Implementing and Managing AlwaysOn Availability Groups
Hands-on Lab
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Lab Environment

During this lab, you will work in a simulated environment with the following computers or virtual machines.

This lab will use the following network environment:

<table>
<thead>
<tr>
<th>Computer Name</th>
<th>Function</th>
<th>Operating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>DomainController</td>
<td>Contoso.com Domain Controller</td>
<td>Windows Server® 2012</td>
</tr>
<tr>
<td>SQLONE</td>
<td>SQL Server Instance</td>
<td>Windows Server 2012</td>
</tr>
<tr>
<td>SQLTWO</td>
<td>SQL Server Instance</td>
<td>Windows Server 2012</td>
</tr>
<tr>
<td>SQLTHREE</td>
<td>SQL Server Instance</td>
<td>Windows Server 2012</td>
</tr>
</tbody>
</table>
Lab Overview

Abstract

AlwaysOn availability groups provides database level high availability and disaster recovery which enables businesses to achieve the required 9’s for their mission critical application.

AlwaysOn Availability Groups is a new feature that was first introduced in SQL Server 2012. In SQL Server 2014 significant enhancements have been made to support a larger amount of replicas, and faster failover, as well as the ability to have a replica running on Windows Azure.

In this lab you will learn how to setup a high availability solution using SQL Server AlwaysOn.

Learning Objectives

After completing the exercises in this lab, you will learn how to provide high availability for an application database using AlwaysOn Availability Groups. As part of the exercise you will do the following

- Configure a Windows Server Failover Cluster for enabling Availability Groups
- Configure an Availability Group using the Availability Group Wizard in SSMS
- Configure an availability group listener and enable the OLTP application to use the listener for automatic redirection
- Configure an application to be a read-only application and redirect the application to use the Active Secondary

Estimated lab time: 90 minutes

The estimated time to complete this lab depends on the hosted infrastructure.

Recommended hardware:

This lab has been tested on a dual quad core CPU, with 16 GB RAM, of which 14 GB is assigned to the virtual machines used in this lab. The estimated lab time is based on completing every portion of the lab, including optional exercises.
About This Lab

Scope

This Hands-on Lab explores the new AlwaysOn high availability solution first introduced in SQL Server 2012. The lab consists of exercises which will allow you to configure the SQL Server AlwaysOn Availability Groups and understand the various options that helps with better availability and improved hardware utilization.

This lab uses a virtual machine infrastructure which has been configured to support Windows Clustering. It is important to understand that the concepts presented in the lab are designed for learning purposes and do not necessarily reflect Windows Clustering best practices.
Exercise 1: Configuring an AlwaysOn Availability Group

Scenario

AlwaysOn Availability Groups, introduced in SQL Server 2012 provide high availability for your application databases. Availability Group allows you to failover a group of databases together and allows configuring multiple instances as replicas to which you can failover, thereby increasing redundancy and availability.

The availability group involves a set of SQL Server instances, known as availability replicas. Each availability replica possesses a local copy of each of the databases in the availability group. Only one of these replicas acts as the primary replica at any point in time and maintains the primary copy of each database. The primary replica makes these databases, known as primary databases, available to users for read/write access. For each primary database, one or more availability replicas, known as secondary replicas, maintain a copy of the database and the database on a secondary replica is referred to as a secondary database.

By the end of this exercise, you will learn:

- How to configure an AlwaysOn Availability Group using the configuration wizard
- In this lab you will start with SQLONE instance as the primary instance
- The majority of the steps will be initiated from the SQLONE virtual machine
## Task 1: Pre-Configuration Validation

### PRE-CONFIGURATION

As part of the lab configuration, steps required to configuring AlwaysOn Availability groups have already been implemented in the Virtual lab Configuration to save time in regards to completion of this lab.

These steps include:

- Configuration of Failover Cluster Service on Each of the nodes that will be used in the AlwaysON AG configuration
- Configuration of Failover Cluster named SQLCLUSTER, as part of the AlwaysON AG Configuration
- Enabling AlwaysOn availability Groups on each of the servers that will participate as replica in the AlwaysOn Group.

<table>
<thead>
<tr>
<th>Validate Failover Cluster Group</th>
<th>1. On the Start Menu, select <strong>Failover Cluster Manager</strong> or start Failover Cluster Manager from the shortcut on the taskbar.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. As <strong>Failover Cluster Manager</strong> displays Validate that <strong>SQLCLUSTER.contoso.com</strong> indicates <strong>Nodes: 3 out of 3 nodes running</strong> And <strong>Cluster Status is UP.</strong></td>
</tr>
<tr>
<td></td>
<td>3. Close Failover Cluster Manager</td>
</tr>
</tbody>
</table>
## Task 2: Configuring AlwaysOn Availability Groups

| View existing application database configuration using SQL Server Management Studio | 1. Log on to the SQLONE  
2. Start SQL Server Management Studio from the Windows Start Menu or the shortcut in the taskbar  
3. Connect to SQLONE.  
4. In the Object Explorer pane, Click on SQLONE and expand the Databases node.  
5. Notice the list of user databases.  
7. No AlwaysOn Availability Groups currently exist. |
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Create a new Availability Group using the wizard on SQLONE</td>
<td>8. On SQLONE in SQL Server Management Studio, select SQLONE and in the AlwaysOn High Availability node of Object Explorer, right click and select New Availability Group Wizard.</td>
</tr>
</tbody>
</table>
9. On the **Introduction** page, click **Next**
10. On the **Specify Availability Group Name** page, in the **Name** box, type **SQLPRODUCTION_AG** and click **Next**.
11. On the **Select Databases** notice the status of the databases, and which ones are enabled for Always On availability groups. Notice the status for **ContosoSalesDB** lists: Full recovery mode is required.

    To be eligible to be included in an Availability Group, databases must meet the following prerequisites:
    - Be a user database.
    - Be a read/write database.
    - Be a multi-user database.
    - Not use AUTO_CLOSE.
    - Use the full recovery mode.
    - Possess a full database backup.
    - Reside on the SQL Server instance where you are creating the availability group and be accessible.
    - Not belong to another availability group.
    - Not be configured for database mirroring.

12. Minimize the **wizard**. (DO NOT CLOSE)
13. In Object Explorer, right Click on **ContosoSalesDB**
14. Select new Query
15. When the query window opens type the following syntax

```
USE MASTER
ALTER DATABASE ContosoSalesDB SET RECOVERY FULL WITH NO_WAIT
GO
BACKUP DATABASE ContosoSalesDB to DISK = '\SQLONE\Backups\ContosoSalesDB.BAK'
```

16. After the backup completed, go back to the AlwaysOn Wizard and click Refresh.
17. Notice that the ContosoSalesDB now meets the prerequisites, select the Database and click Next.
18. On the **Specify Replica** page, Click **Add Replica** to add SQLTWO and SQLTHREE.
19. Configure **Specify Replica** page as:

![Specify Replica page](image)

20. You also enabled each of the replicas with different Readable Secondary options. (SQLTWO non-readable, SQLTHREE - readable)
21. Keep the **SQLTWO** configuration to **Readable Secondary (NO)**, you will modify this in the next lab exercise.
22. Click on Listener

23. Select Create an availability Group listener

24. Specify the following details for the listener:
   
   Listener DNS name: SQLPRODUCTION
   
   Subnet: 192.168.1.0.24
   
   IP address: 192.168.1.220
   
   Port: 1433

   After configuration the listener tab should look like:

25. Click Next.

26. On the Select Initial data Synchronization Page, select Full and provide \SQLONE\Backups as the shared network location accessible by all replicas.

27. Click Next.

28. Review the Validation Page.

29. Click Next.

30. Click Finish.


32. At the Results Page, validate that the wizard completed successfully, and click Close.
33. You have now successfully configured an **AlwaysOn Availability Group**.

34. Refresh the Databases tab in Object Explorer, notice that the ContosoSalesDB is now listed as Synchronized.

**Review**

In this exercise you learned how to create an availability group using the wizard. In the following exercises you will learn how to create a Listener and how to configure a read-write application to reconnect to the new primary on failover of the availability group.
## Exercise 2: Manual Failover of the Availability Group

### Scenario
In this exercise you will learn how to manually failover the availability group using the failover wizard, later in this lab you will also initiate failover using T-SQL syntax.

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Launch the Availability Group Dashboard</strong></td>
<td>1. Open the AlwaysOn Dashboard by Right-click on the **AlwaysOn High Availability</td>
</tr>
<tr>
<td><strong>Review AlwaysOn Health Status in the dashboard</strong></td>
<td>2. Expand the Dashboard to the <strong>SQLPRODUCTION_AG</strong></td>
</tr>
<tr>
<td></td>
<td>3. As the AlwaysOn dashboard displays, review status, indicating a Healthy Status with SQLONE as the primary instance.</td>
</tr>
<tr>
<td><strong>Perform Manual Failover to SQLTWO using the Wizard</strong></td>
<td>4. In the <strong>AlwaysOn Dashboard</strong>, click <strong>Start Failover Wizard</strong></td>
</tr>
<tr>
<td></td>
<td>5. As the Wizard displays click <strong>Next</strong> on the <strong>Introduction Page</strong></td>
</tr>
<tr>
<td></td>
<td>6. Select <strong>SQLTWO</strong> as the new Primary Replica</td>
</tr>
<tr>
<td></td>
<td>7. <strong>Click Next</strong></td>
</tr>
<tr>
<td></td>
<td>8. In the <strong>Connect to Replica</strong> Window, click <strong>Connect</strong>, connect using Windows Authentication</td>
</tr>
<tr>
<td></td>
<td>9. <strong>Click Next</strong></td>
</tr>
<tr>
<td></td>
<td>10. On the <strong>Summary</strong> page, click <strong>Finish</strong> to Initiate Failover</td>
</tr>
<tr>
<td></td>
<td>• As Failover occurs, the AlwaysOn Dashboard will temporary display an error. This is because the refresh rate of the dashboard is different from the actual failover occurring. Refresh the dashboard manually.</td>
</tr>
<tr>
<td></td>
<td>11. You have now initiated a manual failover to the SQLTWO Replica that is currently the primary instance for the database.</td>
</tr>
<tr>
<td></td>
<td>12. Click <strong>Close</strong> on the Results page.</td>
</tr>
</tbody>
</table>
## Exercise 3: Making an application AlwaysOn Enabled

This Task is executed on the machine named SQLONE
If you need to logon to this server use the following credentials:
Username: CONTOSO\LabUser
Password: pass@word1

| Change the application connection String to connect to the SQLPRODUCTION Virtual Network Name | 1. On the Windows Start Screen click Internet Information Services Manager |
| 2. As Internet Information Services 8 manager displays, click on SQLONE | Sites |
| 3. Select ContosoShopService |
| 4. In the ContosoShopService Home Details page double click on Connection Strings |
| 5. Edit the ProductionContosoSales Connection String to replace SQLONE with SQLPRODUCTION |
| 6. The connection string should look like: |

Server=SQLPRODUCTION;database=ContosoSalesDB;user=contosouser;password=pass@word1

7. Restart the ContosoShopService WebService by selecting Manage Website | Restart in the Actions Pane |

You have now redirected an application from a single point of failover to the AlwaysOn Availability Groups Virtual Network Name or Listener

| Start the SQL Server 2012 Contoso Shop Phone App | 8. On the Taskbar click on Internet Explorer |
| 9. The Contoso WebShop Application will display as the main page. |
| 10. Click Contoso Shop. |
11. Click on **TV and Video | Televisions**.
12. Select any random **Television**
13. Click **Purchase**
14. As the order is processed, a message will display indicating which server the order was processed by. (This server will be the primary replica that was set in the previous exercise and thus indicate that the order is processed by SQLTWO)
15. Click **Okay**
16. Click on the Windows Logo to go back to the main application screen
17. Do not close this window, in the next exercise you will generate an automatic failover of an AlwaysOn Availability group
18.

**Application Failover**
   Since this application uses AlwaysON availability groups and is connected to the Virtual Network name SQLPRODUCTION, when the primary node fails, it will automatically failover to one of the replica servers.
## Exercise 4: Causing an application to failover using automatic failover

This Task is executed on the machine named SQLONE
If you need to logon to this server use the following credentials:
Username: CONTOSO\LabUser
Password: pass@word1

<table>
<thead>
<tr>
<th>ShutDown SQLTWO to simulate and enable automatic failover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Since the node SQLTWO currently is the primary node, when automatic failover occurs, another node (SQLONE), will automatically become the primary node. This is because you enabled automatic failover to occur.</td>
</tr>
</tbody>
</table>

1. In the lab console window, click on **SQLTWO**.

![Lab console window with SQLTWO highlighted](image)

2. Click Stop.
3. When prompted to stop the virtual machine, click OK.
4. Switch back to SQLONE
5. If not already open from the last exercise, on the Taskbar click on Internet Explorer.
6. The Contoso WebShop Application will display as the main page.
7. Click Contoso Shop.
8. Click on TV and Video | Televisions.
10. Click Purchase.
11. As the order is processed, a message will display indicating which server the order was processed by.
12. Since Automatic Failover occurred, the order is now processed by the new primary server, SQLONE.