Microsoft® Official Course

Module 11
Implementing Failover Clustering with Hyper-V
Module Overview

• Overview of Integrating Hyper-V with Failover Clustering
• Implementing Hyper-V Virtual Machines on Failover Clusters
• Implementing Hyper-V Virtual Machine Movement
Lesson 1: Overview of Integrating Hyper-V with Failover Clustering

• Options for Making Applications and Services Highly Available
• How Does a Failover Cluster Work with Hyper-V Nodes?
• What’s New in Failover Clustering for Hyper-V in Windows Server 2012?
• What’s New in Failover Clustering for Hyper-V in Windows Server 2012 R2?
• Best Practices for Implementing High Availability in a Virtual Environment
## Options for Making Applications and Services Highly Available

<table>
<thead>
<tr>
<th>High availability options</th>
<th>Description</th>
</tr>
</thead>
</table>
| Host clustering           | • Virtual machines are highly available  
                           | • 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  
                           | • Requires iSCSI or virtual Fibre Channel  
                           |   interface for shared storage  
                           |   connections |
| NLB                       | • Virtual machines are NLB cluster nodes  
                           | • Use for web-based applications |
How Does a Failover Cluster Work with Hyper-V Nodes?

A dedicated network connects the failover cluster nodes.

- Shared bus or iSCSI connection

Node 1

Node 2
What’s New in Failover Clustering for Hyper-V in Windows Server 2012?

The Failover Clustering improvements for Hyper-V in Windows Server 2012 include:

- Support for up to 8,000 virtual machines per cluster
- Multi-select virtual machines for Live Migration
- Virtual machine priority attribute
- CSV improvements
- Virtual machine application monitoring
- Storage of virtual machines on highly available SMB file share
What’s New in Failover Clustering for Hyper-V in Windows Server 2012 R2?

- Windows Server 2012 R2 provides new features for virtual machine clustering, which include:
  - Shared virtual hard disk
  - Virtual machine drain on shutdown
  - Network health detection
Best Practices for Implementing High Availability in a Virtual Environment

- Use Windows Server 2012 R2 as the Hyper-V host
- Plan for failover scenarios
- Plan the network design for failover clustering
- Plan the shared storage for failover clustering
- Use the recommended failover cluster quorum mode
- Deploy standardized Hyper-V hosts
- Develop standard management practices
Lesson 2: Implementing Hyper-V Virtual Machines on Failover Clusters

- Components of Hyper-V Clusters
- Implementing Failover Clustering for Hyper-V Virtual Machines
- Configuring CSV
- Configuring a Shared Virtual Hard Disk
- Using Scale-Out File Servers Over SMB 3 for Virtual Machines
- Considerations for Implementing Hyper-V Clusters
- Demonstration: Implementing Virtual Machines on Clusters (optional)
- Maintaining and Monitoring Virtual Machines in Clusters
Hyper-V cluster components:
- Cluster nodes, must be physical computers
- Cluster networks
- Virtual networks
- Storage for virtual machines
- Virtual machines
Implementing Failover Clustering for Hyper-V Virtual Machines

1. Install and configure Windows Server 2012
2. Configure shared storage
3. Install the Hyper-V and failover clustering features
4. Validate the cluster configuration
5. Create the cluster
6. Create a virtual machine on one of the cluster nodes
7. Make the virtual machine highly available, for existing virtual machine
8. Test virtual machine failover
Configuring CSV

CSV benefits:
- Fewer LUNs required
- Better use of disk space
- Virtual machine files are in a single logical location
- No special hardware required
- Increased resiliency

To implement CSV:
1. Create and format volumes on shared storage
2. Add the disks to failover cluster storage
3. Add the storage to the CSV
Configuring a Shared Virtual Hard Disk

- A failover cluster runs inside virtual machines
- A shared virtual disk is used as shared storage if:
  - Virtual machines do not need access to iSCSI or failover clustering SAN
  - Presented as a virtual serial attached SCSI disk
  - Used only for data
- Requirements for a shared virtual disk:
  - Virtual hard disk must be in VHDX format
  - Connected by using virtual SCSI adapter
  - Stored on a Scale-Out File Server or CSV
- Supported operating system in a virtual machine:
  - Windows Server 2012 or Windows Server 2012 R2
## Shared Virtual Disk vs. Other Shared Storage Technologies

### Comparing guest clustering options

<table>
<thead>
<tr>
<th>Capability</th>
<th>Shared VHDX</th>
<th>Virtual Fibre Channel</th>
<th>iSCSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supported storage</td>
<td>Storage Spaces, serial attached SCSI, Fibre Channel, iSCSI, SMB</td>
<td>Fibre Channel SAN</td>
<td>iSCSI SAN</td>
</tr>
<tr>
<td>How storage is exposed in the virtual machine</td>
<td>Virtual serial attached SCSI</td>
<td>Virtual Fibre Channel LUN</td>
<td>iSCSI LUN</td>
</tr>
<tr>
<td>Flows through the Hyper-V virtual switch</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Storage configured at the Hyper-V host</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Provides low latency and low CPU use</td>
<td>Yes (RDMA or Fibre Channel)</td>
<td>Yes (Fibre Channel)</td>
<td>No</td>
</tr>
<tr>
<td>Requires specific hardware</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Exposes storage architecture</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
• In Windows Server 2012 or newer, you can store virtual machine files on an SMB 3.0 file share
• File servers should run Windows Server 2012 R2
• File server cluster should run in Scale-Out File Server mode
• Hyper-V Manager can be used to create or move virtual machine files to an SMB file share
Considerations for Implementing Hyper-V Clusters

1. Identify the applications that require high availability
2. Identify the application components that must be highly available
3. Identify the application characteristics
4. Identify the total capacity requirements
5. To create the Windows Server 2012 Hyper-V design:
   • Verify basic requirements
   • Configure a dedicated network adapter for the private virtual network
   • Use similar host hardware
   • Verify network configuration
In this demonstration, you will see how to implement highly available virtual machines with failover clustering.
Maintaining and Monitoring Virtual Machines in Clusters

- In Windows Server 2012 failover clustering, you can implement the following technologies for virtual machine maintenance and monitoring:
  - Service and virtual machine health monitoring
  - Network health detection, for Windows Server 2012 R2 only
  - Virtual machine drain on shutdown, for Windows Server 2012 R2 only
Lesson 3: Implementing Hyper-V Virtual Machine Movement

• Virtual Machine Migration Options
• How Does Virtual Machine and Storage Migration Work?
• Using ODX Capable Storage for Virtual Machines
• How Does Live Migration Work?
• How Does Hyper-V Replica Work?
• New Features of Hyper-V Replica in Windows Server 2012 R2
• Demonstration: Implementing Hyper-V Replica (optional)
Available options for moving virtual machines are:

- Virtual Machine and Storage Migration
- Quick Migration
- Live Migration
- Hyper-V Replica
- Export or import of a virtual machine
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
When using ODX-capable storage you achieve following benefits:

- Increase data transfer
- Minimize latency
- Minimize host’s resource usage while copying and migrating data
How Live Migration Works?

Node 1  

Cluster Storage  

Node 2
Hyper-V Replica in Windows Server 2012 enables you to replicate a single virtual machine over a WAN or LAN network to another host.

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

**Diagram:**
- **Primary site**
  - IIS
  - SQL
  - CRM
  - File
  - SAN\NAS

- **Replica site**
  - Recovery virtual machines
  - SAN\NAS
  - Replication traffic
  - WAN link

- **Extended Replica site**
  - Recovery virtual machines
  - SAN\NAS
  - Replication traffic
  - WAN link
To configure Hyper-V Replica, you should:

1. Configure authentication options
2. Configure ports
3. Select replica servers
4. Select location for replica files
5. Enable replication on virtual machine
Hyper-V Replica in Windows Server 2012 R2 is enhanced with the following features:

- The ability to change the replication frequency:
  - The available intervals are 30 seconds, 5 minutes, and 15 minutes

- Extended replication:
  - You can extend Hyper-V Replica to include a third host
Demonstration: Implementing Hyper-V Replica (optional)

In this demonstration, you will see how to implement Hyper-V Replica
Lab: Implementing Failover Clustering with Hyper-V

- Exercise 1: Configuring Hyper-V Replicas
- Exercise 2: Configuring a Failover Cluster for Hyper-V
- Exercise 3: Configuring a Highly Available Virtual Machine

Logon Information

Virtual machines: 20412D-LON-DC1-B
                 20412D-LON-SVR1-B
Host machines:   20412D-LON-HOST1
                 20412D-LON-HOST2
User name:       Adatum\administrator
Password:        Pa$$w0rd

Estimated Time: 75 minutes
The initial deployment of virtual machines on Hyper-V has been successful for A. Datum. As a next step in the deployment, A. Datum is considering ways to ensure that the services and applications deployed on the virtual machines are highly available. As part of the implementation of high availability for most network services and applications, A. Datum also is considering options for making the virtual machines that run on Hyper-V highly available.

As one of the senior network administrators at A. Datum, you are responsible for integrating Hyper-V with failover clustering to ensure that the virtual machines deployed on Hyper-V are highly available. You are responsible for planning the virtual machine and storage configuration, and for implementing the virtual machines as highly available services on the failover cluster. You also are considering other techniques, such as Hyper-V Replica, for ensuring high availability for virtual machines.
Lab Review

• How can you extend Hyper-V Replica in Windows Server 2012 R2?
• What is the difference between Live Migration and Storage Migration?
Module Review and Takeaways

• Review Question
• Tools
• Best Practice
• Common Issues and Troubleshooting Tips