区块链 lab4

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实验目标

自己开发可以在Fabric上运行的链码，并且成功部署在Fabric网络上，并调用各个功能进行测试

实验环境

组织名Peer，通道名bcclass

虽然这个组织Peer中有很多的peer节点，但每个节点安装各自的链码，由节点代表组织为各自安装的链码背书。因为该通道中只有一个组织Peer，所以能够搜集到足够的背书来支持调用链码的交易上链。

实验流程

1. 学习链码的开发，编写链码
2. 打包链码、安装链码、批准链码、实例化链码，在peer节点上完成
3. 调用链码，查看功能是否实现

完成情况

完成了 B 档和 A 档，

B档：在 fabcar 的基础上补充代码，实现了能够体现增删改查功能的链码

A档：实现一个带一定处理逻辑的链码-在前面的基础上实现了对信息的有序查询

实验流程

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实验过程
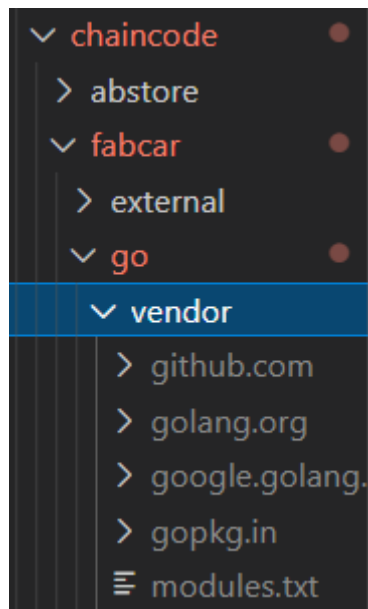
- 在 `chaincode/fabcar/go` 目录下执行如下指令，下载依赖包并存放于vender目录

  ```
  1 GO111MODULE=on go mod vendor
  ```

  为了下载顺利需要修改下载源

  结果如下

- 在 `chaincode` 目录下执行如下代码，将链码打包为 `fabcar.tar.gz`

```
1   peer lifecycle chaincode package fabcar.tar.gz --path
    ../chaincode/fabcar/go/ --lang golang --label fabcar_pqz
```

- 执行如下指令安装链码

```
1   peer lifecycle chaincode install fabcar.tar.gz
```

结果如下

- 查询已经安装的链码信息

可以看到刚才安装的 `fabcar_pqz` 的相关信息

- 根据返回的信息，设置参数，调用下面的命令

```
1   export
    CC_PACKAGE_ID=fabcar_pqz:a01b5e20ad1c964e70c0b0ed1e045e3aefca5482bb0ce3ec
    380f8ccb7e49a287
```

- 执行如下代码，批准链码，命名为 `fabcarpqz`

```
1   peer lifecycle chaincode approveformyorg -o 222.195.70.186:7050 --
    channelID bcclass --name fabcarpqz --version 1.0 --package-id
    $CC_PACKAGE_ID --sequence 1
```

结果如下

```
UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer lifecycle chaincode a
pproveformyorg -o 222.195.70.186:7050 --channelID bcclass --name fabcarpqz --version 1.0 --pack
age-id $CC_PACKAGE_ID --sequence 1
2021-06-18 12:25:15.018 UTC [chaincodeCmd] ClientWait -> INFO 001 txid [09e288b09b2512b04a8ba99
61a5485cd1253bc4b85969f0c237d9b225d499ee5] committed with status (VALID) at node90:10345
```

- 查询批准的链码信息

```
1  peer lifecycle chaincode queryapproved --channelID bcclass -n fabcarpqz
```

结果如下

```
UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer lifecycle chaincode q
ueryapproved --channelID bcclass -n fabcarpqz
Approved chaincode definition for chaincode 'fabcarpqz' on channel 'bcclass':
sequence: 1, version: 1.0, init-required: false, package-id: fabcar_pqz:a01b5e20ad1c964e70c0b0e
d1e045e3aefca5482bb0ce3ec380f8ccb7e49a287, endorsement plugin: escc, validation plugin: vscc
```

- 查询已经批准的组织信息

```
1  peer lifecycle chaincode checkcommitreadiness --channelID bcclass -n
   fabcarpqz --version 1.0 --sequence 1
```

结果如下

```
UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer lifecycle chaincode c
heckcommitreadiness --channelID bcclass -n fabcarpqz --version 1.0 --sequence 1
Chaincode definition for chaincode 'fabcarpqz', version '1.0', sequence '1' on channel 'bcclass
' approval status by org:
Peer: true
```

- 开启链码服务

```
1  peer lifecycle chaincode commit -o 222.195.70.186:7050 --channelID
   bcclass --name fabcarpqz --version 1.0 --sequence 1 --peerAddresses
   222.195.70.190:10345
```

```
UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer lifecycle chaincode c
ommit -o 222.195.70.186:7050 --channelID bcclass --name fabcarpqz --version 1.0 --sequence 1 --
peerAddresses 222.195.70.190:10345
2021-06-18 12:27:30.948 UTC [chaincodeCmd] ClientWait -> INFO 001 txid [e184f1c142086d8075dae8c
0e0f06cb1ec8c56911a05a00f8b4416a0c93d1034] committed with status (VALID) at 222.195.70.190:1034
5
```

- 调用 `initLedger` 初始化数据库

```
1  peer chaincode invoke -o 222.195.70.186:7050 -C bcclass -n fabcarpqz --
   peerAddresses node90:10345 -c '{"function":"initLedger","Args":[]}'
```

结果如下

```
UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer chaincode invoke -o 2
22.195.70.186:7050 -C bcclass -n fabcarpqz --peerAddresses node90:10345 -c '{"function":"initLe
dger","Args":[]}'
2021-06-18 12:27:48.432 UTC [chaincodeCmd] chaincodeInvokeOrQuery -> INFO 001 Chaincode invoke
successful. result: status:200
```

可以看到初始化成功

调用 `queryAllCars` 查询，验证初始化结果

UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer chaincode query -C bc
class -n fabcarpqz -c '{"Args":["queryAllCars"]}'
[{"Key":"CAR0","Record":{"make":"Toyota","model":"Prius","colour":"blue","owner":"Tomoko"}},{"K
ey":"CAR1","Record":{"make":"Ford","model":"Mustang","colour":"red","owner":"Brad"}},{"Key":"CA
R2","Record":{"make":"Hyundai","model":"Tucson","colour":"green","owner":"Jin Soo"}},{"Key":"CA
R3","Record":{"make":"Volkswagen","model":"Passat","colour":"yellow","owner":"Max"}},{"Key":"CA
R4","Record":{"make":"Tesla","model":"S","colour":"black","owner":"Adriana"}},{"Key":"CAR5","Re
cord":{"make":"Peugeot","model":"205","colour":"purple","owner":"Michel"}},{"Key":"CAR6","Recor
d":{"make":"Chery","model":"S22L","colour":"white","owner":"Aarav"}},{"Key":"CAR7","Record":{"m
ake":"Fiat","model":"Punto","colour":"violet","owner":"Pari"}},{"Key":"CAR8","Record":{"make":"
Tata","model":"Nano","colour":"indigo","owner":"Valeria"}},{"Key":"CAR9","Record":{"make":"Hold
en","model":"Barina","colour":"brown","owner":"Shotaro"}}]
UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer chaincode invoke 222.
195.70.186:7050 -C bcclass -n fabcarpqz --peerAddresses node90:10345 -c '{"function":"CreateCar
","Args":["CAR10","Pei","PQZ","Red","pqz"]}'
2021-06-18 12:29:13.945 UTC [chaincodeCmd] InitCmdFactory -> INFO 001 Retrieved channel (bcclas
s) orderer endpoint: node86:7050
2021-06-18 12:29:13.954 UTC [chaincodeCmd] chaincodeInvokeOrQuery -> INFO 002 Chaincode invoke
successful. result: status:200

- 增加一个数据 CAR10

```
1  peer chaincode invoke 222.195.70.186:7050 -C bcclass -n fabcarpqz --
   peerAddresses node90:10345 -c '{"function":"CreateCar","Args":
   ["CAR10","Pei","PQZ","Red","pqz"]}'
```

增加并查看结果

UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer chaincode invoke 222.
195.70.186:7050 -C bcclass -n fabcarpqz --peerAddresses node90:10345 -c '{"function":"CreateCar
","Args":["CAR10","Pei","PQZ","Red","pqz"]}'
2021-06-18 12:29:13.945 UTC [chaincodeCmd] InitCmdFactory -> INFO 001 Retrieved channel (bcclas
s) orderer endpoint: node86:7050
2021-06-18 12:29:13.954 UTC [chaincodeCmd] chaincodeInvokeOrQuery -> INFO 002 Chaincode invoke
successful. result: status:200
UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer chaincode query -C bc
class -n fabcarpqz -c '{"Args":["queryAllCars"]}'
[{"Key":"CAR0","Record":{"make":"Toyota","model":"Prius","colour":"blue","owner":"Tomoko"}},{"K
ey":"CAR1","Record":{"make":"Ford","model":"Mustang","colour":"red","owner":"Brad"}},{"Key":"CA
10","Record":{"make":"Pei","model":"PQZ","colour":"Red","owner":"pqz"}},{"Key":"CAR2","Record"
:{"make":"Hyundai","model":"Tucson","colour":"green","owner":"Jin Soo"}},{"Key":"CAR3","Record"
:{"make":"Volkswagen","model":"Passat","colour":"yellow","owner":"Max"}},{"Key":"CAR4","Record"
:{"make":"Tesla","model":"S","colour":"black","owner":"Adriana"}},{"Key":"CAR5","Record":{"make
":"Peugeot","model":"205","colour":"purple","owner":"Michel"}},{"Key":"CAR6","Record":{"make":"
Chery","model":"S22L","colour":"white","owner":"Aarav"}},{"Key":"CAR7","Record":{"make":"Fiat",
"model":"Punto","colour":"violet","owner":"Pari"}},{"Key":"CAR8","Record":{"make":"Tata","model
":"Nano","colour":"indigo","owner":"Valeria"}},{"Key":"CAR9","Record":{"make":"Holden","model":
"Barina","colour":"brown","owner":"Shotaro"}}]

可以看到数据添加成功

- 删除一个数据

```
1  peer chaincode invoke 222.195.70.186:7050 -C bcclass -n fabcarpqz --
   peerAddresses node90:10345 -c '{"function":"DeleteCar","Args":["CAR9"]}'
```

删除并查看结果

UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer chaincode invoke 222.
195.70.186:7050 -C bcclass -n fabcarpqz --peerAddresses node90:10345 -c '{"function":"DeleteCar
","Args":["CAR9"]}'
2021-06-18 12:30:34.417 UTC [chaincodeCmd] InitCmdFactory -> INFO 001 Retrieved channel (bcclas
s) orderer endpoint: node86:7050
2021-06-18 12:30:34.449 UTC [chaincodeCmd] chaincodeInvokeOrQuery -> INFO 002 Chaincode invoke
successful. result: status:200
UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer chaincode query -C bc
class -n fabcarpqz -c '{"Args":["queryAllCars"]}'
[{"Key":"CAR0","Record":{"make":"Toyota","model":"Prius","colour":"blue","owner":"Tomoko"}},{"K
ey":"CAR1","Record":{"make":"Ford","model":"Mustang","colour":"red","owner":"Brad"}},{"Key":"CA
R10","Record":{"make":"Pei","model":"PQZ","colour":"Red","owner":"pqz"}},{"Key":"CAR2","Record"
:{"make":"Hyundai","model":"Tucson","colour":"green","owner":"Jin Soo"}},{"Key":"CAR3","Record"
:{"make":"Volkswagen","model":"Passat","colour":"yellow","owner":"Max"}},{"Key":"CAR4","Record"
:{"make":"Tesla","model":"S","colour":"black","owner":"Adriana"}},{"Key":"CAR5","Record":{"make
":"Peugeot","model":"205","colour":"purple","owner":"Michel"}},{"Key":"CAR6","Record":{"make":"
Chery","model":"S22L","colour":"white","owner":"Aarav"}},{"Key":"CAR7","Record":{"make":"Fiat",
"model":"Punto","colour":"violet","owner":"Pari"}},{"Key":"CAR8","Record":{"make":"Tata","model
":"Nano","colour":"indigo","owner":"Valeria"}}]
UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer chaincode invoke 222.
195.70.186:7050 -C bcclass -n fabcarpqz --peerAddresses node90:10345 -c '{"function":"ChangeCar
Owner","Args":["CAR1","djl"]}'
2021-06-18 12:32:33.413 UTC [chaincodeCmd] InitCmdFactory -> INFO 001 Retrieved channel (bcclas
s) orderer endpoint: node86:7050
2021-06-18 12:32:33.420 UTC [chaincodeCmd] chaincodeInvokeOrQuery -> INFO 002 Chaincode invoke
successful. result: status:200

可以看到 CAR9 对应的信息消失了，说明删除成功

- 修改 CAR0 对应的数据

```
1  peer chaincode invoke 222.195.70.186:7050 -C bcclass -n fabcarpqz --
   peerAddresses node90:10345 -c '{"function":"UpdateCar","Args":
   ["CAR0","123", "123", "123","123"]}'
```

修改并查看结果

UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer chaincode invoke 222.
195.70.186:7050 -C bcclass -n fabcarpqz --peerAddresses node90:10345 -c '{"function":"UpdateCar
","Args":["CAR0","123", "123", "123","123"]}'
2021-06-18 12:35:50.399 UTC [chaincodeCmd] InitCmdFactory -> INFO 001 Retrieved channel (bcclas
s) orderer endpoint: node86:7050
2021-06-18 12:35:50.408 UTC [chaincodeCmd] chaincodeInvokeOrQuery -> INFO 002 Chaincode invoke
successful. result: status:200
UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer chaincode query -C bc
class -n fabcarpqz -c '{"Args":["queryAllCars"]}'
[{"Key":"CAR0","Record":{"make":"123","model":"123","colour":"123","owner":"123"}},{"Key":"CAR1
","Record":{"make":"Ford","model":"Mustang","colour":"red","owner":"pqz"}},{"Key":"CAR10","Reco
rd":{"make":"Pei","model":"PQZ","colour":"Red","owner":"pqz"}},{"Key":"CAR2","Record":{"make":"
Hyundai","model":"Tucson","colour":"green","owner":"Jin Soo"}},{"Key":"CAR3","Record":{"make":"
Volkswagen","model":"Passat","colour":"yellow","owner":"Max"}},{"Key":"CAR4","Record":{"make":"
Tesla","model":"S","colour":"black","owner":"Adriana"}},{"Key":"CAR5","Record":{"make":"Peugeot
","model":"205","colour":"purple","owner":"Michel"}},{"Key":"CAR6","Record":{"make":"Chery","mo
del":"S22L","colour":"white","owner":"Aarav"}},{"Key":"CAR7","Record":{"make":"Fiat","model":"P
unto","colour":"violet","owner":"Pari"}},{"Key":"CAR8","Record":{"make":"Tata","model":"Nano","
colour":"indigo","owner":"Valeria"}}]

可以看到 CAR0 对应的数据被成功修改

- 查询 CAR0 对应的数据

```
1  peer chaincode invoke 222.195.70.186:7050 -C bcclass -n fabcarpqz --
   peerAddresses node90:10345 -c '{"function":"QueryCar","Args":["CAR0"]}'
```

结果如下

UserPB18111793@block:~/blockchain-lab/lab3/fabric-samples/chaincode$ peer chaincode invoke 222.
195.70.186:7050 -C bcclass -n fabcarpqz --peerAddresses node90:10345 -c '{"function":"QueryCar"
,"Args":["CAR0"]}'
2021-06-18 13:21:52.628 UTC [chaincodeCmd] InitCmdFactory -> INFO 001 Retrieved channel (bcclas
s) orderer endpoint: node86:7050
2021-06-18 13:21:52.637 UTC [chaincodeCmd] chaincodeInvokeOrQuery -> INFO 002 Chaincode invoke
successful. result: status:200 payload:"{\"make\":\"123\",\"model\":\"123\",\"colour\":\"123\",
\"owner\":\"123\"}"

- 有序查询，主要是按照 carName 的字典序进行排序，输出排序后的查询结果（先增加了一个 CAR00，再进行如下查询）

```
1  peer chaincode query -C bcclass -n fabcarpqz -c '{"Args":
   ["QuerySortedCars"]}'
```

结果如下

可以看到查询结果按照 key 的字典序进行了排列

- 需要注意：**query和invoke**的区别
  - query 不会提交到排序节点也不会上链，因为是读交易，没有更改状态。
  - invoke 会进行交易的完整流程，包括背书、排序和验证上链。

  这从上面的截图中也可以看出来

实验总结

通过本次实验，我对开发和部署链码的过程有了更加深入的理解。我首先按照助教的提示成功部署了官方网站上给出的示例 fabcar。接着我对 fabcar 进行了修改，实现了能够体现增删改查功能的链码，并实现一个带一定处理逻辑的链码-在前面的基础上实现了对信息的有序查询。通过这些，我对 fabric 的整体运行流程、链码的部署过程等都有了更加深刻的体会，同时编写链码也让我对 go 语言的使用更加得心应手，收获颇丰。