Module 7

Overview of high availability and disaster recovery

Module Overview

- Defining levels of availability
- Planning high availability and disaster recovery solutions with Hyper-V virtual machines
- Backing up and restoring by using Windows Server Backup
- High Availability with failover clustering in Windows Server 2016

Lesson 1: Defining levels of availability

- What is high availability?
- What is continuous availability?
- What is business continuity?
- Creating a disaster recovery plan
- Highly available networking
- Highly available storage
- Highly available compute or hardware functions

What is high availability?

All parts of an application and the infrastructure it relies on must be highly available:

- Data center infrastructure
  - The room that stores the server must have sufficient power and cooling capacity, and that capacity also must be highly available.
- Server hardware
  - Redundant components can include power supplies, network adapters, processors, and memory.
- Storage
  - To make storage highly available on a single server, you can use **RAID**. If multiple servers are available, you can **replicate data** between servers.
- Network infrastructure
  - Within a LAN, this typically means redundant switches.
- Internet

What is high availability?

All parts of an application and the infrastructure it relies on must be highly available:

- Internet
  - Ideally, you should use two different ISPs and two different physical connectivity methods. For example, one ISP could be land based, and the other wireless.
  - Many firewalls and routers are capable of using one connection for Internet connectivity and failing over to another if the primary service fails.
  - For incoming email, you must use multiple mail exchange (MX) resource records, with one record pointing to the IP address allocated by each ISP
- Network services
  - AD and DNS service are the two services that must be highly available to support the infrastructure services in the organizations.

What is continuous availability?

To provide continuous availability:

- Perform business impact analysis
  - Business impact analysis determines an organization's critical business processes and the potential damage or loss that can result from their disruption or failure
- Perform risk analysis
  - Risk analysis identifies risks and their probability of occurrence.
  - Risk analysis also identifies single points of failure, such as an organization's disk drives, network switches, storage, or power supply
- Perform application specific analysis
- Create different continuous availability strategies for different applications

What is business continuity?

Requirements for business continuity planning should include:

- SLAs for the IT systems
- Contact info and technical background of personnel assigned to recovery
- A secondary site
- Maximum outage time allowed for applications

Business continuity technologies and data collection

You can collect business continuity data from:

- Business impact analysis
- Risk analysis

Technologies for business continuity include:

- NLB
- Failover clustering on physical or virtual machines
- Application-aware high availability
- Conventional data backups
- Online backups
- Virtual machine backups

Highly available networking

Planning for high availability in networking should include redundancy for:

- Network adapters
- Multipath I/O
- Local Area Network
- Wide Area Network
- Internet connectivity

Highly available storage

When planning high availability for storage, consider following technologies:

- RAID
- DAS
- NAS
- SAN
- Cloud services

Highly available compute or hardware functions

- Consider using the high availability features that are built into the operating system:
  - Failover clustering
  - Network Load Balancing
  - RAID
- Follow the best practice guidelines and recommendations for the specific application

Lesson 2: Planning high availability and disaster recovery solutions with Hyper-V virtual machines

- High availability considerations with Hyper-V virtual machines
- Overview of Live Migration
- Live migration requirements
- Demonstration: Configuring live migration (optional)
- Providing high availability with storage migration
- Demonstration: Configuring storage migration (optional)
- Overview of Hyper-V Replica
- Planning for Hyper-V Replica
- Implementing Hyper-V Replica
- Demonstration: Implementing Hyper-V Replica (optional)

High availability considerations with Hyper-V virtual machines

HA options	Description
Host clustering	• Virtual machines are highly available • **Non-cluster aware application도 Clustering을 할 수 있게 된다** • Does not require virtual machine operating system or application to be cluster aware
Guest clustering	• **Virtual machines are failover cluster nodes** • Virtual machine applications must be cluster aware • DNS, File Server, SQL, Exchange • Requires iSCSI or virtual Fibre Channel interface for shared storage connections
NLB	• Virtual machines are NLB cluster nodes • Use for **web-based applications**

Virtual machine migration options

Available options for moving virtual machines are:

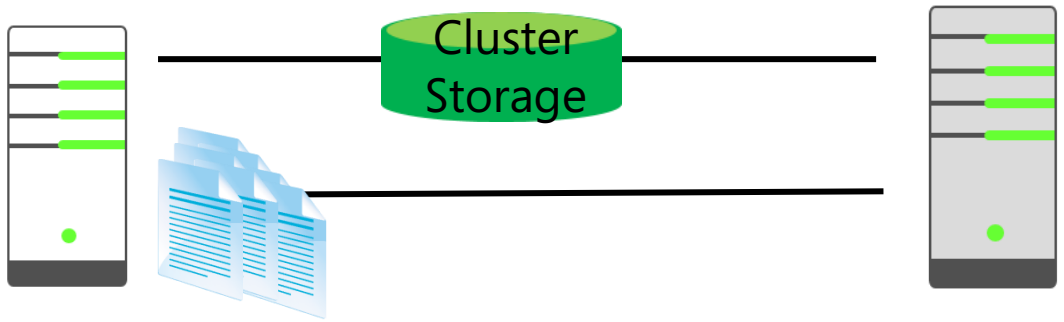
- Virtual machine and storage migration
  - With this method, you move a powered-on virtual machine from one location to another or from one host to another by using the **Move Virtual Machine Wizard** in Hyper-V Manager.
  - Virtual Machine and Storage Migration **does not require failover clustering** or any other high availability technology.
- Quick Migration
  - It requires that you install and configure **the failover clustering**. During the migration process, when you use Quick Migration to move virtual machines between cluster nodes, a virtual machine is placed **in a saved state.**
  - This causes some downtime until it copies the memory content to another node and restores the machine from the saved state.

Virtual machine migration options

Available options for moving virtual machines are:

- Live Migration
  - Live migration enables you to migrate a virtual machine from one host to another **without experiencing downtime**.
  - In addition, hosts do not have to share any storage for this type of migration to be performed.
- Export or import of a virtual machine
  - This is an established method of moving virtual machines **without using a cluster.**
  - You export a virtual machine on one host and then, move exported files physically to another host by performing an import operation. This is a very time-consuming operation.
  - It requires that you turn off a virtual machine during export and import.

Overview of live migration



Node 1

Node 2

Live migration requirements

Live migration requirements include:

- Live migration enabled
- Host computers processor requirements
- **Host computers domain membership** and user accounts configured
  - Active Directory에 소속된 컴퓨터가 Hyper-V host가 되어야 한다
- Hyper-V roles and management tools installed
- Host computers authentication configured
- Host computers performance, network, and bandwidth configured

Demonstration: Configuring live migration (*optional*)

In this demonstration, you will see how to enable and configure live migration

Providing high availability with storage migration

- **Virtual machine and Storage** Migration technology enables you to move a virtual machine and its storage to another location **without downtime**
- During migration, the virtual machine hard disk is copied from one location to another
- Changes are written to both the source and destination drive
- You can move **virtual machine storage** to **the same host**, **another host**, or an **SMB share**
- Storage and virtual machine configuration **can be in different locations**

Demonstration: Configuring storage migration (*optional*)

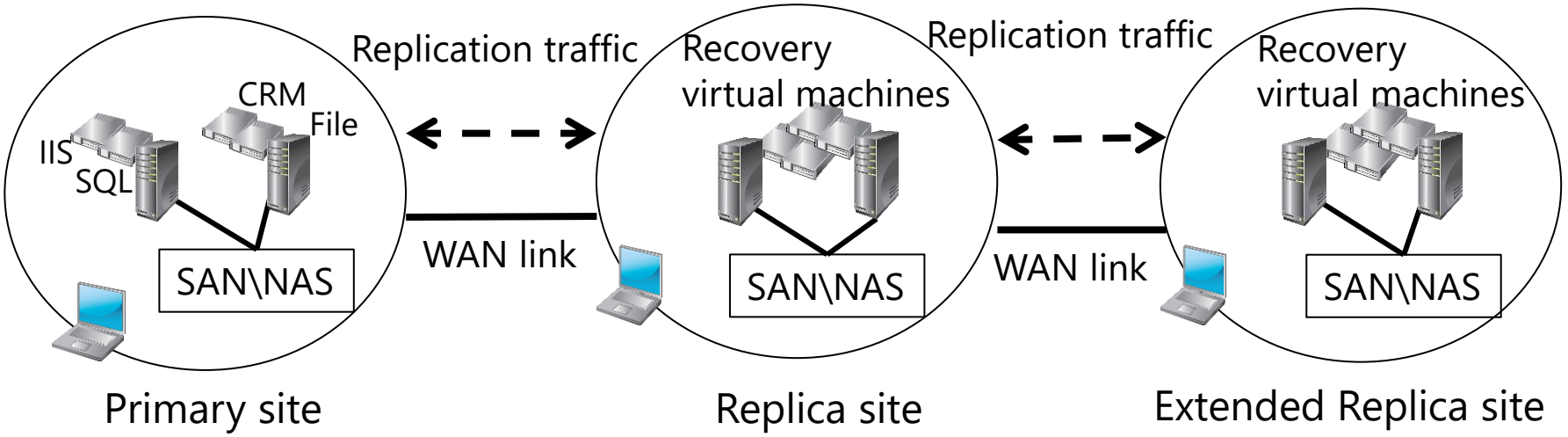
In this demonstration, you will see how to enable and configure storage migration

Overview of Hyper-V Replica

Hyper-V Replica in Windows Server 2016 enables you to replicate a single virtual machine over a WAN or LAN network to another host.
You might want to have **a spare copy of one virtual machine** that you can run if the original virtual machine fails.

Hyper-V Replica components include:

- Replication engine
- Change tracking
- Network module
- Hyper-V Replica Broker role



Planning for Hyper-V Replica

Use Hyper-V Replica features in Windows Server 2016 to:

- Change the replication frequency to either 30 seconds, 5 minutes, or 15 minutes
- Extend replication to include a third host

Implementing Hyper-V Replica

Hyper-V Replica has the following prerequisites:

- The server hardware supports the Hyper-V role on Windows Server 2016
- Sufficient storage exists on both the primary and replica servers
- Network connectivity exists between the locations that host the primary and replica servers
- Firewall rules are correctly configured to enable replication between the primary and replica sites (default is TCP port 80 or 443).
- An X.509v3 certificate exists to support Mutual Authentication with certificates

Hyper-V Replica configuration steps

To configure Hyper-V Replica, you should:

1. Configure authentication and port options
2. Select replica servers
3. Select location for replica files and replication interval
4. Enable replication on virtual machine

Hyper-V Replica failover scenarios include:

- Test failover
- Manual failover
- Failover

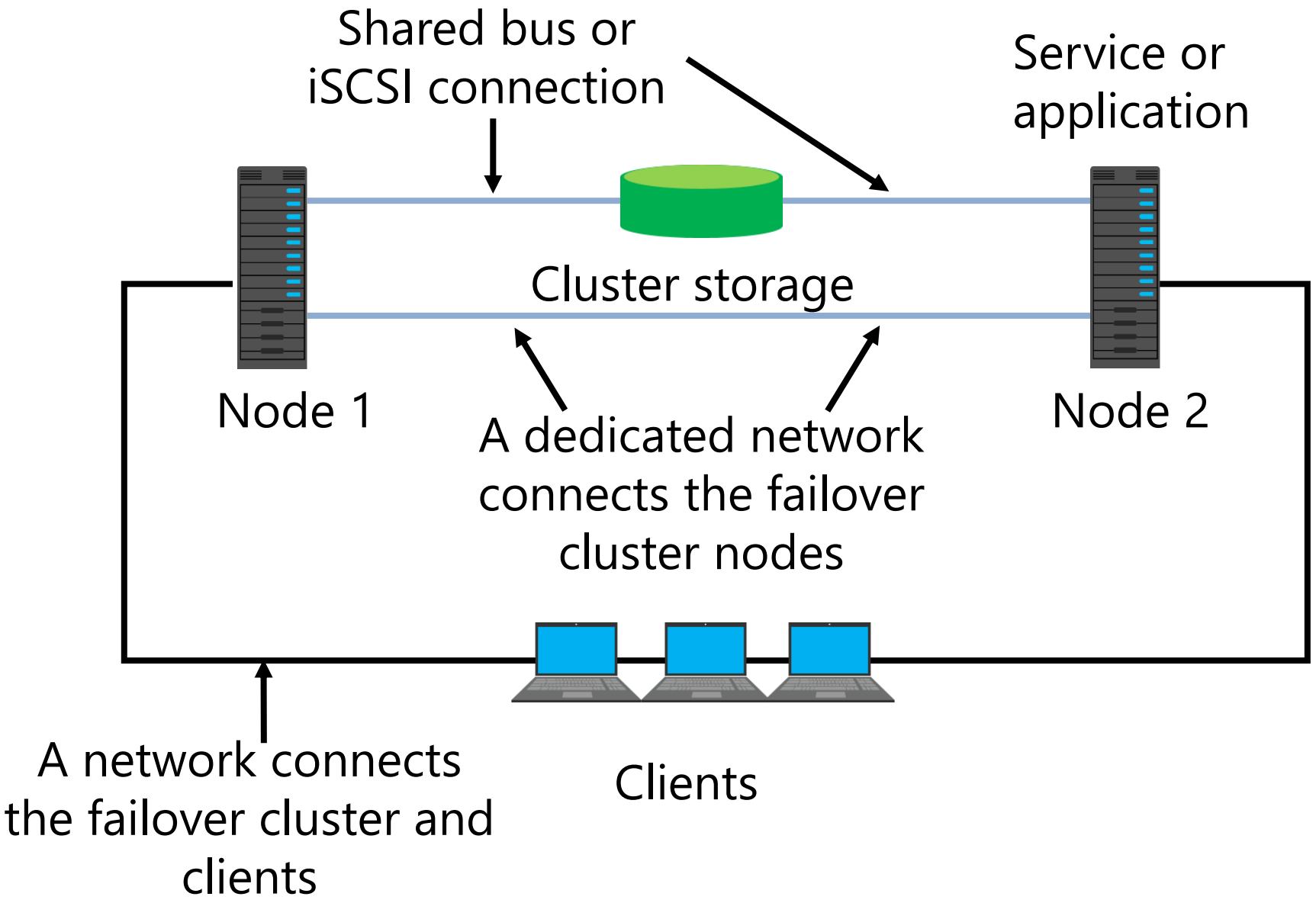
Demonstration: Implementing Hyper-V Replica (*optional*)

In this demonstration, you will see how to implement Hyper-V Replica

Lesson 4: High availability with failover clustering in Windows Server 2016

- What is failover clustering?
- High availability with failover clustering
- Clustering terminology
- Clustering categories and types
- Failover clustering components
- Technology redundancy comparison

What is failover clustering?



High availability with failover clustering

- Failover clustering provides high availability for data, applications, and services
- Failover clustering considerations:
  - Hardware prerequisites
  - Software prerequisites
  - Applications have specific failover clustering configurations
  - Applications must be cluster-aware

Clustering terminology

Failover clustering terminology includes:

- Node
- Service or application
- Shared storage
- Quorum
- Witness
- Failover/Failback
- Clients

Clustering categories and types

- Type of application deployed:
  - Failover clusters
  - Network Load Balancing clusters
- Node location:
  - Single site clusters
  - Multisite clusters
  - Nodes or witness server hosted in cloud environment
- Number of active servers:
  - Active-Active clusters
  - Active-Passive clusters

Failover clustering components

Failover clustering components include:

- Nodes
- Network
- Resource
- Cluster storage
- Quorum
- Witness
- Service or application
- Clients

Technology redundancy comparison

	Zero Downtime	Hardware Failures	Site Failures	Data deletion/ corruption	Automatic failover
Live Migration	Yes	No	No	No	No
Clustering	Depends on application	Yes	Depends on application	No	Yes
Hyper-V Replica	No	Yes	Yes	Depends on application	No
Windows Server Backup	No	Yes	Depends on scenario	Yes	No