

SQL Server Failover Clustering

Interview Questions and Answers

Introduction: This chapter takes you through the SQL Server Failover Clustering related interview questions and answers. These questions are helpful for range of database administrators starting from a junior to an expert level DBA for the technical interview preparation. These questions and answers are deals with the below topics:

- SQL Server Failover Clustering
- Clustering Scenarios

SQL Server Failover Clustering

1. What is Windows Cluster?

Ans:

Clustering is a technology that automatically allows one physical server to take over the tasks and responsibilities of another physical server that has failed. The goal is to ensure that users running mission-critical applications will have very less downtime when a failure occurred. A cluster is a group of independent computer systems, referred to as nodes, working together as a unified computing resource. A cluster provides a single name for clients to use and a single administrative interface, and it guarantees that data is consistent across nodes.

2. What is a Cluster Node?

Ans:

A cluster node is a server within the cluster, and it has Windows Server and the Cluster service installed.

3. What is Cluster Service?

Ans:

The cluster service manages all the activity that is specific to the cluster. One instance of the cluster service runs on each node in the cluster. The cluster service does the following

- Manages Cluster Objects and Configurations
- Manages the local restart policy
- Coordinates with other instances of the cluster service in the cluster
- Handles event notification
- Facilitates communication among other software components

- Performs failover operations

4. What is called a Resource in Windows cluster?

Ans:

A resource is a physical or logical entity, which has below properties:

- Can be brought online and taken offline
- Can be managed in the failover cluster
- Can be owned by only one node at a time

To manage resources, Cluster service communicates with a resource DLL through Resource Monitor.

5. What are the different states of a Resource in Windows cluster?

Ans:

All resources can have following states

- Offline: Resource is offline
- Offline_Pending: Offline initiated and it is in progress
- Online: Resource is currently online
- Online_Pending: Online is initiated and it is in progress
- Failed: Resource failed

6. What is a Cluster Group?

Ans:

A cluster group is a collection of logically grouped cluster resources. It may contain cluster-aware application services, such as SQL Server Group, File Server etc.

7. What is Public Network?

Ans:

A public network/External network provides client systems with access to cluster application services and IP address resources are created on networks that provide clients access to cluster services.

8. What is Private Network in windows cluster?

Ans:

A private network is also called as interconnect or heartbeat connect is a network that is setup between the nodes of the cluster and it carries only internal cluster communications. It is shared only by the cluster nodes, and is not accessible from outside the cluster. It is used by cluster nodes in order to monitor each node's status and communicate with each other.

9. What is Heartbeat in Windows cluster?

Ans:

Heartbeats are messages that Cluster Service regularly sends

between the instances of Cluster Service that are on each node to manage the cluster.

10. What Failover and Failback terms mean in Windows Cluster?

Ans:

Failover: Failover is the process of moving a group of resources from one node to another in the case of a failure. For example, in a cluster where Microsoft SQL Server is running on node **A** and node **A** fails, SQL Server automatically fails over to node **B** of the cluster.

Failback: Failback is the process of returning a resource or group of resources to the node on which it was running before it failed over. For example, when node **A** comes back online, SQL Server can fail back from node **B** to node **A**.

11. What is a Quorum?

Ans:

Quorum for a cluster is the number of elements that must be online for that cluster to continue running. Each element in can cast one “vote” to determine whether the cluster continues running.

The full function of a cluster depends on:

- Quorum
- Capacity of each node to support the services and applications that fail over to that node

Ex:

A cluster with 7 Nodes can still have a Quorum (4 Nodes Online) after 3 node failed as majority wins

But remember it's not just depends on Quorum also other 4 nodes should have capacity to server clients.

- ✓ **Case 1:** On 7 Node Cluster 3 Failed and 4 Online and these 4 are capable to handle the load

Cluster continue serving

- ✓ **Case 2:** On 7 Node Cluster 3 Failed and 4 Online and these 4 are not capable to handle the load

Cluster makes all nodes offline

- ✓ **Case 3:** On 7 Node Cluster 3 Failed and 4 Online and these 4 are not capable to handle the load

Cluster makes all nodes offline

- ✓ **Case 4:** On 7 Node Cluster 4 Failed and 3 Online

Cluster makes all nodes offline as majority votes are offline

12. What are the various Quorum modes available?

Ans:

Quorum Mode: Strategy to define the elements in cluster which can cast vote to make Quorum

Node Majority: Each node that is available and in communication can vote.

Node and Disk Majority: Each node plus a designated disk in the cluster storage (the “disk witness”) can vote, whenever they are available and in communication.

Node and File Share Majority: Each node plus a designated file share created by the administrator (the “file share witness”) can vote, whenever they are available and in communication.

No Majority: Disk Only: The cluster has quorum if one node is available and in communication with a specific disk in the cluster storage.

13. What is Node Majority model?

Ans:

This type of quorum is optimal for clusters having an odd number of nodes. In this configuration, only the nodes have votes. The shared storage does not have a vote. A majority of votes are needed to operate the cluster.

14. What is Node and Disk Majority model?

Ans:

Nodes and a shared disk get votes. This configuration allows a loss of half the nodes, providing the disk witness is available, or over half the nodes are available without the disk witness being available. This is recommended for even number of nodes in the cluster.

15. What is Node and File Share Majority model?

Ans:

This type of quorum is optimal for clusters having an even number of nodes when a shared witness disk is not an option. Other characteristics include the following:

- each node and the file share “witness” gets a vote
- it does not require a shared disk to reach a quorum
- the file share has no special requirements
- the file share should be located at a third site, making this type of quorum the best solution for geographically dispersed clusters

16. What is No Majority: Disk only mode?

Ans:

The disk witness must be available to have quorum, but the number of available nodes doesn't matter. If you have a four-node cluster and only one node is available, but the disk

witness is available, you have quorum. If the disk witness isn't available, then even if all four nodes are available you can't have quorum.

17. What Quorum mode you recommend for a given cluster?

Ans:

I strongly recommend using the cluster software recommended quorum. We can see this if we run Quorum configuration wizard.

18. Can you explain how do you know the current quorum configuration on your cluster?
3 highlighters

Ans:

Failover Cluster Manager: Manage a Cluster and choose the Cluster Name there in that summary you can see the Quorum configuration

Command Prompt: c:\cluster\quorum

19. Can we change the Quorum settings after installing the windows cluster?

Ans:

Yes, we can change the Quorum setting after the Windows Cluster installation.

20. What is Split Brain situation in Cluster?

Ans:

Cluster nodes communicate with each other over the network (port 3343). When nodes are unable to communicate with each other, they all assume the resources of the other (unreachable) nodes have to be brought online. Because the same resource will be brought online on multiple nodes at the same time, data corruption may occur. These results in a situation called “Split Brain.”

21. How Spilt Brain situation is resolved?

Ans:

To prevent Split Brains we need to bring the cluster resource online on a single node (rather than multiple nodes). Each of the online node cast vote for majority and the resources come online on that group which has more votes or has majority. In case of Even number of nodes Quorum also acts as a voter to eliminate split brain situation.

22. What are the Hardware requirements for Windows Server Cluster?

Ans:

- Two windows servers (nodes)
- At least one shared disk array that supports, either SCSI or fiber channel.
- Each server must have a SCSI or fiber channel adapter to

talk to the shared disk array. The shared disk array cannot use the SCSI controller used by the local hard disk or CD-ROM.

- Each server must have two PCI network cards (one for the private connection and one for the public connection)
- 1 IP Address for Windows virtual cluster name

23. Let's say a user is performing a transaction on a clustered server and failover has occurred. What will happen to the Transaction?

Ans:

If it is active/passive, there is a good chance the transaction died, but active/passive is considered by some the better as it is not as difficult to administer. I believe that is what we have on active. Still, active/active may be best depending on what the requirements are for the system.

24. How you do which node is active and which is passive.
3 highlighters

What are the criteria for deciding the active node?

Ans:

Open Cluster Administrator, check the SQL Server group where you can see current owner. So current owner is the active node and other nodes are passive.

25. What are the Hardware requirements for SQL Server Cluster?

Ans:

- 1 IP Address for MSDTC service
- 1 IP Address for SQL Server Active\Passive Instance or 2 IP address for SQL Server Active\Active Instance
- 1 IP Address for SQL Server Analysis services (if needed)

26. How many IP Addresses we require for setting up
4 highlighters

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4 highlighters

Active\Passive SQL Server cluster?

4 highlighters

Ans:

- 2 Windows nodes – Public
- 2 Private IP Addresses – Private
- 1 Windows Virtual Cluster Name
- 1 MSDTC
- 1 SQL Server Virtual Network Name

27. How many IP Addresses we require for setting up Active\Active SQL Server cluster with Analysis services?

Ans:

- 2 Windows nodes – Public
- 2 Private IP Addresses – Private
- 1 Windows Virtual Cluster Name

- 1 MSDTC
- 1 SQL Server Virtual Network Name
- 1 SQL Server Analysis Services

28. How do you open a Cluster Administrator?

Ans:

Start Menu > Run > Cluadmin.msc

29. What is SQL Server Network Name (Virtual Name)?

Ans:

This is the SQL Server Instance name that all client applications will use to connect to the SQL Server.

30. What are the different types of SQL Server Cluster configuration?

Ans:

- Active\Passive
- Active\Active

31. What is the difference between Active\Passive and
3 highlighters—
Active\Active cluster?

Ans:

Active - Passive: Active Passive cluster is a failover cluster configured in a way that only one cluster node is active at any given time. The other node, called as Passive node is always online but in an idle condition, waiting for a failure of the Active Node, upon which the Passive Node takes over the SQL Server Services and this becomes the Active Node, the previous Active Node now being a Passive Node.

Active - Active: It is a failover cluster configured in a way that both the cluster nodes are active at any given point of time. That is, one Instance of SQL Server is running on each of the

nodes always; when one of the nodes has a failure, both the Instances run on the only one node until the failed node is brought up (after fixing the issue that caused the node failure). The instance is then failed over back to its designated node.

32. Difference between SQLSERVER 2005 and SQLSERVER 2008/2012 Cluster Installation?

Ans:

In sql2005 we have the option of installing SQL in remaining nodes from the primary node, But in sql2008 we need to go separately (Login to the both nodes) for installing SQL cluster

33. Is it mandatory to configure MSDTC in Windows Server 2012 cluster before installing SQL Server cluster?

Ans:

No it's not mandatory to configure MSDTC service to install SQL Server in Windows 2012 cluster. Installation will give you a

warning but will not stop the installation.

34. What is the impact on cluster if the quorum disk fails in Windows Server 2008/2012 Cluster?

Ans:

Cluster continues to work but failover will not happen in case of any other failure in the active node.

35. On active directory what are the permissions required for cluster SQL Server service account?

Ans:

Clustered SQL Server Service account should have OBJECT CREATION permissions in the Active Directory.

36. Why SQL Server Services in manual mode on cluster instances?

Ans:

SQL Server services should always be in manual mode on

clustered instances because these are managed by the cluster service and it's taken online on its respective owner node based on the failover.

37. What are “LooksAlive” and “IsAlive” checks?

Ans:

Windows cluster service uses “HeartBeat” process to check nodes availability for both OS and SQL Server. It performs 2 health checks:

- “LooksAlive”
- “IsAlive”

“LooksAlive” Health Check:

- It's a quick lightweight health check
- By default runs for every 5 Seconds

- It doesn't perform detailed check thereof it may not identify the services which are running but responding or in hung state.
- If incase LooksAlive check fails it calls the "IsAlive" check
- Polling interval can be changed by adjusting LooksAlivePollInterval property of Cluster service

"IsAlive" Health Check:

- It's a detailed health check
- By default runs for every 60 Seconds
- Run @@SERVERNAME to ensure that SQL Server is responding to queries
- It can't identify database failure which means it makes sure SQL Server is up, running and responding for queries but it doesn't check database level check.

- When unable to connect to SQL Server it retries for 5 times
- After continues 5 failures Windows cluster service initiate the failover to another node.
- Polling interval can be changed by adjusting IsAlivePollInterval property of Cluster service

38. On windows Cluster what are validation tests?

Ans:

Validation test is a mechanism of verifying that all the components which are participating in the Windows cluster are fine and failover is happening between the nodes.

39. What are the basics tests done by the validation tests in Windows Cluster?

Ans:

Cluster Configuration tests: Validate critical cluster

configuration settings.

Inventory tests: Provide an inventory of the hardware, software, storage and server configurations.

Network tests: Validate that networks are set up properly.

Storage tests: Validate that the storage on which the failover cluster depends is behaving correctly and supports the required functions of the cluster.

System Configuration tests: Validate that the system software and configuration settings are compatible across servers.

40. Where the results of validation tests are stored?

Ans:

These reports are automatically stored for you in <WinDir>\Cluster\Reports as MHTML files.

41. We have a SQL Server cluster instance. As business

required we would like to install a new database which is not critical and failover not required in-case of any issues. Can we keep this database files on local disk instead of clustered disk?

Ans:

No, it's not possible. SQL Server 2014 and all previous versions of SQL Server require databases be created on clustered resources. We can't use local drives or drives which are not part of the cluster group for holding user database files.

42. Can we configure TEMPDB database on a local drive?

Ans:

Yes! From SQL Server 2012 SQL Server cluster configuration supports TEMPDB on local disk. But make sure that the file path is same on all nodes.

43. What is SMB share?

Ans:

SMB stands for Server Message Block (SMB). SMB protocol is a network file sharing protocol that allows applications on a computer to read and write to files and to request services from server programs in a computer network. The SMB protocol can be used on top of its TCP/IP protocol or other network protocols. Windows Server 2012 introduces the new 3.0 version of the SMB protocol.

In the past, we were allowed to store data and log files into the network by activating a trace flag 1807. However, from SQL Server 2012, it is possible to store user and system databases on the network using SMB shares. This applies to both SQL Server stand-alone and SQL Server on Windows Failover Cluster.

- SMB 2.0 introduced with Windows Server 2008
- SMB 2.1 with Windows Server 2008 R2: We could see

significant performance improvements like SQL OLTP workloads.

- SMB 3.0 with Windows Server 2012: Support for transparent failover of file shares providing zero downtime.
- SMB 3.02 with Windows Server 2012 R2: This is the latest version and MTU is turned on by default, which significantly enhances performance in large sequential transfers like SQL Server data warehouse.

44. What are the advantages of using SMB File Share?

Ans:

Before the advantages of SMB, SAN is always the best option for mission critical database systems on clusters.

Advantages of SMB File share:

Build low-cost clustered instances: SMB is less expensive when compare with SAN.

Use for non-productive servers: When any Non-Production environment requires cluster installation we can choose SMB

Less Operational Data Stores: For example to handle archived databases.

Temporary storage: When we need to have storage for temporary purpose.

45. How clustering is different from ALWAYSON?

Ans:

I was confused when I started learning, let me simply explain it:

ALWAYSON Availability Groups: This is an advanced feature of Database Mirroring introduced from SQL Server 2012.

ALWAYSON Failover Cluster: This is same as SQL Server

Failover Cluster with some new features

46. Can you tell me the best feature in SQL Server 2012 ALWAYSON Failover Cluster when compared to SQL Server 2008 R2 Failover Cluster?

Ans:

In SQL Server 2012 ALWAYSON Failover Clusters we can have cluster nodes on different subnets.

47. In a Failover Cluster what are the elements should be matched between nodes?

Ans:

To get the fully functional failover all nodes in a Failover Cluster should have:

- Similar hardware configuration
- Identical software configuration

- Operating system version and patch level
 - SQL Server version and patch level
 - SQL Server components
 - Instance name
48. What are the different services managed by Windows Server Failover Cluster (WSFC) service?

Ans:

The WSFC service manages

- Server cluster configuration
- Quorum configuration
- Failover policy
- Failover operations
- Virtual Network Name (VNN)

- Virtual IP addresses

49. What are the various failures that cause Cluster Failover from one node to other?

Ans:

- Hardware failures
- Operating System failures
- Application/Service failures
- Planned/Manual Failover

50. What are the primary elements of a failover cluster?

Ans:

WSFC Resource Group:

A SQL Server FCI runs in a WSFC resource group. Each node in the resource group maintains a synchronized copy of the

configuration settings and check-pointed registry keys to ensure full functionality of the FCI after a failover, and only one of the nodes in the cluster owns the resource group at a time known as active node.

SQL Server Binaries:

The product binaries are installed locally on each node of the Failover Cluster Instance

Storage:

Contrary to the Always On availability group, an FCI must use shared storage between all nodes of the FCI for database and log storage. The shared storage can be in the form of WSFC cluster disks, disks on a SAN, or file shares on an SMB.

Network Name:

The VNN (Virtual Network Name) for the FCI provides a unified connection point for the FCI. This allows applications to

connect to the VNN without the need to know the currently active node. When a failover occurs, the VNN is registered to the new active node after it starts. This process is transparent to the client or application connecting to SQL Server and this minimize the downtime the application or clients experience during a failure.

Virtual IPs:

In the case of a multi-subnet FCI, a virtual IP address is assigned to each subnet in the FCI. During a failover, the VNN on the DNS server is updated to point to the virtual IP address for the respective subnet. Applications and clients can then connect to the FCI using the same VNN after a multi-subnet failover.

51. When a failover initiated what is the approximate time for cluster failover?

Ans:

It depends on various factors. When your SQL Server instance last performed a checkpoint operation, there can be a substantial amount of dirty pages in the buffer cache. Consequently, failovers last as long as it takes to write the remaining dirty pages to disk. Beginning with Microsoft SQL Server 2012, the FCI can use indirect checkpoints to throttle the amount of dirty pages kept in the buffer cache.

52. Do you see any observations in health monitoring between SQL Server 2008 R2 and 2012?

Ans:

- WSFC service monitors both the health of the underlying WSFC cluster, as well as the health of the SQL Server instance.
- Microsoft SQL Server 2012, the WSFC service uses a

dedicated connection to poll the active SQL Server instance for detailed component diagnostics through a system stored procedure which helps in preventing false failovers.

- The detailed component diagnostics makes it possible to configure a more flexible failover policy, whereby you can choose what failure conditions trigger failovers and which failure conditions do not.
- Also it makes easier the Root Cause Analysis

Cluster Scenarios

53. Can you quickly describe the events occurs when a failover happens? Let's say we have Node 1 and Node 2. Node 1 is active and Node 2 is passive and virtual network name is VirtualNode1.

Ans:

- Steps performed by Failover Cluster Manager when a failover occurred:
 - Stops the SQL Server Agent service and any services dependent on the SQL Server service
 - All dirty pages in the buffer cache are written to disk
 - Stops the SQL Server service
 - Releases Node A's hold on the IP address and network name for VirtualNode1
 - Releases Node A's hold on the shared storage
 - Tells Node B to take control of the shared storage
 - Tells Node B to take control of the IP address and network name for VirtualNode1
 - Starts the SQL Server service on Node B
 - Starts the SQL Server Agent service and any services dependent on the SQL Server service

- Client application connection requests are automatically directed to the new active node using the same virtual network name (VNN)

Case 1: Manual Failover: Performs all above steps

Case 2: Node1 down/failure: Once cluster manager identifies that SQL Server is down/failed on Node-A then steps starts from 6 and performs till step 10.

Case 3: SQL Server service is running but not responding: Failover cluster manager can't note that SQL Server is not available until its "keep alive" check fails. Once it determines SQL Server is not responsive, it tries to perform all steps from 1 to 10 thereof in this case we might see the longer failover times.

54. How to add a new node to existing SQL Server Cluster?

Ans:

We'll talk about 2008 R2 and 2012.

- It's as simple as installing a new SQL Server instance.
- Run SQL Server Setup
- Select “Add node to SQL Server Failover Cluster”
- Next give all required details
- On Cluster Node Configuration Page Name on the node will automatically populated
- Again continue with the next steps and finally “Add Node Progress”
- After successfully adding node we need to make sure the node is working as expected
- Manually Move/Failover SQL Server Service to newly installed node
- After moving cross check all services are online on newly

added node.

55. How to apply service pack on Active/Passive cluster on 2008 and 2012?

Ans:

- Freeze the service groups on Node A (active node).
- Confirm all SQL services are stopped on Node B.
- Upgrade the SQL Server 2008 instance on Node B.
- Reboot node B.
- Unfreeze the service group on node A.
- Fail over the service group to Node B.
- After the service group comes online, freeze the service group on Node B.
- Confirm all SQL services are stopped on Node A.

- Upgrade the SQL Server 2008 instance on Node A.
- Reboot Node A.
- Unfreeze the service group on node B.
- Fail back the service group to Node A.

56. Have you ever applied a service pack on SQL Server 2005 Active/Passive cluster?

Ans:

- Login to the Console on the target node
- Copy the Service Pack to a local drive on the target node
- Move all instances to the target node
- You can only install on the Active Node.
- Move the Cluster Resource to the target node
- Move the MSDTC Resource to the target node

- Verify all users are logged out from all other nodes (RDP and Console sessions)
- Start the Service Pack install
 - ✓ Use a domain account with admin rights to all servers.
 - ✓ Ignore locked files
- Reboot current server
- You should not need to perform the install on any other nodes, nor reboot them. The service pack will update the passive nodes first.

57. You find SP is not applied on all the nodes across the cluster. How to apply SP only on required nodes?

Ans:

If you find that the product level is not consistent across all the

nodes, you will need to fool the 2005 patch installer into only patching the nodes that need updating. To do so, you will have to perform the following steps:

1. Fail Instance, Cluster, and MSDTC groups to an unpatched node
2. Remove any successfully patched nodes from failover candidates of the SQL Server Service of the instance group (do this using Cluster Admin tool)
3. Run the patch
4. After the patch installs successfully, add the Nodes removed in Step 2 back to the SQL Server Service of the Instance group

Why do you need to do this? Well when the patch installer determines that not all nodes in the cluster are at the same

patch level, a passive node operation will fail and will prevent you from moving forward with any further patching.

58. How to change the SQL Server service account in a cluster environment?

Ans:

Method 1: (No failover required)

- Freeze the service group on active node from cluster administrator, change the service account and then restart the service.

Method 2:

- Offline the SQL resources
- Update the service account at SSCM and restart the service as needed

- Add the SQL resources back to online
- Note: Don't forget to update service account at the remaining nodes on the cluster.

Method 3:

- Node 2 (inactive node) change the SQL start-up account
- Fail over the SQL service group from node 1 to node 2.
- Node 1 (now the inactive node) change the SQL start-up account

59. How to apply service pack on Active/Active cluster Nodes?

Ans:

- Make a note of all node names (and/or IP addresses), SQL Server virtual names along with preferred nodes. If there

are more than three nodes you may need to also take note of possible owners for each SQL resource group. For my example assume that I have a cluster with node1 and node2, SQL1 normally lives on node1 and SQL2 normally lives on node2.

- To start with a clean slate and ensure any previous updates are completed both nodes should be restarted if possible. Choose the physical node that you want to patch second and restart that node (in this example node2).
- Restart the node you want to patch first (node1). This will mean that both active SQL instances are now running on node2. Some restarts will be essential, but you could avoid the first two restarts if you need to keep downtime to a minimum and just fail SQL1 over to node2. The main point here is to always patch a passive node.

- In cluster administrator remove node1 from the possible owners lists of SQL1 and SQL2. This means that neither SQL instance can fail over to node1 while it is being patched.
- Run the service pack executable on node1.
- Restart node1.
- Add node1 back into the possible owners lists of SQL1 and SQL2 and fail both instances over to node1.
- Repeat steps 4 – 6 on node2.
- Add node2 back into the possible owners lists of SQL1 and SQL2 and fail both instances over to node2. Check that the build level is correct and review the SQL Server error logs.
- Fail SQL1 over to node1. Check build levels and SQL Server error logs

60. You had a request to install SQL Server 2008 failover cluster on Windows Server 2012 R2. Windows failover cluster is already ready. SQL Server 2008 installation failed at setup support files and the installation was failed for the rule “Cluster Service Verification”. How do you resolve this issue?

Ans:

RCA:

- When verifies log file “InstallFailoverClusterGlobalRules” it's clearly saying that SQL couldn't verifies the cluster service.
- We verified and confirmed windows cluster service is online but SQL couldn't access the cluster service
- We tried installing SQL Server from command line by skipping the rules: Not worked and ended with the same

error.

- “Setup/SkipRules=Cluster_VerifyForErrors/Action=Install FailoverCluster”
- While searching for the solution we found that the problem is expected and the root cause is SQL Server setup is trying to check windows cluster service using the deprecated feature in Windows 2012 R2.
- Deprecated features: Failover Cluster Command Interface (cluster.exe) and Failover Cluster Automation Server.
- Since these are deprecated features these are not enabled by default in Windows 2012 R2

Solution:

- Check the windows Cluster Installation using PowerShell command:

- “Get-WindowsFeature RSAT-Cluster*”
- It showcase all windows cluster features installed/enabled status
- If you observe “Failover Cluster Automation Server” and “Failover Cluster Command Interface” are Available but not installed.
- Install the feature “Failover Cluster Automation Server” using the PowerShell command
- “Install-WindowsFeature -Name RSAT-Clustering-AutomationServer“
- After you see the feature is got installed successfully, try installing SQL Server and you should get succeed at this time.

61. We need to install and configure SQL Server 2012

Active/Passive cluster on Windows Server 2012 R2. Windows cluster is ready. Now can you tell me how do you install SQL Server Failover Cluster? I don't want you to explain step by step but tell me the most important points that we need to take care during the installation?

Ans:

Since Windows Server Failover Cluster is ready will start with the next step:

- Configure MSTDC Role
 - ✓ Go to Failover Cluster Manager → Roles → Configure Role
 - ✓ Select Distributed Transaction Coordinator (DTC)
- **Client Access Point:** Name and IP address required. Make sure that your logged in account should have an appropriate rights on Active Directory (AD) as this creates a

computer object on Active Directory with the given name.

- We need a dedicated drive at least with 2 GB free space for MSDTC, assign that drive to this role
- After this configuration you should be able to see MSDTC is up and running under Roles in Failover Cluster Manager.
- **Install SQL Server on Node -1**

- ✓ Run SQL Server Installer

- ✓ Select “New SQL Server Failover Cluster Instance”

- ✓ **On Instance Configuration Page:**

- ✓ **SQL Server Network Name:** Careful while giving this name as this is the name that applications will use to connect to the database. Clients can identify this SQL instance using this name.

- ✓ **Instance Root Directory:** Need not change this. Remember this is the path where SQL binaries

available not your databases.

- ✓ **Important Note:** Your account which are using for SQL Server Cluster Installation should have proper rights on Active Directory as a new object will be created at AD with this network name.
- ✓ **Cluster Resource Group:** Give a suitable name for Cluster Resource Group
- ✓ Cluster Disk Selection: Select the cluster volumes/disks that are going to be used for storing SQL databases.
- ✓ **Cluster Network Configuration:** Give the ipv4 ip address
- ✓ **Server Configuration:** Give service account under which SQL Server will run. As Microsoft recommended we need to use a Domain/AD account.

- ✓ Continue with the next page and complete the installation on Node-1

➤ **Install SQL Server on Node -2**

- ✓ On Node-2 and start SQL Server installer
 - ✓ Select “Add node to SQL Server Failover Cluster”
 - ✓ Same steps as we followed on Node-1
 - ✓ We need not give Resource Group Name, IP Address and Service Accounts
 - ✓ Give password for service accounts
 - ✓ Continue with the remaining steps as it is and finish the installation.
- Then connect to Failover Cluster Manager and try to failover SQL Server resource from Active (Node 1) to passive (Node 2) to make sure failover is working as expected.

62. Can you tell me few T-SQL commands that you use to quickly know the cluster status?

Ans:

```
/** To find the current instance is Clustered or not **/  
SELECT CASE WHEN SERVERPROPERTY('IsClustered') = 0  
THEN 'Non-clustered' ELSE 'Clustered' End;  
GO  
/** If clustered - Returns Node Name on which SQL Server  
Instance is Currently running**/  
/** If Non-clustered - Returns the hostname**/  
SELECT SERVERPROPERTY  
('ComputerNamePhysicalNetBIOS') AS  
[Current_NodeName];  
/* Find all cluster Nodes information and status ****/  
SELECT * FROM fn_virtualservernodes()
```

--OR

```
SELECT * FROM sys.dm_os_cluster_nodes  
/** Find SQL Server Cluster Shared Drive Names ***/
```

```
SELECT * FROM fn_servershareddrives()
```

--OR

```
SELECT * FROM sys.dm_io_cluster_shared_drives
```

63. Any SQL DBA who works on cluster instances should have a minimum knowledge on using PowerShell. Do you know any PowerShell commands which can be useful in knowing the cluster status?

Ans:

Yes! We use PowerShell commands to get the cluster instance details and also most of the times PS is the only way to fix problems in clustered environment. There are 2 things should be done while using PowerShell:

- Start PowerShell with “Run as Administrator”
- Import the “FailoverClusters” module
- To Import the module FailoverClusters
PS C:\> Import-Module FailoverClusters

Most common cmdlets we use:

Get-ClusterGroup:

- To know the status of all cluster groups in our cluster:
Cluster Name “SQLCUST01”
- PS C:\> Get-ClusterGroup -Cluster SQLCLUSTER
- Get-ClusterResource & Where-Object & Sort-Object:
- Get-ClusterResource: Get all clustered resources information
- Where-Object: Filter only SQL Server Group resources

- Sort-Object: Sort based on the Group name

- Ex:

```
PS C:\> Get-ClusterResource -Cluster SQLCLUSTER |  
Where-Object {$_.OwnerGroup -like "SQL Server*"} |  
Sort-Object -Property OwnerGroup
```

Start-ClusterResource:

- To start a cluster resource SQL Server Input Cluster Name and Resource Name
- Ex: PS C:\> Start-ClusterResource -Cluster SQLCLUSTER -Name "SQL Server (INST1)"

Stop-ClusterResource:

- To stop a cluster resource SQL Server Input Cluster Name

and Resource Name

- Ex: PS C:\> Stop-ClusterResource -Cluster SQLCLUSTER -Name "SQL Server (INST1)"

Move-ClusterGroup:

- It can move an entire resource group from one node to other in a cluster we need to input Resource Group Name, Cluster Name and Node to which the group has to be moved
- PS C:\> Move-ClusterGroup "SQL Server (INST1)" -Cluster SQLCLUSTER -Node SQLNODE02

Note:

Also we can run T-SQL commands at PowerShell to do that we need to import the module sqlps

```
PS C:\> Import-Module sqlps
```

Now check SQL Server ERRORLOG using Powershell:

```
PS    SQLSERVER:\>    Invoke-Sqlcmd    -Query    "EXEC  
master.dbo.XP_READERRORLOG 0, 1, N'error', `  
null,null,null, N'desc'" -ServerInstance "SQL1\INST1"
```

64. I have a 2 Node Active/Passive cluster. On Active Node there are 3 SQL Agent jobs are scheduled. Now a failover initiated and SQL Server Resource group moved to Node 2. My question is “does these jobs are also replicated to Node 2? Or we need to manually create them again on Node 2?

Ans:

All Jobs and Maintenance Plans are taken care by failover procedure. We need not move/create SQL Jobs/Maintenance Plans on other node. The logic is simple all these jobs and maintenance plans are stored on system database MSDB and the failover just starts using the SQL Service on Node 2 but the

datasource (All databases physical file location) is same as it access from Node 1.

65. I have 2 node Active/Passive failover cluster on SQL Server 2012 built on Windows Server 2012 R2. Now on active node SQL instance one of the databases is not coming online due to a page corruption. Can you get it online by initiating a manual failover to other node?

Ans:

No way! Let me give you a clarity on clustering, failover clustering is to give 24X7 support for your Services (Ex SQL Server) not for your data.

- When you have 2 node Active Passive cluster:
- 2 Different SQL Server installed on 2 Nodes
- Both nodes access data/data files from a single shared disk.

- That means if a user database “EmpDB.MDF” is stored on disk E:
- When Node A is active: SQL Server on A access data file from disk E
- When Failover to Node B: SQL Server on A disconnect the session to datafile “EmpDB.MDF” on E drive and a new session starts from SQL Server on Node B to E drive.
- When there is a page corruption on Datafile it can't be resolved by initiating a failover.

66. I need a solution for both my services and data what will be the best solution available in SQL Server?

Ans:

There are few ways:

SQL Server 2008 R2: SQL Server Failover Cluster + Database

Mirroring/Log shipping/Replication

SQL Server 2012/2014: ALWAYSON Failover Clusrering +
ALWAYSON Availability Groups/Log shipping/Replication

SQL Server 2008 R2/2012/2014: Geo-Clustering/Multisite
Failover/Active-Active Cluster configuration: In this we need
not use a central storage and we can use individual disks. But
we need a disk level replication solution. We can use a third
party solution for replicating data between disks Ex:
DataKeeper Cluster Edition. Also the nodes can be in different
subnets this is the new feature added in SQL Server 2012.

67. Can I install all SQL Server components on my cluster?

Ans:

No! SQL Server Integration Services is not “cluster-aware” and
can’t fail back and forth with your cluster. SSRS also not a
cluster aware service but there is an indirect way to installing

SSRS on cluster instance.

68. How to know the approximate time require for failover?

Ans:

There are lots of factors that involve in failover time. Ex: SQL Server databases recovery time and buffer cache that needs to be written to disk etc.

I would recommend:

- Create a test load (Should match with peak load) on your server and capture the failover time.
- To make sure the failover time matching with you service level agreement, have a look into indirect checkpoint.

69. Can we implement clustering on a virtualized server?

Ans:

Yes, we can create failover clusters with virtual servers with

VMware or Hyper-V and try SQL Server clustering. But it is not recommended for premium production applications.

70. You have an incident on one of the premium server due to a cluster failover. While fixing that what is your recommendation? Will you use cluster management console or PowerShell?

Ans:

- I always recommend using PowerShell script.
- Most of the times Cluster Management Console will respond very slowly in case of failures and failovers.
- Make sure you are prepared with the all require PS commands to fix production issues.
- Also you should run PS in admin mode

71. Can we be able to make Cluster Node online without Quorum?

Ans:

We were not able to connect to SQL Server. We tried to connect to Cluster Manager Console even it's not responding for a long time. We found that SQL Server Instance is offline and Windows Failover Cluster Instance is offline too.

RCA:

- 2 Node Active/Passive Cluster
- Node 1 - Active is having 1 vote
- Node 2 - Stand By is having 1 vote
- Quorum Disk is have 1 vote
- Standby node and Quorum Disk went offline
- Windows Failover Cluster Instance (WFCI) checks that

majority of votes are offline

- WFCI is also went to offline
- Of course SQL Server too went offline

Resolution:

- We tried to make Windows Failover Cluster Instance Online without Quorum
- Connect to the current Active Node and make sure Cluster Service is not running from services.msc
- If it is running stop it
- Connect to Power shell console with Admin rights and import required module “FailoverClusters”
- Start the cluster node using the below command to start cluster node without the quorum

- Start-ClusterNode –Name “WSCLUSTER-Premium” - FixQuorum
- Once the WSFC has been brought online, make sure that the cluster node is guaranteed as a voting member by setting the NodeWeight
- (Get-ClusterNode –Name “WSCLUSTER-Premium”).NodeWeight = 1
- Once the WSFC is online, the SQL Server failover clustered instance is automatically brought online
- Then fix the issues on Quorum Disk
- Try to bring the other cluster node online

Note: From SQL Server 2012 and above we can skip the NodeWeight setup step as it will be adjusted dynamically based on the configuration.

72. SQL Server configured on 2 nodes Active/Passive cluster.

Now the requirement is to add SSRS feature to the existing SQL Instance then we can get the same failover functionality for our SSRS. Can you explain how to do this?

Ans:

Since SSRS is not a cluster aware service there is no straight forward method to do this. But yes we can achieve this as below:

Installing SSRS:

- If we try to add SSRS feature to existing SQL clustered instance it fails at rules page and doesn't allow you to install SSRS.
- This can be resolved by skipping the rules using below command: Issue the below command at cmd

Setup.exe/SkipRules=StandaloneInstall_HasClusteredOrPreparedInstanceCheck/Action=Install

- It starts SQL Server installer and bypass the cluster instance check installation rule
- We can be able to add SSRS feature for the existing SQL Server instance
- Once it is done on Active node repeat the same process on passive node.

Configuring SSRS:

- Now configure SSRS using SSRS configuration manager
- Most important part is while giving SQL instance path use the SQL Server failover cluster network/virtual name instead of node name.
- If we use node name while configuring, after failover report

manager failed to locate the SQL Server instance.

- Once SSRS configured on active node do the same on passive node.
- Now your SSRS is installed and configured on clustered instance. Failover SQL Server from Active node to Passive node and test SSRS functionality on passive node.

73. We have been using SQL Server cluster instances for our applications. Now our client required a name change for SQL Server Network name which is being used by our applications to connect to SQL Server cluster instance. How do you change SQL Server network name?

Ans:

Before changing the Network Name:

- Check the current SQL Server Network/Virtual name

- Using T-SQL statement: `SELECT @@Servername` or
- Failover Cluster Manager: Name under Server Name
- List out all clients which are using this SQL Server i.e. Applications, third party tools, reporting tools etc.

Change the SQL Server Network Name:

- From Failover Cluster Manager Right click on Server Name
à Properties
- On General tab you can see the column DNS Name which is nothing but the network/virtual name.
- Change the DNS name with the required new name and click on Apply
- It takes few seconds to change the name

Post changing the Network Name:

- Check the Server name as we did in first step. Now you should see the new name
- Recycle the resources and services: On failover cluster manager right click on Server Name à Take offline and Bring Online.
- Now try to connect to SQL Server instance using the new network/virtual name
- Now Failover SQL Server service from Active node to Passive Node and test the connectivity
- Once you confirm all working fine then inform the clients to update their connection string to sue the newly changed network name to connect to Failover Cluster SQL Server instance.

74. Have you ever removed a SQL Server cluster node from

failover cluster configuration? Can you explain the procedure?

Ans:

Yes!

- Let's say we have 2 node cluster and we are going to remove Node2.
- Connect to the node2 instance
- Mount SQL Server installation setup
- Run setup.exe as administrator
- Go to tab "Maintenance" and select "Remove Node from SQL Server Failover Cluster"
- After that it checks the rules and takes you through the removal steps.
- Mostly no inputs required from us

- A successful cluster node removal, you can verify at Failover Cluster Manager or using DMV “sys.DM_OS_Cluster_Nodes”
75. We have a SQL Server 2012 cluster setup. On active instance one of the DBA members was trying to remove SYSADMIN accounts. He was assisted to remove SYSADMIN role from all existing logins and add a new login “SQL12Admin” with SYSADMIN rights. Accidentally he removed all logins from SYSADMIN role but not able to add “SQL12Admin” to SYSADMIN role as he doesn’t have rights to do that. Also SA account was disabled as a part of security policy. Now tell me how do you get their SYSADMIN rights back for at least one login “SQL12Admin”?

Ans:

Usually if we have the same situation on standalone server this problem can be resolved by restarting SQL Server in single user mode and we can add a login to SYSADMIN role. But in this case we need to deal with the cluster instance.

- On active node open Failover Cluster Manager and expand to the clustered SQL Server group within services and applications. Right-click and select “Take this service or application offline”
- Along with SQL Server cluster disk and IP address is also offline. Bring the clustered disks and the IP address back online by right-clicking those resources and choosing “Bring this resource online.”
- Open command prompt and start SQL Server in single user mode
“net start mssqlserver/m”

- SQL Server starts in single user mode. However it prevents us to connect from SSMS.
- In CMD connect to SQL Server instance using SQLCMD
`sqlcmd -S 192.168.1.102`
- On a successful connection add the login “SQL12Admin” to SYSADMIN role:
`“sp_addsrvrolemember ‘SQL12Admin’, ‘SYSADMIN’”`
- Stop SQL Server
`“net stop mssqlserver”`
- Open Failover Cluster Manager and Right Click on SQL Server group and “Bring this service or application online.”
- Now you should be able to login using “SQL12Admin” with SYSADMIN rights

76. What are the various log files that helps us in

troubleshooting issues and in Root Cause Analysis?

Ans:

SQL Server error logs: Check SQL Server error logs to find out the errors

Windows Event Viewer (System/Application): As usual check this place to find if anything suspicious

Failover Cluster Manager:

We can see the high level details from Cluster Wizard Summary page. Also we can see events and logs by filtering the required events.

Cluster Log Files:

Generate Cluster Log files Using Cluster.exe:

To generate Cluster.log issue below command from CMD:

C:\> cluster/cluster log/g

- PS C:\get-clusterlog
- To get cluster log on required location
PS C:\get-clusterlog –destination C:\Temp
- To get Cluster log for last 30 Min
PS C:\get-clusterlog -TimeSpan 30

Failover Cluster Instance Diagnostics Log using T-SQL:

- Start Diagnostic Logging
- ALTER SERVER CONFIGURATION SET DIAGNOSTICS LOG ON;
- Set Diagnostic File Location:
- ALTER SERVER CONFIGURATION SET DIAGNOSTICS LOG PATH = 'C:\logs';
- Specifying the maximum size of each diagnostic log

- ALTER SERVER CONFIGURATION SET DIAGNOSTICS LOG MAX_SIZE = 30 MB;
- Stop Diagnostic Logging
- ALTER SERVER CONFIGURATION SET DIAGNOSTICS LOG OFF;
- To read Diagnostic log file:

```
SELECT
    xml_data.value ('(event/@name)[1]', 'VARCHAR(max') AS
    'Name'
    ,xml_data.value ('(event/@package)[1]', 'VARCHAR(max') AS
    'Package'
    ,xml_data.value ('(event/@timestamp)[1]', 'datetime') AS
    'Time'
    ,xml_data.value      ('(event/data[@name="state"])/value)
    [1]', 'int') AS 'State'
```

```
,xml_data.value('(event/data[@name="state_desc"]/text)[1]','VARCHAR(max)') AS 'State Description'  
,xml_data.value('(event/data[@name="failure_condition_level"]/value)[1]','int') AS 'Failure Conditions'  
,xml_data.value('(event/data[@name="node_name"]/value)[1]','VARCHAR(max)') AS 'Node_Name'  
,xml_data.value('(event/data[@name="instancename"]/value)[1]','VARCHAR(max)') AS 'Instance Name'  
,xml_data.value('(event/data[@name="creation_time"]/value)[1]','datetime') AS 'Creation Time'  
,xml_data.value('(event/data[@name="component"]/value)[1]','VARCHAR(max)') AS 'Component'  
,xml_data.value('(event/data[@name="data"]/value)[1]','VARCHAR(max)') AS 'Data'  
,xml_data.value('(event/data[@name="info"]/value)
```

```
[1],'VARCHAR(max)') AS 'Info'
FROM
( SELECT object_name AS 'event'
,CONVERT(xml,event_data) AS 'xml_data'
FROM sys.fn_xe_file_target_read_file('C:\Program
Files\Microsoft SQL
Server\MSSQL11.MSSQLSERVER\MSSQL\Log\SQLNODE1_
MSSQLSERVER_SQLDIAG_0_129936003752530000.xel',
NULL,NULL,NULL)
)
AS XEventData
ORDER BY Time;
➤ Stop Diagnostic Logging
➤ ALTER SERVER CONFIGURATION SET DIAGNOSTICS LOG
OFF;
```

77. What is the default location for storing cluster logs?
What are the limitations of cluster log files?

Ans:

- Cluster logs located in %windir%\Cluster\Reports directory on each node of the cluster
- The log files are stored in an *.etl format.
- Naming Format in Windows Server 2008
 - ✓ ClusterLog.etl.001
 - ✓ ClusterLog.etl.002
 - ✓ ClusterLog.etl.003
- Naming Format in Windows Server 2008 R2
 - ✓ Microsoft-Windows-FailoverClustering Diagnostic.etl.001
 - ✓ Microsoft-Windows-FailoverClustering

Diagnostic.etl.002

✓ Microsoft-Windows-FailoverClustering

Diagnostic.etl.003

- The default size of these logs is 100MB each. You can change it as per your requirements.
- We can have maximum 3 *.etl files.
- The ETL.001 file is the active file being used by the live cluster service to write debug entries.
- File rollover happens only on reboot. On reboot, new ETL.001 will be created & last file will be deleted.
- In case, Latest ETL.001 file reaches MAX size, Data inside the file will start truncating on basis of FIFO (First In First Out). But file rollover happens only on reboot.

78. How to revalidate your cluster?

Ans:

- Failover Cluster Console select Failover Cluster Management and click on validate a configuration
- Follow the wizard instructions and on Summary page click on “View Report”
- The same report will be stored on folder
“%SystemRoot%\Cluster\Reports\Validation Report date and time.html”

79. Can you quickly tell me few problems you faced while working with SQL Server clustering instances?

Ans:

Problem 1: SQL Server cannot log on to the network after it migrates to another node

RCA:

- There might be two reasons
- SQL Server service accounts are unable to contact a domain controller.
- SQL Server service account passwords are not identical on all cluster nodes

Resolution:

- Check your event logs for signs of networking issues such as adapter failures or DNS problems. Verify that you can ping your domain controller.
- Update service account passwords correctly on all nodes

Problem 2: Failure of a SQL Server service causes failover

RCA:

- Failure of specific service may cause the SQL Server group to fail over
- For example full text service is failed for some reason and it initiates a failover for SQL Server Group

Resolution:

- For services which should not initiate entire SQL Server Group failover in case of failures should be configured accordingly.
- For example when Full Text Service is failed but DB engine is running fine, this full text failure should not initiate a failover. To achieve this uncheck the property “**Affect the Group**” from full text service advanced properties.

Problem 3: SQL Server Setup fails on a cluster with error 11001
RCA:

- An orphan registry key in
[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Microsoft SQL Server\MSSQL.X\Cluster]

Resolution:

- Make sure the MSSQL.X registry hive is not currently in use, and then delete the cluster key.

Problem 4: Cluster Setup Error: “The installer has insufficient privileges to access this directory: <drive>\Microsoft SQL Server. The installation cannot continue. Log on as an administrator or contact your system administrator”

RCA:

- This error is caused by a SCSI shared drive that is not partitioned properly.

Resolution:

Re-create a single partition on the shared disk:

- Delete the disk resource from the cluster and delete all partitions on the disk.
- Verify in the disk properties that the disk is a basic disk
- Create one partition on the shared disk, format the disk, and assign a drive letter to the disk.
- Add the disk to the cluster
- Run SQL Server Setup.

Problem 5: Applications fail to enlist SQL Server resources in a distributed transaction

RCA:

- Microsoft Distributed Transaction Coordinator (MS DTC) is not completely configured in Windows
- This might affect Linked Servers, Distributed Queries and Remote Stored Procedures

Resolution:

- Fully enable MS DTC services on the servers where SQL Server is installed and MS DTC is configured.
- From control panel change Logon account for MSDTC as “NT AUTHORITY\NetworkService”

we could be able to successfully failover to that node.