# **LOCKSS Node Setup Guide**

LOCKSS Program, Stanford University Libraries

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### 1. Overview

This document explains how to set of a Linux system to install and operate the LOCKSS software.

The general outline of the setup process is as follows.

#### **Procedure 1. Summarized setup process**

- 1. Install the operating system and configure storage volumes. See Section 3.
- 2. Install the LOCKSS software. See Section 4.
- 3. Configure the LOCKSS software. See Section 5.
- 4. Verify the installation. See Section 6.

Skip Step 1 if you are using an existing machine with a Linux operating system that can install packages with **rpm**.

### 2. Checklist

This document uses symbolic placeholders for values that are relevant to your particular environment, such as host names and IP addresses. See Table 1 and make a note of the values corresponding to your situation. Example values are given for illustration purposes.

**Table 1. Symbolic placeholders** 

Symbol Meaning			
	Basic network information		
\${NODEHOST}	The fully qualified host name of the LOCKSS node.		

Symbol	Meaning
	Example value: lockss.myuniversity.edu
	Your value:
\${NODEIP}	The IP address of the LOCKSS node.
	Example value: 192.168.1.123
	Your value:
\${NODENETMASK}	The netmask of the LOCKSS node.
	Example value: 255.255.0
	Your value:
\${NODEGATEWAY}	The IP address of the LOCKSS node's gateway.
	Example value: 192.168.1.1
	Your value:
\${NODEDNS1}	The IP address of the LOCKSS node's primary DNS server.
	Example value: 8.8.8.8
	Your value:
\${NODEDNS2}	Optional. The IP address of the LOCKSS node's secondary DNS server.
	Example value: 8.8.4.4
	Your value:
	Advanced network information (optional)
\${NODENATIP}	Optional. The external IP address of the LOCKSS node, if network address translation (NAT) is in use.
	Example value: 172.31.255.1
	Your value:
\${PROXYIP}	Optional. The IP address of a proxy the LOCKSS node is required to use for outgoing traffic.
	Example value: 192.168.1.100
	Your value:
\${ PROXYPORT }	Optional. The port number for the outgoing proxy at <i>\${PROXYIP}</i> .
	Example value: 8888
	Your value:
	E-mail information
\${MAILHOST}	The host name of the mail relay the LOCKSS node uses.
	Example value: smtp.myuniversity.edu

Symbol	Meaning
	Your value:
\${MAILUSER}	The user name for the mail relay at <i>\${MAILHOST}</i> , if applicable.
	Example value: mailuser
	Your value:
\${MAILPASS}	The password for the mail relay at <i>\${MAILHOST}</i> , if applicable.
	Example value: mailpass
	Your value:
\${ ADMINADDR }	The e-mail address of the LOCKSS node's administrator.
	Example value: jsmith@myuniversity.edu
	Your value:
	Web user interface information
\${USERNET}	User network accessing the Web user interface (UI) of the LOCKSS node, in CIDR notation. If the Web user interface is accessed from multiple user networks, this will be a list.
	Example value: 192.168.1.0/24
	Your value(s):
\${UIUSER}	User name used to access the Web user interface of the LOCKSS node.
	Recommended value: lockss
	Your value:
	LOCKSS network configuration information
\${PLNCONFIG}	The URL of the LOCKSS network's configuration file. This value is given to you by the administrator of the network's infrastructure server. If you are joining the Global LOCKSS Nework (GLN), the value is http://props.lockss.org:8001/daemon/lockss.xml.
	Example value: http://infra.mybigpln.org:8001/mybigpln/lockss.xml
\${ PLNCODE }	A short code representing the name of the LOCKSS network. This value is given to you by the administrator of the network's infrastructure server. If you are joining the Global LOCKSS Nework (GLN), the value is prod.
	Example value: mybigpln
	Your value:

## 3. Setting Up the Machine

### **3.1. Hardware Considerations**

Hardware considerations vary depending on the expected level of activity incurred by the node and the expected cumulative size of the content to be preserved by the node.

We recommend a 64-bit dual-core CPU (quad-core preferred), with 8GB of memory (or more) and a bootcapable CD or DVD drive. The machine can be a dedicated server or a virtual machine.



#### Note

Whether you choose a physical or virtual machine, we no longer recommend a 32-bit architecture for new installations.

We recommend devoting one (preferably two) small disks (for instance solid-state disks) to the system itself (boot partition, EFI system partition, swap partition, root partition), and bundling commodity hard disks into one or more arrays (with software RAID) for the node's storage. If you cannot devote one or two disks to the system, you can alternatively dedicate a modest amount of space from the first storage array to that function. The number and cumulative capacity of the storage arrays depends on the expected size of the content in the network to be harvested and preserved by the node. In its simplest form, a minimal LOCKSS node could consist of a single array of disks, jointly housing a storage array and the system partitions, in a 1U form factor. Some LOCKSS boxes house as many as sixty hard disks in a 4U form factor.

For software RAID, we recommend RAID6 over RAID5. While RAID5 offers some protection against failed disks, the data in the array becomes vulnerable while one disk in the array has failed and is being replaced and repopulated. The data in a RAID6 array does not become vulnerable until two disks in the array have failed; if a single disk in the array fails, the data in the array is not at high risk during the window of time it might take to purchase, install and repopulate a replacement disk.

Note in the planning of your storage needs that the disks providing redundancy to the array -- two per array in RAID6, one per array in RAID5 -- do not contribute to the total usable storage capacity of the array. For instance, an array of six 4TB disks will yield 16TB of usable storage in RAID6, or 20TB in RAID5, minus file system overhead.

You can also use remote storage, for example over iSCSI or NFS. For more information about these options, contact <lockss-support@lockss.org>.

You are encouraged to review your hardware configuration and ask any questions you might have prior to installation by contacting the LOCKSS Team over e-mail at <lockss-support@lockss.org>.

### 3.2. Installing the Operating System

For the operating system, we recommend **CentOS 7**, a flavor of Linux based on Red Hat Enterprise Linux. See Appendix A for a CentOS 7 installation guide, with the following additional considerations for Procedure A.1:

- In Step 12, you will need the networking-related values from Table 1 to set up the node's networking interface: \${NODEHOST}, \${NODEIP}, \${NODENETMASK}, \${NODEGATEWAY}, \${NODEDNS1}, and \${NODEDNS2}.
- In Step 18, you will need to configure storage volumes. The recommended layout and procedure is detailed in Section 3.3.

### **3.3. Configuring Storage Arrays**

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For the node's storage, we recommend bundling disks into arrays, preferably with **RAID6**, otherwise with RAID5. Under CentOS, we recommend the **XFS** file system for these storage arrays, which should have a single mount point each spanning the whole array. Historically in the LOCKSS system, storage mount points have been named /cache0, /cache1, /cache2, etc. This simple layout is illustrated in Figure 1. Only if you cannot dedicate one or two disks to the system partitions will the first storage array (/cache0) look different; see "Shared system array" and Figure 4 below.

#### Figure 1. Storage array



The system itself requires several partitions: a boot partition (mount point /boot), an EFI system partition (mount point /boot/efi), a swap partition, and a root partition (mount point /). The EFI system partition must use a FAT-compatible file system; CentOS recognizes the /boot/efi mount point and assigns it the file system type "EFI System Partition". For the other system partitions, under CentOS we recommend the XFS file system.

We recommend allocating 512MB to both the boot partition and the EFI system partition. We further recommend allocating twice as much as the machine has physical memory to the swap partition. If you are dedicating one or two disks to the system partitions, the remainder of the system disk or disks is for the root partition. If you are using a shared system array instead, you need to decide how much space to allocate to the root partition. We do not recommend less than 20GB of usable space (that is, 20GB on each of the disks involved in the RAID1 array of the root partition).

We recommend the following layout, and offer two alternatives, in order of preference:

- **Dedicated system array.** Ideally, two small disks (for example solid-state disks) are bundled together into a system array. The first disk in the array is the boot device. It has the boot partition, the EFI system partition, and the swap partition, with no counterparts on the second disk in the array. The remainder of the first disk is devoted to the root partition, mirrored using RAID1 to its counterpart on the second disk. This layout is illustrated in Figure 2.
- **Dedicated system disk.** Alternatively, a small disk (for example a solid-state disk) is designated as the system disk. This disk is the boot device, and features the boot partition, the EFI system partition, the swap partition, and the root partition. This layout is illustrated in Figure 3.
- Shared system array. If neither option is applicable, a modest amount of storage from the first storage array can be devoted to the system partitions. The first disk in the first storage array is the boot device. It has the boot partition, the EFI system partition, and the swap partition, with no counterparts on the other

disks in the array. Then it features the root partition, mirrored to its counterparts on each of the other disks in the array using RAID1. (Finally, the remainders of each disk in the array are bundled together into the first storage partition.) This layout is illustrated in Figure 4.

#### Figure 2. Dedicated system array



#### Figure 3. Dedicated system disk



Figure 4. Shared system array



In Appendix B, we present a procedure to configure storage arrays in CentOS 7. (For other operating systems, refer to the usage manual for disk partitioning instructions.)

### 4. Installing the LOCKSS Software

Once the basic installation of your Linux system is complete, you are ready to install the LOCKSS software.

The LOCKSS Team offers a basic integration script to perform pre-requisite system steps on CentOS 7.

#### **Procedure 2. LOCKSS software installation**

1. Install the **wget** utility and net-tools as root with this command:

```
sudo yum install wget net-tools
```

Follow the on-screen prompts.

2. In a working directory, for instance /tmp, download the integration script from GitHub with this command:

wget https://github.com/lockss/admin-tools/raw/master/centos/install-lockss-centos7.sh

3. Run the script as root:

sudo sh install-lockss-centos7.sh

4. For each one of the storage mount points defined in Section 3.3, typically called /cache0, /cache1, /cache2, etc., do the following as root:

```
sudo mkdir /cache0/gamma /cache1/gamma /cache2/gamma ...
sudo chown lockss:lockss /cache0/gamma /cache1/gamma /cache2/gamma ...
sudo chmod 0750 /cache0/gamma /cache1/gamma /cache2/gamma ...
```

This has the effect of creating a single directory in each called gamma (and setting permissions appropriately).

The end result of this section is illustrated in Figure 5.

#### Figure 5. Result of integration script



If you encounter any difficulty during this process, contact <lockss-support@lockss.org> for assistance.

## 5. Configuring the LOCKSS Software

The next step is to configure the LOCKSS software by running the /etc/lockss/hostconfig script as root. The script asks a series of configuration questions. For many, a value is suggested in square brackets; you can accept it by simply hitting **Enter**.

#### **Procedure 3. hostconfig procedure**

1. Run the following command:

```
sudo /etc/lockss/hostconfig
```

You may be prompted for your password.

- 2. Enter the fully qualified host name of the machine, *s*{*NODEHOST*} and hit **Enter**. For instance, the example value in Table 1 would be **lockss.myuniversity.edu**.
- 3. Enter the IP address of the machine, *\${NODEIP}* and hit **Enter**. For instance, the example value in Table 1 would be **192.168.1.123**.
- 4. Next you will be asked if the machine is behind Network Address Translation (NAT).
  - If the machine is not behind NAT (common), simply hit **Enter** to accept the default value **n** (for "no").
  - If the machine is behind NAT (uncommon):
    - Enter **y** (for "yes") and hit **Enter**.
    - Enter the external IP address of the machine behind NAT (\${NODENATIP}), and hit Enter. For instance, the example value in Table 1 would be 172.31.255.1.
- 5. Enter the initial list of subnets that should be granted access to the administrative user interface (UI) of the LOCKSS instance. The default value suggested in square brackets is the class C subnet the machine is currently on. Type in the value *s{userver}*, which can be a single subnet, or a list of subnets separated by semicolons (see Table 1). Hit the **Enter** key to validate your entry.

Note that this setting can be adjusted later in the administrative UI without re-running the configuration script.

- 6. Enter the desired LCAP port (the port over which the LOCKSS node will communicate with other LOCKSS nodes). Unless you are doing something exotic like running multiple LOCKSS instances out of a single IP address, we recommend you hit **Enter** to accept the default value **9729**.
- 7. Enter the desired proxy port (the port on which the LOCKSS node can run a Web proxy for certain client IP addresses). We recommend you simply hit **Enter** to accept the default value **8080**.
- 8. Enter the desired addministrative user interface (UI) port (the port on which the LOCKSS node runs its Web-based UI). We recommend you simply hit **Enter** to accept the default value **8081**.
- 9. Enter the host name of the mail relay for the machine, *\${MAILHOST}* and hit **Enter**. Using the example value in Table 1 you would enter *smtp.myuniversity.edu*.
- 10. Next you will be asked if the mail relay requires a username and password.
  - If the mail relay does not require a username and password (common), hit **Enter** to accept the default value **n** (for "no").

- If the mail relay requires a username and password (uncommon):
  - Enter **y** (for "yes") and hit **Enter**.
  - Enter the username for the mail relay, *\${MAILUSER}* and hit **Enter**. Using the example value in Table 1 you would enter mailuser.
  - Enter the password for the mail relay, *\${MAILPASS}* and hit **Enter**. Using the example value in Table 1 you would enter mailpass.
- 11. Enter the e-mail address of the administrator of the LOCKSS instance, *\${adminaddr}* and hit **Enter**. Using the example value in Table 1 you would enter jsmith@myuniversity.edu.
- 12. Enter the path to the Java executable (**java**). We recommend hitting **Enter** to accept the suggested value derived by the system.
- 13. Enter any command-line switches you wish to pass to the Java executable. By default, this is not necessary and you should simply leave the value empty and simply hit **Enter**.
- 14. Enter the URL of your LOCKSS network's configuration file, *\${PLNCONFIG}*. Only accept the default value if you are joining the Global LOCKSS Network, otherwise enter the value supplied by your LOCKSS network administrator. Using the example value in Table 1 you would enter http://infra.mybigpln.org:8001/mybigpln/lockss.xml.
- 15. Next you will be asked if you require a proxy to access your LOCKSS network's configuration file.
  - If you do not require a proxy to access the configuration file (common), hit **Enter** to accept the default value **NONE**.
  - If you require a proxy to access the configuration file (uncommon), enter *\${PROXYIP}: \${PROXYPORT}* and hit Enter.
- 16. You will then be asked if you would like to enable the configuration failover feature.
  - If you wish to enable the failover feature (recommended):
    - Hit Enter to accept the default answer **Y** (for "yes").
    - You will then be asked the maximum age of the configuration failover file. Accept the default value by hitting **Enter**.
  - If you do not wish to enable the failover feature, enter  $\mathbf{N}$  (for "no"), then hit **Enter**.
- 17. Enter the code name of your LOCKSS network, *\${PLNCODE}*. (The configuration script refers to it as the preservation group name.) Enter the value supplied by your LOCKSS network administrator, or if you are joining the Global LOCKSS Network (GLN), accept the default value **prod**. Using the example value in Table 1, you would enter **mybigpln**.
- 18. Enter the list of gamma directories created in Procedure 2 Step 4, separated by semicolons, then hit **Enter** to validate your entry. In the example machine used throughout this document, there are two storage partitions, /cache0 and /cache1, so the correpsonding gamma directories are /cache0/gamma and /cache1/gamma, meaning you would enter the value /cache0/gamma;/cache1/gamma.
- 19. Enter the path of a temporary storage area for use by the LOCKSS software. We recommend hitting **Enter** to accept the suggested value, which will be derived from the first storage area (e.g. /cache0).
- 20. Enter the username of the main user of the LOCKSS node's administrative user interface (UI), *\${UIUSER}*, and hit Enter. Using the recommended value in Table 1 you would enter lockss.

- 21. Enter the password for the main user of the LOCKSS node's administrative user interface (UI), and hit **Enter**. Then confirm the password, again ending with **Enter**.
- 22. Verify that the configuration values you have entered are correct, and if so, hit **Enter** to accept the default response  $\mathbf{x}$  (for "yes"). If a value is incorrect, type  $\mathbf{n}$  (for "no") and hit **Enter** to go back to the beginning.
- 23. The configuration script will then create files and directories and perform other necessary tasks, asking for confirmation at each step. The response  $\mathbf{y}$  (for "yes") is the default for each, so you can simply hit **Enter**.

Representative screenshots of this interactive process are shown in Figure 6, Figure 7, Figure 8 and Figure 9.

#### Figure 6. Screenshot of hostconfig (1)



Figure 7. Screenshot of hostconfig (2)

```
Mail relay for this machine: [localhost] smtp.myuniversity.edu
Does mail relay smtp.myuniversity.edu need user & password: [N]
E-mail address for administrator: [] jsmith@myuniversity.edu
Path to java: [/bin/java]
Java switches: []
Configuration URL: [http://props.lockss.org:8001/daemon/lockss.xml] http://infra
.mybigpln.org/mybigpln/lockss.xml
Configuration proxy (host:port): [NONE]
Enable config failover: [Y]
Config failover max age: []
Preservation group(s): [prod] mybigpln
Content storage directories: [] /cache0/gamma;/cache1/gamma
Temporary storage directory: [/cache0/gamma;/cache1/gamma
Basword for web UI administration: [] lockss
Password for web UI administration (again): []
Configuration:
LOCKSS_CONFIG_UERSION=1
LOCKSS_HOSTNAME=lockss.myuniversity.edu
LOCKSS_IPADDR=192.168.1.123
LOCKSS_PARTMAL_IPADDR=
LOCKSS_ORET="192.168.1.0/24"
```

#### Figure 8. Screenshot of hostconfig (3)



#### Figure 9. Screenshot of hostconfig (4)

LOCKSS ACCESS SUBNET="192.168.1.0/24"
LOCKSS_MAILHUB=smtp.myuniversity.edu
LOCKSS MAILHUB USER=
LOCKSS MAILHUB PASSWORD=
LOCKSS_EMAIL=jsmith@myuniversity.edu
LOCKSS_JAVA_CMD=/bin/java
LOCKSS_JAVA_SWITCHES=
LOCKSS_JAVA_HEAP=
LOCKSS_PROPS_URL="http://infra.mybigpln.org/mybigpln/lockss.xml"
LOCKSS_PROPS_PROXY="NONE"
LOCKSS_PROPS_SERVER_AUTHENTICATE_KEYSTORE=""
LOCKSS_CONFIG_FAILOVER_ENABLE="Y"
LOCKSS_CONFIG_FAILOVER_MAX_AGE=""
LOCKSS_TEST_GROUP="mybigpln"
LOCKSS_DISK_PATHS="/cache0/gamma;/cache1/gamma"
LOCKSS_ADMIN_USER=lockss
LOCKSS_ADMIN_PASSWD=SHA-256:bc0b3ecbe9a9564b64680ce5d2fad19d61f67ab656d2056c3073
2a5da2006cef
LOCKSS_PROXY_PORT=8080
LOCKSS_UI_PORT=8081
LOCKSS_TMPDIR=/cache0/gamma/tmp
LOCKSS_CLEAR_TMPDIR=yes
LOCKSS_RELEASE=1.72.3-1
LOCKSS_HOME is
OK to store this configuration: [Y] Y_

If you encounter any difficulty during this process, contact <lockss-support@lockss.org> for assistance.

### 6. Verifying the Installation

The **hostconfig** script sets up the LOCKSS daemon to start up when the system boots. You can either reboot the machine, or to cause the LOCKSS daemon to start right away, type this command:

sudo /etc/init.d/lockss start

From an IP address on the machine's authorized subnet (*\${USERNET}*), use a Web browser to access http://*\${NODEHOST}*:8081 or http://*\${NODEIP}*:8081.

## A. Installing CentOS 7

Section last updated: 2017-05-10

CentOS 7 is a popular, enterprise-grade Linux distribution based on Red Hat Enterprise Linux (RHEL). Visit the CentOS Web site at https://www.centos.org/ for downloads, documentation, support, and more.

#### Figure A.1. CentOS Web site front page

CentOS Project ×			8 - 8 %
← → C			☆ :
The CentO	S Project		
The CentOS Project is a communit ecosystem. For users, we offer a co open source communities, we offe build, test, release, and maintain t			
We're also expanding the availabili Amazon, Google, and more. For se			
For more information about updat release announcement in the mail			
Get CentOS Now			
Around CentOS	News & Events	Sponsorship	
	CentOS Dojo - Brussels, Belgium 3 Feb 2017 Come join the CentOS team in Brussels More about Dojos and other Events	CentOS would not be possible without the support of our sponsors. We would like to thank the following product/service for being a CentOS Sponsor DEDICATED HOSTING	
	CentOS Booth at Fosdern 4-5 Feb 2017 Stop by the CentOS Booth at Fosdern, and stay for the devroom talks	tron \$ 54.99	

This section presents a guided overview of the CentOS 7 installation process.

As of this writing, the latest CentOS 7 release is CentOS 7 Release 1611 (codename for November 2016).



#### Note

Although CentOS 6 will receive maintenance updates until 2020, it will only receive full updates until mid-2017, so we no longer recommend it for new installations.

Several variants are offered. The "Minimal" variant fits on a CD and does not install a graphical desktop environment. The "DVD" and "Everything" variants do, but only the "DVD" variant fits on a DVD. The "Netinstall" variant is the smallest to download upfront, and downloads software packages over the network. Since a typical installation does not require many available packages, this variant is the most efficient in total time spent downloading from the network, so we recommend it. The remainder of this section is written in terms of the "Netinstall" variant.

#### Procedure A.1. Overview of CentOS 7 installation

1. Visit https://www.centos.org/download/.



Figure A.2. CentOS Web site download page

2. Click on "alternative downloads" or "More download choices", which takes you to https:// wiki.centos.org/Download.

<b>Figure A</b>	.3. CentOS	Web site	alternative	downloads	page
					P8-

	entos.org/Dov	vnload				
rontPage		Sanara Sanara Tirkis How B 17425 Events Contribute Changelog Dewnlead				
wnload				Search		Text Title
Downlo	oad Cer	ntOS Linux ISO images				
Base Dis	tributior					
	E: CentOS is	-	tOS is important to you	please support	the long-ter	m viability
of th	e CentOS pr	available nee of charge, we do accept (non-infancial) donations for improving, hosting and promoting centos, in cen oject.	to's is important to you,	please support	the long-ter	in viability
Pleas	e use one of	our  many mirrors to download CentOS.				
CentOS	Minor			Release	Release	End- Of-
Linux Version	release	CD and DVD ISO images	Packages	Email	Notes	Life
Linux Version 7	7 (1611)	Rolling: #DVD, #Minimal, #Everything, #LiveGNOME, #LiveKDE [#checksums]   Mirrors: #x86_64	Packages     PRPMs	Email     CentOS	Notes CentOS • RHEL	Life 30 June 2024
Linux Version 7	release 7 (1611) 6.8	Rolling: #DVD, #Minimal, #Everything, #LiveGNOME, #LiveKDE (#checksums)   Mirrors: #x86_64 #1386 #x86_64	Packages     eRPMs     eRPMs	Email • CentOS • CentOS	Notes CentOS • RHEL CentOS • RHEL	Life 30 June 2024 30 Nov 2020
Linux Version 7 6 5	release 7 (1611) 6.8 5.11	Ralling: @DVD, @Minimal, @Everything, @LiveONOME, @LiveKDE (@checksums)   Mirrors: @x86_64 @1386 @x86_64 @1386 @x86_64	Packages     Packages	Email CentOS CentOS CentOS CentOS	Notes CentOS • RHEL CentOS • RHEL CentOS • RHEL	Life 30 June 2024 30 Nov 2020 31 Mar 2017**
Linux Version 7 6 5 \$ \$sha2565L	release 7 (1611) 6.8 5.11 m informatio	Ralling: @DVD, @Minimal, @Everything, @LiveONOME, @LiveKDE (@checksums)   Mirrors: @x80_64 @1386 @x80_64 @1386 @x80_64 on via an https source is provided in the Release Email or Release Notes link above. You can also use the sha256s	Packages     Packages     PRPMs     PRPMs     PRPMs     um.txt.asc file located	Email CentOS CentOS CentOS in any CentOS	Notes CentOS • RHEL CentOS • RHEL CentOS • RHEL directory with	Life 30 June 2024 30 Nov 2020 31 Mar 2017**
Linux Version 7 6 5 \$ \$ \$sha256st Cloud image P Bittorrent	release 7 (1611) 6.8 5.11 m informatii s. You shoul links are als	Ralling: @DVD, @Minimal, @Everything, @LiveONOME, @LiveKDE (@checksums)   Mirrors: @x86_64 @1386 @x86_64 @138	Packages     Packages	Email  CentOS  CentOS  CentOS  CentOS  In any CentOS of	Notes CentOS RHEL CentOS RHEL CentOS RHEL directory with	Life 30 June 2024 30 Nov 2020 31 Mar 2017** h ISO or
Linux Version 7 6 5 \$ \$ sha256sc Cloud image \$ Bittorrent \$ Rolling bu	release 7 (1611) 6.8 5.11 m informatii s. You shoul links are als ilds are upd	Rolling: @DVD, @Minimal, @Everything, @LiveONOME, @LiveKDE (@checksums)   Mirrors: @x86_64 @J386 @x86_64 @J386 @x86_64 on via an https source is provided in the Release Email or Release Notes link above. You can also use the sha2366 adways verify your downloads before using. o available from the above links.	Packages     Packages     PrPMs     PRPMs     PRPMs     Um.txt.asc file located	Email  CentOS  CentOS	Notes CentOS RHEL CentOS RHEL CentOS RHEL CentOS RHEL directory with	Life 30 June 2024 30 Nov 2020 31 Mar 2017** h ISO or

3. In the row for CentOS version 7, click on "Mirrors: x86\_64", which takes you to http://isoredirect.centos.org/centos/7/isos/x86\_64/.



Figure A.4. CentOS Web site download mirror selection

4. Select a mirror.

#### Figure A.5. CentOS Web site download mirror

Index of /7/isos/x86_ ×			8
← → C ① mirror.pac-12.org/7/isos/x86_64/			ជ
ndex of /7/isos/x86	64		
Name	Last modified	Size Description	
Parent Directory			
0_README.txt	08-Dec-2016 05:59	2.4K	
CentOS-7-x86_64-DVD-1611.iso	05-Dec-2016 05:57	4.1G	
CentOS-7-x86_64-DVD-1611.torrent	08-Dec-2016 06:25	164K	
CentOS-7-x86_64-Everything-1611.iso	05-Dec-2016 05:57	7.7G	
CentOS-7-x86_64-Everything-1611.torren	08-Dec-2016 06:25	309K	
CentOS-7-x86_64-LiveGNOME-1611.iso	05-Dec-2016 06:11	1.2G	
CentOS-7-x86_64-LiveGNOME-1611.torrer	nt 08-Dec-2016 06:25	47K	
CentOS-7-x86_64-LiveKDE-1611.iso	05-Dec-2016 06:30	1.7G	
CentOS-7-x86_64-LiveKDE-1611.torrent	08-Dec-2016 06:25	67K	
CentOS-7-x86_64-Minimal-1611.iso	05-Dec-2016 15:44	80M	
CentOS-7-x86_64-Minimal-1611.torrent	08-Dec-2016 06:25	27К	
CentOS-7-x86_64-NetInstall-1611.iso	05-Dec-2016 05:20	77M	
CentOS-7-x86_64-NetInstall-1611.torrent	08-Dec-2016 06:25	15K	
shalsum.txt	08-Dec-2016 06:19	454	
shalsum.txt.asc	08-Dec-2016 06:20	1.3K	
sha256sum.txt	08-Dec-2016 06:13	598	
sha256sum.txt.asc	08-Dec-2016 06:20	1.4K	

- 5. Save the "Netinstall" ISO image to your computer. There is also an option to download the image as a torrent.
- 6. Verify the integrity of the downloaded ISO image using the SHA-256 checksum provided on the mirror. General instructions for how to do this on various platforms are provided at https://wiki.centos.org/TipsAndTricks/sha256sum.
- 7. Burn the ISO image to a CD or DVD. Alternatively, you can perform the installation from a USB key; see https://wiki.centos.org/HowTos/InstallFromUSBkey for details.

- 8. Power the target machine on, such that it boots from the installation CD or DVD (or USB key).
- 9. Use the keyboard arrows to select Install CentOS Linux 7 (I), then hit Enter. The graphical installer will then load.



Figure A.6. CentOS installation boot screen

10. Select the installation language, for instance English  $\rightarrow$  English (United States), then click Continue.

What language would	you like to use during the in	stallation process?
English	Engusn 2	English (United States)
Afrikaans	Afrikaans	English (India)
አማርኛ	Amharic	English (Australia)
العربية	Arabic	English (Canada)
অসমীয়া	Assamese	English (Denmark)
Asturianu	Asturian	English (Ireland)
Беларуская	Belarukian	English (New Zealand)
Български	Bulgarian	English (Nigeria)
বাংলা	Bengali	English (Hong Kong SAR China)
Bosanski	Bosnian	English (Philippines)
Català	Catalan	English (Singapore)
Čeština	Czech	English (South Africa)
Cymraeg	Welsh	English (Zambia)
Dansk	Danish	English (Botswana)

Figure A.7. CentOS installation language

11. Click on Network & Host Name.

#### Figure A.8. CentOS installation network and host name



12. Configure network interfaces as necessary for the machine to have access to the Internet. Enter the machine's fully-qualified domain name in the Host name box. You can then turn an interface on and off with the On/Off toggle, add interfaces with the + button, and configure a selected interface with the Configure button.

The IPv4 Settings (or IPv6 Settings, if applicable) tab in the interface configuration dialog (shown below) enables you to enter networking information, such as the IP address, netmask, gateway, DNS servers, and more.

When the machine is successfully connected, click Done in the top left corner.

Figure A.9. CentOS installation network and host name screen

(enpOS3) ation 82540EM Gigabi	: Ethernet Controller (	PRO/1000 MT Deskt	Et Co	hernet (enpOs3)		
		Editin	g enpOs3			
Connection name	enp0s3					
General	Ethernet	802.1X Security	DCB	IPv4 Settings	IPv6 Set	tings
Method: Auto	matic (DHCP)					•
Addresses						
Address		Netmask	(	ateway		Add
						elete
Additional DN	5 servers:					
Additional sea	rch domains:					
DHCP client ID	:					
🔲 Require IPv	4 addressing for	this connection to compl	ete			
					Roi	utes
					. ) [	_

13. Click on Installation Source.



Figure A.10. CentOS installation source

14. Click the On the network radio button, select http:// from the drop-down menu, and enter the following into the adjacent text box: mirror.centos.org/centos/7/os/x86\_64/, so that the result is http://mirror.centos.org/centos/7/os/x86\_64/. Then click Done in the top left corner.

mirror.ce	itos.org/centos/7/os/x86_64/		Proxy setu
🗌 This U	L refers to a mirror list. ,		
Iditional repositories			
Enabled Name	Name:		
	This URL refers to	o a mirror list.	
	Proxy URL:		
	User name:		
+ - C	Password:		

Figure A.11. CentOS installation source screen

- 15. If networking is set up properly and the installation source URL is entered correctly, the installer will download package information from the network, and eventually the installation URL from above (http://mirror.centos.org/centos/7/os/x86\_64/) will be displayed under the label Installation Source, and the warning icon will disappear.
  - If this process does not succeed, go back to the networking and installation source steps above to establish a network connection and point to the installation mirror.
  - If this process succeeds, click on Software Selection.

![](_page_19_Picture_1.jpeg)

Figure A.12. CentOS installation software selection

- 16. Select an installation profile.
  - If you do not need a graphical desktop environment, select Base Environment  $\_$  Minimal Install.

![](_page_20_Picture_1.jpeg)

Figure A.13. CentOS installation with minimal software

If you need a graphical desktop environment, select Base Environment  $\rightarrow$  GNOME Desktop and Add-Ons for Selected Environment  $\rightarrow$  GNOME Applications (recommended), or Base

•

Environment  $\xrightarrow{}$  KDE Plasma Workspaces and Add-Ons for Selected Environment  $\xrightarrow{}$  KDE Applications.

Environment	Add-Ons for Selected Environment
Minimal Install         Basic functionality.         Compute Node         Installation for performing computation and processing.         Infrastructure Server         Server for operating network infrastructure services.         File and Print Server         File, print, and storage server for enterprises.         Basic Must Server         Server for serving static and dynamic internet content.         Virtualization Host         Minimal virtualization host.         Server for operating network infrastructure services, with a GUI.         ONOME Deaktop         GROME is a highly intuitive and user friendly desktop environment.         KDE Plasma Workspaces         The KDE Plasma Workspaces, a highly-configurable graphical user interface which includes a panel, desktop, system icons and desktop widgets, and many powerful KDE applications.         Development and Creative Workstation         Workstation for software, hardware, graphics, or content development.	Backup Client   Client tools for connecting to a backup server and doing backups.   GNOME Applications   A set of commonly used GNOME Applications.   Internet Applications   Email, chat, and video conferencing software.   Legacy X Window System Compatibility   Compatibility programs for migration from or working with legacy X   Window System environments.   Office Suite and Productivity   A full-purpose office suite, and other productivity tools.   Smart Card Support   Support for using smart card authentication.   Compatibility libraries for applications built on previous versions of CentOS Linux.   Development Tools   A basic development environment.   Security Tools   Security tools for integrity and trust verification.

Figure A.14. CentOS installation with graphical desktop

Then click Done in the top left corner.

17. Click on Installation Destination.

![](_page_22_Picture_1.jpeg)

Figure A.15. CentOS installation destination

18. The Installation Destination screen is the starting point for setting up disk partitions and storage.

For a straightforward installation of a simple system onto a single disk:

- Select the single disk in the Local Standard Disks section. The selected disk gets a check mark.
- In the Partitioning section, select Automatically configure partitioning.
- Click the Done button in the top-left corner.

If you are installing a more complex system, refer to the documented procedure for how to use this screen to customize partitioning, add network storage devices like iSCSI targets, encrypt, and more.

Done	CENTOS LINUX 7 INSTALLATIO
Device Selection	
Select the device(s) you'd like to install to. They will be left untouched until yo	ou click on the main menu's "Begin Installation" button.
Local Standard Disks	
8192 MIB	
Specialized & Network Disks	
Add a disk	
Add a disk	
Add a disk	
Add a disk Other Storage Options Partitioning	
Add a disk         Other Storage Options         Partitioning         (*) Automatically configure partitioning.	
Add a disk         Other Storage Options         Partitioning            • Automatically configure partitioning.         • I will configure partitioning.         • I would like to make additional space available.	
Add a disk	
Add a disk	
Add a disk         Dther Storage Options         Partitioning <ul> <li>Automatically configure partitioning.</li> <li>I would like to make additional space available.</li> </ul> Encryption <ul> <li>Encrypt my data. You'll set a passphrase next.</li> </ul>	
Add a disk  Dther Storage Options Partitioning  Automatically configure partitioning.  I will configure partitioning.  I would like to make additional space available. Encryption Encryption Encrypt my data. You'll set a passphrase next.	
Add a disk   Dther Storage Options Partitioning  Automatically configure partitioning.  I would like to make additional space available. Encryption Encrypt my data. You'll set a passphrase next.	0 disks selected; 0 B capacity: 0 B free <b>Refr</b>

Figure A.16. CentOS installation disk partitioning and selection

- 19. If desired, click on Date & Time, Keyboard, Language Support, Kdump or Security Policy, to review and change settings as needed.
- 20. Click on Begin Installation in the bottom right corner to begin the installation process.
- 21. While packages are downloading and installing, click on Root Password.

![](_page_24_Picture_1.jpeg)

Figure A.17. CentOS installation root password

22. Enter and re-enter a root (administrator) password for the infrastructure server, then click Done in the top left corner.

ROOT PASSWORD			CENTOS LINUX 7 INSTALLATION
	The root account is used for adm	inistering the system. Enter a password for the root use	r.
	Root Password:	•••••	
		Strong	3
	Confirm:	••••••	
			_
		5 <b>1</b> 0	

Figure A.18. CentOS installation root password screen

23. To create a first user account right now (recommended), click on User Creation.

Figure A.19. CentOS installation user creation

	CONFIGURATION	CENTOS LINUX 7 INSTALLATION B us Help!
CentOS	USER SETTINGS	
	ROOT PASSWORD Root password is set	USER CREATION No user will be created
	Complete!	
	CentOS Linux is now si	uccessfully installed, but some configuration still needs to be done. Finish it and then click the Finish configuration button please.
		Finish configuration

24. Enter the user's full name and login name, then enter and re-enter a password.

Check the Make this user administrator box to add this user to the wheel user group, which in CentOS has the effect of granting privileges via **sudo**.

![](_page_26_Picture_3.jpeg)

#### Note

The policies and procedures at your institution for managing users, granting administrator privileges, administering systems, etc. may vary. The remainder of this document assumes that users with administrator privileges cannot log in as root directly or only do so infrequently, and use **sudo** to issue commands as root instead.

Finally, click on Done in the top left corner.

CREATE USER	CENTOS LINUX 7 INSTALLATION Bus Help!
Full name	Fake User
User name	fakeuser
	Tip: Keep your user name shorter than 32 characters and do not use spaces. ☑ Make this user administrator ☑ Require a password to use this account
Password	Strong
Confirm password	••••••
	Advanced

Figure A.20. CentOS installation user creation screen

- 25. Wait for the installation process to finish. The progress bar will eventually say Complete! Click on Finish Configuration.
- 26. Wait for the last installation steps to complete. The label below the progress bar will eventually say CentOS Linux is now successfully installed and ready for you to use. Click on Reboot to reboot the server.
- 27. Before anything else, bring your freshly installed server completely up to date with the latest software and security patches.

In a terminal as the user with administrator privileges created above, enter the command sudo yum update. You will be prompted for your user password to authenticate with sudo, and since this is the first time this user uses sudo, the system will display a security warning.

Figure A.21. Initial CentOS update (1)

![](_page_27_Figure_2.jpeg)

Accept the change set by entering **Y** and hitting **Enter**.

Figure A.22. Initial CentOS update (2)

openssl	×86_64	1:1.0.1e-60.el7_3.1	updates	713 k
openssl-libs	×86_64	1:1.0.1e-60.el7_3.1	updates	959 k
policycoreutils	×86_64	2.5-11.el7_3	updates	841 k
polkit	×86_64	0.112-11.el7_3	updates	167 k
python-firewall	noarch	0.4.3.2-8.1.el7_3.2	updates	301 k
python-perf	×86_64	3.10.0-514.10.2.el7	updates	4.0 M
selinux-policy	noarch	3.13.1-102.el7_3.15	updates	414 k
selinux-policy-targeted	noarch	3.13.1-102.el7_3.15	updates	6.4 M
sudo	×86_64	1.8.6p7-21.el7_3	updates	735 k
systemd	×86_64	219-30.el7_3.7	updates	5.2 M
systemd-libs	×86_64	219-30.el7_3.7	updates	369 k
systemd-sysv	×86_64	219-30.el7_3.7	updates	63 k
tuned	noarch	2.7.1-3.el7_3.1	updates	210 k
tzdata	noarch	2016j-1.el7	updates	442 k
vim-minimal	×86_64	2:7.4.160-1.el7_3.1	updates	436 k
wpa_supplicant	×86_64	1:2.0-21.el7_3	updates	788 k
×fsprogs	×86_64	4.5.0-9.el7_3	updates	895 k
Transaction Summary				
Install 1 Package				
Upgrade 57 Packages				
Total download size: 98 M				
ls this ok [y/d/N]: y_				

Because you are performing updates for the first time, you may be asked to confirm whether to download and install the CentOS software signing key. Accept by entering **Y** and hitting **Enter**.

Figure A.23. Initial CentOS update (3)

(44/58): policycoreutils-2.5-11.el7_3.x86_64.rpm		841	kB	00:00
(45/58): python-perf-3.10.0-514.10.2.el7.x86_64.rpm		4.0	MB	00:01
(46/58): selinux-policy-3.13.1-102.el7_3.15.noarch.rpm	ł	414	kB	00:00
(47/58): NetworkManager-libnm-1.4.0-17.el7_3.x86_64.rpm	ł	443	kB	00:10
(48/58): sudo-1.8.6p7-21.el7_3.x86_64.rpm	ł	735	kB	00:00
(49/58): kernel-3.10.0-514.10.2.el7.x86_64.rpm	ł	37	MB	00:09
(50/58): systemd-libs-219-30.el7_3.7.x86_64.rpm		369	kB	00:00
(51/58): systemd-sysv-219-30.el7 3.7.x86 64.rpm	ł	63	kB	00:00
(52/58): tuned-2.7.1-3.el7 3.1.noarch.rpm	ł	210	kB	00:00
(53/58): tzdata-2016j-1.el7.noarch.rpm <sup>*</sup>	1	442	kB	00:00
(54/58): vim-minimal-7.4.160-1.el7 3.1.x86 64.rpm	ł	436	kB	00:00
(55/58): wpa_supplicant-2.0-21.el7_3.x86_64.rpm		788	kB	00:00
(56/58): sustemd-219-30.el7 3.7.x86 64.rpm	ł	5.2	MB	00:01
(57/58): xfsprogs-4.5.0-9.el7 3.x86_64.rpm	ł	895	kB	00:00
(58/58): selinux-policu-targeted-3.13.1-102.el7 3.15.noarc	i	6.4	MB	00:05
Total 5.9 MB/	2	1 98	3 MB	A0:16
Retrieving key from file:///etc/nki/rnm-gng/RPM-GPG-KEY-Ce	nt.	ns-7		
Immorting GPG keu AxF4A80EB5:				
Userid : "CentOS-7 Key (CentOS 7 Official Signing Key	)	(seci	iritul	centos.org
>"				
Fingernrint: 6341 ab27 53d7 8a78 a7c2 7bb1 24c6 a8a7 f4a8	Ю	eh5		
Package : centos-release-7-3.1611.e17.centos.x86.64 (P	a n.	acond	la)	
From : /etc/nki/rnm-ana/BPM-GPG-KEY-CentOS-7	cean.			
Is this ok [u/N]: u				

When complete, reboot the server again using the **sudo reboot** command (or using your graphical desktop environment's logout/reboot function).

## **B. CentOS 7 Storage Array Configuration**

Section last updated: 2018-09-09

We present the following procedure to implement the designs of Section 3.3 for CentOS 7. (For other operating systems, refer to the usage manual for disk partitioning instructions.)

Unless otherwise specified, the machine used as an example has two 256GB solid-state disks as the first and second disks (labeled sda and sdb), and twelve 2TB disks (labeled sdc through sdn), intended for a 2-disk dedicated system array and two 6-disk RAID6 storage arrays respectively; and further assume the machine has 4GB of memory, meaning we intend to devote 8GB to the swap partition.

#### **Procedure B.1. Storage array configuration (Procedure A.1 Step 18)**

- 1. In this step, you will designate all the disks in the machines for manual partitioning:
  - a. In the Installation Destination screen (Procedure A.1 Step 18), you should see the machine's disks listed. See Figure B.1.

vice Selection				
elect the device(s) you'd lii ocal Standard Disks	ke to install to. They will be le	ft untouched until you click or	n the main menu's "Begin Insta	allation" button.
256 GiB	256 GiB	2048 GiB	2048 GiB	2048 Gil
ATA VBOX HARDDISK sda / 256 GiB free	ATA VBOX HARDDISK sdb / 256 GiB free	ATA VBOX HARDDISK sdc / 2048 GiB free	ATA VBOX HARDDISK sdd / 2048 GiB free	ATA VBOX HAI sde / 2048 G
pecialized & Network Disks	~			
ecialized & Network Disks	itioning. () I will configure partiti	oning.		
Add a disk  her Storage Options artitioning Automatically configure parti I would like to make addition	tioning. () I will configure partitional space available.	oning.		
ecialized & Network Disks Add a disk her Storage Options artitioning Automatically configure parti I would like to make addition neryption Encrypt my data. You'll set a	tioning. O I will configure partitional space available.	oning.		

**Figure B.1. Installation Destination screen** 

b. Select the machine's disks one by one until all have a check mark. See Figure B.2.

#### Figure B.2. Selecting all the disks

INSTALLATION DES	TINATION		CENT	OS LINUX 7 INSTALLATION
Device Selection				
Select the device(s) yo	ou'd like to install to. They wil	l be left untouched until you o	click on the main menu's "Begir	n Installation" button.
Local Standard Disks				
2048 GiB	2048 GiB	2048 GiB	2048 GiB	2048 GiB
		C	C	<i>—</i>
VBOX HARDDISK	ATA VBOX HARDDISK	ATA VBOX HARDDISK	ATA VBOX HARDDISK	ATA VBOX HARDDISK
/ 2048 GiB free	sdk / 2048 GiB free	sdl / 2048 GiB free	sdm / 2048 GiB free	sdn / 2048 GiB free
Specialized & Network D	isks		Disks left un	selected here will not be touched.
Other Storage Options				
Partitioning				
Automatically configur	e partitioning. 🔘 I will configure	partitioning.		
I would like to make a	additional space available.			
Encryption Encrypt my data. You'	ll set a passphrase next.			
Full disk summary and boot	loader		14 disks selected; 24.5 Tif	3 capacity; 24.5 TiB free <u>Refresh</u>

c. Under Other Storage Options, in the Partitioning category, select I will configure partitioning. See Figure B.3.

Done	TINATION		CEN œu	TOS LINUX 7 INSTALLATIO
evice Selection				
Select the device(s) y	ou'd like to install to. They wi	ll be left untouched until you o	lick on the main menu's "Begi	n Installation" button.
2048 GiB	2048 GiB	2048 GiB	2048 GiB	2048 GiB
VBOX HARDDISK / 2048 GiB free	ATA VBOX HARDDISK sdk / 2048 GiB free	ATA VBOX HARDDISK sdl / 2048 GiB free	ATA VBOX HARDDISK sdm / 2048 GiB free	ATA VBOX HARDDIS sdn / 2048 GiB free
Add a disk				
ther Storage Option	s			
Partitioning				
I would like to make	additional space available.	partitioning.		
Encryption				
Encrypt my data. You	'll set a passphrase next.			

#### Figure B.3. Selecting manual partitioning

- d. Click on the Done button in the top-left corner of the Installation Destination screen.
- 2. After clicking on the Done button in the top-left corner of the Installation Destination screen, you will be taken to the Manual Partitioning screen. See Figure B.4.

![](_page_31_Picture_1.jpeg)

Figure B.4. Manual partitioning screen

In the left pane, select Standard partition. See Figure B.5.

![](_page_31_Picture_4.jpeg)

Figure B.5. Manual partitioning screen with standard partitions

- 3. In this step, you will create a partition. The first partition you will create is the boot partition. (This step will then be repeated for other partitions.)
  - a. At the bottom of the left pane, click the + sign to create a new partition.
  - b. In the Mount Point text field, type the mount point. For the boot partition, the value is /boot.
  - c. Leave the Desired Capacity field blank. The result so far is shown in Figure B.6.

#### Figure B.6. Creating the boot partition

MANUAL PARTITIONING		CENTOS LINUX 7 INSTALLATION
Vew CentOS Linux 7 Installation     You haven't created any mount points for your     CentOS Linux 7 installation yet. You can:     Click here to create them automatically.     Create new mount points by clicking the '+'     button.     New mount points will use the following     partitioning scheme:     Standard Partition	ADD A NEW MOUNT POINT More customization options are available after creating the mount point below. Mount Point: //boot Desired Capacity:	inux 7 installation, you'll be able to view their details
+ - C AVAILABLE SPACE 24.5 TIB 14 storage devices selected	Cancel Add mount point	Reset All

- d. Click the Add mount point button.
- 4. In this step, you will set the device type and file system type of the newly created partition, and its size. (Again here, the first partition you will configure is the boot partition, then this step will be repeated for other partitions.)
  - a. In the Desired Capacity field, enter the partition size. In the case of the boot partition, the value is **512** MiB.

![](_page_32_Picture_10.jpeg)

#### Important

Note the "i" in "MiB". Under some definitions, one megabyte is 1,024 kilobytes, and under others, 1,000 kilobytes. CentOS uses the notation with an extra "i", which makes it explicit that the non-decimal definition of 1,024 is meant. In this step and all similar steps, use "MiB" for megabyte, "GiB" for gigabyte, and "TiB" for terabyte -- not the traditional but ambiguous "MB", "GB" and "TB".

b. In the Device Type drop down box, select the correct device type for the partition, which is often Standard Partition or RAID, or the special type Swap for the swap partition. In the case of the boot partition, the device type is Standard Partition.

- c. (Optional) If the device type is RAID, a new drop down box labeled RAID Level will appear so that you can further select the RAID scheme for a RAID partition. (This does not apply to the boot partition.)
- d. In the File System drop down box, select the desired file system type for the partition, which is often xfs, or the special types EFI System Partition for the EFI system partition, or swap for the swap partition. In the case of the boot partition, the correct value is xfs. The result so far is illustrated in Figure B.7.

MANUAL PARTITIONIN	IG		CENTOS LINUX 7 INS	TALLATION Help!
▼ New CentOS Linux	x 7 Installation	sdal		
/boot sdal	256 GiB 〉	Mount Point:	Device (s):	
		Desired Capacity: 512 MiB	ATA VBOX HARDDISK (sda) and 13 others	
			Modify	
		Device Type:		
		File System:		
		xfs <ul> <li>Reformat</li> </ul>		
		Label:	Name:	
			sdal	
			Update	Settings
+ - C			Note: The settings you make on this not be applied until you click on the n 'Begin Installati	screen will nain menu's ion' button.
AVAILABLE SPACE TOTAL 24.25 TiB 24.	L SPACE 5 TiB			
14 storage devices select	ted			Reset All

#### Figure B.7. Modifying the boot partition devices

- e. In the top-right Device(s) category, click the Modify... button.
- 5. In this step, you will select the disks the partition applies to. (The first partition you will do this for is the boot partition, then later this step will be repeated for other partitions.)
  - a. After you click the Modify... button, the Configure Mount Point dialog to select the partition's devices will pop up. By default, every disk with remaining free space is selected. See Figure B.8.

MANUAL PARTITIONING						CENTOS LINUX 7 INSTALLATI	ON !
New CentOS Linux 7 Installa	ation	sdal					
SYSTEM /boot sdai	512 MiB 义	Mount Point: /boot Desired Capacity: 512 MiB		De AT	evice (s): "A VBOX HARDDISH	(sda) and 13 others	
c	ONFIGURE MOU	INT POINT					
		Select one or more disks this o	device m	ay reside or	1.		
	Description		Name	Capacity	Free		
	ATA VBOX HARDE	DISK (VBd12980ca-Oc36f1c3)	sda 📐		255.5 GiB		
A					256 GiB		
	ATA VBOX HARDE	DISK (VB45c1a13a-6725e974)		2048 GiB	2048 GiB		
	ATA VBOX HARDE	DISK (VB312d5abf-04e88c9b)		2048 GiB	2048 GiB		
			J	Cance	el Select		
+ - C					Note: Th not be app	Update Settings e settings you make on this screen wil slied until you click on the main menu" "Begin Installation" button	) 11 5
AVAILABLE SPACETOTAL SPACE24.5 TiB24.5 TiB							
14 storage devices selected						Reset A	all

Figure B.8. Partition device selection dialog

b. Select only the disks corresponding to the partition. In the case of the boot partition, this is only the first disk in the machine, sda. See Figure B.9.

MANUAL PARTITIONING						CENTOS LINUX 7 INSTALLATION
▼ New CentOS Linux 7 Insta	llation	sdal				
SYSTEM /boot sdal	512 MiB 义	Mount Point: /boot Desired Capacity: 512 MiB		D. AT	e <b>vice (s):</b> FA VBOX HARDDISK	(sda) and 13 others
	CONFIGURE MOL	UNT POINT				
		Select one or more disks this	device m	ay reside oi	n.	
	Description		Name	Capacity	Free	
	ATA VBOX HARD	DISK (VB28bfaa8f-6fa4b9a2)	sda	256 GiB	255.5 GiB	
	ATA VBOX HARD	DISK (VB1c1c9de8-OObfc66a)	sdb	256 GiB	256 GiB	
	ATA VBOX HARD	DISK (VBf33981e5-33d2abfb)	sdc	2048 GiB	2048 GiB	
	ATA VBOX HARD	DISK (VBc6abb2c1-79812c25)	sdd	2048 GiB	2048 GiB	
	ATA VBOX HARD	DISK (VB15ctbbet-c2d4ebb4)	sde	Canc	el Select	
+ - C AVAILABLE SPACE TOTAL SPACE					Note: The not be app	Update Settings settings you make on this screen will lied until you click on the main menu's "Begin Installation" button.
24.5 TiB 24.5 TiB						Reset All

Figure B.9. Selecting the boot partition devices

- c. Click the Select button to close the Configure Mount Point dialog.
- d. In the bottom-right corner, click the Update Settings button and allow the system to finalize the characteristics of the partition. The result for the boot partition is shown in Figure B.10.

one			🖽 us Help
<ul> <li>New CentOS Linux</li> </ul>	7 Installation	sdal	
SYSTEM		Mount Point:	Device(s):
/boot sdal	512 MiB 〉	/boot	
		Desired Capacity: 512 MiB	ATA VBOX HARDDISK (sda)
			Modify
		Device Type:	
		Standard Partition   Encrypt	
		File System:	
		xfs   Reformat	
		Label:	Name:
			sdal
+ - C AVAILABLE SPACE 24.5 TIB 24.5	SPACE 5 TIB		Update Settings Note: The settings you make on this screen w not be applied until you click on the main menu 'Begin Installation' butto

Figure B.10. Finalized boot partition

- 6. Repeat Step 3, Step 4 and Step 5 for the EFI system partition:
  - In Step 3, enter /boot/efi in the Mount Point text field.
  - In Step 4, enter the desired partition size (in this example **512 MiB**), select Standard Partition in the Device Type drop down box, and select EFI System Partition in the File System drop down box.
  - In Step 5, select only the first disk (in this example sda).

The result of configuring the EFI system partition is illustrated in Figure B.11.

MANUAL PARTITIONING			CENTOS LINUX 7 INSTALLATION Bus Help!
▼ New CentOS Linux 7	Installation	sda2	
SYSTEM /boot sdal	512 MiB	Mount Point: /boot/efi	Device (s):
<b>/boot/efi</b> sda2	512 MiB >	Desired Capacity: 512 MiB	ATA VBOX HARDDISK (sda)
			Modify
		Device Type: Standard Partition  Encrypt File System: EFI System Partition Reformat	
		Label:	Name: sda2
+ - C			Update Settings Note: The settings you make on this screen will not be applied until you click on the main menu's 'Begin Installation' button.
AVAILABLE SPACETOTAL SPA24.5 TiB24.5 Ti	ib		
14 storage devices selected			Reset All

Figure B.11. Configuring the EFI system partition

- 7. Repeat Step 3, Step 4 and Step 5 for the swap partition:
  - In Step 3, enter swap in the Mount Point text field.
  - In Step 4, enter the desired swap capacity (recommended: twice as much as there is memory, which in our example means 8 GiB), select Standard Partition in the Device Type drop down box, and select swap in the File System drop down box.
  - In Step 5, select only the first disk (in this example sda).

The result of configuring the swap partition is illustrated in Figure B.12.

<ul> <li>New CentOS Linux</li> </ul>	7 Installation	sda 3	
SYSTEM /boot sda1	512 MiB	Mount Point:	Device(s):
/boot/efi sda2	512 MiB	Desired Capacity: 8192 MiB	ATA VBOX HARDDISK (sda)
swap sda3	8192 MiB 义		Modify
		Device Type: Standard Partition	
		swap   Reformat	
		Label:	Name: sda3
			Update Settings
+ - C			not be applied until you click on the main men

Figure B.12. Configuring the swap partition

- 8. Repeat Step 3, Step 4 and Step 5 for the root partition, according to one of these three alternatives:
  - If you are using a dedicated system array or a shared system array:
    - In Step 3, enter / in the Mount Point text field.
    - In Step 4, enter the special keyword max into the Desired Capacity field, select RAID in the Device Type drop down box, select RAID1 (Redundancy) in the RAID Level drop down box, and select xfs in the File System drop down box.
    - In Step 5, select the two disks in the system array (in our example the first two disks in the machine, sda and sdb).

The result of this alternative is shown in Figure B.13.

MANUAL PARTITIONING			CENTOS LINUX 7 INSTALLATION 🖽 us Help!
▼ New CentOS Linux 7 I	nstallation	root	
SYSTEM /boot sdal	512 MiB	Mount Point:	Device(s):
/boot/efi sda3	512 MiB	Desired Capacity:	ATA VBOX HARDDISK (sda) and 1 other
/ root swap sda2	246.87 GiB > 8192 MiB	240.07 00	Modify
		Device Type: RAID  Encrypt File System:  xfs  Reformat	RAID Level: RAID1 (Redundancy)
		Label:	Name: root
+ - C <sup>4</sup> AVAILABLE SPACE TOTAL SPACE 24.01 TIB 24.5 TI	ie B		Undate Settings Note: The settings you make on this screen will not be applied until you click on the main menu's 'Begin Installation' button.
<u>14 storage devices selected</u>	-		Reset All

**Figure B.13.** Configuring the root partition (dedicated system array)

If you are using a dedicated system disk:

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- In Step 3, enter / in the Mount Point text field.
- In Step 4, enter the special keyword **max** into the Desired Capacity field, select Standard Partition in the Device Type drop down box, and select xfs in the File System drop down box.
- In Step 5, select the first disk in the machine, sda.

The result of this alternative is shown in Figure B.14.

MANUAL PARTITIONING			CENTOS LINUX 7 INSTALLATION 🖽 us Help!	
New CentOS Linux 7 Installation		sda5		
SYSTEM /boot sdal	512 MiB	Mount Point:	Device (s):	
/boot/efi sda3	512 MiB	Desired Capacity:	ATA VBOX HARDDISK (sda)	
/ sda5	247 GiB >	247 010	M.J.C.	
swap sda2	8192 MiB		Pidali y	
		Device Type:		
		Standard Partition   Encrypt		
		File System:       xfs         Image: Constraint of the system of the sy		
		Label:	Name: sda5	
			Update Settings	
+ - C'			Note: The settings you make on this screen will not be applied until you click on the main menu's 'Begin Installation' button.	
AVAILABLE SPACE TOTAL SP/ 24.25 TIB 24.5 T	<sup>ACE</sup> TIB			
14 storage devices selected			Reset All	

Figure B.14. Configuring the root partition (dedicated system disk)

If you are using a shared system array:

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- In Step 3, enter / in the Mount Point text field.
- In Step 4, enter the intended usable size of the root partition into the Desired Capacity field, select RAID in the Device Type drop down box, select RAID1 (Redundancy) in the RAID Level drop down box, and select xfs in the File System drop down box. (In Figure B.15, the usable size of 20 GiB is used as an example. In RAID1, it means that 20GB are used on each of the disks in the array, with the root partition appearing to the user as having 20GB of usable space.)
- In Step 5, select all the disks in the shared system array, that is, all the disks in the first storage array. (In all the examples thus far, we were using a hypothetical machine with two small disks for a dedicated system array and twelve large disks for two 6-disk storage arrays. In Figure B.15, the depiction is of a machine with only twelve large disks named sda through

sdl for two 6-disk arrays. The disks selected in this case would then be the first six, sda through sdf.)

The result of this alternative is shown in Figure B.15.

м	ANUAL PARTITIONING	HILL		CENTOS LINUX 7 INSTALLATION 🖼 us Help!
	New CentOS Linux 7 Instal	lation	root	
	SYSTEM /boot sdal	512 MiB	Mount Point:	Device (s):
	/boot/efi sda3	512 MiB	Desired Capacity:	ATA VBOX HARDDISK (sda) and 5 others
	/ root	20 GiB 💙	20 GB	Modify
	swap sda2	8192 MiB		
			Device Type:	RAID Level:
			RAID	RAID1 (Redundancy)
			File System:	
			XIS . We official	
			Label:	Name:
				root
				Updat Settings
				Note: The settings you make on this screen will not be applied until you click on the main menu's
				'Begin Installation' button.
	AVAILABLE SPACETOTAL SPACE23.87 TiB24 TiB			
	12 storage devices selected			Reset All

Figure B.15. Configuring the root partition (shared system array)

- 9. The next step is to configure the storage arrays. Repeat Step 3, Step 4 and Step 5 for **each** storage array:
  - In Step 3, enter the mount point for the storage array in the Mount Point text field: /cache0 for the first storage array, /cache1 for the second, /cache2 for the third, etc.
  - In Step 4, enter the special keyword **max** into the Desired Capacity field, select RAID in the Device Type drop down box, select RAID6 (Redundant Error Checking) in the RAID Level drop down box, and select xfs in the File System drop down box.
  - In Step 5, select only the first disk (in this example sda).

Figure B.16 shows the result of creating storage arrays on our hypothetical machine. The first storage array (mount point /cache0) spans the six disks sdc through sdh, and the second storage array (mount point /cache1) spans the six disks sdi through sdn.

	NG		CENTOS LINUX 7 INSTALLATIO I us Help!
▼ New CentOS Lin	ux 7 Installation	cache1	
DATA /cache0 cache0	8191.49 GiB	Mount Point: /cachel	Device(s):
/cache1 cache1	8191.49 GiB >	Desired Capacity:	ATA VBOX HARDDISK (sdi) and 5 others
SYSTEM /boot sdal	512 MiB	8191.49 GB	Modify
/boot/efi sda3	512 MiB	Device Type:	RAID Level
/ root	246.87 GiB	RAID	RAID Level. RAID6 (Redundant Error Checking)
swap sda2	8192 MiB	File System:	
		Label:	Name: cachel
			Update Settings
+ - C			Note: The settings you make on this screen will not be applied until you click on the main menu's
VAILABLE SPACE	TOTAL SPACE 24.5 TIB		"Begin Installation" button.
4 storage devices sele	ected		Reset Al

Figure B.16. Configuring the storage arrays

- 10. In the top-left corner of the Manual Partitioning screen, click the Done button.
- 11. A Summary of Changes dialog appears (see Figure B.17), allowing you to review the low-level disk partitioning and formatting operations that will take place once the CentOS installation proceeds. Click on the Accept Changes button to return to the main CentOS installation screen.

![](_page_43_Figure_1.jpeg)

Figure B.17. Confirming disk partitioning and formatting actions