NetApp Verified Architecture

FlexPod Datacenter with Microsoft Exchange 2016, SharePoint 2016, and NetApp AFF A300

NVA Deployment

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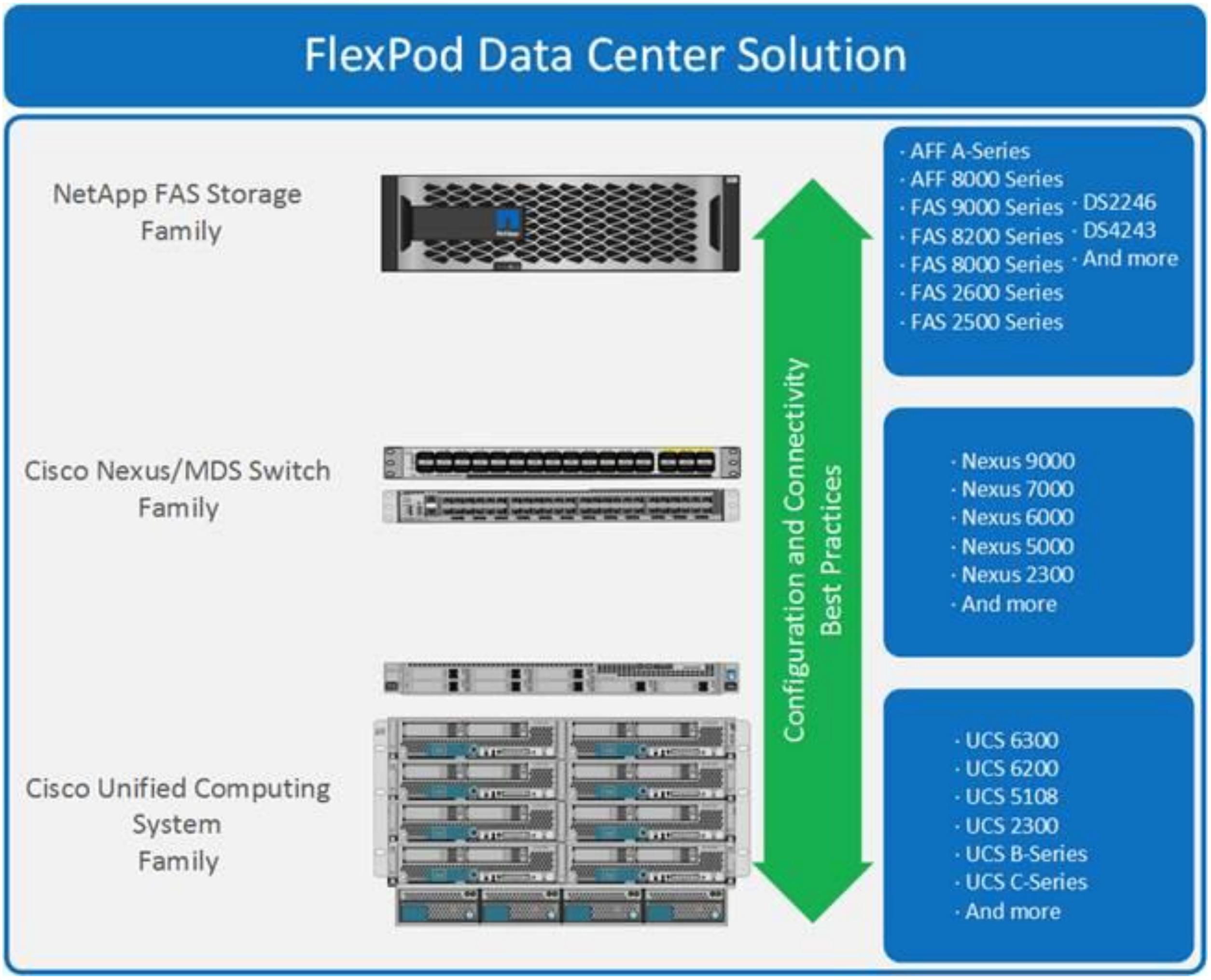
1 Program Summary

FlexPod® is a predesigned, best practice data center architecture that is built on the Cisco Unified Computing System (Cisco UCS), the Cisco Nexus family of switches, and NetApp® AFF A-Series systems. FlexPod is a suitable platform for running a variety of virtualization hypervisors as well as bare-metal operating systems (OSs) and enterprise workloads. FlexPod delivers a baseline configuration and also has the flexibility to be sized and optimized to accommodate many different use cases and requirements. Figure 1 lists the component families that make up the FlexPod Datacenter solution.

Figure 1) FlexPod component families.



This document describes the deployment details for VMware vSphere 6.5, Microsoft Exchange 2016, Microsoft SharePoint 2016, and NetApp All Flash FAS (AFF) built on the FlexPod model from Cisco and NetApp. This document is based on best practices and recommendations from NetApp and Cisco.

2 Solution Overview

While architecting an on-premises solution to host enterprise applications such as Microsoft Exchange and Microsoft SharePoint, you must answer some questions:

- How do I build a secure and resilient infrastructure?

- How do I make sure of the highest level of availability?
- What return on investment (ROI) can I expect?
- How can I build a future-proof infrastructure?
- How do I reduce the complexity of my infrastructure?

The FlexPod architecture is designed to help you answer all these questions. By introducing standardization, FlexPod helps you mitigate the risks and uncertainty involved in planning, designing, and implementing a next-generation data center architecture.

This document focuses on VMware vSphere 6.5, Microsoft Exchange 2016, Microsoft SharePoint 2016, and NetApp ONTAP® 9.1 built on the FlexPod Datacenter architecture. This document also discusses design choices and best practices for this shared infrastructure platform. These design considerations and recommendations are not limited to the specific releases of the components described in this document but are also applicable to other versions.

2.1 Solution Technology

FlexPod is a best practice data center architecture that includes three core components:

- Cisco UCS
- Cisco Nexus switches
- NetApp AFF or FAS systems

These components are connected and configured according to the best practices of both Cisco and NetApp and provide the ideal platform for running a variety of enterprise workloads with confidence. FlexPod can scale up for greater performance and capacity (adding compute, network, or storage resources individually as needed). It can also scale out for environments that need multiple consistent deployments (rolling out additional FlexPod stacks). FlexPod delivers a baseline configuration, and it can also be sized and optimized to accommodate many different use cases.

Typically, the more scalable and flexible a solution is, the more difficult it becomes to maintain a single unified architecture capable of offering the same features and functionality across implementations. This is one of the key benefits of the FlexPod architecture. Each of the component families shown in Figure 1 offers platform and resource options to scale the infrastructure up or down while supporting the same features and functionality that are required under the configuration and connectivity best practices of the FlexPod solution.

The FlexPod solution addresses four primary design principles: availability, scalability, flexibility, and manageability, as follows:

- **Application availability.** Services are accessible and ready to use.
- **Scalability.** Increasing demands are addressed with appropriate resources.
- **Flexibility.** New services are provided and resources are recovered without infrastructure modification requirements.
- **Manageability.** Efficient infrastructure operations are facilitated through open standards and application programming interfaces (APIs).

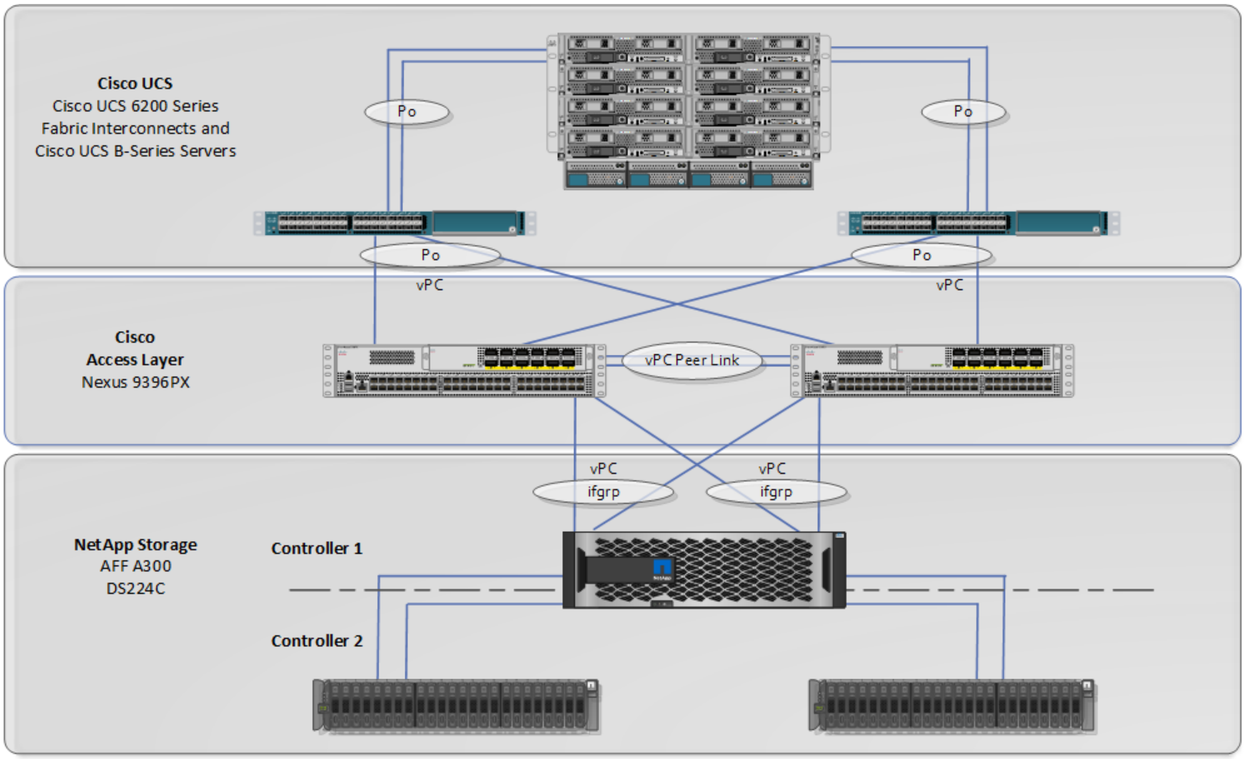
2.2 Use Case Summary

The FlexPod Datacenter with Microsoft Exchange 2016 and Microsoft SharePoint 2016 solution architecture provides a flexible framework for the following use cases:

- Deploying a solution to run Exchange and SharePoint on a single FlexPod platform
- Architecting a SharePoint farm for 10,000 active users
- Architecting an Exchange environment for 10,000 active users with 5GB mailboxes

Figure 2 represents the topology deployed for these use cases.

Figure 2) FlexPod Datacenter for Microsoft Exchange 2016 and Microsoft SharePoint 2016 solution topology.



3 Technology Requirements

Cisco, NetApp, and VMware have interoperability matrixes that must be referenced to determine support for any specific implementation of a FlexPod solution. See the following links for more information:

- NetApp Interoperability Matrix Tool
- Cisco UCS Hardware and Software Interoperability Tool
- VMware Compatibility Guide

3.1 Hardware Requirements

Table 1 lists the hardware components required to implement the use case.

Table 1) Hardware requirements.

Hardware	Model Number	Quantity
Cisco UCS 6200 Series fabric interconnects	FI 6248UP	2
Cisco UCS B200 blades	B200 M4 using Cisco UCS VIC 1340	8
Cisco UCS 5108 chassis	Cisco UCSB-5108-AC2	1
Cisco Nexus 9000	Cisco Nexus 9396PX	2
NetApp AFF A300	AFF A300	1 HA pair

Hardware	Model Number	Quantity
NetApp DS224C disk shelves	Disk shelves populated with 3.8TB SSDs	2 shelves with 24 drives each

3.2 Software Requirements

Table 2 lists the software components required to implement the use case.

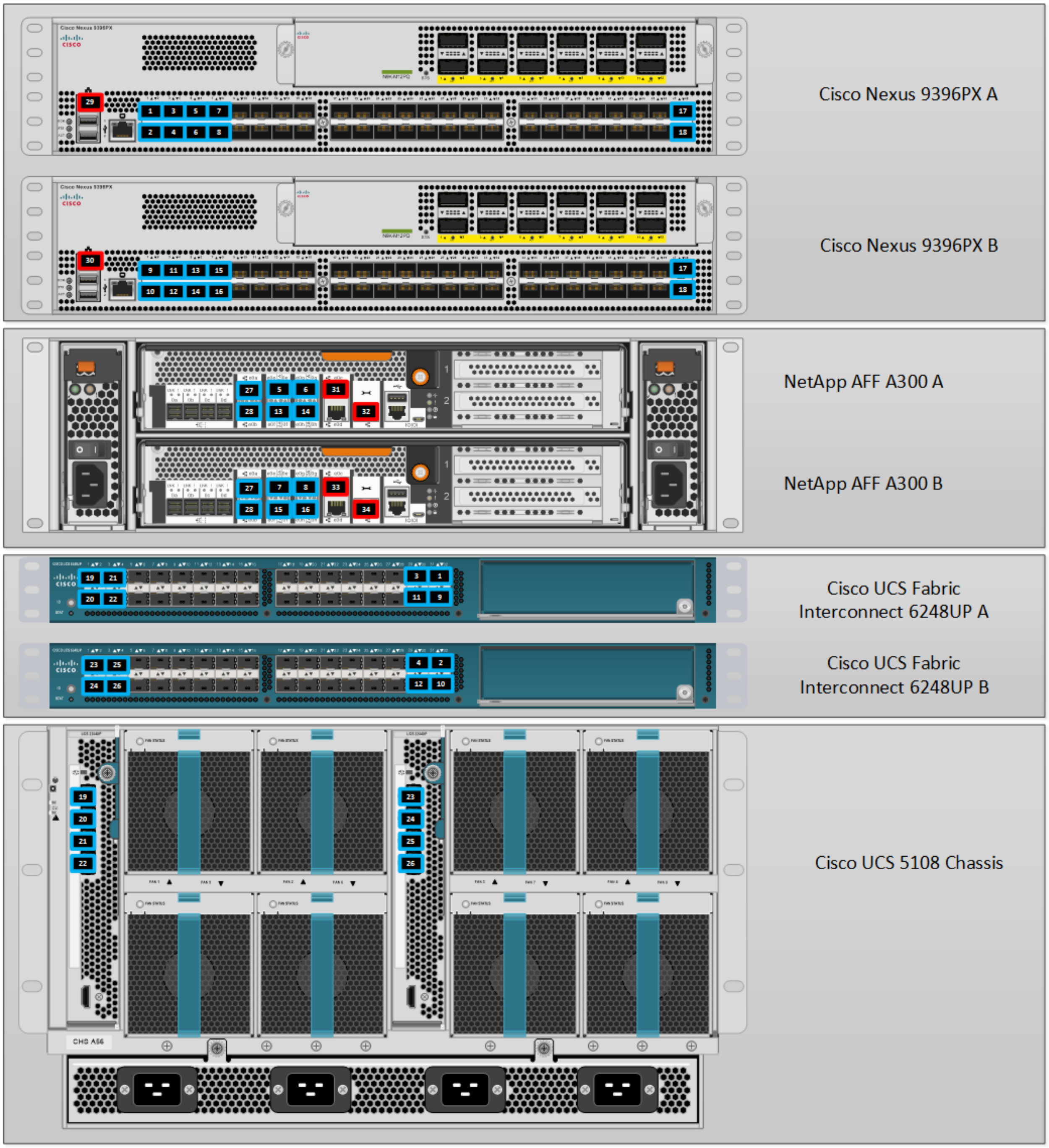
Table 2) Software requirements.

Software/Firmware	Version
Compute	
Cisco UCS Manager	3.1(3a)
Networking	
Cisco NX-OS	7.0(3)I4(6)
Storage	
NetApp ONTAP	9.1
NetApp VSC	6.2.1
VMware vSphere	
VMware ESXi	6.5.0, 4887370
VMware vCenter Server	6.5.0, 4944578
Microsoft SQL Server	
Microsoft SQL Server	2016
Microsoft SQL Server Management Studio	16.5.3
Microsoft Apps	
Microsoft SharePoint	2016
Microsoft Exchange	2016
Backup and Recovery	
DocAve Backup and Restore	Version 6 SF9
NetApp SnapDrive®	7.1.4
NetApp SnapManager® for Exchange	7.2
NetApp Single Mailbox Recovery	7.2

4 FlexPod Cabling on ONTAP

Figure 3 illustrates the cabling diagram for this FlexPod use case on ONTAP.

Figure 3) FlexPod cabling diagram for use case on ONTAP.



The information provided in Table 3 through Table 8 corresponds to the connections shown in Figure 2.

Table 3) Cisco Nexus 9396PX A cabling information.

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
Cisco Nexus 9396PX A	Eth1/1	10GbE	Cisco UCS fabric interconnect A	Eth1/31	1

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
	Eth1/2	10GbE	Cisco UCS fabric interconnect B	Eth1/31	2
	Eth1/3	10GbE	Cisco UCS fabric interconnect A	Eth1/29	3
	Eth1/4	10GbE	Cisco UCS fabric interconnect B	Eth1/29	4
	Eth1/5	10GbE	NetApp controller A	e0e	5
	Eth1/6	10GbE	NetApp controller B	e0e	7
	Eth1/7	10GbE	NetApp controller A	e0g	6
	Eth1/8	10GbE	NetApp controller B	e0g	8
	Eth1/47	10GbE	Cisco Nexus 9396PX B	Eth1/47	17
	Eth1/48	10GbE	Cisco Nexus 9693PX B	Eth1/48	18
	MGMT0	1GbE	GbE management switch	Any	29

Table 4) Cisco Nexus 9396PX B cabling information.

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
Cisco Nexus 9396PX B	Eth1/1	10GbE	Cisco UCS fabric interconnect A	Eth1/32	9
	Eth1/2	10GbE	Cisco UCS fabric interconnect B	Eth1/32	10
	Eth1/3	10GbE	Cisco UCS fabric interconnect A	Eth1/30	11
	Eth1/4	10GbE	Cisco UCS fabric interconnect B	Eth1/30	12
	Eth1/5	10GbE	NetApp controller A	e0f	13
	Eth1/6	10GbE	NetApp controller B	e0f	15
	Eth1/7	10GbE	NetApp controller A	e0h	14
	Eth1/8	10GbE	NetApp controller B	e0h	16
	Eth1/47	10GbE	Cisco Nexus 9396PX A	Eth1/47	17
	Eth1/48	10GbE	Cisco Nexus 9693PX A	Eth1/48	18
	MGMT0	1GbE	GbE management switch	Any	30

Table 5) NetApp controller A cabling information.

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
NetApp controller A	e0M	1GbE	GbE management switch	Any	32
	e0c	1GbE	GbE management switch	Any	31
	e0a	10GbE	NetApp controller B	e0a	**27**
	e0b	10GbE	NetApp controller B	e0b	**28**
	e0e	10GbE	Cisco Nexus 9396PX A	Eth1/5	**5**
	e0f	10GbE	Cisco Nexus 9396PX B	Eth1/5	**13**
	e0g	10GbE	Cisco Nexus 9396PX A	Eth1/7	**6**
	e0h	10GbE	Cisco Nexus 9396PX B	Eth1/7	**14**

Note: The term `e0M` refers to the physical Ethernet port labeled with a wrench icon on the rear of the chassis.

Table 6) NetApp controller B cabling information.

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
NetApp controller B	e0M	1GbE	GbE management switch	Any	34
	e0c	1GbE	GbE management switch	Any	33
	e0a	10GbE	NetApp controller A	e0a	**27**
	e0b	10GbE	NetApp controller A	e0b	**28**
	e0e	10GbE	Cisco Nexus 9396PX A	Eth1/6	**7**
	e0f	10GbE	Cisco Nexus 9396PX B	Eth1/6	**15**
	e0g	10GbE	Cisco Nexus 9396PX A	Eth1/8	**8**
	e0h	10GbE	Cisco Nexus 9396PX B	Eth1/8	**16**

Note: The term `e0M` refers to the physical Ethernet port labeled with a wrench icon on the rear of the chassis.

Table 7) Cisco UCS fabric interconnect A cabling information.

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
Cisco UCS fabric interconnect A	Eth1/1	10GbE	Cisco UCS chassis 1 IOM A	Port 1	**19**
	Eth1/2	10GbE	Cisco UCS chassis 1 IOM A	Port 2	**20**
	Eth 1/3	10GbE	Cisco UCS chassis 1 IOM A	Port 3	**21**

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
	Eth 1/4	10GbE	Cisco UCS chassis 1 IOM A	Port 4	22
	Eth1/29	10GbE	Cisco Nexus 9396PX A	Eth1/1	3
	Eth1/30	10GbE	Cisco Nexus 9396PX B	Eth1/1	11
	Eth1/31	10GbE	Cisco Nexus 9396PX A	Eth1/3	1
	Eth1/32	10GbE	Cisco Nexus 9396PX B	Eth1/3	9
	MGMT0	1GbE	GbE management switch	Any	
	L1	1GbE	Cisco UCS fabric interconnect B	L1	
	L2	1GbE	Cisco UCS fabric interconnect B	L2	

Table 8) Cisco UCS fabric interconnect B cabling information.

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
Cisco UCS fabric interconnect B	Eth1/1	10GbE	Cisco UCS chassis 1 IOM B	Port 1	23
	Eth1/2	10GbE	Cisco UCS chassis 1 IOM B	Port 2	24
	Eth 1/3	10GbE	Cisco UCS chassis 1 IOM B	Port 3	25
	Eth 1/4	10GbE	Cisco UCS chassis 1 IOM B	Port 4	26
	Eth1/29	10GbE	Cisco Nexus 9396PX A	Eth1/2	4
	Eth1/30	10GbE	Cisco Nexus 9396PX B	Eth1/2	12
	Eth1/31	10GbE	Cisco Nexus 9396PX A	Eth1/4	2
	Eth1/32	10GbE	Cisco Nexus 9396PX B	Eth1/4	10
	MGMT0	1GbE	GbE management switch	Any	
	L1	1GbE	Cisco UCS fabric interconnect B	L1	
	L2	1GbE	Cisco UCS fabric interconnect B	L2	

5 Deployment Procedures

The procedures in the following sections must be completed in a sequential manner to deploy this FlexPod Datacenter solution:

1. NetApp Storage Configuration

2. Cisco UCS Server Configuration
3. Cisco Nexus Storage Networking Configuration
4. VMware vSphere Configuration
5. VMware vCenter 6.5a Configuration
6. NetApp Virtual Storage Console (VSC) 6.2.1 deployment
7. Service account creation
8. SQL Server 2016 Installation and Configuration
9. Microsoft SharePoint 2016 Installation and Configuration
10. DocAve 6 Installation
11. Microsoft Exchange 2016 Installation and Configuration
12. SnapManager for Exchange Installation and Configuration

5.1 NetApp Storage Configuration

AFF Series Controller

For instructions on the physical installation of AFF controllers, follow the procedures in the AFF Series documentation on the NetApp Support site. When planning the physical location of the storage systems, refer to the Hardware Universe.

NetApp Hardware Universe

The NetApp Hardware Universe is an online application that provides information about supported hardware and software components for specific ONTAP versions. This tool provides configuration information for all NetApp storage appliances that are currently supported by the ONTAP software. It can also compare component compatibilities.

To verify configuration information in the Hardware Universe, complete the following steps:

1. Access the Hardware Universe site to verify that the hardware and software components are supported with the version of ONTAP that you plan to install.
2. Click the Platforms tab to view the compatibility between ONTAP software versions and NetApp storage appliances with the desired specifications.
3. Alternatively, click the Compare Storage Systems tab to compare components by storage appliance.

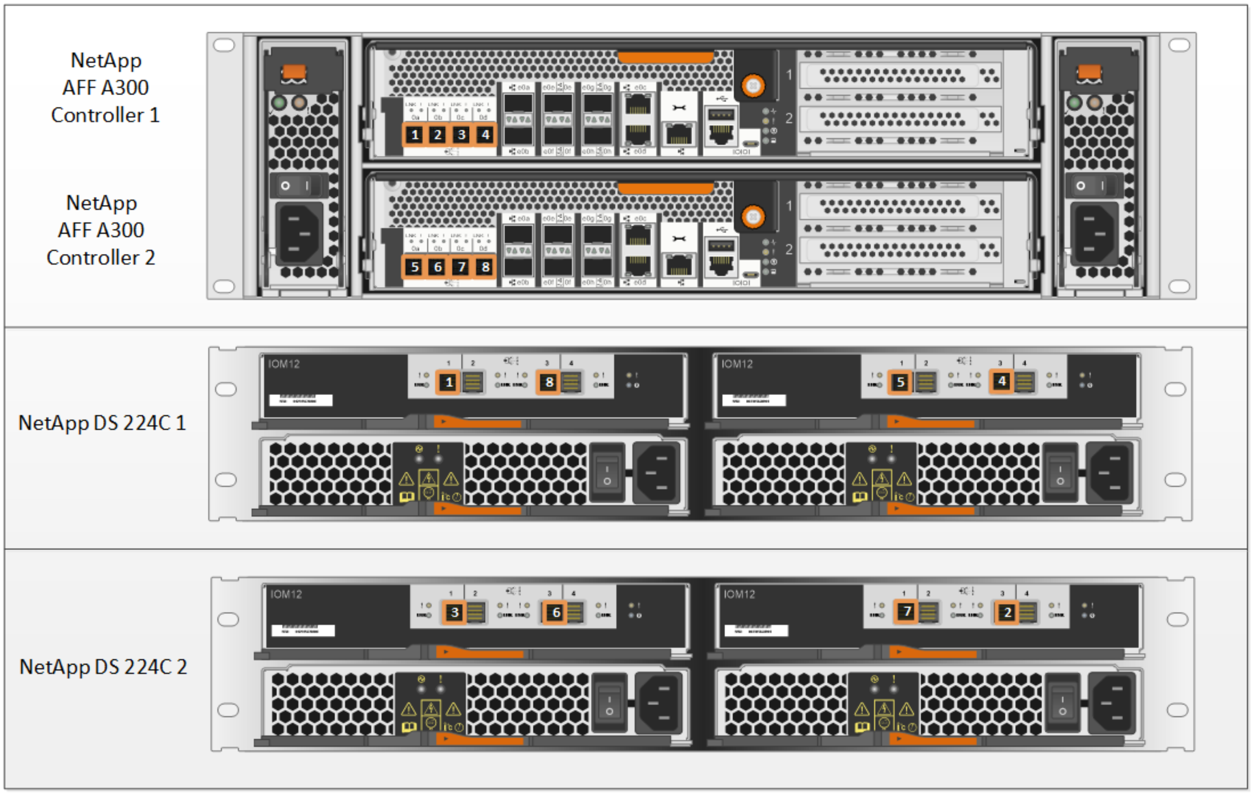
Disk Shelves

NetApp storage systems support a wide variety of disk shelves and disk drives. Visit the NetApp Support site to view a complete list of supported disk shelves. This solution is built on DS224C disk shelves with SSDs. These disks provide the highest level of performance available.

When using SAS disk shelves with NetApp storage controllers, refer to the SAS Disk Shelves Universal SAS and ACP Cabling Guide for information about cabling guidelines.

Figure 4 illustrates the cabling diagram for this FlexPod use case on ONTAP.

Figure 4) Cabling diagram for NetApp storage with NetApp disk shelves.



ONTAP

This procedure assumes that the storage system has been installed and cabled and is ready for setup. For detailed information about storage system installation, see the preceding resources.

Configure ONTAP Nodes

Before running the setup script, review the configuration worksheets in the ONTAP 9.1 Software Setup Guide to learn about the information required to configure ONTAP. Table 9 lists the information that you need to configure two ONTAP nodes. You should customize the cluster detail values with the information that is applicable to your deployment.

Table 9) Cluster details for the ONTAP software configuration.

Cluster Detail	Cluster Detail Value
Cluster name	`<<var_clustername>>`
ONTAP base license	`<<var_cluster_base_license_key>>`
Cluster management IP address	`<<var_clustermgmt_ip>>`
Cluster management netmask	`<<var_clustermgmt_mask>>`
Cluster management port	`<<var_clustermgmt_port>>`
Cluster management gateway	`<<var_clustermgmt_gateway>>`
Cluster node 01 IP address	`<<var_node01_mgmt_ip>>`

Cluster Detail	Cluster Detail Value
Cluster node 01 netmask	<<var_node01_mgmt_mask>>
Cluster node 01 gateway	<<var_node01_mgmt_gateway>>
Cluster node 01 service processor IP address	<<var_node01_sp_ip>>
Cluster node 01 service processor netmask	<<var_node01_sp_netmask>>
Cluster node 01 service processor gateway	<<var_node01_sp_gateway>>
Cluster node 02 IP address	<<var_node02_mgmt_ip>>
Cluster node 02 netmask	<<var_node02_mgmt_mask>>
Cluster node 02 gateway	<<var_node02_mgmt_gateway>>
Cluster node 02 service processor IP address	<<var_node02_sp_ip>>
Cluster node 02 service processor netmask	<<var_node02_sp_netmask>>
Cluster node 02 service processor gateway	<<var_node02_sp_gateway>>
Cluster password	<<var_password>>
Cluster DNS domain name	<<var_dns_domain_name>>
Nameserver IP	<<var_nameserver_ip>>
Controller location	<<var_node_location>>
Cluster node 01 name	<<var_node01>>
Cluster node 02 name	<<var_node02>>
Cluster node 01 aggregate name	<<var_node01_rootaggrname>>

Node Setup

Before you start the process of creating a storage cluster, you need to set up the individual nodes, which involves enabling the NetApp AutoSupport® remote support diagnostics system, assigning the node management IP addresses, and so on.

1. To perform the node setup, connect to the storage cluster node 01 console port. Console settings are:
   - Baud rate: 115200
   - Data bits: 8
   - Parity: none
   - Stop bit: 1
   - Flow control: none
2. Enable AutoSupport on the node.

```
Welcome to node setup.

You can enter the following commands at any time:
  "help" or "?" - if you want to have a question clarified,
  "back" - if you want to change previously answered questions, and
  "exit" or "quit" - if you want to quit the setup wizard.
     Any changes you made before quitting will be saved.
```

```
To accept a default or omit a question, do not enter a value.

This system will send event messages and weekly reports to NetApp Technical
Support.
To disable this feature, enter "autosupport modify -support disable" within 24
hours.
Enabling AutoSupport can significantly speed problem determination and
resolution should a problem occur on your system.
For further information on AutoSupport, see:
http://support.netapp.com/autosupport/

Type yes to confirm and continue {yes}: yes
```

3. Assign the node management IP address, netmask, and gateway.

```
Enter the node management interface port [e0M]: e0M
Enter the node management interface IP address: <<var_node01_mgmt_ip>>
Enter the node management interface netmask: <<var_node01_mgmt_mask>>
Enter the node management interface default gateway: <<var_node01_mgmt_gateway>>
```

4. After the node management IP is assigned, press Ctrl+C to get out of the cluster setup, log in to the shell, and set the storage failover mode to HA.

```
login: admin
******************************************************
* This is a serial console session. Output from this *
* session is mirrored on the SP console session.     *
******************************************************

::> storage failover modify -mode ha
Mode is already set to HA.

::> system node reboot
Warning: Are you sure you want to reboot node "localhost"? {y|n}: y
```

5. After the node reboots, set up the node with the preassigned values.

```
Welcome to node setup.

You can enter the following commands at any time:
  "help" or "?" - if you want to have a question clarified,
  "back" - if you want to change previously answered questions, and
  "exit" or "quit" - if you want to quit the setup wizard.
     Any changes you made before quitting will be saved.

To accept a default or omit a question, do not enter a value.

Enter the node management interface port [e0M]: Enter
Enter the node management interface IP address [10.61.184.218]: Enter

Enter the node management interface netmask [255.255.255.0]: Enter
Enter the node management interface default gateway [10.61.184.1]: Enter

This node has its management address assigned and is ready for cluster setup.

To complete cluster setup after all nodes are ready, download and run the System Setup utility
from the NetApp Support Site and use it to discover the configured nodes.

For System Setup, this node's management address is: 10.61.184.218.

Alternatively, you can use the "cluster setup" command to configure the cluster.

Wed Jul 13 13:10:49 UTC 2016
login:
```

6. Repeat this procedure for storage cluster node 02.

Create Cluster on Node 01

In the ONTAP data management software, the first node in a cluster performs the cluster-create operation. All other nodes perform a cluster-join operation. The first node in the cluster is considered node 01. Use the values from Table 9 to complete the configuration of the cluster and each node.

To create a cluster on node 01, complete the following steps:

1. Keep using the console connection that you have connected to the storage cluster node 01.
2. At the login prompt, enter admin and run the following command:

```
login: admin
******************************************************
* This is a serial console session. Output from this *
* session is mirrored on the SP console session.     *
******************************************************
::> cluster setup
```

3. The Cluster Setup wizard starts on the console.

```
Welcome to the cluster setup wizard.
You can enter the following commands at any time:
"help" or "?" - if you want to have a question clarified,
"back" - if you want to change previously answered questions, and
"exit" or "quit" - if you want to quit the cluster setup wizard.
Any changes you made before quitting will be saved.
You can return to cluster setup at any time by typing "cluster setup".
To accept a default or omit a question, do not enter a value.
Do you want to create a new cluster or join an existing cluster? {create, join}:
```

4. Run the following command to create a new cluster:

```
create
```

5. Enter `no` for the single-node cluster option.

```
Do you intend for this node to be used as a single node cluster? {yes, no} [no]: no
```

6. Enter `no` for the option to use network switches for the cluster network.

```
Will the cluster network be configured to use network switches? [yes]:no
```

7. The system defaults are displayed. Enter `no` for the option to use the system defaults. Follow these prompts to configure the cluster ports:

```
Existing cluster interface configuration found:

Port    MTU     IP              Netmask
e0a     9000    169.254.122.114 255.255.0.0
e0b     9000    169.254.124.58  255.255.0.0

Do you want to use this configuration? {yes, no} [yes]:no

System Defaults:
Private cluster network ports [e0a,e0b].

Cluster port MTU values will be set to 9000.
Cluster interface IP addresses will be automatically generated.

Do you want to use these defaults? {yes, no} [yes]: no

Enter the cluster administrator's (username "admin") password: <<var_password>>
Retype the password: <<var_password>>

List the private cluster network ports [e0a,e0b]: Enter
Enter the cluster ports' MTU size [9000]:  Enter
Enter the cluster network netmask [255.255.0.0]:  Enter

Generating a default IP address. This can take several minutes...
Enter the cluster interface IP address for port e0a [169.254.28.157]: Enter
```

```
Generating a default IP address. This can take several minutes...
Enter the cluster interface IP address for port e0b [169.254.32.222]: Enter
```

8. Use the information in Table 9 to create a cluster.

```
Enter the cluster name: <<var_clustername>>
Enter the cluster base license key: <<var_cluster_base_license_key>>
Creating cluster <<var_clustername>>

Enter an additional license key []:<<var_nfs_license>>
Enter an additional license key []:<<var_iscsi_license>>
```

Note: The cluster-create process can take a minute or two.

Note: For this design, we need to provide additional licenses for NetApp SnapRestore® data recovery software, NetApp FlexClone® data replication software, and the NetApp SnapManager suite.

```
Enter the cluster management interface port [e0c]: e0c
Enter the cluster management interface IP address: <<var_clustermgmt_ip>>
Enter the cluster management interface netmask: <<var_clustermgmt_mask>>
Enter the cluster management interface default gateway: <<var_clustermgmt_gateway>>
```

9. Enter the DNS domain name.

```
Enter the DNS domain names:<<var_dns_domain_name>>
Enter the name server IP addresses:<<var_nameserver_ip>>
```

Note: If you have more than one server IP address, separate them with commas.

10. The cluster-create operation is done. Follow the steps in the next subsection to join node 02 to the cluster that we just created.

Join Node 02 to Cluster

The first node in the cluster performs the cluster-create operation. All other nodes perform a cluster-join operation. The first node in the cluster is considered node 01, and the node joining the cluster in this example is node 02. Table 10 lists the cluster network information required for joining node 02 to the existing cluster. You should customize the cluster detail values with the information that is applicable to your deployment.

Table 10) Cluster details for the cluster-join operation.

Cluster Details	Cluster Detail Value
Cluster node 02 IP address	`<<var_node02_mgmt_ip>>`
Cluster node 02 netmask	`<<var_node02_mgmt_mask>>`
Cluster node 02 gateway	`<<var_node02_mgmt_gateway>>`
Cluster node 02 service processor IP address	`<<var_node02_sp_ip>>`
Cluster node 02 service processor netmask	`<<var_node02_sp_netmask>>`
Cluster node 02 service processor gateway	`<<var_node02_sp_gateway>>`

To join node 02 to the existing cluster, complete the following steps:

1. At the login prompt, enter `admin` and run the following command:

```
login: admin
******************************************************
* This is a serial console session. Output from this *
* session is mirrored on the SP console session.     *
```

```
******************************************************
::> cluster setup
```

2. The Cluster Setup wizard starts on the console.

```
Welcome to the cluster setup wizard.
You can enter the following commands at any time:
"help" or "?" - if you want to have a question clarified,
"back" - if you want to change previously answered questions, and
"exit" or "quit" - if you want to quit the cluster setup wizard.
Any changes you made before quitting will be saved.
You can return to cluster setup at any time by typing "cluster setup".
To accept a default or omit a question, do not enter a value.
Do you want to create a new cluster or join an existing cluster?
{join}:
```

3. Run the following command to join a cluster:

```
join
```

4. The ONTAP software detects the existing cluster and agrees to join the same cluster. Follow these prompts to join the cluster:

```
Existing cluster interface configuration found:

Port    MTU     IP              Netmask
e0a     9000    169.254.195.20  255.255.0.0
e0b     9000    169.254.209.147 255.255.0.0

Do you want to use this configuration? {yes, no} [yes]: no

System Defaults:
Private cluster network ports [e0a,e0b].
Cluster port MTU values will be set to 9000.
Cluster interface IP addresses will be automatically generated.

Do you want to use these defaults? {yes, no} [yes]: no

Step 1 of 3: Join an Existing Cluster
You can type "back", "exit", or "help" at any question.

List the private cluster network ports [e0a,e0b]: Enter
Enter the cluster ports' MTU size [9000]:  Enter
Enter the cluster network netmask [255.255.0.0]: Enter

Generating a default IP address. This can take several minutes...
Enter the cluster interface IP address for port e0a [169.254.73.101]: Enter

Generating a default IP address. This can take several minutes...
Enter the cluster interface IP address for port e0b [169.254.191.73]: Enter
```

5. Use the information in Table 10 to join node 02 to the cluster.

```
Enter the name of the cluster you would like to join [<<var_clustername>>]:Enter
```

Note: The node should find the cluster name.

Note: The cluster-join process can take a minute or two.

6. Node 02 has successfully joined the cluster.

Configure Initial Cluster Settings

To log in to the cluster, complete the following steps:

1. Open a Secure Shell (SSH) connection to the cluster IP address or to the host name.
2. Log in as the `admin` user with the password that you entered earlier.

   Note: Use Table 9 and Table 10 for the input parameters for this section.

Assign Disks for Optimal Performance

SSDs are capable of significant I/O throughput, and proper disk assignment is required for optimal performance. To achieve optimal performance with SSDs, the disks in each chassis should be split between the controllers. Do not use the default allocation method of assigning all disks in a shelf to a single controller. In this solution, disks 0–11 on each chassis should be assigned to a controller, and disks 12–23 should be assigned to the other controller.

To assign the disks as required for this solution, complete the following steps:

1. Verify the current disk allocation.

```
disk show
```

2. Assign disks to the appropriate controller.

```
disk assign –disk <disk path name> -owner <<var_node01/02>> [-force]
```

Note: The `–force` option might be required if the disks are already assigned to another node. Verify that the disk is not a member of an existing aggregate before changing ownership.

Zero All Spare Disks

To zero all spare disks in the cluster, run the following command:

```
disk zerospares
```

Create Aggregates

An aggregate containing the root volume is created during the ONTAP setup process. To create additional aggregates, determine the aggregate name, the node on which to create it, and the number of disks that the aggregate contains.

This solution uses one aggregate on each controller, with 46 drives per aggregate. To create the aggregates required for this solution, complete the following steps:

1. Run the following commands:

```
aggr create -aggregate n01_ssd01 -nodes <<var_node01>> -diskcount 23
aggr create -aggregate n02_ssd01 -nodes <<var_node02>> -diskcount 23
```

Note: Retain at least one disk (select the largest disk) in the configuration as a spare. A best practice is to have at least one spare for each disk type and size per controller.

Note: The aggregate cannot be created until disk zeroing completes. Run the `aggr show` command to display the aggregate creation status. Do not proceed until both `n01_ssd01` and `n02_ssd01` are online.

2. Disable NetApp Snapshot™ copies for the two data aggregates that you created in step 1.

```
system node run -node <<var_node01>> aggr options n01_ssd01 nosnap on
system node run -node <<var_node02>> aggr options n02_ssd01 nosnap on
```

3. Delete any existing Snapshot copies for the two data aggregates.

```
system node run -node <<var_node01>> snap delete –A –a –f n01_ssd01
system node run -node <<var_node02>> snap delete –A –a –f n02_ssd01
```

4. Rename the root aggregate on node 01 to match the naming convention for this aggregate on node 02.

```
aggr show
aggr rename –aggregate aggr0 –newname <<var_node01_rootaggrname>>
```

Verify Storage Failover

To confirm that storage failover is enabled, complete the following steps for a failover pair:

1. Verify the status of storage failover.

```
storage failover show
```

2. Both nodes, `<<var_node01>>` and `<<var_node02>>`, must be capable of performing a takeover. If the nodes are capable of performing a takeover, go to step 4.
3. Enable failover on one of the two nodes.

```
storage failover modify -node <<var_node01>> -enabled true
```

Note: Enabling failover on one node enables it for both nodes.

4. Verify the HA status for the two-node cluster.

Note: This step is not applicable for clusters with more than two nodes.

```
cluster ha show
```

5. If HA is configured, go to step 7.
6. Enable the HA mode only for the two-node cluster.

Note: Do not run this command for clusters with more than two nodes because doing so causes problems with failover.

```
cluster ha modify -configured true
Do you want to continue? {y|n}: y
```

7. Verify that the hardware-assisted failover feature is correctly configured and, if needed, modify the partner IP address.

```
storage failover hwassist show
storage failover modify –hwassist-partner-ip <<var_node02_mgmt_ip>> -node <<var_node01>>
storage failover modify –hwassist-partner-ip <<var_node01_mgmt_ip>> -node <<var_node02>>
```

Set Onboard UTA2 Ports Personality

To set the personality of the onboard unified target adapter 2 (UTA2) ports, complete the following steps:

1. Run the `ucadmin show` command to verify the current mode and current type of the ports.

```
Barsoom::> ucadmin show
                       Current  Current    Pending  Pending    Admin
Node          Adapter  Mode     Type       Mode     Type       Status
------------  -------  -------  ---------  -------  ---------  -----------
Barsoom-01    0e       cna      target     -        -          online
Barsoom-01    0f       cna      target     -        -          online
Barsoom-01    0g       cna      target     -        -          online
Barsoom-01    0h       cna      target     -        -          online
Barsoom-02    0e       cna      target     -        -          online
Barsoom-02    0f       cna      target     -        -          online
Barsoom-02    0g       cna      target     -        -          online
Barsoom-02    0h       cna      target     -        -          online
8 entries were displayed.
```

2. Verify that the current mode of the ports in use is `cna` and the current type is `target`. If this is not the case, change the port personality by running the following command:

```
ucadmin modify -node <home node of the port> -adapter <port name> -mode cna -type target
```

Note: The ports must be offline in order to run this command:

```
network fcp adapter modify -node Colts-stcl-1-02 -adapter 0h -status-admin down
```

Disable Flow Control on 10GbE and UTA2 Ports

A NetApp best practice is to disable flow control on all of the 10GbE and UTA2 ports that are connected to external devices. To disable flow control, run the following command:

```
network port modify -node * -port e0e..e0h -flowcontrol-admin none
Warning: Changing the network port settings will cause a several second interruption in carrier.
Do you want to continue? {y|n}: y
```

Note: The `–node` and `–port` parameters in this example take advantage of the range operator available in the ONTAP shell.

Set Auto-Revert on Cluster Management Interface

To set the auto-revert parameter on the cluster management interface, run the following command:

```
network interface modify –vserver <<var_clustername>> -lif cluster_mgmt –auto-revert true
```

Set Up Management Broadcast Domain

To set up the default broadcast domain for the management network interfaces, run the following commands:

```
broadcast-domain remove-ports -broadcast-domain Default -ports <<var_node01>>:e0e,
<<var_node01>>:e0f, <<var_node01>>:e0g, <<var_node01>>:e0h, <<var_node02>>:e0e,
<<var_node02>>:e0f, <<var_node02>>:e0g, <<var_node02>>:e0h
broadcast-domain show
```

Set Up Service Processor Network Interface

To assign a static IPv4 address to the service processor on each node, run the following commands:

```
system service-processor network modify -node <<var_node01>> -address-family IPv4 -enable true -
dhcp none -ip-address <<var_node01_sp_ip>> -netmask <<var_node01_sp_netmask>> -gateway
<<var_node01_sp_gateway>>

system service-processor network modify -node <<var_node02>> -address-family IPv4 -enable true -
dhcp none -ip-address <<var_node02_sp_ip>> -netmask <<var_node02_sp_netmask>> -gateway
<<var_node02_sp_gateway>>
```

Note: The service processor IP addresses should be in the same subnet as the node management IP addresses.

Create Jumbo Frame MTU Broadcast Domains in ONTAP

To create a data broadcast domain with an MTU of 9000, run the following commands:

```
broadcast-domain create -broadcast-domain Infra_NFS -mtu 9000
broadcast-domain create -broadcast-domain Infra_iSCSI-A -mtu 9000
broadcast-domain create -broadcast-domain Infra_iSCSI-B -mtu 9000
```

Create LACP Interface Groups

The LACP interface group (ifgrp) requires two or more Ethernet interfaces and a switch that supports the Link Aggregation Control Protocol (LACP). Therefore, confirm that the switch is configured properly.

To create interface groups, run the following commands:

```
ifgrp create -node <<var_node01>> -ifgrp a0a -distr-func port -mode multimode_lacp
ifgrp add-port -node <<var_node01>> -ifgrp a0a -port e0e
ifgrp add-port -node <<var_node01>> -ifgrp a0a -port e0f
ifgrp add-port -node <<var_node01>> -ifgrp a0a -port e0g
ifgrp add-port -node <<var_node01>> -ifgrp a0a -port e0h
ifgrp create -node <<var_node02>> -ifgrp a0a -distr-func port -mode multimode_lacp
ifgrp add-port -node <<var_node02>> -ifgrp a0a -port e0e
ifgrp add-port -node <<var_node02>> -ifgrp a0a -port e0f
ifgrp add-port -node <<var_node02>> -ifgrp a0a -port e0g
ifgrp add-port -node <<var_node02>> -ifgrp a0a -port e0h

ifgrp show
```

Note: All interfaces must be in the down status before being added to an interface group.

Note: The interface group name must follow the standard naming convention of `<number><letter>`, where:

- `<number>` is an integer in the range of 0 to 999 without leading zeros.
- `<letter>` is a lowercase letter.

Configure Jumbo Frames

To configure an ONTAP network port to use jumbo frames (which usually have an MTU of 9,000 bytes), run the following command from the cluster shell:

```
network port modify -node * -port a0a -mtu 9000
WARNING: Changing the network port settings will cause a serveral second interruption in carrier.
Do you want to continue? {y|n}: y
```

Note: Modifications to an interface group cause the underlying physical ports to inherit the same configuration. If the ports are later removed from the interface group, they retain these same settings. However, the inverse is not true; modifying the individual ports does not modify the interface group of which the ports are a member.

Note: After the MTU for the interface group is set to 9,000, all new VLAN interfaces created on that interface group also have an MTU of 9,000 bytes. Existing VLAN interfaces retain their original MTU after the ifgroup is changed.

Create VLANs

To create NFS and iSCSI VLANs and add them to their respective broadcast domains, run the following commands:

```
network port vlan create –node <<var_node01>> -vlan-name a0a-<<var_NFS_vlan_id>>
network port vlan create –node <<var_node02>> -vlan-name a0a-<<var_NFS_vlan_id>>
broadcast-domain add-ports -broadcast-domain <<var_NFS_broadcast_domain>> -ports
<<var_node01>>:a0a-<<var_NFS_vlan_id>>, <<var_node02>>:a0a-<<var_NFS_vlan_id>>

network port vlan create -node <<var_node01>> -vlan-name a0a-<<var_iSCSI-A_vlan_id>>
network port vlan create -node <<var_node01>> -vlan-name a0a-<<var_iSCSI-B_vlan_id>>
network port vlan create -node <<var_node02>> -vlan-name a0a-<<var_iSCSI-A_vlan_id>>
network port vlan create -node <<var_node02>> -vlan-name a0a-<<var_iSCSI-B_vlan_id>>

broadcast-domain add-ports -broadcast-domain <<var_iSCSI-A_broadcast_domain>> -ports
<<var_node01>>:a0a-<<var_iSCSI-A_vlan_id>>, <<var_node02>>:a0a-<<var_iSCSI-A_vlan_id>>

broadcast-domain add-ports -broadcast-domain <<var_iSCSI-B_broadcast_domain>> -ports
<<var_node01>>:a0a-<<var_iSCSI-B_vlan_id>>, <<var_node02>>:a0a-<<var_iSCSI-B_vlan_id>>
```

Enable Cisco Discovery Protocol

To enable the Cisco Discovery Protocol (CDP) on the NetApp storage controllers, run the following command:

```
system node run -node * options cdpd.enable on
```

To be effective, CDP must also be enabled on directly connected networking equipment such as switches and routers.

Configure NTP

To configure time synchronization on the cluster, complete the following steps:

1. Set the time zone for the cluster.

```
timezone <<var_timezone>>
```

   Note: For example, in the Eastern United States, the time zone is `America/New_York`.

2. Set the date for the cluster.

```
date <ccyymmddhhmm.ss>
```

   Note: The format for the date is `<[century][year][month][day][hour][minute].[second]>` (for example, 201707241320.00).

3. Configure the Network Time Protocol (NTP) servers for the cluster.

```
cluster time-service ntp server create -server <<var_global_ntp_server_ip>>
```

Configure SNMP

To configure SNMP, complete the following steps:

1. Configure the SNMP basic information, such as the location and contact. When polled, this information is visible as the `sysLocation and sysContact` variables in SNMP.

```
snmp contact <<var_snmp_contact>>
snmp location “<<var_snmp_location>>”
snmp init 1
options snmp.enable on
```

2. Configure SNMP traps to send to remote hosts.

```
snmp traphost add <<var_oncommand_server_fqdn>>
```

Configure SNMPv1 Access

To configure SNMPv1 access, set the shared secret plain-text password, which is called a community.

```
snmp community delete all
snmp community add ro <<var_snmp_community>>
```

Use the `delete all` command with caution. If community strings are used for other monitoring products, then the `delete all` command removes them.

Create SNMPv3 User

SNMPv3 requires that a user be defined and configured for authentication. To create and configure a user for SNMPv3, complete the following steps:

1. Run the `security snmpusers` command to view the engine ID.
2. Create a user called `snmpv3user`.

```
security login create -user-or-group-name snmpv3user -authmethod usm -application snmp
```

3. Enter the authoritative entity’s engine ID and select `md5` as the authentication protocol.
4. When prompted, enter a password for the authentication protocol. The password must have a minimum of eight characters.
5. Select `des` as the privacy protocol.
6. When prompted, enter a password for the privacy protocol. The password must have a minimum of eight characters.

Configure AutoSupport HTTPS

AutoSupport sends support summary information to NetApp through HTTPS. To configure AutoSupport, run the following command:

```
system node autosupport modify -node * -state enable –mail-hosts <<var_mailhost>> -transport
https -support enable -to <<var_storage_admin_email>>
```

Note: To enable AutoSupport to send messages using SMTP, change the `–transport` value in the preceding command to `smtp`. When configuring AutoSupport to use SMTP, be sure to enable mail relay on the mail server for the cluster management and node management IP addresses.

Configure HTTPS Access

Secure access to the storage controller is configured by default with self-signed certificates.

Set Up Storage VM

Create Storage VM

To create an infrastructure storage virtual machine (SVM), complete the following steps:

Note: The SVM is referred to as a Vserver in the ONTAP command-line interface (CLI).

1. Run the `vserver create` command.

```
vserver create -vserver Infra-SVM -rootvolume rootvol -aggregate n01_ssd01 -rootvolume-security-
style unix
```

2. Select the SVM data protocols to configure.

```
vserver remove-protocols –vserver Infra-SVM -protocols fcp,cifs,ndmp
```

3. Add the two data aggregates to the infra-SVM aggregate list for the VSC.

```
vserver modify -vserver Infra-SVM -aggr-list n01_ssd01, n02_ssd01
```

4. Enable and run the NFS protocol in the infra-SVM.

```
nfs create -vserver Infra-SVM -udp disabled
```

5. Turn on the SVM `vstorage` parameter for the NetApp NFS VAAI plug-in.

```
vserver nfs modify –vserver Infra-SVM –vstorage enabled
vserver nfs show
```

Create Load-Sharing Mirror of SVM Root Volume

To create a load-sharing mirror of an SVM root volume, complete the following steps:

1. Create a volume to be the load-sharing mirror of the root volume of the infrastructure SVM on each node.

```
volume create –vserver Infra-SVM –volume rootvol_m01 –aggregate n01_ssd01 –size 1GB –type DP
volume create –vserver Infra-SVM –volume rootvol_m02 –aggregate n02_ssd01 –size 1GB –type DP
```

2. Create a job schedule to update the root volume mirror relationships every 15 minutes.

```
job schedule interval create -name 15min -minutes 15
```

3. Create the mirroring relationships.

```
snapmirror create –source-path Infra-SVM:rootvol –destination-path Infra-SVM:rootvol_m01 –type LS
-schedule 15min
snapmirror create –source-path Infra-SVM:rootvol –destination-path Infra-SVM:rootvol_m02 –type LS
-schedule 15min
```

4. Initialize the mirroring relationship.

```
snapmirror initialize-ls-set –source-path Infra-SVM:rootvol
```

Create iSCSI Service

Create the iSCSI service on each SVM.

Note: This command also starts the iSCSI service and sets the iSCSI IQN for the SVM.

```
iscsi create -vserver Infra-SVM
iscsi show
```

Configure HTTPS Access

Secure access to the storage controller is configured by default with self-signed certificates.

Configure NFSv3

To configure NFSv3 on the SVM, complete the following steps:

1. Create a new rule for each ESXi host in the default export policy. Assign a rule for each ESXi host created so that each host has its own rule index. For example, the first ESXi host has rule index 1, the second ESXi host has rule index 2, and so on.

```
vserver export-policy rule create -vserver Infra-SVM -policyname default -ruleindex 1 -
clientmatch <<var_esxi_host1_nfs_ip>> -rorule sys -rwrule sys -superuser sys -allow-suid false
…
vserver export-policy rule create -vserver Infra-SVM -policyname default -ruleindex 8 -
clientmatch <<var_esxi_host8_nfs_ip>> -rorule sys -rwrule sys -superuser sys -allow-suid false
```

2. Assign the default export policy to the infrastructure SVM root volume.

```
volume modify -vserver Infra-SVM -volume rootvol -policy default
```

Create FlexVol Volumes

To create a NetApp FlexVol® volume, run the following commands:

```
volume create -vserver Infra-SVM -volume infra_datastore_1 -aggregate n01_ssd01 -size 1TB -state
online -policy default -junction-path /infra_datastore_1 -space-guarantee none -percent-snapshot-
space 0

volume create -vserver Infra-SVM -volume infra_swap -aggregate n02_ssd01 -size 100GB -state
online -policy default -junction-path /infra_swap -space-guarantee none -percent-snapshot-space 0
-snapshot-policy none

volume create -vserver Infra-SVM -volume esxi_boot -aggregate n02_ssd01 -size 500GB -state online
-policy default -space-guarantee none -percent-snapshot-space 0

snapmirror update-ls-set -source-path Infra-SVM:rootvol
```

Create Boot LUNs for ESXi Hosts

The following procedure describes the process for configuring boot LUNs on the SSD aggregates, but it could be used on any ONTAP storage system. To create boot LUNs for ESXi hosts, complete the following steps:

1. Turn off automatic Snapshot copies on the volume.

```
volume modify –vserver Infra-SVM –volume esxi_boot –snapshot-policy none
```

2. Enable deduplication on the volume.

```
volume efficiency on –vserver Infra-SVM –volume esxi_boot
```

3. Create LUNs for ESXi boot partitions for infrastructure hosts.

```
lun create -vserver Infra-SVM -volume esxi_boot -lun VM-Host-Infra-01 -size 15GB -ostype vmware -
space-reserve disabled
…
lun create -vserver Infra-SVM -volume esxi_boot -lun VM-Host-Infra-08 -size 15GB -ostype vmware -
space-reserve disabled
```

Create iSCSI LIFs

To create four iSCSI LIFs (two on each node), run the following commands:

```
network interface create -vserver Infra-SVM -lif iscsi_lif01a -role data -data-protocol iscsi -
home-node <<var_node01>> -home-port a0a-<<var_iSCSI-A_vlan_id>> -address
<<var_node01_iscsi_lif01a_ip>> -netmask <<var_node01_iscsi_lif01a_mask>> -status-admin up -
failover-policy disabled -firewall-policy data -auto-revert false

network interface create -vserver Infra-SVM -lif iscsi_lif01b -role data -data-protocol iscsi -
home-node <<var_node01>> -home-port a0a-<<var_iSCSI-B_vlan_id>> -address
<<var_node01_iscsi_lif01b_ip>> -netmask <<var_node01_iscsi_lif01b_mask>> -status-admin up -
failover-policy disabled -firewall-policy data -auto-revert false

network interface create -vserver Infra-SVM -lif iscsi_lif02a -role data -data-protocol iscsi -
home-node <<var_node02>> -home-port a0a-<<var_iSCSI-A_vlan_id>> -address
<<var_node02_iscsi_lif02a_ip>> -netmask <<var_node02_iscsi_lif02a_mask>> -status-admin up -
failover-policy disabled -firewall-policy data -auto-revert false

network interface create -vserver Infra-SVM -lif iscsi_lif02b -role data -data-protocol iscsi -
home-node <<var_node02>> -home-port a0a-<<var_iSCSI-B_vlan_id>> -address
<<var_node02_iscsi_lif02b_ip>> -netmask <<var_node02_iscsi_lif02b_mask>> -status-admin up -
failover-policy disabled -firewall-policy data -auto-revert false

network interface show
```

Create NFS LIFs

To create an NFS LIF, run the following commands:

```
network interface create -vserver Infra-SVM -lif nfs_infra_node_1 -role data -data-protocol nfs -
home-node <<var_node01>> -home-port a0a-<<var_nfs_vlan_id>> -address <<var_node01_nfs_ip>> -
netmask <<var_node01_nfs_mask>> -status-admin up -failover-policy broadcast-domain-wide -
firewall-policy data -auto-revert true

network interface create -vserver Infra-SVM -lif nfs_infra_node_2 -role data -data-protocol nfs -
home-node <<var_node02>> -home-port a0a-<<var_nfs_vlan_id>> -address <<var_node02_nfs_ip>> -
netmask <<var_node02_nfs_mask>> -status-admin up -failover-policy broadcast-domain-wide -
firewall-policy data -auto-revert true
```

Add Infrastructure SVM Administrator

To add the infrastructure SVM administrator and SVM administration LIF in the out-of-band management network, complete the following steps:

1. Run the following commands:

```
network interface create -vserver Infra-SVM -lif vsmgmt -role data -data-protocol none -home-node
<<var_node02>> -home-port e0M -address <<var_svm_mgmt_ip>> -netmask <<var_svm_mgmt_mask>> -
status-admin up -failover-policy broadcast-domain-wide -firewall-policy mgmt -auto-revert true
```

Note: The SVM management IP in this step should be in the same subnet as the storage cluster management IP.

2. Create a default route to allow the SVM management interface to reach the outside world.

```
network route create -vserver Infra-SVM -destination 0.0.0.0/0 -gateway <<var_svm_mgmt_gateway>>
network route show
```

3. Set a password for the SVM vsadmin user and unlock the user.

```
security login password -username vsadmin -vserver Infra-SVM
Enter a new password: <<var_password>>
Enter it again: <<var_password>>

security login unlock -username vsadmin -vserver Infra-SVM
```

Configure iSCSI Boot

The iSCSI IQN values required for this step are not available until the Cisco UCS service profile has been configured. Complete the steps in the section “Create Service Profile Templates” and then run the following commands using the IQN variables listed in Table 12.

1. Create igroups for LUN mapping.

```
igroup create –vserver Infra-SVM –igroup VM-Host-Infra-01 –protocol iscsi –ostype vmware –
initiator <<var_vm_host_infra_01_iqn>>
igroup create –vserver Infra-SVM –igroup VM-Host-Infra-02 –protocol iscsi –ostype vmware –
initiator <<var_vm_host_infra_02_iqn>>
…
igroup create –vserver Infra-SVM –igroup VM-Host-Infra-08 –protocol iscsi –ostype vmware –
initiator <<var_vm_host_infra_08_iqn>>
```

2. Map boot LUNs to hosts.

```
lun map –vserver Infra-SVM –volume esxi_boot –lun VM-Host-Infra-01 –igroup VM-Host-Infra-01 –lun-
id 0
lun map –vserver Infra-SVM –volume esxi_boot –lun VM-Host-Infra-02 –igroup VM-Host-Infra-02 –lun-
id 0
…
lun map –vserver Infra-SVM –volume esxi_boot –lun VM-Host-Infra-08 –igroup VM-Host-Infra-08 –lun-
id 0
```

Set Up SVM for Exchange and SharePoint Workload

Create SVM

To create an SVM for Exchange and SharePoint, complete the following steps:

Note: The SVM is referred to as a Vserver in the ONTAP CLI.

1. Run the `vserver create` command.

```
vserver create -vserver Work-SVM -rootvolume rootvol -aggregate n02_ssd01 -rootvolume-security-
style unix
```

2. Select the SVM data protocols to configure.

```
vserver remove-protocols –vserver Work-SVM -protocols fcp,cifs,ndmp
```

3. Add the two data aggregates to the Work-SVM aggregate list for the VSC.

```
vserver modify -vserver Work-SVM -aggr-list n01_ssd01, n02_ssd01
```

4. Enable and run the NFS protocol in the Work-SVM.

```
nfs create -vserver Work-SVM -udp disabled
```

5. Turn on the SVM `vstorage` parameter for the NetApp NFS VAAI plug-in.

```
vserver nfs modify –vserver Work-SVM –vstorage enabled
vserver nfs show
```

Create Load-Sharing Mirror of SVM Root Volume

To create a load-sharing mirror of an SVM root volume, complete the following steps:

1. Create a volume to be the load-sharing mirror of the root volume of the infrastructure SVM on each node.

```
volume create –vserver Work-SVM –volume rootvol_m01 –aggregate n01_ssd01 –size 1GB –type DP
volume create –vserver Work-SVM –volume rootvol_m02 –aggregate n02_ssd01 –size 1GB –type DP
```

2. Create the mirroring relationships.

```
snapmirror create –source-path Work-SVM:rootvol –destination-path Work-SVM:rootvol_m01 –type LS -
schedule 15min
snapmirror create –source-path Work-SVM:rootvol –destination-path Work-SVM:rootvol_m02 –type LS -
schedule 15min
```

3. Initialize the mirroring relationship.

```
snapmirror initialize-ls-set –source-path Work-SVM:rootvol
```

Create iSCSI Service

Create the iSCSI service on each SVM. This command also starts the iSCSI service and sets the iSCSI IQN for the SVM.

```
iscsi create –vserver Work-SVM
iscsi show
```

Configure HTTPS Access

Secure access to the storage controller is configured by default with self-signed certificates.

Configure NFSv3

To configure NFSv3 on the SVM, complete the following steps:

1. Create a new rule for each ESXi host in the default export policy. Assign a rule for each ESXi host created so that each host has its own rule index. For example, the first ESXi host has rule index 1, the second ESXi host has rule index 2, and so on.

```
vserver export-policy rule create -vserver Work-SVM -policyname default -ruleindex 9 -clientmatch
<<var_esxi_host1_nfs_ip>> -rorule sys -rwrule sys -superuser sys -allow-suid false
…
vserver export-policy rule create -vserver Work-SVM -policyname default -ruleindex 16 -
clientmatch <<var_esxi_host8_nfs_ip>> -rorule sys -rwrule sys -superuser sys -allow-suid false
```

2. Assign the default export policy to the infrastructure SVM root volume.

```
volume modify –vserver Work-SVM –volume rootvol –policy default
```

Create FlexVol Volumes

To create NetApp FlexVol volumes for SQL databases and SharePoint VMs, run the following commands:

```
volume create -vserver Work-SVM -volume VM_datastore_1 -aggregate n01_ssd01 -size 1TB -state
online -policy default -junction-path /VM_datastore_1 -space-guarantee none -percent-snapshot-
space 0

volume create -vserver Work-SVM -volume SQL1_Data -aggregate n01_ssd01 -size 1TB -state online -
policy default -space-guarantee none -percent-snapshot-space 0

volume create -vserver Work-SVM -volume SQL1_SharePoint -aggregate n01_ssd01 -size 8TB -state
online -policy default -space-guarantee none -percent-snapshot-space 0

volume create -vserver Work-SVM -volume SQL1_Log -aggregate n01_ssd01 -size 2TB -state online -
policy default -space-guarantee none -percent-snapshot-space 0

volume create -vserver Work-SVM -volume SQL1_Snapinfo -aggregate n01_ssd01 -size 2TB -state
online -policy default -space-guarantee none -percent-snapshot-space 0

volume create -vserver Work-SVM -volume SQL2_Data -aggregate n02_ssd01 -size 1TB -state online -
policy default -space-guarantee none -percent-snapshot-space 0
```

```
volume create -vserver Work-SVM -volume SQL2_SharePoint -aggregate n02_ssd01 -size 8TB -state
online -policy default -space-guarantee none -percent-snapshot-space 0

volume create -vserver Work-SVM -volume SQL2_Log -aggregate n02_ssd01 -size 2TB -state online -
policy default -space-guarantee none -percent-snapshot-space 0

volume create -vserver Work-SVM -volume SQL2_Snapinfo -aggregate n02_ssd01 -size 2TB -state
online -policy default -space-guarantee none -percent-snapshot-space 0

volume create -vserver Work-SVM -volume DocAve1_Media -aggregate n01_ssd01 -size 1.2TB -state
online -policy default -space-guarantee none -percent-snapshot-space 0

snapmirror update-ls-set -source-path Work-SVM:rootvol
```

Note: The Exchange volumes are created later due to their number and specificity.

Create iSCSI LIFs

To create four iSCSI LIFs (two on each node), run the following commands:

```
network interface create -vserver Work-SVM -lif iscsi_lif01a -role data -data-protocol iscsi -
home-node <<var_node01>> -home-port a0a-<<var_iSCSI-A_vlan_id>> -address
<<var_node01_iscsi_lif01a_ip>> -netmask <<var_node01_iscsi_lif01a_mask>> -status-admin up -
failover-policy disabled -firewall-policy data -auto-revert false

network interface create -vserver Work-SVM -lif iscsi_lif01b -role data -data-protocol iscsi -
home-node <<var_node01>> -home-port a0a-<<var_iSCSI-B_vlan_id>> -address
<<var_node01_iscsi_lif01b_ip>> -netmask <<var_node01_iscsi_lif01b_mask>> -status-admin up -
failover-policy disabled -firewall-policy data -auto-revert false

network interface create -vserver Work-SVM -lif iscsi_lif02a -role data -data-protocol iscsi -
home-node <<var_node02>> -home-port a0a-<<var_iSCSI-A_vlan_id>> -address
<<var_node02_iscsi_lif02a_ip>> -netmask <<var_node02_iscsi_lif02a_mask>> -status-admin up -
failover-policy disabled -firewall-policy data -auto-revert false

network interface create -vserver Work-SVM -lif iscsi_lif02b -role data -data-protocol iscsi -
home-node <<var_node02>> -home-port a0a-<<var_iSCSI-B_vlan_id>> -address
<<var_node02_iscsi_lif02b_ip>> -netmask <<var_node02_iscsi_lif02b_mask>> -status-admin up -
failover-policy disabled -firewall-policy data -auto-revert false

network interface show
```

Create NFS LIFs

To create an NFS LIF, run the following commands:

```
network interface create -vserver Work-SVM -lif nfs_work_node_1 -role data -data-protocol nfs -
home-node <<var_node01>> -home-port a0a-<<var_nfs_vlan_id>> -address <<var_nfs_work_1>> -netmask
<<var_nfs_work_1_mask>> -status-admin up -failover-policy broadcast-domain-wide -firewall-policy
data -auto-revert true

network interface create -vserver Work-SVM -lif nfs_work_node_2 -role data -data-protocol nfs -
home-node <<var_node02>> -home-port a0a-<<var_nfs_vlan_id>> -address <<var_nfs_work_2>> -netmask
<<var_nfs_work_2_mask>> -status-admin up -failover-policy broadcast-domain-wide -firewall-policy
data -auto-revert true
```

Add Infrastructure SVM Administrator

To add the work SVM administrator and SVM administration LIF in the out-of-band management network, complete the following steps:

1. Run the following commands:

```
network interface create -vserver Work-SVM -lif vsmgmt -role data -data-protocol none -home-node
<<var_node02>> -home-port e0M -address <<var_svm_mgmt_ip>> -netmask <<var_svm_mgmt_mask>> -
status-admin up -failover-policy broadcast-domain-wide -firewall-policy mgmt -auto-revert true
```

Note: The SVM management IP in this step should be in the same subnet as the storage cluster management IP.

2. Create a default route to allow the SVM management interface to reach the outside world.

```
network route create -vserver Work-SVM -destination 0.0.0.0/0 -gateway <<var_svm_mgmt_gateway>>
network route show
```

3. Set a password for the SVM `vsadmin` user and unlock the user.

```
security login password -username vsadmin -vserver Work-SVM
Enter a new password: <<var_password>>
Enter it again: <<var_password>>

security login unlock -username vsadmin -vserver Work-SVM
```

5.2 Cisco UCS Server Configuration

This section provides the complete configuration of the Cisco UCS server environment.

FlexPod Cisco UCS Base

Set Up Cisco UCS 6248 Fabric Interconnect for FlexPod Environments

This section provides detailed procedures for configuring the Cisco UCS for use in a FlexPod environment. The steps explain how to provision the Cisco UCS B-Series servers and should be followed precisely to avoid improper configuration.

Cisco UCS 6248 Fabric Interconnect A

To configure Cisco UCS for use in a FlexPod environment, complete the following steps:

1. Connect to the console port on the first Cisco UCS 6248 fabric interconnect.

```
Enter the configuration method. (console/gui) ? console
Enter the setup mode; setup newly or restore from backup.(setup/restore)? setup
You have chosen to setup a new Fabric interconnect. Continue? (y/n): y
Enforce strong password? (y/n) [y]: y
Enter the password for "admin": <<var_password>>
Confirm the password for "admin": <<var_password>>
Is this fabric interconnect part of a cluster (select 'no' for standalone)? (yes/no) [n]: y
Enter the switch fabric (A/B) []:A
Enter the system name: <<var_ucs_clustername>>
Physical switch Mgmt0 IPv4 address: <<var_ucsa_mgmt_ip>>
Physical switch Mgmt0 IPv4 netmask: <<var_ucsa_mgmt_mask>>
IPv4 address of the default gateway: <<var_ucsa_mgmt_gateway>>
Cluster IPv4 address: <<var_ucs_cluster_ip>>
Configure the DNS Server IPv4 address? (yes/no) [n]: y
DNS IPv4 address: <<var_nameserver_ip>>
Configure the default domain name? (yes/no) [n]: y
Default domain name: <<var_dns_domain_name>>
Join centralized management environment (UCS Central)? (yes/no) [n]: Enter
```

2. Review the settings displayed on the console. If they are correct, answer `yes` to apply and save the configuration.
3. Wait for the login prompt to verify that the configuration has been saved.

Cisco UCS 6248 Fabric Interconnect B

To configure Cisco UCS for use in a FlexPod environment, complete the following steps:

1. Connect to the console port on the second Cisco UCS 6248 fabric interconnect.

```
Enter the configuration method. (console/gui) ? console
Installer has detected the presence of a peer Fabric interconnect. This Fabric interconnect will
```

```
be added to the cluster. Continue (y/n) ? y
Enter the admin password of the peer Fabric interconnect: <<var_password>>
Physical switch Mgmt0 IPv4 address: <<var_ucsb_mgmt_ip>>
Apply and save the configuration (select 'no' if you want to re-enter)? (yes/no): y
```

2. Wait for the login prompt to confirm that the configuration has been saved.

FlexPod Cisco UCS Setup

Log In to Cisco UCS Manager

To log in to the Cisco UCS environment, complete the following steps:

1. Open a web browser and navigate to the Cisco UCS 6248 fabric interconnect cluster address.
2. Click the Launch UCS Manager link inside the HTML box to open the Cisco UCS Manager software.
3. If prompted to accept the security certificates, accept as necessary.
4. When prompted, enter `admin` as the user name and enter the administrative password.
5. Click Login to log in to Cisco UCS Manager.

Upgrade Cisco UCS Manager Software to Version 3.1(3a)

This reference architecture uses Cisco UCS Manager software version 3.1(3a). To upgrade the Cisco UCS Manager software and the Cisco UCS 6248 fabric interconnect software to version 3.1(3a), refer to Cisco UCS Manager Install and Upgrade Guides.

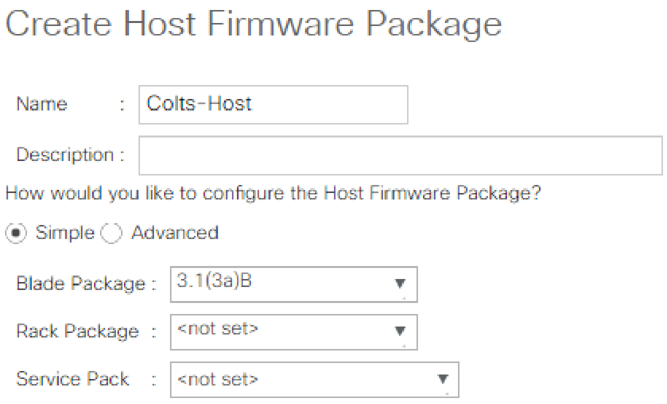
Create Host Firmware Package

Firmware management policies allow the administrator to select the corresponding packages for a given server configuration. These policies often include packages for adapter, BIOS, board controller, FC adapters, host bus adapter (HBA) option ROM, and storage controller properties. This procedure assumes that the appropriate firmware has been uploaded to the Cisco UCS fabric interconnects.

To create a firmware management policy for a given server configuration in the Cisco UCS environment, complete the following steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Policies > Root.
3. Right-click Host Firmware Packages.
4. Select Create Host Firmware Package.
5. Enter `<<host_fw_pkg_name>>` as the name of the host firmware package.
6. Keep the Simple option selected.

7. Select version 3.1(3a)B for the blade package.



Create Host Firmware Package

Name : Colts-Host

Description :

How would you like to configure the Host Firmware Package?

● Simple ○ Advanced

Blade Package : 3.1(3a)B

Rack Package : <not set>

Service Pack : <not set>

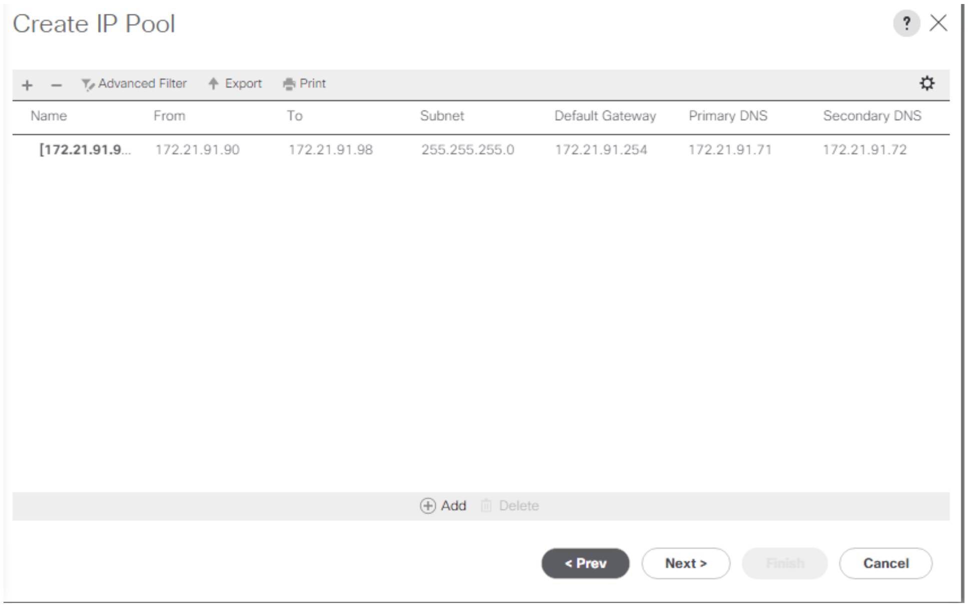
8. Click OK to create the host firmware package.
9. Click OK.

Add Block of IP Addresses for Out-of-Band KVM Access

To create a block of IP addresses for server keyboard, video, and mouse (KVM) access in the Cisco UCS environment, complete the following steps:

Note: This block of IP addresses should be in the same subnet as the management IP addresses for the Cisco UCS Manager. IP address blocks cannot be modified after they are created. If changes are required, the range of addresses must be deleted and then recreated.

1. In Cisco UCS Manager, click the LAN tab in the navigation pane.
2. Select Pools > Root > IP Pools.
3. Right-click IP Pools and select Create IP Pool.
4. Name the pool `in-band-mgmt`.
5. Click Next.
6. Click Add.
7. Enter the starting IP address of the block, the number of IP addresses required, and the subnet and gateway information.



Name	From	To	Subnet	Default Gateway	Primary DNS	Secondary DNS
[172.21.91.9...	172.21.91.90	172.21.91.98	255.255.255.0	172.21.91.254	172.21.91.71	172.21.91.72

8. Click Finish to create the IP block.
9. Click OK in the confirmation message.

Synchronize Cisco UCS to NTP

To synchronize the Cisco UCS environment to the NTP server, complete the following steps:

1. In the Cisco UCS Manager, click the Admin tab in the navigation pane.
2. Select All > Timezone Management.
3. In the Properties pane, select the appropriate time zone in the Timezone menu.
4. Click Save Changes and then click OK.
5. Click Add NTP Server.
6. Enter `<<var_global_ntp_server_ip>>` and click OK.
7. Click OK.

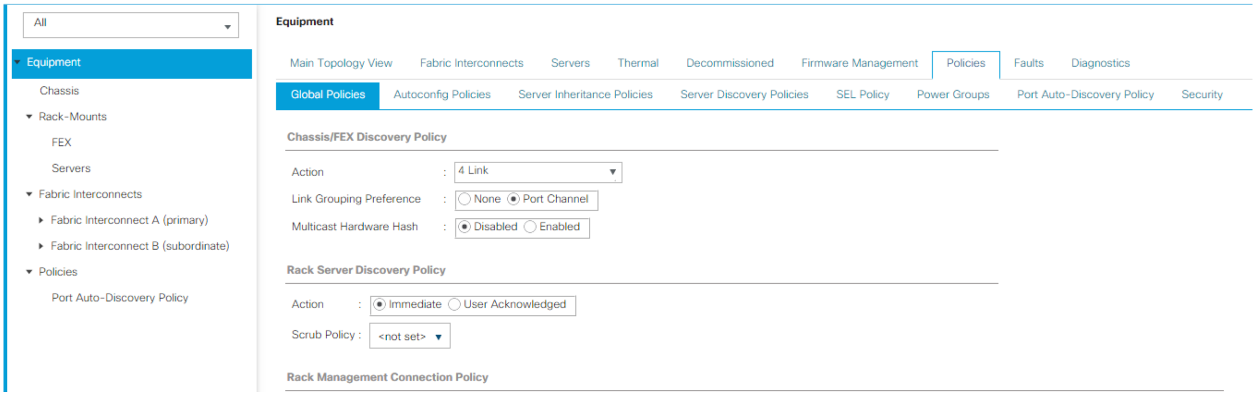
Edit Chassis Discovery Policy

Setting the discovery policy simplifies the addition of Cisco UCS B-Series chassis and Cisco UCS C-Series servers.

To modify the chassis discovery policy, complete the following steps:

1. In Cisco UCS Manager, click the Equipment tab in the navigation pane and select Equipment from the tree on the left.
2. In the right pane, click the Policies tab.

3. Under Global Policies, set Chassis/FEX Discovery Policy to 4 Link or set it to match the number of uplink ports that are cabled between the chassis and the fabric interconnects.
4. Set the Link Grouping Preference option to Port Channel.



Chassis/FEX Discovery Policy

Action : 4 Link

Link Grouping Preference : ○ None ● Port Channel

Multicast Hardware Hash : ● Disabled ○ Enabled

Rack Server Discovery Policy

Action : ● Immediate ○ User Acknowledged

Scrub Policy : <not set>

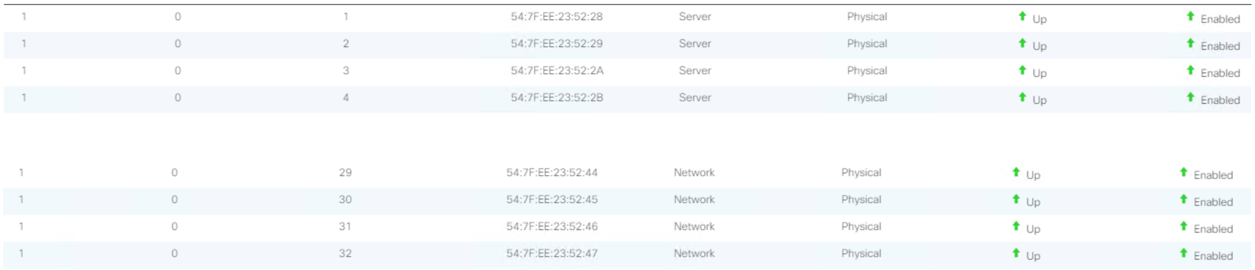
Rack Management Connection Policy

5. Click Save Changes.
6. Click OK.

Enable Server and Uplink Ports

To enable server and uplink ports, complete the following steps:

1. In Cisco UCS Manager, click the Equipment tab in the navigation pane.
2. Select Equipment > Fabric Interconnects > Fabric Interconnect A (Primary) > Fixed Module.
3. Expand Ethernet Ports.
4. Select the ports that are connected to the chassis. Right-click the ports and select Configure as Server Port.
5. Click Yes to confirm the server ports and click OK.
6. Select ports 29, 30, 31, and 32, which are connected to the Cisco Nexus 9396PX switches. Right-click the ports and select Configure as Uplink Port.
7. Click Yes to confirm the uplink ports and click OK.
8. In the left pane, navigate to fabric interconnect A. In the right pane, navigate to Physical Ports > Ethernet Ports. Confirm that the ports are configured correctly in the If Role column.



1	0	1	54:7F:EE:23:52:28	Server	Physical	↑ Up	↑ Enabled
1	0	2	54:7F:EE:23:52:29	Server	Physical	↑ Up	↑ Enabled
1	0	3	54:7F:EE:23:52:2A	Server	Physical	↑ Up	↑ Enabled
1	0	4	54:7F:EE:23:52:2B	Server	Physical	↑ Up	↑ Enabled
1	0	29	54:7F:EE:23:52:44	Network	Physical	↑ Up	↑ Enabled
1	0	30	54:7F:EE:23:52:45	Network	Physical	↑ Up	↑ Enabled
1	0	31	54:7F:EE:23:52:46	Network	Physical	↑ Up	↑ Enabled
1	0	32	54:7F:EE:23:52:47	Network	Physical	↑ Up	↑ Enabled

9. Select Equipment > Fabric Interconnects > Fabric Interconnect B (Subordinate) > Fixed Module.
10. Expand Ethernet Ports.
11. Select the ports that are connected to the chassis. Right-click the ports and select Configure as Server Port.
12. Click Yes to confirm server ports and click OK.

13. Select ports 29, 30, 31, and 32, which are connected to the Cisco Nexus 9396 switches. Right-click the ports and select Configure as Uplink Port.
14. Click Yes to confirm the uplink ports and click OK.
15. In the left pane, navigate to fabric interconnect B. In the right pane, navigate to Physical Ports > Ethernet Ports. Confirm that the ports are configured correctly in the If Role column.

Acknowledge Cisco UCS Chassis

To acknowledge all Cisco UCS chassis, complete the following steps:

1. In Cisco UCS Manager, click the Equipment tab in the Navigation pane.
2. Expand Chassis and select the chassis that is listed.
3. Right-click the chassis and select Acknowledge Chassis.
4. Click Yes and then click OK to complete chassis acknowledgement.

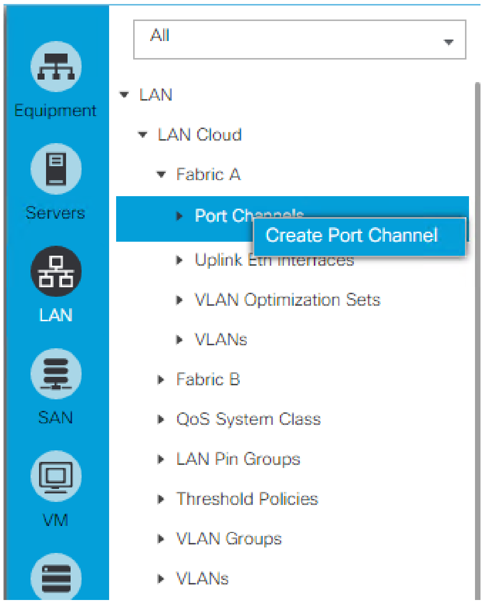
Create Uplink Port Channels to Cisco Nexus 9396PX Switches

To configure the necessary port channels in the Cisco UCS environment, complete the following steps:

1. In Cisco UCS Manager, click the LAN tab in the navigation pane.

   Note: This procedure creates two port channels: one from fabric A to both Cisco Nexus 9396PX switches and one from fabric B to both Cisco Nexus 9396PX switches.

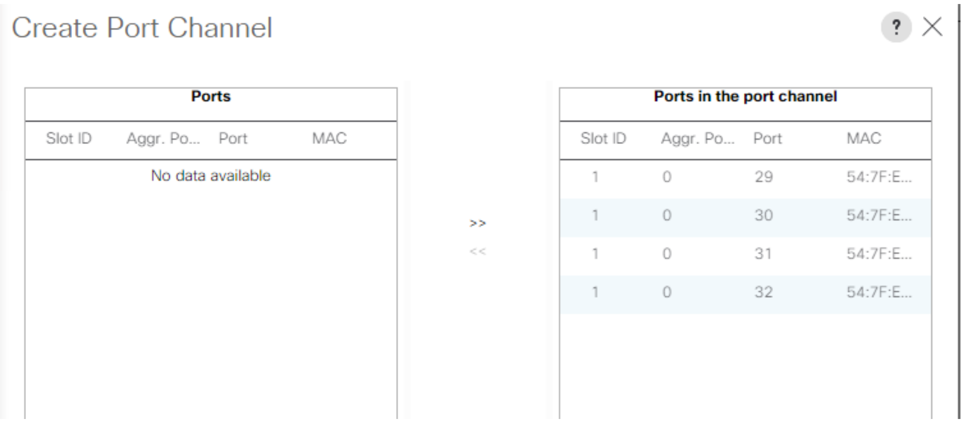
2. Under LAN > LAN Cloud, expand the fabric A node.



3. Right-click Port Channels.
4. Select Create Port Channel.
5. Enter `<<var_fabric_A_Portchannel_ID>>` as the unique ID of the port channel.
6. Enter `<<var_fabric_A_Portchannel_name>>` as the name of the port channel.
7. Click Next.
8. Select the following ports to be added to the port channel:
   - Slot ID 1 and port 29
   - Slot ID 1 and port 30

- Slot ID 1 and port 31
- Slot ID 1 and port 32

9. Click >> to add the ports to the port channel.



Ports

Slot ID	Aggr. Po...	Port	MAC
No data available			

Ports in the port channel

Slot ID	Aggr. Po...	Port	MAC
1	0	29	54:7F:E...
1	0	30	54:7F:E...
1	0	31	54:7F:E...
1	0	32	54:7F:E...

10. Click Finish to create the port channel.
11. Click OK.
12. In the navigation pane, under LAN > LAN Cloud, expand the fabric B node.
13. Right-click Port Channels.
14. Select Create Port Channel.
15. Enter `<<var_fabric_B_Portchannel_ID>>` as the unique ID of the port channel.
16. Enter `<<var_fabric_B_Portchannel_name>>` as the name of the port channel.
17. Click Next.
18. Select the following ports to be added to the port channel:
    - Slot ID 1 and port 29
    - Slot ID 1 and port 30
    - Slot ID 1 and port 31
    - Slot ID 1 and port 32
19. Click >> to add the ports to the port channel.
20. Click Finish to create the port channel.
21. Click OK.

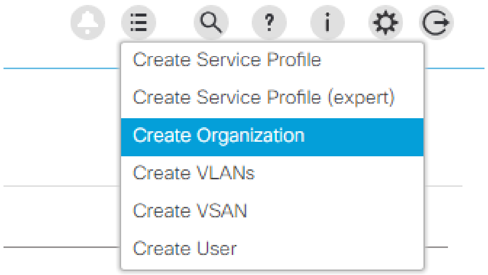
Create Organization (Optional)

Organizations are used to organize resources and restrict access to various groups within the IT organization, thereby enabling multitenancy of the compute resources.

Note: Although the use of organizations is not assumed in this document, this section covers the process of creating an organization.

To configure an organization in the Cisco UCS environment, complete the following steps:

1. In Cisco UCS Manager, from the menu in the toolbar at the top of the window, select Create Organization.



2. Enter a name for the organization.
3. Optional: Enter a description for the organization.
4. Click OK.
5. Click OK in the confirmation message.

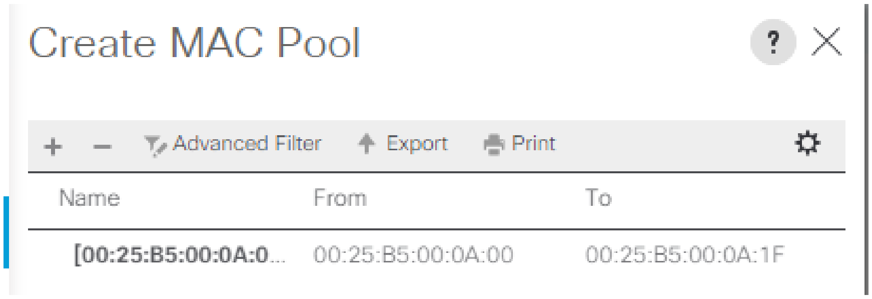
Create MAC Address Pools

To configure the necessary MAC address pools for the Cisco UCS environment, complete the following steps:

1. In Cisco UCS Manager, click the LAN tab in the navigation pane.
2. Select Pools > Root.

   Note: This procedure creates two MAC address pools, one for each switching fabric.

3. Right-click MAC Pools under the root organization.
4. Select Create MAC Pool to create the MAC address pool.
5. Enter `MAC_Pool_A` as the name of the MAC pool.
6. Optional: Enter a description for the MAC pool.
7. Keep the assignment order setting at Default.
8. Click Next.
9. Click Add to add a block of MAC addresses to the pool.



Create MAC Pool

Name	From	To
[00:25:B5:00:0A:0...	00:25:B5:00:0A:00	00:25:B5:00:0A:1F

10. Specify the starting MAC address in the block for fabric A.

    Note: For the FlexPod solution, the recommendation is to place `0A` in the next-to-last octet of the starting MAC address to identify all MAC addresses in this pool as fabric A addresses.

11. Specify a size for the MAC address pool that is sufficient to support the available blade or server resources.
12. Click OK.
13. Click Finish.
14. In the confirmation message, click OK.

15. Right-click MAC Pools under the root organization.
16. Select Create MAC Pool to create the MAC address pool.
17. Enter `MAC_Pool_B` as the name of the MAC pool.
18. Optional: Enter a description for the MAC pool.
19. Keep the assignment order setting at Default.
20. Click Next.
21. Click Add to add a block of MAC addresses to the pool.
22. Specify the starting MAC address in the block for fabric B.

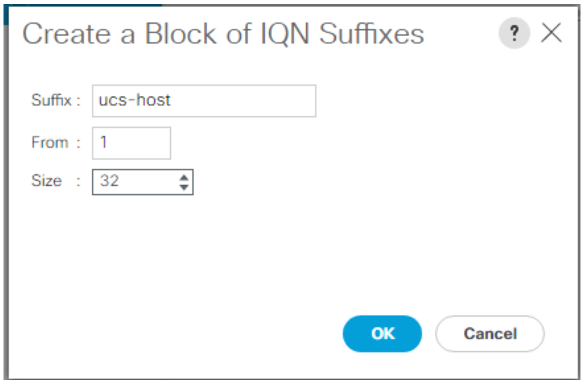
    Note: For the FlexPod solution, the recommendation is to place `0B` in the next-to-last octet of the starting MAC address to identify all MAC addresses in this pool as fabric B addresses.

23. Specify a size for the MAC address pool that is sufficient to support the available blade or server resources.
24. Click OK.
25. Click Finish.
26. In the confirmation message, click OK.

Create IQN Pools for iSCSI Boot

To configure the necessary IQN pools for the Cisco UCS environment, complete the following steps:

1. In the Cisco UCS Manager, select the SAN tab on the left.
2. Select Pools > Root.
3. Right-click IQN Pools under the root organization.
4. Select Create IQN Suffix Pool to create the IQN pool.
5. Enter `IQN_Pool` for the name of the IQN pool.
6. Optional: Enter a description for the IQN pool.
7. Enter `iqn.1992-08.com.cisco` as the prefix.
8. Select Sequential for Assignment Order.
9. Click Next.
10. Click Add.
11. Enter `ucs-host` as the suffix.
12. Enter `1` in the From field.
13. Specify a size of the IQN block sufficient to support the available server resources.



Create a Block of IQN Suffixes

Suffix : ucs-host

From : 1

Size : 32

14. Click OK.

15. Click Finish.
16. In the message box that displays, click OK.

Create IP Pools for iSCSI Boot

These steps provide details for configuring the necessary IP pools iSCSI boot for the Cisco UCS environment.

1. In the Cisco UCS Manager, select the LAN tab on the left.
2. Select Pools > Root.
3. Two IP pools are created, one for each switching fabric.
4. Right-click IP Pools under the root organization.
5. Select Create IP Pool to create the IP pool.
6. Enter `iSCSI_IP_Pool_A` for the name of the IP pool.
7. Optional: Enter a description of the IP pool.
8. Select Sequential for Assignment Order.
9. Click Next.
10. Click Add.
11. In the From field, enter the beginning of the range to assign as iSCSI IP addresses.
12. Set the size to enough addresses to accommodate the servers.
13. Click OK.
14. Click Finish.
15. Right-click IP Pools under the root organization.
16. Select Create IP Pool to create the IP pool.
17. Enter `iSCSI_IP_Pool_B` for the name of the IP pool.
18. Optional: Enter a description of the IP pool.
19. Select Sequential for Assignment Order.
20. Click Next.
21. Click Add.
22. In the From field, enter the beginning of the range to assign as iSCSI IP addresses.
23. Set the size to enough addresses to accommodate the servers.
24. Click OK.
25. Click Finish.

Create UUID Suffix Pool

To configure the necessary universally unique identifier (UUID) suffix pool for the Cisco UCS environment, complete the following steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Pools > Root.
3. Right-click UUID Suffix Pools.
4. Select Create UUID Suffix Pool.
5. Enter `UUID_Pool` as the name of the UUID suffix pool.
6. Optional: Enter a description for the UUID suffix pool.
7. Keep the Prefix setting as Derived.

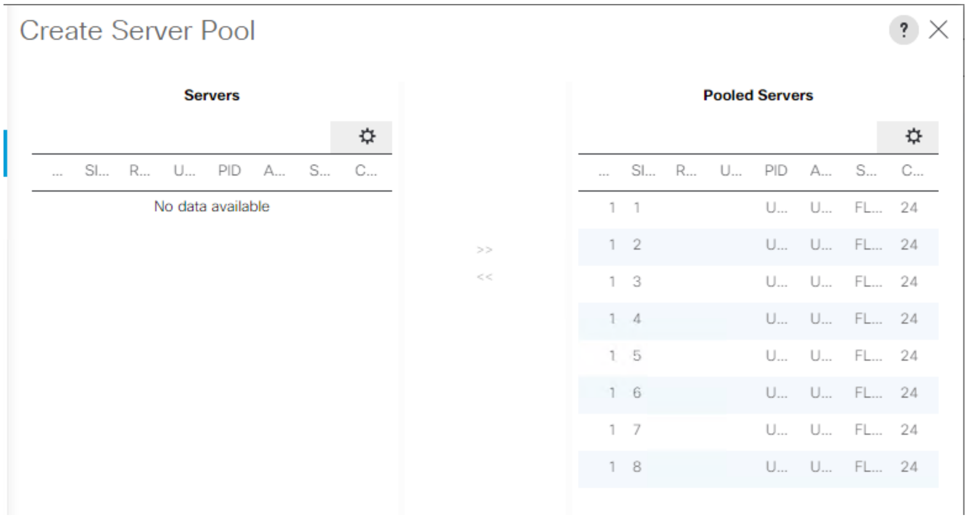
8. Keep the Assignment Order setting at Default.
9. Click Next.
10. Click Add to add a block of UUIDs to the pool.
11. Keep the From field at the default setting.
12. Specify a size for the UUID block that is sufficient to support the available blade or server resources.
13. Click OK.
14. Click Finish.
15. Click OK.

Create Server Pool (Optional)

To configure the necessary server pools for the Cisco UCS environment, complete the following steps:

Note: Consider creating unique server pools to achieve the granularity that is required in your environment.

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Pools > Root.
3. Right-click Server Pools.
4. Select Create Server Pool.
5. Enter `Host_Pool` as the name of the server pool.
6. Optional: Enter a description for the server pool.
7. Click Next.
8. Select the servers to be used for the pool and click >> to add them to the `Host_Pool` server pool.



Create Server Pool

Servers

...	Sl...	R...	U...	PID	A...	S...	C...
No data available							

Pooled Servers

...	Sl...	R...	U...	PID	A...	S...	C...
1	1			U...	U...	FL...	24
1	2			U...	U...	FL...	24
1	3			U...	U...	FL...	24
1	4			U...	U...	FL...	24
1	5			U...	U...	FL...	24
1	6			U...	U...	FL...	24
1	7			U...	U...	FL...	24
1	8			U...	U...	FL...	24

9. Click Finish.
10. Click OK.

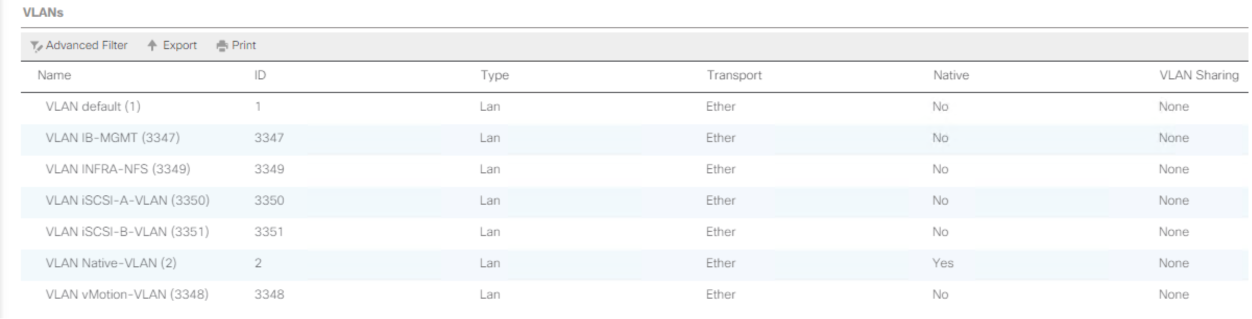
Create VLANs

To configure the necessary virtual local area networks (VLANs) for the Cisco UCS environment, complete the following steps:

1. In Cisco UCS Manager, click the LAN tab in the navigation pane.
2. Select LAN > LAN Cloud.

3. Right-click VLANs.
4. Select Create VLANs.
5. Enter `Native-VLAN` as the name of the VLAN to be used as the native VLAN.
6. Keep the Common/Global option selected for the scope of the VLAN.
7. Enter the native VLAN ID.
8. Keep the Sharing Type as None.
9. Click OK and then click OK again.
10. Expand the list of VLANs in the navigation pane, right-click the newly created Native VLAN, and select Set as Native VLAN.
11. Click Yes and then click OK.
12. Right-click VLANs.
13. Select Create VLANs.
14. Enter `iSCSI-A-VLAN` as the name of the VLAN to be used for the first iSCSI VLAN.
15. Keep the Common/Global option selected for the scope of the VLAN.
16. Enter the VLAN ID for the first iSCSI VLAN.
17. Click OK and then OK again.
18. Right-click VLANs.
19. Select Create VLANs.
20. Enter `iSCSI-B-VLAN` as the name of the VLAN to be used for the second iSCSI VLAN.
21. Keep the Common/Global option selected for the scope of the VLAN.
22. Enter the VLAN ID for the second iSCSI VLAN.
23. Click OK and then OK again.
24. Right-click VLANs.
25. Select Create VLANs.
26. Enter `Mgmt-VLAN` as the name of the VLAN to be used for management traffic.
27. Keep the Common/Global option selected for the scope of the VLAN.
28. Enter the in-band management VLAN ID.
29. Keep the Sharing Type as None.
30. Click OK and then click OK again.
31. Right-click VLANs.
32. Select Create VLANs.
33. Enter NFS-VLAN as the name of the VLAN to be used for NFS.
34. Keep the Common/Global option selected for the scope of the VLAN.
35. Enter the NFS VLAN ID.
36. Keep the Sharing Type as None.
37. Click OK and then click OK again.
38. Right-click VLANs.
39. Select Create VLANs.
40. Enter vMotion as the name of the VLAN to be used for vMotion.
41. Keep the Common/Global option selected for the scope of the VLAN.
42. Enter the vMotion VLAN ID.
43. Keep the Sharing Type as None.

44. Click OK and then click OK again.



Name	ID	Type	Transport	Native	VLAN Sharing
VLAN default (1)	1	Lan	Ether	No	None
VLAN IB-MGMT (3347)	3347	Lan	Ether	No	None
VLAN INFRA-NFS (3349)	3349	Lan	Ether	No	None
VLAN iSCSI-A-VLAN (3350)	3350	Lan	Ether	No	None
VLAN iSCSI-B-VLAN (3351)	3351	Lan	Ether	No	None
VLAN Native-VLAN (2)	2	Lan	Ether	Yes	None
VLAN vMotion-VLAN (3348)	3348	Lan	Ether	No	None

Create VLAN Group and Assign Inband Profile

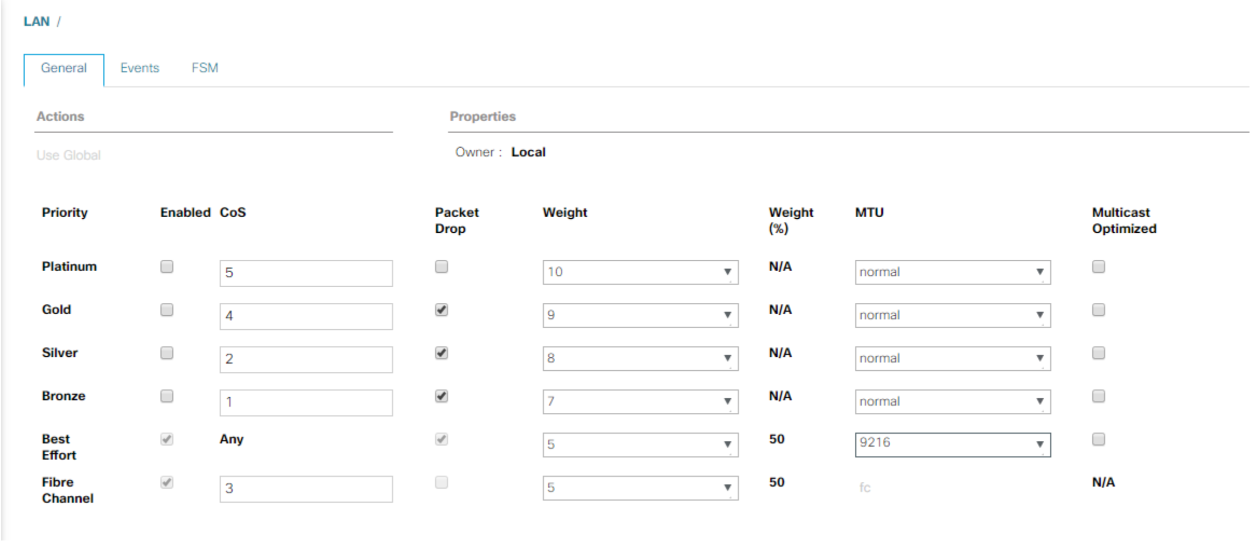
A VLAN group is required to set up inband KVM access. To create a VLAN group, complete the following steps:

1. In the Cisco UCS Manager, click the LAN tab in the navigation pane.
2. Select LAN > LAN Cloud.
3. Right-click VLAN Groups and select Create VLAN Group.
4. Name the VLAN group FlexPod and select all VLANs.
5. Select the radio button next to the Native VLAN and click Next.
6. Click Next.
7. Select the two uplink port channels and use the >> button to add them to the VLAN group.
8. Select LAN > LAN Cloud. Then select the Global Policies tab.
9. In the Inband VLAN Group box, select FlexPod VLAN Group, select MGMT-VLAN Network as the network, and select `in-band-mgmt` as the IP pool name.
10. Select Save Changes and then select OK.

Set Jumbo Frames in Cisco UCS Fabric

To configure jumbo frames and enable quality of service (QoS) in the Cisco UCS fabric, complete the following steps:

1. In Cisco UCS Manager, click the LAN tab in the navigation pane.
2. Select LAN > LAN Cloud > QoS System Class.
3. In the right pane, click the General tab.
4. On the Best Effort row, enter `9216` in the box under the MTU column.



Owner : **Local**

Priority	Enabled	CoS	Packet Drop	Weight	Weight (%)	MTU	Multicast Optimized
Platinum	□	5	□	10	N/A	normal	□
Gold	□	4	☑	9	N/A	normal	□
Silver	□	2	☑	8	N/A	normal	□
Bronze	□	1	☑	7	N/A	normal	□
Best Effort	☑	Any	☑	5	50	9216	□
Fibre Channel	☑	3	□	5	50	fc	N/A

5. Click Save Changes.
6. Click OK.

Create Local Disk Configuration Policy (Optional)

A local disk configuration for the Cisco UCS environment is necessary if the servers in the environment do not have a local disk.

Note: This policy should not be used on servers that contain local disks.

To create a local disk configuration policy, complete the following steps:

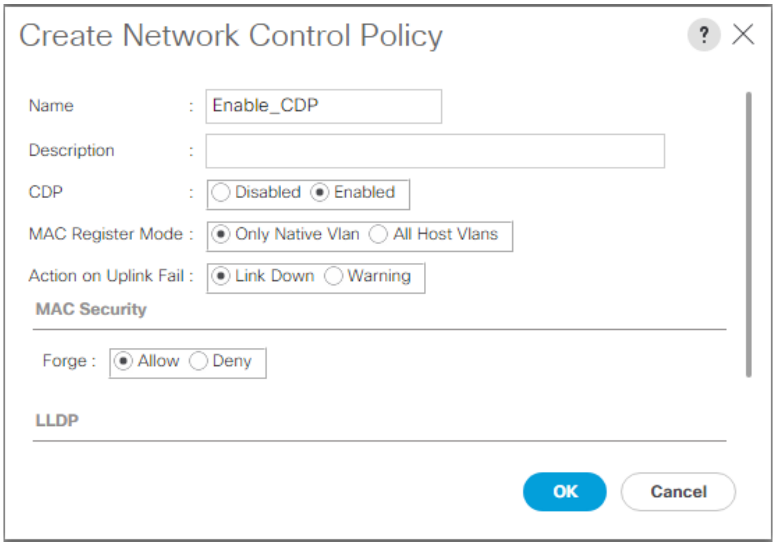
1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Policies > Root.
3. Right-click Local Disk Config Policies.
4. Select Create Local Disk Configuration Policy.
5. Enter `iSCSI-Boot` as the local disk configuration policy name.
6. Change the mode to No Local Storage.
7. Keep the FlexFlash State and FlexFlash RAID Reporting State settings at Disable.
8. Click OK to create the local disk configuration policy.
9. Click OK.

Create Network Control Policy for Cisco Discovery Protocol

To create a network control policy that enables Cisco Discovery Protocol (CDP) on virtual network ports, complete the following steps:

1. In Cisco UCS Manager, click the LAN tab in the navigation pane.
2. Select Policies > Root.
3. Right-click Network Control Policies.
4. Select Create Network Control Policy.
5. Enter `Enable_CDP` as the policy name.
6. For CDP, select the Enabled option.
7. Click OK to create the network control policy.

8. Click OK.



Create Network Control Policy

Name : Enable_CDP

Description :

CDP : ○ Disabled ● Enabled

MAC Register Mode : ● Only Native Vlan ○ All Host Vlans

Action on Uplink Fail : ● Link Down ○ Warning

MAC Security

Forge : ● Allow ○ Deny

LLDP

Create Power Control Policy

To create a power control policy for the Cisco UCS environment, complete the following steps:

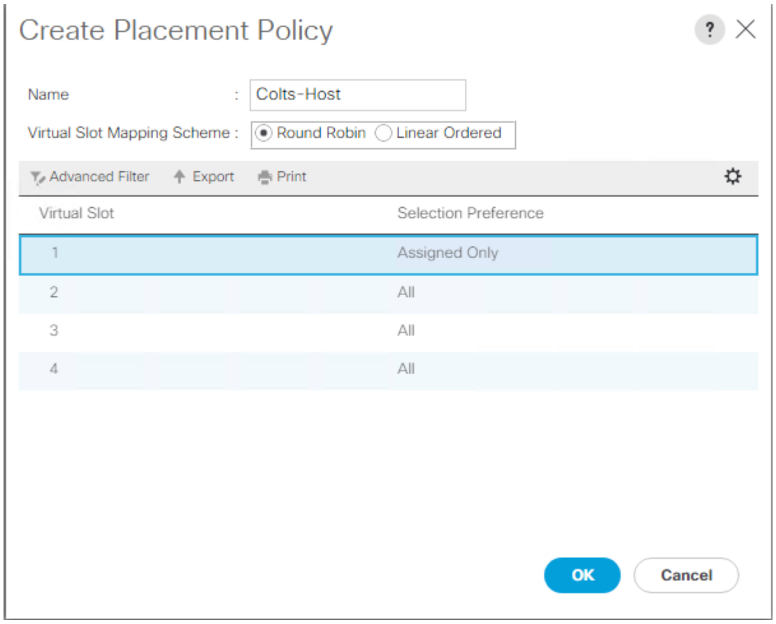
1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Policies > Root.
3. Right-click Power Control Policies.
4. Select Create Power Control Policy.
5. Enter `No-Power-Cap` as the power control policy name.
6. Change the power capping setting to No Cap.
7. Click OK to create the power control policy.
8. Click OK.

Create vNIC/vHBA Placement Policy for VM Infrastructure Hosts

To create a virtual network interface card/virtual host bus adapter (vNIC/vHBA) placement policy for the infrastructure hosts, complete the following steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Policies > Root.
3. Right-click vNIC/vHBA Placement Policies.
4. Select Create Placement Policy.

5. Enter `Colts-Host` as the name of the placement policy.
6. Click 1 and select Assigned Only under the Selection Preference column.



Create Placement Policy

Name : Colts-Host

Virtual Slot Mapping Scheme : ● Round Robin ○ Linear Ordered

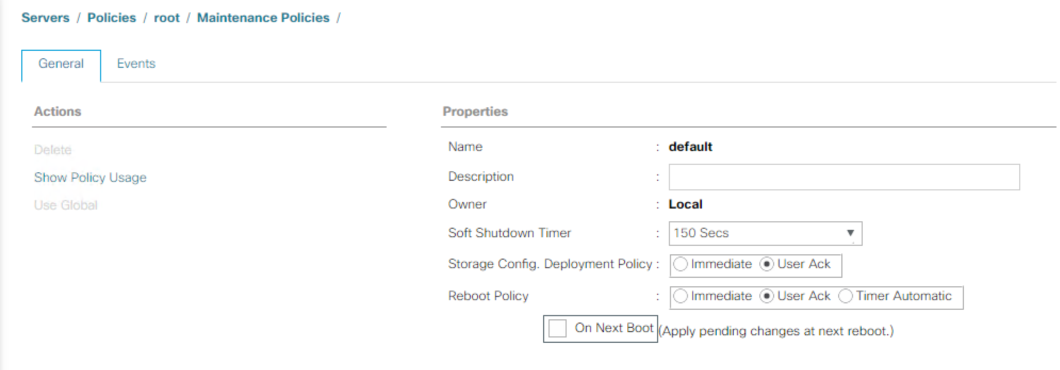
Virtual Slot	Selection Preference
1	Assigned Only
2	All
3	All
4	All

7. Click OK and then click OK again.

Update Default Maintenance Policy

To update the default maintenance policy, complete the following steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Policies > Root.
3. Select Maintenance Policies > Default.
4. Change the reboot policy setting to User Ack.



Servers / Policies / root / Maintenance Policies /

Properties

Name : default

Description :

Owner : Local

Soft Shutdown Timer : 150 Secs

Storage Config. Deployment Policy : ○ Immediate ● User Ack

Reboot Policy : ○ Immediate ● User Ack ○ Timer Automatic

□ On Next Boot (Apply pending changes at next reboot.)

5. Click Save Changes.
6. Click OK to acknowledge the change.

Create vNIC Templates

This section describes how to create the required vNICs.

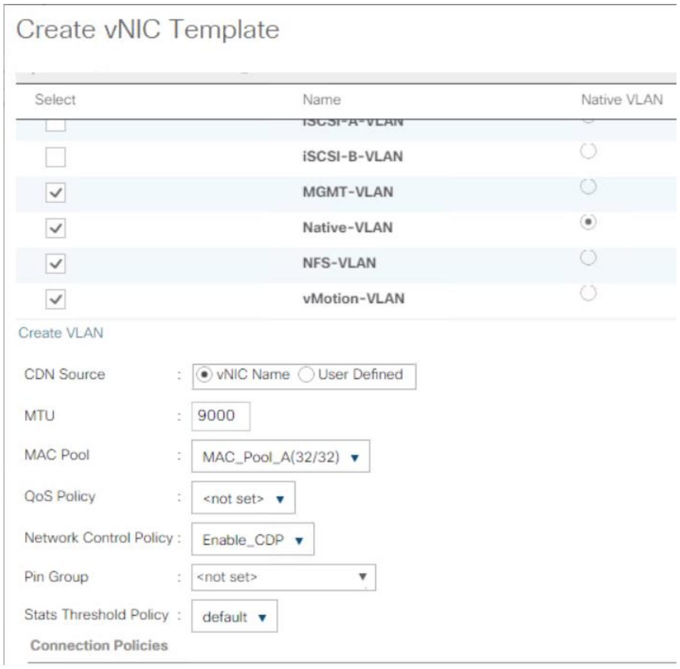
Create Data vNICs

To create multiple vNIC templates for the Cisco UCS environment, complete the following steps:

1. In Cisco UCS Manager, click the LAN tab in the navigation pane.
2. Select Policies > Root.
3. Right-click vNIC Templates.
4. Select Create vNIC Template.
5. Enter `vNIC_Template_A` as the vNIC template name.
6. For fabric ID, select Fabric A.

   Note: Do not select the Enable Failover checkbox.

   Note: Under Target, do not select the VM checkbox.
7. Select Updating Template as the template type.
8. Under VLANs, select the checkboxes for the following VLANs:
   – `MGMT-VLAN`
   – `Native-VLAN`
   – `vMotion-VLAN`
   – `NFS-VLAN`
9. Set `Native-VLAN` as the native VLAN.
10. For MTU, enter `9000`.
11. In the MAC Pool list, select `MAC_Pool_A`.
12. In the Network Control Policy list, select `Enable_CDP`.



Create vNIC Template

Select	Name	Native VLAN
□	iSCSI-A-VLAN	○
□	iSCSI-B-VLAN	○
☑	MGMT-VLAN	○
☑	Native-VLAN	●
☑	NFS-VLAN	○
☑	vMotion-VLAN	○

Create VLAN

CDN Source	:	● vNIC Name ○ User Defined
MTU	:	9000
MAC Pool	:	MAC_Pool_A(32/32) ▾
QoS Policy	:	<not set> ▾
Network Control Policy	:	Enable_CDP ▾
Pin Group	:	<not set> ▾
Stats Threshold Policy	:	default ▾

Connection Policies

13. Click OK to create the vNIC template.
14. Click OK.
15. In the navigation pane, click the LAN tab.

16. Select Policies > Root.
17. Right-click vNIC Templates.
18. Select Create vNIC Template.
19. Enter `vNIC_Template_B` as the vNIC template name.
20. Select Fabric B.

    Note: Do not select the Enable Failover checkbox.

    Note: Under Target, do not select the VM checkbox.
21. Select Updating Template as the template type.
22. Under VLANs, select the checkboxes for the following VLANs:
    - `MGMT-VLAN`
    - `Native-VLAN`
    - `vMotion-VLAN`
    - `NFS-VLAN`
23. Set `Native-VLAN` as the native VLAN.
24. For MTU, enter `9000`.
25. In the MAC Pool list, select `MAC_Pool_B`.
26. In the Network Control Policy list, select `Enable_CDP`.
27. Click OK to create the vNIC template.
28. Click OK.

Create iSCSI vNICs

To create iSCSI vNICs, complete the following steps:

1. Select the LAN tab on the left.
2. Select Policies > Root.
3. Right-click vNIC Templates.
4. Select Create vNIC Template.
5. Enter `iSCSI_Template_A` as the vNIC template name.
6. Leave Fabric A selected. Do not select the Enable Failover checkbox.
7. Under Target, make sure that the VM checkbox is not selected.
8. Select Updating Template for Template Type.
9. Under VLANs, select `iSCSI-A-VLAN`.
10. Set `iSCSI-A-VLAN` as the native VLAN.
11. Under MTU, enter `9000`.
12. From the MAC Pool list, select `MAC_Pool_A`.
13. From the Network Control Policy list, select `Enable_CDP`.
14. Click OK to complete creating the vNIC template.
15. Click OK.
16. Select the LAN tab on the left.
17. Select Policies > Root.
18. Right-click vNIC Templates.
19. Select Create vNIC Template.

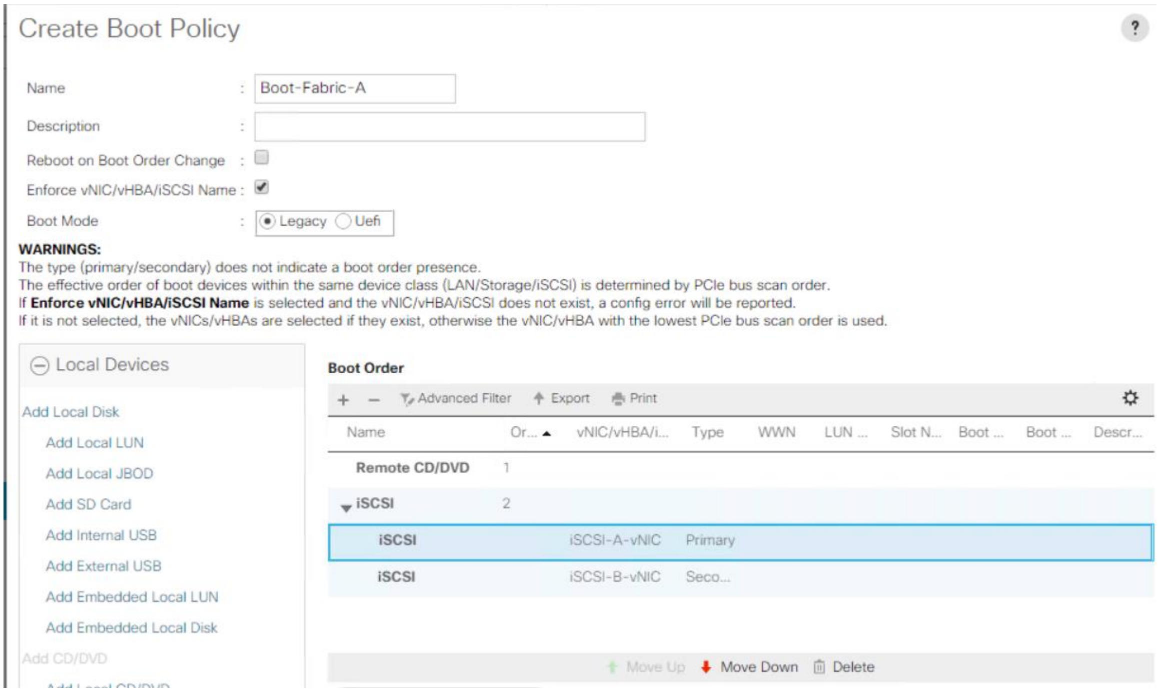
20. Enter `iSCSI_Template_B` as the vNIC template name.
21. Select Fabric B. Do not select the Enable Failover checkbox.
22. Under Target, make sure that the VM checkbox is not selected.
23. Select Updating Template for Template Type.
24. Under VLANs, select `iSCSI-B-VLAN`.
25. Set `iSCSI-B-VLAN` as the native VLAN.
26. Under MTU, enter `9000`.
27. From the MAC Pool list, select `MAC_Pool_B`.
28. From the Network Control Policy list, select `Enable_CDP`.
29. Click OK to complete creating the vNIC template.
30. Click OK.

Create Boot Policy

This procedure applies to a Cisco UCS environment in which two iSCSI logical interfaces (LIFs) are on cluster node 1 (`iscsi_lif01a` and `iscsi_lif01b`) and two iSCSI LIFs are on cluster node 2 (`iscsi lif02a` and `iscsi lif02b`). One boot policy is configured in this procedure. This policy configures the primary target to be `iscsi_lif01a`.

To create boot policies for the Cisco UCS environment, complete the following steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Policies > Root.
3. Right-click Boot Policies.
4. Select Create Boot Policy.
5. Enter `Boot-Fabric-A` as the name of the boot policy.
6. Optional: Enter a description for the boot policy.
7. Keep the Reboot on Boot Order Change option cleared.
8. Expand the Local Devices drop-down menu and select Add Remote CD/DVD.
9. Expand the iSCSI vNICs section and select Add iSCSI Boot.
10. In the Add iSCSI Boot dialog box, enter `iSCSI-A-vNIC`.
11. Click OK.
12. Select Add iSCSI Boot.
13. In the Add iSCSI Boot dialog box, enter `iSCSI-B-vNIC`.
14. Click OK.
15. Click OK to save the boot policy. Click OK to close the Boot Policy window.



Create Boot Policy

Name : Boot-Fabric-A

Description :

Reboot on Boot Order Change : □

Enforce vNIC/vHBA/iSCSI Name : ☑

Boot Mode : ● Legacy ○ Uefi

WARNINGS:
The type (primary/secondary) does not indicate a boot order presence.
The effective order of boot devices within the same device class (LAN/Storage/iSCSI) is determined by PCIe bus scan order.
If **Enforce vNIC/vHBA/iSCSI Name** is selected and the vNIC/vHBA/iSCSI does not exist, a config error will be reported.
If it is not selected, the vNICs/vHBAs are selected if they exist, otherwise the vNIC/vHBA with the lowest PCIe bus scan order is used.

Boot Order

Name	Or... ▲	vNIC/vHBA/i...	Type	WWN	LUN ...	Slot N...	Boot ...	Boot ...	Descr...
Remote CD/DVD	1								
▾ iSCSI	2								
iSCSI		iSCSI-A-vNIC	Primary						
iSCSI		iSCSI-B-vNIC	Seco...						

Create Service Profile Templates

In this procedure, one service profile template for ESXi hosts is created for fabric A boot.

To create the service profile template, complete the following steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Service Profile Templates > Root.
3. Right-click Root.
4. Select Create Service Profile Template to open the Create Service Profile Template wizard.
5. Identify the service profile template.
6. Enter `VM-Host-Infra-Fabric-A` as the name of the service profile template. This service profile template is configured to boot from node 1 on fabric A.
7. Select the Updating Template option.
8. Under UUID, select `UUID_Pool` as the UUID pool.
9. Click Next.

Configure Storage Provisioning

To configure the storage policy, complete the following steps:

1. If you have servers with no physical disks, select the iSCSI-Boot Local Storage Policy. Otherwise, select the default local storage policy.
2. Click Next.

Configure Networking Options

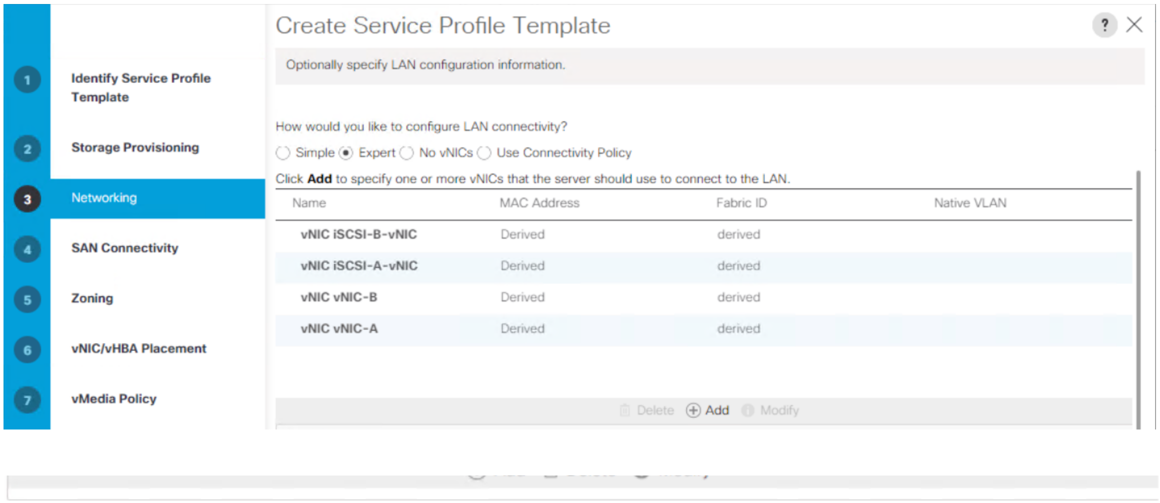
To configure the networking options, complete the following steps:

1. Keep the default setting for Dynamic vNIC Connection Policy.
2. Select the Expert option to configure LAN connectivity.

3. Click the upper Add button to add a vNIC to the template.
4. In the Create vNIC dialog box, enter `vNIC-A` as the name of the vNIC.
5. Select the Use vNIC Template checkbox.
6. In the vNIC Template list, select `vNIC_Template_A`.
7. In the Adapter Policy list, select VMware.
8. Click OK to add this vNIC to the template.
9. On the Networking page of the wizard, click the upper Add button to add another vNIC to the template.
10. In the Create vNIC box, enter `vNIC-B` as the name of the vNIC.
11. Select the Use vNIC Template checkbox.
12. In the vNIC Template list, select `vNIC_Template_B`.
13. In the Adapter Policy list, select VMware.
14. Click OK to add the vNIC to the template.
15. Click the upper Add button to add a vNIC to the template.
16. In the Create vNIC dialog box, enter `iSCSI-A-vNIC` as the name of the vNIC.
17. Select the Use vNIC Template checkbox. In the vNIC Template list, select `iSCSI_Template_A`.
18. In the Adapter Policy list, select VMware.
19. Click OK to add this vNIC to the template.
20. Click the upper Add button to add a vNIC to the template.
21. In the Create vNIC dialog box, enter `iSCSI-B-vNIC` as the name of the vNIC.
22. Select the Use vNIC Template checkbox.
23. In the vNIC Template list, select `iSCSI_Template_B`.
24. In the Adapter Policy list, select VMware.
25. Click OK to add this vNIC to the template.
26. Expand the iSCSI vNICs section (if it is not already expanded).
27. Select `iqn-pool` under Initiator Name Assignment.
28. Click the lower Add button in the iSCSI vNIC section to define a vNIC.
29. Enter `iSCSI-A-vNIC` as the name of the vNIC.
30. Select `iSCSI-A-vNIC` for Overlay vNIC.
31. Set the iSCSI Adapter Policy to default.
32. Set the VLAN to `iSCSI-A-VLAN`.
33. Leave the MAC Address set to None.
34. Click OK.
35. Click the lower Add button in the iSCSI vNIC section to define a vNIC.
36. Enter `iSCSI-B-vNIC` as the name of the vNIC.
37. Set the Overlay vNIC to `iSCSI-B-vNIC`.
38. Set the iSCSI Adapter Policy to default.
39. Set the VLAN to `iSCSI-B-VLAN`.
40. Leave the MAC Address set to None.
41. Click OK.
42. Click OK.

43. Review the table in the Networking page to make sure that all vNICs were created.

44. Click Next.



Create Service Profile Template

Optionally specify LAN configuration information.

How would you like to configure LAN connectivity?

○ Simple ● Expert ○ No vNICs ○ Use Connectivity Policy

Click **Add** to specify one or more vNICs that the server should use to connect to the LAN.

Name	MAC Address	Fabric ID	Native VLAN
vNIC iSCSI-B-vNIC	Derived	derived	
vNIC iSCSI-A-vNIC	Derived	derived	
vNIC vNIC-B	Derived	derived	
vNIC vNIC-A	Derived	derived	

Configure Storage Options

To configure the storage options, complete the following steps:

1. Select the No vHBAs option for the How Would You Like to Configure SAN Connectivity? field.
2. Click Next.

Configure Zoning Options

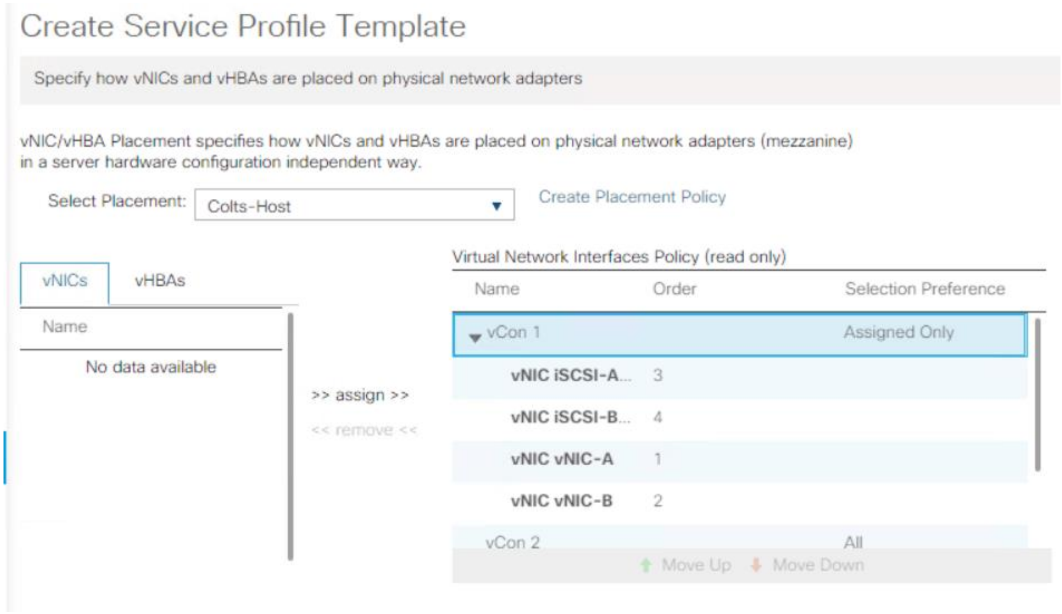
To configure the zoning options, complete the following step:

1. Set no zoning options and click Next.

Configure vNIC/HBA Placement

To configure vNIC/HBA placement, complete the following steps:

1. Set the vNIC/vHBA placement options.
2. In the Select Placement list, select the `Colts-Host` placement policy.
3. Select vCon1 and assign the vHBAs/vNICs to the virtual network interfaces policy in the following order:
   a. `vNIC-A`
   b. `vNIC-B`
   c. `iSCSI-vNIC-A`
   d. `iSCSI-vNIC-B`
4. Review the table to verify that all vNICs and vHBAs were assigned to the policy in the appropriate order.



Create Service Profile Template

Specify how vNICs and vHBAs are placed on physical network adapters

vNIC/vHBA Placement specifies how vNICs and vHBAs are placed on physical network adapters (mezzanine) in a server hardware configuration independent way.

Select Placement: Colts-Host

Virtual Network Interfaces Policy (read only)

Name	Order	Selection Preference
vCon 1		Assigned Only
vNIC iSCSI-A...	3	
vNIC iSCSI-B...	4	
vNIC vNIC-A	1	
vNIC vNIC-B	2	
vCon 2		All

5. Click Next.

Configure vMedia Policy

To configure the vMedia policy, complete the following step:

1. Click Next.

Configure Server Boot Order

To configure the server boot order, complete the following steps:

1. Select `Boot-Fabric-A` for Boot Policy.
2. In the Boot Order pane, select `iSCSI-A-vNIC`.
3. Click the Set iSCSI Boot Parameters button.
4. Leave the Set iSCSI Boot Parameters dialog box `<not set>` to use the single Service Profile Initiator Name defined in the previous steps.
5. Set `iSCSI_IP_Pool_A` as the Initiator IP address policy.
6. Keep the iSCSI Static Target Interface button selected and click the Add button.
7. Log in to the storage cluster management interface and run the `iscsi show` command.
8. Note or copy the iSCSI target name for infra-SVM.
9. In the Create iSCSI Static Target dialog box, paste the iSCSI target node name from infra-SVM.
10. Enter the IP address of `iSCSI_lif02a` for the IPv4 Address field.
11. Click OK to add the iSCSI static target.
12. Keep the iSCSI Static Target Interface option selected and click the Add button.
13. In the Create iSCSI Static Target window, paste the iSCSI target node name from infra-SVM into the iSCSI Target Name field.
14. Enter the IP address of `iscsi_`lif01a in the IPv4 Address field.
15. Click OK.
16. Click OK.

17. In the Boot Order pane, select `iSCSI-vNIC-B`.
18. Click the Set iSCSI Boot Parameters button.
19. In the Set iSCSI Boot Parameters dialog box, set the Initiator Name Assignment to `<not set>`.
20. In the Set iSCSI Boot Parameters dialog box, set the initiator IP address policy to `iSCSI_IP_Pool_B`.
21. Keep the iSCSI Static Target Interface option selected and click the Add button.
22. In the Create iSCSI Static Target window, paste the iSCSI target node name from infra-SVM into the iSCSI Target Name field (same target name as earlier).
23. Enter the IP address of `iscsi_lif02b` in the IPv4 address field.
24. Click OK to add the iSCSI static target.
25. Keep the iSCSI Static Target Interface option selected and click the Add button.
26. In the Create iSCSI Static Target dialog box, paste the iSCSI target node name from infra-SVM into the iSCSI Target Name field.
27. Enter the IP address of `iscsi_lif01b` in the IPv4 Address field.
28. Click OK.
29. Click OK.
30. Review the table to make sure that all boot devices were created and identified. Verify that the boot devices are in the correct boot sequence.
31. Click Next to continue to the next section.

Configure Maintenance Policy

To configure the maintenance policy, complete the following steps:

1. Select the default Maintenance Policy.
2. Click Next.

Configure Server Assignment

To configure the server assignment, complete the following steps:

1. In the Pool Assignment list, select Host`_Pool`.
2. Select Down as the power state to be applied when the profile is associated with the server.
3. Expand Firmware Management at the bottom of the page and select Colts-Host from the Host Firmware list.
4. Click Next.

Configure Operational Policies

To configure the operational policies, complete the following steps:

1. Expand Power Control Policy Configuration and select No-Power-Cap in the Power Control Policy list.
2. Click Finish to create the service profile template.
3. Click OK in the confirmation message.

Create Service Profiles

To create service profiles from the service profile template, complete the following steps:

1. In Cisco UCS Manager, click the Servers tab in the navigation pane.
2. Select Service Profile Templates > Root > Service Template `VM-Host-Infra-Fabric-A`.

3. Right-click `VM-Host-Infra-Fabric-A` and select Create Service Profiles from Template.
4. Enter `VM-Host-Infra-0` as the service profile prefix.
5. Enter `1` in the Name Suffix Starting Number field.
6. Enter `8` as the number of instances to create.
7. Click OK to create the service profiles for infrastructure hosts.
8. Click OK in the confirmation message.

Gather Necessary Information

After the Cisco UCS service profiles have been created, each infrastructure blade in the environment must have a unique configuration. To proceed with the FlexPod deployment, specific information must be gathered from each Cisco UCS blade and from the NetApp controllers. Insert the required information into the following tables.

Table 11) iSCSI LIFs for iSCSI IQN.

SVM	iSCSI Target IQN
Infra-SVM	

Note: To gather the iSCSI IQN, run the `iscsi show` command on the storage cluster management interface.

Table 12) vNIC iSCSI IQNs for fabric A and fabric B.

Cisco UCS Service Profile Name	iSCSI IQN	Variables
VM-Host-Infra-01		`<< var_vm_host_infra_01_iqn>>`
VM-Host-Infra-02		`<< var_vm_host_infra_02_iqn>>`
VM-Host-Infra-08		`<< var_vm_host_infra_08_iqn>>`

Note: To gather the vNIC IQN information, launch the Cisco UCS Manager GUI. In the navigation pane, click the Servers tab. Expand Servers > Service Profiles > Root. Click each service profile and then click the iSCSI vNICs tab on the right. Note the initiator name displayed at the top of the page under Service Profile Initiator Name.

5.3 Cisco Nexus Storage Networking Configuration

This section describes how to configure the Cisco Nexus switches for use in the FlexPod environment.

FlexPod Cisco Nexus Base

The following procedures describe how to configure the Cisco Nexus switches for use in a base FlexPod environment. Before configuring the switches, make sure that they are running Cisco Nexus NX-OS 7.0(3)I4(6) or later.

Set Up Initial Configuration

Cisco Nexus 9396PX A

To set up the initial configuration for the Cisco Nexus A switch on `<<var_nexus_A_hostname>>`, complete the following steps:

1. Configure the switch.

Note: On initial boot and connection to the serial or console port of the switch, the NX-OS setup should automatically start and attempt to enter power on autoprovisioning.

```
Abort Power on Auto Provisioning and continue with normal setup? (yes/no) [n]: yes
Do you want to enforce secure password standard (yes/no): yes
Enter the password for "admin": <<var_password>>
Confirm the password for "admin": <<var_password>>
Would you like to enter the basic configuration dialog (yes/no): yes
Create another login account (yes/no) [n]: Enter
Configure read-only SNMP community string (yes/no) [n]: Enter
Configure read-write SNMP community string (yes/no) [n]: Enter
Enter the switch name: <<var_nexus_A_hostname>>
Continue with Out-of-band (mgmt0) management configuration? (yes/no) [y]: Enter
Mgmt0 IPv4 address: <<var_nexus_A_mgmt0_ip>>
Mgmt0 IPv4 netmask: <<var_nexus_A_mgmt0_netmask>>
Configure the default gateway? (yes/no) [y]: Enter
IPv4 address of the default gateway: <<var_nexus_A_mgmt0_gw>>
Configure advanced IP options? (yes/no) [n]: Enter
Enable the telnet service? (yes/no) [n]: Enter
Enable the ssh service? (yes/no) [y]: Enter
Type of ssh key you would like to generate (dsa/rsa): rsa
Number of rsa key bits <1024-2048> : 1024
Configure the ntp server? (yes/no) [n]: y
NTP server IPv4 address: <<var_global_ntp_server_ip>>
Configure default interface layer (L3/L2) [L2]: Enter
Configure default switchport interface state (shut/noshut) [noshut]: shut
Configure CoPP system profile (strict/moderate/lenient/dense/skip) [strict]: Enter
Would you like to edit the configuration? (yes/no) [n]: Enter
```

2. Review the configuration summary before enabling the configuration.

```
Use this configuration and save it? (yes/no) [y]: Enter
```

Cisco Nexus 9396PX B

To set up the initial configuration for the Cisco Nexus B switch on `<<var_nexus_B_hostname>>`, complete the following steps:

1. Configure the switch.

Note: On initial boot and connection to the serial or console port of the switch, the NX-OS setup should automatically start and attempt to enter power on autoprovisioning.

```
Abort Power on Auto Provisioning and continue with normal setup? (yes/no) [n]: yes
Do you want to enforce secure password standard (yes/no): yes
Enter the password for "admin": <<var_password>>
Confirm the password for "admin": <<var_password>>
Would you like to enter the basic configuration dialog (yes/no): yes
Create another login account (yes/no) [n]: Enter
Configure read-only SNMP community string (yes/no) [n]: Enter
Configure read-write SNMP community string (yes/no) [n]: Enter
Enter the switch name: <<var_nexus_B_hostname>>
Continue with Out-of-band (mgmt0) management configuration? (yes/no) [y]: Enter
Mgmt0 IPv4 address: <<var_nexus_B_mgmt0_ip>>
Mgmt0 IPv4 netmask: <<var_nexus_B_mgmt0_netmask>>
Configure the default gateway? (yes/no) [y]: Enter
IPv4 address of the default gateway: <<var_nexus_B_mgmt0_gw>>
Configure advanced IP options? (yes/no) [n]: Enter
Enable the telnet service? (yes/no) [n]: Enter
Enable the ssh service? (yes/no) [y]: Enter
   Type of ssh key you would like to generate (dsa/rsa): rsa
   Number of rsa key bits <1024-2048> : 1024
  Configure the ntp server? (yes/no) [n]: y
  NTP server IPv4 address: <<var_global_ntp_server_ip>>
Configure default interface layer (L3/L2) [L2]: Enter
Configure default switchport interface state (shut/noshut) [noshut]: shut
Configure CoPP system profile (strict/moderate/lenient/dense/skip) [strict]: Enter
Would you like to edit the configuration? (yes/no) [n]: Enter
```

2. Review the configuration summary before enabling the configuration.

```
Use this configuration and save it? (yes/no) [y]: Enter
```

FlexPod Cisco Nexus iSCSI Storage vSphere on ONTAP

This section describes how to configure the FlexPod environment for iSCSI.

Enable Licenses

Cisco Nexus 9396PX A and Cisco Nexus 9396PX B

To license the Cisco Nexus switches, complete the following steps on both switches:

1. Log in as an administrator.
2. Run the following commands:

```
config t
feature interface-vlan
feature lacp
feature vpc
feature lldp
```

Set Global Configurations

Cisco Nexus 9396PX A and Cisco Nexus 9396PX B

To set global configurations, run the following commands on both switches to set global configurations and jumbo frames in QoS:

```
spanning-tree port type network default
spanning-tree port type edge bpduguard default
spanning-tree port type edge bpdufilter default
port-channel load-balance src-dst l4port
ntp server <<var_global_ntp_server_ip>> use-vrf default
ntp source <var_switch_ntp_ip>
ntp master 3
ip route 0.0.0.0/0 <<var_ib-mgmt-vlan_gateway>>
copy run start
```

Create VLANs

Cisco Nexus 9396PX A and Cisco Nexus 9396PX B

To create the necessary VLANs, run the following commands from the global configuration mode on both switches:

```
vlan <<var_ib-mgmt_vlan_id>>
name IB-MGMT-VLAN
exit
vlan <<var_native_vlan_id>>
name Native-VLAN
exit
vlan <<var_vmotion_vlan_id>>
name vMotion-VLAN
exit
vlan <<var_nfs_vlan_id>>
name NFS-VLAN
exit
vlan <<var_iscsi-a_vlan_id>>
name iSCSI-A-VLAN
exit
vlan <<var_iscsi-b_vlan_id>>
name iSCSI-B-VLAN
```

```
exit
```

Add NTP Distribution Interface

Cisco Nexus 9396PX A and Cisco Nexus 9396PX B

From the global configuration mode, run the following commands:

```
interface Vlan<<var_ib-mgmt_vlan_id>>
ip address <var_switch_ntp_ip>/<var_ib-mgmt_vlan_netmask_length>
no shutdown
exit
```

Add Individual Port Descriptions for Troubleshooting

Cisco Nexus 9396PX A

To add individual port descriptions for troubleshooting activity and verification for switch A, run the following commands from the global configuration mode:

```
interface Eth1/1
description <<var_ucs_clustername>>-A:1/31
exit
interface Eth1/2
description <<var_ucs_clustername>>-B:1/31
exit
interface Eth1/3
description <<var_ucs_clustername>>-A:1/29
exit
interface Eth1/4
description <<var_ucs_clustername>>-B:1/29
exit
interface Eth1/5
description <<var_node01>>:e0e
exit
interface Eth1/6
description <<var_node01>>:e0g
exit
interface Eth1/7
description <<var_node02>>:e0e
exit
interface Eth1/8
description <<var_node02>>:e0g
exit
interface Eth1/47
description <<var_nexus_B_hostname>>:1/47
exit
interface Eth1/48
description <<var_nexus_B_hostname>>:1/48
exit
```

Cisco Nexus 9396PX B

To add individual port descriptions for troubleshooting activity and verification for switch B, run the following commands from the global configuration mode:

```
interface Eth1/1
description <<var_ucs_clustername>>-A:1/32
exit
interface Eth1/2
description <<var_ucs_clustername>>-B:1/32
exit
interface Eth1/3
description <<var_ucs_clustername>>-A:1/30
exit
interface Eth1/4
```

```
description <<var_ucs_clustername>>-B:1/30
exit
interface Eth1/5
description <<var_node01>>:e0f
exit
interface Eth1/6
description <<var_node01>>:e0h
exit
interface Eth1/7
description <<var_node02>>:e0f
exit
interface Eth1/8
description <<var_node02>>:e0h
exit
interface Eth1/47
description <<var_nexus_A_hostname>>:1/47
exit
interface Eth1/48
description <<var_nexus_A_hostname>>:1/48
exit
```

Create Port Channels

Cisco Nexus 9396PX A and Cisco Nexus 9396PX B

To create the necessary port channels between devices, run the following commands from the global configuration mode:

```
interface Po10
description vPC peer-link
exit
interface Eth1/47-48
channel-group 10 mode active
no shutdown
exit
interface Po11
description <<var_node01>>
exit
interface Eth1/5-6
channel-group 11 mode active
no shutdown
exit
interface Po12
description <<var_node02>>
exit
interface Eth1/7-8
channel-group 12 mode active
no shutdown
exit
interface Po13
description <<var_ucs_clustername>>-A
exit
interface Eth1/1
channel-group 13 mode active
no shutdown
exit
interface Eth1/3
channel-group 13 mode active
no shutdown
exit
interface Po14
description <<var_ucs_clustername>>-B
exit
interface Eth1/2
channel-group 14 mode active
no shutdown
exit
interface Eth1/4
channel-group 14 mode active
```

```
no shutdown
exit
copy run start
```

Configure Port Channels for Cisco Nexus 9396PX A and Cisco Nexus 9396PX B

To configure port channel parameters, run the following commands from the global configuration mode on both switches:

```
interface Po10
switchport mode trunk
switchport trunk native vlan <<var_native_vlan_id>>
switchport trunk allowed vlan <<var_ib-mgmt_vlan_id>>, <<var_nfs_vlan_id>>,
<<var_vmotion_vlan_id>>, <<var_iscsi-a_vlan_id>>, <<var_iscsi-b_vlan_id>>
spanning-tree port type network
exit

interface Po11
switchport mode trunk
switchport trunk native vlan <<var_native_vlan_id>>
switchport trunk allowed vlan <<var_nfs_vlan_id>>, <<var_iscsi-a_vlan_id>>, <<var_iscsi-
b_vlan_id>>
spanning-tree port type edge trunk
mtu 9216
exit

interface Po12
switchport mode trunk
switchport trunk native vlan <<var_native_vlan_id>>
switchport trunk allowed vlan <<var_nfs_vlan_id>>, <<var_iscsi-a_vlan_id>>, <<var_iscsi-
b_vlan_id>>
spanning-tree port type edge trunk
mtu 9216
exit

interface Po13
switchport mode trunk
switchport trunk native vlan <<var_native_vlan_id>>
switchport trunk allowed vlan <<var_ib-mgmt_vlan_id>>, <<var_nfs_vlan_id>>,
<<var_vmotion_vlan_id>>, <<var_iscsi-a_vlan_id>>, <<var_iscsi-b_vlan_id>>
spanning-tree port type edge trunk
mtu 9216
exit

interface Po14
switchport mode trunk
switchport trunk native vlan <<var_native_vlan_id>>
switchport trunk allowed vlan <<var_ib-mgmt_vlan_id>>, <<var_nfs_vlan_id>>,
<<var_vmotion_vlan_id>>, <<var_iscsi-a_vlan_id>>, <<var_iscsi-b_vlan_id>>
spanning-tree port type edge trunk
mtu 9216
exit
copy run start
```

Configure Virtual Port Channels for Cisco Nexus 9396PX A

To configure virtual port channels (vPCs) for switch A, run the following commands from the global configuration mode:

```
vpc domain <<var_nexus_vpc_domain_id>>
role priority 10
peer-keepalive destination <<var_nexus_B_mgmt0_ip>> source <<var_nexus_A_mgmt0_ip>>
peer-switch
peer-gateway
delay restore 150
auto-recovery
exit
```

```
interface Po10
vpc peer-link
exit

interface Po11
vpc 11
exit

interface Po12
vpc 12
exit

interface Po13
vpc 13
exit

interface Po14
vpc 14
exit
copy run start
```

Configure Virtual Port Channels for Cisco Nexus 9396PX B

To configure vPCs for switch B, run the following commands from the global configuration mode:

```
vpc domain <<var_nexus_vpc_domain_id>>
role priority 20
peer-keepalive destination <<var_nexus_A_mgmt0_ip>> source <<var_nexus_B_mgmt0_ip>>
peer-switch
peer-gateway
delay restore 150
auto-recovery
exit

interface Po10
vpc peer-link
exit

interface Po11
vpc 11
exit

interface Po12
vpc 12
exit

interface Po13
vpc 13
exit

interface Po14
vpc 14
exit
copy run start
```

Note: Remember to run `copy run start` to permanently save the switch configurations.

Uplink into Existing Network Infrastructure

Depending on the available network infrastructure, several methods and features can be used to uplink the FlexPod environment. If an existing Cisco Nexus environment is present, NetApp recommends using vPCs to uplink the Cisco Nexus 9396PX switches included in the FlexPod environment into the infrastructure. The previous procedures can be used to create an uplink vPC to the existing environment. Make sure to run `copy run start` to save the configuration on each switch after the configuration is completed.

5.4 VMware vSphere Configuration

This section describes how to configure VMware vSphere 6.5.

FlexPod VMware ESXi 6.5 on ONTAP

The procedures in the following sections provide detailed instructions for installing VMware ESXi 6.5 in a FlexPod environment. This procedure assumes that the ESXi host service profiles have been created and that boot LUNs have been created and mapped to each host. After the procedures are completed, eight iSCSI-booted ESXi hosts must be provisioned. These procedures are customized to include the environment variables.

Note: Several methods exist for installing ESXi in a VMware environment. The procedures in this section focus on how to use the built-in KVM console and virtual media features in Cisco UCS Manager to map remote installation media to individual servers and connect to their iSCSI boot LUNs.

Open Cisco UCS IP KVM Console for Each Blade

The IP KVM enables the administrator to begin the installation of the operating system through remote media. You must log in to the Cisco UCS environment to run the IP KVM.

To log in to the Cisco UCS environment, complete the following steps:

1. Open a web browser and enter the IP address of the Cisco UCS cluster. This step launches the Cisco UCS Manager application.
2. If prompted to accept security certificates, accept as necessary.
3. When prompted, enter `admin` as the user name and enter the administrative password.
4. To log in to Cisco UCS Manager, click Login.
5. From the main menu, click the Servers tab.
6. Select Servers > Service Profiles > Root > `VM-Host-Infra-01`.
7. Right-click `VM-Host-Infra-01` and select KVM Console.
8. If prompted to accept an unencrypted KVM session, accept as necessary.
9. Repeat for each host to be installed.

Set Up VMware ESXi Installation

To prepare the server for the operating system installation, complete the following steps on each ESXi host:

1. In the KVM window, click the Virtual Media node.
2. If prompted to accept an unencrypted KVM session, accept as necessary.
3. Click Add Image.
4. Browse to the ESXi installer ISO image file and click Open.
5. Select the Mapped checkbox to map the newly added image.
6. Click the KVM tab to monitor the server boot.
7. Boot the server by selecting Boot Server and clicking OK.
8. Click OK again.

Install ESXi

To install VMware ESXi to the iSCSI LUN that was prepared for each host, complete the following steps on each host:

1. On reboot, the machine detects the presence of the ESXi installation media. Select the ESXi installer from the boot menu that is displayed.
2. After the installer is finished loading, press Enter to continue with the installation.
3. Read and accept the end-user license agreement (EULA). Press F11 to accept and continue.
4. Select `NETAPP LUN C-mode` as the installation disk for ESXi and press Enter to continue with the installation.
5. Select the appropriate keyboard layout and press Enter.
6. Enter and confirm the root password and press Enter.
7. The installer issues a warning that the selected disk will be repartitioned. Press F11 to continue with the installation.
8. After the installation is complete, click the Virtual Media tab and clear the checkmark next to the ESXi installation media. Click Yes.

   Note: The ESXi installation image must be unmapped so that the server reboots into ESXi and not into the installer.

9. From the KVM tab, press Enter to reboot the server.

Set Up Management Networking for ESXi Hosts

Adding a management network for each VMware host is necessary for managing the hosts. To configure the ESXi hosts with access to the management network, complete the following steps:

1. After the server has finished rebooting, press F2 to customize the system.
2. Use `root` as the login name, enter the corresponding password, and press Enter to log in.
3. Select the Configure the Management Network option and press Enter.
4. Select the VLAN (Optional) option and press Enter.
5. Enter `<<var_mgmt_vlan_id>>` and press Enter.
6. From the Configure Management Network menu, select IP Configuration and press Enter.
7. Using the spacebar, select the Set Static IP Address and Network Configuration option.
8. Enter the IP address for managing the ESXi host.
9. Enter the subnet mask for the ESXi host.
10. Enter the default gateway for the ESXi host.
11. Press Enter to accept the changes to the IP configuration.
12. Select the IPv6 Configuration option and press Enter.
13. Using the spacebar, unselect Enable IPv6 (restart required) and press Enter.
14. Select the DNS Configuration option and press Enter.

    Note: Because the IP address is assigned manually, the DNS information must also be entered manually.

15. Enter the IP address of the primary DNS server.
16. Optional: Enter the IP address of the secondary DNS server.
17. Enter the FQDN for the ESXi host.
18. Press Enter to accept the changes to the DNS configuration.
19. Press Esc to exit the Configure Management Network submenu.
20. Press Y to confirm the changes and return to the main menu.
21. The ESXi host reboots. After reboot, press F2 and log in as `root` again.

22. Select Test Management Network to verify that the management network is set up correctly and press Enter.
23. Press Enter to run the test.
24. Press Enter to exit the window.
25. Press Esc to log out of the VMware console.

Log in to VMware ESXi Hosts by Using VMware Host Client

To log in to the VM-Host-Infra-01 ESXi host, complete the following steps:

1. Open a web browser on the management workstation and navigate to the VM-Host-Infra-01 management IP address.
2. Click Open the VMware Host Client.
3. Enter `root` for the user name.
4. Enter the root password.
5. Click Login to connect.
6. Repeat this process to log in to other hosts in separate browser tabs or windows.

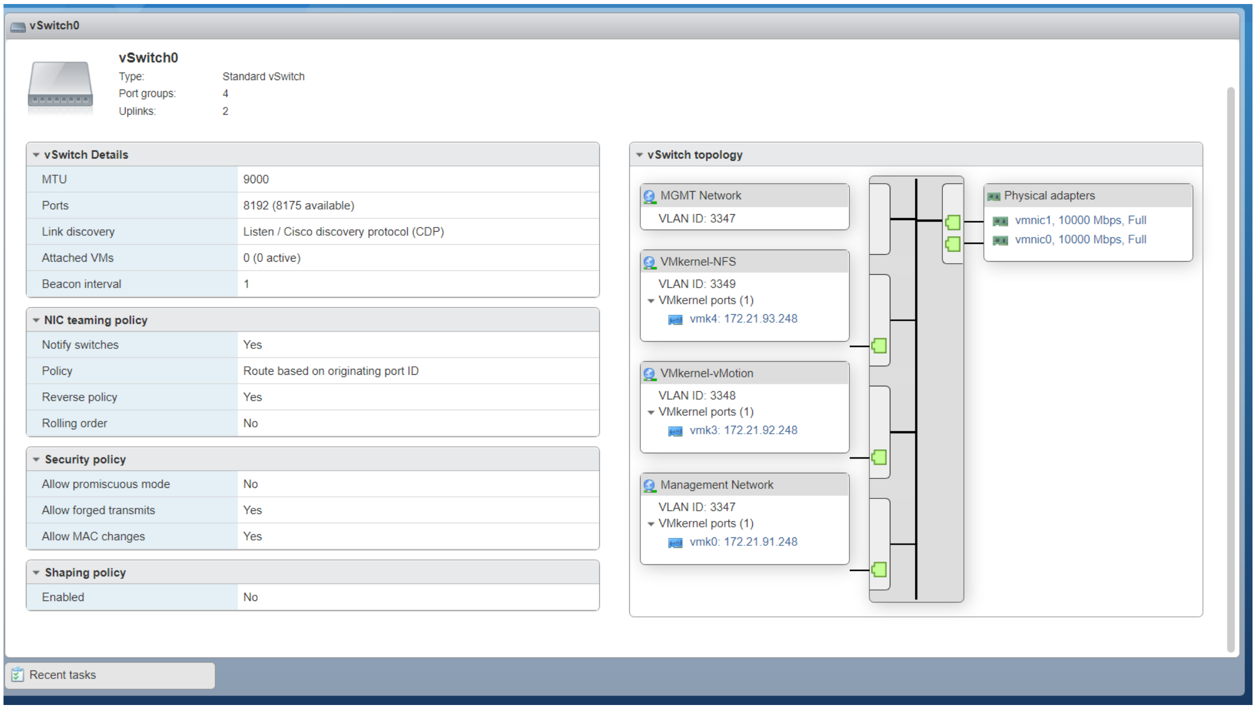
Set Up VMkernel Ports and Virtual Switch

To set up the VMkernel ports and the virtual switches on the ESXi hosts, complete the following steps:

1. From the Host Client, select Networking on the left.
2. In the center pane, select the Virtual switches tab.
3. Select vSwitch0.
4. Select Edit settings.
5. Change the MTU to 9000.
6. Click Add uplink and then select vmnic1 from the drop-down box.
7. Click Save.
8. Select Networking on the left.
9. In the center pane, select the Virtual switches tab.
10. Select iScsiBootvSwitch.
11. Select Edit settings.
12. Change the MTU to 9000.
13. Click Save.
14. Select Networking on the left.
15. Select the VMkernel NICs tab.
16. Select vmk1 iScsiBootPG.
17. Select Edit settings.
18. Change the MTU to 9000.
19. Click Save.
20. Select Networking on the left.
21. Select the Virtual switches tab.
22. Select the Add standard virtual switch.
23. Provide a name of iScsciBootvSwitch-B for the vSwitch name.
24. Set the MTU to 9000.

25. Select vmnic3 from the Uplink 1 pull-down options.
26. Click Add.
27. In the center pane, select the VMkernel NICs tab.
28. Select Add VMkernel NIC.
29. Specify a new port group name of iScsiBootPG-B.
30. Select iScsciBootvSwitch-B for Virtual switch.
31. Set the MTU to 9000. Do not enter a VLAN ID.
32. Select Static for the IPv4 settings and expand the option to provide the Address and Subnet Mask within the Configuration.
33. Click Create.
34. On the left, select Networking, then select the Port groups tab.
35. In the center pane, right-click VM Network and select Remove.
36. Click Remove to complete removing the port group.
37. In the center pane, select Add port group.
38. Name the port group MGMT Network, enter `<<mgmt-vlan-id>>` in the VLAN ID field, and make sure Virtual switch vSwitch0 is selected.
39. Click Add to finalize the edits for the MGMT Network.
40. At the top, select the VMkernel NICs tab.
41. Click Add VMkernel NIC.
42. In the New Port Group field, enter VMkernel-vMotion.
43. For the virtual switch, select vSwitch0 selected.
44. Enter `<vmotion-vlan-id>` for the VLAN ID.
45. Change the MTU to 9000.
46. Select Static IPv4 settings and expand IPv4 settings.
47. Enter the ESXi host vMotion IP address and netmask.
48. Select the vMotion stack TCP/IP stack.
49. Under Services, select vMotion.
50. Click Create.
51. Click Add VMkernel NIC.
52. In the New Port Group field, enter VMkernel-NFS.
53. For the virtual switch, select vSwitch0 selected.
54. Enter `<nfs-vlan-id>` for the VLAN ID.
55. Change the MTU to 9000.
56. Select Static IPv4 settings and expand IPv4 settings.
57. Enter the ESXi host infrastructure NFS IP address and netmask.
58. Do not select any of the services.
59. Click Create.
60. Click the Port Groups tab.
61. In the center pane, select Add Port Group.
62. Name the port group iSCSIA Network, do not enter a VLAN ID field, and make sure Virtual switch iScsiBootvSwitch is selected.
63. Click Add to finalize the edits for the iSCSIA Network.

64. In the center pane, select Add port group.
65. Name the port group iSCSIB Network but do not enter a VLAN ID field. Make sure that the virtual switch iScsiBootvSwitch-B is selected.
66. Click Add to finalize the edits for the iSCSIB network.
67. Select the Virtual Switches tab, then vSwitch0. The properties for vSwitch0 VMkernel NICs should be similar to the following example:



vSwitch0

vSwitch0
Type: Standard vSwitch
Port groups: 4
Uplinks: 2

vSwitch Details

MTU	9000
Ports	8192 (8175 available)
Link discovery	Listen / Cisco discovery protocol (CDP)
Attached VMs	0 (0 active)
Beacon interval	1

NIC teaming policy

Notify switches	Yes
Policy	Route based on originating port ID
Reverse policy	Yes
Rolling order	No

Security policy

Allow promiscuous mode	No
Allow forged transmits	Yes
Allow MAC changes	Yes

Shaping policy

Enabled	No

vSwitch topology

MGMT Network
VLAN ID: 3347

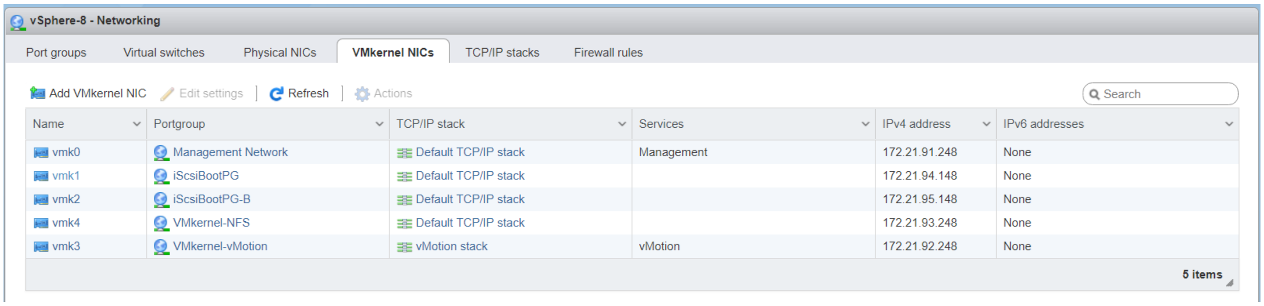
VMkernel-NFS
VLAN ID: 3349
VMkernel ports (1)
vmk4: 172.21.93.248

VMkernel-vMotion
VLAN ID: 3348
VMkernel ports (1)
vmk3: 172.21.92.248

Management Network
VLAN ID: 3347
VMkernel ports (1)
vmk0: 172.21.91.248

Physical adapters
vmnic1, 10000 Mbps, Full
vmnic0, 10000 Mbps, Full

68. Select the VMkernel NICs tab to confirm configured virtual adapters. The adapters listed should be similar to the following example:



vSphere-8 - Networking

Name	Portgroup	TCP/IP stack	Services	IPv4 address	IPv6 addresses
vmk0	Management Network	Default TCP/IP stack	Management	172.21.91.248	None
vmk1	iScsiBootPG	Default TCP/IP stack		172.21.94.148	None
vmk2	iScsiBootPG-B	Default TCP/IP stack		172.21.95.148	None
vmk4	VMkernel-NFS	Default TCP/IP stack		172.21.93.248	None
vmk3	VMkernel-vMotion	vMotion stack	vMotion	172.21.92.248	None

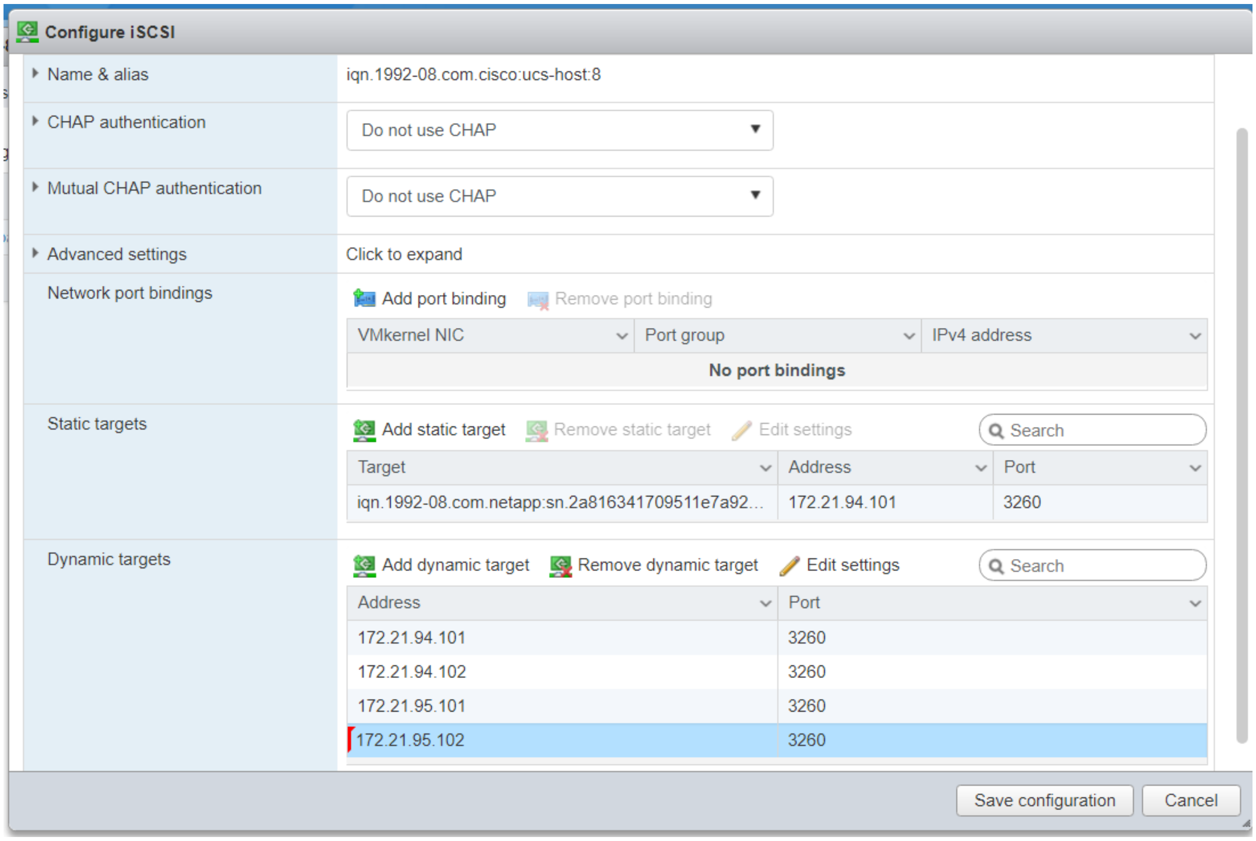
5 items

Set Up iSCSI Multipathing

To set up the iSCSI multipathing on the ESXi hosts, complete the following steps:

1. From each host client, select Storage in the left pane.
2. In the center pane, click Adapters.
3. Select the iSCSI software adapter and click Configure iSCSI.
4. Under Dynamic Targets, click Add Dynamic Target.
5. Enter the IP address of `iSCSI_lif01a`.

6. Repeat steps 1 through 5 using each of these IP addresses: `iscsi_lif01b`, `iscsi_lif02a`, and `iscsi_lif02b`.
7. Click Save Configuration.



Configure iSCSI

Name & alias: iqn.1992-08.com.cisco:ucs-host:8

CHAP authentication: Do not use CHAP

Mutual CHAP authentication: Do not use CHAP

Advanced settings: Click to expand

Network port bindings

VMkernel NIC	Port group	IPv4 address
No port bindings		

Static targets

Target	Address	Port
iqn.1992-08.com.netapp:sn.2a816341709511e7a92...	172.21.94.101	3260

Dynamic targets

Address	Port
172.21.94.101	3260
172.21.94.102	3260
172.21.95.101	3260
172.21.95.102	3260

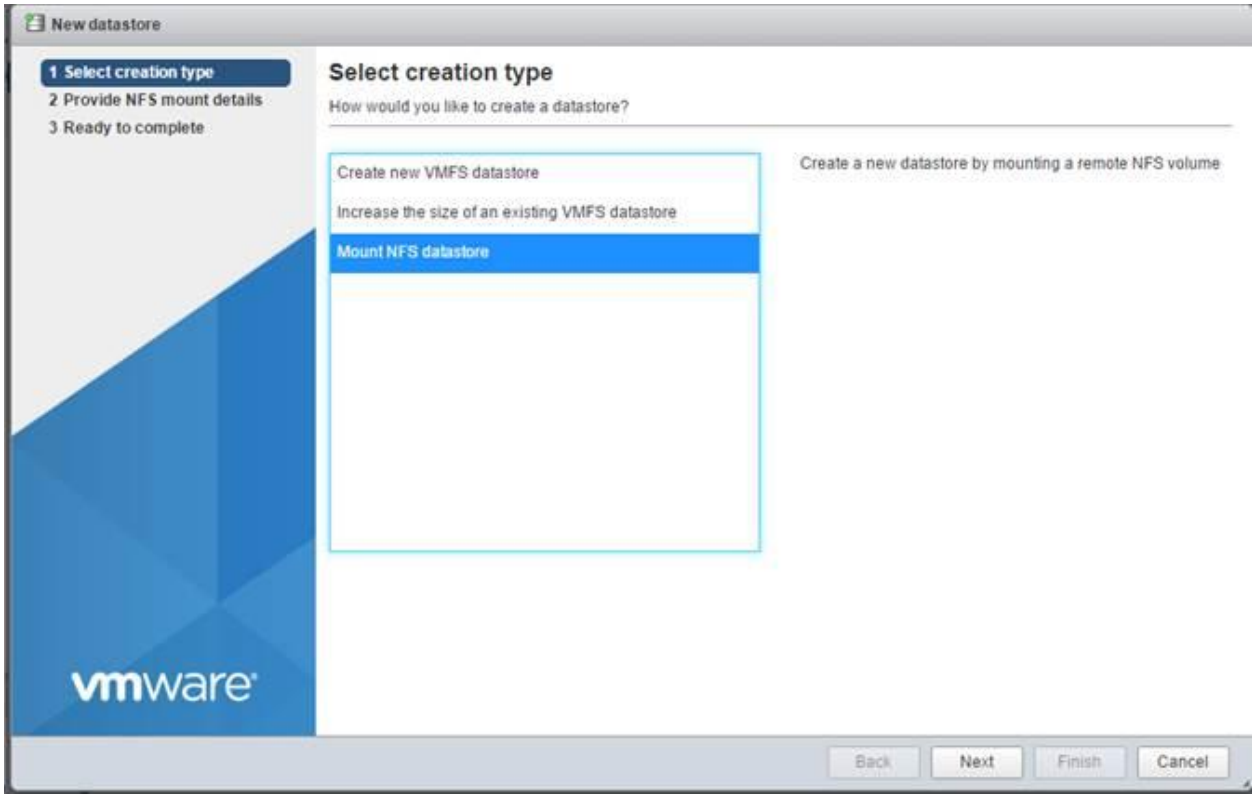
Note: To get the complete `iscsi_lif` IP address, log in to the NetApp storage cluster management interface and type the “network interface show” command.

Note: The host automatically rescans the storage adapter, and the targets are added to static targets.

Mount Required Datastores

To mount the required datastores, complete the following steps on each ESXi host:

1. From the host client, select Storage in the left pane.
2. In the center pane, select Datastores.
3. In the center pane, select New Datastore to add a new datastore.
4. In the New Datastore message, select Mount NFS Datastore and click Next.



Select creation type

How would you like to create a datastore?

- Create new VMFS datastore
- Increase the size of an existing VMFS datastore
- Mount NFS datastore

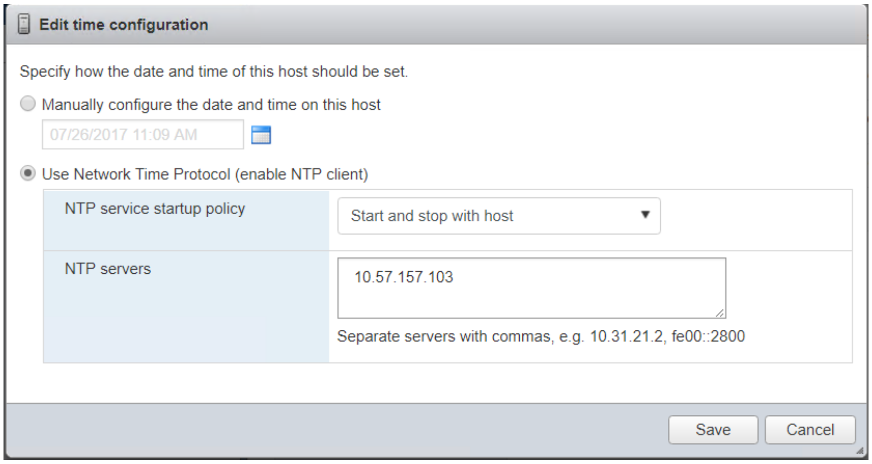
Create a new datastore by mounting a remote NFS volume

5. Enter `infra_datastore_1` for the datastore name. Enter the IP address for the `nfs_lif01` LIF for the NFS server. Enter `/infra_datastore_1` for the NFS share. Leave the NFS version set at NFS. Click Next.
6. Click Finish. The datastore should now appear in the datastore list.
7. In the center pane, select New Datastore to add a new datastore.
8. In the new datastore message, select Mount NFS datastore and click Next.
9. Enter `infra_swap` for the datastore name. Enter the IP address for the `nfs_lif02` LIF for the NFS server. Enter `/infra_swap` for the NFS share. Leave the NFS version set at NFS 3. Click Next.
10. Click Finish. The datastore should now appear in the datastore list.
11. Repeat steps 1 through 10 to mount the VM datastore on all of the ESXi hosts.

Configure NTP on ESXi Hosts

To configure NTP on the ESXi hosts, complete the following steps on each host:

1. From the host client, select Manage in the left pane.
2. In the center pane, select the Time & Date tab.
3. Click Edit settings.
4. Make sure Use Network Time Protocol (enable NTP client) is selected.
5. From the drop-down menu, select Start and Stop with Host.
6. Enter the IP address for the NTP server.



Edit time configuration

Specify how the date and time of this host should be set.

○ Manually configure the date and time on this host

07/26/2017 11:09 AM

● Use Network Time Protocol (enable NTP client)

NTP service startup policy	Start and stop with host
NTP servers	10.57.157.103 Separate servers with commas, e.g. 10.31.21.2, fe00::2800

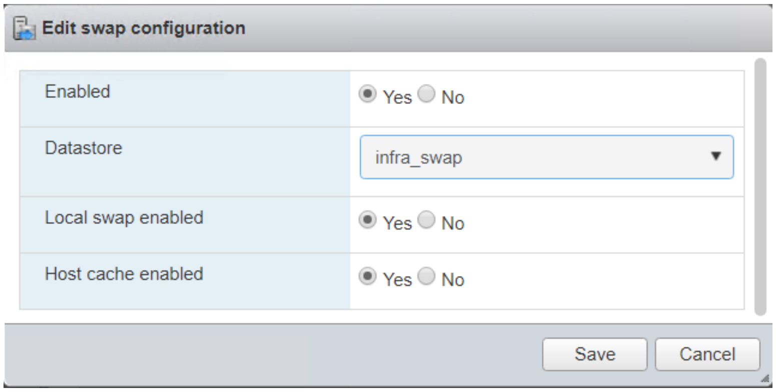
7. Click Save to save the configuration changes.
8. Select Actions > NTP Service > Start.
9. Verify that NTP service is now running and that the clock is set to approximately the correct time.

   Note: The NTP server time might vary slightly from the host time.

Move VM Swap File Location for Infrastructure Hosts

To configure NTP on the ESXi hosts, complete the following steps on each host:

1. From the host client, select Manage in the left pane.
2. In the center pane, select the Swap tab.
3. Click Edit settings.
4. Select `infra_swap` from the datastore drop-down menu.



Edit swap configuration

Enabled	● Yes ○ No
Datastore	infra_swap
Local swap enabled	● Yes ○ No
Host cache enabled	● Yes ○ No

5. Click Save to save the configuration changes.

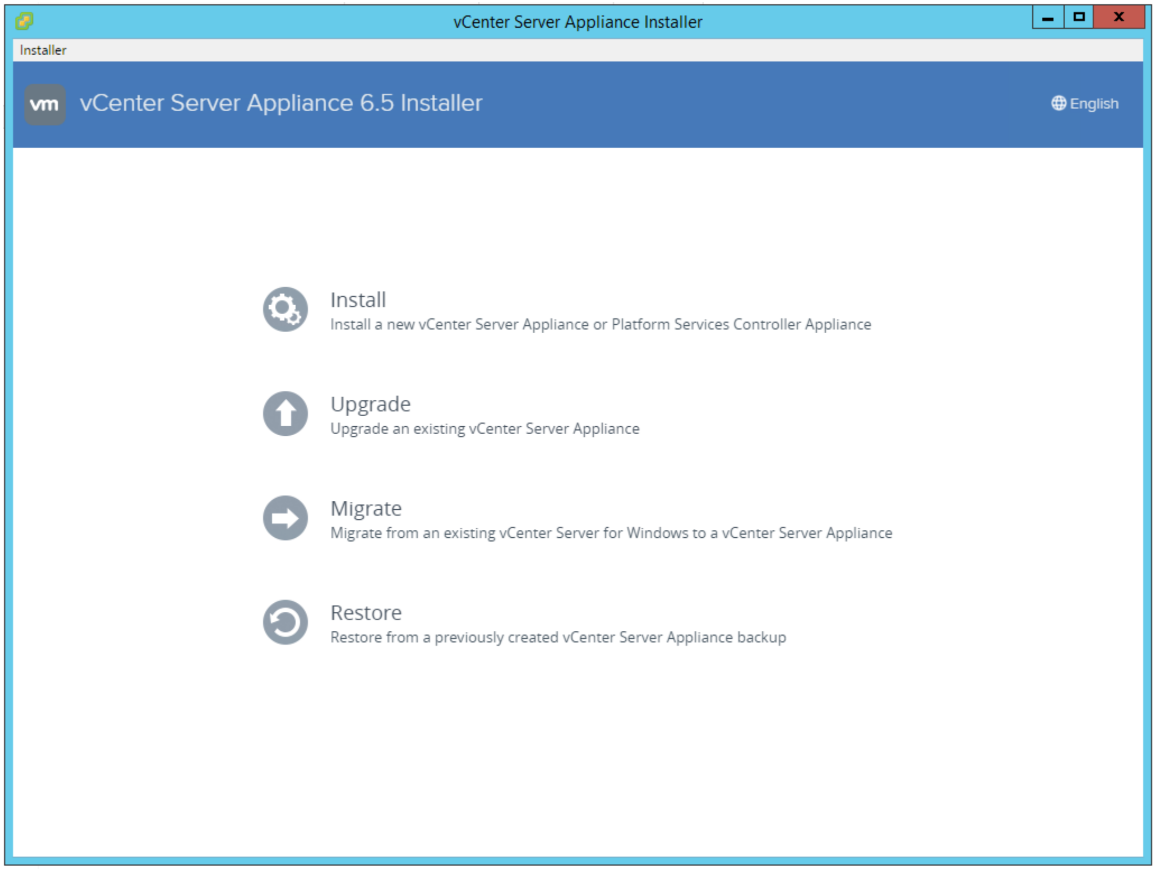
5.5 VMware vCenter 6.5a Configuration

The procedures in the following subsections provide detailed instructions for installing the VMware vCenter 6.5a Server Appliance in an environment. After completing the installation procedure, you need to configure the VMware vCenter Server.

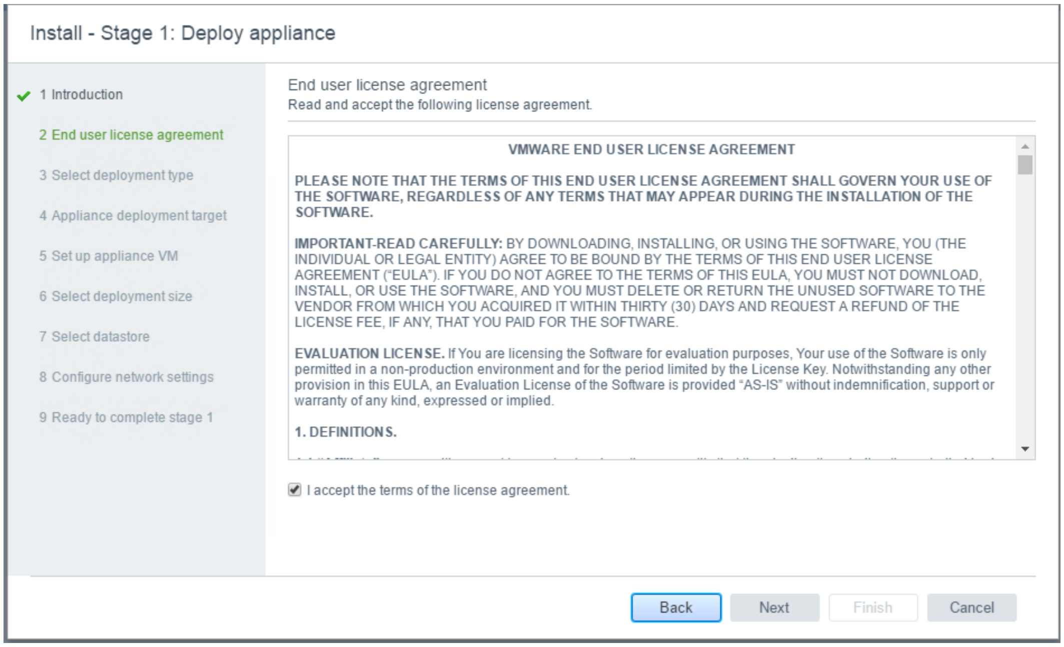
Build VMware vCenter Server Appliance

The VCSA deployment consists of two stages: installation and configuration. To build the VMware vCenter VM, complete the following steps:

1. Locate and copy the `VMware-VCSA-all-6.5.0-4944578.iso` file to the desktop of the management workstation. This ISO is for the VMware vSphere 6.5 vCenter Server Appliance.
2. Using ISO mounting software, mount the ISO image as a disk on the management workstation. For example, mount the image by running the `mount` command in Windows Server 2012.
3. In the mounted disk directory, navigate to the `vcsa-ui-installer > win32` directory and double-click `installer.exe` to start the vCenter Server Appliance Installer wizard.


vCenter Server Appliance Installer
Installer
vm
vCenter Server Appliance 6.5 Installer
English
Install
Install a new vCenter Server Appliance or Platform Services Controller Appliance
Upgrade
Upgrade an existing vCenter Server Appliance
Migrate
Migrate from an existing vCenter Server for Windows to a vCenter Server Appliance
Restore
Restore from a previously created vCenter Server Appliance backup

4. Click Install to start the vCenter Server Appliance Deployment wizard.
5. In the introduction section, click Next.
6. Read and accept the license agreement and click Next.


Install - Stage 1: Deploy appliance
✓ 1 Introduction
2 End user license agreement
3 Select deployment type
4 Appliance deployment target
5 Set up appliance VM
6 Select deployment size
7 Select datastore
8 Configure network settings
9 Ready to complete stage 1
Back
Next
Finish
Cancel

End user license agreement

Read and accept the following license agreement.

VMWARE END USER LICENSE AGREEMENT

PLEASE NOTE THAT THE TERMS OF THIS END USER LICENSE AGREEMENT SHALL GOVERN YOUR USE OF THE SOFTWARE, REGARDLESS OF ANY TERMS THAT MAY APPEAR DURING THE INSTALLATION OF THE SOFTWARE.

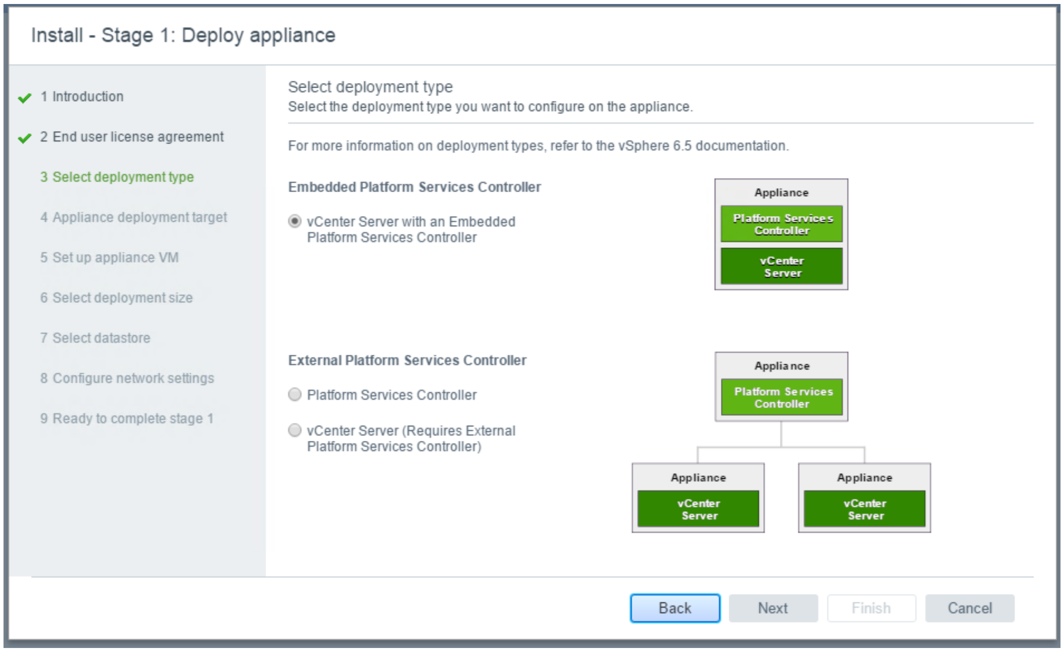
IMPORTANT-READ CAREFULLY: BY DOWNLOADING, INSTALLING, OR USING THE SOFTWARE, YOU (THE INDIVIDUAL OR LEGAL ENTITY) AGREE TO BE BOUND BY THE TERMS OF THIS END USER LICENSE AGREEMENT ("EULA"). IF YOU DO NOT AGREE TO THE TERMS OF THIS EULA, YOU MUST NOT DOWNLOAD, INSTALL, OR USE THE SOFTWARE, AND YOU MUST DELETE OR RETURN THE UNUSED SOFTWARE TO THE VENDOR FROM WHICH YOU ACQUIRED IT WITHIN THIRTY (30) DAYS AND REQUEST A REFUND OF THE LICENSE FEE, IF ANY, THAT YOU PAID FOR THE SOFTWARE.

EVALUATION LICENSE. If You are licensing the Software for evaluation purposes, Your use of the Software is only permitted in a non-production environment and for the period limited by the License Key. Notwithstanding any other provision in this EULA, an Evaluation License of the Software is provided "AS-IS" without indemnification, support or warranty of any kind, expressed or implied.

1. DEFINITIONS.

☑ I accept the terms of the license agreement.

7. In the Select Deployment Type section, select Embedded Platform Services Controller.


Install - Stage 1: Deploy appliance
✓ 1 Introduction
✓ 2 End user license agreement
3 Select deployment type
4 Appliance deployment target
5 Set up appliance VM
6 Select deployment size
7 Select datastore
8 Configure network settings
9 Ready to complete stage 1
Appliance
Platform Services Controller
vCenter Server
Appliance
Platform Services Controller
Appliance
vCenter Server
Appliance
vCenter Server
Back
Next
Finish
Cancel

Select deployment type

Select the deployment type you want to configure on the appliance.

For more information on deployment types, refer to the vSphere 6.5 documentation.

Embedded Platform Services Controller

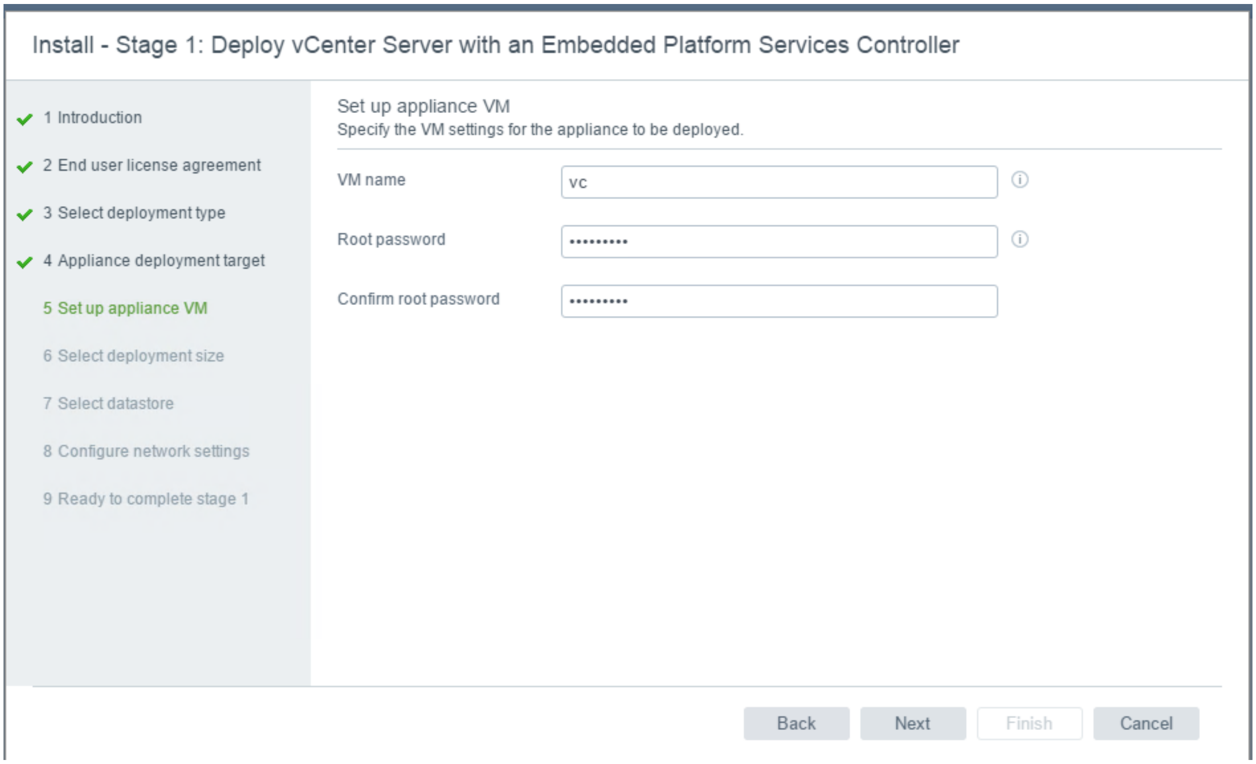
● vCenter Server with an Embedded Platform Services Controller

External Platform Services Controller

○ Platform Services Controller

○ vCenter Server (Requires External Platform Services Controller)

8. In the Appliance Deployment Target fields, enter the ESXi host name or IP address, user name, and password.
9. Click Yes to accept the certificate.
10. In the Set Up Appliance VM section, enter the appliance name and password. Click Next.


Install - Stage 1: Deploy vCenter Server with an Embedded Platform Services Controller
✓ 1 Introduction
✓ 2 End user license agreement
✓ 3 Select deployment type
✓ 4 Appliance deployment target
5 Set up appliance VM
6 Select deployment size
7 Select datastore
8 Configure network settings
9 Ready to complete stage 1
Back
Next
Finish
Cancel

Set up appliance VM

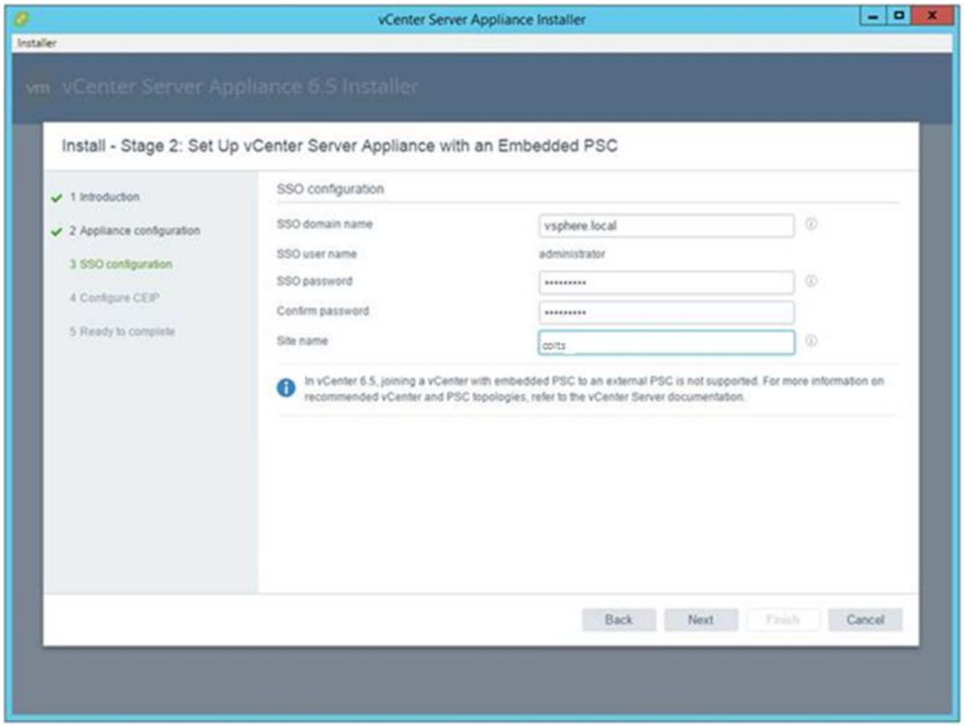
Specify the VM settings for the appliance to be deployed.

VM name: vc

Root password: •••••••••

Confirm root password: •••••••••

11. In the Select Deployment Size section, select the deployment size and storage size (for example, select Small). Click Next.
12. Select the `infra_datastore_1` and click Next.
13. In the Network Settings section, configure the following settings and then click Next:
    a. Choose a network: IB-MGMT Network
    b. IP version: IPV4
    c. IP assignment: static
    d. System name: `<vcenter-fqdn-or-ip>`
    e. IP address: `<vcenter-ip>`
    f. Subnet mask or prefix length: `<vcenter-subnet-mask>`
    g. Default gateway: `<vcenter-gateway>`
    h. DNS servers: `<dns-server>`
14. Review all of the values and click Finish to complete the installation.
15. The vCenter appliance installation takes a few minutes to complete.
16. Click Continue to proceed with stage two of the configuration.
17. Click Next.
18. In the Appliance Configuration section, configure the following settings and then click Next:
    a. Time synchronization mode: synchronize time with NTP servers
    b. NTP servers: `<ntp_server_ip>`
    c. SSH access: enabled
19. Complete the single sign-on (SSO) configuration and click Next.


vCenter Server Appliance Installer
Installer
vm vCenter Server Appliance 6.5 Installer

Install - Stage 2: Set Up vCenter Server Appliance with an Embedded PSC

✓ 1 Introduction
✓ 2 Appliance configuration
3 SSO configuration
4 Configure CEIP
5 Ready to complete

SSO configuration

SSO domain name: vsphere.local

SSO user name: administrator

SSO password: ••••••••••

Confirm password: ••••••••••

Site name: colts

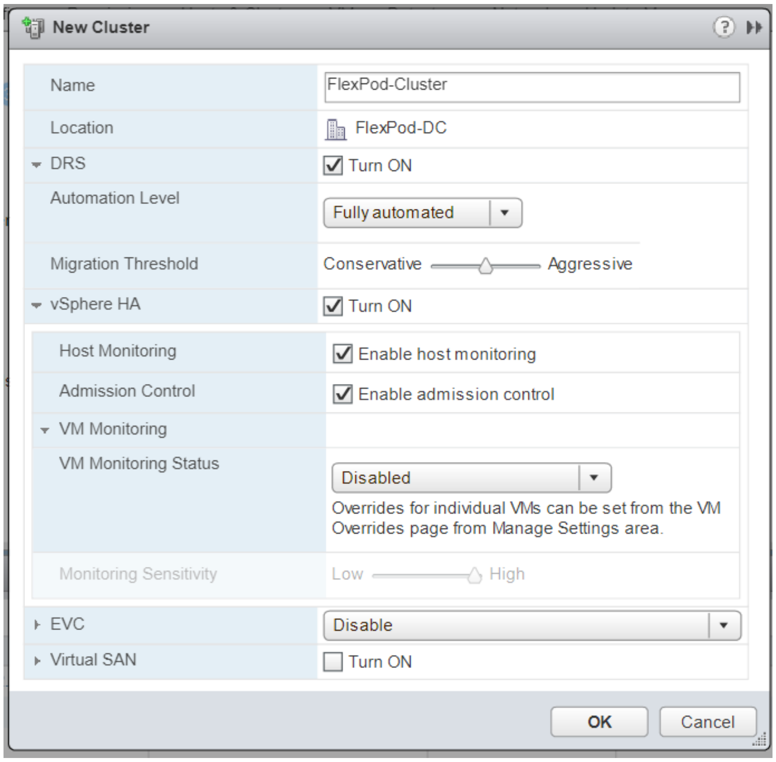
In vCenter 6.5, joining a vCenter with embedded PSC to an external PSC is not supported. For more information on recommended vCenter and PSC topologies, refer to the vCenter Server documentation.

20. If needed, select Join the VMware’s Customer Experience Improvement Program (CEIP) and click Next.
21. Review the configuration and click Finish.
22. Click OK.

Set Up VMware vCenter Server

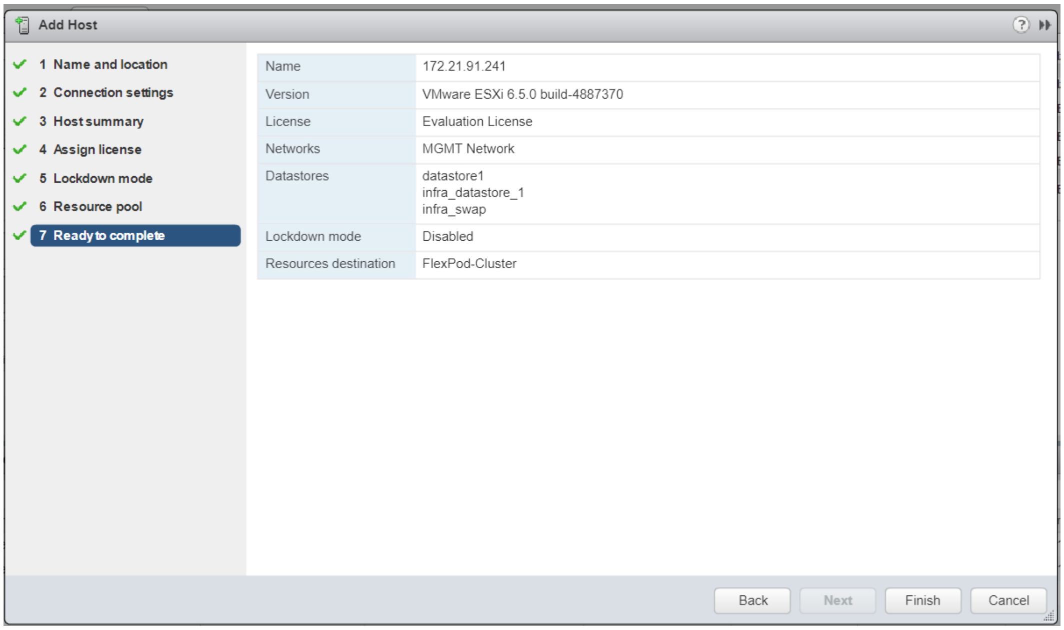
To set up the VMware vCenter Server, complete the following steps:

1. Using a web browser, navigate to `https://<vcenter-ip>/vsphere-client`.
2. Click Download Enhanced Authentication Plugin and then install by double-clicking the downloaded file.
3. Log in using the SSO user name and password created during the vCenter installation.
4. In the center pane, click Create Datacenter.
5. In the Datacenter Name field, enter FlexPod-DC and click OK.
6. In the center pane, right-click the FlexPod-DC data center from the list. Click New Cluster.
7. Name the cluster FlexPod-Cluster.
8. Select the Turn On option for DRS and then leave the default values.
9. Select the Turn On option for vSphere HA and then leave the default values.



Name	FlexPod-Cluster
Location	FlexPod-DC
DRS	☑ Turn ON
Automation Level	Fully automated
Migration Threshold	Conservative — Aggressive
vSphere HA	☑ Turn ON
Host Monitoring	☑ Enable host monitoring
Admission Control	☑ Enable admission control
VM Monitoring	
VM Monitoring Status	Disabled Overrides for individual VMs can be set from the VM Overrides page from Manage Settings area.
Monitoring Sensitivity	Low — High
EVC	Disable
Virtual SAN	□ Turn ON

10. Click OK to create the new cluster.
11. In the left pane, right-click FlexPod-Management and click Add Host.
12. In the Host field, enter either the IP address or the FQDN name of one of the VMware ESXi hosts. Click Next.
13. Enter root as the user name and the root password. Click Next.
14. Click Yes to accept the certificate.
15. Review the host details and click Next.
16. Assign a license or leave in evaluation mode and then click Next.
17. Click Next.
18. Click Next again.
19. Review the configuration parameters. Click Finish to add the host.



Name	172.21.91.241
Version	VMware ESXi 6.5.0 build-4887370
License	Evaluation License
Networks	MGMT Network
Datastores	datastore1 infra_datastore_1 infra_swap
Lockdown mode	Disabled
Resources destination	FlexPod-Cluster

20. Repeat steps 1 through 19 to add the remaining VMware ESXi hosts to the cluster.

5.6 NetApp VSC 6.2.1 Deployment Procedure

This section describes the deployment procedures for the VSC.

VSC 6.2.1 Preinstallation Considerations

The following licenses are required for VSC on storage systems that run ONTAP 9.1:

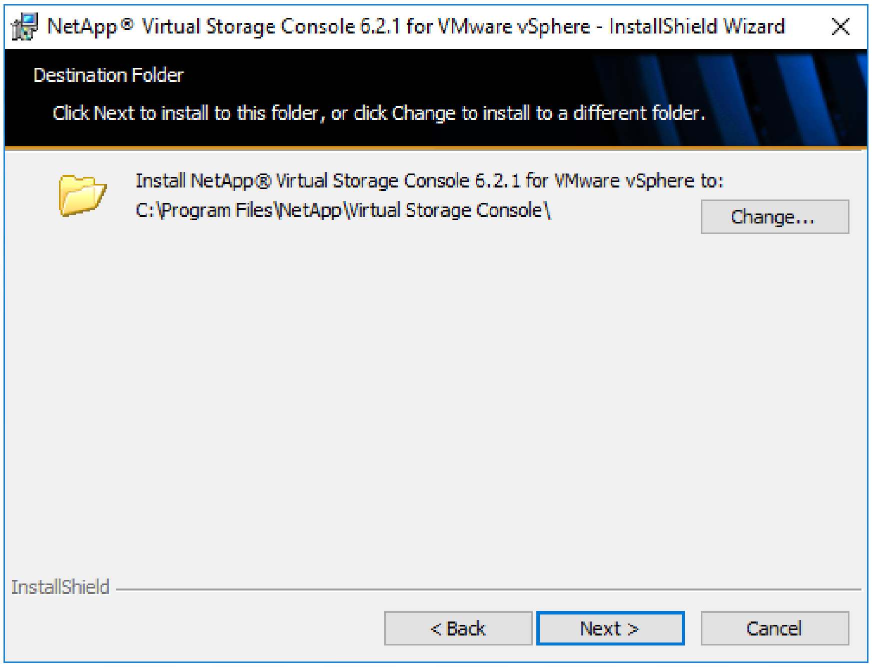
- Protocol licenses (NFS and iSCSI)
- NetApp FlexClone (for provisioning and cloning only)
- NetApp SnapRestore (for backup and recovery)
- NetApp SnapManager Suite

Install VSC 6.2.1

To install the VSC 6.2.1 software, complete the following steps:

1. Build a VSC VM with Windows Server 2016, 4GB of RAM, two CPUs, and one virtual network interface in the `MGMT Network` port group. The virtual network interface should be a VMXNET 3 adapter.
2. Bring up the VM, install VMware Tools, assign the IP address and gateway in the MGMT subnet, and join the machine to the Active Directory (AD) domain.
3. Install all Windows updates on the VM.
4. Log in to the VSC VM as the FlexPod admin user by using the VMware console.
5. From the VMware console on the VSC VM, download the x64 version of Virtual Storage Console 6.2.1P1 from the NetApp Support site.
6. Right-click the `VSC-6.2.1-win64.exe` and select Run as Administrator.
7. Select the appropriate language and click OK.
8. On the Installation wizard Welcome page, click Next.
9. Select the checkbox to accept the message and click Next.

10. Click Next to accept the default installation location.



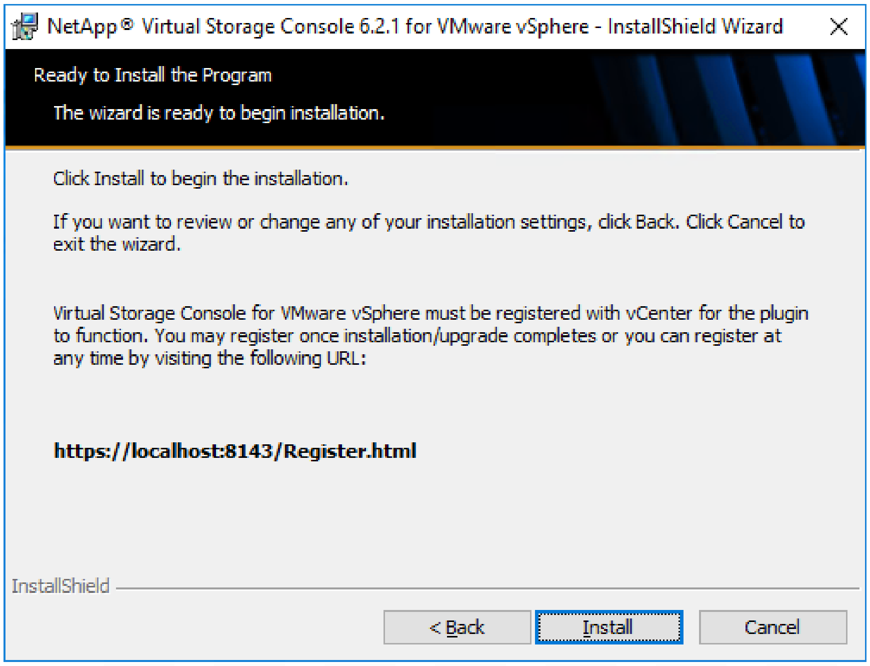
NetApp® Virtual Storage Console 6.2.1 for VMware vSphere - InstallShield Wizard

Destination Folder

Click Next to install to this folder, or click Change to install to a different folder.

Install NetApp® Virtual Storage Console 6.2.1 for VMware vSphere to:
C:\Program Files\NetApp\Virtual Storage Console\

11. Click Install.



NetApp® Virtual Storage Console 6.2.1 for VMware vSphere - InstallShield Wizard

Ready to Install the Program

The wizard is ready to begin installation.

Click Install to begin the installation.

If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.

Virtual Storage Console for VMware vSphere must be registered with vCenter for the plugin to function. You may register once installation/upgrade completes or you can register at any time by visiting the following URL:

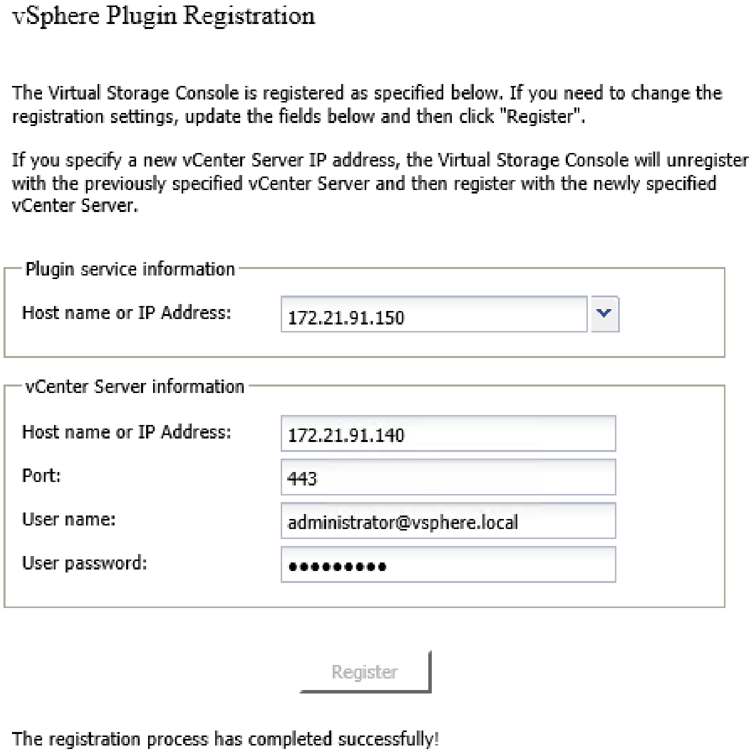
https://localhost:8143/Register.html

12. Click Finish.

Register VSC with vCenter Server

To register the VSC with the vCenter Server, complete the following steps:

1. A browser window with the registration URL opens automatically when the installation phase is complete. If the URL does not open automatically, open https://localhost:8143/Register.html in Internet Explorer.
2. Click Continue to This Website (Not Recommended).
3. In the Plug-in Service Information section, select the local IP address of the VSC VM.
4. In the vCenter Server Information section, enter the host name or IP address, the user name (FlexPod admin user or root), and the user password for the vCenter Server. Click Register to complete the registration.


vSphere Plugin Registration

The Virtual Storage Console is registered as specified below. If you need to change the registration settings, update the fields below and then click "Register".

If you specify a new vCenter Server IP address, the Virtual Storage Console will unregister with the previously specified vCenter Server and then register with the newly specified vCenter Server.

Plugin service information

Host name or IP Address: 172.21.91.150

vCenter Server information

Host name or IP Address: 172.21.91.140

Port: 443

User name: administrator@vsphere.local

User password: •••••••••

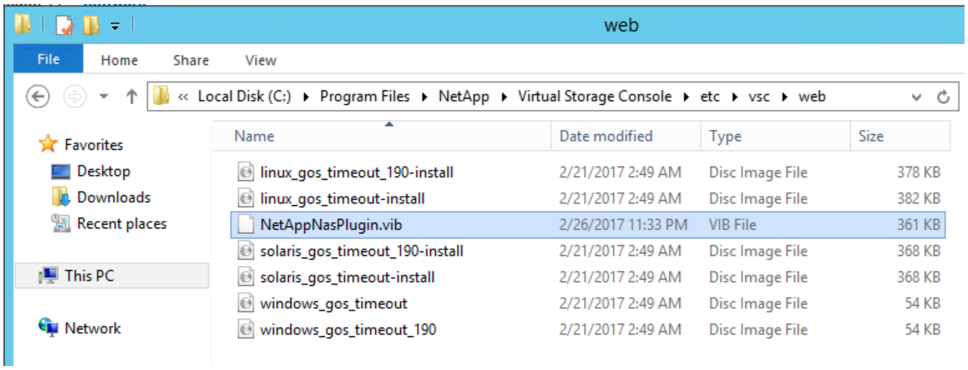
The registration process has completed successfully!

5. With a successful registration, the storage controller discovery automatically begins.

Install NetApp NFS VAAI Plug-In

To install the NetApp NFS VAAI Plug-In, complete the following steps:

1. Download the NetApp NFS Plug-In 1.1.2 for VMware `.vib` file from the NFS plug-in download on the VSC VM.
2. Rename the downloaded file `NetAppNasPlugin.vib`.
3. Move the file to the `C:\Program Files\NetApp\Virtual Storage Console\etc\vsc\web` folder.


web
File
Home
Share
View
« Local Disk (C:) ▸ Program Files ▸ NetApp ▸ Virtual Storage Console ▸ etc ▸ vsc ▸ web
Favorites
Desktop
Downloads
Recent places
This PC
Network

Name	Date modified	Type	Size
linux_gos_timeout_190-install	2/21/2017 2:49 AM	Disc Image File	378 KB
linux_gos_timeout-install	2/21/2017 2:49 AM	Disc Image File	382 KB
NetAppNasPlugin.vib	2/26/2017 11:33 PM	VIB File	361 KB
solaris_gos_timeout_190-install	2/21/2017 2:49 AM	Disc Image File	368 KB
solaris_gos_timeout-install	2/21/2017 2:49 AM	Disc Image File	368 KB
windows_gos_timeout	2/21/2017 2:49 AM	Disc Image File	54 KB
windows_gos_timeout_190	2/21/2017 2:49 AM	Disc Image File	54 KB

Discover and Add Storage Resources

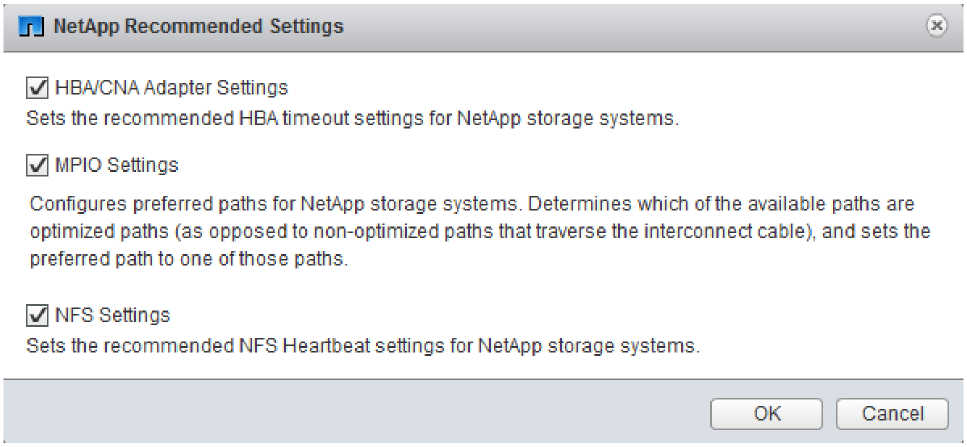
To discover storage resources for the monitoring and host configuration capability and the provisioning and cloning capability, complete the following steps:

1. Using the vSphere web client, log in to the vCenter Server as the FlexPod admin user. If the vSphere web client was previously opened, close it and then reopen it.
2. On the home page, click the Home tab and click Virtual Storage Console.
3. Select Storage Systems. From the Objects tab, click Actions > Modify.
4. In the IP Address/Hostname field, enter the storage cluster management IP address. Enter admin for the user name and the admin password for password. Confirm Use TLS to Connect to This Storage System is selected. Click OK.
5. Click OK to accept the controller privileges.
6. Wait for the Storage Systems to update. You might need to click Refresh to complete this update.

Optimal Storage Settings for ESXi Hosts

VSC allows for the automated configuration of storage-related settings for all ESXi hosts that are connected to NetApp storage controllers. To use these settings, complete the following steps:

1. On the home page, click vCenter > Hosts and Clusters. For each ESXi host, right-click and select NetApp VSC > Set Recommended Values for these hosts.



NetApp Recommended Settings

☑ HBA/CNA Adapter Settings

Sets the recommended HBA timeout settings for NetApp storage systems.

☑ MPIO Settings

Configures preferred paths for NetApp storage systems. Determines which of the available paths are optimized paths (as opposed to non-optimized paths that traverse the interconnect cable), and sets the preferred path to one of those paths.

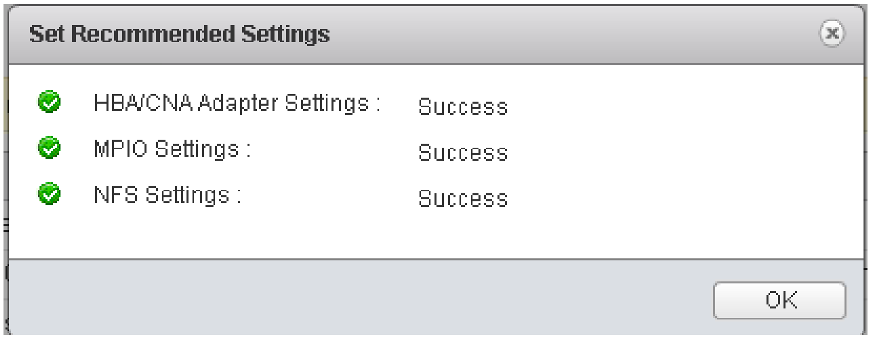
☑ NFS Settings

Sets the recommended NFS Heartbeat settings for NetApp storage systems.

2. Check the settings that are to be applied to the selected vSphere hosts. Click OK to apply the settings.

Note: This functionality sets values for HBAs and converged network adapters (CNAs), sets appropriate paths and path-selection plug-ins, and verifies appropriate settings for software-based I/O (NFS and iSCSI).

3. Click OK.



Set Recommended Settings

✓	HBA/CNA Adapter Settings :	Success
✓	MPIO Settings :	Success
✓	NFS Settings :	Success

4. On the home page, in the vSphere Web Client, select Virtual Storage Console.
5. On the left pane, under Virtual Storage Console, select NFS VAAI Tools.
6. Make sure that NFS Plug-in for VMware VAII Version 1.1.2-3 is shown.
7. Click Install on Host.
8. Select all the ESXi hosts and click Install.
9. For each host for which settings were adjusted in the previous step, place the host in maintenance mode, reboot the host, and exit maintenance mode.

5.7 Service Accounts Creation

This section describes the service accounts that are required to install SQL Server, SharePoint 2016, and Exchange 2016.

Provision the user accounts and user groups listed in Table 13 and Table 14.

Table 13) Service user accounts.

Component	User Account	Suggested Name	Description
SQL, SharePoint	Component installation account	SPInstall	This optional account is used to install all SharePoint and SQL Server components.
SQL Server	SQL Server instance service account	SPSQLSvc	This account is used as the service account for all instances of SQL Server.
SharePoint	SharePoint farm account	SPFarm	This account is used to access the SQL database and run all core farm services.
SQL, DocAve, Exchange	SnapDrive service account	SDWSvc	This account is used to run the SnapDrive service.
DocAve	DocAve	DocAveSvc	This account is used to run the DocAve IIS application pool.
Exchange	SnapManager for Exchange	SMESvc	This account is used to run the SnapManager for Exchange service.

Note: The DocAveSvc account should be a part of the local administrator group on the DocAve Manager VM.

Note: Make sure that the DocAveSvc account is part of the farm administrators group in SharePoint Central Administration: navigate to Central Administration site > Security > Manage the Farms Administrators Group > Add user.

Table 14) Service user groups.

Component	Group	Members	Description
SQL	SQL-Admins	SPInstall, SPFarm, SDWSvc	Group used to grant administrative access to the SQL instance installation.

5.8 SQL Server 2016 Installation and Configuration

To install and configure SQL Server 2016 to host the SharePoint 2016 databases, complete the procedures outlined in this section.

Create VMs

Create two primary VMs and up to eight (optional) secondary SQL replicas. Table 15 lists the VM configuration parameters for the SQL Server 2016 installation.

Table 15) SQL Server 2016: VM configuration parameters.

Role	Number of VMs	RAM (GB)	CPU	HDD (GB)	Network
SQL	2	20GB	4	80GB	Mgmt, iSCSIA, iSCSIB

To prepare the VMs for SQL Server installation, complete the following steps:

1. Provision Windows Server 2016: each instance should have at least 20GB of RAM, four vCPUs, 80GB HDD and virtual network interfaces in the MGMT network, and iSCSIA and iSCSIB port groups. The virtual network interfaces should be VMXNET 3 adapters.
2. Install VMware Tools, assign the IP address and gateway in the MGMT subnet, and join the machine to the AD domain.
3. Launch a PowerShell prompt by right-clicking the PowerShell icon in the taskbar and then selecting Run as Administrator.
4. Enable remote management and remote desktop using the SCONFIG application.

```
SCONFIG
```

5. Select Configure Remote Management.
6. Select Enable Remote Management.
7. Select Return to the main menu.
8. Select Remote Desktop.
9. Enter `E` to Enable.
10. Enter `2` to allow any version of remote desktop. You are then returned to the main menu.
11. Select Exit to Command Line.
12. Add the Windows failover clustering and multipath I/O features by running the following command:

```
Add-WindowsFeature NET-Framework-Core, Failover-Clustering, Multipath-IO, RSAT-Clustering-AutomationServer -IncludeManagementTools -Restart -Source D:\Sources\Sxs
```

Note: SnapDrive for Windows requires .Net 3.5, and SnapManager for SharePoint requires the RSAT-Clustering-Automation feature.

13. Configure local administrator access.

```
# SQL service account
Add-LocalGroupMember -Group Administrators -Member Colts\SPSQLSvc
# SnapDrive service account
Add-LocalGroupMember -Group Administrators -Member Colts\SDWSVC
#Dedicated installation account
Add-LocalGroupMember -Group Administrators -Member Colts\SPInstall
```

Note: For future serviceability, NetApp recommends that you use a dedicated installation account that can be disabled after the software is deployed. This account can then be reenabled at any point in the future if access is denied.

14. Repeat steps 1 through 13 for each SQL VM.
15. Install the Windows updates on the VM.

Configure iSCSI

To configure iSCSI connections from the SQL VMs to the NetApp storage controllers, run the following PowerShell commands from each host:

1. Start the iSCSI service.

```
Set-Service -Name MSiSCSI -StartupType Automatic
Start-Service -Name MSiSCSI
```

2. Configure iSCSI target portals for each path to the workload SVM.

```
New-IscsiTargetPortal -InitiatorPortalAddress <<SQL_VM_iSCSIA_IP>> -TargetPortalAddress
<<Work_SVM_iSCSI01a_IP>>
New-IscsiTargetPortal -InitiatorPortalAddress <<SQL_VM_iSCSIA_IP>> -TargetPortalAddress
<<Work_SVM_iSCSI02a_IP>>
New-IscsiTargetPortal -InitiatorPortalAddress <<SQL_VM_iSCSIB_IP>> -TargetPortalAddress
<<Work_SVM_iSCSI01b_IP>>
New-IscsiTargetPortal -InitiatorPortalAddress <<SQL_VM_iSCSIB_IP>> -TargetPortalAddress
<<Work_SVM_iSCSI02b_IP>>
```

3. Connect to the target for workload SVM.

```
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<SQL_VM_iSCSIA_IP>> -TargetPortalAddress <<Work_SVM_iSCSI01a_IP>>
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<SQL_VM_iSCSIA_IP>> -TargetPortalAddress <<Work_SVM_iSCSI01b_IP>>
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<SQL_VM_iSCSIB_IP>> -TargetPortalAddress <<Work_SVM_iSCSI02a_IP>>
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<SQL_VM_iSCSIB_IP>> -TargetPortalAddress <<Work_SVM_iSCSI02b_IP>>
```

4. Verify the connections by running the following command:

```
Get-IscsiConnection
```

5. Configure MPIO for ONTAP.

```
New-MSDSMSupportedHW -VendorId NETAPP -ProductId "LUN C-Mode"
Update-MPIOClaimedHW -Confirm:$false
Restart-Computer
```

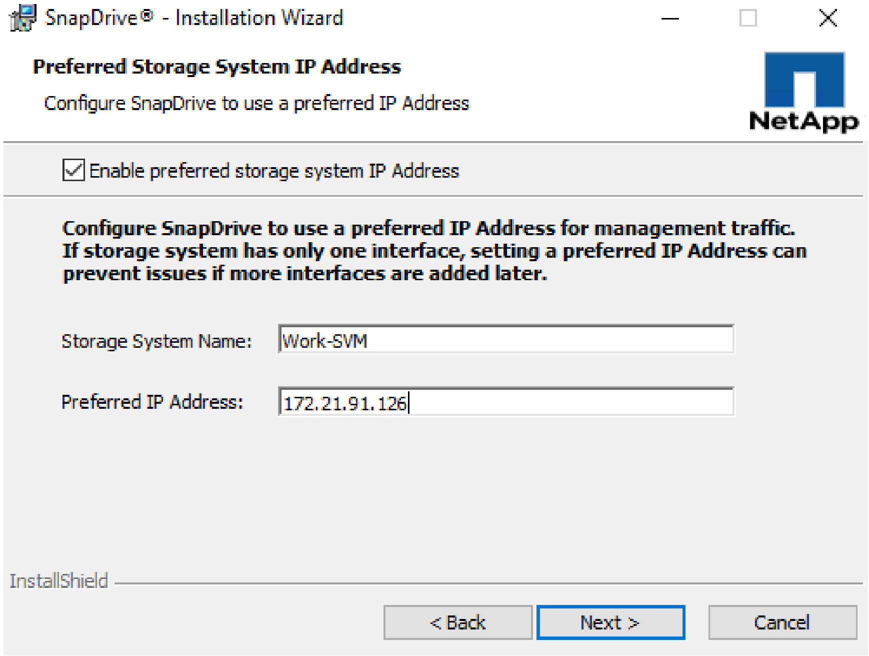
6. Repeat steps 1 through 5 for each SQL VM.

Install SnapDrive for Windows

To install SnapDrive for Windows, run `SnapDrive7.1.4_x64.exe` as administrator and complete the following steps using the installation wizard:

1. On the SnapDrive installation wizard home page, click Next.
2. Select the Per Storage System for the license type option and click Next.
3. On the Customer Information page, enter the customer information and click Next.
4. (Optional) Change the SnapDrive installation folder. On the Destination Folder page, click Next.
5. Select the Enable SnapDrive to Communicate Through the Windows Firewall option and click Next.
6. Enter an account that can be used as a service account for the SnapDrive services and click Next.

   Note: This account must be a member of the Built-In Administrators group.
7. Make sure that the SnapDrive web service ports are not conflicting. Click Next.
8. On the Preferred Storage System IP Address page, select the Enable Preferred Storage System IP Address option at the top of the page. Specify the name of the storage system to configure SnapDrive for management traffic. Click Next.



SnapDrive® - Installation Wizard

Preferred Storage System IP Address

Configure SnapDrive to use a preferred IP Address

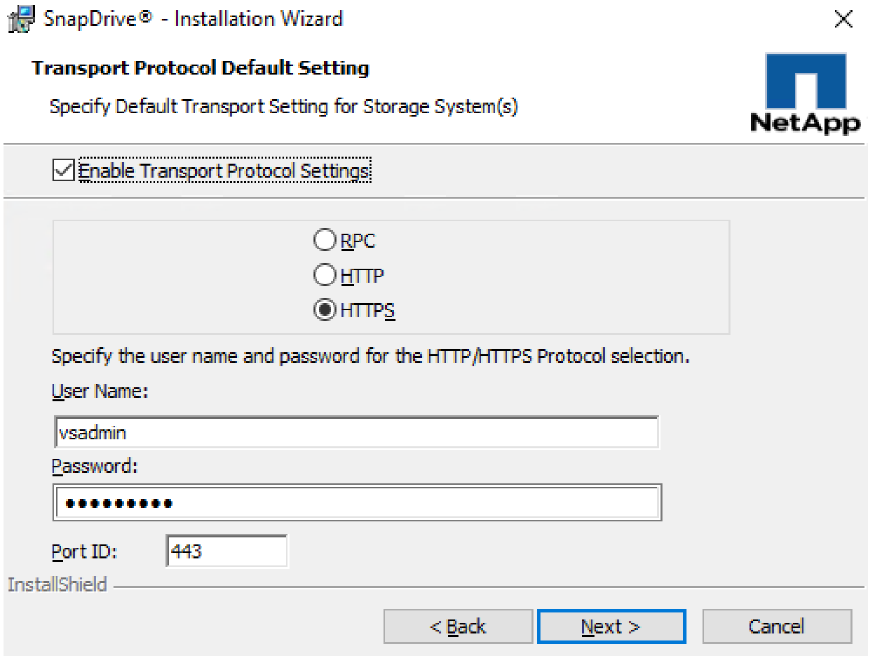
☑ Enable preferred storage system IP Address

Configure SnapDrive to use a preferred IP Address for management traffic. If storage system has only one interface, setting a preferred IP Address can prevent issues if more interfaces are added later.

Storage System Name: Work-SVM

Preferred IP Address: 172.21.91.126

9. On the Transport Protocol Default Setting page, select the Enable the Transport Protocol Settings option. Enabling the transport protocol allows you to talk to the storage system.
10. Select the HTTPS option. Selecting HTTPS require you to enter a user name, password, and port ID. Click Next.



SnapDrive® - Installation Wizard

Transport Protocol Default Setting

Specify Default Transport Setting for Storage System(s)

☑ Enable Transport Protocol Settings

○ RPC
○ HTTP
● HTTPS

Specify the user name and password for the HTTP/HTTPS Protocol selection.

User Name: vsadmin

Password: ●●●●●●●●●

Port ID: 443

11. On the Unified Manager Configuration page, click Next.
12. Click Install to begin the SnapDrive installation.
13. Repeat steps 1 through 11 for each SQL node.

Mount Storage

In the previous subsection, you configured the iSCSI connections and installed SnapDrive on each of the SQL VMs. In this section, you create and mount all of the external storage.

Table 16 lists the storage information for the SQL primary site.

Table 16) SQL primary site storage.

Server	Volume	Mount Point	LUN Size
SQL01	SQL1_Data	M:\	500GB
SQL01	SQL1_Log	L:\	1TB
SQL01	SQL1_SharePoint	N:\	4TB
SQL01	SQL1_Snapinfo	S:\	1TB
SQL02	SQL2_Data	M:\	500GB
SQL02	SQL2_Log	L:\	1TB
SQL02	SQL2_SharePoint	N:\	4TB
SQL02	SQL2_Snapinfo	S:\	1TB

Note: NetApp recommends using SnapDrive for Windows to create the LUNs to house the databases and logs for your SQL Server instances. There are two methods available to create the LUNs: either use the SDW GUI or use the SnapDrive CLI (SDCLI). The following examples use the SDCLI method.

1. Create SQL instance root LUN.

```
sdcli disk create -dtype dedicated -m SQL01 -D D:\ -p Work-
SVM.colts.local:/vol/SQL1_Data/Data.lun -I SQL01 iqn.1991-05.com.microsoft:sql01.colts.local -z
500G
```

2. Create SQL instance log LUN.

```
sdcli disk create -dtype dedicated -m SQL01 -D L:\ -p Work-SVM.colts.local:/vol/SQL1_Log/Log.lun
-I SQL01 iqn.1991-05.com.microsoft:sql01.colts.local -z 1T
```

3. Create SQL instance data LUN.

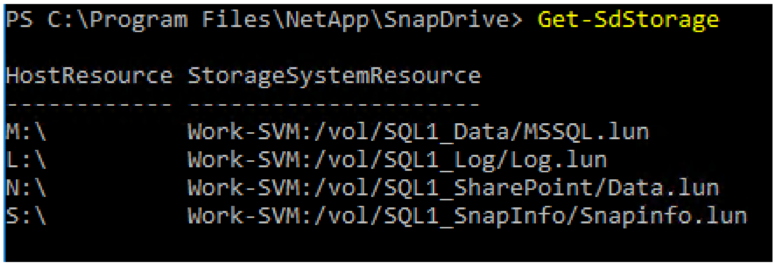
```
sdcli disk create -dtype dedicated -m SQL01 -D N:\ -p Work-
SVM.colts.local:/vol/SQL1_SharePoint/Data.lun -I SQL01 iqn.1991-
05.com.microsoft:sql01.colts.local -z 4T
```

4. Create SQL DocAve SnapInfo LUN.

```
sdcli disk create -dtype dedicated -m SQL01 -D D:\ -p Work-
SVM.colts.local:/vol/SQL1_Data/Data.lun -I SQL01 iqn.1991-05.com.microsoft:sql01.colts.local -z
1T
```

5. Confirm the LUNs have all been created and mounted to the appropriate path by running the following SnapDrive PowerShell command:

```
Get-SdStorage
```



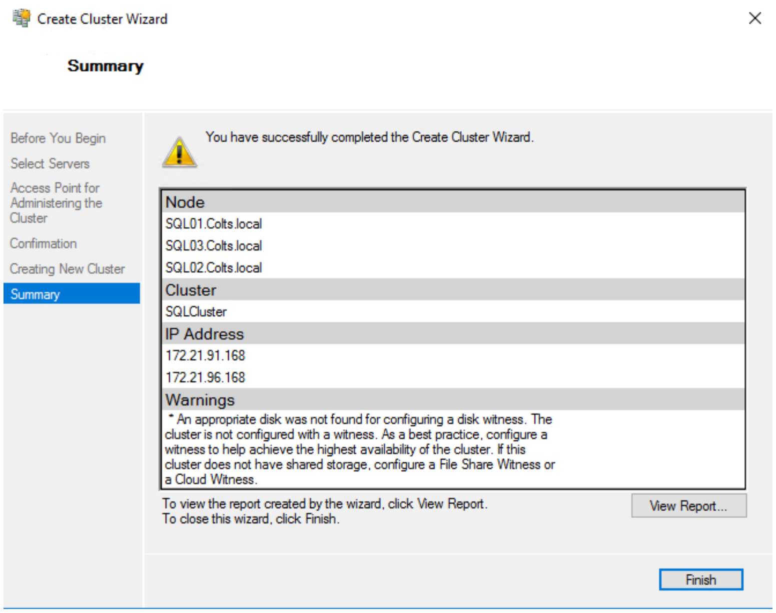
```
PS C:\Program Files\NetApp\SnapDrive> Get-SdStorage

HostResource StorageSystemResource
------------ ---------------------
M:\          Work-SVM:/vol/SQL1_Data/MSSQL.lun
L:\          Work-SVM:/vol/SQL1_Log/Log.lun
N:\          Work-SVM:/vol/SQL1_SharePoint/Data.lun
S:\          Work-SVM:/vol/SQL1_SnapInfo/Snapinfo.lun
```

6. Repeat steps 1 through 5 on any of the remaining SQL Server instances, substituting as needed. At a minimum, both of the primary site SQL Server instances must be prepared.

Create Windows Failover Cluster

To create a Windows failover cluster, complete the following steps:

1. On the Create Cluster wizard, click Next on the Before You Begin page.
2. On the Access Point for Administering the Cluster page, enter the cluster name, select the appropriate network, provide the cluster IP address, and click Next.
3. On the Confirmation page, verify the cluster details and click Next. Because storage is added later, you should clear the Add All Eligible Storage to the Cluster option. The Creating New Cluster page displays the progress of the cluster installation.
4. After the cluster is successfully created, the Summary page displays the summary of the cluster configuration details. The Summary page displays the warning that An Appropriate Disk was not Found for Configuring Disk Witness. This warning can be ignored because a file share witness is configured later.



You have successfully completed the Create Cluster Wizard.

Node
SQL01.Colts.local
SQL03.Colts.local
SQL02.Colts.local
Cluster
SQLCluster
IP Address
172.21.91.168
172.21.96.168
Warnings
* An appropriate disk was not found for configuring a disk witness. The cluster is not configured with a witness. As a best practice, configure a witness to help achieve the highest availability of the cluster. If this cluster does not have shared storage, configure a File Share Witness or a Cloud Witness.

To view the report created by the wizard, click View Report.
To close this wizard, click Finish.

5. Click Finish.
6. You can view the cluster configuration details by connecting to the newly created cluster from the Failover Cluster Manager window on the VMs.

Configure File Share Witness

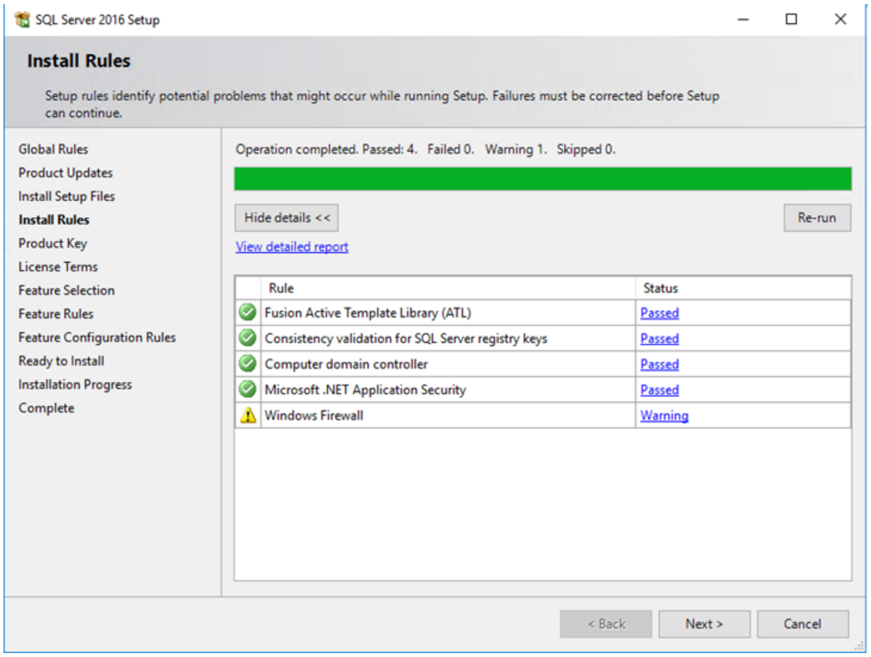
The Windows failover cluster is configured using the file share majority quorum model. The cluster is configured so that only production VMs participate in cluster voting. This approach makes sure that the failure of a DR VM does not affect the cluster status. To configure the file share witness, complete the following steps:

1. On the Failover Cluster Manager page, navigate to Failover Cluster Manager > <Cluster Name>.
2. Right-click the cluster and select More Actions > Configure Custom Quorum Settings. The Configure Cluster Quorum wizard opens.
3. Click Next on the Before You Begin page.
4. On the Select Quorum Configuration Option page, select the Select the Quorum Witness option and click Next.
5. On the Select Quorum Witness page, select the Configure a File Share Witness option and click OK.
6. On the Configure File Share Witness page, specify the file share that is used by the file share witness resource and click Next.
7. On the Confirmation page, verify the configuration details and click Next.
8. The Summary displays the summary of quorum settings that are configured for the cluster. Click Finish.
9. After the file witness is configured, validate the cluster by running all of the recommended tests.

Install SQL Server 2016

For this design, you create three standalone instances of SQL Server 2016: two standalone instances running on the primary stack and the third standalone instance running on the secondary stack. When you create the AlwaysOn Availability Groups in a later section, you set up synchronous replication between the two instances on the primary stack and asynchronous replication with the instance on the secondary stack. To install a standalone SQL Server instance, complete the following steps:

1. Log in to the VM and then browse to the SQL Server 2016 ISO.
2. Double click `setup.exe`.
3. In the left pane, click Installation and select New SQL Server Standalone Installation or Add Features to an Existing Installation.
4. In the Install Rules section, click Next.



SQL Server 2016 Setup

Install Rules

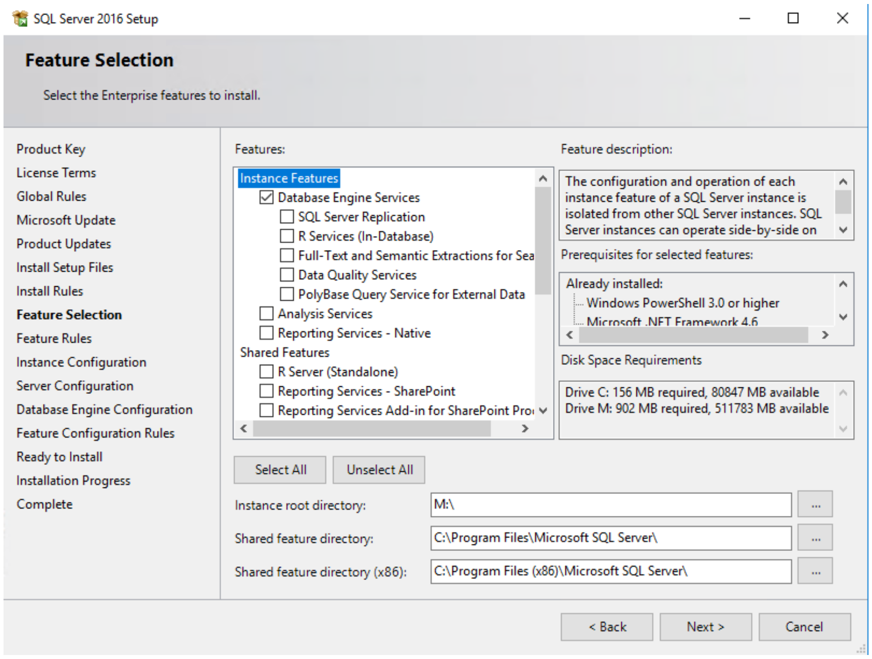
Setup rules identify potential problems that might occur while running Setup. Failures must be corrected before Setup can continue.

- Global Rules
- Product Updates
- Install Setup Files
- **Install Rules**
- Product Key
- License Terms
- Feature Selection
- Feature Rules
- Feature Configuration Rules
- Ready to Install
- Installation Progress
- Complete

Operation completed. Passed: 4. Failed 0. Warning 1. Skipped 0.

Rule	Status
✓ Fusion Active Template Library (ATL)	Passed
✓ Consistency validation for SQL Server registry keys	Passed
✓ Computer domain controller	Passed
✓ Microsoft .NET Application Security	Passed
⚠ Windows Firewall	Warning

5. Enter the product key and click Next.
6. Accept the license terms and click Next.
7. Select Database Engine Services and change the instance root to the data LUN provisioned early. Click Next.



SQL Server 2016 Setup

Feature Selection

Select the Enterprise features to install.

- Product Key
- License Terms
- Global Rules
- Microsoft Update
- Product Updates
- Install Setup Files
- Install Rules
- **Feature Selection**
- Feature Rules
- Instance Configuration
- Server Configuration
- Database Engine Configuration
- Feature Configuration Rules
- Ready to Install
- Installation Progress
- Complete

Features:

- Instance Features
  - ☑ Database Engine Services
    - ☐ SQL Server Replication
    - ☐ R Services (In-Database)
    - ☐ Full-Text and Semantic Extractions for Sea
    - ☐ Data Quality Services
    - ☐ PolyBase Query Service for External Data
  - ☐ Analysis Services
  - ☐ Reporting Services - Native
- Shared Features
  - ☐ R Server (Standalone)
  - ☐ Reporting Services - SharePoint
  - ☐ Reporting Services Add-in for SharePoint Pro

Feature description:

The configuration and operation of each instance feature of a SQL Server instance is isolated from other SQL Server instances. SQL Server instances can operate side-by-side on

Prerequisites for selected features:

Already installed:
- Windows PowerShell 3.0 or higher
- Microsoft .NET Framework 4.6

Disk Space Requirements

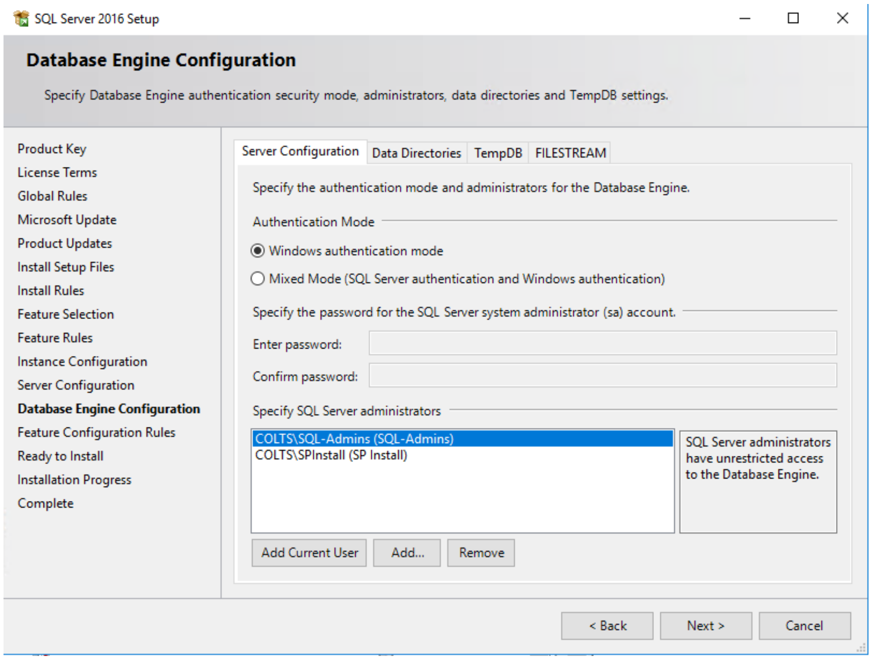
Drive C: 156 MB required, 80847 MB available
Drive M: 902 MB required, 511783 MB available

Instance root directory: M:\

Shared feature directory: C:\Program Files\Microsoft SQL Server\

Shared feature directory (x86): C:\Program Files (x86)\Microsoft SQL Server\

8. Select Default Instance and click Next.
9. On the Server Configuration page, specify the SPSQL service account details and collation configuration details and click Next.
10. On the Database Engine Configuration page, select the Windows authentication mode and add the SQL administrators group and the SPInstall service account in the SQL Server administrators section.



Database Engine Configuration

Specify Database Engine authentication security mode, administrators, data directories and TempDB settings.

Specify the authentication mode and administrators for the Database Engine.

Authentication Mode

● Windows authentication mode

○ Mixed Mode (SQL Server authentication and Windows authentication)

Specify the password for the SQL Server system administrator (sa) account.

Enter password:

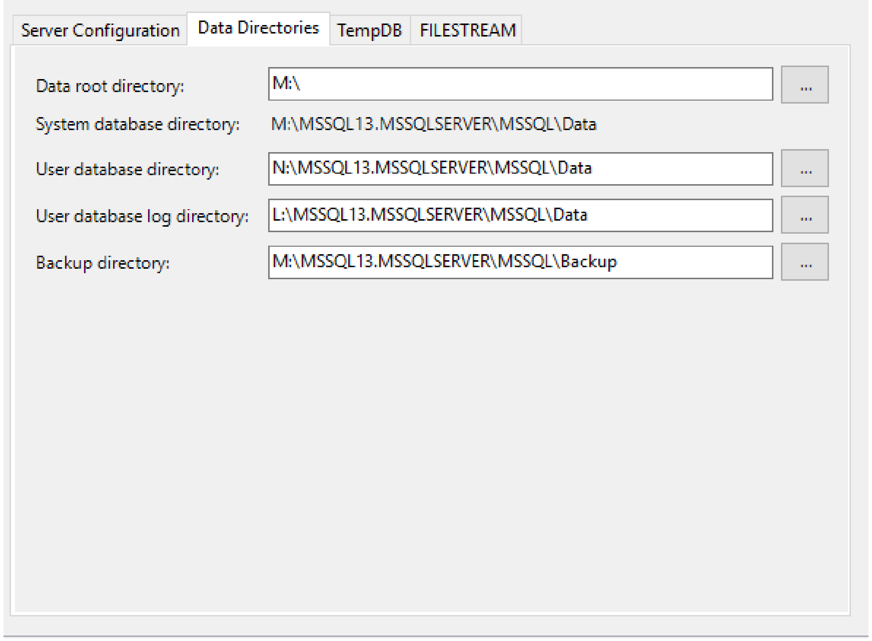
Confirm password:

Specify SQL Server administrators

COLTS\SQL-Admins (SQL-Admins)
COLTS\SPInstall (SP Install)

SQL Server administrators have unrestricted access to the Database Engine.

11. From the Data Directories tab, make sure that the root directory and the database and log directories are set appropriately to the LUNs created earlier.



Data root directory: M:\

System database directory: M:\MSSQL13.MSSQLSERVER\MSSQL\Data

User database directory: N:\MSSQL13.MSSQLSERVER\MSSQL\Data

User database log directory: L:\MSSQL13.MSSQLSERVER\MSSQL\Data

Backup directory: M:\MSSQL13.MSSQLSERVER\MSSQL\Backup

12. The Feature Configuration Rules feature runs automatically. Verify the output and click Next.

13. On the Ready to Install page, verify the installation options and click Install to begin the SQL Server installation.
14. After the installation is complete, verify the installation summary and click Close to close the wizard.
15. Repeat steps 1 through 14 on the remaining SQL Server instances.

Configure SQL Service Dependency

In order to support the data operations, DocAve must perform with the SQL AG; therefore, NetApp installed the SQL instance on a dedicated LUN. This step made sure that the instance-level files were not on the same LUN as the SharePoint data. Unfortunately, this introduces a race condition where the iSCSI LUNs must be mounted before the SQL service can start. To address this issue, the SQL service is made dependent on the iSCSI service.

1. To make the SQL service dependent on the iSCSI service, run the following command from an `admin cmd` prompt:

```
sc config MSSQLSERVER depend= MSiSCSI
```

Install SQL Management Studio

With SQL Server 2016, the management tools must be installed separately from the database engine. Open the SQL Server Installation Center by double-clicking `setup.exe` on the SQL Server 2016 ISO and then complete the following steps:

1. In the left pane, select Installation and then click Install SQL Server Management Tools.
2. From the Microsoft website, download and install the SQL Server Management Studio (SSMS) executable file.
3. After the installation is complete, click Close.

Configure Windows Firewall on SQL VMs

To allow traffic on ports 1433, 1434, and 5022 on the SQL Server VMs, log in to each of the SQL Server VMs and complete the following steps:

1. Open a PowerShell prompt and run the following commands to create the necessary Windows firewall rules:

```
$splat = @{Action='allow';Direction='Inbound'}
New-NetFirewallRule -DisplayName “SQL Default Instance" –Protocol TCP –LocalPort 1433 @splat
New-NetFirewallRule -DisplayName “SQL Admin Connection” –Protocol TCP –LocalPort 1434 @splat
New-NetFirewallRule -DisplayName “SQL AG EndPoint” –Protocol TCP –LocalPort 5022 @splat
New-NetFirewallRule -DisplayName “SQL Server Browser Service” –Protocol UDP `
     –LocalPort 1434 @splat
New-NetFirewallRule -DisplayName “SQL Server Browse Button Service” –Protocol UDP `
     –LocalPort 1433 @splat
New-NetFirewallRule -DisplayName “DocAve Agent” –Protocol TCP –LocalPort 14004 @splat
```

Note: Although DocAve is not yet installed, the firewall rule is staged to ease configuration.

Configure Maximum Degree of Parallelism

The maximum degree of parallelism is a feature that enables you to use all of the available CPUs for each of the queries. For SharePoint, set the max degree to one by completing the following steps on all SQL Server instances:

1. Open Microsoft SQL Server Management Studio and connect to the SQL DB instance by using the administrator account.
2. Right-click the instance and click Properties.
3. In the left pane, click Advanced.

4. In the right pane, find the section for Parallelism and change the Max Degree of Parallelism to 1. Click OK.
5. Configure Server Roles.

Make sure that the SPINSTALL user account you created has enough privileges to create databases in the SQL Server instance. To do this, complete the following steps on all of the SQL Server instances:

1. Connect to the database instance by using the SQL Server Management Studio.
2. In the left pane, expand the Security section, expand Logins, and then select the `<<Domain Name>>/SPINSTALL` user account.
3. Right-click the account, click Properties, and then select Server Roles in the left pane of the new dialog box.
4. Select the `dbcreator` and `securityadmin` roles and click OK.

Create AlwaysOn Availability Group

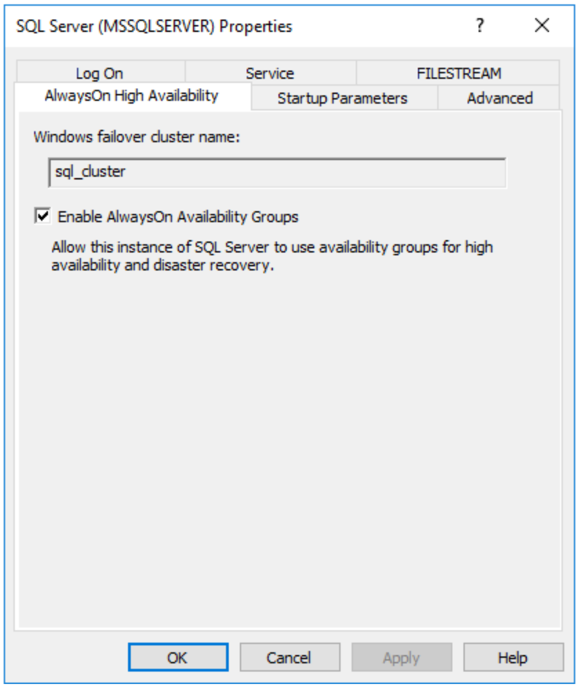
This section describes the procedure for creating an AlwaysOn Availability Group.

For more information about this procedure, see Getting Started with AlwaysOn Availability Group (SQL Server).

Enable AlwaysOn Availability Groups on Each SQL Server

To enable the AlwaysOn Availability Group on each SQL Server, complete the following steps:

1. Open the SQL Server Configuration Manager.
2. Double-click SQL Server (MSSQLSERVER) Service to open the Properties dialog box.
3. From the AlwaysOn Availability tab, select the Enable AlwaysOn Availability Groups option. Click OK.



Windows failover cluster name: sql_cluster

☑ Enable AlwaysOn Availability Groups

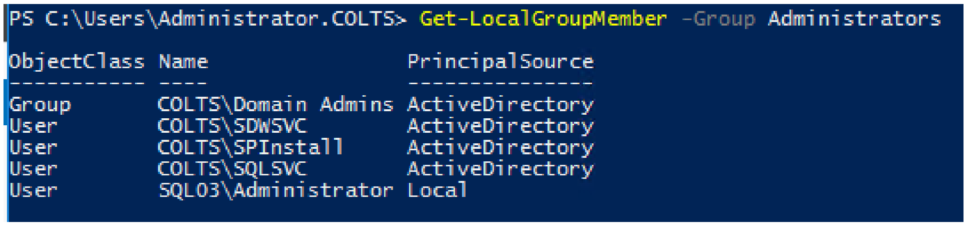
Allow this instance of SQL Server to use availability groups for high availability and disaster recovery.

4. Restart the service.

Prepare All Servers for AlwaysOn Availability Group

To prepare the servers for the AlwaysOn Availability Group, complete the following steps:

1. Add the computer account of the primary site server to the administrator’s group on each SQL Server.
2. Verify the installation account to the administrator's group on each SQL Server.



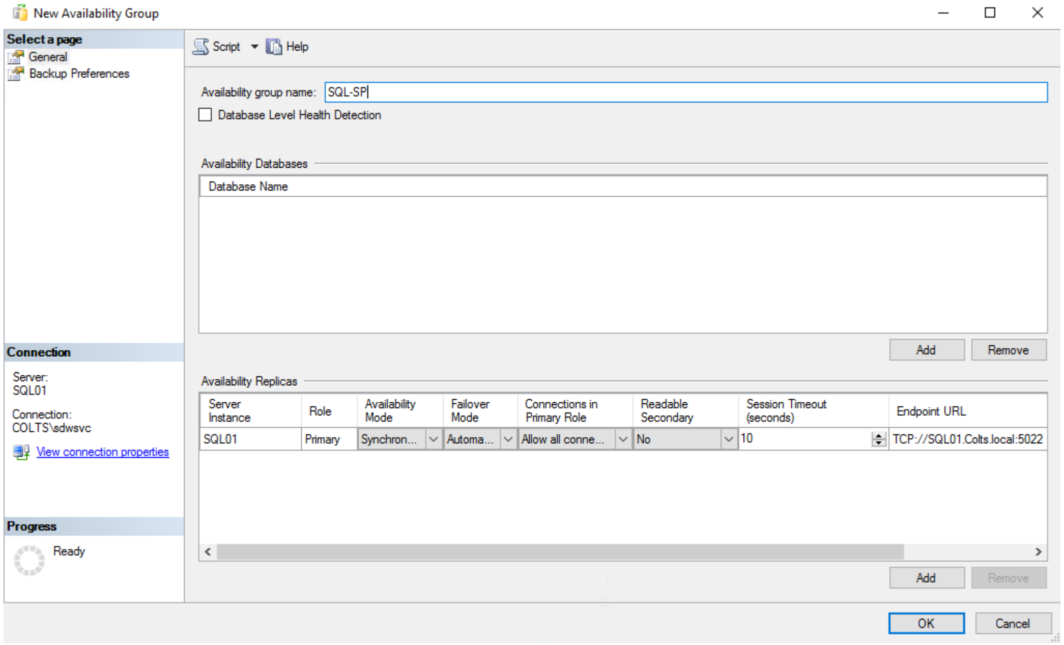
```
PS C:\Users\Administrator.COLTS> Get-LocalGroupMember -Group Administrators

ObjectClass Name                 PrincipalSource
----------- ----                 ---------------
Group       COLTS\Domain Admins ActiveDirectory
User        COLTS\SDWSVC         ActiveDirectory
User        COLTS\SPInstall      ActiveDirectory
User        COLTS\SQLSVC         ActiveDirectory
User        SQL03\Administrator Local
```

3. Verify the installation account to the sysadmin role on each SQL Server.

Create and Configure AlwaysOn Availability Group

This section describes how to create the AlwaysOn Availability Group with just one instance on the primary stack. After installing SharePoint, you add the remaining replicas and databases to the Availability Group. To create the Availability Group, complete the following steps:

1. Open SQL Management Studio.
2. Browse to AlwaysOn High Availability, right-click Availability Groups, and then select New Availability Group.
3. Enter the Availability Group name and click OK.



Availability group name: SQL-SP

☐ Database Level Health Detection

Availability Databases

Database Name

Availability Replicas

Server Instance	Role	Availability Mode	Failover Mode	Connections in Primary Role	Readable Secondary	Session Timeout (seconds)	Endpoint URL
SQL01	Primary	Synchron...	Automa...	Allow all conne...	No	10	TCP://SQL01.Colts.local:5022

Connection

Server:
SQL01

Connection:
COLTS\sdwsvc

Progress

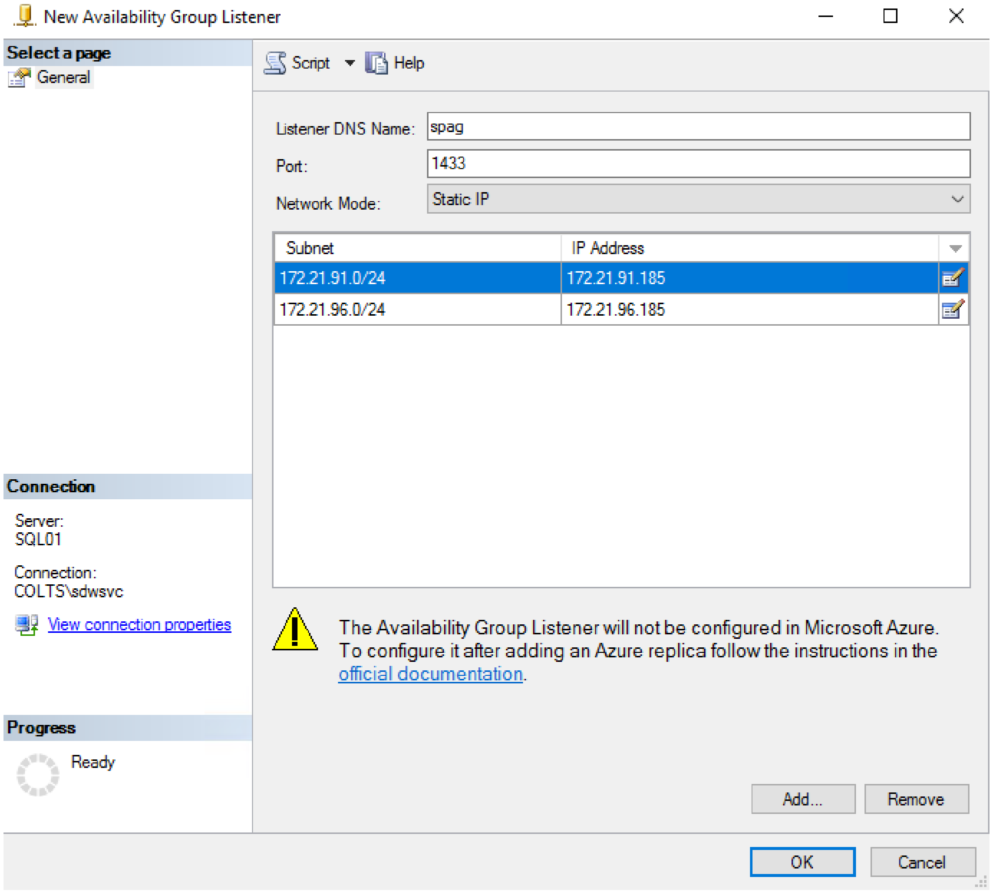
Ready

4. Validate the Availability Group in SQL Management Studio.

Add Availability Group Listener

After the AlwaysOn Availability Group is created, you must add an Availability Group Listener by completing the following steps:

1. Return to the SQL Server Management Studio.
2. Expand the Availability Group that you recently created. In the left pane, right-click the Availability Group Listeners.
3. Enter a value in the Listener DNS Name field.
4. Enter the port number that you want to use. In this example, the default port is 1433.
5. Select Static IP from the Network Mode drop-down menu and then click Add to assign an IP address.



Listener DNS Name: spag
Port: 1433
Network Mode: Static IP

Subnet	IP Address
172.21.91.0/24	172.21.91.185
172.21.96.0/24	172.21.96.185

Server:
SQL01

Connection:
COLTS\sdwsvc

View connection properties

Ready

The Availability Group Listener will not be configured in Microsoft Azure. To configure it after adding an Azure replica follow the instructions in the official documentation.

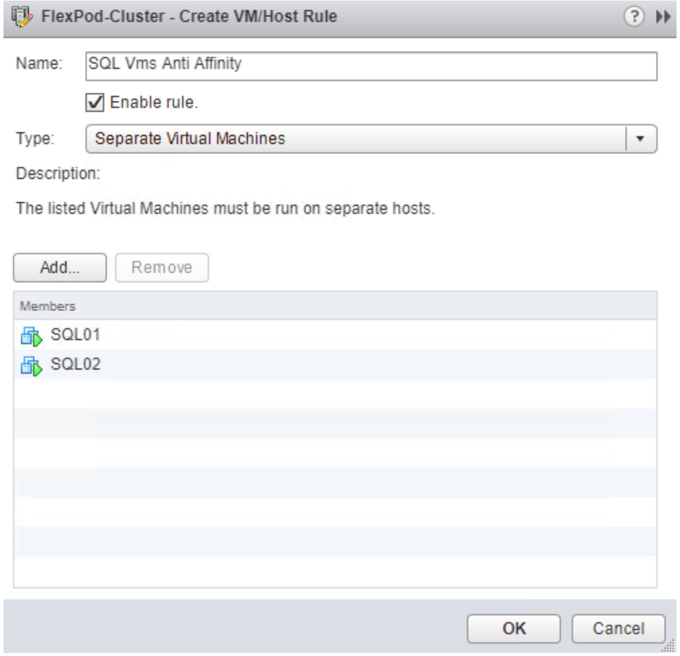
6. Add any additional subnets for the optional secondary sites.
7. After you enter the IP address, click OK.
8. Verify that the Availability Group Listener was created in the SQL Server Management Studio.

Configure Antiaffinity Rules for SQL VMs

To make sure that the entire SQL cluster does not go down when a single host in the vSphere environment fails, you need to configure antiaffinity rules. By using antiaffinity rules, vSphere DRS tries to keep the two SQL VMs apart, so that when a problem occurs with one host, you do not lose both SQL VMs. To configure these antiaffinity rules, complete the following steps:

1. Log in to the vCenter Server.
2. Go to Hosts and Clusters view and then select the cluster.
3. In the right pane, click Configure.
4. Select VM/Host Rules.
5. Click Add.

6. Specify a name for the rule and then select the Enable Rule option.
7. From the Type drop-down menu, select Separate Virtual Machines.
8. Click Add to add the two SQL VMs and click OK.



Name: SQL Vms Anti Affinity

☑ Enable rule.

Type: Separate Virtual Machines

Description:

The listed Virtual Machines must be run on separate hosts.

SQL01
SQL02

SnapManager for Microsoft SQL Server

DocAve Manager, which you install later in this guide, is used to back up the SharePoint farm. However, for DocAve Manager to be able to perform the backup and recovery operations, SnapManager for Microsoft SQL Server must be installed. This section describes the necessary steps to install and configure SnapManager.

Install SnapManager for Microsoft SQL Server

To install SnapManager for Microsoft SQL Server, complete the following steps:

1. Run `SMSQL7.2.2P2_x64.exe` as administrator to start the InstallShield wizard for SnapManager for Microsoft SQL Server.
2. Click Install to confirm the installation of the required C++ and SQL compatibility components and launch the installation wizard.
3. Click Next to install the SnapManager for SQL Server in the InstallShield wizard.
4. Enter user name and organization information. On the Customer Information page, select the license type and click Next.
5. (Optional) Change the SnapManager for SQL Installation folder. Click Next on the Destination Folder page.
6. Enter the user account information and make sure that the account has the SQL Server sysadmin role. Click Next.

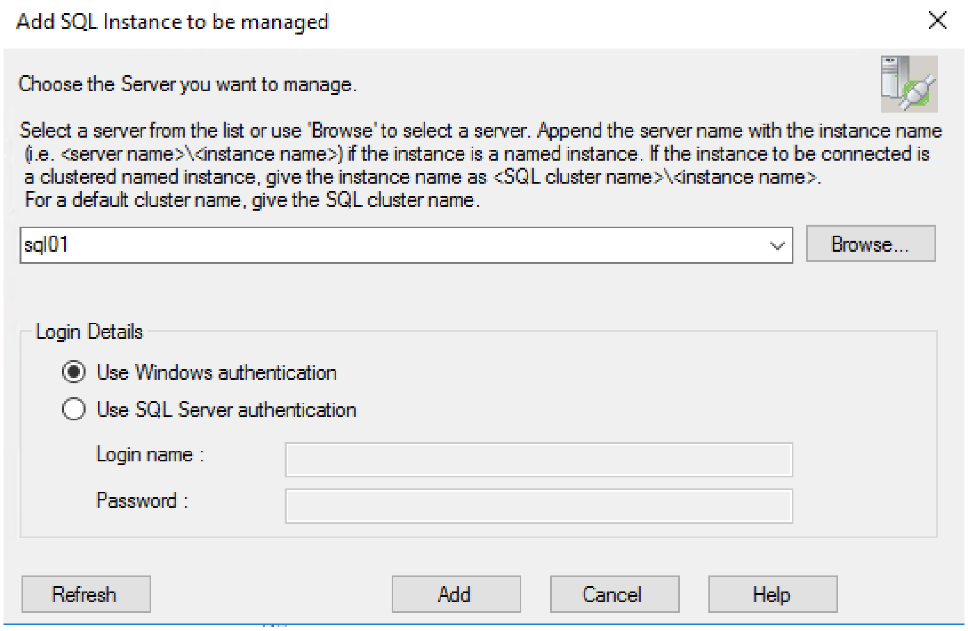
   Note: NetApp opted to reuse the SDW Service account, but larger organizations might select a dedicated account.

7. On the Ready to Install the Program page, click Install.
8. On the InstallShield Wizard Completed page, click Finish.
9. Repeat steps 1 through 8 for each node that is running a SQL Server instance.

Configure SnapManager for Microsoft SQL Server

To configure SnapManager for SQL Server, complete the following steps:

1. Open SnapManager for Microsoft SQL Server.
2. Enter the SQL Server instance to be managed and then click Browse to select an instance. In the Login Details area, select the Use Windows Authentication option and click Add.



Add SQL Instance to be managed

Choose the Server you want to manage.

Select a server from the list or use "Browse" to select a server. Append the server name with the instance name (i.e. <server name>\<instance name>) if the instance is a named instance. If the instance to be connected is a clustered named instance, give the instance name as <SQL cluster name>\<instance name>. For a default cluster name, give the SQL cluster name.

sql01

Login Details

● Use Windows authentication

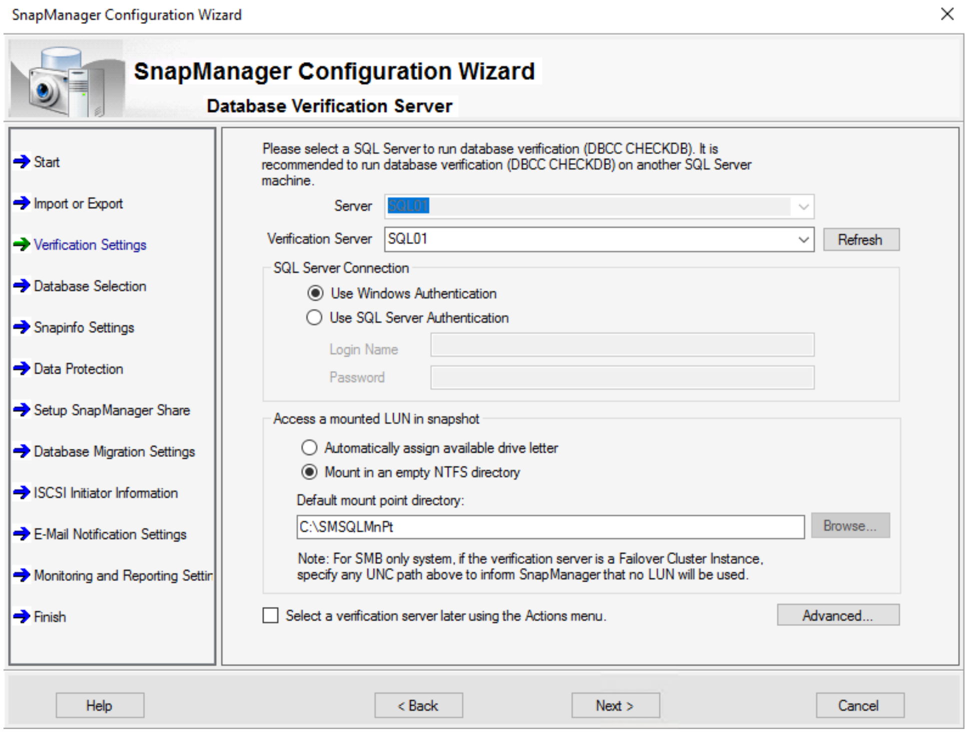
○ Use SQL Server authentication

Login name :

Password :

Note: Make sure that the SDWSVC domain account that you created is added to the SQL Server with the sysadmin role.

3. The wizard detects that the selected server instance is not configured with SnapManager, and a message displays prompting you to run the SnapManager Configuration wizard. Click OK.
4. Click Next to continue to the SnapManager configuration.
5. For database verification, select another SQL Server to run the database verification, select the Mount in an Empty NTFS Directory option, and then click Browse to specify the mount point directory. Click Next.



SnapManager Configuration Wizard

SnapManager Configuration Wizard

Database Verification Server

Please select a SQL Server to run database verification (DBCC CHECKDB). It is recommended to run database verification (DBCC CHECKDB) on another SQL Server machine.

Server: SQL01

Verification Server: SQL01

SQL Server Connection

● Use Windows Authentication

○ Use SQL Server Authentication

Login Name

Password

Access a mounted LUN in snapshot

○ Automatically assign available drive letter

● Mount in an empty NTFS directory

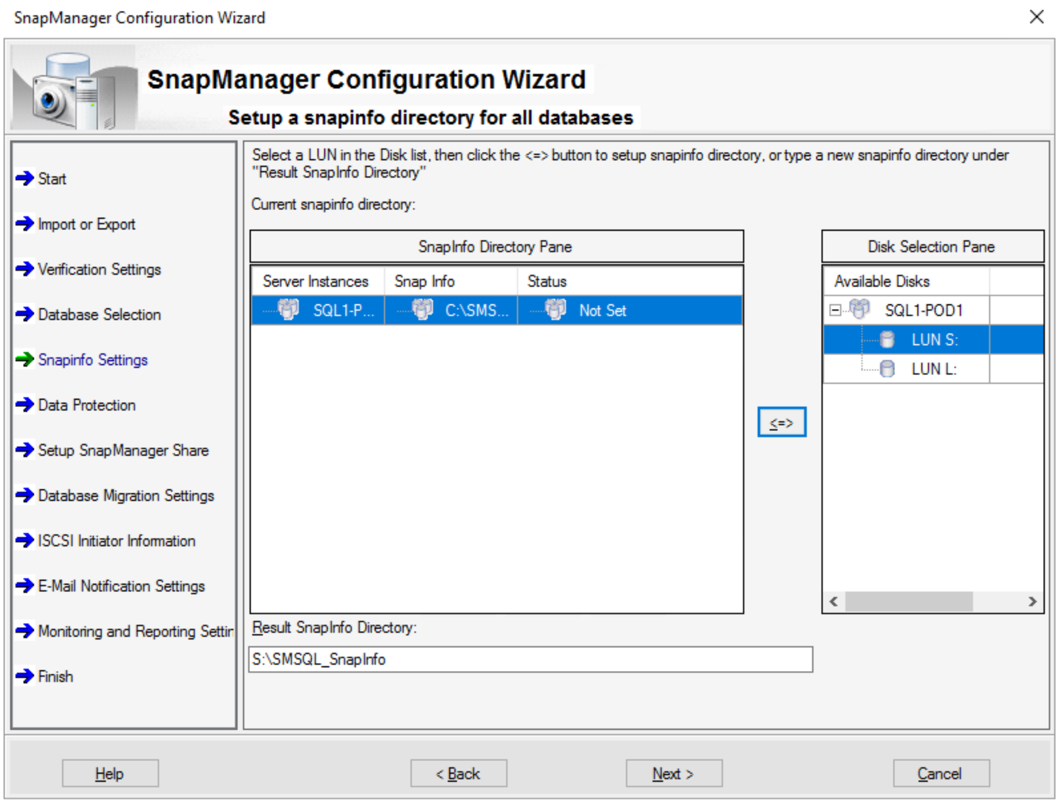
Default mount point directory: C:\SMSQLMnPt

Note: For SMB only system, if the verification server is a Failover Cluster Instance, specify any UNC path above to inform SnapManager that no LUN will be used.

□ Select a verification server later using the Actions menu.

Note: When the server instance selected for SnapManager configuration is heavily used, NetApp recommends using another server. Therefore, always run the verification on the standalone SQL instance and never on the production cluster. Configure accordingly.

6. It is not necessary to configure anything on the Database Selection pane. However, if needed, select the database from the Database Selection pane and move it to the Disk Selection pane. The database should be listed in the Database Location Results pane. Click Next.
7. Select the Single SnapInfo Directory option for the SnapInfo directory type. Click Next.
8. Select and then click the SnapInfo LUN listed in the Disk Selection pane list in the Result SnapInfo Directory. Click Next.



SnapManager Configuration Wizard

Setup a snapinfo directory for all databases

Select a LUN in the Disk list, then click the <=> button to setup snapinfo directory, or type a new snapinfo directory under "Result SnapInfo Directory"

Current snapinfo directory:

Server Instances	Snap Info	Status
SQL1-P...	C:\SMS...	Not Set

Available Disks
SQL1-POD1
LUN S:
LUN L:

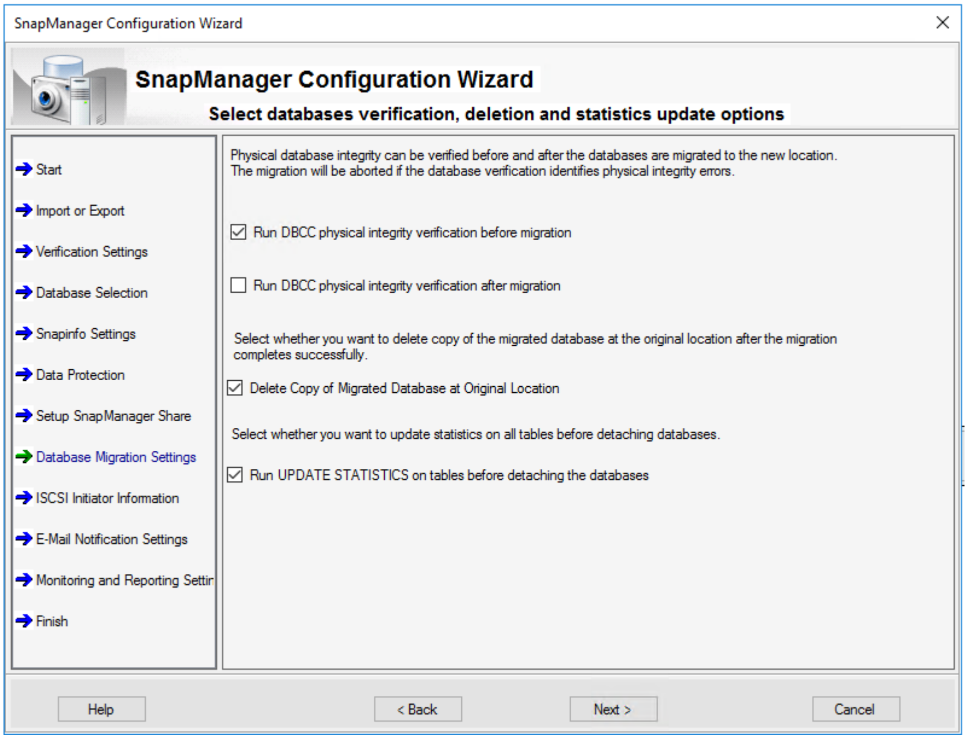
Result SnapInfo Directory:

S:\SMSQL_SnapInfo

9. Clear the Enable SnapManager Share option and then click Next.

   Note: You can use the Configuration wizard to set a network location as a centralized location for copies of transaction logs. At the time logs are backed up, the backups are copied to this share. However, in this solution, NetApp opted to clear the Enable SnapManager share to save on redundant log storage.

10. For the database migration to be effective, the physical database integrity must be verified. To verify the database integrity, select the options shown in the following figure and then click Next.


SnapManager Configuration Wizard
Start
Import or Export
Verification Settings
Database Selection
Snapinfo Settings
Data Protection
Setup SnapManager Share
Database Migration Settings
ISCSI Initiator Information
E-Mail Notification Settings
Monitoring and Reporting Settir
Finish
Help
< Back
Next >
Cancel

SnapManager Configuration Wizard

Select databases verification, deletion and statistics update options

Physical database integrity can be verified before and after the databases are migrated to the new location. The migration will be aborted if the database verification identifies physical integrity errors.

☑ Run DBCC physical integrity verification before migration

□ Run DBCC physical integrity verification after migration

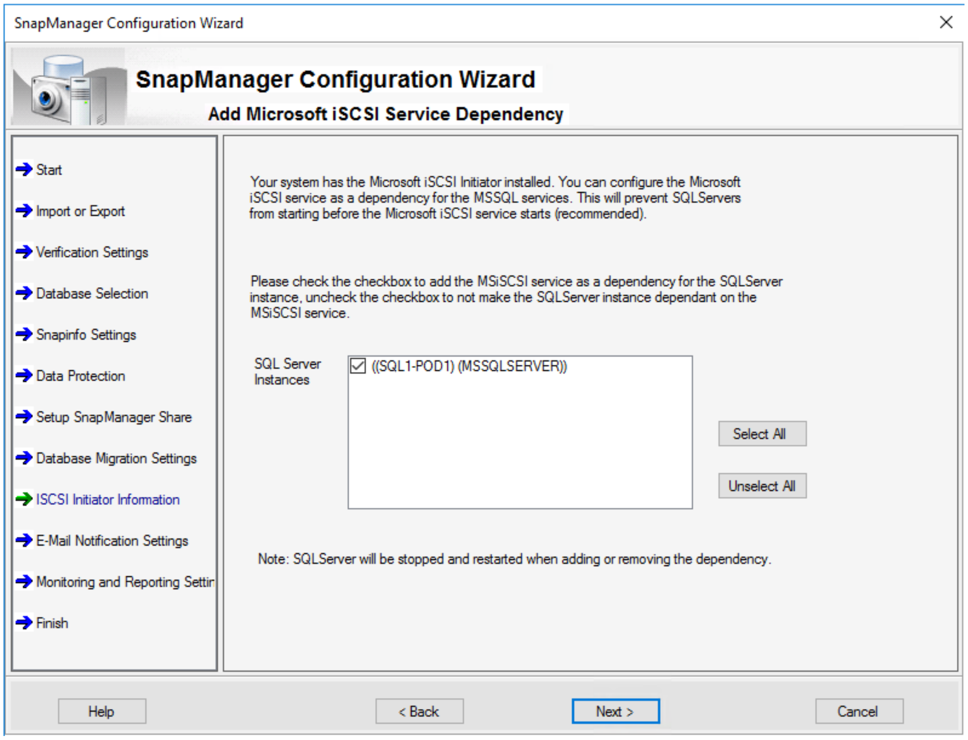
Select whether you want to delete copy of the migrated database at the original location after the migration completes successfully.

☑ Delete Copy of Migrated Database at Original Location

Select whether you want to update statistics on all tables before detaching databases.

☑ Run UPDATE STATISTICS on tables before detaching the databases

11. On the Add Microsoft iSCSI Service Dependency page, select the iSCSI service as a dependency for the SQL Server instance. In a server cluster that uses only iSCSI service for the shared storage device, you must make the cluster instance dependent on the Microsoft iSCSI initiator service. This is to make sure that the Microsoft iSCSI initiator service starts before the cluster instance starts. Adding or removing service dependency restarts the SQL Server. Click Next.



SnapManager Configuration Wizard

Add Microsoft iSCSI Service Dependency

Your system has the Microsoft iSCSI Initiator installed. You can configure the Microsoft iSCSI service as a dependency for the MSSQL services. This will prevent SQLServers from starting before the Microsoft iSCSI service starts (recommended).

Please check the checkbox to add the MSiSCSI service as a dependency for the SQLServer instance, uncheck the checkbox to not make the SQLServer instance dependant on the MSiSCSI service.

SQL Server Instances: ☑ ((SQL1-POD1) (MSSQLSERVER))

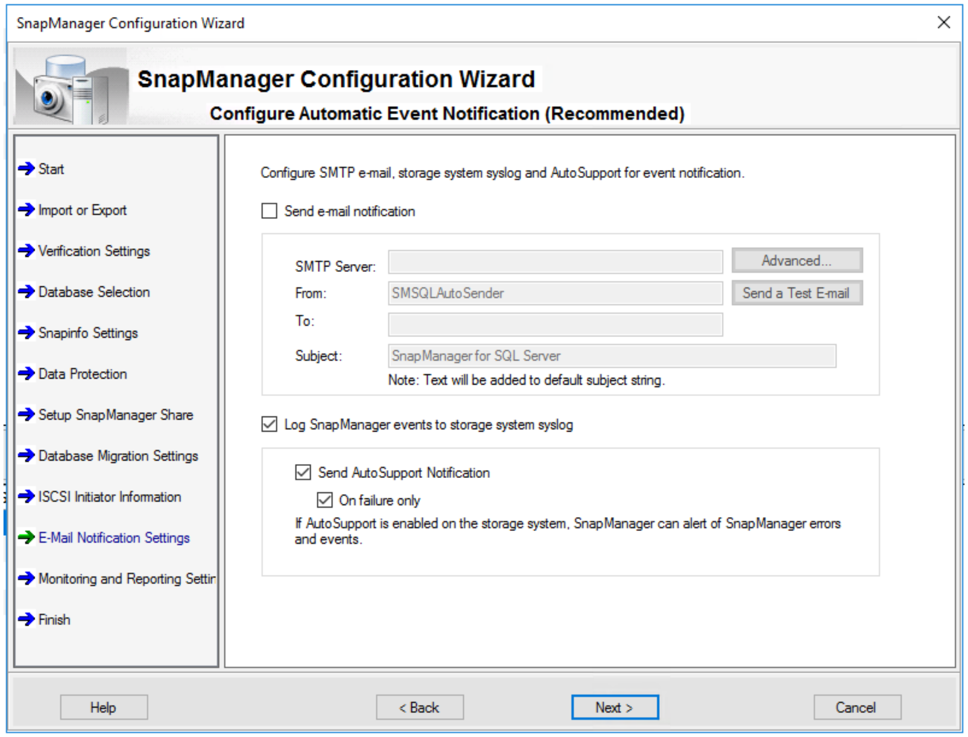
Note: SQLServer will be stopped and restarted when adding or removing the dependency.

12. On the Configure Automatic Event Notification page, to post SnapManager events to the storage system syslog, select the Log SnapManager Events to Storage System Syslog option.

    SnapManager is configured to log events to the storage system syslog; therefore, select the Send AutoSupport Notification option.

    To limit SnapManager event logging to failure events, select the On Failure Only option.

    Click Next.



SnapManager Configuration Wizard

SnapManager Configuration Wizard

Configure Automatic Event Notification (Recommended)

Configure SMTP e-mail, storage system syslog and AutoSupport for event notification.

□ Send e-mail notification

SMTP Server:

From: SMSQLAutoSender

To:

Subject: SnapManager for SQL Server

Note: Text will be added to default subject string.

☑ Log SnapManager events to storage system syslog

☑ Send AutoSupport Notification

☑ On failure only

If AutoSupport is enabled on the storage system, SnapManager can alert of SnapManager errors and events.

13. To enable SnapManager to send automatic, scheduled e-mail notifications on the status of all backup, verification, and clone operations, configure the monitoring and reporting settings. Click Next.

    Note: In this example, these settings were not configured.

14. On the Configuration Status page, click the Configuration Task List. The configuration task lists the order in which the selected tasks are executed. Click Start Now.
15. When a message displays indicating the successful completion for configuring SQL Server with SnapManager, click OK.
16. After the SnapManager configuration is complete, verify the status of the tasks and click Close.
17. Repeat steps 1 through 16 on the remaining SQL Server instances.

5.9 Microsoft SharePoint 2016 Installation and Configuration

This section describes how to install and configure a SharePoint 2016 farm.

Create VMs

To install and configure SharePoint 2016 for 10,000 active users, deploy the VMs listed in this section on the vSphere environment. Table 17 lists the specific configuration parameters, such as amount of CPU, memory, and HDD space, required for each VM.

To deploy a highly scalable and reliable SharePoint farm, create multiple VMs for a particular SharePoint role. Table 17 lists the VM configuration parameters for the SharePoint 2016 installation. Table 17 also lists the number of VMs needed for each role.

Table 17) SharePoint 2016: VM configuration parameters.

Role	Number of VMs	RAM (GB)	CPU	HDD (GB)
Web front	6	16GB	4	80GB
Application	3	20GB	4	100GB
Distributed cache	1	16GB	4	80GB
Search	3	20GB	4	100GB

1. Create the VMs listed in Table 17 and attach a virtual network interface in the MGMT network port group. The virtual network interface should be a VMXNET 3 adapter. After you successfully create the VMs, install Windows Server 2016 on each of them.
2. Bring up the VMs, install VMware Tools, assign the IP address and gateway in the MGMT subnet, rename the host, and then join the machine to the AD domain.
3. Reboot each VM for it to successfully join the domain.
4. After the VM is back online, launch a PowerShell prompt by right-clicking the PowerShell icon in the taskbar and then select Run as Administrator.
5. Enable remote management and remote desktop by using the SCONFIG application.

```
SCONFIG
```

6. Select Configure Remote Management.
7. Select Enable Remote Management.
8. Select Return to the Main Menu.
9. Select Remote Desktop.
10. Enter `E` to enable.
11. Enter `2` to allow any version of remote desktop. You are returned to the main menu.
12. Select Exit to Command Line.
13. Install all Windows updates on the VM.

Configure iSCSI and Install SnapDrive

After you deploy the VMs required to run the SharePoint farm, configure iSCSI and install SnapDrive only on the three search VMs. This is a prerequisite step needed for the DocAve Manager installation and configuration. To configure iSCSI and install SnapDrive for Windows on the search VMs, complete the following steps on each search VM:

1. Add the multipath-IO features by running the following command:

```
Add-WindowsFeature NET-Framework-Core, Multipath-IO -IncludeManagementTools -Restart -Source
D:\Sources\Sxs
```

Note: SnapDrive for Windows requires .Net 3.5.

2. Configure local administrator access.

```
# SnapDrive service account
Add-LocalGroupMember -Group Administrators -Member Colts\SDWSVC
```

Note: For future serviceability, NetApp recommends that you use a dedicated installation account that can be disabled after the software is deployed. This account can then be reenabled at any point in the future if access is denied.

3. Install the Windows updates on the VM.

Configure iSCSI

To configure iSCSI connections from the DocAve VMs to the NetApp storage controllers, run the following PowerShell commands from each host:

1. Start the iSCSI service.

```
Set-Service -Name MSiSCSI -StartupType Automatic
Start-Service -Name MSiSCSI
```

2. Configure iSCSI target portals for each path to the workload SVM.

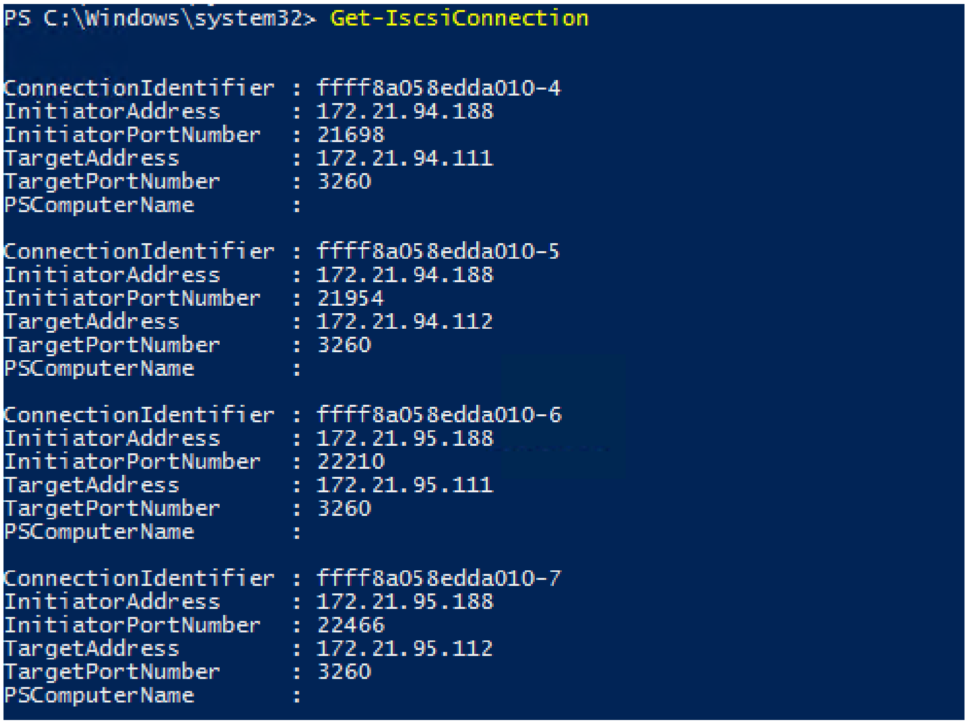
```
New-IscsiTargetPortal -InitiatorPortalAddress <<Search_VM_iSCSIA_IP>> -TargetPortalAddress
<<Work_SVM_iSCSI01a_IP>>
New-IscsiTargetPortal -InitiatorPortalAddress <<Search_VM_iSCSIA_IP>> -TargetPortalAddress
<<Work_SVM_iSCSI02a_IP>>
New-IscsiTargetPortal -InitiatorPortalAddress <<Search_VM_iSCSIB_IP>> -TargetPortalAddress
<<Work_SVM_iSCSI01b_IP>>
New-IscsiTargetPortal -InitiatorPortalAddress <<Search_VM_iSCSIB_IP>> -TargetPortalAddress
<<Work_SVM_iSCSI02b_IP>>
```

3. Connect to the target for workload SVM.

```
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<Search_VM_iSCSIA_IP>> -TargetPortalAddress <<Work_SVM_iSCSI01a_IP>>
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<Search_VM_iSCSIA_IP>> -TargetPortalAddress <<Work_SVM_iSCSI01b_IP>>
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<Search_VM_iSCSIB_IP>> -TargetPortalAddress <<Work_SVM_iSCSI02a_IP>>
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<Search_VM_iSCSIB_IP>> -TargetPortalAddress <<Work_SVM_iSCSI02b_IP>>
```

4. Verify the connections by running the following command:

```
Get-IscsiConnection
```



```
PS C:\Windows\system32> Get-IscsiConnection


ConnectionIdentifier : ffff8a058edda010-4
InitiatorAddress     : 172.21.94.188
InitiatorPortNumber  : 21698
TargetAddress        : 172.21.94.111
TargetPortNumber     : 3260
PSComputerName       :

ConnectionIdentifier : ffff8a058edda010-5
InitiatorAddress     : 172.21.94.188
InitiatorPortNumber  : 21954
TargetAddress        : 172.21.94.112
TargetPortNumber     : 3260
PSComputerName       :

ConnectionIdentifier : ffff8a058edda010-6
InitiatorAddress     : 172.21.95.188
InitiatorPortNumber  : 22210
TargetAddress        : 172.21.95.111
TargetPortNumber     : 3260
PSComputerName       :

ConnectionIdentifier : ffff8a058edda010-7
InitiatorAddress     : 172.21.95.188
InitiatorPortNumber  : 22466
TargetAddress        : 172.21.95.112
TargetPortNumber     : 3260
PSComputerName       :
```

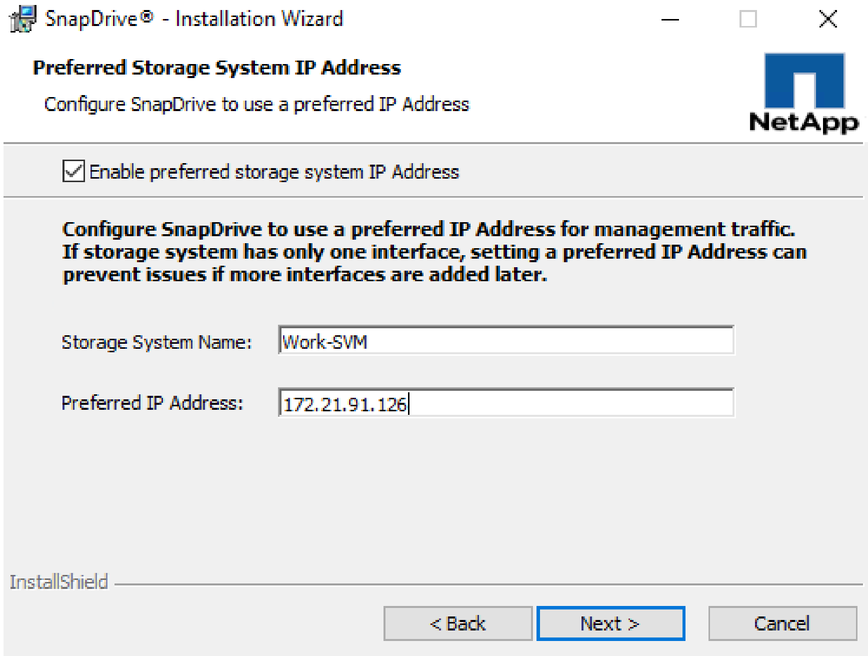
5. Configure MPIO for ONTAP.

```
New-MSDSMSupportedHW -VendorId NETAPP -ProductId "LUN C-Mode"
Update-MPIOClaimedHW -Confirm:$false
Restart-Computer
```

Install SnapDrive for Windows

To install SnapDrive for Windows, run `SnapDrive7.1.4_x64.exe` as administrator and follow the installation wizard:

1. On the SnapDrive installation wizard home page, click Next.
2. Select the Per Storage System option for the license type. Click Next.
3. On the SnapDrive Installation Wizard Customer Information page, enter the customer information and click Next.
4. (Optional) Change the SnapDrive Installation folder. On the Destination Folder page, click Next.
5. Select the Enable SnapDrive to Communicate Through the Windows Firewall option and click Next.
6. Enter an account that can be used as a service account for the SnapDrive services. This account must be a member of the built-in administrators group. Click Next.
7. Make sure that the SnapDrive web service ports are not conflicting. Click Next.
8. On the Preferred Storage System IP Address page, verify the Enable Preferred Storage System IP address and specify the storage system to configure SnapDrive for management traffic. Click Next.


SnapDrive® - Installation Wizard

Preferred Storage System IP Address

Configure SnapDrive to use a preferred IP Address

☑ Enable preferred storage system IP Address

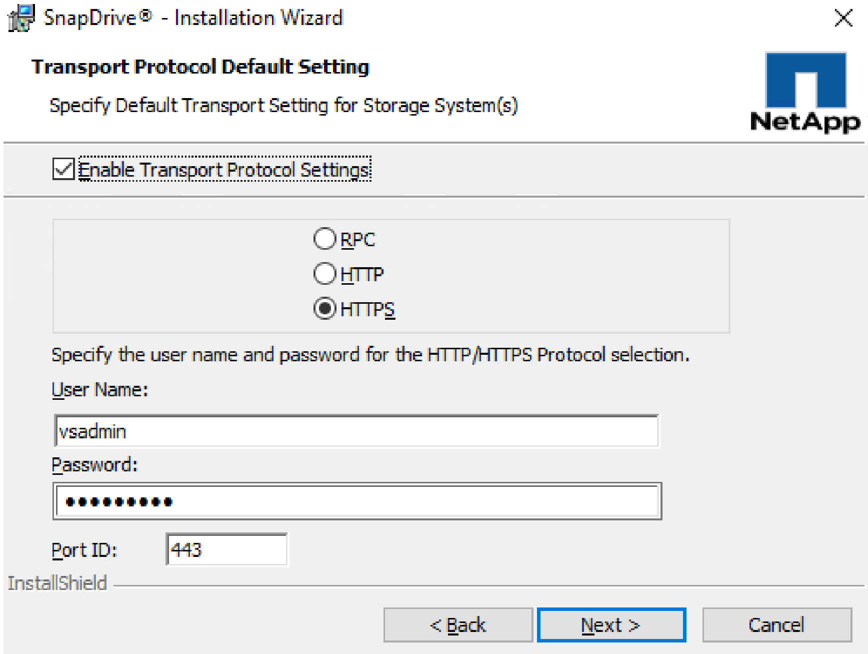
Configure SnapDrive to use a preferred IP Address for management traffic. If storage system has only one interface, setting a preferred IP Address can prevent issues if more interfaces are added later.

Storage System Name: Work-SVM

Preferred IP Address: 172.21.91.126

9. On the Transport Protocol Default Setting page, select the Enable the Transport Protocol Settings option. By enabling the transport protocol, you can talk to the storage system.

   Select the HTTPS option. This requires you to enter a user name, password, and port ID. Click Next.


SnapDrive® - Installation Wizard

Transport Protocol Default Setting

Specify Default Transport Setting for Storage System(s)

☑ Enable Transport Protocol Settings

○ RPC
○ HTTP
● HTTPS

Specify the user name and password for the HTTP/HTTPS Protocol selection.

User Name: vsadmin

Password: ●●●●●●●●●

Port ID: 443

10. On the Unified Manager Configuration page, click Next.
11. Click Install to begin the SnapDrive installation.

Create Index LUNs for Search Servers

To create index LUNs for the search servers, complete the following steps:

1. SSH into the cluster management interface for the storage system and then run the following commands to create a new volume for index LUNs:

```
volume create -vserver Work-SVM -volume Search_Index -aggregate n01_ssd01 -size 500GB -state
online -policy default -space-guarantee none -percent-snapshot-space 0

snapmirror update-ls-set -source-path Work-SVM:rootvol
```

2. NetApp recommends using SnapDrive for Windows to create the LUNs. There are two methods available to create the LUNs: either use the SDW GUI or use the SDCLI. The following examples are for using the SDCLI method.

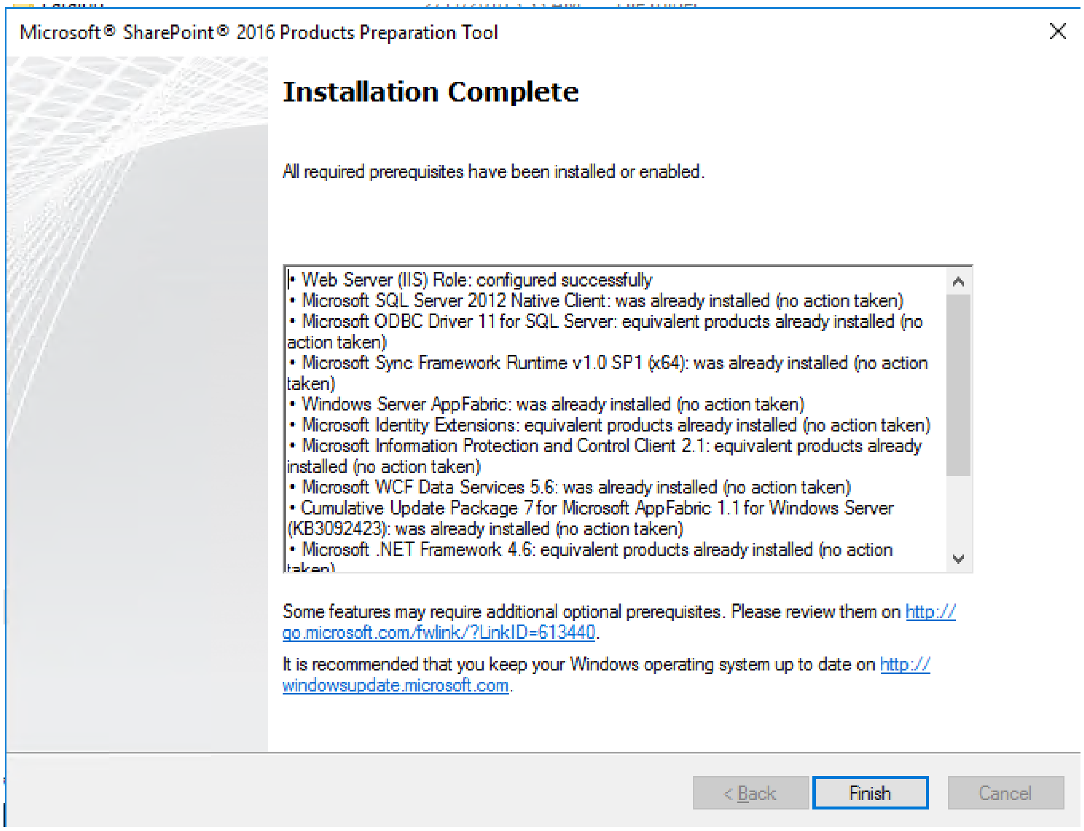
```
sdcli disk create -dtype dedicated -m SearchXX -D L:\ -p Work-SVM:/vol/Search_Index/IndexXX.lun -
I initiatorname -z 100GB
```

   a. Use the following environment variables for the SDCLI:
   – `-m`: machine name
   – `-D`: mount point location
   – `-p`: path to the volume where the LUN is created
   – `-I`: initiator name
   – `-z`: LUN size
   b. Change the variables to meet the requirements of your environment.
   c. After the `L:\` drive is mounted, create a new directory called Index in the `L:\` drive.

Install SharePoint 2016 Prerequisites

The VMs are ready to use. Before you install SharePoint 2016, you need to install the SharePoint prerequisites.

1. Establish a remote desktop session with each VM.
2. Add the SPINSTALL user to the local administrators group on all the SharePoint VMs.
3. Log in to the VMs by using the SPINSTALL user account.
4. Mount the SharePoint 2016 ISO to the VM and then browse to it.
5. Find the `prerequisiteinstaller.exe` and double-click it.
6. Click Next.
7. Review and accept the license agreement and click Next.
8. After a few minutes, you see a screen that asks you to restart your system to continue with the installation. Click Finish.
9. After the VM is back, mount the ISO again and start the prerequisite installer again.
10. Review and accept the license agreement and click Next.
11. When the installation is complete, click Finish.



Installation Complete

All required prerequisites have been installed or enabled.

- Web Server (IIS) Role: configured successfully
- Microsoft SQL Server 2012 Native Client: was already installed (no action taken)
- Microsoft ODBC Driver 11 for SQL Server: equivalent products already installed (no action taken)
- Microsoft Sync Framework Runtime v1.0 SP1 (x64): was already installed (no action taken)
- Windows Server AppFabric: was already installed (no action taken)
- Microsoft Identity Extensions: equivalent products already installed (no action taken)
- Microsoft Information Protection and Control Client 2.1: equivalent products already installed (no action taken)
- Microsoft WCF Data Services 5.6: was already installed (no action taken)
- Cumulative Update Package 7 for Microsoft AppFabric 1.1 for Windows Server (KB3092423): was already installed (no action taken)
- Microsoft .NET Framework 4.6: equivalent products already installed (no action taken)

Some features may require additional optional prerequisites. Please review them on http://go.microsoft.com/fwlink/?LinkID=613440.

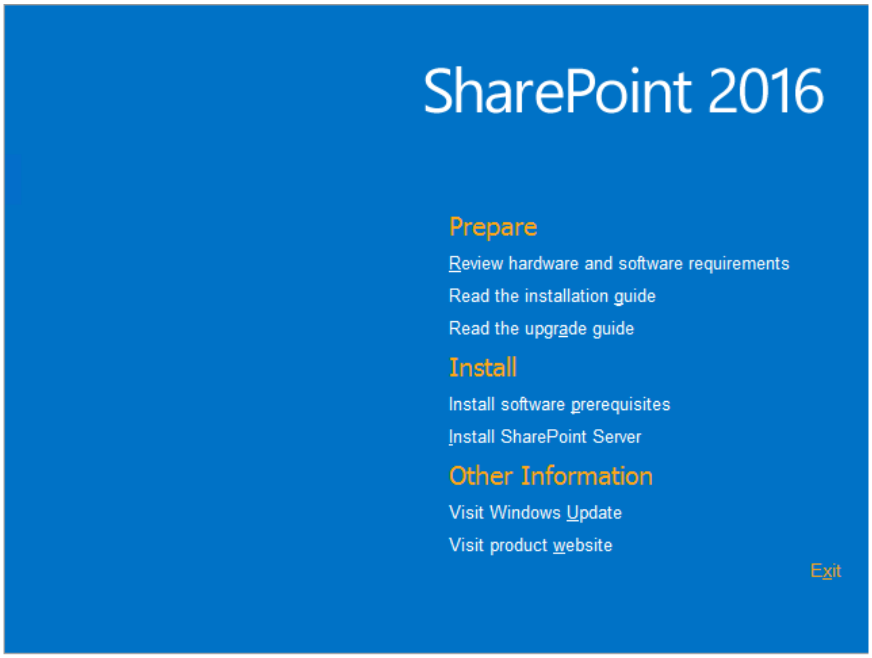
It is recommended that you keep your Windows operating system up to date on http://windowsupdate.microsoft.com.

12. Repeat steps 1 through 11 on all the SharePoint VMs.

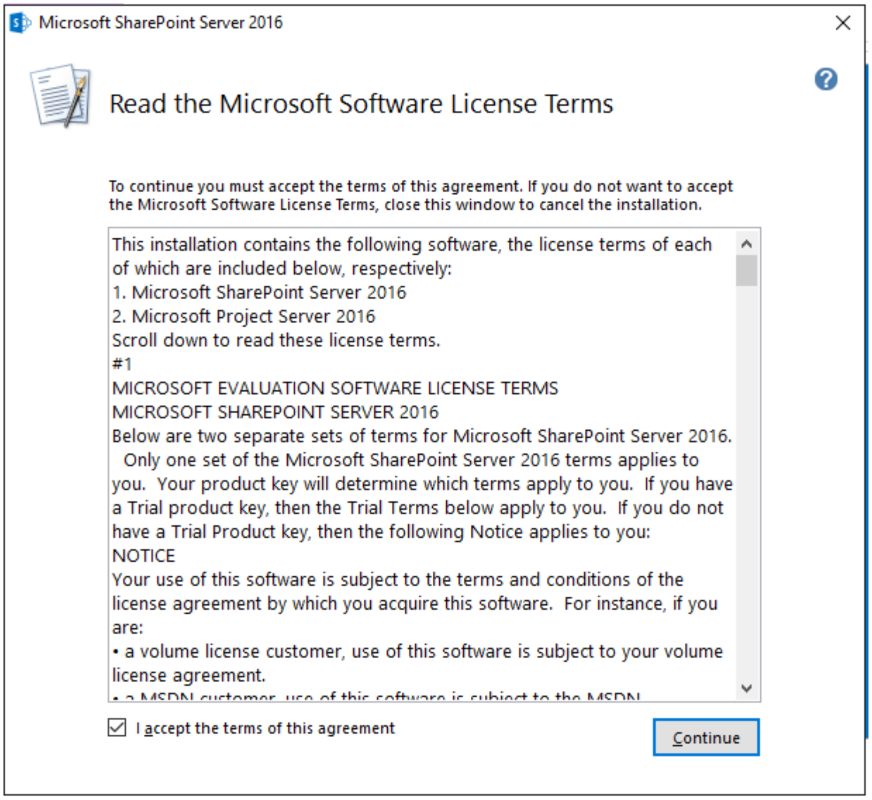
Install SharePoint 2016

Now that the prerequisites are installed, install SharePoint on all the VMs by completing the following steps:

1. Log in to the SharePoint VM by using the SPINSTALL user account.
2. Mount the SharePoint 2016 ISO to the VM and then browse to it.
3. Double-click the `splash.html` file.


SharePoint 2016
Prepare
Review hardware and software requirements
Read the installation guide
Read the upgrade guide
Install
Install software prerequisites
Install SharePoint Server
Other Information
Visit Windows Update
Visit product website
Exit

4. Click Install SharePoint Server.
5. Enter the product key and click Continue.
6. Review and accept the license agreement and click Continue.


Microsoft SharePoint Server 2016
Read the Microsoft Software License Terms

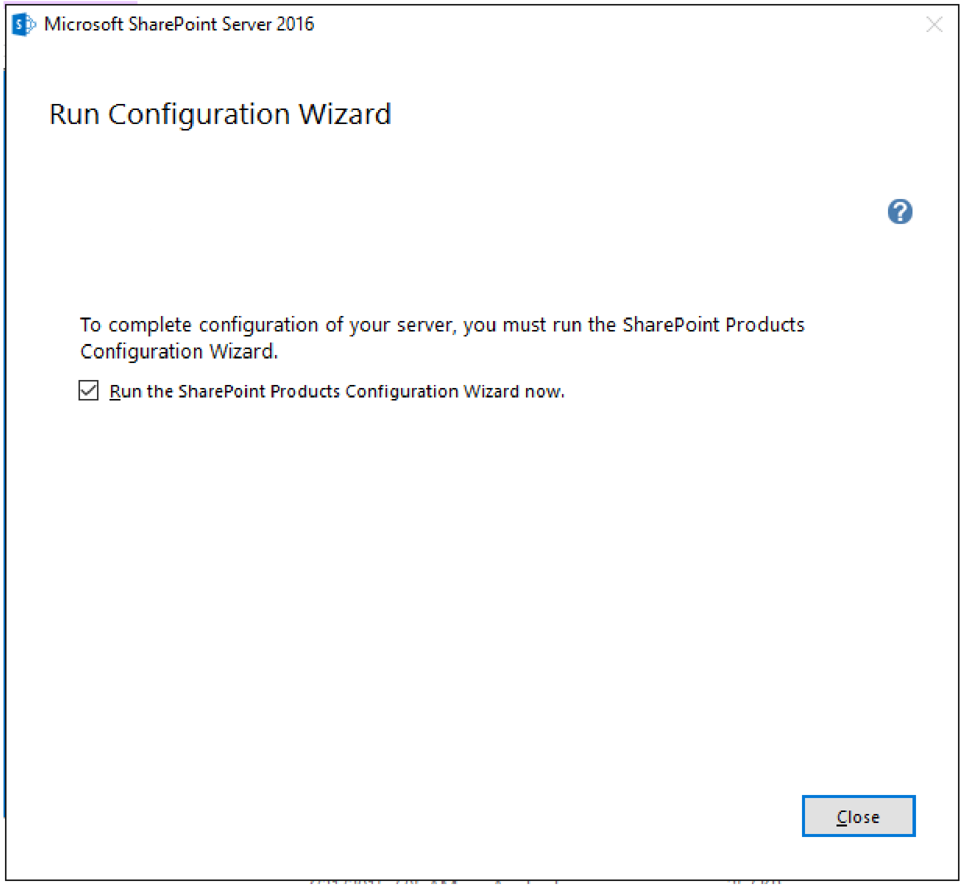
To continue you must accept the terms of this agreement. If you do not want to accept the Microsoft Software License Terms, close this window to cancel the installation.

This installation contains the following software, the license terms of each of which are included below, respectively:
1. Microsoft SharePoint Server 2016
2. Microsoft Project Server 2016
Scroll down to read these license terms.
#1
MICROSOFT EVALUATION SOFTWARE LICENSE TERMS
MICROSOFT SHAREPOINT SERVER 2016
Below are two separate sets of terms for Microsoft SharePoint Server 2016. Only one set of the Microsoft SharePoint Server 2016 terms applies to you. Your product key will determine which terms apply to you. If you have a Trial product key, then the Trial Terms below apply to you. If you do not have a Trial Product key, then the following Notice applies to you:
NOTICE
Your use of this software is subject to the terms and conditions of the license agreement by which you acquire this software. For instance, if you are:
• a volume license customer, use of this software is subject to your volume license agreement.
• a MSDN customer, use of this software is subject to the MSDN

☑ I accept the terms of this agreement

7. You can select a custom installation location; if not, click Install Now.

8. After the installation is complete, make sure that the Run the SharePoint Products Configuration Wizard Now option is selected. Do not click Close now.



Microsoft SharePoint Server 2016

Run Configuration Wizard

To complete configuration of your server, you must run the SharePoint Products Configuration Wizard.

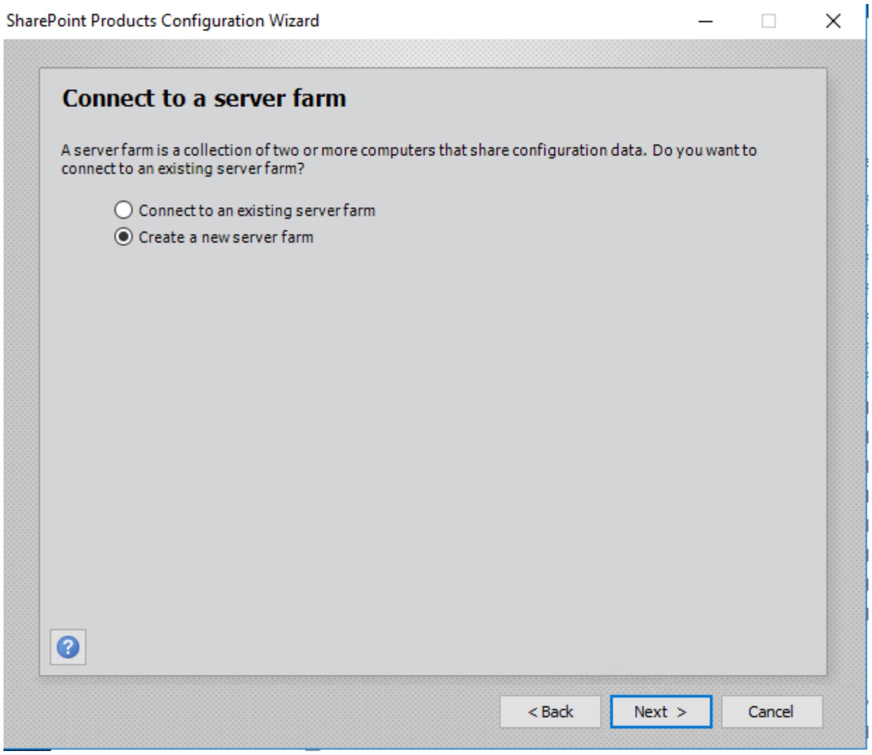
☑ Run the SharePoint Products Configuration Wizard now.

9. Log in to the other SharePoint VMs and repeat steps 1 through 8.
10. After SharePoint is installed on all of the VMs, go back to the first application server VM and click Close to launch the Products Configuration wizard.

Create SharePoint 2016 Farm

After you click Close on the Application Server VM, the SharePoint Products Configuration wizard starts. To configure the specific role on each VM, complete the following steps:

1. Click Next and then click Yes.
2. Select the Create a New Server Farm option. Click Next.


SharePoint Products Configuration Wizard

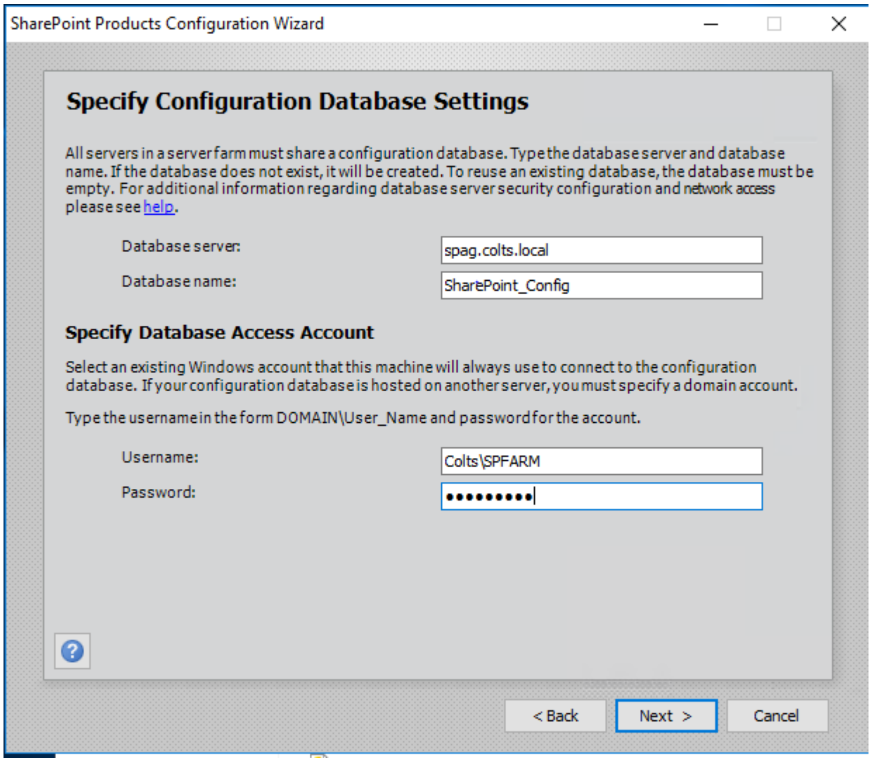
Connect to a server farm

A server farm is a collection of two or more computers that share configuration data. Do you want to connect to an existing server farm?

○ Connect to an existing server farm

● Create a new server farm

3. Enter the availability group listener information and the `<<Domain Name>>\SPFARM` credentials. Click Next.


SharePoint Products Configuration Wizard

Specify Configuration Database Settings

All servers in a server farm must share a configuration database. Type the database server and database name. If the database does not exist, it will be created. To reuse an existing database, the database must be empty. For additional information regarding database server security configuration and network access please see help.

Database server: spag.colts.local

Database name: SharePoint_Config

Specify Database Access Account

Select an existing Windows account that this machine will always use to connect to the configuration database. If your configuration database is hosted on another server, you must specify a domain account.

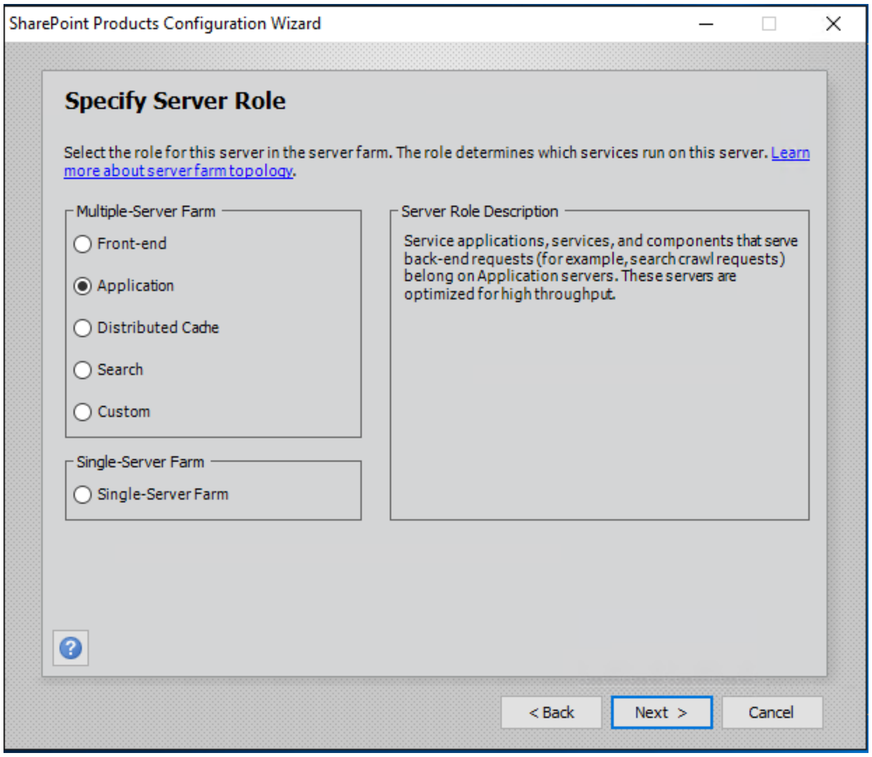
Type the username in the form DOMAIN\User_Name and password for the account.

Username: Colts\SPFARM

Password: ••••••••••

4. Select and enter a passphrase, which is used by other servers to join the server farm.

5. Select Application as the role for this VM and click Next.



SharePoint Products Configuration Wizard

Specify Server Role

Select the role for this server in the server farm. The role determines which services run on this server. Learn more about server farm topology.

Multiple-Server Farm

○ Front-end

● Application

○ Distributed Cache

○ Search

○ Custom

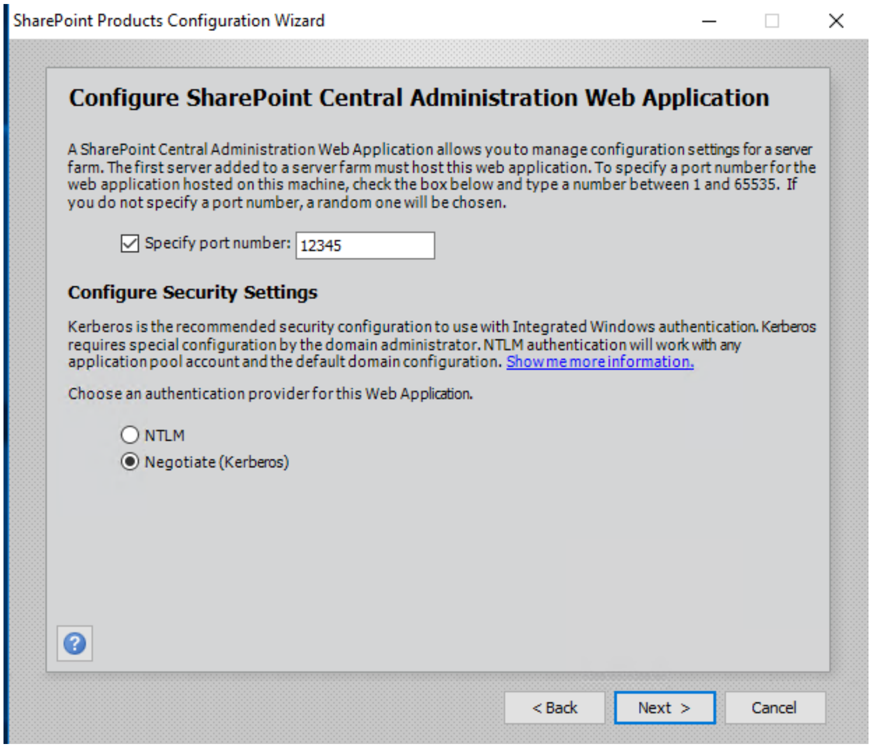
Single-Server Farm

○ Single-Server Farm

Server Role Description

Service applications, services, and components that serve back-end requests (for example, search crawl requests) belong on Application servers. These servers are optimized for high throughput.

6. (Optional) Specify a custom port number, select NTLM or Negotiate (Kerberos) as the security setting, and then click Next.



SharePoint Products Configuration Wizard

Configure SharePoint Central Administration Web Application

A SharePoint Central Administration Web Application allows you to manage configuration settings for a server farm. The first server added to a server farm must host this web application. To specify a port number for the web application hosted on this machine, check the box below and type a number between 1 and 65535. If you do not specify a port number, a random one will be chosen.

☑ Specify port number: 12345

Configure Security Settings

Kerberos is the recommended security configuration to use with Integrated Windows authentication. Kerberos requires special configuration by the domain administrator. NTLM authentication will work with any application pool account and the default domain configuration. Show me more information.

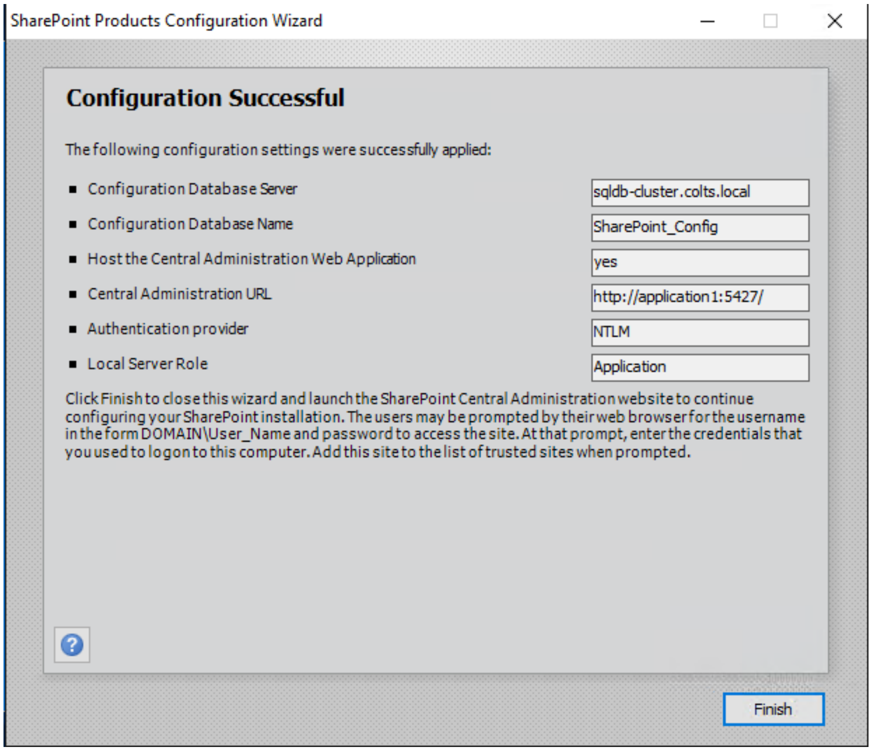
Choose an authentication provider for this Web Application.

○ NTLM

● Negotiate (Kerberos)

7. Review the configuration settings and click Next.

8. After the configuration settings are successfully applied, capture the central administration URL address and click Finish.



Configuration Successful

The following configuration settings were successfully applied:

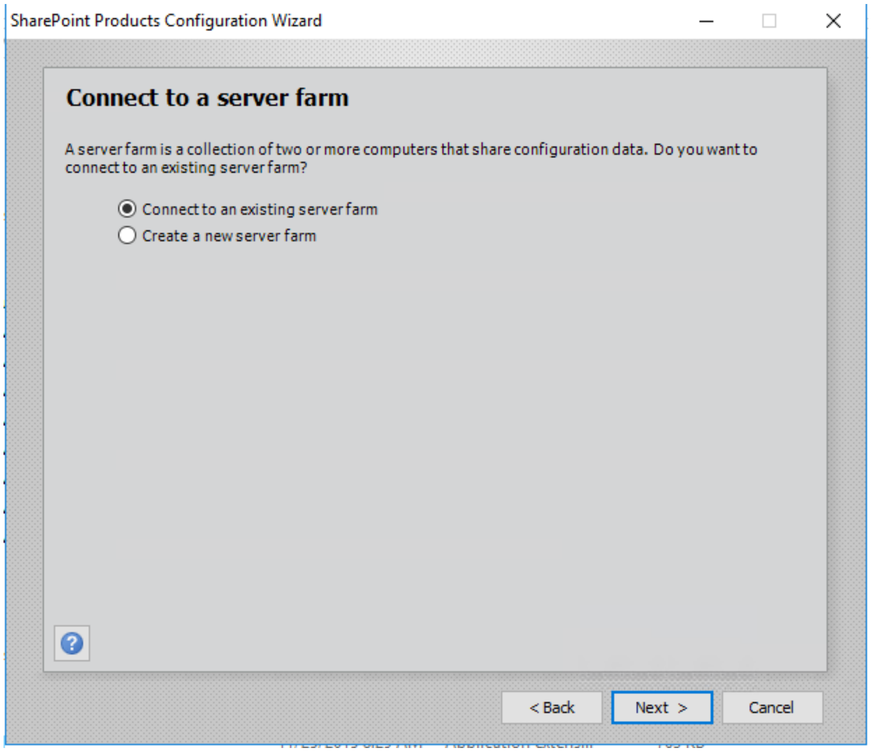
- Configuration Database Server: sqldb-cluster.colts.local
- Configuration Database Name: SharePoint_Config
- Host the Central Administration Web Application: yes
- Central Administration URL: http://application1:5427/
- Authentication provider: NTLM
- Local Server Role: Application

Click Finish to close this wizard and launch the SharePoint Central Administration website to continue configuring your SharePoint installation. The users may be prompted by their web browser for the username in the form DOMAIN\User_Name and password to access the site. At that prompt, enter the credentials that you used to logon to this computer. Add this site to the list of trusted sites when prompted.

Add Servers to SharePoint 2016 Farm

After the SharePoint 2016 farm is created on the first application server, go back to the other VMs that you created and join them to the farm and install specific roles. Complete the following steps on all the SharePoint VMs to have a fully populated SharePoint farm:

1. Log in to all of the remaining SharePoint VMs by using the SPINSTALL account.
2. Click Close on the SharePoint Installation wizard to open the SharePoint Products Configuration wizard.
3. Click Next and then click Yes.
4. Select the Connect to an Existing Server Farm option and click Next.



SharePoint Products Configuration Wizard

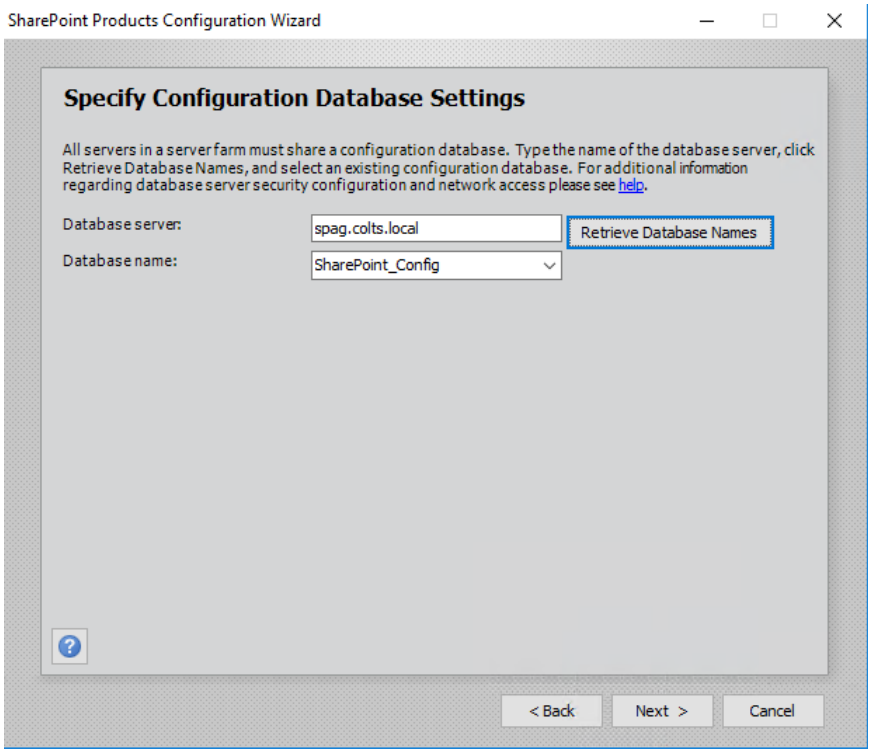
Connect to a server farm

A server farm is a collection of two or more computers that share configuration data. Do you want to connect to an existing server farm?

● Connect to an existing server farm

○ Create a new server farm

5. Enter the availability group listener name and click Retrieve Database Names. This step should return the `SharePoint_Config` database that was created in the previous subsection. Click Next.



SharePoint Products Configuration Wizard

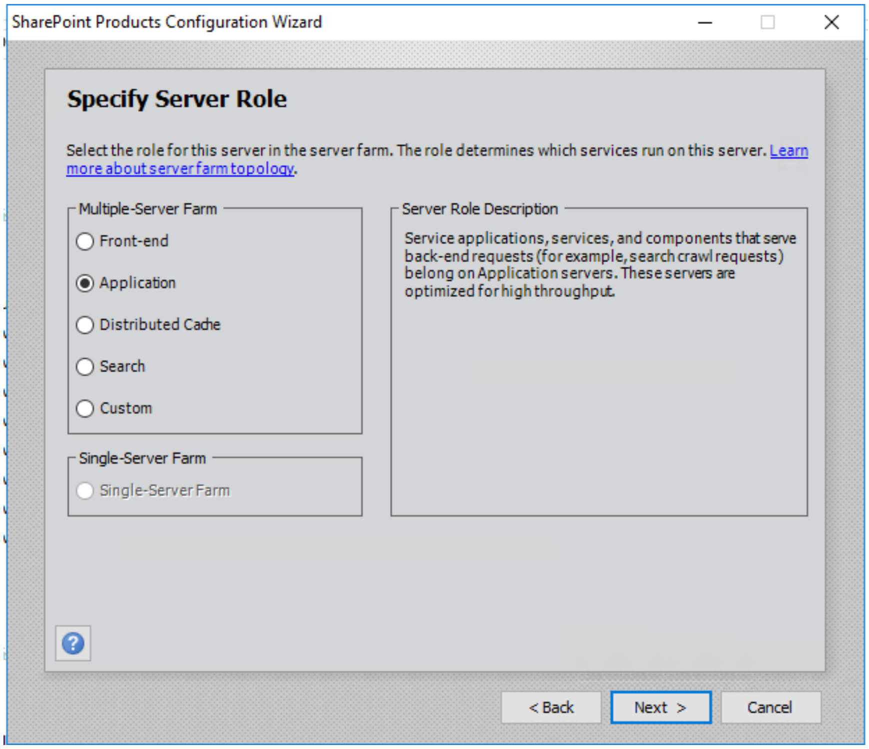
Specify Configuration Database Settings

All servers in a server farm must share a configuration database. Type the name of the database server, click Retrieve Database Names, and select an existing configuration database. For additional information regarding database server security configuration and network access please see help.

Database server: spag.colts.local

Database name: SharePoint_Config

6. Enter the passphrase that you used during the farm creation and click Next.
7. Depending on which VM you are running the wizard, select the specific role and click Next.



SharePoint Products Configuration Wizard

Specify Server Role

Select the role for this server in the server farm. The role determines which services run on this server. Learn more about server farm topology.

Multiple-Server Farm

○ Front-end

● Application

○ Distributed Cache

○ Search

○ Custom

Single-Server Farm

○ Single-Server Farm

Server Role Description

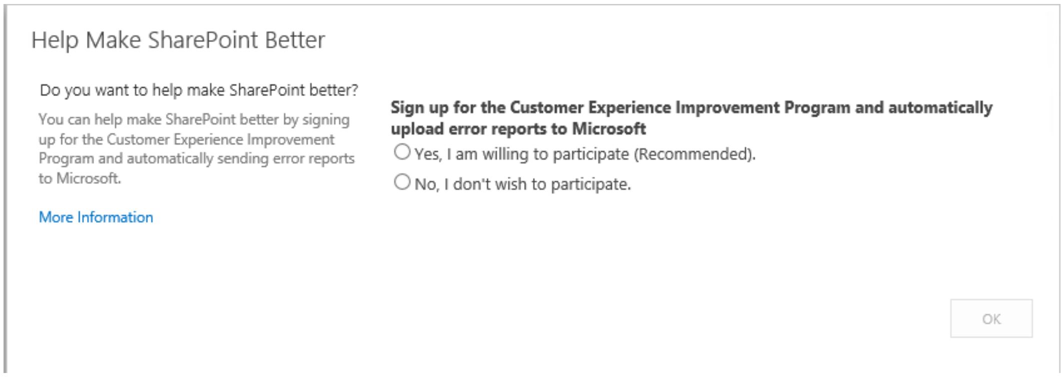
Service applications, services, and components that serve back-end requests (for example, search crawl requests) belong on Application servers. These servers are optimized for high throughput.

8. Click Next.
9. After the installation is complete, click Finish.

Configure SharePoint 2016 Farm

After the VMs are joined to the SharePoint farm and the respective roles are installed, configure the SharePoint farm by completing the following steps:

1. Log in to the first application server and navigate to the central administration portal.
2. Select Yes or No to participate in the Customer Experience Improvement Program.



Help Make SharePoint Better

Do you want to help make SharePoint better?

You can help make SharePoint better by signing up for the Customer Experience Improvement Program and automatically sending error reports to Microsoft.

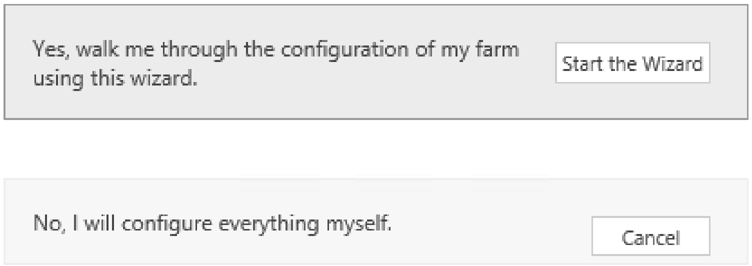
More Information

Sign up for the Customer Experience Improvement Program and automatically upload error reports to Microsoft

○ Yes, I am willing to participate (Recommended).

○ No, I don't wish to participate.

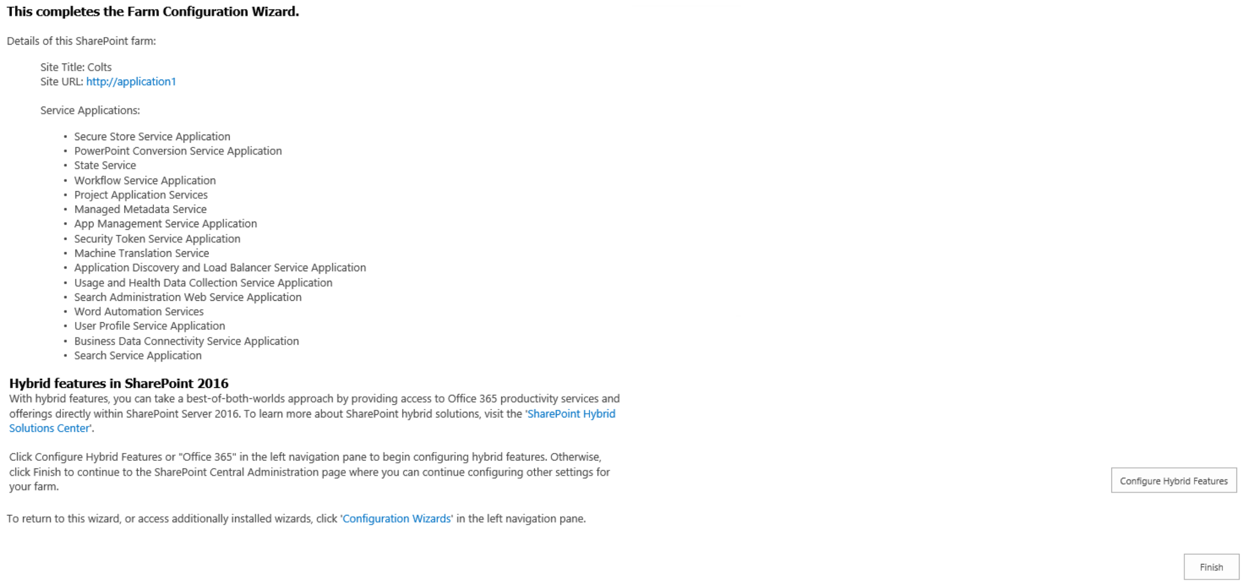
3. Click Start the Wizard to start the farm configuration.



Yes, walk me through the configuration of my farm using this wizard.

No, I will configure everything myself.

4. Select the Use Existing Managed Account option to use the SPFARM account to configure the farm.
5. Select the service applications and services that you want to include in this farm and click Next.
6. Create a site collection and click OK.
7. Click Finish.



This completes the Farm Configuration Wizard.

Details of this SharePoint farm:

Site Title: Colts
Site URL: http://application1

Service Applications:

- Secure Store Service Application
- PowerPoint Conversion Service Application
- State Service
- Workflow Service Application
- Project Application Services
- Managed Metadata Service
- App Management Service Application
- Security Token Service Application
- Machine Translation Service
- Application Discovery and Load Balancer Service Application
- Usage and Health Data Collection Service Application
- Search Administration Web Service Application
- Word Automation Services
- User Profile Service Application
- Business Data Connectivity Service Application
- Search Service Application

Hybrid features in SharePoint 2016

With hybrid features, you can take a best-of-both-worlds approach by providing access to Office 365 productivity services and offerings directly within SharePoint Server 2016. To learn more about SharePoint hybrid solutions, visit the 'SharePoint Hybrid Solutions Center'.

Click Configure Hybrid Features or "Office 365" in the left navigation pane to begin configuring hybrid features. Otherwise, click Finish to continue to the SharePoint Central Administration page where you can continue configuring other settings for your farm.

To return to this wizard, or access additionally installed wizards, click 'Configuration Wizards' in the left navigation pane.

8. Log in to the remaining VMs and browse to the Central Administration page.
9. Click Start the Wizard.
10. The farm is already on the first host, so you should get an immediate response. Click Finish.

Configure Index Component for SharePoint Search Servers

After the farm is configured, configure the index location by running the following script on each of the search servers:

1. Open the SharePoint management shell as an administrator and run the following script:

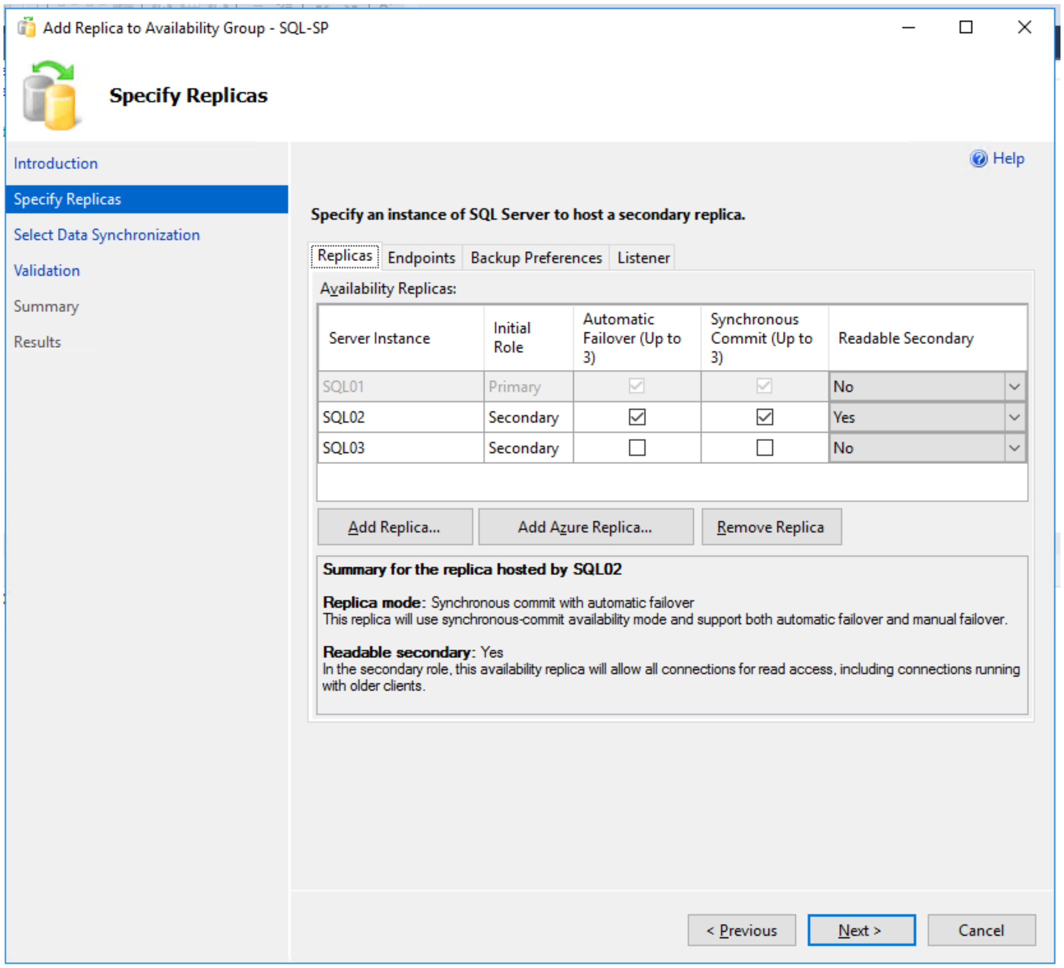
```
#Get Search Service Instance and Start on New Index Server
$ssi = Get-SPEnterpriseSearchServiceInstance -Identity $env:COMPUTERNAME
Start-SPEnterpriseSearchServiceInstance -Identity $ssi

#Wait for Search Service Instance to come online
do {$online = Get-SPEnterpriseSearchServiceInstance -Identity $ssi; Write-Host "Waiting for
service: " $online.Status}
until ($online.Status -eq "Online")

#Clone Active Search Topology
```

```
$ssa = Get-SPEnterpriseSearchServiceApplication
$active = Get-SPEnterpriseSearchTopology -SearchApplication $ssa -Active
$clone = New-SPEnterpriseSearchTopology -SearchApplication $ssa -Clone –SearchTopology $active

#Create New Index Component for Index Partition 0
$sic = New-SPEnterpriseSearchIndexComponent –SearchTopology $clone -SearchServiceInstance $ssi -
IndexPartition 0 -RootDirectory "L:\Index"

#Activate the Cloned Search Topology
Set-SPEnterpriseSearchTopology -Identity $clone
#Review new topology
Get-SPEnterpriseSearchTopology -Active -SearchApplication $ssa

#Monitor Distribution of Index
do {$activeState = Get-SPEnterpriseSearchStatus -SearchApplication $ssa |
Where-Object {$_.Name -eq $sic.Name}; Write-Host "Waiting for active distribution: "
$activeState.State}
until ($activeState.State -eq "Active")
```

Add Replicas and SharePoint Databases to AlwaysOn Availability Group

After SharePoint 2016 is successfully installed, add replicas and all the databases to the AlwaysOn Availability Group that you created in the section titled “SQL Server Installation” by completing the following steps:

1. Connect to the SQL instance on the primary stack where you created the Availability Group.
2. In the left pane, expand the Availability Group.
3. Right-click the availability replicas and click Add Replicas. Click Next.
4. Connect to the remaining two SQL instances: Set Synchronous Commit, Automatic Failover, and Readable Secondary for the instance running on the primary stack and select Asynchronous Commit, Manual Failover, and No Readable Secondary for the instance on the secondary stack.



Specify an instance of SQL Server to host a secondary replica.

Availability Replicas:

Server Instance	Initial Role	Automatic Failover (Up to 3)	Synchronous Commit (Up to 3)	Readable Secondary
SQL01	Primary	☑	☑	No
SQL02	Secondary	☑	☑	Yes
SQL03	Secondary	□	□	No

Summary for the replica hosted by SQL02

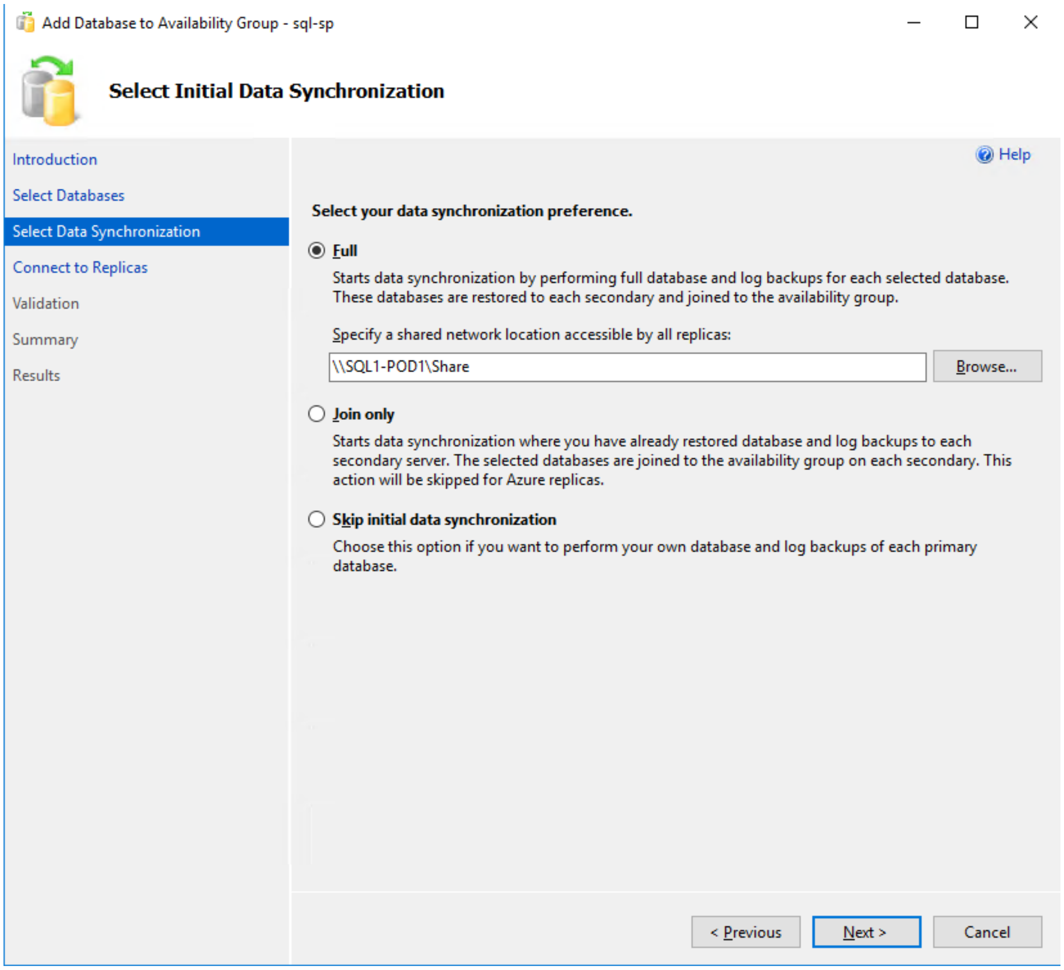
Replica mode: Synchronous commit with automatic failover
This replica will use synchronous-commit availability mode and support both automatic failover and manual failover.

Readable secondary: Yes
In the secondary role, this availability replica will allow all connections for read access, including connections running with older clients.

Note: If the Next button is grayed out, then run the following query against SQL01 to enable the HADR endpoint.

```
create endpoint [Hadr_endpoint]
 state=started
 as tcp (listener_port = 5022, listener_ip = all)
 for database_mirroring (role = all, authentication = windows negotiate, encryption = required
algorithm aes)
go
```

5. Click Next.
6. Enter a shared network location and then click Next.



Select your data synchronization preference.

● Full

Starts data synchronization by performing full database and log backups for each selected database. These databases are restored to each secondary and joined to the availability group.

Specify a shared network location accessible by all replicas:

\\SQL1-POD1\Share

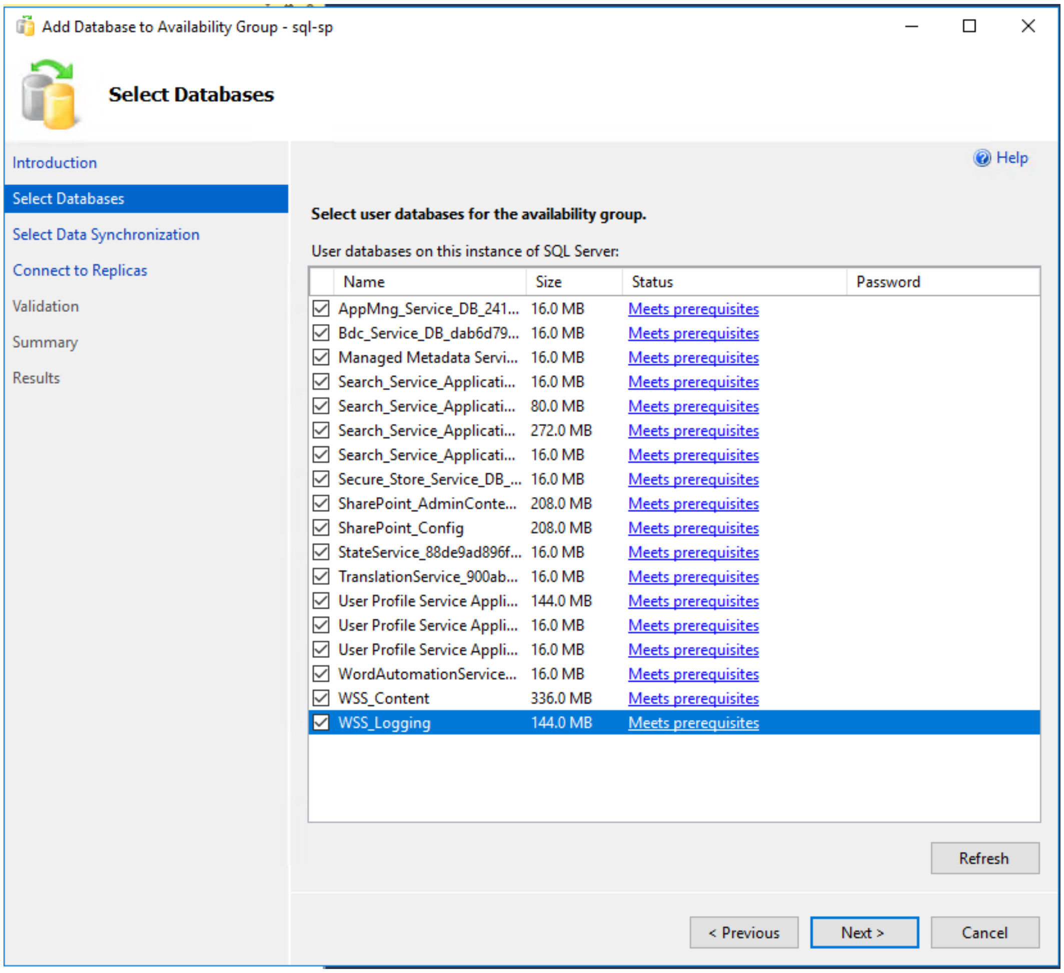
○ Join only

Starts data synchronization where you have already restored database and log backups to each secondary server. The selected databases are joined to the availability group on each secondary. This action will be skipped for Azure replicas.

○ Skip initial data synchronization

Choose this option if you want to perform your own database and log backups of each primary database.

7. Click Next.
8. After the rules are passed, click Next.
9. Click Finish and then close the wizard after it successfully completes.
10. After the replicas are added, right-click the availability databases under the Availability Groups and click Add Database.
11. Click Next.
12. Select all of the SharePoint databases and click Next.



Select user databases for the availability group.

User databases on this instance of SQL Server:

	Name	Size	Status	Password
☑	AppMng_Service_DB_241...	16.0 MB	Meets prerequisites	
☑	Bdc_Service_DB_dab6d79...	16.0 MB	Meets prerequisites	
☑	Managed Metadata Servi...	16.0 MB	Meets prerequisites	
☑	Search_Service_Applicati...	16.0 MB	Meets prerequisites	
☑	Search_Service_Applicati...	80.0 MB	Meets prerequisites	
☑	Search_Service_Applicati...	272.0 MB	Meets prerequisites	
☑	Search_Service_Applicati...	16.0 MB	Meets prerequisites	
☑	Secure_Store_Service_DB_...	16.0 MB	Meets prerequisites	
☑	SharePoint_AdminConte...	208.0 MB	Meets prerequisites	
☑	SharePoint_Config	208.0 MB	Meets prerequisites	
☑	StateService_88de9ad896f...	16.0 MB	Meets prerequisites	
☑	TranslationService_900ab...	16.0 MB	Meets prerequisites	
☑	User Profile Service Appli...	144.0 MB	Meets prerequisites	
☑	User Profile Service Appli...	16.0 MB	Meets prerequisites	
☑	User Profile Service Appli...	16.0 MB	Meets prerequisites	
☑	WordAutomationService...	16.0 MB	Meets prerequisites	
☑	WSS_Content	336.0 MB	Meets prerequisites	
☑	WSS_Logging	144.0 MB	Meets prerequisites	

Note: To take a full backup of a particular database, go back to the SQL Server Management Studio and right-click the database. Select Tasks > Back Up and then click OK.

Note: To set the recovery model to full, right-click the database and click Properties. In the left pane, select Options and then change the recovery model to Full. Click OK.

13. Click Next.
14. Connect to the existing SQL replicas and click Next.
15. After the rules pass, click Next.
16. Click Finish. Click Close after the wizard completes successfully.

5.10 DocAve 6 Installation

This section describes how to deploy DocAve 6 in support of the SharePoint installation.

Create VM

Table 18 lists the VM configuration parameters for the DocAve 6 installation.

Table 18) DocAve 6: VM configuration parameters.

Role	Number of VMs	RAM(GB)	CPU	HDD(GB)	Network
DocAve	1	6GB	4	80GB	Mgmt, iSCSIA, iSCSIB

To create VMs for use in the DocAve 6 installation, complete the following steps:

1. Provision Windows Server 2016 with at least 6GB of RAM, four vCPUs, 80GB HDD, and virtual network interfaces in the MGMT network, iSCSIA, and iSCSIB port groups. The virtual network interfaces should be VMXNET 3 adapters.
2. Install VMware Tools, assign the IP address and gateway in the MGMT subnet, and join the machine to the AD domain.
3. Launch a PowerShell prompt by right-clicking the PowerShell icon in the taskbar and selecting Run as Administrator.
4. Enable remote management and remote desktop by using the SCONFIG application.

```
SCONFIG
```

5. Select Configure Remote Management.
6. Select Enable Remote Management.
7. Select Return to the Main Menu.
8. Select Remote Desktop.
9. Enter `E` to enable.
10. Enter `2` to allow any version of remote desktop. After this step, you are returned to the main menu.
11. Select Exit to Command Line.
12. Add the Windows failover clustering and multipath I/O features by running the following command:

```
Add-WindowsFeature NET-Framework-Core, Multipath-IO -IncludeManagementTools -Restart -Source
D:\Sources\Sxs
```

Note: SnapDrive for Windows requires .Net 3.5.

13. Configure local administrator access.

```
# SnapDrive service account
Add-LocalGroupMember -Group Administrators -Member Colts\SDWSVC
#Dedicated installation account
Add-LocalGroupMember -Group Administrators -Member Colts\SPInstall
```

Note: For future serviceability, NetApp recommends that you use a dedicated installation account that can be disabled after the software is deployed. This account can then be reenabled at any point in the future if access is denied.

14. Install the Windows updates on the VM.

Configure iSCSI

To configure iSCSI connections from the DocAve VMs to the NetApp storage controllers, run the following PowerShell commands from each host:

1. Start the iSCSI service.

```
Set-Service -Name MSiSCSI -StartupType Automatic
Start-Service -Name MSiSCSI
```

2. Configure iSCSI target portals for each path to the SharePoint SVM.

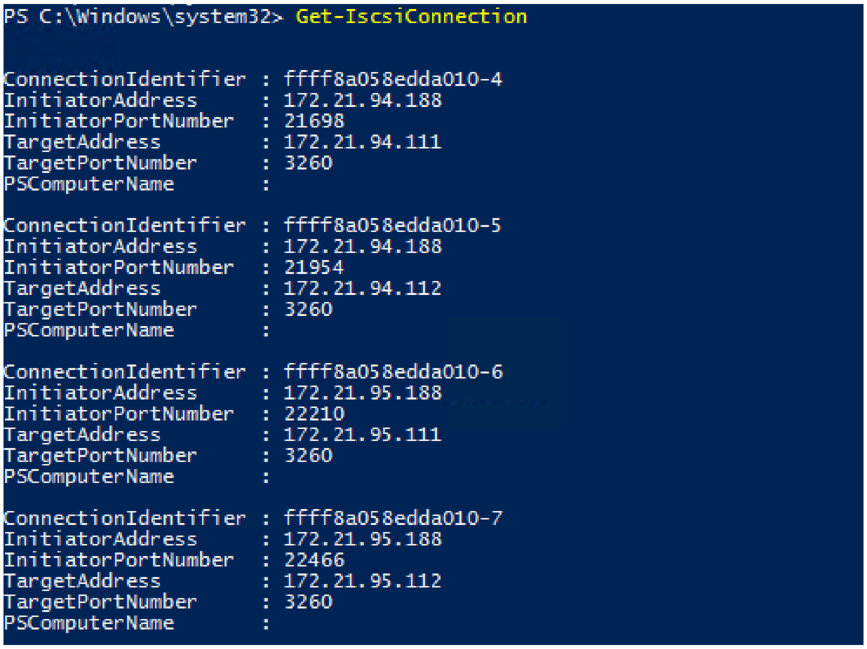
```
New-IscsiTargetPortal -InitiatorPortalAddress <<DocAve_VM_iSCSIA_IP>> -TargetPortalAddress
<<SharePoint_SVM_iSCSI01a_IP>>
New-IscsiTargetPortal -InitiatorPortalAddress <<DocAve_VM_iSCSIA_IP>> -TargetPortalAddress
<<SharePoint_SVM_iSCSI02a_IP>>
New-IscsiTargetPortal -InitiatorPortalAddress <<DocAve_VM_iSCSIB_IP>> -TargetPortalAddress
<<SharePoint_SVM_iSCSI01b_IP>>
New-IscsiTargetPortal -InitiatorPortalAddress <<DocAve_VM_iSCSIB_IP>> -TargetPortalAddress
<<SharePoint_SVM_iSCSI02b_IP>>
```

3. Connect to the target for SharePoint SVM.

```
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<DocAve_VM_iSCSIA_IP>> -TargetPortalAddress
<<SharePoint_SVM_iSCSI01a_IP>>
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<DocAve_VM_iSCSIA_IP>> -TargetPortalAddress
<<SharePoint_SVM_iSCSI01b_IP>>
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<DocAve_VM_iSCSIB_IP>> -TargetPortalAddress
<<SharePoint_SVM_iSCSI02a_IP>>
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<DocAve_VM_iSCSIB_IP>> -TargetPortalAddress
<<SharePoint_SVM_iSCSI02b_IP>>
```

4. Verify the connections by running the following command:

```
Get-IscsiConnection
```



```
PS C:\Windows\system32> Get-IscsiConnection


ConnectionIdentifier : ffff8a058edda010-4
InitiatorAddress     : 172.21.94.188
InitiatorPortNumber  : 21698
TargetAddress        : 172.21.94.111
TargetPortNumber     : 3260
PSComputerName       :

ConnectionIdentifier : ffff8a058edda010-5
InitiatorAddress     : 172.21.94.188
InitiatorPortNumber  : 21954
TargetAddress        : 172.21.94.112
TargetPortNumber     : 3260
PSComputerName       :

ConnectionIdentifier : ffff8a058edda010-6
InitiatorAddress     : 172.21.95.188
InitiatorPortNumber  : 22210
TargetAddress        : 172.21.95.111
TargetPortNumber     : 3260
PSComputerName       :

ConnectionIdentifier : ffff8a058edda010-7
InitiatorAddress     : 172.21.95.188
InitiatorPortNumber  : 22466
TargetAddress        : 172.21.95.112
TargetPortNumber     : 3260
PSComputerName       :
```

5. Configure MPIO for ONTAP.

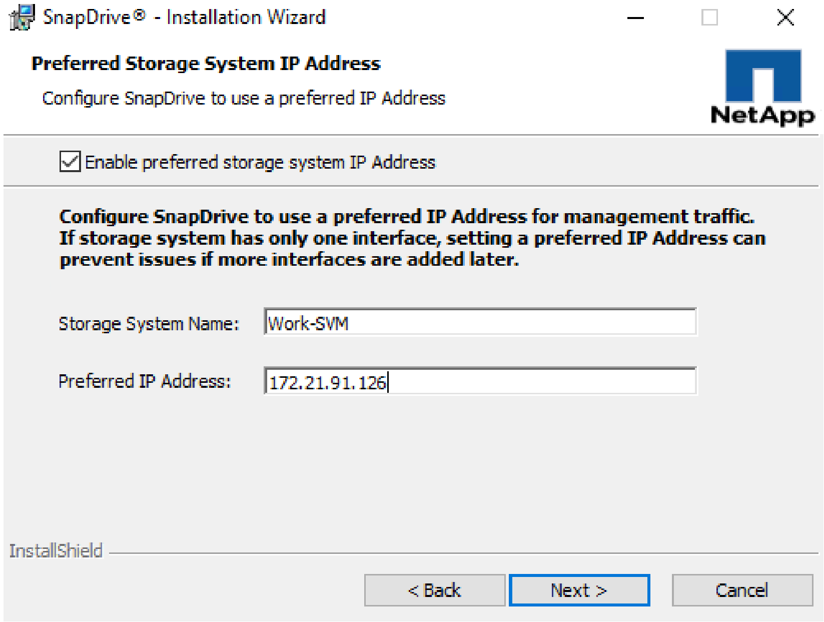
```
New-MSDSMSupportedHW -VendorId NETAPP -ProductId "LUN C-Mode"
Update-MPIOClaimedHW -Confirm:$false
Restart-Computer
```

Install SnapDrive for Windows

To install SnapDrive for Windows, run `SnapDrive7.1.4_x64.exe` as administrator and complete the following steps in the installation wizard:

1. On the SnapDrive Installation wizard home page, click Next.
2. In the SnapDrive wizard, click Per Storage System for the license type and click Next.
3. On the Customer Information page, enter the customer information and click Next.
4. (Optional) Change the SnapDrive Installation folder and click Next on the Destination Folder page.
5. Select the Enable SnapDrive to Communicate Through the Windows Firewall option and click Next.
6. Enter an account that can be used as a service account for the SnapDrive services. This account must be a member of the built-in administrators group. Click Next.
7. Make sure that the SnapDrive web service ports are not conflicting. Click Next.

8. On the Preferred Storage System IP Address page, select the Enable Preferred Storage System IP Address option. Specify the storage system to configure SnapDrive for management traffic. Click Next.



Preferred Storage System IP Address

Configure SnapDrive to use a preferred IP Address

☑ Enable preferred storage system IP Address

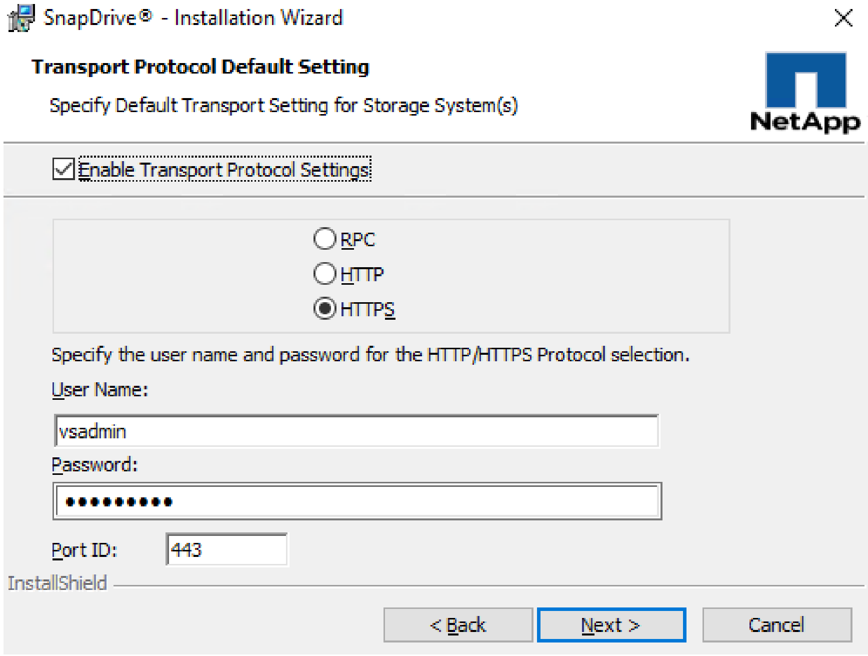
Configure SnapDrive to use a preferred IP Address for management traffic. If storage system has only one interface, setting a preferred IP Address can prevent issues if more interfaces are added later.

Storage System Name: Work-SVM

Preferred IP Address: 172.21.91.126

9. Select the Enable the Transport Protocol Settings option. By enabling the transport protocol, you can talk to the storage system.

   Select the HTTPS option. This requires you to enter a user name, password, and port ID. Click Next.



Transport Protocol Default Setting

Specify Default Transport Setting for Storage System(s)

☑ Enable Transport Protocol Settings

○ RPC
○ HTTP
● HTTPS

Specify the user name and password for the HTTP/HTTPS Protocol selection.

User Name: vsadmin

Password: •••••••••

Port ID: 443

10. Click Next in the Unified Manager Configuration.
11. Click Install to begin the SnapDrive installation.

Mount Storage

In the previous subsection, you configured the iSCSI connections and installed SnapDrive on both DocAve VMs. In this section, create and mount all of the external storage.

Table 19) SQL primary site storage.

Server	Volume	Mount Point	LUN Size
DocAve01	DocAve1_Media	M:\	1TB

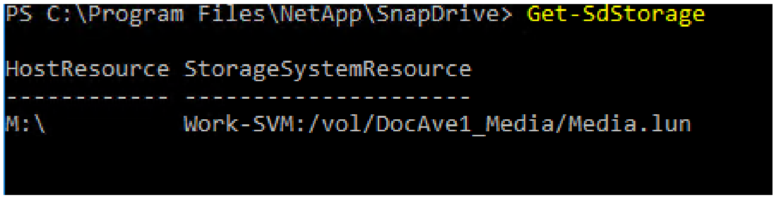
Note: NetApp recommends using SnapDrive for Windows to create the LUNs to house the databases and logs for your SQL Server instances. There are two methods available to create the LUNs: use the SDW GUI or the SDCLI. The following examples use the SDCLI method.

1. Create a DocAve media LUN.

```
sdcli disk create -dtype dedicated -m DocAve01 -D M:\ -p Work-
SVM.colts.local:/vol/DocAve1_Media/Media.lun -I DocAve01 iqn.1991-
05.com.microsoft:DocAve01.colts.local -z 1TB
```

2. Make sure that the LUNs have all been created and mounted to the appropriate path by running the following SnapDrive PowerShell command:

```
Get-SdStorage
```



```
PS C:\Program Files\NetApp\SnapDrive> Get-SdStorage

HostResource StorageSystemResource
------------ ---------------------
M:\          Work-SVM:/vol/DocAve1_Media/Media.lun
```

Install Prerequisites for DocAve Manager

To install the prerequisites for DocAve Manager, complete the following step:

1. Install the required IIS components by running the following command:

```
Install-WindowsFeature  Web-Common-Http,Web-Default-Doc, Web-Static-Content, Web-App-Dev, Web-
Asp-Net, Web-Net-Ext, Web-ISAPI-Ext, Web-ISAPI-Filter, Web-Mgmt-Console, Web-Mgmt-Compat, Web-
Metabase, NET-HTTP-Activation, NET-Non-HTTP-Activ
```

Note: Make sure that the Windows Process Activation Service and World Wide Web Publishing Service are running.

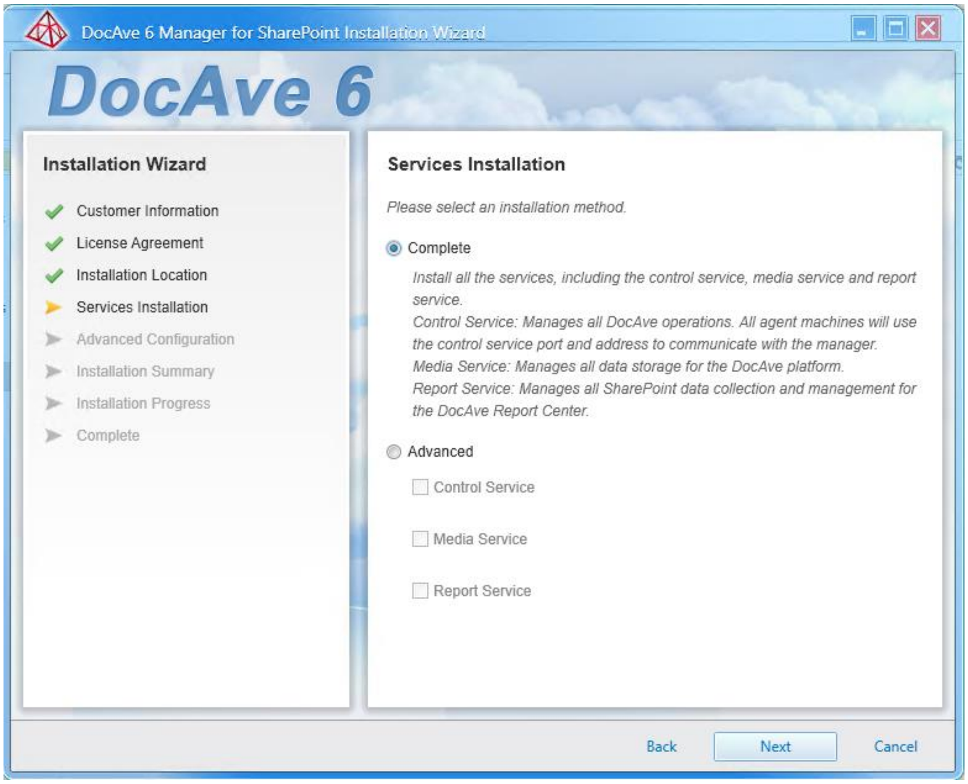
Install DocAve Manager

To install the DocAve Manager, complete the following steps:

1. Unzip the `DocAve_v6_Manager` folder and double-click the `setup.exe` file.
2. Click Next.
3. On the Customer Information page, enter your name and organization in the designated fields. Click Next.
4. Review and accept the DocAve license agreement. Click Next.

   Note: After the DocAve Manager installation completes, you can navigate to the manager installation path …`\Manager\lic\` to see your demo licenses.

5. Select the installation location and click Next.
6. On the Service Installation page, select the Complete installation method and click Next.



Services Installation

Please select an installation method.

● Complete

Install all the services, including the control service, media service and report service.
Control Service: Manages all DocAve operations. All agent machines will use the control service port and address to communicate with the manager.
Media Service: Manages all data storage for the DocAve platform.
Report Service: Manages all SharePoint data collection and management for the DocAve Report Center.

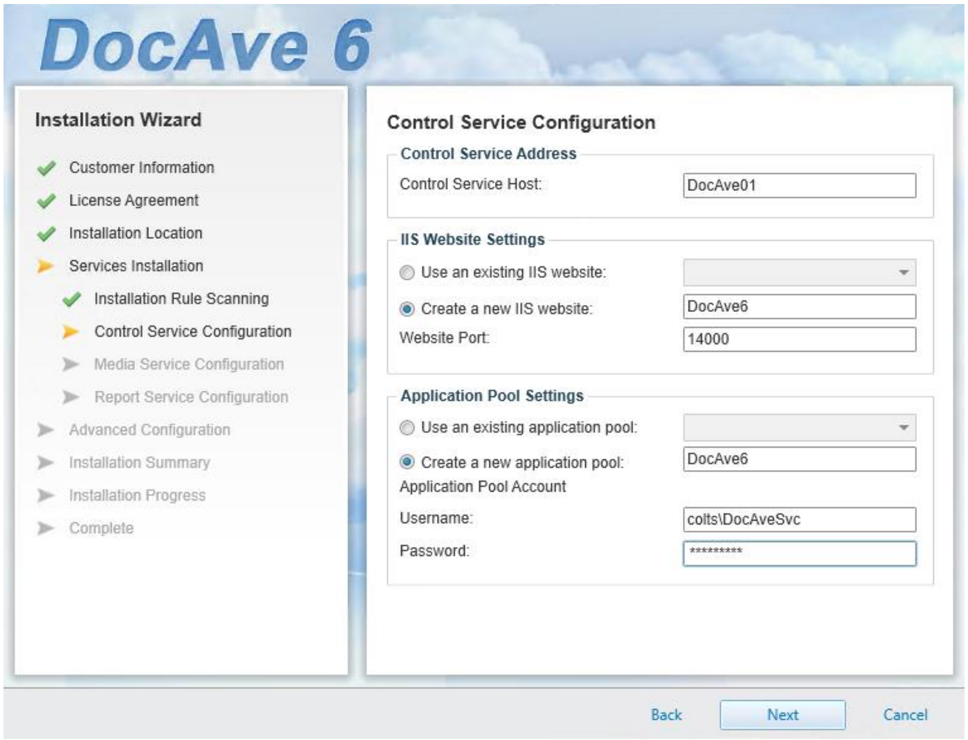
○ Advanced

□ Control Service

□ Media Service

□ Report Service

7. All of the validation rules should pass. If they don't pass, resolve the issues and click Rescan. After all of the rules pass, click Next.
8. On the Control Service Configuration page, enter the domain credentials in the Application Pool Settings section and click Next.



Control Service Configuration

Control Service Address

Control Service Host: DocAve01

IIS Website Settings

○ Use an existing IIS website:

● Create a new IIS website: DocAve6

Website Port: 14000

Application Pool Settings

○ Use an existing application pool:

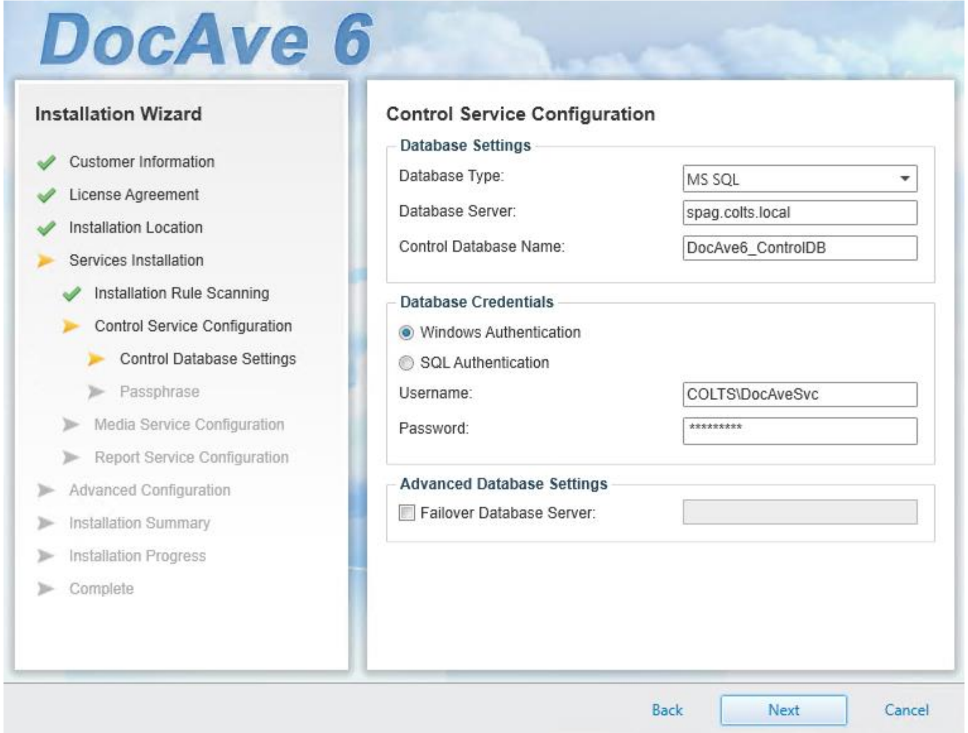
● Create a new application pool: DocAve6

Application Pool Account

Username: colts\DocAveSvc

Password: *********

9. On the Control Service Configuration page, under Database Credentials, enter the user name and password of the AlwaysOn Availability Listener. Click Next.



Control Service Configuration

Database Settings

Database Type: MS SQL

Database Server: spag.colts.local

Control Database Name: DocAve6_ControlDB

Database Credentials

● Windows Authentication

○ SQL Authentication

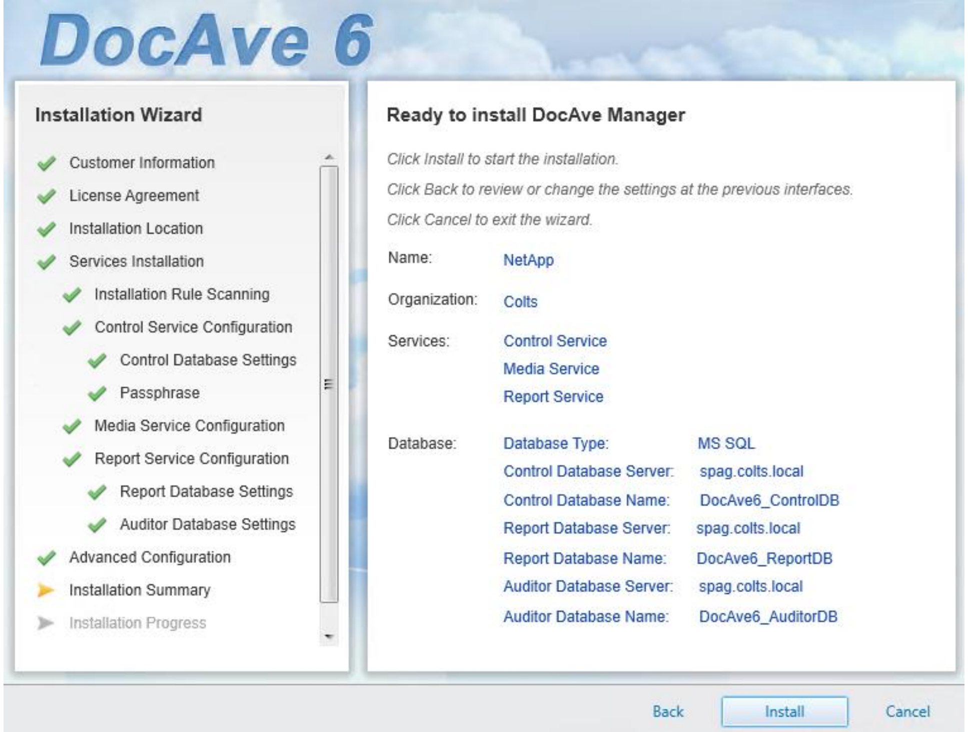
Username: COLTS\DocAveSvc

Password: *********

Advanced Database Settings

□ Failover Database Server:

10. When the installer detects that the database does not exist, click OK to create it.
11. On the Control Service Passphrase page, enter a passphrase and click Next.
12. On the Media Server Configuration page, verify the port selection and click Next.
13. On the Report Service Configuration page, verify the port and click Next.
14. On the Report Service—Report Database Settings page, select the Use the Previous Database Settings option and click Next.
15. When the installer detects that the database does not exist, click OK to create it.
16. On the Report Service—Auditor Database Settings page, select the Use the Previous Database Settings option and click Next.
17. When the installer detects that the database does not exist, click OK to create it.
18. Select Built-In Certificate and click Next.
19. Click Install.



Ready to install DocAve Manager

Click Install to start the installation.

Click Back to review or change the settings at the previous interfaces.

Click Cancel to exit the wizard.

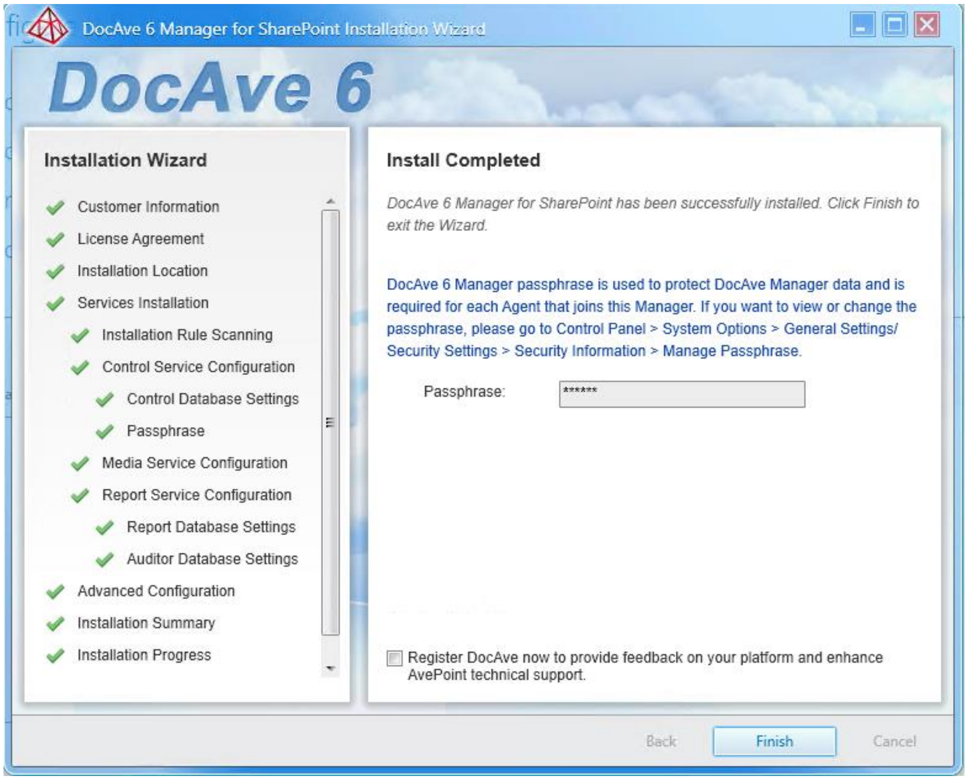
Name: NetApp

Organization: Colts

Services: Control Service
Media Service
Report Service

Database:
Database Type: MS SQL
Control Database Server: spag.colts.local
Control Database Name: DocAve6_ControlDB
Report Database Server: spag.colts.local
Report Database Name: DocAve6_ReportDB
Auditor Database Server: spag.colts.local
Auditor Database Name: DocAve6_AuditorDB

20. After the installation is complete, click Finish.



Install Completed

DocAve 6 Manager for SharePoint has been successfully installed. Click Finish to exit the Wizard.

DocAve 6 Manager passphrase is used to protect DocAve Manager data and is required for each Agent that joins this Manager. If you want to view or change the passphrase, please go to Control Panel > System Options > General Settings/ Security Settings > Security Information > Manage Passphrase.

Passphrase: ******

□ Register DocAve now to provide feedback on your platform and enhance AvePoint technical support.

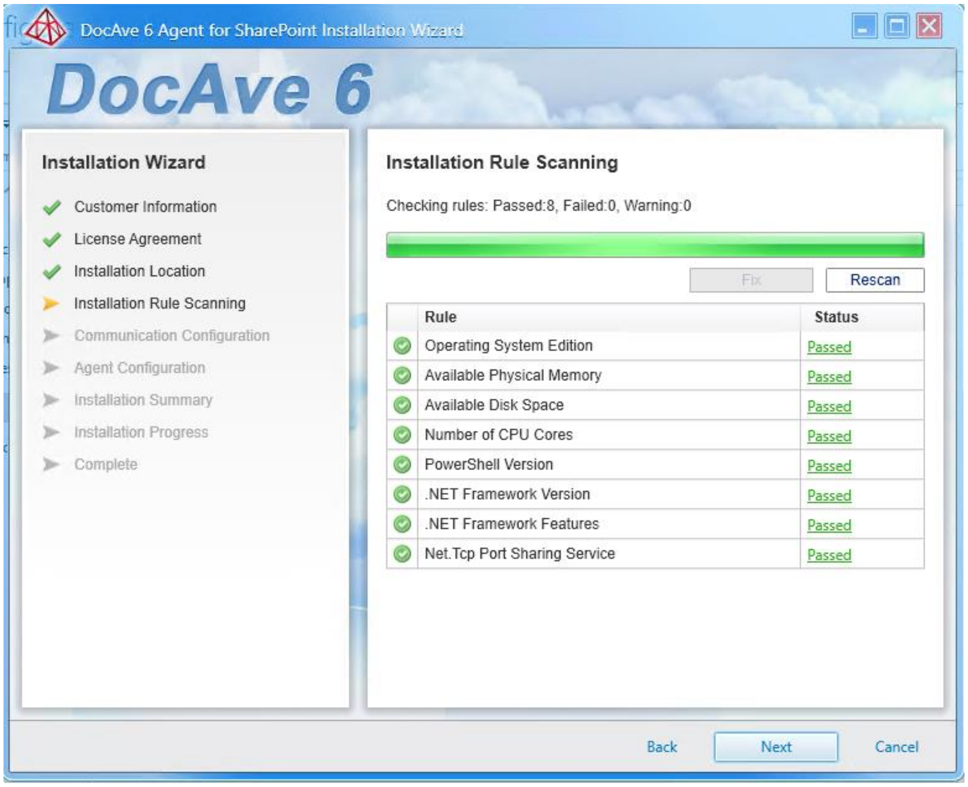
Install DocAve Agent

The DocAve Agent must be installed on every server participating in the farm (DocAve Media, SQL, front-end, search, application, and cache servers) by completing the following steps:

1. Before installing the DocAve Agent, add the DocAveSvc account to the local administrators group.

```
Add-LocalGroupMember -Group Administrators -Member Colts\DocAveSvc
```

2. Run the `DocAve_v6_Agent` setup file to start the SMSP Agent Installation wizard.
3. Click Next.
4. Enter the name and organization and click Next.
5. Review and accept the license agreement and click Next.
6. Select the installation location and click Next.
7. After the installation rules have passed, click Next.

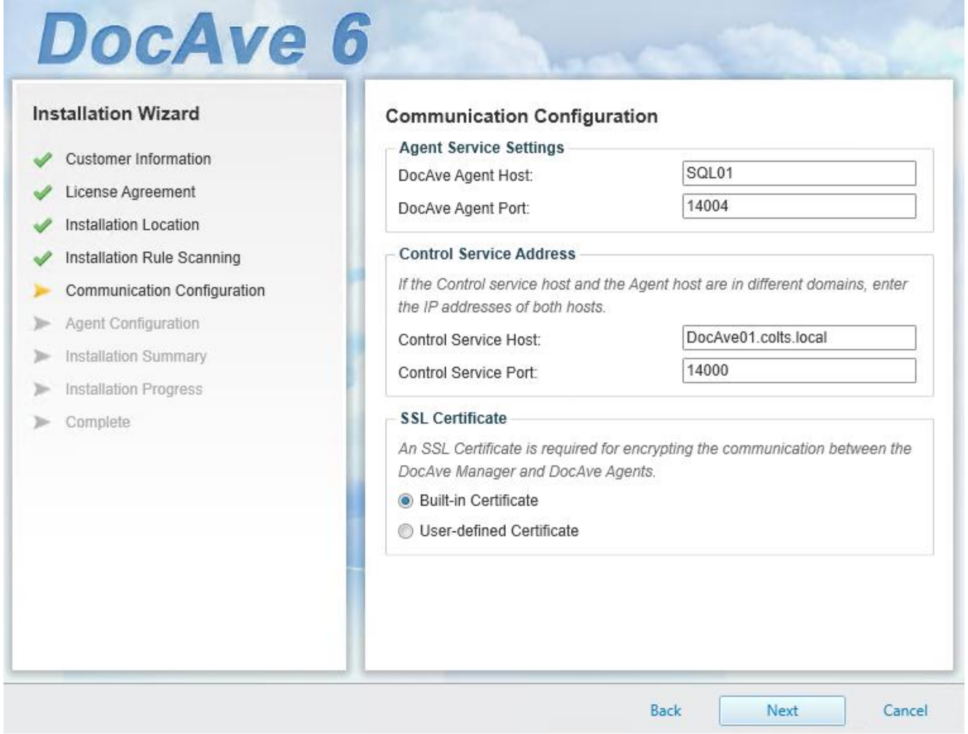


Installation Rule Scanning

Checking rules: Passed:8, Failed:0, Warning:0

Rule	Status
Operating System Edition	Passed
Available Physical Memory	Passed
Available Disk Space	Passed
Number of CPU Cores	Passed
PowerShell Version	Passed
.NET Framework Version	Passed
.NET Framework Features	Passed
Net.Tcp Port Sharing Service	Passed

8. Enter the host name of the DocAve control service host and click Next.



Communication Configuration

Agent Service Settings

DocAve Agent Host: SQL01

DocAve Agent Port: 14004

Control Service Address

If the Control service host and the Agent host are in different domains, enter the IP addresses of both hosts.

Control Service Host: DocAve01.colts.local

Control Service Port: 14000

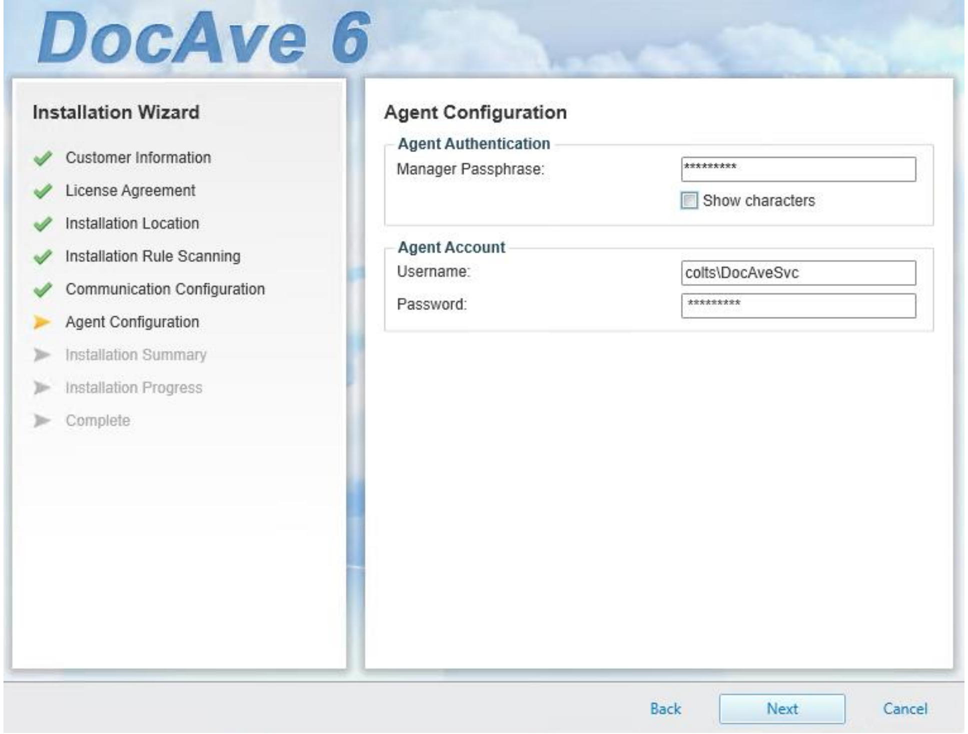
SSL Certificate

An SSL Certificate is required for encrypting the communication between the DocAve Manager and DocAve Agents.

● Built-in Certificate

○ User-defined Certificate

9. Enter the manager passphrase and agent account details and click Next.



Agent Configuration

Agent Authentication

Manager Passphrase: *********

□ Show characters

Agent Account

Username: colts\DocAveSvc

Password: *********

10. Click Install.
11. After the installation is complete, click Finish.

12. Repeat steps 1 through 11 to install the DocAve Agent on all of the SharePoint servers (front-end, application, search, and cache) and on all of the SQL Server instances.

    Note: If you did not do so earlier, add the inbound rule to the SQL Server VM firewalls to allow the DocAve Agent port.

```
$splat = @{Action='allow';Direction='Inbound'}
New-NetFirewallRule -DisplayName “DocAve Agent” –Protocol TCP –LocalPort 14004 @splat
```

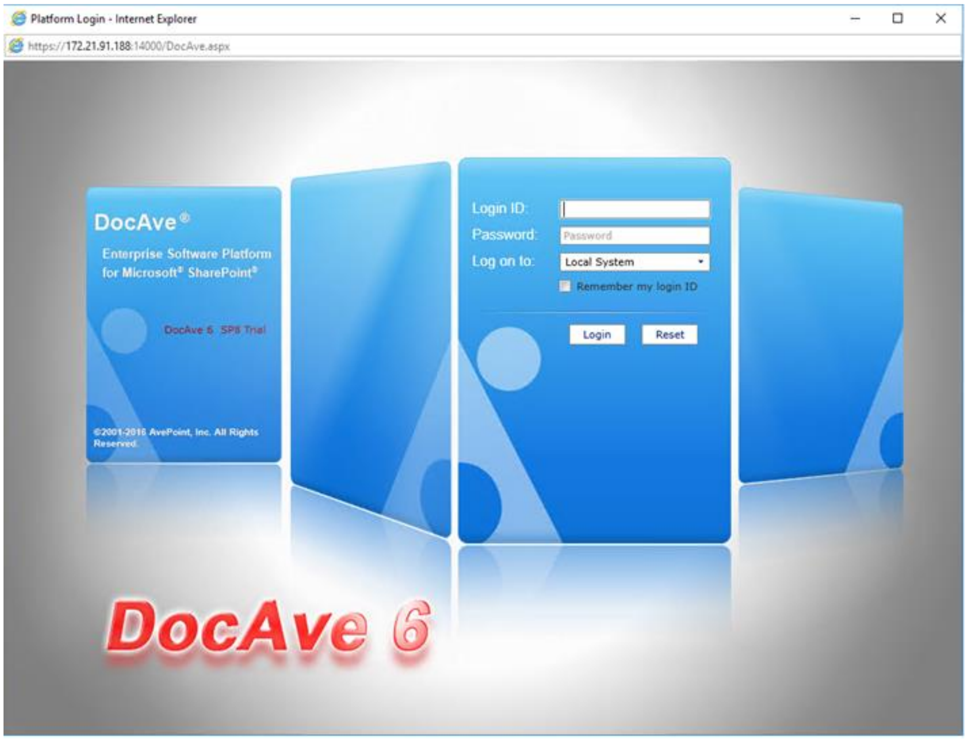
Configure DocAve Manager

To configure DocAve Manager, complete the following steps:

1. Open the SMSP Management console using a supported web browser by navigating to https://DocAve01:14000/.

    Note: If you do not have Silverlight installed, the system prompts you to install it.

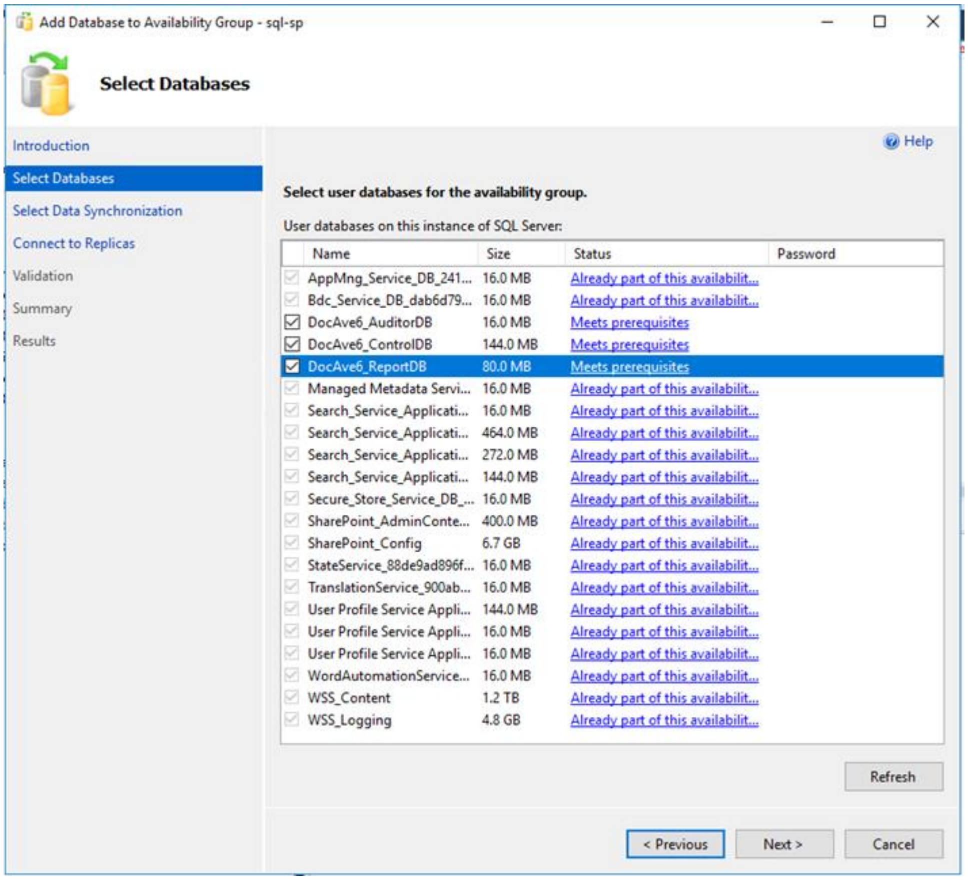
    Note: Enter the DocAve default credentials and click Login.
    The default credentials during installation are: user name is `admin` and password is `admin`.


Platform Login - Internet Explorer
https://172.21.91.188:14000/DocAve.aspx
DocAve®
Enterprise Software Platform for Microsoft® SharePoint®
DocAve 6 SP8 Trial
©2001-2016 AvePoint, Inc. All Rights Reserved.
Login ID:
Password:
Password
Log on to:
Local System
□ Remember my login ID
Login
Reset
DocAve 6

Add DocAve Databases to AlwaysOn Availability Group

After DocAve is installed and configured, add the databases that DocAve configured to the AlwaysOn Availability Group by completing the following steps:

1. Log in to the SQL Server Management Studio and expand the Availability Group.
2. Right-click the Availability Group and click Add Databases.
3. Click Next.
4. Select the DocAve databases and click Next.



Select user databases for the availability group.

User databases on this instance of SQL Server:

	Name	Size	Status	Password
☑	AppMng_Service_DB_241...	16.0 MB	Already part of this availabilit...	
☑	Bdc_Service_DB_dab6d79...	16.0 MB	Already part of this availabilit...	
☑	DocAve6_AuditorDB	16.0 MB	Meets prerequisites	
☑	DocAve6_ControlDB	144.0 MB	Meets prerequisites	
☑	DocAve6_ReportDB	80.0 MB	Meets prerequisites	
☑	Managed Metadata Servi...	16.0 MB	Already part of this availabilit...	
☑	Search_Service_Applicati...	16.0 MB	Already part of this availabilit...	
☑	Search_Service_Applicati...	464.0 MB	Already part of this availabilit...	
☑	Search_Service_Applicati...	272.0 MB	Already part of this availabilit...	
☑	Search_Service_Applicati...	144.0 MB	Already part of this availabilit...	
☑	Secure_Store_Service_DB_...	16.0 MB	Already part of this availabilit...	
☑	SharePoint_AdminConte...	400.0 MB	Already part of this availabilit...	
☑	SharePoint_Config	6.7 GB	Already part of this availabilit...	
☑	StateService_88de9ad896f...	16.0 MB	Already part of this availabilit...	
☑	TranslationService_900ab...	16.0 MB	Already part of this availabilit...	
☑	User Profile Service Appli...	144.0 MB	Already part of this availabilit...	
☑	User Profile Service Appli...	16.0 MB	Already part of this availabilit...	
☑	User Profile Service Appli...	16.0 MB	Already part of this availabilit...	
☑	WordAutomationService...	16.0 MB	Already part of this availabilit...	
☑	WSS_Content	1.2 TB	Already part of this availabilit...	
☑	WSS_Logging	4.8 GB	Already part of this availabilit...	

5. Click Next.
6. Connect to the replicas and click Next.
7. After all of the rules are validated, click Next.
8. Click Finish and then Close.

5.11 Microsoft Exchange 2016 Installation and Configuration

This section describes how to install and configure Exchange 2016. Based on the sizing outlined in the FlexPod Datacenter with Microsoft Applications and NetApp AFF A-Series Design Guide, this installation requires eight primary servers hosting two active copies of the database. For documentation purposes, a third offsite copy of the database to cover multisite considerations has been documented. However, this offsite copy is optional because two active copies with SnapManager backups provide sufficient availability and serviceability. Table 20 lists the database distribution.

Table 20) Database distribution.

Database Name	Primary	Secondary	Offsite
DAG1-DB01	MBX01	MBX02	SecMbx01
DAG1-DB02	MBX02	MBX03	SecMbx02
DAG1-DB03	MBX03	MBX04	SecMbx03
DAG1-DB04	MBX04	MBX05	SecMbx04

Database Name	Primary	Secondary	Offsite
DAG1-DB05	MBX05	MBX06	SecMbx01
DAG1-DB06	MBX06	MBX07	SecMbx02
DAG1-DB07	MBX07	MBX08	SecMbx03
DAG1-DB08	MBX08	MBX01	SecMbx04
DAG1-DB09	MBX01	MBX03	SecMbx01
DAG1-DB10	MBX02	MBX04	SecMbx02
DAG1-DB11	MBX03	MBX05	SecMbx03
DAG1-DB12	MBX04	MBX06	SecMbx04
DAG1-DB13	MBX05	MBX07	SecMbx01
DAG1-DB14	MBX06	MBX08	SecMbx02
DAG1-DB15	MBX07	MBX01	SecMbx03
DAG1-DB16	MBX08	MBX02	SecMbx04
DAG1-DB17	MBX01	MBX04	SecMbx01
DAG1-DB18	MBX02	MBX05	SecMbx02
DAG1-DB19	MBX03	MBX06	SecMbx03
DAG1-DB20	MBX04	MBX07	SecMbx04
DAG1-DB21	MBX05	MBX08	SecMbx01
DAG1-DB22	MBX06	MBX01	SecMbx02
DAG1-DB23	MBX07	MBX02	SecMbx03
DAG1-DB24	MBX08	MBX03	SecMbx04
DAG1-DB25	MBX01	MBX05	SecMbx01
DAG1-DB26	MBX02	MBX06	SecMbx02
DAG1-DB27	MBX03	MBX07	SecMbx03
DAG1-DB28	MBX04	MBX08	SecMbx04
DAG1-DB29	MBX05	MBX01	SecMbx01
DAG1-DB30	MBX06	MBX02	SecMbx02
DAG1-DB31	MBX07	MBX03	SecMbx03
DAG1-DB32	MBX08	MBX04	SecMbx04

Create Volumes

Based on the user workload, create two volumes per database instance for a total of 128 volumes on the primary site and 64 volumes on the secondary site. To create the volumes that house the LUNs for

Exchange data and logs, use the OnCommand System Manager or PowerShell toolkit or enter the commands into the storage management console. The following command shows the syntax necessary to create a new database volume. The size of the volumes can be adjusted to meet your requirements.

```
volume create -vserver Exchange_SVM1 -volume DBx -aggregate aggrxx -size 3.6TB -space-guarantee
none -snapshot-policy none -foreground true -Security-style ntfs

volume create -vserver Exchange_SVM1 -volume LOGx -aggregate aggrxx size 625GB -space-guarantee
none snapshot-policy none -foreground true -Security-style ntfs
```

After the volumes are created, change the volume option to turn on Read Reallocate to improve performance of the database reads.

```
vol modify -vserver Exchange_SVM1 -volume volume_name -read-realloc on
```

Create VMs

To install and configure an Exchange deployment for 10,000 active users, deploy the VMs listed in Table 21 on the vSphere environment. This table lists the VM configuration parameters for Microsoft 2016 installation.

Table 21) Microsoft Exchange 2016: VM configuration parameters.

Role	Number of VMs	RAM (GB)	CPU	HDD (GB)
Mailbox	8	64GB	8	450GB

1. Create the VMs listed in Table 21 and attach a virtual network interface in the MGMT network port group. The virtual network interface should be a VMXNET 3 adapter. After the VMs are created, install Windows Server 2016 on them.
2. Install VMware Tools, assign the IP address and gateway in the MGMT subnet, and join the machine to the AD domain.
3. Launch a PowerShell prompt by right-clicking the PowerShell icon in the taskbar and select Run as Administrator.
4. Enable remote management and remote desktop by using the SCONFIG application.

```
SCONFIG
```

5. Select Configure Remote Management.
6. Select Enable Remote Management.
7. Select Return to the Main Menu.
8. Select Remote Desktop.
9. Enter `E` to enable.
10. Enter `2` to allow any version of remote desktop. You are returned to the main menu.
11. Select Exit to Command Line.
12. Add .NET 3.5 and multipath I/O features by running the following command:

```
Add-WindowsFeature NET-Framework-Core, Multipath-IO -IncludeManagementTools -Restart -Source
D:\Sources\Sxs
```

Note: SnapDrive for Windows requires .Net 3.5.

13. Configure local administrator access.

```
# SnapDrive service account
Add-LocalGroupMember -Group Administrators -Member Colts\SDWSVC
# SnapManager for Exchange Service Account
Add-LocalGroupMember -Group Administrators -Member COLTS\SMESVC
# Dedicated installation account
```

```
Add-LocalGroupMember -Group Administrators -Member Colts\ExchInstall
```

Note: For future serviceability, NetApp recommends that you use a dedicated installation account that can be disabled after the software is deployed. This account can then be reenabled at any point in the future if access is denied.

14. Repeat steps 1 through 13 for each mailbox VM.
15. Install the Windows updates on the VM.

Configure iSCSI

To configure iSCSI connections from the mailbox VMs to the NetApp storage controllers, run the following PowerShell commands from each host:

1. Start the iSCSI service.

```
Set-Service -Name MSiSCSI -StartupType Automatic
Start-Service -Name MSiSCSI
```

2. Configure iSCSI target portals for each path to the workload SVM.

```
New-IscsiTargetPortal -InitiatorPortalAddress <<SQL_VM_iSCSIA_IP>> -TargetPortalAddress
<<Work_SVM_iSCSI01a_IP>>
New-IscsiTargetPortal -InitiatorPortalAddress <<SQL_VM_iSCSIA_IP>> -TargetPortalAddress
<<Work_SVM_iSCSI02a_IP>>
New-IscsiTargetPortal -InitiatorPortalAddress <<SQL_VM_iSCSIB_IP>> -TargetPortalAddress
<<Work_SVM_iSCSI01b_IP>>
New-IscsiTargetPortal -InitiatorPortalAddress <<SQL_VM_iSCSIB_IP>> -TargetPortalAddress
<<Work_SVM_iSCSI02b_IP>>
```

3. Connect to the target for SharePoint SVM.

```
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<SQL_VM_iSCSIA_IP>> -TargetPortalAddress <<Work_SVM_iSCSI01a_IP>>
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<SQL_VM_iSCSIA_IP>> -TargetPortalAddress <<Work_SVM_iSCSI01b_IP>>
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<SQL_VM_iSCSIB_IP>> -TargetPortalAddress <<Work_SVM_iSCSI02a_IP>>
Get-IscsiTarget |Connect-IscsiTarget -IsPersistent $True -IsMultipathEnabled $True `
  -InitiatorPortalAddress <<SQL_VM_iSCSIB_IP>> -TargetPortalAddress <<Work_SVM_iSCSI02b_IP>>
```

4. Verify the connections by running the following command:

```
Get-IscsiConnection
```

5. Configure MPIO for ONTAP.

```
New-MSDSMSupportedHW -VendorId NETAPP -ProductId "LUN C-Mode"
Update-MPIOClaimedHW -Confirm:$false
Restart-Computer
```

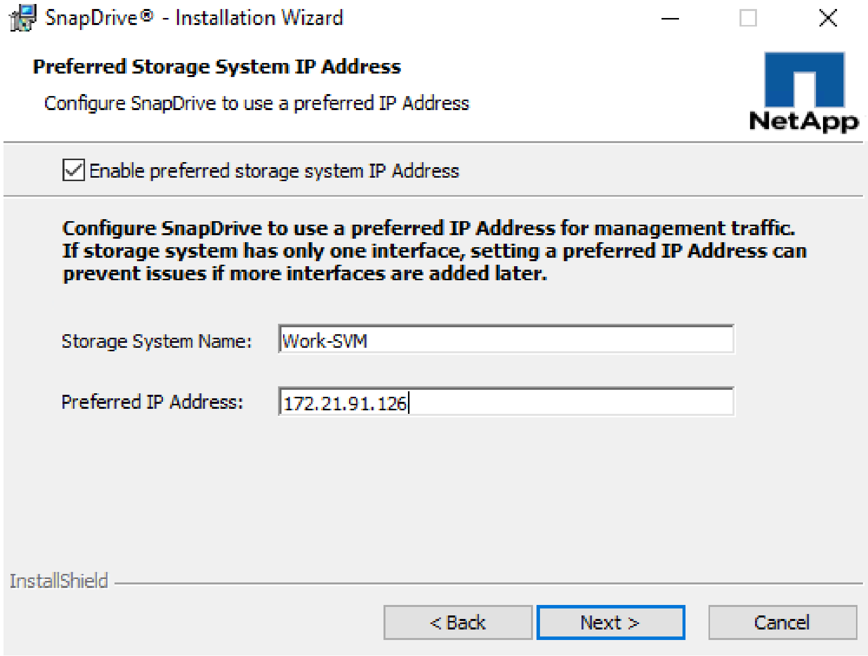
6. Repeat steps 1 through 5 for each mailbox VM.

SnapDrive for Windows

To install SnapDrive for Windows, run `SnapDrive7.1.4_x64.exe` as administrator and complete the following steps by using the installation wizard:

1. On the SnapDrive Installation wizard home page, click Next.
2. Select Per Storage System as the license type. Click Next.
3. On the Customer Information page, enter the customer information. Click Next.
4. (Optional) Change the SnapDrive Installation folder. Click Next on the Destination Folder page.
5. Select the Enable SnapDrive to Communicate Through the Windows Firewall option and click Next.
6. Enter an account that can be used as a service account for the SnapDrive services. This account must be a member of the built-in administrators group. Click Next.

7. Make sure that the SnapDrive web service ports are not conflicting. Click Next.
8. On the Preferred Storage System IP Address page, select the Enable Preferred Storage System IP Address option. Specify the storage system to configure SnapDrive for management traffic. Click Next.



SnapDrive® - Installation Wizard

Preferred Storage System IP Address

Configure SnapDrive to use a preferred IP Address

☑ Enable preferred storage system IP Address

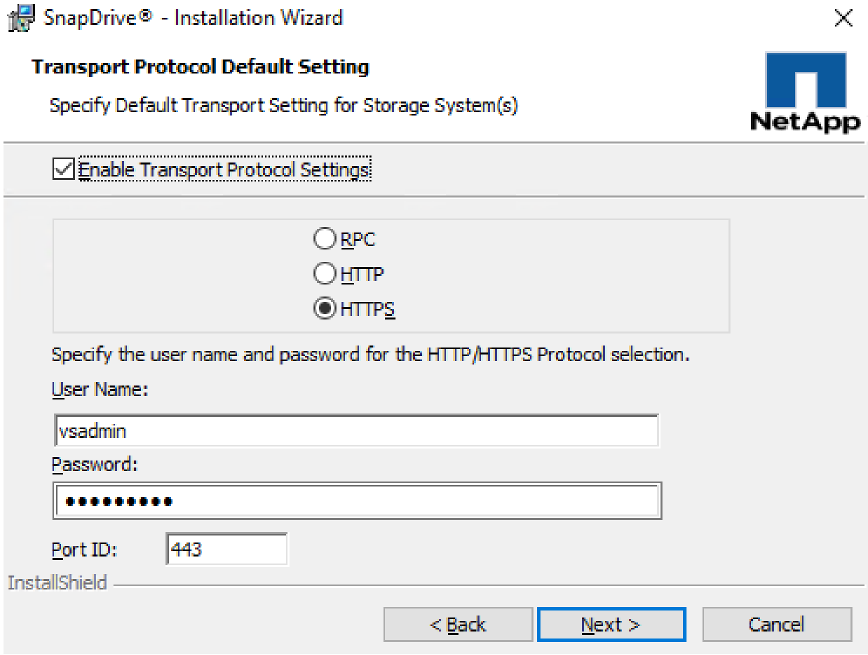
Configure SnapDrive to use a preferred IP Address for management traffic. If storage system has only one interface, setting a preferred IP Address can prevent issues if more interfaces are added later.

Storage System Name: Work-SVM

Preferred IP Address: 172.21.91.126

9. On the Transport Protocol Default Setting page, select the Enable the Transport Protocol Settings option. Enabling the transport protocol allows you to talk to the storage system.

   Select the HTTPS option. Selecting HTTPS requires you to enter a user name, password, and port ID. Click Next.



SnapDrive® - Installation Wizard

Transport Protocol Default Setting

Specify Default Transport Setting for Storage System(s)

☑ Enable Transport Protocol Settings

○ RPC
○ HTTP
● HTTPS

Specify the user name and password for the HTTP/HTTPS Protocol selection.

User Name: vsadmin

Password: •••••••••

Port ID: 443

10. Click Next in the Unified Manager Configuration.

11. Click Install to begin the SnapDrive installation.
12. Repeat steps 1 through 11 for each mailbox VM.

Create LUNs

This section describes how to create the required LUNs and map them to the appropriate location.

Table 22) Exchange LUN reference.

Server	Database	Volume	VolSize	LUN Size	LUN	Mount
MBX1	DB01	DAG1_DB01_1	3.6T	2.4TB	/vol/DAG1_DB01_1/DB01.lun	C:\db\DB01
MBX2	DB01	DAG1_DB01_2	3.6T	2.4TB	/vol/DAG1_DB01_2/DB01.lun	C:\db\DB01
MBX2	DB02	DAG1_DB02_1	3.6T	2.4TB	/vol/DAG1_DB02_1/DB02.lun	C:\db\DB02
MBX3	DB02	DAG1_DB02_2	3.6T	2.4TB	/vol/DAG1_DB02_2/DB02.lun	C:\db\DB02
MBX3	DB03	DAG1_DB03_1	3.6T	2.4TB	/vol/DAG1_DB03_1/DB03.lun	C:\db\DB03
MBX4	DB03	DAG1_DB03_2	3.6T	2.4TB	/vol/DAG1_DB03_2/DB03.lun	C:\db\DB03
MBX4	DB04	DAG1_DB04_1	3.6T	2.4TB	/vol/DAG1_DB04_1/DB04.lun	C:\db\DB04
MBX5	DB04	DAG1_DB04_2	3.6T	2.4TB	/vol/DAG1_DB04_2/DB04.lun	C:\db\DB04
MBX5	DB05	DAG1_DB05_1	3.6T	2.4TB	/vol/DAG1_DB05_1/DB05.lun	C:\db\DB05
MBX6	DB05	DAG1_DB05_2	3.6T	2.4TB	/vol/DAG1_DB05_2/DB05.lun	C:\db\DB05
MBX6	DB06	DAG1_DB06_1	3.6T	2.4TB	/vol/DAG1_DB06_1/DB06.lun	C:\db\DB06
MBX7	DB06	DAG1_DB06_2	3.6T	2.4TB	/vol/DAG1_DB06_2/DB06.lun	C:\db\DB06
MBX7	DB07	DAG1_DB07_1	3.6T	2.4TB	/vol/DAG1_DB07_1/DB07.lun	C:\db\DB07
MBX8	DB07	DAG1_DB07_2	3.6T	2.4TB	/vol/DAG1_DB07_2/DB07.lun	C:\db\DB07
MBX8	DB08	DAG1_DB08_1	3.6T	2.4TB	/vol/DAG1_DB08_1/DB08.lun	C:\db\DB08
MBX1	DB08	DAG1_DB08_2	3.6T	2.4TB	/vol/DAG1_DB08_2/DB08.lun	C:\db\DB08
MBX1	DB09	DAG1_DB09_1	3.6T	2.4TB	/vol/DAG1_DB09_1/DB09.lun	C:\db\DB09
MBX3	DB09	DAG1_DB09_2	3.6T	2.4TB	/vol/DAG1_DB09_2/DB09.lun	C:\db\DB09
MBX2	DB10	DAG1_DB10_1	3.6T	2.4TB	/vol/DAG1_DB10_1/DB10.lun	C:\db\DB10
MBX4	DB10	DAG1_DB10_2	3.6T	2.4TB	/vol/DAG1_DB10_2/DB10.lun	C:\db\DB10
MBX3	DB11	DAG1_DB11_1	3.6T	2.4TB	/vol/DAG1_DB11_1/DB11.lun	C:\db\DB11
MBX5	DB11	DAG1_DB11_2	3.6T	2.4TB	/vol/DAG1_DB11_2/DB11.lun	C:\db\DB11
MBX4	DB12	DAG1_DB12_1	3.6T	2.4TB	/vol/DAG1_DB12_1/DB12.lun	C:\db\DB12
MBX6	DB12	DAG1_DB12_2	3.6T	2.4TB	/vol/DAG1_DB12_2/DB12.lun	C:\db\DB12
MBX5	DB13	DAG1_DB13_1	3.6T	2.4TB	/vol/DAG1_DB13_1/DB13.lun	C:\db\DB13
MBX7	DB13	DAG1_DB13_2	3.6T	2.4TB	/vol/DAG1_DB13_2/DB13.lun	C:\db\DB13

Server	Database	Volume	VolSize	LUN Size	LUN	Mount
MBX6	DB14	DAG1_DB14_1	3.6T	2.4TB	/vol/DAG1_DB14_1/DB14.lun	C:\db\DB14
MBX8	DB14	DAG1_DB14_2	3.6T	2.4TB	/vol/DAG1_DB14_2/DB14.lun	C:\db\DB14
MBX7	DB15	DAG1_DB15_1	3.6T	2.4TB	/vol/DAG1_DB15_1/DB15.lun	C:\db\DB15
MBX1	DB15	DAG1_DB15_2	3.6T	2.4TB	/vol/DAG1_DB15_2/DB15.lun	C:\db\DB15
MBX8	DB16	DAG1_DB16_1	3.6T	2.4TB	/vol/DAG1_DB16_1/DB16.lun	C:\db\DB16
MBX2	DB16	DAG1_DB16_2	3.6T	2.4TB	/vol/DAG1_DB16_2/DB16.lun	C:\db\DB16
MBX1	DB17	DAG1_DB17_1	3.6T	2.4TB	/vol/DAG1_DB17_1/DB17.lun	C:\db\DB17
MBX4	DB17	DAG1_DB17_2	3.6T	2.4TB	/vol/DAG1_DB17_2/DB17.lun	C:\db\DB17
MBX2	DB18	DAG1_DB18_1	3.6T	2.4TB	/vol/DAG1_DB18_1/DB18.lun	C:\db\DB18
MBX5	DB18	DAG1_DB18_2	3.6T	2.4TB	/vol/DAG1_DB18_2/DB18.lun	C:\db\DB18
MBX3	DB19	DAG1_DB19_1	3.6T	2.4TB	/vol/DAG1_DB19_1/DB19.lun	C:\db\DB19
MBX6	DB19	DAG1_DB19_2	3.6T	2.4TB	/vol/DAG1_DB19_2/DB19.lun	C:\db\DB19
MBX4	DB20	DAG1_DB20_1	3.6T	2.4TB	/vol/DAG1_DB20_1/DB20.lun	C:\db\DB20
MBX7	DB20	DAG1_DB20_2	3.6T	2.4TB	/vol/DAG1_DB20_2/DB20.lun	C:\db\DB20
MBX5	DB21	DAG1_DB21_1	3.6T	2.4TB	/vol/DAG1_DB21_1/DB21.lun	C:\db\DB21
MBX8	DB21	DAG1_DB21_2	3.6T	2.4TB	/vol/DAG1_DB21_2/DB21.lun	C:\db\DB21
MBX6	DB22	DAG1_DB22_1	3.6T	2.4TB	/vol/DAG1_DB22_1/DB22.lun	C:\db\DB22
MBX1	DB22	DAG1_DB22_2	3.6T	2.4TB	/vol/DAG1_DB22_2/DB22.lun	C:\db\DB22
MBX7	DB23	DAG1_DB23_1	3.6T	2.4TB	/vol/DAG1_DB23_1/DB23.lun	C:\db\DB23
MBX2	DB23	DAG1_DB23_2	3.6T	2.4TB	/vol/DAG1_DB23_2/DB23.lun	C:\db\DB23
MBX8	DB24	DAG1_DB24_1	3.6T	2.4TB	/vol/DAG1_DB24_1/DB24.lun	C:\db\DB24
MBX3	DB24	DAG1_DB24_2	3.6T	2.4TB	/vol/DAG1_DB24_2/DB24.lun	C:\db\DB24
MBX1	DB25	DAG1_DB25_1	3.6T	2.4TB	/vol/DAG1_DB25_1/DB25.lun	C:\db\DB25
MBX5	DB25	DAG1_DB25_2	3.6T	2.4TB	/vol/DAG1_DB25_2/DB25.lun	C:\db\DB25
MBX2	DB26	DAG1_DB26_1	3.6T	2.4TB	/vol/DAG1_DB26_1/DB26.lun	C:\db\DB26
MBX6	DB26	DAG1_DB26_2	3.6T	2.4TB	/vol/DAG1_DB26_2/DB26.lun	C:\db\DB26
MBX3	DB27	DAG1_DB27_1	3.6T	2.4TB	/vol/DAG1_DB27_1/DB27.lun	C:\db\DB27
MBX7	DB27	DAG1_DB27_2	3.6T	2.4TB	/vol/DAG1_DB27_2/DB27.lun	C:\db\DB27
MBX4	DB28	DAG1_DB28_1	3.6T	2.4TB	/vol/DAG1_DB28_1/DB28.lun	C:\db\DB28
MBX8	DB28	DAG1_DB28_2	3.6T	2.4TB	/vol/DAG1_DB28_2/DB28.lun	C:\db\DB28
MBX5	DB29	DAG1_DB29_1	3.6T	2.4TB	/vol/DAG1_DB29_1/DB29.lun	C:\db\DB29

Server	Database	Volume	VolSize	LUN Size	LUN	Mount
MBX1	DB29	DAG1_DB29_2	3.6T	2.4TB	/vol/DAG1_DB29_2/DB29.lun	C:\db\DB29
MBX6	DB30	DAG1_DB30_1	3.6T	2.4TB	/vol/DAG1_DB30_1/DB30.lun	C:\db\DB30
MBX2	DB30	DAG1_DB30_2	3.6T	2.4TB	/vol/DAG1_DB30_2/DB30.lun	C:\db\DB30
MBX7	DB31	DAG1_DB31_1	3.6T	2.4TB	/vol/DAG1_DB31_1/DB31.lun	C:\db\DB31
MBX3	DB31	DAG1_DB31_2	3.6T	2.4TB	/vol/DAG1_DB31_2/DB31.lun	C:\db\DB31
MBX8	DB32	DAG1_DB32_1	3.6T	2.4TB	/vol/DAG1_DB32_1/DB32.lun	C:\db\DB32
MBX4	DB32	DAG1_DB32_2	3.6T	2.4TB	/vol/DAG1_DB32_2/DB32.lun	C:\db\DB32
MBX1	DB01	DAG1_Log01_1	100G	50GB	/vol/DAG1_Log01_1/Log01.lun	C:\log\DB01
MBX2	DB01	DAG1_Log01_2	100G	50GB	/vol/DAG1_Log01_2/Log01.lun	C:\log\DB01
MBX2	DB02	DAG1_Log02_1	100G	50GB	/vol/DAG1_Log02_1/Log02.lun	C:\log\DB02
MBX3	DB02	DAG1_Log02_2	100G	50GB	/vol/DAG1_Log02_2/Log02.lun	C:\log\DB02
MBX3	DB03	DAG1_Log03_1	100G	50GB	/vol/DAG1_Log03_1/Log03.lun	C:\log\DB03
MBX4	DB03	DAG1_Log03_2	100G	50GB	/vol/DAG1_Log03_2/Log03.lun	C:\log\DB03
MBX4	DB04	DAG1_Log04_1	100G	50GB	/vol/DAG1_Log04_1/Log04.lun	C:\log\DB04
MBX5	DB04	DAG1_Log04_2	100G	50GB	/vol/DAG1_Log04_2/Log04.lun	C:\log\DB04
MBX5	DB05	DAG1_Log05_1	100G	50GB	/vol/DAG1_Log05_1/Log05.lun	C:\log\DB05
MBX6	DB05	DAG1_Log05_2	100G	50GB	/vol/DAG1_Log05_2/Log05.lun	C:\log\DB05
MBX6	DB06	DAG1_Log06_1	100G	50GB	/vol/DAG1_Log06_1/Log06.lun	C:\log\DB06
MBX7	DB06	DAG1_Log06_2	100G	50GB	/vol/DAG1_Log06_2/Log06.lun	C:\log\DB06
MBX7	DB07	DAG1_Log07_1	100G	50GB	/vol/DAG1_Log07_1/Log07.lun	C:\log\DB07
MBX8	DB07	DAG1_Log07_2	100G	50GB	/vol/DAG1_Log07_2/Log07.lun	C:\log\DB07
MBX8	DB08	DAG1_Log08_1	100G	50GB	/vol/DAG1_Log08_1/Log08.lun	C:\log\DB08
MBX1	DB08	DAG1_Log08_2	100G	50GB	/vol/DAG1_Log08_2/Log08.lun	C:\log\DB08
MBX1	DB09	DAG1_Log09_1	100G	50GB	/vol/DAG1_Log09_1/Log09.lun	C:\log\DB09
MBX3	DB09	DAG1_Log09_2	100G	50GB	/vol/DAG1_Log09_2/Log09.lun	C:\log\DB09
MBX2	DB10	DAG1_Log10_1	100G	50GB	/vol/DAG1_Log10_1/Log10.lun	C:\log\DB10
MBX4	DB10	DAG1_Log10_2	100G	50GB	/vol/DAG1_Log10_2/Log10.lun	C:\log\DB10
MBX3	DB11	DAG1_Log11_1	100G	50GB	/vol/DAG1_Log11_1/Log11.lun	C:\log\DB11
MBX5	DB11	DAG1_Log11_2	100G	50GB	/vol/DAG1_Log11_2/Log11.lun	C:\log\DB11
MBX4	DB12	DAG1_Log12_1	100G	50GB	/vol/DAG1_Log12_1/Log12.lun	C:\log\DB12
MBX6	DB12	DAG1_Log12_2	100G	50GB	/vol/DAG1_Log12_2/Log12.lun	C:\log\DB12

Server	Database	Volume	VolSize	LUN Size	LUN	Mount
MBX5	DB13	DAG1_Log13_1	100G	50GB	/vol/DAG1_Log13_1/Log13.lun	C:\log\DB13
MBX7	DB13	DAG1_Log13_2	100G	50GB	/vol/DAG1_Log13_2/Log13.lun	C:\log\DB13
MBX6	DB14	DAG1_Log14_1	100G	50GB	/vol/DAG1_Log14_1/Log14.lun	C:\log\DB14
MBX8	DB14	DAG1_Log14_2	100G	50GB	/vol/DAG1_Log14_2/Log14.lun	C:\log\DB14
MBX7	DB15	DAG1_Log15_1	100G	50GB	/vol/DAG1_Log15_1/Log15.lun	C:\log\DB15
MBX1	DB15	DAG1_Log15_2	100G	50GB	/vol/DAG1_Log15_2/Log15.lun	C:\log\DB15
MBX8	DB16	DAG1_Log16_1	100G	50GB	/vol/DAG1_Log16_1/Log16.lun	C:\log\DB16
MBX2	DB16	DAG1_Log16_2	100G	50GB	/vol/DAG1_Log16_2/Log16.lun	C:\log\DB16
MBX1	DB17	DAG1_Log17_1	100G	50GB	/vol/DAG1_Log17_1/Log17.lun	C:\log\DB17
MBX4	DB17	DAG1_Log17_2	100G	50GB	/vol/DAG1_Log17_2/Log17.lun	C:\log\DB17
MBX2	DB18	DAG1_Log18_1	100G	50GB	/vol/DAG1_Log18_1/Log18.lun	C:\log\DB18
MBX5	DB18	DAG1_Log18_2	100G	50GB	/vol/DAG1_Log18_2/Log18.lun	C:\log\DB18
MBX3	DB19	DAG1_Log19_1	100G	50GB	/vol/DAG1_Log19_1/Log19.lun	C:\log\DB19
MBX6	DB19	DAG1_Log19_2	100G	50GB	/vol/DAG1_Log19_2/Log19.lun	C:\log\DB19
MBX4	DB20	DAG1_Log20_1	100G	50GB	/vol/DAG1_Log20_1/Log20.lun	C:\log\DB20
MBX7	DB20	DAG1_Log20_2	100G	50GB	/vol/DAG1_Log20_2/Log20.lun	C:\log\DB20
MBX5	DB21	DAG1_Log21_1	100G	50GB	/vol/DAG1_Log21_1/Log21.lun	C:\log\DB21
MBX8	DB21	DAG1_Log21_2	100G	50GB	/vol/DAG1_Log21_2/Log21.lun	C:\log\DB21
MBX6	DB22	DAG1_Log22_1	100G	50GB	/vol/DAG1_Log22_1/Log22.lun	C:\log\DB22
MBX1	DB22	DAG1_Log22_2	100G	50GB	/vol/DAG1_Log22_2/Log22.lun	C:\log\DB22
MBX7	DB23	DAG1_Log23_1	100G	50GB	/vol/DAG1_Log23_1/Log23.lun	C:\log\DB23
MBX2	DB23	DAG1_Log23_2	100G	50GB	/vol/DAG1_Log23_2/Log23.lun	C:\log\DB23
MBX8	DB24	DAG1_Log24_1	100G	50GB	/vol/DAG1_Log24_1/Log24.lun	C:\log\DB24
MBX3	DB24	DAG1_Log24_2	100G	50GB	/vol/DAG1_Log24_2/Log24.lun	C:\log\DB24
MBX1	DB25	DAG1_Log25_1	100G	50GB	/vol/DAG1_Log25_1/Log25.lun	C:\log\DB25
MBX5	DB25	DAG1_Log25_2	100G	50GB	/vol/DAG1_Log25_2/Log25.lun	C:\log\DB25
MBX2	DB26	DAG1_Log26_1	100G	50GB	/vol/DAG1_Log26_1/Log26.lun	C:\log\DB26
MBX6	DB26	DAG1_Log26_2	100G	50GB	/vol/DAG1_Log26_2/Log26.lun	C:\log\DB26
MBX3	DB27	DAG1_Log27_1	100G	50GB	/vol/DAG1_Log27_1/Log27.lun	C:\log\DB27
MBX7	DB27	DAG1_Log27_2	100G	50GB	/vol/DAG1_Log27_2/Log27.lun	C:\log\DB27
MBX4	DB28	DAG1_Log28_1	100G	50GB	/vol/DAG1_Log28_1/Log28.lun	C:\log\DB28

Server	Database	Volume	VolSize	LUN Size	LUN	Mount
MBX8	DB28	DAG1_Log28_2	100G	50GB	/vol/DAG1_Log28_2/Log28.lun	C:\log\DB28
MBX5	DB29	DAG1_Log29_1	100G	50GB	/vol/DAG1_Log29_1/Log29.lun	C:\log\DB29
MBX1	DB29	DAG1_Log29_2	100G	50GB	/vol/DAG1_Log29_2/Log29.lun	C:\log\DB29
MBX6	DB30	DAG1_Log30_1	100G	50GB	/vol/DAG1_Log30_1/Log30.lun	C:\log\DB30
MBX2	DB30	DAG1_Log30_2	100G	50GB	/vol/DAG1_Log30_2/Log30.lun	C:\log\DB30
MBX7	DB31	DAG1_Log31_1	100G	50GB	/vol/DAG1_Log31_1/Log31.lun	C:\log\DB31
MBX3	DB31	DAG1_Log31_2	100G	50GB	/vol/DAG1_Log31_2/Log31.lun	C:\log\DB31
MBX8	DB32	DAG1_Log32_1	100G	50GB	/vol/DAG1_Log32_1/Log32.lun	C:\log\DB32
MBX4	DB32	DAG1_Log32_2	100G	50GB	/vol/DAG1_Log32_2/Log32.lun	C:\log\DB32

NetApp recommends using SnapDrive for Windows to create the LUNs to house the databases and logs for your Exchange servers. There are two methods available to create the LUNs: use the SDW GUI or the SDCLI. The following examples use the SDCLI method.

```
sdcli disk create -dtype dedicated -m mailbox1 -D c:\DB\DBx -p Share-SVM:/vol/DBx/DBx.lun -I
initiatorname -z lunsize
```

Use the following environment variables for the SDCLI:

- `-m`: machine name
- `-D`: mount point location
- `-p`: path to the volume where the LUN is created
- `-I`: initiator name
- `-z`: LUN size

Change the variables to meet the requirements of your environment.

Install Exchange 2016 Prerequisites

The VMs are ready to use. Before you install Exchange 2016, you need to install the SharePoint prerequisites.

1. Install Windows Server 2016 prerequisites for the mailbox role.

```
Install-WindowsFeature NET-Framework-45-Features, RPC-over-HTTP-proxy, RSAT-Clustering, RSAT-
Clustering-CmdInterface, RSAT-Clustering-Mgmt, RSAT-Clustering-PowerShell, Web-Mgmt-Console, WAS-
Process-Model, Web-Asp-Net45, Web-Basic-Auth, Web-Client-Auth, Web-Digest-Auth, Web-Dir-Browsing,
Web-Dyn-Compression, Web-Http-Errors, Web-Http-Logging, Web-Http-Redirect, Web-Http-Tracing, Web-
ISAPI-Ext, Web-ISAPI-Filter, Web-Lgcy-Mgmt-Console, Web-Metabase, Web-Mgmt-Console, Web-Mgmt-
Service, Web-Net-Ext45, Web-Request-Monitor, Web-Server, Web-Stat-Compression, Web-Static-
Content, Web-Windows-Auth, Web-WMI, Windows-Identity-Foundation, RSAT-ADDS
```

2. Repeat step 1 for each Exchange VM.

Install Unified Communications Management API 4.0

To install Unified Communications Management API 4.0 Runtime, complete the following steps:

1. Download the Unified Communications Managed API 4.0 Runtime: http://www.microsoft.com/en-us/download/details.aspx?id=34992.
2. Right-click the `UcmaRuntimeSetup.exe` file and select Run As Administrator.

3. In the introduction window, click Next.
4. Review and accept the license terms and click Install.
5. Click Finish to complete the installation.
6. Repeat steps 1 through 5 for each Exchange VM.

Prepare Active Directory for Exchange Server 2016 U6

This section describes how to prepare Active Directory for the Exchange 2016 installation.

Extend Active Directory Schema

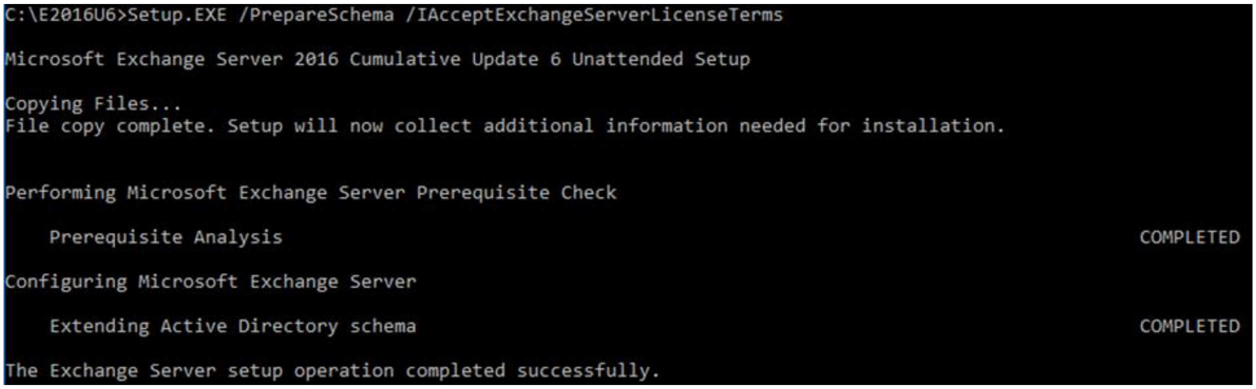
To extend the AD schema, complete the following steps:

1. Run `setup.exe` from the Exchange distribution with the parameters listed in step 2.

   Note: This operation must be executed just one time from a single server.

2. Open an elevated command prompt and run the following command to extend the AD schema:

```
Setup.exe /PrepareSchema /IAcceptExchangeServerLicenseTerms
```



```
C:\E2016U6>Setup.EXE /PrepareSchema /IAcceptExchangeServerLicenseTerms

Microsoft Exchange Server 2016 Cumulative Update 6 Unattended Setup

Copying Files...
File copy complete. Setup will now collect additional information needed for installation.


Performing Microsoft Exchange Server Prerequisite Check

    Prerequisite Analysis                                                                COMPLETED

Configuring Microsoft Exchange Server

    Extending Active Directory schema                                                    COMPLETED

The Exchange Server setup operation completed successfully.
```

Prepare AD

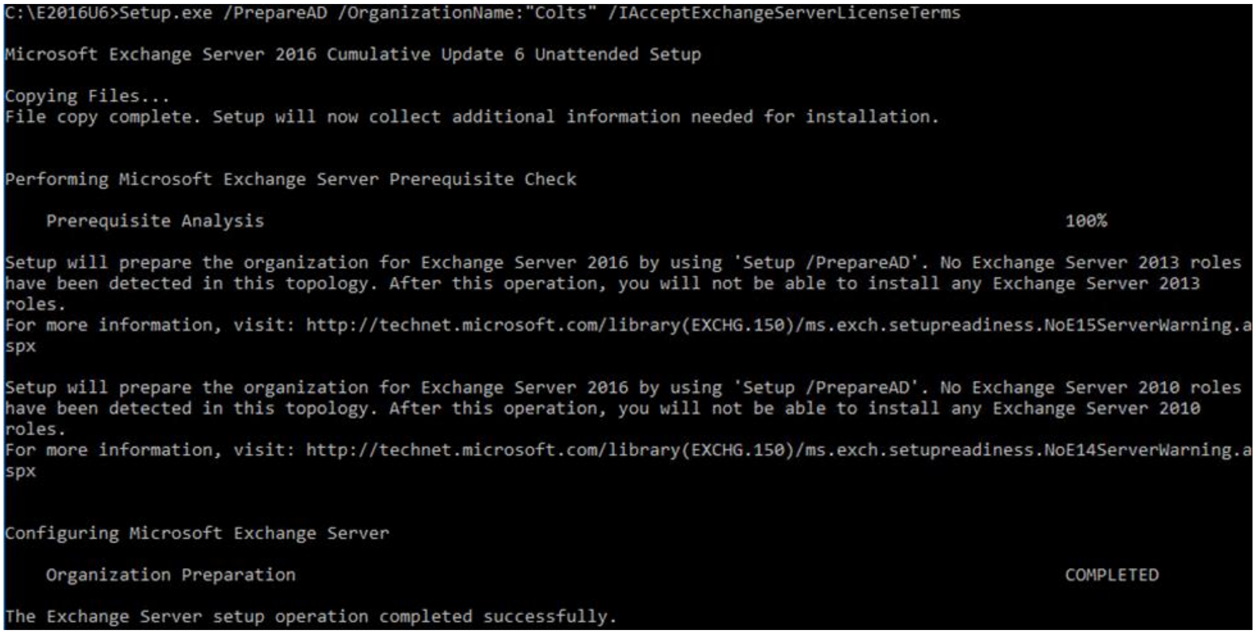
To prepare AD, complete the following steps:

1. Run `setup.exe` from the Exchange distribution with the parameters listed in step 2.

   Note: This operation must be executed just one time from a single server.

2. Open an elevated command prompt and run the following command to prepare AD:

```
Setup.exe /PrepareAD /OrganizationName:”Colts” /IAcceptExchangeServerLicenseTerms
```



```
C:\E2016U6>Setup.exe /PrepareAD /OrganizationName:"Colts" /IAcceptExchangeServerLicenseTerms

Microsoft Exchange Server 2016 Cumulative Update 6 Unattended Setup

Copying Files...
File copy complete. Setup will now collect additional information needed for installation.


Performing Microsoft Exchange Server Prerequisite Check

    Prerequisite Analysis                                                                  100%

Setup will prepare the organization for Exchange Server 2016 by using 'Setup /PrepareAD'. No Exchange Server 2013 roles
have been detected in this topology. After this operation, you will not be able to install any Exchange Server 2013
roles.
For more information, visit: http://technet.microsoft.com/library(EXCHG.150)/ms.exch.setupreadiness.NoE15ServerWarning.a
spx

Setup will prepare the organization for Exchange Server 2016 by using 'Setup /PrepareAD'. No Exchange Server 2010 roles
have been detected in this topology. After this operation, you will not be able to install any Exchange Server 2010
roles.
For more information, visit: http://technet.microsoft.com/library(EXCHG.150)/ms.exch.setupreadiness.NoE14ServerWarning.a
spx


Configuring Microsoft Exchange Server

    Organization Preparation                                                               COMPLETED

The Exchange Server setup operation completed successfully.
```

Prepare AD Domains

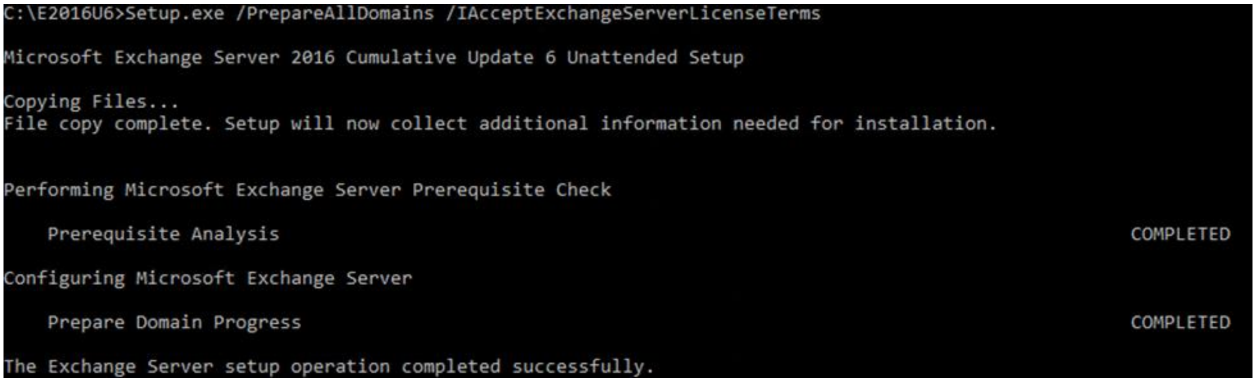
To prepare the AD domains, complete the following steps:

1. Run `setup.exe` from the Exchange distribution with the parameters listed in step 2.

   Note: This operation must be executed just one time from a single server.

2. Open an elevated command prompt and run the following command to prepare AD domains:

```
Setup.exe /PrepareAllDomains /IAcceptExchangeServerLicenseTerms
```



```
C:\E2016U6>Setup.exe /PrepareAllDomains /IAcceptExchangeServerLicenseTerms

Microsoft Exchange Server 2016 Cumulative Update 6 Unattended Setup

Copying Files...
File copy complete. Setup will now collect additional information needed for installation.


Performing Microsoft Exchange Server Prerequisite Check

    Prerequisite Analysis                                                                  COMPLETED

Configuring Microsoft Exchange Server

    Prepare Domain Progress                                                                COMPLETED

The Exchange Server setup operation completed successfully.
```

Verify AD Preparation

To verify the AD preparation, complete the following steps:

1. Open ADSI Edit.
2. Right-click ADSI Edit in the navigation pane and click Connect.
3. In Connection Settings, select the Select a Well-Known Naming Context option and then select Configuration. Click OK.
4. Expand Configuration [<domain FQDN>], CN=Configuration, DC=domain, DC=com, CN=Services, CN=Microsoft Exchange.

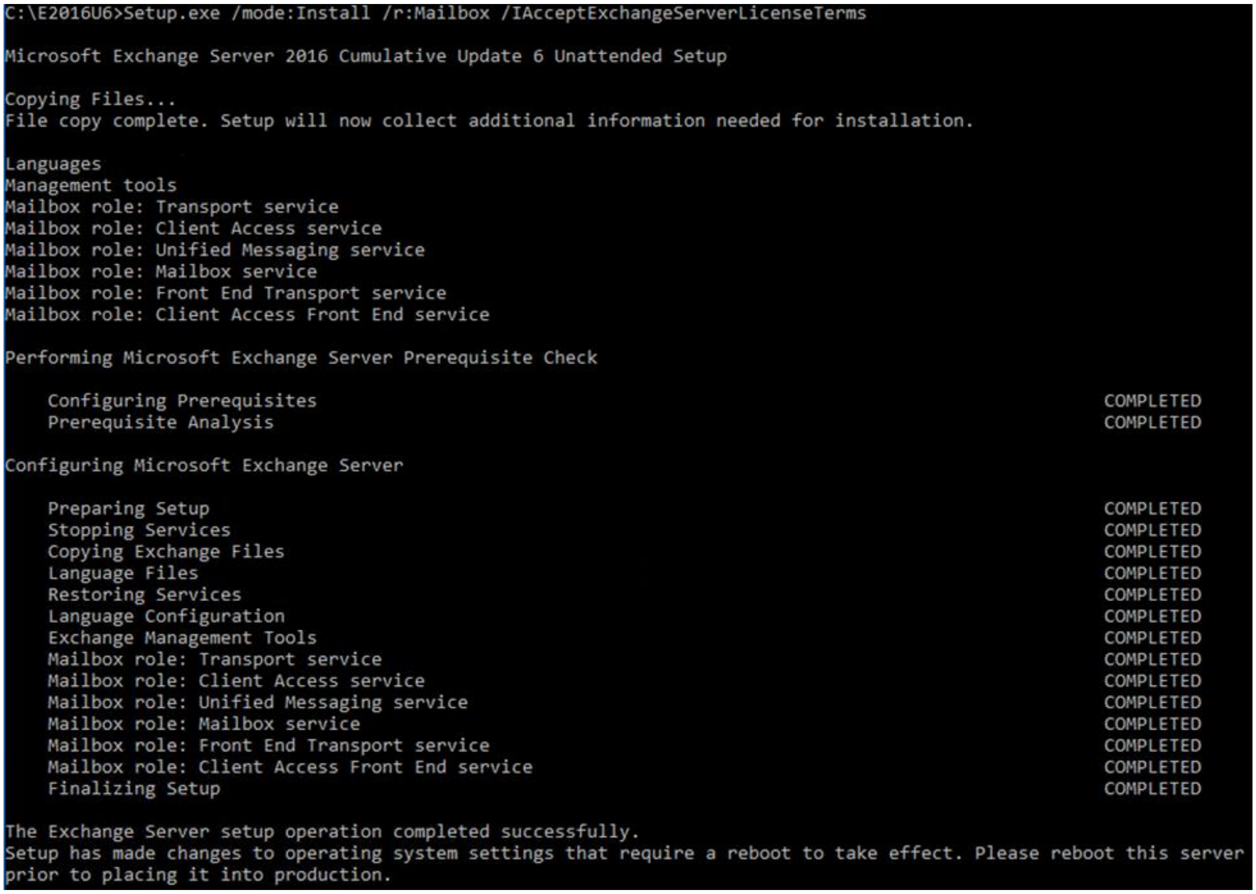
5. Right-click CN=<your Exchange organization name> and then select Properties.
6. Make sure the value in msExchangeProductId matches the value in the Exchange 2016 Active Directory versions table for the version of Exchange 2016 you are installing.

Install Exchange Server 2016 Mailbox Role

To perform an unattended installation of Exchange 2016, complete the following steps:

1. Run the following command from the Exchange 2016 installation directory to install the mailbox role:

```
Setup.exe /mode:Install /r:Mailbox /IAcceptExchangeServerLicenseTerms
```



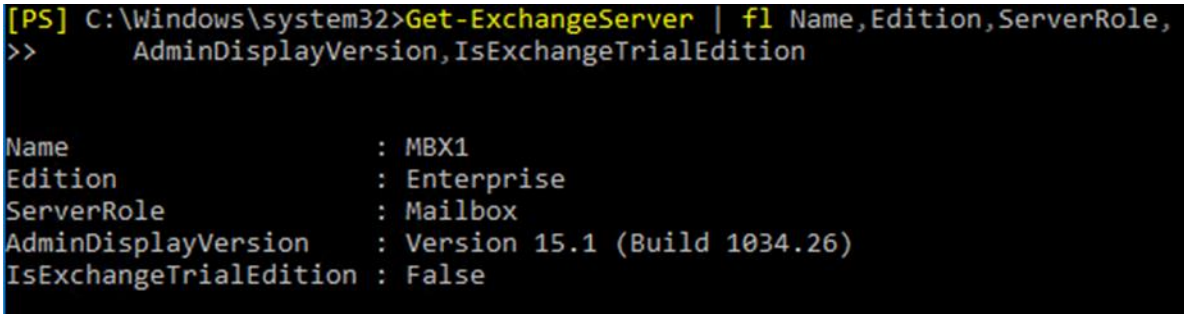
```
C:\E2016U6>Setup.exe /mode:Install /r:Mailbox /IAcceptExchangeServerLicenseTerms

Microsoft Exchange Server 2016 Cumulative Update 6 Unattended Setup

Copying Files...
File copy complete. Setup will now collect additional information needed for installation.

Languages
Management tools
Mailbox role: Transport service
Mailbox role: Client Access service
Mailbox role: Unified Messaging service
Mailbox role: Mailbox service
Mailbox role: Front End Transport service
Mailbox role: Client Access Front End service

Performing Microsoft Exchange Server Prerequisite Check

    Configuring Prerequisites                                                                   COMPLETED
    Prerequisite Analysis                                                                       COMPLETED

Configuring Microsoft Exchange Server

    Preparing Setup                                                                             COMPLETED
    Stopping Services                                                                           COMPLETED
    Copying Exchange Files                                                                      COMPLETED
    Language Files                                                                              COMPLETED
    Restoring Services                                                                          COMPLETED
    Language Configuration                                                                      COMPLETED
    Exchange Management Tools                                                                   COMPLETED
    Mailbox role: Transport service                                                             COMPLETED
    Mailbox role: Client Access service                                                         COMPLETED
    Mailbox role: Unified Messaging service                                                     COMPLETED
    Mailbox role: Mailbox service                                                               COMPLETED
    Mailbox role: Front End Transport service                                                   COMPLETED
    Mailbox role: Client Access Front End service                                               COMPLETED
    Finalizing Setup                                                                            COMPLETED

The Exchange Server setup operation completed successfully.
Setup has made changes to operating system settings that require a reboot to take effect. Please reboot this server
prior to placing it into production.
```

2. Enter the product key by using the Exchange Management Shell.

```
Set-ExchangeServer $env:COMPUTERNAME -ProductKey *****-*****-****-*****-*****
```

3. Restart the MSExchangeIS service for the new key to take effect.
4. Verify that the Exchange enterprise license has taken effect.

```
Get-ExchangeServer | fl Name,Edition,ServerRole,
     AdminDisplayVersion,IsExchangeTrialEdition
```



```
[PS] C:\Windows\system32>Get-ExchangeServer | fl Name,Edition,ServerRole,
>>      AdminDisplayVersion,IsExchangeTrialEdition


Name                   : MBX1
Edition                : Enterprise
ServerRole             : Mailbox
AdminDisplayVersion    : Version 15.1 (Build 1034.26)
IsExchangeTrialEdition : False
```

5. Restart the computer to finalize the installation.
6. Repeat steps 1 through 5 on the remaining Exchange servers.

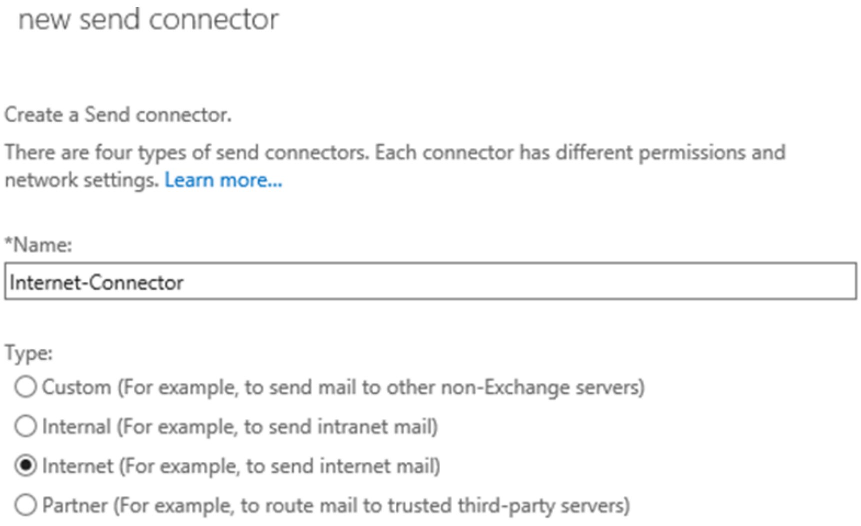
   Note: At the time of this validation, the CU6 installer failed to stage the necessary file. This resulted in errors related to the autodiscover service. Copy the following shared web configuration file to the ClientAccess root installation folder if the `SharedWebConfig.config` file is missing.

```
copy "C:\Program Files\Microsoft\Exchange Server\V15\FrontEnd\HttpProxy\SharedWebConfig.config"
"C:\Program Files\Microsoft\Exchange Server\V15\ClientAccess\SharedWebConfig.config"
```

Configure Mail Flow

To configure mail flow, complete the following steps:

1. Open the EAC by browsing to https://localhost/ecp on any of the mailbox servers.
2. Enter your user name and password and click Sign in.
3. In the left pane, click Mail Flow and then select Send Connecters in the top-right pane. Click the + symbol to add a new connector.
4. In the New Send Connector wizard, enter the name for the new send connecter and then select Internet. Click Next.



new send connector

Create a Send connector.

There are four types of send connectors. Each connector has different permissions and network settings. Learn more...

*Name:

Internet-Connector

Type:

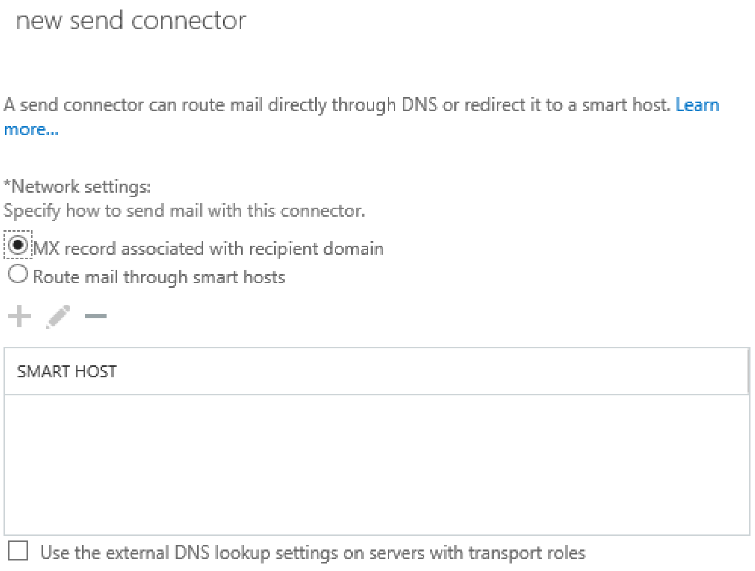
○ Custom (For example, to send mail to other non-Exchange servers)

○ Internal (For example, to send intranet mail)

● Internet (For example, to send internet mail)

○ Partner (For example, to route mail to trusted third-party servers)

5. Select the MX Record Associated with Recipient Domain option and click Next.



new send connector

A send connector can route mail directly through DNS or redirect it to a smart host. Learn more...

*Network settings:
Specify how to send mail with this connector.

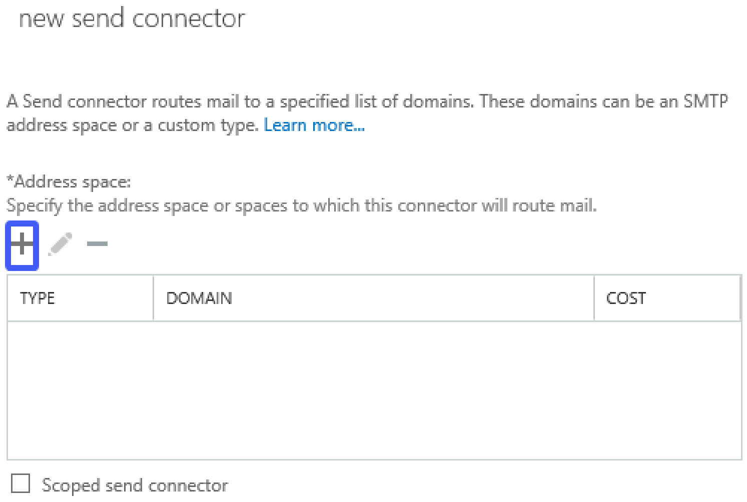
● MX record associated with recipient domain

○ Route mail through smart hosts

SMART HOST

□ Use the external DNS lookup settings on servers with transport roles

6. Click the + symbol to enter the new address space.



new send connector

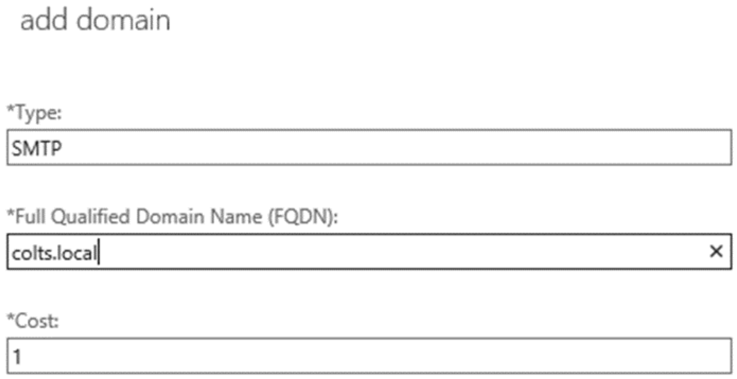
A Send connector routes mail to a specified list of domains. These domains can be an SMTP address space or a custom type. Learn more...

*Address space:
Specify the address space or spaces to which this connector will route mail.

TYPE	DOMAIN	COST

□ Scoped send connector

7. Make sure that the connector type is SMTP. Enter the domain name and click Save.



add domain

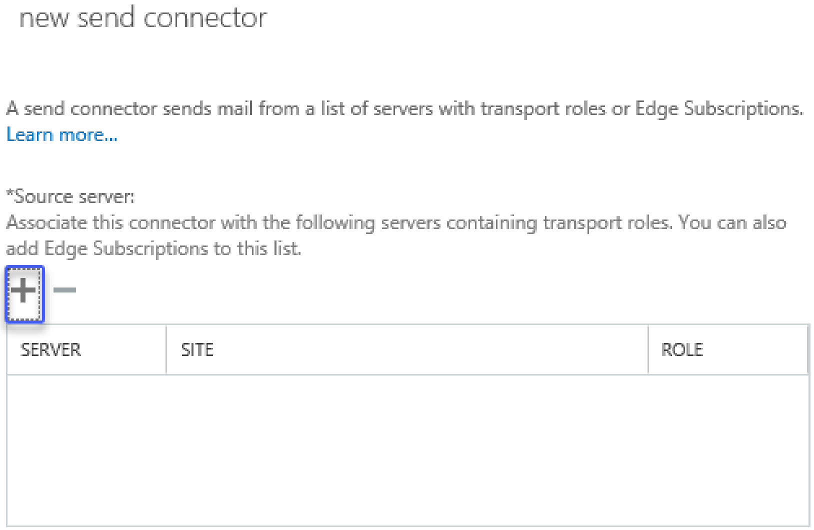
*Type:
SMTP

*Full Qualified Domain Name (FQDN):
colts.local

*Cost:
1

8. Make sure that the Scope Send Connector option is not selected. Click Next.

9. Click the + symbol to add the source servers.



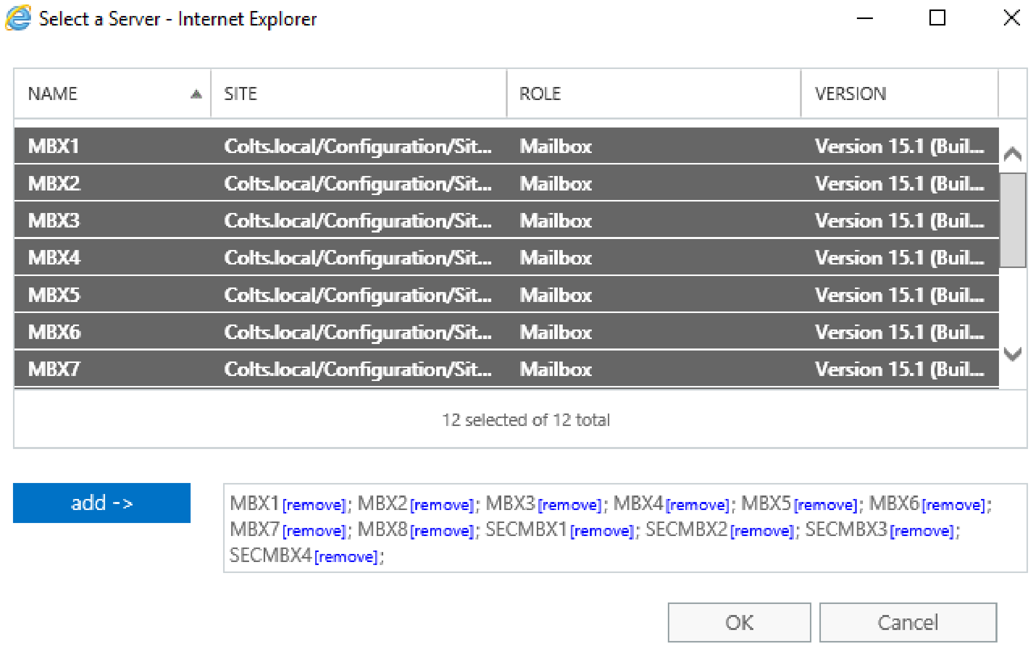
new send connector

A send connector sends mail from a list of servers with transport roles or Edge Subscriptions.
Learn more...

*Source server:
Associate this connector with the following servers containing transport roles. You can also add Edge Subscriptions to this list.

SERVER	SITE	ROLE

10. Select all of Exchange servers that run the mailbox role and click add. Click OK.



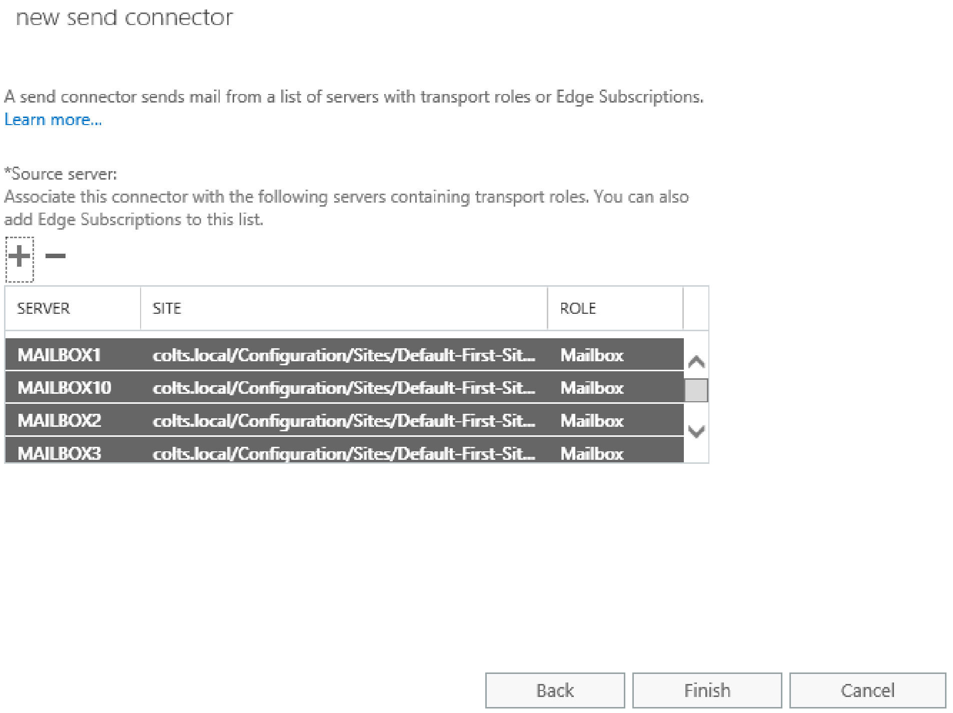
Select a Server - Internet Explorer

NAME	SITE	ROLE	VERSION
MBX1	Colts.local/Configuration/Sit...	Mailbox	Version 15.1 (Buil...
MBX2	Colts.local/Configuration/Sit...	Mailbox	Version 15.1 (Buil...
MBX3	Colts.local/Configuration/Sit...	Mailbox	Version 15.1 (Buil...
MBX4	Colts.local/Configuration/Sit...	Mailbox	Version 15.1 (Buil...
MBX5	Colts.local/Configuration/Sit...	Mailbox	Version 15.1 (Buil...
MBX6	Colts.local/Configuration/Sit...	Mailbox	Version 15.1 (Buil...
MBX7	Colts.local/Configuration/Sit...	Mailbox	Version 15.1 (Buil...

12 selected of 12 total

MBX1 [remove]; MBX2 [remove]; MBX3 [remove]; MBX4 [remove]; MBX5 [remove]; MBX6 [remove]; MBX7 [remove]; MBX8 [remove]; SECMBX1 [remove]; SECMBX2 [remove]; SECMBX3 [remove]; SECMBX4 [remove];

11. Click Finish to complete the wizard.



new send connector

A send connector sends mail from a list of servers with transport roles or Edge Subscriptions.
Learn more...

*Source server:
Associate this connector with the following servers containing transport roles. You can also add Edge Subscriptions to this list.

SERVER	SITE	ROLE
MAILBOX1	colts.local/Configuration/Sites/Default-First-Sit...	Mailbox
MAILBOX10	colts.local/Configuration/Sites/Default-First-Sit...	Mailbox
MAILBOX2	colts.local/Configuration/Sites/Default-First-Sit...	Mailbox
MAILBOX3	colts.local/Configuration/Sites/Default-First-Sit...	Mailbox

12. Verify that the new connection was created successfully.

Install Microsoft Exchange Management Tools on Remote Management Computer

Log in to the remote management computer. Open a command window and navigate to the Exchange installation files. The file location might be on a network share.

1. Run the following command:

```
Setup.exe /Role:ManagementTools /IAcceptExchangeServerLicenseTerms
```

Configure DNS

The DNS configuration for any solution is dependent on whether the use case and budget justify a unified or dedicated namespace. For this reference implementation, NetApp chose an alternate configuration: a unified namespace that spanned two physical locations to provide enhanced availability with a hot standby third DAG copy. A basic layer 4 load balancer was implemented without session affiant to enforce the active/passive site model. This configuration allowed NetApp to validate the full load on the primary site, while showing how easy it was to add site resiliency to any deployment.

Note: If you are deploying a full active/active DAG, you can use a round-robin DNS instead of a load balancer by adding a fourth DAG copy in the secondary site.

1. Create a DNS record pointing to the load balancer virtual IP.

```
Dnscmd /RecordAdd colts.local autodiscover A 172.21.91.199
dnscmd /RecordAdd colts.local mail A 172.21.91.199
```

2. Create an MX record.

```
dnscmd /recordadd colts.local @ MX 10 mail.colts.local
```

Configure Exchange Services

Use the data in Table 23 to reconfigure each mailbox server to use the DNS alias.

Table 23) External URL configuration information.

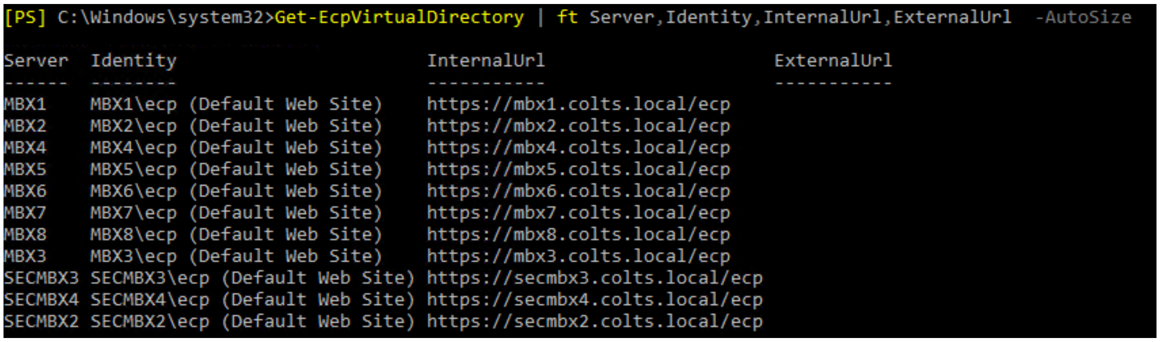
Name	Virtual Directory	External URL Value
Exchange control panel (ECP)	ECP	https://mail.colts.local/ecp
Exchange web services (EWS)	EWS	https://mail.colts.local/EWS/Exchange.asmx
Active sync	Microsoft-Server-ActiveSync	https://mail.colts.local/Microsoft-Server-ActiveSync
Outlook address book (OAB)	OAB	https://mail.colts.local/OAB
Outlook web access (OWA)	OWA	https://mail.colts.local/OWA
PowerShell	PowerShell	http://mail.colts.local/powershell

Configure and Verify Exchange Control Panel

To configure and verify the ECP, complete the following steps:

1. Open the Exchange management shell and confirm the current ECP configuration.

```
Get-EcpVirtualDirectory | ft Server,Identity,InternalUrl,ExternalUrl  -AutoSize
```



```
[PS] C:\Windows\system32>Get-EcpVirtualDirectory | ft Server,Identity,InternalUrl,ExternalUrl  -AutoSize

Server  Identity                       InternalUrl                     ExternalUrl
------  --------                       -----------                     -----------
MBX1    MBX1\ecp (Default Web Site)    https://mbx1.colts.local/ecp
MBX2    MBX2\ecp (Default Web Site)    https://mbx2.colts.local/ecp
MBX4    MBX4\ecp (Default Web Site)    https://mbx4.colts.local/ecp
MBX5    MBX5\ecp (Default Web Site)    https://mbx5.colts.local/ecp
MBX6    MBX6\ecp (Default Web Site)    https://mbx6.colts.local/ecp
MBX7    MBX7\ecp (Default Web Site)    https://mbx7.colts.local/ecp
MBX8    MBX8\ecp (Default Web Site)    https://mbx8.colts.local/ecp
MBX3    MBX3\ecp (Default Web Site)    https://mbx3.colts.local/ecp
SECMBX3 SECMBX3\ecp (Default Web Site) https://secmbx3.colts.local/ecp
SECMBX4 SECMBX4\ecp (Default Web Site) https://secmbx4.colts.local/ecp
SECMBX2 SECMBX2\ecp (Default Web Site) https://secmbx2.colts.local/ecp
```

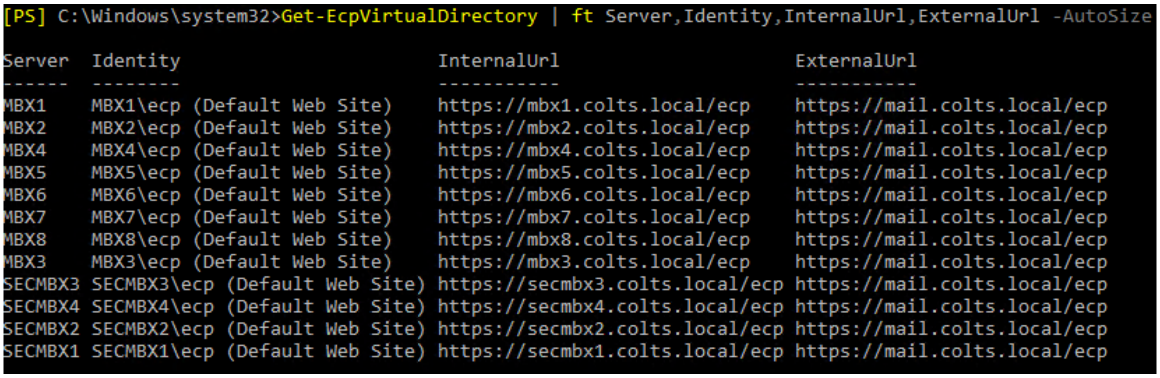
2. Update the external URL for each mailbox server.

```
$Splat = @{ ExternalUrl = "https://mail.colts.local/ecp" }
Get-EcpVirtualDirectory | Set-EcpVirtualDirectory @Splat
```

Note: When the Outlook web access URL updates, disregard the warnings.

3. Verify the proper configuration of the external URL.

```
 Get-EcpVirtualDirectory | ft Server,Identity,InternalUrl,ExternalUrl -AutoSize
```



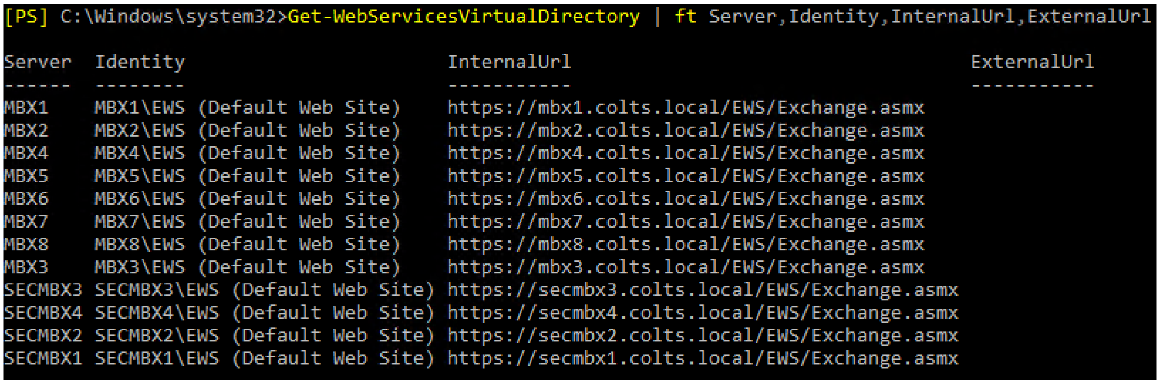
```
[PS] C:\Windows\system32>Get-EcpVirtualDirectory | ft Server,Identity,InternalUrl,ExternalUrl -AutoSize

Server  Identity                       InternalUrl                     ExternalUrl
------  --------                       -----------                     -----------
MBX1    MBX1\ecp (Default Web Site)    https://mbx1.colts.local/ecp    https://mail.colts.local/ecp
MBX2    MBX2\ecp (Default Web Site)    https://mbx2.colts.local/ecp    https://mail.colts.local/ecp
MBX4    MBX4\ecp (Default Web Site)    https://mbx4.colts.local/ecp    https://mail.colts.local/ecp
MBX5    MBX5\ecp (Default Web Site)    https://mbx5.colts.local/ecp    https://mail.colts.local/ecp
MBX6    MBX6\ecp (Default Web Site)    https://mbx6.colts.local/ecp    https://mail.colts.local/ecp
MBX7    MBX7\ecp (Default Web Site)    https://mbx7.colts.local/ecp    https://mail.colts.local/ecp
MBX8    MBX8\ecp (Default Web Site)    https://mbx8.colts.local/ecp    https://mail.colts.local/ecp
MBX3    MBX3\ecp (Default Web Site)    https://mbx3.colts.local/ecp    https://mail.colts.local/ecp
SECMBX3 SECMBX3\ecp (Default Web Site) https://secmbx3.colts.local/ecp https://mail.colts.local/ecp
SECMBX4 SECMBX4\ecp (Default Web Site) https://secmbx4.colts.local/ecp https://mail.colts.local/ecp
SECMBX2 SECMBX2\ecp (Default Web Site) https://secmbx2.colts.local/ecp https://mail.colts.local/ecp
SECMBX1 SECMBX1\ecp (Default Web Site) https://secmbx1.colts.local/ecp https://mail.colts.local/ecp
```

Configure and Verify Exchange Web Services

To configure and verify the EWS configuration, complete the following steps:

1. Open the Exchange management shell and confirm the current EWS configuration.

```
Get-WebServicesVirtualDirectory | ft Server,Identity,InternalUrl,ExternalUrl -AutoSize
```



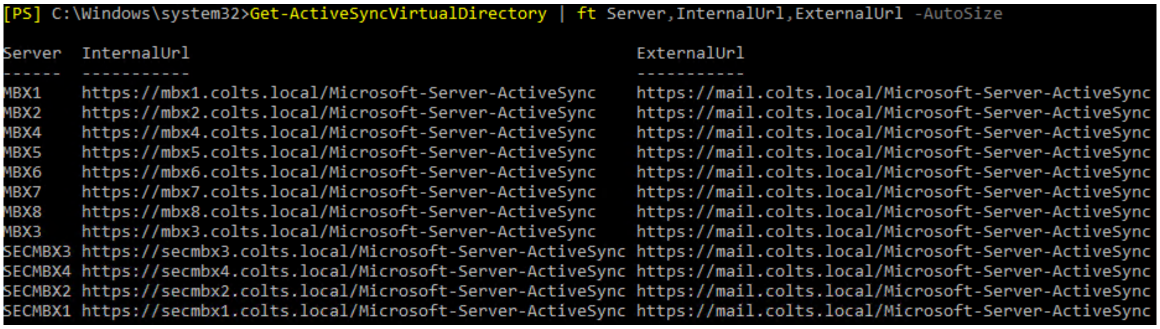
```
[PS] C:\Windows\system32>Get-WebServicesVirtualDirectory | ft Server,Identity,InternalUrl,ExternalUrl

Server  Identity                       InternalUrl                                   ExternalUrl
------  --------                       -----------                                   -----------
MBX1    MBX1\EWS (Default Web Site)    https://mbx1.colts.local/EWS/Exchange.asmx
MBX2    MBX2\EWS (Default Web Site)    https://mbx2.colts.local/EWS/Exchange.asmx
MBX4    MBX4\EWS (Default Web Site)    https://mbx4.colts.local/EWS/Exchange.asmx
MBX5    MBX5\EWS (Default Web Site)    https://mbx5.colts.local/EWS/Exchange.asmx
MBX6    MBX6\EWS (Default Web Site)    https://mbx6.colts.local/EWS/Exchange.asmx
MBX7    MBX7\EWS (Default Web Site)    https://mbx7.colts.local/EWS/Exchange.asmx
MBX8    MBX8\EWS (Default Web Site)    https://mbx8.colts.local/EWS/Exchange.asmx
MBX3    MBX3\EWS (Default Web Site)    https://mbx3.colts.local/EWS/Exchange.asmx
SECMBX3 SECMBX3\EWS (Default Web Site) https://secmbx3.colts.local/EWS/Exchange.asmx
SECMBX4 SECMBX4\EWS (Default Web Site) https://secmbx4.colts.local/EWS/Exchange.asmx
SECMBX2 SECMBX2\EWS (Default Web Site) https://secmbx2.colts.local/EWS/Exchange.asmx
SECMBX1 SECMBX1\EWS (Default Web Site) https://secmbx1.colts.local/EWS/Exchange.asmx
```

2. Update the external URL for each mailbox server.

```
$Splat = @{ ExternalUrl = "https://mail.colts.local/EWS/Exchange.asmx" }
Get-WebServicesVirtualDirectory | Set-WebServicesVirtualDirectory @Splat
```

3. Verify that the external URL is configured.

```
Get-WebServicesVirtualDirectory | ft Server,InternalUrl,ExternalUrl -AutoSize
```



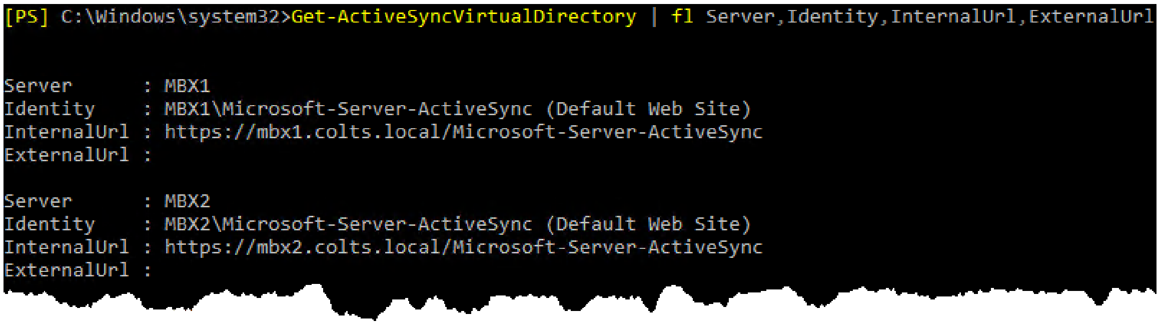
```
[PS] C:\Windows\system32>Get-ActiveSyncVirtualDirectory | ft Server,InternalUrl,ExternalUrl -AutoSize

Server  InternalUrl                                             ExternalUrl
------  -----------                                             -----------
MBX1    https://mbx1.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX2    https://mbx2.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX4    https://mbx4.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX5    https://mbx5.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX6    https://mbx6.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX7    https://mbx7.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX8    https://mbx8.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX3    https://mbx3.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
SECMBX3 https://secmbx3.colts.local/Microsoft-Server-ActiveSync https://mail.colts.local/Microsoft-Server-ActiveSync
SECMBX4 https://secmbx4.colts.local/Microsoft-Server-ActiveSync https://mail.colts.local/Microsoft-Server-ActiveSync
SECMBX2 https://secmbx2.colts.local/Microsoft-Server-ActiveSync https://mail.colts.local/Microsoft-Server-ActiveSync
SECMBX1 https://secmbx1.colts.local/Microsoft-Server-ActiveSync https://mail.colts.local/Microsoft-Server-ActiveSync
```

Configure and Verify Active Sync

To configure and verify the current active sync configuration, complete the following steps:

1. Open the Exchange management shell and confirm the current active sync configuration.

```
Get-ActiveSyncVirtualDirectory | fl Server,Identity,InternalUrl,ExternalUrl
```



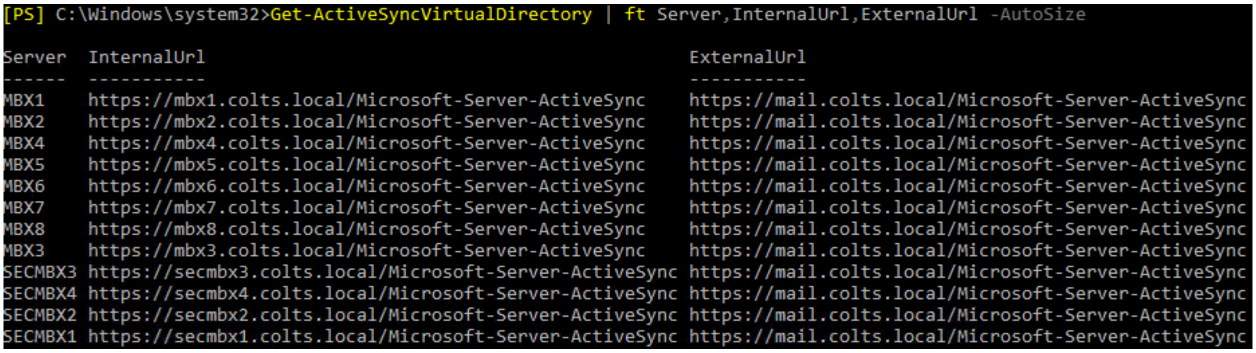
```
[PS] C:\Windows\system32>Get-ActiveSyncVirtualDirectory | fl Server,Identity,InternalUrl,ExternalUrl


Server      : MBX1
Identity    : MBX1\Microsoft-Server-ActiveSync (Default Web Site)
InternalUrl : https://mbx1.colts.local/Microsoft-Server-ActiveSync
ExternalUrl :

Server      : MBX2
Identity    : MBX2\Microsoft-Server-ActiveSync (Default Web Site)
InternalUrl : https://mbx2.colts.local/Microsoft-Server-ActiveSync
ExternalUrl :
```

2. Update the external URL for each mailbox server.

```
$Splat = @{ ExternalUrl = "https://mail.colts.local/Microsoft-Server-ActiveSync" }
Get-ActiveSyncVirtualDirectory | Set-ActiveSyncVirtualDirectory @Splat
```

3. Verify that the external URL is configured.

```
Get-ActiveSyncVirtualDirectory | ft Server,InternalUrl,ExternalUrl -AutoSize
```



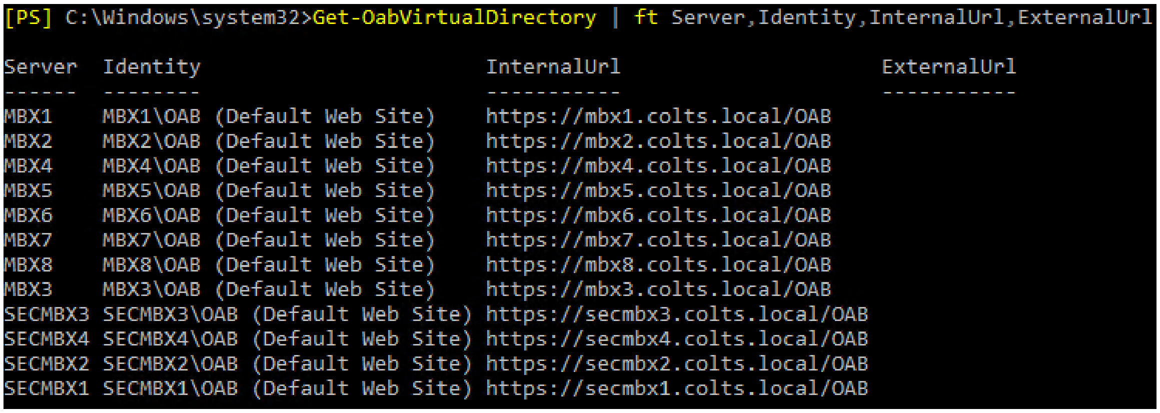
```
[PS] C:\Windows\system32>Get-ActiveSyncVirtualDirectory | ft Server,InternalUrl,ExternalUrl -AutoSize

Server  InternalUrl                                           ExternalUrl
------  -----------                                           -----------
MBX1    https://mbx1.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX2    https://mbx2.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX4    https://mbx4.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX5    https://mbx5.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX6    https://mbx6.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX7    https://mbx7.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX8    https://mbx8.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
MBX3    https://mbx3.colts.local/Microsoft-Server-ActiveSync    https://mail.colts.local/Microsoft-Server-ActiveSync
SECMBX3 https://secmbx3.colts.local/Microsoft-Server-ActiveSync https://mail.colts.local/Microsoft-Server-ActiveSync
SECMBX4 https://secmbx4.colts.local/Microsoft-Server-ActiveSync https://mail.colts.local/Microsoft-Server-ActiveSync
SECMBX2 https://secmbx2.colts.local/Microsoft-Server-ActiveSync https://mail.colts.local/Microsoft-Server-ActiveSync
SECMBX1 https://secmbx1.colts.local/Microsoft-Server-ActiveSync https://mail.colts.local/Microsoft-Server-ActiveSync
```

Configure and Verify Outlook Address Book

To configure and verify the current OAB configuration, complete the following steps:

1. Open the Exchange management shell and confirm the current OAB configuration.

```
Get-OabVirtualDirectory | ft Server,Identity,InternalUrl,ExternalUrl -AutoSize
```



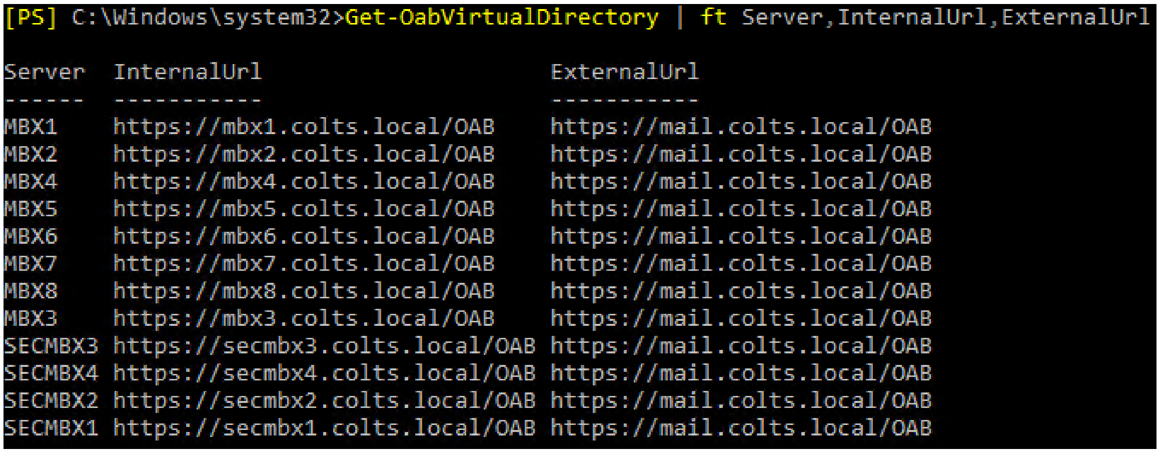
```
[PS] C:\Windows\system32>Get-OabVirtualDirectory | ft Server,Identity,InternalUrl,ExternalUrl

Server  Identity                      InternalUrl                      ExternalUrl
------  --------                      -----------                      -----------
MBX1    MBX1\OAB (Default Web Site)    https://mbx1.colts.local/OAB
MBX2    MBX2\OAB (Default Web Site)    https://mbx2.colts.local/OAB
MBX4    MBX4\OAB (Default Web Site)    https://mbx4.colts.local/OAB
MBX5    MBX5\OAB (Default Web Site)    https://mbx5.colts.local/OAB
MBX6    MBX6\OAB (Default Web Site)    https://mbx6.colts.local/OAB
MBX7    MBX7\OAB (Default Web Site)    https://mbx7.colts.local/OAB
MBX8    MBX8\OAB (Default Web Site)    https://mbx8.colts.local/OAB
MBX3    MBX3\OAB (Default Web Site)    https://mbx3.colts.local/OAB
SECMBX3 SECMBX3\OAB (Default Web Site) https://secmbx3.colts.local/OAB
SECMBX4 SECMBX4\OAB (Default Web Site) https://secmbx4.colts.local/OAB
SECMBX2 SECMBX2\OAB (Default Web Site) https://secmbx2.colts.local/OAB
SECMBX1 SECMBX1\OAB (Default Web Site) https://secmbx1.colts.local/OAB
```

2. Update the external URL for each mailbox server.

```
$Splat = @{ ExternalUrl = "https://mail.colts.local/OAB" }
Get-OabVirtualDirectory | Set-OabVirtualDirectory @Splat
```

3. Verify that the external URL is configured.

```
Get-OabVirtualDirectory | ft Server,InternalUrl,ExternalUrl -AutoSize
```



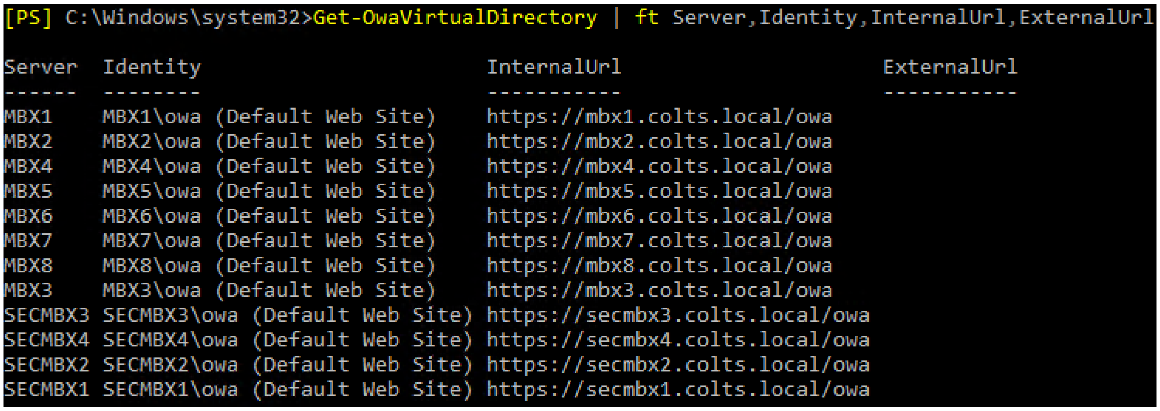
```
[PS] C:\Windows\system32>Get-OabVirtualDirectory | ft Server,InternalUrl,ExternalUrl

Server  InternalUrl                    ExternalUrl
------  -----------                    -----------
MBX1    https://mbx1.colts.local/OAB    https://mail.colts.local/OAB
MBX2    https://mbx2.colts.local/OAB    https://mail.colts.local/OAB
MBX4    https://mbx4.colts.local/OAB    https://mail.colts.local/OAB
MBX5    https://mbx5.colts.local/OAB    https://mail.colts.local/OAB
MBX6    https://mbx6.colts.local/OAB    https://mail.colts.local/OAB
MBX7    https://mbx7.colts.local/OAB    https://mail.colts.local/OAB
MBX8    https://mbx8.colts.local/OAB    https://mail.colts.local/OAB
MBX3    https://mbx3.colts.local/OAB    https://mail.colts.local/OAB
SECMBX3 https://secmbx3.colts.local/OAB https://mail.colts.local/OAB
SECMBX4 https://secmbx4.colts.local/OAB https://mail.colts.local/OAB
SECMBX2 https://secmbx2.colts.local/OAB https://mail.colts.local/OAB
SECMBX1 https://secmbx1.colts.local/OAB https://mail.colts.local/OAB
```

Configure and Verify Outlook Web Access

To configure and verify the current OWA configuration, complete the following steps:

1. Open the Exchange management shell and confirm the current OWA configuration.

```
Get-OwaVirtualDirectory | ft Server,Identity,InternalUrl,ExternalUrl -AutoSize
```



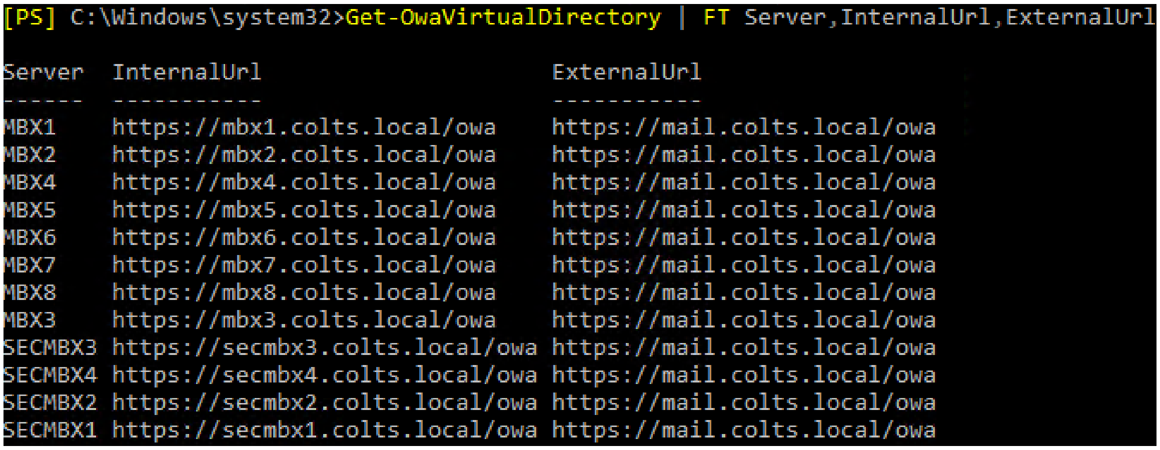
```
[PS] C:\Windows\system32>Get-OwaVirtualDirectory | ft Server,Identity,InternalUrl,ExternalUrl

Server  Identity                     InternalUrl                     ExternalUrl
------  --------                     -----------                     -----------
MBX1    MBX1\owa (Default Web Site)    https://mbx1.colts.local/owa
MBX2    MBX2\owa (Default Web Site)    https://mbx2.colts.local/owa
MBX4    MBX4\owa (Default Web Site)    https://mbx4.colts.local/owa
MBX5    MBX5\owa (Default Web Site)    https://mbx5.colts.local/owa
MBX6    MBX6\owa (Default Web Site)    https://mbx6.colts.local/owa
MBX7    MBX7\owa (Default Web Site)    https://mbx7.colts.local/owa
MBX8    MBX8\owa (Default Web Site)    https://mbx8.colts.local/owa
MBX3    MBX3\owa (Default Web Site)    https://mbx3.colts.local/owa
SECMBX3 SECMBX3\owa (Default Web Site) https://secmbx3.colts.local/owa
SECMBX4 SECMBX4\owa (Default Web Site) https://secmbx4.colts.local/owa
SECMBX2 SECMBX2\owa (Default Web Site) https://secmbx2.colts.local/owa
SECMBX1 SECMBX1\owa (Default Web Site) https://secmbx1.colts.local/owa
```

2. Update the external URL for each mailbox server.

```
$Splat = @{ ExternalUrl = "https://mail.colts.local/owa" }
Get-OwaVirtualDirectory | Set-OwaVirtualDirectory @Splat
```

3. Verify that the external URL is configured.

```
Get-OwaVirtualDirectory | FT Server,InternalUrl,ExternalUrl -AutoSize
```



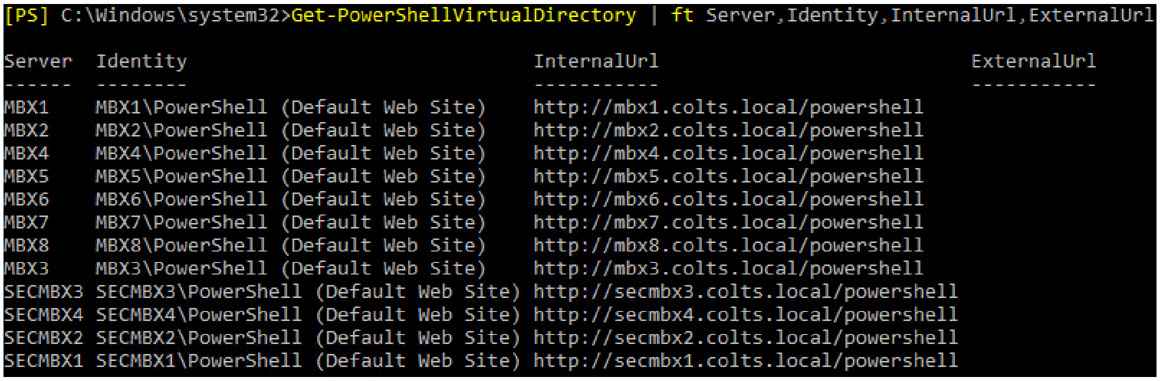
```
[PS] C:\Windows\system32>Get-OwaVirtualDirectory | FT Server,InternalUrl,ExternalUrl

Server  InternalUrl                      ExternalUrl
------  -----------                      -----------
MBX1    https://mbx1.colts.local/owa     https://mail.colts.local/owa
MBX2    https://mbx2.colts.local/owa     https://mail.colts.local/owa
MBX4    https://mbx4.colts.local/owa     https://mail.colts.local/owa
MBX5    https://mbx5.colts.local/owa     https://mail.colts.local/owa
MBX6    https://mbx6.colts.local/owa     https://mail.colts.local/owa
MBX7    https://mbx7.colts.local/owa     https://mail.colts.local/owa
MBX8    https://mbx8.colts.local/owa     https://mail.colts.local/owa
MBX3    https://mbx3.colts.local/owa     https://mail.colts.local/owa
SECMBX3 https://secmbx3.colts.local/owa  https://mail.colts.local/owa
SECMBX4 https://secmbx4.colts.local/owa  https://mail.colts.local/owa
SECMBX2 https://secmbx2.colts.local/owa  https://mail.colts.local/owa
SECMBX1 https://secmbx1.colts.local/owa  https://mail.colts.local/owa
```

Configure and Verify PowerShell

To configure and verify the current PowerShell configuration, complete the following steps:

1. Open the Exchange management shell and confirm the current PowerShell configuration.

```
Get-PowerShellVirtualDirectory | ft Server,Identity,InternalUrl,ExternalUrl -AutoSize
```



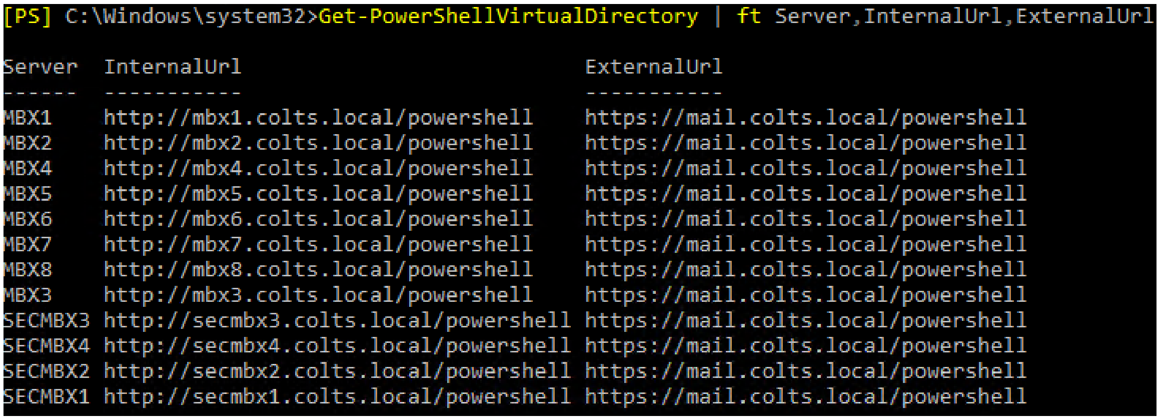
```
[PS] C:\Windows\system32>Get-PowerShellVirtualDirectory | ft Server,Identity,InternalUrl,ExternalUrl

Server  Identity                               InternalUrl                              ExternalUrl
------  --------                               -----------                              -----------
MBX1    MBX1\PowerShell (Default Web Site)     http://mbx1.colts.local/powershell
MBX2    MBX2\PowerShell (Default Web Site)     http://mbx2.colts.local/powershell
MBX4    MBX4\PowerShell (Default Web Site)     http://mbx4.colts.local/powershell
MBX5    MBX5\PowerShell (Default Web Site)     http://mbx5.colts.local/powershell
MBX6    MBX6\PowerShell (Default Web Site)     http://mbx6.colts.local/powershell
MBX7    MBX7\PowerShell (Default Web Site)     http://mbx7.colts.local/powershell
MBX8    MBX8\PowerShell (Default Web Site)     http://mbx8.colts.local/powershell
MBX3    MBX3\PowerShell (Default Web Site)     http://mbx3.colts.local/powershell
SECMBX3 SECMBX3\PowerShell (Default Web Site) http://secmbx3.colts.local/powershell
SECMBX4 SECMBX4\PowerShell (Default Web Site) http://secmbx4.colts.local/powershell
SECMBX2 SECMBX2\PowerShell (Default Web Site) http://secmbx2.colts.local/powershell
SECMBX1 SECMBX1\PowerShell (Default Web Site) http://secmbx1.colts.local/powershell
```

2. Update the external URL for each mailbox server.

```
$Splat = @{ ExternalUrl = "https://mail.colts.local/powershell" }
Get-PowerShellVirtualDirectory | Set-PowerShellVirtualDirectory @Splat
```

3. Verify that the external URL is configured.

```
Get-PowerShellVirtualDirectory | ft Server,InternalUrl,ExternalUrl -AutoSize
```



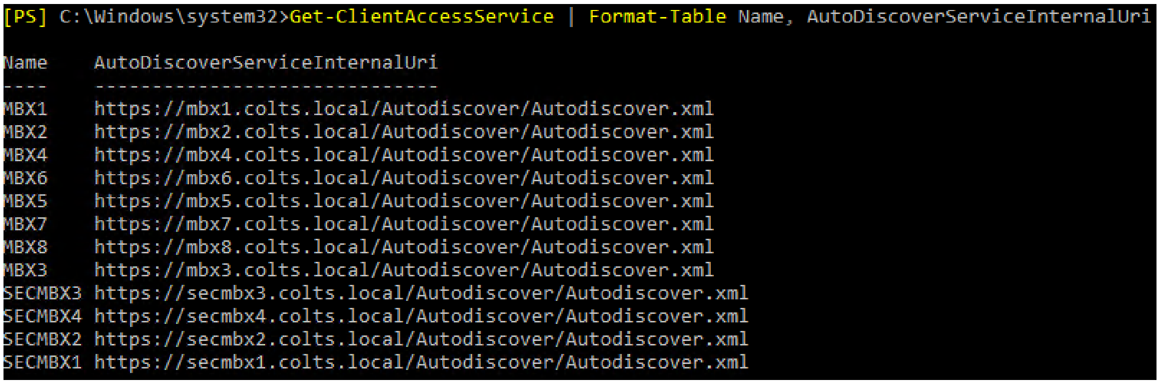
```
[PS] C:\Windows\system32>Get-PowerShellVirtualDirectory | ft Server,InternalUrl,ExternalUrl

Server  InternalUrl                           ExternalUrl
------  -----------                           -----------
MBX1    http://mbx1.colts.local/powershell    https://mail.colts.local/powershell
MBX2    http://mbx2.colts.local/powershell    https://mail.colts.local/powershell
MBX4    http://mbx4.colts.local/powershell    https://mail.colts.local/powershell
MBX5    http://mbx5.colts.local/powershell    https://mail.colts.local/powershell
MBX6    http://mbx6.colts.local/powershell    https://mail.colts.local/powershell
MBX7    http://mbx7.colts.local/powershell    https://mail.colts.local/powershell
MBX8    http://mbx8.colts.local/powershell    https://mail.colts.local/powershell
MBX3    http://mbx3.colts.local/powershell    https://mail.colts.local/powershell
SECMBX3 http://secmbx3.colts.local/powershell https://mail.colts.local/powershell
SECMBX4 http://secmbx4.colts.local/powershell https://mail.colts.local/powershell
SECMBX2 http://secmbx2.colts.local/powershell https://mail.colts.local/powershell
SECMBX1 http://secmbx1.colts.local/powershell https://mail.colts.local/powershell
```

Configure and Verify Client Access

To configure and verify the current client access configuration, complete the following steps:

1. Open the Exchange management shell and confirm the current client access configuration.

```
Get-ClientAccessService | Format-Table Name, AutoDiscoverServiceInternalUri -Auto
```



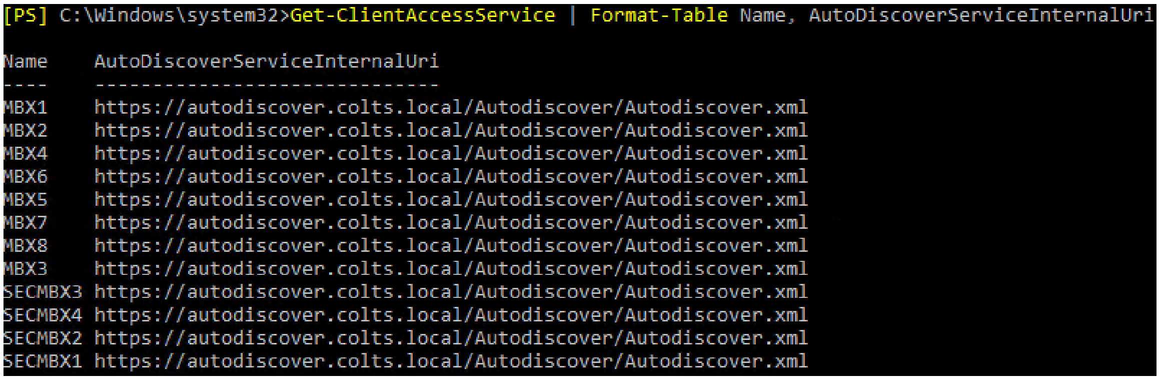
```
[PS] C:\Windows\system32>Get-ClientAccessService | Format-Table Name, AutoDiscoverServiceInternalUri

Name    AutoDiscoverServiceInternalUri
----    ------------------------------
MBX1    https://mbx1.colts.local/Autodiscover/Autodiscover.xml
MBX2    https://mbx2.colts.local/Autodiscover/Autodiscover.xml
MBX4    https://mbx4.colts.local/Autodiscover/Autodiscover.xml
MBX6    https://mbx6.colts.local/Autodiscover/Autodiscover.xml
MBX5    https://mbx5.colts.local/Autodiscover/Autodiscover.xml
MBX7    https://mbx7.colts.local/Autodiscover/Autodiscover.xml
MBX8    https://mbx8.colts.local/Autodiscover/Autodiscover.xml
MBX3    https://mbx3.colts.local/Autodiscover/Autodiscover.xml
SECMBX3 https://secmbx3.colts.local/Autodiscover/Autodiscover.xml
SECMBX4 https://secmbx4.colts.local/Autodiscover/Autodiscover.xml
SECMBX2 https://secmbx2.colts.local/Autodiscover/Autodiscover.xml
SECMBX1 https://secmbx1.colts.local/Autodiscover/Autodiscover.xml
```

2. Update the external URL for each mailbox server.

```
$Splat = @{ AutoDiscoverServiceInternalUri =
       'https://autodiscover.colts.local/Autodiscover/Autodiscover.xml'
}
Get-ClientAccessService| Set-ClientAccessService @Splat
```

3. Verify that the external URL is configured.

```
Get-ClientAccessService | Format-Table Name, AutoDiscoverServiceInternalUri -Auto
```



```
[PS] C:\Windows\system32>Get-ClientAccessService | Format-Table Name, AutoDiscoverServiceInternalUri

Name    AutoDiscoverServiceInternalUri
----    ------------------------------
MBX1    https://autodiscover.colts.local/Autodiscover/Autodiscover.xml
MBX2    https://autodiscover.colts.local/Autodiscover/Autodiscover.xml
MBX4    https://autodiscover.colts.local/Autodiscover/Autodiscover.xml
MBX6    https://autodiscover.colts.local/Autodiscover/Autodiscover.xml
MBX5    https://autodiscover.colts.local/Autodiscover/Autodiscover.xml
MBX7    https://autodiscover.colts.local/Autodiscover/Autodiscover.xml
MBX8    https://autodiscover.colts.local/Autodiscover/Autodiscover.xml
MBX3    https://autodiscover.colts.local/Autodiscover/Autodiscover.xml
SECMBX3 https://autodiscover.colts.local/Autodiscover/Autodiscover.xml
SECMBX4 https://autodiscover.colts.local/Autodiscover/Autodiscover.xml
SECMBX2 https://autodiscover.colts.local/Autodiscover/Autodiscover.xml
SECMBX1 https://autodiscover.colts.local/Autodiscover/Autodiscover.xml
```

Add Permissions to DAG Witness Server

DAGs with an even number of member servers require a witness server and witness directory. The witness server and witness directory are used for quorum purposes and do not need to run any Exchange roles. The witness server must run Windows Server 2016, Windows Server 2012 R2, Windows Server 2012, Windows Server 2008 R2, or Windows Server 2008. The witness server cannot be a DAG member server, and it must be in the same AD forest as the DAG member servers.

Note: The Exchange Trusted Subsystem universal security group must be added to the local administrators group if Exchange 2016 roles are not installed on the witness server.

To add permissions to the DAG witness server, complete the following steps:

1. Log in to the witness server VM > open Computer Management > select Local Users and Groups > and select the local administrators group.

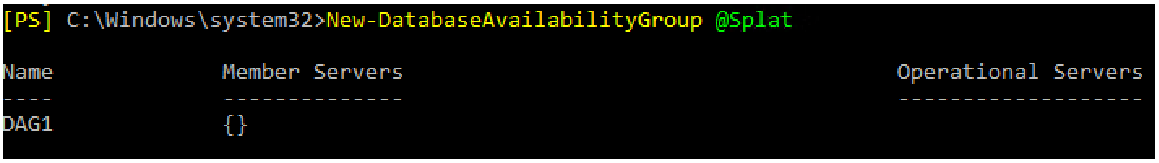
2. Open the administrators local group and add the Exchange Trusted Subsystem universal security group. Click OK.
3. Click OK again to accept the changes.

Create DAG

To create a new DAG, complete the following steps:

1. Open the Exchange management shell and create a new DAG.

```
$Splat = @{
    Name = 'DAG1'
    WitnessServer = 'witness.colts.local'
    WitnessDirectory = 'C:\Witness\DAG1'
    DatabaseAvailabilityGroupIpAddresses = '172.21.91.200','172.21.96.200'
}
New-DatabaseAvailabilityGroup @Splat
```

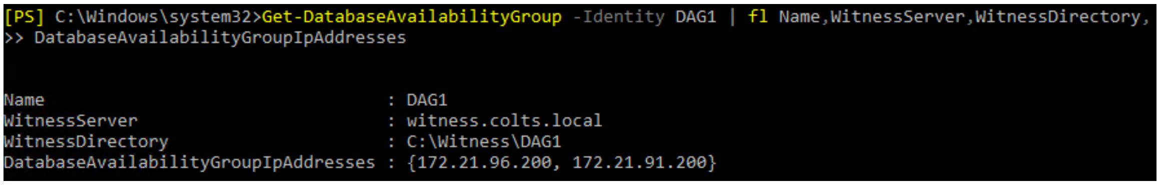


```
[PS] C:\Windows\system32>New-DatabaseAvailabilityGroup @Splat

Name             Member Servers                                    Operational Servers
----             --------------                                    -------------------
DAG1             {}
```

Note: The second IP address is for the optional secondary site. Add or remove as needed to account for each site participating in the DAG.

2. Verify that the DAG was created with the correct parameters.

```
Get-DatabaseAvailabilityGroup -Identity DAG1 | fl Name,WitnessServer,WitnessDirectory,
DatabaseAvailabilityGroupIpAddresses
```

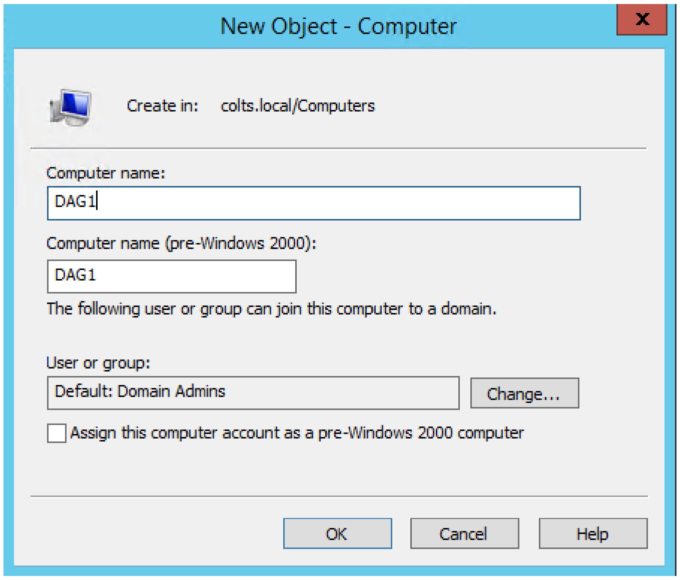


```
[PS] C:\Windows\system32>Get-DatabaseAvailabilityGroup -Identity DAG1 | fl Name,WitnessServer,WitnessDirectory,
>> DatabaseAvailabilityGroupIpAddresses


Name                                 : DAG1
WitnessServer                        : witness.colts.local
WitnessDirectory                     : C:\Witness\DAG1
DatabaseAvailabilityGroupIpAddresses : {172.21.96.200, 172.21.91.200}
```

Prestage Cluster Name Object

To prestage the cluster name object (CNO), complete the following steps:

1. Open Active Directory Users and Computers.
2. Right-click the organizational unit in which you want to create the new account, select New, and select Computers.
3. In New Objects—Computer, enter the computer account name for the CNO. This is the DAG name that was used to create the DAG. Click OK to create the account.



Create in: colts.local/Computers

Computer name:
DAG1

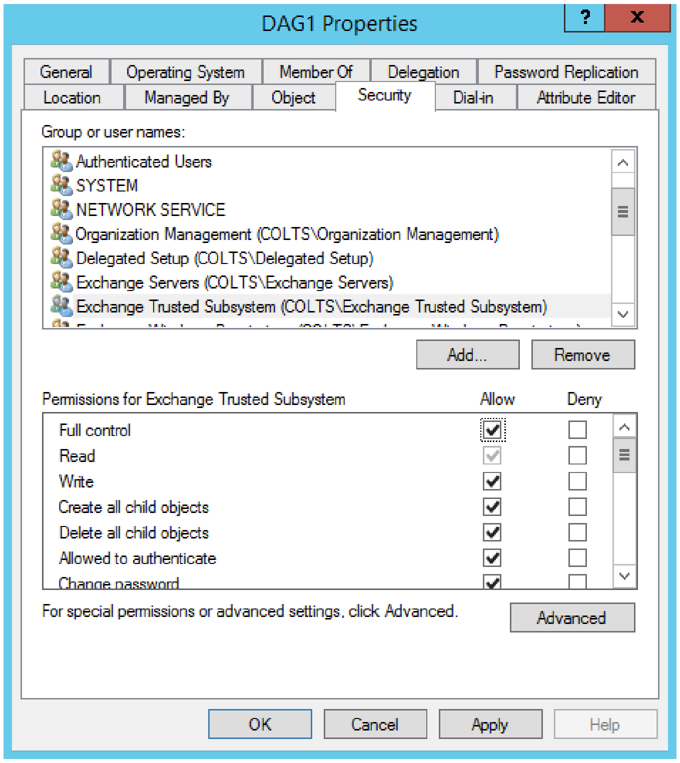
Computer name (pre-Windows 2000):
DAG1

The following user or group can join this computer to a domain.

User or group:
Default: Domain Admins

□ Assign this computer account as a pre-Windows 2000 computer

4. Right-click the new computer account and then click Disable Account. Click Yes to confirm the disable action and then click OK.
5. If Advanced Features aren't enabled, turn them on by clicking View and then clicking Advanced Features.
6. Right-click the new computer account and then click Properties.
7. From the Security tab, in <Computer Name> Properties, click Add.
8. Add the Exchange Trusted Subsystem, then enter Exchange Trusted Subsystem in the Enter the Object Names to Select field. Click OK to add the USG.
9. Select the Exchange Trusted Subsystem USG and, in the Permissions for Exchange Trusted Subsystem field, select Full Control in the Allow column. Click OK to save the permission settings.



Group or user names:

- Authenticated Users
- SYSTEM
- NETWORK SERVICE
- Organization Management (COLTS\Organization Management)
- Delegated Setup (COLTS\Delegated Setup)
- Exchange Servers (COLTS\Exchange Servers)
- Exchange Trusted Subsystem (COLTS\Exchange Trusted Subsystem)

Permissions for Exchange Trusted Subsystem	Allow	Deny
Full control	☑	□
Read	☑	□
Write	☑	□
Create all child objects	☑	□
Delete all child objects	☑	□
Allowed to authenticate	☑	□
Change password	☑	□

For special permissions or advanced settings, click Advanced.

Add Mailbox Servers to DAG

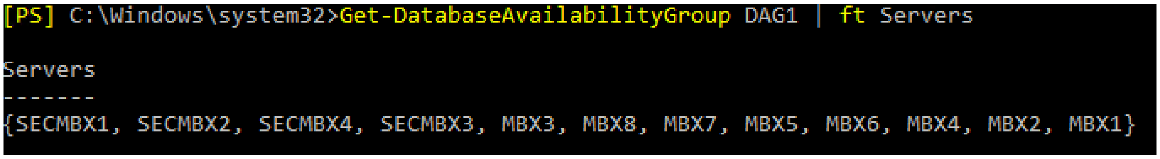
To add mailbox servers to the DAG, complete the following steps:

1. Open the Exchange Management Shell and add the mailbox servers to the DAG.

```
Add-DatabaseAvailabilityGroupServer -Identity DAG1 -MailboxServer 'MBX1'
Add-DatabaseAvailabilityGroupServer -Identity DAG1 -MailboxServer 'MBX2'
Add-DatabaseAvailabilityGroupServer -Identity DAG1 -MailboxServer 'MBX3'
Add-DatabaseAvailabilityGroupServer -Identity DAG1 -MailboxServer 'MBX4'
Add-DatabaseAvailabilityGroupServer -Identity DAG1 -MailboxServer 'MBX5'
Add-DatabaseAvailabilityGroupServer -Identity DAG1 -MailboxServer 'MBX6'
Add-DatabaseAvailabilityGroupServer -Identity DAG1 -MailboxServer 'MBX7'
Add-DatabaseAvailabilityGroupServer -Identity DAG1 -MailboxServer 'MBX8'
Add-DatabaseAvailabilityGroupServer -Identity DAG1 -MailboxServer 'SecMBX1'
Add-DatabaseAvailabilityGroupServer -Identity DAG1 -MailboxServer 'SecMBX2'
Add-DatabaseAvailabilityGroupServer -Identity DAG1 -MailboxServer 'SecMBX3'
Add-DatabaseAvailabilityGroupServer -Identity DAG1 -MailboxServer 'SecMBX4'
```

2. Verify that the servers were added to the DAG.

```
Get-DatabaseAvailabilityGroup DAG1 | ft Servers
```



```
[PS] C:\Windows\system32>Get-DatabaseAvailabilityGroup DAG1 | ft Servers

Servers
-------
{SECMBX1, SECMBX2, SECMBX4, SECMBX3, MBX3, MBX8, MBX7, MBX5, MBX6, MBX4, MBX2, MBX1}
```

Create Databases on Exchange Mailbox Servers

To create new databases on the Exchange mailbox servers, complete the following steps:

1. Use the information in Table 24 to create the new databases on the Exchange mailbox servers.

Table 24) Databases on Exchange mailbox servers.

Database Name	Server	EDB File Path	Log Folder Path
DAG1-DB01	MBX01	C:\db\DB01\DB01.edb	C:\log\DB01
DAG1-DB02	MBX02	C:\db\DB02\DB02.edb	C:\log\DB02
DAG1-DB03	MBX03	C:\db\DB03\DB03.edb	C:\log\DB03
DAG1-DB04	MBX04	C:\db\DB04\DB04.edb	C:\log\DB04
DAG1-DB05	MBX05	C:\db\DB05\DB05.edb	C:\log\DB05
DAG1-DB06	MBX06	C:\db\DB06\DB06.edb	C:\log\DB06
DAG1-DB07	MBX07	C:\db\DB07\DB07.edb	C:\log\DB07
DAG1-DB08	MBX08	C:\db\DB08\DB08.edb	C:\log\DB08
DAG1-DB09	MBX01	C:\db\DB09\DB09.edb	C:\log\DB09
DAG1-DB10	MBX02	C:\db\DB10\DB10.edb	C:\log\DB10
DAG1-DB11	MBX03	C:\db\DB11\DB11.edb	C:\log\DB11
DAG1-DB12	MBX04	C:\db\DB12\DB12.edb	C:\log\DB12
DAG1-DB13	MBX05	C:\db\DB13\DB13.edb	C:\log\DB13
DAG1-DB14	MBX06	C:\db\DB14\DB14.edb	C:\log\DB14
DAG1-DB15	MBX07	C:\db\DB15\DB15.edb	C:\log\DB15
DAG1-DB16	MBX08	C:\db\DB16\DB16.edb	C:\log\DB16
DAG1-DB17	MBX01	C:\db\DB17\DB17.edb	C:\log\DB17
DAG1-DB18	MBX02	C:\db\DB18\DB18.edb	C:\log\DB18
DAG1-DB19	MBX03	C:\db\DB19\DB19.edb	C:\log\DB19
DAG1-DB20	MBX04	C:\db\DB20\DB20.edb	C:\log\DB20
DAG1-DB21	MBX05	C:\db\DB21\DB21.edb	C:\log\DB21
DAG1-DB22	MBX06	C:\db\DB22\DB22.edb	C:\log\DB22
DAG1-DB23	MBX07	C:\db\DB23\DB23.edb	C:\log\DB23
DAG1-DB24	MBX08	C:\db\DB24\DB24.edb	C:\log\DB24
DAG1-DB25	MBX01	C:\db\DB25\DB25.edb	C:\log\DB25
DAG1-DB26	MBX02	C:\db\DB26\DB26.edb	C:\log\DB26
DAG1-DB27	MBX03	C:\db\DB27\DB27.edb	C:\log\DB27
DAG1-DB28	MBX04	C:\db\DB28\DB28.edb	C:\log\DB28
DAG1-DB29	MBX01	C:\db\DB29\DB29.edb	C:\log\DB29
DAG1-DB30	MBX02	C:\db\DB30\DB30.edb	C:\log\DB30
DAG1-DB31	MBX03	C:\db\DB31\DB31.edb	C:\log\DB31

Database Name	Server	EDB File Path	Log Folder Path
DAG1-DB32	MBX04	C:\db\DB32\DB32.edb	C:\log\DB32

2. Create the new databases.

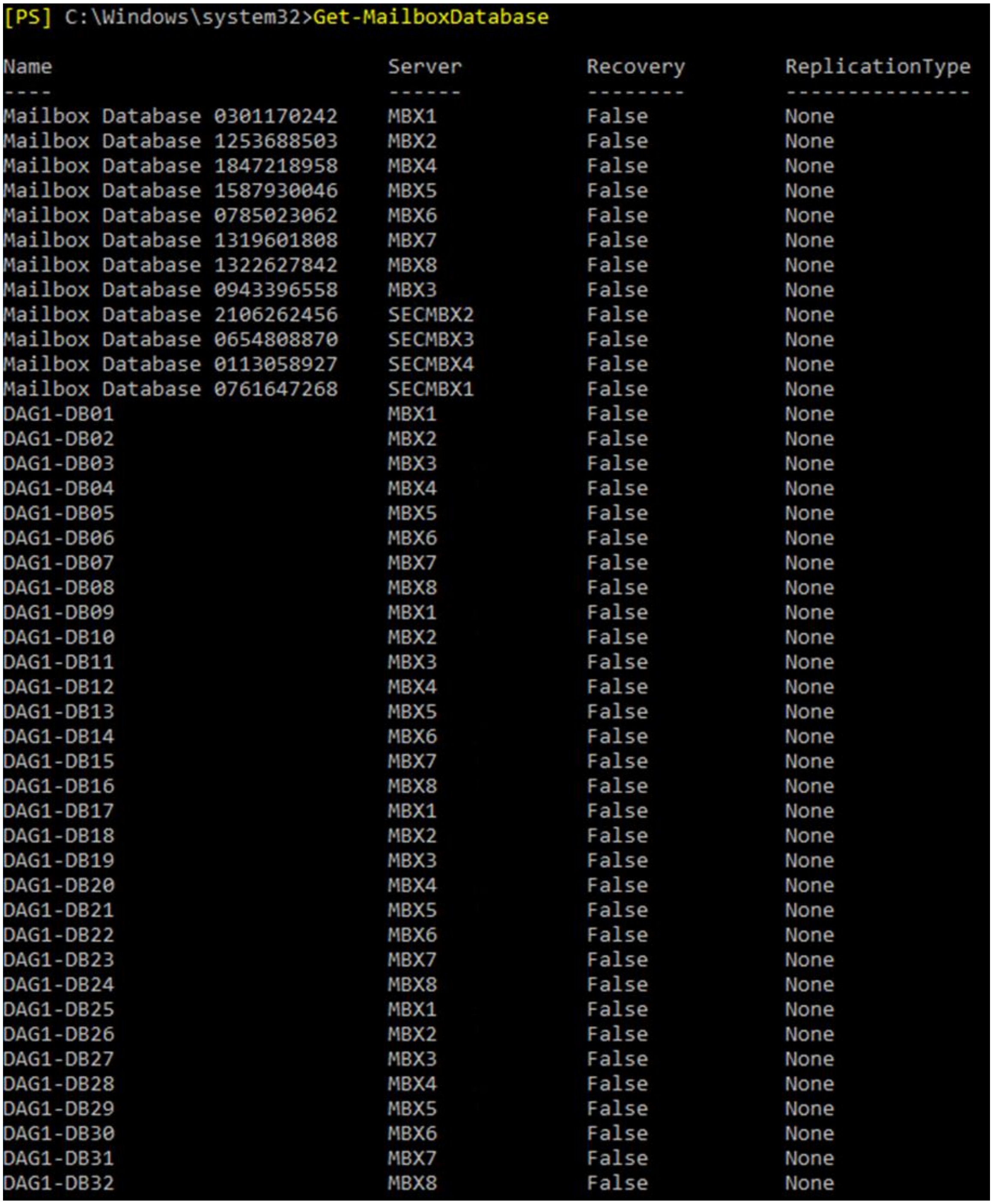
```
New-MailboxDatabase -Server MBX01 -Name DAG1-DB01 -Edb C:\db\DB01\DB01.edb -Log C:\log\DB01
New-MailboxDatabase -Server MBX02 -Name DAG1-DB02 -Edb C:\db\DB02\DB02.edb -Log C:\log\DB02
New-MailboxDatabase -Server MBX03 -Name DAG1-DB03 -Edb C:\db\DB03\DB03.edb -Log C:\log\DB03
New-MailboxDatabase -Server MBX04 -Name DAG1-DB04 -Edb C:\db\DB04\DB04.edb -Log C:\log\DB04
New-MailboxDatabase -Server MBX05 -Name DAG1-DB05 -Edb C:\db\DB05\DB05.edb -Log C:\log\DB05
New-MailboxDatabase -Server MBX06 -Name DAG1-DB06 -Edb C:\db\DB06\DB06.edb -Log C:\log\DB06
New-MailboxDatabase -Server MBX07 -Name DAG1-DB07 -Edb C:\db\DB07\DB07.edb -Log C:\log\DB07
New-MailboxDatabase -Server MBX08 -Name DAG1-DB08 -Edb C:\db\DB08\DB08.edb -Log C:\log\DB08
New-MailboxDatabase -Server MBX01 -Name DAG1-DB09 -Edb C:\db\DB09\DB09.edb -Log C:\log\DB09
New-MailboxDatabase -Server MBX02 -Name DAG1-DB10 -Edb C:\db\DB10\DB10.edb -Log C:\log\DB10
New-MailboxDatabase -Server MBX03 -Name DAG1-DB11 -Edb C:\db\DB11\DB11.edb -Log C:\log\DB11
New-MailboxDatabase -Server MBX04 -Name DAG1-DB12 -Edb C:\db\DB12\DB12.edb -Log C:\log\DB12
New-MailboxDatabase -Server MBX05 -Name DAG1-DB13 -Edb C:\db\DB13\DB13.edb -Log C:\log\DB13
New-MailboxDatabase -Server MBX06 -Name DAG1-DB14 -Edb C:\db\DB14\DB14.edb -Log C:\log\DB14
New-MailboxDatabase -Server MBX07 -Name DAG1-DB15 -Edb C:\db\DB15\DB15.edb -Log C:\log\DB15
New-MailboxDatabase -Server MBX08 -Name DAG1-DB16 -Edb C:\db\DB16\DB16.edb -Log C:\log\DB16
New-MailboxDatabase -Server MBX01 -Name DAG1-DB17 -Edb C:\db\DB17\DB17.edb -Log C:\log\DB17
New-MailboxDatabase -Server MBX02 -Name DAG1-DB18 -Edb C:\db\DB18\DB18.edb -Log C:\log\DB18
New-MailboxDatabase -Server MBX03 -Name DAG1-DB19 -Edb C:\db\DB19\DB19.edb -Log C:\log\DB19
New-MailboxDatabase -Server MBX04 -Name DAG1-DB20 -Edb C:\db\DB20\DB20.edb -Log C:\log\DB20
New-MailboxDatabase -Server MBX05 -Name DAG1-DB21 -Edb C:\db\DB21\DB21.edb -Log C:\log\DB21
New-MailboxDatabase -Server MBX06 -Name DAG1-DB22 -Edb C:\db\DB22\DB22.edb -Log C:\log\DB22
New-MailboxDatabase -Server MBX07 -Name DAG1-DB23 -Edb C:\db\DB23\DB23.edb -Log C:\log\DB23
New-MailboxDatabase -Server MBX08 -Name DAG1-DB24 -Edb C:\db\DB24\DB24.edb -Log C:\log\DB24
New-MailboxDatabase -Server MBX01 -Name DAG1-DB25 -Edb C:\db\DB25\DB25.edb -Log C:\log\DB25
New-MailboxDatabase -Server MBX02 -Name DAG1-DB26 -Edb C:\db\DB26\DB26.edb -Log C:\log\DB26
New-MailboxDatabase -Server MBX03 -Name DAG1-DB27 -Edb C:\db\DB27\DB27.edb -Log C:\log\DB27
New-MailboxDatabase -Server MBX04 -Name DAG1-DB28 -Edb C:\db\DB28\DB28.edb -Log C:\log\DB28
New-MailboxDatabase -Server MBX05 -Name DAG1-DB29 -Edb C:\db\DB29\DB29.edb -Log C:\log\DB29
New-MailboxDatabase -Server MBX06 -Name DAG1-DB30 -Edb C:\db\DB30\DB30.edb -Log C:\log\DB30
New-MailboxDatabase -Server MBX07 -Name DAG1-DB31 -Edb C:\db\DB31\DB31.edb -Log C:\log\DB31
New-MailboxDatabase -Server MBX08 -Name DAG1-DB32 -Edb C:\db\DB32\DB32.edb -Log C:\log\DB32
```

3. Restart the Microsoft Exchange Information Store on each Exchange server after creating each database. Run the following command from the PowerShell Console on each Exchange server:

```
Restart-Service MSExchangeIS
```

4. Verify the Exchange database configuration.

```
Get-MailboxDatabase
```



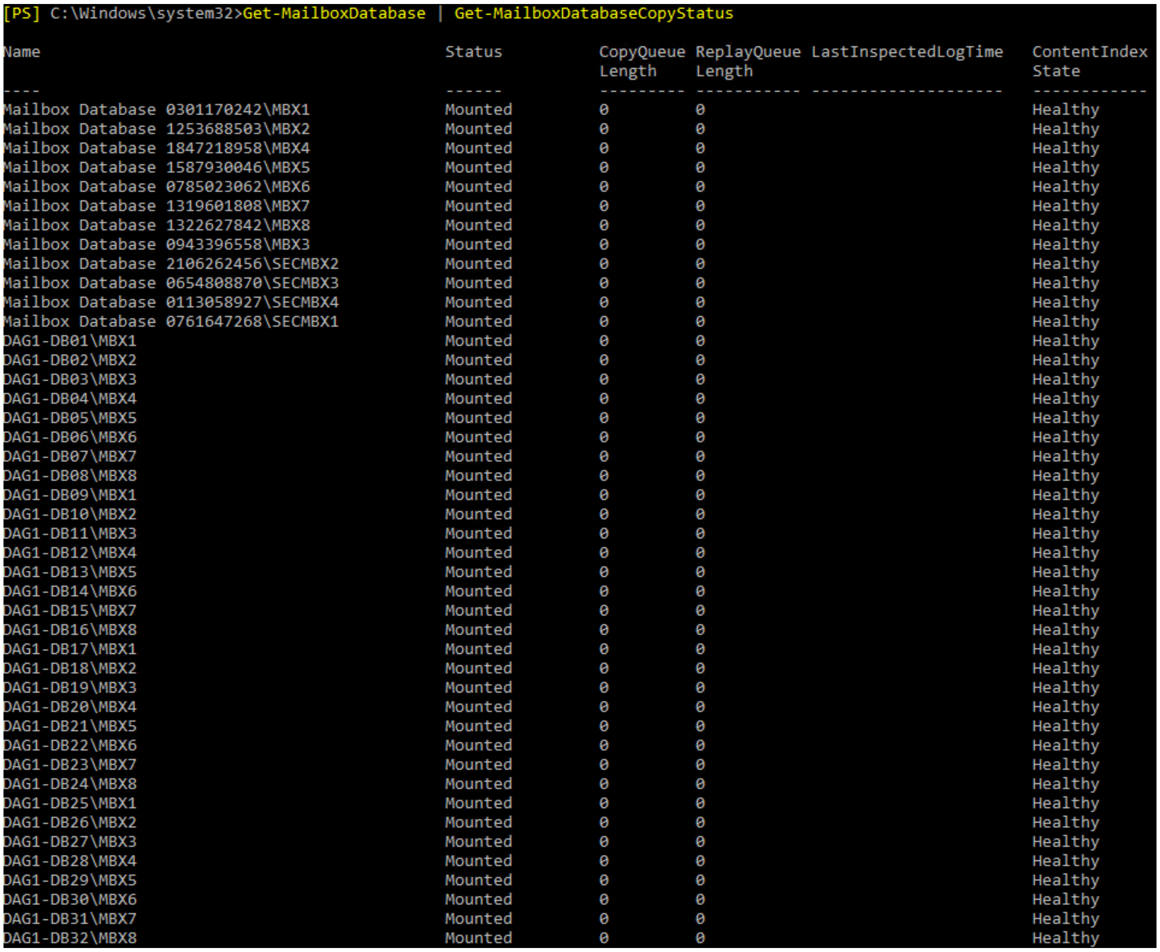
```
[PS] C:\Windows\system32>Get-MailboxDatabase

Name                           Server          Recovery        ReplicationType
----                           ------          --------        ---------------
Mailbox Database 0301170242    MBX1            False           None
Mailbox Database 1253688503    MBX2            False           None
Mailbox Database 1847218958    MBX4            False           None
Mailbox Database 1587930046    MBX5            False           None
Mailbox Database 0785023062    MBX6            False           None
Mailbox Database 1319601808    MBX7            False           None
Mailbox Database 1322627842    MBX8            False           None
Mailbox Database 0943396558    MBX3            False           None
Mailbox Database 2106262456    SECMBX2         False           None
Mailbox Database 0654808870    SECMBX3         False           None
Mailbox Database 0113058927    SECMBX4         False           None
Mailbox Database 0761647268    SECMBX1         False           None
DAG1-DB01                      MBX1            False           None
DAG1-DB02                      MBX2            False           None
DAG1-DB03                      MBX3            False           None
DAG1-DB04                      MBX4            False           None
DAG1-DB05                      MBX5            False           None
DAG1-DB06                      MBX6            False           None
DAG1-DB07                      MBX7            False           None
DAG1-DB08                      MBX8            False           None
DAG1-DB09                      MBX1            False           None
DAG1-DB10                      MBX2            False           None
DAG1-DB11                      MBX3            False           None
DAG1-DB12                      MBX4            False           None
DAG1-DB13                      MBX5            False           None
DAG1-DB14                      MBX6            False           None
DAG1-DB15                      MBX7            False           None
DAG1-DB16                      MBX8            False           None
DAG1-DB17                      MBX1            False           None
DAG1-DB18                      MBX2            False           None
DAG1-DB19                      MBX3            False           None
DAG1-DB20                      MBX4            False           None
DAG1-DB21                      MBX5            False           None
DAG1-DB22                      MBX6            False           None
DAG1-DB23                      MBX7            False           None
DAG1-DB24                      MBX8            False           None
DAG1-DB25                      MBX1            False           None
DAG1-DB26                      MBX2            False           None
DAG1-DB27                      MBX3            False           None
DAG1-DB28                      MBX4            False           None
DAG1-DB29                      MBX5            False           None
DAG1-DB30                      MBX6            False           None
DAG1-DB31                      MBX7            False           None
DAG1-DB32                      MBX8            False           None
```

5. Mount the databases.

```
Get-MailboxDatabase | Mount-Database
```

6. Verify that the databases are mounted.

```
Get-MailboxDatabase | Get-MailboxDatabaseCopyStatus
```



```
[PS] C:\Windows\system32>Get-MailboxDatabase | Get-MailboxDatabaseCopyStatus

Name                                          Status          CopyQueue ReplayQueue LastInspectedLogTime  ContentIndex
                                                              Length    Length                            State
----                                          ------          --------- ----------- --------------------  ------------
Mailbox Database 0301170242\MBX1              Mounted         0         0                                 Healthy
Mailbox Database 1253688503\MBX2              Mounted         0         0                                 Healthy
Mailbox Database 1847218958\MBX4              Mounted         0         0                                 Healthy
Mailbox Database 1587930046\MBX5              Mounted         0         0                                 Healthy
Mailbox Database 0785023062\MBX6              Mounted         0         0                                 Healthy
Mailbox Database 1319601808\MBX7              Mounted         0         0                                 Healthy
Mailbox Database 1322627842\MBX8              Mounted         0         0                                 Healthy
Mailbox Database 0943396558\MBX3              Mounted         0         0                                 Healthy
Mailbox Database 2106262456\SECMBX2           Mounted         0         0                                 Healthy
Mailbox Database 0654808870\SECMBX3           Mounted         0         0                                 Healthy
Mailbox Database 0113058927\SECMBX4           Mounted         0         0                                 Healthy
Mailbox Database 0761647268\SECMBX1           Mounted         0         0                                 Healthy
DAG1-DB01\MBX1                                Mounted         0         0                                 Healthy
DAG1-DB02\MBX2                                Mounted         0         0                                 Healthy
DAG1-DB03\MBX3                                Mounted         0         0                                 Healthy
DAG1-DB04\MBX4                                Mounted         0         0                                 Healthy
DAG1-DB05\MBX5                                Mounted         0         0                                 Healthy
DAG1-DB06\MBX6                                Mounted         0         0                                 Healthy
DAG1-DB07\MBX7                                Mounted         0         0                                 Healthy
DAG1-DB08\MBX8                                Mounted         0         0                                 Healthy
DAG1-DB09\MBX1                                Mounted         0         0                                 Healthy
DAG1-DB10\MBX2                                Mounted         0         0                                 Healthy
DAG1-DB11\MBX3                                Mounted         0         0                                 Healthy
DAG1-DB12\MBX4                                Mounted         0         0                                 Healthy
DAG1-DB13\MBX5                                Mounted         0         0                                 Healthy
DAG1-DB14\MBX6                                Mounted         0         0                                 Healthy
DAG1-DB15\MBX7                                Mounted         0         0                                 Healthy
DAG1-DB16\MBX8                                Mounted         0         0                                 Healthy
DAG1-DB17\MBX1                                Mounted         0         0                                 Healthy
DAG1-DB18\MBX2                                Mounted         0         0                                 Healthy
DAG1-DB19\MBX3                                Mounted         0         0                                 Healthy
DAG1-DB20\MBX4                                Mounted         0         0                                 Healthy
DAG1-DB21\MBX5                                Mounted         0         0                                 Healthy
DAG1-DB22\MBX6                                Mounted         0         0                                 Healthy
DAG1-DB23\MBX7                                Mounted         0         0                                 Healthy
DAG1-DB24\MBX8                                Mounted         0         0                                 Healthy
DAG1-DB25\MBX1                                Mounted         0         0                                 Healthy
DAG1-DB26\MBX2                                Mounted         0         0                                 Healthy
DAG1-DB27\MBX3                                Mounted         0         0                                 Healthy
DAG1-DB28\MBX4                                Mounted         0         0                                 Healthy
DAG1-DB29\MBX5                                Mounted         0         0                                 Healthy
DAG1-DB30\MBX6                                Mounted         0         0                                 Healthy
DAG1-DB31\MBX7                                Mounted         0         0                                 Healthy
DAG1-DB32\MBX8                                Mounted         0         0                                 Healthy
```

7. Add additional copies to each database.

```
Add-MailboxDatabaseCopy -Identity DAG1-DB01 -MailboxServer MBX02 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB02 -MailboxServer MBX03 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB03 -MailboxServer MBX04 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB04 -MailboxServer MBX05 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB05 -MailboxServer MBX06 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB06 -MailboxServer MBX07 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB07 -MailboxServer MBX08 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB08 -MailboxServer MBX01 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB09 -MailboxServer MBX03 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB10 -MailboxServer MBX04 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB11 -MailboxServer MBX05 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB12 -MailboxServer MBX06 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB13 -MailboxServer MBX07 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB14 -MailboxServer MBX08 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB15 -MailboxServer MBX01 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB16 -MailboxServer MBX02 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB17 -MailboxServer MBX04 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB18 -MailboxServer MBX05 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB19 -MailboxServer MBX06 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB20 -MailboxServer MBX07 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB21 -MailboxServer MBX08 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB22 -MailboxServer MBX01 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB23 -MailboxServer MBX02 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB24 -MailboxServer MBX03 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB25 -MailboxServer MBX05 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB26 -MailboxServer MBX06 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB27 -MailboxServer MBX07 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB28 -MailboxServer MBX08 -ActivationPreference 2
```

```
Add-MailboxDatabaseCopy -Identity DAG1-DB29 -MailboxServer MBX01 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB30 -MailboxServer MBX02 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB31 -MailboxServer MBX03 -ActivationPreference 2
Add-MailboxDatabaseCopy -Identity DAG1-DB32 -MailboxServer MBX04 -ActivationPreference 2
```

Note: Repeat for any additional copies as needed.

```
Add-MailboxDatabaseCopy -Identity DAG1-DB01 -MailboxServer SecMbx01 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB02 -MailboxServer SecMbx02 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB03 -MailboxServer SecMbx03 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB04 -MailboxServer SecMbx04 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB05 -MailboxServer SecMbx01 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB06 -MailboxServer SecMbx02 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB07 -MailboxServer SecMbx03 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB08 -MailboxServer SecMbx04 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB09 -MailboxServer SecMbx01 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB10 -MailboxServer SecMbx02 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB11 -MailboxServer SecMbx03 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB12 -MailboxServer SecMbx04 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB13 -MailboxServer SecMbx01 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB14 -MailboxServer SecMbx02 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB15 -MailboxServer SecMbx03 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB16 -MailboxServer SecMbx04 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB17 -MailboxServer SecMbx01 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB18 -MailboxServer SecMbx02 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB19 -MailboxServer SecMbx03 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB20 -MailboxServer SecMbx04 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB21 -MailboxServer SecMbx01 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB22 -MailboxServer SecMbx02 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB23 -MailboxServer SecMbx03 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB24 -MailboxServer SecMbx04 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB25 -MailboxServer SecMbx01 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB26 -MailboxServer SecMbx02 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB27 -MailboxServer SecMbx03 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB28 -MailboxServer SecMbx04 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB29 -MailboxServer SecMbx01 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB30 -MailboxServer SecMbx02 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB31 -MailboxServer SecMbx03 -ActivationPreference 3
Add-MailboxDatabaseCopy -Identity DAG1-DB32 -MailboxServer SecMbx04 -ActivationPreference 3
```

8. Enable database circular logging.

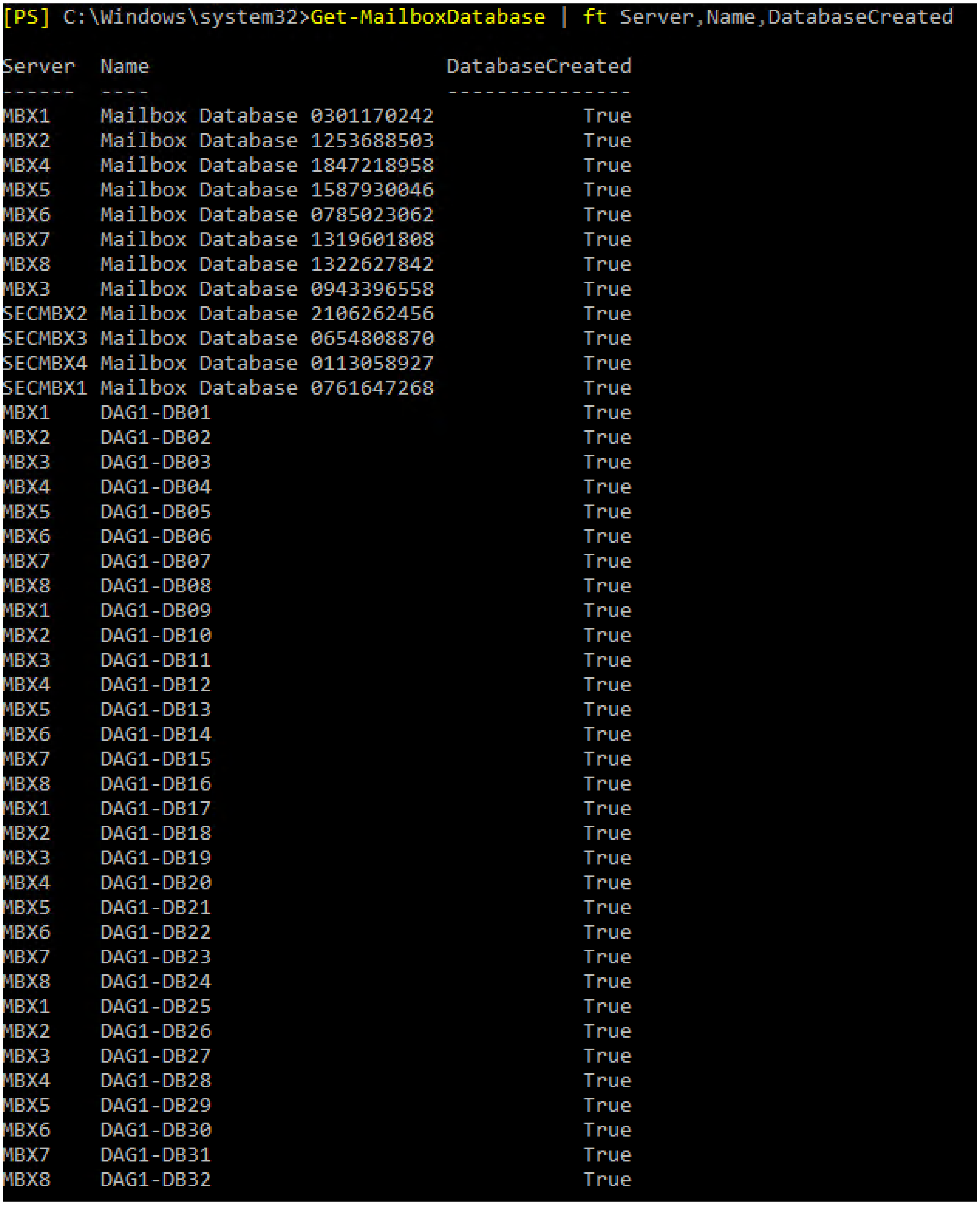
```
Get-MailboxDatabase | Set-MailboxDatabase -CircularLoggingEnabled $true
```

9. Mount databases.

```
Get-MailboxDatabase | Mount-Database
```

10. Verify that the databases are created.

```
Get-MailboxDatabase | ft Server,Name,DatabaseCreated
```



```
[PS] C:\Windows\system32>Get-MailboxDatabase | ft Server,Name,DatabaseCreated

Server  Name                        DatabaseCreated
------  ----                        ---------------
MBX1    Mailbox Database 0301170242            True
MBX2    Mailbox Database 1253688503            True
MBX4    Mailbox Database 1847218958            True
MBX5    Mailbox Database 1587930046            True
MBX6    Mailbox Database 0785023062            True
MBX7    Mailbox Database 1319601808            True
MBX8    Mailbox Database 1322627842            True
MBX3    Mailbox Database 0943396558            True
SECMBX2 Mailbox Database 2106262456            True
SECMBX3 Mailbox Database 0654808870            True
SECMBX4 Mailbox Database 0113058927            True
SECMBX1 Mailbox Database 0761647268            True
MBX1    DAG1-DB01                              True
MBX2    DAG1-DB02                              True
MBX3    DAG1-DB03                              True
MBX4    DAG1-DB04                              True
MBX5    DAG1-DB05                              True
MBX6    DAG1-DB06                              True
MBX7    DAG1-DB07                              True
MBX8    DAG1-DB08                              True
MBX1    DAG1-DB09                              True
MBX2    DAG1-DB10                              True
MBX3    DAG1-DB11                              True
MBX4    DAG1-DB12                              True
MBX5    DAG1-DB13                              True
MBX6    DAG1-DB14                              True
MBX7    DAG1-DB15                              True
MBX8    DAG1-DB16                              True
MBX1    DAG1-DB17                              True
MBX2    DAG1-DB18                              True
MBX3    DAG1-DB19                              True
MBX4    DAG1-DB20                              True
MBX5    DAG1-DB21                              True
MBX6    DAG1-DB22                              True
MBX7    DAG1-DB23                              True
MBX8    DAG1-DB24                              True
MBX1    DAG1-DB25                              True
MBX2    DAG1-DB26                              True
MBX3    DAG1-DB27                              True
MBX4    DAG1-DB28                              True
MBX5    DAG1-DB29                              True
MBX6    DAG1-DB30                              True
MBX7    DAG1-DB31                              True
MBX8    DAG1-DB32                              True
```

5.12 SnapManager for Exchange Installation and Configuration

After Exchange 2016 is installed and configured, install and configure NetApp SnapManager for Exchange (SME) 7.2. SnapManager for Microsoft Exchange Server is a host-side component of the NetApp integrated storage solution for Microsoft Exchange, offering application-aware primary Snapshot copies of Exchange databases. To start backing up your Exchange databases using SME, complete the procedures in the following sections.

Configure Service Accounts

The SnapManager service account that is required for SME to work properly must be configured using the following step:

1. Add the SME-SVC domain user to the Exchange Server Management Role Group.

Install SnapManager

To install SnapManager, complete the following steps:

1. Download the latest SME installer from the NetApp Support site.
2. Double-click the `downloaded .exe` file.
3. On the Welcome page, click Next.
4. Enter the user name and organization details, select the Per Storage System license type, and click Next.
5. Browse to the location where you want to install SnapManager and click Next.
6. Enter the SME-SVC account details and click Next.
7. Click Install.
8. Click Finish when the installation is done to close the wizard.
9. Repeat steps 1 through 8 for each mailbox server in your Exchange environment.

Configure Windows Firewall

To enable SnapManager communications and for DAG support, create the following firewall rules on all the mailbox servers:

1. Create an inbound rule that allows the SnapManager service to communicate.

```
$splat = @{
    Action      = 'allow'
    Direction   = 'Inbound'
    DisplayName = 'SnapManager for Exchange'
    Program     = 'C:\Program Files\NetApp\SnapManager for Exchange\SnapMgrService.exe'
}
New-NetFirewallRule @Splat
New-NetFirewallRule -DisplayName "SME 810" -Protocol TCP -LocalPort 810 -Action Allow
```

Connect SnapManager to Exchange Servers

Connect to the Exchange servers from SnapManager and then complete the configuration wizard by completing the following steps:

1. From the Windows Start menu, click SnapManager for Exchange. The SnapManager console opens, and a message informs you that you need to specify an Exchange server.
2. Click OK. The Add Exchange Server to be Managed dialog box is displayed.
3. To select a server, double-click one in the list or click Browse.

   Note: In this example, because DAG was used, we connected to each DAG member and then connected to the DAG.
4. After selecting a server, click Add. SnapManager connects to the server and then displays a message informing you that SnapManager for Exchange is not configured on the Exchange server.
5. Click OK. The Configuration wizard is displayed.
6. Click Next in the SME Configuration wizard.
7. Select the Select a Verification Server Later Using the Options Menu option and click Next.

8. Click Next.
9. The correct database layout was used during the Exchange installation; therefore, you do not need to migrate storage to LUNs. Click Next.
10. On the Select a Set of Logs page, click Next.
11. Verify the SnapInfo directory destinations. The SnapInfo directories should coexist on the log LUNs. Click Next.
12. On the Configure Dataset page, click Next.
13. Select the Yes, Add the Microsoft iSCSI Service as a Dependency for Exchange System Attendant Service option and click Next.
14. Configure the appropriate notification settings on the AutoSupport Settings page and click Next.
15. Configure the appropriate monitoring and reporting settings and click Next.
16. Click Finish.
17. Review the configuration tasks and click Start Now.
18. Click OK in the successful completion message and click Close.
19. Repeat steps 1 through 18 for all of the mailbox servers.
20. After all of the mailbox servers have been added on the primary and secondary stacks, follow the instructions for how you can create backup and restore jobs for the DAG in the SnapManager 7.2 for Microsoft Exchange Server Installation Guide.

Install Single Mailbox Recovery

NetApp Single Mailbox Recovery (SMBR) works with your existing Microsoft Exchange Server backup architecture and procedures and allows you to recover individual mailboxes, folders, messages, attachments, and even calendars, notes, and tasks directly to your production Microsoft Exchange Server or any PST file. To install NetApp SMBR, complete the following steps:

1. Before you start with the installation, make sure that the VM on which you are installing SMBR meets the following prerequisites:

   a. .NET Framework 3.5 SP1 and .NET Framework 4.0

   b. NetApp SnapDrive

   c. Microsoft Office Outlook 2007 and later (32-bit versions only)

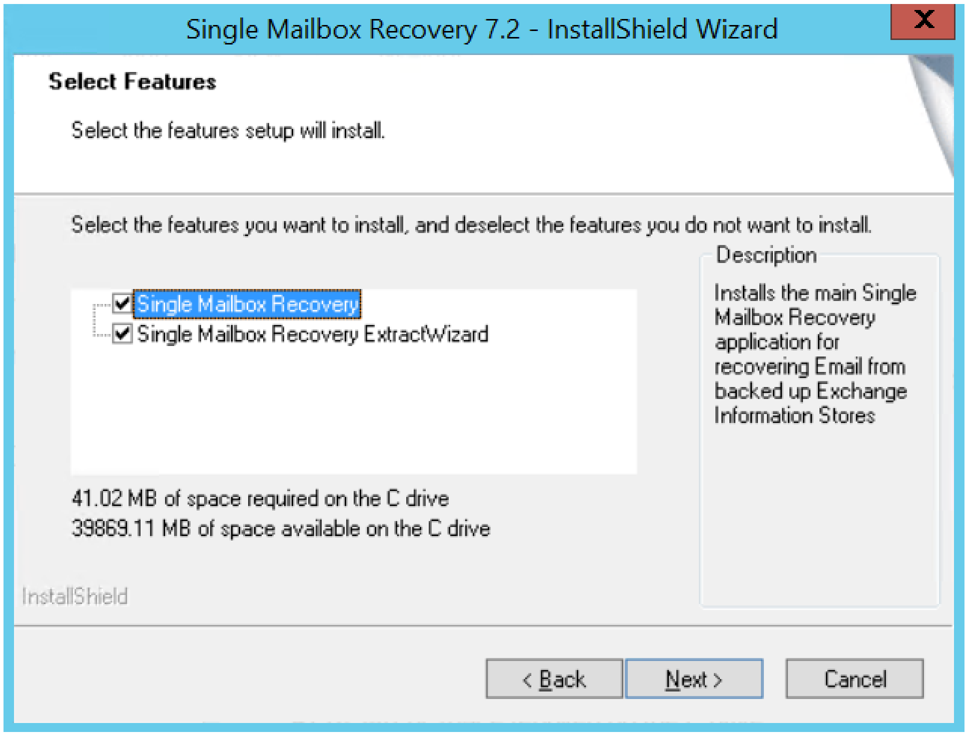
   d. Microsoft Exchange Management Tools

```
\\mailbox1\C$\E2016U6\Setup.EXE" /role:managementtools /IAcceptExchangeServerLicenseTerms
/installwindowscomponents
```

   e. NetApp SnapManager for Exchange 7.2

```
"SME7.2P2_x64.exe" /s /v"/qb+ SILENT_MODE=1 SVCUSERNAME=<<Domain Name>>\<<SME-SVC Account>>
SVCUSERPASSWORD=<<password>> SVCCONFIRMUSERPASSWORD=<<password>> /L*V C:\SME_Install.log"
```

2. Download the latest copy of NetApp Single Mailbox Recovery from the NetApp Support site.
3. Double-click `SMBR72.exe` to start the installation.
4. Click Install to install the Microsoft Visual C++ prerequisites.
5. Click Next.
6. Enter the user name and company name and click Next.
7. Browse to the installation destination folder and click Next.
8. Select both features listed on the page and click Next.



Single Mailbox Recovery 7.2 - InstallShield Wizard

Select Features

Select the features setup will install.

Select the features you want to install, and deselect the features you do not want to install.

☑ Single Mailbox Recovery

☑ Single Mailbox Recovery ExtractWizard

Description

Installs the main Single Mailbox Recovery application for recovering Email from backed up Exchange Information Stores

41.02 MB of space required on the C drive

39869.11 MB of space available on the C drive

9. When the installation is complete, click Finish.

6 Solution Verification

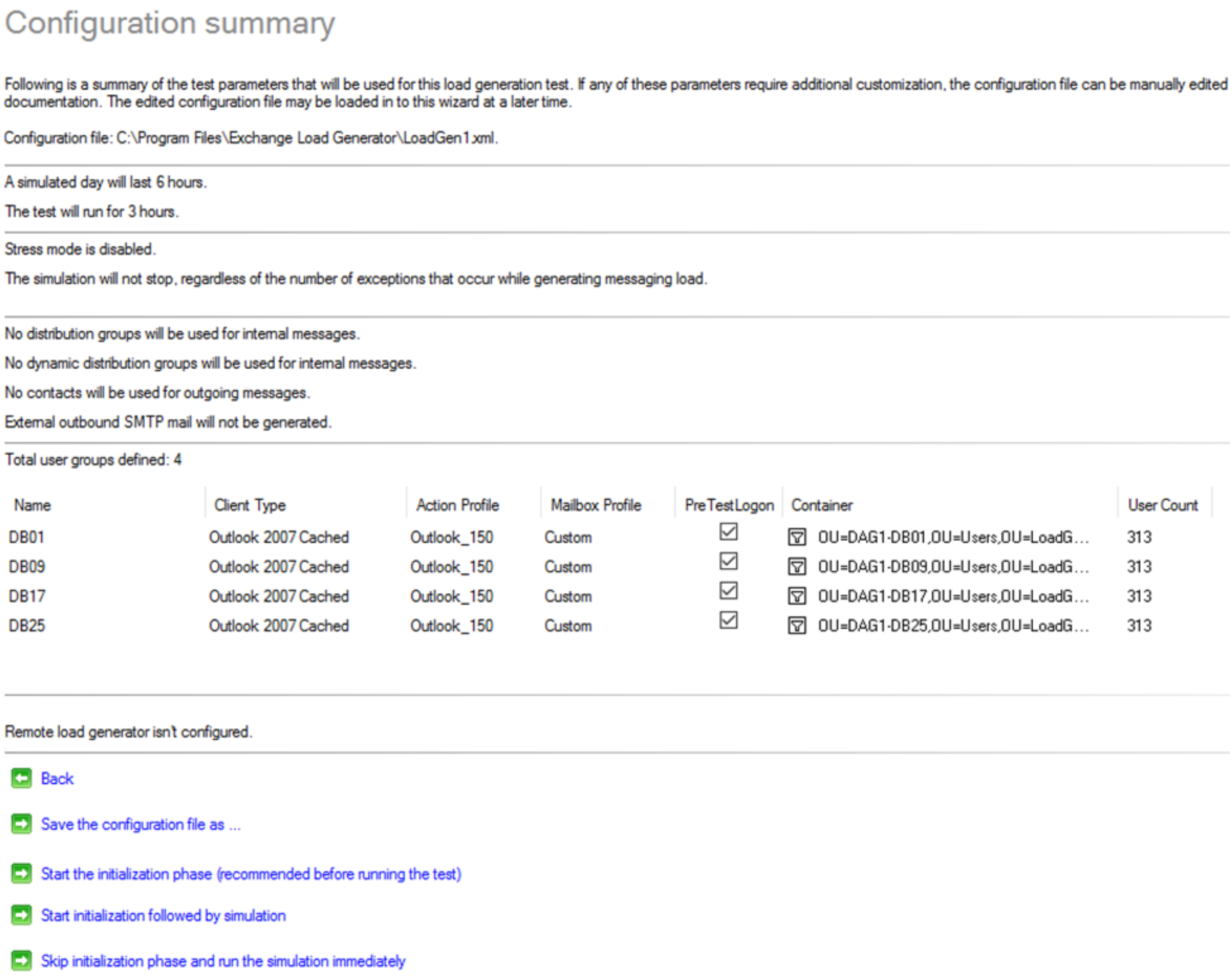
6.1 Exchange 2016 Verification

Exchange 2016 was verified by using Microsoft Exchange Load Generator 2013 (LoadGen) because it tested all aspects of Exchange. Jet Stress was run during the installation to prevalidate the storage configuration.

Microsoft Exchange LoadGen 2013 Verification

Eight workload generation hosts were deployed in a separate load generation cluster. While it was not mandatory, the workload was run from a dedicated cluster to capture pure workload performance characteristics. Each LoadGen host was given four Exchange databases and 1,252 users to validate. Each user was configured by using the Exchange 2007 cached client to perform 150 actions against a 2GB mailbox, as seen in Figure 5.

Figure 5) Exchange LoadGen 2013 configuration summary.



Configuration summary

Following is a summary of the test parameters that will be used for this load generation test. If any of these parameters require additional customization, the configuration file can be manually edited documentation. The edited configuration file may be loaded in to this wizard at a later time.

Configuration file: C:\Program Files\Exchange Load Generator\LoadGen1.xml.

A simulated day will last 6 hours.

The test will run for 3 hours.

Stress mode is disabled.

The simulation will not stop, regardless of the number of exceptions that occur while generating messaging load.

No distribution groups will be used for internal messages.

No dynamic distribution groups will be used for internal messages.

No contacts will be used for outgoing messages.

External outbound SMTP mail will not be generated.

Total user groups defined: 4

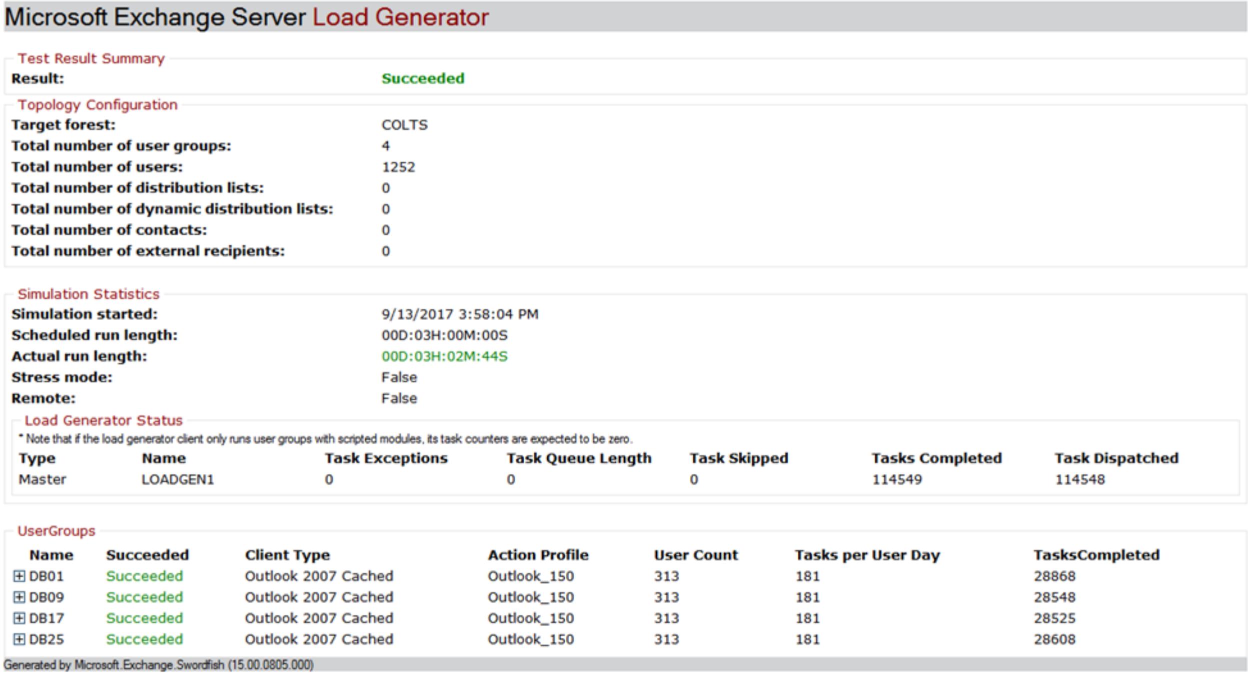
Name	Client Type	Action Profile	Mailbox Profile	PreTestLogon	Container	User Count
DB01	Outlook 2007 Cached	Outlook_150	Custom	☑	OU=DAG1-DB01,OU=Users,OU=LoadG...	313
DB09	Outlook 2007 Cached	Outlook_150	Custom	☑	OU=DAG1-DB09,OU=Users,OU=LoadG...	313
DB17	Outlook 2007 Cached	Outlook_150	Custom	☑	OU=DAG1-DB17,OU=Users,OU=LoadG...	313
DB25	Outlook 2007 Cached	Outlook_150	Custom	☑	OU=DAG1-DB25,OU=Users,OU=LoadG...	313

Remote load generator isn't configured.

Back
Save the configuration file as ...
Start the initialization phase (recommended before running the test)
Start initialization followed by simulation
Skip initialization phase and run the simulation immediately

All eight LoadGen hosts were run in parallel with the SharePoint workload. The results are shown in Figure 6 through Figure 13.

Figure 6) Results for LoadGen host 1.



Microsoft Exchange Server Load Generator

Test Result Summary

Result:	Succeeded

Topology Configuration

Target forest:	COLTS
Total number of user groups:	4
Total number of users:	1252
Total number of distribution lists:	0
Total number of dynamic distribution lists:	0
Total number of contacts:	0
Total number of external recipients:	0

Simulation Statistics

Simulation started:	9/13/2017 3:58:04 PM
Scheduled run length:	00D:03H:00M:00S
Actual run length:	00D:03H:02M:44S
Stress mode:	False
Remote:	False

Load Generator Status

* Note that if the load generator client only runs user groups with scripted modules, its task counters are expected to be zero.

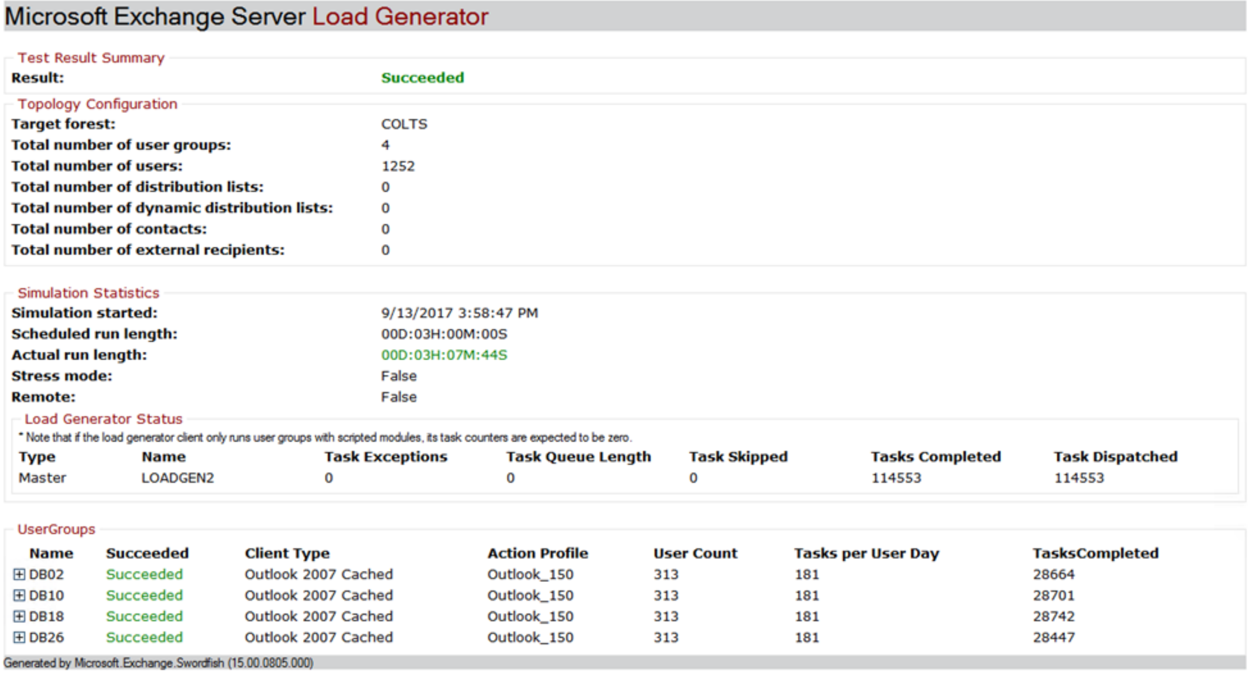
Type	Name	Task Exceptions	Task Queue Length	Task Skipped	Tasks Completed	Task Dispatched
Master	LOADGEN1	0	0	0	114549	114548

UserGroups

Name	Succeeded	Client Type	Action Profile	User Count	Tasks per User Day	TasksCompleted
⊞ DB01	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28868
⊞ DB09	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28548
⊞ DB17	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28525
⊞ DB25	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28608

Generated by Microsoft.Exchange.Swordfish (15.00.0805.000)

Figure 7) Results for LoadGen host 2.



Microsoft Exchange Server Load Generator

Test Result Summary

Result:	Succeeded

Topology Configuration

Target forest:	COLTS
Total number of user groups:	4
Total number of users:	1252
Total number of distribution lists:	0
Total number of dynamic distribution lists:	0
Total number of contacts:	0
Total number of external recipients:	0

Simulation Statistics

Simulation started:	9/13/2017 3:58:47 PM
Scheduled run length:	00D:03H:00M:00S
Actual run length:	00D:03H:07M:44S
Stress mode:	False
Remote:	False

Load Generator Status

* Note that if the load generator client only runs user groups with scripted modules, its task counters are expected to be zero.

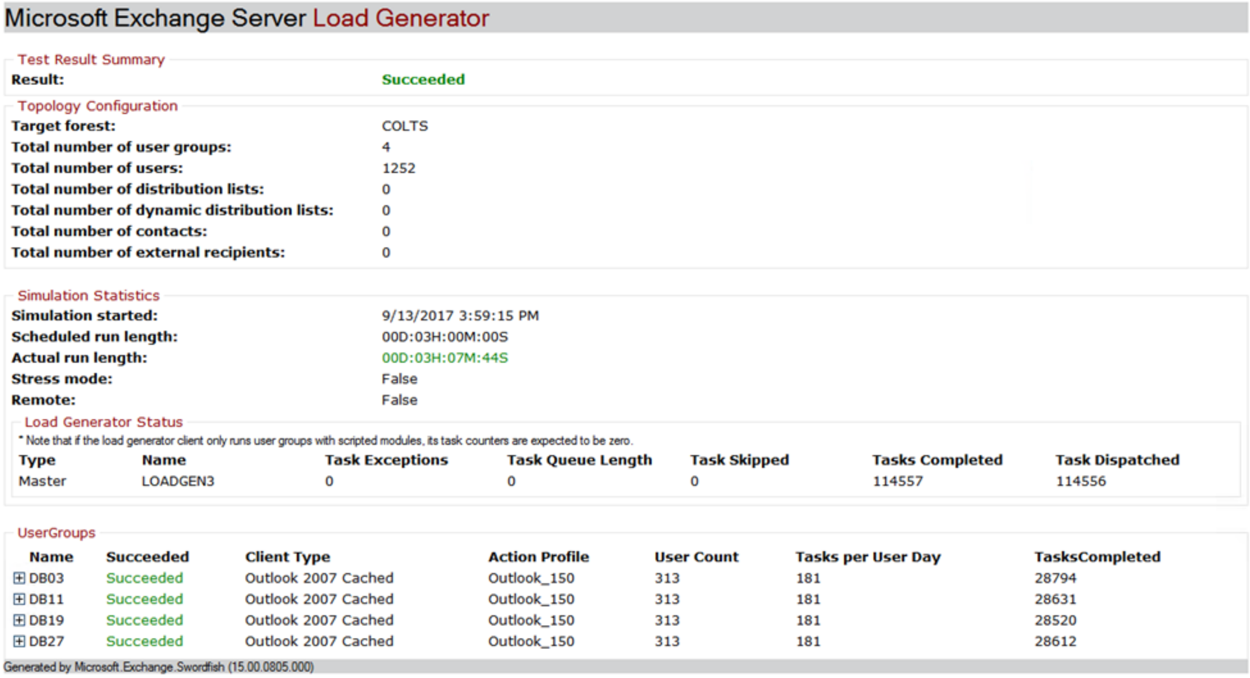
Type	Name	Task Exceptions	Task Queue Length	Task Skipped	Tasks Completed	Task Dispatched
Master	LOADGEN2	0	0	0	114553	114553

UserGroups

Name	Succeeded	Client Type	Action Profile	User Count	Tasks per User Day	TasksCompleted
⊞ DB02	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28664
⊞ DB10	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28701
⊞ DB18	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28742
⊞ DB26	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28447

Generated by Microsoft.Exchange.Swordfish (15.00.0805.000)

Figure 8) Results for LoadGen host 3.



Microsoft Exchange Server Load Generator

Test Result Summary

Result:	Succeeded

Topology Configuration

Target forest:	COLTS
Total number of user groups:	4
Total number of users:	1252
Total number of distribution lists:	0
Total number of dynamic distribution lists:	0
Total number of contacts:	0
Total number of external recipients:	0

Simulation Statistics

Simulation started:	9/13/2017 3:59:15 PM
Scheduled run length:	00D:03H:00M:00S
Actual run length:	00D:03H:07M:44S
Stress mode:	False
Remote:	False

Load Generator Status

* Note that if the load generator client only runs user groups with scripted modules, its task counters are expected to be zero.

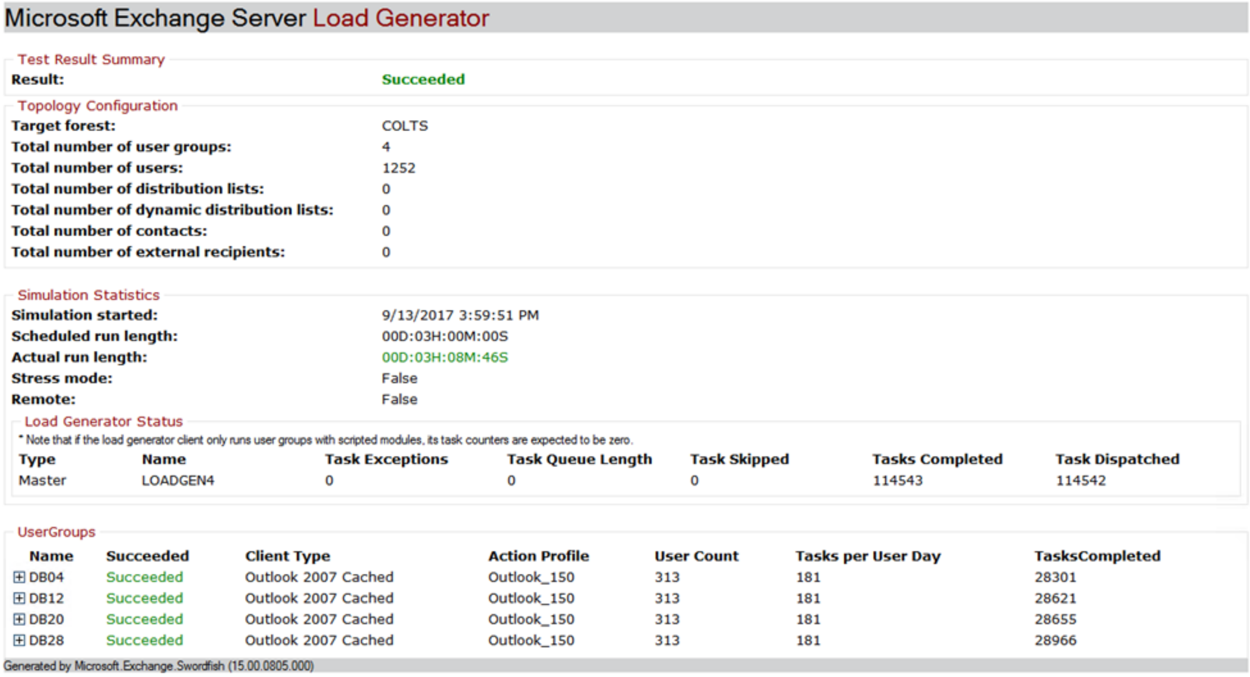
Type	Name	Task Exceptions	Task Queue Length	Task Skipped	Tasks Completed	Task Dispatched
Master	LOADGEN3	0	0	0	114557	114556

UserGroups

Name	Succeeded	Client Type	Action Profile	User Count	Tasks per User Day	TasksCompleted
⊞ DB03	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28794
⊞ DB11	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28631
⊞ DB19	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28520
⊞ DB27	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28612

Generated by Microsoft.Exchange.Swordfish (15.00.0805.000)

Figure 9) Results for LoadGen host 4.



Microsoft Exchange Server Load Generator

Test Result Summary

Result:	Succeeded

Topology Configuration

Target forest:	COLTS
Total number of user groups:	4
Total number of users:	1252
Total number of distribution lists:	0
Total number of dynamic distribution lists:	0
Total number of contacts:	0
Total number of external recipients:	0

Simulation Statistics

Simulation started:	9/13/2017 3:59:51 PM
Scheduled run length:	00D:03H:00M:00S
Actual run length:	00D:03H:08M:46S
Stress mode:	False
Remote:	False

Load Generator Status

* Note that if the load generator client only runs user groups with scripted modules, its task counters are expected to be zero.

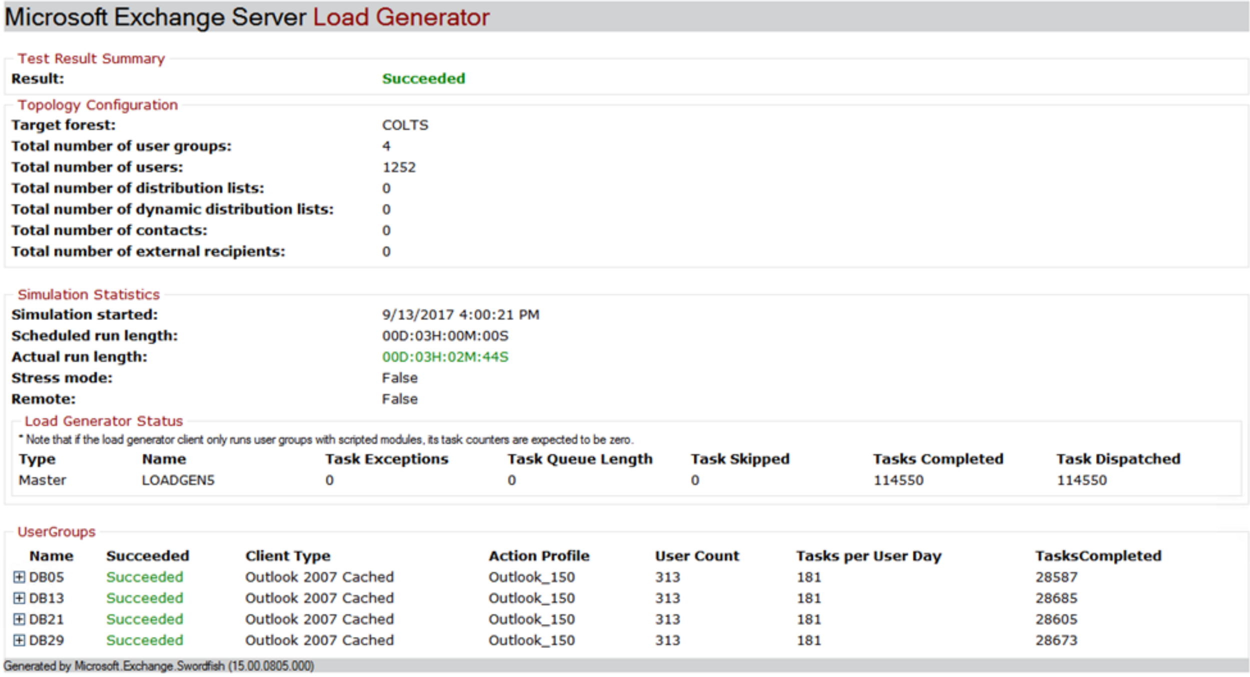
Type	Name	Task Exceptions	Task Queue Length	Task Skipped	Tasks Completed	Task Dispatched
Master	LOADGEN4	0	0	0	114543	114542

UserGroups

Name	Succeeded	Client Type	Action Profile	User Count	Tasks per User Day	TasksCompleted
⊞ DB04	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28301
⊞ DB12	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28621
⊞ DB20	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28655
⊞ DB28	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28966

Generated by Microsoft.Exchange.Swordfish (15.00.0805.000)

Figure 10) Results for LoadGen host 5.



Microsoft Exchange Server Load Generator

Test Result Summary

Result:	Succeeded

Topology Configuration

Target forest:	COLTS
Total number of user groups:	4
Total number of users:	1252
Total number of distribution lists:	0
Total number of dynamic distribution lists:	0
Total number of contacts:	0
Total number of external recipients:	0

Simulation Statistics

Simulation started:	9/13/2017 4:00:21 PM
Scheduled run length:	00D:03H:00M:00S
Actual run length:	00D:03H:02M:44S
Stress mode:	False
Remote:	False

Load Generator Status

* Note that if the load generator client only runs user groups with scripted modules, its task counters are expected to be zero.

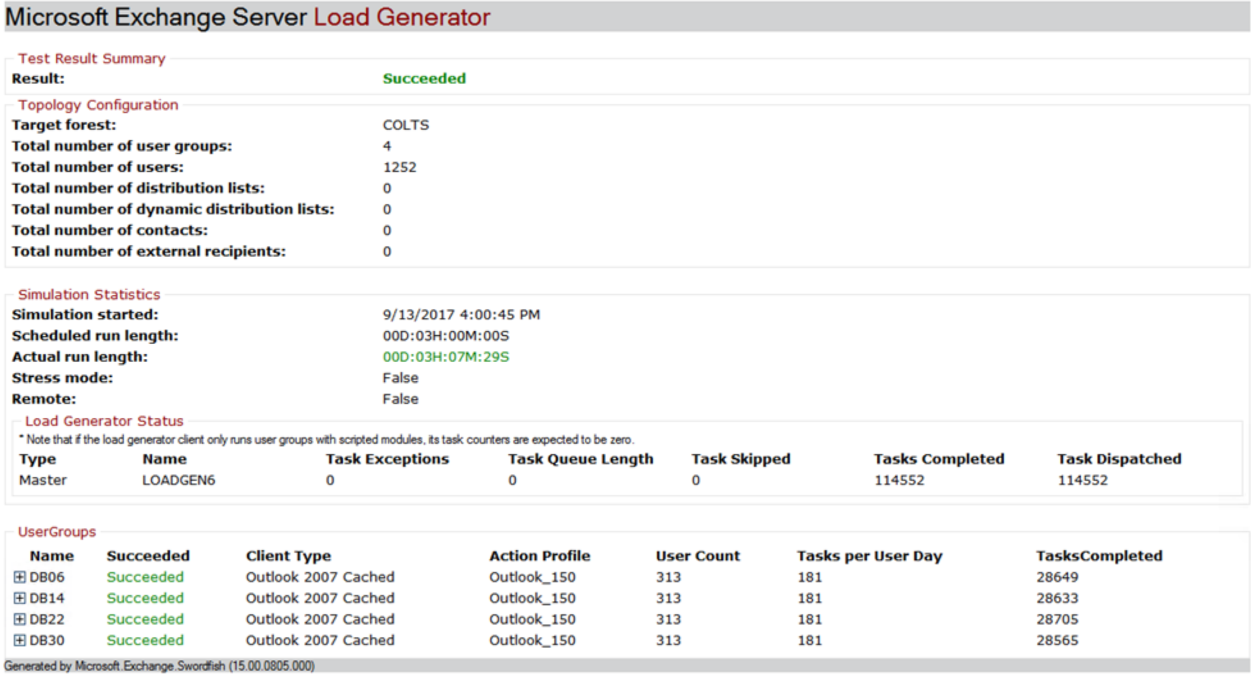
Type	Name	Task Exceptions	Task Queue Length	Task Skipped	Tasks Completed	Task Dispatched
Master	LOADGEN5	0	0	0	114550	114550

UserGroups

Name	Succeeded	Client Type	Action Profile	User Count	Tasks per User Day	TasksCompleted
⊞ DB05	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28587
⊞ DB13	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28685
⊞ DB21	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28605
⊞ DB29	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28673

Generated by Microsoft.Exchange.Swordfish (15.00.0805.000)

Figure 11) Results for LoadGen host 6.



Microsoft Exchange Server Load Generator

Test Result Summary

Result:	Succeeded

Topology Configuration

Target forest:	COLTS
Total number of user groups:	4
Total number of users:	1252
Total number of distribution lists:	0
Total number of dynamic distribution lists:	0
Total number of contacts:	0
Total number of external recipients:	0

Simulation Statistics

Simulation started:	9/13/2017 4:00:45 PM
Scheduled run length:	00D:03H:00M:00S
Actual run length:	00D:03H:07M:29S
Stress mode:	False
Remote:	False

Load Generator Status

* Note that if the load generator client only runs user groups with scripted modules, its task counters are expected to be zero.

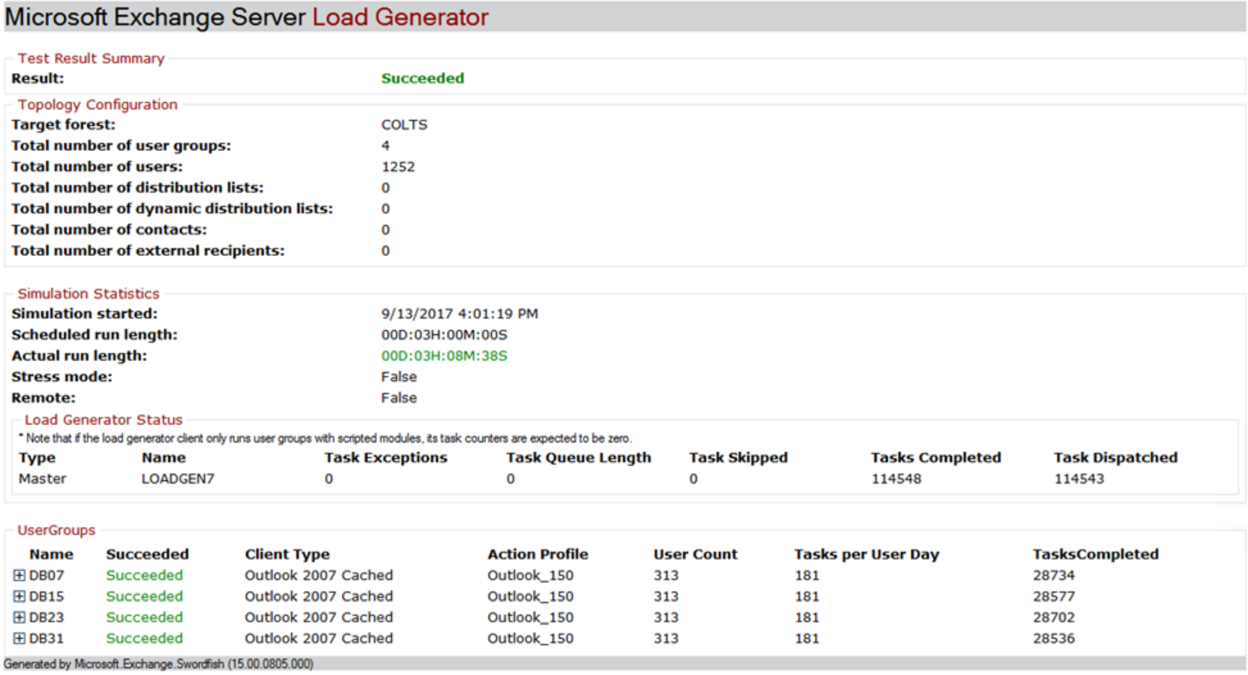
Type	Name	Task Exceptions	Task Queue Length	Task Skipped	Tasks Completed	Task Dispatched
Master	LOADGEN6	0	0	0	114552	114552

UserGroups

Name	Succeeded	Client Type	Action Profile	User Count	Tasks per User Day	TasksCompleted
⊞ DB06	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28649
⊞ DB14	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28633
⊞ DB22	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28705
⊞ DB30	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28565

Generated by Microsoft.Exchange.Swordfish (15.00.0805.000)

Figure 12) Results for LoadGen host 7.



Microsoft Exchange Server Load Generator

Test Result Summary

Result:	Succeeded

Topology Configuration

Target forest:	COLTS
Total number of user groups:	4
Total number of users:	1252
Total number of distribution lists:	0
Total number of dynamic distribution lists:	0
Total number of contacts:	0
Total number of external recipients:	0

Simulation Statistics

Simulation started:	9/13/2017 4:01:19 PM
Scheduled run length:	00D:03H:00M:00S
Actual run length:	00D:03H:08M:38S
Stress mode:	False
Remote:	False

Load Generator Status

* Note that if the load generator client only runs user groups with scripted modules, its task counters are expected to be zero.

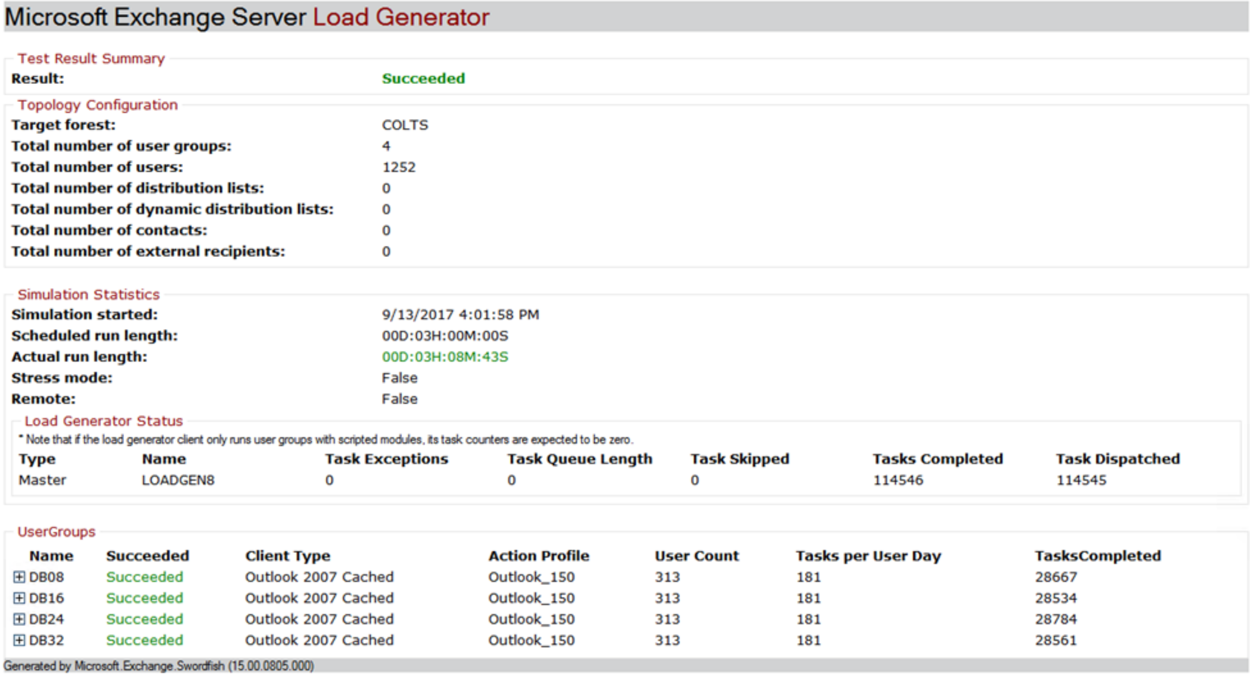
Type	Name	Task Exceptions	Task Queue Length	Task Skipped	Tasks Completed	Task Dispatched
Master	LOADGEN7	0	0	0	114548	114543

UserGroups

Name	Succeeded	Client Type	Action Profile	User Count	Tasks per User Day	TasksCompleted
⊞ DB07	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28734
⊞ DB15	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28577
⊞ DB23	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28702
⊞ DB31	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28536

Generated by Microsoft.Exchange.Swordfish (15.00.0805.000)

Figure 13) Results for LoadGen host 8.



Microsoft Exchange Server Load Generator

Test Result Summary

Result:	Succeeded

Topology Configuration

Target forest:	COLTS
Total number of user groups:	4
Total number of users:	1252
Total number of distribution lists:	0
Total number of dynamic distribution lists:	0
Total number of contacts:	0
Total number of external recipients:	0

Simulation Statistics

Simulation started:	9/13/2017 4:01:58 PM
Scheduled run length:	00D:03H:00M:00S
Actual run length:	00D:03H:08M:43S
Stress mode:	False
Remote:	False

Load Generator Status

* Note that if the load generator client only runs user groups with scripted modules, its task counters are expected to be zero.

Type	Name	Task Exceptions	Task Queue Length	Task Skipped	Tasks Completed	Task Dispatched
Master	LOADGEN8	0	0	0	114546	114545

UserGroups

Name	Succeeded	Client Type	Action Profile	User Count	Tasks per User Day	TasksCompleted
⊞ DB08	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28667
⊞ DB16	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28534
⊞ DB24	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28784
⊞ DB32	Succeeded	Outlook 2007 Cached	Outlook_150	313	181	28561

Generated by Microsoft.Exchange.Swordfish (15.00.0805.000)

Performance Results and Analysis

Depending on the complexity of the deployment and user activity, Exchange 2016 server performance varies between environments, as shown in Table 25.

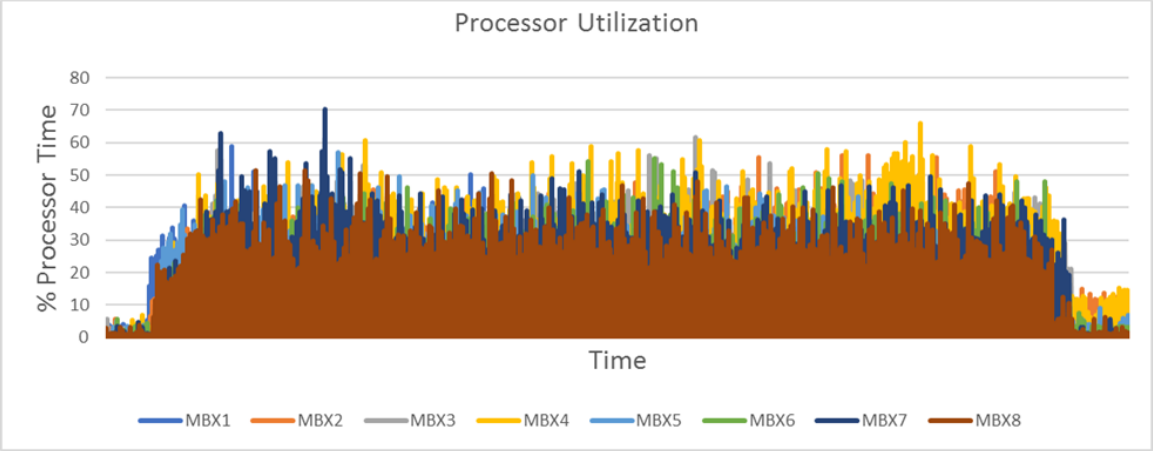
Table 25) Exchange performance results. .

Counter	MBX1	MBX2	MBX3	MBX4	MBX5	MBX6	MBX7	MBX8
MSExchange RpcClientAccess\Active User Count	869	866	860	866	856	862	860	859
MSExchange RpcClientAccess\User Count	1,050	1,062	1,062	1,066	1,050	1,063	1,068	1,065
MSExchangeIS Store\Messages Delived/Sec	4.3	4.3	4.3	4.4	4.3	4.3	4.3	4.3
MSExchangeIS Store\Messages Submitted/Sec	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
MSExchange ADAccess Domain Controllers(AD1)\LDAP Read Time	1.2	1	0.9	1	1.1	1	0.9	0.9
MSExchange ADAccess Domain Controllers(AD1)\LDAP Search Time	1.1	1.2	1.2	1.3	1.3	1.4	1.3	1.3
MSExchange ADAccess Domain Controllers(AD2)\LDAP Read Time	1.4	1.6	1.6	1.8	1.4	1.6	1.8	1.7
MSExchange ADAccess Domain Controllers(AD2)\LDAP Search Time	1.2	1.3	1.4	1.5	1.5	1.4	1.4	1.7
MSExchangeIS Client Type(*)\RPC Average Latency	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.4
NET CLR Memory(_Global_)\% Time in GC	0.9	1	1	0.9	1.2	0.9	1.1	1

Processor Utilization

Figure 14 is a graph that shows the percentage of CPU utilization for the mailbox servers.

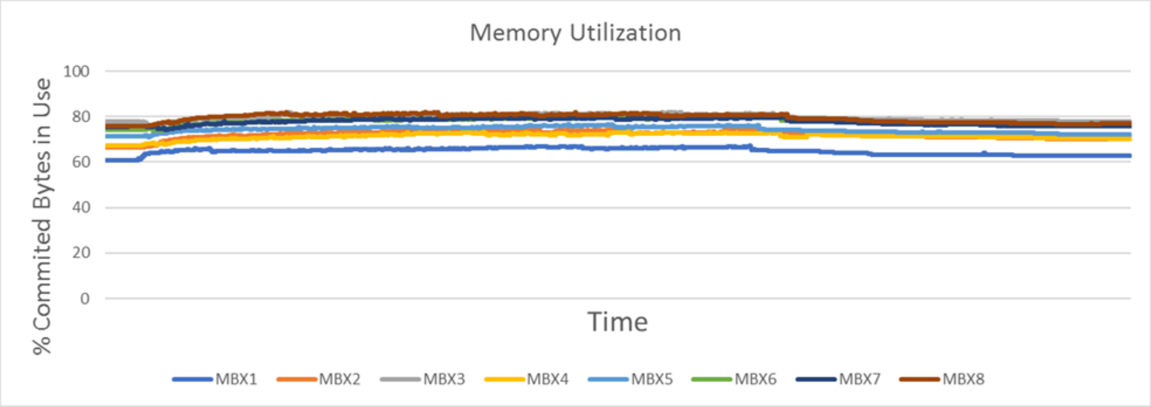
Figure 14) Processor utilization.



Memory Utilization

Figure 15 is a graph that shows the percentage of memory utilization for the mailbox servers.

Figure 15) Memory utilization.



6.2 SharePoint 2016 Verification

The physical architecture of the test farm consists of 10 Visual Studio Team System (VSTS) 2008 controllers. Servers and the network infrastructures, which together create the SharePoint environment, are tailored with respect to the size and topology, as explained in the subsequent sections.

Modeling a SharePoint Server 2016 environment begins with analyzing the current requirements and estimating the expected future demand and targets for the deployment. Decisions are made about the key solution that an environment must support and establishment of all of the important metrics and parameters. The SharePoint Server 2016 environment is modeled with consideration to enterprise workload characteristics such as the number of users, most frequently used operations, and datasets such as content size and content distribution demands and is tailored in accordance with Microsoft recommendations.

Workload Characteristics

Sizing a SharePoint environment workload is a factor in the solution. The system under test should sustain the described workload demands, user base, and usage characteristics. Table 26 lists these workload characteristics.

Table 26) Workload characteristics.

Workload Characteristics	Value
Number of users (unique users in a 24-hour period)	10,000
Concurrent users at peak time (distinct users generating requests in a given time frame)	10,000
Percentage of browse operations	30%
Percentage of open operations	30%
Percentage of search operations	30%
Percentage of upload operations	10%

Workload Mix (100 RPH)

SharePoint farm requirements include the number of users and their usage characteristics. The performance test considered a heavy profile: a single active user made 100 different requests per hour to the SharePoint 2016 farm. One hundred requests per hour per user were considered for this test case.

User activities or usage characteristics were modeled based on the enterprise business environment needs: for example, from organizations such as marketing, engineering, and so on. In general, the environment hosts central team sites; publishing portals for internal teams; and enterprise collaboration of organizations, teams, and projects. Sites created in these environments were used as communication portals, host applications for business solutions, and channels for general collaboration. Searching, editing, and uploading documents; participating in discussions; posting and commenting on blogs; and so on were among the most common activities.

Performance Test Framework

The performance test provided the responsiveness, throughput, reliability, and scalability of a SharePoint 2016 farm under a given workload. The results of the performance test and analysis can help you estimate the hardware configuration required for a SharePoint 2016 farm to support 10,000 users under production operation in a FlexPod solution.

Test Methodology

In this solution, we used Microsoft VSTS in conjunction with the custom code to simulate real-world SharePoint user activity. Validating the performance of the SharePoint 2016 farm with the associated tools (VSTS, bulk loader) was a complex activity and is not required for every deployment.

NetApp recommends that you perform validation testing when custom code for the SharePoint 2016 farm is available.

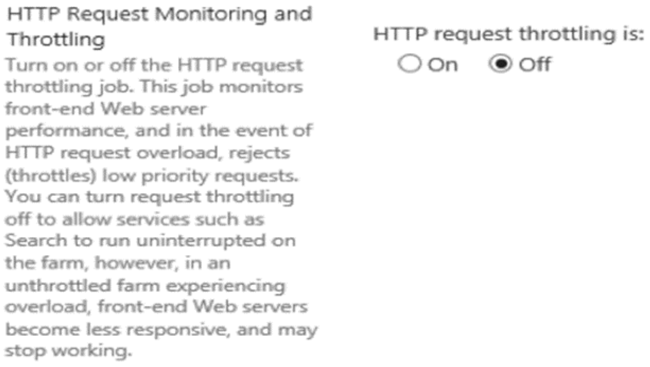
The 2TB content database that was created has sites, site collections, and other important features that constitute the dataset.

HTTP Throttling

HTTP throttling is a SharePoint 2016 feature that allows the server to discard the server requests when it is too busy. Every five seconds, a dedicated job runs and checks the server resources to compare with the resource levels configured for the server. By default, the server CPU, memory, request in queue, and request wait time are being monitored. The server enters a throttling period after three consecutive unsuccessful HTTP GET checks. The server remains in this period until a successful check is done. Requests generated before the server enters the throttling mode are accepted and completed. Any new HTTP GET request or Search Robot request generates a 503 error message and is logged in the event viewer. Also, while the server is in a throttling period, no new timer jobs can be get started.

To monitor the server performance, the HTTP throttling is turned off, as shown in Figure 16.

Figure 16) HTTP throttling: off mode.



HTTP Request Monitoring and Throttling

Turn on or off the HTTP request throttling job. This job monitors front-end Web server performance, and in the event of HTTP request overload, rejects (throttles) low priority requests. You can turn request throttling off to allow services such as Search to run uninterrupted on the farm, however, in an unthrottled farm experiencing overload, front-end Web servers become less responsive, and may stop working.

HTTP request throttling is:

○ On ● Off

Performance Results and Analysis

Depending on the complexity of the deployment and the components involved in the architecture, SharePoint 2016 server performance varies between environments. Performance of the SharePoint architecture is determined by the user experience.

The following major performance counters measure user experience:

- **Requests per second:** number of requests per second taken by the SharePoint server
- **Average response time:** amount of time the SharePoint server takes to return the results of a request to the user
- **Average page response time:** average time to download the page and all its dependent requests such as images, css, js, and so on

Table 21 shows the results for the applied workload (100 RPH) on the created SharePoint farm.

Table 27) Applied workload (100 RPH) on the created SharePoint farm.

Load Server Number	User Count	Average Requests per Second	Average Response Time (Sec)	Average Page Time (Sec)
1	1,000	28.3	0.47	0.52
2	1,000	28.2	0.48	0.53
3	1,000	28.2	0.48	0.53
4	1,000	28.2	0.49	0.54
5	1,000	28.2	0.49	0.53
6	1,000	28.2	0.49	0.54
7	1,000	28.3	0.48	0.53
8	1,000	28.3	0.49	0.54
9	1,000	28.3	0.49	0.54
10	1,000	28.2	0.49	0.53

Table 27 shows how you can easily support more than 10,000 active SharePoint users with subsecond response times.

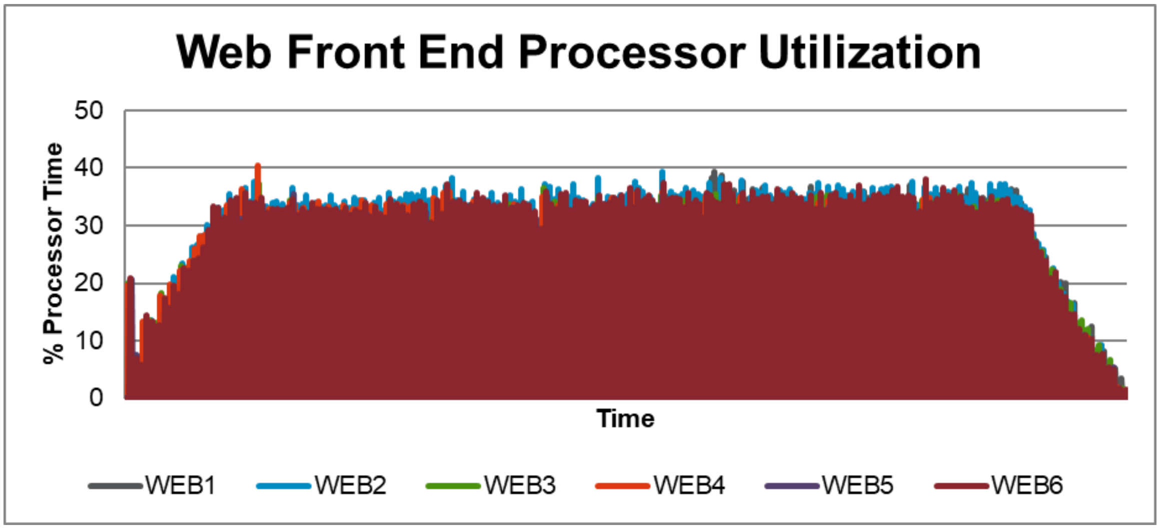
Processor Utilization

This section contains graphs that show the percentage of CPU utilization for the different components in the SharePoint 2016 farm.

Web Front-End Server

The graph in Figure 17 shows the CPU utilization of the SharePoint web front-end servers. Under a heavy workload of 10,000 users, virtual servers are hosted on Cisco UCS B200 M4 servers. CPU utilization remained at around 35% to 40% on an average. The graph shows the linear growth in the CPU utilization for the increase in the user load and their workloads. The graph shows the virtual server on Cisco UCS B200 M4 server's capacity to accommodate more workloads with ease without causing any stress.

Figure 17) SharePoint web front-end processor utilization.



Application and Search Servers

The graphs in Figure 18 and Figure 19 show the CPU utilization of the SharePoint application and search servers. Under a heavy load of 10,000 active users, the servers are not under heavy utilization. This implies that more than 10,000 active users can be easily supported, or a component failure in the farm can be easily sustained.

Figure 18) SharePoint application server processor utilization.

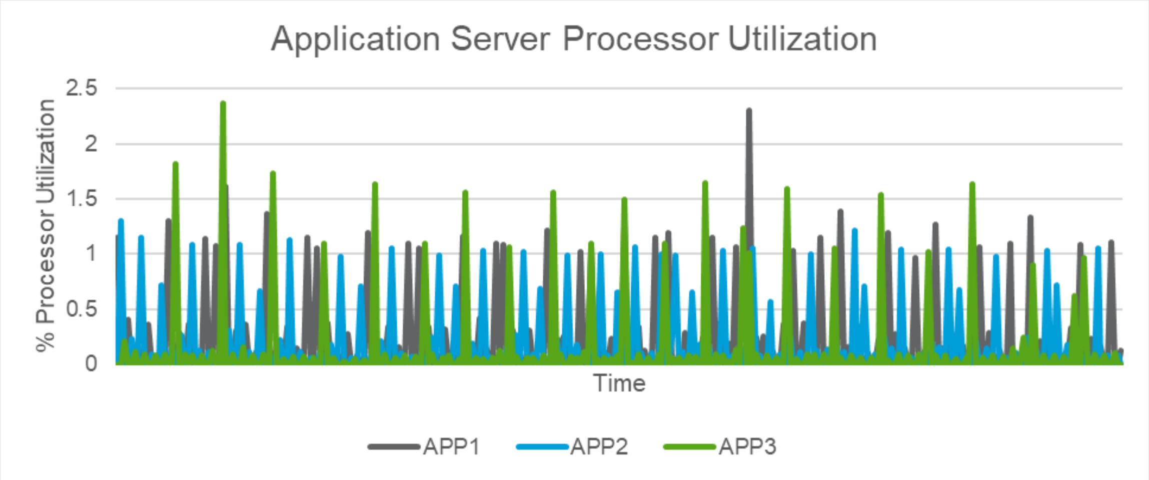
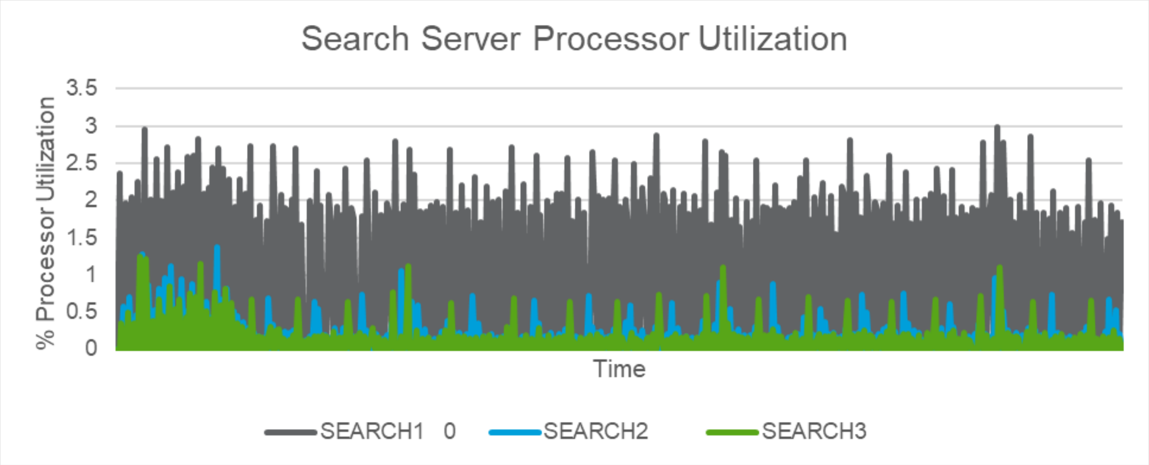


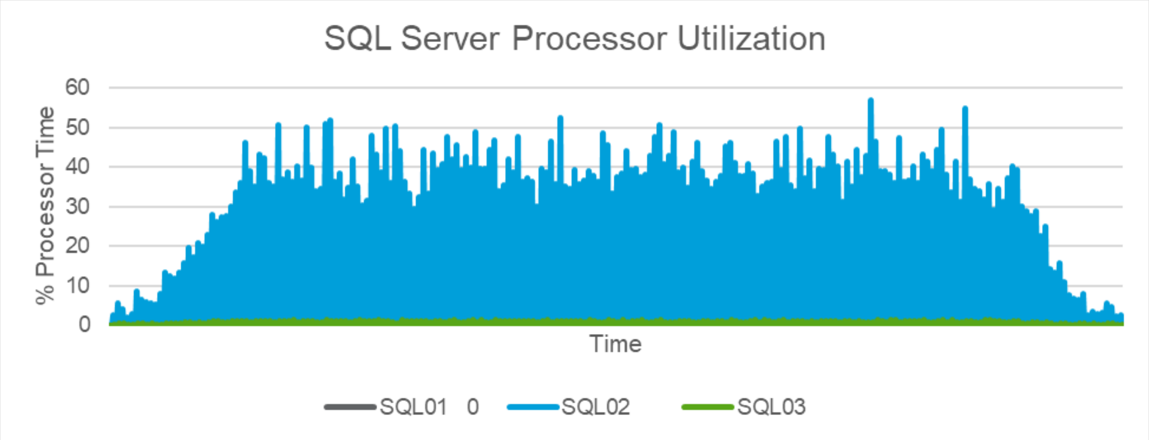
Figure 19) SharePoint search server processor utilization.



Database Server

The graph in Figure 20 shows the SQL Server 2016 database server CPU utilization. On average, the overall CPU utilization at the database tier with virtual servers remained at around 35% (when the server was hosted on the Cisco UCS B200 M4). FlexPod accommodated more CPU utilization without causing stress on its performance. Also, as shown in this graph, only the active SQL Server was under 35% utilization; the remaining servers were at 5% to 10% utilization.

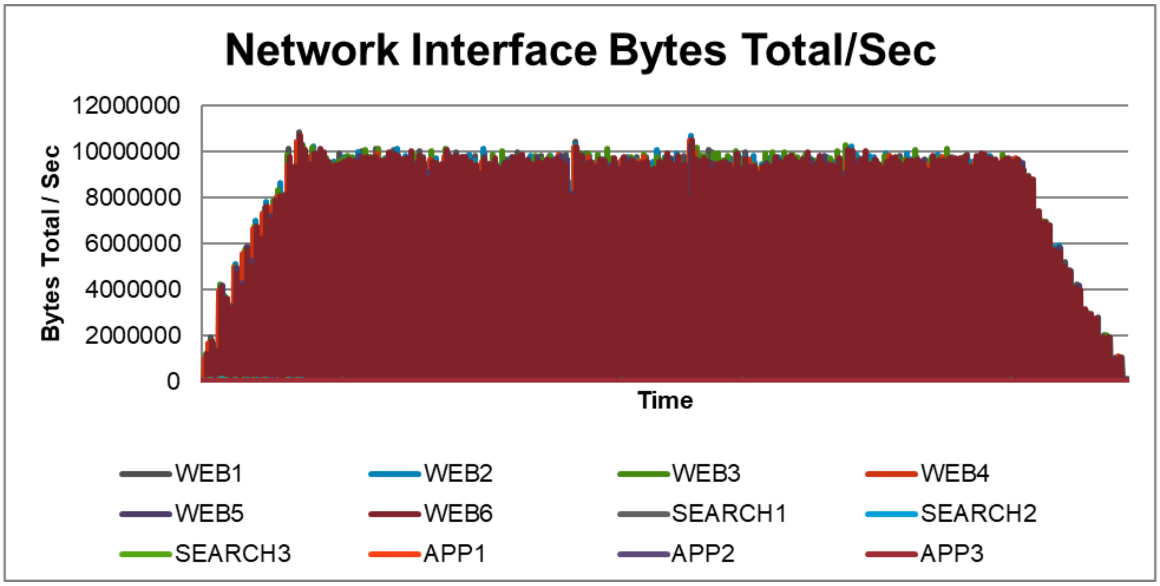
Figure 20) SQL Server processor utilization.



Network Utilization

The graph in Figure 21 shows the network utilization at the web front-end application and search servers of the SharePoint 2016 large farm. This graph also shows the aggregated performance numbers of the network utilization on all of the servers in the farm.

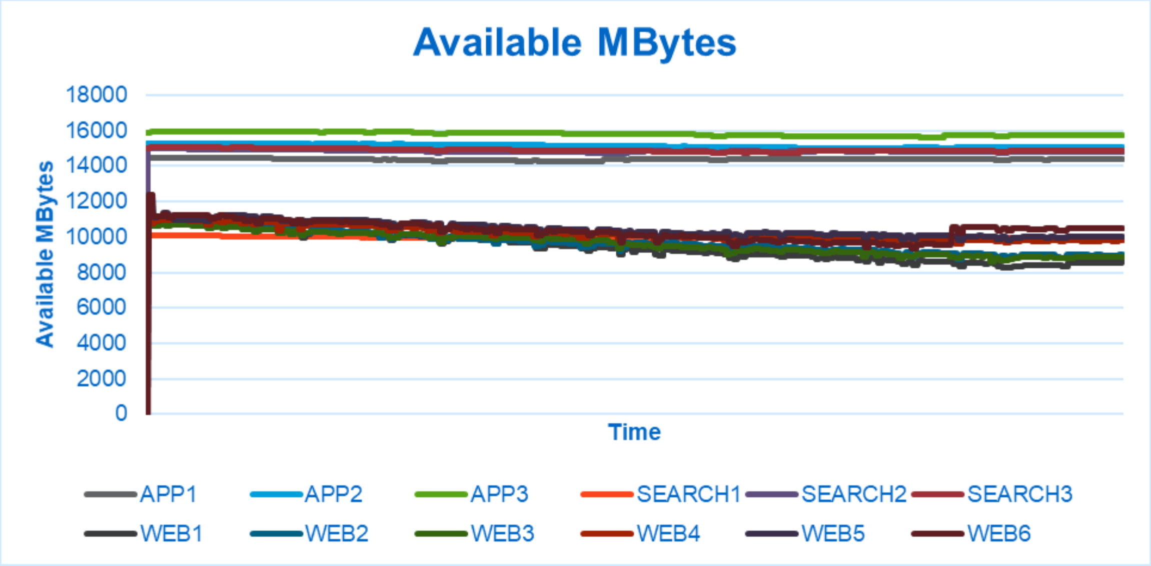
Figure 21) Network utilization.



Memory Utilization

The graph in Figure 22 shows the memory utilization of the SharePoint 2016 server farm under workloads of 10,000 users.

Figure 22) Memory utilization.

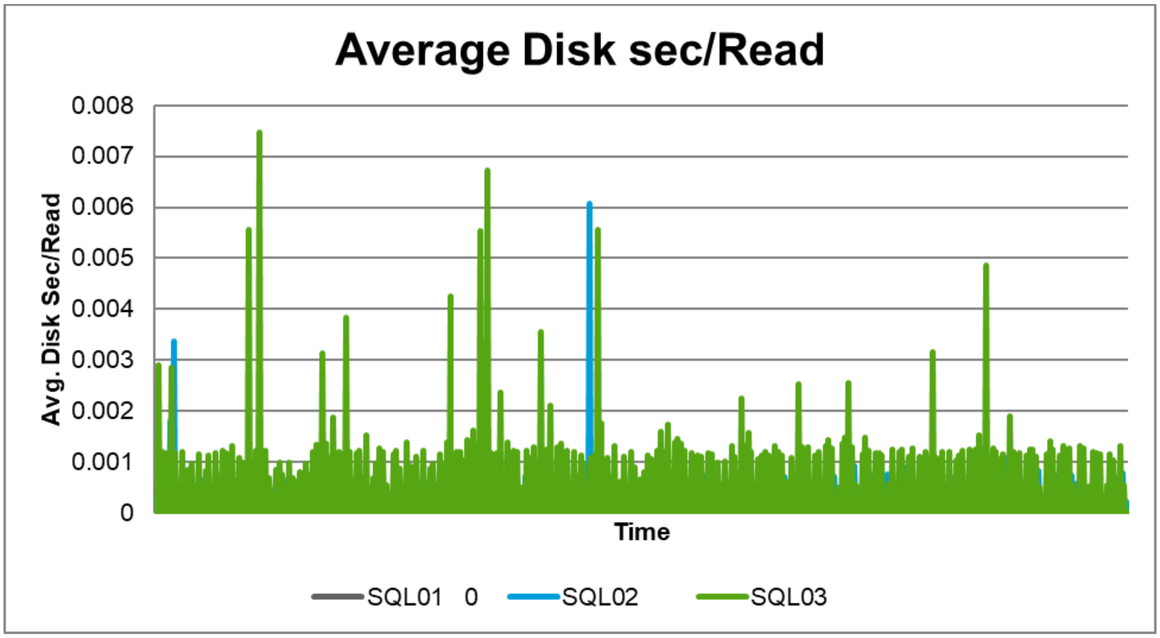


The maximum memory utilization on the web front-end server's application server and SQL Server at the maximum user load is within 50% of the available physical memory. This utilization indicates that the CPU is available for further expansion, while providing high availability for all SharePoint roles hosted on various SharePoint tiers.

Read Latency

The graph in Figure 23 shows the average latency observed during the performance study on the Microsoft SQL Server instances. The performance tests show a maximum read latency of 7.5ms.

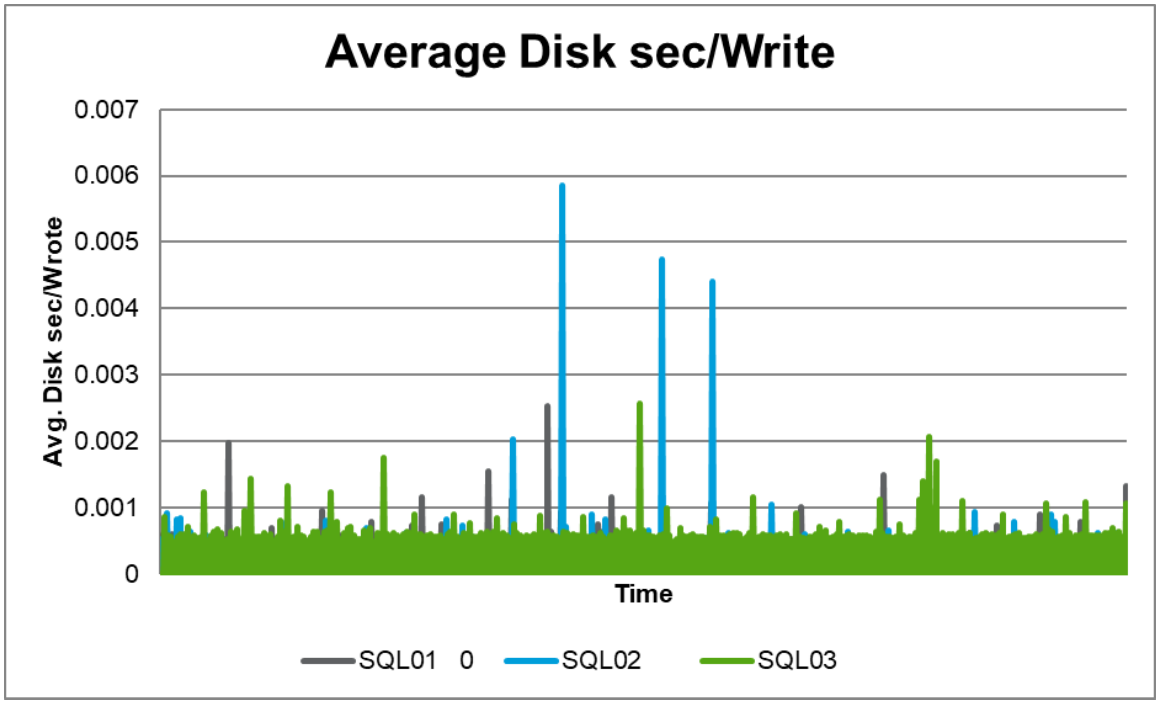
Figure 23) Average read latency.



Write Latency

The graph in Figure 24 shows the average latency observed during the performance study on the Microsoft SQL Server instances. The performance tests show a maximum write latency of 6ms.

Figure 24) Average write latency.



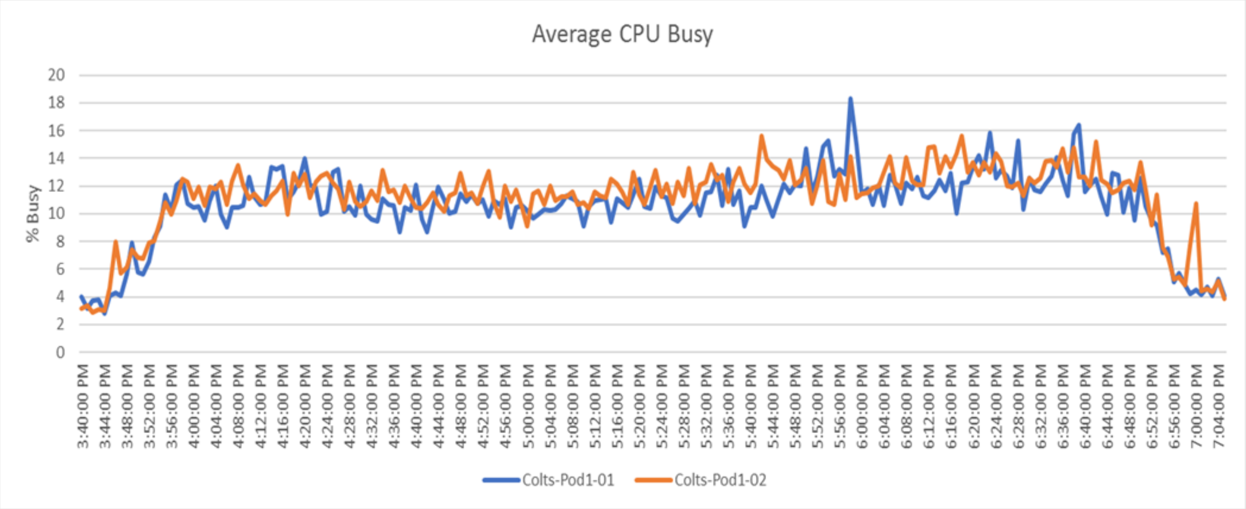
NetApp A300 Performance

For each combined performance run, ONTAP was monitored by using Harvest, Graphite, and Grafana to capture the combined load of both Exchange and SharePoint.

Average CPU Busy

The graph in Figure 25 shows the average processor utilization throughout the SharePoint and Exchange combined testing.

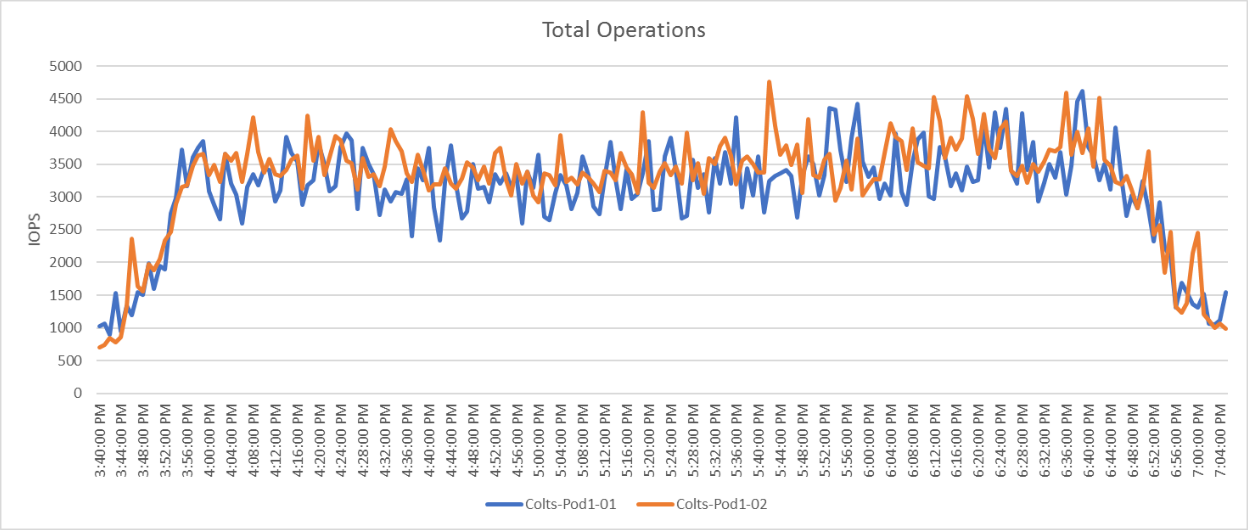
Figure 25) Average CPU utilization.



Total Storage Operations

The graph in Figure 26 shows the total operations performed throughout the SharePoint and Exchange combined testing.

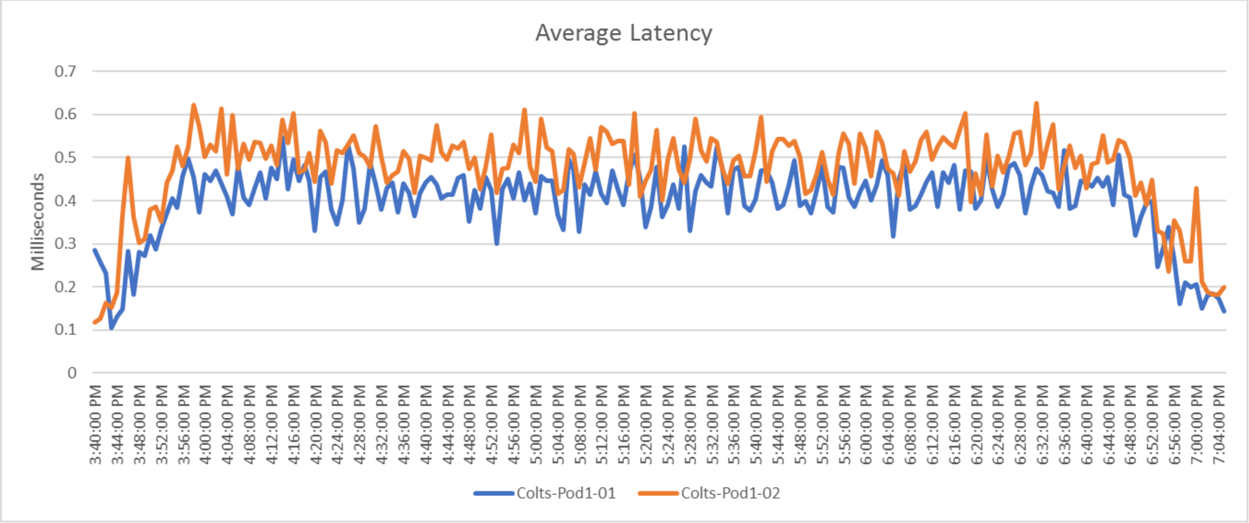
Figure 26) Total storage operations.



Average Latency

The graph in Figure 27 shows the average latency achieved throughout the SharePoint and Exchange combined testing.

Figure 27) Average latency.



7 Conclusion

The performance validation proved that the SharePoint farm can easily support 10,000 concurrent users as well as 10,000 concurrent Exchange users running from a shared infrastructure. The FlexPod solution composed of Cisco UCS servers, NetApp All Flash FAS storage, and VMware delivered an average response time well below one second.

In addition to the validated workload performance found in Exchange and SharePoint, this solution also highlights the power of the NetApp A300 storage controller. It easily handled the combined workloads while delivering consistent submillisecond performance and only consumed an average of 14% CPU. If needed, this solution architecture could be scaled up significantly, and/or additional workloads could be added to the FlexPod architecture (capacity permitting).

Appendix A: LoadGen Configuration

Configure Outlook Anywhere for LoadGen 2013 Clients

To configure Outlook Anywhere for LoadGen 2013 clients, complete the following step:

1. Configure the Outlook Anywhere namespace.

```
Get-OutlookAnywhere | Set-OutlookAnywhere -ExternalHostname mail.colts.local `
    -DefaultAuthenticationMethod NTLM  -ExternalClientsRequireSsl $true
```

SSL Certificates

This section describes how to issue an HTTPS certificate from an enterprise CA.

Create Exchange CSR

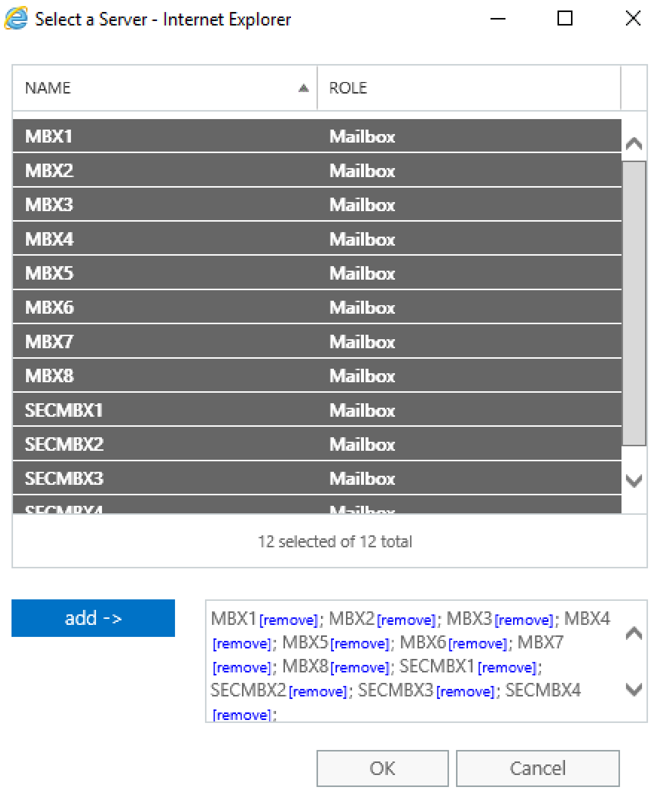
To create Exchange CSR, complete the following steps:

1. Log in to the Exchange Admin Center.
2. From the left tab, select Servers. In the top-right corner, select Certificates.
3. Click the + symbol to start the Certificate Request wizard.
4. Select the Create a Request for a Certificate from a Certification Authority option and click Next.
5. Enter a friendly name for the certificate and click Next.
6. Do not select the Wildcard Certificate option. Click Next.
7. Click browse and then select the server where the new certificate is stored.
8. Select the additional Exchange SANs and click Next.
9. Review the host names that are included in the new certificate, adding any additional host names as needed. If you are not using wildcards, either go through the steps in the wizard for each mailbox host or add those additional SANs now. Click Next.
10. Enter the organization information for the new certificate and click Next.
11. Enter an UNC path where the new CSR can be stored and click Finish.

Install SSL Certificates on Exchange Servers

To install SSL certificates on the Exchange servers, complete the following steps:

1. Log in to the Exchange Admin Center.
2. From the left tab, select Servers. In the top-right corner, select Certificates.
3. Select the Certificate in the Pending Request Status option and click Complete.
4. Enter the UNC path to the CER to reimport.
5. Enter the required information and click Next.
6. Click the + symbol and select the servers participating in the namespace. Click Add and then Click OK.



Select a Server - Internet Explorer

NAME	ROLE
MBX1	Mailbox
MBX2	Mailbox
MBX3	Mailbox
MBX4	Mailbox
MBX5	Mailbox
MBX6	Mailbox
MBX7	Mailbox
MBX8	Mailbox
SECMBX1	Mailbox
SECMBX2	Mailbox
SECMBX3	Mailbox
SECMBX4	Mailbox

12 selected of 12 total

MBX1 [remove]; MBX2 [remove]; MBX3 [remove]; MBX4 [remove]; MBX5 [remove]; MBX6 [remove]; MBX7 [remove]; MBX8 [remove]; SECMBX1 [remove]; SECMBX2 [remove]; SECMBX3 [remove]; SECMBX4 [remove];

7. Click Finish to apply the certificate to the designated servers.

Appendix B: SharePoint Load Testing Tools

Sample Tool to Create Large Number of Random Documents

In this solution, a bulk loader tool was used to create unique documents. The tool was written using the Microsoft.net 4.0 framework, which creates documents based on a Wikipedia dump file. The utility enables you to create up to 10 million unique Word, Excel, PowerPoint, or HTML files of various sizes and load different content types of different sizes directly into the SharePoint 2016 document library.

For more information about the bulk loader tool, see the Microsoft Developer Network library.

Sample Tool to Load Documents into SharePoint

In this solution, the data bulk loader tool was used to load documents into the SharePoint server. The tool was written using C# and the Microsoft .NET 3.5 framework to be compatible with SharePoint server. This tool takes the bulk loader tool disk output files as input and loads them directly into the SharePoint server. This simulates the same folder and file structure and uses targeted web applications and document libraries specified in the application configuration.

For more information about the load Bulk 2SP tool, see SharePoint 2010 Bulk Document Importer.

Sample Code for SharePoint Performance Testing

In this solution, the visual studio 2010 SP1 was used to test SharePoint performance, which provides load and stress testing for search document download and view page scenarios. Refer to the sample code and customize it in your own solution to validate the SharePoint 2016 performance.

For more information, see SharePoint Performance Tests.

Where to Find Additional Information

This section provides links to additional information and reference material for the subjects contained in this document.

Cisco UCS

The following links provide additional information about the Cisco UCS:

- Cisco Design Zone for Data Centers
  http://www.cisco.com/c/en/us/solutions/enterprise/design-zone-data-centers/index.html
- Cisco UCS
  http://www.cisco.com/c/en/us/products/servers-unified-computing/index.html
- Cisco UCS 6200 Series Fabric Interconnects
  http://www.cisco.com/en/US/products/ps11544/index.html
- Cisco UCS 5100 Series Blade Server Chassis
  http://www.cisco.com/en/US/products/ps10279/index.html
- Cisco UCS B-Series Blade Servers
  http://www.cisco.com/c/en/us/products/servers-unified-computing/ucs-b-series-blade-servers/index.html
- Cisco UCS Adapters
  http://www.cisco.com/en/US/products/ps10277/prod_module_series_home.html
- Cisco UCS Manager
  http://www.cisco.com/en/US/products/ps10281/index.html

Cisco Nexus Networking

The following link provides additional information about Cisco Nexus 9000 Series switches:

- Cisco Nexus 9000 Series Switches
  http://www.cisco.com/c/en/us/products/switches/nexus-9000-series-switches/index.html

NetApp AFF Storage

The following links provide additional information about NetApp ONTAP and AFF A-Series storage:

- ONTAP 9.1 Documentation
  http://docs.netapp.com/ontap-9/index.jsp
- Hardware Universe
  https://hwu.netapp.com

VMware vSphere

The following link provides additional information about VMware vSphere:

- VMware vSphere Documentation Center
  http://pubs.vmware.com/vsphere-65/index.jsp

- VMware vSphere Configuration Maximums
  https://www.vmware.com/pdf/vsphere6/r65/vsphere-65-configuration-maximums.pdf

Interoperability Matrixes

The following links provide information about interoperability tools:

- Cisco UCS Hardware and Software Interoperability Tool
  http://www.cisco.com/web/techdoc/ucs/interoperability/matrix/matrix.html
- NetApp Interoperability Matrix Tool
  http://support.netapp.com/matrix
- VMware Compatibility Guide
  http://www.vmware.com/resources/compatibility

Version History

Version	Date	Document Version History
1.0	October 2017	Initial release.

Refer to the Interoperability Matrix Tool (IMT) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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