In this lab, you will explore some of the new features and capabilities of Windows Server 2012 R2 for server infrastructure and fabric administrators. This lab is designed to point out the location of new features, discuss and describe them, and enable you to understand and explain these features to customers. In most cases you will not fully implement features, merely locate them, understand the options, and understand the process of configuring them.
Introduction

Objectives
After completing this lab, you will be able to:

- Explore generation 2 VMs.
- Work with extended replication.
- Implement shared VHDX.

Prerequisites
Before working on this lab, you must have:

- An understanding of virtualization concepts.
- An understanding of networking concepts.
- Familiarity with Windows PowerShell.

Overview of the lab
In this lab, you will explore some of the new features and capabilities of Windows Server 2012 R2 for server infrastructure and fabric administrators. This lab is designed to point out the location of new features, discuss and describe them, and enable you to understand and explain these features to customers. In most cases you will not fully implement features, merely locate them, understand the options, and understand the process of configuring them.

Virtual machine technology
This lab is completed using virtual machines that run on Windows Server 2012 Hyper-V technology. To log on to the virtual machines, press CTRL+ALT+END and enter your logon credentials.

Computers in this lab
This lab uses computers as described in the following table. Before you begin the lab, you must ensure that the virtual machines are started and then log on to the computers.

<table>
<thead>
<tr>
<th>Virtual Machine</th>
<th>Role</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>Domain controller</td>
<td>Domain controller</td>
</tr>
<tr>
<td>Server1</td>
<td>Hyper-V server</td>
<td>Virtualized Hyper-V server</td>
</tr>
<tr>
<td>Server2</td>
<td>Hyper-V server</td>
<td>Virtualized Hyper-V server</td>
</tr>
<tr>
<td>Server3</td>
<td>Hyper-V server</td>
<td>Virtualized Hyper-V server</td>
</tr>
</tbody>
</table>

All user accounts in this lab use the password Password!

Note regarding pre-release software
Portions of this lab may include software that is not yet released, and as such may still contain active or known issues. While every effort has been made to ensure this lab functions as written, unknown or unanticipated results may be encountered as a result of using pre-release software.
Note regarding user account control
Some steps in this lab may be subject to user account control. User account control is a technology which provides additional security to computers by requesting that users confirm actions that require administrative rights. Tasks that generate a user account control confirmation are denoted using a shield icon. If you encounter a shield icon, confirm your action by selecting the appropriate button in the dialog box that is presented.

Note on activation
The virtual machines for these labs may have been built by using software that has not been activated. This is by design in the lab to prevent the redistribution of activated software. The unactivated state of software has been taken into account in the design of the lab. Consequently, the lab is in no way affected by this state. For operating systems other than Windows 8.1, click Cancel or Close if prompted by an activation dialog box. If you are prompted by an Activate screen for Windows 8.1, press the Windows key to display the Start screen.
Exercise 1: Getting to Know Hyper-V

In this exercise, you will explore some new features in Windows Server 2012 R2 Hyper-V including generation two VMs, shared virtual hard disks (VHDX), and VHDX Quality of Service (QoS).

Working with generation two VMs

A generation two VM is a new form of virtual machine that is based on UEFI system standards and is not limited by traditional BIOS. Generation two VMs feature only SCSI-based disks and can PXE boot using synthetic network adapters. The generation of a VM must be defined when it is created and cannot be changed afterwards without recreating the virtual machine and reinstalling the operating system. Only Windows Server 2012 R2 can be installed in a generation two VM.

Begin this task logged on to Server1 as Contoso\Administrator with the password Passw0rd!

1. On Server1, open Server Manager.
2. In Server Manager, on the Tools menu, click Hyper-V Manager.
3. In Hyper-V manager, click Server1.
4. In the Actions pane, click New, and then click Virtual Machine.
5. Click Next.
6. In Name, type G2VM, and then click Next.
7. Click Generation 2, and then click Next.
   ✅ You are warned that you cannot change this once the VM has been created.
8. In Startup memory, type 32, and then click Next.
   ✅ This is a sample VM on a virtualized Hyper-V server, so you are using an artificial RAM value.
9. Continue clicking Next until you reach the end of the wizard, and then click Finish.
10. Right-click G2VM, and then click Settings.
    ✅ There is no IDE bus, only SCSI.
11. Click Firmware.
    ✅ There are configuration settings for Secure Boot as well as the boot order.
12. Leave the Settings for G2VM open for the next task.

Configure shared VHDX and Storage QoS

Windows Server 2012 R2 enables two new key features for service providers and fabric administrators: shared VHDX and Storage Quality of Service (QoS). Shared VHDX enables guest clusters to be created using a shared VHD file as the shared storage. This shared VHD file can be on any valid storage location for Hyper-V, including highly available SMB shares.
Storage QoS enables an administrator to limit the number of input/output operations per second (IOPS) that a single VHD can generate. An IOP is a single 8K read or write activity to a physical disk.

Begin this task logged on to Server1 as Contoso\Administrator with the password Passw0rd!

1. On the taskbar, click Windows PowerShell.
2. Type the following command, and then press ENTER.
   
   ```
   Get-WindowsFeature *cluster* | Install-WindowsFeature
   ```
   
   ✤ You may need to press ENTER when this step completes.
3. Type the following command, and then press ENTER.
   
   ```
   FLTMC attach svhdxflt c:
   ```
   
   ✤ This command manually enables the shared VHDX filter on c:.
   ✤ IMPORTANT: This is an unsupported scenario and is used in this lab environment only. This command will not work in any other environment.
4. In Settings for G2VM on Server1, expand SCSI Controller, and then expand Hard Drive.
5. Click Advanced Features.
6. Check Enable Quality of Service Management.
7. In Maximum IOPS, type 65.
   
   ✤ This is an approximate equivalent of one 10K HDD using a 4K page size.
8. Click Apply.
9. Click SCSI Controller, and then click Add.
10. Click New, and then in the New Virtual Hard Disk Wizard, click Next.
11. On the Choose Disk Type page, click Next.
12. In Name, type Shared.vhdx, and then click Next.
13. Click Finish.
14. In the Settings for G2VM on HV1 dialog box, click Apply.
15. Expand Shared.VHDX, and then click Advanced Features.
   
   ✤ This computer is configured to allow Shared VHD on a local DAS disk. This is not a supported scenario and does not work outside of this lab environment. A Cluster Shared Volume or a Scale-Out File Server is required as the storage location for a shared VHDX.
16. Check Enable virtual hard disk sharing.
17. Click OK.

   ✤ This VHDX file can now be used by another VM on the same host, or on a different host if the VHDX is located on a shared file server, and be used as shared storage to create a guest cluster.
Online resize of VHD and VHDX files

Windows Server 2012 R2 enables you to change the size of VHD and VHDX files while the virtual machine is running. This is done through Windows PowerShell or through the UI by editing the VHD.

Begin this task logged on to DC as Contoso\Administrator with the password Passw0rd!

You are running in a virtualized Hyper-V server (nested virtualization), so you cannot boot the guest VMs. This means you cannot technically do an ONLINE resize.

1. Open Windows PowerShell.
2. Type the following command, and then press ENTER.
   
   Show-command Resize-virtualdisk

3. Click Cancel.

Live migration protocol choices

Windows Server 2012 R2 provides a choice in protocol configurations. You can choose from the following three performance options:

2. Compressed TCP/IP live migration.
3. SMB live migration with support for SMB Direct (RDMA) live migration.

Begin this task logged on to Server1 as Contoso\Administrator with the password Passw0rd!

1. In Hyper-V Manager, click SERVER1, and then in the Actions pane, click Hyper-V Settings.
2. Expand Live Migrations, and then click Advanced Features.
   
   You have three choices, as described above.

3. Click Cancel.
Exercise 2: Hyper-V Replica and Extended Replica

In this exercise, you will implement Hyper-V Replica and Hyper-V Extended Replica to configure secondary and tertiary failover for virtual machines.

Configure Hyper-V to enable replication

In this task, you will configure your three Hyper-V servers to enable replication. You will also enable the required firewall rules for Hyper-V Replica.

Begin this task logged on to Server1 as Contoso\Administrator using the password Passw0rd!

1. Open Windows PowerShell.
2. Type the following command, and then press ENTER.
   - This will enable Hyper-V Replica on all three Hyper-V servers with a very flexible replication configuration.
     ```
     ICM Server1, Server2, Server3 {Set-VMReplicationServer -ReplicationEnabled:$True -AllowedAuthenticationType Kerberos -ReplicationAllowedFromAnyServer:$True -DefaultStorageLocation c:\Replica}
     ```
3. To verify that replication is enabled on Server1, type the following command, and then press ENTER.
   ```
   Get-VMReplicationServer
   ```
4. To enable the Hyper-V replica firewall rules, type the following command, and then press ENTER.
   ```
   1..3 | % {ICM Server$_ {Get-NetFirewallRule -DisplayName *Replica* | Enable-NetFirewallRule}}
   ```

Configure secondary replication

In this task, you will implement Hyper-V extended replication to extend Hyper-V Replica from two servers to three servers. This is useful in scenarios where you wish to maintain one replica within your data center and a second replica at a remote site or with an external provider.

Begin this task logged on to Server1 as Contoso\Administrator using the password Passw0rd!

1. In Hyper-V Manager, in the Actions pane, click New, and then click Virtual Machine.
2. Click Next.
3. In Name, type G1VM, and then click Next.
4. Click **Generation 1**, and then click **Next**.
   - You are warned that you cannot change this once the VM has been created.

5. In Startup memory, type **32**, and then click **Next**.
   - This is a sample VM on a virtualized Hyper-V server, so you are using an artificial RAM value.

6. Continue clicking **Next** until you reach the end of the wizard, and then click **Finish**.

7. In Hyper-V Manager, click **G1VM**.

8. In the Actions pane, click **Enable Replication**.

9. On the Before You Begin page, click **Next**.

10. In Replica Server, type **Server2**, and then click **Next**.

11. Accept the default Authentication type, and then click **Next**.

12. Accept the default Replication VHDs, and then click **Next**.

13. In Replication Frequency, select **30 seconds**, and then click **Next**.
   - Hyper-V in Windows Server 2012 R2 supports replication intervals as low as every 30 seconds.

14. In Configure Additional Recovery Points, select **Create additional hourly recovery points**, and then click **Next**.
   - Hyper-V in Windows Server 2012 R2 allows replication checkpoints to occur every hour for up to 24 hours.

15. In Choose Initial Replication Method, click **Next**, and then click **Finish**.

16. Log on to **Server2** as **Contoso\Administrator** using the password **Passw0rd!**

17. Open **Server Manager**, and then on the Tools menu, click **Hyper-V Manager**.

18. In Hyper-V Manager, click **Server2**.
   - The virtual machine has replicated to Server1. If this were a production virtual machine, the replication would take a longer period of time.

19. In the Actions pane, click **Replication**, and then click **Extend Replication**.

20. On the Before You Begin page, click **Next**.

21. In Replica Server, type **Server3**, and then click **Next**.

22. Accept the default Authentication type, and then click **Next**.

23. In Replication Frequency, select **5 Minutes**, and then click **Next**.

24. In Configure Additional Recovery Points, select **Create additional hourly recovery points**, and then click **Next**.
   - Hyper-V in Windows Server 2012 R2 allows additional replication checkpoints for extended replication to occur every hour for up to 24 hours.
25. In Choose Initial Replication Method, click **Next**, and then click **Finish**.
   ⚫ If you receive a Kerberos authentication error, log off and on to Server 1 2 and 3 to resynchronize the clock and then repeat Step 25. **This is not a requirement in a production environment.**

26. In Hyper-V Manager, right-click Hyper-V Manager, click **Connect to Server**, and then type **Server3**.

27. Click **OK**.
   ⚫ You will see the extended replication VM on this Hyper-V server.
Exercise 3: Conduct Planned and Unplanned Failover

This exercise simulates a bad day in anyone’s life. First you will perform a planned failover to the secondary site, then an unplanned failover to the tertiary site.

Conduct a planned failover to the secondary replica

In this task, you will conduct a planned failover to the secondary site with reverse replication.

Begin this task logged on to Server2 as Contoso\Administrator using the password Passw0rd!

1. Open Server Manager.
2. On the Tools menu, click Hyper-V Manager.
3. In Hyper-V Manager click Server2.
4. In Hyper-V Manager, click G1VM.
5. In the Actions pane, click Replication, and then click Failover.
6. Select Latest Recovery Point, and then click Fail Over.
7. In the Actions pane, click Replication, and then click View Replication Health.
   - The suggested action is to reverse replication. You will not perform this task as it will break extended replication.
8. Click Close.

Conduct an unplanned failover to the extended replica

In this task, you will conduct an unplanned failover to your extended replica, making it the primary copy of the replicated virtual machine.

Begin this task logged on to Server3 as Contoso\Administrator using the password Passw0rd!

1. In Hyper-V Manager, click Server3.
2. Click G1VM.
3. In the Actions pane, click Replication, and then click Remove Replication.
4. Click Remove Replication.
5. Click G1VM, and then in the Actions pane, click Start.
   - IMPORTANT: The G1VM virtual machine will not start due to the fact that it is running on a virtualized Hyper-V server. This is expected.

This is the end of the lab.