LAB7: Implementation of Basic commands in Hyperledger

Aim: To understand the fundamentals of Hyperledger Fabric and learn basic commands for opening and closing a network in Hyperledger. This includes learning how to start and stop a network using simple commands.

Pre-requisites: Git, IDE, Docker Desktop.

Introduction:

Hyperledger is an open-source blockchain platform that aims to provide enterprise-grade distributed ledger technology for building permissioned networks. It is a global collaboration hosted by The Linux Foundation, including leaders in finance, banking, IoT, supply chain, and technology.

Hyperledger Fabric is one of the frameworks within the Hyperledger project, designed for developing enterprise blockchain solutions. It allows for the creation of permissioned blockchain networks that support smart contracts, digital assets, and more.

In a Hyperledger Fabric network, there are different types of nodes, including peers, orderers, and clients. Peers are responsible for storing the ledger and executing chaincode (smart contracts). Orderers maintain the order of transactions and create blocks. Clients interact with the network through peers to invoke chaincode.

The network is permissioned, meaning that only authorized participants can join and participate in the network. Transactions are validated through a consensus mechanism agreed upon by network participants, and the ledger is updated accordingly.

Working:

1.Hyperledger Fabric is a permissioned, modular blockchain platform designed for enterprise applications.

2.It uses a modular architecture that allows for flexible deployment and customization of its components.

3.In Hyperledger Fabric, a network is comprised of multiple organizations, each of which can host one or more nodes.

4.Nodes are the individual instances of Hyperledger Fabric that host smart contracts, validate transactions, and maintain a copy of the ledger.

5.To participate in a network, each organization must first create and enroll identities for its members.

6.Organizations can communicate with each other over channels, which are private communication pathways that are shared only between the organizations involved.

7.Each channel has its own ledger, which is a tamper-resistant record of all transactions that have taken place between the organizations on that channel.

8.Smart contracts are deployed to the nodes in the network and are invoked through transactions submitted by clients.

9.Consensus is achieved through a pluggable consensus mechanism, which allows different networks to use different algorithms to achieve consensus.

10.In Hyperledger Fabric, network updates are performed through chaincode upgrades, which allow for the live update of smart contracts without needing to shut down the network.

11.Finally, network administrators can monitor and manage the network using tools like Hyperledger Fabric Explorer, which provides a graphical interface for visualizing the state of the network and its components.

Implementation:

1. Install the required binaries, images and dockers of Hyperledger. Visit the official documentation for choosing your required version.

https://hyperledger-fabric.readthedocs.io/en/release-2.3/install.html#installing-the-latest-release

2. Open your favorite IDE most preferably VScode. Try to clone the official GitHub repository of Hyperledger Fabric. Type the below command in the terminal.

command – git clone https://github.com/hyperledger/fabric-samples

```
\Desktop\hyperledger> git clone https://github.com/hyperledger/fabric-samples
```

3. change the directory to test-network so as to get the access of switching the network on and off.

Command – cd test-network

```
\Desktop\hyperledger> cd test-network
```

4. Create a repository called chaincode, which is used for the deployment of chaincode contract which are primitive for Hyperledger.

Command – mkdir chaincode

5. Open the new network in the chaincode directory for a new connection using the below command.

Command - /.network.sh up

Note - When you start the network, you start the required components, such as orderers, peers, and certificate authorities. You also configure them to work together as a distributed system by creating and joining channels, installing and instantiating chaincodes, and setting up policies and permissions. These steps can be performed using the command-line interface (CLI) or through the Hyperledger Fabric SDKs.

Once the network is up and running, you can use APIs and SDKs to interact with it and perform various blockchain operations, such as submitting transactions, querying the ledger, and managing identities and permissions.

Starting the network is a critical step in the lifecycle of a Hyperledger Fabric blockchain network. It needs to be done correctly and carefully to ensure the network operates securely.

6. To stop the network after the connection, use the following command:

Command - /.network.sh down

Note - This command stops and removes all the containers that were started when the network was brought up. It also deletes any volumes that were created during the process. Running this command will result in the loss of all data stored in the network, such as ledger data and chaincode state. Therefore, use this command only when you no longer need to use the network.

Note - To view the connection clearly, you need to connect your Docker Desktop to the network. You need to download the Docker Desktop and setup so that the network can be clearly visible. For more details and in-depth analysis on setup you can visit the official documentation of Hyperledger Fabric.

https://hyperledger-fabric.readthedocs.io/en/release-2.3/install.html#installing-the-latest-release

Conclusion:

The above exercise explained how to set up and launch a Hyperledger Fabric blockchain network using the command-line interface. We covered the necessary steps for creating and configuring the network, including creating a chaincode directory, launching the network using the "network up" command, and stopping it using the "network down" command. We also emphasized the importance of performing these steps carefully and correctly to ensure that the network operates correctly and securely. By following these instructions and referring to the official Hyperledger Fabric documentation, developers can become proficient in creating and deploying blockchain applications using this powerful platform.