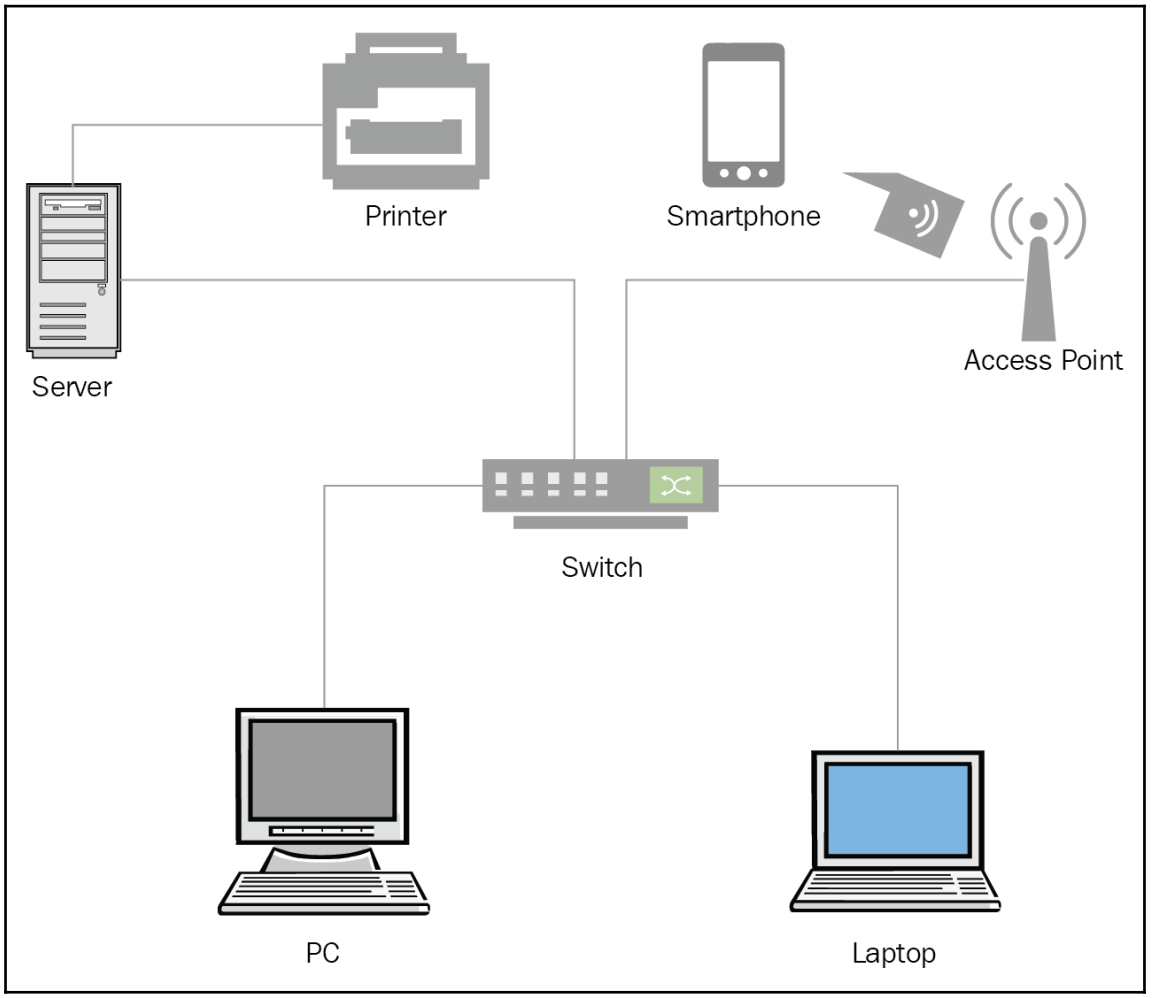
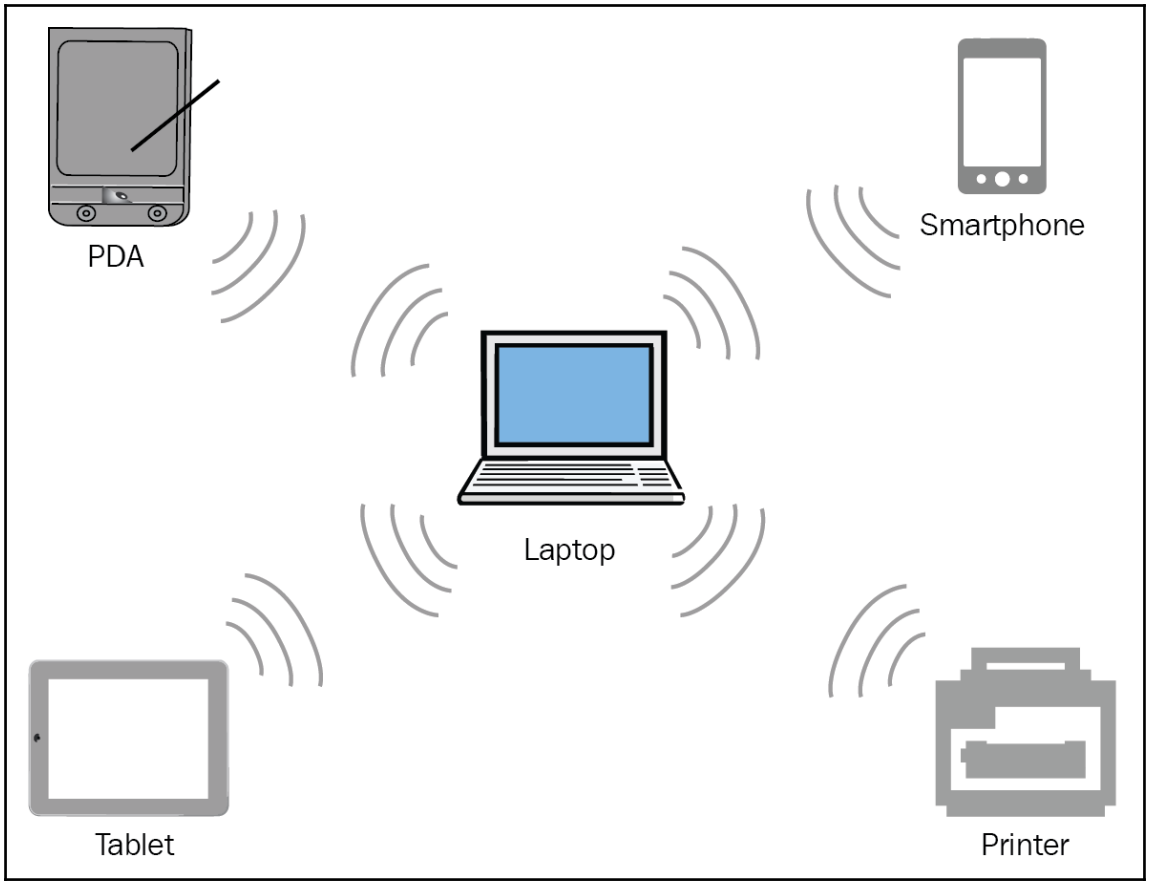
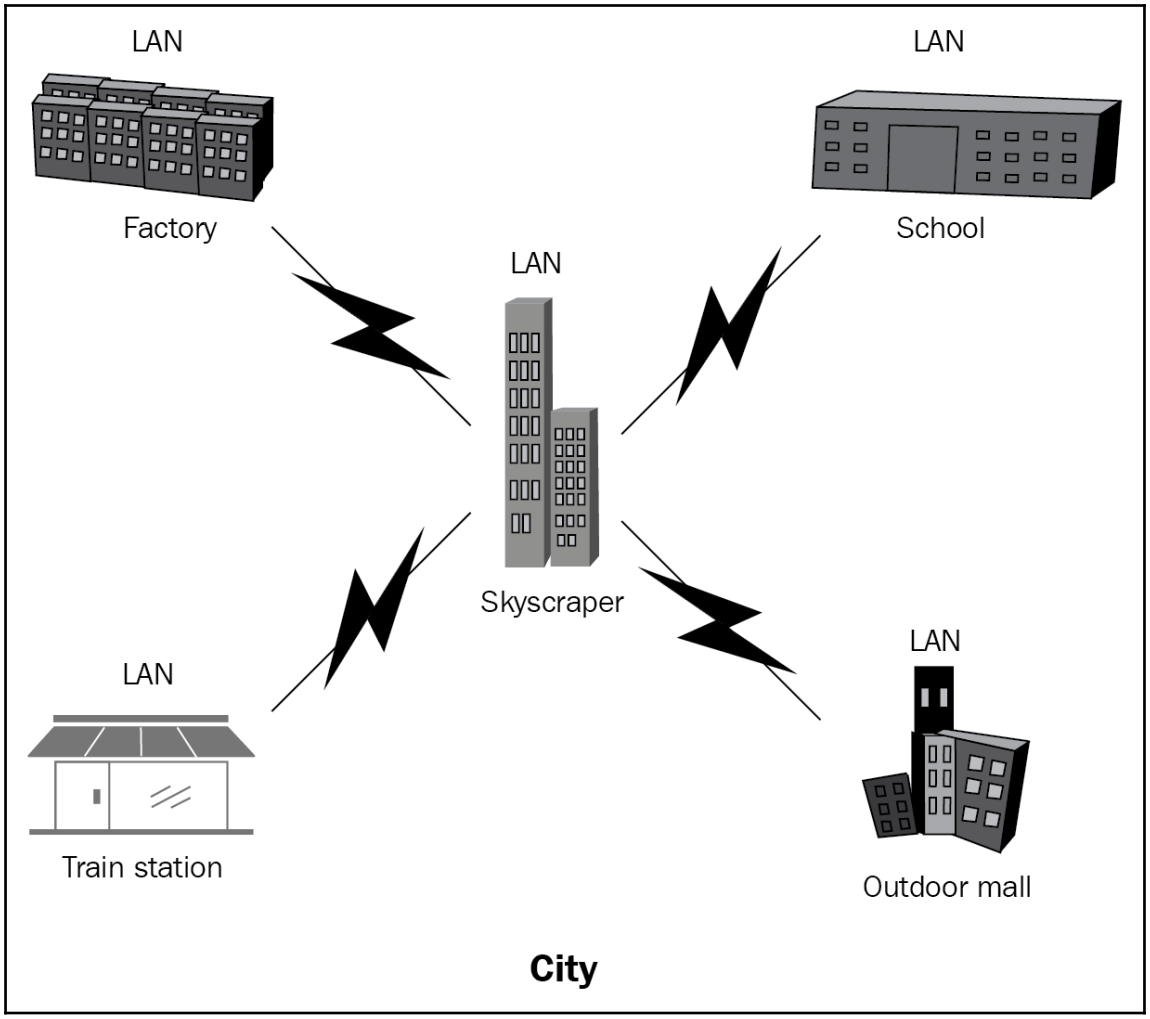
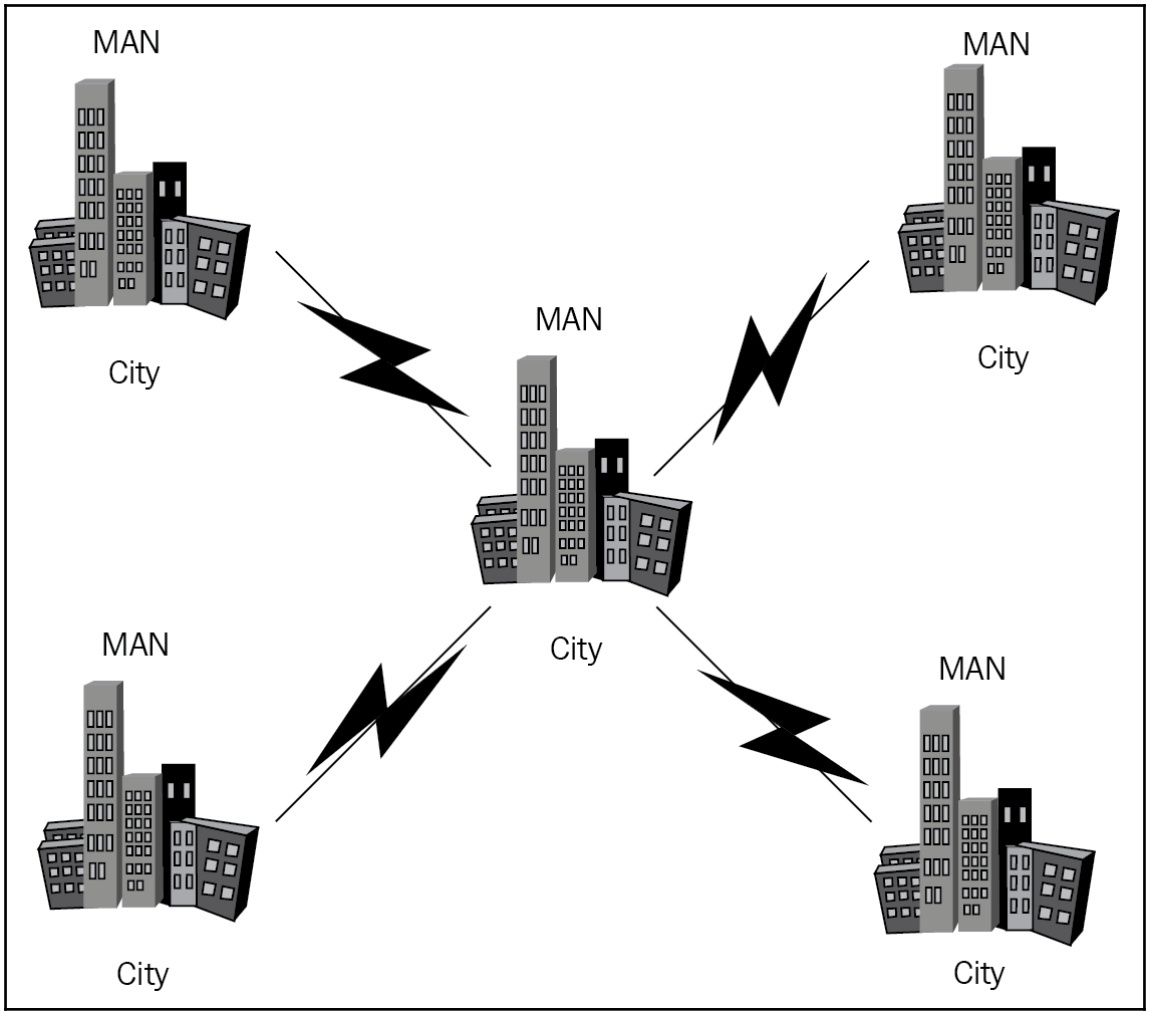
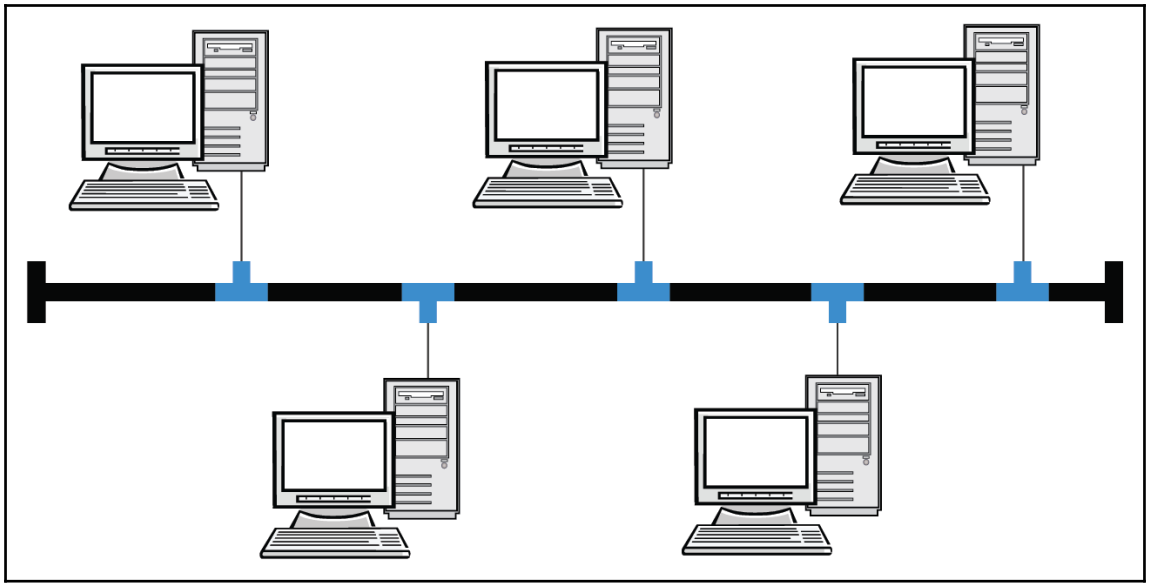
Chapter 1: Introduction to Computer Networks

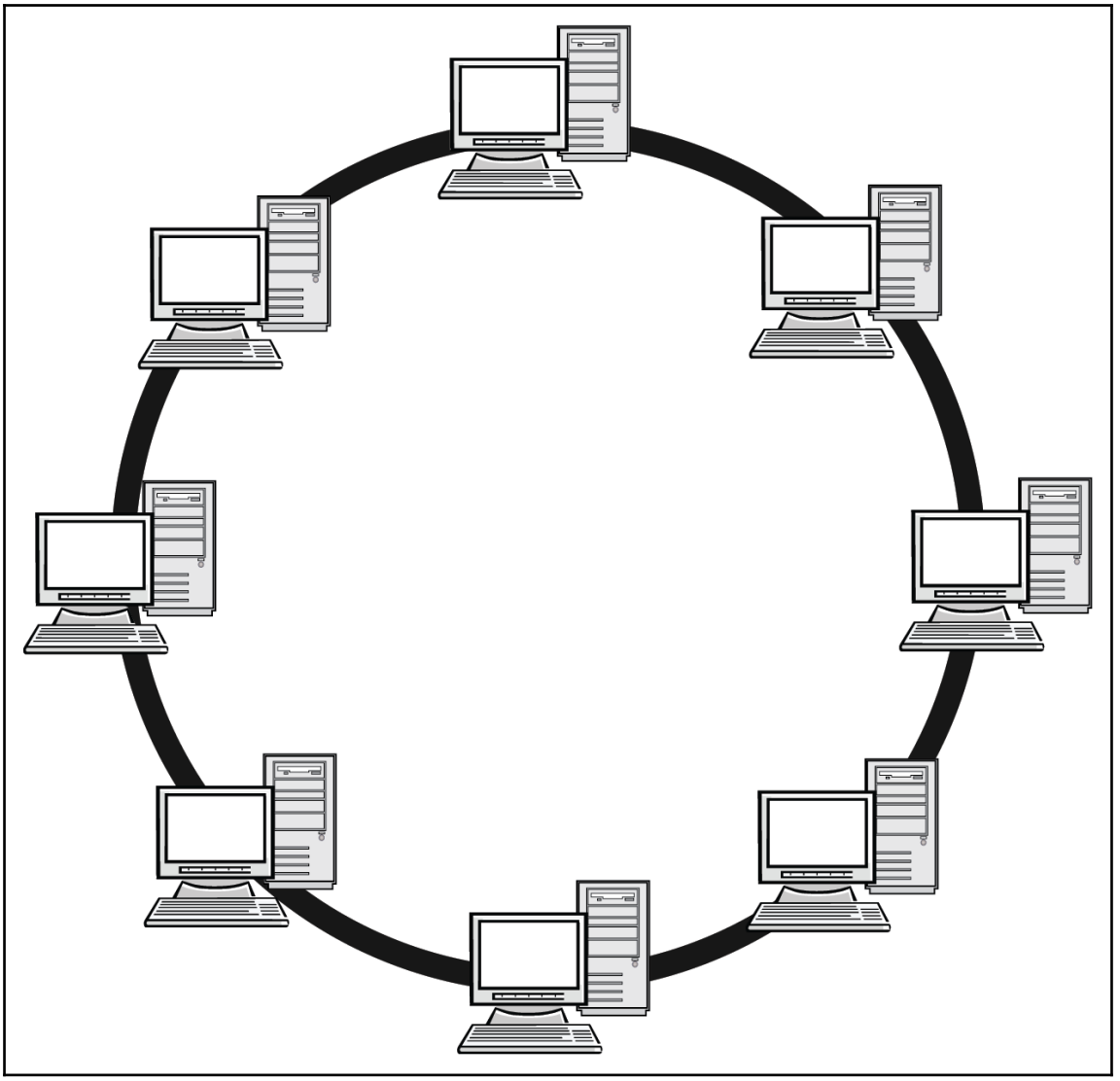


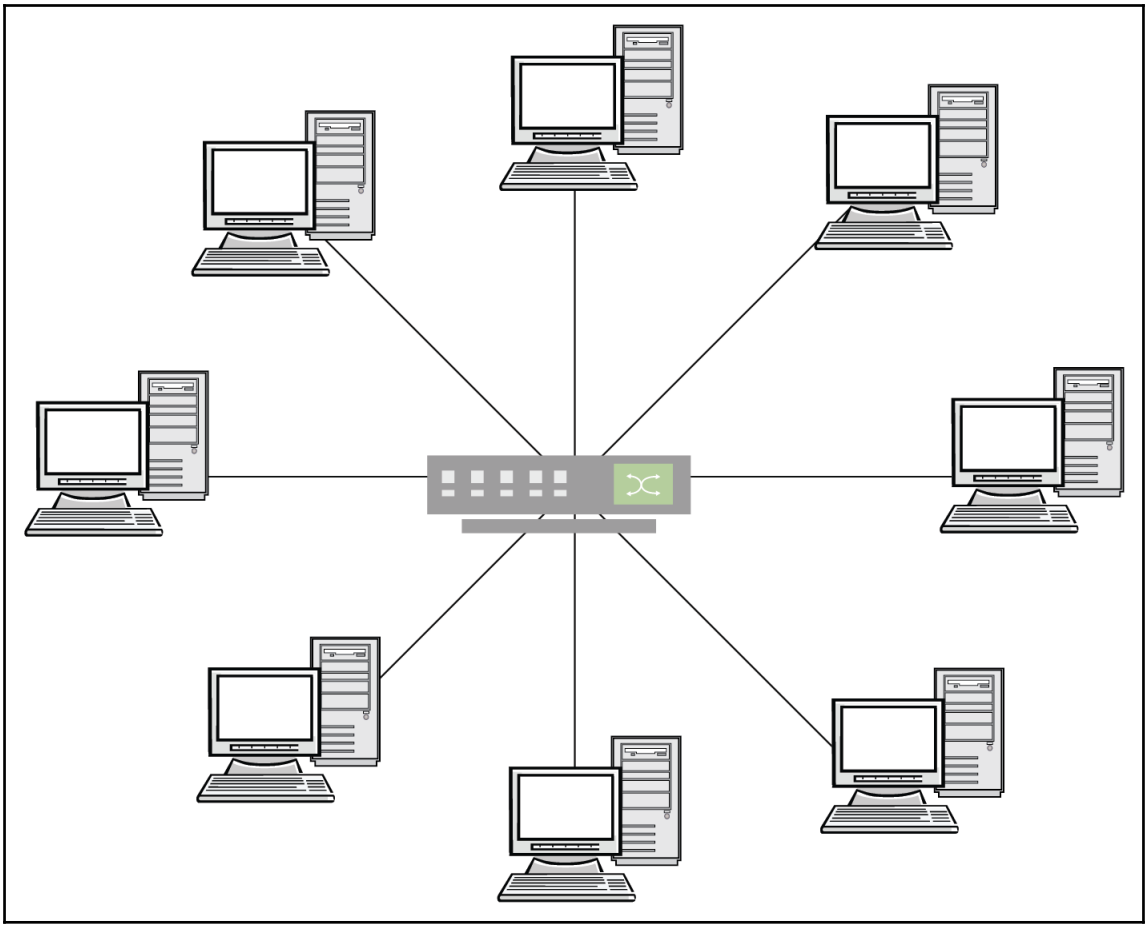

PDA
Smartphone
Laptop
Tablet
Printer

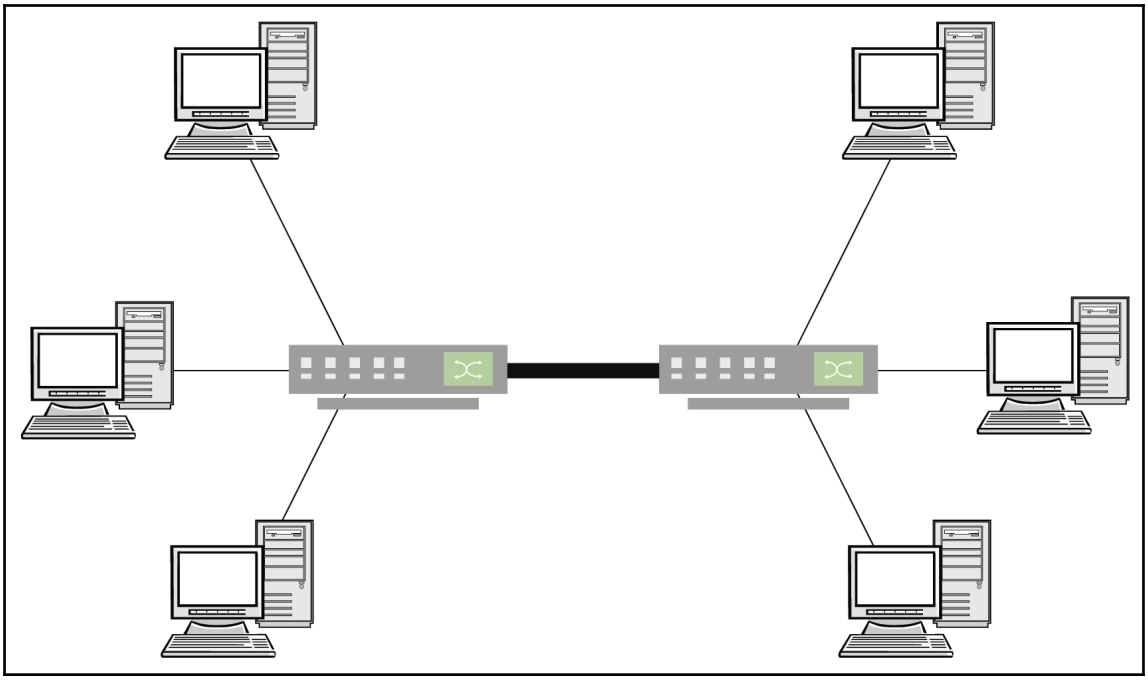

LAN
Factory
LAN
School
LAN
Skyscraper
LAN
Train station
LAN
Outdoor mall
City

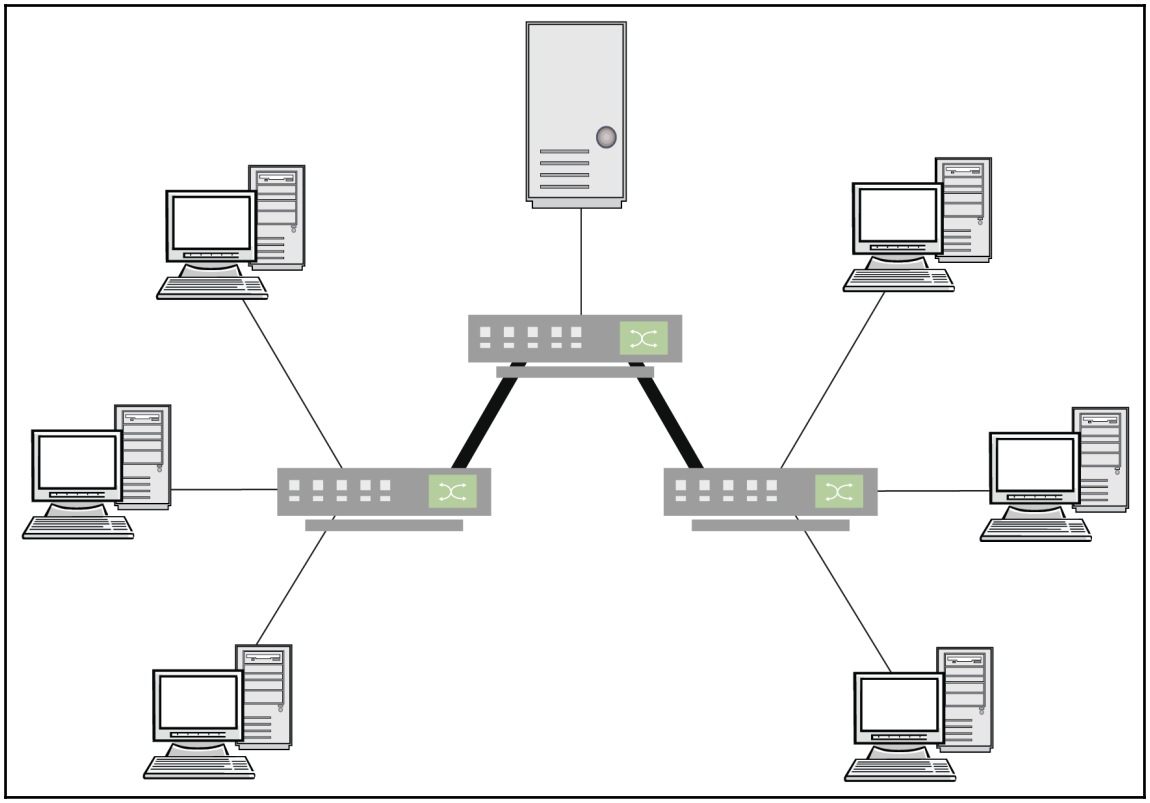

MAN
City
MAN
City
MAN
City
MAN
City
MAN
City

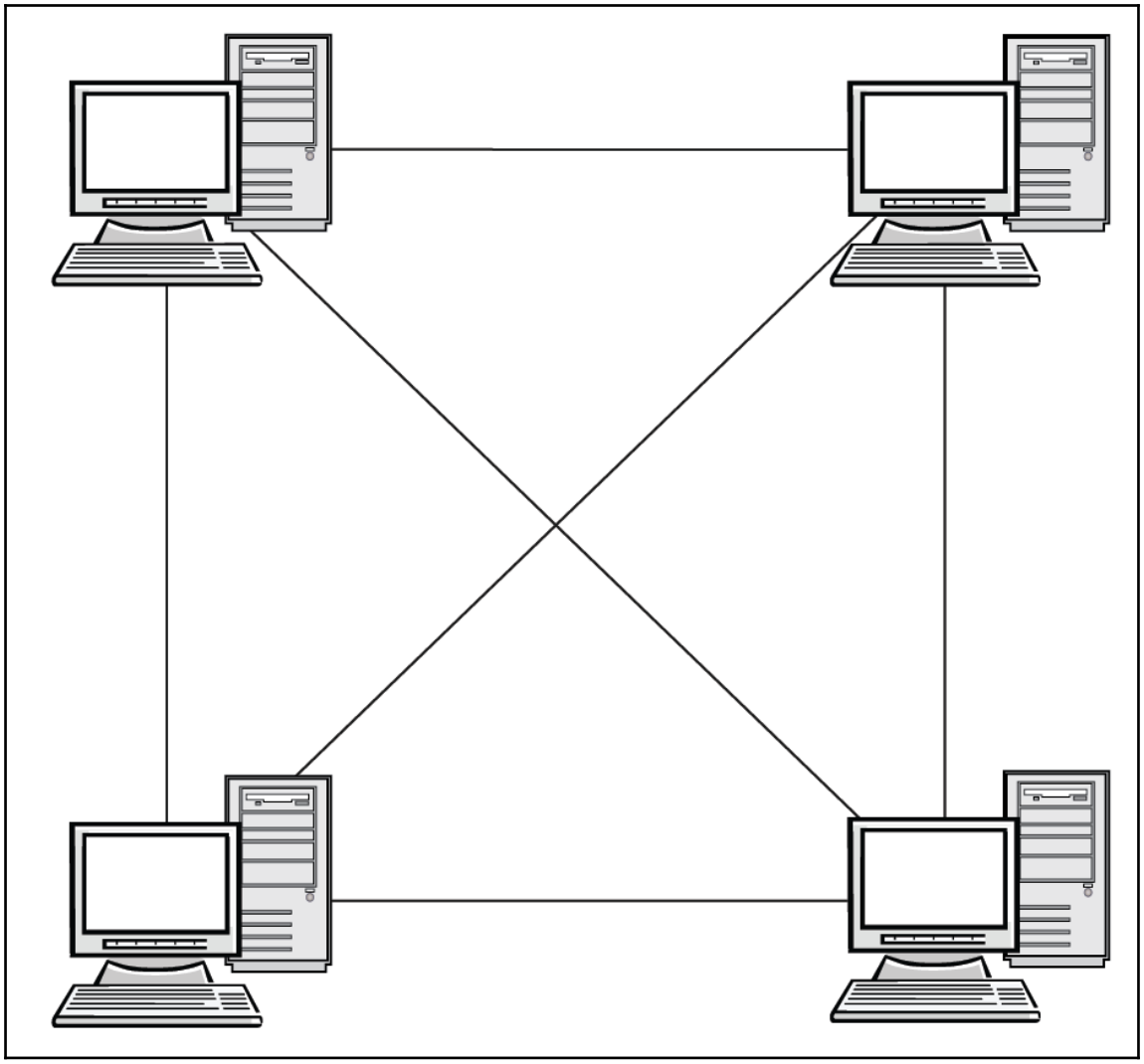


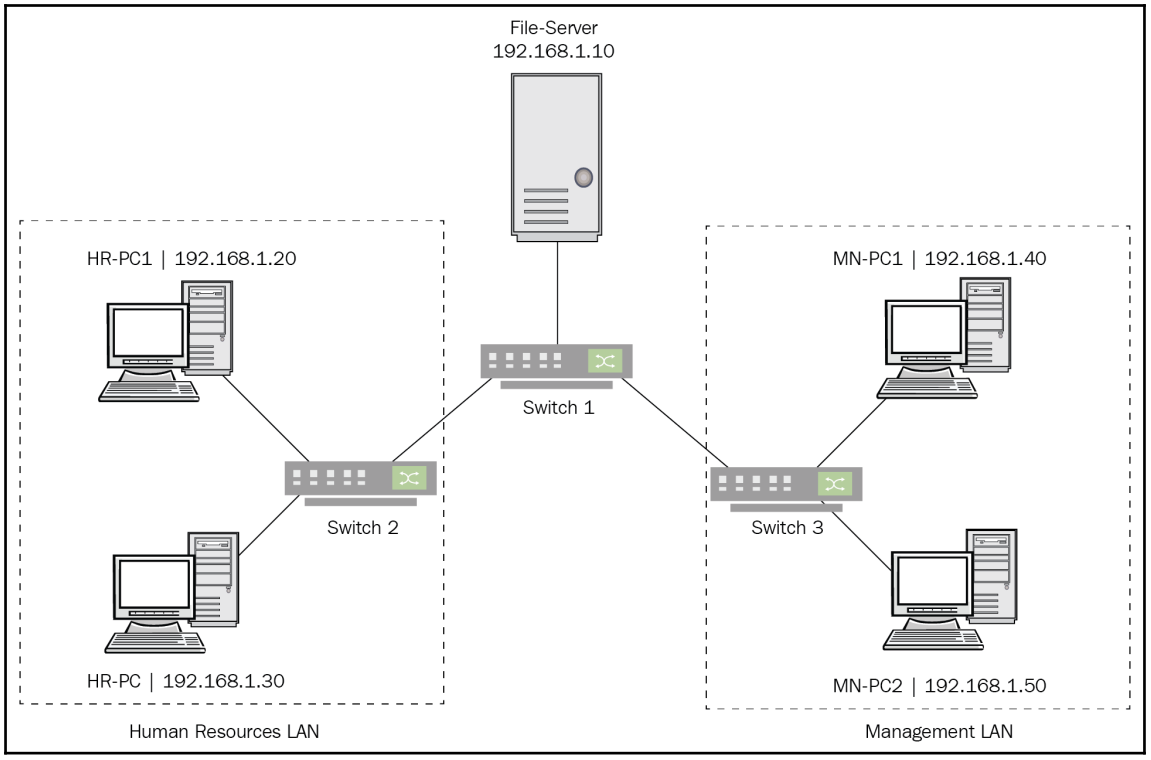


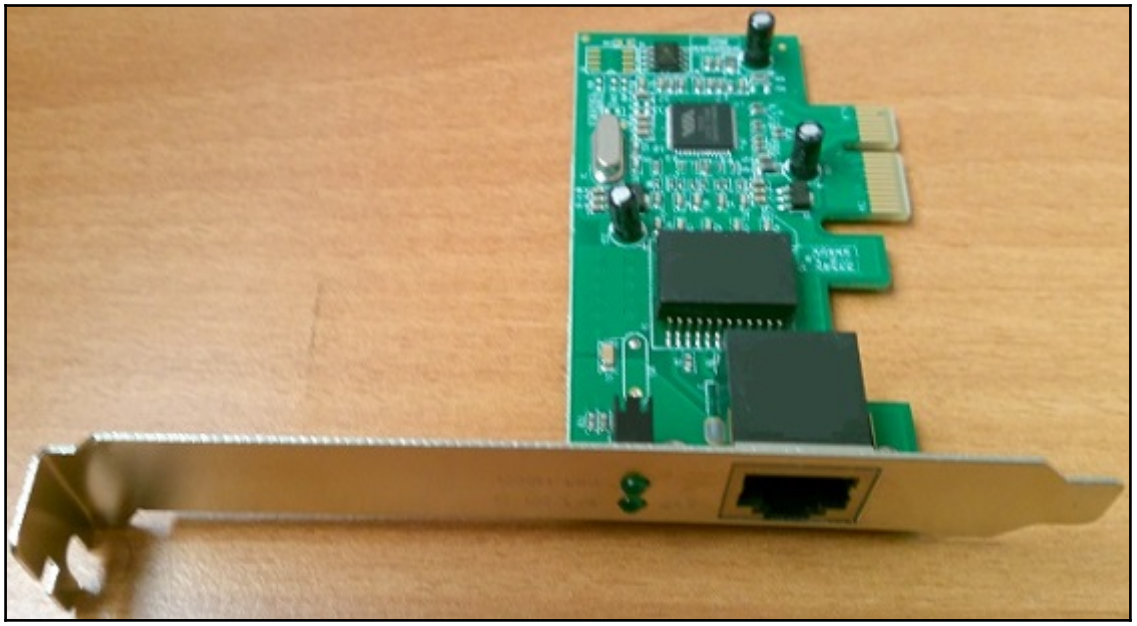


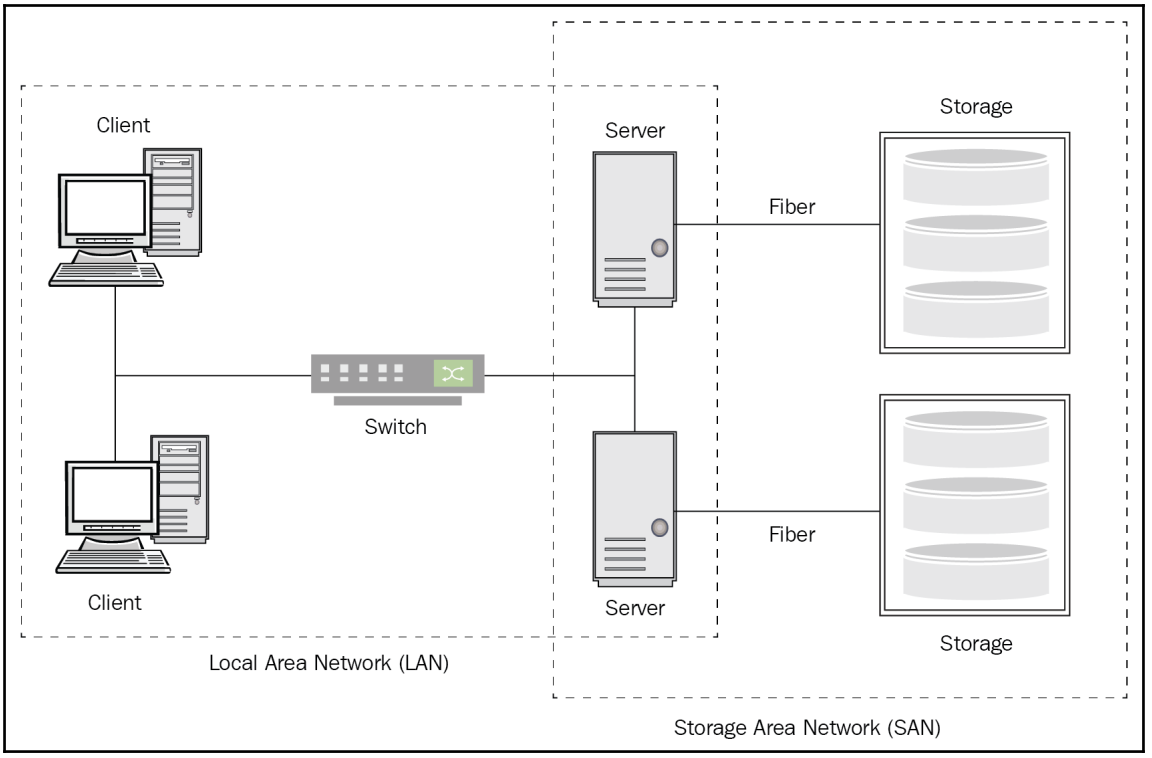




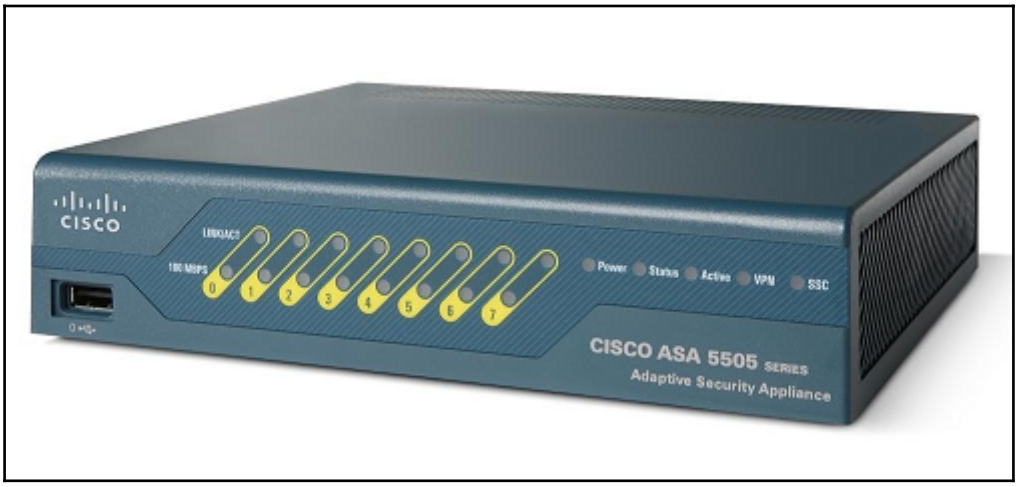



File-Server
192.168.1.10
HR-PC1 | 192.168.1.20
Switch 1
MN-PC1 | 192.168.1.40
Switch 2
Switch 3
HR-PC | 192.168.1.30
MN-PC2 | 192.168.1.50
Human Resources LAN
Management LAN

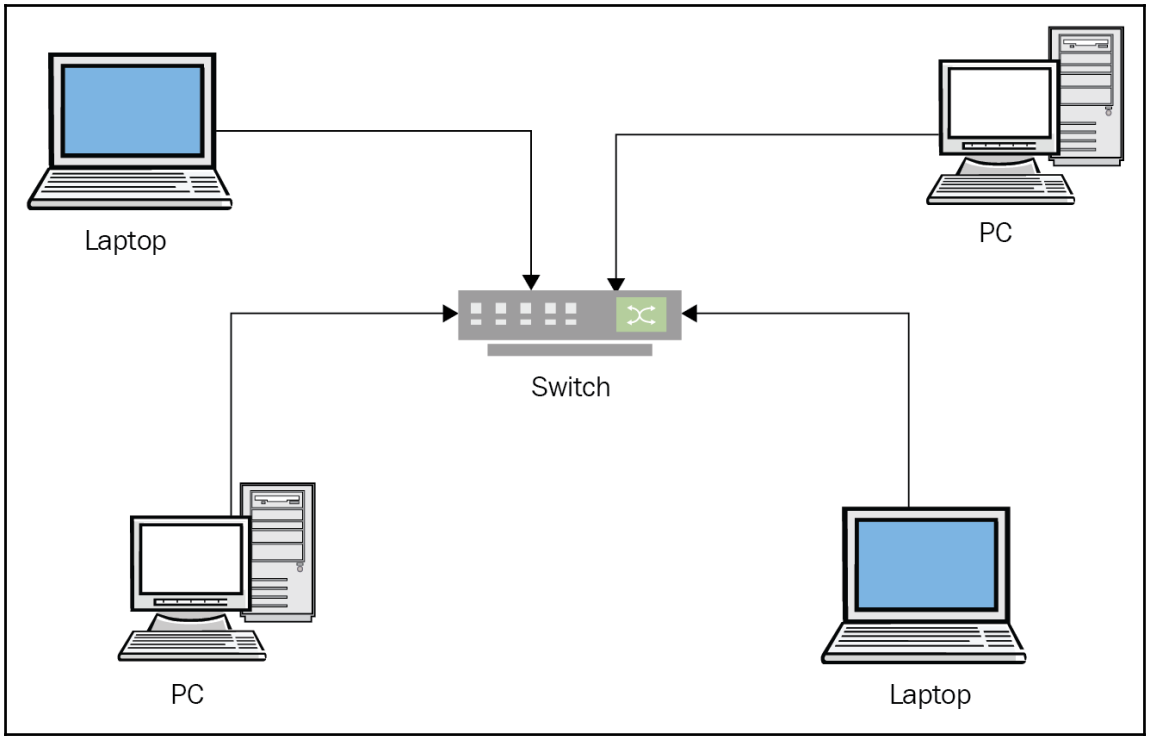


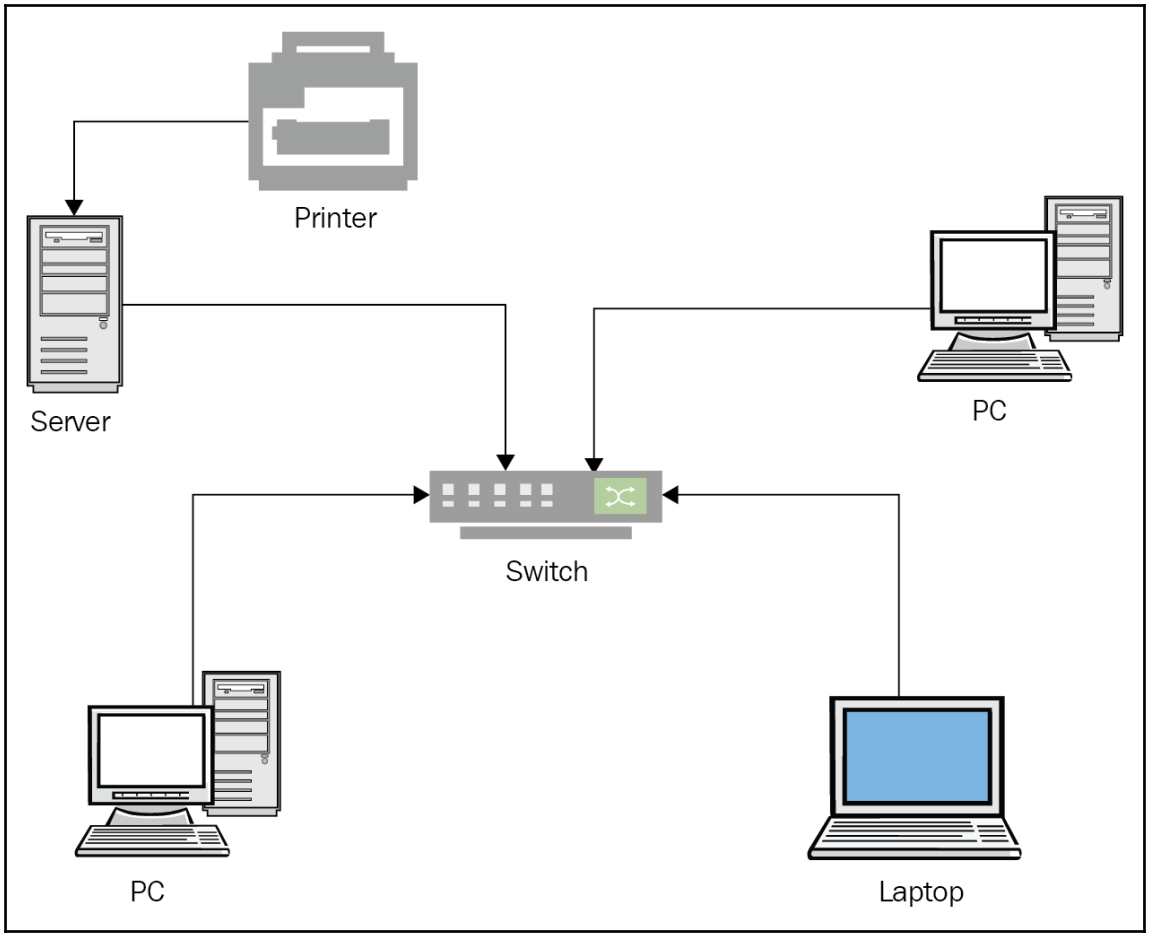

Client
Server
Storage
Fiber
Switch
Client
Server
Fiber
Storage
Local Area Network (LAN)
Storage Area Network (SAN)

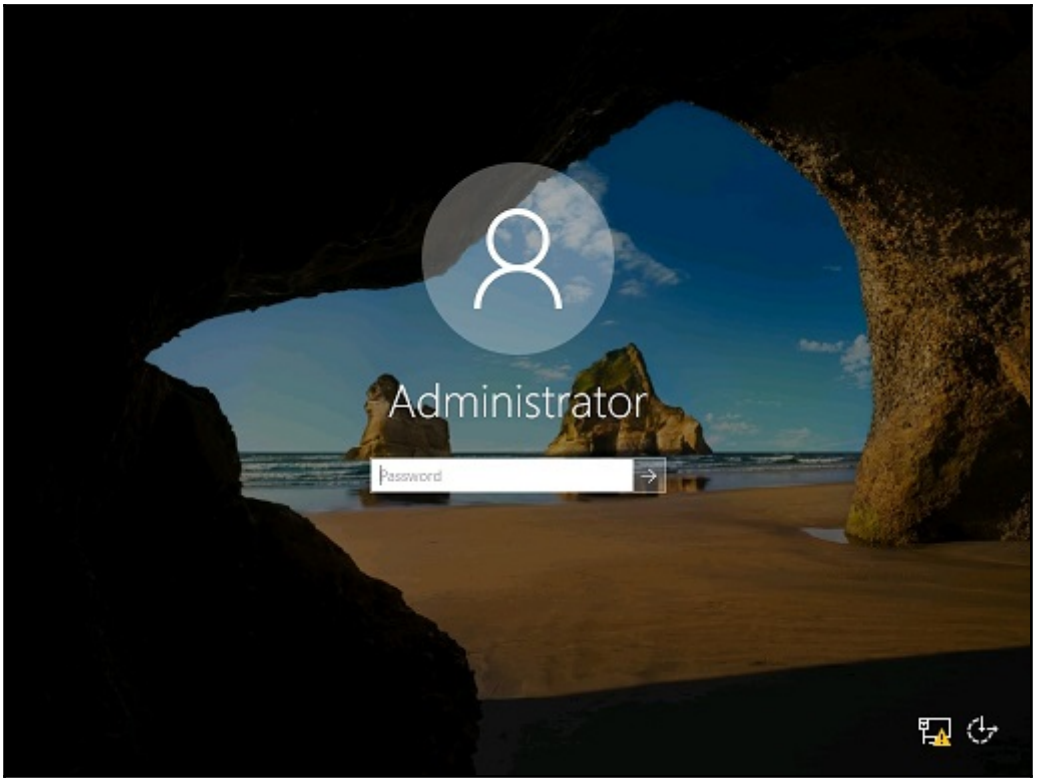

Cisco 2800 Series
Cisco 2800 Series
Cisco 2800 Series
Cisco 3600...

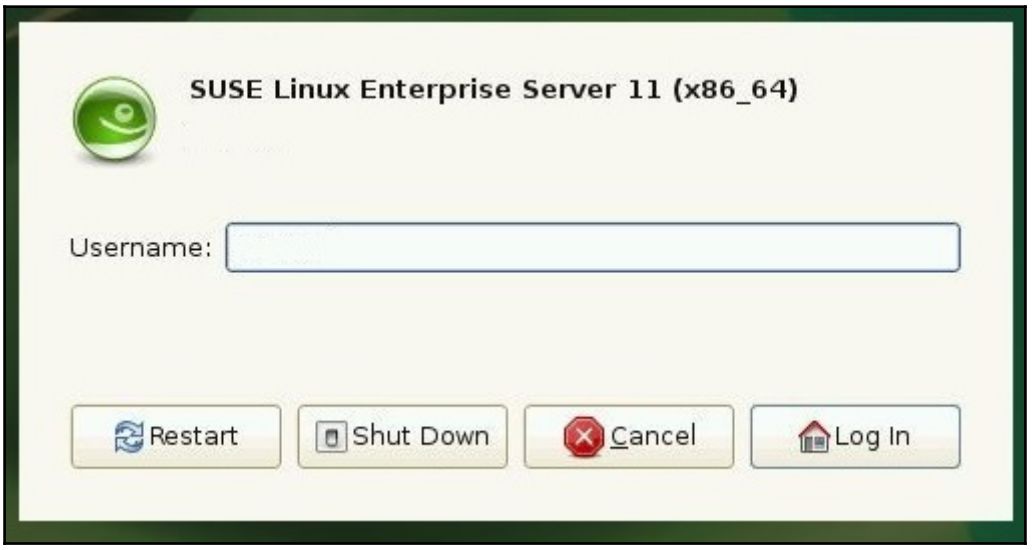

CISCO
LINK/ACT
10/100 MBPS
0
1
2
3
4
5
6
7
Power
Status
Active
VPN
SSC
CISCO ASA 5505 SERIES
Adaptive Security Appliance


Air Live
802.11b Wireless AP
WL-5460AP
LINKSYS
Wireless-G
Broadband Router
With 4-Port Switch
Model WRT54GL
Ethernet
Power
DMZ
WLAN
1 2 3 4 Internet


Laptop
PC
Switch
PC
Laptop

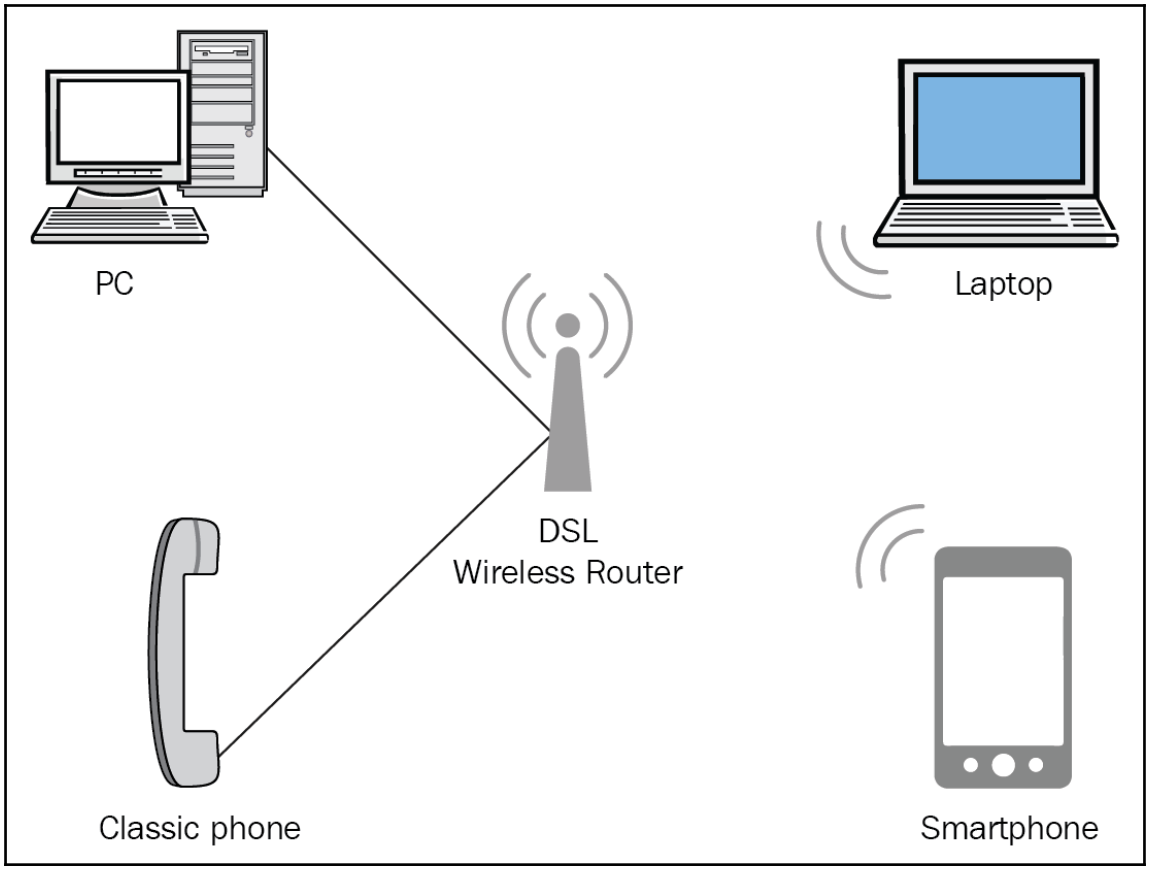

Printer
Server
PC
Switch
PC
Laptop


Administrator
Password

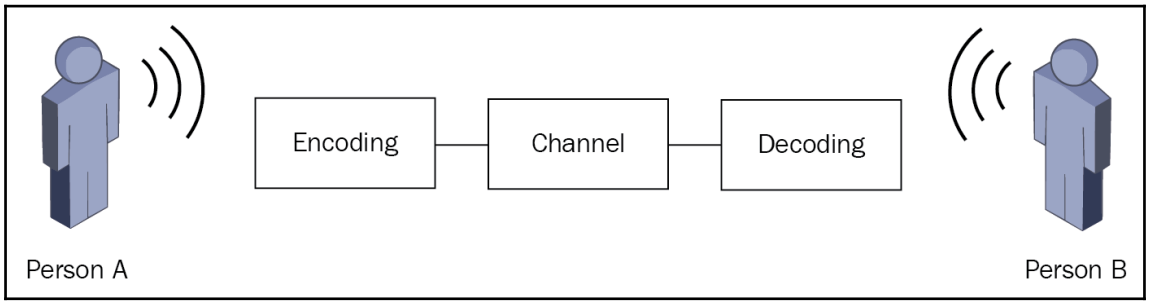

SUSE Linux Enterprise Server 11 (x86_64)
Username:
Restart
Shut Down
Cancel
Log In

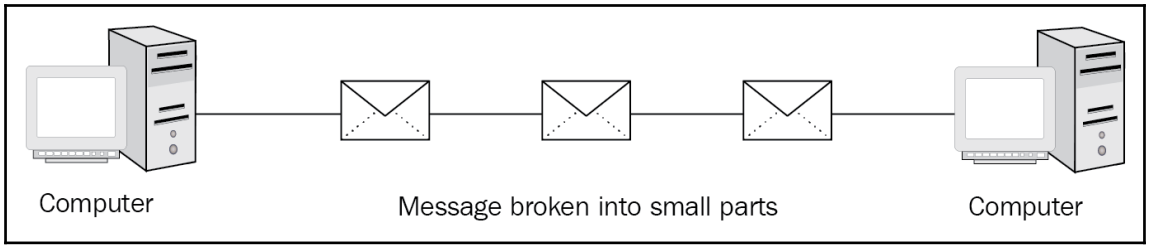

Mac OS X Server
Name:
Password:
Log In

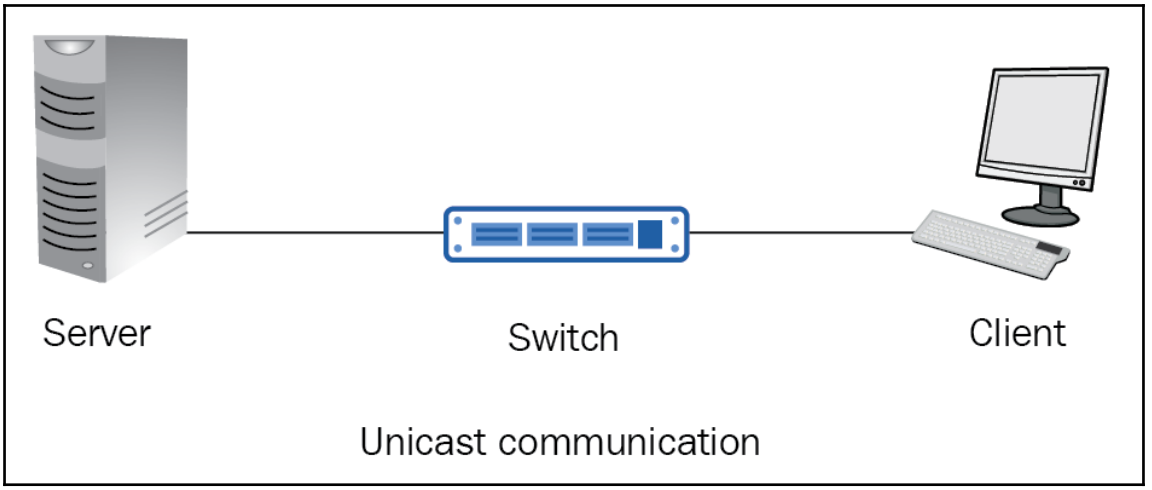

LITECH OPTICAL CABLE SM 9/125 3.0MM FT

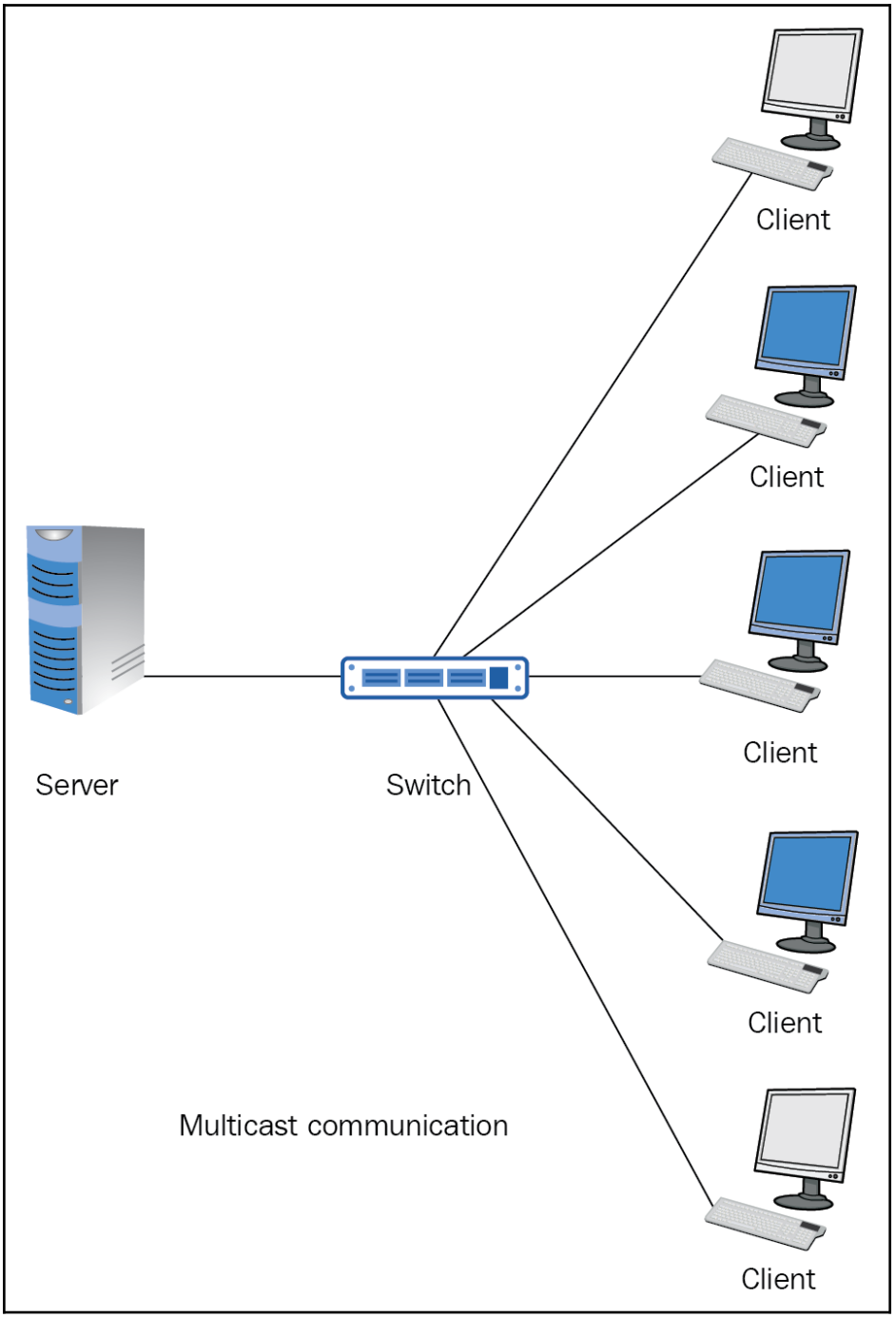

PC
Laptop
DSL
Wireless Router
Classic phone
Smartphone

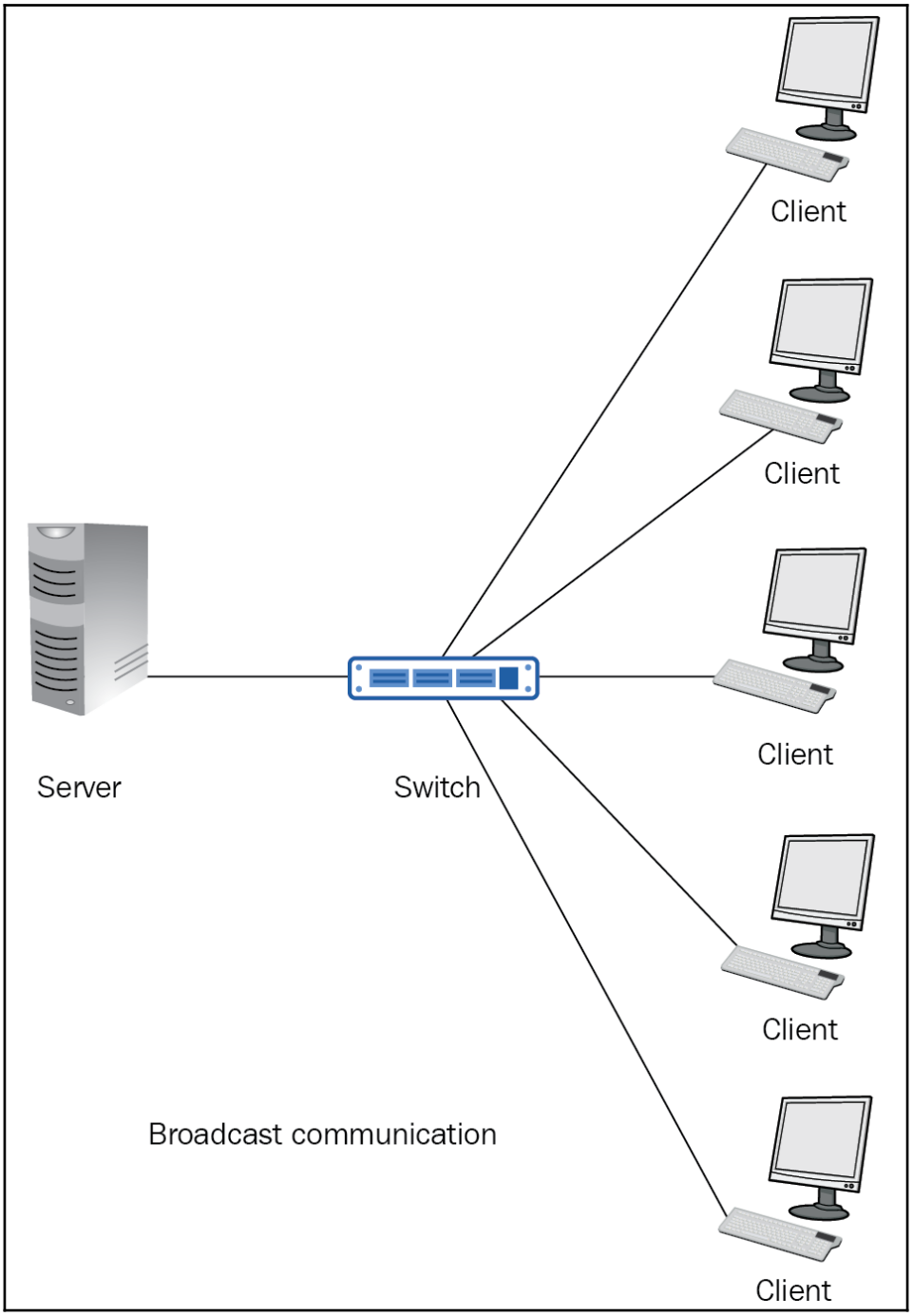
Chapter 2: Communication in computer networks

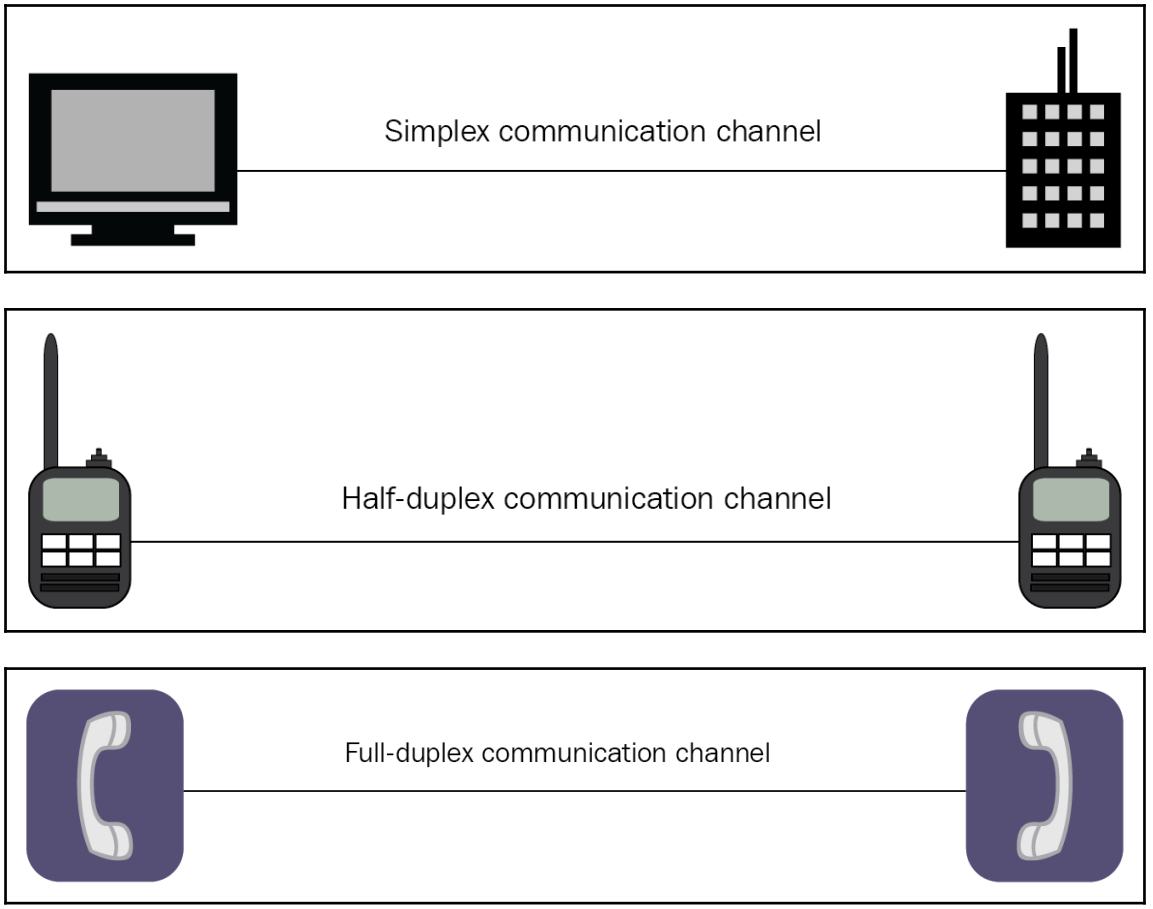


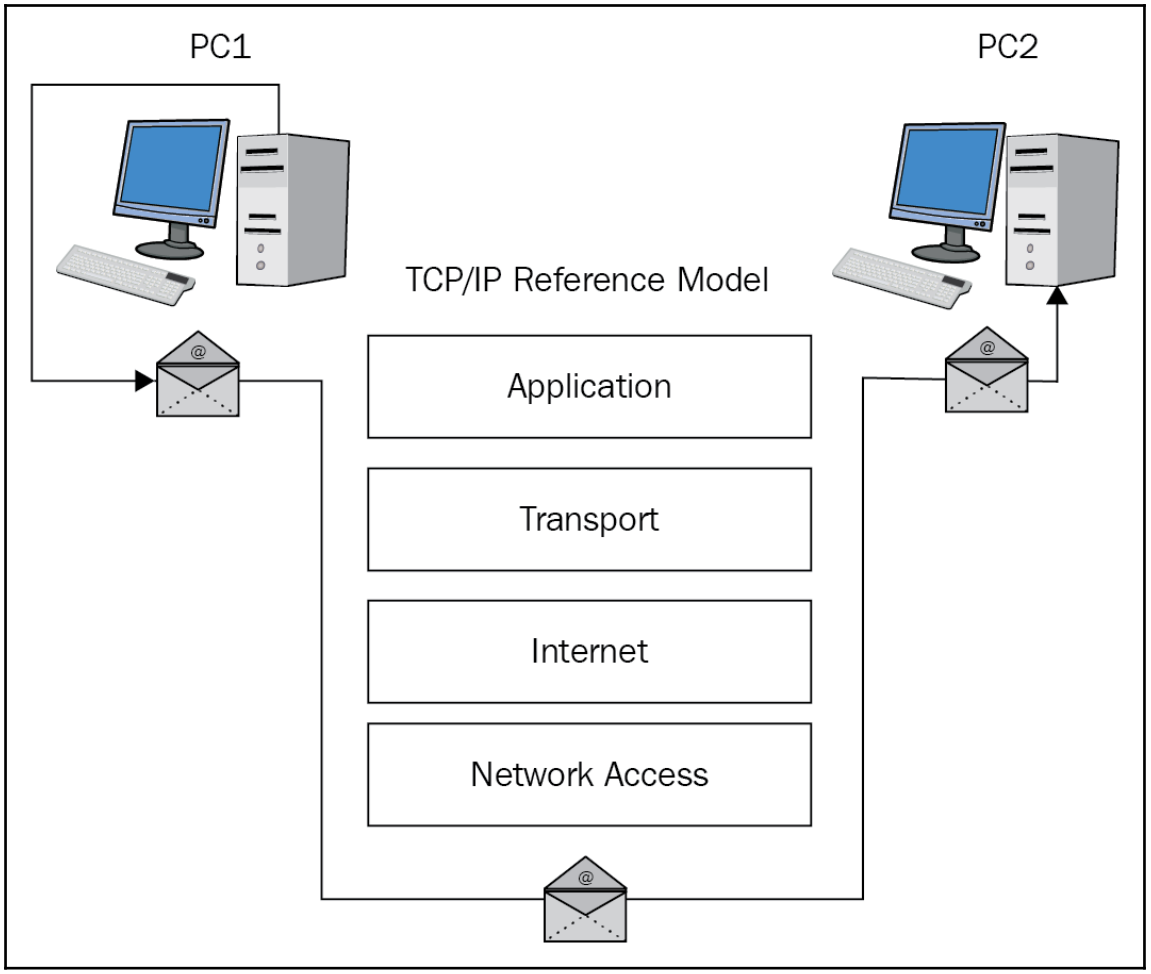


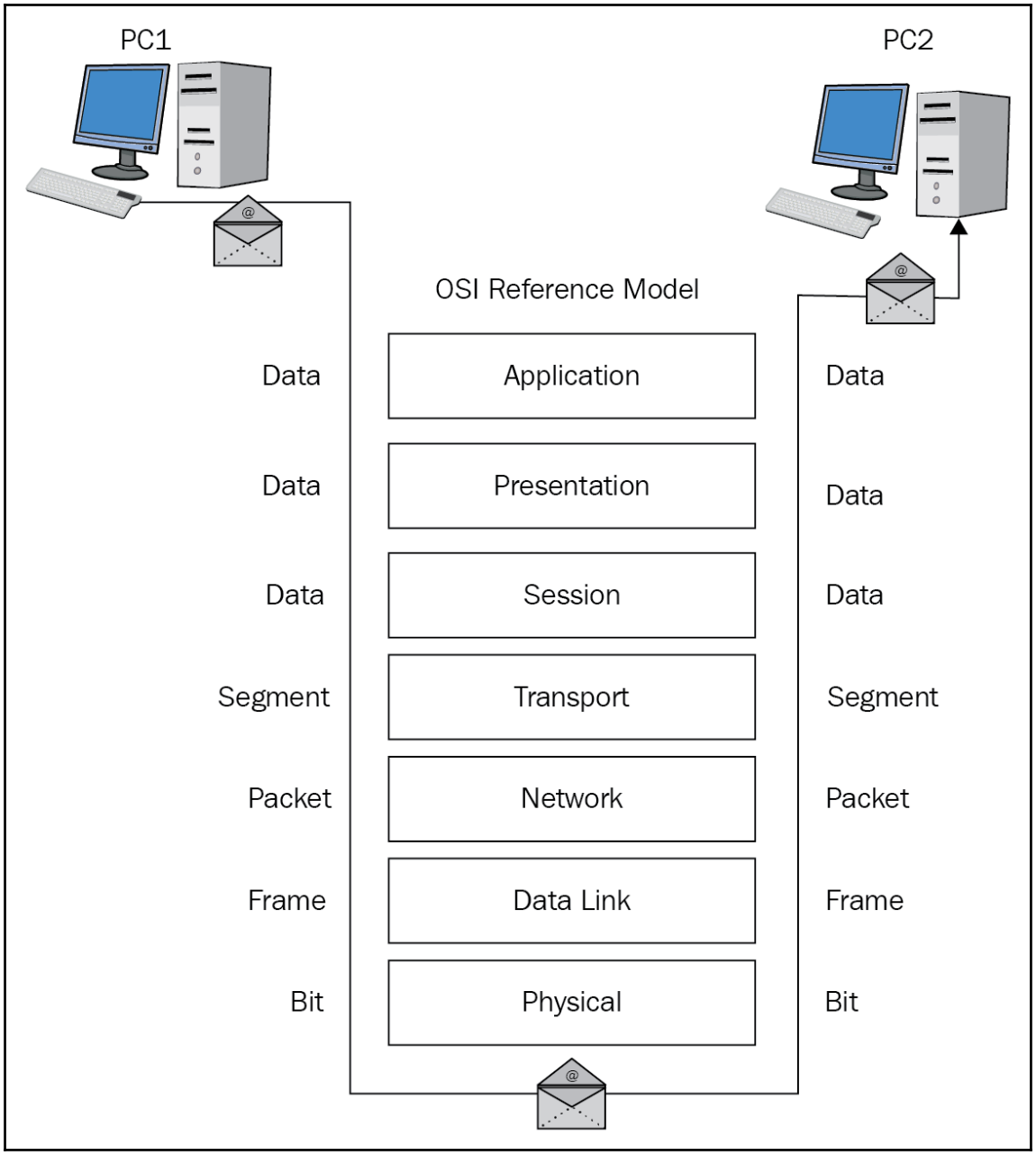

Server
Switch
Client
Unicast communication

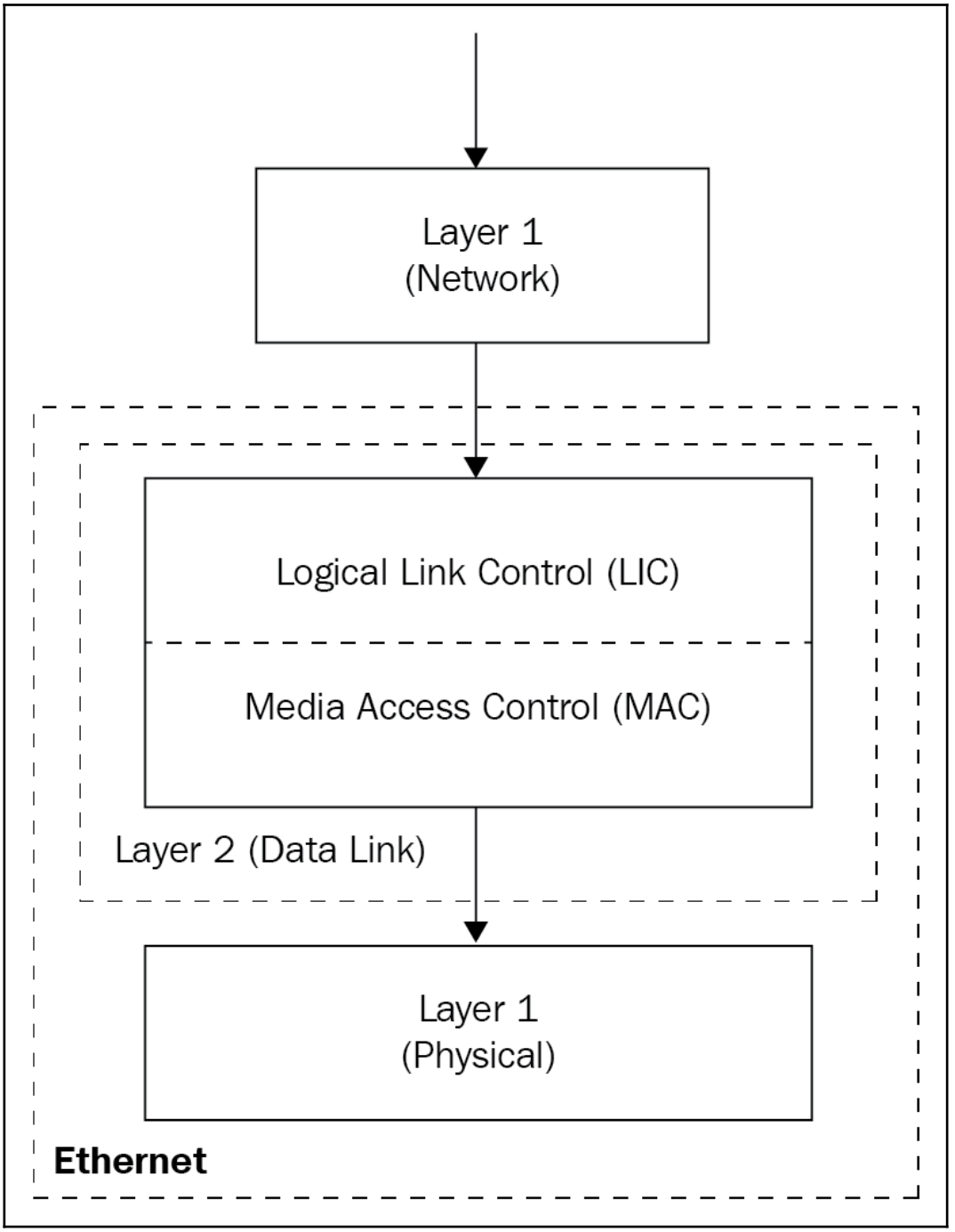

Client
Client
Client
Client
Client
Server
Switch
Multicast communication


Client
Client
Client
Client
Client
Server
Switch
Broadcast communication


Simplex communication channel
Half-duplex communication channel
Full-duplex communication channel

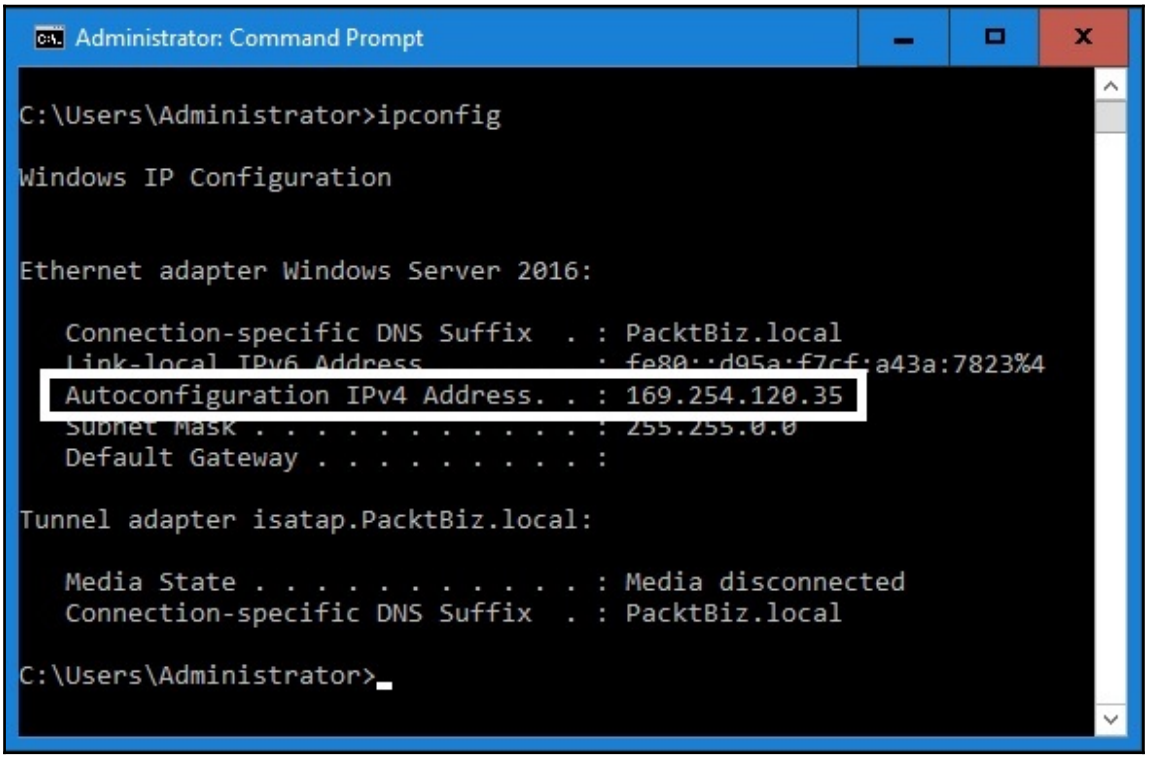

PC1
PC2
TCP/IP Reference Model
Application
Transport
Internet
Network Access

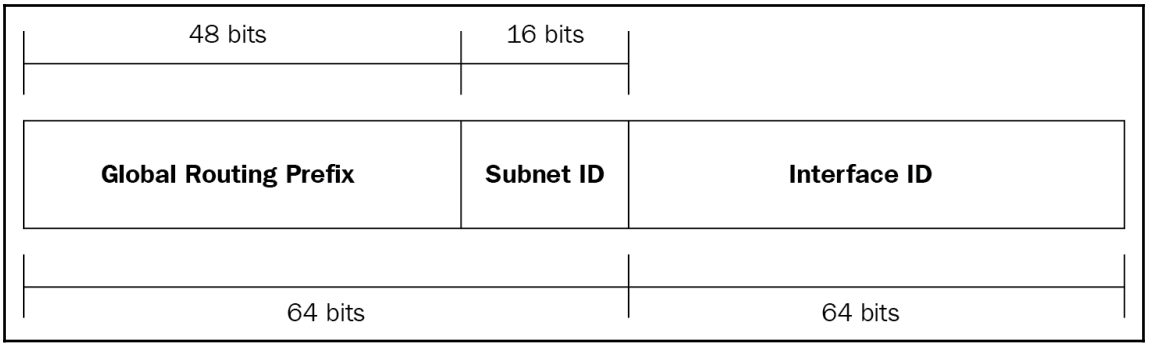

PC1
PC2
OSI Reference Model
Data
Application
Data
Data
Presentation
Data
Data
Session
Data
Segment
Transport
Segment
Packet
Network
Packet
Frame
Data Link
Frame
Bit
Physical
Bit


Layer 1
(Network)
Logical Link Control (LIC)
Media Access Control (MAC)
Layer 2 (Data Link)
Layer 1
(Physical)
Ethernet

Preamble (7 bytes)	Start Frame Delimiter SFD (1 byte)	Destination MAC Address (6 bytes)	Source MAC Address (6 bytes)	EtherType (2 bytes)	Data (46-1500 bytes)	Frame Check Sequence FCS (4 bytes)

Organizationally Unique Identifier (OUI) (24 bits)	Vendor Assigned (24 bits)

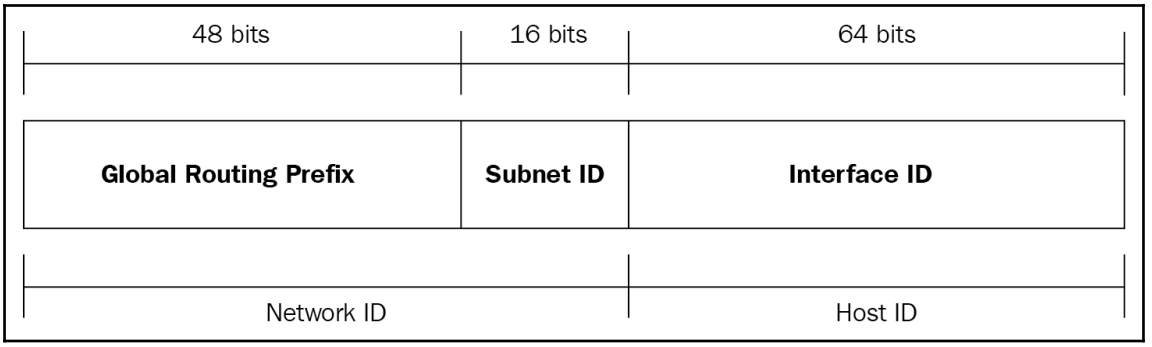




Class	Network Prefix	Subnet Mask	Borrowed Bits	Subnets	Hosts per Subnet
A	/8	255.0.0.0	0	1	16777214
	/9	255.128.0.0	1	2	8388606
	/10	255.192.0.0	2	4	4194302
	/11	255.224.0.0	3	8	2097150
	/12	255.240.0.0	4	16	1048574
	/13	255.248.0.0	5	32	524286
	/14	255.252.0.0	6	64	262142
	/15	255.254.0.0	7	128	131070
	/16	255.255.0.0	8	256	65534
	/17	255.255.128.0	9	512	32766
	/18	255.255.192.0.	10	1024	16382
	/19	255.255.224.0	11	2048	8190
	/20	255.255.240.0	12	4096	4094
	/21	255.255.248.0	13	8192	2046
	/22	255.255.252.0	14	16384	1022
	/23	255.255.254.0	15	32768	510
	/24	255.255.255.0	16	65536	254
	/25	255.255.255.128	17	131072	126
	/26	255.255.255.192	18	262144	62
	/27	255.255.255.224	19	524288	30
	/28	255.255.255.240	20	1048576	14
	/29	255.255.255.248	21	2097152	6
	/30	255.255.255.252	22	4194304	2

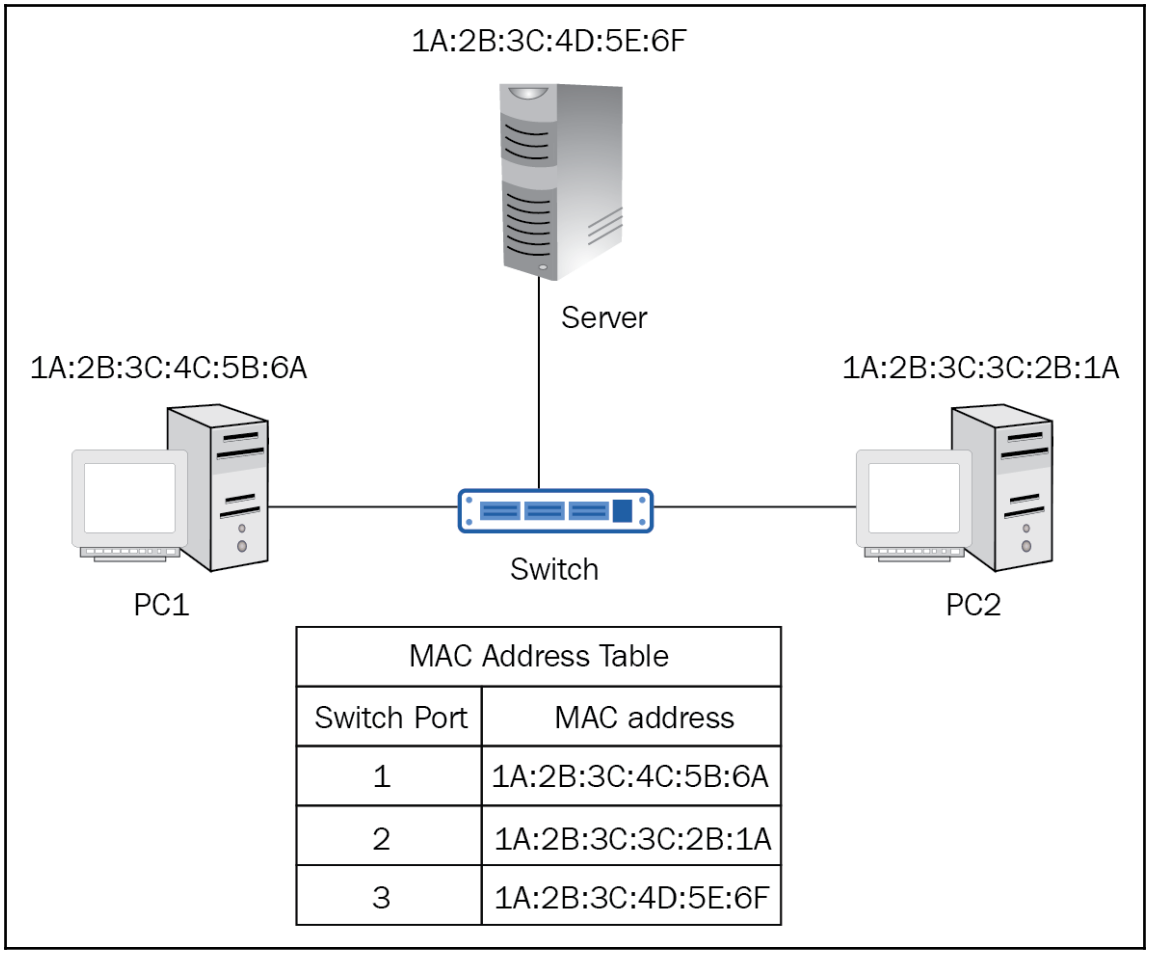
Class	Network Prefix	Subnet Mask	Borrowed Bits	Subnets	Hosts per Subnet
B	/16	255.255.0.0	0	0	65534
	/17	255.255.128.0	1	2	32766
	/18	255.255.192.0.	2	4	16382
	/19	255.255.224.0	3	8	8190
	/20	255.255.240.0	4	16	4094
	/21	255.255.248.0	5	32	2046
	/22	255.255.252.0	6	64	1022
	/23	255.255.254.0	7	128	510
	/24	255.255.255.0	8	256	254
	/25	255.255.255.128	9	512	126
	/26	255.255.255.192	10	1024	62
	/27	255.255.255.224	11	2048	30
	/28	255.255.255.240	12	4096	14
	/29	255.255.255.248	13	8192	6
	/30	255.255.255.252	14	16384	2

Class	Network Prefix	Subnet Mask	Borrowed Bits	Subnets	Hosts per Subnet
C	/24	255.255.255.0	0	0	254
	/25	255.255.255.128	1	2	126
	/26	255.255.255.192	2	4	62
	/27	255.255.255.224	3	8	30
	/28	255.255.255.240	4	16	14
	/29	255.255.255.248	5	32	6
	/30	255.255.255.252	6	64	2

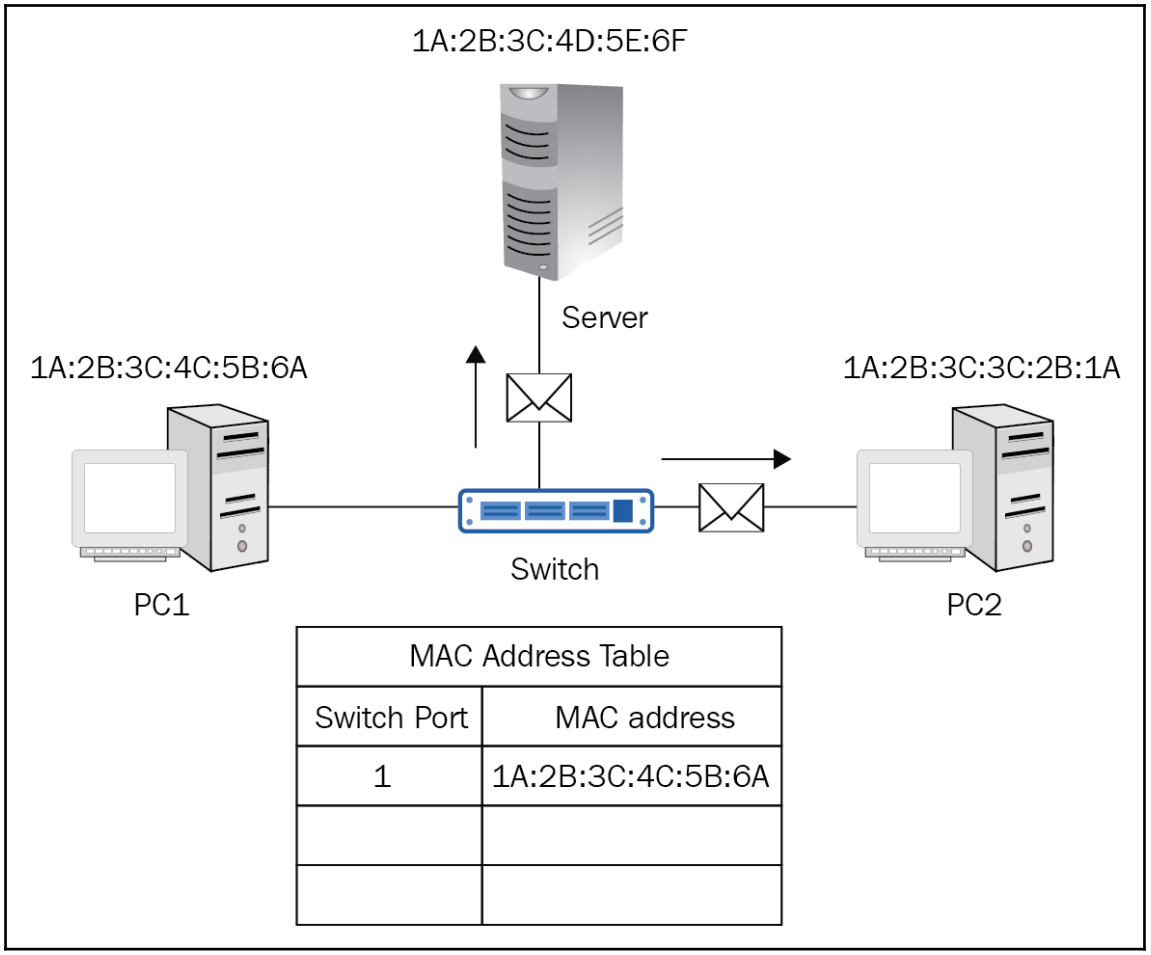

48 bits
16 bits
64 bits
Global Routing Prefix
Subnet ID
Interface ID
Network ID
Host ID

Chapter 3: Introduction to Switching

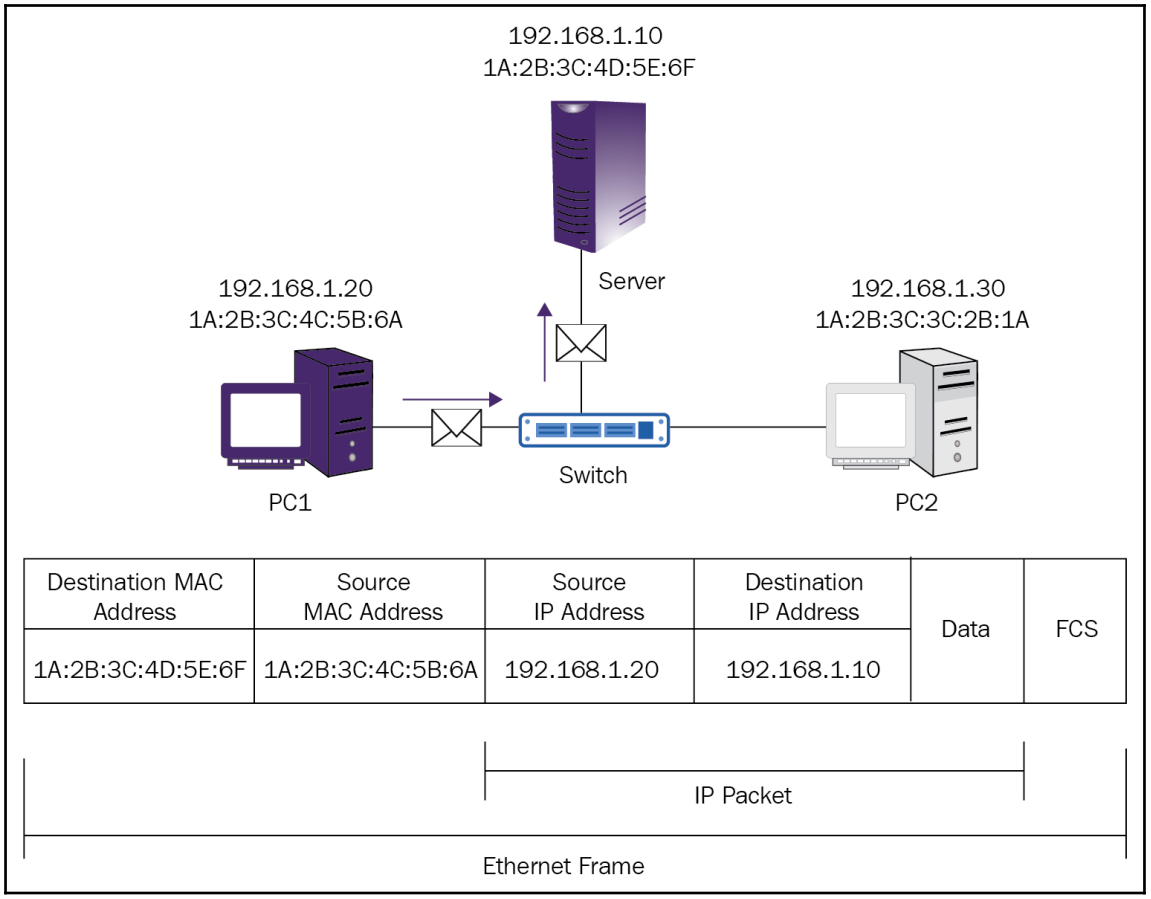
```
Switch#show mac-address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----

   1    0005.5ed4.c3ab    DYNAMIC     Fa0/1
   1    0006.2ac8.ee32    DYNAMIC     Fa0/3
   1    000a.41d4.1c01    DYNAMIC     Fa0/4
   1    0010.1128.9993    DYNAMIC     Fa0/5
   1    0060.5c2e.d5bc    DYNAMIC     Fa0/2
   1    00e0.f7cc.1413    DYNAMIC     Fa0/6
```



MAC Address Table	
Switch Port	MAC address
1	1A:2B:3C:4C:5B:6A
2	1A:2B:3C:3C:2B:1A
3	1A:2B:3C:4D:5E:6F



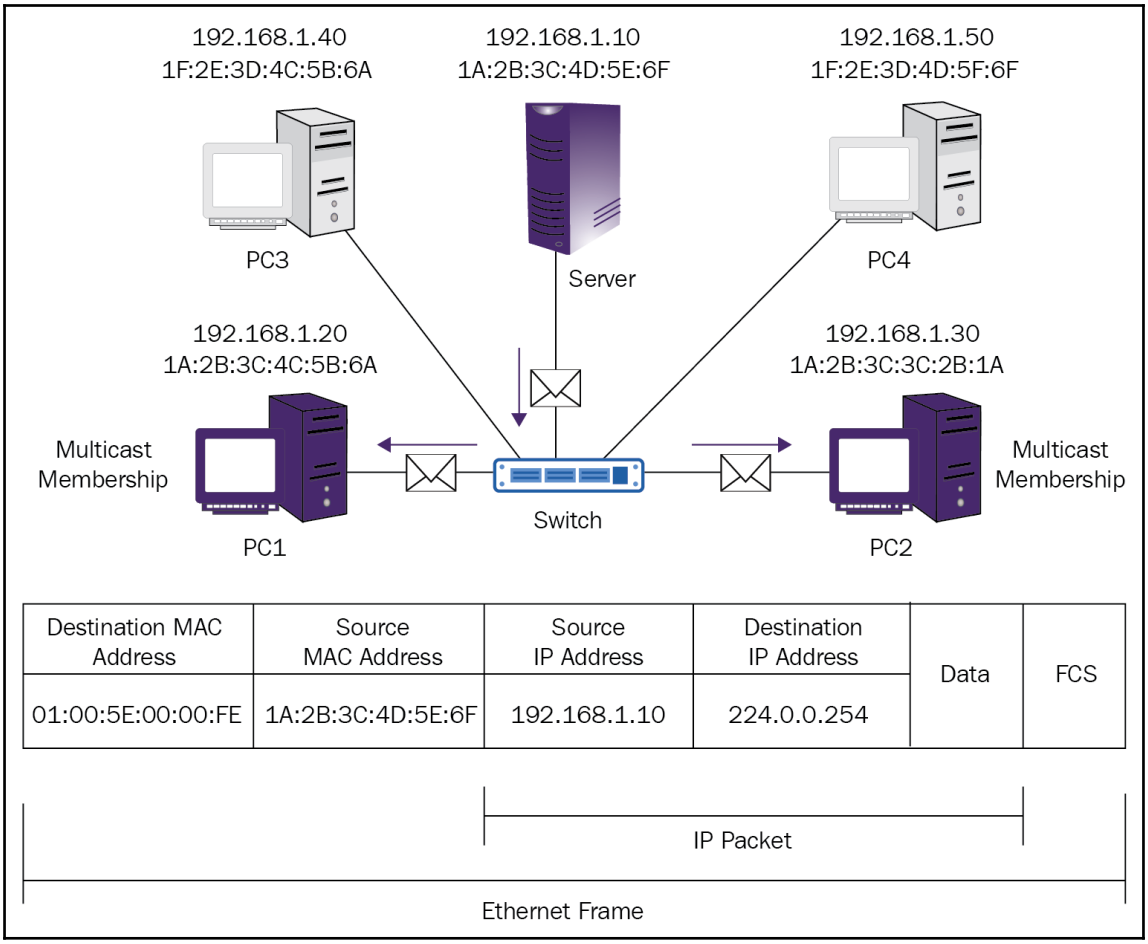
MAC Address Table	
Switch Port	MAC address
1	1A:2B:3C:4C:5B:6A



Destination MAC Address	Source MAC Address	Source IP Address	Destination IP Address	Data	FCS
1A:2B:3C:4D:5E:6F	1A:2B:3C:4C:5B:6A	192.168.1.20	192.168.1.10		

IP Packet

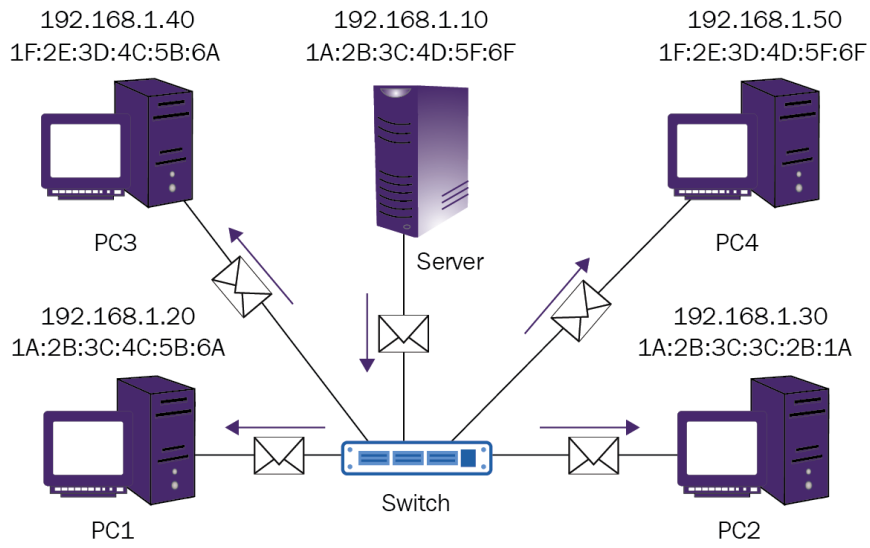
Ethernet Frame



Destination MAC Address	Source MAC Address	Source IP Address	Destination IP Address	Data	FCS
01:00:5E:00:00:FE	1A:2B:3C:4D:5E:6F	192.168.1.10	224.0.0.254		

IP Packet

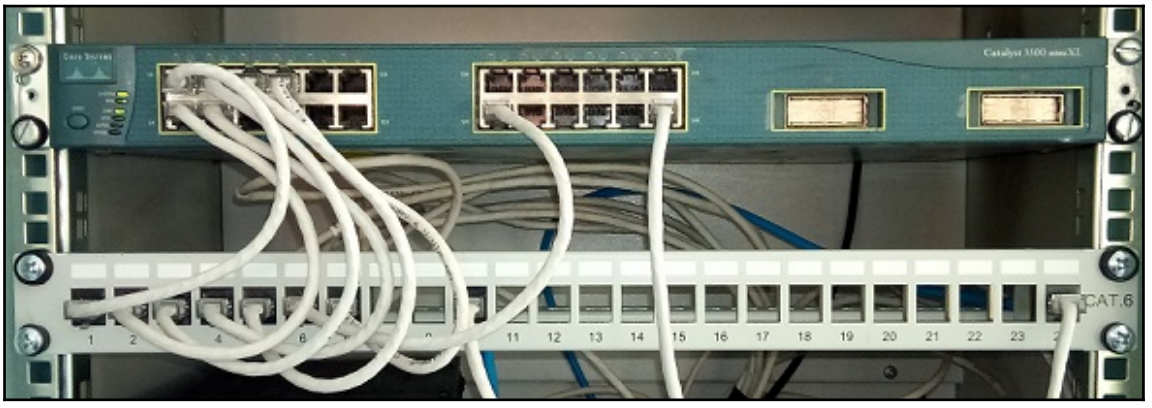
Ethernet Frame



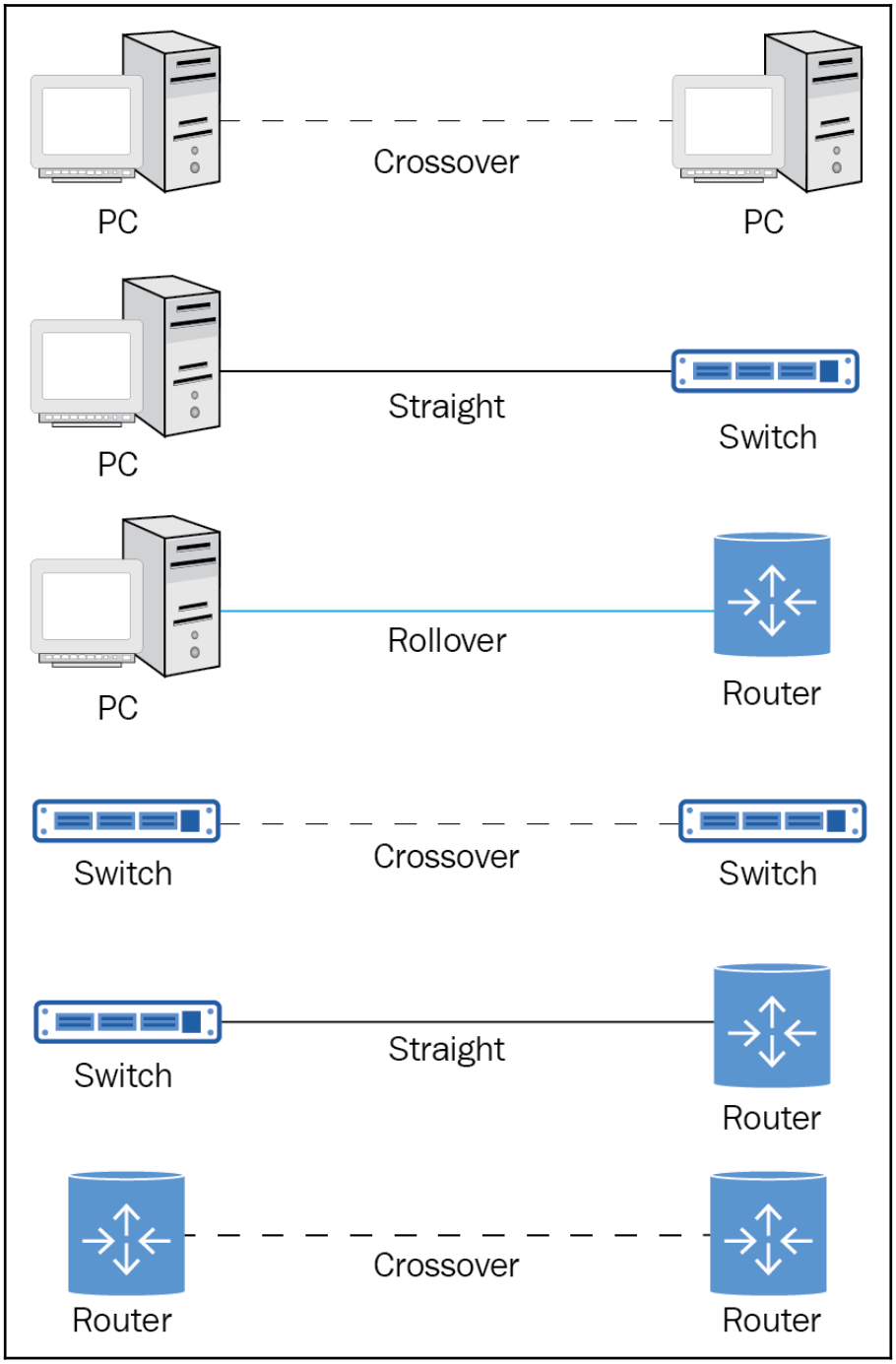
Destination MAC Address	Source MAC Address	Source IP Address	Destination IP Address	Data	FCS
FF:FF:FF:FF:FF:FF	1A:2B:3C:4D:5E:6F	192.168.1.10	194.168.1.255		

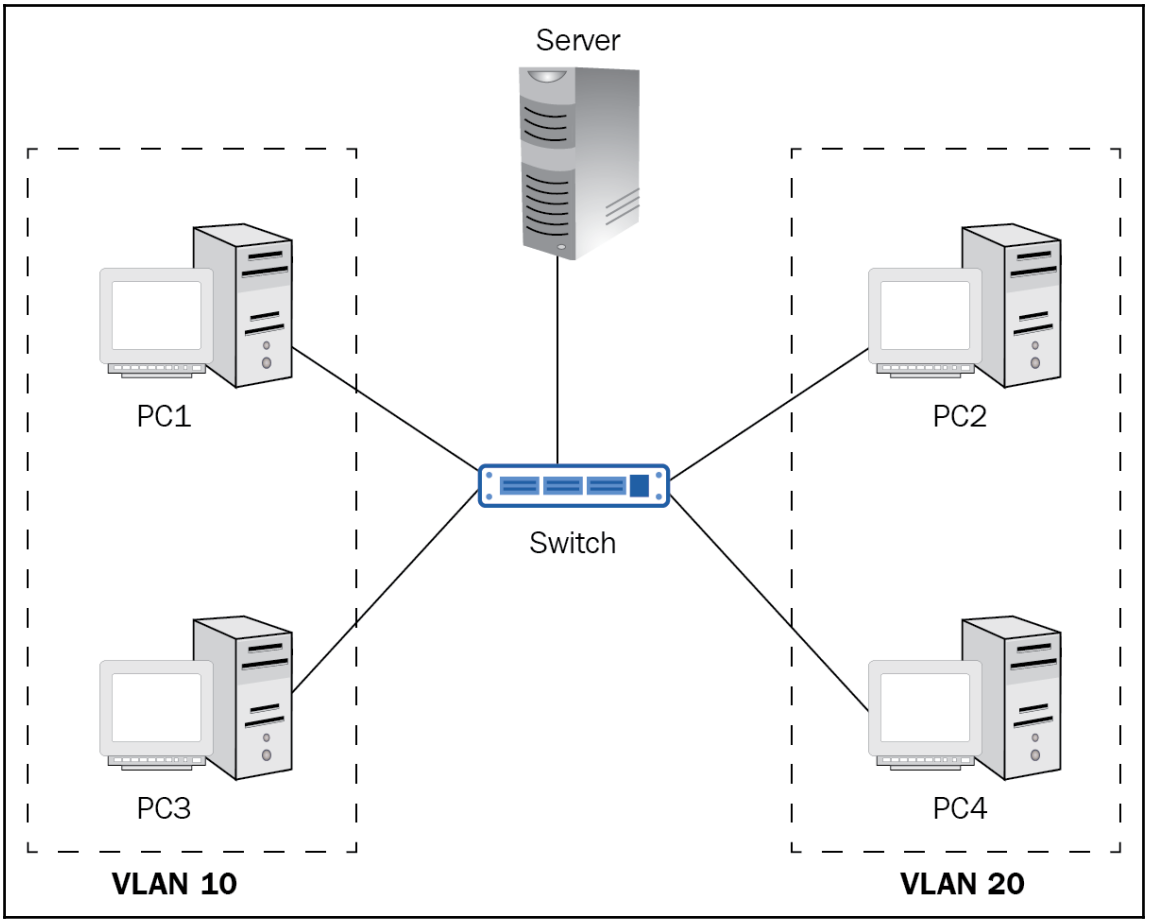
IP Packet

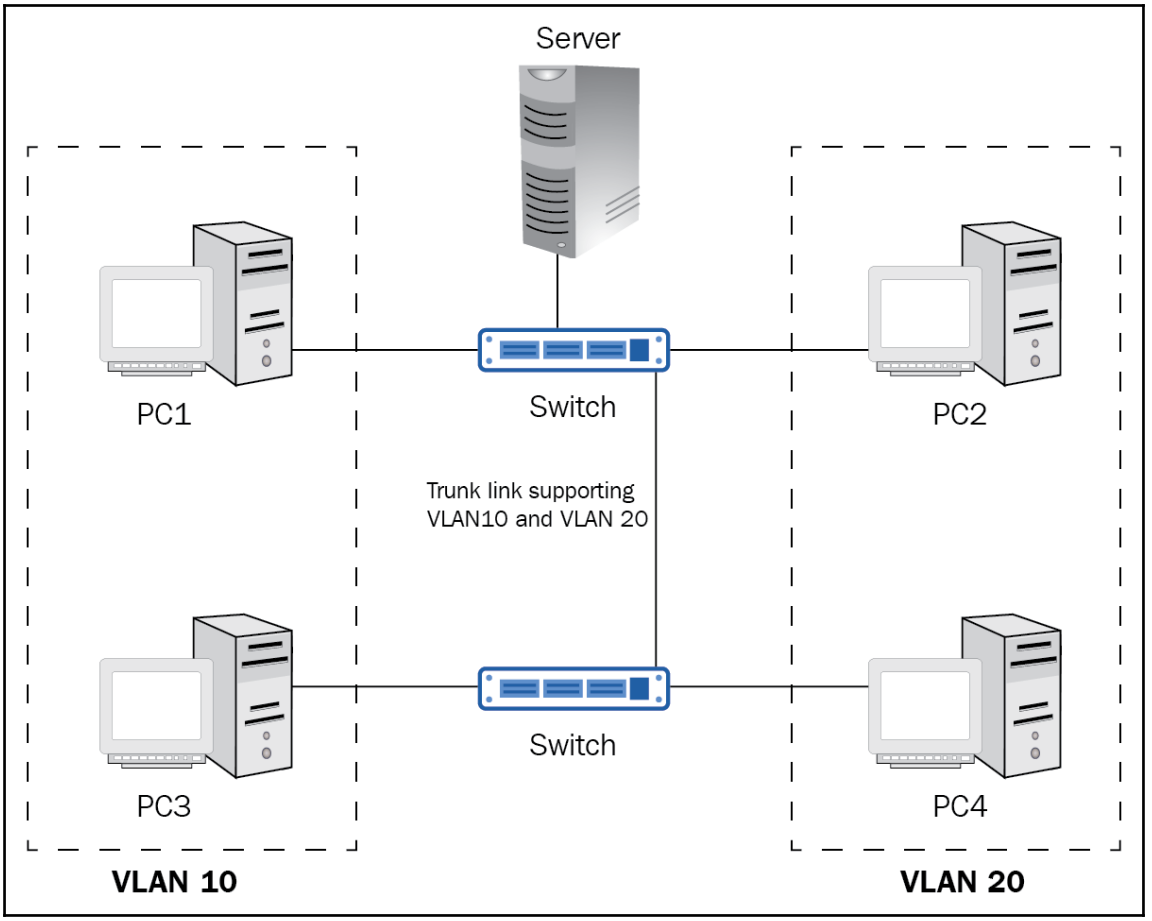
Ethernet Frame

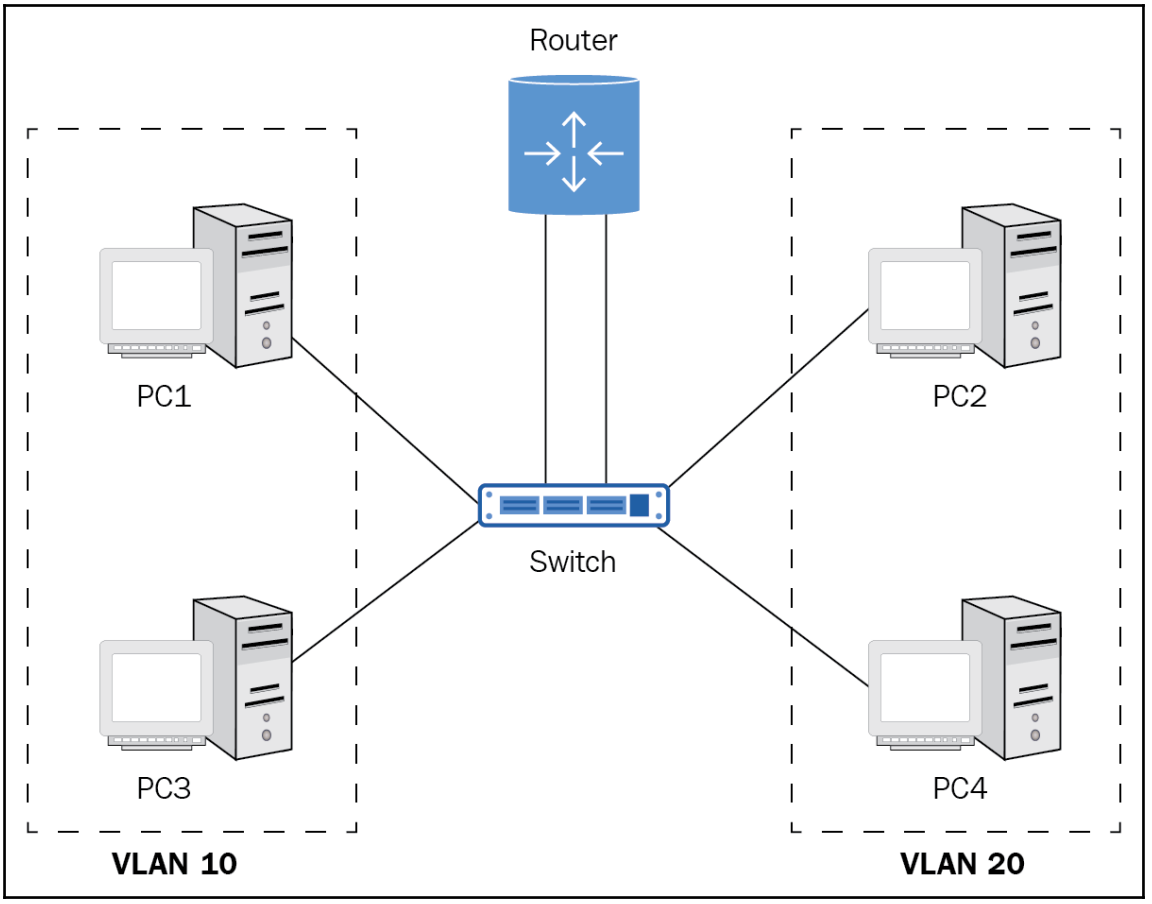


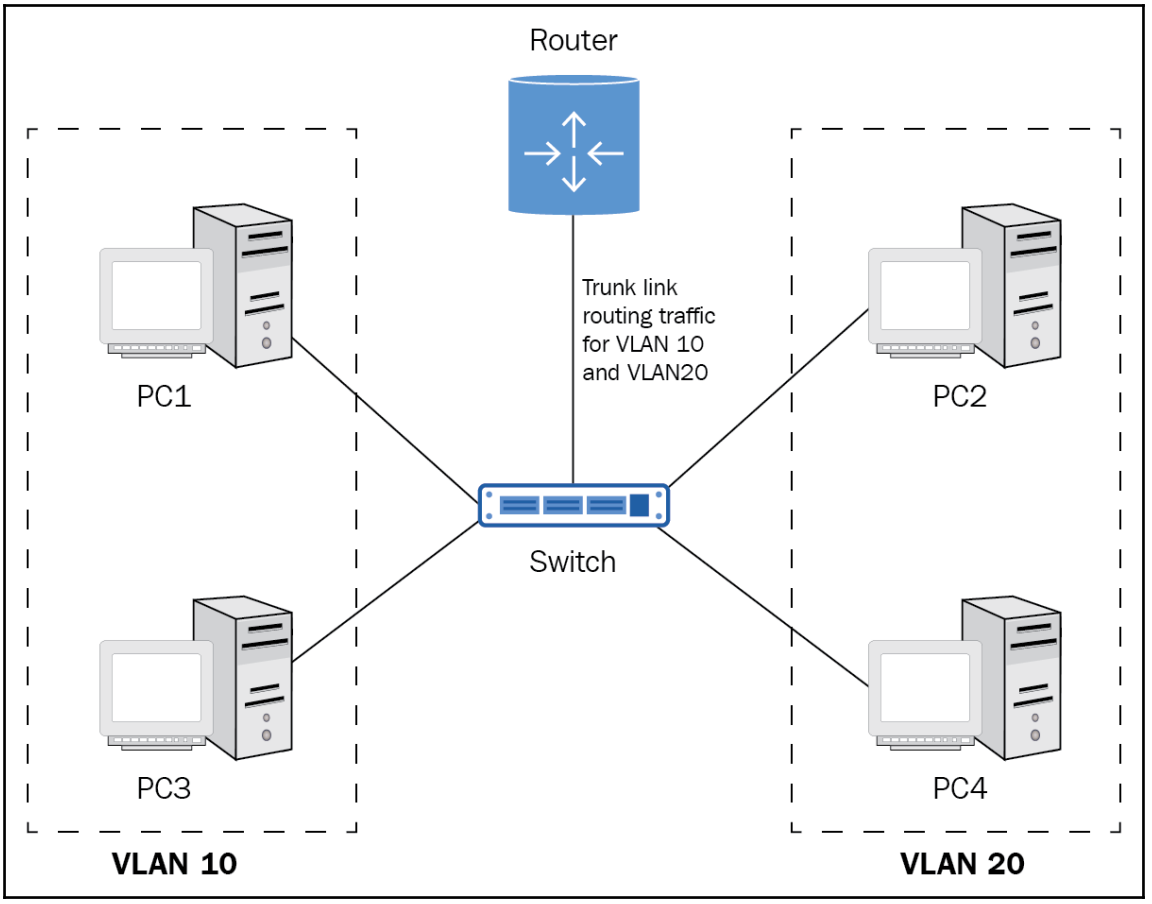

CISCO SYSTEMS
CAUTION: BOTTOM SURFACE MAY BE HOT
CONSOLE
Catalyst 3560 SERIES PoE-8

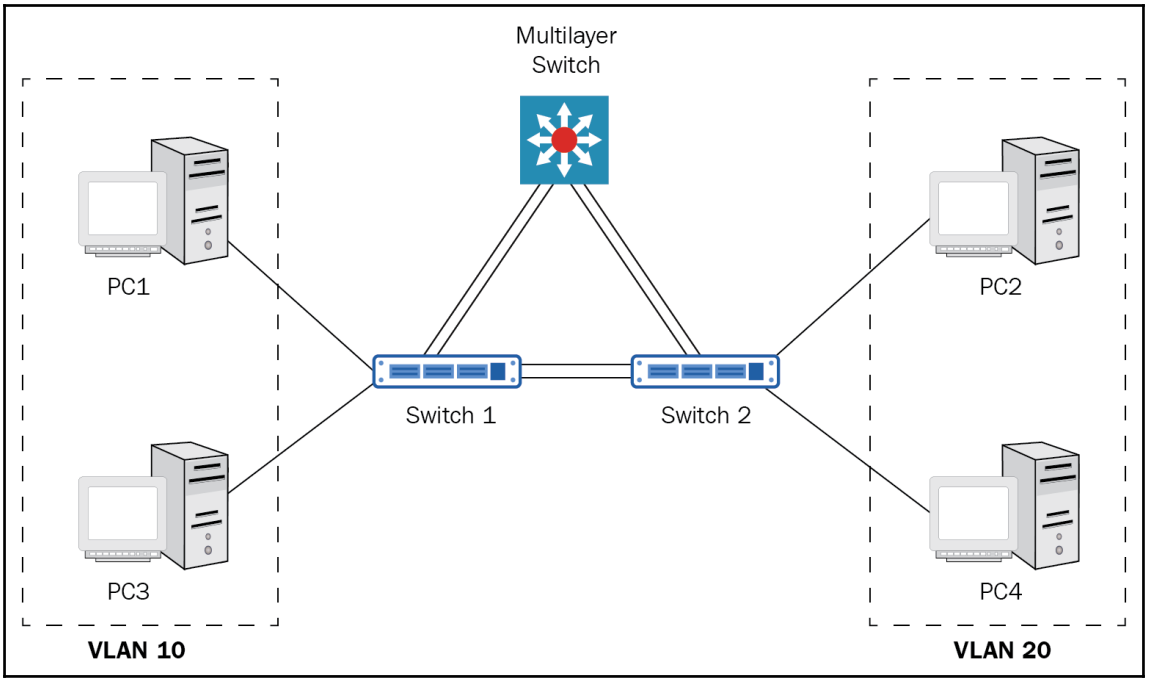

PC
Crossover
PC
PC
Straight
Switch
PC
Rollover
Router
Switch
Crossover
Switch
Switch
Straight
Router
Router
Crossover
Router

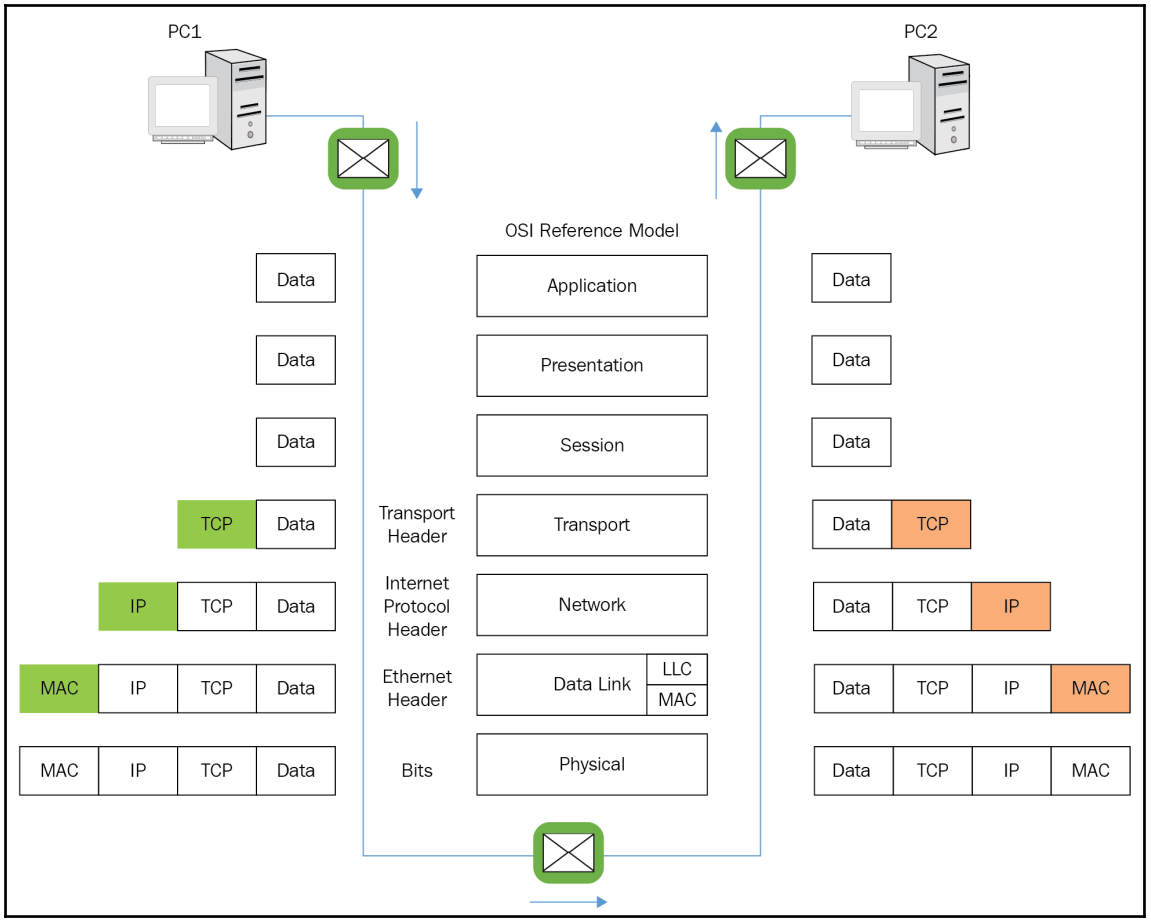

Server
PC1
PC2
Switch
PC3
PC4
VLAN 10
VLAN 20

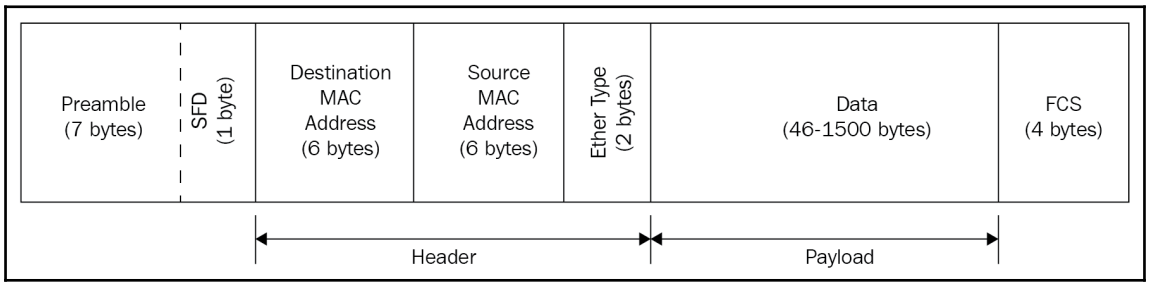

Server
PC1
Switch
PC2
Trunk link supporting
VLAN10 and VLAN 20
PC3
Switch
PC4
VLAN 10
VLAN 20

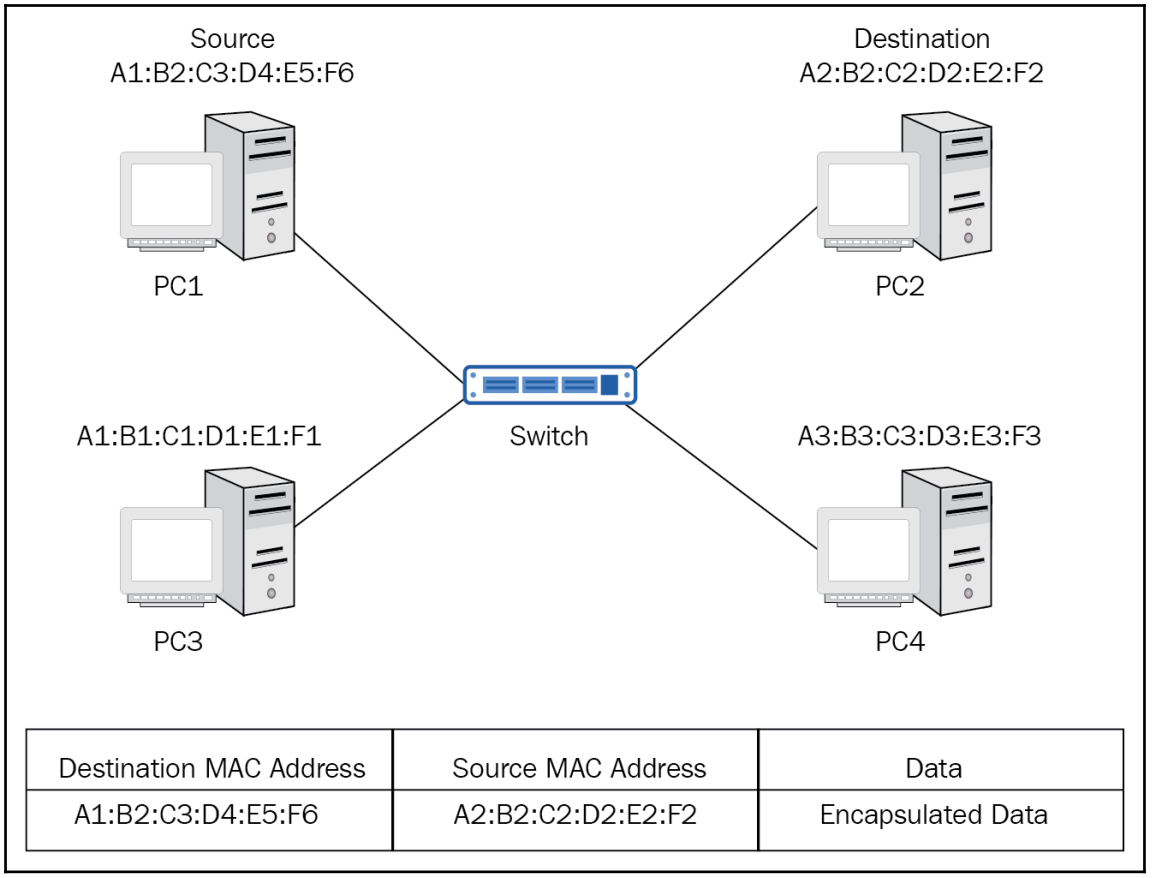

Router
PC1
PC2
Switch
PC3
PC4
VLAN 10
VLAN 20


Router
Trunk link
routing traffic
for VLAN 10
and VLAN20
PC1
PC2
Switch
PC3
PC4
VLAN 10
VLAN 20


Multilayer
Switch
PC1
PC2
Switch 1
Switch 2
PC3
PC4
VLAN 10
VLAN 20

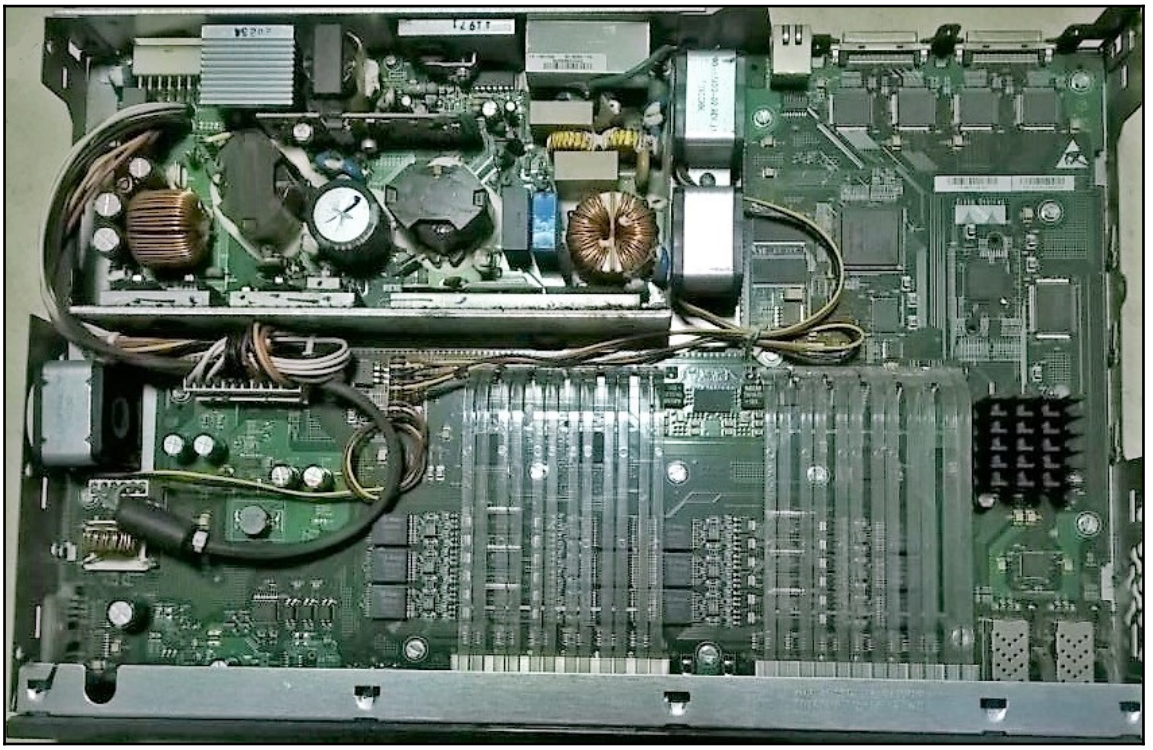

PC1
PC2
OSI Reference Model
Data
Application
Data
Data
Presentation
Data
Data
Session
Data
TCP
Data
Transport Header
Transport
Data
TCP
IP
TCP
Data
Internet Protocol Header
Network
Data
TCP
IP
MAC
IP
TCP
Data
Ethernet Header
Data Link
LLC
MAC
Data
TCP
IP
MAC
MAC
IP
TCP
Data
Bits
Physical
Data
TCP
IP
MAC


Preamble (7 bytes)
SFD (1 byte)
Destination MAC Address (6 bytes)
Source MAC Address (6 bytes)
Ether Type (2 bytes)
Data (46-1500 bytes)
FCS (4 bytes)
Header
Payload



Destination MAC Address	Source MAC Address	Data
A1:B2:C3:D4:E5:F6	A2:B2:C2:D2:E2:F2	Encapsulated Data

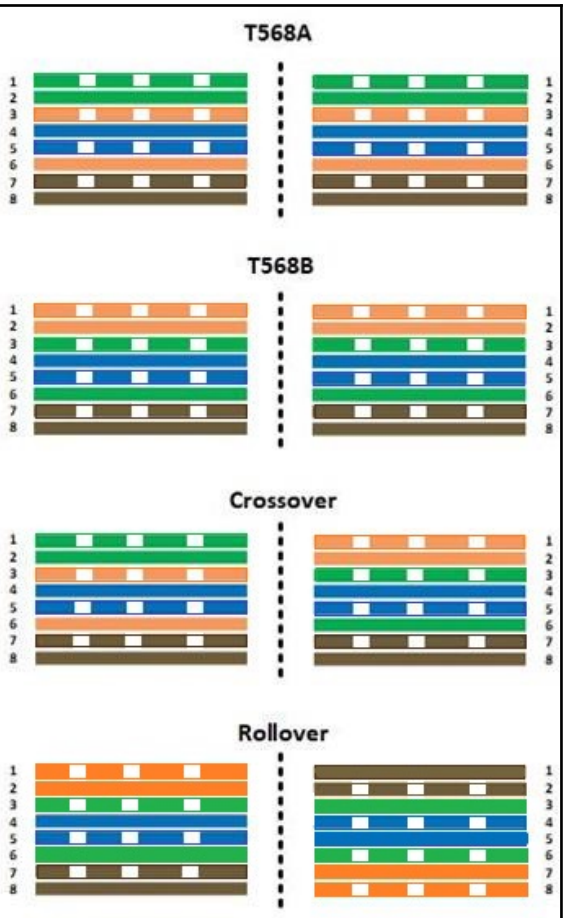
Chapter 4: Setting up the Switch



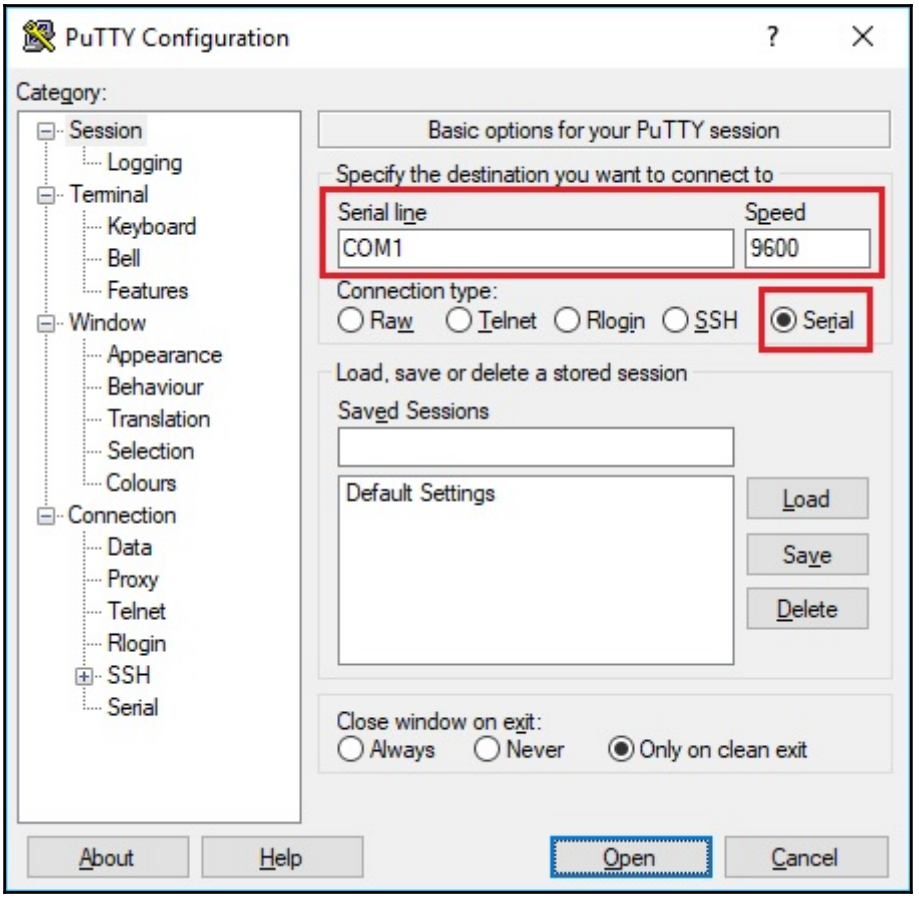
USB-to-DB-9

Rollover console cable

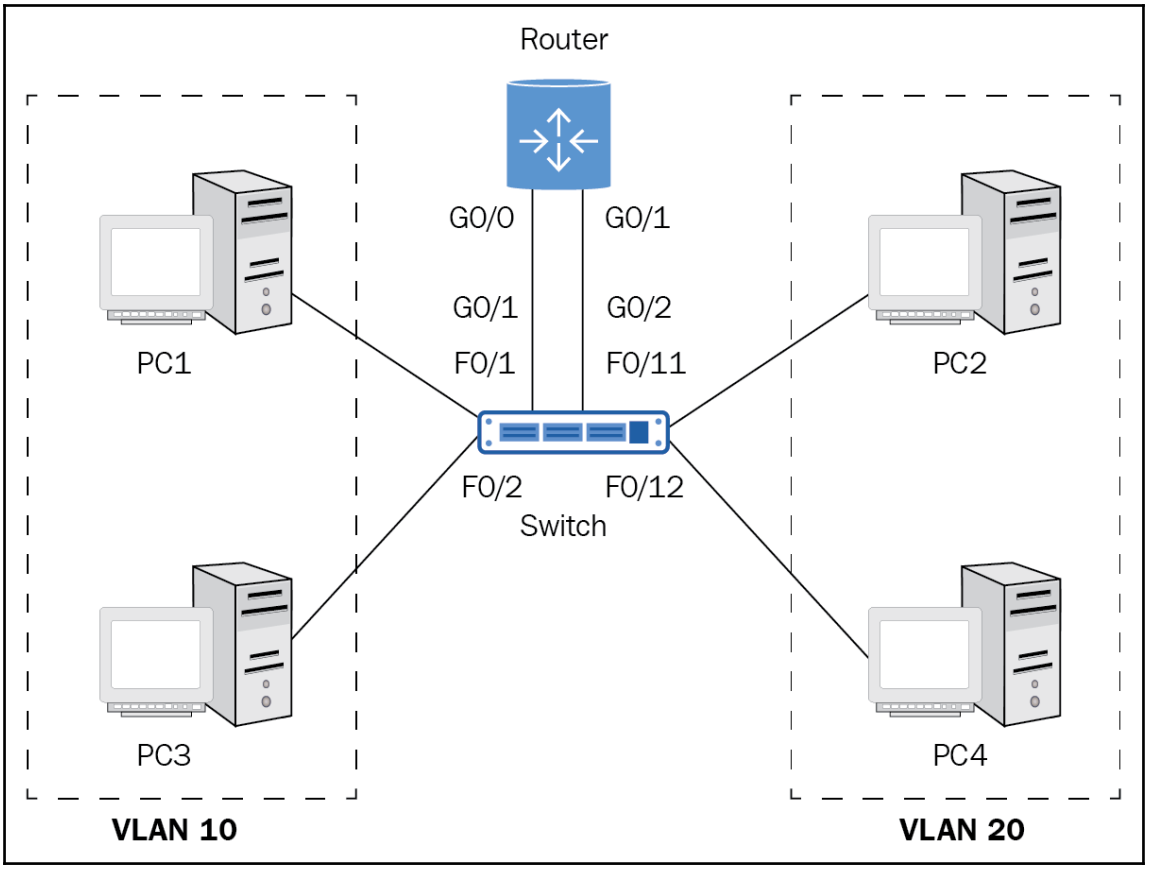
DB-9-to-RJ-45

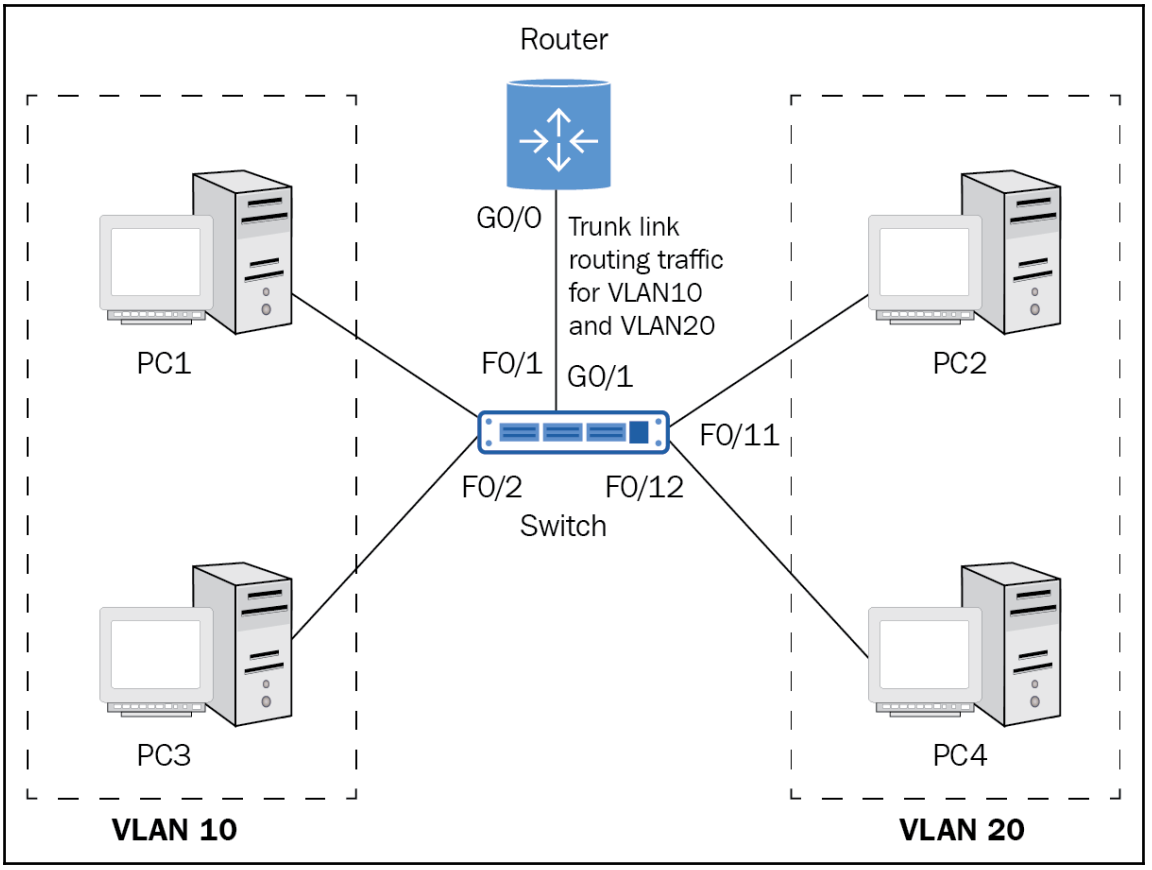


Twisted pairs wiring standards



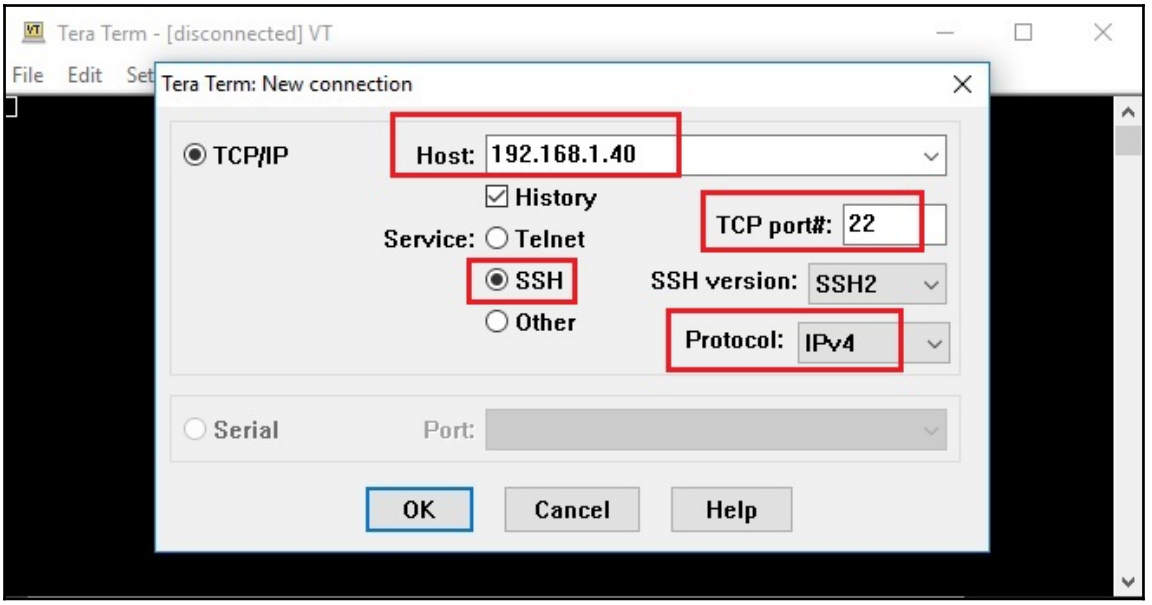

```
Switch    Ports  Model              SW Version            SW Image
------    -----  -----              ----------            ----------
*    1    26     WS-C2960-24TT      12.2                  C2960-LANBASE-M

Cisco IOS Software, C2960 Software (C2960-LANBASE-M), Version 12.2(25)FX,
RELEASE SOFTWARE (fc1)
Copyright (c) 1986-2005 by Cisco Systems, Inc.
Compiled Wed 12-Oct-05 22:05 by pt_team

Press RETURN to get started!



Switch>
```


Router
G0/0
G0/1
G0/1
G0/2
F0/1
F0/11
PC1
PC2
F0/2
F0/12
Switch
PC3
PC4
VLAN 10
VLAN 20

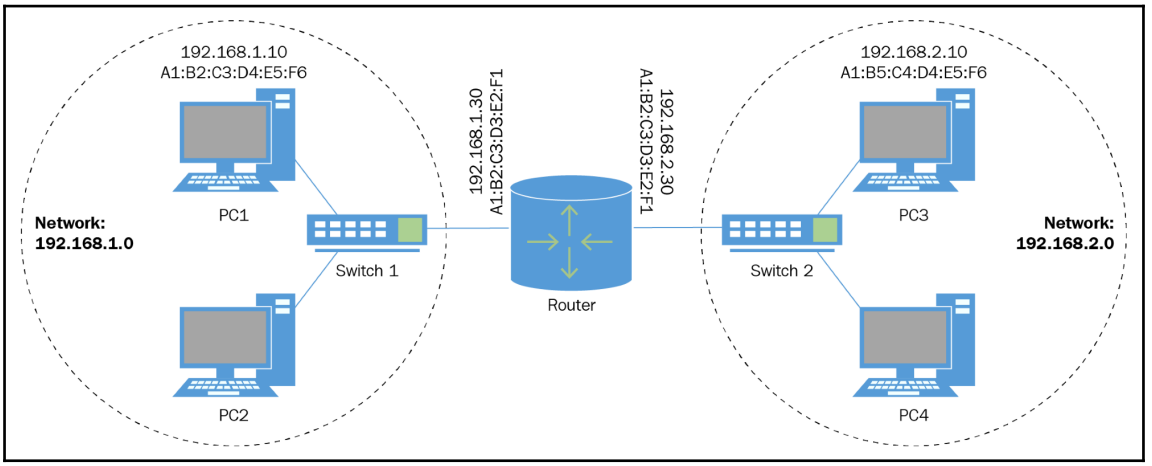


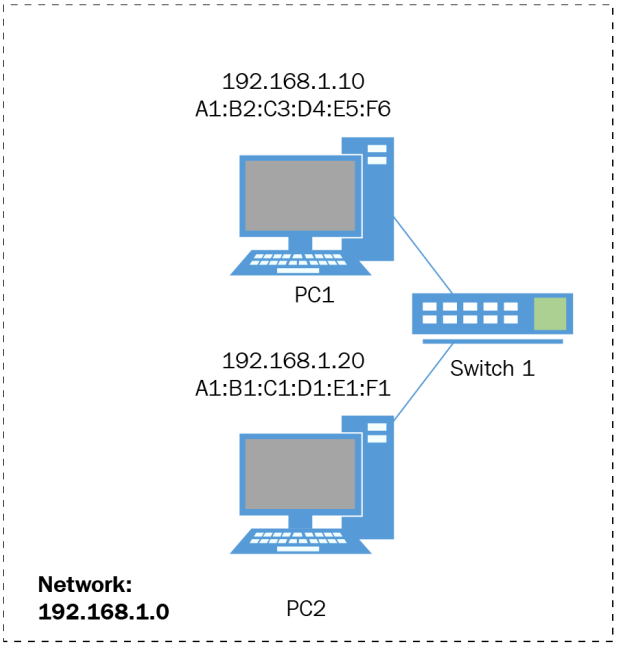

```
C:\>telnet 192.168.1.30
Trying 192.168.1.30 ...Open


User Access Verification

Password:
Switch>exit

[Connection to 192.168.1.30 closed by foreign host]
```

```
C:\>ssh -l user 192.168.1.40
Open
Password:



Test>exit

[Connection to 192.168.1.40 closed by foreign host]
```

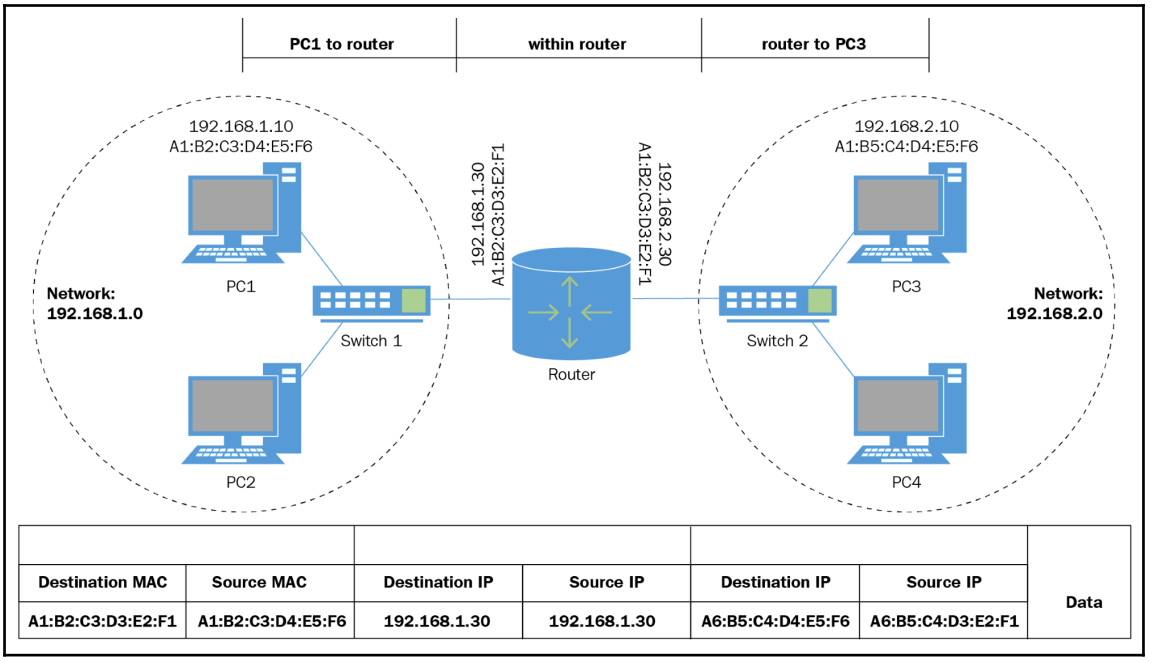


Chapter 5: Introduction to Routing

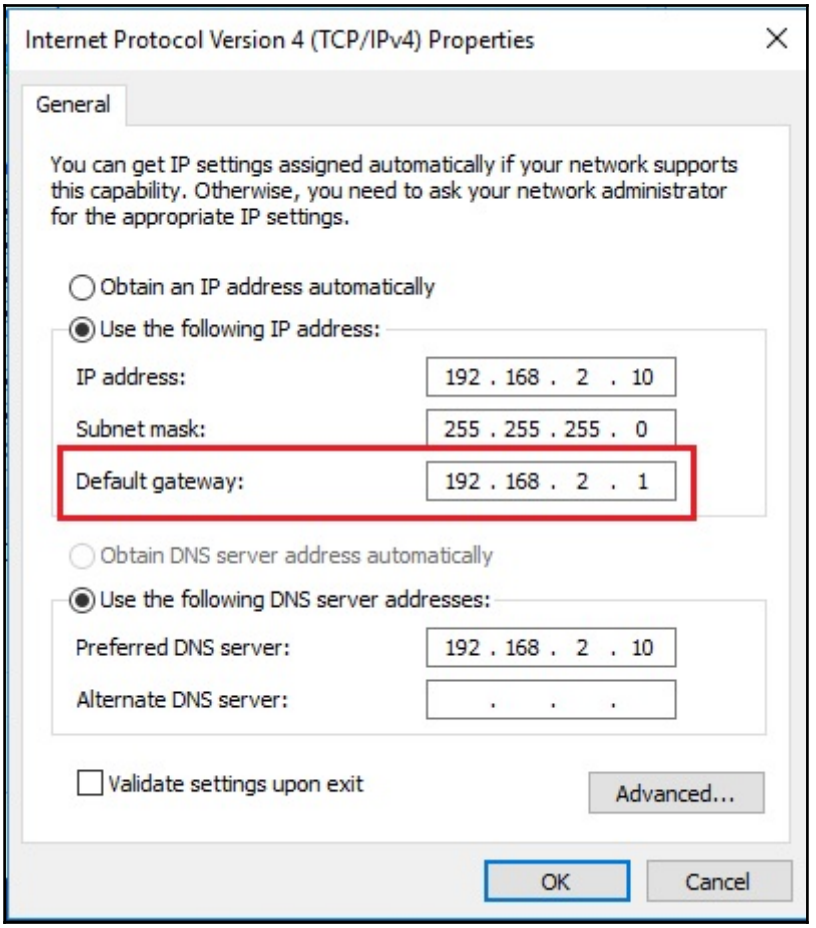




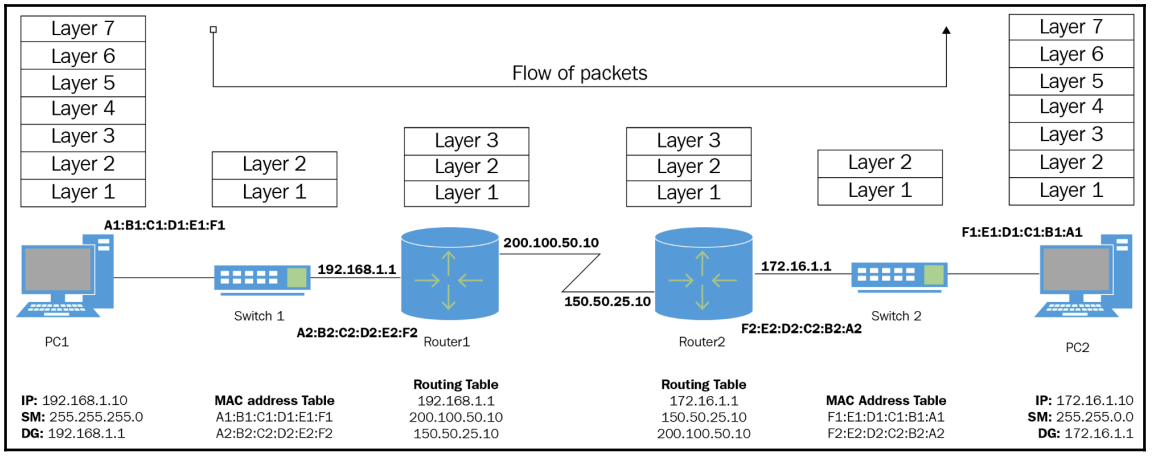
Communication segment from PC1 to PC2				Data
Destination MAC	**Source MAC**	**Destination IP**	**Source IP**	
A1:B1:C1:D1:E1:F1	**A1:B2:C3:D4:E5:F6**	**192.168.1.20**	**192.168.1.10**	

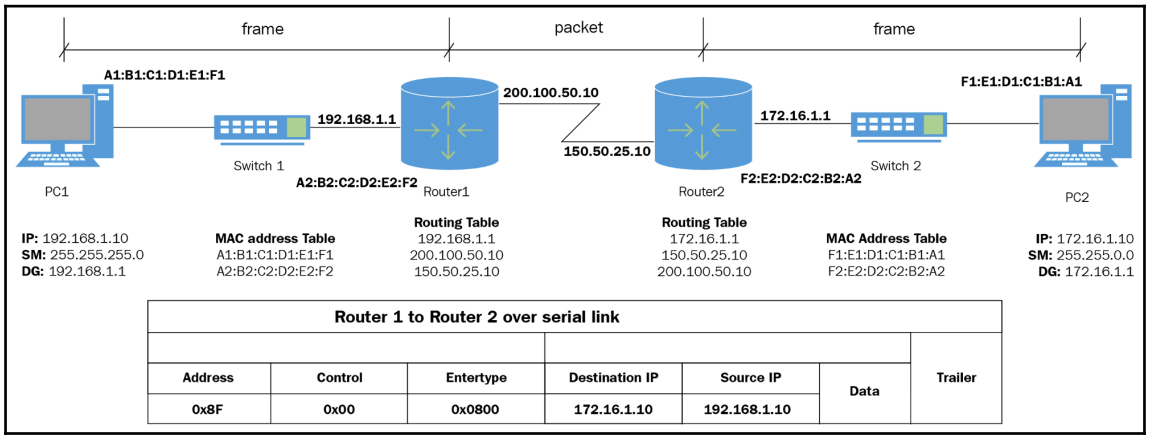


Destination MAC	**Source MAC**	**Destination IP**	**Source IP**	**Destination IP**	**Source IP**	**Data**
A1:B2:C3:D3:E2:F1	**A1:B2:C3:D4:E5:F6**	**192.168.1.30**	**192.168.1.30**	**A6:B5:C4:D4:E5:F6**	**A6:B5:C4:D3:E2:F1**	


Internet Protocol Version 4 (TCP/IPv4) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
192 . 168 . 2 . 10
Subnet mask:
255 . 255 . 255 . 0
Default gateway:
192 . 168 . 2 . 1
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
192 . 168 . 2 . 10
Alternate DNS server:
Validate settings upon exit
Advanced...
OK
Cancel

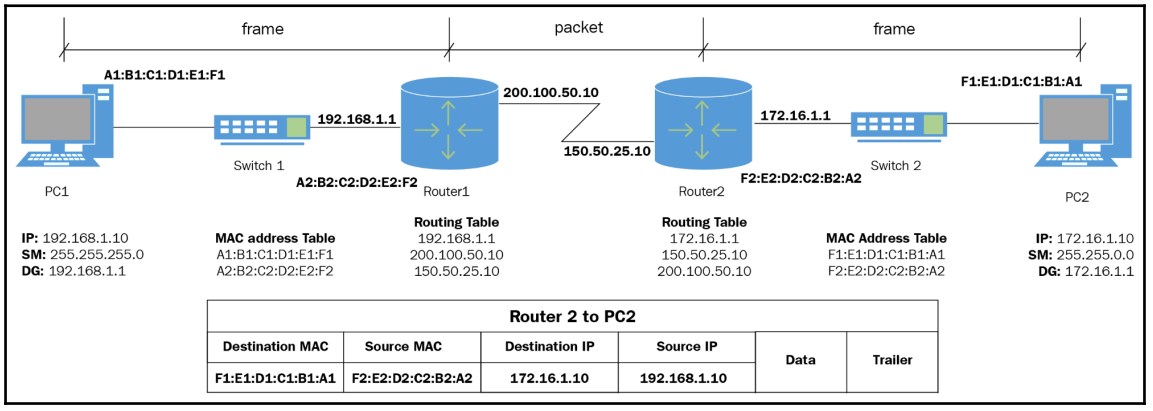
```
C:\Users\Administrator>route print
===========================================================================
Interface List
  5...00 15 5d 3c c9 01 ......Microsoft Hyper-V Network Adapter #3
  1...........................Software Loopback Interface 1
 15...00 00 00 00 00 00 00 e0 Microsoft ISATAP Adapter #3
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0      192.168.2.1     192.168.2.10    271
        127.0.0.0        255.0.0.0         On-link         127.0.0.1    331
        127.0.0.1  255.255.255.255         On-link         127.0.0.1    331
  127.255.255.255  255.255.255.255         On-link         127.0.0.1    331
      192.168.2.0    255.255.255.0         On-link      192.168.2.10    271
     192.168.2.10  255.255.255.255         On-link      192.168.2.10    271
    192.168.2.255  255.255.255.255         On-link      192.168.2.10    271
        224.0.0.0        240.0.0.0         On-link         127.0.0.1    331
        224.0.0.0        240.0.0.0         On-link      192.168.2.10    271
  255.255.255.255  255.255.255.255         On-link         127.0.0.1    331
  255.255.255.255  255.255.255.255         On-link      192.168.2.10    271
===========================================================================
Persistent Routes:
  Network Address          Netmask  Gateway Address  Metric
          0.0.0.0          0.0.0.0      192.168.2.1  Default
          0.0.0.0          0.0.0.0      192.168.1.1  Default
          0.0.0.0          0.0.0.0       172.16.1.1  Default
===========================================================================

IPv6 Route Table
===========================================================================
Active Routes:
 If Metric Network Destination      Gateway
  1    331 ::1/128                  On-link
  5    271 fe80::/64                On-link
  5    271 fe80::fc3a:98f3:88f2:f63f/128
                                    On-link
  1    331 ff00::/8                 On-link
  5    271 ff00::/8                 On-link
===========================================================================
Persistent Routes:
  None

C:\Users\Administrator>_
```





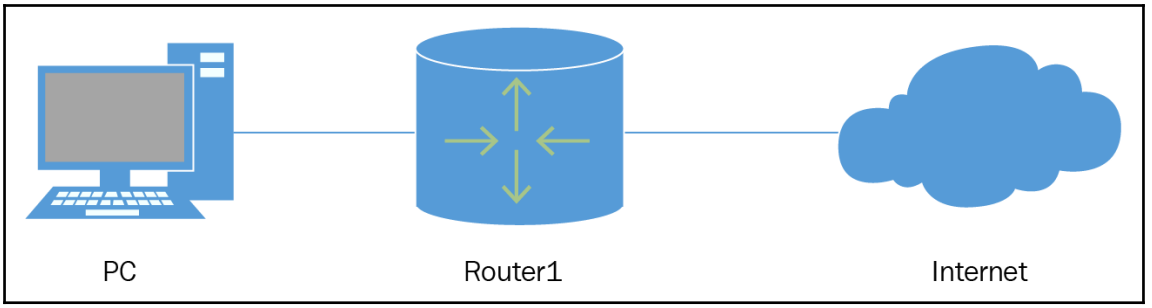
Router 1 to Router 2 over serial link

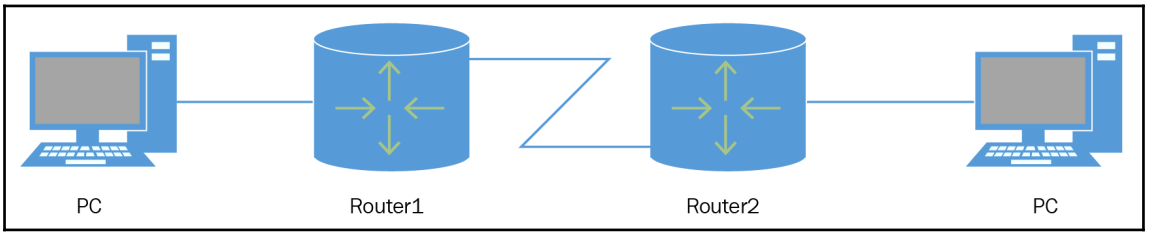
Address	**Control**	**Entertype**	**Destination IP**	**Source IP**	**Data**	**Trailer**
0x8F	**0x00**	**0x0800**	**172.16.1.10**	**192.168.1.10**		

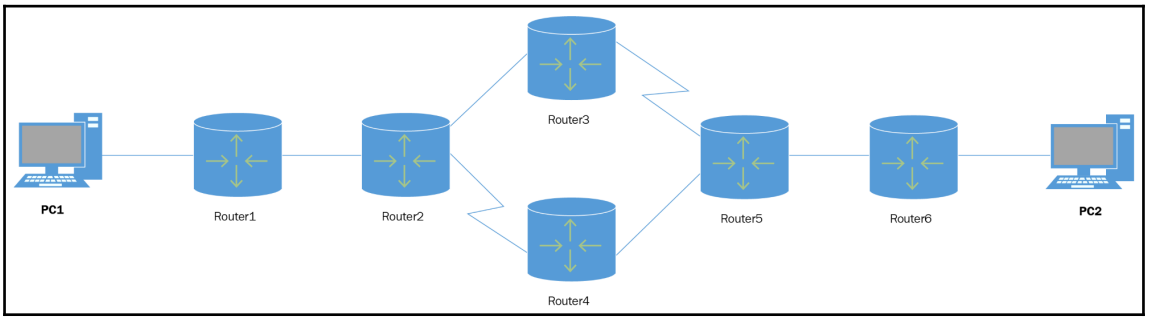


Router 2 to PC2

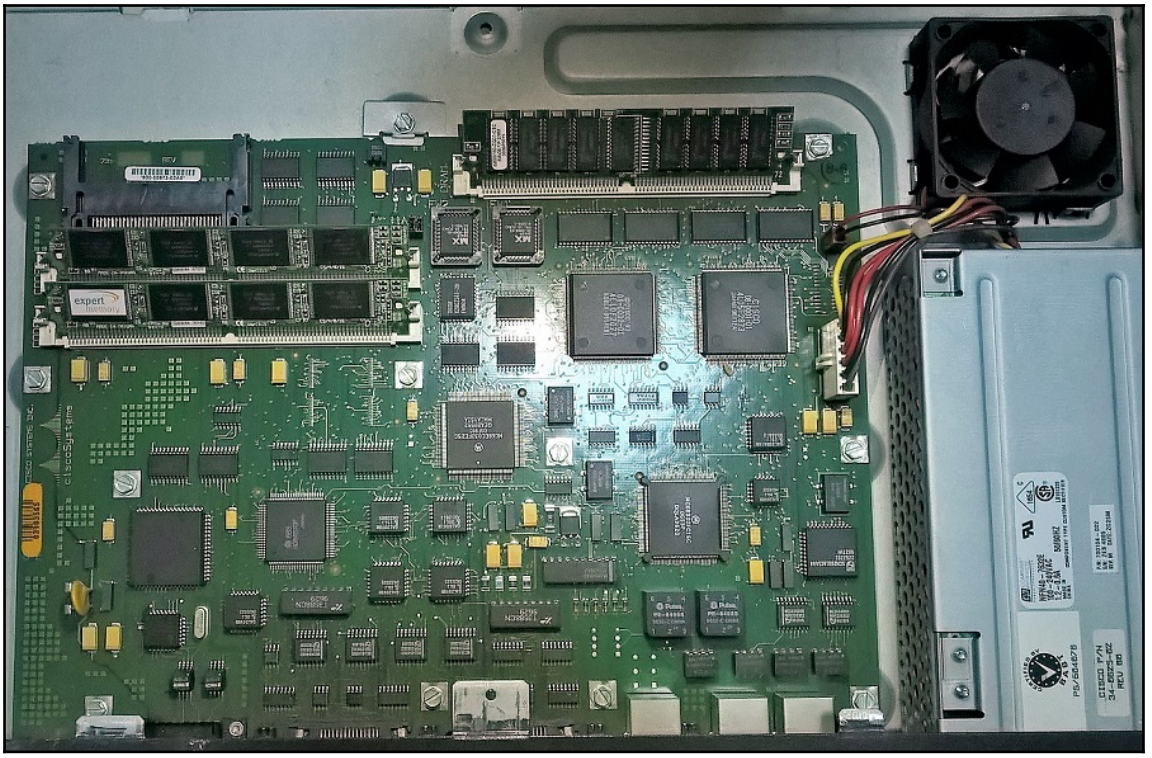
Destination MAC	**Source MAC**	**Destination IP**	**Source IP**	**Data**	**Trailer**
F1:E1:D1:C1:B1:A1	**F2:E2:D2:C2:B2:A2**	**172.16.1.10**	**192.168.1.10**		


PC
Router1
Internet

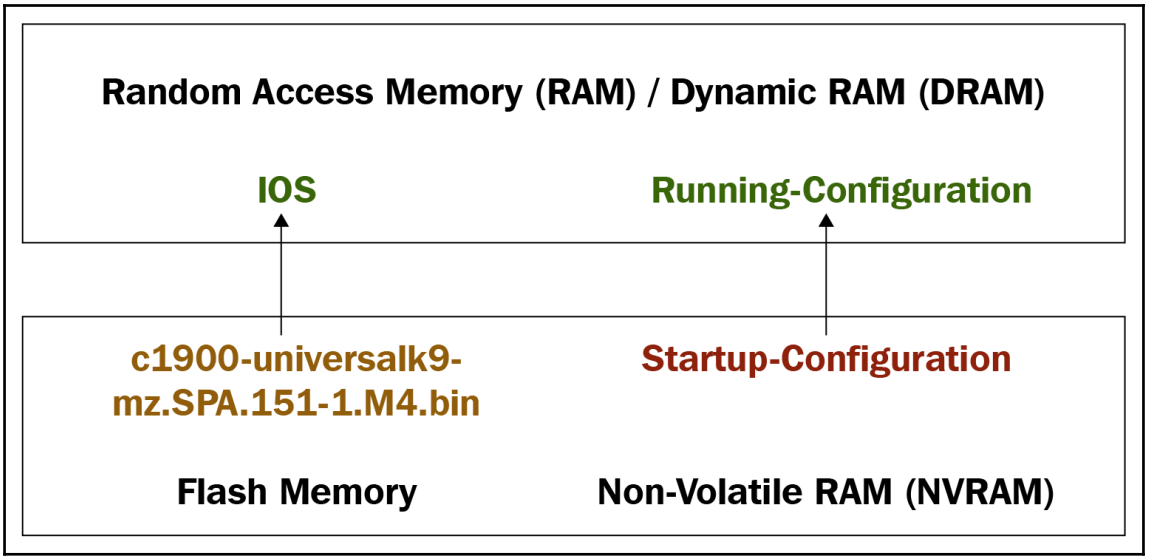

PC
Router1
Router2
PC


PC1
Router1
Router2
Router3
Router4
Router5
Router6
PC2


Cisco Systems
POWER
RPS
ACTIVITY
Cisco 2600




HWIC 3
VIC2-2FXO
SEE MANUAL BEFORE INSTALLATION
IN USE
HWIC 4ESW
PWR LNK PWR LNK PWR LNK PWR LNK
HWIC 1
VIC2-2BRI-NT/TE
B1
B2
OK
ISDN BRI S/T 1
ISDN BRI S/T 0
SEE MANUAL BEFORE INSTALLATION
DO NOT INSTALL INTERFACE CARDS WITH POWER APPLIED
A=ACT S=SPEED
F=FDX L=LINK
FE 0/1
FE 0/0
CISCO2811
PVDM1
PVDM0
AIM1
AIM0



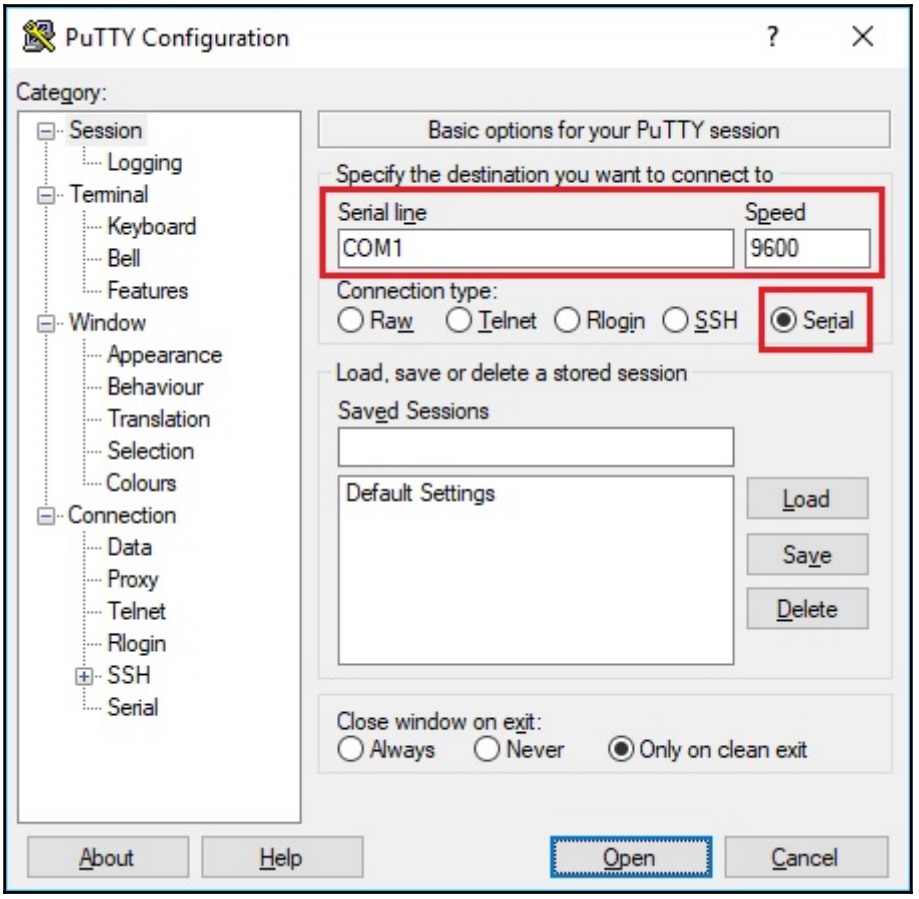

```
SP1>en
SP1#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/16 is subnetted, 1 subnets
S       10.10.0.0/16 [1/0] via 203.0.113.2
     203.0.113.0/24 is variably subnetted, 5 subnets, 2 masks
C       203.0.113.0/30 is directly connected, GigabitEthernet0/0
L       203.0.113.1/32 is directly connected, GigabitEthernet0/0
S       203.0.113.4/30 [1/0] via 203.0.113.10
C       203.0.113.8/30 is directly connected, GigabitEthernet0/1
L       203.0.113.9/32 is directly connected, GigabitEthernet0/1
```

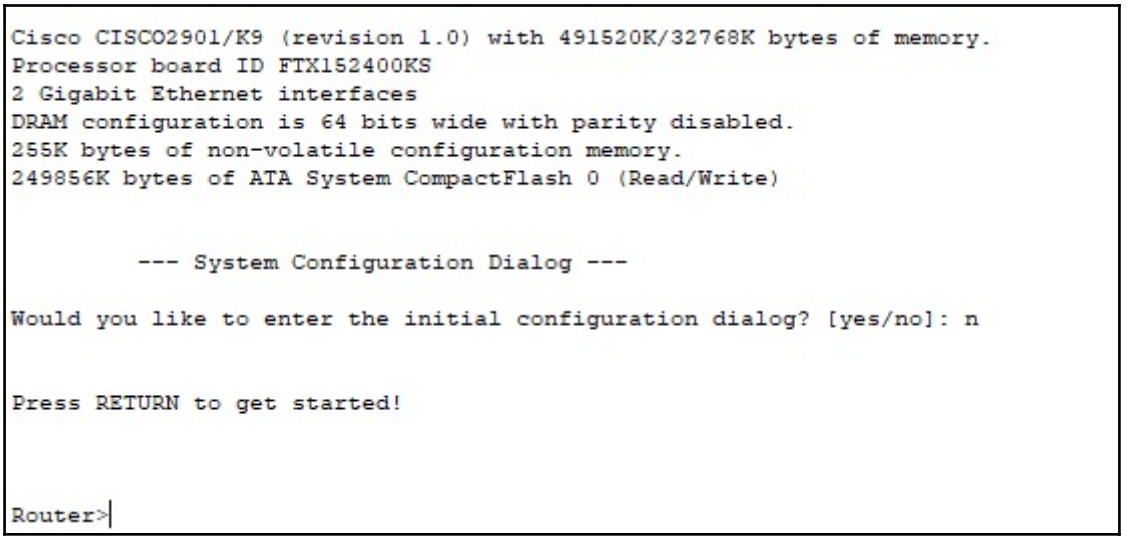
Chapter 6: Setting up the router

USB-to-DB-9

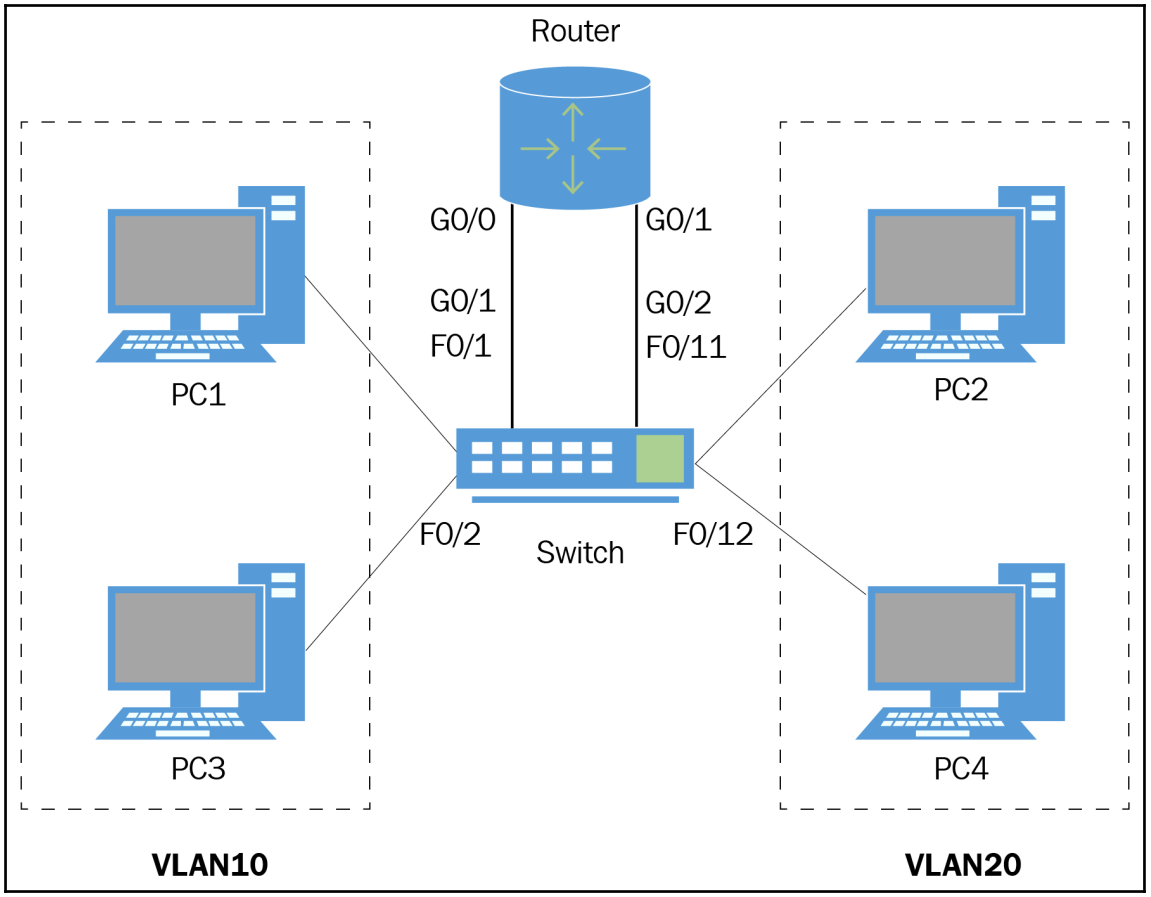
Rollover console cable

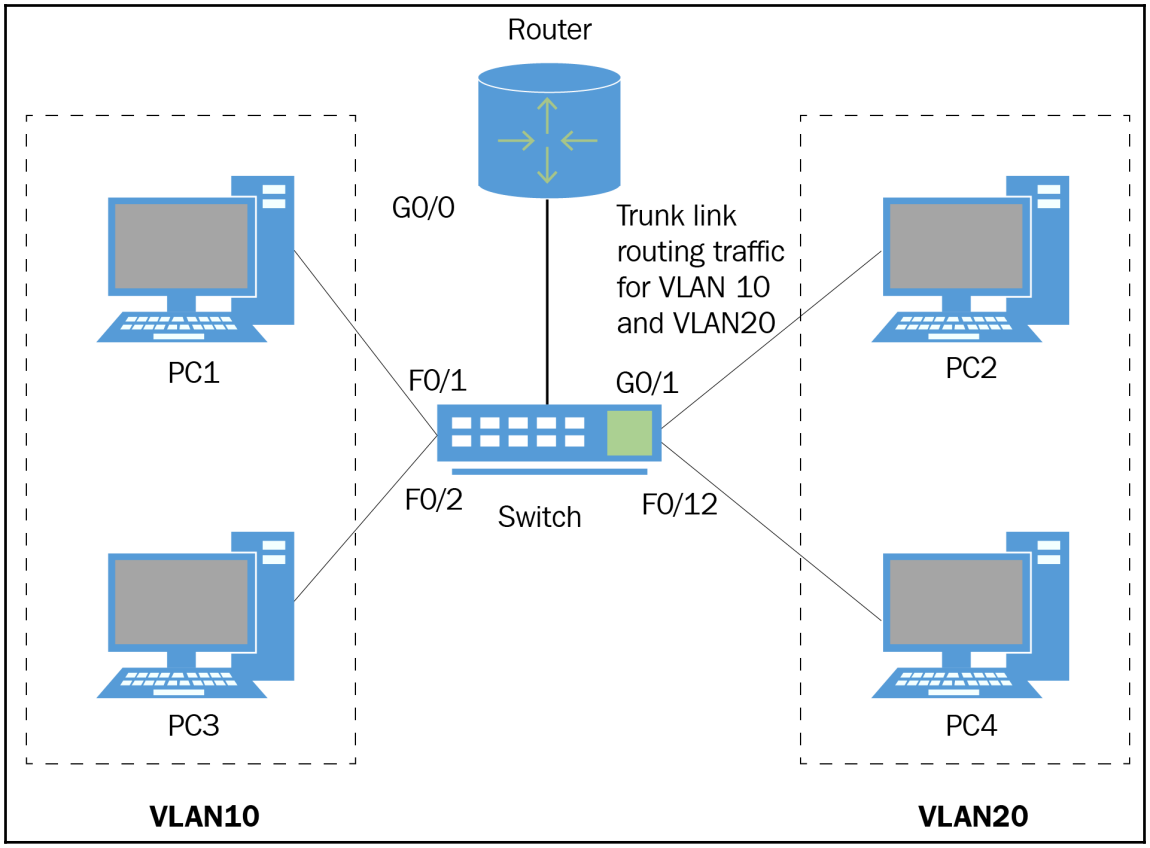

Cisco 2800 Series
100-240V ~ 2A
50/60 Hz


PuTTY Configuration
Category:
Session
Logging
Terminal
Keyboard
Bell
Features
Window
Appearance
Behaviour
Translation
Selection
Colours
Connection
Data
Proxy
Telnet
Rlogin
SSH
Serial
Basic options for your PuTTY session
Specify the destination you want to connect to
Serial line
Speed
COM1
9600
Connection type:
Raw
Telnet
Rlogin
SSH
Serial
Load, save or delete a stored session
Saved Sessions
Default Settings
Load
Save
Delete
Close window on exit:
Always
Never
Only on clean exit
About
Help
Open
Cancel

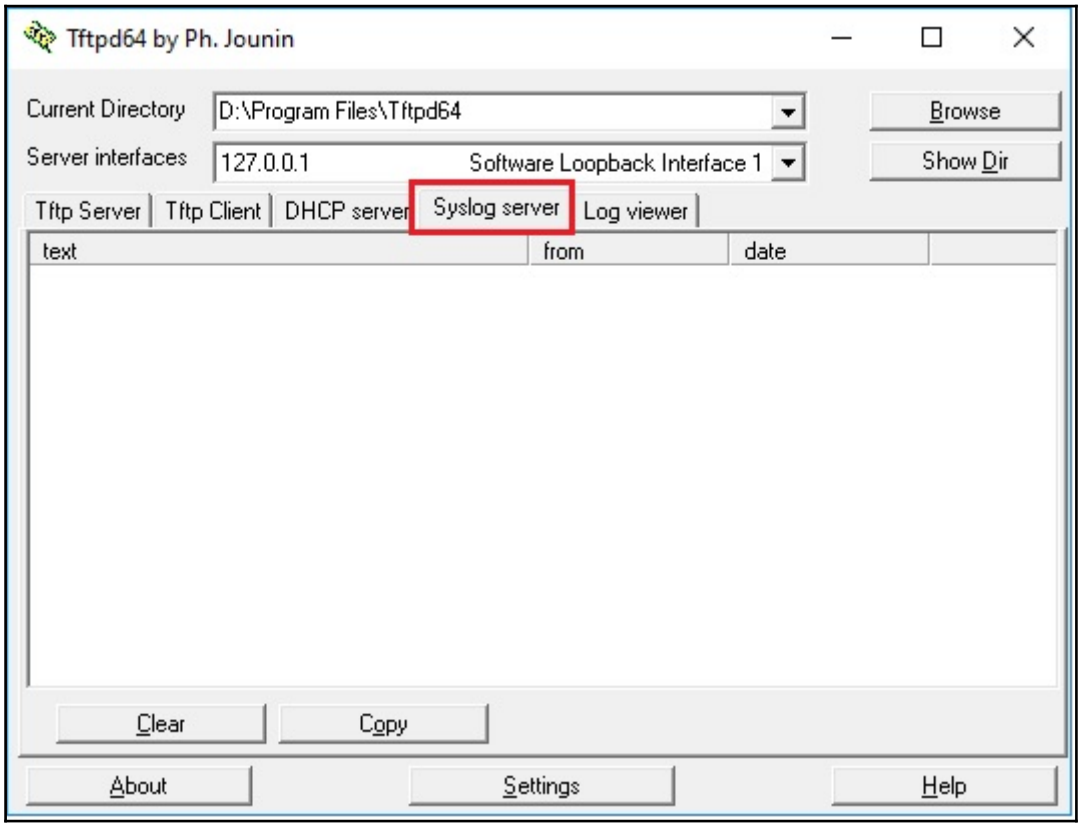

Cisco CISCO2901/K9 (revision 1.0) with 491520K/32768K bytes of memory.
Processor board ID FTX152400KS
2 Gigabit Ethernet interfaces
DRAM configuration is 64 bits wide with parity disabled.
255K bytes of non-volatile configuration memory.
249856K bytes of ATA System CompactFlash 0 (Read/Write)
--- System Configuration Dialog ---
Would you like to enter the initial configuration dialog? [yes/no]: n
Press RETURN to get started!
Router>

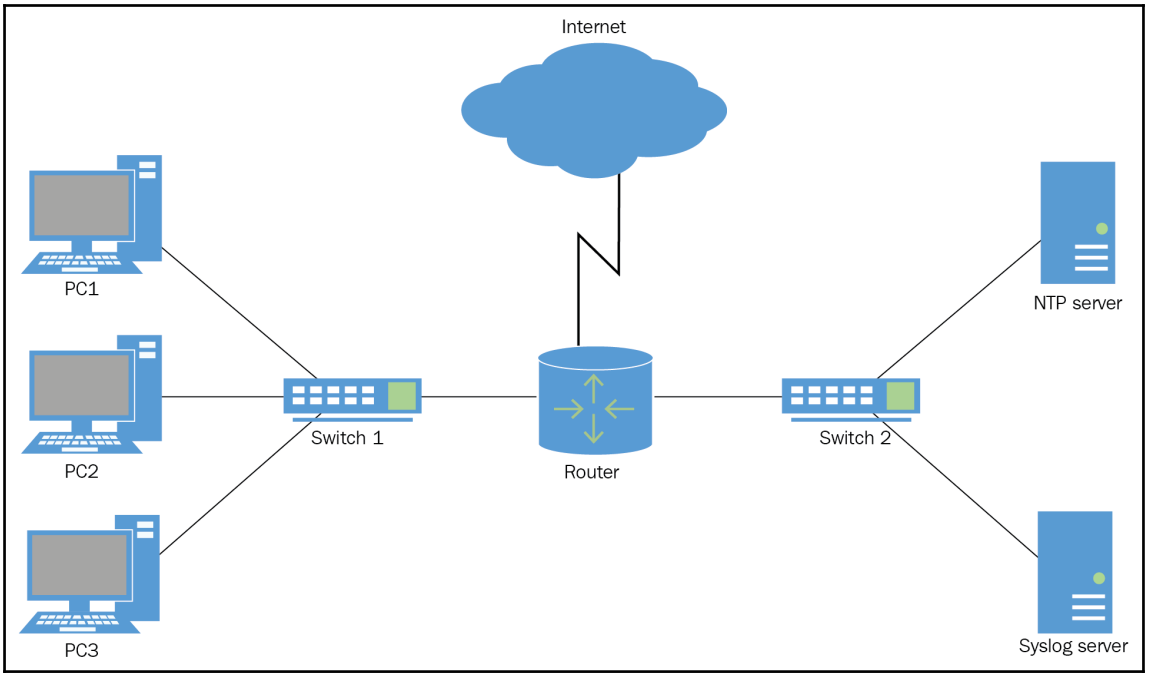
```
Router#show version
Cisco IOS Software, C2900 Software (C2900-UNIVERSALK9-M), Version 15.1(4)M4, RELEASE SOFTWARE (fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2012 by Cisco Systems, Inc.
Compiled Thurs 5-Jan-12 15:41 by pt_team

ROM: System Bootstrap, Version 15.1(4)M4, RELEASE SOFTWARE (fc1)
cisco2911 uptime is 19 seconds
System returned to ROM by power-on
System image file is "flash0:c2900-universalk9-mz.SPA.151-1.M4.bin"
Last reload type: Normal Reload

This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export, distribute or use encryption.
Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to
export@cisco.com.
Cisco CISCO2911/K9 (revision 1.0) with 491520K/32768K bytes of memory.
Processor board ID FTX152400KS
3 Gigabit Ethernet interfaces
DRAM configuration is 64 bits wide with parity disabled.
255K bytes of non-volatile configuration memory.
249856K bytes of ATA System CompactFlash 0 (Read/Write)

License Info:

License UDI:

-------------------------------------------------
Device#   PID                 SN
-------------------------------------------------
*0        CISCO2911/K9        FTX15247VIV


Technology Package License Information for Module:'c2900'

-----------------------------------------------------------------
Technology    Technology-package          Technology-package
              Current       Type          Next reboot
-----------------------------------------------------------------
ipbase        ipbasek9      Permanent     ipbasek9
security      None          None          None
uc            None          None          None
data          None          None          None

Configuration register is 0x2102
```


Router
G0/0
G0/1
G0/1
F0/1
G0/2
F0/11
PC1
PC2
F0/2
Switch
F0/12
PC3
PC4
VLAN10
VLAN20


Router
G0/0
Trunk link
routing traffic
for VLAN 10
and VLAN20
PC1
PC2
F0/1
G0/1
F0/2
Switch
F0/12
PC3
PC4
VLAN10
VLAN20

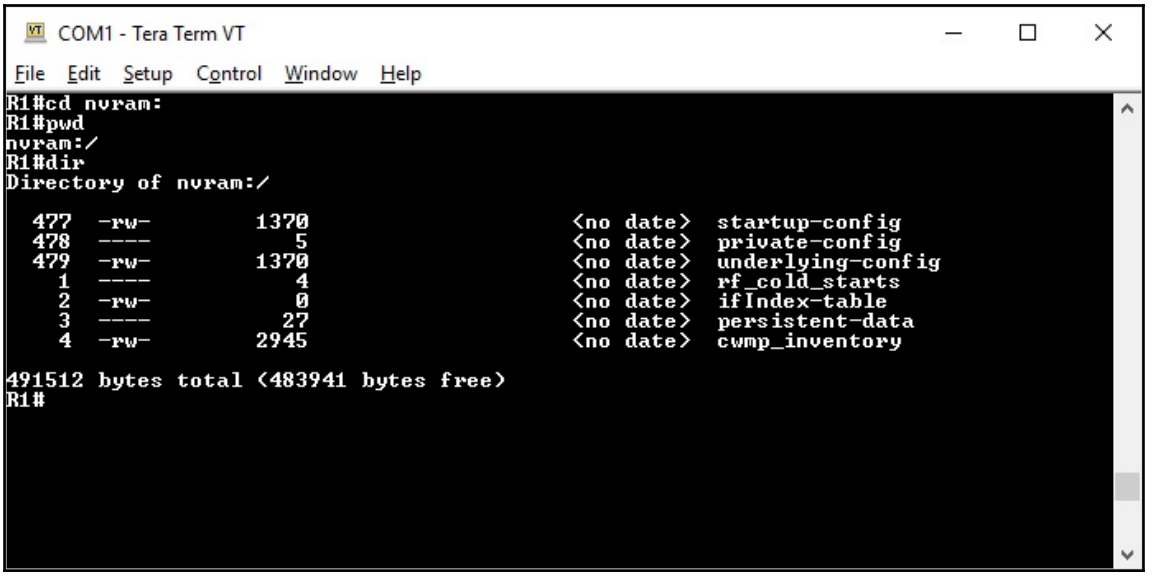
Chapter 7: Network Services and Maintenance





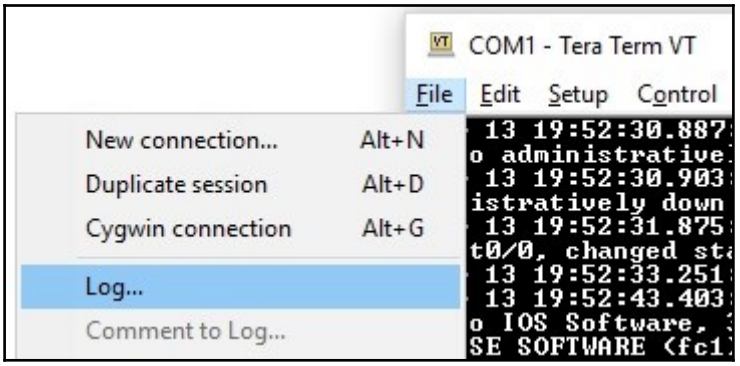

```
Router#show file systems
File Systems:

        Size(b)       Free(b)      Type  Flags  Prefixes
*     255744000     221896413      disk     rw  flash0: flash:#
        262136        255005     nvram     rw  nvram:
```

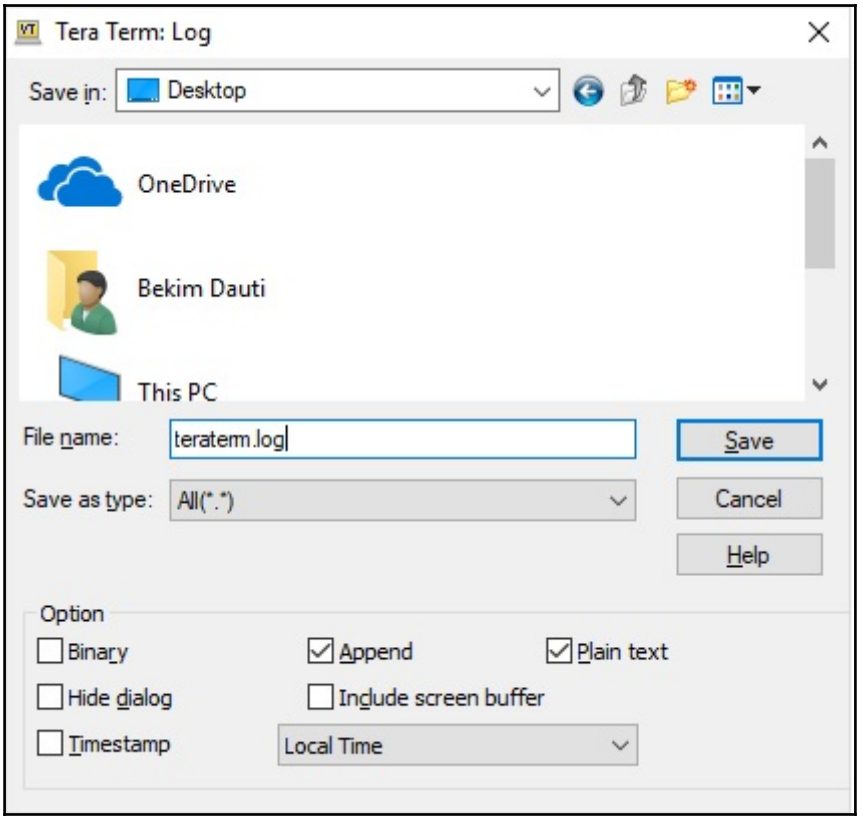
```
Router#dir
Directory of flash0:/

    3  -rw-    33591768          <no date>  c2900-universalk9-mz.SPA.151-4.M4.bin
    2  -rw-       28282          <no date>  sigdef-category.xml
    1  -rw-      227537          <no date>  sigdef-default.xml

255744000 bytes total (221896413 bytes free)
```

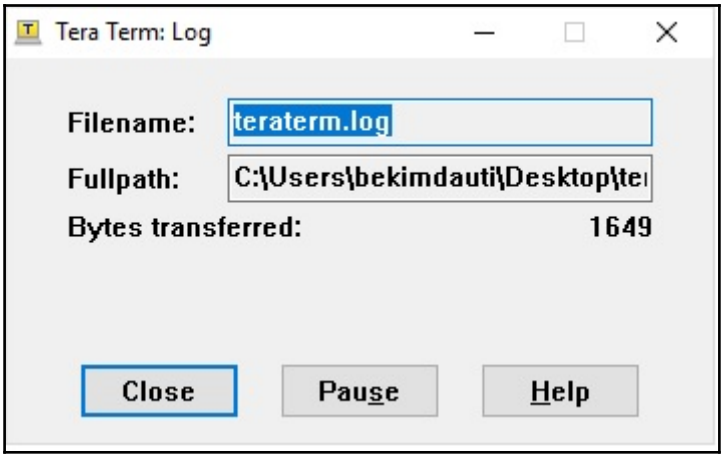


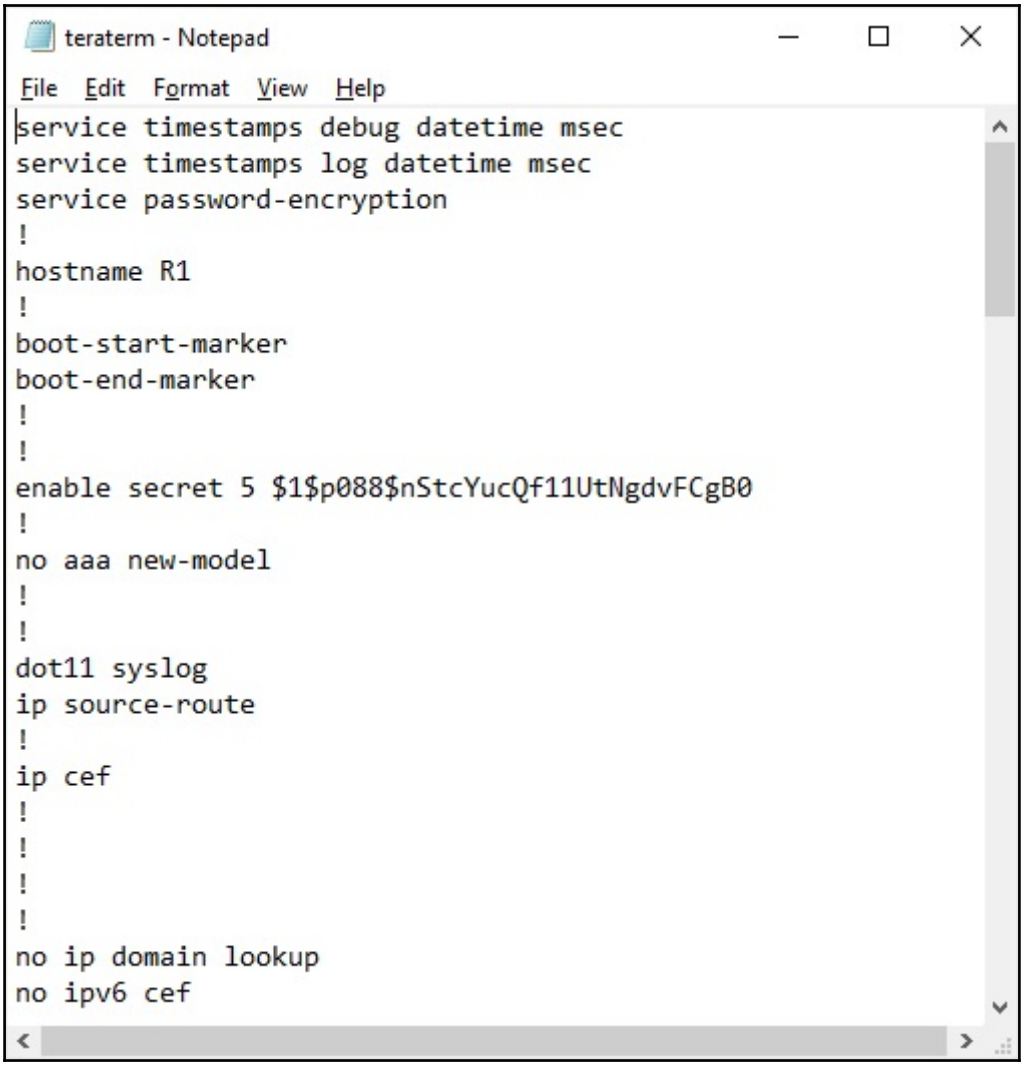

```
Switch#show file systems
File Systems:

        Size(b)       Free(b)      Type  Flags  Prefixes
*      64016384      55098373     flash     rw  flash:
          29688         23590     nvram     rw  nvram:
```

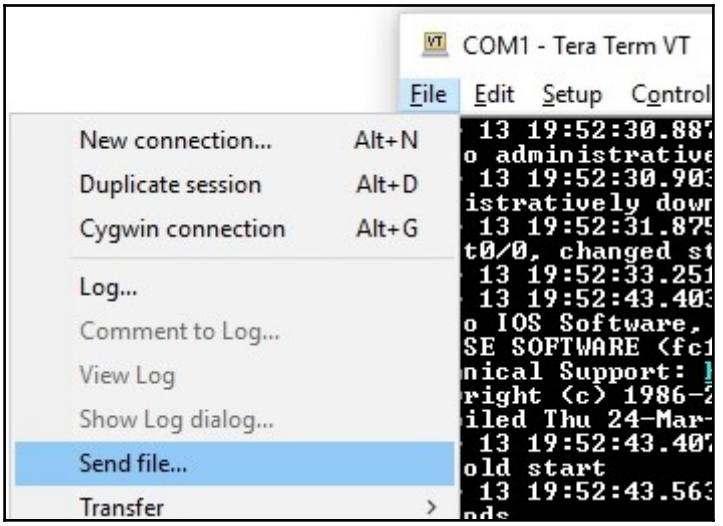
```
Switch#dir
Directory of flash:/

    3  -rw-     8662192          <no date>  c3560-advipservicesk9-mz.122-37.SE1.bin
    2  -rw-       28282          <no date>  sigdef-category.xml
    1  -rw-      227537          <no date>  sigdef-default.xml

64016384 bytes total (55098373 bytes free)
```

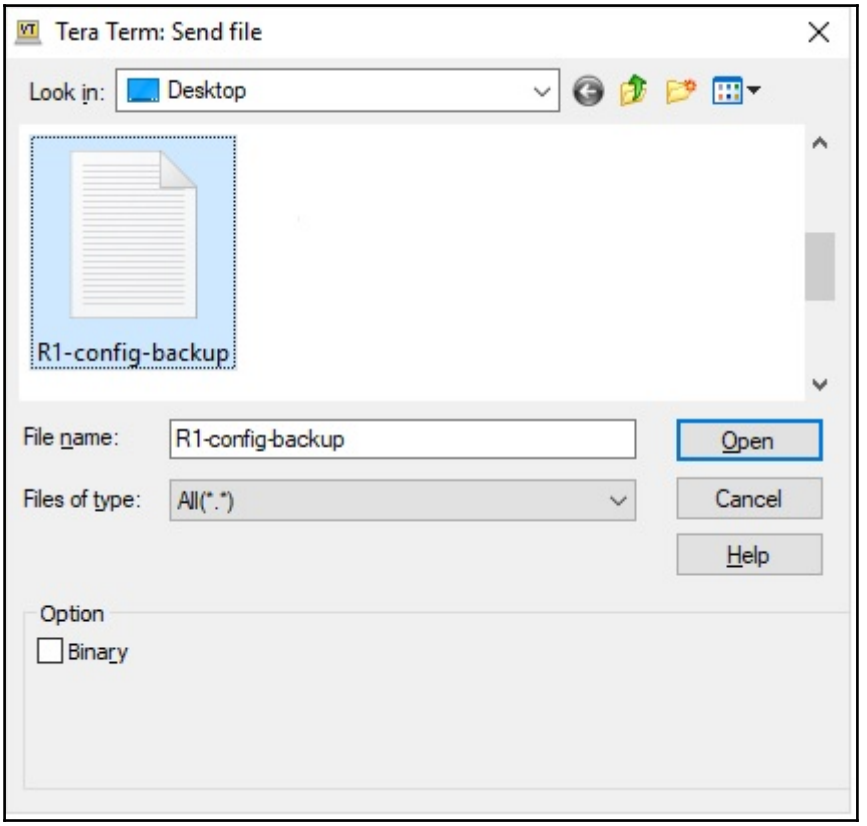

COM1 - Tera Term VT
File Edit Setup Control
New connection... Alt+N
Duplicate session Alt+D
Cygwin connection Alt+G
Log...
Comment to Log...
13 19:52:30.887
o administrative
13 19:52:30.903
istratively down
13 19:52:31.875
t0/0, changed st
13 19:52:33.251
13 19:52:43.403
o IOS Software,
SE SOFTWARE (fc1

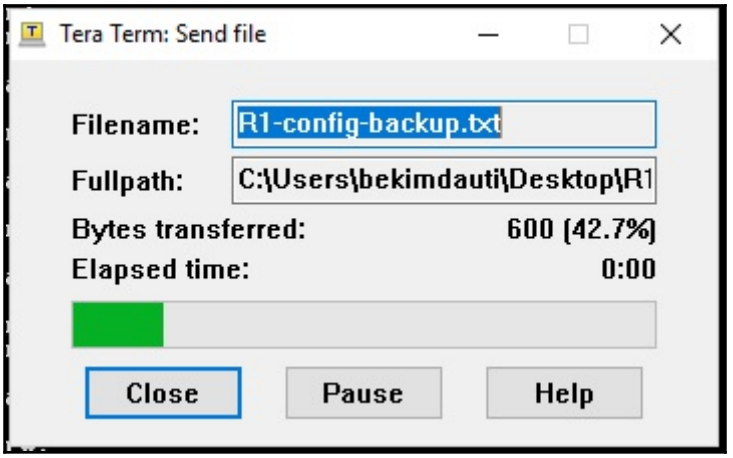

Tera Term: Log
Save in: Desktop
OneDrive
Bekim Dauti
This PC
File name: teraterm.log
Save as type: All(*.*)
Save
Cancel
Help
Option
Binary
Append
Plain text
Hide dialog
Include screen buffer
Timestamp
Local Time

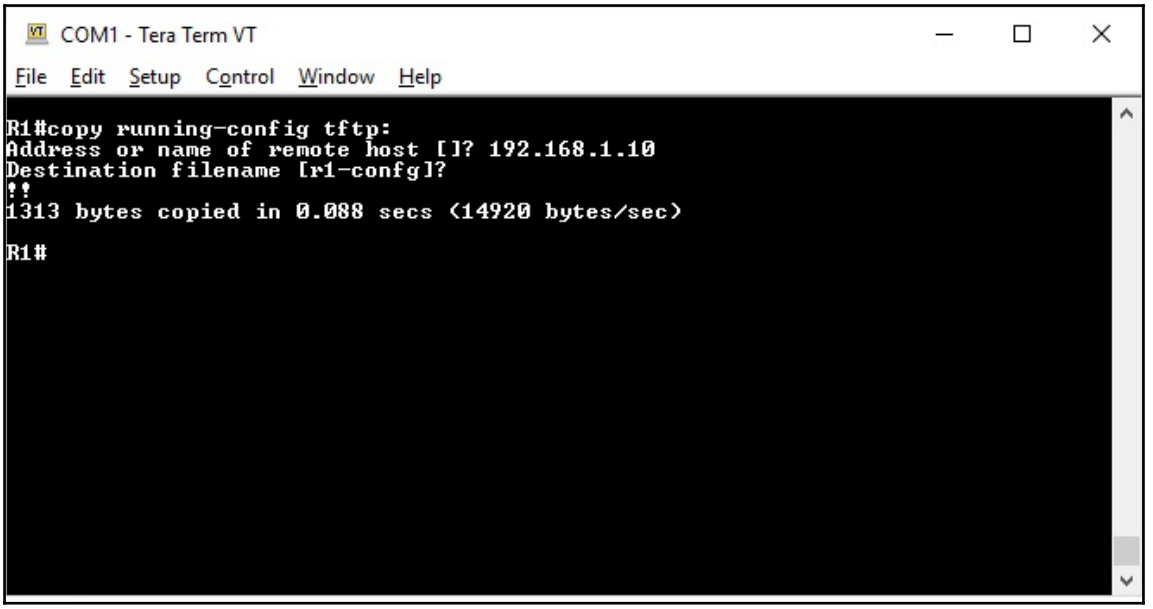

Tera Term: Log
Filename:
teraterm.log
Fullpath:
C:\Users\bekimdauti\Desktop\te
Bytes transferred:
1649
Close
Pause
Help

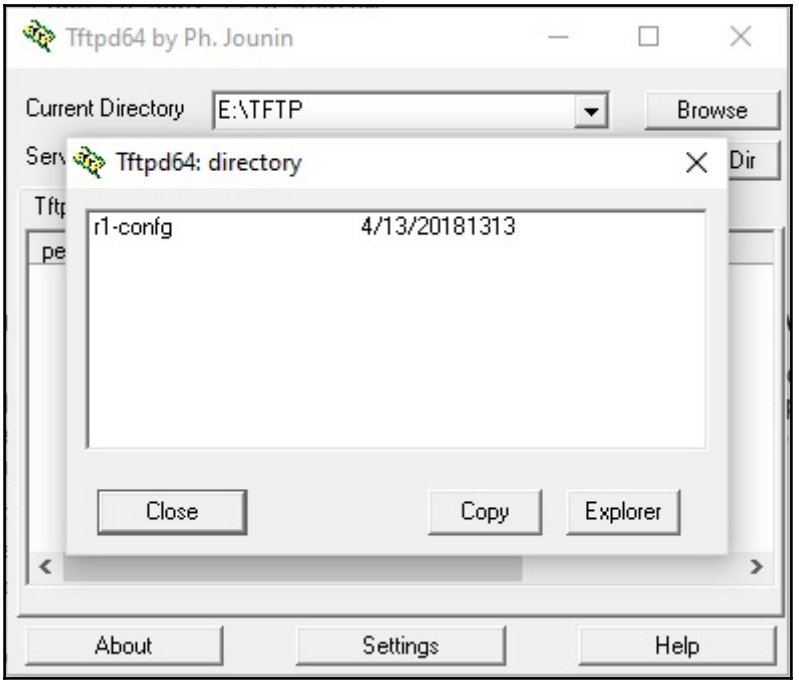

teraterm - Notepad
File Edit Format View Help
service timestamps debug datetime msec
service timestamps log datetime msec
service password-encryption
!
hostname R1
!
boot-start-marker
boot-end-marker
!
!
enable secret 5 1p088$nStcYucQf11UtNgdvFCgB0
!
no aaa new-model
!
!
dot11 syslog
ip source-route
!
ip cef
!
!
!
!
no ip domain lookup
no ipv6 cef

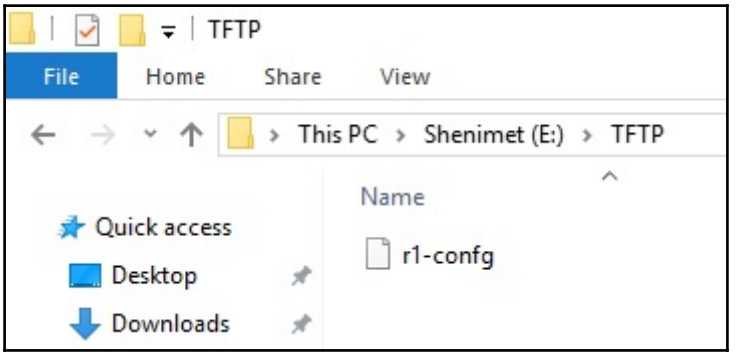

COM1 - Tera Term VT
File Edit Setup Control
New connection... Alt+N
Duplicate session Alt+D
Cygwin connection Alt+G
Log...
Comment to Log...
View Log
Show Log dialog...
Send file...
Transfer


Tera Term: Send file
Look in: Desktop
R1-config-backup
File name: R1-config-backup
Open
Files of type: All(*.*)
Cancel
Help
Option
Binary


Tera Term: Send file
Filename:
R1-config-backup.txt
Fullpath:
C:\Users\bekimdauti\Desktop\R1
Bytes transferred:
600 (42.7%)
Elapsed time:
0:00
Close
Pause
Help


COM1 - Tera Term VT
File Edit Setup Control Window Help
R1#copy running-config tftp:
Address or name of remote host []? 192.168.1.10
Destination filename [r1-confg]?
!!
1313 bytes copied in 0.088 secs (14920 bytes/sec)
R1#

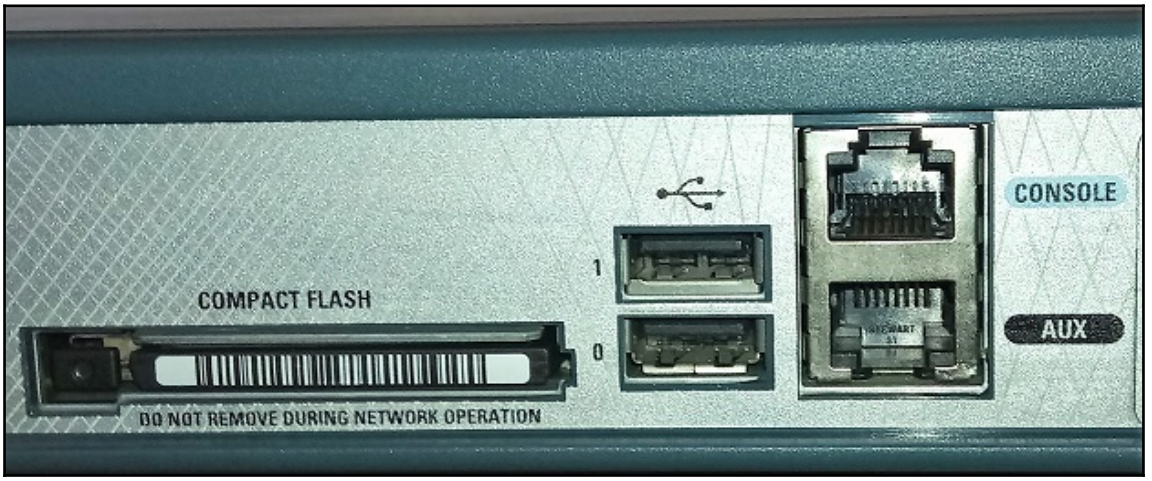

Tftpd64 by Ph. Jounin
Current Directory
E:\TFTP
Browse
Tftpd64: directory
r1-confg 4/13/20181313
Close
Copy
Explorer
About
Settings
Help

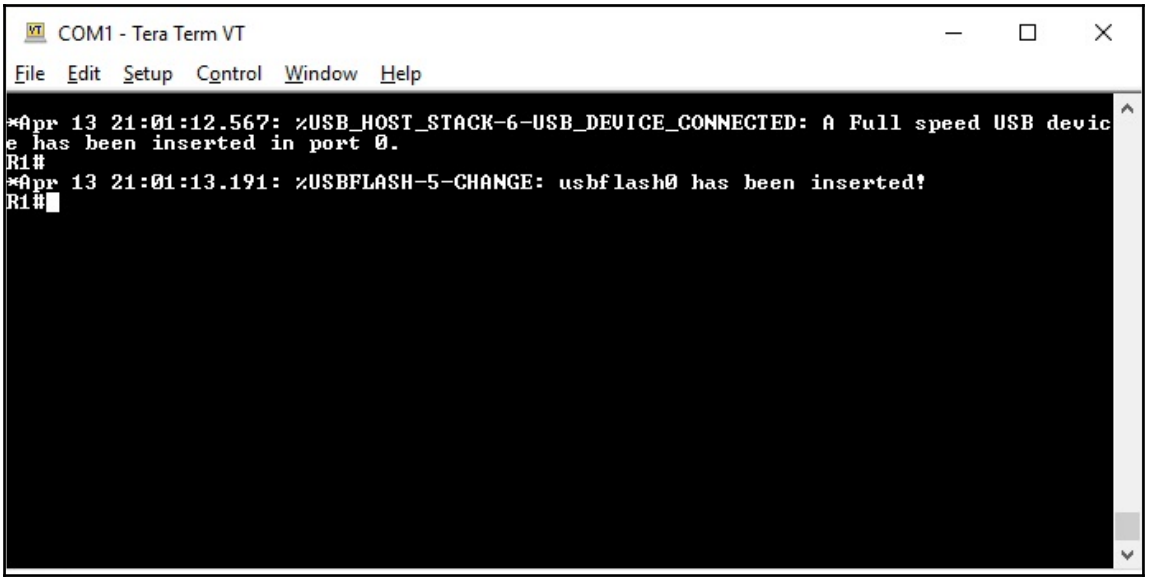

TFTP
File
Home
Share
View
This PC
Shenimet (E:)
TFTP
Quick access
Desktop
Downloads
Name
r1-confg

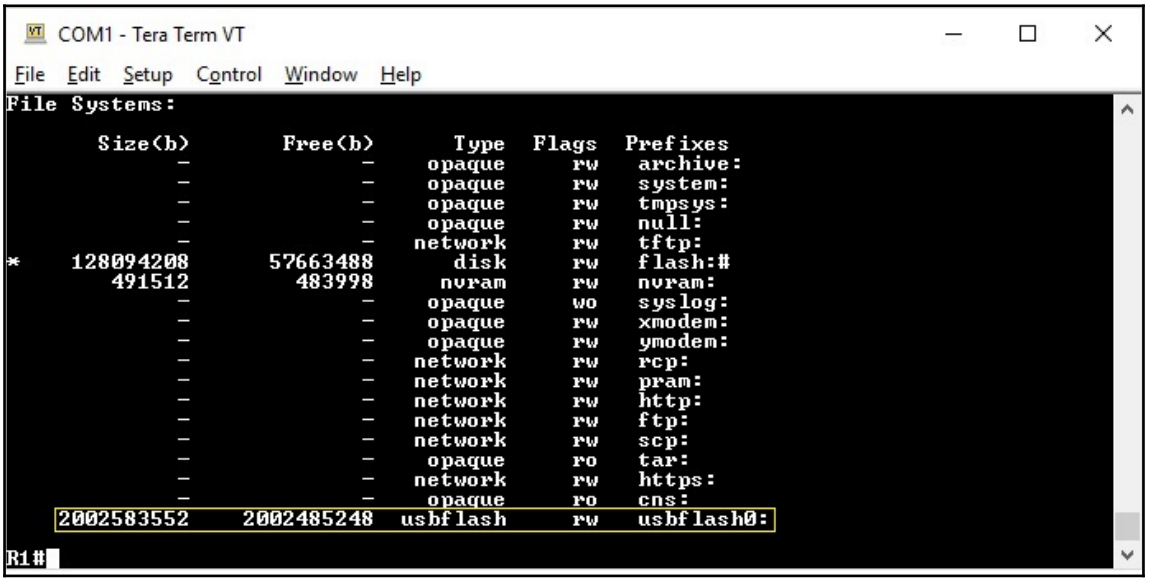
COM1 - Tera Term VT

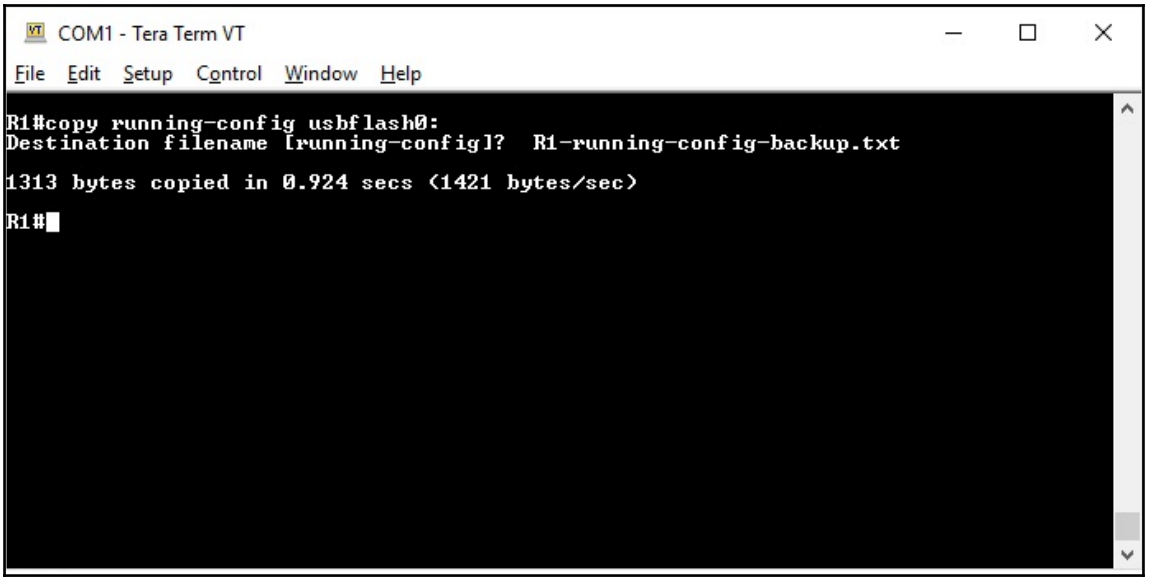
File Edit Setup Control Window Help

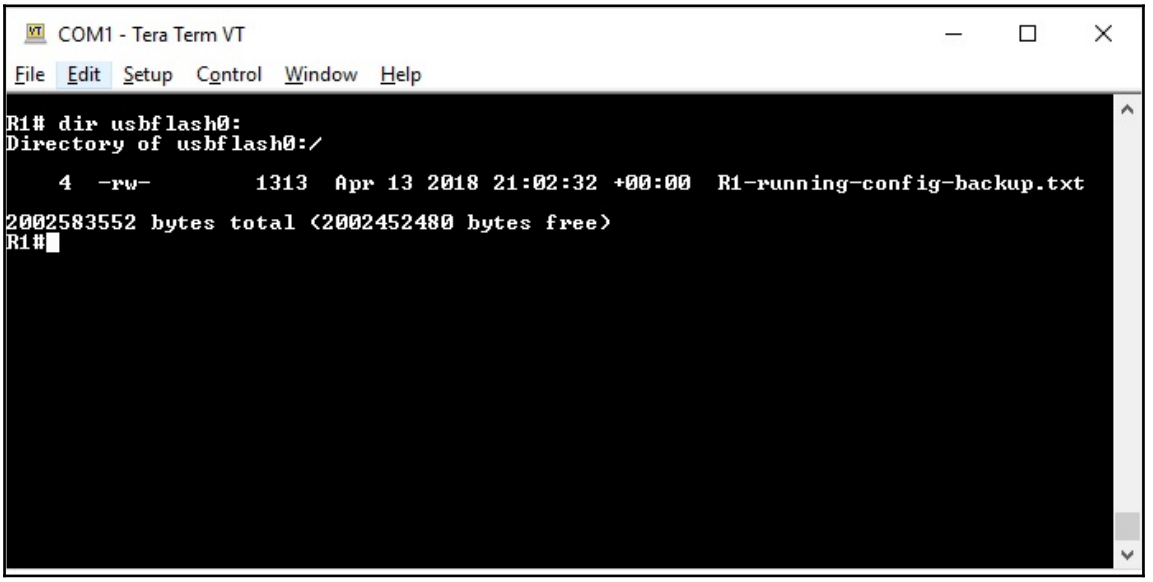
```
R1#copy tftp: running-config
Address or name of remote host []? 192.168.1.10
Source filename []? Router-running-config.txt
Destination filename [running-config]?
Accessing tftp://192.168.1.10/Router-running-config.txt...
Loading Router-running-config.txt from 192.168.1.10 (via GigabitEthernet0/0): !
[OK - 1238 bytes]

1238 bytes copied in 0.092 secs (13457 bytes/sec)

R1#
*Apr 13 20:45:53.503: %SYS-5-CONFIG_I: Configured from tftp://192.168.1.10/Route
r-running-config.txt by console
R1#
```

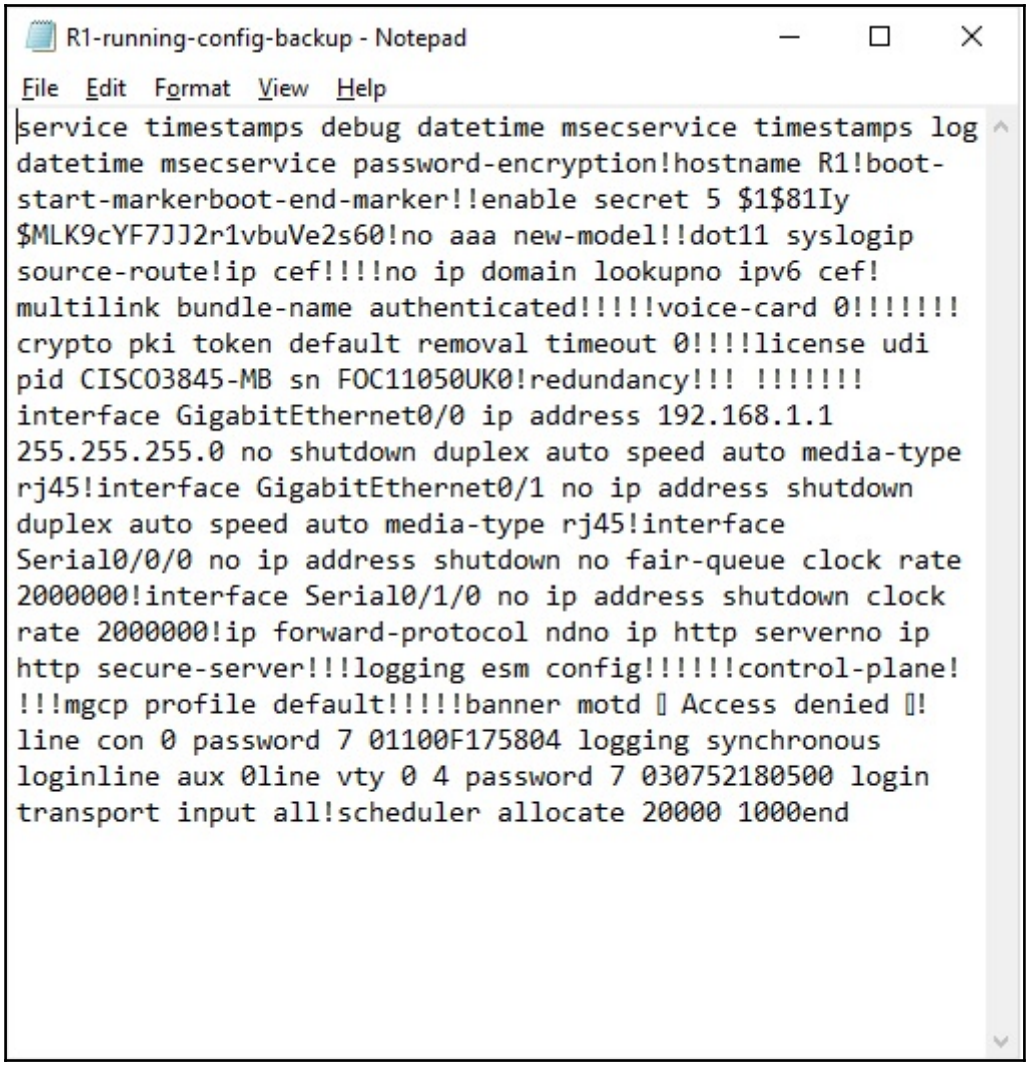



COM1 - Tera Term VT
File Edit Setup Control Window Help
*Apr 13 21:01:12.567: %USB_HOST_STACK-6-USB_DEVICE_CONNECTED: A Full speed USB device has been inserted in port 0.
R1#
*Apr 13 21:01:13.191: %USBFLASH-5-CHANGE: usbflash0 has been inserted!
R1#


COM1 - Tera Term VT
File Edit Setup Control Window Help
File Systems:
Size(b) Free(b) Type Flags Prefixes
- - opaque rw archive:
- - opaque rw system:
- - opaque rw tmpsys:
- - opaque rw null:
- - network rw tftp:
* 128094208 57663488 disk rw flash:#
491512 483998 nvram rw nvram:
- - opaque wo syslog:
- - opaque rw xmodem:
- - opaque rw ymodem:
- - network rw rcp:
- - network rw pram:
- - network rw http:
- - network rw ftp:
- - network rw scp:
- - opaque ro tar:
- - network rw https:
- - opaque ro cns:
2002583552 2002485248 usbflash rw usbflash0:
R1#


COM1 - Tera Term VT
File Edit Setup Control Window Help
R1#copy running-config usbflash0:
Destination filename [running-config]? R1-running-config-backup.txt
1313 bytes copied in 0.924 secs (1421 bytes/sec)
R1#

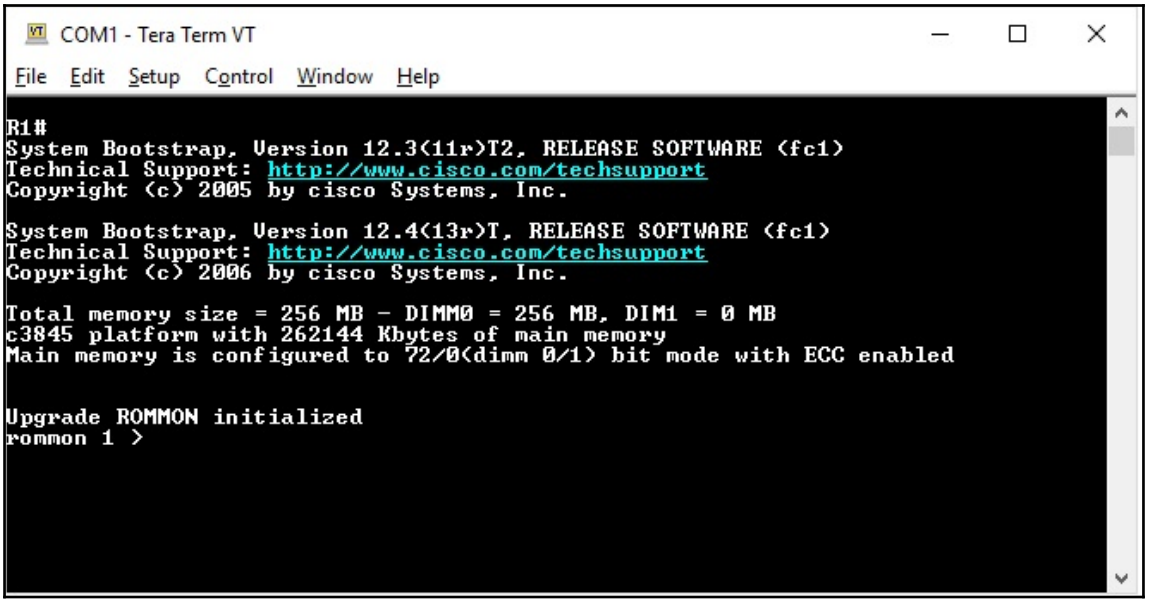

COM1 - Tera Term VT
File Edit Setup Control Window Help
R1# dir usbflash0:
Directory of usbflash0:/
4 -rw- 1313 Apr 13 2018 21:02:32 +00:00 R1-running-config-backup.txt
2002583552 bytes total (2002452480 bytes free)
R1#

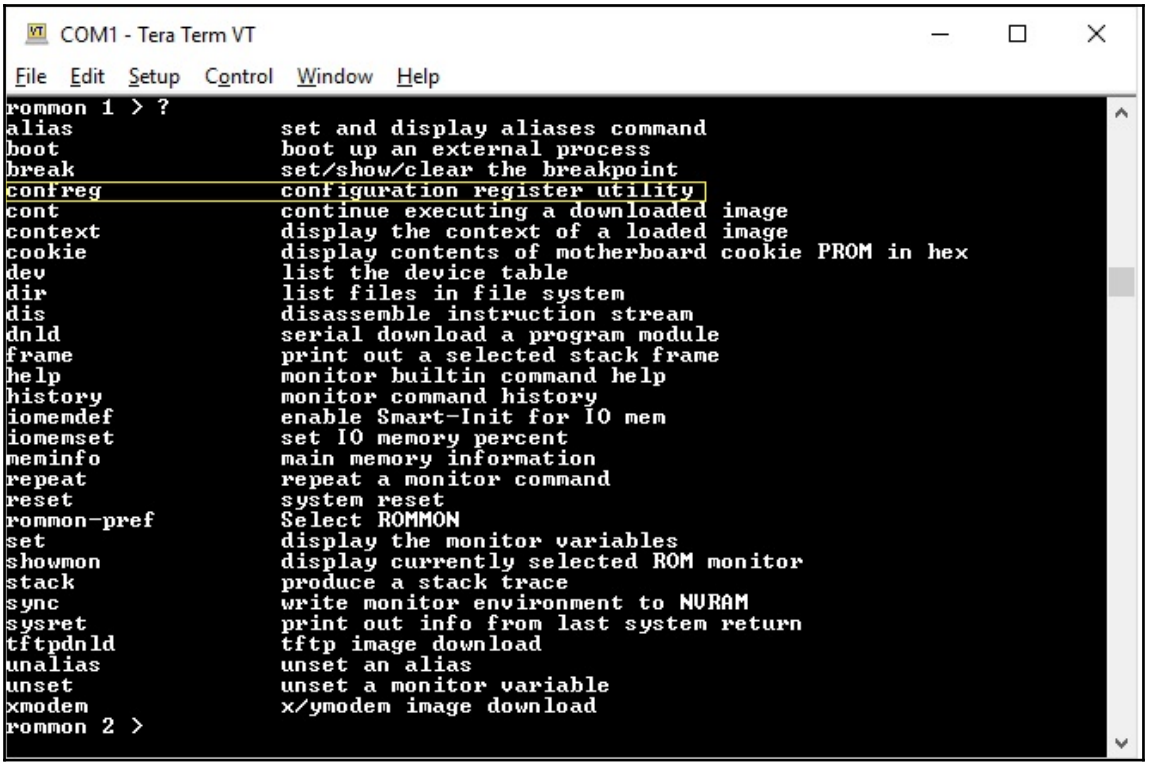

R1-running-config-backup - Notepad
File Edit Format View Help
service timestamps debug datetime msecservice timestamps log
datetime msecservice password-encryption!hostname R1!boot-
start-markerboot-end-marker!!enable secret 5 $1$81Iy
$MLK9cYF7JJ2r1vbuVe2s60!no aaa new-model!!dot11 syslogip
source-route!ip cef!!!!no ip domain lookupno ipv6 cef!
multilink bundle-name authenticated!!!!!voice-card 0!!!!!!!
crypto pki token default removal timeout 0!!!!license udi
pid CISCO3845-MB sn FOC11050UK0!redundancy!!! !!!!!!!
interface GigabitEthernet0/0 ip address 192.168.1.1
255.255.255.0 no shutdown duplex auto speed auto media-type
rj45!interface GigabitEthernet0/1 no ip address shutdown
duplex auto speed auto media-type rj45!interface
Serial0/0/0 no ip address shutdown no fair-queue clock rate
2000000!interface Serial0/1/0 no ip address shutdown clock
rate 2000000!ip forward-protocol ndno ip http serverno ip
http secure-server!!!logging esm config!!!!!!control-plane!
!!!mgcp profile default!!!!!banner motd Access denied !!
line con 0 password 7 01100F175804 logging synchronous
loginline aux 0line vty 0 4 password 7 030752180500 login
transport input all!scheduler allocate 20000 1000end

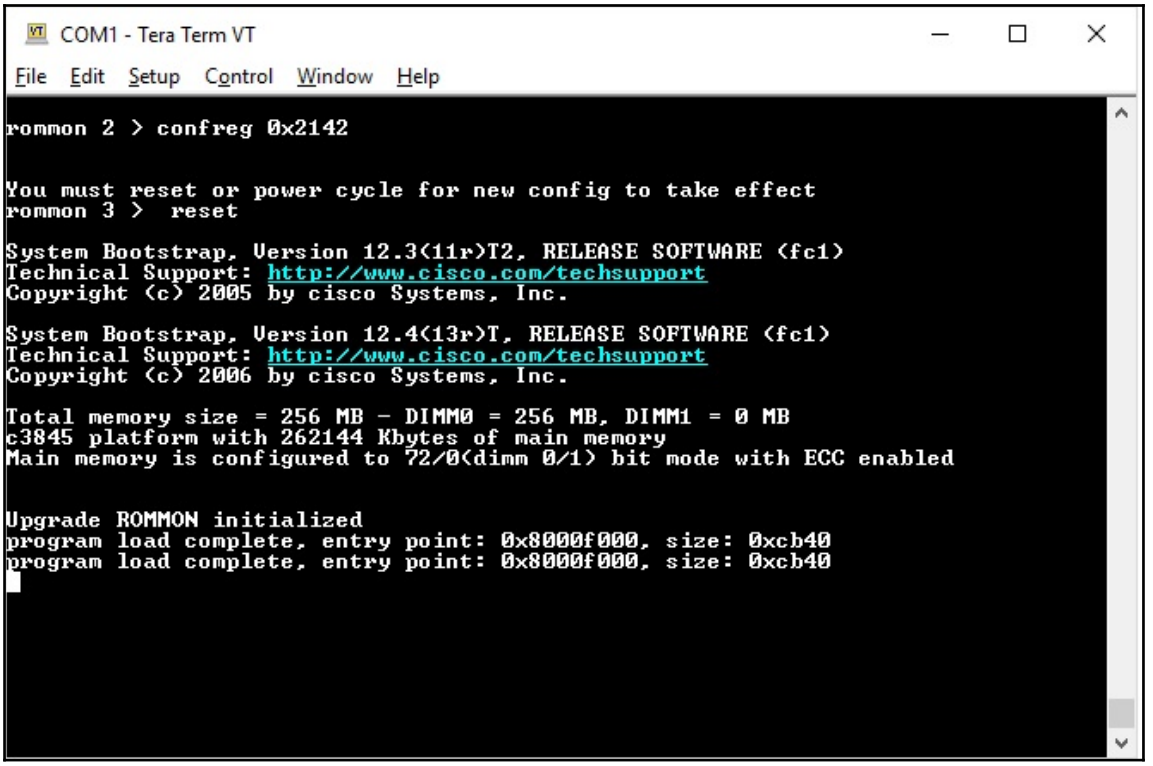
COM1 - Tera Term VT

File Edit Setup Control Window Help

```
R1#copy usbflash0:R1-running-config-backup.txt running-config
Destination filename [running-config]?
1237 bytes copied in 0.124 secs (9976 bytes/sec)

R1#
```


COM1 - Tera Term VT
File Edit Setup Control Window Help
R1#
System Bootstrap, Version 12.3(11r)T2, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2005 by cisco Systems, Inc.
System Bootstrap, Version 12.4(13r)T, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 2006 by cisco Systems, Inc.
Total memory size = 256 MB - DIMM0 = 256 MB, DIM1 = 0 MB
c3845 platform with 262144 Kbytes of main memory
Main memory is configured to 72/0(dimm 0/1) bit mode with ECC enabled
Upgrade ROMMON initialized
rommon 1 >


COM1 - Tera Term VT
File Edit Setup Control Window Help
rommon 1 > ?
alias set and display aliases command
boot boot up an external process
break set/show/clear the breakpoint
confreg configuration register utility
cont continue executing a downloaded image
context display the context of a loaded image
cookie display contents of motherboard cookie PROM in hex
dev list the device table
dir list files in file system
dis disassemble instruction stream
dnld serial download a program module
frame print out a selected stack frame
help monitor builtin command help
history monitor command history
iomemdef enable Smart-Init for IO mem
iomemset set IO memory percent
meminfo main memory information
repeat repeat a monitor command
reset system reset
rommon-pref Select ROMMON
set display the monitor variables
showmon display currently selected ROM monitor
stack produce a stack trace
sync write monitor environment to NVRAM
sysret print out info from last system return
tftpdnld tftp image download
unalias unset an alias
unset unset a monitor variable
xmodem x/ymodem image download
rommon 2 >

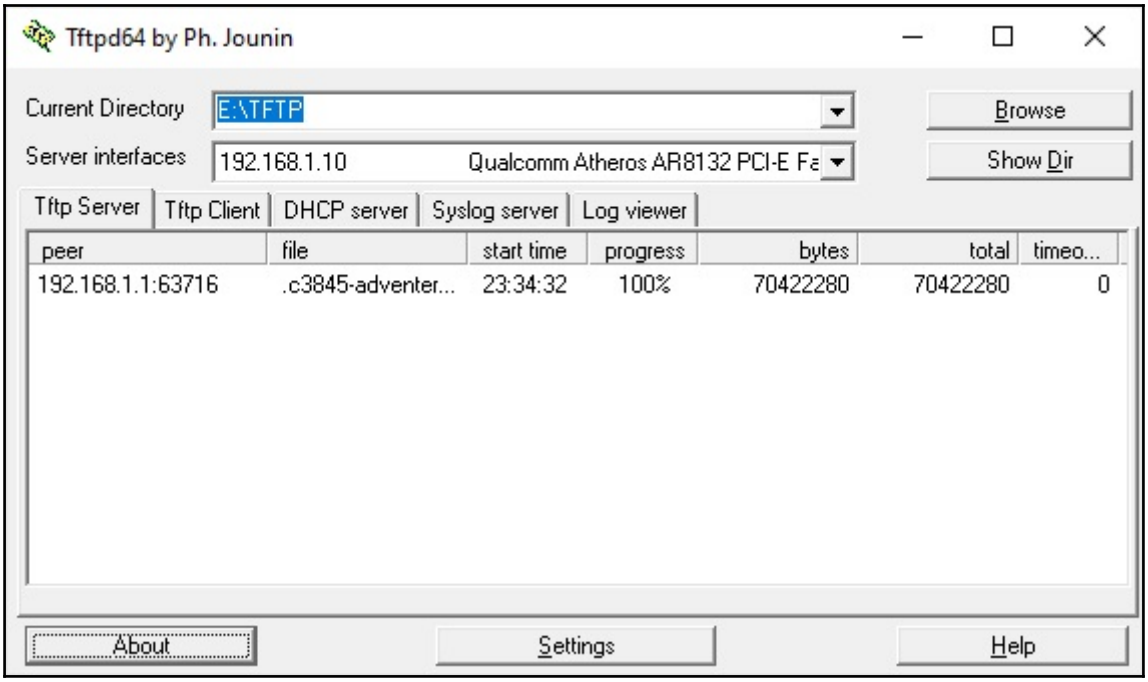


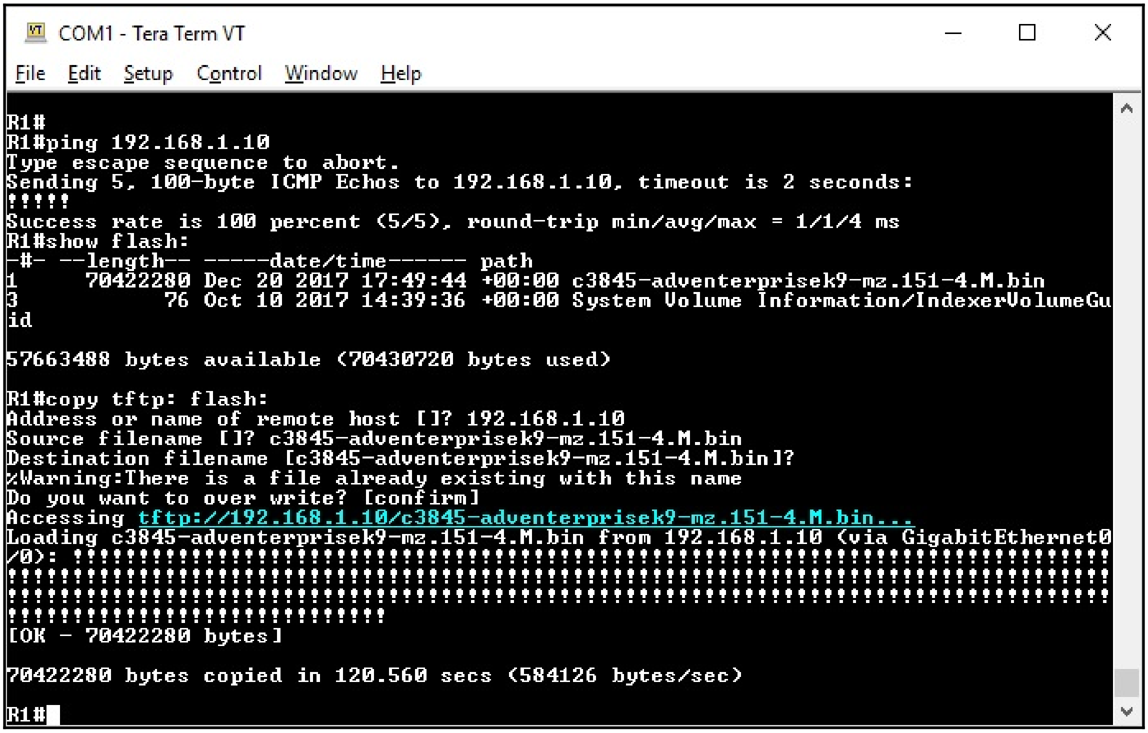
c2900-universalk9-mz.SPA.151-1.M4.bin

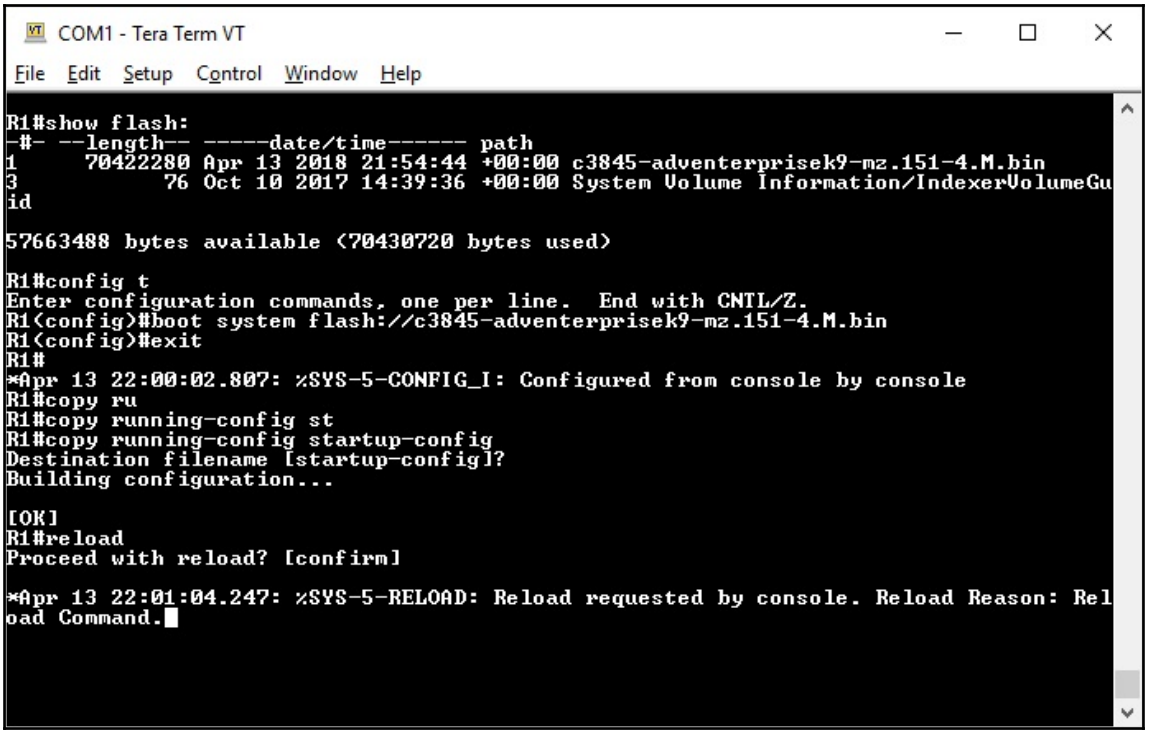
COM1 - Tera Term VT

File Edit Setup Control Window Help

```
R1#ping 192.168.1.10
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
R1#
R1#
R1#show flash:
-#- --length-- -----date/time------ path
1     70422280 Dec 20 2017 17:49:44 +00:00 c3845-adventerprisek9-mz.151-4.M.bin
3           76 Oct 10 2017 14:39:36 +00:00 System Volume Information/IndexerVolumeGu
id

57663488 bytes available (70430720 bytes used)

R1#copy flash: tftp:
Source filename []? c3845-adventerprisek9-mz.151-4.M.bin
Address or name of remote host []? 192.168.1.10
Destination filename [c3845-adventerprisek9-mz.151-4.M.bin]?
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!
70422280 bytes copied in 100.040 secs (703941 bytes/sec)

R1#
```


Tftpd64 by Ph. Jounin
Current Directory
E:\TFTP
Browse
Server interfaces
192.168.1.10
Qualcomm Atheros AR8132 PCI-E Fa
Show Dir
Tftp Server
Tftp Client
DHCP server
Syslog server
Log viewer
peer
file
start time
progress
bytes
total
timeo...
192.168.1.1:63716
.c3845-adventer...
23:34:32
100%
70422280
70422280
0
About
Settings
Help


COM1 - Tera Term VT
File Edit Setup Control Window Help
R1#
R1#ping 192.168.1.10
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms
R1#show flash:
-#- --length-- -----date/time------ path
1 70422280 Dec 20 2017 17:49:44 +00:00 c3845-adventerprisek9-mz.151-4.M.bin
3 76 Oct 10 2017 14:39:36 +00:00 System Volume Information/IndexerVolumeGu
id
57663488 bytes available (70430720 bytes used)
R1#copy tftp: flash:
Address or name of remote host []? 192.168.1.10
Source filename []? c3845-adventerprisek9-mz.151-4.M.bin
Destination filename [c3845-adventerprisek9-mz.151-4.M.bin]?
%Warning:There is a file already existing with this name
Do you want to over write? [confirm]
Accessing tftp://192.168.1.10/c3845-adventerprisek9-mz.151-4.M.bin...
Loading c3845-adventerprisek9-mz.151-4.M.bin from 192.168.1.10 (via GigabitEthernet0
/0): !!!
!!
!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 70422280 bytes]
70422280 bytes copied in 120.560 secs (584126 bytes/sec)
R1#


COM1 - Tera Term VT
File Edit Setup Control Window Help
R1#show flash:
-#- --length-- -----date/time------ path
1 70422280 Apr 13 2018 21:54:44 +00:00 c3845-adventerprisek9-mz.151-4.M.bin
3 76 Oct 10 2017 14:39:36 +00:00 System Volume Information/IndexerVolumeGu
id
57663488 bytes available (70430720 bytes used)
R1#config t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#boot system flash://c3845-adventerprisek9-mz.151-4.M.bin
R1(config)#exit
R1#
*Apr 13 22:00:02.807: %SYS-5-CONFIG_I: Configured from console by console
R1#copy ru
R1#copy running-config st
R1#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R1#reload
Proceed with reload? [confirm]
*Apr 13 22:01:04.247: %SYS-5-RELOAD: Reload requested by console. Reload Reason: Rel
oad Command.

Chapter 8: Network Troubleshooting

```
CD2#show interface gigabitEthernet 0/1 status
Port      Name               Status       Vlan       Duplex  Speed Type
Gig0/1                       connected    10         auto    auto  10/100BaseTX
```

```
CD2#show cdp neighbors detail

Device ID: Acc3
Entry address(es):
Platform: cisco 2960, Capabilities: Switch
Interface: FastEthernet0/21, Port ID (outgoing port): FastEthernet0/21
Holdtime: 176

Version :
Cisco IOS Software, C2960 Software (C2960-LANBASE-M), Version 12.2(25)FX, RELEASE SOFTWARE (fc1)
Copyright (c) 1986-2005 by Cisco Systems, Inc.
Compiled Wed 12-Oct-05 22:05 by pt_team

advertisement version: 2
Duplex: full
---------------------------
```

```
CD2#show interface gigabitEthernet 0/1
GigabitEthernet0/1 is up, line protocol is up (connected)
  Hardware is Lance, address is 0002.1690.e019 (bia 0002.1690.e019)
 BW 1000000 Kbit, DLY 1000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 1000Mb/s
  input flow-control is off, output flow-control is off
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:08, output 00:00:05, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue :0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     956 packets input, 193351 bytes, 0 no buffer
     Received 956 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 watchdog, 0 multicast, 0 pause input
     0 input packets with dribble condition detected
     2357 packets output, 263570 bytes, 0 underruns
     0 output errors, 0 collisions, 10 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
```

```
CD2#show port-security interface gigabitEthernet 0/1
Port Security              : Enabled
Port Status                : Secure-up
Violation Mode             : Shutdown
Aging Time                 : 0 mins
Aging Type                 : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses      : 1
Total MAC Addresses        : 1
Configured MAC Addresses   : 0
Sticky MAC Addresses       : 0
Last Source Address:Vlan   : 0001.6470.2502:10
Security Violation Count   : 0
```

```
Router# show ip interface brief
Interface                  IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0         203.0.113.5     YES manual up                    up
GigabitEthernet0/1         203.0.113.10    YES manual up                    up
GigabitEthernet0/2         unassigned      YES unset  administratively down down
Vlan1                      unassigned      YES unset  administratively down down
```

```
Router# show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/16 is subnetted, 1 subnets
S       10.10.0.0/16 [1/0] via 203.0.113.6
     203.0.113.0/24 is variably subnetted, 5 subnets, 2 masks
S       203.0.113.0/30 [1/0] via 203.0.113.9
C       203.0.113.4/30 is directly connected, GigabitEthernet0/0
L       203.0.113.5/32 is directly connected, GigabitEthernet0/0
C       203.0.113.8/30 is directly connected, GigabitEthernet0/1
L       203.0.113.10/32 is directly connected, GigabitEthernet0/1
```

```
Router# show history
  en
  config t
   show history
```

```
Router#ping 10.10.10.11

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.10.11, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/2/10 ms
```

```
Packet Tracer PC Command Line 1.0
C:\>tracert 10.10.10.11

Tracing route to 10.10.10.11 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      10.10.10.11

Trace complete.
```

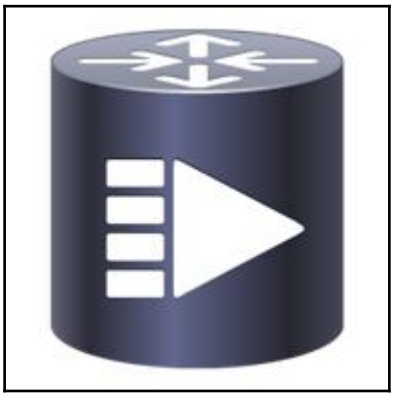
```
Router# traceroute 10.10.10.11
Type escape sequence to abort.
Tracing the route to 10.10.10.11

  1    10.10.10.11     1 msec    11 msec    0 msec
```

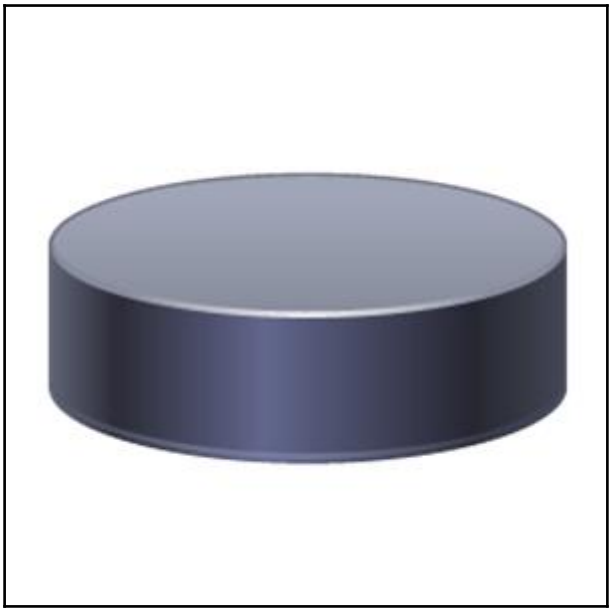
```
Router# show arp
Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet  10.10.10.1              14  0000.0C07.AC01  ARPA   GigabitEthernet0/1
Internet  10.10.10.2               -  00D0.FFEB.2D02  ARPA   GigabitEthernet0/1
Internet  10.10.10.11             14  0001.6310.5D05  ARPA   GigabitEthernet0/1
Internet  10.10.20.1               -  00D0.FFEB.2D03  ARPA   GigabitEthernet0/2
Internet  203.0.113.2              -  00D0.FFEB.2D01  ARPA   GigabitEthernet0/0
```

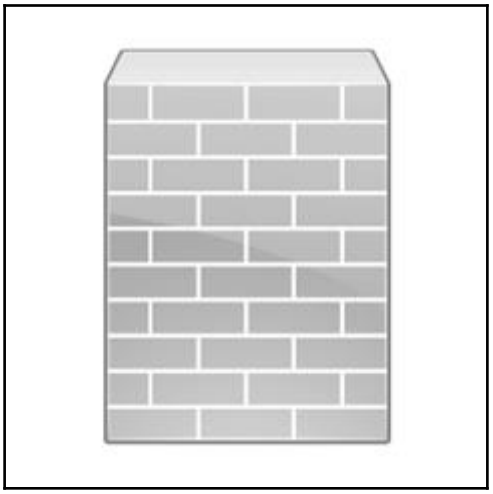
```
Router# show protocols
Global values:
  Internet Protocol routing is enabled
GigabitEthernet0/0 is up, line protocol is up
  Internet address is 203.0.113.2/30
GigabitEthernet0/1 is up, line protocol is up
  Internet address is 10.10.10.2/24
GigabitEthernet0/2 is up, line protocol is up
  Internet address is 10.10.20.1/30
Vlan1 is administratively down, line protocol is down
```

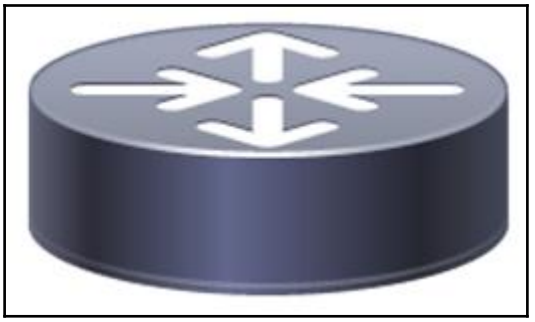
```
Router#debug ?
  aaa              AAA Authentication, Authorization and Accounting
  custom-queue     Custom output queueing
  eigrp            EIGRP Protocol information
  frame-relay      Frame Relay
  ip               IP information
  ipv6             IPv6 information
  ntp              NTP information
  ppp              PPP (Point to Point Protocol) information
  standby          Hot Standby Router Protocol (HSRP)
```

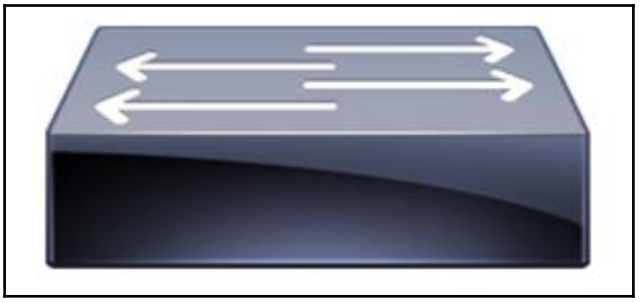
Appendix B: Cisco devices icons











Appendix E: Subnetting

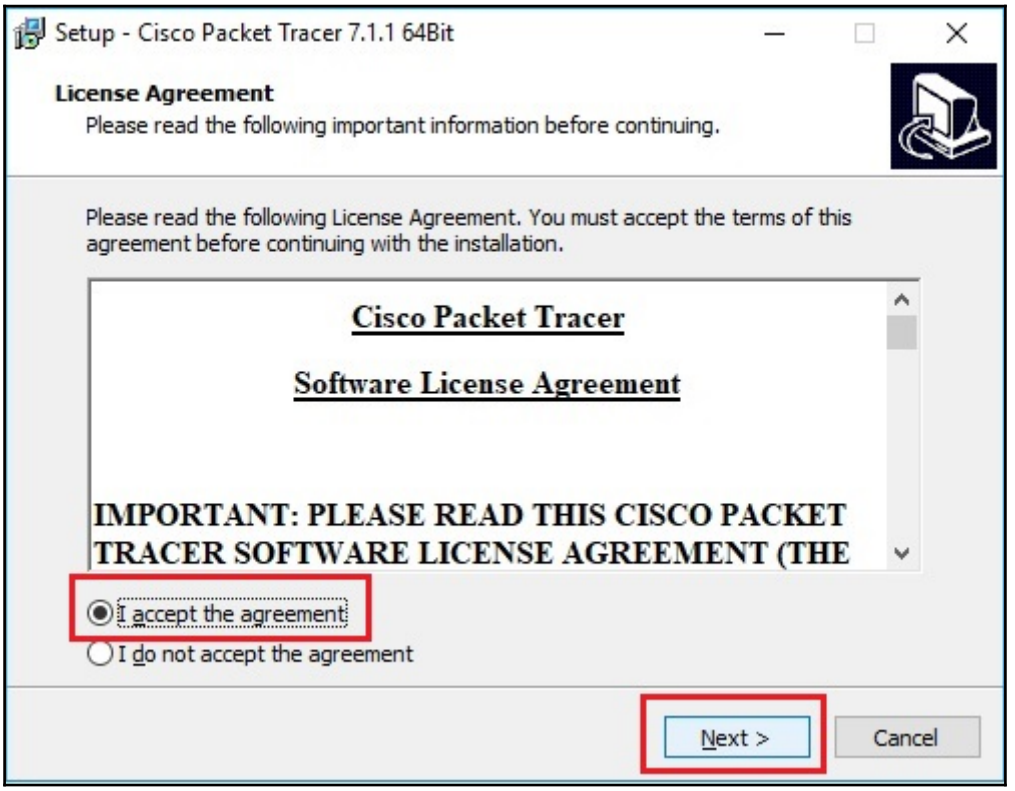
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	**64**	**32**	**16**	**8**	**4**	**2**	**1**

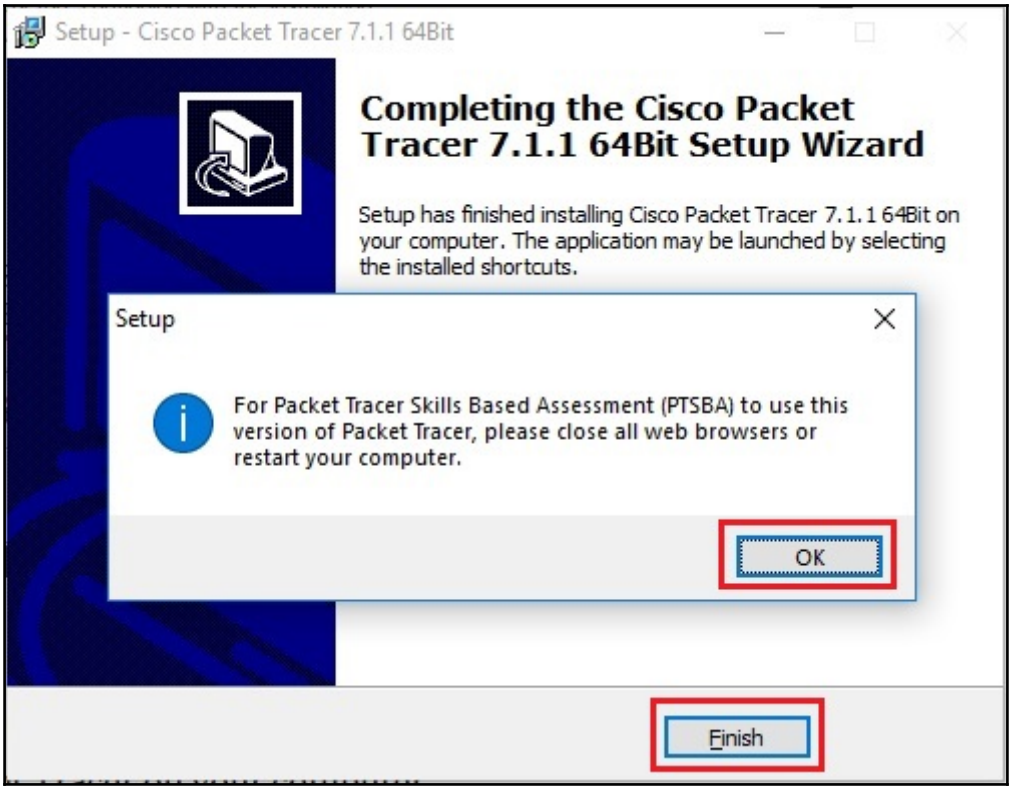
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	**64**	**32**	**16**	**8**	**4**	**2**	**1**
1	**1**	**0**	**0**	**0**	**1**	**0**	**0**

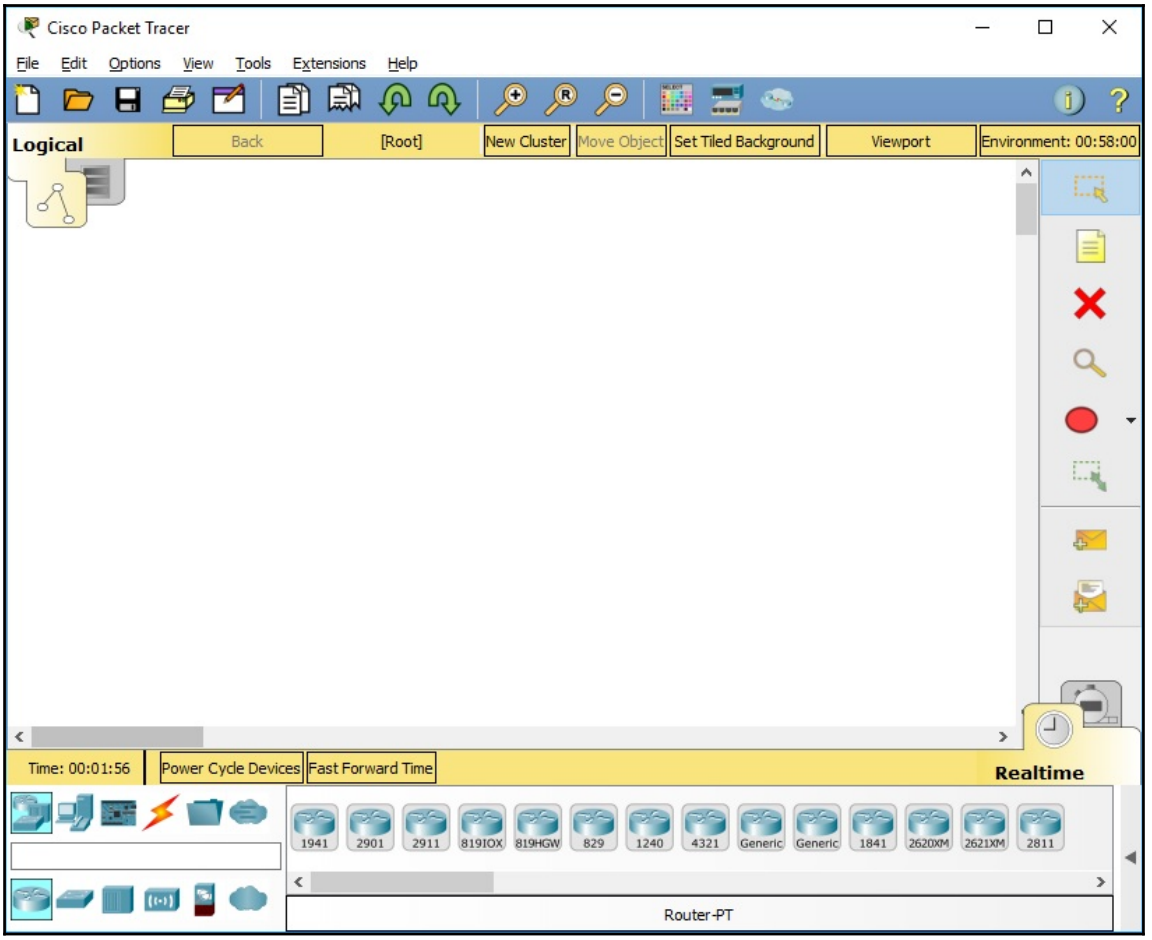
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	**64**	**32**	**16**	**8**	**4**	**2**	**1**
1	**1**	**0**	**0**	**0**	**1**	**0**	**0**

128 + 64 + 0 + 0 + 0 + 4 + 0 + 0

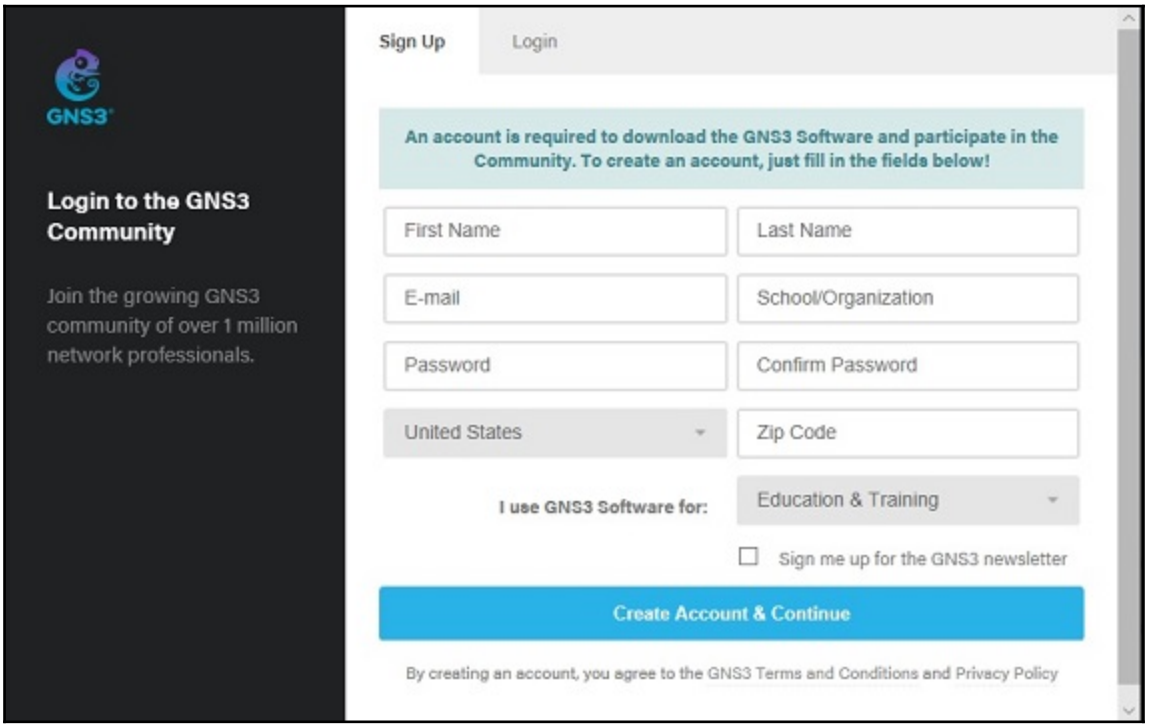
Appendix F: Cisco Packet Tracer

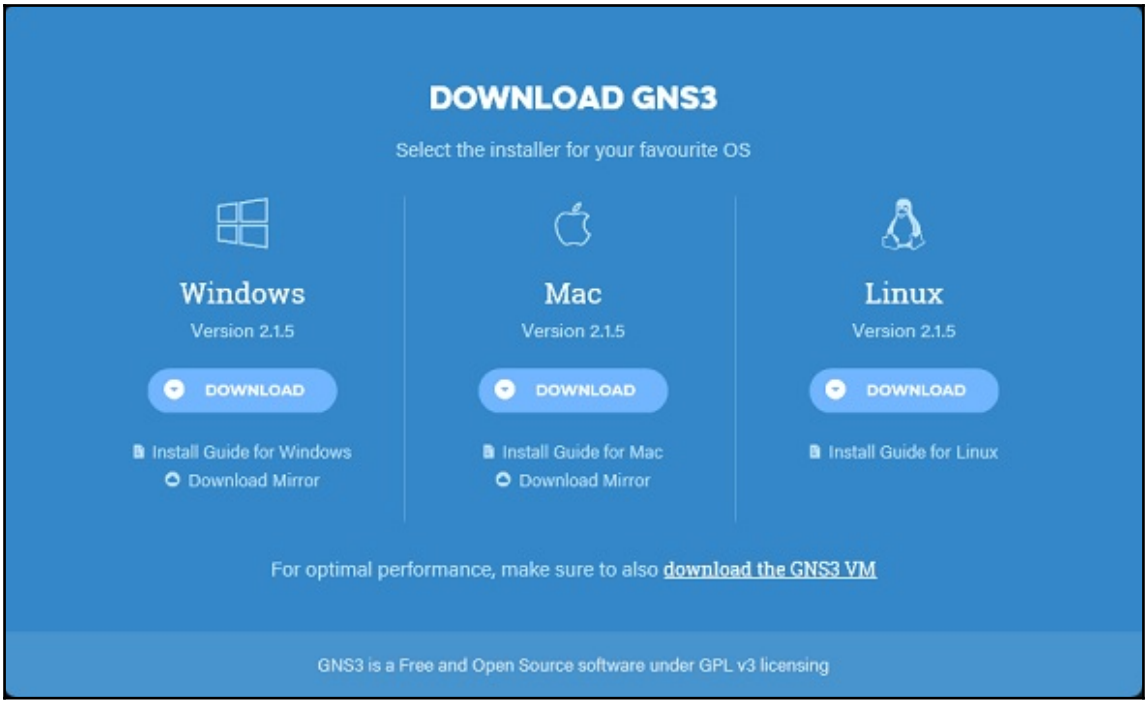


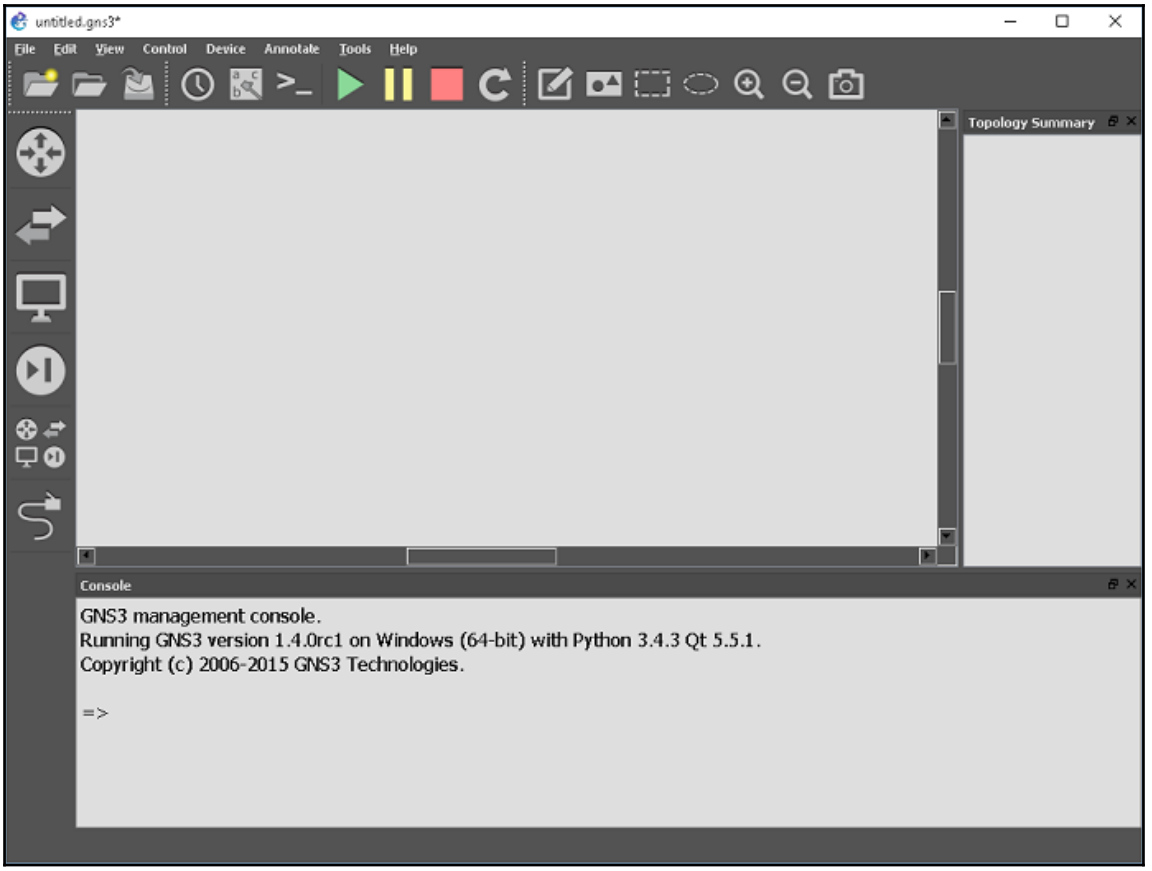

Setup - Cisco Packet Tracer 7.1.1 64Bit
Completing the Cisco Packet Tracer 7.1.1 64Bit Setup Wizard
Setup has finished installing Cisco Packet Tracer 7.1.1 64Bit on your computer. The application may be launched by selecting the installed shortcuts.
Setup
For Packet Tracer Skills Based Assessment (PTSBA) to use this version of Packet Tracer, please close all web browsers or restart your computer.
OK
Finish


Cisco Packet Tracer
File Edit Options View Tools Extensions Help
Logical
Back
[Root]
New Cluster
Move Object
Set Tiled Background
Viewport
Environment: 00:58:00
Time: 00:01:56
Power Cycle Devices
Fast Forward Time
Realtime
1941
2901
2911
819IOX
819HGW
829
1240
4321
Generic
Generic
1841
2620XM
2621XM
2811
Router-PT

Appendix G: Graphical Network Simulator-3 (GNS3)




DOWNLOAD GNS3
Select the installer for your favourite OS
Windows
Version 2.1.5
DOWNLOAD
Install Guide for Windows
Download Mirror
Mac
Version 2.1.5
DOWNLOAD
Install Guide for Mac
Download Mirror
Linux
Version 2.1.5
DOWNLOAD
Install Guide for Linux
For optimal performance, make sure to also download the GNS3 VM
GNS3 is a Free and Open Source software under GPL v3 licensing


untitled.gns3*
File
Edit
View
Control
Device
Annotate
Tools
Help
Topology Summary
Console
GNS3 management console.
Running GNS3 version 1.4.0rc1 on Windows (64-bit) with Python 3.4.3 Qt 5.5.1.
Copyright (c) 2006-2015 GNS3 Technologies.
=>