

RH199 - RHCSA Rapid Track Course

Orientation to the classroom environment:

classroom.example.com - Classroom Server

Canonical name of classroom server:

materials.example.com

content.example.com

bastion.lab.example.com - Gateway

workstation.lab.example.com - Client (Laptop)

servera.lab.example.com

serverb.lab.example.com

utility.lab.example.com - IPA / NFS

Credentials:

root -> redhat

student -> student (SUDO)

EX200:

<https://www.redhat.com/en/services/training/ex200-red-hat-certified-system-administrator-rhcsa-exam>

Remote Exam:

<https://www.redhat.com/en/services/certification/remote-exams>

Chapter 1

Hardware Console Login:



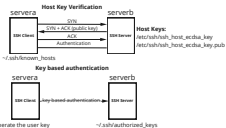
Pseudo terminals (pts/0, pts/1,...)

SSH - Secure SHell - Remote Rendering Tool (Port: 22/tcp)

ssh USER@SERVER or # ssh -l USER SERVER

private key (decryption)

public key (encryption)



- Generate the user key
ssh-keygen
- Copy the key to remote server
ssh-copy-id -i PUB_KEY User@Server

What's new in RHEL 8?

- Cockpit Administration tool installed by default
- Red Hat Insights
- Red Hat Ansible Engine
- DNF (Dantified Yum) replaced YUM - Package Management
- nftables replaced iptables - Inbuilt firewall
- Default display server 'wayland'
- Stratis filesystem introduced
- Podman, Buildah, & Skopeo utilities available by default

Minimum Hardware Requirements:

<https://access.redhat.com/articles/rhel-limits>

Task Affinity:

https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux_for_real_time/7/html/reference_guide/chap-affinity

Offline RedHat Subscription - <https://access.redhat.com/solutions/3121571>

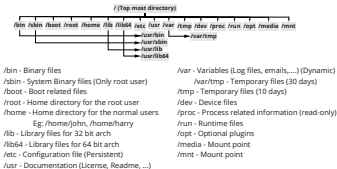
- Support - <https://access.redhat.com/support>
- Updates
- Knowledgebase Access - <http://access.redhat.com/knowledgebase>

Red Hat Insights

<https://cloud.redhat.com/insights/>

Chapter 2

File System Hierarchy




- Commands:**
- ls - To list the files/directories
 - l Long listing format (Alias command **#ll**)
 - lh Size in human-readable format
 - li inode number
 - la All the files & directories (Alias command **#ll**. Only to display hidden files/directories)
 - ld Current directory information
 - cd - To switch between directories
 - Home directory (**# cd**)
 - Previous working directory
 - Parent directory
 - Current directory
 - pwd - Present Working Directory
 - touch - To create an empty file-if file/directory already exists, touch will update the timestamp
 - mkdir - Make Directories
-
- file - File Type
 - stat - File information
 - cat - To view the file content
 - > Add the content(Overwrite)
 - >> Append the content
 - n Number the lines
 - vim - File editor (**# vimtutor** - Documentation page for vim)
 - wc - Word count (**LINE WORD CHAR**)
 - l Line count
 - w Word count
 - c Character count
 - head - First 10 lines of the file
 - n Number of lines to display
 - tail - Last 10 lines of the file
 - n Number of lines to display
 - less - Display the file content in page by page

Links:


Symbolic or Soft Link (**# ln -s SRC DEST)**

- Shortcut (base of access)
- Applicable on both files & directories.
- Original files & soft links will have different inodes.
- Soft links always be in 0 size



Hard Link (**# ln SRC DEST)**

- Backup
- Applicable only on files
- Same-inode & size as the original file



Chapter 3

Users & Groups Management

/etc/passwd

/etc/default/useradd

Users:

- Super User:
 - root - UID: 0
- System Users:
 - Static system users - UID: 1 to 200
 - Dynamic system users - UID: 201 to 999
- Normal Users:
 - UID: 1000 to 65536

User creation will update the below files,

/etc/passwd - Username:Password_RefUID:GID:GECOS:Home_Directory:Shell

/etc/shadow - Username:Password_LastPassChngDate:MinDaysToChngPass:MaxDaysToChngPass:WarnDaysInActiveDays:ExpireDate

/etc/group - Groupname:Password_RefGID:GroupMembers

/etc/gshadow - Groupname:Password_GroupAdmin:GroupMembers

/home/GID - Home directory of the user

/var/spool/mail/FILE - Mail location of the user

Groups:

- Primary or Auxiliary groups
 - Each user must have a primary group
 - Primary group name will be the same as the user name
- Secondary or Supplementary groups
 - Inheritance

Group creation will update the below files,

/etc/group - Groupname:Password_RefGID:GroupMembers

/etc/gshadow - Groupname:Password_GroupAdmin:GroupMembers

Commands:

- To view the user information,
id or **# id USERNAME**
grep passwd USERNAME
grep shadow USERNAME
grep group GROUPNAME
grep gshadow GROUPNAME
- To manage a user,
useradd -u UID -g PRiGrp -s SecGrp -c GEcos -l SHELL USERNAME
usermod -u UID -g PRiGrp -sG SecGrp -c GEcos -s SHELL USERNAME
userdel -r USERNAME
- To manage a group,
groupadd -g GID GROUPNAME
groupmod -g GID GROUPNAME
groupdel GIDGROUPNAME
- To temporarily change the primary group
newgrp GIDGROUPNAME (Requires the group password)
- To add the users to the secondary groups,
usermod -sG SecGrp Username
OR
passwd
 - a Add the user to the group
 - d Delete the user from the group
 - M To set the list of users as the member of the group

- To set the user passwd,
passwd USERNAME OR **# passwd --stdin USERNAME**
- To set the group passwd,
groupadd GROUPNAME
- To view/set the password aging
chage -l USERNAME
chage USERNAME

Restricting the user account from login:

- # usermod -L USERNAME -> Lock the user account**
- # usermod -U USERNAME -> Unlock the user account**
- # passwd -l USERNAME -> To lock the password**
- # passwd -u USERNAME -> To unlock the password**
- # passwd -S USERNAME -> To view the password status**
- # usermod -s /bin/nologin USERNAME -> To set the nologin shell**

SubC: Super User DO

/etc/passwd: OR **/etc/passwd.db**

To edit **/etc/passwd**, use **# visudo** (For the syntax verification)

USERNAME	HOSTNAME=(USERNAME)	COMMANDS
%GROUPNAME	HOSTNAME=(USERNAME)	COMMANDS


Examples:

```
richard ALL=(ALL) NOPASSWD: ALL
harry server,serverb(:root) NOPASSWD: /usr/bin/useradd,/usr/bin/userdel
%devgrp ALL=(ALL) NOPASSWD: ALL
```

Chapter - 4

File System Permissions

ls -l OR **# ll**



File Type

- Text file
- Directory
- b - Block device
- l - Symbolic Link
- c - Character device

To change the owner(user): (-R recursive)

- # chown USER FILE/DIR**
- # chown USER:GROUP FILE/DIR**
- # chown USER:GROUP FILE/DIR**

To change the group owner: (-R recursive)

- # chgrp GID FILE/DIR**

To change the permissions: (-R recursive)

- # chmod PERMISSiONS FILE/DIR**

u - user r (R) - read
g - group w (W) - write
o - others x (X) - execute
a - all

Numerical	Alphabetical
ugo	u=rwxg=r
777	u=rwxg=r
644	u=rw-o=r
666	u=rw-g=r
657	u=rw-o=r

	Files	Directory
Read	To read the content	To list all the sub files/dirs.
Write	To edit the content	To create/delete/rename all the sub files/dirs.
Execute	To run the file	Switch into the directory (standalone)

Umask:

Value which sets the default file/directory permissions.

- # umask VALUE** - Session level (temporary)
- ~/.bashrc** - User level
- /etc/profile** - Global level

Super user - 000	Normal users - 002
7 7 7	7 7 7
0 0 3 (-)	0 0 3 (-)
7 5 5 (-new-r-x) Dir	7 5 5 (-new-r-x) Dir
1 1 1 (-)	1 1 1 (-)
6 4 4 (-new-o-r) File	6 4 4 (-new-o-r) File

Special Permissions:

- 4 - SUID (User)**- Applicable only for executable files.
Normal users can execute /bin command
chmod u+s PATH OR **# chmod 4000 PATH**
- 2 - SGID (Group)**- Applicable for both executable files and directories.
Inherit the group ownership to all the future sub files and sub directories
chmod g+s PATH OR **# chmod 2755 PATH**
- 1 - Sticky Bit (Other)**- Applicable only for directories.
To restrict the user actions on the file/dir owned by others.
chmod o+t PATH OR **# chmod 1777 PATH**

Chapter 5

SELinux - Security Enhanced Linux

Policy

- Booleans (Set of policies)
- Context (Labelling)

Modes:

- Enabled
 - Enforcing **[DEFAULT]**
Strictly follows the policy
 - Permissive (Logs)
- Disabled

Config File: /etc/selinux/config

setenforce { 1 | 0 | enforcing | permissive }

getenforce

sestatus

Booleans - Set of policies

To view the boolean status,

```
# semanage boolean -l
```

```
# getsebool -a
```

```
# setsebool -P BOOLEAN [on | off]
```

Contexts - Labelling

- User / Role / **Type** / Level
_u: _r: _t: s0

To relabel the entire filesystem,

```
# restorecon -R/ OR # touch /autorelabel
```

```
# reboot
```

To create SELinux custom policy:

https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/8/html/using_selinux/writing-a-custom-selinux-policy_using_selinux

Chapter 6

Process Management

CPUS = No of Sockets * Cores per Socket * Thread per Core

= 1 * 2 * 2

= 4

Process Scheduler Time slicing tool

cpu0 ← Process1 - 5s - Idle

 ← Process5 - Idle - 5s

cpu1 ← Process2

cpu2 ← Process3

cpu3 ← Process4

Until RHEL 6 -> **init** -> PID: 1

From RHEL 7 -> **systemd** -> PID: 1

Parent Process -> Forks

Process Status:

R -> Running	< High Priority
S -> Sleeping (Idle)	N Low Priority
D -> Sleeping (Waiting for I/O)	s Session Leader
K -> Sleeping (Uninterruptible)	+ Foreground Process
T -> Stopped	L Locked into memory
X -> Terminated	l Multi-threaded process
Z -> Zombie (Defunct)	

Kill Signals:

15 SIGTERM [DEFAULT]
9 SIGKILL
19 SIGSTOP
18 SIGCONT

Process Priorities:

Nice Level	0	+19
-20		
High	Default	Low

PR = NI + 20

-18 + 20 = 2

+15 + 20 = 35

tuned

```
# tuned-adm list      # tuned-adm active
```

```
# systemctl -a | grep vm.swappiness
```

If vm.swappiness=30

When RAM 70% utilized, idle process moved to swap space

If vm.swappiness=20

When RAM 80% utilized, idle process moved to swap space

Chapter 7

Package Management

Subscription

Red Hat Store - <https://www.redhat.com/en/store/>

Red Hat Offline Subscription

<https://access.redhat.com/solutions/3121571>

Offline Repo Config: <https://access.redhat.com/solutions/3176811>

Red Hat Learning Subscription

<https://www.redhat.com/en/services/training/learning-subscription>

- RHEL
- Red Hat Smart Management (RHEL + Satellite + Insights)

Advisories:

- Security (RHSA)
- Bugfix (RHBA)
- Enhancements (RHEA)

Until RHEL 7 - YUM (Yellowdog Updater Modified)

From RHEL 8 - DNF (Dantified YUM)

RPM - Red Hat Package Manager

Package Repository -> Collection of RPMs

From RHEL 8,

- BaseOS
- AppStream (Modularity)
 - Stable version (Admin)
 - Latest version (Developer / Test)

Module Name	Stream	Profile
Postgresql	10	server,client,devel
Postgresql	12	server,client

Chapter 8

Basic Storage Management

MBR (Master Boot Record)

2048 sectors

5GB	3GB	Extended	
16	16	16	16

- Primary Partition
- Extended Partition (Space for logical partitions)
 - Logical Partition

GPT (GUID Partition Table)

128 Partitions

- Primary Partition

512b

446b Bootloader

64b Partition Table

2b Cyclic Redundancy Check (CRC)

- Create the partition (#lsblk)**

```
# parted
```

```
# fdisk (MBR)
```

```
# gdisk (GPT)
```
- Format the filesystem (#lsblk -f OR #blkid)**

Assigning the filesystem

```
# mkfs -t FILESYSTEM PARTITION
```

```
ext3
```

```
ext4
```

```
xfs
```

```
ntfs
```

```
vfat
```

```
iso9660
```
- Mount the filesystem (#df -hT)**

Mapping the partition to the directory

```
# mount                      #Temporary
```

```
# vim /etc/fstab            #Permanent
```

Swap Space (#free)

1. Create the partition (Primary/Logical)
2. Format the partition (Swap filesystem)
 - a. `#mkswap /dev/vdc2`
3. Activate the swap space
 - a. `# swapon /dev/vdc2` | `#swapon /dev/vdc2` (Temporary)
 - b. `# vim /etc/fstab` (Permanent)
 - c. `# swapon -s` -> To list all the active swap partitions
 - d. `# swapon -a` -> To activate all the swap partitions defined in fstab

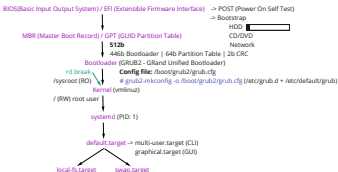
- To refresh the partition table,
partprobe
- To wait for the system to detect new partition created and update the file under /dev directory,
udevadm settle

RHEL 8 Partitioning Reference:

https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/8/html/performing_a_standard_rhel_installation/partitioning-reference_installing-rhel

Chapter 9

Boot Process



Root password recovery:

- Reboot the system and interrupt the boot menu.
- Highlight the kernel menu and press 'e' to edit
- At the end of the line starts with 'linux16', append 'rd.break console=tty2'
- Press ctrl+x to boot
- # mount -o remount,rw /sysroot
chroot /sysroot
passwd --stdin root

touch /.autorelabel OR # load_policy -i
restorecon -Rv /
exit
exit

```
switch_root:/# mount -o remount,rw /sysroot/  
switch_root:/# chroot /sysroot/  
sh-4.4# passwd --stdin root  
Changing password for user root.  
redhat  
passwd: all authentication tokens updated successfully.  
sh-4.4# touch /.autorelabel  
sh-4.4# exit  
exit  
switch_root:/# exit_
```

systemd

Command: # systemctl

Unit files: /usr/lib/systemd/system/

On boot unit files: /etc/systemd/system/

- Booting is much faster comparative to init

- Units:

1. service
2. target
3. slice
4. path
5. timer
6. mount
7. automount
8. device
9. swap
10. scope
11. socket

service:

systemctl OPTION UNIT

enable
disable
start
stop
restart
try-restart -> Restart only the running service
reload
mask
unmask
status | is-active | is-enabled

target:

- multi-user.target (CLI)
- graphical.target (GUI)
multi-user.target + display manager
- emergency.target
- rescue.target

OPTION:

- get-default
- set-default
- isolate

Chapter 10

IPv4Networking

CLI: # nmcli

Config file: /etc/sysconfig/network-scripts/ifcfg-NAME

TUI: # nmtui

GUI: # nm-connection-editor

Ethernet or Interface

eth0

eth1

Connection

intracon

IP: 192.168.1.25/24, GW: 192.168.1.254

intercon

DHCP

devcon

IP: 10.0.0.35/16, GW: 10.0.0.254, DNS: 10.0.0.254

DNS:

/etc/resolv.conf

To set the hostname:

hostnamectl set-hostname HOSTNAME
(/etc/hostname)

Chapter 11

Analyzing and Storing Logs

systemd-journald - To collect the logs

/run/log/journal/

vim /etc/systemd/journald.conf

Storage=persistent

rsyslog - To store the journal logs persistently in an organized way

/var/log/

boot.log Boot related logs
dnf.log Package related logs
maillog Mail related logs
lastlog Login informations
secure Authentication

/etc/rsyslog.conf

FACILITY.PRIORITY

FILENAME

Code	Severity	Keyword	Description
0	Emergency	emerg (panic)	System is unusable.
1	Alert	alert	Action must be taken immediately.
2	Critical	crit	Critical conditions.
3	Error	err (error)	Error conditions.
4	Warning	warn (warn)	Warning conditions.
5	Notice	notice	Normal but significant condition.
6	Informational	info	Informational messages.
7	Debug	debug	Debug-level messages.

Facility Number	Keyword	Facility Description
0	kernel	kernel messages
1	user	user-level messages
2	mail	mail system
3	daemon	system daemons
4	auth	security/authentication messages
5	syslog	messages generated internally by syslogd
6	lpr	line printer subsystem
7	news	network news subsystem
8	uucp	UUCP subsystem
9	clock	clock daemon
10	authpriv	security/authentication messages
11	ftp	ftp daemon
12	ntp	ntp subsystem
13	log	log itself
14	log	log itself
15	cron	cron daemon
16	local0	local user 0 (local0)
17	local1	local user 1 (local1)
18	local2	local user 2 (local2)
19	local3	local user 3 (local3)
20	local4	local user 4 (local4)
21	local5	local user 5 (local5)
22	local6	local user 6 (local6)
23	local7	local user 7 (local7)

NTP - Network Time Protocol



General Description

A "panic" condition usually affecting multiple applications/sites. At this level it would usually notify all tech staff on call.

Should be corrected immediately, therefore notify staff who can fix the problem. An example would be the loss of a primary ISP connection.

Should be corrected immediately, but indicates failure in a primary system, an example is a loss of a backup ISP connection.

Non-urgent failures, these should be relayed to developers or admins; each item must be resolved within a given time.

Warning messages, not an error, but indication that an error will occur if action is not taken, e.g. file system 85% full - each item must be resolved within a given time.

Events that are unusual but not error conditions - might be summarized in an email to developers or admins to spot potential problems - no immediate action required.

Normal operational messages - may be harvested for reporting, measuring throughput, etc. - no action required.

Info useful to developers for debugging the application, not useful during operations.

DNS Resolution:

<https://access.redhat.com/solutions/58625>

<https://access.redhat.com/discussions/702573>

