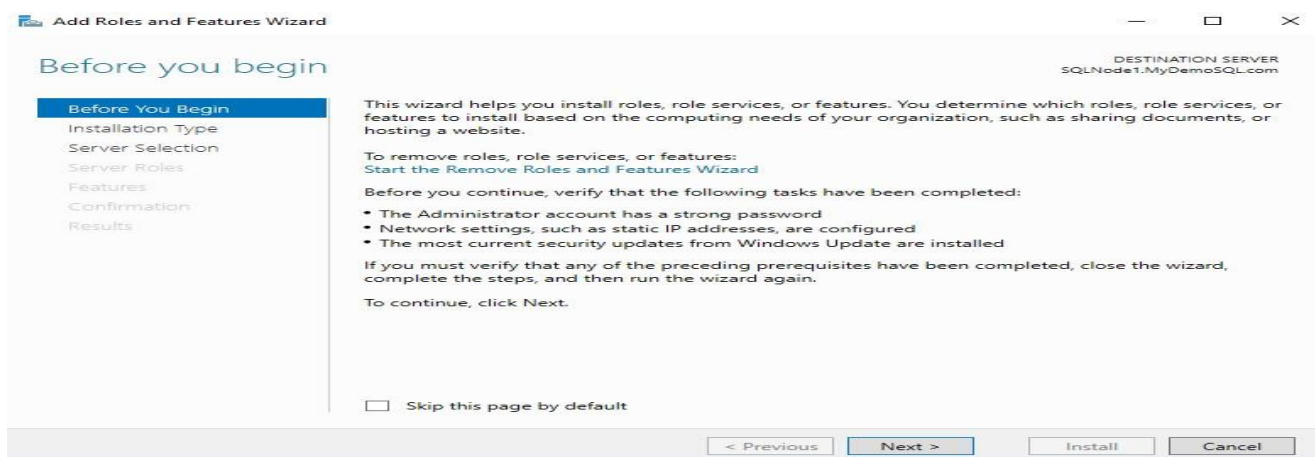


Failover Cluster configuration for SQL Server AlwaysOn Availability Groups

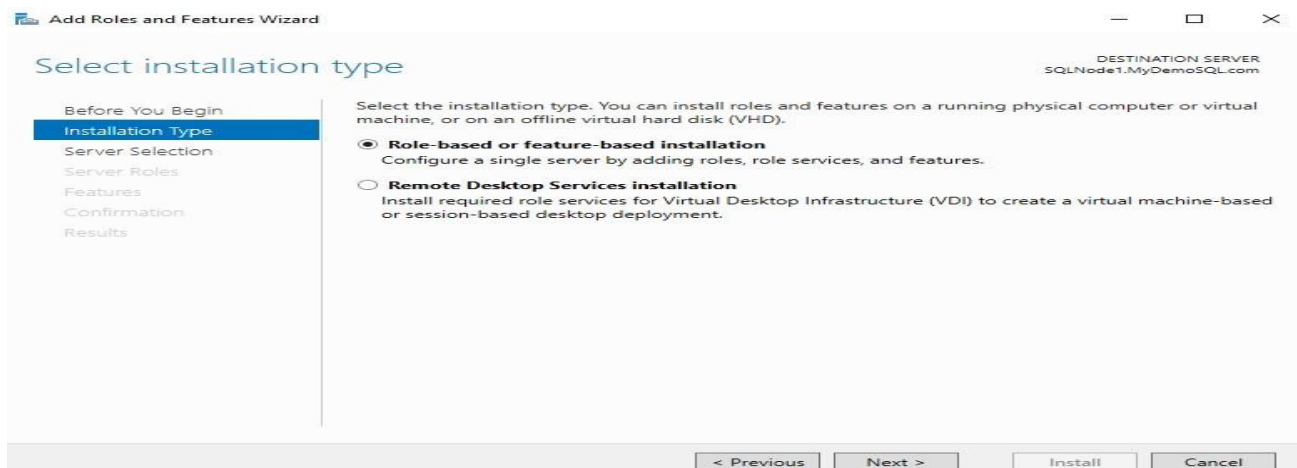
We require a minimum of two nodes failover cluster for the SQL Server always on availability groups. We can setup AG without cluster as well starting from SQL Server 2017, but it gives you limited AG functionality. It is out of scope topic for this article series. We prepared the following VMs for our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

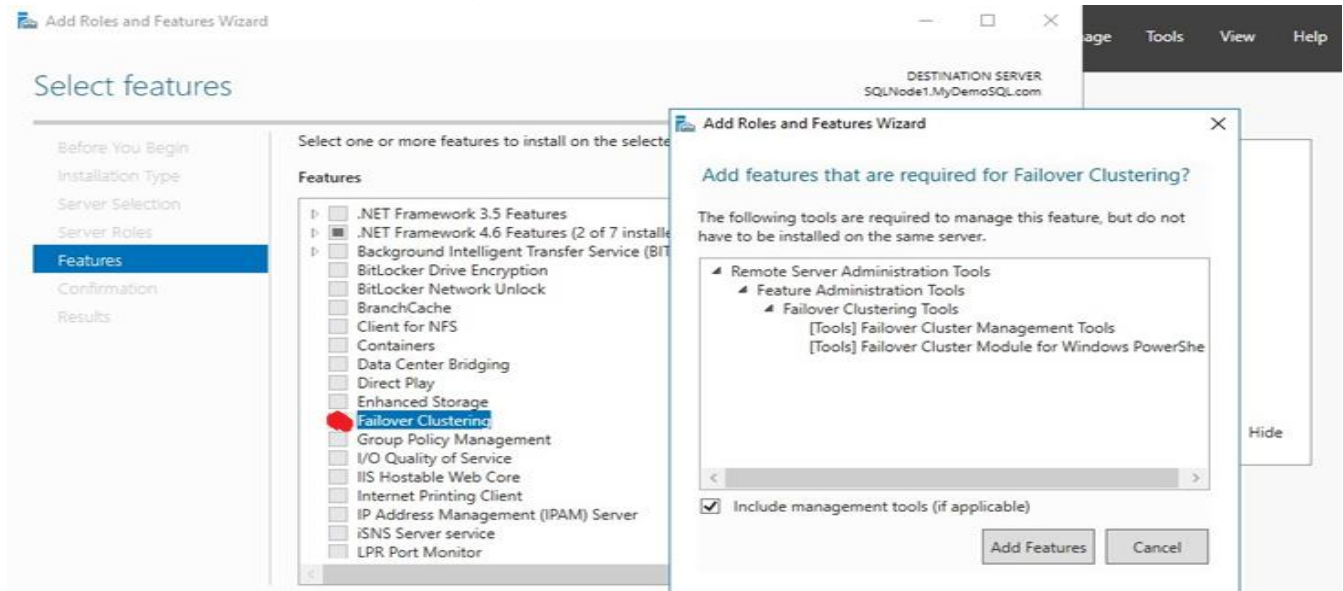
Now, we have a requirement to set up the Windows failover cluster for **FINPORTALDB** and **FINPORTALDB2**. To do so, launch Add Roles and Feature Wizard from the server manager. Enable the **Failover Clustering** feature in both the SQL nodes.



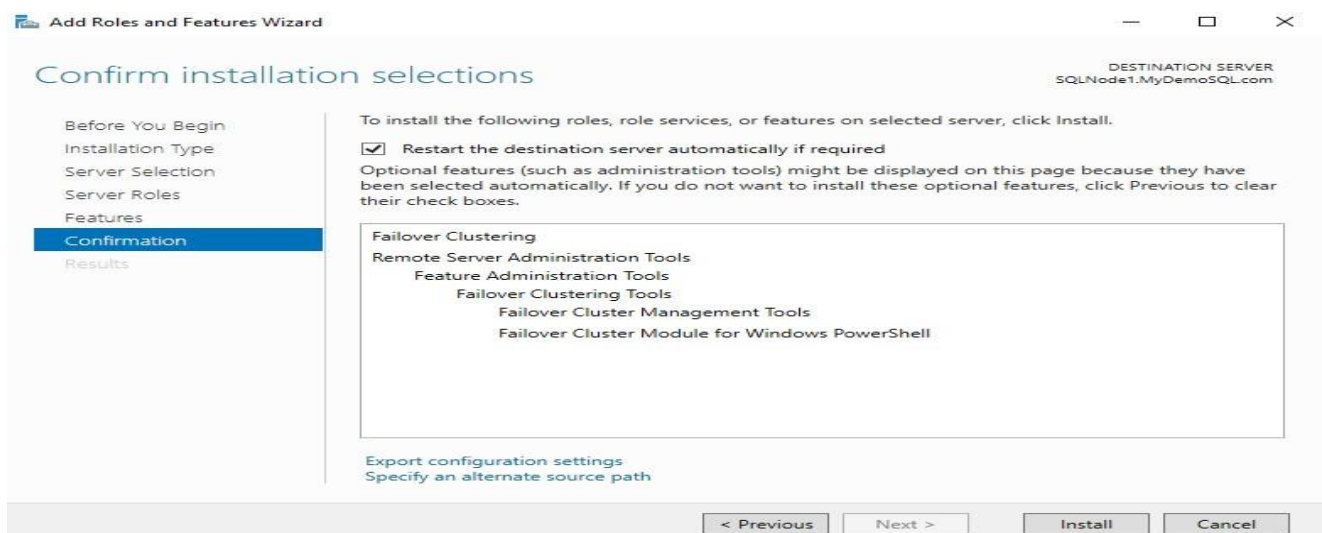
Confirm the failover cluster installation for SQL Server AlwaysOn Availability Groups.



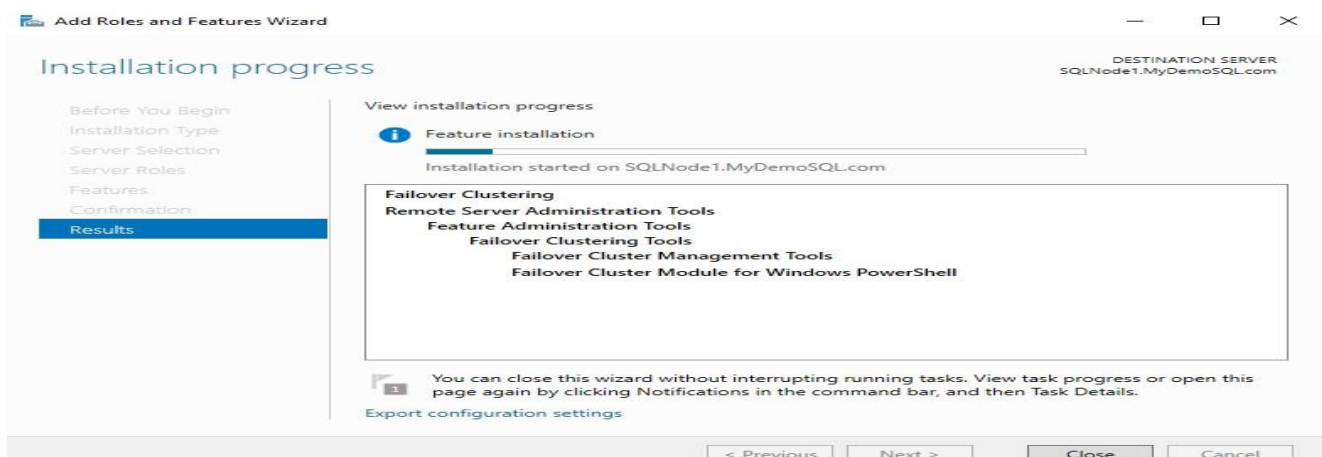
Put a tick mark on **Failover Clustering** and click on *Add Features* to install the feature with dependency.



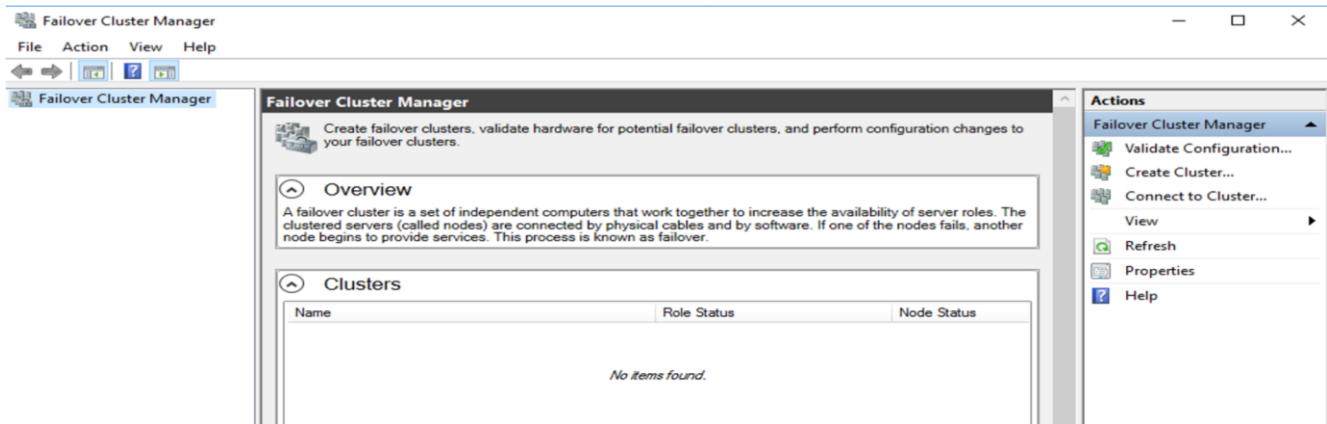
Review and confirm the installation. You can see it installs failover Cluster Management Tools along with the Failover Cluster Module for Windows PowerShell.



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**

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.19043.1348]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\system32>ping finportaldb

Pinging finportaldb.lbad.com [192.168.100.53] with 32 bytes of data:
Reply from 192.168.100.53: bytes=32 time=1ms TTL=127
Reply from 192.168.100.53: bytes=32 time=1ms TTL=127
Reply from 192.168.100.53: bytes=32 time=1ms TTL=127
Reply from 192.168.100.53: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.100.53:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Windows\system32>
```

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

```
Administrator: Command Prompt

C:\Windows\system32>ping finportaldb2

Pinging finportaldb2.lbad.com [192.168.100.133] with 32 bytes of data:
Reply from 192.168.100.133: bytes=32 time=1ms TTL=127
Reply from 192.168.100.133: bytes=32 time=3ms TTL=127
Reply from 192.168.100.133: bytes=32 time=1ms TTL=127
Reply from 192.168.100.133: bytes=32 time=1ms TTL=127

Ping statistics for 192.168.100.133:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 3ms, Average = 1ms

C:\Windows\system32>
```

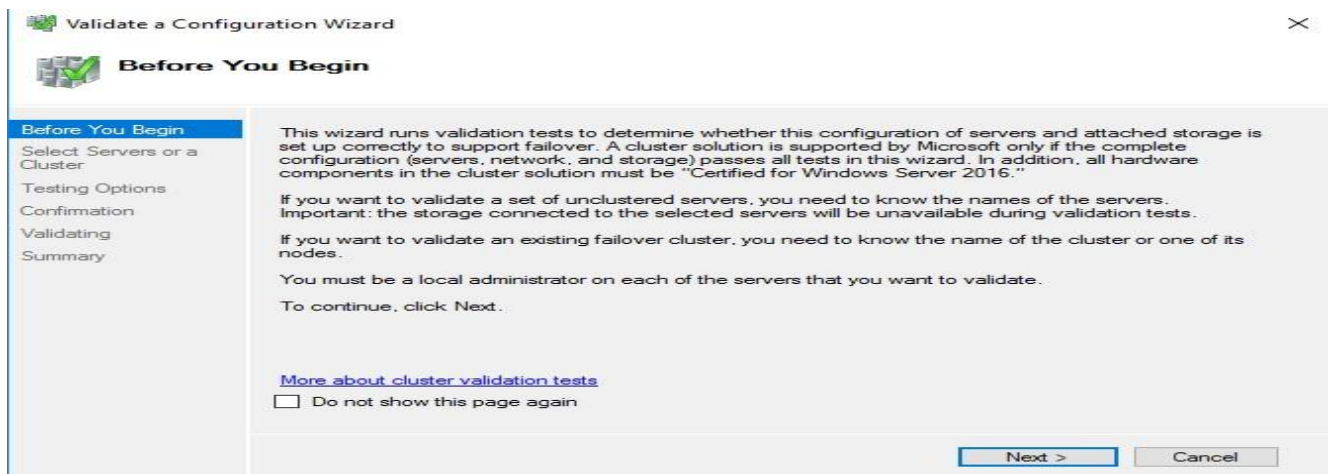
In case it does not work for you, disable the Windows firewall in both the nodes. Search for Windows Firewall in Start and disable all firewalls.

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



Validate Configurations for SQL Server always on availability groups

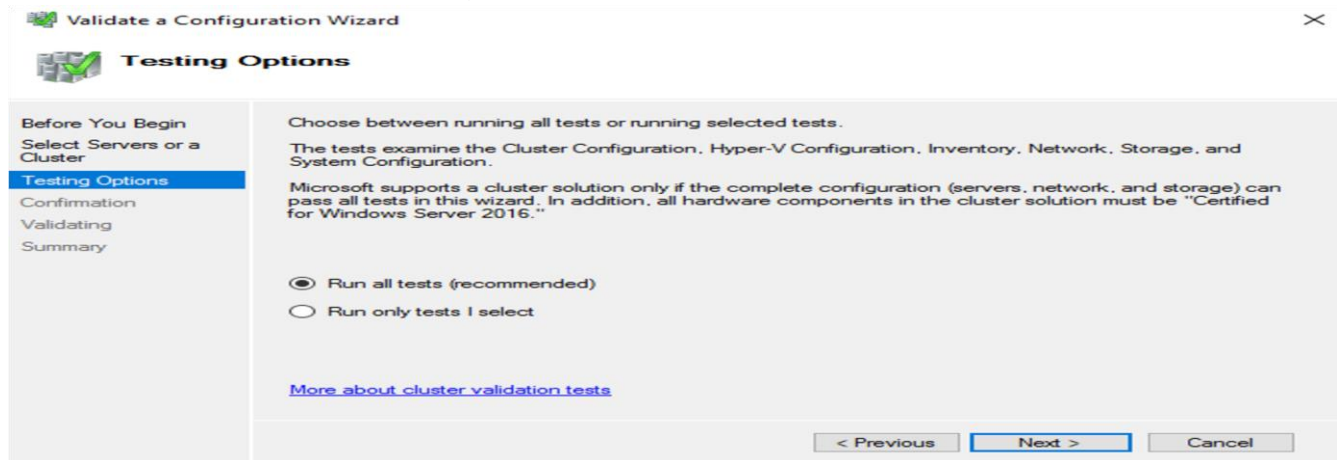
Click on the **Validate Configurations** in the **Actions** menu. You can read the description for learning purposes.



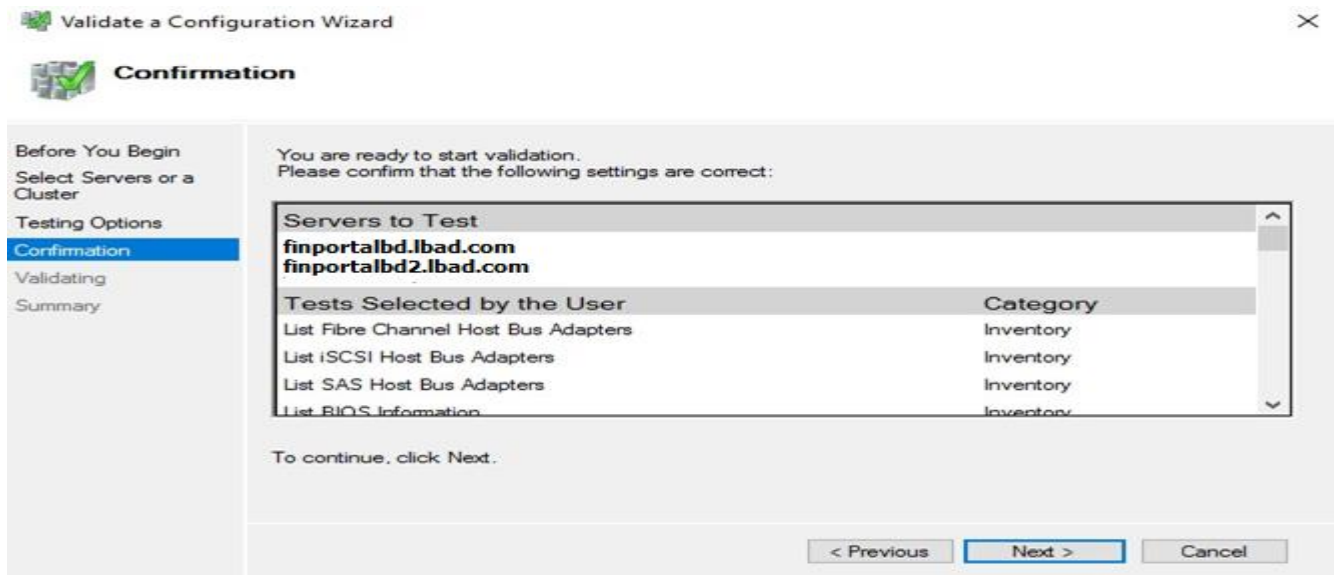
On the next page, add the nodes you want to add in the failover cluster. Here, I added both nodes for my cluster.



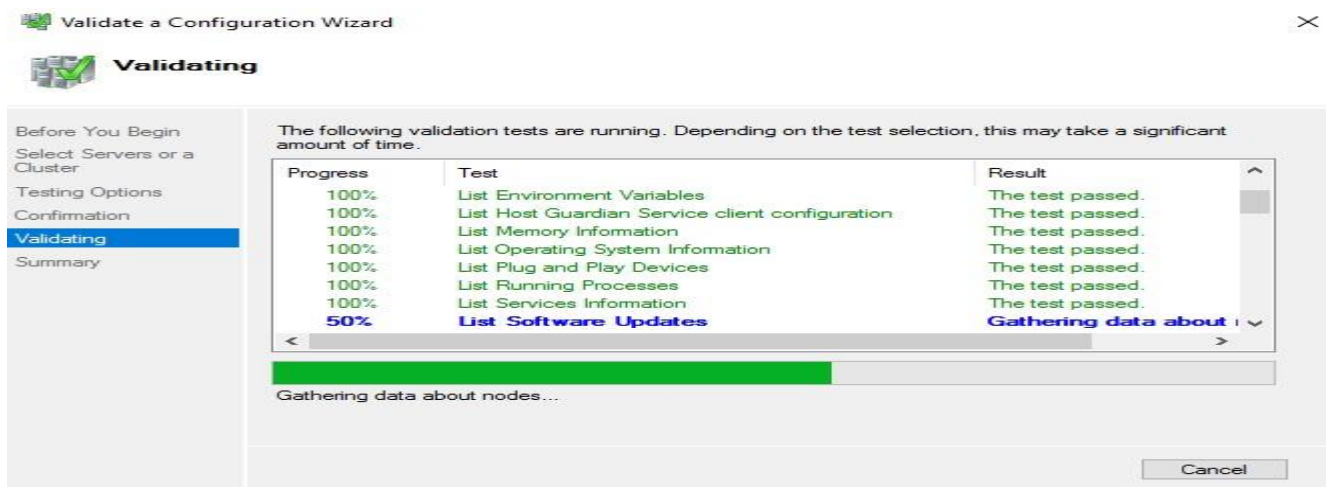
It performs various tests such as cluster configuration, network, Storage and Hyper-V configuration. We can perform limited tests as well, but it is good to perform all tests.



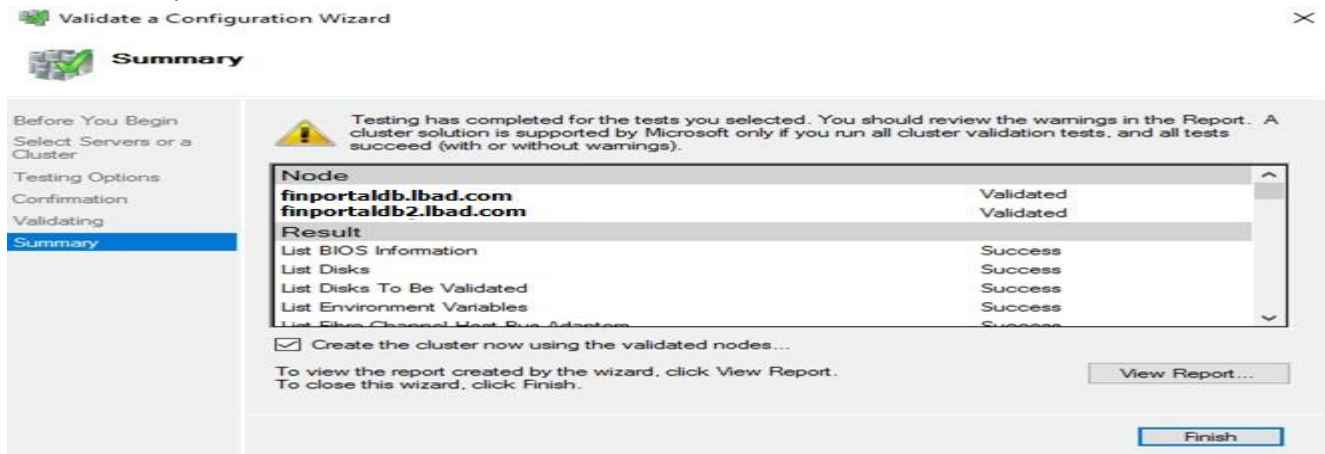
On the next page, it shows the servers for validation and lists down all tests it is going to perform.



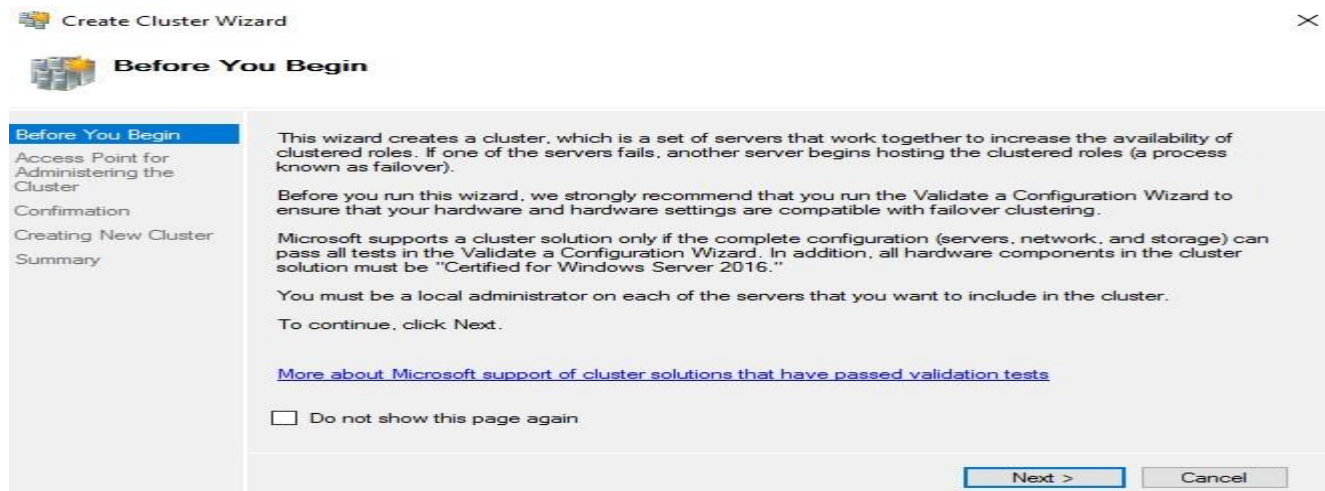
It starts validations one by one for all rules. It shows the result of each test, whether passed, failed or any warnings.



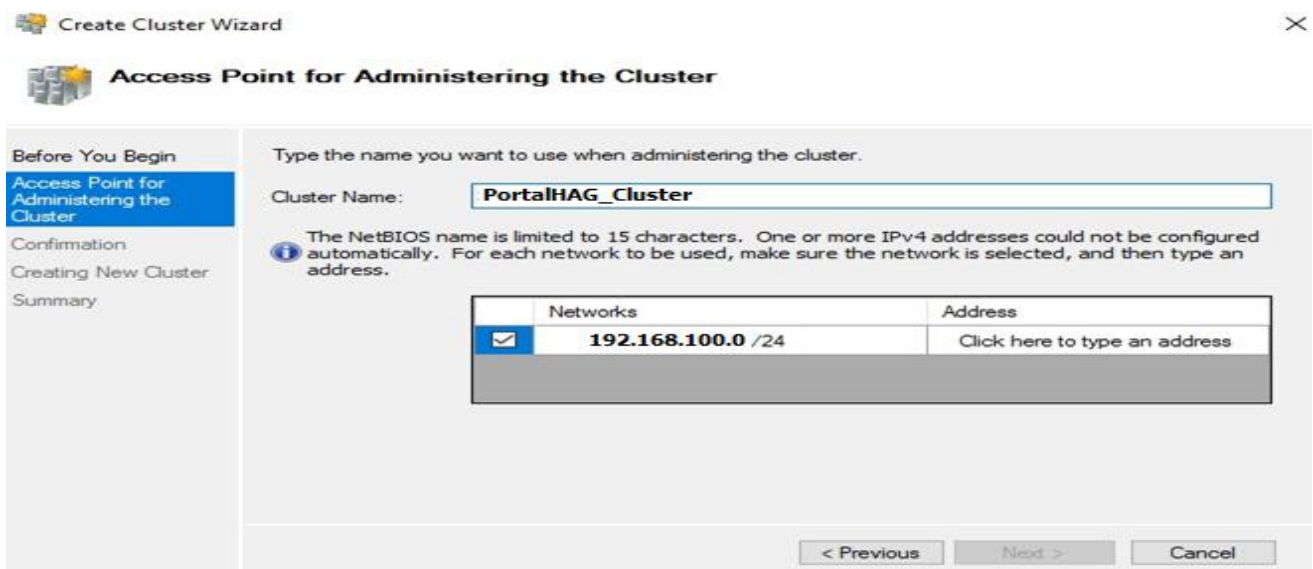
You can review the result of all test parameters in a cluster. Once reviewed, put a check on the **Create the cluster now using validated nodes...** It does not allow any additional nodes at this point. If you want, you can finish the process and revalidate the cluster servers.



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.

Create Cluster Wizard

Access Point for Administering the Cluster

Before You Begin
Access Point for Administering the Cluster
Confirmation
Creating New Cluster
Summary

Type the name you want to use when administering the cluster.

Cluster Name: **PortalHAG_Cluster**

The NetBIOS name is limited to 15 characters. One or more IPv4 addresses could not be configured automatically. For each network to be used, make sure the network is selected, and then type an address.

	Networks	Address
<input checked="" type="checkbox"/>	192.168.100.0 /24	192 . 168 . 100 . 134

< Previous **Next >** Cancel

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

Create Cluster Wizard

Confirmation

Before You Begin
Access Point for Administering the Cluster
Confirmation
Creating New Cluster
Summary

You are ready to create a cluster.
The wizard will create your cluster with the following settings:

Cluster
PortalHAG_Cluster

Node
finportaldb.lbad.com
finportaldb2.lbad.com

Cluster registration
DNS and Active Directory Domain Services

☒ Add all eligible storage to the cluster.
To continue, click Next.

< Previous **Next >** Cancel

It forms the failover cluster from both SQL nodes specified.

Create Cluster Wizard

Creating New Cluster

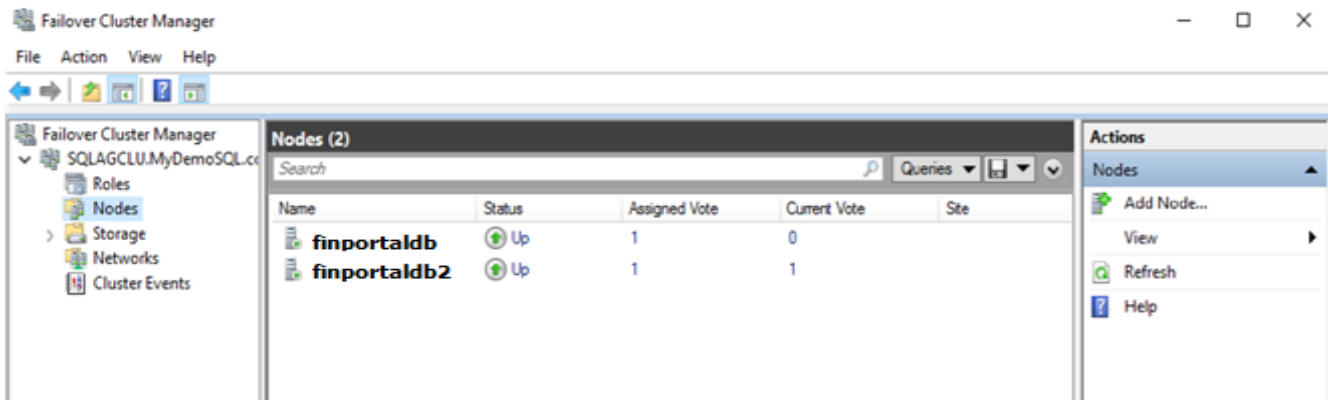
Before You Begin
Access Point for Administering the Cluster
Confirmation
Creating New Cluster
Summary

Please wait while the cluster is configured.

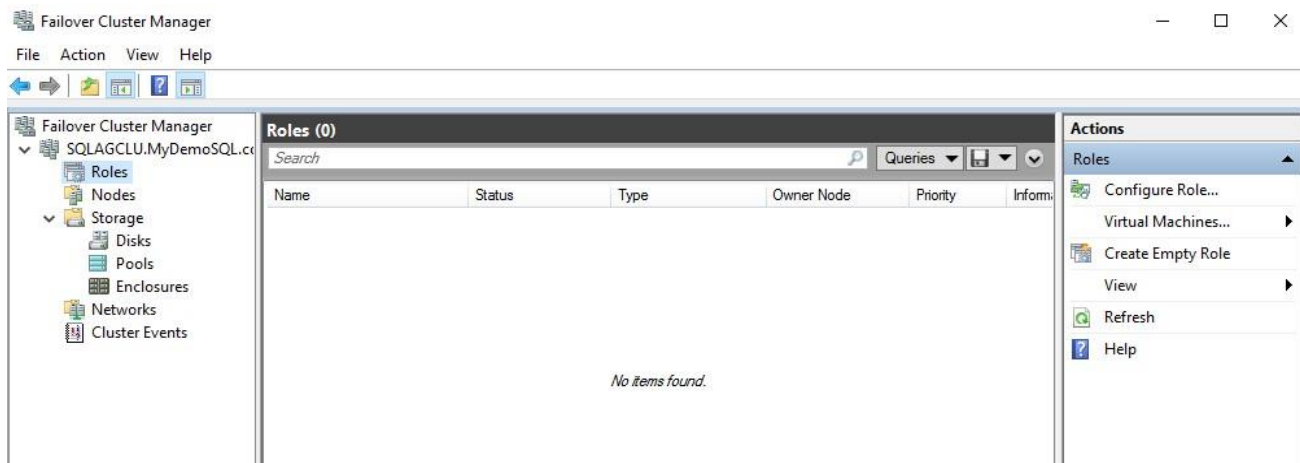
Forming cluster **PortalHAG_Cluster**

Cancel

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 be able to communicate with each other. When they are not able to communicate, each node will think the other 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.

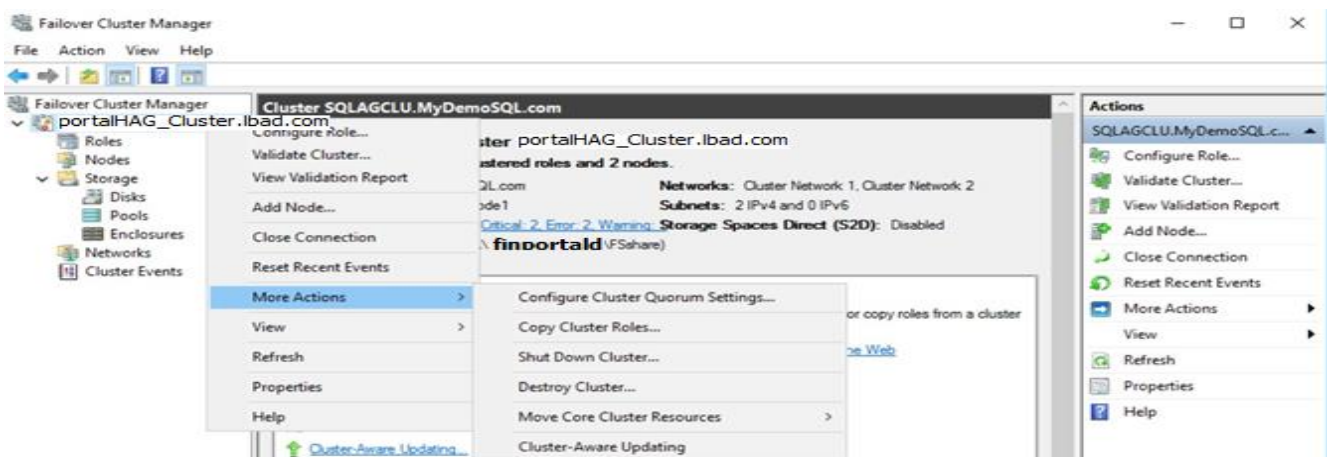
To prevent such a split-brain situation, the Quorum model which implements a voting system in cluster nodes of the cluster resource, was introduced. There are four quorum models in the cluster:

- **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

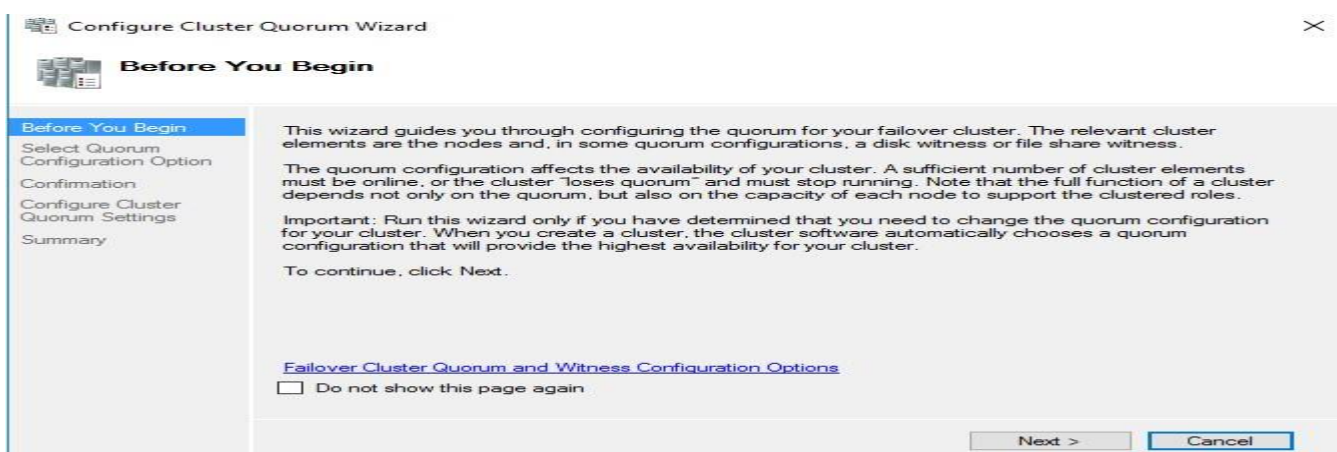
If a Quorum is not available, and some nodes are down, the cluster will not run, and it will go down. The quorum will keep running the cluster based on the majority of votes in the group. Let's say we have three nodes in cluster SQL1, SQL2, and SQL3. This means we have an odd number of clusters and each 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.

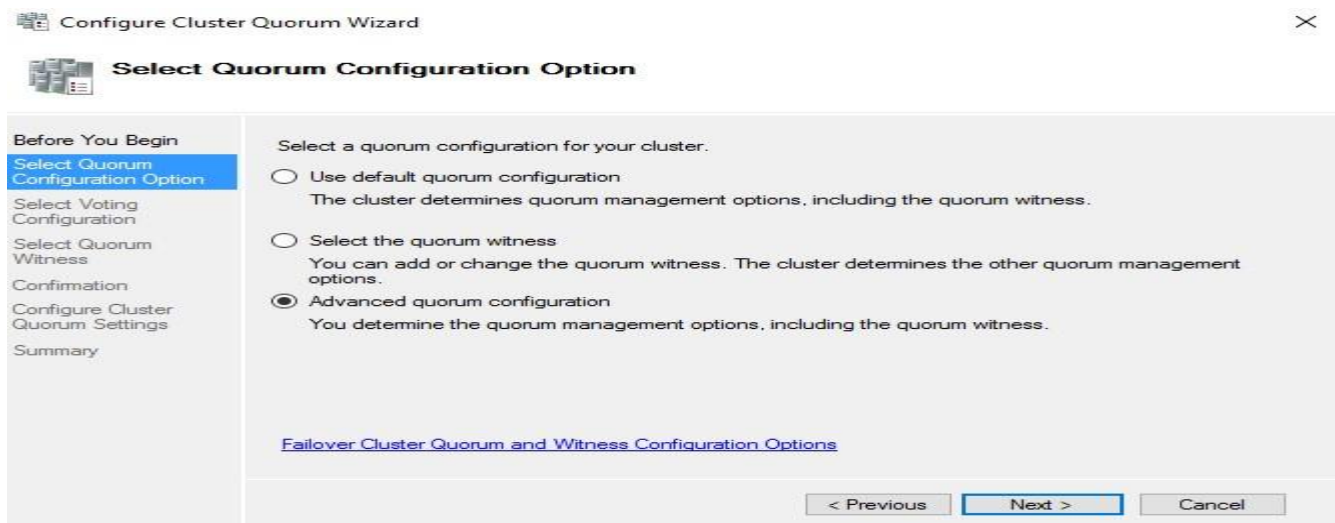
Now, right-click on the Cluster name and go to **More Actions -> Configure Cluster Quorum Settings**.



It launches the cluster quorum wizard with a brief introduction.



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



Configure Cluster Quorum Wizard

Select Quorum Configuration Option

Before You Begin

- Select Quorum Configuration Option
- Select Voting Configuration
- Select Quorum Witness
- Confirmation
- Configure Cluster Quorum Settings
- Summary

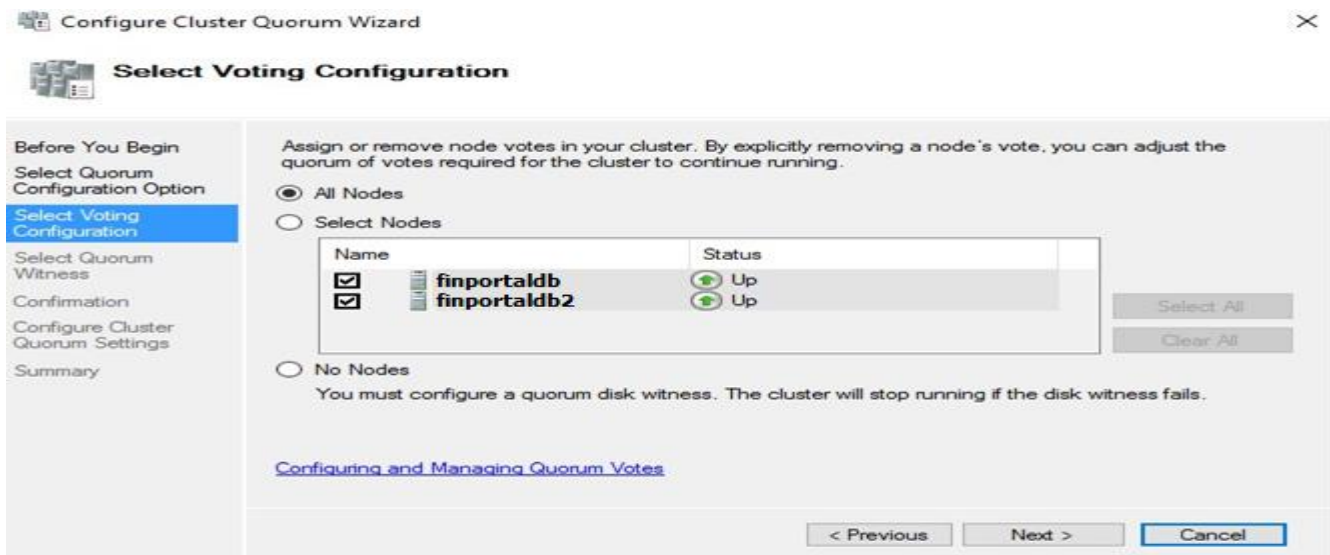
Select a quorum configuration for your cluster.

- ☐ Use default quorum configuration
The cluster determines quorum management options, including the quorum witness.
- ☐ Select the quorum witness
You can add or change the quorum witness. The cluster determines the other quorum management options.
- ☒ **Advanced quorum configuration**
You determine the quorum management options, including the quorum witness.

[Failover Cluster Quorum and Witness Configuration Options](#)

< Previous **Next >** Cancel

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



Configure Cluster Quorum Wizard

Select Voting Configuration

Before You Begin

- Select Quorum Configuration Option
- Select Voting Configuration
- Select Quorum Witness
- Confirmation
- Configure Cluster Quorum Settings
- Summary

Assign or remove node votes in your cluster. By explicitly removing a node's vote, you can adjust the quorum of votes required for the cluster to continue running.

- ☒ **All Nodes**
- ☐ Select Nodes
- ☐ No Nodes
You must configure a quorum disk witness. The cluster will stop running if the disk witness fails.

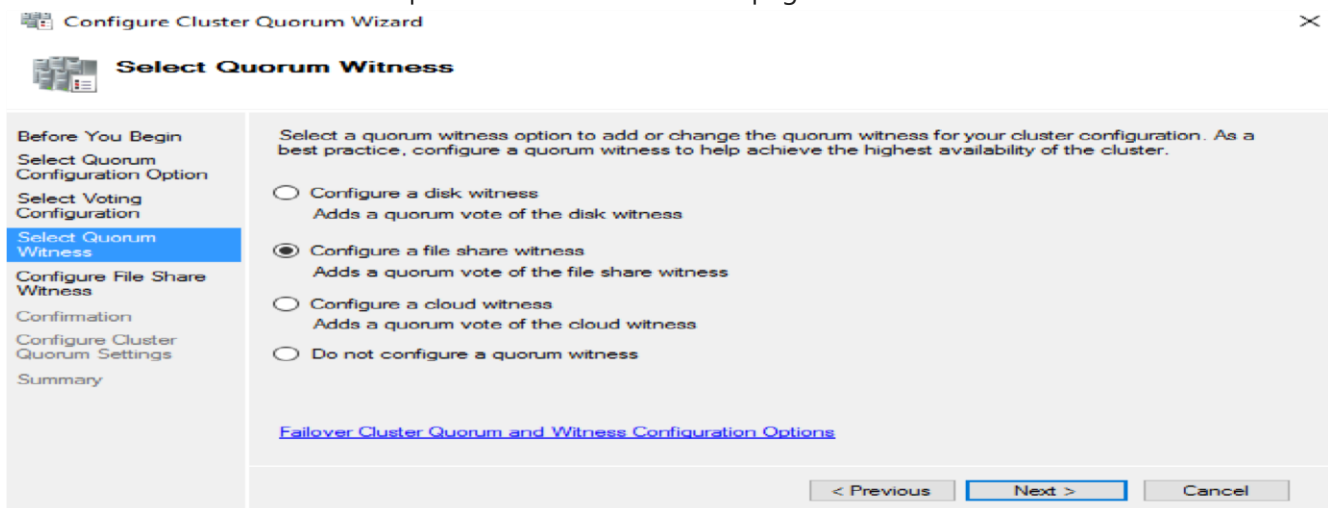
Name	Status
<input checked="" type="checkbox"/> finportaldb	Up
<input checked="" type="checkbox"/> finportaldb2	Up

Select All Clear All

[Configuring and Managing Quorum Votes](#)

< Previous Next > **Cancel**

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



Configure Cluster Quorum Wizard

Select Quorum Witness

Before You Begin

- Select Quorum Configuration Option
- Select Voting Configuration
- Select Quorum Witness
- Configure File Share Witness
- Confirmation
- Configure Cluster Quorum Settings
- Summary

Select a quorum witness option to add or change the quorum witness for your cluster configuration. As a best practice, configure a quorum witness to help achieve the highest availability of the cluster.

- ☐ Configure a disk witness
Adds a quorum vote of the disk witness
- ☒ **Configure a file share witness**
Adds a quorum vote of the file share witness
- ☐ Configure a cloud witness
Adds a quorum vote of the cloud witness
- ☐ Do not configure a quorum witness

[Failover Cluster Quorum and Witness Configuration Options](#)

< Previous **Next >** Cancel

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.

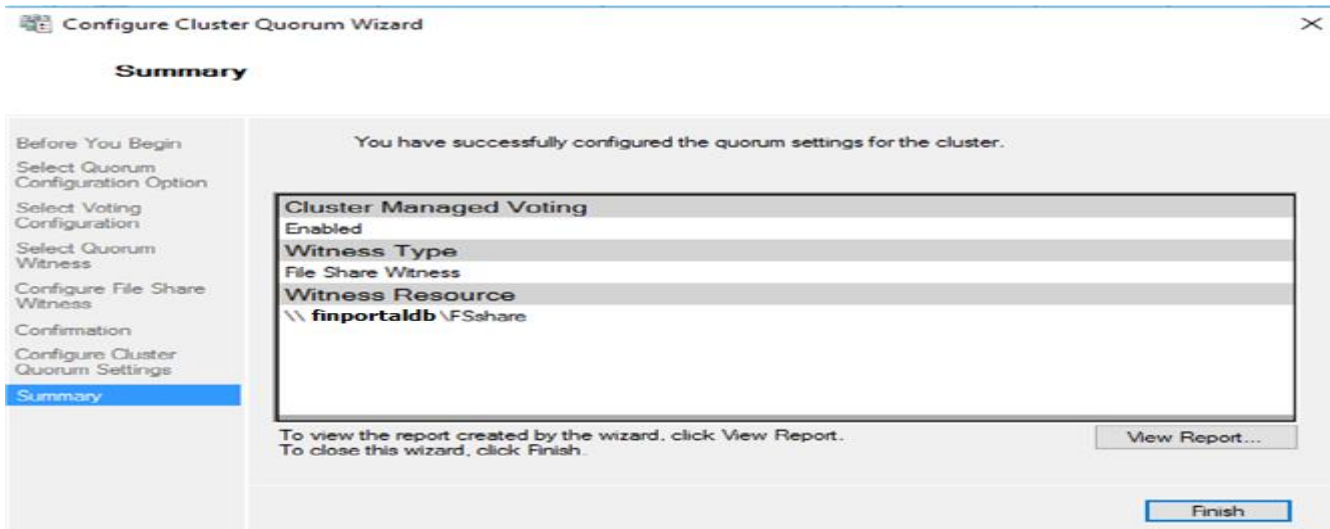
Specify the shared folder path as a file share path.

The screenshot shows the 'Configure File Share Witness' step of the 'Configure Cluster Quorum Wizard'. The left sidebar contains a list of steps: 'Before You Begin', 'Select Quorum Configuration Option', 'Select Voting Configuration', 'Select Quorum Witness', 'Configure File Share Witness' (highlighted), 'Confirmation', 'Configure Cluster Quorum Settings', and 'Summary'. The main area contains the following text: 'Please select a file share that will be used by the file share witness resource. This file share must not be hosted by this cluster. It can be made more available by hosting it on another cluster.' Below this is a 'File Share Path:' label and a text box containing '\\finportaldb\FShare'. To the right of the text box is a 'Browse...' button. At the bottom right are three buttons: '< Previous', 'Next >' (highlighted), and 'Cancel'.

Review your configuration and confirm to proceed further.

The screenshot shows the 'Confirmation' step of the 'Configure Cluster Quorum Wizard'. The left sidebar is the same as the previous screenshot, with 'Confirmation' highlighted. The main area contains the text: 'You are ready to configure the quorum settings of the cluster.' Below this is a box titled 'Configure Cluster Quorum Settings' which contains the following information: 'File Share Witness' with the value '\\finportaldb\FShare', 'Cluster Managed Voting' with the value 'Enabled', and 'Voting Nodes:' with the value 'All nodes are configured to have quorum votes'. Below this box is the text: 'To continue, click Next.' At the bottom right are three buttons: '< Previous', 'Next >' (highlighted), and 'Cancel'.

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.

