Deploying SharePoint 2016 utilizing Dell Storage SC Series arrays

Best Practices

Dell Engineering
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A Dell Best Practices Guide

Revisions

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1 Introduction

This document provides best practice recommendations and many step-by-step procedures for:

- Storage configuration for each server in a Microsoft® SharePoint® 2016 farm.
- SharePoint 2016 running in a virtualized environment.
- Installation of SharePoint 2016.
- Enabling and configuring SharePoint Binary Large Object (BLOB) cache.
- Changing the search index location to a Dell™ Storage SC Series volume.

1.1 Audience

This document is highly technical and is intended for storage and systems administrators who manage Microsoft SharePoint Server 2016 in a physical or virtual environment utilizing a Dell Storage SC Series array. Readers should have a good working knowledge of Microsoft SharePoint 2016, Microsoft Windows Server® 2012 R2, Microsoft Hyper-V®, and the Dell Storage SC Series array.

1.2 Purpose

This document provides an overview of Microsoft SharePoint Server 2016, and introduces best practice guidelines and additional guidance for the process of deploying SharePoint Server 2016 utilizing Dell Storage SC Series volumes.

2 Product overview

A brief overview of the major components that comprise the tested environment is provided in this section.

2.1 Dell Storage SC Series overview

The Dell Storage SC Series array is an enterprise-class storage area network (SAN) that lowers capital expenditures, reduces storage management and administration time, provides continuous data availability and enables storage virtualization. The SC Series Fluid Data Architecture manages data dynamically at the block-level, maximizing utilization, automating tiered storage, simplifying replication and speeding data recovery.

2.2 Microsoft SharePoint 2016 overview

Microsoft SharePoint 2016 is a web application platform that is primarily used for business collaboration. SharePoint 2016 provides intranet portals, content management, file sharing, identity management, search, business connectivity services, and more.

A typical SharePoint 2016 environment consists of at least 3 servers: A front-end web server, an application server, and a Microsoft SQL database server. A logical grouping of SharePoint servers that share common resources is referred to as a farm. SharePoint 2016 is a scalable solution; servers can be added to the farm as business needs and size change. These servers can include additional front-end web servers, dedicated application servers to service roles such as query, index, content processing and analytics, Microsoft Office Web Apps servers, and additional SQL database servers.

New to SharePoint 2016 is the MinRole feature. When SharePoint 2016 is installed, the role of that server in a farm topology is selected (Front-end, Application, Distributed Cache, Search, Custom, or Single-Server Farm) and SharePoint configures only the services for the selected role on that server, optimizing performance for each server in the farm.

All SharePoint 2016 servers can be hosted on dedicated physical servers, or in a virtualized environment.

2.3 Microsoft Hyper-V overview

Hyper-V is a layer of software that sits between the physical server hardware layer and the Hyper-V guest virtual machines (VMs). Hyper-V presents hardware resources in a virtualized manner from the host server to the guest VMs. Hyper-V hosts (also referred to as nodes or virtualization servers) can host multiple Hyper-V guest VMs, which are isolated from each other but share the same underlying hardware resources (e.g. processors, memory, networking, and other I/O devices).

Consolidating traditional physical servers to virtual servers on a single host server has many advantages: increased agility, better resource utilization, increased power efficiency and reduced operational and maintenance costs. In addition, Hyper-V guest VMs and the associated management tools offer greater flexibility for managing resources, balancing load, provisioning systems, and ensuring quick recovery.

2.4 Deployment environment overview

For consistency purposes, all screenshots and examples in this document are from the servers or Hyper-V guest VMs running Windows Server 2012 R2. The initial release of SharePoint 2016 (in May 2016) was used for deployment.

3 Server storage configuration

Prior to installing SharePoint 2016, properly configure the storage on each server that will reside in the farm for each SharePoint farm server role. In the following section, storage configurations are detailed for each SharePoint farm server role.

Note: As a best practice, system files and SharePoint 2016 application data should not reside on the same volume. The following section assumes that a system volume is already mapped and configured for each of the SharePoint 2016 farm server roles.

3.1 SQL server storage configuration

It is highly recommended that the reader review the *Dell Storage SC Series Arrays and Microsoft SQL Server* Best Practices Guide before proceeding.

At a minimum, five SC Series volumes should be provisioned to the SQL Server. As called out in the table below, the specific volumes that host SharePoint 2016 data require higher performance and should be located in a disk pool with faster disks if possible.

Table 1 SQL server volume provisioning recommendations

File Type	Number of Volumes	Volume performance requirements
Data root directory (includes system DBs)	1 per instance	Lower performance may be acceptable
Tempdb data and transaction log	1 per instance	High performance may be required
Native SQL Server backup	1 per instance	Lower performance may be acceptable
SharePoint DB data	At least 1 per instance	High performance required
SharePoint DB transaction log	At least 1 per instance	High performance required

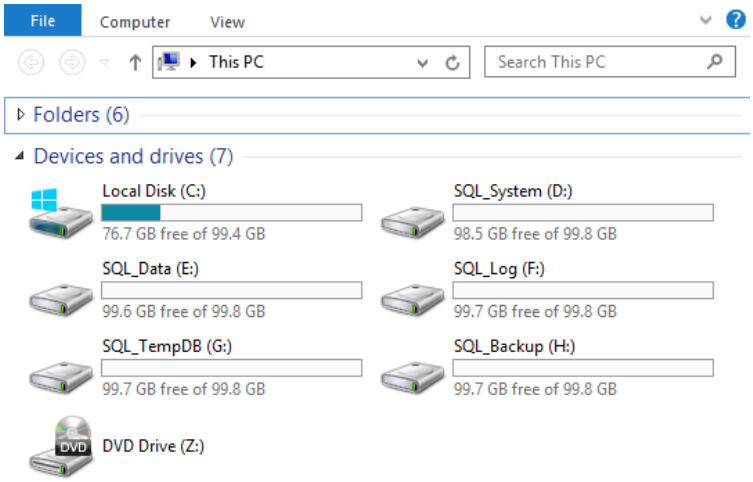


Figure 1 SQL server disk configuration example

Note: For best performance, host SharePoint 2016 content databases and associated logs individually on separate SC Series volumes. Provision two SC Series volumes for a SharePoint 2016 content database that is to be hosted on the SQL server. Place the database on one of the volumes and the log on the other. For information on how to change database and log location, refer to Microsoft TechNet.

A complete listing of all SharePoint 2016 databases can be found on Microsoft TechNet.

3.2 Application and front-end web server storage configuration

Provision at least one SC Series volume to both an application and a front-end web server. During the SharePoint installation, change install paths to point to the SC Series volume. SharePoint 2016 installation details are in section 5 of this document.

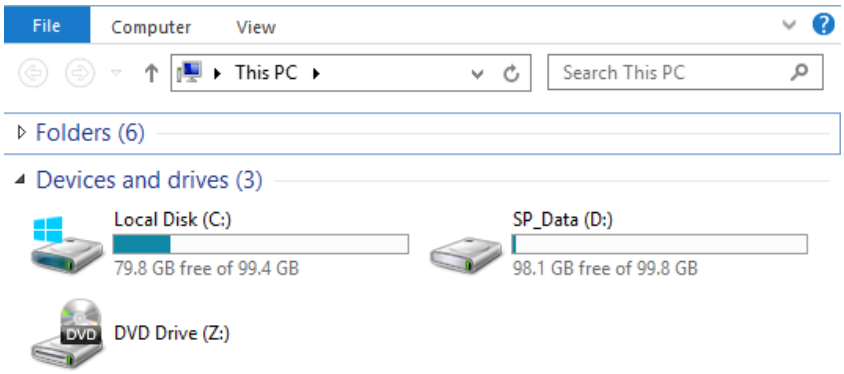


Figure 2 Application server with single SharePoint 2016 volume

3.2.1 Search service application

A SharePoint 2016 Search service application is a powerful tool used to crawl web applications andcollect data. The collected data is stored in a content index.

Although a search service application can be created and run on either an application or front-end web server, the best practice is to host the application on a server configured for the search farm role.

Provision an additional SC Series volume to the search server that will host a search service application.

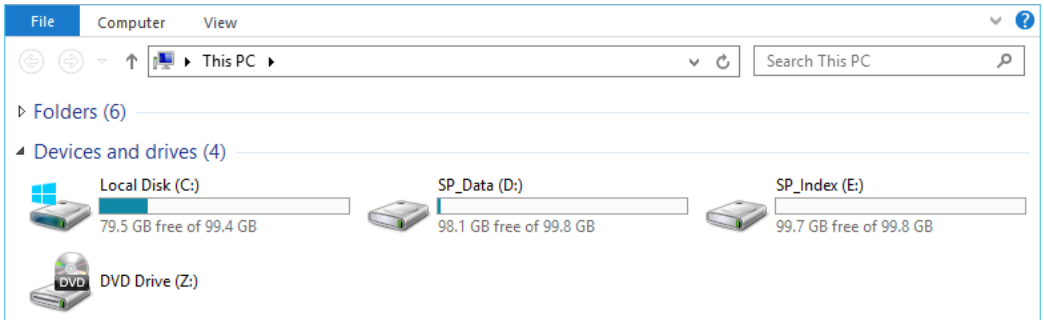


Figure 3 Search server with index volume

By default, SharePoint 2016 stores all content indexes for search service applications on the c: drive. During installation, the location of search content index files can be specified; change the location to utilize the SC Series volume.

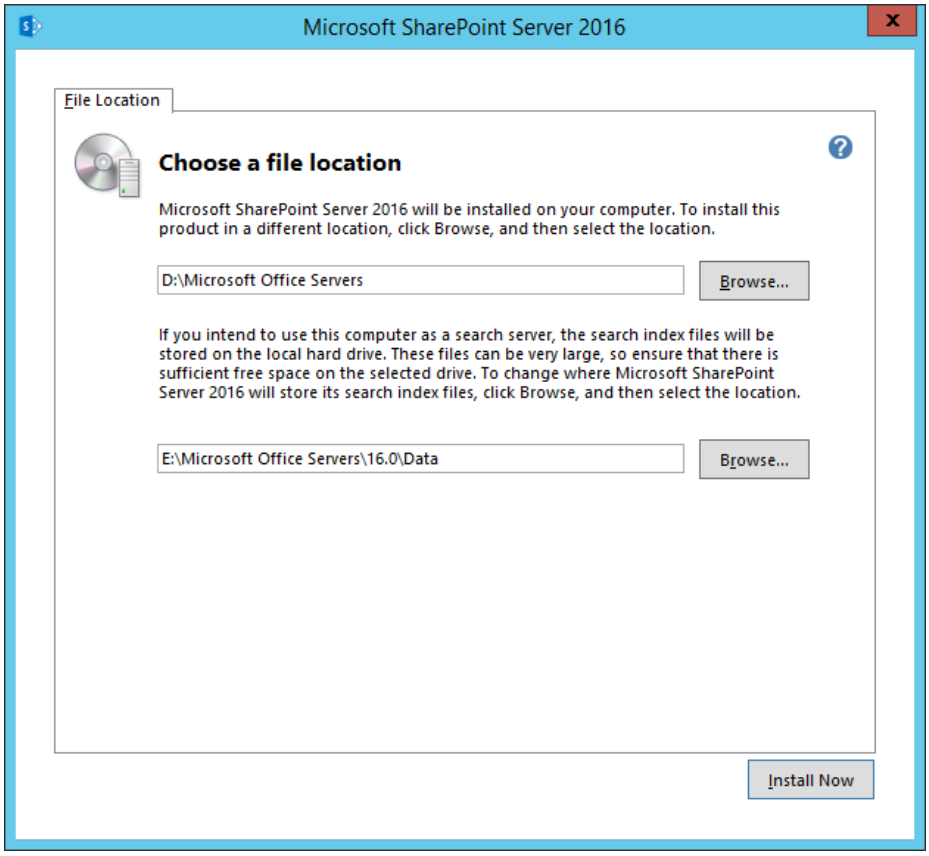


Figure 4 Changing content index location

Note: Refer to section 7 to change the index location after SharePoint 2016 has been installed.

4 Deploying SharePoint 2016 in a Hyper-V virtual environment

A virtualized SharePoint 2016 environment running on Windows Server 2012/R2 Hyper-V is fully supported by Microsoft, and in some cases, is preferable to a physical environment. A virtual SharePoint 2016 environment offers the following benefits:

- Optimized resource allocation
- Reduced infrastructure and management costs
- Higher availability
- Ability to scale quickly and inexpensively

The following section discusses considerations and best practices for virtualizing a SharePoint 2016 farm on Microsoft Hyper-V.

It is strongly recommended that the various Dell SC Series and Compellent Storage Center Best Practices for Microsoft Hyper-V guides are reviewed on Dell TechCenter before proceeding.

4.1 Guest generations and virtual disk controllers

With Windows Server 2012 R2 a Hyper-V guest VM can be designated as either a Generation 1 or Generation 2 guest.

Generation 1 Hyper-V guest VMs (Windows Server 2012 and below) can only boot from a virtual disk attached to a Virtual IDE controller. Generation 2 Hyper-V guest VMs (Windows Server 2012 R2 only) do not have the option to add a Virtual IDE controller, and can boot from a virtual disk attached to a virtual SCSI controller, or from the network.

There is no difference in performance between virtual disks attached to a virtual IDE or a virtual SCSI controller. There is also no difference in performance between Generation 1 and Generation 2 Hyper-V guest VMs.

As a best practice, create Hyper-V guest VMs as Generation 2 whenever possible. Generation 2 Hyper-V guest VMs offer the secure boot feature that prevents malicious code from running at boot time. Generation 2 Hyper-V guest VMs also build considerably quicker than their Generation 1 Hyper-V guest VM counterparts because unnecessary legacy hardware components have been removed from the guest.

For more information about Generation 2 Hyper-V guest VMs, refer to Microsoft TechNet.

4.2 Hyper-V guest VM storage

Windows Server 2012 R2 Hyper-V offers the following storage options for guest VMs:

- Virtual Hard Disks
- In-guest iSCSI
- Virtual Fibre Channel
- Shared virtual disks
- Pass-through disks from the physical host

The following section details each type of Hyper-V guest VM storage listed above, with best practices and recommendations for each storage type.

Note: Performance differences between direct-attached storage (in-guest iSCSI, virtual fibre channel) and a VHDX file that resides on a Dell Storage SC Series volume are negligible.

Ultimately, what type of Hyper-V guest VM storage to use depends on business requirements, SAN connectivity, and personal preference.

4.2.1 Virtual hard disks

Microsoft introduced the VHDX virtual hard disk format in Windows Server 2012. The VHDX virtual hard disk format included many improvements over the older VHD format, including:

- Capacity of up to 64 TB
- Data corruption protection
- Improved performance on large sector disks
- Support for 4KB sectors
- Support for TRIM (automatic space reclamation)
- Support for ODX (offloaded data transfer)

As a best practice, SharePoint 2016 Hyper-V guest VMs should utilize VHDX virtual hard disks.

Note: Storage Center Operating System (SCOS) 6.3.1 and above supports TRIM and ODX. For more information about TRIM and ODX support in SC Series arrays, refer to the *Windows Server 2012 R2 Best Practices for Dell Compellent Storage Center*.

Microsoft recommends that all virtual hard disks used in a virtualized Hyper-V SharePoint 2016 environment be created as a fixed size to prevent overprovisioning of the underlying SC Series volume. Creating a fixed disk also negates any performance impact the guest VM may incur when a differencing or dynamically expanding disk needs to grow in size.

Keep in mind that no matter the size of the fixed disk, only the actual data used will be consumed on the SC Series array. For example, a 60 GB fixed VHDX file that has 15 GB of actual data will still only consume 15 GB of space on the SC Series array, even though a fixed VHDX will consume the full amount of space on the volume from the perspective of the host server.

4.2.2 In-guest iSCSI

Using the built-in iSCSI initiator, Hyper-V guest VMs can connect directly to the SC Series to map volumes directly inside the guest VM, bypassing the hypervisor. SharePoint 2016 and SQL Server installation and user data are stored on the iSCSI mapped volumes.

An advantage of using in-guest iSCSI to directly attach SC Series volumes to a guest VM is that Replays can be taken directly of the iSCSI mapped volumes. This allows for fast, granular recovery of data located on the volume, such as a SQL database. Restoring individual files from a Hyper-V guest VM running SQL server and utilizing VHDX virtual hard disks is possible, but is more of a manual process.

Note: Hyper-V guest VMs that utilize in-guest iSCSI connectivity SC Series volumes still require the use of a VHDX file to boot.

4.2.3 Virtual fibre channel

One of the new features introduced with Windows Server 2012 Hyper-V, and still supported with Windows Server 2012 R2, is the ability for guest VMs to use virtual Fibre Channel (vFC) adapters to connect to SAN volumes directly. This functionality was added by Microsoft in large part because many environments use Fibre Channel exclusively (instead of or in addition to iSCSI) to access SAN storage. vFC allows administrators to present SAN volumes as direct-attached storage to guest VMs to allow the guest VMs to be clustered. Prior to vFC, iSCSI was required in order to present SAN volumes directly to guest VMs for clustering. Environments that were Fibre Channel based were unable to configure guest VM clusters, short of introducing iSCSI to their environments.

4.2.4 Shared virtual disks

Windows Server 2012 R2 added support for shared virtual disks (in the .vhdx format). Shared .vhdx files allow guest VMs to be clustered without the use of direct-attached volumes (iSCSI or virtual fibre channel) to the guests.

Note: For more information on how to configure Hyper-V guests to use shared virtual disks, refer to *Windows Failover Clustering with Windows Server 2012 R2 and Dell Compellent Storage Center*.

4.2.5 Pass-through disks

Pass-through disks are volumes that are mapped directly to the Hyper-V host and exclusively accessed by Hyper-V guest VMs. Pass-through disks are a legacy configuration carried through since the first version of Hyper-V. In older versions of Hyper-V pass-through disks provided better performance than VHD files residing on volumes mapped to the host. With the performance gains of VHDX files, the gap between pass-through disks and virtual hard disks is now negligible.

Pass-through disks cannot be used with highly-available guests in a clustered Hyper-V environment.

It is not recommended to use pass-through disks in a Hyper-V virtualized SharePoint 2016 environment. In-guest iSCSI connectivity (when available) offers the same functionality as pass-through disks, while also providing the ability for guests to be deployed in a clustered environment.

4.3 Hyper-V guest file placement

As previously mentioned, system files and SharePoint 2016 application data should not reside on the same volume. Two separate VHDX files will appear within a guest as different volumes, such as the C: and D: drives. If those two VHDX files reside on the same host volume, both VHDX files could request disk I/O at the same time causing performance degradation in the guest VM. For best performance, each VHDX file that represents a Hyper-V guest VM virtual disk should reside on a dedicated SC Series volume.

In a highly-available clustered Hyper-V environment, guest files are required to reside on a Cluster Shared Volume (CSV). For best performance in this configuration, store each guest VHDX file on a dedicated SC Series volume formatted as a CSV. For example, a front-end web server with both a C: (system) and D: (application) drive would require the use of two CSVs.

As previously mentioned, Hyper-V guest VMs that utilize in-guest iSCSI connectivity to SC Series volumes still require the use of a virtual hard disk to boot. The VHDX file should reside on a dedicated SC Series volume presented to the host, or on a dedicated SC Series volume formatted as a CSV if the guest VM is deployed in a Hyper-V cluster.

5 Installing a new SharePoint 2016 farm

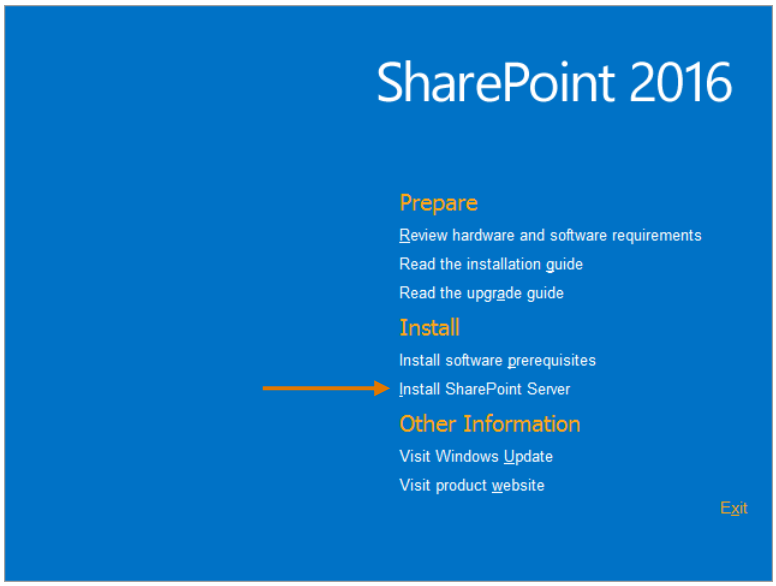
This section details the installation process of SharePoint 2016 on the application and front-end web servers. No installation is needed on the SQL server, although the installer will create and configure databases as instructed from the application server.

Be advised that SharePoint 2016 requires the installation of prerequisites before the application will install. The prerequisites installer can be found on main SharePoint 2016 install splash screen under **Install** > **Install software prerequisites**. Software perquisites should be installed on both the application and front-end web servers before continuing.

5.1 Application server installation

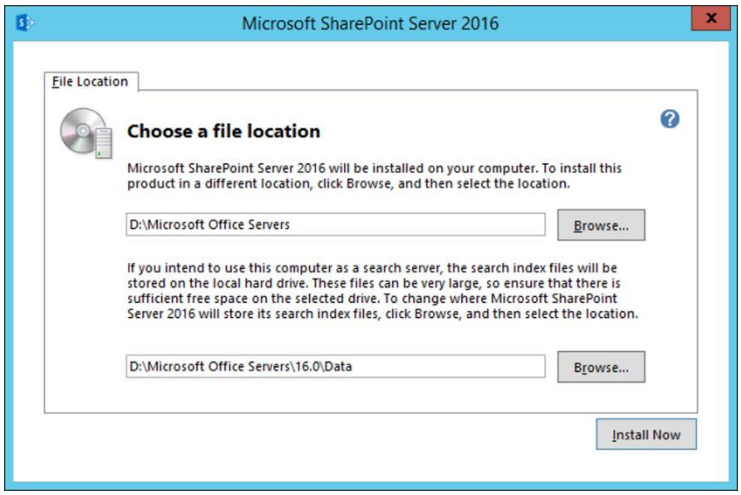
To install SharePoint 2016 on the application server:

1. Log on as an administrator to the application server.
2. Double-click the SharePoint 2016 install media to launch the install splash screen.
3. Select **Install SharePoint Server**.

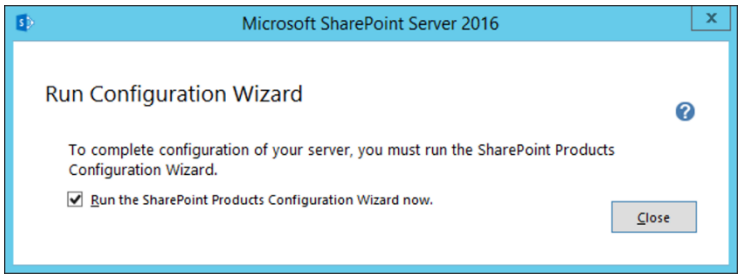


4. Enter a product key, then click **Continue**.
5. Check the box to agree to the license terms and click **Continue**.

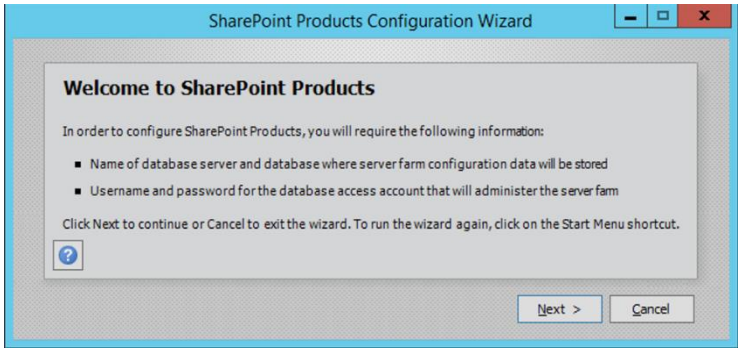
6. On the Choose a file location screen change the default installation path to point to a SC Series Volume and click **Install Now**.



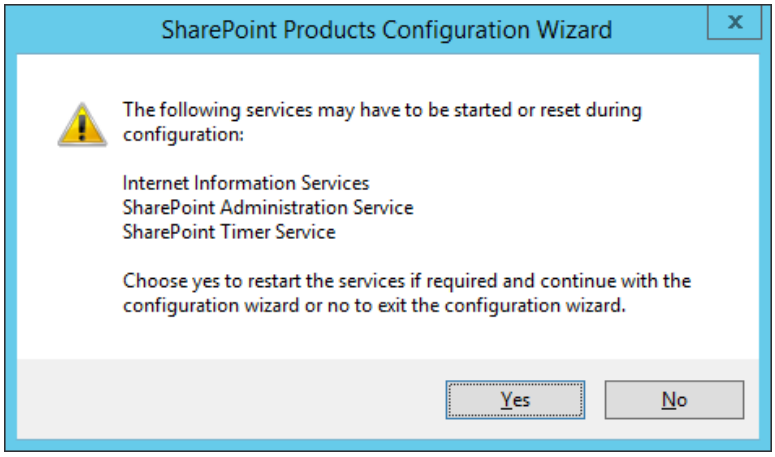
7. When installation has completed, leave the box checked to **Run the SharePoint Products Configuration Wizard now** and click **Close**.



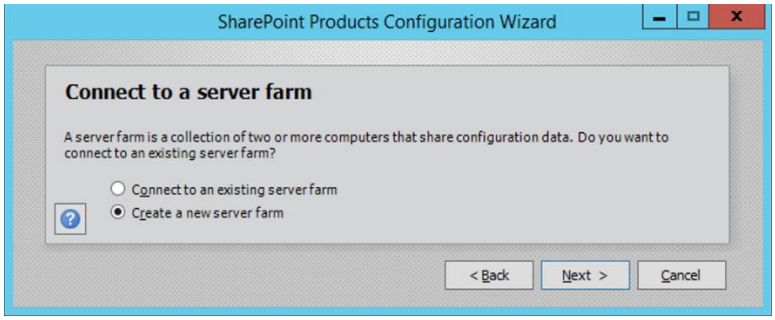
8. Click **Next** on the SharePoint Products Configuration Wizard screen.



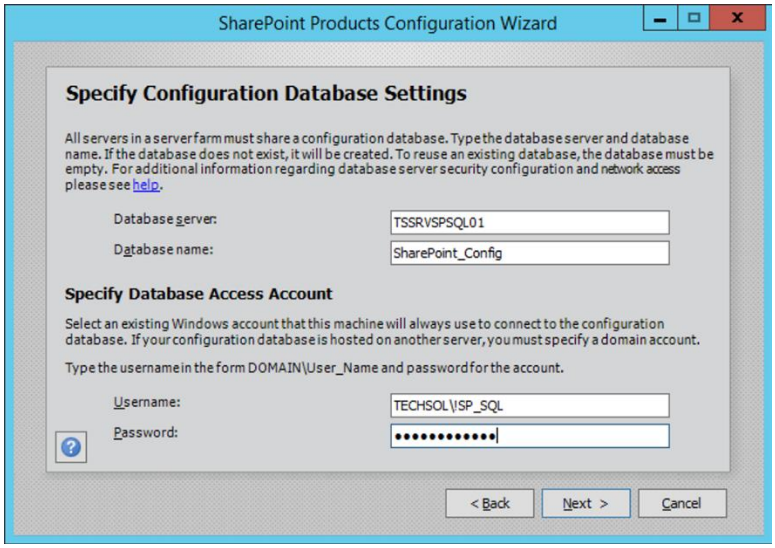
9. If prompted, click **Yes** to restart any services.



10. On the Connect to a server farm screen, select **Create a new server farm**, and click **Next**.

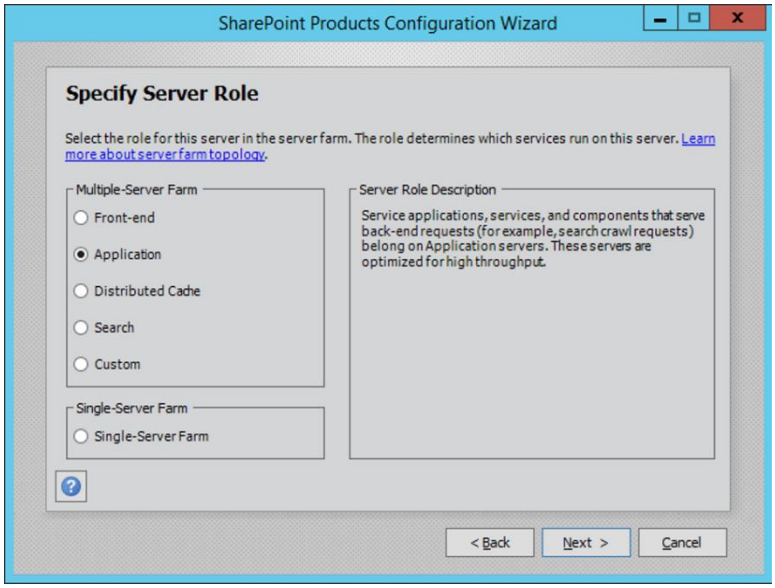


11. Identify the SQL server to connect to as well as a username and password. Click **Next**.

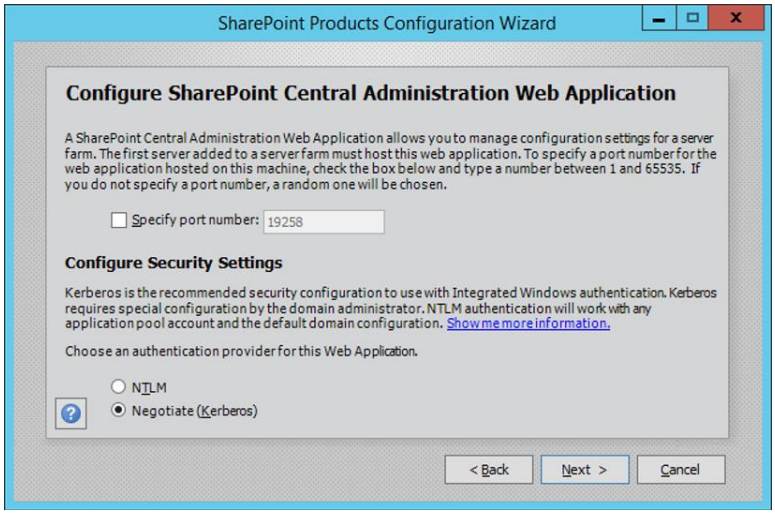


12. Enter a passphrase that other servers will use to join the SharePoint 2016 farm. Click **Next**.

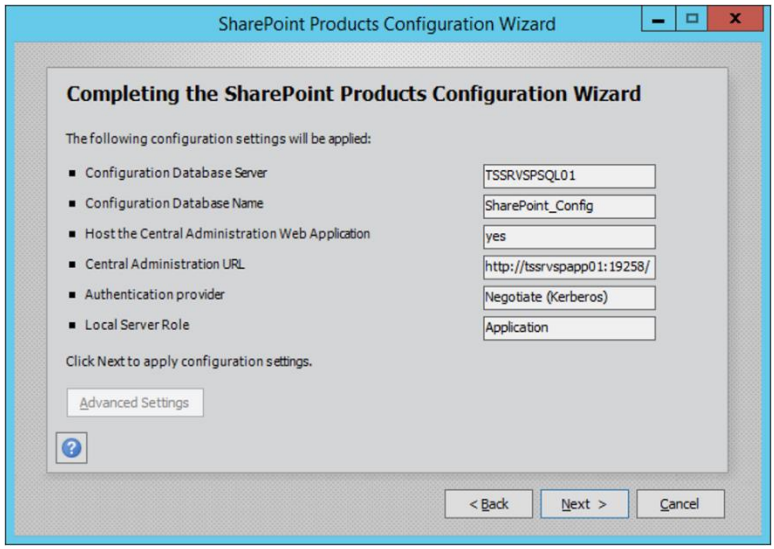
13. Select **Application** in the Specify Server Role window. Click **Next**.



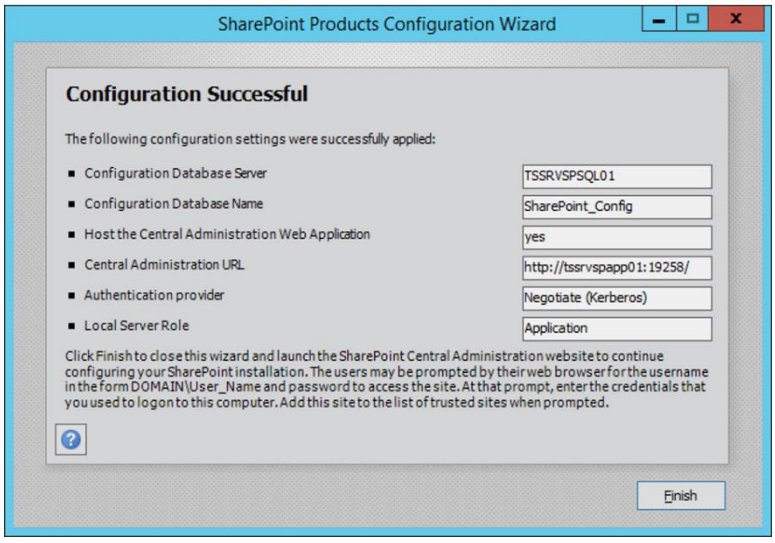
14. If desired, specify a port for the SharePoint central administration web application. Select the type of security to use within SharePoint. Click **Next**.



15. Verify settings and click **Next**.



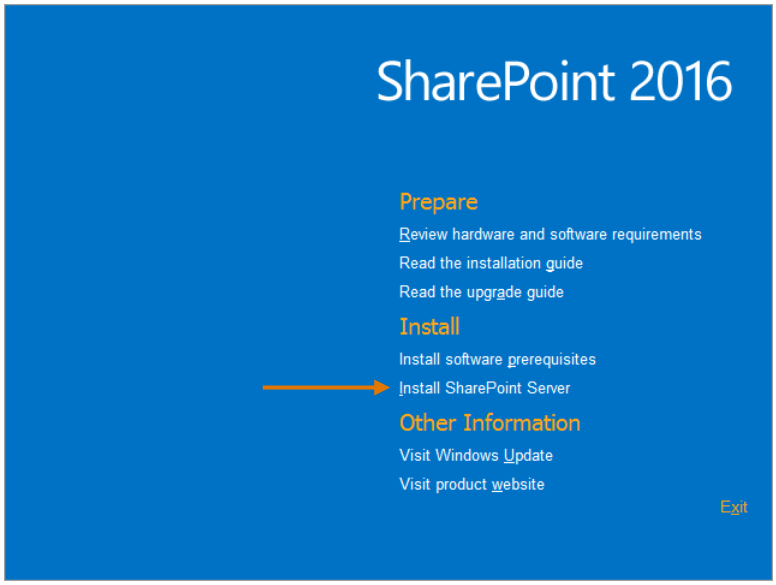
16. Click **Finish** when setup completes.



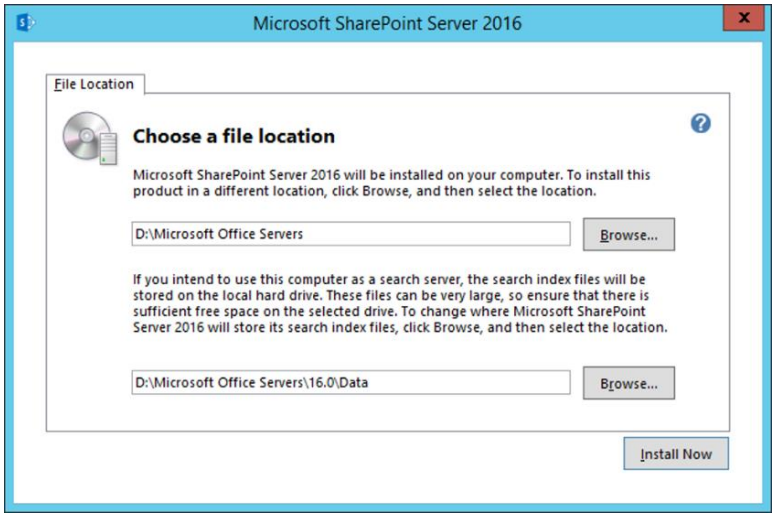
5.2 Front-End Web server installation

To install SharePoint 2016 on the front-end web server:

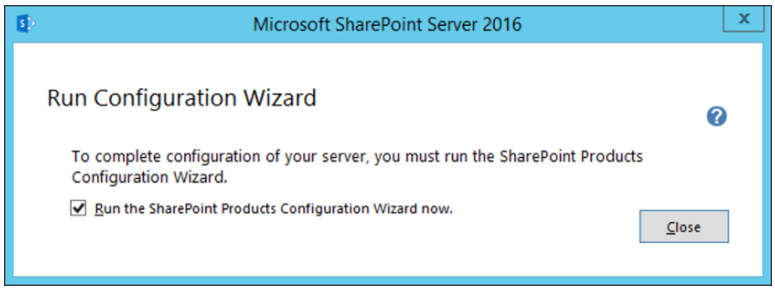
1. Log on as an administrator to the front-end web server.
2. Double-click the SharePoint 2016 install media to launch the install splash screen.
3. Select **Install SharePoint Server**.



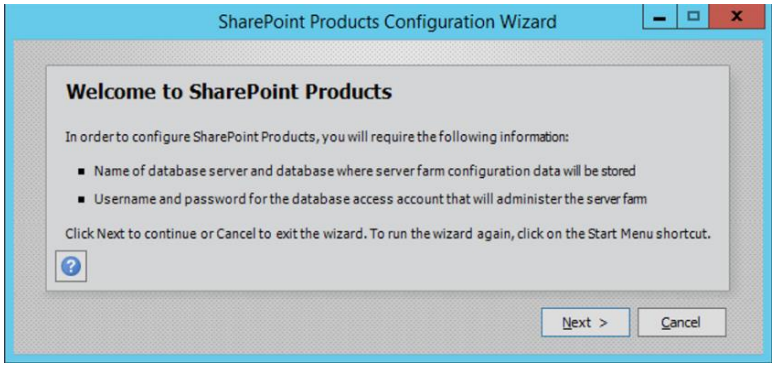
4. Enter a product key and click **Continue**.
5. Check the box to agree to the license terms and click **Continue**.
6. On the Choose a file location screen change the default installation path to point to a SC Series Volume.
7. Click **Install Now**.



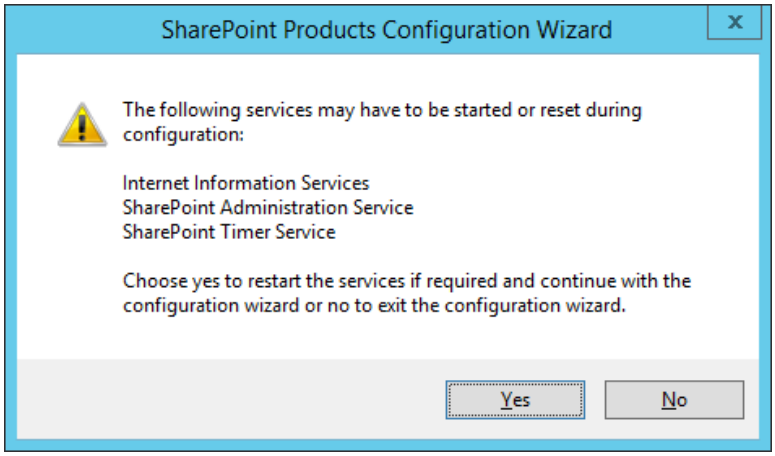
8. When installation has completed, leave the box checked to **Run the SharePoint Products Configuration Wizard now** and click **Close**.



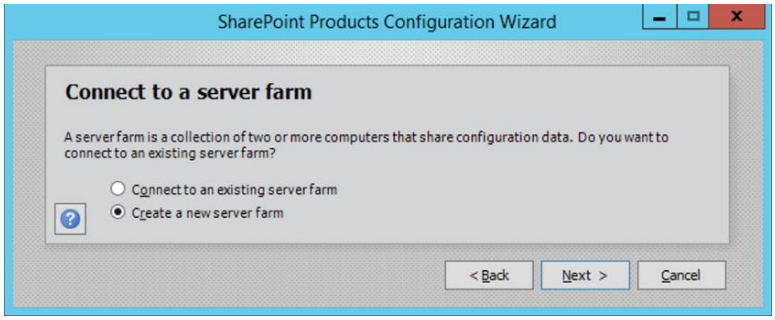
9. Click **Next** on the SharePoint Products Configuration Wizard screen.



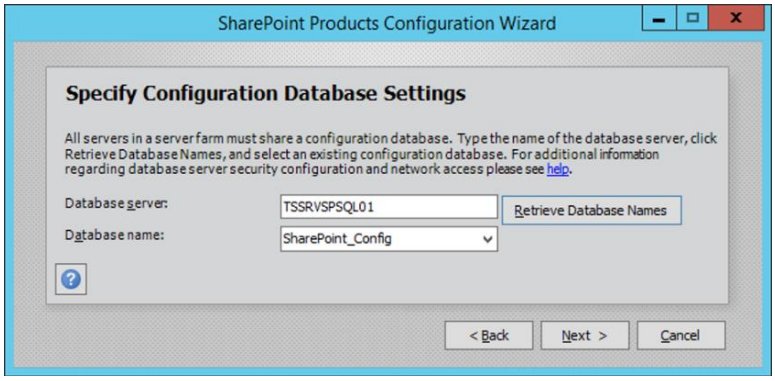
10. If prompted, click **Yes** to restart any services.



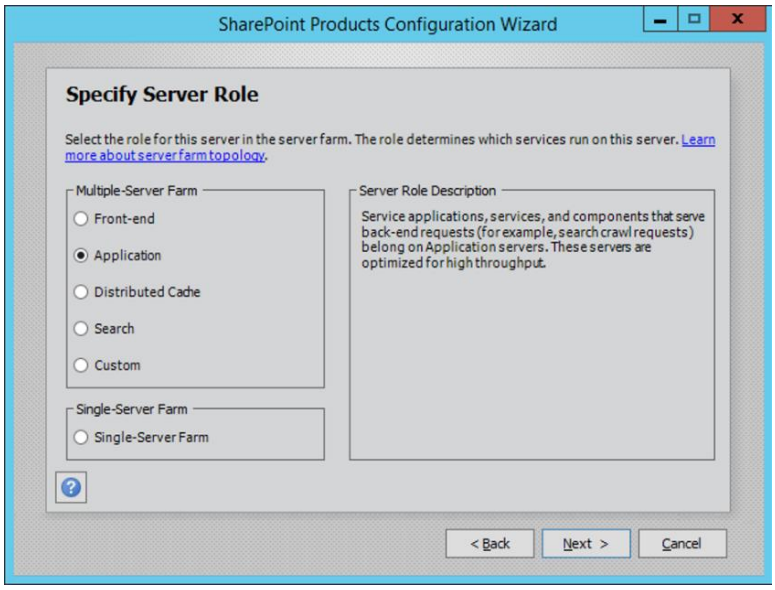
11. On the Connect to a server farm screen, select **Connect to an existing server farm** and click **Next**.



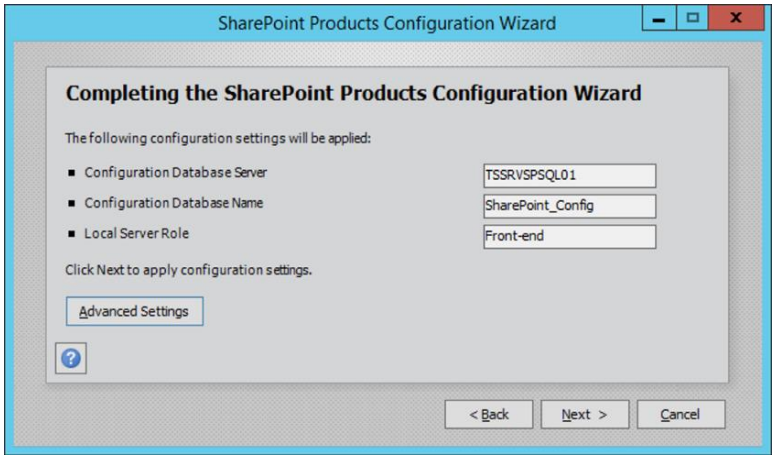
12. Enter the farm database server name, and select the correct SharePoint database. Click **Next**.



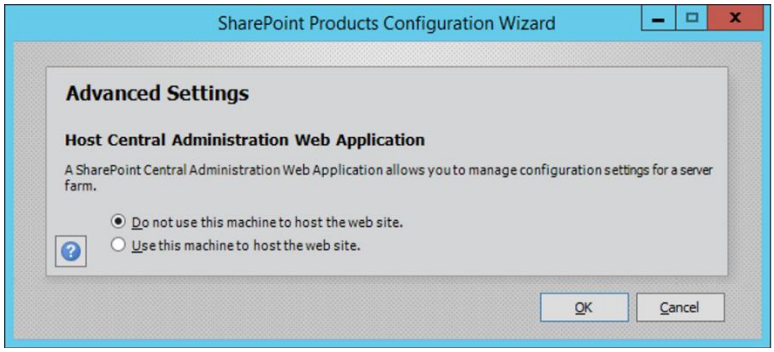
13. Enter the passphrase to connect to the farm. Click **Next**.
14. Select **Front-end** in the Specify Server Role window. Click **Next**.



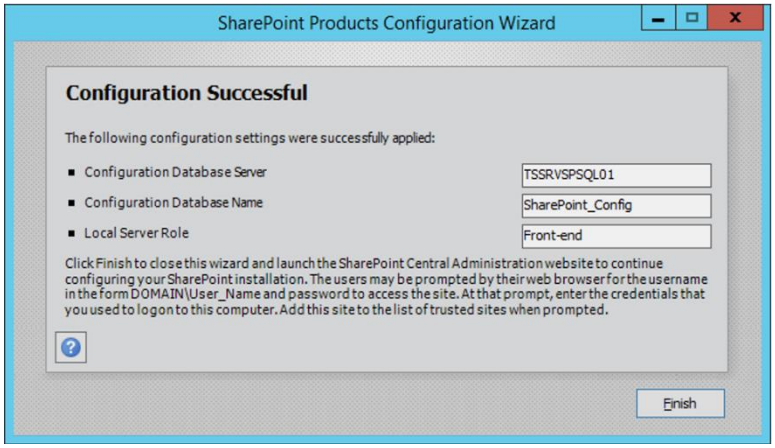
15. Verify the configuration is correct, then click **Next**.



a. By clicking the **Advanced Settings** button, an option appears to host the Central Administration web application on this server. Select an option and click **OK**.



16. Click **Finish** when the wizard completes.



6 SharePoint 2016 cache settings

SharePoint 2016 uses the following types of caches to improve user experience by loading web pages faster:

- Binary Large Object (BLOB) cache
- Output cache
- Object cache
- Anonymous search results cache

Of the four cache types listed above, only the BLOB cache can be configured to reside on a volume other than where SharePoint 2016 was installed. The process to enable and configure the BLOB cache is discussed in detail in this section.

Note: The output, object and anonymous search results caches can be configured to improve overall performance in SharePoint 2016. For more information about SharePoint cache settings, refer to Microsoft TechNet.

6.1 BLOB cache

In SharePoint 2016 the BLOB cache is used to store frequently accessed files that are used to display web pages. These files include pictures, videos, audio and also .css and .js (java) files. The first time these files are requested they are retrieved from the SQL server and stored in a directory on the front-end web server. Subsequent requests for the files are then served directly from the web server, increasing the speed at which the files are displayed on the web page, and also reducing the load on the SQL server.

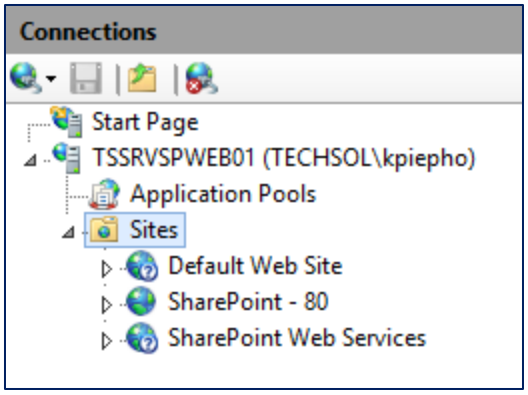
Files to be included in the BLOB cache are specified by extension. New file type extensions can be added to the cache, and extensions can also be removed. This functionality also allows the BLOB cache to be restricted to only caching certain types of files, such as .jpg or .pdf.

A separate BLOB cache exists for each web application in a SharePoint 2016 environment. By default, the BLOB cache is disabled on all web applications.

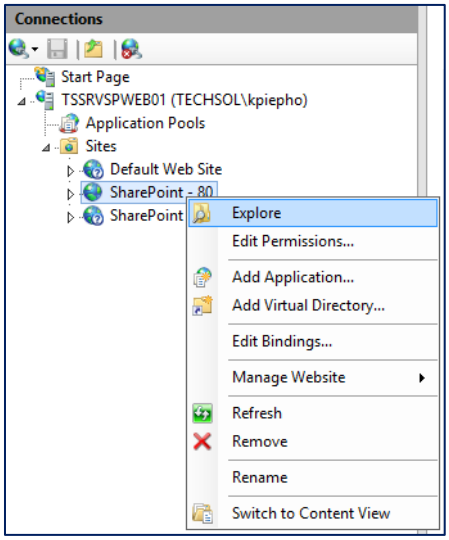
6.1.1 Enabling and configuring the BLOB cache

To enable and configure the BLOB cache:

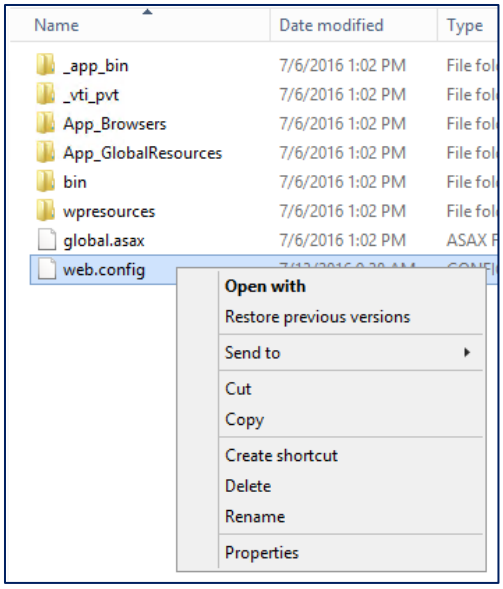
1. Log on as an administrator to the front-end web server.
2. Open Internet Information Services (IIS) Manager by going to **Start** > **Apps** > **Administrative Tools** > **Internet Information Services (IIS) Manager**.
3. Within **IIS Manager** in the **Connections** pane, expand the web server and then expand Sites.



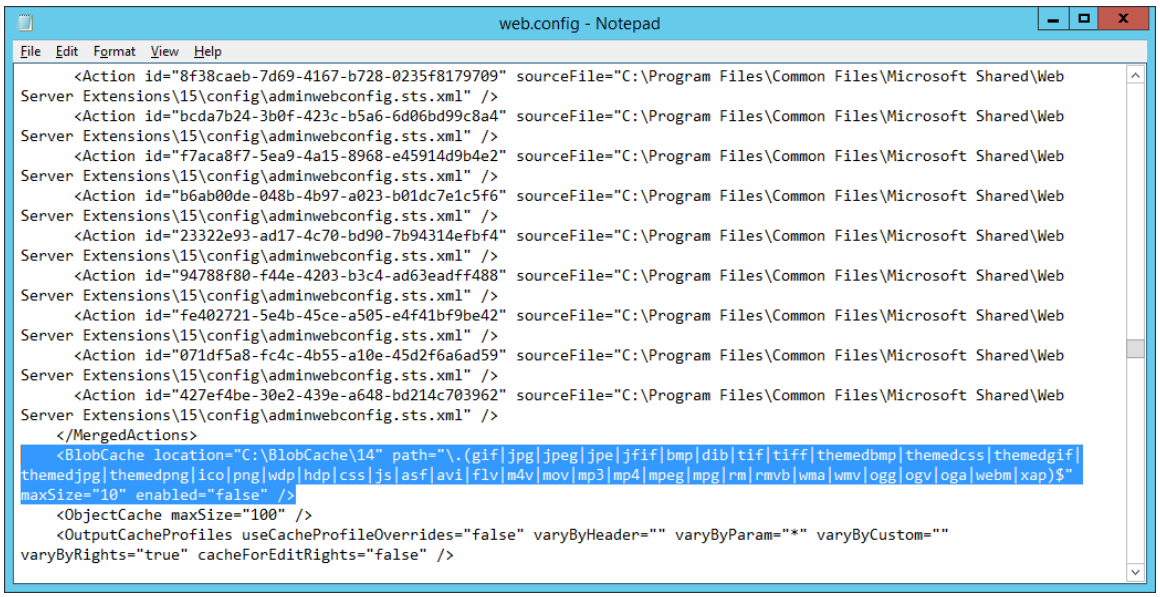
4. Right-click the web application where the BLOB cache will be configured and select **Explore**.



5. In Windows Explorer, right click the web.config file and select **Open with**.



6. Select **More options** in the file open dialog window, and then select **Notepad**.
7. In the web.config file locate the line that starts with <BlobCache location="C:\BlobCache\14".



8. Change the location to reside on a SC Series volume.
9. If needed, add or remove file type extensions from the list.
10. Adjust the maxSize (in GB) value if needed.

Note: The maximum size value is determined by estimating the size of the content to be stored in the cache, and then adding a 20% buffer to that value. For example, if the estimated size of the BLOB cache is 100 GB, the maxSize value should be set to 120. Microsoft recommends that the cache size not be set to anything less than 10 GB.

Free space on the SC Series volume where the BLOB cache will reside should be greater than the maximum cache size.

11. Change the enabled value to "true".

```
    <BlobCache location="D:\BlobCache" path="\.(gif|jpg|jpeg|jpe|jfif|bmp|dib|tif|tiff|themedbmp|themedcss|themedgif|
themedjpg|themedpng|ico|png|wdp|hdp|css|js|asf|avi|flv|m4v|mov|mp3|mp4|mpeg|mpg|rm|rmvb|wma|wmv|ogg|ogv|oga|webm|xap)$"
maxSize="120" enabled="true" />
```

12. Save the web.config file.
13. Repeat this process for any other web applications in the environment that have a need to enable the BLOB cache.

7 Configuring SharePoint 2016 search settings

By default, the context index for a Search service application is located on the C: drive. For smaller environments, the default location may provide suitable search performance. In larger environments, or where greater search performance is required, it is recommended to change the default search content index location to be located on a SC Series volume.

During SharePoint 2016 installation, the user is presented with an option to change the search index location. If an alternate location was not specified, and/or the location needs to be changed after installation, SharePoint 2016 does not natively provide a mechanism to change the default content index location through the central administration GUI. Instead, multiple Windows PowerShell™ commands must be used. To make this task easier, a PowerShell script can be downloaded from Microsoft TechNet that will automatically run all the necessary commands to change the content index location.

For more information about managing the content index in SharePoint 2016, refer to Microsoft TechNet.

A Technical support and resources

For 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 Customer Portal is an online portal for existing customers. A valid portal account is required to access the Customer Portal. Once logged in to the Portal, go to **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.

Support.dell.com is focused on meeting customer needs with proven services and support.

Storage Solutions Technical Documents on Dell TechCenter provide expertise that helps to ensure customer success on Dell Storage platforms.

A.1 Related documentation

Table 2 Referenced or recommended resources

Vendor	Resource
Dell	Windows Server MPIO Best Practices for Dell Compellent Storage Center
Dell	Windows Server 2012 R2 Best Practices for Dell Compellent Storage Center
Dell	Windows Failover Clustering with Windows Server 2012 R2 and Dell Compellent Storage Center
Dell	Hyper-V 2012 R2 Best Practices for Dell Compellent Storage Center
Dell	Dell Storage SC Series Arrays and Microsoft SQL Server Best Practices
Microsoft	Deployment guide for SharePoint 2016
Microsoft	Best Practices for virtualizing and managing SharePoint
Microsoft	Best Practices for virtualizing and managing SQL Server
Microsoft	Windows Server 2012 R2 Hyper-V best practices blog
Microsoft	Resilient File System Overview
Microsoft	Cache settings operations in SharePoint Server