

MS SQL Server DBA

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## Types of Quorums in Windows Failover Cluster



## **Types of Quorum in Windows Failover Cluster:**

In a Windows Failover Cluster, quorum is a critical concept used to ensure that the cluster can continue to function properly in the event of a node failure or network partition. The quorum configuration determines how many votes are required for the cluster to maintain its operational state and make decisions regarding the cluster's health and availability.

Quorum is essential to prevent split-brain scenarios, where different parts of the cluster think they are the active part and might make conflicting decisions.

In Windows Server Failover Clusters (WSFC), there are several types of quorum configurations, each suited to different cluster topologies and requirements. The most common quorum types include:

1. Node Majority
2. Disk Majority
3. Node and Disk Majority
4. Node and File Share Majority
5. No Majority (Split-Brain) – Not commonly used today.

Let's dive deeper into each type of quorum configuration:

### **1. Node Majority Quorum**

This is the default quorum configuration for clusters with an odd number of nodes. In this configuration, each node in the cluster has a "vote," and the cluster requires a majority of votes to remain online.

#### **Key Features:**

- Applicable to: Clusters with an odd number of nodes.
- Majority rule: The cluster requires more than half of the total votes to function. For example, if there are 5 nodes in the cluster, the cluster needs at least 3 votes to maintain quorum.
- How it works: If a node fails or becomes disconnected, the other nodes that are still online will form a majority and maintain cluster operations.

#### **Pros:**

- Simpler: Ideal for clusters with an odd number of nodes, such as 3, 5, or 7 nodes.
- No reliance on shared storage: It does not require shared storage (such as a quorum disk), which can make the configuration simpler.

#### **Cons:**

- Limited tolerance for failures: If more than half of the nodes fail or lose connectivity to each other, the cluster will lose quorum and stop functioning.

#### **Best Use Case:**

- Used in environments where clusters have an odd number of nodes and no shared storage is required, such as for smaller or mid-sized clusters with high availability needs.

## 2. Disk Majority Quorum

In this configuration, the cluster uses a shared disk as a witness. The cluster's quorum is determined by the majority of votes between the nodes and the quorum disk.

### Key Features:

- Applicable to: Multi-node clusters with shared storage.
- Majority rule: The cluster requires the majority of votes from the nodes plus the disk vote to maintain quorum. The disk acts as a "tie-breaker" in cases where an even number of nodes is involved.
- How it works: If the quorum disk is accessible by at least one node and a majority of nodes are still functioning, the cluster can continue to operate.

### Pros:

- Tie-breaking mechanism: Ideal for clusters with an even number of nodes. The quorum disk can help break ties and maintain cluster availability.
- Simplifies recovery: If a node fails, the quorum disk can help the remaining nodes maintain control over the cluster.

### Cons:

- Dependency on shared storage: This configuration requires a shared disk for quorum purposes, which introduces additional complexity and hardware requirements.
- Risk of disk failure: If the quorum disk itself fails, the cluster can lose quorum.

### Best Use Case:

- Best suited for clusters with shared storage in environments with an even number of nodes, such as file server clusters or clusters that require shared storage for failover operations.

## 3. Node and Disk Majority Quorum

This quorum configuration is a combination of Node Majority and Disk Majority. It allows the cluster to work with either a majority of nodes or a quorum disk to maintain quorum.

### Key Features:

- Applicable to: Multi-node clusters with shared storage.
- Majority rule: The cluster requires either the majority of node votes or the quorum disk vote to maintain quorum.
- How it works: This configuration provides flexibility and fault tolerance. If one part of the cluster fails (either nodes or quorum disk), the cluster can still continue operating as long as the majority of nodes or the quorum disk is available.

### Pros:

- Increased fault tolerance: The cluster has multiple ways to determine quorum, providing a level of redundancy.
- Works with both odd and even nodes: Suitable for both clusters with odd and even numbers of nodes, as the quorum disk provides a flexible tie-breaking mechanism.

**Cons:**

- Requires shared storage: The need for a quorum disk may complicate setup and hardware requirements.
- Potential for reliance on quorum disk: If the quorum disk becomes unavailable, the cluster could lose quorum.

**Best Use Case:**

- Best for larger clusters or those where there is shared storage but flexibility in terms of quorum decision-making is needed, especially with an even number of nodes.

#### 4. Node and File Share Majority Quorum

This quorum configuration uses a file share witness in place of a quorum disk. The file share witness is typically hosted on a server that is accessible to all nodes in the cluster and serves as a tie-breaker when needed.

**Key Features:**

- Applicable to: Clusters where there is no shared disk or where storage is not feasible.
- Majority rule: The cluster requires a majority of votes from nodes plus the file share witness to maintain quorum.
- How it works: The file share witness acts as a “voting” entity for quorum. If the file share is reachable and a majority of nodes are available, the cluster remains operational.

**Pros:**

- No shared disk required: This configuration is ideal for scenarios where shared storage is not available or practical.
- Flexibility: A file share witness can be located on any accessible server, providing a low-cost and highly flexible solution.

**Cons:**

- Dependency on the file share: If the file share becomes unavailable, the cluster could lose quorum, so it's essential to ensure the file share is highly available.
- Network dependency: The file share witness relies on network connectivity, which means network issues could impact quorum availability.

**Best Use Case:**

- Ideal for smaller clusters, such as in multi-site clusters where shared storage is not feasible. Also useful in cloud-based or virtualized environments where creating a quorum disk may be difficult.

#### 5. No Majority (Split-Brain)

This is an older quorum model that is no longer commonly used in modern cluster setups, but it can still be found in legacy systems.

**Key Features:**

- Applicable to: Older clusters with no quorum disk or no majority of nodes.

- How it works: The cluster continues to operate as long as at least one node is online, without a majority vote.
- Split-brain: This can lead to the "split-brain" problem, where multiple nodes believe they have control over the cluster, leading to inconsistent data or conflicting decisions.

**Pros:**

- Simple: Very simple to set up.

**Cons:**

- Risk of split-brain: The lack of a quorum or failover mechanism can lead to multiple parts of the cluster believing they are the active part, potentially causing data corruption and application downtime.
- Not recommended: This configuration is generally discouraged and should only be used in very specific legacy scenarios.

**Best Use Case:**

- Only applicable in legacy environments, where upgrading the quorum model to a more modern configuration isn't possible.

**Comparison of Quorum Types**

Quorum Type	Ideal Use Case	Dependencies	Fault Tolerance
Node Majority	Odd number of nodes, no shared storage	None	High, as long as majority of nodes are available
Disk Majority	Even number of nodes, with shared storage	Shared quorum disk	Relies on shared disk; less fault-tolerant than Node Majority
Node and Disk Majority	Even number of nodes, with shared storage	Shared disk	More fault-tolerant than Disk Majority alone
Node and File Share Majority	Clusters without shared storage or where shared storage is unavailable	File share witness	Highly flexible, no shared disk required
No Majority (Split-Brain)	Legacy clusters with no shared storage or quorum disk	None	Very low fault tolerance; not recommended

**summary:**

Choosing the right quorum model for a Windows Failover Cluster depends on your cluster topology, the number of nodes, and whether shared storage is available.

- Node Majority is suitable for clusters with an odd number of nodes.
- Disk Majority and Node and Disk Majority are useful for clusters with even numbers of nodes and shared storage.
- Node and File Share Majority is ideal for situations where shared storage is unavailable but a file share can act as a tie-breaker.
- No Majority is an older, less reliable quorum type that should be avoided in modern clusters due to the risk of split-brain scenarios.

Properly configuring quorum ensures high availability and prevents inconsistent cluster states in the event of failures or partitions.