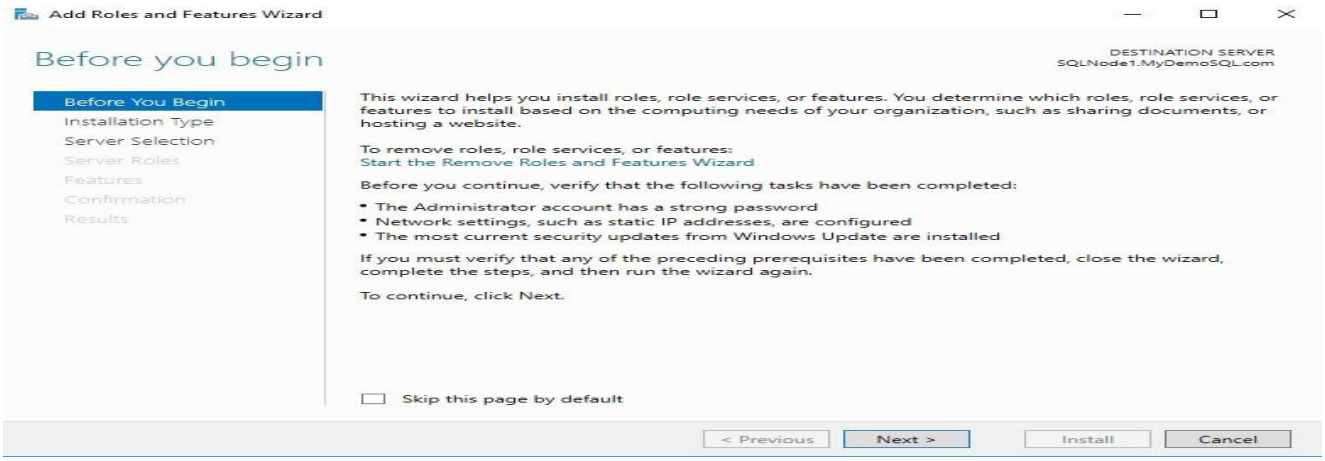
Failover Cluster configuration for SQL Server AlwaysOn Availability Groups

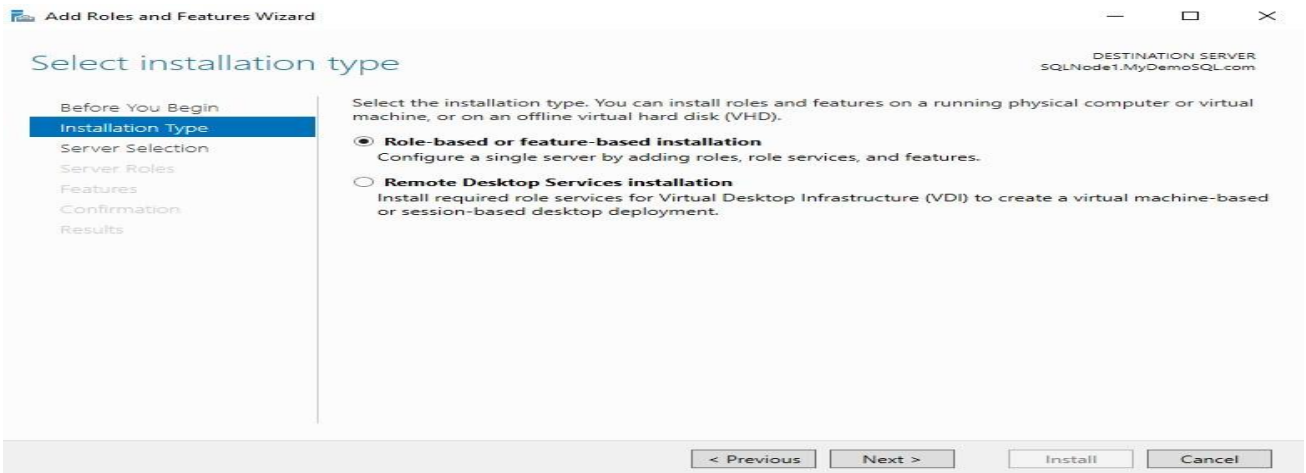
We require a minimum of two nodes failover cluster for the SQL Server always on availability groups. We can setup AG without cluster as well starting from SQL Server 2017, but it gives you limited AG functionality. It is out of scope topic for this article series. We prepared the following VMs for our demo purposes.

Server Name	IP address	Role
LBAD	192.168.0.230	Domain Controller and Active Directory
FINPORTALDB	192.168.100.53	Primary Node of PortalSQL_AG
FINPORTALDB2	192.168.100.133	Secondary Node of PortalSQL_AG

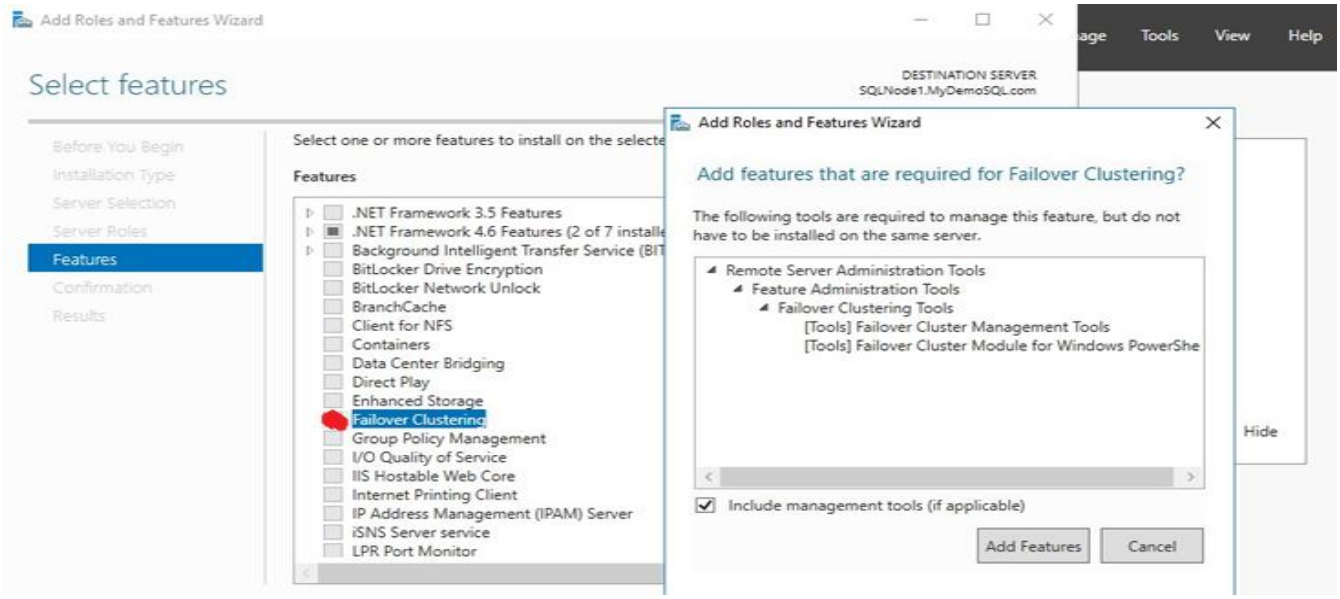
Now, we have a requirement to set up the Windows failover cluster for **FINPORTALDB** and **FINPORTALDB2**. To do so, launch Add Roles and Feature Wizard from the server manager. Enable the **Failover Clustering** feature in both the SQL nodes.



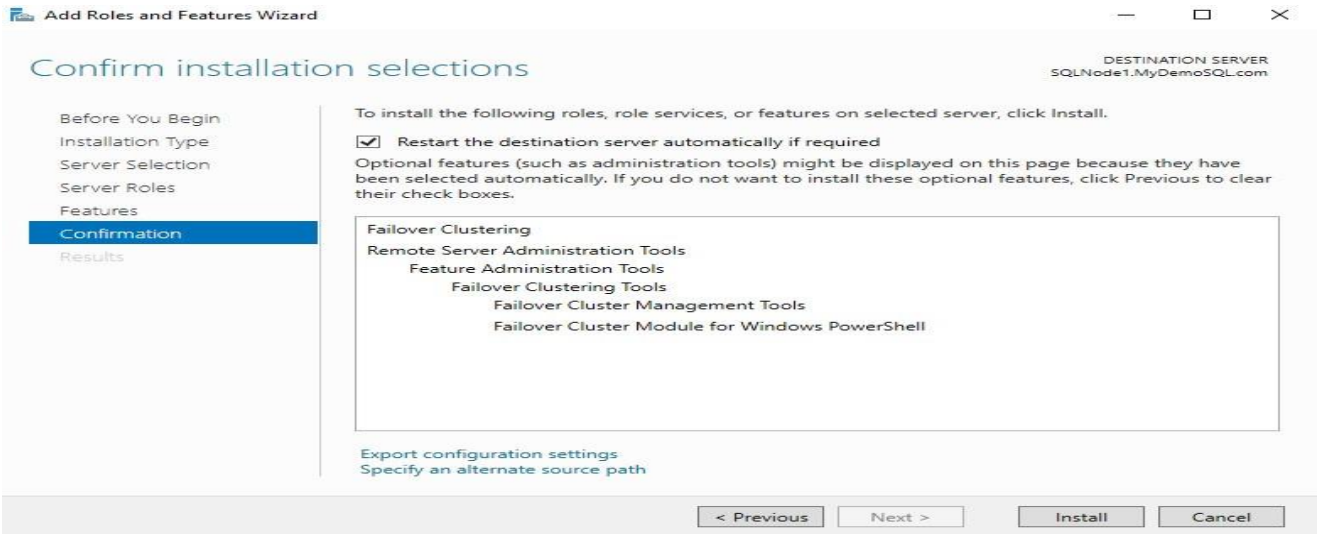
Confirm the failover cluster installation for SQL Server AlwaysOn Availability Groups.



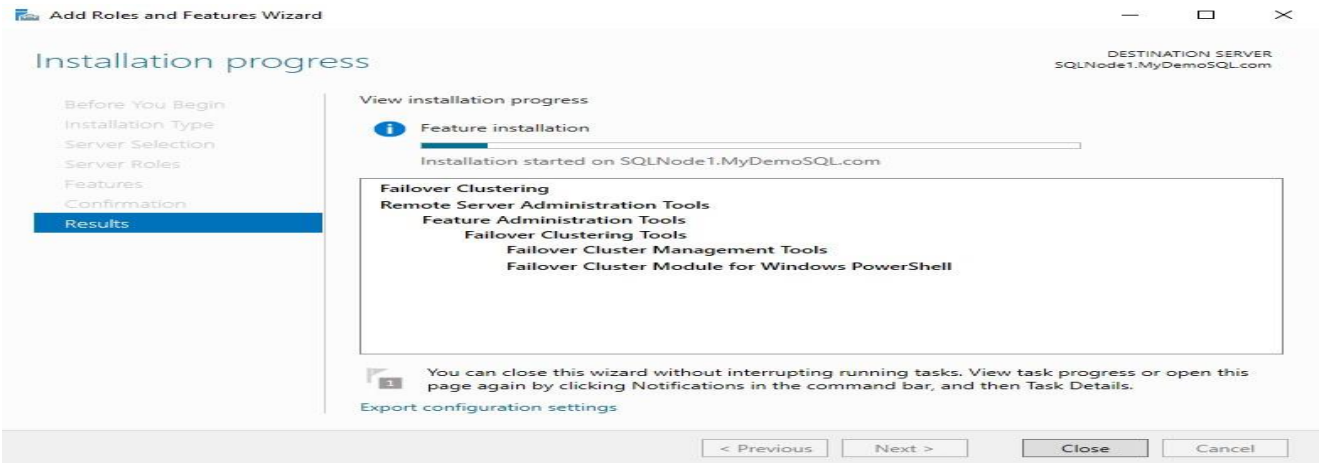
Put a tick mark on **Failover Clustering** and click on *Add Features* to install the feature with dependency.



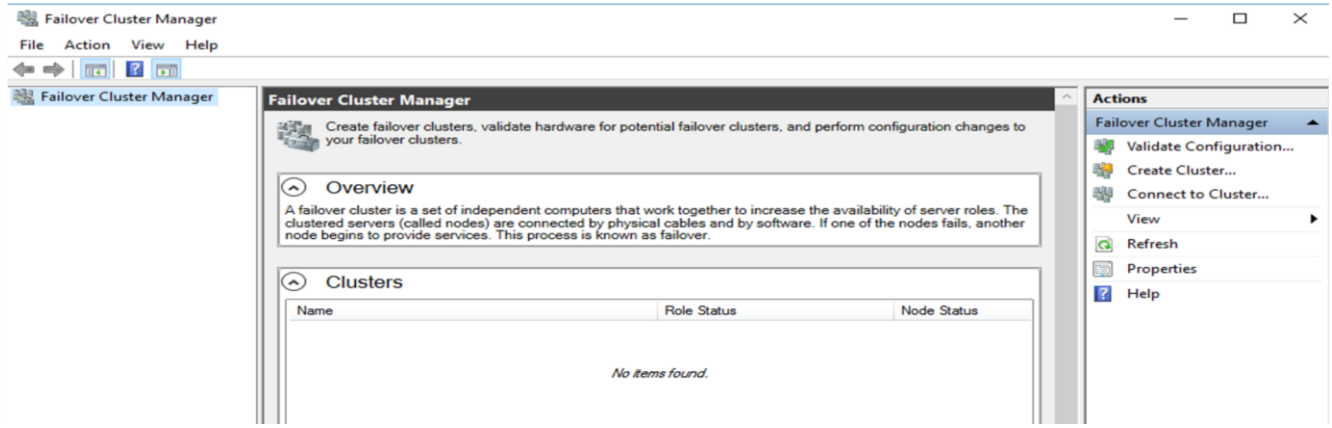
Review and confirm the installation. You can see it installs failover Cluster Management Tools along with the Failover Cluster Module for Windows PowerShell.



It quickly installs the features on your respective server.

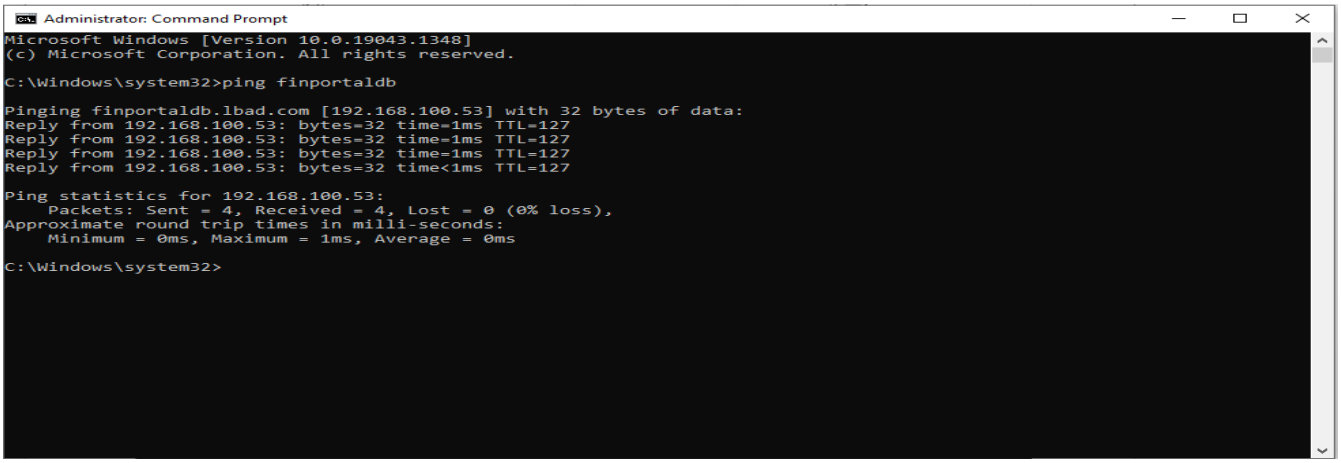


Once you enabled the feature on both nodes, search and launch failover clustering from the start menu. It currently shows no items found because we haven't configured the cluster yet.

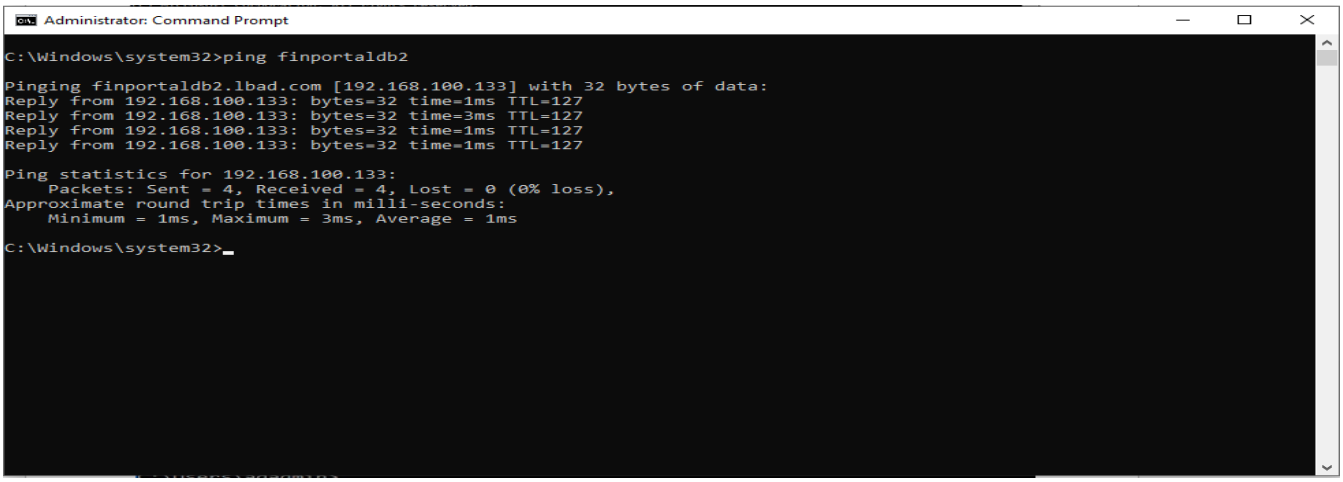


Before we proceeded further, check the ping response from **FINPORTALDB** to **FINPORTALDB2** and vice-versa.

Ping response from **FINPORTALDB** to **FINPORTALDB2**



Ping response from **FINPORTALDB2** to **FINPORTALDB**

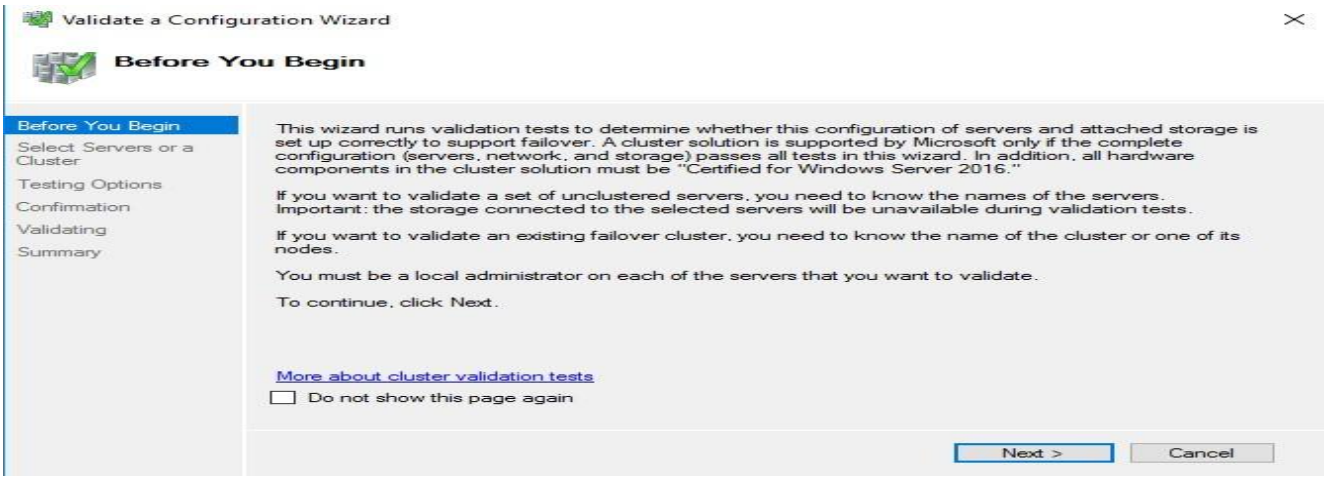


In case it does not work for you, disable the Windows firewall in both the nodes. Search for Windows Firewall in Start and disable all firewalls.

Note: Please do not disable the firewall in a production environment due to security reasons.

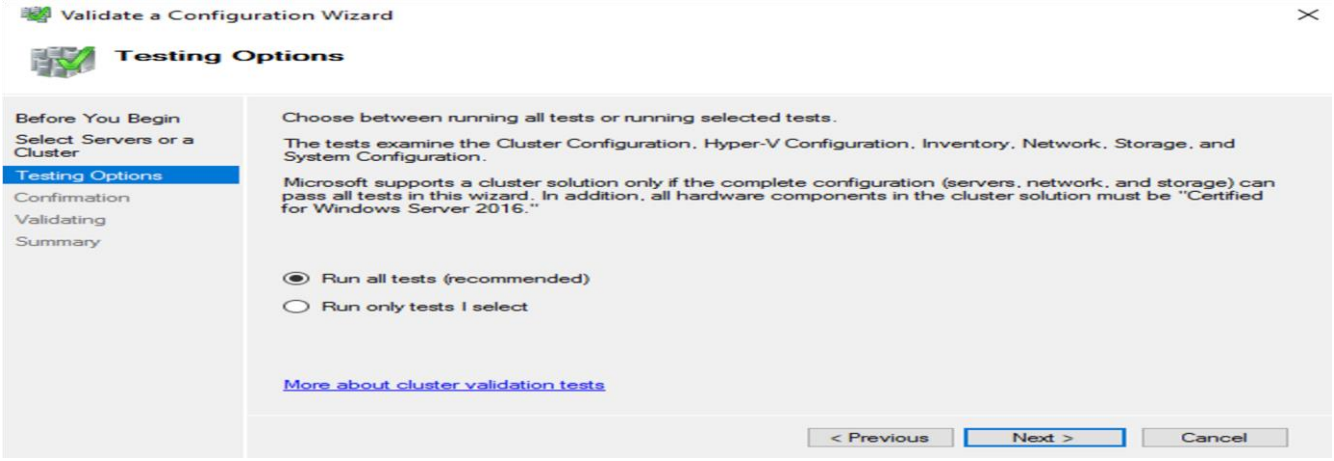
Validate Configurations for SQL Server always on availability groups

Click on the **Validate Configurations** in the **Actions** menu. You can read the description for learning purposes.

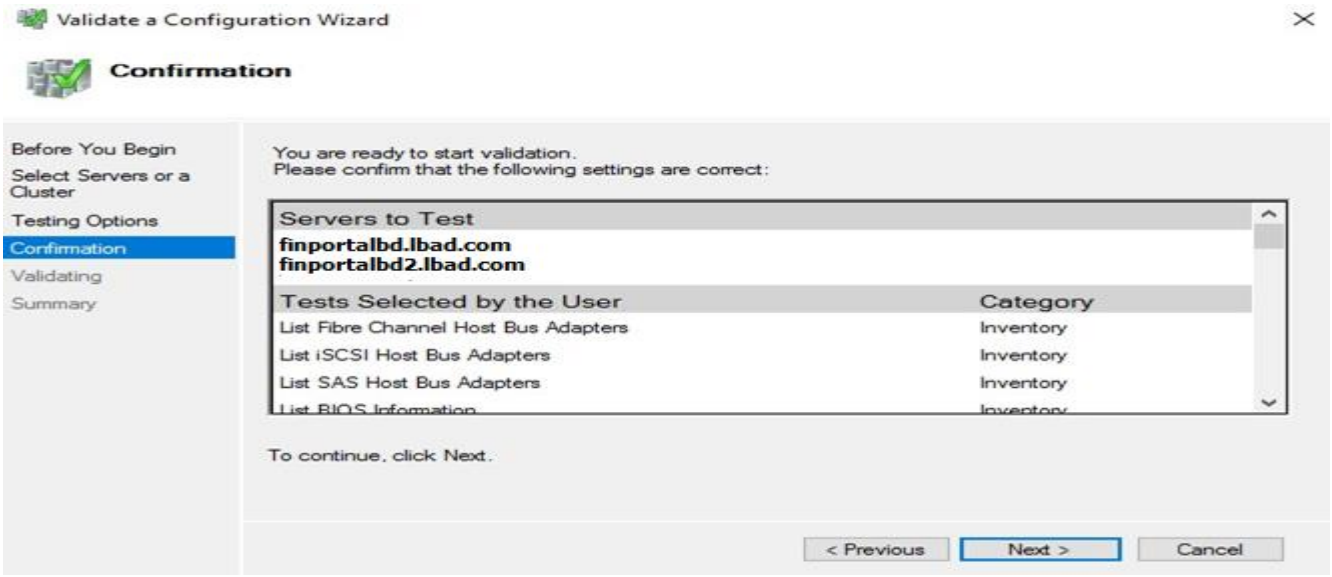


On the next page, add the nodes you want to add in the failover cluster. Here, I added both nodes for my cluster.

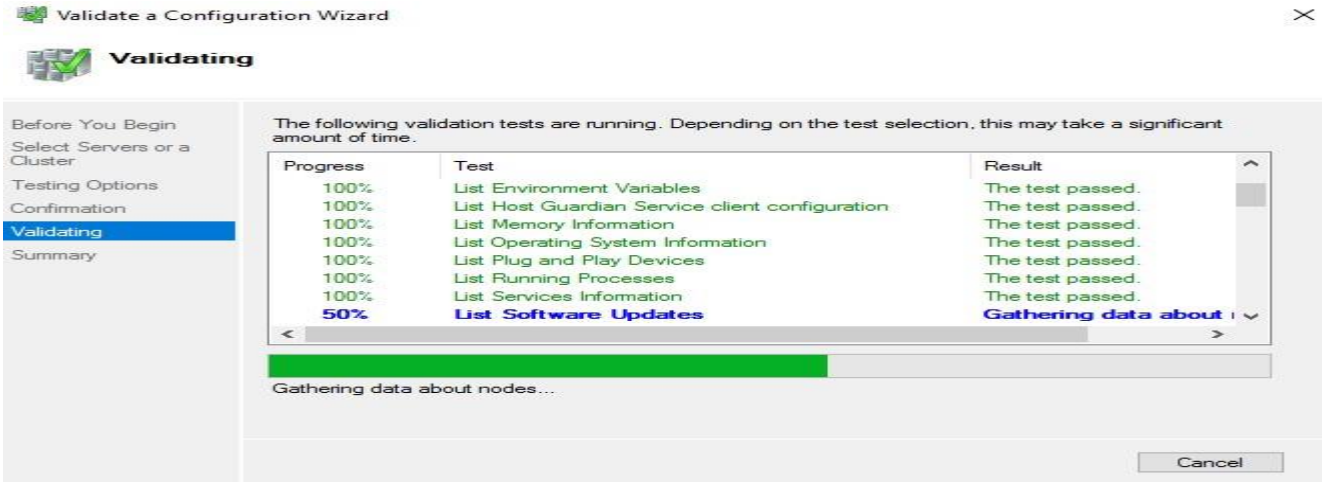
It performs various tests such as cluster configuration, network, Storage and Hyper-V configuration. We can perform limited tests as well, but it is good to perform all tests.



On the next page, it shows the servers for validation and lists down all tests it is going to perform.

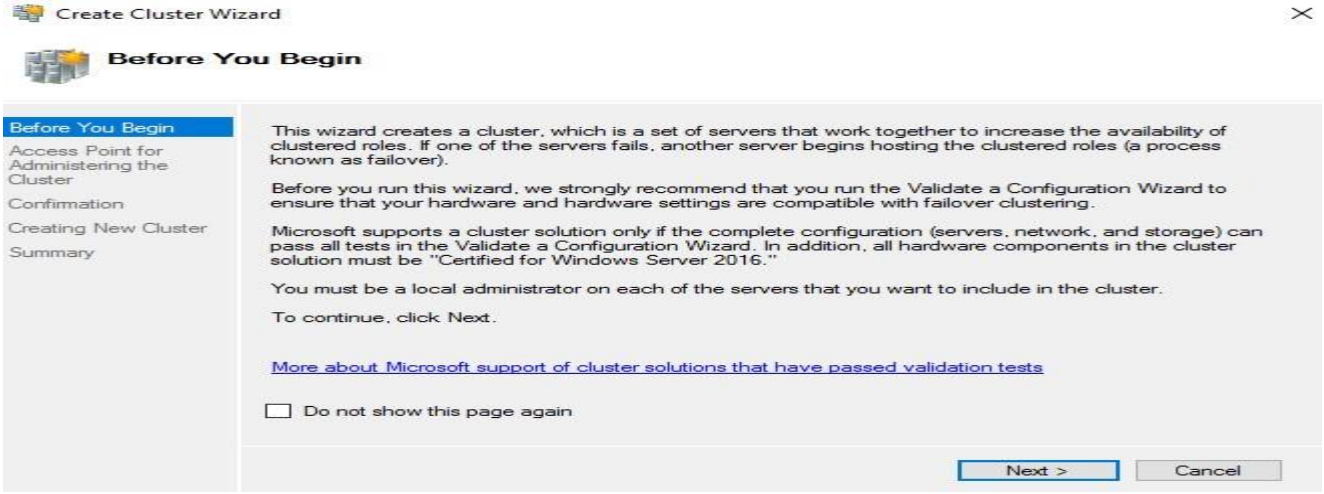


It starts validations one by one for all rules. It shows the result of each test, whether passed, failed or any warnings.

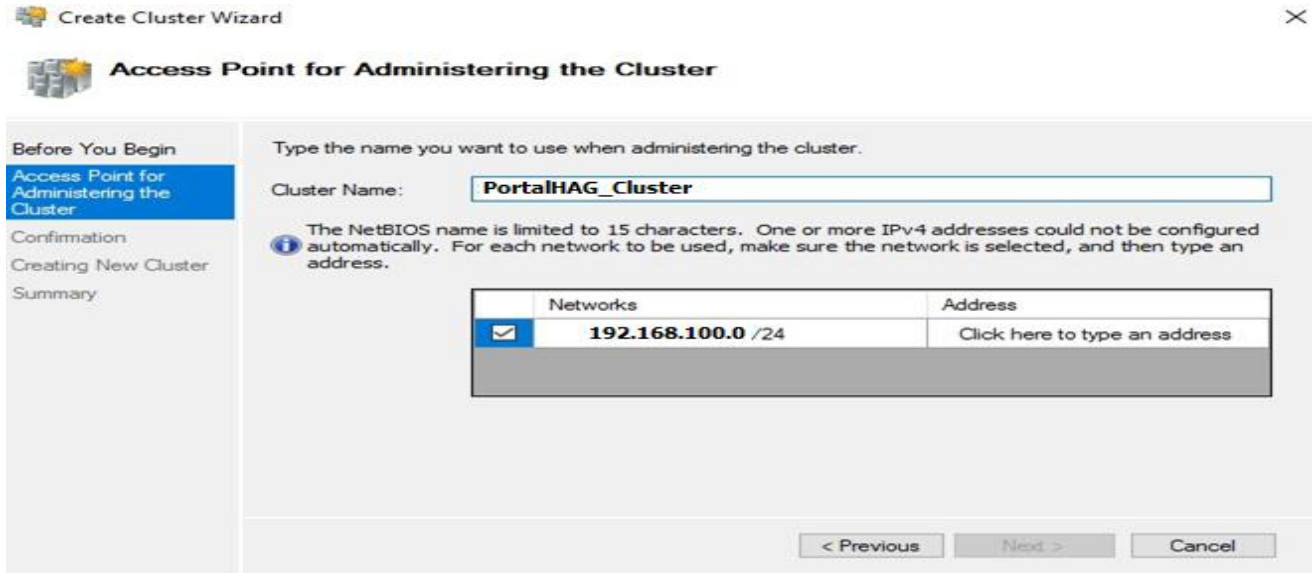


You can review the result of all test parameters in a cluster. Once reviewed, put a check on the **Create the cluster now using validated nodes…** It does not allow any additional nodes at this point. If you want, you can finish the process and revalidate the cluster servers.

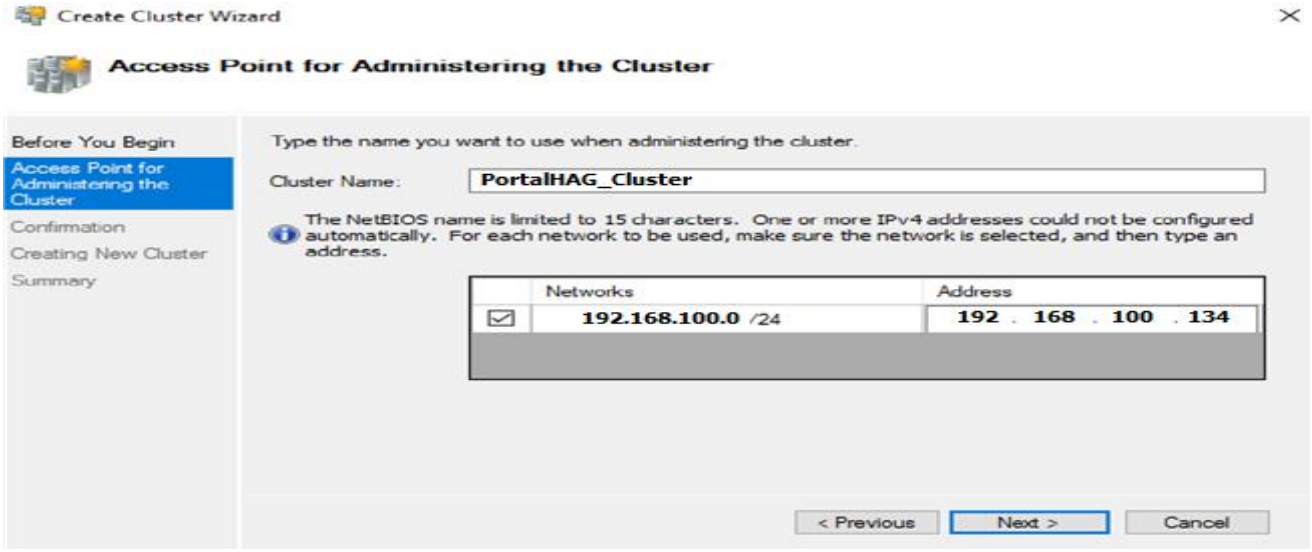
It launches the Create Cluster Wizard.



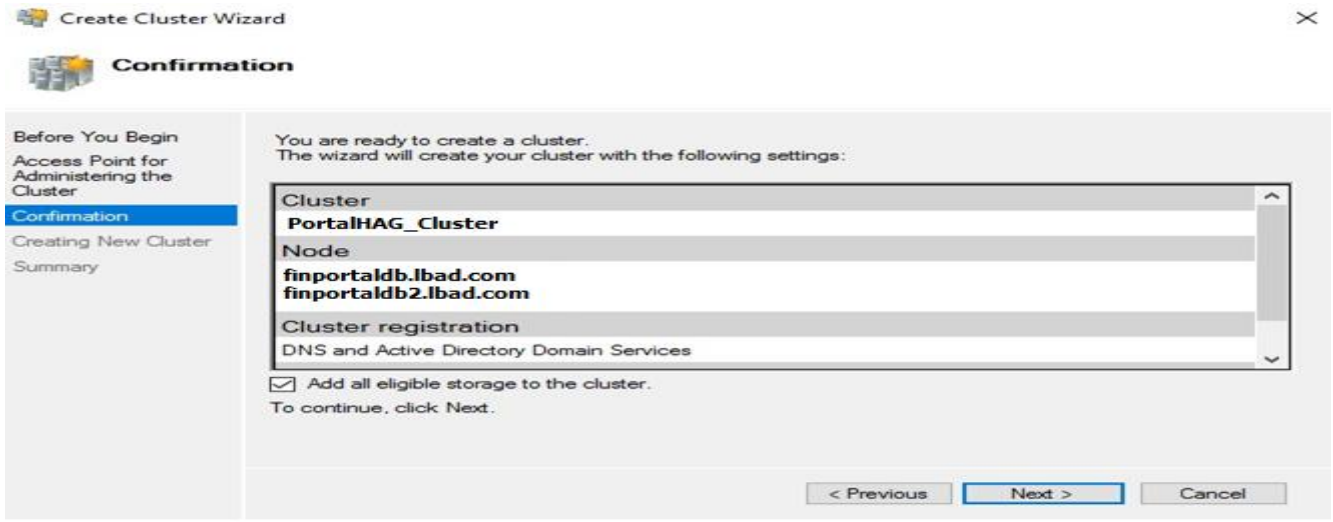
On the next page, we define an access point for administrating the cluster. It is a cluster name and cluster IP address.



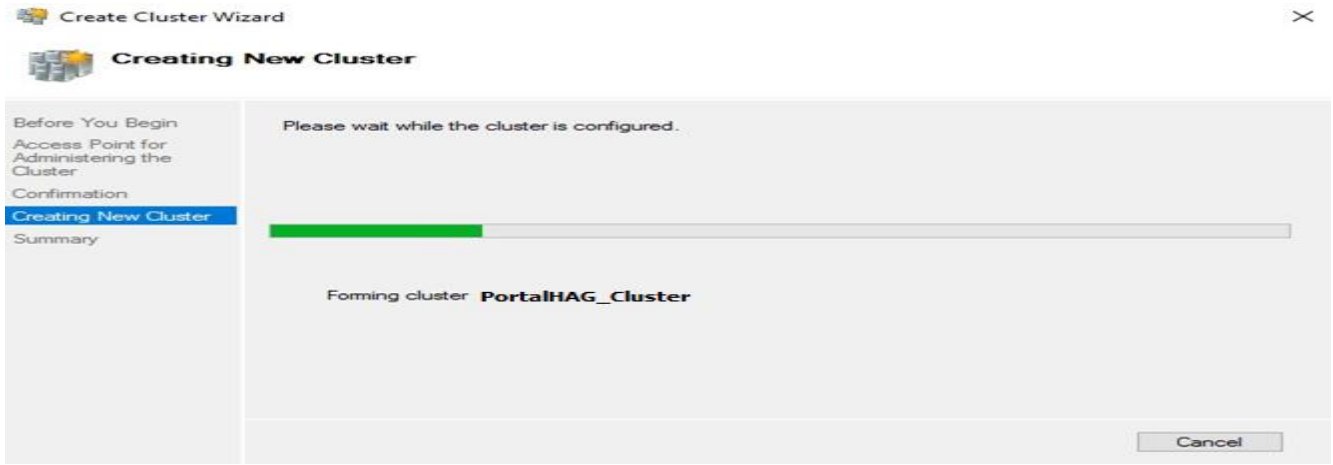
Give a unique name for the cluster in your environment along with a virtual IP address. It should be in the IP range of the nodes network.



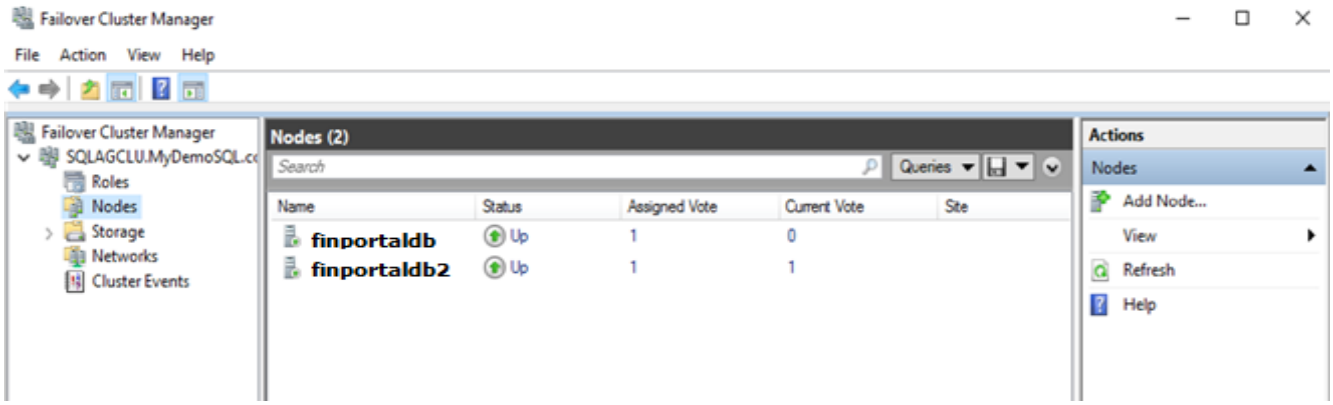
The cluster configuration is now complete. Click Next to start the cluster build process.



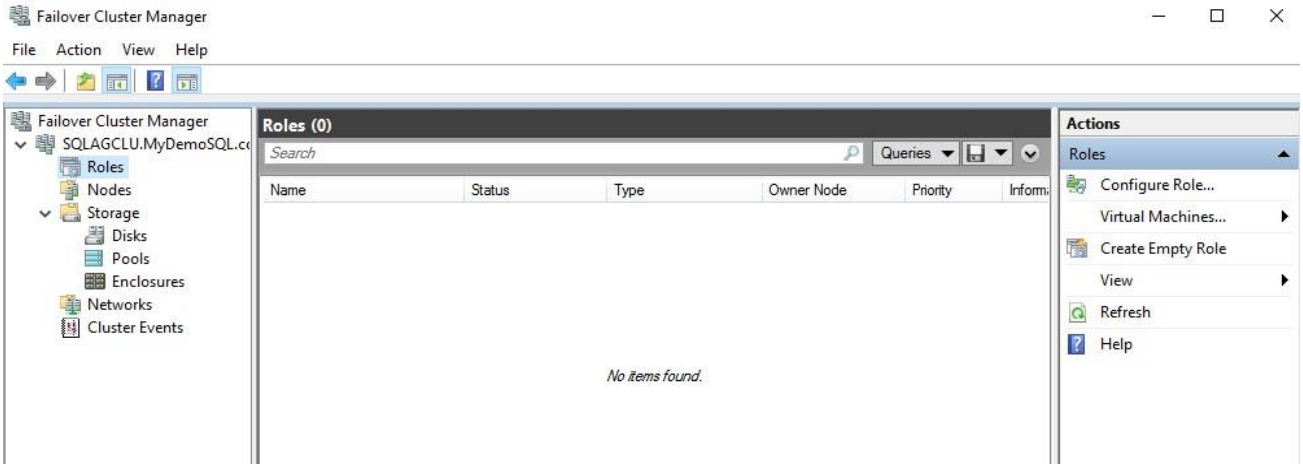
It forms the failover cluster from both SQL nodes specified.



Once the process is finished, launch the Failover cluster manager and view the nodes. It should show both nodes in the Up status.



Click on Roles, and it is empty because we have not added any roles yet in this cluster. You can verify the cluster name as **SQLAGCLU.MyDemoSQL.com**



Cluster Quorum Configuration

Quorum configuration is another important step in the cluster environment as it allows the cluster to keep running even nodes may be down in the failover cluster.

In the failover cluster, we have multiple nodes. If we have a two-node cluster and both node servers are at different data centers locations, and the network is down in data centers, the nodes will not able to communicate with each other. When they are not able to communicate, each node will think the another node is not available, so each node will take responsibility and become the primary server

As both nodes simultaneously self-configure primary, this causes the cluster to split into two parts. As both nodes are working, it creates a data loss situation. This is commonly referred to as a “Split-brain” situation.

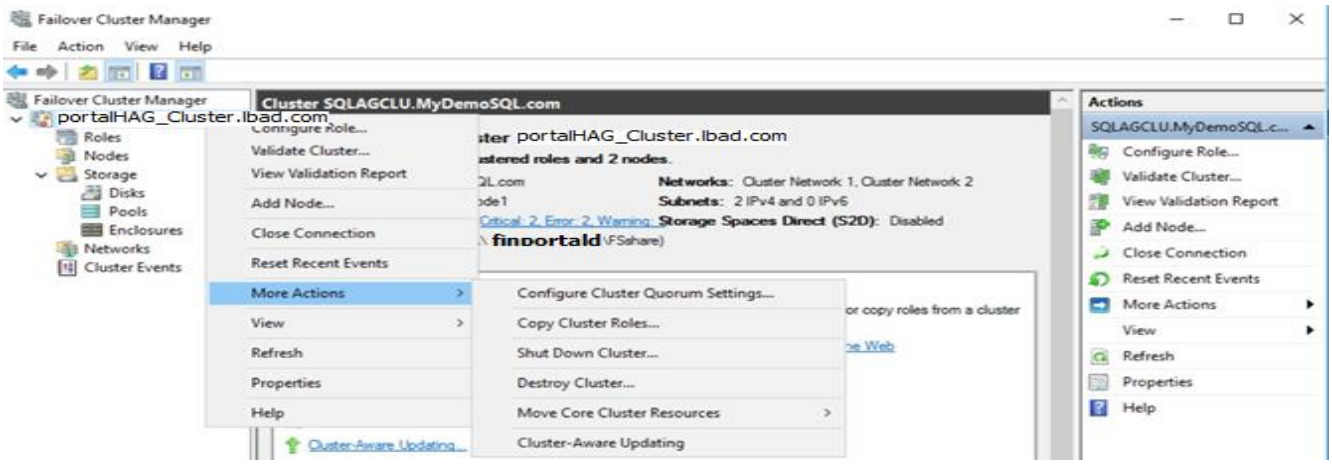
To prevent such a split-brain situation, the Quorum model which implements a voting system in cluster nodes of the cluster resource, was introduced. There are four quorum models in the cluster

- **Node Majority** – Each node has a vote. This is suitable for an Odd number of nodes
- **Node and Disk Majority** – This is suitable for an even number of nodes. The disk provides a vote to get a majority of votes
- **Node and File Share Majority** – This is the same as Node and Disk Majority, only a file share used instead
- **No Majority** – In this model, Disk is enough to form the quorum

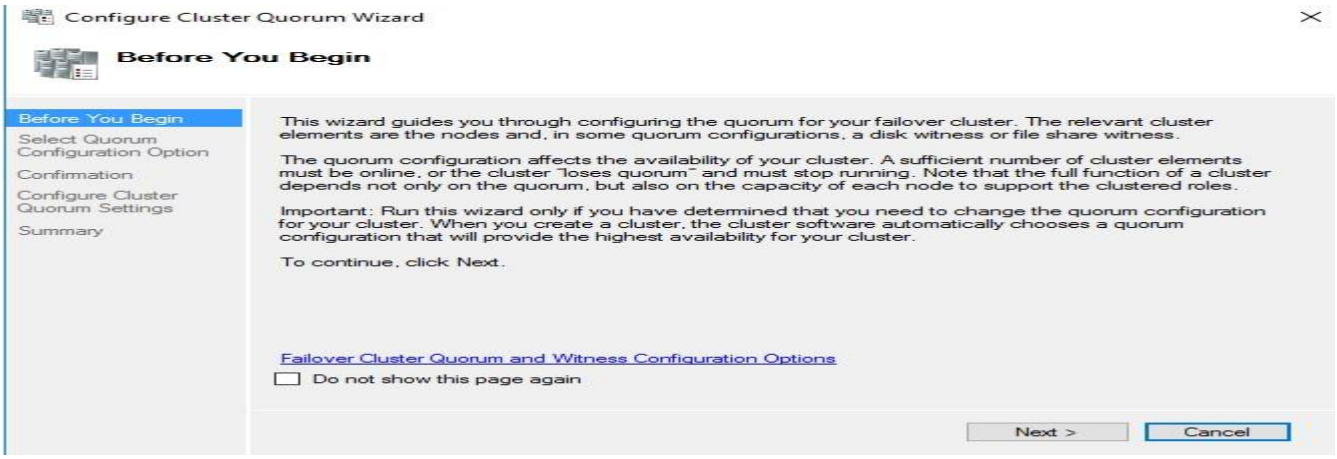
If a Quorum is not available, and some nodes are down, the cluster will not run, and it will go down. The quorum will keep running the cluster based on the majority of votes in the group. Let's say we have three nodes in cluster SQL1, SQL2, and SQL3. This means we have an odd number of clusters and each node will get one vote. In case any node failed then we will have two votes. So out of three votes, the group got two votes which represents the majority. So the failover cluster will keep running even if one node failed.

Let's say, we have a two-node cluster, SQL1 and SQL2, which is an even numbered node cluster, and one of the nodes, SQL2, fails. In this case, we will have only one vote for SQL1, which is not a majority to keep the cluster running, so in this case the disk will take precedence, providing one more vote to provide majority. So, in this case, SQL1 and the disk will together provide two votes which form the majority, so in this way the quorum will keep cluster running. This is referred to as Node and Disk Majority.

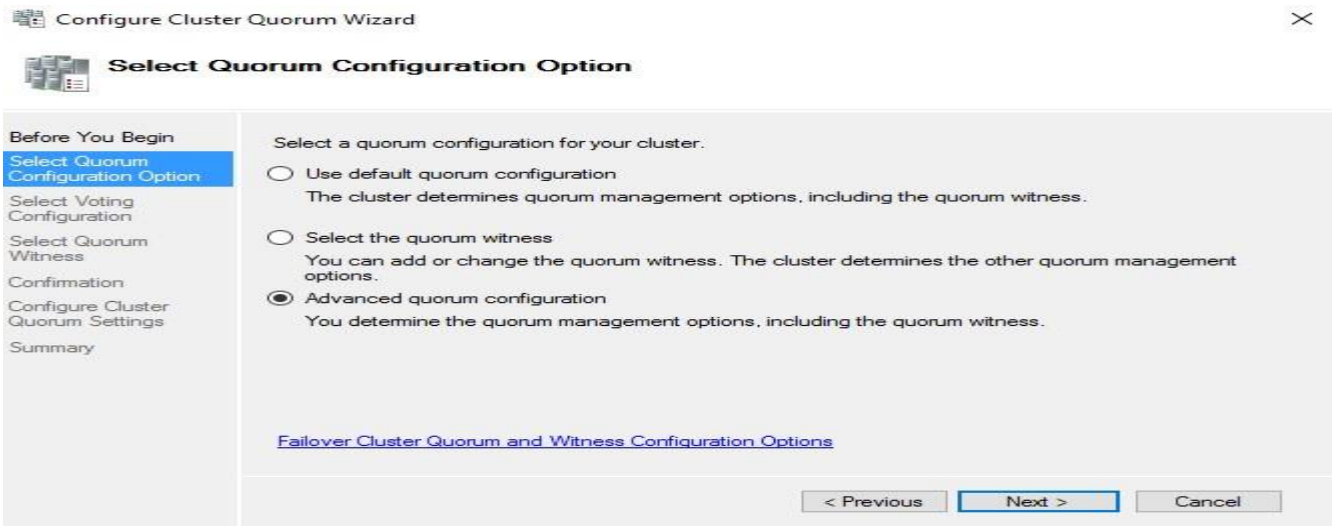
Now, right-click on the Cluster name and go to **More Actions -> Configure Cluster Quorum Settings.**



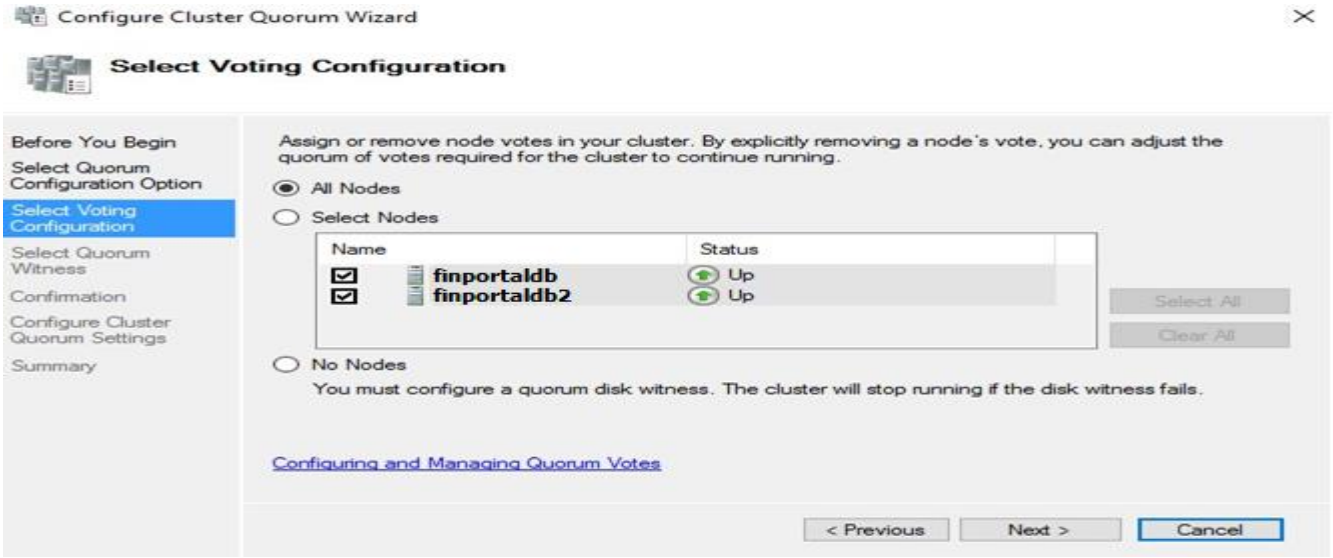
It launches the cluster quorum wizard with a brief introduction.



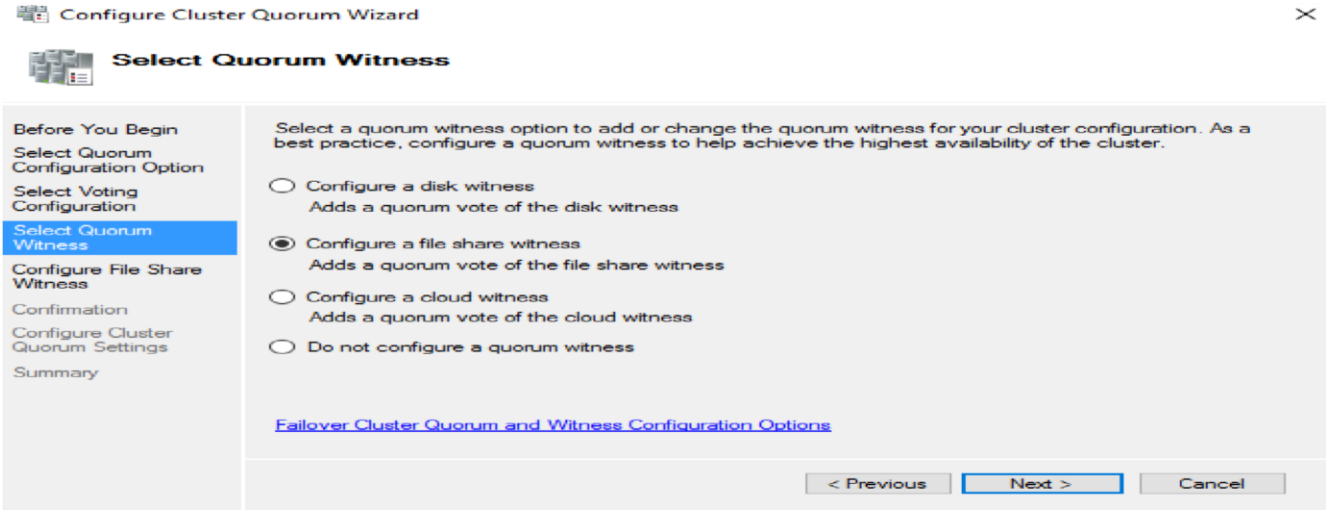
Select the option **Advanced quorum configuration** from the quorum confirmation options.



We can decide which nodes can do voting in a failover cluster configuration. By default, it selects all failover cluster nodes for voting eligibility.



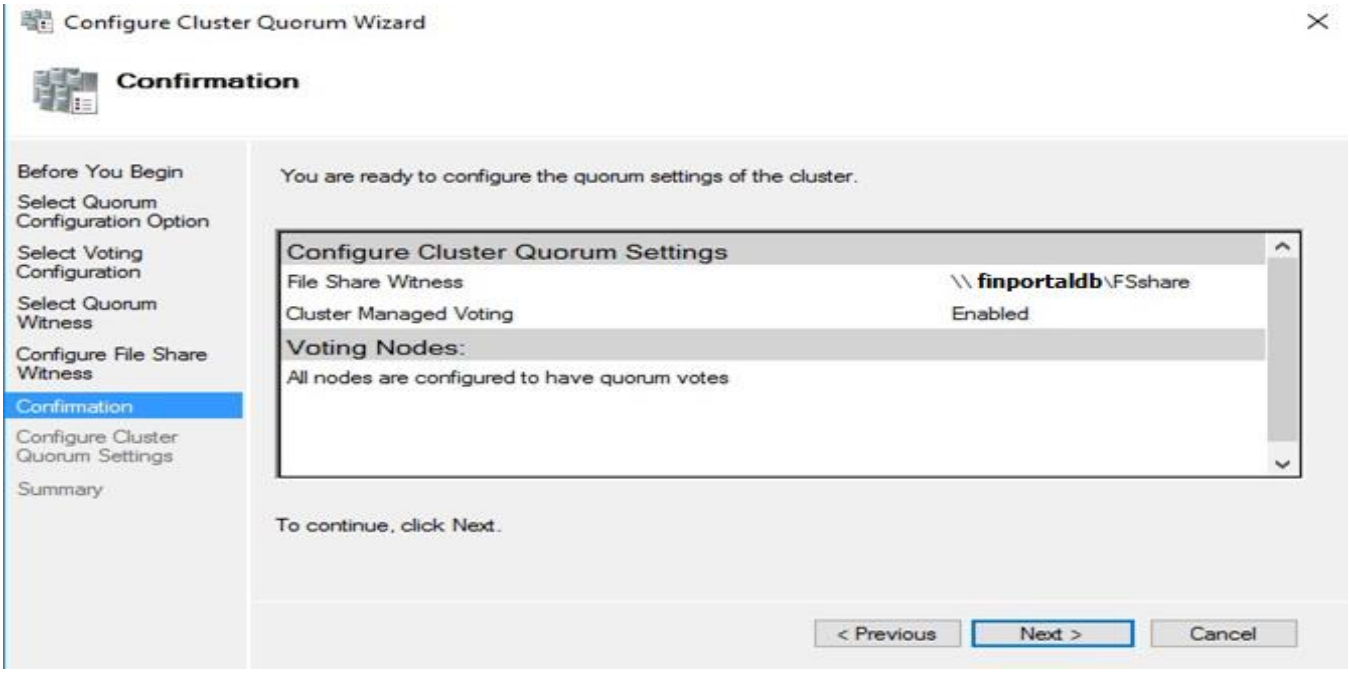
Select the file share witness as a quorum witness on the next page.



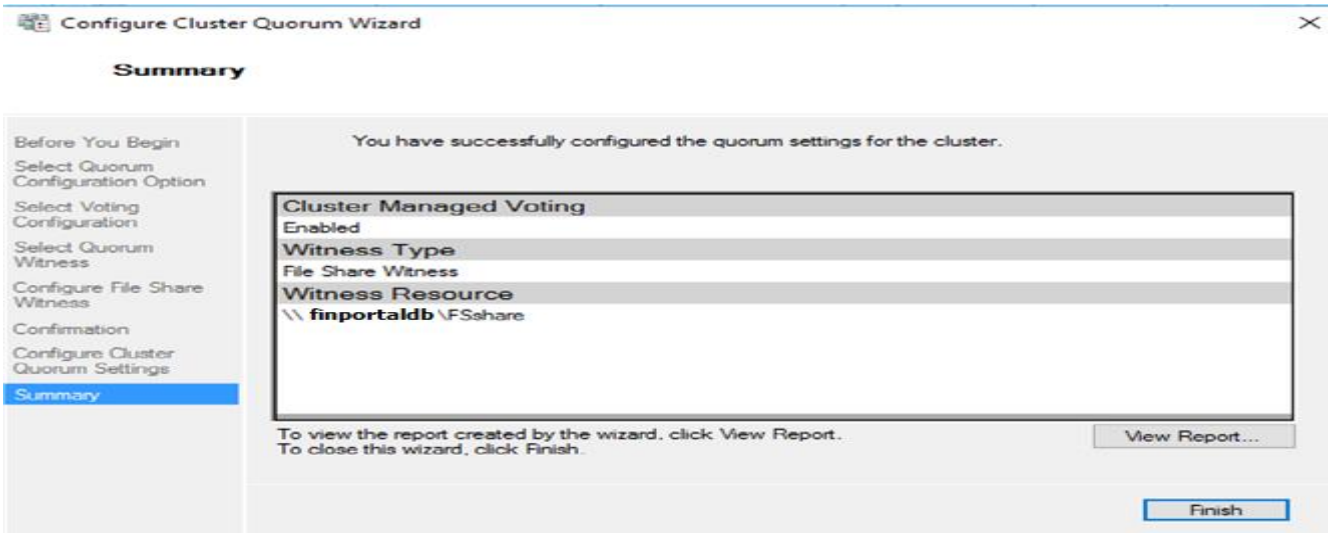
Before we proceed for the next step, create a file share in the domain controller VM and permit the Windows account by which we log in to SQL nodes. Ideally, you should not create the file share on the cluster nodes because in case that particular node goes down, file share witness also goes down.

Specify the shared folder path as a file share path.

Review your configuration and confirm to proceed further.



It has successfully configured the file share witness in our failover cluster configuration, as shown below.



You can connect to the failover cluster manager, and it shows the file share witness in the console.