

# Linux (RHEL, Debian, Ubuntu and SLES) : System Administration

## Presentation

**Objectives** : Learn Red Hat Enterprise Server, Debian Linux, SUSE Linux Enterprise Server and Ubuntu Linux system administration.

**Who can benefit**: Linux users and technicians / Windows™, Mac and Unix users/administrators.

**Prerequisites**: Computer literacy.

**Learning technique** : Clear, theoretical course content divided into lessons and extensive LABS available on-line 24/24 7/7.

**Duration** : 35 hours.

**Instructor** : Certified [LPI](#).

**Student Progression** : Student progression is monitored both in terms of effective course duration and in terms of student comprehension using self-assessment tests.

**Resources** : RHEL 7, Debian 8, SLES 12 and Ubuntu 16.04 Virtual Appliances.

## Cursus

- **Managing Users and Groups**

- Groups
- Users
- Commands
  - Groups
    - groupadd
    - groupdel
    - groupmod
    - newgrp
    - gpasswd
  - Users
    - useradd
    - userdel

- usermod
- passwd
- Configuration
- LAB #1 - Managing Groups and Users
- su et su -
- sudo
- **Commands** : getent, grpck, grpconv, grpunconv, pwck, pwconv, pwunconv, groupadd, groupdel, groupmod, newgrp, gpasswd, useradd, userdel, usermod, passwd, id, groups, su, sudo.

## • Package Management

- Compiling Software the Old Way
    - ./configure
    - make
    - make check
    - make install
  - RHEL and SLES and the rpm command
  - Yellow Dog Updater Modified and RHEL
    - Configuration
    - Repositories
    - Usage
    - LAB #1 - Working with Yum
    - The yumdownloader command
  - Zypper and SLES
    - Configuration
    - Repositories
    - Usage
    - LAB #2 - Working with Zypper
  - Debian and Ubuntu and the dpkg Command
  - Advanced Package Tool and Debian/Ubuntu
    - Configuration
    - Repositories
    - Usage
    - LAB #1 - Working with Apt
  - Shared Libraries
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- Presentation

- Introduction
- Shared Object Locations
- ld-linux.so.2
- The ldd Command
- The /etc/ld.so.conf File
- The ldconfig Command

- **Commands** : rpm, yum, yumdownloader, zypper, dpkg, apt-get, apt-cache, mc, wget, configure, make, ldd, ldconfig.

- **Managing File Permissions**

- Preparation
- Basic Unix File Permissions
  - Changing Permissions with chmod
    - Symbolic Mode
    - Octal Mode
- The umask command
- Changing the Owner or the Group with chown and chgrp
- Advanced Unix Permissions
  - SUID/SGID bit
  - Inheritance Flag
  - Sticky bit
- ACLs
  - Command Line Switches
- Ext2/Ext3/Ext4 Attributes
- **Commands** : chmod, umask, chown, chgrp, setfacl, getfacl, chattr, lsattr.

- **Managing Disks and Swap Space**

- Block Devices
  - Partitions
    - Master Boot Record
    - Apple Partition Map
    - GUID Partition Table
  - Partitioning
    - LAB #1 - Using fdisk and parted
  - Journalled Filesystems
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- Presentation
- Ext3
- Ext4
- ReiserFS
- XFS
- JFS
- Btrfs
- Swap Space
  - Swap Size
  - Swap Partitions
  - The swapon Command
  - The swapoff Command
  - The /etc/fstab file
  - Swap Files
- Logical Volume Manager (LVM)
  - Physical Volumes (PV)
  - Volume Groups (VG) and Physical Extents (PE)
  - Logical Volumes (LV)
  - Administration
  - Snapshots
  - Deleting Volumes
  - Mirrored Logical Volumes
  - Attributes
  - Striped Logical Volumes
  - Metadata
- **Commands** : fdisk, gdisk, parted, swapon, swapoff, mkswap, dumpe2fs, tune2fs, mke2fs, mkfs.ext3, e2fsck, resize2fs, debugfs, e2label, mkfs.ext4, mkfs.xfs, xfs\_check, xfs\_repair, xfs\_admin, xfs\_growfs, xfs\_info, xfs\_metadump, xfs\_db, xfs\_admin, mkfs.reiserfs, mkreiserfs, reiserfsck, reiserfstune, resize\_reiserfs, debugreiserfs, mkfs.jfs, jfs\_tune, jfs\_fsck, jfs\_febugfs, btrfs-balance, btrfs-check, btrfs-device, btrfs-filesystem, btrfs-inspect-internal, btrfs-property, btrfs-qgroup, btrfs-quota, btrfs-qgroup, btrfs-receive, btrfs-replace, btrfs-rescue, btrfs-restore, btrfs-scrub, btrfs-send, btrfs-subvolume, pvcreate, vgcreate, lvcreate, pvdisplay, vgdisplay, lvdisplay, lvextend, lvreduce, resize2fs, lvs, lvremove, vgremove, pvremove, lvconvert, vgs, pvs, lvchange, vgcfgbackup, vgcfgrestore.

- **Process Scheduling**

- cron
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- anacron
- at
- **Commands** : cron, anacron, at.

- **Archiving and Compression**

- Archiving
  - tar
    - Presentation
    - LAB #1 - Using tar
  - cpio
    - Presentation
    - Command Line Switches
    - LAB #2 - Using cpio
  - dd
    - Presentation
    - Command Line Switches
    - LAB #3 - Using dd
  - dump and restore
    - Presentation
- Compression
  - gzip
    - Presentation
    - LAB #4 - Using gzip
  - bzip2
    - Presentation
    - LAB #5 - Using bzip2
  - xz
    - Presentation
    - LAB #5 - Using xz
  - Other Tools
- **Commands** : tar, cpio, dd, dump, restore, gzip, gunzip, bzip2, bunzip2, xz, compress, uncompress, rar, unrar, zip, unzip.

- **Process Management**

- Process Types
  - Process priorities
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- Synchronous and Asynchronous
- Process Commands
  - The ps Command
  - The pstree Command
  - The top Command
  - The fg and bg Commands
  - The wait Command
  - The nice Command
  - The renice Command
  - The nohup Command
  - The kill Command
- **Commands** : ps, pstree, top, fg, bg, wait, nice, renice, nohup, kill.

- **Managing Logs**

- The /var/log/messages file
  - The /bin/dmesg Command
  - The /var/log/audit/audit.log file
    - Managing Audit Events
      - auditd
      - auditctl
      - audispd
    - Viewing Audit Events
      - The aureport Command
      - The ausearch Command
  - Applications
  - rsyslog
    - Priorities
    - Facilities
    - /etc/rsyslog.conf
      - Modules
      - Global Directives
      - Rules
        - Facility.Priority
        - Facility!Priority
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- Facility=Priority
- Using the \* Wildcard
- n Facilities with Identical Priorities
- n Selectors with Identical Actions
- /usr/bin/logger
- /usr/bin/logrotate
- Journald
  - Viewing logs
  - Viewing logs of a specific application
  - Viewing the logs of the last boot process
  - Viewing logs of a specific priority
  - Viewing logs over a date period
  - Viewing logs in real time
  - Viewing logs using keywords
- **Commands** : dmesg, auditd, auditctl, audoispd, aureport, ausearch, rsyslog, logger, logrotate, journalctl.

## • Printer Management

- Introduction
    - Protocols
    - Daemon
  - Configuration
    - /etc/cups/cupsd.conf
    - Filters
    - Backends
    - Logs
    - Printers
  - Administration
    - The lpstat Command
    - The lpadmin Command
    - The accept and cupsenable Commands
    - Setting Up the Default Printer
    - Using a .ppd File to Add a Printer
    - Classes
    - The /etc/cups/printers.conf File
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- The /etc/cups/classes.conf File
- The cancel Command
- The lpmove Command
- Destroying a Class
- Web Interface
- Graphical Interface
- **Commands** : lpadmin, accept, reject, cupsenable, cupsdisable, lpstat, cancel, lpmove, lpinfo, lppasswd, lp.

## • System Startup and Shutdown

- System Startup
  - Boot Loader
    - BIOS Systems
    - EFI Systems
- GRUB
  - GRUB LEGACY on RHEL 6
  - GRUB 2 on RHEL 7, Debian 8, Ubuntu 16.04 and SLES 12
    - The /boot/grub/device.map file
    - The /etc/default/grub file
    - Files in the /etc/grub.d directory
      - /etc/grub.d/10\_Linux
      - /etc/grub.d/30\_os-prober
      - /etc/grub.d/40\_custom
      - /etc/grub.d/41\_custom
      - Password protection
- Initramfs
  - Initramfs on RHEL and SLES
    - The dracut Command
  - Initramfs on Debian/Ubuntu
    - The mkinitramfs Command
  - Initramfs on SLES
    - The mkinitrd Command
- Kernel Booting Process
- SysVinit startup process
  - The Init Process

- RUNLEVELS
- Unix System V Startup Scripts
- Inittab
- The /etc/init.d directory
- The rcX.d Directories
- The update-rc.d Command
- The chkconfig Command
- openSUSE
- Upstart startup process
  - System Initialisation
  - Runlevels
  - [CTL]-[ALT]-[DEL]
  - mingetty
  - rc.sysinit
  - The /etc/rc.d/init.d Directory
  - The /etc/rc.d/rcX.d Directories
  - Managing Upstart services
- The Systemd startup process
  - The systemctl command
  - Configuration files
  - The systemd-analyze command
  - Managing systemd services
- System Shutdown
  - The shutdown Command
  - The reboot command
  - The halt Command
  - The poweroff Command
- **Commands** : grub\_install, runlevel, init, telinit, chkconfig, update-rc.d, dracut, mkinitramfs, mkinitrd, initctl, start, stop, restart, systemctl, systemd-analyze, shutdown, halt, reboot, poweroff.

- **Managing Integrated Peripherals**

- Special Files
  - Commands
    - The lspci Command
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- The lsusb Command
- The dmidecode Command
- The /proc Directory
  - Sub-directories
    - ide/scsi
    - acpi
    - bus
    - net
    - sys
    - The sysctl Command
  - Files
    - /proc/cpuinfo
    - /proc/interrupts
    - /proc/dma
    - /proc/ioports
    - /proc/devices
    - /proc/modules
    - /proc/diskstats
    - /proc/partitions
    - /proc/swaps
    - /proc/loadavg
    - /proc/meminfo
    - /proc/version
  - Interpreting Information in /proc
    - Commands
      - free
      - uptime or w
      - iostat
      - vmstat
      - mpstat
      - sar
    - Production Environments
      - Identifying a System with a CPU Bottleneck
      - Identifying a Memory Problem

- Identifying I/O Bottlenecks
  - USB Modules
  - udev
    - The udevadm Command
  - The /sys Filesystem
  - Planning resources - the collectd command
  - Limiting Resources
    - ulimit
    - Control groups
  - **Commands:** lspci, lsusb, dmidecode, free, uptime, w, iostat, vmstat, mpstat, sar, udevadm, collectd, sysctl.
  - **Managing a the Network**
    - Communication models
      - OSI
        - NDIS and ODI
      - TCP/IP
        - Messages, Datagrams and Segments
        - Establishing a TCP connection
        - The TCP header
        - The UDP header
        - Fragmentation and Re-encapsulation
        - TCPv4 Classes
        - Subnet Masks
          - Variable Length Subnet Masks - VLSM
        - Ports and sockets
    - Configuring a Network Client under Linux
      - /etc/services
      - Ethernet address resolution with arp
    - Configuring TCP/IP on RHEL 6 and Debian 6
      - RHEL 6
        - DHCP
          - /etc/sysconfig/network
          - /etc/sysconfig/network-scripts/ifcfg-ethX (où X=0,1 ...)
        - Fixed IP Address
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- /etc/sysconfig/network
  - /etc/sysconfig/network-scripts/ifcfg-ethX (où X=0,1 ...)
  - Debian 6
    - DHCP
      - /etc/network/interfaces
    - Fixed IP Address
      - /etc/network/interfaces
  - The hostname command
  - The ifconfig command
  - Manually bringing up and down a network interface
  - The /etc/networks file
  - IP address resolution
    - /etc/resolv.conf
    - /etc/nsswitch.conf
    - /etc/hosts
  - Configuring TCP/IP on RHEL 7, Debian 8, Ubuntu 16.04 and SLES 12
    - The nmcli command
    - Connections and Profiles
    - Adding a second IP address to an existing profile
    - The hostname command
    - The ip command
    - Manually bringing up and down a network interface
  - Network Services
    - xinetd
    - TCP Wrapper
  - Network Diagnostic Commands
    - ping
    - ping6
    - netstat-i
    - traceroute
    - traceroute 6
    - tracepath6
  - Static Routing Tables on RHEL 6
    - The route Command
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- The netstat Command
  - Turning routing ON/OFF
  - Static Routing Tables on RHEL 7, Debian 8, Ubuntu 16.04 and SLES 12
    - The ip Command
    - Turning routing ON/OFF
  - Remote Administration
    - Telnet
    - ssh
    - wget
    - ftp
    - scp
  - Administrating an NFS server
    - Presentation
    - NFSv3 services and processes
    - Basic commands
    - Server installation on RHEL 6 and Debian 6
    - Client installation on RHEL 6 and Debian 6
    - Server installation on RHEL 7 and Debian 8
    - Client installation on RHEL 7 and Debian 8
    - The rpcinfo command
    - The nfsstat command
  - Packet Sniffers
    - TCPdump
    - Wireshark
  - Port Scanners
    - nmap
    - netcat
  - The Netfilter Firewall
    - Introduction
    - Configuration using scripts on RHEL 6 and Debian 6
    - Configuration using firewalld on RHEL 7, Debian 8, Ubuntu 16.04 and SLES 12
  - Cryptologie
    - GnuPG
    - Public Key Infrastructures
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- X509 Certificates
  - SSH and SCP
  - SSH Tunneling
- **Commands** : netstat, arp, nslookup, dig, ifconfig, ifup, ifdown, ifstatus, NetworkManager, hostname, uname, nmcli, ip, network-manager, ping, ping6, Traceroute, Traceroute6, Tracepath6, tcpd, xinetd, route, ntpd, telnet, wget, ftp, tcpdump, wireshark, nmap, netcat, iptables, gpg, firewall-cmd, ssh, scp.