

OpenRHCE

A Creative Commons Courseware for RHCE Preparation

```
# tail -f /var/log/messages
$
# fdisk -l
$ df -h
# ifconfig eth0
# yum install gnome-applet-vm
$ ssh scott@192.168.1.100
# lvcreate -L 12G -n SRV01 vmstore
# service network restart
```

Course Outline

Contents

Course Outline	3
Session One: Introduction	8
Introductions: Your Instructor	9
Introductions: Your Instructor	10
Qualifications:	11
Personal:	12
Introductions: Fellow Students	13
Please Introduce Yourself	14
Introductions: The Course	15
Expectations	16
Preparation Recommendations	17
The Red Hat Certification Landscape	18

RHCSA Objectives	19
RHCSA Objectives: Understand & Use Essential Tools	20
RHCSA: ...Essential Tools... (cont)	21
RHCSA: Operate Running Systems	22
RHCSA: Configure Local Storage	23
RHCSA: Create and Configure File Systems	24
RHCSA: Deploy, Configure & Maintain	25
RHCSA: Manage Users and Groups	26
RHCSA: Manage Security	27
RHCE Objectives	28
RHCE: System Configuration and Management	29
RHCE: Network Services	30
RHCE: HTTP/HTTPS	31
RHCE: DNS	32
RHCE: FTP	33
RHCE: NFS	34

RHCE: SMB	35
RHCE: SMTP	36
RHCE: SSH	37
RHCE: NTP	38
Operating a System: Boot, Reboot, Shutdown	39
Operating a System: Runlevels	40
Operating a System: Single User Mode	41
Operating a System: Log Files	42
Operating a System: Start/Stop Virtual Machines	43
Operating a System: Virtual Machine Consoles	44
Operating a System: Virtual Machine Text Console	45
Operating a System: Start, stop, and check the status of network services	46
Operating a System: Modify the system bootloader	47
Session 2 Storage and filesystems	48
Local Storage: Working with Partitions	49

Local Storage: Working with Logical Volume Management	50
Local Storage: Working with LUKS encrypted storage	51
Local Storage: Using UUIDs and Filesystem Labels	52
Local Storage: Adding New Storage	53
File systems: Working with Common Linux Filesystems	54
File systems: Working with LUKS-encrypted filesystems	55
Filesystem Permissions: Basic Permissions	56
Filesystem Permissions: Extended Attributes	57
Filesystem Permissions: Use case -- Collaborative Directories	58
Filesystems Permissions: File Access Control Lists	59
Network Storage: Working with CIFS network file systems	60
Network Storage: Working with NFS file systems	61
Network Storage: Working with iSCSI devices	62
Session 3 Managing software, processes, kernel attribute, and users and groups	63

Managing Software	64
Manage Processes and Services	65
Manage system performance	66
Manage Users and Groups	67
Session 4 Networking and routing	68
Session 5 Firewalls and SELinux	69
Session 6 Virtualization	70
Session 7 Logging and remote access	71
Session 8 Network Time Protocol	72
Session 9 HTTP and FTP	73
Session 10 NFS and Samba	74
Session 11 DNS and SMTP	75
Session 12 Finish uncompleted topics, Review, or Practice	76
Exam	

Session One: Introduction

Introductions: Your Instructor

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Introductions: Your Instructor

Qualifications:

- RHCSA, RHCE #110-008-877 (RHEL6)
- Also: CTT+, CLA, CLP, CNI, LPIC1, Linux+
- Curriculum Developer and Trainer for a major computer manufacturer for going on 11 years
- Linux Enthusiast since 2000

Personal:

- Husband, father, disciple and
- Fun: Part-time Balloon Entertainer

Introductions: Fellow Students

Please Introduce Yourself

- Name
- Where you work or what you do.
- What Linux experience do you already have?
- What goals do you have for this class?
- Something fun about yourself.

Introductions: The Course

Expectations

- Should I be able to pass the RHCE on this class alone?

A stunning number of seasoned professionals taking Red Hat's own prep courses fail to pass on first attempt.

- Planning for more than one attempt is prudent.
- Maximizing your out-of-class preparation time is prudent.

Preparation Recommendations

- Practice/Study Environment

- 2 or 3 systems or VMs, networked together. Virtualized hosting providers may be an alternative.
- RHEL 6 (eval), CENTOS 6 (when available), or Fedora (Fedora 13 will be closest to RHEL 6)
- Red Hat docs at:

http://docs.redhat.com/docs/en-US/Red_Hat_Enterprise_Linux/index.html

- RHCE Objectives and other information at:

<http://www.redhat.com/certification/>

- Take initiative -- form a study group.
- Practice, practice, practice!

The Red Hat Certification Landscape

- RHCSA

RHCSA is new, replacing the RHCT. It is the "core" sysadmin certification from Red Hat. To earn RHCE and other system administration certs will require first earning the RHCSA.

- RHCE

RHCE is a senior system administration certification. It is an eligibility requirement for taking any COE exams and is thus a requirement for the upper-level credentials as well.

- Certificates of Expertise

COEs are incremental credentials demonstrating skills and knowledge in specialized areas. They are worthy credentials in their own right, but also the building blocks of the upper level credentials.

- RHCSS, RHCDS, RHCA

These upper level credentials recognize those who have achieved expertise in several related specialized areas. Each one requires multiple COEs.

RHCSA Objectives

RHCSA Objectives: Understand & Use Essential Tools

- Access a shell prompt and issue commands with correct syntax
- Use input-output redirection (>, >>, |, 2>, etc.)
- Use grep and regular expressions to analyze text
- Access remote systems using ssh and VNC
- Log in and switch users in multi-user runlevels
- Archive, compress, unpack and uncompress files using tar, star, gzip, and bzip2

RHCSA: ...Essential Tools... (cont)

- Create and edit text files
- Create, delete, copy and move files and directories
- Create hard and soft links
- List, set and change standard ugo/rwx permissions
- Locate, read and use system documentation including man, info, and files in /usr/share/doc .

[Note: Red Hat may use applications during the exam that are not included in Red Hat Enterprise Linux for the purpose of evaluating candidate's abilities to meet this objective.]

RHCSA: Operate Running Systems

- Boot, reboot, and shut down a system normally
- Boot systems into different runlevels manually
- Use single-user mode to gain access to a system
- Identify CPU/memory intensive processes, adjust process priority with renice, and kill processes
- Locate and interpret system log files
- Access a virtual machine's console
- Start and stop virtual machines
- Start, stop and check the status of network services

RHCSA: Configure Local Storage

- List, create, delete and set partition type for primary, extended, and logical partitions
- Create and remove physical volumes, assign physical volumes to volume groups, create and delete logical volumes
- Create and configure LUKS-encrypted partitions and logical volumes to prompt for password and mount a decrypted file system at boot
- Configure systems to mount file systems at boot by Universally Unique ID (UUID) or label
- Add new partitions, logical volumes and swap to a system non-destructively

RHCSA: Create and Configure File Systems

- Create, mount, unmount and use ext2, ext3 and ext4 file systems
- Mount, unmount and use LUKS-encrypted file systems
- Mount and unmount CIFS and NFS network file systems
- Configure systems to mount ext4, LUKS-encrypted and network file systems automatically
- Extend existing unencrypted ext4-formatted logical volumes
- Create and configure set-GID directories for collaboration
- Create and manage Access Control Lists (ACLs)
- Diagnose and correct file permission problems

RHCSA: Deploy, Configure & Maintain

- Configure networking and hostname resolution statically or dynamically
- Schedule tasks using cron
- Configure systems to boot into a specific runlevel automatically
- Install Red Hat Enterprise Linux automatically using Kickstart
- Configure a physical machine to host virtual guests
- Install Red Hat Enterprise Linux systems as virtual guests
- Configure systems to launch virtual machines at boot
- Configure network services to start automatically at boot
- Configure a system to run a default configuration HTTP server
- Configure a system to run a default configuration FTP server
- Install and update software packages from Red Hat Network, a remote repository, or from the local filesystem
- Update the kernel package appropriately to ensure a bootable system
- Modify the system bootloader

RHCSA: Manage Users and Groups

- Create, delete, and modify local user accounts
- Change passwords and adjust password aging for local user accounts
- Create, delete and modify local groups and group memberships
- Configure a system to use an existing LDAP directory service for user and group information

RHCSA: Manage Security

- Configure firewall settings using system-config-firewall or iptables
- Set enforcing and permissive modes for SELinux
- List and identify SELinux file and process context
- Restore default file contexts
- Use boolean settings to modify system SELinux settings
- Diagnose and address routine SELinux policy violations

RHCE Objectives

RHCE: System Configuration and Management

- Route IP traffic and create static routes
- Use iptables to implement packet filtering and configure network address translation (NAT)
- Use /proc/sys and sysctl to modify and set kernel run-time parameters
- Configure system to authenticate using Kerberos
- Build a simple RPM that packages a single file
- Configure a system as an iSCSI initiator that persistently mounts an iSCSI target
- Produce and deliver reports on system utilization (processor, memory, disk, and network)
- Use shell scripting to automate system maintenance tasks
- Configure a system to log to a remote system
- Configure a system to accept logging from a remote system

RHCE: Network Services

Network services are an important subset of the exam objectives. RHCE candidates should be capable of meeting the following objectives for each of the network services listed below:

- Install the packages needed to provide the service
- Configure SELinux to support the service
- Configure the service to start when the system is booted
- Configure the service for basic operation
- Configure host-based and user-based security for the service

RHCE candidates should also be capable of meeting the following objectives associated with specific services:

RHCE: HTTP/HTTPS

- Install the packages needed to provide the service
- Configure SELinux to support the service
- Configure the service to start when the system is booted
- Configure the service for basic operation
- Configure host-based and user-based security for the service
- Configure a virtual host
- Configure private directories
- Deploy a basic CGI application
- Configure group-managed content

RHCE: DNS

- Install the packages needed to provide the service
- Configure SELinux to support the service
- Configure the service to start when the system is booted
- Configure the service for basic operation
- Configure host-based and user-based security for the service
- Configure a caching-only name server
- Configure a caching-only name server to forward DNS queries
- Note: Candidates are not expected to configure master or slave name servers

RHCE: FTP

- Install the packages needed to provide the service
- Configure SELinux to support the service
- Configure the service to start when the system is booted
- Configure the service for basic operation
- Configure host-based and user-based security for the service
- Configure anonymous-only download

RHCE: NFS

- Install the packages needed to provide the service
- Configure SELinux to support the service
- Configure the service to start when the system is booted
- Configure the service for basic operation
- Configure host-based and user-based security for the service
- Provide network shares to specific clients
- Provide network shares suitable for group collaboration

RHCE: SMB

- Install the packages needed to provide the service
- Configure SELinux to support the service
- Configure the service to start when the system is booted
- Configure the service for basic operation
- Configure host-based and user-based security for the service
- Provide network shares to specific clients
- Provide network shares suitable for group collaboration

RHCE: SMTP

- Install the packages needed to provide the service
- Configure SELinux to support the service
- Configure the service to start when the system is booted
- Configure the service for basic operation
- Configure host-based and user-based security for the service
- Configure a mail transfer agent (MTA) to accept inbound email from other systems
- Configure an MTA to forward (relay) email through a smart host

RHCE: SSH

- Install the packages needed to provide the service
- Configure SELinux to support the service
- Configure the service to start when the system is booted
- Configure the service for basic operation
- Configure host-based and user-based security for the service
- Configure key-based authentication
- Configure additional options described in documentation

RHCE: NTP

- Install the packages needed to provide the service
- Configure SELinux to support the service
- Configure the service to start when the system is booted
- Configure the service for basic operation
- Configure host-based and user-based security for the service
- Synchronize time using other NTP peers

Operating a System: Boot, Reboot, Shutdown

- GRUB Menu
- Display Manager Screen
- Gnome or KDE
- Terminal commands: shutdown, halt, poweroff, reboot, init

Operating a System: Runlevels

- Default
- From GRUB Menu

Operating a System: Single User Mode

- Password Recovery

Note: SELinux bug prevents password changes while set to "Enforcing".

Operating a System: Log Files

`/var/log/*`

View with `cat`, `less` or other tools

Search with `grep`

Operating a System: Start/Stop Virtual Machines

- Using virt-manager
- Using virsh commands

Operating a System: Virtual Machine Consoles

- virt-manager
- virt-viewer

Operating a System: Virtual Machine Text Console

With libguestfs-tools installed and the VM in question shut-down, from the host:

```
# virt-edit {VMname} /boot/grub/menu.lst
```

There, append to the kernel line:

```
console=tty0 console=ttyS0.
```

After saving, the following commands should allow a console based view of the boot process and a console login:

```
# virsh start {VMname} ; virsh console {VMname}
```

Operating a System: Start, stop, and check the status of network services

Operating a System: Modify the system bootloader

```
# fdisk -l
```

```
$ df -h
```

```
# ifconfig eth0
```

```
# yum install gnome-applet-vm
```

```
$ ssh scott@192.168.1.100
```

```
# lvcreate -L 12G -n SRV01 vmstore
```

```
# service network restart
```

Session 2 Storage and filesystems

```
# fdisk -l
```

```
$ df -h
```

```
# ifconfig eth0
```

```
# yum install gnome-applet-vm
```

```
$ ssh scott@192.168.1.100
```

```
# lvcreate -L 12G -n SRV01 vmstore
```

```
# service network restart
```


Local Storage: Working with Partitions

List, create, delete and set partition type for primary, extended, and logical partitions

Local Storage: Working with Logical Volume Management

Create and remove physical volumes, assign physical volumes to volume groups, create and delete logical volumes

Local Storage: Working with LUKS encrypted storage

Create and configure LUKS-encrypted partitions and logical volumes to prompt for password and mount a decrypted file system at boot

Local Storage: Using UUIDs and Filesystem Labels

Configure systems to mount file systems at boot by Universally Unique ID (UUID) or label

Local Storage: Adding New Storage

Add new partitions, logical volumes, and swap to a system non-destructively

File systems: Working with Common Linux Filesystems

Create, mount, unmount and use ext2, ext3 and ext4 file systems

Extend existing unencrypted ext4-formatted logical volumes

File systems: Working with LUKS-encrypted filesystems

Mount, unmount and use LUKS-encrypted file systems

Filesystem Permissions: Basic Permsissions

Filesystem Permissions: Extended Attributes

Filesystem Permissions: Use case -- Collaborative Directories

Filesystems Permissions: File Access Control Lists

Create and manage File Access Control Lists

Network Storage: Working with CIFS network file systems

Mount and unmount CIFS network file systems

Network Storage: Working with NFS file systems

Mount and unmount NFS file systems

Network Storage: Working with iSCSI devices

Configure a system as an iSCSI initiator that persistently mounts an iSCSI target

Session 3 Managing software, processes, kernel attribute, and users and groups

Managing Software

- RHN
- Repos
- **Yum**
 - Install and update software packages from Red Hat Network, a remote repository, or from the local filesystem
- rpm
- **Building RPMs**
 - Build a simple RPM that packages a single file
- Signing and Publishing RPMs
- Update the kernel package appropriately to ensure a bootable system

Manage Processes and Services

- Configure network services to start automatically at boot
- Configure systems to boot into a specific runlevel automatically
- Identify CPU/memory intensive processes, adjust process priority with renice, and kill processes
- Schedule tasks using cron

Manage system performance

- Use /proc/sys and sysctl to modify and set kernel run-time parameters
- Produce and deliver reports on system utilization (processor, memory, disk, and network)
- Use shell scripting to automate system maintenance tasks

Manage Users and Groups

- Create, delete, and modify local user accounts
- Change passwords and adjust password aging for local user accounts
- Create, delete and modify local groups and group memberships
- Configure a system to use an existing LDAP directory service for user and group information
- Configure system to authenticate using Kerberos

Session 4 Networking and routing

- o Networking & Routing + * Configure networking and hostname resolution statically or dynamically + * Route IP traffic and create static routes

Session 5 Firewalls and SELinux

- o IPTables + * Configure firewall settings using system-config-firewall or iptables
- o SELinux + * Set enforcing and permissive modes for SELinux + * List and identify SELinux file and process context + * Restore default file contexts + * Use boolean settings to modify system SELinux settings + * Diagnose and address routine SELinux policy violations

Session 6 Virtualization

- o KVM Virtualization + * Configure a physical machine to host virtual guests + *
- Install Red Hat Enterprise Linux systems as virtual guests + * Configure systems to launch virtual machines at boot + *
- Install Red Hat Enterprise Linux automatically using Kickstart

Session 7 Logging and remote access

o + - Remote Logging + * Configure a system to log to a remote system + *
Configure a system to accept logging from a remote system o + - Remote Access +
SSH # * Install the packages needed to provide the service # * Configure SELinux
to support the service # * Configure the service to start when the system is booted
* Configure the service for basic operation # * Configure host-based and
user-based security for the service # * Configure key-based authentication # *
Configure additional SSH options described in documentation + VNC # * Install the
packages needed to provide the service # * Configure SELinux to support the
service # * Configure the service to start when the system is booted # * Configure
the service for basic operation # * Configure host-based and user-based security
for the service

Session 8 Network Time Protocol

o NTP + * Install the packages needed to provide the service + * Configure SELinux to support the service + * Configure the service to start when the system is booted + * Configure the service for basic operation + * Configure host-based and user-based security for the service

Session 9 HTTP and FTP

Session 10 NFS and Samba

Session 11 DNS and SMTP

Session 12 Finish uncompleted topics, Review, or Practice Exam