



**EXPRESSCLUSTER X for Windows**

**Quick Start Guide for Windows Server Container**

**(MySQL)**

**Version 3**  
**May 10, 2017**



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# 1 About This Guide

## 1.1 Using This Guide

This guide provides a hands-on “Quick Start” set of instructions to create MySQL container cluster with EXPRESSCLUSTER X on Windows Server 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 Windows Server Container.

## 1.2 Revision History

Version	Date	Description
1	Feb 15, 2017	Initial version
2	Mar 23, 2017	Added sample command to open TCP firewall port for MySQL. Added warning for MySQL license to use ODBC monitor resource. Added description to setup environment variable "HTTP_PROXY".
3	May 10, 2017	Changed command line sample for “docker network” command to create a transparent network. Replace yen symbol with backslash.

## 1.3 Evaluation Environment

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

- Windows Server 2016 Datacenter (Desktop Experience)
- MySQL 5.7.14
- MySQL Connector/ODBC 5.3.6
- EXPRESSCLUSTER X 3.3 for Windows (internal version: 11.33)

## 1.4 For More Information

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We have the following guides 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.

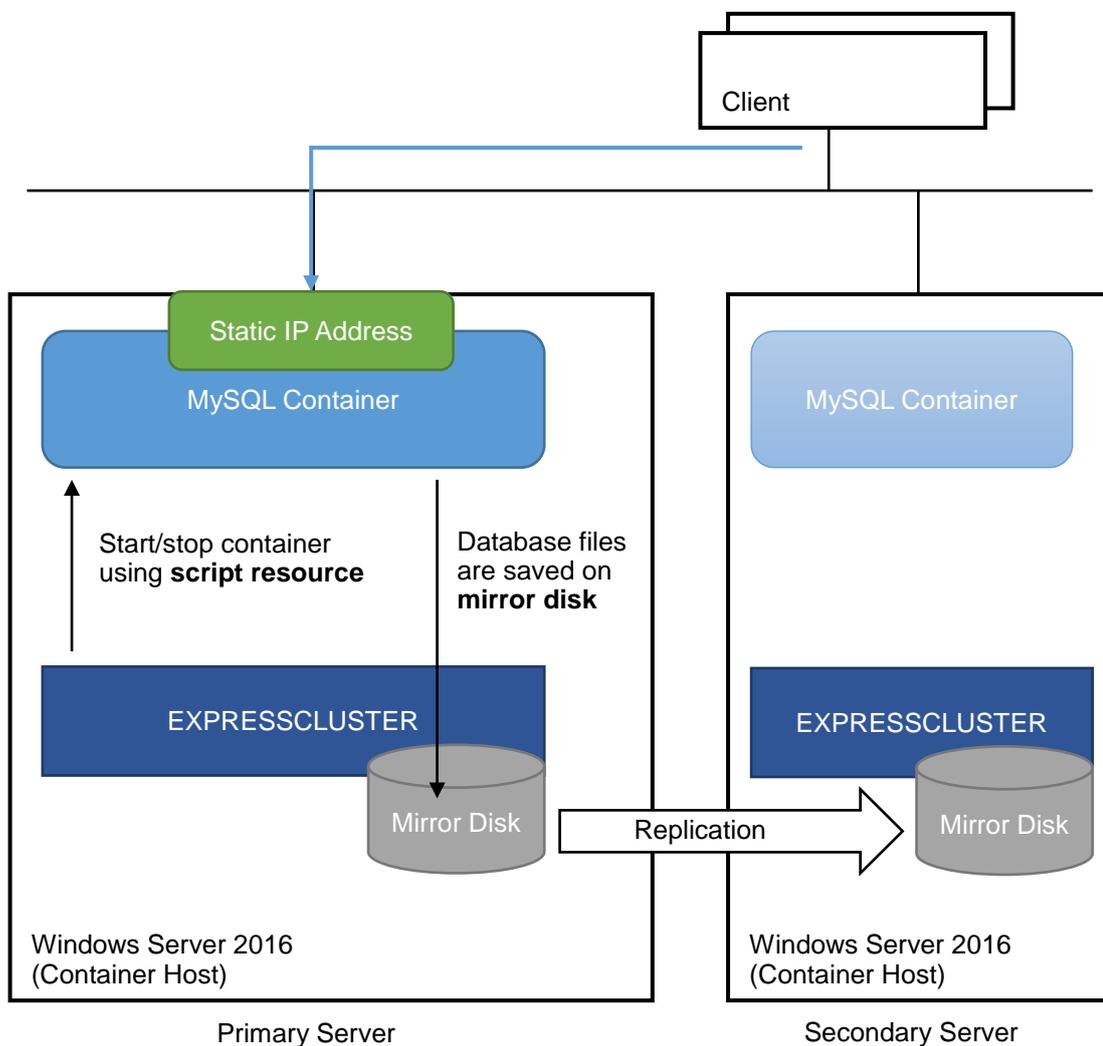
The above stated guides can also be found at

<http://www.nec.com/en/global/prod/expresscluster/en/support/manuals.html>

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## 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.
- MySQL is installed on the container.
- Database files are saved on a partition controlled by **mirror disk resource**.
- MySQL container is controlled by **script resource**.
- Client machines use the static IP address of MySQL container to access to the database.



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## 3 System Requirements and Planning

### 3.1 System Requirements

- Windows Server Container  
Refer to Microsoft website.  
<https://docs.microsoft.com/en-us/virtualization/windowscontainers/quick-start/quick-start-windows-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: MySQL 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	mysql	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	<b>Cluster Partition:</b> Drive Letter: W Size: 17 MB
#2	Windows Server 2016 Datacenter	<b>Data Partition:</b> Drive Letter: X Size: 10 GB
#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	root (MySQL user)	passw0rd
#4	Administrator	passw0rd

---

## 4 Windows Server Container Setup

### 4.1 Setup Container and Docker (Primary Server)

1. Install Windows updates to ensure that your Windows Server system is up-to-date.
2. 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)
```

3. Install the OneGet PowerShell module.

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

4. Install the latest version of Docker.

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

5. Restart the primary server.

```
PS> Restart-Computer
```

6. 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
```

7. 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.

8. Download the latest Windows Server Core container image.

```
C:\> docker pull microsoft/windowsservercore
```

## 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 MySQL 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 server.

---

## **5.2 Install EXPRESSCLUSTER X (Secondary Server)**

Follow 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-mysql), 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-mysql), 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 MySQL and Connector/ODBC Setup

### 7.1 Install MySQL (Primary Server Container)

1. Login to the primary server with an Administrator account.
2. Download the latest MySQL zip file (e.g. mysql-5.7.14-winx64.zip) from MySQL website.
3. Confirm that the failover group is running on the primary server.
4. Open TCP firewall port for MySQL if the firewall is on.

```
C:\> netsh advfirewall firewall add rule name="mysql-tcp"  
dir=in protocol=TCP localport=3306 action=allow
```

5. Create a directory on the mirror disk (e.g. X:\mysql\data).

```
C:\> mkdir X:\mysql\data
```

6. Save the MySQL zip file downloaded earlier to X:\mysql.
7. Create a file called my.ini in X:\mysql with the following contents:

```
[mysqld]  
basedir=C:\\mysql  
datadir=C:\\mydata\\data
```

8. Create a container (e.g. mysql).

```
C:\> docker run -d -it --name mysql -v X:\mysql:C:\mydata --  
network=trans1 --ip 192.168.1.21 microsoft/windowsservercore  
cmd
```

9. Login to the container with the following command.

```
C:\> docker attach mysql
```

10. Press the return key to gain access to the container in the command window.
11. Copy the MySQL zip file to the root directory of the container.

```
C:\> copy C:\mydata\mysql-5.7.14-winx64.zip .
```

12. Start PowerShell on the container.

```
C:\> PowerShell
```

13. Extract the contents of the MySQL zip file.

```
PS> Expand-Archive mysql-5.7.14-winx64.zip
```

- 
14. Create a directory for MySQL.

```
PS> mkdir mysql
```

15. Copy all of the MySQL directories and files to the MySQL directory.

```
PS> robocopy C:\mysql-5.7.14-winx64\mysql-5.7.14-winx64  
C:\mysql /MIR
```

16. Initialize MySQL data directory.

```
PS> .\mysql\bin\mysqld.exe --defaults-  
file=C:\mydata\my.ini --initialize
```

17. Install MySQL as a service.

```
PS> .\mysql\bin\mysqld.exe --install mysql --defaults-  
file=C:\mydata\my.ini
```

18. Check if MySQL is stopped.

```
PS> Get-Service mysql
```

Status	Name	DisplayName
-----	----	-----
Stopped	mysql	mysql

19. Start MySQL service.

```
PS> Start-Service mysql
```

20. Locate the temporary password for the root user.

```
PS> cat C:\mydata\data\%env:COMPUTERNAME%.err  
:  
... [Note] A temporary password is generated for  
root@localhost: Qs#&M?tbr1YV
```

21. Connect to MySQL. Enter the password when prompted.

```
PS> .\mysql\bin\mysql.exe -u root -p  
Enter password:
```

22. Change the root password.

```
mysql> ALTER USER 'root'@'localhost' IDENTIFIED BY  
'password';
```

- 
23. Create a database for monitoring (e.g. testdb).

```
mysql> CREATE DATABASE testdb;
```

24. Allow any remote clients to connect to the database. Replace 'your password' with the one just changed.

```
mysql> GRANT ALL PRIVILEGES ON testdb.* TO root@%"  
IDENTIFIED BY 'your password' WITH GRANT OPTION;
```

25. Quit the connection.

```
mysql> exit  
Bye
```

26. Press Ctrl + P and Ctrl + Q to logout from the container.

## 7.2 Confirm Connectivity to Primary Server

1. Login to the client machine.
2. Save the MySQL zip file on the client machine to the root directory.
3. Extract the contents of the MySQL zip file.

```
PS> Expand-Archive mysql-5.7.14-winx64.zip
```

4. Create a directory for MySQL.

```
PS> mkdir mysql
```

5. Copy all of MySQL directories and files to the MySQL directory.

```
PS> robocopy C:\mysql-5.7.14-winx64\mysql-5.7.14-winx64  
C:\mysql /MIR
```

6. Connect to MySQL. Enter the password when prompted.

```
PS> .\mysql\bin\mysql.exe -h 192.168.1.21 -u root -p  
Enter password:
```

7. Check if the database (e.g. testdb) is existing.

---

```
mysql> SHOW DATABASES;
+-----+
| Database          |
+-----+
| information_schema |
| mysql              |
| performance_schema |
| sys                |
| testdb             |
+-----+
5 rows in set (0.02 sec)
```

8. Quit the connection.

```
mysql> exit
Bye
```

9. Stop the container on the primary server.

```
C:\> docker stop mysql
```

### 7.3 Install MySQL (Secondary Server Container)

1. Move the failover group to the secondary server with WebManager.
2. Login to the secondary server with an Administrator account.
3. Open TCP firewall port for MySQL if the firewall is on.

```
C:\> netsh advfirewall firewall add rule name="mysql-tcp"
dir=in protocol=TCP localport=3306 action=allow
```

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

```
C:\> docker run -d -it --name mysql -v X:\mysql:C:\mydata --
network=trans1 --ip 192.168.1.21 microsoft/windowsservercore
cmd
```

5. Login to the container with the following command.

```
C:\> docker attach mysql
```

6. Press the return key to gain access to the container in the command window.

- 
- Copy the MySQL zip file to the root directory of the container.

```
C:\> copy C:\mydata\mysql-5.7.14-winx64.zip
```

- Start PowerShell on the container.

```
C:\> PowerShell
```

- Extract the contents of the MySQL zip file.

```
PS> Expand-Archive mysql-5.7.14-winx64.zip
```

- Create a directory for MySQL.

```
PS> mkdir mysql
```

- Copy all of MySQL directories and files to the MySQL directory.

```
PS> robocopy C:\mysql-5.7.14-winx64\mysql-5.7.14-winx64  
C:\mysql /MIR
```

- Install MySQL as a service.

```
PS> .\mysql\bin\mysqld.exe --install mysql --defaults-  
file=C:\mydata\my.ini
```

- Check if MySQL is stopped.

```
PS> Get-Service mysql
```

Status	Name	DisplayName
Stopped	mysql	mysql

- Start MySQL service.

```
PS> Start-Service mysql
```

- Connect to MySQL. Enter the password when prompted.

```
PS> .\mysql\bin\mysql.exe -u root -p  
Enter password:
```

- Check if the database (e.g. testdb) is existing.

---

```
mysql> SHOW DATABASES;
+-----+
| Database          |
+-----+
| information_schema |
| mysql              |
| performance_schema |
| sys                |
| testdb             |
+-----+
5 rows in set (0.02 sec)
```

17. Quit the connection.

```
mysql> exit
Bye
```

18. Press Ctrl + P and Ctrl + Q to logout from the container.

## 7.4 Confirm Connectivity to Secondary Server

1. Login to the client machine.
2. Connect to MySQL. Enter the password when prompted.

```
PS> .\mysql\bin\mysql.exe -h 192.168.1.21 -u root -p
Enter password:
```

3. Check if the database (e.g. testdb) is existing.

```
mysql> SHOW DATABASES;
+-----+
| Database          |
+-----+
| information_schema |
| mysql              |
| performance_schema |
| sys                |
| testdb             |
+-----+
5 rows in set (0.02 sec)
```

- 
4. Quit the connection.

```
mysql> exit
Bye
```

5. Stop the container on the secondary server.

```
C:\> docker stop mysql
```

## 7.5 Setup Connector/ODBC (Primary Server)

1. Download and install the **Microsoft Visual C++ 2013 Redistributable Package** if it is not already installed.
2. Download the appropriate **Connector/ODBC** for Windows from the MySQL website.
3. Run Connector/ODBC installer.
4. Run the **ODBC Data Source Administrator** (odbcad32.exe).
5. Select the **System DSN** tab. Click **Add**.
6. Select the **MySQL ODBC ANSI Driver** and click **Finish**.
7. Enter the **Data Source Name** and IP address of the container.
8. Enter **root** in the **User** field and the root user password in the **Password** field.
9. In the **Database** drop down list select the database created on the container (e.g. testdb).
10. Click the **Test** button to test connectivity to the MySQL database.
11. Click **OK**.

## 7.6 Setup Connector/ODBC (Secondary Server)

1. Follow the steps in section **7.5** on the secondary server.
2. Stop the container on the primary server before next section.

```
C:\> docker stop mysql
```

---

## 8 MySQL Cluster Setup

### 8.1 Add the Script Resource to Control Container

1. Download the script files for MySQL Server 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-mysql**. 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-mysql** 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-mysql** 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 ODBC Monitor Resource for MySQL

**Warning:**

**MySQL commercial license is required** to use ODBC 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 **ODBC monitor**. Click **Next**.
  4. In the **Monitor Resource Definition** window, click the **Browse** button to select the **Target Resource**.
  5. Select the **script** resource (e.g. script-mysql) 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 window, choose **Level 2 (monitoring by update/select)** for **Monitor Level**.
  8. Enter **User Name**, **Data Source Name** and **Password**. Click **Next**.
  9. Click the **Browse** button to select the **script** resource (e.g. script-mysql) for **Recovery Target** and click **OK**.
  10. 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 MySQL container is running.

```
C:\> docker ps
CONTAINER ID ... STATUS      ... NAMES
a29b6a76f2e1 ... Up 8 minutes ... mysql
```

6. Confirm that MySQL is running on the container.

```
C:\> docker exec mysql sc query mysql
SERVICE_NAME: mysql
        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.

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# 10 Appendix

## 10.1 System Planning Worksheet

- Machine #1: Primary Server (Container Host)
- Machine #2: Secondary Server (Container Host)
- Machine #3: MySQL 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		<b>Cluster Partition:</b> Drive Letter: Size:
#2		<b>Data Partition:</b> Drive Letter: Size:
#3	N/A	N/A
#4		N/A

**Table 3: Logins and Passwords**

Machine	Login	Password
#1		
#2		
#3		
#4		