

Cisco Unified Computing System: Meet the Challenges of Microsoft SharePoint Server Workloads

What You Will Learn

Designing an enterprise-class Microsoft SharePoint Server 2013 environment presents many challenges. Learn how to overcome them with best practices and design concepts from Cisco.

When you are designing an enterprise-class Microsoft SharePoint Server 2013 environment, you need to consider many options: database implementation, server configuration, software configuration, and the hardware that will run the SharePoint Server 2013 farms. You also must plan for the management and governance of the SharePoint environment to help ensure that it will continue to offer acceptable levels of performance and reliability in the future. A basic design engagement can require several days to evaluate the various SharePoint options and allow the designer or architect to determine how to meet the organization's requirements.

This document introduces some critical SharePoint Server 2013 design concepts and best practices. It also shows that the Cisco Unified Computing System™ (Cisco UCS™) is well suited for larger and more complex SharePoint Server 2013 environments. Cisco has accumulated these best practices over nearly a decade of designing SharePoint environments for companies of all sizes, and they reveal many potential advantages for organizations that choose the Cisco® platform.

This document provides an overview of the elements you need to consider in designing a SharePoint Server farm. It assumes a basic familiarity with networking concepts and with the configuration of high-capacity server farms.

Design Challenges with SharePoint

A primary concept of any SharePoint design is right-sizing the SharePoint Server implementation to meet an organization's needs. For organizations that already have SharePoint installed (typically a previous version of SharePoint Server or the lower-end free version of SharePoint Server called Microsoft SharePoint Foundation 2010), this task tends to be easy because the IT team will have some knowledge of the platform as well as informed opinions about what did and did not work in the organization. In a completely new implementation in which the organization has little or no SharePoint experience, the challenge is to match expectations with best-practice design philosophies gained in the field by the SharePoint architect.

Classic errors in design include both overbuilding and underbuilding the SharePoint environment. Overbuilding can result in an overly complex SharePoint environment, with a dozen servers or more, often with an overwhelming number of features enabled (such as managed metadata, workflows, forms, business intelligence, and other SharePoint Enterprise features) that exceed IT's ability to support them. The feature set can also exceed the user community's skills, especially when sufficient training is not offered, resulting in the impression that SharePoint is "too complicated" or "never works right." Underbuilding can yield equally counterproductive results, such as slow page loads, timeouts during uploads or downloads, system outages, and overly simplistic feature sets that frustrate users.

Today the cloud is a popular option for SharePoint Server 2013 deployments for two main reasons:

- The deployments require a large number of servers to meet the performance and availability needs of medium-sized and large organizations.
- Most SharePoint Server 2013 environments are evolutionary in nature.

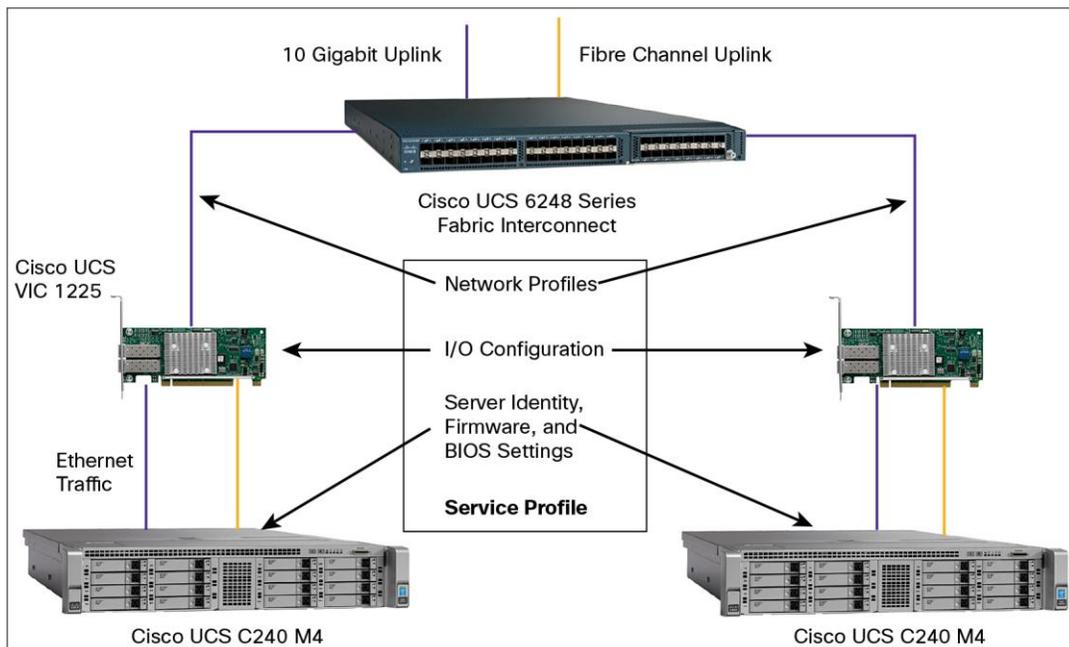
Clouds can be private to an organization and hosted in company-owned data centers, or they can be public and hosted by a service provider.

Building the SharePoint Server 2013 Farm Infrastructure

Let's look at the main components of a SharePoint Server 2013 farm running in an enterprise-class Cisco UCS environment. Cisco UCS provides a completely integrated network and server infrastructure, which can be used as a foundation for a SharePoint Server 2013 farm.

Figure 1 shows a sample Cisco UCS configuration that can be used to host a small to medium-sized SharePoint Server farm. It includes Cisco UCS C-Series Rack Servers, Cisco UCS virtual interface cards (VICs), and a Cisco UCS 6100 Series Fabric Interconnect. Cisco UCS service profiles are used to set up network profiles, the VIC I/O configurations, and the server's identity, firmware, and BIOS settings.

Figure 1. Sample Cisco UCS Configuration Showing Main Hardware and Software Components



One clear benefit is that a single, trusted vendor is providing all the components needed for the SharePoint farm. Cisco provides detailed guidelines about specific configurations that are supported for SharePoint Server 2013, which will be discussed later in this document. Additional capabilities of Cisco UCS include the following:

- **Dynamic provisioning and service profiles:** Cisco UCS Manager supports service profiles, which contain abstracted server states, creating a stateless environment. It implements role-based and policy-based management focused on service profiles and templates. These mechanisms can fully provision one or many servers and their network connectivity in minutes, rather than hours or days. This feature can be very valuable in SharePoint environments, in which new servers need to be provisioned on short notice or new farms need to be provisioned for specific development activities. For instance, numerous enterprises have more than 15,000 users and 20 or more development farms to support the development activities occurring on the SharePoint platform, so the capability to rapidly provision a new server can be very valuable.
- **Embedded multirole management:** Management is embedded in the fabric interconnects. All attached systems are handled as a single, redundant Cisco UCS management domain. Cisco UCS Manager controls all aspects of system configuration and operation, eliminating the need to use multiple, separate element managers for each system component. The result is a reduction in the number of management modules and consoles and more control over your IT infrastructure for greater productivity.
- **Cisco VN-Link virtualization support:** Cisco VN-Link capabilities allow a virtual machine's virtual network adapters to be managed in the same way as physical network adapters. This feature allows virtual network adapters to be centrally configured and managed without the complexity of traditional systems, which interpose multiple layers in virtualized environments. I/O configurations and network profiles move along with virtual machines, helping increase security and efficiency while reducing complexity. With VN-Link, all network traffic to and from a virtual machine passes through the distributed virtual switch and the hypervisor. Switching occurs in the Cisco fabric interconnects. This approach enables network policies to be applied to the virtual machines and the traffic between the virtual machines.
- **Cisco UCS virtual interface cards:** Cisco UCS VICs are high-performance 10-Gbps converged network adapters (CNAs) that provide highly flexible virtual networking capabilities. Cisco UCS VICs can radically reduce the number of required network interface cards (NICs) and host bus adapters (HBAs). They support up to 256 dynamic virtual adapters and interfaces and can provide up to 80 Gbps of bandwidth. With support for Cisco SingleConnect technology, they can unify LAN, SAN, and systems connections over a single physical link for rack servers, blade servers, and virtual machines. Cisco UCS VICs can be used in a redundant configuration with two fabric extenders and two fabric interconnects.
- **Cisco Unified Fabric and fabric interconnects:** Cisco Unified Fabric leads to a dramatic reduction in the number of network adapters, blade server switches, and cabling by passing all network and storage traffic over one cable to the parent fabric interconnects. This approach improves performance, radically simplifies network cabling, and reduces the number of devices that need to be powered, cooled, secured, and managed. The Cisco UCS 6100 Series offers important features and benefits, including:
 - High-performance unified fabric with line-rate, low-latency, lossless 10 Gigabit Ethernet and Fibre Channel over Ethernet (FCoE) functions
 - Centralized unified management with Cisco UCS Manager software
 - Virtual machine-optimized services with support for Cisco VN-Link technology

The next critical components of the SharePoint Server 2013 environment are the servers. These servers can be physical or virtual. SharePoint Server 2013 requires Microsoft Windows Server 2008 R2 Service Pack 1 (SP1) or later and the 64-bit version of Microsoft SQL Server 2008 R2 SP1 or later. A critical part of the design process is complying with organizational standards while meeting the anticipated needs of the organization for the foreseeable life of the technology. For example, some organizations have standards that require all servers to be virtualized and all implementations to be designed to meet anticipated end-user requirements for the next three to five years.

The Cisco UCS product line starts with a set of basic product offerings for both rack-mount and blade servers that fit into the Cisco server chassis. Cisco built this server line from the ground up to create a product line that is designed for today's computing requirements. Cisco's goal was to reduce the overall complexity of configurations by offloading complex processes to modules such as the VICs and the fabric interconnects. Cisco's networking products, software, and accomplishments are legendary, and Cisco incorporated its networking expertise into the Cisco UCS line of servers. The Cisco UCS server line consists of the following:

- **Cisco UCS C-Series Rack Servers:** The Cisco C-Series servers are rack-mountable servers that come in a variety of configurations, ranging from the entry-level Cisco UCS C240 M4 Rack Server to the top-of-the-line Cisco UCS C460 M4 Rack Server.
 - Cisco UCS C240 M4 Rack Server: This high-density rack server comes in a 2-rack-unit (2RU) form factor. It supports up to two Intel® Xeon® processor E5-2600 v3 CPUs, up to 1.5 terabytes (TB) of RAM, up to 24 Small Form Factor (SFF) drives or 12 Large Form Factor (LFF) drives, a modular LAN-on-motherboard (mLOM) slot, two integrated 1 Gigabit Ethernet LAN-on-motherboard (LOM) connections, and up to six PCI Express (PCIe) 3.0 slots (four full-height).
 - Cisco UCS C460 M4 Rack Server: This high-performance rack server comes in a 4RU form factor. It supports up to four Intel Xeon processor E7-4800 or E7-8800 CPUs; up to 6 TB of RAM; up to 12 SFF Serial Attached SCSI (SAS), Serial ATA (SATA), or solid state disk (SSD) disks; two Gigabit Ethernet LOM ports; two 10 Gigabit Ethernet ports; and up to 10 PCIe Gen 3 slots.
- **Cisco UCS 5100 Series Blade Server Chassis:** The Cisco UCS 5108 Blade Server Chassis comes in a 6RU form factor. As Figure 2 shows, it can house up to eight half-width or four full-width Cisco UCS B-Series Blade Servers. Four hot-swappable power supplies are accessible from the front of the chassis. The rear of the chassis contains eight hot-swappable fans, four power connectors (one per power supply), and two I/O bays for Cisco UCS 2100 Series Fabric Extenders or the Cisco UCS 6324 Fabric Interconnect. A passive midplane provides up to 80 Gbps of I/O bandwidth per server slot and up to 160 Gbps of I/O bandwidth for two slots.
- **Cisco UCS B-Series Blade Servers:** The Cisco UCS B-Series Blade Servers come in a variety of configurations, ranging from the entry-level Cisco B200 M4 Blade Server to the top-of-the-line Cisco B460 M4 Blade Server.
 - Cisco B200 M4 Blade Server: This blade server supports up to two Intel Xeon processor E5-2600 v3 CPUs; up to 1.5 TB of RAM; up to two 2.5-inch SFF SAS or SATA SSDs or hard disk drives (HDDs); a 2-port, 40 Gigabit Ethernet, or FCoE-capable mLOM mezzanine adapter; and I/O throughput of up to 80 Gbps. Each chassis can contain up to eight Cisco B200 M4 Blade Servers.
 - Cisco B460 M4 Blade Server: This blade server supports up to four Intel Xeon processor E7-4800 v2 and E7-8800 v2 CPUs, up to 6 TB of RAM, up to four 2.5-inch SFF HDD or SSD drives, two mLOM slots for Cisco UCS VICs, six PCIe mezzanine slots, and I/O throughput of up to 320 Gbps. Each chassis can contain up to four Cisco B460 M4 Blade Servers.

Figure 2. Cisco UCS 5108 Blade Server Chassis



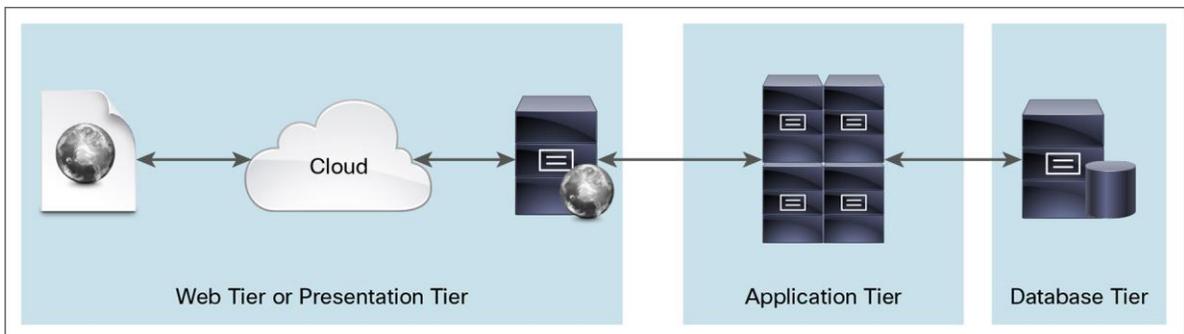
Cisco UCS Statelessness

Cisco UCS relies on the concept of statelessness, which allows the personality settings of one server to be applied to another server automatically at failover. This feature helps SharePoint administrators quickly perform change management activities such as hardware upgrades. Cisco UCS service profiles capture the configuration settings of the servers and the LAN and SAN interfaces, enabling the administrator to rapidly provision new servers for deployment or rapidly replace failed servers. Service profiles also link to storage parameters such as the host and storage group for the relevant server.

SharePoint Server 2013 Three-Tier Architecture and Cisco Validated Design Program

SharePoint Server 2013 uses a three-tier architecture, shown in Figure 3. This three-tier design facilitates scalability and flexibility. It consists of a web tier, application tier, and database tier.

Figure 3. SharePoint Server 2013 Three-Tier Architecture



The three tiers have different responsibilities:

- **Web tier:** The web tier is responsible for hosting webpages, web services, and the web parts that are needed to process user requests. It is also responsible for directing application-tier requests to the appropriate application server host.
- **Application tier:** The application tier is responsible for hosting SharePoint services. Each service can reside on a dedicated application server, or services with similar performance characteristics can be grouped on a server. Grouped services can be scaled out across multiple servers.

- **Database tier:** The database tier hosts multiple SharePoint databases, which can be categorized broadly by their roles as search database, content database, and service database. In larger environments, SharePoint databases can be grouped by role and deployed on multiple database servers.

The next sections discuss some of the most important best practices for each of these tiers. You will see how you can best use the capabilities of the Cisco UCS platform to run SharePoint Server 2013.

To help guide your specific SharePoint Server 2013 implementations, Cisco offers its Cisco Validated Design program. This program provides detailed information about fully tested and supported configurations for SharePoint Server 2013. Table 1 shows the virtual machine configuration for a SharePoint Server 2013 farm based on a Cisco Validated Design that has been verified to support up to 100,000 users and 40 million items.

Table 1. Sample SharePoint Farm Virtual Machine Configuration

Role	Virtual Machine	Web Front End, Application, and Database Server	RAM (GB)	Processor
Web	12	Web front end	8	4 vCPUs
Application (Search)	8	Application server with query processing and index components	16	4 vCPUs
Application (Search)	4	Application server with crawl, search administration, analytics, and content processing components	8	4 vCPUs
Database	2	Database server with all search databases	16	4 vCPUs
SMSP	2	Backup and restore	4	2 vCPUs

This configuration consists of a total of 28 virtual machines: 12 web front-end servers, 12 application servers, 2 database servers, and 2 backup servers. A virtualized environment like VMware vSphere or Microsoft Hyper-V provides many advantages for configuration and management. For example, it provides the capability to rapidly change CPU and memory configurations during proof-of-concept (PoC) and user-acceptance implementations. In addition, vSphere and Hyper-V support the use of up to 64 virtual CPUs (vCPUs) per virtual machine. Another useful feature of vSphere and Hyper-V is the capability to take snapshots of server configurations prior to updates, upgrades, or new code rollouts. They enable you to roll back the changes if a problem occurs. However, snapshots can affect virtual machine disk performance, so you should use them only as temporary solutions.

Table 2 shows the hardware and software infrastructure used in the SharePoint farm in the Cisco Validated Design.

Table 2. SharePoint Farm Hardware and Software Components

Vendor	Name	Version	Description
Cisco	Cisco 6248UP	UCSM 2.0(IS)	Cisco UCS 6248UP Series Fabric Interconnects
Cisco	Cisco UCS Chassis	5108	Chassis
Cisco	Nexus 5548UP Switch	NX-OS	Nexus Switch 5000 Series
Cisco	UCS Blade Server	B200 M2	Half Width Blade Server
Cisco	UCS Blade Server	B250 M2	Full Width Blade Server
VMware	ESXi 5.1u1	5.1u1	Hypervisor
VMware	vCenter Server	5.1u1	VMware Management
Microsoft	Windows Server 2012 R2	2012 R2	Operating System
Microsoft	Microsoft SharePoint Server	SharePoint 2013 SP1	Web Front End SharePoint 2013 Enterprise Edition
Microsoft	Microsoft SharePoint Server	SharePoint 2013 SP1	Application Server SharePoint 2013 Enterprise Edition
Microsoft	SQL Server	2014	Database Server SQL Server 2014 Enterprise Edition
Microsoft	VSTS 2010	SP1	Load Test Controller VSTS 2010 Ultimate Edition

Vendor	Name	Version	Description
Microsoft	VSTS 2010	SP1	Load Test Agents VSTS 2010 Ultimate Edition
NetApp	FAS8040 controller	8.0.1	NetApp Storage Controller FC/FCoE/iSCSI/Ethernet
NetApp	SnapDrive	7.0.3	SnapDrive for Windows
NetApp	SnapManager for SQL Server	7.1	SnapManager for Microsoft SQL Server
NetAPP	SnapManager for SharePoint	8.1	SnapManager for Microsoft SharePoint

This configuration and the testing results are fully documented in the “FlexPod Data Center with Microsoft SharePoint 2013 and Cisco Application Centric Infrastructure (ACI) Design Guide,” which is discussed in the “For More Information” section of this document.

After a production rollout, some organizations realize that a specific configuration does not provide the performance that the user community is demanding and subsequently need to rebuild all or part of the farm. As SharePoint grows in popularity and becomes a mission-critical application, many organizations require high-availability and disaster-recovery solutions that can completely fail over SharePoint farms to co-locations that are geographically separated from the main data center. The capability to copy or clone server images can greatly facilitate this process.

SQL Server Database Tier

SharePoint Server 2013 stores data uploaded to a SharePoint site in a SQL Server database. SharePoint Server 2013 supports using the 64-bit edition of SQL Server 2014, SQL Server 2012, or SQL Server 2008 R2 SP1. Because the SQL Server database is a core component of the SharePoint installation, optimizing the I/O on the SQL Server is very important.

In a Cisco UCS environment, organizations can choose whether to create physical SQL Server instances or virtual SQL Server instances. Today most organizations implement virtualized SQL Server instances using a vSphere or Hyper-V virtualization platform. The SQL Server instances can provide high availability by implementing a Microsoft Windows Server Failover Cluster, database mirroring, or Microsoft AlwaysOn Availability Groups.

The Cisco UCS platform's support for up to 60 cores and 768 GB of RAM make it an excellent platform for the SQL Server database tier. SQL Server is a resource-intensive application that can take advantage of large amounts of RAM. This pairing is particularly advantageous if your database tier is virtualized. In that case, you need a host that can run multiple demanding workloads. Some of the best practices for implementing the SQL Server database tier in SharePoint Server 2013 include the following:

- Use a dedicate server system for the database tier. Although technically there is no reason the SQL Server database tier could not support databases used by other applications, if you want the database tier to provide the best possible support for SharePoint, the SQL Server system should be used only by the SharePoint farm.
- Configure SQL Server settings and security before implementing SharePoint. There are several SQL Server settings that are recommended for SharePoint deployments that are different from most standalone SQL Server deployments:
 - Do not enable autcreate statistics on a server that hosts SQL Server and SharePoint Server.
 - Set the maximum degree of parallelism (MAXDOP) to 1. Higher settings will cause a less optimal query plan to be used.

-
- Evaluate high availability using SQL Server AlwaysOn. In SQL Server 2014, AlwaysOn is Microsoft's premier availability technology. It provides high availability with automatic failover as well as disaster recovery from remote sites or Microsoft Windows Azure. All the SharePoint databases can be added to AlwaysOn Availability Groups.
 - Use dynamic memory for virtualized SQL Server instances. Today most organizations implement their SharePoint database tier using virtual machines running either vSphere or Hyper-V. Both virtualization platforms support dynamic memory features that allow the Enterprise Editions of SQL Server 2014, SQL Server 2012, and SQL Server 2008 to dynamically allocate more memory as resource demands increase and then release it when workloads decline.
 - Plan your SQL Server storage configuration. Storage is a critical component of an effective SQL Server implementation. SQL Server's tempdb data files and transaction logs should be located on the fastest-performing storage resource. Content database transaction log files and search databases should be on the next-best-performing storage resource. Content database data files are suitable for slower storage resources.

Web and Application Tiers

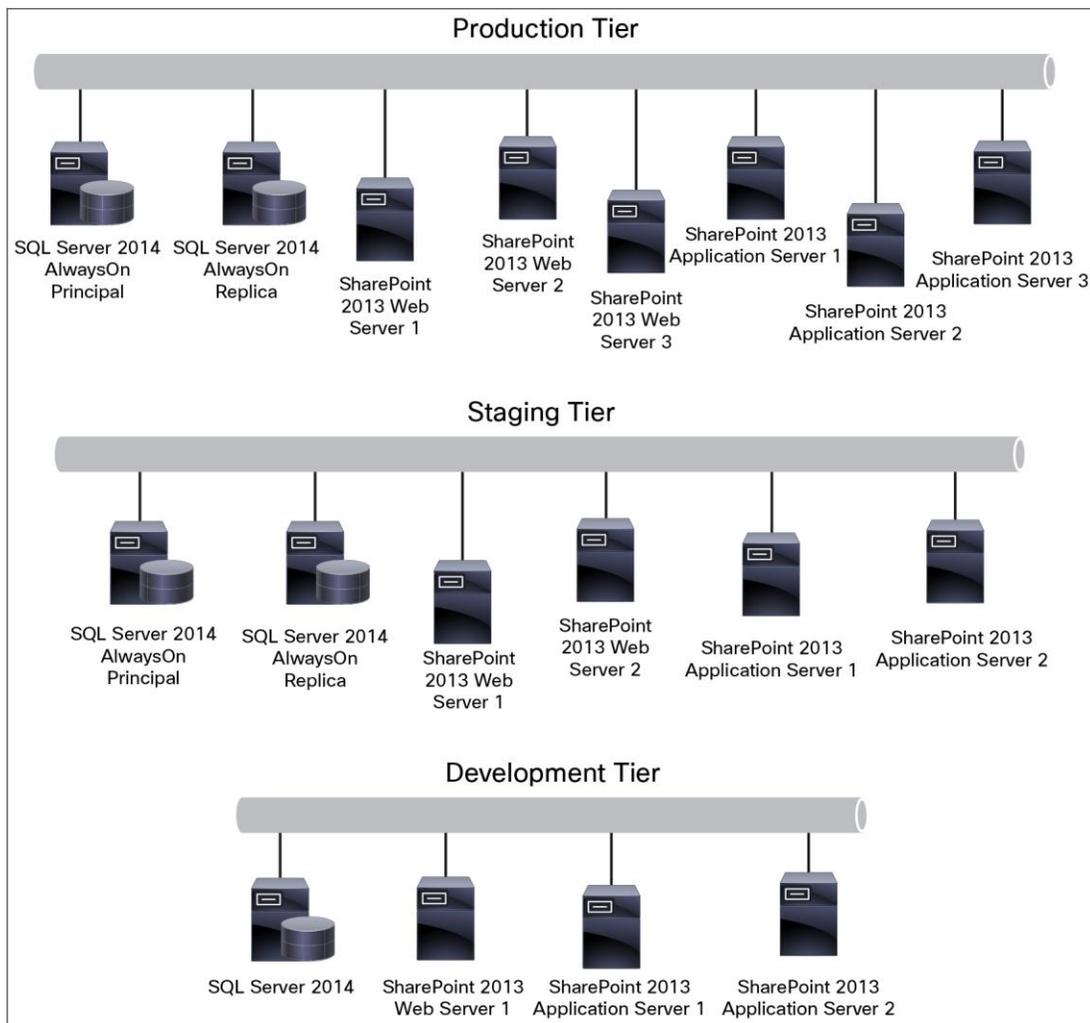
After the SQL Server design has been completed, the SharePoint front-end servers need to be designed. Today this process involves determining the number of web-tier and application-tier virtual machines required and then determining which SharePoint components will be installed on which server. Several of these applications and services have high computing and memory requirements. Cisco UCS provides the processing cores and memory required to handle computation-intensive workloads. In addition, the Cisco UCS unified fabric and VICs provide the bandwidth required to support low-latency connections between the different servers in the SharePoint farm. Some basic best practices to follow when building out your SharePoint web and application tiers include the following:

- Decide which service applications will be placed on the web server. Each SharePoint application service has different performance, resource, and availability requirements. The configuration and placement of the applications will affect performance.
- Determine which of the application-server-based service applications are truly required. Install and enable **only** the service applications that will help the organization meet its business and technology goals. When selecting applications, consider the skill sets of the IT staff and the user population to both support and use these features.
- Determine which SharePoint Server 2013 Enterprise features are truly required. Enabling some SharePoint Server 2013 Enterprise features may require additional configurations. For example, enabling PerformancePoint requires the installation and configuration of PerformancePoint Services. Similarly, enabling some SharePoint Server 2013 Enterprise features may require the installation of companion products such as Microsoft Project Server 2013 or Microsoft Office Web Applications, which in turn may require you to add more application servers to the farm.
- Use dedicated service accounts. The use of dedicated domain service accounts for SharePoint services enables you to have detailed control over the security rights and permissions of those accounts. You should follow the principle of least privilege, giving these services only the rights that they really need.
- Use Secure Sockets Layer (SSL) for the SharePoint Central Administration site. The SharePoint Central Administration site regularly requires account credentials for different operations. The use of SSL protects those credentials and helps ensure that they are not passed across the network in plain text.

- Configure collection of use and health data. Regular monitoring of your SharePoint environment is vital to detecting trends and new use patterns. Enabling the collection of SharePoint use and health data will write use and health data to the logging folder and the logging database.

Figure 4 provides an example of a three-tier configuration for a medium-sized SharePoint Server 2013 farm. In many organizations, these configurations are not static but need to be monitored and tuned over time to help ensure that end-user requirements are being met. A common occurrence is the evolution of the SharePoint Server 2013 environment from basic intranet and collaboration functions to an application development platform that supports more advanced capabilities such as business intelligence applications, complex workflows and business processes, and customized applications to meet specific business requirements. For this reason, organizations often need to add new servers with very specific functions. These servers may need to be added to the SQL Server database layer, SharePoint application layer, or web layer. The capabilities of the Cisco UCS platform allow IT to quickly create the base server images, allowing IT to then rapidly install the operating system, the virtualization platform, and the necessary software.

Figure 4. Sample Three-Tier Server Farm Configuration



Conclusion

Cisco UCS provides a scalable and flexible foundation for Microsoft SharePoint Server 2013. It allows IT departments to focus less on making everything work together and more on helping ensure that the SharePoint Server software configuration meets the organization's requirements.

Cisco UCS simplifies the lives of overworked and understaffed IT departments. An enterprise-level multitier SharePoint Server 2013 environment will be supporting thousands of end users. This environment will require numerous components. IT will need to install networking components, such as hubs, switches, and routers. It will also need to install servers, virtual server hosts, and a variety of software products, including the Windows Server OS, SQL Server, and SharePoint Server. The organization will need to spend considerable time and energy to plan, configure, and implement the SharePoint Server farm so that it meets the organization's requirements. Cisco UCS provides a scalable and flexible foundation that allows IT departments to focus less on making everything work together and more on helping ensure that their SharePoint Server 2013 software configuration meets their organization's requirements.

For More Information

Here is a selection of reference materials, websites, and white papers that you can use to learn more about the Cisco UCS line of servers and how to implement Microsoft SharePoint Server 2013 on the Cisco UCS platform:

- [Microsoft Applications on Cisco UCS](#)

- [Cisco Unified Computing System](#)

This page provides access to many resources that provide more information about the Cisco UCS platform, including the components that make up this product line. It also provides links to additional resources such as customer case studies, white papers, performance benchmarks, and analyst reports.

- [Microsoft SharePoint Server 2010 on Cisco Unified Computing System](#)

This white paper presents the performance and scalability study for a medium-sized SharePoint farm built using Cisco UCS servers. Besides sharing the test results, the white paper discusses the three-tiered architecture (web, application, and database tiers) used in the SharePoint farm's implementation. This white paper provides guidance and a better understanding of the performance impact of different SharePoint workloads to help organizations correctly size and design a farm architecture that can support their workloads.

- [FlexPod Data Center with Microsoft SharePoint 2013 and Cisco Application Centric Infrastructure \(ACI\) Design Guide](#)

This design guide discusses how to deploy SharePoint Server 2013 Enterprise on FlexPod for VMware. It demonstrates how enterprises can apply best practices for VMware vSphere, VMware vCenter, Cisco UCS, Cisco Nexus® Family switches, and NetApp FAS.

- **Cisco Unified Computing System (UCS): A Complete Reference Guide to the Cisco Data Center Virtualization Server Architecture**

This book, written by Silvano Gai, Tommi Salli, and Roger Andersson, is available from Amazon and other retailers. It provides a detailed guide to server components and data center technologies and describes how to use these components and technologies to build a state-of-the-art data center server.



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at www.cisco.com/go/offices.

 Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: www.cisco.com/go/trademarks. Third party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1110R)