

Deploying the 60TB Data Warehouse Fast Track Reference Architecture for Microsoft SQL Server 2016 using Dell EMC PowerEdge R730 and SC5020

Deployment guide with step-by-step instructions

Abstract

This paper provides step-by-step instructions for building a balanced configuration for a Microsoft SQL Server data warehouse workload and requirements for preparing the hardware platform and provisioning the OS to achieve a balanced, optimized 60TB configuration.

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Overview

This guide provides step-by-step instructions to build a balanced configuration for a Microsoft® SQL Server® data warehouse workload, as specified in the companion reference architecture document, [60TB Data Warehouse Fast Track Reference Architecture for Microsoft SQL Server 2016 using Dell EMC PowerEdge R730 and SC5020](#). This guide also covers requirements for preparing the hardware platform and provisioning the OS to achieve a balanced, optimized 60TB configuration for a Microsoft SQL Server 2016 data warehouse by using Dell EMC™ PowerEdge™ R730 servers, Dell EMC SC5020 storage arrays, and Microsoft Data Warehouse Fast Track (DWFT) principles.

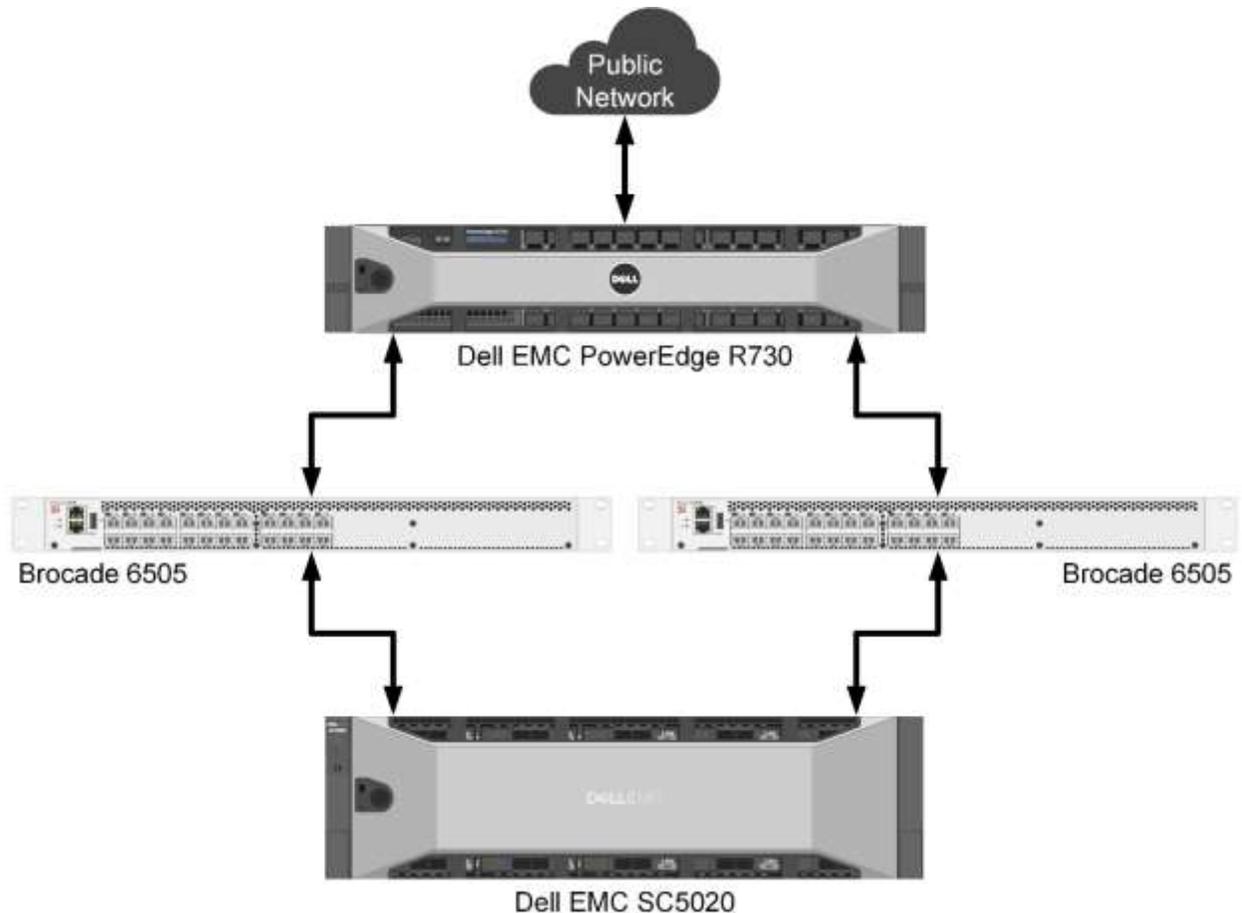


Figure 1 Single server reference architecture

Note: The 60TB solution includes both a single server configuration and a highly available (HA) configuration. For simplicity, this guide only covers the single server implementation.

1 Solution requirements

This section lists the hardware and software components required to implement the single server reference architecture. The versions of firmware on the server used to validate the reference architecture are also listed.

Table 1 Hardware and software components

Component	Description	
Server	Dell EMC PowerEdge R730	
	Processors	Two Intel® Xeon® E5-2689v4 (3.1Ghz, 10 cores, 20 threads)
	Total cores	20
	Total logical processors	40 (Intel Hyper-Threading Technology enabled)
	Total memory	768 GB
	Network adapters	Minimum of one network adapter (1 Gbps or 10 Gbps based on requirements) Recommended to have more than one network adapter with load balancing configured
	Host bus adapters	Two QLogic® QLE2662 dual port 16 Gbps FC HBA
Software	Operating system	Windows Server® 2016 Standard Edition
	Database software	SQL Server 2016 Enterprise Edition
Storage	Storage array	Dell EMC SC5020 (SCOS v7.2.10)
	Disk drives	20 x 1.92 TB read intensive SSDs (2.5" SAS)
	SAN switches	Two Brocade® 6505 with 16 Gbps SFPs

Table 2 Server firmware versions

Hardware component	Firmware version
BIOS	2.4.3
Backplane 1	2.25
Dell 32 Bit uEFI Diagnostics	4239A36
Dell OS Driver Pack	16.10.10
Integrated Dell Remote Access Controller	2.43.43.43
Intel Ethernet 10G 4P X520/I350 rNDC	17.5.10
Intel Gigabit 4P X520/I350 rNDC	17.5.10
Lifecycle Controller	2.43.43.43
OS Collector	2.1, A00
Power Supply	00.24.35
QLogic QLE2662	08.00.15
System CPLD	1.0.1

2 Deployment workflow

This section outlines the sequence of deploying the 60TB Data Warehouse Fast Track for SQL Server 2016 reference architecture using the Dell EMC PowerEdge R730 server and Dell EMC SC5020 storage array.

To deploy the reference architecture, perform the following tasks:

1. Configure the Dell EMC SC5020 storage array.
2. Configure the Dell EMC PowerEdge R730 server.
3. Install and configure Microsoft Windows Server 2016 operating system.
4. Install and configure Microsoft SQL Server 2016 Enterprise Edition.

This guide assumes the reader has a general understanding of installing and configuring Microsoft Windows servers, Microsoft SQL Server and Dell EMC SC Series arrays.

3 Cabling requirements

The diagram in Figure 2 shows how to cable the R730 server, the Fibre Channel (FC) switches, and the SC5020 storage array.

Port 1 on each host bus adapter (HBA) in the server and ports 1 and 2 on each HBA in the SC5020 should be connected to the same Brocade 6505 switch. Port 2 on each HBA in the server and ports 3 and 4 on each HBA in the SC5020 should be connected to the other Brocade 6505 switch.

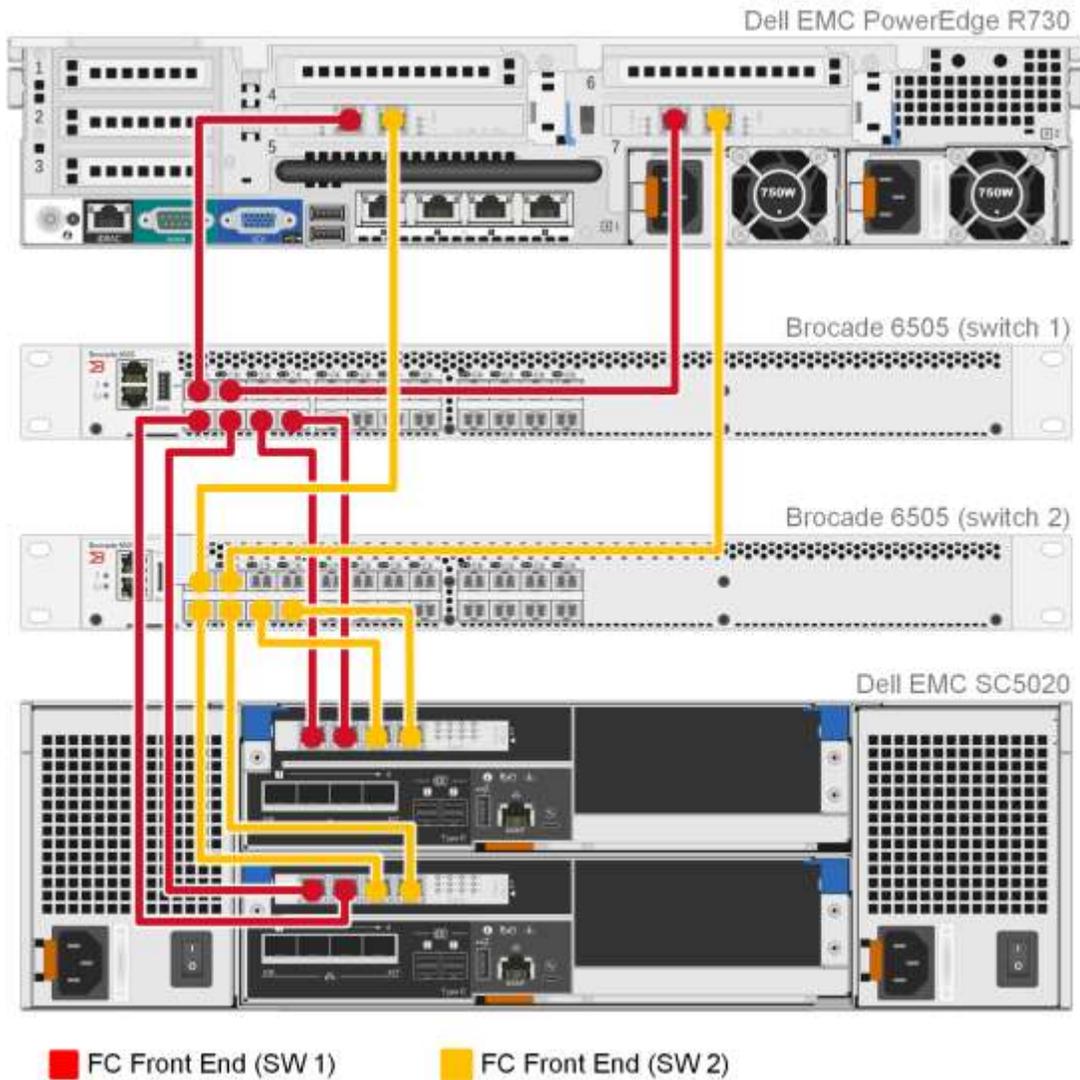


Figure 2 Single server configuration cabling diagram

4 Configure the Dell EMC SC5020 storage array

This section describes the configuration of the SC5020 storage array.

4.1 Configure local ports

The FC ports should be configured to use two fault domains in virtual port mode. Ports 1 and 2 from each controller should be put into fault domain 1 and ports 3 and 4 from each controller put into fault domain 2.

4.2 Configure disks

All 20 disks should be in the Assigned disk folder. One disk will automatically be defined as a hot spare, leaving 19 active disks.

4.3 Configure the storage type

The Assigned disk folder should be configured for single redundancy, using a 512KB page size.

4.4 Allow storage profile selection

In order to create a custom storage profile, you must allow the selection of storage profiles in your storage preferences.

To allow storage profile selection, perform the following steps:

1. Open the Dell Storage Manager (DSM) client and connect to the Storage Center.
2. Click the **Storage** tab.
3. Right-click the Storage Center and select **Edit Settings**.
4. Click the **Preferences** tab.
5. Under Storage, below the Storage Profile drop-down list, select **Allow Storage Profile Selection**.
6. Click **OK**.

4.5 Turn off write cache

It is a best practice to disable write cache in all flash arrays.

To disable write cache, perform the following steps:

1. Open the DSM client and connect to the Storage Center.
2. Click the **Storage** tab.
3. Right-click the Storage Center and select **Edit Settings**.
4. Click the **Storage** tab.
5. Under Cache, de-select **Write Cache Enabled**.
6. Click **OK**.

4.6 Create the RAID 5 All Tiers storage profile

All SQL Server data volumes will use a custom storage profile to ensure that RAID 5 is always used.

To create the custom storage profile, perform the following steps:

1. Open the DSM client and connect to the Storage Center.
2. Click the **Storage** tab.
3. Right-click Storage Profiles and select Create Storage Profile. The Create Storage Profile dialog box appears.
4. In the **Name** textbox, type **RAID 5 All Tiers**.
5. Under Data Writes, in the Write RAID Type drop-down list, select **Parity (RAID 5 / RAID 6)**.
6. Under Snapshot Data, in the Tier 1 Snapshot RAID Type drop-down list, select **Parity (RAID 5 / RAID 6)**.
7. Under Snapshot Data, in the Tier 2 Snapshot RAID Type drop-down list, select **Parity (RAID 5 / RAID 6)**.
8. Under Snapshot Data, in the Tier 3 Snapshot RAID Type drop-down list, select **Parity (RAID 5 / RAID 6)**.
9. Click **OK**.

4.7 Create the server object

A server object is used when presenting storage to a server. To create the server object, perform the following steps:

1. Open the DSM client and connect to the Storage Center.
2. Click the **Storage** tab.
3. Right-click **Servers** and select **Create Server**. The **Create Server** dialog box appears.
4. In the **Name** textbox, enter the name of the server.
5. In the **Operating System** drop-down list, select **Windows Server 2016 Singlepath**. (The operating system definition will be changed after Windows has been installed.)
6. In the **Host Bus Adapters** list box, select all four FC ports for the server.
7. Click **OK**.

4.8 Remove default snapshot profiles

Remove any default snapshot profiles by performing the following steps:

1. Open the DSM client and connect to the Storage Center.
2. Click the **Storage** tab.
3. Right-click the Storage Center and select **Edit Settings**.
4. Click the **Preferences** tab.
5. Under **Snapshot**, click **Change** to the right of **Snapshot Profiles**. The **Select Snapshot Profiles** dialog box appears.
6. Un-check all snapshot profiles in the list at the top of the dialog box and click **OK**.
7. Click **OK**.

4.9 Create the volumes

A total of 10 Storage Center volumes are used in the reference architecture and are listed in Table 3.

Table 3 Storage Center volumes

Volume Name	Storage Profile	Volume Size
Boot	Recommended (All Tiers)	200 GB
MPHost	Recommended (All Tiers)	1 GB
SQLSystem	Recommended (All Tiers)	20 GB
SQLLog	Recommended (All Tiers)	Site Dependent
SQLData01	RAID 5 All Tiers	Site Dependent
SQLData02	RAID 5 All Tiers	Site Dependent
SQLData03	RAID 5 All Tiers	Site Dependent
SQLData04	RAID 5 All Tiers	Site Dependent
TempdbData01	Recommended (All Tiers)	Site Dependent
TempdbData02	Recommended (All Tiers)	Site Dependent

To create the Storage Center volumes, perform the following steps:

1. Open the DSM client and connect to the Storage Center.
2. Click the **Storage** tab.
3. For each volume in Table 3, perform the following steps:
 - a. Right-click **Volumes** and select **Create Volume**. The **Create Volume** dialog box appears.
 - b. In the **Name** text box, enter the volume name.
 - c. In the **Size** text box, enter the volume size.
 - d. In the **Volume Folder** tree, select the desired volume folder.
 - e. After **Snapshot Profiles**, verify that no snapshot profiles are listed.
 - f. In the **Storage Profile** list box, select the appropriate storage profile.
 - g. Click **OK**.

4.10 Map the boot volume to the server

Since the server is not using the MPIO version of the Windows Server 2016 operating system definition, only one path will be created for the boot volume. This is intentional because MPIO will need to be configured in the operating system before multiple paths can be used on a volume. The operation system definition will be changed to the MPIO version once Windows has been installed and configured.

To map the boot volume to the server, perform the following steps:

1. Open the DSM client and connect to the Storage Center.
2. Click the **Storage** tab.
3. Expand the volume folder that contains the boot volume.
4. Right-click the boot volume and select **Map Volume to Server**. The **Map Volume to Server** dialog box appears.
5. Select the server and click **Next**.
6. Click **Advanced Options**.
7. Under **Select LUN**, select **Map volume using LUN 0**.
8. Click **Finish**.

5 Configure the Dell EMC PowerEdge R730 server

5.1 Update the firmware

The firmware update feature of the Lifecycle Controller can be used to update the firmware on the server. The Lifecycle Controller is accessible during the server boot cycle.

To update the firmware using the Lifecycle Controller, perform the following steps:

1. Reboot the server and press **F10** when prompted to enter the Lifecycle Controller.
2. On the left-hand side of the screen, click **Firmware Update**.
3. Click Launch Firmware Update.
4. On the **Select Update Repository** screen, leave **FTP Server** selected and click **Next**.
5. On the **Enter Access Details** screen, under Proxy Settings, uncheck **Enable Settings** and click **Next**.
6. On the **Select Updates** screen, available updates will have a check mark next to the component name. After verifying the list of selected updates, click **Apply**. This will apply the updates and reboot the server.
7. After rebooting, the server will enter the Lifecycle Controller. In some cases, it may be necessary to repeat this process until all updates have been applied.
8. To exit the Lifecycle Controller, click **Exit** in the upper right-hand corner of the screen.
9. In the **Confirmation** dialog box, click **Yes**. The server will reboot.

5.2 Configure the System BIOS

The BIOS can be configured using System Setup, which is accessible during the server boot cycle.

To configure the BIOS using System Setup, perform the following steps:

1. Reboot the server and press **F2** when prompted to enter System Setup.
2. On the **System Setup** main menu, click **System BIOS**.
3. Set the system profile to **Performance**:
 - h. Click System Profile Settings.
 - i. In the **System Profile** drop-down list, select **Performance**.
 - j. Click **Back** to exit System Profile Settings.
4. Enable hyper-threading:
 - a. Click Processor Settings.
 - b. For the **Logical Processor** option, select **Enabled**.
 - c. Click **Back** to exit Processor Settings.
5. Click **Finish** to exit System BIOS.
6. Click **Finish** to exit System Setup.
7. On the **Confirm Exit** dialog box, click **Yes**. The server will reboot.

5.3 Reset the HBAs to default settings

The HBAs can be reset using QLogic Fast!UTIL. QLogic Fast!UTIL is accessible during the server boot cycle.

To reset the HBAs using QLogic Fast!UTIL, perform the following steps:

1. Reboot the server and press **[Ctrl]+[Q]** when prompted to enter QLogic Fast!UTIL.
2. In **Select Host Adapter**, select the first port in the list and press **[Enter]**.
3. Reset the HBA port to factory defaults:
 - a. In Fast!UTIL Options, select **Configuration Settings** and press **[Enter]**.
 - b. In Configuration Settings, select **Restore Default Settings** and press **[Enter]**.
 - c. After **Adapter Defaults Restored** is displayed, press any key to return to the **Configuration Settings** screen.
 - d. Press **[Esc]** to exit **Configuration Settings**. When prompted, select **Save Changes** and press **[Enter]**.
4. In Fast!UTIL Options, select **Select Host Adapter** and press **[Enter]**.
5. In **Select Host Adapter**, select the next port in the list and press **[Enter]**.
6. Using the instructions in step 3, reset the port to factory defaults. Repeat these steps until all four ports have been configured.

5.4 Configure the HBAs

The HBAs can be configured using QLogic Fast!UTIL. QLogic Fast!UTIL is accessible during the server boot cycle. This section assumes that QLogic Fast!UTIL is still open on the server.

To configure the HBAs using QLogic Fast!UTIL, perform the following steps:

1. In Fast!UTIL Options, select **Select Host Adapter** and press **[Enter]**.
2. In **Select Host Adapter**, select the first port in the list and press **[Enter]**.
3. Set the parameters on the HBA port according to best practices:
 - a. In Configuration Settings, select **Adapter Settings** and press **[Enter]**.
 - b. In Adapter Settings:
 - i. Set **Host Adapter BIOS** to **Enabled**.
 - ii. Set **Connection Options** to **1** (Point to point only).
 - iii. Press **[Esc]** to exit Adapter Settings.
 - c. In Configuration Settings, select **Advanced Adapter Settings** and press **[Enter]**.
 - d. In Advanced Adapter Settings:
 - i. Set **Enable LIP Reset** to **Yes**.
 - ii. Set **Login Retry Count** to **60**.
 - iii. Set **Port Down Retry Count** to **60**.
 - iv. Set **Link Down Timeout** to **30**.
 - v. Press **[Esc]** to exit Advanced Adapter Settings.
 - e. Press **[Esc]** to exit **Configuration Settings**. When prompted, select **Save Changes** and press **[Enter]**.
4. In Fast!UTIL Options, select **Select Host Adapter** and press **[Enter]**.

5. In **Select Host Adapter**, select the next port in the list and press **[Enter]**.
6. Using the instructions in step 3, set the parameters according to best practices. Repeat these steps until all four ports have been configured.

5.5 Configure the HBA port to boot from SAN

Only one path exists for the mapping between the server and the boot volume. The HBA port for that path needs to be configured to boot from SAN. Once the server is configured to use MPIO, the steps in this section will need to be repeated to configure each HBA port to boot from SAN. This section assumes that QLogic Fast!UTIL is still open on the server.

To configure the HBA port to boot from SAN using QLogic Fast!UTIL, perform the following steps:

1. In Fast!UTIL Options, select **Select Host Adapter** and press **[Enter]**.
2. In **Select Host Adapter**, select the first port in the list and press **[Enter]**.
3. In **Fast!UTIL Options**, select **Scan Fibre Devices** and press **[Enter]**. If a device is displayed, this is the port used for the boot volume. If a device is not displayed, go back and select the next port in the host adapter list and scan for devices. Keep repeating until the scan displays a device. Once the port for the boot volume is discovered, press **[Esc]** to exit **Scan Fibre Devices**.
4. In Fast!UTIL Options screen, select **Configuration Settings** and press **[Enter]**.
5. In Configuration Settings screen, select **Selectable Boot Settings** and press **[Enter]**.
6. In Selectable Boot Settings:
 - a. Set Selectable Boot to Enabled.
 - b. Select the first boot port entry and press **[Enter]**.
 - c. Select the boot device from the list and press **[Enter]**.
 - d. Press **[Esc]** to exit Selectable Boot Settings.
7. Press **[Esc]** to exit **Configuration Settings**. When prompted, select **Save changes** and press **[Enter]**.
8. Press **[Esc]** to exit **Fast!UTIL**. When prompted, select **Reboot System** and press **[Enter]**. The server will reboot.

6 Install and configure Microsoft Windows Server 2016

6.1 Install Microsoft Windows Server 2016

The OS Deployment feature of the Lifecycle Controller can be used to install the operating system. One advantage of this approach is that Windows will be installed with the proper drivers for the R730.

To install Windows using the Lifecycle Controller, perform the following steps:

1. Reboot the server and press **[F10]** when prompted to enter **Lifecycle Controller**.
2. Click **OS Deployment** on the left-hand side of the screen.
3. Click Deploy OS.
4. Under **Boot Mode**, select **BIOS**. (**BIOS** should already be selected.)
5. Under Available Operating Systems, select Microsoft Windows Server 2016 and click Next.
6. Under Select Installation Mode, select Manual Install and click Next.
7. Insert the Windows Server 2016 install media and click **Next**.
8. Review the options that were selected on the previous screens. If the information is correct, click **Finish**. The server will reboot. If prompted to boot from the Windows install disk, press any key. The **Windows Setup** screen will appear.
9. On the first screen, enter the following and click **Next**.
 - Language to install
 - Time and currency format
 - Keyboard or input method
10. On the next screen, click **Install Now**. The **Windows Setup** dialog box will appear.
11. On the Select the operating system you want to install screen, select **Windows Server 2016 Standard (Desktop Experience)** and click **Next**.
12. On the **Applicable notices and License terms** screen, accept the license terms by selecting **I accept the license terms** and click **Next**.
13. On the Which type of installation do you want? screen, click Custom: Install Windows only (advanced).
14. On the Where do you want to install Windows? screen, click Drive 0 and click Next.
15. The Windows installation will start. After it is done, the server will reboot.
16. On the **Customize Settings** screen, enter the Administrator password and click **Finish**.

6.2 Configure Microsoft Windows Server 2016

Once Windows is installed, it needs to be configured for the Data Warehouse Fast Track workload.

To configure Windows, begin with these steps:

1. Press **[Ctrl] + [Alt] + [Delete]** and login as Administrator.
2. On the **Networks** pop-up window on the right-hand side of the screen, click **No**.

To complete the configuration, perform the steps in the following subsections in order.

6.2.1 Set the server name (optional)

1. In **Server Manager**, click **Local Server** on the left-hand side of the screen.
2. In the **Properties** pane, click the current server name next to the label **Computer name**. The **System Properties** dialog box appears.
3. Click **Change**. The **Computer Name/Domain Changes** dialog box appears.
4. In the **Computer name** text box, enter the server name and click **OK**.
5. Click **OK** to acknowledge the computer restart.
6. Click **Close** to exit System Properties.
7. Click **Restart Now**. The server will reboot. When the server is back online, login as **Administrator**.

6.2.2 Set the IP address (optional)

1. In **Server Manager**, click **Local Server** on the left-hand side of the screen.
2. In the **Properties** pane, click **IPv4 address assigned by DHCP, IPv6 enabled** next to the label for the active Ethernet port. The **Network Connections** window will appear.
3. Right-click the icon for the active Ethernet port and select **Properties**.
4. Select **Internet Protocol Version 4 (TCP/IPv4)** in the list box and click **Properties**. The **Internet Protocol Version 4 (TCP/IPv4) Properties** dialog box appears.
5. Select **Use the following IP address** and enter the following:
 - IP address
 - Subnet
 - Gateway
6. Select **Use the following DNS** server addresses and enter the following:
 - Preferred DNS server
 - Alternate DNS server
7. Click **OK**.
8. Click **Close**.
9. On the **Networks** pop-up window on the right-hand side of the screen, click **No**.
10. Close the **Network Connections** window.

6.2.3 Enable Remote Desktop (RDP) (optional)

1. In **Server Manager**, click **Local Server** on the left-hand side of the screen.
2. In the **Properties** pane, click **Disabled** next to the label **Remote Desktop**. The **System Properties** dialog box appears.
3. In the **Remote Desktop** pane, select **Allow Remote connections to this computer**.
4. A **Remote Desktop Connection** dialog box appears, stating that the **Remote Desktop Firewall** exception will be enabled. Click **OK**.
5. Click **OK**.

6.2.4 Install the Multipath I/O feature

1. In **Server Manager**, click **Local Server** on the left-hand side of the screen.
2. Scroll down until the **Roles and Features** pane is visible.
3. In the **Tasks** drop-down list at the top of the pane, select **Add Roles and Features**. The **Add Roles and Features** wizard will start.
4. On the **Before you begin** screen, click **Next**.
5. On the **Select installation type** screen, select **Role-based or feature-based installation**, and click **Next**.

6. On the **Select destination server** screen, select the server and click **Next**.
7. On the **Select server roles** screen, click **Next** without selecting any roles.
8. On the **Select features** screen, do the following:
 - a. Scroll down and select **Multipath I/O**.
 - b. Click **Next**.
9. Click **Install**.
10. When the installation is complete, click **Close**.
11. Clear the installations completion message in **Server Manager**:
 - a. Click the flag icon in the menu bar.
 - b. Click the **X** to close the feature installation message.
 - c. Click the flag icon in the menu bar.

6.2.5 Remove install disk

Eject the Windows installation disk from the server.

6.2.6 Set the time zone of the server (optional)

1. Place the cursor over the time in the lower left-hand corner of the screen.
2. Right-click and select **Adjust date/time**. The **Settings** window will appear.
3. Under **Time zone**, select the correct time zone in the drop-down list.
4. Close the **Settings** window.

6.2.7 Configure MPIO

1. Open Control Panel.
2. In the **View by** drop-down list, select **Small icons**.
3. Click the **MPIO** icon. The **MPIO Properties** dialog box appears.
4. Click **Add**. The **Add MPIO Support** dialog box appears.
5. In the **Device Hardware Id** text box, enter **COMPELNTCompellent Vol** (there is a space between **COMPELNTCompellent** and **Vol**) and click **OK**.
6. The **Reboot Required** dialog box appears.
7. Click **Yes**. The server will reboot. When the server is back online, login as Administrator.

6.2.8 Apply MPIO best practices

Use the PowerShell script provided in the MPIO best practices guide to apply best practices settings to the server. The document is available on Dell TechCenter:

http://en.community.dell.com/techcenter/extras/m/white_papers/20437917. After running the PowerShell script, reboot the server. When the server is back online, login as Administrator.

6.2.9 Set the Power Plan

Set the **Power Plan** to **High performance**:

1. Open the Control Panel.
2. Click the **Power Options** icon.
3. In the **Power Options** window, under Preferred plans, select **High performance**.
4. Close the **Power Options** window.

6.2.10 Remove SMBv1 (optional)

1. Run the following PowerShell command:

```
Remove-WindowsFeature -Name "FS-SMB1"
```

2. Reboot the server. When the server is back online, login as Administrator.

6.2.11 Configure Windows Updates (optional)

1. Click the start icon.
2. Click the settings icon.
3. Click Update & security.
4. Under Update Status, click Check for updates.
5. Apply all important updates.
6. Repeat until there are no results after clicking **Check for updates** and Update Status shows **Your device is up to date**.

6.2.12 Create a local SQL Server service account

Create a local SQL Server service account called **SQLService**:

1. Open Computer Management.
2. Expand Local Users and Groups.
3. Right-click **Users** and select **New User**. The **New User** dialog box appears.
4. In the **User name** text box, enter **SQLService**.
5. In the Description text box, enter **SQL Server service account**.
6. In the **Password** and **Confirm password** text boxes, enter the password.
7. Deselect User must change password at next logon.
8. Select Password never expires.
9. Click **Create**.
10. Click **Close**.
11. Close Computer Management.

6.2.13 Lock pages in memory

Grant the **Lock pages in memory** right to the SQL Server service account:

1. Right-click the **Start** icon and select **Run**.
2. In the **Open** text box, enter **secpol.msc**. The **Local Security Policy** window appears.
3. Expand Local Policies.
4. Select User Rights Assignment.
5. In the Policy list, double-click Lock pages in memory. The Lock pages in memory Properties dialog box appears.
6. Click **Add User or Group**. The Select Users or Groups dialog box appears.
7. Enter **SQLService** in the text box.
8. Click **Check Names** and click **OK**.
9. Click **OK**.
10. Close the Local Security Policy window.

6.2.14 Change the optical drive letter (optional)

Change the drive letter for the optical drive to **Z**:

1. Open Disk Management.
2. Right-click the optical drive in the list of disks in the lower pane of the center of the screen and select **Change Drive Letter and Paths**. The **Change Drive Letter and Paths** dialog box appears.
3. Click **Change**. The **Change Drive Letter or Path** dialog box appears.
4. Select **Z** from the drop-down list of drive letters and click **OK**.
5. A **Disk Management** dialog box will appear asking if you want to continue. Click **Yes**.
6. Close Computer Management.

6.2.15 Configure the Windows Firewall

Because security requirements can vary significantly from site to site, the configuration of the firewall is not included in this document. Using default settings, the Windows firewall may interfere with RDP connections and with connections to SQL Server. During validation of the solution, the Windows firewall was disabled.

6.3 Configure the Windows volumes

This section describes the steps required to configure the Storage Center volumes for use by Windows.

6.3.1 Change the operating system definition in the Storage Center

The Storage Center server object will need to be changed to use the MPIO version of the operating system definition. This will allow volume mappings to use all available paths.

To change the operating system definition of the server object, perform the following steps:

1. Open the DSM client and connect to the Storage Center.
2. Click the **Storage** tab.
3. Expand the server folder that contains the server object.
4. Right-click the server and select **Edit Settings**. The **Edit Server Settings** dialog box appears.
5. In the **Operating System** drop-down list, select **Windows Server 2016 MPIO** and click **OK**.

6.3.2 Change boot volume mappings

Modify the mappings for the boot volume to take advantage of MPIO.

1. Open the DSM client and connect to the Storage Center.
2. Click the **Storage** tab.
3. Select the boot volume.
4. On the right-hand side of the volume tree, click the **Mappings** tab.
5. Click **Edit Settings**. The **Edit Volume Mapping Settings** dialog box appears.
6. Click **Continue**.
7. Under **Configure Multipathing**, in the **Maximum number of paths per Server** list box, select **32**.
8. Click **OK**.

6.3.3 Configure each HBA port in the server to boot from SAN

To take advantage of all paths for the boot volume, each HBA port needs to be configured to boot from SAN. The HBAs can be configured using QLogic Fast!UTIL, which is accessible during the server boot cycle.

To configure each HBA port using QLogic Fast!UTIL, perform the following steps:

1. Reboot the server and press **[Ctrl] + [Q]** when prompted to enter QLogic Fast!UTIL.
2. In **Select Host Adapter**, select the first port in the list and press **[Enter]**.
3. For each HBA port, do the following:
 - a. In Fast!UTIL Options, select Configuration Settings and press **[Enter]**.
 - b. In Configuration Settings, select Selectable Boot Settings and press **[Enter]**.
 - c. Set Selectable Boot to Enabled.
 - d. Select the first boot port entry and press **[Enter]**.
 - e. Select the first device from the list and press **[Enter]**.
 - f. Select the second boot port entry and press **[Enter]**.
 - g. Select the second device from the list and press **[Enter]**.
 - h. Press **[Esc]** to exit Selectable Boot Settings.
 - i. Press **[Esc]** to exit **Configuration Settings**. When prompted, select **Save changes** and press **[Enter]**.
 - j. In Fast!UTIL Options, select Select Host Adapter and press **[Enter]**.
 - k. In **Select Host Adapter**, select the next port in the list and press **[Enter]**.
 - l. Using the instructions in this step (step 3), configure each HBA port to boot from SAN. Repeat the instructions until all four ports have been configured.
4. Press **[Esc]** to exit **Fast!UTIL**. When prompted, select **Reboot System** and press **[Enter]**. The server will reboot.

6.3.4 Map and format the remaining volumes.

All volumes, except for the boot volume, will need to be mapped to the server and formatted in Windows. These volumes, along with required parameters, are listed in Table 4.

Table 4 Remaining volumes to map and format

Volume Name	Drive Letter/ Mount point	Volume Label	Allocation Unit
MPHost	M:\	MPHost	Default
SQLSystem	M:\ft\SQLSystem	SQLSystem	64K
SQLLog	M:\ft\SQLLog	SQLLog	64K
SQLData01	M:\ft\SQLData01	SQLData01	64K
SQLData02	M:\ft\SQLData02	SQLData02	64K
SQLData03	M:\ft\SQLData03	SQLData03	64K
SQLData04	M:\ft\SQLData04	SQLData04	64K
TempdbData01	M:\ft\TempdbData01	TempdbData01	64K
TempdbData02	M:\ft\TempdbData02	TempdbData02	64K

Execute the following steps for each volume, one at time, in order as the volumes are listed in Table 4:

1. Open the DSM client and connect to the Storage Center.
2. Click the **Storage** tab.
3. Map the volume in the DSM client:
 - a. Expand the volume folder containing the volume.
 - b. Right-click the volume and select **Map Volume to Server**. The **Map Volume to Server** dialog box appears.
 - c. Expand the server folder containing the server object.
 - d. Select the server object and click **Next**.
 - e. Review the information and click **Finish**.
4. Format the volume on the Windows server:
 - a. Open Disk Management.
 - b. Click **Action** in the menu bar and select **Rescan Disks**. Continue to rescan disks until the new disk appears. It may take multiple rescans.
 - c. Right-click the new disk and select **Online**.
 - d. Right-click the new disk and select **Initialize Disk**. The **Initialize Disk** dialog box appears.
 - e. Under Use the following partition style for the selected disks, select GPT.
 - f. Click **OK**.
 - g. Right-click the unallocated space of the new disk and select **New Simple Volume**.
 - h. The New Simple Volume Wizard starts.
 - i. Click **Next**.
 - j. On the **Specify Volume Size** screen, keep the default size, and click **Next**.
 - k. On the **Assign Drive Letter or Path** screen, use the drive letter or mount point listed in Table 4 for the volume and click **Next**.
 - l. On the Format Partition screen:
 - i. In the **File system** drop-down list, select **NTFS**.
 - ii. In the **Allocation unit size** drop-down list, select the value from Table 4.
 - iii. In the **Volume label** text box, enter the value from Table 4 and click **Next**.
 - m. Review the settings and click **Finish**.

Once the volumes have been mapped and formatted, perform the following steps:

1. Verify that the odd-numbered SQL Server data volumes are on one controller and the even-numbered SQL Server data volumes are on the other controller. This can be corrected by remapping the volume and specifying the correct controller.
2. Verify that the tempdb data volumes are on different controllers. This can be corrected by remapping the volume and specifying the correct controller.
3. Create a folder named **Data** on each mount point under **M:\ft**, with the exception of **M:\ft\SQLSystem**, by doing the following:
 - a. Open File Explorer.
 - b. Select the mount point (for example, **M:\ft\SQLData01**) in the directory tree.
 - c. Right-click the mount point and select **New** and then **Folder**.
 - d. Name the folder **Data**.
 - e. Repeat until all mount points (except for **M:\ft\SQLSystem**) have a **Data** folder.

7 Install and Configure Microsoft SQL Server 2016 Enterprise Edition

7.1 Install Microsoft SQL Server 2016 Enterprise Edition

To install SQL Server 2016 Enterprise Edition, perform the following steps:

1. Insert the SQL Server 2016 Enterprise Edition install media.
2. Double-click **Setup.exe**. The **SQL Server Installation Center** window will appear.
3. Click **Installation** in the pane on the left-hand side.
4. Click New SQL Server stand-alone installation or add features to an existing installation. The SQL Server 2016 Setup dialog box will appear.
5. On the **Product Key** screen, enter the product key and click **Next**.
6. On the **License Terms** screen, select **I accept the terms** and click **Next**.
7. On the Microsoft Update screen, leave Use Microsoft Update to check for updates unselected and click **Next**.
8. On the **Feature Selection** screen, select the following features and click **Next**:
 - Database Engine Services
 - SQL Server Replication (optional)
 - Full-Text and Semantic Extractions for Search (optional)
 - Client Tools Connectivity
 - Client Tools Backwards Compatibility
 - Documentation Components
9. On the Instance Configuration screen, leave Default Instance selected and MSSQLSERVER in the Instance ID textbox. Click **Next**.
10. On the **Server Configuration** screen, do the following:

On the **Service Accounts** tab:

 - a. Enter the SQL Server service account name (**.\SQLService**) and password for the SQL Server Agent.
 - b. Change the startup type for the SQL Server Agent to **Automatic**.
 - c. Enter the SQL Server service account name (**.\SQLService**) and the SQL Server Database Engine.
 - d. Select Grant Perform Volume Maintenance Task privilege to SQL Server Database Engine Service.
 - e. On the **Collation** tab, leave the Collation at the default setting and click **Next**.
11. On the **Database Engine Configuration** screen, do the following:

On the **Server Configuration** tab:

 - a. Under Authentication Mode, select Mixed Mode.
 - b. Enter and confirm the sa password.
 - c. Click Add Current User.

On the **Data Directories** tab:

- a. In the Data root directory text box, enter M:\ft\SQLSystem.
- d. Leave the remaining directory text boxes as-is.

On the **TempDB** tab

- a. In the **Number of files** list box, enter 8.
 - e. Remove existing directories in the **Data directories** list box. Select the directory and click **Remove**.
 - f. Add the directory **M:\ft\TempdbData01\Data**. Click Add. The **Browse for Folder** dialog box appears. Select the folder and click **OK**.
 - g. Add the directory **M:\ft\TempdbData02\Data**. Click Add. The **Browse for Folder** dialog box appears. Select the folder and click **OK**.
 - h. In the Log directory list box, enter M:\ft\SQLLog\Data.
 - i. On the FILESTREAM tab (optional), select Enable FILESTREAM for Transaction-SQL access and click **Next**.
12. On the **Ready to Install** screen, click **Install**.
 13. On the **Complete** screen, click **Close**.
 14. Close the SQL Server Installation Center window.
 15. Remove the SQL Server install media.

7.2 Install SQL Server 2016 Service Pack 1

Some installation media includes Service Pack 1 (SP1) for SQL Server 2016. If the installation media being used includes SP1, this section can be skipped.

To install SQL Server 2016 SP1, perform the following steps:

1. Download SQL Server 2016 SP1 from Microsoft.
2. Double-click the installation executable (ie: SQLServer2016SP1-KB3182545-x64-ENU.exe).
3. On the License Terms screen, select **I accept the license terms** and click **Next**.
4. On the **Select Features** screen, don't change any selections and click **Next**.
5. On the **Check Files In Use** screen, after the file check is complete, click **Next**.
6. On the **Ready to Update** screen, click **Update**.
7. On the **Complete** screen, click **Close**.

7.3 Install Cumulative Update 3 for SQL Server Service Pack 1

To install Cumulative Update 3 (CU3) for SQL Server SP1, perform the following steps:

1. Download SQL Server SP1 CU3 from Microsoft.
2. Double-click the installation executable (ie: SQLServer2016-KB4019916-x64.exe).
3. On the License Terms screen, select I accept the license terms and click **Next**.
4. On the **Select Features** screen, don't change any selections and click **Next**.
5. On the **Check Files In Use** screen, after the file check is complete, click **Next**.
6. On the **Ready to Update** screen, click **Update**.
7. On the **Complete** screen, click **Close**.

7.4 Install SQL Server Management Studio (optional)

Starting with SQL Server 2016, SQL Server Management Studio (SSMS) is no longer installed as part of the SQL Server installation. SSMS is installed separately.

1. Download the latest SSMS installation package from Microsoft.
2. Double-click the SSMS setup executable (ie: SSMS-Setup-ENU.exe).
3. On the **Welcome** screen, click **Install**.
4. On the Setup Completed screen, click **Close**.

7.5 Configure Microsoft SQL Server 2016 Enterprise Edition

After SQL Server is installed, a few configuration changes need to be made to optimize SQL Server for the Data Warehouse Fast Track workload

To configure SQL Server, perform the steps in sections 7.5.1 through 7.5.7.

7.5.1 Add startup parameters

Add the **-E** startup parameter:

1. Open SQL Server Configuration Manager.
2. In the left-hand pane, click **SQL Server Services**.
3. Right-click the SQL Server (MSSQLSERVER) service and select Properties. The SQL Server (MSSQLSERVER) Properties dialog box appears.
4. Click the Startup Parameters tab.
5. In the **Specify a startup parameter** text box, enter **-E** and click **Add**.
6. Click **OK**. A **Warning** dialog box appears, saying that the service needs to be stopped and restarted in order for the changes to take effect. Click **OK**.
7. Right-click SQL Server (MSSQLSERVER) and select Restart.
8. Close SQL Server Configuration Manager.

7.5.2 Open SQL Server Management Studio

1. The **Connect to Server** dialog box appears.
2. In the **Server name** text box, enter the server name.
3. In the **Authentication** drop down list, select Windows Authentication.
4. Click **Connect**.

7.5.3 Turn on advanced configuration options

1. Click **New Query** on the toolbar.
2. Enter the following T-SQL:

```
EXECUTE sp_configure 'show advanced options', 1
GO
RECONFIGURE
GO
```

3. Click **!Execute** on the toolbar.

7.5.4 Set SQL Server maximum memory

Set the SQL Server maximum memory to 706 GB:

1. Click **New Query** on the toolbar.
2. Enter the following T-SQL:

```
EXECUTE sp_configure 'max server memory (MB)', '722944'
GO
RECONFIGURE
GO
```

3. Click **!Execute** on the toolbar.

7.5.5 Set the max degree of parallelism (MAXDOP)

1. Click **New Query** on the toolbar.
2. Enter the following T-SQL to set the max degree of parallelism to 20:

```
EXECUTE sp_configure 'max degree of parallelism', '20'
GO
RECONFIGURE
GO
```

3. Click **!Execute** on the toolbar.

7.5.6 Configure the resource governor

1. Click **New Query** on the toolbar.
2. Enter the following T-SQL to configure the resource governor to limit memory grants to 12 percent:

```
ALTER WORKLOAD GROUP [default]
WITH( request_max_memory_grant_percent = 12 )
GO
ALTER RESOURCE GOVERNOR RECONFIGURE;
GO
```

3. Click **!Execute** on the toolbar.

7.5.7 Expand tempdb files

1. Click **New Query** on the toolbar.
2. Enter the following T-SQL to expand the existing tempdb files, replacing *<log file size>* and *<data file size>* with the appropriate file size:

```
ALTER DATABASE tempdb MODIFY FILE
( NAME = N'templog',
  SIZE = <log file size> )
ALTER DATABASE tempdb MODIFY FILE
( NAME = N'tempdev',
  SIZE = <data file size> )
ALTER DATABASE tempdb MODIFY FILE
( NAME = N'temp2',
  SIZE = <data file size> )
ALTER DATABASE tempdb MODIFY FILE
( NAME = N'temp3',
  SIZE = <data file size> )
ALTER DATABASE tempdb MODIFY FILE
```

```
( NAME = N'temp4',  
  SIZE = <data file size> )  
ALTER DATABASE tempdb MODIFY FILE  
( NAME = N'temp5',  
  SIZE = <data file size> )  
ALTER DATABASE tempdb MODIFY FILE  
( NAME = N'temp6',  
  SIZE = <data file size> )  
ALTER DATABASE tempdb MODIFY FILE  
( NAME = N'temp7',  
  SIZE = <data file size> )  
ALTER DATABASE tempdb MODIFY FILE  
( NAME = N'temp8',  
  SIZE = <data file size> )
```

3. Click **!Execute** on the toolbar.

8 Verify the Deployment

Use telnet from a client machine to verify that applications can successfully connect to the database server.

Note: The telnet client must already be installed on the client machine.

Perform the following steps on a client machine:

1. Open command prompt.
2. Type **telnet <ip address> 1433**, replacing **<ip address>** with the IP address of the SQL Server machine, and press **Enter**. A blank screen will be displayed if the connection is successful.
3. Press **[Ctrl] + [C]** to close the telnet connection.
4. Type **quit** to exit telnet.
5. Close command prompt.

A Technical support and resources

[Dell.com/support](https://dell.com/support) is focused on meeting customer needs with proven services and support.

[Dell TechCenter](https://delltechcenter.com) is an online technical community where IT professionals have access to numerous resources for Dell EMC software, hardware and services.

[Storage Solutions Technical Documents](#) on Dell TechCenter provide expertise that helps to ensure customer success on Dell EMC Storage platforms.

A.1 Related documentation

See the following referenced or recommended resources related to this document:

- [Dell SQL Server Solutions](#)
- [Dell Data Warehouse Fast Track for SQL Server Advisor](#)
- [Dell Storage technical content on Dell TechCenter](#)