrpccpp-client0 (0.7.0-1build2) ...
Setting up libcurl4-openssl-dev:amd64 (7.58.0-2ubuntu3.21) ...
Setting up libjsonrpccpp-dev (0.7.0-1build2) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for libc-bin (2.27-3ubuntu1.6) ...
root@ESME6:~#
```

II. Création de comptes pour le réseau privé Ethereum



```
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for libc-bin (2.27-3ubuntu1.6) ...
root@ESME6:~# mkdir private-ethereum
root@ESME6:~# cd private-ethereum/
root@ESME6:~/private-ethereum# geth --datadir data account new
INFO [11-04|10:23:50.526] Maximum peer count                       ETH=50 LES=0 total=50
INFO [11-04|10:23:50.527] 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:
```

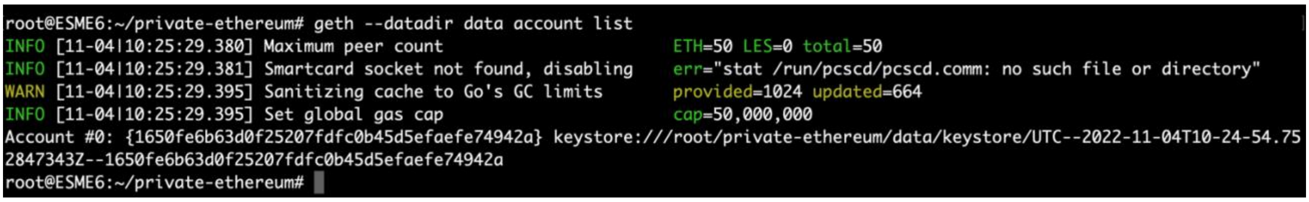
On choisit un mot de passe par défaut.



```
Your new key was generated

Public address of the key:   0x1650fE6b63D0F25207FdFc0b45d5EFAEFe74942A
Path of the secret key file: data/keystore/UTC--2022-11-04T10-24-54.752847343Z--1650fe6b63d0f25207fdfc0b45d5efaefe74942a

- 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!

root@ESME6:~/private-ethereum#
```

On obtient notre accountId.

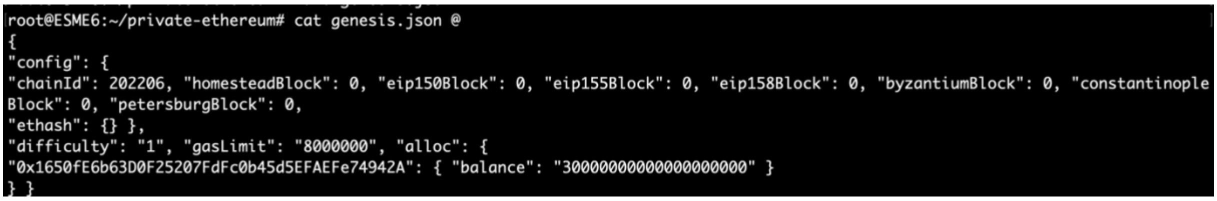
Voici nos données du account:



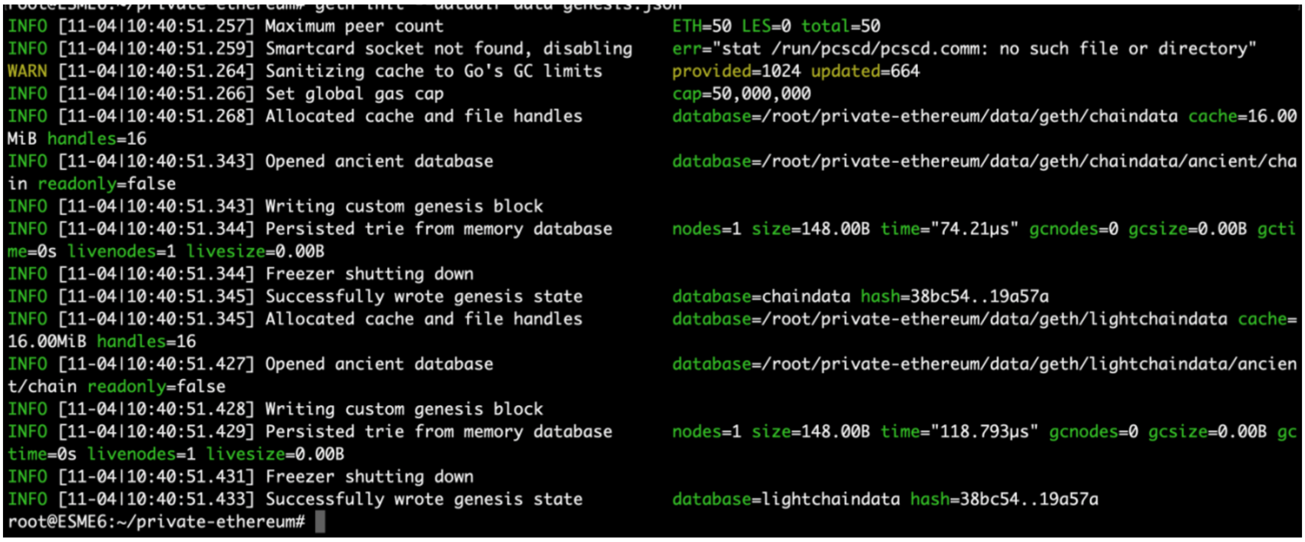
```
root@ESME6:~/private-ethereum# geth --datadir data account list
INFO [11-04|10:25:29.380] Maximum peer count                       ETH=50 LES=0 total=50
INFO [11-04|10:25:29.381] Smartcard socket not found, disabling    err="stat /run/pcscd/pcscd.comm: no such file or directory"
WARN [11-04|10:25:29.395] Sanitizing cache to Go's GC limits       provided=1024 updated=664
INFO [11-04|10:25:29.395] Set global gas cap                       cap=50,000,000
Account #0: {1650fe6b63d0f25207fdfc0b45d5efaefe74942a} keystore:///root/private-ethereum/data/keystore/UTC--2022-11-04T10-24-54.75
2847343Z--1650fe6b63d0f25207fdfc0b45d5efaefe74942a
root@ESME6:~/private-ethereum# 
```

III. Creation du Genesis File uniquement sur le serveur fourni dans un premier temps!

On choisit la chainId :202206.

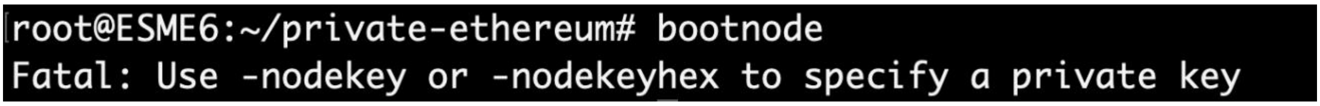


```
root@ESME6:~/private-ethereum# cat genesis.json @
{
"config": {
"chainId": 202206, "homesteadBlock": 0, "eip150Block": 0, "eip155Block": 0, "eip158Block": 0, "byzantiumBlock": 0, "constantinople
Block": 0, "petersburgBlock": 0,
"ethash": {} },
"difficulty": "1", "gasLimit": "8000000", "alloc": {
"0x1650fE6b63D0F25207FdFc0b45d5EFAEFe74942A": { "balance": "30000000000000000000" }
} }
```

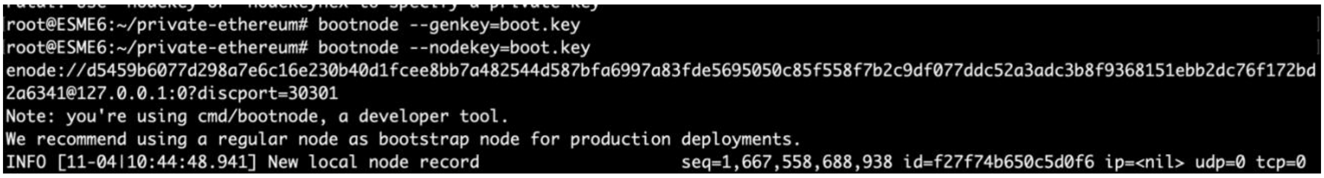


```
root@ESME6:~/private-ethereum# geth init --datadir data genesis.json
INFO [11-04|10:40:51.257] Maximum peer count                       ETH=50 LES=0 total=50
INFO [11-04|10:40:51.259] Smartcard socket not found, disabling    err="stat /run/pcscd/pcscd.comm: no such file or directory"
WARN [11-04|10:40:51.264] Sanitizing cache to Go's GC limits       provided=1024 updated=664
INFO [11-04|10:40:51.266] Set global gas cap                       cap=50,000,000
INFO [11-04|10:40:51.268] Allocated cache and file handles         database=/root/private-ethereum/data/geth/chaindata cache=16.00
MiB handles=16
INFO [11-04|10:40:51.343] Opened ancient database                  database=/root/private-ethereum/data/geth/chaindata/ancient/cha
in readonly=false
INFO [11-04|10:40:51.343] Writing custom genesis block
INFO [11-04|10:40:51.344] Persisted trie from memory database      nodes=1 size=148.00B time="74.21µs" gcnodes=0 gcsize=0.00B gcti
me=0s livenodes=1 livesize=0.00B
INFO [11-04|10:40:51.344] Freezer shutting down
INFO [11-04|10:40:51.345] Successfully wrote genesis state         database=chaindata hash=38bc54..19a57a
INFO [11-04|10:40:51.345] Allocated cache and file handles         database=/root/private-ethereum/data/geth/lightchaindata cache=
16.00MiB handles=16
INFO [11-04|10:40:51.427] Opened ancient database                  database=/root/private-ethereum/data/geth/lightchaindata/ancien
t/chain readonly=false
INFO [11-04|10:40:51.428] Writing custom genesis block
INFO [11-04|10:40:51.429] Persisted trie from memory database      nodes=1 size=148.00B time="118.793µs" gcnodes=0 gcsize=0.00B gc
time=0s livenodes=1 livesize=0.00B
INFO [11-04|10:40:51.431] Freezer shutting down
INFO [11-04|10:40:51.433] Successfully wrote genesis state         database=lightchaindata hash=38bc54..19a57a
root@ESME6:~/private-ethereum# 
```

IV. Configuration du Bootnode uniquement sur le serveur dans un premier temps :

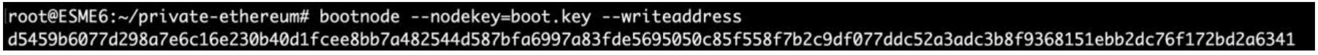


```
root@ESME6:~/private-ethereum# bootnode
Fatal: Use -nodekey or -nodekeyhex to specify a private key
```



```
Fatal: Use -nodekey or -nodekeyhex to specify a private key
root@ESME6:~/private-ethereum# bootnode --genkey=boot.key
root@ESME6:~/private-ethereum# bootnode --nodekey=boot.key
enode://d5459b6077d298a7e6c16e230b40d1fcee8bb7a482544d587bfa6997a83fde5695050c85f558f7b2c9df077ddc52a3adc3b8f9368151ebb2dc76f172bd
2a6341@127.0.0.1:0?discport=30301
Note: you're using cmd/bootnode, a developer tool.
We recommend using a regular node as bootstrap node for production deployments.
INFO [11-04|10:44:48.941] New local node record                    seq=1,667,558,688,938 id=f27f74b650c5d0f6 ip=<nil> udp=0 tcp=0
```

On vérifie qu’on a le même enode :

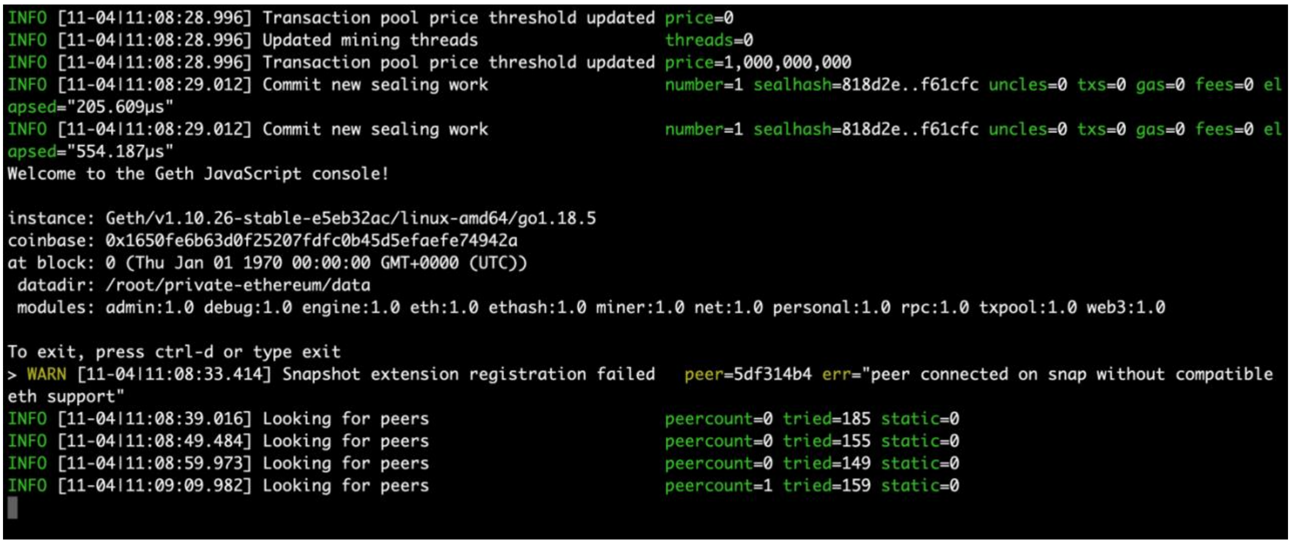


```
root@ESME6:~/private-ethereum# bootnode --nodekey=boot.key --writeaddress
d5459b6077d298a7e6c16e230b40d1fcee8bb7a482544d587bfa6997a83fde5695050c85f558f7b2c9df077ddc52a3adc3b8f9368151ebb2dc76f172bd2a6341
```

On a bien le même enode.

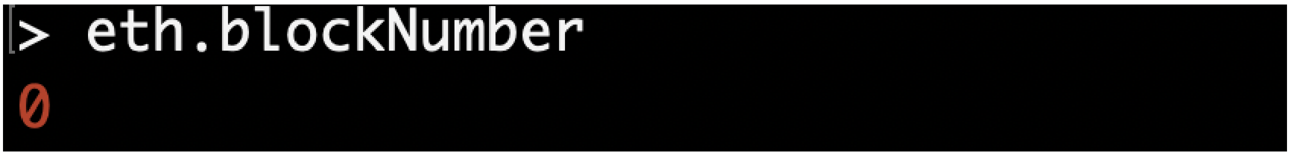
V. Configurez votre Ethereum Private Blockchain et commencer à miner uniquement sur le serveur dans un premier temps.

```
geth --mine --networkid 202206 --http.port 30301 --nat extip:64.227.65.30 --miner.etherbase=0x1650fE6b63D0F25207FdFc0b45d5EFAEFe74942A --datadir data console
```



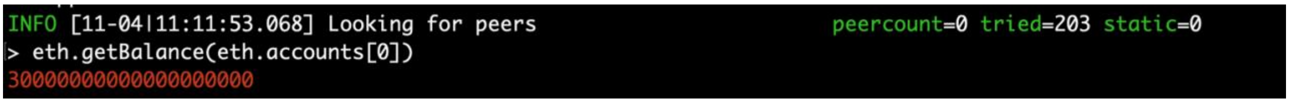
```
INFO [11-04|11:08:28.996] Transaction pool price threshold updated price=0
INFO [11-04|11:08:28.996] Updated mining threads                   threads=0
INFO [11-04|11:08:28.996] Transaction pool price threshold updated price=1,000,000,000
INFO [11-04|11:08:29.012] Commit new sealing work                  number=1 sealhash=818d2e..f61cfc uncles=0 txs=0 gas=0 fees=0 el
apsed="205.609µs"
INFO [11-04|11:08:29.012] Commit new sealing work                  number=1 sealhash=818d2e..f61cfc uncles=0 txs=0 gas=0 fees=0 el
apsed="554.187µs"
Welcome to the Geth JavaScript console!

instance: Geth/v1.10.26-stable-e5eb32ac/linux-amd64/go1.18.5
coinbase: 0x1650fe6b63d0f25207fdfc0b45d5efaefe74942a
at block: 0 (Thu Jan 01 1970 00:00:00 GMT+0000 (UTC))
 datadir: /root/private-ethereum/data
 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

To exit, press ctrl-d or type exit
> WARN [11-04|11:08:33.414] Snapshot extension registration failed   peer=5df314b4 err="peer connected on snap without compatible
eth support"
INFO [11-04|11:08:39.016] Looking for peers                        peercount=0 tried=185 static=0
INFO [11-04|11:08:49.484] Looking for peers                        peercount=0 tried=155 static=0
INFO [11-04|11:08:59.973] Looking for peers                        peercount=0 tried=149 static=0
INFO [11-04|11:09:09.982] Looking for peers                        peercount=1 tried=159 static=0
```

On vérifie l'état de la Blockchain et le numéro de Block qui doit être à zero avec la commande : $ eth.blockNumber



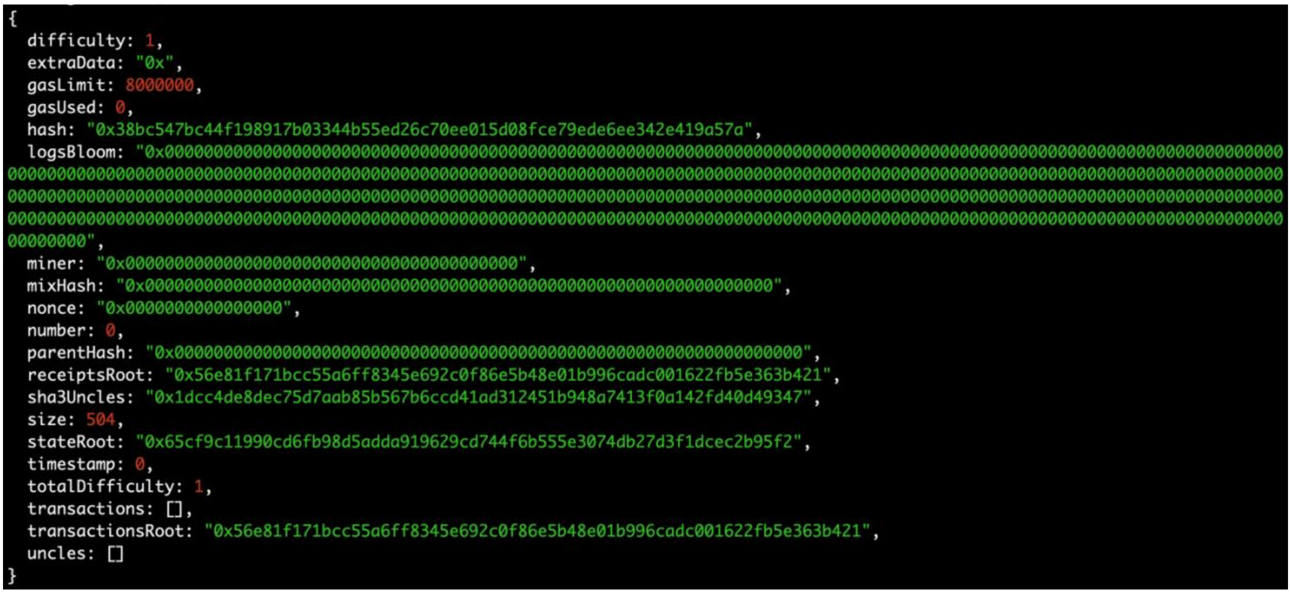
```
> eth.blockNumber
0
```

On vérifie qu'on a reçu à l'initialisation du genesis block nos ethers : $ eth.getBalance(eth.accounts[0])



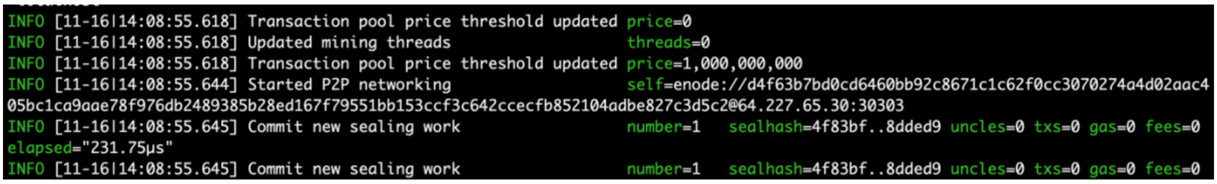
```
INFO [11-04|11:11:53.068] Looking for peers                        peercount=0 tried=203 static=0
> eth.getBalance(eth.accounts[0])
30000000000000000000
```

On vérifie le genesis block : $ eth.getBlock(0)



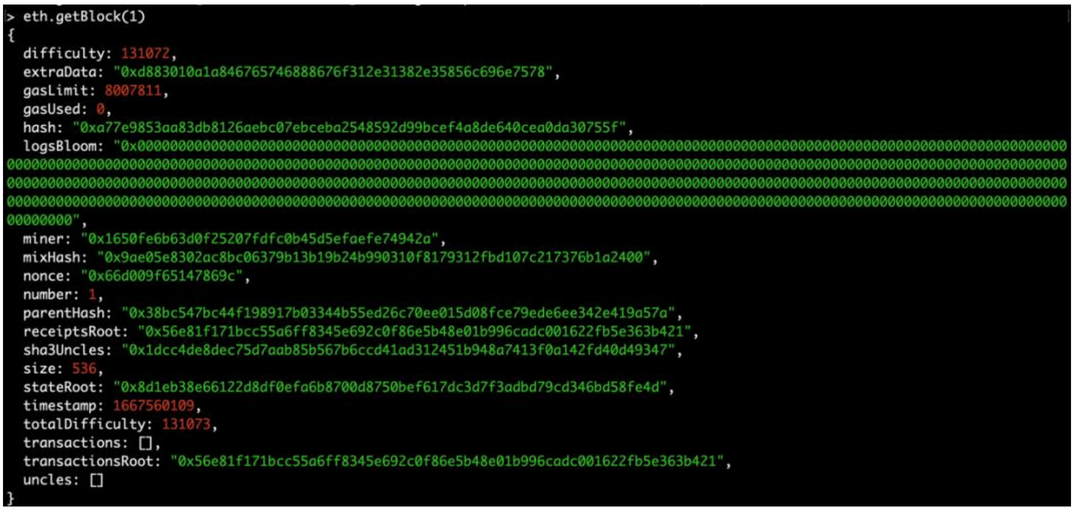
```
{
  difficulty: 1,
  extraData: "0x",
  gasLimit: 8000000,
  gasUsed: 0,
  hash: "0x38bc547bc44f198917b03344b55ed26c70ee015d08fce79ede6ee342e419a57a",
  logsBloom: "0x000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000",
  miner: "0x0000000000000000000000000000000000000000",
  mixHash: "0x0000000000000000000000000000000000000000000000000000000000000000",
  nonce: "0x0000000000000000",
  number: 0,
  parentHash: "0x0000000000000000000000000000000000000000000000000000000000000000",
  receiptsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  sha3Uncles: "0x1dcc4de8dec75d7aab85b567b6ccd41ad312451b948a7413f0a142fd40d49347",
  size: 504,
  stateRoot: "0x65cf9c11990cd6fb98d5adda919629cd744f6b555e3074db27d3f1dcec2b95f2",
  timestamp: 0,
  totalDifficulty: 1,
  transactions: [],
  transactionsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  uncles: []
}
```

On lance la commande de mining : miner.start(1)



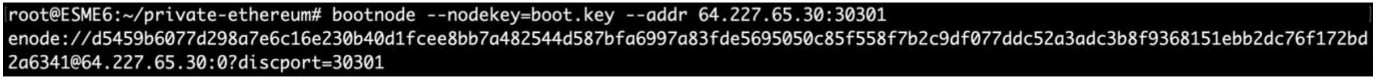
```
INFO [11-16|14:08:55.618] Transaction pool price threshold updated price=0
INFO [11-16|14:08:55.618] Updated mining threads                   threads=0
INFO [11-16|14:08:55.618] Transaction pool price threshold updated price=1,000,000,000
INFO [11-16|14:08:55.644] Started P2P networking                   self=enode://d4f63b7bd0cd6460bb92c8671c1c62f0cc3070274a4d02aac4
05bc1ca9aae78f976db2489385b28ed167f79551bb153ccf3c642ccecfb852104adbe827c3d5c2@64.227.65.30:30303
INFO [11-16|14:08:55.645] Commit new sealing work                  number=1   sealhash=4f83bf..8dded9 uncles=0 txs=0 gas=0 fees=0
elapsed="231.75µs"
INFO [11-16|14:08:55.645] Commit new sealing work                  number=1   sealhash=4f83bf..8dded9 uncles=0 txs=0 gas=0 fees=0
```

On lance eth.getBlock(1) :



```
> eth.getBlock(1)
{
  difficulty: 131072,
  extraData: "0xd883010a1a846765746888676f312e31382e35856c696e7578",
  gasLimit: 8007811,
  gasUsed: 0,
  hash: "0xa77e9853aa83db8126aebc07ebceba2548592d99bcef4a8de640cea0da30755f",
  logsBloom: "0x000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000",
  miner: "0x1650fe6b63d0f25207fdfc0b45d5efaefe74942a",
  mixHash: "0x9ae05e8302ac8bc06379b13b19b24b990310f8179312fbd107c217376b1a2400",
  nonce: "0x66d009f65147869c",
  number: 1,
  parentHash: "0x38bc547bc44f198917b03344b55ed26c70ee015d08fce79ede6ee342e419a57a",
  receiptsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  sha3Uncles: "0x1dcc4de8dec75d7aab85b567b6ccd41ad312451b948a7413f0a142fd40d49347",
  size: 536,
  stateRoot: "0x8d1eb38e66122d8df0efa6b8700d8750bef617dc3d7f3adbd79cd346bd58fe4d",
  timestamp: 1667560109,
  totalDifficulty: 131073,
  transactions: [],
  transactionsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  uncles: []
}
```

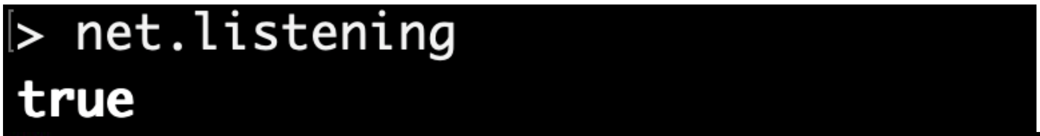
On affecte notre adresse ip à notre nœud :



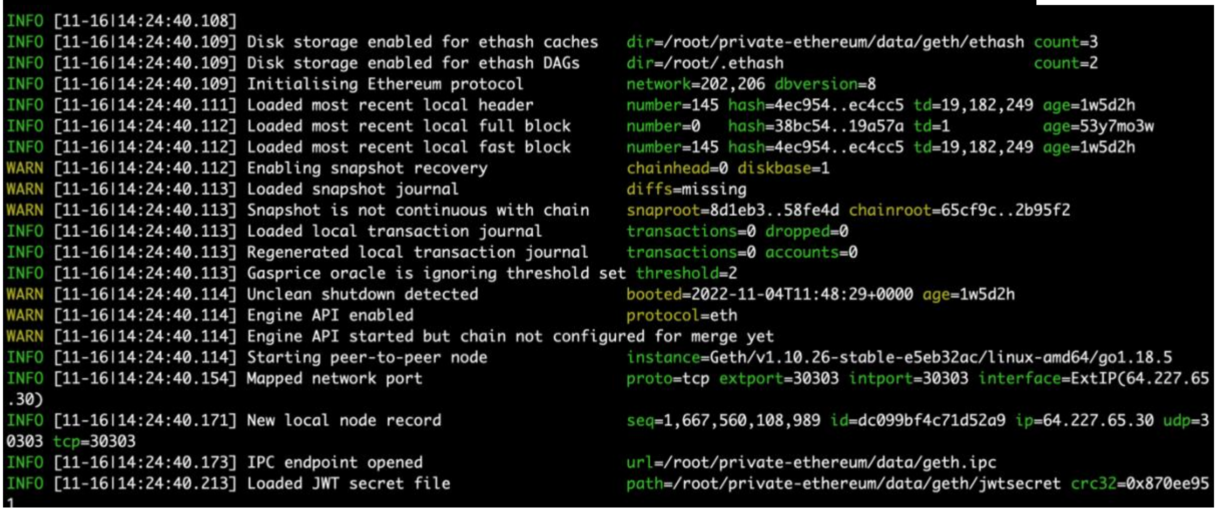
```
root@ESME6:~/private-ethereum# bootnode --nodekey=boot.key --addr 64.227.65.30:30301
enode://d5459b6077d298a7e6c16e230b40d1fcee8bb7a482544d587bfa6997a83fde5695050c85f558f7b2c9df077ddc52a3adc3b8f9368151ebb2dc76f172bd
2a6341@64.227.65.30:0?discport=30301
```

VI. Démarrage de vos nœuds sur les ordinateurs de vos camarades

Nous lançons la synchronisation côté serveur :

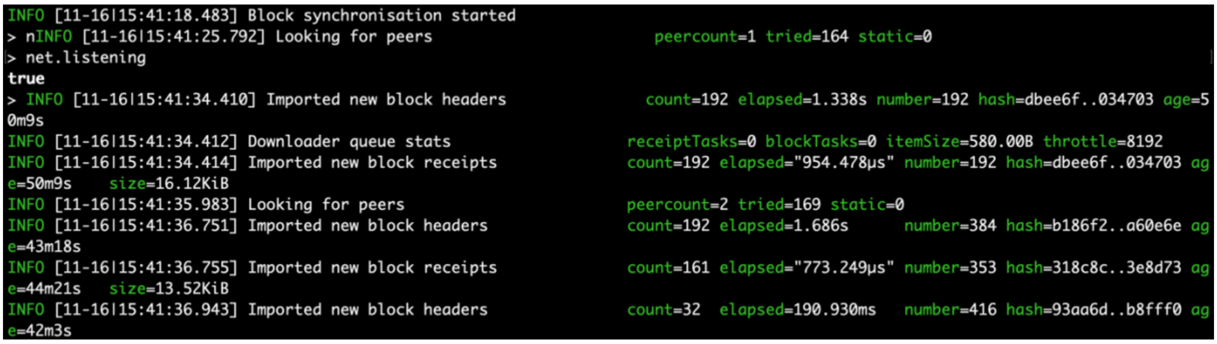


```
> net.listening
 true
```



```
INFO [11-16|14:24:40.108]
INFO [11-16|14:24:40.109] Disk storage enabled for ethash caches   dir=/root/private-ethereum/data/geth/ethash count=3
INFO [11-16|14:24:40.109] Disk storage enabled for ethash DAGs     dir=/root/.ethash                           count=2
INFO [11-16|14:24:40.109] Initialising Ethereum protocol           network=202,206 dbversion=8
INFO [11-16|14:24:40.111] Loaded most recent local header          number=145 hash=4ec954..ec4cc5 td=19,182,249 age=1w5d2h
INFO [11-16|14:24:40.112] Loaded most recent local full block      number=0   hash=38bc54..19a57a td=1          age=53y7mo3w
INFO [11-16|14:24:40.112] Loaded most recent local fast block      number=145 hash=4ec954..ec4cc5 td=19,182,249 age=1w5d2h
WARN [11-16|14:24:40.112] Enabling snapshot recovery               chainhead=0 diskbase=1
WARN [11-16|14:24:40.113] Loaded snapshot journal                  diffs=missing
WARN [11-16|14:24:40.113] Snapshot is not continuous with chain    snaproot=8d1eb3..58fe4d chainroot=65cf9c..2b95f2
INFO [11-16|14:24:40.113] Loaded local transaction journal         transactions=0 dropped=0
INFO [11-16|14:24:40.113] Regenerated local transaction journal    transactions=0 accounts=0
INFO [11-16|14:24:40.113] Gasprice oracle is ignoring threshold set threshold=2
WARN [11-16|14:24:40.114] Unclean shutdown detected                booted=2022-11-04T11:48:29+0000 age=1w5d2h
WARN [11-16|14:24:40.114] Engine API enabled                       protocol=eth
WARN [11-16|14:24:40.114] Engine API started but chain not configured for merge yet
INFO [11-16|14:24:40.114] Starting peer-to-peer node               instance=Geth/v1.10.26-stable-e5eb32ac/linux-amd64/go1.18.5
INFO [11-16|14:24:40.154] Mapped network port                      proto=tcp extport=30303 intport=30303 interface=ExtIP(64.227.65
.30)
INFO [11-16|14:24:40.171] New local node record                    seq=1,667,560,108,989 id=dc099bf4c71d52a9 ip=64.227.65.30 udp=3
0303 tcp=30303
INFO [11-16|14:24:40.173] IPC endpoint opened                      url=/root/private-ethereum/data/geth.ipc
INFO [11-16|14:24:40.213] Loaded JWT secret file                   path=/root/private-ethereum/data/geth/jwtsecret crc32=0x870ee95
1
```

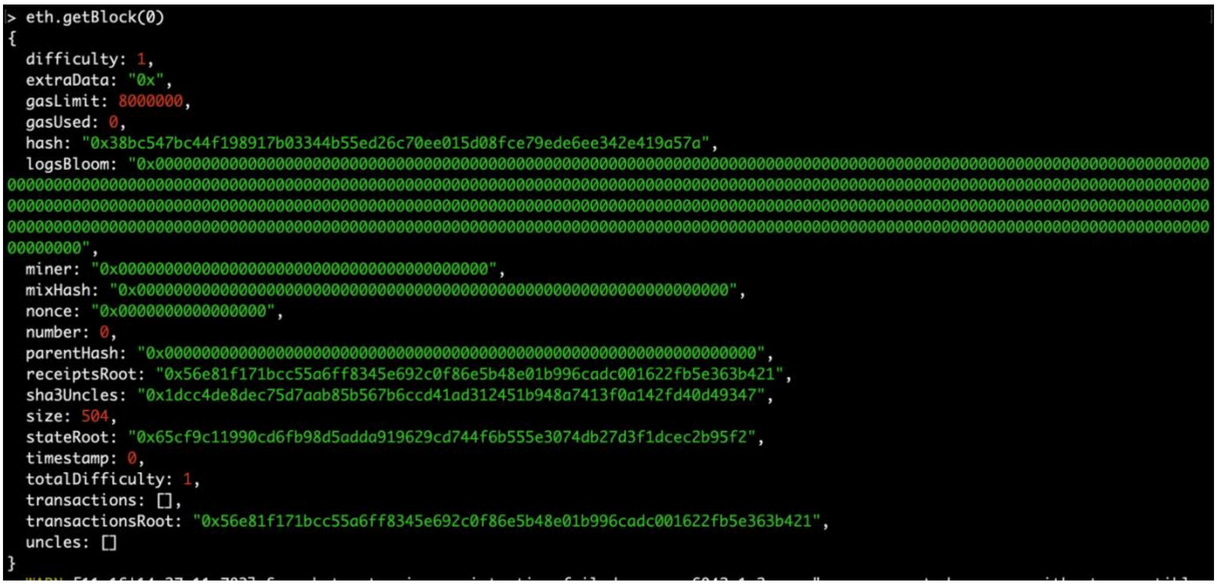
On cherche à voir s’il s’est synchronise au block :



```
INFO [11-16|15:41:18.483] Block synchronisation started
> nINFO [11-16|15:41:25.792] Looking for peers                        peercount=1 tried=164 static=0
> net.listening
true
> INFO [11-16|15:41:34.410] Imported new block headers               count=192 elapsed=1.338s number=192 hash=dbee6f..034703 age=5
0m9s
INFO [11-16|15:41:34.412] Downloader queue stats                   receiptTasks=0 blockTasks=0 itemSize=580.00B throttle=8192
INFO [11-16|15:41:34.414] Imported new block receipts              count=192 elapsed="954.478µs" number=192 hash=dbee6f..034703 ag
e=50m9s    size=16.12KiB
INFO [11-16|15:41:35.983] Looking for peers                        peercount=2 tried=169 static=0
INFO [11-16|15:41:36.751] Imported new block headers               count=192 elapsed=1.686s      number=384 hash=b186f2..a60e6e ag
e=43m18s
INFO [11-16|15:41:36.755] Imported new block receipts              count=161 elapsed="773.249µs" number=353 hash=318c8c..3e8d73 ag
e=44m21s   size=13.52KiB
INFO [11-16|15:41:36.943] Imported new block headers               count=32  elapsed=190.930ms   number=416 hash=93aa6d..b8fff0 ag
e=42m3s
```

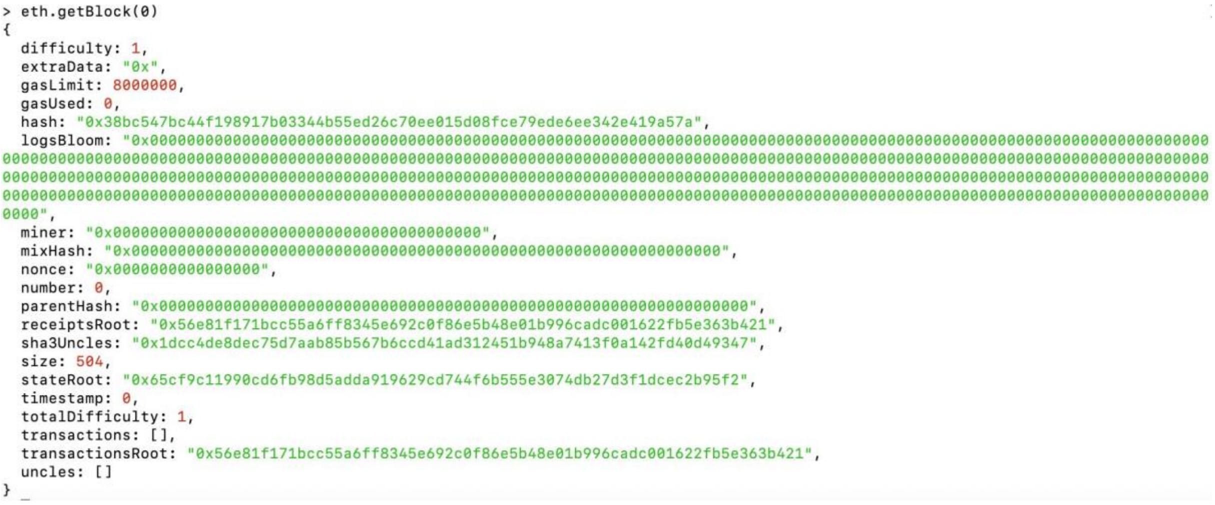
On vérifie le premier block :

Côté serveur :



```
> eth.getBlock(0)
{
  difficulty: 1,
  extraData: "0x",
  gasLimit: 8000000,
  gasUsed: 0,
  hash: "0x38bc547bc44f198917b03344b55ed26c70ee015d08fce79ede6ee342e419a57a",
  logsBloom: "0x000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000",
  miner: "0x0000000000000000000000000000000000000000",
  mixHash: "0x0000000000000000000000000000000000000000000000000000000000000000",
  nonce: "0x0000000000000000",
  number: 0,
  parentHash: "0x0000000000000000000000000000000000000000000000000000000000000000",
  receiptsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  sha3Uncles: "0x1dcc4de8dec75d7aab85b567b6ccd41ad312451b948a7413f0a142fd40d49347",
  size: 504,
  stateRoot: "0x65cf9c11990cd6fb98d5adda919629cd744f6b555e3074db27d3f1dcec2b95f2",
  timestamp: 0,
  totalDifficulty: 1,
  transactions: [],
  transactionsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  uncles: []
}
```

Côté client :

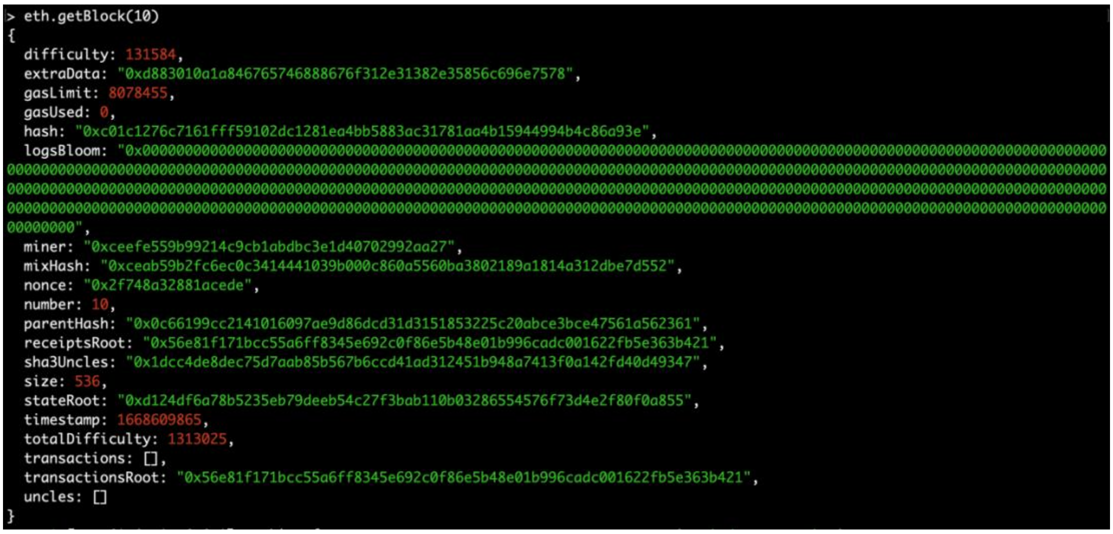


```
> eth.getBlock(0)
{
  difficulty: 1,
  extraData: "0x",
  gasLimit: 8000000,
  gasUsed: 0,
  hash: "0x38bc547bc44f198917b03344b55ed26c70ee015d08fce79ede6ee342e419a57a",
  logsBloom: "0x0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000",
  miner: "0x0000000000000000000000000000000000000000",
  mixHash: "0x0000000000000000000000000000000000000000000000000000000000000000",
  nonce: "0x0000000000000000",
  number: 0,
  parentHash: "0x0000000000000000000000000000000000000000000000000000000000000000",
  receiptsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  sha3Uncles: "0x1dcc4de8dec75d7aab85b567b6ccd41ad312451b948a7413f0a142fd40d49347",
  size: 504,
  stateRoot: "0x65cf9c11990cd6fb98d5adda919629cd744f6b555e3074db27d3f1dcec2b95f2",
  timestamp: 0,
  totalDifficulty: 1,
  transactions: [],
  transactionsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  uncles: []
} _
```

On a bien le même block 0 et 1 des 2 côtés.

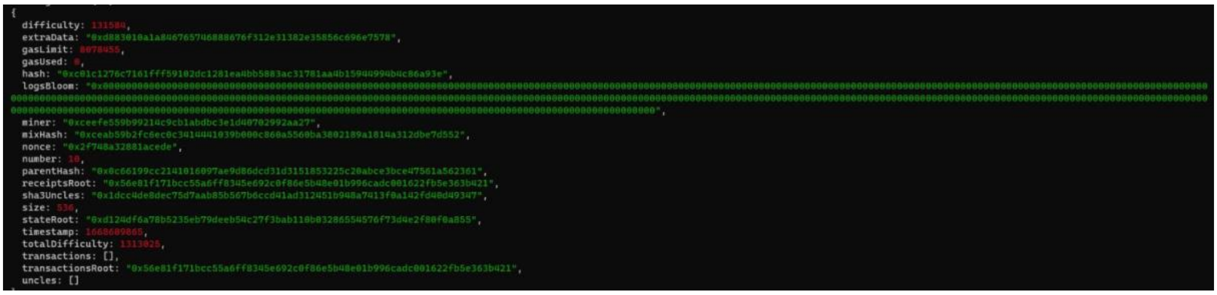
On a le même block 10 :

Côté serveur :



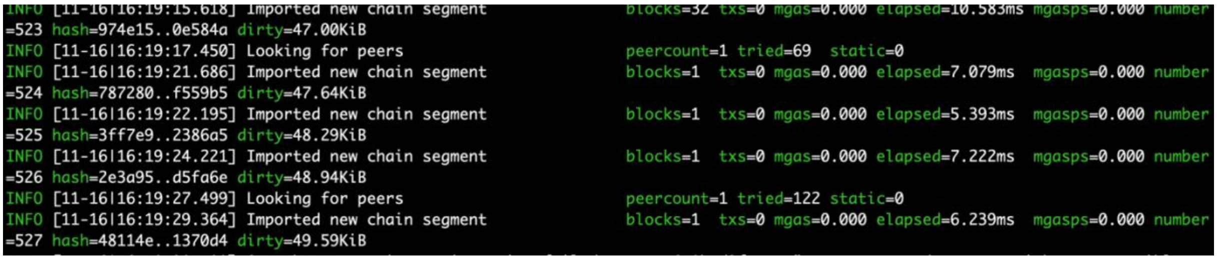
```
> eth.getBlock(10)
{
  difficulty: 131584,
  extraData: "0xd883010a1a846765746888676f312e31382e35856c696e7578",
  gasLimit: 8078455,
  gasUsed: 0,
  hash: "0xc01c1276c7161fff59102dc1281ea4bb5883ac31781aa4b15944994b4c86a93e",
  logsBloom: "0x000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000",
  miner: "0xceefe559b99214c9cb1abdbc3e1d40702992aa27",
  mixHash: "0xceab59b2fc6ec0c3414441039b000c860a5560ba3802189a1814a312dbe7d552",
  nonce: "0x2f748a32881acede",
  number: 10,
  parentHash: "0x0c66199cc2141016097ae9d86dcd31d3151853225c20abce3bce47561a562361",
  receiptsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  sha3Uncles: "0x1dcc4de8dec75d7aab85b567b6ccd41ad312451b948a7413f0a142fd40d49347",
  size: 536,
  stateRoot: "0xd124df6a78b5235eb79deeb54c27f3bab110b03286554576f73d4e2f80f0a855",
  timestamp: 1668609865,
  totalDifficulty: 1313025,
  transactions: [],
  transactionsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  uncles: []
}
```

Côté client :



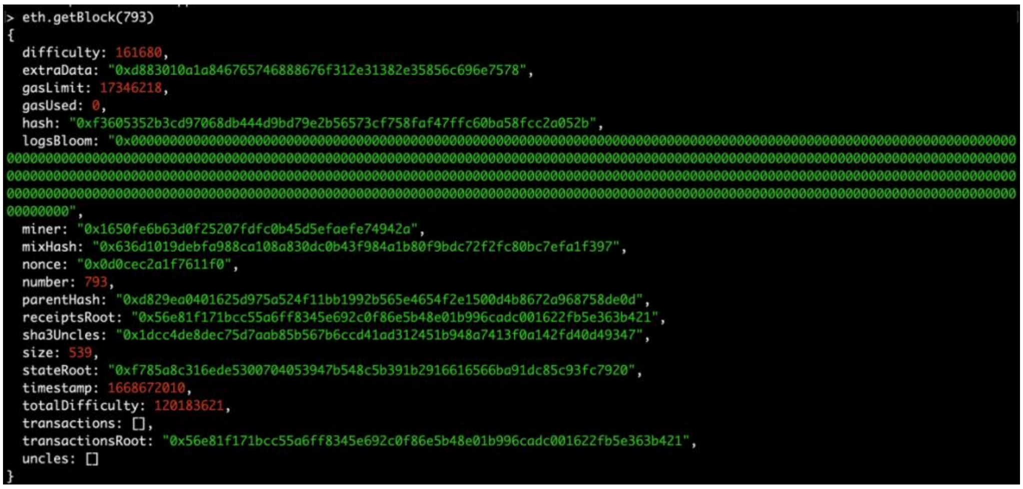
```
{
  difficulty: 131584,
  extraData: "0xd883010a1a846765746888676f312e31382e35856c696e7578",
  gasLimit: 8078455,
  gasUsed: 0,
  hash: "0xc01c1276c7161fff59102dc1281ea4bb5883ac31781aa4b15944994b4c86a93e",
  logsBloom: "0x00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000",
  miner: "0xceefe559b99214c9cb1abdbc3e1d40702992aa27",
  mixHash: "0xceab59b2fc6ec0c3414441039b000c860a5560ba3802189a1814a312dbe7d552",
  nonce: "0x2f748a32881acede",
  number: 10,
  parentHash: "0x0c66199cc2141016097ae9d86dcd31d3151853225c20abce3bce47561a562361",
  receiptsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  sha3Uncles: "0x1dcc4de8dec75d7aab85b567b6ccd41ad312451b948a7413f0a142fd40d49347",
  size: 536,
  stateRoot: "0xd124df6a78b5235eb79deeb54c27f3bab110b03286554576f73d4e2f80f0a855",
  timestamp: 1668609865,
  totalDifficulty: 1313025,
  transactions: [],
  transactionsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  uncles: []
```

Les clients ont bien réussi à miner :



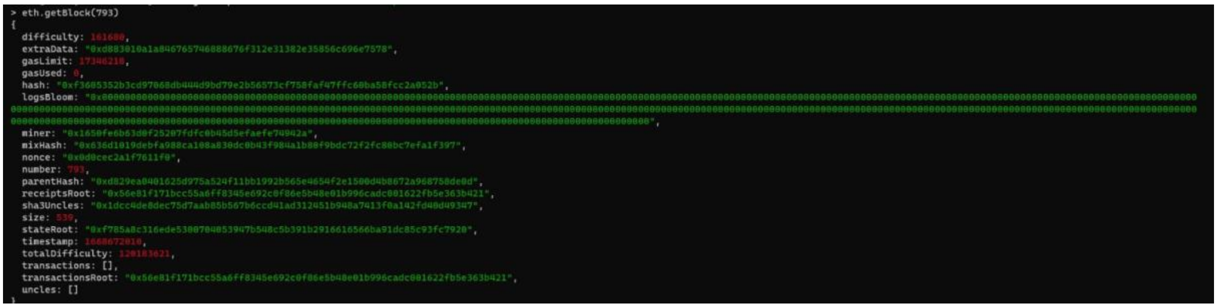
```
INFO [11-16|16:19:15.618] Imported new chain segment               blocks=32 txs=0 mgas=0.000 elapsed=10.583ms mgasps=0.000 number
=523 hash=974e15..0e584a dirty=47.00KiB
INFO [11-16|16:19:17.450] Looking for peers                        peercount=1 tried=69  static=0
INFO [11-16|16:19:21.686] Imported new chain segment               blocks=1  txs=0 mgas=0.000 elapsed=7.079ms  mgasps=0.000 number
=524 hash=787280..f559b5 dirty=47.64KiB
INFO [11-16|16:19:22.195] Imported new chain segment               blocks=1  txs=0 mgas=0.000 elapsed=5.393ms  mgasps=0.000 number
=525 hash=3ff7e9..2386a5 dirty=48.29KiB
INFO [11-16|16:19:24.221] Imported new chain segment               blocks=1  txs=0 mgas=0.000 elapsed=7.222ms  mgasps=0.000 number
=526 hash=2e3a95..d5fa6e dirty=48.94KiB
INFO [11-16|16:19:27.499] Looking for peers                        peercount=1 tried=122 static=0
INFO [11-16|16:19:29.364] Imported new chain segment               blocks=1  txs=0 mgas=0.000 elapsed=6.239ms  mgasps=0.000 number
=527 hash=48114e..1370d4 dirty=49.59KiB
```

Le lendemain, le serveur mine un nouveau block numéro 793 et on retrouve le même block.
Côté serveur :



```
> eth.getBlock(793)
{
  difficulty: 161680,
  extraData: "0xd883010a1a846765746888676f312e31382e35856c696e7578",
  gasLimit: 17346218,
  gasUsed: 0,
  hash: "0xf3605352b3cd97068db444d9bd79e2b56573cf758faf47ffc60ba58fcc2a052b",
  logsBloom: "0x000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000",
  miner: "0x1650fe6b63d0f25207fdfc0b45d5efaefe74942a",
  mixHash: "0x636d1019debfa988ca108a830dc0b43f984a1b80f9bdc72f2fc80bc7efa1f397",
  nonce: "0x0d0cec2a1f7611f0",
  number: 793,
  parentHash: "0xd829ea0401625d975a524f11bb1992b565e4654f2e1500d4b8672a968758de0d",
  receiptsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  sha3Uncles: "0x1dcc4de8dec75d7aab85b567b6ccd41ad312451b948a7413f0a142fd40d49347",
  size: 539,
  stateRoot: "0xf785a8c316ede5300704053947b548c5b391b2916616566ba91dc85c93fc7920",
  timestamp: 1668672010,
  totalDifficulty: 120183621,
  transactions: [],
  transactionsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  uncles: []
}
```

Côté client :



```
> eth.getBlock(793)
{
  difficulty: 161680,
  extraData: "0xd883010a1a846765746888676f312e31382e35856c696e7578",
  gasLimit: 17346218,
  gasUsed: 0,
  hash: "0xf3605352b3cd97068db444d9bd79e2b56573cf758faf47ffc60ba58fcc2a052b",
  logsBloom: "0x00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000",
  miner: "0x1650fe6b63d0f25207fdfc0b45d5efaefe74942a",
  mixHash: "0x636d1019debfa988ca108a830dc0b43f984a1b80f9bdc72f2fc80bc7efa1f397",
  nonce: "0x0d0cec2a1f7611f0",
  number: 793,
  parentHash: "0xd829ea0401625d975a524f11bb1992b565e4654f2e1500d4b8672a968758de0d",
  receiptsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  sha3Uncles: "0x1dcc4de8dec75d7aab85b567b6ccd41ad312451b948a7413f0a142fd40d49347",
  size: 539,
  stateRoot: "0xf785a8c316ede5300704053947b548c5b391b2916616566ba91dc85c93fc7920",
  timestamp: 1668672010,
  totalDifficulty: 120183621,
  transactions: [],
  transactionsRoot: "0x56e81f171bcc55a6ff8345e692c0f86e5b48e01b996cadc001622fb5e363b421",
  uncles: []
}
```

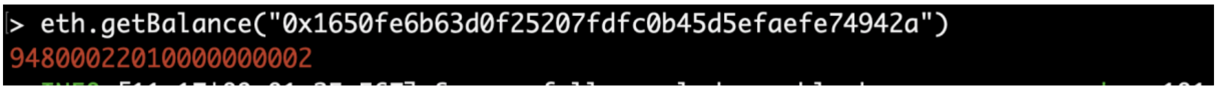
Bonus :

1)

On réalise des transactions :

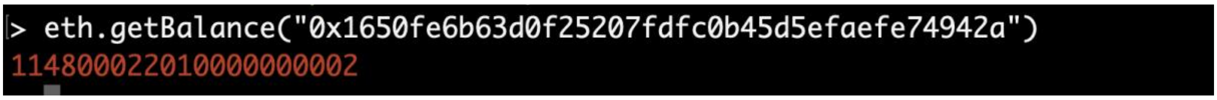
On remarque une différence de solde pendant la transaction :

Avant la transaction :



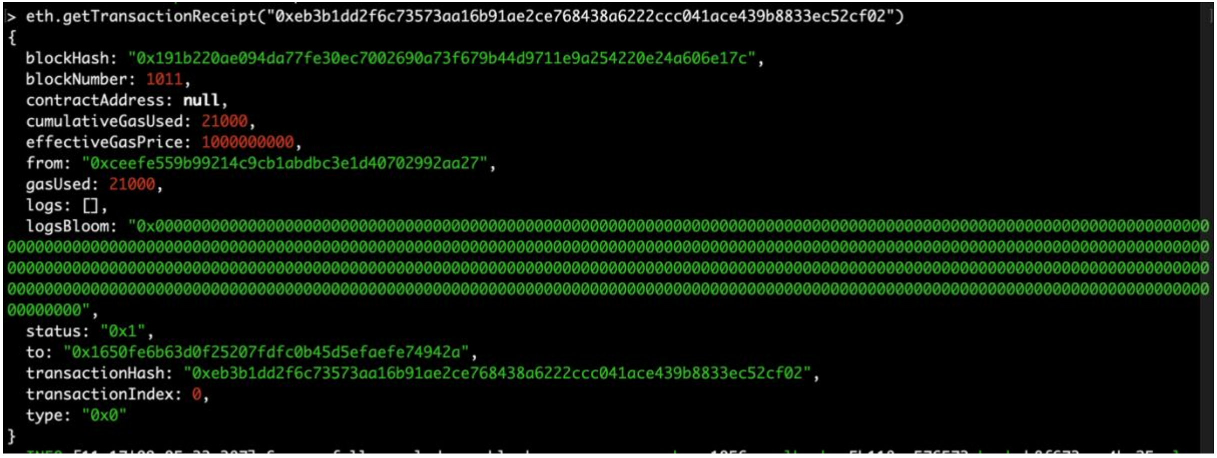
```
> eth.getBalance("0x1650fe6b63d0f25207fdfc0b45d5efaefe74942a")
94800022010000000002
```

Après la transaction :



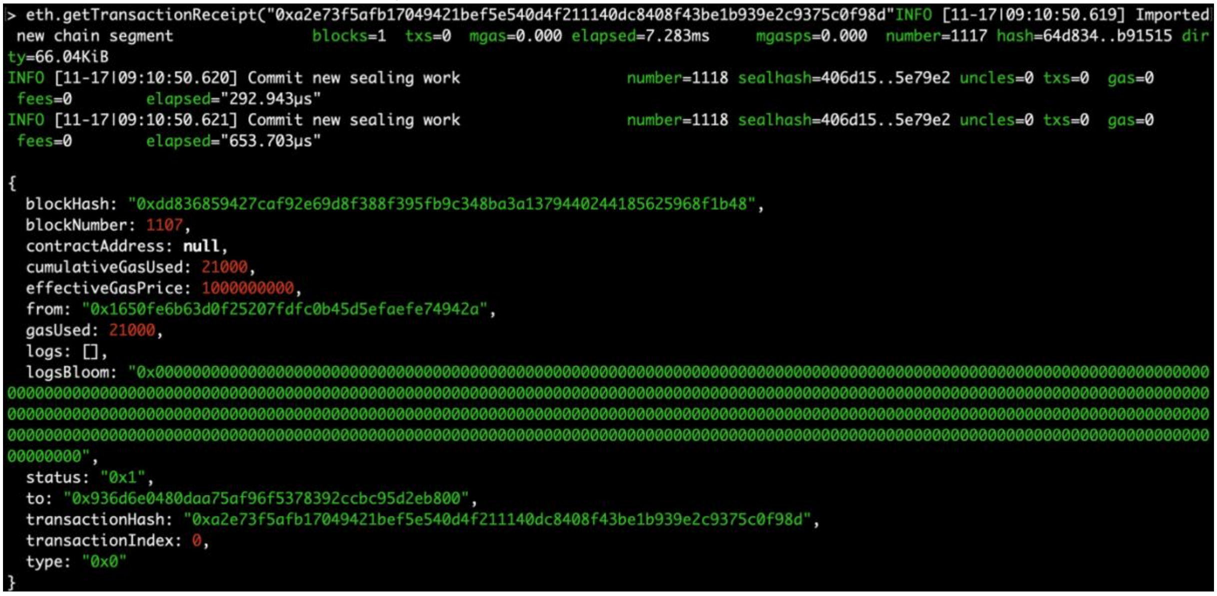
```
> eth.getBalance("0x1650fe6b63d0f25207fdfc0b45d5efaefe74942a")
114800022010000000002
```

Voici les infos de la transaction (Serveur => PC1 (je suis donc receveur) :



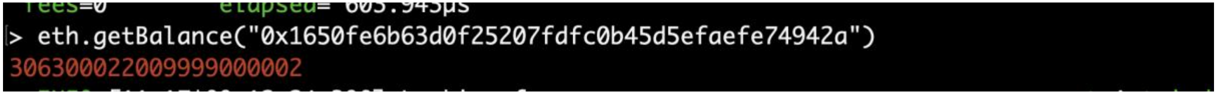
```
> eth.getTransactionReceipt("0xeb3b1dd2f6c73573aa16b91ae2ce768438a6222ccc041ace439b8833ec52cf02")
{
  blockHash: "0x191b220ae094da77fe30ec7002690a73f679b44d9711e9a254220e24a606e17c",
  blockNumber: 1011,
  contractAddress: null,
  cumulativeGasUsed: 21000,
  effectiveGasPrice: 1000000000,
  from: "0xceefe559b99214c9cb1abdbc3e1d40702992aa27",
  gasUsed: 21000,
  logs: [],
  logsBloom: "0x000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000",
  status: "0x1",
  to: "0x1650fe6b63d0f25207fdfc0b45d5efaefe74942a",
  transactionHash: "0xeb3b1dd2f6c73573aa16b91ae2ce768438a6222ccc041ace439b8833ec52cf02",
  transactionIndex: 0,
  type: "0x0"
}
```

On réalise une deuxième transaction entre serveur et pc2 :
eth.sendTransaction({from:eth.coinbase,to: "0x936d6e0480daa75af96f5378392ccbc95d2eb800", value:1000000})



```
> eth.getTransactionReceipt("0xa2e73f5afb17049421bef5e540d4f211140dc8408f43be1b939e2c9375c0f98d"INFO [11-17|09:10:50.619] Imported
 new chain segment               blocks=1  txs=0  mgas=0.000 elapsed=7.283ms     mgasps=0.000  number=1117 hash=64d834..b91515 dir
ty=66.04KiB
INFO [11-17|09:10:50.620] Commit new sealing work                number=1118 sealhash=406d15..5e79e2 uncles=0 txs=0  gas=0
 fees=0        elapsed="292.943µs"
INFO [11-17|09:10:50.621] Commit new sealing work                number=1118 sealhash=406d15..5e79e2 uncles=0 txs=0  gas=0
 fees=0        elapsed="653.703µs"

{
  blockHash: "0xdd836859427caf92e69d8f388f395fb9c348ba3a1379440244185625968f1b48",
  blockNumber: 1107,
  contractAddress: null,
  cumulativeGasUsed: 21000,
  effectiveGasPrice: 1000000000,
  from: "0x1650fe6b63d0f25207fdfc0b45d5efaefe74942a",
  gasUsed: 21000,
  logs: [],
  logsBloom: "0x000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000",
  status: "0x1",
  to: "0x936d6e0480daa75af96f5378392ccbc95d2eb800",
  transactionHash: "0xa2e73f5afb17049421bef5e540d4f211140dc8408f43be1b939e2c9375c0f98d",
  transactionIndex: 0,
  type: "0x0"
}
```

On remarque une différence dans le solde après les transactions vers le pc2 :

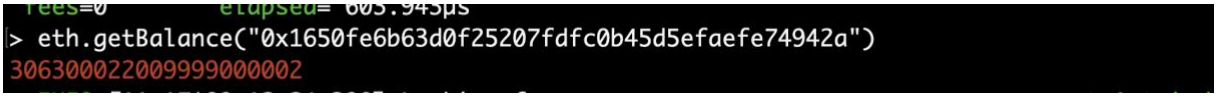


```
> eth.getBalance("0x1650fe6b63d0f25207fdfc0b45d5efaefe74942a")
306300022009999000002
```

(La différence de solde est assez importante car on avait plusieurs transactions en pending vers le pc2).

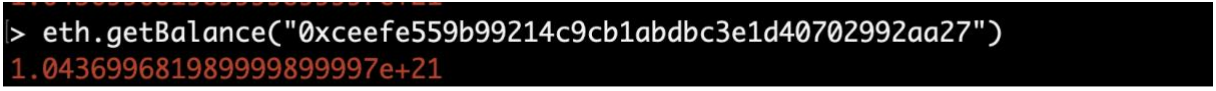
2) On check les soldes de chacun

Le serveur :



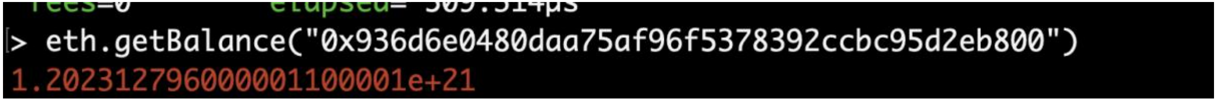
```
> eth.getBalance("0x1650fe6b63d0f25207fdfc0b45d5efaefe74942a")
306300022009999000002
```

Le pc1 :



```
> eth.getBalance("0xceefe559b99214c9cb1abdbc3e1d40702992aa27")
1.0436996819899998899997e+21
```

Le pc2 :



```
> eth.getBalance("0x936d6e0480daa75af96f5378392ccbc95d2eb800")
1.2023127960000001100001e+21
```