

1.112.1 Fundamentals of TCP/IP Weight 4

Linux Professional Institute Certification — 102

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Outline

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1 Context

Topic 112 Networking Fundamentals [14]

1.112.1 Fundamentals of TCP/IP [4]

1.112.3 TCP/IP configuration and troubleshooting [7]

1.112.4 Configure Linux as a PPP client [3]

2 Objective

Description of Objective

Candidates should demonstrate a proper understanding of network fundamentals. This objective includes the understanding of IP-addresses, network masks and what they mean (i.e. determine a network and broadcast address for a host based on its subnet mask in “dotted quad” or abbreviated notation or determine the network address, broadcast address and netmask when given an IP-address and number of bits). It also covers the understanding of the network classes and classless subnets (CIDR) and the reserved addresses for private network use. It includes the understanding of the function and application of a default route. It also includes the understanding of basic internet protocols (IP, ICMP, TCP, UDP) and the more common TCP and UDP ports (20, 21, 23, 25, 53, 80, 110, 119, 139, 143, 161).

Key files, terms, and utilities include:

`/etc/services` — file mapping port numbers to names

`ftp` — FTP client program

`telnet` — telnet client program

`host` — program to test DNS servers

`ping` — program to test connectivity to other machines via ICMP

dig — program to test DNS servers

traceroute — program to test the path to a remote machine, showing routers along the way

whois — queries information about the owner of a domain

3 Context

(2.2) Networking Fundamentals [14]

1.112.1 Fundamentals of TCP/IP [4]

1.112.3 TCP/IP configuration and troubleshooting [7]

1.112.4 Configure Linux as a PPP client [3]

4 Resources

Fundamentals of TCP/IP [4]

References

- [1] W. Richard Stevens. *TCP/IP Illustrated, Volume 1: The Protocols* Addison Wesley
- [2] Olaf Kirch and Terry Dawson. *Linux Network Administrator's Guide* O'Reilly 2000.
<http://tldp.org/LDP/nag2/>
- [3] Angie Nash and Jason Nash. *LPIC 1 Certification Bible* Hungry Minds

5 IP Addressing

IP addressing

This objective includes the understanding of:

- IP-addresses, network masks and what they mean, i.e.,
 - determine a network and broadcast address for a host based on its subnet mask in “dotted quad” or abbreviated notation or
 - determine the network address, broadcast address and netmask when given an IP-address and number of bits.

6 Classful Addressing (Obsolete)

IP Address Classes (Classic)

Class A — 255.0.0.0

```
00000000.00000000.00000000.00000000 - 0.0.0.0
01111111.11111111.11111111.11111111 - 127.255.255.255
```

Class B — 255.255.0.0

```
10000000.00000000.00000000.00000000 - 128.0.0.0
10111111.11111111.11111111.11111111 - 191.255.255.255
```

Class C — 255.255.255.0

```
11000000.00000000.00000000.00000000 - 192.0.0.0
11011111.11111111.11111111.11111111 - 223.255.255.255
```

7 Loopback address

IP Address - Loopback

Reserved Space 127.0.0.0 — 127.255.255.255
127.0.0.1 localhost

8 Private addresses

IP Address - Private Networks

There are IP ranges set aside for private address spaces. These should not be made visible on the internet.

Class A

10.0.0.0 -- 10.255.255.255

Class B

172.16.0.0 -- 172.32.255.255

Class C

192.168.0.0 -- 192.168.255.255

9 Subnetting

IP Address — Subnetting

Network: 192.168.192.0
Subnet: 255.255.255.224

10 Adding a Default Route

IP Address - Default Route

```
$ sudo route add default gw 192.168.1.1 ←
```

11 Model of network layers

DoD Layer Model

Application ftp, telnet, mail, http protocols

Transport TCP, UDP protocols

Network IP, ICMP, IGMP protocols

Link Ethernet, Token Ring, FDDI

12 Basic Internet Protocols

Basic Internet Protocols

IP

ICMP

TCP

UDP

13 Ports and Port Numbers

13.1 /etc/services

Ports and Port Numbers

5

```
$ less /etc/services
ftp          21/tcp
ftp          21/udp      fsp fspd
ssh          22/tcp      # SSH Remote Login Protocol
ssh          22/udp      # SSH Remote Login Protocol
telnet       23/tcp
telnet       23/udp
# 24 - private mail system
smtp         25/tcp      mail
smtp         25/udp      mail
time         37/tcp      timserver
```

13.2 Main port numbers

Ports and Port Numbers

FTP 20, 21

Telnet 23

SSH 22

smtp 25

DNS 53

http 80

pop3 110

nntp 119

netbios 137, 138, 139

imap2 143

snmp 161

Port Number vRanges

1–255 Original reserved ports (till 1992) (256-1023 UNIX)

1–1023 Well Known or Famous Port Numbers - Reserved

1024–65535 Unprivileged

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