

This document has below sections:

- I) Technical Overview of the implementation
- II) Starting the complete solution
- III) Execution of requests in Postman
- IV) Couch DB data view
- V) Negative Test Cases (Validation scenarios demonstrated)
- VI) Shutting down the network
- VII) Additional checks
- VIII) Future scope for enhancements

#### **List of commands to be executed:**

1. From pharma-net/network folder run the below command:  
`./pankaj-network.sh up -i 1.4.9 -l node -c pharmachannel -f docker-compose-e2e.yaml -t 120 -d 10 -a -o etcdraft -s couchdb`
2. From pharma-net/application folder run below commands in sequence:  
`npm install  
node .`

### **I) Technical Overview of the implementation**

To make the project implementation more realistic, in addition to the project requirements, I considered below additional points:

1. Enabled TLS security across the network.
2. Enabled Certification Authorities for registrar and manufacturer, distributor, retailer, transporter and consumer organizations.
3. etcdraft is the recommended consensus algorithm and mandatory in 2.2 onwards. Considering this, I too used etcdraft (configured set of 3 orderers).
4. Used couch database for all the nodes to support complex queries.
5. Automated execution of few business use cases. (Explained later in the document).
6. Adjusted the delay timings to compensate if the network speed is bit slow and computing capacity is bit lower.
7. Using 'latest' for fabric images is risky, as it keeps pulling latest images, and the changes may be incompatible with our application. Hence to avoid this, I used explicit version (1.4.9) of fabric docker images and libraries.
8. As a good coding practice, and as suggested in the recorded sessions, implemented state and statelist abstractions/interface style.
9. Verification step added after each transaction request, and verified with expected and actual values.

Actual Value for hierarchyKey: "1"  
Expected Value for hierarchyKey: "1"

This and similar can be seen in each screen shot of verification step.

10. Customized the names of the chaincode containers spawned is started with 'cc-' (short for chaincode) instead of 'dev-'
11. Chaincode container for each peer of all organizations will be started during startup of the network. This will avoid any delay when the first request reaches to any peer of the network.
12. The user certificate and private key will get registered automatically at start up of the application, also exposed webservice to register any different certificate and/or private key for the user.
13. Few test cases mentioned the requirement to return the created object as response of the call, however in blockchain technology it's not recommended to query immediately after the putting the entity on the ledger, hence I have provided separate calls to retrieve the current state of the entities, and those calls are included in the collection of postman collections.
14. Response of **viewShipment** is customized to include objects of all assets too. So the state of each asset alongwith the shipment can be seen and verified at once.
15. Created the addToWallet function and exposed as REST service, and its corresponding postman collection named Wallet is added. This is completely optional. The Admin user of each organization gets imported to wallet during starting up of the application. This is provided for completeness of the solution.

## II) Starting the complete solution

### Pre-requisite:

- The complete code is extracted and kept inside pharma-net folder such that pharma-net folder have following 4 folders: application, chaincode, network, test
- docker service is up and running, and docker is configured such that docker commands run without sudo.

Starting complete solution involves 2 major steps:

- a) Building the network and starting it up.
- b) Starting the nodeJS application to run the server and expose REST webservices to call chaincode functions.

Steps in detail:

#### a) Building the network and starting it up:

Commands in this section needs to be executed on console from location: pharma-net/network

Script to use to build the network and run the commands: **pankaj-network.sh**

Below are various options supported:

1) ./pankaj-network.sh up -i 1.4.9 -l node -c pharmachannel -f docker-compose-e2e.yaml -t 120 -d 10 -a -o etcdraft -s couchdb

It generates crypto material, chaincode artifacts if does not exist, then, creates and starts the network, installs and instantiate the chaincode, and also starts chaincode container of every peer in the network by calling dummy warmUp method.

2) ./pankaj-network.sh generate -c pharmachannel -o etcdraft

Used to generate the crypto material and channel artifacts.

3) ./pankaj-network.sh network -i 1.4.9 -l node -c pharmachannel -f docker-compose-e2e.yaml -t 120 -d 10 -a -o etcdraft -s couchdb

Used to build and start the network.

4) ./pankaj-network.sh install -i 1.4.9 -l node -c pharmachannel -t 120 -d 10

Install and instantiate chaincode.

5) ./pankaj-network.sh tests -i 1.4.9 -l node -c pharmachannel -t 120 -d 10

Executes sanity tests to verify if the network is built correctly and sample transactions are executed.

6) ./pankaj-network.sh down -i 1.4.9 -l node -c pharmachannel -f docker-compose-e2e.yaml -t 120 -d 10

Used to bring down and clean-up the network.

You just need to execute with 'up' option as below, and observe the console. The relevant screen shots are pasted below to verify.

./pankaj-network.sh up -i 1.4.9 -l node -c pharmachannel -f docker-compose-e2e.yaml -t 120 -d 10 -a -o etcdraft -s couchdb

Known Issues: Downloading of fabric images may take longer to download at first time, hence if the execution fails with indication of timeout, please bring whole network down with command:

./pankaj-network.sh down -i 1.4.9 -l node -c pharmachannel -f docker-compose-e2e.yaml -t 120 -d 10

and then continue with the command:

./pankaj-network.sh up -i 1.4.9 -l node -c pharmachannel -f docker-compose-e2e.yaml -t 120 -d 10 -a -o etcdraft -s couchdb

### Network Creation:

1. You will see screen similar to below when the execution starts.

```
/usr/pankaj/pharma-net/network> ./pankaj-network.sh up -i 1.4.9 -l node -c pharmachannel -f docker-compose-e2e.yaml -t 120 -d 5 -a -o etcdraft -s couchdb
=====
Pharma Network to prevent drug counterfeiting
Advanced Certification Programme in Blockchain
conducted by IIIT Bangalore and upGrad
Capstone Project – on Hyperledger Fabric – v1.4.9
Project by – Pankaj Mahadev

BANKAJ MAHADEV
=====
Building fabric network and installing chaincodes for channel 'pharmachannel' with CLI timeout of '120' seconds and CLI delay of '5' seconds and using database 'couchdb'
Continue? [Y/n] y
proceeding ...
=====
starting with: Building fabric network and installing chaincodes
LOCAL_VERSION=1.4.9
DOCKER_IMAGE_VERSION=1.4.9
```

2. Next it will generate the crypto material and channel artifacts.

3. Next, the network will be created and the nodes will be started:

4. Next, the channel is created:

## 5. Next, all peers will join the channel:

```
Having all peers join the channel...
-----  

+ peer channel join -b pharmachannel.block  

+ res=0  

+ set +x  

2022-08-05 04:48:56.295 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:49:00.450 UTC [channelCmd] executeTxn => INFO 001 Successfully submitted proposal to join channel  

===== peer0.manufacturer joined channel 'pharmachannel' ======  

-----  

+ peer channel join -b pharmachannel.block  

+ res=0  

+ set +x  

2022-08-05 04:49:16.010 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:49:11.178 UTC [channelCmd] executeTxn => INFO 001 Successfully submitted proposal to join channel  

===== peer1.manufacturer joined channel 'pharmachannel' ======  

-----  

+ peer channel join -b pharmachannel.block  

+ res=0  

+ set +x  

2022-08-05 04:49:26.172 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:49:20.041 UTC [channelCmd] executeTxn => INFO 001 Successfully submitted proposal to join channel  

===== peer1.distributor joined channel 'pharmachannel' ======  

-----  

+ peer channel join -b pharmachannel.block  

+ res=0  

+ set +x  

2022-08-05 04:49:26.719 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:49:20.791 UTC [channelCmd] executeTxn => INFO 001 Successfully submitted proposal to join channel  

===== peer1.distributor joined channel 'pharmachannel' ======  

-----  

+ peer channel join -b pharmachannel.block  

+ res=0  

+ set +x  

2022-08-05 04:49:36.127 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:49:39.301 UTC [channelCmd] executeTxn => INFO 001 Successfully submitted proposal to join channel  

===== peer0.retailer joined channel 'pharmachannel' ======  

-----  

+ peer channel join -b pharmachannel.block  

+ res=0  

+ set +x  

2022-08-05 04:49:45.352 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:49:40.594 UTC [channelCmd] executeTxn => INFO 001 Successfully submitted proposal to join channel  

===== peer1.retailer joined channel 'pharmachannel' ======  

-----  

+ peer channel join -b pharmachannel.block  

+ res=0  

+ set +x  

2022-08-05 04:50:06.266 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:50:10.289 UTC [channelCmd] executeTxn => INFO 001 Successfully submitted proposal to join channel  

===== peer0.consumer joined channel 'pharmachannel' ======  

-----  

+ peer channel join -b pharmachannel.block  

+ res=0  

+ set +x  

2022-08-05 04:50:16.200 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:50:20.413 UTC [channelCmd] executeTxn => INFO 001 Successfully submitted proposal to join channel  

===== peer0.consumer joined channel 'pharmachannel' ======  

-----  

+ peer channel join -b pharmachannel.block  

+ res=0  

+ set +x  

2022-08-05 04:50:26.323 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:50:30.617 UTC [channelCmd] executeTxn => INFO 001 Successfully submitted proposal to join channel  

===== peer1.transporter joined channel 'pharmachannel' =====
```

## 6. Next, update anchor for registrar and users organization:

```
Updating anchor peers for transporter
-----  

+ peer channel update -o orderer.pharma-network.com:7050 -c pharmachannel -f ./channel-artifacts/manufacturersPSPanchors.tx --tls true --cafile /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/ordererOrganizations/pharma-network.com/orderers/orderer.pharma-network.com/msp/tlscacerts/tlsca.pharma-network.com-cert.pem  

+ res=0  

+ set +x  

2022-08-05 04:50:46.299 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:50:36.267 UTC [channelCmd] executeTxn => INFO 001 Successfully submitted channel update  

===== Anchor peers updated for org 'manufacturersPSP' on channel 'pharmachannel' ======  

-----  

Updated anchor peers for manufacturer
-----  

+ peer channel update -o orderer.pharma-network.com:7050 -c pharmachannel -f ./channel-artifacts/distributor#SPanchors.tx --tls true --cafile /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/ordererOrganizations/pharma-network.com/orderers/orderer.pharma-network.com/msp/tlscacerts/tlsca.pharma-network.com-cert.pem  

+ res=0  

+ set +x  

2022-08-05 04:50:47.745 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:50:47.791 UTC [channelCmd] executeTxn => INFO 001 Successfully submitted channel update  

===== Anchor peers updated for org 'distributorsMSP' on channel 'pharmachannel' ======  

-----  

Updated anchor peers for distributor
-----  

+ peer channel update -o orderer.pharma-network.com:7050 -c pharmachannel -f ./channel-artifacts/retailer#SPanchors.tx --tls true --cafile /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/ordererOrganizations/pharma-network.com/orderers/orderer.pharma-network.com/msp/tlscacerts/tlsca.pharma-network.com-cert.pem  

+ res=0  

+ set +x  

2022-08-05 04:50:59.144 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:50:59.219 UTC [channelCmd] executeTxn => INFO 001 Successfully submitted channel update  

===== Anchor peers updated for org 'retailerMSP' on channel 'pharmachannel' ======  

-----  

Updated anchor peers for retailer
-----  

+ peer channel update -o orderer.pharma-network.com:7050 -c pharmachannel -f ./channel-artifacts/consumer#SPanchors.tx --tls true --cafile /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/ordererOrganizations/pharma-network.com/orderers/orderer.pharma-network.com/msp/tlscacerts/tlsca.pharma-network.com-cert.pem  

+ res=0  

+ set +x  

2022-08-05 04:51:39.665 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:51:20.921 UTC [channelCmd] update => INFO 001 Successfully submitted channel update  

===== Anchor peers updated for org 'consumerMSP' on channel 'pharmachannel' ======  

-----  

Updated anchor peers for consumer
-----  

+ peer channel update -o orderer.pharma-network.com:7050 -c pharmachannel -f ./channel-artifacts/transporter#SPanchors.tx --tls true --cafile /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/ordererOrganizations/pharma-network.com/orderers/orderer.pharma-network.com/msp/tlscacerts/tlsca.pharma-network.com-cert.pem  

+ res=0  

+ set +x  

2022-08-05 04:51:22.492 UTC [channelCmd] InitCmdFactory +> INFO 001 Endorser and orderer connections initialized  

2022-08-05 04:51:23.040 UTC [channelCmd] update => INFO 001 Successfully submitted channel update  

===== Anchor peers updated for org 'transporterMSP' on channel 'pharmachannel' ======  

-----  

Updated anchor peers for transporter
-----  

==== All GOOD, pankaj-pharma-network created successfully...!
```

## 7. Installation and Instantiation of chaincode:

Next is, install the chaincodes on peer0.register, peer1.register and peer0.users node, and instantiate on peer0.register node.

```
Installing chaincodes on peer0.manufacturer
+ peer chaincode install -n pharmanet -v 1.0 -l node -p /opt/gopath/src/github.com/chaincode/node
+ res=0
+ set +x
2022-08-05 04:33:34.276 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 001 Using default escc
2022-08-05 04:33:42.436 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 002 Using default vscc
2022-08-05 04:33:49.798 UTC [chaincodeCmd] install > INFO 003 Installed remotely response:<status:200 payload:"OK" >
===== Chaincode installed on peer0.manufacturer =====
===== chaincode installed on peer0.manufacturer =====

Installing chaincodes on peer1.manufacturer
+ peer chaincode install -n pharmanet -v 1.0 -l node -p /opt/gopath/src/github.com/chaincode/node
+ res=0
+ set +x
2022-08-05 04:51:42.812 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 001 Using default escc
2022-08-05 04:53:42.816 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 002 Using default vscc
2022-08-05 04:53:49.798 UTC [chaincodeCmd] install > INFO 003 Installed remotely response:<status:200 payload:"OK" >
===== Chaincode installed on peer1.manufacturer =====
===== chaincode installed on peer1.manufacturer =====

Installing chaincodes on peer0.distributor
+ peer chaincode install -n pharmanet -v 1.0 -l node -p /opt/gopath/src/github.com/chaincode/node
+ res=0
+ set +x
2022-08-05 04:53:46.298 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 001 Using default escc
2022-08-05 04:54:06.208 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 002 Using default vscc
2022-08-05 04:54:50.063 UTC [chaincodeCmd] install > INFO 003 Installed remotely response:<status:200 payload:"OK" >
===== Chaincode installed on peer0.distributor =====
===== chaincode installed on peer0.distributor =====

Installing chaincodes on peer1.distributor
+ peer chaincode install -n pharmanet -v 1.0 -l node -p /opt/gopath/src/github.com/chaincode/node
+ res=0
+ set +x
2022-08-05 04:51:50.942 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 001 Using default escc
2022-08-05 04:53:50.942 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 002 Using default vscc
2022-08-05 04:53:55.615 UTC [chaincodeCmd] install > INFO 003 Installed remotely response:<status:200 payload:"OK" >
===== Chaincode installed on peer1.distributor =====
===== chaincode installed on peer1.distributor =====

Installing chaincodes on peer0.retailer
+ peer chaincode install -n pharmanet -v 1.0 -l node -p /opt/gopath/src/github.com/chaincode/node
+ res=0
+ set +x
2022-08-05 04:53:56.088 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 001 Using default escc
2022-08-05 04:53:56.088 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 002 Using default vscc
2022-08-05 04:53:59.018 UTC [chaincodeCmd] install > INFO 003 Installed remotely response:<status:200 payload:"OK" >
===== Chaincode installed on peer0.retailer =====
===== chaincode installed on peer0.retailer =====

Installing chaincodes on peer1.retailer
+ peer chaincode install -n pharmanet -v 1.0 -l node -p /opt/gopath/src/github.com/chaincode/node
+ res=0
+ set +x
2022-08-05 04:53:59.491 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 001 Using default escc
2022-08-05 04:53:59.847 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 002 Using default vscc
2022-08-05 04:53:59.119 UTC [chaincodeCmd] install > INFO 003 Installed remotely response:<status:200 payload:"OK" >
===== Chaincode installed on peer1.retailer =====
===== chaincode installed on peer1.retailer =====

Installing chaincodes on peer0.transporter
+ peer chaincode install -n pharmanet -v 1.0 -l node -p /opt/gopath/src/github.com/chaincode/node
+ res=0
+ set +x
2022-08-05 04:53:04.678 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 001 Using default escc
2022-08-05 04:52:04.679 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 002 Using default vscc
2022-08-05 04:52:08.043 UTC [chaincodeCmd] install > INFO 003 Installed remotely response:<status:200 payload:"OK" >
===== Chaincode installed on peer0.transporter =====
===== chaincode installed on peer0.transporter =====

Installing chaincodes on peer1.transporter
+ peer chaincode install -n pharmanet -v 1.0 -l node -p /opt/gopath/src/github.com/chaincode/node
+ res=0
+ set +x
2022-08-05 04:52:08.670 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 001 Using default escc
2022-08-05 04:52:08.670 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 002 Using default vscc
2022-08-05 04:52:08.003 UTC [chaincodeCmd] install > INFO 003 Installed remotely response:<status:200 payload:"OK" >
===== Chaincode installed on peer1.transporter =====
===== chaincode installed on peer1.transporter =====

Installing chaincodes on peer0.consumer
+ peer chaincode install -n pharmanet -v 1.0 -l node -p /opt/gopath/src/github.com/chaincode/node
+ res=0
+ set +x
2022-08-05 04:52:18.368 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 001 Using default escc
2022-08-05 04:52:18.368 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 002 Using default vscc
2022-08-05 04:52:18.368 UTC [chaincodeCmd] install > INFO 003 Installed remotely response:<status:200 payload:"OK" >
===== Chaincode installed on peer0.consumer =====
===== chaincode installed on peer0.consumer =====

Installing chaincodes on peer1.consumer
+ peer chaincode install -n pharmanet -v 1.0 -l node -p /opt/gopath/src/github.com/chaincode/node
+ res=0
+ set +x
2022-08-05 04:52:18.443 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 001 Using default escc
2022-08-05 04:52:18.443 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 002 Using default vscc
2022-08-05 04:52:18.806 UTC [chaincodeCmd] install > INFO 003 Installed remotely response:<status:200 payload:"OK" >
===== Chaincode installed on peer1.consumer =====
===== chaincode installed on peer1.consumer =====

Instantiating chaincodes on peer0.manufacturer
=====
Instantiating chaincode on peer0.manufacturer on channel 'pharmacchannel'
+ peer chaincode instantiate -o orderer.pharma-network.com:7050 --tls true --cafile /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/ordererOrganizations/pharma-network.com/orderers/orderer.pharma-network.com/tlsca/tlsca.pharma-network.com-cert.pem -C pharmacchannel -n pharmanet -l node -v 1.0 -c '{"Args":["org.pharma-network.pharmanet:instantiate"]}' -P 'OR ('"manufacturerMSP.member"'','"retailerMSP.member"'','"consumerMSP.member"'','"transporterMSP.member"'')
+ res=0
+ set +x
2022-08-05 04:52:29.498 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 001 Using default escc
2022-08-05 04:52:29.498 UTC [chaincodeCmd] checkChaincodeDefinition > INFO 002 Using default vscc
2022-08-05 04:52:29.498 UTC [chaincodeCmd] instant > INFO 003 Chaincode is instantiated on peer0.manufacturer on channel 'pharmacchannel'
=====
```

## 8. Start chaincode linked to each of the peer of every organization.

```
starting peer peer0.manufacturer of pankaj-pharma-network
+ peer chaincode query -C pharmachannel -n pharmanet -c '{"Args":["org.pharma-network.pharmanet:warmUp"]}'
+ res=0
+ set +x
=====
===== warmUp query transaction successful on peer0.manufacturer on channel 'pharmachannel'
=====
===== peer peer0.manufacturer of pankaj-pharma-network started successfully =====
===== starting peer peer0.manufacturer of pankaj-pharma-network =====
{"Args":["org.pharma-network.pharmanet:warmUp"]}
+ peer chaincode query -C pharmachannel -n pharmanet -c '{"Args":["org.pharma-network.pharmanet:warmUp"]}'
+ res=0
+ set +x
=====
===== warmUp query transaction successful on peer0.manufacturer on channel 'pharmachannel'
=====
===== peer peer0.manufacturer of pankaj-pharma-network started successfully =====
===== starting peer peer0.distributor of pankaj-pharma-network =====
{"Args":["org.pharma-network.pharmanet:warmUp"]}
+ peer chaincode query -C pharmachannel -n pharmanet -c '{"Args":["org.pharma-network.pharmanet:warmUp"]}'
+ res=0
+ set +x
=====
===== warmUp query transaction successful on peer0.distributor on channel 'pharmachannel'
=====
===== peer peer0.distributor of pankaj-pharma-network started successfully =====
===== starting peer peer0.distributor of pankaj-pharma-network =====
{"Args":["org.pharma-network.pharmanet:warmUp"]}
+ peer chaincode query -C pharmachannel -n pharmanet -c '{"Args":["org.pharma-network.pharmanet:warmUp"]}'
+ res=0
+ set +x
=====
===== warmUp query transaction successful on peer0.retailer on channel 'pharmachannel'
=====
===== peer peer0.retailer of pankaj-pharma-network started successfully =====
===== starting peer peer0.retailer of pankaj-pharma-network =====
{"Args":["org.pharma-network.pharmanet:warmUp"]}
+ peer chaincode query -C pharmachannel -n pharmanet -c '{"Args":["org.pharma-network.pharmanet:warmUp"]}'
+ res=0
+ set +x
=====
===== warmUp query transaction successful on peer0.retailer on channel 'pharmachannel'
=====
===== peer peer0.retailer of pankaj-pharma-network started successfully =====
===== starting peer peer0.consumer of pankaj-pharma-network =====
{"Args":["org.pharma-network.pharmanet:warmUp"]}
+ peer chaincode query -C pharmachannel -n pharmanet -c '{"Args":["org.pharma-network.pharmanet:warmUp"]}'
+ res=0
+ set +x
=====
===== warmUp query transaction successful on peer0.consumer on channel 'pharmachannel'
=====
===== peer peer0.consumer of pankaj-pharma-network started successfully =====
===== starting peer peer0.consumer of pankaj-pharma-network =====
{"Args":["org.pharma-network.pharmanet:warmUp"]}
+ peer chaincode query -C pharmachannel -n pharmanet -c '{"Args":["org.pharma-network.pharmanet:warmUp"]}'
+ res=0
+ set +x
=====
===== warmUp query transaction successful on peer0.transporter on channel 'pharmachannel'
=====
===== peer peer0.transporter of pankaj-pharma-network started successfully =====
===== starting peer peer0.transporter of pankaj-pharma-network =====
{"Args":["org.pharma-network.pharmanet:warmUp"]}
+ peer chaincode query -C pharmachannel -n pharmanet -c '{"Args":["org.pharma-network.pharmanet:warmUp"]}'
+ res=0
+ set +x
=====
===== warmUp query transaction successful on peer0.transporter on channel 'pharmachannel'
=====
===== peer peer0.transporter of pankaj-pharma-network started successfully =====
=====
===== All GOOD, pankaj-pharma-network installation, instantiation and warm-up completed =====
Completed: Building Fabric network and installing chaincodes
```



## Sanity Tests:

**This is optional.**

Have added few tests to verify that the network is up and running fine.

It will create few companies of all types, and will verify the retrieval is successful and also checks if the attribute values are correctly stored. E.g. it will verify the hierarchyKey value for each organization to have expected value of 1 if manufacturer, 2 if distributor and so on.

These tests can be executed with 'tests' option as below:

```
./pankaj-network.sh tests -i 1.4.9 -l node -c pharmachannel -f docker-compose-e2e.yaml -t 120 -d 10 -a -o etcdraft -s couchdb
Invoking registerCompany for company: comp-manu-1, First, Location-1 and Manufacturer - (executing on peer0.manufacturer)
=====
+ peer chaincode invoke -o orderer.pharma-network.com:7050 --tls true --cafile /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/ordererOrganizations/pharma-network.com/orderers/orderer.pharma-network.com/msp/tlsca.pharma-network.com-cert.pem -C pharmachannel -n pharmanet --peerAddresses peer0.manufacturer.pharma-network.com:7051 --tlsRootCertFiles /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/peerOrganizations/manufacturer.pharma-network.com/peers/peer0.manufacturer.pharma-network.com/tls/ca.crt -c '{"Args":["org.pharma-network.pharmanet:registerCompany","comp-manu-1","First","Location-1","Manufacturer"]}'
+ res=0
+ set +x
=====
===== Chaincode invoke successful, result: status:200 payload:"Success: company registered with companyCRN: COMP-MANU-1, and companyName: FIRST on pankaj-pharma-network"
=====
===== Invoke transaction successful on peer0.manufacturer on channel 'pharmachannel'
```

```
Querying Company object for company: comp-manu-1 and first - (executing on peer1.manufacturer)
=====
=====
===== Querying on peer1.manufacturer on channel 'pharmachannel'... =====
+ C_PARAMETER='{"Args":["org.pharma-network.pharmanet:viewCompany","comp-manu-1","first"]}'
+ peer chaincode query -C pharmachannel -n pharmanet -c '{"Args":["org.pharma-network.pharmanet:viewCompany","comp-manu-1","first"]}'
Attempting to Query peer1.manufacturer ...5 secs
+ res=0
+ set +x
Actual Value for hierarchyKey: "1"
Expected Value for hierarchyKey: "1"
=====
+ class="org.pharma-network.pharmanet.company","keyField":"companyID","key":"COMP-MANU-1:FIRST","companyCRN":"COMP-MANU-1","companyID":1
=====
===== Query successful on peer1.manufacturer on channel 'pharmachannel'
```

## b) Starting the nodeJS application:

Commands in this section needs to be executed on console from location: pharma-net/application

On terminal window, switch to pharma-net/application folder.

Run the below command to install pre-requisite nodejs libraries:

npm install

```
/usr/pankaj/pharma-net/application>npm install
```

This will give output like below:

```
npm WARN deprecated har-validator@0.7.7: this library is no longer supported
npm WARN deprecated cloudant-follow@0.17.0: This package is no longer maintained.
npm WARN deprecated querystring@2.0.0: The querying API is considered Legacy. New code should use the URLSearchParams API instead.
npm WARN deprecated unibrot@1.0.0: Please upgrade to version 7 or higher. These versions may use different code paths in certain circumstances, which is known to be problematic. See https://v8.dev/blog/math-random for details.
npm WARN deprecated core-js@3.18.5: core-js@3.18.5 has been deprecated in favor of core-js@3.19.0. This version is no longer maintained and is not recommended for usage due to the number of issues. Because of the V8 engine whims, feature detection in old core-js versions could cause a slowdown up to 100x even if nothing is polyfilled. Some versions have web compatibility issue(s). Please, upgrade your dependencies to the actual version of core-js.
npm WARN deprecated gRPC@24.11: This library will not receive further updates other than security fixes. We recommend using @grpc/grpc-js instead.

added 421 packages, and audited 422 packages in 1m
24 packages are looking for funding
  run `npm fund` for details
  6 high severity vulnerabilities
  To address all issues (including breaking changes), run:
    npm audit fix --force
  Run `npm audit` for details.
```

Then run either of the below commands:

node .

OR

node index.js

This will start the application and **add the admin user identity** for all organizations (manufacturer, distributor, retailer, transporter and consumer) to the wallet. This will be used later while invoking and querying chaincode functions using respective connection-profiles.

```
/usr/pankaj/pharma-net/application>node .
certificatePath for - manufacturer: ../network/crypto-config/peerOrganizations/manufacturer.pharma-network.com/users/Admin@manufacturer.pharma-network.com/sp/signcerts/Admin@manufacturer.pharma-network.com-cert.pem
privateKeyPath for - manufacturer: ../network/crypto-config/peerOrganizations/manufacturer.pharma-network.com/users/Admin@manufacturer.pharma-network.com/sp/keystore/e64fffaaf22fe67231719cb0c93bf00211387c5e14c56db15f3f9271695934_sk
certificatePath for - distributor: ../network/crypto-config/peerOrganizations/distributor.pharma-network.com/users/Admin@distributor.pharma-network.com/sp/signcerts/Admin@distributor.pharma-network.com-cert.pem
privateKeyPath for - distributor: ../network/crypto-config/peerOrganizations/distributor.pharma-network.com/users/Admin@distributor.pharma-network.com/sp/keystore/5da6bb109dd07568c5ce0d0b85c3da6e39bababd7cf2e28ff6e85ac749682d_sk
certificatePath for - retailer: ../network/crypto-config/peerOrganizations/retailer.pharma-network.com/users/Admin@retailer.pharma-network.com/sp/signcerts/Admin@retailer.pharma-network.com-cert.pem
privateKeyPath for - retailer: ../network/crypto-config/peerOrganizations/retailer.pharma-network.com/users/Admin@retailer.pharma-network.com/sp/keystore/371f82185bc26c323c9be8ac9ecfde412b8764830128766b1cea901beb72617_sk
certificatePath for - transporter: ../network/crypto-config/peerOrganizations/transporter.pharma-network.com/users/Admin@transporter.pharma-network.com/sp/signcerts/Admin@transporter.pharma-network.com-cert.pem
privateKeyPath for - transporter: ../network/crypto-config/peerOrganizations/transporter.pharma-network.com/users/Admin@transporter.pharma-network.com/sp/keystore/371f82185bc26c323c9be8ac9ecfde412b8764830128766b1cea901beb72617_sk
certificatePath for - consumer: ../network/crypto-config/peerOrganizations/consumer.pharma-network.com/users/Admin@consumer.pharma-network.com-sp/signcerts/Admin@consumer.pharma-network.com-cert.pem
privateKeyPath for - consumer: ../network/crypto-config/peerOrganizations/consumer.pharma-network.com/users/Admin@consumer.pharma-network.com-sp/keystore/e3516d2916872a07735fd11ba3de4001a58a5ea72a1fcad9b7907c4445_sk
Distributed Pankaj-Pharma-network App listening on port 3000!
```

## Execution of chiancode functions from Postman:

Import the below collection files into Postman:

Wallet.postman\_collection.json

Initiation.postman\_collection.json

Supply Chain.postman\_collection.json

History.postman\_collection.json

**orgGroupName** attribute in each request will be used to identify the connection-profile of the organization on which this chaincode function will be executed.

**Execution of calls from Wallet collection is OPTIONAL.** The Admin user of each of the organization is added to the .identity folder inside the pharma-net/application folder during the startup of the nodeJS application.

I have provided this collection for completeness of the solution.

If the certificatePath and privateKeyPath is empty string in the request, then it uses the certificate and private key file from pharma-net/network/crypto-config.

## III) Execution of requests in Postman

### 1. Default certificate (.pem) and private key file (.sk) from network/crypto-config gets added during application startup

```
certificatePath for - manufacturer: ../network/crypto-config/peerOrganizations/manufacturer.pharma-network.com/users/Admin@manufacturer.pharma-network.com-sp/signcerts/Admin@manufacturer.pharma-network.com-cert.pem
privateKeyPath for - manufacturer: ../network/crypto-config/peerOrganizations/manufacturer.pharma-network.com/users/Admin@manufacturer.pharma-network.com-sp/keystore/e64fffaaf22fe67231719cb0c93bf00211387c5e14c56db15f3f9271695934_sk
User identity added to wallet for: manufacturer
User credentials added to wallet for: manufacturer
certificatePath for - distributor: ../network/crypto-config/peerOrganizations/distributor.pharma-network.com/users/Admin@distributor.pharma-network.com-sp/signcerts/Admin@distributor.pharma-network.com-cert.pem
privateKeyPath for - distributor: ../network/crypto-config/peerOrganizations/distributor.pharma-network.com/users/Admin@distributor.pharma-network.com-sp/keystore/5da6bb109dd07568c5ce0d0b85c3da6e39bababd7cf2e28ff6e85ac749682d_sk
User identity added to wallet for: distributor
User credentials added to wallet for: distributor
certificatePath for - retailer: ../network/crypto-config/peerOrganizations/retailer.pharma-network.com/users/Admin@retailer.pharma-network.com-sp/signcerts/Admin@retailer.pharma-network.com-cert.pem
privateKeyPath for - retailer: ../network/crypto-config/peerOrganizations/retailer.pharma-network.com/users/Admin@retailer.pharma-network.com-sp/keystore/371f82185bc26c323c9be8ac9ecfde412b8764830128766b1cea901beb72617_sk
User identity added to wallet for: retailer
User credentials added to wallet for: retailer
certificatePath for - transporter: ../network/crypto-config/peerOrganizations/transporter.pharma-network.com/users/Admin@transporter.pharma-network.com-sp/signcerts/Admin@transporter.pharma-network.com-cert.pem
privateKeyPath for - transporter: ../network/crypto-config/peerOrganizations/transporter.pharma-network.com/users/Admin@transporter.pharma-network.com-sp/keystore/371f82185bc26c323c9be8ac9ecfde412b8764830128766b1cea901beb72617_sk
User identity added to wallet for: transporter
User credentials added to wallet for: transporter
certificatePath for - consumer: ../network/crypto-config/peerOrganizations/consumer.pharma-network.com/users/Admin@consumer.pharma-network.com-sp/signcerts/Admin@consumer.pharma-network.com-cert.pem
privateKeyPath for - consumer: ../network/crypto-config/peerOrganizations/consumer.pharma-network.com/users/Admin@consumer.pharma-network.com-sp/keystore/e3516d2916872a07735fd11ba3de4001a58a5ea72a1fcad9b7907c4445_sk
User credentials added to wallet for: consumer
```

2. Adding Admin user of Manufacturer to Wallet: (optional. Already registered as shown in 1)

Wallet / addToWallet - Manufacturer

POST ▼ http://localhost:3000/addToWallet

Params Authorization Headers (10) **Body** ● Pre-request Script Tests Settings

● none ● form-data ● x-www-form-urlencoded ● raw ● binary ● GraphQL **JSON**

```
1 {  
2   "orgGroupName": "manufacturer",  
3   "certificatePath": "",  
4   "privateKeyPath": ""  
5 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize **JSON** ▼

```
1 {  
2   "status": "success",  
3   "message": "User credentials added to wallet for: manufacturer"  
4 }
```

3. Adding Admin user of Distributor to Wallet: (optional. Already registered as shown in 1)

Wallet / addToWallet - Distributor

POST ▼ http://localhost:3000/addToWallet

Params Authorization Headers (10) **Body** ● Pre-request Script Tests Settings

● none ● form-data ● x-www-form-urlencoded ● raw ● binary ● GraphQL **JSON** ▼

```
1 {  
2   "orgGroupName": "distributor",  
3   "certificatePath": "",  
4   "privateKeyPath": ""  
5 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize **JSON** ▼

```
1 {  
2   "status": "success",  
3   "message": "User credentials added to wallet for: distributor"  
4 }
```

4. Adding Admin user of Retailer to Wallet: (optional. Already registered as shown in 1)

Wallet / addToWallet - Retailer

POST <http://localhost:3000/addToWallet>

Params Authorization Headers (10) **Body** Pre-request Script

none  form-data  x-www-form-urlencoded  raw  binary

```
1 {
2   "orgGroupName": "retailer",
3   "certificatePath": "",
4   "privateKeyPath": ""
5 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {
2   "status": "success",
3   "message": "User credentials added to wallet for: retailer"
4 }
```

5. Adding Admin user of Transporter to Wallet: (optional. Already registered as shown in 1)

Wallet / addToWallet - Transporter

POST <http://localhost:3000/addToWallet>

Params Authorization Headers (10) **Body** Pre-request Script Tests Settings

none  form-data  x-www-form-urlencoded  raw  binary  GraphQL **JSON**

```
1 {
2   "orgGroupName": "transporter",
3   "certificatePath": "",
4   "privateKeyPath": ""
5 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {
2   "status": "success",
3   "message": "User credentials added to wallet for: transporter"
4 }
```

6. Adding Admin user of Consumer to Wallet: (optional. Already registered as shown in 1)

Wallet / addToWallet - Consumer

POST <http://localhost:3000/addToWallet>

Params Authorization Headers (10) Body Pre-request Script Tests

none form-data x-www-form-urlencoded raw binary GraphQL

```
1
2   "orgGroupName": "consumer",
3   "certificatePath": "",
4   "privateKeyPath": ""
5 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1
2   "status": "success",
3   "message": "User credentials added to wallet for: consumer"
4 }
```

7. Creating Manufacturing company – Sun Pharma:

Initiation / Manufacturer - Create and View / registerCompany - Sun Pharma

POST <http://localhost:3000/registerCompany>

Params Authorization Headers (10) Body Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1
2   "orgGroupName": "manufacturer",
3   "companyCRN": "MAN001",
4   "companyName": "Sun Pharma",
5   "location": "Chennai",
6   "organizationRole": "manufacturer"
7 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1
2   "transactionType": "Invoke",
3   "status": "success",
4   "message": "Success: company registered with companyCRN: MAN001, and companyName: SUN PHARMA on pankaj-pharma-network"
5 }
```

## 8. View Manufacturing company – Sun Pharma:

Initiation / Manufacturer - Create and View / viewCompany - Sun Pharma

POST <http://localhost:3000/viewCompany>

Params Authorization Headers (10) **Body** Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1 {  
2   "orgGroupName": "consumer",  
3   "companyCRN": "MAN001",  
4   "companyName": "Sun Pharma"  
5 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {  
2   "transactionType": "Query",  
3   "status": "success",  
4   "company": {  
5     "class": "org.pharma-network.pharmanet.company",  
6     "keyField": "companyId",  
7     "key": "MAN001:SUNPHARMA",  
8     "companyCRN": "MAN001",  
9     "companyID": "org.pharma-network.pharmanet.companyMAN001SUNPHARMA",  
10    "companyName": "SUN PHARMA",  
11    "hierarchyKey": "1",  
12    "location": "CHENNAI",  
13    "organisationRole": "MANUFACTURER"  
14  }  
15 }
```

## 9. Creating Transporter company – FedEx:

Initiation / First Transporter - Create and View / registerCompany - FedEx

The screenshot shows a Postman interface for a POST request to `http://localhost:3000/registerCompany`. The 'Body' tab is selected, showing a JSON payload:

```
1 {
2   "orgGroupName": "transporter",
3   "companyCRN": "TRA001",
4   "companyName": "FedEx",
5   "location": "Delhi",
6   "organisationRole": "transporter"
7 }
```

Below the body, the 'Headers' tab is selected, showing 10 headers. The 'Test Results' tab is also visible.

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {
2   "transactionType": "Invoke",
3   "status": "success",
4   "message": "Success: company registered with companyCRN: TRA001, and companyName: FEDEX on pankaj-pharma-network"
5 }
```

## 10. Viewing Transporter company – FedEx:

Initiation / First Transporter - Create and View / viewCompany - FedEx

The screenshot shows a Postman interface for a POST request to `http://localhost:3000/viewCompany`. The 'Body' tab is selected, showing a JSON payload:

```
1 {
2   "orgGroupName": "consumer",
3   "companyCRN": "TRA001",
4   "companyName": "FedEx"
5 }
```

Below the body, the 'Headers' tab is selected, showing 10 headers. The 'Test Results' tab is also visible.

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {
2   "transactionType": "Query",
3   "status": "success",
4   "company": {
5     "class": "org.pharma-network.pharmanet.company",
6     "keyField": "companyID",
7     "key": "TRA001:FEDEX",
8     "companyCRN": "TRA001",
9     "companyID": "org.pharma-network.pharmanet.company#TRA001#FEDEX#",
10    "companyName": "FEDEX",
11    "location": "DELHI",
12    "organisationRole": "TRANSPORTER"
13  }
14 }
```

## 11. Creating Transporter company – Blue Dart:

Initiation / Second Transporter - Create and View / registerCompany - Blue Dart

The screenshot shows a Postman interface with a POST request to `http://localhost:3000/registerCompany`. The 'Body' tab is selected, showing a JSON payload for creating a company named 'Blue Dart'. The response body shows a success message indicating the company was registered.

```
1 {  
2   "orgGroupName": "transporter",  
3   "companyCRN": "TRA002",  
4   "companyName": "Blue Dart",  
5   "location": "Bangalore",  
6   "organisationRole": "transporter"  
7 }
```

```
1 {  
2   "transactionType": "Invoke",  
3   "status": "success",  
4   "message": "Success: company registered with companyCRN: TRA002, and companyName: BLUE DART on pankaj-pharma-network"  
5 }
```

## 12. Viewing Transporter company – FedEx:

Initiation / Second Transporter - Create and View / viewCompany - Blue Dart

The screenshot shows a Postman interface with a POST request to `http://localhost:3000/viewCompany`. The 'Body' tab is selected, showing a JSON payload for querying a company by CRN. The response body shows a detailed company object including its ID, name, location, and role.

```
1 {  
2   "orgGroupName": "consumer",  
3   "companyCRN": "TRA002",  
4   "companyName": "Blue Dart"  
5 }
```

```
1 {  
2   "transactionType": "Query",  
3   "status": "success",  
4   "company": {  
5     "class": "org.pharma-network.pharmanet.company",  
6     "keyField": "companyID",  
7     "key": "TRA002:BLUEDART",  
8     "companyCRN": "TRA002",  
9     "companyID": "org.pharma-network.pharmanet.company#TRA002#BLUEDART#",  
10    "companyName": "BLUE DART",  
11    "location": "BANGALORE",  
12    "organisationRole": "TRANSPORTER"  
13  }  
14 }
```

### 13. Creating Distributor company – VG Pharma:

Initiation / Distributor - Create and View / registerCompany - VG Pharma

The screenshot shows a Postman interface with a POST request to `http://localhost:3000/registerCompany`. The 'Body' tab is selected, showing a JSON payload:

```
1
2   "orgGroupName": "distributor",
3   "companyCRN": "DIST001",
4   "companyName": "VG Pharma",
5   "location": "Vizag",
6   "organizationRole": "distributor"
7 }
```

Below the body, the 'Body' tab is selected again, showing the response:

```
1
2   "transactionType": "Invoke",
3   "status": "success",
4   "message": "Success: company registered with companyCRN: DIST001, and companyName: VG PHARMA on pankaj-pharma-network"
5 }
```

### 14. Viewing Distributor company – VG Pharma:

Initiation / Distributor - Create and View / viewCompany - VG Pharma

The screenshot shows a Postman interface with a POST request to `http://localhost:3000/viewCompany`. The 'Body' tab is selected, showing a JSON payload:

```
1
2   "orgGroupName": "consumer",
3   "companyCRN": "DIST001",
4   "companyName": "VG Pharma"
5 }
```

Below the body, the 'Body' tab is selected again, showing the response:

```
1
2   "transactionType": "Query",
3   "status": "success",
4   "company": {
5     "class": "org.pharma-network.pharmanet.company",
6     "keyField": "companyID",
7     "key": "DIST001:VGPHARMA",
8     "companyCRN": "DIST001",
9     "companyID": "DIST001:VGPHARMA",
10    "companyName": "VG PHARMA",
11    "hierarchyKey": "2",
12    "location": "VIZAG",
13    "organisationRole": "DISTRIBUTOR"
14  }
15 }
```

## 15. Creating Retailer company – upGrad:

Initiation / Retailer - Create and View / registerCompany - upGrad

POST http://localhost:3000/registerCompany

Params Authorization Headers (10) Body Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1 {  
2   "orgGroupName": "retailer",  
3   "companyCRN": "RET002",  
4   "companyName": "upgrad",  
5   "location": "Mumbai",  
6   "organizationRole": "retailer"  
7 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {  
2   "transactionType": "Invoke",  
3   "status": "success",  
4   "message": "Success: company registered with companyCRN: RET002, and companyName: UPGRAD on pankaj-pharma-network"  
5 }
```

## 16. Viewing Retailer company – upGrad:

Initiation / Retailer - Create and View / viewCompany - upGrad

POST http://localhost:3000/viewCompany

Params Authorization Headers (10) Body Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1 {  
2   "orgGroupName": "retailer",  
3   "companyCRN": "RET002",  
4   "companyName": "upgrad"  
5 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {  
2   "transactionType": "Query",  
3   "status": "success",  
4   "company": {  
5     "class": "org.pharma-network.pharmanet.company",  
6     "keyField": "companyID",  
7     "key": "RET002:UPGRAD",  
8     "companyCRN": "RET002",  
9     "companyID": "org.pharma-network.pharmanet.companyRET002UPGRAD",  
10    "companyName": "UPGRAD",  
11    "hierarchyKey": "3",  
12    "location": "MUMBAI",  
13    "organisationRole": "RETAILER"  
14  }  
15 }
```

## 17. Creating Drug – Paracetamol-001:

Initiation / Drug - Add and View / addDrug - Paracetamol-001

The screenshot shows the Postman interface with a POST request to `http://localhost:3000/addDrug`. The 'Body' tab is selected, showing a JSON payload with fields: `"orgGroupName": "manufacturer"`, `"drugName": "Paracetamol"`, `"serialNo": "001"`, `"mfgDate": "2022-07-22"`, `"expDate": "2025-12-31"`, and `"companyCRN": "MAN001"`. Below the body, the response is shown in JSON format, indicating success with message: "Success: drug added with drugName: PARACETAMOL, and serialNo: 001 for manufacturer: MAN001 on pankaj-pharma-network".

```
1
2   "orgGroupName": "manufacturer",
3   "drugName": "Paracetamol",
4   "serialNo": "001",
5   "mfgDate": "2022-07-22",
6   "expDate": "2025-12-31",
7   "companyCRN": "MAN001"
8 }
```

```
1
2   "transactionType": "Invoke",
3   "status": "success",
4   "message": "Success: drug added with drugName: PARACETAMOL, and serialNo: 001 for manufacturer: MAN001 on pankaj-pharma-network"
5 }
```

## 18. Viewing Drug – Paracetamol-001:

Initiation / Drug - Add and View / viewDrug - Paracetamol-001

The screenshot shows the Postman interface with a POST request to `http://localhost:3000/viewDrug`. The 'Body' tab is selected, showing a JSON payload with fields: `"orgGroupName": "consumer"`, `"drugName": "Paracetamol"`, and `"serialNo": "001"`. Below the body, the response is shown in JSON format, indicating success with a drug object containing details like class, keyField, key, expiryDate, manufacturer, manufacturingDate, name, owner, productID, serialNo, and shipment.

```
1
2   "orgGroupName": "consumer",
3   "drugName": "Paracetamol",
4   "serialNo": "001"
5 }
```

```
1
2   {
3     "transactionType": "Query",
4     "status": "success",
5     "drug": {
6       "class": "org.pharma-network.pharmanet.drug",
7       "keyField": "productID",
8       "key": "PARACETAMOL:001",
9       "expiryDate": "2025-12-31",
10      "manufacturer": "org.pharma-network.pharmanet.company:MAN001:SUNPHARMA",
11      "manufacturingDate": "2022-07-22",
12      "name": "PARACETAMOL",
13      "owner": "org.pharma-network.pharmanet.company:MAN001:SUNPHARMA",
14      "productID": "org.pharma-network.pharmanet.drug:PARACETAMOL:001",
15      "serialNo": "001",
16      "shipment": []
17    }
18  }
```

## 19. Creating Drug – Paracetamol-002:

Initiation / Drug - Add and View / addDrug - Paracetamol-002

The screenshot shows the Postman interface with a POST request to `http://localhost:3000/addDrug`. The 'Body' tab is selected, showing a JSON payload:

```
1 {
2   "orgGroupName": "manufacturer",
3   "drugName": "Paracetamol",
4   "serialNo": "002",
5   "mfgDate": "2022-07-22",
6   "expDate": "2025-12-31",
7   "companyCRN": "MAN001"
8 }
```

Below the body, the response is shown in JSON format:

```
1 {
2   "transactionType": "Invoke",
3   "status": "success",
4   "message": "Success: drug added with drugName: PARACETAMOL, and serialNo: 002 for manufacturer: MAN001 on pankaj-pharma-network"
5 }
```

## 20. Viewing Drug – Paracetamol-002:

Initiation / Drug - Add and View / viewDrug - Paracetamol-002

The screenshot shows the Postman interface with a POST request to `http://localhost:3000/viewDrug`. The 'Body' tab is selected, showing a JSON payload:

```
1 {
2   "orgGroupName": "consumer",
3   "drugName": "Paracetamol",
4   "serialNo": "002"
5 }
```

Below the body, the response is shown in JSON format:

```
1 {
2   "transactionType": "Query",
3   "status": "success",
4   "drug": {
5     "class": "org.pharma-network.pharmanet.drug",
6     "keyField": "productID",
7     "key": "PARACETAMOL:002",
8     "expiryDate": "2025-12-31",
9     "manufacturer": "org.pharma-network.pharmanet.companyMAN001SUNPHARMA",
10    "manufacturingDate": "2022-07-22",
11    "name": "PARACETAMOL",
12    "owner": "org.pharma-network.pharmanet.companyMAN001SUNPHARMA",
13    "productID": "org.pharma-network.pharmanet.drugPARACETAMOL:002",
14    "serialNo": "002",
15    "shipment": []
16  }
17 }
```

## 21. Creating Drug – Paracetamol-003:

Initiation / Drug - Add and View / addDrug - Paracetamol-003

The screenshot shows the Postman interface with a POST request to `http://localhost:3000/addDrug`. The 'Body' tab is selected, showing a JSON payload:

```
1 {
2   "orgGroupName": "manufacturer",
3   "drugName": "Paracetamol",
4   "serialNo": "003",
5   "mfgDate": "2022-07-22",
6   "expDate": "2025-12-31",
7   "companyCRN": "MAN001"
8 }
```

The 'Test Results' section shows the response:

```
1 {
2   "transactionType": "Invoke",
3   "status": "success",
4   "message": "Success: drug added with drugName: PARACETAMOL, and serialNo: 003 for manufacturer: MAN001 on pankaj-pharma-network"
5 }
```

## 22. Viewing Drug – Paracetamol-003:

Initiation / Drug - Add and View / viewDrug - Paracetamol-003

The screenshot shows the Postman interface with a POST request to `http://localhost:3000/viewDrug`. The 'Body' tab is selected, showing a JSON payload:

```
1 {
2   "orgGroupName": "consumer",
3   "drugName": "Paracetamol",
4   "serialNo": "003"
5 }
```

The 'Test Results' section shows the response:

```
1 {
2   "transactionType": "Query",
3   "status": "success",
4   "drug": {
5     "class": "org.pharma-network.pharmanet.drug",
6     "keyField": "productID",
7     "key": "PARACETAMOL:003",
8     "expiryDate": "2025-12-31",
9     "manufacturer": "org.pharma-network.pharmanet.company MAN001 SUNPHARMA",
10    "manufacturingDate": "2022-07-22",
11    "name": "PARACETAMOL",
12    "owner": "org.pharma-network.pharmanet.company MAN001 SUNPHARMA",
13    "productID": "org.pharma-network.pharmanet.drug PARACETAMOL 003",
14    "serialNo": "003",
15    "shipment": []
16  }
17 }
```

## 23. Creating Drug – Paracetamol-004:

Initiation / Drug - Add and View / addDrug - Paracetamol-004

POST <http://localhost:3000/addDrug>

Params Authorization Headers (10) **Body** Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1 {
2   "orgGroupName": "manufacturer",
3   "drugName": "Paracetamol",
4   "serialNo": "004",
5   "mfgDate": "2022-07-22",
6   "expDate": "2025-12-31",
7   "companyCRN": "MAN001"
8 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {
2   "transactionType": "Invoke",
3   "status": "success",
4   "message": "Success: drug added with drugName: PARACETAMOL, and serialNo: 004 for manufacturer: MAN001 on pankaj-pharma-network"
5 }
```

## 24. Viewing Drug – Paracetamol-004:

Initiation / Drug - Add and View / viewDrug - Paracetamol-004

POST <http://localhost:3000/viewDrug>

Params Authorization Headers (10) **Body** Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1 {
2   "orgGroupName": "consumer",
3   "drugName": "Paracetamol",
4   "serialNo": "004"
5 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {
2   "transactionType": "Query",
3   "status": "success",
4   "drug": {
5     "class": "org.pharma-network.pharmanet.drug",
6     "keyField": "productID",
7     "key": "PARACETAMOL:004",
8     "expiryDate": "2025-12-31",
9     "manufacturer": "org.pharma-network.pharmanet.company#MAN001#SUNPHARMA#",
10    "manufacturingDate": "2022-07-22",
11    "name": "PARACETAMOL",
12    "owner": "org.pharma-network.pharmanet.company#MAN001#SUNPHARMA#",
13    "productID": "org.pharma-network.pharmanet.drug#PARACETAMOL#004#",
14    "serialNo": "004",
15    "shipment": []
16  }
17 }
```

## 25. Creating PO - Distributor on Manufacturer - (VG Pharma on Sun Pharma):

Supply Chain / Part-a: Distributor Purchasing from Manufacturer / createPO - VG Pharma raises on Sun Pharma

POST http://localhost:3000/createPO

Params Authorization Headers (10) Body Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1 {  
2   "orgGroupName": "distributor",  
3   "buyerCRN": "DIST001",  
4   "sellerCRN": "MAN001",  
5   "drugName": "Paracetamol",  
6   "quantity": "3"  
7 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {  
2   "transactionType": "Invoke",  
3   "status": "success",  
4   "message": "Success: purchase order added with buyerCRN: DIST001, sellerCRN: MAN001, drugName: PARACETAMOL and quantity: 3 on pankaj-pharma-network"  
5 }
```

## 26. Viewing PO - Distributor on Manufacturer - (VG Pharma on Sun Pharma):

Supply Chain / Part-a: Distributor Purchasing from Manufacturer / viewPO

POST http://localhost:3000/viewPO

Params Authorization Headers (10) Body Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1 {  
2   "orgGroupName": "distributor",  
3   "buyerCRN": "DIST001",  
4   "drugName": "Paracetamol"  
5 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {  
2   "transactionType": "Query",  
3   "status": "success",  
4   "purchaseOrder": {  
5     "class": "org.pharma-network.pharmanet.purchaseorder",  
6     "keyField": "pOID",  
7     "key": "DIST001:PARACETAMOL",  
8     "buyer": "org.pharma-network.pharmanet.company DIST001 VGPHARMA",  
9     "buyerCRN": "DIST001",  
10    "drugName": "PARACETAMOL",  
11    "pOID": "org.pharma-network.pharmanet.purchaseorder DIST001 PARACETAMOL",  
12    "quantity": "3",  
13    "seller": "org.pharma-network.pharmanet.company MAN001 SUNPHARMA"  
14  }  
15 }
```

## 27. Creating Shipment – Manufacturer to Transporter - (Sun Pharma to FedEx):

Supply Chain / Part-a: Distributor Purchasing from Manufacturer / [createShipment - Sun Pharma to FedEx](#)

POST <http://localhost:3000/createShipment>

Params Authorization Headers (10) Body **Body** Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1
2   "orgGroupName": "manufacturer",
3   "buyerCRN": "DIST001",
4   "drugName": "Paracetamol",
5   "listOfAssets": [
6     "001",
7     "002",
8     "003"
9   ],
10  "transporterCRN": "TRA001"
11
```

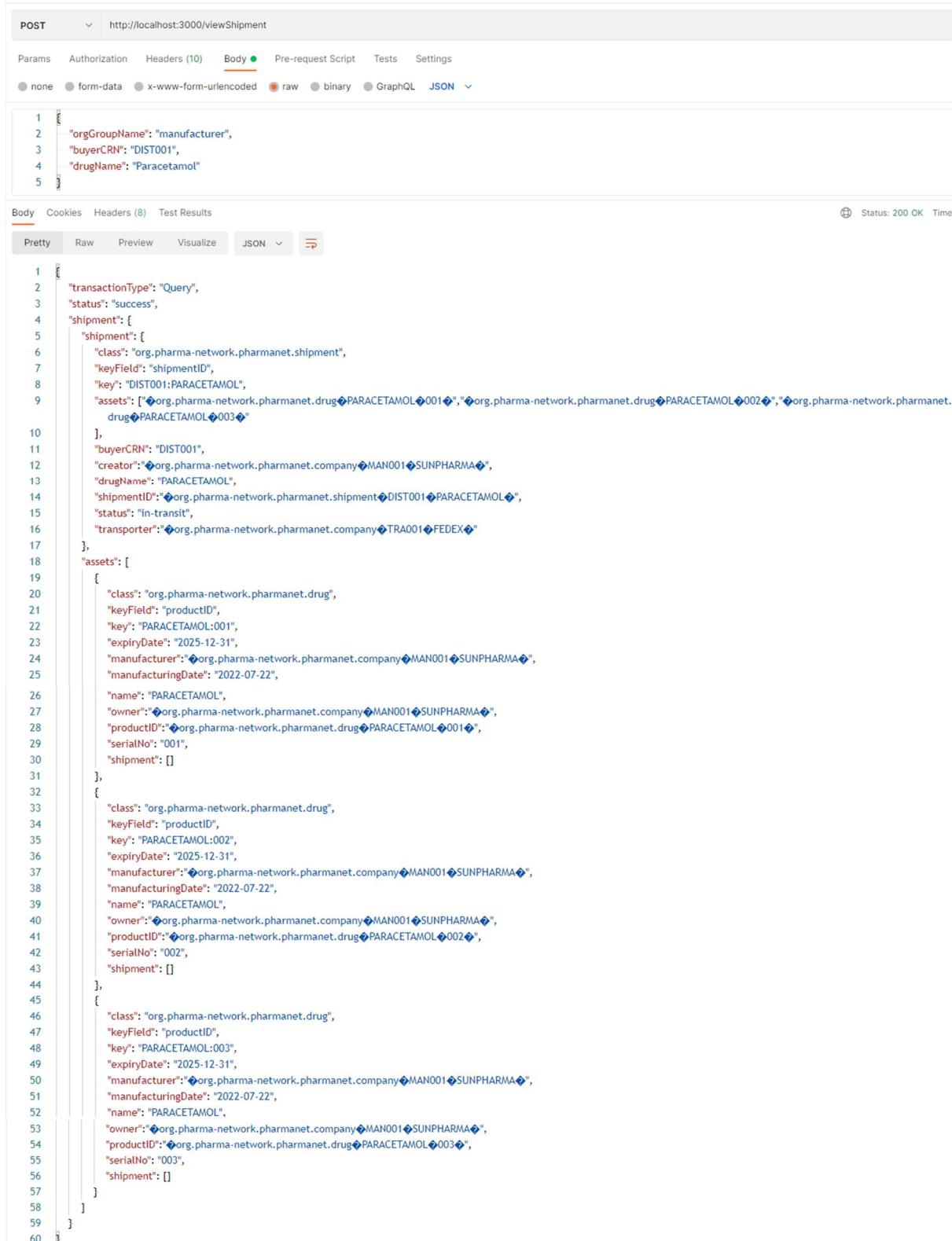
Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1
2   "transactionType": "Invoke",
3   "status": "success",
4   "message": "Success: shipment created with buyerCRN: DIST001, drugName: PARACETAMOL and transporterCRN: TRA001 on pankaj-pharma-network"
5
```

## 28. Viewing Shipment – Manufacturer to Transporter - (Sun Pharma to FedEx):

Supply Chain / Part-a: Distributor Purchasing from Manufacturer / viewShipment (in-transit)



POST http://localhost:3000/viewShipment

Params Authorization Headers (10) Body **JSON** Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1 "orgGroupName": "manufacturer",
2 "buyerCRN": "DIST001",
3 "drugName": "Paracetamol"
4
5
```

Body Cookies Headers (8) Test Results

Status: 200 OK Time

Pretty Raw Preview Visualize JSON

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```

"transactionType": "Query",  
"status": "success",  
"shipment": {  
 "shipment": {  
 "class": "org.pharma-network.pharmanet.shipment",  
 "keyField": "shipmentID",  
 "key": "DIST001:PARACETAMOL",  
 "assets": ["◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆001◆", "◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆002◆", "◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆003◆"]  
 },  
 "buyerCRN": "DIST001",  
 "creator": "◆org.pharma-network.pharmanet.company◆MAN001◆SUNPHARMA◆",  
 "drugName": "PARACETAMOL",  
 "shipmentID": "◆org.pharma-network.pharmanet.shipment◆DIST001◆PARACETAMOL◆",  
 "status": "in-transit",  
 "transporter": "◆org.pharma-network.pharmanet.company◆TRA001◆FEDEX◆"  
},  
"assets": [  
 {  
 "class": "org.pharma-network.pharmanet.drug",  
 "keyField": "productID",  
 "key": "PARACETAMOL:001",  
 "expiryDate": "2025-12-31",  
 "manufacturer": "◆org.pharma-network.pharmanet.company◆MAN001◆SUNPHARMA◆",  
 "manufacturingDate": "2022-07-22",  
 "name": "PARACETAMOL",  
 "owner": "◆org.pharma-network.pharmanet.company◆MAN001◆SUNPHARMA◆",  
 "productID": "◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆001◆",  
 "serialNo": "001",  
 "shipment": []  
 },  
 {  
 "class": "org.pharma-network.pharmanet.drug",  
 "keyField": "productID",  
 "key": "PARACETAMOL:002",  
 "expiryDate": "2025-12-31",  
 "manufacturer": "◆org.pharma-network.pharmanet.company◆MAN001◆SUNPHARMA◆",  
 "manufacturingDate": "2022-07-22",  
 "name": "PARACETAMOL",  
 "owner": "◆org.pharma-network.pharmanet.company◆MAN001◆SUNPHARMA◆",  
 "productID": "◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆002◆",  
 "serialNo": "002",  
 "shipment": []  
 },  
 {  
 "class": "org.pharma-network.pharmanet.drug",  
 "keyField": "productID",  
 "key": "PARACETAMOL:003",  
 "expiryDate": "2025-12-31",  
 "manufacturer": "◆org.pharma-network.pharmanet.company◆MAN001◆SUNPHARMA◆",  
 "manufacturingDate": "2022-07-22",  
 "name": "PARACETAMOL",  
 "owner": "◆org.pharma-network.pharmanet.company◆MAN001◆SUNPHARMA◆",  
 "productID": "◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆003◆",  
 "serialNo": "003",  
 "shipment": []  
 }]

## 29. Updating Shipment – Transporter to Distributor - (FedEx to VG Pharma):

Supply Chain / Part-a: Distributor Purchasing from Manufacturer / update Shipment - FedEx to VG Pharma

The screenshot shows the Postman application interface. At the top, it displays a POST request to <http://localhost:3000/updateShipment>. Below the URL, there are tabs for Params, Authorization, Headers (10), Body (selected), Pre-request Script, Tests, and Settings. Under the Body tab, the content type is set to JSON. The request body contains the following JSON payload:

```
1 "orgGroupName": "transporter",
2   "buyerCRN": "DIST001",
3   "drugName": "Paracetamol",
4   "transporterCRN": "TRA001"
```

Below the request body, the response tab is selected, showing the following JSON response:

```
1 "transactionType": "Invoke",
2   "status": "success",
3   "message": "Success: status for Shipment with DIST001,PARACETAMOLand TRA001 updated to delivered, and ownership of associated drugs transferred accordingly"
```

### 30. Viewing updated Shipment – Transporter to Distributor - (FedEx to VG Pharma):

Supply Chain / Part-a: Distributor Purchasing from Manufacturer / view updated Shipment (delivered)

POST http://localhost:3000/viewShipment

Params Authorization Headers (10) Body Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```

1 "orgGroupName": "manufacturer",
2 "buyerCRN": "DIST001",
3 "drugName": "Paracetamol"
4
5

```

Body Cookies Headers (8) Test Results Status: 200 OK Time: ~

Pretty Raw Preview Visualize JSON

```

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```

"transactionType": "Query",  
"status": "success",  
"shipment": {  
"shipment": {  
"class": "org.pharma-network.pharmanet.shipment",  
"keyField": "shipmentID",  
"key": "DIST001:PARACETAMOL",  
"assets": ["◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆001◆", "◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆002◆", "◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆003◆"]  
},  
"buyerCRN": "DIST001",  
"creator": "◆org.pharma-network.pharmanet.company◆MAN001◆SUNPHARMA◆",  
"drugName": "PARACETAMOL",  
"shipmentID": "◆org.pharma-network.pharmanet.shipment◆DIST001◆PARACETAMOL◆",  
"status": "delivered",  
"transporter": "◆org.pharma-network.pharmanet.company◆TRA001◆FEDEX◆"  
},  
"assets": [  
{
 "class": "org.pharma-network.pharmanet.drug",  
 "keyField": "productID",  
 "key": "PARACETAMOL:001",  
 "expiryDate": "2025-12-31",  
 "manufacturer": "◆org.pharma-network.pharmanet.company◆MAN001◆SUNPHARMA◆",  
 "manufacturingDate": "2022-07-22",  
 "name": "PARACETAMOL",  
 "owner": "◆org.pharma-network.pharmanet.company◆DIST001◆VGPHARMA◆",  
 "productID": "◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆001◆",  
 "serialNo": "001",  
 "shipment": ["◆org.pharma-network.pharmanet.shipment◆DIST001◆PARACETAMOL◆"]
},  
{
 "class": "org.pharma-network.pharmanet.drug",  
 "keyField": "productID",  
 "key": "PARACETAMOL:002",  
 "expiryDate": "2025-12-31",  
 "manufacturer": "◆org.pharma-network.pharmanet.company◆MAN001◆SUNPHARMA◆",  
 "manufacturingDate": "2022-07-22",  
 "name": "PARACETAMOL",  
 "owner": "◆org.pharma-network.pharmanet.company◆DIST001◆VGPHARMA◆",  
 "productID": "◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆002◆",  
 "serialNo": "002",  
 "shipment": ["◆org.pharma-network.pharmanet.shipment◆DIST001◆PARACETAMOL◆"]
},  
{
 "class": "org.pharma-network.pharmanet.drug",  
 "keyField": "productID",  
 "key": "PARACETAMOL:003",  
 "expiryDate": "2025-12-31",  
 "manufacturer": "◆org.pharma-network.pharmanet.company◆MAN001◆SUNPHARMA◆",  
 "manufacturingDate": "2022-07-22",  
 "name": "PARACETAMOL",  
 "owner": "◆org.pharma-network.pharmanet.company◆DIST001◆VGPHARMA◆",  
 "productID": "◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆003◆",  
 "serialNo": "003",  
 "shipment": ["◆org.pharma-network.pharmanet.shipment◆DIST001◆PARACETAMOL◆"]
}
]
}

### 31. Creating PO – Retailer on Distributor – (upGrad on VG Pharma):

Supply Chain / Part-b: Retailer Purchasing from Distributor / createPO - upGrad raises on VG Pharma

POST http://localhost:3000/createPO

Params Authorization Headers (10) Body Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1 {  
2   "orgGroupName": "retailer",  
3   "buyerCRN": "RET002",  
4   "sellerCRN": "DIST001",  
5   "drugName": "Paracetamol",  
6   "quantity": "2"  
7 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {  
2   "transactionType": "Invoke",  
3   "status": "success",  
4   "message": "Success: purchase order added with buyerCRN: RET002, sellerCRN: DIST001, drugName: PARACETAMOL and quantity: 2 on pankaj-pharma-network"  
5 }
```

### 32. Viewing PO – Retailer on Distributor – (upGrad on VG Pharma):

Supply Chain / Part-b: Retailer Purchasing from Distributor / viewPO

POST http://localhost:3000/viewPO

Params Authorization Headers (10) Body Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1 {  
2   "orgGroupName": "retailer",  
3   "buyerCRN": "RET002",  
4   "drugName": "Paracetamol"  
5 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {  
2   "transactionType": "Query",  
3   "status": "success",  
4   "purchaseOrder": {  
5     "class": "org.pharma-network.pharmanet.purchaseorder",  
6     "keyField": "pOID",  
7     "key": "RET002:PARACETAMOL",  
8     "buyer": "org.pharma-network.pharmanet.company RET002 UPGRAD",  
9     "buyerCRN": "RET002",  
10    "drugName": "PARACETAMOL",  
11    "pOID": "org.pharma-network.pharmanet.purchaseorder RET002 PARACETAMOL",  
12    "quantity": "2",  
13    "seller": "org.pharma-network.pharmanet.company DIST001 VGPHARMA"  
14  }  
15 }
```

### 33. Creating Shipment – Distributor to Transporter - (VG Pharma to Blue Dart):

Supply Chain / Part-b: Retailer Purchasing from Distributor / [createShipment - VG Pharma to Blue Dart](#)

POST <http://localhost:3000/createShipment>

Params Authorization Headers (10) Body Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1
2 "orgGroupName": "distributor",
3 "buyerCRN": "RET002",
4 "drugName": "Paracetamol",
5 "listOfAssets": [
6   "001",
7   "002"
8 ],
9 "transporterCRN": "TRA002"
10
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {}
2 "transactionType": "Invoke",
3 "status": "success",
4 "message": "Success: shipment created with buyerCRN: RET002, drugName: PARACETAMOL and transporterCRN: TRA002 on pankaj-pharma-network"
5
```

### 34. Viewing Shipment – Distributor to Transporter - (VG Pharma to Blue Dart):

Supply Chain / Part-b: Retailer Purchasing from Distributor / viewShipment (in-transit)

POST <http://localhost:3000/viewShipment>

Params Authorization Headers (10) **Body** Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1 "orgGroupName": "distributor",
2 "buyerCRN": "RET002",
3 "drugName": "Paracetamol"
4
5
```

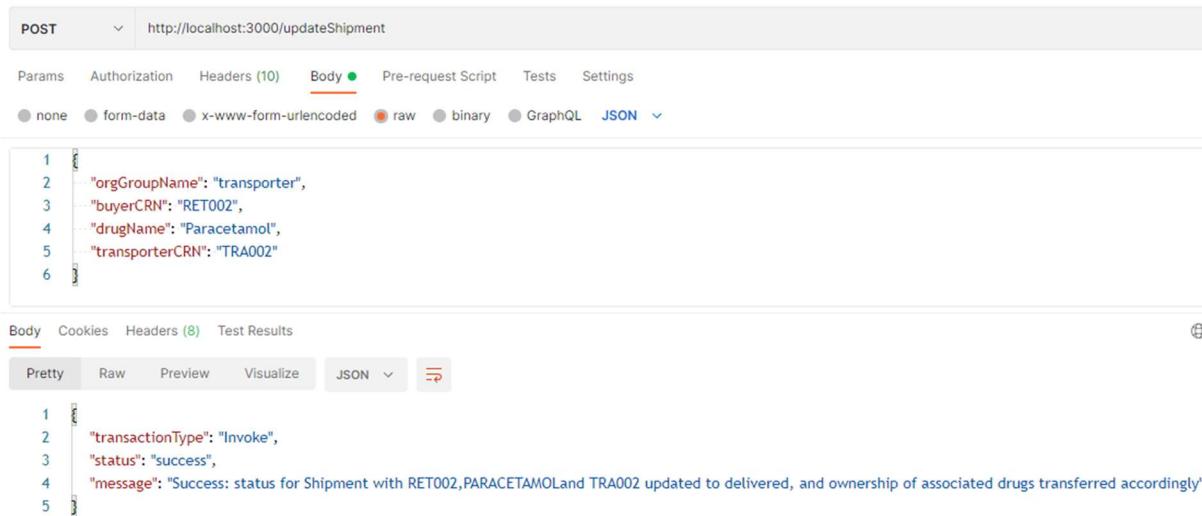
Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1
2 "transactionType": "Query",
3 "status": "success",
4 "shipment": {
5     "shipment": {
6         "class": "org.pharma-network.pharmanet.shipment",
7         "keyField": "shipmentID",
8         "key": "RET002:PARACETAMOL",
9         "assets": ["◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆001◆", "◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆002◆"],
10    },
11    "buyerCRN": "RET002",
12    "creator": "◆org.pharma-network.pharmanet.company◆DIST001◆VGPHARMA◆",
13    "drugName": "PARACETAMOL",
14    "shipmentID": "◆org.pharma-network.pharmanet.shipment◆RET002◆PARACETAMOL◆",
15    "status": "in-transit",
16    "transporter": "◆org.pharma-network.pharmanet.company◆TRA002◆BLUEDART◆"
17 },
18 "assets": [
19     {
20         "class": "org.pharma-network.pharmanet.drug",
21         "keyField": "productID",
22         "key": "PARACETAMOL:001",
23         "expiryDate": "2025-12-31",
24         "manufacturer": "◆org.pharma-network.pharmanet.company◆MAN001◆SUNPHARMA◆",
25         "manufacturingDate": "2022-07-22",
26         "name": "PARACETAMOL",
27         "owner": "◆org.pharma-network.pharmanet.company◆DIST001◆VGPHARMA◆",
28         "productID": "◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆001◆",
29         "serialNo": "001",
30         "shipment": ["◆org.pharma-network.pharmanet.shipment◆DIST001◆PARACETAMOL◆"]
31     }
32 },
33 {
34     "class": "org.pharma-network.pharmanet.drug",
35     "keyField": "productID",
36     "key": "PARACETAMOL:002",
37     "expiryDate": "2025-12-31",
38     "manufacturer": "◆org.pharma-network.pharmanet.company◆MAN001◆SUNPHARMA◆",
39     "manufacturingDate": "2022-07-22",
40     "name": "PARACETAMOL",
41     "owner": "◆org.pharma-network.pharmanet.company◆DIST001◆VGPHARMA◆",
42     "productID": "◆org.pharma-network.pharmanet.drug◆PARACETAMOL◆002◆",
43     "serialNo": "002",
44     "shipment": ["◆org.pharma-network.pharmanet.shipment◆DIST001◆PARACETAMOL◆"]
45   }
46 }
47 ]
48 }
49 }
```

### 35. Creating updated Shipment – Transporter to Retailer - (Blue Dart to upGrad):

Supply Chain / Part-b: Retailer Purchasing from Distributor / update Shipment - Blue Dart to upGrad



POST <http://localhost:3000/updateShipment>

Params Authorization Headers (10) **Body** Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1 "orgGroupName": "transporter",
2 "buyerCRN": "RET002",
3 "drugName": "Paracetamol",
4 "transporterCRN": "TRA002"
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 "transactionType": "Invoke",
2 "status": "success",
3 "message": "Success: status for Shipment with RET002,PARACETAMOLand TRA002 updated to delivered, and ownership of associated drugs transferred accordingly"
```

## 36. Viewing updated Shipment – Transporter to Retailer - (Blue Dart to upGrad):

Supply Chain / Part-b: Retailer Purchasing from Distributor / view updated Shipment (delivered)

POST http://localhost:3000/viewShipment

Params Authorization Headers (10) Body Pre-request Script Tests Settings

Body Cookies Headers (8) Test Results Status:

Pretty Raw Preview Visualize JSON

```
1 "orgGroupName": "retailer",
2 "buyerCRN": "RET002",
3 "drugName": "Paracetamol"
4
5 }
```

```
1
2 "transactionType": "Query",
3 "status": "success",
4 "shipment": {
5   "shipment": {
6     "class": "org.pharma-network.pharmanet.shipment",
7     "keyField": "shipmentID",
8     "key": "RET002:PARACETAMOL",
9     "assets": ["org.pharma-network.pharmanet.drug:PARACETAMOL:001", "org.pharma-network.pharmanet.drug:PARACETAMOL:002"]
10   },
11   "buyerCRN": "RET002",
12   "creator": "org.pharma-network.pharmanet.company:DIST001:VGPHARMA",
13   "drugName": "PARACETAMOL",
14   "shipmentID": "org.pharma-network.pharmanet.shipment:RET002:PARACETAMOL",
15   "status": "delivered",
16   "transporter": "org.pharma-network.pharmanet.company:TRA002:BLUEDART"
17 },
18 "assets": [
19   {
20     "class": "org.pharma-network.pharmanet.drug",
21     "keyField": "productID",
22     "key": "PARACETAMOL:001",
23     "expiryDate": "2025-12-31",
24     "manufacturer": "org.pharma-network.pharmanet.company:MAN001:SUNPHARMA",
25     "manufacturingDate": "2022-07-22",
26     "name": "PARACETAMOL",
27     "owner": "org.pharma-network.pharmanet.company:RET002:UPGRAD",
28     "productID": "org.pharma-network.pharmanet.drug:PARACETAMOL:001",
29     "serialNo": "001",
30     "shipment": ["org.pharma-network.pharmanet.shipment:DIST001:PARACETAMOL", "org.pharma-network.pharmanet.shipment:RET002:PARACETAMOL"]
31   },
32   {
33     "class": "org.pharma-network.pharmanet.drug",
34     "keyField": "productID",
35     "key": "PARACETAMOL:002",
36     "expiryDate": "2025-12-31",
37     "manufacturer": "org.pharma-network.pharmanet.company:MAN001:SUNPHARMA",
38     "manufacturingDate": "2022-07-22",
39     "name": "PARACETAMOL",
40     "owner": "org.pharma-network.pharmanet.company:RET002:UPGRAD",
41     "productID": "org.pharma-network.pharmanet.drug:PARACETAMOL:002",
42     "serialNo": "002",
43     "shipment": ["org.pharma-network.pharmanet.shipment:DIST001:PARACETAMOL", "org.pharma-network.pharmanet.shipment:RET002:PARACETAMOL"]
44   }
45 ]
46 }
47 ]
48 }
```

### 37. Customer buys from Retailer - (Akash from upGrad):

Supply Chain / Part-c: Customer buys from a retailer / retailDrug - Akash buys from upGrad  

POST  http://localhost:3000/retailDrug

Params Authorization Headers (10) **Body**  Pre-request Script Tests Settings

none  form-data  x-www-form-urlencoded  raw  binary  GraphQL **JSON** 

```
1 {
2   "orgGroupName": "retailer",
3   "serialNo": "001",
4   "drugName": "Paracetamol",
5   "retailerCRN": "RET002",
6   "customerAadhar": "AAD001"
7 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize **JSON** 

```
1 {
2   "transactionType": "Invoke",
3   "status": "success",
4   "message": "Success: RET002 sold PARACETAMOL-001 to AAD001"
5 }
```

### 38. View Owner of Drug – new Owner AAD001:

Supply Chain / Part-c: Customer buys from a retailer / viewDrug - Paracetamol-001

POST  http://localhost:3000/viewDrug

Params Authorization Headers (10) **Body**  Pre-request Script Tests Settings

none  form-data  x-www-form-urlencoded  raw  binary  GraphQL **JSON** 

```
1 {
2   "orgGroupName": "consumer",
3   "drugName": "Paracetamol",
4   "serialNo": "001"
5 }
```

Body Cookies Headers (8) Test Results 

Pretty Raw Preview Visualize **JSON** 

```
1 {
2   "transactionType": "Query",
3   "status": "success",
4   "drug": [
5     {
6       "class": "org.pharma-network.pharmanet.drug",
7       "keyField": "productID",
8       "key": "PARACETAMOL:001",
9       "expiryDate": "2025-12-31",
10      "manufacturer": "org.pharma-network.pharmanet.companyMAN001SUNPHARMA",
11      "manufacturingDate": "2022-07-22",
12      "name": "PARACETAMOL",
13      "owner": "AAD001",
14      "productId": "org.pharma-network.pharmanet.drugPARACETAMOL001",
15      "serialNo": "001",
16      "shipment": ["org.pharma-network.pharmanet.shipmentDIST001PARACETAMOL", "org.pharma-network.pharmanet.shipmentRET002PARACETAMOL"]
17    }
18  ]
```

### 39. View Drug History – Manufacturer till Customer – Paracetamol-001 - Sun Pharma till Aakash:

History / viewHistory - History of Drug - Paracetamol-001

POST http://localhost:3000/viewHistory

Params Authorization Headers (10) Body Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```
1 "orgGroupName": "consumer",
2 "drugName": "Paracetamol",
3 "serialNo": "001"
4
5
```

Body Cookies Headers (8) Test Results Status: 200

Pretty Raw Preview Visualize JSON

```
1
2   "transactionType": "Query",
3   "status": "success",
4   "drug": [
5     {
6       "class": "org.pharma-network.pharmanet.drug",
7       "expiryDate": "2025-12-31",
8       "key": "PARACETAMOL:001",
9       "keyField": "productID",
10      "manufacturer": "org.pharma-network.pharmanet.company#MAN001#SUNPHARMA",
11      "manufacturingDate": "2022-07-22",
12      "name": "PARACETAMOL",
13      "owner": "org.pharma-network.pharmanet.company#MAN001#SUNPHARMA",
14      "productID": "org.pharma-network.pharmanet.drug#PARACETAMOL#001",
15      "serialNo": "001",
16      "shipment": []
17    },
18    {
19      "class": "org.pharma-network.pharmanet.drug",
20      "expiryDate": "2025-12-31",
21      "key": "PARACETAMOL:001",
22      "keyField": "productID",
23      "manufacturer": "org.pharma-network.pharmanet.company#MAN001#SUNPHARMA",
24      "manufacturingDate": "2022-07-22",
25      "name": "PARACETAMOL",
26      "owner": "org.pharma-network.pharmanet.company#DIST001#VGPHARMA",
27      "productID": "org.pharma-network.pharmanet.drug#PARACETAMOL#001",
28      "serialNo": "001",
29      "shipment": ["org.pharma-network.pharmanet.shipment#DIST001#PARACETAMOL"]
30    },
31    {
32      "class": "org.pharma-network.pharmanet.drug",
33      "expiryDate": "2025-12-31",
34      "key": "PARACETAMOL:001",
35      "keyField": "productID",
36      "manufacturer": "org.pharma-network.pharmanet.company#MAN001#SUNPHARMA",
37      "manufacturingDate": "2022-07-22",
38      "name": "PARACETAMOL",
39      "owner": "org.pharma-network.pharmanet.company#RET002#UPGRAD",
40      "productID": "org.pharma-network.pharmanet.drug#PARACETAMOL#001",
41      "serialNo": "001",
42      "shipment": ["org.pharma-network.pharmanet.shipment#DIST001#PARACETAMOL", "org.pharma-network.pharmanet.shipment#RET002#PARACETAMOL"]
43    },
44    ],
45  },
46  {
47    "class": "org.pharma-network.pharmanet.drug",
48    "expiryDate": "2025-12-31",
49    "key": "PARACETAMOL:001",
50    "keyField": "productID",
51    "manufacturer": "org.pharma-network.pharmanet.company#MAN001#SUNPHARMA",
52    "manufacturingDate": "2022-07-22",
53    "name": "PARACETAMOL",
54    "owner": "AAD001",
55    "productID": "org.pharma-network.pharmanet.drug#PARACETAMOL#001",
56    "serialNo": "001",
57    "shipment": ["org.pharma-network.pharmanet.shipment#DIST001#PARACETAMOL", "org.pharma-network.pharmanet.shipment#RET002#PARACETAMOL"]
58  }
59 ]
60 }
```

## 40. View Drug Current State – Paracetamol-001 -

History / viewDrug - current state of Drug - Paracetamol-001

POST http://localhost:3000/viewDrug

Params Authorization Headers (10) Body Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL JSON

```

1 "orgGroupName": "consumer",
2 "drugName": "Paracetamol",
3 "serialNo": "001"
4
5

```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```

1
2 "transactionType": "Query",
3 "status": "success",
4 "drug": {
5   "class": "org.pharma-network.pharmanet.drug",
6   "keyField": "productID",
7   "key": "PARACETAMOL:001",
8   "expiryDate": "2025-12-31",
9   "manufacturer": "org.pharma-network.pharmanet.company#MAN001#SUNPHARMA",
10  "manufacturingDate": "2022-07-22",
11  "name": "PARACETAMOL",
12  "owner": "AAD001",
13  "productID": "org.pharma-network.pharmanet.drug#PARACETAMOL#001",
14  "serialNo": "001",
15  "shipment": ["org.pharma-network.pharmanet.shipment#DIST001#PARACETAMOL", "org.pharma-network.pharmanet.shipment#RET002#PARACETAMOL"]
16 }
17
18

```

### IV) Couch DB data view:

Login to [http://localhost:5984/\\_utils](http://localhost:5984/_utils) with username: COUCH\_USER and password: COUCH\_PASS

Project Fauxton - \_all\_dbs

localhost:5984/\_utils/#/\_all\_dbs

Databases

Name	Size	# of Docs	Actions
_replicator	3.8 KB	1	
_users	3.8 KB	1	
pharmacchannel_	43.5 KB	2	
pharmacchannel_lscc	0.7 KB	1	
pharmacchannel_pharmanet	10.7 KB	13	

If clicked on the pharmacchannel\_pharmanet, it will show the records as below:

localhost:5984/\_utils/#/database/pharmacchannel\_pharmanet/\_all\_docs

All Documents

Run A Query with Mongo

Permissions

Changes

Design Documents

Table Metadata JSON

id	key	value
org.pharma-network.pharmanet.company.DIST001.VGPHARMA	org.pharma-network.pharmanet.company.DIST001.VGPHARMA	{"rev": "1-410f1e3a551fe04a827978508c3b532"}
org.pharma-network.pharmanet.company.MAN001.SUNPHARMA	org.pharma-network.pharmanet.company.MAN001.SUNPHARMA	{"rev": "1-89cd85a2632c24573046609566fd25e"}
org.pharma-network.pharmanet.company.RET002.UPGRAD	org.pharma-network.pharmanet.company.RET002.UPGRAD	{"rev": "1-8c364d41c537065527a7fe7bf02c45"}
org.pharma-network.pharmanet.company.TRA001.FEDEX	org.pharma-network.pharmanet.company.TRA001.FEDEX	{"rev": "1-1351a35b508ef9f4100678ab89c2172"}
org.pharma-network.pharmanet.company.TRA002.BLUEART	org.pharma-network.pharmanet.company.TRA002.BLUEART	{"rev": "1-3e2a309751fb0b778331da23b64df5"}
org.pharma-network.pharmanet.drug.PARACETAMOL.001	org.pharma-network.pharmanet.drug.PARACETAMOL.001	{"rev": "4-5889ea8697824993501cd4b8f23c4"}
org.pharma-network.pharmanet.drug.PARACETAMOL.002	org.pharma-network.pharmanet.drug.PARACETAMOL.002	{"rev": "3-c9a23b9fb639213cd02a69657e5ba2fe"}
org.pharma-network.pharmanet.drug.PARACETAMOL.003	org.pharma-network.pharmanet.drug.PARACETAMOL.003	{"rev": "2-d28750516a3bac27d0abaabfb93327"}
org.pharma-network.pharmanet.drug.PARACETAMOL.004	org.pharma-network.pharmanet.drug.PARACETAMOL.004	{"rev": "1-dc88c5c599bd5de08904383d26f683"}
org.pharma-network.pharmanet.purchaseorder.DIST001.PARACETAMOL.	org.pharma-network.pharmanet.purchaseorder.DIST001.PARACETAMOL.	{"rev": "1-882d696359a55323210f6ce77fe773b"}
org.pharma-network.pharmanet.purchaseorder.RET002.PARACETAMOL	org.pharma-network.pharmanet.purchaseorder.RET002.PARACETAMOL	{"rev": "1-633eedf93fdb43e84791320b0bab925"}
org.pharma-network.pharmanet.shipment.DIST001.PARACETAMOL	org.pharma-network.pharmanet.shipment.DIST001.PARACETAMOL	{"rev": "2-642c6a93bd514889573c64073d5f7a3"}
org.pharma-network.pharmanet.pharmanet.RET002.PARACETAMOL	org.pharma-network.pharmanet.pharmanet.RET002.PARACETAMOL	{"rev": "2-408c45c4b781d92fc60314bf1989b4f92"}

The revision number in the last column can be seen, as it get increased each time a transaction invoked on the entity.

If clicked on the JSON tab, it shows the complete JSON of the record.

e.g. the record for Manufacturer company - Sun Pharma is seen as below:

```
id "org.pharma-network.pharmanet.company MAN001 SUNPHARMA"
{
  "id": "\u0000org.pharma-network.pharmanet.company\000MAN001\000SUNPHARMA\000",
  "key": "\u0000org.pharma-network.pharmanet.company\000MAN001\000SUNPHARMA\000",
  "value": {
    "rev": "1-89cd85a2632c24573046609566fda25e"
  },
  "doc": {
    "_id": "\u0000org.pharma-network.pharmanet.company\000MAN001\000SUNPHARMA\000",
    "_rev": "1-89cd85a2632c24573046609566fda25e",
    "class": "org.pharma-network.pharmanet.company",
    "companyCRN": "MAN001",
    "companyID": "\u0000org.pharma-network.pharmanet.company\000MAN001\000SUNPHARMA\000",
    "companyName": "SUN PHARMA",
    "hierarchyKey": "1",
    "key": "MAN001:SUNPHARMA",
    "keyField": "companyID",
    "location": "CHENNAI",
    "organisationRole": "MANUFACTURER",
    "~version": "\u0000CgMBBwA="
  }
}
```

## V) Negative Test Cases (Validation scenarios demonstrated):

Lot of validations implemented and can be seen in the code, however not possible to show all of them here. Hence showing a few of them for demonstration purpose.

1. Registering a company that is already registered:

Initiation / Manufacturer - Create and View / registerCompany - Sun Pharma

The screenshot shows a Postman API testing interface. The request method is POST, and the URL is `http://localhost:3000/registerCompany`. The Body tab is selected, showing the following JSON payload:

```
1 {
2   "orgGroupName": "manufacturer",
3   "companyCRN": "MAN001",
4   "companyName": "Sun Pharma",
5   "location": "Chennai",
6   "organizationRole": "manufacturer"
7 }
```

The response tab shows the following JSON error message:

```
1 {
2   "transactionType": "Invoke",
3   "status": "error",
4   "message": "Error: Company Already Exists for companyCRN: MAN001, and name: SUN PHARMA"
5 }
```

2. Registering a company with a role other than Manufacturer, Distributor, Retailer, Transporter:

The screenshot shows a Postman interface with a POST request to `http://localhost:3000/registerCompany`. The 'Body' tab is selected, showing a JSON payload:

```
1 {  
2   "orgGroupName": "consumer",  
3   "companyCRN": "CON001",  
4   "companyName": "Aakash",  
5   "location": "Pune",  
6   "organizationRole": "consumer"  
7 }
```

The response body is also displayed in JSON format:

```
1 {  
2   "transactionType": "Invoke",  
3   "status": "error",  
4   "message": "Error: Invalid Organization Role: CONSUMER"  
5 }
```

3. Raising a PO without a quantity:

The screenshot shows a Postman interface with a POST request to `http://localhost:3000/createPO`. The 'Body' tab is selected, showing a JSON payload:

```
1 {  
2   "orgGroupName": "distributor",  
3   "buyerCRN": "DIST001",  
4   "sellerCRN": "MAN001",  
5   "drugName": "Paracetamol",  
6   "quantity": ""  
7 }
```

The response body is also displayed in JSON format:

```
1 {  
2   "transactionType": "Invoke",  
3   "status": "error",  
4   "message": "Error: Invalid purchase order request, quantity should be at least 1"  
5 }
```

#### 4. Quantity in PO does not match with number of items in Shipment:

Supply Chain / Part-a: Distributor Purchasing from Manufacturer / createShipment - Sun Pharma to FedEx

POST http://localhost:3000/createShipment

Params Authorization Headers (10) Body Pre-request Script Tests Settings

Body

```
1 {
2   "orgGroupName": "manufacturer",
3   "buyerCRN": "DIST001",
4   "drugName": "Paracetamol",
5   "listOfAssets": [
6     "001",
7     "002",
8     "003",
9     "004"
10   ],
11   "transporterCRN": "TRA001"
12 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {
2   "transactionType": "Invoke",
3   "status": "error",
4   "message": "Error: Invalid shipment request, number of items ordered in PO: 3 and number of items requested in shipment: 4 does not match"
5 }
```

#### 5. Raising a PO for a seller that is not register on network:

POST http://localhost:3000/createPO

Params Authorization Headers (10) Body Pre-request Script Tests Settings

Body

```
1 {
2   "orgGroupName": "distributor",
3   "buyerCRN": "DIST001",
4   "sellerCRN": "MAN002",
5   "drugName": "Paracetamol",
6   "quantity": "3"
7 }
```

Body Cookies Headers (8) Test Results

Pretty Raw Preview Visualize JSON

```
1 {
2   "transactionType": "Invoke",
3   "status": "error",
4   "message": "Error: Invalid sellerCRN. Company does not exist for sellerCRN: MAN002"
5 }
```

## VI) Shutting down the network:

```
./pankaj-network.sh down -i 1.4.9 -l node -c pharmachannel -f docker-compose-e2e.yaml -t 120 -d 10
```

```
/usr/pankaj/pharma-net/network>./pankaj-network.sh down -i 1.4.9 -l node -c pharmachannel -f docker-compose-e2e.yaml -t 120 -d 10 -a -o etcdraft -s couchdb
=====
Pharma Network to prevent drug counterfeiting
Advanced Certification Programme in Blockchain
conducted by IIIT Bangalore and upGrad
Capstone Project - on Hyperledger Fabric - v1.4.9
Project by - Pankaj Mahadik
=====
=====
Stopping for channel 'pharmachannel' with CLI timeout of '120' seconds and CLI delay of '10' seconds and using database 'couchdb'
Continue? [Y/n] y
proceeding ...

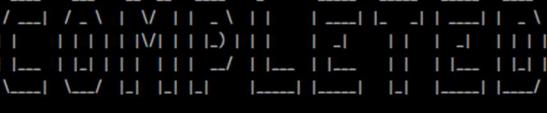
=====
=====
starting with: Stopping
Stopping cli ... done
Stopping peer0.retailer.pharma-network.com ... done
Stopping peer1.retailer.pharma-network.com ... done
Stopping peer1.consumer.pharma-network.com ... done
Stopping peer0.manufacturer.pharma-network.com ... done
Stopping peer1.transporter.pharma-network.com ... done
Stopping peer0.transporter.pharma-network.com ... done
Stopping peer1.distributor.pharma-network.com ... done
Stopping peer1.manufacturer.pharma-network.com ... done
Stopping peer0.consumer.pharma-network.com ... done
Stopping peer0.distributor.pharma-network.com ... done
Stopping ca.transporter.pharma-network.com ... done
Stopping ca.retailer.pharma-network.com ... done
Stopping ca.consumer.pharma-network.com ... done
Stopping orderer2.pharma-network.com ... done
Stopping ca.distributor.pharma-network.com ... done
Stopping couchdb.peer1.retailer.pharma-network.com ... done
Stopping orderer.pharma-network.com ... done
Stopping orderer3.pharma-network.com ... done
Stopping ca.manufacturer.pharma-network.com ... done
Stopping couchdb.peer0.transporter.pharma-network.com ... done
Stopping couchdb.peer1.transporter.pharma-network.com ... done
Stopping couchdb.peer0.consumer.pharma-network.com ... done
Stopping couchdb.peer0.manufacturer.pharma-network.com ... done
Stopping couchdb.peer0.distributor.pharma-network.com ... done
Stopping couchdb.peer1.distributor.pharma-network.com ... done
```

```
Stopping couchdb.peer1.distributor.pharma-network.com ... done
Stopping couchdb.peer0.retailer.pharma-network.com ... done
Stopping couchdb.peer1.manufacturer.pharma-network.com ... done
Stopping couchdb.peer1.consumer.pharma-network.com ... done
Removing cli ... done
Removing peer0.retailer.pharma-network.com ... done
Removing peer1.retailer.pharma-network.com ... done
Removing peer1.consumer.pharma-network.com ... done
Removing peer0.manufacturer.pharma-network.com ... done
Removing peer1.transporter.pharma-network.com ... done
Removing peer0.transporter.pharma-network.com ... done
Removing peer1.distributor.pharma-network.com ... done
Removing peer1.manufacturer.pharma-network.com ... done
Removing peer0.consumer.pharma-network.com ... done
Removing peer0.distributor.pharma-network.com ... done
Removing ca.transporter.pharma-network.com ... done
Removing ca.retailer.pharma-network.com ... done
Removing ca.consumer.pharma-network.com ... done
Removing orderer2.pharma-network.com ... done
Removing ca.distributor.pharma-network.com ... done
Removing couchdb.peer1.retailer.pharma-network.com ... done
Removing orderer.pharma-network.com ... done
Removing orderer3.pharma-network.com ... done
Removing ca.manufacturer.pharma-network.com ... done
Removing couchdb.peer0.transporter.pharma-network.com ... done
Removing couchdb.peer1.transporter.pharma-network.com ... done
Removing couchdb.peer0.consumer.pharma-network.com ... done
Removing couchdb.peer0.manufacturer.pharma-network.com ... done
Removing couchdb.peer0.distributor.pharma-network.com ... done
Removing couchdb.peer1.distributor.pharma-network.com ... done
Removing couchdb.peer0.retailer.pharma-network.com ... done
Removing couchdb.peer1.manufacturer.pharma-network.com ... done
Removing couchdb.peer1.consumer.pharma-network.com ... done
Removing network pankaj_pharma-network
Removing volume pankaj_orderer.pharma-network.com
Removing volume pankaj_peer0.manufacturer.pharma-network.com
Removing volume pankaj_peer1.manufacturer.pharma-network.com
Removing volume pankaj_peer0.distributor.pharma-network.com
Removing volume pankaj_peer1.distributor.pharma-network.com
Removing volume pankaj_peer0.retailer.pharma-network.com
Removing volume pankaj_peer1.retailer.pharma-network.com
Removing volume pankaj_peer0.consumer.pharma-network.com
Removing volume pankaj_peer1.consumer.pharma-network.com
Removing volume pankaj_peer0.transporter.pharma-network.com
Removing volume pankaj_peer1.transporter.pharma-network.com
Removing volume pankaj_orderer2.pharma-network.com
Removing volume pankaj_orderer3.pharma-network.com
dcb744bddbf
163d4fc7a80a
0fc958f7ee80
ec20c9e98788
37a015db1acc
298657c1b09b
cf1421bfe550
70e382efa77a
94d331af386f
b7799bae6bf9
Untagged: cc-peer1.transporter.pharma-network.com-pharmanet-1.0-2dba4fac3d280f6d4faede92b1847bb6519ba4dffde619846aa907178851e17:latest
```

```

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Deleted: sha256:865c68bc7f74102c54ae61bb562e4dcf7f10a28123723c3a0a89e668b407717b
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Deleted: sha256:9eb0bec0a19043db1b0cd856805fd8025194bef34959ed43c4e8afe3c3bcd27d8
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Untagged: cc-peer1.retailer.pharma-network.com-pharmanet-1.0-1d0a2b19b0db81e0db6f8328e6bd479183380255bdc9e5f9f94d3cb4bd151979:latest
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Deleted: sha256:9eb0bec0a19043db1b0cd856805fd8025194bef34959ed43c4e8afe3c3bcd27d8
Untagged: cc-peer1.retailer.pharma-network.com-pharmanet-1.0-1d0a2b19b0db81e0db6f8328e6bd479183380255bdc9e5f9f94d3cb4bd151979:latest
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Deleted: sha256:871ea947ef433ec5d15e178e2ee35a96689b1a055e16d4ba8ca12e9dd4121f
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Untagged: cc-peer1.manufacturer.pharma-network.com-pharmanet-1.0-c470c20ce28e194f2068df196a23ccfad0fb5f96f1e2f5ce8002741b7b48976:latest
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Deleted: sha256:bd12ea5c9c9b274cc3ba4df4c138b93d994038a9fcf59498e76e683dac26d83
Untagged: cc-peer0.manufacturer.pharma-network.com-pharmanet-1.0-ff5409c1bla41759b40556e6159ee7fa9c08b72c04f7373a2bc27c415dadd56:latest
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Deleted: sha256:d21ab7404fed0cf2f10c45885a79eaa0494ccfb200de4056438575e492
Deleted: sha256:e153834b3b084128cbe1b06b45e227b591be4a338a20a6e3c663d5d0b3b46cd
Deleted: sha256:731fa65a3a8247cdc7f2b1f679af38528344e2b2fd191e0961e03344f277
Completed: Stopping

```



## VII) Additional checks:

1. Command below shows all the docker containers with current state (up or exited).

**docker ps -a**

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
002430420000	cc-peer0.transporter.pharma-network.com-pharmanet-1.0-36ca1db3e1c27093ecc749e73238a1392fd3e6262e190ed2173b33cc689d69fd:latest	" /bin/sh -c '/d' /usr/bin/true"	2 minutes ago	Up 2 minutes		cc-peer0.transporter.pharma-network.com-pharmanet-1.0
1434f78a8808	cc-peer0.transporter.pharma-network.com-pharmanet-1.0-36ca1db3e1c27093ecc749e73238a1392fd3e6262e190ed2173b33cc689d69fd:latest	" /bin/sh -c '/d' /usr/bin/true"	3 minutes ago	Up 2 minutes		cc-peer0.transporter.pharma-network.com-pharmanet-1.0
4fc9587ee088	cc-peer1.consumer.pharma-network.com-pharmanet-1.0-d0fa56edf4e7fb9f9ecfc4b943e43bbaed532cc9db80556a7bc26360172cd4d	" /bin/sh -c '/d' /usr/bin/true"	3 minutes ago	Up 3 minutes		cc-peer1.consumer.pharma-network.com-pharmanet-1.0
ec:cc8987888	cc-peer0.consumer.pharma-network.com-pharmanet-1.0-d0fa56edf4e7fb9f9ecfc4b943e43bbaed532cc9db80556a7bc26360172cd4d	" /bin/sh -c '/d' /usr/bin/true"	3 minutes ago	Up 3 minutes		cc-peer0.consumer.pharma-network.com-pharmanet-1.0
77a051bacc	cc-peer1.retailer.pharma-network.com-pharmanet-1.0-1d0a2b19b0db81e0dbd81e0db6f8328e6bd479183380255bdc9e5f9f94d3cb4bd151979	" /bin/sh -c '/d' /usr/bin/true"	4 minutes ago	Up 4 minutes		cc-peer1.retailer.pharma-network.com-pharmanet-1.0
cc-peer0.retailer.pharma-network.com-pharmanet-1.0-1d0a2b19b0db81e0dbd81e0db6f8328e6bd479183380255bdc9e5f9f94d3cb4bd151979	" /bin/sh -c '/d' /usr/bin/true"	4 minutes ago	Up 4 minutes		cc-peer0.retailer.pharma-network.com-pharmanet-1.0	
c14295254959	cc-peer1.distributor.pharma-network.com-pharmanet-1.0-f248dc45628abf32fe7e642671a65241f98ff998bc305696b5c56beb006dd475:latest	" /bin/sh -c '/d' /usr/bin/true"	4 minutes ago	Up 4 minutes		cc-peer1.distributor.pharma-network.com-pharmanet-1.0
cc-peer0.distributor.pharma-network.com-pharmanet-1.0-f248dc45628abf32fe7e642671a65241f98ff998bc305696b5c56beb006dd475:latest	" /bin/sh -c '/d' /usr/bin/true"	4 minutes ago	Up 4 minutes		cc-peer0.distributor.pharma-network.com-pharmanet-1.0	
4436847a386f	cc-peer0.manufacturer.pharma-network.com-pharmanet-1.0-c470c20ce28e194f2068df196a23ccfad0fb5f96f1e2f5ce8002741b7b48976:latest	" /bin/sh -c '/d' /usr/bin/true"	5 minutes ago	Up 5 minutes		cc-peer0.manufacturer.pharma-network.com-pharmanet-1.0
7799866f9f	cc-peer0.manufacturer.pharma-network.com-pharmanet-1.0-ff5409c1bla41759b40556e6159ee7fa9c08b72c04f7373a2bc27c415dadd56:latest	" /bin/sh -c '/d' /usr/bin/true"	6 minutes ago	Up 6 minutes		cc-peer0.manufacturer.pharma-network.com-pharmanet-1.0
07f9f9323a58	hyperledger/fabric-tools:amd4-1.4.0	" /bin/bash"	13 minutes ago	Up 12 minutes		
09e3a6200000	hyperledger/fabric-peer:amd4-1.4.0	" peer node start"	13 minutes ago	Up 13 minutes	8.0.0.0:11851->11851/tcp	peer0.transporter.pharma-network.com
104361000000	hyperledger/fabric-peer:amd4-1.4.0	" peer node start"	13 minutes ago	Up 13 minutes	8.0.0.0:12951->12951/tcp	peer0.retailer.pharma-network.com
01161047444	hyperledger/fabric-peer:amd4-1.4.0	" peer node start"	13 minutes ago	Up 13 minutes	8.0.0.0:14851->14851/tcp	peer0.consumer.pharma-network.com
566e2083ff08	hyperledger/fabric-peer:amd4-1.4.0	" peer node start"	14 minutes ago	Up 13 minutes	0.0.0.0:7051->7051/tcp	peer0.manufacturer.pharma-network.com
48439f7080db	hyperledger/fabric-peer:amd4-1.4.0	" peer node start"	14 minutes ago	Up 13 minutes	0.0.0.0:16951->16951/tcp	peer1.transporter.pharma-network.com
d2f159353a	hyperledger/fabric-peer:amd4-1.4.0	" peer node start"	14 minutes ago	Up 13 minutes	0.0.0.0:19051->19051/tcp	peer1.retailer.pharma-network.com
e5e386979fd	hyperledger/fabric-peer:amd4-1.4.0	" peer node start"	14 minutes ago	Up 13 minutes	0.0.0.0:21951->21951/tcp	peer1.distributor.pharma-network.com
4439997a0000	hyperledger/fabric-peer:amd4-1.4.0	" peer node start"	14 minutes ago	Up 13 minutes	0.0.0.0:23951->23951/tcp	peer1.consumer.pharma-network.com
5c1390a70134	hyperledger/fabric-peer:amd4-1.4.0	" peer node start"	14 minutes ago	Up 13 minutes	0.0.0.0:13051->13051/tcp	peer1.distributor.pharma-network.com
2348ef4ad4c	hyperledger/fabric-peer:amd4-1.4.0	" peer node start"	14 minutes ago	Up 13 minutes	0.0.0.0:9051->9051/tcp	peer1.manufacturer.pharma-network.com
f7f583553a	hyperledger/fabric-ca:amd4-1.4.0	" sh -c '/Fabric-ca-start'"	14 minutes ago	Up 13 minutes	0.0.0.0:11954->7054/tcp	ca.transporter.pharma-network.com
30f706a4644	hyperledger/fabric-ca:amd4-1.4.0	" sh -c '/Fabric-ca-start'"	14 minutes ago	Up 14 minutes	0.0.0.0:11954->7054/tcp	ca.retailer.pharma-network.com
731939433000	hyperledger/fabric-ca:amd4-1.4.0	" sh -c '/Fabric-ca-start'"	14 minutes ago	Up 14 minutes	0.0.0.0:11954->7054/tcp	ca.consumer.pharma-network.com
032090ca225	hyperledger/fabric-ca:amd4-1.4.0	" sh -c '/Fabric-ca-start'"	14 minutes ago	Up 14 minutes	0.0.0.0:11954->7054/tcp	ca.distributor.pharma-network.com
012090ca225	hyperledger/fabric-ca:amd4-1.4.0	" sh -c '/Fabric-ca-start'"	14 minutes ago	Up 14 minutes	0.0.0.0:11954->7054/tcp	ca.manufacturer.pharma-network.com
533ab0d26289	hyperledger/fabric-orderer:amd4-1.4.0	" /bin/true"	14 minutes ago	Up 13 minutes	4369/tcp, 9100/tcp, 0.0.0.0:19864->19864/tcp	orderer1.transporter.pharma-network.com
7ec0e2448d	hyperledger/fabric-orderer:amd4-1.4.0	" /bin/true"	14 minutes ago	Up 14 minutes	4369/tcp, 9100/tcp, 0.0.0.0:19864->19864/tcp	orderer1.retailer.pharma-network.com
saas710edcfc	hyperledger/fabric-orderer:amd4-1.4.0	" /bin/true"	14 minutes ago	Up 14 minutes	4369/tcp, 9100/tcp, 0.0.0.0:19864->19864/tcp	orderer1.consumer.pharma-network.com
a33230000000	hyperledger/fabric-orderer:amd4-1.4.0	" /bin/true"	14 minutes ago	Up 14 minutes	4369/tcp, 9100/tcp, 0.0.0.0:19864->19864/tcp	orderer1.distributor.pharma-network.com
6666708754	hyperledger/fabric-orderer:amd4-1.4.0	" /bin/true"	14 minutes ago	Up 14 minutes	4369/tcp, 9100/tcp, 0.0.0.0:19864->19864/tcp	orderer1.manufacturer.pharma-network.com
f5eab7408d7c	hyperledger/fabric-couchdb:0.4.21	" /bin/true"	14 minutes ago	Up 14 minutes	4369/tcp, 9100/tcp, 0.0.0.0:14984->14984/tcp	couchdb1.transporter.pharma-network.com
aa12d33a99	hyperledger/fabric-couchdb:0.4.21	" /bin/true"	14 minutes ago	Up 14 minutes	4369/tcp, 9100/tcp, 0.0.0.0:14984->14984/tcp	couchdb1.retailer.pharma-network.com
77608205339	hyperledger/fabric-couchdb:0.4.21	" /bin/true"	14 minutes ago	Up 14 minutes	4369/tcp, 9100/tcp, 0.0.0.0:14984->14984/tcp	couchdb1.consumer.pharma-network.com
4303975326	hyperledger/fabric-couchdb:0.4.21	" /bin/true"	14 minutes ago	Up 14 minutes	4369/tcp, 9100/tcp, 0.0.0.0:14984->14984/tcp	couchdb1.distributor.pharma-network.com
4449994044	hyperledger/fabric-couchdb:0.4.21	" /bin/true"	14 minutes ago	Up 14 minutes	4369/tcp, 9100/tcp, 0.0.0.0:14984->14984/tcp	couchdb1.manufacturer.pharma-network.com
3871e298034	hyperledger/fabric-couchdb:0.4.21	" /bin/true"	14 minutes ago	Up 13 minutes	4369/tcp, 9100/tcp, 0.0.0.0:19864->19864/tcp	couchdb2.transporter.pharma-network.com
2563b1740688	hyperledger/fabric-couchdb:0.4.21	" /bin/true"	14 minutes ago	Up 14 minutes	4369/tcp, 9100/tcp, 0.0.0.0:19864->19864/tcp	couchdb2.retailer.pharma-network.com
ee78633c8a	hyperledger/fabric-couchdb:0.4.21	" /bin/true"	14 minutes ago	Up 13 minutes	4369/tcp, 9100/tcp, 0.0.0.0:19864->19864/tcp	couchdb2.consumer.pharma-network.com

## **VIII) Future Scope of enhancements:**

- i) If same distributor wish to raise PO for same drug multiple times, this is not possible currently, because the composite key only considers buyerCRN and drugName. Timestamp or some kind of serial number needs to be added to make it unique, so multiple Pos can be raised.
- ii) Once the Shipment is created, the shipment id needs to be updated on PO, so later looking at PO we can find corresponding shipment.
- iii) Doctor's prescription can be asked from customer while retailer sell drug.
- iv) Instead of using single admin user, separate users identities can be configured.

I've verified multiple times that the whole end to end flow runs successfully.  
Please feel free to call me on 9890787870 if faced any issues or need any further information.

Thank you for evaluating my work...!