

Deploying the 385TB Data Warehouse Fast Track Reference Architecture for Microsoft SQL Server 2017 using Dell EMC PowerEdge R940 and SC9000

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 385TB configuration.

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Revisions

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November 2018	Initial release
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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 *385TB Data Warehouse Fast Track Reference Architecture for Microsoft SQL Server 2017 using Dell EMC PowerEdge R940 and SC9000*, available on the [SC Series technical documents](#) page. This guide also covers requirements for preparing the hardware platform and provisioning the OS to achieve a balanced, optimized 385TB configuration for a Microsoft SQL Server 2017 data warehouse by using Dell EMC™ PowerEdge™ R940 servers, Dell EMC SC9000 storage arrays, and Microsoft Data Warehouse Fast Track (DWFT) principles.

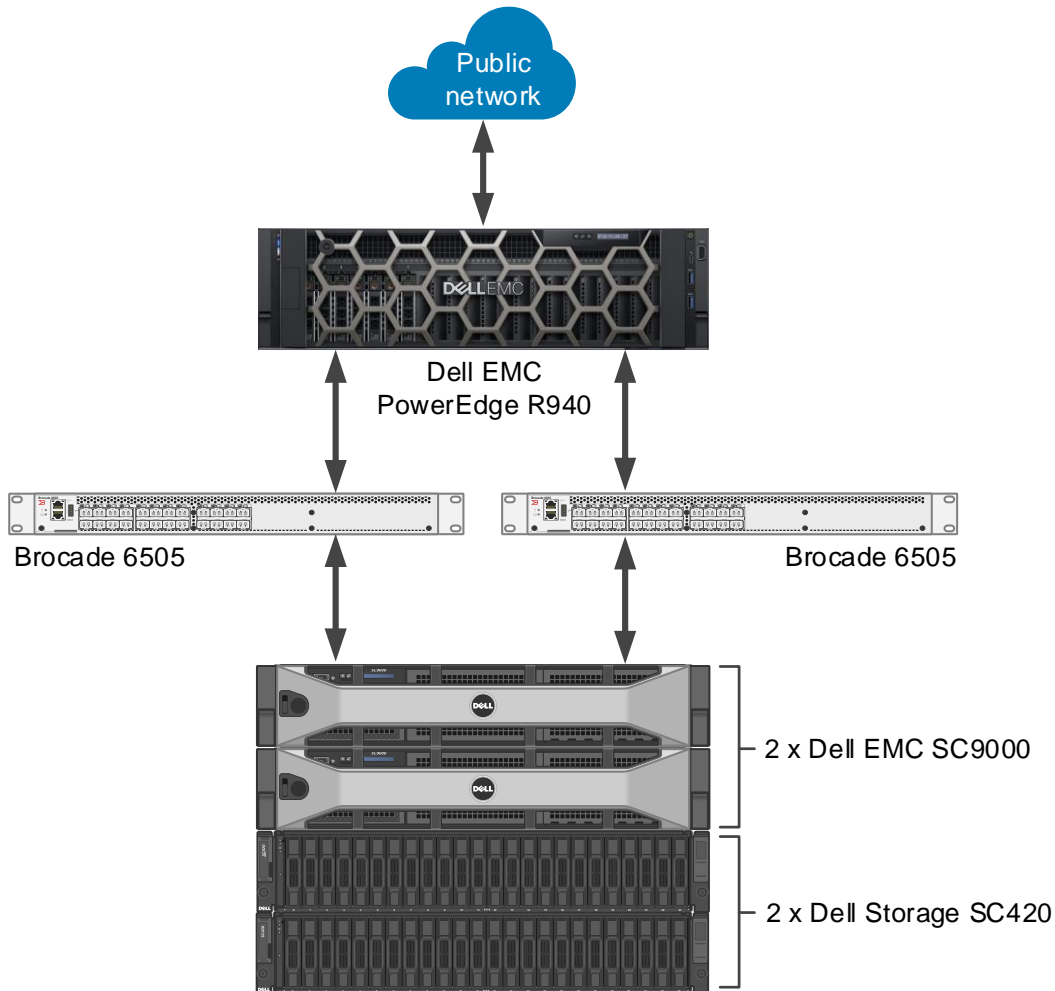


Figure 1 Single-server reference architecture

Note: The 385TB 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	PowerEdge R940	
	Processors	Four Intel® Xeon® Platinum 8168 Processors (2.7GHz, 24 cores, 48 threads)
	Total cores	96
	Total logical processors	192 (Intel Hyper-Threading Technology enabled)
	Total memory	3072GB
	Network adapters	Minimum of one network adapter (1Gbps or 10Gbps based on requirements) Recommended to have more than one network adapter with load balancing configured
	Host bus adapters	Eight QLogic® QLE2662 dual-port 16Gbps FC HBAs
Software	Operating system	Microsoft Windows Server® 2016 Enterprise Edition
	Database software	SQL Server 2017 Enterprise Edition
Storage	Storage array	SC9000 (SCOS v7.3.2)
	Disk drives	48 x 3.84TB read-intensive SSDs (2.5-inch SAS)
	SAN switches	Two Brocade® 6505 with 16Gbps SFPs

Table 2 Server firmware versions

Hardware component	Firmware version
BIOS	1.4.9
Backplane 1	3.56
Dell™ 64 Bit uEFI Diagnostics	4301A18
Dell OS Driver Pack	18.04.07,A00
Integrated Dell Remote Access Controller (iDRAC)	3.21.23.22
Broadcom® Gigabit 4P X520/I350 rNDC	20.8.4
Lifecycle Controller	3.21.23.22
OS Collector	3.0
Power supply	00.32.55
QLogic QLE2662	14.07.05
System CPLD	0.4.0
PowerEdge RAID Controller (PERC) H730P adapter	25.5.5.0005

2 Deployment workflow

This section outlines the sequence of deploying the 385TB Data Warehouse Fast Track for SQL Server 2017 reference architecture using the PowerEdge R940 server and SC9000 storage array.

To deploy the reference architecture, perform the following tasks:

1. Configure the SC9000 storage array.
2. Configure the PowerEdge R940 server.
3. Install and configure the Windows Server 2016 operating system.
4. Install and configure SQL Server 2017 Enterprise Edition.

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

3 Cabling requirements

Figure 2 shows how to cable the R940 server, the Fibre Channel (FC) switches, and the SC9000 storage array.

Port 1 on each host bus adapter (HBA) in the server and ports 1 and 2 on each HBA in the SC9000 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 SC9000 should be connected to the other Brocade 6505 switch.

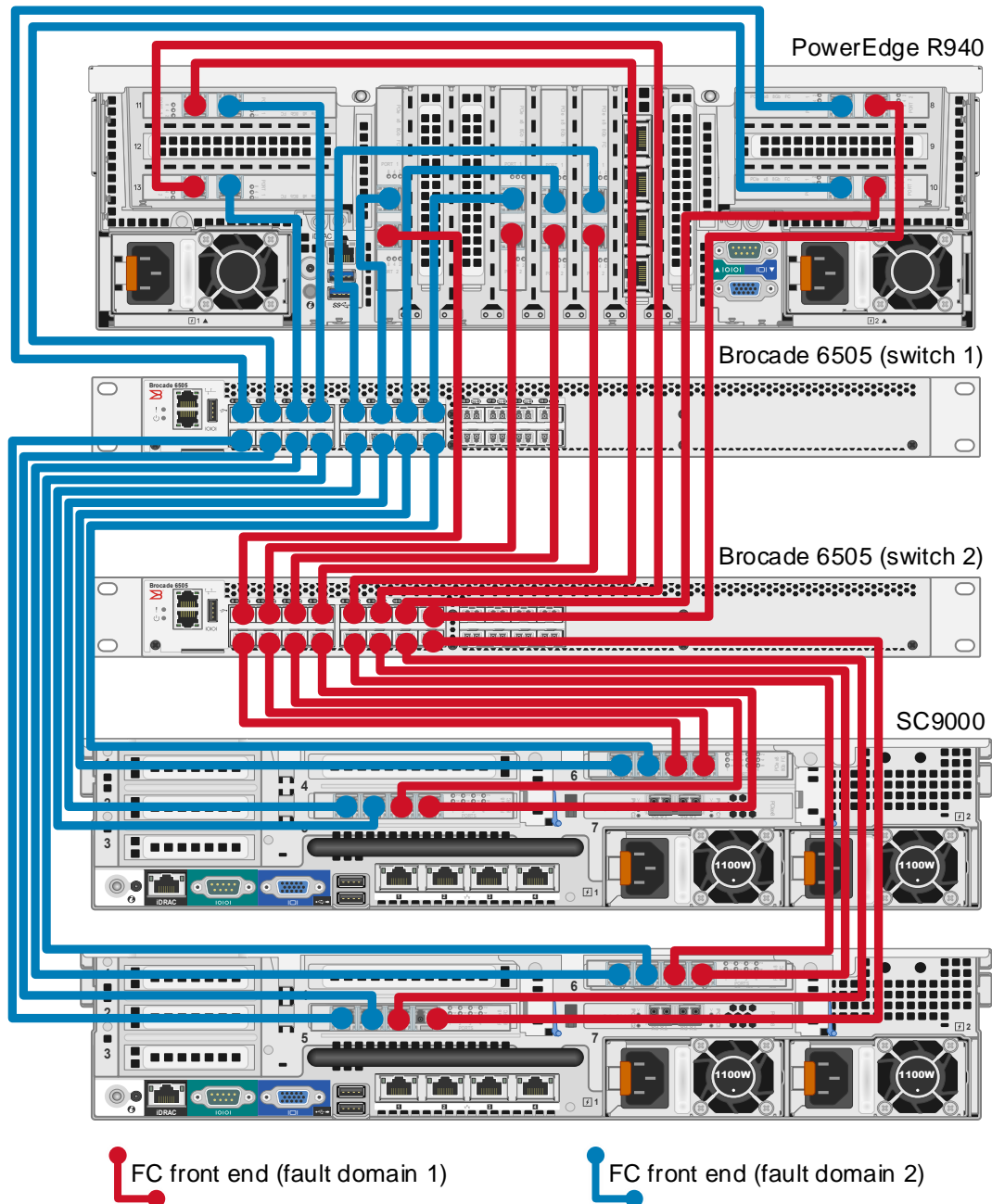


Figure 2 Single-server configuration cabling diagram

4 Configure SC9000 storage array

This section describes the configuration of the SC9000 storage array.

4.1 Configure local ports

Configure the FC ports to use two fault domains in virtual port mode. Put ports 1 and 2 from each HBA on each controller into fault domain 1, and put ports 3 and 4 from each HBA on each controller into fault domain 2.

4.2 Configure disks

Put all 48 disks in the Assigned disk folder. The distributed spare feature introduced in SCOS 7.3.1 makes all disks active, so none are reserved as dedicated spares.

4.3 Configure storage type

Configure the Assigned disk folder for single redundancy, using a 512 KB page size.

4.4 Allow storage profile selection

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 SC Series array.
2. Click the **Storage** tab.
3. Right-click the SC Series array 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 Create 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 SC Series array.
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**, set the **Snapshot RAID Type** for Tier 1, Tier 2, and Tier 3 to **Parity (RAID 5 / RAID 6)**.
7. Click **OK**.

4.6 Create 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 SC Series array.
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**.

4.7 Remove default snapshot profiles

Remove any default snapshot profiles by performing the following steps:

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

4.8 Create volumes

A total of thirteen SC Series volumes are used in the reference architecture and are listed in Table 3.

Table 3 SC Series volumes

Volume name	Storage profile	Volume size
MPSHost	Recommended (All Tiers)	1GB
SQLSystem	Recommended (All Tiers)	20GB
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
SQLData05	RAID 5 All Tiers	Site dependent
SQLData06	RAID 5 All Tiers	Site dependent
SQLData07	RAID 5 All Tiers	Site dependent
SQLData08	RAID 5 All Tiers	Site dependent
TempdbData01	Recommended (All Tiers)	Site dependent
TempdbData02	Recommended (All Tiers)	Site dependent

To create the SC Series volumes, perform the following steps:

1. Open the DSM client and connect to the SC Series array.
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**.

5 Configure PowerEdge R940 server

5.1 Update 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 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**:
 - a. Click **System Profile Settings**.
 - b. In the **System Profile** drop-down list, select **Performance**.
 - c. 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 HBAs to default settings

The HBAs can be reset using QLogic Fast!UTIL, which 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 ports have been configured.

5.4 Configure HBAs

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

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 ports have been configured.

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 R940 server.

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** if not 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 screen, **Which type of installation do you want?**, click **Custom: Install Windows only (advanced)**.
14. On the screen, **Where do you want to install Windows?**, 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, perform the following prerequisite steps:

1. Press **[Ctrl]+[Alt]+[Delete]** and log in 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, perform 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 the 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, log in as Administrator.

6.2.8 Apply MPIO best practices

To apply best practices settings to the server, use the PowerShell script provided in the best-practices document, [Dell EMC SC Series Storage and Microsoft Multipath I/O](#). After running the PowerShell script, reboot the server. When the server is back online, log in 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, log in 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 the Computer Management window.

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 the Computer Management window.

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 SC Series volumes for use by Windows.

6.3.1 Change the operating system definition in the SC Series array

The SC Series 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 SC Series array.
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 Map and format the volumes.

All volumes 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
SQLData05	M:\ft\SQLData05	SQLData05	64K
SQLData06	M:\ft\SQLData06	SQLData06	64K
SQLData07	M:\ft\SQLData07	SQLData07	64K
SQLData08	M:\ft\SQLData08	SQLData08	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 SC Series array.
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 the **File Explorer**.
 - b. Select the mount point (for example, M:\ft\SQLData01) in the directory tree.
 - c. Right-click the mount point, select **New**, and select **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 2017 Enterprise Edition

7.1 Install Microsoft SQL Server 2017 Enterprise Edition

To install SQL Server 2017 Enterprise Edition, perform the following steps:

1. Insert the SQL Server 2017 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 2017 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 the **Grant Perform Volume Maintenance Task** privilege to **SQL Server Database Engine Service**.

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**.
- b. Leave the remaining directory text boxes as-is.

On the **TempDB** tab:

- a. In the **Number of files** list box, enter **8**.
 - b. Remove existing directories in the Data directories list box. Select the directory and click **Remove**.
 - c. Add the directory **M:\ft\TempdbData01\Data**. Click **Add**. The Browse for Folder dialog box appears. Select the folder and click **OK**.
 - d. Add the directory **M:\ft\TempdbData02\Data**. Click **Add**. The Browse for Folder dialog box appears. Select the folder and click **OK**.
 - e. In the **Log directory** list box, enter **M:\ft\SQLLog\Data**.
 - f. 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 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 file (for example, SSMS-Setup-ENU.exe).
3. On the **Welcome** screen, click **Install**.
4. On the **Setup Completed** screen, click **Close**.

7.3 Configure Microsoft SQL Server 2017 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 the following subsections.

7.3.1 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**.

7.3.2 Turn on advanced configuration options

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

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

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

7.3.3 Set SQL Server maximum memory

Set the SQL Server maximum memory to 3040 GB:

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

```
EXECUTE sp_configure 'max server memory (MB)', '3112960'  
GO  
RECONFIGURE  
GO
```

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

7.3.4 Set the max degree of parallelism (MAXDOP)

During rowstore tests, MAXDOP=16 was used for I/O testing and MAXDOP=72 was used for CPU testing. For columnstore tests, MAXDOP=96 was used.

1. Click **New Query** on the toolbar.
2. Enter the following T-SQL commands to set the maximum degree of parallelism to 96:

```
EXECUTE sp_configure 'max degree of parallelism', '96'  
GO  
RECONFIGURE  
GO
```

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

7.3.5 Configure the resource governor

During rowstore I/O tests, resource governor was set to 5. For all other tests, it was set to 12.

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

7.3.6 Expand tempdb files

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

[Storage technical documents and videos](#) 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](#)
- 385TB Data Warehouse Fast Track Reference Architecture for Microsoft SQL Server 2017 using Dell EMC PowerEdge R940 and SC9000, available at [SC Series technical documents](#)