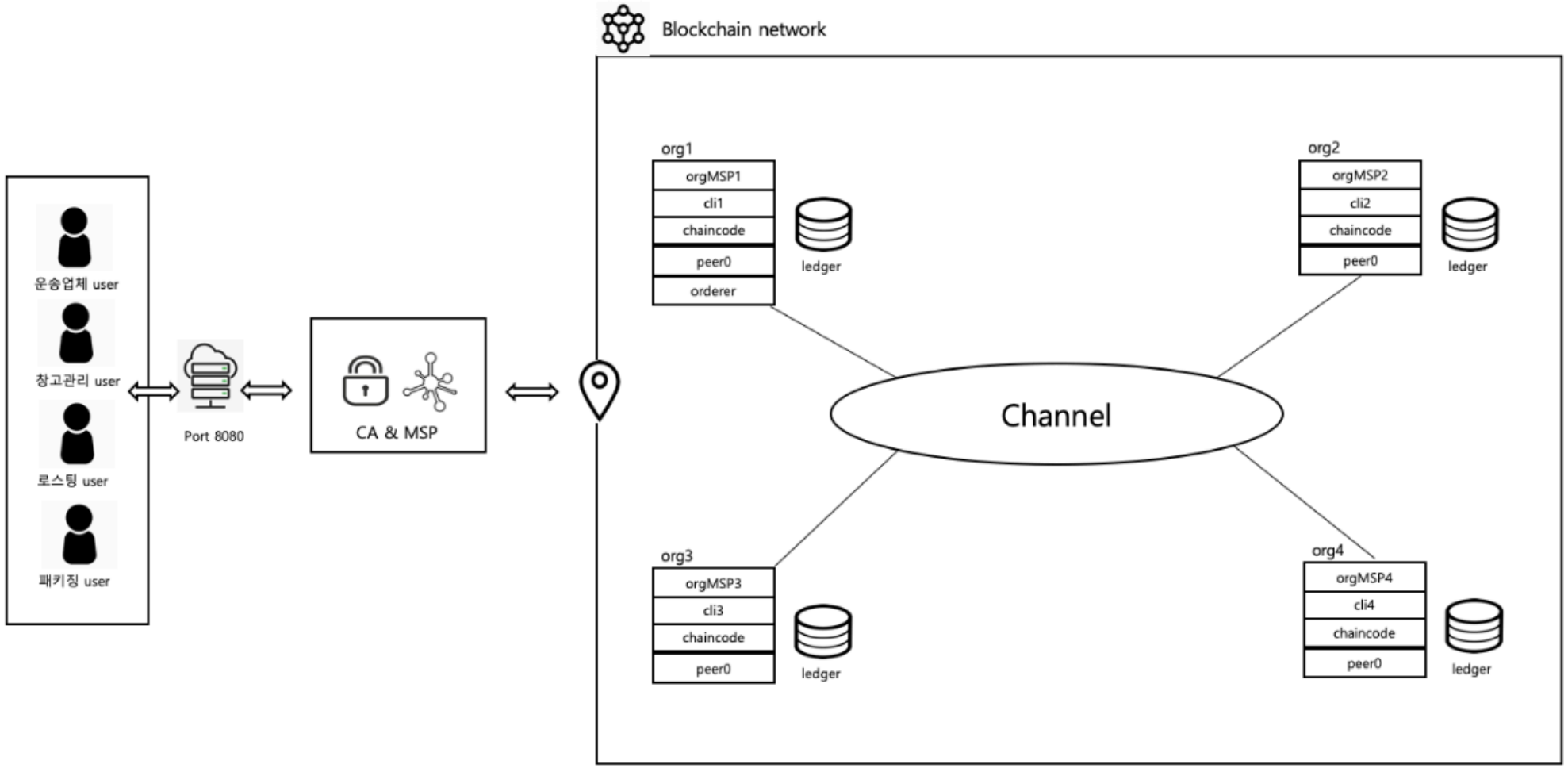
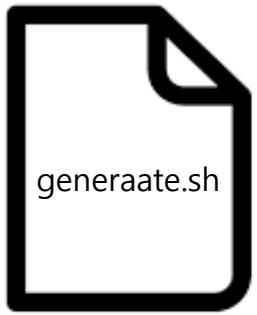
네트워크 구성도

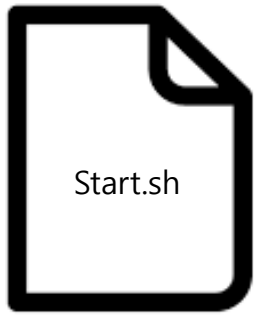


오픈소스 : https://github.com/saarc

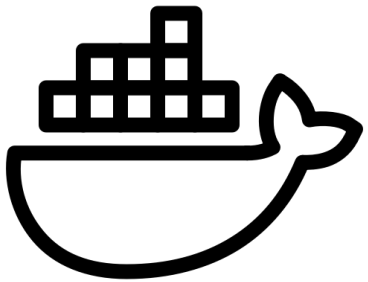
네트워크 구축 프로세스



각 기관의 MSP 키, 채널, 제니시스 블록 생성

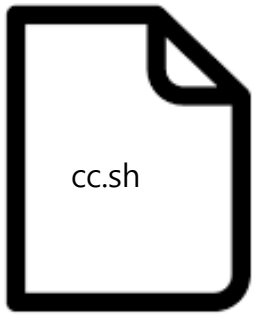


각 기관이 컨테이너를 통해 실행되고, 채널에 가입 됨 (네트워크 합류)



docker-compose.yml

생성된 MSP키 값을 docker-compose.yml의 기관별 keyFIle 부분에 하드코딩.



채널에 체인코드를 베포하여 각 기관들에 체인코드가 베포됨

네트워크 구축 프로세스 - 쉘 스크립트

1 generate.sh

각 기관의 MSP Key, 채널, 제네시스 블록 생성

```
(base) hongui-MacBook-Air:config hongjoonkim$ ls
Org1MSPanchors.tx       Org2MSPanchors.tx       Org3MSPanchors.tx       Org4MSPanchors.tx       channel.tx              genesis.block
```

각 기관의 MSP key값

```
(base) hongui-MacBook-Air:network hongjoonkim$ ls crypto-config/peerOrganizations/org1.example.com/ca/ | grep _sk
46a67ada4d31a72ebeabdd27fdd732e3cd684537b5b22050a4897a6e2005ce8f_sk   Org1
(base) hongui-MacBook-Air:network hongjoonkim$ ls crypto-config/peerOrganizations/org2.example.com/ca/ | grep _sk
8f9e35c3c3289b6bab87d1b0e622c005ee47a71663b4f35e50131a5ecddbee31_sk   Org2
(base) hongui-MacBook-Air:network hongjoonkim$ ls crypto-config/peerOrganizations/org3.example.com/ca/ | grep _sk
2ff3f56b047a26f105ec866a12c9b8e17283f34c0f8d5c68047f3128b59fdf57_sk   Org3
(base) hongui-MacBook-Air:network hongjoonkim$ ls crypto-config/peerOrganizations/org4.example.com/ca/ | grep _sk
800c9b1dbaeb67ef2aeacae87d5f56e09b8cca24982aa4df9b1aeb1292a63428_sk   Org4
```

네트워크 구축 프로세스 - 쉘 스크립트

2 start.sh

```
services:
  ca1.example.com:
    image: hyperledger/fabric-ca
    environment:
      - FABRIC_CA_HOME=/etc/hyperledger/fabric-ca-server
      - FABRIC_CA_SERVER_CA_NAME=ca.example.com
      - FABRIC_CA_SERVER_CA_CERTFILE=/etc/hyperledger/fabric-ca-server-config/ca.org1.example.com-cert.pem
      - FABRIC_CA_SERVER_CA_KEYFILE=/etc/hyperledger/fabric-ca-server-config/2c37ee5915b4ca4c79ab29b7ab6847fbf65b485aa06e9d25657c6ca4dc8a868d_sk
    ports:
      - "7054:7054"
    command: sh -c 'fabric-ca-server start -b admin:adminpw'
    volumes:
      - ./crypto-config/peerOrganizations/org1.example.com/ca/:/etc/hyperledger/fabric-ca-server-config
    container_name: ca1.example.com
    networks:
      - basic
```

MSP키 값 하드코딩 부분

그림0. docker-compse.yml

네트워크 구축 프로세스 - 쉘 스크립트

2 start.sh

Docker composer service 실행

```
docker ps -a
CONTAINER ID        IMAGE                      COMMAND                  CREATED             STATUS              PORTS                                                 NAMES
0789e10cafc3        hyperledger/fabric-tools   "/bin/bash"              4 seconds ago       Up Less than a second                                                     cli3
a08335a83020        hyperledger/fabric-tools   "/bin/bash"              4 seconds ago       Up Less than a second                                                     cli
6797bff12774        hyperledger/fabric-tools   "/bin/bash"              4 seconds ago       Up Less than a second                                                     cli2
5ad4680eb0a2        hyperledger/fabric-tools   "/bin/bash"              6 seconds ago       Up 1 second                                                               cli4
846dd5639ba1        hyperledger/fabric-peer    "peer node start"        9 seconds ago       Up 3 seconds        0.0.0.0:9051->7051/tcp, 0.0.0.0:9053->7053/tcp    peer0.org3.
example.com
77bd7ea54a2e        hyperledger/fabric-peer    "peer node start"        9 seconds ago       Up 4 seconds        0.0.0.0:7051->7051/tcp, 0.0.0.0:7053->7053/tcp    peer0.org1.
example.com
99d0daa58e0f        hyperledger/fabric-peer    "peer node start"        10 seconds ago      Up 5 seconds        0.0.0.0:6051->7051/tcp, 0.0.0.0:6053->7053/tcp    peer0.org4.
example.com
fd595403dd39        hyperledger/fabric-peer    "peer node start"        10 seconds ago      Up 4 seconds        0.0.0.0:8051->7051/tcp, 0.0.0.0:8053->7053/tcp    peer0.org2.
example.com
8659a630ad71        hyperledger/fabric-orderer "orderer"                16 seconds ago      Up 9 seconds        0.0.0.0:7050->7050/tcp                            orderer.exa
mple.com
10cbb907ca53        hyperledger/fabric-couchdb "tini -- /docker-ent…"   16 seconds ago      Up 9 seconds        4369/tcp, 9100/tcp, 0.0.0.0:5984->5984/tcp        couchdb1
832aa43b22e0        hyperledger/fabric-ca      "sh -c 'fabric-ca-se…"   16 seconds ago      Up 9 seconds        0.0.0.0:9054->7054/tcp                            ca3.example
.com
f4c579be96f9        hyperledger/fabric-couchdb "tini -- /docker-ent…"   16 seconds ago      Up 8 seconds        4369/tcp, 9100/tcp, 0.0.0.0:7984->5984/tcp        couchdb3
e4a98459bae4        hyperledger/fabric-ca      "sh -c 'fabric-ca-se…"   16 seconds ago      Up 10 seconds       0.0.0.0:8054->7054/tcp                            ca2.example
.com
7c94d30d6739        hyperledger/fabric-couchdb "tini -- /docker-ent…"   16 seconds ago      Up 10 seconds       4369/tcp, 9100/tcp, 0.0.0.0:8984->5984/tcp        couchdb4
298344e320d4        hyperledger/fabric-couchdb "tini -- /docker-ent…"   16 seconds ago      Up 11 seconds       4369/tcp, 9100/tcp, 0.0.0.0:6984->5984/tcp        couchdb2
85399c25ea47        hyperledger/fabric-ca      "sh -c 'fabric-ca-se…"   16 seconds ago      Up 11 seconds       0.0.0.0:6054->7054/tcp                            ca4.example
.com
150f625d08e3        hyperledger/fabric-ca      "sh -c 'fabric-ca-se…"   16 seconds ago      Up 12 seconds       0.0.0.0:7054->7054/tcp                            ca1.example
.com
```

그림1. 생성된 컨테이너들

네트워크 구축 프로세스 - 쉘 스크립트

2 start.sh

생성된 container (각 기관들)를 생성된 채널에 가입

```
# Create the channel
docker exec cli peer channel create -o orderer.example.com:7050 -c mychannel -f /etc/hyperledger/configtx/channel.tx
2019-12-13 08:50:49.228 UTC [channelCmd] InitCmdFactory -> INFO 001 Endorser and orderer connections initialized
2019-12-13 08:50:49.326 UTC [cli.common] readBlock -> INFO 002 Received block: 0
# Join peer0.org1.example.com to the channel.
docker exec -e "CORE_PEER_LOCALMSPID=Org1MSP" -e "CORE_PEER_MSPCONFIGPATH=/etc/hyperledger/msp/users/Admin@org1.example.com/msp" peer0.org1.example.com peer channel join -b /etc/
hyperledger/configtx/mychannel.block
2019-12-13 08:50:49.770 UTC [channelCmd] InitCmdFactory -> INFO 001 Endorser and orderer connections initialized
2019-12-13 08:50:50.273 UTC [channelCmd] executeJoin -> INFO 002 Successfully submitted proposal to join channel
sleep 5
# Join peer0.org2.example.com to the channel.
docker exec -e "CORE_PEER_LOCALMSPID=Org2MSP" -e "CORE_PEER_MSPCONFIGPATH=/etc/hyperledger/msp/users/Admin@org2.example.com/msp" peer0.org2.example.com peer channel join -b /etc/
hyperledger/configtx/mychannel.block
2019-12-13 08:50:55.976 UTC [channelCmd] InitCmdFactory -> INFO 001 Endorser and orderer connections initialized
2019-12-13 08:50:56.309 UTC [channelCmd] executeJoin -> INFO 002 Successfully submitted proposal to join channel
sleep 5
# Join peer0.org2.example.com to the channel.
docker exec -e "CORE_PEER_LOCALMSPID=Org3MSP" -e "CORE_PEER_MSPCONFIGPATH=/etc/hyperledger/msp/users/Admin@org3.example.com/msp" peer0.org3.example.com peer channel join -b /etc/
hyperledger/configtx/mychannel.block
2019-12-13 08:51:01.760 UTC [channelCmd] InitCmdFactory -> INFO 001 Endorser and orderer connections initialized
2019-12-13 08:51:02.104 UTC [channelCmd] executeJoin -> INFO 002 Successfully submitted proposal to join channel
sleep 5
# Join peer0.org4.example.com to the channel.
docker exec -e "CORE_PEER_LOCALMSPID=Org4MSP" -e "CORE_PEER_MSPCONFIGPATH=/etc/hyperledger/msp/users/Admin@org4.example.com/msp" peer0.org4.example.com peer channel join -b /etc/
hyperledger/configtx/mychannel.block
2019-12-13 08:51:07.614 UTC [channelCmd] InitCmdFactory -> INFO 001 Endorser and orderer connections initialized
2019-12-13 08:51:07.953 UTC [channelCmd] executeJoin -> INFO 002 Successfully submitted proposal to join channel
sleep 5
```

그림2. 각 컨테이너들의 채널 가입

네트워크 구축 프로세스 - 쉘 스크립트

3 cc.sh

각 기관에 체인코드 베포

```
(base) hongui-MacBook-Air:network hongjoonkim$ ./cc.sh
2019-12-13 08:59:34.896 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 001 Using default escc
2019-12-13 08:59:34.896 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 002 Using default vscc
2019-12-13 08:59:36.955 UTC [chaincodeCmd] install -> INFO 003 Installed remotely response:<status:200 payload:"OK" >
2019-12-13 08:59:37.278 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 001 Using default escc
2019-12-13 08:59:37.279 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 002 Using default vscc
2019-12-13 08:59:37.642 UTC [chaincodeCmd] install -> INFO 003 Installed remotely response:<status:200 payload:"OK" >
2019-12-13 08:59:37.990 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 001 Using default escc
2019-12-13 08:59:37.990 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 002 Using default vscc
2019-12-13 08:59:38.334 UTC [chaincodeCmd] install -> INFO 003 Installed remotely response:<status:200 payload:"OK" >
2019-12-13 08:59:38.676 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 001 Using default escc
2019-12-13 08:59:38.676 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 002 Using default vscc
2019-12-13 08:59:39.012 UTC [chaincodeCmd] install -> INFO 003 Installed remotely response:<status:200 payload:"OK" >
2019-12-13 08:59:39.360 UTC [chaincodeCmd] InitCmdFactory -> INFO 001 Retrieved channel (mychannel) orderer endpoint: orderer.example.com:7050
2019-12-13 08:59:39.363 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 002 Using default escc
2019-12-13 08:59:39.363 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 003 Using default vscc
-----------------------------------END-----------------------------------
(base) hongui-MacBook-Air:network hongjoonkim$
```

그림3. 체인코드 베포 결과화면

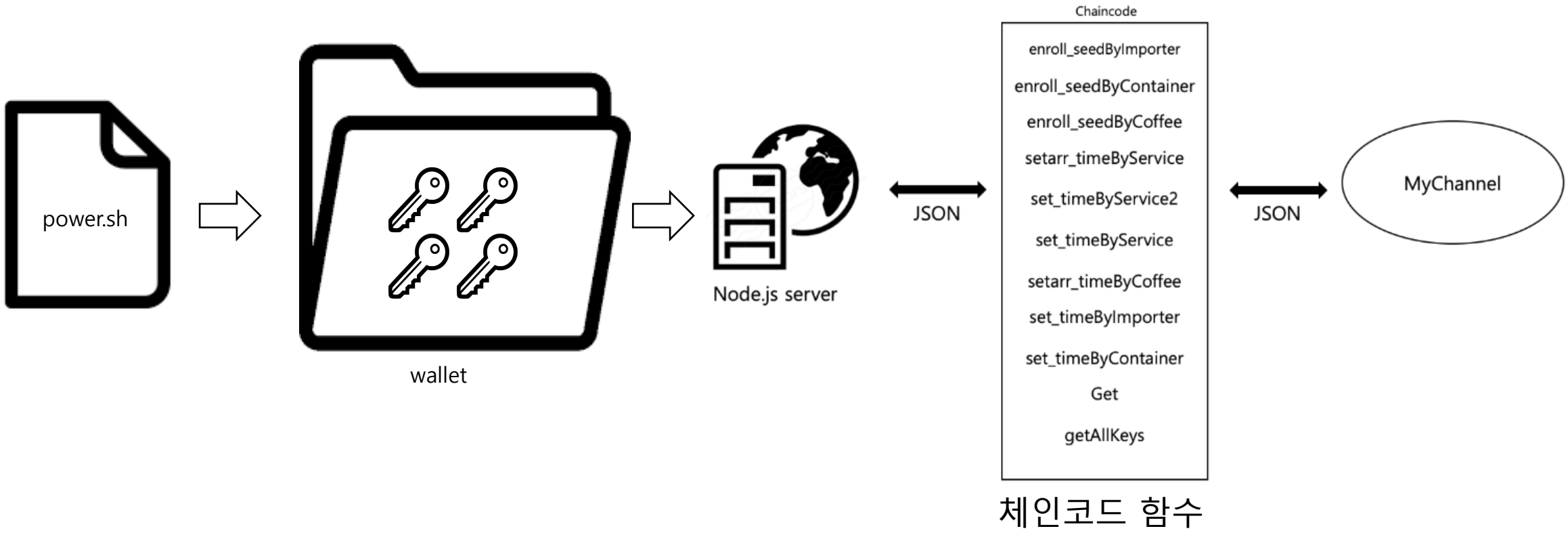
네트워크 구축 프로세스 - 쉘 스크립트

3 cc.sh

```
[root@c4863489d351:/# ls
bin  boot  dev  etc  home  host  lib  lib64  media  mnt  opt  proc  root  run  sbin  srv  sys  tmp  usr  var
[root@c4863489d351:/# cd var/
[root@c4863489d351:/var# ls
backups  cache  hyperledger  lib  local  lock  log  mail  opt  run  spool  tmp
[root@c4863489d351:/var# cd hyperledger/
[root@c4863489d351:/var/hyperledger# ls
production
[root@c4863489d351:/var/hyperledger# cd production/
[root@c4863489d351:/var/hyperledger/production# ls
chaincodes  ledgersData  transientStore
[root@c4863489d351:/var/hyperledger/production# cd chaincodes/
[root@c4863489d351:/var/hyperledger/production/chaincodes# ls
sacc.1.7    작성된chaincode
root@c4863489d351:/var/hyperledger/production/chaincodes#
```

그림4. Org4 컨테이너속에 체인코드 베포 확인

서버 프로세스



체인코드 함수

서버 프로세스

1 power.sh

```
(base) hongui-MacBook-Air:enrollAdmin hongjoonkim$ ./power.sh
Wallet path: /Users/hongjoonkim/Desktop/Walton_final_project/application/wallet
Successfully enrolled admin user "admin" and imported it into the wallet
Wallet path: /Users/hongjoonkim/Desktop/Walton_final_project/application/wallet
Successfully enrolled admin user "admin" and imported it into the wallet
Wallet path: /Users/hongjoonkim/Desktop/Walton_final_project/application/wallet
Successfully enrolled admin user "admin" and imported it into the wallet
Wallet path: /Users/hongjoonkim/Desktop/Walton_final_project/application/wallet
Successfully enrolled admin user "admin4" and imported it into the wallet
(base) hongui-MacBook-Air:enrollAdmin hongjoonkim$
```

각 기관의 MSP를 이용하여 기관별로 CA 생성

그림5. power.sh 실행 화면

서버 프로세스

1 power.sh 실행 결과

```
(base) hongui-MacBook-Air:application hongjoonkim$ cd wallet/
(base) hongui-MacBook-Air:wallet hongjoonkim$ ls
admin1   admin2   admin3   admin4
```

그림6. wallet 폴더에 생성된 기관별 CA

```
" ============================================================================
" Netrw Directory Listing                                        (netrw v165)
"   /Users/hongjoonkim/Desktop/Walton_final_project/application/wallet/admin1
"   Sorted by      name
"   Sort sequence: [\/]$,\<core\%(\.\d\+\)\=\>,\.h$,\.c$,\.cpp$,\~\=\*$,*,\.o$,\.obj$,\.info$,\.swp$,\.bak$,\~$
"   Quick Help: <F1>:help  -:go up dir  D:delete  R:rename  s:sort-by  x:special
" ============================================================================
../
./
admin1
fafe40427a39bcc930bae3c2bb92f3ef7f1c7be72d1bfac654e04af927265818-priv
fafe40427a39bcc930bae3c2bb92f3ef7f1c7be72d1bfac654e04af927265818-pub
~
```

그림7. 기관1의 CA 키 값

서버 프로세스

1 회원 가입

```
----------------------========================----------------------------
Successfully registered and enrolled admin user ID : <<<   2   >>> and imported it into the wallet
----------------------========================----------------------------
```

생성된 기관의 CA를 통해 기관별 User 가입

```
(base) hongui-MacBook-Air:application hongjoonkim$ cd wallet/
(base) hongui-MacBook-Air:wallet hongjoonkim$ ls
2       admin1  admin2  admin3  admin4
```

Wallet 폴더에 가입된 ID 확인

서버 프로세스

2 체인코드 호출 (유통업체 Org1)

```
------유통업체 ( 원두 이력 등록 ) ---------
날짜 등록 :  2019.12.20
Block Number: 4
Transaction ID: d2b888534fec871bd85427710215ee22d2b328aeea90bcb0a734cfac8eb9d550
Status: VALID
----------------------------------
key : 1001
정보 등록에 성공 했습니다.
Socket Connected
```

```
----------유통업체 (출고 날짜 등록)---------------
날짜 등록 :  2019.12.22
배송지 :  인천논현1동
Block Number: 5
 Transaction ID: bb005239da62d94e212732e1834361fac2ad21b53433068dcff25952e9a2ba06
Status: VALID
-----------------------------------------
정보 등록에 성공 했습니다.
Socket Connected
```

서버 프로세스

2 체인코드 호출 (창고관리 업체 Org2)

```
----------창고관리--------------
----     원두이력 등록         ----
Block Number: 6
 Transaction ID: 58ea732587833f5700d9b152ed8316bddc93de54a09be96b2dbc632698e02178
 Status: VALID
------------------------------
정보 등록에 성공 했습니다.
Socket Connected
```

```
----------창고관리--------------
----     출고날짜 등록       ----
Block Number: 7
 Transaction ID: c54057677446e0de37e15e57dc8dc0c45d730e1cbf136b58fe65d41ac2469560
 Status: VALID
------------------------------
정보 등록에 성공 했습니다.
Socket Connected
```

서버 프로세스

2 체인코드 호출 (로스팅 업체 Org3)

```
----------------커피가게 ------------------
-              도착날짜 등록                -
Block Number: 8
 Transaction ID: 442def8e829be8b43bde4573f5cc52b587a2df436509c8e3d20a666f9ce0f7f8
 Status: VALID
---------------------------------------
정보 등록에 성공 했습니다.
Socket Connected
```

```
----------------커피가게 ---------------
-              로스팅 등록               -
Block Number: 9
 Transaction ID: e7159de8ff8120a449b97eb7a919352a11212ddd067a1ae06ed440c7cff85185
 Status: VALID
---------------------------------------
정보 등록에 성공 했습니다.
Socket Connected
```

서버 프로세스

2 체인코드 호출 (패키징 업체 Org4)

```
---------패키징가게-----------
-      상품도착날짜 등록       -
Block Number: 10
 Transaction ID: 6f09af8089c115eac239807951d3e31a1892894b464aa7a4a43a9887654d9cc1
 Status: VALID
------------------------------
정보 등록에 성공 했습니다.
Socket Connected
```

```
---------패키징가게------------
-      패키징 시간 등록         -
Block Number: 11
 Transaction ID: 52751e4ec00f0933a463eb2269c61f37b34ab23d5e4894606e28b5c68e53959a
 Status: VALID
--------------------------
```

서버 프로세스

2 체인코드 호출 (Org1,Org2, Org3, Org4)