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Cisco HyperFlex Hyperconverged Infrastructure All Flash Solution for SAP HANA

Skylake based solution

January 2019

Contents

Solution overview

This document provides a high-level view of the certified hyperconverged infrastructure (HCI) for SAP HANA using a Cisco HyperFlex™ system.

SAP landscapes frequently are deployed in virtualization environments. In recent years, SAP has been encouraging its customers to migrate to SAP's own database platform of the future: SAP HANA. In the past, SAP HANA databases were deployable on virtual servers or on physical machines, and now they are allowed and certified to run under a hyperconverged infrastructure.

With the launch of the Cisco HyperFlex system, Cisco offers a low-cost, easy-to-deploy, high-performance hyperconverged virtual server platform that is an excellent solution for both SAP HANA databases and SAP landscapes. You can use this Cisco HyperFlex solution to deploy SAP application servers, fully virtualized SAP HANA servers, and other non-HANA virtual servers on the same hyperconverged infrastructure.

Document purpose

This document describes the deployment of a single production SAP HANA virtual machine on a single node of a Cisco HyperFlex 3.0 all-flash cluster with SUSE Linux Enterprise Server (SLES) for SAP 12 SP3 as the operating system. This document uses a four-node Cisco HyperFlex cluster as an example, so the cluster can have four production SAP HANA virtual machines.

Red Hat Enterprise Linux (RHEL) for SAP Applications also can be installed; however, RHEL is not covered in this document.

This document does not cover the installation and configuration of the Cisco HyperFlex HX Data Platform. For information, see the section "Installing a Cisco HyperFlex node" later in this document. The discussions of the Cisco HyperFlex node are for informational purposes only.

Solution benefits

The Cisco HyperFlex for SAP HANA solution offers the following benefits:

- Single hardware platform: The Cisco Unified Computing System™ (Cisco UCS®) is the base platform for Cisco HyperFlex systems, which provide a fully contained hyperconverged environment, combining networking, storage, and virtualization resources in a single system. You can deploy additional Cisco UCS servers alongside the Cisco HyperFlex solution in the same Cisco UCS domain to service other workloads.
- Simplified management: A single administrator can manage all aspects of Cisco UCS and the Cisco HyperFlex system through Cisco UCS Manager and the VMware vCenter Web Client, making tasks much easier and faster to complete.
- Rapid deployment: The programmability and ease of use of Cisco UCS Manager allow you to deploy Cisco HyperFlex systems quickly. These features also allow you to rapidly provision additional Cisco UCS servers for other workload requirements.

Customers who have already invested in Cisco products and technologies can mitigate their risk further by deploying familiar and tested Cisco UCS technology.

Audience

The target audience for this document includes storage administrators, data center architects, database administrators, field consultants, IT managers, SAP solution architects, and customers who want to implement SAP HANA on the Cisco HyperFlex HCI solution. A working knowledge of SAP HANA Database, Linux, server, storage, and network technologies is assumed.

Infrastructure overview

SAP has defined hardware and software requirements for running SAP HANA on a hyperconverged infrastructure.

CPU

Although SAP allows the Skylake CPU models (which use eight or more cores) listed in the SAP HANA Tailored Data-center Integration (TD)I Phase V model for use in an SAP HANA HCI deployment, not all the CPU models are supported in the Cisco HyperFlex configuration. You must validate the CPU models supported in your Cisco HyperFlex configuration before proceeding with the installation.

You also need to consider an important SAP limitation for socket use. The socket that the storage controller virtual machine uses cannot be shared to run the SAP HANA virtual machine. That is, the SAP HANA virtual machine cannot share a socket with non-SAP workloads.

Memory

SAP HANA is supported in the following memory configurations:

- SAP HANA 2.0 with memory per socket up to 768 GB for SAP NetWeaver Business Warehouse (BW) with all TDI-supported processor models and up to 1.5 TB with only Intel® Xeon® Platinum M (8xxxM) CPUs
- SAP HANA 2.0 with memory per socket up to 1.5 TB for SAP Business Suite on SAP HANA (SoH) (with Intel Xeon Platinum M processors)

Cisco HyperFlex HX240c M5 All Flash Node for SAP HANA

All-flash Cisco HyperFlex servers are used for SAP HANA in an HCI deployment. The Cisco HyperFlex HX240c M5 All Flash Node is excellent for high-performance, high-capacity clusters.

Physically, the system is installed as a cluster of three or more Cisco HyperFlex HX240c M5 All Flash Nodes that are integrated into a single system by a pair of Cisco UCS 6300 Series Fabric Interconnects.

Cisco HyperFlex solution design

The Cisco HyperFlex system provides a fully contained virtual server platform with computing and memory resources, integrated networking connectivity, a distributed high-performance log-based file system for virtual machine storage, and hypervisor software for running the virtualized servers, all within a single Cisco UCS management domain (Figure 1).

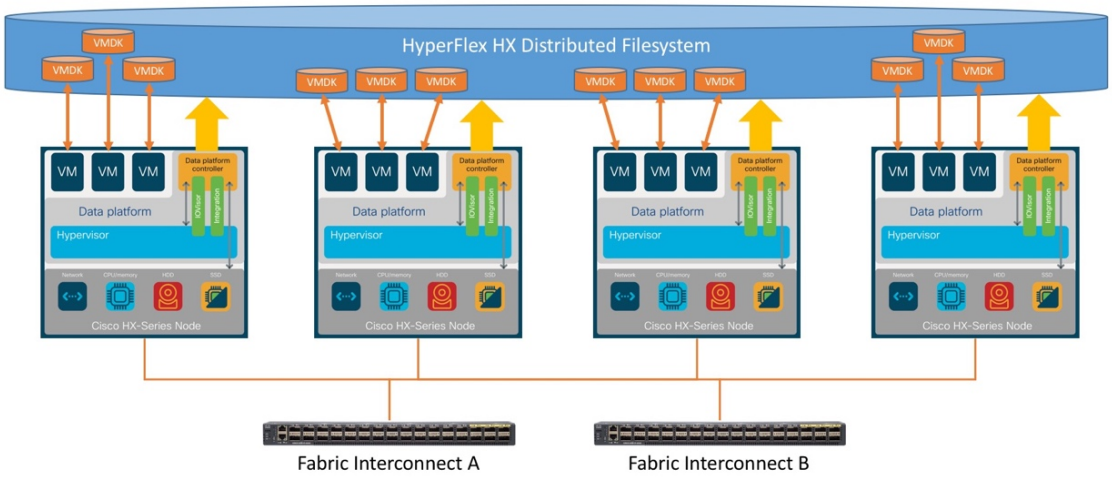


Figure 1.
Cisco HyperFlex system overview

The following are the components of a Cisco HyperFlex system for SAP HANA on hyperconverged infrastructure:

- One pair of Cisco UCS fabric interconnects:
  - Cisco UCS 6332 Fabric Interconnect
- Three to 32 Cisco HyperFlex HX-Series rack-mount servers (minimum of four nodes recommended)
  - Cisco HyperFlex HX240c M5SX All Flash rack-mount servers
- Cisco HyperFlex HX Data Platform software
- VMware vSphere ESXi hypervisor
- VMware vCenter Server (end-user supplied)
- VMware vCenter plug-in
- Cisco HyperFlex Connect
- Cisco Intersight™ platform

Configuration used for SAP certification

The following sections detail the physical hardware, software revisions, and firmware versions used to install a four-node cluster of the Cisco HyperFlex system for SAP HANA on HCI certification.

Physical components

Table 1 lists the physical components for the solution used for SAP certification.

Table 1. Cisco HyperFlex system components

Component	Hardware required
Fabric interconnects	2 Cisco UCS 6332-16UP Fabric Interconnects
Servers	4 Cisco HyperFlex HX240c M5SX All Flash rack-mount servers

For complete server specifications and more information, please refer to the Cisco HyperFlex HX240c M5SX All Flash Node specification sheet:

https://www.cisco.com/c/dam/en/us/products/collateral/hyperconverged-infrastructure/hyperflex-hx-series/hxaf-240c-m5-specsheet.pdf

Table 2 lists the hardware component options for one Cisco HyperFlex HX240c M5SX All Flash server model used for SAP certification.

Table 2. Cisco HX240c M5SX All Flash Node server sample configuration

Cisco HyperFlex HX240c M5SX All Flash Node options	Hardware required
Processors	Intel Xeon CPU (All models certified for SAP HANA TDI with 8 or more cores and listed in the Cisco HyperFlex compatibility list are supported.)
Memory	24 x 32-GB (768-GB) double-data-rate 4 (DDR4) 2666-MHz 1.2V modules
Disk controller	Cisco 12-Gbps modular SAS) host bus adapter (HBA)
Hard drives	• 1 x 240-GB 2.5-inch Cisco UCS Enterprise Value 6-Gbps SATA solid-state disk (SSD) • 1 x 375-GB 2.5-inch Optane Extreme Performance SSD • 18 x 960-GB 2.5-inch Enterprise Value 6-Gbps SATA SSDs
Network	Cisco UCS Virtual Interface Card (VIC) 1387 modular LAN on motherboard (mLOM)
Boot device	1 x 240-GB M.2 form-factor SATA SSD
Optional	Cisco QSA module to convert 40 Gigabit Ethernet Quad Enhanced Small Form-Factor Pluggable (QSFP+) to 10 Gigabit Ethernet SFP+

Software components

Table 3 lists the software components and the versions required for the Cisco HyperFlex system.

Table 3. Software components

Component	Software required
Hypervisor	VMware ESXi Release 6.5.0 U2- 8294253 (Cisco custom image for ESXi Release 6.5 to be downloaded from Cisco.com Downloads portal)
Management server	VMware vCenter Server for Microsoft Windows or vCenter Server Appliance Release 6.5 or later
Cisco HyperFlex HX Data Platform	Cisco HyperFlex HX Data Platform Software Release 3.0 or later
Cisco UCS firmware	Cisco UCS infrastructure software, Cisco UCS B-Series and C-Series bundles, Revision 3.2(3g) or later
SAP HANA	SAP HANA 2.0 Revision 31 or later

Physical topology

The Cisco HyperFlex system is composed of a pair of Cisco UCS fabric interconnects along with up to 32 Cisco HyperFlex HX-Series rack-mount servers per cluster. You can install up to eight separate Cisco HyperFlex clusters under a single pair of fabric interconnects. The two fabric interconnects both connect to every HX-Series rack-mount server. Upstream network connections, also referred to as northbound network connections, are made from the fabric interconnects to the customer data center network at the time of installation (Figure 2).

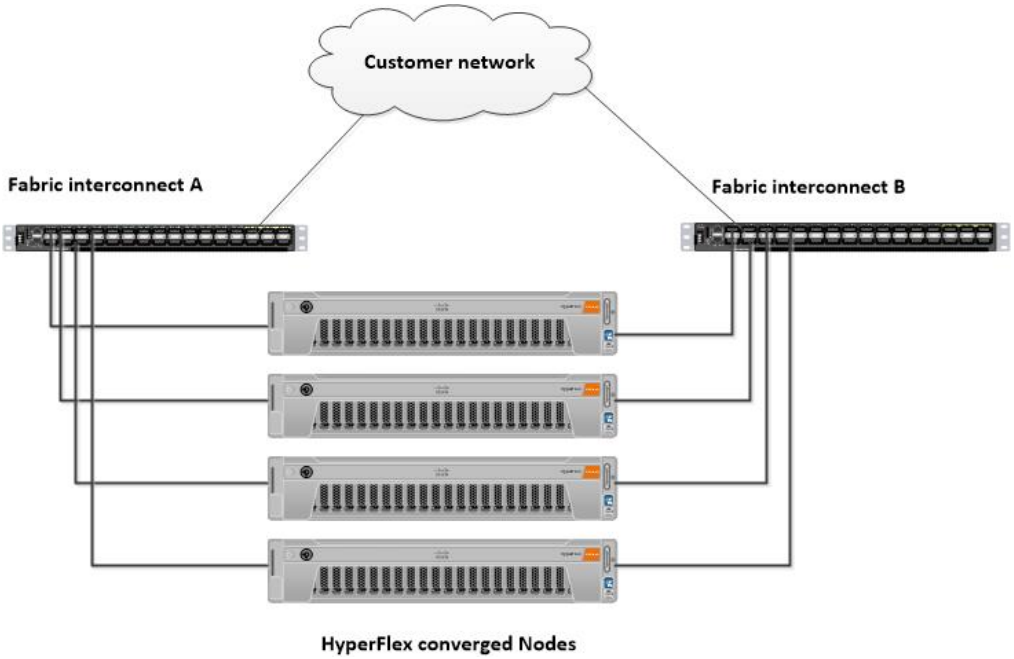


Figure 2.
Cisco HyperFlex standard cluster topology Cabling

The fabric interconnects and HX-Series rack-mount servers need to be cabled properly before you begin the installation.

Table 4 provides a sample cabling map for installing a Cisco HyperFlex system with four Cisco HyperFlex converged servers.

Table 4. Sample fabric interconnect cabling map

Device	Port	Connected to	Port	Type	Length	Notes
UCS6332-A	L1	UCS6332-B	L1	CAT 5	1 ft	
UCS6332-A	L2	UCS6332-B	L2	CAT 5	1 ft	
UCS6332-A	mgmt0	Customer LAN				
UCS6332-A	1/1	HX server 1	mLOM port 1	Twinax	3m	Server 1
UCS6332-A	1/2	HX server 2	mLOM port 1	Twinax	3m	Server 2
UCS6332-A	1/3	HX server 3	mLOM port 1	Twinax	3m	Server 3
UCS6332-A	1/4	HX server 4	mLOM port 1	Twinax	3m	Server 4
UCS6332-A	1/5					
UCS6332-A	1/6					
UCS6332-A	1/7					
UCS6332-A	1/8					
UCS6332-A	1/9					
UCS6332-A	1/10					
UCS6332-A	1/11					
UCS6332-A	1/12					
UCS6332-A	1/13					
UCS6332-A	1/14					
UCS6332-A	1/15					
UCS6332-A	1/16					
UCS6332-A	1/17					
UCS6332-A	1/18					
UCS6332-A	1/19					
UCS6332-A	1/20					

Device	Port	Connected to	Port	Type	Length	Notes
UCS6332-A	1/21					
UCS6332-A	1/22					
UCS6332-A	1/23					
UCS6332-A	1/24					
UCS6332-A	1/25	Customer LAN				Uplink
UCS6332-A	1/26	Customer LAN				Uplink
UCS6332-A	1/27					
UCS6332-A	1/28					
UCS6332-A	1/29					
UCS6332-A	1/30					
UCS6332-A	1/31					
UCS6332-A	1/32					
UCS6332-B	L1	UCS6332-A	L1	CAT 5	1 ft	
UCS6332-B	L2	UCS6332-A	L2	CAT 5	1 ft	
UCS6332-B	mgmt0	Customer LAN				
UCS6332-B	1/1	HX server 1	mLOM port 2	Twinax	3m	Server 1
UCS6332-B	1/2	HX server 2	mLOM port 2	Twinax	3m	Server 2
UCS6332-B	1/3	HX server 3	mLOM port 2	Twinax	3m	Server 3
UCS6332-B	1/4	HX server 4	mLOM port 2	Twinax	3m	Server 4
UCS6332-B	1/5					
UCS6332-B	1/6					
UCS6332-B	1/7					
UCS6332-B	1/8					
UCS6332-B	1/9					
UCS6332-B	1/10					
UCS6332-B	1/11					
UCS6332-B	1/12					

Device	Port	Connected to	Port	Type	Length	Notes
UCS6332-B	1/13					
UCS6332-B	1/14					
UCS6332-B	1/15					
UCS6332-B	1/16					
UCS6332-B	1/17					
UCS6332-B	1/18					
UCS6332-B	1/19					
UCS6332-B	1/20					
UCS6332-B	1/21					
UCS6332-B	1/22					
UCS6332-B	1/23					
UCS6332-B	1/24					
UCS6332-B	1/25	Customer LAN				Uplink
UCS6332-B	1/26	Customer LAN				Uplink
UCS6332-B	1/27					
UCS6332-B	1/28					
UCS6332-B	1/29					
UCS6332-B	1/30					
UCS6332-B	1/31					
UCS6332-B	1/32					

IP addressing

IP addresses that are used in the Cisco HyperFlex system can be categorized into the following groups:

- Cisco UCS Manager: Cisco UCS Manager assigns and uses these addresses. Cisco UCS Manager uses three IP addresses: one address is assigned to each Cisco UCS fabric interconnect, and the third IP address is a roaming address for management of the Cisco UCS cluster. In addition, at least one IP address per Cisco UCS blade or HX-Series rack-mount server is required for the hx-ext-mgmt IP address pool. These addresses are assigned to the Cisco Integrated Management Controller (IMC) interface of the physical servers. Because these management addresses are assigned from a pool, they need to be provided in a contiguous block of addresses. These addresses must all be in the same subnet.
- Cisco HyperFlex and VMware ESXi management: These addresses are used to manage the ESXi hypervisor hosts and the Cisco HyperFlex storage platform controller virtual machines. Two IP addresses per node in the Cisco HyperFlex cluster are required from the same subnet, and a single additional IP address is needed as the roaming Cisco HyperFlex cluster management interface. These addresses can be assigned from the same subnet as the Cisco UCS Manager addresses, or they can be separate.
- Cisco HyperFlex replication: The Cisco HyperFlex storage platform controller virtual machines use these addresses for clusters that are configured to replicate virtual machines to one another. One IP address per HX-Series node is required, plus one additional IP address as a roaming clustered replication interface. These addresses are assigned to a pool as part of a postinstallation activity described later in this document and are not needed to complete the initial installation of a Cisco HyperFlex cluster. These addresses can be from the same subnet as the Cisco HyperFlex and VMware ESXi management addresses, but the VLAN IDs and subnets should be unique.
- Cisco HyperFlex storage: The Cisco HyperFlex storage platform controller virtual machines use these addresses. They use them as VMkernel interfaces on the ESXi hypervisor hosts to send and receive data to and from the Cisco HyperFlex HX Data Platform distributed file system. Two IP addresses per node in the Cisco HyperFlex cluster are required from the same subnet, and a single additional IP address is needed as the roaming Cisco HyperFlex cluster storage interface. You should provision a subnet that is not used in the network for other purposes. Alternatively, you could use nonroutable IP address ranges for these interfaces. In addition, if the Cisco UCS domain will contain multiple Cisco HyperFlex clusters, you should use a different subnet and VLAN ID for the Cisco HyperFlex storage traffic for each cluster. This method is safer because it helps ensure that storage traffic from multiple clusters cannot intermix.
- VMware vMotion: The ESXi hypervisor hosts use these IP addresses as VMkernel interfaces to enable vMotion capabilities. One or more IP addresses per node in the Cisco HyperFlex cluster are required from the same subnet. You can use multiple addresses and VMkernel interfaces if you want to enable multiple-network interface card (NIC) vMotion, although this configuration would require additional manual steps.

Considerations for SAP HANA on Cisco HyperFlex solutions

Several considerations apply when you use SAP HANA on a Cisco HyperFlex solution.

Scale

Cisco HyperFlex standard clusters for an SAP HANA production environment can currently scale from a minimum of 3 to a maximum of 32 nodes.

Although Cisco HyperFlex can support as few as three nodes, you should start with a four-node cluster for an SAP HANA on HCI solution.

SAP rules for SAP HANA on hyperconverged infrastructure

Because the current certified solution of Cisco HyperFlex for SAP HANA on hyperconverged infrastructure does not allow the physical socket to be shared between an SAP HANA virtual machine and the storage controller virtual machine, you can use only one socket of the node to host a production SAP HANA virtual machine.

Also, because one full socket must be dedicated for the SAP HANA virtual machine, only one SAP HANA virtual machine per HX-Series node is allowed to run.

To summarize:

- The storage controller virtual machine uses eight virtual CPUs (vCPUs) or four cores, which also can be shared to run nonproduction SAP HANA virtual machines or other SAP workloads only. You must consider this workload when choosing the frequency of the CPU.
- One socket must be dedicated for the SAP HANA virtual machine (Figure 3).

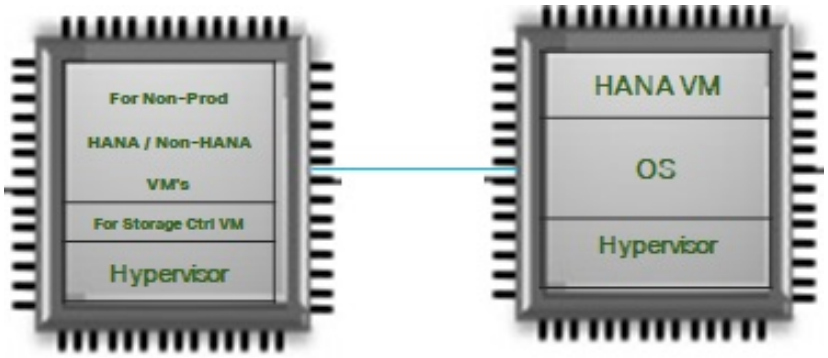


Figure 3.
CPU placement for the virtual machines

Installing a Cisco HyperFlex node

Cisco HyperFlex system installation is performed primarily through a deployable Cisco HyperFlex installer virtual machine, available for download at Cisco.com as an OVA file. The installer virtual machine performs most of the Cisco UCS configuration work, and you can use it to simplify the installation of ESXi on the Cisco HyperFlex hosts. The installer virtual machine also performs significant portions of the ESXi configuration. You can also use the installer virtual machine to install the Cisco HyperFlex HX Data Platform software and create the Cisco HyperFlex cluster.

You can follow the Cisco HyperFlex installation instructions using the Cisco Validated Design at Cisco HyperFlex 3.0 for Virtual Server Infrastructure with VMware ESXi.

Note: When installing the Cisco HyperFlex system, choose a replication factor of 2 to meet the key performance indicator (KPI) requirements for SAP HANA.

Cisco HyperFlex system postinstallation check

After you have installed the Cisco HyperFlex system, you can use a new HTML 5–based web user interface as the primary management tool for the Cisco HyperFlex system (Figure 4). Through this centralized point of control for the cluster, administrators can create volumes, monitor data platform health, and manage resource use. Administrators also can use this data to predict when the cluster needs to be scaled. To use the Cisco HyperFlex Connect user interface, connect using a web browser to the Cisco HyperFlex cluster IP address: http://<hx controller cluster ip>.

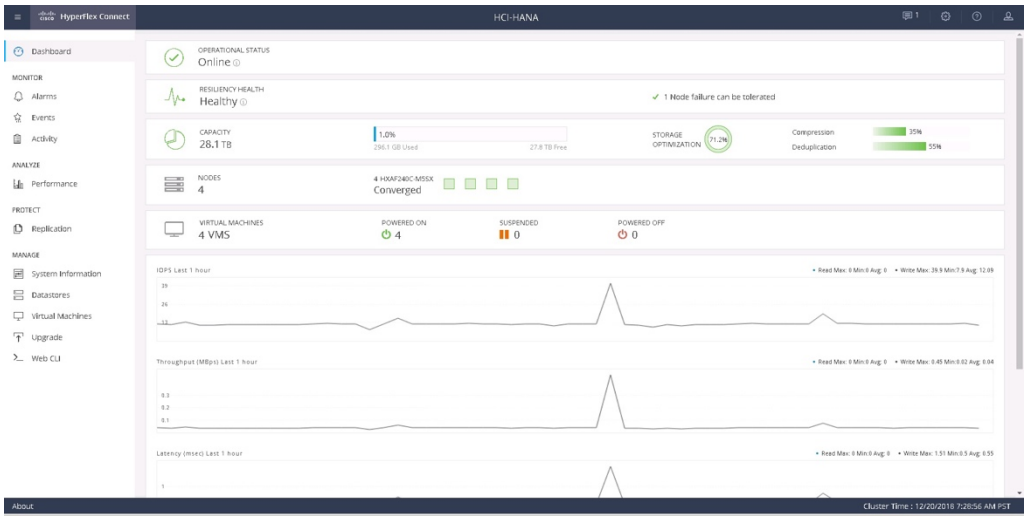


Figure 4.
Cisco HyperFlex Connect GUI

Preparing an SAP HANA virtual machine for OS installation

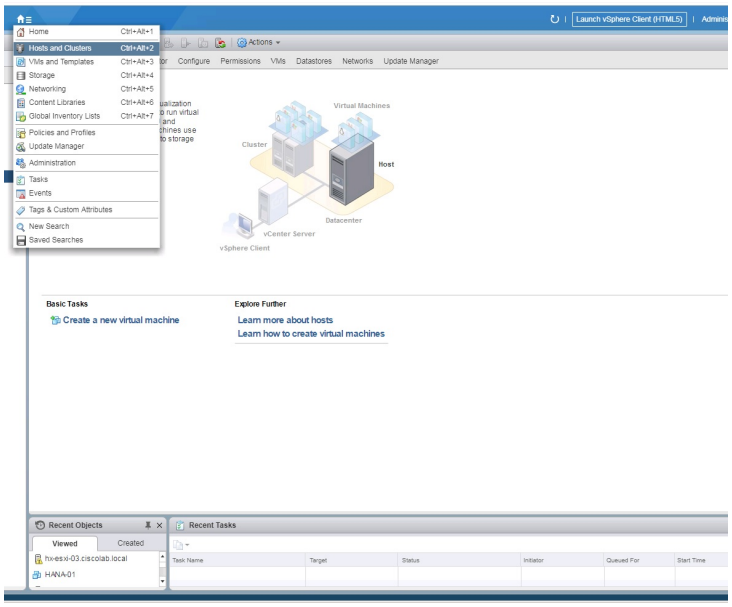
This section explains the creation of a single virtual machine for a production SAP HANA environment that is ready for OS installation. As specified in the current supported certification scenario, you can have one production SAP HANA virtual machine per HX-Series node.

You must repeat the same steps to create additional production SAP HANA virtual machines on the other HX-Series nodes.

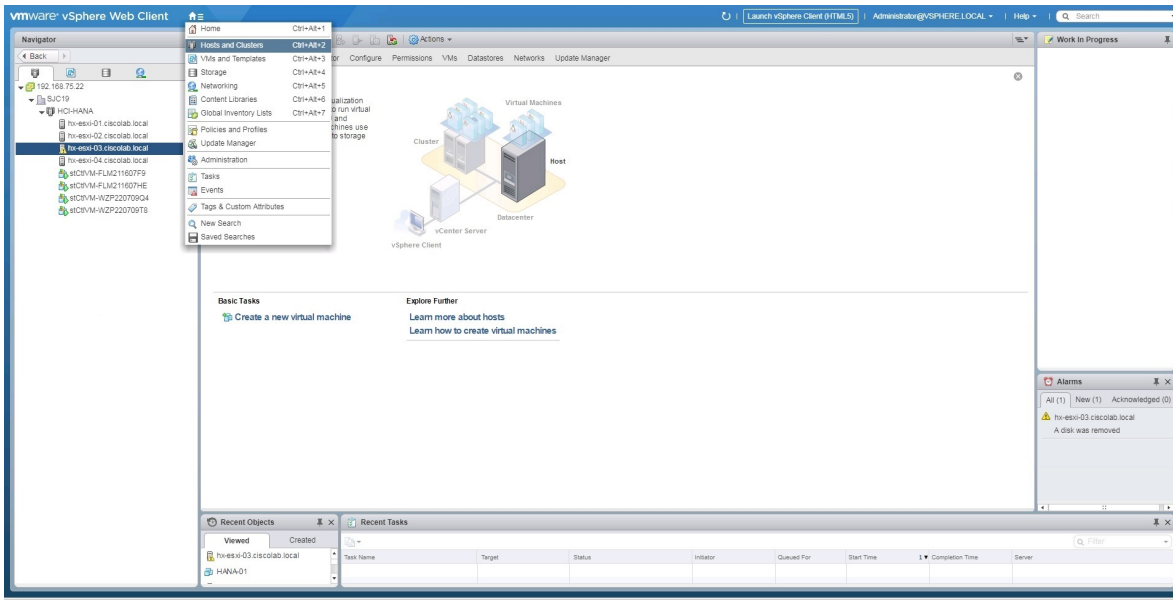
Remember that you can have only one SAP HANA production virtual machine per HX-Series node, so use caution when creating the virtual machines.

These steps show how to create a 512-GB virtual machine to run a production SAP HANA environment as an example. Follow the same steps to create additional virtual machines for a production SAP HANA environment and remember to host only one production SAP HANA virtual machine per HX-Series node.

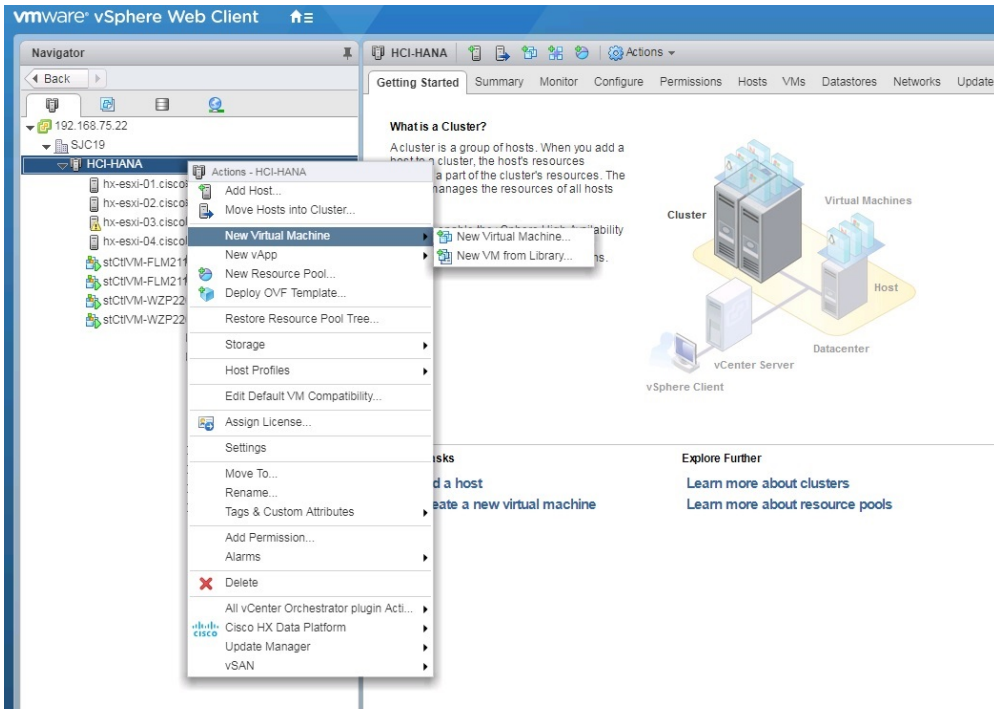
1. After the Cisco HyperFlex system is installed and accessible, log in to VMware vSphere to access the vCenter instance for the Cisco HyperFlex cluster: https://<vSphere IP address>.
2. After logging in to vSphere, click the Hosts & Clusters icon at the top of the screen.



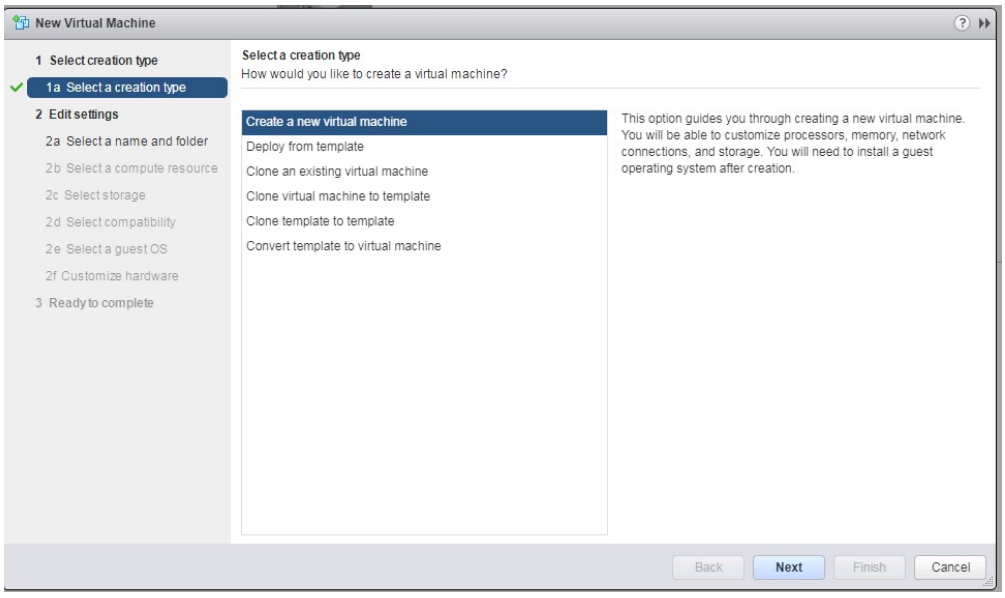
Hosts & Clusters displays the connected Cisco HX-Series and ESX nodes and the storage controller virtual machines running on the nodes. These storage controller virtual machine configurations should never be modified because doing so would void the support for the cluster.



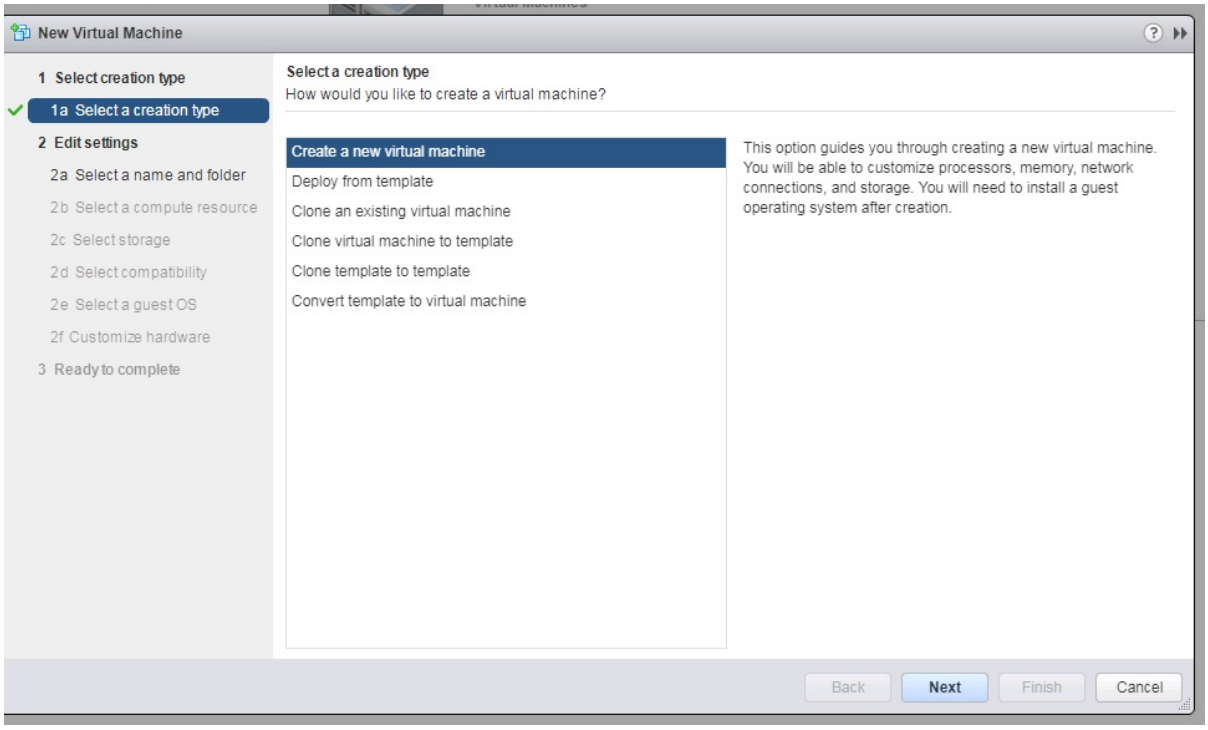
3. Right-click the cluster and choose New Virtual Machine to create the virtual machine.



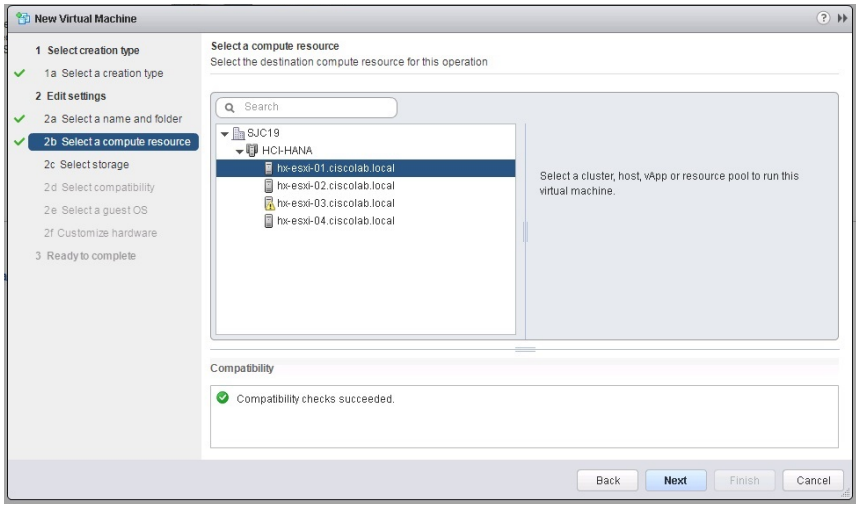
4. On the screen that appears, select “Create a new virtual machine” and click Next at the bottom of the screen.



5. On the next screen, enter the name of the SAP HANA virtual machine and choose the vCenter data center that was created; click Next at the bottom of the screen.

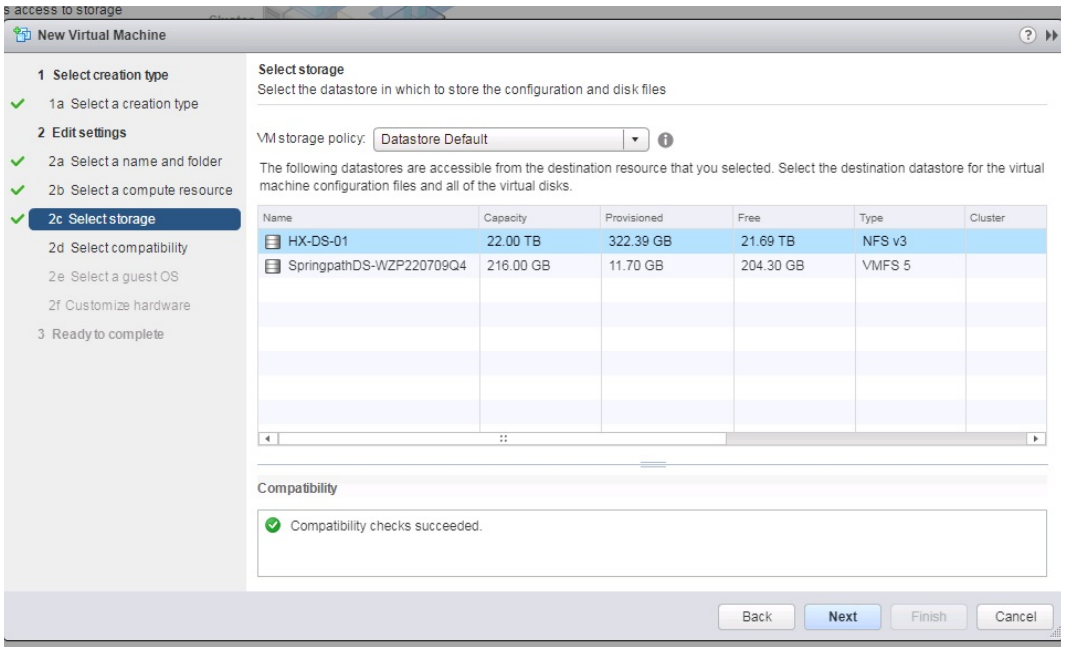


6. On the next screen, choose the computing resource or HX-Series node on which the SAP HANA virtual machine is to be placed. Then click Next.

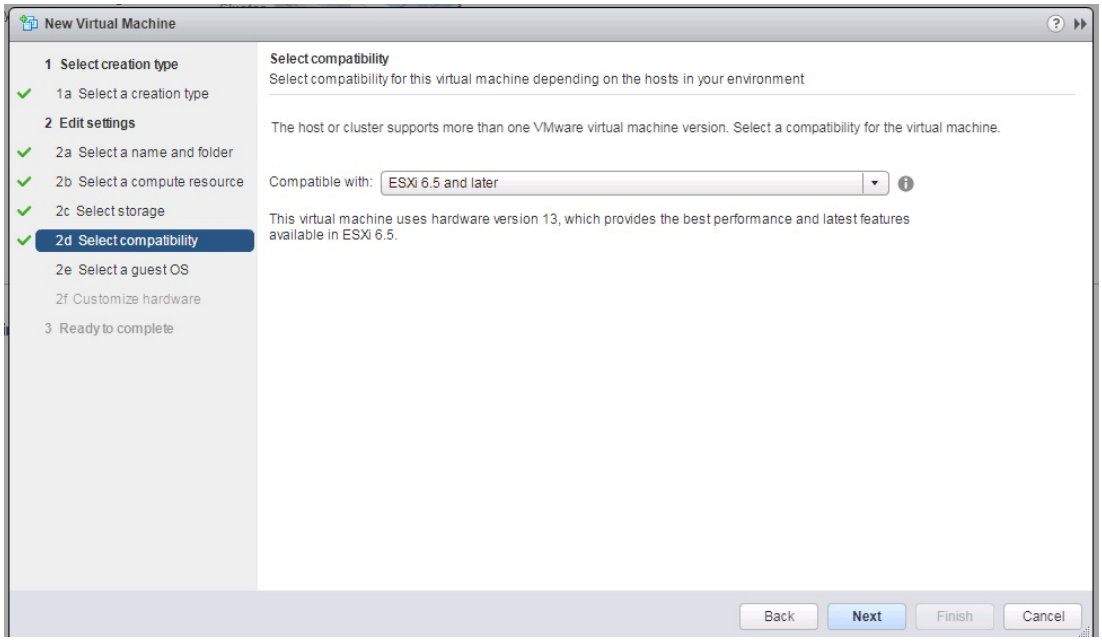


Note: As specified for the current certified solution for Cisco HyperFlex for SAP HANA on hyperconverged infrastructure, only one production SAP HANA virtual machine can be run per HX-Series node.

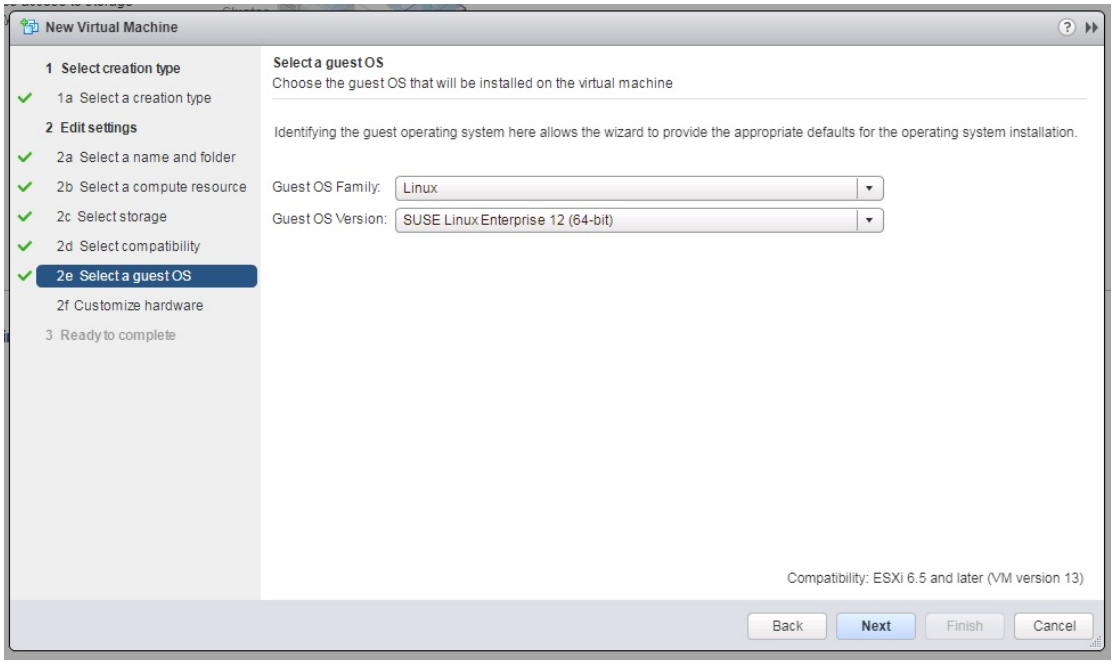
7. After you have selected the HX-Series node for the SAP HANA virtual machine, select the datastore for the virtual machine that was created with the Cisco HyperFlex installation. Then click Next.



8. Select the compatibility option. Choose “ESXi 6.5 and later” and click Next.



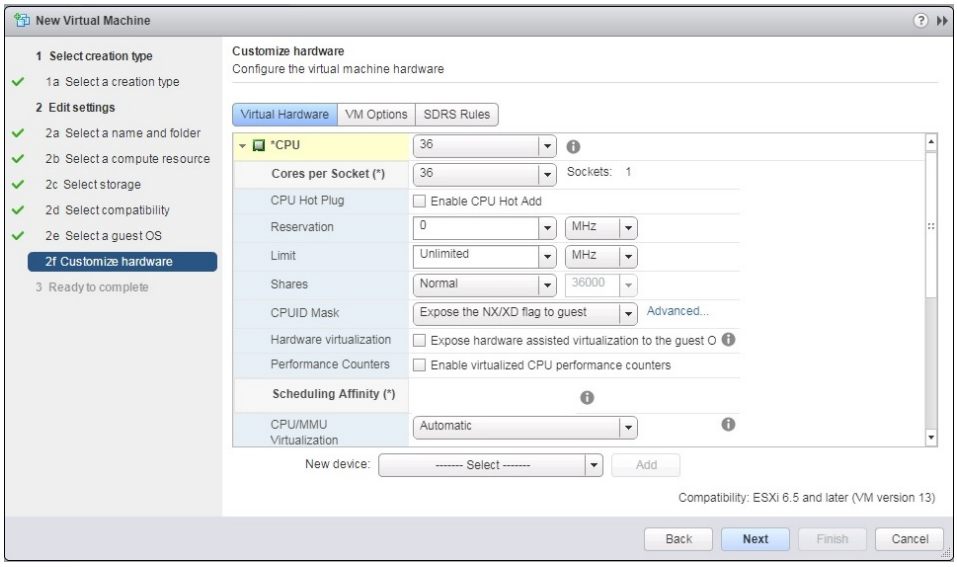
9. For the OS family, choose Linux, and for the OS version choose SUSE Linux Enterprise 12 (64-Bit). Then click Next.



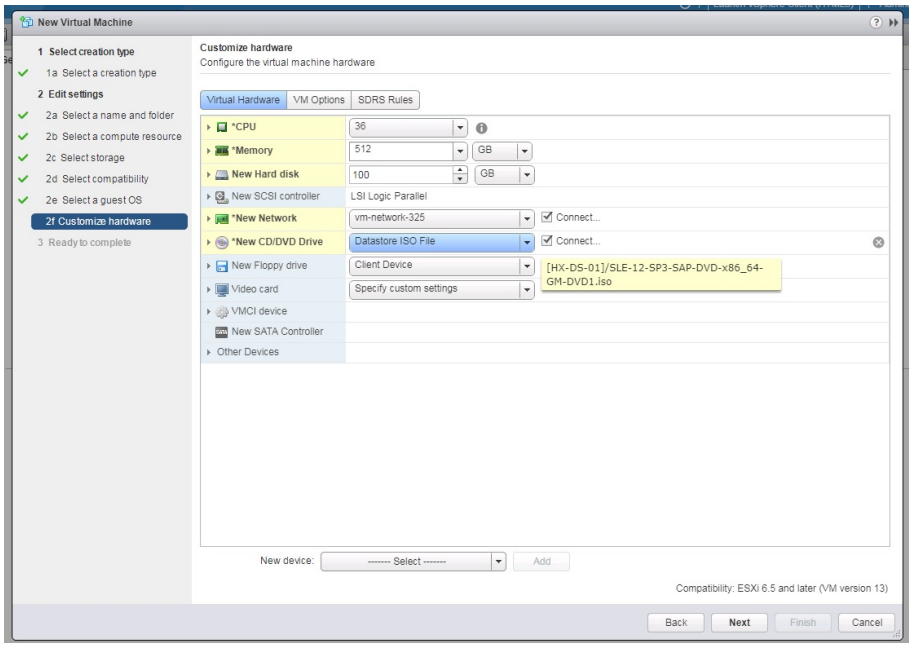
On the next screen, we have to customize the resources needed to run the production SAP HANA virtual machine. As stated in the previous section, the SAP HANA virtual machine in the current certified solution uses one full socket in the HX-Series node. Depending on the model of the CPU that has been used, the number of vCPUs has to be chosen. Also, we need to pin the SAP HANA virtual machine to the second socket of the HX-Series node.

This guide uses the Intel Xeon Gold 6140 processor as an example. This CPU has 18 physical cores and 36 logical threads.

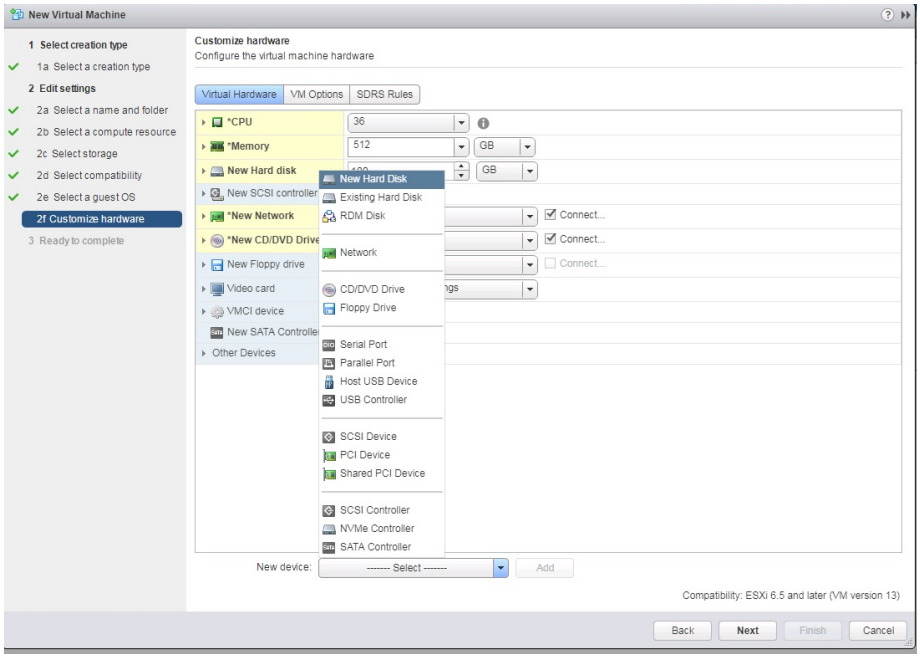
10. For this example, set the CPU resource to 36, which is the maximum number of threads for the full-socket CPU that is used in this document for reference. Then click Next.



11. For the memory value, enter **512** (GB), used here as an example.
12. For the new hard disk size, enter **100** (GB). This value will be used for the operating system.
13. For the network, select the appropriate access VLAN to allow access to the virtual machine in the network.
14. Select Datastore ISO File and choose the SLES ISO file from the drop-down menu.
15. Click the Connect checkbox.

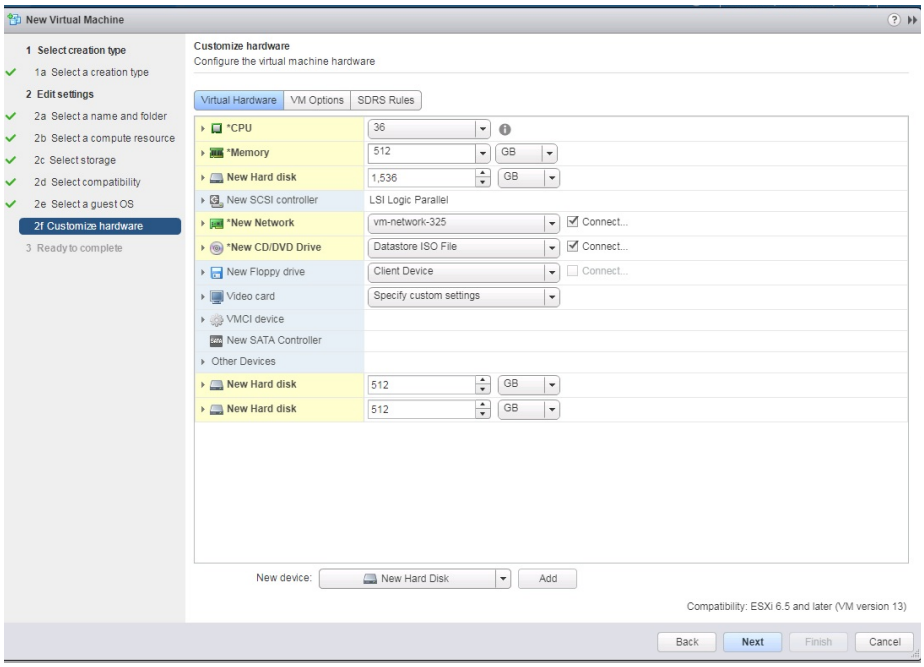


16. The next step is to add the disks for the data, log, and shared file system for SAP HANA. From the “New Hard disk” drop-down menu, choose New Hard Disk and click Add.

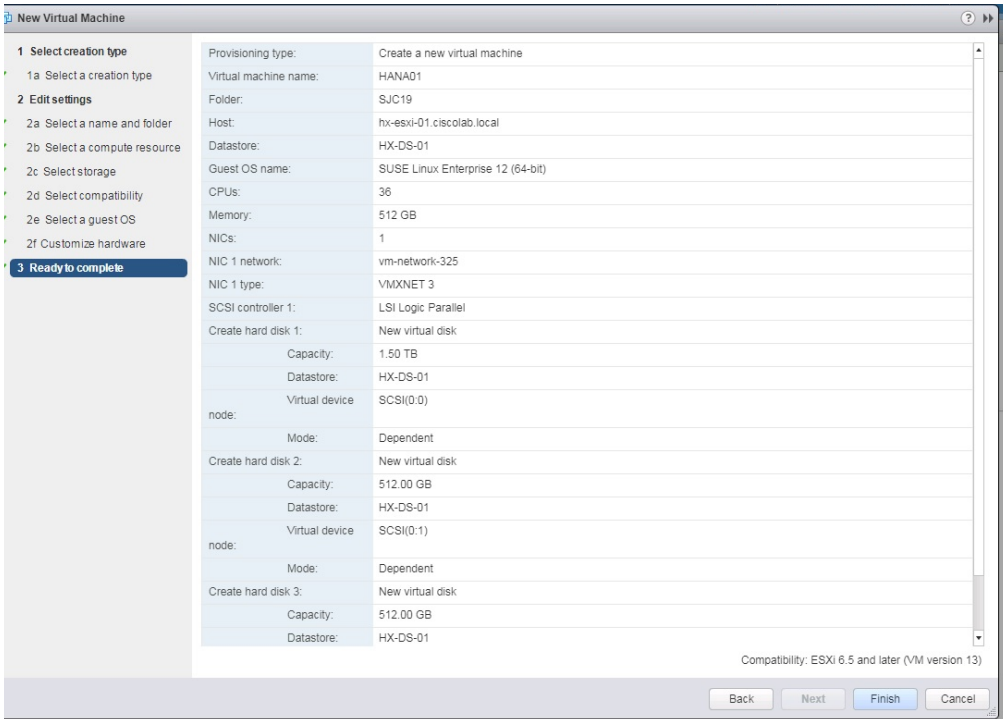


In the example here, for a 512-GB memory SAP HANA virtual machine, a disk size of 1536 GB (1.5 TB) is used for the data file system.

17. Repeat these steps to add two more 512-GB disks for the log and shared file systems.
18. When the required drives have been added, click Next.



19. The final confirmation window shows the customized hardware settings for the SAP HANA file system. Review the settings carefully and make sure that no other SAP HANA virtual machine is on the HX-Series node that was used to install this virtual machine.
20. Click Finish to create the virtual machine.



Pinning the production SAP HANA virtual machine with NUMA node

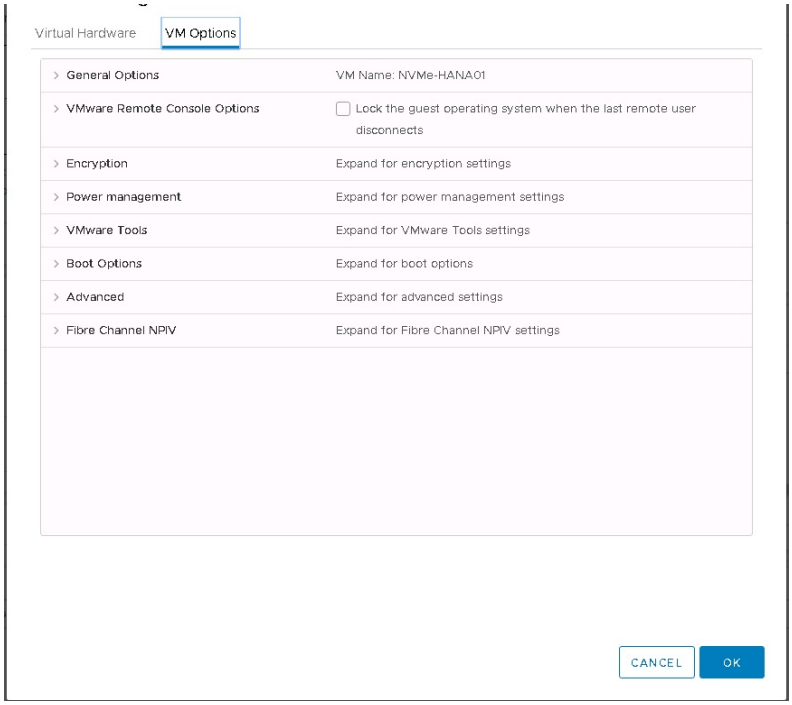
SAP states that in an HCI environment, the production SAP HANA virtual machine cannot share the socket with the storage controller of the HCI or nonproduction SAP HANA virtual machines. To follow this rule, you should pin the SAP HANA virtual machine to the non-uniform memory access (NUMA) node that does not have the storage controller virtual machine assigned.

Note: This process is critical to enable SAP support for the production SAP HANA virtual machines on hyperconverged infrastructure.

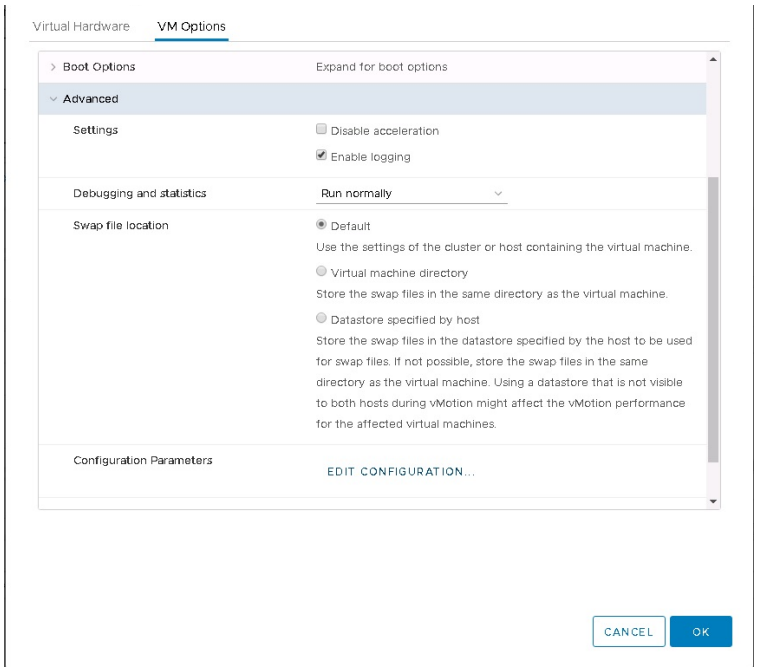
In Cisco HyperFlex hyperconverged infrastructure, because the Cisco HyperFlex HX220c M5SN All Flash Node is a two-socket server, the storage controller uses NUMA node 0, and therefore the production SAP HANA virtual machine need to be assigned to NUMA node 1.

Follow these steps to assign the production SAP HANA virtual machine to NUMA node 1.

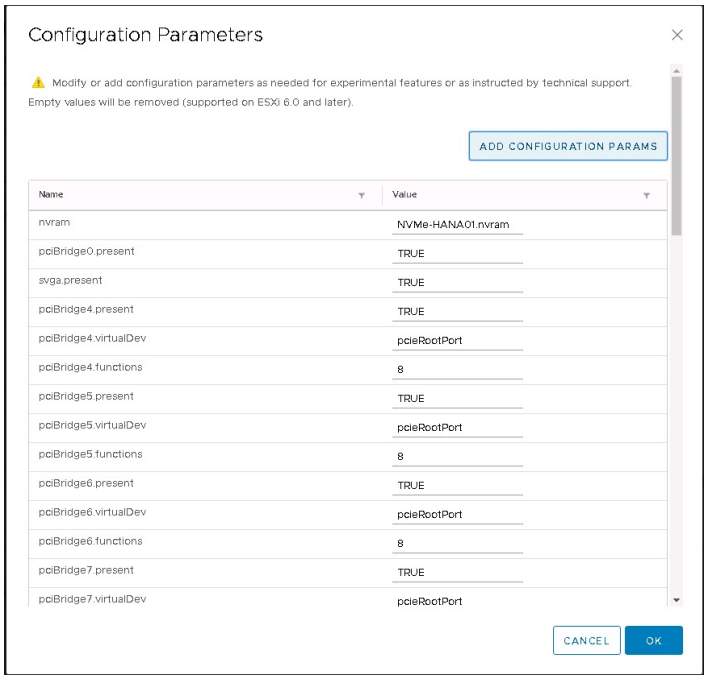
1. From the vSphere data center, right-click the SAP HANA virtual machine and choose Settings.
2. In the Edit window, select VM Options.



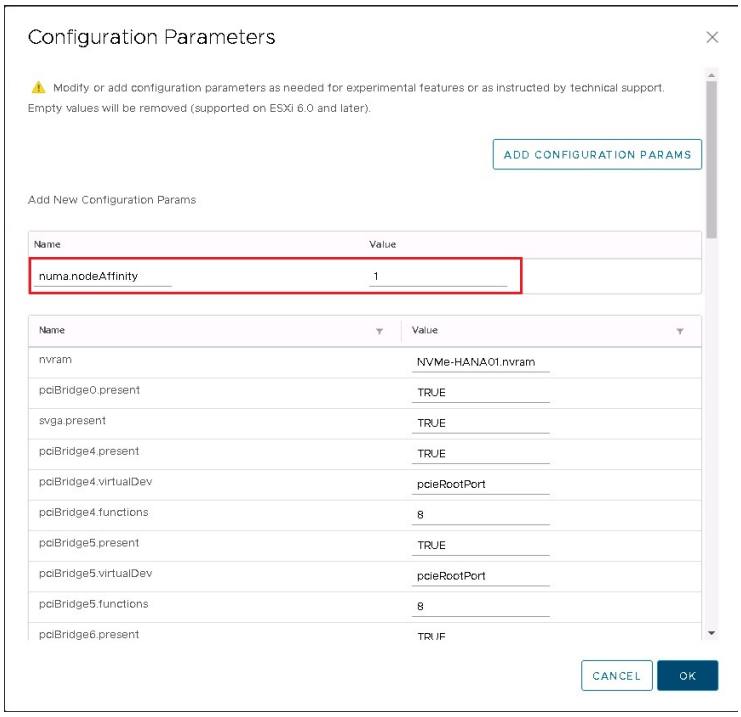
3. Expand the Advanced menu and click Edit Configuration.



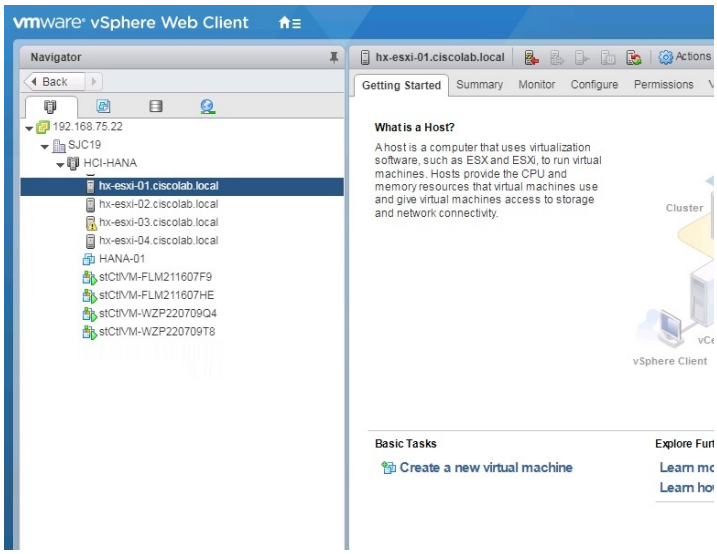
4. In the Configuration Parameters window, click Add Configuration Params.



5. Enter the parameter name **numa.nodeAffinity** and the value **1**.



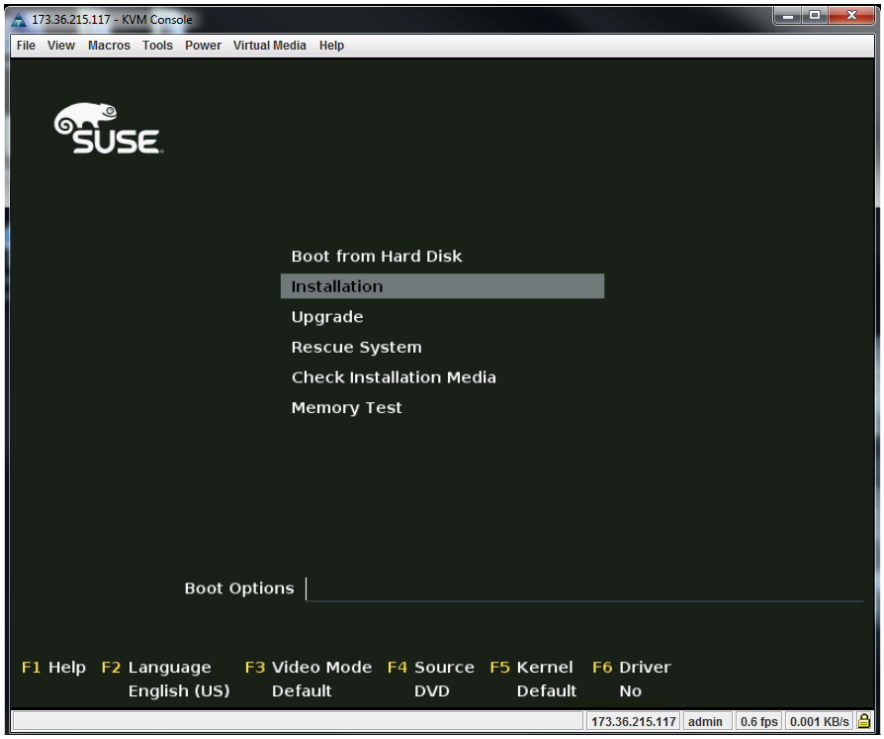
6. Click OK to save the settings and proceed to the next process. The virtual machine is now ready for the OS installation.



Installing the operating system on the SAP HANA virtual machine

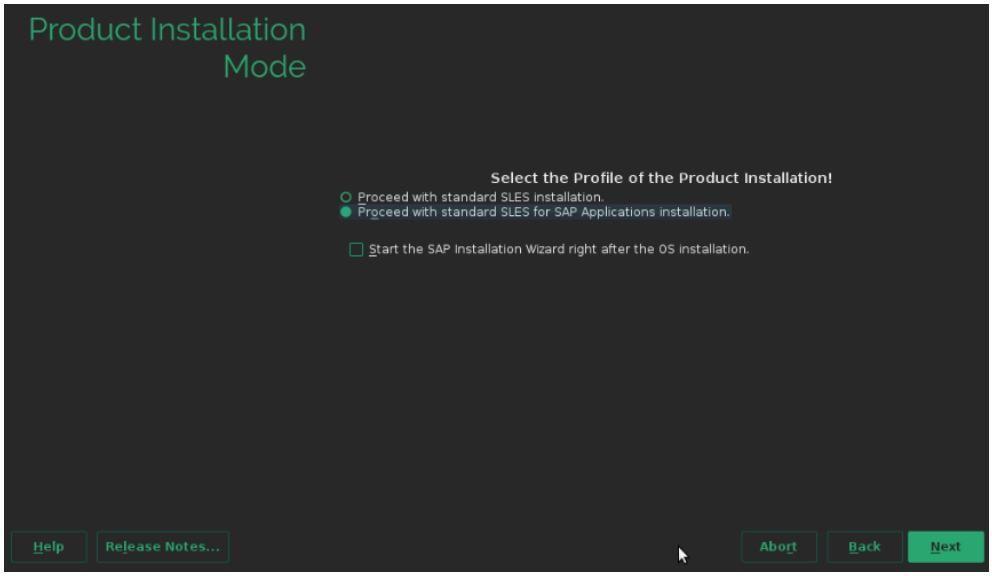
To install SLES 12 for SAP SP3, perform the following steps:

1. Mount the SLES for SAP 12 SP3 ISO file from the datastore.
2. Power on the virtual machine created in the preceding steps
3. From the boot menu, select Installation

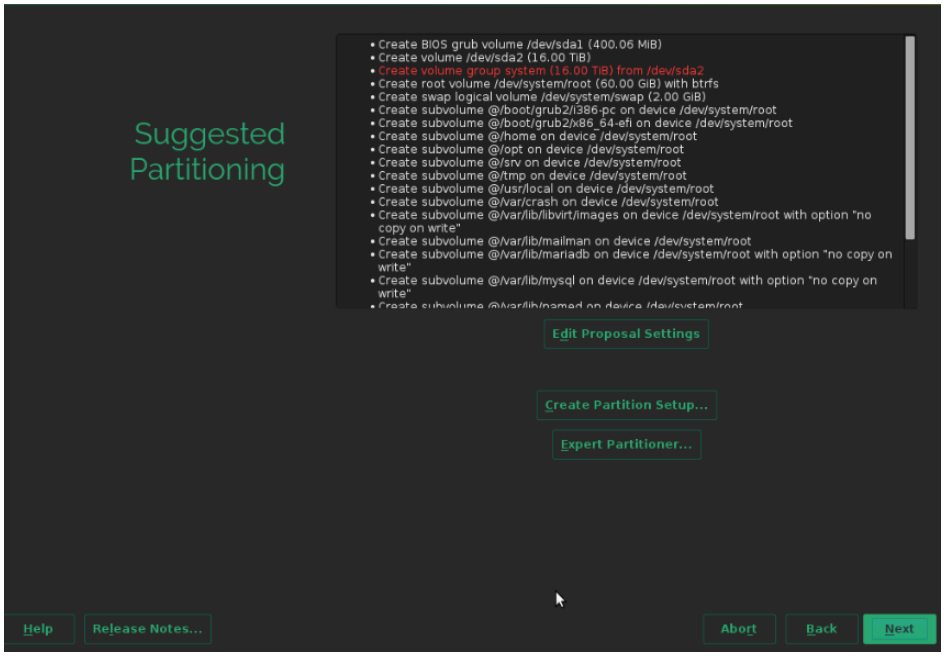


4. On the Language, Keyboard and License Agreement page, select your preferred language and keyboard Layout, agree to the license terms, and select Next.
5. On the Network Settings page, select Next. You will return to the network configuration as part of the postinstallation tasks.
6. On the Registration page, select Skip Registration. You will register later as part of the postinstallation tasks.

7. On the Product Installation Mode page, select the “Proceed with standard SLES for SAP Applications installation” option.



8. On the Add On Product page, select Next. In this configuration example, there are no additional products to install.
9. On the Suggested Partitioning page, select Expert Partitioner.

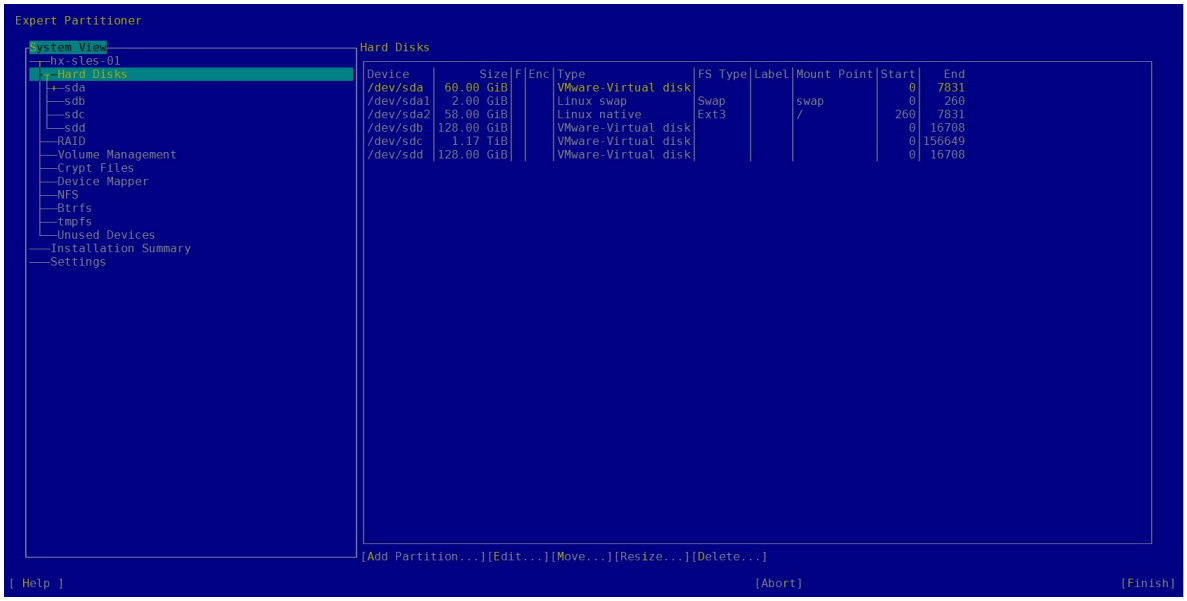


10. At the left, choose System View > Linux > Hard Disks > sda.
11. Clear the suggested partitions.
12. Create partitions with sizes based on the memory size of the SAP HANA virtual machine, as shown in Table 5.

Table 5. Partition sizes

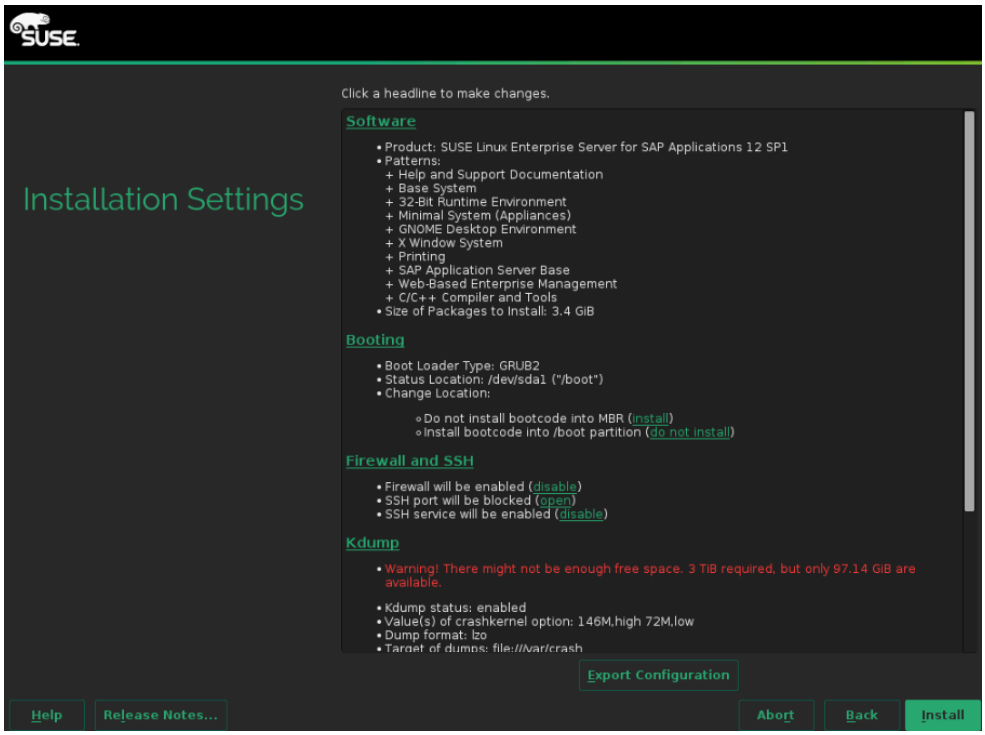
Disk	Partition	Type	Mount	Size
sda	sda1	Ext3	/	98 GB
	sda2	Swap	Swap	2 GB
sdb	sdb1	XFS	Shared	512 GB
sdc	sdc1	XFS	Data	1.5 TB
sdd	sdd1	XFS	Log	512 GB

13. After you have created the partitions, the partition information should look like the following screenshot.



14. Click Accept to return to the Installation Settings page.
15. Review the updated partition information. Then click Next.
16. For Clock and Time Zone, choose the appropriate time zone and select the hardware clock set to UTC.
17. For the password for the system administrator root, enter an appropriate password.

18. On the Installation Settings screen, review the default information.

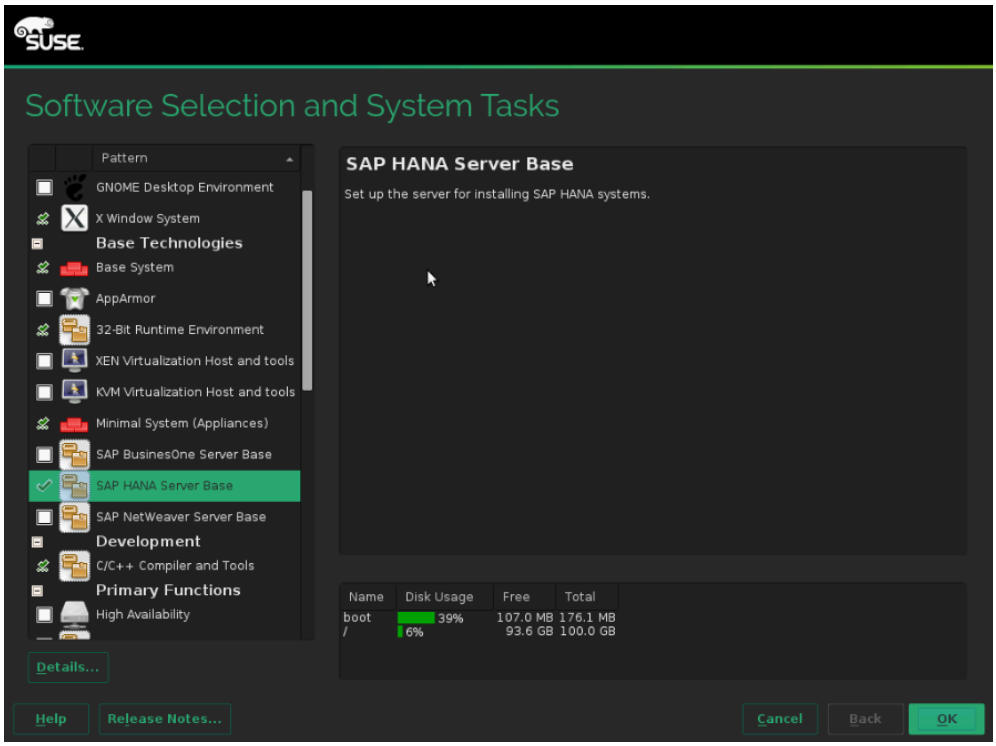


19. Now customize the software selection. Click the Software headline to make changes as follows:

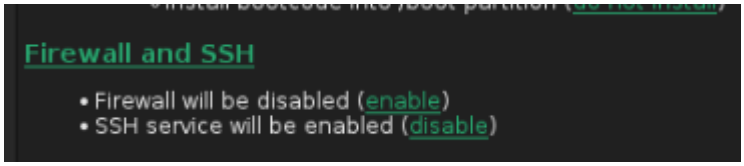
    a. Deselect Gnome Desktop Environment.

    b. Select C/C++ Compiler and Tools.

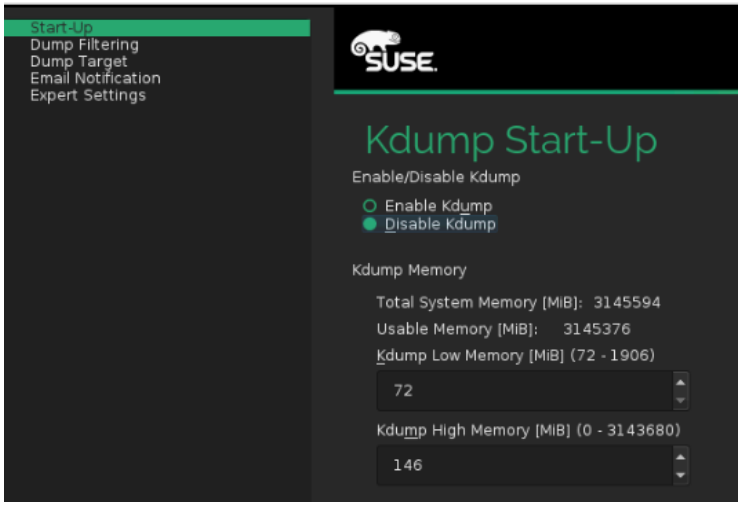
    c. Select SAP HANA Server Base.



20. Click OK.
21. Under the Firewall and SSH headline, disable the firewall. This selection automatically enables Secure Shell (SSH) Protocol service.



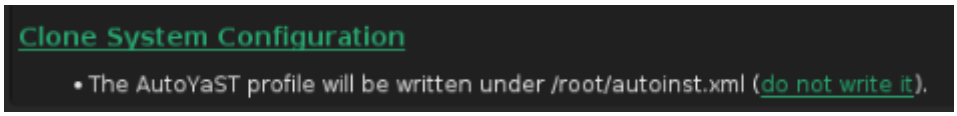
22. Click the Kdump headline and select Disable Kdump.



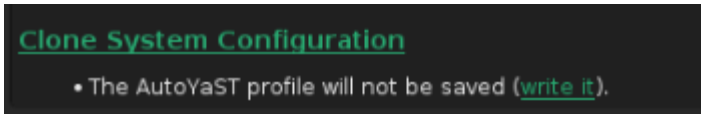
23. Click OK.
24. Click the Set Default Systemd Target headline and select “Text mode.”

25. Click OK.

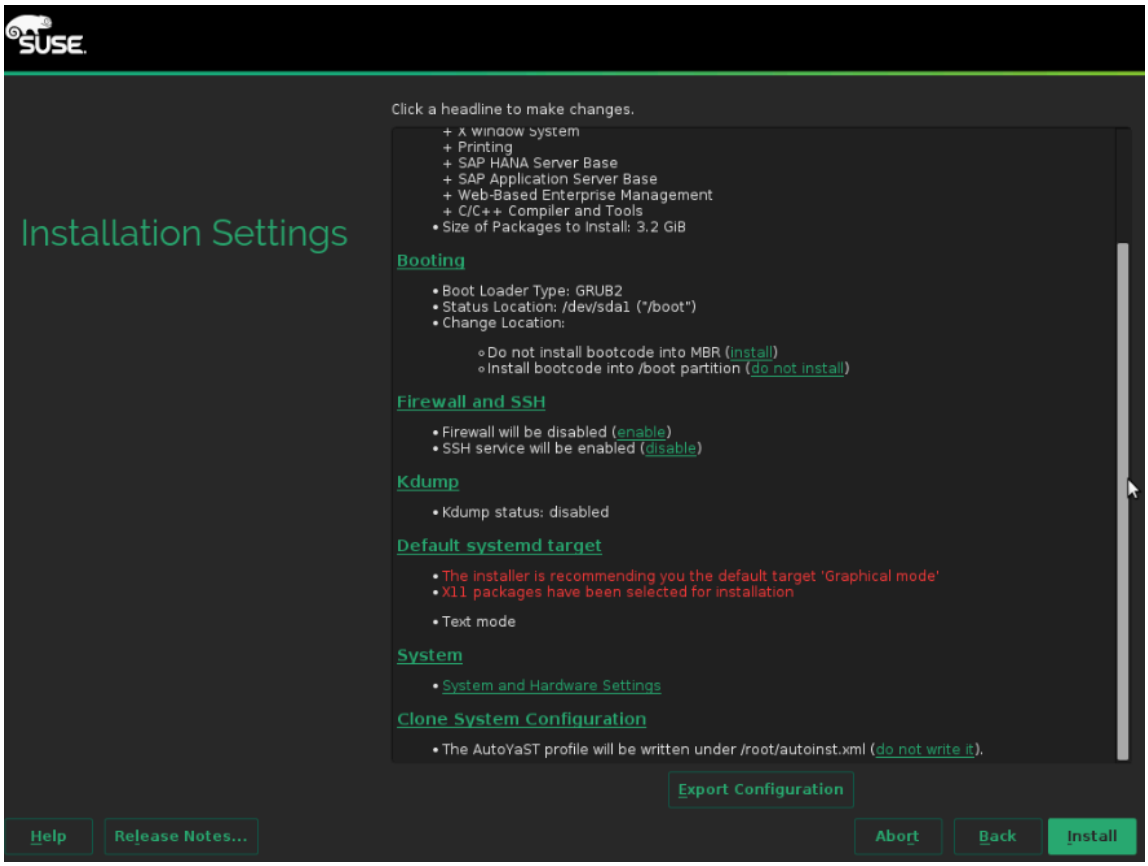
26. Click the Clone System Configuration headline and click the link “do not write it.”



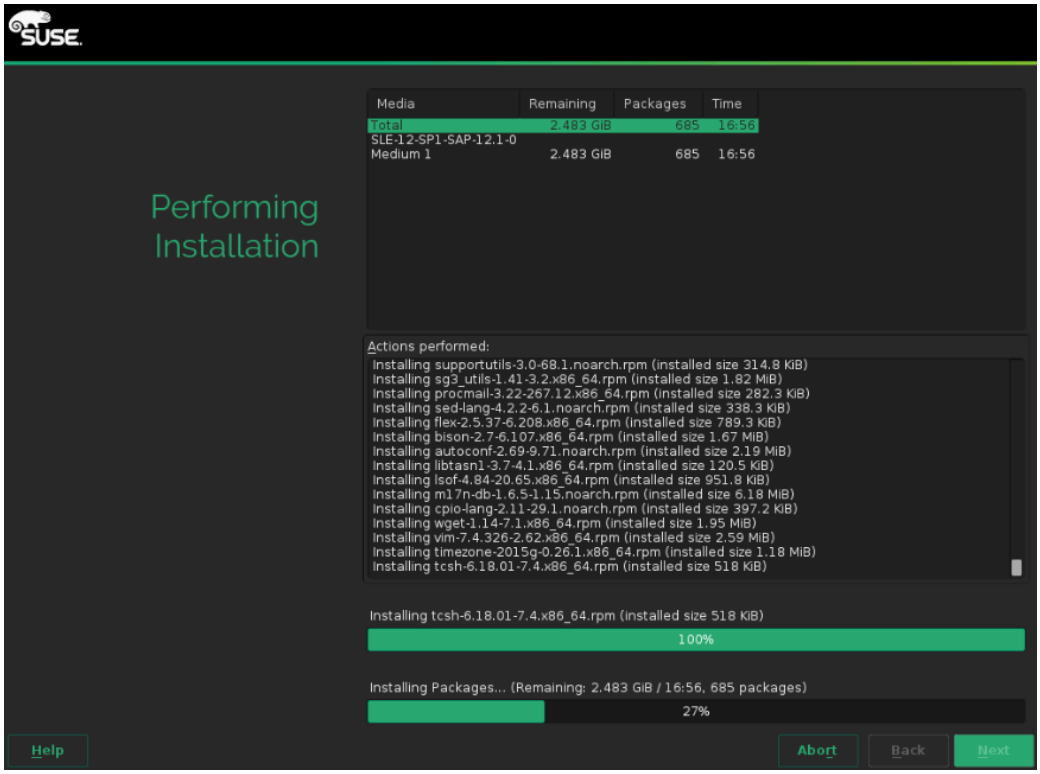
You will then see a message telling you that the AutoYaST profile will not be saved.



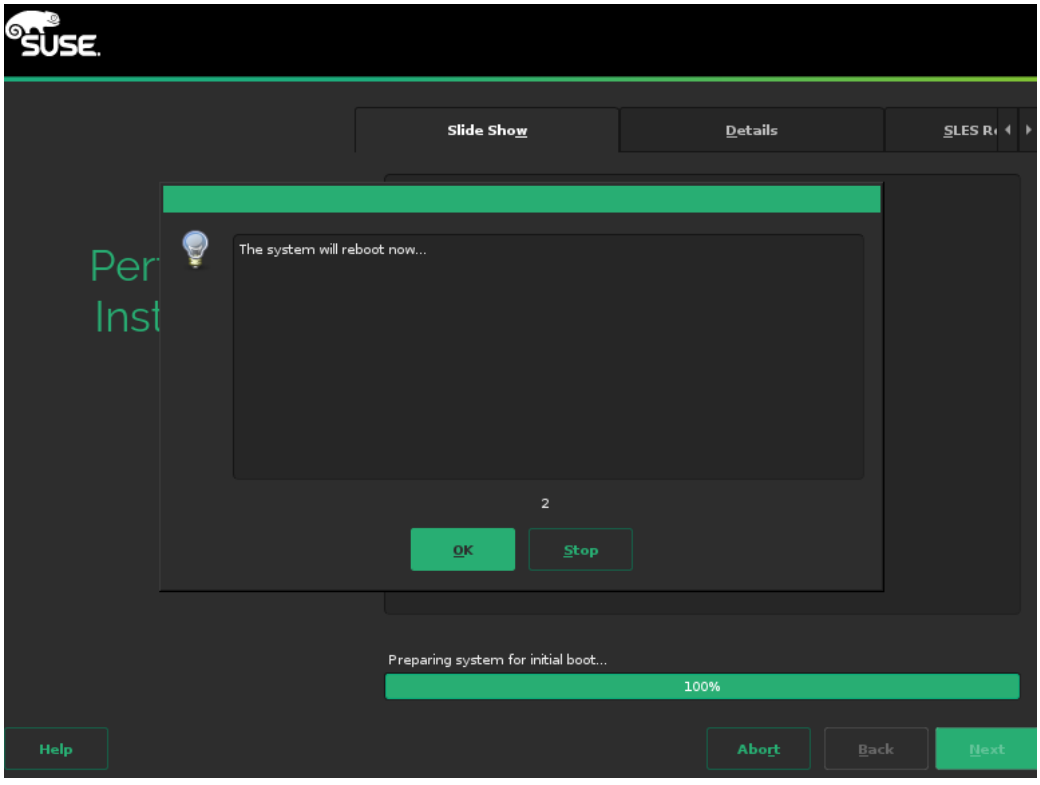
27. Leave the Booting and System default selections unchanged.



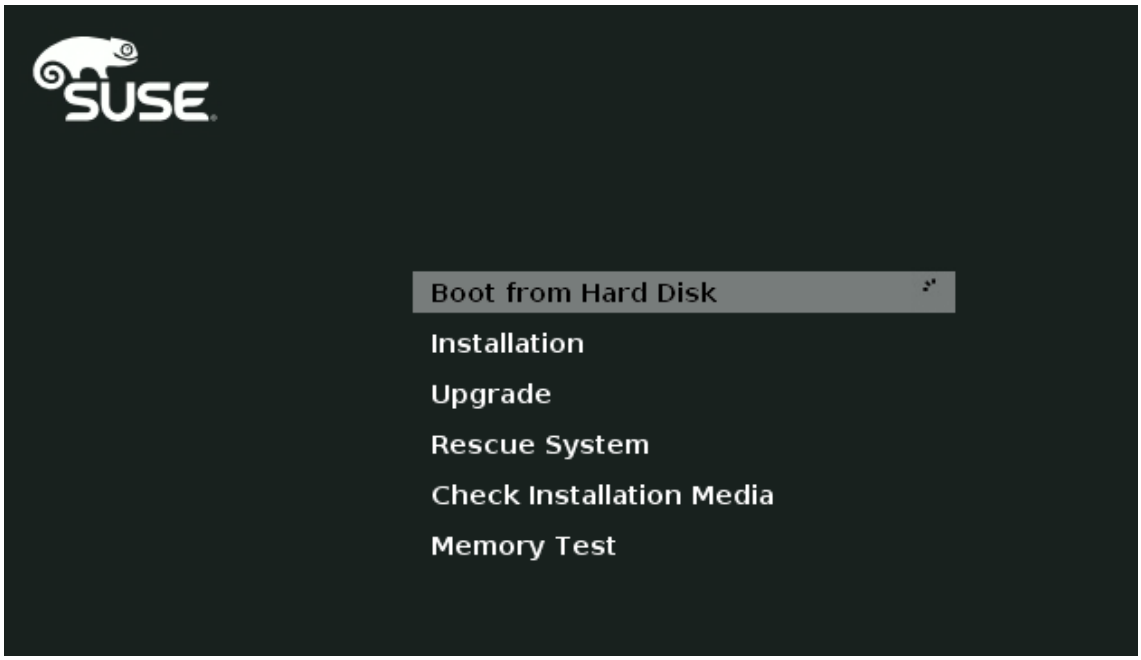
28. Click Install. Also select Install at subsequent Confirm Installation prompts. The installation starts, and you can monitor the status.



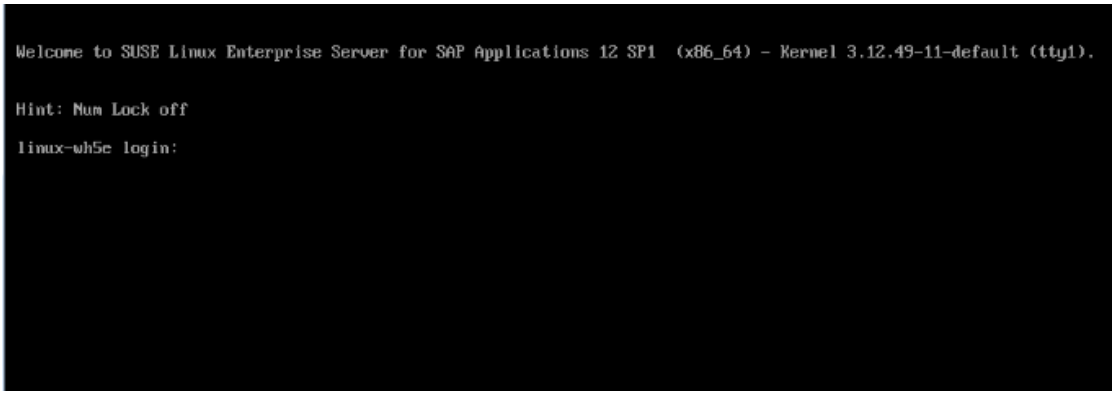
29. You will see a reboot alert when the installation is complete. Click OK and then click Next.



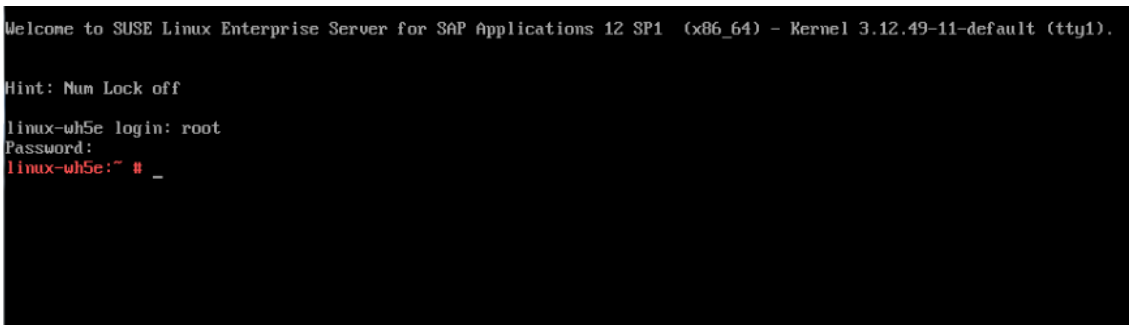
30. The system will reboot and boot from the disk on startup. Select Boot from Hard Disk.



The system then displays the login prompt.

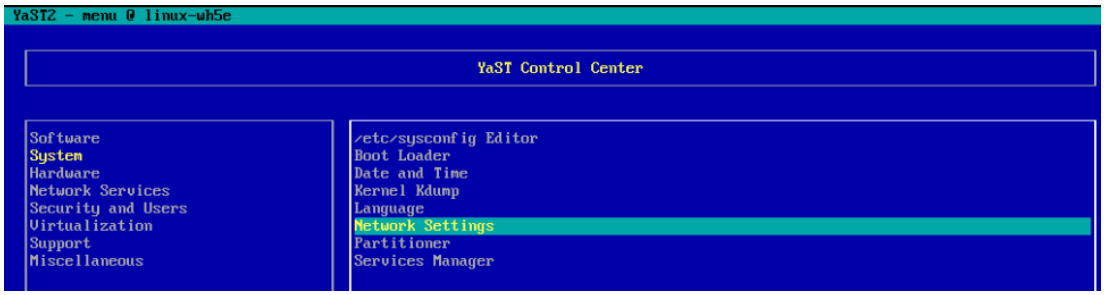


31. Use the VMware console to log in to the installed system as the user **root** with the password <**root password**>.

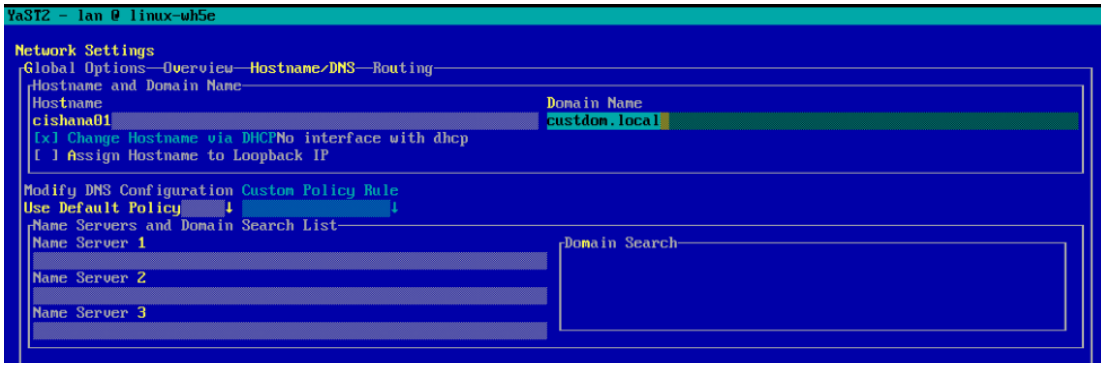


32. Configure the host name and disable IPv6.

```
#yast2
```

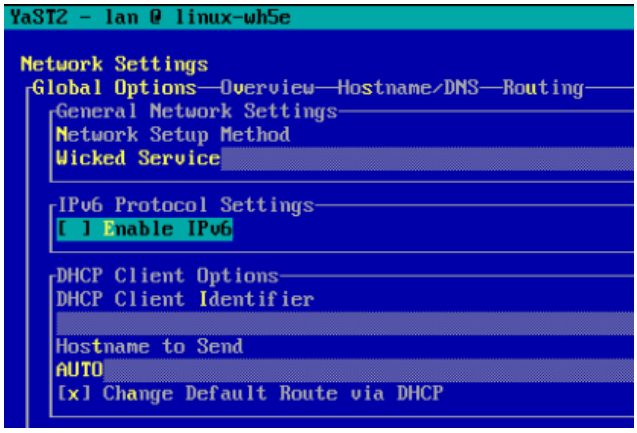


33. Choose System > Network Settings and press Alt+S to select the Hostname/DNS tab.



34. Enter the host name and enter the Domain Name System (DNS) server address of your network for resolution, if necessary. Then press Alt+O.
35. On the Global Options tab, using Alt+G, disable IPv6 by deselecting Enable IPv6.

Note: Changing the IPv6 setting requires a reboot to make the change take effect.



36. Press Alt+O to save the network configuration. Press Alt+Q to quit the YaST Control Center.
37. Reboot the server to make the IPv6 selection and the hostname settings take effect:

```
#reboot
```

38. Use **ifconfig** to list the available virtual machine interface names and go to the network configuration directory and create a configuration. In this example, the device name is eth1.

```
#cd /etc/sysconfig/network
#vi ifcfg-eth1
BOOTROTO='static'
```

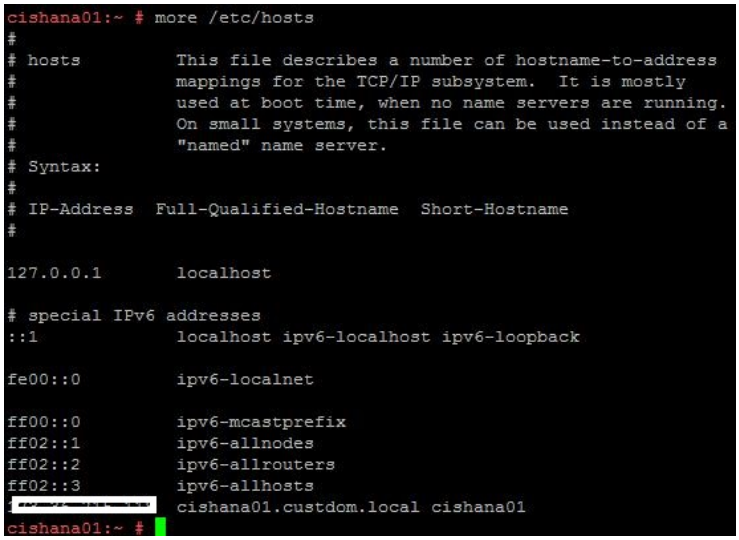
```
IPADDR='<<access_ip_address>>'
NETMASK='<<acess_nw_netmask>>'
NETWORK=''
MTU=''
REMOTE_IPADDR=''
STARTMODE='auto'
USERCONTROL='no'
```

39. Add the default gateway.

```
#cd /etc/sysconfig/network
# vi routes
default <<access_gateway_ip>> - -
```

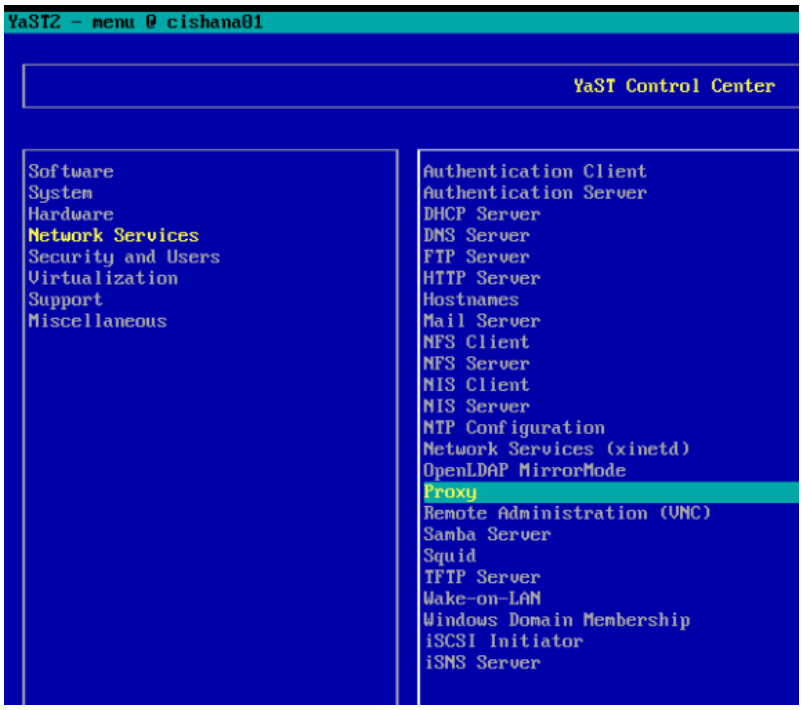
Note: Be sure that the system has access to the Internet or to a SUSE update server to install the patches.

40. Verify /etc/hosts.

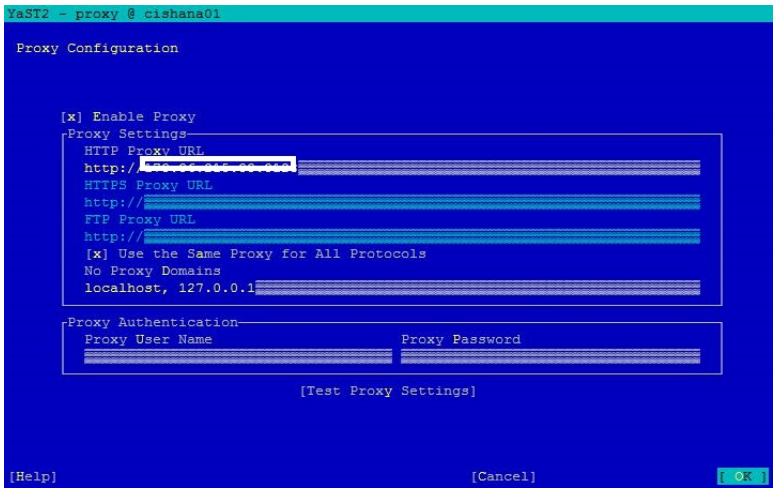


41. If required, set up a proxy service so that the appliance can reach the Internet:

```
#yast2
```



42. Enter the proxy server and port as shown in the following sample configuration. Select OK and then quit YaST to save the configuration.



43. Register the system with SUSE to receive the latest patches. For more information, refer to the SUSE knowledgebase article at https://www.suse.com/de-de/support/kb/doc?id=7016626.

    The system must have access to the Internet to proceed with this step.

    ```
    #SUSEConnect -r <<registration_code>> -e <<email_address>>
    ```

44. Update the system with the following command. Again, the system must have access to the Internet to proceed with this step.

    ```
    #zypper update
    ```

45. Follow the on-screen instructions to complete the update process. Reboot the server and log in to the system again.

Postinstallation VMware and OS configuration

To optimize the use of the SAP HANA database with SLES 12 or SLES for SAP 12 SP3, apply the settings by referring to this SAP HANA note: 2205917 – SAP HANA DB: Recommended OS settings for SLES 12 / SLES for SAP Applications 12.

Refer the SAP Note 2161991: VMware vSphere configuration guidelines for recommended configuration guidelines for VMware vSphere.

Preparing SAP HANA file systems

Follow these steps to prepare the SAP HANA file systems:

1. Create file systems in the data, log, and HANA shared mount:

```
#mkfs.xfs -f /dev/sdb1 (for Shared)
#mkfs.xfs -f /dev/sdc1 (for Data)
#mkfs.xfs -f /dev/sdd1 (for Log)
```

2. Create mount directories for the data, log, and HANA shared file systems:

```
#mkdir -p /hana/data
#mkdir -p /hana/log
#mkdir -p /hana/shared
```

   The following is a sample /etc/fstab entry. Make sure that you use the same mount options for the data and log file systems as shown in the example.

```
UUID=fc76372c-6bbe-4269-910d-6f40d23dcf80 swap                 swap       defaults
0 0
UUID=df8a6b63-ecea-4d6f-86af-ebb7ecd3abd9 /                    ext3
acl,user_xattr        1 1
#HANA Disks
/dev/sdb        /hana/shared    xfs   defaults    1 2
/dev/sdc        /hana/data      xfs   defaults    1 2
/dev/sdd        /hana/log       xfs   defaults    1 2
```

3. Use the following command to mount the file systems:

```
#mount -a
```

4. Use the **df -h** command to check the status of all mounted volumes:

```
hx-sles-01:~ # df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda2        57G  6.1G    50G  11% /
/dev/sdd        512G   41G   471G  32% /hana/log
/dev/sdc        1.5T  457G   1.1T  39% /hana/data
/dev/sdb        512G   77G   435G  60% /hana/shared
```

5. Change the directory permissions **before** you install SAP HANA. Use the **chown** command on each SAP HANA node after the file systems are mounted:

```
#chmod -R 777 /hana/data
#chmod -R 777 /hana/log
#chmod -R 777 /hana/shared
```

Installing SAP HANA

Use the official SAP documentation, which describes the installation process with and without the SAP unified installer.

For the SAP HANA installation documentation, refer to the SAP HANA Server Installation Guide.

All other SAP installation and administration documentation is available at http://service.sap.com/instguides.

Important SAP Notes

Read the following SAP notes before you start the installation. These SAP notes contain the latest information about the installation, as well as corrections to the installation documentation.

The latest SAP notes are available at https://service.sap.com/notes.

SAP HANA IMDB notes

- SAP note 1514967: SAP HANA: Central note
- SAP note 2298750: SAP HANA Platform SPS 12 Release Note
- SAP note 1523337: SAP HANA database: Central note
- SAP note 2000003: FAQ: SAP HANA
- SAP note 2380257: SAP HANA 2.0 Release Notes
- SAP note 1681092: Support for multiple SAP HANA databases on a single SAP HANA appliance
- SAP note 1514966: SAP HANA: Sizing the SAP HANA database
- SAP note 1637145: SAP BW on HANA: Sizing the SAP HANA database
- SAP note 1793345: Sizing for Suite on HANA

Linux notes

- SAP note 2205917: SAP HANA DB: Recommended OS settings for SLES 12 and SLES for SAP Applications 12
- SAP note 2235581: SAP HANA: Supported operating systems
- SAP note 1944799: SAP HANA guidelines for the SLES operating system
- SAP note 1557506: Linux paging improvements
- SAP note 1740136: SAP HANA: Wrong mount option may lead to corrupt persistency

Third-party software notes

- SAP note 1730928: Using external software in an SAP HANA appliance
- SAP note 1730929: Using external tools in an SAP HANA appliance
- SAP note 1730930: Using antivirus software in an SAP HANA appliance
- SAP note 1730932: Using backup tools with Backint for SAP HANA

SAP HANA virtualization notes

- SAP note 2652670: SAP HANA VM on VMware vSphere
- SAP note 2161991: VMware vSphere configuration guidelines
- SAP note 2393917: SAP HANA on VMware vSphere 6.5 and 6.7 in production
- SAP note 2015392: VMware recommendations for latency-sensitive SAP applications

Performing SAP HANA postinstallation checkup

For an SAP HANA system installed with <SID> set to **SKL** and the system number <nr> set to **00**, log in as **<sid>adm ir skladm** and run the commands presented here. Commands for checking SAP HANA services follow:

```
skladm@cishana01:/usr/sap/SKL/HDB00> /usr/sap/hostctrl/exe//sapcontrol -nr 00 -function
GetProcessList


19.05.2016 11:29:27
GetProcessList
OK
name, description, dispstatus, textstatus, starttime, elapsedtime, pid
hdbdaemon, HDB Daemon, GREEN, Running, 2016 04 13 08:51:49, 866:37:38, 41691
hdbcompileserver, HDB Compileserver, GREEN, Running, 2016 04 13 08:51:56, 866:37:31, 41837
hdbindexserver, HDB Indexserver, GREEN, Running, 2016 04 13 08:52:00, 866:37:27, 41863
hdbnameserver, HDB Nameserver, GREEN, Running, 2016 04 13 08:51:50, 866:37:37, 41711
hdbpreprocessor, HDB Preprocessor, GREEN, Running, 2016 04 13 08:51:56, 866:37:31, 41839
hdbwebdispatcher, HDB Web Dispatcher, GREEN, Running, 2016 04 13 08:53:11, 866:36:16, 42431
hdbxsengine, HDB XSEngine, GREEN, Running, 2016 04 13 08:52:00, 866:37:27, 41865
skladm@cishana01-skl:/usr/sap/SKL/HDB00>
```

Tuning the SAP HANA performance parameters

After SAP HANA is installed, tune the parameters as shown in Table 6 and explained in the following SAP notes.

Table 6. Tuning parameters

Parameters	Data file system	Log file system
max_parallel_io_requests	256	Default
async_read_submit	On	On
async_write_submit_blocks	All	All
async_write_submit_active	Auto	On

For SAP HANA 2.0 installations, use either hdbsql or the Structured Query Language (SQL) function in SAP HANA Studio or the cockpit and the following SQL commands:

```
ALTER SYSTEM ALTER CONFIGURATION ('global.ini', 'SYSTEM') SET ('fileio',
'fileio.max_parallel_io_requests[Data]') = '256' WITH RECONFIGURE;


ALTER SYSTEM ALTER CONFIGURATION ('global.ini', 'SYSTEM') SET ('fileio', 'fileio.
async_write_submit_active [Data]') = 'Auto' WITH RECONFIGURE;
```

For more information, refer to SAP Note 2399079: Elimination of hdbparam in HANA 2.

Downloading revisions

To download revisions, you need to connect to the service marketplace and select the software download area to search for available patches.

Refer to http://help.sap.com/hana/SAP_HANA_Master_Update_Guide_en.pdf for update procedures for SAP HANA.

For more information

See the following links for additional information:

- For information about SAP HANA, see https://hana.sap.com/abouthana.html.
- For information about certified and supported SAP HANA hardware, see https://global.sap.com/community/ebook/2014-09-02-hana-hardware/enEN/index.html.

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