EXPRESSCLUSTER X for Windows

Quick Start Guide for Hyper-V Container

(SQL Server Express)

Version 1
Nov 21, 2017

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Contents

1 About This Guide

1.1 Using This Guide

This guide provides a hands-on “Quick Start” set of instructions to create SQL Server Express container cluster with EXPRESSCLUSTER X for Windows on Hyper-V Container. The guide assumes users have Microsoft Windows system administration knowledge and skills with experience in installation and configuration of Microsoft Windows operating systems, networks, and Hyper-V Container.

1.2 Revision History

Version	Date	Description
1	Nov 21, 2017	Initial Version

1.3 Evaluation Environment

This clustering method has been evaluated with the following OS and software.

- Windows Server 2016 Datacenter (Desktop Experience)
- SQL Server 2016 Express
- EXPRESSCLUSTER X 3.3 for Windows (internal version: 11.35)

1.4 For More Information

The following guides are available for instant support.

- **Getting Started Guide** – This guide explains general cluster concepts and overview of EXPRESSCLUSTER functionality.

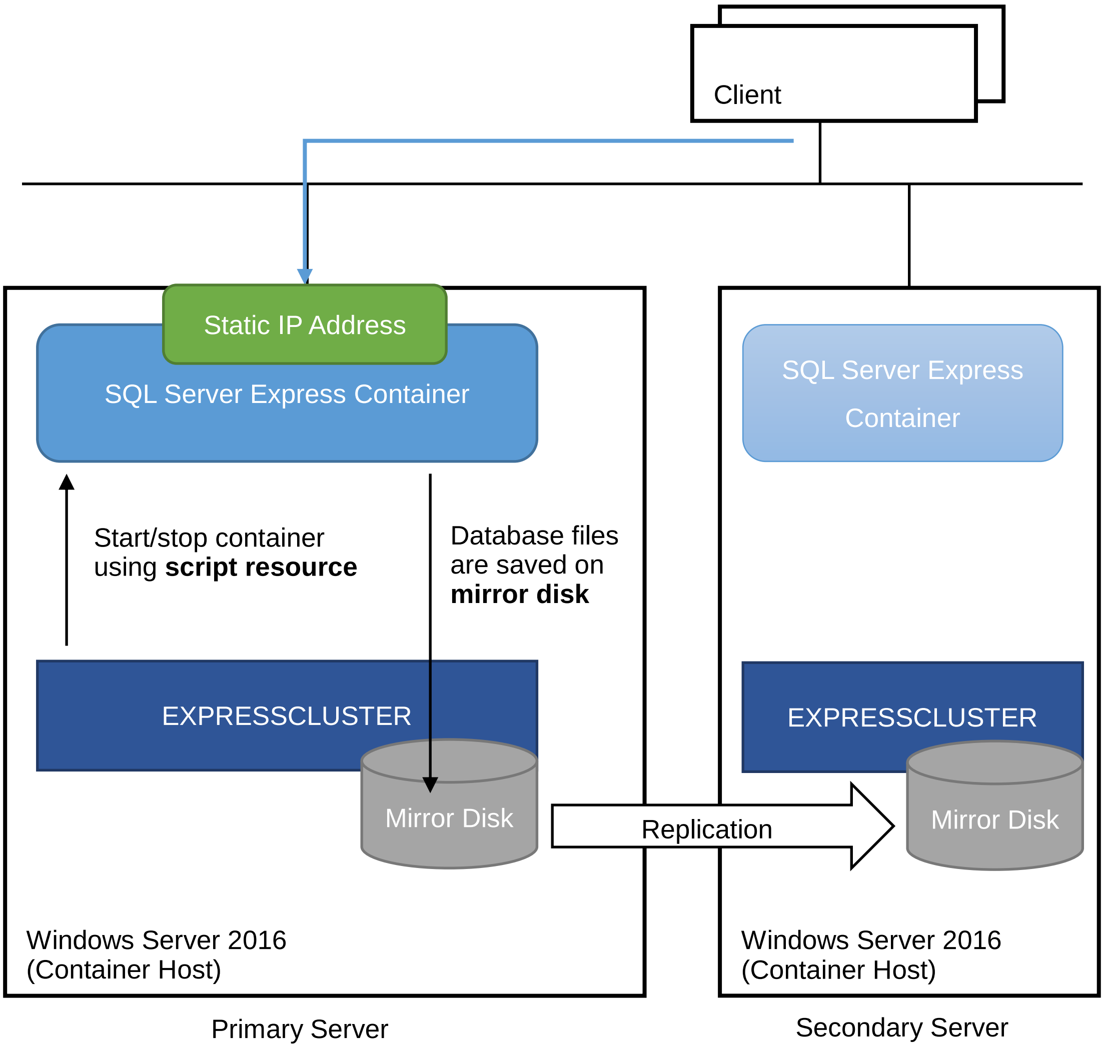
- **Installation and Configuration Guide** – This guide explains EXPRESSCLUSTER X installation and configuration procedures in detail.

- **Reference Guide** – This is a reference of commands that can be put in EXPRESSCLUSTER X scripts and maintenance commands that can be executed from the server command prompt.

The above stated guides can also be found at http://www.nec.com/en/global/prod/expresscluster/en/support/manuals.html .

2 Overview

- The container OS image and the container are saved on the system drive of the primary and the secondary servers.
- EXPRESSCLUSTER is installed on the container host.
- SQL Server Express is installed on the container.
- Database files are saved on a partition controlled by **mirror disk resource**.
- SQL Server Express container is controlled by **script resource**.
- Client machines use the static IP address of SQL Server Express container to access to the database.


Client
Static IP Address
SQL Server Express Container
Start/stop container using **script resource**
Database files are saved on **mirror disk**
EXPRESSCLUSTER
Mirror Disk
Replication
SQL Server Express Container
EXPRESSCLUSTER
Mirror Disk
Windows Server 2016 (Container Host)
Windows Server 2016 (Container Host)
Primary Server
Secondary Server

3 System Requirements and Planning

3.1 System Requirements

- Hyper-V Container
  Refer to Microsoft website.
  https://docs.microsoft.com/en-us/virtualization/windowscontainers/deploy-containers/deploy-containers-on-server

- EXPRESSCLUSTER
  Refer to EXPRESSCLUSTER X ***Getting Started Guide***.

3.2 System Planning

Here are sample parameters for a cluster. In section **10.1**, there is **System Planning Worksheet**. Fill out all tables to create a cluster.

Machine #1: Primary Server (Container Host)
Machine #2: Secondary Server (Container Host)
Machine #3: SQL Server Express Container
Machine #4: Test Client Machine

Table 1: Network Configuration

Machine	Hostname/ Container Name	IP Address	Mirror Disk Connect
#1	server1	192.168.0.11/24	mdc1
		192.168.1.11/24	Do Not Use
#2	server2	192.168.0.12/24	mdc1
		192.168.1.12/24	Do Not Use
#3	mssql	192.168.1.21/24	N/A
#4	client1	192.168.1.99/24	N/A

Table 2: OS and Disk Configuration

Machine	OS	Mirror Disk
#1	Windows Server 2016 Datacenter	**Cluster Partition:** Drive Letter: W Size: 17 MB **Data Partition:** Drive Letter: X Size: 10 GB
#2	Windows Server 2016 Datacenter	
#3	N/A	N/A
#4	Windows Server 2016 Datacenter	N/A

Table 3: Logins and Passwords

Machine	Login	Password
#1	Administrator	passw0rd
#2	Administrator	passw0rd
#3	sa (SQL Server user)	passw0rd
#4	Administrator	passw0rd

4 Hyper-V Container Setup

4.1 Setup Container and Docker (Primary Server)

1. **If the container host is itself a Hyper-V virtual machine, nested virtualization will need to be enabled** before installing the Hyper-V role on the virtual machine. The container host virtual machine must be turned off when running the following command.

   ```
   PS> Set-VMProcessor -VMName <virtual machine name> -
   ExposeVirtualizationExtensions $true

   PS> Set-VMProcessor -VMName <virtual machine name>|FL
    :
   ExposeVirtualizationExtensions            : True
    :
   ```

2. Install Windows updates to ensure that your Windows Server system is up-to-date.
3. If a proxy server is used to access to the internet, it is necessary to set **HTTP_PROXY** as environment variables.

   ```
   PS> [Environment]::SetEnvironmentVariable("HTTP_PROXY",
   "http://yourproxyserver:port",
   [EnvironmentVariableTarget]::Machine)
   ```

4. Install the OneGet PowerShell module.

   ```
   PS> Install-Module -Name DockerMsftProvider -Repository
   PSGallery -Force
   ```

5. Install the latest version of Docker.

   ```
   PS> Install-Package -Name docker -ProviderName
   DockerMsftProvider
   ```

6. Install Hyper-V role.

   ```
   PS> Install-WindowsFeature hyper-v
   ```

7. Restart the primary server.

   ```
   PS> Restart-Computer
   ```

8. Create a transparent network.

```
C:\> docker network create -d transparent --
subnet=192.168.1.0/24 -o
com.docker.network.windowsshim.interface="Ethernet" trans1
```

Note:
If the primary and/or secondary servers are virtual machines running on Hyper-V, run the following command **on Hyper-V host** to enable MAC address spoofing. Replace **ContainerHostVM** below with the virtual machine name.

```
PS> Get-VMNetworkAdapter -VMName ContainerHostVM | Set-
VMNetworkAdapter -MacAddressSpoofing On
```

9. When a transparent network is created, the network configuration will change and the assigned IP address will be removed. Reassign the missing static IP address to the proper network adapter.
10. Download the latest Windows Server Core container image.

```
C:\> docker pull microsoft/mssql-server-windows-express
```

4.2 Setup Container and Docker (Secondary Server)

Follow the steps in section **4.1** on the secondary server.

5 EXPRESSCLUSTER X Installation

5.1 Install EXPRESSCLUSTER X (Primary Server)

1. Insert the EXPRESSCLUSTER X CD-ROM into a CD-ROM drive on the primary server (container host).
2. In the pop-up window, click **NEC EXPRESSCLUSTER for Windows**.
3. Click on **NEC EXPRESSCLUSTER X 3.x for Windows**.
4. In the **Welcome** window, click **Next**.
5. In the **Choose Destination Location** window, click **Next**.
6. In the next window, click **Install**.
7. In the **Port Number** window, if necessary, modify the default port numbers. Click **Next**.
8. In the **Filter Settings of Shared Disk** window, click **Next**.
9. Click **Yes** in the **Confirmation** window to skip shared disk filtering.
10. In the **License Manager** window, click **Register**.
11. In the **License Registration** window, click **Register with License Information**.
12. In the **Product Selection** window, select the **OS** and **Product/Trial** types. For **Product Name**, click **EXPRESSCLUSTER X 3.x for Windows**. Click **Next**.
13. In the **License Unit Selection** window, depending on the type of license, enter the number of **CPU** or **Node Units**. Click **Next**.
14. In the **License Key Entry** window, enter the **Serial No.** and **License Key**. Click **Next**.
15. In the **License Registration Confirmation** window, confirm the information entered is correct. Click **Next**.
16. Click **OK**. If the license registration fails, start again from step 10.
17. Repeat steps 10 **-** 16 again for the **EXPRESSCLUSTER X Replicator 3.x for Windows** product license. Select **EXPRESSCLUSTER X Replicator 3.x for Windows** as the **Product Name** in step 12.
18. If a **Database Agent** license was purchased for monitoring SQL Server Express inside the container, install it using the above instructions.
19. When the licenses have been successfully registered, click **Finish**.
20. On the **InstallShield Wizard Complete** window, click the **No, I will restart my computer later** option button, and then click **Finish**.
21. In the next window, click **Exit**. Click **Exit**. (Two times total).
22. Restart the primary server.

5.2 Install EXPRESSCLUSTER X (Secondary Server)

Perform all of the steps in section **5.1** on the secondary server.

5.3 Confirm Connectivity Between Servers

Ping the servers in the cluster to confirm that there are no issues in connectivity. Also be sure that all ports used by EXPRESSCLUSTER are able to communicate through the Windows Firewall.

6 Base Cluster Setup

6.1 Start WebManager

Confirm that Java Runtime Environment (JRE) is installed on a machine to be used for cluster management. See the installation requirements section of the EXPRESSCLUSTER X ***Getting Started Guide*** for a compatible version. For this guide, use the primary server for cluster management. Install JRE if necessary. Then start by accessing port 29003 of the primary server from the web browser of the cluster management machine, using the primary server’s IP address (e.g. http://192.168.1.11:29003). When the security warning window displays, select the **Always trust content from this publisher** check box. Click **Run**.

6.2 Create Cluster

1. When WebManager is opened for the first time, there is a pop-up window with two options. Click **Start cluster generation wizard**.
2. In the confirmation window, click **Start Cluster Generation Wizard for standard edition**.
3. In the new window, type a **Cluster Name** (e.g. cluster-mssql), and click **Next**.
4. In the next window, to add another server to the cluster, click **Add**.
5. Type the **Server Name** or the **IP Address** of the secondary server, and then click **OK**.
6. Both servers are now on the list. If the primary server is not in the top (Master Server) position, then move it up. Click **Next**.

6.3 Setup Network Configuration

1. EXPRESSCLUSTER X automatically detects the IP addresses of the servers. The primary network is for heartbeat and data mirroring; set the **MDC** on this row as **mdc1**. The secondary network is for heartbeat only. Click **Next**.
2. In the **NP Resolution** window, click **Next**.

6.4 Create Failover Group

1. To add a group, in the **Cluster Generation Wizard**, in the **Group** section, click **Add**.
2. In the next window, select **failover** for group **Type**. Name the group (e.g. failover-mssql), click **Next**, and then click **Next**. (Two times total).
3. Select the default options for the **Group Attribute Settings**, and then click **Next**.

6.5 Create Mirror Disk Resource

1. In the **Group Resource** section of the **Cluster Generation Wizard**, to add a resource, click **Add**.
2. Click **Get License Info** to retrieve the active license.
3. To add a mirror disk resource, from the **Type** drop down menu, select **mirror disk resource**, and then click **Next**.
4. Confirm the **Follow the default dependency** box is selected, and then click **Next**.
5. Confirm the default options are correct, and then click **Next**.
6. Select the primary server name and click **Add**.
7. Click **Connect** to populate the server partitions.
8. Select the drive letter of the data partition for mirroring (e.g. X:) in the **Data Partition** box, and the drive letter of the cluster partition (e.g. W:) in the **Cluster Partition** box. Click **OK**.

   Warning:

   Specify different partitions for data partition and cluster partition. If the same partition is specified, data on the mirror disk may be corrupted.
9. Repeat steps 6 – 8 for the secondary server.
10. Click **Finish**.
11. Click **Finish**, and then click **Next**.
12. Click **Finish**.
13. Click **Yes** to enable recovery action when an error occurs in a monitor resource.

6.6 Upload the Cluster Configuration and Start Cluster

1. In WebManager window, click the **File** menu and then **Apply the Configuration File**. Click **OK**. Click **OK**. (Two times total).
2. After the upload is complete, change from **Config Mode** to **Operation Mode**.

3. Restart **Cluster Manager**. Click the **Service** menu, and then click **Restart Manager**. Click **OK**.
4. Click the **Service** menu, and then click **Start Cluster**. Click **OK**.
5. When the cluster tree displays after a few seconds, in the left pane of WebManager window, expand the **%failover group%** section, right click **%mirror disk%**, and click **Details** to monitor the disk synchronization progress. Mirror disk copy starts automatically, replicating data from the primary server to the secondary server.

   Note:

   This step may take a while depending on the size of the data on the mirror disk partition.
6. After the copy completes, in the **Mirror Disk Helper** window, click **Close**.
7. In the Cluster Manager window, all icons in the tree view should now be green.
8. Confirm that the cluster is functioning.
   - Move the **%failover group%** to the secondary server.
   - Move the **%failover group%** back to the primary server.

   Note:

   These tests do not affect server functionality. They confirm that the mirror disks on each server in the cluster are functioning properly. The mirror disk is now controlled by EXPRESSCLUSTER X and is only accessible from the active server.

7 SQL Server Express Setup

7.1 Configure SQL Server Express (Primary Server)

1. Login to the primary server with an Administrator account.
2. Confirm that the failover group is running on the primary server.
3. Open the TCP and UDP firewall port for SQL Server Express if the firewall is on.

```
C:\> netsh advfirewall firewall add rule name="sqlexp-tcp"
dir=in protocol=TCP localport=1433 action=allow
```

```
C:\> netsh advfirewall firewall add rule name="sqlexp-udp"
dir=in protocol=UDP localport=1434 action=allow
```

4. Create a directory on the mirror disk (e.g. X:\mssql).

```
C:\> mkdir X:\mssql
```

5. Create a container (e.g. mssql).

```
C:\> docker run -d -it --name mssql -v X:\mssql:C:\mydata --
network=trans1 --ip=192.168.1.21 -e sa_password=passw0rd -e
ACCEPT_EULA=Y --isolation=hyperv microsoft/mssql-server-
windows-express:latest
```

6. Stop the SQL Server Express service on the container.

```
C:\> docker exec mssql net stop MSSQL$SQLEXPRESS
```

7. Copy master mdf and log files from default path to C:\mydata (mapped to X:\mssql on the mirror disk).

```
C:\> docker exec -it mssql cmd /c copy "C:\Program
Files\Microsoft SQL
Server\MSSQL13.SQLEXPRESS\MSSQL\DATA\master.mdf" C:\mydata\

C:\> docker exec -it mssql cmd /c copy "C:\Program
Files\Microsoft SQL
Server\MSSQL13.SQLEXPRESS\MSSQL\DATA\mastlog.ldf" C:\mydata\
```

8. Change startup parameters of SQL Server Express.

```
C:\> docker exec -it mssql cmd /c reg add
"HKLM\SOFTWARE\Microsoft\Microsoft SQL
Server\MSSQL13.SQLEXPRESS\MSSQLServer\Parameters" /v SQLArg0
/t REG_SZ /d "-dC:\mydata\master.mdf"

C:\> docker exec -it mssql cmd /c reg add
"HKLM\SOFTWARE\Microsoft\Microsoft SQL
Server\MSSQL13.SQLEXPRESS\MSSQLServer\Parameters" /v SQLArg2
/t REG_SZ /d "-lC:\mydata\mastlog.ldf"
```

9. Confirm that the startup parameters have changed.

```
C:\> docker exec mssql reg query
"HKLM\SOFTWARE\Microsoft\Microsoft SQL
Server\MSSQL13.SQLEXPRESS\MSSQLServer\Parameters"

HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Microsoft SQL
Server\MSSQL13.SQLEXPRESS\MSSQLServer\Parameters
  SQLArg0  REG_SZ  -dC:\mydata\master.mdf
  SQLArg1  REG_SZ  -eC:\Program Files\Microsoft SQL
Server\MSSQL13.SQLEXPRESS\MSSQL\Log\ERRORLOGS
  SQLArg2  REG_SZ  -lC:\mydata\mastlog.ldf
```

10. Start the SQL Server Express service on the container.

```
C:\> docker exec mssql net start MSSQL$SQLEXPRESS
```

11. Check if SQL Server Express instance is running.

```
C:\> docker exec mssql sc query MSSQL$SQLEXPRESS
SERVICE_NAME: MSSQL$SQLEXPRESS
        TYPE               : 10  WIN32_OWN_PROCESS
        STATE              : 4  RUNNING
        :
```

12. Connect to SQL Server Express. Enter the password when prompted.

```
C:\> docker exec -it mssql sqlcmd –S . -U sa
Password:
1>
```

13. Create a database for monitoring (e.g. testdb).

```
1> create database testdb
2> go
```

14. Check if the database for monitoring is existing.

```
1> select name from sys.databases
2> go
name
------------------------------------------------------------
master
 :
testdb
```

15. Quit the connection.

```
1> exit
```

16. Stop the SQL Server Express container.

```
C:\> docker stop mssql
```

17. Move the failover group from the primary server to the secondary server.

7.2 Configure SQL Server Express (Secondary Server)

1. Login to the secondary server with an Administrator account.
2. Confirm that the failover group is running on the secondary server.
3. Open the TCP and UDP firewall port for SQL Server Express if the firewall is on.

```
C:\> netsh advfirewall firewall add rule name="sqlexp-tcp"
dir=in protocol=TCP localport=1433 action=allow
```

```
C:\> netsh advfirewall firewall add rule name="sqlexp-udp"
dir=in protocol=UDP localport=1434 action=allow
```

4. Create a container (e.g. mssql).

```
C:\> docker run -d -it --name mssql -v X:\mssql:C:\mydata --
network=trans1 --ip=192.168.1.21 -e sa_password=passw0rd -e
ACCEPT_EULA=Y --isolation=hyperv microsoft/mssql-server-
windows-express:latest
```

5. Stop the SQL Server Express service on the container.

```
C:\> docker exec mssql net stop MSSQL$SQLEXPRESS
```

6. Change startup parameters of SQL Server Express.

```
C:\> docker exec -it mssql cmd /c reg add
"HKLM\SOFTWARE\Microsoft\Microsoft SQL
Server\MSSQL13.SQLEXPRESS\MSSQLServer\Parameters" /v SQLArg0
/t REG_SZ /d "-dC:\mydata\master.mdf"

C:\> docker exec -it mssql cmd /c reg add
"HKLM\SOFTWARE\Microsoft\Microsoft SQL
Server\MSSQL13.SQLEXPRESS\MSSQLServer\Parameters" /v SQLArg2
/t REG_SZ /d "-lC:\mydata\mastlog.ldf"
```

7. Confirm that the startup parameters have changed.

```
C:\> docker exec mssql reg query
"HKLM\SOFTWARE\Microsoft\Microsoft SQL
Server\MSSQL13.SQLEXPRESS\MSSQLServer\Parameters"

HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Microsoft SQL
Server\MSSQL13.SQLEXPRESS\MSSQLServer\Parameters
  SQLArg0  REG_SZ  -dC:\mydata\master.mdf
  SQLArg1  REG_SZ  -eC:\Program Files\Microsoft SQL
Server\MSSQL13.SQLEXPRESS\MSSQL\Log\ERRORLOGS
  SQLArg2  REG_SZ  -lC:\mydata\mastlog.ldf
```

8. Start the SQL Server Express service on the container.

```
C:\> docker exec mssql net start MSSQL$SQLEXPRESS
```

9. Check if SQL Server Express instance is running.

```
C:\> docker exec mssql sc query MSSQL$SQLEXPRESS
SERVICE_NAME: MSSQL$SQLEXPRESS
        TYPE               : 10  WIN32_OWN_PROCESS
        STATE              : 4  RUNNING
        :
```

10. Connect to SQL Server Express. Enter the password when prompted.

```
C:\> docker exec -it mssql sqlcmd –S . -U sa
Password:
1>
```

11. Check if the database for monitoring is existing.

```
1> select name from sys.databases
2> go
name
------------------------------------------------------------
master
 :
testdb
```

12. Quit the connection.

```
1> exit
```

7.3 Confirm Connectivity from the Client

1. Download **Microsoft ODBC Driver 13 for SQL Server** and **Microsoft Command Line Utilities 13 for SQL Server** from Microsoft SQL Server 2016 Feature Pack.
2. Run **msodbcsql.msi** to install Microsoft ODBC Driver 13 for SQL Server on the client machine.
3. Run **MsSqlCmdLnUtils.msi** to install Microsoft Command Line Utilities 13 for SQL Server on the client machine.
4. Connect to SQL Server Express. Enter the password when prompted.

```
C:\> "C:\Program Files\Microsoft SQL Server\Client
SDK\ODBC\130\Tools\Binn\SQLCMD.EXE" -S 192.168.1.21 -U sa
Password:
1>
```

5. Check if the database for monitoring is existing.

```
1> select name from sys.databases
2> go
name
------------------------------------------------------------
master
 :
testdb
```

6. Quit the connection.

```
1> exit
```

7. Move the failover group back from the secondary server to the primary server.
8. Follow the steps 4 - 6 to check the connectivity.
9. Stop the container on the primary server before next section.

```
C:\> docker stop mssql
```

8 SQL Server Express Cluster Setup

8.1 Add the Script Resource to Control Container

1. Download the script files for SQL Server Express container clustering from the NEC web site:
   http://www.nec.com/en/global/prod/expresscluster/en/support/Setup.html
2. Start WebManager and change to **Config Mode**.
3. Right-click on the **%failover group%**, and then click **Add Resource**.
4. From the **Type** drop down menu, select **script resource**. As the resource **Name**, enter **script-mssql**. Click **Next**.
5. Confirm the default dependency (**Follow the default dependency** box is checked), and then click **Next.**
6. Confirm the default options are correct, and then click **Next.**
7. Select **start.bat** in the left pane and click the **Replace** button.
8. Navigate to the scripts that were downloaded, open the **script-mssql** folder, select the new **start.bat** file, and click **Open**.
9. Click **Yes** to replace.
10. Select **start.bat** and click **Edit**.
11. Locate the line which starts **docker start <container name>**.
12. Edit the container name and save changes if necessary. Close the file.
13. Select **stop.bat** in the left pane and click the **Replace** button.
14. Navigate to the scripts that were downloaded, open the **script-mssql** folder, select the new **stop.bat** file, and click **Open**.
15. Click **Yes** to replace.
16. Select **stop.bat** and click **Edit**.
17. Locate the line which starts **docker stop <container name>**.
18. Edit the container name and save changes if necessary. Close the file.
19. Click the **Tuning** button.
20. Enter 0 for **Normal Return Value** for the **start** and **stop** sections. Click **OK**.
21. Click **Finish**.

8.2 Add SQL Server Monitor Resource

1. Right-click on the **Monitors**, and then click **Add Monitor Resource**.
2. Click **Get License Info** to retrieve the active license.
3. From the **Type** drop down menu, select **SQL Server monitor**. Click

Next.

4. In the **Monitor Resource Definition** window, click the **Browse** button to select the **Target Resource**.
5. Select the recently configured **script** resource (e.g. **script-mssql**) and click **OK**.
6. Change the **Wait Time to Start Monitoring** number from 0 to 5. This will give the container more time to mount before monitoring begins. This may need to be adjusted later if necessary. Click **Next**.
7. In the next windows, choose **Level 2 (monitoring by update/select)** for **Monitor Level**.
8. Enter the name of an existing database which can be used for monitoring in the **Database Name** field (e.g. **testdb**).
9. The **Instance Name** is the **<IP address of container (e.g. 192.168.2.21)>\SQLEXPRESS**.
10. Enter **sa** for the **User Name**.
11. Click **Change** and enter the password.
12. For the **ODBC Driver Name**, enter **SQL Server**. Click **Next**.

    Note:

    The other ODBC Driver is also available. Download, install and setup ODBC Driver and enter the name for the **ODBC Driver Name** (e.g. ODBC Driver 13.1 for SQL Server).
13. Click the **Browse** button to select the **script** resource (e.g. **script-mssql**) for **Recovery Target** and click **OK**.
14. Click **Finish**.

8.3 Upload the Cluster Configuration

1. Click the **File** menu, and then **Apply the Configuration File**. Click **OK** on the confirmation message popup. If the changes are applied successfully, click **OK**.
2. After the upload is complete, change to the **Operation Mode**.
3. Right-click on the **%failover_group%** and select **Start**. Select the primary server to start the group on and click **OK**.
4. Confirm that all icons of group resources and monitor resources are green.
5. Confirm that SQL Server Express container is running.

```
C:\> docker ps
CONTAINER ID ... STATUS       ... NAMES
e62406a3ba15 ... Up 8 minutes ... mssql
```

6. Confirm that SQL Server Express is running on the container.

```
C:\> docker exec mssql sc query MSSQL$SQLEXPRESS
SERVICE_NAME: MSSQL$SQLEXPRESS
        TYPE               : 10  WIN32_OWN_PROCESS
        STATE              : 4  RUNNING
        :
```

9 Verify Functionality

9.1 Move the Failover Group

1. Using WebManager, move the **%failover_group%** from the primary server to the secondary server and confirm the following.
   - The client can access to the database.
   - The container on the primary server should be in a stopped state.
   - The container on the secondary server should be started.
2. Using WebManager, move the **%failover_group%** back to the primary server and confirm the following.
   - The client can access to the database.
   - The container on the primary server should be started.
   - The container on the secondary server should be in a stopped state.

9.2 Failover on Server Shutdown

1. Restart the primary server and confirm the following.
   - The client can access to the database.
   - The container on the secondary server should be started.
2. After the primary server comes back to the cluster, restart the secondary server and confirm the following.
   - The client can access to the database.
   - The container on the primary server should be started.

10 Appendix

10.1 System Planning Worksheet

Machine #1: Primary Server (Container Host)
Machine #2: Secondary Server (Container Host)
Machine #3: SQL Server Epxress Container
Machine #4: Test Client Machine

Table 1: Network Configuration

Machine	Hostname/ Container Name	IP Address	Mirror Disk Connect
#1			
#2			
#3			N/A
#4			N/A

Table 2: OS and Disk Configuration

Machine	OS	Mirror Disk
#1		**Cluster Partition:** Drive Letter: Size: **Data Partition:** Drive Letter: Size:
#2		
#3	N/A	N/A
#4		N/A

Table 3: Logins and Passwords

Machine	Login	Password
#1		
#2		
#3		
#4		