Deploying the 55TB Data Warehouse Fast Track Reference Architecture for Microsoft SQL Server 2014 using PowerEdge R730 and Dell Storage SC4020

Dell Storage Engineering
December 2015
Revisions

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>December 2015</td>
<td>Initial release</td>
</tr>
</tbody>
</table>

Acknowledgements

Author: Mike Matthews, Dell Storage Applications Engineering

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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, *55TB Data Warehouse Fast Track Reference Architecture for Microsoft SQL Server 2014 using PowerEdge R730 and Dell Storage SC4020*. This guide also covers requirements for preparing the hardware platform and provisioning the OS to achieve a balanced, optimized 55TB configuration for a Microsoft SQL Server 2014 data warehouse by using Dell™ PowerEdge™ R730 servers, Dell Storage SC4020 storage arrays, and Microsoft Data Warehouse Fast Track (DWFT) principles.

![Diagram of single server reference architecture](image)

**Figure 1** Single server reference architecture

**Note:** The 55TB 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

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server</td>
<td>PowerEdge R730</td>
</tr>
<tr>
<td>Processors</td>
<td>2 x Intel® Xeon® Processor E5-2697 v3 (2.6Ghz, 14 cores, 28 threads)</td>
</tr>
<tr>
<td>Total cores</td>
<td>28</td>
</tr>
<tr>
<td>Total logical processors</td>
<td>56 (Intel Hyper-Threading Technology enabled)</td>
</tr>
<tr>
<td>Total memory</td>
<td>768 GB</td>
</tr>
<tr>
<td>Network adapters</td>
<td>Minimum of one network adapter (1Gbps or 10Gbps based on requirements)</td>
</tr>
<tr>
<td></td>
<td>Recommended to have more than one network adapter with load balancing configured</td>
</tr>
<tr>
<td>Host bus adapters</td>
<td>4 x QLogic® QLE2562 dual port 8 Gbps FC HBA</td>
</tr>
<tr>
<td>Software</td>
<td>Operating system Microsoft® Windows Server® 2012 R2 Standard Edition</td>
</tr>
<tr>
<td>Database software</td>
<td>SQL Server 2014 Enterprise Edition</td>
</tr>
<tr>
<td>Storage</td>
<td>Storage array 1 x Dell Storage SC4020 (SCOS v6.5.20)</td>
</tr>
<tr>
<td>Disk drives</td>
<td>18 x 1.6 TB read intensive SSDs (2.5” SAS)</td>
</tr>
<tr>
<td>SAN switches</td>
<td>2 x Brocade® 6505 with 8 Gbps SFPs</td>
</tr>
</tbody>
</table>

Table 2 Server firmware versions

<table>
<thead>
<tr>
<th>Hardware component</th>
<th>Firmware version</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS</td>
<td>1.1.4</td>
</tr>
<tr>
<td>Dell 64 Bit uEFI Diagnostics</td>
<td>4239A14</td>
</tr>
<tr>
<td>Dell OS Single Driverpack for 13G</td>
<td>14.10.00, A00</td>
</tr>
<tr>
<td>Integrated Dell Remote Access Controller</td>
<td>2.02.01.01</td>
</tr>
<tr>
<td>Intel Ethernet 10G 4P X520/i350 rNDC</td>
<td>16.0.24</td>
</tr>
<tr>
<td>Intel Gigabit 4P X520/i350 rNDC</td>
<td>16.0.24</td>
</tr>
<tr>
<td>Lifecycle Controller</td>
<td>2.02.01.01</td>
</tr>
<tr>
<td>Hardware component</td>
<td>Firmware version</td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>OS Collector</td>
<td>OSC_1.0</td>
</tr>
<tr>
<td>Power Supply</td>
<td>00.24.35</td>
</tr>
<tr>
<td>System CPLD</td>
<td>1.0.1</td>
</tr>
</tbody>
</table>
2 Deployment workflow

This section outlines the sequence of deploying the 55TB Data Warehouse Fast Track for SQL Server 2014 reference architecture using the Dell PowerEdge R730 server and Dell Storage SC4020 storage array.

To deploy the reference architecture, perform the following tasks:

1. Configure the Dell Storage SC4020 storage array.
2. Configure the Dell PowerEdge R730 server.
3. Install and configure Microsoft Windows Server 2012 R2 operating system.

This guide assumes the reader has a general understanding of installing and configuring Microsoft Windows servers, Microsoft SQL Server, and Dell Storage 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 SC4020 storage array.

Port 1 on each host bus adapter (HBA) in the server and ports 1 and 2 on each module in the SC4020 should be connected to the same Brocade 6505 switch. Port 2 on each HBA in the server and ports 3 and 4 on each module in the SC4020 should be connected to the other Brocade 6505 switch.

Figure 2  Single server configuration cabling diagram
4 Configure the Dell Storage SC4020 storage array
This section describes the configuration of the SC4020 storage array.

4.1 Configure local ports
The front-end Fibre Channel (FC) ports and back-end SAS ports can be configured using the Configure Local Ports wizard.

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 0 and ports 3 and 4 from each controller put into fault domain 1. In addition, all eight ports should be configured as front-end ports by selecting Front End for the purpose.

All four SAS ports should be configured as back-end ports by selecting Back End for the purpose.

4.2 Configure disks
All 18 disks should be added to the Assigned disk folder. One disk should be defined as a hot spare, leaving 17 active disks.

4.3 Configure the disk folder
The Assigned disk folder should be configured for single redundancy, using a 2MB page size.

4.4 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 Storage Center GUI.
2. Expand Storage.
3. Right-click Storage Profiles and select Create Storage Profile. The Create Storage Profile dialog box appears.
4. In the RAID Type Used frame, select RAID 5/RAID 6 only.
5. In the Storage Tiers Used frame, select all tiers and click Continue.
6. In the Name textbox, type RAID 5 All Tiers.
7. Click Create Now.
4.5 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 Storage Center GUI.
2. Right-click Servers and select Create Server. The Create Server dialog box appears.
3. Select all eight FC ports for the server and click Continue.
4. In the server folder list, select the desired server folder.
5. In the Name textbox, enter the name of the server.
6. In the Operating System drop-down list, select Windows 2012 and click Continue. (The operating system definition will be changed after Windows has been installed.)
7. Click Create Now.

4.6 Create the volumes

A total of 14 Storage Center volumes are used in the reference architecture and are listed in Table 3.

Table 3 Storage Center volumes

<table>
<thead>
<tr>
<th>Volume name</th>
<th>Storage profile</th>
<th>Volume size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boot</td>
<td>Recommended (All Tiers)</td>
<td>200 GB</td>
</tr>
<tr>
<td>MPhost</td>
<td>Recommended (All Tiers)</td>
<td>1 GB</td>
</tr>
<tr>
<td>SQLSystem</td>
<td>Recommended (All Tiers)</td>
<td>20 GB</td>
</tr>
<tr>
<td>SQLLog</td>
<td>Recommended (All Tiers)</td>
<td>Site Dependent</td>
</tr>
<tr>
<td>SQLData01</td>
<td>RAID 5 All Tiers</td>
<td>Site Dependent</td>
</tr>
<tr>
<td>SQLData02</td>
<td>RAID 5 All Tiers</td>
<td>Site Dependent</td>
</tr>
<tr>
<td>SQLData03</td>
<td>RAID 5 All Tiers</td>
<td>Site Dependent</td>
</tr>
<tr>
<td>SQLData04</td>
<td>RAID 5 All Tiers</td>
<td>Site Dependent</td>
</tr>
<tr>
<td>SQLData05</td>
<td>RAID 5 All Tiers</td>
<td>Site Dependent</td>
</tr>
<tr>
<td>SQLData06</td>
<td>RAID 5 All Tiers</td>
<td>Site Dependent</td>
</tr>
</tbody>
</table>
To create the Storage Center volumes, perform the following steps:

1. Open the Storage Center GUI.
2. Configure volume defaults to allow a Storage Profile to be selected:
   a. Right-click the Storage Center name in the upper left-hand side of the screen and select *Configure My Volume Defaults*.
   b. Click the **Advanced** tab. (The **Advanced** tab looks like a button.)
   c. Select **Allow Storage Profile selection** and click **OK**.
3. Expand *Storage* in the pane on the left-hand side of the screen.
4. 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 **Size** text box, enter the volume size.
   c. Click **Advanced**.
   d. Select the appropriate storage profile and click **Continue**.
   e. Deselect any selected Replay Profiles and click **Continue**.
   f. Select the desired volume folder.
   g. In the **Name** text box, enter the volume name.
   h. Click **Continue** and click **OK**.
4.7 Map the boot volume to the server

Since the server is not using the MPIO version of the Windows Server 2012 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 Storage Center GUI.
2. Expand the volume folder that contains the boot volume.
3. Right-click the boot volume and select Map Volume to Server.
4. Select the server and click Continue.
5. Click Advanced.
6. Select Map volume using LUN 0 and click Continue.
7. Click Create Now.
Configure the Dell 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. On **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 Configure the HBAs

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

To configure 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.
11. In Select Host Adapter, select the first port in the list and press Enter.
12. 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.
13. 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. Set Execution Throttle to 256.
      vi. Press Esc to exit Advanced Adapter Settings.
   e. Press Esc to exit Configuration Settings. When prompted, select Save Changes and press Enter.
15. In Select Host Adapter, select the next port in the list and press Enter.
16. Using the instructions in steps 3 and 4, reset the port to factory defaults and set the parameters according to best practices. Repeat these steps until all 8 ports have been configured.
5.4 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 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.
17. In Select Host Adapter, select the first port in the list and press Enter.
18. 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.
21. 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.
22. Press Esc to exit Configuration Settings. When prompted, select Save changes and press Enter.
23. 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 2012 R2

6.1 Install Microsoft Windows Server 2012 R2

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.)
7. Insert the Windows Server 2012 R2 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
11. On the Select the operating system you want to install screen, select Windows Server 2012 R2 Standard (Server with a GUI) and click Next.
12. On the License terms screen, accept the license terms by clicking on I accept the license terms and click Next.
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 Settings screen, enter the Administrator password and click Finish.
6.2 Configure Microsoft Windows Server 2012 R2

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, log in 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.
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.
39. In the Properties pane, click Disabled next to the label Remote Desktop. The System Properties box appears.
40. In the Remote Desktop pane, select Allow Remote connections to this computer.
41. A Remote Desktop Connection dialog box appears, stating that the Remote Desktop Firewall exception will be enabled. Click OK.
42. Click OK.

6.2.4 Install the .NET Framework 3.5 and Multipath I/O features

1. In Server Manager, click Local Server on the left-hand side of the screen.
43. Scroll down until the Roles and Features pane is visible.
44. 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.
45. On the Before you begin screen, click Next.
46. On the Select installation type screen, select Role-based or feature-based installation, and click Next.
47. On the Select destination server screen, select the server and click Next.
48. On the Select server roles screen, click Next without selecting any roles.
49. On the Select features screen, do the following:
   b. Scroll down and select Multipath I/O.
   c. Click Next.
51. On the Confirm installation selections screen, click Specify an alternate source path. A box appears.
52. In the Path text box, enter E:\Sources\SxS\ and click OK. If the Windows install disk is mounted using a different drive letter, use that drive letter instead of E:\.
53. Click Install.
54. When the installation is complete, click Close.
55. 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 Date and Time dialog box will appear.
3. Click Change time zone. The Time Zone Settings box will appear.
4. In the Time zone drop-down list, select the correct time zone and click OK.
5. Click OK.

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 box appears.
4. Click Add. The Add MPIO Support 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 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.

6.2.9 Configure Windows Updates (optional)
1. Open Control Panel.
2. Click the Windows Update icon.
3. In the Windows Update window, click Change settings.
4. In the Change settings window, under Important Updates, select Download updates but let me choose whether to install them.
5. Click OK. Windows Update will check for updates.
6. After the update check is complete, click XX important updates are available, where XX is the number of important updates.
7. On the Select the updates you want to install screen, leave all of the important updates selected and click Install.
8. After installation has completed, you will need to reboot the server. Click Restart now. When the server comes back online, log in as Administrator.
9. Repeat the process to check for Windows updates and install any important updates, until no more important updates are available.
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.
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.

Lock pages in memory

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

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

Change the optical drive letter (optional)

Change the drive letter for the optical drive to Z:

1. Open Computer Management.
2. Click Disk Management.
3. 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.
4. Click Change. The Change Drive Letter or Path box appears.
5. Select Z from the drop-down list of drive letters and click OK.
6. A Disk Management dialog box will appear asking if you want to continue. Click Yes.
6.2.13 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 Storage Center GUI.
2. Expand the server folder that contains the server object.
3. Right-click the server and select Properties. The Server Properties – FastTrack4S box appears.
4. In the Operating System drop-down list, select Windows 2012 MPIO and click OK.

6.3.2 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.
50. In Select Host Adapter, select the first port in the list and press Enter.
51. 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 51), configure each HBA port to boot from SAN. Repeat the instructions until all 8 ports have been configured.
52. Press Esc to exit Fast!UTIL. When prompted, select Reboot System and press Enter. The server will reboot.
6.3.3 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>
<thead>
<tr>
<th>Volume name</th>
<th>Drive letter/ mount point</th>
<th>Volume label</th>
<th>Allocation unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPHhost</td>
<td>M:\</td>
<td>MPHhost</td>
<td>Default</td>
</tr>
<tr>
<td>SQLSystem</td>
<td>M:\ft\SQLSystem</td>
<td>SQLSystem</td>
<td>64K</td>
</tr>
<tr>
<td>SQLLog</td>
<td>M:\ft\SQLLog</td>
<td>SQLLog</td>
<td>64K</td>
</tr>
<tr>
<td>SQLData01</td>
<td>M:\ft\SQLData01</td>
<td>SQLData01</td>
<td>64K</td>
</tr>
<tr>
<td>SQLData02</td>
<td>M:\ft\SQLData02</td>
<td>SQLData02</td>
<td>64K</td>
</tr>
<tr>
<td>SQLData03</td>
<td>M:\ft\SQLData03</td>
<td>SQLData03</td>
<td>64K</td>
</tr>
<tr>
<td>SQLData04</td>
<td>M:\ft\SQLData04</td>
<td>SQLData04</td>
<td>64K</td>
</tr>
<tr>
<td>SQLData05</td>
<td>M:\ft\SQLData05</td>
<td>SQLData05</td>
<td>64K</td>
</tr>
<tr>
<td>SQLData06</td>
<td>M:\ft\SQLData06</td>
<td>SQLData06</td>
<td>64K</td>
</tr>
<tr>
<td>SQLData07</td>
<td>M:\ft\SQLData07</td>
<td>SQLData07</td>
<td>64K</td>
</tr>
<tr>
<td>SQLData08</td>
<td>M:\ft\SQLData08</td>
<td>SQLData08</td>
<td>64K</td>
</tr>
<tr>
<td>TempdbData01</td>
<td>M:\ft\TempdbData01</td>
<td>TempdbData01</td>
<td>64K</td>
</tr>
<tr>
<td>TempdbData02</td>
<td>M:\ft\TempdbData02</td>
<td>TempdbData02</td>
<td>64K</td>
</tr>
</tbody>
</table>

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

1. Map the volume on the Storage Center:
   a) Open the Storage Center GUI.
b) Expand the volume folder containing the volume.
c) Right-click the volume and select Map Volume to Server. The Map Volume to Server box appears.
d) Expand the server folder containing the server object.
e) Select the server object and click Continue.
f) Review the information and click Create Now.

2. Format the volume on the Windows server:
   a) Open Computer Management.
   b) Expand Storage.
   c) Right-click Disk Management and select Rescan Disks. Continue to rescan disks until the new disk appears. It may take multiple rescans.
   d) Right-click the new disk and select Online.
   e) Right-click the new disk and select Initialize Disk. The Initialize Disk dialog box appears.
   f) Under Use the following partition style for the selected disks, select MBR for volumes that are less than 2TB. Select GPT for volumes that are 2TB or larger.
   g) Click OK.
   h) Right-click the unallocated space of the new disk and select New Simple Volume…
   j) Click Next.
   k) On the Specify Volume Size screen, keep the default size, and click Next.
   l) 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.
   m) On the Format Partition screen:
      i. In the File system drop down list, select NTFS.
      ii. In the Allocation unit size, select the value from Table 4.
      iii. In the Volume label text box, enter the value from Table 4 and click Next.
   n) 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.

6.3.4 Configure MPIO for the SQL Server data volumes

Each SQL Server data volume needs to be configured with an MPIO policy of failover-only, with a unique active path. Each volume will have 16 paths to choose from. When choosing the active path, first sort by Path Id, and then select the path number listed in Table 5. The path number is the position of the path within the list that is sorted by Path Id. For example, if the path number is 4, choose the 4th path in the sorted list of paths.

<table>
<thead>
<tr>
<th>Volume</th>
<th>Active path number</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQLData01</td>
<td>1</td>
</tr>
<tr>
<td>SQLData02</td>
<td>3</td>
</tr>
<tr>
<td>SQLData03</td>
<td>6</td>
</tr>
<tr>
<td>SQLData04</td>
<td>8</td>
</tr>
<tr>
<td>SQLData05</td>
<td>11</td>
</tr>
<tr>
<td>SQLData06</td>
<td>9</td>
</tr>
<tr>
<td>SQLData07</td>
<td>16</td>
</tr>
<tr>
<td>SQLData08</td>
<td>14</td>
</tr>
</tbody>
</table>
For each volume listed in Table 5, perform the following steps on the Windows server:

1. Open Computer Management.
2. Expand Storage.
3. Click Disk Management.
4. Right-click the Windows disk for the volume and select Properties. The disk properties box will appear.
5. Click the MPIO tab.
6. In the Select the MPIO policy drop-down list, select Fail Over Only.
7. In the path list, select all paths and click Edit... The MPIO Path Details box will appear.
8. In the Path State drop-down list, select Standby and click OK.
9. In the path list, select the path that should be active and click Edit... (Note: Clicking Path Id may not sort the path list properly.) The MPIO Path Details box will appear.
10. In the Path State drop-down list, select Active/Optimized and click OK.
11. Click OK.
7 Install and Configure Microsoft SQL Server 2014 Enterprise Edition

7.1 Install Microsoft SQL Server 2014 Enterprise Edition

To install SQL Server 2014 Enterprise Edition, perform the following steps:

1. Insert the SQL Server 2014 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 on New SQL Server stand-alone installation or add features to an existing installation. The SQL Server 2014 Setup 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 Install Rules screen, verify all tests passed and click Next.
10. 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
    > Management Tools – Basic
    > Management Tools – Complete
12. 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.
    > On the Collation tab, leave the Collation at the default setting and click Next.
13. On the **Database Engine Configuration** screen, do the following:
   > On the **Server Configuration** tab:
     a. Select **Mixed Mode**.
     d. Enter and confirm the sa password.
     e. Click **Add Current User**.
   > On the **Data Directories** tab:
     a. In the **Data root directory** text box, enter `M:\ft\SQLSystem`.
     f. Leave the remaining directory text boxes as-is.
   > On the **FILESTREAM** tab (optional), select **Enable FILESTREAM for Transaction-SQL access** and click **Next**.
14. On the **Ready to Install** screen, click **Install**.
15. On the **Complete** screen, click **Close**.
16. Close the **SQL Server Installation Center** window.
17. Remove the SQL Server install media.

### 7.2 Configure Microsoft SQL Server 2014 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 in order.

#### 7.2.1 Add startup parameters

Add the **–E** and **–T1117** startup parameters:

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** box appears.
4. Click the **Startup Parameters** tab.
5. In the **Specify a startup parameter** text box, enter **–E** and click **Add**.
6. In the **Specify a startup parameter** text box, enter **–T1117** and click **Add**.
7. 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**.
8. Right-click **SQL Server (MSSQLSERVER)** and select **Restart**.
9. Close SQL Server Configuration Manager.

#### 7.2.2 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**.

#### 7.2.3 Turn on advanced configuration options

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

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

53. Click Execute on the toolbar.

### 7.2.4 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:

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

54. Click Execute on the toolbar.

### 7.2.5 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:

```sql
EXECUTE sp_configure max degree of parallelism', '28'
GO
RECONFIGURE
GO
```

55. Click Execute on the toolbar.

### 7.2.6 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:

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

56. Click Execute on the toolbar.
7.2.7 Configure tempdb

1. Move the existing tempdb files:
   a. Click **New Query** on the toolbar.
   b. Enter the following T-SQL to move the existing tempdb files:

   ```sql
   ALTER DATABASE tempdb MODIFY FILE 
   ( NAME = N'templog', 
     FILENAME = N'M:\ft\SQLLog\Data\templog.ldf' )
   ALTER DATABASE tempdb MODIFY FILE 
   ( NAME = N'tempdev', 
     FILENAME = N'M:\ft\TempdbData01\Data\tempdb.mdf' )
   ``
   c. Click **Execute** on the toolbar.
   d. Restart the SQL Server service.
   e. Right-click the instance name on the left-hand side of the screen and select **Restart**.
   f. A popup box asks if you want to continue. Click **Yes**.
   g. A second popup box asks if you want to continue. Click **Yes**.

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

   ```sql
   ALTER DATABASE tempdb MODIFY FILE 
   ( NAME = N'templog', 
     SIZE = <data file size> )
   ALTER DATABASE tempdb MODIFY FILE 
   ( NAME = N'tempdev', 
     SIZE = <log file size> )
   ``
   c. Click **Execute** on the toolbar.

58. Add 7 more data files for tempdb. All tempdb data files should be the same size.
   a. Click **New Query** on the toolbar.
   b. Enter the following T-SQL to add 7 tempdb data files, replacing `<data file size>` with the appropriate file size:

   ```sql
   ALTER DATABASE tempdb ADD FILE 
   ( NAME = N'tempdev2', 
     FILENAME = N'M:\ft\TempdbData01\Data\tempdev2.ndf', 
     SIZE = <data file size> )
   ALTER DATABASE tempdb ADD FILE 
   ( NAME = N'tempdev3', 
     FILENAME = N'M:\ft\TempdbData01\Data\tempdev3.ndf', 
     SIZE = <data file size> )
   ALTER DATABASE tempdb ADD FILE 
   ( NAME = N'tempdev4', 
     FILENAME = N'M:\ft\TempdbData01\Data\tempdev4.ndf', 
     SIZE = <data file size> )
   ALTER DATABASE tempdb ADD FILE 
   ( NAME = N'tempdev5', 
     FILENAME = N'M:\ft\TempdbData02\Data\tempdev5.ndf', 
     SIZE = <data file size> )
   ```
ALTER DATABASE tempdb ADD FILE
  ( NAME = N'tempdev6',
    FILENAME = N'M:\ft\TempdbData02\Data\tempdev6.ndf',
    SIZE = <data file size> )
ALTER DATABASE tempdb ADD FILE
  ( NAME = N'tempdev7',
    FILENAME = N'M:\ft\TempdbData02\Data\tempdev7.ndf',
    SIZE = <data file size> )
ALTER DATABASE tempdb ADD FILE
  ( NAME = N'tempdev8',
    FILENAME = N'M:\ft\TempdbData02\Data\tempdev8.ndf',
    SIZE = <data file size> )

59. 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 + ]** to close the telnet connection.
4. Type `quit` to exit telnet.
5. Close **Command Prompt**.
A Additional resources

A.1 Technical support and resources

For Copilot support of Dell SC Series products:

- Global online support
- Email: support@compellent.com (non-emergency business hours)
- Phone: 866-EZ-STORE (866-397-8673) (United States only)

The Dell SC Series Portal is an online portal for existing customers. A valid portal account is required to access the Knowledge Center. Once logged in to the portal, click Knowledge Center.

Dell TechCenter is an online technical community for IT professionals and is a great resource to discover and learn about a wide range of technologies such as storage, servers, networking, software, and cloud management.

A.2 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