

Cisco UCS Scale-Up Solution for SAP HANA on M5 Rack Servers



Design and Deploy an SAP HANA Single-Node Solution Based on Standalone Cisco UCS M5 Rack Servers with SLES 12 for SAP SP2.

February 2018

Contents

- Executive summary**4
- Solution overview**.....4
 - Introduction4
- Audience**.....4
 - Purpose of this document.....5
 - Solution summary: Cisco UCS C480 M5 Rack Server5
 - Solution summary: Cisco UCS C240 M5 Rack Server6
 - Solution Summary: Cisco UCS C220 M5 Rack Server.....7
- Infrastructure overview**.....8
 - Cisco UCS C480 M5 Rack Server8
 - Cisco UCS C240 M5 Rack Server9
 - High performance for data-intensive applications.....10
 - Cisco UCS C220 M5 Rack Server10
 - High performance for data-intensive applications.....11
- Solution design**11
 - SAP HANA system11
 - Hardware requirements for the SAP HANA database12
 - File system layout.....12
 - Operating system14
- Deployment hardware and software configuration guidelines**14
- Preparing the SAP HANA scale-up node**.....15
 - Configuring the Cisco Integrated Management Controller15
 - Launching the KVM console19
 - Configuring BIOS settings21
 - Rebooting the server to implement BIOS changes.....28
 - RAID options.....28
 - Configuring RAID29
 - Installing the operating system.....38
 - Post-installation OS configuration74
 - Configuring bonding for high availability74
 - Preparing SAP HANA data, log, and shared file systems79
- Installing SAP HANA**82
 - Important SAP Notes.....82
 - SAP HANA IMDB notes.....82
 - Linux notes83
 - Third-party software notes83
 - SAP HANA virtualization notes83
 - Performing an SAP HANA post-installation checkup83
 - Commands for checking SAP HANA services83
 - Commands for checking SAP HANA database (HDB) information.....84
 - Tuning the SAP HANA performance parameters.....84
- Maintenance operations**.....84

Maintaining the operating system.....	84
Prerequisites.....	85
Updating the OS and kernel.....	85
Updating SUSE and the kernel online	85
Operating and maintaining SAP HANA.....	95
Monitoring SAP HANA.....	95
Starting and stopping SAP HANA.....	97
sapcontrol.....	97
Downloading revisions.....	100
For more information.....	100
Appendix: Solution variables used in this document.....	101

Executive summary

Organizations in every industry are generating and using more data than ever before: from customer transactions and supplier delivery considerations to real-time user-consumption statistics. Without reliable infrastructure that can store, process, and analyze big data sets in real time, companies are unable to use this information to their advantage. The Cisco® Scale-Up Solution for SAP HANA with the Cisco Unified Computing System™ (Cisco UCS®) using the Cisco UCS M5 Rack Server helps companies more easily harness information and make better business decisions that let them stay ahead of the competition. Our solutions help improve access to all your data to accelerate business decision making with policy-based, simplified management, lower deployment risk, and reduced total cost of ownership (TCO). Our innovations help enable you to unlock the intelligence in your data and interpret it with a new dimension of context and insight to help you gain a sustainable, competitive business advantage.

The Cisco solution for SAP HANA with the Cisco UCS M5 rack-mount server provides a robust platform for SAP HANA workloads in a single node.

Solution overview

This section introduces the solution discussed in this document.

Introduction

The Cisco UCS C480 M5 scale-up solution provides prevalidated, ready-to-deploy infrastructure, reducing the time and complexity involved in configuring and validating a traditional data center deployment. The reference architecture detailed in this document highlights the resiliency and ease of deployment of an SAP HANA solution.

SAP HANA is SAP's implementation of in-memory database (IMDB) technology. The SAP HANA database takes advantage of the low-cost main memory (RAM), faster access, and data-processing capabilities of multicore processors to provide better performance for analytical and transactional applications. SAP HANA offers a multiple-engine, query-processing environment that supports relational data (with both row- and column-oriented physical representations in a hybrid engine) as well as graph and text processing for semistructured and unstructured data management within the same system. As an appliance, SAP HANA combines software components from SAP optimized for certified hardware. However, this solution has a preconfigured hardware setup and preinstalled software package that is dedicated to SAP HANA.

In 2013, SAP introduced the SAP HANA Tailored Datacenter Integration (TDI) option. TDI offers a more open and flexible way to integrate SAP HANA into the data center by reusing existing enterprise storage hardware, thereby reducing hardware costs. With the introduction of SAP HANA TDI for shared infrastructure, the Cisco UCS Integrated Infrastructure solution provides the advantages of an integrated computing, storage, and network stack and the programmability of Cisco UCS. The TDI option enables organizations to run multiple SAP HANA production systems on a shared infrastructure. It also enables customers to run SAP application servers and an SAP HANA database hosted on the same infrastructure.

For more information about SAP HANA, see the SAP help portal: <http://help.sap.com/hana/>

Audience

The intended audience for this document includes sales engineers, field consultants, professional services staff, IT managers, partner engineers, and customers deploying the Cisco solution for SAP HANA. External references are provided wherever applicable, but readers are expected to be familiar with the technology, infrastructure, and database security policies of the customer installation.

Purpose of this document

This document describes the steps required to deploy and configure a Cisco data center solution for SAP HANA. This document showcases one of the variants of Cisco's solution for SAP HANA. Although readers of this document are expected to have sufficient knowledge to install and configure the products used, configuration details that are important to the deployment of this solution are provided in this document.

Solution summary: Cisco UCS C480 M5 Rack Server

The Cisco Scale-Up Solution for SAP HANA can use the Cisco UCS C480 M5 Rack Server. Tables 1, 2, and 3 summarize the server specifications and show proposed disk configurations for the SAP HANA use case.

Table 1. Overview of Cisco UCS C480 M5 Rack Server configuration

CPU specifications	2.50-GHz Intel® Xeon® Platinum 8180 processor Quantity: 2 or 4	
Possible memory configurations	Analytics <ul style="list-style-type: none"> 16-GB DDR4: Quantity 12 (192 GB) 32-GB DDR4: Quantity 12 (384 GB) 32-GB DDR4: Quantity 24 (768 GB) 64-GB DDR4: Quantity 24 (1.5 TB) 128-GB DDR4: Quantity 24 (3 TB) 	SAP Business Suite on SAP HANA (SoH) <ul style="list-style-type: none"> 16-GB DDR4: Quantity 12 (192 GB) 32-GB DDR4: Quantity 12 (384 GB) 32-GB DDR4: Quantity 24 (768 GB) 64-GB DDR4: Quantity 24 (1.5 TB) 128-GB DDR4: Quantity 24 (3 TB) 128-GB DDR4: Quantity 48 (6 TB)
Hard-disk drive (HDD) type and quantity	Any of the following: <ul style="list-style-type: none"> 1.8-TB 10,000-rpm SAS drive: Quantity 20 3.8-TB solid-state disk (SSD): Quantity 8 3.8-TB SSD: Quantity 3 (for up to 1.5-TB memory configurations) 	
BIOS	C480M5.3.1.0.248.0518171057	
Cisco Integrated Management Controller (IMC) firmware	Version 3.1(0.213)	
LSI MegaRAID controller	Cisco 12-Gbps SAS modular RAID controller	
Network card	Cisco UCS Virtual Interface Card (VIC) 1385: Quantity 1 For 10-Gbps connectivity: Onboard Intel 1 Gigabit Ethernet controller: Quantity 2 Onboard Intel 10BASE-T Ethernet controller: Quantity 2	
Power supply	Redundant power supplies: Quantity 4	

Table 2. Cisco UCS C480 M5 proposed disk layout

Disk	Disk type	Drive group	RAID level	Virtual drive
Slot (1 through 20)	SAS HDD	DG0	50	VD0
Slot (1 through 8)	SSD	DG0	5	VD0
Slot (1 through 3; up to 1.5 TB of RAM)	SSD	DG0	5	VD0

Table 3. Cisco UCS C480 M5 proposed disk configuration

Drives used	RAID type	Used for	File system
Any of the following: <ul style="list-style-type: none"> • 20 x 1.8-TB SAS HDD • 8 x 3.8 TB SSD • 3 x 3.8 TB SSD 	Any of the following: <ul style="list-style-type: none"> • RAID 50 • RAID 5 • RAID 5 	Operating system	Ext3
		Data file system	XFS
		Log file system	XFS
		SAP HANA shared file system	XFS

Solution summary: Cisco UCS C240 M5 Rack Server

The Cisco Scale-Up Solution for SAP HANA can also use the Cisco UCS C240 M5 Rack Server. Tables 4, 5, and 6 summarize the server specifications and show proposed disk configurations for the SAP HANA use case.

Table 4. Overview of Cisco UCS C240 M5 Rack Server configuration

CPU specifications	2.50-GHz Intel Xeon Platinum 8180 processor Quantity: 2
Possible memory configurations	Analytics <ul style="list-style-type: none"> • 16-GB DDR4: Quantity 12 (192 GB) • 32-GB DDR4: Quantity 12 (384 GB) • 32-GB DDR4: Quantity 24 (768 GB) • 64-GB DDR4: Quantity 24 (1.5 TB) • 128-GB DDR4: Quantity 24 (3 TB)
HDD type and quantity	Any of the following: <ul style="list-style-type: none"> • 1.8-TB 10,000-rpm SAS drive: Quantity 20 • 3.8-TB SSD: Quantity 8 • 3.8-TB SSD: Quantity 3 (for up to 1.5-TB memory configurations)
BIOS	C480M5.3.1.0.248.0518171057
Cisco IMC firmware	Version 3.1(1d)
Network card	Cisco UCS VIC 1385: Quantity 1 For 10-Gbps connectivity: <ul style="list-style-type: none"> • Onboard Intel 1 Gigabit Ethernet controller: Quantity 2 • Onboard Intel 10BASE-T Ethernet controller: Quantity 2
Power supply	Redundant power supplies: Quantity 2

Table 5. Cisco UCS C240 M5 proposed disk layout

Disk	Disk type	Drive group	RAID level	Virtual drive
Slot (1 through 20)	SAS HDD	DG0	50	VD0
Slot (1 through 8)	SSD	DG0	5	VD0
Slot (1 through 3; up to 1.5 TB of RAM)	SSD	DG0	5	VD0

Table 6. Cisco UCS C240 M5 proposed disk configuration

Drives used	RAID type	Used for	File system
Any of the following: <ul style="list-style-type: none"> • 20 x 1.8-TB SAS HDD • 8 x 3.8-TB SSD • 3 x 3.8-TB SSD 	Any of the following: <ul style="list-style-type: none"> • RAID 50 • RAID 5 • RAID 5 	Operating system	Ext3
		Data file system	XFS
		Log file system	XFS
		SAP HANA shared file system	XFS

Solution Summary: Cisco UCS C220 M5 Rack Server

The Cisco Scale-Up Solution for SAP HANA can also use the Cisco UCS C220 M5 Rack Server. Tables 7, 8, and 9 summarize the server specifications and show proposed disk configurations for the SAP HANA use case.

Table 7. Overview of Cisco UCS C220 M5 Rack Server configuration

CPU specifications	2.50-GHz Intel Xeon Platinum 8180 processor Quantity: 2
Possible memory configurations	Analytics <ul style="list-style-type: none"> • 16-GB DDR4: Quantity 12 (192 GB) • 32-GB DDR4: Quantity 12 (384 GB) • 32-GB DDR4: Quantity 24 (768 GB) • 64-GB DDR4: Quantity 24 (1.5 TB) • 128-GB DDR4: Quantity 24 (3 TB)
HDD type and quantity	Any of the following: <ul style="list-style-type: none"> • 3.8-TB SSD: Quantity 8 • 3.8-TB SSD: Quantity 3 (for up to 1.5-TB memory configurations)
BIOS	C480M5.3.1.0.248.0518171057
Cisco IMC firmware	Version 3.1(1d)
Network card	Cisco UCS VIC 1385: Quantity 1 For 10-Gbps connectivity: <ul style="list-style-type: none"> • Onboard Intel 1 Gigabit Ethernet controller: Quantity 2 • Onboard Intel 10BASE-T Ethernet controller: Quantity 2
Power supply	Redundant power supplies: Quantity 2

Table 8. Cisco UCS C220 M5 proposed disk layout

Disk	Disk type	Drive group	RAID level	Virtual drive
Slot (1 through 8)	SSD	DG0	5	VD0
Slot (1 through 3; up to 1.5 TB of RAM)	SSD	DG0	5	VD0

Table 9. Cisco UCS C220 M5 proposed disk configuration

Drives used	RAID type	Used for	File system
Any of the following: <ul style="list-style-type: none"> • 8 x 3.8-TB SSD • 3 x 3.8-TB SSD 	Any of the following: <ul style="list-style-type: none"> • RAID 5 • RAID 5 	Operating system	Ext3
		Data file system	XFS
		Log file system	XFS
		SAP HANA shared file system	XFS

Infrastructure overview

The Cisco Scale-Up Solution for SAP HANA uses the Cisco UCS M5 generation of rack servers.

Cisco UCS C480 M5 Rack Server

The Cisco UCS C480 M5 Rack Server (Figure 1) can be deployed as a standalone server or in a Cisco UCS managed environment. When used in combination with Cisco UCS Manager, the C480 M5 brings the power and automation of unified computing to enterprise applications, including Cisco SingleConnect technology, drastically reducing switching and cabling requirements. Cisco UCS Manager uses service profiles, templates, and policy-based management to enable rapid deployment and help ensure deployment consistency. It also enables end-to-end server visibility, management, and control in both virtualized and bare-metal environments.

- IMDBs
- Big data analytics
- Virtualization and virtual desktop infrastructure (VDI) workloads
- Bare-metal applications

The C480 M5 is a storage- and I/O-optimized enterprise-class rack server that delivers industry-leading performance for IMDBs, big data analytics, virtualization, VDI, and bare-metal applications. It delivers outstanding levels of expandability and performance for standalone or Cisco UCS managed environments in a 4-rack-unit (4RU) form factor. And because of its modular design, you pay for only what you need.

The C480 M5 offers these capabilities:

- Latest Intel Xeon Scalable processors with up to 28 cores per socket and support for two- or four-processor configurations
- 2666-MHz DDR4 memory and 48 DIMM slots for up to 6 TB of total memory
- 12 PCI Express (PCIe) 3.0 slots
- Six x8 full-height, full length slots
- Six x16 full-height, full length slots
- Flexible storage options with support up to 32 small-form-factor (SFF) 2.5-inch, SAS, SATA, and PCIe Non-Volatile Memory Express (NVMe) disk drives
- Cisco 12-Gbps SAS modular RAID controller in a dedicated slot
- Internal Secure Digital (SD) and M.2 boot options
- Dual embedded 10 Gigabit Ethernet LAN-on-motherboard (LOM) ports

Figure 1. Cisco UCS C480 M5 Rack Server



Cisco UCS C240 M5 Rack Server

The Cisco UCS C240 M5 Rack Server (Figure 2) is a 2-socket, 2RU rack server offering industry-leading performance and expandability. It supports a wide range of storage and I/O-intensive infrastructure workloads, from big data and analytics to collaboration. Cisco UCS C-Series Rack Servers can be deployed as standalone servers or as part of a Cisco UCS managed environment to take advantage of Cisco's standards-based unified computing innovations that help reduce customers' TCO and increase their business agility.

In response to ever-increasing computing and data-intensive real-time workloads, the enterprise-class C240 M5 server extends the capabilities of the Cisco UCS portfolio in a 2RU form factor. It incorporates the Intel Xeon Scalable processors, supporting up to 20 percent more cores per socket, twice the memory capacity, and five times more

NVMe PCIe SSDs compared to the previous generation of servers. These improvements deliver significant performance and efficiency gains that will improve your application performance. The C240 M5 delivers outstanding levels of storage expandability with exceptional performance, with:

- Latest Intel Xeon Scalable CPUs with up to 28 cores per socket
- Up to 24 DDR4 DIMMs for improved performance
- Intel 3D XPoint-ready support, with built-in support for next-generation nonvolatile memory technology
- Up to 26 hot-swappable SFF 2.5-inch drives, including 2 rear hot-swappable SFF drives (up to 10 support NVMe PCIe SSDs on the NVMe-optimized chassis version), or 12 large-form-factor (LFF) 3.5-inch drives plus 2 rear hot-swappable SFF drives
- Support for a 12-Gbps SAS modular RAID controller in a dedicated slot, leaving the remaining PCIe Generation 3.0 slots available for other expansion cards
- Modular LOM (mLOM) slot that can be used to install a Cisco UCS VIC without consuming a PCIe slot, supporting dual 10- or 40-Gbps network connectivity
- Dual embedded Intel x550 10GBASE-T LOM ports
- Modular M.2 or SD cards that can be used for bootup

High performance for data-intensive applications

The Cisco UCS C240 M5 Rack Server is well-suited for a wide range of enterprise workloads, including:

- Big data and analytics
- Collaboration
- Small and medium-sized business (SMB) databases
- Virtualization and consolidation
- Storage servers
- High-performance appliances

C240 M5 servers can be deployed as standalone servers or in a Cisco UCS managed environment. When used in combination with Cisco UCS Manager, the C240 M5 brings the power and automation of unified computing to enterprise applications, including Cisco SingleConnect technology, drastically reducing switching and cabling requirements.

Cisco UCS Manager uses service profiles, templates, and policy-based management to enable rapid deployment and help ensure deployment consistency. It also enables end-to-end server visibility, management, and control in both virtualized and bare-metal environments.

Figure 2. Cisco UCS C240 M5 Rack Server



Cisco UCS C220 M5 Rack Server

The Cisco UCS C220 M5 Rack Server (Figure 3) is among the most versatile general-purpose enterprise infrastructure and application servers in the industry. It is a high-density 2-socket rack server that delivers industry-leading performance and efficiency for a wide range of workloads, including virtualization, collaboration, and bare-metal applications. The Cisco UCS C-Series Rack Servers can be deployed as standalone servers or as part of Cisco UCS to take advantage of Cisco's standards-based unified computing innovations that help reduce customers' TCO and increase their business agility.

The C220 M5 server extends the capabilities of the Cisco UCS portfolio in a 1RU form factor. It incorporates the Intel Xeon Scalable processors, supporting up to 20 percent more cores per socket, twice the memory capacity, 20 percent greater storage density, and five times more PCIe NVMe SSDs compared to the previous generation of servers. These improvements deliver significant performance and efficiency gains that will improve your application performance. The C220 M5 delivers outstanding levels of expandability and performance in a compact package, with:

- Latest Intel Xeon Scalable CPUs with up to 28 cores per socket
- Up to 24 DDR4 DIMMs for improved performance

- Intel 3D XPoint-ready support, with built-in support for next-generation nonvolatile memory technology
- Up to 10 SFF 2.5-inch drives or 4 LFF 3.5-inch drives (77 TB of storage capacity with all NVMe PCIe SSDs)
- Support for a 12-Gbps SAS modular RAID controller in a dedicated slot, leaving the remaining PCIe Generation 3.0 slots available for other expansion cards
- mLOM slot that can be used to install a Cisco UCS VIC without consuming a PCIe slot, supporting dual 10- or 40-Gbps network connectivity
- Dual embedded Intel x550 10GBASE-T LOM ports

High performance for data-intensive applications

The Cisco UCS C220 M5 Rack Server is well-suited for a wide range of enterprise workloads, including:

- Big data and analytics
- Collaboration
- SMB databases
- Virtualization and consolidation
- Storage servers
- High-performance appliances

C220 M5 servers can be deployed as standalone servers or in a Cisco UCS managed environment. When used in combination with Cisco UCS Manager, the C220 M5 brings the power and automation of unified computing to enterprise applications, including Cisco SingleConnect technology, drastically reducing switching and cabling requirements.

Cisco UCS Manager uses service profiles, templates, and policy-based management to enable rapid deployment and help ensure deployment consistency. It also enables end-to-end server visibility, management, and control in both virtualized and bare-metal environments.

Figure 3. Cisco UCS C220 M5 Rack Server



Solution design

This section describes the SAP HANA system requirements defined by SAP and the architecture of the Cisco UCS solution for SAP HANA.

SAP HANA system

An SAP HANA scale-up system on a single server is the simplest of the installation types. You can run an SAP HANA system entirely on one host and then scale the system up as needed. All data and processes are located on the same server and can be accessed locally. The network requirements for this option are at least one 1 Gigabit Ethernet access network and one 10 Gigabit Ethernet storage network.

Hardware requirements for the SAP HANA database

SAP defines hardware and software requirements for running SAP HANA systems. For the latest information about the CPU and memory configurations supported for SAP HANA, see <https://global.sap.com/community/ebook/2014-09-02-hana-hardware/enEN/index.html>.

Note: This document does not cover the updated information published by SAP. Additional information is available at <http://saphana.com>.

File system layout

Figures 4, 5, and 6 show the file system layouts and the storage sizes required to install and operate SAP HANA. When installing SAP HANA on a host, specify the mount point for the installation binaries (/hana/shared/<sid>), data files (/hana/data/<sid>), and log files (/hana/log/<sid>), where sid is the instance identifier of the SAP HANA installation.

Figure 4. Proposed disk layout with partition mapping with 20 SAS drives

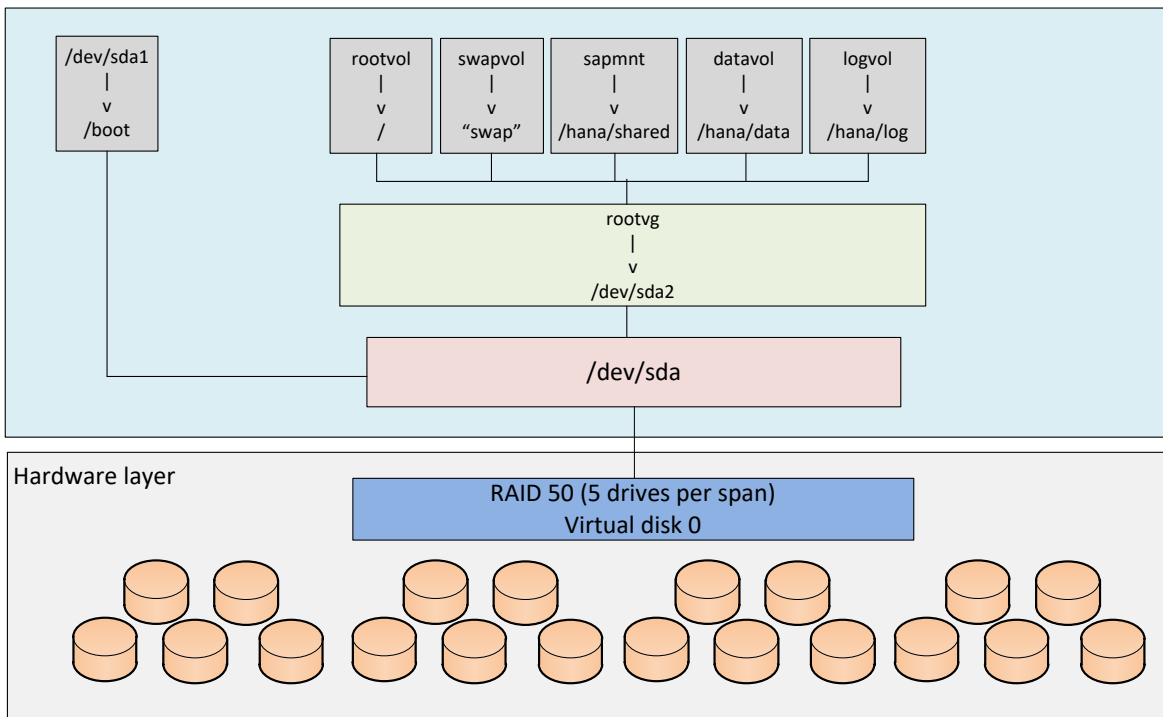


Figure 5. Proposed disk layout with partition mapping with eight SSD drives

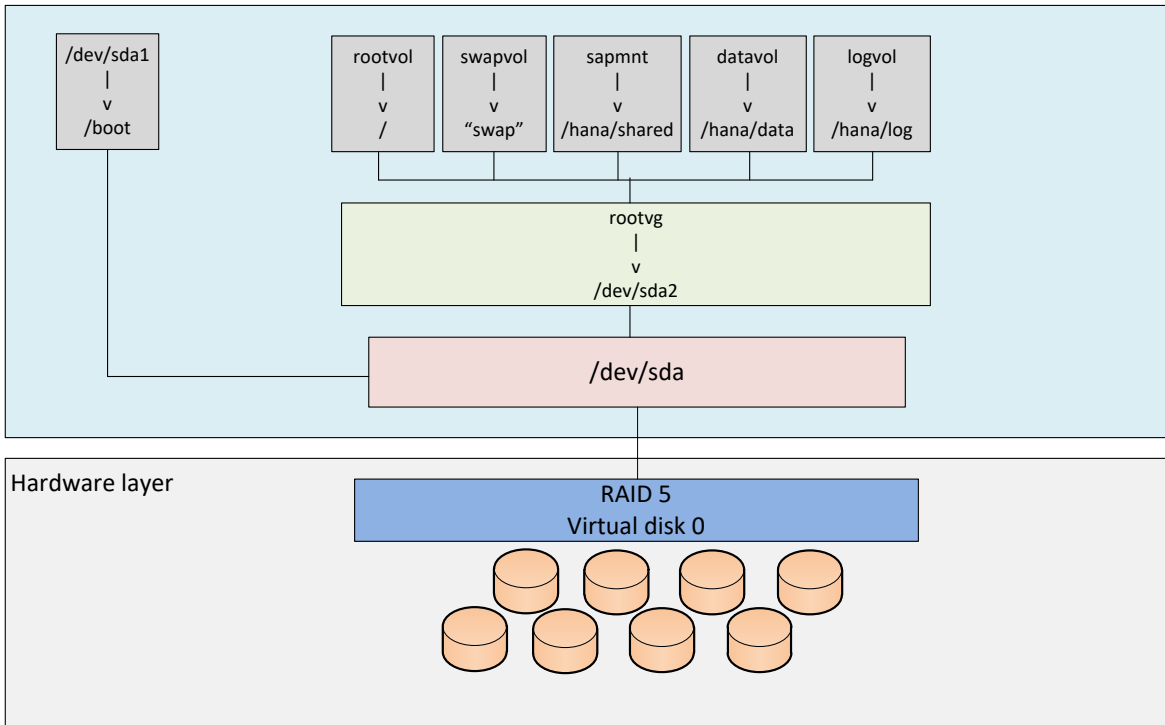
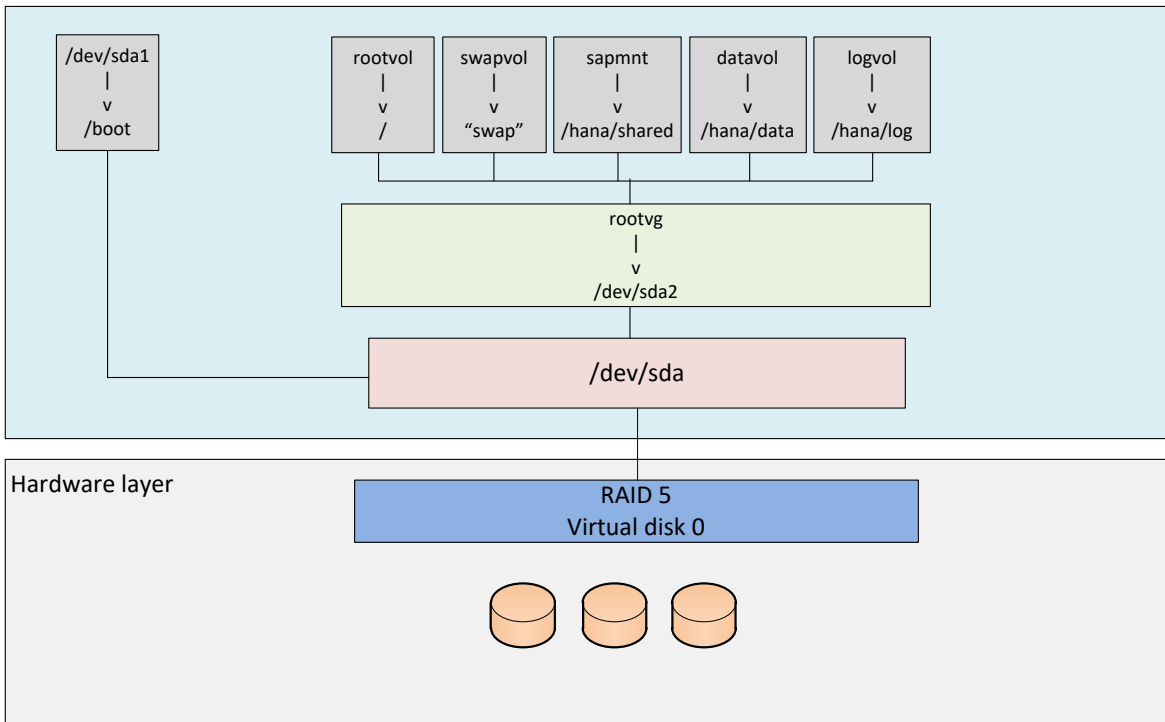


Figure 6. Proposed disk layout with partition mapping with three SSD drives (up to 1.5-TB memory configurations)



The storage size for the file system is based on the amount of memory on the SAP HANA host.

Here are some sample file system sizes for a single-node system with 3 TB of memory:

- /hana/shared: 1 x memory (3 TB)
- /hana/data: 3 x memory (9 TB)
- /hana/log: 1 x memory (512 GB)

Note: For solutions based on the Intel Xeon Platinum processor, the size of the log volume (/hana/log) must be as follows:

- Half of the server memory for systems \leq 256 GB of memory
- Minimum of 512 GB for systems with \geq 512 GB of memory

Operating system

SAP HANA supports the following operating systems:

- SUSE Linux Enterprise Server (SLES) for SAP applications
- Red Hat Enterprise Linux (RHEL) for SAP HANA

Note: This document provides installation steps for SLES for SAP 12 SP2.

Deployment hardware and software configuration guidelines

This section is intended to enable you to fully configure the customer environment. In this process, various steps require you to insert customer-specific naming conventions, IP addresses, and VLAN schemes, as well as to record appropriate MAC addresses. Table 10 lists the configuration variables that are used throughout this document. You can complete this table using your specific site variables and use it in implementing the configuration steps presented in this document.

Table 10. Configuration variables

Variable	Description	Customer implementation value
<<var_cimc_ip_address>>	Cisco UCS C480 M5 server's IMC IP address	
<<var_cimc_ip_netmask>>	Cisco UCS C480 M5 server's IMC network netmask	
<<var_cimc_gateway_ip>>	Cisco UCS C480 M5 server's IMC network gateway IP address	
<<var_raid50_vd_name>>	Name for virtual drive VD0 during RAID configuration	
<<var_hostname.domain>>	SAP HANA node's fully qualified domain name (FQDN)	
<<var_sys_root-pw>>	SAP HANA node's root password	
<<var_lvm_vg_name>>	SAP HANA node's OS logical volume management (LVM) volume group name	
<<var_mgmt_ip_address>>	SAP HANA node's management and administration IP address	
<<var_mgmt_nw_netmask>>	SAP HANA node's management network netmask	
<<var_mgmt_gateway_ip>>	Cisco UCS C480 M5 server's management and administrative network gateway IP address	
<<var_mgmt_netmask_prefix>>	Netmask prefix in Classless Inter-Domain Routing (CIDR) notation	

Figure 8. BIOS POST screen (continued)

2. Press F8 to display the IMC configuration (Figure 9).

Figure 9. Cisco UCS C480 IMC configuration view (local display)

```

Cisco IMC Configuration Utility Version 2.0 Cisco Systems, Inc.
*****
NIC Properties
NIC mode                NIC redundancy
Dedicated:             [X]      None:                    [X]
Shared LOM:            [ ]      Active-standby:         [ ]
Shared LOM 10G:        [ ]      Active-active:          [ ]
Cisco Card:            [ ]      VLAN (Advanced)
Shared LOM Ext:        [ ]      VLAN enabled:           [ ]
Default VIC
Slot:                  1         VLAN ID:                 1
                               Priority:                0
IP (Basic)
IPv4:                  [X]  IPv6:                    [ ]
DHCP enabled           [ ]
CIMC IP:               173.36.215.117
Prefix/Subnet:        255.255.255.0
Gateway:              173.36.215.1
Pref DNS Server:      0.0.0.0

*****
<Up/Down>Selection  <F10>Save  <Space>Enable/Disable  <F5>Refresh  <ESC>Exit
<F1>Additional settings

```

3. Use the console network IP address <<var_cimc_ip_address>>, netmask <<var_cimc_ip_netmask>>, and gateway <<var_cimc_gateway_ip>> for the IPv4 settings of the IMC. Select None for network interface card (NIC) redundancy.
4. Press F10 to save the configuration and exit the utility.
5. Open a web browser on a computer on the same network with Java and Adobe Flash installed.
6. Enter the IMC IP address of the Cisco UCS C480 M5 server: http://<var_cimc_ip_address>.
7. Enter the login credentials as updated in the IMC configuration. The default username and password are **admin** and **password** (Figure 10).

Figure 10. Cisco IMC login screen

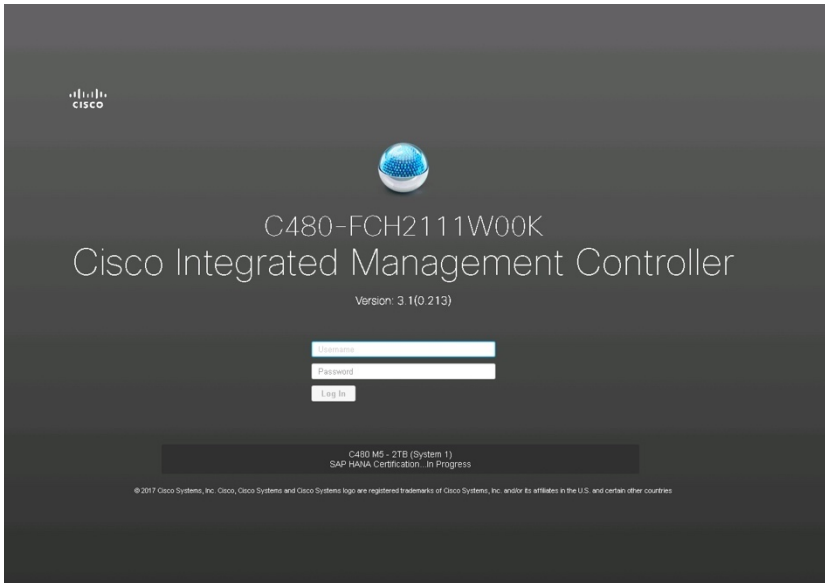
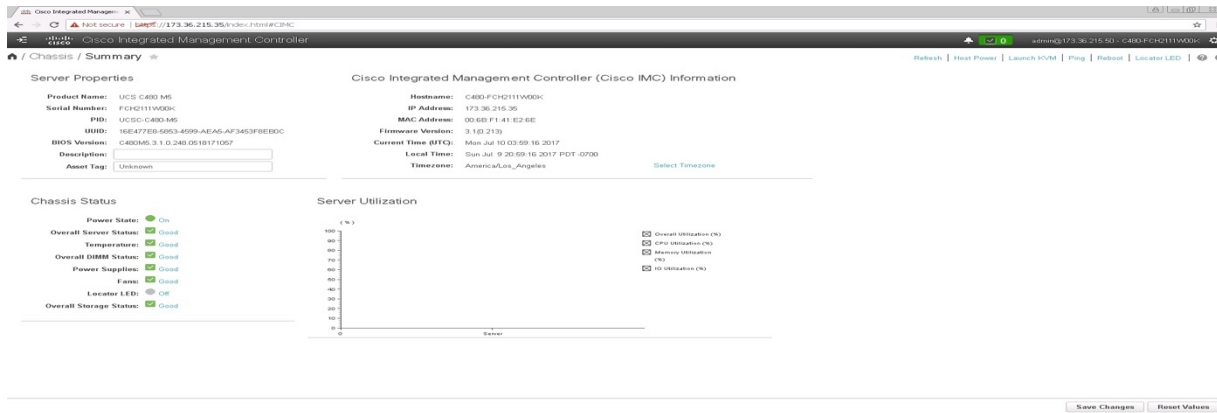


Figure 11 shows the results.

Figure 11. Cisco IMC summary screen



Launching the KVM console

You next need to launch the KVM console and map the SLES 12 for SAP SP2 DVD ISO file for the installation.

1. Click Launch KVM in the top-left corner of the IMC homepage (Figure 12).

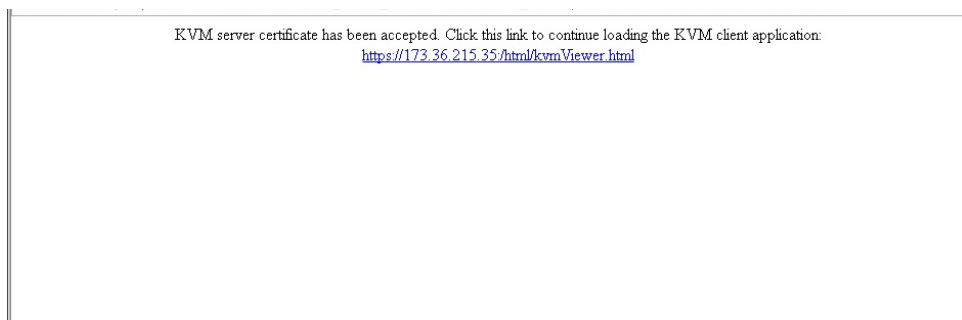
Starting the IMC Release 3.0, two options are available for launching the KVM: one using the Java console and other using the browser-based HTML KVM console. In this example, the HTML KVM console has been used.

Figure 12. Cisco IMC homescreen

[[PLS SUPPLY THE MISSING FIGURE]]

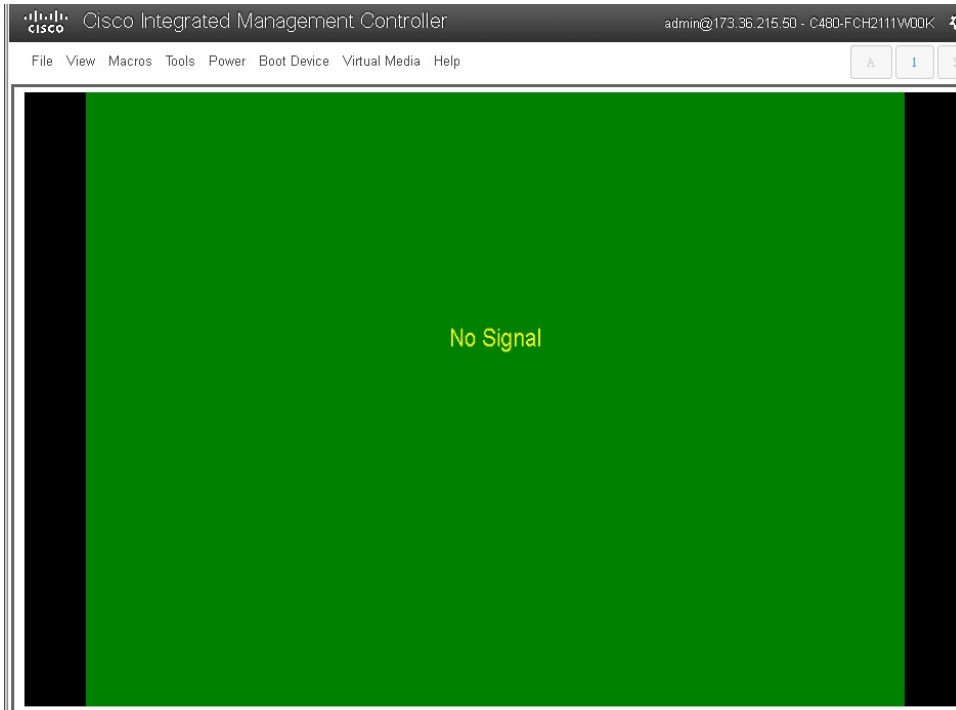
2. After you select the HTML-based console, a certificate confirmation window appears. Click the provided hyperlink to continue (Figure 13).

Figure 13. Click the hyperlink to load the KVM application



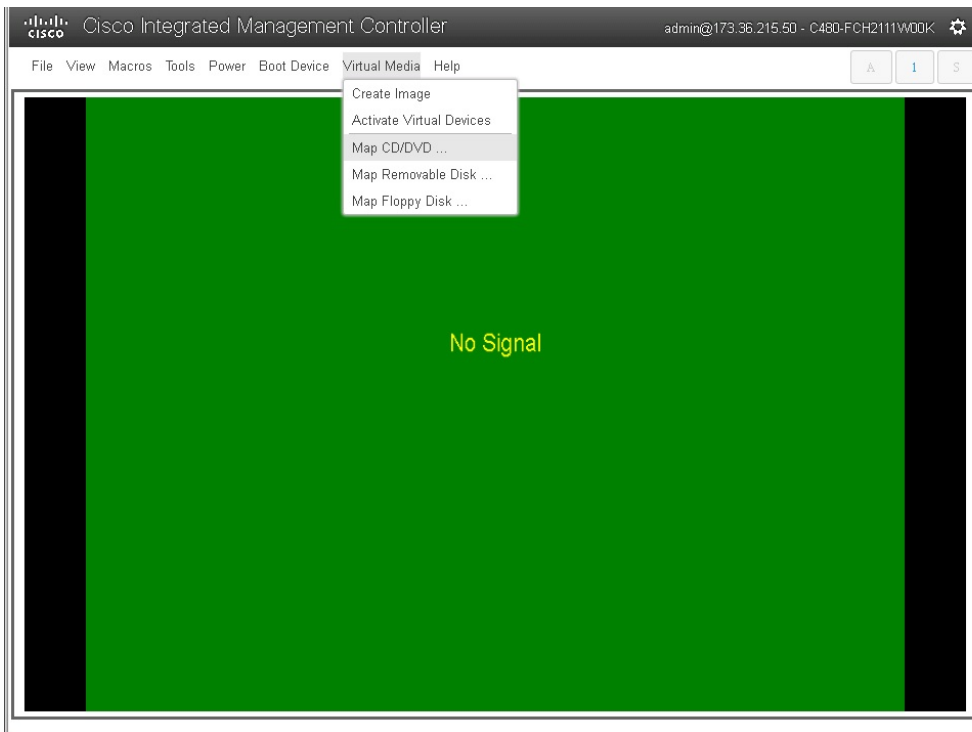
The KVM window will appear (Figure 14).

Figure 14. KVM window



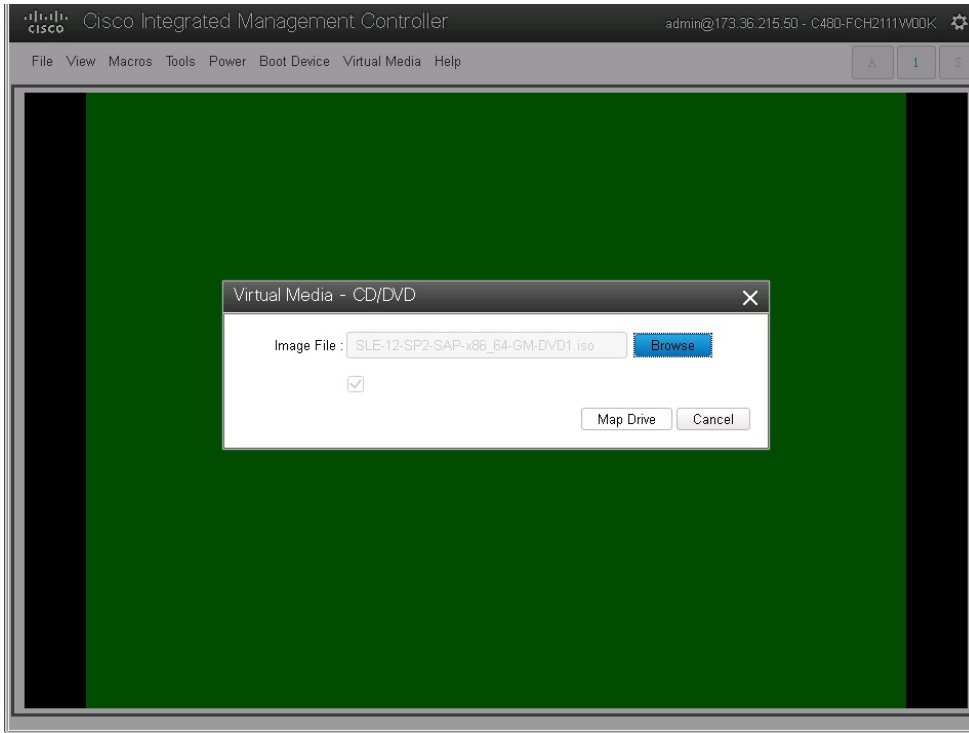
3. In the menu bar at the top of the KVM window, choose Virtual Media > Activate Virtual Devices > Map CD/DVD (Figure 15).

Figure 15. Beginning the CD/DVD mapping process



4. Browse for the SLES 12 for SAP SP2 DVD ISO file and click Map Drive (Figure 16).

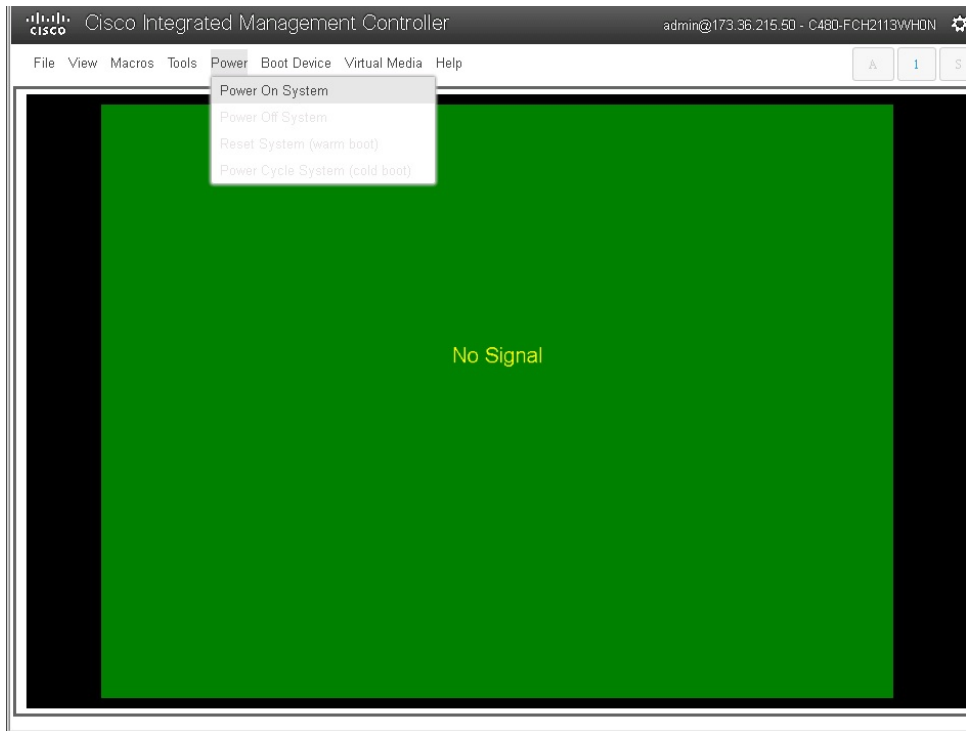
Figure 16. Click Map Drive



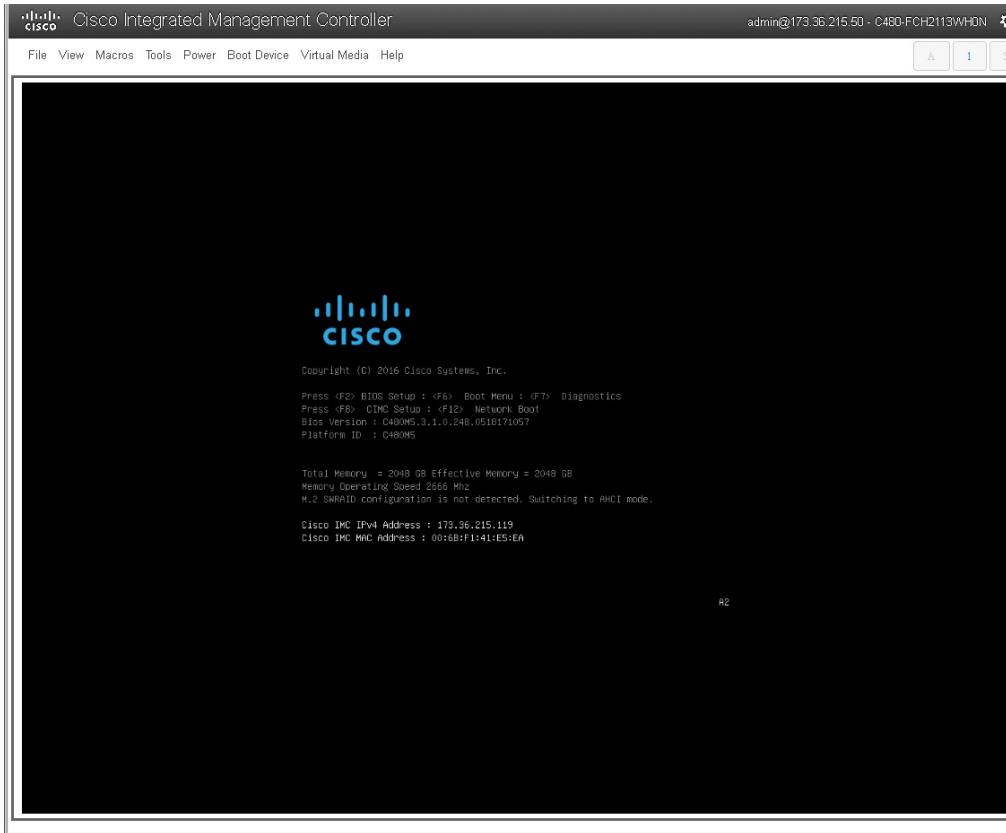
Configuring BIOS settings

You need to power on the server and configure some BIOS settings before proceeding with the RAID configuration.

1. From the menu bar at the top of the KVM window, choose Power > Power On System (Figure 17).

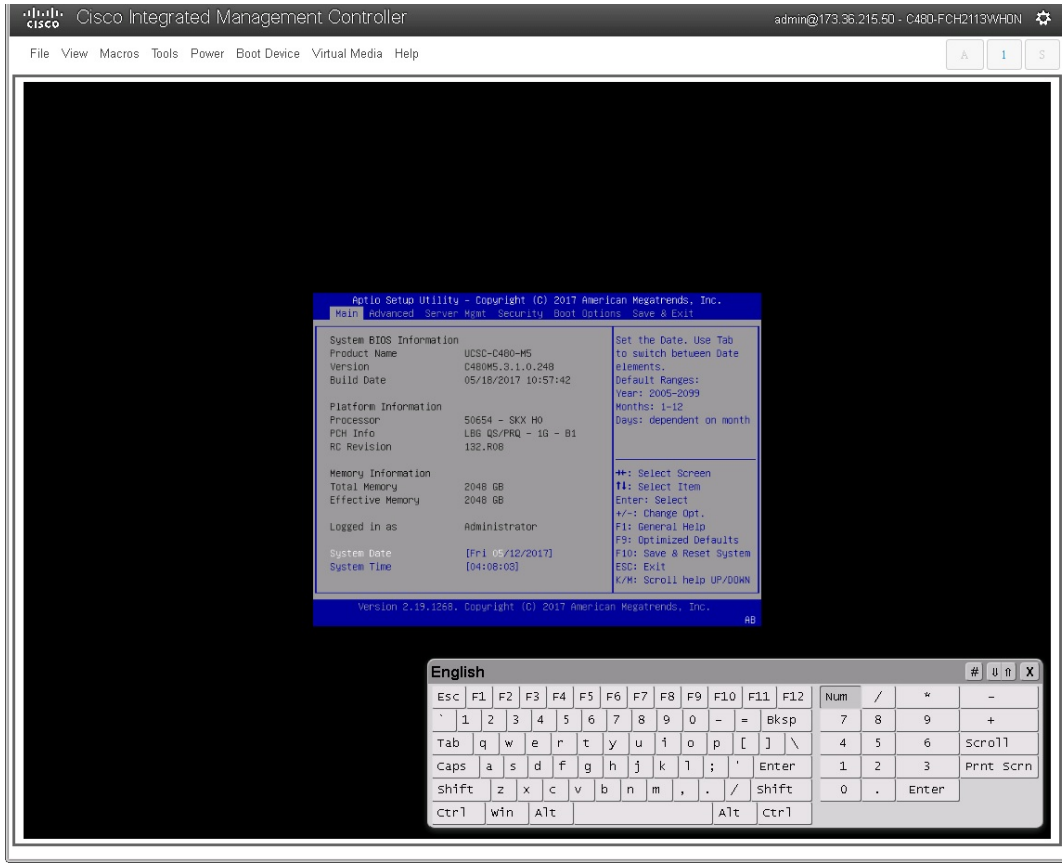
Figure 17. Powering on the system

2. After the server has booted, press F2 to enter the BIOS menu (Figure 18).

Figure 18. Press F2

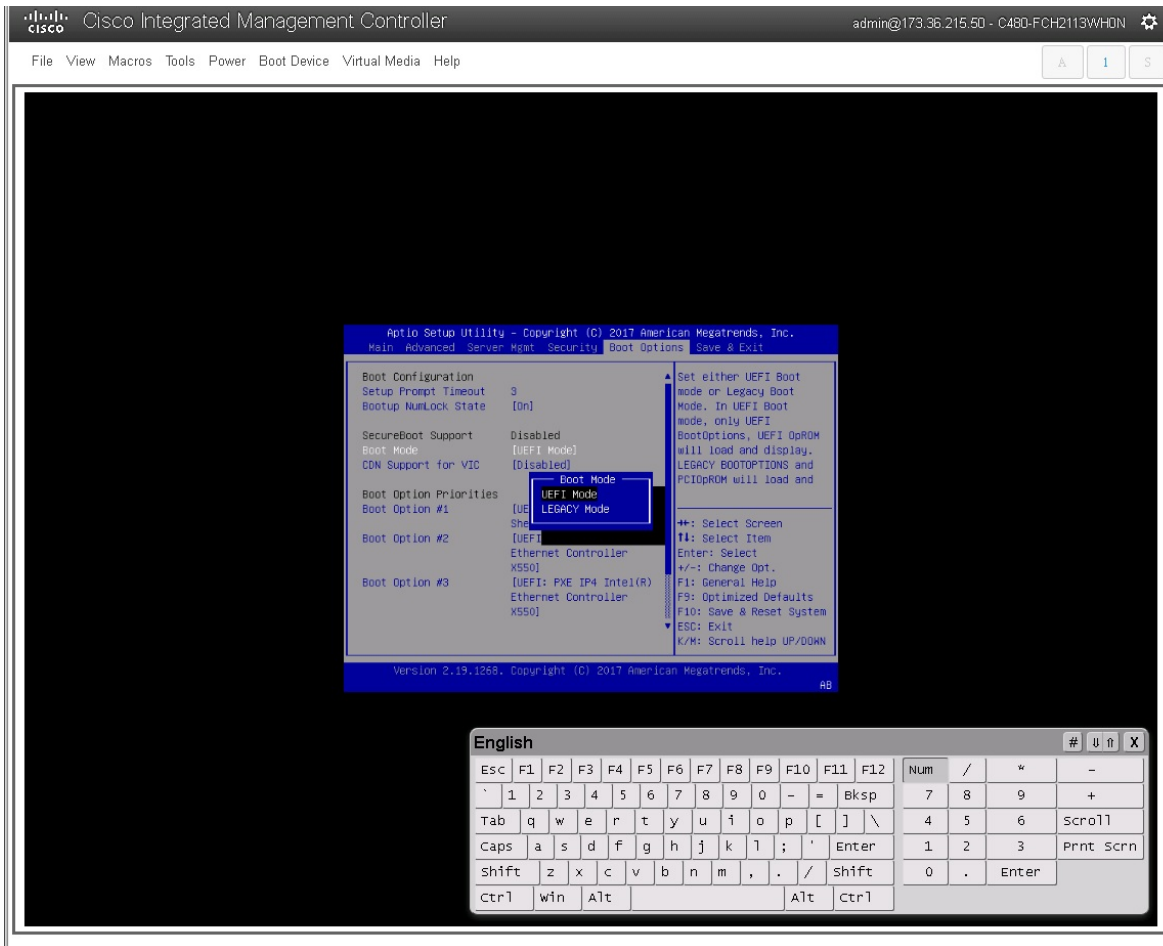
3. For a better keyboard experience, from the View menu select the on-screen keyboard (Figure 19).

Figure 19. On-screen keyboard



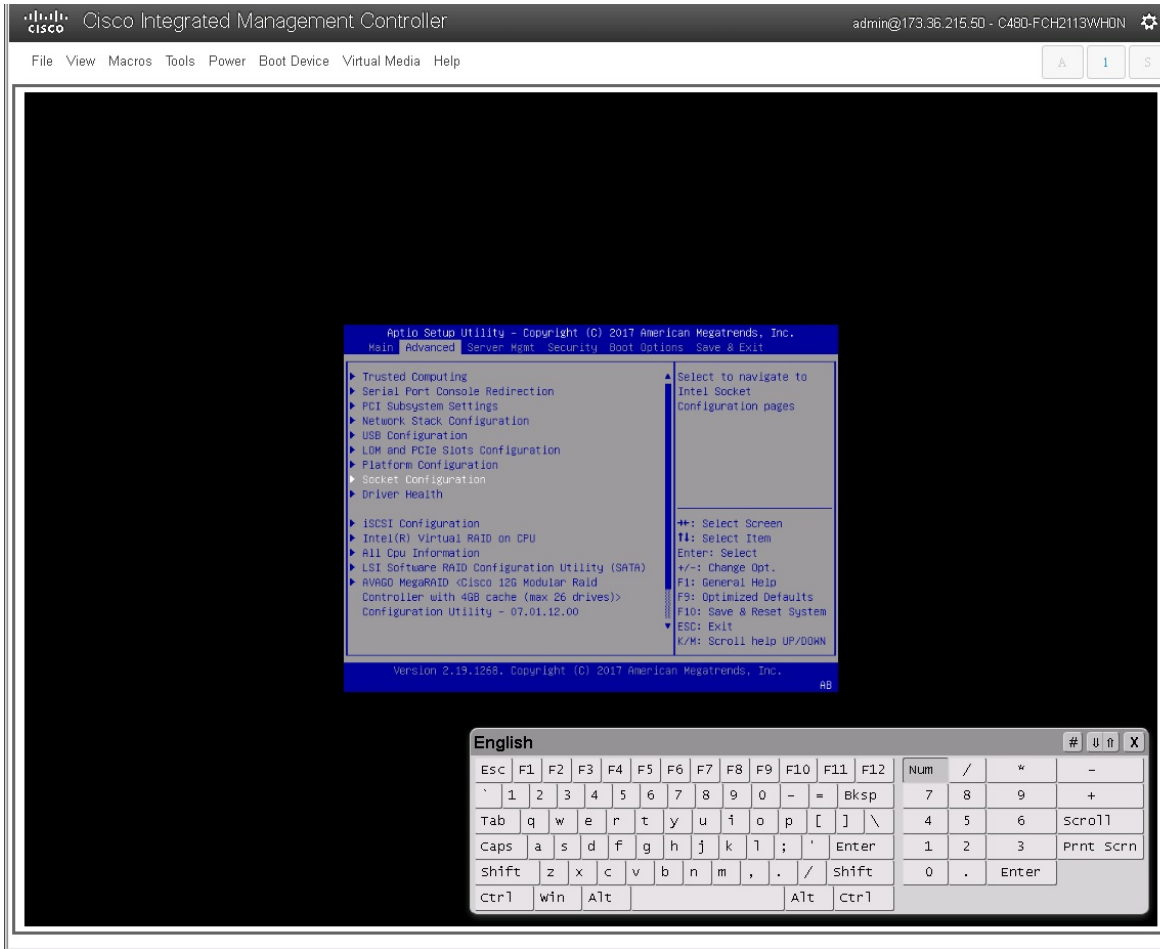
4. From the BIOS menu, choose Boot Options > Boot Mode > UEFI Mode (Figure 20). This setting selects the Unified Extensible Firmware Interface (UEFI).

Figure 20. Choose UEFI Mode



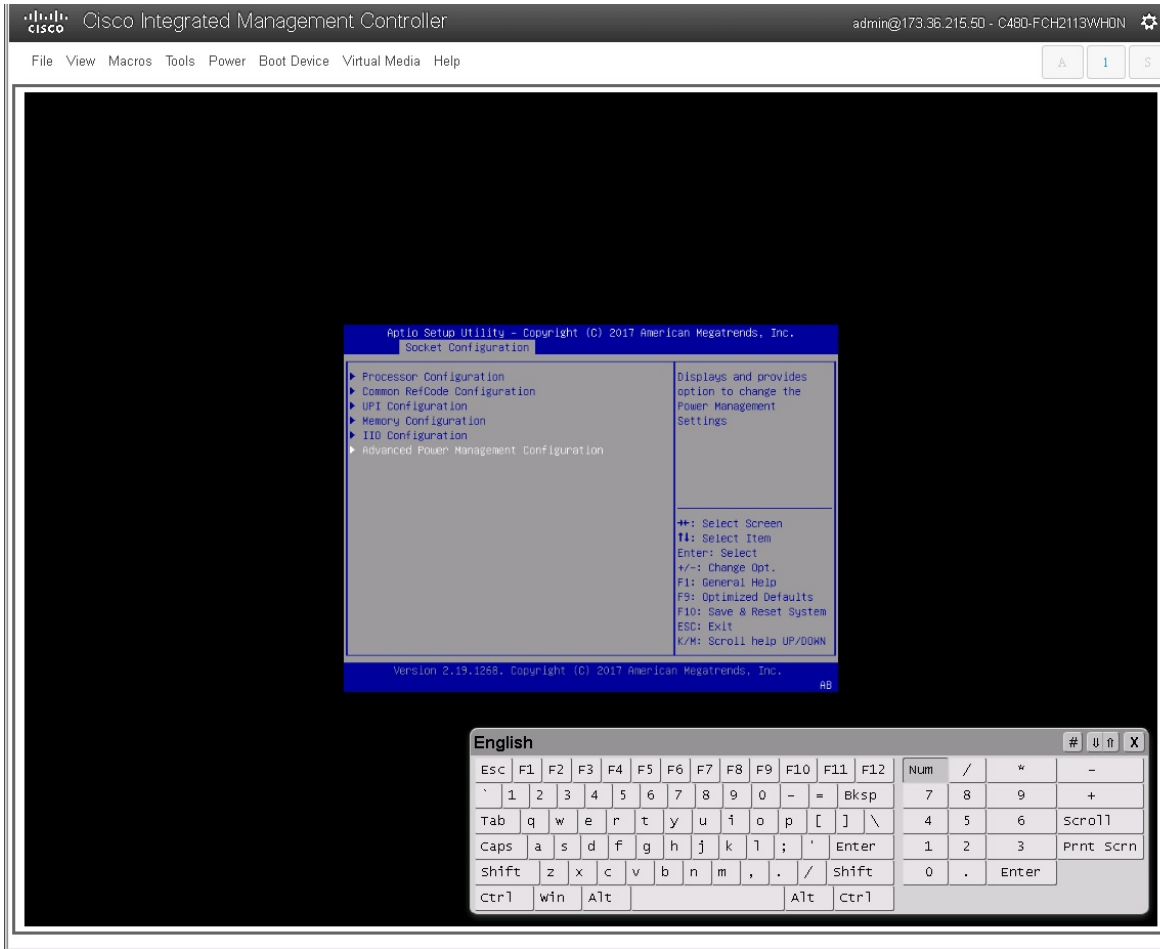
5. Disable the C-states of the CPU as recommended in the SAP for HANA requirements. From the BIOS menu, choose Advanced > Socket Configuration (Figure 21).

Figure 21. Choose Socket Configuration



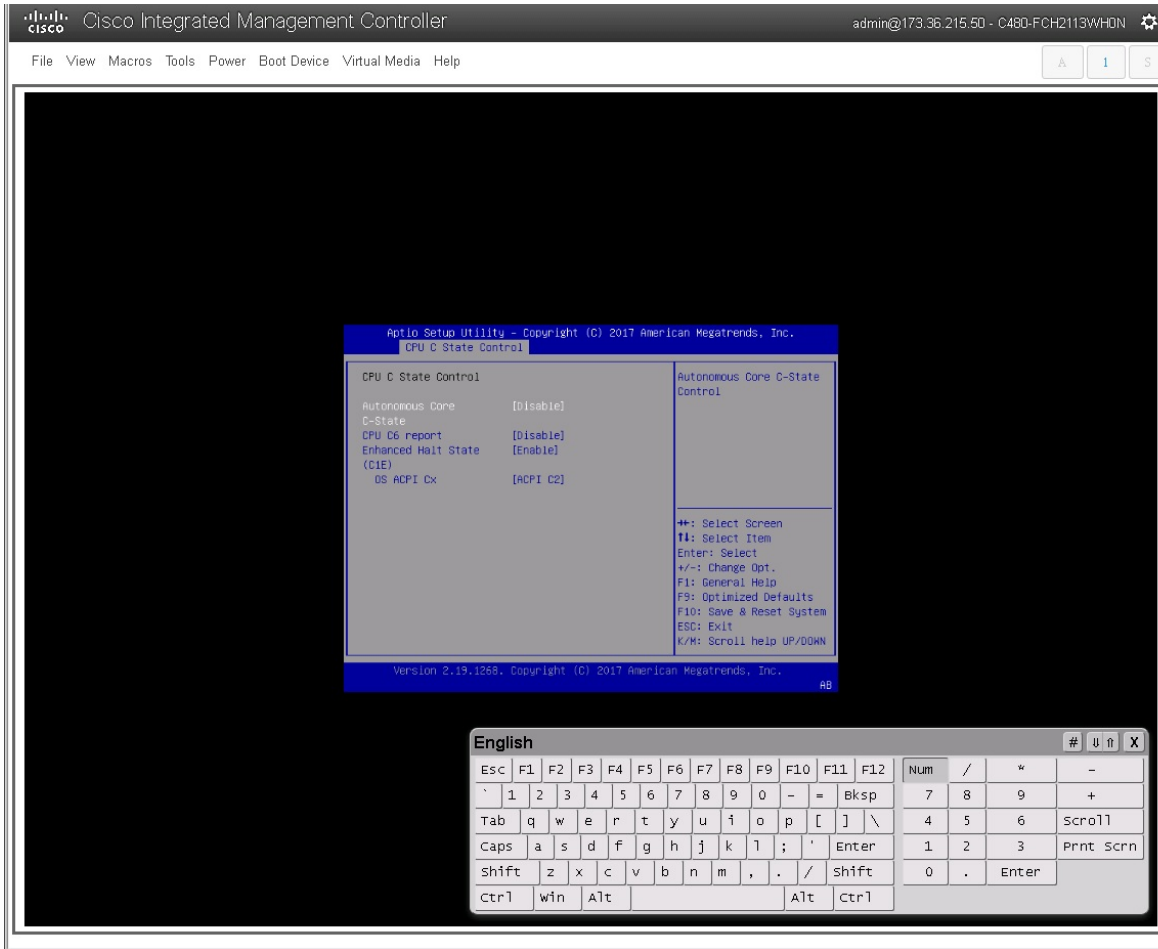
6. Choose Advanced Power Management Configuration (Figure 22).

Figure 22. Choose Advanced Power Management Configuration



7. Disable the C-states as shown in Figure 23.

Figure 23. Disabling C-states



8. After disabling the C-states, press F10 and save the BIOS settings.

Rebooting the server to implement BIOS changes

To make the boot options and CPU C-states take effect, reboot the server.

You are now ready to configure RAID.

RAID options

This document covers all scale-up solutions with 2- and 4-socket configurations of the Cisco UCS M5 platform.

Table 11 lists the RAID options and the available platforms.

Table 11. RAID options

Platform	SAS (20 drives)	SSD (3 or 8 drives)
Cisco UCS C480	RAID 50	RAID 5
Cisco UCS C240	RAID 50	RAID 5
Cisco UCS C220	-	RAID 5

Table 12 lists the settings that you need to configure when you create the virtual drives.

Table 12. RAID settings

RAID settings	RAID 50	RAID 5
Stripe size	256	128
Read policy	Read ahead	Read ahead
Write policy	Write back	Write back
I/O policy	Cached	Default

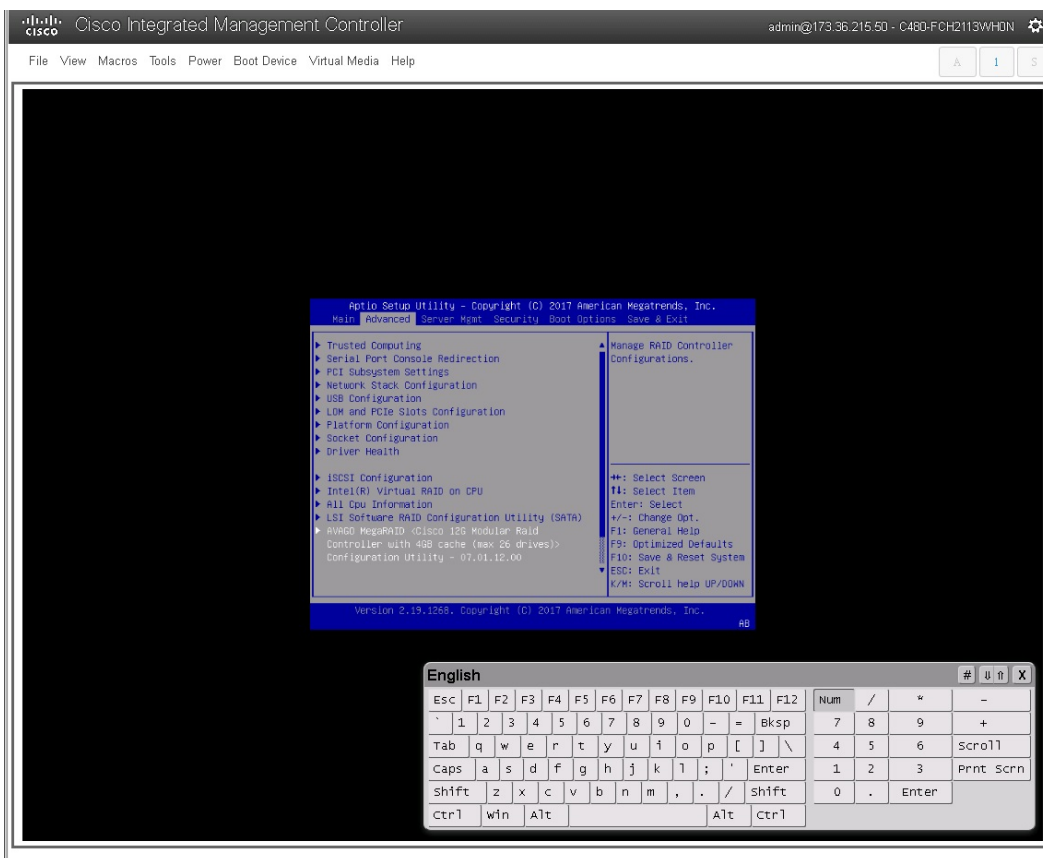
Configuring RAID

The following procedure shows the RAID 50 configuration with SAS drives on the Cisco UCS C480 M5 server used for SAP HANA.

The same procedure applies to the creation of RAID 5 virtual drives with SSD-based options except that the number of drives will be three or eight and the RAID level will be RAID 5.

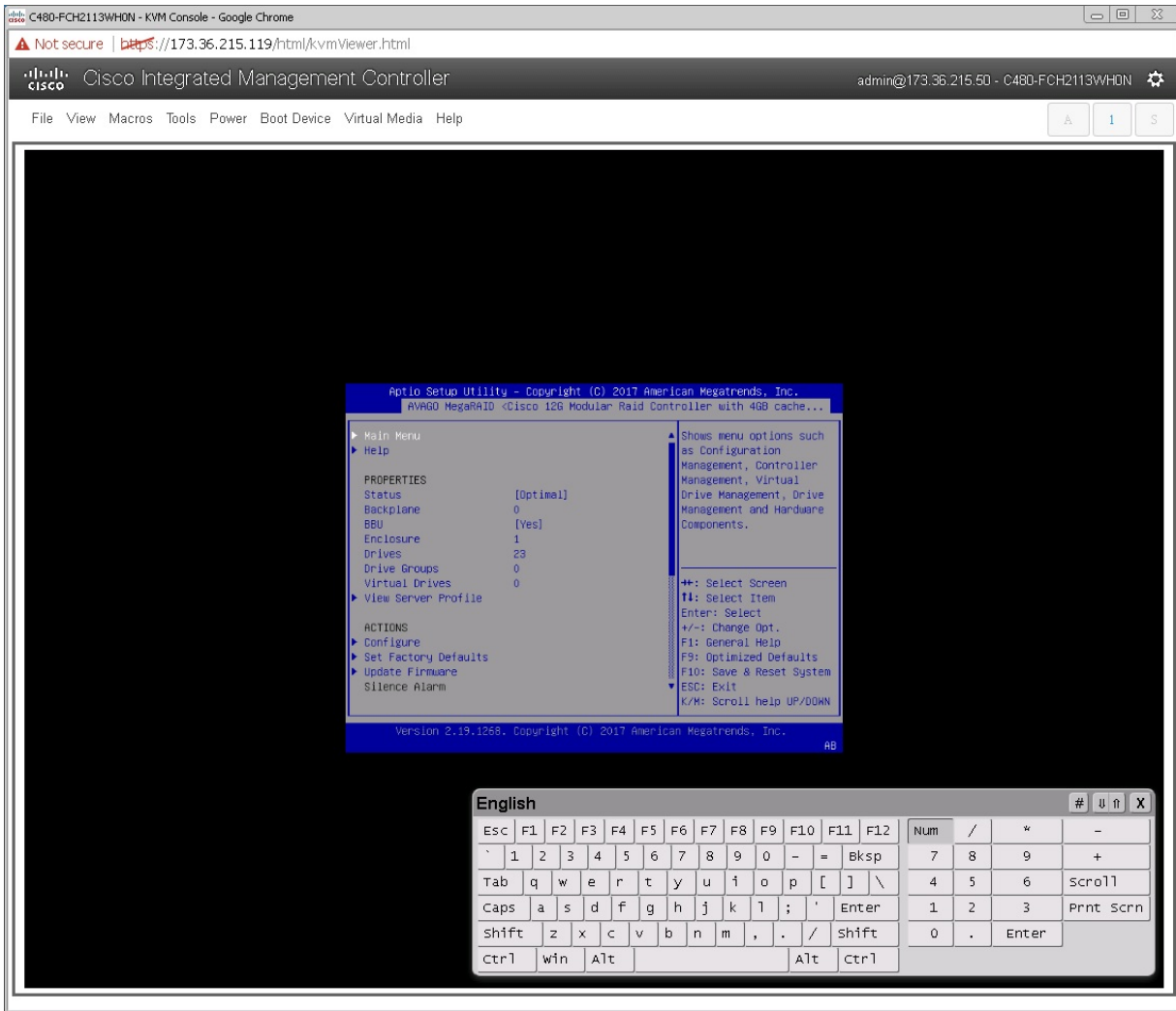
1. Boot the server and press F2 to enter the BIOS menu.
2. Select the Avago MegaRAID Utility to proceed with the RAID configuration (Figure 24).

Figure 24. Select Avago MegaRAID



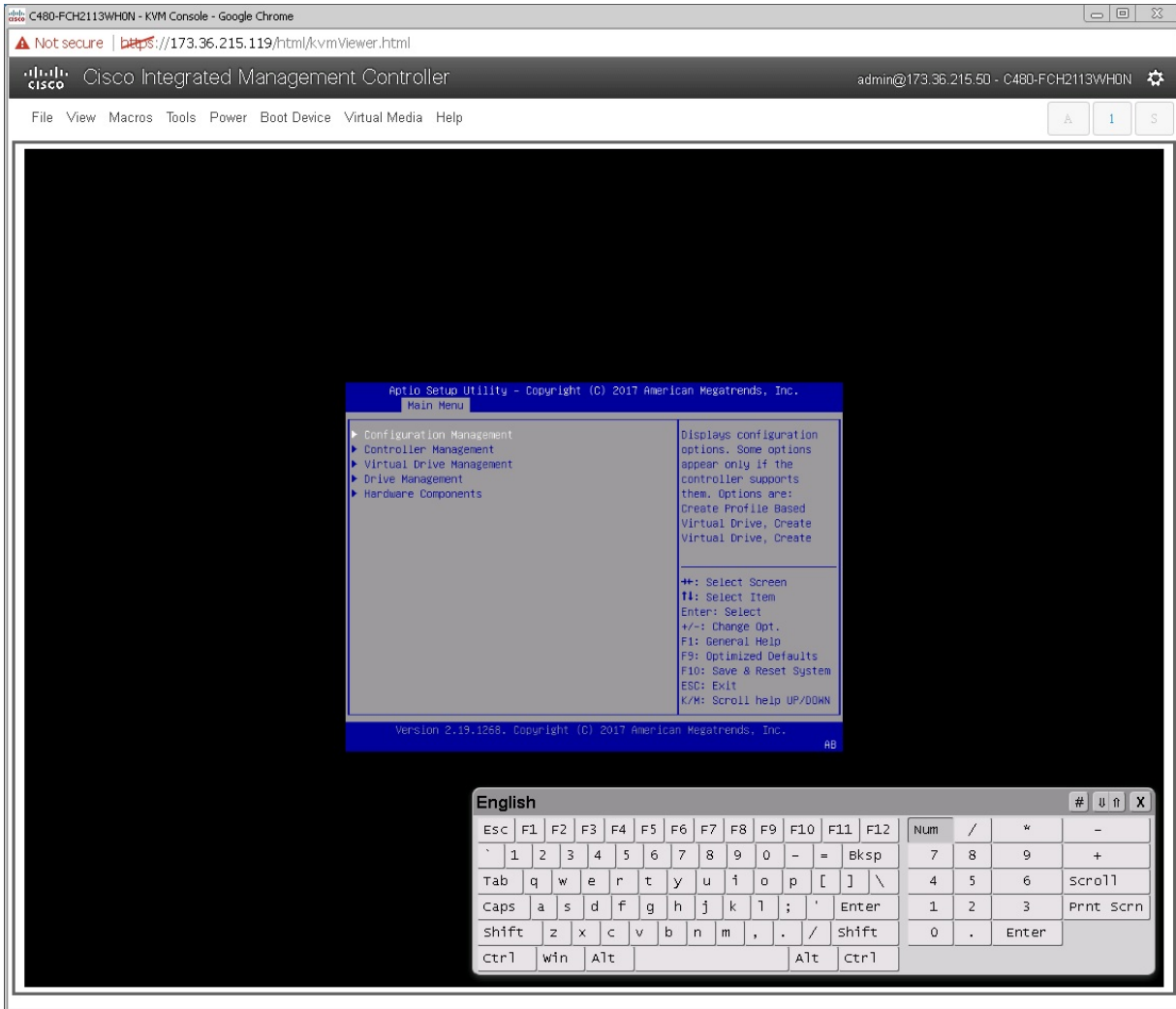
3. Choose Main Menu (Figure 25).

Figure 25. Choose Main Menu



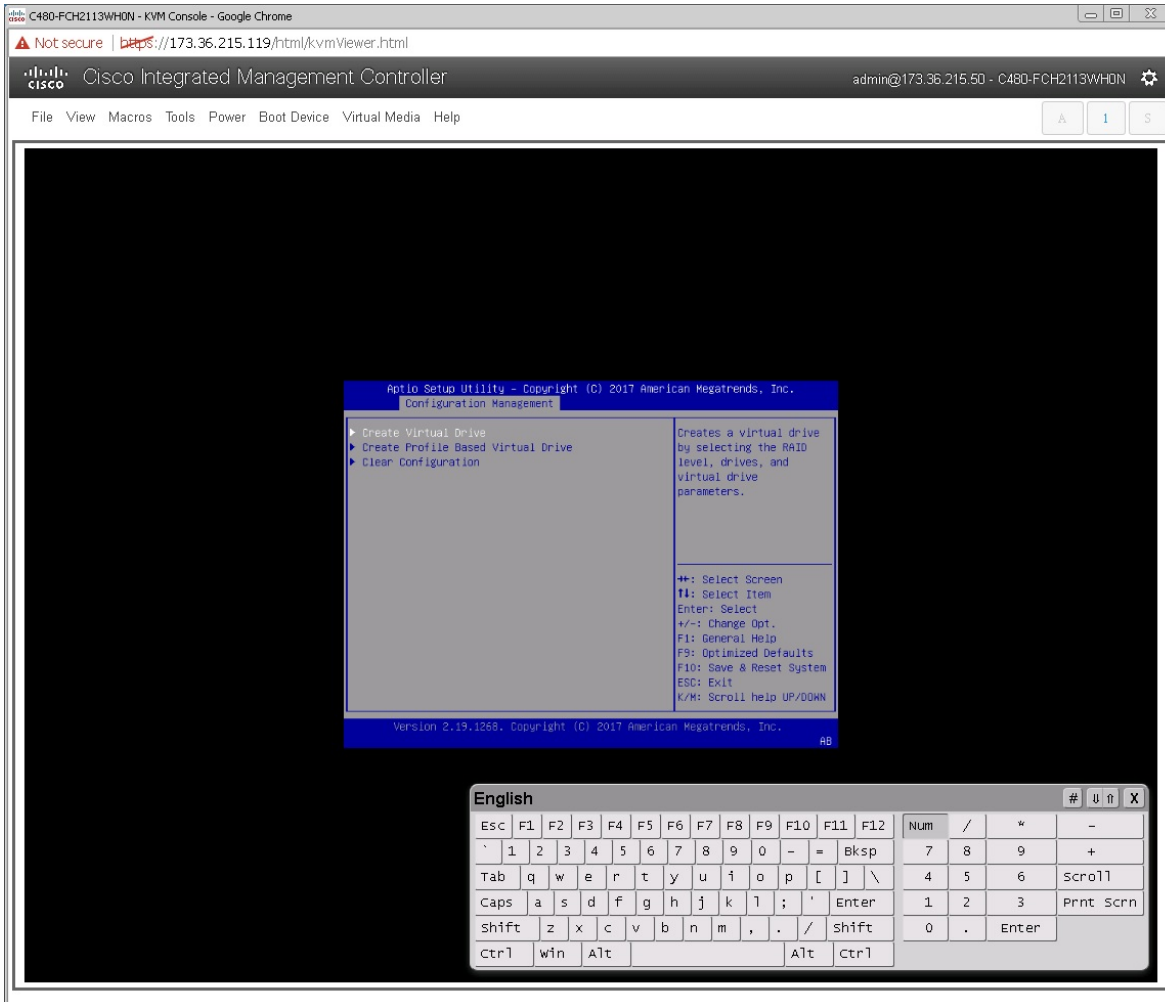
4. Choose Configuration Management (Figure 26).

Figure 26. Choose Configuration Management



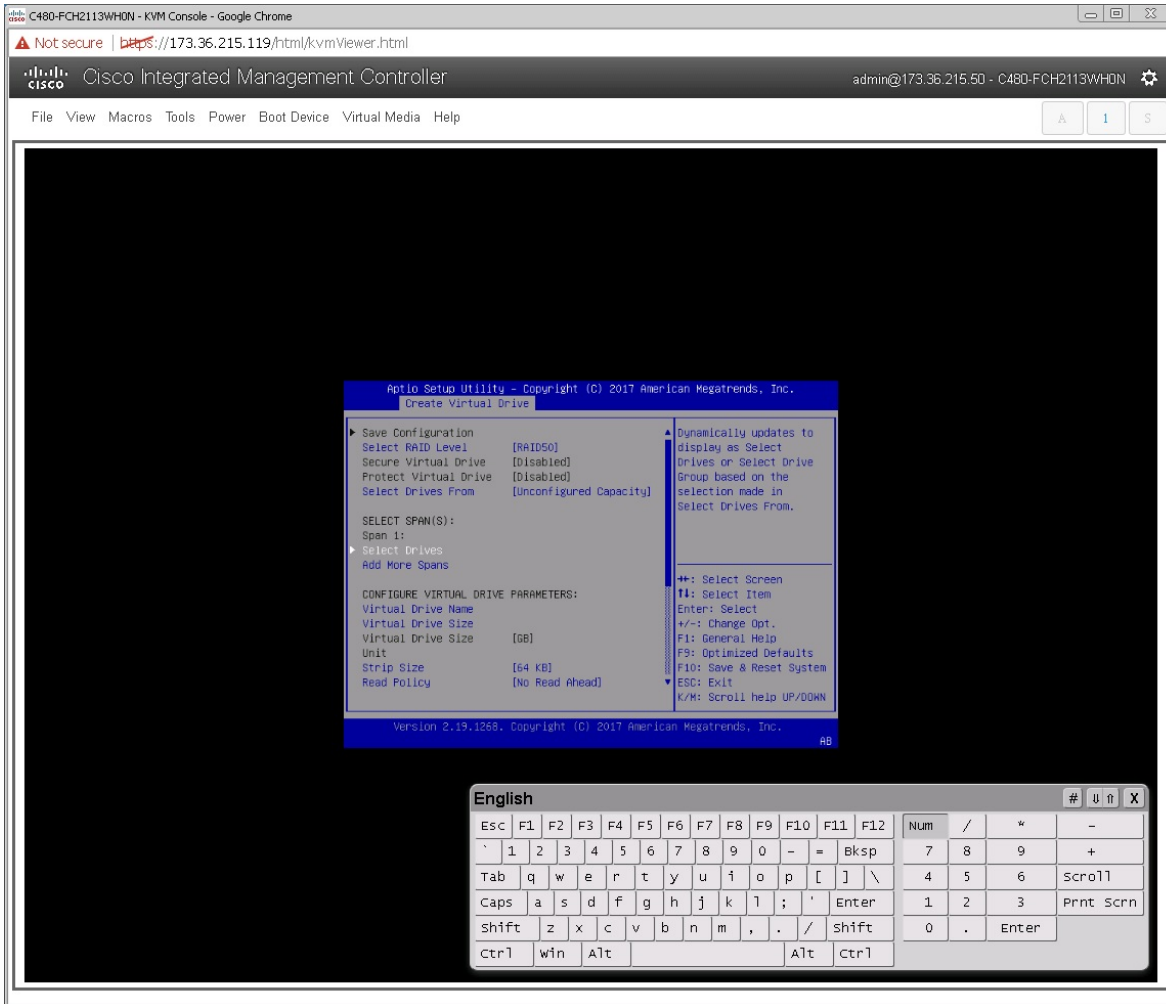
5. Choose Create Virtual Drive (Figure 27).

Figure 27. MegaRAID Configuration Utility: Create Virtual Drive



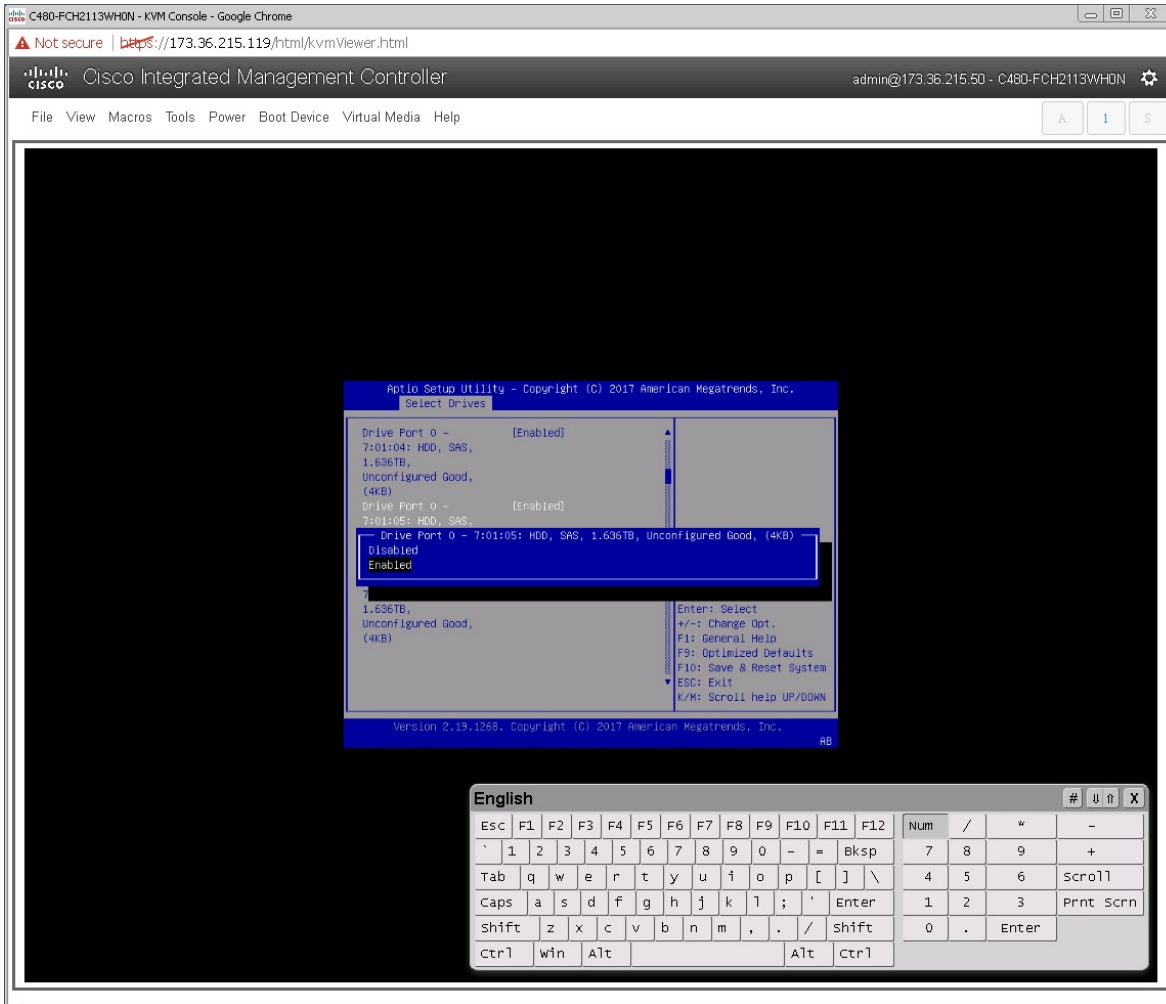
6. Choose the following options to create a RAID 50 virtual drive with 20 disks and five spans:
 - a. For RAID Level, choose RAID50.
 - b. Choose Select Drives (Figure 28).

Figure 28. Choosing RAID options



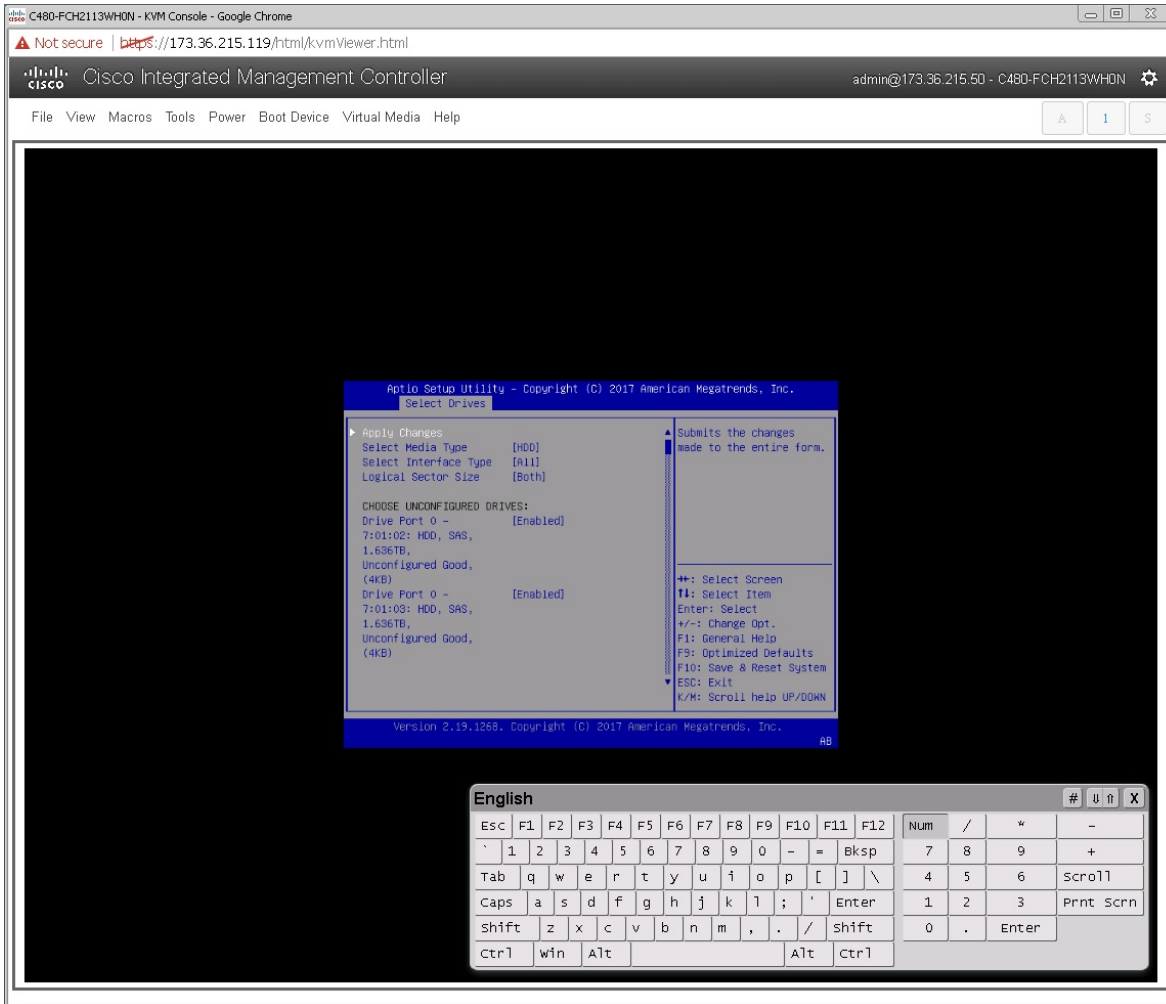
c. Select the first five disks by choosing Enabled as shown in Figure 29.

Figure 29. Choose Enabled



d. Scroll up or down and on the Select Drives screen, choose Apply Changes (Figure 30).

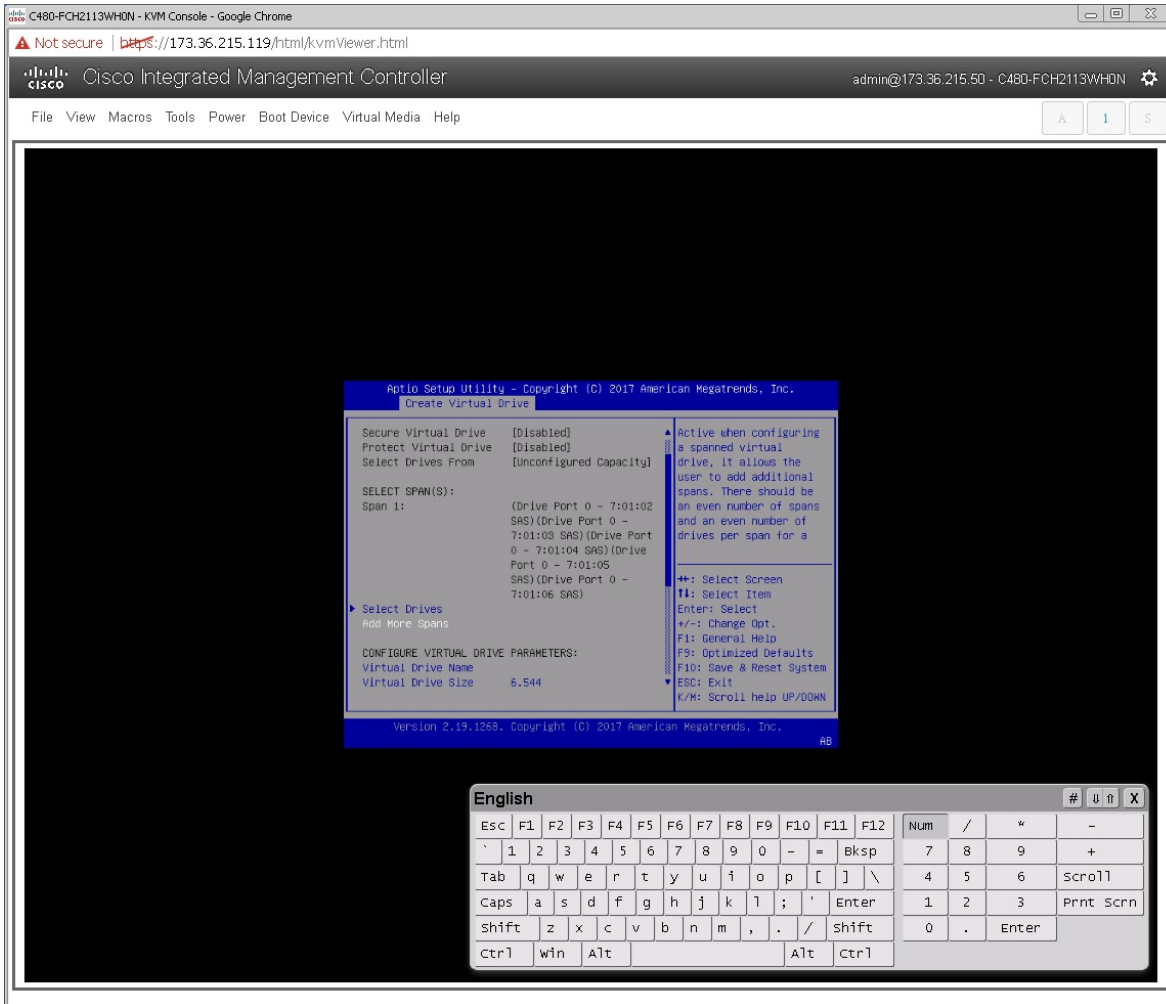
Figure 30. Apply the changes



e. Choose OK in the confirmation window.

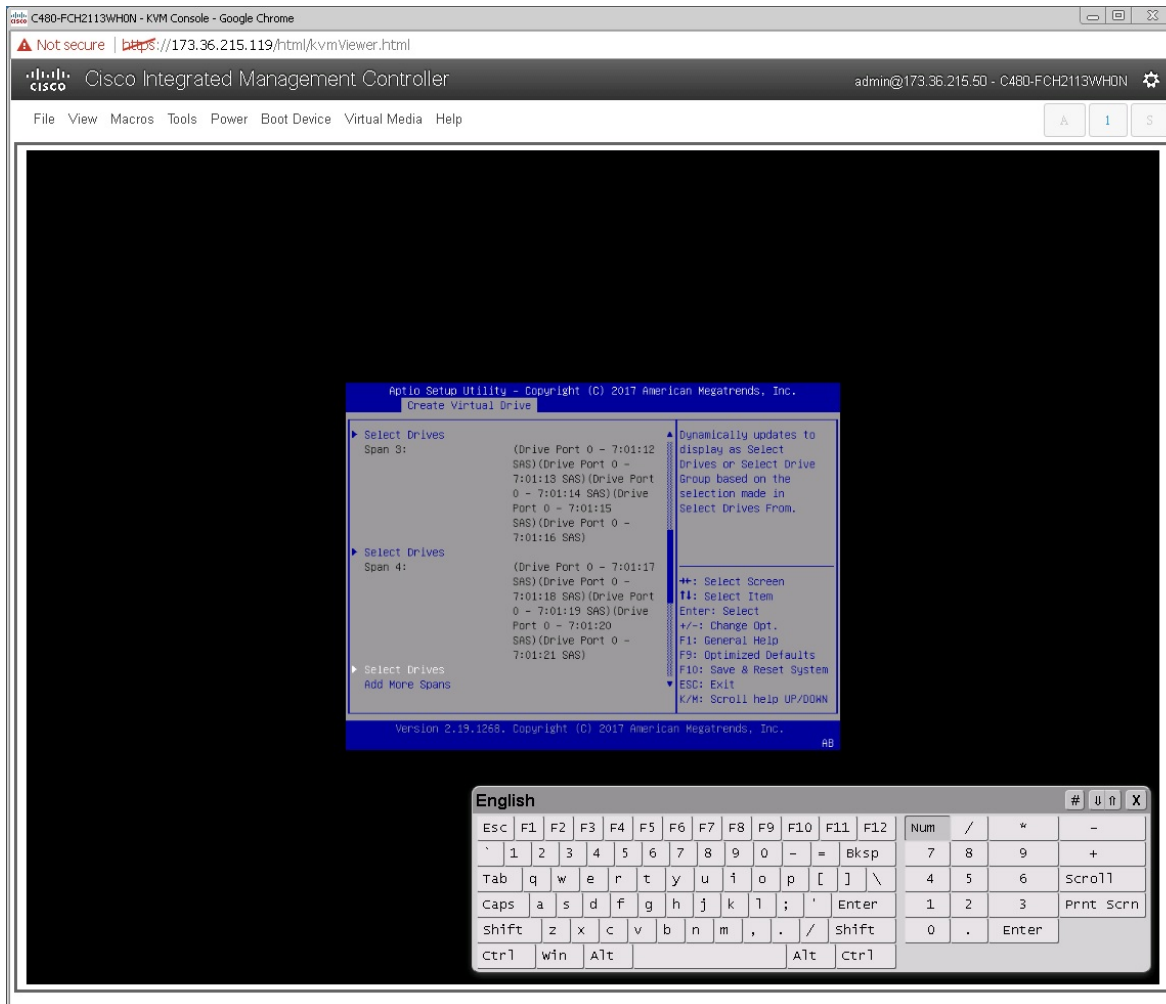
7. Add four more spans using the same process as in step 6 (Figure 31).

Figure 31. Add more spans



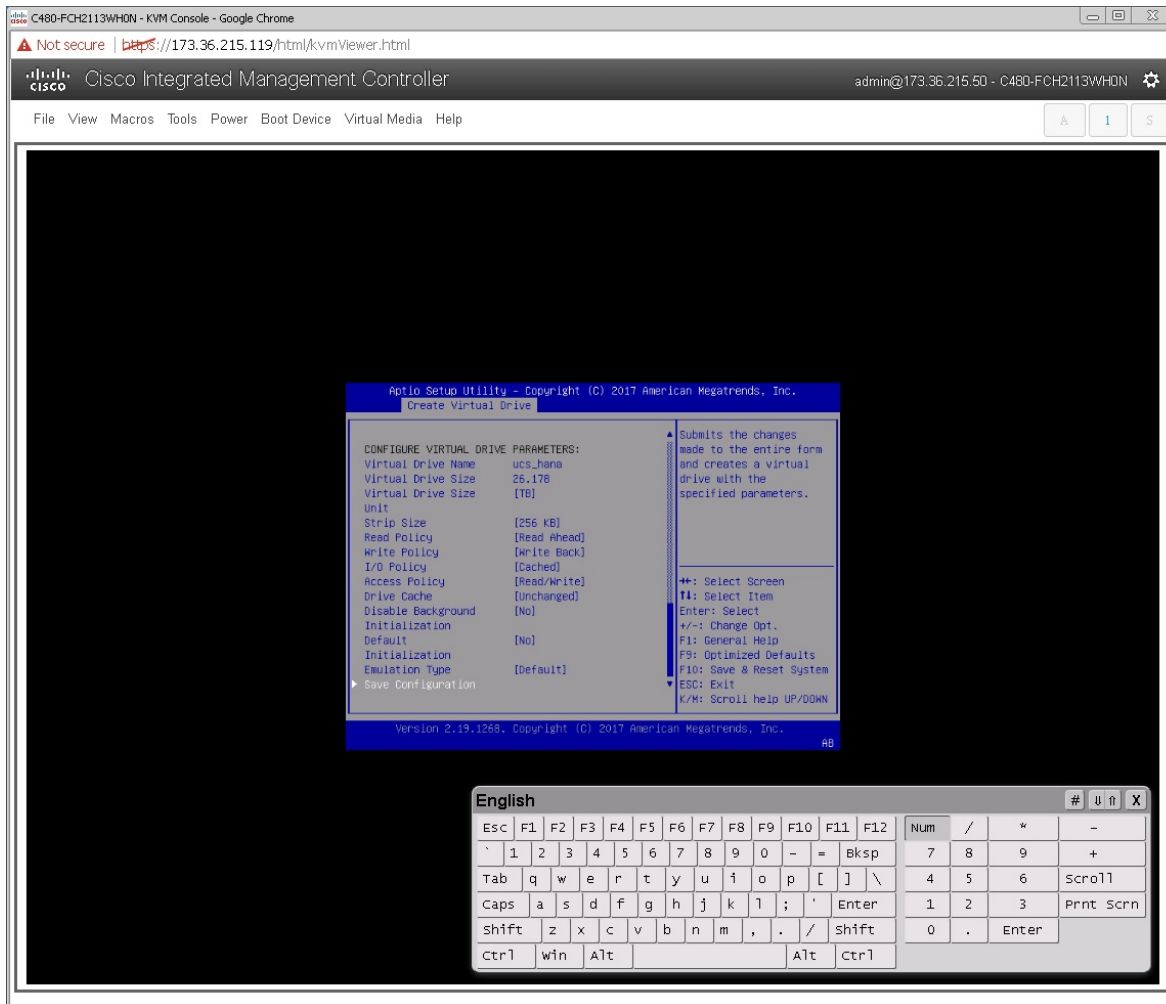
- After repeating the steps to add spans and drives, verify that four spans with five drives per span have been added (Figure 32).

Figure 32. Verifying that the spans and drives have been added



9. Configure the virtual drive parameters as shown in Figure 33.
 - a. Name the virtual drive <<var_raid50_vd_name>>.
 - b. For Strip Size, choose 256KB.
 - c. For Read Policy, choose Read Ahead.
 - d. For Write Policy, choose Write Back.

When you are done, choose Save Configuration and press Enter.

Figure 33. Virtual drive parameters


10. In the next window, the utility will ask for confirmation. Choose OK to proceed.

Note: The RAID settings described here apply only to a configuration using 20 SAS drives with RAID 50. Refer to Table 12 for the RAID options for SSD drives with RAID 5 settings.

11. Wait for the initialization process for VD0 to complete, which may take several minutes.

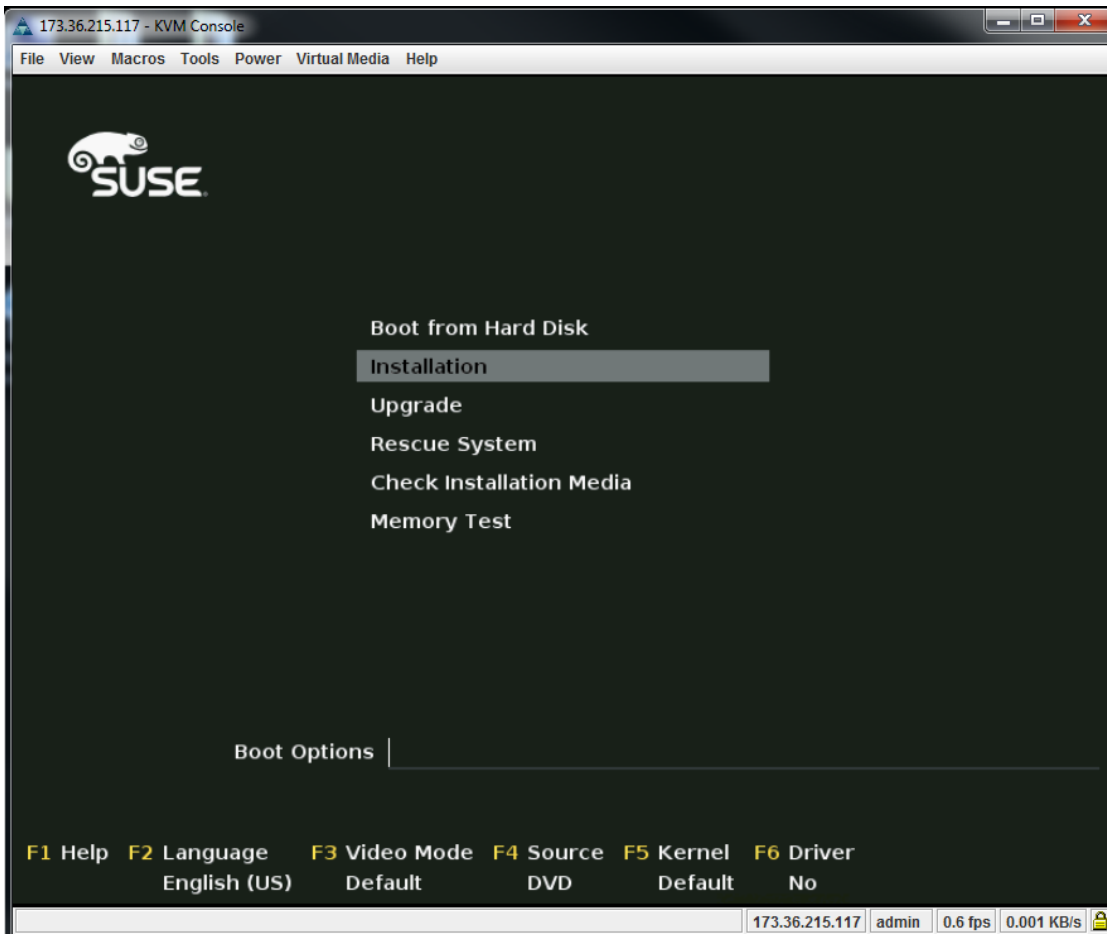
12. Press Esc and choose OK to exit the RAID configuration utility.

13. Press Ctrl+Alt+Del to reboot the server.

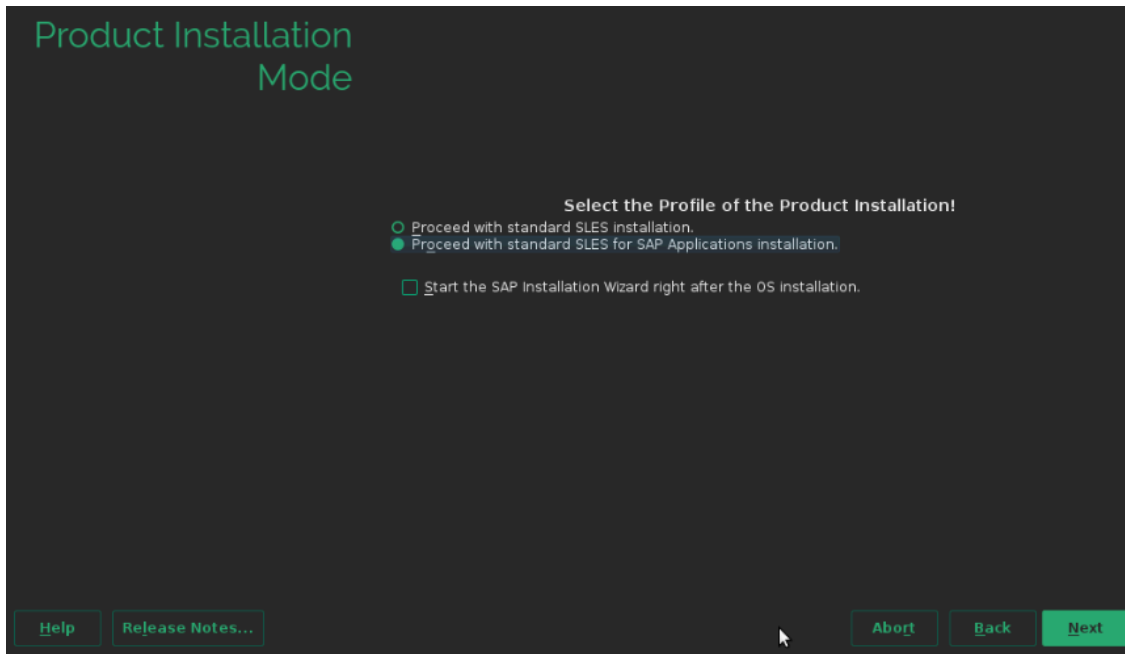
Installing the operating system

This section shows the installation procedure for SLES 12 for SAP SP2 on local drives.

1. Follow the steps in the section **“Launching the KVM console”** [\[\[PLS ADD LINK\]\]](#) to mount and boot the ISO image (Figure 34).

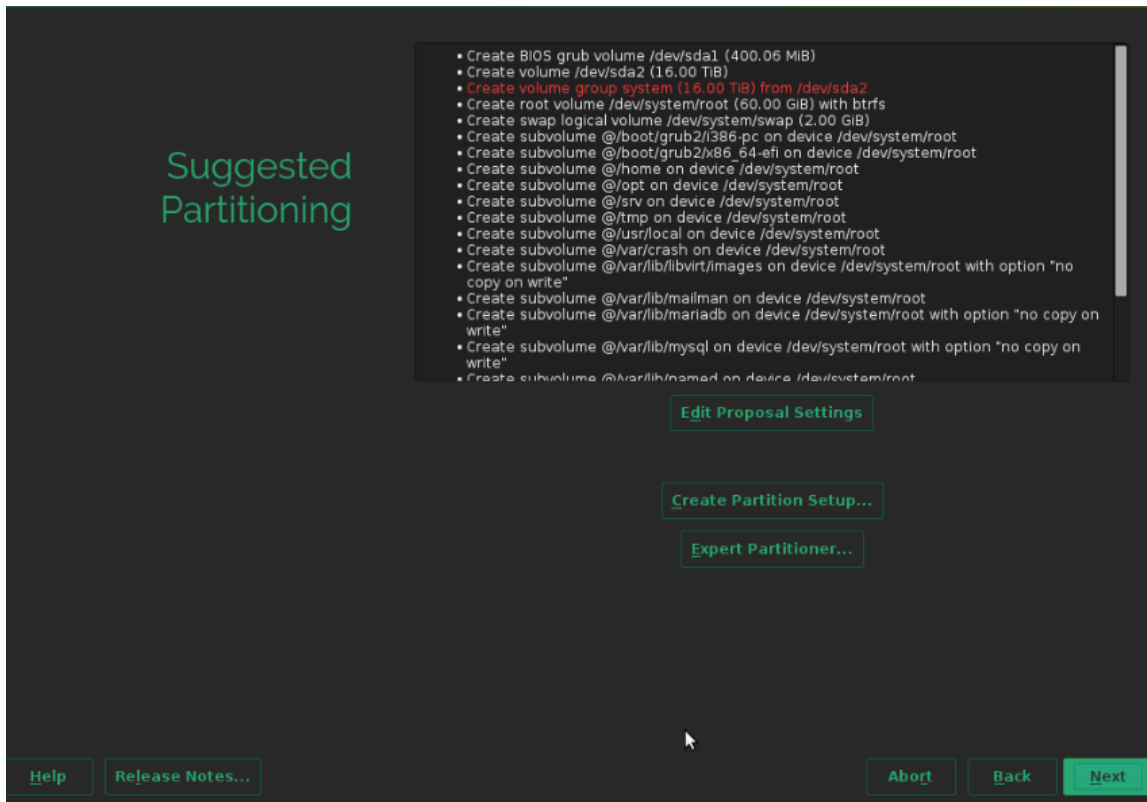
Figure 34. Booting to the ISO image

2. On the Language, Keyboard and License Agreement page, select your preferred language and keyboard Layout, agree to the license terms, and select Next.
3. On the Network Settings page, select Next. You will return to the network configuration as part of the post-installation tasks.
4. On the Registration page, select Skip Registration. You will register later as part of the post-installation tasks.
5. On the Product Installation Mode page, select the “Proceed with standard SLES for SAP Applications installation” option (Figure 35).

Figure 35. Product Installation Mode page

6. On the Add On Product page, select Next. In this configuration example, there are no additional products to install.
7. On the Suggested Partitioning page, select Expert Partitioner (Figure 36).

Figure 36. Suggested partitioning initial proposal: Select Expert Partitioner



8. At the the left, choose System View > Linux > Hard Disks > sda.
9. Clear the suggested partitions. The example here shows two suggested partitions: sda1 and sda2. Use the following steps to delete sda1 and sda2.
 - a. Delete partition sda2 (Figures 37 and 38).

Figure 37. Expert Partitioner: Delete partition sda2

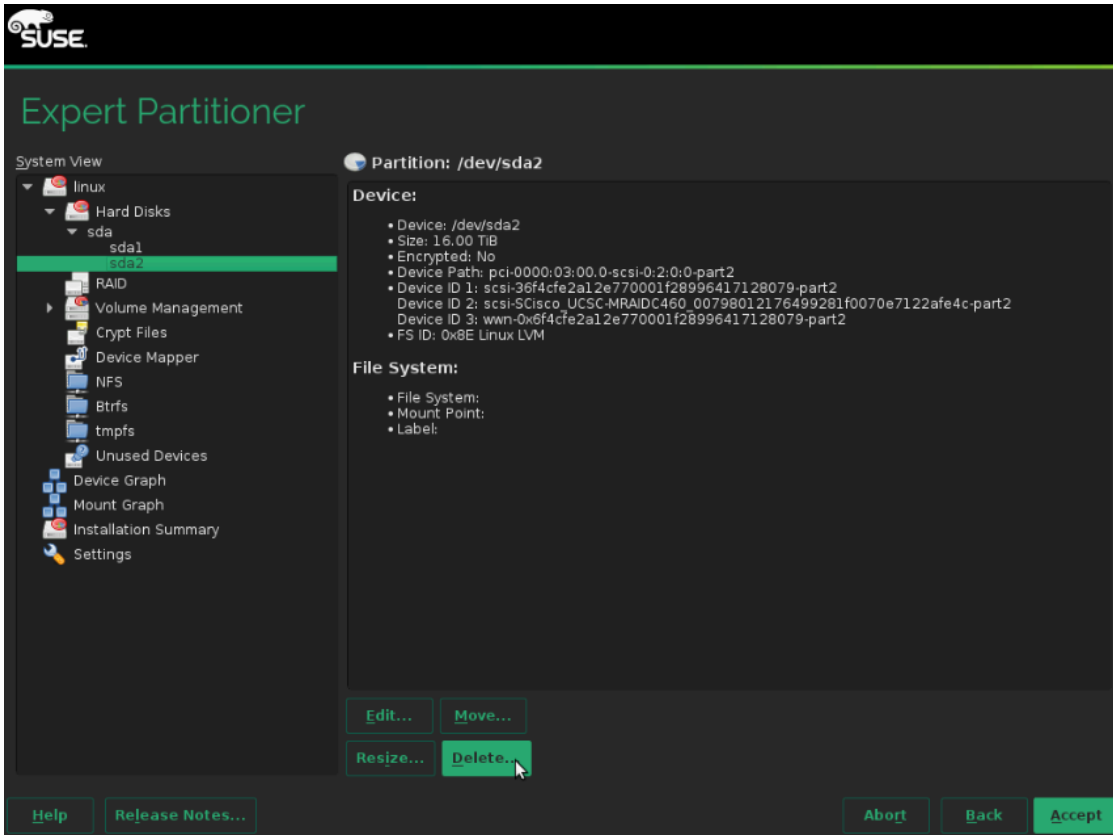
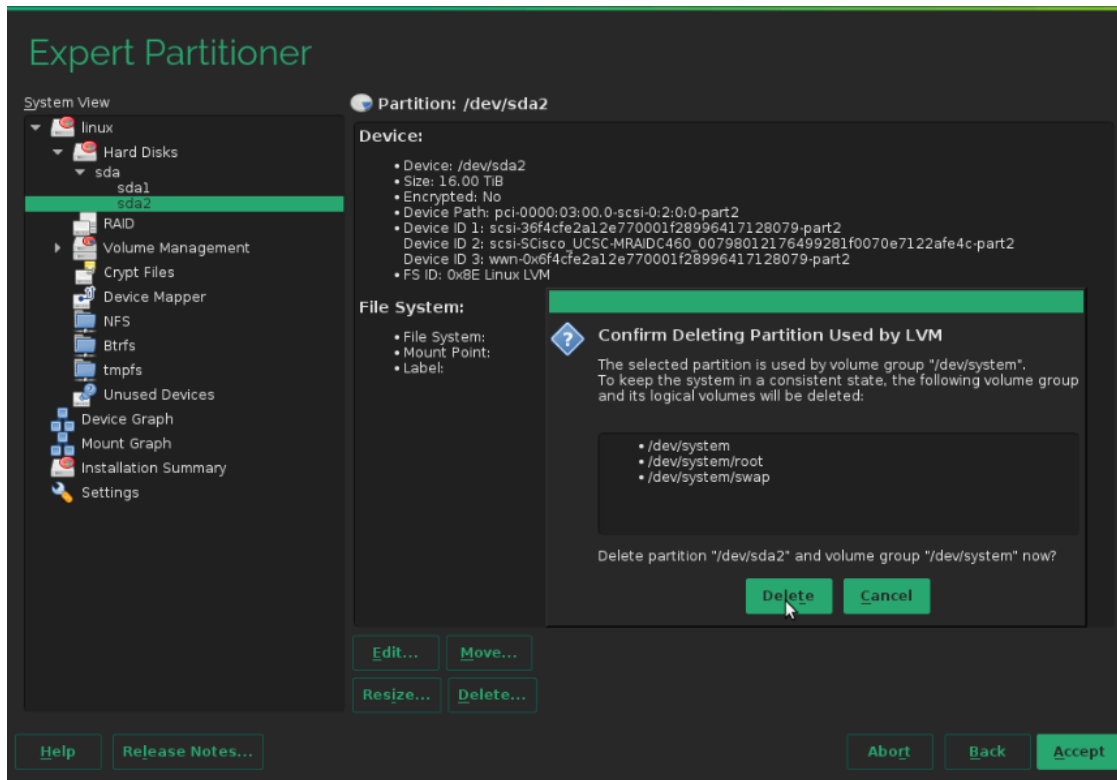


Figure 38. Expert Partitioner: Confirm deletion of partition sda2



b. Delete partition sda1 (Figures 39 and 40).

Figure 39. Expert Partitioner: Delete partition sda1

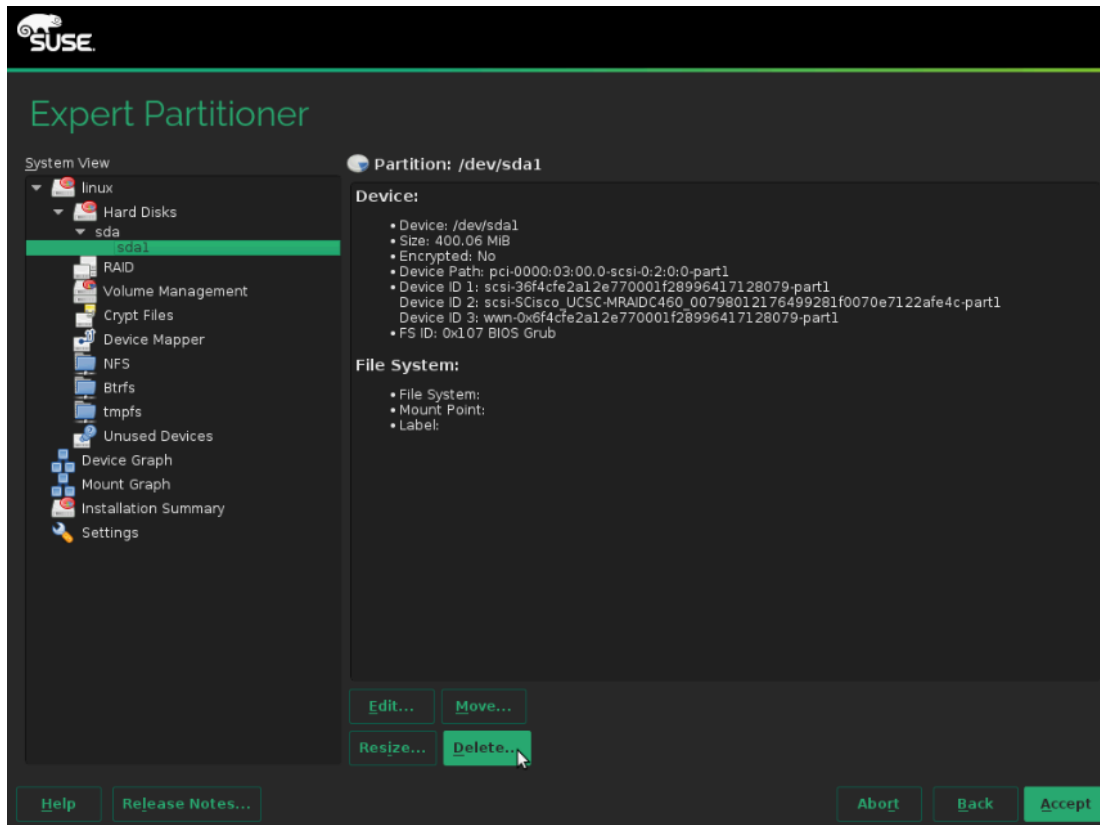
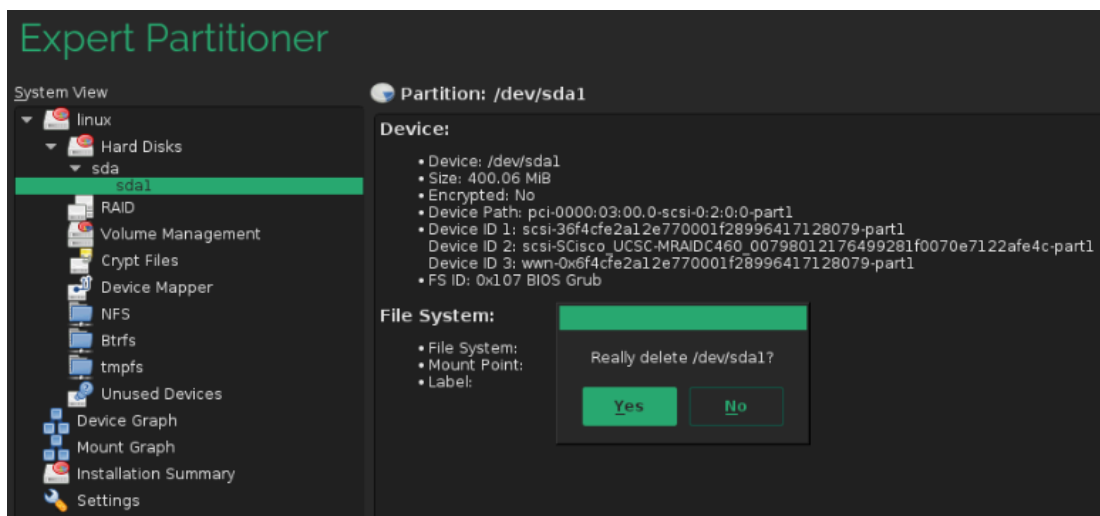


Figure 40. Expert Partitioner: Confirm deletion of partition sda1



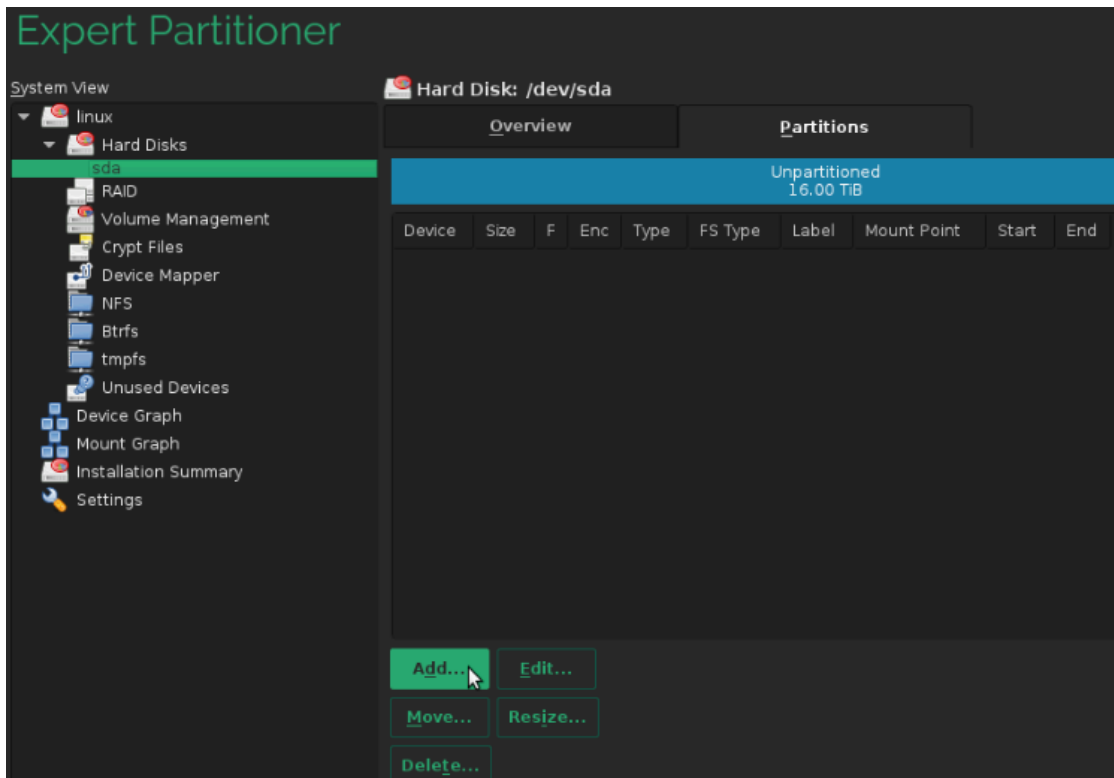
Now, from the unpartitioned device sda, you will use the steps here to do the following:

- Create a 200-MB /boot partition (/dev/sda1) from the disk device available (/dev/sda).

- Create another partition (`/dev/sda2`), assigning the rest of the available space in the device (`/dev/sda`). Assign this partition to Linux LVM, hence making it a physical volume.
- Create a volume group (`hanavg`) and assign the available physical volume (`/dev/sda2`) to it.
- Create a logical volume for `/filesystem` with a size of 100 GB and using the Ext3 file system.
- Create a swap volume with a size of 2 GB.

10. In the Expert Partitioner, choose the device `/dev/sda` and click Add (Figure 41).

Figure 41. Add new partition



11. Create a partition with a size of 200 MB for `/boot` (Figure 42).

Figure 42. Adding a partition: Specify the new partition size



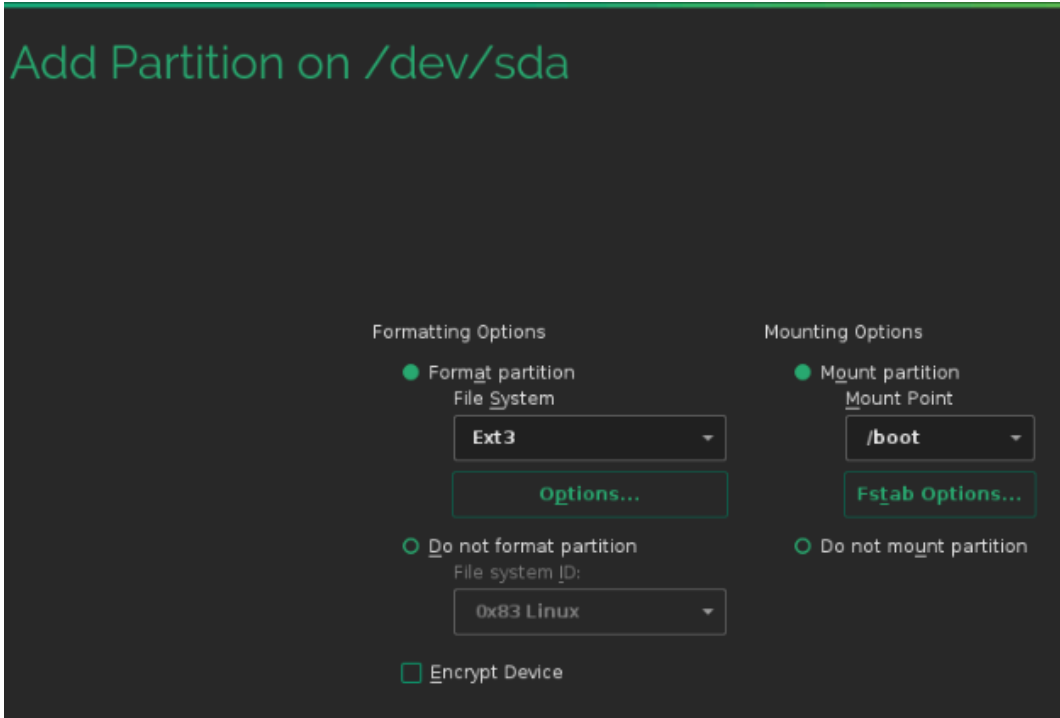
12. Click Next. For Role, select Operating System (Figure 43).

Figure 43. Adding a partition: Specify the role



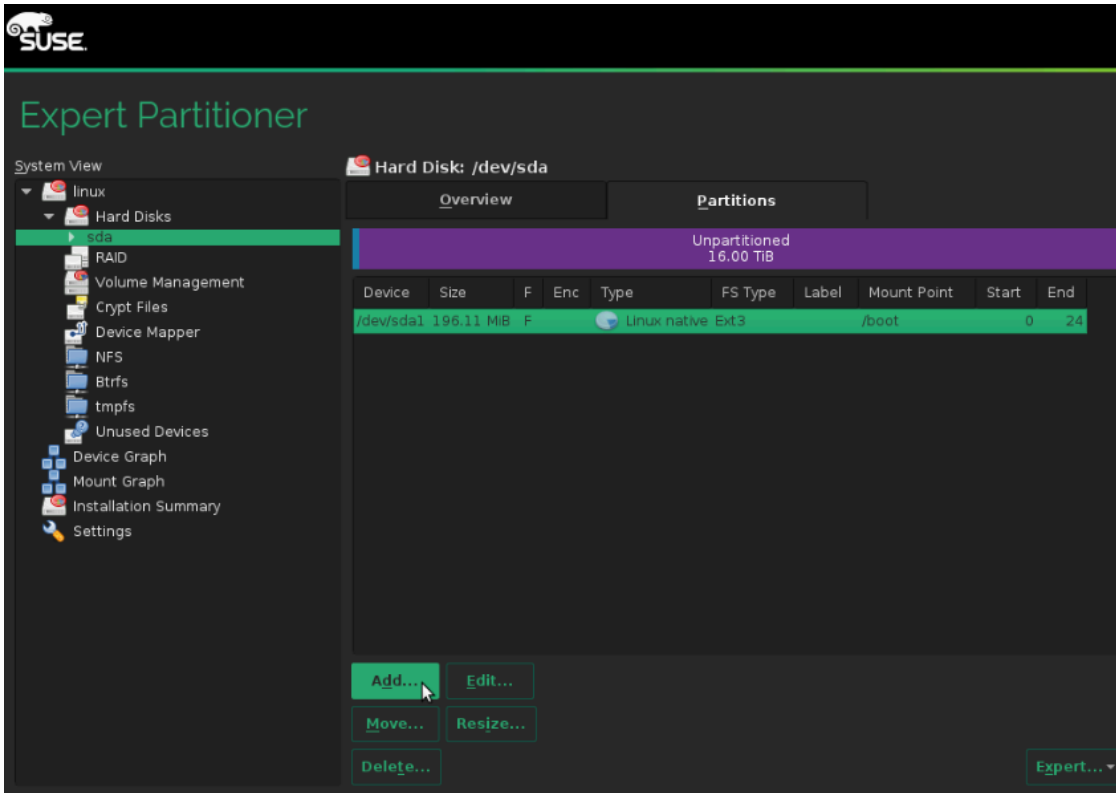
13. Click Next. Select Ext3 as the file system and /boot for the mount point (Figure 44).

Figure 44. Adding a partition: Select formatting and mounting options



14. Click Finish. Then click Add to add another partition (Figure 45).

Figure 45. Expert Partitioner: Add another partition



15. Allocate the rest of available space to the partition (Figure 46).

Figure 46. Adding another partition: Specify the partition size



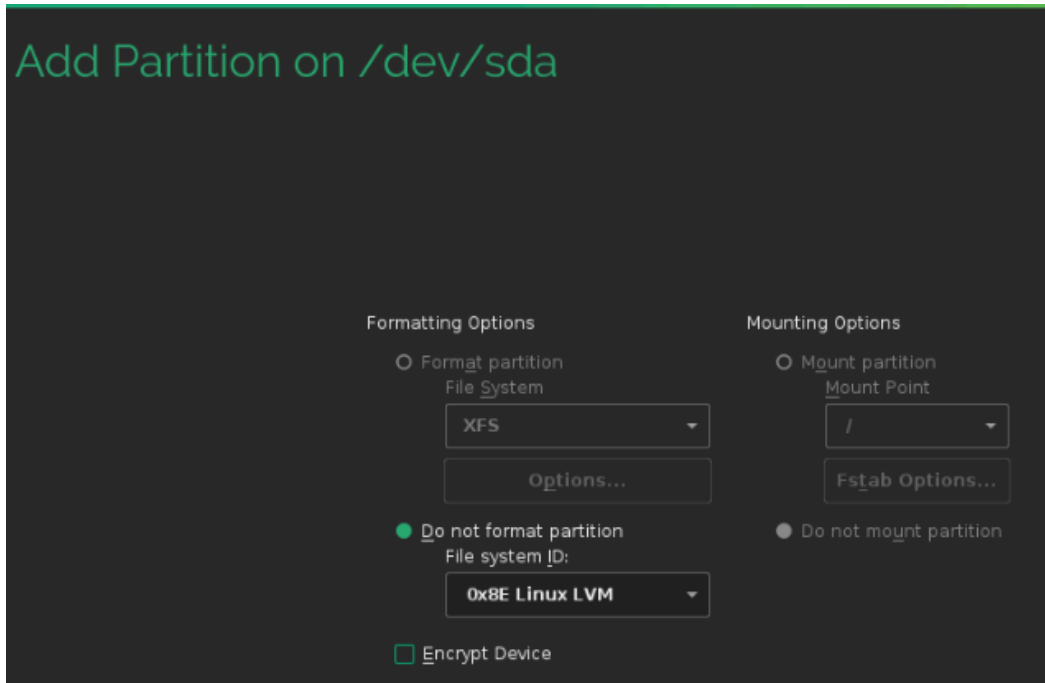
16. Click Next. For Role, choose Data and ISV Applications (Figure 47).

Figure 47. Adding another partition: Specify the role



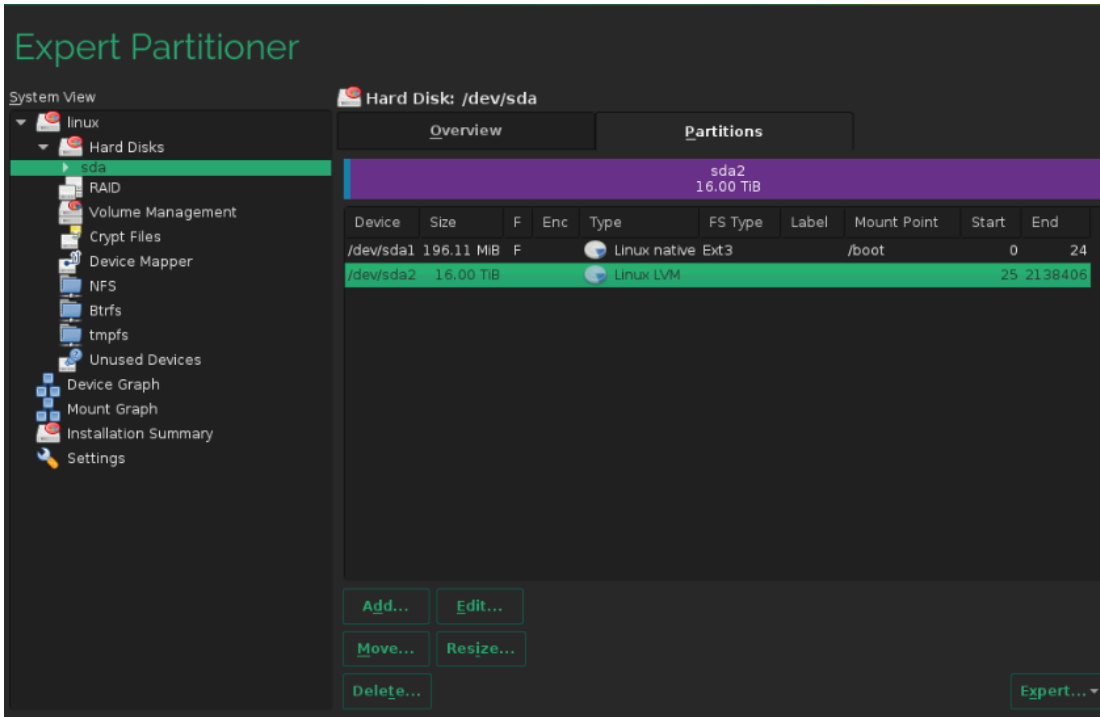
17. Assign the partition with the file system ID 0x8E Linux LVM (Figure 48).

Figure 48. Adding another partition: Specify formatting and mounting options



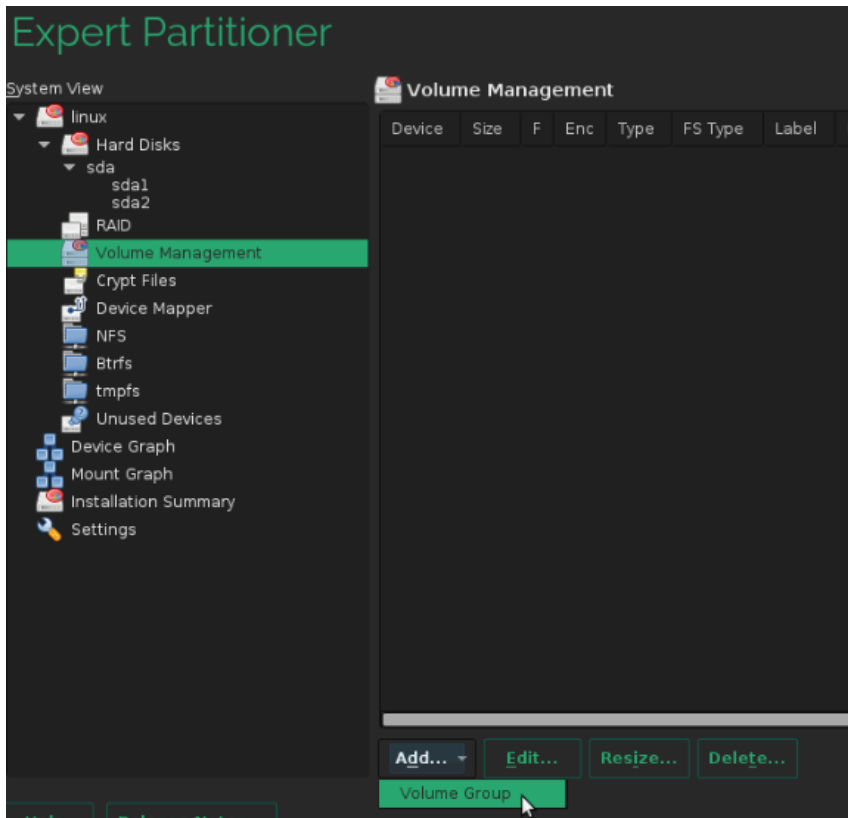
18. Click Finish. You will see an overview of your partitions (Figure 49).

Figure 49. Expert Partitioner: Hard disk /dev/sda partitions overview



19. In the System View pane on the left, select Volume Management. Click Add > Volume Group (Figure 50).

Figure 50. Expert Partitioner volume management: Add a volume group



20. Provide a name for the volume group, select `/dev/sda2` from the list of available physical volumes, and click Add (Figures 51 and 52).

Figure 51. Add Volume Group: Select an available physical volume

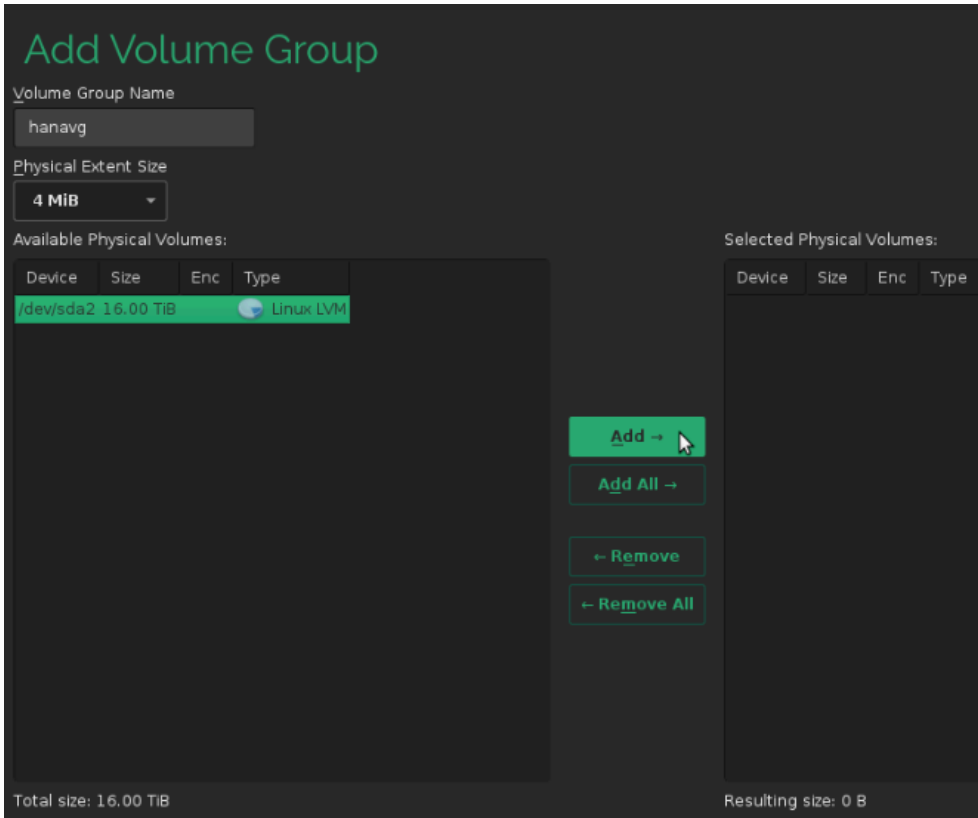
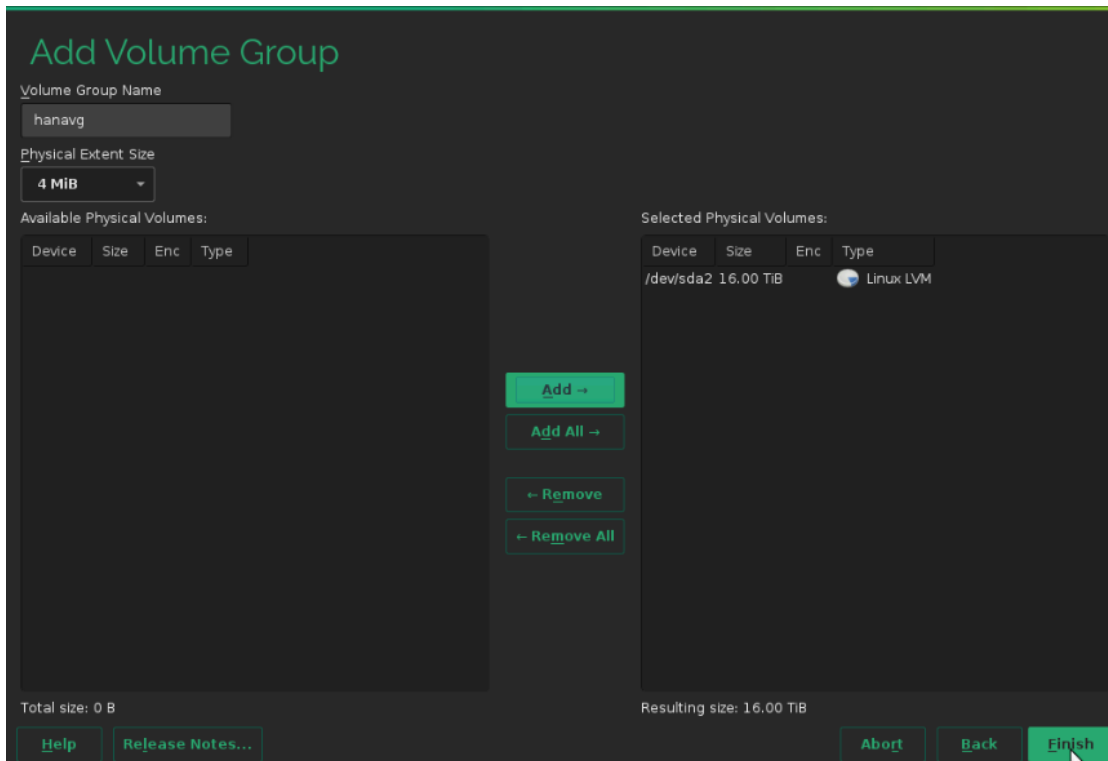


Figure 52. Add Volume Group (continued)

Add Volume Group

Volume Group Name
hanavg

Physical Extent Size
4 MIB

Available Physical Volumes:

Device	Size	Enc	Type
--------	------	-----	------

Selected Physical Volumes:

Device	Size	Enc	Type
/dev/sda2	16.00 TiB		Linux LVM

Total size: 0 B

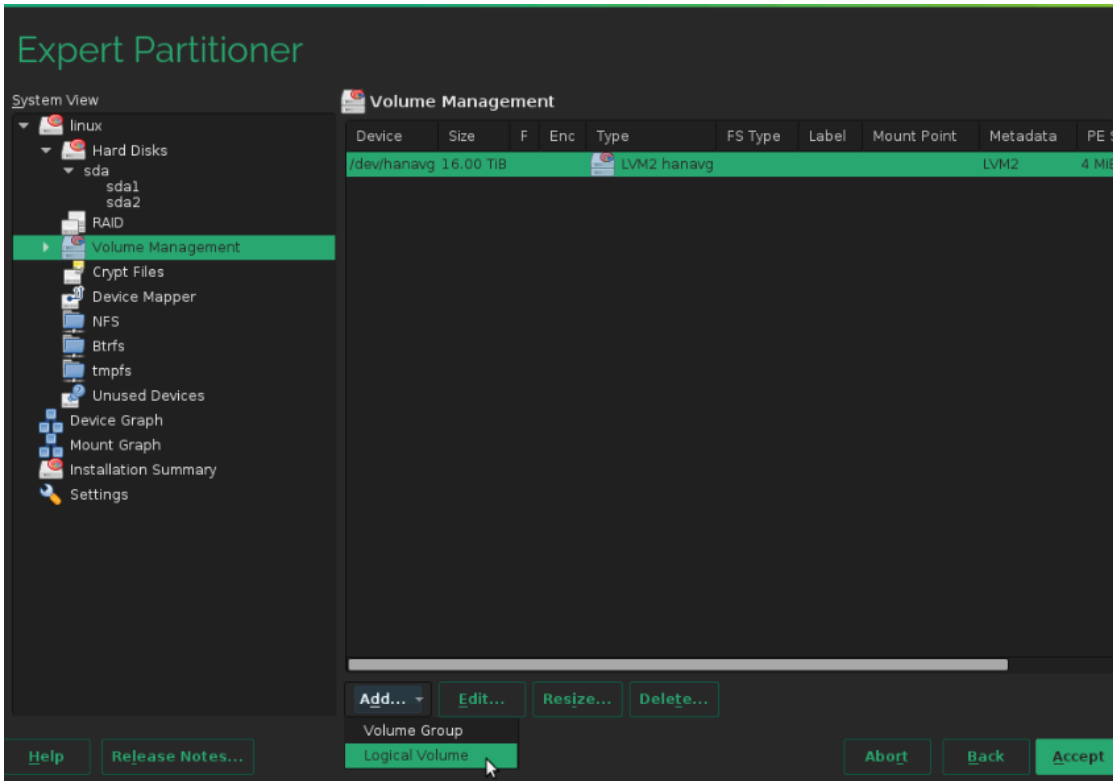
Resulting size: 16.00 TiB

Buttons: Add →, Add All →, ← Remove, ← Remove All, Help, Release Notes..., Abort, Back, Finish

21. Click Finish.

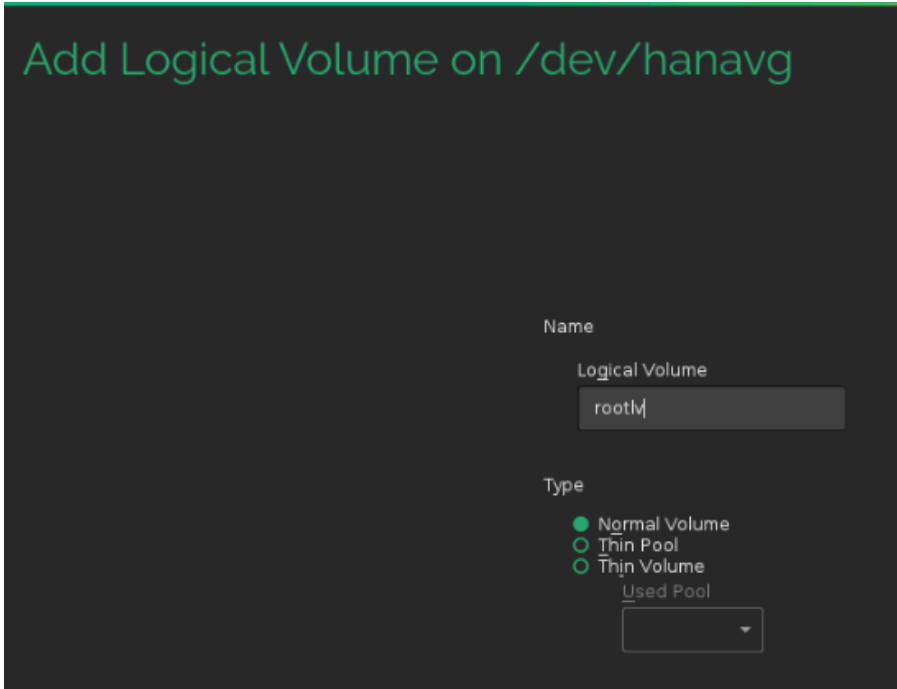
22. Under Volume Management, click Add and select Logical Volume (Figure 53).

Figure 53. Expert Partitioner: Add a logical volume



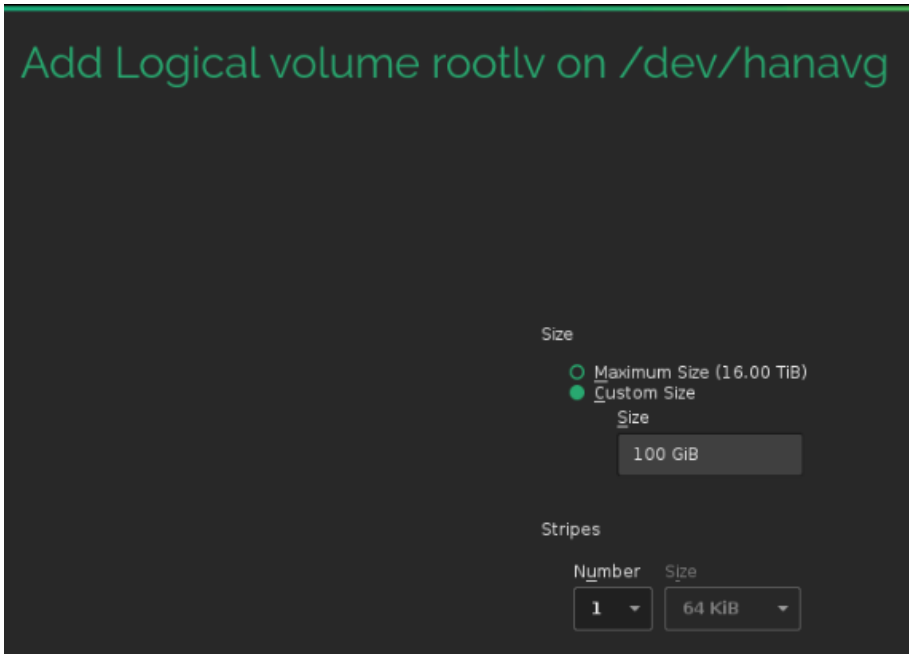
23. Add a logical volume with the name rootlv in the volume group (Figures 54).

Figure 54. Adding a logical volume: Specify the name and type



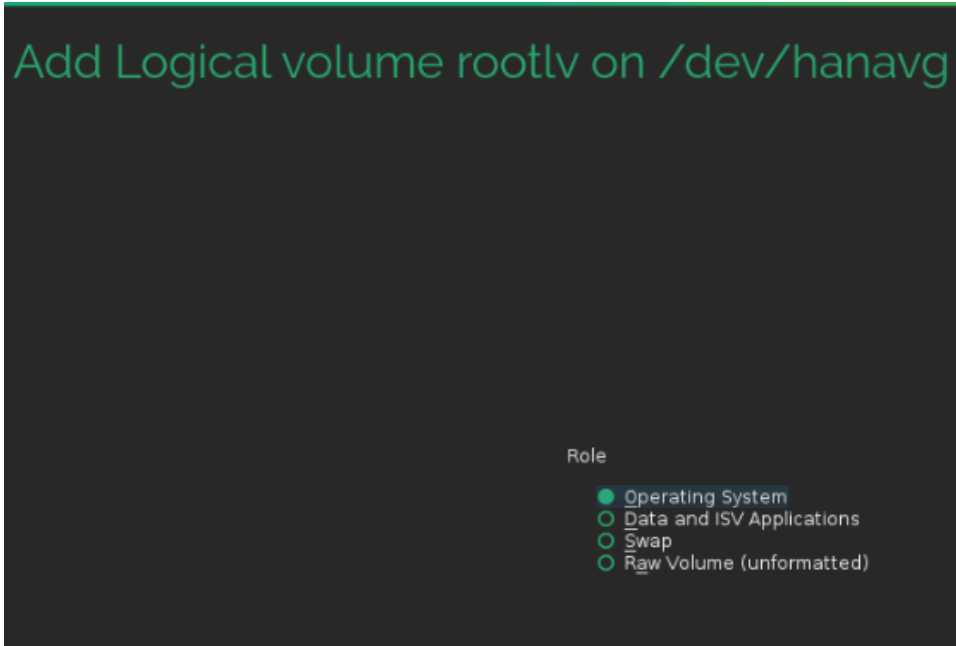
24. Click Next. Specify a size of 100 GB and 1 stripe (Figure 55).

Figure 55. Adding a logical volume: Specify the size and stripe



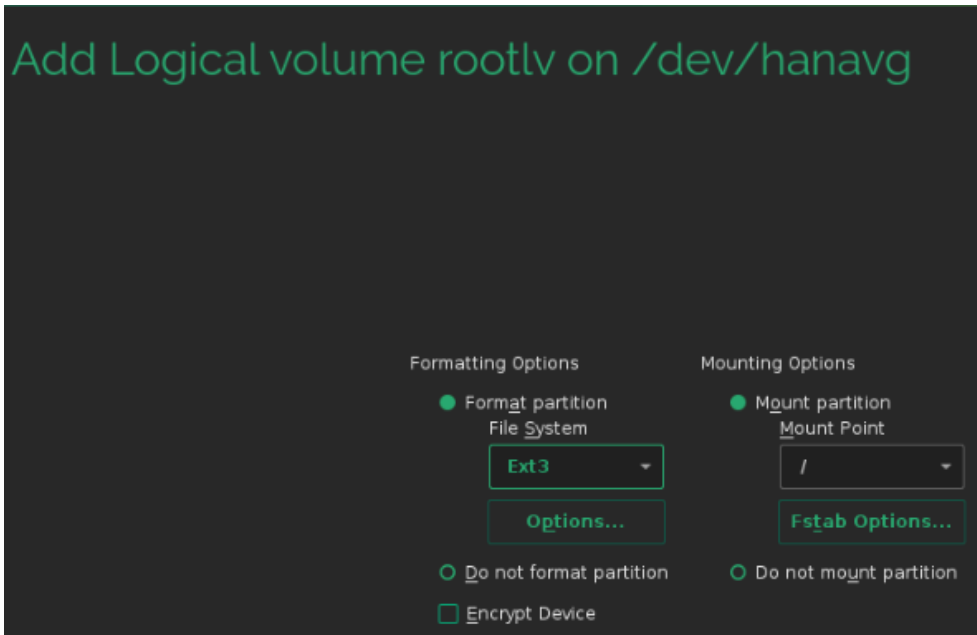
25. Click Next. For Role, specify Operating System (Figure 56).

Figure 56. Adding a logical volume: Specify the role



26. Click Next. Specify the formatting and mounting options. Format the 100-GB logical volume rootlv with the Ext3 file system and assign the / mount point (Figure 57).

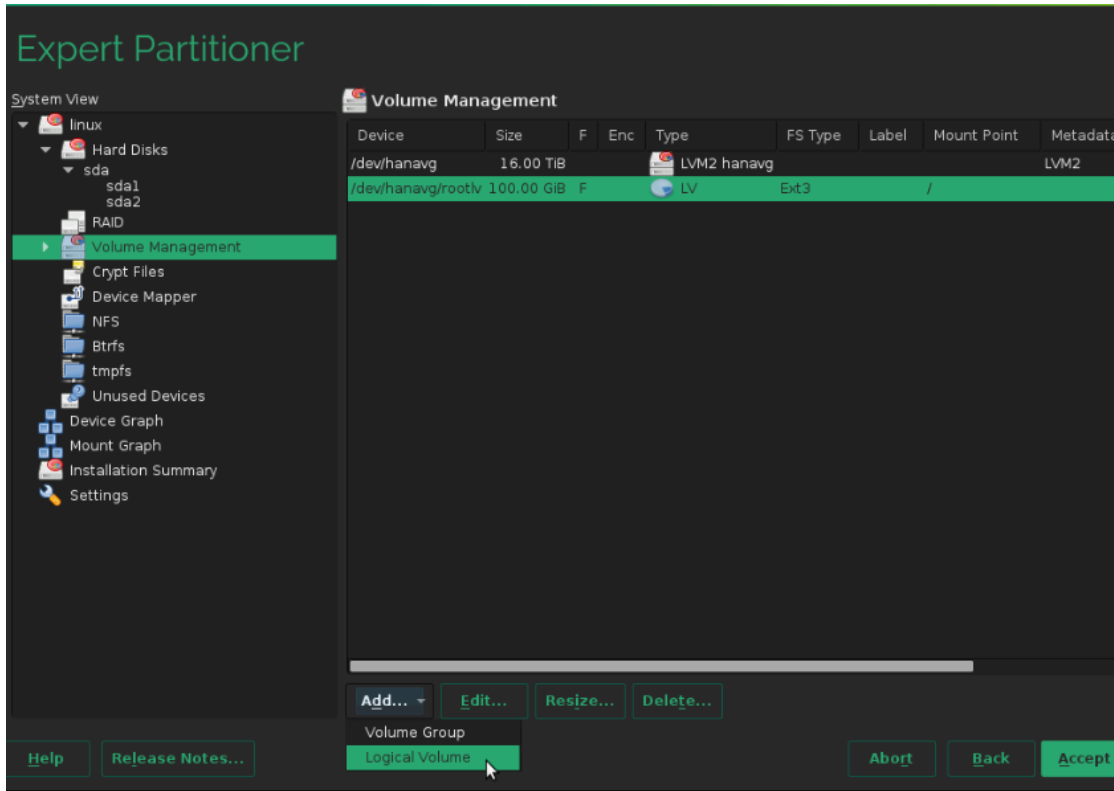
Figure 57. Adding a logical volume: Specify formatting and mounting options



27. Click Finish.

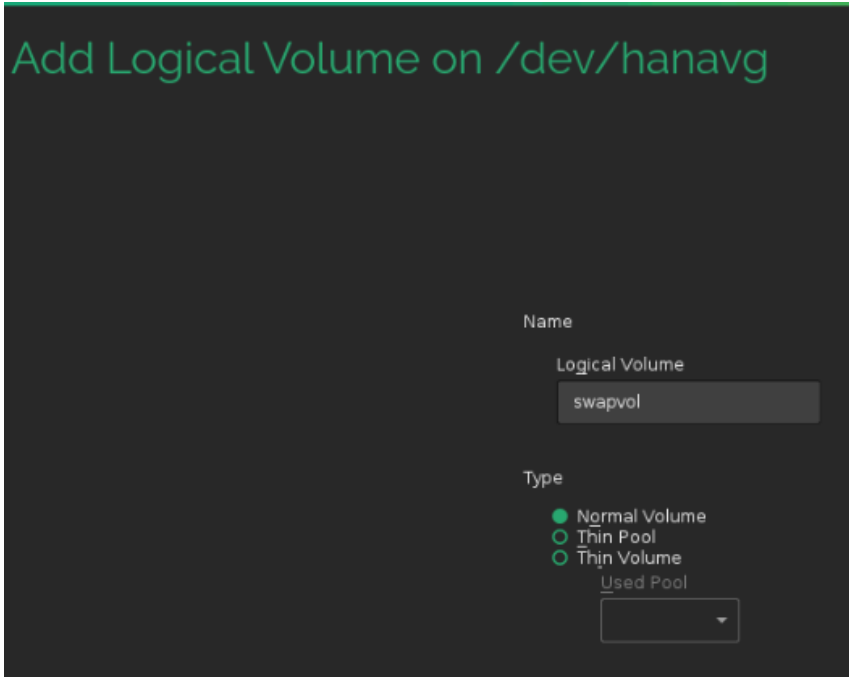
28. Create a swap volume with a size of 2 GB. Under Volume Management, click Add and select Logical Volume (Figure 58).

Figure 58. Expert Partitioner volume management: Add another logical volume



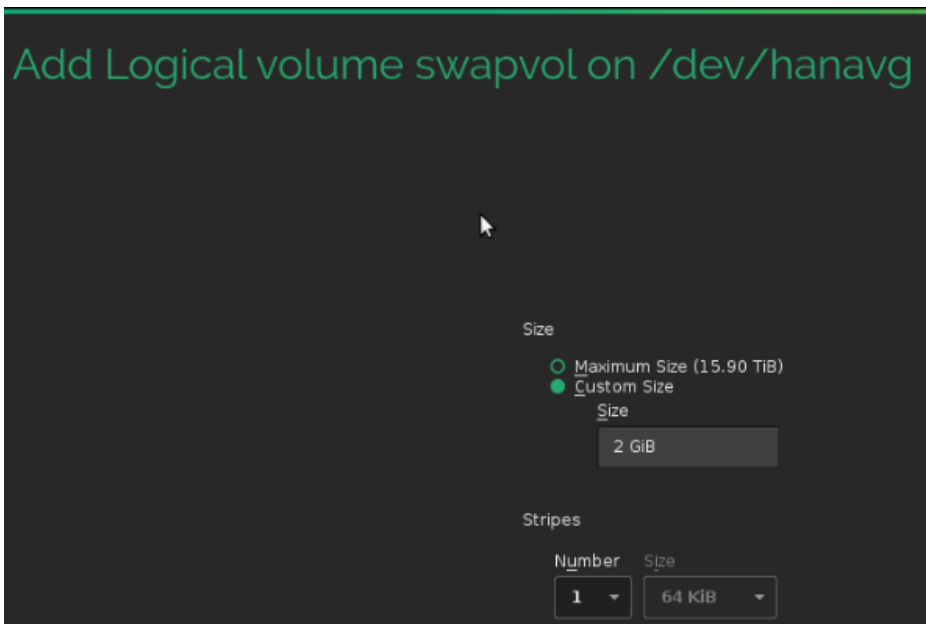
29. Add a logical volume for swapping with the name swapvol (Figure 59). Then click Next.

Figure 59. Adding another logical volume: Specify the name and type



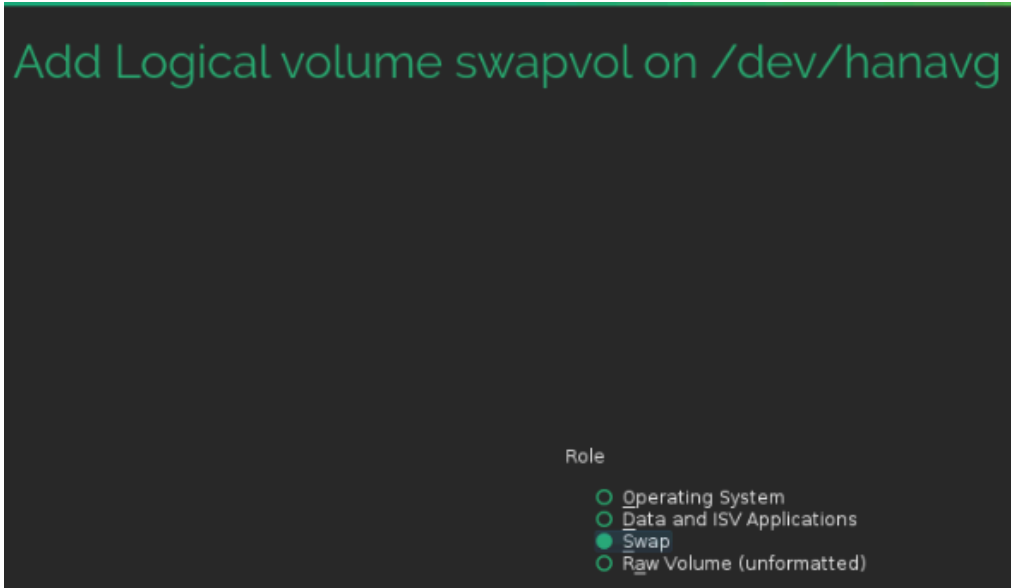
30. Assign a space of 2 GB and one stripe (Figure 60). Then click Next.

Figure 60. Adding another logical volume: Specify size and stripe information



31. For Role, select Swap (Figure 61). Then click Next.

Figure 61. Adding another logical volume: Specify the role



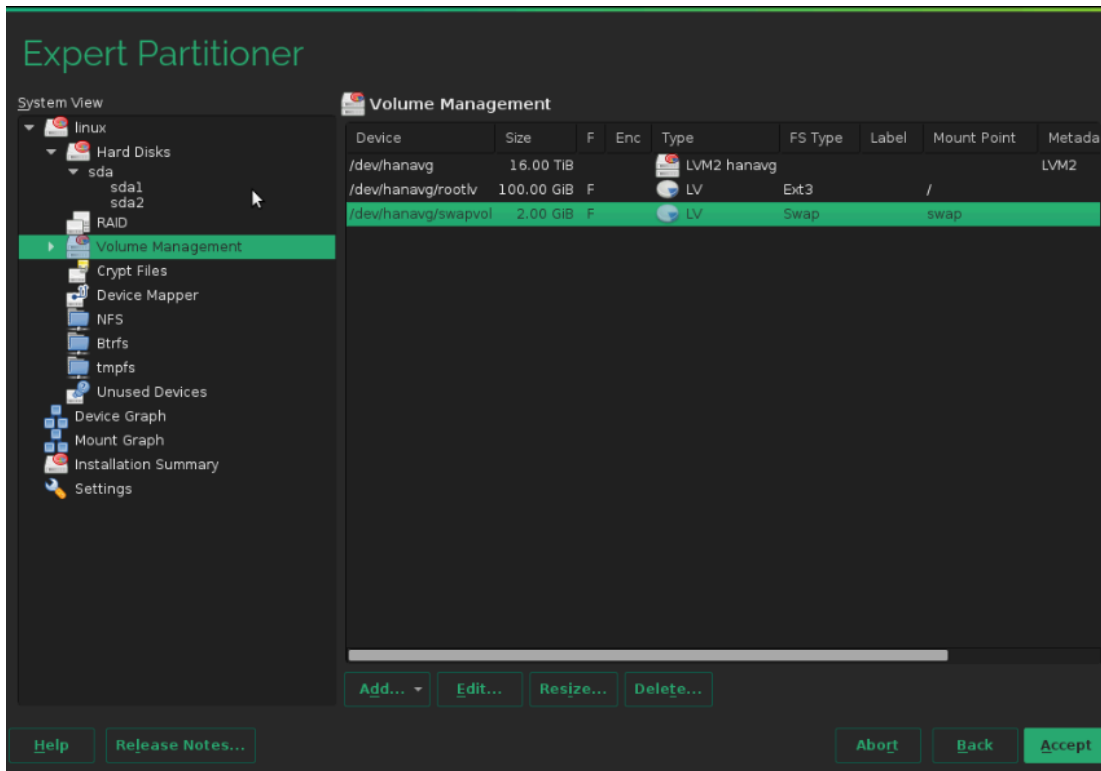
32. Specify the formatting and mounting options (Figure 62).

Figure 62. Adding another logical volume: Specify formatting and mounting options



33. Click Finish. A summary page appears (Figure 63).

Figure 63. Expert Partitioner: Volume management summary page



34. Click Accept to return to the Installation Settings page.

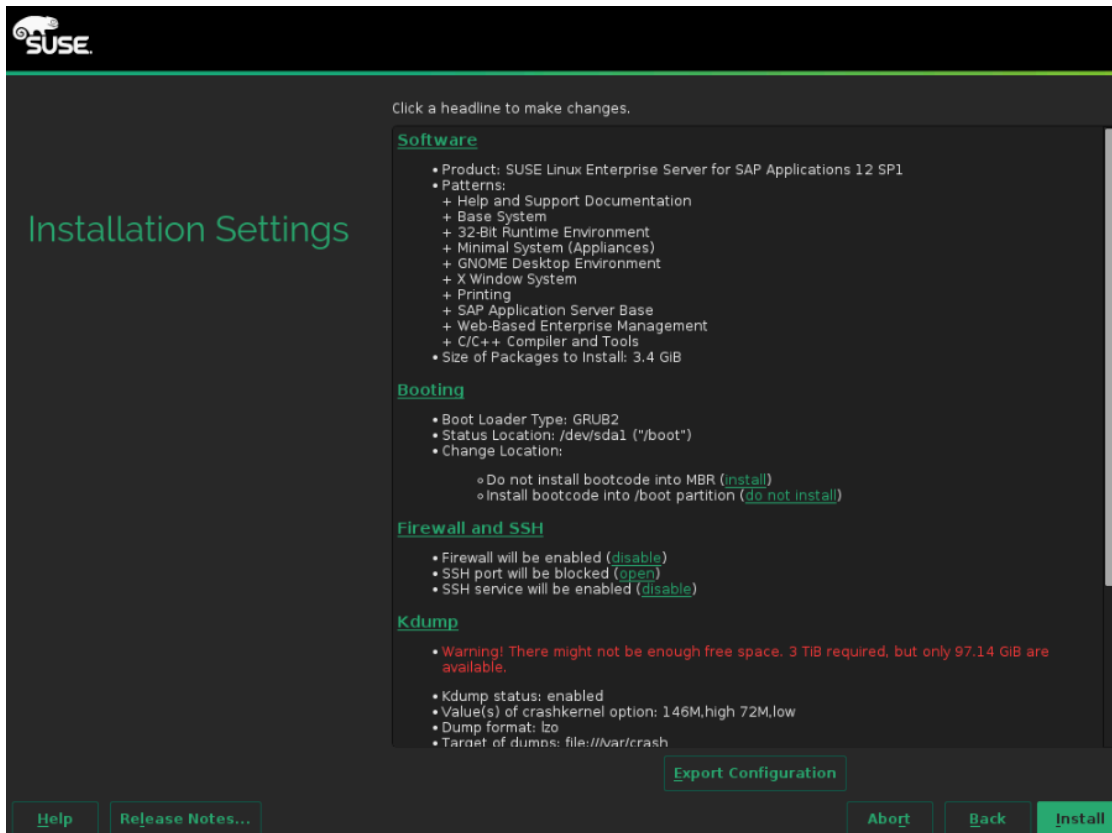
35. Review the updated partition information (Figure 64). Then click Next.

36. For Clock and Time Zone, choose the appropriate time zone and select the hardware clock set to UTC.

37. For the password for the system administrator root, enter the appropriate password using <<var_sys_root-pw>>.

38. On the Installation Settings screen, review the default information (Figure 65).

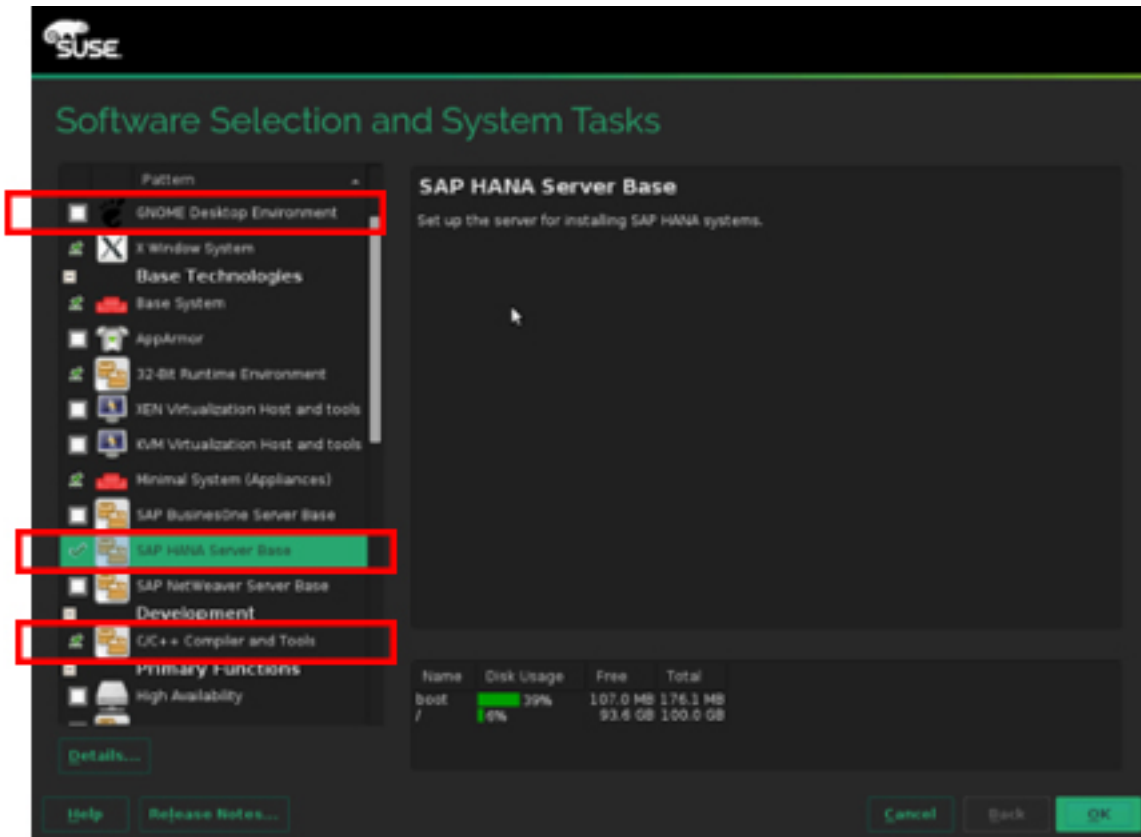
Figure 64. Installation Settings: Default proposal



39. Now customize the software selection. Click the Software headline to make changes as shown in Figure 66:

- a. Deselect GNOME Desktop Environment.
- b. Select C/C++ Compiler and Tools.
- c. Select SAP HANA Server Base.

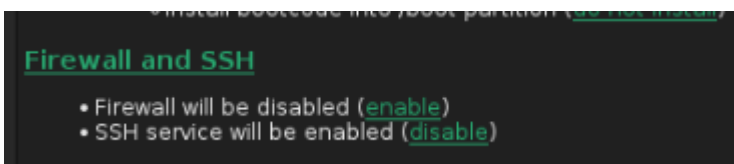
Figure 65. Software Selection and System Tasks: Customized settings



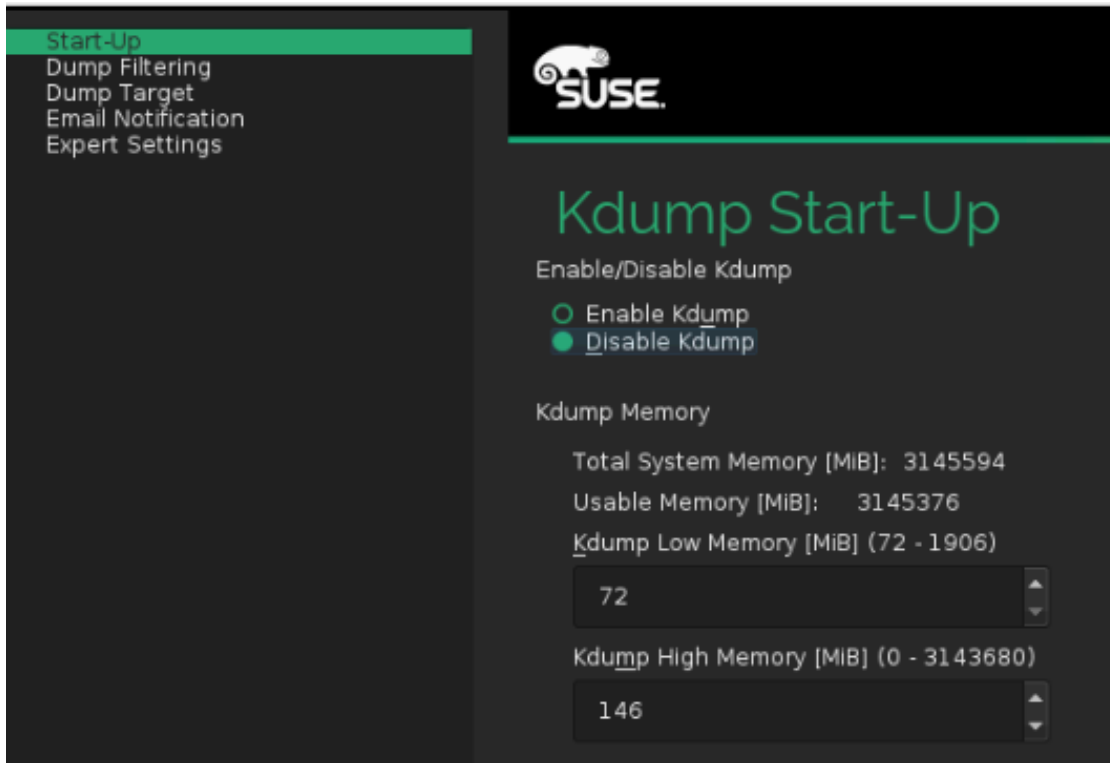
40. Click OK.

41. Under the Firewall and SSH headline, disable the firewall. This selection will automatically enable Secure Shell (SSH) service (Figure 67).

Figure 66. Firewall and SSH service customized



42. Click the Kdump headline and select Disable Kdump (Figure 68).

Figure 67. Disabling Kdump

43. Click OK.

44. Click the “Default systemd target” headline and choose “Text mode” (Figure 69).

Figure 68. Setting the default systemd target to Text mode



45. Click OK.

46. Click the Clone System Configuration headline and click “do not write it” (Figures 70 and 71).

Figure 69. Clone system configuration selection

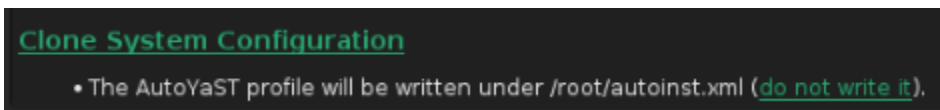
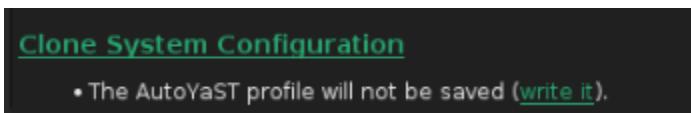
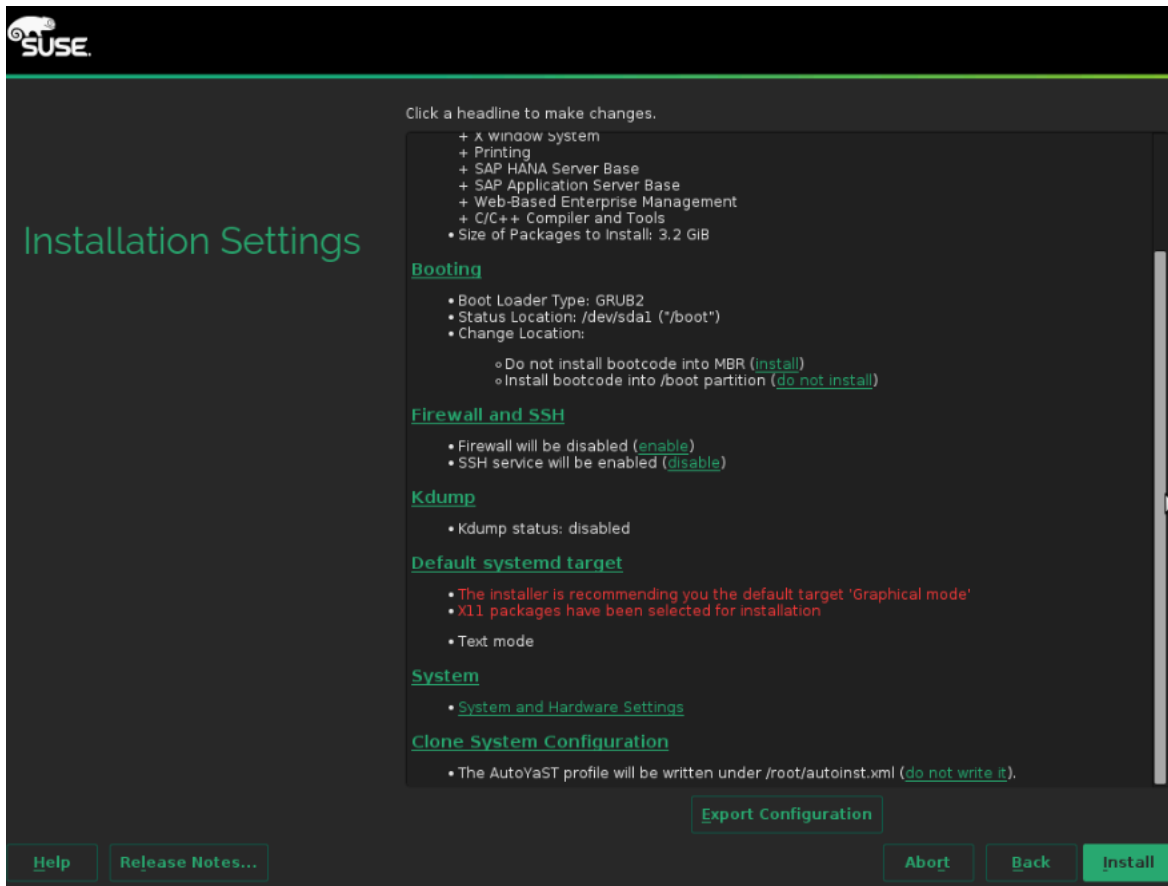


Figure 70. Clone system configuration selection (continued)



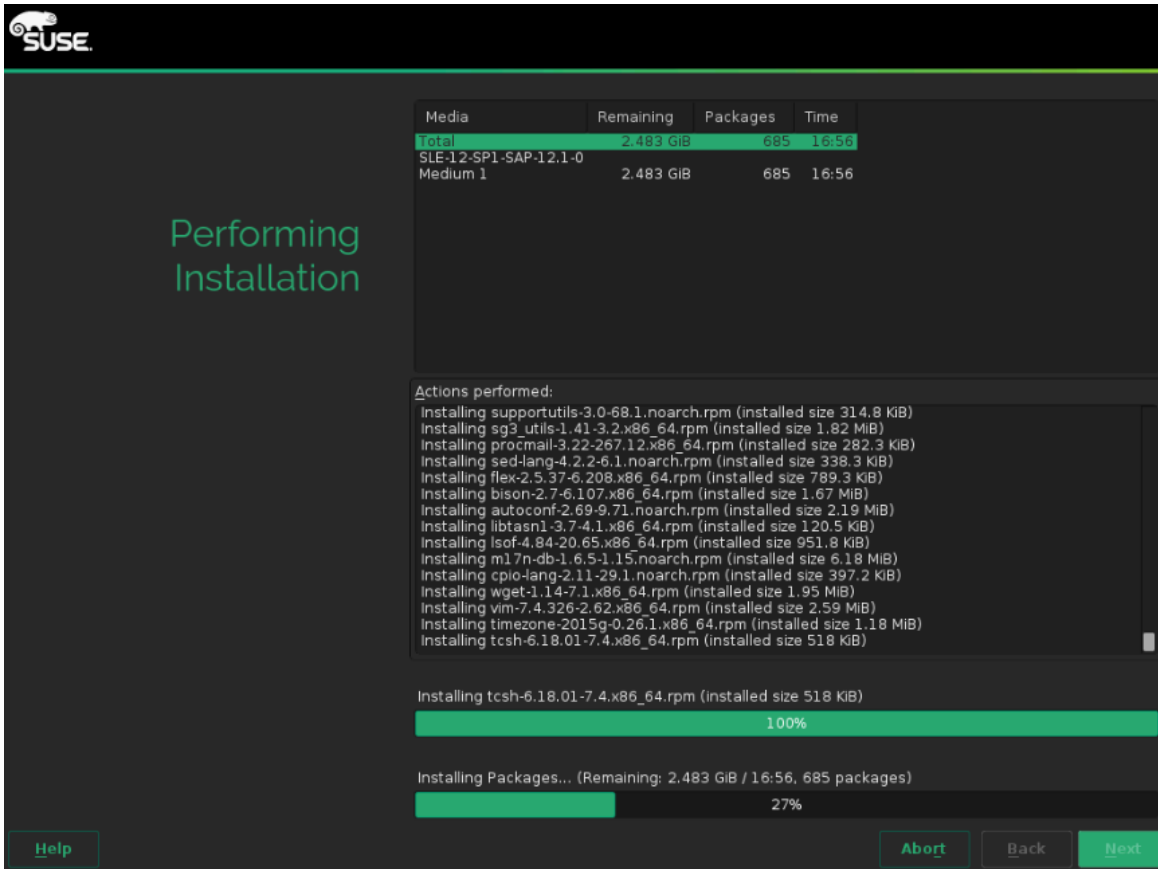
47. Leave the Booting and System default selections unchanged (Figure 72).

Figure 71. Installation Settings: Final selections



48. Click Install. Also select Install at subsequent Confirm Installation prompts. The installation starts, and you can monitor the status (Figures 73 and 74).

Figure 72. Performing the installation



SUSE

Performing Installation

Media	Remaining	Packages	Time
Total	2.483 GiB	685	16:56
SLE-12-SP1-SAP-12.1-0			
Medium 1	2.483 GiB	685	16:56

Actions performed:

- Installing supportutils-3.0-68.1.noarch.rpm (installed size 314.8 KiB)
- Installing sg3_utils-1.41-3.2.x86_64.rpm (installed size 1.82 MiB)
- Installing procmail-3.22-267.12.x86_64.rpm (installed size 282.3 KiB)
- Installing sed-lang-4.2.2-6.1.noarch.rpm (installed size 338.3 KiB)
- Installing flex-2.5.37-6.208.x86_64.rpm (installed size 789.3 KiB)
- Installing bison-2.7-6.107.x86_64.rpm (installed size 1.67 MiB)
- Installing autoconf-2.69-9.71.noarch.rpm (installed size 2.19 MiB)
- Installing libtasn1-3.7-4.1.x86_64.rpm (installed size 120.5 KiB)
- Installing lsof-4.84-20.65.x86_64.rpm (installed size 951.8 KiB)
- Installing m17n-db-1.6.5-1.15.noarch.rpm (installed size 6.18 MiB)
- Installing cpio-lang-2.11-29.1.noarch.rpm (installed size 397.2 KiB)
- Installing wget-1.14-7.1.x86_64.rpm (installed size 1.95 MiB)
- Installing vim-7.4.326-2.62.x86_64.rpm (installed size 2.59 MiB)
- Installing timezone-2015g-0.26.1.x86_64.rpm (installed size 1.18 MiB)
- Installing tcsh-6.18.01-7.4.x86_64.rpm (installed size 518 KiB)

Installing tcsh-6.18.01-7.4.x86_64.rpm (installed size 518 KiB)

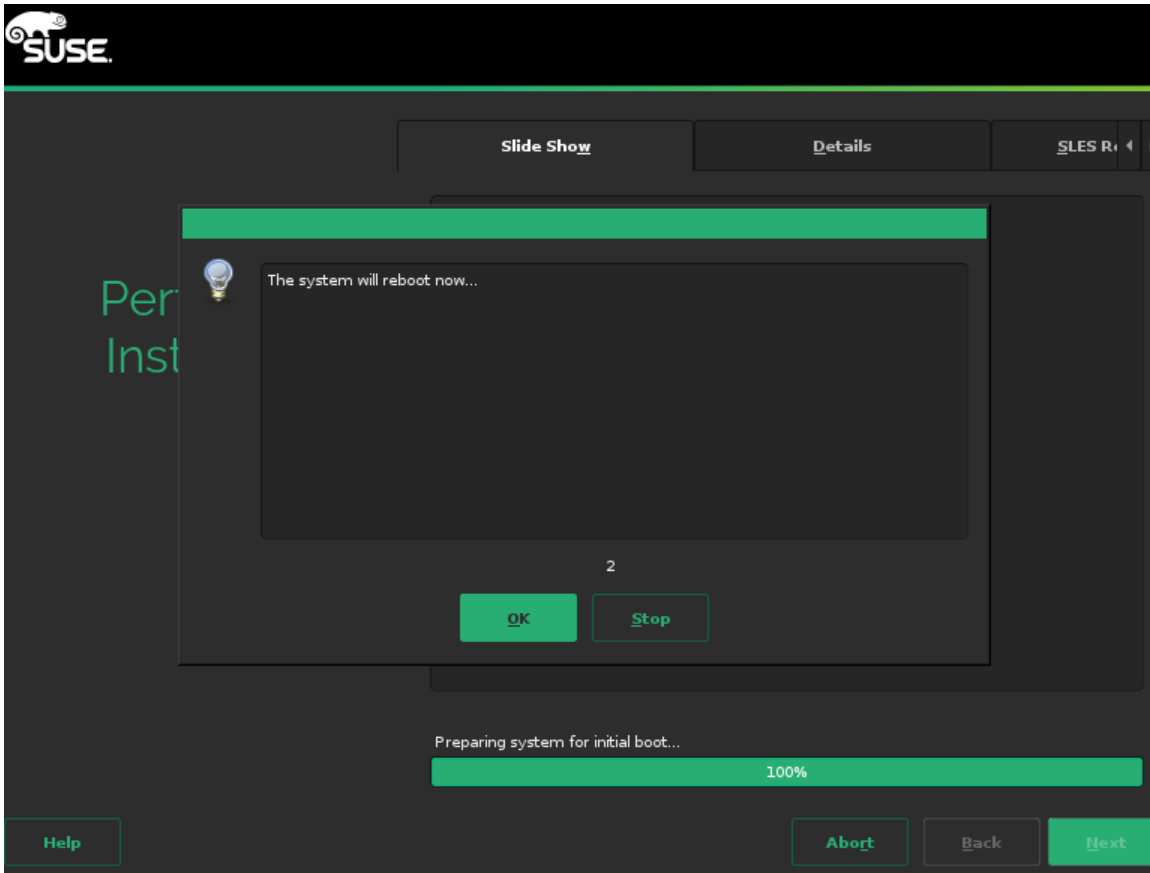
100%

Installing Packages... (Remaining: 2.483 GiB / 16:56, 685 packages)

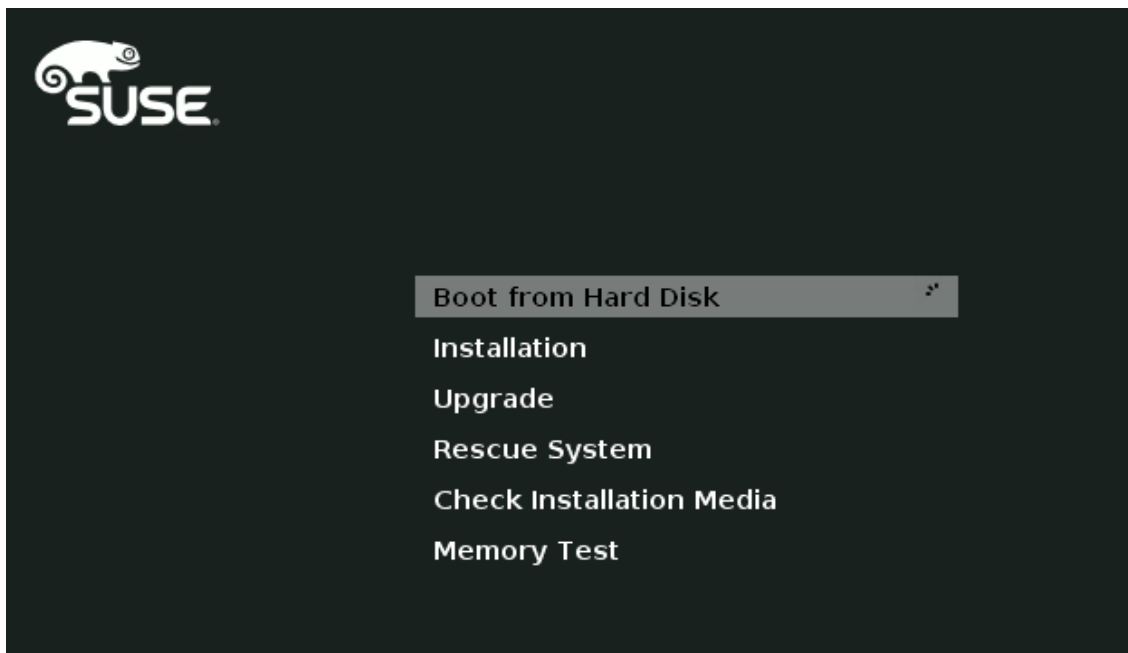
27%

[Help](#) [Abort](#) [Back](#) [Next](#)

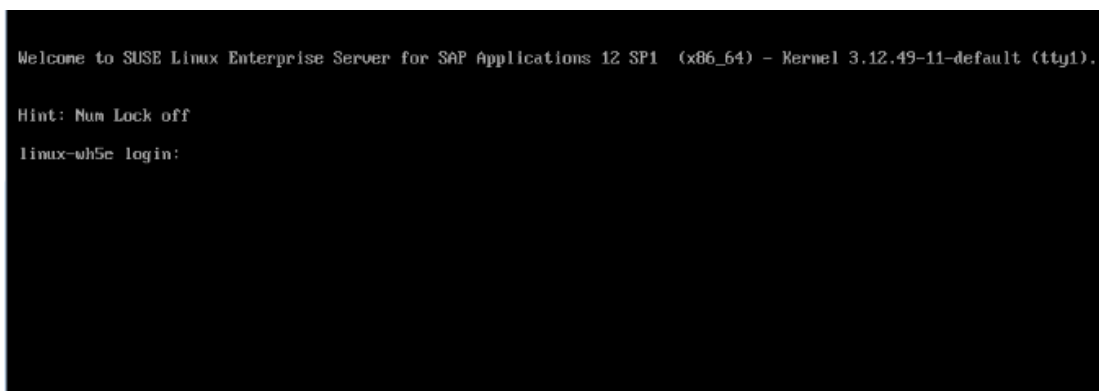
Figure 73. Performing the installation: Reboot alert when installation is complete



The system will reboot and boot from disk on startup (Figure 75).

Figure 74. Booting from hard disk

The system then displays the login prompt (Figure 76).

Figure 75. Login prompt

49. Use the KVM console to log in to the installed system as the user root with the password <<var_sys_root-pw>> (Figure 77).

Figure 76. Login using root

```

Welcome to SUSE Linux Enterprise Server for SAP Applications 12 SP1 (x86_64) - Kernel 3.12.49-11-default (tty1).

Hint: Num Lock off

linux-wh5e login: root
Password:
linux-wh5e:~ # _

```

50. Configure the host name and disable IPv6 (Figure 78):

```
#yast2
```

Figure 77. YaST Control Center: Network Settings

```

YaST2 - menu @ linux-wh5e

YaST Control Center

Software
System
Hardware
Network Services
Security and Users
Virtualization
Support
Miscellaneous

/etc/sysconfig Editor
Boot Loader
Date and Time
Kernel Kdump
Language
Network Settings
Partitioner
Services Manager

```

51. Choose System > Network Settings and press Alt+S to select the Hostname/DNS tab (Figure 79).

Figure 78. YaST Control Center: Hostname/DNS

```

YaST2 - lan @ linux-wh5e

Network Settings
Global Options—Overview—Hostname/DNS—Routing
Hostname and Domain Name
Hostname: cishana01 Domain Name: custdon.local
[x] Change Hostname via DHCP No interface with dhcp
[ ] Assign Hostname to Loopback IP

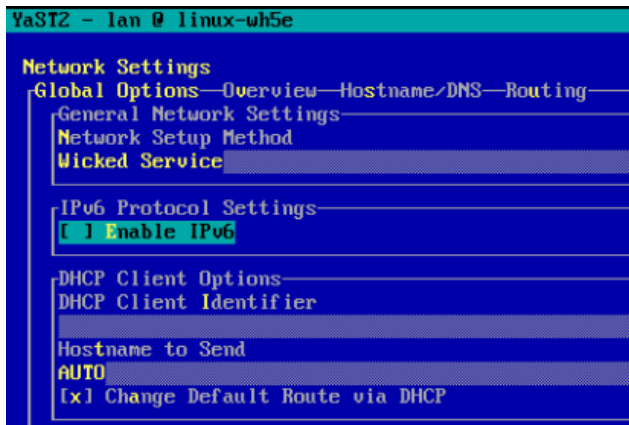
Modify DNS Configuration Custom Policy Rule
Use Default Policy ↓
Name Servers and Domain Search List
Name Server 1 Domain Search
Name Server 2
Name Server 3

```

52. Enter <<var_hostname.domain>>. Also enter the Domain Name System (DNS) server address of your network for resolution, if necessary. Then press Alt+O.

53. On the Global Options tab, using Alt+G, disable IPv6 by deselecting the Enable IPv6 option as shown in Figure 80. Note that changing the IPv6 setting requires a reboot to make the change take effect.

Figure 79. YaST: IPv6 setting



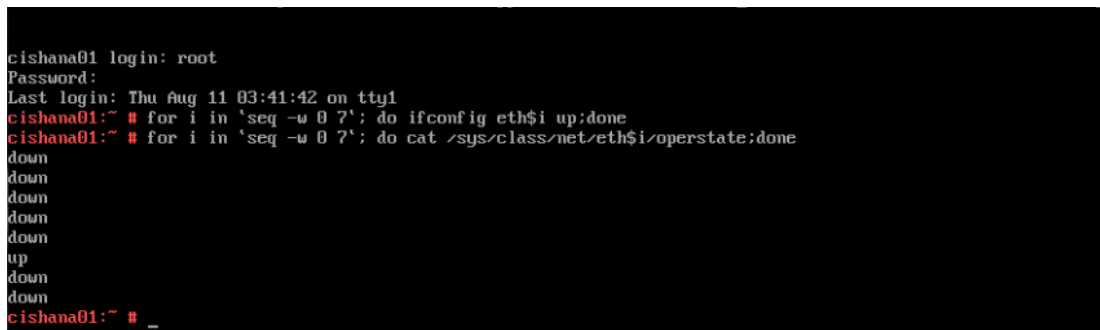
54. Press Alt+O to save the network configuration. Press Alt+Q to quit the YaST Control Center.

55. Reboot the server to make the IPv6 selection and the host-name settings take effect:

```
#reboot
```

56. Identify the Ethernet interface port that is connected to the top-of-the-rack (ToR) switch. For now, you can use that port for management connectivity to the host. You can also check the port by using the **ifconfig** command, as shown in the example in Figure 81.

Figure 80. Network interface configuration



57. Assign `<<var_mgmt_ip_address>>` as the IP address and enter `<<var_mgmt_nw_netmask>>` as the subnet mask for the available interface (for example, eth5). You can use this configuration temporarily until you port it to a high-availability bond device and create another with the Cisco VIC's 10-Gbps ports.

58. Go to the network configuration directory and create a configuration for eth5:

```

#cd /etc/sysconfig/network
#vi ifcfg-eth5
BOOTPROTO='static'
IPADDR='<<var_mgmt_ip_address>>'
NETMASK='<<var_mgmt_nw_netmask>>'
NETWORK=''
  
```

```

MTU=''
REMOTE_IPADDR=''
STARTMODE='auto'
USERCONTROL='no'

```

59. Add the default gateway:

```

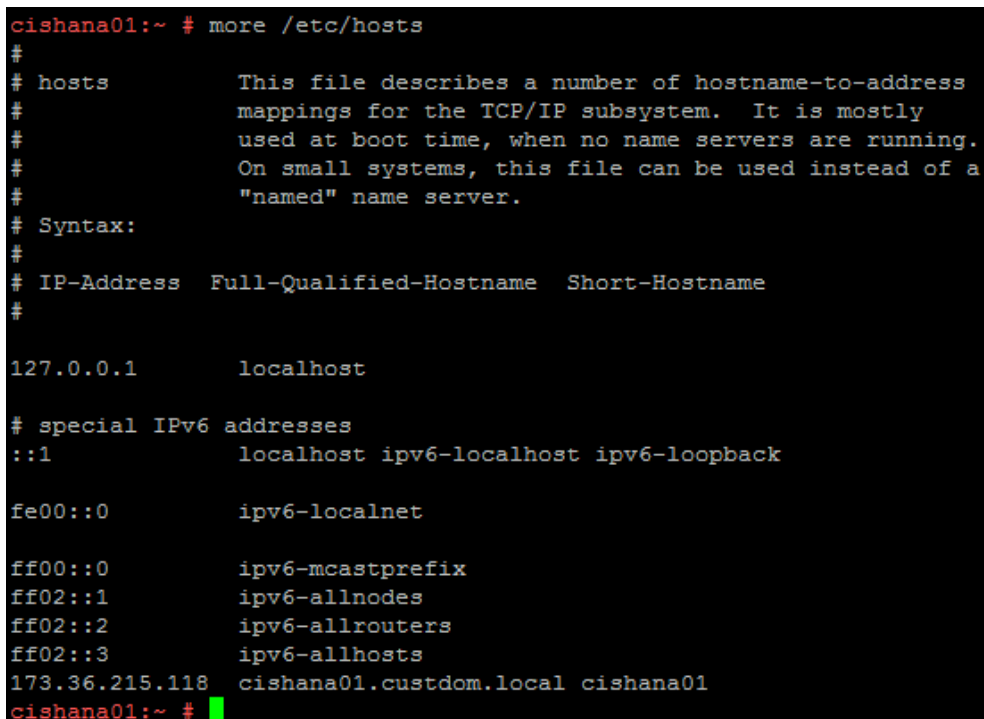
#cd /etc/sysconfig/network
# vi routes
default <<var_mgmt_gateway_ip>> - -

```

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

60. Verify /etc/hosts as shown in the example in Figure 82.

Figure 81. Verifying /etc/hosts



```

cishana01:~ # more /etc/hosts
#
# hosts          This file describes a number of hostname-to-address
#                mappings for the TCP/IP subsystem.  It is mostly
#                used at boot time, when no name servers are running.
#                On small systems, this file can be used instead of a
#                "named" name server.
# Syntax:
#
# IP-Address    Full-Qualified-Hostname  Short-Hostname
#
127.0.0.1      localhost
# special IPv6 addresses
::1           localhost ipv6-localhost ipv6-loopback
fe00::0       ipv6-localnet
ff00::0       ipv6-mcastprefix
ff02::1       ipv6-allnodes
ff02::2       ipv6-allrouters
ff02::3       ipv6-allhosts
173.36.215.118 cishana01.custdom.local cishana01
cishana01:~ #

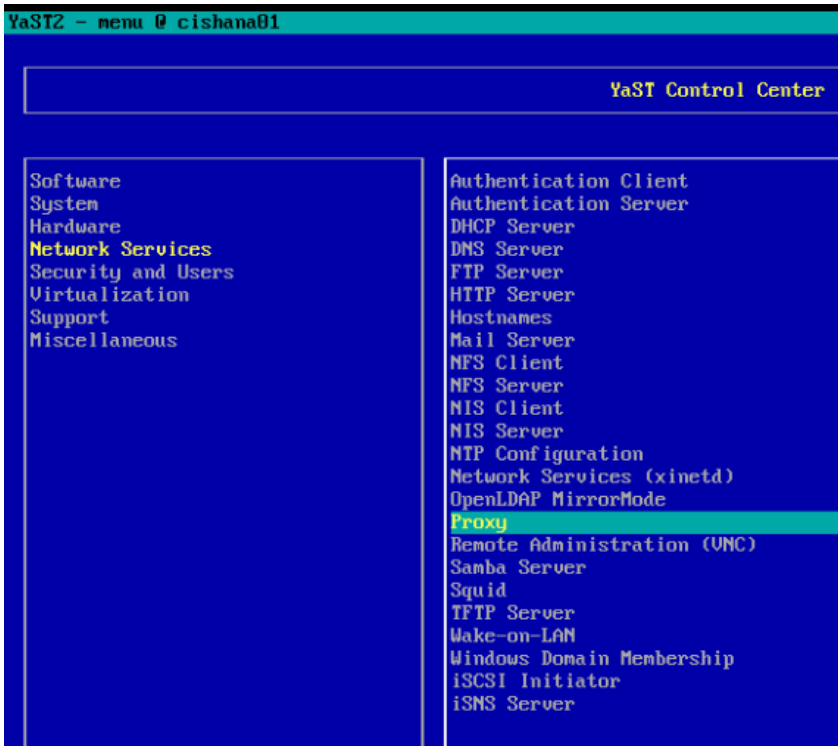
```

61. Set up a proxy service so that the appliance can reach the Internet (Figure 83):

```

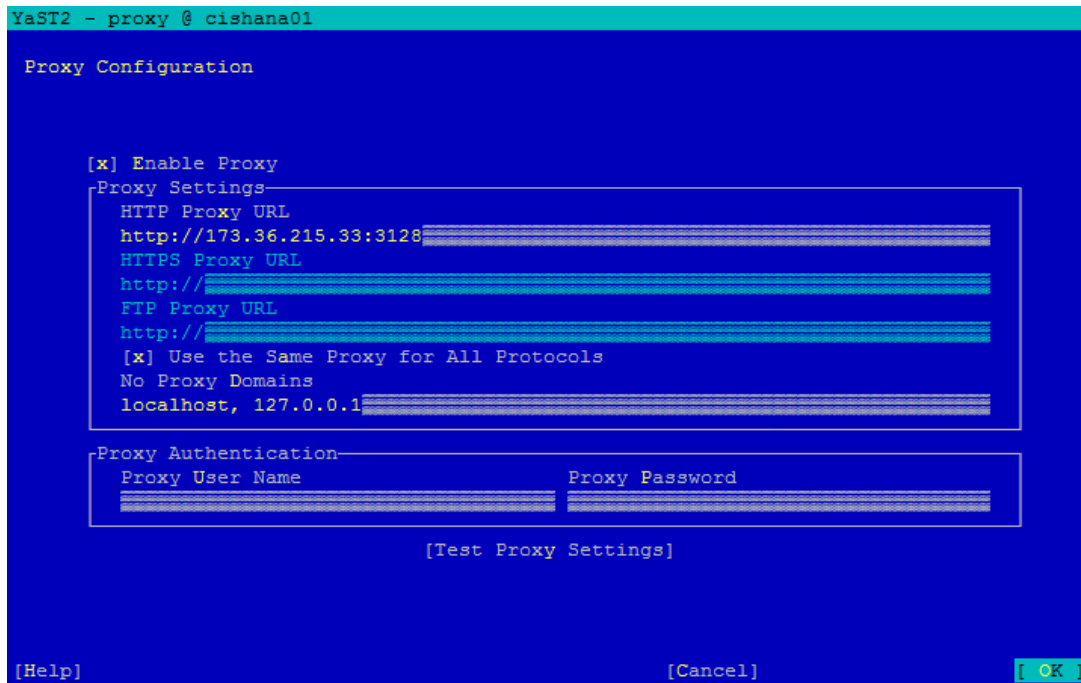
#yast2

```


Figure 82. YaST: Proxy configuration

62. Enter the proxy server and port as shown in the sample configuration in Figure 84. Select OK and then quit YaST to save the configuration.

Figure 83. YaST2: Proxy configuration (continued)



63. 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>>
```

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

```
#zypper update
```

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

Post-installation OS configuration

To optimize the use of the SAP HANA database with SLES 12 or SLES for SAP 12 SP1, apply the settings by referring this SAP HANA note: [2205917 - SAP HANA DB: Recommended OS settings for SLES 12 / SLES for SAP Applications 12](#).

Configuring bonding for high availability

To configure a bond for high availability, first view the Ethernet interfaces available in the system.

By examining the hardware and MAC addresses of the interfaces using the **ifconfig** command and the properties using **ethtool**, you can clearly differentiate the interfaces for the two dual-port Cisco UCS VIC 1225 adapters installed in the server as well as the onboard 1-Gbps interface.

A bond configured with two 1-Gbps ports can be used for the administration, management, and access networks, and a bond configured with two ports, using one port from each dual-port VIC, can be used for a backup network. Additional interfaces can be configured on the VICs based on needs.

In the example in Figure 85, the ethtool output for the interfaces showing Fibre Channel support and 10-Gbps indicates that eth0 through eth4 are VIC ports. In addition, a close observation of their MAC addresses reveals that eth0 and eth1 and that eth2 and eth3 are ports on the same VICs (in both cases, the last octet of the MAC address differs).

Therefore, for high availability, eth0 and eth2 form one possible slave pair for creating a 10-Gbps bond device.

Likewise, 1-Gbps interfaces eth4 and eth5 are potential slave interfaces for a 1-Gbps bond device.

In this section, you will manually create these two bond interfaces.

Note: In SLES, use of YaST is recommended. It provides an easier wizard like approach for creation of bond devices. For ease of implementation, this section provides steps manual configuration.

Figure 84. The ifconfig output provides an overview of the interfaces

```

cishana01:~ # ifconfig -a | grep HW
eth0      Link encap:Ethernet HWaddr 84:B8:02:8B:31:40
eth1      Link encap:Ethernet HWaddr 84:B8:02:8B:31:41
eth2      Link encap:Ethernet HWaddr 84:B8:02:8B:DE:20
eth3      Link encap:Ethernet HWaddr 84:B8:02:8B:DE:21
eth4      Link encap:Ethernet HWaddr 88:1D:FC:39:F2:12
eth5      Link encap:Ethernet HWaddr 88:1D:FC:39:F2:13
eth6      Link encap:Ethernet HWaddr 88:1D:FC:39:F2:16
eth7      Link encap:Ethernet HWaddr 88:1D:FC:39:F2:18
cishana01:~ # for i in `seq -w 0 7`;do ethtool eth$i > /tmp/ethinfo; head -n 5 /tmp/ethinfo;done
Settings for eth0:
  Supported ports: [ FIBRE ]
  Supported link modes:   10000baseT/Full
  Supports auto-negotiation: No
  Advertised link modes:  10000baseT/Full
Settings for eth1:
  Supported ports: [ FIBRE ]
  Supported link modes:   10000baseT/Full
  Supports auto-negotiation: No
  Advertised link modes:  10000baseT/Full
Settings for eth2:
  Supported ports: [ FIBRE ]
  Supported link modes:   10000baseT/Full
  Supports auto-negotiation: No
  Advertised link modes:  10000baseT/Full
Settings for eth3:
  Supported ports: [ FIBRE ]
  Supported link modes:   10000baseT/Full
  Supports auto-negotiation: No
  Advertised link modes:  10000baseT/Full
Settings for eth4:
  Supported ports: [ TP ]
  Supported link modes:   10baseT/Half 10baseT/Full
                        10GbaseT/Half 10GbaseT/Full
                        1000baseT/Full
Settings for eth5:
  Supported ports: [ TP ]
  Supported link modes:   10baseT/Half 10baseT/Full
                        10GbaseT/Half 10GbaseT/Full
                        1000baseT/Full
Settings for eth6:
  Supported ports: [ TP ]
  Supported link modes:   100baseT/Full
                        1000baseT/Full
                        10000baseT/Full
Settings for eth7:
  Supported ports: [ TP ]
  Supported link modes:   100baseT/Full
                        1000baseT/Full
                        10000baseT/Full
cishana01:~ #

```

1. Create 1-Gbps bond device ifcfg-bond0 with eth4 and eth5 as slaves.
 - a. Create a bond0 configuration file:

```
# vi /etc/sysconfig/network/ifcfg-bond0
BONDING_MASTER='yes'
BONDING_MODULE_OPTS='mode=active-backup miimon=100'
BOOTPROTO='static'
BROADCAST=''
ETHTOOL_OPTIONS=''
IPADDR='<<var_mgmt_ip_address>>/<<var_mgmt_netmask_prefix>>'
MTU=''
NAME=''
NETWORK=''
REMOTE_IPADDR=''
STARTMODE='auto'
USERCONTROL='no'
BONDING_SLAVE0='eth4'
BONDING_SLAVE1='eth5'
```

- b. Modify the eth4 and eth5 configuration files:

```
# vi /etc/sysconfig/network/ifcfg-eth4
BOOTPROTO='none'
BROADCAST=''
ETHTOOL_OPTIONS=''
IPADDR=''
MTU=''
NAME='VIC Ethernet NIC'
NETMASK=''
NETWORK=''
REMOTE_IPADDR=''
STARTMODE='hotplug'
USERCONTROL='no'
```

```
# vi /etc/sysconfig/network/ifcfg-eth5
BOOTPROTO='none'
BROADCAST=''
ETHTOOL_OPTIONS=''
IPADDR=''
MTU=''
NAME='VIC Ethernet NIC'
NETMASK=''
NETWORK=''
REMOTE_IPADDR=''
```

```
STARTMODE='hotplug'
USERCONTROL='no'
```

c. Test the configuration.

Restart the network service to bring up the bond0 interface. Then enter the following command:

```
# rcnetwork restart
```

To query the current status of the Linux kernel bonding driver, enter the following command:

```
# cat /proc/net/bonding/bond0
```

Figure 86 shows sample output.

Figure 85. Sample bond0 configuration test output

```
cishana01:/etc/sysconfig/network # cat /proc/net/bonding/bond0
Ethernet Channel Bonding Driver: v3.7.1 (April 27, 2011)

Bonding Mode: fault-tolerance (active-backup)
Primary Slave: None
Currently Active Slave: eth5
MII Status: up
MII Polling Interval (ms): 100
Up Delay (ms): 0
Down Delay (ms): 0

Slave Interface: eth4
MII Status: down
Speed: Unknown
Duplex: Unknown
Link Failure Count: 0
Permanent HW addr: 88:1d:fc:39:f2:12
Slave queue ID: 0

Slave Interface: eth5
MII Status: up
Speed: 1000 Mbps
Duplex: full
Link Failure Count: 0
Permanent HW addr: 88:1d:fc:39:f2:13
Slave queue ID: 0
cishana01:/etc/sysconfig/network # █
```

2. Create 10-Gbps bond device ifcfg-bond1 with eth0 and eth2 as slaves.

a. Create a bond1 configuration file:

```
# vi /etc/sysconfig/network/ifcfg-bond1
BONDING_MASTER='yes'
BONDING_MODULE_OPTS='mode=active-backup miimon=100'
BOOTPROTO='static'
BROADCAST=''
ETHTOOL_OPTIONS=''
```

```
IPADDR='<<ip_address_customer_usecase>>/<<netmask_prefix>>'
MTU=''
NAME=''
NETWORK=''
REMOTE_IPADDR=''
STARTMODE='auto'
USERCONTROL='no'
BONDING_SLAVE0='eth0'
BONDING_SLAVE1='eth2'
```

- b. Modify the eth0 and eth2 configuration files:

```
# vi /etc/sysconfig/network/ifcfg-eth0
BOOTPROTO='none'
BROADCAST=''
ETHTOOL_OPTIONS=''
IPADDR=''
MTU=''
NAME='VIC Ethernet NIC'
NETMASK=''
NETWORK=''
REMOTE_IPADDR=''
STARTMODE='hotplug'
USERCONTROL='no'
```

```
# vi /etc/sysconfig/network/ifcfg-eth2
BOOTPROTO='none'
BROADCAST=''
ETHTOOL_OPTIONS=''
IPADDR=''
MTU=''
NAME='VIC Ethernet NIC'
NETMASK=''
NETWORK=''
REMOTE_IPADDR=''
STARTMODE='hotplug'
USERCONTROL='no'
```

- c. Test the configuration.

Restart the networking service to bring up the bond0 interface. Enter the following command:

```
# rcnetwork restart
```

To query the current status of Linux kernel bonding driver, enter the following command:

```
# cat /proc/net/bonding/bond1
```

Figure 87 shows sample output.

Figure 86. Sample bond1 configuration test output

```
cishana01:/etc/sysconfig/network # cat /proc/net/bonding/bond1
Ethernet Channel Bonding Driver: v3.7.1 (April 27, 2011)

Bonding Mode: fault-tolerance (active-backup)
Primary Slave: None
Currently Active Slave: None
MII Status: down
MII Polling Interval (ms): 100
Up Delay (ms): 0
Down Delay (ms): 0

Slave Interface: eth0
MII Status: down
Speed: Unknown
Duplex: Unknown
Link Failure Count: 0
Permanent HW addr: 84:b8:02:8b:31:40
Slave queue ID: 0

Slave Interface: eth2
MII Status: down
Speed: Unknown
Duplex: Unknown
Link Failure Count: 0
Permanent HW addr: 84:b8:02:5b:de:20
Slave queue ID: 0
cishana01:/etc/sysconfig/network #
```

Preparing SAP HANA data, log, and shared file systems

To prepare the file systems, you start by carving out logical volumes for the data, log, and HANA shared files. Then you create the file systems. Then you update /etc/fstab and mount the volumes.

1. Use the following command to check for the available physical volume (PV), as shown in Figure 88:

```
#pvdisplay
```

Figure 87. Checking for the physical volume

```
[root@cishana01 ~]# pvdisplay
--- Physical volume ---
PV Name           /dev/sda2
VG Name           hanavg
PV Size           16.00 TiB / not usable 0
Allocatable       yes
PE Size           4.00 MiB
Total PE          4193418
Free PE           4167306
Allocated PE      26112
PV UUID           zvb8AK-Dyf8-fkyU-Xznt-1XHx-RgmZ-9q6qI6
```

2. Use the following command to check for the available volume group (VG) hanavg (Figure 89):

```
#vgdisplay
```

Figure 88. Checking for the volume group

```
[root@cishana01 ~]# vgsdisplay
--- Volume group ---
VG Name          hanavg
System ID
Format           lvm2
Metadata Areas   1
Metadata Sequence No 3
VG Access        read/write
VG Status        resizable
MAX LV           0
Cur LV          2
Open LV          2
Max PV           0
Cur PV          1
Act PV           1
VG Size          16.00 TiB
PE Size          4.00 MiB
Total PE         4193418
Alloc PE / Size  26112 / 102.00 GiB
Free PE / Size   4167306 / 15.90 TiB
VG UUID          4sIS1V-tpWq-cSse-qjaY-0V1V-0dFu-38jYrV
```

3. Create logical volumes (LVs) for the data, log, and HANA shared file systems (Figure 90):

```
lvcreate -name <<lvname>> -I<<stripesize>> -L<<volume-size>> <<parent-vg-name>>
# lvcreate --name datalv -I256 -L9T hanavg
# lvcreate --name loglv -I256 -L512G hanavg
# lvcreate --name sharedlv -I256 -L3T hanavg
```

Figure 89. Creating logical volumes

```
[root@cishana01 ~]# lvcreate --name datalv -I256 -L9T hanavg
Ignoring stripesize argument with single stripe.
Logical volume "datalv" created.

[root@cishana01 ~]# lvcreate --name loglv -I256 -L512G hanavg
Ignoring stripesize argument with single stripe.
Logical volume "loglv" created.

[root@cishana01 ~]# lvcreate --name sharedlv -I256 -L3T hanavg
Ignoring stripesize argument with single stripe.
Logical volume "sharedlv" created.
```

4. Create file systems in the data, log and HANA shared volumes (Figure 91):

```
#mkfs.xfs -f /dev/hanavg/datalv
#mkfs.xfs -f /dev/hanavg/loglv
#mkfs.xfs -f /dev/hanavg/sharedlv
```


Figure 90. Creating file systems

```
[root@cishana01 ~]# mkfs.xfs -f /dev/hanavg/datalv
meta-data=/dev/hanavg/datalv      isize=256    agcount=9, agsize=268435455 blks
      =                               sectsz=512   attr=2, projid32bit=0
data      =                               bsize=4096  blocks=2415919095, imaxpct=5
      =                               sunit=0     swidth=0 blks
naming    =version 2                 bsize=4096  ascii-ci=0
log       =internal log              bsize=4096  blocks=521728, version=2
      =                               sectsz=512   sunit=0 blks, lazy-count=1
realtime  =none                       extsz=4096  blocks=0, rtextents=0
[root@cishana01 ~]# mkfs.xfs -f /dev/hanavg/loglv
meta-data=/dev/hanavg/loglv       isize=256    agcount=4, agsize=33554432 blks
      =                               sectsz=512   attr=2, projid32bit=0
data      =                               bsize=4096  blocks=134217728, imaxpct=25
      =                               sunit=0     swidth=0 blks
naming    =version 2                 bsize=4096  ascii-ci=0
log       =internal log              bsize=4096  blocks=65536, version=2
      =                               sectsz=512   sunit=0 blks, lazy-count=1
realtime  =none                       extsz=4096  blocks=0, rtextents=0
[root@cishana01 ~]# mkfs.xfs -f /dev/hanavg/sharedlv
meta-data=/dev/hanavg/sharedlv    isize=256    agcount=4, agsize=201326592 blks
      =                               sectsz=512   attr=2, projid32bit=0
data      =                               bsize=4096  blocks=805306368, imaxpct=5
      =                               sunit=0     swidth=0 blks
naming    =version 2                 bsize=4096  ascii-ci=0
log       =internal log              bsize=4096  blocks=393216, version=2
      =                               sectsz=512   sunit=0 blks, lazy-count=1
realtime  =none                       extsz=4096  blocks=0, rtextents=0
```

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

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

6. Mount options vary from the default Linux settings for XFS for SAP HANA data and log volumes. 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.

<code>/dev/mapper/hanavg-rootlv</code>	<code>/</code>	<code>ext3</code>	<code>defaults</code>	<code>1 1</code>
<code>UUID=fc2e52c4-e6f6-4e9a-9ad1-86aeb3369942</code>	<code>/boot</code>	<code>ext3</code>	<code>defaults</code>	
<code>1 2</code>				
<code>/dev/mapper/hanavg-swapvol</code>	<code>swap</code>	<code>swap</code>	<code>defaults</code>	<code>0 0</code>
<code>/dev/hanavg/datalv</code>	<code>/hana/data</code>			
<code>xfs nobARRIER,NOATIME,NODIRATIME,LOGBUFS=8,LOGBSIZE=256k,ASYNCSWALLOC,ALLOCSIZE=131072k</code>				<code>1 2</code>
<code>/dev/hanavg/loglv</code>	<code>/hana/log</code>	<code>xfs</code>		
<code>nobARRIER,NOATIME,NODIRATIME,LOGBUFS=8,LOGBSIZE=256k,ASYNCSWALLOC,ALLOCSIZE=131072k</code>				<code>1 2</code>
<code>/dev/hanavg/sharedlv</code>	<code>/hana/shared</code>	<code>xfs</code>	<code>defaults</code>	<code>1 2</code>

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

```
#mount -a
```

8. Use the `df -h` command to check the status of all mounted volumes (Figure 92).

Figure 91. Checking the status of mounted volumes

```
[root@cishana01 ~]# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/mapper/hanavg-rootlv
                99G  882M   93G   1% /
/dev/sda1       485M   47M  414M  11% /boot
tmpfs           1.5T     0  1.5T   0% /dev/shm
/dev/mapper/hanavg-datalv
                9.0T   33M   9.0T   1% /hana/data
/dev/mapper/hanavg-loglv
                512G   33M  512G   1% /hana/log
/dev/mapper/hanavg-sharedlv
                3.0T   33M   3.0T   1% /hana/shared
[root@cishana01 ~]#
```

9. 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, see [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 can be found 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 1780950](#): Connection problems due to host name resolution
- [SAP Note 1755396](#): Released disaster tolerant (DT) solutions for SAP HANA with disk replication
- [SAP Note 1890444](#): HANA system slow due to CPU power save mode
- [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 1731000](#): Nonrecommended configuration changes
- [SAP Note 1557506](#): Linux paging improvements
- [SAP Note 1726839](#): SAP HANA database: Potential crash when using XFS file system
- [SAP Note 1740136](#): SAP HANA: Wrong mount option may lead to corrupt persistency
- [SAP Note 1829651](#): Time-zone settings in SAP HANA scale-out landscapes

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 1788665](#): SAP HANA running on VMware vSphere virtual machines

Performing an SAP HANA post-installation 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 bwladm and run the commands presented here.

Commands for checking SAP HANA services

```
bwladm@cishana01:/usr/sap/BWL/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
hdbcompileservers, 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
bwladm@cishana01-bwl:/usr/sap/BWL/HDB00>
```

Commands for checking SAP HANA database (HDB) information

```

bwladm@cishana01:/usr/sap/BWL/HDB00> HDB info
USER          PID    PPID %CPU   VSZ   RSS COMMAND
bwladm       59578  59577 0.0 108472 1944 -sh
bwladm       59663  59578 0.0 114080 2020 \_ /bin/sh /usr/sap/BWL/HDB00/HDB info
bwladm       59692  59663 0.0 118048 1596 \_ ps fx -U bwladm -o
user,pid,ppid,pcpu,vsz,rss,args
bwladm       41683    1 0.0 22188 1640 sapstart
pf=/hana/shared/BWL/profile/BWL_HDB00_cishana01-bwl
bwladm       41691  41683 0.0 582888 290988 \_ /usr/sap/BWL/HDB00/cishana01-
bwl/trace/hdb.sapBWL_HDB00 -d -nw -f /usr/sap/BWL/HDB00/cishana01-bwl/daemon.ini
bwladm       41711  41691 0.3 54292416 2058900 \_ hdbnameserver
bwladm       41837  41691 0.1 4278472 1243356 \_ hdbcompileserver
bwladm       41839  41691 0.2 11773976 8262724 \_ hdbpreprocessor
bwladm       41863  41691 6.2 22143172 18184604 \_ hdbindexserver
bwladm       41865  41691 0.5 8802064 2446612 \_ hdbxsengine
bwladm       42431  41691 0.1 4352988 823220 \_ hdbwebdispatcher
bwladm       41607    1 0.0 497576 23232 /usr/sap/BWL/HDB00/exe/sapstartsrv
pf=/hana/shared/BWL/profile/BWL_HDB00_cishana01-bwl -D -u bwladm
bwladm@cishana01-bwl:/usr/sap/BWL/HDB00>

```

Tuning the SAP HANA performance parameters

After SAP HANA is installed, tune the parameters as shown in Table 13 and explained in the following SAP Notes.

Table 13. 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

- [SAP Note 2399079](#): Elimination of hdbparam in HANA 2
- [SAP Note 2186744](#): FAQ: SAP HANA Parameters

Maintenance operations

This section discusses how to maintain and operate SUSE and SAP HANA.

Maintaining the operating system

The customer is responsible for implementing security updates and patches, adding software components, and changing OS settings that may be requested by SAP for future releases of SAP HANA or that may be required by SUSE to help ensure system security and stability. See the related SAP OSs notes for required OS settings.

This section describes how to update the OS and the implications of updating OS components. It is not meant to replace the Linux administration documentation.

Prerequisites

Whenever you change the OS or parts of the OS such as drivers and kernel parameters, be sure that you have at least a backup copy of your SAP HANA system, preferably not stored on the appliance. You also should check the related OS notes or Cisco support channels for additional information.

Some changes may require a reboot and should be applied when SAP HANA is shut down.

Updating the OS and kernel

Not all updates and patches update the OS kernel. But if a kernel update is necessary, you need to take specific precautions. During the entire update process, SAP HANA must be shut down.

These are the general steps for updating the kernel:

- Perform these tasks before updating the kernel:
 - Stop SAP HANA and back up the existing log area (in case the device causes a problem and needs to be re-created).
 - Unmount /hana/log and clean /etc/fstab.
- Update the kernel using YaST (or a manual procedure).
- Perform these tasks after updating the kernel:
 - Check the GRUB file and boot sector (menu.lst).
 - Reboot and check /etc/fstab.

The following steps present the tasks in more detail.

1. Back up the SAP HANA log area.
 - a. Stop SAP HANA. Then move to the log area and back up the HANA log partition.

```
cishana01 :~ # cd /hana/log
cishana01 :/hana/log # find . -xdev | cpio -oav > /backup/hana.log.cpio
```

- b. If the backup partition has enough room, choose it. Otherwise, choose an appropriate location for the backup.

2. Unmount /hana/log.

```
cishana01 :~ #umount /hana/log
```

Updating SUSE and the kernel online

You can update the operating system and kernel either through YaST or manually.

Option 1: Using YaST

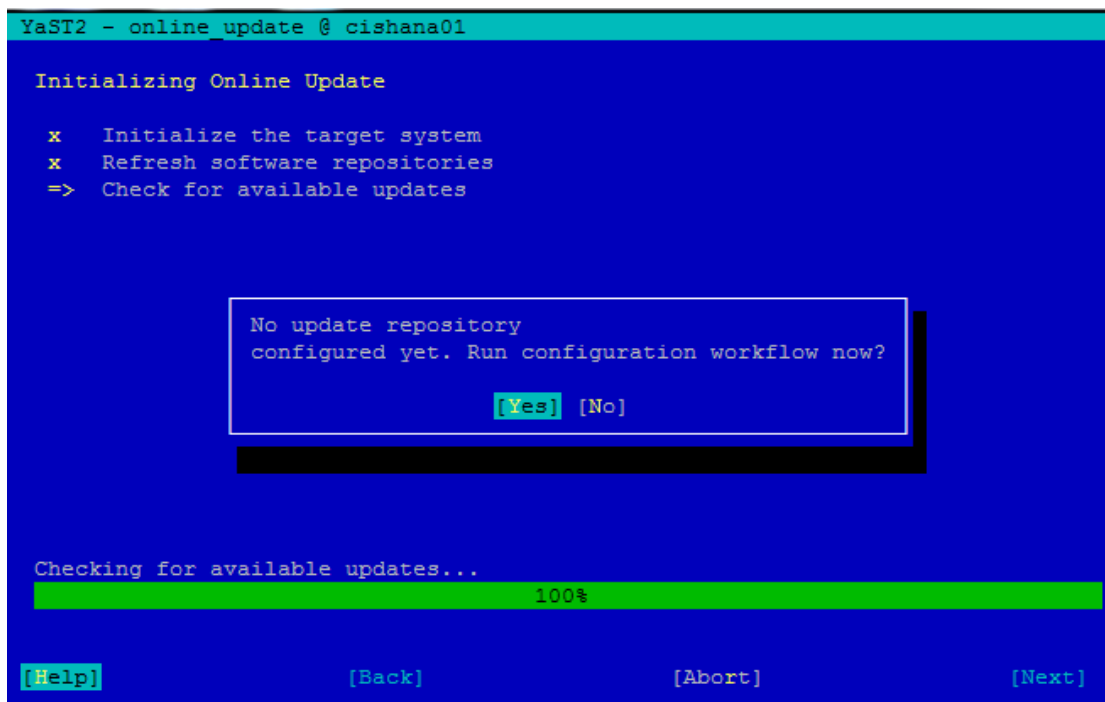
You can update the OS online using YaST. This method will update all OS components; a kernel update may also be included.

1. Set up a proxy service, if necessary, so that the appliance can reach the Internet. Make sure that **PROXY_ENABLED** is set to **"yes"** and that the appropriate proxy server host, IP address, and port are configured and used.

```
cishana01:~ # cd /etc/sysconfig/
cishana01:/etc/sysconfig # vi proxy
PROXY_ENABLED="yes"
HTTP_PROXY="http://<Proxy_server_IP>:<Proxy_Service_port>"
HTTPS_PROXY="http://<Proxy_server_IP>:<Proxy_service_port>"
FTP_PROXY="http://<Proxy_server_IP>:<Proxy_service_port>"
```

2. Start YaST and choose Software > Online Update.
 - a. Select Yes to configure the update repository (Figure 93).

Figure 92. YaST: Online update



```
YaST2 - online update @ cishana01

Initializing Online Update

x  Initialize the target system
x  Refresh software repositories
=> Check for available updates

No update repository
configured yet. Run configuration workflow now?

[Yes] [No]

Checking for available updates...
100%

[Help] [Back] [Abort] [Next]
```

- b. Log in with the Novel account you used for licensing to register the server (Figure 94). Then click Next.

Figure 93. YaST online update: Registration

```
YaST2 - online_update @ cishana01

Registration                                                    [Network Configuration...]

SUSE Linux Enterprise Server for SAP Applications 12 SP1

Please enter a registration or evaluation code for this product and your
User Name/E-mail address from the SUSE Customer Center in the fields below.
Access to security and general software updates is only possible on
a registered system.

E-mail Address
=====
Registration Code
=====
[Local Registration Server...]
[Skip Registration]

[Help]                [Back]                [Abort]                [Next]
```

- c. An overview of the available extension and modules is displayed (Figure 95). Click Next.

Figure 94. YaST online update: Extension and Module Selection

```
YaST2 - online_update @ cishana01

Extension and Module Selection

Available Extensions and Modules

[ ] SUSE Enterprise Storage 2.1 x86_64          [ ] Legacy Module 12 x86_6
[ ] SUSE Enterprise Storage 3 x86_6
[ ] SUSE Linux Enterprise High Availability GEO Extension 12 S[ ] Public Cloud Module 12 x8
[ ] SUSE Linux Enterprise Live Patching 12 x86_6
[ ] SUSE Linux Enterprise Workstation Extension 12 SP1 x86_6 [ ] Toolchain Module 12 x86_6
[ ] SUSE Linux Enterprise Software Development Kit 12 SP1 x86_
[ ] Advanced Systems Management Module 12 x86_6          [ ] Web and Scripting Module
[ ] Certifications Module 12 x86_6
[ ] Containers Module 12 x86_6

Details

SUSE Linux Enterprise Workstation Extension extends the functionality of SUSE Linux
Enterprise Server with packages of SUSE Linux Enterprise Desktop, like additional desktop
applications (office suite, email client, graphical editor ...) and libraries. It allows
to combine both products to create a full featured Workstation.

[Help]                [Back]                [Abort]                [Next]
```

- d. A list of the available patches from the online repository is displayed (Figure 96). Click Accept.

Figure 95. YaST online update: Patches list

```
YaST2 - online_update @ cishana01

[Filterâ]          [Actionsâ]          [Viewâ]          [Dependenciesâ]

Name              Kind                Summary
SUSE-SLE-HA-12-SP1-2016-1010 recommended Recommended update for libdlm
SUSE-SLE-HA-12-SP1-2016-102  recommended Recommended update for sle-ha-manuals
SUSE-SLE-HA-12-SP1-2016-1049 recommended Recommended update for crmsh
SUSE-SLE-HA-12-SP1-2016-1052 recommended Recommended update for libdlm
SUSE-SLE-HA-12-SP1-2016-1121 recommended Recommended update for pssh
SUSE-SLE-HA-12-SP1-2016-1142 security           Security update for hawk2
SUSE-SLE-HA-12-SP1-2016-1158 recommended Recommended update for resource-agents
SUSE-SLE-HA-12-SP1-2016-1204 recommended Recommended update for crmsh
SUSE-SLE-HA-12-SP1-2016-284  recommended Recommended update for fence-agents
SUSE-SLE-HA-12-SP1-2016-312  recommended Recommended update for yast2-drbd
SUSE-SLE-HA-12-SP1-2016-360  recommended Recommended update for hawk2 and yast2
SUSE-SLE-HA-12-SP1-2016-365  recommended Recommended update for crmsh
SUSE-SLE-HA-12-SP1-2016-390  optional          Initial release of aws-vpc-move-ip

Filter: Online Update Patches          Total Download Size: 18.5 MB

Patch: SUSE-SLE-HA-12-SP1-2016-1010 Kind: recommended Version: 1

This update for libdlm to version 4.0.4 includes the following
changes:

- Don't SIGKILL dlm_controld
- Make systemd stop dlm on corosync restart
- dlm_controld: don't log error from cpg_dispatch
- Fix rejection of valid connections in dlm_controld
- Make fail_time in dlm_stonith optional
- Fix segmentation fault during status printing in libdlmcontrol
- Add dlm_stonith man page
- Output of dlm_tool ls should distinguish causes for wait fencing
message. (bnc#977201)

[Helpâ]          [Cancel] [Accept]
```

The system will download all available patches (Figures 97 and 98).

Figure 96. YaST online update: Package update

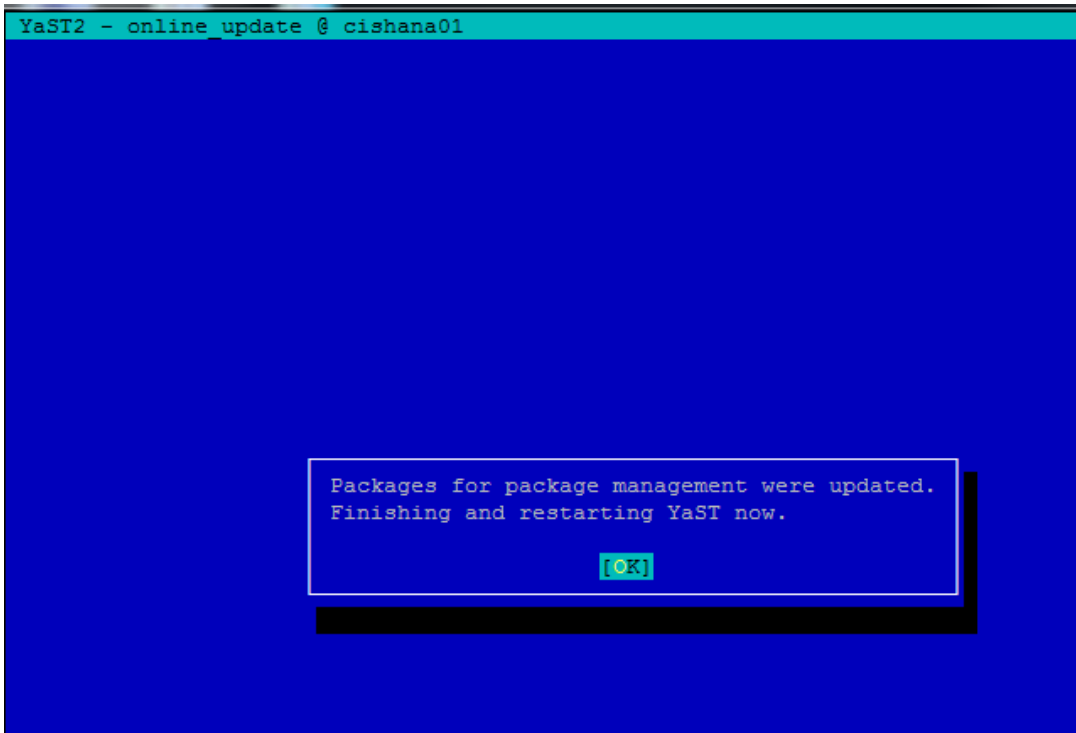


Figure 97. YaST online update: List of packages updated

```
YaST2 - online_update @ cishana01

[Filterâ]      [Actionsâ]      [Viewâ]      [Dependenciesâ]

+ Name      Kind      Summary
a+ SUSE-SLE-HA-12-SP1-2016-1010 recommended Recommended update for libdlm
a+ SUSE-SLE-HA-12-SP1-2016-1049 recommended Recommended update for crmsh
a+ SUSE-SLE-HA-12-SP1-2016-1052 recommended Recommended update for libdlm
a+ SUSE-SLE-HA-12-SP1-2016-1158 recommended Recommended update for resource-agents
a+ SUSE-SLE-HA-12-SP1-2016-1204 recommended Recommended update for crmsh
a+ SUSE-SLE-HA-12-SP1-2016-284  recommended Recommended update for fence-agents
a+ SUSE-SLE-HA-12-SP1-2016-365  recommended Recommended update for crmsh
a+ SUSE-SLE-HA-12-SP1-2016-423  recommended Recommended update for resource-agents
a+ SUSE-SLE-HA-12-SP1-2016-595  recommended Recommended update for pacemaker
a+ SUSE-SLE-HA-12-SP1-2016-681  recommended Recommended update for sbd
a+ SUSE-SLE-HA-12-SP1-2016-758  recommended Recommended update for resource-agents
a+ SUSE-SLE-HA-12-SP1-2016-799  recommended Recommended update for crmsh
a+ SUSE-SLE-HA-12-SP1-2016-954  recommended Recommended update for python-dateutil

Filter: Needed Patches      Total Download Size: 2.12 GB

Patch: SUSE-SLE-HA-12-SP1-2016-1010 Kind: recommended Version: 1

This update for libdlm to version 4.0.4 includes the following
changes:

- Don't SIGKILL dlm_controld
- Make systemd stop dlm on corosync restart
- dlm_controld: don't log error from cpg_dispatch
- Fix rejection of valid connections in dlm_controld
- Make fail_time in dlm_stonith optional
- Fix segmentation fault during status printing in libdlmcontrol
- Add dlm_stonith man page
- Output of dlm_tool ls should distinguish causes for wait fencing
  message. (bnc#977201)

[Helpâ]      [Cancel] [Accept]
```

- e. Some patches may require a reboot after installation. Select Continue (Figure 99).

Figure 98. YaST online update: Package update

```
YaST2 - online_update @ cishana01
```

[Filterá]	[Actionsá]	[Viewá]	[Dependenciesá]
a+	Name	Kind	Summary
a+	SUSE-SLE-HA-12-SP1-2016-1010	recommended	Recommended update for libdlm
a+	SUSE-SLE-HA-12-SP1-2016-1049	recommended	Recommended update for crmsh
a+	SUSE-SLE-HA-12-SP1-2016-1052	recommended	Recommended update for libdlm
a+	SUSE-SLE-HA-12-SP1-2016-1158	recommended	Recommended update for resource-agents
a+	SUSE-SLE-HA-12-SP1-2016-1204	recommended	Recommended update for crmsh
a+	SUSE-SLE-HA-12-SP1-2016-284	recommended	Recommended update for fence-agents
a+	SUSE-SLE-HA-12-SP1-2016-365	recommended	Recommended update for crmsh
a+	SUSE-SLE-HA-12-SP1-2016-423	recommended	Recommended update for resource-agents

These patches will need rebooting after installation

```

SUSE-SLE-SERVER-12-SP1-2016-1012: Security update for the Linux
Kernel
SUSE-SLE-SERVER-12-SP1-2016-1004: Security update for the Linux
Kernel
SUSE-SLE-SERVER-12-SP1-2016-600: Security update for the Linux
Kernel

```

Filter: [Continue] [Back] [Skip All]

```

- Don't
- Make systemd stop dlm on corosync restart
- dlm_control: don't log error from cpg_dispatch
- Fix rejection of valid connections in dlm_controld
- Make fail_time in dlm_stonith optional
- Fix segmentation fault during status printing in libdlmcontrol
- Add dlm_stonith man page
- Output of dlm_tool ls should distinguish causes for wait fencing
message. (bnc#977201)

```

[Helpá] [Cancel] [Accept]

Patches are downloaded and installed at this time (Figure 99).

Figure 100. YaST online update: Release Notes

```
YaST2 - online_update @ cishana01

Release Notes

Language
English (US)

Release Notes

12.1.20160801

Abstract

This document provides guidance and an overview to high level general features
and updates for SUSE Linux Enterprise Server 12 SP1. Besides architecture or
product-specific information, it also describes the capabilities and
limitations of SLES 12 SP1. General documentation may be found at: http://
www.suse.com/documentation/sles-12/.

Table of Contents

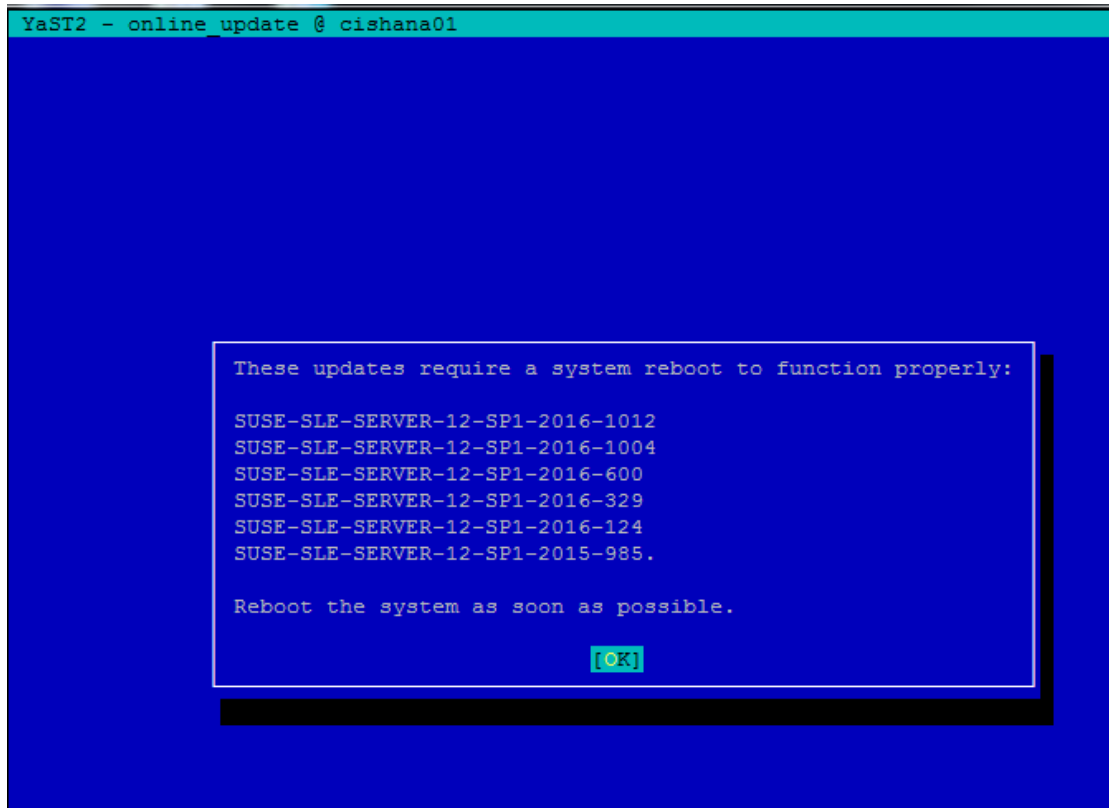
1. SUSE Linux Enterprise Server

  1.1. What's New?
  1.2. Documentation and Other Information
  1.3. How to Obtain Source Code
  1.4. Support Statement for SUSE Linux Enterprise Server
  1.5. Derived and Related Products
  1.6. Security, Standards, and Certification

2. Installation and Upgrade

[Help ]           [Back ]           [Abort]           [Close]
```

g. Click OK to acknowledge the reboot prompt (Figure 102).

Figure 101. YaST online update: Reboot message

```
YaST2 - online update @ cishana01

These updates require a system reboot to function properly:

SUSE-SLE-SERVER-12-SP1-2016-1012
SUSE-SLE-SERVER-12-SP1-2016-1004
SUSE-SLE-SERVER-12-SP1-2016-600
SUSE-SLE-SERVER-12-SP1-2016-329
SUSE-SLE-SERVER-12-SP1-2016-124
SUSE-SLE-SERVER-12-SP1-2015-985.

Reboot the system as soon as possible.

[OK]
```

- h. Quit YaST.
- i. Reboot the system to make the patch installation take effect.

Operating and maintaining SAP HANA

SAP HANA operation and maintenance are described in detail in many related SAP documents. For a complete list of the documentation, see <http://help.sap.com/hana>.

This document summarizes only a few important operation and maintenance procedures. Most of the procedures described in this document are command-line interface (CLI) procedures and are independent of any GUI requiring an X terminal or other GUI front end (Microsoft Windows PC, Linux desktop, etc.). CLI procedures can be started using the KVM or any SSH tool such as PuTTY (for Windows) or Terminal (for Mac OS), or any Linux terminal window to connect to the SAP HANA database system (the appliance).

Monitoring SAP HANA

Three easy CLI methods are available to check the running SAP HANA database.

saphostagent

Start a shell and connect to the SAP HANA system as the root user.

```
cishana01:~ # /usr/sap/hostctrl/exe/saphostctrl -function ListDatabases
Instance name: HDB00, Hostname: cishana01, Vendor: HDB, Type: hdb, Release: 1.00.60.0379371
  Database name: HAN, Status: Error
cishana01:~ #
```

Get a list of installed SAP HANA instances or databases.

```
cishana01:~ # /usr/sap/hostctrl/exe/saphostctrl -function ListInstances
Inst Info : HAN - 00 - cishana01 - 740, patch 17, changelist 1413428
cishana01:~ #
```

Using this information (system ID [SID] and system number), you can use `sapcontrol` to gather more information about the running SAP HANA database.

sapcontrol

In a shell, use the `sapcontrol` function `GetProcessList` to display a list of running SAP HANA OS processes.

```
cishana01:~ # /usr/sap/hostctrl/exe/sapcontrol -nr 00 -function GetProcessList
19.07.2016 14:54:45
GetProcessList
OK
name, description, dispstatus, textstatus, starttime, elapsedtime, pid
hdbdaemon, HDB Daemon, GREEN, Running, 2016 07 15 11:57:45, 98:57:00, 8545
hdbnameserver, HDB Nameserver, GREEN, Running, 2016 07 15 12:05:27, 98:49:18, 11579
hdbpreprocessor, HDB Preprocessor, GREEN, Running, 2013 08 15 12:05:27, 98:49:18, 11580
hdbindexserver, HDB Indexserver, GREEN, Running, 2016 07 15 12:05:27, 98:49:18, 11581
hdbstatisticsserver, HDB Statisticsserver, GREEN, Running, 2016 07 15 12:05:27, 98:49:18, 11582
hdbxsengine, HDB XSEngine, GREEN, Running, 2016 07 15 12:05:27, 98:49:18, 11583
sapwebdisp_hdb, SAP WebDispatcher, GREEN, Running, 2016 07 15 12:05:27, 98:49:18, 11584
hdbcompileserver, HDB Compileserver, GREEN, Running, 2016 07 15 12:05:27, 98:49:18, 11585
```

You see processes such as `hdbdaemon`, `hdbnameserver`, and `hdbindexserver` that belong to a running SAP HANA database.

You can also get a system instance list, which is more useful for a scale-out appliance.

```
cishana01:~ # /usr/sap/hostctrl/exe/sapcontrol -nr 00 -function GetSystemInstanceList
19.07.2016 15:03:12
GetSystemInstanceList
OK
hostname, instanceNr, httpPort, httpsPort, startPriority, features, dispstatus
cishana01, 0, 50013, 0, 0.3, HDB, GREEN
```


HDB info

Another important tool is the **HDB** command, which needs to be issued by the <SID>adm user: the OS user who owns the SAP HANA database.

As the root user on the SAP HANA appliance, enter the command shown here.

```
cishana01:~ # su - hanadm
```

```
cishana01:/usr/sap/HAN/HDB00> HDB info
USER      PID  PPID %CPU   VSZ   RSS COMMAND
hanadm   61208 61207 1.6  13840 2696 -sh
hanadm   61293 61208 0.0  11484 1632 \_ /bin/sh /usr/sap/HAN/HDB00/HDB info
hanadm   61316 61293 0.0   4904  872 \_ ps fx -U hanadm -o
user,pid,ppid,pcpu,vsz,rss,args
hanadm   8532  1  0.0  20048 1468 sapstart pf=/hana/shared/HAN/profile/HAN_HDB00_cishana01
hanadm   8545  8532 1.5 811036 290140 \_ /usr/sap/HAN/HDB00/cishana01/trace/hdb.sapHAN_HDB00
-d -nw -f /usr/sap/HAN/HDB00/cis
hanadm  11579  8545 6.6 16616748 1789920 \_ hdbnameserver
hanadm  11580  8545 1.5 5675392 371984 \_ hdbpreprocessor
hanadm  11581  8545 10.9 18908436 6632128 \_ hdbindexserver
hanadm  11582  8545 8.7 17928872 3833184 \_ hdbstatisticsserver
hanadm  11583  8545 7.4 17946280 1872380 \_ hdbxsengine
hanadm  11584  8545 0.0 203396 16000 \_ sapwebdisp_hdb
pf=/usr/sap/HAN/HDB00/cishana01/wdisp/sapwebdisp.pfl -f /usr/sap/H
hanadm  11585  8545 1.5 15941688 475708 \_ hdbcompileserver
hanadm   8368  1  0.0 216268 75072 /usr/sap/HAN/HDB00/exe/sapstartsrv
pf=/hana/shared/HAN/profile/HAN_HDB00_cishana01 -D -u
```

This command produces output similar to that from the **sapcontrol GetProcessList** function, with a bit more information about the process hierarchy.

Starting and stopping SAP HANA

Before you stop the SAP HANA appliance, you must be able to stop and start the SAP HANA database. You can use the commands shown here.

sapcontrol

You can use the **sapcontrol** functions **StartSystem** and **StopSystem** to start and stop a SAP HANA database.

Stop the system with the **StopSystem** function.

```
cishana01:~ # /usr/sap/hostctrl/exe/sapcontrol -nr 00 -function StopSystem HDB
19.07.2016 15:05:35
StopSystem
OK
```

Use the following command to check that the database has stopped.

```
cishana01:~ # /usr/sap/hostctrl/exe/sapcontrol -nr 00 -function GetSystemInstanceList
19.07.2016 15:05:58
GetSystemInstanceList
OK
hostname, instanceNr, httpPort, httpsPort, startPriority, features, dispstatus
cishana01, 0, 50013, 0, 0.3, HDB, YELLOW
Wait for the status to be GRAY.
cishana01:~ # /usr/sap/hostctrl/exe/sapcontrol -nr 00 -function GetSystemInstanceList
19.07.2016 15:07:52
GetSystemInstanceList
OK
hostname, instanceNr, httpPort, httpsPort, startPriority, features, dispstatus
cishana01, 0, 50013, 0, 0.3, HDB, GRAY
```

Alternatively, use the **HDB info** command.

```
cishana01:~ # su -l hanadm
cishana01:/usr/sap/HAN/HDB00> HDB info
USER    PID PPID %CPU  VSZ  RSS COMMAND
hanadm  61477 61476 2.0 13840 2692 -sh
hanadm  61562 61477 0.0 11484 1632 \_ /bin/sh /usr/sap/HAN/HDB00/HDB info
hanadm  61585 61562 0.0 4904 872 \_ ps fx -U hanadm -o user,pid,ppid,pcpu,vsz,rss,args
hanadm  8368 1 0.0 216784 75220 /usr/sap/HAN/HDB00/exe/sapstartsrv
pf=/hana/shared/HAN/profile/HAN_HDB00_cishana01 -D -u
cishana01:/usr/sap/HAN/HDB00>
```

You can start the database again with the **sapcontrol** command **StartSystem** function.

```
cishana01:~ # /usr/sap/hostctrl/exe/sapcontrol -nr 00 -function StartSystem HDB
19.07.2016 15:08:48
StartSystem
OK
```

To check the system status, use the **sapcontrol** command **GetSystemInstanceList** function. Wait for the status to be **GREEN**.

```
cishana01:~ # /usr/sap/hostctrl/exe/sapcontrol -nr 00 -function GetSystemInstanceList
19.07.2016 15:10:19
GetSystemInstanceList
OK
hostname, instanceNr, httpPort, httpsPort, startPriority, features, dispstatus
cishana01, 0, 50013, 0, 0.3, HDB, GREEN
```

HDB

You can use the **HDB start** and **stop** commands to stop and start the SAP HANA database.

Use **HDB stop** to stop the database.

```
cishana01:~ # su - hanadm
cishana01:/usr/sap/HAN/HDB00> HDB stop
hdbdaemon will wait maximal 300 seconds for NewDB services finishing.
Stopping instance using: /usr/sap/HAN/SYS/exe/hdb/sapcontrol -prot NI_HTTP -nr 00 -function
19.07.2016 19:10:37
Stop
OK
StopWait 400 2
```

In contrast to **sapcontrol**, this command waits until the database is stopped or started.

```
cishana01:/usr/sap/HAN/HDB00> HDB start
StartService
Impromptu CCC initialization by 'rscpcInit'.
  See SAP note 1266393.
OK
OK
Starting instance using: /usr/sap/HAN/SYS/exe/hdb/sapcontrol -prot NI_HTTP -nr 00 -function
StartWait 2700 2
19.07.2016 19:11:20
Start
OK
```

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

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>.

Appendix: Solution variables used in this document

Before starting the configuration process, you need to collect some specific configuration information. Table 14 provides information to help you assemble the required network and host address, numbering, and naming information. This worksheet can also be used as a “leave behind” document for future reference.

Table 14. Solution variables used in this document

Variable	Description	Value used in the lab for this document
<<var_cimc_ip_address>>	Cisco UCS C480 M5 server's IMC IP address	173.36.215.117
<<var_cimc_ip_netmask>>	Cisco UCS C480 M5 server's IMC network netmask	255.255.255.0
<<var_cimc_gateway_ip>>	Cisco UCS C480 M5 server's IMC network gateway IP address	173.36.215.1
<<var_raid50_vd_name>>	Name for virtual drive VD0 during RAID configuration	ucs_hana
<<var_hostname.domain>>	SAP HANA node FQDN	cishana01.custdom.local
<<var_sys_root-pw>>	SAP HANA node's root password	Saphana1!
<<var_lvm_vg_name>>	SAP HANA node's OS LVM volume group name	hanavg
<<var_mgmt_ip_address>>	SAP HANA node's management and administration IP address	173.36.215.118
<<var_mgmt_nw_netmask>>	SAP HANA node's management network netmask	255.255.255.0
<<var_mgmt_gateway_ip>>	Cisco UCS C480 M5 server's management and administration network gateway IP address	173.36.215.1
<<var_mgmt_netmask_prefix>>	Netmask prefix in CIDR notation	24

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