Deploying SharePoint 2013 utilizing Dell Compellent Storage Center

Best Practices

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A Dell Best Practices Guide

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Executive summary

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

- Storage configuration for each server in a SharePoint 2013 farm.
- SharePoint 2013 running in a virtualized environment.
- Installation of SharePoint 2013.
- Enabling and configuring SharePoint Binary Large Object (BLOB) cache.
- Changing the search index location to a Dell Compellent SAN volume.

1 Preface

This document is highly technical and is intended for storage and systems administrators who manage Microsoft SharePoint Server 2013 in a physical or virtual environment utilizing Dell Compellent Storage Center. Readers should have a good working knowledge of Microsoft SharePoint 2013, Microsoft Windows Server 2012 R2, Microsoft Hyper-V, and the Dell Compellent Storage Center.

1.1 Customer support

Dell Compellent provides live support at 1-866-EZSTORE (866.397.8673), 24 hours a day, 7 days a week, 365 days a year. For additional support, email Dell Compellent at support@compellent.com. Dell Compellent responds to emails during normal business hours.

2 Introduction

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

2.1 Dell Compellent Storage Center overview

The Dell Compellent Storage Center 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.   Storage Center's 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 2013 overview

Microsoft SharePoint 2013 is a web application platform that is primarily used for business collaboration. SharePoint 2013 provides intranet portals, content management, file sharing, identity management, search, business connectivity services, and more.

A typical SharePoint 2013 environment consists of at least 3 servers: A web server, application server, and Microsoft SQL Server database server. A logical grouping of SharePoint servers that share common resources is referred to as a farm. SharePoint 2013 is a scalable solution; additional servers can be added to the farm as business needs and size change. These servers can include additional web servers, dedicated application servers to service roles such as query, index, content processing and analytics, Microsoft Office Web Apps servers, and additional SQL Server database servers.

All SharePoint 2013 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's 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 servers or Hyper-V guest VMs running Windows Server 2012 R2. SharePoint 2013 SP1 was used for deployment, as the initial release of SharePoint 2013 is not supported on Windows Server 2012 R2.

3 Server storage configuration

Prior to installing SharePoint 2013, the storage on each server that will reside in the farm should be properly configured for each SharePoint farm server role. In the following section, storage configurations will be detailed for each SharePoint farm server role.

> **Note:** As a best practice, system files and SharePoint 2013 application data should not reside on the same volume. The following section assumes that a system volume will already be mapped and configured for each of the SharePoint 2013 farm server roles.

3.1 SQL Server storage configuration

It is highly recommended that the reader review the **Microsoft SQL Server Best Practices with Dell Compellent Storage Center guide** located on Dell TechCenter before proceeding.

At a minimum, five Dell Compellent volumes should be provisioned to an instance of SQL Server. As called out in the table below, the specific volumes that will host SharePoint 2013 databases 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 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
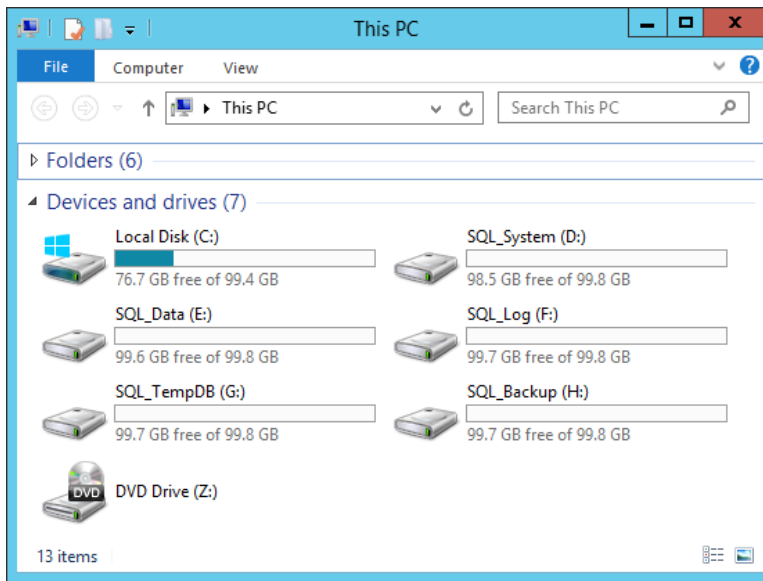
Figure 1   Database server disk configuration example

> **Note:** For best performance, SharePoint 2013 content databases and associated logs should be hosted individually on separate Dell Compellent SAN Volumes. Provision two Dell Compellent SAN volumes for each SharePoint 2013 content database. The data files should reside on one of the volumes, and the log files should reside on the other. For information on how to change data and log file location, please refer to http://technet.microsoft.com/en-us/library/ms345483.aspx.

Multiple databases are used in SharePoint 2013. A complete listing of all SharePoint 2013 databases can be found at http://technet.microsoft.com/en-us/library/cc678868(v=office.15).aspx.

3.2   Application and Web front-end server storage configuration

At least one Dell Compellent volume should be provisioned to both an Application and Web front-end server. During SharePoint installation, install paths should be changed to point to the Dell Compellent SAN volume. SharePoint 2013 installation is detailed in the Installing a new SharePoint 2013 farm section of this document.
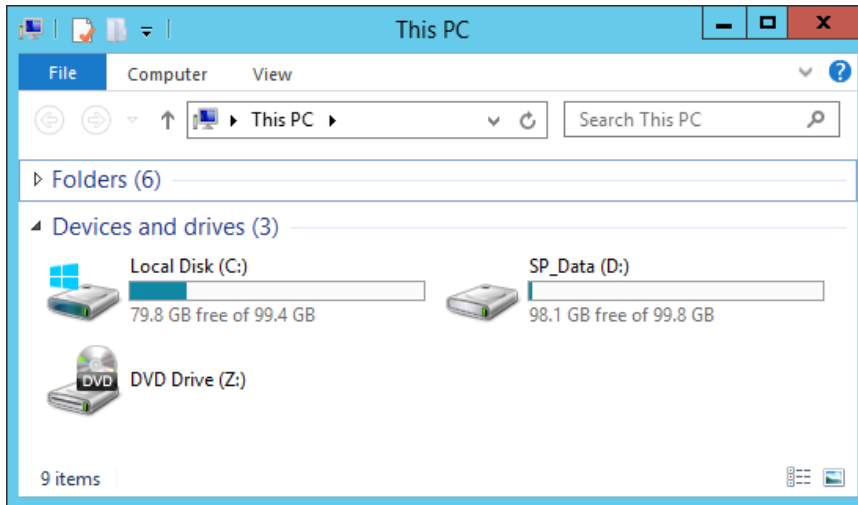
Figure 2   Application server with single SharePoint 2013 volume

3.2.1   Search service application

A SharePoint 2013 Search service application is powerful tool used to crawl a web application and collect data about it. Collected data is stored in a content index.

A Search service application can run on either an Application or Web front-end server. In larger SharePoint farms, a separate server may be used to host only the Search service application to minimize any performance impact on other servers in the farm.

As a best practice, provision an additional Dell Compellent SAN volume to a server that will host a Search service application. The content index location for the Search service application can be changed to utilize the Dell Compellent SAN volume.

> **Note:** By default, SharePoint 2013 stores all content indexes for Search service applications on the C: drive. Refer to Installing a new SharePoint 2013 farm section of this document for details on changing the index location during SharePoint 2013 installation, or Configuring SharePoint 2013 search settings to change the index location after SharePoint 2013 has been installed.
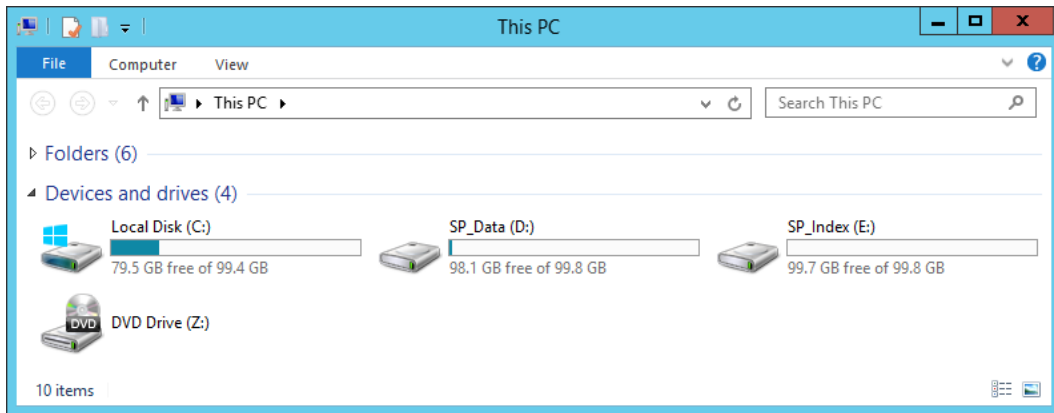
Figure 3   Application server with index volume

4 Deploying SharePoint 2013 in a Hyper-V virtual environment

A virtualized SharePoint 2013 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 2013 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 2013 farm on Microsoft Hyper-V.

It is strongly recommended that the reader review the **Dell Compellent Storage Center Best Practices for Microsoft Hyper-V Guide** located on [Dell TechCenter](#) before proceeding.

4.1 Guest generations and virtual disk controllers

With Windows Server 2012 a Hyper-V guest VM can now 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, although virtual IDE boot disks are limited to 2 TB size. There is also no difference in performance between Generation 1 and Generation 2 Hyper-V guest VMs.

As a best practice, Hyper-V guest VMs should be created as Generation 2 whenever possible. Generation 2 Hyper-V guest VMs offer the secure boot feature which 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, as unnecessary legacy hardware components have been removed from the guest.

For more information about Generation 2 Hyper-V guest VMs, please refer to
http://technet.microsoft.com/en-us/library/dn282285.aspx.

4.2 Hyper-V guest VM storage

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

- Virtual Hard Disks (formatted as .VHD or .VHDX)
- In-guest iSCSI
- Virtual Fibre Channel
- 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 Compellent SAN volume are negligible.

Ultimately, deciding what type of Hyper-V guest VM storage to use depends on business requirements, SAN transport, 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 2013 Hyper-V guest VMs should utilize VHDX virtual hard disks.

> **Note:** Storage Center 6.3.1 and above supports TRIM and ODX. For more information about TRIM and ODX support in Storage Center, please refer to the **Dell Compellent Storage Center Windows Server 2012 R2 Best Practices Guide** located on [Dell TechCenter](#).

Microsoft recommends that all virtual hard disks used in a virtualized Hyper-V SharePoint 2013 environment be created as a fixed size to prevent overprovisioning of the underlying Dell Compellent SAN 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 Storage Center. 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 Storage Center, 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 Dell Compellent Storage Center to map volumes directly inside the guest VM, bypassing the hypervisor. SharePoint 2013 and SQL Server installation and user data are stored on the iSCSI mapped volumes.

An advantage of using in-guest iSCSI to directly attach Dell Compellent SAN volumes to a guest VM is that Replays can be taken directly of the iSCSI mapped volumes. This allows for fast, granular backup and recovery of SQL Server databases using Replay Manager's SQL Server extension. 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 to Dell Compellent SAN 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.

Note: Virtual fibre channel connectivity is supported on Dell Compellent Storage Center 6.3.1 and above.

4.2.4   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. Pass through disks were required if the disk had to be (or might need to be expanded beyond) 2 TB in size. The maximum size of a legacy VHD is 2 TB. With the performance gains of VHDX files, the gap between pass-through disks and virtual hard disks is now negligible.

It is not recommended to use pass-through disks in a Hyper-V virtualized SharePoint 2013 environment. In-guest iSCSI connectivity and virtual fibre channel offer the same functionality as pass-through disks. Shared VHDX files (with Server 2012 R2) now provide for guest clustering without the need to present direct attached storage using iSCSI or vFC.

In general, using pass-through or direct-attached storage for guest VMs is discouraged because these disks create a dependency from the guest to the physical layer, which can limit VM mobility to other hosts or clusters.

4.3 Hyper-V guest file placement

As previously mentioned, system files and SharePoint 2013 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: drive. If those two VHDX files both 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 Dell Compellent SAN 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, each guest VHDX file should reside on a dedicated Dell Compellent SAN volume formatted as a CSV. For example, a Web front-end 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 Dell Compellent SAN volumes still require the use of a virtual hard disk to boot. The VHDX file should reside on a dedicated Dell Compellent SAN volume presented to the host, or on a dedicated Dell Compellent SAN volume formatted as a CSV if the guest VM is deployed in a Hyper-V cluster.

5 Installing a new SharePoint 2013 farm

This section details the installation process of SharePoint 2013 on the Application and Web front-end servers. No installation is needed on the SQL database server, although the installer will create and configure databases as instructed from the Application server.

Please be advised that SharePoint 2013 requires the installation of prerequisites before the application will install. The prerequisites installer can be found on main SharePoint 2013 install splash screen under **Install** > **Install software prerequisites**. Software perquisites should be installed on both the Application and Web front-end servers before continuing.

5.1 Application server installation

To install SharePoint 2013 on the Application server:

1. Log on as an administrator to the Application server.
2. Double-click the SharePoint 2013 install media to launch the install splash screen.
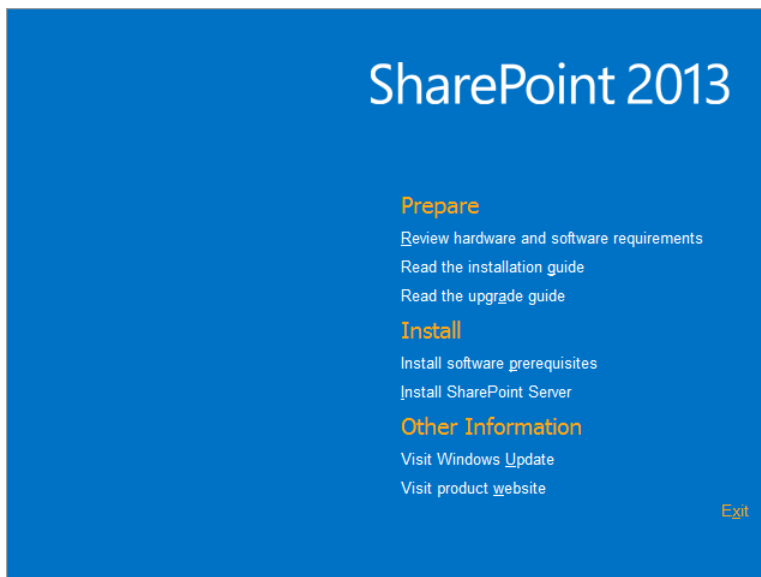
Figure 4   Installer splash screen

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. Verify **Complete** is selected in the **Server Type** window. Click the **File Location** tab.
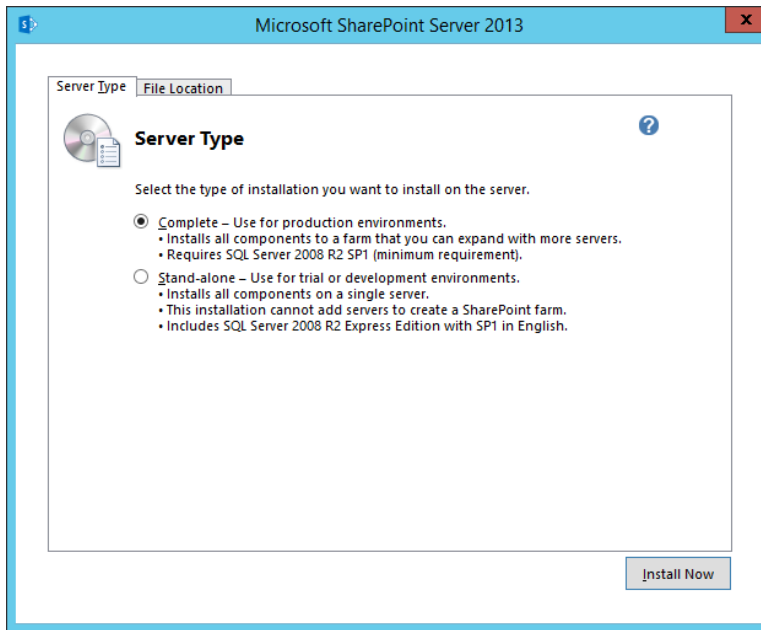
Figure 5   Server type selection

7. On the **Choose a file location** screen change the default installation path to point to a Dell
    Compellent Volume. If this server will host a Search service application, also change the search
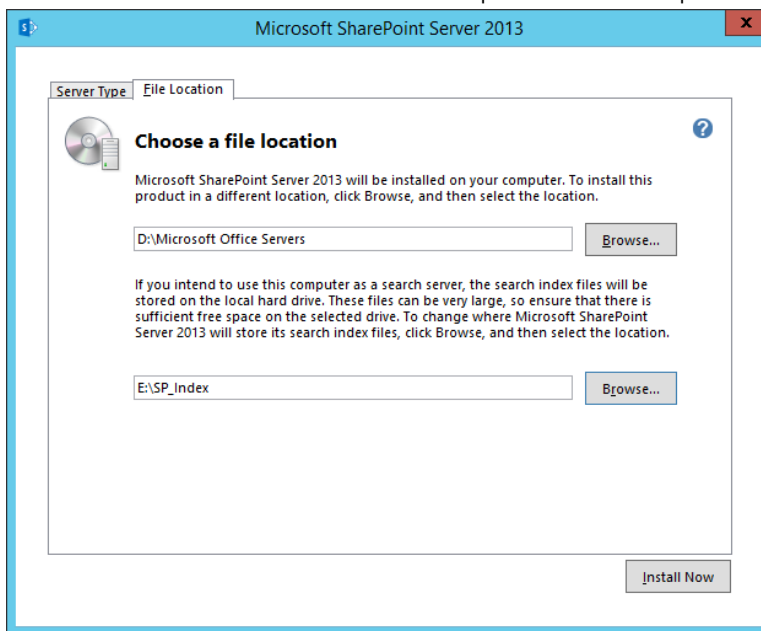   index location to reside on a separate Dell Compellent Volume.

Figure 6   Server with Search service application

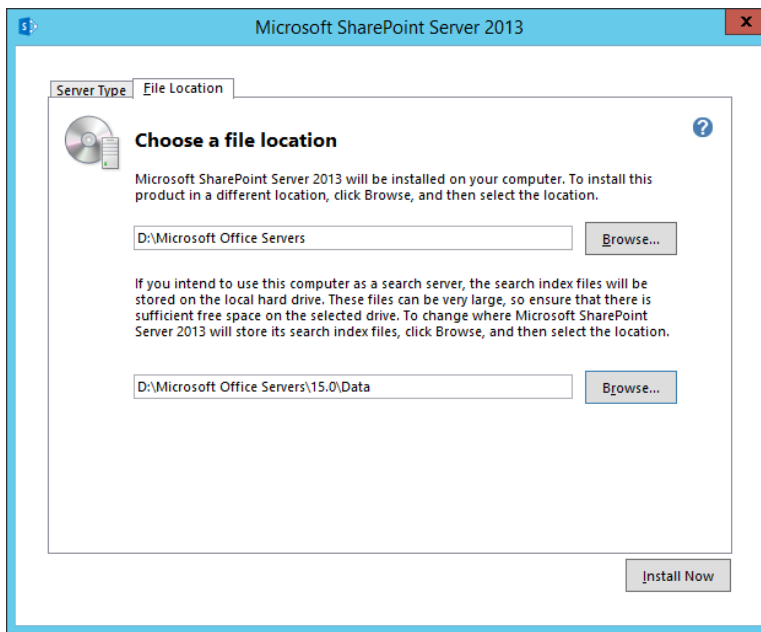**Note:** If this server will not host a Search service application, change the search index location to match
the installation path.

Figure 7   Server without Search service application

8. Click **Install Now**.
9. When the installation has completed, leave the box checked to **Run the SharePoint Products Configurations Wizard now** and click **Close**.
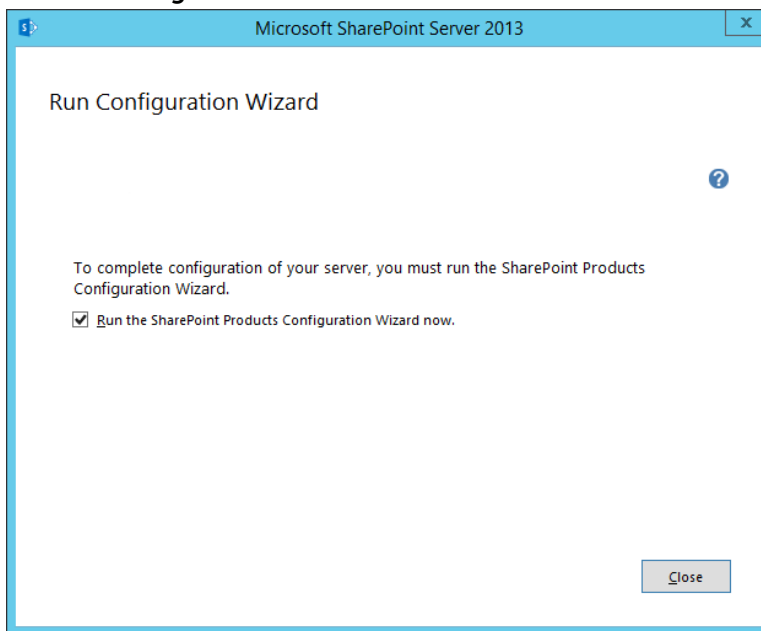
Figure 8   Run configuration wizard

10. Click **Next** on the SharePoint Products Configuration Wizard screen.
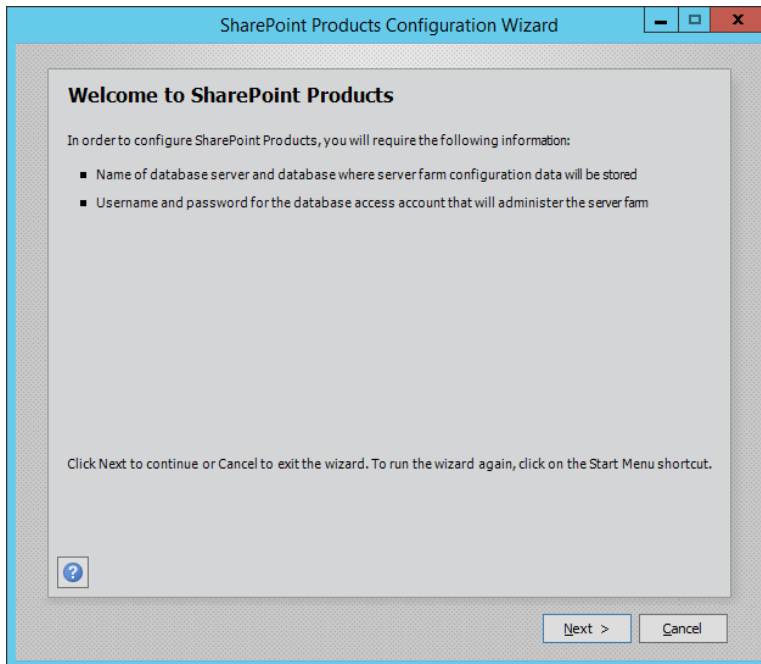
Figure 9   SharePoint products config wizard

11. If prompted, click **Yes** to restart any services.
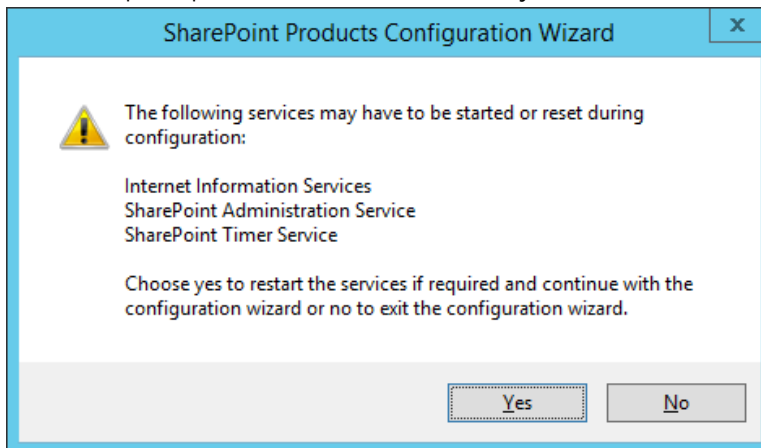
Figure 10   Service restart confirmation

12. On the Connect to a server farm screen select **Create a new server farm**, and click **Next**.
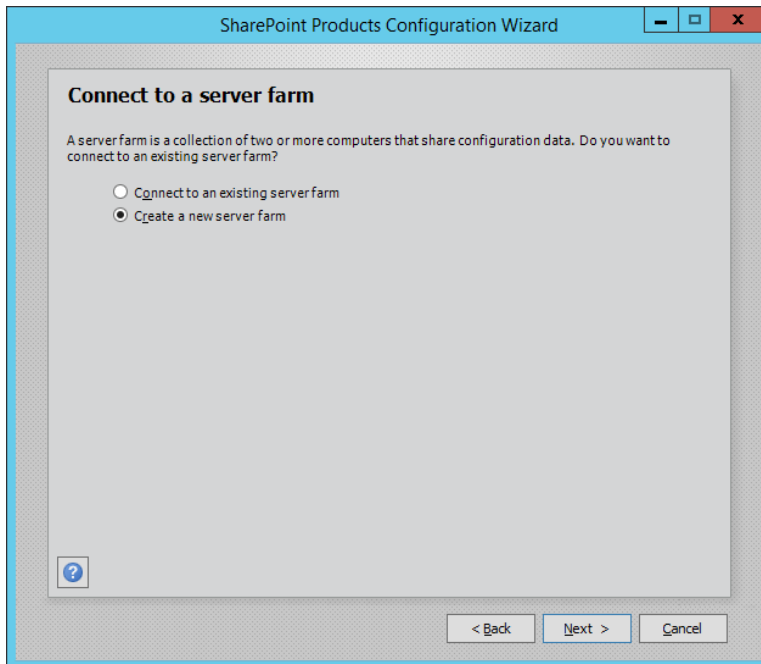
Figure 11   Create a new server farm

13. Enter the SQL server to connect to, and a username and password to connect as. Click **Next**.
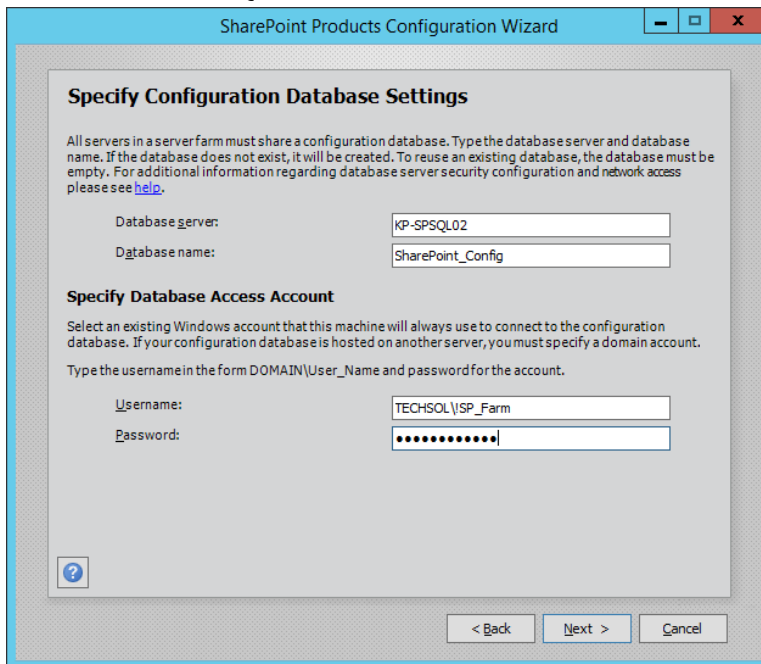
Figure 12   DB settings

14. Enter a passphrase that other servers will use to join the SharePoint 2013 farm. Click **Next**.
15. If desired, specify a port for the SharePoint central administration web application. Select the type of security to use within SharePoint. Click **Next**.
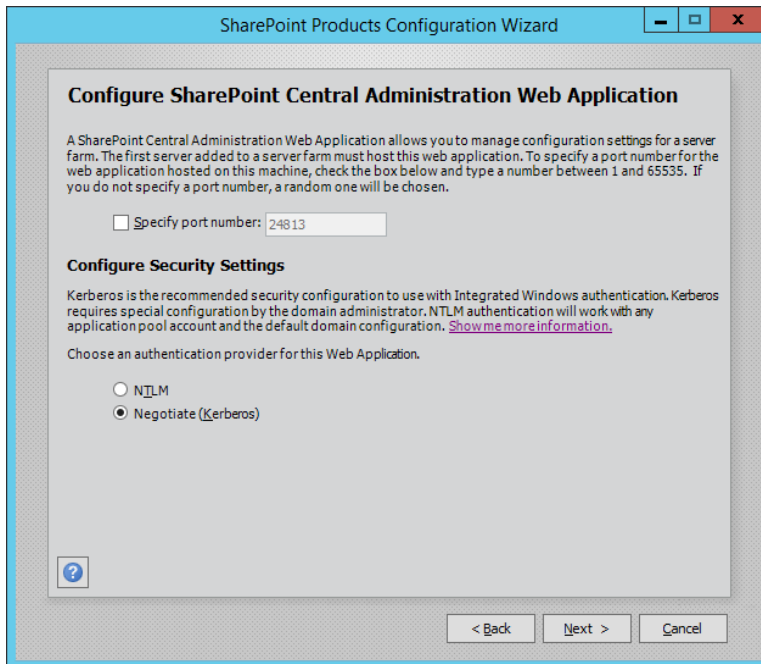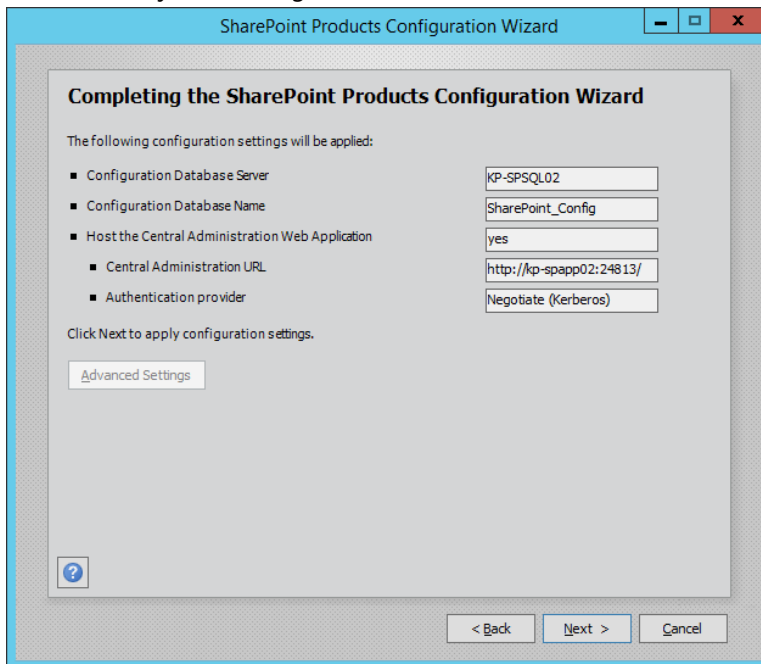
Figure 13   Central administration settings

16. Verify the settings and click **Next**.

Figure 14   Completing the wizard

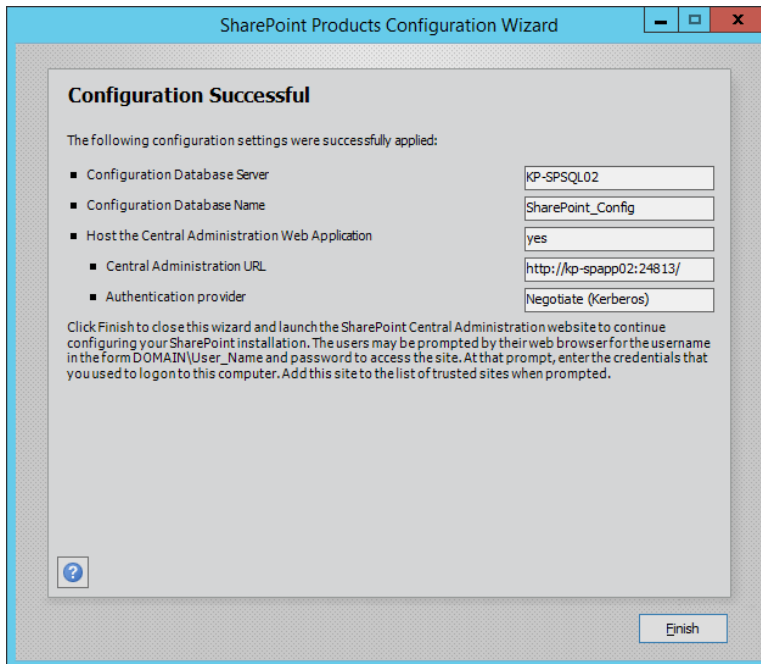17. Click **Finish** when setup completes.

Figure 15   Configuration successful

5.2   Web front-end server installation

To install SharePoint 2013 on the Web front-end server:

1. Log on as an administrator to the Application server.
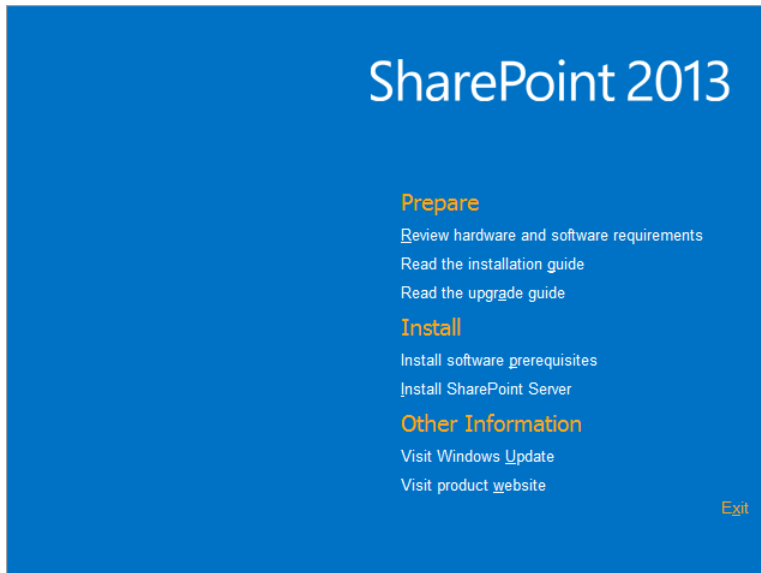2. Double-click the SharePoint 2013 install media to launch the install splash screen.

Figure 16   Installer splash screen

3. Select **Install SharePoint Server**.

4. Enter a product key and then click **Continue**.
5. Check the box to agree to the license terms and click **Continue**.
6. Verify **Complete** is selected in the **Server Type** window. Click the **File Location** tab.
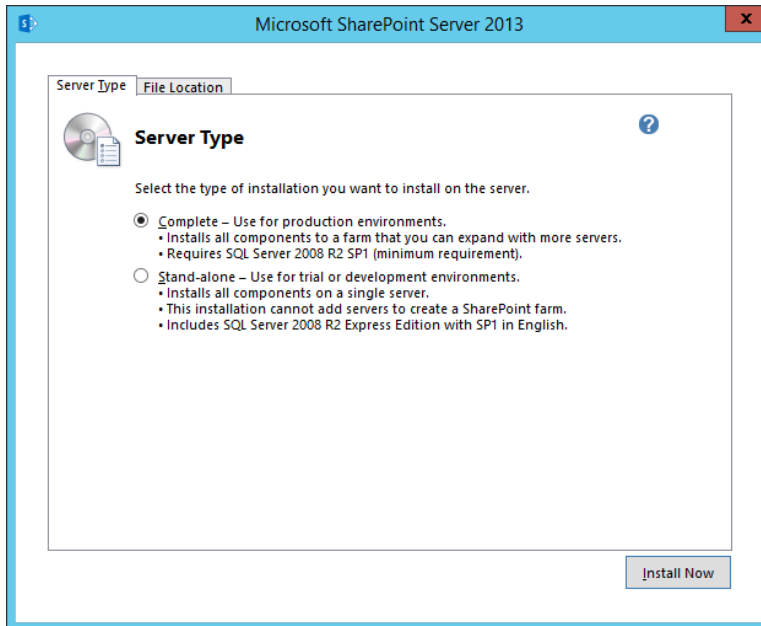

Figure 17   Server type selection

7. On the **Choose a file location** screen change the default installation path to point to a Dell Compellent Volume. If this server will host a Search service application, also change the search index location to reside on a separate Dell Compellent Volume.
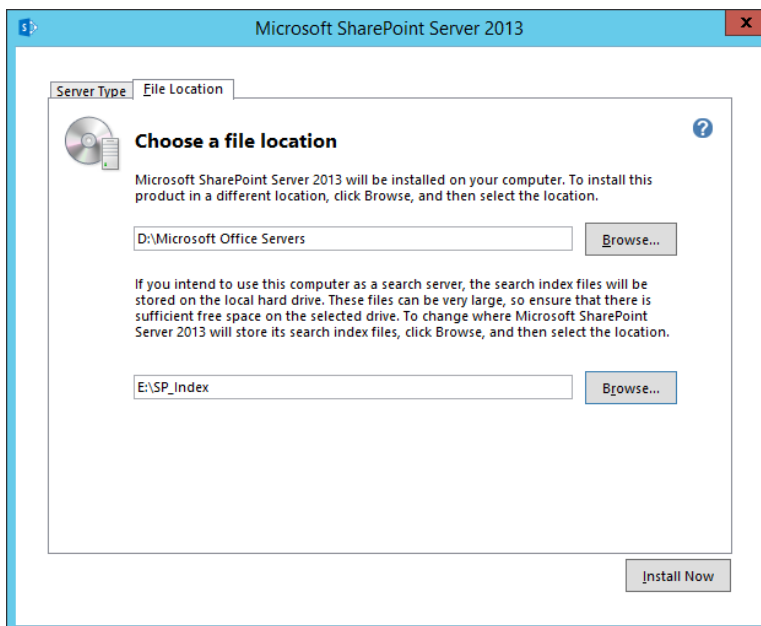

Figure 18   Server with Search service application

Note: If this server will not host a Search service application, change the search index location to match the installation path.
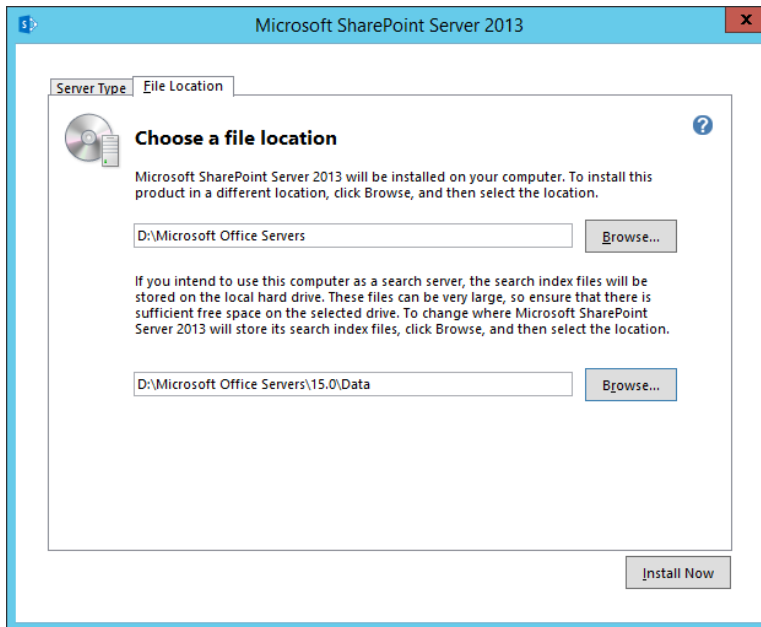

Figure 19   Server without Search service application

8. Click **Install Now**.
9. When installation has completed, leave the box checked to **Run the SharePoint Products Configurations Wizard** now and click **Close**.
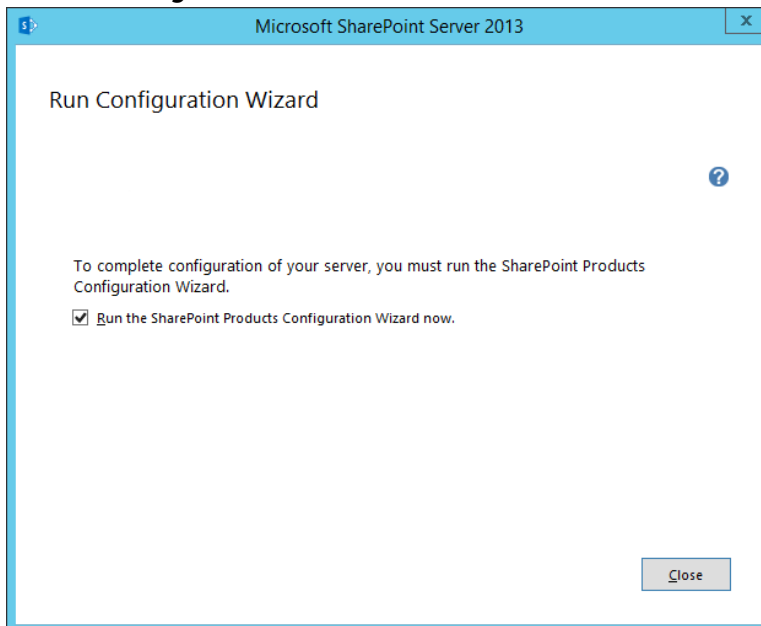

Figure 20   Run configuration wizard

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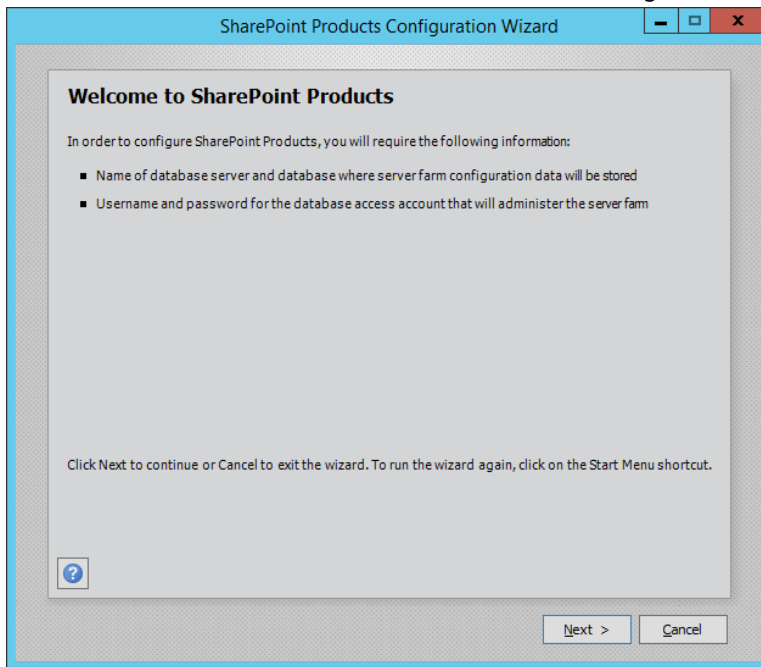

Figure 21   SharePoint products config wizard

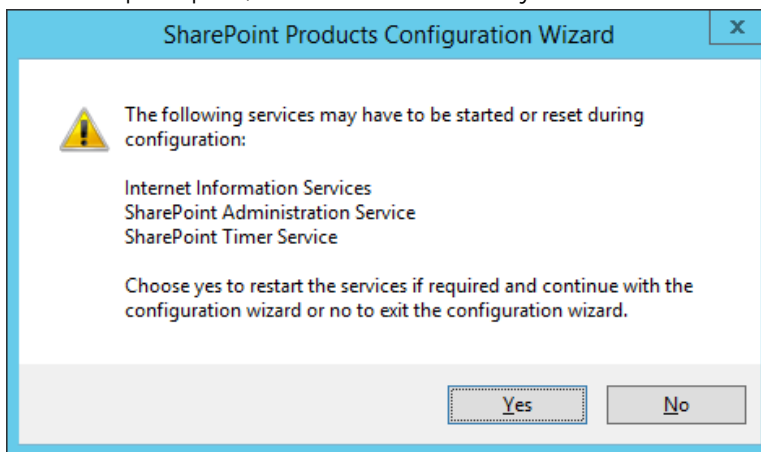11. If prompted, click **Yes** to restart any services.

Figure 22   Service restart confirmation

12. On the Connect to a server farm screen, select **Connect to an existing server farm** and click **Next**.
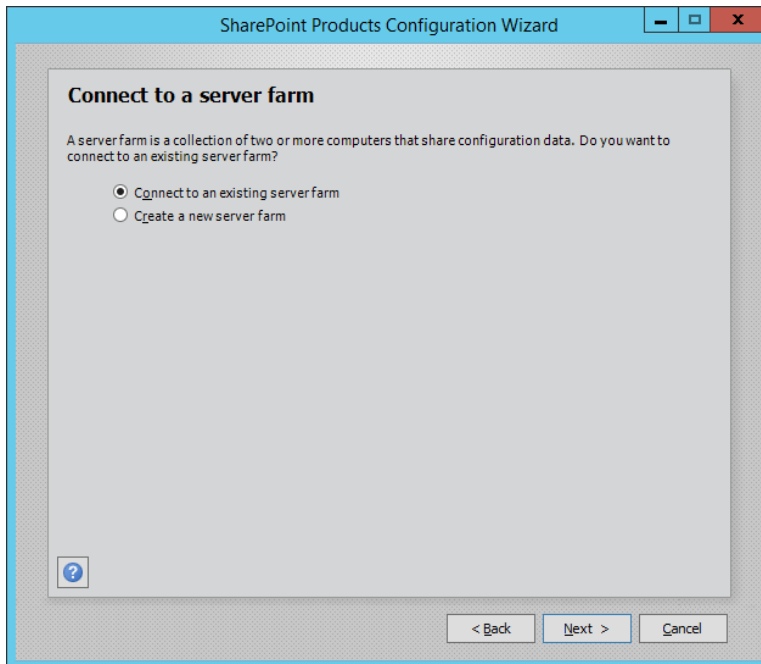
Figure 23   Connect to an existing farm

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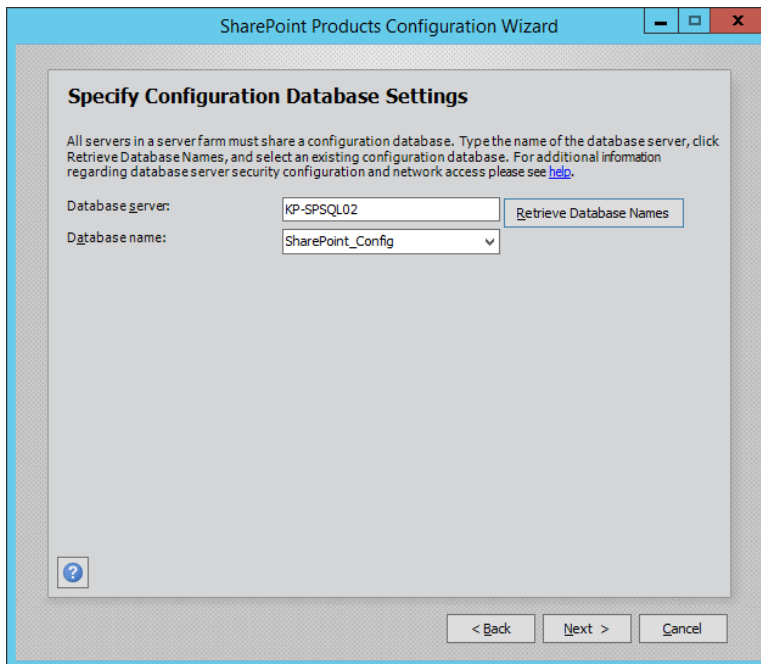

Figure 24   Specify config DB

14. Enter the passphrase to connect to the farm. Click **Next**.
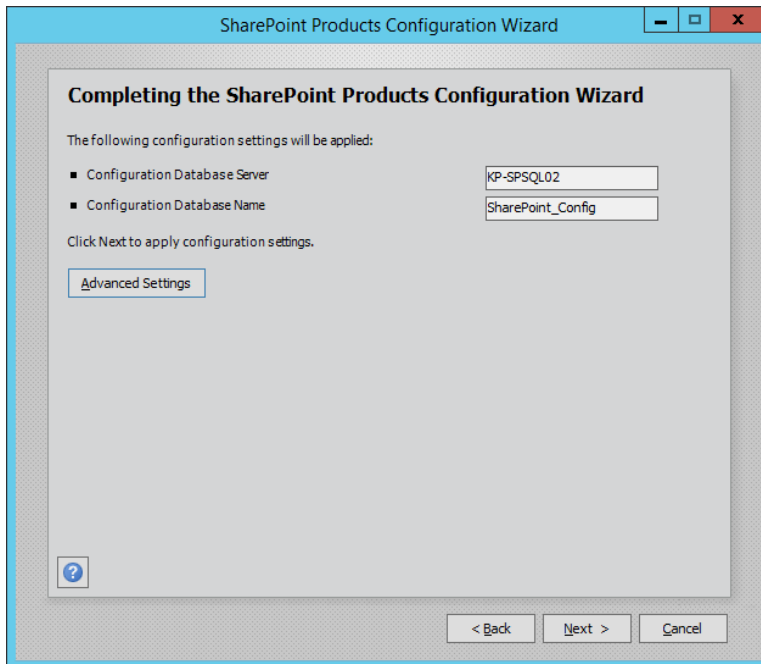15. Verify the configuration database server and name are correct, then click **Next**.

Figure 25   Completing config wizard

      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**.
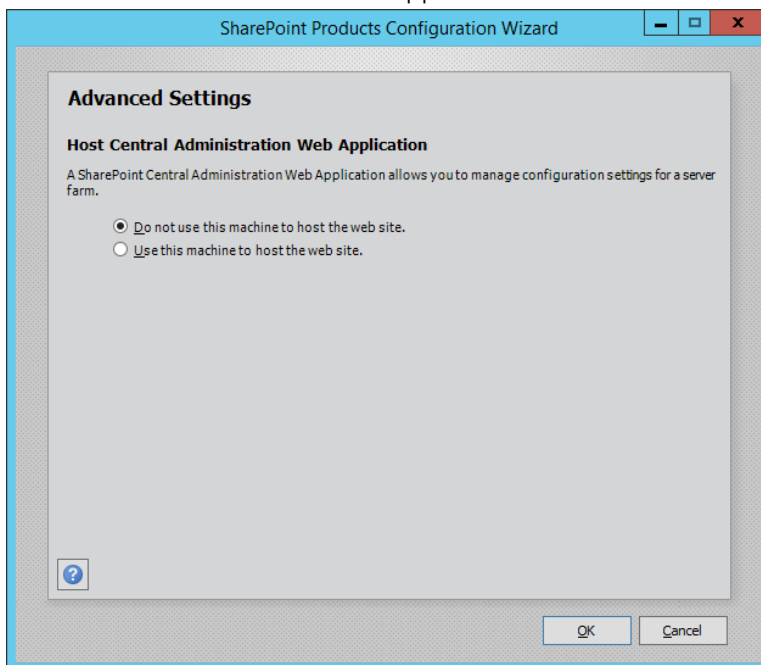

Figure 26   Host central administration web application options

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

6 SharePoint 2013 cache settings

SharePoint 2013 uses the following cache types 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 2013 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 2013. For more information about SharePoint cache settings, please refer to Microsoft TechNet.

6.1 BLOB cache

In SharePoint 2013 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 database 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 database 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 2013 environment. By default, the BLOB cache is disabled on all web applications.

Note: The BLOB cache must be enabled to use the SharePoint 2013 image renditions feature.

6.1.1 Enabling and configuring the BLOB cache

To enable and configure the BLOB cache:

17. Log on as an administrator to the front-end web server.
18. Open Internet Information Services (IIS) Manager by going to **Start > Apps > Administrative Tools > Internet Information Services (IIS) Manager**.
19. Within **IIS Manager** in the **Connections** pane, expand the web server and then expand **Sites**.
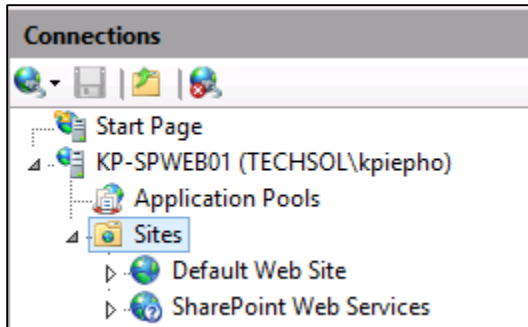
Figure 27   Front-end web server

20. Right-click the desired web application and select **Explore**.
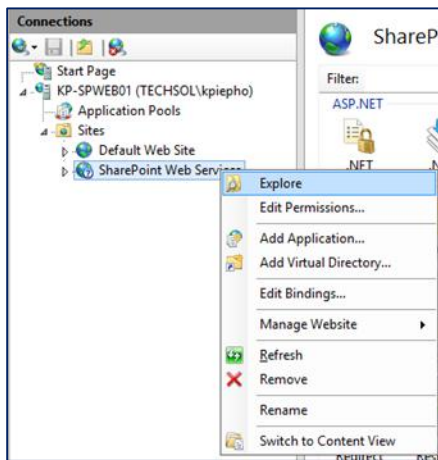

Figure 28   Explore web application

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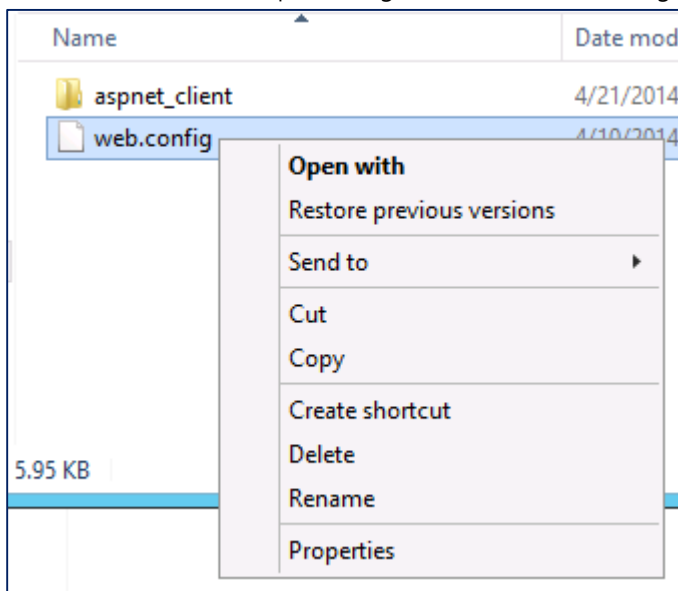

Figure 29   Open web.config file

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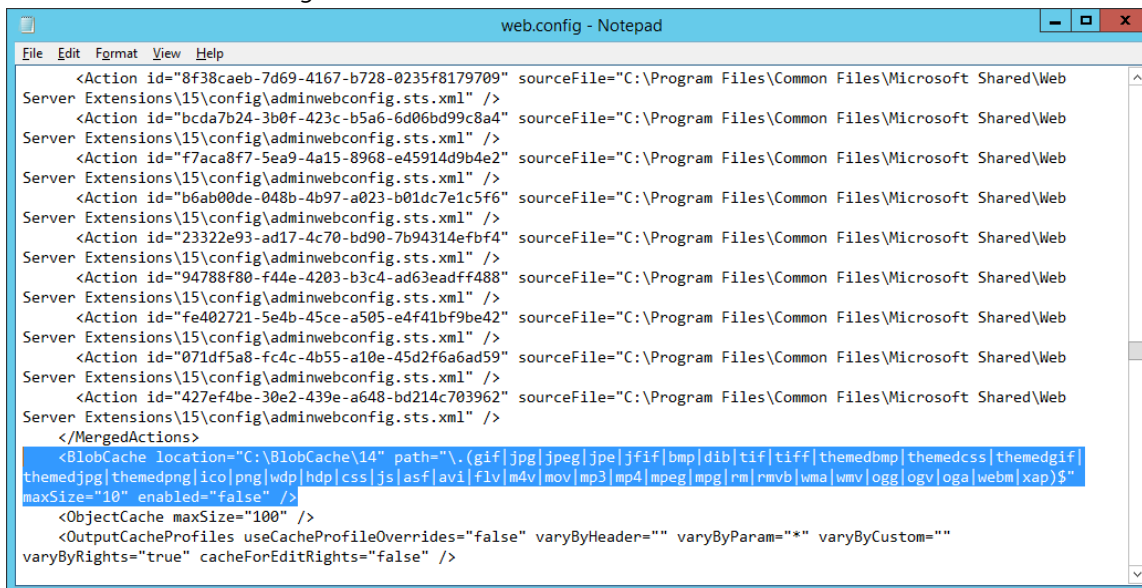

Figure 30   Blob cache entry

24. Change the location to reside on a Dell Compellent volume.
25. If needed, add or remove file type extensions from the list.
26. 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 Dell Compellent volume where the BLOB cache will reside should be greater than the maximum cache size.

27. Change the value for enabled to "true".

Figure 31   Updated values

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

7 Configuring SharePoint 2013 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 Dell Compellent volume.

During SharePoint 2013 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 2013 natively does not provide a mechanism to change the default content index location through the Central Administration GUI. Instead, multiple Windows PowerShell commands must be used. To automate this task, 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 2013, please refer to Microsoft TechNet.

8 Backup and recovery

At the present time Dell Compellent does not offer an integrated solution to backup and restore all components of a SharePoint 2013 environment. However, Replay Manager can be used to protect SharePoint 2013 SQL Server content and configuration databases. The built-in backup and recovery tools included in SharePoint 2013 provide administrators the ability to script and schedule backups and restores of the entire farm, web applications and site collections.

Detailed information on how to backup and restore SQL Server databases using Dell Compellent Replay Manager can be found in the *Replay Manager Administrator's Guide*, located on Dell TechCenter.

For more information about the built-in backup and recovery tools in SharePoint 2013, please refer to http://technet.microsoft.com/en-us/library/ee428315(v=office.15).aspx.

9 Conclusion

Hopefully this document has proved helpful and has accomplished its purpose by providing administrators with answers to commonly asked questions associated with deploying SharePoint Server 2013 utilizing Dell Compellent Storage Center.

For more information, please refer to the documentation as listed under "Additional resources" below.

A Additional resources

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

DellTechCenter.com is an IT Community where you can connect with Dell Customers and Dell employees for the purpose of sharing knowledge, best practices, and information about Dell products and installations.

Referenced or recommended Dell Compellent publications on Dell TechCenter:
http://en.community.dell.com/techcenter/storage/w/wiki/5018.compellent-technical-content.aspx

- Dell Compellent Storage Center Users Guide
- Windows Server MPIO Best Practices for Dell Compellent Storage Center
- Windows Server 2012 R2 Best Practices for Dell Compellent Storage Center
- Windows Failover Clustering with Windows Server 2012 R2 and Dell Compellent Storage Center
- Hyper-V 2012 R2 Best Practices for Dell Compellent Storage Center
- Microsoft SQL Server Best Practices with Dell Compellent Storage Center

Referenced or recommended Microsoft publications:

- Deployment guide for SharePoint 2013:
  http://www.microsoft.com/en-us/download/details.aspx?id=30384
- Best practices for virtualizing and managing SharePoint 2013:
  http://download.microsoft.com/download/0/0/1/001ADCCC-A45B-47E3-8DA4-ED51E3208021/Best_Practices_for_Virtualizing_and_Managing_SharePoint_2013.pdf
- Best practices for virtualizing and managing SQL Server 2012:
  http://download.microsoft.com/download/6/1/D/61DDE9B6-AB46-48CA-8380-D7714C9CB1AB/Best_Practices_for_Virtualizing_and_Managing_SQL_Server_2012.pdf
- Technical diagrams for SharePoint 2013:
  http://technet.microsoft.com/en-us/library/cc263199(v=office.15).aspx
- Windows Server 2012 R2 Hyper-V best practices blog:
  http://blogs.technet.com/b/askpfeplat/archive/2013/03/10/windows-server-2012-hyper-v-best-practices-in-easy-checklist-form.aspx
- Cache settings operations in SharePoint Server 2013:
  http://technet.microsoft.com/en-us/library/cc261797(v=office.15).aspx