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REG NO:920419205010

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SUBJECT:IT8711-FOSS and cloud computing laboratory

EXERCISE NO:9

PROCEDURAL STEPS

Step 1: Download the following Packages

1. hadoop-3.2.2.tar.gz

Link: <https://www.apache.org/dyn/closer.cgi/hadoop/common/hadoop-3.2.2/hadoop-3.2.2.tar.gz>

2. 7zip to unzip the tar.gz file

Link: <https://www.7-zip.org/download.html>

3. Java 8 (JDK-8U333 & JRE-8U333)

Link: <https://www.oracle.com/java/technologies/javase/javase8u211-later-archive-downloads.html>

4. Hadoop dll Files

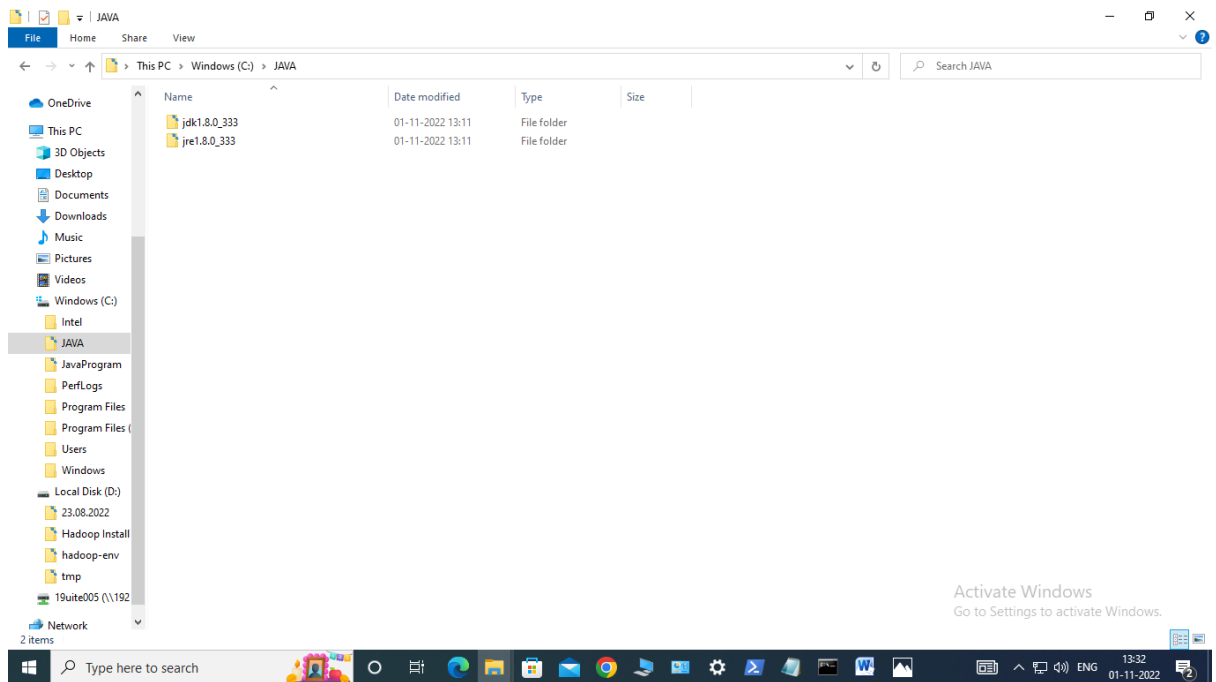
Link: <https://github.com/cdarlint/winutils/archive/refs/heads/master.zip>

5. hadoop-hdfs-3.2.2.jar

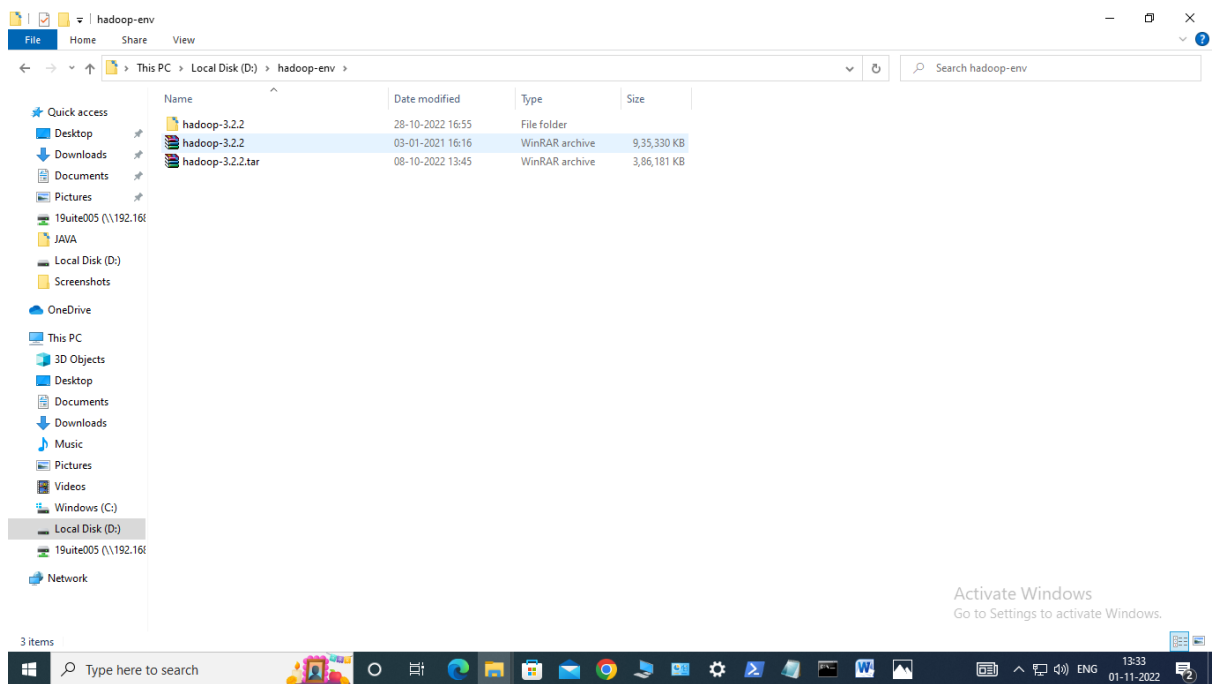
Link: <https://jar-download.com/artifacts/org.apache.hadoop/hadoop-hdfs/3.2.2/source-code>

Step 2: Install / Extract the following Packages:

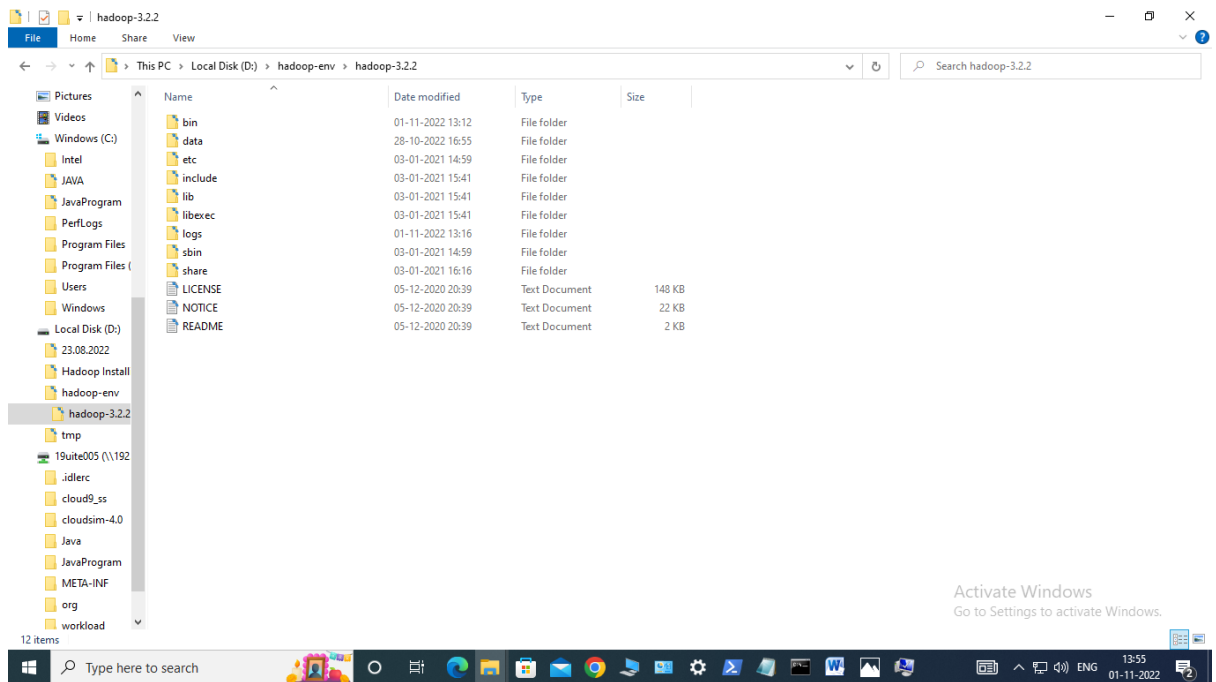
1. Install Java 8 in the location **c:\JAVA**. Also create two folders namely “jdk1.8.0_333” and “jre1.8.0_333”.



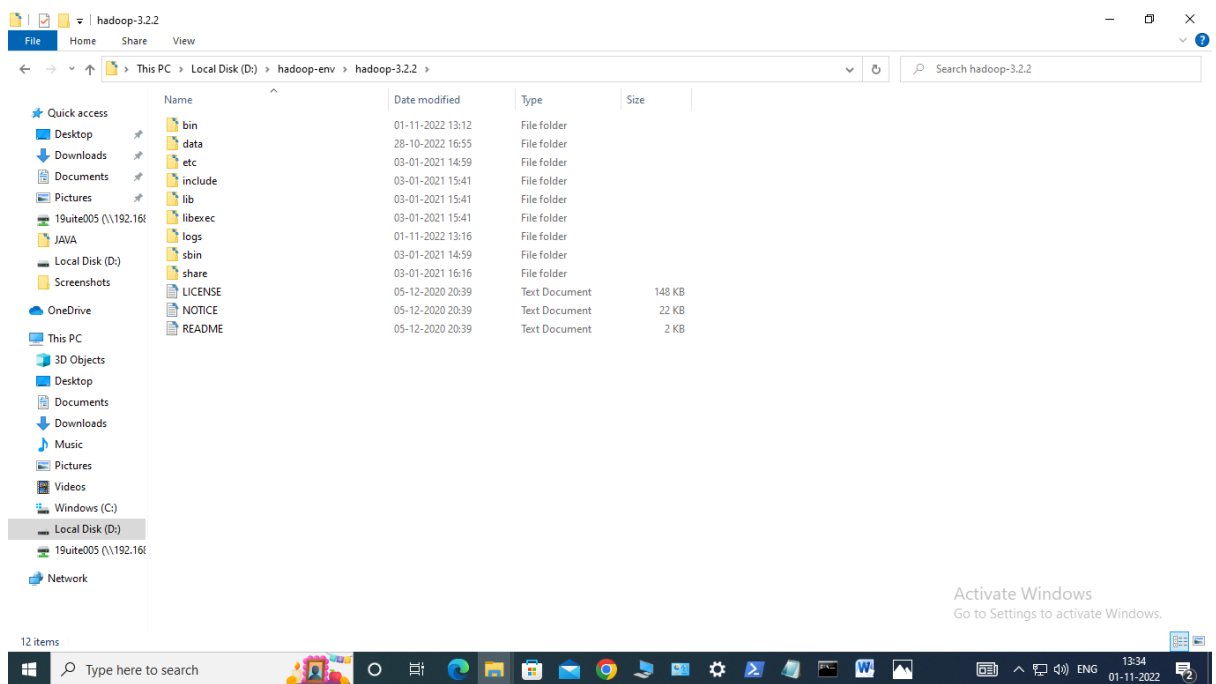
2. Create a folder “hadoop-env” in D:\



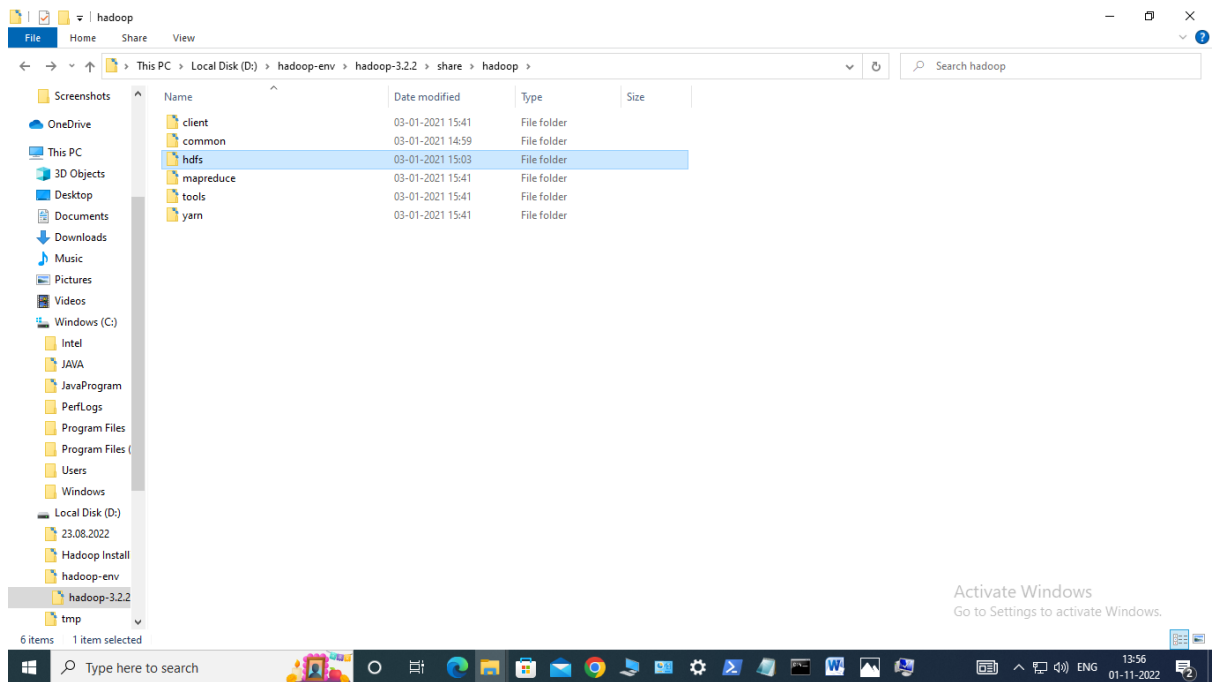
3. Paste the downloaded “hadoop-3.2.2.tar.gz” into “d:\ hadoop-env”



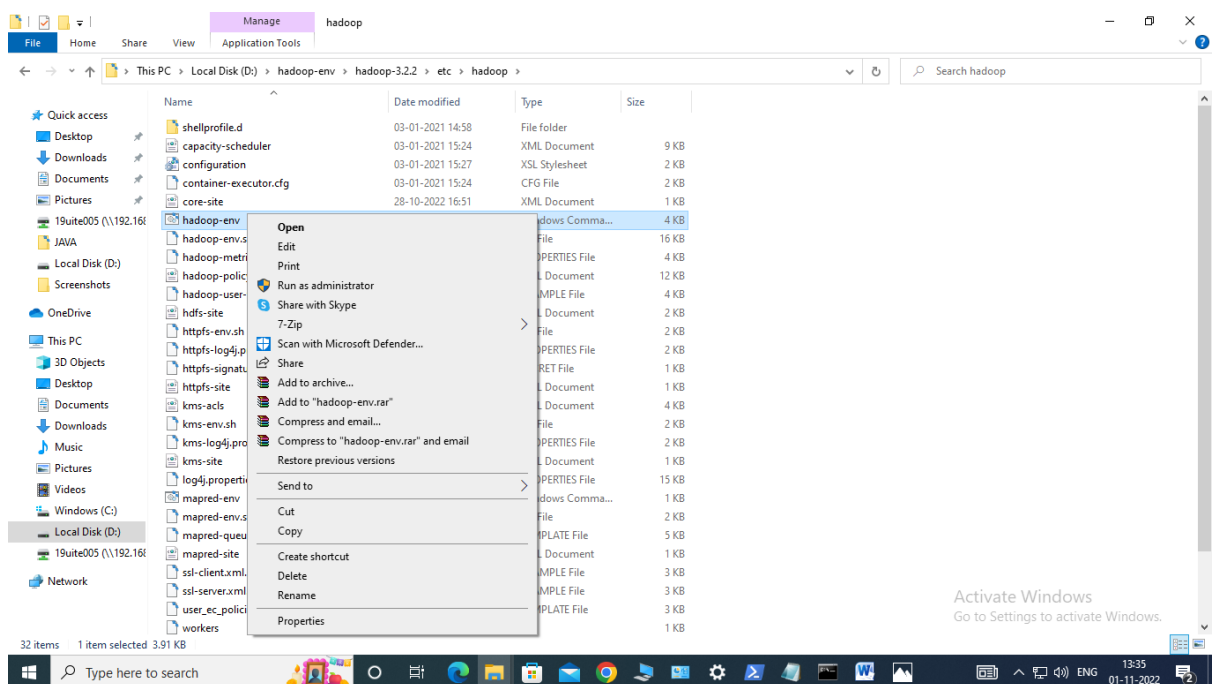
4. Unzip the “hadoop-3.2.2.tar.gz” using 7zip (do the unzip function two times)
5. Copy the downloaded Hadoop dll files to the location “D:\hadoop-env\hadoop-3.2.2\bin”



6. Copy the downloaded hadoop-hdfs-3.2.2.jar to “D:\hadoop-env\hadoop-3.2.2\share\hadoop\hdfs”

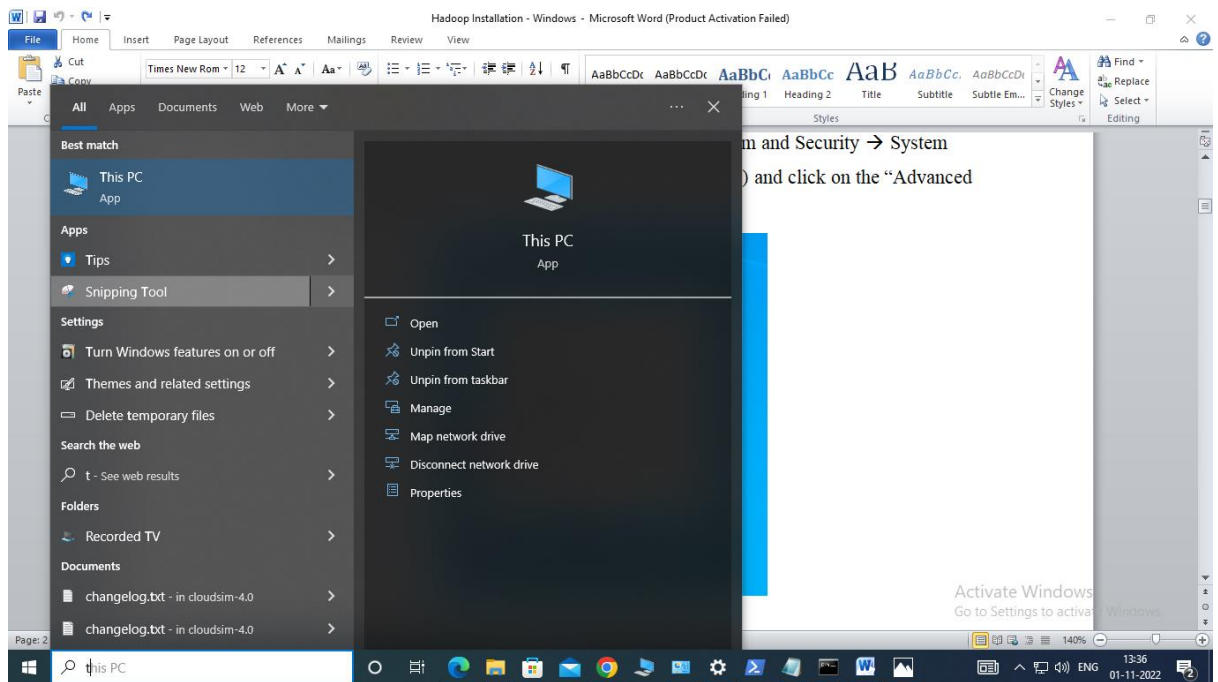


7. Edit the JAVA_HOME = C:\JAVA\jdk1.8.0_333 in the path “D:\hadoop-env\hadoop-3.2.2\etc\hadoop\hadoop-env.cmd

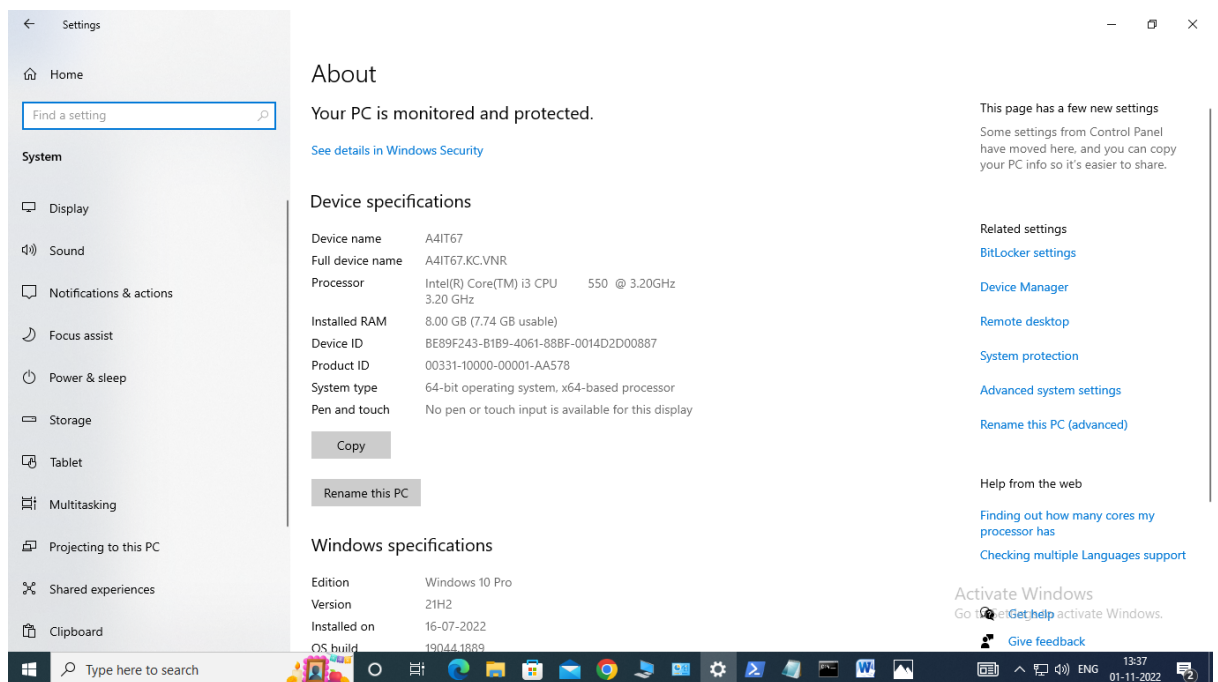


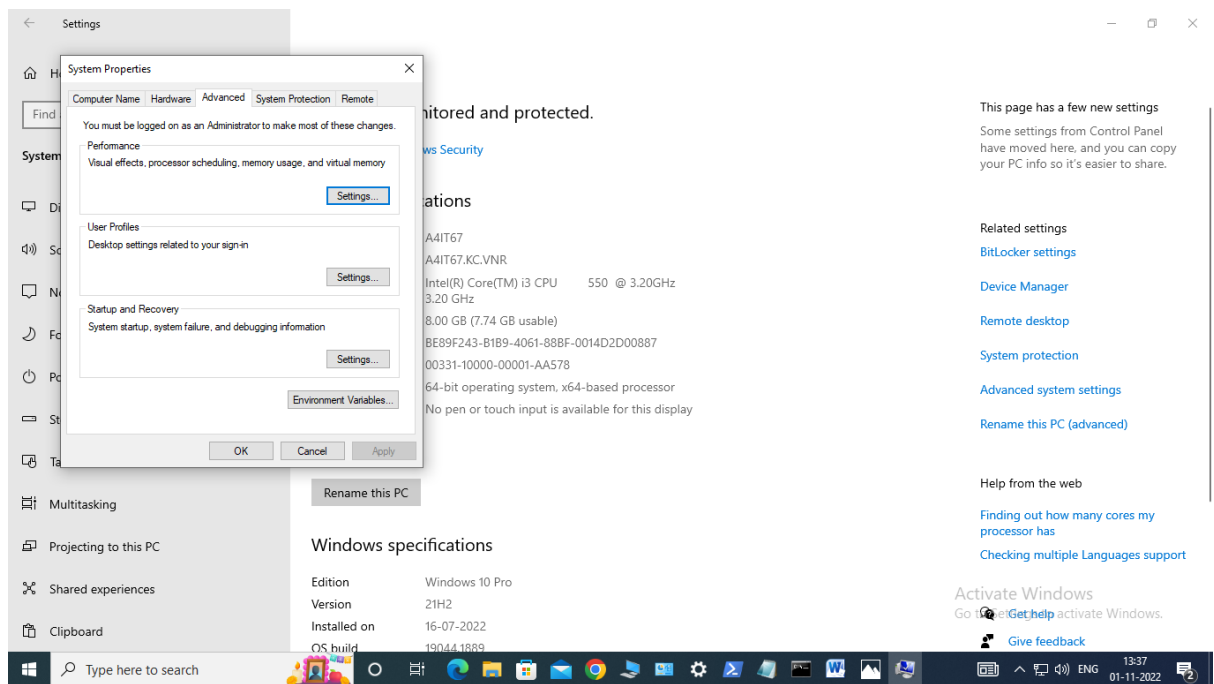
Step 3: Set the path for Java and Hadoop in system environment variables

To edit environment variables, go to Control Panel → System and Security → System (or) right-click “This PC” → Properties (My Computer icon) and click on the “Advanced system settings” link.

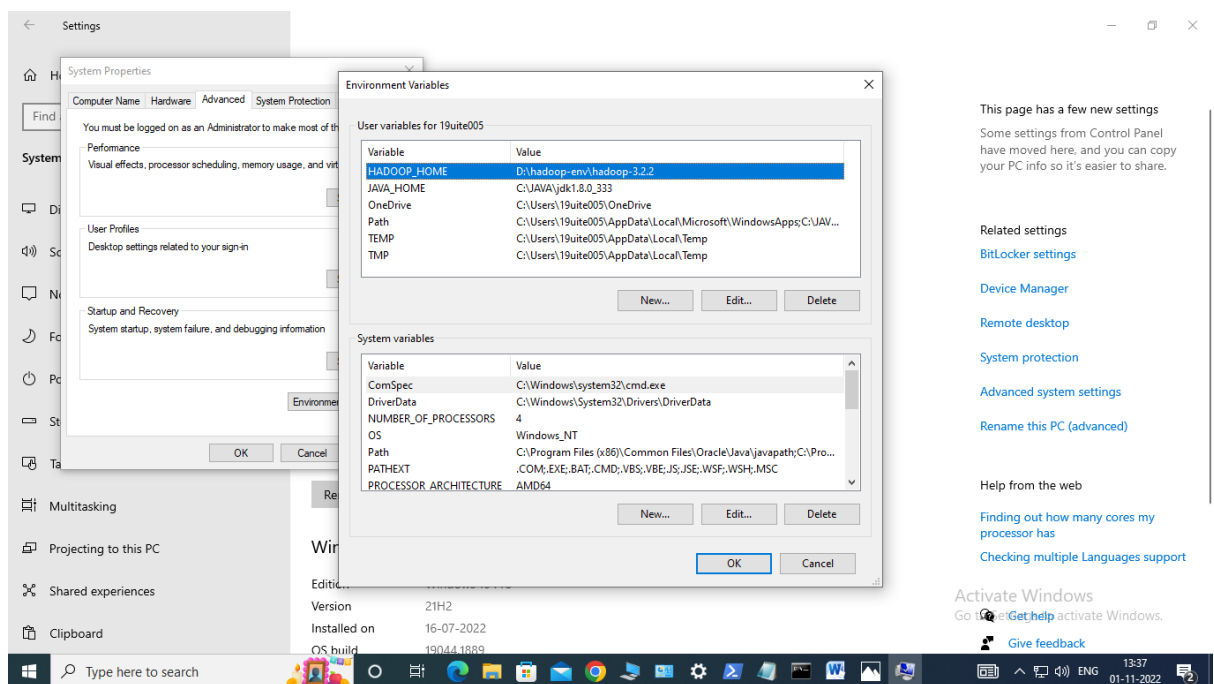


When the “Advanced system settings” dialog appears, go to the “Advanced” tab and click on the “Environment variables” button located on the bottom of the dialog.

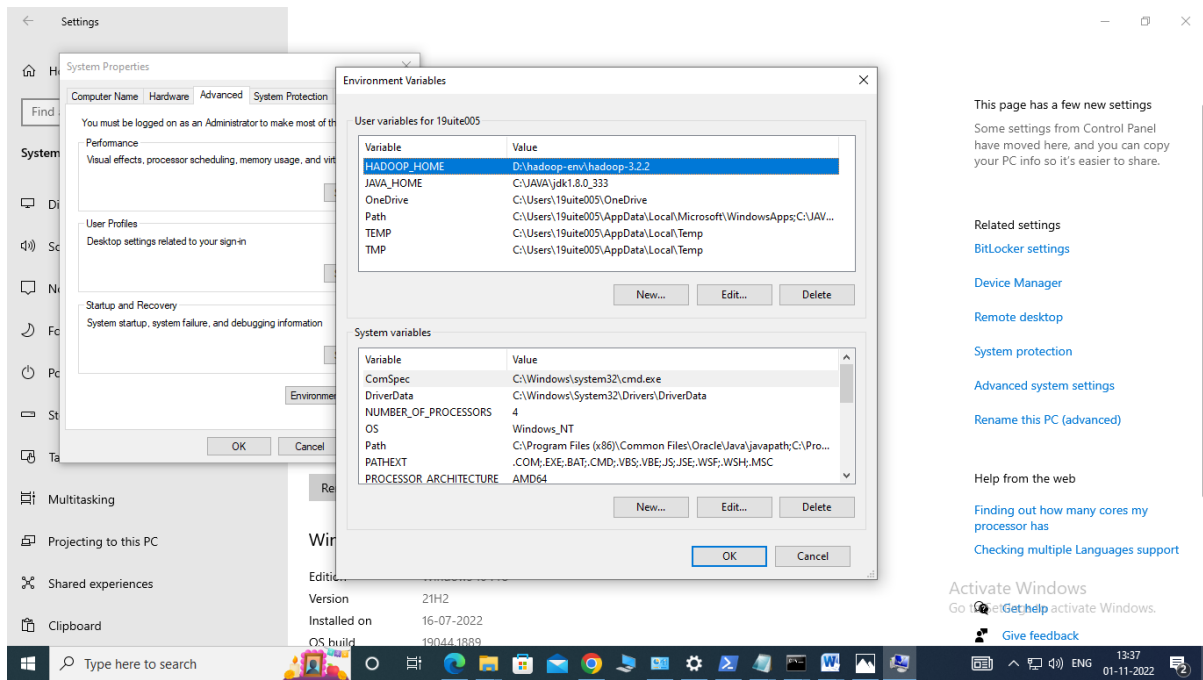




In the “Environment Variables” dialog, press the “New” button to add a new variable.



Now, Edit the PATH variable to add the Java and Hadoop binaries paths as shown in the following screenshots.

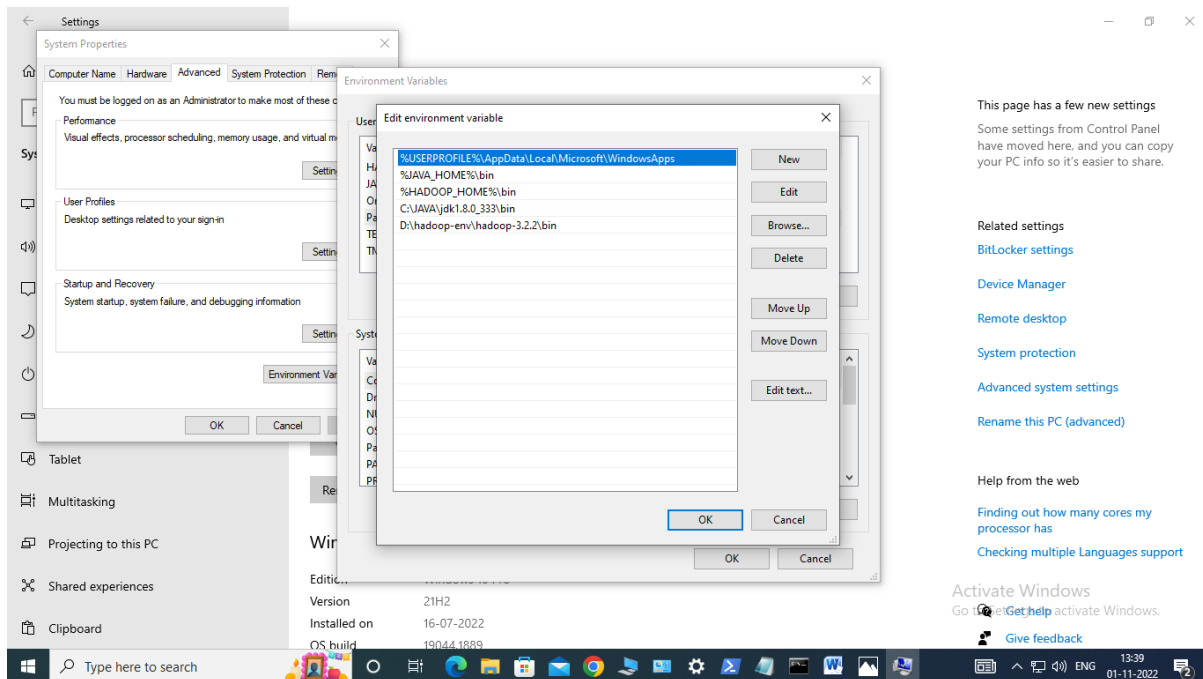


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Some settings from Control Panel have moved here, and you can copy your PC info so it's easier to share.

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Step 4: Open Command Prompt as Administrator and run the following command:
hadoop -version

Step 5: Configuring Hadoop cluster

There are **four files** to configure Hadoop cluster:

Location of the File: **"D:\hadoop-env\hadoop-3.2.2\etc\hadoop"**

File Name: "hdfs-site.xml"

Add the following properties within the <configuration></configuration> element:

```
<property>
```

```
<name>dfs.replication</name>
```

```
<value>1</value>
```

```
</property>
```

```
<property>
```

```
<name>dfs.namenode.name.dir</name>
```

```
<value>file:///D:/hadoop-env/hadoop-3.2.2/data/dfs/namenode</value>
```

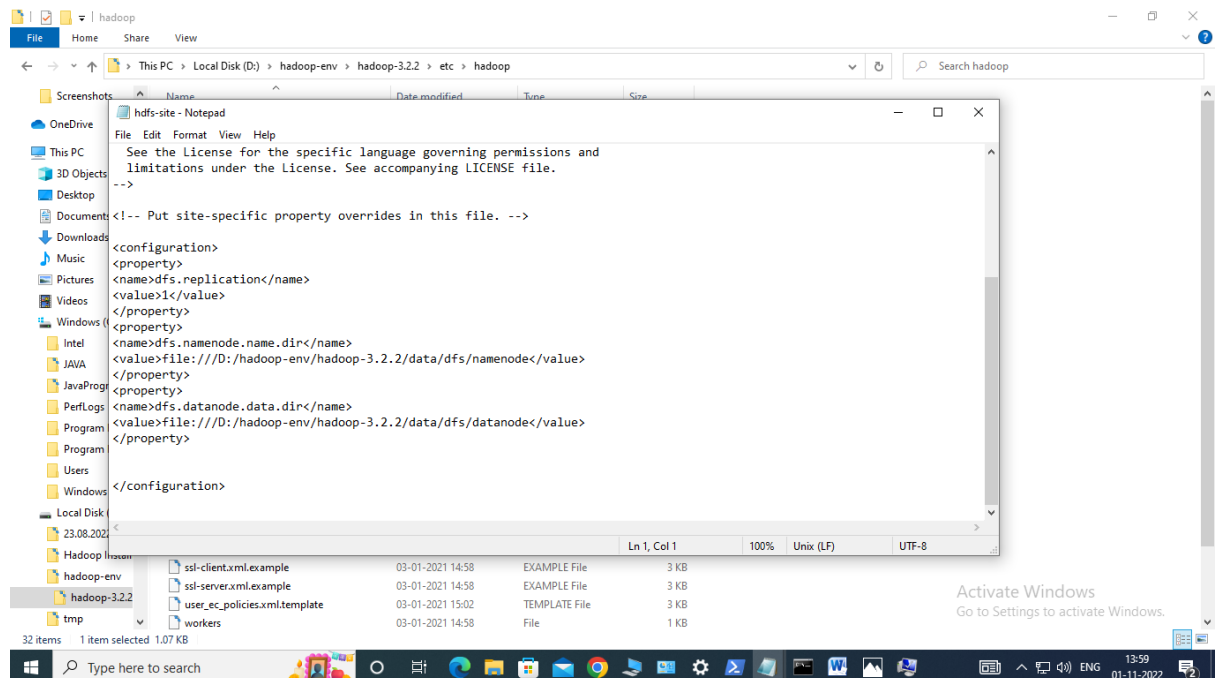
```
</property>
```

```
<property>
```

```
<name>dfs.datanode.data.dir</name>
```

```
<value>file:///D:/hadoop-env/hadoop-3.2.2/data/dfs/datanode</value>
```

```
</property>
```



File Name: “core-site.xml”

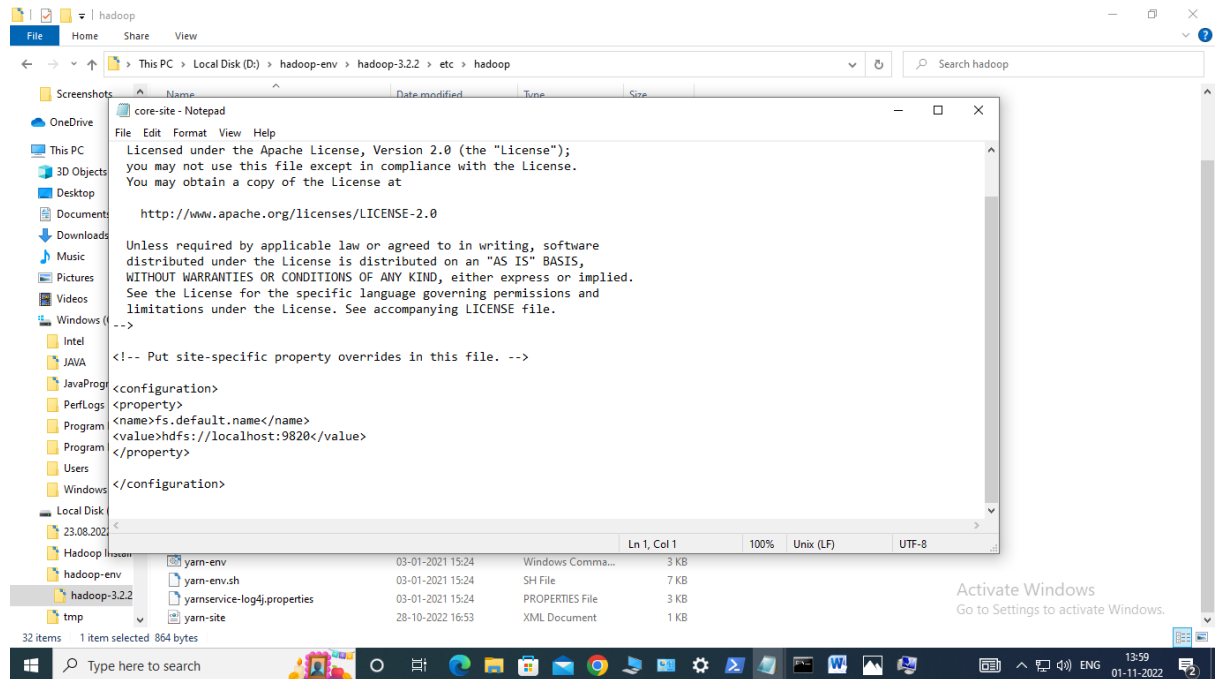
Add the following properties within the <configuration></configuration> element:

```
<property>
```

```
<name>fs.default.name</name>
```

```
<value>hdfs://localhost:9820</value>
```

```
</property>
```



File Name: “mapred-site.xml”

Add the following properties within the <configuration></configuration> element:

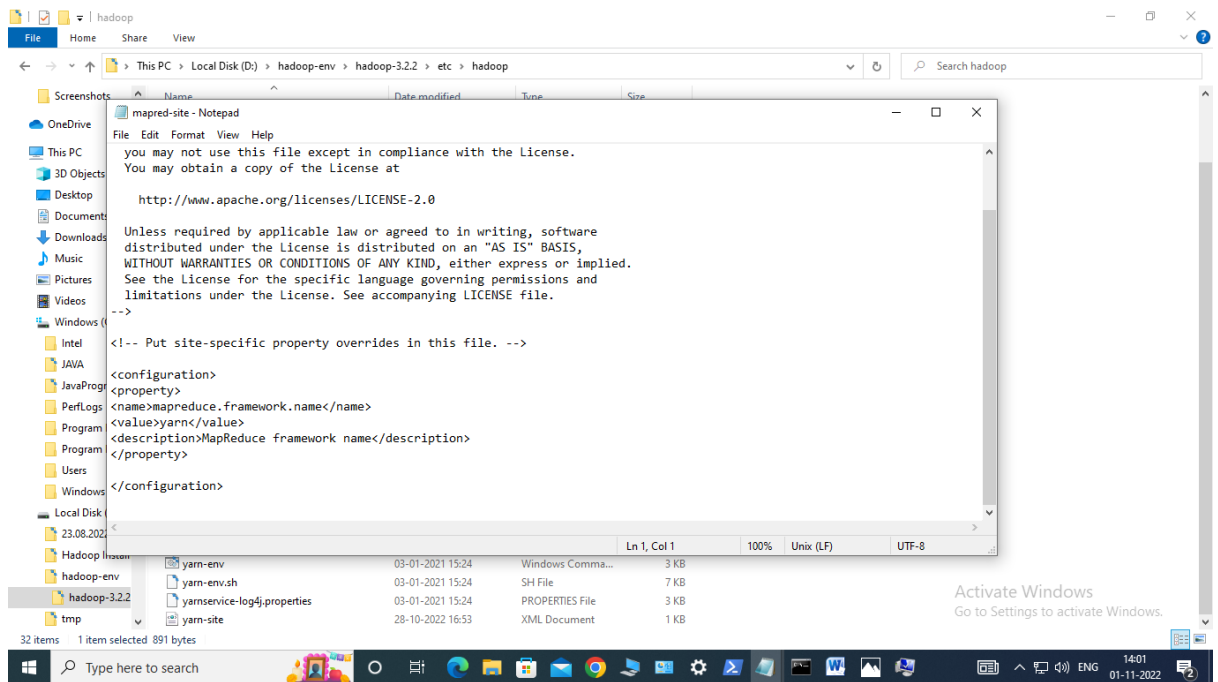
```
<property>
```

```
<name>mapreduce.framework.name</name>
```

```
<value>yarn</value>
```

```
<description>MapReduce framework name</description>
```

```
</property>
```



File Name: "yarn-site.xml"

Add the following properties within the <configuration></configuration> element:

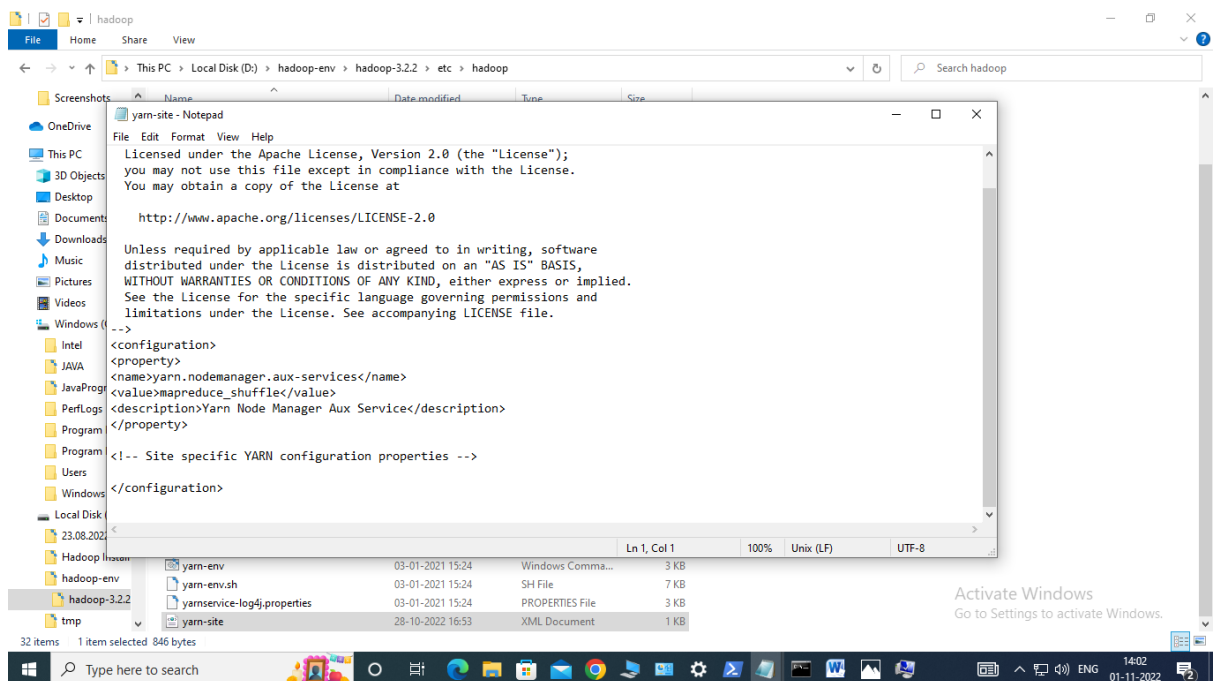
```
<property>
```

```
<name>yarn.nodemanager.aux-services</name>
```

```
<value>mapreduce_shuffle</value>
```

```
<description>Yarn Node Manager Aux Service</description>
```

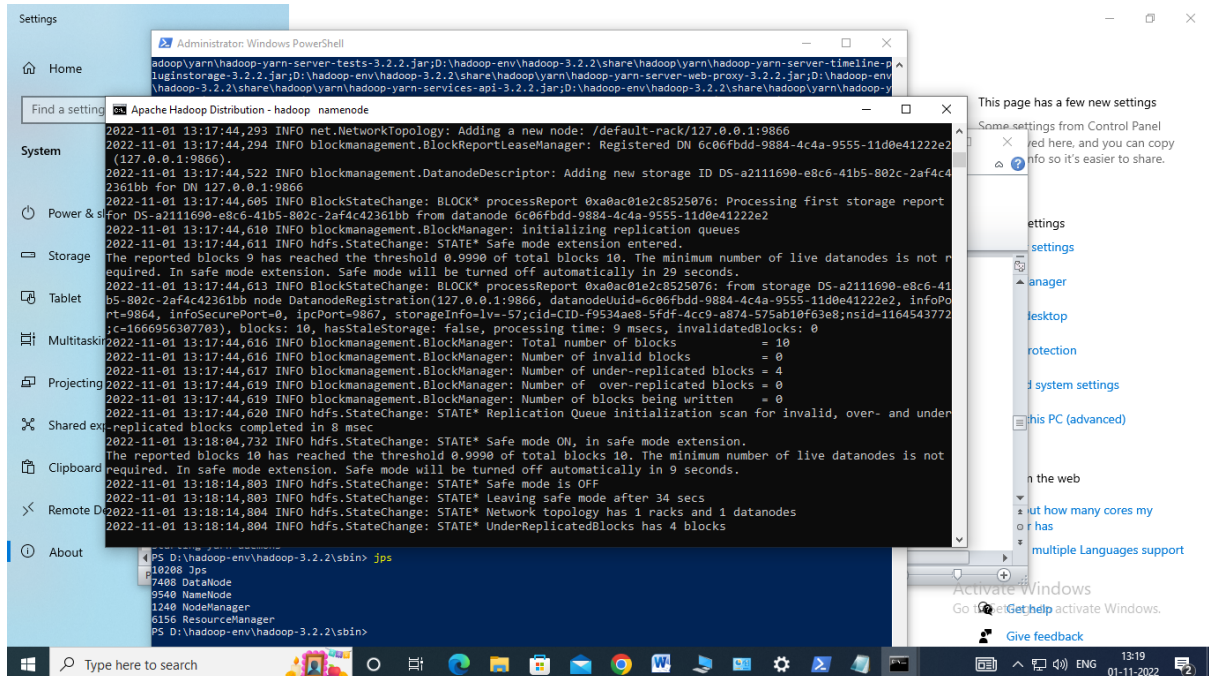
```
</property>
```



Step 6: Format the namenode

After finishing the configuration, format the name using the following command

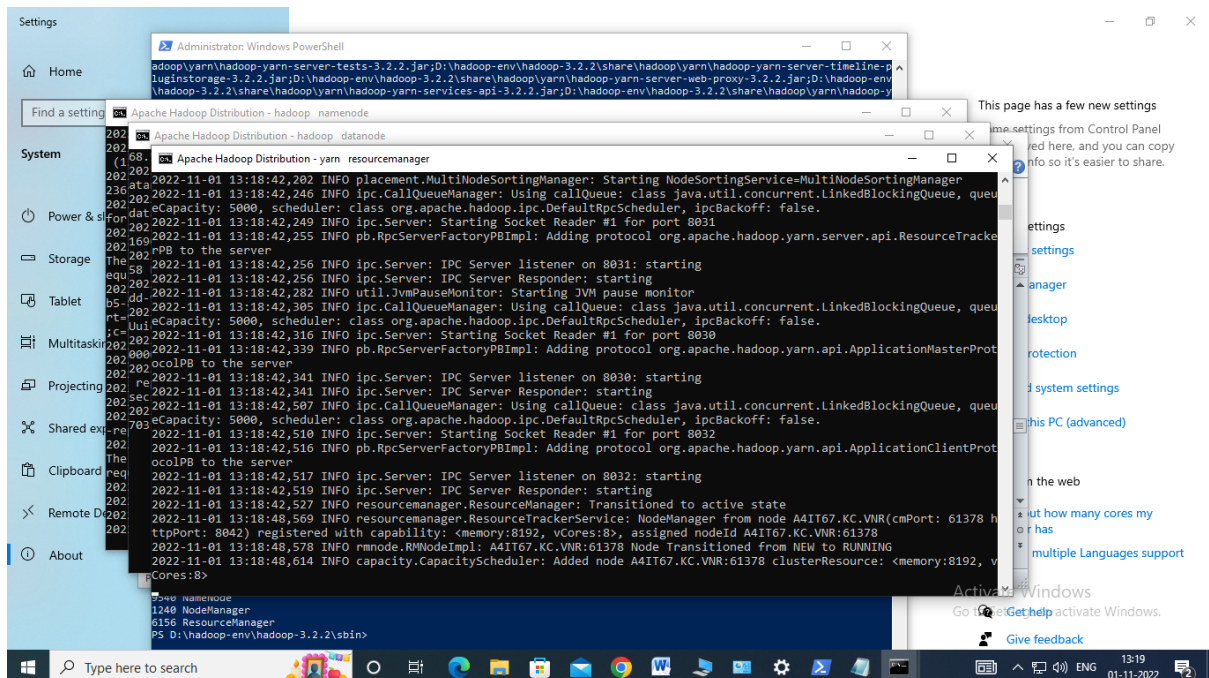
hdfs namenode -format



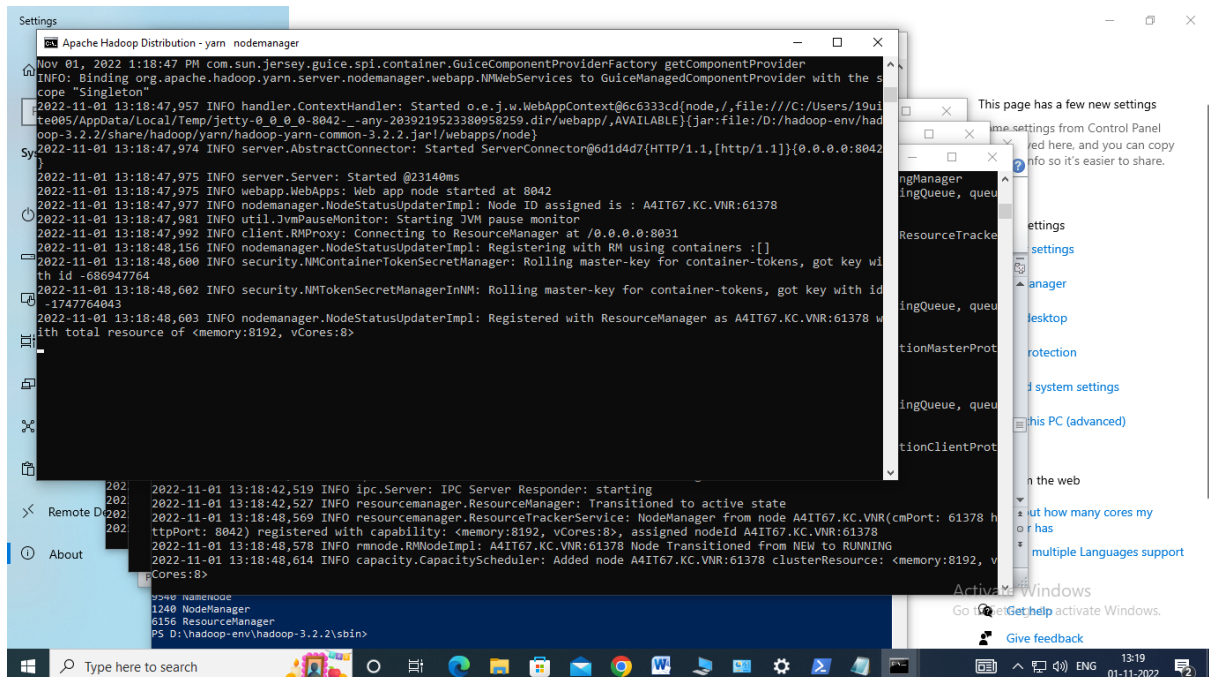
Step 7: Start the Hadoop nodes

Now navigate to the location “D:\hadoop-env\hadoop-3.2.2\sbin” in powershell and then run the following command to start the Hadoop nodes:

.\start-dfs.cmd



Two command prompt windows will open (one for the **namenode** and one for the **datanode**) as follows:

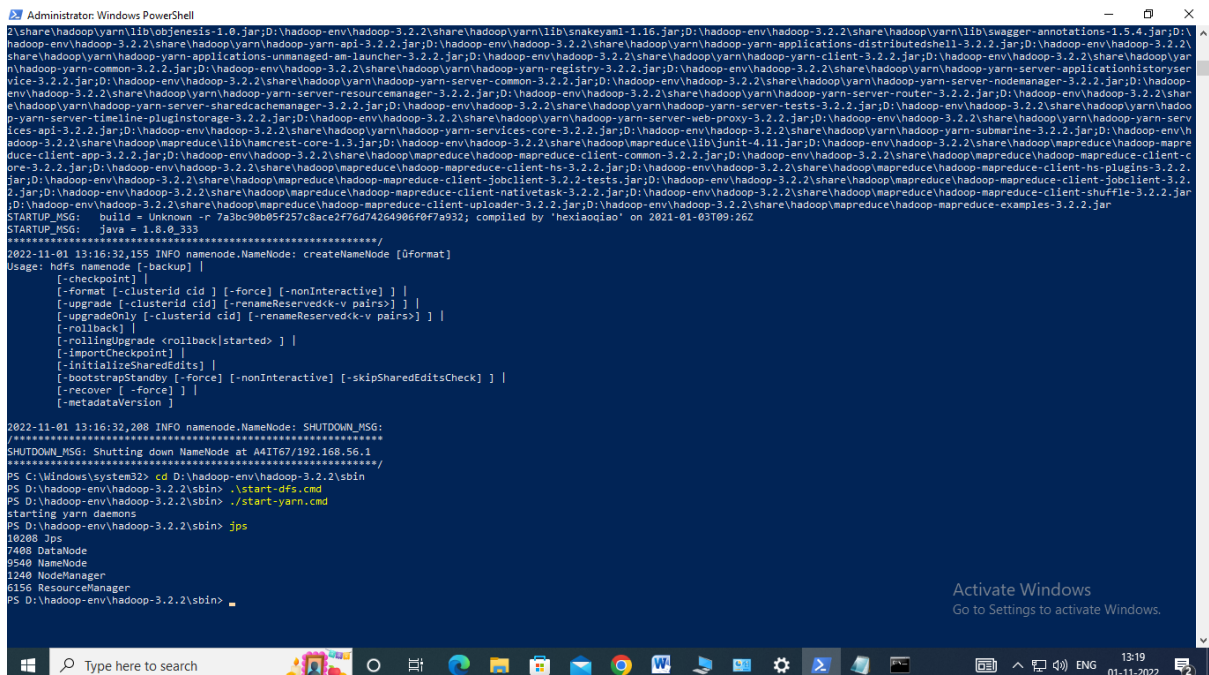


```
Nov 01, 2022 1:18:47 PM com.sun.jersey.guice.spi.container.GuiceComponentProviderFactory.getComponentProvider
INFO: Binding org.apache.hadoop.yarn.server.nodemanager.webapp.NMWebServices to GuiceManagedComponentProvider with the scope "Singleton"
2022-11-01 13:18:47,957 INFO handler.ContextHandler: Started o.e.j.w.WebAppContext@6c6333cd{/node/,file:///C:/Users/19ui/te005/AppData/Local/Temp/jetty-0_0_0-8042_/_any-2039219523380958259_dir/webapp/,AVAILABLE}{jar:file:/D:/hadoop-env/hadoop-3.2.2/share/hadoop/yarn/hadoop-yarn-common-3.2.2.jar!/webapps/node}
2022-11-01 13:18:47,974 INFO server.AbstractConnector: Started ServerConnector@6d1d4d7[HTTP/1.1,[http/1.1]]{0.0.0.0:8042}
2022-11-01 13:18:47,975 INFO server.Server: Started @23140ms
2022-11-01 13:18:47,975 INFO webapp.WebApps: Web app node started at 8042
2022-11-01 13:18:47,977 INFO nodemanager.NodeStatusUpdaterImpl: Node ID assigned is : A4IT67.KC.VNR:61378
2022-11-01 13:18:47,981 INFO util.JvmPauseMonitor: Starting JVM pause monitor
2022-11-01 13:18:47,992 INFO client.RMPProxy: Connecting to ResourceManager at /0.0.0.0:8031
2022-11-01 13:18:48,156 INFO nodemanager.NodeStatusUpdaterImpl: Registering with RM using containers :[]
2022-11-01 13:18:48,600 INFO security.NMContainerTokenSecretManager: Rolling master-key for container-tokens, got key with id -680947764
-1747764043
2022-11-01 13:18:48,603 INFO nodemanager.NodeStatusUpdaterImpl: Registered with ResourceManager as A4IT67.KC.VNR:61378 with total resource of <memory:8192, vCores:8>
2022-11-01 13:18:42,519 INFO ipc.Server: IPC Server Responder: starting
2022-11-01 13:18:42,527 INFO resourcemanager.ResourceManager: Transitioned to active state
2022-11-01 13:18:48,569 INFO resourcemanager.ResourceTrackerService: NodeManager from node A4IT67.KC.VNR(cmPort: 61378 httpPort: 8042) registered with capability: <memory:8192, vCores:8>, assigned nodeId A4IT67.KC.VNR:61378
2022-11-01 13:18:48,578 INFO rnode.RMNodeImpl: A4IT67.KC.VNR:61378 Node Transitioned from NEW to RUNNING
2022-11-01 13:18:48,614 INFO capacity.CapacityScheduler: Added node A4IT67.KC.VNR:61378 clusterResource: <memory:8192, vCores:8>

PS D:\hadoop-env\hadoop-3.2.2\sbin>
```

Next, Start the Hadoop Yarn service using the following command:

./start-yarn.cmd



```
2\share\hadoop\yarn\lib\obj\genesis-1.0.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\lib\snakeyaml-1.16.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\lib\swagger-annotations-1.5.4.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-nodemanager-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-resourcemanager-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-router-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-tests-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-applicationhistoryservice-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-common-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-nodemanager-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-shadedcachemanager-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-timeline-pluginstorage-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-web-proxy-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-services-api-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-services-core-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-submarine-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\lib\hacrest-core-1.3.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\lib\junit-4.11.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-app-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-common-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-core-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-hs-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-hs-plugins-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-jobclient-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-jobclient-3.2.2-tests.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-jobclient-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-uploader-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-examples-3.2.2.jar
STARTUP_MSG: build = Unknown - r7a3be9b05f257c8ace2776d7426496f87a592; compiled by 'hexiaoliang' on 2021-01-03T09:26Z
STARTUP_MSG: java = 1.8.0.333
*****
2022-11-01 13:16:32,155 INFO namenode.NameNode: createNameNode [0format]
Usage: hdfs namenode [-backup] [-checkpoint] [-format [-clusterid cid] [-force] [-nonInteractive] ] |
[-upgrade [-clusterid cid] [-renameReserved<k-v pairs>] ] |
[-upgradeOnly [-clusterid cid] [-renameReserved<k-v pairs>] ] |
[-rollback] |
[-rollingUpgrade [-rollback|started] ] |
[-importCheckpoint] |
[-initializeSharedEdits] |
[-bootstrapStandby [-force] [-nonInteractive] [-skipSharedEditsCheck] ] |
[-recover [-force] ] |
[-metadataVersion]
2022-11-01 13:16:32,208 INFO namenode.NameNode: SHUTDOWN_MSG:
SHUTDOWN_MSG: Shutting down NameNode at A4IT67/192.168.56.1
*****
PS C:\Windows\system32> cd D:\hadoop-env\hadoop-3.2.2\sbin
PS D:\hadoop-env\hadoop-3.2.2\sbin> ./start-dfs.cmd
PS D:\hadoop-env\hadoop-3.2.2\sbin> ./start-yarn.cmd
starting yarn daemons
PS D:\hadoop-env\hadoop-3.2.2\sbin> jps
18208 Jps
7488 DataNode
9540 NameNode
1240 NodeManager
6156 ResourceManager
PS D:\hadoop-env\hadoop-3.2.2\sbin>
```

To make sure that all services started successfully, Run the following command:

jps

It should display the following services:

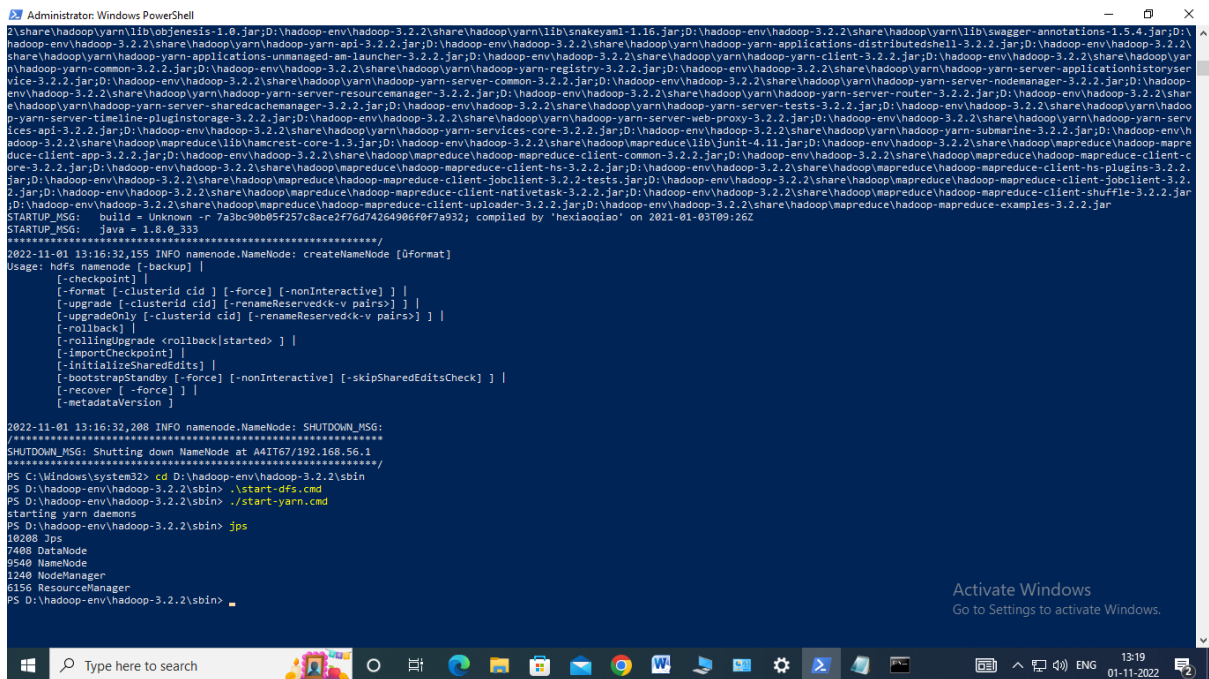
14560 DataNode

4960 ResourceManager

5936 NameNode

768 NodeManager

14636 Jps



```
Administrator: Windows PowerShell
2\share\hadoop\yarn\lib\commons-logging-1.0.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\lib\snakeyaml-1.16.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\lib\swagger-annotations-1.5.4.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-api-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-applications-distributedshell-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-applications-unmanaged-am-launcher-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-client-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-common-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-registry-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-applicationhistoryservice-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-common-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-nodemanager-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-resourcemanager-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-router-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-tests-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-timeline-pluginstorage-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-server-web-proxy-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-services-api-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-services-core-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\yarn\hadoop-yarn-submarine-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\lib\hamcrest-core-1.3.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\lib\junit-4.11.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-app-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-common-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-core-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-hs-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-hs-plugins-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-jobclient-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-jobclient-3.2.2-tests.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-jobclient-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-nativeutils-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-shuffle-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-client-uploader-3.2.2.jar;D:\hadoop-env\hadoop-3.2.2\share\hadoop\mapreduce\hadoop-mapreduce-examples-3.2.2.jar
STARTUP_MSG:   build = Unknown -r 7a3bc98b05f257c8ace2f76d74264906f8f7a932; compiled by 'hexiaogiao' on 2021-01-03T09:16:22
STARTUP_MSG:   java = 1.8.0_333
*****
2022-11-01 13:16:32,155 INFO namenode.NameNode: createNameNode [0format]
Usage: hdfs namenode [-backup] |
    [-checkPoint] |
    [-format [-clusterId cid] [-force] [-nonInteractive]] |
    [-upgrade [-clusterId cid] [-renameReservedKv pairs]] |
    [-upgradeOnly [-clusterId cid] [-renameReservedKv pairs]] |
    [-rollback] |
    [-rollingUpgrade <rollback>started] |
    [-importCheckpoint] |
    [-initializeSharedEdits] |
    [-bootstrapStandby [-force] [-nonInteractive] [-skipSharedEditsCheck]] |
    [-recover [-force]] |
    [-metadataVersion]
2022-11-01 13:16:32,208 INFO namenode.NameNode: SHUTDOWN_MSG:
*****
SHUTDOWN_MSG: Shutting down NameNode at A41T67/192.168.56.1
*****
PS C:\Windows\system32> cd D:\hadoop-env\hadoop-3.2.2\sbin
PS D:\hadoop-env\hadoop-3.2.2\sbin> .\start-dfs.cmd
PS D:\hadoop-env\hadoop-3.2.2\sbin> .\start-yarn.cmd
starting yarn daemons
PS D:\hadoop-env\hadoop-3.2.2\sbin> jps
10208 Jps
7488 DataNode
9540 NameNode
1240 NodeManager
6156 ResourceManager
PS D:\hadoop-env\hadoop-3.2.2\sbin>
```


OUTPUT

Hadoop Web UI

<http://localhost:9870/dfshealth.html>

The screenshot shows the Hadoop Web UI Overview page for the NameNode at localhost:9820. The page has a green header with navigation tabs: Hadoop, Overview (selected), Datanodes, Datanode Volume Failures, Snapshot, Startup Progress, and Utilities. The main content area is titled 'Overview 'localhost:9820' (active)'. It contains a table with the following information:

Started:	Tue Nov 01 13:17:37 +0530 2022
Version:	3.2.2, r7a3bc90b05f257c8ace27f6d74264906f07a932
Compiled:	Sun Jan 03 14:56:00 +0530 2021 by hexiaoqiao from branch-3.2.2
Cluster ID:	CID-f9534ae8-5fdf-4cc9-a874-575ab10f63e8
Block Pool ID:	BP-790173473-192.168.56.1-1666956307703

Below the table is a 'Summary' section with the following text:

Security is off.
Safemode is off.
20 files and directories, 10 blocks (10 replicated blocks, 0 erasure coded block groups) = 30 total filesystem object(s).
Heap Memory used 101.28 MB of 195 MB Heap Memory. Max Heap Memory is 889 MB.
Non Heap Memory used 51.29 MB of 52.59 MB Committed Non Heap Memory. Max Non Heap Memory is <unbounded>.

At the bottom right, there is a 'Activate Windows' watermark with the text 'Go to Settings to activate Windows.' The Windows taskbar is visible at the bottom of the screen.

<http://localhost:9864/datanode.html>

The screenshot shows the Hadoop Web UI DataNode page for the DataNode at localhost:9864. The page has a green header with navigation tabs: Hadoop, Overview, and Utilities (selected). The main content area is titled 'DataNode on A4IT67.KC.VNR:9866'. It contains a table with the following information:

Cluster ID:	CID-f9534ae8-5fdf-4cc9-a874-575ab10f63e8
Version:	3.2.2, r7a3bc90b05f257c8ace27f6d74264906f07a932

Below the table is a 'Block Pools' section with a table showing the block pool information for the DataNode:

NameNode Address	Block Pool ID	Actor State	Last Heartbeat	Last Block Report	Last Block Report Size (Max Size)
localhost:9820	BP-790173473-192.168.56.1-1666956307703	RUNNING	0s	34 minutes	100 B (64 MB)

Below the block pools table is a 'Volume Information' section with a table showing the volume information for the DataNode:

Directory	Storage Type	Capacity Used	Capacity Left	Capacity Reserved	Reserved Space for Replicas	Blocks
D:\hadoop-env\hadoop-3.2.2\data\dfs\datanode	DISK	1020.78 KB	220.7 GB	0 B	0 B	10

At the bottom right, there is a 'Activate Windows' watermark with the text 'Go to Settings to activate Windows.' The Windows taskbar is visible at the bottom of the screen.

<http://localhost:8088/cluster>

The screenshot shows the Hadoop web interface at localhost:8088. The 'All Applications' page is active. The left sidebar contains navigation links: Cluster, About Nodes, Node Labels, Applications, NEW, NEW SAVING, SUBMITTED, ACCEPTED, RUNNING, FINISHED, FAILED, and KILLED. The 'Tools' link is highlighted. The main content area shows cluster metrics (0 apps submitted, 0 pending, 0 running, 0 completed, 0 containers running, 0 used resources, 0 total resources, 0 reserved) and a table of applications. The table is empty, with a message 'Showing 0 to 0 of 0 entries'.

Cluster Metrics	Apps Submitted	Apps Pending	Apps Running	Apps Completed	Containers Running	Used Resources	Total Resources	Reserved
	0	0	0	0	0	<memory:0, vCores:0>	<memory:8192, vCores:8>	<memory:0>

Cluster Nodes Metrics	Active Nodes	Decommissioning Nodes	Decommissioned Nodes	Lost Nodes	Unhealthy Nodes
	1	0	0	0	0

Scheduler Metrics	Scheduler Type	Scheduling Resource Type	Minimum Allocation	Maximum Allocation
Capacity Scheduler		[memory-mb (unit=Mi), vcores]	<memory:1024, vCores:1>	<memory:8192, vCores:4>

Show 20 entries															
ID	User	Name	Application Type	Queue	Application Priority	StartTime	LaunchTime	FinishTime	State	FinalStatus	Running Containers	Allocated CPU VCores	Allocated Memory MB	Allocated GPUs	Reserved CPU VCores
No data available in table															

Showing 0 to 0 of 0 entries