

Ethereum Private Network

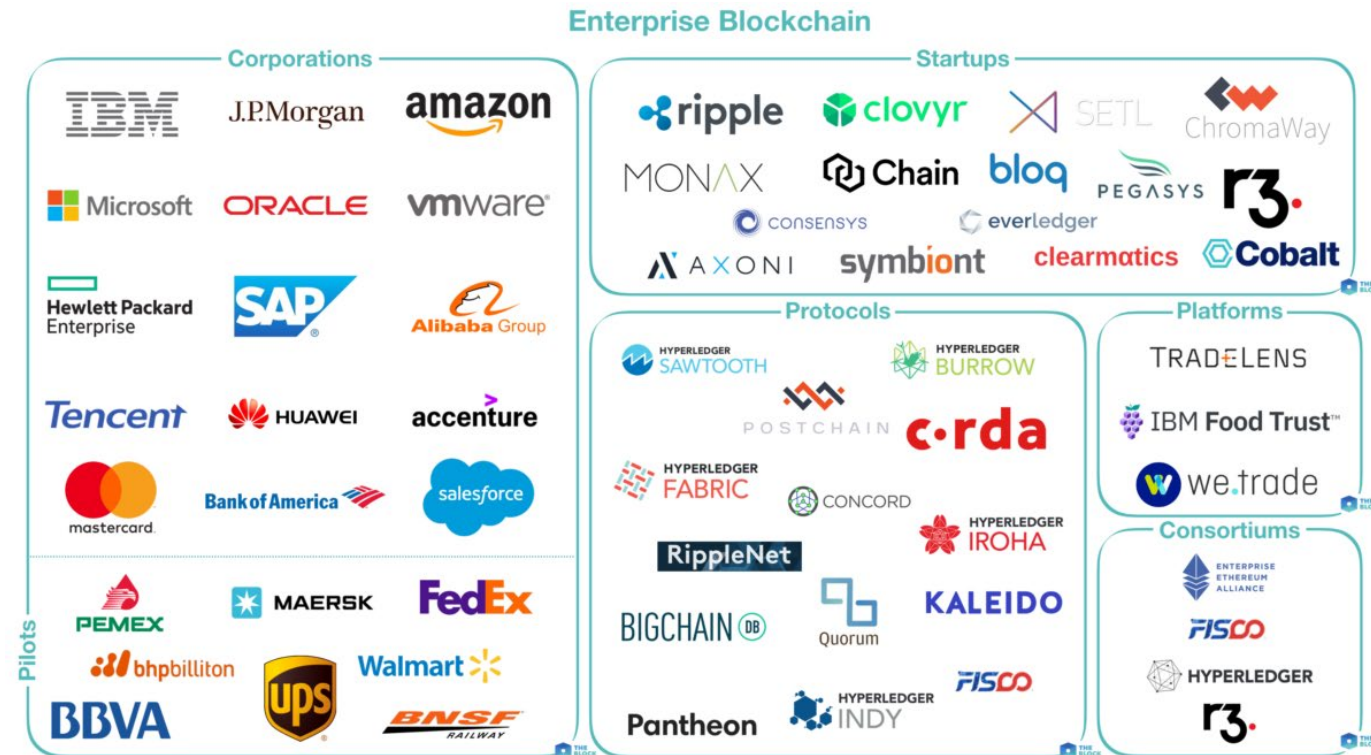
권수호

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Enterprise Blockchain

▪ Blockchain for Business :

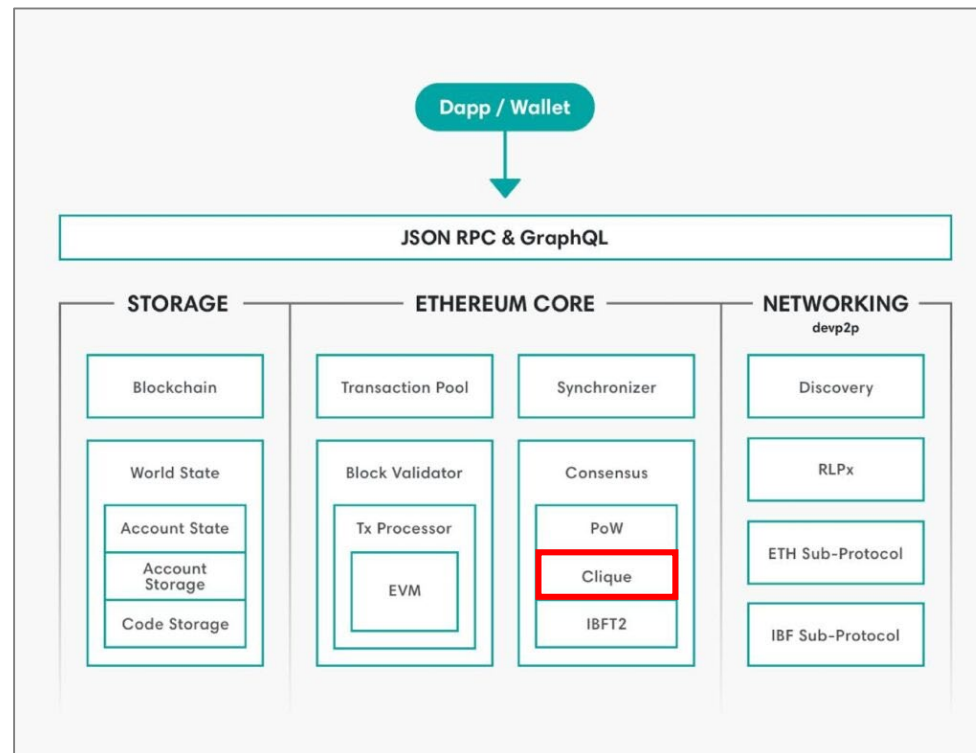
- The enterprise blockchain market is huge, and there are different solutions available to implement blockchain for enterprise -- **Hyperledger**, **Corda**, **Quorum**, and **Ethereum** are the well-known providers. You can set up enterprise blockchain in different ways, on a **cloud**, or **on-premise**.



Validator Nodes

▪ Proof of Authority :

- We will use **proof of authority (PoA)** consensus to setup the private network. In **PoA-based networks**, transactions and blocks are validated by approved accounts, known as **validators** or **sealer**. The process is automated and does not require validators to be constantly monitoring their computers. **PoA algorithms rely on a set of N trusted nodes called the authorities**.
- Types of Nodes in **PoA** Network
 - **Validator/Authority** - Validate, confirm transactions, and add new blocks into blockchain.
 - **Full Node** - This node keeps a copy of the full blockchain.



Private Network(1/12)

▪ Make Your Own Private Ethereum Network :

- **Step 01.** Create folders like node1, node2, node3. Use "**mkdir xxx**" command to create each folders.

```
C:\WINDOWS\system32\cmd.exe

c:\Home\Project\Smart-Contract\Private>mkdir node1
c:\Home\Project\Smart-Contract\Private>mkdir node2
c:\Home\Project\Smart-Contract\Private>mkdir node3

c:\Home\Project\Smart-Contract\Private>tree
폴더 PATH의 목록입니다.
볼륨 일련 번호는 4E9A-22CD입니다.
C:.
|-- node1
|-- node2
|-- node3

c:\Home\Project\Smart-Contract\Private>
```

- **Step 02.** Create validator accounts for each node. Use "**geth --datadir xxx account new**" command for each folders and **save the accounts**. You also need to **remember all passwords** for each newly created accounts.

```
C:\WINDOWS\system32\cmd.exe

c:\Home\Project\Smart-Contract\Private>geth --datadir node1 account new
INFO [07-06|10:08:28.927] Maximum peer count      ETH=50 LES=0 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: 0x75E3692F01Dc714F82637c9AC99bF6145b39Be86
Path of the secret key file: node1\keystore\UTC--2021-07-06T01-08-32.220864900Z--75e3692f01dc714f82637c9ac99bf6145b39be86

- 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!

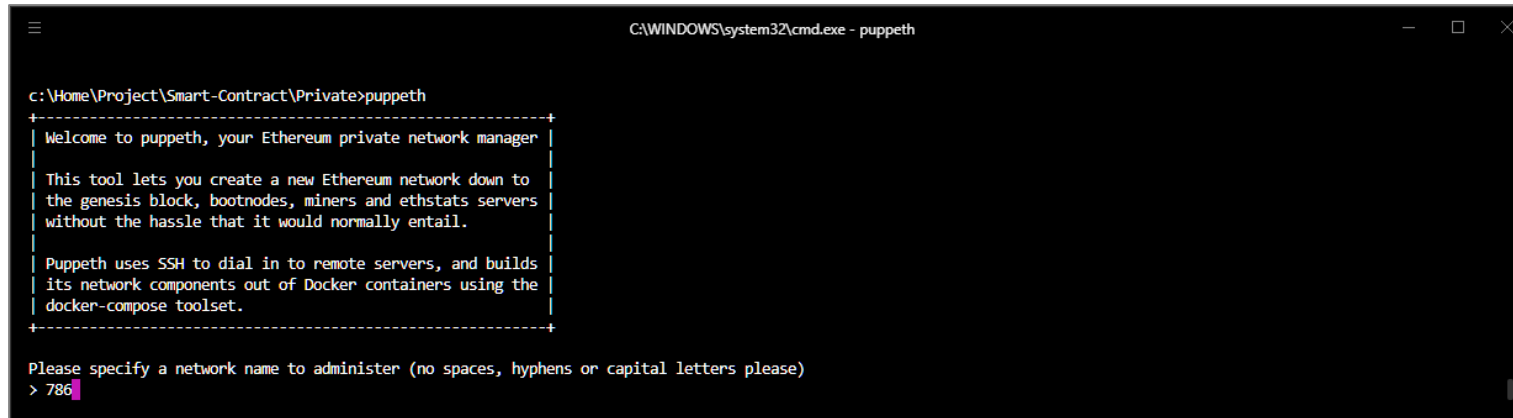
c:\Home\Project\Smart-Contract\Private>
```

```
accounts.txt
1 0x75E3692F01Dc714F82637c9AC99bF6145b39Be86
2 0x47e0e9906B615Cb4238B72E398673933A590AE30
3 0xb9749440CB4704b6b4487BF6499471C2A733BB2F
```

Private Network(2/12)

▪ Make Your Own Private Ethereum Network :

- **Step 03.** Create "**genesis.json**" file. Use "**puppeth**" tool for generating genesis file. This tool will be installed with geth when you are choosing "**geth with tools**" option for download or build from the source code with "make all" command. Run "**puppeth**" command.
- **Step 04.** Specify the name of the genesis file.

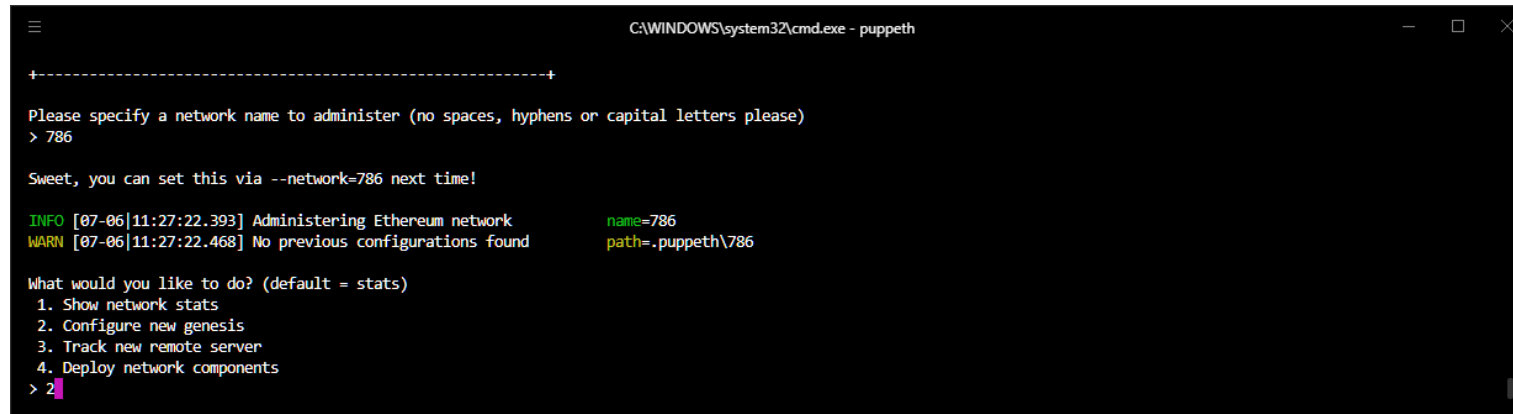


```
C:\WINDOWS\system32\cmd.exe - puppeth

c:\Home\Project\Smart-Contract\Private>puppeth
+-----+
| Welcome to puppeth, your Ethereum private network manager |
|
| This tool lets you create a new Ethereum network down to |
| the genesis block, bootnodes, miners and ethstats servers |
| without the hassle that it would normally entail.         |
|
| Puppeth uses SSH to dial in to remote servers, and builds |
| its network components out of Docker containers using the |
| docker-compose toolset.                                   |
+-----+

Please specify a network name to administer (no spaces, hyphens or capital letters please)
> 786
```

- **Step 05.** Generate new genesis file. Select 2 for "Configure new genesis" and select 1 for "Create new genesis from scratch".



```
C:\WINDOWS\system32\cmd.exe - puppeth

+-----+

Please specify a network name to administer (no spaces, hyphens or capital letters please)
> 786

Sweet, you can set this via --network=786 next time!

INFO [07-06|11:27:22.393] Administering Ethereum network      name=786
WARN [07-06|11:27:22.468] No previous configurations found    path=.puppeth\786

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
```

Private Network(3/12)

▪ Make Your Own Private Ethereum Network :

- **Step 06.** Select **PoA**. Select 2 for "Clique - proof-of-authority".
- **Step 07.** Enter **1** for block time. It means the block interval time in seconds.

```
C:\WINDOWS\system32\cmd.exe - puppeth

3. Track new remote server
4. Deploy network components
> 2

What would you like to do? (default = create)
1. Create new genesis from scratch
2. Import already existing genesis
> 1

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)
> 1
```

- **Step 08.** Provides accounts for authority you already created before. When you are done, just type "enter" key.

```
C:\WINDOWS\system32\cmd.exe - puppeth

2. Import already existing genesis
> 1

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)
> 1

Which accounts are allowed to seal? (mandatory at least one)
> 0x75E3692F01Dc714F82637c9AC99bF6145b39Be86
> 0x47e0e9906B615Cb4238B72E398673933A590AE30
> 0xb9749440CB4704b6b4487BF6499471C2A733BB2F
> 0x
```

Private Network(4/12)

▪ Make Your Own Private Ethereum Network :

- **Step 09.** Provide accounts to get some free ethers. You can use your previous accounts again.

```
C:\WINDOWS\system32\cmd.exe - puppeth

> 0x75E3692F01Dc714F82637c9AC99bF6145b39Be86
> 0x47e0e9906B615Cb4238B72E398673933A590AE30
> 0xb9749440CB4704b6b4487BF6499471C2A733BB2F
> 0x

Which accounts should be pre-funded? (advisable at least one)
> 0x75E3692F01Dc714F82637c9AC99bF6145b39Be86
> 0x47e0e9906B615Cb4238B72E398673933A590AE30
> 0xb9749440CB4704b6b4487BF6499471C2A733BB2F
> 0x

Should the precompile-addresses (0x1 .. 0xff) be pre-funded with 1 wei? (advisable yes)
> yes

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

- **Step 10.** Specify your chain/network ID.

```
C:\WINDOWS\system32\cmd.exe - puppeth

> 0x75E3692F01Dc714F82637c9AC99bF6145b39Be86
> 0x47e0e9906B615Cb4238B72E398673933A590AE30
> 0xb9749440CB4704b6b4487BF6499471C2A733BB2F
> 0x

Which accounts should be pre-funded? (advisable at least one)
> 0x75E3692F01Dc714F82637c9AC99bF6145b39Be86
> 0x47e0e9906B615Cb4238B72E398673933A590AE30
> 0xb9749440CB4704b6b4487BF6499471C2A733BB2F
> 0x

Should the precompile-addresses (0x1 .. 0xff) be pre-funded with 1 wei? (advisable yes)
> yes

Specify your chain/network ID if you want an explicit one (default = random)
> 786
```

Private Network(5/12)

▪ Make Your Own Private Ethereum Network :

- **Step 11.** Select 2 for "Manage existing genesis" and select 2 for "Export genesis configurations".

```
C:\WINDOWS\system32\cmd.exe - puppeth

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

1. Modify existing configurations
2. Export genesis configurations
3. Remove genesis configuration
> 2

Which folder to save the genesis specs into? (default = current)
Will create 786.json, 786-aleth.json, 786-harmony.json, 786-parity.json
> 
```

- **Step 12.** Just type "enter" key to generate genesis file in the current directory. You can see that "**Aleth**" and "**Parity**" will not support the newly generated "**genesis.json**" file. "**Ctrl+C**" will let you leave the prompt.

```
C:\WINDOWS\system32\cmd.exe - puppeth

> 2

Which folder to save the genesis specs into? (default = current)
Will create 786.json, 786-aleth.json, 786-harmony.json, 786-parity.json
> 
INFO [07-06|11:48:38.228] Saved native genesis chain spec      path=786.json
ERROR[07-06|11:48:38.229] Failed to create Aleth chain spec     err="unsupported consensus engine"
ERROR[07-06|11:48:38.229] Failed to create Parity chain spec    err="unsupported consensus engine"
INFO [07-06|11:48:38.230] Saved genesis chain spec              client=harmony path=786-harmony.json

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


Private Network(6/12)

- **Make Your Own Private Ethereum Network :**

- **Step 13.** Check your genesis files. You can see 2 "**786-xxx.json**" files in your current folder.



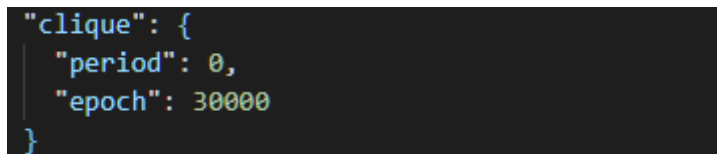
```
C:\WINDOWS\system32\cmd.exe

c:\Home\Project\Smart-Contract\Private 디렉터리

2021-07-06 오전 11:48 <DIR>      .
2021-07-06 오전 11:48 <DIR>      ..
2021-07-06 오전 11:45 <DIR>      .puppeth
2021-07-06 오전 11:48          22,034 786-harmony.json
2021-07-06 오전 11:48          22,034 786.json
2021-07-06 오전 10:18          130 accounts.txt
2021-07-06 오전 10:08 <DIR>      node1
2021-07-06 오전 10:11 <DIR>      node2
2021-07-06 오전 10:17 <DIR>      node3
                3개 파일          44,198 바이트
                6개 디렉터리 400,547,450,880 바이트 남음

c:\Home\Project\Smart-Contract\Private>
```

- **Step 14.** Edit the created "**genesis.json(=786.json)**" file to set "**period**" field to 0 in "**clique(PoA)**". This will automatically force "**geth**" to only create a new block whenever there is a transaction in the network.



```
"clique": {
  "period": 0,
  "epoch": 30000
}
```

- **Make Your Own Private Ethereum Network :**

- ```
c:\Home\Project\Smart-Contract\Private>geth --datadir node1/ init genesis.json
INFO [07-06|12:02:11.568] Maximum peer count ETH=50 LES=0 total=50
INFO [07-06|12:02:11.639] Set global gas cap cap=50,000,000
INFO [07-06|12:02:11.644] Allocated cache and file handles database=c:\Home\Project\Smart-Contract\Private\node1\geth\chaindata cache=16.00MiB handles=16
INFO [07-06|12:02:11.659] Writing custom genesis block
INFO [07-06|12:02:11.665] Persisted trie from memory database nodes=360 size=51.05KiB time=1.0321ms gcnodes=0 gcsizes=0.00B gctime=0s livenodes=1 livesize=0.00B
INFO [07-06|12:02:11.672] Successfully wrote genesis state database=chaindata hash=0800df..8f126a
INFO [07-06|12:02:11.676] Allocated cache and file handles database=c:\Home\Project\Smart-Contract\Private\node1\geth\lightchaindata cache=16.00MiB handles=16
INFO [07-06|12:02:11.691] Writing custom genesis block
INFO [07-06|12:02:11.696] Persisted trie from memory database nodes=360 size=51.05KiB time=1.0006ms gcnodes=0 gcsizes=0.00B gctime=0s livenodes=1 livesize=0.00B
INFO [07-06|12:02:11.702] Successfully wrote genesis state database=lightchaindata hash=0800df..8f126a

c:\Home\Project\Smart-Contract\Private>
```

2021-07-07

# Private Network(8/12)

## ▪ Run the Private Network :

- **Step 01.** Make your password file like "password.txt" in each folders.
- **Step 02.** Run "geth" with the following option in each folders. **You need to use the account created for the folder.**

```
geth --noub --datadir $pwd --nodiscover --ipcpath gethnode1.ipc --syncmode full --port 30310 --miner.gasprice 0 --miner.gastarget 470000000000 --http --http.addr 127.0.0.1 --http.port 8545 --http.api admin,eth,miner,net,txpool,personal,web3 --mine --allow-insecure-unlock --unlock "0x75E3692F01Dc714F82637c9AC99bF6145b39Be86" --password password.txt
```

```
c:\Home\Project\Smart-Contract\Private\node1>geth --noub --datadir=$pwd --syncmode full --port 30310 --miner.gasprice 0 --miner.gastarget 470000000000 --http --http.addr 127.0.0.1 --http.port 8545 --http.api admin,eth,miner,net,txpool,personal,web3 --mine --allow-insecure-unlock --unlock "0x75E3692F01Dc714F82637c9AC99bF6145b39Be86" --password passwd.txt
INFO [07-06|13:14:59.407] Starting Geth on Ethereum mainnet...
INFO [07-06|13:14:59.488] Bumping default cache on mainnet
INFO [07-06|13:14:59.493] Maximum peer count
WARN [07-06|13:14:59.495] Option noub is deprecated and USB is deactivated by default. Use --usb to enable
INFO [07-06|13:14:59.500] Set global gas cap
WARN [07-06|13:14:59.503] Sanitizing invalid miner gas price
INFO [07-06|13:14:59.506] Allocated trie memory caches
INFO [07-06|13:14:59.509] Allocated cache and file handles
INFO [07-06|13:14:59.541] Opened ancient database
INFO [07-06|13:14:59.546] Initialised chain configuration
0 Constantinople: 0 Petersburg: 0 Istanbul: 0, Muir Glacier: <nil>, Berlin: <nil>, London: <nil>, Engine: clique}
INFO [07-06|13:14:59.559] Initialising Ethereum protocol
INFO [07-06|13:14:59.568] Loaded most recent local header
INFO [07-06|13:14:59.572] Loaded most recent local full block
INFO [07-06|13:14:59.575] Loaded most recent local fast block
INFO [07-06|13:14:59.579] Loaded local transaction journal
INFO [07-06|13:14:59.585] Regenerated local transaction journal
INFO [07-06|13:14:59.589] Gasprice oracle is ignoring threshold set
WARN [07-06|13:14:59.591] Unclean shutdown detected
WARN [07-06|13:14:59.595] Unclean shutdown detected
INFO [07-06|13:14:59.598] Starting peer-to-peer node
INFO [07-06|13:14:59.633] New local node record
INFO [07-06|13:14:59.639] Started P2P networking
1e7a4c2ad3c13343a202172c2c003301f91d4@127.0.0.1:30310
INFO [07-06|13:14:59.640] IPC endpoint opened
INFO [07-06|13:14:59.651] HTTP server started
INFO [07-06|13:15:00.548] Unlocked account
INFO [07-06|13:15:00.554] Transaction pool price threshold updated
INFO [07-06|13:15:00.557] Transaction pool price threshold updated
INFO [07-06|13:15:00.560] Etherbase automatically configured
INFO [07-06|13:15:00.564] Commit new mining work
INFO [07-06|13:15:00.564] Sealing paused, waiting for transactions

provided=1024 updated=4096
ETH=50 LES=0 total=50
cap=50,000,000
provided=0 updated=0
clean=614.00MiB dirty=1024.00MiB
database=c:\Home\Project\Smart-Contract\Private\node1\geth\chaindata cache=2.00GiB handles=8192
database=c:\Home\Project\Smart-Contract\Private\node1\geth\chaindata\ancient readonly=false
config="{ChainID: 786 Homestead: 0 DAO: <nil> DAOsupport: false EIP150: 0 EIP155: 0 EIP158: 0 Byzantium:
network=1 dbversion=8
number=0 hash=0800df..8f126a td=1 age=1h44m31s
number=0 hash=0800df..8f126a td=1 age=1h44m31s
number=0 hash=0800df..8f126a td=1 age=1h44m31s
transactions=0 dropped=0
transactions=0 accounts=0
threshold=2
booted=2021-07-06T13:11:22+0900 age=3m37s
booted=2021-07-06T13:12:51+0900 age=2m8s
instance=Geth/v1.10.4-stable-aa637fd3/windows-amd64/go1.16.4
seq=7 id=2302d12693c081b7 ip=127.0.0.1 udp=30310 tcp=30310
self=enode://32d866aa8b9bdd4d0d2a6e076b41d921173c7fdb2b2b258b90a39c6bdf7f7160355dc4ea20b6b4d95192835e
url=\\.\pipe\geth.ipc
endpoint=127.0.0.1:8545 prefix= cors= vhosts=localhost
address=0x75E3692F01Dc714F82637c9AC99bF6145b39Be86
price=0
price=0
address=0x75E3692F01Dc714F82637c9AC99bF6145b39Be86
number=1 sealhash=dec982..868696 uncles=0 txs=0 gas=0 fees=0 elapsed=0s
```

# Note : Geth Command Option

---

- Other Nodes :

- Node2 -

```
geth --nousb --datadir $pwd --nodiscover --ipcpath gethnode2.ipc --syncmode full --port 30311 --miner.gasprice 0 --miner.gastarget 470000000000 --http --http.addr 127.0.0.1 --http.port 8546 --http.api admin,eth,miner,net,txpool,personal,web3 --mine --allow-insecure-unlock --unlock "0x47e0e9906B615Cb4238B72E398673933A590AE30" --password password.txt
```

- Node3 -

```
geth --nousb --datadir $pwd --nodiscover --ipcpath gethnode3.ipc --syncmode full --port 30312 --miner.gasprice 0 --miner.gastarget 470000000000 --http --http.addr 127.0.0.1 --http.port 8547 --http.api admin,eth,miner,net,txpool,personal,web3 --mine --allow-insecure-unlock --unlock "0xb9749440CB4704b6b4487BF6499471C2A733BB2F" --password password.txt
```

# Note : Geth Command

---

## ▪ Options :

- **--nousb** : Disables monitoring for and managing USB hardware wallets.
- **--datadir=\$pwd** : Data directory for the databases and keystore.
- **--syncmode full** : Enables full chain sync (default: "fast").
- **--port 3030** : assign port geth process.
- **--miner.gasprice 0** : On private network we don't want to pay anything, so make it zero.
- **--miner.gastarget 4700000000000** : Use same as the genesis file. However, actual gaslimit is dynamic for new block and depends on the previous block.
- **--http** : Enable the HTTP-RPC server.
- **--http.addr 127.0.0.1** : HTTP-RPC server listening interface (default: "localhost").
- **--http.port 8545** : HTTP-RPC server listening port (default: 8545).
- **--http.api** : Bunch of APIs to be used over RPC calls.
- **--mine** : Enable mining.
- **--allow-insecure-unlock** : Allow insecure account unlocking when account-related RPCs are exposed by http.
- **--unlock "0x251B7dC42D7472314fE4d6c3b9CAD2fb5927d7c8"** : Account to unlock, we'll use the address of node1.
- **--password password.txt** : Password file to use for non-interactive password input.

## ▪ Additional Options :

- **--http.corsdomain "\*"** : Comma separated list of domains from which to accept cross origin requests (browser enforced).
- **--http.vhosts="\*"** : Comma separated list of virtual hostnames from which to accept requests (server enforced). Accepts '\*' wildcard.
- **--miner.threads value** : Number of CPU threads to use for mining (default: 0).

# Private Network(9/12)

---

- **Run the Private Network :**

- **Step 03.** Keep the "**enode**" information when you run the "**geth**" command in previous page.

```
enode://32d866aa8b9bddd4d0d2a6e076b41d921173c7fdb2b2b2b258b90a39c6bdf7f7160355dc4ea20b6b4d95192835e1e7a4c2ad3c13343a202172c2c003301f91d4@127.0.0.1:30310
```

- **Step 04.** Run the "**geth**" command with **different port, http.port, account and password** options in each directory and get the "**enode**" information.
  - **Step 05.** Make "**static-nodes.json**" file with all the "**enode**" information you got from the previous "**geth**" run. Copy "**static-nodes.json**" file into each folders.

```
[

 "enode://32d866aa8b9bddd4d0d2a6e076b41d921173c7fdb2b2b2b258b90a39c6bdf7f7160355dc4ea20b6b4d95192835e1e7a4c2ad3c13343a202172c2c003301f91d4@127.0.0.1:30310",

 "enode://a19a5f05738ef9bf6175d9b0b2cf30ab6cae5b3d9e45c5e7f1b94d063cfdd66ea83d9bb33daa6f6502c126ea57e575fe27e0dcb6cd0efd0d3d0ab8004a475d98@127.0.0.1:30311",

 "enode://ecb307906a28fd41d3a2969f7106b4f7300effdea8ba44f3bbce820d60cd512981f516c018c20710b5ac59f80a34638ff930fc4d586f454f8a48f25759cb8828@127.0.0.1:30312"
]
```

# Private Network(10/12)

---

- **Run the Private Network :**

- **Step 06.** Run "geth" in different terminals for each folders. Here we will have 3 geth node.
- **Step 07.** Run "geth attach http://127.0.0.1:8545" command.



```
C:\WINDOWS\system32\cmd.exe - geth attach http://127.0.0.1:8545

c:\Home\Project\Smart-Contract\Private\node1\geth>geth attach http://127.0.0.1:8545
Welcome to the Geth JavaScript console!

instance: Geth/v1.10.4-stable-aa637fd3/windows-amd64/go1.16.4
coinbase: 0x75e3692f01dc714f82637c9ac99bf6145b39be86
at block: 0 (Tue Jul 06 2021 11:30:28 GMT+0900 (KST))
datadir: c:\Home\Project\Smart-Contract\Private\node1
modules: admin:1.0 eth: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
>
```

# Private Network(11/12)

## ▪ Run the Private Network :

- **Step 08.** Check all the peer nodes in geth attached console with "**admin.peers**" command.

```
C:\WINDOWS\system32\cmd.exe - geth attach http://127.0.0.1:8545

c:\Home\Project\Smart-Contract\Private\node1>geth attach http://127.0.0.1:8545
Welcome to the Geth JavaScript console!

instance: Geth/v1.10.4-stable-aa637fd3/windows-amd64/go1.16.4
coinbase: 0x75e3692f01dc714f82637c9ac99bf6145b39be86
at block: 0 (Tue Jul 06 2021 11:30:28 GMT+0900 (KST))
datadir: c:\Home\Project\Smart-Contract\Private\node1
modules: admin:1.0 eth: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
> admin.peers
[[
 {
 caps: ["eth/65", "eth/66", "snap/1"],
 enode: "enode://ecb307906a28fd41d3a2969f7106b4f7300effdea8ba44f3bbce820d66cd512981f516c018c20710b5ac59f80a34638ff930fc4d586f454f8a48f25759cb8828@127.0.0.1:49945",
 id: "08496acc6a37ea7f11a821ca2f0d58008500c9bd008140598400b5a0c93a9962",
 name: "Geth/v1.10.4-stable-aa637fd3/windows-amd64/go1.16.4",
 network: {
 inbound: true,
 localAddress: "127.0.0.1:30310",
 remoteAddress: "127.0.0.1:49945",
 static: false,
 trusted: false
 },
 protocols: {
 eth: {
 difficulty: 1,
 head: "0x0800dfff22d5d2d207d26300e7af14ce490ad8f840b054566a6d7fc09d8f126a",
 version: 66
 },
 snap: {
 version: 1
 }
 }
 },
 {
 caps: ["eth/65", "eth/66", "snap/1"],
 enode: "enode://a19a5f05738ef9bf6175d9b0b2cf30ab6cae5b3d9e45c5e7f1b94d063cfd66ea83d9bb33daa6f6502c126ea57e575fe27e0dc6cd0efd0d3d0ab8004a475d98@127.0.0.1:49938",
 id: "82bfee98fd5116a8de083af2914f2bcd9894074b7523fa45f1bfc89eabb46f2",
 name: "Geth/v1.10.4-stable-aa637fd3/windows-amd64/go1.16.4",
 network: {
 inbound: true,
 localAddress: "127.0.0.1:30310",
 remoteAddress: "127.0.0.1:49938",
 static: false,
 trusted: false
 },
 protocols: {
 eth: {
 difficulty: 1,
 head: "0x0800dfff22d5d2d207d26300e7af14ce490ad8f840b054566a6d7fc09d8f126a",
 version: 66
 },
 snap: {
 version: 1
 }
 }
 }
]]
>
```



# Private Network(12/12)

- **Peers :**

- As you can see the following screen shot, you have 2 peers for each geth nodes.

```
INFO [07-06|16:59:42.828] Etherbase automatically configured address=0xb9749440CB4704b6b4487BF6499471C2A733BB2F
INFO [07-06|16:59:42.833] Commit new mining work number=1 sealhash=142621..ec8039 uncles=0 txs=0 gas=0 fees=0 elapsed="587.8µs"
INFO [07-06|16:59:42.833] Sealing paused, waiting for transactions
INFO [07-06|17:00:16.950] Looking for peers peercount=2 tried=2 static=3
```

- You can also find out the number of discovered peers with "**net.peerCount**" command in geth attached console.

```
> net.peerCount
2
>
```

## Note : Transmitting Transaction

- **Truffle :**

- Use "**truffle migrate --network=develop**" command to send "**contract creation transaction**" to the private network.
- Make sure that the "**truffle-config.js**" file has "**develop**" network configuration like the following.

```
develop: {
 host: "127.0.0.1",
 port: 8545,
 network_id: "*",
},
```

- When you meet an error like "**block gaslimit**", then you need to change the "**genesis.json**" file. Increase the **block gaslimit value** in hexadecimal format.

[illegible]

# Note : Check Result

## ▪ Screenshot :

- You can see that the transactions are mined and included in a block.

```
INFO [07-07|10:28:40.577] Commit new mining work number=3 sealhash=2d68ad..4e2af6 uncles=0 txs=0 gas=0 fees=0 elapsed="789.7µs"
INFO [07-07|10:28:40.578] Sealing paused, waiting for transactions
INFO [07-07|10:28:41.612] Commit new mining work number=3 sealhash=aa5d9f..45b99b uncles=0 txs=1 gas=95470 fees=0 elapsed=0s
INFO [07-07|10:28:41.613] Successfully sealed new block number=3 sealhash=aa5d9f..45b99b hash=a8c849..c11f32 elapsed="950.9µs"
INFO [07-07|10:28:41.619] Commit new mining work number=4 sealhash=3cfaed..68fdd3 uncles=0 txs=0 gas=0 fees=0 elapsed="998.4µs"
INFO [07-07|10:28:41.619] Sealing paused, waiting for transactions
INFO [07-07|10:28:41.625] ⚡mined potential block number=3 hash=a8c849..c11f32
INFO [07-07|10:28:41.665] Imported new chain segment blocks=1 txs=1 mgas=0.095 elapsed="999.8µs" mgasps=95.489 number=3 hash=2d17a1..21cf28 dirty=8.48KiB
INFO [07-07|10:28:41.665] Commit new mining work number=4 sealhash=3cfaed..68fdd3 uncles=1 txs=0 gas=0 fees=0 elapsed=0s
INFO [07-07|10:28:42.679] Commit new mining work number=4 sealhash=8b2cb2..e443b6 uncles=1 txs=1 gas=286,565 fees=0 elapsed="607.8µs"
INFO [07-07|10:28:42.679] Signed recently, must wait for others
INFO [07-07|10:28:42.692] Imported new chain segment blocks=1 txs=1 mgas=0.287 elapsed=1.081ms mgasps=264.921 number=4 hash=d67f5c..544d14 dirty=11.15KiB
INFO [07-07|10:28:42.702] Commit new mining work number=5 sealhash=161256..fdabd3 uncles=1 txs=0 gas=0 fees=0 elapsed=0s
INFO [07-07|10:28:42.702] Sealing paused, waiting for transactions
INFO [07-07|10:28:42.713] Chain reorg detected number=3 hash=a8c849..c11f32 drop=1 dropfrom=d67f5c..544d14 add=1 addfrom=f5727f..bc3c30
INFO [07-07|10:28:42.739] Commit new mining work number=5 sealhash=f4b356..0d3598 uncles=1 txs=1 gas=27341 fees=0 elapsed=1.110ms
INFO [07-07|10:28:42.743] Imported new chain segment blocks=1 txs=1 mgas=0.287 elapsed=31.865ms mgasps=8.993 number=4 hash=f5727f..bc3c30 dirty=11.15KiB
INFO [07-07|10:28:42.773] Commit new mining work number=5 sealhash=d5c7aa..7c9485 uncles=2 txs=0 gas=0 fees=0 elapsed=1.001ms
INFO [07-07|10:28:42.773] Sealing paused, waiting for transactions
INFO [07-07|10:28:42.773] Successfully sealed new block number=5 sealhash=f4b356..0d3598 hash=e813e1..b7fa28 elapsed=34.45ms
INFO [07-07|10:28:42.774] Imported new chain segment blocks=1 txs=1 mgas=0.027 elapsed=1.002ms mgasps=27.267 number=5 hash=51047c..8d1d0c dirty=14.19KiB
INFO [07-07|10:28:42.795] Commit new mining work number=5 sealhash=41bc4d..e91d45 uncles=2 txs=1 gas=27341 fees=0 elapsed=22.941ms
INFO [07-07|10:28:42.820] ⚡mined potential block number=5 hash=e813e1..b7fa28
INFO [07-07|10:28:42.853] Sealing paused, waiting for transactions
INFO [07-07|10:28:42.857] Commit new mining work number=6 sealhash=aab218..e9a88b uncles=2 txs=0 gas=0 fees=0 elapsed=4.151ms
INFO [07-07|10:28:42.857] Successfully sealed new block number=5 sealhash=41bc4d..e91d45 hash=56a124..29f2e2 elapsed=66.833ms
INFO [07-07|10:28:42.881] ⚡mined potential block number=5 hash=56a124..29f2e2
```