Apache Cassandra 3.11.17 Installation on Windows OS

Table of Contents

This document outlines the steps needed to install **Apache Cassandra 3.11.17** with single-node and multi-node cluster configuration on Windows Operating system.

1. Overview:

Apache Cassandra is an open-source, highly scalable and distributed NoSQL (Not only SQL) database management system that is designed to handle large amounts of structured and unstructured data distributed across multiple commodity servers.

Apache Cassandra is initially developed at **Facebook** with a combination of distribution storage and replication model from Amazon Dynamo and column-family data model from Google Bigtable. It has a distributed architecture where large volumes of structed and unstructured data can be stored on multiple commodity hardware machines which provides high availability with no single point of failure, making it a popular choice for enterprises needing robust data solutions.

Apache Cassandra follows decentralized, peer to peer model. Unlike traditional databases that use master-slave architecture, Cassandra operates on peer-to-peer model which is nothing but all nodes in Cassandra cluster are identical, with no master nodes and each node communicates with other nodes directly, ensuring no bottlenecks and single point of failure.

The key components of Cassandra include **Node, Data Center, Cluster, Commit log, Mem-table, SSTable**. It is important to understand these terminologies in Cassandra.

- **Node**: It is the basic component in Cassandra. A node is nothing but a machine where data is actually stored
- **Data Center**: It is a collection of many nodes.
- **Cluster**: It is a collection of multiple data centers
- **Commit Log**: It is the first entry point while data to Cassandra. Data is first written to commit log which is a durable write-ahead log on disk. This helps in data recovery and sync in case of any crash in nodes.
- **Mem-table**: After writing data to commit log, data is stored in memtable which is an in-memory data structure.
- **SSTable**: Once the mem-table reaches a certain size, then data is flushed to disk and is stored in a SSTable (Sorted String table), an immutable data file.
- **Consistency levels**: Cassandra allows users to choose consistency level for their read and write operations, balancing between consistency and availability.
- **Partitioning**: Cassandra uses partitioning concept to distribute data across cluster. It hashes partition key of a row with a consistent hashing mechanism and determines which node will store that row.
- **Replication Strategy**: Based on the replication factor configured, Cassandra replicates partitions across multiple nodes to ensure data availability and fault tolerance. Cassandra

follows two replication strategies – **SimpleStrategy** (allows to specify single replication factor to copy data across cluster) **NetworkTopologyStrategy** (allows to specify replication factor for each data center in the cluster)

Note:
The latest release of Apache Cassandra from 4.0+ does not support the direct installation on Windows operating system. If you would like to use Apache Cassandra 4.0+ version, then go with Docker image or install it on Linux operating system.

2. Prerequisites:

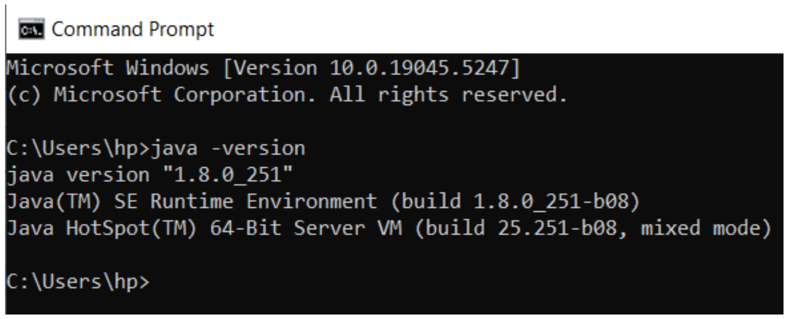
The following prerequisites need to be installed before running Cassandra.

1. **File Archiver:** Any file archiver such as **7zip** or **WinRAR** is needed to unzip the downloaded Spark binaries. 7zip can be downloaded from the 7zip Downloads website and WinRAR can be downloaded from the RAR lab Downloads website.

2. **JRE 8:** Cassandra 3.11 requires Java 8 runtime environment supporting up to JDK 1.8_251 release. You can download the JDK 8u251 release from Oracle Java Archive Downloads website. For the complete JDK installation steps, look at here.

   Verify the installed Java version using the below command:

```
java -version
```

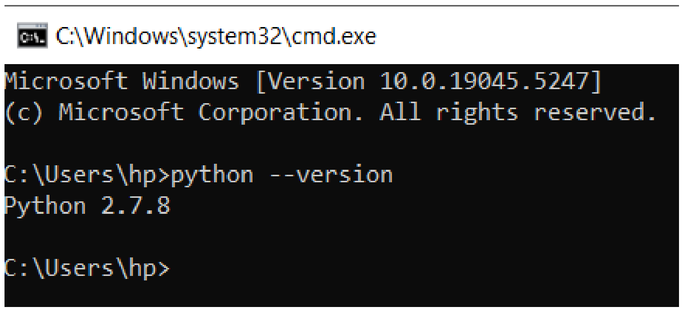


```
Microsoft Windows [Version 10.0.19045.5247]
(c) Microsoft Corporation. All rights reserved.

C:\Users\hp>java -version
java version "1.8.0_251"
Java(TM) SE Runtime Environment (build 1.8.0_251-b08)
Java HotSpot(TM) 64-Bit Server VM (build 25.251-b08, mixed mode)

C:\Users\hp>
```

3. **Python 2.7**: Cassandra 3.11 requires Python 2.7 to be installed to be able to use **cqlsh** tool. You can install Python 2.7.8 release from the official Python Downloads website and set the python install location in PATH environment variable.

   Verify the installed Python version using the below command:

```
python --version
```


C:\Windows\system32\cmd.exe

```
Microsoft Windows [Version 10.0.19045.5247]
(c) Microsoft Corporation. All rights reserved.

C:\Users\hp>python --version
Python 2.7.8

C:\Users\hp>
```

It displays that **Python 2.7.8** version is installed.

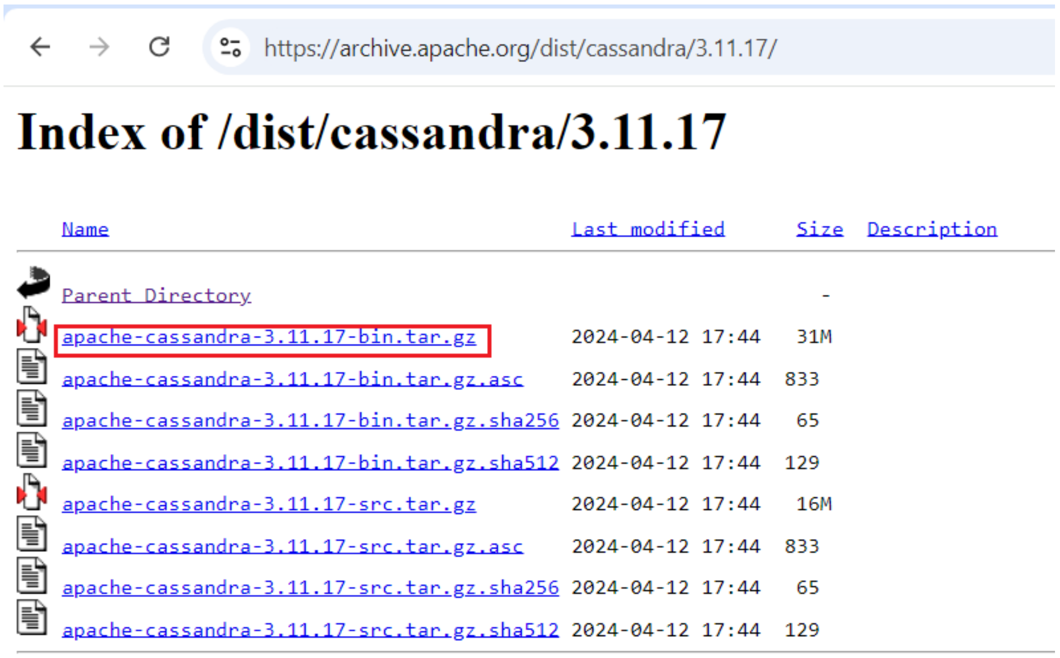
3. Install Cassandra:

Let us see the step by step procedure to install Apache Cassandra in Windows.

3.1. Download Cassandra Binaries:

You can get the stable release from the official Apache Cassandra Downloads website. At the time of this document preparation, the most recent stable release is **4.1.7** which cannot be used on Windows system directly. So, let us go the Cassandra Archive location and download **3.11.17** release.

On the Cassandra Archive 3.11.17 page, click on apache-cassandra-3.11.17-bin.tar.gz link which downloads the file into your **Downloads** folder in your machine.

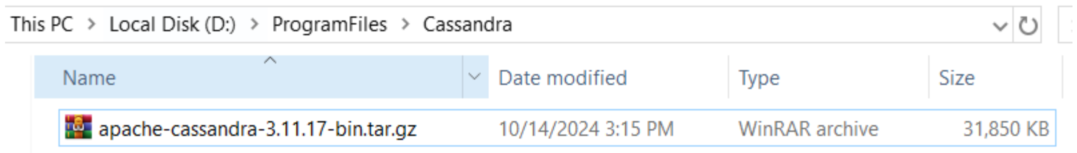

https://archive.apache.org/dist/cassandra/3.11.17/

Index of /dist/cassandra/3.11.17

```
Name                                       Last modified      Size  Description

Parent Directory                                                 -
apache-cassandra-3.11.17-bin.tar.gz        2024-04-12 17:44    31M
apache-cassandra-3.11.17-bin.tar.gz.asc    2024-04-12 17:44   833
apache-cassandra-3.11.17-bin.tar.gz.sha256 2024-04-12 17:44    65
apache-cassandra-3.11.17-bin.tar.gz.sha512 2024-04-12 17:44   129
apache-cassandra-3.11.17-src.tar.gz        2024-04-12 17:44    16M
apache-cassandra-3.11.17-src.tar.gz.asc    2024-04-12 17:44   833
apache-cassandra-3.11.17-src.tar.gz.sha256 2024-04-12 17:44    65
apache-cassandra-3.11.17-src.tar.gz.sha512 2024-04-12 17:44   129
```

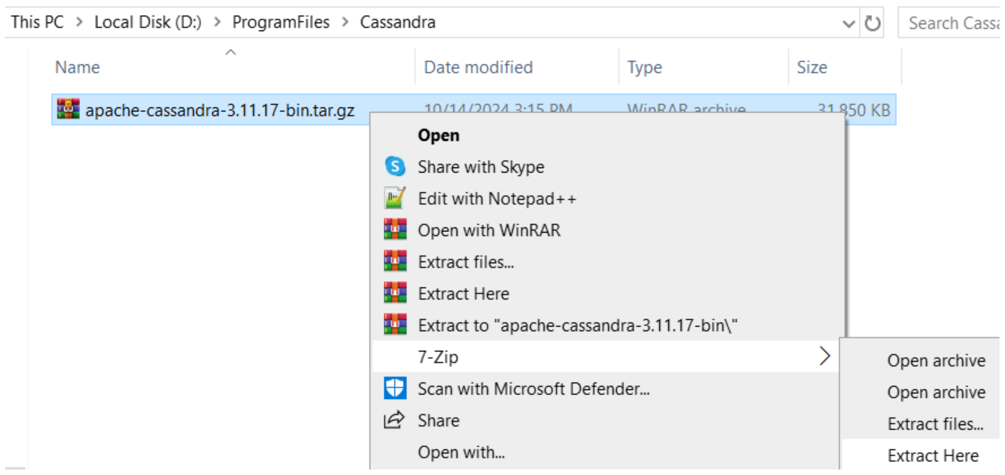
After the binary file is downloaded, unpack it using any file archiver (**7zip** or **WinRAR**) utility as below:

- Choose the installation directory in your machine and copy `apache-cassandra-3.11.17-bin.tar.gz` file to that directory. Here, we are choosing Cassandra installation directory as `D:\ProgramFiles\Cassandra.`

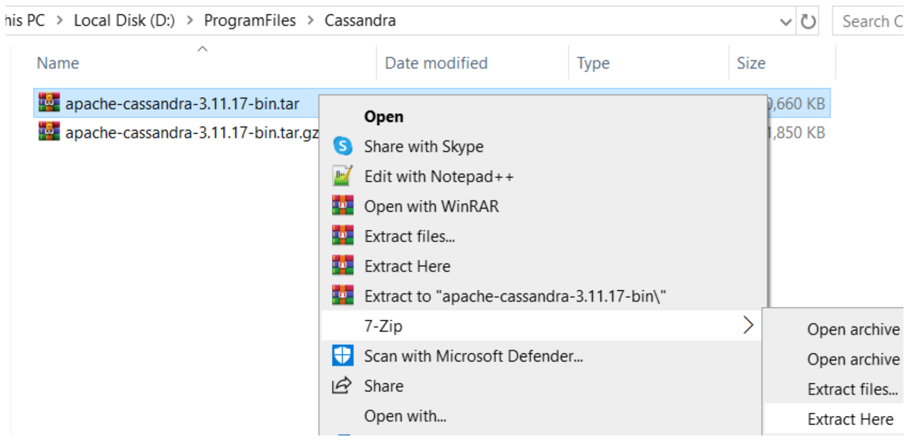


Name	Date modified	Type	Size
apache-cassandra-3.11.17-bin.tar.gz	10/14/2024 3:15 PM	WinRAR archive	31,850 KB

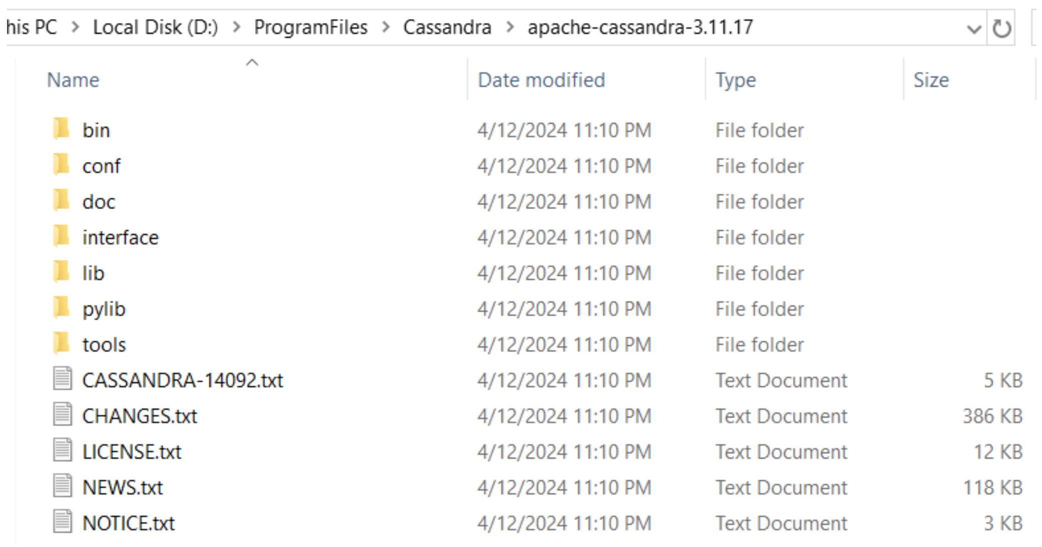
- Right click on `apache-cassandra-3.11.17-bin.tar.gz` and choose **7-Zip -> Extract Here** option which extracts a new packed file `apache-cassandra-3.11.17-bin.tar.`



- Next, unpack `apache-cassandra-3.11.17-bin.tar` file using **7zip** utility.


his PC > Local Disk (D:) > ProgramFiles > Cassandra
Search C
Name
Date modified
Type
Size
apache-cassandra-3.11.17-bin.tar
apache-cassandra-3.11.17-bin.tar.gz
Open
Share with Skype
Edit with Notepad++
Open with WinRAR
Extract files...
Extract Here
Extract to "apache-cassandra-3.11.17-bin\"
7-Zip
Scan with Microsoft Defender...
Share
Open with...
Open archive
Open archive
Extract files...
Extract Here

- The tar file extraction may take few minutes to finish. After finishing, you see a folder named `apache-cassandra-3.11.17-bin` which consists of Cassandra binaries and libraries.



his PC > Local Disk (D:) > ProgramFiles > Cassandra > apache-cassandra-3.11.17

Name	Date modified	Type	Size
bin	4/12/2024 11:10 PM	File folder	
conf	4/12/2024 11:10 PM	File folder	
doc	4/12/2024 11:10 PM	File folder	
interface	4/12/2024 11:10 PM	File folder	
lib	4/12/2024 11:10 PM	File folder	
pylib	4/12/2024 11:10 PM	File folder	
tools	4/12/2024 11:10 PM	File folder	
CASSANDRA-14092.txt	4/12/2024 11:10 PM	Text Document	5 KB
CHANGES.txt	4/12/2024 11:10 PM	Text Document	386 KB
LICENSE.txt	4/12/2024 11:10 PM	Text Document	12 KB
NEWS.txt	4/12/2024 11:10 PM	Text Document	118 KB
NOTICE.txt	4/12/2024 11:10 PM	Text Document	3 KB

3.2. Set up Environment variables:

After installing pre-requisites and Cassandra binaries, we should configure the below environment variables defining Java and Cassandra default paths.

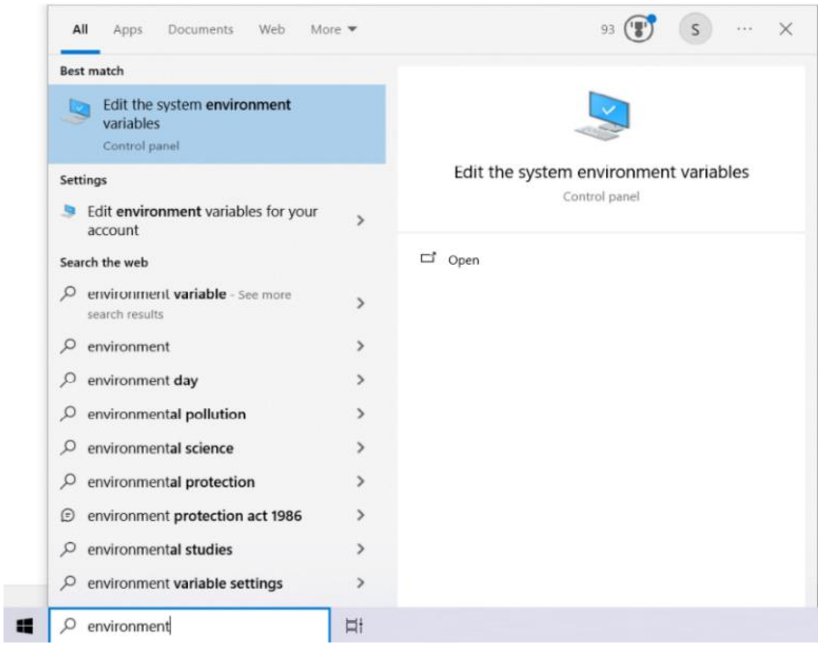
- **JAVA_HOME**: This is the JDK installation directory path in the machine *(in my machine, it is `D:\ProgramFiles\Java\jdk1.8.0_251`)*. Ignore it if this is already done.

- **CASSANDRA_HOME**: This is the Cassandra installation directory path in the machine *(in our case, it is `D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17`)*

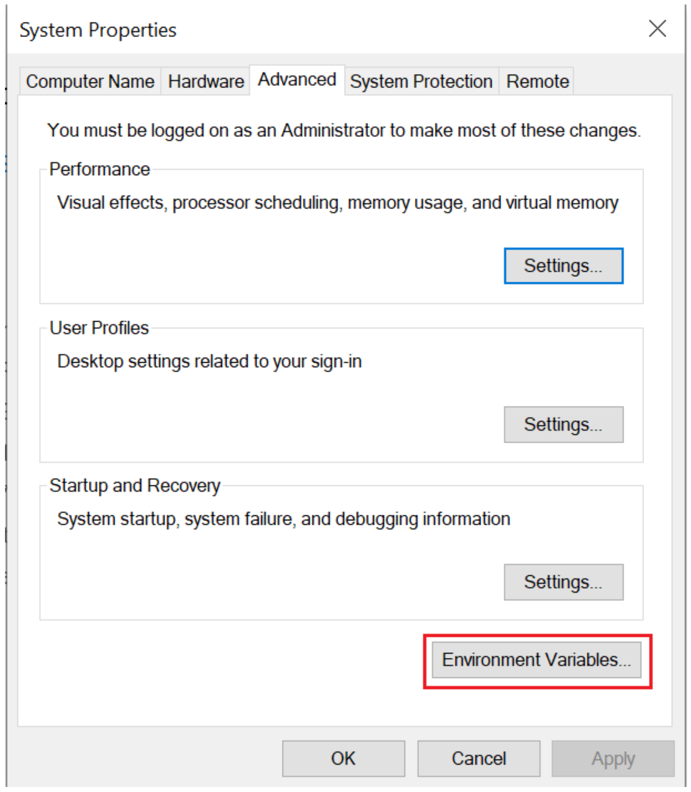
These variables need to be added to either **User environment variables** or **System environment variables** depending on Cassandra configuration needed **for a single user** or **for multiple users**.

In this tutorial, we will add User environment variables since we are configuring Cassandra for a single user. If you would like to configure Cassandra for multiple users, then define System environment variables.

In the Windows search bar, start typing “environment variables” and select the first match which opens up **System Properties** dialog.


All
Apps
Documents
Web
More
Best match
Edit the system environment variables
Control panel
Settings
Edit environment variables for your account
Search the web
environment variable - See more search results
environment
environment day
environmental pollution
environmental science
environmental protection
environment protection act 1986
environmental studies
environment variable settings
Edit the system environment variables
Control panel
Open
environment

On the **System Properties** window, press **Environment Variables** button.



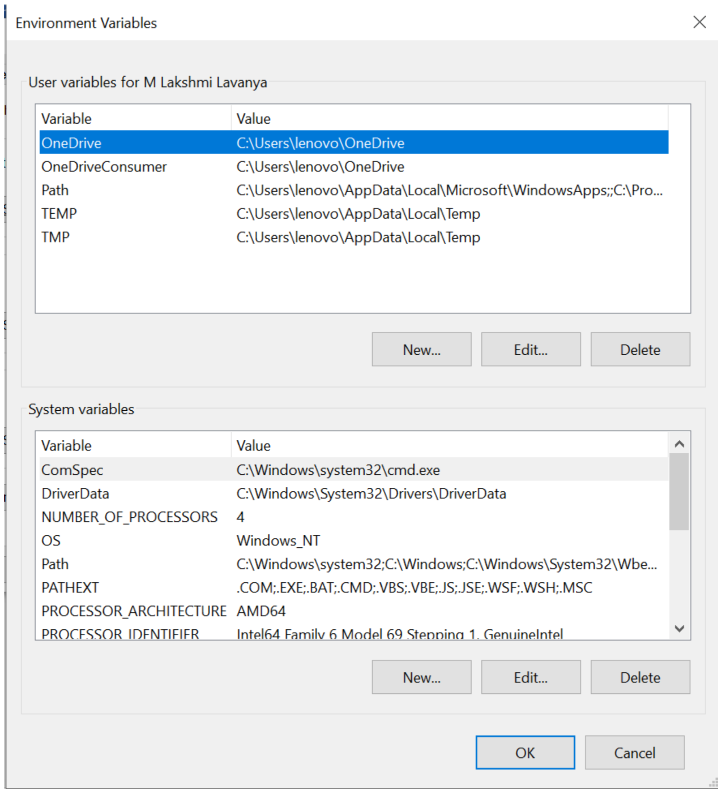
You must be logged on as an Administrator to make most of these changes.

Visual effects, processor scheduling, memory usage, and virtual memory

Desktop settings related to your sign-in

System startup, system failure, and debugging information

In the **Environment Variables** dialog, click on **New** under **User variables** section.


Environment Variables

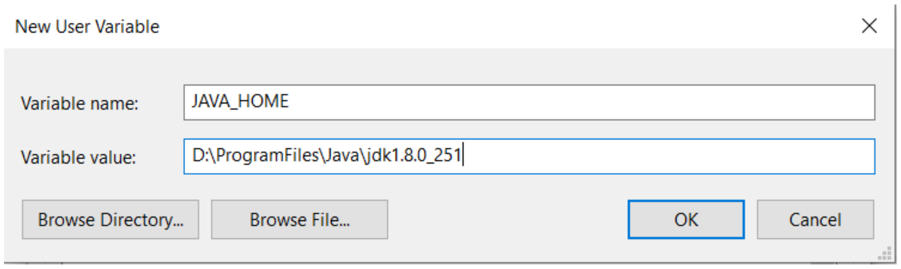
User variables for M Lakshmi Lavanya

Variable	Value
OneDrive	C:\Users\lenovo\OneDrive
OneDriveConsumer	C:\Users\lenovo\OneDrive
Path	C:\Users\lenovo\AppData\Local\Microsoft\WindowsApps;;C:\Pro...
TEMP	C:\Users\lenovo\AppData\Local\Temp
TMP	C:\Users\lenovo\AppData\Local\Temp

System variables

Variable	Value
ComSpec	C:\Windows\system32\cmd.exe
DriverData	C:\Windows\System32\Drivers\DriverData
NUMBER_OF_PROCESSORS	4
OS	Windows_NT
Path	C:\Windows\system32;C:\Windows;C:\Windows\System32\Wbe...
PATHEXT	.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH;.MSC
PROCESSOR_ARCHITECTURE	AMD64
PROCESSOR_IDENTIFIER	Intel64 Family 6 Model 69 Stepping 1, GenuineIntel

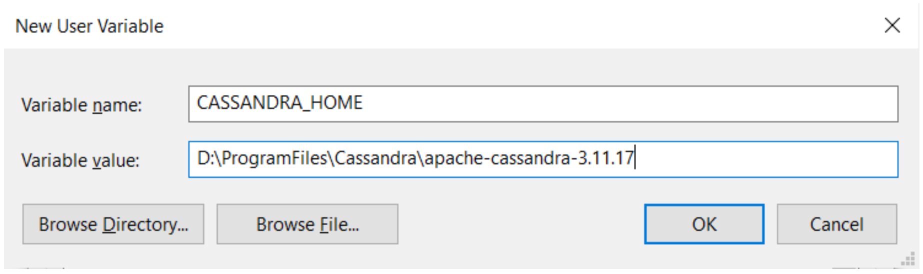
Add `JAVA_HOME` variable and press OK.


New User Variable

Variable name: JAVA_HOME

Variable value: D:\ProgramFiles\Java\jdk1.8.0_251

Click on **New** again and add `CASSANDRA_HOME` variable and press OK.

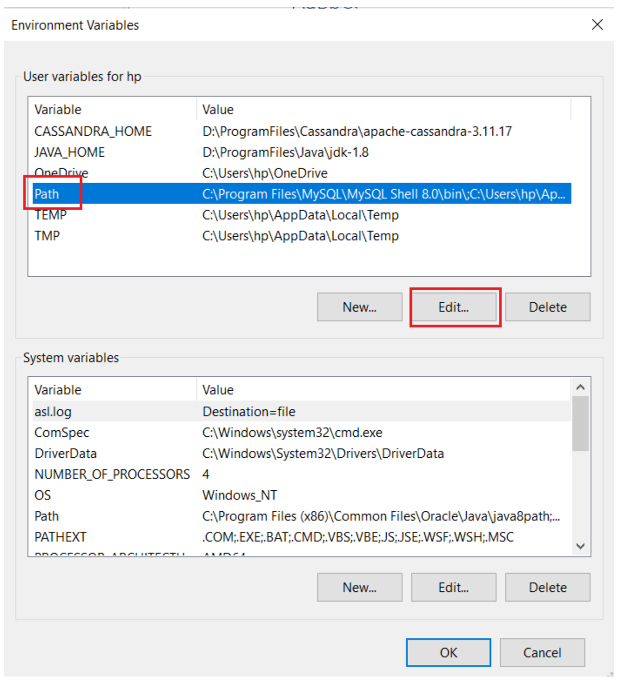

New User Variable

Variable name: CASSANDRA_HOME

Variable value: D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17

Now, we will update `PATH` variable to add Java, and Cassandra binary paths.

Select `PATH` variable under **User Variables** and press **Edit** button.

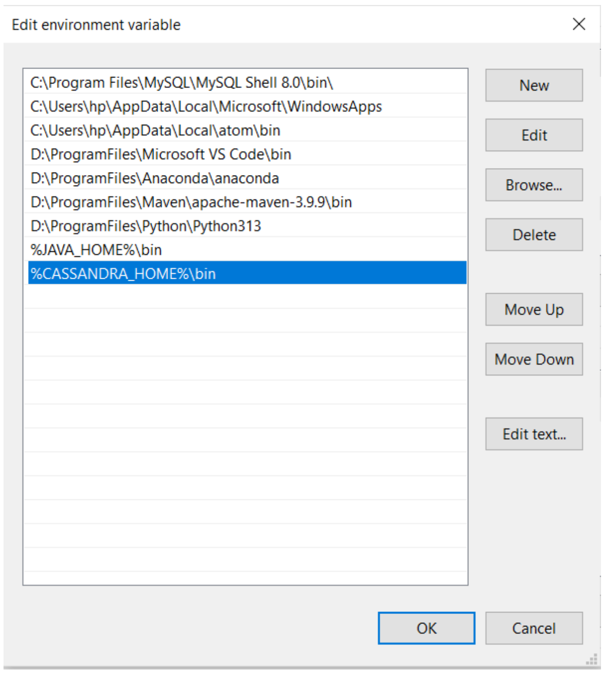


Variable	Value
CASSANDRA_HOME	D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17
JAVA_HOME	D:\ProgramFiles\Java\jdk-1.8
OneDrive	C:\Users\hp\OneDrive
Path	C:\Program Files\MySQL\MySQL Shell 8.0\bin\;C:\Users\hp\Ap...
TEMP	C:\Users\hp\AppData\Local\Temp
TMP	C:\Users\hp\AppData\Local\Temp

Variable	Value
asl.log	Destination=file
ComSpec	C:\Windows\system32\cmd.exe
DriverData	C:\Windows\System32\Drivers\DriverData
NUMBER_OF_PROCESSORS	4
OS	Windows_NT
Path	C:\Program Files (x86)\Common Files\Oracle\Java\java8path;...
PATHEXT	.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH;.MSC

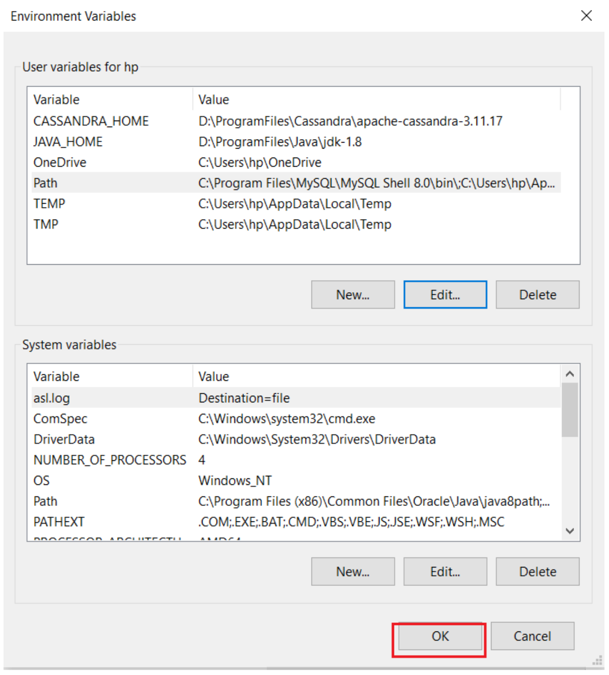
Press **New** and add the following values and press OK.

```
%JAVA_HOME%\bin
%CASSANDRA_HOME%\bin
```



```
C:\Program Files\MySQL\MySQL Shell 8.0\bin\
C:\Users\hp\AppData\Local\Microsoft\WindowsApps
C:\Users\hp\AppData\Local\atom\bin
D:\ProgramFiles\Microsoft VS Code\bin
D:\ProgramFiles\Anaconda\anaconda
D:\ProgramFiles\Maven\apache-maven-3.9.9\bin
D:\ProgramFiles\Python\Python313
%JAVA_HOME%\bin
%CASSANDRA_HOME%\bin
```

Press OK again to apply environment variable changes and close window.



User variables for hp

Variable	Value
CASSANDRA_HOME	D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17
JAVA_HOME	D:\ProgramFiles\Java\jdk-1.8
OneDrive	C:\Users\hp\OneDrive
Path	C:\Program Files\MySQL\MySQL Shell 8.0\bin\;C:\Users\hp\Ap...
TEMP	C:\Users\hp\AppData\Local\Temp
TMP	C:\Users\hp\AppData\Local\Temp

System variables

Variable	Value
asl.log	Destination=file
ComSpec	C:\Windows\system32\cmd.exe
DriverData	C:\Windows\System32\Drivers\DriverData
NUMBER_OF_PROCESSORS	4
OS	Windows_NT
Path	C:\Program Files (x86)\Common Files\Oracle\Java\java8path;...
PATHEXT	.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH;.MSC

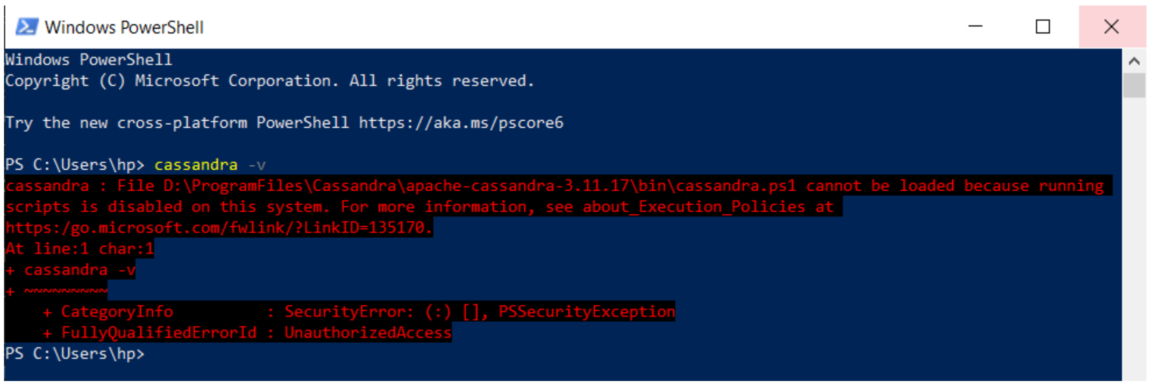
3.3. Verify Cassandra Installation:

Open **Windows PowerShell** and run the following command to verify if Cassandra is installed properly: *(you cannot do this from **Command Prompt** and must use **Windows PowerShell**)*

```
cassandra -v
```

Note:

While executing the above script, you may encounter an error *cassandra : File D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin\cassandra.ps1 cannot be loaded because running scripts is disabled on this system*, as shown below. This error occurs when you do not have permissions to execute the PowerShell script.



```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\hp> cassandra -v
cassandra : File D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin\cassandra.ps1 cannot be loaded because running
scripts is disabled on this system. For more information, see about_Execution_Policies at
https:/go.microsoft.com/fwlink/?LinkID=135170.
At line:1 char:1
+ cassandra -v
+ ~~~~~~~~~
    + CategoryInfo          : SecurityError: (:) [], PSSecurityException
    + FullyQualifiedErrorId : UnauthorizedAccess
PS C:\Users\hp>
```
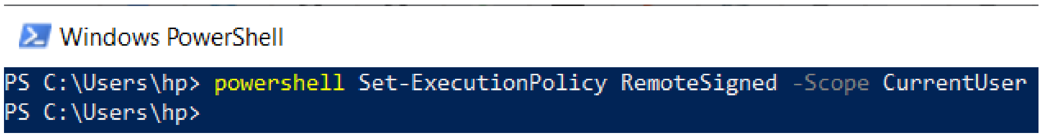

To resolve the above error, run the below command to set the execution policy to 'Remotesigned' for the current user.

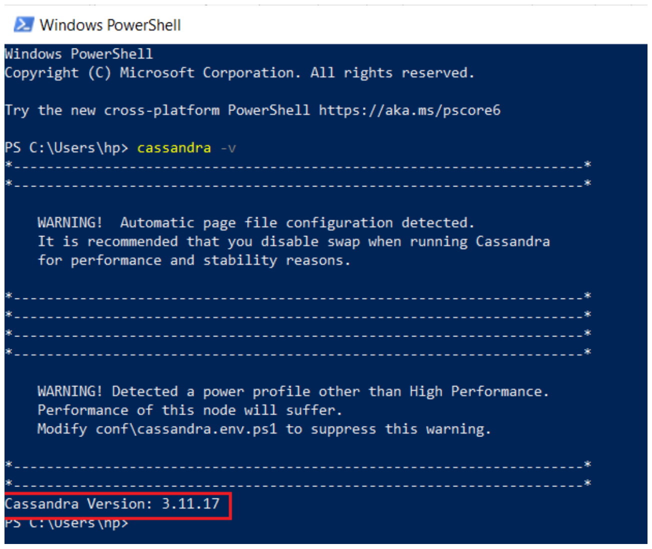
```
powershell Set-ExecutionPolicy RemoteSigned -Scope CurrentUser
```


Windows PowerShell

```
PS C:\Users\hp> powershell Set-ExecutionPolicy RemoteSigned -Scope CurrentUser
PS C:\Users\hp>
```

Now, you should be able to verify the Cassandra version installed by running this command

```
cassandra -v
```


Windows PowerShell

```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\hp> cassandra -v
*---------------------------------------------------------------------*
*---------------------------------------------------------------------*

    WARNING!  Automatic page file configuration detected.
    It is recommended that you disable swap when running Cassandra
    for performance and stability reasons.

*---------------------------------------------------------------------*
*---------------------------------------------------------------------*
*---------------------------------------------------------------------*
*---------------------------------------------------------------------*

    WARNING! Detected a power profile other than High Performance.
    Performance of this node will suffer.
    Modify conf\cassandra.env.ps1 to suppress this warning.

*---------------------------------------------------------------------*
*---------------------------------------------------------------------*
Cassandra Version: 3.11.17
PS C:\Users\hp>
```
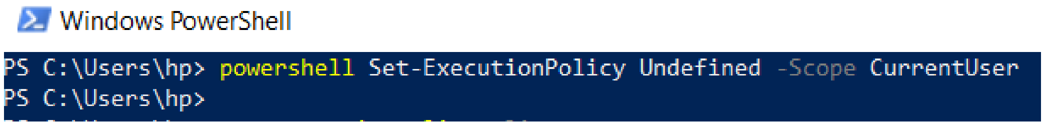

Here, it shows **3.11.17** version which indicates that Cassandra has been installed successfully.

Note:
It is necessary to have PowerShell execution policy set to either 'RemoteSigned' or 'Unrestricted' to be able to run Cassandra commands from **Windows PowerShell** prompt in Windows system. Going forward, we will execute Cassandra commands from **Command Prompt** itself and so let us revert the execution policy that we have set earlier by executing the below command in Windows PowerShell.

```
powershell Set-ExecutionPolicy Undefined -Scope CurrentUser
```


Windows PowerShell

```
PS C:\Users\hp> powershell Set-ExecutionPolicy Undefined -Scope CurrentUser
PS C:\Users\hp>
```

4. Configure Cassandra:

When Cassandra is used on a single node, there is no need to make any changes to the default configuration but if you would like to setup a Cassandra cluster with multiple nodes, it is important to know the configuration details.

The key configuration files used in Cassandra are available under `%CASSANDRA_HOME%\conf` folder.

1. **cassandra.yml** – It is the primary config file for each node instance to configure the cluster name, IP address, directory paths, etc.
2. **cassandra-env.sh** – Environment file to set java environment settings such as MAX_HEAP_SIZE.
3. **Cassandra-rackdc.properties** – Config file used to set the rack and data center to which the node belongs to.
4. **Cassandra-topology.properties** – Config file used to specify the IP address for racks and data centers in the cluster.

Though we are using Cassandra with single node, let us see how some configuration changes can be made for cluster setup.

Open `cassandra.yml` from `%CASSANDRA_HOME%\conf` directory and set the following properties:

- `cluster_name`: Name of the cluster. By default, it is set to `Test Cluster`. You can change it to the desired name, for instance, `CassandraDBCluster`. Make sure that all nodes in the cluster use the same `cluster_name`.
- `num_tokens`: Number of tokens. By default, this is set to 256. Any value greater than 1 is treated as virtual node so that token distribution will happen automatically.
- `listen_address`: IP address or hostname of the current node to be used by other nodes to connect to this node. By default, it is set to `localhost` but you can change it to the internal IP address of the node.
- `rpc_address`: Internal IP address for thrift client connections. By default, it is set to `localhost` but you can change it to the internal IP address of the node.
- `seed_provider`: List of internal IP addresses of hosts that are deemed contact points. In the config file of every node, we should specify the IP address of seed nodes. By default, it is set to `"127.0.0.1"` and should be updated with internal IP addresses of all hosts in the cluster.
- `endpoint_snitch`: It gives some information about network topology so that Cassandra can efficiently route requests. By default, it is set to `SimpleSnatch` class which is appropriate for cluster setup with single datacenter. For multi-data center

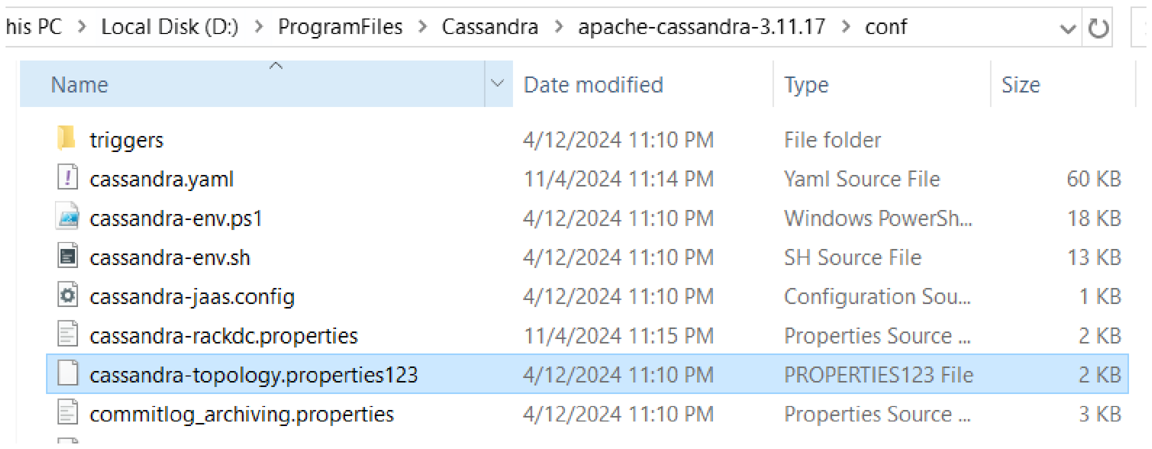
deployments, it is recommended to use `GossipingPropertyFileSnitch` with which rack and datacenter for the local node are specified in `Cassandra-rackdc.properties` and propagated to other nodes via gossip. Cassandra supports other types of snitches such as `PropertyFileSnitch`, `Ec2Snitch`, `Ec2MultiRegionSnitch`, `RackInferringSnitch`, etc.

- `auto_bootstrap`: This configuration is not available in the file and can be added and set to `false`. This configuration is optional if nodes are added to existing cluster but required when creating a new cluster with no data.

Locate the above settings in `cassandra.yml` file and modify as below:

```
cluster_name: 'CassandraDBCluster'
listen_address: 127.0.0.1
rpc_address: 127.0.0.1
seed_provider:
  - class_name: org.apache.cassandra.locator.SimpleSeedProvider
    parameters:
         - seeds: "127.0.0.1"
endpoint_snitch: GossipingPropertyFileSnitch
auto_bootstrap: false
```

When the `endpoint_snitch` is set to `GossipingPropertyFileSnitch` in `cassandra.yaml` file, it always loads `cassandra-topology.properties` file if present and so, it is recommended to remove or rename this file in `%CASSANDRA_HOME%\conf` directory on all nodes.



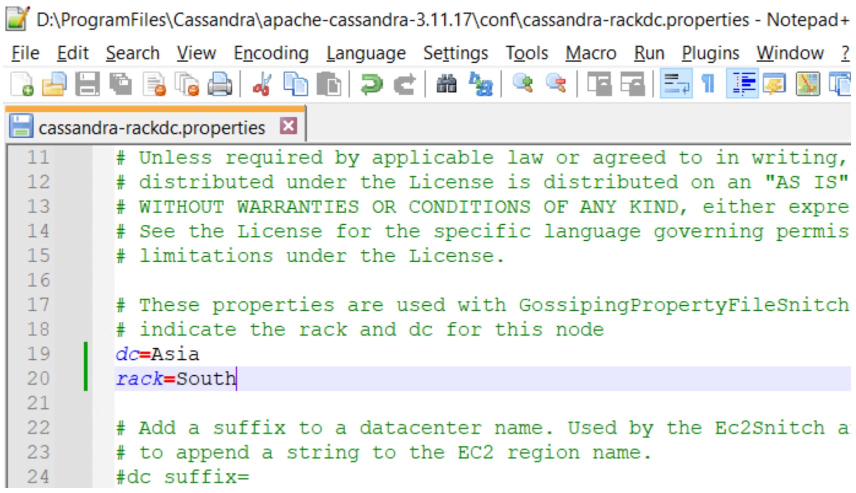
his PC > Local Disk (D:) > ProgramFiles > Cassandra > apache-cassandra-3.11.17 > conf

Name	Date modified	Type	Size
triggers	4/12/2024 11:10 PM	File folder	
cassandra.yaml	11/4/2024 11:14 PM	Yaml Source File	60 KB
cassandra-env.ps1	4/12/2024 11:10 PM	Windows PowerSh...	18 KB
cassandra-env.sh	4/12/2024 11:10 PM	SH Source File	13 KB
cassandra-jaas.config	4/12/2024 11:10 PM	Configuration Sou...	1 KB
cassandra-rackdc.properties	11/4/2024 11:15 PM	Properties Source ...	2 KB
cassandra-topology.properties123	4/12/2024 11:10 PM	PROPERTIES123 File	2 KB
commitlog_archiving.properties	4/12/2024 11:10 PM	Properties Source ...	3 KB

Now, we can assign a datacenter and a rack name of the current node in `%CASSANDRA_HOME%\conf\cassandra-rackdc.properties` file. By default, `dc` is set to `dc1` and `rack` is set to `rack1`. Change these settings if you want to put the node on a different rack in a different datacenter.

In `cassandra-rackdc.properties` file, modify as below:

```
dc=Asia
rack=South
```


D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\conf\cassandra-rackdc.properties - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
cassandra-rackdc.properties

```
# Unless required by applicable law or agreed to in writing,
# distributed under the License is distributed on an "AS IS"
# WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either expre
# See the License for the specific language governing permis
# limitations under the License.

# These properties are used with GossipingPropertyFileSnitch
# indicate the rack and dc for this node
dc=Asia
rack=South

# Add a suffix to a datacenter name. Used by the Ec2Snitch a
# to append a string to the EC2 region name.
#dc_suffix=
```

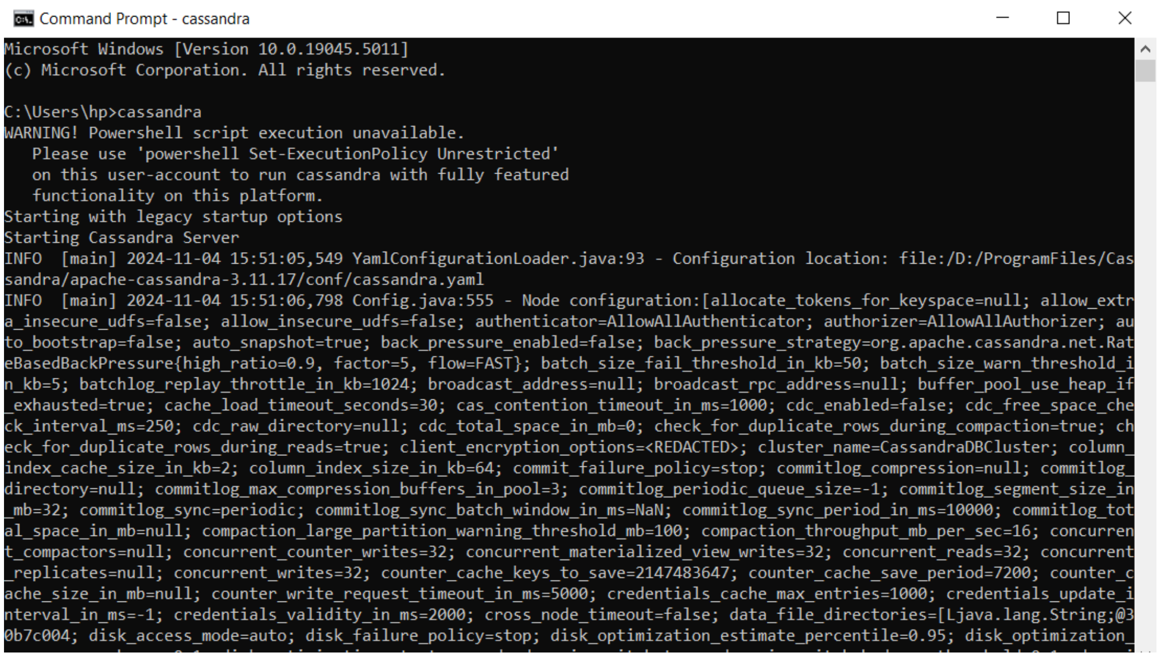
5. Start Cassandra:

It is time to start the Cassandra service and test the connection.

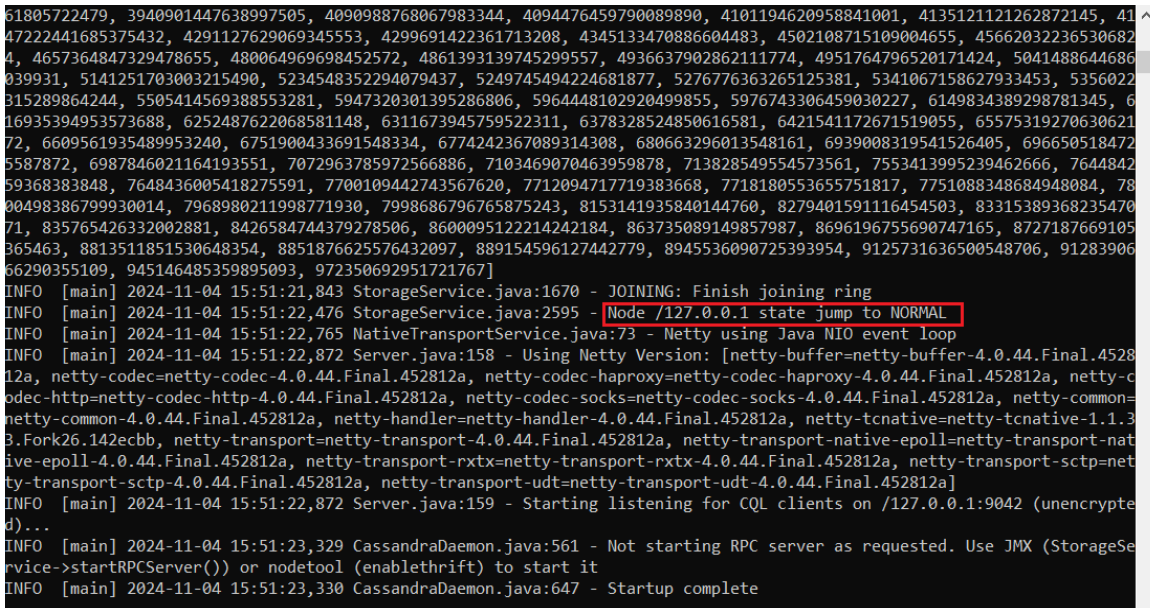
5.1. Start Cassandra Service:

Open **Command Prompt** and start Cassandra service using the below command:

```
cassandra
```



```
Microsoft Windows [Version 10.0.19045.5011]
(c) Microsoft Corporation. All rights reserved.

C:\Users\hp>cassandra
WARNING! Powershell script execution unavailable.
   Please use 'powershell Set-ExecutionPolicy Unrestricted'
   on this user-account to run cassandra with fully featured
   functionality on this platform.
Starting with legacy startup options
Starting Cassandra Server
INFO  [main] 2024-11-04 15:51:05,549 YamlConfigurationLoader.java:93 - Configuration location: file:/D:/ProgramFiles/Cas
sandra/apache-cassandra-3.11.17/conf/cassandra.yaml
INFO  [main] 2024-11-04 15:51:06,798 Config.java:555 - Node configuration:[allocate_tokens_for_keyspace=null; allow_extr
a_insecure_udfs=false; allow_insecure_udfs=false; authenticator=AllowAllAuthenticator; authorizer=AllowAllAuthorizer; au
to_bootstrap=false; auto_snapshot=true; back_pressure_enabled=false; back_pressure_strategy=org.apache.cassandra.net.Rat
eBasedBackPressure{high_ratio=0.9, factor=5, flow=FAST}; batch_size_fail_threshold_in_kb=50; batch_size_warn_threshold_i
n_kb=5; batchlog_replay_throttle_in_kb=1024; broadcast_address=null; broadcast_rpc_address=null; buffer_pool_use_heap_if
_exhausted=true; cache_load_timeout_seconds=30; cas_contention_timeout_in_ms=1000; cdc_enabled=false; cdc_free_space_che
ck_interval_ms=250; cdc_raw_directory=null; cdc_total_space_in_mb=0; check_for_duplicate_rows_during_compaction=true; ch
eck_for_duplicate_rows_during_reads=true; client_encryption_options=<REDACTED>; cluster_name=CassandraDBCluster; column_
index_cache_size_in_kb=2; column_index_size_in_kb=64; commit_failure_policy=stop; commitlog_compression=null; commitlog_
directory=null; commitlog_max_compression_buffers_in_pool=3; commitlog_periodic_queue_size=-1; commitlog_segment_size_in
_mb=32; commitlog_sync=periodic; commitlog_sync_batch_window_in_ms=NaN; commitlog_sync_period_in_ms=10000; commitlog_tot
al_space_in_mb=null; compaction_large_partition_warning_threshold_mb=100; compaction_throughput_mb_per_sec=16; concurren
t_compactors=null; concurrent_counter_writes=32; concurrent_materialized_view_writes=32; concurrent_reads=32; concurrent
_replicates=null; concurrent_writes=32; counter_cache_keys_to_save=2147483647; counter_cache_save_period=7200; counter_c
ache_size_in_mb=null; counter_write_request_timeout_in_ms=5000; credentials_cache_max_entries=1000; credentials_update_i
nterval_in_ms=-1; credentials_validity_in_ms=2000; cross_node_timeout=false; data_file_directories=[Ljava.lang.String;@3
0b7c004; disk_access_mode=auto; disk_failure_policy=stop; disk_optimization_estimate_percentile=0.95; disk_optimization_
```



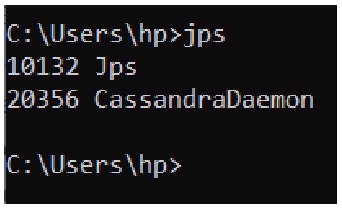
```
61805722479, 3940901447638997505, 4090988768067983344, 4094476459790089890, 4101194620958841001, 4135121121262872145, 41
47222441685375432, 4291127629069345553, 4299691422361713208, 4345133470886604483, 4502108715109004655, 45662032236530682
4, 4657364847329478655, 4800649696984525 72, 4861393139745299557, 4936637902862111774, 4951764796520171424, 5041488644686
039931, 5141251703003215490, 5234548352294079437, 5249745494224681877, 5276776363265125381, 5341067158627933453, 5356022
315289864244, 5505414569388553281, 5947320301395286806, 5964448102920499855, 5976743306459030227, 6149834389298781345, 6
16935394953573688, 6252487622068581148, 6311673945759522311, 6378328524850616581, 6421541172671519055, 65575319270630621
72, 6609561935489953240, 6751900433691548334, 6774242367089314308, 6806632960135481 61, 6939008319541526405, 696650518472
5587872, 6987846021164193551, 7072963785972566886, 7103469070463959878, 7138285495545735 61, 7553413995239462666, 7644842
59368383848, 7648436005418275591, 7700109442743567620, 7712094717719383668, 7718180553655751817, 7751088348684948084, 78
00498386799930014, 7968980211998771930, 7998686796765875243, 8153141935840144760, 8279401591116454503, 83315389368235470
71, 8357654263320028 81, 8426584744379278506, 8600095122214242184, 8637350891498579 87, 8696196755690747165, 8727187669105
365463, 8813511851530648354, 8851876625576432097, 8891545961274427 79, 8945536090725393954, 9125731636500548706, 91283906
66290355109, 9451464853598950 93, 9723506929517217 67]
INFO  [main] 2024-11-04 15:51:21,843 StorageService.java:1670 - JOINING: Finish joining ring
INFO  [main] 2024-11-04 15:51:22,476 StorageService.java:2595 - Node /127.0.0.1 state jump to NORMAL
INFO  [main] 2024-11-04 15:51:22,765 NativeTransportService.java:73 - Netty using Java NIO event loop
INFO  [main] 2024-11-04 15:51:22,872 Server.java:158 - Using Netty Version: [netty-buffer=netty-buffer-4.0.44.Final.4528
12a, netty-codec=netty-codec-4.0.44.Final.452812a, netty-codec-haproxy=netty-codec-haproxy-4.0.44.Final.452812a, netty-c
odec-http=netty-codec-http-4.0.44.Final.452812a, netty-codec-socks=netty-codec-socks-4.0.44.Final.452812a, netty-common=
netty-common-4.0.44.Final.452812a, netty-handler=netty-handler-4.0.44.Final.452812a, netty-tcnative=netty-tcnative-1.1.3
3.Fork26.142ecbb, netty-transport=netty-transport-4.0.44.Final.452812a, netty-transport-native-epoll=netty-transport-nat
ive-epoll-4.0.44.Final.452812a, netty-transport-rxtx=netty-transport-rxtx-4.0.44.Final.452812a, netty-transport-sctp=net
ty-transport-sctp-4.0.44.Final.452812a, netty-transport-udt=netty-transport-udt-4.0.44.Final.452812a]
INFO  [main] 2024-11-04 15:51:22,872 Server.java:159 - Starting listening for CQL clients on /127.0.0.1:9042 (unencrypte
d)...
INFO  [main] 2024-11-04 15:51:23,329 CassandraDaemon.java:561 - Not starting RPC server as requested. Use JMX (StorageSe
rvice->startRPCServer()) or nodetool (enablethrift) to start it
INFO  [main] 2024-11-04 15:51:23,330 CassandraDaemon.java:647 - Startup complete
```

On the console, you will see a message “**Node /127.0.0.1 state jump to NORMAL**” which indicates that the Cassandra instance has started and is up and running. Do not close this command prompt window.

We can also use the `jps` command to verify Cassandra service:

```
jps
```

It should display **CassandraDaemon** which denotes that **Cassandra** service is running.

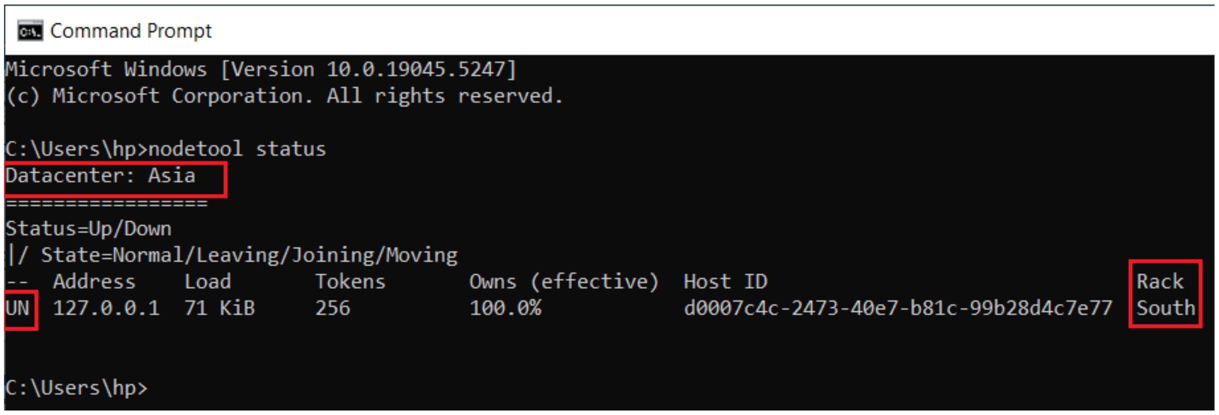


```
C:\Users\hp>jps
10132 Jps
20356 CassandraDaemon

C:\Users\hp>
```

5.2. Verify Node Status:

Now, let us check the status of current node using `nodetool` utility with the following command:

```
nodetool status
```

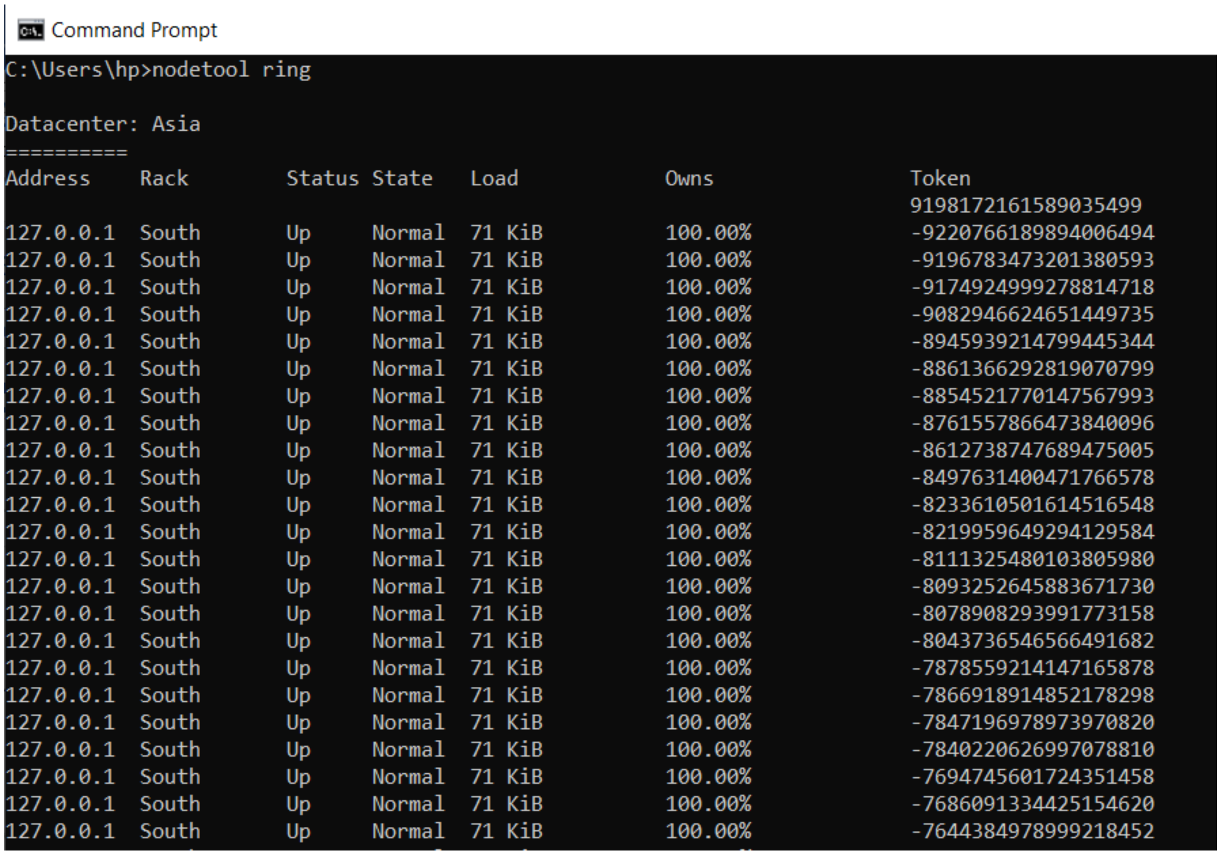


```
Command Prompt
Microsoft Windows [Version 10.0.19045.5247]
(c) Microsoft Corporation. All rights reserved.

C:\Users\hp>nodetool status
Datacenter: Asia
================
Status=Up/Down
|/ State=Normal/Leaving/Joining/Moving
--  Address    Load       Tokens       Owns (effective)  Host ID                               Rack
UN  127.0.0.1  71 KiB     256          100.0%            d0007c4c-2473-40e7-b81c-99b28d4c7e77  South


C:\Users\hp>
```

Here, you can see the process status, listening address, tokens, host ID, data center and rack name of the current node.

Check the token distribution of the node using the following command

```
nodetool ring
```



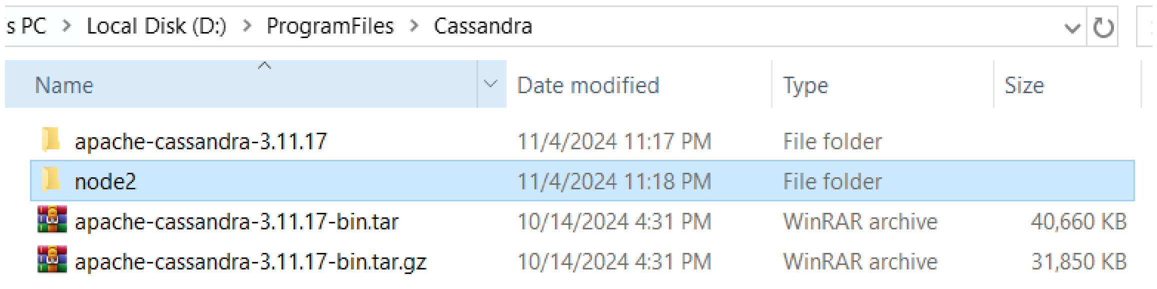
```
Command Prompt
C:\Users\hp>nodetool ring

Datacenter: Asia
==========
Address    Rack        Status State   Load            Owns                Token
                                                                          9198172161589035499
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -9220766189894006494
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -9196783473201380593
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -9174924999278814718
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -9082946624651449735
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -8945939214799445344
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -8861366292819070799
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -8854521770147567993
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -8761557866473840096
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -8612738747689475005
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -8497631400471766578
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -8233610501614516548
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -8219959649294129584
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -8111325480103805980
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -8093252645883671730
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -8078908293991773158
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -8043736546566491682
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -7878559214147165878
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -7866918914852178298
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -7847196978973970820
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -7840220626997078810
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -7694745601724351458
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -7686091334425154620
127.0.0.1  South       Up     Normal  71 KiB          100.00%             -7644384978999218452
```

6. Configure Multi-Node Cluster:

For the purpose of this documentation, we will create a second Cassandra node in the same system with a different address but in the real-time project, we should configure one node per system in a Cassandra cluster.

6.1. Extract Cassandra Binaries:

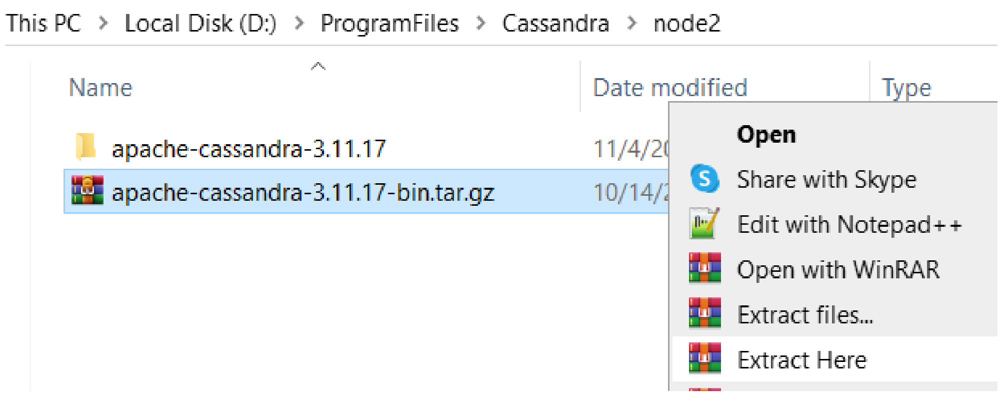
To set up a new Cassandra node, create a new folder where a new instance of Cassandra can be installed. In my case, I created `node2` folder under `D:\ProgramFiles\Cassandra` location.



s PC > Local Disk (D:) > ProgramFiles > Cassandra

Name	Date modified	Type	Size
apache-cassandra-3.11.17	11/4/2024 11:17 PM	File folder	
node2	11/4/2024 11:18 PM	File folder	
apache-cassandra-3.11.17-bin.tar	10/14/2024 4:31 PM	WinRAR archive	40,660 KB
apache-cassandra-3.11.17-bin.tar.gz	10/14/2024 4:31 PM	WinRAR archive	31,850 KB

Copy the Cassandra binary file `apache-cassandra-3.11.17-bin.tar.gz` to the new folder and extract contents of it.



This PC > Local Disk (D:) > ProgramFiles > Cassandra > node2

Name	Date modified	Type
apache-cassandra-3.11.17	11/4/20	
apache-cassandra-3.11.17-bin.tar.gz	10/14/	

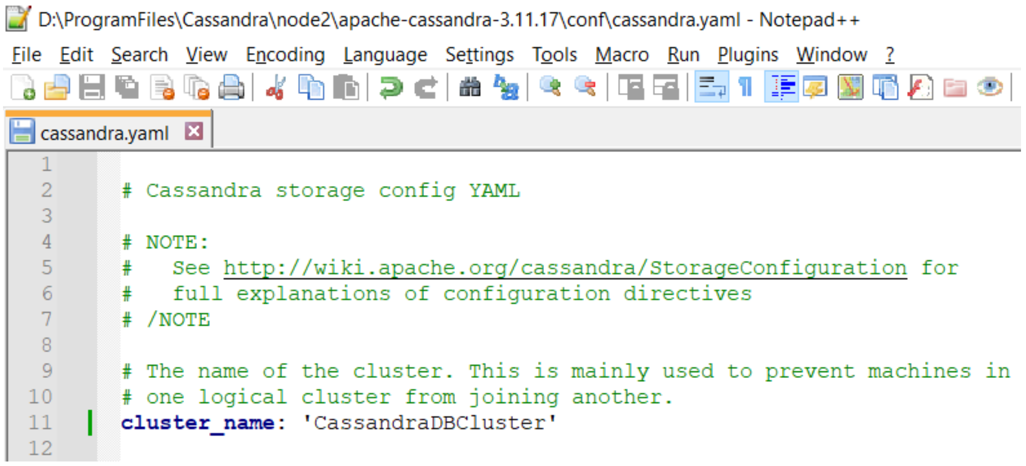
6.2. Modify Configuration Files:

We should update the following files in the new Cassandra install location to configure the second node.

```
cassandra.yaml
cassandra-rackdc.properties
cassandra-env.sh
```

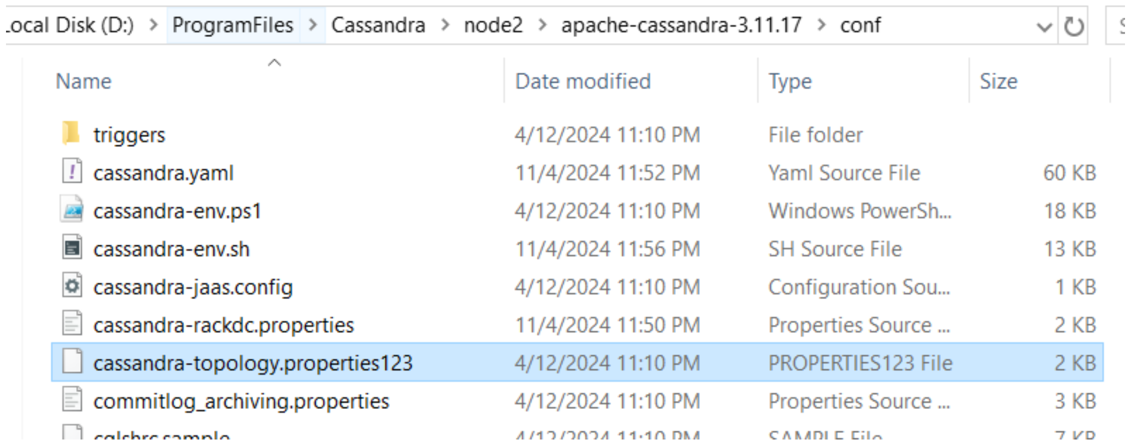
Go to `D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\conf` and edit `cassandra.yaml` file with the following settings:

```
cluster_name: 'CassandraDBCluster'
listen_address: 127.0.0.2
rpc_address: 127.0.0.2
seed_provider:
  - class_name: org.apache.cassandra.locator.SimpleSeedProvider
    parameters:
         - seeds: "127.0.0.1,127.0.0.2"
endpoint_snitch: GossipingPropertyFileSnitch
```


D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\conf\cassandra.yaml - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
cassandra.yaml

```

# Cassandra storage config YAML

# NOTE:
#   See http://wiki.apache.org/cassandra/StorageConfiguration for
#   full explanations of configuration directives
# /NOTE

# The name of the cluster. This is mainly used to prevent machines in
# one logical cluster from joining another.
cluster_name: 'CassandraDBCluster'

```

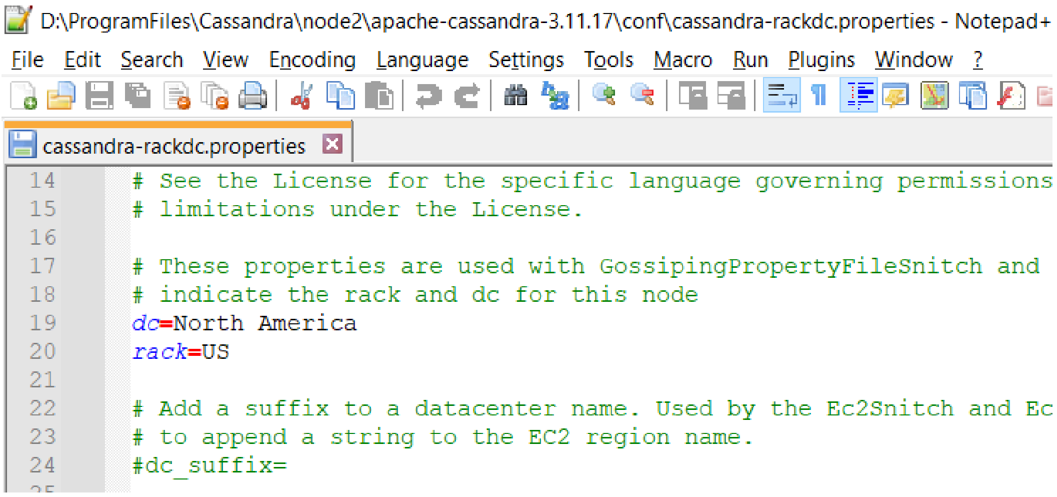
When the `endpoint_snitch` is set to `GossipingPropertyFileSnitch` in `cassandra.yaml` file, it always loads `cassandra-topology.properties` file if present and so, it is recommended to remove or rename this file.


Local Disk (D:) > ProgramFiles > Cassandra > node2 > apache-cassandra-3.11.17 > conf

Name	Date modified	Type	Size
triggers	4/12/2024 11:10 PM	File folder	
cassandra.yaml	11/4/2024 11:52 PM	Yaml Source File	60 KB
cassandra-env.ps1	4/12/2024 11:10 PM	Windows PowerSh...	18 KB
cassandra-env.sh	11/4/2024 11:56 PM	SH Source File	13 KB
cassandra-jaas.config	4/12/2024 11:10 PM	Configuration Sou...	1 KB
cassandra-rackdc.properties	11/4/2024 11:50 PM	Properties Source ...	2 KB
cassandra-topology.properties123	4/12/2024 11:10 PM	PROPERTIES123 File	2 KB
commitlog_archiving.properties	4/12/2024 11:10 PM	Properties Source ...	3 KB

Now, open `cassandra-rackdc.properties` file and change the data center and rack name as below. Note that we are putting this new node altogether in a different data center compared to the existing node which is on `Asia` DC.

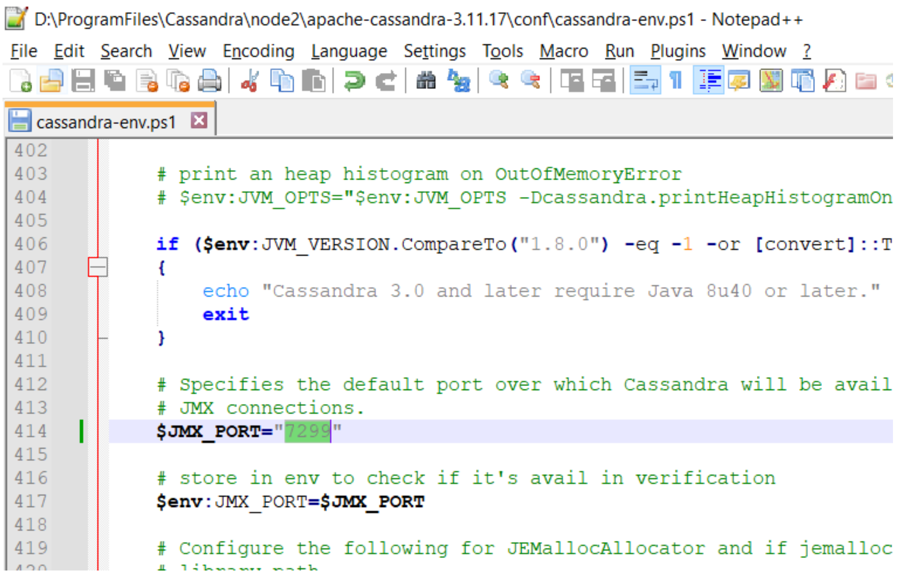
```
dc=North America
rack=US
```


D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\conf\cassandra-rackdc.properties - Notepad+
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
cassandra-rackdc.properties

```
# See the License for the specific language governing permissions
# limitations under the License.

# These properties are used with GossipingPropertyFileSnitch and
# indicate the rack and dc for this node
dc=North America
rack=US

# Add a suffix to a datacenter name. Used by the Ec2Snitch and Ec
# to append a string to the EC2 region name.
#dc_suffix=
```

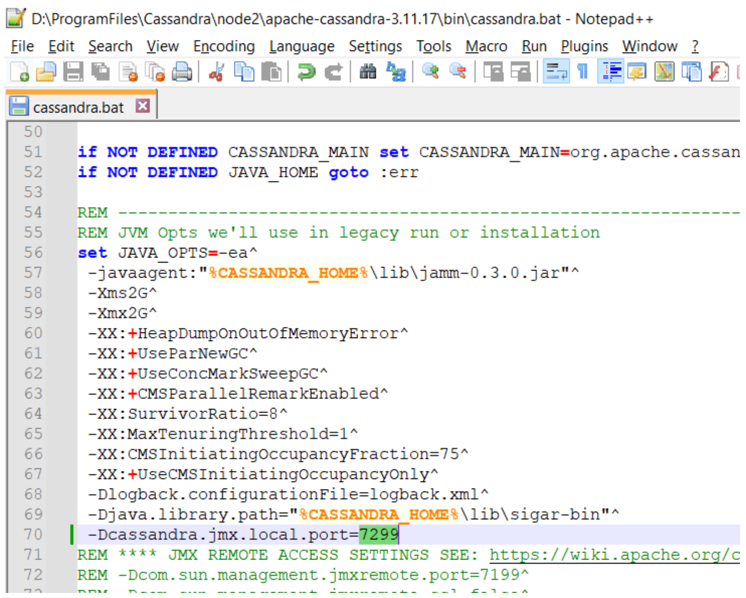
Additionally, it is required to change JMX port number in `cassandra-env.ps1` and `cassandra.bat` files.

Open `cassandra-env.ps1` in `D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\conf` location and update `JMX_PORT` value from `7199` to `7299`.


D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\conf\cassandra-env.ps1 - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
cassandra-env.ps1

```

    # print an heap histogram on OutOfMemoryError
    # $env:JVM_OPTS="$env:JVM_OPTS -Dcassandra.printHeapHistogramOn

    if ($env:JVM_VERSION.CompareTo("1.8.0") -eq -1 -or [convert]::T
    {
        echo "Cassandra 3.0 and later require Java 8u40 or later."
        exit
    }

    # Specifies the default port over which Cassandra will be avail
    # JMX connections.
    $JMX_PORT="7299"

    # store in env to check if it's avail in verification
    $env:JMX_PORT=$JMX_PORT

    # Configure the following for JEMallocAllocator and if jemalloc
```

Open `cassandra.bat` in `D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\bin` location and update `Dcassandra.jmx.local.port` value from `7199` to `7299`.


D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\bin\cassandra.bat - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
cassandra.bat

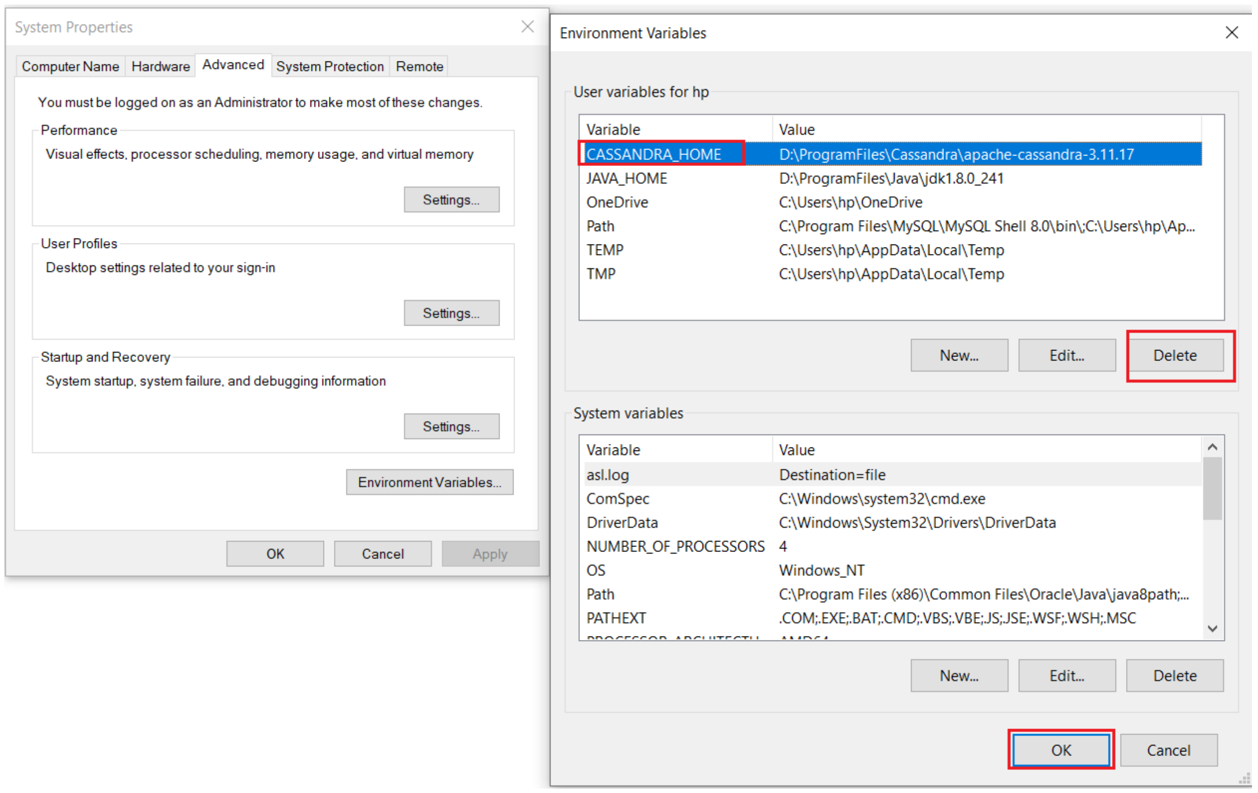
```
if NOT DEFINED CASSANDRA_MAIN set CASSANDRA_MAIN=org.apache.cassan
if NOT DEFINED JAVA_HOME goto :err

REM ---------------------------------------------------------------
REM JVM Opts we'll use in legacy run or installation
set JAVA_OPTS=-ea^
 -javaagent:"%CASSANDRA_HOME%\lib\jamm-0.3.0.jar"^
 -Xms2G^
 -Xmx2G^
 -XX:+HeapDumpOnOutOfMemoryError^
 -XX:+UseParNewGC^
 -XX:+UseConcMarkSweepGC^
 -XX:+CMSParallelRemarkEnabled^
 -XX:SurvivorRatio=8^
 -XX:MaxTenuringThreshold=1^
 -XX:CMSInitiatingOccupancyFraction=75^
 -XX:+UseCMSInitiatingOccupancyOnly^
 -Dlogback.configurationFile=logback.xml^
 -Djava.library.path="%CASSANDRA_HOME%\lib\sigar-bin"^
 -Dcassandra.jmx.local.port=7299
REM **** JMX REMOTE ACCESS SETTINGS SEE: https://wiki.apache.org/c
REM -Dcom.sun.management.jmxremote.port=7199^
```

6.3. Remove Environment Variable:

Whenever we try to start Cassandra, it always refers to the configuration defined in `CASSANDRA_HOME` environment variable and when this variable is not set, it tries to look for config files available in the current directory.

Since we are configuring the second node on the same machine, we should remove `CASSANDRA_HOME` environment variable that we set earlier.

Open **Environment Variables** window and select `CASSANDRA_HOME` under **User variables** section and click on **Delete** button. Then press OK to apply environment variable changes and close window.



You must be logged on as an Administrator to make most of these changes.

Visual effects, processor scheduling, memory usage, and virtual memory

Desktop settings related to your sign-in

System startup, system failure, and debugging information

User variables for hp

Variable	Value
CASSANDRA_HOME	D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17
JAVA_HOME	D:\ProgramFiles\Java\jdk1.8.0_241
OneDrive	C:\Users\hp\OneDrive
Path	C:\Program Files\MySQL\MySQL Shell 8.0\bin\;C:\Users\hp\Ap...
TEMP	C:\Users\hp\AppData\Local\Temp
TMP	C:\Users\hp\AppData\Local\Temp

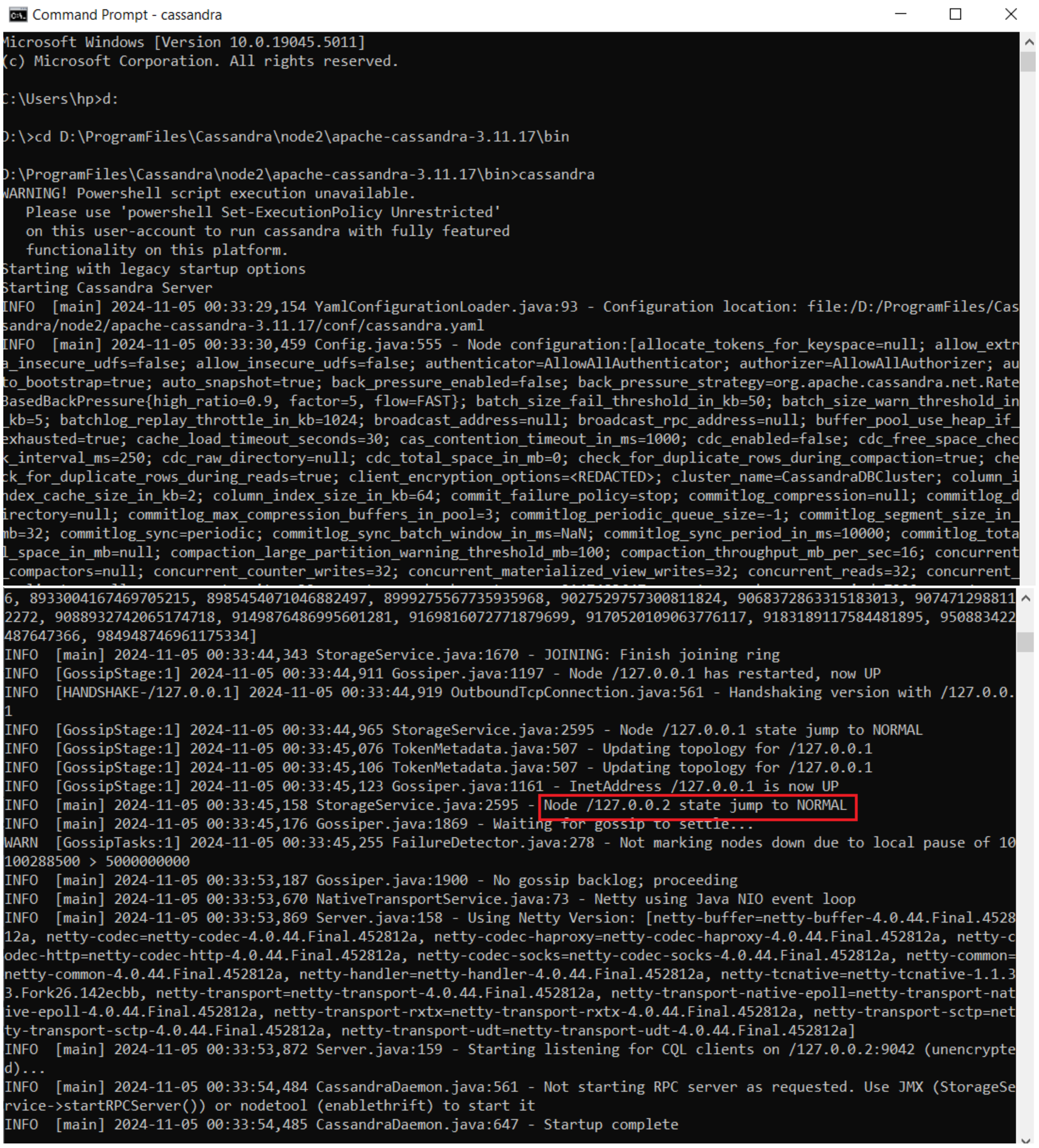
System variables

Variable	Value
asl.log	Destination=file
ComSpec	C:\Windows\system32\cmd.exe
DriverData	C:\Windows\System32\Drivers\DriverData
NUMBER_OF_PROCESSORS	4
OS	Windows_NT
Path	C:\Program Files (x86)\Common Files\Oracle\Java\java8path;...
PATHEXT	.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH;.MSC

6.4. Start Cassandra Service:

Open **Command Prompt** and start Cassandra service by navigating to the location where the second instance was installed:

```
D:
cd D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\bin
cassandra
```



```
icrosoft Windows [Version 10.0.19045.5011]
(c) Microsoft Corporation. All rights reserved.

:\Users\hp>d:

:\>cd D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\bin

:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\bin>cassandra
ARNING! Powershell script execution unavailable.
   Please use 'powershell Set-ExecutionPolicy Unrestricted'
   on this user-account to run cassandra with fully featured
   functionality on this platform.
tarting with legacy startup options
tarting Cassandra Server
INFO  [main] 2024-11-05 00:33:29,154 YamlConfigurationLoader.java:93 - Configuration location: file:/D:/ProgramFiles/Cas
sandra/node2/apache-cassandra-3.11.17/conf/cassandra.yaml
INFO  [main] 2024-11-05 00:33:30,459 Config.java:555 - Node configuration:[allocate_tokens_for_keyspace=null; allow_extr
a_insecure_udfs=false; allow_insecure_udfs=false; authenticator=AllowAllAuthenticator; authorizer=AllowAllAuthorizer; au
to_bootstrap=true; auto_snapshot=true; back_pressure_enabled=false; back_pressure_strategy=org.apache.cassandra.net.Rate
BasedBackPressure{high_ratio=0.9, factor=5, flow=FAST}; batch_size_fail_threshold_in_kb=50; batch_size_warn_threshold_in
_kb=5; batchlog_replay_throttle_in_kb=1024; broadcast_address=null; broadcast_rpc_address=null; buffer_pool_use_heap_if_
exhausted=true; cache_load_timeout_seconds=30; cas_contention_timeout_in_ms=1000; cdc_enabled=false; cdc_free_space_chec
k_interval_ms=250; cdc_raw_directory=null; cdc_total_space_in_mb=0; check_for_duplicate_rows_during_compaction=true; che
ck_for_duplicate_rows_during_reads=true; client_encryption_options=<REDACTED>; cluster_name=CassandraDBCluster; column_i
ndex_cache_size_in_kb=2; column_index_size_in_kb=64; commit_failure_policy=stop; commitlog_compression=null; commitlog_d
irectory=null; commitlog_max_compression_buffers_in_pool=3; commitlog_periodic_queue_size=-1; commitlog_segment_size_in_
mb=32; commitlog_sync=periodic; commitlog_sync_batch_window_in_ms=NaN; commitlog_sync_period_in_ms=10000; commitlog_tota
l_space_in_mb=null; compaction_large_partition_warning_threshold_mb=100; compaction_throughput_mb_per_sec=16; concurrent
_compactors=null; concurrent_counter_writes=32; concurrent_materialized_view_writes=32; concurrent_reads=32; concurrent_
```

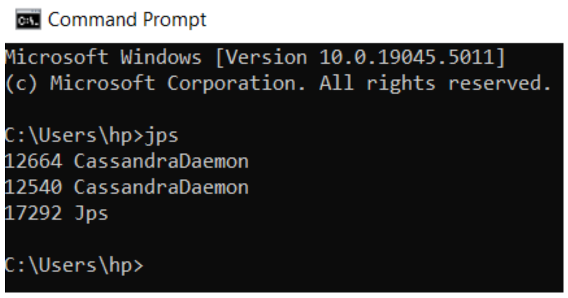
```
6, 8933004167469705215, 8985454071046882497, 8999275567735935968, 9027529757300811824, 9068372863315183013, 907471298811
2272, 9088932742065174718, 9149876486995601281, 9169816072771879699, 9170520109063776117, 9183189117584481895, 950883422
487647366, 9849487469611175334]
INFO  [main] 2024-11-05 00:33:44,343 StorageService.java:1670 - JOINING: Finish joining ring
INFO  [GossipStage:1] 2024-11-05 00:33:44,911 Gossiper.java:1197 - Node /127.0.0.1 has restarted, now UP
INFO  [HANDSHAKE-/127.0.0.1] 2024-11-05 00:33:44,919 OutboundTcpConnection.java:561 - Handshaking version with /127.0.0.
1
INFO  [GossipStage:1] 2024-11-05 00:33:44,965 StorageService.java:2595 - Node /127.0.0.1 state jump to NORMAL
INFO  [GossipStage:1] 2024-11-05 00:33:45,076 TokenMetadata.java:507 - Updating topology for /127.0.0.1
INFO  [GossipStage:1] 2024-11-05 00:33:45,106 TokenMetadata.java:507 - Updating topology for /127.0.0.1
INFO  [GossipStage:1] 2024-11-05 00:33:45,123 Gossiper.java:1161 - InetAddress /127.0.0.1 is now UP
INFO  [main] 2024-11-05 00:33:45,158 StorageService.java:2595 - Node /127.0.0.2 state jump to NORMAL
INFO  [main] 2024-11-05 00:33:45,176 Gossiper.java:1869 - Waiting for gossip to settle...
WARN  [GossipTasks:1] 2024-11-05 00:33:45,255 FailureDetector.java:278 - Not marking nodes down due to local pause of 10
100288500 > 5000000000
INFO  [main] 2024-11-05 00:33:53,187 Gossiper.java:1900 - No gossip backlog; proceeding
INFO  [main] 2024-11-05 00:33:53,670 NativeTransportService.java:73 - Netty using Java NIO event loop
INFO  [main] 2024-11-05 00:33:53,869 Server.java:158 - Using Netty Version: [netty-buffer=netty-buffer-4.0.44.Final.4528
12a, netty-codec=netty-codec-4.0.44.Final.452812a, netty-codec-haproxy=netty-codec-haproxy-4.0.44.Final.452812a, netty-c
odec-http=netty-codec-http-4.0.44.Final.452812a, netty-codec-socks=netty-codec-socks-4.0.44.Final.452812a, netty-common=
netty-common-4.0.44.Final.452812a, netty-handler=netty-handler-4.0.44.Final.452812a, netty-tcnative=netty-tcnative-1.1.3
3.Fork26.142ecbb, netty-transport=netty-transport-4.0.44.Final.452812a, netty-transport-native-epoll=netty-transport-nat
ive-epoll-4.0.44.Final.452812a, netty-transport-rxtx=netty-transport-rxtx-4.0.44.Final.452812a, netty-transport-sctp=net
ty-transport-sctp-4.0.44.Final.452812a, netty-transport-udt=netty-transport-udt-4.0.44.Final.452812a]
INFO  [main] 2024-11-05 00:33:53,872 Server.java:159 - Starting listening for CQL clients on /127.0.0.2:9042 (unencrypte
d)...
INFO  [main] 2024-11-05 00:33:54,484 CassandraDaemon.java:561 - Not starting RPC server as requested. Use JMX (StorageSe
rvice->startRPCServer()) or nodetool (enablethrift) to start it
INFO  [main] 2024-11-05 00:33:54,485 CassandraDaemon.java:647 - Startup complete
```

On the console, you will see a message “**Node /127.0.0.2 state jump to NORMAL**” which indicates that the Cassandra instance has started and is up and running. Do not close this command prompt window.

We can also use the `jps` command to verify Cassandra service:

```
jps
```

It should display two **CassandraDaemon** daemons which denotes that 2 instances of **Cassandra** are running.

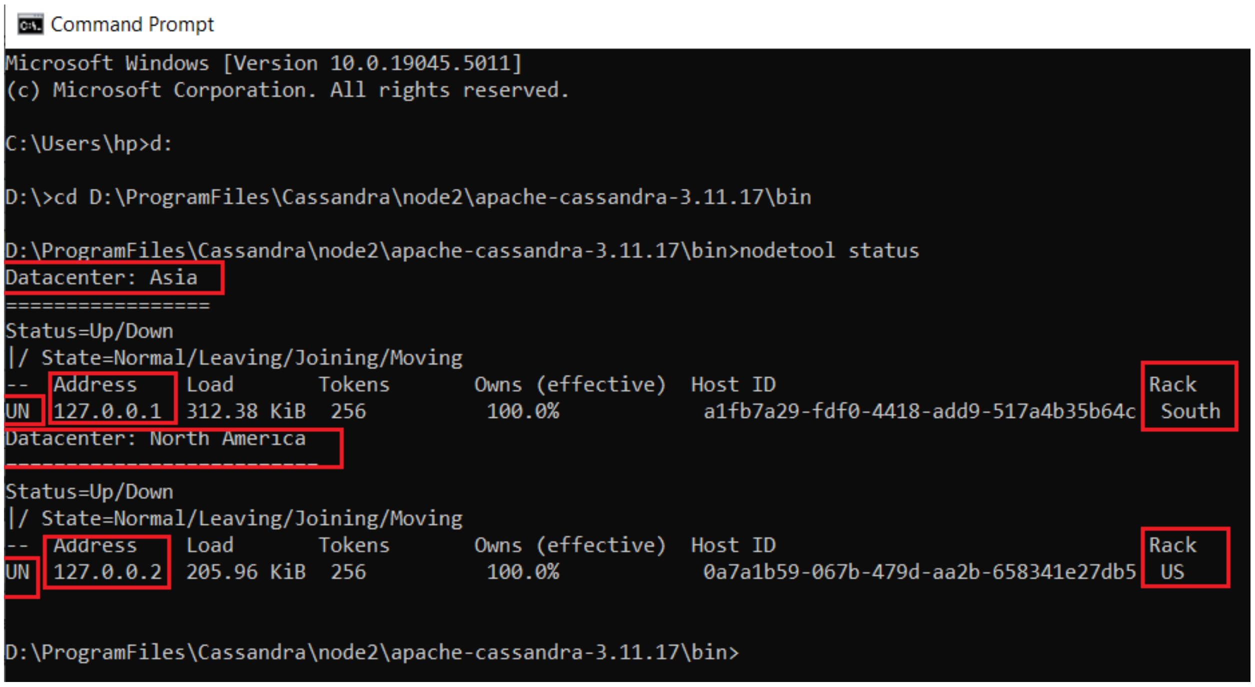


```
Command Prompt
Microsoft Windows [Version 10.0.19045.5011]
(c) Microsoft Corporation. All rights reserved.

C:\Users\hp>jps
12664 CassandraDaemon
12540 CassandraDaemon
17292 Jps

C:\Users\hp>
```

6.5. Verify Node Status:

Now, let us check the status of nodes using `nodetool` utility by running the following commands:

```
D:
cd D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\bin
nodetool status
```

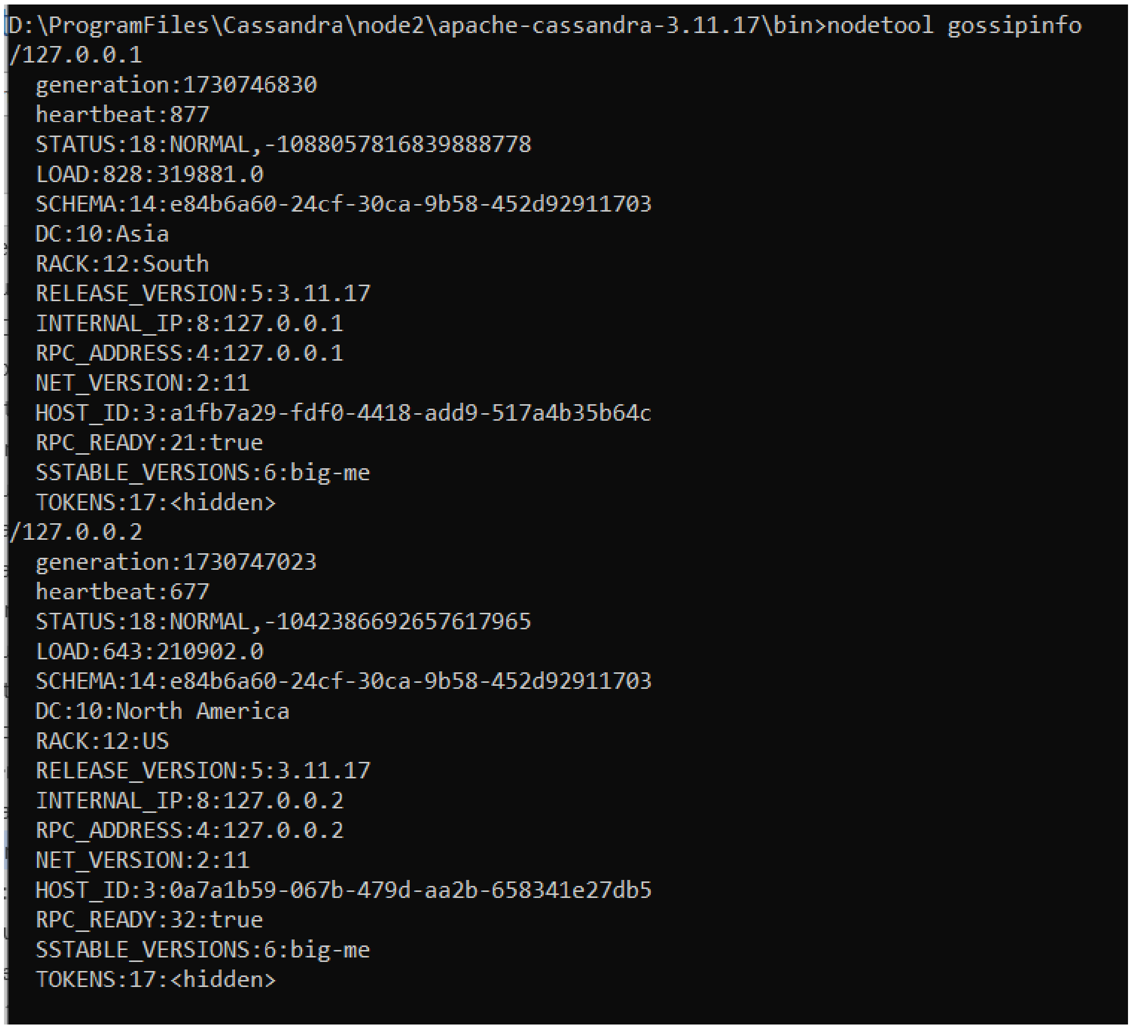


```
Command Prompt
Microsoft Windows [Version 10.0.19045.5011]
(c) Microsoft Corporation. All rights reserved.

C:\Users\hp>d:

D:\>cd D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\bin

D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\bin>nodetool status
Datacenter: Asia
================
Status=Up/Down
|/ State=Normal/Leaving/Joining/Moving
--  Address    Load        Tokens       Owns (effective)  Host ID                               Rack
UN  127.0.0.1  312.38 KiB  256          100.0%            a1fb7a29-fdf0-4418-add9-517a4b35b64c  South
Datacenter: North America
=========================
Status=Up/Down
|/ State=Normal/Leaving/Joining/Moving
--  Address    Load        Tokens       Owns (effective)  Host ID                               Rack
UN  127.0.0.2  205.96 KiB  256          100.0%            0a7a1b59-067b-479d-aa2b-658341e27db5  US

D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\bin>
```

Here, you can see that node1 under `Asia` DC and node 2 under `North America` DC and both nodes status shows `UN` which means the node is **U**p and reporting **N**ormal state.

Run the following `nodetool` command to get the gossip information of each node:

```
nodetool gossipinfo
```



```
D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\bin>nodetool gossipinfo
/127.0.0.1
  generation:1730746830
  heartbeat:877
  STATUS:18:NORMAL,-1088057816839888778
  LOAD:828:319881.0
  SCHEMA:14:e84b6a60-24cf-30ca-9b58-452d92911703
  DC:10:Asia
  RACK:12:South
  RELEASE_VERSION:5:3.11.17
  INTERNAL_IP:8:127.0.0.1
  RPC_ADDRESS:4:127.0.0.1
  NET_VERSION:2:11
  HOST_ID:3:a1fb7a29-fdf0-4418-add9-517a4b35b64c
  RPC_READY:21:true
  SSTABLE_VERSIONS:6:big-me
  TOKENS:17:<hidden>
/127.0.0.2
  generation:1730747023
  heartbeat:677
  STATUS:18:NORMAL,-1042386692657617965
  LOAD:643:210902.0
  SCHEMA:14:e84b6a60-24cf-30ca-9b58-452d92911703
  DC:10:North America
  RACK:12:US
  RELEASE_VERSION:5:3.11.17
  INTERNAL_IP:8:127.0.0.2
  RPC_ADDRESS:4:127.0.0.2
  NET_VERSION:2:11
  HOST_ID:3:0a7a1b59-067b-479d-aa2b-658341e27db5
  RPC_READY:32:true
  SSTABLE_VERSIONS:6:big-me
  TOKENS:17:<hidden>
```

7. CQLSH:

Cassandra provides an interactive tool called Cassandra Query Language Shell (`cqlsh`) to communicate with Cassandra database and execute queries using Cassandra Query Language (CQL). The CQL is very similar to SQL but suited for JOINless structure.

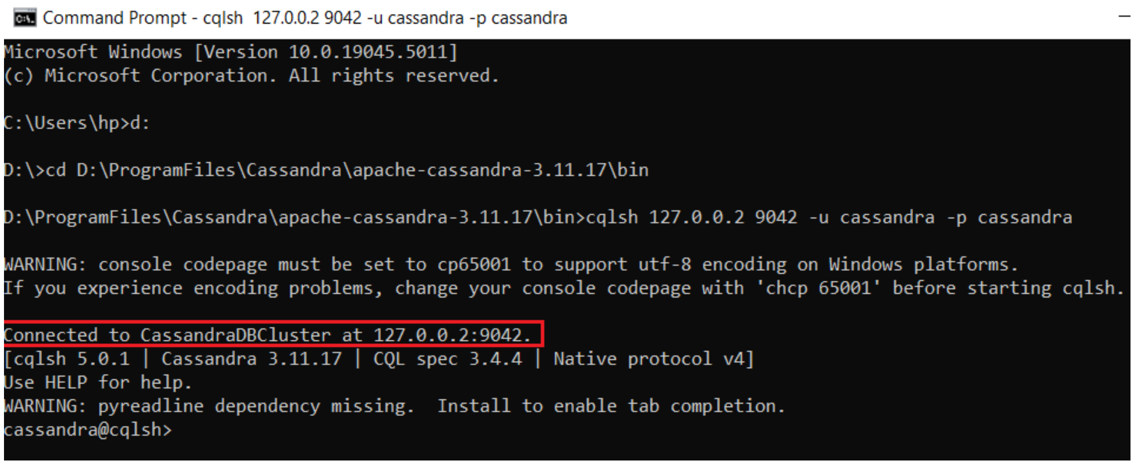
While using `cqlsh`, we can specify the IP address and port to connect to a specific Cassandra node with specific username and password. We can use the default user `cassandra` and password `cassandra` to connect to database.

Open **Command Prompt** and run the following commands to launch CQLSH tool connecting to second node in our system

```
cd D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin
cqlsh 127.0.0.2 9042
```

or

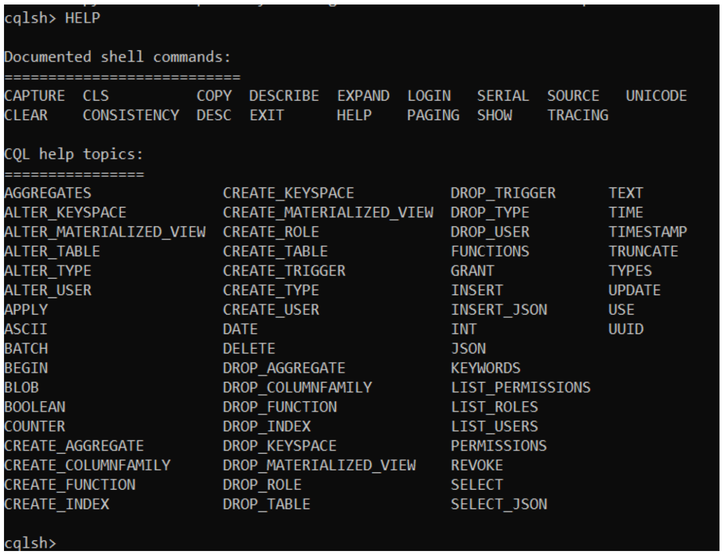
```
cd D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin
cqlsh 127.0.0.2 9042 -u cassandra -p cassandra
```


Command Prompt - cqlsh 127.0.0.2 9042 -u cassandra -p cassandra

```
Microsoft Windows [Version 10.0.19045.5011]
(c) Microsoft Corporation. All rights reserved.

C:\Users\hp>d:

D:\>cd D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin

D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>cqlsh 127.0.0.2 9042 -u cassandra -p cassandra

WARNING: console codepage must be set to cp65001 to support utf-8 encoding on Windows platforms.
If you experience encoding problems, change your console codepage with 'chcp 65001' before starting cqlsh.

Connected to CassandraDBCluster at 127.0.0.2:9042.
[cqlsh 5.0.1 | Cassandra 3.11.17 | CQL spec 3.4.4 | Native protocol v4]
Use HELP for help.
WARNING: pyreadline dependency missing.  Install to enable tab completion.
cassandra@cqlsh>
```

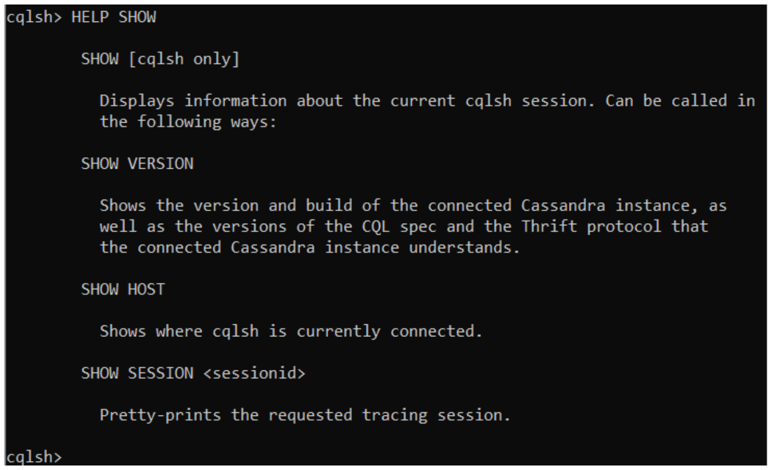
Here, we can see that it is connected to `CassandraDBCluster` at node address `127.0.0.2:9042`

On `cqlsh>` prompt, use `HELP` command that lists out all possible commands that can be triggered to interact with Cassandra.



```
cqlsh> HELP

Documented shell commands:
===========================
CAPTURE  CLS          COPY  DESCRIBE  EXPAND  LOGIN   SERIAL  SOURCE   UNICODE
CLEAR    CONSISTENCY  DESC  EXIT      HELP    PAGING  SHOW    TRACING

CQL help topics:
================
AGGREGATES               CREATE_KEYSPACE           DROP_TRIGGER      TEXT
ALTER_KEYSPACE           CREATE_MATERIALIZED_VIEW  DROP_TYPE         TIME
ALTER_MATERIALIZED_VIEW  CREATE_ROLE               DROP_USER         TIMESTAMP
ALTER_TABLE              CREATE_TABLE              FUNCTIONS         TRUNCATE
ALTER_TYPE               CREATE_TRIGGER            GRANT             TYPES
ALTER_USER               CREATE_TYPE               INSERT            UPDATE
APPLY                    CREATE_USER               INSERT_JSON       USE
ASCII                    DATE                      INT               UUID
BATCH                    DELETE                    JSON
BEGIN                    DROP_AGGREGATE            KEYWORDS
BLOB                     DROP_COLUMNFAMILY         LIST_PERMISSIONS
BOOLEAN                  DROP_FUNCTION             LIST_ROLES
COUNTER                  DROP_INDEX                LIST_USERS
CREATE_AGGREGATE         DROP_KEYSPACE             PERMISSIONS
CREATE_COLUMNFAMILY      DROP_MATERIALIZED_VIEW    REVOKE
CREATE_FUNCTION          DROP_ROLE                 SELECT
CREATE_INDEX             DROP_TABLE                SELECT_JSON

cqlsh>
```

To get more help on each command, use `HELP` followed by command name. For example, to know more details about `SHOW` command, run `HELP SHOW` as shown here

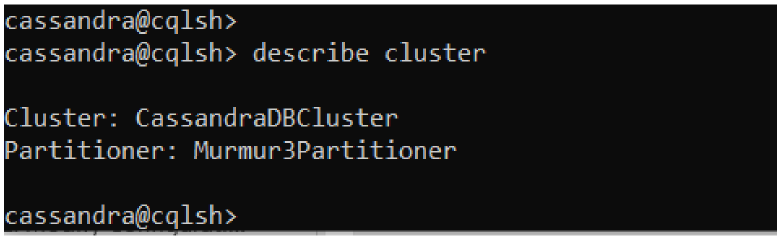


```
cqlsh> HELP SHOW

        SHOW [cqlsh only]

          Displays information about the current cqlsh session. Can be called in
          the following ways:

        SHOW VERSION

          Shows the version and build of the connected Cassandra instance, as
          well as the versions of the CQL spec and the Thrift protocol that
          the connected Cassandra instance understands.

        SHOW HOST

          Shows where cqlsh is currently connected.

        SHOW SESSION <sessionid>

          Pretty-prints the requested tracing session.

cqlsh>
```

7.1. Describe Cluster:

Use the below CQLSH command to see the information about the connected Cassandra cluster, such as the cluster name, and the partitioner and snitch in use. When you are connected to a non-system keyspace, also shows endpoint-range ownership information for the Cassandra ring.

```
DESCRIBE CLUSTER
```

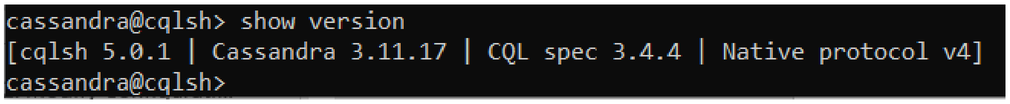


```
cassandra@cqlsh>
cassandra@cqlsh> describe cluster

Cluster: CassandraDBCluster
Partitioner: Murmur3Partitioner

cassandra@cqlsh>
```

7.2. View Version:

Use the below CQLSH command to see the version and build of the connected Cassandra instance:

```
SHOW VERSION
```



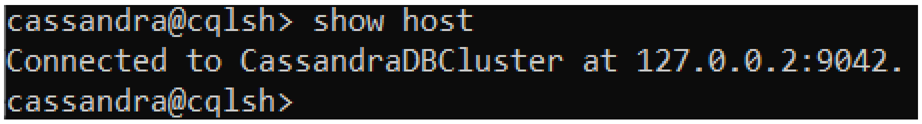
```
cassandra@cqlsh> show version
[cqlsh 5.0.1 | Cassandra 3.11.17 | CQL spec 3.4.4 | Native protocol v4]
cassandra@cqlsh>
```

Here, you can see that the CQLSH version 5.0.1 and Cassandra 3.11.17 that we installed.

7.3. Show Host:

To see where the current CQLSH session is connected, run the below command:

```
SHOW HOST
```



```
cassandra@cqlsh> show host
Connected to CassandraDBCluster at 127.0.0.2:9042.
cassandra@cqlsh>
```

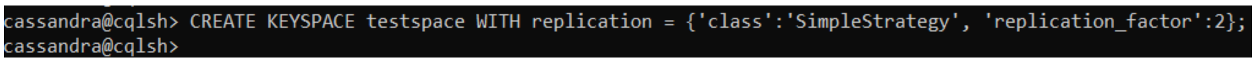
Here, you can see that the current CQLSH instance is connected to `CassaandraDBCluster`.

7.4. Create Keyspace:

A keyspace in Cassandra is like database in RDBMS and contains column families, indexes, user defined types, data center awareness, strategy used in keyspace, replication factor, etc.

Let us create a new keyspace named `testspace` with replication factor `2` using the below command:

```
CREATE KEYSPACE testspace WITH replication =
{'class':'SimpleStrategy', 'replication_factor':2};
```



```
cassandra@cqlsh> CREATE KEYSPACE testspace WITH replication = {'class':'SimpleStrategy', 'replication_factor':2};
cassandra@cqlsh>
```

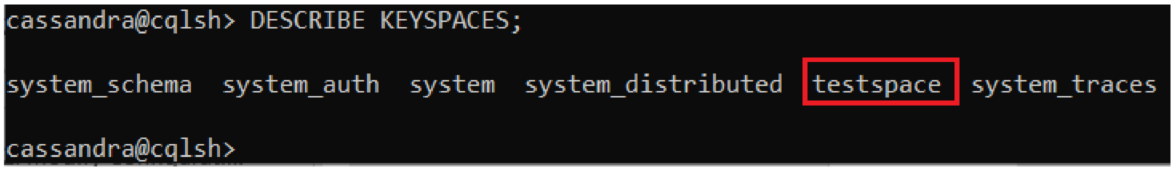
Cassandra keyspace can be created with two types of strategy declaration:

- **SimpleStrategy**: This strategy is used in the case of one data center. In this strategy, the first replica is placed on the selected node and the remaining nodes are placed in clockwise direction in the ring without considering rack or node location.
- **NetworkTopologyStrategy**: This strategy is used in the case of more than one data centers. In this strategy, you have to provide replication factor for each data center separately.

Replication Factor is another property to be specified for a keyspace. Replication factor is the number of replicas of data placed on different nodes.

Use `describe` command to verify if the new keyspace was created or not:

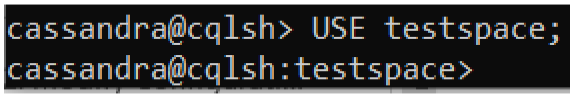
```
DESCRIBE KEYSPACES;
```



```
cassandra@cqlsh> DESCRIBE KEYSPACES;

system_schema  system_auth  system  system_distributed  testspace  system_traces

cassandra@cqlsh>
```

The use command in Cassandra sets the current working keyspace. Run the following command to set testspace as our working keyspace:

```
USE testspace;
```



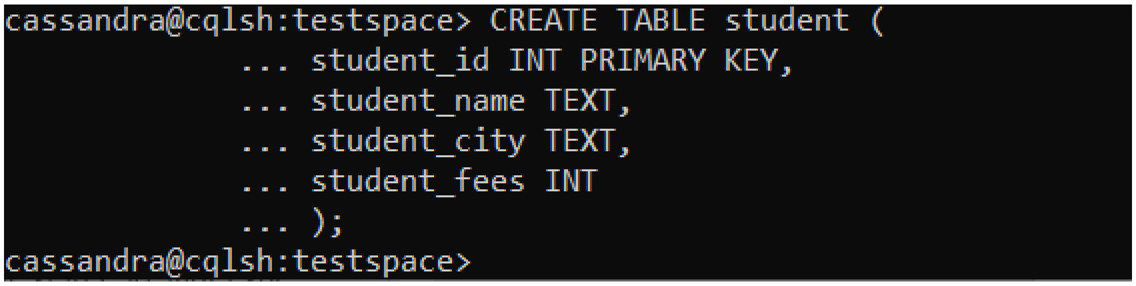
```
cassandra@cqlsh> USE testspace;
cassandra@cqlsh:testspace>
```

7.5. Create Table:

In Cassandra, CREATE TABLE command is used to create a table with column families to store data just like table in RDBMS. This command expects the table name, column name, data type and a primary key. The datatypes in Cassandra can be text, int, date, decimal, double, float, set, list, map, etc.

Use this command to create table named student:

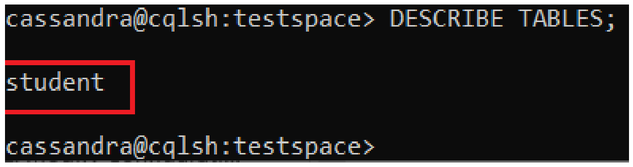
```
CREATE TABLE student (
student_id INT PRIMARY KEY,
student_name TEXT,
student_city TEXT,
student_fees INT
);
```



```
cassandra@cqlsh:testspace> CREATE TABLE student (
                ... student_id INT PRIMARY KEY,
                ... student_name TEXT,
                ... student_city TEXT,
                ... student_fees INT
                ... );
cassandra@cqlsh:testspace>
```

Use describe command to verify if the table was created or not:

```
DESCRIBE TABLES;
```



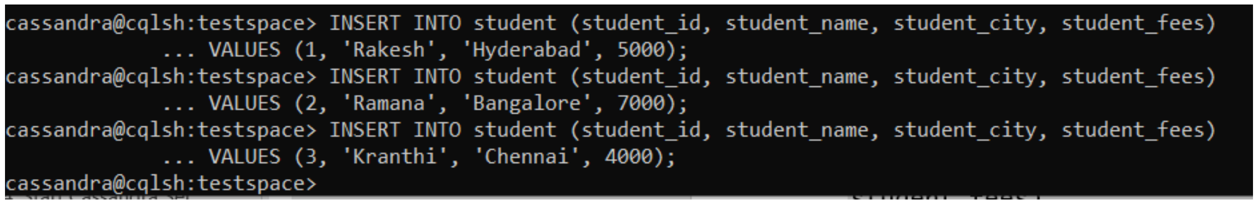
```
cassandra@cqlsh:testspace> DESCRIBE TABLES;

student

cassandra@cqlsh:testspace>
```

7.6. Insert Data:

The `INSERT` command is used to insert data into table columns.

Run the following commands to insert some data into `student` table:

```
INSERT INTO student (student_id, student_name, student_city,
student_fees)
VALUES (1, 'Rakesh', 'Hyderabad', 5000);
INSERT INTO student (student_id, student_name, student_city,
student_fees)
VALUES (2, 'Ramana', 'Bangalore', 7000);
INSERT INTO student (student_id, student_name, student_city,
student_fees)
VALUES (3, 'Kranthi', 'Chennai', 4000);
```

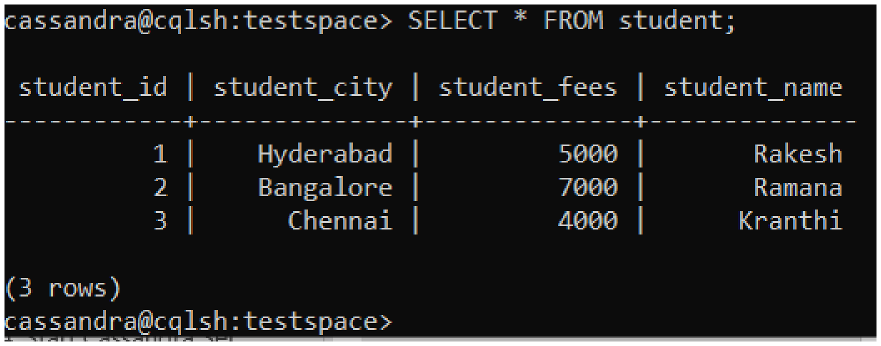


```
cassandra@cqlsh:testspace> INSERT INTO student (student_id, student_name, student_city, student_fees)
           ... VALUES (1, 'Rakesh', 'Hyderabad', 5000);
cassandra@cqlsh:testspace> INSERT INTO student (student_id, student_name, student_city, student_fees)
           ... VALUES (2, 'Ramana', 'Bangalore', 7000);
cassandra@cqlsh:testspace> INSERT INTO student (student_id, student_name, student_city, student_fees)
           ... VALUES (3, 'Kranthi', 'Chennai', 4000);
cassandra@cqlsh:testspace>
```

7.7. Read Data:

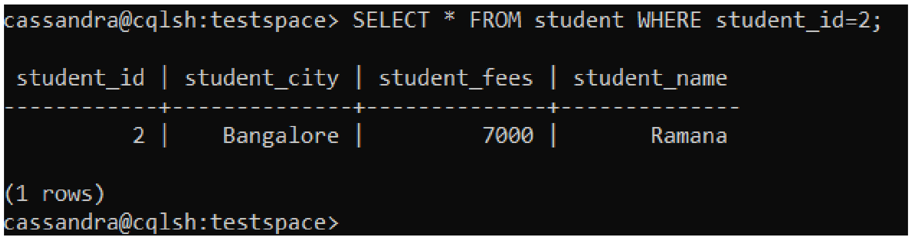
Use `SELECT` command to read data from the table.

```
SELECT * FROM student;
```



```
cassandra@cqlsh:testspace> SELECT * FROM student;

 student_id | student_city | student_fees | student_name
------------+--------------+--------------+--------------
          1 |    Hyderabad |         5000 |       Rakesh
          2 |    Bangalore |         7000 |       Ramana
          3 |      Chennai |         4000 |      Kranthi

(3 rows)
cassandra@cqlsh:testspace>
```

```
SELECT * FROM student WHERE student_id=2;
```

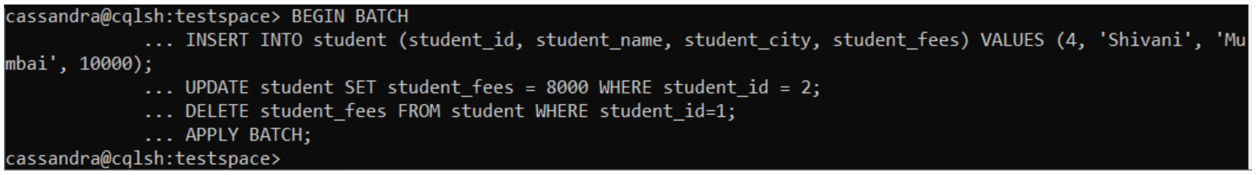

```
cassandra@cqlsh:testspace> SELECT * FROM student WHERE student_id=2;

 student_id | student_city | student_fees | student_name
------------+--------------+--------------+--------------
          2 |    Bangalore |         7000 |       Ramana

(1 rows)
cassandra@cqlsh:testspace>
```

7.8. Batch Queries:

In Cassandra, the `BATCH` command is used to execute multiple DML statements such as `insert`, `update`, `delete`, etc. simultaneously. It is very useful when you have to update some column as well as delete some of the existing data.

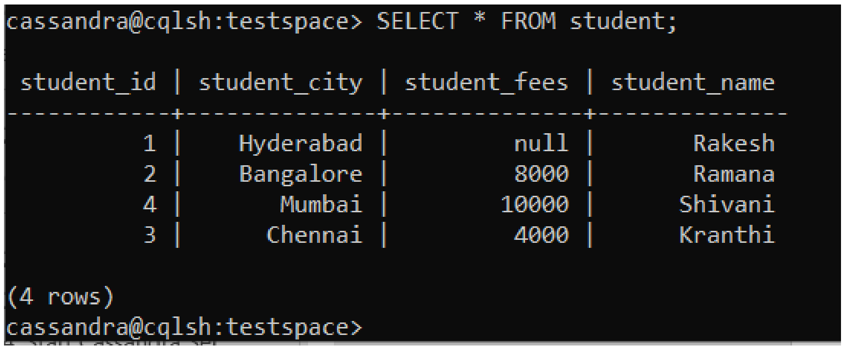
Run the following batch operations to insert a new record, update the existing record and delete a column data.

```
BEGIN BATCH
INSERT INTO student (student_id, student_name, student_city,
student_fees) VALUES (4, 'Shivani', 'Mumbai', 10000);
UPDATE student SET student_fees = 8000 WHERE student_id = 2;
DELETE student_fees FROM student WHERE student_id=1;
APPLY BATCH;
```


```
cassandra@cqlsh:testspace> BEGIN BATCH
           ... INSERT INTO student (student_id, student_name, student_city, student_fees) VALUES (4, 'Shivani', 'Mu
mbai', 10000);
           ... UPDATE student SET student_fees = 8000 WHERE student_id = 2;
           ... DELETE student_fees FROM student WHERE student_id=1;
           ... APPLY BATCH;
cassandra@cqlsh:testspace>
```

Now the `BATCH` is applied, we can verify it by using `SELECT` command:

```
SELECT * FROM student;
```

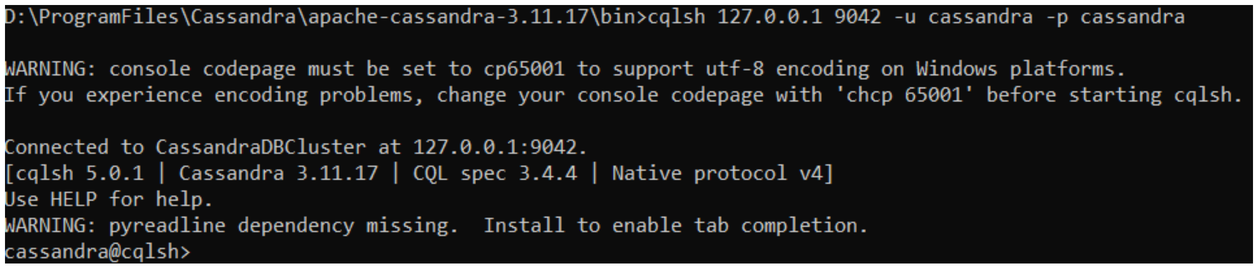

```
cassandra@cqlsh:testspace> SELECT * FROM student;

 student_id | student_city | student_fees | student_name
------------+--------------+--------------+--------------
          1 |    Hyderabad |         null |       Rakesh
          2 |    Bangalore |         8000 |       Ramana
          4 |       Mumbai |        10000 |      Shivani
          3 |      Chennai |         4000 |      Kranthi

(4 rows)
cassandra@cqlsh:testspace>
```

Use `exit;` command to exit out of cqlsh.

7.9. Data Replication:

Now, let us connect to the first node instance to verify if the data is replicated.

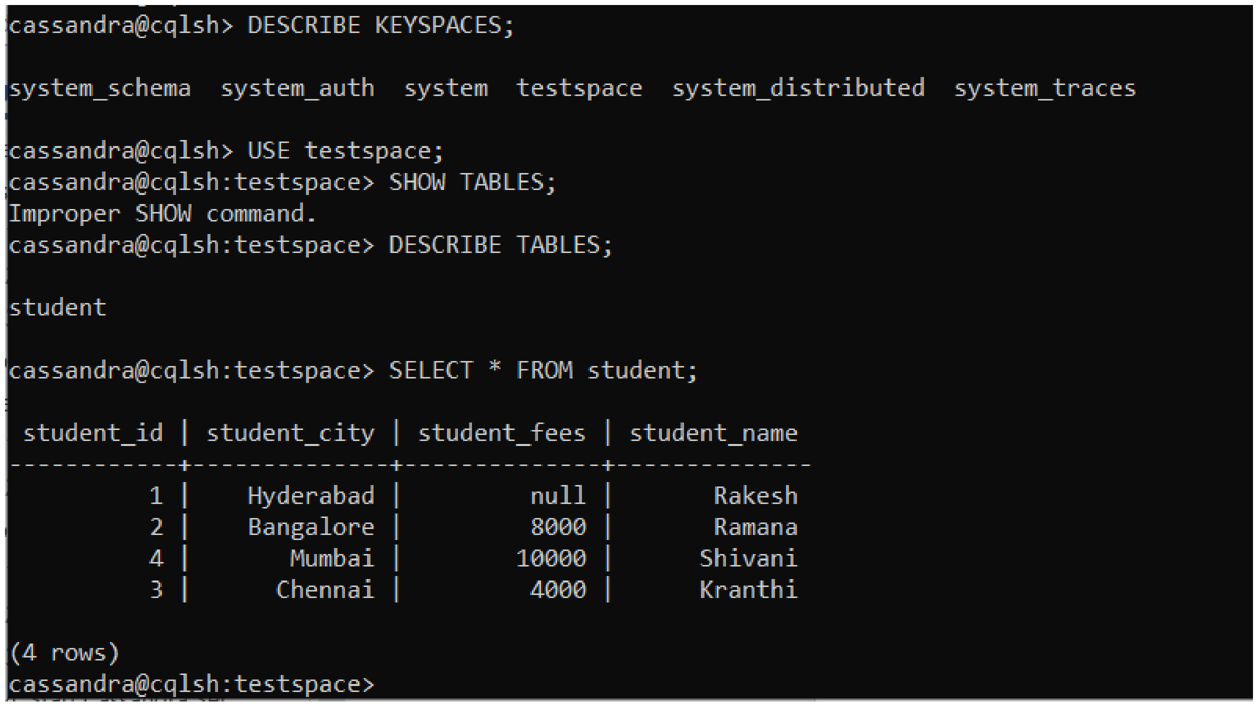
```
cd D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin
cqlsh 127.0.0.1 9042 -u cassandra -p cassandra
```



```
D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>cqlsh 127.0.0.1 9042 -u cassandra -p cassandra

WARNING: console codepage must be set to cp65001 to support utf-8 encoding on Windows platforms.
If you experience encoding problems, change your console codepage with 'chcp 65001' before starting cqlsh.

Connected to CassandraDBCluster at 127.0.0.1:9042.
[cqlsh 5.0.1 | Cassandra 3.11.17 | CQL spec 3.4.4 | Native protocol v4]
Use HELP for help.
WARNING: pyreadline dependency missing.  Install to enable tab completion.
cassandra@cqlsh>
```

Run the following commands to see the table data that we created in the second node.

```
DESCRIBE KEYSPACES;
USE testspace;
DESCRIBE TABLES;
SELECT * FROM student;
```



```
cassandra@cqlsh> DESCRIBE KEYSPACES;

system_schema  system_auth  system  testspace  system_distributed  system_traces

cassandra@cqlsh> USE testspace;
cassandra@cqlsh:testspace> SHOW TABLES;
Improper SHOW command.
cassandra@cqlsh:testspace> DESCRIBE TABLES;

student

cassandra@cqlsh:testspace> SELECT * FROM student;

 student_id | student_city | student_fees | student_name
------------+--------------+--------------+--------------
          1 |    Hyderabad |         null |       Rakesh
          2 |    Bangalore |         8000 |       Ramana
          4 |       Mumbai |        10000 |      Shivani
          3 |      Chennai |         4000 |      Kranthi

(4 rows)
cassandra@cqlsh:testspace>
```

8. NodeTool Utility:

Cassandra provides a `nodetool` utility which is a command line interface for monitoring Cassandra cluster and performing routine database operations. This utility is commonly used to output a quick summary of the ring and its current state of general health with the status command.

The `nodetool` utility provides commands for decommissioning a node, running repair, and moving partitioning tokens and for viewing detailed metrics for tables, server metrics, and compaction statistics, etc.

When you have multi-node cluster, you can provide the node host name and JMX port to connect:

```
nodetool -h HOSTNAME -p JMX_PORT COMMAND
```

If a username and password for RMI authentication are set explicitly in the `cassandra-env.sh` file, then you must specify credentials along with hostname/IP address and port to connect to a specific Cassandra node:

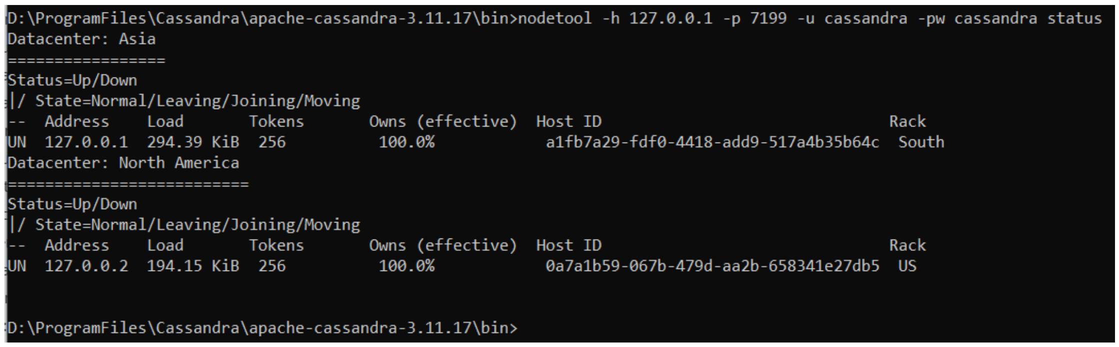
```
nodetool -h HOSTNAME -p JMX_PORT -u JMX_USERNAME -pw JMX_PASSWORD
COMMAND
```

Open **Command Prompt** and run the following commands to get node status connecting to pri node in our system:

```
cd D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin
nodetool -h 127.0.0.1 -p 7199 -u cassandra -pw cassandra status
```

Use the below command to connect to secondary node in our system:

```
nodetool -h 127.0.0.1 -p 7299 -u cassandra -pw cassandra status
```



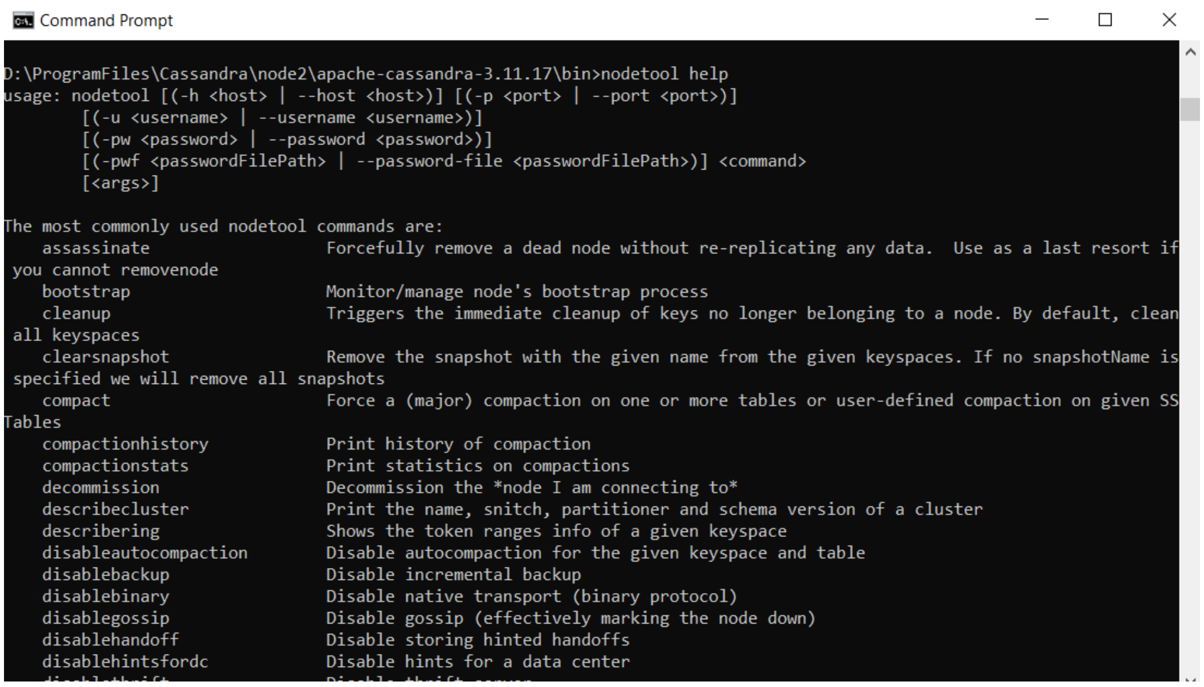
```
D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>nodetool -h 127.0.0.1 -p 7199 -u cassandra -pw cassandra status
Datacenter: Asia
================
Status=Up/Down
|/ State=Normal/Leaving/Joining/Moving
--  Address    Load       Tokens       Owns (effective)  Host ID                               Rack
UN  127.0.0.1  294.39 KiB  256          100.0%            a1fb7a29-fdf0-4418-add9-517a4b35b64c  South
Datacenter: North America
=========================
Status=Up/Down
|/ State=Normal/Leaving/Joining/Moving
--  Address    Load       Tokens       Owns (effective)  Host ID                               Rack
UN  127.0.0.2  194.15 KiB  256          100.0%            0a7a1b59-067b-479d-aa2b-658341e27db5  US


D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>
```

Some of the generally used commands are described below for your understanding.

8.1. Nodetool help:

This is a basic command which lists all the available `nodetool` commands. This command is useful to learn about the available commands.

```
nodetool help
```



Command Prompt

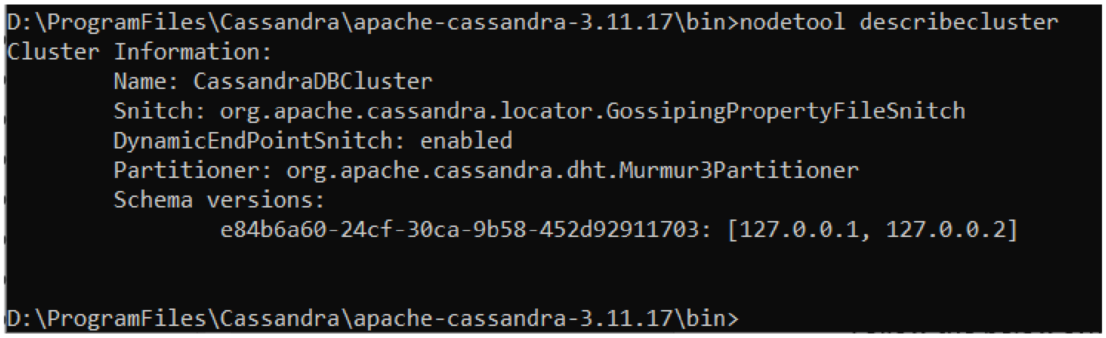
```
D:\ProgramFiles\Cassandra\node2\apache-cassandra-3.11.17\bin>nodetool help
usage: nodetool [(-h <host> | --host <host>)] [(-p <port> | --port <port>)]
        [(-u <username> | --username <username>)]
        [(-pw <password> | --password <password>)]
        [(-pwf <passwordFilePath> | --password-file <passwordFilePath>)] <command>
        [<args>]

The most commonly used nodetool commands are:
    assassinate                  Forcefully remove a dead node without re-replicating any data.  Use as a last resort if
 you cannot removenode
    bootstrap                    Monitor/manage node's bootstrap process
    cleanup                      Triggers the immediate cleanup of keys no longer belonging to a node. By default, clean
 all keyspaces
    clearsnapshot                Remove the snapshot with the given name from the given keyspaces. If no snapshotName is
 specified we will remove all snapshots
    compact                      Force a (major) compaction on one or more tables or user-defined compaction on given SS
Tables
    compactionhistory            Print history of compaction
    compactionstats              Print statistics on compactions
    decommission                 Decommission the *node I am connecting to*
    describecluster              Print the name, snitch, partitioner and schema version of a cluster
    describering                 Shows the token ranges info of a given keyspace
    disableautocompaction        Disable autocompaction for the given keyspace and table
    disablebackup                Disable incremental backup
    disablebinary                Disable native transport (binary protocol)
    disablegossip                Disable gossip (effectively marking the node down)
    disablehandoff               Disable storing hinted handoffs
    disablehintsfordc            Disable hints for a data center
```

8.2. Nodetool describecluster:

This command provides the basic cluster information such as cluster name, endpoint-snitch being used, partitioner and schema versions.

Follow the below syntax to use this command:

```
nodetool [options] describecluster
```



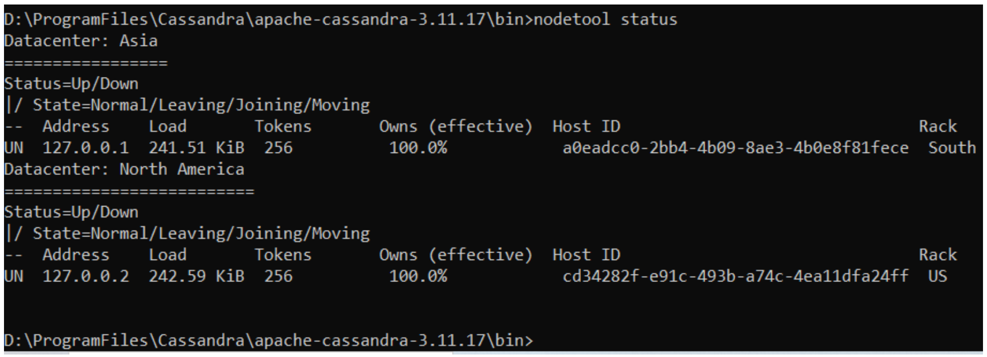
```
D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>nodetool describecluster
Cluster Information:
        Name: CassandraDBCluster
        Snitch: org.apache.cassandra.locator.GossipingPropertyFileSnitch
        DynamicEndPointSnitch: enabled
        Partitioner: org.apache.cassandra.dht.Murmur3Partitioner
        Schema versions:
                e84b6a60-24cf-30ca-9b58-452d92911703: [127.0.0.1, 127.0.0.2]


D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>
```

8.3. Nodetool status:

This command is useful to monitor the cluster's health and performance. It can help detect any ongoing anomalies as well as the status of each of the nodes.

Follow the below syntax to use this command:

```
nodetool <options> status ( -r | --resolve-ip ) -- <keyspace>
```



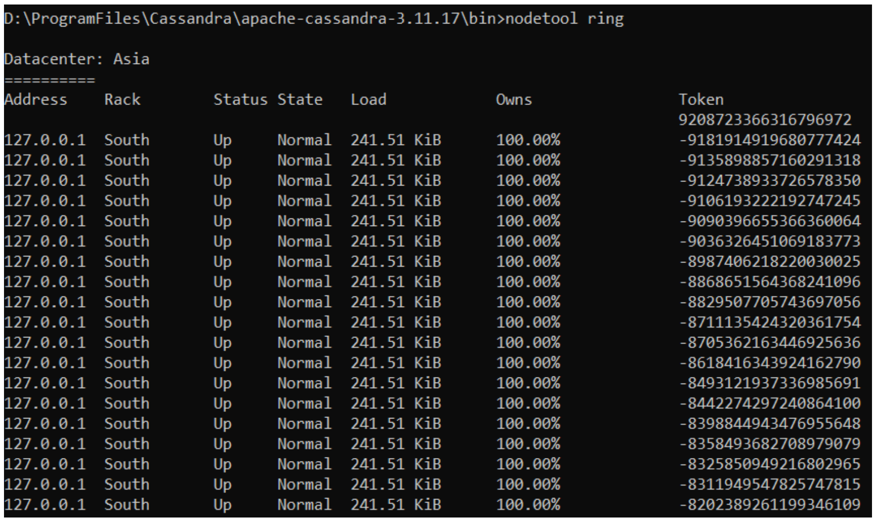
```
D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>nodetool status
Datacenter: Asia
================
Status=Up/Down
|/ State=Normal/Leaving/Joining/Moving
--  Address    Load       Tokens       Owns (effective)  Host ID                               Rack
UN  127.0.0.1  241.51 KiB  256          100.0%            a0eadcc0-2bb4-4b09-8ae3-4b0e8f81fece  South
Datacenter: North America
=========================
Status=Up/Down
|/ State=Normal/Leaving/Joining/Moving
--  Address    Load       Tokens       Owns (effective)  Host ID                               Rack
UN  127.0.0.2  242.59 KiB  256          100.0%            cd34282f-e91c-493b-a74c-4ea11dfa24ff  US


D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>
```

8.4. Nodetool ring:

It displays token ring information with the status of each of the ndoes. The token ring is responsible for managing the partitioning of data within the Cassandra cluster. This command is critical if a cluster is facing data consistency issues. By default, `nodetool ring` displays all nodes that are involved in the ring and tokens that are assigned to each one of them. Optionally, you can specify the keyspace name and table name arguments to filter the output and display information.

Follow the below syntax to use this command:

```
nodetool ring [keyspace] [table]
```



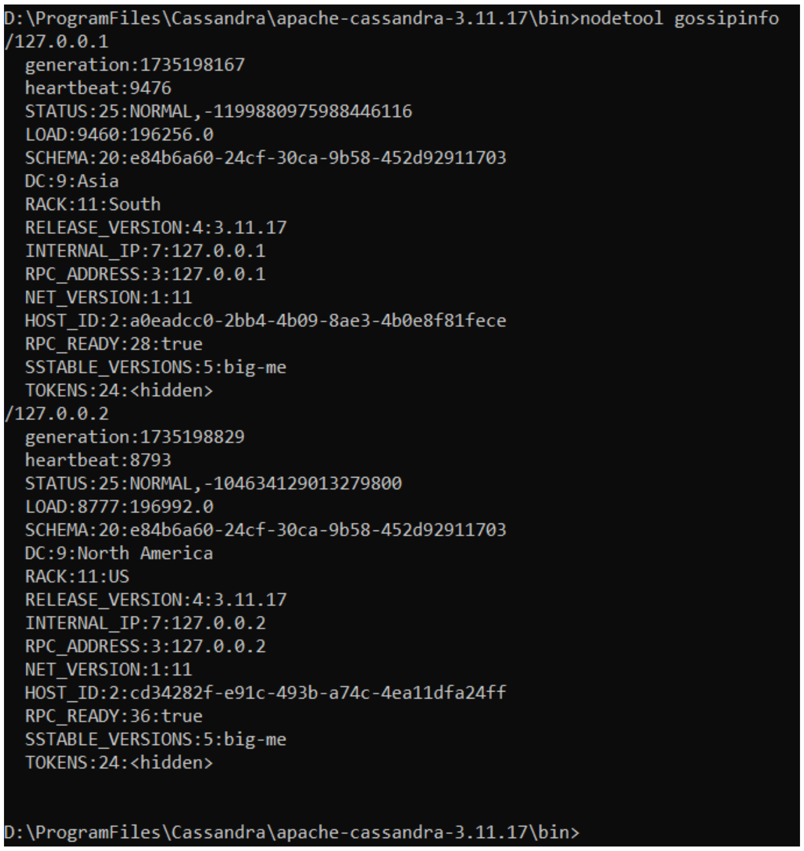
```
D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>nodetool ring

Datacenter: Asia
==========
Address    Rack       Status State   Load            Owns                Token
                                                                         9208723366316796972
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -9181914919680777424
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -9135898857160291318
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -9124738933726578350
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -9106193222192747245
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -9090396655366360064
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -9036326451069183773
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -8987406218220030025
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -8868651564368241096
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -8829507705743697056
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -8711135424320361754
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -8705362163446925636
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -8618416343924162790
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -8493121937336985691
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -8442274297240864100
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -8398844943476955648
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -8358493682708979079
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -8325850949216802965
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -8311949547825747815
127.0.0.1  South      Up     Normal  241.51 KiB      100.00%             -8202389261199346109
```

8.5. Nodetool gossipinfo:

It provides the gossip protocol related statistics.

Follow the below syntax to use this command:

```
nodetool [options] gossipinfo
```



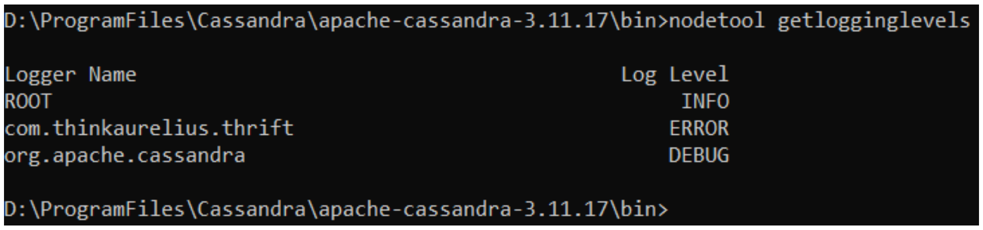
```
D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>nodetool gossipinfo
/127.0.0.1
  generation:1735198167
  heartbeat:9476
  STATUS:25:NORMAL,-1199880975988446116
  LOAD:9460:196256.0
  SCHEMA:20:e84b6a60-24cf-30ca-9b58-452d92911703
  DC:9:Asia
  RACK:11:South
  RELEASE_VERSION:4:3.11.17
  INTERNAL_IP:7:127.0.0.1
  RPC_ADDRESS:3:127.0.0.1
  NET_VERSION:1:11
  HOST_ID:2:a0eadcc0-2bb4-4b09-8ae3-4b0e8f81fece
  RPC_READY:28:true
  SSTABLE_VERSIONS:5:big-me
  TOKENS:24:<hidden>
/127.0.0.2
  generation:1735198829
  heartbeat:8793
  STATUS:25:NORMAL,-104634129013279800
  LOAD:8777:196992.0
  SCHEMA:20:e84b6a60-24cf-30ca-9b58-452d92911703
  DC:9:North America
  RACK:11:US
  RELEASE_VERSION:4:3.11.17
  INTERNAL_IP:7:127.0.0.2
  RPC_ADDRESS:3:127.0.0.2
  NET_VERSION:1:11
  HOST_ID:2:cd34282f-e91c-493b-a74c-4ea11dfa24ff
  RPC_READY:36:true
  SSTABLE_VERSIONS:5:big-me
  TOKENS:24:<hidden>


D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>
```

8.6. Nodetool getlogginglevels:

It gives logging levels defined in the database for all areas

Follow the below syntax to use this command:

```
nodetool [options] getlogginglevels
```



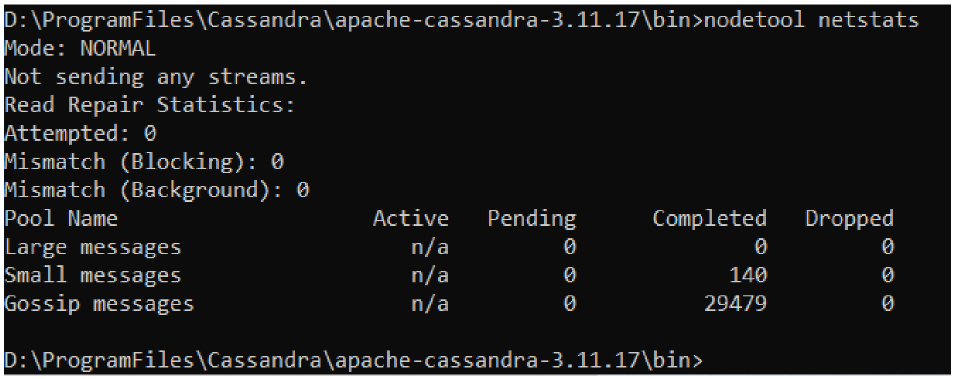
```
D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>nodetool getlogginglevels

Logger Name                                        Log Level
ROOT                                                    INFO
com.thinkaurelius.thrift                               ERROR
org.apache.cassandra                                   DEBUG

D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>
```

8.7. Nodetool netstats:

This command provides the network information about the host machine.

Follow the below syntax to use this command:

```
nodetool [options] netstats
```



```
D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>nodetool netstats
Mode: NORMAL
Not sending any streams.
Read Repair Statistics:
Attempted: 0
Mismatch (Blocking): 0
Mismatch (Background): 0
Pool Name                    Active   Pending      Completed   Dropped
Large messages                  n/a         0              0         0
Small messages                  n/a         0            140         0
Gossip messages                 n/a         0          29479         0

D:\ProgramFiles\Cassandra\apache-cassandra-3.11.17\bin>
```

8.8. Nodetool tablestats:

This command provides statistics about one or more tables. The table stats are updated when SSTables change through compaction or flushing. Cassandra uses the metrics-core library to make the output more informative and easier to understand.

Follow the below syntax to use this command:

```
nodetool [options] tablestats
```

8.9. Nodetool cleanup:

This command that is required to remove data from nodes when a new node is added to a cluster and token ring is re-distributed. After `cleanup` it is recommended to run `compact` command.

Follow the below syntax to use `cleanup` command:

```
nodetool [connection_options] cleanup [-j num_jobs] [--]
[keyspace_name table_name [table_name ...]]
```

8.10. Nodetool compact:

This command is useful to perform compaction to merge several SSTables (data files in Cassandra) and keep the resultant SSTable with the latest updated data.

When a data update or delete operation is triggered, Cassandra does not overwrite or delete the data. In case of updates, a different timestamped version of updates is maintained and in case of deletes, the data is marked for deletion as **tombstones** and then the latest version of data is obtained post the merge of the SSTables. Therefore, it is important to perform compactions on a periodic basis in order to keep the cluster healthy.

Follow the below syntax to use `compact` command:

```
nodetool [options] compact [(-et <end_token> | --end-token
<end_token>)]
[(-s | --split-output)] [(-st <start_token> | --start-token
<start_token>)] [--] [<keyspace> [<tables>...]]
[--user-defined] <relative_path_to_SSTable file>
```

8.11. Nodetool decommission:
It decommissions the node where this command is executed, and the data of the node is streamed to the next node in the ring. It is one of the important commands that need to be executed when the cluster needs to be scaled to ensure no data loss.

Follow the below syntax to use `decommission` command:

```
nodetool [options] decommission
```

8.12. Nodetool drain:
It flushes all memtables (temporary tables usually on the heap) to the SSTables on disk. Once the command is executed, the node stops listening for connections from clients and other nodes. The node is marked as DS (Down/Stopped) in the cluster in the `nodetool status` command output. This command is usually run before any maintenance activities or when upgrading a node to a newer version of Cassandra.

Follow the below syntax to use `drain` command:

```
nodetool [options] drain
```

8.13. Nodetool garbagecollect:
It performs single SSTable compactions to eliminate updates or logically deleted data (Tombstones).

For each SSTable, the command creates a new SSTable with unnecessary data cleaned out. By default, `garbagecollect` removes rows or partitions that have been deleted or overwritten with newer data. It can also remove deleted or overwritten cell values when `-g` argument is specified. This command can eliminate expired tombstones which are older than `gc_grace_seconds`, but not fresh ones.

Note that `garbagecollect` with `-g` cell option incurs very high Disk I/O and hence it should be ensured that enough disk space is available.

Follow the below syntax to use this command:

```
nodetool options garbagecollect [--] keyspace_name table_name
```

8.14. Nodetool join:

It adds a new node to the cluster. When this command is executed, the new node will start to communicate with other nodes in the cluster and receive data from them. It is important to ensure that the new node has the same version of Cassandra as the existing nodes in the cluster.

Follow the below syntax to use this command:

```
nodetool <options> join
```

8.15. Nodetool removenode:

This command is useful when a node is no longer needed or when a node has failed and needs to be replaced or removed. Before removing the dead node, `nodetool decommission` command must be run first on the node being removed and then `nodetool removenode` command should be executed on the live node in the cluster.

When a node is removed, Cassandra redistributes the data that was stored on that node to the remaining nodes in the cluster. After the data has been redistributed, the node being removed will be marked as “removed” and will no longer participate in the cluster.

It is important to ensure that all data has been successfully redistributed before decommissioning or shutting down the node being removed. This can be checked using `nodetool status` and monitoring the “UN” (up and normal) status of all nodes in the cluster.
It is recommended to perform a full repair of the cluster after removing a node to ensure data consistency. This can be done using `nodetool repair` command.

Follow the below syntax to use `nodetool removenode` command:

```
nodetool [connection_options] removenode -- <status> | <force> | <ID>
```

8.16. Nodetool assasinate:

This command is used to assassinate a node and should be performed when the `nodetool removenode` command fails.

Follow the below syntax to use `nodetool assasinate` command:

```
nodetool [options] assassinate <ip_address>
```

8.17. Nodetool repair:

Since frequent data deletions and downtime in nodes may lead to data inconsistencies, `nodetool repair` ensures data consistency across all nodes in the cluster. It works by comparing the data on each node with the data on other nodes and resolving any inconsistencies. This is done by constructing a **merkle tree** whose leaves are the hashes of the individual keys.

Note that while `nodetool repair` is running, it can cause increased network traffic and disk I/O on the nodes in the cluster. This can impact the performance of other applications running on the same nodes. It can also cause temporary data unavailability during the repair process which can be mitigated by running repairs during off-peak hours or using incremental repair (new data since last repair) instead of full repair (complete data).

If `nodetool repair` is interrupted or fails for any reason, it can leave the cluster in an inconsistent state and so it is important to monitor the progress of `nodetool repair` and ensure that it completes successfully.

Follow the below syntax to use this command:

```
nodetool repair [-full|-inc]
```

Congratulations!! You have successfully installed Apache Cassandra with single node and multi-node configuration and executed database queries using CQLSH tool along with an overview of nodetool utility to monitor and manage Cassandra cluster in Windows operating system.