Standard Operating Procedure

Title	Build a VMWare Cluster with vSAN
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Revision History and Document Management

	Date	Name
Initial Release:	15AUGUST2023	Konrad Jeziorski
Revision:		

Summary of the Policy/Purpose of this SOP

This Standard Operating Procedure (SOP) aims to provide comprehensive technical instructions to the client's technical personnel responsible for building three clusters with clustered shared storage and configuring a Domain Controller. The environment will utilize Hyper-V as the virtualization platform, and each server was Windows Server 2016 Datacenter installed. The SOP's primary objective is to deliver a detailed, step-by-step guide for a smooth and efficient production environment implementation.

Critical tasks covered by this SOP include:

1. Prerequisites verification, including hardware requirements and resource accessibility.
2. Set Domain Controller server.
3. Install three VMware ESXi on Hosts (VMWare Workstation).
4. Install and Configure VMware vCenter.
5. Perform Updates.
6. Networking and Storage Configuration.
7. Implement vSAN.
8. Verification Testing.

The Standard Operating Procedure (SOP) focuses on providing detailed technical instructions to the client's technical personnel responsible for building clusters with clustered shared storage (vSAN) and configuring a Domain Controller in the VMware vSphere environment. The SOP applies to environments utilizing VMware vSphere as the virtualization platform and leveraging vSAN technology to provide storage for the cluster. It outlines the step-by-step process to implement a sample production environment, emphasizing the importance of meeting prerequisites, configuring the Domain Controller, building the vSAN cluster, and conducting verification testing. The SOP aims to ensure the successful deployment of properly configured clusters with vSAN clustered shared storage in the VMware vSphere virtualization environment. The SOP was developed based on information and requairements from a client.

Actors

Responsible:	
Accountable:	
Consulted:	
Informed	

Contents

Resources and Prerequisites

1. Image of the Guest OS, downloaded from the software repository, which has had its checksum verified.
2. A suitable host
    i. Workstation 17 with hardware compatibility set to ESXi 6.7.
    ii. VMware vSphere Hypervisor (ESXi) 6.7U3b
3. Access to documentation, for reference
    i. Microsoft Server
    ii. VMWare
4. Hard disk space to accommodate the proposed build.
5. The minimum requirements for this setup include at least 32 GB of RAM, essential licenses for software and operating systems. Use the name of your assigned location for the DC and DNS (e.g. maynooth.ads.electric-petrol.ie for this template).
6. Furthermore, a fundamental requirement is a pre-installed Domain Controller, conforming to the specifications outlined in Table 1 (which falls outside the purview of the SOP procedures). This designated Domain Controller must feature network settings aligned with those specified in Table 5. Additionally, critical services such as Active Directory (AD), Domain Name System (DNS), Dynamic Host Configuration Protocol (DHCP), and Network Time Protocol (NTP) should be meticulously configured on the Server DC1.
7. The vCenter license for this template is valid for a duration of 60 days.

Inputs:

Domain Controller Server OS Specification

OS	Windows Server 2016 Datacenter 64-bit GUI
VM Name	DC1
Processors / Cores	2
Main memory	4 GB
Network Adapters	Management
Virtual Disks	50 GB
Admin username and password	The password must contain at least one number, symbol, uppercase and lowercase letter.

Table 1: DC OS Specification

First ESXi Server OS Specification

OS	VMware vSphere Hypervisor (ESXi) 6.7
VM Name	ESXi-1
Processors / Cores	8
Main memory	18 GB
Network Adapters	Management, vSAN
Virtual Disks	60 GB (OS), 100 GB (capacity tier), 20 GB (cache tier), 350 GB (vCeter)
Admin username and password	The password must contain at least one number, symbol, uppercase and lowercase letter.

Table 2: First Cluster OS Specification

Second ESXi Server OS Specification

OS	VMware vSphere Hypervisor (ESXi) 6.7
VM Name	ESXi-2
Processors / Cores	2
Main memory	10 GB
Network Adapters	Management, vSAN
Virtual Disks	60 GB (OS),100 GB (capacity tier), 20 GB (cache tier)
Admin username and password	The password must contain at least one number, symbol, uppercase and lowercase letter.

Table 3: First Cluster OS Specification

Third ESXi Server OS Specification

OS	VMware vSphere Hypervisor (ESXi) 6.7
VM Name	ESXi-3
Processors / Cores	2
Main memory	10 GB
Network Adapters	Management, vSAN
Virtual Disks	60 GB (OS),100 GB (capacity tier), 20 GB (cache tier)
Admin username and password	The password must contain at least one number, symbol, uppercase and lowercase letter.

Table 4: Third Cluster OS Specification

Network Configuration:

Configuring Adapters

	Management Network (vmnet8) 192.168.190.0 /24	vSAN Network (vmnet1) 192.168.122.0 /24
DC1	192.168.190.10	
ESXi-1	192.168.190.101	192.168.122.111
ESXi-2	192.168.190.102	192.168.122.112
ESXi-3	192.168.190.103	192.168.122.113

Table 5: IP Addressing for Servers Adapters

Actions

Set the DC1 VM

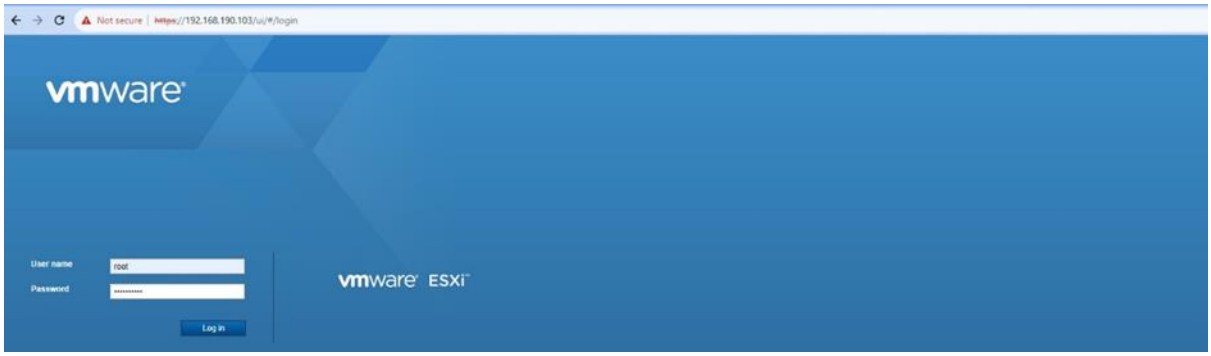
As part of the preparation process, set up a virtual machine to serve as the Domain Controller, adhering to the specifications outlined in the "Resources and Prerequisites" section and Table 1 and Table 5.

Create the ESXis VMs

1. Launch VMware Workstation on the host machine.
2. Open the "File" menu and select "New Virtual Machine" to initiate the Virtual Machine Wizard.
3. Configure the Virtual Machine:
   a) Name the virtual machine (e.g., ESXi-3),
   b) Specify the location for the virtual machine files,

c) Choose "I will install the operating system later".

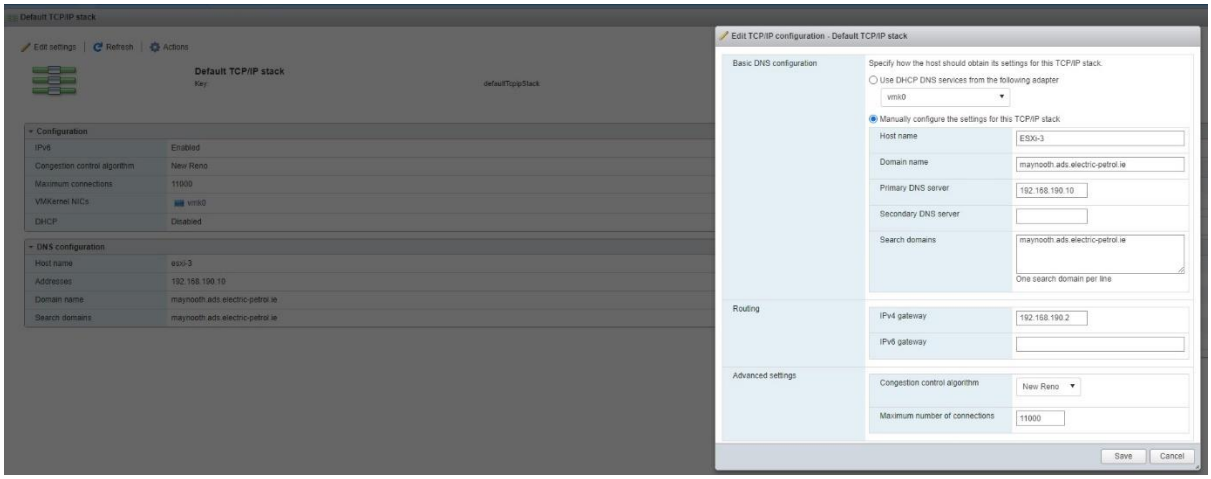
4. Assign Hardware Resources:
   a) Allocate the required number of processors and cores, memory and virtual disks based on the specifications in Table 1.
   b) Connect the virtual machine to the appropriate network switch for management and vSAN, following the details in Table 5.
5. Mount the VMware ESXi 6.7 ISO image to the virtual machine's CD/DVD drive.
6. Power on the virtual machine.
7. During boot, follow the on-screen prompts to start the installation of VMware ESXi.
8. Choose the appropriate installation options and accept the license terms.
9. Set the IP address, subnet mask, default gateway, and DNS (DC1 IP address) settings according to the details in Table 5 for first adapter.
10. Set a robust password for the administrator account, adhering to the company's password policy.
11. Finish the installation process and reboot the virtual machine.
12. Access the ESXi management interface using a web browser, confirming successful installation and access.



13. Repeat the process for the remaining ESXi VMs based on the specifications in Tables 2-5 and Table 5.

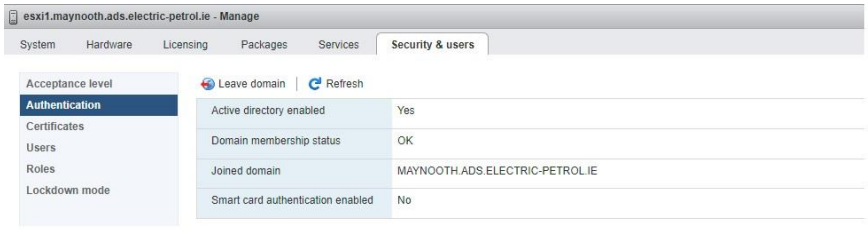
Initial Configuration of ESXi Servers

1. Log in to the ESXi host's management interface using administrator credentials.
2. Navigate to Networking > Default TCP/IP stack and Edit settings and see the host name field where we can enter a new hostname. Do the same for the other ESXi servers.



ESXi integration with Active Directory

3. Go to Manage > Security & Users > Autentication and click “Join domain”.
4. Complete the Domain name, username, and password fields. The username should be an Active Directory (AD) user with the necessary privileges for AD authentication.
5. After applying the settings, ensure that the domain membership status is indicated as "OK".



Storage

6. Navigate to "Datastores" to manage the storage resources.
7. Click "New Datastore" to create a new datastore for virtual machine storage.
8. Follow the prompts to select the storage type (local, NFS, iSCSI, NVMe) and configure the necessary parameters.
9. When prompted for datastore name, use "esxi-capacity_tier" for the 100 GB capacity disks and "esxi-cache_tier" for the 20 GB capacity disks.
10. Verify that the new datastores appear in the list of datastores and are accessible.

Installing vCenter Server and Subsequent Configuration

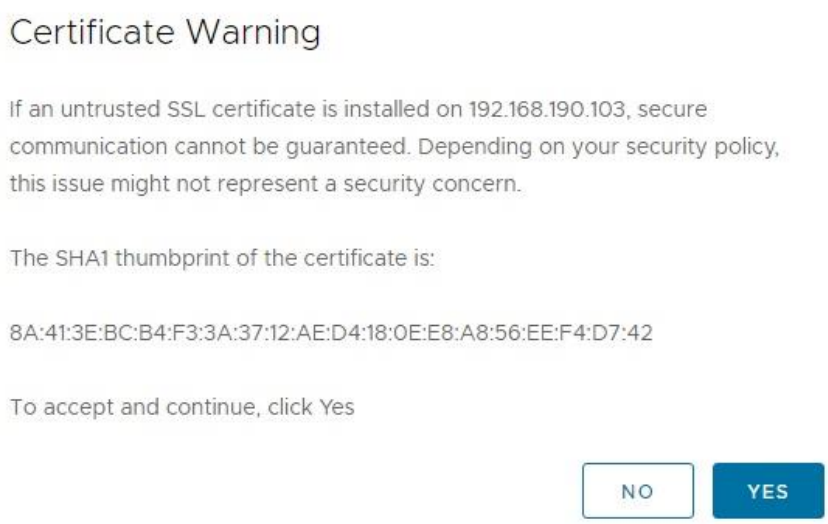
The following procedure outlines the installation, update, and configuration of VMware vCenter Server. This installation is pivotal to enhancing the management capabilities of the virtualized environment and will pave the way for networking configurations and subsequent storage configurations.

Prerequisites

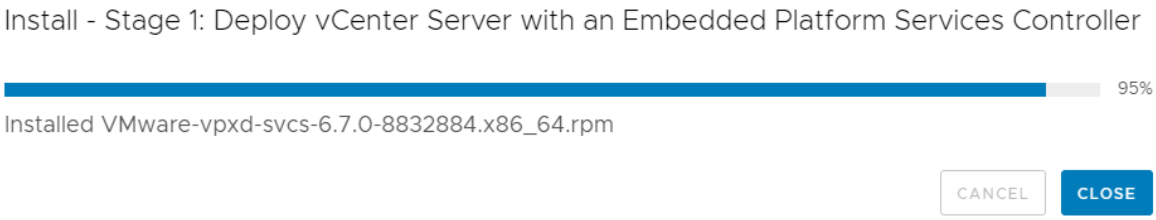
- VMware ESXi host is operational.
- Access to the ESXi host's management interface using a web browser.
- VMware vCenter Server 6.7U3s ISO image with Windows-based system for vCenter Server installation.

Installing vCenter Server – Stage 1

1. Mount the ISO and use the install wizard to configure vCenter 6.7.
2. Open the directory vcsa-ui-installer > win32 > installer.exe.
3. Go ahead and click “Install”, then “Next” to deploy vCenter server.
4. Accept the EUL.
5. Specify vCenter Server deployment target (for this template: host > 192.168.190.103).
6. Enter the IP/fqdn and the credentials. Should see a popup “Certificate Warning”. Select Yes to accept the warning.

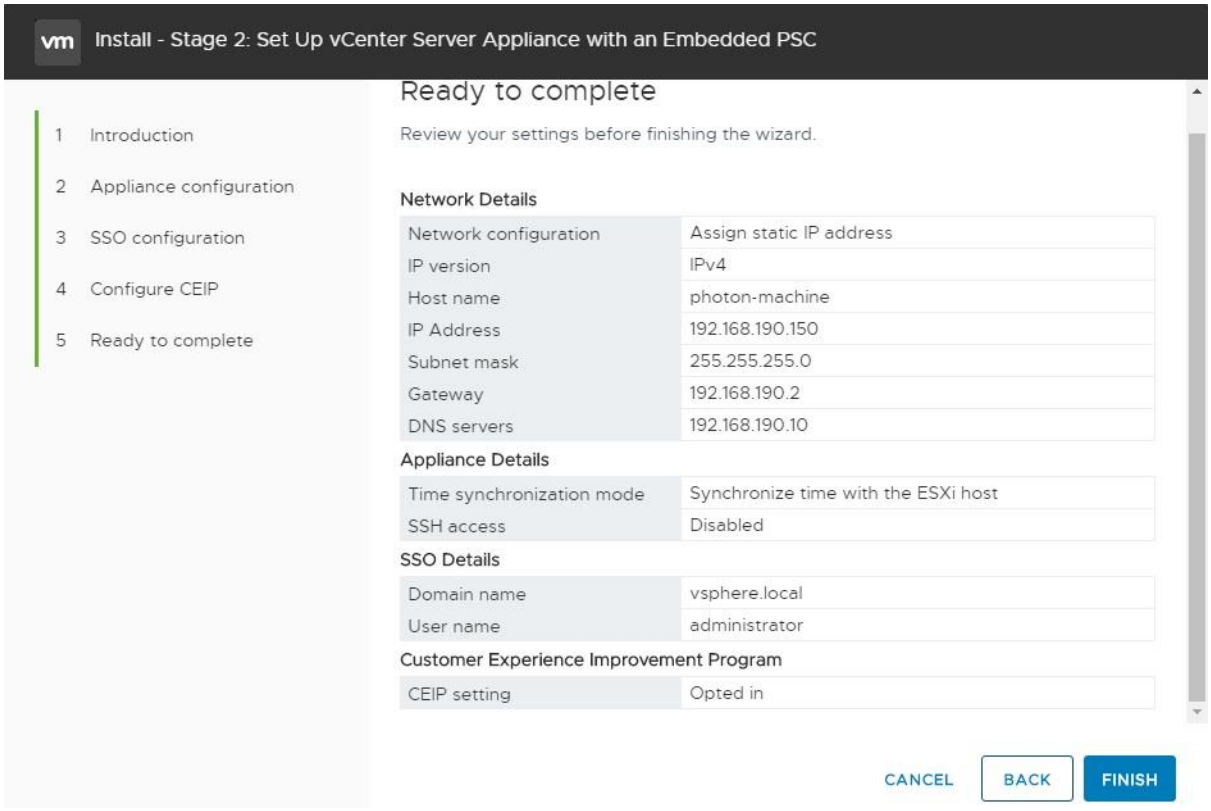


7. Specify a name for the VM and set the root password. Chose “Tiny” size for deployment size. If you need more, select higher size.
8. Select “Install on a new vSAN cluster containing the target host”. Claim all the 200GB disks as capacity tier, and the 20GB disk as cache tier.
9. Configure the network settings.
   a) Select IPv4 or IPv6 based on your network configuration.
   b) Enter the hostname for the vCenter Server Appliance.
   c) Specify the IP address for the vCenter Server Appliance.
   d) Enter the subnet mask.
   e) Provide the IP address of the default gateway.
   f) Enter the IP addresses of DNS servers.
   g) Specify the DNS domain name.
10. Review the summary page and verify if everything is correct. If it is, click on “Next”; otherwise, click "Back" to make changes to the settings.
11. Click on "Finish." The installation process will take approximately 30 minutes to complete.

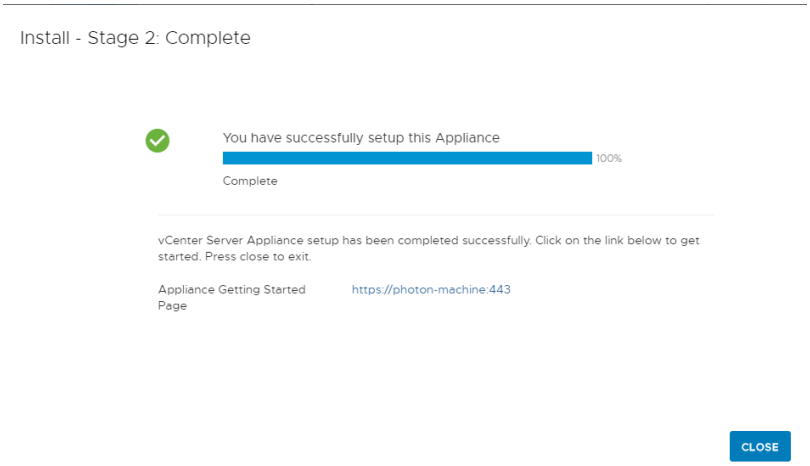


Installing vCenter Server – Stage 2

12. Into the setup wizard for stage 2 Click Next.
13. Choose the appropriate time synchronization method.
14. Assign a suitable name for the vCenter Server Appliance or chose the default “vsphere.local”and enter a strong password for the root user.
15. Leave the "Configure CEIP (Customer Experience Improvement Program) as the default setting and click "Next."
16. On the summary page, review the information provided. If everything appears correct, click "Finish."



17. The installation process will take some time to complete. Once it is finished, verify the completion of the installation.



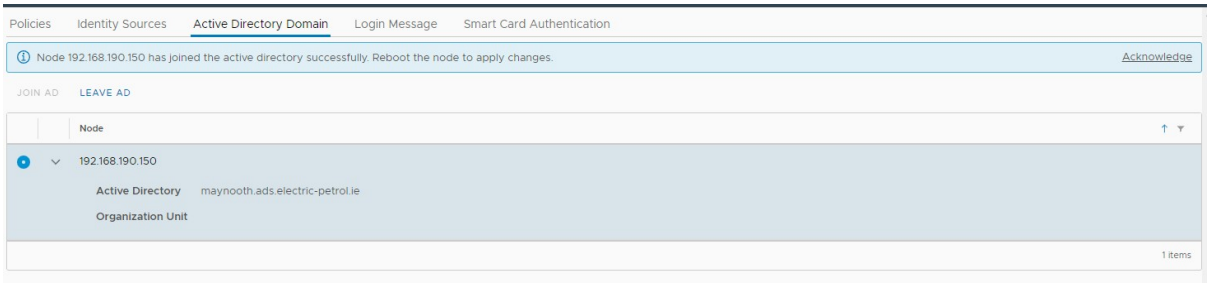
Initial Settings of vCenter

1. In the address bar of the web browser, enter the IP address of vCenter Server ("192.168.190.150") to access the vCenter Server's web interface.
2. Log in with the name “Administrator@vcenter.local” and the password provided during the installation.

Join vCenter to Active Directory Domain

3. To join an Active Directory Domain, follow these steps:
   a) From the home menu button, navigate to Administration > Single Sign On > Configuration > Active Directory.
   b) Click on "Join AD."

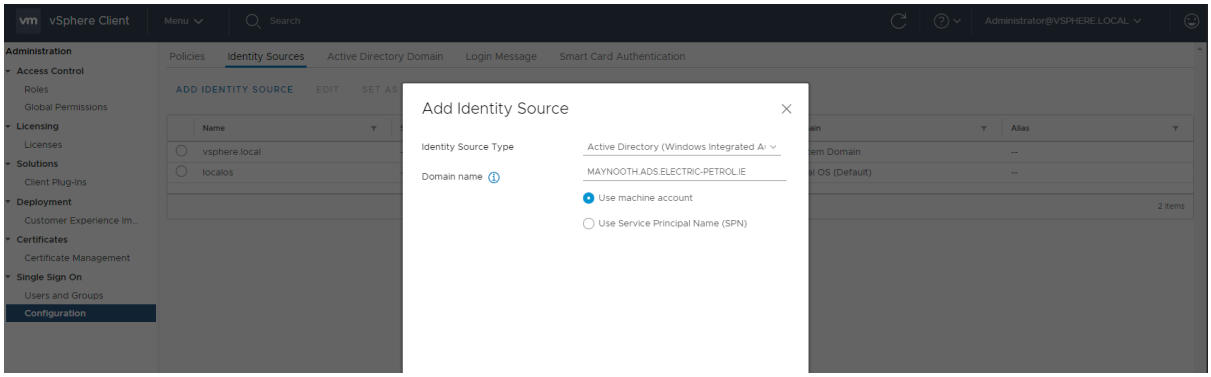
c) Provide the required domain information, including domain name, organizational unit (OU), and domain administrator credentials.
d) Click "Join" to initiate the process.
e) The system will attempt to join the Active Directory domain. Once completed, you should receive a confirmation message indicating successful domain integration.



4. If all the configurations have been successful, we need to reboot the system. Take a 10-minute break to allow all the components to restart and come up again properly. This ensures that any changes made during the configuration process take effect and that the system is in a stable state before proceeding with further tasks. To perform a reboot: Navigate Summary > Action > Power > Reboot.

Add an Identity Source

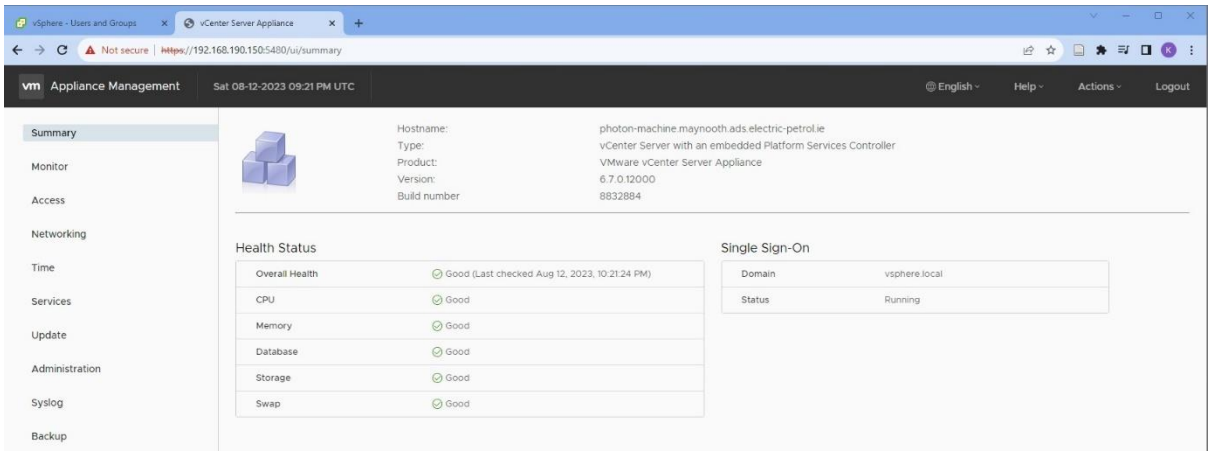
5. The next step involves setting up an AD domain controller as an identity source for authentication. By following these steps, you will configure the AD domain controller as an identity source, enabling it to be used for authentication within the vCenter environment. This allows users to log in using their Active Directory credentials.
   a) Navigate to the "Home" menu.
   b) Click on "Administration."
   c) Choose "Single Sign-On."
   d) Select "Configuration."
   e) Within the "Configuration" section, locate and click on "Identity Sources."
   f) Click on "Add Identity Source."
   g) Provide information about new Identity Source.
   h) Confirm your selections by clicking "OK."



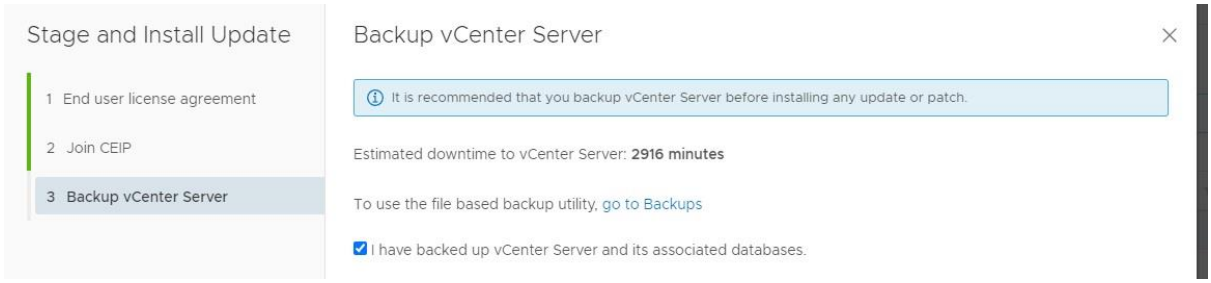
6. Select the domain and then click “Set as Default”.

Updating vCenter

1. Before beginning this section, it is recommended to take a snapshot of the ESXi server dedicated for vCenter. Snapshots serve as a backup point in case any issues arise during the update process.
2. Access the server's console login by opening a web browser and navigating to https://Server_IP_Address:5480 (for this example https://192.168.190.150:5480)
3. Log in using appropriate credentials.
4. Once logged in, navigate to the "Update" or "Appliance Management" section.



5. Check for available updates and patches. If updates are found, proceed with the update process.
6. Follow the on-screen prompts to download and install the updates. The system may reboot during this process.



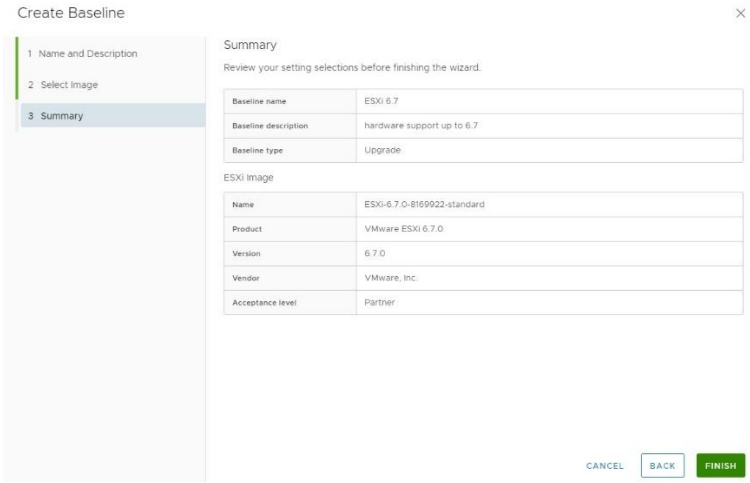
7. Wait until the update is finished and observe the new login interface

Updating ESXi Hosts

Update ESXi hosts immediately to the latest release. For a working system, follow these steps to update ESXi hosts using vCenter Update Manager:

1. Click the main menu icon within the vCenter interface.
2. Select "Update Manager."
3. In the "Update Manager" interface, navigate to "ESXi Images."
4. Load the most recent base image available for ESXi under the "ESXi Images" section.

5. Proceed to the "Updates" tab.
6. Click on "Download" to retrieve the latest updates and patches for your ESXi hosts.
7. Once the updates are downloaded, go to a specific cluster or host where you want to apply the updates.
8. Attach a baseline to the cluster or host. A baseline is a set of patches and updates that you want to apply.



Adding Cluster and ESXi Hosts to vCenter

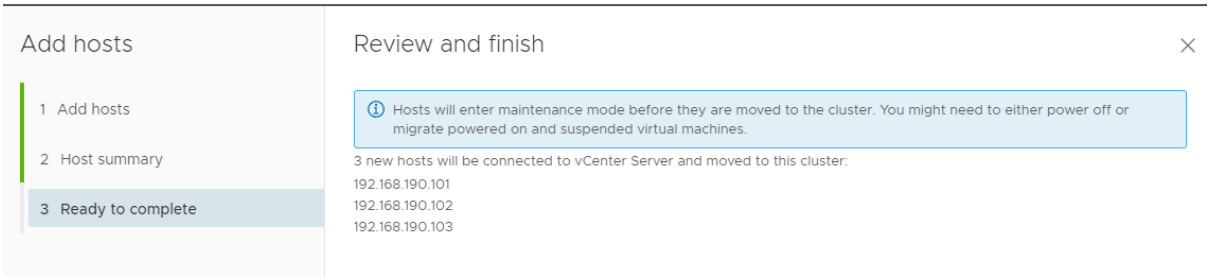
This procedure outlines the steps for adding a cluster and ESXi hosts to vCenter in order to centrally manage them.

Create Cluster

1. In vCenter select "Hosts and Clusters" from the left panel.
2. Right-click on the area where you want to create a new cluster.
3. Choose "New Cluster."
4. Enter the cluster name and any other relevant details.
5. Enable “vSAN” for the cluster.
6. Click "OK" to create the cluster.

Add Hosts

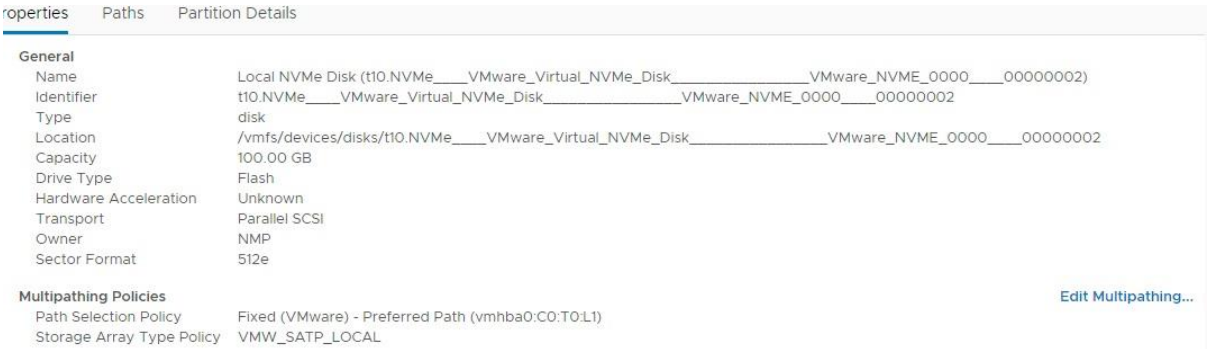
7. Select the created cluster from the navigation tree.
8. Right-click and choose "Add Host."
9. On the Add hosts page, add new or existing hosts to the cluster.
10. Click the New hosts tab.
11. Enter the relevant information into the IP Address and credentials text boxes for those hosts.
12. To add additional new hosts, click the "Add Host" button.
13. Click "Finish" to complete the process of adding the host to the cluster.



Disks Erase

If vCenter is not detecting your disks, formatting may be necessary to prepare them for use within the vCenter environment. This procedure provides step-by-step instructions for formatting disks within vCenter.

1. Navigate to "Hosts and Clusters."
2. Select the host that has the disks you want to format.
3. Click on the "Configure" tab and choose "Storage."
4. Under the "Hardware" section, click on "Storage Devices."
5. Locate the specific disk you want to format and select it.
6. Click on "Erase Partitions" to initiate the formatting process.
7. Follow the prompts to confirm and proceed with the disk erasure. Note that all data on the disk will be permanently deleted.
8. Once the erasure process is complete, the disk will be in a raw state and ready for reconfiguration.

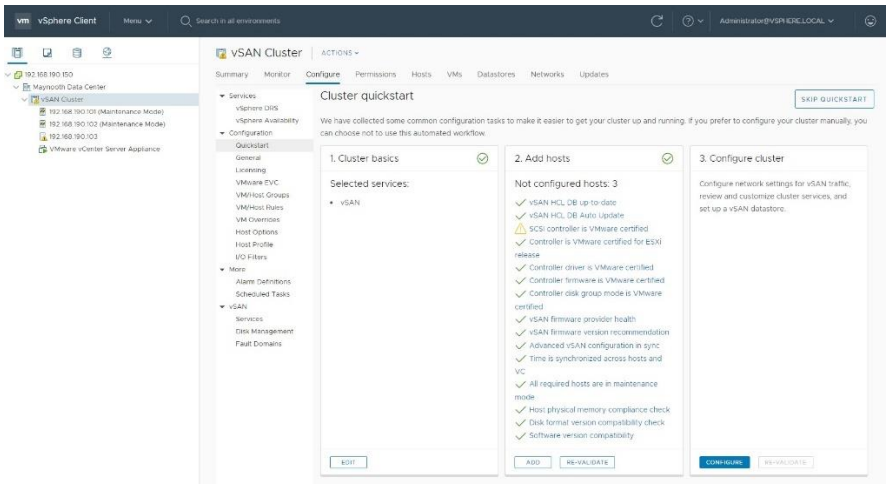


Shared Storage

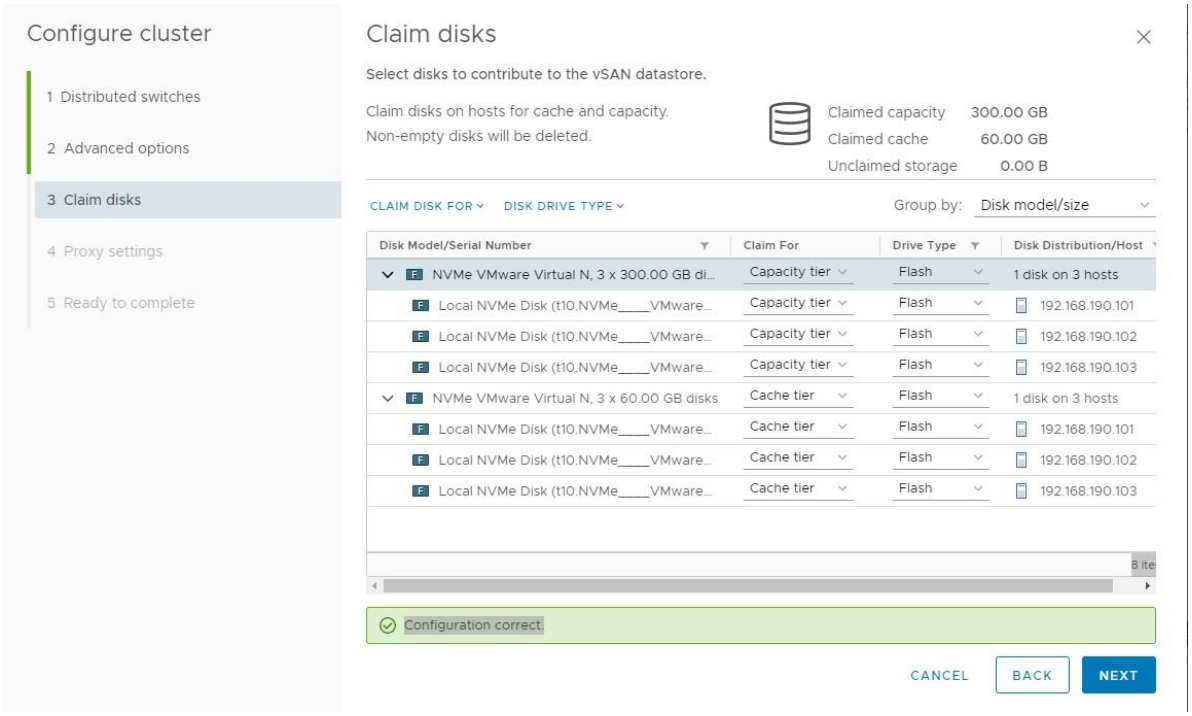
vSAN is a software-defined technology that revolutionizes storage by providing resilience, scalability, and performance. It achieves this by pooling local storage resources from vSphere hosts to create a shared storage environment. This configuration process will focus on setting up vSAN to enhance your storage infrastructure.

Create vSAN

1. Navigate to the Cluster, then access "Configure" and select "Quickstart."
2. Locate the rectangular blue button "Configure" situated at the bottom left corner and click on it.



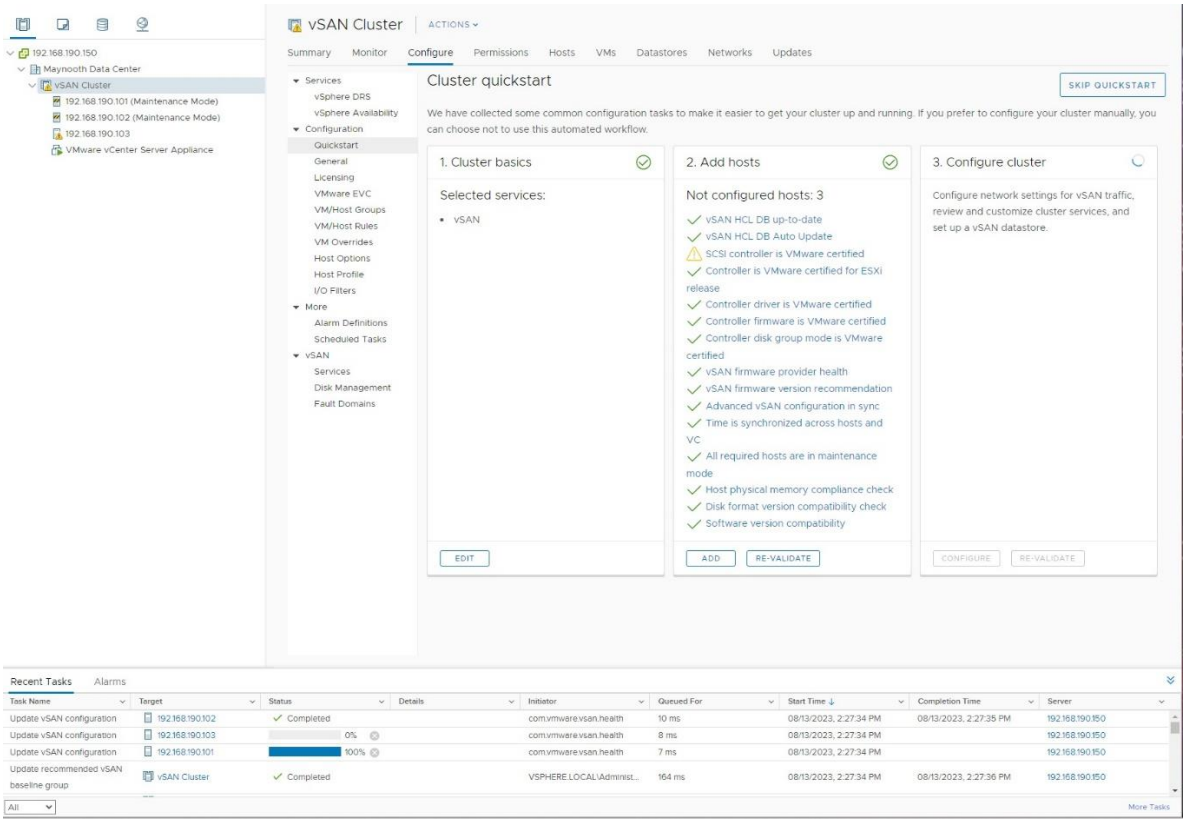
3. The network setup procedures for vSAN will be covered in the next section. Proceed to the next step "Claim disks."



Go through and claim the following:

- 100GB Claim as capacity tier,
- 20GB Claim as cache tier.

4. Click "Next" twice, and in the "Review" section check everything, then click "Finish".
5. The installation process for cluster configuration and vSAN update will commence.



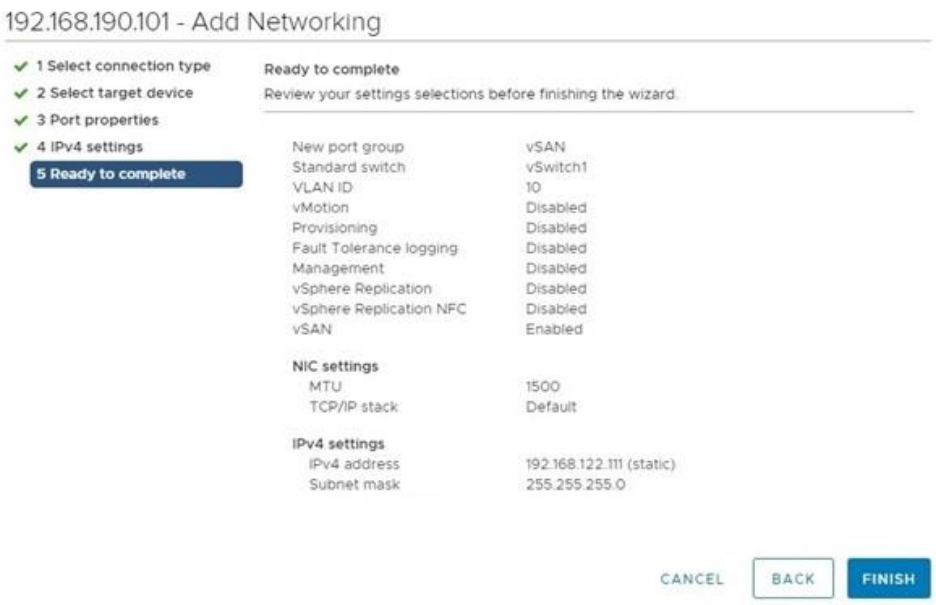
6. After finalizing the cluster installation, continue to the next section on network settings.

vSAN Network

Adding vSAN VMkernel Network with new Standard Switch

In this setup, vSAN utilizes a standard virtual switch for network connectivity. A standard switch is created on each individual host in the cluster, and vSAN traffic flows through this switch. Each host manages its own switch, resulting in relatively simpler configuration and management. However, this approach might entail more manual setup and potentially greater administrative effort when dealing with multiple hosts in the cluster.

7. Navigate to the "Hosts and Clusters" view.
8. Select the target host or cluster where you want to add a network for vSAN.
9. Click on the "Configure" tab.
10. Choose "Networking".
11. Click "Add Networking" and select "VMkernel Network Adapter".
12. Select “New Standard Switch” and click on “Next”.
13. Assign the network adapters “(New) vmnic1”.
14. Give a descriptive network label (e.g., "vSAN Network"), and select the appropriate VLAN ID.
15. Enable "vSAN Traffic" for this network.
16. Enter the appropriate network settings (From Table 5 in “vSAN Network”
17. Review the settings and click "Finish" to complete the creating VMkernel interface.

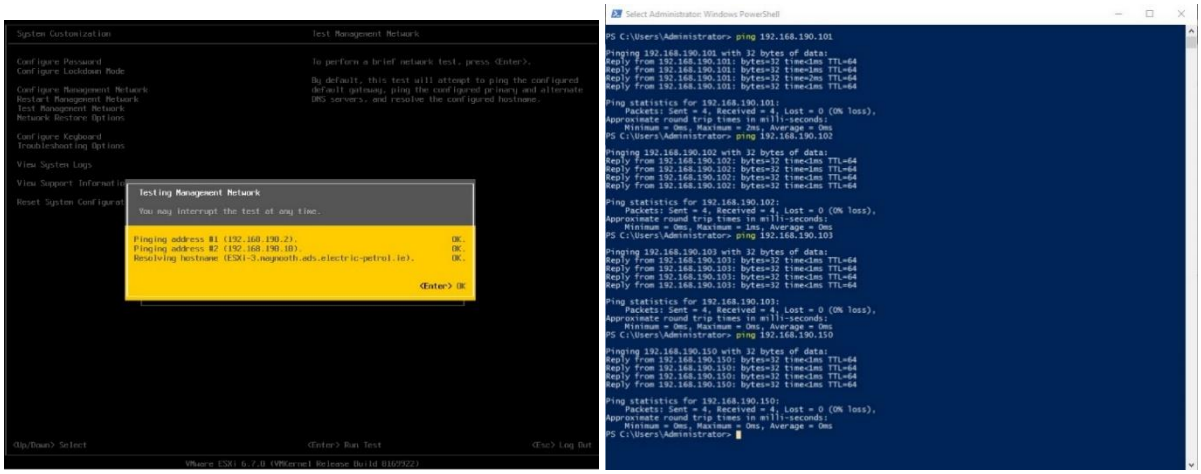


18. Repeat steps 9-17 for each ESXi host.
19. After completing these steps, vSAN configuration is finished.

Acceptance Tests

1. Management network:
    - Perform network management connectivity test.
2. Datastore Check: Create a new vSAN datastore.
    - Add a virtual machine and ensure it runs without issues.
3. Disk Resilience:
    - Safely disconnect a disk and confirm data access.
4. Health Check:
    - Run vSAN health check and resolve problems if found.
5. Capacity Watch:
    - Monitor storage use over time.
6. Maintenance Mode:
    - Observe how host maintenance affects vSAN.

Test Output for "1. Management Network"



Build Book Entry: vSAN Deployment

This logbook entry encapsulates the key takeaways and outcomes of deploying VMware vSAN. The objective was to enhance our understanding of vSAN's role in storage transformation and the essential steps for successful implementation.

Key Outcomes:

Enhanced Storage: VMware vSAN empowers us to pool local storage resources across vSphere hosts, resulting in a unified and scalable shared storage environment. This technology improves our virtualized infrastructure's resilience, scalability, and performance.

Network Configuration: The decision between utilizing a standard virtual switch or a distributed virtual switch significantly influences vSAN's network architecture and overall performance. Making an informed choice during network setup is crucial.

Cluster Configuration: Through vSAN, we have configured and established clusters by integrating network settings, enabling vSAN on individual hosts.

Management: Effective management of network settings and host communication intricacies is pivotal for the seamless operation of vSAN. Our deployment is a culmination of meticulous attention to these facets.

Next Steps: Ongoing monitoring, maintenance, and optimization of the vSAN deployment to ensure continued operational excellence and alignment with evolving business needs.