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In Collaboration with

UNIVERSITY OF WESTMINSTER

Assessment Report

For

Inventory Management System

A development by

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Course Work 2

Concurrent and **Distributed Systems**

(7SENG007C)

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Introduction

The inventory management system is intended to manage the inventory of goods via a distributed system. Managers of warehouses are facilitated with highly available services to continue the daily warehouse order processing without any impact.

Specialty of the system

- Highly available
- High accuracy
- Fault tolerance ability

Target audience

- Clerks
- Warehouse managers

Pre-requisites

Project files

Extract the following zip files into a location and use the provided commands to run the project.

1. **IIT-Inventory-NameService.zip**
2. **IIT-Inventory-Server.zip**
3. **IIT-Inventory-Client.zip**

Example extraction location

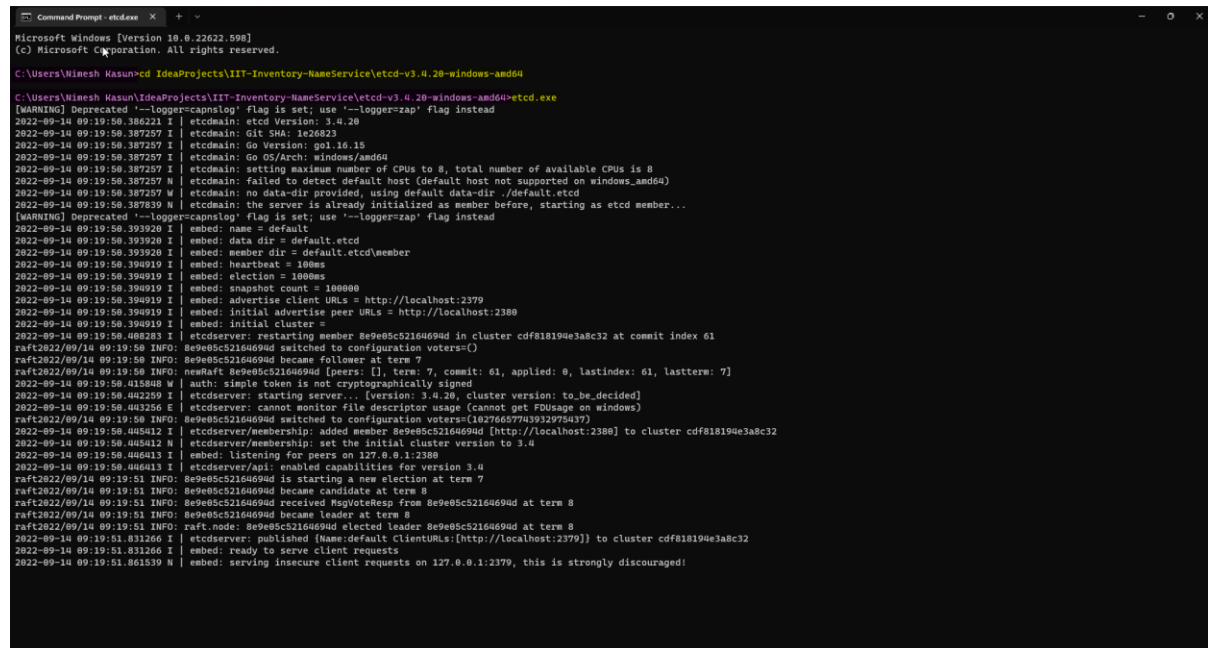
C:\Users\Nimesh Kasun\IdeaProjects

Commands to run the servers (Windows)

Open Command Prompt/ Terminal

Start NameService Server:

```
> cd IdeaProjects\IIT-Inventory-NameService\etcd-v3.4.20-windows-amd64
> etcd.exe
```

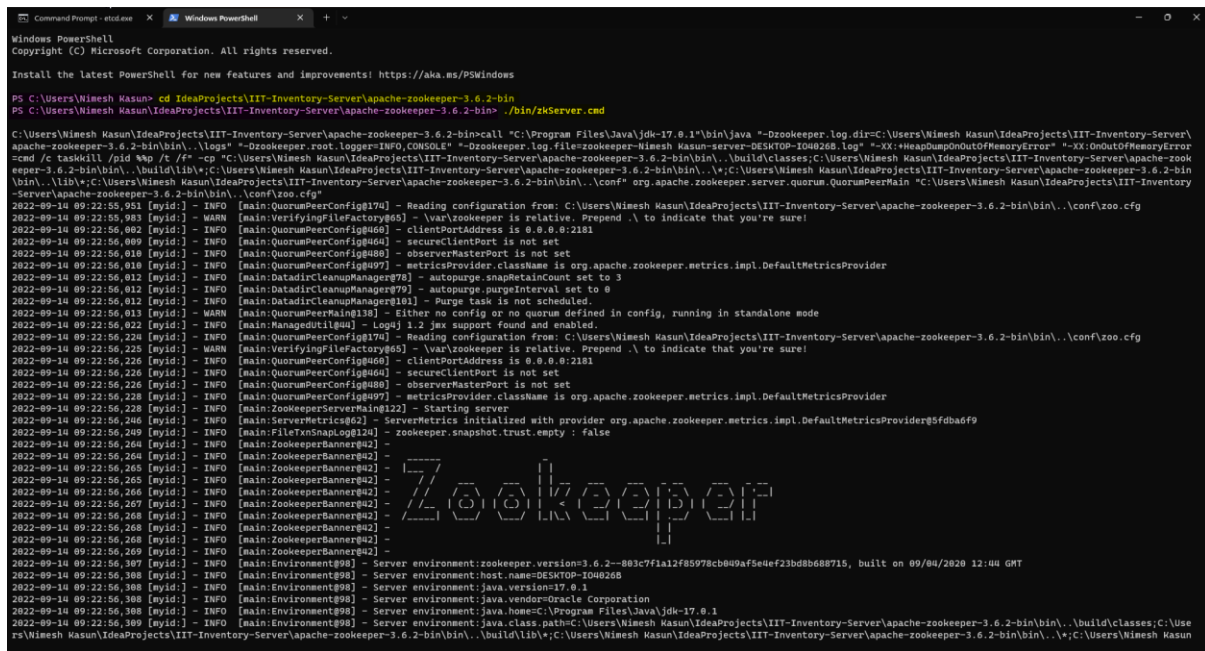


```
Microsoft Windows [Version 10.0.22622.598]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Nimesh Masun>cd IdeaProjects\IIT-Inventory-NameService\etcd-v3.4.20-windows-amd64
C:\Users\Nimesh Masun\IdeaProjects\IIT-Inventory-NameService\etcd-v3.4.20-windows-amd64>etcd.exe
[WARNING] Deprecated '--logger=capnslog' flag is set; use '--logger=zap' flag instead
2022-09-14 09:19:50.386221 I etcdmain: etcd Version: 3.4.20
2022-09-14 09:19:50.387257 I etcdmain: Git SHA: 1c26823
2022-09-14 09:19:50.387257 I etcdmain: Go Version: go1.16.15
2022-09-14 09:19:50.387257 I etcdmain: Go OS/Arch: windows/amd64
2022-09-14 09:19:50.387257 I etcdmain: setting maximum number of CPUs to 8, total number of available CPUs is 8
2022-09-14 09:19:50.387257 I etcdmain: failed to detect default host (default host not supported on windows_amd64)
2022-09-14 09:19:50.387257 W etcdmain: no data-dir provided, using default data-dir ./default.etcd
2022-09-14 09:19:50.387839 N etcdmain: the server is already initialized as member before, starting as etcd member...
[WARNING] Deprecated '--logger=capnslog' flag is set; use '--logger=zap' flag instead
2022-09-14 09:19:50.393920 I embed: name = default
2022-09-14 09:19:50.393920 I embed: data dir = default.etcd
2022-09-14 09:19:50.393920 I embed: member dir = default.etcd/member
2022-09-14 09:19:50.394919 I embed: heartbeat = 100ms
2022-09-14 09:19:50.394919 I embed: election = 1000ms
2022-09-14 09:19:50.394919 I embed: snapshot count = 100000
2022-09-14 09:19:50.394919 I embed: advertise client URLs = http://localhost:2379
2022-09-14 09:19:50.394919 I embed: initial advertise peer URLs = http://localhost:2380
2022-09-14 09:19:50.394919 I embed: initial cluster =
2022-09-14 09:19:50.408283 I etcdserver: restarting member 8e9e85c52164694d in cluster cdf818194e3a8c32 at commit index 61
raft2022/09/14 09:19:50 INFO: 8e9e85c52164694d switched to configuration voters={0}
raft2022/09/14 09:19:50 INFO: 8e9e85c52164694d became follower at term 7
raft2022/09/14 09:19:50 INFO: newRaft 8e9e85c52164694d [peers: [], term: 7, commit: 61, applied: 0, lastindex: 61, lastterm: 7]
2022-09-14 09:19:50.415808 W auth: simple token is not cryptographically signed
2022-09-14 09:19:50.442289 I etcdserver: starting server... [version: 3.4.20, cluster version: to be decided]
2022-09-14 09:19:50.443256 E etcdserver: cannot monitor file descriptor usage (cannot get FDUsage on windows)
raft2022/09/14 09:19:50 INFO: 8e9e85c52164694d switched to configuration voters={18276657743932975437}
2022-09-14 09:19:50.448512 I etcdserver/membership: added member 8e9e85c52164694d [http://localhost:2380] to cluster cdf818194e3a8c32
2022-09-14 09:19:50.448512 W etcdserver/membership: set the initial cluster version to 3.4
2022-09-14 09:19:50.448613 I embed: listening for peers on 127.0.0.1:2380
2022-09-14 09:19:50.448613 I etcdserver/api: enabled capabilities for version 3.4
raft2022/09/14 09:19:51 INFO: 8e9e85c52164694d is starting a new election at term 7
raft2022/09/14 09:19:51 INFO: 8e9e85c52164694d became candidate at term 8
raft2022/09/14 09:19:51 INFO: 8e9e85c52164694d received MsgVoteResp from 8e9e85c52164694d at term 8
raft2022/09/14 09:19:51 INFO: 8e9e85c52164694d became leader at term 8
raft2022/09/14 09:19:51 INFO: raft.node: 8e9e85c52164694d elected leader 8e9e85c52164694d at term 8
2022-09-14 09:19:51.831266 I etcdserver: published [name:default ClientURLs:[http://localhost:2379]] to cluster cdf818194e3a8c32
2022-09-14 09:19:51.831266 I embed: ready to serve client requests
2022-09-14 09:19:51.861539 N embed: serving insecure client requests on 127.0.0.1:2379, this is strongly discouraged!
```

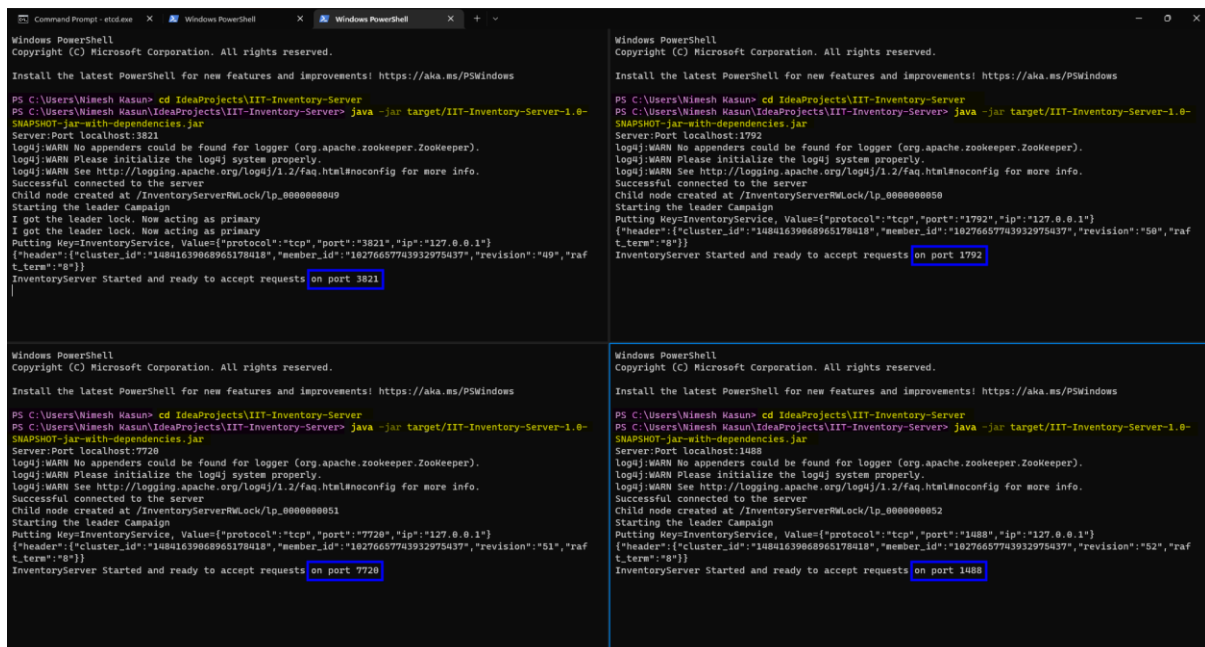
Start ZooKeeper Server:

```
> cd IdeaProjects\IIT-Inventory-Server\apache-zookeeper-3.6.2-bin
> ./bin/zkServer.cmd
```



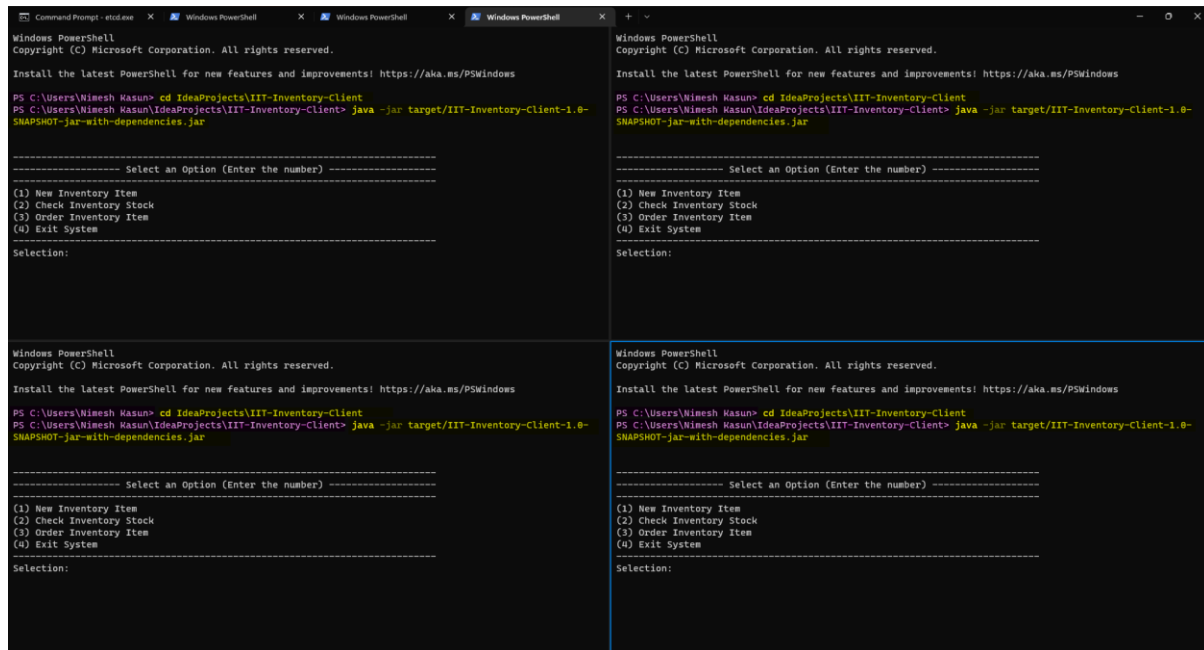
Start Inventory Server with multiple processes

```
> cd IdeaProjects\IIT-Inventory-Server
> java -jar target/IIT-Inventory-Server-1.0-SNAPSHOT-jar-with-dependencies.jar
```



Start Client Server as multiple warehouses

```
> cd IdeaProjects\IIT-Inventory-Client  
  
> java -jar target/IIT-Inventory-Client-1.0-SNAPSHOT-jar-with-dependencies.jar
```

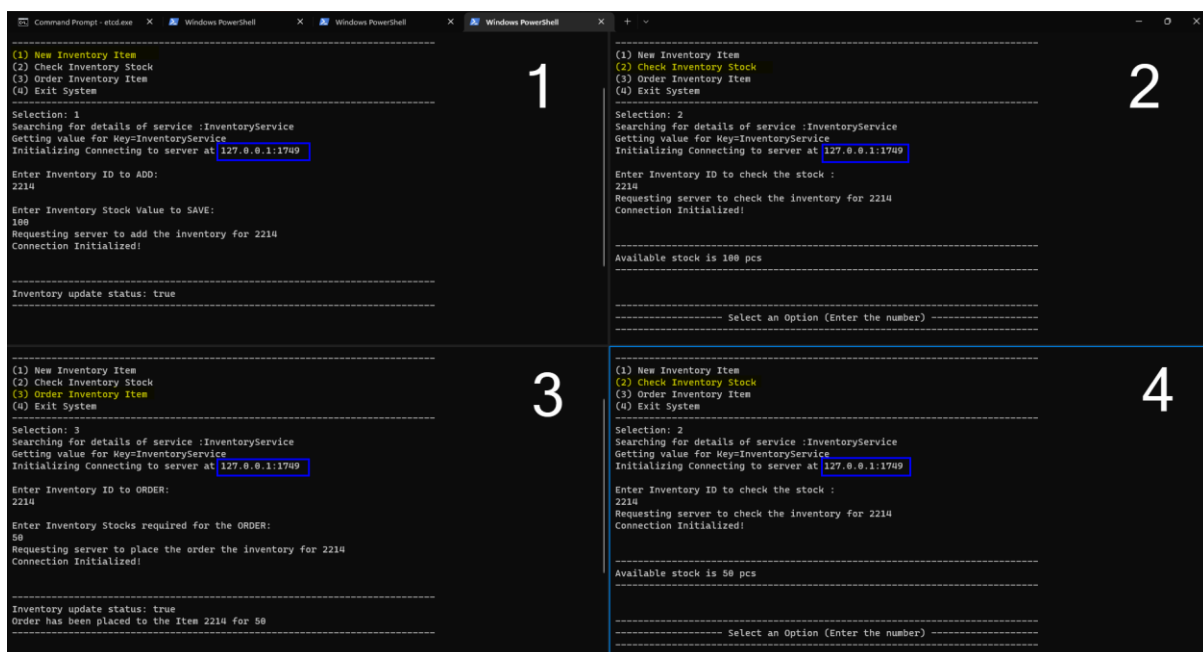


System Functionality

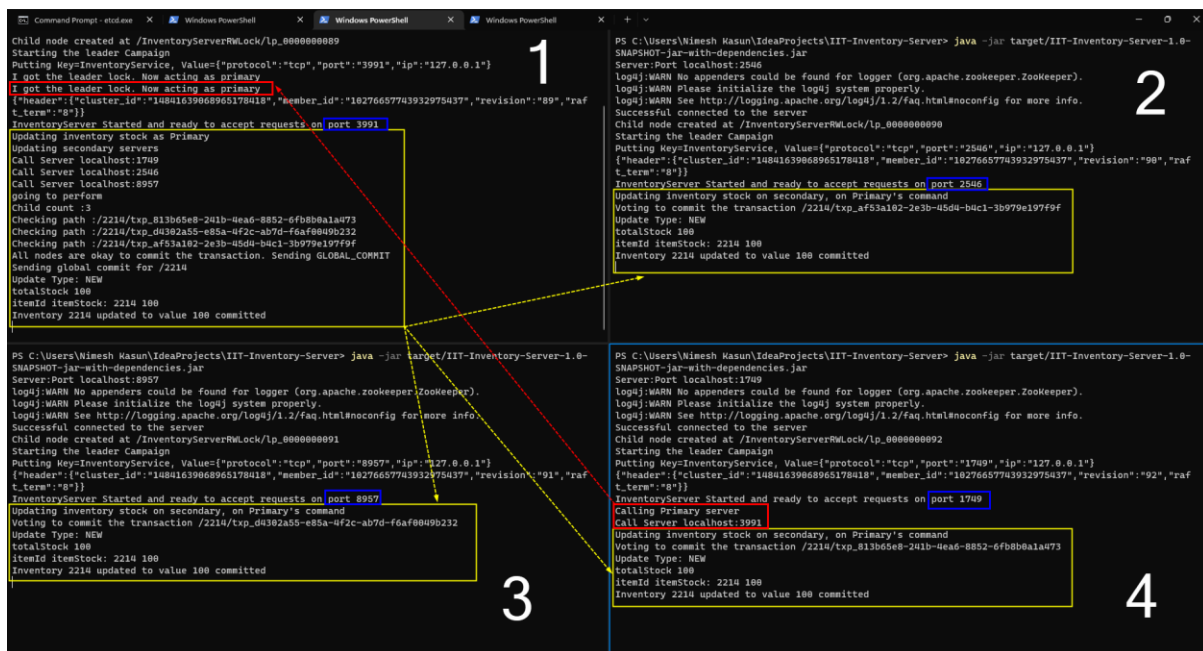
The developed system is integrated with ZooKeeper which allows to control one or more server nodes which are acting as multiple processes of the same server. These nodes are synchronized and in the event of unavailability of any node, other nodes are ready to serve the client requests without impacting the user experience or a loss of data.

Below explains the ZooKeeper integration used.

- Any number of client nodes can be used to add new stocks to the system.
 - If the item is new, a new item will be added to the system.
 - If the stock arrives for an existing item, system will be adding the new stock to the existing stock count for that item.
- Below picture shows the client interface and all clients has connected to the last started Inventory Server which is online via 127.0.0.1:1749



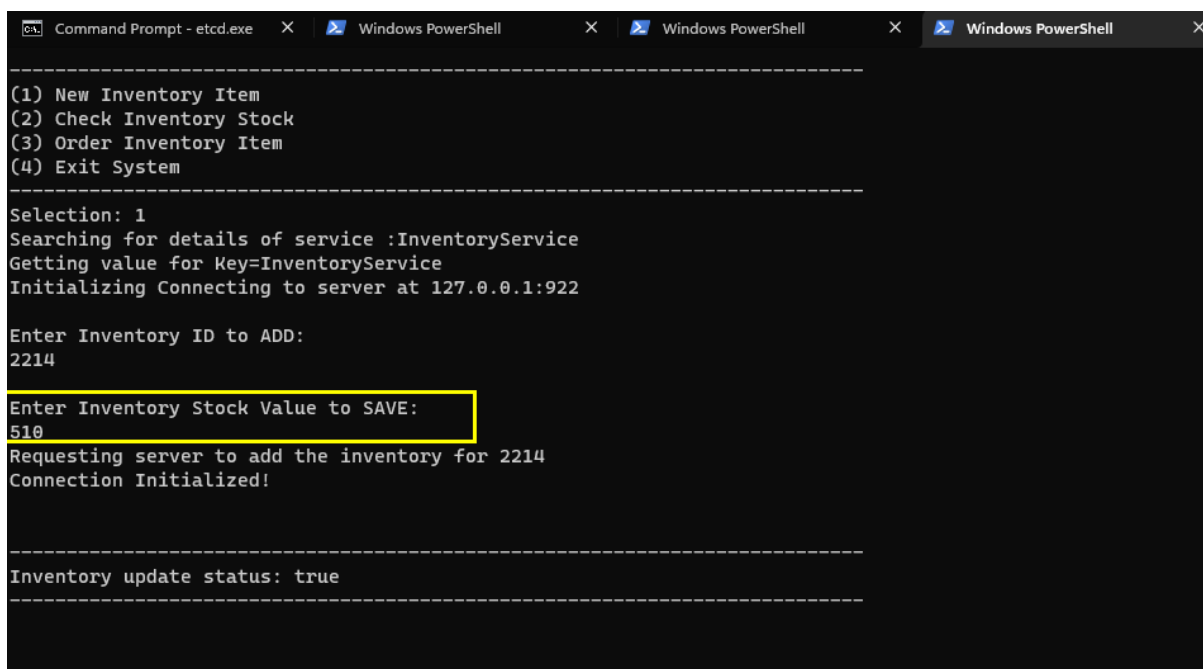
- However, while executing the client requests, this server will be calling the primary server, which has the leader lock acquired. (127.0.0.1:3991)
- Below picture shows the multiple inventory server processes running on multiple ports.
 1. 127.0.0.1:3991 (Got the leader lock since started first)
 2. 127.0.0.1:2546
 3. 127.0.0.1:8957
 4. 127.0.0.1:1749 (Last started and all new clients are connected to this)



➤ Below set of images shows in order, the server logs when client requests followings in order:

- (1) New Inventory Item (*Image 1 below*)
- (2) Check Inventory Item (*Image 2 below*)
- (3) Order Inventory Item (*Image 3 below*)
- (4) Check Inventory Item (*Image 4 below*)

- Based on below images, it's noticeable that only the primary server who got the leader lock is processing requests and then notify all other secondary servers/nodes to update their data as well.




```

Voting to commit the transaction /2215/txp_647H85d2-647e-4317-9d6a-9d87cd58907e
Update Type: NEW
totalStock 310
Itemid ItemStock: 2215 310
Inventory 2215 updated to value 310 committed
PS C:\Users\Nimesh Masun\IdeaProjects\IIT-Inventory-Server> java -jar target/IIT-Inventory-Server-1.0-SNAPSHOT-jar-with-dependencies.jar
Server:Port localhost:1156
log4j:WARN No appenders could be found for logger (org.apache.zookeeper.ZooKeeper).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
Successful connected to the server
Child node created at /InventoryServerRWLock/Lp_0000000099
Starting the leader Campaign
Putting Key=InventoryService, Value={"protocol":"tcp","port":"1156","ip":"127.0.0.1"}
{"header":{"cluster_id":"14841639868965178418","member_id":"18276657743932975437","revision":"98","raft_term":"8"}}
InventoryServer Started and ready to accept requests on port 1156
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_364f5585-38eb-4823-abde-b0186e88fcc1
Update Type: NEW
totalStock 510
Itemid ItemStock: 2214 510
Inventory 2214 updated to value 510 committed

Child node created at /InventoryServerRWLock/Lp_0000000099
Starting the leader Campaign
Putting Key=InventoryService, Value={"protocol":"tcp","port":"7287","ip":"127.0.0.1"}
{"header":{"cluster_id":"14841639868965178418","member_id":"18276657743932975437","revision":"96","raft_term":"8"}}
InventoryServer Started and ready to accept requests on port 7287
I got the leader lock. Now acting as primary
Updating inventory stock as Primary
Updating secondary servers
Call Server localhost:1156
Call Server localhost:922
Call Server localhost:7615
going to perform
Child count :3
Checking path :/2214/txp_17dc6850-690e-4290-afce-24fallb969ec
Checking path :/2214/txp_364f5585-38eb-4823-abde-b0186e88fcc1
Checking path :/2214/txp_481b1b6f-d4fd-41f4-98c7-5314391b9ea7
All nodes are okay to commit the transaction. Sending GLOBAL_COMMIT
Sending global commit for /2214
Update Type: NEW
totalStock 510
Itemid ItemStock: 2214 510
Inventory 2214 updated to value 510 committed

Request for inventory stock check received..
Checking stock for inventory 2214
Responding.. stock for inventory 2214 is 500
Accessing critical section. Time remaining : 4 seconds.
Releasing the lock 19:21:41
PS C:\Users\Nimesh Masun\IdeaProjects\IIT-Inventory-Server> java -jar target/IIT-Inventory-Server-1.0-SNAPSHOT-jar-with-dependencies.jar
Server:Port localhost:7615
log4j:WARN No appenders could be found for logger (org.apache.zookeeper.ZooKeeper).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
Successful connected to the server
Child node created at /InventoryServerRWLock/Lp_0000000097
Starting the leader Campaign
Putting Key=InventoryService, Value={"protocol":"tcp","port":"7615","ip":"127.0.0.1"}
{"header":{"cluster_id":"14841639868965178418","member_id":"18276657743932975437","revision":"97","raft_term":"8"}}
InventoryServer Started and ready to accept requests on port 7615
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_481b1b6f-d4fd-41f4-98c7-5314391b9ea7
Update Type: NEW
totalStock 510
Itemid ItemStock: 2214 510
Inventory 2214 updated to value 510 committed

```

- This enables all the servers to maintain the accuracy and be ready in case the primary server shutdown, then to get the leadership as assigned and act as the new primary server.

```

Child node created at /InventoryServerRWLock/Lp_0000000089
Starting the leader Campaign
Putting Key=InventoryService, Value={"protocol":"tcp","port":"3991","ip":"127.0.0.1"}
I got the leader lock. Now acting as primary
InventoryServer Started and ready to accept requests on port 3991
Updating inventory stock as Primary
Updating secondary servers
Call Server localhost:1749
Call Server localhost:2546
Call Server localhost:8957
going to perform
Child count :3
Checking path :/2214/txp_813b65e8-241b-4ea6-8852-6fb8b0a1a473
Checking path :/2214/txp_d4382a58-e85a-4f2c-ab7d-f6af0049b232
Checking path :/2214/txp_af53a102-2e3b-45d4-b4c1-3b979e197f9f
All nodes are okay to commit the transaction. Sending GLOBAL_COMMIT
Sending global commit for /2214
Update Type: NEW
totalStock 100
Itemid ItemStock: 2214 100
Inventory 2214 updated to value 100 committed

PS C:\Users\Nimesh Masun\IdeaProjects\IIT-Inventory-Server> java -jar target/IIT-Inventory-Server-1.0-SNAPSHOT-jar-with-dependencies.jar
Server:Port localhost:8957
log4j:WARN No appenders could be found for logger (org.apache.zookeeper.ZooKeeper).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
Successful connected to the server
Child node created at /InventoryServerRWLock/Lp_0000000091
Starting the leader Campaign
Putting Key=InventoryService, Value={"protocol":"tcp","port":"8957","ip":"127.0.0.1"}
{"header":{"cluster_id":"14841639868965178418","member_id":"18276657743932975437","revision":"91","raft_term":"8"}}
InventoryServer Started and ready to accept requests on port 8957
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_d4382a58-e85a-4f2c-ab7d-f6af0049b232
Update Type: NEW
totalStock 100
Itemid ItemStock: 2214 100
Inventory 2214 updated to value 100 committed

Child node created at /InventoryServerRWLock/Lp_0000000099
Starting the leader Campaign
Putting Key=InventoryService, Value={"protocol":"tcp","port":"2546","ip":"127.0.0.1"}
{"header":{"cluster_id":"14841639868965178418","member_id":"18276657743932975437","revision":"98","raft_term":"8"}}
InventoryServer Started and ready to accept requests on port 2546
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_af53a102-2e3b-45d4-b4c1-3b979e197f9f
Update Type: NEW
totalStock 100
Itemid ItemStock: 2214 100
Inventory 2214 updated to value 100 committed

PS C:\Users\Nimesh Masun\IdeaProjects\IIT-Inventory-Server> java -jar target/IIT-Inventory-Server-1.0-SNAPSHOT-jar-with-dependencies.jar
Server:Port localhost:1749
log4j:WARN No appenders could be found for logger (org.apache.zookeeper.ZooKeeper).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
Successful connected to the server
Child node created at /InventoryServerRWLock/Lp_0000000092
Starting the leader Campaign
Putting Key=InventoryService, Value={"protocol":"tcp","port":"1749","ip":"127.0.0.1"}
{"header":{"cluster_id":"14841639868965178418","member_id":"18276657743932975437","revision":"92","raft_term":"8"}}
InventoryServer Started and ready to accept requests on port 1749
Calling Primary server
Call Server localhost:3991
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_813b65e8-241b-4ea6-8852-6fb8b0a1a473
Update Type: NEW
totalStock 100
Itemid ItemStock: 2214 100
Inventory 2214 updated to value 100 committed

```

```

Command Prompt - etcd.exe X Windows PowerShell X Windows PowerShell X Windows PowerShell X
Child node created at /InventoryServerRwLock/Lp_0000000089
Starting the leader Campaign
Putting Key=InventoryService, Value={"protocol":"tcp","port":"3991","ip":"127.0.0.1"}
I got the leader lock. Now acting as primary
I got the leader lock. Now acting as primary
{"header":{"cluster_id":"14841639868965178418","member_id":"18276657743932975437","revision":"89","raft_t_term":"8"}}
InventoryServer Started and ready to accept requests on port 3991
Updating inventory stock as Primary
Updating secondary servers
Call Server localhost:1749
Call Server localhost:2546
Call Server localhost:8957
going to perform
Child count :3
Checking path :/2214/txp_813b65e8-241b-4ead-8852-6fb80a1a473
Checking path :/2214/txp_d4382a55-e85a-4f2c-ab7d-f6af0049b232
Checking path :/2214/txp_af53a102-2e3b-45d4-bdc1-3b979e197f9f
All nodes are okay to commit the transaction. Sending GLOBAL_COMMIT
Sending global commit for /2214
Update Type: NEW
totalStock 100
itemId itemStock: 2214 100
Inventory 2214 updated to value 100 committed

PS C:\Users\Nimesh Masun\IdeaProjects\IIT-Inventory-Server> java -jar target/IIT-Inventory-Server-1.0-SNAPSHOT-jar-with-dependencies.jar
Server:Port localhost:2546
log4j:WARN No appenders could be found for logger (org.apache.zookeeper.ZooKeeper).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
Successful connected to the server
Child node created at /InventoryServerRwLock/Lp_0000000091
Starting the leader Campaign
Putting Key=InventoryService, Value={"protocol":"tcp","port":"8957","ip":"127.0.0.1"}
{"header":{"cluster_id":"14841639868965178418","member_id":"18276657743932975437","revision":"91","raft_t_term":"8"}}
InventoryServer Started and ready to accept requests on port 8957
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_d4382a55-e85a-4f2c-ab7d-f6af0049b232
Update Type: NEW
totalStock 100
itemId itemStock: 2214 100
Inventory 2214 updated to value 100 committed

PS C:\Users\Nimesh Masun\IdeaProjects\IIT-Inventory-Server> java -jar target/IIT-Inventory-Server-1.0-SNAPSHOT-jar-with-dependencies.jar
Server:Port localhost:2546
log4j:WARN No appenders could be found for logger (org.apache.zookeeper.ZooKeeper).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
Successful connected to the server
Child node created at /InventoryServerRwLock/Lp_0000000092
Starting the leader Campaign
Putting Key=InventoryService, Value={"protocol":"tcp","port":"1749","ip":"127.0.0.1"}
{"header":{"cluster_id":"14841639868965178418","member_id":"18276657743932975437","revision":"92","raft_t_term":"8"}}
InventoryServer Started and ready to accept requests on port 1749
Calling Primary server
Call Server localhost:3991
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_813b65e8-241b-4ead-8852-6fb80a1a473
Update Type: NEW
totalStock 100
itemId itemStock: 2214 100
Inventory 2214 updated to value 100 committed

Contesting to acquire lock checkInv
Successful connected to the server
Child node created at /checkInv/Lp_0000000078
lock: iit.inv.sync.lock.client.DistributedLock@238ddc8
I got the lock at 18:48:55
Request for inventory stock check received..
Checking stock for inventory 2214
Responding, stock for inventory 2214 is 100
Accessing critical section. Time remaining : 5 seconds.
Releasing the lock 18:49:00

Checking path :/2214/txp_d4382a55-e85a-4f2c-ab7d-f6af0049b232
Checking path :/2214/txp_af53a102-2e3b-45d4-bdc1-3b979e197f9f
All nodes are okay to commit the transaction. Sending GLOBAL_COMMIT
Sending global commit for /2214
Update Type: NEW
totalStock 100
itemId itemStock: 2214 100
Inventory 2214 updated to value 100 committed
Updating inventory stock as Primary
Updating secondary servers
Call Server localhost:1749
Call Server localhost:2546
Call Server localhost:8957
going to perform
Child count :3
Checking path :/2214/txp_8ead825d-bc20-4785-92d0-fa38be8b34a1
Checking path :/2214/txp_1257baba-f37c-4366-82b0-625e8519f445
Checking path :/2214/txp_70274824-7c40-4b6b-b6c8-04ea20abb1ad
All nodes are okay to commit the transaction. Sending GLOBAL_COMMIT
Sending global commit for /2214
Update Type: ORDER
remainingStock 50
itemIdForOrder itemStockForOrder: 2214 50
Inventory 2214 updated to value 50 committed

SNAPSHOT-jar-with-dependencies.jar
Server:Port localhost:8957
log4j:WARN No appenders could be found for logger (org.apache.zookeeper.ZooKeeper).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
Successful connected to the server
Child node created at /InventoryServerRwLock/Lp_0000000091
Starting the leader Campaign
Putting Key=InventoryService, Value={"protocol":"tcp","port":"8957","ip":"127.0.0.1"}
{"header":{"cluster_id":"14841639868965178418","member_id":"18276657743932975437","revision":"91","raft_t_term":"8"}}
InventoryServer Started and ready to accept requests on port 8957
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_d4382a55-e85a-4f2c-ab7d-f6af0049b232
Update Type: NEW
totalStock 100
itemId itemStock: 2214 100
Inventory 2214 updated to value 100 committed
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_70274824-7c40-4b6b-b6c8-04ea20abb1ad
Update Type: ORDER
remainingStock 50
itemIdForOrder itemStockForOrder: 2214 50
Inventory 2214 updated to value 50 committed

SNAPSHOT-jar-with-dependencies.jar
Server:Port localhost:2546
log4j:WARN No appenders could be found for logger (org.apache.zookeeper.ZooKeeper).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
Successful connected to the server
Child node created at /InventoryServerRwLock/Lp_0000000090
Starting the leader Campaign
Putting Key=InventoryService, Value={"protocol":"tcp","port":"2546","ip":"127.0.0.1"}
{"header":{"cluster_id":"14841639868965178418","member_id":"18276657743932975437","revision":"90","raft_t_term":"8"}}
InventoryServer Started and ready to accept requests on port 2546
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_af53a102-2e3b-45d4-bdc1-3b979e197f9f
Update Type: NEW
totalStock 100
itemId itemStock: 2214 100
Inventory 2214 updated to value 100 committed
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_1257baba-f37c-4366-82b0-625e8519f445
Update Type: ORDER
remainingStock 50
itemIdForOrder itemStockForOrder: 2214 50
Inventory 2214 updated to value 50 committed

Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_813b65e8-241b-4ead-8852-6fb80a1a473
totalStock 100
itemId itemStock: 2214 100
Inventory 2214 updated to value 100 committed
Successful connected to the server
Child node created at /checkInv/Lp_0000000078
lock: iit.inv.sync.lock.client.DistributedLock@238ddc8
I got the lock at 18:48:55
Request for inventory stock check received..
Checking stock for inventory 2214
Responding, stock for inventory 2214 is 100
Accessing critical section. Time remaining : 5 seconds.
Releasing the lock 18:49:00
Calling Primary server
Call Server localhost:3991
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_8ead825d-bc20-4785-92d0-fa38be8b34a1
Update Type: ORDER
remainingStock 50
itemIdForOrder itemStockForOrder: 2214 50
Inventory 2214 updated to value 50 committed

```

```

Checking path :/2214/txp_d4382a55-e85a-4f2c-ab7d-f6af0049b232
Checking path :/2214/txp_af53a102-2e3b-45d4-b4c1-3b979e197f9f
All nodes are okay to commit the transaction. Sending GLOBAL_COMMIT
Sending global commit for /2214
Update Type: NEW
totalStock 100
itemId itemStock: 2214 100
Inventory 2214 updated to value 180 committed
Updating inventory stock as Primary
Updating secondary servers
Call Server localhost:1749
Call Server localhost:2546
Call Server localhost:8957
going to perform
Child count :3
Checking path :/2214/txp_0ead825d-bc2b-4785-92d0-fa38be8b34a1
Checking path :/2214/txp_1257baba-f37c-4366-82b0-625e8519f4u5
Checking path :/2214/txp_78274824-7c4b-4b6b-b6c8-04ea28abb1ad
All nodes are okay to commit the transaction. Sending GLOBAL_COMMIT
Sending global commit for /2214
Update Type: ORDER
remainingStock 50
itemIdForOrder itemStockForOrder: 2214 50
Inventory 2214 updated to value 50 committed

SNAPSHOT-jar-with-dependencies.jar
Server:Port localhost:8907
log4j:WARN No appenders could be found for logger (org.apache.zookeeper.ZooKeeper).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
Successful connected to the server
Child node created at /InventoryServerRMLock/Lp_0000000091
Starting the leader Campaign
Putting Key=InventoryService, Value={"protocol":"tcp","port":"8957","ip":"127.0.0.1"}
{"header":{"cluster_id":"14041639868965178418","member_id":"10276657743932975437","revision":"90","raf
t_term":"8"}}
InventoryServer Started and ready to accept requests on port 8957
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_d4382a55-e85a-4f2c-ab7d-f6af0049b232
Update Type: NEW
totalStock 100
itemId itemStock: 2214 100
Inventory 2214 updated to value 180 committed
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_78274824-7c4b-4b6b-b6c8-04ea28abb1ad
Update Type: ORDER
remainingStock 50
itemIdForOrder itemStockForOrder: 2214 50
Inventory 2214 updated to value 50 committed

I Got the lock at 10:48:55
Request for inventory stock check received..
Checking stock for inventory 2214
Responding.. stock for inventory 2214 is 100
Accessing critical section. Time remaining : 5 seconds.
Releasing the lock 10:49:00
Calling Primary server
Call Server localhost:3991
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_0ead825d-bc2b-4785-92d0-fa38be8b34a1
Update Type: ORDER
remainingStock 50
itemIdForOrder itemStockForOrder: 2214 50
Inventory 2214 updated to value 50 committed
Contesting to acquire lock checkInv
Successful connected to the server
Child node created at /checkInv/Lp_0000000079
lock: it:inv.sync.lock.client.DistributedLock1990f5a2
I Got the lock at 10:49:33
Request for inventory stock check received..
Checking stock for inventory 2214
Responding.. stock for inventory 2214 is 50
Accessing critical section. Time remaining : 2 seconds.
Releasing the lock 10:49:35

```

- Below images shows that in a situation where the primary server or any node get shut down, if it's a primary server, the leadership will be transferred to immediately available server.
- And all the new clients will be connected to the next available server.
- And if a new node joins, it'll also be available to the users with updated data. If and when a client request comes to new node, it hands over to leader node to process. Then leader node processes the request and update all other nodes with updated data including the new nodes.

```

Checking path :/2214/txp_d4382a55-e85a-4f2c-ab7d-f6af0049b232
Checking path :/2214/txp_af53a102-2e3b-45d4-b4c1-3b979e197f9f
All nodes are okay to commit the transaction. Sending GLOBAL_COMMIT
Sending global commit for /2214
Update Type: NEW
totalStock 100
itemId itemStock: 2214 100
Inventory 2214 updated to value 180 committed
Updating inventory stock as Primary
Updating secondary servers
Call Server localhost:1749
Call Server localhost:2546
Call Server localhost:8957
going to perform
Child count :3
Checking path :/2214/txp_0ead825d-bc2b-4785-92d0-fa38be8b34a1
Checking path :/2214/txp_1257baba-f37c-4366-82b0-625e8519f4u5
Checking path :/2214/txp_78274824-7c4b-4b6b-b6c8-04ea28abb1ad
All nodes are okay to commit the transaction. Sending GLOBAL_COMMIT
Sending global commit for /2214
Update Type: ORDER
remainingStock 50
itemIdForOrder itemStockForOrder: 2214 50
Inventory 2214 updated to value 50 committed
Ps C:\Users\Nimesh Masun\IdeaProjects\IIT-Inventory-Server>

SNAPSHOT-jar-with-dependencies.jar
Server:Port localhost:8907
log4j:WARN No appenders could be found for logger (org.apache.zookeeper.ZooKeeper).
log4j:WARN Please initialize the log4j system properly.
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Successful connected to the server
Child node created at /InventoryServerRMLock/Lp_0000000091
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Update Type: ORDER
remainingStock 50
itemIdForOrder itemStockForOrder: 2214 50
Inventory 2214 updated to value 50 committed
I got the leader lock. Now acting as primary

I Got the lock at 10:48:55
Request for inventory stock check received..
Checking stock for inventory 2214
Responding.. stock for inventory 2214 is 100
Accessing critical section. Time remaining : 5 seconds.
Releasing the lock 10:49:00
Calling Primary server
Call Server localhost:3991
Updating inventory stock on secondary, on Primary's command
Voting to commit the transaction /2214/txp_0ead825d-bc2b-4785-92d0-fa38be8b34a1
Update Type: ORDER
remainingStock 50
itemIdForOrder itemStockForOrder: 2214 50
Inventory 2214 updated to value 50 committed
Contesting to acquire lock checkInv
Successful connected to the server
Child node created at /checkInv/Lp_0000000079
lock: it:inv.sync.lock.client.DistributedLock1990f5a2
I Got the lock at 10:49:33
Request for inventory stock check received..
Checking stock for inventory 2214
Responding.. stock for inventory 2214 is 50
Accessing critical section. Time remaining : 2 seconds.
Releasing the lock 10:49:35
Ps C:\Users\Nimesh Masun\IdeaProjects\IIT-Inventory-Server>

```

The screenshot displays a Windows desktop with three open Notepad++ windows. The active window contains a Java program named `InventoryManagement.java`. Below the code editor, there are two separate terminal windows running the application.

Left Terminal Window:

```
Selection: 1
Searching for details of service :InventoryService
Getting value for Key:InventoryService
Initializing Connecting to server at 127.0.0.1:1709
Enter Inventory ID to Add:
2214
Enter Inventory Stock Value to Save:
890
Requesting server to add the inventory for 2214
Service unavailable, looking for a service provider..
Searching for details of service :InventoryService
Getting value for Key:InventoryService
Initializing Connecting to server at 127.0.0.1:1709
Service unavailable, looking for a service provider..
Searching for details of service :InventoryService
Getting value for Key:InventoryService
Initializing Connecting to server at 127.0.0.1:1709
Service unavailable, looking for a service provider..
Searching for details of service :InventoryService
Getting value for Key:InventoryService
Initializing Connecting to server at 127.0.0.1:1709
Service unavailable, looking for a service provider..
Searching for details of service :InventoryService
Getting value for Key:InventoryService
Initializing Connecting to server at 127.0.0.1:1709
Service unavailable, looking for a service provider..
Searching for details of service :InventoryService
Getting value for Key:InventoryService
Connection Initialized!
```

Right Terminal Window:

```
----- Select an Option (Enter the number) -----
(1) New Inventory Item
(2) Check Inventory Stock
(3) Order Inventory Item
(4) Exit System

Selection: |

----- Select an Option (Enter the number) -----
(1) New Inventory Item
(2) Check Inventory Stock
(3) Order Inventory Item
(4) Exit System

Selection: |
```

- As per above images, workshop managers can place orders to the system. System will be checking whether the inventory stock is sufficient to place the firstly received order for specific item and if so, the firstly received order for that item will be processed.
- If the system receives another order for the same item at the same time, it'll be processed next by checking the same conditions above and process if the stock is sufficient for the second and/or remaining orders.
 - Below image shows when two orders are placed parallely AND stock **is sufficient**, orders are processed first-come first-served basis and finalize the transactions.

2.1

1

2.2

3

Available stock is 500 pcs

Inventory update status: true
Order has been placed to the Item 2214 for 100

Available stock is 300 pcs

- Below image shows when two orders are placed parallelly AND stock is **not sufficient**, orders are processed first-come first-served basis and finalize the transactions and the second order is not placed due to insufficient stocks.

```

----- Select an Option (Enter the number) -----
(1) New Inventory Item
(2) Check Inventory Stock
(3) Order Inventory Item
(4) Exit System

Selection: 2
Searching for details of service :InventoryService
Getting value for Key:InventoryService
Initializing Connecting to server at 127.0.0.1:4742

Enter Inventory ID to check the stock :
2214
Requesting server to check the inventory for 2214
Connection Initialized!

Available stock is 300 pcs

----- Select an Option (Enter the number) -----
(1) New Inventory Item
(2) Check Inventory Stock
(3) Order Inventory Item
(4) Exit System

Selection: 3
Searching for details of service :InventoryService
Getting value for Key:InventoryService
Initializing Connecting to server at 127.0.0.1:4742

Enter Inventory ID to ORDER:
2214
Enter Inventory Stocks required for the ORDER:
200
Requesting server to place the order the inventory for 2214
Connection Initialized!

Inventory update status: false
Order couldn't be placed to the Item 2214 for 200
  
```

```

(1) New Inventory Item
(2) Check Inventory Stock
(3) Order Inventory Item
(4) Exit System

Selection: 2
Searching for details of service :InventoryService
Getting value for Key:InventoryService
Initializing Connecting to server at 127.0.0.1:4742

Enter Inventory ID to ORDER:
2214
Enter Inventory Stocks required for the ORDER:
200
Requesting server to place the order the inventory for 2214
Connection Initialized!

Inventory update status: true
Order has been placed to the Item 2214 for 200
  
```

```

----- Select an Option (Enter the number) -----
(1) New Inventory Item
(2) Check Inventory Stock
(3) Order Inventory Item
(4) Exit System

Selection: 2
Searching for details of service :InventoryService
Getting value for Key:InventoryService
Initializing Connecting to server at 127.0.0.1:4742

Enter Inventory ID to check the stock :
2214
Requesting server to check the inventory for 2214
Connection Initialized!

Available stock is 300 pcs
  
```