

Blockchain

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Agenda

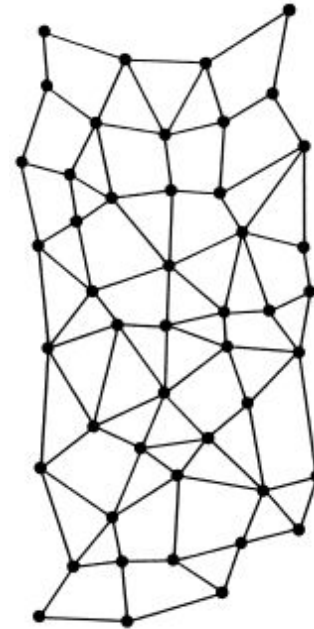
- ❑ Blockchain
 - ❑ Definição
 - ❑ Resumos criptográficos
 - ❑ Assinaturas digitais
 - ❑ Algoritmos de consenso
- ❑ Blockchain: pública x privada
 - ❑ Ethereum
 - ❑ Hyperledger Fabric
- ❑ Aplicação
- ❑ Considerações finais



O que é Blockchain?

Definição

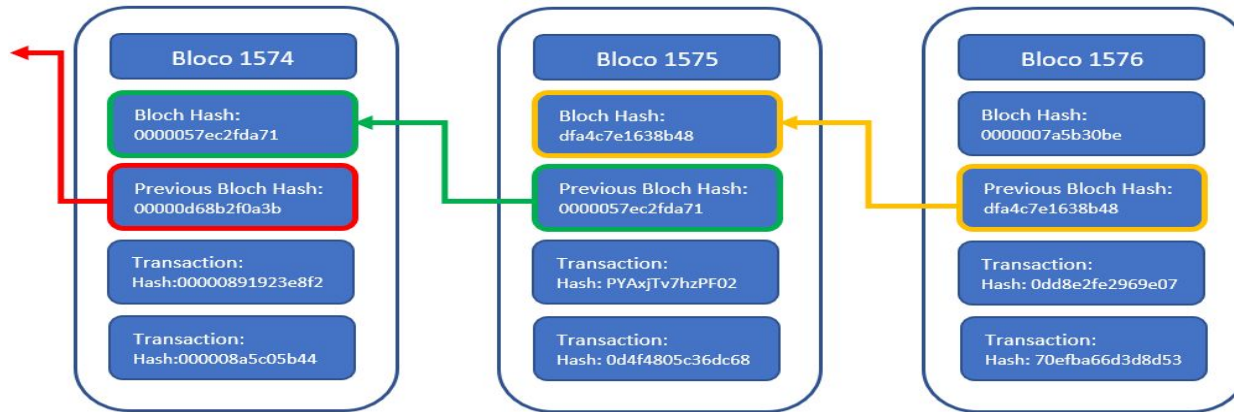
- ❑ Blockchain é uma cadeia de blocos, que faz parte de um sistema de registro coletivo
- ❑ Banco de dados Distribuído e descentralizado





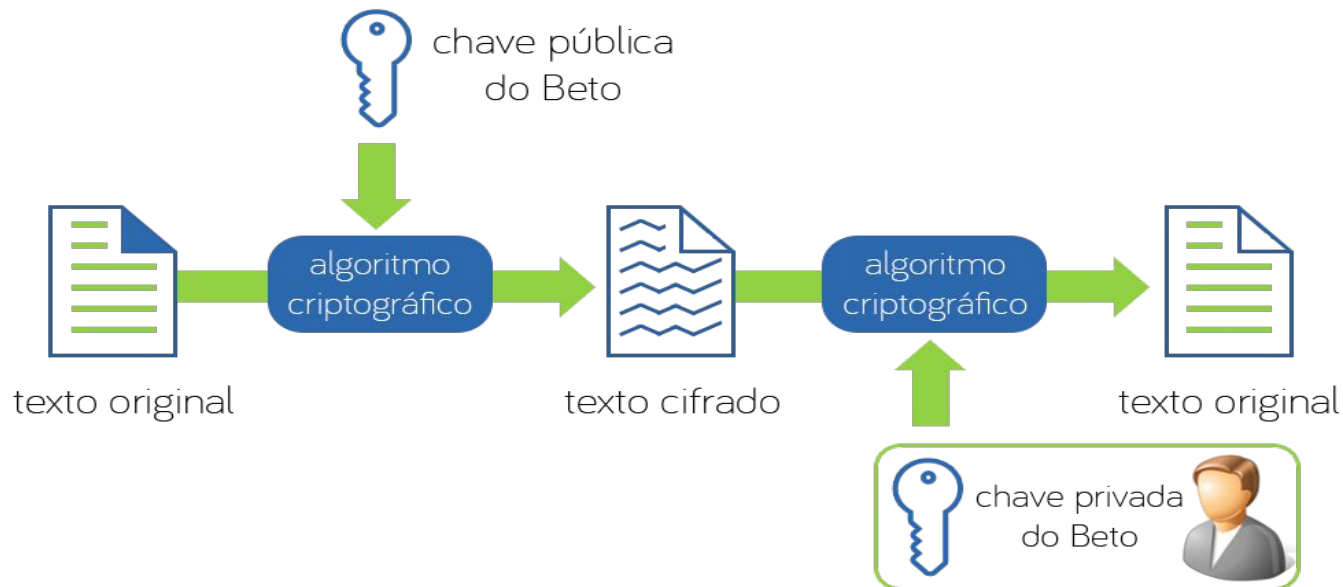
Resumos criptográficos

- ❑ Resistência à colisão
- ❑ Ocultação



Assinaturas digitais

- ❑ Chave pública e privada
- ❑ Certificados digitais
 - ❑ IPC: Infraestrutura de Chave Pública





Algoritmos de consenso

- ❑ Algoritmos de consenso são um processo de tomada de decisão para um grupo.
- ❑ PoW - Proof-of-Work
- ❑ PoS - Proof-of-Stake



Blockchain: Pública x Privada



Blockchain Pública

- ❑ Qualquer entidade pode integrar a rede, mantendo a anonimidade em sua participação
- ❑ Única propriedade passível de confiança é a imutabilidade do estado da Blockchain
- ❑ Utilizam um incentivo econômico para lidar com a falta de confiança e o custo de participação
- ❑ Promove transações transparentes
- ❑ Bitcoin, Ethereum



Blockchain Privada

- ❑ Participação na rede sujeita a um convite
- ❑ Todos os participantes são conhecidos, identificados e frequentemente controlados
- ❑ Operam sobre um certo modelo de governança
- ❑ Risco de ações maliciosas é reduzido neste tipo de blockchain
- ❑ Ideal para interesses privados e corporativos
- ❑ Hyperledger Fabric



Contratos inteligentes

- ❑ *“Um protocolo de transação informatizado que executa os termos de um contrato” - Nick Szabo*
- ❑ Representa a lógica de negócio da aplicação que utiliza blockchain
- ❑ Funciona como uma aplicação distribuída confiável
- ❑ Recebe sua confiabilidade e segurança da blockchain e do consenso entre os pares
- ❑ Operam sobre uma determinada arquitetura (order-execute)
- ❑ Necessário lidar com o determinismo das operações



Ethereum

- ❑ Implementação de blockchain pública
- ❑ Plataforma de desenvolvimento de aplicações descentralizadas
- ❑ Contratos inteligentes são denominados “Dapps”
- ❑ Possui sua moeda digital: Ether
- ❑ Ações que demandam poder computacional na plataforma são recompensadas em Ether



Hyperledger Fabric

- ❑ Implementação de blockchain privado
- ❑ Plataforma de desenvolvimento de aplicações descentralizadas
- ❑ Contratos inteligentes são denominados “chaincode”
- ❑ Primeira plataforma do gênero a suportar linguagens de propósito geral (Java, Go, Node.js)
- ❑ Possui arquitetura altamente modular e configurável
- ❑ Não utiliza criptomoeda



Aplicação



Hyperledger Fabric Network

- ❑ Construção de uma rede utilizando Hyperledger Fabric
- ❑ Rede formada por duas organizações, as quais possuem dois pares cada.
- ❑ Formação do canal através da instalação do chaincode
- ❑ Operações básicas entre os pares



1º passo: Material criptográfico

- ❑ Geração de material criptográfico para as entidades da rede
- ❑ Possibilita a autenticação para a comunicação e a realização de transações entre as entidades
- ❑ Certificados relacionados entre as organizações e seus respectivos pares

1º passo: Material criptográfico



```
first-network : bash — Konsole
Arquivo  Editar  Exibir  Favoritos  Configurações  Ajuda
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$ ../bin/cryptogen generate --config=./crypto-config.yaml
org1.example.com
org2.example.com
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$ █
```



2º passo: Configuração de transações

- ❑ Geração de arquivos de configuração para transações
- ❑ Arquivos gerados:
 - ❑ Genesis Block
 - ❑ configuration transaction
 - ❑ Anchor peer transactions



2º passo: Configuração de transações

```
first-network : bash — Konsole
Arquivo  Editar  Exibir  Favoritos  Configurações  Ajuda
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$ export FABRIC_CFG_PATH=$PWD
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$ ../bin/configtxgen -profile TwoOrgsOrdererGenesis -chann
elID byfn-sys-channel -outputBlock ./channel-artifacts/genesis.block
2019-12-06 10:53:25.018 -03 [common.tools.configtxgen] main -> INFO 001 Loading configuration
2019-12-06 10:53:25.132 -03 [common.tools.configtxgen.localconfig] completeInitialization -> INFO 002 orderer type:
solo
2019-12-06 10:53:25.132 -03 [common.tools.configtxgen.localconfig] Load -> INFO 003 Loaded configuration: /home/taua
n/fabric-samples/first-network/configtx.yaml
2019-12-06 10:53:25.229 -03 [common.tools.configtxgen.localconfig] completeInitialization -> INFO 004 orderer type:
solo
2019-12-06 10:53:25.229 -03 [common.tools.configtxgen.localconfig] LoadTopLevel -> INFO 005 Loaded configuration: /h
ome/tauan/fabric-samples/first-network/configtx.yaml
2019-12-06 10:53:25.231 -03 [common.tools.configtxgen] doOutputBlock -> INFO 006 Generating genesis block
2019-12-06 10:53:25.231 -03 [common.tools.configtxgen] doOutputBlock -> INFO 007 Writing genesis block
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$ █
```

first-network : bash



2º passo: Configuração de transações

```
first-network : bash — Konsole
Arquivo  Editar  Exibir  Favoritos  Configurações  Ajuda
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$ export CHANNEL_NAME=mychannel && ../bin/configtxgen -pro
file TwoOrgsChannel -outputCreateChannelTx ./channel-artifacts/channel.tx -channelID $CHANNEL_NAME
2019-12-06 11:00:55.295 -03 [common.tools.configtxgen] main -> INFO 001 Loading configuration
2019-12-06 11:00:55.392 -03 [common.tools.configtxgen.localconfig] Load -> INFO 002 Loaded configuration: /home/tauan
/fabric-samples/first-network/configtx.yaml
2019-12-06 11:00:55.488 -03 [common.tools.configtxgen.localconfig] completeInitialization -> INFO 003 orderer type: s
olo
2019-12-06 11:00:55.488 -03 [common.tools.configtxgen.localconfig] LoadTopLevel -> INFO 004 Loaded configuration: /ho
me/tauan/fabric-samples/first-network/configtx.yaml
2019-12-06 11:00:55.488 -03 [common.tools.configtxgen] doOutputChannelCreateTx -> INFO 005 Generating new channel con
figtx
2019-12-06 11:00:55.490 -03 [common.tools.configtxgen] doOutputChannelCreateTx -> INFO 006 Writing new channel tx
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$ ../bin/configtxgen -profile TwoOrgsChannel -outputAnchorP
eersUpdate ./channel-artifacts/Org1MSPanchors.tx -channelID $CHANNEL_NAME -asOrg Org1MSP
2019-12-06 11:03:26.880 -03 [common.tools.configtxgen] main -> INFO 001 Loading configuration
2019-12-06 11:03:26.977 -03 [common.tools.configtxgen.localconfig] Load -> INFO 002 Loaded configuration: /home/tauan
/fabric-samples/first-network/configtx.yaml
2019-12-06 11:03:27.073 -03 [common.tools.configtxgen.localconfig] completeInitialization -> INFO 003 orderer type: s
olo
2019-12-06 11:03:27.074 -03 [common.tools.configtxgen.localconfig] LoadTopLevel -> INFO 004 Loaded configuration: /ho
me/tauan/fabric-samples/first-network/configtx.yaml
2019-12-06 11:03:27.074 -03 [common.tools.configtxgen] doOutputAnchorPeersUpdate -> INFO 005 Generating anchor peer u
pdate
2019-12-06 11:03:27.074 -03 [common.tools.configtxgen] doOutputAnchorPeersUpdate -> INFO 006 Writing anchor peer upda
te
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$ ../bin/configtxgen -profile TwoOrgsChannel -outputAnchorP
eersUpdate ./channel-artifacts/Org2MSPanchors.tx -channelID $CHANNEL_NAME -asOrg Org2MSP
2019-12-06 11:03:45.390 -03 [common.tools.configtxgen] main -> INFO 001 Loading configuration
2019-12-06 11:03:45.487 -03 [common.tools.configtxgen.localconfig] Load -> INFO 002 Loaded configuration: /home/tauan
/fabric-samples/first-network/configtx.yaml
```




2º passo: Configuração de transações

```
first-network : bash — Konsole
Arquivo  Editar  Exibir  Favoritos  Configurações  Ajuda
2019-12-06 11:00:55.488 -03 [common.tools.configtxgen] doOutputChannelCreateTx -> INFO 005 Generating new channel con
figtx
2019-12-06 11:00:55.490 -03 [common.tools.configtxgen] doOutputChannelCreateTx -> INFO 006 Writing new channel tx
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$ ../bin/configtxgen -profile TwoOrgsChannel -outputAnchorP
eersUpdate ./channel-artifacts/Org1MSPanchors.tx -channelID $CHANNEL_NAME -asOrg Org1MSP
2019-12-06 11:03:26.880 -03 [common.tools.configtxgen] main -> INFO 001 Loading configuration
2019-12-06 11:03:26.977 -03 [common.tools.configtxgen.localconfig] Load -> INFO 002 Loaded configuration: /home/tauan
/fabric-samples/first-network/configtx.yaml
2019-12-06 11:03:27.073 -03 [common.tools.configtxgen.localconfig] completeInitialization -> INFO 003 orderer type: s
olo
2019-12-06 11:03:27.074 -03 [common.tools.configtxgen.localconfig] LoadTopLevel -> INFO 004 Loaded configuration: /ho
me/tauan/fabric-samples/first-network/configtx.yaml
2019-12-06 11:03:27.074 -03 [common.tools.configtxgen] doOutputAnchorPeersUpdate -> INFO 005 Generating anchor peer u
pdate
2019-12-06 11:03:27.074 -03 [common.tools.configtxgen] doOutputAnchorPeersUpdate -> INFO 006 Writing anchor peer upda
te
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$ ../bin/configtxgen -profile TwoOrgsChannel -outputAnchorP
eersUpdate ./channel-artifacts/Org2MSPanchors.tx -channelID $CHANNEL_NAME -asOrg Org2MSP
2019-12-06 11:03:45.390 -03 [common.tools.configtxgen] main -> INFO 001 Loading configuration
2019-12-06 11:03:45.487 -03 [common.tools.configtxgen.localconfig] Load -> INFO 002 Loaded configuration: /home/tauan
/fabric-samples/first-network/configtx.yaml
2019-12-06 11:03:45.585 -03 [common.tools.configtxgen.localconfig] completeInitialization -> INFO 003 orderer type: s
olo
2019-12-06 11:03:45.585 -03 [common.tools.configtxgen.localconfig] LoadTopLevel -> INFO 004 Loaded configuration: /ho
me/tauan/fabric-samples/first-network/configtx.yaml
2019-12-06 11:03:45.585 -03 [common.tools.configtxgen] doOutputAnchorPeersUpdate -> INFO 005 Generating anchor peer u
pdate
2019-12-06 11:03:45.586 -03 [common.tools.configtxgen] doOutputAnchorPeersUpdate -> INFO 006 Writing anchor peer upda
te
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$ █
```



3º passo: Iniciar a rede

- ❑ Utilizaremos o Docker-compose para iniciar as imagens previamente estabelecidas para iniciar a rede
- ❑ Operações serão iniciadas a partir do bloco genesis criado

3º passo: Iniciar a rede



```
first-network : bash — Konsole
Arquivo  Editar  Exibir  Favoritos  Configurações  Ajuda
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$ sudo docker-compose -f docker-compose-cli.yaml up -d
[sudo] senha para tauan:
Creating network "net_byfn" with the default driver
Creating volume "net_orderer.example.com" with default driver
Creating volume "net_peer0.org1.example.com" with default driver
Creating volume "net_peer1.org1.example.com" with default driver
Creating volume "net_peer0.org2.example.com" with default driver
Creating volume "net_peer1.org2.example.com" with default driver
Creating orderer.example.com    ... done
Creating peer1.org2.example.com ... done
Creating peer1.org1.example.com ... done
Creating peer0.org1.example.com ... done
Creating peer0.org2.example.com ... done
Creating cli                     ... done
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$
```



4º passo: Criando o canal

- ❑ Nesta etapa iremos utilizar os arquivos de configuração de transação de canal para estabelecer a criação do canal e a inclusão dos pares componentes de cada organização no canal



4º passo: Criando o canal

```
first-network : sudo — Konsole
Arquivo  Editar  Exibir  Favoritos  Configurações  Ajuda
tauan@tauan-Aspire-A515-51G:~/fabric-samples/first-network$ sudo docker exec -it cli bash
[sudo] senha para tauan:
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_MSPCONFIGPATH=/opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org1.example.com/users/Admin@org1.example.com/msp
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_ADDRESS=peer0.org1.example.com:7051
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_LOCALMSPID="Org1MSP"
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_TLS_ROOTCERT_FILE=/opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org1.example.com/peers/peer0.org1.example.com/tls/ca.crt
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# export CHANNEL_NAME=mychannel
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# peer channel create -o orderer.example.com:7050 -c $CHANNEL_NAME -f ./channel-artifacts/channel.tx --tls --cafile /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/ordererOrganizations/example.com/orderers/orderer.example.com/msp/tlscacerts/tlsca.example.com-cert.pem
2019-12-06 15:33:43.851 UTC [channelCmd] InitCmdFactory -> INFO 001 Endorser and orderer connections initialized
2019-12-06 15:33:44.281 UTC [cli.common] readBlock -> INFO 002 Received block: 0
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# █
```

first-network : sudo



4º passo: Criando o canal

```
first-network : sudo — Konsole
Arquivo  Editar  Exibir  Favoritos  Configurações  Ajuda
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# peer channel join -b mychannel.block
2019-12-06 15:36:17.994 UTC [channelCmd] InitCmdFactory -> INFO 001 Endorser and orderer connections initialized
2019-12-06 15:36:18.821 UTC [channelCmd] executeJoin -> INFO 002 Successfully submitted proposal to join channel
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_MSPCONFIGPATH=/opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org2.example.com/users/Admin@org2.example.com/msp CORE_PEER_ADDRESS=peer0.org2.example.com:9051 CORE_PEER_LOCALMSPID="Org2MSP" CORE_PEER_TLS_ROOTCERT_FILE=/opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org2.example.com/peers/peer0.org2.example.com/tls/ca.crt peer channel join -b mychannel.block
2019-12-06 15:38:08.930 UTC [channelCmd] InitCmdFactory -> INFO 001 Endorser and orderer connections initialized
2019-12-06 15:38:09.745 UTC [channelCmd] executeJoin -> INFO 002 Successfully submitted proposal to join channel
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# █
```

first-network : sudo



5º passo: Definindo pares âncoras

- ❑ Nesta etapa iremos atualizar o canal para definir os pares âncoras de cada organização
- ❑ Estes pares serão peer0 de ambas as organizações (Org1 e Org2)



5º passo: Definindo pares âncoras

```
first-network : sudo — Konsole
Arquivo  Editar  Exibir  Favoritos  Configurações  Ajuda
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# peer channel update -o orderer.example.com:7050
-c $CHANNEL_NAME -f ./channel-artifacts/Org1MSPanchors.tx --tls --cafile /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/ordererOrganizations/example.com/orderers/orderer.example.com/msp/tlscacerts/tlsca.example.com-cert.pem
2019-12-06 15:49:03.161 UTC [channelCmd] InitCmdFactory -> INFO 001 Endorser and orderer connections initialized
2019-12-06 15:49:03.180 UTC [channelCmd] update -> INFO 002 Successfully submitted channel update
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_MSPCONFIGPATH=/opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org2.example.com/users/Admin@org2.example.com/msp CORE_PEER_ADDRESS=peer0.org2.example.com:9051 CORE_PEER_LOCALMSPID="Org2MSP" CORE_PEER_TLS_ROOTCERT_FILE=/opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org2.example.com/peers/peer0.org2.example.com/tls/ca.crt peer channel update -o orderer.example.com:7050 -c $CHANNEL_NAME -f ./channel-artifacts/Org2MSPanchors.tx --tls --cafile /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/ordererOrganizations/example.com/orderers/orderer.example.com/msp/tlscacerts/tlsca.example.com-cert.pem
2019-12-06 15:49:23.711 UTC [channelCmd] InitCmdFactory -> INFO 001 Endorser and orderer connections initialized
2019-12-06 15:49:23.721 UTC [channelCmd] update -> INFO 002 Successfully submitted channel update
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# █
```

first-network : sudo



6º passo: Instalação do chaincode

- ❑ Iremos utilizar um chaincode já existente
- ❑ O processo de instalação é realizado primeiro nos pares, então o chaincode é instanciado no canal



6º passo: Instalação do chaincode

```
first-network : sudo — Konsole
Arquivo  Editar  Exibir  Favoritos  Configurações  Ajuda
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# peer chaincode install -n mycc -v 1.0 -p github.com/chaincode/chaincode_example02/go/
2019-12-06 15:56:26.775 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 001 Using default escc
2019-12-06 15:56:26.775 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 002 Using default vscc
2019-12-06 15:56:28.803 UTC [chaincodeCmd] install -> INFO 003 Installed remotely response:<status:200 payload:"OK" >

root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_MSPCONFIGPATH=/opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org2.example.com/users/Admin@org2.example.com/msp
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_ADDRESS=peer0.org2.example.com:9051
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_LOCALMSPID="Org2MSP"
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_TLS_ROOTCERT_FILE=/opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org2.example.com/peers/peer0.org2.example.com/tls/ca.crt
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# peer chaincode install -n mycc -v 1.0 -p github.com/chaincode/chaincode_example02/go/
2019-12-06 15:56:59.086 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 001 Using default escc
2019-12-06 15:56:59.086 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 002 Using default vscc
2019-12-06 15:56:59.332 UTC [chaincodeCmd] install -> INFO 003 Installed remotely response:<status:200 payload:"OK" >

root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# █
```

first-network : sudo



6º passo: Instalação do chaincode

```
first-network : sudo — Konsole
Arquivo  Editar  Exibir  Favoritos  Configurações  Ajuda
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# peer chaincode instantiate -o orderer.example.com:7050 --tls --cafile /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/ordererOrganizations/example.com/orderers/orderer.example.com/msp/tlscacerts/tlsca.example.com-cert.pem -C $CHANNEL_NAME -n mycc -v 1.0 -c '{"Args":["init","a","100","b","200"]}' -P "AND ('Org1MSP.peer','Org2MSP.peer')"
2019-12-06 15:58:37.973 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 001 Using default escc
2019-12-06 15:58:37.973 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 002 Using default vscc
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer#
```



Operações no canal

- ❑ Iremos demonstrar algumas operações no canal para verificar a corretude de estabelecimento do mesmo
- ❑ Consultas e transferências baseadas no valores 'a' e 'b' instanciados pelo chaincode no canal



Consultas e transferência

```
first-network : sudo — Konsole
Arquivo  Editar  Exibir  Favoritos  Configurações  Ajuda
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# peer chaincode query -C $CHANNEL_NAME -n mycc -c '{"Args":["query","a"]}'
100
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# peer chaincode invoke -o orderer.example.com:7050 --tls true --cafile /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/ordererOrganizations/example.com/orderers/orderer.example.com/msp/tlscacerts/tlsca.example.com-cert.pem -C $CHANNEL_NAME -n mycc --peerAddresses peer0.org1.example.com:7051 --tlsRootCertFiles /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org1.example.com/peers/peer0.org1.example.com/tls/ca.crt --peerAddresses peer0.org2.example.com:9051 --tlsRootCertFiles /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org2.example.com/peers/peer0.org2.example.com/tls/ca.crt -c '{"Args":["invoke","a","b","10"]}'
2019-12-06 16:05:36.259 UTC [chaincodeCmd] chaincodeInvokeOrQuery -> INFO 001 Chaincode invoke successful. result: status:200
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# peer chaincode query -C $CHANNEL_NAME -n mycc -c '{"Args":["query","a"]}'
90
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer#
```



Instalação do chaincode em um novo par

```
first-network : sudo — Konsole
Arquivo  Editar  Exibir  Favoritos  Configurações  Ajuda

root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_MSPCONFIGPATH=/opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org2.example.com/users/Admin@org2.example.com/msp
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_ADDRESS=peer1.org2.example.com:10051
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_LOCALMSPID="Org2MSP"
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_TLS_ROOTCERT_FILE=/opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org2.example.com/peers/peer1.org2.example.com/tls/ca.crt
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# peer chaincode install -n mycc -v 1.0 -p github.com/chaincode/chaincode_example02/go/
2019-12-06 16:15:55.898 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 001 Using default escc
2019-12-06 16:15:55.898 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 002 Using default vscc
2019-12-06 16:15:56.113 UTC [chaincodeCmd] install -> INFO 003 Installed remotely response:<status:200 payload:"OK" >

root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# CORE_PEER_MSPCONFIGPATH=/opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org2.example.com/users/Admin@org2.example.com/msp CORE_PEER_ADDRESS=peer1.org2.example.com:10051 CORE_PEER_LOCALMSPID="Org2MSP" CORE_PEER_TLS_ROOTCERT_FILE=/opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/org2.example.com/peers/peer1.org2.example.com/tls/ca.crt peer channel join -b mychannel.block
2019-12-06 16:16:12.433 UTC [channelCmd] InitCmdFactory -> INFO 001 Endorser and orderer connections initialized
2019-12-06 16:16:13.275 UTC [channelCmd] executeJoin -> INFO 002 Successfully submitted proposal to join channel
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# peer chaincode query -C $CHANNEL_NAME -n mycc -c '{"Args":["query","a"]}'
Error: endorsement failure during query. response: status:500 message:"make sure the chaincode mycc has been successfully instantiated and try again: chaincode mycc not found"
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# peer chaincode query -C $CHANNEL_NAME -n mycc -c '{"Args":["query","a"]}'
90
root@2092ef85325f:/opt/gopath/src/github.com/hyperledger/fabric/peer# █
```



Considerações finais

- ❑ Esta aplicação mostra o funcionamento básico do hyperledger fabric, relacionando seus artefatos e softwares adicionais (docker)
- ❑ Hyperledger fabric possui ferramentas para serviços de ordenação (Raft, Kafka) e persistência de dados (CouchDB)
- ❑ Esta plataforma de desenvolvimento possibilita uma diversidade de aplicações com os benefícios do blockchain e a praticidade proposta no estabelecimento da rede.



| **Obrigado!**