

# CompTIA Linux+ Certification Exam Objectives (XK0-003)

## Introduction

The CompTIA Linux+ certification is a vendor neutral credential. The Linux+ exam is a validation of “foundation” level Linux skills and knowledge, and is used by organizations and security professionals around the globe.

The skills and knowledge measured by this examination are derived from an industry-wide Job Task Analysis (JTA) and were validated through a global survey in Q4, 2008. The results of the survey were used to validate the content of the subject areas (domains) and exam objectives, as well as the overall domain weightings, ensuring the importance of one domain relative to another.

The CompTIA Linux+ certification is aimed at an IT administrator experienced in Windows or other operating systems who also has at least 6-12 months as a Linux system administrator.

The exam assumes experience with command line utilities, common administrative tasks, and troubleshooting.

Domain	Percentage of Examination
1.0 Installation & Configuration	22%
2.0 System Maintenance & Operations	28%
3.0 Application & Services	23%
4.0 Networking	14%
5.0 Security	13%
<b>Total</b>	100%

**\*\*Note:** The lists of examples provided in bulleted format below each objective are not exhaustive lists. Other examples of technologies, processes or tasks pertaining to each objective may also be included on the exam although not listed or covered in this objectives document.

*CompTIA is constantly reviewing the content of our exams and updating test questions to be sure our exams are current and the security of the questions is protected. When necessary, we will publish updated exams based on existing exam objectives. Please know that all related exam preparation materials will still be valid.*

## 1.0 Installation and Configuration

### 1.1 Compare and contrast installation sources

- Physical installation media
  - CD-ROM
  - DVD
- Network types
  - HTTP
  - FTP
  - NFS

### 1.2 Implement partitioning schemes and filesystem layout using the following tools and practices

- LVM
- RAID
- fdisk
- parted
- mkfs

### 1.3 Explain the purpose for using each of the following filesystem types

- Local
  - EXT2
  - EXT3
  - Reiser
  - FAT
  - NTFS
  - VFAT
  - ISO9660
- Network
  - NFS
  - SMBFS / CIFS

### 1.4 Conduct routine mount and unmount of filesystems

- mount
- umount
- /etc/fstab

### 1.5 Explain the advantages of having a separate partition or volume for any of the following directories

- /boot
- /home
- /tmp
- /usr
- /var
- /opt

### 1.6 Explain the purpose of the following directories

- /
- /bin
- /dev
- /etc
- /mnt
- /proc

- /root
- /sbin
- /usr/bin
- /usr/local
- /usr/lib
- /usr/lib64
- /usr/share
- /var/log

### 1.7 Configure the boot process including the following

- GRUB
  - /boot/grub/grub.conf
  - /boot/grub/menu.lst
  - grub-install
  - grub

### 1.8 Perform the following package management functions

- Install, remove and update programs
  - rpm
    - rpm -Uvh
    - rpm -qa
    - rpm -e
    - yum
  - deb
    - dpkg -i
    - dpkg -r
    - apt-get
    - apt-cache search
  - source
    - ./configure
    - make
    - make install
    - make uninstall
    - tar
    - make clean
    - autoconf
    - make test
    - tar.gz
    - INSTALL
    - bzip
    - gzip
- Resolve dependencies
- Add and remove repositories

### 1.9 Configure profile and environment variables system-wide and at the user level

- PS1
- PS2
- PATH
- EDITOR
- TERM
- PAGER
- HOME

- PRINTER

### 1.10 Troubleshoot boot issues using the following tools

- Kernel options
- Single-user mode (including recovering the root user)
- Rescue - live CDs, DVDs and USB keys
- dmesg

### 1.11 Manage devices using the following tools

- lsusb
- lspci
- lsmod
- /sys
- modprobe
- /proc
- /etc/modules.conf
- /etc/modprobe.conf
- Hardware Compatibility List (HCL)

## 2.0 System Maintenance and Operations

### 2.1 Given a scenario, use the following fundamental Linux tools, techniques and resources

- Directory navigation (cd, ls, pushd, popd, pwd)
- File commands
  - file
  - test
  - find
  - locate
  - slocate
  - which
  - whereis
  - ln
  - ls -F
  - mknod
  - touch
  - mkdir
  - mv
  - cp
  - rm
  - cd
  - file types
    - hardlinks, softlinks, directory, device file, regular file, named pipe
- File editing with vi
- Process management
  - ps
  - kill
  - top
  - iostat
  - pstree
  - nice
  - renice
  - signals
  - PID

- PPID
- I/O redirection
  - <
  - >
  - =
  - ==
  - |
  - ;
  - tee
  - xargs
  - STDIN
  - STDOUT
  - STDERR
- Special devices
  - /dev/null
  - /dev/random
  - /dev/zero
  - /dev/urandom
- System documentation
  - Man pages
    - man #
    - apropos
    - makewhatis
    - whatis
  - Info pages
  - /usr/share/docs
- Virtual consoles
- Kernel / architecture information
  - cat
  - /proc/version
  - uname
  - common sysctl settings
  - /etc/sysctl.conf

## 2.2 Conduct basic tasks using BASH

- Basics of scripting (only: execute permission, #!/bin/bash, sh script)
- Shell features
  - history
  - tab completion

## 2.3 Given a scenario, analyze system and application logs to troubleshoot Linux systems

- Common log files
  - /var/log/messages
  - /var/log/syslog
  - /var/log/maillog
  - /var/log/secure
  - /var/log/lastlog
- Rotated logs
- Searching and interpreting log files
  - grep
  - tail -f
  - awk
  - sed

## 2.4 Conduct and manage backup and restore operations

- Copying data
  - rsync and ftp
- Archive and restore commands
  - cpio
  - tar
  - dump
  - restore
  - dd
- Write to removable media (CD-RW, DVD-RW)

## 2.5 Explain the following features and concepts of X11

- Starting and stopping X11
- Difference between the X11 client and server
- Window managers and display managers (KDM, GDM)
- Multiple desktops
- X11 configuration file (xorg.conf)
- Terminal emulators (xterm, etc)

## 2.6 Explain the difference in runlevels and their purpose

- Command: init
- Runlevels
  - 0 – Halt
  - 1 – single-user mode
  - 2 – single-user mode with networking
  - 3 – networked multi-user mode
  - 4 – user configurable
  - 5 – X11 multi-user mode
  - 6 – reboot

## 2.7 Manage filesystems using the following

- Check disk usage (df, du)
- Quotas
  - edquota
  - repquota
  - quotacheck
- Check and repair filesystems (fsck)
- Loopback devices (ISO filesystems)
- NFS
  - configuration
  - mount
  - exportfs
  - fstab
  - /etc/exports
  - showmount
- Swap
  - mkswap
  - swapon
  - swapoff

## 2.8 Implement task scheduling using the following tools

- cron (cron.allow, cron.deny)
- crontab command syntax
- crontab file format

- at (atq)

### 2.9 Utilize performance monitoring tools and concepts to identify common problems

- Commands
  - sar
  - iostat
  - vmstat
  - uptime
  - top
- Load average

## 3.0 Application and Services

### 3.1 Manage Linux system services using the following

- /etc/init.d
  - start
  - stop
  - restart
- inetd
- xinetd
- chkconfig

### 3.2 Implement interoperability with Windows using the following

- rdesktop – client
- vnc – server and client
- Samba – server and client
  - smb.conf
  - Winbind
  - lmhosts
- Security and authentication (Kerberos)

### 3.3 Implement, configure and maintain Web and FTP services

- Apache
  - Maintain PHP settings (php.ini)
  - Edit Apache configuration files
    - Enable and disable modules
  - Containers
    - Virtual hosts
    - Directories
  - Access control (.htaccess)
  - CGI (ExecCGI, ScriptAlias)
  - Commands: apachectl (-t, -S, graceful, restart)
  - Configuring apache logs
- FTP services
  - Configure FTP users
    - /etc/ftpusers
    - chroot
  - Configure anonymous access

### 3.4 Given a scenario, explain the purpose of the following web-related services

- Tomcat
- Apache
- Squid

### **3.5 Troubleshoot web-related services using the following utilities**

- Commands
  - curl
  - wget
  - ftp
  - telnet

### **3.6 Given a scenario, troubleshoot common FTP problems**

- Active vs. passive
- ASCII vs. binary

### **3.7 Given a scenario, perform the following MySQL administrative tasks**

- Locate configuration file
- Starting and stopping
- Test the connection

### **3.8 Explain the purpose of each of the following mail services, protocols and features**

- Protocols
  - SMTP
  - IMAP
  - POP3
- MTA
  - Postfix
  - Sendmail
- Email aliases
  - /etc/aliases
  - newaliases

### **3.9 Deploy and manage CUPS print services**

- Enable and disable queues
- Web management interface (port 631)
- Printing commands
  - lpr
  - lp
  - lpq
  - lpstat
  - cancel

### **3.10 Set up, install, configure and maintain a BIND DNS server and related services**

- DNS utilities
  - named
  - rndc
- Config file locations (/var/named)
- Forward zones, reverse zones, root hints

### **3.11 Perform basic administration of the DHCP server**

- /etc/dhcpd.conf
- dhcpd.leases

### **3.12 Given a scenario, troubleshoot NTP related issues**

- /etc/ntp.conf
- ntpdate
- date
- ntpq -p



## 4.0 Networking

### 4.1 Identify common networking ports and the associated service

- 20
- 21
- 22
- 23
- 25
- 53
- 80
- 110
- 123
- 143
- 443
- 631
- 3306
- /etc/services

### 4.2 Execute network interface configuration using the following

- dhclient
- dhcpcd
- ifconfig
- iwconfig
- route
- ifup
- ifdown
- network configuration files

### 4.3 Implement configurations and/or configuration changes for the following

- Packet filtering: iptables
- Hostname lookup
  - /etc/hosts
  - /etc/nsswitch.conf
  - /etc/resolv.conf

### 4.4 Explain the different DNS record types and the process of DNS resolution

- Local resolution
- TTL/caching
- Root name servers
- A
- MX
- PTR
- CNAME
- NS
- TXT

### 4.5 Troubleshoot basic connectivity issues using the following tools

- netstat
- ping
- traceroute
- arp

- telnet
- route

#### 4.6 Troubleshoot name resolution issues using the following tools

- dig
- host
- nslookup
- hostname

## 5.0 Security

### 5.1 Manage and monitor user and group accounts using the following

- Tools
  - useradd
  - userdel
  - usermod
  - groupadd
  - groupdel
  - groupmod
  - lock
  - who
  - w
  - last
  - whoami
- Files
  - /etc/skel
  - /etc/passwd
  - /etc/shadow
  - /etc/group

### 5.2 Given a scenario, select the appropriate file permissions and ownership and troubleshoot common problems

- Tools
  - chmod
  - chown
  - chroot
  - chgrp
  - lsattr
  - chattr
  - umask
- Special permissions
  - setuid
  - setgid
  - sticky bit

### 5.3 Explain the basics of SELinux

- Running modes
  - Enabled
  - Disabled
  - Permissive

### 5.4 Given a scenario, implement privilege escalation using the following

- sudo
- su

- /etc/sudoers

**5.5 Explain the appropriate use of the following security related utilities**

- nmap
- Wireshark
- NESSUS
- Snort
- Tripwire

**5.6 Use checksum and file verification utilities**

- md5sum
- sha1sum
- gpg

**5.7 Deploy remote access facilities using the following**

- SSH
  - Secure tunnels
  - SFTP
  - X11 forwarding
  - Keygen
- VNC

**5.8 Explain the methods of authentication**

- PAM
- LDAP
- NIS
- RADIUS
- Two-factor authentication

## **Acronym List**

ASCII	American Standard Code for Information Interchange
ACPI	Advanced Configuration and Power Interface
BASH	Bourne Again Shell
BIND	Berkeley Internet Naming Domain
CD	Compact Disc
CGI	Common Gateway Interface
CIFS	Common Internet File System
CUPS	Common Unix Printing System
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Service
DVD	Digital Versatile Disc
EXT	Extended File System
FAT	File Allocation Table
FTP	File Transfer Protocol
GB	Gigabyte
GDM	GNOME Display Manager
GNU	GNU's not Unix
GPG	GNU Privacy Guard
GRUB	Grand Unified Bootloader
GUID	Globally Unique Identifier
HDD	Hard Disk Drive
HTTP	Hyper Text Transfer Protocol
HTTPS	Hyper Text Transfer Protocol-Secure
IMAP	Internet Message Access Protocol
ISC	Internet Systems Consortium
ISO	International Organization for Standardization
JVM	Java Virtual Machine
KDM	KDE Display Manager
L2TP	Level 2 Transfer Protocol
LDAP	Lightweight Directory Access Protocol
LILO	Linux Loader
LVM	Logical Volume Manager
MAC	Media Access Control
MB	Megabyte
MTA	Mail Transport Agent
MUA	Mail User Agent
MX	Mail Exchanger
NFS	Network File System

NIC	Network Interface Card
NIS	Network Information Service
NMAP	Network Mapper
NNTP	Network News Transfer Protocol
NSCD	Name Service Cache Daemon
NTFS	NT File System
NTP	Network Time Protocol
OS	Operating System
PAM	Pluggable Authentication Module
PHP	Hypertext Preprocessor
PID	Process ID
POP	Post Office Protocol
PPC	Power PC
PPID	Parent Process ID
PPP	Point to Point Protocol
RADIUS	Remote Authentication Dial-in User Services
RAID	Redundant Array of Independent Disks
RDP	Remote Desktop Protocol
ReiserFS	Reiser File System
RPM	RPM Package Manager
SAN	Storage Area Network
SCP	Secure Copy
SCSI	Small Computer System Interface
SELinux	Security Enhanced Linux
SFTP	Secure File Transfer Protocol
SH	Shell
SMBFS	Server Message Block File System
SMTP	Simple Mail Transport Protocol
SNMP	Simple Network Management Protocol
SSH	Secure Shell
SSID	Service Set Identifier
TTL	Time to Live
USB	Universal Serial Bus
VFAT	Virtual File Allocation Table
VNC	Virtual Network Computing