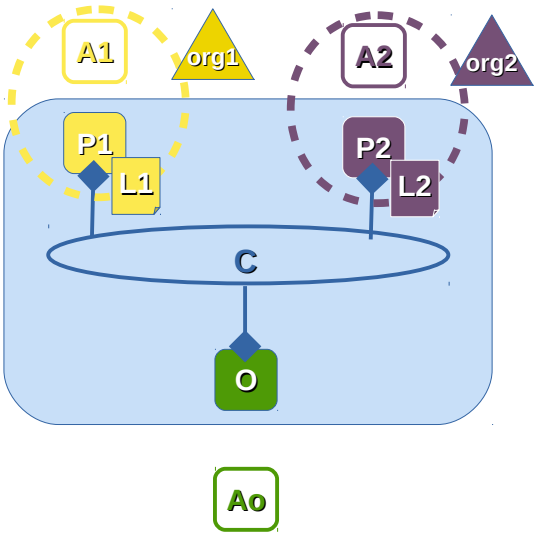
TP objectives:

1/ Setup environment

2/ Configure Domain, and Security :
- Generate cryptographic material
- Generate genesis block
- Generate a channel

3/ Run network :

Network overview:



A1 & A2 : applications outside network

P1 : shop.sfeir.lu

P2 : warehouse.sfeir.lu

L1 & L2 : copy of ledger installed on peer P1 & P2

Org1 & Org2 : organization n*1**,** organization n* 2

O : oSfeir.sfeir.lu

C : channel : « sfeirchannel »

TP:

1. Setup environment

- Run command **[1]** ;

```
[1]

./init.sh binaries
```

- Script should download hyperledger fabric tools and create following directories:

/bin	[**hyperledger fabric tools**]
|-configtxgen	[generate channel configuration]
|-configtxlator	[decrypt/encrypt messages]
|-cryptogen	[generate crypto material]
|-discover	[--]
|-fabric-ca-client	[client to interact with fabric CA]
|-idemixgen	[tool to build MSP directories]
|-orderer	[execute cmd on orderer]
|-peer	[execute cmd on peer]
/config	
|-configtx.yaml	[domains configuration]
|-core.yaml	[global peer configuration]
|-orderer.yaml	[global network configuration]

2. Configure Domain, and Security

a) Define and generate MSP configuration

Objectives :
- Define and generate cryptographic material for all network components of Blockchain. (orderer, peers …)

- Execute this command **[1]** :

```
[1]

. init.sh setup
```

NOTE : « . init.sh setup » (space between dot and init.sh)

- Edit « crypto-config » file and check the configuration for expecting organisations, see section as below :

```
OrdererOrgs:
        - Name: Orderer
          Domain: sfeir.lu
        Specs:
          - Hostname: orderer
PeerOrgs:
        - Name: Shop
          Domain: shop.sfeir.lu
        Template:
          Count: 1
        Users:
          Count: 1
        - Name: Warehouse
          Domain: warehouse.sfeir.lu
        Template:
          Count: 1
        Users:
          Count: 1
```

- Execute this command **[1]** to generate the crypto material :

```
[1]

cryptogen generate --config=./crypto-config.yaml
```

- Check the result of command **[1]** :

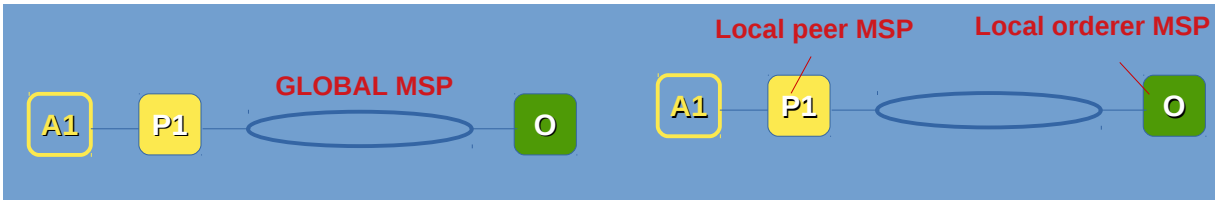
```
/crypto-config
    (1) /ordererOrganizations
            /sfeir.lu
                /ca (1.1)
                |- ca.sfeir.lu-cert.pem
                |- <private key>
                /msp (1.2)
                    /admincerts
                    |- Admin@sfeir.lu-cert.pem
                    /cacerts
                    |- ca.sfeir.lu-cert.pem
                    /tlscerts
                    |- tlsca.sfeir.lu-cert.pem
                /orderers (1.3)
                    /oSfeir.sfeir.lu
                        /msp
                            /admincerts
                            |- Admin@sfeir.lu-cert.pem
                            /cacerts
                            |- ca.sfeir.lu-cert.pem
                            /keystore
                            |- <private key>
                            /signcerts
                            |- oSfeir.sfeir.lu-cert.pem
                            /tlscacerts
```


(1.4)

```
                                        |- tlsca.sfeir.lu-cert.pem
                                /tls
                                |- ca.crt
                                |- server.crt
                                |- server.key
                        /tlsca
                        |- tlsca.sfeir.lu-cert.pem
                        |- <private key>
                        /users (1.5)
                                /Admin@sfeir.lu
                                        /admincerts
                                        |- Admin@sfeir.lu-cert.pem
                                        /cacerts
                                        |- ca.sfeir.lu-cert.pem
                                        /keystore
                                        |- <private key>
                                        /signcerts
                                        |- oSfeir.sfeir.lu-cert.pem
                                        /tlscacerts
                                        |- tlsca.sfeir.lu-cert.pem
                                /tls
                                |- ca.crt
                                |- server.crt
                                |- server.key
(2) /peerOrganizations
                /peer0.shop.sfeir.lu
                /peer0.warehouse.sfeir.lu
                        /ca (2.1)
                        |- ca.warehouse.sfeir.lu-cert.pem
                        |- <private key>
                        /msp (2.2)
                                /admincerts
                                |- Admin@warehouse .sfeir.lu-cert.pem
                                /cacerts
                                |- ca.warehouse.sfeir.lu-cert.pem
                                /tlscerts
                                |- tlsca.warehouse.sfeir.lu-cert.pem
                        /peers (2.3)
                                /msp
                                        /admincerts
                                        |- Admin@warehouse .sfeir.lu-cert.pem
                                        /cacerts
                                        |- ca.warehouse.sfeir.lu-cert.pem
                                        /keystore ——— SIGN PROCESS
                                        |- <private key>
                                        /signcerts ——— VERIFY PROCESS
                                        |- peer0.warehouse.sfeir.lu-cert.pem
                                        /tlscacerts
                                        |- tlsca.warehouse.sfeir.lu-cert.pem
                                /tls
                                |- ca.crt
                                |- server.crt
                                |- server.key
                        /tlsca (2.4)
                        |- tlsca.sfeir.lu-cert.pem
                        |- <private key>
                        /users (2.5)
                                /Admin@Warehouse.sfeir.lu
```

```
/msp
        /admincerts
        |- Admin@warehouse.sfeir.lu-cert.pem
        /cacerts
        |- ca.warehouse.sfeir.lu-cert.pem
        /keystore
        |- <private key>
        /signcerts
        |- warehouse.sfeir.lu-cert.pem
        /tlscacerts
        |- tlsca.warehouse.sfeir.lu-cert.pem
/tls
|- ca.crt
|- server.crt
|- server.key
```

(1) and (2) – crypto material configuration for each **organization.**
(1.1) and (2.1) - crypto material for the **Root** Certification Authority (**CA**) **of oganization** to deliver certificates for CA intermediaries which participate to BC process.
(1.2) and (2.2) - crypto material for the **Membership Service Provider of organization** in charge to deliver verifiable member identities.
(1.3) and (1.3) - specific crypto material for each membership of the organization issue of root CA, MSP, TLS ...
(1.4) and (2.4) - crypto material for the **Root Certification Authority of organization** to deliver certificates for **TLS transport**.
(1.5) and (2.5) – crypto material for each users of organization (administrator, specific users...)
MSP is installed at different level of the network :



notes : Global configuration will corresponds to 1.1 (2.1), 1.2 (2.2), 1.4 (2.4), 1.5 (2.5).

Each **Organization** requires a unique **root certificate** (ca), that binds peers and orderers.

Transactions and **communications** (tlscert) within Fabric are **signed** by an entity's **private key** (keystore), and then **verified** by means of a **public key** (signcerts used for authenticating).

Some complexe organization needs to certifiate peers on their organization, and need a CA (intermediate) for that.

3. Generate genesis block

a) Define ledger configuration

- Edit file «configtx.yaml », file and check the configuration for expecting organisations, see section as below as below :

```
Organizations:
    - &OrdererOrg
        Name: OrdererOrg
        ID: OSfeirMSP
        MSPDir: crypto-config/ordererOrganizations/sfeir.lu/msp
    - &Org1
        Name: ShopMSP
        ID: ShopMSP
        MSPDir: crypto-config/peerOrganizations/shop.sfeir.lu/msp
        AnchorPeers:
            - Host: peer0.shop.sfeir.lu
              Port: 7051
    - &Org2
        Name: WarehouseMSP
        ID: WarehouseMSP
        MSPDir: crypto-config/peerOrganizations/warehouse.sfeir.lu/msp
        AnchorPeers:
            - Host: peer0.warehouse.sfeir.lu
              Port: 7051
################################################################################
Application: &ApplicationDefaults
    Organizations:
################################################################################
Orderer: &OrdererDefaults
    OrdererType: solo
    Addresses:
        - orderer.sfeir.lu:7050
    BatchTimeout: 2s
    BatchSize:
        MaxMessageCount: 10
        AbsoluteMaxBytes: 99 MB
        PreferredMaxBytes: 512 KB
    Kafka:
        Brokers:
            - 127.0.0.1:9092
    Organizations:
################################################################################
Profiles:
    OrdererGenesis:
        Orderer:
            <<: *OrdererDefaults
            Organizations:
                - *OrdererOrg
        Consortiums:
            SampleConsortium:
                Organizations:
                    - *Org1
                    - *Org2
    OneOrgChannel:
        Consortium: SampleConsortium
        Application:
            <<: *ApplicationDefaults
            Organizations:
                - *Org1
                - *Org2
```

b) Generate first block of ledger

- Execute this command **[1]** to generate first block :

```
[1] #

configtxgen -profile OrdererGenesis  -outputBlock ./config/genesis.block
```

- Check that a new file is generated issue of command **[1].** (on directory ./channel-artifacts)

```
[common/tools/configtxgen] doOutputBlock -> INFO 007 Generating genesis block
[common/tools/configtxgen] doOutputBlock -> INFO 008 Writing genesis block
```

4. Generate channel + configuration

- Execute this command **[1]** :

```
[1] #

configtxgen -profile TwoOrgChannel -outputCreateChannelTx ./config/channel.tx -channelID sfeircn
```

- A new channel « sfeircn » is created.

```
[common/tools/configtxgen] doOutputChannelCreateTx -> INFO 006 Writing new channel tx
```

- Execute this command **[2]** and **[3]** :

```
[2] #

configtxgen -profile TwoOrgChannel -outputAnchorPeersUpdate ./config/ShopMSPanchors.tx
-channelID sfeircn -asOrg ShopMSP

[3] #

configtxgen -profile TwoOrgChannel -outputAnchorPeersUpdate ./config/WarehouseMSPanchors.tx
-channelID sfeircn -asOrg WarehouseMSP
```

- Shop and Warehouse org are added to the channel « sfeircn ».

Command **[2]** or **[3]** results :

```
[common/tools/configtxgen] doOutputAnchorPeersUpdate -> INFO 002 Generating anchor peer update
[common/tools/configtxgen] doOutputAnchorPeersUpdate -> INFO 003 Writing anchor peer update
```

5. Run network

- Run command **[1]** ;

```
[1] #

./init.sh docker-images
```

- Script will download docker hyperledger-fabric images inside your repositories. You can then check on your repositories: (it can get time to fetch images ...)

```
[1] #

docker images


==>
REPOSITORY                    TAG             IMAGE ID         CREATED          SIZE
hyperledger/fabric-tools      1.3.0           7aea1cc899d1     9 days ago       1.51GB
hyperledger/fabric-tools      latest          7aea1cc899d1     9 days ago       1.51GB
hyperledger/fabric-ccenv      1.3.0           8651e7160d88     9 days ago       1.43GB
hyperledger/fabric-ccenv      latest          8651e7160d88     9 days ago       1.43GB
hyperledger/fabric-orderer    1.3.0           b1a1dd788841     9 days ago       152MB
hyperledger/fabric-orderer    latest          b1a1dd788841     9 days ago       152MB
hyperledger/fabric-peer       1.3.0           ef0e7788ead0     9 days ago       159MB
hyperledger/fabric-peer       latest          ef0e7788ead0     9 days ago       159MB
hyperledger/fabric-ca         1.3.0           784b38dab5ba     11 days ago      244MB
hyperledger/fabric-ca         latest          784b38dab5ba     11 days ago      244MB
hyperledger/fabric-zookeeper  0.4.12          bca71b814159     2 weeks ago      1.39GB
hyperledger/fabric-zookeeper  latest          bca71b814159     2 weeks ago      1.39GB
hyperledger/fabric-kafka      0.4.12          58b901c762ea     2 weeks ago      1.4GB
hyperledger/fabric-kafka      latest          58b901c762ea     2 weeks ago      1.4GB
hyperledger/fabric-couchdb    0.4.12          fe8d64d1233c     2 weeks ago      1.45GB
hyperledger/fabric-couchdb    latest          fe8d64d1233c     2 weeks ago      1.45GB
```

- Run command **[2]** ;

```
[2] #

./init.sh replace-pki
```

Notes : edit « docker-sfeir.yaml » to consult docker compose configuration.

```
[3] #

docker-compose -f docker-sfeir.yaml up --remove-orphans -d ca.shop.sfeir.lu
ca.warehouse.sfeir.lu orderer.sfeir.lu peer0.shop.sfeir.lu peer0.warehouse.sfeir.lu
```

- Command **[3]** starts ca(s), orderer, couchdb and peer(s) containers.

Notes : couchdb is used to store ledger metadata data.

```
Starting ca.shop.sfeir.lu
Starting orderer.sfeir.lu
Starting ca.warehouse.sfeir.lu
Starting couchdb
Starting peer0.shop.sfeir.lu
Starting peer0.warehouse.sfeir.lu
```

6. Install and instanciate channel

- Run command **[1]** ;

```
[1] #

docker exec -e "CORE_PEER_LOCALMSPID=ShopMSP" -e
"CORE_PEER_MSPCONFIGPATH=/etc/hyperledger/msp/users/Admin@shop.sfeir.lu/msp"
peer0.shop.sfeir.lu peer channel create -o orderer.sfeir.lu:7050 -c sfeircn -f
/etc/hyperledger/configtx/channel.tx
```

- check results on log :
  « readBlock -> INFO 004 Received block: 0 »

- Run command **[2]** ;

```
[2] #

docker exec -e "CORE_PEER_LOCALMSPID=ShopMSP" -e
"CORE_PEER_MSPCONFIGPATH=/etc/hyperledger/msp/users/Admin@shop.sfeir.lu/msp"
peer0.shop.sfeir.lu peer channel join -b sfeircn.block
```

- check results on log :
  « [channelCmd] executeJoin -> INFO 002 Successfully submitted proposal to join channel »

- Run command **[3]** ;

```
[3] #

docker exec peer0.warehouse.sfeir.lu peer channel fetch 0 sfeircn.block --channelID sfeircn --orderer
orderer.sfeir.lu:7050
```

- check results on log :
  « readBlock -> INFO 002 Received block: 0 »

- Run command **[4]** ;

```
[4] #

docker exec -e "CORE_PEER_LOCALMSPID=WarehouseMSP" -e
"CORE_PEER_MSPCONFIGPATH=/etc/hyperledger/msp/users/Admin@warehouse.sfeir.lu
/msp" peer0.warehouse.sfeir.lu peer channel join -b sfeircn.block
```

- check results on log :
  « [channelCmd] executeJoin -> INFO 002 Successfully submitted proposal to join channel »

7. Install Chaincode

- Run command **[1]** ;

```
[1] #

docker-compose -f docker-sfeir.yaml up -d cli
```

- Run command **[2]** to install the chaincode in channel for peer 1 ;

```
[2] #

docker exec cli peer chaincode install -n sfeircc -v 1.0 -l golang -p
github.com/hyperledger/fabric/examples/chaincode/go
```

- check results on log :

```
2018-10-13 07:09:26.321 UTC [chaincodeCmd] install -> INFO 052 Installed remotely response:<status:200 payload:"OK" >
```

- Run command **[3]** to install the chaincode in channel for peer 2 ;

```
[3] #

docker exec -e "CORE_PEER_ADDRESS=peer0.warehouse.sfeir.lu:7051" -e
"CORE_PEER_LOCALMSPID=WarehouseMSP" -e
"CORE_PEER_MSPCONFIGPATH=/opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/pee
rOrganizations/warehouse.sfeir.lu/users/Admin@warehouse.sfeir.lu/msp" cli peer chaincode
install -n sfeircc -v 1.0 -l golang -p github.com/hyperledger/fabric/examples/chaincode/go
```

- check results on log :

```
2018-10-13 07:09:26.321 UTC [chaincodeCmd] install -> INFO 052 Installed remotely response:<status:200 payload:"OK" >
```

8. Invoke Chaincode

- Run command **[1]** ;

```
[1] #

docker exec cli peer chaincode instantiate -o orderer.sfeir.lu:7050 -C
sfeircn -n sfeircc -l golang -v 1.0 -c '{"Args":["init"]}'
```

```
docker exec cli peer chaincode instantiate -o orderer.sfeir.lu:7050 -C sfeircn -n sfeircc -l golang
-v 1.0 -c '{"Args":["order", "0001", "SHOP_1","SKU002","10000", "1000"]}'


docker exec cli peer chaincode invoke -o orderer.sfeir.lu:7050 -C sfeircn
-n sfeircc -c '{"Args":["read", "0001"]}'


docker exec cli peer chaincode query -C sfeircn -n sfeircc -c '{"Args":
["read", "0001"]}'
```

Notes :

MSP : « Membership Service Provider » : Allows to identify actor inside network, and to provide CA to trust member identity.

Crypto material : « crypto-config.yaml » file ;
→ "OrdererOrgs" - Definition of organizations managing orderer nodes.
- Define a name, and the business domain for an ordererOrgs.
- Use « Specs » for an explicit definition of peer : hostname (+ commonName)
-(or) Use «Template » for quickly create peer sequentially.

→ "PeerOrgs" - Definition of organizations managing peer nodes.