

# Topic 105: Shells and Shell Scripting

## 105.1 Customize and use the shell environment

Weight: 4

**Description:** Candidates should be able to customize shell environments to meet users' needs. Candidates should be able to modify global and user profiles.

**Key Knowledge Areas:**

- Set environment variables (e.g. PATH) at login or when spawning a new shell.
- Write Bash functions for frequently used sequences of commands.
- Maintain skeleton directories for new user accounts.
- Set command search path with the proper directory.

The following is a partial list of the used files, terms and utilities:

- .
- source
- /etc/bash.bashrc
- /etc/profile
- env
- export
- set
- unset
- ~/.bash\_profile
- ~/.bash\_login
- ~/.profile
- ~/.bashrc
- ~/.bash\_logout
- function
- alias

## 105.2 Customize or write simple scripts

**Weight:** 4

**Description:** Candidates should be able to customize existing scripts, or write simple new Bash scripts.

**Key Knowledge Areas:**

- Use standard sh syntax (loops, tests).
- Use command substitution.
- Test return values for success or failure or other information provided by a command.
- Execute chained commands.
- Perform conditional mailing to the superuser.
- Correctly select the script interpreter through the shebang (#!) line.
- Manage the location, ownership, execution and suid-rights of scripts.

The following is a partial list of the used files, terms and utilities:

- for
- while
- test
- if
- read
- seq
- exec
- ||
- &&

## **Topic 106: User Interfaces and Desktops**

### **106.1 Install and configure X11**

**Weight:** 2

**Description:** Candidates should be able to install and configure X11.

**Key Knowledge Areas:**

- Understanding of the X11 architecture.
- Basic understanding and knowledge of the X Window configuration file.

- Overwrite specific aspects of Xorg configuration, such as keyboard layout.
- Understand the components of desktop environments, such as display managers and window managers.
- Manage access to the X server and display applications on remote X servers.
- Awareness of Wayland.

The following is a partial list of the used files, terms and utilities:

- /etc/X11/xorg.conf
- /etc/X11/xorg.conf.d/
- ~/.xsession-errors
- xhost
- xauth
- DISPLAY
- X

## 106.2 Graphical Desktops

**Weight:** 1

**Description:** Candidates should be aware of major Linux desktops. Furthermore, candidates should be aware of protocols used to access remote desktop sessions.

**Key Knowledge Areas:**

- Awareness of major desktop environments
- Awareness of protocols to access remote desktop sessions

The following is a partial list of the used files, terms and utilities:

- KDE
- Gnome
- Xfce
- X11
- XDMCP
- VNC

- Spice
- RDP

## **106.3 Accessibility**

**Weight:** 1

**Description:** Demonstrate knowledge and awareness of accessibility technologies.

**Key Knowledge Areas:**

- Basic knowledge of visual settings and themes.
- Basic knowledge of assistive technology.

The following is a partial list of the used files, terms and utilities:

- High Contrast/Large Print Desktop Themes.
- Screen Reader.
- Braille Display.
- Screen Magnifier.
- On-Screen Keyboard.
- Sticky/Repeat keys.
- Slow/Bounce/Toggle keys.
- Mouse keys.
- Gestures.
- Voice recognition.

## **Topic 107: Administrative Tasks**

### **107.1 Manage user and group accounts and related system files**

**Weight:** 5

**Description:** Candidates should be able to add, remove, suspend and change user accounts.

**Key Knowledge Areas:**

- Add, modify and remove users and groups.
- Manage user/group info in password/group databases.
- Create and manage special purpose and limited accounts.

The following is a partial list of the used files, terms and utilities:

- /etc/passwd
- /etc/shadow
- /etc/group
- /etc/skel/
- chage
- getent
- groupadd
- groupdel
- groupmod
- passwd
- useradd
- userdel
- usermod

## **107.2 Automate system administration tasks by scheduling jobs**

**Weight:** 4

**Description:** Candidates should be able to use cron and systemd timers to run jobs at regular intervals and to use at to run jobs at a specific time.

**Key Knowledge Areas:**

- Manage cron and at jobs.
- Configure user access to cron and at services.
- Understand systemd timer units.

The following is a partial list of the used files, terms and utilities:

- /etc/cron.{d,daily,hourly,monthly,weekly}/
- /etc/at.deny
- /etc/at.allow

- /etc/crontab
- /etc/cron.allow
- /etc/cron.deny
- /var/spool/cron/
- crontab
- at
- atq
- atrm
- systemctl
- systemd-run

## 107.3 Localisation and internationalisation

**Weight:** 3

**Description:** Candidates should be able to localize a system in a different language than English. As well, an understanding of why LANG=C is useful when scripting.

**Key Knowledge Areas:**

- Configure locale settings and environment variables.
- Configure timezone settings and environment variables.

The following is a partial list of the used files, terms and utilities:

- /etc/timezone
- /etc/localtime
- /usr/share/zoneinfo/
- LC\_\*
- LC\_ALL
- LANG
- TZ
- /usr/bin/locale
- tzselect
- timedatectl
- date
- iconv
- UTF-8

- ISO-8859
- ASCII
- Unicode

## **Topic 108: Essential System Services**

### **108.1 Maintain system time**

**Weight:** 3

**Description:** Candidates should be able to properly maintain the system time and synchronize the clock via NTP.

**Key Knowledge Areas:**

- Set the system date and time.
- Set the hardware clock to the correct time in UTC.
- Configure the correct timezone.
- Basic NTP configuration using ntpd and chrony.
- Knowledge of using the pool.ntp.org service.
- Awareness of the ntpq command.

The following is a partial list of the used files, terms and utilities:

- /usr/share/zoneinfo/
- /etc/timezone
- /etc/localtime
- /etc/ntp.conf
- /etc/chrony.conf
- date
- hwclock
- timedatectl
- ntpd
- ntpdate
- chronyc
- pool.ntp.org

### **108.2 System logging**

**Weight: 4**

**Description:** Candidates should be able to configure rsyslog. This objective also includes configuring the logging daemon to send log output to a central log server or accept log output as a central log server. Use of the systemd journal subsystem is covered. Also, awareness of syslog and syslog-ng as alternative logging systems is included.

**Key Knowledge Areas:**

- Basic configuration of rsyslog.
- Understanding of standard facilities, priorities and actions.
- Query the systemd journal.
- Filter systemd journal data by criteria such as date, service or priority.
- Configure persistent systemd journal storage and journal size.
- Delete old systemd journal data.
- Retrieve systemd journal data from a rescue system or file system copy.
- Understand interaction of rsyslog with systemd-journal.
- Configuration of logrotate.
- Awareness of syslog and syslog-ng.

**Terms and Utilities:**

- /etc/rsyslog.conf
- /var/log/
- logger
- logrotate
- /etc/logrotate.conf
- /etc/logrotate.d/
- journalctl
- systemd-cat
- /etc/systemd/journald.conf
- /var/log/journal/

## **108.3 Mail Transfer Agent (MTA) basics**

**Weight: 3**



**Description:** Candidates should be aware of the commonly available MTA programs and be able to perform basic forward and alias configuration on a client host. Other configuration files are not covered.

**Key Knowledge Areas:**

- Create e-mail aliases.  
Configure e-mail forwarding.  
Knowledge of commonly available MTA programs (postfix, sendmail, exim) (no configuration).

**Terms and Utilities:**

- ~/.forward
- sendmail emulation layer commands
- newaliases
- mail
- mailq
- postfix
- sendmail
- exim

## **108.4 Manage printers and printing**

**Weight:** 2

**Description:** Candidates should be able to manage print queues and user print jobs using CUPS and the LPD compatibility interface.

**Key Knowledge Areas:**

- Basic CUPS configuration (for local and remote printers).
- Manage user print queues.
- Troubleshoot general printing problems.
- Add and remove jobs from configured printer queues.

**The following is a partial list of the used files, terms and utilities:**

- CUPS configuration files, tools and utilities
- /etc/cups/

- lpd legacy interface (lpr, lprm, lpq)

## **Topic 109: Networking Fundamentals**

### **109.1 Fundamentals of internet protocols**

**Weight:** 4

**Description:** Candidates should demonstrate a proper understanding of TCP/IP network fundamentals.

**Key Knowledge Areas:**

- Demonstrate an understanding of network masks and CIDR notation.
- Knowledge of the differences between private and public "dotted quad" IP addresses.
- Knowledge about common TCP and UDP ports and services (20, 21, 22, 23, 25, 53, 80, 110, 123, 139, 143, 161, 162, 389, 443, 465, 514, 636, 993, 995).
- Knowledge about the differences and major features of UDP, TCP and ICMP.
- Knowledge of the major differences between IPv4 and IPv6.
- Knowledge of the basic features of IPv6.

The following is a partial list of the used files, terms and utilities:

- /etc/services
- IPv4, IPv6
- Subnetting
- TCP, UDP, ICMP

### **109.2 Persistent network configuration**

**Weight:** 4

**Description:** Candidates should be able to manage the persistent network configuration of a Linux host.

**Key Knowledge Areas:**

- Understand basic TCP/IP host configuration.
- Configure ethernet and wi-fi network using NetworkManager.
- Awareness of systemd-networkd.

The following is a partial list of the used files, terms and utilities:

- /etc/hostname
- /etc/hosts
- /etc/nsswitch.conf
- /etc/resolv.conf
- nmcli
- hostnamectl
- ifup
- ifdown

## 109.3 Basic network troubleshooting

**Weight:** 4

**Description:** Candidates should be able to troubleshoot networking issues on client hosts.

**Key Knowledge Areas:**

- Manually configure network interfaces, including viewing and changing the configuration of network interfaces using iproute2.
- Manually configure routing, including viewing and changing routing tables and setting the default route using iproute2.
- Debug problems associated with the network configuration.
- Awareness of legacy net-tools commands.

The following is a partial list of the used files, terms and utilities:

- ip
- hostname
- ss
- ping
- ping6
- traceroute

- traceroute6
- tracepath
- tracepath6
- netcat
- ifconfig
- netstat
- route

## **109.4 Configure client side DNS**

**Weight:** 2

**Description:** Candidates should be able to configure DNS on a client host.

**Key Knowledge Areas:**

- Query remote DNS servers.
- Configure local name resolution and use remote DNS servers.
- Modify the order in which name resolution is done.
- Debug errors related to name resolution.
- Awareness of systemd-resolved.

The following is a partial list of the used files, terms and utilities:

- /etc/hosts
- /etc/resolv.conf
- /etc/nsswitch.conf
- host
- dig
- getent

## **Topic 110: Security**

### **110.1 Perform security administration tasks**

**Weight:** 3

**Description:** Candidates should know how to review system configuration to ensure host security in accordance with local security policies.

### Key Knowledge Areas:

- Audit a system to find files with the suid/sgid bit set.
- Set or change user passwords and password aging information.
- Being able to use nmap and netstat to discover open ports on a system.
- Set up limits on user logins, processes and memory usage.
- Determine which users have logged in to the system or are currently logged in.
- Basic sudo configuration and usage.

The following is a partial list of the used files, terms and utilities:

- find
- passwd
- fuser
- lsof
- nmap
- chage
- netstat
- sudo
- /etc/sudoers
- su
- usermod
- ulimit
- who, w, last

## 110.2 Setup host security

**Weight:** 3

**Description:** Candidates should know how to set up a basic level of host security.

### Key Knowledge Areas:

- Awareness of shadow passwords and how they work.
- Turn off network services not in use.
- Understand the role of TCP wrappers.

The following is a partial list of the used files, terms and utilities:

- /etc/nologin
- /etc/passwd
- /etc/shadow
- /etc/xinetd.d/
- /etc/xinetd.conf
- systemd.socket
- /etc/inittab
- /etc/init.d/
- /etc/hosts.allow
- /etc/hosts.deny

## 110.3 Securing data with encryption

Weight: 4

**Description:** The candidate should be able to use public key techniques to secure data and communication.

**Key Knowledge Areas:**

- Perform basic OpenSSH 2 client configuration and usage.
- Understand the role of OpenSSH 2 server host keys.
- Perform basic GnuPG configuration, usage and revocation.
- Use GPG to encrypt, decrypt, sign and verify files.
- Understand SSH port tunnels (including X11 tunnels).

The following is a partial list of the used files, terms and utilities:

- ssh
- ssh-keygen
- ssh-agent
- ssh-add
- ~/.ssh/id\_rsa and id\_rsa.pub
- ~/.ssh/id\_dsa and id\_dsa.pub
- ~/.ssh/id\_ecdsa and id\_ecdsa.pub
- ~/.ssh/id\_ed25519 and id\_ed25519.pub
- /etc/ssh/ssh\_host\_rsa\_key and ssh\_host\_rsa\_key.pub

- /etc/ssh/ssh\_host\_dsa\_key and ssh\_host\_dsa\_key.pub
- /etc/ssh/ssh\_host\_ecdsa\_key and ssh\_host\_ecdsa\_key.pub
- /etc/ssh/ssh\_host\_ed25519\_key and ssh\_host\_ed25519\_key.pub
- ~/.ssh/authorized\_keys
- ssh\_known\_hosts
- gpg
- gpg-agent
- ~/.gnupg/