Microsoft

Implementing Windows Server Failover Cluster

Module 2

Learning Units covered in this Module

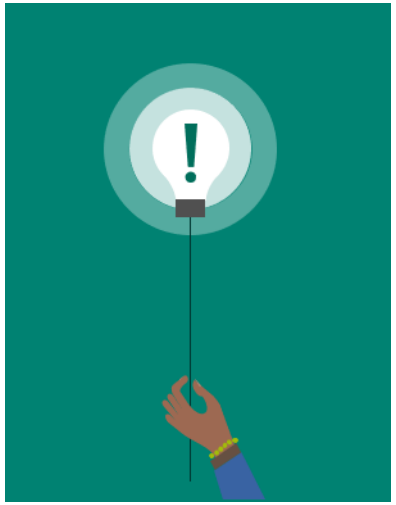
- Lesson 1: Planning of Windows Server Failover Cluster
- Lesson 2: Creating Windows Failover Cluster
- Lesson 3: Configuring Cluster Quorum

Lesson 1: Planning of Windows Server Failover Cluster

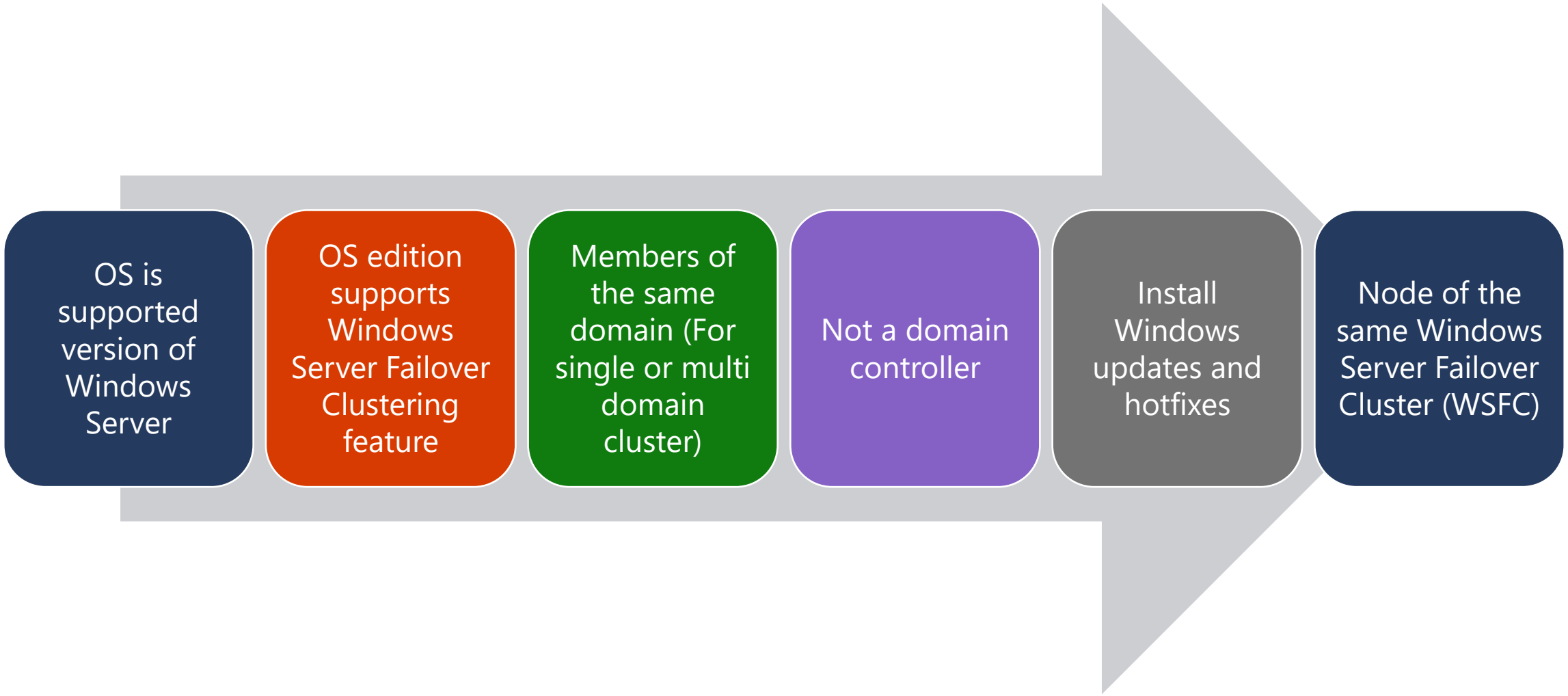
Objectives

After completing this learning, you will be able to:

- Understand Windows Server Failover Cluster (WSFC)
- Understand why we need to learn about WSFC



Checklist: Requirements



Why do we need to learn about WSFC?

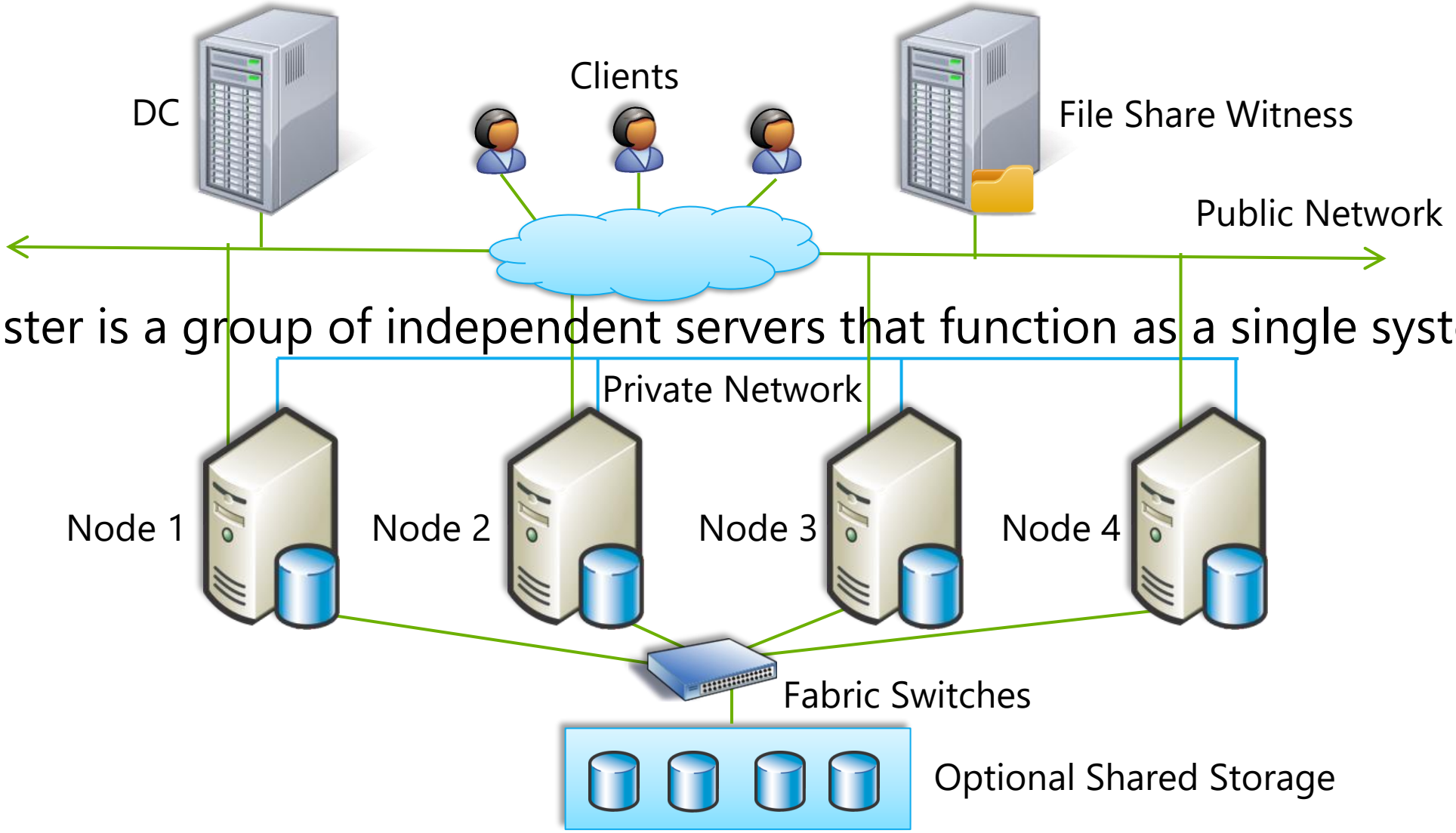
Both AGs and FCIs leverage the Windows Server operating system and WSFC as a platform technology.

More than ever before, successful database administrators will rely upon a solid understanding of these technologies.

It is now critically important that database administrators understand the inner workings of WSFC clusters and quorum management.

Always On health monitoring, management, and failure recovery steps are all intrinsically tied to your WSFC configuration.

Overview of a Failover Cluster



What Does A Failover Cluster Do?

Provides infrastructure features that support the HA/DR scenarios of hosted applications such as SQL Server.

If a cluster node or service fails, the services that were hosted on that node can be automatically or manually transferred to another available node in a process known as ***failover***.

The nodes in the WSFC cluster work together to collectively provide these types of capabilities:

- Distributed metadata and notifications
- Resource management
- Health monitoring
- Failover coordination

Failover Cluster Configurations

Single-domain Clusters

- Clusters with all nodes joined to the same domain.

Multi-domain Clusters

- Clusters with nodes which are members of different domains.

Workgroup Clusters

- Clusters with nodes which are member servers / workgroup (not domain joined).

Benefits and Limitations of Windows Failover Clustering

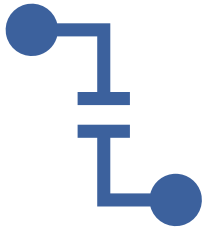
Benefits

High Availability

High Reliability

Scalability

Reduced TCO



Limitations

Does not provide fault tolerance

Does not protect from disk failures, network failures or power outages

Does not load balance

Questions?

Knowledge Check

What is a Windows Server Failover Cluster (WSFC)?

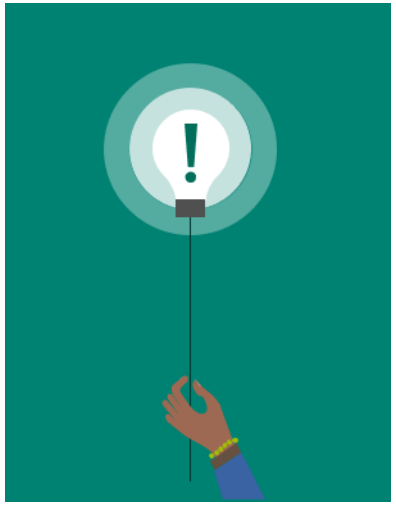
Do you need shared storage to deploy a failover cluster?

Lesson 2: Creating Windows Server Failover Cluster

Objectives

After completing this learning, you will be able to:

- Understand how to create a WSFC



Checklist: Building a Failover Cluster

You can build a Failover Cluster with all editions of Windows Server

All hardware used must be certified

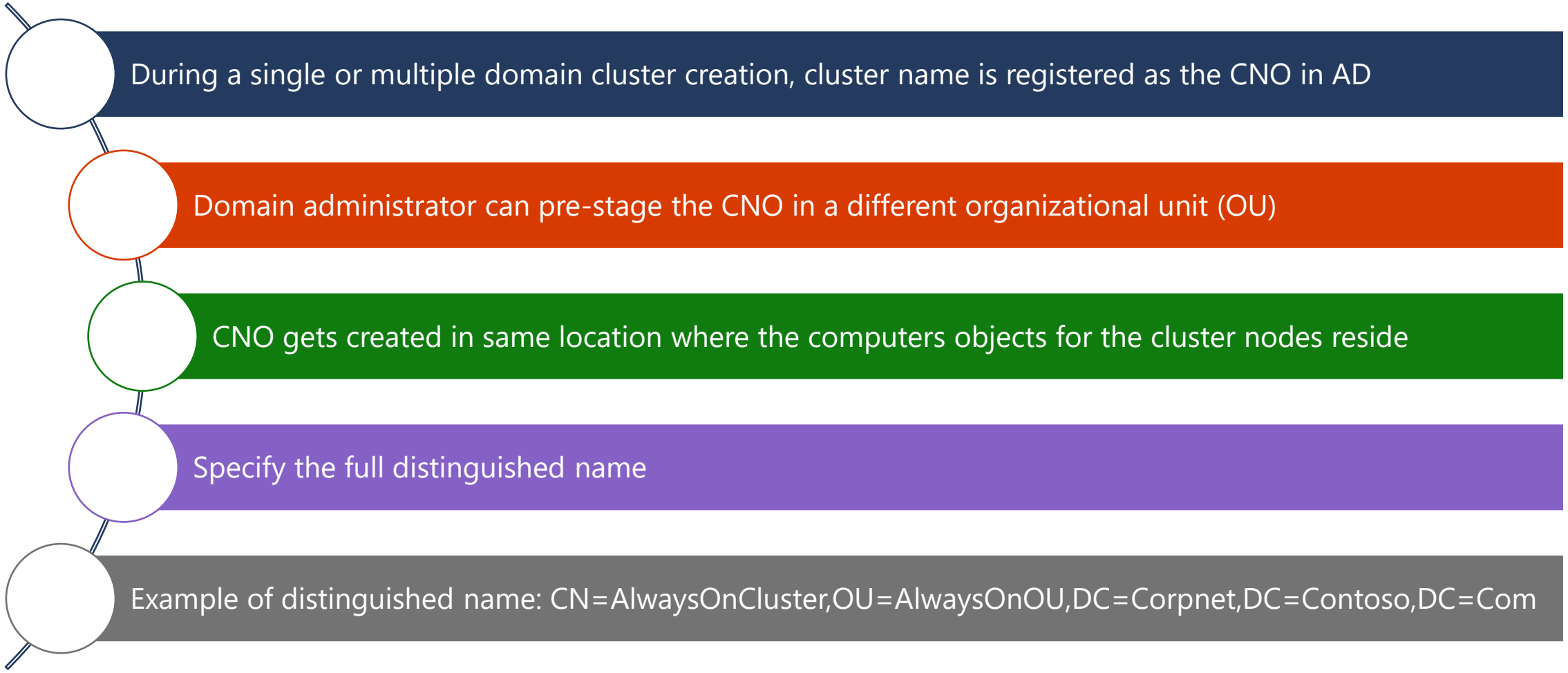
All nodes must have the Failover Clustering feature

Configure the network(s) that the cluster will use

Configure shared storage (if using)

Entire setup must pass Cluster Validation

Cluster Name Object (CNO)



What permissions are required?

Account used to create the cluster requires

- Administrative permissions on all cluster nodes
- Create Computer objects and Read All Properties

CNO must have

- Create Computer Objects and Read All Properties privileges in the OU it currently resides in to be able to create Virtual Computer Objects (VCO's)

Installing a Failover Cluster

- Exercise 1: Installing a 3-node WSFC.

Questions?

Knowledge Check

What is a CNO?

How can we place the CNO in a different OU?

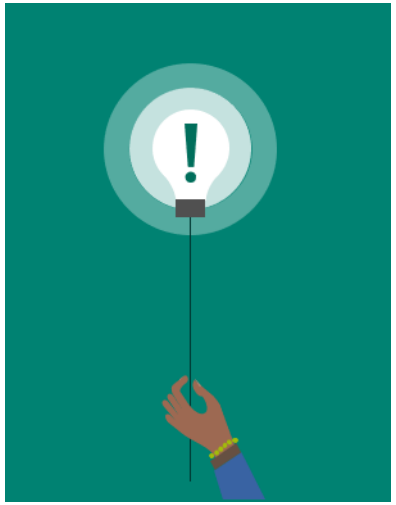
What permissions does the CNO require to create a VCO?

Lesson 3: Configuring Cluster Quorum

Objectives

After completing this learning, you will be able to:

- Understand how to configure Cluster Quorum



What is a Quorum?

Determined by the number of voting elements that must be part of active cluster membership for that cluster to start properly or continue running.

By default, every node in the cluster has a single quorum vote.

In addition, a quorum witness (when configured) has an additional single quorum vote. You can configure one quorum witness for each cluster.

A quorum witness can be a designated disk, file share or a cloud witness resource.

Each element can cast one "vote" to determine whether the cluster can run.

Whether a cluster has quorum to function properly is determined by the majority of the voting elements in the active cluster membership.

Why is it so important?

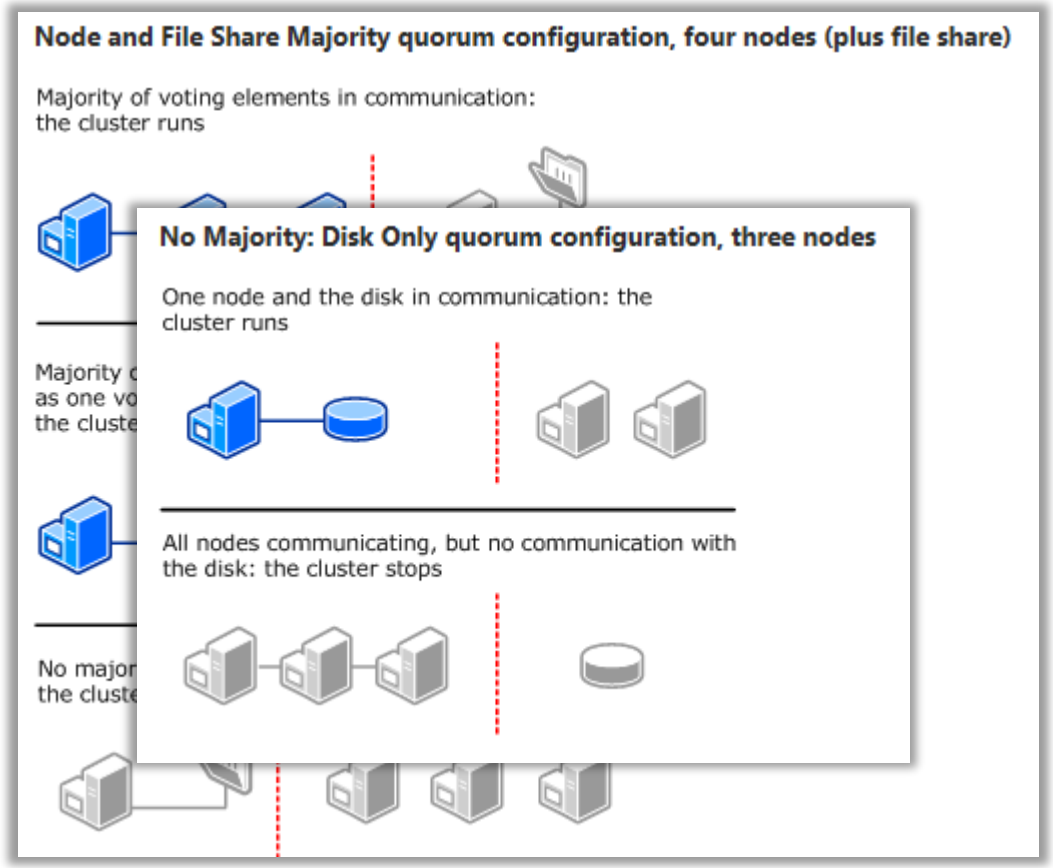
It helps ensure that the failover cluster can start properly or continue running when the active cluster membership changes.

Avoid split-brain scenario, when a subset of nodes cannot communicate with another subset of nodes (a split cluster), the cluster quorum configuration helps ensure that only one of the subsets continues running as a cluster.

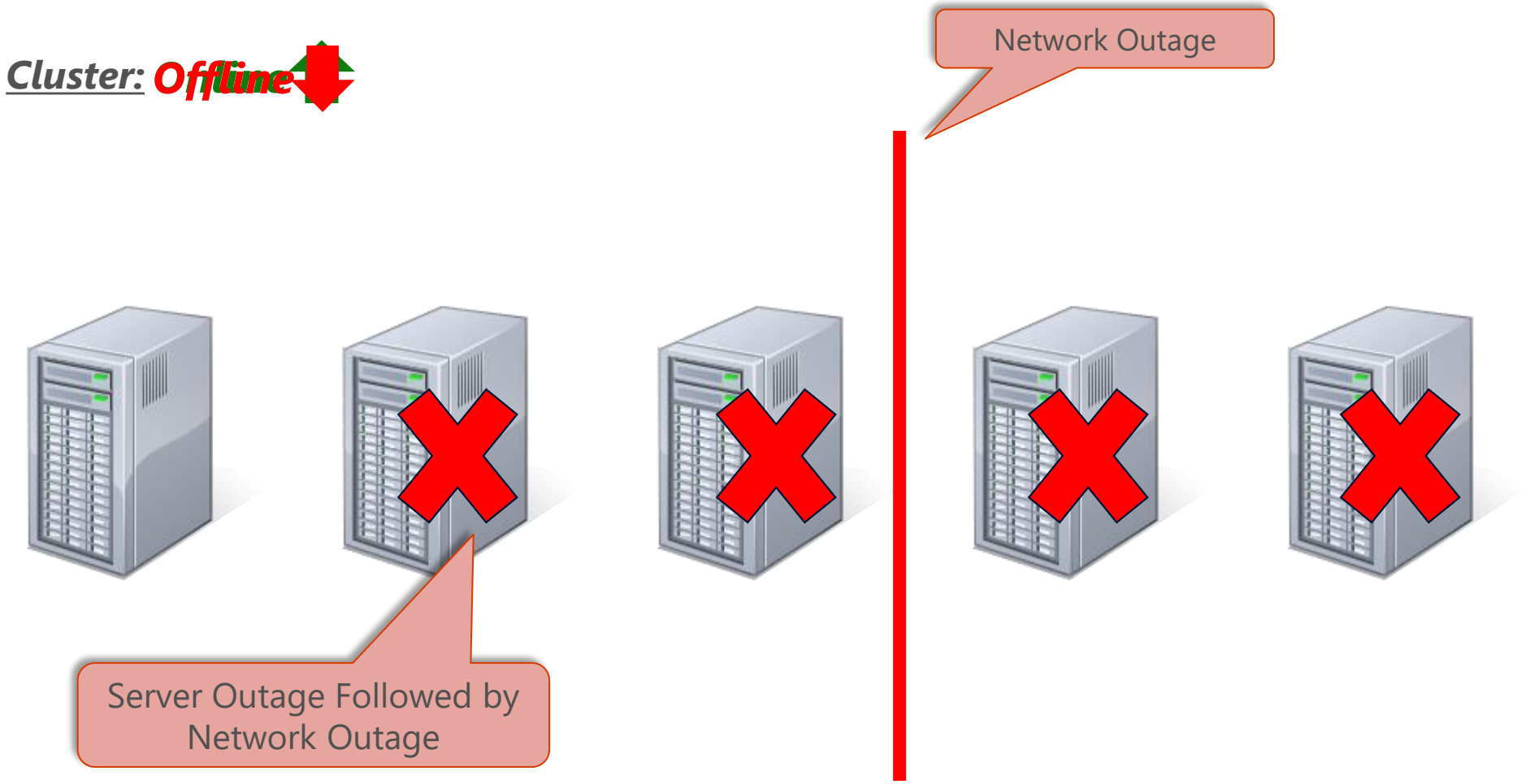
Configuring a witness vote helps the cluster sustain one extra node down in certain configuration.

Quorum Modes

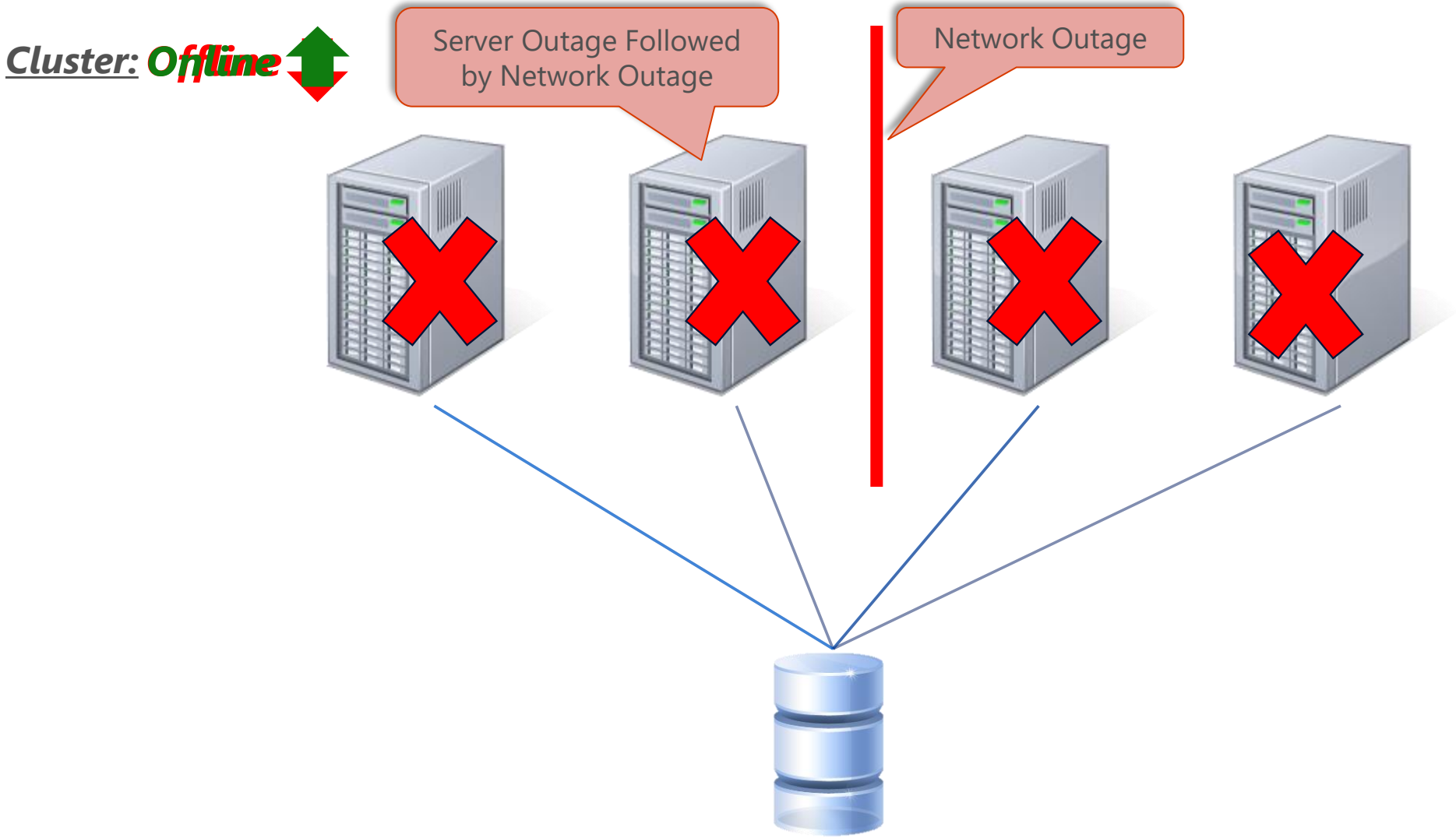
Node majority (no witness)	• Only nodes have votes. No quorum witness is configured. The cluster quorum is the majority of voting nodes in the active cluster membership.
Node majority with witness (disk, file share or cloud witness)	• Nodes have votes. In addition, a quorum witness has a vote. The cluster quorum is the majority of voting nodes in the active cluster membership plus a witness vote.
No majority (disk witness only) – ***Not Recommended***	• No nodes have votes. Only a disk witness has a vote. The cluster quorum is determined by the state of the disk witness.



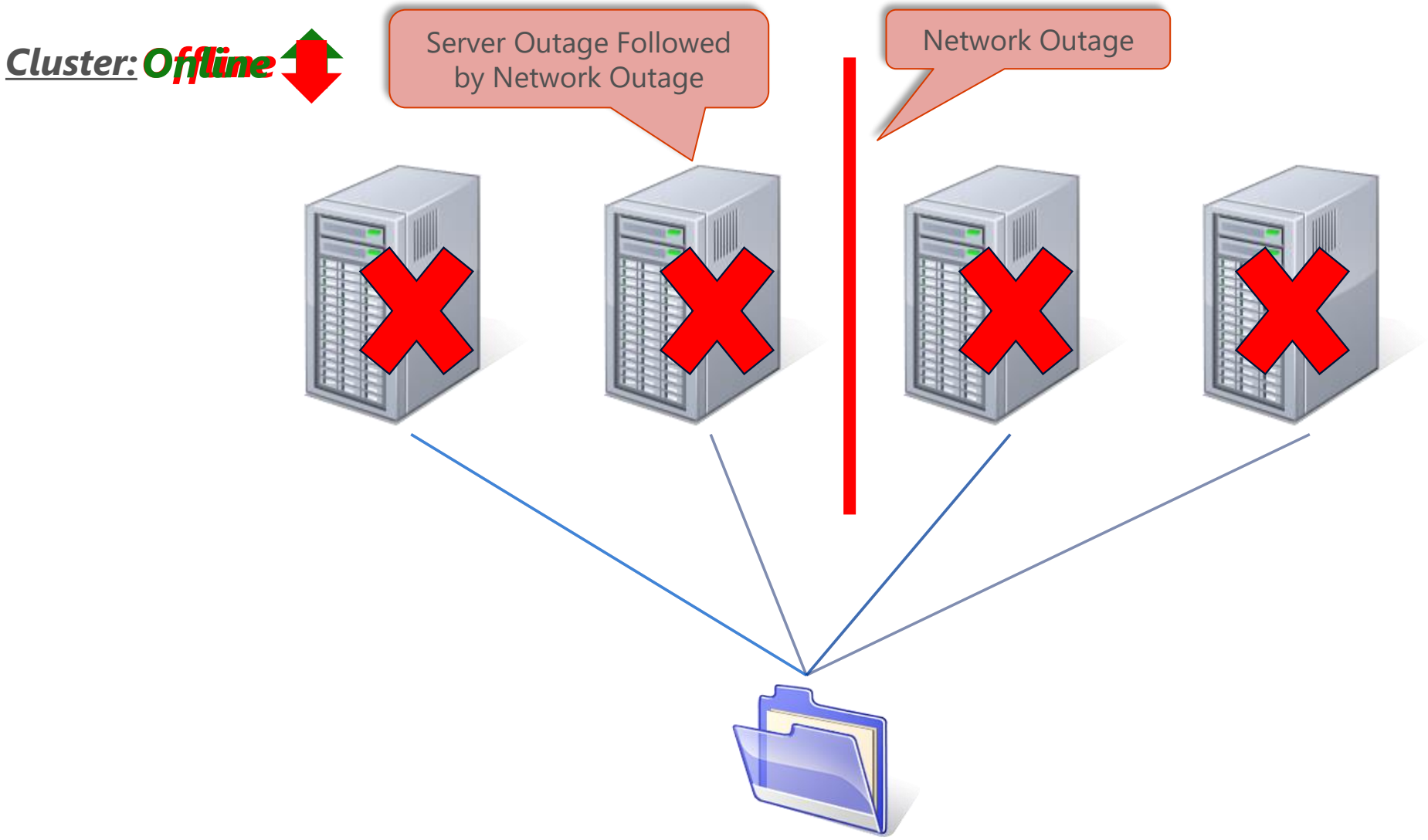
Node Majority



Node Majority with Witness (Disk)

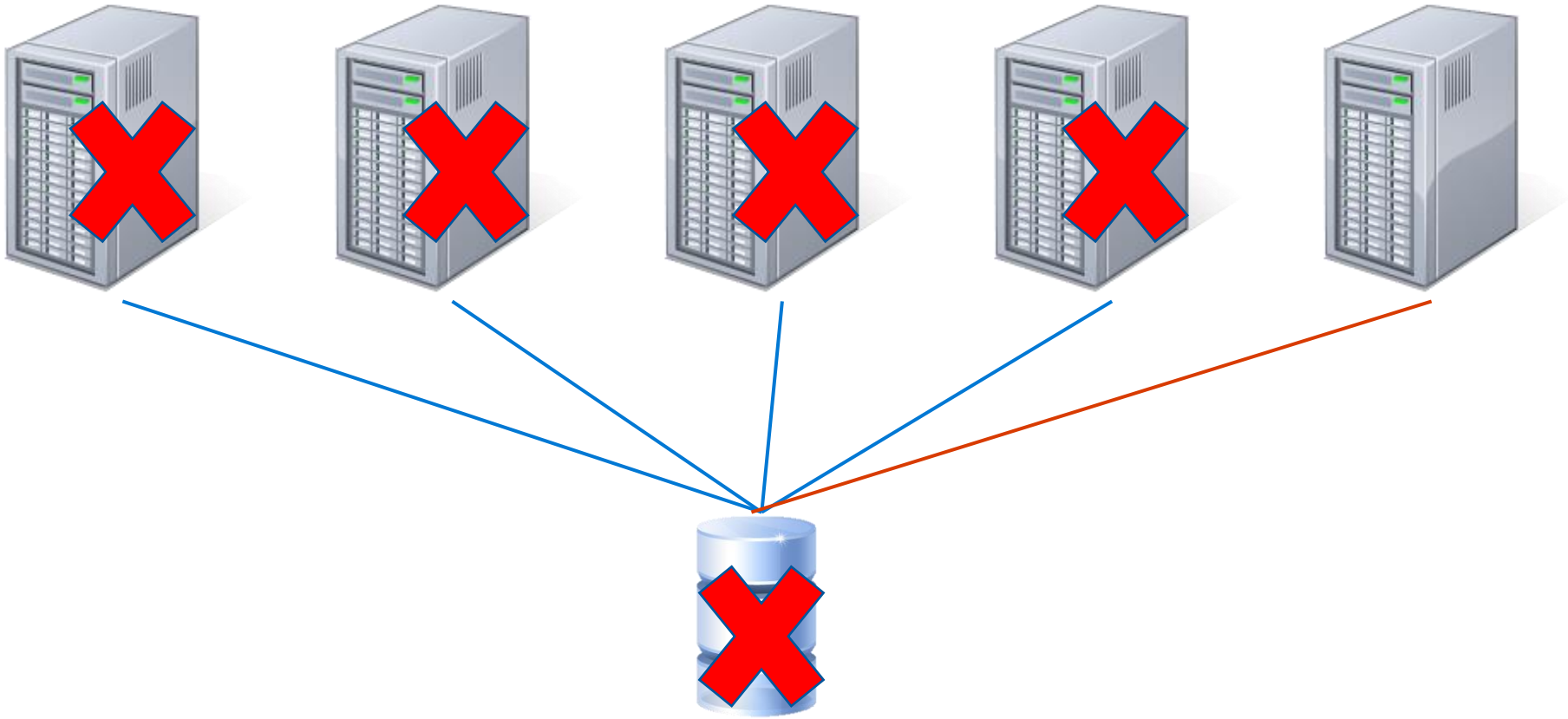


Node Majority with Witness (File Share)



No Majority or Disk Only

Cluster: ***Offline***



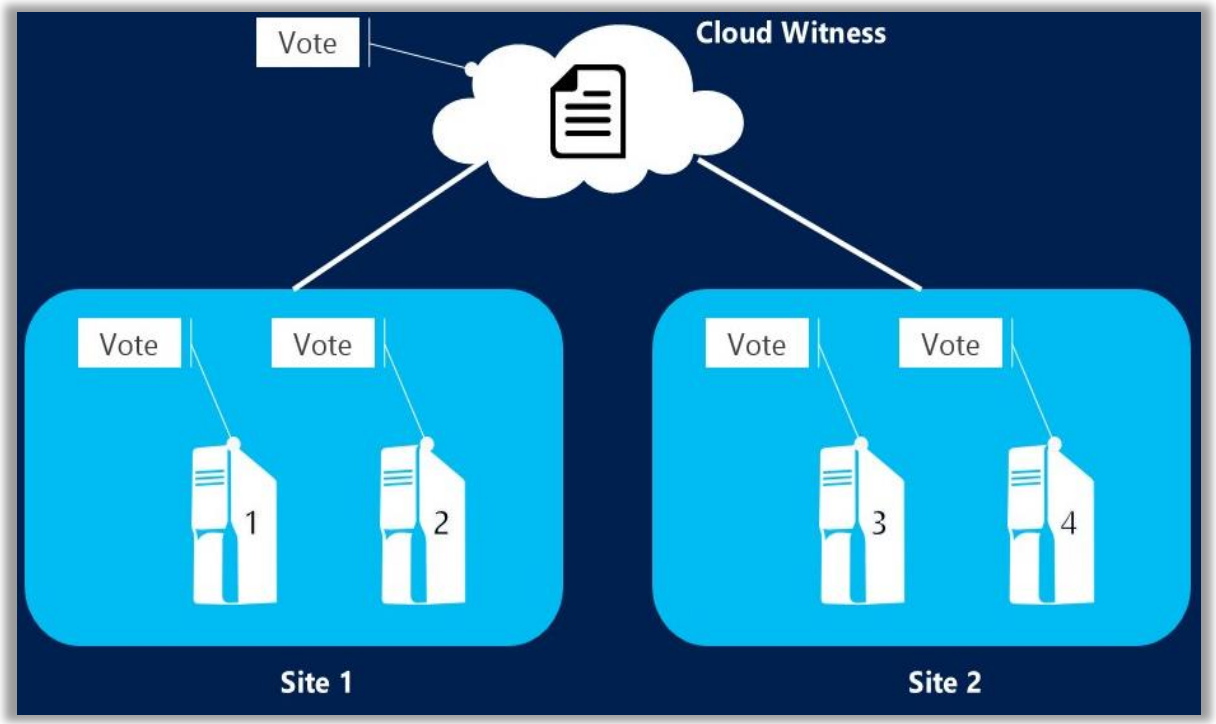
Azure Cloud Witness

Cloud Witness is a new type of Failover Cluster quorum witness that leverages Microsoft Azure as the arbitration point.

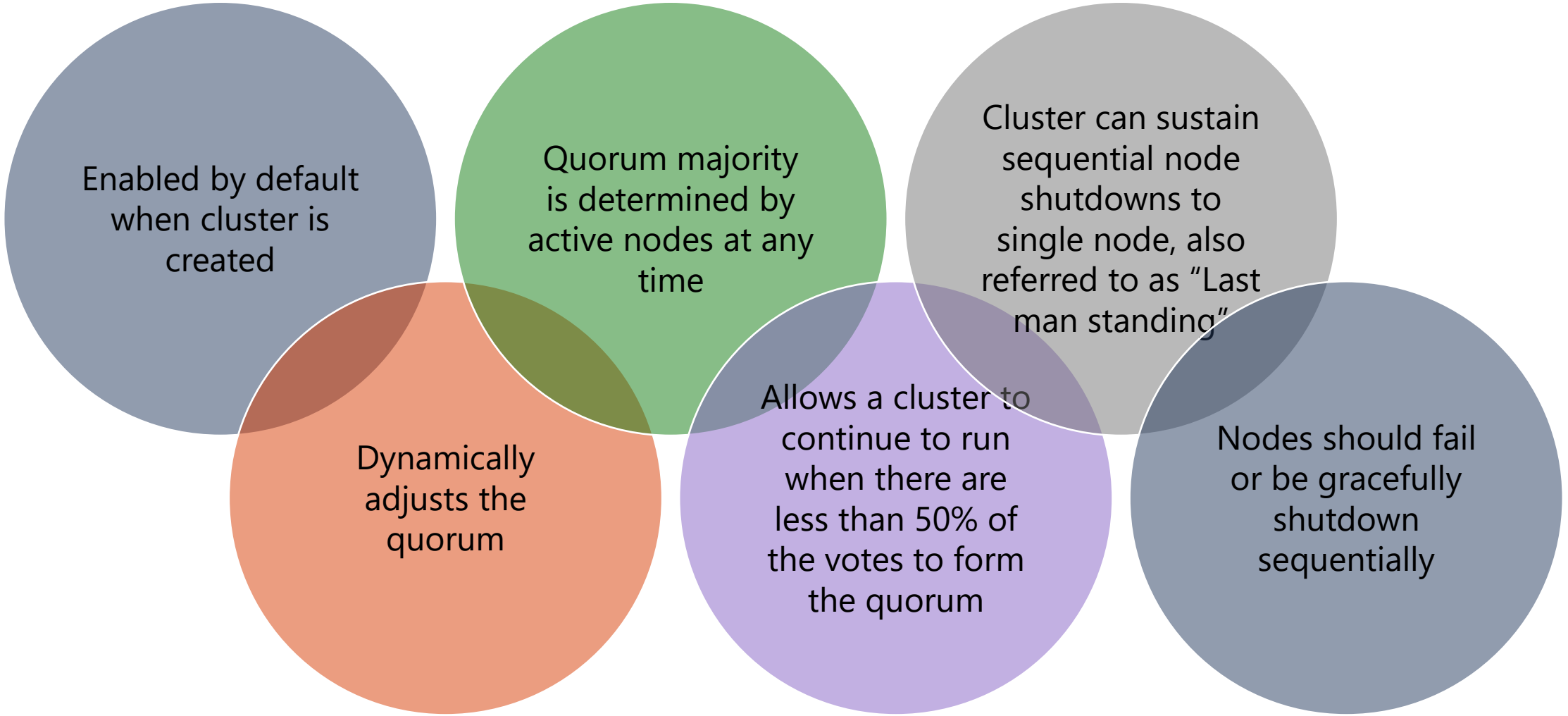
It uses Azure Blob Storage to read/write a blob file, which is then used as an arbitration point in case of split-brain resolution.

Very low on-going $cost to the Storage Account.

There is no third separate site that is required, Cloud Witness, like any other quorum witness, gets a vote and can participate in quorum calculations.



Dynamic Quorum



Dynamic Witness

Enabled automatically

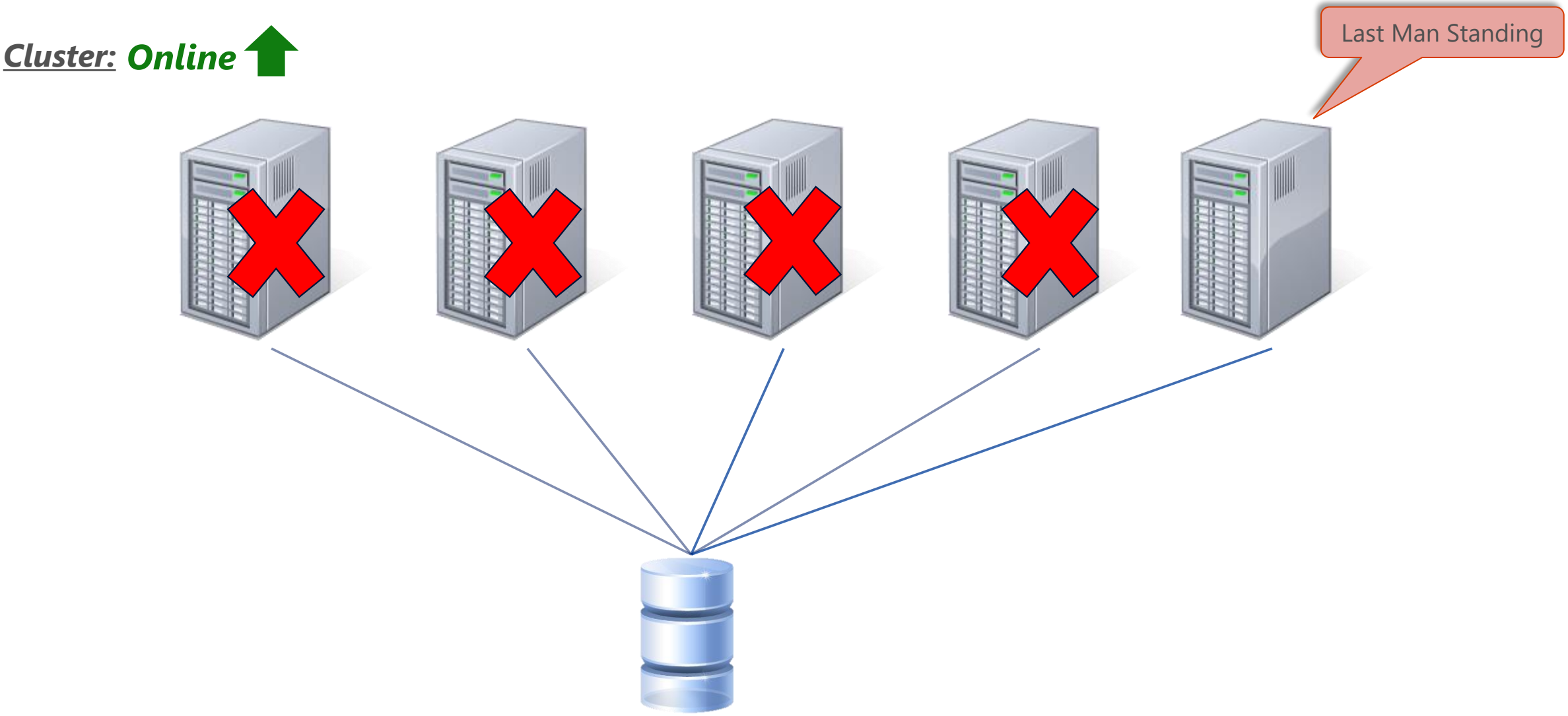
Cluster dynamically adjusts witness vote

If there are odd number of votes in the quorum, witness doesn't have a vote

If there are even number of votes in the quorum, witness has a vote

Recommendation – Always include quorum witness and the cluster will decide when to use it

Dynamic Witness



Demonstration: Last Man Standing Scenario

In this demonstration, you will understand the concept of “Last Man Standing”

Configuring Cluster Quorum

- Exercise 1: Configuring Cluster Quorum

Questions?

Knowledge Check

You have a seven node Windows Server failover cluster. What will happen if four nodes are gracefully shutdown sequentially?

Module Summary

Overview of Windows Server Failover Cluster

Creating Windows Server Failover Cluster

Configuring Cluster Quorum