

Implementing and Managing AlwaysOn Availability Groups

Hands-on Lab

This Page Intentionally Left Blank

Terms of Use

© 2011 Microsoft Corporation. All rights reserved.

By using this Hands-on Lab, you agree to the following terms:

The technology/functionality described in this Hands-on Lab is provided by Microsoft Corporation in a “sandbox” testing environment for purposes of obtaining your feedback and to provide you with a learning experience. You may only use the Hands-on Lab to evaluate such technology features and functionality and provide feedback to Microsoft. You may not use it for any other purpose. You may not modify, copy, distribute, transmit, display, perform, reproduce, publish, license, create derivative works from, transfer, or sell this Hands-on Lab or any portion thereof.

COPYING OR REPRODUCTION OF THE HANDS-ON LAB (OR ANY PORTION OF IT) TO ANY OTHER SERVER OR LOCATION FOR FURTHER REPRODUCTION OR REDISTRIBUTION IS EXPRESSLY PROHIBITED.

THIS HANDS-ONLAB PROVIDES CERTAIN SOFTWARE TECHNOLOGY/PRODUCT FEATURES AND FUNCTIONALITY, INCLUDING POTENTIAL NEW FEATURES AND CONCEPTS, IN A SIMULATED ENVIRONMENT WITHOUT COMPLEX SET-UP OR INSTALLATION FOR THE PURPOSE DESCRIBED ABOVE. THE TECHNOLOGY/CONCEPTS REPRESENTED IN THIS HANDS-ON LAB MAY NOT REPRESENT FULL FEATURE FUNCTIONALITY AND MAY NOT WORK THE WAY A FINAL VERSION MAY WORK. WE ALSO MAY NOT RELEASE A FINAL VERSION OF SUCH FEATURES OR CONCEPTS. YOUR EXPERIENCE WITH USING SUCH FEATURES AND FUNCTIONALITY IN A PHYSICAL ENVIRONMENT MAY ALSO BE DIFFERENT.

FEEDBACK. If you give feedback about the technology features, functionality and/or concepts described in this Hands-on Lab to Microsoft, you give to Microsoft, without charge, the right to use, share and commercialize your feedback in any way and for any purpose. You also give to third parties, without charge, any patent rights needed for their products, technologies and services to use or interface with any specific parts of a Microsoft software or service that includes the feedback. You will not give feedback that is subject to a license that requires Microsoft to license its software or documentation to third parties because we include your feedback in them. These rights survive this agreement.

MICROSOFT CORPORATION HEREBY DISCLAIMS ALL WARRANTIES AND CONDITIONS WITH REGARD TO THE HANDS-ON LAB, INCLUDING ALL WARRANTIES AND CONDITIONS OF MERCHANTABILITY, WHETHER EXPRESS, IMPLIED OR STATUTORY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT. MICROSOFT DOES NOT MAKE ANY ASSURANCES OR REPRESENTATIONS WITH REGARD TO THE ACCURACY OF THE RESULTS, OUTPUT THAT DERIVES FROM USE OF THE VIRTUAL LAB, OR SUITABILITY OF THE INFORMATION CONTAINED IN THE VIRTUAL LAB FOR ANY PURPOSE.

This Page Intentionally Left Blank

Table of Contents

Lab Environment	6
Lab Overview	7
About This Lab	8
Exercise 1: Configuring an AlwaysOn Availability Group.....	9
Exercise 2: Manual Failover of the Availability Group.....	16
Exercise 3: Making an application AlwaysOn Enabled	17
Exercise 4: Causing an application to failover using automatic failover	19

Lab Environment

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

This lab will use out the following network environment:

Computer Name	DomainController
Function	Contoso.com Domain Controller
Operating System	Windows Server® 2012
Computer Name	SQLONE
Operating System	Windows Server 2012
Function	SQL Server Instance
Computer Name	SQLTWO
Operating System	Windows Server 2012
Function	SQL Server Instance
Computer Name	SQLTHREE
Operating System	Windows Server 2012
Function	SQL Server Instance

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.

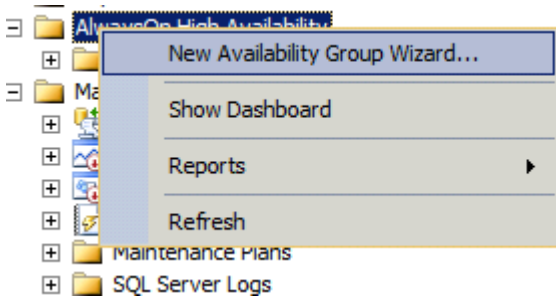
By the end of this exercise, you will learn:

- 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

	<p>PRE-CONFIGURATION</p> <p>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.</p> <p>These steps include:</p> <ul style="list-style-type: none"> - 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.
<p>Validate Failover Cluster Group</p>	<ol style="list-style-type: none"> 1. On the Start Menu, select Failover Cluster Manager or start Failover Cluster Manager from the shortcut on the taskbar. 2. As Failover Cluster Manager displays Validate that SQLCLUSTER.contoso.com indicates Nodes: 3 out of 3 nodes running And Cluster Status is UP. <p>Note: Since all of the nodes were started together at the beginning of the lab, you may see that 1 or more of the nodes have failed. Please wait for the cluster to report that all 3 nodes are running and that the Cluster Status is UP.</p> <ol style="list-style-type: none"> 3. Close Failover Cluster Manager

Task 2: Configuring AlwaysOn Availability Groups

<p>View existing application database configuration using SQL Server Management Studio</p>	<ol style="list-style-type: none"> 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. 6. Expand AlwaysOn High Availability Node. 7. No AlwaysOn Availability Groups currently exist.
<p>Create a new Availability Group using the wizard on SQLONE</p>	<ol style="list-style-type: none"> 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. 

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 Replicas

Specify an instance of SQL Server to host a secondary replica.

Server Instance	Initial Role	Automatic Failover (Up to 2)	Synchronous Commit (Up to 3)	Readable Secondary
SQLONE	Primary	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	No
SQLTWO	Secondary	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	No
SQLTHREE	Secondary	<input type="checkbox"/>	<input type="checkbox"/>	Yes

Summary for the replica hosted by SQLTHREE

Replica mode: Asynchronous commit
This replica will use asynchronous-commit availability mode and support only forced failover (with possible data loss).

Readable secondary: Yes
In the secondary role, this availability replica will allow all connections for read access, including connections running with older clients.

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:

The screenshot shows the 'New Availability Group' wizard with the 'Specify Replicas' step selected. The 'Listener' tab is active, showing options to either not create a listener now or to create one. The 'Create an availability group listener' option is selected. The configuration fields are filled with: Listener DNS Name: SQLPRODUCTION, Port: 1433, Network Mode: Static IP, Subnet: 192.168.1.0/24, and IP Address: 192.168.1.220. Navigation buttons at the bottom include '< Previous', 'Next >', and 'Cancel'.

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**.
31. On the New Availability Summary page, click **Finish**.
32. At the Results Page, validate that the wizard completed successfully, and click **Close**.

- | | |
|--|---|
| | <p>33. You have now successfully configured an AlwaysOn Availability Group.</p> <p>34. Refresh the Databases tab in Object Explorer, notice that the ContosoSalesDB is now listed as Synchronized.</p> |
|--|---|


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

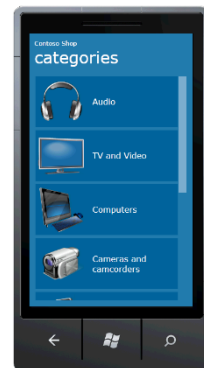
Scenario

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.

Launch the Availability Group Dashboard	1. Open the AlwaysOn Dashboard by Right-click on the AlwaysOn High Availability Show Dashboard
Review AlwaysOn Health Status in the dashboard	2. Expand the Dashboard to the SQLPRODUCTION_AG 3. As the AlwaysOn dashboard displays, review status, indicating a Healthy Status with SQLONE as the primary instance.
Perform Manual Failover to SQLTWO using the Wizard	4. In the AlwaysOn Dashboard , click Start Failover Wizard 5. As the Wizard displays click Next on the Introduction Page 6. Select SQLTWO as the new Primary Replica 7. Click Next 8. In the Connect to Replica Window, click Connect , connect using Windows Authentication 9. Click Next 10. On the Summary page, click Finish to Initiate Failover <div data-bbox="542 1144 1323 1379" style="border: 1px solid #ccc; padding: 10px; margin: 10px 0;">  <ul style="list-style-type: none"> 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. </div> 11. You have now initiated a manual failover to the SQLTWO Replica that is currently the primary instance for the database. 12. Click Close on the Results page.

Exercise 3: Making an application AlwaysOn Enabled

<p>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</p>	
<p>Change the application connection String to connect to the SQLPRODUCTION Virtual Network Name</p>	<ol style="list-style-type: none"> 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: <pre>Server=SQLPRODUCTION;database=ContosoSalesDB;user=contosouser;password=pass@word1</pre> 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
<p>Start the SQL Server 2012 Contoso Shop Phone App</p>	<ol style="list-style-type: none"> 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 theVirtual 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

ShutDown SQLTWO to simulate and enable automatic failover

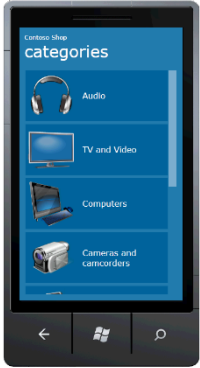
Since the node SQLTWO currently is the primary node, when automatic failover occurs, another node (SQLONE), will automatically become the primary node.

This is because you enabled automatic failover to occur.

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



2. Click Stop.
3. When prompted to stop the virtual machine, click OK.
4. Switch back to SQLONE

<p>Place a new order using the Contoso Windows Phone App</p>	<ol style="list-style-type: none">5. If not already open from the last exercise, On the Taskbar click on Internet Explorer6. The Contoso WebShop Application will display as the main page.7. Click Contoso Shop.  <ol style="list-style-type: none">8. Click on TV and Video Televisions.9. Select any random Television10. Click Purchase11. 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.
--	---