



SRI RAMACHANDRA
INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(Category - I Deemed to be University) Porur, Chennai
SRI RAMACHANDRA FACULTY OF ENGINEERING AND TECHNOLOGY

CSC 60
DISTRIBUTED SYSTEM

Submitted by

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MASTER OF SCIENCE

in

DATA ANALYTICS

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BONAFIDE CERTIFICATE

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TABLE OF CONTENTS

QUESTION NO.	PAGE NO.	CO's
1	4	CO1
2	17	CO2
3	22	CO3
4	35	CO4
5	49	CO5

Q1.A) An App development company planned to set up their hosting server in a spare computer. What are the challenges faced by the company and how they overcome those challenges? Help them with the relevant solution. Also provide the features of the proposed solution with respect to the effective deployment of the website diagrammatically.

SOLUTION:

*As the company decided to host their web server on the spare computer they have followed the Centralized System terminology where The mobile app and website hosted in a centralized server.

***CENTRALISED SYSTEM:**

Centralized systems are systems that use client/server architecture where one or more client nodes are directly connected to a central server. This is the most commonly used type of system in many organizations where a client sends a request to a company server and receives the response.

DISADVANTAGE OF CENTERALIZED SYSTEM:

*High Latency
*Single point of failure
*Performance and storage- Limited vertical scalability
*It can't handle security and privacy

*The solution to handle this problem is Resolved by using Distributed System as it is scalability allows the system to grow and shrink on demand.

DISTRIBUTED SYSTEM:

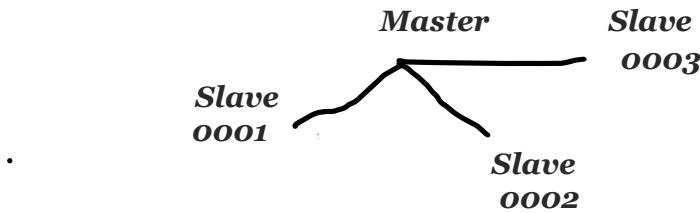
*The Distributed system is a system of several process, running on different computers, communicate with each other through the network and are sharing a state or working together to achieve a common goal.

*By Using the Distributed system Method The company grows well.

FEATURES OF DISTRIBUTED SYSTEMS:

- All the nodes in the distributed system are connected to each other. So nodes can easily share data with other nodes.
- More nodes can easily be added to the distributed system i.e. it can be scaled as required.
- Failure of one node does not lead to the failure of the entire distributed system. Other nodes can still communicate with each other.
- Resources like printers can be shared with multiple nodes rather than being restricted to just one.

B) Implement the Leader election algorithm in ZooKeeper based on the distributed system architecture represented below.



What happens when the leader dies?

SOLUTION:

STEP 1:

*Every node that connects to zookeeper volunteers to become a leader.

*Each node submits its candidacy by adding a Z node that represents itself under the election parent since zookeeper maintains a global order it can name each Z node according to the order of their addition.

STEP 2:

*After each node finishes creating a Z node it would query the current children of the election parent notice that because of that order that zookeeper provides us each node when querying the children of the election parent is guaranteed to see all the Z nodes created prior to its own Z node creation.

STEP 3:

*The Z node note that the current node created is the smallest number it knows that it is now the leader on the other hand if the Z note that the current node is not the smallest then the node knows that is not the leader and it is now waiting for instructions from the elected leader.

*ZOOKEEPER TERMINAL

*Connecting the Zookeeper

*Connecting to the Command line of Zookeeper

```
Command Prompt - zkCli
2022-09-19 22:56:51,892 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:os.name=Windows 11
2022-09-19 22:56:51,892 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:os.arch=amd64
2022-09-19 22:56:51,892 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:os.version=10.0
2022-09-19 22:56:51,892 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:user.name=Brinda
2022-09-19 22:56:51,892 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:user.home=C:\Users\Brinda
2022-09-19 22:56:51,892 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:user.dir=C:\apache-zookeeper-3.8.0-bin\bin
2022-09-19 22:56:51,892 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:os.memory.free=102MB
2022-09-19 22:56:51,892 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:os.memory.max=1682MB
2022-09-19 22:56:51,892 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:os.memory.total=115MB
2022-09-19 22:56:51,892 [myid:] - INFO  [main:o.a.z.ZooKeeper@657] - Initiating client connection, connectString=localhost:2181 sessionTimeout=30000 watcher=org.apache.zookeeper.ZooKeeperMain$MyWatcher@7c16995e
2022-09-19 22:56:51,932 [myid:] - INFO  [main:o.a.z.c.X509Util@7] - Setting -D jdk.tls.rejectClientInitiatedRenegotiation=true to disable client-initiated TLS renegotiation
2022-09-19 22:56:52,627 [myid:] - INFO  [main:o.a.z.ClientCnxnSocket@239] - jute.maxbuffer value is 1048575 Bytes
2022-09-19 22:56:52,659 [myid:] - INFO  [main:o.a.z.ClientCnxn@1732] - zookeeper.request.timeout value is 0. feature.enabled=false
Welcome to ZooKeeper!
2022-09-19 22:56:52,674 [myid:localhost:2181] - INFO  [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1171] - Opening socket connection to server localhost/0:0:0:0:0:1:2181
2022-09-19 22:56:52,674 [myid:localhost:2181] - INFO  [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1173] - SASL config status: Will not attempt to authenticate using SASL (unknown error)
2022-09-19 22:56:52,690 [myid:localhost:2181] - INFO  [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1005] - Socket connection established, initiating session, client: /0:0:0:0:0:0:1:50141, server: localhost/0:0:0:0:0:0:1:2181
JLine support is enabled
2022-09-19 22:56:52,737 [myid:localhost:2181] - INFO  [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1444] - Session establishment complete on server localhost/0:0:0:0:0:0:1:2181, session id = 0x1000307999d0000, negotiated timeout = 30000

WATCHER::

watchedEvent state:SyncConnected type:None path:null
[zk: localhost:2181(CONNECTED) 0] -
```

*creating parent Node

Create /Master

```

2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.name=Windows 11
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.arch=amd64
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.version=10.0
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.name=Brinda
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.home=C:/Users/Brinda
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.dir=C:/apache-zookeeper-3.8.0-bin\bin
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.free=102MB
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.max=1682MB
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.total=15MB
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.ZooKeeperMain$MyWatcher@637] - Initiating client connection, connectString=localhost:2181 sessionTimeout=30000 watcher=org.apache.zookeeper.ZooKeeperMain$MyWatcher@7c16905e
2022-09-19 22:56:51,932 [myid:] - INFO [main:o.a.z.c.X509Util@77] - Setting -D jdk.tls.rejectClientInitiatedRenegotiation=true to disable client-initiated TLS renegotiation
Welcome to ZooKeeper!
2022-09-19 22:56:52,627 [myid:] - INFO [main:o.a.z.ClientCnxnSocket@239] - jute.maxbuffer value is 1048575 Bytes
2022-09-19 22:56:52,659 [myid:] - INFO [main:o.a.z.ClientCnxn@1732] - zookeeper.request.timeout value is 0. feature enabled=false
2022-09-19 22:56:52,674 [myid:] - INFO [main-SendThread[localhost:2181]:o.a.z.ClientCnxn$SendThread@1171] - Opening socket connection to server localhost/0:0:0:0:0:0:1:2181.
2022-09-19 22:56:52,674 [myid:] - INFO [main-SendThread[localhost:2181]:o.a.z.ClientCnxn$SendThread@1173] - SASL config status: Will not attempt to authenticate using SASL (unknown error)
2022-09-19 22:56:52,690 [myid:localhost:2181] - INFO [main-SendThread[localhost:2181]:o.a.z.ClientCnxn$SendThread@1005] - Socket connection established, initiating session
, client: /0:0:0:0:0:0:1:50141, server: localhost/0:0:0:0:0:0:1:2181
JLine support is enabled
2022-09-19 22:56:52,737 [myid:localhost:2181] - INFO [main-SendThread[localhost:2181]:o.a.z.ClientCnxn$SendThread@1444] - Session establishment complete on server localhost/0:0:0:0:0:0:1:2181, session id = 0x1000307999d0000, negotiated timeout = 30000
WATCHER:::

WatchedEvent state:SyncConnected type:None path:null
[zk: localhost:2181(CONNECTED) 0] create /Master
Created /Master
[zk: localhost:2181(CONNECTED) 1] -

```

*Creating ChildNode 1 (slave0001)

Create -s -e /Master/slave0001

```

2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.name=Windows 11
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.arch=amd64
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.version=10.0
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.name=Brinda
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.home=C:/Users/Brinda
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.dir=C:/apache-zookeeper-3.8.0-bin\bin
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.free=102MB
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.max=1682MB
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.total=15MB
2022-09-19 22:56:51,892 [myid:] - INFO [main:o.a.z.ZooKeeperMain$MyWatcher@637] - Initiating client connection, connectString=localhost:2181 sessionTimeout=30000 watcher=org.apache.zookeeper.ZooKeeperMain$MyWatcher@7c16905e
2022-09-19 22:56:51,932 [myid:] - INFO [main:o.a.z.c.X509Util@77] - Setting -D jdk.tls.rejectClientInitiatedRenegotiation=true to disable client-initiated TLS renegotiation
Welcome to ZooKeeper!
2022-09-19 22:56:52,627 [myid:] - INFO [main:o.a.z.ClientCnxnSocket@239] - jute.maxbuffer value is 1048575 Bytes
2022-09-19 22:56:52,659 [myid:] - INFO [main:o.a.z.ClientCnxn@1732] - zookeeper.request.timeout value is 0. feature enabled=false
2022-09-19 22:56:52,674 [myid:] - INFO [main-SendThread[localhost:2181]:o.a.z.ClientCnxn$SendThread@1171] - Opening socket connection to server localhost/0:0:0:0:0:0:1:2181.
2022-09-19 22:56:52,674 [myid:] - INFO [main-SendThread[localhost:2181]:o.a.z.ClientCnxn$SendThread@1173] - SASL config status: Will not attempt to authenticate using SASL (unknown error)
2022-09-19 22:56:52,690 [myid:localhost:2181] - INFO [main-SendThread[localhost:2181]:o.a.z.ClientCnxn$SendThread@1005] - Socket connection established, initiating session
, client: /0:0:0:0:0:0:1:50141, server: localhost/0:0:0:0:0:0:1:2181
JLine support is enabled
2022-09-19 22:56:52,737 [myid:localhost:2181] - INFO [main-SendThread[localhost:2181]:o.a.z.ClientCnxn$SendThread@1444] - Session establishment complete on server localhost/0:0:0:0:0:0:1:2181, session id = 0x1000307999d0000, negotiated timeout = 30000
WATCHER:::

WatchedEvent state:SyncConnected type:None path:null
[zk: localhost:2181(CONNECTED) 0] create /Master
Created /Master
[zk: localhost:2181(CONNECTED) 1] create -s -e /Master/slave0001
Created /Master/slave0001@0001000000000000
[zk: localhost:2181(CONNECTED) 2] -

```

*Creating ChildNode 2 (slave0002)

*Opening a new command prompt

Create -s -e /Master/slave0002

```

2022-09-19 23:11:36,059 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.version=10.0
2022-09-19 23:11:36,059 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.name=Brinda
2022-09-19 23:11:36,059 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.home=C:\Users\Brinda
2022-09-19 23:11:36,059 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.dir=C:\apache-zookeeper-3.8.0-bin\bin
2022-09-19 23:11:36,059 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.free=102MB
2022-09-19 23:11:36,059 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.max=1682MB
2022-09-19 23:11:36,059 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.total=159MB
2022-09-19 23:11:36,074 [myid:] - INFO [main:o.a.z.ZooKeeper@637] - Initiating client connection, connectString=localhost:2181 sessionTimeout=30000 watcher=org.apache.zookeeper.ZooKeeperMain$MyWatcher@7c16905e
2022-09-19 23:11:36,098 [myid:] - INFO [main:o.a.z.c.X509Util@77] - Setting -D jdk.tls.rejectClientInitiatedRenegotiation=true to disable client-initiated TLS renegotiation
2022-09-19 23:11:36,793 [myid:] - INFO [main:o.a.z.ClientCnxnSocket@239] - jute.maxbuffer value is 1048575 Bytes
2022-09-19 23:11:36,808 [myid:] - INFO [main:o.a.z.ClientCnxn@1752] - zookeeper.request.timeout value is 0. feature enabled=false
Welcome to ZooKeeper!
2022-09-19 23:11:36,824 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1171] - Opening socket connection to server localhost/0:0:0:0:0:0:1:2181.
2022-09-19 23:11:36,824 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1173] - SASL config status: Will not attempt to authenticate using SASL (unknown error)
2022-09-19 23:11:36,840 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1005] - Socket connection established, initiating session
, client: /0:0:0:0:0:0:1:50460, server: localhost/0:0:0:0:0:0:1:2181
JLine support is enabled
2022-09-19 23:11:36,887 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1444] - Session establishment complete on server localhost/0:0:0:0:0:0:1:2181, session id = 0x1000307999d0002, negotiated timeout = 30000
WATCHER::

WatchedEvent state:SyncConnected type:None path:null
[zk: localhost:2181(CONNECTED) 0] create -s -e /Master/slave0002
Created /Master/slave00020000000004
[zk: localhost:2181(CONNECTED) 1]

```

*Creating ChildNode 3 (slave0003)

*Opening a new command prompt

Create -s -e /Master/slave0003

```

2022-09-19 23:12:56,391 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.version=10.0
2022-09-19 23:12:56,391 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.name=Brinda
2022-09-19 23:12:56,391 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.home=C:\Users\Brinda
2022-09-19 23:12:56,391 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.dir=C:\apache-zookeeper-3.8.0-bin\bin
2022-09-19 23:12:56,391 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.free=102MB
2022-09-19 23:12:56,391 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.max=1682MB
2022-09-19 23:12:56,391 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.total=159MB
2022-09-19 23:12:56,406 [myid:] - INFO [main:o.a.z.c.X509Util@77] - Setting -D jdk.tls.rejectClientInitiatedRenegotiation=true to disable client-initiated TLS renegotiation
2022-09-19 23:12:51,118 [myid:] - INFO [main:o.a.z.ClientCnxnSocket@239] - jute.maxbuffer value is 1048575 Bytes
2022-09-19 23:12:51,141 [myid:] - INFO [main:o.a.z.ClientCnxn@1732] - zookeeper.request.timeout value is 0. feature enabled=false
Welcome to ZooKeeper!
2022-09-19 23:12:51,157 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1171] - Opening socket connection to server localhost/127.0.0.1:2181.
2022-09-19 23:12:51,157 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1173] - SASL config status: Will not attempt to authenticate using SASL (unknown error)
2022-09-19 23:12:51,157 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1005] - Socket connection established, initiating session
, client: /127.0.0.1:50487, server: localhost/127.0.0.1:2181
JLine support is enabled
2022-09-19 23:12:51,188 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1444] - Session establishment complete on server localhost/127.0.0.1:2181, session id = 0x1000307999d0003, negotiated timeout = 30000
WATCHER::

WatchedEvent state:SyncConnected type:None path:null
[zk: localhost:2181(CONNECTED) 0] create -s -e /Master/slave0003
Created /Master/slave00030000000005
[zk: localhost:2181(CONNECTED) 1]

```

*Creating Watches for ChildNode1 from ChildNode2

*Go to command prompt 2 and type

get -s -w /Master/slave00000003

```

2022-09-19 23:11:36,059 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.max=1682MB
2022-09-19 23:11:36,059 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.total=15MB
2022-09-19 23:11:36,074 [myid:] - INFO [main:o.a.z.ZooKeeper@637] - Initiating client connection, connectString=localhost:2181 sessionTimeout=30000 watcher=org.apache.zookeeper.ZooKeeperMain$MyWatcher@7c16995e
2022-09-19 23:11:36,090 [myid:] - INFO [main:o.a.z.c.X509Util@77] - Setting -D jdk.tls.rejectClientInitiatedRenegotiation=true to disable client-initiated TLS renegotiation
2022-09-19 23:11:36,793 [myid:] - INFO [main:o.a.z.ClientCnxnSocket@239] - jute.maxbuffer value is 1048575 Bytes
2022-09-19 23:11:36,808 [myid:] - INFO [main:o.a.z.ClientCnxn@1732] - zookeeper.request.timeout value is 0. feature enabled=false
Welcome to ZooKeeper!
2022-09-19 23:11:36,824 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1171] - Opening socket connection to server localhost/0:0:0:0:0:0:1:2181.
2022-09-19 23:11:36,824 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1173] - SASL config status: Will not attempt to authenticate using SASL (unknown error)
2022-09-19 23:11:36,846 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1005] - Socket connection established, initiating session
, client: /0:0:0:0:0:0:1:50468, server: localhost/0:0:0:0:0:0:1:2181
JLine support is enabled
2022-09-19 23:11:36,887 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1444] - Session establishment complete on server localhost/0:0:0:0:0:0:1:2181, session id = 0x1000307999d0002, negotiated timeout = 30000
WATCHER::
```

WatchedEvent state:SyncConnected type:None path:null
[zk: localhost:2181(CONNECTED) 0] create -s -e /Master/slave000000004
Created /Master/slave000000000004
[zk: localhost:2181(CONNECTED) 1] ls /Master
[slave000000000004, slave000000000005, slave100000000003]
[zk: localhost:2181(CONNECTED) 2] get -s -w /Master/slave100000000003
null
cZxid = 0x191
ctime = Mon Sep 19 23:09:54 IST 2022
mZxid = 0x191
mtime = Mon Sep 19 23:09:54 IST 2022
pZxid = 0x191
cversion = 0
dataVersion = 0
aclVersion = 0
ephemeralOwner = 0x1000307999d0001
dataLength = 0
numChildren = 0
[zk: localhost:2181(CONNECTED) 3]

*Creating watches for ChildNode2 from ChildNode3

*Go to command prompt 3

get -s -w /Master/slave00000004

```

2022-09-19 23:12:50,391 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.max=1682MB
2022-09-19 23:12:50,391 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.total=15MB
2022-09-19 23:12:50,391 [myid:] - INFO [main:o.a.z.ZooKeeper@637] - Initiating client connection, connectString=localhost:2181 sessionTimeout=30000 watcher=org.apache.zookeeper.ZooKeeperMain$MyWatcher@7c16995e
2022-09-19 23:12:50,406 [myid:] - INFO [main:o.a.z.c.X509Util@77] - Setting -D jdk.tls.rejectClientInitiatedRenegotiation=true to disable client-initiated TLS renegotiation
2022-09-19 23:12:51,110 [myid:] - INFO [main:o.a.z.ClientCnxnSocket@239] - jute.maxbuffer value is 1048575 Bytes
2022-09-19 23:12:51,141 [myid:] - INFO [main:o.a.z.ClientCnxn@1732] - zookeeper.request.timeout value is 0. feature enabled=false
Welcome to ZooKeeper!
2022-09-19 23:12:51,157 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1171] - Opening socket connection to server localhost/127.0.0.1:2181.
2022-09-19 23:12:51,157 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1173] - SASL config status: Will not attempt to authenticate using SASL (unknown error)
2022-09-19 23:12:51,157 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1005] - Socket connection established, initiating session
, client: /127.0.0.1:50487, server: localhost/127.0.0.1:2181
JLine support is enabled
2022-09-19 23:12:51,188 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1444] - Session establishment complete on server localhost/127.0.0.1:2181, session id = 0x1000307999d0003, negotiated timeout = 30000
WATCHER::
```

WatchedEvent state:SyncConnected type:None path:null
[zk: localhost:2181(CONNECTED) 0] create -s -e /Master/slave00000004
Created /Master/slave000000000004
[zk: localhost:2181(CONNECTED) 1] ls /Master
[slave000000000004, slave000000000005, slave100000000003]
[zk: localhost:2181(CONNECTED) 2] get -s -w /Master/slave000000000004
null
cZxid = 0x194
ctime = Mon Sep 19 23:11:57 IST 2022
mZxid = 0x194
mtime = Mon Sep 19 23:11:57 IST 2022
pZxid = 0x194
cversion = 0
dataVersion = 0
aclVersion = 0
ephemeralOwner = 0x1000307999d0002
dataLength = 0
numChildren = 0
[zk: localhost:2181(CONNECTED) 3]

*THE CURRENT LEADER NODE WITH LEAST SEQUENCE IS
CHILDNODE1

```

2022-09-19 23:08:36,281 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.version=10.0
2022-09-19 23:08:36,281 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.name=Brinda
2022-09-19 23:08:36,281 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.home=C:\Users\Brinda
2022-09-19 23:08:36,281 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.dir=C:\apache-zookeeper-3.8.0-bin\bin
2022-09-19 23:08:36,281 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.free=102MB
2022-09-19 23:08:36,281 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.max=1682MB
2022-09-19 23:08:36,281 [myid:] - INFO [main:o.a.z.ZooKeeper@637] - Initiating client connection, connectString=localhost:2181 sessionTimeout=30000 watcher=org.apache.zookeeper.ZooKeeperMain$MyWatcher@c169958
2022-09-19 23:08:36,312 [myid:] - INFO [main:o.a.z.c.X509Util@77] - Setting -D jdk.tls.rejectClientInitiatedRenegotiation=true to disable client-initiated TLS renegotiation
2022-09-19 23:08:37,015 [myid:] - INFO [main:o.a.z.ClientCnxnSocket@239] - jute.maxbuffer value is 1048575 Bytes
2022-09-19 23:08:37,051 [myid:] - INFO [main:o.a.z.ClientCnxn@1732] - zookeeper.request.timeout value is 0. feature enabled=false
Welcome to ZooKeeper!
2022-09-19 23:08:37,047 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1171] - Opening socket connection to server localhost/127.0.0.1:2181.
2022-09-19 23:08:37,047 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1173] - SASL config status: Will not attempt to authenticate using SASL (unknown error)
2022-09-19 23:08:37,051 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1005] - Socket connection established, initiating session
, client: /127.0.0.1:58394, server: localhost/127.0.0.1:2181
JLine support is enabled
2022-09-19 23:08:37,082 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1444] - Session establishment complete on server localhost/127.0.0.1:2181, session id = 0x1000307999d0001, negotiated timeout = 30000
WATCHER::

WatchedEvent state:SyncConnected type:None path:null
[zk: localhost:2181(CONNECTED) 0] create -s -e /Master/slave1
Created /Master/slave1000000003
[zk: localhost:2181(CONNECTED) 1]

WATCHER::

WatchedEvent state:SyncConnected type:None path:null
[zk: localhost:2181(CONNECTED) 0] create -s -e /Master/slave0002
Created /Master/slave00020000000004
[zk: localhost:2181(CONNECTED) 1] ls /Master
[slave00020000000004, slave00030000000005, slave1000000003]
[zk: localhost:2181(CONNECTED) 2] get -s -w /Master/slave1000000003
null
cZxid = 0x191
ctime = Mon Sep 19 23:09:54 IST 2022
mZxid = 0x191
mtime = Mon Sep 19 23:09:54 IST 2022
pZxid = 0x191
cversion = 0
dataVersion = 0
aclVersion = 0
ephemeralOwner = 0x1000307999d0001
dataLength = 0
numChildren = 0
[zk: localhost:2181(CONNECTED) 3]
WATCHER::

WatchedEvent state:SyncConnected type:NodeDeleted path:/Master/slave1000000003

```

*As we close the ChildNode1(Leader) The Watch has gone to ChildNode2

SO, THE CHILDMODE2 HAS BECOME LEADER NOW

```

2022-09-19 23:11:36,090 [myid:] - INFO [main:o.a.z.c.X509Util@77] - Setting -D jdk.tls.rejectClientInitiatedRenegotiation=true to disable client-initiated TLS renegotiation
2022-09-19 23:11:36,793 [myid:] - INFO [main:o.a.z.ClientCnxnSocket@239] - jute.maxbuffer value is 1048575 Bytes
2022-09-19 23:11:36,808 [myid:] - INFO [main:o.a.z.ClientCnxn@1732] - zookeeper.request.timeout value is 0. feature enabled=false
Welcome to ZooKeeper!
2022-09-19 23:11:36,824 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1171] - Opening socket connection to server localhost/0.0.0.0:2181.
2022-09-19 23:11:36,824 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1173] - SASL config status: Will not attempt to authenticate using SASL (unknown error)
2022-09-19 23:11:36,840 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1005] - Socket connection established, initiating session
, client: /0.0.0.0:0.0:1:58460, server: localhost/0.0.0.0:0.0:1:2181
JLine support is enabled
2022-09-19 23:11:36,887 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1444] - Session establishment complete on server localhost/0.0.0.0:0.0:1:2181, session id = 0x1000307999d0002, negotiated timeout = 30000
WATCHER::

WatchedEvent state:SyncConnected type:None path:null
[zk: localhost:2181(CONNECTED) 0] create -s -e /Master/slave0002
Created /Master/slave00020000000004
[zk: localhost:2181(CONNECTED) 1] ls /Master
[slave00020000000004, slave00030000000005, slave1000000003]
[zk: localhost:2181(CONNECTED) 2] get -s -w /Master/slave1000000003
null
cZxid = 0x191
ctime = Mon Sep 19 23:09:54 IST 2022
mZxid = 0x191
mtime = Mon Sep 19 23:09:54 IST 2022
pZxid = 0x191
cversion = 0
dataVersion = 0
aclVersion = 0
ephemeralOwner = 0x1000307999d0001
dataLength = 0
numChildren = 0
[zk: localhost:2181(CONNECTED) 3]
WATCHER::

WatchedEvent state:SyncConnected type:NodeDeleted path:/Master/slave1000000003

```

*As we close the ChildNode2(Leader) The Watch has gone to ChildNode3

SO, THE CHILDMODE3 HAS BECOME LEADER NOW

*Thus the Leader Election Process is Ilusterated.

```

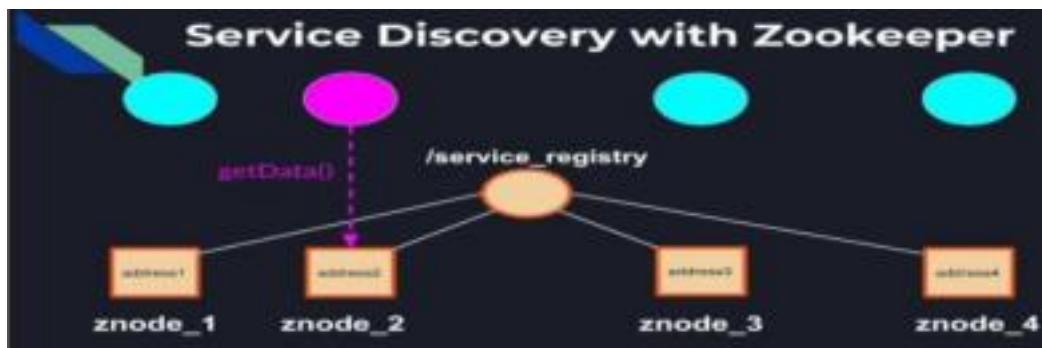
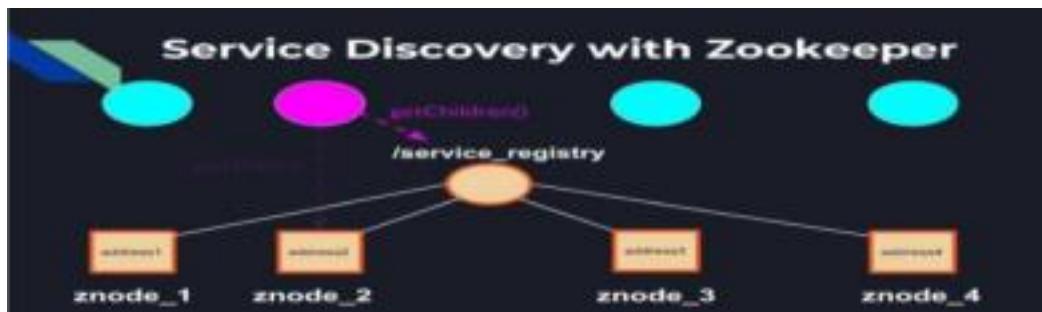
Command Prompt - zkCli
2022-09-19 23:12:50,406 [myid:] - INFO [main:o.a.z.c.X509Util@77] - Setting -D jdk.tls.rejectClientInitiatedRenegotiation=true to disable client-initiated TLS renegotiation
2022-09-19 23:12:51,110 [myid:] - INFO [main:o.a.z.ClientCnxnSocket@239] - jute.maxbuffer value is 1048575 Bytes
2022-09-19 23:12:51,141 [myid:] - INFO [main:o.a.z.ClientCnxn@1732] - zookeeper.request.timeout value is 0. feature.enabled=false
Welcome to Zookeeper!
2022-09-19 23:12:51,157 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1171] - Opening socket connection to server localhost/127.0.0.1:2181
2022-09-19 23:12:51,157 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1173] - SASL config status: Will not attempt to authenticate using SASL (unknown error)
2022-09-19 23:12:51,157 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1005] - Socket connection established, initiating session
client: /127.0.0.1:50487, server: localhost/127.0.0.1:2181
Line support is enabled
2022-09-19 23:12:51,188 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1444] - Session establishment complete on server localhost/127.0.0.1:2181, session id = 0x1000307999d0003, negotiated timeout = 30000
WATCHER:::

WatchedEvent state:SyncConnected type:None path:null
[zk: localhost:2181(CONNECTED) 0] create -s -e /Master/slave0003
Created /Master/slave00030000000005
[zk: localhost:2181(CONNECTED) 1] ls /Master
[slave00020000000004, slave00030000000005, slave1000000003]
[zk: localhost:2181(CONNECTED) 2] get -s -w /Master/slave00020000000004
null
cZxid = 0x194
ctime = Mon Sep 19 23:11:57 IST 2022
mZxid = 0x194
mtime = Mon Sep 19 23:11:57 IST 2022
pZxid = 0x194
cversion = 0
dataVersion = 0
aclVersion = 0
ephemeralOwner = 0x1000307999d0002
dataLength = 0
numChildren = 0
[zk: localhost:2181(CONNECTED) 3]
WATCHER:::

WatchedEvent state:SyncConnected type:NodeDeleted path:/Master/slave00020000000004

```

C) Implement automated service registry by creating the following nodes in ZooKeeper and get the Data and Child nodes associated. Explain the process and terminologies in detail.



EXPLANATION:

*To build an automated service registry in zookeeper first we have to start the zookeeper server by using the command : zkServer

*After that we have to start the zookeeper command line to run the commands by using : zkCli command.

*To create the service_registry as a Sequential node the command used is the command : Create -s /service_registry

*As the service registry contains 4childnodes we create 4 Child nodes under service registry To create the child nodes of service_registry the command used is:

```
create /service _registry0000000027/Z_Node1
```

```
create /service _registry0000000027/Z_Node2
```

```
create /service _registry0000000027/Z_Node3
```

```
create /service _registry0000000027/Z_Node4
```

*After creating the childnodes we have to create the data for each child nodes by using the command:

```
set /service _registry000000027/Z_Node1 "address1"
```

```
set /service _registry000000027/Z_Node1 "address2"
```

```
set /service _registry000000027/Z_Node1 "address3"
```

set /service _registry00000002/E_Node1 address1

After setting the data's for each childnodes the command used to get the data from the Childnode is:

get/service _registry000000002/Z_Node1

get /service _registry000000002/Z_NodeZ

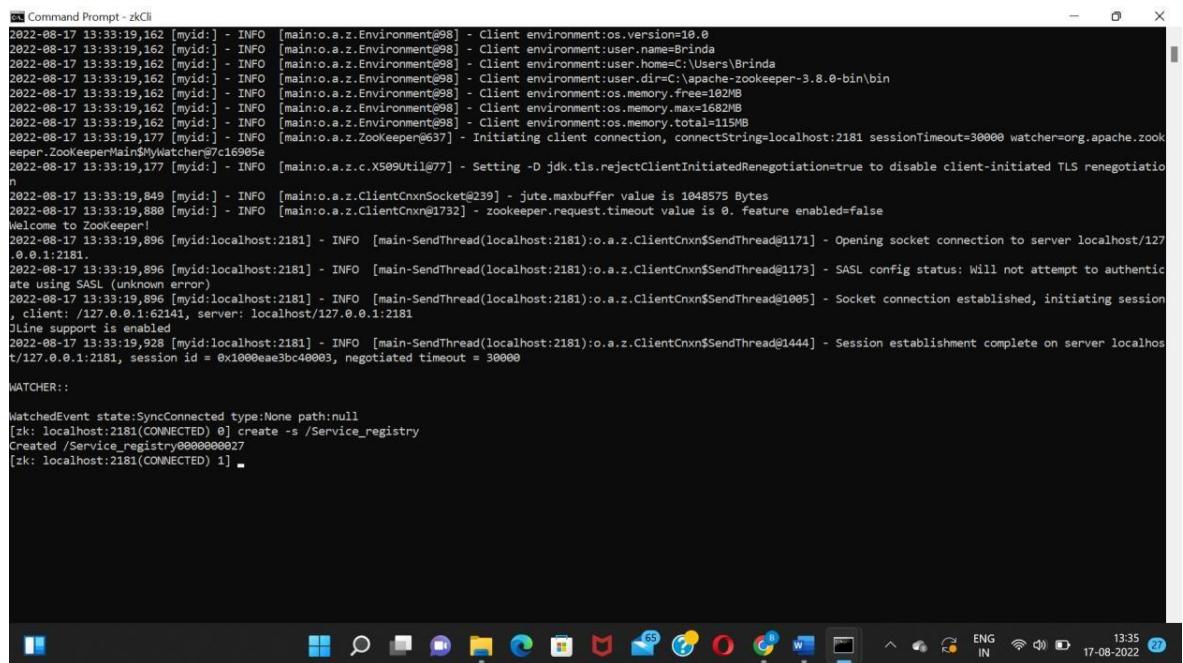
get /service _registry000000002/Z_Nodes

get /service _registry0000000027/Z_Node4

ZOOKEEPER ENVIRONMENT:

```
2022-08-17 13:12:33,821 [myid:] - INFO [main|o.a.z.s.q.QuorumPeerConfig@460] - observerMasterPort is not set
2022-08-17 13:12:33,821 [myid:] - INFO [main|o.a.z.s.q.QuorumPeerConfig@477] - metricsProvider.className is org.apache.zookeeper.metrics.impl.DefaultMetricsProvider
2022-08-17 13:12:33,836 [myid:] - INFO [main|o.a.z.s.ZooKeeperServerMain@123] - Starting server
2022-08-17 13:12:33,914 [myid:] - INFO [main|o.a.z.s.ServerMetrics@64] - ServerMetrics initialized with provider org.apache.zookeeper.metrics.impl.DefaultMetricsProvider@dd3bcd
2022-08-17 13:12:35,008 [myid:] - INFO [main|o.a.z.s.a.DigestAuthenticationProvider@47] - ACL digest algorithm is: SHA1
2022-08-17 13:12:35,008 [myid:] - INFO [main|o.a.z.s.a.DigestAuthenticationProvider@61] - zookeeper.DigestAuthenticationProvider.enabled = true
2022-08-17 13:12:35,024 [myid:] - INFO [main|o.a.z.s.p.FileTxnSnapLog@124] - zookeeper.snapshot.trust.empty : false
2022-08-17 13:12:35,055 [myid:] - INFO [main|o.a.z.ZooKeeperBanner@42] -
2022-08-17 13:12:35,055 [myid:] - INFO [main|o.a.z.ZooKeeperBanner@42] -
2022-08-17 13:12:35,055 [myid:] - INFO [main|o.a.z.ZooKeeperBanner@42] - 
2022-08-17 13:12:35,055 [myid:] - INFO [main|o.a.z.ZooKeeperBanner@42] -
2022-08-17 13:12:35,071 [myid:] - INFO [main|o.a.z.ZooKeeperBanner@42] -
2022-08-17 13:12:35,182 [myid:] - INFO [main|o.a.z.Environment@98] - Server environment:zookeeper.version=3.8.0-5a02a05edd59aae6ac762f7ea82e92a68eb9c0f, built on 2022-08-25 08:49 UTC
2022-08-17 13:12:35,182 [myid:] - INFO [main|o.a.z.Environment@98] - Server environment:host.name=DESKTOP-HH5DG9B
2022-08-17 13:12:35,182 [myid:] - INFO [main|o.a.z.Environment@98] - Server environment:java.version=1.8_0_333
2022-08-17 13:12:35,182 [myid:] - INFO [main|o.a.z.Environment@98] - Server environment:java.vendor=Oracle Corporation
2022-08-17 13:12:35,182 [myid:] - INFO [main|o.a.z.Environment@98] - Server environment:java.home=C:\Java\jdk1.8.0_333\jre
2022-08-17 13:12:35,182 [myid:] - INFO [main|o.a.z.Environment@98] - Server environment:java.class.path=C:\apache-zookeeper-3.8.0-bin\bin..\build\classes;C:\apache-zookeeper-3.8.0-bin\bin..\build\lib\*;C:\apache-zookeeper-3.8.0-bin\bin\..;*;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\audience-annotations-0.12.0.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\commons-cli-1.4.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\commons-io-2.11.0.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\jackson-core-2.13.1.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\jackson-databind-2.13.1.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\jackson-module-jaxb-annotations-2.10.0.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\jetty-9.4.43.v20210629.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\jetty-io-9.4.43.v20210629;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\jetty-9.4.43.v20210629;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\jetty-util-9.4.43.v20210629;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\jline-2.14.6.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\logback-classic-1.2.10.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\logback-core-1.2.10.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\metrics-core-4.1.12.1.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\netty-common-4.1.73.Final.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\netty-resolver-4.1.73.Final.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\netty-tcnative-1.0.48.Final.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\netty-transport-classes-2.0.48.Final.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\netty-transport-native-epoll-4.1.73.Final.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\simpleclient_common-0.9.0.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\simpleclient_hotspot-0.9.0.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\simpleclient_servlet-0.9.0.jar;C:\apache-zookeeper-3.8.0-bin\bin\..;lib\snapy-java-1.1.77.jar
```

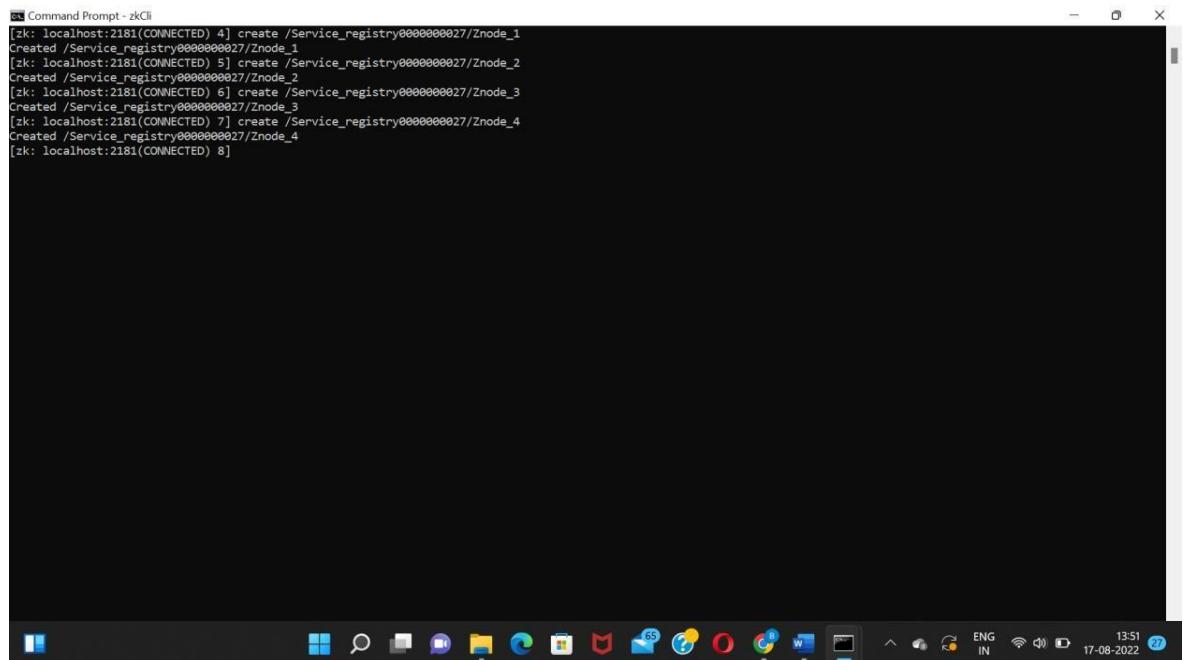
Creating the Parent Node Service_registry



```
cmd Command Prompt - zkCli
2022-08-17 13:33:19,162 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.version=10.0
2022-08-17 13:33:19,162 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.name=Brinda
2022-08-17 13:33:19,162 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.home=C:\Users\Brinda
2022-08-17 13:33:19,162 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:user.dir=C:\apache-zookeeper-3.8.0-bin\bin
2022-08-17 13:33:19,162 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.free=102MB
2022-08-17 13:33:19,162 [myid:] - INFO [main:o.a.z.Environment@98] - Client environment:os.memory.max=1602MB
2022-08-17 13:33:19,177 [myid:] - INFO [main:o.a.z.ZooKeeper@637] - Initiating client connection, connectString=localhost:2181 sessionTimeout=30000 watcher=org.apache.zookeeper.ZooKeeper$MyWatcher@216905e
2022-08-17 13:33:19,177 [myid:] - INFO [main:o.a.z.c.X509Util@77] - Setting -D jdk.tls.rejectClientInitiatedRenegotiation=true to disable client-initiated TLS renegotiation
2022-08-17 13:33:19,849 [myid:] - INFO [main:o.a.z.ClientCnxnSocket@239] - jute.maxbuffer value is 1048575 Bytes
2022-08-17 13:33:19,886 [myid:] - INFO [main:o.a.z.ClientCnxn@1732] - zookeeper.request.timeout value is 0. feature enabled=false
Welcome to ZooKeeper!
2022-08-17 13:33:19,896 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1171] - Opening socket connection to server localhost/127.0.0.1:2181.
2022-08-17 13:33:19,896 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1173] - SASL config status: Will not attempt to authenticate using SASL (unknown error)
2022-08-17 13:33:19,896 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1005] - Socket connection established, initiating session
, client: /127.0.0.1:62141, server: localhost/127.0.0.1:2181
JLine support is enabled
2022-08-17 13:33:19,928 [myid:localhost:2181] - INFO [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1444] - Session establishment complete on server localhost/127.0.0.1:2181, session id = 0x1000eae3bc40003, negotiated timeout = 30000
WATCHER::
```

The screenshot shows a Windows Command Prompt window titled "Command Prompt - zkCli". The window displays log output from the Apache ZooKeeper client. It starts with the connection to the local host at port 2181, showing various environment variables and the initiation of a client connection. It then moves on to creating a parent node named "Service_registry" under the root path. The command used was "create /Service_registry000000027". The output shows the node was successfully created with ID 1.

Creating the Child Nodes ZNode_1,ZNode_2,ZNode_3,ZNode_4



```
cmd Command Prompt - zkCli
[zk: localhost:2181(CONNECTED) 4] create /Service_registry000000027/Znode_1
Created /Service_registry000000027/Znode_1
[zk: localhost:2181(CONNECTED) 5] create /Service_registry000000027/Znode_2
Created /Service_registry000000027/Znode_2
[zk: localhost:2181(CONNECTED) 6] create /Service_registry000000027/Znode_3
Created /Service_registry000000027/Znode_3
[zk: localhost:2181(CONNECTED) 7] create /Service_registry000000027/Znode_4
Created /Service_registry000000027/Znode_4
[zk: localhost:2181(CONNECTED) 8]
```

The screenshot shows a Windows Command Prompt window titled "Command Prompt - zkCli". It continues from the previous log, showing the creation of four child nodes ("Znode_1", "Znode_2", "Znode_3", and "Znode_4") under the parent node "Service_registry". Each node is created with ID 1. The command used for each creation is "create /Service_registry000000027/childname".

Setting the Data for All the childnodes as address1,address2,address3,address4

```
ca Command Prompt - zkCli
[zk: localhost:2181(CONNECTED) 4] create /Service_registry000000027/Znode_1
Created /Service_registry000000027/Znode_1
[zk: localhost:2181(CONNECTED) 5] create /Service_registry000000027/Znode_2
Created /Service_registry000000027/Znode_2
[zk: localhost:2181(CONNECTED) 6] create /Service_registry000000027/Znode_3
Created /Service_registry000000027/Znode_3
[zk: localhost:2181(CONNECTED) 7] create /Service_registry000000027/Znode_4
Created /Service_registry000000027/Znode_4
[zk: localhost:2181(CONNECTED) 8] set /Service_registry000000027/Znode_1 "address1"
[zk: localhost:2181(CONNECTED) 9] set /Service_registry000000027/Znode_2 "address2"
[zk: localhost:2181(CONNECTED) 10] set /Service_registry000000027/Znode_3 "address3"
[zk: localhost:2181(CONNECTED) 11] set /Service_registry000000027/Znode_4 "address4"
[zk: localhost:2181(CONNECTED) 12]
```

To get All the childnodes of Service_registry

```
ca Command Prompt - zkCli
[zk: localhost:2181(CONNECTED) 4] create /Service_registry000000027/Znode_1
Created /Service_registry000000027/Znode_1
[zk: localhost:2181(CONNECTED) 5] create /Service_registry000000027/Znode_2
Created /Service_registry000000027/Znode_2
[zk: localhost:2181(CONNECTED) 6] create /Service_registry000000027/Znode_3
Created /Service_registry000000027/Znode_3
[zk: localhost:2181(CONNECTED) 7] create /Service_registry000000027/Znode_4
Created /Service_registry000000027/Znode_4
[zk: localhost:2181(CONNECTED) 8] set /Service_registry000000027/Znode_1 "address1"
[zk: localhost:2181(CONNECTED) 9] set /Service_registry000000027/Znode_2 "address2"
[zk: localhost:2181(CONNECTED) 10] set /Service_registry000000027/Znode_3 "address3"
[zk: localhost:2181(CONNECTED) 11] set /Service_registry000000027/Znode_4 "address4"
[zk: localhost:2181(CONNECTED) 12] ls /Service_registry000000027
[Znode_1, Znode_2, Znode_3, Znode_4]
[zk: localhost:2181(CONNECTED) 13] ls -R /Service_registry000000027
/Service_registry000000027
/Service_registry000000027/Znode_1
/Service_registry000000027/Znode_2
/Service_registry000000027/Znode_3
/Service_registry000000027/Znode_4
[zk: localhost:2181(CONNECTED) 14]
```

Getting the Data's of All the child node

```

[zk: localhost:2181(CONNECTED) 4] create /Service_registry0000000027/Znode_1
Created /Service_registry0000000027/Znode_1
[zk: localhost:2181(CONNECTED) 5] create /Service_registry0000000027/Znode_2
Created /Service_registry0000000027/Znode_2
[zk: localhost:2181(CONNECTED) 6] create /Service_registry0000000027/Znode_3
Created /Service_registry0000000027/Znode_3
[zk: localhost:2181(CONNECTED) 7] create /Service_registry0000000027/Znode_4
Created /Service_registry0000000027/Znode_4
[zk: localhost:2181(CONNECTED) 8] set /Service_registry0000000027/Znode_1 "address1"
[zk: localhost:2181(CONNECTED) 9] set /Service_registry0000000027/Znode_2 "address2"
[zk: localhost:2181(CONNECTED) 10] set /Service_registry0000000027/Znode_3 "address3"
[zk: localhost:2181(CONNECTED) 11] set /Service_registry0000000027/Znode_4 "address4"
[zk: localhost:2181(CONNECTED) 12] ls /Service_registry0000000027
[Znode_1, Znode_2, Znode_3, Znode_4]
[zk: localhost:2181(CONNECTED) 13] ls -R /Service_registry0000000027
/Service_registry0000000027/Znode_1
/Service_registry0000000027/Znode_2
/Service_registry0000000027/Znode_3
/Service_registry0000000027/Znode_4
[zk: localhost:2181(CONNECTED) 14] get /Service_registry0000000027/Znode_1
address1
[zk: localhost:2181(CONNECTED) 15] get /Service_registry0000000027/Znode_2
address2
[zk: localhost:2181(CONNECTED) 16] get /Service_registry0000000027/Znode_3
address3
[zk: localhost:2181(CONNECTED) 17] get /Service_registry0000000027/Znode_4
address4
[zk: localhost:2181(CONNECTED) 18] 

```

We have got the data's of node1 as address1, node2 as address2, node3 as address3.

Q2.A). Implement the algorithm in Java for a document partitioning based on keywords for the document details given below

Document Words Corpus

D0 [Kafka,Zookeeper, Broker] Zookeeper, Broker D1 [Broker,Kafka]

D2 [Broker,kafka,zookeeper]

D3 [zookeeper,kafka]

```

TFIDFCalculator.java - Notepad
File Edit View
for (String word : doc) {
    if (term.equalsIgnoreCase(word)) {
        n++;
        break;
    }
}
return Math.log(docs.size() / n);
}

public double tfIdf(List<String> doc, List<List<String>> docs, String term) {
    return tf(doc, term) * idf(docs, term);
}

public static void main(String[] args) {
    String s;
    List<String> doc1 = Arrays.asList("Kafka", "Zookeeper", "Broker");
    List<String> doc2 = Arrays.asList("Broker", "Kafka");
    List<String> doc3 = Arrays.asList("Broker", "Zookeeper", "Kafka");
    List<String> doc4 = Arrays.asList("Zookeeper", "Kafka");

    List<List<String>> documents = Arrays.asList(doc1, doc2, doc3, doc4);

    cd C:\Java\jdk1.8.0_333\bin
    calculator = new TFIDFCalculator();
    System.out.println("TF-IDF CALCULATION:\n*****");
    calculator.data();
    double tfidf = calculator.tfIdf(doc2, documents, calculator.dname);
    System.out.println("TF-IDF (Broker) = " + tfidf);
}

```

```
Command Prompt
Microsoft Windows [Version 10.0.22000.856]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Brida>cd C:\Java\jdk1.8.0_333\bin

C:\Java\jdk1.8.0_333\bin>javac TFIDFCalculator.java

C:\Java\jdk1.8.0_333\bin>java TFIDFCalculator
TF-IDF CALCULATION:
*****
Enter the string you want to choose:[Zookeeper,Broker,Kafka]
Broker
TF-IDF (Zookeeper) = 0.14384103622589042

C:\Java\jdk1.8.0_333\bin>
```

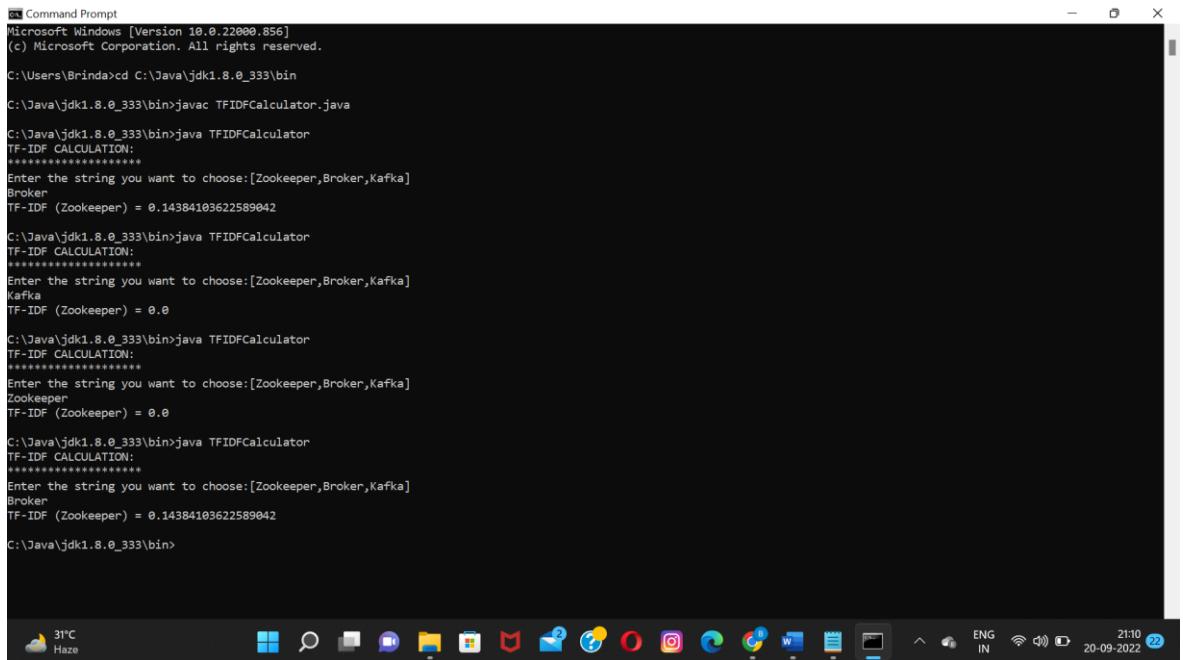
```
Command Prompt
Microsoft Windows [Version 10.0.22000.856]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Brida>cd C:\Java\jdk1.8.0_333\bin

C:\Java\jdk1.8.0_333\bin>javac TFIDFCalculator.java

C:\Java\jdk1.8.0_333\bin>java TFIDFCalculator
TF-IDF CALCULATION:
*****
Enter the string you want to choose:[Zookeeper,Broker,Kafka]
Kafka
TF-IDF (Zookeeper) = 0.0

C:\Java\jdk1.8.0_333\bin>
```



```
Microsoft Windows [Version 10.0.22000.856]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Bridna>cd C:\Java\jdk1.8.0_333\bin

C:\Java\jdk1.8.0_333\bin>javac TFIDFCalculator.java

C:\Java\jdk1.8.0_333\bin>java TFIDFCalculator
TF-IDF CALCULATION:
*****
Enter the string you want to choose:[Zookeeper,Broker,Kafka]
Broker
TF-IDF (Zookeeper) = 0.14384103622589042

C:\Java\jdk1.8.0_333\bin>java TFIDFCalculator
TF-IDF CALCULATION:
*****
Enter the string you want to choose:[Zookeeper,Broker,Kafka]
Kafka
TF-IDF (Zookeeper) = 0.0

C:\Java\jdk1.8.0_333\bin>java TFIDFCalculator
TF-IDF CALCULATION:
*****
Enter the string you want to choose:[Zookeeper,Broker,Kafka]
Zookeeper
TF-IDF (Zookeeper) = 0.0

C:\Java\jdk1.8.0_333\bin>java TFIDFCalculator
TF-IDF CALCULATION:
*****
Enter the string you want to choose:[Zookeeper,Broker,Kafka]
Broker
TF-IDF (Zookeeper) = 0.14384103622589042

C:\Java\jdk1.8.0_333\bin>
```

B) “Without an easy way to communicate between nodes that we can't really build a distributed system”. Justify your approach towards the same using a real time example.

MSC DEGREE EXAMINATION
DISTRIBUTED SYSTEMS
PROJECT ASSESSMENT

UNIQUE ID: ET321004

- 2) B) "Without an easy way to communicate between nodes that we can't really build a distributed system". Justify your approach towards the same using a real time example.

The Easy way to communicate between nodes that we can't really build a distributed system is by using Network Model TCP/IP Model.

(TCP /IP) TRANSMISSION CONTROL PROTOCOL / INTERNET PROTOCOL

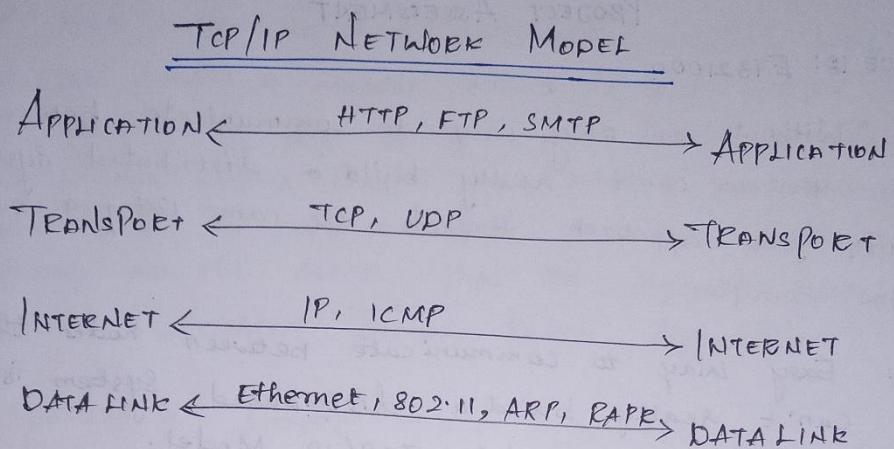
* TCP/IP is the Transmission Control Protocol / Internet Protocol which is used to deliver data packets between the source application or device and the destination using methods and structures, such as address information, within data packets.

TCP/IP contains 4 Layers, such as

- * Application Layer
- * Transport Layer
- * Internet / Network Layer
- * DataLink Layer.

In this Model, Each Layer is getting service from the layer underneath it and it's communicating with the same layer on the other machine or station using

their relevant protocols. The purpose of TCP/IP model is to allow communication over large distances.



DATA LINK LAYER:

- * The Data Link Layer is concerned with all the details of interfacing with the hardware, and in charge of the Physical delivery of the data between two points connected by a single link.
- * Those can be either two different hosts or a host and a router.
- * This abstraction layer is in charge of encapsulating and encoding our data. It takes care of the flow, control, the error, that action and many lower level details.
- * The most common protocol in this layer is the ethernet protocol which wrap the data into frames and uses mac address to deliver data packets from source to destination.

INTERNET / NETWORK LAYER :

An internet layer is a second layer of TCP/IP layer of the TCP/IP model. It is also known as a network layer. The main work of this layer is to send the packets from any network, and any computer till they reach the destination.

- * The internet layer get service from the data link layer and thinks a higher level of role.
- * It is the charge of delivering the data, potentially across multiple networks, and then routing the packets from the source computer.
- * So the destination computer protocol that allows to accomplish this is the internet protocol.

TRANSPORT LAYER

Transport Layer helps you to control the reliability of a link through flow control, error control, and segmentation or de-segmentation. The transport layer also offers an acknowledgement of the successful data transmission and sends the next data in case no error occurred. TCP is the best-known example of the transport layer.

- * This abstraction layer takes care of delivering the messages and end from the process on one machine to another process on the other machine and the transport layer.

- * Each endpoint on socket identifies itself by 16 bit port.
- * The Listening Port is chosen ahead of time by the destination application, by the source port is generated on the fly by sender.
- * There are two primary protocols, datagram protocol and the transmission control protocol.

APPLICATION LAYER

The Application layer is the layer, which is closest to the end-user. It means the application layer allows user to interact with other software applications. Application layer interacts with software applications to implement a communicating component.

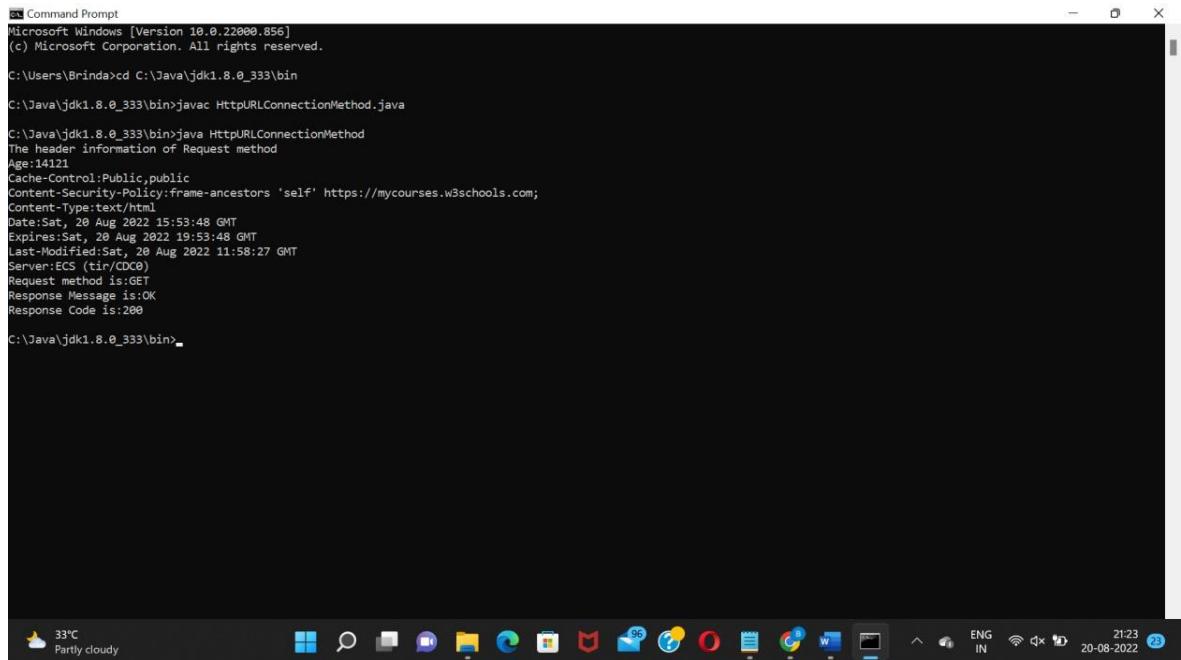
In application layer the application file is deployed. Example of the application layer is an application such as file transfer, email, remote login.

In application layer, we have many different protocols already defined for us for different purpose.

APPLICATION LAYER PROTOCOLS

Protocol	Purpose
* FTP (File Transfer Protocol)	* Transferring files through web.
* DNS (Domain Name System)	* Translating host names into IP addresses.
* HTTP (Hypertext Transfer Protocol)	* Transmitting Hypemedia sound, images, videos.

Implement Http Request and Http Response header details for the url taken as input.



```
Command Prompt
Microsoft Windows [Version 10.0.22000.856]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Brinda>cd C:\Java\jdk1.8.0_333\bin

C:\Java\jdk1.8.0_333\bin>java HttpURLConnectionMethod.java

The header information of Request method
Age:14121
Cache-Control:Public,public
Content-Security-Policy:frame-ancestors 'self' https://mycourses.w3schools.com;
Content-Type:text/html
Date:Sat, 28 Aug 2022 15:53:48 GMT
Expires:Sat, 28 Aug 2022 19:53:48 GMT
Last-Modified:Sat, 28 Aug 2022 11:58:27 GMT
Server:CS (tir/CD0)
Request method is:GET
Response Message is:OK
Response Code is:200

C:\Java\jdk1.8.0_333\bin>
```

3.A) Assume that an enterprise has a cluster of three servers:

- Server A can handle 30 requests per second, on average
- Server B can handle 20 requests per second, on average
- Server C can handle 15 requests per second, on average

Next, assume that the load balancer receives 6 requests.

- 4 requests are sent to Server A
- 5 requests are sent to Server B
- 2 request is sent to Server C.

Specify the type of load balancing algorithm used in the above scenario with proper justification

3) A) Assume that an enterprise has a cluster of three servers:

Server A can handle 30 request per second on average

Server B can handle 20 request per second, on average

Server C can handle 15 request per second on average.

SOLUTION:

* The Load Balancer Algorithm used here is Weighted Round Robin Algorithm.

* A weight is assigned to each server based on criteria chosen by the site administrator. The most commonly used criterion is the server's traffic handling capacity. The higher the weight, the larger the proportion of client request the server receives.

* Here each server contains different weights where Server A can handle 30 request which contains higher weights and Server B can handle 20 request per second which is less weight than Server A and Server C can handle 15 request per second which is less than Server B. So, the best algorithm which fit the cluster is WEIGHTED ROUND ROBIN ALGORITHM.

Next, assume that the load balancer receives 6 requests.

* 4 requests are sent to Server A

* 5 requests are sent to Server B

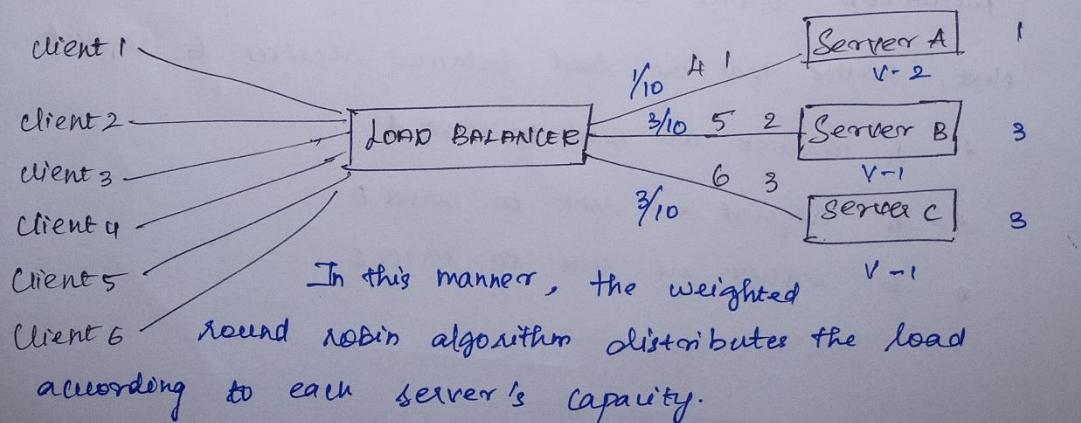
* 6 requests are sent to Server C

- * The Load Balancer Algorithm used here is Weighted Round Robin Algorithm.
- * Each server contains different weights where server A can handle 4 requests which is less weight compared to other servers and server B can handle 5 requests which has higher weight than server A and server C can handle 6 weights which contains higher weight among all the servers. Thus the algorithm we can use is "Weighted Round Robin Algorithm".

WEIGHTED ROUND ROBIN ALGORITHM

The Weighted Round Robin Load Balancing Algorithm allows site administrators to assign weights to each server based on criteria like traffic-handling capacity. Servers with higher weights receive a higher proportion of client requests. For a simplified cluster.

- * This describes how to assign weights to your data centers and origin servers to gain more precise control over the distribution of load between them.



B) Implement Round Robin Load balancing on three servers running at ports 127.0.0.1:9084, 127.0.0.1:9085 and 127.0.0.1:9086 using HAProxy.

WORKING WITH UBUNTU

Ubuntu:

STEP1:

Installing haproxy in ubuntu:

Start ubuntu->Terminal

```
>sudo apt-get update #command to update the OS in ubuntu
```

```
>sudo apt-get install haproxy #installing haproxy in ubuntu
```

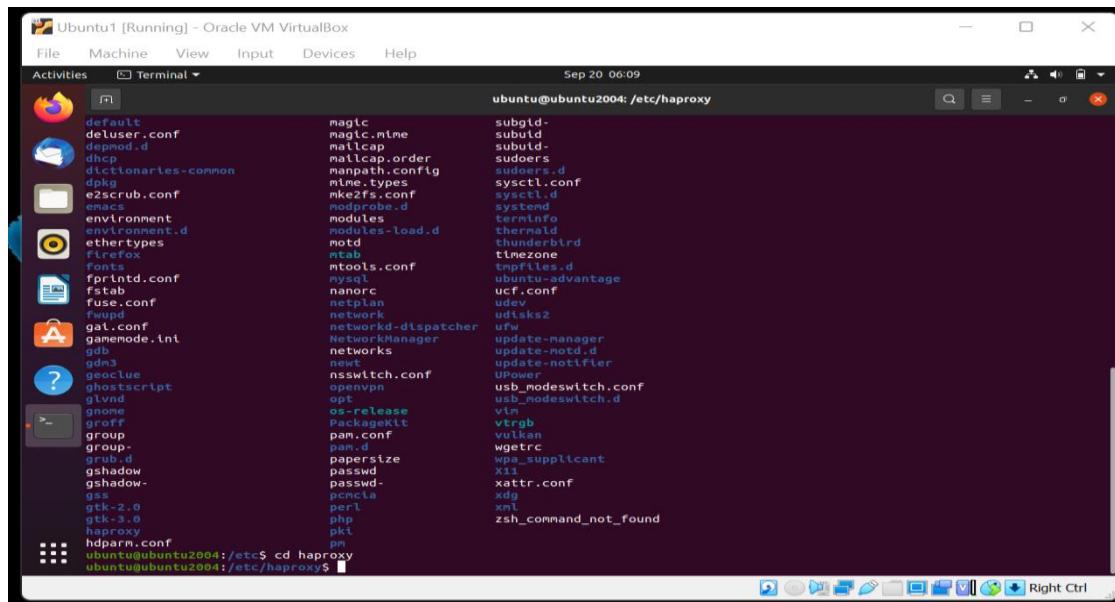
```
>cd ..
```

```
>cd ..
```

```
>cd etc
```

```
>ls
```

We can see haproxy



```
>cd haproxy
```

STEP2:

Open a new terminal:

```
>cd ..
```

```
>cd ..
```

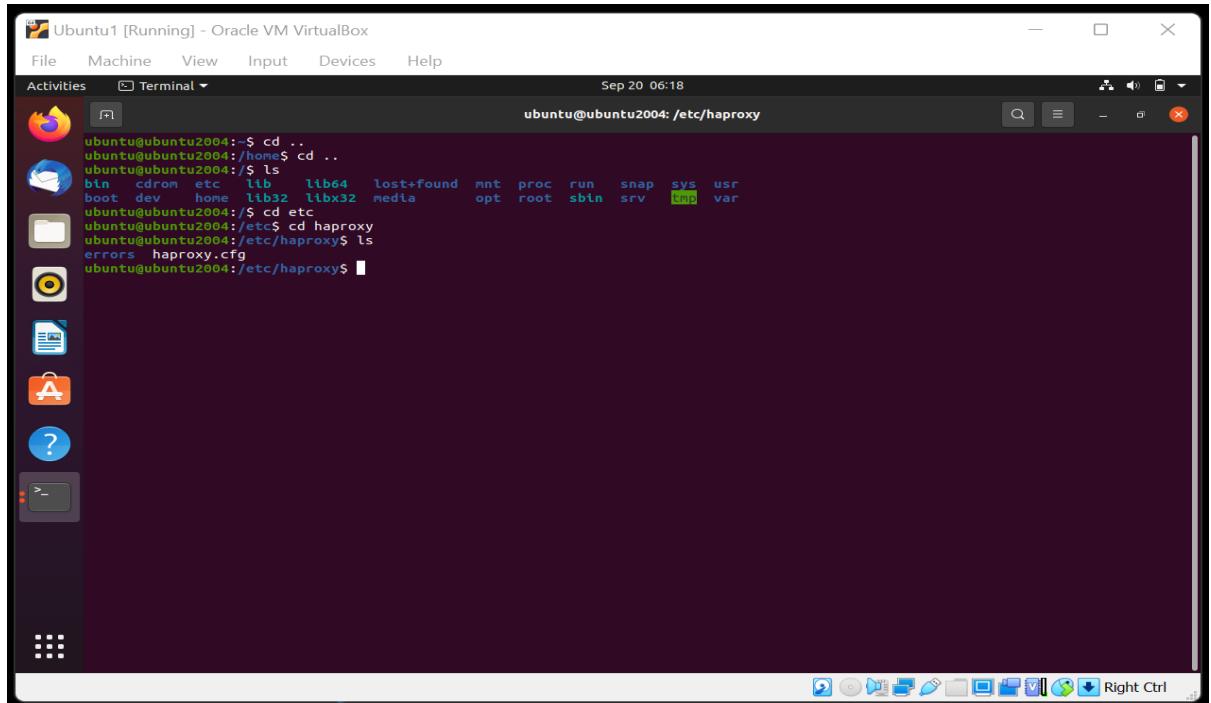
```
>ls
```

```
>cd etc
```

```
>cd haproxy
```

```
>ls
```

We can see haproxy.cfg



STEP3:

Go to Terminal->New Window

```
>sudo apt-get update #you will get all the things updated
```

```
>sudo apt-get install python
```

```

Get:21 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 DEP-11 Metadata [278 kB]
Get:22 http://us.archive.ubuntu.com/ubuntu focal-updates/main DEP-11 48x48 Icons [60.8 kB]
Get:23 http://us.archive.ubuntu.com/ubuntu focal-updates/main DEP-11 64x64 Icons [94.1 kB]
Get:24 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 c-n-f Metadata [15.9 kB]
Get:25 http://us.archive.ubuntu.com/ubuntu focal-updates/restricted amd64 Packages [1,262 kB]
Get:26 http://us.archive.ubuntu.com/ubuntu focal-updates/restricted Translation-en [179 kB]
Get:27 http://us.archive.ubuntu.com/ubuntu focal-updates/universe i386 Packages [691 kB]
Get:28 http://us.archive.ubuntu.com/ubuntu focal-updates/universe amd64 Packages [953 kB]
Get:29 http://us.archive.ubuntu.com/ubuntu focal-updates/universe Translation-en [218 kB]
Get:30 http://us.archive.ubuntu.com/ubuntu focal-updates/universe amd64 DEP-11 Metadata [391 kB]
Get:31 http://us.archive.ubuntu.com/ubuntu focal-updates/universe amd64 c-n-f Metadata [21.5 kB]
Get:32 http://us.archive.ubuntu.com/ubuntu focal-updates/universe Translation-en [144 kB]
Get:33 http://us.archive.ubuntu.com/ubuntu focal-updates/multiverse i386 Packages [8,448 kB]
Get:34 http://us.archive.ubuntu.com/ubuntu focal-updates/multiverse Translation-en [7,316 kB]
Get:35 http://us.archive.ubuntu.com/ubuntu focal-updates/multiverse amd64 DEP-11 Metadata [940 kB]
Get:36 http://us.archive.ubuntu.com/ubuntu focal-updates/multiverse amd64 c-n-f Metadata [588 kB]
Get:37 http://us.archive.ubuntu.com/ubuntu focal-backports/main amd64 Packages [45.6 kB]
Get:38 http://us.archive.ubuntu.com/ubuntu focal-backports/main i386 Packages [36.1 kB]
Get:39 http://us.archive.ubuntu.com/ubuntu focal-backports/main amd64 DEP-11 Metadata [7,972 kB]
Get:40 http://us.archive.ubuntu.com/ubuntu focal-backports/main DEP-11 48x48 Icons [6,976 kB]
Get:41 http://us.archive.ubuntu.com/ubuntu focal-backports/main DEP-11 64x64 Icons [22.6 kB]
Get:42 http://us.archive.ubuntu.com/ubuntu focal-backports/main amd64 c-n-f Metadata [1,420 kB]
Get:43 http://us.archive.ubuntu.com/ubuntu focal-backports/universe i386 Packages [13.5 kB]
Get:44 http://us.archive.ubuntu.com/ubuntu focal-backports/universe amd64 Packages [23.9 kB]
Get:45 http://us.archive.ubuntu.com/ubuntu focal-backports/universe amd64 DEP-11 Metadata [30.5 kB]
Get:46 http://us.archive.ubuntu.com/ubuntu focal-backports/universe DEP-11 48x48 Icons [13.2 kB]
Get:47 http://us.archive.ubuntu.com/ubuntu focal-backports/universe DEP-11 64x64 Icons [22.6 kB]
Get:48 http://us.archive.ubuntu.com/ubuntu focal-backports/universe amd64 c-n-f Metadata [866 kB]
Fetched 13.3 MB in 35s (384 kB/s)
Reading package lists... done
ubuntu@ubuntu2004: ~ Sudo apt-get install python
Reading package lists...
Building dependency tree...
Reading state information...
Note, selecting 'python-is-python2' instead of 'python'.
python-is-python2 is already the newest version (2.7.17-4).
0 upgraded, 0 newly installed, 0 to remove and 316 not upgraded.
ubuntu@ubuntu2004: ~
```

STEP4:

Open another terminal:

>sudo apt-get install php7.4-cli

```

Reading package lists... Done
Building dependency tree...
Reading state information... Done
The following additional packages will be installed:
  php7.4-common php7.4-json php7.4-opcache php7.4-readline
Suggested packages:
  php-pear
The following packages will be upgraded:
  php7.4-cli php7.4-common php7.4-json php7.4-opcache php7.4-readline
5 upgraded, 0 newly installed, 0 to remove and 311 not upgraded.
Need to get 2,638 kB of archives.
After this operation, 12.3 kB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 php7.4-readline amd64 7.4.3-4ubuntu2.13 [12.6 kB]
Get:2 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 php7.4-opcache amd64 7.4.3-4ubuntu2.13 [199 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 php7.4-json amd64 7.4.3-4ubuntu2.13 [19.2 kB]
Get:4 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 php7.4-cli amd64 7.4.3-4ubuntu2.13 [1,426 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 php7.4-common amd64 7.4.3-4ubuntu2.13 [981 kB]
Fetched 2,638 kB in 14s (189 kB/s)
(Reading database ... 146802 files and directories currently installed.)
Preparing to unpack .../php7.4-readline_7.4.3-4ubuntu2.13_amd64.deb ...
Unpacking php7.4-readline (7.4.3-4ubuntu2.13) over (7.4.3-4ubuntu2.12) ...
Preparing to unpack .../php7.4-opcache_7.4.3-4ubuntu2.13_amd64.deb ...
Unpacking php7.4-opcache (7.4.3-4ubuntu2.13) over (7.4.3-4ubuntu2.12) ...
Preparing to unpack .../php7.4-json_7.4.3-4ubuntu2.13_amd64.deb ...
Unpacking php7.4-json (7.4.3-4ubuntu2.13) ...
Setting up php7.4-common (7.4.3-4ubuntu2.13) ...
Setting up php7.4-readline (7.4.3-4ubuntu2.13) ...
Setting up php7.4-opcache (7.4.3-4ubuntu2.13) ...
Setting up php7.4-json (7.4.3-4ubuntu2.13) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for php7.4-cli (7.4.3-4ubuntu2.13) ...
ubuntu@ubuntu2004: ~
```

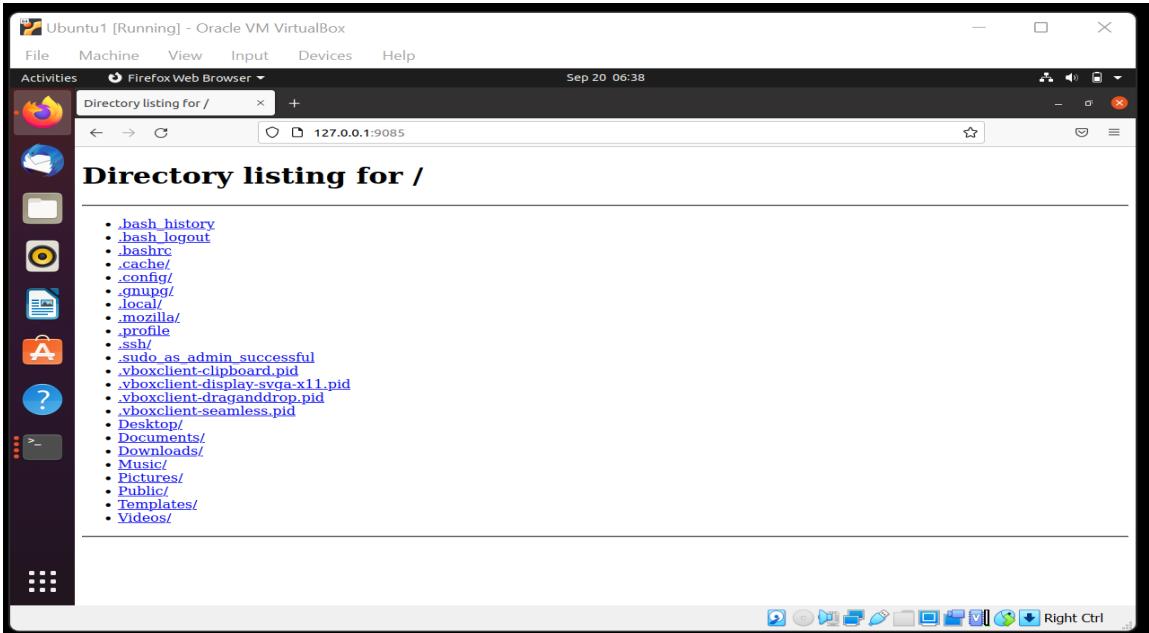
STEP5:

Go to the terminal where you installed python:

Start http server at the port 9085 and bind to host ip address.

This is web server 1

```
Get:23 http://us.archive.ubuntu.com/ubuntu focal-updates/main DEP-11 64x64 Icons [98.3 kB]
Get:24 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 c-n-f Metadata [15.9 kB]
Get:25 http://us.archive.ubuntu.com/ubuntu focal-updates/restricted amd64 Packages [1,262 kB]
Get:26 http://us.archive.ubuntu.com/ubuntu focal-updates/restricted Translation-en [179 kB]
Get:27 http://us.archive.ubuntu.com/ubuntu focal-updates/universe i386 Packages [691 kB]
Get:28 http://us.archive.ubuntu.com/ubuntu focal-updates/universe amd64 Packages [953 kB]
Get:29 http://us.archive.ubuntu.com/ubuntu focal-updates/universe Translation-en [218 kB]
Get:30 http://us.archive.ubuntu.com/ubuntu focal-updates/universe amd64 DEP-11 Metadata [391 kB]
Get:31 http://us.archive.ubuntu.com/ubuntu focal-updates/universe amd64 c-n-f Metadata [21.5 kB]
Get:32 http://us.archive.ubuntu.com/ubuntu focal-updates/multiverse amd64 Packages [24.4 kB]
Get:33 http://us.archive.ubuntu.com/ubuntu focal-updates/multiverse i386 Packages [8,448 kB]
Get:34 http://us.archive.ubuntu.com/ubuntu focal-updates/multiverse Translation-en [7,316 kB]
Get:35 http://us.archive.ubuntu.com/ubuntu focal-updates/multiverse amd64 DEP-11 Metadata [940 kB]
Get:36 http://us.archive.ubuntu.com/ubuntu focal-updates/multiverse amd64 c-n-f Metadata [588 kB]
Get:37 http://us.archive.ubuntu.com/ubuntu focal-backports/main amd64 Packages [45.6 kB]
Get:38 http://us.archive.ubuntu.com/ubuntu focal-backports/main i386 Packages [36.1 kB]
Get:39 http://us.archive.ubuntu.com/ubuntu focal-backports/main amd64 DEP-11 Metadata [7,972 kB]
Get:40 http://us.archive.ubuntu.com/ubuntu focal-backports/main DEP-11 48x48 Icons [6,976 kB]
Get:41 http://us.archive.ubuntu.com/ubuntu focal-backports/main DEP-11 64x64 Icons [10.5 kB]
Get:42 http://us.archive.ubuntu.com/ubuntu focal-backports/main amd64 c-n-f Metadata [1,420 kB]
Get:43 http://us.archive.ubuntu.com/ubuntu focal-backports/universe i386 Packages [13.5 kB]
Get:44 http://us.archive.ubuntu.com/ubuntu focal-backports/universe amd64 Packages [23.9 kB]
Get:45 http://us.archive.ubuntu.com/ubuntu focal-backports/universe amd64 DEP-11 Metadata [30.5 kB]
Get:46 http://us.archive.ubuntu.com/ubuntu focal-backports/universe DEP-11 48x48 Icons [13.2 kB]
Get:47 http://us.archive.ubuntu.com/ubuntu focal-backports/universe DEP-11 64x64 Icons [22.6 kB]
Get:48 http://us.archive.ubuntu.com/ubuntu focal-backports/universe amd64 c-n-f Metadata [860 kB]
Fetched 13.3 MB in 35s (384 kB/s)
Reading package lists... Done
ubuntu@ubuntu2004:~$ sudo apt-get install python
Reading package lists... Done
Building dependency tree
Reading state information... Done
Note, selecting 'python-is-python2' instead of 'python'
python-is-python2 is already the newest version (2.7.17-4).
0 upgraded, 0 newly installed, 0 to remove and 316 not upgraded.
ubuntu@ubuntu2004:~$ python3 -m http.server 9085 --bind 127.0.0.1
Serving HTTP on 127.0.0.1 port 9085 (http://127.0.0.1:9085/)
```



STEP6:

Open the terminal where you installed php:

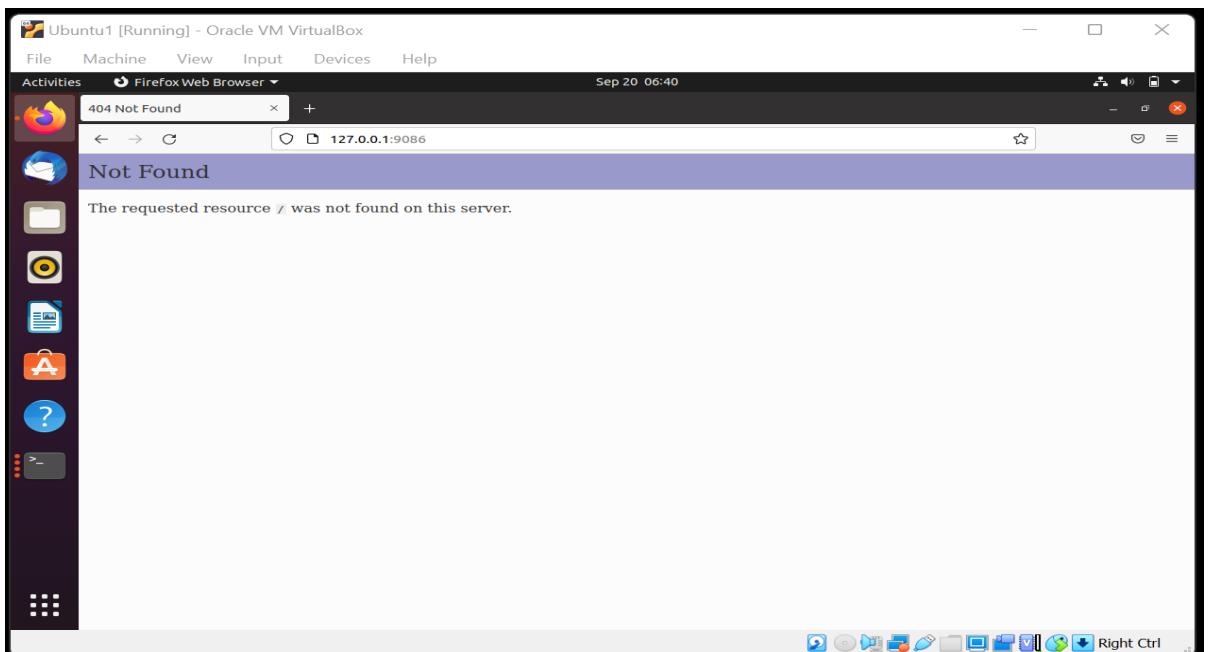
And give the command

```
php -S 127.0.0.1:9086
```

```

ubuntu1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Sep 20 06:54
ubuntu@ubuntu2004: ~
After this operation, 12.3 kB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 php7.4-readline amd64 7.4.3-4ubuntu2.13 [12.6 kB]
Get:2 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 php7.4-opcache amd64 7.4.3-4ubuntu2.13 [199 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 php7.4-json amd64 7.4.3-4ubuntu2.13 [19.2 kB]
Get:4 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 php7.4-cli amd64 7.4.3-4ubuntu2.13 [1,426 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 php7.4-common amd64 7.4.3-4ubuntu2.13 [981 kB]
Fetched 2,638 kB in 14s (189 kB/s)
(Reading database ... 146802 files and directories currently installed.)
Preparing to unpack .../php7.4-readline_7.4.3-4ubuntu2.13_amd64.deb ...
Unpacking php7.4-readline (7.4.3-4ubuntu2.13) over (7.4.3-4ubuntu2.12) ...
Preparing to unpack .../php7.4-opcache_7.4.3-4ubuntu2.13_amd64.deb ...
Unpacking php7.4-opcache (7.4.3-4ubuntu2.13) over (7.4.3-4ubuntu2.12) ...
Preparing to unpack .../php7.4-json_7.4.3-4ubuntu2.13_amd64.deb ...
Unpacking php7.4-json (7.4.3-4ubuntu2.13) over (7.4.3-4ubuntu2.12) ...
Preparing to unpack .../php7.4-cli_7.4.3-4ubuntu2.13_amd64.deb ...
Unpacking php7.4-cli (7.4.3-4ubuntu2.13) over (7.4.3-4ubuntu2.12) ...
Preparing to unpack .../php7.4-common_7.4.3-4ubuntu2.13_amd64.deb ...
Unpacking php7.4-common (7.4.3-4ubuntu2.13) over (7.4.3-4ubuntu2.12) ...
Setting up php7.4-common (7.4.3-4ubuntu2.13) ...
Setting up php7.4-readline (7.4.3-4ubuntu2.13) ...
Setting up php7.4-opcache (7.4.3-4ubuntu2.13) ...
Setting up php7.4-json (7.4.3-4ubuntu2.13) ...
Setting up php7.4-cli (7.4.3-4ubuntu2.13) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for php7.4-cli (7.4.3-4ubuntu2.13) ...
[ Tue Sep 20 06:39:24 2022] PHP 7.4.3 Development Server (http://127.0.0.1:9086) started
^Cubuntu@ubuntu2004:~$ php -S 127.0.0.1:9086
[Tue Sep 20 06:40:09 2022] PHP 7.4.3 Development Server (http://127.0.0.1:9086) started
[Tue Sep 20 06:40:26 2022] 127.0.0.1:38790 Accepted
[Tue Sep 20 06:40:26 2022] 127.0.0.1:38790 [404]: (null) / - No such file or directory
[Tue Sep 20 06:40:26 2022] 127.0.0.1:38790 Closing
[Tue Sep 20 06:40:26 2022] 127.0.0.1:38792 Accepted
[Tue Sep 20 06:40:26 2022] 127.0.0.1:38792 [404]: (null) /favicon.ico - No such file or directory
[Tue Sep 20 06:40:26 2022] 127.0.0.1:38792 Closing
[Tue Sep 20 06:48:04 2022] 127.0.0.1:38794 Accepted
[Tue Sep 20 06:48:04 2022] 127.0.0.1:38794 [404]: (null) / - No such file or directory

```



STEP7:

Go to haproxy terminal:

>sudo nano haproxy.cfg

Press Enter

Then press ctrl+O, Choose haproxy, after defaults type:

frontend myfrontend

bind 127.0.0.1:9084 ->this is the frontend server

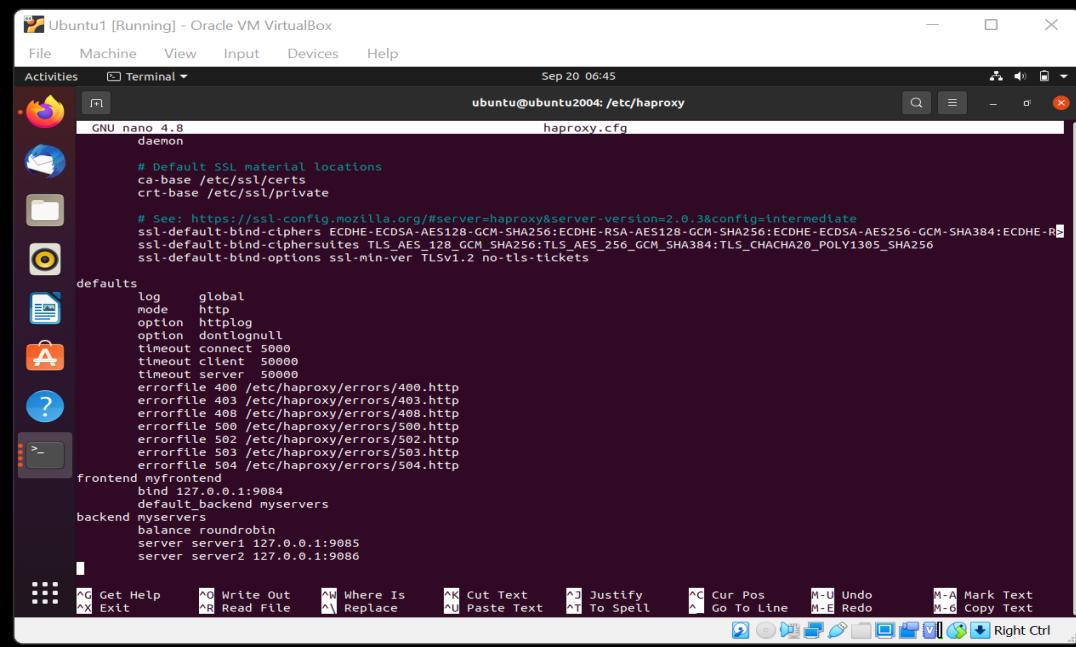
default -backend myservers Press enter

backend myservers

balance roundrobin

server server1 127.0.0.1:9085

server server2 127.0.0.2:9086



```
GNU nano 4.8                               ubuntu@ubuntu2004: /etc/haproxy
                                           
# Default SSL material locations
ca-base /etc/ssl/certs
crt-base /etc/ssl/private

# See: https://ssl-config.mozilla.org/#server=haproxy&server-version=2.0.3&config=intermediate
ssl-default-bind-ciphers ECDHE-ECDSA-AES128-GCM-SHA256:ECDHE-ECDSA-AES256-GCM-SHA384:ECDHE-RSA-AES128-GCM-SHA256:ECDHE-RSA-AES256-GCM-SHA384:TLS_AES_128_GCM_SHA256:TLS_AES_256_GCM_SHA384:TLS_CHACHA20_POLY1305_SHA256
ssl-default-bind-ciphersuites TLS_AES_128_GCM_SHA256:TLS_AES_256_GCM_SHA384:TLS_CHACHA20_POLY1305_SHA256
ssl-default-bind-options ssl-min-ver TLSv1.2 no-tls-tickets

defaults
    log     global
    mode    http
    option  httplog
    option  dontnull
    timeout connect 50000
    timeout client  50000
    timeout server  50000
    errorfile 400 /etc/haproxy/errors/400.http
    errorfile 403 /etc/haproxy/errors/403.http
    errorfile 408 /etc/haproxy/errors/408.http
    errorfile 500 /etc/haproxy/errors/500.http
    errorfile 502 /etc/haproxy/errors/502.http
    errorfile 503 /etc/haproxy/errors/503.http
    errorfile 504 /etc/haproxy/errors/504.http

frontend myfrontend
    bind 127.0.0.1:9084
    default_backend myservers
backend myservers
    balance roundrobin
    server server1 127.0.0.1:9085
    server server2 127.0.0.1:9086
```

Press Ctrl+O->Press enter->Ctrl+X

Now type,

>sudo service haproxy restart

The server restarts

The screenshot shows a desktop environment with a terminal window open. The terminal output is as follows:

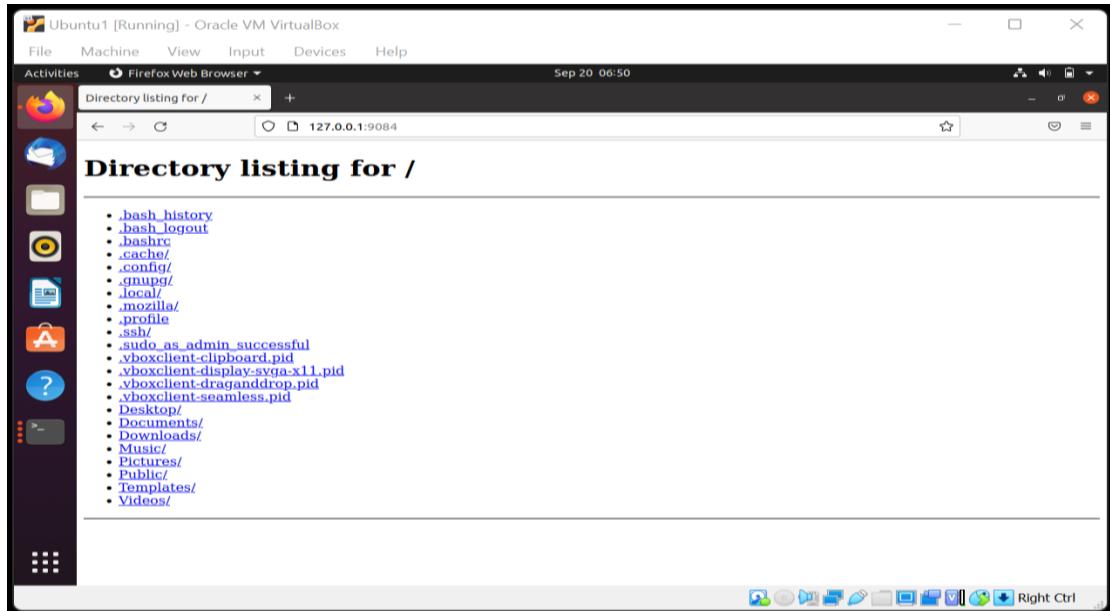
```
ubuntu@ubuntu2004: /etc/haproxy
sudoers
sudoers.d
sysctl.conf
sysctl.d
systemd
terminfo
thermal
thunderbird
timezone
tmpfs
tmpfs.conf
ubuntu-advantage
ucf.conf
udev
udisks2
ufw
update-manager
update-notifier
update-notifier
UPower
usb_modeswitch.conf
usb_modeswitch.d
vmlinuz
vt
vt�
vt�
vtrgb
vulkan
wgetrc
wpa_supplicant
X11
xattr.conf
X11
xml
zsh_command_not_found

ubuntu@ubuntu2004: /etc/haproxy$ sudo nano haproxy.cfg
ubuntu@ubuntu2004: /etc/haproxy$ sudo nano haproxy.cfg
ubuntu@ubuntu2004: /etc/haproxy$ sudo service haproxy restart
ubuntu@ubuntu2004: /etc/haproxy$
```

STEP8:

In firefox,type <http://127.0.0.1:9084>

Now,when we refresh each time,the server1 and server2 starts alternatively.



C) Build a publisher subscriber architecture for the enterprise using Kafka and Zookeeper.

OPENING THE COMMAND PROMPT TO ON THE ZOOKEEPER SERVER

OPEN NEW COMMAND PROMPT TO START THE COMMAND LINE

```
cmd Command Prompt - zkCli
2022-09-16 11:21:39,232 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:java.library.path=C:\java\jdk1.8.0_321\bin;c:\Windows\SunJava\bin;c:\Windows\systems32;c:\Windows;c:\Windows\system32;c:\Windows;c:\Windows\System32\WBem;c:\Windows\System32\WindowsPowerShell\v1.0\;c:\Windows\System32\OpenSSH;c:\Program Files (x86)\NVIDIA Corporation\PhysX\Common;c:\Program Files\NVIDIA Corporation\NVIDIA NVDLISR;%JAVA_HOME%\bin;%ZOOKEEPER_HOME%\bin;c:\Users\sam shankar\AppData\Local\Microsoft\WindowsApps;c:\Program Files\MongoDB\Server\4.0\bin;;
2022-09-16 11:21:39,233 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:java.io.tmpdir=C:\Users\SAMASHA-1\AppData\Local\Temp
2022-09-16 11:21:39,233 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:java.compiler=-NA
2022-09-16 11:21:39,234 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:os.name=Windows 11
2022-09-16 11:21:39,234 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:os.arch=amd64
2022-09-16 11:21:39,240 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:os.version=10.8
2022-09-16 11:21:39,240 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:user.name=sam shankar
2022-09-16 11:21:39,241 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:user.home=C:\Users\sam shankar
2022-09-16 11:21:39,242 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:user.dir=C:\apache-zookeeper-3.8.0-bin\bin
2022-09-16 11:21:39,243 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:os.memory.free=19798B
2022-09-16 11:21:39,243 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:os.memory.max=3154MB
2022-09-16 11:21:39,244 [myid:] - INFO  [main:o.a.z.Environment@98] - Client environment:os.memory.total=213MB
2022-09-16 11:21:39,244 [myid:] - INFO  [main:o.a.z.ZooKeeper@637] - Initiating client connection, connectString=localhost:2181 sessionTimeout=30000 watcher=org.apache.zookeeper.ZooKeeperMain$MyWatcher@7c16905e
2022-09-16 11:21:39,258 [myid:] - INFO  [main:o.a.z.c.X509Util@77] - Setting -D jdk.tls.rejectClientInitiatedRenegotiation=true to disable client-initiated TLS renegotiations
2022-09-16 11:21:39,508 [myid:] - INFO  [main:o.a.z.ClientCnxnSocket@239] - jute.maxbuffer value is 1948575 Bytes
2022-09-16 11:21:39,528 [myid:] - INFO  [main:o.a.z.ClientCnxn@1732] - zookeeper.request.timeout value is 0. feature.enabled=false
Welcome to ZooKeeper!
2022-09-16 11:21:39,538 [myid:localhost:2181] - INFO  [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1171] - Opening socket connection to server localhost/127.0.0.1:2181
2022-09-16 11:21:39,539 [myid:localhost:2181] - INFO  [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1173] - SASL config status: Will not attempt to authenticate using SASL (unknown error)
2022-09-16 11:21:39,541 [myid:localhost:2181] - INFO  [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1005] - Socket connection established, initiating session, client: /127.0.0.1:62908, server: localhost/127.0.0.1:2181
JLine support is enabled
2022-09-16 11:21:39,568 [myid:localhost:2181] - INFO  [main-SendThread(localhost:2181):o.a.z.ClientCnxn$SendThread@1444] - Session establishment complete on server localhost/127.0.0.1:2181, session id = 0x100004368ff0000, negotiated timeout = 30000

WATCHER::

WatchedEvent state:SyncConnected type:None path:null
[zk: localhost:2181(CONNECTED) 0]
```

OPENING ANOTHER COMMAND PROMPT TO START THE KAFKA

```
Microsoft Windows [Version 10.0.22000.978]
(c) Microsoft Corporation. All rights reserved.

C:\Users\sam shankar>cd C:\kafka_2.13-3.2.1

C:\kafka_2.13-3.2.1>dir
Volume in drive C is Windows-SSD
Volume Serial Number is 2071-88CC

Directory of C:\kafka_2.13-3.2.1

15-09-2022  22:09    <DIR>          .
15-09-2022  22:09    <DIR>          bin
15-09-2022  22:09    <DIR>          config
15-09-2022  22:09    <DIR>          libs
22-07-2022  06:03            14,649 LICENSE
15-09-2022  22:09    <DIR>          licenses
22-07-2022  06:03            28,184 NOTICE
15-09-2022  22:09    <DIR>          site-docs
                           2 File(s)       42,824 bytes
                           6 Dir(s)   5,329,100,800 bytes free

C:\kafka_2.13-3.2.1>
```

THE KAFKA SERVER GETS STARTED

COMMAND: .\bin\windows\kafka-server-start.bat .\config\server.properties

OPEN ANOTHER COMMAND PROMPT TO CREATE A TOPIC BY PRODUCER AND CONSUMER

COMMAND TO CREATE A TOPIC IS:

```
kafka-topics.bat --create --topic test-topic406 --bootstrap-server  
localhost:9092
```

--replication-factor 1 --partitions 4

```
C:\ Command Prompt
Microsoft Windows [Version 10.0.22000.978]
(c) Microsoft Corporation. All rights reserved.

C:\Users\sam shankar>cd C:\kafka_2.13-3.2.1\bin\windows

C:\kafka_2.13-3.2.1\bin\windows>kafka-topics.bat --create --topic test-topic406 --bootstrap-server localhost:9092 --replication-factor 1 --partitions 4
Created topic test-topic406.

C:\kafka_2.13-3.2.1\bin\windows>
```

The screenshot shows a Windows Command Prompt window titled "C:\ Command Prompt". The command `kafka-topics.bat --create` is run with parameters to create a topic named "test-topic406" with a replication factor of 1 and 4 partitions. The output confirms the topic was created. The system tray at the bottom shows the date as 16-09-2022 and the time as 12:45.

COMMAND TO PRODUCE THE CONTENT OF THE TOPIC IS:

kafka-console-producer.bat --topic test-topic406 --bootstrap-server localhost:9092

COMMAND TO CONSUME THE CONTENT OF THE TOPIC IS:

kafka-console-consumer.bat --topic test-topic406 --from-beginning --bootstrap-server localhost:9092

```
C:\kafka_2.13-3.2.1\bin\windows>kafka-topic.bat --create --topic test-topic123 --bootstrap-server localhost:9092 --replication-factor 1
'kafka-topic.bat' is not recognized as an internal or external command,
operable program or batch file.

C:\kafka_2.13-3.2.1\bin\windows>kafka-topic.bat --create --topic test-topic123 --bootstrap-server localhost:9092 --replication-factor 1 --partitions 4
'kafka-topic.bat' is not recognized as an internal or external command,
operable program or batch file.

C:\kafka_2.13-3.2.1\bin\windows>kafka-topics.bat --create --topic test-topic123 --bootstrap-server localhost:9092 --replication-factor 1 --partitions 4
Error while executing topic command : Topic 'test-topic123' already exists.
[2022-09-13 15:22:21,326] ERROR org.apache.kafka.common.errors.TopicExistsException: Topic 'test-topic123' already exists.
  (kafka.admin.TopicCommand$)

C:\kafka_2.13-3.2.1\bin\windows>kafka-topics.bat --create --topic test-topic406 --bootstrap-server localhost:9092 --replication-factor 1 --partitions 4
Created topic test-topic406.

C:\kafka_2.13-3.2.1\bin\windows>kafka-console-producer.bat --topic test-topic406 --bootstrap-server localhost:9092
>Welcome
>kafka
>helloTerminate batch job (Y/N)? Y

C:\kafka_2.13-3.2.1\bin\windows>kafka-console-consumer.bat --topic test-topic406 --from-beginning --bootstrap-server localhost:9092
kafka
Welcome
```

This screenshot shows a Windows Command Prompt window with several commands. It first attempts to run `kafka-topic.bat` to create a topic, which fails because it's not found. Then, it runs `kafka-topics.bat` to create a topic named "test-topic123", but it fails again due to a replication factor of 1. Finally, it successfully creates a topic named "test-topic406". After creating the topic, it runs `kafka-console-producer.bat` to produce some sample data ("Welcome", "kafka", "hello"). When prompted to terminate the batch job, it enters "Y". Finally, it runs `kafka-console-consumer.bat` to consume the data from the topic.

OUTPUT:

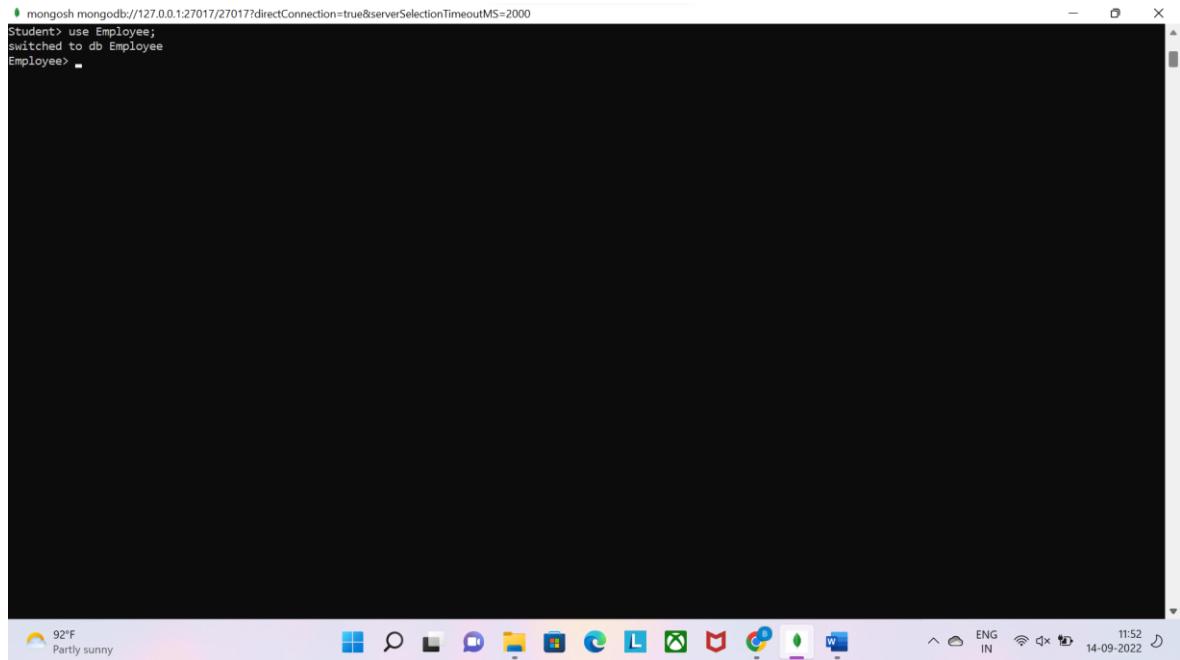
We can able to see the content of the topic

Kafka

Welcome

4. A) Implement the following commands in MongoDB.

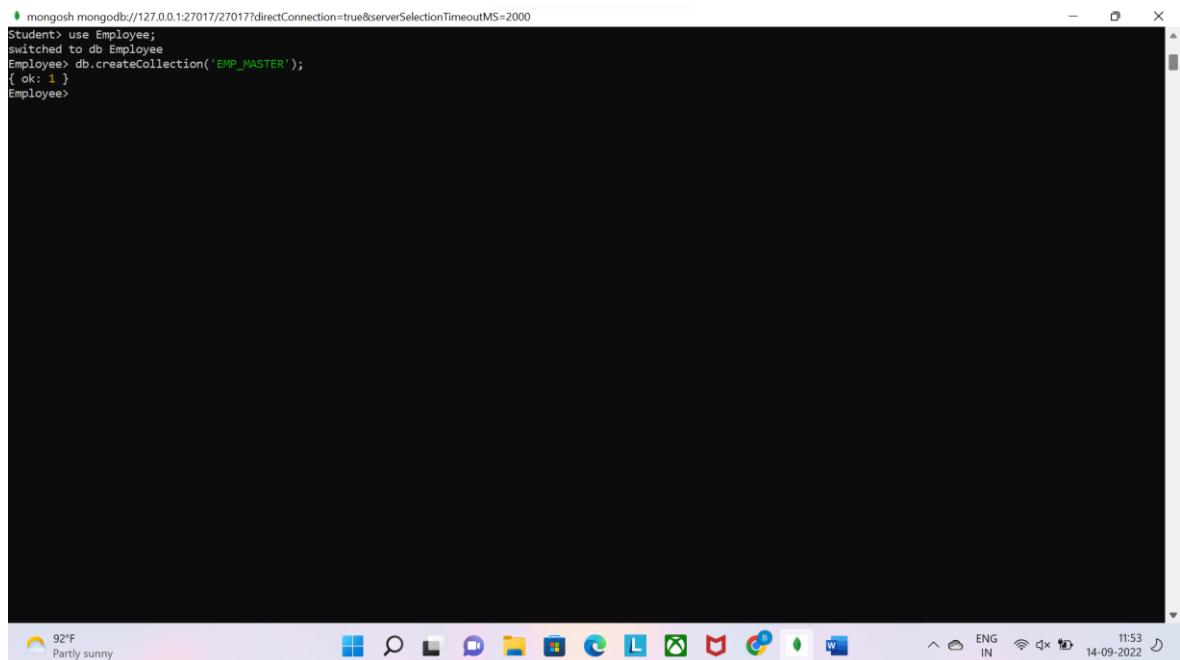
i) Create database Employee and Make Collection With name "EMP_MASTER" .



```
mongosh mongodb://127.0.0.1:27017/27017?directConnection=true&serverSelectionTimeoutMS=2000
Student> use Employee;
switched to db Employee
Employee>
```

Database Employee is created

Use Employee;



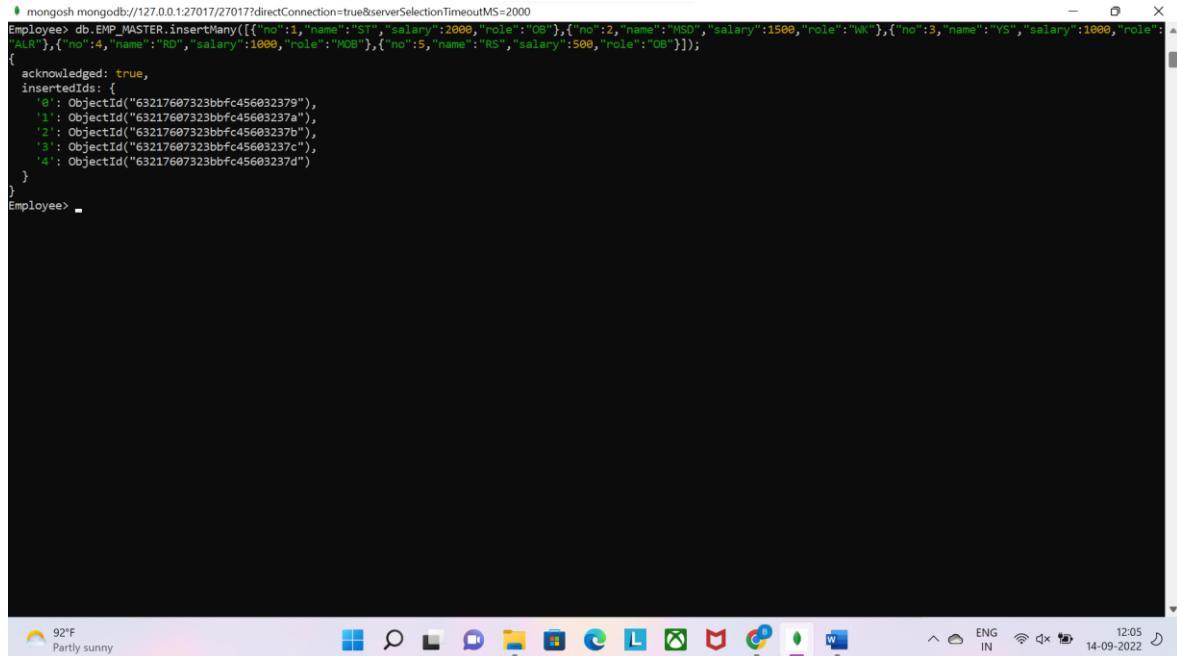
```
mongosh mongodb://127.0.0.1:27017/27017?directConnection=true&serverSelectionTimeoutMS=2000
Student> use Employee;
switched to db Employee
Employee> db.createCollection('EMP_MASTER');
{ ok: 1 }
Employee>
```

db.createCollection("EMP_MASTER");

The Collection is created with the name "EMP_MASTER".

ii) Insert the following records into EMP_MASTER Collection.

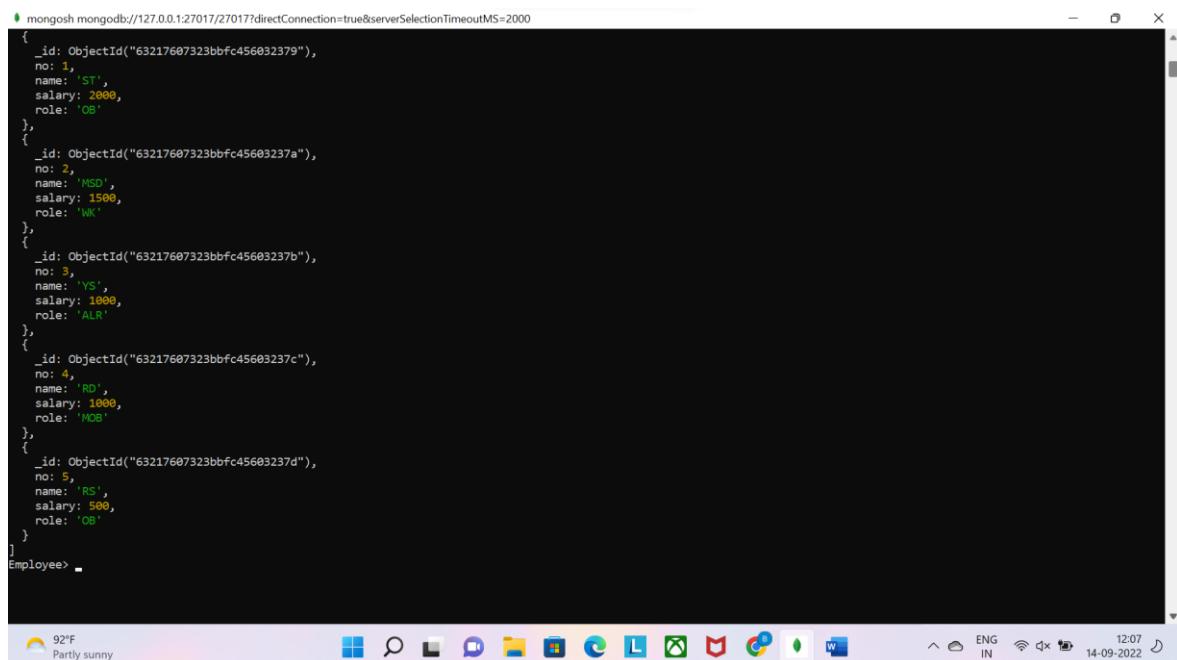
no:1,name:"ST",salary:2000,role:"OB",
no:2,name:"MSD",salary:1500,role:"WK",
no:3,name:"YS",salary:1000,role:"ALR",
no:4,name:"RD",salary:1000,role:"MOB",
no:5,name:"RS",salary:500,role:"OB".



```
mongosh mongodb://127.0.0.1:27017/27017?directConnection=true&serverSelectionTimeoutMS=2000
Employee> db.EMP_MASTER.insertMany([{"no":1, "name": "ST", "salary": 2000, "role": "OB"}, {"no":2, "name": "MSD", "salary": 1500, "role": "WK"}, {"no":3, "name": "YS", "salary": 1000, "role": "ALR"}, {"no":4, "name": "RD", "salary": 1000, "role": "MOB"}, {"no":5, "name": "RS", "salary": 500, "role": "OB"}])
{
  acknowledged: true,
  insertedIds: [
    '0': ObjectId("63217607323bbfc456032379"),
    '1': ObjectId("63217607323bbfc45603237a"),
    '2': ObjectId("63217607323bbfc45603237b"),
    '3': ObjectId("63217607323bbfc45603237c"),
    '4': ObjectId("63217607323bbfc45603237d")
  ]
}
Employee>
```

Inserted all the records by using,
Db.EMP_MASTER.insertMany();

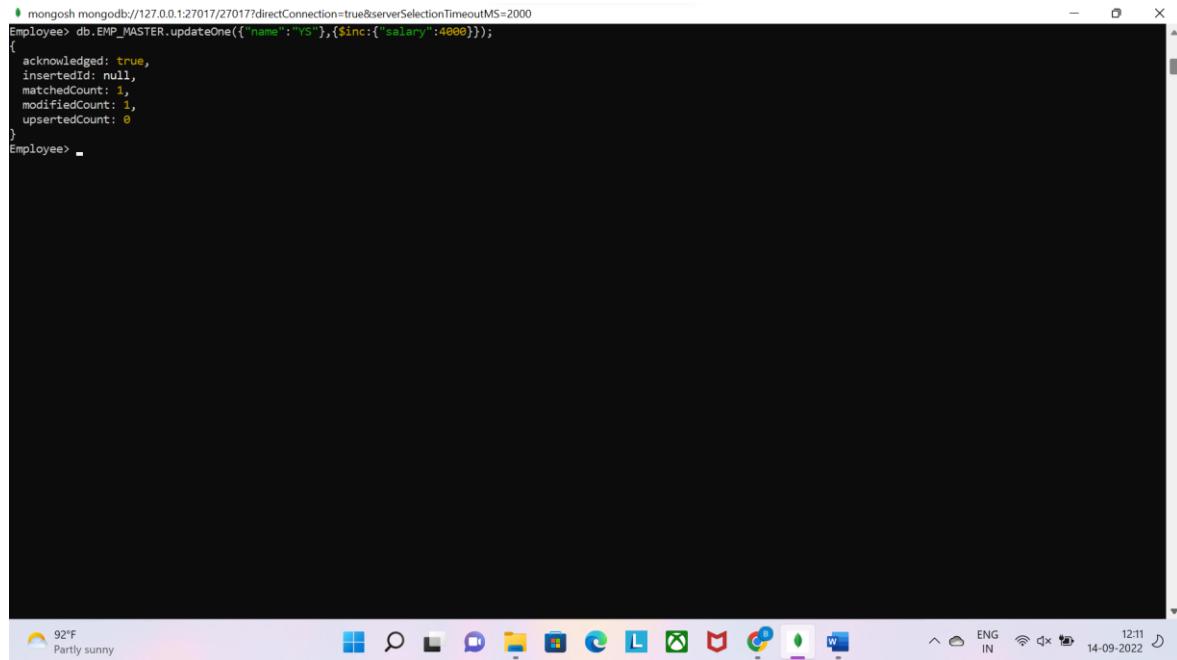
iii) Display Data in Proper Format



```
mongosh mongodb://127.0.0.1:27017/27017?directConnection=true&serverSelectionTimeoutMS=2000
{
  "_id": ObjectId("63217607323bbfc456032379"),
  "no": 1,
  "name": "ST",
  "salary": 2000,
  "role": "OB"
},
{
  "_id": ObjectId("63217607323bbfc45603237a"),
  "no": 2,
  "name": "MSD",
  "salary": 1500,
  "role": "WK"
},
{
  "_id": ObjectId("63217607323bbfc45603237b"),
  "no": 3,
  "name": "YS",
  "salary": 1000,
  "role": "ALR"
},
{
  "_id": ObjectId("63217607323bbfc45603237c"),
  "no": 4,
  "name": "RD",
  "salary": 1000,
  "role": "MOB"
},
{
  "_id": ObjectId("63217607323bbfc45603237d"),
  "no": 5,
  "name": "RS",
  "salary": 500,
  "role": "OB"
}
]
Employee>
```

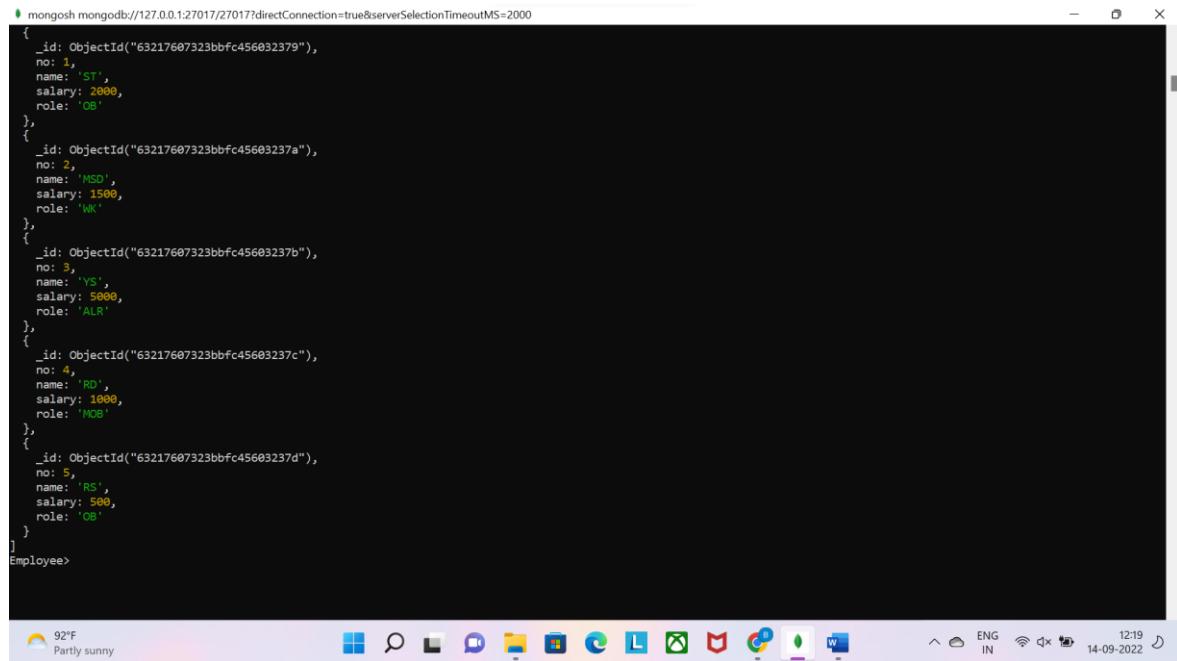
By using db.EMP_MASTER.find().pretty();
The data will be displayed in the neat format.

iv)Update Salary of Employee where Name is "YS" by +4000



```
mongosh mongodb://127.0.0.1:27017/27017?directConnection=true&serverSelectionTimeoutMS=2000
Employee> db.EMP_MASTER.updateOne({name:"YS"},{$inc:{salary:4000}});
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
Employee>
```

The salary of YS is updated by 4000 by using,
db.EMP_MASTER.updateOne();



```
mongosh mongodb://127.0.0.1:27017/27017?directConnection=true&serverSelectionTimeoutMS=2000
{
  "_id": ObjectId("63217607323bbfc456032379"),
  "no": 1,
  "name": "ST",
  "salary": 2000,
  "role": "OB"
},
{
  "_id": ObjectId("63217607323bbfc45603237a"),
  "no": 2,
  "name": "MSD",
  "salary": 1500,
  "role": "WK"
},
{
  "_id": ObjectId("63217607323bbfc45603237b"),
  "no": 3,
  "name": "YS",
  "salary": 5000,
  "role": "ALR"
},
{
  "_id": ObjectId("63217607323bbfc45603237c"),
  "no": 4,
  "name": "RD",
  "salary": 1000,
  "role": "MOB"
},
{
  "_id": ObjectId("63217607323bbfc45603237d"),
  "no": 5,
  "name": "RS",
  "salary": 500,
  "role": "OB"
}
]
Employee>
```

We can able to see the salary of YS updated by 5000.

v)Update role of "YS" as "MOB".

```
mongosh mongodb://127.0.0.1:27017/27017?directConnection=true&serverSelectionTimeoutMS=2000
Employee> db.EMP_MASTER.updateOne({"name": "YS"}, {$set: {"role": "MOB"}});
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
Employee>
```

To update the role of YS to MOB by using,
Db.EMP_MASTER.updateOne({“name”：“YS”},{\$set:{“role”：“MOB”}});

```
mongosh mongodb://127.0.0.1:27017/27017?directConnection=true&serverSelectionTimeoutMS=2000
{
  "_id": ObjectId("63217607323bbfc456032379"),
  "no": 1,
  "name": "ST",
  "salary": 2000,
  "role": "OB"
},
{
  "_id": ObjectId("63217607323bbfc45603237a"),
  "no": 2,
  "name": "MSD",
  "salary": 1500,
  "role": "WK"
},
{
  "_id": ObjectId("63217607323bbfc45603237b"),
  "no": 3,
  "name": "YS",
  "salary": 5000,
  "role": "MOB"
},
{
  "_id": ObjectId("63217607323bbfc45603237c"),
  "no": 4,
  "name": "RD",
  "salary": 1000,
  "role": "MOB"
},
{
  "_id": ObjectId("63217607323bbfc45603237d"),
  "no": 5,
  "name": "RS",
  "salary": 500,
  "role": "OB"
}
]
Employee>
```

We can able to see the Role of YS is updated by MOB.

vi) Delete particular record

```

mongosh mongodb://127.0.0.1:27017/27017?directConnection=true&serverSelectionTimeoutMS=2000
{
  "_id": ObjectId("63217607323bbfc456032379"),
  "no": 1,
  "name": "ST",
  "salary": 2000,
  "role": "OB"
},
{
  "_id": ObjectId("63217607323bbfc45603237a"),
  "no": 2,
  "name": "MSD",
  "salary": 1500,
  "role": "WK"
},
{
  "_id": ObjectId("63217607323bbfc45603237b"),
  "no": 3,
  "name": "VS",
  "salary": 5000,
  "role": "MOB"
},
{
  "_id": ObjectId("63217607323bbfc45603237c"),
  "no": 4,
  "name": "RD",
  "salary": 1000,
  "role": "MOB"
},
{
  "_id": ObjectId("63217607323bbfc45603237d"),
  "no": 5,
  "name": "RS",
  "salary": 500,
  "role": "OB"
}
]
Employee> db.EMP_MASTER.deleteOne({{"no":4}});
{ acknowledged: true, deletedCount: 1 }
Employee>

```

The screenshot shows a Windows desktop environment with a MongoDB shell window open. The shell displays a list of five documents in the EMP_MASTER collection. The fourth document, which has a 'no' value of 4, is deleted using the `deleteOne` method. A confirmation message is shown at the bottom of the shell window.

To delete a record by using,

```
db.EMP_MASTER.deleteOne({{"no":4});
```

```

mongosh mongodb://127.0.0.1:27017/27017?directConnection=true&serverSelectionTimeoutMS=2000
{
  "_id": ObjectId("63217607323bbfc456032379"),
  "no": 1,
  "name": "ST",
  "salary": 2000,
  "role": "OB"
},
{
  "_id": ObjectId("63217607323bbfc45603237a"),
  "no": 2,
  "name": "MSD",
  "salary": 1500,
  "role": "WK"
},
{
  "_id": ObjectId("63217607323bbfc45603237b"),
  "no": 3,
  "name": "VS",
  "salary": 5000,
  "role": "MOB"
},
{
  "_id": ObjectId("63217607323bbfc45603237d"),
  "no": 5,
  "name": "RS",
  "salary": 500,
  "role": "OB"
}
Employee>

```

The screenshot shows the same MongoDB shell window after the deletion. The document with 'no' value 4 is missing from the list, confirming its removal.

We can able to see the record 4 is deleted from the Collection EMP_MASTER.

B) Perform Replication and Sharding concept in MongoDB using three different servers.

MONGODB REPLICATION SET AND SHARDING

CREATING REPLICATION SET

Primary port: 2001

Secondary ports: 2002,2003

```
Command Prompt
Microsoft Windows [Version 10.0.22000.856]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Brinda>start mongod --configsvr -replicaSet test -logpath C:\data\rs1\1.log --dbpath C:\data\rs1 --port 2001
C:\Users\Brinda>start mongod --configsvr -replicaSet test -logpath C:\data\rs2\1.log --dbpath C:\data\rs2 --port 2002
C:\Users\Brinda>start mongod --configsvr -replicaSet test -logpath C:\data\rs3\1.log --dbpath C:\data\rs3 --port 2003
C:\Users\Brinda>
```

Three Replication set has been created in the port 2001,2002 and 2003.

CONFIGURING THE PORTS

```
Command Prompt - mongo --port 2001
Enable MongoDB's free cloud-based monitoring service, which will then receive and display
metrics about your deployment (disk utilization, CPU, operation statistics, etc).

The monitoring data will be available on a MongoDB website with a unique URL accessible to you
and anyone you share the URL with. MongoDB may use this information to make product
improvements and to suggest MongoDB products and deployment options to you.

To enable free monitoring, run the following command: db.enableFreeMonitoring()
To permanently disable this reminder, run the following command: db.disableFreeMonitoring()
---

> config={_id:"Brinda",members:[{_id:0,host:"localhost:2001"},{_id:1,host:"localhost:2002"},{_id:2,host:"localhost:2003"}]};

{
    "_id" : "Brinda",
    "members" : [
        {
            "_id" : 0,
            "host" : "localhost:2001"
        },
        {
            "_id" : 1,
            "host" : "localhost:2002"
        },
        {
            "_id" : 2,
            "host" : "localhost:2003"
        }
    ]
}
>
```

```
Command Prompt - mongo --port 2001
Enable MongoDB's free cloud-based monitoring service, which will then receive and display
metrics about your deployment (disk utilization, CPU, operation statistics, etc).

The monitoring data will be available on a MongoDB website with a unique URL accessible to you
and anyone you share the URL with. MongoDB may use this information to make product
improvements and to suggest MongoDB products and deployment options to you.

To enable free monitoring, run the following command: db.enableFreeMonitoring()
To permanently disable this reminder, run the following command: db.disableFreeMonitoring()
---

> config={_id:"Brinda",members:[{_id:0,host:"localhost:2001"},{_id:1,host:"localhost:2002"},{_id:2,host:"localhost:2003"}]};

{
    "_id" : "Brinda",
    "members" : [
        {
            "_id" : 0,
            "host" : "localhost:2001"
        },
        {
            "_id" : 1,
            "host" : "localhost:2002"
        },
        {
            "_id" : 2,
            "host" : "localhost:2003"
        }
    ]
}
> rs.initiate(config)
{
    "ok" : 1,
    "$gleStats" : {
        "lastOpTime" : Timestamp(1662448670, 1),
        "electionId" : ObjectId("000000000000000000000000")
    }
}
```

Configuring the replication set

```
Brinda:SECONDARY> rs.status()
{
    "set" : "Brinda",
    "date" : ISODate("2022-09-06T07:19:10.619Z"),
    "myState" : 1,
    "term" : NumberLong(1),
    "syncingTo" : "",
    "syncSourceHost" : "",
    "syncSourceId" : -1,
    "configsvr" : true,
    "heartbeatIntervalMillis" : NumberLong(2000),
    "optimes" : {
        "lastCommittedOptime" : {
            "ts" : Timestamp(1662448741, 1),
            "t" : NumberLong(1)
        },
        "readConcernMajorityOptime" : {
            "ts" : Timestamp(1662448741, 1),
            "t" : NumberLong(1)
        },
        "appliedOptime" : {
            "ts" : Timestamp(1662448741, 1),
            "t" : NumberLong(1)
        },
        "durableOptime" : {
            "ts" : Timestamp(1662448741, 1),
            "t" : NumberLong(1)
        }
    },
    "lastStableCheckpointTimestamp" : Timestamp(1662448741, 1),
    "electionCandidateMetrics" : {
        "lastElectionReason" : "electionTimeout",
        "lastElectionDate" : ISODate("2022-09-06T07:18:01.319Z"),
        "electionTerm" : NumberLong(1),
        "lastCommittedOptimeAtElection" : {
            "ts" : Timestamp(0, 0),
            "t" : NumberLong(-1)
        },
        "lastSeenOptimeAtElection" : {
            "ts" : Timestamp(1662448670, 1),
            "t" : NumberLong(-1)
        }
    }
}
```

PORT 2002 (SECONDARY PORT)

```
cmd Command Prompt - mongo --port 2002
C:\Users\Brinda>mongo --port 2002
MongoDB shell version v4.0.28
connecting to: mongodb://127.0.0.1:2002/?gssapiServiceName=mongodb
Implicit session: session { "_id" : UUID("79587df7-10b1-4f15-80d2-27d8a0d4d041") }
MongoDB server version: 4.0.28
Server has startup warnings:
2022-09-06T12:39:47.072+0530 I CONTROL [initandlisten]
2022-09-06T12:39:47.072+0530 I CONTROL [initandlisten] ** WARNING: Access control is not enabled for the database.
2022-09-06T12:39:47.072+0530 I CONTROL [initandlisten] ** Read and write access to data and configuration is unrestricted.
2022-09-06T12:39:47.072+0530 I CONTROL [initandlisten]
2022-09-06T12:39:47.072+0530 I CONTROL [initandlisten] ** WARNING: This server is bound to localhost.
2022-09-06T12:39:47.072+0530 I CONTROL [initandlisten] ** Remote systems will be unable to connect to this server.
2022-09-06T12:39:47.072+0530 I CONTROL [initandlisten] ** Start the server with --bind_ip <address> to specify which IP
2022-09-06T12:39:47.072+0530 I CONTROL [initandlisten] ** addresses it should serve responses from, or with --bind_ip_all to
2022-09-06T12:39:47.072+0530 I CONTROL [initandlisten] ** bind to all interfaces. If this behavior is desired, start the
2022-09-06T12:39:47.072+0530 I CONTROL [initandlisten] ** server with --bind_ip 127.0.0.1 to disable this warning.
2022-09-06T12:39:47.072+0530 I CONTROL [initandlisten]
...
Enable MongoDB's free cloud-based monitoring service, which will then receive and display
metrics about your deployment (disk utilization, CPU, operation statistics, etc).

The monitoring data will be available on a MongoDB website with a unique URL accessible to you
and anyone you share the URL with. MongoDB may use this information to make product
improvements and to suggest MongoDB products and deployment options to you.

To enable free monitoring, run the following command: db.enableFreeMonitoring()
To permanently disable this reminder, run the following command: db.disableFreeMonitoring()
---

Brinda:SECONDARY>
```

PORT 2003(SECONDARY PORT)

```
C:\Users\Brinda>mongo --port 2003
MongoDB shell version v4.0.28
connecting to: mongodb://127.0.0.1:2003/?gssapiServiceName=mongodb
Implicit session: session { "id" : UUID("b3f31212-5262-4ab7-a885-60328d46b075") }
MongoDB server version: 4.0.28
Server has startup warnings:
2022-09-06T12:40:05.812+0530 I CONTROL [initandlisten] 
2022-09-06T12:40:05.812+0530 I CONTROL [initandlisten] ** WARNING: Access control is not enabled for the database.
2022-09-06T12:40:05.812+0530 I CONTROL [initandlisten] ** Read and write access to data and configuration is unrestricted.
2022-09-06T12:40:05.812+0530 I CONTROL [initandlisten] 
2022-09-06T12:40:05.812+0530 I CONTROL [initandlisten] ** WARNING: This server is bound to localhost.
2022-09-06T12:40:05.812+0530 I CONTROL [initandlisten] ** Remote systems will be unable to connect to this server.
2022-09-06T12:40:05.812+0530 I CONTROL [initandlisten] ** Start the server with --bind_ip <address> to specify which IP
2022-09-06T12:40:05.813+0530 I CONTROL [initandlisten] ** addresses it should serve responses from, or with --bind_ip_all to
2022-09-06T12:40:05.813+0530 I CONTROL [initandlisten] ** bind to all interfaces. If this behavior is desired, start the
2022-09-06T12:40:05.813+0530 I CONTROL [initandlisten] ** server with --bind_ip 127.0.0.1 to disable this warning.
2022-09-06T12:40:05.813+0530 I CONTROL [initandlisten] 
...
Enable MongoDB's free cloud-based monitoring service, which will then receive and display
metrics about your deployment (disk utilization, CPU, operation statistics, etc).

The monitoring data will be available on a MongoDB website with a unique URL accessible to you
and anyone you share the URL with. MongoDB may use this information to make product
improvements and to suggest MongoDB products and deployment options to you.

To enable free monitoring, run the following command: db.enableFreeMonitoring()
To permanently disable this reminder, run the following command: db.disableFreeMonitoring()
```
Brinda:SECONDARY>
```

```
C:\Users\Brinda>rs.status()
To permanently disable this reminder, run the following command: db.disableFreeMonitoring()
```
Brinda:SECONDARY> rs.status()
{
  "set" : "Brinda",
  "date" : ISODate("2022-09-06T07:44:36.402Z"),
  "myState" : 2,
  "term" : NumberLong(1),
  "syncingTo" : "localhost:2001",
  "syncSourceHost" : "localhost:2001",
  "syncSourceId" : 0,
  "configsvr" : true,
  "heartbeatIntervalMillis" : NumberLong(2000),
  "optimes" : {
    "lastCommittedOpTime" : {
      "ts" : Timestamp(1662450272, 1),
      "t" : NumberLong(1)
    },
    "readConcernMajorityOpTime" : {
      "ts" : Timestamp(1662450272, 1),
      "t" : NumberLong(1)
    },
    "appliedOpTime" : {
      "ts" : Timestamp(1662450272, 1),
      "t" : NumberLong(1)
    },
    "durableOpTime" : {
      "ts" : Timestamp(1662450272, 1),
      "t" : NumberLong(1)
    }
  },
  "lastStableCheckpointTimestamp" : Timestamp(1662450242, 1),
  "electionParticipantMetrics" : {
    "votedForCandidate" : true,
    "electionTerm" : NumberLong(1),
    "lastVoteDate" : ISODate("2022-09-06T07:18:01.325Z"),
    "electionCandidateMemberId" : 0,
    "voteReason" : "",
    "lastAppliedOpTimeAtElection" : {
      ...
    }
  }
}
Brinda:SECONDARY>
```

CREATING SHARDS

```

C:\Command Prompt
Microsoft Windows [Version 10.0.22000.856]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Brinda>start mongod --shardsvr --port 2004 -logpath C:\data\shard\s0\log\s0.log --dbpath C:\data\shard\s0
C:\Users\Brinda>start mongod --shardsvr --port 2005 -logpath C:\data\shard\s1\log\s1.log --dbpath C:\data\shard\s1
C:\Users\Brinda>start mongod --shardsvr --port 2006 -logpath C:\data\shard\s2\log\s2.log --dbpath C:\data\shard\s2
C:\Users\Brinda>

```

Three shards has been created in the port 2004,2005 and 2006.

STARTING THE MONGO SERVICE

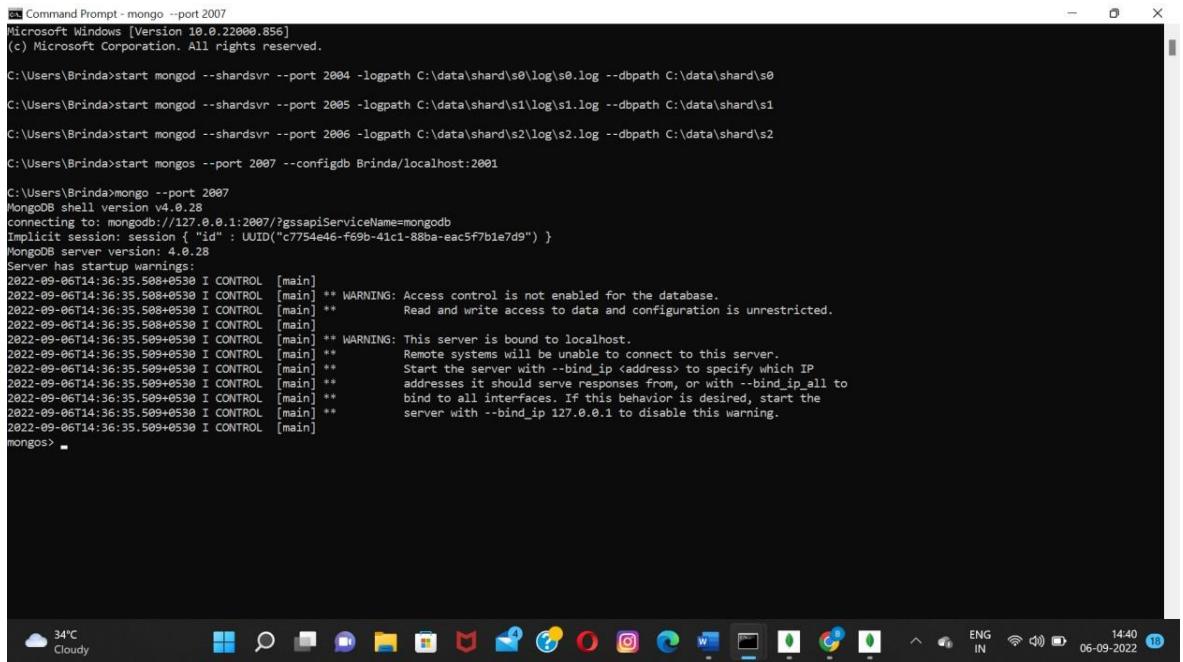
```

C:\Command Prompt
Microsoft Windows [Version 10.0.22000.856]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Brinda>start mongod --shardsvr --port 2004 -logpath C:\data\shard\s0\log\s0.log --dbpath C:\data\shard\s0
C:\Users\Brinda>start mongod --shardsvr --port 2005 -logpath C:\data\shard\s1\log\s1.log --dbpath C:\data\shard\s1
C:\Users\Brinda>start mongod --shardsvr --port 2006 -logpath C:\data\shard\s2\log\s2.log --dbpath C:\data\shard\s2
C:\Users\Brinda>start mongos --port 2007 --configdb Brinda=localhost:2001
C:\Users\Brinda> C:\Program Files\MongoDB\Server\4.0\bin\mongos.exe
2022-09-06T14:36:35.538+0530 I ASIO [ReplicaSetMonitor-TaskExecutor] Connecting to localhost:2001
2022-09-06T14:36:35.552+0530 I ASIO [ReplicaSetMonitor-TaskExecutor] Connecting to localhost:2002
2022-09-06T14:36:35.557+0530 I NETWORK [ReplicaSetMonitor-TaskExecutor-1] changing hosts to Brinda/localhost:2001,localhost:2002,localhost:2003 from Brinda/localhost:2001
2022-09-06T14:36:35.558+0530 I SHARDING [ReplicaSetMonitor-TaskExecutor-1] Updating ShardRegistry connection string for shard config from Brinda/localhost:2001 to: Brinda/localhost:2001,localhost:2002,localhost:2003
2022-09-06T14:36:35.562+0530 I NETWORK [ReplicaSetMonitor-TaskExecutor-1] localhost:2002 detected as new replica set primary for Brinda; Old primary was :27017
2022-09-06T14:36:35.562+0530 I ASIO [ReplicaSetMonitor-TaskExecutor] Connecting to localhost:2003
2022-09-06T14:36:35.566+0530 I ASIO [ShardRegistry] Connecting to localhost:2002
2022-09-06T14:36:35.567+0530 I ASIO [ShardRegistry] Connecting to localhost:2002
2022-09-06T14:36:35.572+0530 I ASIO [ShardRegistry] Connecting to localhost:2002
2022-09-06T14:36:35.572+0530 I SHARDING [ShardRegistry] Received reply from config server node (unknown) indicating config server optime term has increased, previous optime { ts: Timestamp(0, 0), t: -1 }, now { ts: Timestamp(1662455189, 1), t: 2 }
2022-09-06T14:36:35.583+0530 W SHARDING [replicaSetLockPinger] pinging failed for distributed lock pinger :: caused by :: LockStateChangeFailed: findAndModify query predicate didn't match any lock document
2022-09-06T14:36:37.581+0530 I ASIO [ShardRegistry] Connecting to localhost:2003
2022-09-06T14:36:37.605+0530 W FTDC [mongosMain] FTDC is disabled because neither '--logpath' nor set parameter 'diagnosticDataCollectionDirectoryPath' are specified.
2022-09-06T14:36:38.029+0530 I FTDC [mongosMain] Initializing full-time diagnostic data capture with directory ''
2022-09-06T14:36:38.037+0530 I NETWORK [mongosMain] Waiting for connections on port 2007
2022-09-06T14:36:38.061+0530 I SH_RFR [ConfigServerCatalogCacheLoader-0] Refresh for database config took 25 ms and found { _id: "config", primary: "config", partitioned: true }
2022-09-06T14:36:38.065+0530 I CONTROL [LogicalSessionCacheReap] Sessions collection is not set up; waiting until next sessions reap interval: Collection config.system.sessions is not sharded.
2022-09-06T14:36:38.065+0530 I CONTROL [LogicalSessionCacheRefresh] Sessions collection is not set up; waiting until next sessions refresh interval: Collection config.system.sessions is not sharded.

```

CONNECTING MONGOS

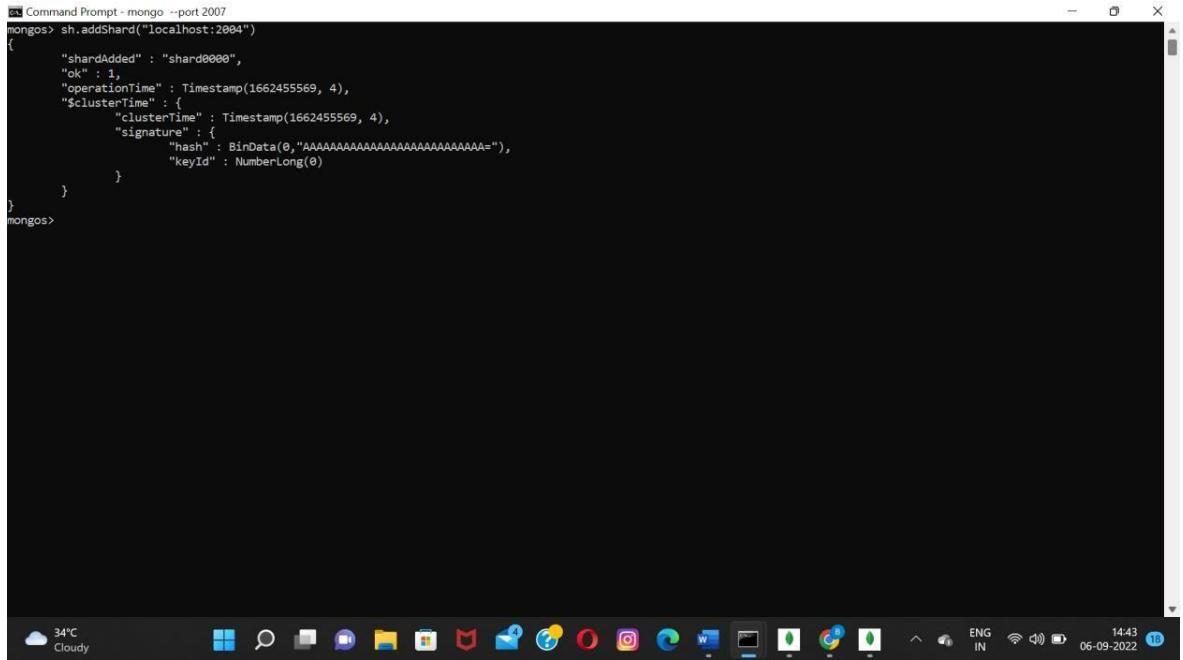


```
C:\ Command Prompt - mongo --port 2007
Microsoft Windows [Version 10.0.22000.856]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Bridna>start mongod --shardsvr --port 2004 --logpath C:\data\shard\s0\log\s0.log --dbpath C:\data\shard\s0
C:\Users\Bridna>start mongod --shardsvr --port 2005 --logpath C:\data\shard\s1\log\s1.log --dbpath C:\data\shard\s1
C:\Users\Bridna>start mongod --shardsvr --port 2006 --logpath C:\data\shard\s2\log\s2.log --dbpath C:\data\shard\s2
C:\Users\Bridna>start mongos --port 2007 --configdb Brinda/localhost:2001

C:\Users\Bridna>mongo --port 2007
MongoDB shell version v4.0.28
connecting to: mongodb://127.0.0.1:2007/?gssapiServiceName=mongodb
Implicit session: session { "id" : UUID("c7754e46-f69b-4ici-88ba-eac5f7b1e7d9") }
MongoDB server version: 4.0.28
Server has startup warnings:
2022-09-06T14:36:35.508+0530 I CONTROL [main]
2022-09-06T14:36:35.508+0530 I CONTROL [main] ** WARNING: Access control is not enabled for the database.
2022-09-06T14:36:35.508+0530 I CONTROL [main] ** Read and write access to data and configuration is unrestricted.
2022-09-06T14:36:35.508+0530 I CONTROL [main]
2022-09-06T14:36:35.509+0530 I CONTROL [main] ** WARNING: This server is bound to localhost.
2022-09-06T14:36:35.509+0530 I CONTROL [main] ** Remote systems will be unable to connect to this server.
2022-09-06T14:36:35.509+0530 I CONTROL [main] ** Start the server with --bind_ip <address> to specify which IP
2022-09-06T14:36:35.509+0530 I CONTROL [main] ** addresses it should serve responses from, or with --bind_ip_all to
2022-09-06T14:36:35.509+0530 I CONTROL [main] ** bind to all interfaces. If this behavior is desired, start the
2022-09-06T14:36:35.509+0530 I CONTROL [main] ** server with --bind_ip 127.0.0.1 to disable this warning.
2022-09-06T14:36:35.509+0530 I CONTROL [main]
mongos>
```

CONFIGURING THE SHARD 2004



```
C:\ Command Prompt - mongo --port 2007
mongos> sh.addShard("localhost:2004")
{
  "shardAdded" : "shard0000",
  "ok" : 1,
  "operationTime" : Timestamp(1662455569, 4),
  "$clusterTime" : {
    "clusterTime" : Timestamp(1662455569, 4),
    "signature" : {
      "hash" : BinData(0,"AAAAAAAAAAAAAAAAAAAAAAA="),
      "keyId" : NumberLong(0)
    }
  }
}
mongos>
```

CONFIGURING THE SHARD 2005

```
Command Prompt - mongo --port 2007
mongos> sh.addShard("localhost:2005")
{
  "shardAdded" : "shard0001",
  "ok" : 1,
  "operationTime" : Timestamp(1662455665, 2),
  "$clusterTime" : {
    "clusterTime" : Timestamp(1662455665, 2),
    "signature" : {
      "hash" : BinData(0,"AAAAAAAAAAAAAAAAAAAAAAA="),
      "keyId" : NumberLong(0)
    }
  }
}
mongos>
```

CONFIGURING THE SHARD 2006

```
Command Prompt - mongo --port 2007
mongos> sh.addShard("localhost:2006")
{
  "shardAdded" : "shard0002",
  "ok" : 1,
  "operationTime" : Timestamp(1662455713, 2),
  "$clusterTime" : {
    "clusterTime" : Timestamp(1662455713, 2),
    "signature" : {
      "hash" : BinData(0,"AAAAAAAAAAAAAAAAAAAAAAA="),
      "keyId" : NumberLong(0)
    }
  }
}
mongos>
```

ENABLE SHARDING FO THE DATABASE MSCDB

```
Command Prompt - mongo --port 2007
mongos> sh.enableSharding("Mscdb")
{
    "ok" : 1,
    "operationTime" : Timestamp(1662455952, 5),
    "$clusterTime" : {
        "clusterTime" : Timestamp(1662455952, 5),
        "signature" : {
            "hash" : BinData(0,"AAAAAAAAAAAAAAAAAAAAAAA="),
            "keyId" : NumberLong(0)
        }
    }
}
mongos>
```

HASH SHARDING

```
Command Prompt - mongo --port 2007
mongos> sh.shardCollection("Mscdb.Student", {"std_id": "hashed"})
{
    "collectionssharded" : "Mscdb.Student",
    "collectionUUID" : UUID("ea0d2a0c-bcf8-4eaa-a771-5e20dea5ded2"),
    "ok" : 1,
    "operationTime" : Timestamp(1662456246, 24),
    "$clusterTime" : {
        "clusterTime" : Timestamp(1662456246, 24),
        "signature" : {
            "hash" : BinData(0,"AAAAAAAAAAAAAAAAAAAAAAA="),
            "keyId" : NumberLong(0)
        }
    }
}
mongos>
```

VIEWING THE COLLECTION

```
Command Prompt - mongo --port 2007
mongos> show collections
Student
mongos> show dbs
Mscdb 0.000GB
admin 0.000GB
config 0.003GB
mongos>
```

INSERTING RECORDS IN THE COLLECTION

```
Command Prompt - mongo --port 2007
mongos> show collections
Student
mongos> show dbs
Mscdb 0.000GB
admin 0.000GB
config 0.003GB
mongos> for(i=0;i<10000;i++){db.Student.insert({std_id:i,type:"fulltime"})}
WriteResult({ "nInserted" : 1 })
mongos>
```

CHECKING THE SHARD DISTRIBUTION

```

Command Prompt - mongo --port 2007
mongos> show collections
Student
Mscdb
admin
config
mongos> for(i=0;i<10000;i++){db.Student.insert({std_id:i,type:"fulltime"})}
WriteResult({ "nInserted" : 1 })
mongos> db.Student.getShardDistribution()

Shard shard0000 at localhost:2004
data : 186KiB docs : 3349 chunks : 2
estimated data per chunk : 93KiB
estimated docs per chunk : 1674

Shard shard0002 at localhost:2006
data : 182KiB docs : 3285 chunks : 2
estimated data per chunk : 91KiB
estimated docs per chunk : 1642

Shard shard0001 at localhost:2005
data : 187KiB docs : 3366 chunks : 2
estimated data per chunk : 93KiB
estimated docs per chunk : 1683

Totals
data : 556KiB docs : 10000 chunks : 6
Shard shard0000 contains 33.48% data, 33.48% docs in cluster, avg obj size on shard : 57B
Shard shard0002 contains 32.85% data, 32.85% docs in cluster, avg obj size on shard : 57B
Shard shard0001 contains 33.66% data, 33.66% docs in cluster, avg obj size on shard : 57B

mongos>

```

The taskbar at the bottom shows various icons including Cloudy, File Explorer, Task View, and several browser tabs.

The data has been distributed into 3 shards by 33.46% by shard0000, 32.85% by shard0002 and 33.66% by shard0001.

STATUS OF HASH SHARDS

```

Command Prompt - mongo --port 2007
mongos> sh.status()
--- Sharding Status ---
sharding version: {
  "_id" : 1,
  "minCompatibleVersion" : 5,
  "currentVersion" : 6,
  "clusterId" : ObjectId("6316f429bd42ebf309ca70ca")
}
shards:
  { "_id" : "shard0000", "host" : "localhost:2004", "state" : 1 }
  { "_id" : "shard0001", "host" : "localhost:2005", "state" : 1 }
  { "_id" : "shard0002", "host" : "localhost:2006", "state" : 1 }

active mongoses:
  "4.0.28" : 1
autosplit:
  Currently enabled: yes
balancer:
  Currently enabled: yes
  Currently running: no
  Failed balancer rounds in last 5 attempts: 0
  Migration Results for the last 24 hours:
    682 : Success
databases:
  { "_id" : "Mscdb", "primary" : "shard0001", "partitioned" : true, "version" : { "uuid" : UUID("1026d52c-26e4-472a-a78a-71654fe738b7"), "lastMod" : 1 } }
    Mscdb.Student
      shard key: { "std_id" : "hashed" }
      unique: false
      balancing: true
      chunks:
        shard0000 2
        shard0001 2
        shard0002 2
      { "std_id" : { "$minKey" : 1 } } --> { "std_id" : NumberLong("-6148914691236517204") } on : shard0000 Timestamp(1, 0)
      { "std_id" : NumberLong("-6148914691236517204") } -->> { "std_id" : NumberLong("-3074457345618258602") } on : shard0000 Timestamp(1, 1)
      { "std_id" : NumberLong("-3074457345618258602") } -->> { "std_id" : NumberLong(0) } on : shard0001 Timestamp(1, 2)
      { "std_id" : NumberLong(0) } -->> { "std_id" : NumberLong("3074457345618258602") } on : shard0001 Timestamp(1, 3)
      { "std_id" : NumberLong("3074457345618258602") } -->> { "std_id" : NumberLong("6148914691236517204") } on : shard0002 Timestamp(1, 4)
      { "std_id" : NumberLong("6148914691236517204") } -->> { "std_id" : { "$maxKey" : 1 } } on : shard0002 Timestamp(1, 5)
  { "_id" : "config", "primary" : "config", "partitioned" : true }

mongos>

```

The taskbar at the bottom shows various icons including Cloudy, File Explorer, Task View, and several browser tabs.

We can able to see the status of the shards state is 1 for the shards “shard0000”, “shard0001” and “shard0002”.

5. A. Deploy the library application as jar file in Google Cloud and incorporate the various services used in cloud for effective deployment and use of the application. Justify your building block and its impact on the usage of application in detail.

CREATING BIUCKET

The screenshot shows the Google Cloud Storage interface. On the left, there's a sidebar with 'Cloud Storage' selected under 'Buckets'. The main area is titled 'Bucket details' for 'distributed_sys'. It shows basic information: Location (us (multiple regions in United States)), Storage class (Standard), Public access (Not public), and Protection (None). Below this, there are tabs for 'OBJECTS', 'CONFIGURATION', 'PERMISSIONS', 'PROTECTION', and 'LIFECYCLE'. Under 'OBJECTS', it says 'No rows to display'. At the bottom, there are buttons for 'UPLOAD FILES', 'UPLOAD FOLDER', 'CREATE FOLDER', 'TRANSFER DATA', 'MANAGE HOLDS', 'DOWNLOAD', and 'DELETE'. There's also a 'Filter by name prefix only' dropdown and a 'Filter objects and folders' search bar. The status bar at the bottom right shows the date as 20-09-2022 and the time as 21:39.

This screenshot is identical to the one above, showing the 'Bucket details' page for the 'distributed_sys' bucket. The interface, data, and status bar are all the same, indicating no changes have been made to the bucket configuration or contents.

UPLOADING JAR FILE

The screenshot shows the Google Cloud Storage interface. On the left, a sidebar has 'Cloud Storage' selected under 'Buckets'. The main area is titled 'Bucket details' for 'distributed_sys'. It shows basic bucket metadata: Location (us - multiple regions in United States), Storage class (Standard), Public access (Not public), and Protection (None). Below this are tabs for 'OBJECTS', 'CONFIGURATION', 'PERMISSIONS', 'PROTECTION', and 'LIFECYCLE'. Under 'OBJECTS', there's a table with one item: 'cloud-library-application-1.0-SNA...' (388.8 KB, application/octet-stream, created Sep 20, 2022). At the bottom right, a notification bar says 'Uploads and FinalAssessment operations' with a status of 'Complete'.

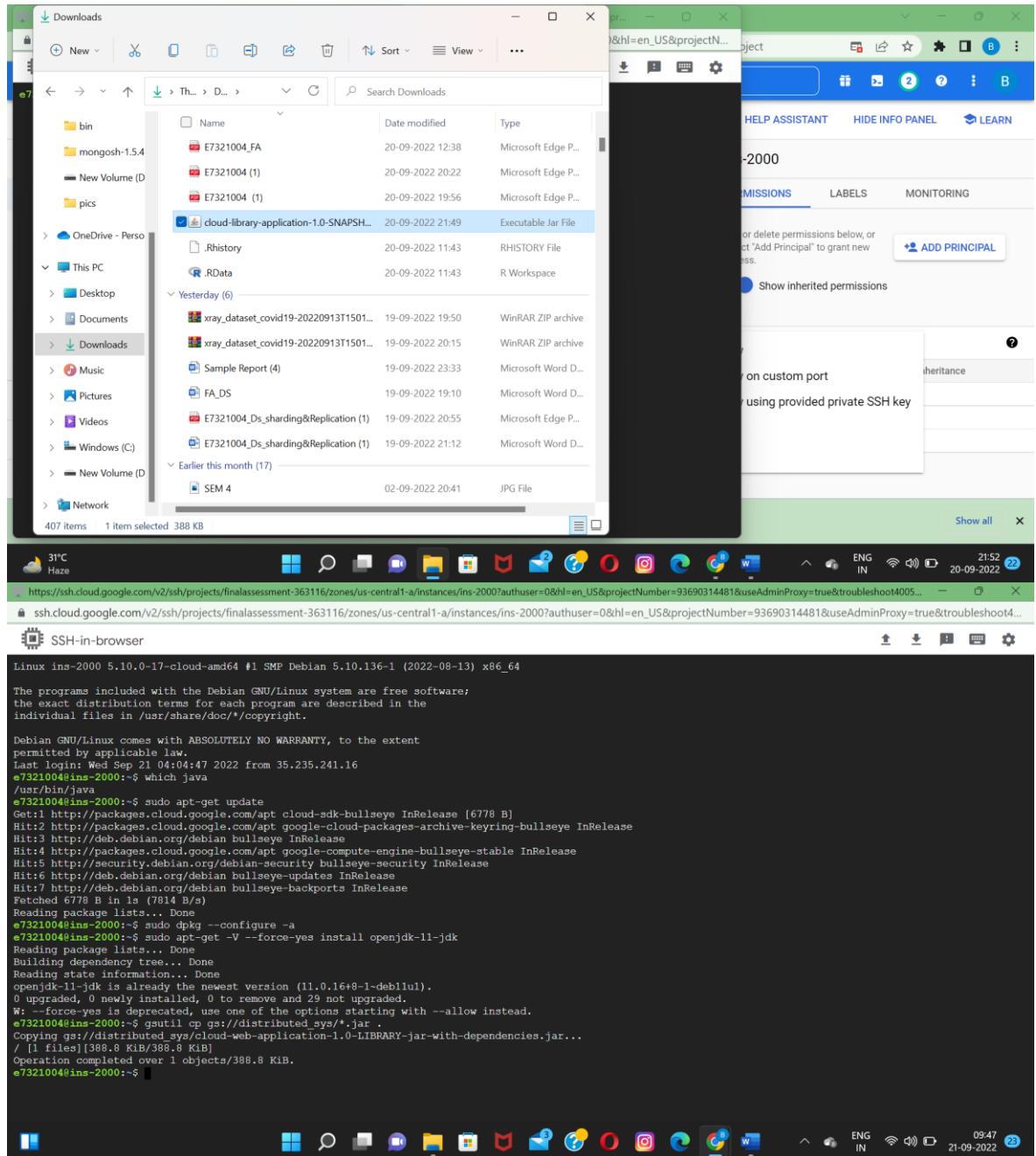
CREATING INSTANCE

The screenshot shows the 'Create an instance' page in Google Cloud. The left sidebar lists options: 'New VM instance' (selected), 'New VM instance from template', 'New VM instance from machine image', and 'Marketplace'. The main form starts with 'Name' (ins-2000) and 'Labels' (ADD LABELS). It includes dropdowns for 'Region' (us-central1 (Iowa)) and 'Zone' (us-central1-a). To the right, a 'Monthly estimate' section shows a single row for 'Compute Engine pricing' with a link to 'Compute Engine pricing' and a 'LESS' button. At the bottom, 'Machine configuration' is set to 'GENERAL-PURPOSE' with 'Series' (E2) and 'Machine type' (e2-micro (2 vCPU, 1 GB memory)). The system tray at the bottom shows the date as 20-09-2022 and time as 21:46.

The screenshot shows the Google Cloud Compute Engine interface. On the left, a sidebar under 'Compute Engine' lists 'Virtual machines' (selected), 'Storage', and other options like 'Marketplace' and 'Release Notes'. The main area displays 'INSTANCES' and 'INSTANCE SCHEDULES'. A table shows one instance: 'ins-2000' (Status: Up, Name: ins-2000, Zone: us-central1-a). Below the table, 'Related actions' include 'Explore Actifio GO' and 'View billing report'. On the right, a sidebar titled 'Select an instance' has tabs for 'PERMISSIONS', 'LABELS', and 'MONITORING', with a message: 'Please select at least one resource.' The bottom status bar shows the date and time as 20-09-2022 21:47.

JAR FILE

The screenshot shows the Google Cloud Storage interface. On the left, a sidebar under 'Cloud Storage' lists 'Buckets' (selected), 'Monitoring', and 'Settings'. The main area shows 'Bucket details' for 'distributed_sys'. It lists the location as 'us (multiple regions in United States)', storage class as 'Standard', public access as 'Not public', and protection as 'None'. Below this, the 'OBJECTS' tab is selected, showing a table of objects. One object is listed: 'cloud-web-application-1.0-LIBRA...' (Size: 388.8 KB, Type: application/octet-stream, Created: Sep 20, 20..., Last modified: Sep 20, 20..., Storage class: Standard, Public access: Not public). The bottom status bar shows the date and time as 20-09-2022 23:12.



```

https://ssh.cloud.google.com/v2/ssh/projects/finalassessment-363116/zones/us-central1-a/instances/ins-2000?authuser=0&hl=en_US&projectNumber=93690314481&useAdminProxy=true&troubleshoot400...
ssh.cloud.google.com/v2/ssh/projects/finalassessment-363116/zones/us-central1-a/instances/ins-2000?authuser=0&hl=en_US&projectNumber=93690314481&useAdminProxy=true&troubleshoot4...
SSH-in-browser

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Sep 21 04:04:47 2022 from 35.235.241.16
e7321004@ins-2000:~$ which java
/usr/bin/java
e7321004@ins-2000:~$ sudo apt-get update
Get:1 http://packages.cloud.google.com/apt cloud-sdk-bullseye InRelease [6778 B]
Hit:2 http://packages.cloud.google.com/apt google-cloud-packages-archive-keyring-bullseye InRelease
Hit:3 http://deb.debian.org/debian bullseye InRelease
Hit:4 http://packages.cloud.google.com/apt google-compute-engine-bullseye-stable InRelease
Hit:5 http://security.debian.org/debian-security bullseye-security InRelease
Hit:6 http://deb.debian.org/debian bullseye-updates InRelease
Hit:7 http://deb.debian.org/debian bullseye-backports InRelease
Fetched 6778 B in 1s (7814 B/s)
Reading package lists... Done
e7321004@ins-2000:~$ sudo dpkg --configure -a
e7321004@ins-2000:~$ sudo apt-get -V --force-yes install openjdk-11-jdk
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
openjdk-11-jdk is already the newest version (11.0.16+8-1-deb11u1).
0 upgraded, 0 newly installed, 0 to remove and 29 not upgraded.
W: --force-yes is deprecated, use one of the options starting with --allow instead.
e7321004@ins-2000:~$ gutil cp gs://distributed_sys/cloud-web-application-1.0-LIBRARY-jar-with-dependencies.jar...
/ [1 files][388.8 KIB/388.8 KIB]
Operation completed over 1 objects/388.8 Kib.
e7321004@ins-2000:~$ sudo java -cloud-web-application-1.0-LIBRARY-jar-with-dependencies
Unrecognized option: -cloud-web-application-1.0-LIBRARY-jar-with-dependencies
Error: Could not create the Java Virtual Machine.
Error: A fatal exception has occurred. Program will exit.
e7321004@ins-2000:~$ sudo java -jar cloud-web-application-1.0-LIBRARY-jar-with-dependencies.jar 80 &
[1] 10098
e7321004@ins-2000:~$ Started server on port 80

```

Today's Quote:

"When I let go of what I am, I become what I might be." – Lao Tzu

Hostname: "ins-2000"

CREATING INSTANCE TEMPLATE:

Screenshot of the Google Cloud Compute Engine 'Create an instance template' page.

Name: instance-temp

Labels: + ADD LABELS

Machine configuration

Machine family: GENERAL-PURPOSE

Series: E2

Machine type: (dropdown menu)

Pricing: \$7.99 (Monthly estimate)

Item	Monthly estimate
2 vCPU + 1 GB memory	\$6.89
10 GB balanced persistent disk	\$1.10
Sustained use discount	-\$0.00
Total	\$7.99

Description: Description, deletion protection, reservations, automation, and availability policies

Reservations: Automatically use created reservation

Automation: Startup script

```
sudo apt-get -V --force yes install openjdk-11-jdk
gsutil cp gs://distributed_sys/* jar.
sudo java -jar cloud-web-application-1.0-LIBRARY-jar-with-dependencies.jar 80 &
```

Metadata: You can set custom metadata for an instance or project outside of the server-defined metadata. This is useful for passing in arbitrary values to your project or instance that can be queried by your code on the instance. Learn more

Cost: \$7.99 (That's about \$0.01 hourly)

Pricing: Compute Engine pricing ▲ LESS

Buttons: CREATE, CANCEL, EQUIVALENT COMMAND LINE

Screenshot of the Google Cloud Platform (GCP) Instance Templates page and the Create VM instance configuration page.

Instance Templates Page:

- The URL is `console.cloud.google.com/compute/instanceTemplates/list?project=finalassessment-363116`.
- The left sidebar shows the Compute Engine section with "Virtual machines" expanded, showing "VM instances", "Instance templates" (selected), "Sole-tenant nodes", "Machine images", "TPUs", "Committed use discounts", and "Migrate to Virtual Machine...".
- The main area displays a table of instance templates:

Name	Machine type	Image	Disk type	Actions
instance-template-1	e2-micro	debian-11-bullseye-v20220822	Balanced persistent disk	⋮
- A message on the right says "Select an instance template" and "PERMISSIONS" and "LABELS". A note says "Please select at least one resource."

Create VM Instance Page:

- The URL is `console.cloud.google.com/compute/instancesAdd?creationFlow=fromTemplate&project=finalassessment-363116&templateName=instance-template-1`.
- The title is "CREATE VM".
- The left sidebar shows options: "New VM instance" (selected), "New VM instance from template" (disabled), "New VM instance from machine image" (disabled), and "Marketplace".
- The main form shows:
 - Select template:** "instance-template-1" (selected).
 - Customize VM instance:**
 - Source template:** "instance-template-1".
 - Change Template:** Button.
 - Name:** "instance-template-1".
 - Labels:** "+ ADD LABELS".
 - Region:** "us-west4 (Las Vegas)".
 - Zone:** "us-west4-b".
 - Machine configuration:**
 - Machine family:** (dropdown menu).
 - Monthly estimate:** \$7.99. Note: That's about \$0.01 hourly. Pay for what you use: No upfront costs and per second billing.
 - Item:** 2 vCPU + 1 GB memory, 10 GB balanced persistent disk.
 - Sustained use discount:** -\$0.00.
 - Total:** \$7.99.

The screenshot shows the Google Cloud Platform Compute Engine interface. On the left, a sidebar lists 'Virtual machines' under 'Compute Engine', including 'VM instances', 'Instance templates', 'Sole-tenant nodes', 'Machine images', 'TPUs', 'Committed use discounts', and 'Migrate to Virtual Machine...'. Below that is a 'Storage' section with 'Marketplace' and 'Release Notes'. The main content area is titled 'VM instances' and shows two instances: 'ins-2000' and 'instance-template-1'. The 'ins-2000' instance is selected. To the right, a 'Select an instance' panel is open, displaying tabs for 'PERMISSIONS', 'LABELS', and 'MONITORING', with a message stating 'Please select at least one resource.' Below the instances, a 'Related actions' section features a link to 'Explore Actifio GO'. At the bottom, a large terminal window titled 'SSH-in-browser' shows a Debian system log, starting with:

```

Linux instance-template-2 5.10.0-17-cloud-amd64 #1 SMP Debian 5.10.136-1 (2022-08-13) x86_64
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
e7321004@instance-template-2:~$ sudo apt-get -Y --force-yes install openjdk-11-jdk
E: Command line option 'Y' [from '-Y'] is not understood in combination with the other options.
e7321004@instance-template-2:~$ gsutil cp://buckets_1234567/*.jar .
CommandException: Invalid command "cp://buckets_1234567/*.jar".
e7321004@instance-template-2:~$ gsutil cp gs://buckets_1234567/*.jar .
Copying gs://buckets_1234567/cloud-web-application-1.0-SNAPSHOT-jar-with-dependencies.jar...
/ [1 files] [388.8 KIB/388.8 KIB]
Operation completed over 1 objects/388.8 Kib.
e7321004@instance-template-2:~$ sudo java -jar cloud-web-application-1.0-SNAPSHOT-jar-with-dependencies.jar 80 &[1] 18870
e7321004@instance-template-2:~$ Started server on port 80
server received a request for a quote
server received a request for a quote
e7321004@instance-template-2:~$ 

```

The screenshot shows the Google Cloud Platform Compute Engine VM Instances page. On the left, a sidebar lists options like Virtual machines, VM instances, Instance templates, Sole-tenant nodes, Machine images, TPUs, Committed use discounts, Marketplace, and Release Notes. The main area displays three VM instances:

Instance	In use by	Internal IP	External IP	Connect
commendations		10.128.0.2 (nic0)	34.172.11.68 (nic0)	SSH
		10.182.0.2 (nic0)	34.125.151.154 (nic0)	SSH
		10.182.0.3 (nic0)	34.125.85.173 (nic0)	SSH

A right-hand panel titled "Select an instance" contains tabs for PERMISSIONS, LABELS, and MONITORING, with a message stating "Please select at least one resource." Below the main content, the system tray shows weather (76°F Haze), system status, and date/time (08:15 16-09-2022).

Today's Quote:

"The future belongs to those who prepare for it today." - Malcolm X

The screenshot shows a browser window with the URL "Not secure | 34.125.85.173". The content of the page is a quote from Malcolm X: *"The future belongs to those who prepare for it today."*

CREATING INSTANCE GROUP

Continuous Assessment 2 | google cloud - Yahoo India | Create Instance Group - | Distributed Search | Distributed Search | +

console.cloud.google.com/compute/instanceGroups/add?project=calcium-ember-362514

Forecasting US Nat...

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DISMISS ACTIVATE

Google Cloud My Project Search Products, resources, docs (/)

Create Instance Group

New managed instance group (stateless)
Automatically manage groups of VMs that do stateless serving and batch processing.

New managed instance group (stateful)
Automatically manage groups of VMs that have persistent data or configurations (such as databases or legacy applications).

New unmanaged instance group
Manually manage groups of load balancing VMs.

Name * instance-group-1

Description

Instance template * instance-template-2

Number of instances Based on autoscaling configuration

Location

CREATE CANCEL EQUIVALENT COMMAND LINE

76°F Haze

Continuous Assessment 2 | google cloud - Yahoo India | Create Instance Group - | Distributed Search | Distributed Search | +

console.cloud.google.com/compute/instanceGroups/add?project=calcium-ember-362514

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Create Instance Group

New managed instance group (stateless)
Automatically manage groups of VMs that do stateless serving and batch processing.

New managed instance group (stateful)
Automatically manage groups of VMs that have persistent data or configurations (such as databases or legacy applications).

New unmanaged instance group
Manually manage groups of load balancing VMs.

Autoscaling

Use autoscaling to automatically add and remove instances to the group for periods of high and low load. [Learn more](#)

Autoscaling mode
On: add and remove instances to the group

Minimum number of instances * 2

Maximum number of instances * 6

To maximize availability, the minimum number of instances should be at least equal to the number of zones. Additional instances will be placed in different zones.
[Distributing instances using regional managed instance groups](#)

Autoscaling metrics

Use metrics to help determine when to scale the group. [Learn more](#)

CPU utilization: 60% (default)

CREATE CANCEL EQUIVALENT COMMAND LINE

76°F Haze

The screenshot shows the Google Cloud Compute Engine interface. On the left, a sidebar lists options like VM instances, Instance templates, Sole-tenant nodes, Machine images, TPUs, Committed use discounts, Marketplace, and Release Notes. The main area is titled 'Instance groups' and includes a 'CREATE INSTANCE GROUP' button, a 'REFRESH' button, and a 'DELETE' button. A table displays an instance group named 'instance-group-1' with 2 instances, using template 'instance-template-2'. The table also shows details such as Group type (Managed), Creation time (Sep 16, 2022, 8:25:05 AM UTC+05:30), Recommendation (On: Target CPU utilization 60%), and Autoscaling. A success message at the bottom says 'Successfully created instance group "instance-group-1"'.

STATIC GROUPS

The screenshot shows the Google Cloud VPC networks interface. On the left, a sidebar lists options like VPC networks, IP addresses, Bring your own IP, Firewall, Routes, VPC network peering, Shared VPC, Serverless VPC access, and Packet mirroring. The main area is titled 'IP addresses' and includes buttons for 'RESERVE EXTERNAL STATIC ADDRESS', 'REFRESH', and 'HELP ASSISTANT'. A table shows two IP addresses: one external (34.110.204.5) and one internal (10.128.0.2). A success message at the bottom says 'Successfully created address "vpcnetworks"'.

The screenshot shows the Google Cloud Network services interface for creating a new HTTP(S) load balancer. The left sidebar lists options like Load balancing, Cloud DNS, Cloud CDN, Cloud NAT, Traffic Director, Service Directory, Cloud Domains, Marketplace, and Release Notes. The main panel is titled "New HTTP(S) load balancer" and shows the following steps:

- Name**: myload (Lowercase, no spaces)
- Frontend configuration**
- Backend configuration** (selected)
- Routing rules**
- Review and finalize (optional)**

Backend configuration details:
Create or select a backend service for incoming traffic. You can add multiple backend services and backend buckets to serve different types of content.

Backend services table:
Name: backconfig, Region: us-central1, Instance groups/Network endpoint groups: 1 instance group

CREATE and **CANCEL** buttons are at the bottom.

google cloud - Yahoo India Search | Free Trial And Free Tier | Google | Load balancing - Network services

console.cloud.google.com/net-services/loadbalancing/list/loadBalancers?project=calcium-ember-362514&supportedpurview=project

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Network services Load balancing + CREATE LOAD BALANCER REFRESH DELETE HELP ASSISTANT

Load balancing Cloud DNS Cloud CDN Cloud NAT Traffic Director Service Directory Cloud Domains Marketplace Release Notes

Get real-time analytics with Network Intelligence Center

Use Network Intelligence Center for comprehensive monitoring and troubleshooting. [Learn more](#)

- ✓ Visualize your network resources
- ✓ Diagnose and prevent connectivity issues
- ✓ View packet loss and latency metrics
- ✓ Keep your firewall rules strict and efficient

GO TO NETWORK INTELLIGENCE CENTER REMIND ME LATER

LOAD BALANCERS BACKENDS FRONTENDS

Filter Enter property name or value

Name	Load balancer type	Protocols	Region	Backends
myload	HTTP(S)	HTTP		1 backend service (1 instance group, 0 network endpoint)

90°F Mostly sunny

google cloud - Yahoo India Search | Free Trial And Free Tier | Google | Load balancer details - Network

console.cloud.google.com/net-services/loadbalancing/details/httpAdvanced/myload?project=calcium-ember-362514&supportedpurview=project

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Network services Load balancer details EDIT DELETE

Load balancing Cloud DNS Cloud CDN Cloud NAT Traffic Director Service Directory Cloud Domains Marketplace Release Notes

myload

Faster web performance and improved web protection with Cloud CDN and Cloud Armor. [Learn more](#) DISMISS

DETAILS MONITORING CACHING

Frontend

Protocol	IP:Port	Certificate	SSL Policy	Network Tier
HTTP	34.95.67.189:80	-		Premium

Routing rules

Hosts	Paths	Backend
All unmatched (default)	All unmatched (default)	backconfig

90°F Mostly sunny

google cloud - Yahoo India Search | Google | Load balancer details - Network

console.cloud.google.com/net-services/loadbalancing/details/httpAdvanced/myload?project=calcium-ember-362514&supportedpurview=project

Forecasting US Nat...

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Google Cloud My Project Search Products, resources, docs (/)

Network services Load balancer details EDIT DELETE

All unmatched (default) All unmatched (default) backconfig

Backend

Backend services

1. backconfig

Endpoint protocol	Named port	Timeout	Health check	Cloud CDN	Logging
HTTP	http	30 seconds	health	Enabled VIEW CDN DETAILS	Disabled

ADVANCED CONFIGURATIONS

Name ↑	Type	Scope	Healthy	Autoscaling	Balancing mode	Selected ports ?	Capacity
instance-group-1	Instance group	us-central1	2	On: Target CPU utilization 60%	Max backend utilization: 80%	80	100%

90°F Mostly sunny

google cloud - Yahoo India Search | Google | Load balancing - Network service

console.cloud.google.com/net-services/loadbalancing/list/frontends?project=calcium-ember-362514&supportedpurview=project

Forecasting US Nat...

Free trial status: ₹31,926.49 credit and 76 days remaining - with a full account, you'll get unlimited access to all of Google Cloud Platform.

DISMIS ACTIVATE

Google Cloud My Project Search Products, resources, docs (/)

Network services Load balancing REFRESH HELP ASSISTANT HIDE INFO PANEL

Get real-time analytics with Network Intelligence Center

Use Network Intelligence Center for comprehensive monitoring and troubleshooting. [Learn more](#)

- ✓ Visualize your network resources
- ✓ Diagnose and prevent connectivity issues
- ✓ View packet loss and latency metrics
- ✓ Keep your firewall rules strict and efficient

GO TO NETWORK INTELLIGENCE CENTER REMIND ME LATER

LOAD BALANCERS BACKENDS FRONTENDS

Filter Enter property name or value

Forwarding rule name ↑	Frontend type	Scope	Address	IP v
frontconfig	HTTP(S)	Global	34.95.67.189	IPv

Select a forwarding rule

Labels help organize your resources (e.g., cost_center:sales)

90°F Mostly sunny

VM instances - Compute Engine Distributed Search

Not secure | 34.125.193.1

Today's Quote:

"Only those who will risk going too far can possibly find out how far one can go." – T. S. Eliot

GRAWLING THE WEBPAGE:

The screenshot shows the Google Cloud Compute Engine interface. On the left, a sidebar menu includes options like Virtual machines, Storage, Instance groups, VM Manager, Bare Metal Solution, and Marketplace. The main panel displays the configuration for a VM instance named 'newinstance'. The 'DETAILS' tab is selected, showing basic information such as Name (newinstance), Instance Id (6740487493877957997), Status (Running), and Machine configuration (Machine type: e2-micro, CPU platform: Intel Broadwell, Architecture: x86_64). The 'Logs' section shows Cloud Logging and Serial port 1 (console) logs. The 'Basic information' and 'Machine configuration' sections provide detailed settings for the instance.

Logs

Cloud Logging
Serial port 1 (console)
▼ SHOW MORE

Basic information

Name	newinstance
Instance Id	6740487493877957997
Description	None
Type	Instance
Status	Running
Creation time	Sep 15, 2022, 11:13:31 AM UTC+05:30
Zone	us-west4-b
Instance template	None
In use by	None
Reservations	Automatically choose
Labels	None
Deletion protection	Disabled
Confidential VM service	Disabled
Preserved state size	0 GB

Machine configuration

Machine type	e2-micro
CPU platform	Intel Broadwell
Architecture	x86_64
vCPUs to core ratio	—
Custom visible cores	—
Display device	Disabled Enable to use screen capturing and recording tools
GPUs	None

Networking

Free trial status: ₹31,926.49 credit and 76 days remaining - with a full account, you'll get unlimited access to all of Google Cloud Platform.

DISMISSED ACTIVATE

VM instances

CREATE INSTANCE OPERATIONS HELP ASSISTANT HIDE INFO PANEL LEARN

Select an instance

PERMISSIONS LABELS MONITORING

Please select at least one resource.

Related actions

- Explore Actifio GO: Back up your VMs and set up disaster recovery
- View billing report: View and manage your Compute Engine

90°F Mostly sunny

11:02 16-09-2022

Click on its SSH and give command:

>curl -k -L -s 34.98.112.210 > outfile

>cat outfile

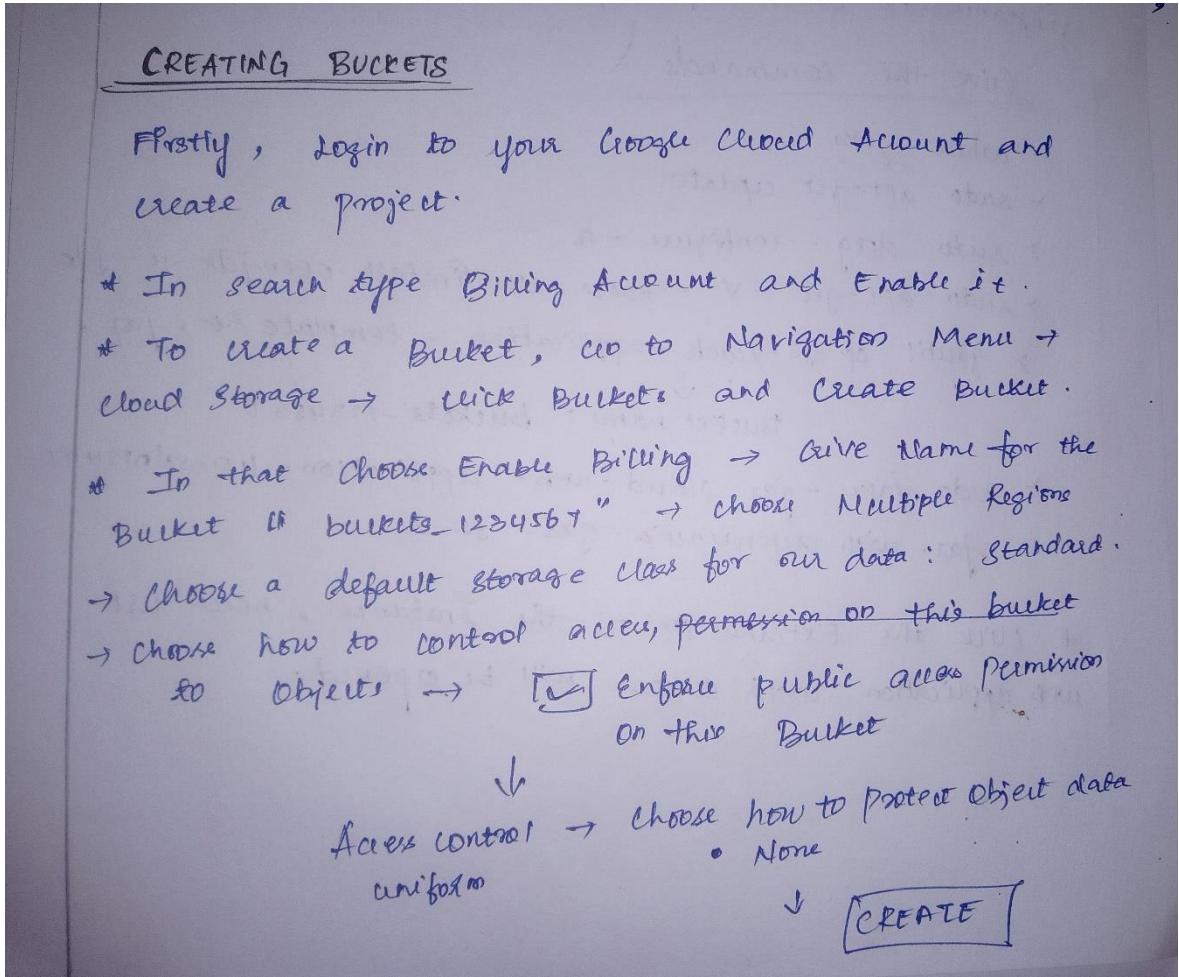
Here 34.98.112.210 is the load balancer frontend ip address

```

<!--
~ MIT License
~
~ Copyright (c) 2019 Michael Pogrebinsky - Distributed Systems & Cloud Computing with Java
~
~ Permission is hereby granted, free of charge, to any person obtaining a copy
~ of this software and associated documentation files (the "Software"), to deal
~ in the Software without restriction, including without limitation the rights
~ to use, copy, modify, merge, publish, distribute, sublicense, and/or sell
~ copies of the Software, and to permit persons to whom the Software is
~ furnished to do so, subject to the following conditions:
~
~ The above copyright notice and this permission notice shall be included in all
~ copies or substantial portions of the Software.
~
~ THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR
~ IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY,
~ FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE
~ AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER
~ LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM,
~ OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE
~ SOFTWARE.
--><!doctype html>
<html>
<head>
<title>Distributed Search</title>

```

STEPS:



CREATING INSTANCE

To create the Instance Go to the Navigation Menu

→ Compute Engine → Choose VM Instance → Create Instance → Give name of the Instance "Instance1" →

Region : us - Central (Mumbai) , Zone → us-central1-a

Give the Machine Type as : e2 - micro.

↓ Firewall: Allow HTTP traffic

Click **CREATE**

After Creating the Instance , Click **SS** near the Instance → OS will get opened.

Give the commands

> which java

> sudo apt-get update

> sudo dpkg --configure -a

> sudo apt-get -v --force-yes install openjdk-11-jdk

> gnutar cp gs://web-application-template/* .jar .

Bucket name: buckets-1234567

> sudo java -jar cloud-web-application-1.0-SNAPSHOT.jar -with-dependencies.jar 80 &

* Click the External IP of the Instance , new URL web application with quotes will be opened.

CREATING INSTANCE TEMPLATE

To create the Instance Template → In search Bar type "Instance template" → Create Instance Template → Give Template name, Machine type : micro → Firewall: Allow HTTP traffic → Advanced Options Management: Under Automation Type write the code:

```
#!/bin/bash
sudo apt-get update
sudo apt-get -y --force Yes install openjdk-11-jdk
apt-get install libcurl4-openssl-dev
sudo java -jar cloud -web -application -1.0-SNAPSHOT-
jar -with-dependencies.jar 8080
```

Give **[CREATE]**

CREATE VM FROM TEMPLATE

Near the Template Name → Under Actions: → Create VM without changing any value settings. **[Create]**.

Near Newly created instance → Click the External IP we can able to view the Quotes Base web page.

CREATING INSTANCE GROUP

Search for Instance Group → select the Instance template → Location: Multiple zones → Target PIS Shape: E8 → Autoscaling: Autoscaling Mode: On, add & remove instance group

Minimum no. of Instances: 2, Maximum no. of instances

6

cool down period: 600 seconds → Auto scaling: health check
[CREATE].

STATIC GROUPS

In search type: VPC networks → Click on IP address on the left column → Reserve external static address → Give name, Network service tier: Premium → Type: global → IP: IPv4 → Click [RESERVE]

LOAD BALANCING

Create Load Balance → Under HTTPS config: → Start configuration → [Continue] → Create new Frontend (Config is used) → Create the Backend configuration

→ Health check → Create Health → Give Name → Protocol: HTTP, Request path: /status → Check interval: 5, Timeout 5, Healthy threshold: 2, Unhealthy threshold: 2 → Save → [Create] → Choose Backend loader & click [Create]. Load balancer is created.

* Copy the IP address in frontend, the web application will gets opened.

GRANTING THE WEB PAGE:

Go to VM instances → Create Instance → Name: "new instance", Machine type: e2-micro, [Create]

click on the instance → open the browser window
terminal will be loaded, here the commands

> curl -k -L -o 34.11.22.227 > outfile

(IP of Load Balancer)

> cat outfile

After this click the IP of the instance enter,
web page will get opened with content.

B. Ram developed web application related to User registration page as a jar file, your task is to deploy it in GCP using the basic building blocks of the Cloud Infrastructure. Justify your approach and its impact on deploying the application in GCP.

CREATING BUCKET

The screenshot shows the Google Cloud Storage 'Create a bucket' wizard. On the left sidebar, under 'Cloud Storage', there are links for 'Buckets', 'Monitoring', and 'Settings'. The main panel has a title 'Create a bucket' with a back arrow. It contains two main sections: 'Name your bucket' and 'Choose where to store your data'. In the 'Name your bucket' section, a text input field contains 'buckets_1234567'. Below it, a note says 'Tip: Don't include any sensitive information'. Under 'LABELS (OPTIONAL)', there is a dropdown menu. A 'CONTINUE' button is at the bottom of this section. To the right, a 'Good to know' sidebar lists 'Location pricing' (with a note about storage rates varying by region), 'Current configuration: Multi-region / Standard', and an 'ESTIMATE YOUR MONTHLY COST' table. The table shows a single row for 'us (multiple regions in United States)' with a cost of '\$0.026 per GB-month'. The top of the screen shows a browser toolbar with multiple tabs and a search bar. The bottom of the screen shows a taskbar with various icons and system status indicators.

UPLOADING THE JAR FILE

The screenshot shows the Google Cloud Storage interface. On the left, a sidebar lists 'Cloud Storage', 'Buckets' (selected), 'Monitoring', and 'Settings'. The main area displays 'Bucket details' for 'buckets_1234567'. It shows the location as 'us (multiple regions in United States)', storage class as 'Standard', public access as 'Not public', and protection as 'None'. Below this, the 'OBJECTS' tab is selected, showing a list of files. One file, 'cloud-web-application-1.0-SNAPSHOT.jar', is listed with a size of 388.8 KB, type 'application/octet-stream', and creation date as Sep 14, 2022. The status is 'Standard' and public access is 'Not public'. At the bottom of the objects list, there are buttons for 'UPLOAD FILES', 'UPLOAD FOLDER', 'CREATE FOLDER', 'TRANSFER DATA', 'MANAGE HOLDS', 'DOWNLOAD', and 'DELETE'. A toolbar at the top right includes 'DISMISS' and 'ACTIVATE' buttons.

CREATING VM INSTANCE

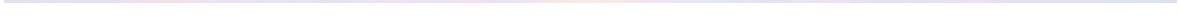
The screenshot shows the Google Compute Engine interface. On the left, a sidebar lists 'Virtual machines' (selected), 'Instance templates', 'Sole-tenant nodes', 'Machine images', 'TPUs', 'Committed use discounts', 'Marketplace', and 'Release Notes'. The main area displays 'VM instances' with a table showing one instance named 'cloud-instances'. The table columns include 'Status' (green checkmark), 'Name' (cloud-instances), 'Zone' (us-central1-a), 'Recommend' (SSH dropdown), and 'Connect' (three-dot menu). To the right, a 'Select an instance' panel is open, showing tabs for 'PERMISSIONS', 'LABELS', and 'MONITORING'. A message in the permissions tab says 'Please select at least one resource.' A toolbar at the top right includes 'DISMISS' and 'ACTIVATE' buttons.

```

https://ssh.cloud.google.com/v2/ssh/projects/calciun-ember-362514/zones/us-central1-a/instances/cloud-instances?authuser=0&hl=en_US&projectNumber=865841908168&useAdminProxy=true&troubl... - ssh.cloud.google.com/v2/ssh/projects/calciun-ember-362514/zones/us-central1-a/instances/cloud-instances?authuser=0&hl=en_US&projectNumber=865841908168&useAdminProxy=true&troubl...
SSH-in-browser
Adding debian:Starfield_Services_Root_Certificate_Authority_-_G2.pem
Adding debian:SSU_.com_Root_Certification_Authority_ECC.pem
Adding debian:Hellenic_Academic_and_Research_Institutions_RootCA_2011.pem
Adding debian:certSIGN_Root_CA_G2.pem
Adding debian:D-TRUST_Root_Class_3_CA_2_2009.pem
Adding debian:Atos_TrustedRoot_2011.pem
Adding debian:Szigna_Root_CA_2017.pem
Adding debian:SSU_.com_EV_Root_Certification_Authority_RSA_R2.pem
Adding debian:SecureTrust_CA.pem
Adding debian:Entrust_Root_Certification_Authority_-_G2.pem
Adding debian:Certigma.pem
Adding debian:TrustCor_RootCert_CA-1.pem
Adding debian:Hongkong_Post_Root_CA_1.pem
Adding debian:emSign_ECC_Root_CA_-G3.pem
Adding debian:DigiCert_Global_Root_G3.pem
Adding debian:Certum_Trusted_Network_CA_2.pem
Adding debian:Entrust_Root_Certification_Authority_-_G4.pem
Adding debian:DigiCert_Global_Root_CA.pem
done.
Processing triggers for libc-bin (2.31-13+deb11u3) ...
Processing triggers for man-db (2.9.4-2) ...
Processing triggers for ca-certificates (20210119) ...
Updating certificates in /etc/ssl/certs...
0 added, 0 removed; done.
Running hooks in /etc/ca-certificates/update.d...

done.
done.
e7321004@cloud-instances:~$ gsutil cp gs://buckets_1234567/*.jar .
Copying gs://buckets_1234567/cloud-web-application-1.0-SNAPSHOT-jar-with-dependencies.jar...
/ [files] [388.8 KiB/388.8 KiB]
Operation completed over 1 objects/388.8 KiB.
e7321004@cloud-instances:~$ sudo java -jar cloud-web-application-1.0-SNAPSHOT-jar-with-dependencies.jar 80 &
[1] 4639
e7321004@cloud-instances:~$ Started server on port 80
e7321004@cloud-instances:~$ 

```



CREATING INSTANCE TEMPLATE

Module 5: GCP Demo | google cloud - Yahoo India Search | Instance templates - Compute Engine | Distributed Search | +

console.cloud.google.com/compute/instanceTemplates/list?project=calcium-ember-362514

Forecasting US Nat...

Free trial status: ₹31,935.32 credit and 77 days remaining - with a full account, you'll get unlimited access to all of Google Cloud Platform.

DISMISS ACTIVATE

Google Cloud My Project Search Products, resources, docs (/)

Compute Engine Instance temp... CREATE INSTANCE TEMPLATE REFRESH LEARN HIDE INFO PANEL

Virtual machines VM instances Instance templates Sole-tenant nodes Machine images TPUs Committed use discounts Marketplace Release Notes

Instance templates are saved VM configurations used to create identical VMs, either individually or as part of managed instance groups. [Learn more](#)

Filter instance templates

<input type="checkbox"/>	Name ▲	Machine type	Image	Disk type	Actions
<input type="checkbox"/>	instance-template-1	e2-micro	debian-11-bullseye-v20220822	Balanced persistent disk	⋮
<input type="checkbox"/>	instance-template-2	e2-micro	debian-11-bullseye-v20220822	Balanced persistent disk	⋮

Select an instance template

PERMISSIONS LABELS

Please select at least one resource.

76°F Haze ENG IN 08:14 16-09-2022

Module 5: GCP Demo | google cloud - Yahoo India Search | VM instances - Compute Engine | Distributed Search | +

console.cloud.google.com/compute/instances?project=calcium-ember-362514

Forecasting US Nat...

Free trial status: ₹31,935.32 credit and 77 days remaining - with a full account, you'll get unlimited access to all of Google Cloud Platform.

DISMISS ACTIVATE

Google Cloud My Project Search Products, resources, docs (/)

Compute Engine VM instances CREATE INSTANCE OPERATIONS HELP ASSISTANT LEARN HIDE INFO PANEL

Virtual machines VM instances Instance templates Sole-tenant nodes Machine images TPUs Committed use discounts Marketplace Release Notes

VM instances are highly configurable virtual machines for running workloads on Google infrastructure. [Learn more](#)

Filter Enter property name or value

<input type="checkbox"/>	Status	Name ▲	Zone	Recommen Connect	⋮
<input type="checkbox"/>	✓	cloud-instances	us-central1-a	SSH	⋮
<input type="checkbox"/>	✓	instance-template-1	us-west4-b	SSH	⋮
<input type="checkbox"/>	✓	instance-template-2	us-west4-b	SSH	⋮

Select an instance

PERMISSIONS LABELS MONITORING

Please select at least one resource.

76°F Haze ENG IN 08:15 16-09-2022

```

https://ssh.cloud.google.com/v2/ssh/projects/calcium-ember-362514/zones/us-west4-b/instances/instance-template-2?authuser=0&hl=en_US&projectNumber=865841908168&useAdminProxy=true&trou...
ssh.cloud.google.com/v2/ssh/projects/calcium-ember-362514/zones/us-west4-b/instances/instance-template-2?authuser=0&hl=en_US&projectNumber=865841908168&useAdminProxy=true&trou...
SSH-in-browser

Linux instance-template-2 5.10.0-17-cloud-amd64 #1 SMP Debian 5.10.136-1 (2022-08-13) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/*copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.

e7321004@instance-template-2:~$ sudo apt-get -Y --force-yes install openjdk-11-jdk
E: Command line option 'Y' [from -Y] is not understood in combination with the other options.
e7321004@instance-template-2:~$ gsutil cp gs://buckets_1234567/*.jar .
CommandException: Invalid command "cp://buckets_1234567/*.jar".
e7321004@instance-template-2:~$ gsutil cp gs://buckets_1234567/*.jar .
Copying gs://buckets_1234567/cloud-web-application-1.0-SNAPSHOT-jar-with-dependencies.jar...
/ [1 files] [388.8 KiB/388.8 KiB]
Operation completed over 1 objects/388.8 KiB.

e7321004@instance-template-2:~$ sudo java -jar cloud-web-application-1.0-SNAPSHOT-jar-with-dependencies.jar 80 &[1] 18870
e7321004@instance-template-2:~$ Started server on port 80
server received a request for a quote
e7321004@instance-template-2:~$ 

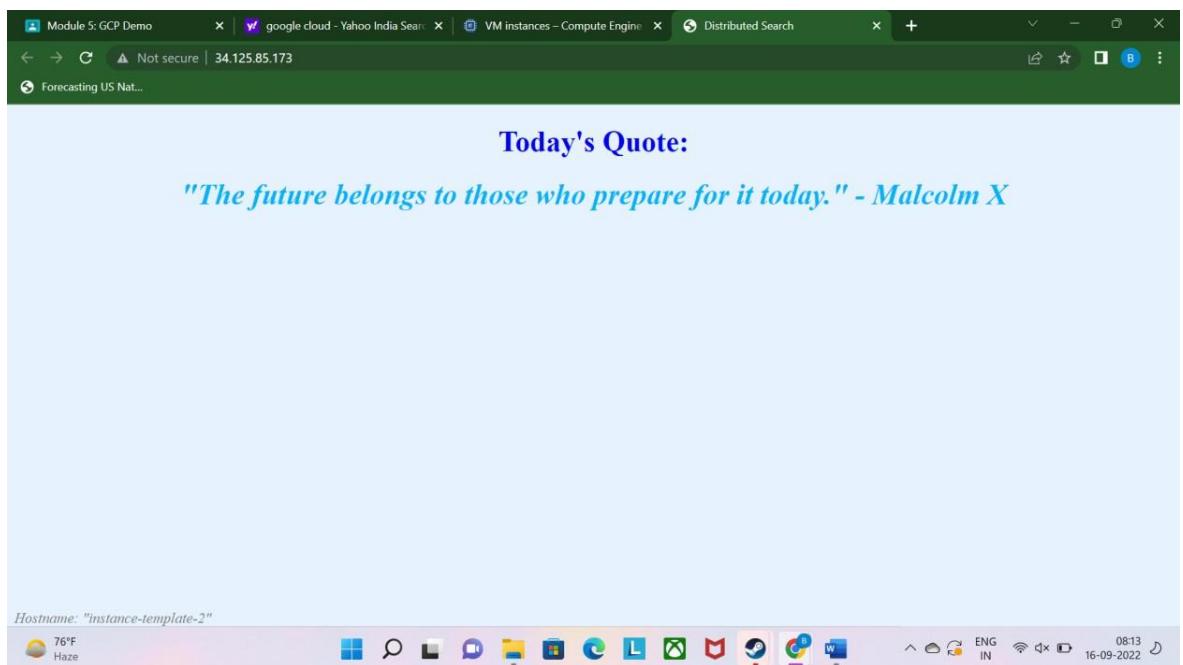
```

INSTANCES	INSTANCE SCHEDULES			
commendations	In use by	Internal IP	External IP	Connect
		10.128.0.2 (nic0)	34.172.11.68 (nic0)	SSH
		10.182.0.2 (nic0)	34.125.151.154 (nic0)	SSH
		10.182.0.3 (nic0)	34.125.85.173 (nic0)	SSH

Select an instance

PERMISSIONS LABELS MONITORING

Please select at least one resource.



CREATING INSTANCE GROUP

A screenshot of the Google Cloud Platform interface for creating a new instance group. The top navigation bar shows "Continuous Assessment 2", "Create Instance Group", "Distributed Search", and "Forecasting US Nat...". A message about a free trial is visible. The main content area is titled "Create Instance Group" and shows three options: "New managed instance group (stateless)", "New managed instance group (stateful)", and "New unmanaged instance group". The "New managed instance group (stateless)" option is selected. It includes fields for "Name" (set to "instance-group-1"), "Description", "Instance template" (set to "instance-template-2"), and "Number of instances" (set to "Based on autoscaling configuration"). At the bottom, there are "CREATE", "CANCEL", and "EQUIVALENT COMMAND LINE" buttons. The system tray at the bottom right shows the date as 16-09-2022 and the time as 08:24.

Autoscaling

Use autoscaling to automatically add and remove instances to the group for periods of high and low load. [Learn more](#)

Autoscaling mode: On: add and remove instances to the group

Minimum number of instances *: 2

Maximum number of instances *: 6

To maximize availability, the minimum number of instances should be at least equal to the number of zones. Additional instances will be placed in different zones.

Distributing instances using [regional managed instance groups](#)

Autoscaling metrics

Use metrics to help determine when to scale the group. [Learn more](#)

CPU utilization: 60% (default)

CREATE CANCEL EQUIVALENT COMMAND LINE

76°F Haze

Continuous Assessment 2 | google cloud - Yahoo India | Create Instance Group - | Distributed Search | Distributed Search | + | - | X

Forecasting US Nat... DISMISS ACTIVATE

Google Cloud My Project Search Products, resources, docs (/)

Instance groups COMPUTE ENGINE CREATE INSTANCE GROUP REFRESH DELETE HELP ASSISTANT LEARN

Virtual machines VM instances Instance templates Sole-tenant nodes Machine images TPUs Committed use discounts Marketplace Release Notes

Instance groups

Instance groups are collections of VM instances that use load balancing and automated services, like autoscaling and autohealing. [Learn more](#)

Filter Enter property name or value

Status	Name ↑	Instances	Template	Group type	Creation time	Recommendation	Autoscaling
<input checked="" type="checkbox"/>	instance-group-1	2	instance-template-2	Managed	Sep 16, 2022, 8:25:05 AM UTC+05:30		On: Target CPU utilization 60%

Successfully created instance group "instance-group-1".

78°F Haze

Continuous Assessment 2 | google cloud - Yahoo India | Instance groups - Compute | Distributed Search | Distributed Search | + | - | X

Forecasting US Nat... DISMISS ACTIVATE

Google Cloud My Project Search Products, resources, docs (/)

Instance groups COMPUTE ENGINE CREATE INSTANCE GROUP REFRESH DELETE HELP ASSISTANT LEARN

Virtual machines VM instances Instance templates Sole-tenant nodes Machine images TPUs Committed use discounts Marketplace Release Notes

STATIC GROUPS

The screenshot shows the Google Cloud VPC network IP addresses page. On the left sidebar, under 'VPC network', 'IP addresses' is selected. The main area displays a table of IP addresses with columns for Name, IP address, Access type, Region, and Type. A success message at the bottom right says 'Successfully created address "vpcnetworks".'

Name	IP address	Access type	Region	Type
vpcnetworks	34.110.204.5	External	Static	IPv4 ADDRESS
-	10.128.0.2	Internal	us-central1	Ephemeral
-	10.128.0.3	Internal	us-central1	Ephemeral
-	10.128.0.4	Internal	us-central1	Ephemeral

The screenshot shows the Google Cloud Network services - New HTTP(S) load balancer creation page. The left sidebar lists 'Load balancing' as the selected option under 'Network services'. The main form has a 'Name' field set to 'myload'. Under 'Backend configuration', there is a note about Advanced Traffic Management. The 'Backend services & backend buckets' dropdown is set to 'backconfig'. At the bottom, there are 'CREATE' and 'CANCEL' buttons.

Backend configuration

Only backend services created for HTTP(S) Load Balancer with Advanced Traffic Management will be visible. Backend services created for the Classic HTTP(S) Load Balancer cannot be used.

Backend services & backend buckets

backconfig

The screenshot shows the Google Cloud Network services interface for creating a new HTTP(S) load balancer. The left sidebar lists various network services: Load balancing, Cloud DNS, Cloud CDN, Cloud NAT, Traffic Director, Service Directory, Cloud Domains, Marketplace, and Release Notes. The main panel is titled "New HTTP(S) load balancer" and shows the "Backend configuration" step selected. A note states: "Only backend services created for HTTP(S) Load Balancer with Advanced Traffic Management will be visible. Backend services created for the Classic HTTP(S) Load Balancer cannot be used." Below this is a "Backend services & backend buckets" dropdown set to "backconfig". The "Backend services" table shows one entry: backconfig (us-central1). At the bottom are "CREATE" and "CANCEL" buttons.

The screenshot shows the Google Cloud Network services interface for managing load balancers. The left sidebar is identical to the previous screen. The main panel is titled "Load balancing" and shows a single load balancer named "myload" listed under the "LOAD BALANCERS" tab. The "myload" row shows it is of type "HTTP(S)", uses "HTTP" protocol, and has "1 backend service (1 instance group, 0 network endpoint)". Below the table is a "Filter" input field and a "GO TO NETWORK INTELLIGENCE CENTER" button. The status bar at the bottom indicates "90°F Mostly sunny" and the date "16-09-2022".

Google Cloud - Yahoo India Search | Free Trial And Free Tier | Google Cloud Platform | Load balancer details - Network

Forecasting US Nat...

Free trial status: ₹31,926.49 credit and 76 days remaining - with a full account, you'll get unlimited access to all of Google Cloud Platform.

DISMISS ACTIVATE

Google Cloud My Project Search Products, resources, docs (/)

Network services Load balancer details EDIT DELETE

myload

Faster web performance and improved web protection with Cloud CDN and Cloud Armor. [Learn more](#)

DISMISS

DETAILS MONITORING CACHING

Frontend

Protocol	IP:Port	Certificate	SSL Policy	Network Tier
HTTP	34.95.67.189:80	-	-	Premium

Routing rules

Hosts	Paths	Backend
All unmatched (default)	All unmatched (default)	backconfig

90°F Mostly sunny

Google Cloud - Yahoo India Search | Free Trial And Free Tier | Google Cloud Platform | Load balancer details - Network

Forecasting US Nat...

Free trial status: ₹31,926.49 credit and 76 days remaining - with a full account, you'll get unlimited access to all of Google Cloud Platform.

DISMISS ACTIVATE

Google Cloud My Project Search Products, resources, docs (/)

Network services Load balancer details EDIT DELETE

All unmatched (default) All unmatched (default) backconfig

Backend

Backend services

1. backconfig

Endpoint protocol	Named port	Timeout	Health check	Cloud CDN	Logging
HTTP	http	30 seconds	health	Enabled VIEW CDN DETAILS	Disabled

ADVANCED CONFIGURATIONS

Name	Type	Scope	Healthy	Autoscaling	Balancing mode	Selected ports	Capacity
instance-group-1	Instance group	us-central1	2 of 2	On: Target CPU utilization 60%	Max backend utilization: 80%	80	100%

90°F Mostly sunny

Get real-time analytics with Network Intelligence Center

Use Network Intelligence Center for comprehensive monitoring and troubleshooting. [Learn more](#)

- ✓ Visualize your network resources
- ✓ Diagnose and prevent connectivity issues
- ✓ View packet loss and latency metrics
- ✓ Keep your firewall rules strict and efficient

[GO TO NETWORK INTELLIGENCE CENTER](#) [REMIND ME LATER](#)

	LOAD BALANCERS	BACKENDS	FRONTENDS	
<input type="checkbox"/> Forwarding rule name ↑	Frontend type	Scope	Address	IP v
<input type="checkbox"/> frontconfig	HTTP(S)	Global	34.95.67.189	IPv-

Select a forwarding rule

Labels help organize your resources (e.g., cost_center:sales)

Today's Quote:
"Only those who will risk going too far can possibly find out how far one can go." – T. S. Eliot

GRAWLING THE WEBPAGE:

VM instances

newinstance

DETAILS **OBSERVABILITY** **OS INFO** **SCREENSHOT**

SSH CONNECT TO SERIAL CONSOLE

Logs
Cloud Logging
Serial port 1 (console)
SHOW MORE

Basic information

Name	newinstance
Instance Id	6740487493877957997
Description	None
Type	Instance
Status	Running
Creation time	Sep 15, 2022, 11:13:31 AM UTC+05:30
Zone	us-west4-b
Instance template	None
In use by	None
Reservations	Automatically choose
Labels	None
Deletion protection	Disabled
Confidential VM service	Disabled
Preserved state size	0 GB

Machine configuration

Machine type	e2-micro
CPU platform	Intel Broadwell
Architecture	x86/64
vCPUs to core ratio	—
Custom visible cores	—
Display device	Disabled
GPUs	None

Networking

Click on its SSH and give command:

>curl -k -L -s 34.98.112.210 > outfile

>cat outfile

Here 34.98.112.210 is the load balancer frontend ip address

```
<!--
~ MIT License
~
~ Copyright (c) 2019 Michael Pogrebinsky - Distributed Systems & Cloud Computing with Java
~
~ Permission is hereby granted, free of charge, to any person obtaining a copy
~ of this software and associated documentation files (the "Software"), to deal
~ in the Software without restriction, including without limitation the rights
~ to use, copy, modify, merge, publish, distribute, sublicense, and/or sell
~ copies of the Software, and to permit persons to whom the Software is
~ furnished to do so, subject to the following conditions:
~
~ The above copyright notice and this permission notice shall be included in all
~ copies or substantial portions of the Software.
~
~ THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR
~ IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY,
~ FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE
~ AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER
~ LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM,
~ OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE
~ SOFTWARE.
--><!doctype html>
<html>
<head>
<title>Distributed Search</title>
```

STEPS:

CREATING BUCKETS

Firstly, login to your Google Cloud Account and create a project.

- * In search type Billing Account and Enable it.
- * To create a Bucket, go to Navigation Menu → Cloud Storage → click Buckets and Create Bucket.
- * In that choose Enable Billing → Give name for the Bucket "buckets_1234567" → choose Multiple Regions.
- Choose a default storage class for our data: Standard.
- Choose how to control access permission on this bucket to objects → Enforce public access permission on this Bucket

↓
Access control → choose how to protect object data uniformly

- None

↓ [CREATE]

CREATING INSTANCE

To create the Instance Go to the Navigation Menu
→ Compute Engine → Choose VM Instance → Create Instance → Give name of the instance "instance1" → Region : us - central (Mumbai) , Zone → us-central1-a
Give the machine type as : e2 - micro.

↓ Firewall: Allow HTTP traffic

Click **CREATE**

After creating the instance , click set near the instance → OS will get opened.

Give the commands

- > which java
- > sudo apt-get update
- > sudo dpkg --configure -a
- > sudo apt-get -v --force-yes install openjdk-11-jdk
- > gnutar cp gs://web-application-template/*.jar .
↓

Bucket name : buckets-1234567

- > sudo java -jar cloud-web-application-1.0-SNAPSHOT.jar -with-dependencies.jar 80 &

* Click the External IP of the instance , new URL web application with queues will be opened.

CREATING INSTANCE TEMPLATE

To create the Instance Template → In search Bar type "Instance template" → Create Instance Template
→ Give Template name, Machine type : micro → Firewall: Allow HTTP traffic → Advanced Options

Management: Under Automation TYPE write the code:

```
#!/bin/bash
sudo apt-get update
sudo apt-get -y install openjdk-8-jdk
gutil cp gs://buckets-1234567/* .jar
sudo java -jar cloud-web-application-1.0-SNAPSHOT-
.jar -with-dependencies.jar 8080
```

Click [CREATE]

CREATE VM FROM TEMPLATE

Near the Template Name → Under Actions: → Create VM without changing any value settings. [Create].

Near Newly created instance → Click the External IP we can able to view the Quotes Base web page.

CREATING INSTANCE GROUP

Search For Instance Group → select the Instance template → Location: Multiple zones → Target PIs. Shape: E8en → Autoscaling: Autoscaling Mode: On, add & remove instance group

Minimum no. of Instances: 2, Maximum no. of instances

6

cool down period: 600 seconds → Auto scaling: health check
[CREATE]

STATIC GROUPS

In search type: VPC networks → Click on IP address on the left column → Reserve external static address → Give name, Network Service tier: Premium → Type: global → IP: IPv4 → Click [RESERVE]

LOAD BALANCING

Create Load Balance → Under HTTPS config: → Start configuration → [continue] → Create new frontended (config is used) → Create the Backend configuration

→ Health check → Create Health → Give Name → Protocol: HTTP, Request path: /status → Check interval: 5, Timeout 5, Healthy threshold: 2, Unhealthy threshold: 2 → Save → [Create] → Choose Backend loader & click [Create]. Load balancer is created.

* Copy the IP address in front-end, the web application will gets opened.

GRANULATING THE WEB PAGE:

Go to VM instances → Create Instance → Name: "new instance", Machine type: e2-micro, [Create]

click `SSH` in the instance → Open the browser window
terminal will be loaded, here the commands

`> curl -k -L -s 34.111.22.227 > outfile`

(IP of Load Balancer)

`> cat outfile`

After this click the IP of the Instance enter,
web page will get opened with `curl`.