

Linux/Networking Smart Start

Course Program

Language: **EN**

Duration:

40 theoretical hours

20 practical hours

10-15 hours for individual project

Summary

The purpose of the course is to provide beginners with theoretical knowledge of the basics of server administration with GNU/Linux-based operating systems (namely Canonical Ubuntu) with a specialization in the network component, sufficient for their further hiring for trainee positions in the GL.

Program:

1. Introduction to Smart Start
2. Starting with Linux
 - a. GNU/Linux overview
 - b. Kernel, drivers, GUI, userspace processes
 - c. Linux distributives
 - d. Users, groups, passwords
 - e. File attributes
 - f. Processes vs daemons
 - g. Background processes
 - h. Signals and killing
 - i. Ubuntu installation to virtual machine
3. An introduction to the Linux boot and startup processes
 - a. How linux is starting
 - b. bootloaders
 - c. device tree
 - d. rootfs
 - e. init.d
4. Linux command line intro. Part 1
 - a. Terminal vs console vs Shell
 - b. Command structure. Starting in background
 - c. man
 - d. Most useful commands
 - e. package installation
 - f. Navigation
 - g. File operations
 - h. find
 - i. Escaping
5. Linux command line intro. Part 2
 - a. Input/output streams
 - b. Pipes
 - c. wildcards
 - d. vim
 - e. bash / sh

- f. bash variables
- g. special variables
- h. Eval, \$(), ``, xargs

6. File System

- a. Filesystem type and hierarchy
- b. Virtual file systems (tmpfs, procfs, sysfs, ...)
- c. files, soft and hard links
- d. inode
- e. Aliases of directories
- f. File attributes

7. Command-line processors

- a. cut
- b. tr
- c. sort
- d. sed
- e. awk
- f. grep

8. Other useful information

- a. hexdump
- b. lsof
- c. ulimit
- d. ps
- e. top
- f. syslog
- g. dmesg
- h. monitoring
- i. wget, curl
- j. crond
- k. archives

9. Bash scripting

- a. Conditional statements (if, then else, case)
- b. Variables
- c. Evaluations
- d. string operations in bash
- e. Bash command substitution
- f. Functions
- g. Parameters
- h. Basic Bash commands (echo, read, etc.)

10. Introduction to networks

- a. Bit of history
- b. Evolution of the communication technologies
- c. Consumer, enterprise and operator technologies
- d. RFCs

11. Networking basics

- a. Model OSI
- b. Network subsystem in OS
- c. Routing
- d. Traffic encapsulation
- e. Traffic manipulation, filtering

12. OS network tools

- a. Configuration of the operating system:
(hostname, ifconfig / iproute2, route / iproute2, netstat, dhcp)
- b. Debugging OS configuration:
(ping, traceroute / mtr, host, dig)
- c. System network services:
(ifup, connman, netplan, NetworkManager)

13. Typical application network stack

- a. Streaming protocols TCP/IP
- b. Datagram protocols UDP/IP
- c. Network diagnostic ICMP

14. Domain name system

- a. Concept of name resolution
- b. Tools:
(host, nslookup, delv, whois)

15. Debugging network applications

- a. Basic tools: (nettop / iftop, dstat)
- b. Connectivity tools and scanners:
(telnet, netcat (nc), nmap)
- c. Network data monitoring and debugging applications:
(tcpdump, iptraf (iptraf-ng), trafshow)
- d. Network performance (ttcp)

16. OpenWRT buildroot

- a. Introduction, HW archs
- b. Usage, application
- c. UCI (Configuration)
- d. Buildroot (Compilation)
- e. Packages Structure
- f. Licenses

17. Virtualization

- a. Full virtualization
- b. XEN
- c. Proprietary
- d. Paravirtualization
- e. Hypervisors
- f. Containerization
- g. LXC/LXD
- h. Docker / Podman
- i. MS Hyper-V

18. Remote network access

- a. Concept of the remote access
(commandline access with telnet(mactelnet), ssh)
- b. File/data access
(ftp, tftp, sftp, scp)
- c. SSH tunneling
- d. Networking Filesystems
(NFS, SSHFS, SAMBA)

19. Individual project. Intro session

20. Smart Start Sum-up. Project presentation

Individual course project:

The course project should begin after the basic material has been mastered, which means that the actual start is in the second half of the theoretical lectures. The concept of the course project is currently under development, but the key characteristics of the assignment include the following:

- As part of the course project, the participant has to build a system that performs a certain function.
- The system consists of several network nodes (servers or virtual servers).
- The network topology and configuration should be developed by the participant and presented in the form of visual materials.
- The set of services included in the implementation of the functionality must be documented.
- Relevant nodes should be configured and all related services should be brought up with the start of the relevant nodes
- The correct operation of the functionality needs to be demonstrated from the moment of data entry to the display of results