

# 1.112.1

## Fundamentals of TCP/IP

### Weight 4

Linux Professional Institute Certification — 102

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# Topic 112 Networking Fundamentals [14]

Where we are up to

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### 1.112.3 TCP/IP configuration and troubleshooting [7]

### 1.112.4 Configure Linux as a PPP client [3]

# Description of Objective

## 1.112.1 Fundamentals of TCP/IP

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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).

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# Key files, terms, and utilities include:

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`/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

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## (2.2) Networking Fundamentals [14]

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# Fundamentals of TCP/IP [4]

Resources of interest



W. Richard Stevens.

*TCP/IP Illustrated, Volume 1: The Protocols*  
Addison Wesley



Olaf Kirch and Terry Dawson.

*Linux Network Administrator's Guide*  
O'Reilly 2000.

<http://tldp.org/LDP/nag2/>



Angie Nash and Jason Nash.

*LPIC 1 Certification Bible*  
Hungry Minds

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# IP addressing

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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.



# IP Address Classes (Classic)

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## Class A — 255.0.0.0

00000000.00000000.00000000.00000000 - 0.0.0.0  
011111111.11111111.11111111.11111111 - 127.255.255.255

## Class B — 255.255.0.0

10000000.00000000.00000000.00000000 - 128.0.0.0  
101111111.11111111.11111111.11111111 - 191.255.255.255

## Class C — 255.255.255.0

11000000.00000000.00000000.00000000 - 192.0.0.0  
110111111.11111111.11111111.11111111 - 223.255.255.255

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# IP Address - Loopback

Reserved Space 127.0.0.0 — 127.255.255.255  
127.0.0.1 localhost

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# 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

# IP Address — Subnetting

Network: 192.168.192.0  
Subnet: 255.255.255.224

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# IP Address - Default Route

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

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# DoD Layer Model

**Application** ftp, telnet, mail, http protocols

**Transport** TCP , UDP protocols

**Network** IP, ICMP, IGMP protocols

**Link** Ethernet, Token Ring, FDDI

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# Basic Internet Protocols

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# Ports and Port Numbers

## Listing the Ports

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```
$ 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
```

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# 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

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# Port Number vRanges

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

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**1–1023** Well Known or Famous Port Numbers - Reserved

**1024–65535** Unprivileged

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